

## Engine - TDV6 2.7L Diesel -

### Sealers

| Description                               | Land Rover Part No. |
|-------------------------------------------|---------------------|
| Camshaft caps                             | 8510302             |
| 'T' joints - ladder frame to engine block | STC 50550           |
| Coolant plug - threaded                   | STC 50552           |
| Oil pump upper middle retaining bolt      | STC 50552           |

### Lubricants

| Description           | Specification                                                  |
|-----------------------|----------------------------------------------------------------|
| Engine oil, SAE 5W-30 | Use 5W/30 oil to specification WSS-M2C-913B meeting ACEA B1/B3 |

**Note: WSS is a Ford prefix to the oil specification**

### Capacities

| Engine Oil Capacity                                                                   | Specification                            |
|---------------------------------------------------------------------------------------|------------------------------------------|
| Dry fill including filter for factory fitted engine                                   | 6.55 litres (11.5 pints) (6.9 US quarts) |
| Dry fill including filter for all new engines fitted in service                       | 7.05 litres (12.4 pints) (7.4 US quarts) |
| Oil and filter change                                                                 | 5.54 litres (9.6 pints) (5.8 US quarts)  |
| Amount of oil required to bring level from 'MIN' to 'MAX' mark on oil level indicator | 1.5 litres (2.6 pints) (1.6 US quarts)   |

### Dimensions

| Item   | Specification     |
|--------|-------------------|
| Length | 523 mm (20.59 in) |
| Width  | 717 mm (28.25 in) |
| Height | 771 mm (30.35 in) |

### General Specifications

| Item                                          | Specification                                                                                                                               |
|-----------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| Type                                          | 2.7 litre, 60 degree 'V', common rail direct injection, turbocharged and intercooled diesel, twin overhead camshafts, 4 valves per cylinder |
| Cylinder arrangement                          | V6, numbers 1 and 4 cylinders at front of engine when engine is viewed from rear                                                            |
| Cylinder numbering                            | Number 1 cylinder - right hand bank; Number 4 cylinder - left hand bank                                                                     |
| Bore - nominal                                | 81.0 mm (3.188 in)                                                                                                                          |
| Stroke                                        | 88.0 mm (3.464 in)                                                                                                                          |
| Capacity                                      | 2720 cm <sup>3</sup> (165.9 in <sup>3</sup> )                                                                                               |
| Firing order                                  | 1 - 4 - 2 - 5 - 3 - 6                                                                                                                       |
| Compression ratio                             | 17.3:1                                                                                                                                      |
| Direction of rotation                         | Anti-clockwise viewed from rear of engine                                                                                                   |
| Maximum power                                 | 147 kW (200 PS) (197 bhp) @ 4000 rev/min                                                                                                    |
| Maximum torque                                | 440 Nm (324 lb-ft) @ 1900 rev/min                                                                                                           |
| <b>Engine oil pressure:</b>                   |                                                                                                                                             |
| At idle                                       | 0.7 bar (70 kPa) (10 lb/in <sup>2</sup> )                                                                                                   |
| At 3500 rev/min                               | 1.9 bar (190kPa) (27.5 lb/ft <sup>2</sup> )                                                                                                 |
| <b>Maximum permissible cylinder head warp</b> |                                                                                                                                             |
| Total flame face                              | 0.1 mm                                                                                                                                      |
| 150 mm x 150 mm square on flame face          | 0.05 mm                                                                                                                                     |
| 25 mm x 25 mm square on flame face            | 0.025 mm                                                                                                                                    |

### Torque Specifications

| Description                                           | Nm          | lb-ft       |
|-------------------------------------------------------|-------------|-------------|
| Accessory drive belt idler retaining bolt             | 47          | 35          |
| Accessory drive belt tensioner M8 retaining bolts     | 47          | 35          |
| Accessory drive belt tensioner M10 retaining bolts    | 25          | 18          |
| Air conditioning (A/C) compressor retaining bolts     | 23          | 17          |
| A/C compressor mounting bracket retaining bolts       | 23          | 17          |
| A/C compressor low pressure pipe fixing               | 9           | 7           |
| A/C manifold retaining bolt                           | 20          | 15          |
| Battery positive cable mounting bolts                 | 10          | 7           |
| <b>* Camshaft inner bearing cap retaining bolts</b>   |             |             |
| Stage 1: tighten bolts 1 to 14                        | 1           | 1           |
| Stage 2: tighten bolts 1 to 14                        | 5           | 4           |
| Stage 3: tighten bolts 1 to 14                        | 10          | 7           |
| <b>* Camshaft outer bearing cap retaining bolts</b>   |             |             |
| Stage 1: tighten bolts 1 to 4                         | 1           | 1           |
| Stage 2: tighten bolts 1 to 4                         | 5           | 4           |
| Stage 3: tighten bolts 1 to 4                         | 10          | 7           |
| Camshaft position sensor retaining bolt               | 10          | 7           |
| <b>+<sup>1</sup> Camshaft hub retaining bolts</b>     |             |             |
| Stage 1                                               | 80          | 59          |
| Stage 2                                               | Further 90° | Further 90° |
| Camshaft pulley retaining bolts                       | 23          | 17          |
| Camshaft timing belt cover securing bolts             | 10          | 7           |
| <b>+<sup>2</sup> Crankshaft pulley retaining bolt</b> |             |             |
| Stage 1                                               | 100         | 74          |

| Description                                                                          | Nm           | lb-ft        |
|--------------------------------------------------------------------------------------|--------------|--------------|
| Stage 2                                                                              | Further 90°  | Further 90°  |
| Crankshaft damper bolts                                                              | 14           | 10           |
| Crankshaft position sensor retaining bolt                                            | 5            | 4            |
| Crankshaft rear seal retainer plate                                                  | 10           | 7            |
| Coolant outlet elbow                                                                 | 10           | 7            |
| <b>* +<sup>2</sup> Cylinder head retaining bolts</b>                                 |              |              |
| Stage 1                                                                              | 20           | 15           |
| Stage 2                                                                              | 40           | 30           |
| Stage 3                                                                              | 80           | 59           |
| Stage 4                                                                              | Further 180° | Further 180° |
| Differential front mounting bracket heat shield                                      | 10           | 7            |
| EGR valve inlet tube                                                                 | 10           | 7            |
| EGR valve mounting bolts                                                             | 10           | 7            |
| EGR valve support bracket fixing                                                     | 10           | 7            |
| Engine breather tube securing bolt                                                   | 10           | 7            |
| Engine mount retaining nuts to cross member                                          | 62           | 46           |
| Engine mount bracket to engine mount retaining bolts                                 | 62           | 46           |
| Engine mount bracket to engine block retaining bolts                                 | 115          | 85           |
| Exhaust cross over pipe retaining nuts                                               | 24           | 18           |
| Exhaust manifold heat shield retaining bolts                                         | 10           | 7            |
| Exhaust manifold retaining nuts                                                      | 23           | 17           |
| Exhaust manifold retaining studs                                                     | 13           | 10           |
| <b>* + Flexplate retaining bolts</b>                                                 |              |              |
| Stage 1                                                                              | 50           | 37           |
| Stage 2                                                                              | Further 45°  | Further 45°  |
| Stage 3                                                                              | Further 45°  | Further 45°  |
| Fuel injection pump                                                                  | 23           | 17           |
| Fuel injection pump pulley retaining nut                                             | 50           | 37           |
| Fuel injection supply manifold                                                       | 23           | 17           |
| Fuel injection supply manifold securing bracket                                      | 23           | 17           |
| <b>Fuel injection supply line unions</b>                                             |              |              |
| Stage 1 - High pressure fuel supply line union at the fuel injection diverter rail   | 15           | 11           |
| Stage 2 - High pressure fuel supply line union at the fuel injection supply manifold | 15           | 11           |
| Stage 3 - High pressure fuel supply line union at the fuel injection diverter rail   | 30           | 22           |
| Stage 4 - High pressure fuel supply line union at the fuel injection supply manifold | 30           | 22           |
| Fuel injection high pressure supply line mounting bolt                               | 10           | 7            |
| Fuel injector retaining bolts                                                        | 10           | 7            |
| Fuel filter mounting bolts                                                           | 10           | 7            |
| Generator retaining bolts                                                            | 23           | 17           |
| Generator mount bracket retaining bolts                                              | 23           | 17           |
| Glow plugs                                                                           | 11           | 8            |
| Intake air shut off throttle elbow support bracket bolts                             | 10           | 7            |
| Knock sensor retaining bolts                                                         | 20           | 15           |
| Oil cooler to cylinder block retaining bolts                                         | 10           | 7            |
| Oil level indicator tube upper retaining bolt                                        | 10           | 7            |
| Oil pan retaining bolts                                                              | 10           | 7            |
| Oil pump screen and pick-up tube                                                     | 10           | 7            |
| Oil pump to engine block retaining bolts                                             | 10           | 7            |
| Oil pan drain plug                                                                   | 23           | 17           |
| Oil separator retaining bolts                                                        | 10           | 7            |
| Oil temperature sensor                                                               | 10           | 7            |
| Oil filter                                                                           | 25           | 18           |
| Piston cooling jet retaining bolt                                                    | 10           | 7            |
| Power steering bracket retaining bolts                                               | 23           | 17           |
| Power steering pump retaining bolts                                                  | 23           | 17           |
| Power steering high pressure pipe fixing                                             | 25           | 18           |
| Primary timing chain tensioner retaining bolts                                       | 10           | 7            |
| Secondary timing chain tensioner bolts                                               | 10           | 7            |
| Starter motor retaining bolts                                                        | 45           | 33           |
| Timing belt tensioner retaining bolt                                                 | 24           | 18           |
| Timing belt idler pulley retaining bolt                                              | 45           | 33           |
| Transmission fluid cooler pipe securing bracket                                      | 10           | 7            |
| Transmission retaining bolts                                                         | 45           | 33           |
| Turbo heat shield                                                                    | 10           | 7            |
| Turbo support bracket                                                                | 22           | 16           |
| Coolant pump retaining bolts                                                         | 10           | 7            |
| Coolant pump pulley retaining bolts                                                  | 23           | 17           |
| Coolant pump outlet pipe retaining bolts                                             | 10           | 7            |
| Valve cover retaining bolts                                                          | 10           | 7            |
| Vacuum pump retaining bolts                                                          | 23           | 17           |
| Vacuum pump retaining nuts                                                           | 13           | 10           |

**\* Bolts must be tightened in sequence**

**+ New bolts must be installed**

**<sup>1</sup> Lightly oil bolt threads**

<sup>2</sup> Do not apply lubricant to bolt threads

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## Engine - TDV6 2.7L Diesel - Engine

Description and Operation

External View



E44216

### GENERAL

The TdV6 engine is a 2.7 litre, direct injection, six-cylinder diesel engine having two banks of three cylinders, arranged at 60 degrees to each other. There are 4 valves per cylinder, which are operated by two overhead camshafts per cylinder bank. The engine emission comply with ECD3 (European Commission Directive) legislative requirements and employs two catalytic converters, electronic engine management control, positive crankcase ventilation and exhaust gas recirculation to limit the emission of pollutants. The unit is water cooled and turbo-charged. The fuel injection system features common rail technology.

The cylinder block is manufactured in Compacted Graphite Iron (CGI) and is coupled with a separate aluminium ladder frame to provide a lightweight, compact and very stiff bottom end of the engine. The cylinder heads are cast aluminium with a moulded plastic camshaft cover. The single-piece oil sump is formed from stamped steel. The cast iron exhaust manifolds are unique for each cylinder bank and a moulded plastic acoustic cover is fitted over the upper engine to reduce engine-generated noise.

### TECHNICAL FEATURES

The technical features include:

- 60 degree 'vee' 6 cylinder engine with a CGI cylinder block

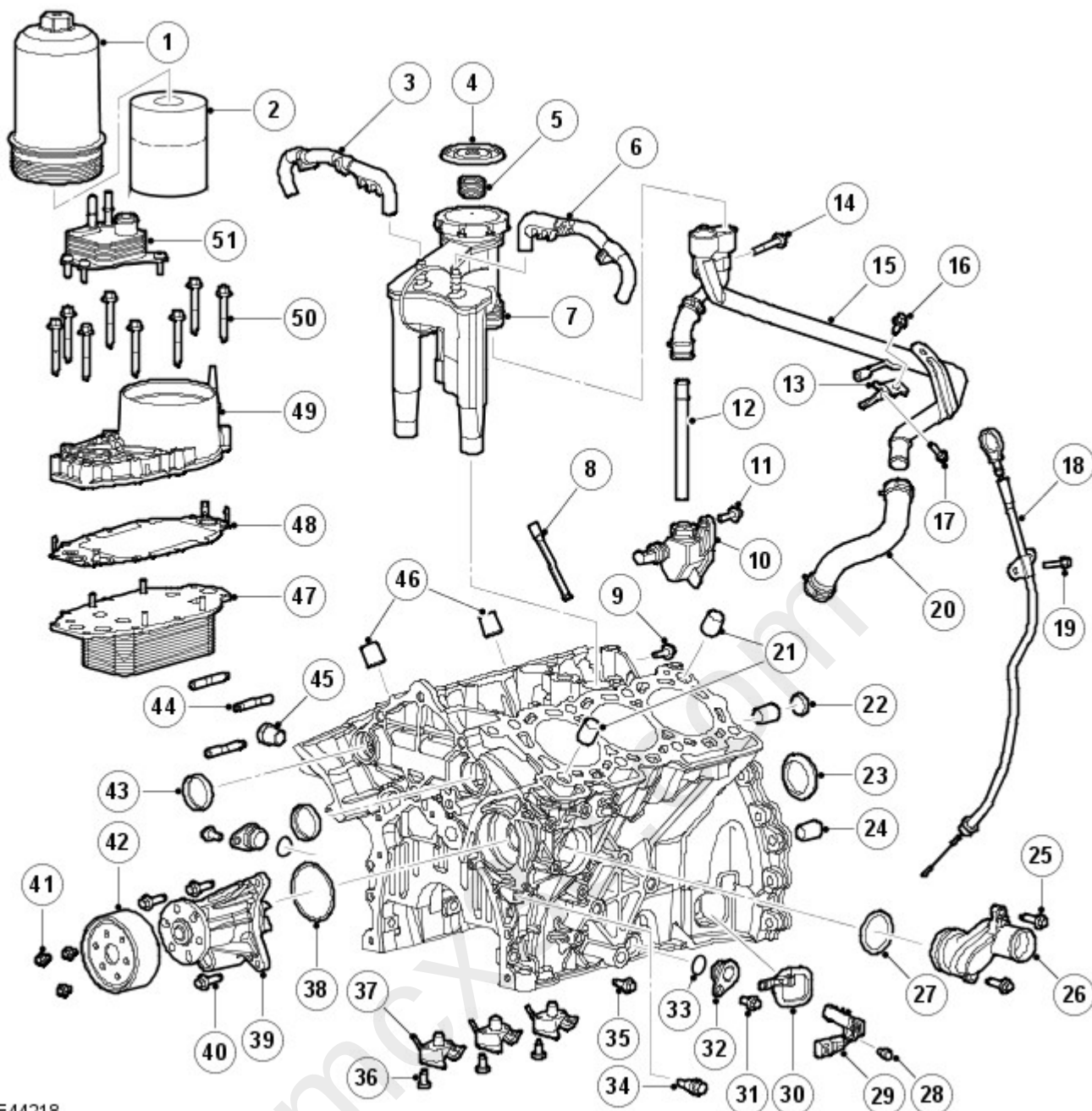
- Plastic cylinder head cover
- Two light, high strength, aluminium cylinder heads
- 4-valve technology with centrally arranged fuel injectors
- Steel roller rockers with hydraulic lash adjusters
- Twin plenum intake system integrated with the camshaft cover
- Variable Geometry Turbocharger
- Common rail direct fuel injection system
- High pressure fuel pump
- Gallery cooled pistons with a central crown bowl
- Two electronically controlled Exhaust Gas Recirculation (EGR) valves
- Two EGR coolers
- Exhaust re-treatment by means of a diesel specific oxidation catalytic converter and primary catalytic converter
- Cooling fan with electro-viscous clutch drive.

## ENGINE DATA

The technical data is detailed below:

| DESCRIPTION                     | TYPE                                                                          |
|---------------------------------|-------------------------------------------------------------------------------|
| <b>Configuration</b>            | 60 degree V6                                                                  |
| <b>Maximum power</b>            | 147 kW at 4000 rpm                                                            |
| <b>Maximum torque</b>           | 440 Nm at 1900 rpm                                                            |
| <b>Displacement</b>             | 2720cc                                                                        |
| <b>Stroke / bore</b>            | 81mm/88mm                                                                     |
| <b>Compression ratio</b>        | 17.3:1                                                                        |
| <b>Firing order</b>             | 1 4 2 5 3 6                                                                   |
| <b>Oil capacity</b>             | 6.55 litres (initial fill)<br>5.45 litres (service fill, includes oil filter) |
| <b>Engine weight (with oil)</b> | 235kg (Automatic)<br>260kg (Manual, inc. clutch plate and cover)              |

## CYLINDER BLOCK COMPONENTS



E44218

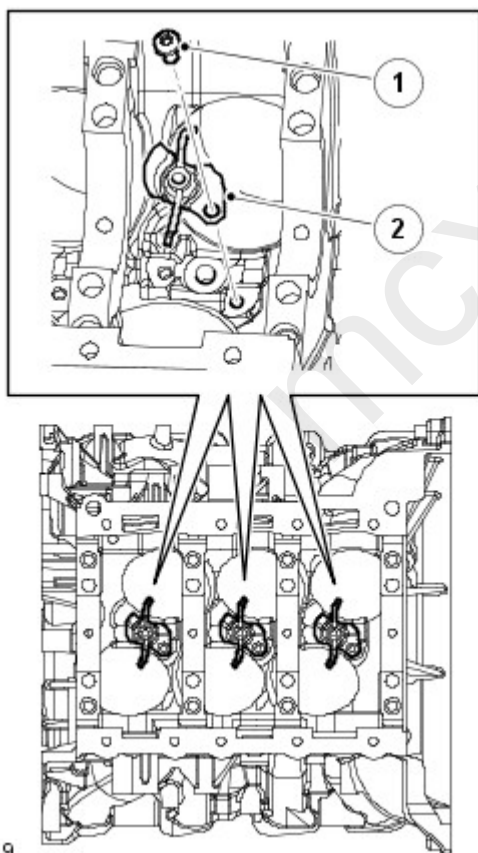
| Item | Part Number | Description                                    |
|------|-------------|------------------------------------------------|
| 1    | -           | Oil filter cap                                 |
| 2    | -           | Oil filter element                             |
| 3    | -           | Scavenge pipe                                  |
| 4    | -           | Diaphragm                                      |
| 5    | -           | Spring                                         |
| 6    | -           | Scavenge pipe                                  |
| 7    | -           | Crankcase ventilation oil separator assembly   |
| 8    | -           | Turbocharger feed filter                       |
| 9    | -           | Bolt                                           |
| 10   | -           | Crankcase ventilation drain reservoir assembly |
| 11   | -           | Bolt                                           |
| 12   | -           | Crankcase ventilation oil return tube          |
| 13   | -           | Bracket                                        |
| 14   | -           | Bolt                                           |
| 15   | -           | Crankcase ventilation oil return assembly      |
| 16   | -           | Bolt                                           |
| 17   | -           | Bolt                                           |
| 18   | -           | Oil level gauge                                |
| 19   | -           | Bolt                                           |
| 20   | -           | Crankcase ventilation return hose              |
| 21   | -           | Cylinder head locating dowels                  |
| 22   | -           | Core plug                                      |
| 23   | -           | Seal                                           |
| 24   | -           | Transmission locating dowel                    |
| 25   | -           | Bolt                                           |
| 26   | -           | Nut                                            |
| 27   | -           | Washer                                         |
| 28   | -           | Bolt                                           |
| 29   | -           | Nut                                            |
| 30   | -           | Washer                                         |
| 31   | -           | Bolt                                           |
| 32   | -           | Nut                                            |
| 33   | -           | Washer                                         |
| 34   | -           | Bolt                                           |
| 35   | -           | Nut                                            |
| 36   | -           | Washer                                         |
| 37   | -           | Bolt                                           |
| 38   | -           | Nut                                            |
| 39   | -           | Washer                                         |
| 40   | -           | Bolt                                           |
| 41   | -           | Nut                                            |
| 42   | -           | Washer                                         |
| 43   | -           | Bolt                                           |
| 44   | -           | Nut                                            |
| 45   | -           | Washer                                         |
| 46   | -           | Bolt                                           |
| 47   | -           | Nut                                            |
| 48   | -           | Washer                                         |
| 49   | -           | Bolt                                           |
| 50   | -           | Nut                                            |
| 51   | -           | Washer                                         |

|    |   |                                      |
|----|---|--------------------------------------|
| 25 | - | Bolt, 2 of                           |
| 26 | - | Water inlet connector assembly       |
| 27 | - | O ring                               |
| 28 | - | Bolt                                 |
| 29 | - | Crankshaft position (CKP) sensor     |
| 30 | - | Cylinder block aperture cover        |
| 31 | - | Bolt                                 |
| 32 | - | Blanking plug                        |
| 33 | - | O ring                               |
| 34 | - | Crankshaft timing plug               |
| 35 | - | Bolt                                 |
| 36 | - | Bolt, 3 of                           |
| 37 | - | Piston cooling jets                  |
| 38 | - | O ring                               |
| 39 | - | Water pump                           |
| 40 | - | Bolt, 3 of                           |
| 41 | - | Bolt, 3 of                           |
| 42 | - | Water pump pulley                    |
| 43 | - | Core plug                            |
| 44 | - | Stud bolts, 3 of                     |
| 45 | - | Coolant drain plug                   |
| 46 | - | Cylinder head locating dowels        |
| 47 | - | Lower oil filter and cooler assembly |
| 48 | - | Seal                                 |
| 49 | - | Upper oil filter and cooler assembly |
| 50 | - | Bolt, 8 of                           |
| 51 | - | Fuel cooler                          |

## Cylinder Block

The cylinders and crankcase are contained in the cylinder block, which is of single cast CGI construction with a hollow beam structure. With this type of construction less material is required than for a conventional cast iron block, therefore, reducing engine weight and length.

### Piston Cooling Jets



E44219

| Item | Part Number | Description        |
|------|-------------|--------------------|
| 1    | -           | Bolt               |
| 2    | -           | Piston cooling jet |

Jets located in the cylinder block provide piston and gudgeon pin lubrication and cooling. These jets spray oil on to the inside of the piston, the oil then flows through two internal wave shaped channels to help cool each piston crown.

Lubrication oil is distributed through the cylinder block, via the main oil gallery and channels bored in the block, to all critical moving parts. These channels divert oil to the main and big-end bearings via holes machined into the crankshaft.

A tapping at the rear RH side of the cylinder block, below the RH cylinder head, connects a pipe to the turbocharger by means of a banjo connection. Oil is supplied, under pressure, via this tapping, from the oil pump to provide lubrication for the turbocharger bearings.

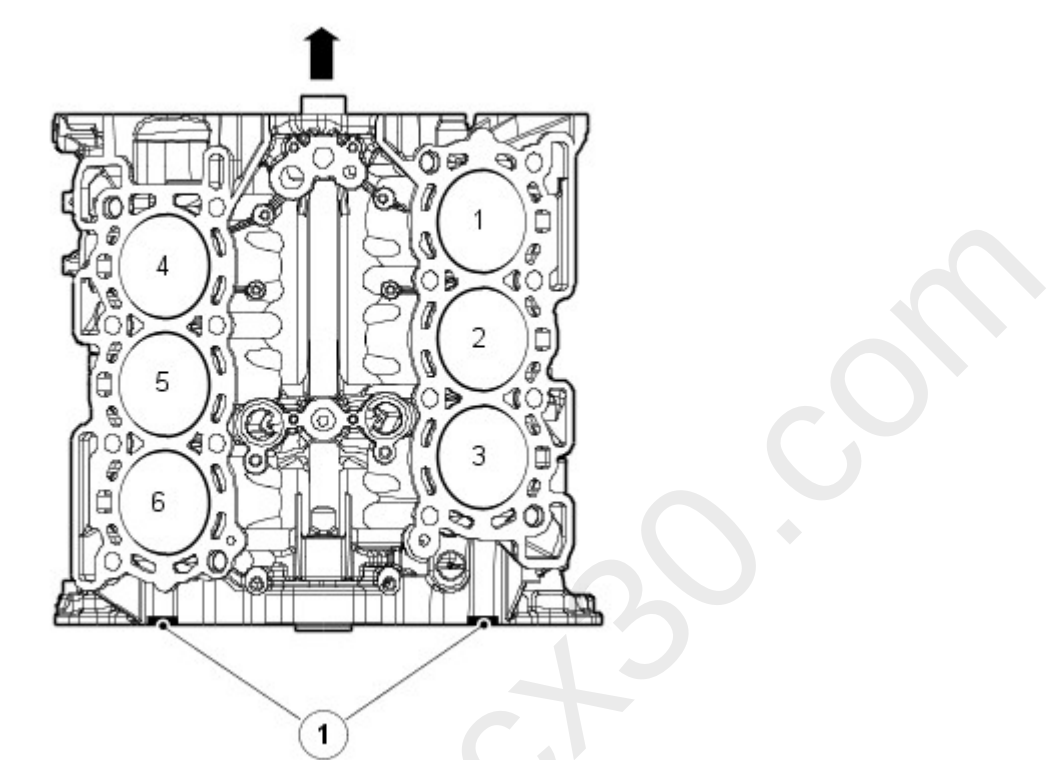
Cylinder cooling is achieved by coolant circulating through chambers in the cylinder block casting.

Two hollow metal dowels are used to locate the cylinder heads to the cylinder block, one on each side at the rear of the unit.

A port is included at the rear LH side of the ladder frame, below the turbocharger, to connect the turbocharger oil return pipe to the sump.

A plug sealing the lubrication cross-drilling gallery is located at the front RH side of the cylinder block. Plugs for the main lubrication gallery are included at the front and rear of the cylinder block.

Engine Data Locations

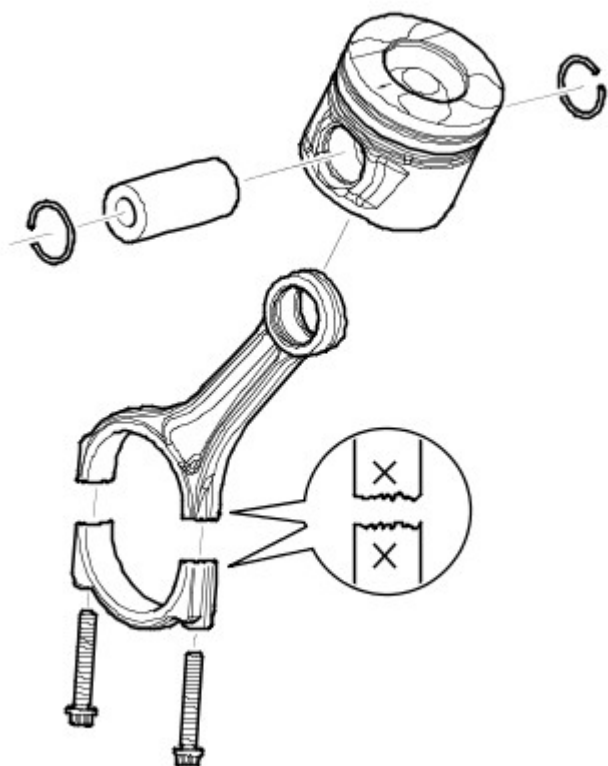


E44217

| Item | Part Number | Description           |
|------|-------------|-----------------------|
| 1    | -           | Engine data locations |

Engine data is marked at two locations at the back of the cylinder block. Component diameters are represented by alphabetical and numerical codes; keys to the codes are in the Service Repair Procedures (SRP) Manual.

Connecting Rods and Pistons

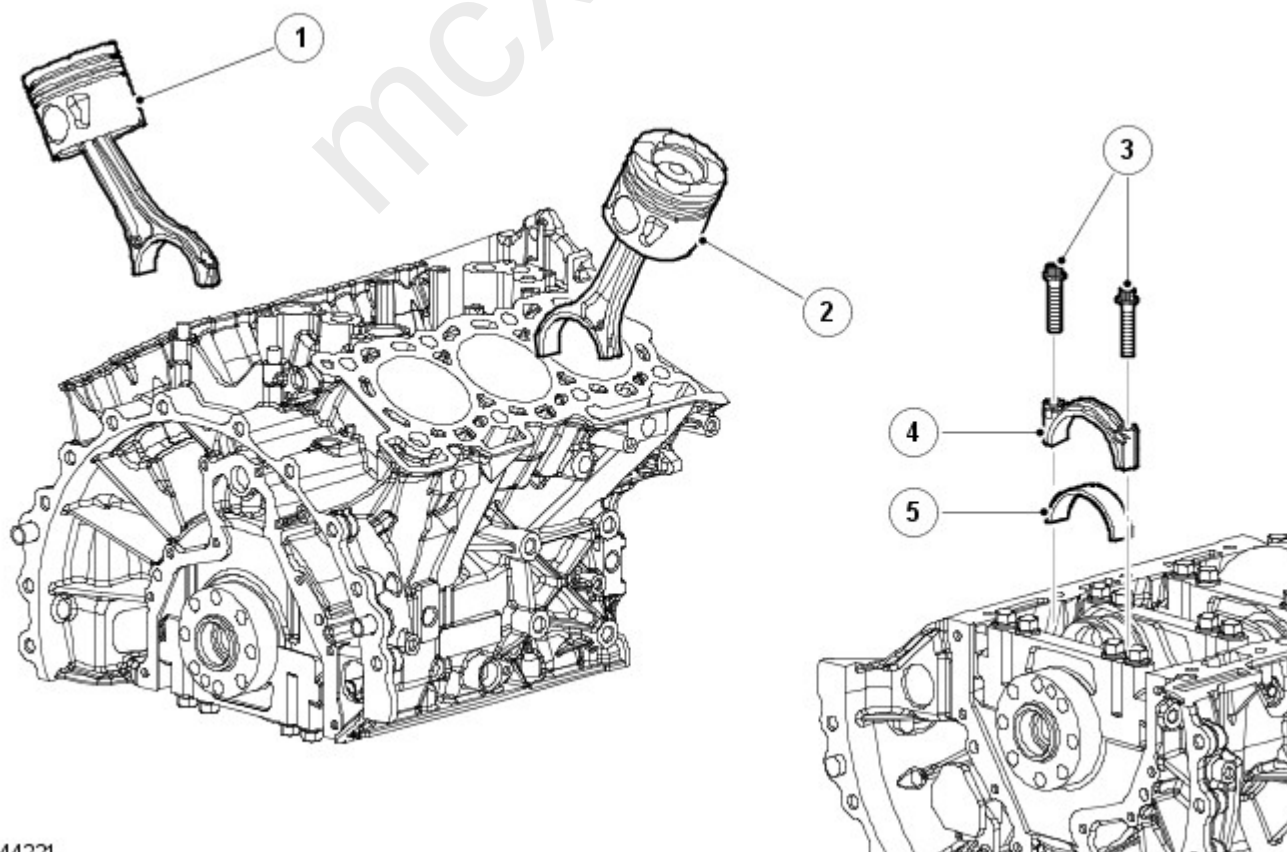


E44220

The connecting rods are manufactured from sinter-forged steel and have fracture-split bearing caps. The bearing caps are produced by fracturing the opposing sides of the connecting rod at the bearing horizontal centre-line. As well as being easier to manufacture, when reassembled the fractured surfaces interlock to form a strong seamless joint. The cylinder position is etched on adjoining sides of the joint to identify matching connecting rods and bearing caps. The selective connecting rod bearings are aluminium/tin split plain bearings. The connecting rod bearing is 'sputter coated', which is a manufacturing process that layers the bearing material to produce a higher load capacity for improved durability.

- **NOTE:** The connecting rods are not selective.

#### Connecting Rod Installation



E44221

| Item | Part Number | Description                                       |
|------|-------------|---------------------------------------------------|
| 1    | -           | Piston and connecting rod assembly, cylinders 4-6 |
| 2    | -           | Piston and connecting rod assembly, cylinders 1-3 |
| 3    | -           | Bolts                                             |
| 4    | -           | Connecting rod bearing cap                        |
| 5    | -           | Connecting rod lower bearing                      |

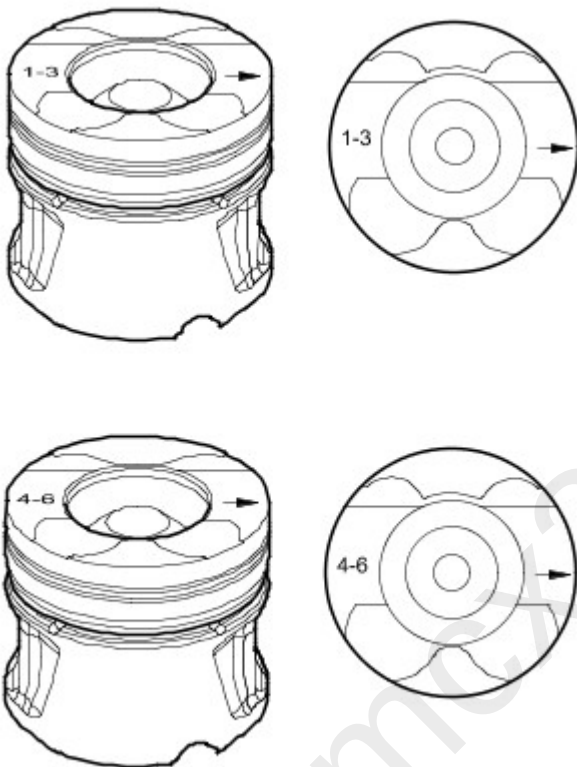
When installing a connecting rod, ensure the back of the connecting rod faces the centre of the 'vee'.

The pistons are made from aluminium alloy and are fitted with three rings. The piston crown incorporates a pronounced bowl; this forms the combustion chamber, which promotes swirl and turbulence necessary for good combustion and improved emissions. In addition, the piston skirt has a molybdenum-coated surface, which counteracts scoring of the cylinder bore and piston.

The piston also incorporates a double wave gallery within the piston crown to enhance piston cooling. The pistons are supplied oil by means of spray jets located in the cylinder block oil gallery. These jets ensure optimum piston cooling to counteract the high temperatures generated by the combustion process.

Each piston is installed on a wrist pin located in a aluminium/tin bushing in the connecting rod.

#### Piston Installation



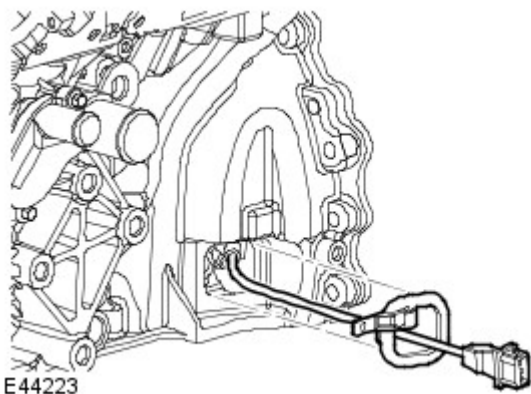
E44222

When installing pistons ensure the arrows on the piston crowns all point to the front of the engine and the pistons are located in the correct cylinder banks, i.e. cylinders 1, 2, 3 or cylinders 4, 5, 6.

- **NOTE:** All pistons are common single grade/single part number for all engines.

The piston top ring is a taper type and is fitted with the taper to the top of the piston. All rings marked 'top' are assembled with 'top' uppermost. All rings must be spaced evenly around the piston before installing. The circumference gap of the double bevelled oil control ring must be opposite the spiral control joint.

#### Crankshaft Position Sensor



The Crankshaft Position (CKP) sensor is located at the rear of the crankshaft, behind the flywheel in the LH side of the rear oil seal retainer. The sensor provides an input of engine crankshaft speed and position. The sensor works on the principle of the Hall effect and scans a trigger wheel (magnetic disc) on the crankshaft. An air gap of 0.4 to 1.5mm, between the trigger wheel and the CKP sensor, is achieved by the positional mounting of the sensor. For additional information, refer to: [Electronic Engine Controls](#) (303-14A Electronic Engine Controls - TDV6 2.7L Diesel, Description and Operation).

### Starter Motor

The engine starter motor is installed at the rear RH side of the ladder frame, at the cylinder block to ladder frame split line. For additional information, refer to: [Starting System](#) (303-06A Starting System - TDV6 2.7L Diesel, Description and Operation).

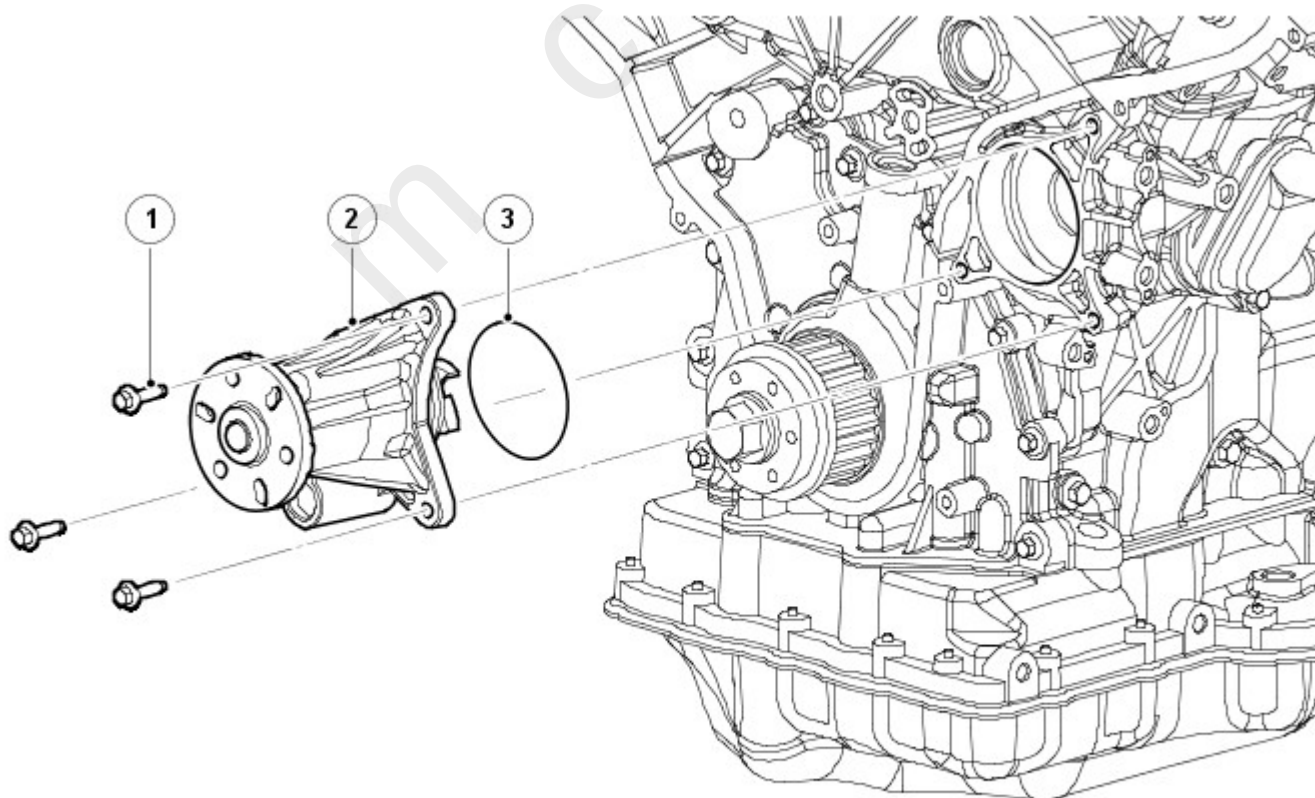
### Coolant Drain Plug

Two coolant drain plugs are installed in the cylinder block, one is fitted in the rear RH side, and the other is fitted in the middle of the cylinder block on the LH side.

### Cylinder Block Heater

On vehicles destined for cold climates, a cylinder block heater replaces a core plug in the middle of the cylinder block on the LH side.

### Coolant Pump



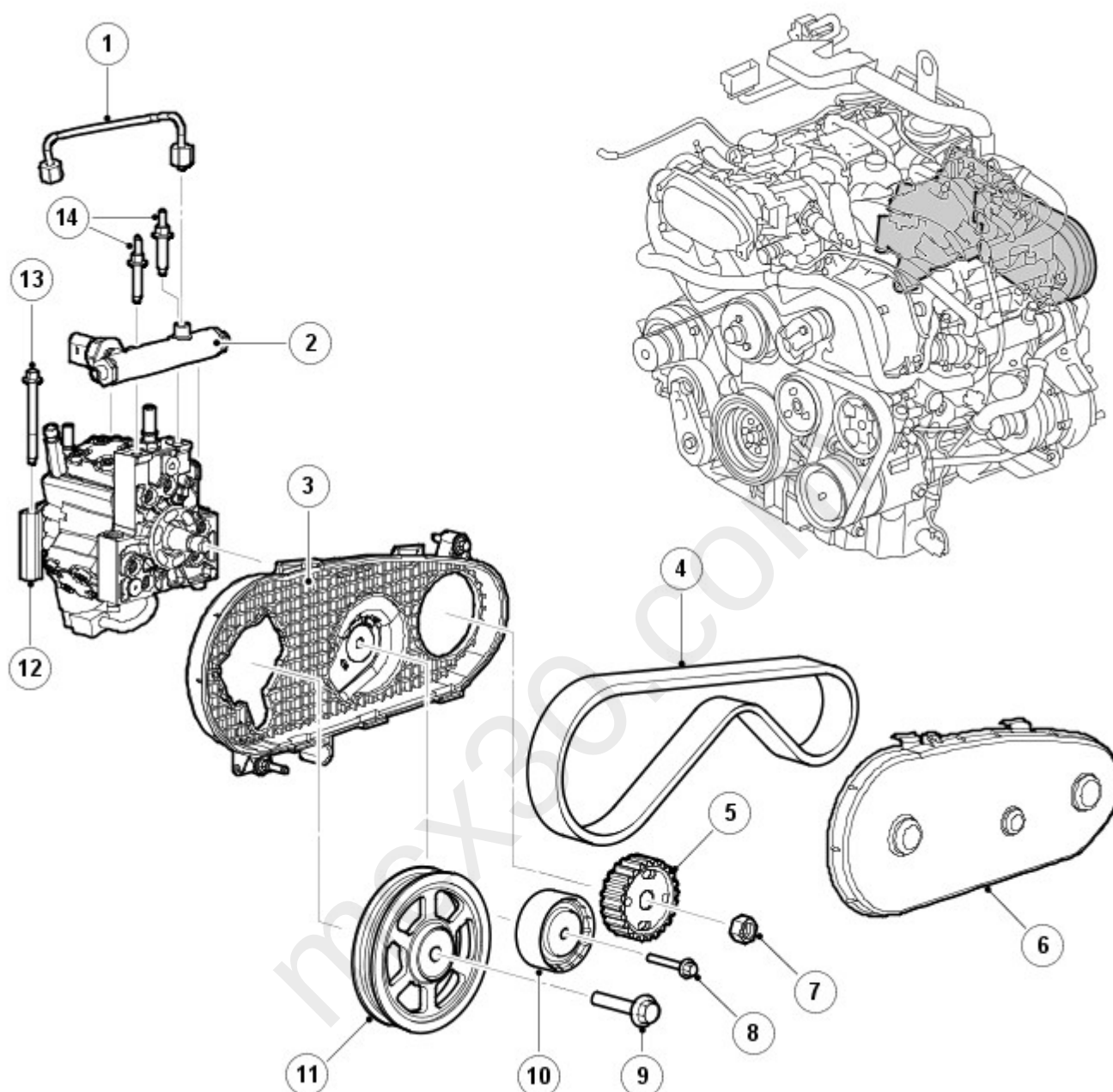
E44224

| Item | Part Number | Description |
|------|-------------|-------------|
| 1    | -           | Bolts       |

|   |   |               |
|---|---|---------------|
| 2 | - | Water pump    |
| 3 | - | 'O' ring seal |

The coolant pump is installed on the LH side of the cylinder block front face and is secured and sealed via three bolts and an 'O' ring seal. The coolant pump is driven by a poly-vee belt via the crankshaft.

### High-Pressure Fuel Pump



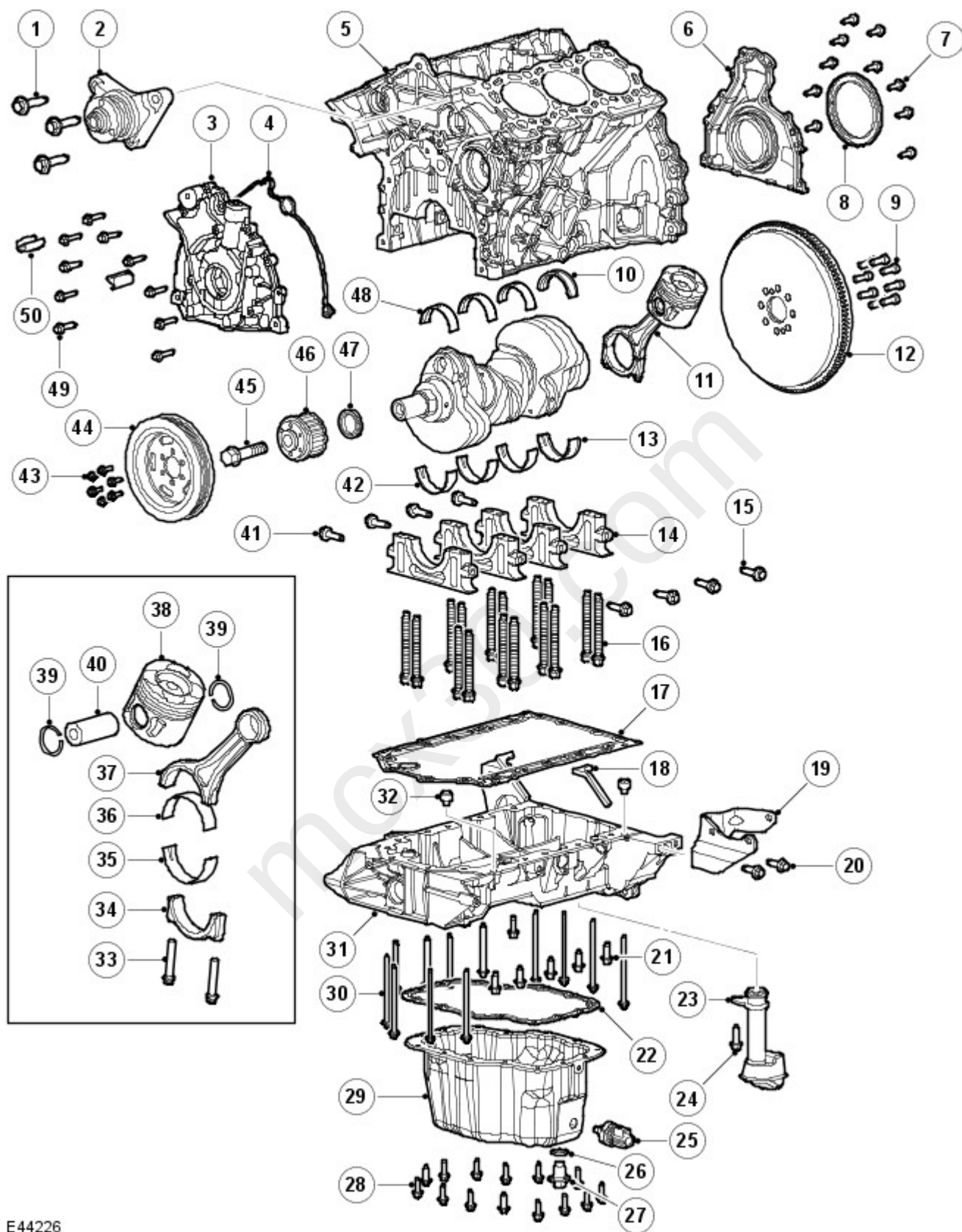
E44225

| Item | Part Number | Description                |
|------|-------------|----------------------------|
| 1    | -           | Fuel pipe                  |
| 2    | -           | Diverter rail assembly     |
| 3    | -           | Rear cover                 |
| 4    | -           | Belt                       |
| 5    | -           | Fuel pump pulley           |
| 6    | -           | Front cover                |
| 7    | -           | Nut                        |
| 8    | -           | Bolt                       |
| 9    | -           | Bolt                       |
| 10   | -           | Tensioner                  |
| 11   | -           | LH exhaust camshaft pulley |
| 12   | -           | High pressure fuel pump    |
| 13   | -           | Bolt                       |
| 14   | -           | Stud bolts                 |

The high-pressure fuel pump supplies the common rail with fuel and is fixed to the rear of the cylinder block in the centre of the 'vee'. The pump is a 3 radial piston type controlled by the EMS and belt driven from the exhaust camshaft of the LH cylinder head.

For additional information, refer to: [Electronic Engine Controls](#) (303-14A Electronic Engine Controls - TDV6 2.7L Diesel,

## CRANKSHAFT AND SUMP COMPONENTS



E44226

| Item | Part Number | Description            |
|------|-------------|------------------------|
| 1    | -           | Bolts, 3 of            |
| 2    | -           | Fan driver bracket     |
| 3    | -           | Oil pump               |
| 4    | -           | Seal                   |
| 5    | -           | Cylinder block         |
| 6    | -           | Rear oil seal retainer |

|    |   |                                          |
|----|---|------------------------------------------|
| 7  | - | Bolts, 10 of                             |
| 8  | - | Crankshaft position sensor trigger wheel |
| 9  | - | Bolts, 8 of                              |
| 10 | - | Main thrust bearing, upper               |
| 11 | - | Piston and connecting rod assembly       |
| 12 | - | Flywheel                                 |
| 13 | - | Lower main thrust bearing                |
| 14 | - | Main bearing caps, 4 of                  |
| 15 | - | Cross bolts, 4 of                        |
| 16 | - | Main bearing cap bolts, 16 of            |
| 17 | - | Gasket                                   |
| 18 | - | Seal                                     |
| 19 | - | Bracket                                  |
| 20 | - | Bolts, 2 of                              |
| 21 | - | Bolts, 6 of                              |
| 22 | - | Gasket                                   |
| 23 | - | Oil pick-up                              |
| 24 | - | Bolt                                     |
| 25 | - | Oil temperature sensor                   |
| 26 | - | Seal                                     |
| 27 | - | Drain plug                               |
| 28 | - | Bolts, 14 of                             |
| 29 | - | Oil pan assembly                         |
| 30 | - | Bolts, 12 of                             |
| 31 | - | Ladder frame                             |
| 32 | - | Dowel                                    |
| 33 | - | Bolts, 2 of                              |
| 34 | - | Connecting rod cap                       |
| 35 | - | Connecting rod cap bearing               |
| 36 | - | Connecting rod bearing                   |
| 37 | - | Connecting rod                           |
| 38 | - | Piston                                   |
| 39 | - | Piston pin retainer                      |
| 40 | - | Piston pin                               |
| 41 | - | Cross bolts, 4 of                        |
| 42 | - | Lower main bearings                      |
| 43 | - | Bolts, 5 of                              |
| 44 | - | Crankshaft damper pulley                 |
| 45 | - | Bolt                                     |
| 46 | - | Crankshaft drive pulley                  |
| 47 | - | Crankshaft front oil seal                |
| 48 | - | Upper main bearings                      |
| 49 | - | Bolts, 10 of                             |
| 50 | - | Seal                                     |

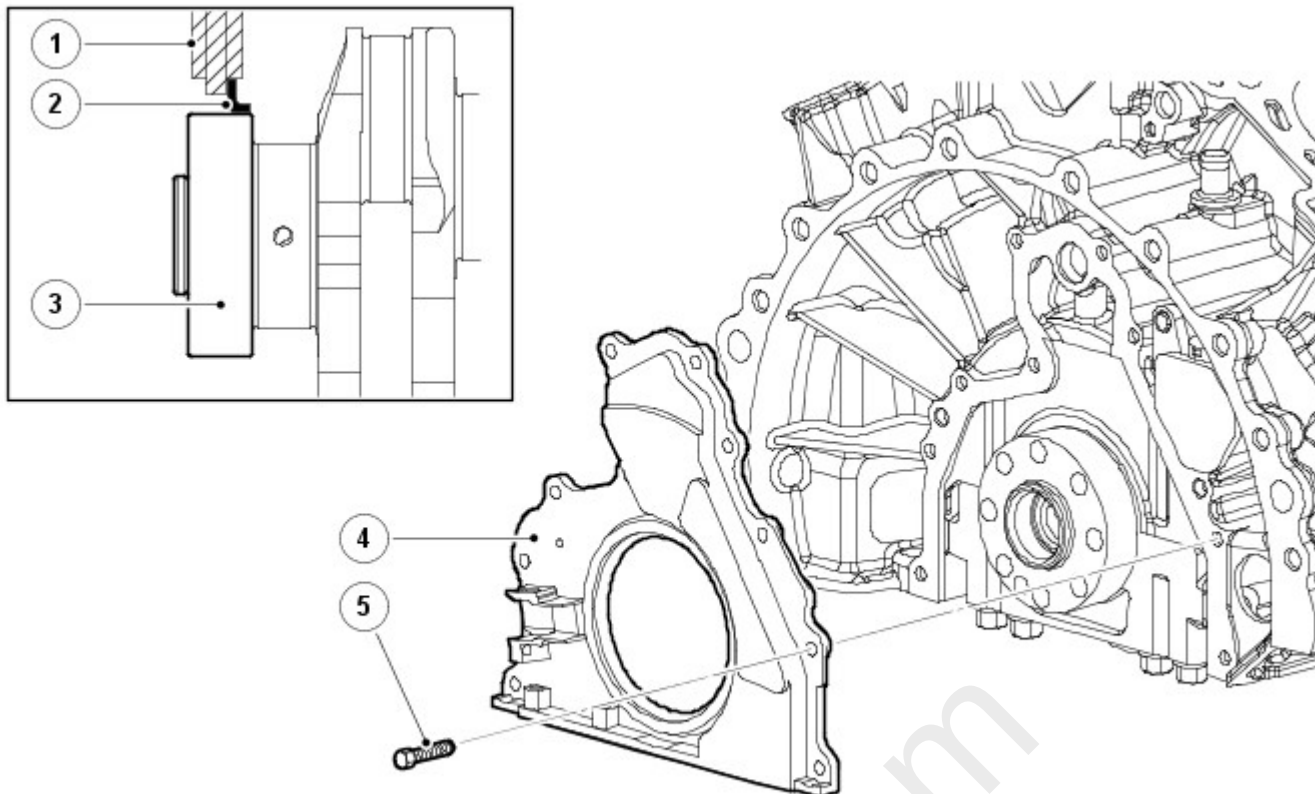
## Crankshaft

The crankshaft is forged steel and fillet rolled with induction hardened journals, which run in four bearings with clamped two layer bearing shells.

The main bearing caps are double and cross-bolted, this adds to the strength and rigidity of the engine block.

The crankshaft drive pulley is not keyed onto the crankshaft; it is secured to the crankshaft by a single bolt.

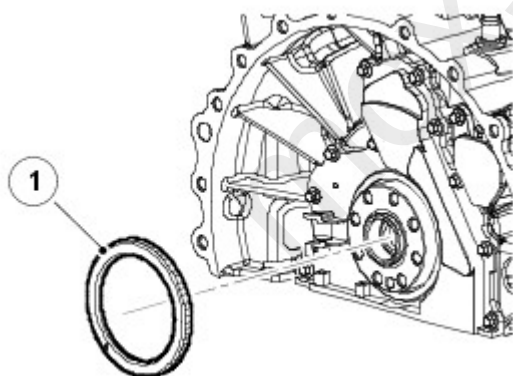
- NOTE: Under no circumstances must the crankshaft pulley be tightened or loosened with the timing belt fitted.
- NOTE: Do not attempt to remove the crankshaft drive pulley unless you have the correct special crankshaft-locking tool.



E44227

| Item | Part Number | Description            |
|------|-------------|------------------------|
| 1    | -           | Housing                |
| 2    | -           | Seal                   |
| 3    | -           | Crankshaft             |
| 4    | -           | Rear oil seal retainer |
| 5    | -           | Bolt                   |

The crankshaft rear oil seal is a press fit in the rear oil seal retainer. The rear oil seal retainer also houses the CKP sensor.



E44228

| Item | Part Number | Description              |
|------|-------------|--------------------------|
| 1    | -           | CKP sensor trigger wheel |

The trigger wheel is located on the rear of the crankshaft. It is pressed onto the crankshaft using a special tool, which also precisely aligns the trigger wheel for crankshaft position and timing. The trigger wheel consists of 60 magnets, minus 2 for ECM crankshaft position reference and synchronisation. The magnets cannot be seen on the trigger-wheel; therefore, it can only be positioned using the special tool.

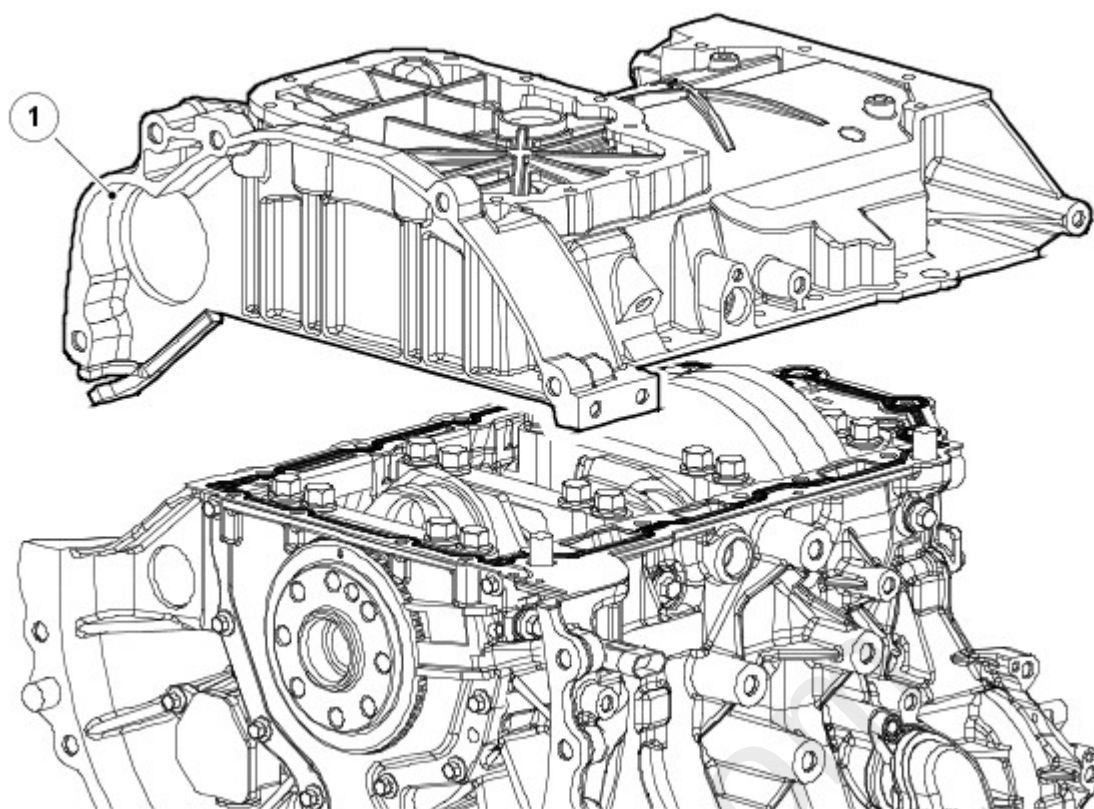
The CKP sensor air gap is 0.4mm to 0.5mm there is no adjustment. The sensor bolts into the rear oil seal retainer and the tolerance on the retainer and sensor gives an air gap within the specified range.

• **NOTE:** If the trigger wheel is removed for any reason, a new trigger wheel must be fitted. Do not reuse the old trigger wheel.

## Main Bearings

The main bearings are aluminium/tin split plain selective bearings. An oil groove in the top half of each bearing transfers oil into the crankshaft for lubrication of the connecting rod bearings. The upper and lower shells of bearing number four contain integral thrust washers, which limits the end float of the crankshaft.

## Ladder Frame



E44229

| Item | Part Number | Description  |
|------|-------------|--------------|
| 1    | -           | Ladder frame |

The ladder frame is fitted to the lower cylinder block to stiffen the base structure thus helping to reduce Noise, Vibration and Harshness (NVH). The frame is made of high-pressure die cast aluminium and also incorporates an oil baffle plate to reduce oil foaming and slosh.

The ladder frame is secured to the cylinder block with 2 dowels, 2 locator pins for the gasket and 18 retaining bolts; three different lengths of bolts are used:

- M6 x 20, 6 of
- M8 x 75, 4 of
- M6 x 105, 8 of

Iron inserts, cast into the main bearing supports of the ladder frame, minimise main bearing clearance changes due to heat expansion.

A gasket seals the joint between the ladder frame and the cylinder block.

A port for the oil level gauge tube is included in the casting on the LH side of the ladder frame.

An oil pick-up pipe with integral strainer locates in the front of the ladder frame to provide oil to the crankshaft driven oil pump.

## Sump

The sump consists of a pressed steel oil pan bolted to the aluminium alloy ladder frame with 14 M6 x 16 bolts. The engine oil drain plug and the oil temperature sensor are located at the rear left corner of the sump.

A reusable gasket seals the joint between the oil pan and the ladder frame; a bead of sealant seals the joint between the sump and the ladder frame.

## Oil Temperature Sensor

The engine oil temperature sensor is located at the rear left corner of the sump. The sensor provides the ECM and the instrument pack with the engine oil temperature status.

The sensor circuit consists of an internal voltage divider circuit which, incorporates an Negative Temperature Coefficient (NTC) thermistor. As the engine oil temperature rises the resistance through the sensor decreases and visa versa. The output from the sensor is the change in voltage, as the thermistor allows more current to pass to earth relative to the temperature of the oil.

For additional information, refer to: [Electronic Engine Controls](#) (303-14A Electronic Engine Controls - TDV6 2.7L Diesel, Description and Operation).

## Rear Oil Seal Retainer

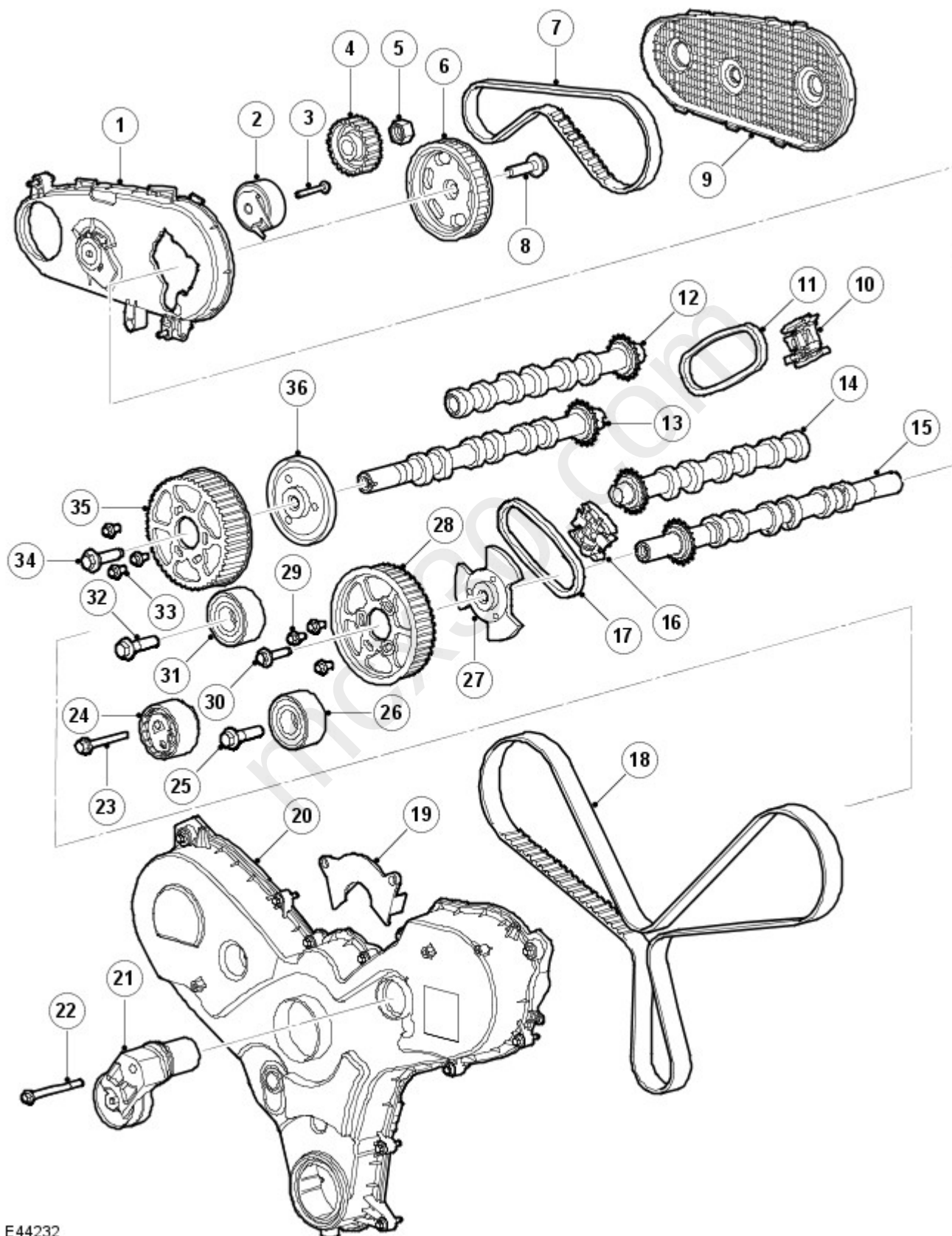
The crankshaft rear oil seal retainer is attached to the rear of the cylinder block by ten bolts and is sealed with a rubber seal. The retainer also houses the crankshaft position sensor.

## Dual Mass Flywheel

On vehicles with manual transmission, the dual mass flywheel is bolted on the rear of the crankshaft with eight bolts. A dowel on the crankshaft flange ensures that the flywheel is correctly located. A ring gear is fitted on the outer diameter of the flywheel. The ring gear is not serviceable.

The dual mass flywheel is used to insulate the gearbox from torsional and transient vibrations produced by the engine. For additional information, refer to: [Clutch](#) (308-01 Clutch - TDV6 2.7L Diesel, Description and Operation).

## CAMSHAFT TIMING COMPONENTS



E44232

| Item | Part Number | Description |
|------|-------------|-------------|
|------|-------------|-------------|

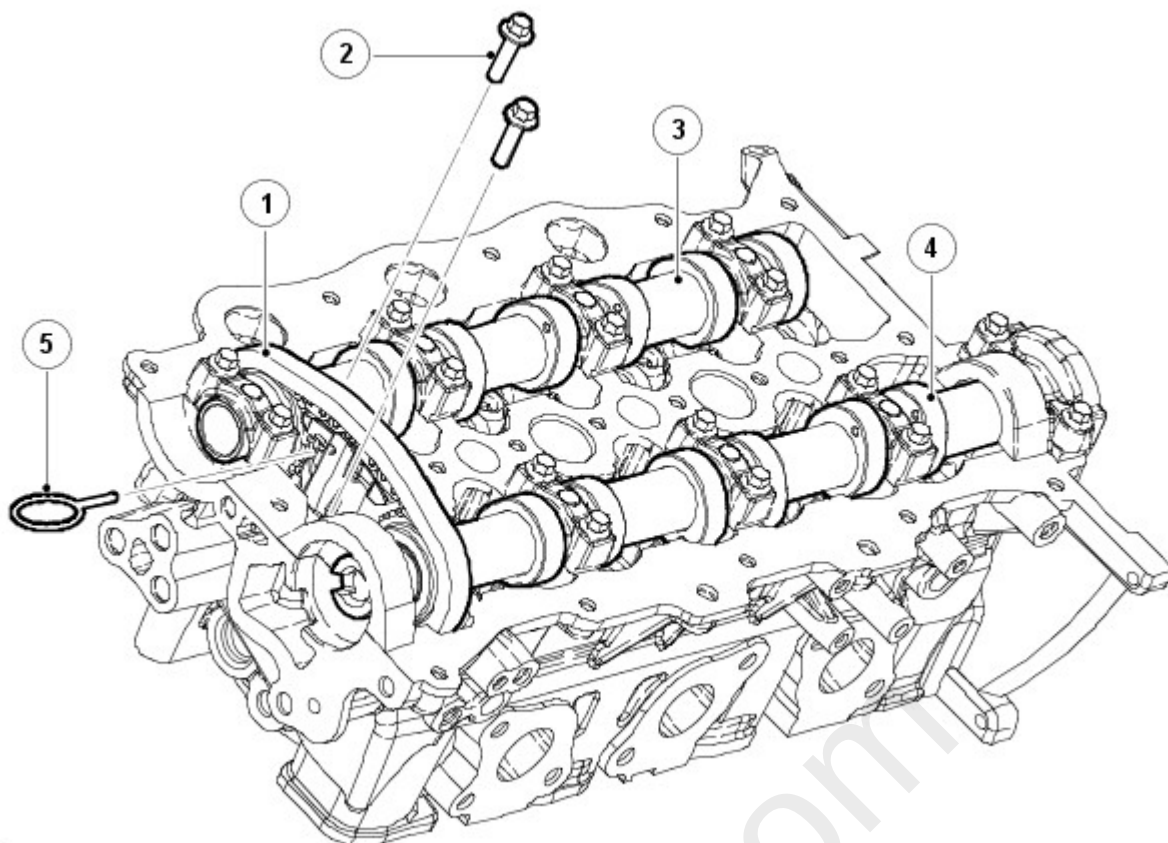
|    |   |                                               |
|----|---|-----------------------------------------------|
| 1  | - | Rear Engine Accessory Drive (READ) rear cover |
| 2  | - | READ tensioner                                |
| 3  | - | Bolt                                          |
| 4  | - | Fuel pump pulley                              |
| 5  | - | Nut                                           |
| 6  | - | READ camshaft pulley                          |
| 7  | - | READ belt                                     |
| 8  | - | Bolt                                          |
| 9  | - | READ front cover                              |
| 10 | - | RH chain tensioner                            |
| 11 | - | RH timing chain                               |
| 12 | - | RH inlet camshaft                             |
| 13 | - | RH exhaust camshaft                           |
| 14 | - | LH inlet camshaft                             |
| 15 | - | LH exhaust camshaft                           |
| 16 | - | LH chain tensioner                            |
| 17 | - | LH timing chain                               |
| 18 | - | Timing belt                                   |
| 19 | - | Front cover bridge                            |
| 20 | - | Primary drive cover                           |
| 21 | - | Idler                                         |
| 22 | - | Bolt                                          |
| 23 | - | Bolt                                          |
| 24 | - | Tensioner                                     |
| 25 | - | Bolt                                          |
| 26 | - | Idler                                         |
| 27 | - | Camshaft hub                                  |
| 28 | - | LH camshaft timing pulley                     |
| 29 | - | Bolt, 3 of                                    |
| 30 | - | Bolt, 1 of                                    |
| 31 | - | Idler                                         |
| 32 | - | Bolt, 1 of                                    |
| 33 | - | Bolt, 3 of                                    |
| 34 | - | Bolt, 1 of                                    |
| 35 | - | RH camshaft timing pulley                     |
| 36 | - | Camshaft hub                                  |

### Primary Drive

Primary drive is provided by a single toothed belt from the crankshaft to the exhaust camshaft gears of each cylinder bank via two idler pulleys and a tensioner.

Timing belt adjustment is carried out by an eccentric type tensioner mounted on the RH front face of the cylinder block.

### Secondary Drive



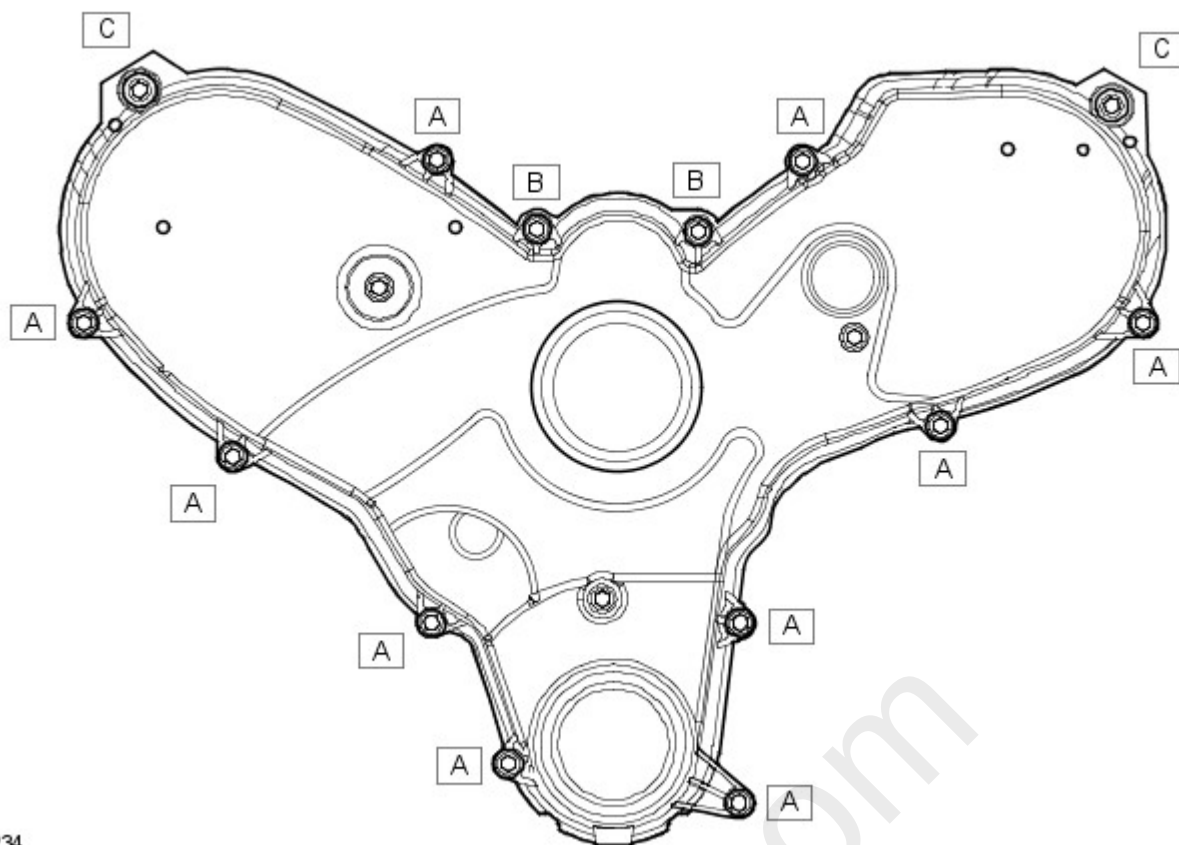
E44233

| Item | Part Number | Description          |
|------|-------------|----------------------|
| 1    | -           | Timing chain         |
| 2    | -           | Bolts                |
| 3    | -           | Inlet camshaft       |
| 4    | -           | Exhaust camshaft     |
| 5    | -           | Tensioner firing pin |

Secondary drive is provided by two short crossover chains, which transfer drive from the exhaust camshaft gears to the inlet camshaft gears. The crossover drives are located at the rear of the RH cylinder bank and the front of the LH cylinder bank. This allows for a much shorter and simpler run for the main camshaft drive belt at the front of the engine.

Each crossover chain is tensioned via an automatic chain tensioner, which acts directly on the chains via a guide rail. The tensioners are located between the exhaust and inlet camshafts at the front or rear of the cylinder head, depending on the cylinder bank.

#### Timing Cover

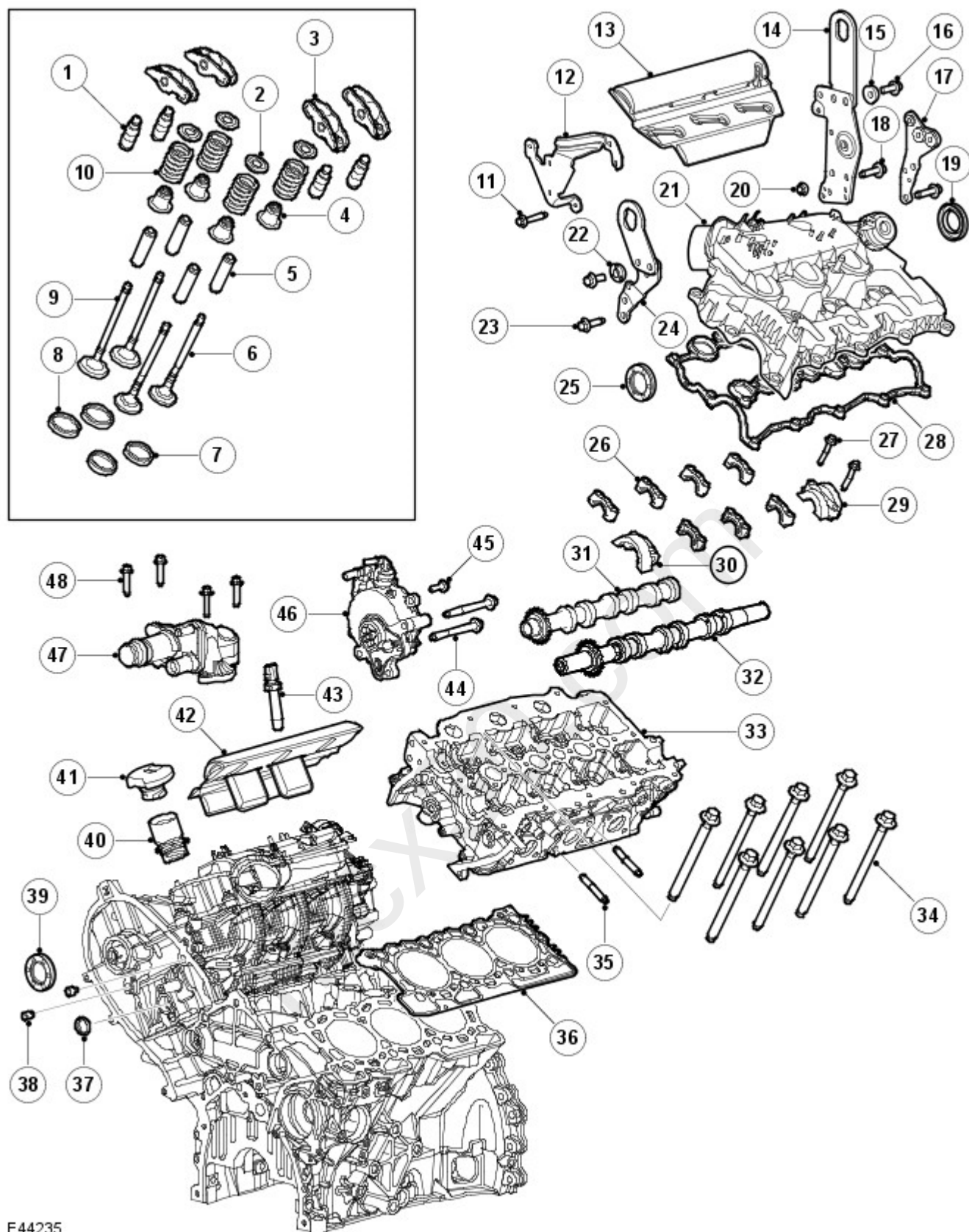


E44234

| Item | Part Number | Description           |
|------|-------------|-----------------------|
| A    | -           | Bolt (M6 x 32), 13 of |
| B    | -           | Bolt (M6 x 36), 2 of  |
| C    | -           | Bolt (M6 x 30), 2 of  |

The plastic timing cover is bolted to the front of the cylinder block and cylinder heads with sixteen bolts and sealed with a rubber seal.

## CYLINDER HEAD COMPONENTS

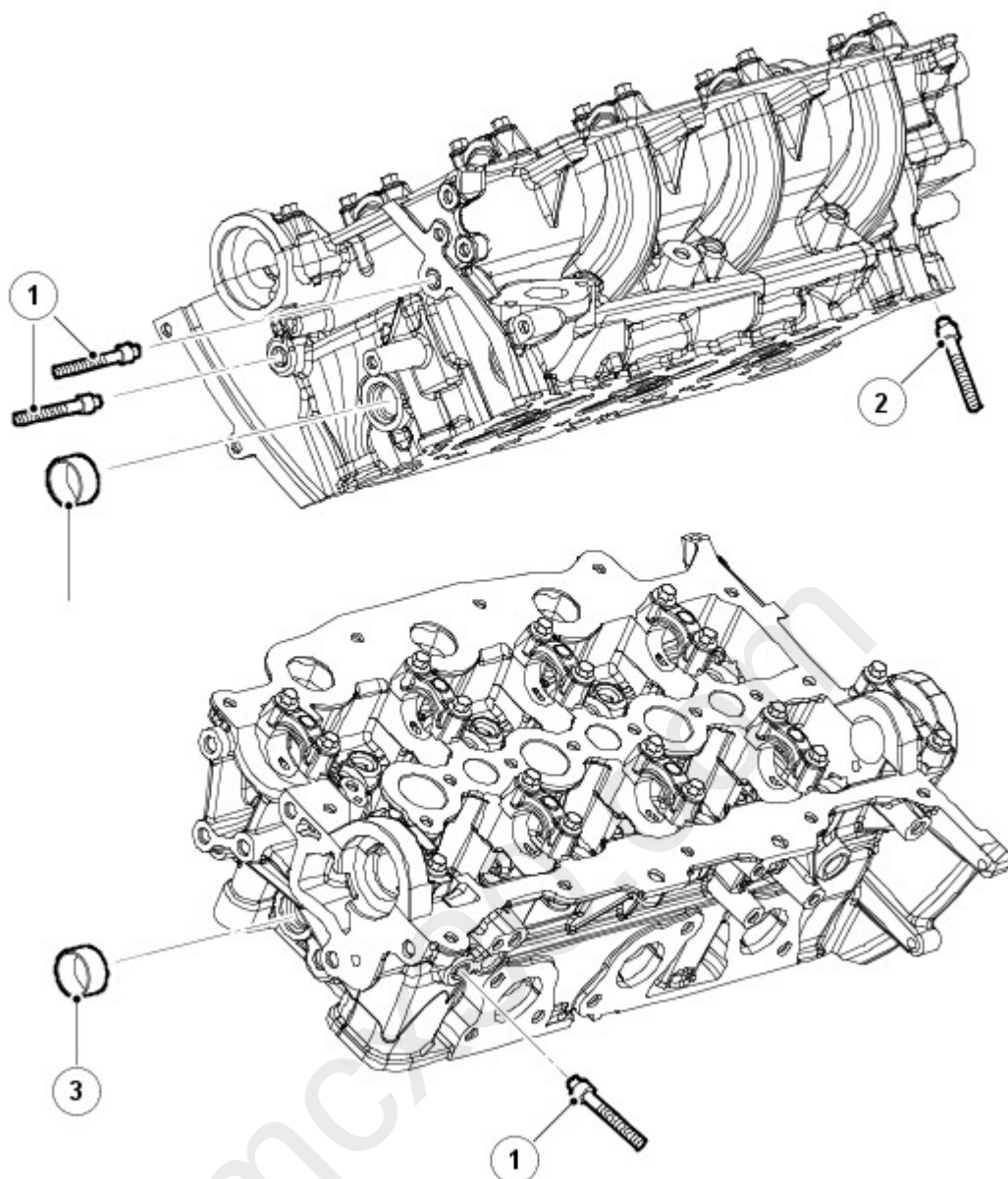


E44235

| Item | Part Number | Description              |
|------|-------------|--------------------------|
| 1    | -           | Hydraulic lash adjusters |
| 2    | -           | Valve spring retainers   |
| 3    | -           | Roller rockers           |
| 4    | -           | Valve stem seals         |
| 5    | -           | Valve guides             |
| 6    | -           | Exhaust valves           |
| 7    | -           | Intake valves            |
| 8    | -           | Exhaust valve seats      |
| 9    | -           | Intake valve seats       |
| 10   | -           | Valve springs            |
| 11   | -           | Bolt                     |

|    |   |                                       |
|----|---|---------------------------------------|
| 12 | - | Bracket                               |
| 13 | - | Cover                                 |
| 14 | - | Lifting eye                           |
| 15 | - | Washer                                |
| 16 | - | Bolt                                  |
| 17 | - | Bracket                               |
| 18 | - | Bolt                                  |
| 19 | - | Seal                                  |
| 20 | - | Cap                                   |
| 21 | - | Inlet manifold cover assembly         |
| 22 | - | Washer                                |
| 23 | - | Bolt                                  |
| 24 | - | Lifting eye                           |
| 25 | - | Seal                                  |
| 26 | - | Camshaft bearing caps                 |
| 27 | - | Bolts                                 |
| 28 | - | Gasket                                |
| 29 | - | Camshaft bearing cap and seal housing |
| 30 | - | Camshaft bearing cap and seal housing |
| 31 | - | Inlet camshaft                        |
| 32 | - | Exhaust camshaft                      |
| 33 | - | LH cylinder head                      |
| 34 | - | Cylinder head bolts                   |
| 35 | - | Exhaust manifold studs                |
| 36 | - | LH cylinder head gasket               |
| 37 | - | Core plug                             |
| 38 | - | Plug                                  |
| 39 | - | Seal                                  |
| 40 | - | Oil filler tube                       |
| 41 | - | Oil filler cap                        |
| 42 | - | Cover                                 |
| 43 | - | Injectors                             |
| 44 | - | Bolts                                 |
| 45 | - | Bolt                                  |
| 46 | - | Vacuum pump                           |
| 47 | - | Water outlet assembly                 |
| 48 | - | Bolts                                 |

#### Cylinder Heads



E44236

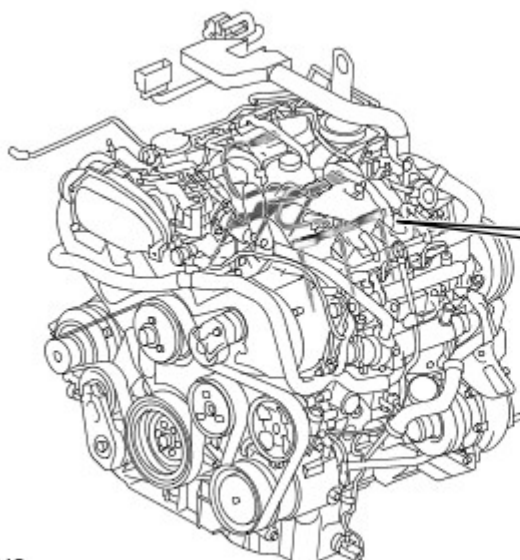
The aluminium gravity die cast cylinder heads are unique to each cylinder bank. Eight deep-seated bolts, to reduce distortion, secure each cylinder head to the cylinder block. The cylinder head bolts are located beneath the camshafts, four under the inlet camshaft and four under the exhaust camshaft. Two hollow dowels align each cylinder head with the cylinder block.

- NOTE: The cylinder head bolts are not accessible with the camshafts fitted.
- NOTE: The cylinder head cannot be reworked.

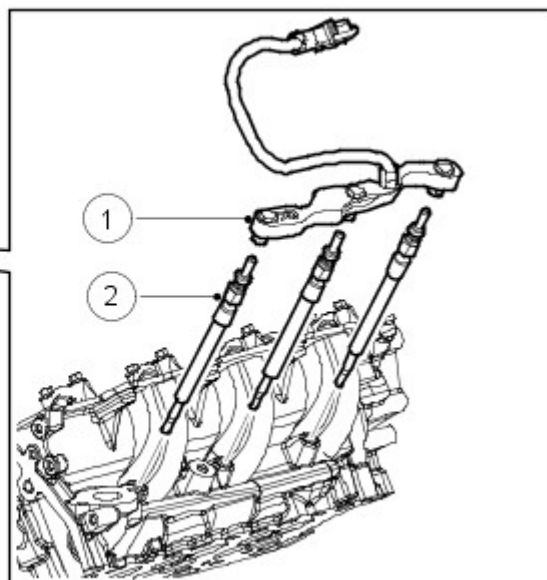
The cylinder head has four ports machined at each cylinder location, two exhaust ports and two inlet ports. One of the inlet ports is helical and functions as a swirl port, the other is arranged laterally as a tangential port and functions as a charge port.

The six fuel injection nozzles are centrally mounted; one above each cylinder and each is fixed to the cylinder head by means of a clamp and two M6 x 35 bolts.

For additional information, refer to: [Electronic Engine Controls](#) (303-14A Electronic Engine Controls - TDV6 2.7L Diesel, Description and Operation) / [Fuel Charging and Controls](#) (303-04A Fuel Charging and Controls - TDV6 2.7L Diesel, Description and Operation).

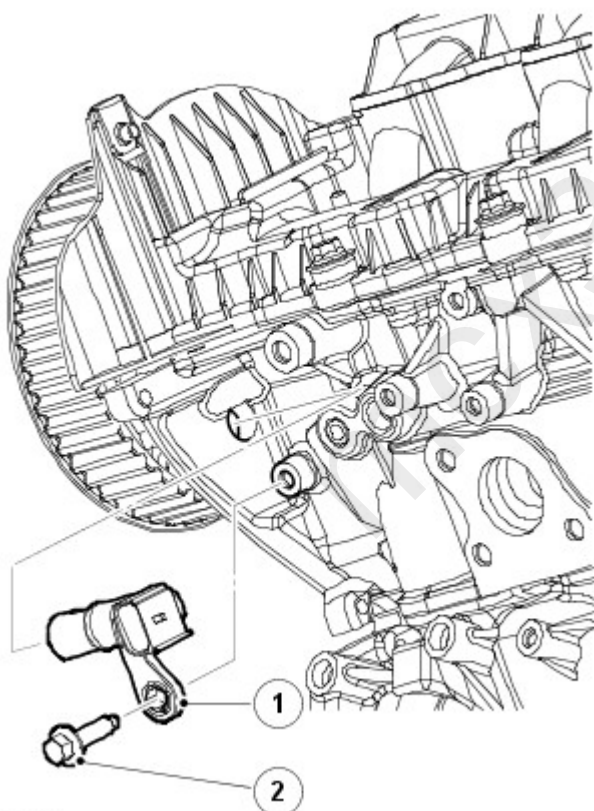


E44240



| Item | Part Number | Description       |
|------|-------------|-------------------|
| 1    | -           | Harness connector |
| 2    | -           | Glow plugs        |

The glow plugs are arranged centrally on the inlet side of the cylinder head, between the two inlet ports of each cylinder. For additional information, refer to: [Electronic Engine Controls](#) (303-14A Electronic Engine Controls - TDV6 2.7L Diesel, Description and Operation).



E44241

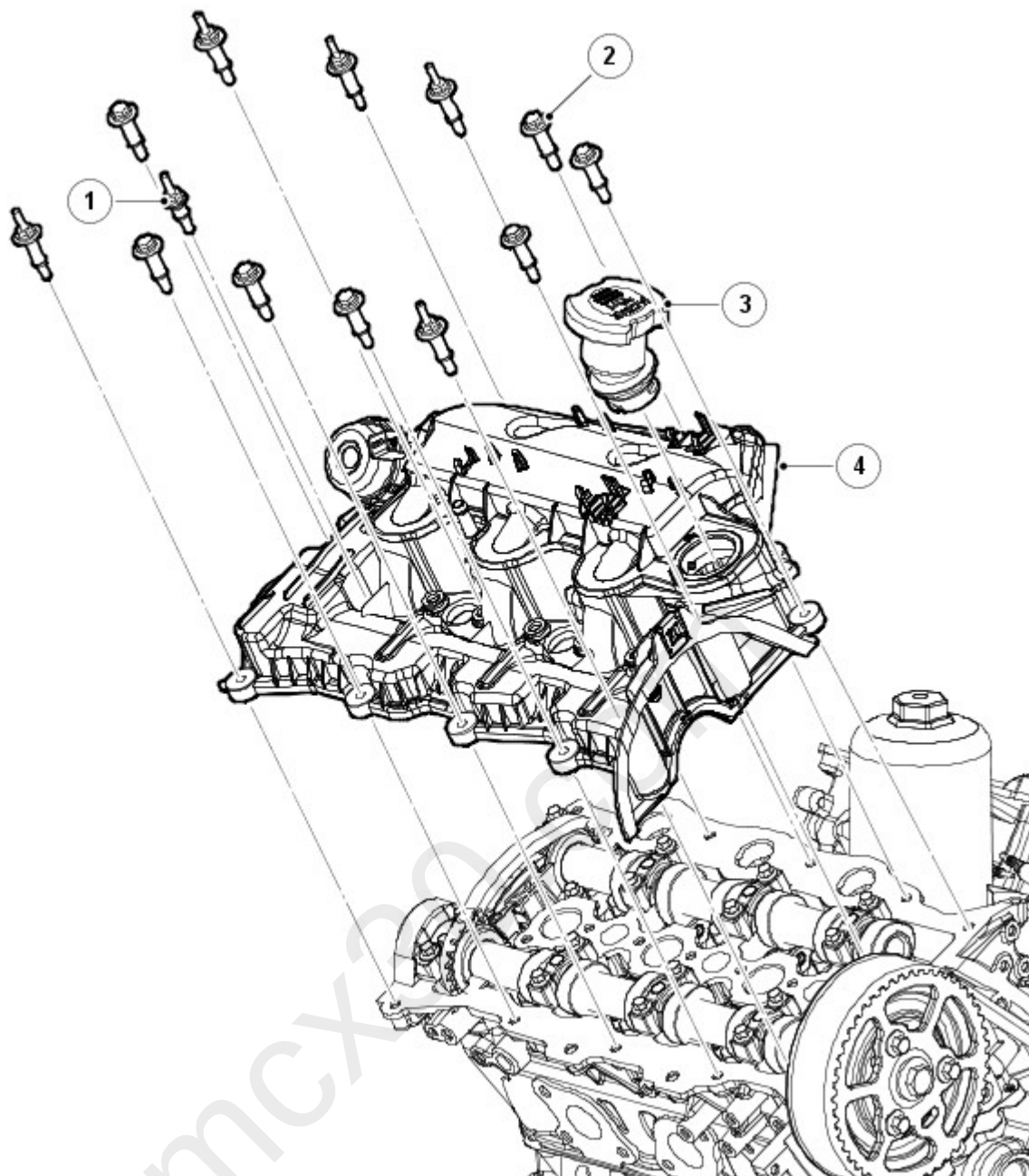
| Item | Part Number | Description                    |
|------|-------------|--------------------------------|
| 1    | -           | Camshaft Position (CMP) sensor |

The CMP sensor locates through a hole in a flange on the front LH side of the LH cylinder head. The exhaust camshaft gear of the LH cylinder head incorporates a trigger wheel, which is used in conjunction with the sensor to measure engine position.

For additional information, refer to: [Electronic Engine Controls](#) (303-14A Electronic Engine Controls - TDV6 2.7L Diesel, Description and Operation).

The engine lifting eyes are bolted to the cylinder head, one at the front and two at the rear, one per cylinder head.

#### Camshaft Covers



E44237

| Item | Part Number | Description                |
|------|-------------|----------------------------|
| 1    | -           | Stud bolt M6 x 40, 6 of    |
| 2    | -           | Bolt M6 x 40, 7 of         |
| 3    | -           | Oil filler aperture        |
| 4    | -           | RH camshaft cover assembly |

The camshaft covers are manufactured from vinyl ester composite. The RH bank camshaft cover incorporates an outlet for the full load engine breather and the engine oil filler cap. The LH bank camshaft cover incorporates an outlet for the part load engine breather.

For additional information, refer to: [Engine Emission Control](#) (303-08A Engine Emission Control - TDV6 2.7L Diesel, Description and Operation).

Silicon rubber in-groove gaskets seal the joints between the camshaft covers and the cylinder heads. Together with spacers and seals on the camshaft cover fasteners, they also isolate the covers from direct contact with the cylinder heads, to reduce noise.

### Cylinder Head Gasket

The cylinder head gasket is a three-layer, laminated steel type and is available in five different thickness. The choice of gasket thickness is dependent on the maximum piston protrusion. Gasket thickness is identified by serrations cut into the front end of the gasket.

**Gasket Selection Table**

| Piston Protrusion (mm) | Gasket Thickness (mm) | Identification |
|------------------------|-----------------------|----------------|
| 0.541 - 0.590          | 1.12                  | 1              |
| 0.591 - 0.640          | 1.17                  | 2              |
| 0.641 - 0.690          | 1.22                  | 3              |
| 0.691 - 0.740          | 1.27                  | 4              |

| Piston Protrusion (mm) | Gasket Thickness (mm) | Identification |
|------------------------|-----------------------|----------------|
| 0.741 - 0.790          | 1.32                  | 5              |

To calculate the correct cylinder head gasket thickness, each piston must be measured at two points, with an average of the two measurements taken to determine the piston protrusion. The highest of the three measurements will determine the gasket required for that particular cylinder head.

- **NOTE:** The difference between the maximum and minimum protrusion measurement in any one bank should not be greater than 0.1mm. It is permissible to have a different grade of gaskets between the LH and RH banks.

## Camshafts

The camshafts are of a hollow steel tube construction, with pressed on sintered lobes. Each camshaft is retained by aluminium alloy caps, five for the exhaust camshafts and four for the inlet camshafts. Location letters, A to I for the intake camshaft and R to Z for the exhaust camshaft, are marked on the outer faces of the caps for each cylinder head.

The LH cylinder bank exhaust camshaft is machined to accept a rear camshaft gear. The rear camshaft gear provides drive for High Pressure (HP) fuel pump, located centrally at the rear of the 'vee', via a short-toothed belt and tensioner pulley.

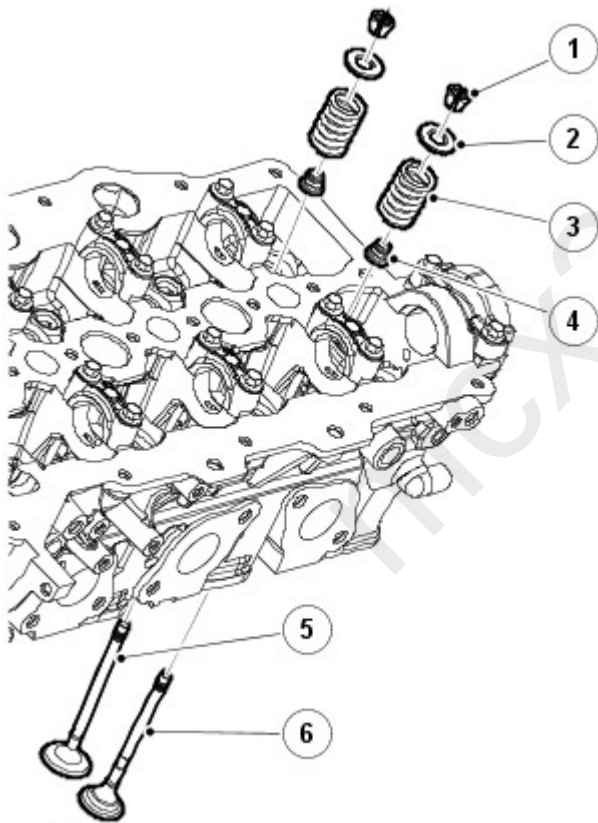
The RH cylinder head exhaust camshaft is machined at the rear end to provide a drive connection for the vacuum pump.

- **NOTE:** The camshaft drive sprockets also form the thrust faces for the camshaft endfloat. In production the endfloat is 0.065mm to 0.185mm. In service, if the endfloat is out of specification, the camshaft(s) or cylinder head(s) may have to be replaced.

## Camshaft Timing

| Valve                | Position   |
|----------------------|------------|
| Inlet valve opens    | 8.5° BTDC  |
| Inlet valve closes   | 35.5° ABDC |
| Exhaust valve opens  | 64° BBDC   |
| Exhaust valve closes | 12° ATDC   |

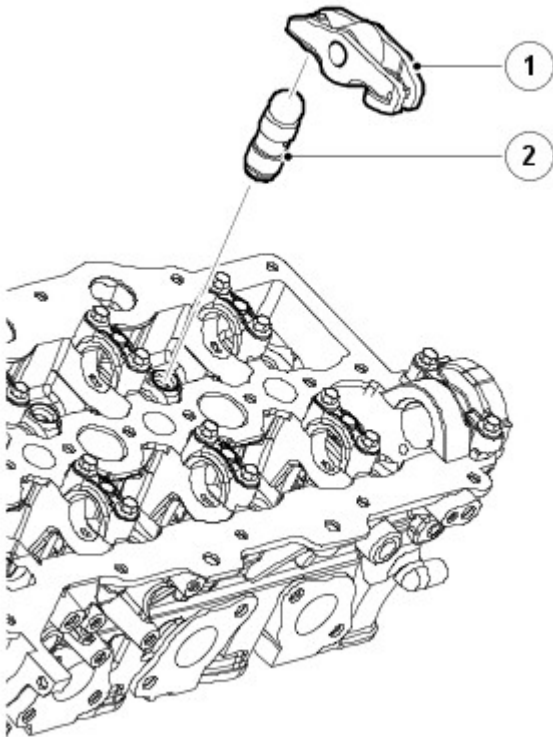
## Inlet and Exhaust Valves



E44239

| Item | Part Number | Description            |
|------|-------------|------------------------|
| 1    | -           | Valve spring collets   |
| 2    | -           | Valve spring retainers |
| 3    | -           | Valve spring           |
| 4    | -           | Valve stem seal        |
| 5    | -           | Inlet valve            |
| 6    | -           | Exhaust valve          |

Each cylinder head incorporates two overhead camshafts operating four valves per cylinder via steel roller rockers with hydraulic lash adjusters.

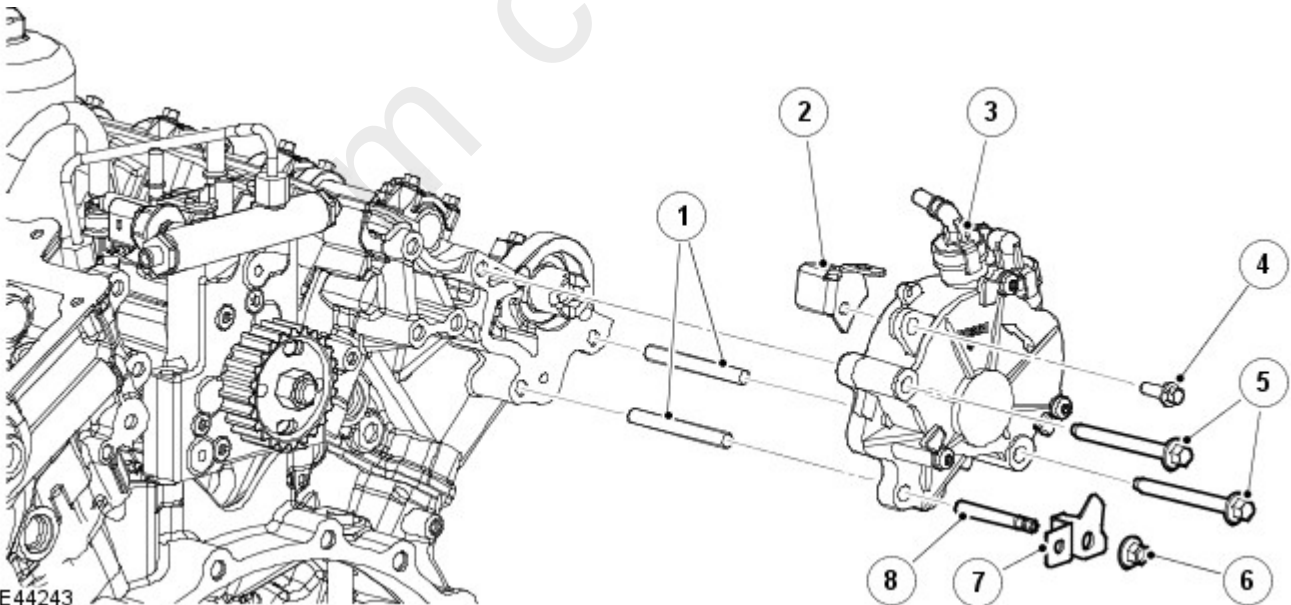


E44238

| Item | Part Number | Description             |
|------|-------------|-------------------------|
| 1    | -           | Roller rocker           |
| 2    | -           | Hydraulic lash adjuster |

The lightweight valve gear provides good economy and noise levels. Valve head diameters are 31mm (1.220 in) for the exhaust and 35mm (1.378 in) for the intake. All valves have 5mm (0.197 in) diameter stems supported in sintered metal seats and guide inserts. Collets, valve collars and spring seats locate single valve springs on both intake and exhaust valves. Valve stem seals are integrated into the spring seats.

### Vacuum Pump

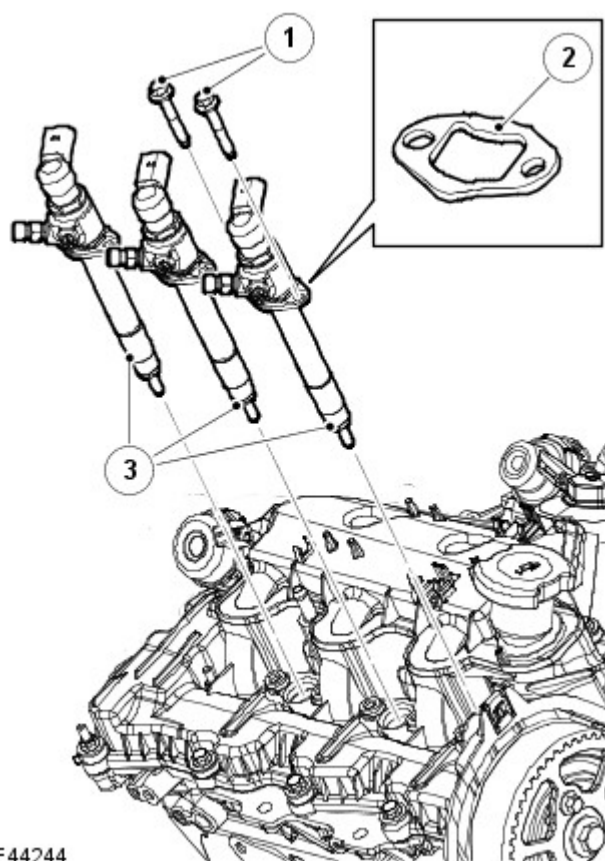


E44243

| Item | Part Number | Description                          |
|------|-------------|--------------------------------------|
| 1    | -           | Location dowels                      |
| 2    | -           | Bracket                              |
| 3    | -           | Vacuum pump                          |
| 4    | -           | Bolt                                 |
| 5    | -           | Bolts                                |
| 6    | -           | Nut                                  |
| 7    | -           | Bracket (transmission breather hose) |
| 8    | -           | Stud                                 |

The vacuum pump is located at the rear of the RH side cylinder head and is driven from the exhaust camshaft.

## Fuel Injectors



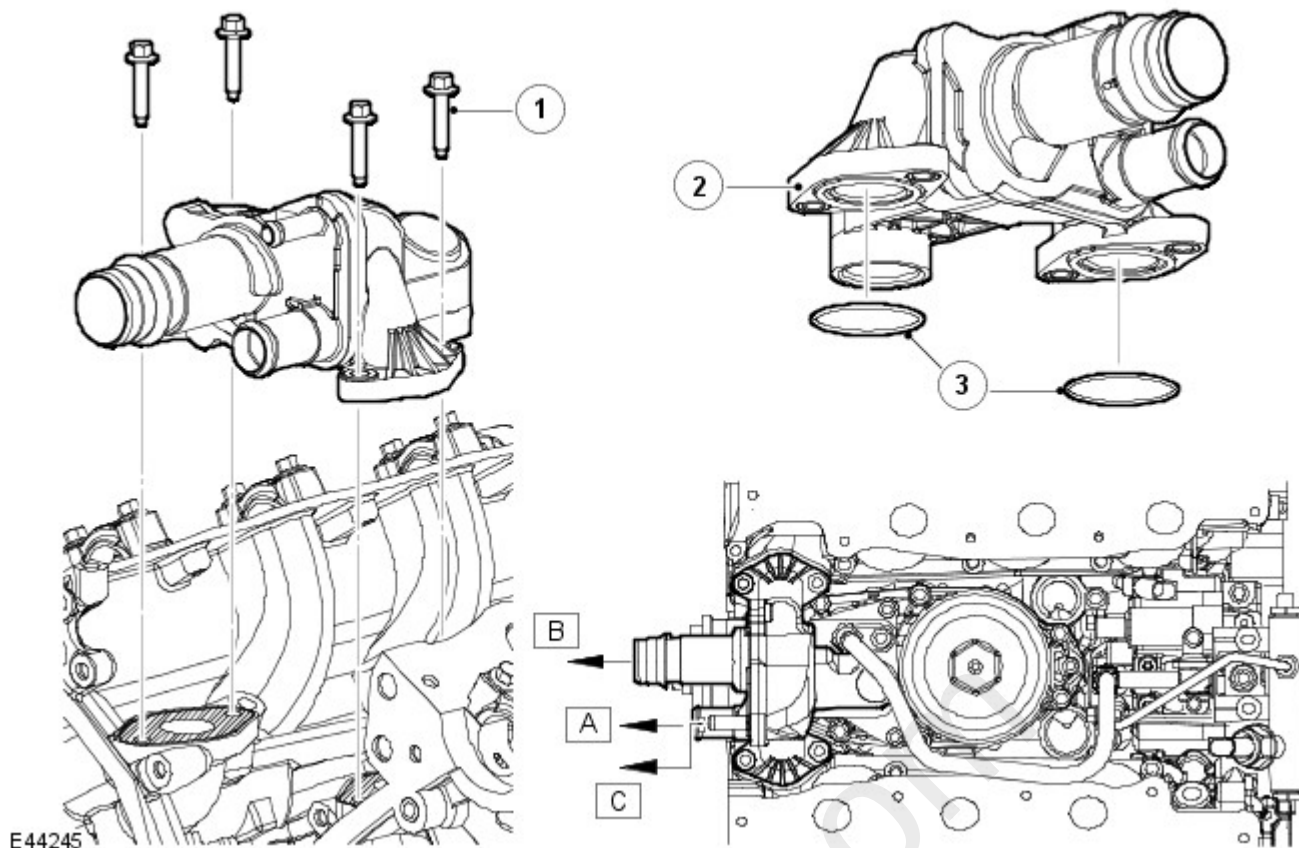
E44244

| Item | Part Number | Description          |
|------|-------------|----------------------|
| 1    | -           | Bolt, 2 per injector |
| 2    | -           | Clamp                |
| 3    | -           | Injectors            |

The fuel injectors inject the quantity of fuel required for all the engine operating conditions into the combustion chambers. The quantity of fuel injected during each working cycle is composed of a noise-reducing pilot injection phase and a main injection phase.

The six, side fed, piezo electrically controlled fuel injectors are installed in the fuel rails. The start of fuel injection and the quantity of fuel injected is controlled directly by the ECM. Two O-rings seal each injector to the manifold interface. For additional information, refer to: [Electronic Engine Controls](#) (303-14A Electronic Engine Controls - TDV6 2.7L Diesel, Description and Operation) / [Fuel Charging and Controls](#) (303-04A Fuel Charging and Controls - TDV6 2.7L Diesel, Description and Operation).

## Water Outlet Assembly



| Item | Part Number | Description                                    |
|------|-------------|------------------------------------------------|
| 1    | -           | Bolt, 4 of                                     |
| 2    | -           | Water outlet assembly                          |
| 3    | -           | Seals                                          |
| A    | -           | Water outlet housing assembly, EGR outlet      |
| B    | -           | Water outlet housing assembly, radiator outlet |
| C    | -           | Water outlet housing assembly, bleed valve     |

The water outlet assembly connects the cooling channels of the cylinder block to the cooling channels of the LH and RH cylinder heads and provides the coolant outlet for the EGR and coolant return.

## LUBRICATION SYSTEM

### General

Oil is drawn from the reservoir in the oil pan and pressurised by the oil pump. The output from the oil pump is then filtered and distributed through internal oil passageways.

All moving parts are lubricated by pressure or splash oil. Pressurised oil is also provided for operation of the hydraulic adjusters and the timing gear chain tensioners.

The engine is lubricated by a force-feed oil circulation system with a full flow oil filter. The oil cooler forms a unit with the oil filter and fuel cooler, which is mounted centrally in the middle of the cylinder block between the two banks of cylinders. The engine oil is cooled using the engine cooling system. This eliminates the need for an additional engine oil cooler remotely mounted.

The fuel cooler, which forms part of the oil filter body, is also cooled by engine coolant. In addition there is a further fuel cooler in the return line to the fuel tank.

The oil returns to the oil pan under gravity. Large drain holes through the cylinder heads and cylinder block ensure the quick return of the oil, reducing the volume of oil required and enabling an accurate check of the contents soon after the engine stops.

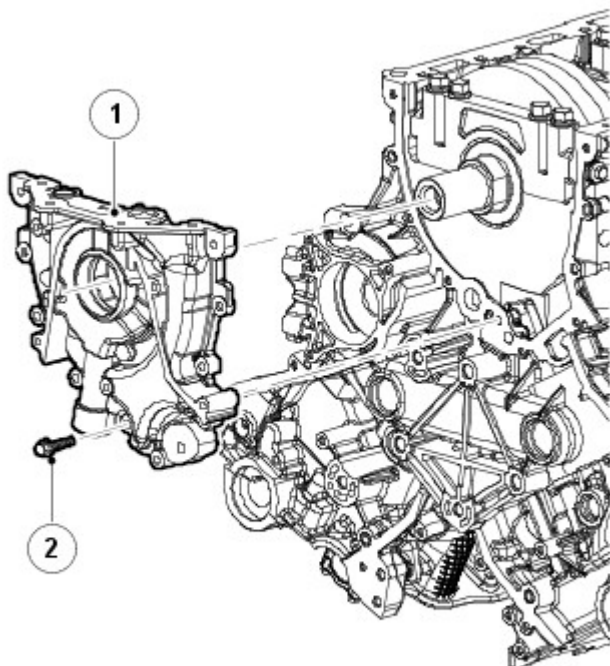
System replenishment is through the oil filler cap on the RH camshaft cover.

With the exception of the pump and level gauge, all oil system components are installed on the sump.

### Oil Pick-up

The moulded composite oil pick-up is immersed in the oil reservoir to provide a supply to the oil pump during all normal vehicle attitudes. The castellated inlet allows the supply to be maintained even if the sump pan is deformed (e.g. by 'grounding'). A mesh screen in the inlet prevents debris from entering the oil system.

### Oil Pump



E44230

| Item | Part Number | Description |
|------|-------------|-------------|
| 1    | -           | Oil pump    |
| 2    | -           | Bolt        |

The oil pump is a gear type pump and is bolted and dowelled to the front of the engine block. It is sealed by means of a rubber gasket, which is recessed into the oil pump housing. The pump inlet and outlet ports align with oil passages in the ladder frame.

The pumping element is an eccentric rotor, which is directly driven by flats on the crankshaft. An integral pressure relief valve regulates pump outlet pressure at 4.5 Bar (65.25 Psi).

The front crankshaft oil seal is housed in the oil pump casing and is fitted such that its front face is 1mm underflush with the machined front face of the oil pump.

- **NOTE:** The seal is not to be pushed all the way into the bore as this will block the seal drains.

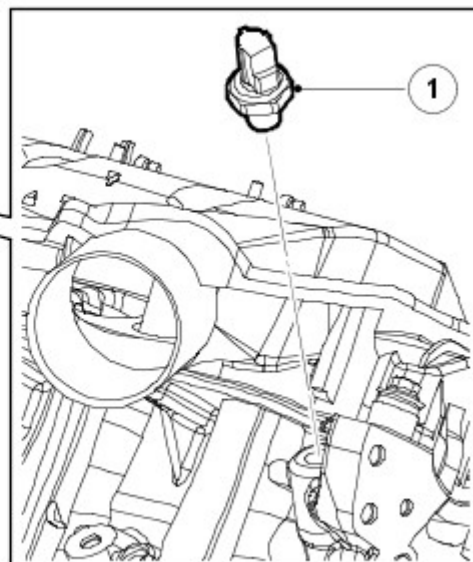
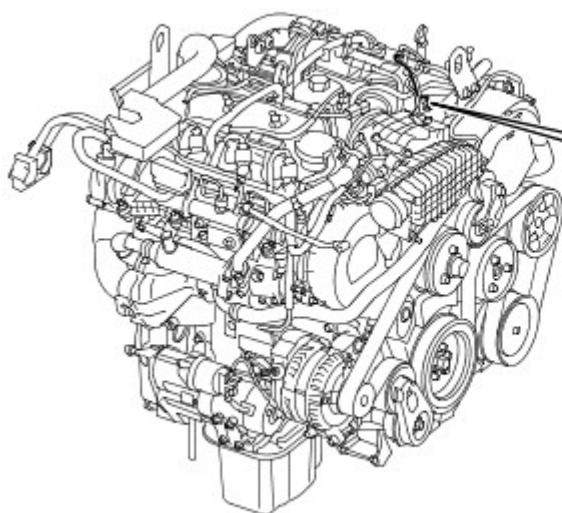
### Oil Filter

The oil filter is a replaceable cartridge installed on an adapter in the centre of the 'vee'. An internal bypass facility permits full flow bypass if the filter is blocked.

- **NOTE:** In service care must be taken when removing the oil filter to minimise oil drips and spillage into the engine 'vee' and cam covers:

- Do not use air/power tools
- Unscrew oil filter cap 4-5 turns
- Leave for a minimum of 1 minute to allow to drain
- Remove cap, ensuring minimal oil spillage
- Replace oil filter element into the cap (can only be fitted in one direction)
- Replace cap and torque to specification.

### Oil Pressure Switch



E44247

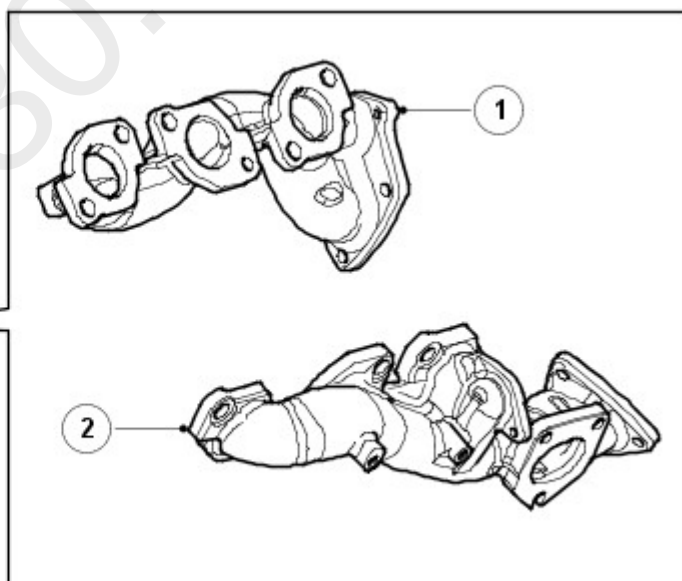
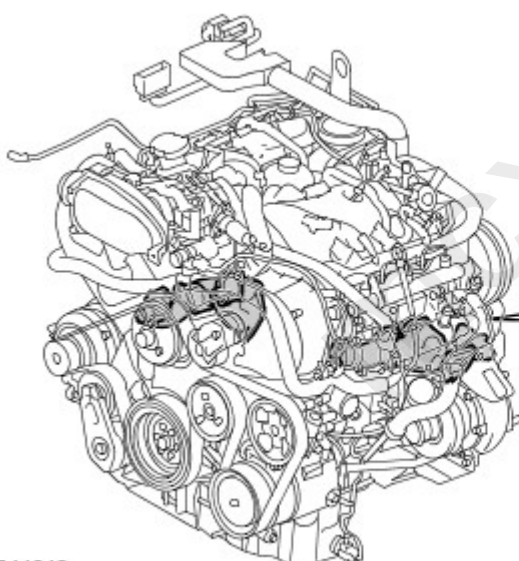
| Item | Part Number | Description         |
|------|-------------|---------------------|
| 1    | -           | Oil pressure switch |

The oil pressure switch, located in the 'vee' at the front of the LH cylinder head, connects a ground input to the instrument cluster when oil pressure is present. The switch operates at a pressure of 0.15 to 0.41 Bar (2.2 to 5.9 Psi).

### Oil Level Gauge

The oil level gauge locates midway along the LH side of the oil pan, supported in a tube installed in the ladder frame. Two holes in the end of the gauge indicate the minimum and maximum oil levels. There is a difference of approximately 1 litre (1 US quart) between the two levels.

### EXHAUST MANIFOLD



E44248

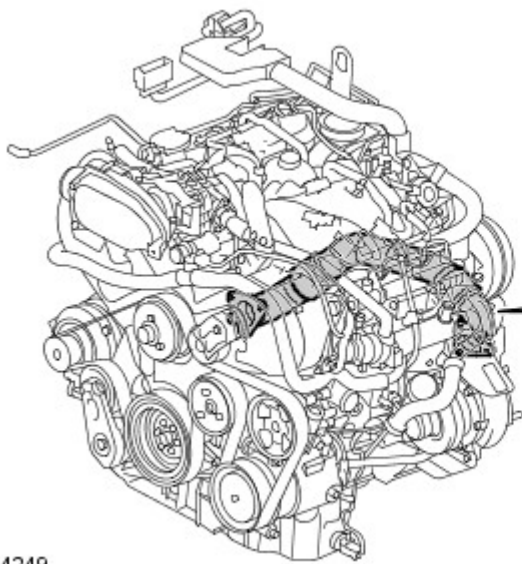
| Item | Part Number | Description         |
|------|-------------|---------------------|
| 1    | -           | LH exhaust manifold |
| 2    | -           | RH exhaust manifold |

The exhaust manifolds are cast from steel alloy and are unique for each cylinder bank. They are sealed to the cylinder head by means of a steel gasket. Sacrificial plastic sleeves are used to align the manifolds. These sleeves must be changed when refitting the manifolds. Spacers on the securing bolts allow the manifolds to expand and retract with changes of temperature while maintaining the clamping loads.

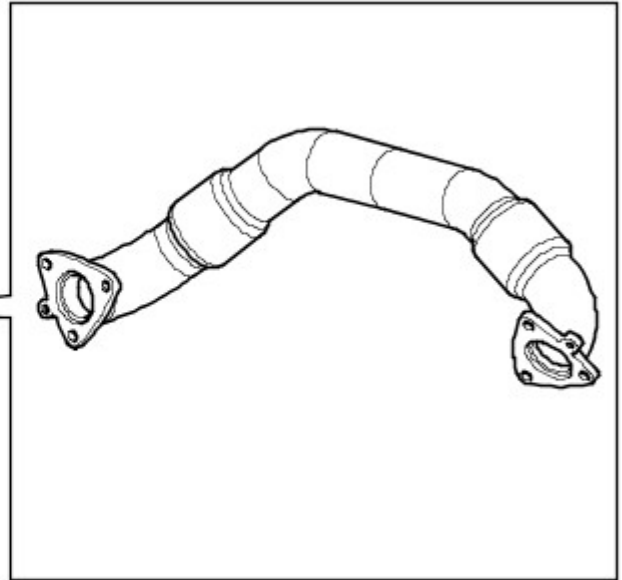
Each manifold has a connection for the EGR transfer pipe.

The engine is fitted with a Variable Geometry Turbocharger (VGT), which is fixed to the exhaust manifold by a three hole flange with a steel gasket.

Crossover Pipe



E44249



A crossover pipe carries the exhaust gasses from the RH exhaust manifold to the turbocharger on the LH exhaust manifold. The crossover pipe is located at the rear of the engine and is routed across the top of the transmissions bell housing.

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## **Engine - TDV6 2.7L Diesel - Engine**

Diagnosis and Testing

For additional information.

REFER to: [Engine - TDV6 2.7L Diesel](#) (303-00 Engine System - General Information, Diagnosis and Testing).

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# Engine - TDV6 2.7L Diesel - Engine Oil Draining and Filling

General Procedures

| Special Tool(s)                                                                             |                            |
|---------------------------------------------------------------------------------------------|----------------------------|
| <br>E54553 | Oil filter element remover |
|                                                                                             | 303-1128                   |

1. Disconnect the battery ground cable.  
For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

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

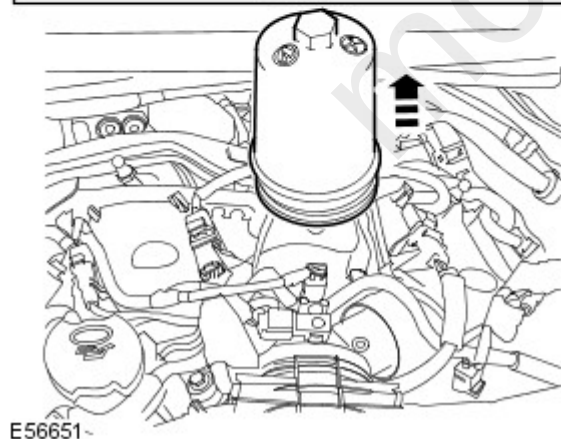
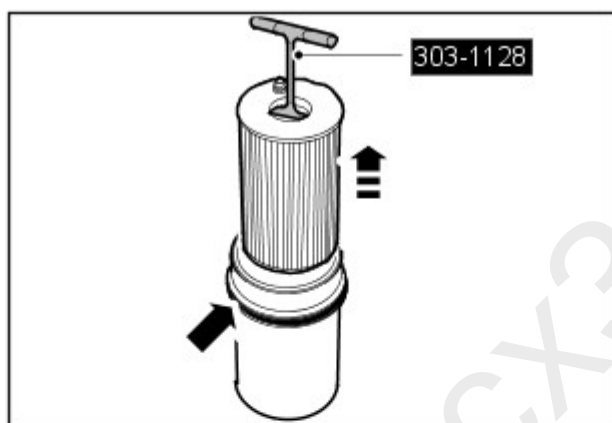
Raise and support the vehicle.

3. Remove the engine cover.  
For additional information, refer to: [Engine Cover - TDV6 3.0L Diesel](#) (501-05 Interior Trim and Oramentation, Removal and Installation).

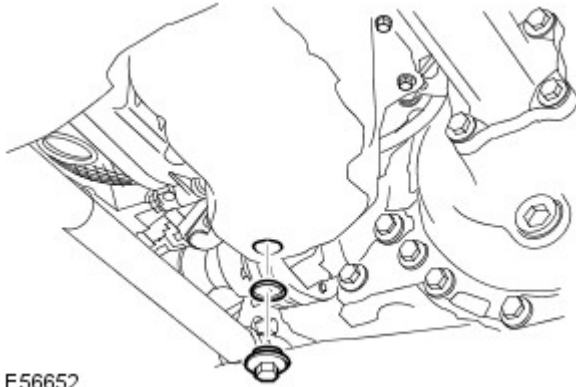
4.  **CAUTION:** When removing the oil filter assembly, make sure the fuel temperature sensor is not damaged.

Using the special tool, remove the oil filter element.

- Loosen the element cover 4 complete turns to allow engine oil to drain from the filter cover.
- Remove element cover.
- Remove and discard the O-ring seal.



5. Remove the engine undershield.  
For additional information, refer to: [Engine Undershield](#) (501-02 Front End Body Panels, Removal and Installation).



**6. Remove the lubricant drain plug.**

- Position a container to collect the fluid.
- Discard the oil pan drain plug seal.

**7. Install the lubricant drain plug.**

- Clean the component mating faces.
- Install a new sealing washer.
- Tighten the drain plug to 25 Nm (18 lb.ft).

**8. Install the oil filter element.**

- Clean the components.
- Make sure the oil filter element spigot aligns with the hole in the filter housing.
- Install a new O-ring seal.
- Tighten the element cover to 25 Nm (18 lb.ft).

**9. Fill the engine with oil.**

**10. Install the engine undershield.**

For additional information, refer to: [Engine Undershield](#) (501-02 Front End Body Panels, Removal and Installation).

**11. Install the engine cover.**

For additional information, refer to: [Engine Cover - TDV6 3.0L Diesel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

**12. Connect the battery ground cable.**

For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

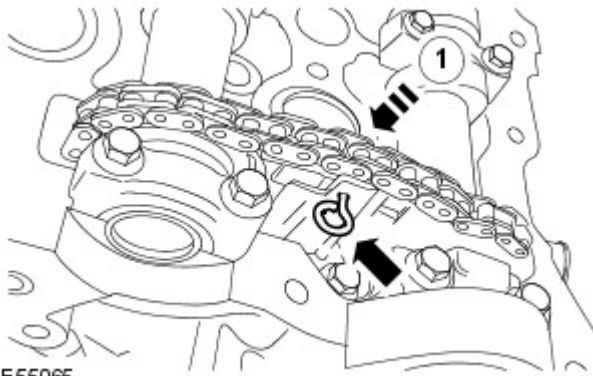
**13. Check and top-up the engine oil.**

# Engine - TDV6 2.7L Diesel - Camshaft RH

In-vehicle Repair

## Removal

1. Disconnect the battery ground cable.  
For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).
2. Remove the camshaft front seal.  
For additional information, refer to: [Camshaft Front Seal](#) (303-01A Engine - TDV6 2.7L Diesel, In-vehicle Repair).
3. Remove the brake vacuum pump.  
For additional information, refer to: [Brake Vacuum Pump - TDV6 2.7L Diesel](#) (206-07 Power Brake Actuation, Removal and Installation).
4. Remove the RH valve cover.  
For additional information, refer to: [Valve Cover RH](#) (303-01A Engine - TDV6 2.7L Diesel, In-vehicle Repair).
5. Retain the secondary timing chain tensioner piston.
  - Reposition the secondary timing chain tensioner.
  - Install a 1.5 mm (0.060 in.) diameter pin into the secondary timing chain tensioner piston.

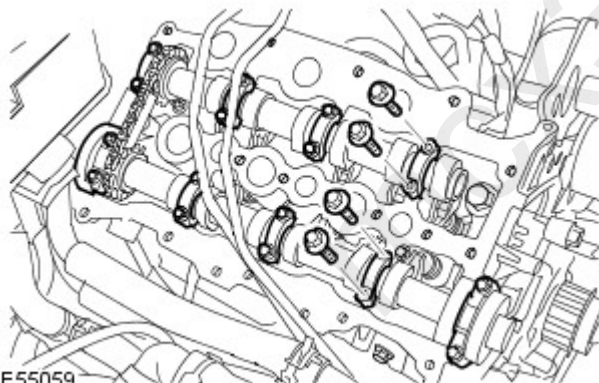


E55065

6.  **CAUTION:** Evenly and progressively, release the camshaft bearing caps.

Remove the camshaft bearing caps.

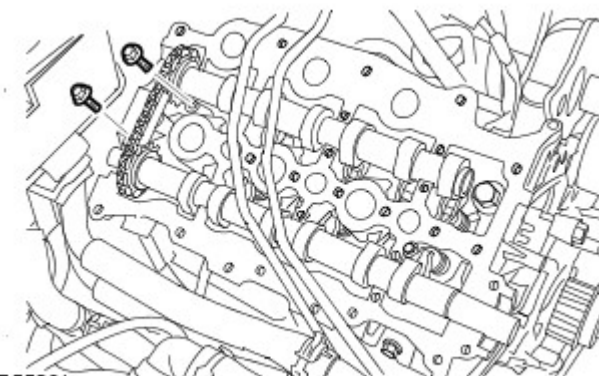
- Remove the 18 retaining bolts.



E55059

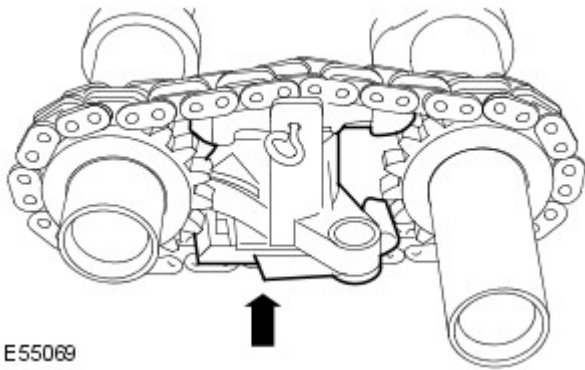
7. Remove the camshafts and secondary timing chain tensioner assembly.

- Remove the two retaining bolts.
- Release the RH secondary timing chain tensioner.



E55061

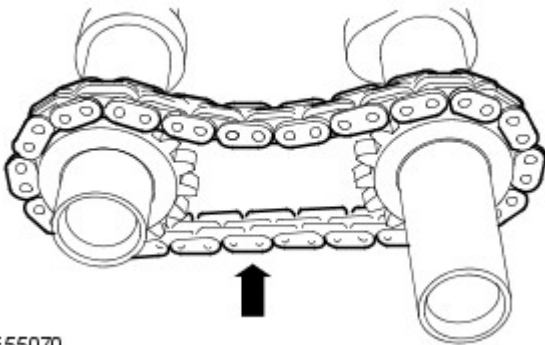
8. Remove the secondary timing chain tensioner.



E55069

9. Remove the RH camshafts.

- Release the secondary timing chain from the RH camshafts.



E55070

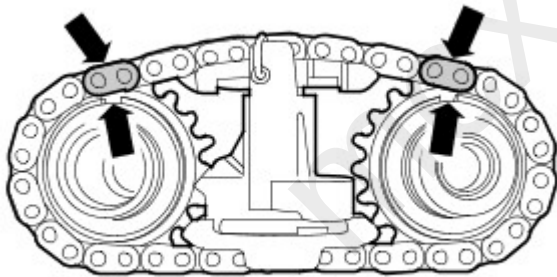
### Installation

1. Install the secondary timing chain onto the camshafts.

2.  **CAUTION:** Do not release the secondary timing chain tensioner locking pin until all of the camshaft bearing caps have been installed.

Install the secondary timing chain tensioner.

- Align the marks on the camshafts with the marks on the secondary timing chain.



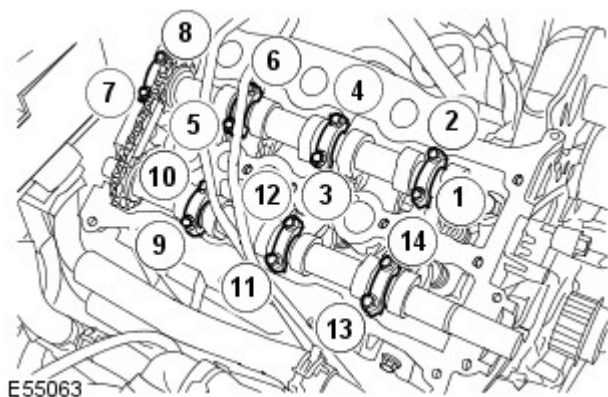
E55062

3. Install the camshafts and secondary timing chain tensioner assembly.

- Lubricate the journals and camshaft lobes.

4. Attach the RH secondary timing chain tensioner.

- Tighten the two retaining bolts to 10 Nm (7 lb.ft).

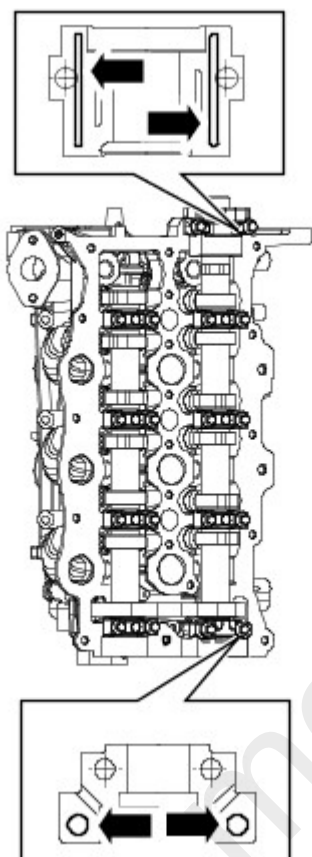


**5. Install the camshaft bearing caps.**

- Do not install the two exhaust camshaft end bearing caps at this stage.
- Tighten the bolts evenly in three stages in the sequence shown.
- Stage one: Tighten to 1 Nm (1 lb.ft).
- Stage two: Tighten to 5 Nm (4 lb.ft).
- Stage three: Tighten to 10 Nm (7 lb.ft).

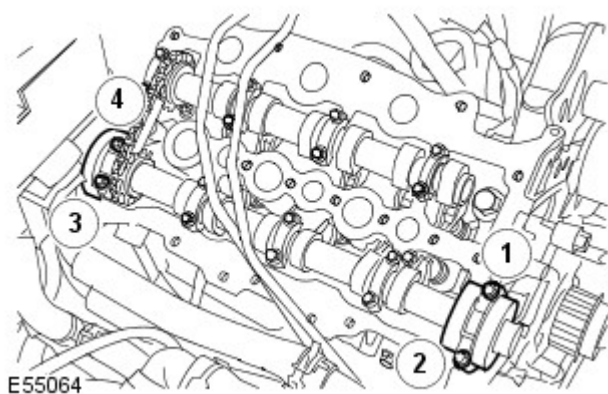
**6. Apply sealant to the two exhaust camshaft end bearing caps at the positions shown.**

For additional information, refer to: [Specifications](#) (303-01A Engine - TDV6 2.7L Diesel, Specifications).



**7. Install the camshaft bearing caps.**

- Tighten the bolts evenly in three stages in the sequence shown.
- Stage one: Tighten to 1 Nm (1 lb.ft).
- Stage two: Tighten to 5 Nm (4 lb.ft).
- Stage three: Tighten to 10 Nm (7 lb.ft).



**8. Release the secondary timing chain tensioner piston.**

- Remove the locking pin.

**9. Install the RH valve cover.**

For additional information, refer to: [Valve Cover RH](#) (303-01A

Engine - TDV6 2.7L Diesel, In-vehicle Repair).

**10.** Install the brake vacuum pump.

For additional information, refer to: [Brake Vacuum Pump - TDV6 2.7L Diesel](#) (206-07 Power Brake Actuation, Removal and Installation).

**11.** Install the camshaft front seal.

For additional information, refer to: [Camshaft Front Seal](#) (303-01A Engine - TDV6 2.7L Diesel, In-vehicle Repair).

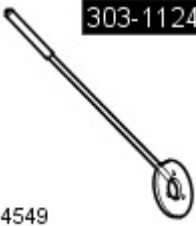
**12.** Connect the battery ground cable.

For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

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**Engine - TDV6 2.7L Diesel - Camshaft Front Seal**

In-vehicle Repair

| <b>Special Tool(s)</b>                                                                                                   |                                             |
|--------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|
|  <p><b>303-1124</b></p> <p>E54549</p>   | Holder - Camshaft Pulleys Front<br>303-1124 |
|  <p><b>303-1119</b></p> <p>E54542</p>   | Installer - Camshaft Oil Seal<br>303-1119   |
|  <p><b>303-1118</b></p> <p>E54541</p>   | Remover - Camshaft Oil Seal<br>303-1118     |
|  <p><b>303-1126</b></p> <p>E54551</p> | Timing Pin - Camshaft Pulleys<br>303-1126   |

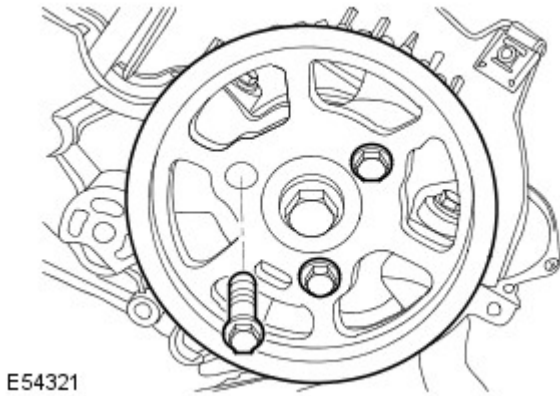
**Removal**

1. Disconnect the battery ground cable.  
For additional information, refer to: Specifications (414-00, Specifications).
2. Raise and support the vehicle.
3. Remove and discard the timing belt.  
For additional information, refer to: [Timing Belt](#) (303-01A Engine - TDV6 2.7L Diesel, In-vehicle Repair).
4. Remove the special tool.
  - Stage one: Retain the camshaft pulley.
  - Stage two: Remove the special tool.



5. Remove the camshaft pulley.

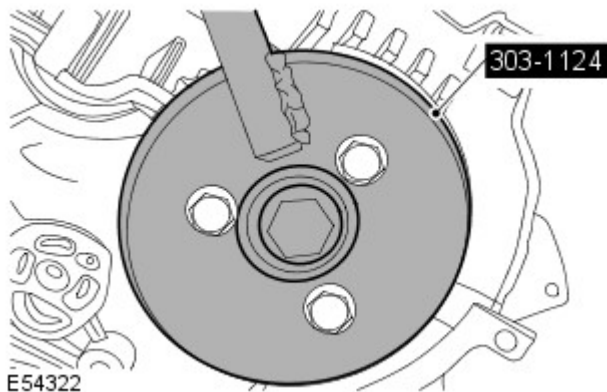
- Remove the three retaining bolts.



E54321

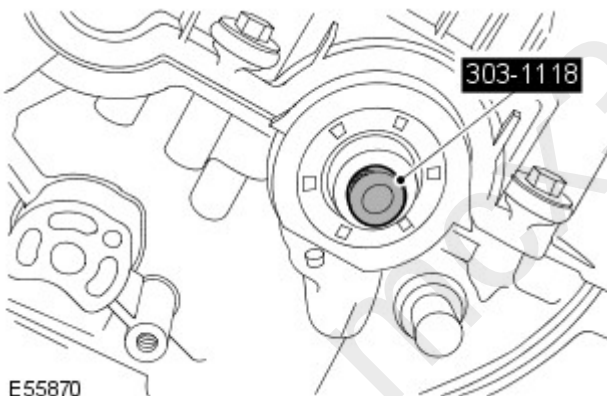
6. Using the special tool, remove the camshaft pulley hub.

- Remove and discard the retaining bolt.



E54322

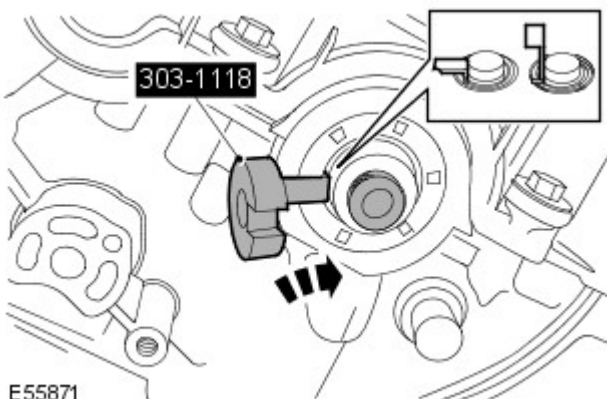
7. Install the special tool to the camshaft.



E55870

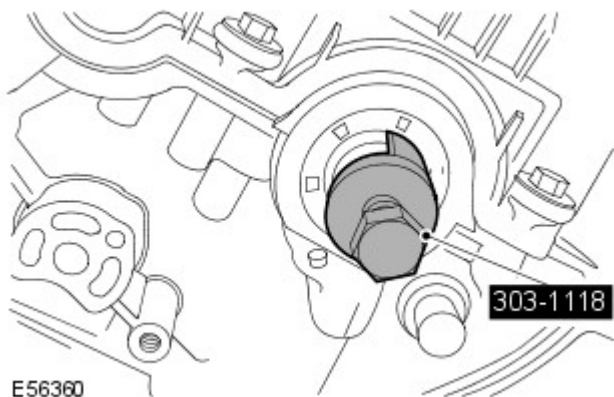
8.  **CAUTION:** Make sure the special tool is correctly seated behind the camshaft seal. Failure to follow this instruction may result in damage to the special tool.

Install the special tool into the camshaft front seal.

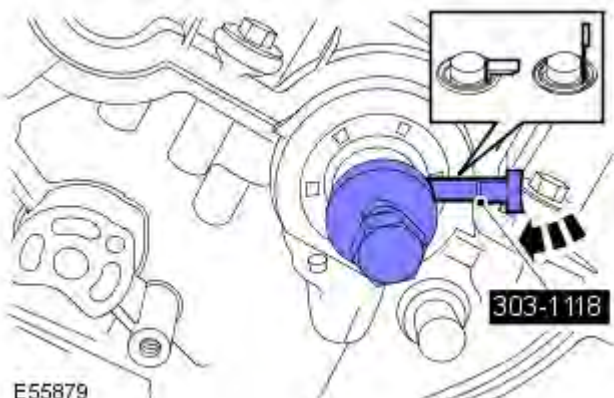


E55871

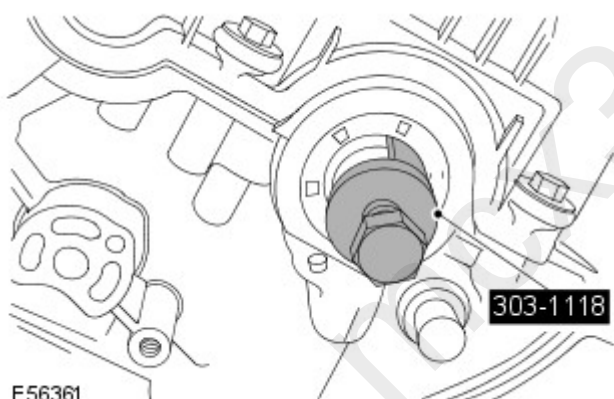
9. Install the special tool extracting bolt.



10. Install the special tool into the camshaft front seal.



11. Using the special tool, remove the camshaft front seal.



## Installation

### 1. CAUTIONS:



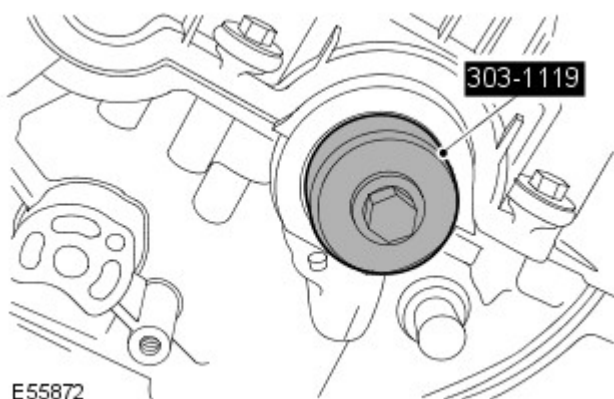
Make sure the seal is installed correctly.

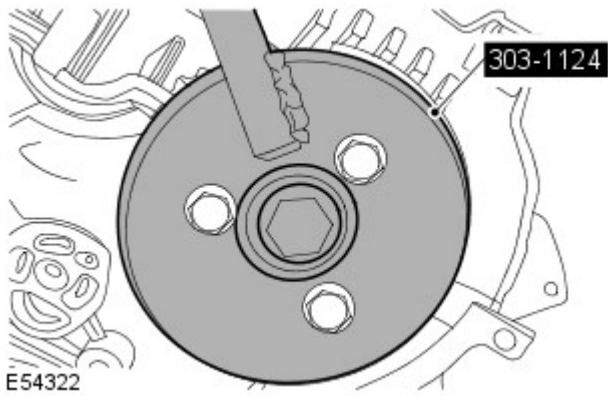


Do not use any lubricant on the camshaft front seal or the camshaft. Failure to follow this instruction may result in damage to the vehicle.

Using the special tool, install the camshaft front seal.

- Clean the component mating faces.
- Use the discarded camshaft pulley hub retaining bolt with the special tool.





**2. Using the special tool, install the camshaft pulley hub.**

- Install a new retaining bolt.
- Tighten the retaining bolt in two stages:
  - Stage one: Tighten to 80 Nm (59 lb.ft).
  - Stage two: Tighten a further 80 degrees.

**3. Install the camshaft pulley.**

- Install the bolts, but do not tighten fully at this stage.

**4. Install the special tool.**

- Stage one: Retain the camshaft pulley.
- Stage two: Install the special tool.



**5. Install the new timing belt.**

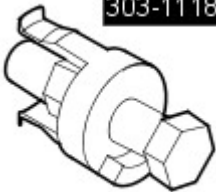
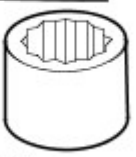
For additional information, refer to: [Timing Belt](#) (303-01A Engine - TDV6 2.7L Diesel, In-vehicle Repair).

**6. Connect the battery ground cable.**

For additional information, refer to: Specifications (414-00, Specifications).

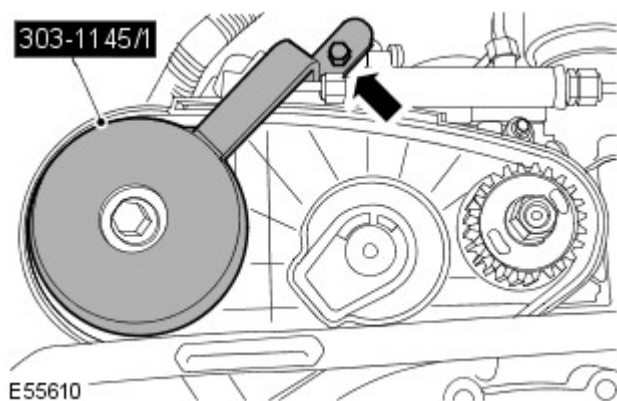
**Engine - TDV6 2.7L Diesel - Camshaft Rear Seal**

In-vehicle Repair

| <b>Special Tool(s)</b>                                                                                                     |                                            |
|----------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|
|  <p><b>303-1118</b></p> <p>E54541</p>     | Camshaft Seal Remover<br>303-1118          |
|  <p><b>303-1119</b></p> <p>E54542</p>     | Camshaft Seal Installer<br>303-1119        |
|  <p><b>303-1145/1</b></p> <p>E60399</p>   | Camshaft pulley holding tool<br>303-1145/1 |
|  <p><b>303-1145/2</b></p> <p>E60429</p> | Camshaft pulley bolt remover<br>303-1145/2 |
|  <p><b>303-1145/3</b></p> <p>E60430</p> | Camshaft pulley bolt socket<br>303-1145/3  |

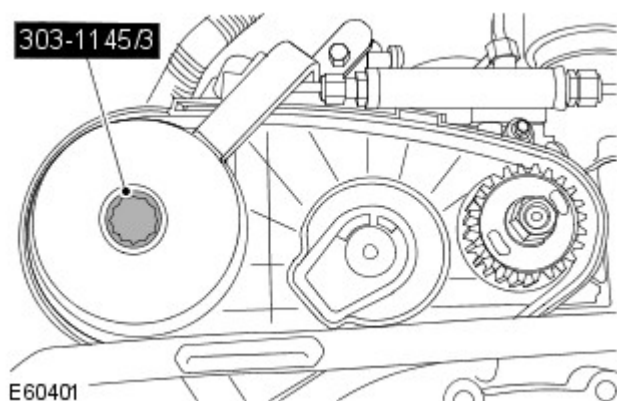
**Removal**

1. Disconnect the battery ground cable.  
For additional information, refer to: Specifications (414-00, Specifications).
2. Remove the fuel injection pump belt.  
For additional information, refer to: [Fuel Injection Pump Belt - VIN Range: SALLA000304->END OF 06 MY](#) (303-05A Accessory Drive - TDV6 2.7L Diesel, Removal and Installation).

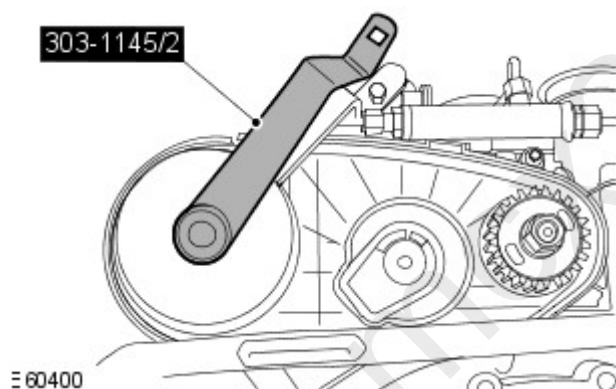


3. Install the special tool to the camshaft rear pulley.

- Rotate the crankshaft to align the special tool to the engine lifting bracket.
- Install the special tool retaining bolt.



4. Install the special tool to the camshaft rear pulley retaining bolt.

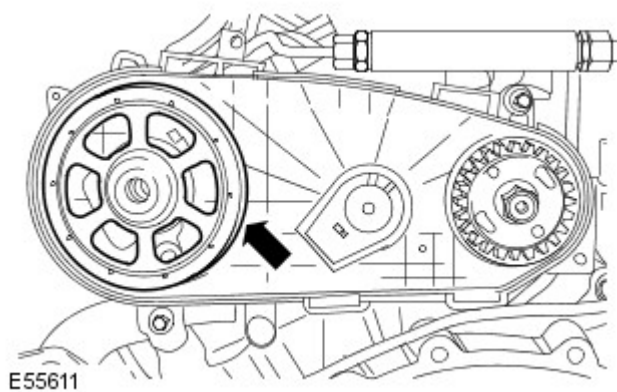


5. Using the special tools, remove and discard the camshaft rear pulley retaining bolt.

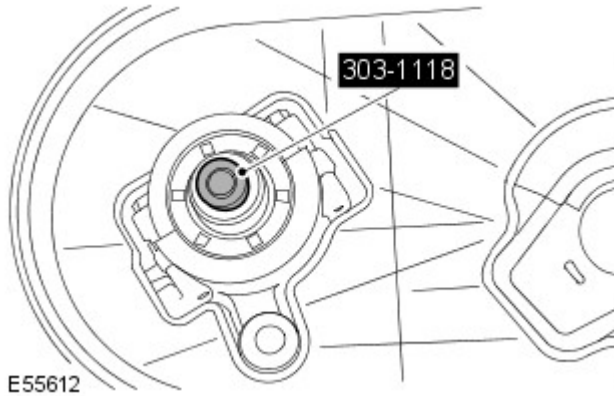
- Rotate the crankshaft clockwise to retain the camshaft rear pulley.

6. Remove the special tools.

7. Remove the camshaft rear pulley.



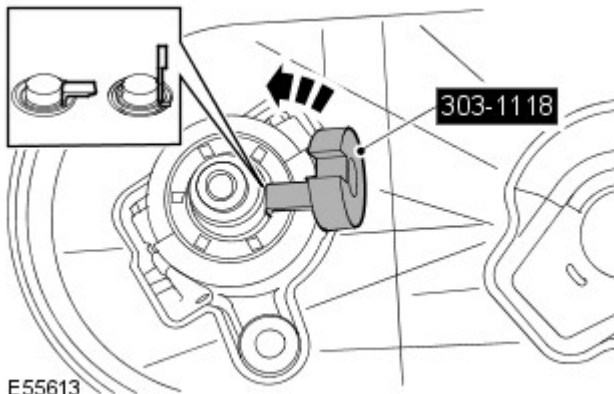
8. Install the special tool to the camshaft.



E55612

9.  **CAUTION:** Make sure the special tool is correctly seated behind the camshaft seal. Failure to follow this instruction may result in damage to the special tool.

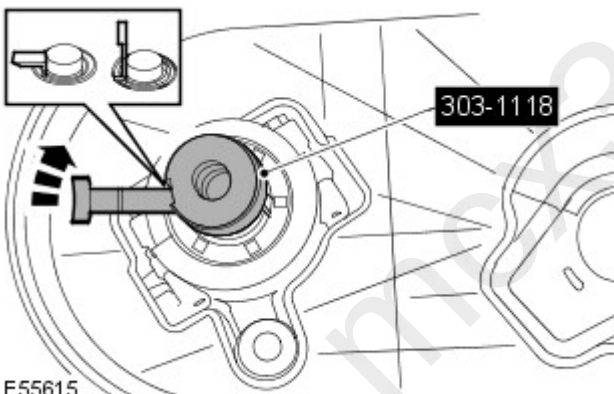
Install the special tool into the camshaft rear seal.



E55613

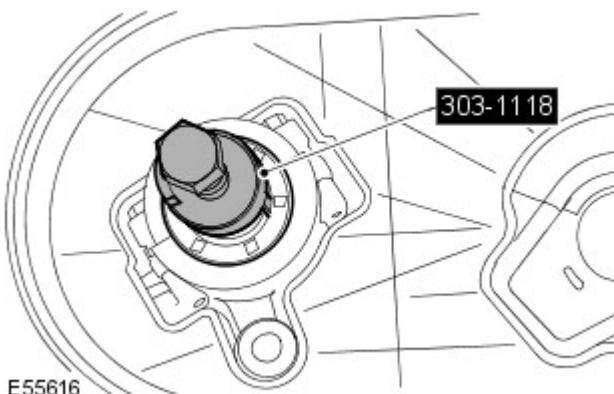
10.  **CAUTION:** Make sure the special tool is correctly seated behind the camshaft seal. Failure to follow this instruction may result in damage to the special tool.

Install the special tool into the camshaft rear seal.



E55615

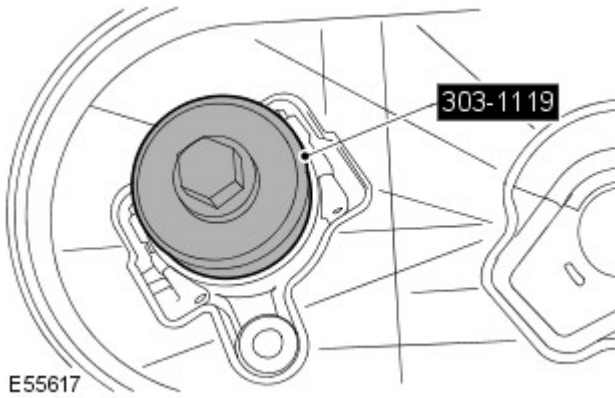
11. Using the special tool, remove and discard the camshaft rear seal.



E55616

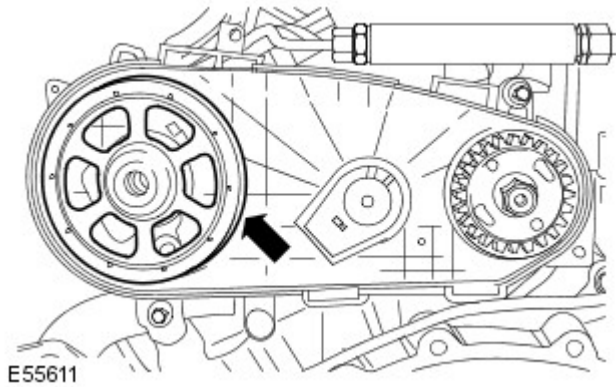
## Installation

1. Using the special tool, install the new camshaft rear seal.



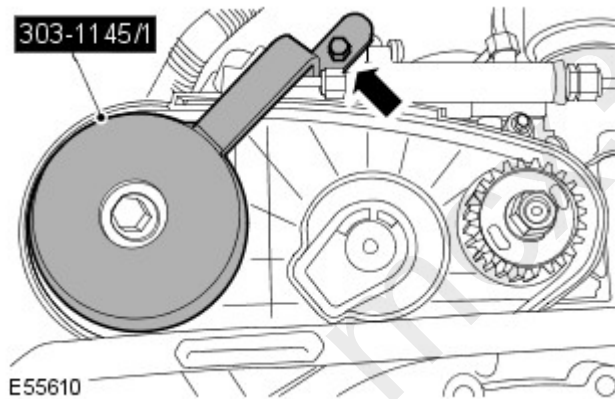
2. Install the camshaft rear pulley.

- Install a new camshaft pulley retaining bolt.

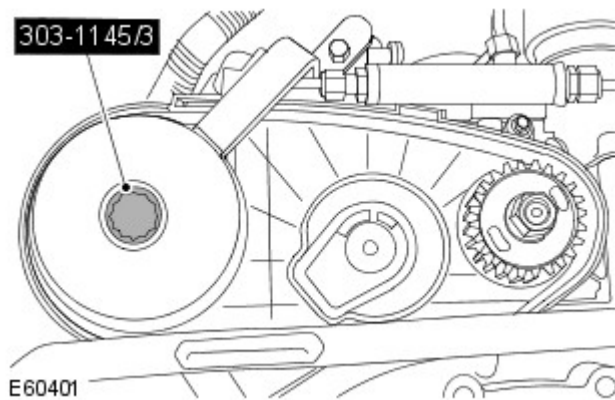


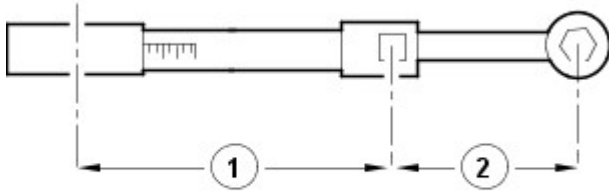
3. Install the special tool to the camshaft rear pulley.

- Install the special tool retaining bolt.



4. Install the special tool to the camshaft rear pulley retaining bolt.





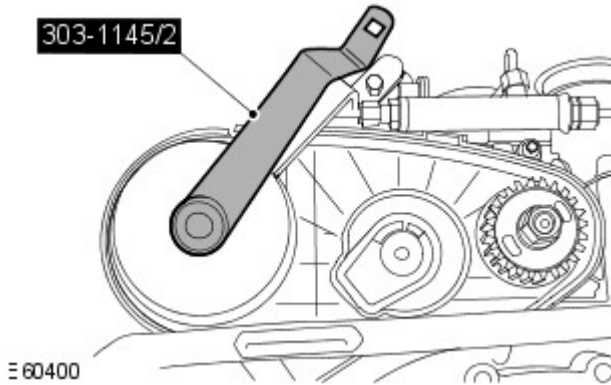
E37107

5.  **CAUTION:** Make sure the torque wrench setting procedure is followed correctly. Failure to follow this instruction may result in damage to the vehicle.

Calculate the setting for the torque wrench.

- Stage 1: Multiply the required torque by the effective length of the torque wrench (1).
- Stage 2: Add the effective length of the special tool (2) to the effective length of the torque wrench.
- Stage 3: Divide the total of stage 1 by the total of stage 2.
- Stage 4: Set the torque wrench to the figure arrived at in stage 3.

303-1145/2



E60400

6.  **CAUTION:** Make sure the torque wrench setting procedure is followed correctly. Failure to follow this instruction may result in damage to the vehicle.

Using the special tools, tighten the camshaft rear pulley retaining bolt to 40 Nm (30 lb.ft).

7.  **CAUTION:** Make sure the torque wrench setting procedure is followed correctly. Failure to follow this instruction may result in damage to the vehicle.

- Rotate the crankshaft counter-clockwise to retain the camshaft rear pulley.
- Stage one: Tighten to 80 Nm (59 lb.ft).
- Stage two: Tighten a further 80 degrees.

8. Remove the special tools.

9.  **CAUTION:** Install a new fuel injection pump belt. Failure to follow this instruction may result in damage to the vehicle.

Install the fuel injection pump belt.

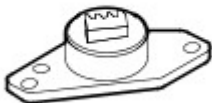
For additional information, refer to: [Fuel Injection Pump Belt - VIN Range: SALLA000304->END OF 06 MY](#) (303-05A Accessory Drive - TDV6 2.7L Diesel, Removal and Installation).

10. Connect the battery ground cable.

For additional information, refer to: Specifications (414-00, Specifications).

**Engine - TDV6 2.7L Diesel - Crankshaft Front Seal**

In-vehicle Repair

| <b>Special Tool(s)</b>                                                                                                    |                                                            |
|---------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|
|  <p><b>303-1123</b></p> <p>E 54546</p>   | <p>Locking Tool - Flywheel</p> <p>303-1123</p>             |
|  <p><b>303-1116</b></p> <p>E 54539</p>   | <p>Timing Pin - Manual Transmission</p> <p>303-1116</p>    |
|  <p><b>303-1117</b></p> <p>E 54540</p>   | <p>Timing Pin - Automatic Transmission</p> <p>303-1117</p> |
|  <p><b>303-1120</b></p> <p>E 54543</p> | <p>Crankshaft Front Seal Remover</p> <p>303-1120</p>       |
|  <p><b>303-1122</b></p> <p>E 54545</p> | <p>Crankshaft Front Seal Sleeve</p> <p>303-1122</p>        |
|  <p><b>303-1121</b></p> <p>E 54544</p> | <p>Crankshaft Front Seal Installer</p> <p>303-1121</p>     |

**Removal**

All vehicles

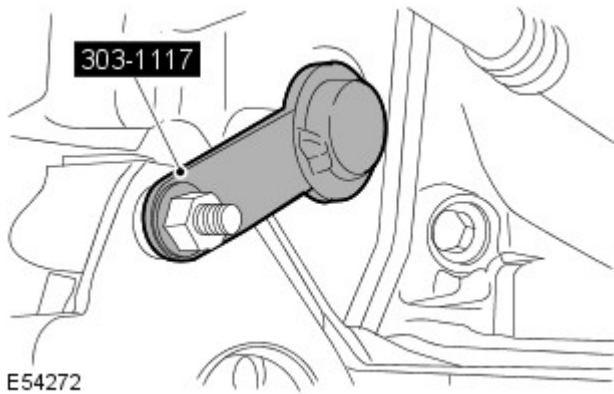
1. Disconnect the battery ground cable.  
For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).
2. Remove and discard the timing belt.  
For additional information, refer to: [Timing Belt](#) (303-01A Engine - TDV6 2.7L Diesel, In-vehicle Repair).

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

Raise and support the vehicle.

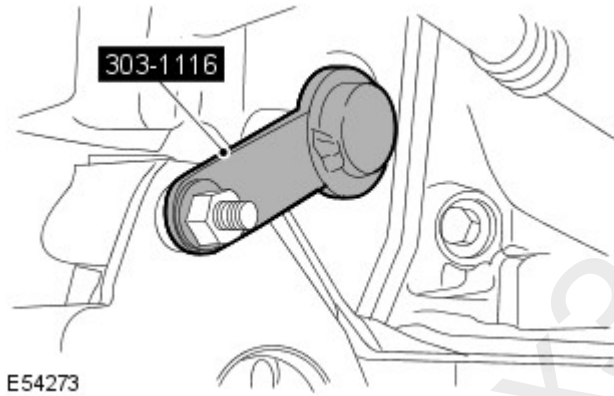
Vehicles with automatic transmission

**4.** Remove the special tool.



Vehicles with manual transmission

**5.** Remove the special tool.



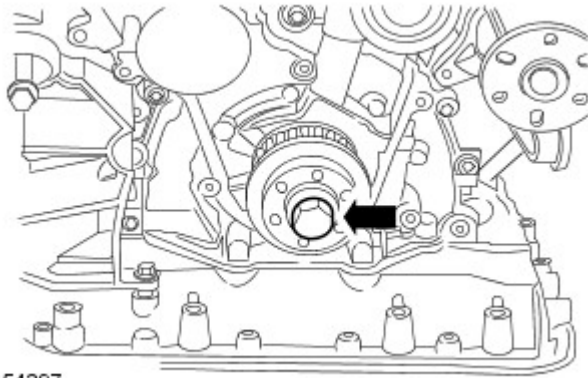
All vehicles

**6.** Install the special tool.



**7.** Loosen the crankshaft pulley retaining bolt.

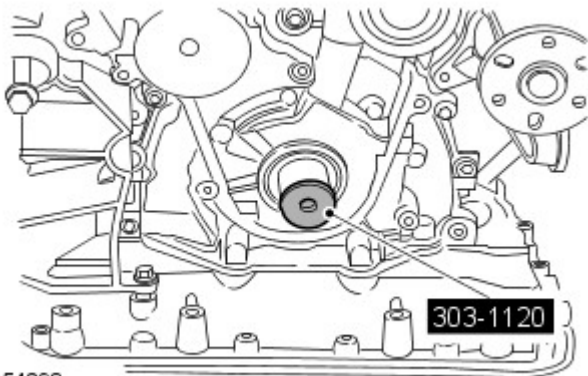
**8.** Using a suitable tool, release the crankshaft pulley.



E54297

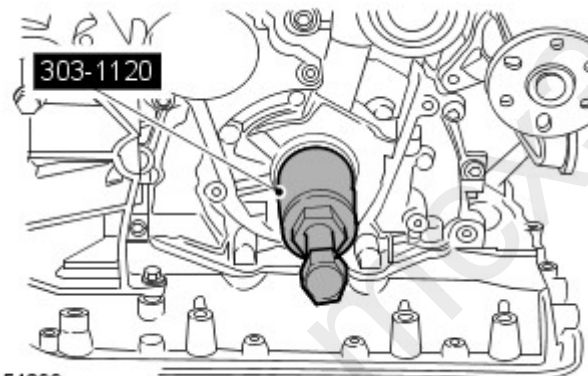
**9. Remove the crankshaft pulley.**

- Remove the crankshaft pulley retaining bolt.
- Discard the bolt.



E54298

**10. Install the special tool to the crankshaft.**



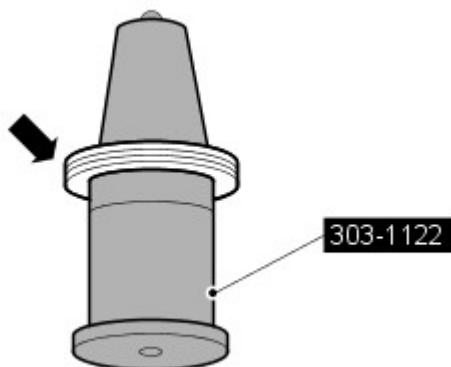
E54299

**11. Using the special tool, remove the crankshaft front seal.**

- Remove the special tool.
- Remove and discard the seal from the special tool.

## Installation

All vehicles



E54300

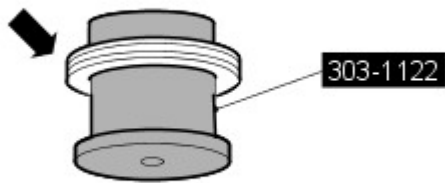
**1. ⚠ CAUTION:** Do not use any lubricant on the crankshaft front seal, special tools or the crankshaft. Failure to follow this instruction may result in damage to the vehicle.

- **NOTE:** Make sure all component mating faces are clean.

Install a new crankshaft front seal to the special tool.

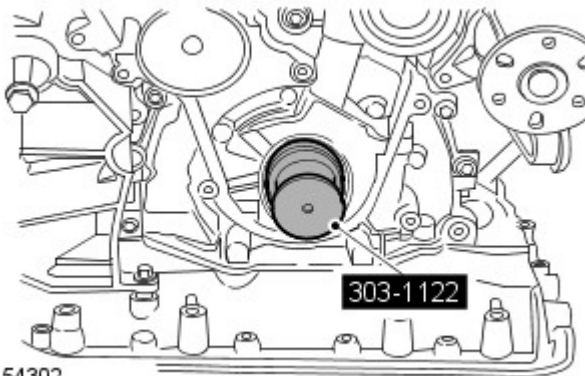
2. Reposition the crankshaft front seal along the special tool.

- Remove the sleeve from the special tool.



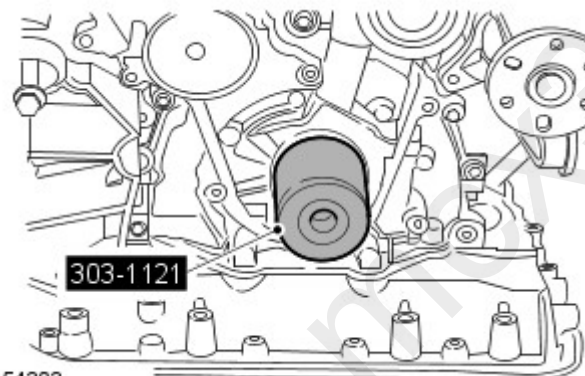
E54301

3. Install the special tool to the crankshaft.



E54302

4. Install the special tool to the crankshaft.

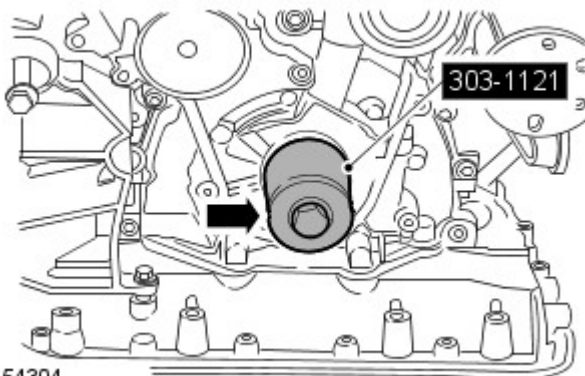


E54303

5. **⚠ CAUTION:** Make sure the seal is installed correctly.

Using the special tool, install the crankshaft front seal.

- Use the discarded crankshaft bolt with the service tool.



E54304

6. **⚠ CAUTION:** Make sure the seal is installed correctly.

Remove the special tool.

- Remove and discard the crankshaft pulley retaining bolt.

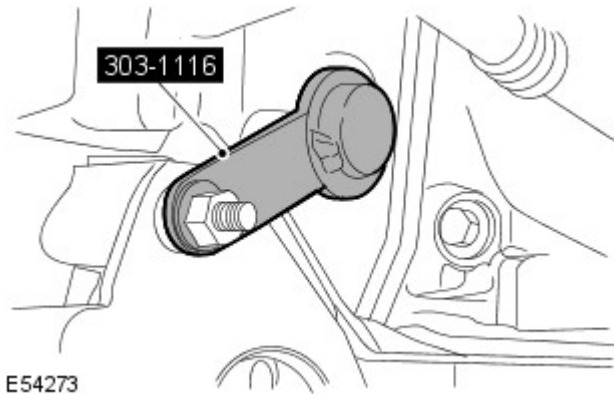
**7. Install the crankshaft pulley.**

- Install a new crankshaft pulley retaining bolt.
- Tighten the retaining bolt in two stages:
  - Stage one: Tighten to 100 Nm (74 lb.ft).
  - Stage two: Tighten a further 90 degrees.

**8. Remove the special tool.**

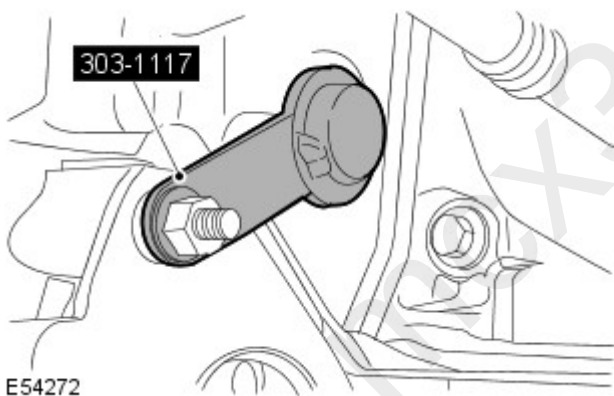
**Vehicles with manual transmission**

**9. Install the special tool.**



**Vehicles with automatic transmission**

**10. Install the special tool.**



**All vehicles**

**11. Install the new timing belt.**

For additional information, refer to: [Timing Belt](#) (303-01A Engine - TDV6 2.7L Diesel, In-vehicle Repair).

**12. Connect the battery ground cable.**

For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

## Engine - TDV6 2.7L Diesel - Crankshaft Rear Seal with Retainer Plate

In-vehicle Repair

### Removal

- NOTE: The crankshaft rear seal and retainer plate are supplied as an assembly and cannot be serviced separately.

1. Disconnect the battery ground cable.  
For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

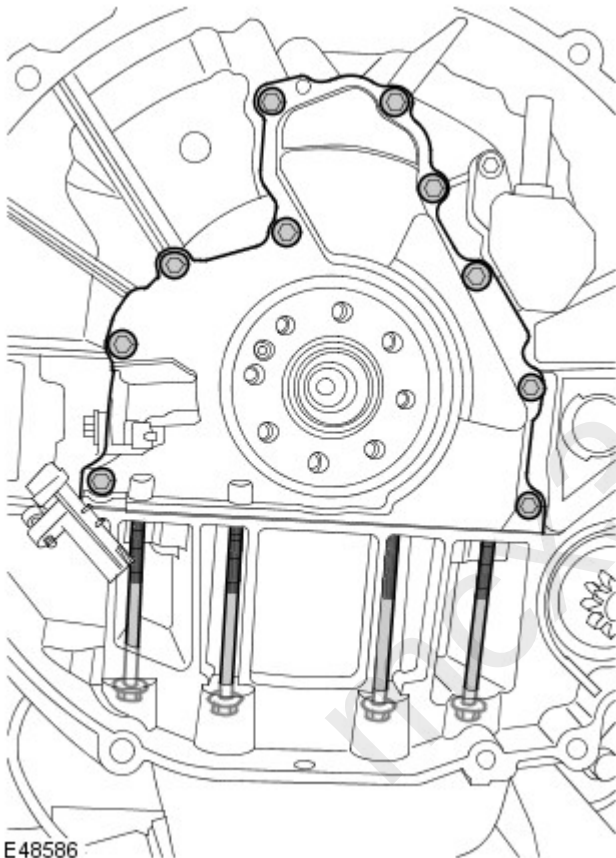
2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

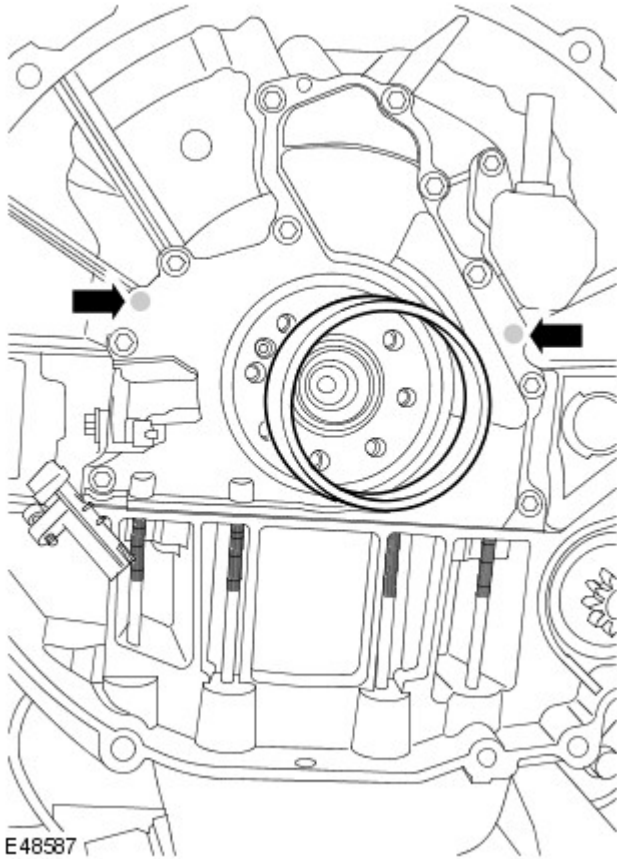
3. Remove the CKP sensor ring.  
For additional information, refer to: [Crankshaft Position \(CKP\) Sensor Ring](#) (303-14A Electronic Engine Controls - TDV6 2.7L Diesel, Removal and Installation).

4. Remove the crankshaft retainer plate.

- Remove the 14 bolts.



### Installation



#### 1. CAUTIONS:



Oil seals must be fitted dry.



Tighten the bolts securing the seal retainer to the cylinder block first.

Install the crankshaft retainer plate.

- Clean the component mating faces.
- Install the seal retainer with its protection sleeve onto the crankshaft.
- Locate the seal retainer onto the sump flange.
- Engage the seal retainer dowels with the cylinder block and lightly tighten 2 bolts on opposite sides of the retainer.
- Remove the seal protection sleeve.
- Install remaining bolts and tighten all bolts evenly to 10 Nm (7 lb.ft).

#### 2. Install the CKP sensor ring to the crankshaft.

For additional information, refer to: [Crankshaft Position \(CKP\) Sensor Ring](#) (303-14A Electronic Engine Controls - TDV6 2.7L Diesel, Removal and Installation).

#### 3. Connect the battery ground cable.

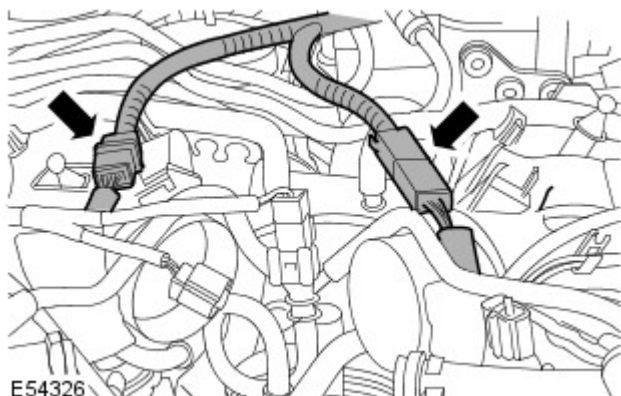
For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

# Engine - TDV6 2.7L Diesel - Cylinder Head LH

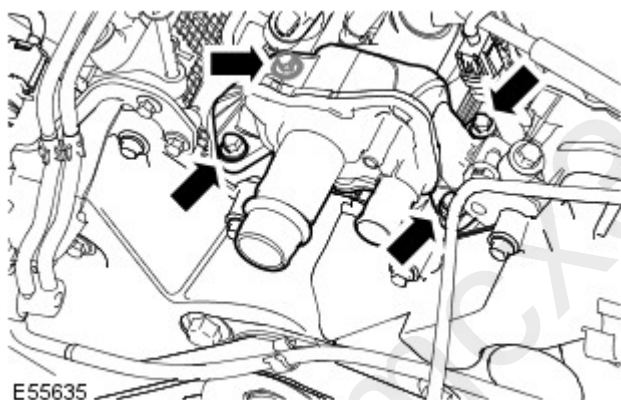
In-vehicle Repair

## Removal

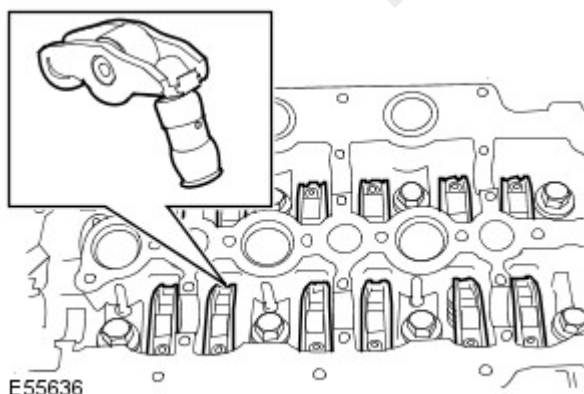
1. Disconnect the battery ground cable.  
For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).
2. Remove the LH bank camshafts.
3. Remove the LH exhaust manifold.  
For additional information, refer to: [Exhaust Manifold LH](#) (303-01A Engine - TDV6 2.7L Diesel, In-vehicle Repair).
4. Disconnect the LH glow plug wiring harness electrical connector.

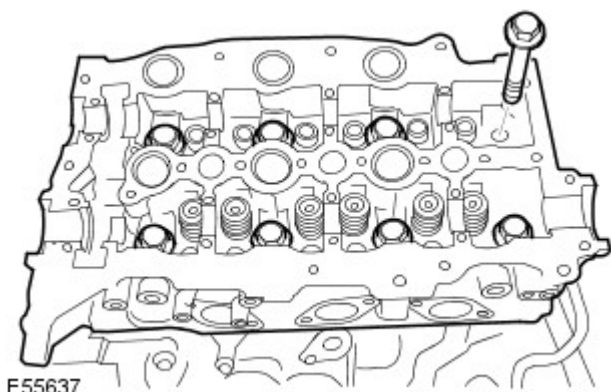


5. Remove the cylinder head coolant outlet connector.



6. Remove the hydraulic adjuster and rocker assemblies.





## 7. CAUTIONS:



Only use a plastic scraper to clean off the old gasket.



The cylinder head must not be placed mating face down. Failure to follow this instruction may result in damage to the vehicle.

Remove the LH cylinder head assembly.

- Remove and discard the eight cylinder head bolts.
- Remove and discard the cylinder head gasket.

## Installation

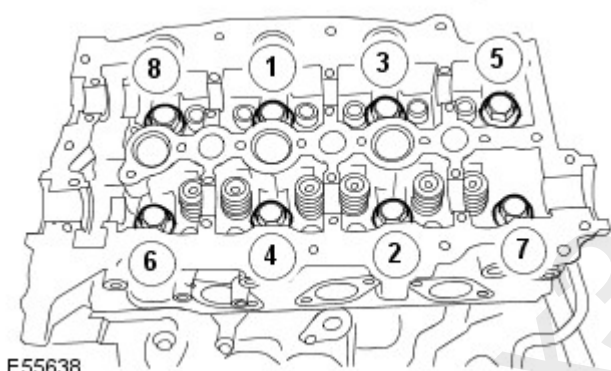
1. Clean the component mating faces.
2. Check cylinder head face for distortion, across the center and from corner to corner.
3. **NOTE:** The cylinder head gasket must be installed over the cylinder head to cylinder block dowels.

Install a new cylinder head gasket.



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

- **NOTE:** Install a new cylinder head gasket.
- **NOTE:** The cylinder head gasket must be installed over the cylinder head to cylinder block dowels.
- **NOTE:** Make sure the cylinder head is installed in its original position.
- **NOTE:** Tighten the retaining bolts in the indicated sequence in four stages.



Install the LH cylinder head assembly and install new cylinder head retaining bolts.

- Stage one: Tighten to 20 Nm (15 lb.ft).
- Stage two: Tighten to 40 Nm (30 lb.ft).
- Stage three: Tighten to 80 Nm (59 lb.ft).
- Stage four: Tighten a further 180 degrees.

5. Install the hydraulic adjuster and rocker assemblies.
6. Connect the LH glow plug wiring harness electrical connector.
7. **NOTE:** Install new O-ring seals.

Install the cylinder head coolant outlet connector.

- Install the four retaining bolts and tighten to 10 Nm (7 lb.ft).

8. Install the LH exhaust manifold.  
For additional information, refer to: [Exhaust Manifold LH](#) (303-01A Engine - TDV6 2.7L Diesel, In-vehicle Repair).
9. Install the LH bank camshafts.
10. Connect the battery ground cable.  
For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

# Engine - TDV6 2.7L Diesel - Cylinder Head RH

In-vehicle Repair

## Removal

1. Disconnect the battery ground cable.  
For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).
2. Remove the RH exhaust manifold.  
For additional information, refer to: [Exhaust Manifold RH](#) (303-01A Engine - TDV6 2.7L Diesel, In-vehicle Repair).
3. Remove the RH camshafts.
4.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

5. Release the engine breather tube.

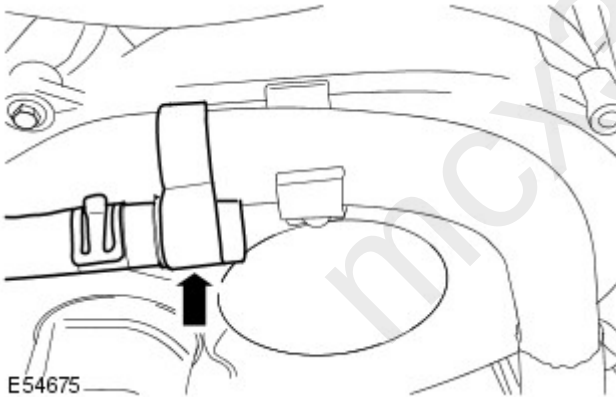
- Remove the retaining bolt.



E55043

6. Release the coolant bleed hose.

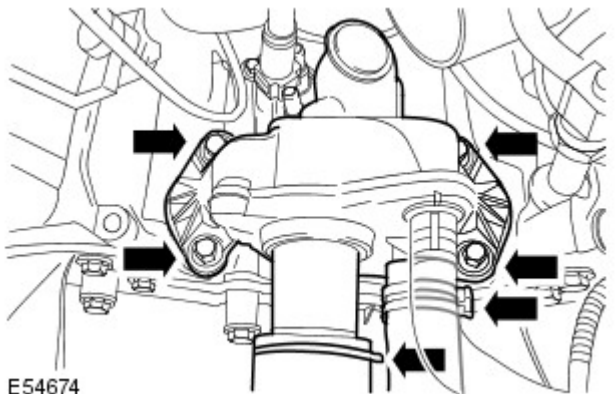
- Release the retaining clip.



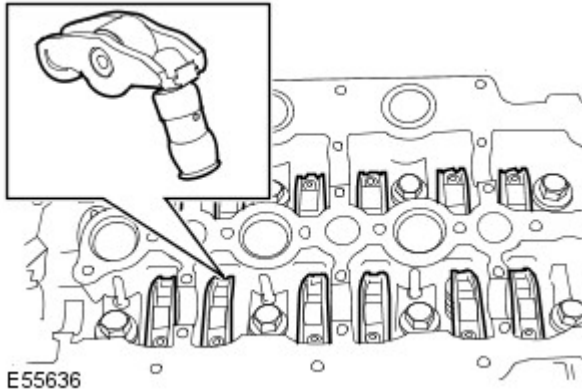
E54675

7. Remove the cylinder head coolant elbow.

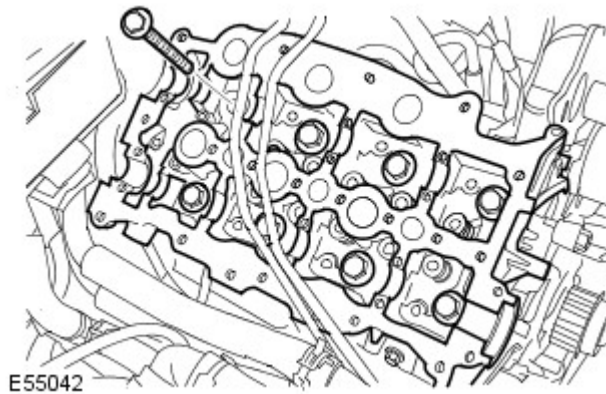
- Release the two retaining clips and disconnect the hoses.
- Remove the four retaining bolts.
- Remove and discard the O-ring seals.



E54674



8. Remove the hydraulic adjuster and rocker assemblies.



#### 9. CAUTIONS:



The cylinder head must not be placed mating face down. Failure to follow this instruction may result in damage to the vehicle.



Only use a plastic scraper to clean off the old gasket.

Remove the RH cylinder head assembly.

- Remove and discard the eight cylinder head bolts.
- Remove and discard the cylinder head gasket.

### Installation

1. Clean the component mating faces.
2. Check cylinder head face for distortion, across the center and from corner to corner.  
For additional information, refer to: [Specifications](#) (303-01A Engine - TDV6 2.7L Diesel, Specifications).



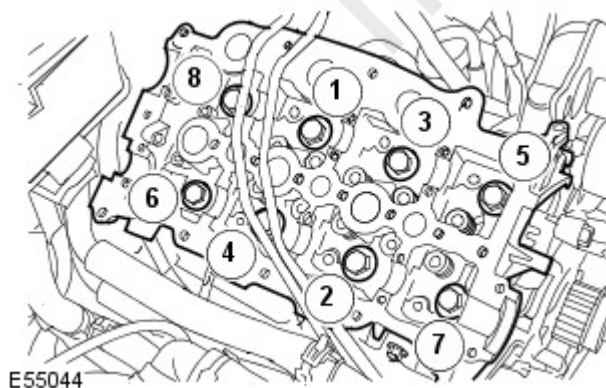
**CAUTION:** The head gasket must be installed over the cylinder block dowels.

Install a new cylinder head gasket.

**4. NOTE:** Tighten the retaining bolts in the indicated sequence in four stages.

Install the RH cylinder head assembly

- Install new cylinder head retaining bolts.
- Tighten the bolts evenly in four stages to the sequence shown.
- Stage one: Tighten to 20 Nm (15 lb.ft).
- Stage two: Tighten to 40 Nm (30 lb.ft).
- Stage three: Tighten to 80 Nm (59 lb.ft).
- Stage four: Tighten a further 180 degrees.



5. Install the hydraulic adjuster and rocker assemblies.

6. Install the cylinder head coolant outlet elbow.

- Install new O-ring seals.
- Install the four retaining bolts and tighten to 10 Nm (7 lb.ft).
- Connect the hoses and secure with the clips.

7. Secure the coolant bleed hose.
8. Secure the engine breather tube.
  - Tighten the bolt to 10 Nm (7 lb.ft).
9. Install the RH camshafts.
10. Install the RH exhaust manifold.

For additional information, refer to: [Exhaust Manifold RH](#) (303-01A Engine - TDV6 2.7L Diesel, In-vehicle Repair).
11. Connect the battery ground cable.

For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

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# Engine - TDV6 2.7L Diesel - Valve Cover LH

In-vehicle Repair

## Removal

### • WARNINGS:



Wait at least 30 seconds after the engine stops before commencing any repair to the high-pressure fuel injection system. Failure to follow this instruction may result in personal injury.



Do not carry or operate cellular phones when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.



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



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



Do not carry out any repairs to the fuel system with the engine running. The fuel pressure within the system can be as high as 1650 bar (23,931 lb-sq-in). Failure to follow this instruction may result in personal injury.

### • CAUTIONS:



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

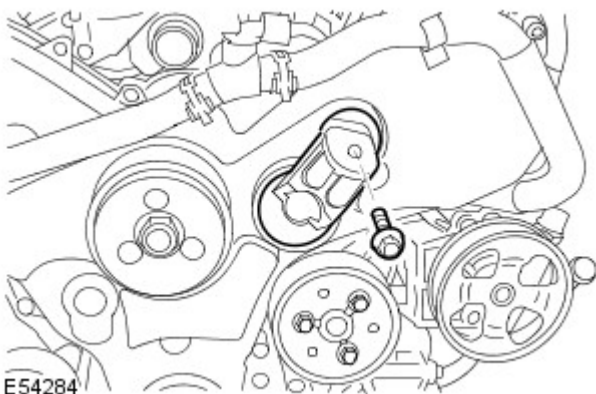


Always carry out the cleaning process before carrying out any repairs to the fuel injection system components. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.



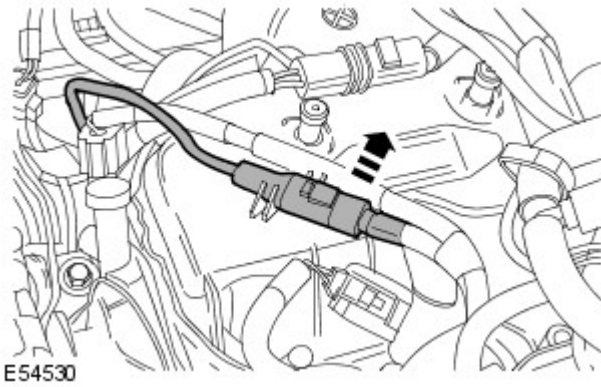
Diesel fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or lines. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

1. Disconnect the battery ground cable.  
For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).
2. Remove the intake air shutoff throttle.  
For additional information, refer to: [Intake Air Shutoff Throttle](#) (303-04A Fuel Charging and Controls - TDV6 2.7L Diesel, Removal and Installation).
3. Remove the accessory drive belt.  
For additional information, refer to: [Accessory Drive Belt](#) (303-05A Accessory Drive - TDV6 2.7L Diesel, Removal and Installation).
4. Remove the accessory drive belt idler pulley.
  - Remove the retaining bolt.

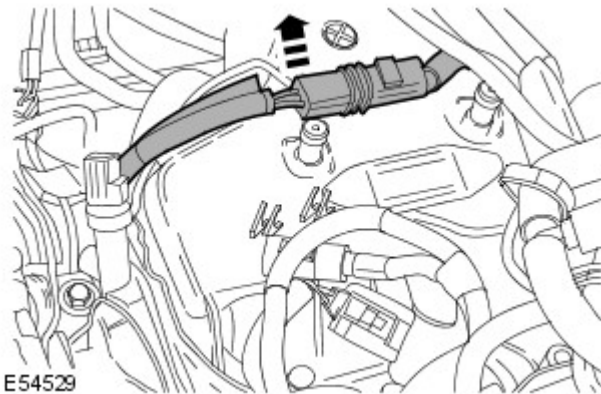


5. Release the knock sensor (KS) harness from the valve cover.

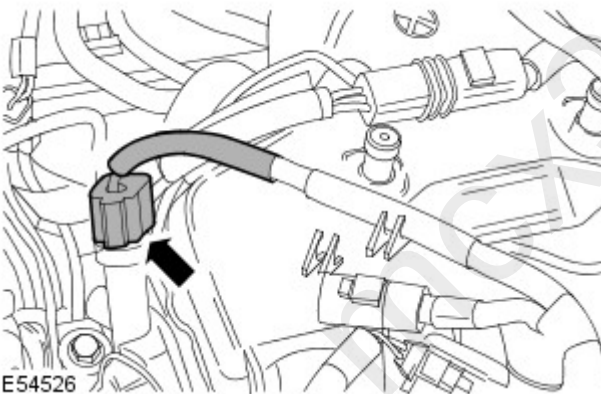
6. Disconnect the KS electrical connector.



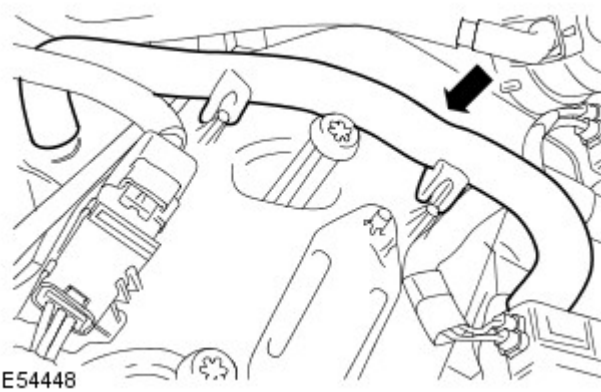
7. Release the glow plug harness from the valve cover.



8. Disconnect the engine oil pressure (EOP) sensor electrical connector.



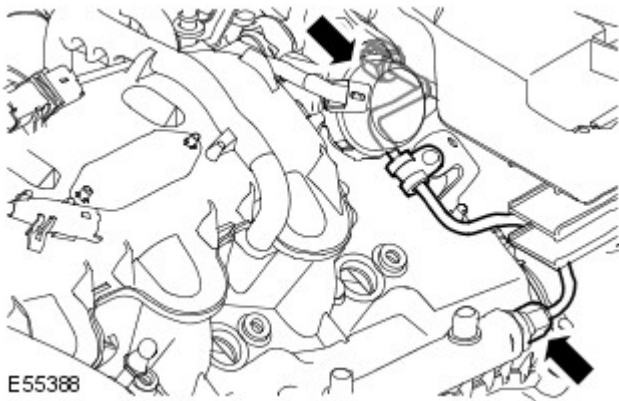
9. Disconnect the valve cover breather hose.



10. Remove the fuel injector.  
For additional information, refer to: [Fuel Injector](#) (303-04A Fuel Charging and Controls - TDV6 2.7L Diesel, Removal and Installation).
11. Remove the 2 remaining fuel injectors.

12. Release the high-pressure fuel supply line.

- Remove the retaining bolt.



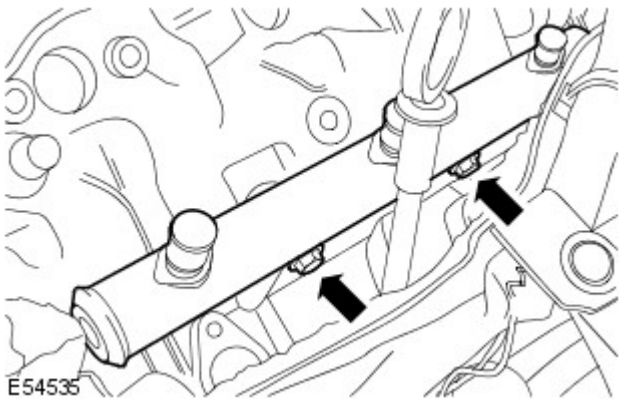
13.  **CAUTION:** Make sure that the high-pressure fuel supply line remains in contact with the fuel injection supply manifold and the fuel injection diverter rail until both unions have been detached and cleaned. Failure to follow this instruction may result in foreign matter ingress to the fuel injection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

Remove and discard the high-pressure fuel supply line.

- Install blanking caps to the exposed ports.

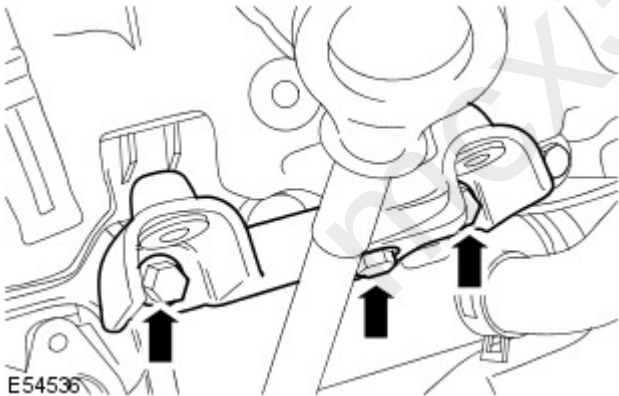
14. Remove the fuel injection supply manifold.

- Remove the two retaining bolts.

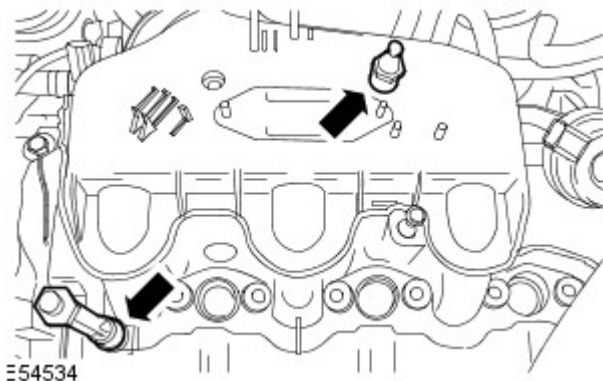


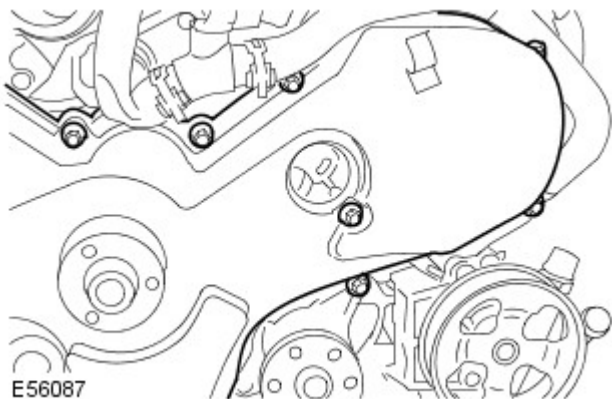
15. Remove the fuel injection supply manifold securing bracket.

- Release the dipstick tube.
- Remove the three retaining bolts.



16. Remove the engine cover locating studs.



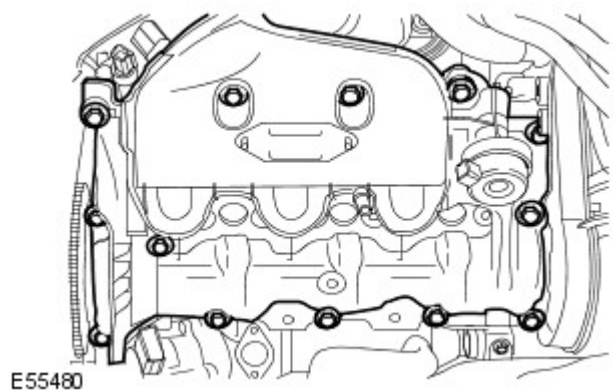


**17. Release the timing belt cover.**

- Reposition the timing cover to access the two front valve cover retaining bolts.
- Fully loosen the seven timing belt cover retaining bolts shown.

**18. Remove the LH valve cover.**

- Loosen the 13 valve cover retaining bolts.



**Installation**

**1. Install the LH valve cover.**

- Tighten the 13 retaining bolts to 10 Nm (7 lb.ft).

**2. Attach the timing belt cover.**

- Tighten the seven retaining bolts to 10 Nm (7 lb.ft).

**3. Install the engine cover locating studs.**

**4. Install the fuel injection supply manifold securing bracket.**

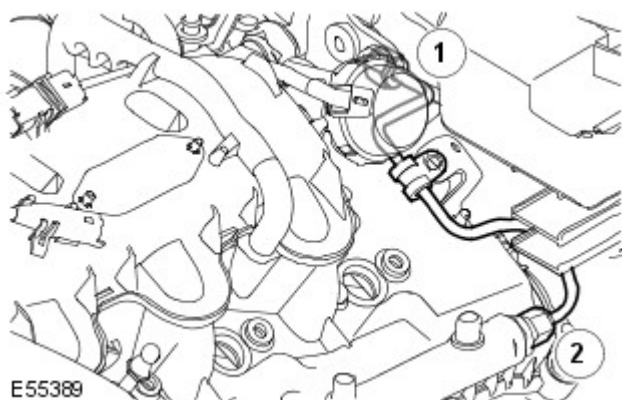
- Install the two retaining bolts.
- Tighten the bolts to 23 Nm (17 lb.ft).
- Secure the dipstick tube.

**5. Install the fuel injection supply manifold.**

- Install the two bolts, but do not fully tighten at this stage.

**6. Install a new high-pressure fuel supply line.**

- Remove the blanking caps from the ports.
- Install the new high-pressure fuel supply line, but do not tighten unions at this stage.
- Tighten the fuel injection supply manifold retaining bolts to 23 Nm (17 lb.ft).
- Tighten the fuel injection supply line unions in the sequence shown in four stages:
  - Stage 1: Tighten the high-pressure fuel supply line union at the fuel injection diverter rail to 15 Nm (11 lb.ft).
  - Stage 2: Tighten the high-pressure fuel supply line union at the fuel injection supply manifold to 15 Nm (11 lb.ft).



- Stage 3: Tighten the high-pressure fuel supply line union at the fuel injection diverter rail to 30 Nm (22 lb.ft).
- Stage 4: Tighten the high-pressure fuel supply line union at the fuel injection supply manifold to 30 Nm (22 lb.ft).

**7. Secure the high-pressure fuel supply line.**

- Tighten the retaining bolt to 10 Nm (7 lb.ft).

**8. Install the fuel injector.**

For additional information, refer to: [Fuel Injector](#) (303-04A Fuel Charging and Controls - TDV6 2.7L Diesel, Removal and Installation).

**9. Install the 2 remaining fuel injectors.**

**10. Connect the valve cover breather hose.**

**11. Connect the EOP sensor electrical connector.**

**12. Connect the KS electrical connector.**

**13. Attach the glow plug harness and KS harness to the valve cover.**

**14. Install the accessory drive belt idler pulley.**

- Install the retaining bolt and tighten to 47 Nm (35 lb.ft).

**15. Install the accessory drive belt.**

For additional information, refer to: [Accessory Drive Belt](#) (303-05A Accessory Drive - TDV6 2.7L Diesel, Removal and Installation).

**16. Install the intake air shutoff throttle.**

For additional information, refer to: [Intake Air Shutoff Throttle](#) (303-04A Fuel Charging and Controls - TDV6 2.7L Diesel, Removal and Installation).

**17. Connect the battery ground cable.**

For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

## Engine - TDV6 2.7L Diesel - Valve Cover RH

In-vehicle Repair

### Removal

#### • WARNINGS:



Wait at least 30 seconds after the engine stops before commencing any repair to the high-pressure fuel injection system. Failure to follow this instruction may result in personal injury.



Do not carry or operate cellular phones when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.



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



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



Do not carry out any repairs to the fuel system with the engine running. The fuel pressure within the system can be as high as 1650 bar (23,931 lb-sq-in). Failure to follow this instruction may result in personal injury.

#### • CAUTIONS:



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



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

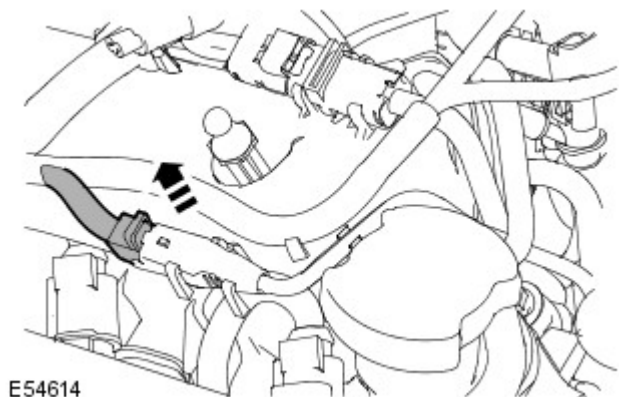


Diesel fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or lines. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

1. Disconnect the battery ground cable.  
For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).
2. Remove the intake air shutoff throttle.  
For additional information, refer to: [Intake Air Shutoff Throttle](#) (303-04A Fuel Charging and Controls - TDV6 2.7L Diesel, Removal and Installation).
3. Release the glow plug harness from the valve cover.



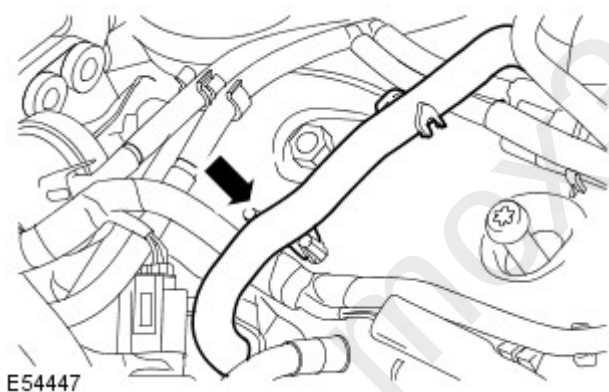
4. Release the knock sensor (KS) harness from the valve cover.



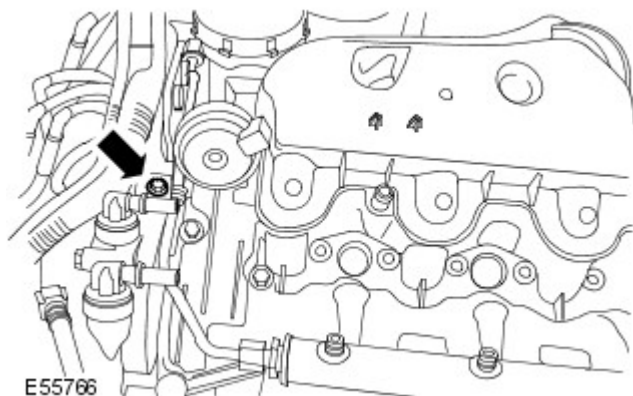
5. Disconnect the KS electrical connector.

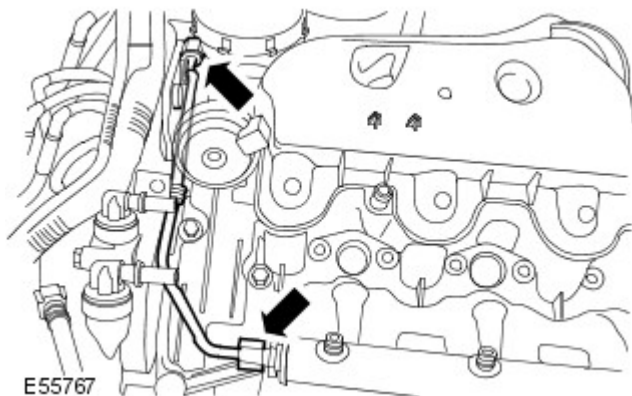


6. Disconnect the valve cover breather hose.



7. Remove the fuel injector.  
For additional information, refer to: [Fuel Injector](#) (303-04A Fuel Charging and Controls - TDV6 2.7L Diesel, Removal and Installation).
8. Remove the remaining fuel injectors.
9. Release the high-pressure fuel supply line.
- Remove the retaining bolt.

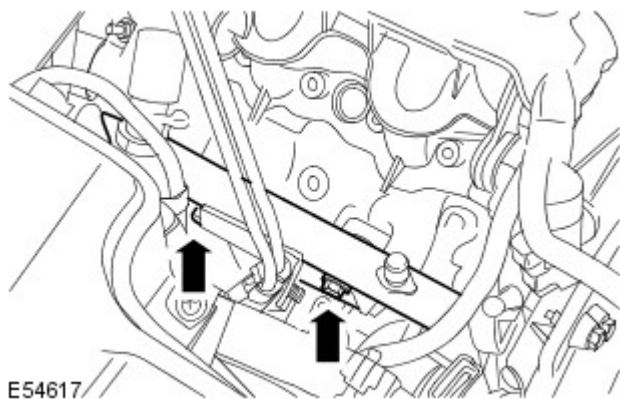




**10. ⚠ CAUTION:** Make sure that the high-pressure fuel supply line remains in contact with the fuel injection supply manifold and the fuel injection diverter rail until both unions have been detached and cleaned. Failure to follow this instruction may result in foreign matter ingress to the fuel injection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

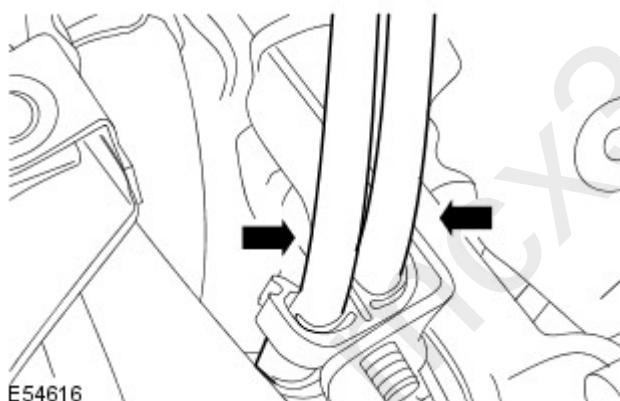
Remove and discard the high-pressure fuel supply line.

- Install blanking caps to the exposed ports.

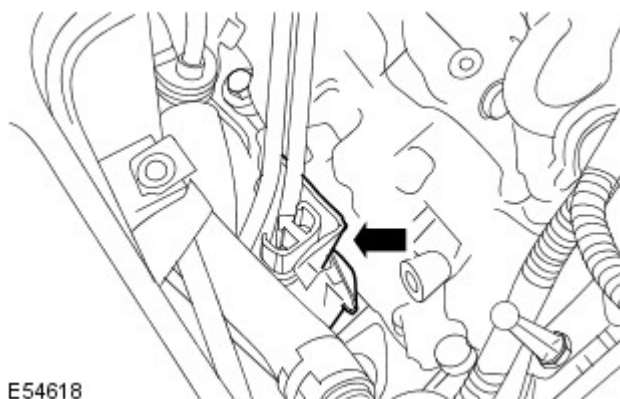


**11.** Remove the fuel injection supply manifold.

- Remove the two retaining bolts.

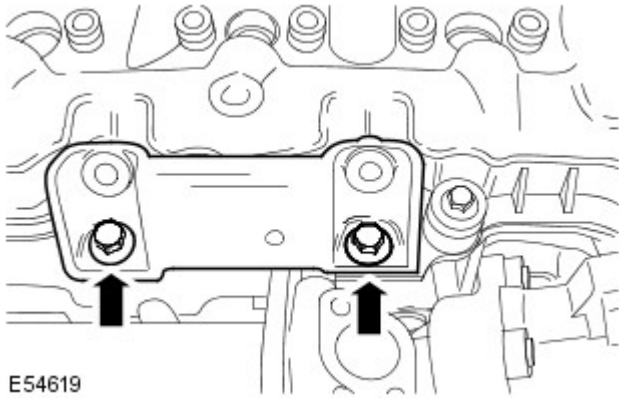


**12.** Detach the fuel lines.



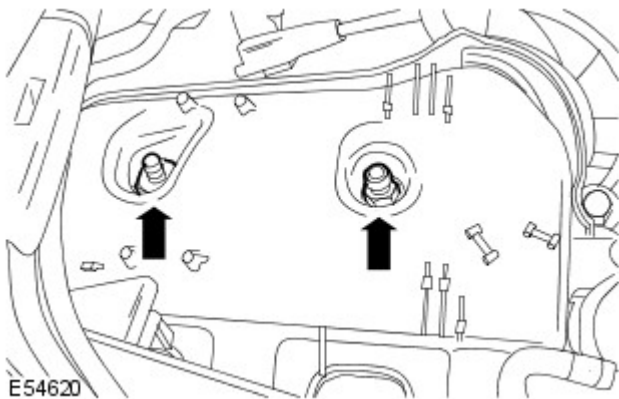
**13.** Remove the fuel line securing bracket.

- Remove the retaining bolt.

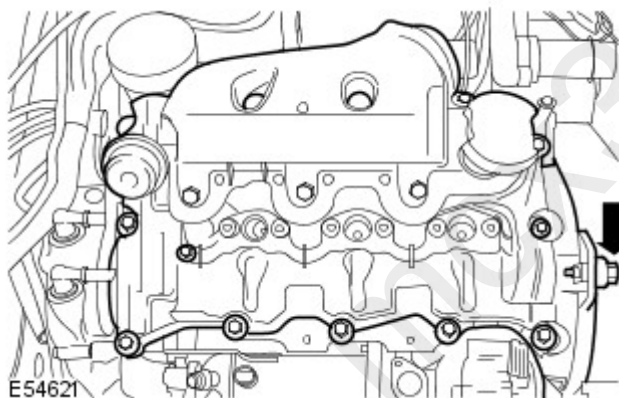


**14.** Remove the fuel injection supply manifold securing bracket.

- Remove the two retaining bolts.



**15.** Remove the engine cover locating studs.



**16.** Remove the RH valve cover.

- Fully loosen the 14 valve cover retaining bolts.

## Installation

**1.** Install the RH valve cover.

- Tighten the 14 retaining bolts to 10 Nm (7 lb.ft).

**2.** Install the engine cover locating studs.

**3.** Install the fuel injection supply manifold securing bracket.

- Install the two retaining bolts.
- Tighten the bolts to 23 Nm (17 lb.ft).

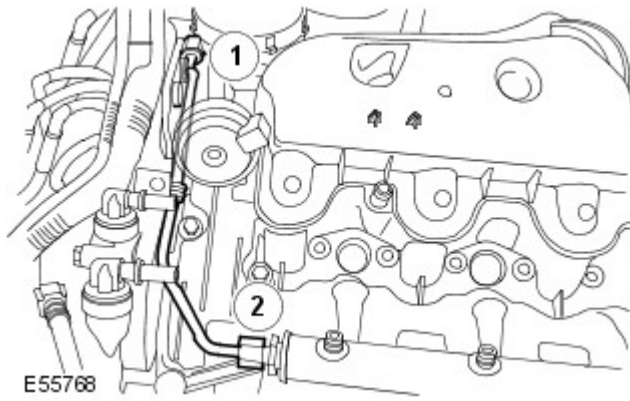
**4.** Install the fuel line retaining bracket.

- Tighten to 10 Nm (7 lb.ft).

**5.** Attach the fuel lines to the retaining bracket.

**6.** Install the fuel injection supply manifold.

- Install the two bolts, but do not fully tighten at this stage.



**7. Install a new high-pressure fuel supply line.**

- Remove the blanking caps from the ports.
- Loosely install the new high-pressure fuel supply line.
- Tighten the fuel injection supply manifold retaining bolts to 23 Nm (17 lb.ft).
- Tighten the fuel injection supply line unions in the sequence shown in four stages:
- Stage 1: Tighten the high-pressure fuel supply line union at the fuel injection diverter rail to 15 Nm (11 lb.ft).
- Stage 2: Tighten the high-pressure fuel supply line union at the fuel injection supply manifold to 15 Nm (11 lb.ft).
- Stage 3: Tighten the high-pressure fuel supply line union at the fuel injection diverter rail to 30 Nm (22 lb.ft).
- Stage 4: Tighten the high-pressure fuel supply line union at the fuel injection supply manifold to 30 Nm (22 lb.ft).

**8. Secure the high-pressure fuel supply line.**

- Tighten the bolt to 10 Nm (7 lb.ft).

**9. Install the fuel injector.**

For additional information, refer to: [Fuel Injector](#) (303-04A Fuel Charging and Controls - TDV6 2.7L Diesel, Removal and Installation).

**10. Install the remaining fuel injectors.**

**11. Connect the valve cover breather hose.**

**12. Connect the KS electrical connector.**

**13. Attach the glow plug harness and KS harness to the valve cover.**

**14. Install the intake air shutoff throttle.**

For additional information, refer to: [Intake Air Shutoff Throttle](#) (303-04A Fuel Charging and Controls - TDV6 2.7L Diesel, Removal and Installation).

**15. Connect the battery ground cable.**

For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

## Engine - TDV6 2.7L Diesel - Engine Mount LH

In-vehicle Repair

### Removal

1. Disconnect the battery ground cable.  
For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).
2. Remove the turbocharger.  
For additional information, refer to: [Turbocharger](#) (303-04B Fuel Charging and Controls - Turbocharger - TDV6 2.7L Diesel, Removal and Installation).

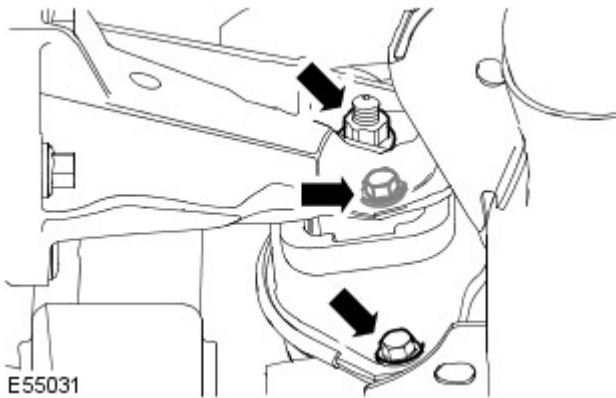
3.  **CAUTION:** Protect the engine during this operation.

Support the engine.

- Raise the engine clear of its LH mount.

4. Remove the engine mount.

- Remove the retaining nut.
- Raise the engine clear of its LH mount.
- Remove and discard the two retaining bolts.



### Installation

1. Install the engine mount.
  - Clean the component mating faces.
  - Install new retaining bolts.
  - Tighten the bolts to 45 Nm (33 lb.ft), then a further 60 degrees.
2.  **CAUTION:** Protect the engine during this operation.  
Lower the engine onto its mount.
3. Install the engine mount retaining nut.
  - Tighten the nut to 90 Nm (66 lb.ft).
4. Install the turbocharger.  
For additional information, refer to: [Turbocharger](#) (303-04B Fuel Charging and Controls - Turbocharger - TDV6 2.7L Diesel, Removal and Installation).
5. Connect the battery ground cable.  
For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

**Engine - TDV6 2.7L Diesel - Camshafts LH**

In-vehicle Repair

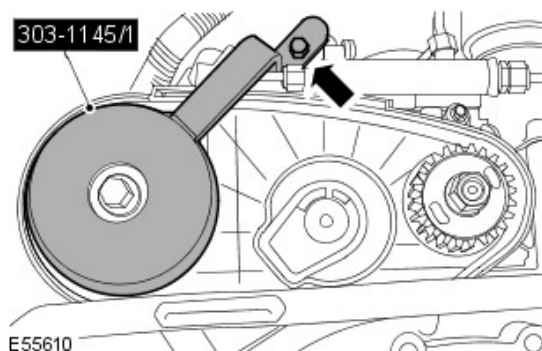
| Special Tool(s)                                                                                           |                                            |
|-----------------------------------------------------------------------------------------------------------|--------------------------------------------|
| <br>303-1145/1<br>E60399 | Camshaft pulley holding tool<br>303-1145/1 |
| <br>303-1145/2<br>E60429 | Camshaft pulley bolt remover<br>303-1145/2 |
| <br>303-1145/3<br>E60430 | Camshaft pulley bolt socket<br>303-1145/3  |
| <br>303-1119<br>E54542  | Installer - Camshaft Oil Seal<br>303-1119  |

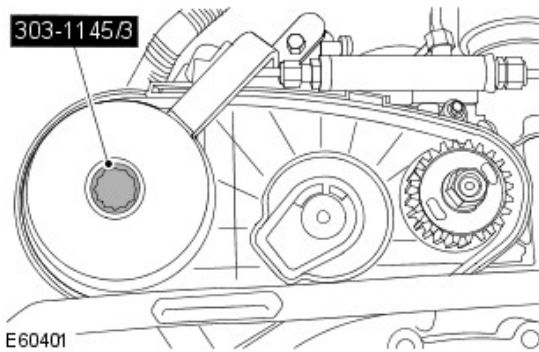
**Materials**

| Name        | Specification |
|-------------|---------------|
| Loctite 242 | ESK-M4G247-A1 |

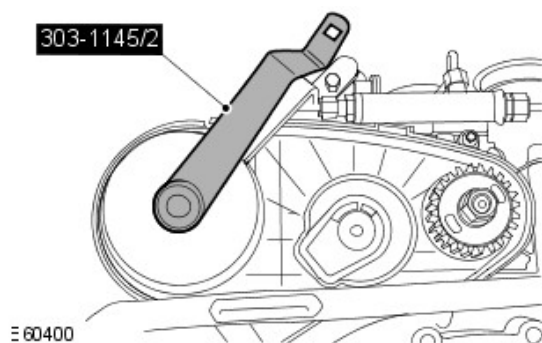
**Removal**

1. Disconnect the battery ground cable.  
For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).
2. Remove the camshaft front seal.  
For additional information, refer to: [Camshaft Front Seal](#) (303-01A Engine - TDV6 2.7L Diesel, In-vehicle Repair).
3. Remove the LH valve cover.  
For additional information, refer to: [Valve Cover LH](#) (303-01A Engine - TDV6 2.7L Diesel, In-vehicle Repair).
4. Remove the fuel injection pump belt.  
For additional information, refer to: [Fuel Injection Pump Belt - VIN Range: SALLA000304->END OF 06 MY](#) (303-05A Accessory Drive - TDV6 2.7L Diesel, Removal and Installation).
5. Install the special tool to the camshaft rear pulley.
  - Rotate the crankshaft to align the special tool to the engine lifting bracket.
  - Install the special tool retaining bolt.





6. Install the special tool to the camshaft rear pulley retaining bolt.

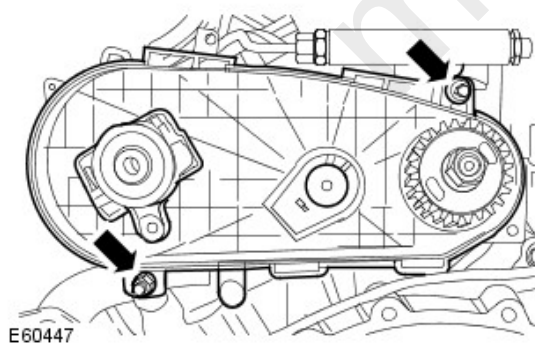
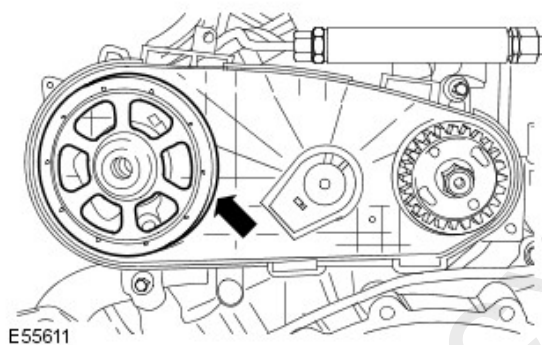


7. Using the special tools, remove and discard the camshaft rear pulley retaining bolt.

- Rotate the crankshaft clockwise to retain the camshaft rear pulley.

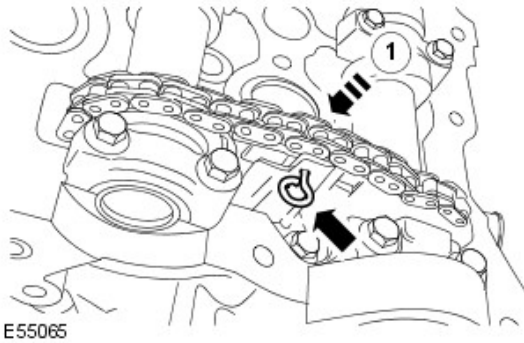
8. Remove the special tools.

9. Remove the camshaft rear pulley.



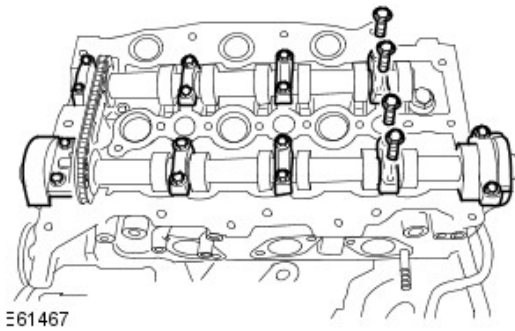
10. Remove the fuel injection pump belt rear cover.

- Remove the fuel injection pump belt rear cover retaining bolt.



11. Retain the secondary timing chain tensioner piston.

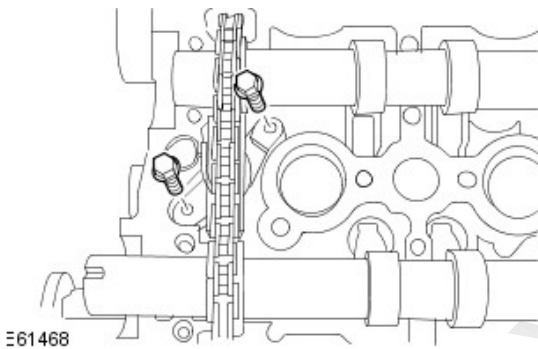
- Reposition the secondary timing chain tensioner.
- Install a 1.5 mm (0.060 in.) diameter pin into the secondary timing chain tensioner piston.



12.  **CAUTION:** Evenly and progressively, release the camshaft bearing caps.

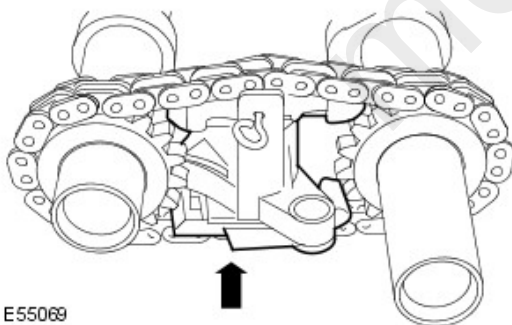
Remove the camshaft bearing caps.

- Remove the 18 retaining bolts.

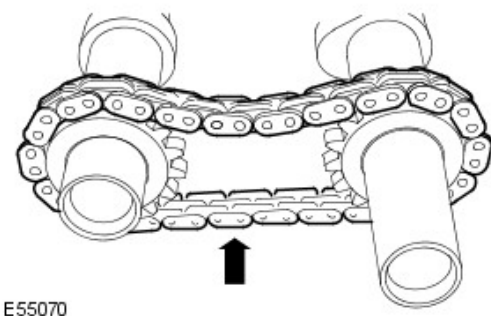


13. Remove the camshafts and secondary timing chain tensioner assembly.

- Remove the two retaining bolts.
- Release the LH secondary timing chain tensioner.



14. Remove the secondary timing chain tensioner.



15. Remove the LH camshafts.

- Release the secondary timing chain from the LH camshafts.
- Remove and discard the LH camshaft rear seal.

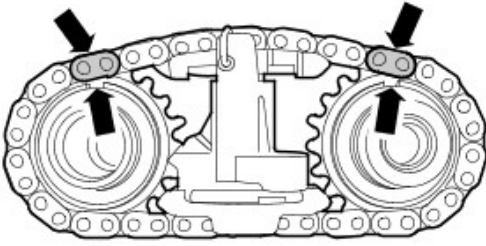
## Installation

1. Install the secondary timing chain onto the camshafts.

2.  **CAUTION:** Do not release the secondary timing chain tensioner locking pin until all of the camshaft bearing caps have been installed.

Install the secondary timing chain tensioner.

- Align the marks on the camshafts with the marks on the secondary timing chain.



E55062

3. Install the camshafts and secondary timing chain tensioner assembly.

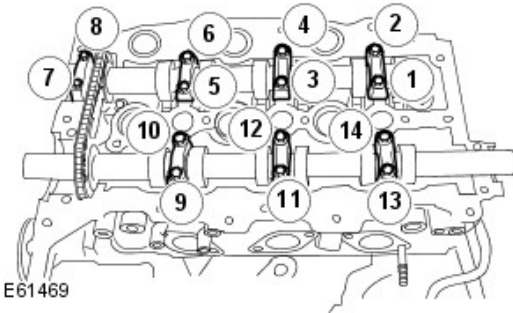
- Lubricate the journals and camshaft lobes.

4. Attach the LH secondary timing chain tensioner.

- Tighten the two retaining bolts to 10 Nm (7 lb.ft).

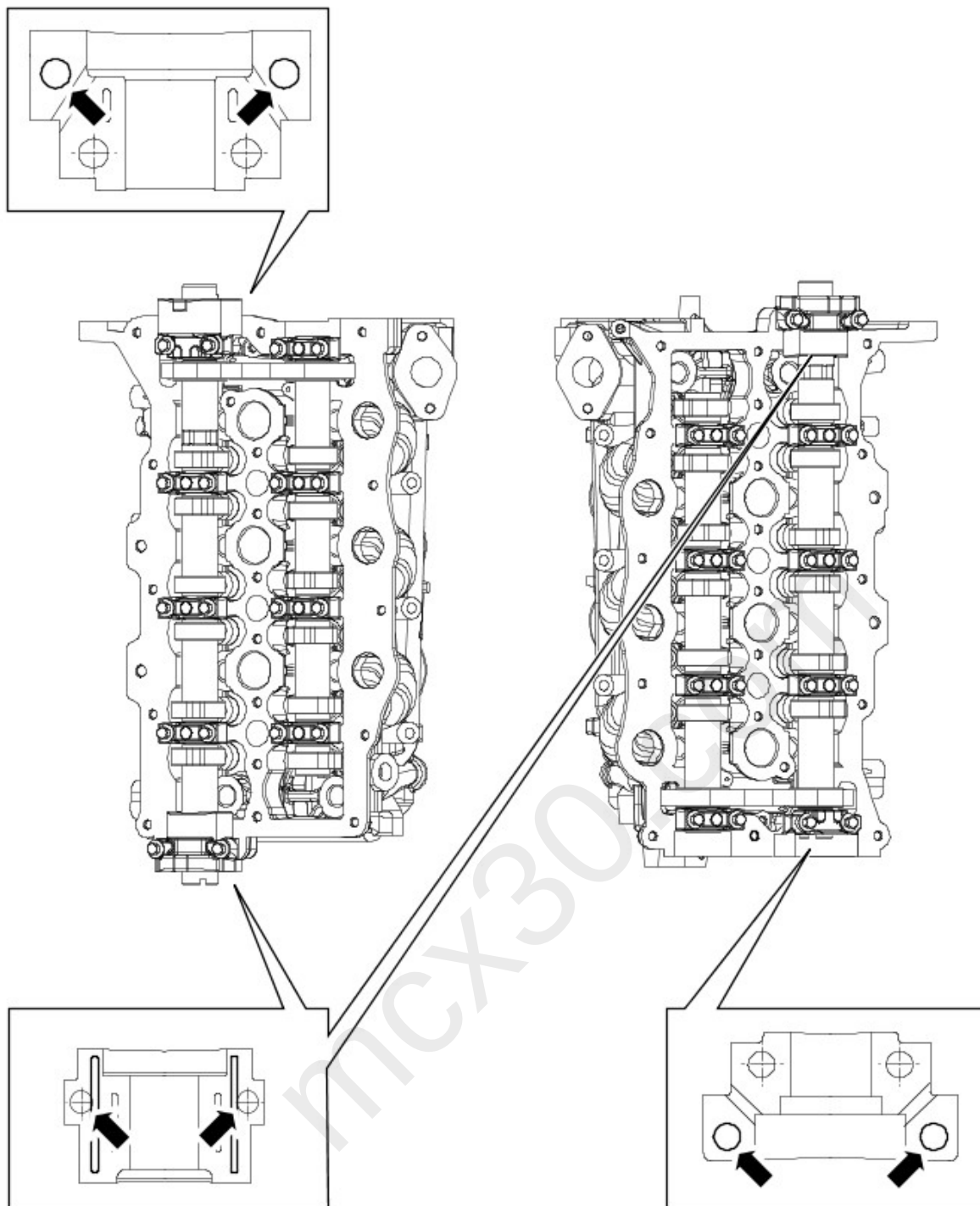
5. Install the camshaft bearing caps.

- Do not install the two exhaust camshaft end bearing caps at this stage.
- Tighten the bolts evenly in three stages in the sequence shown.
- Stage one: Tighten to 1 Nm (1 lb.ft).
- Stage two: Tighten to 5 Nm (4 lb.ft).
- Stage three: Tighten to 10 Nm (7 lb.ft).



E61469

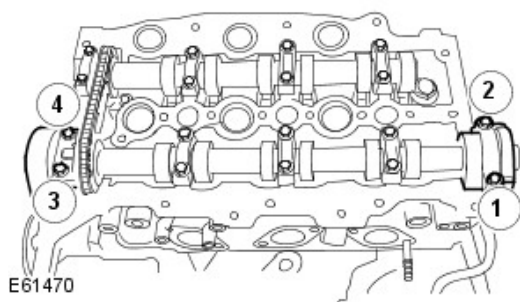
6. Apply sealant to the two exhaust camshaft end bearing caps at the positions shown. For additional information, refer to: [Specifications](#) (303-01A Engine - TDV6 2.7L Diesel, Specifications).



E55072

7. Install the exhaust camshaft end bearing caps.

- Tighten the bolts evenly in three stages in the sequence shown.
- Stage one: Tighten to 1 Nm (1 lb.ft).
- Stage two: Tighten to 5 Nm (4 lb.ft).
- Stage three: Tighten to 10 Nm (7 lb.ft).



E61470

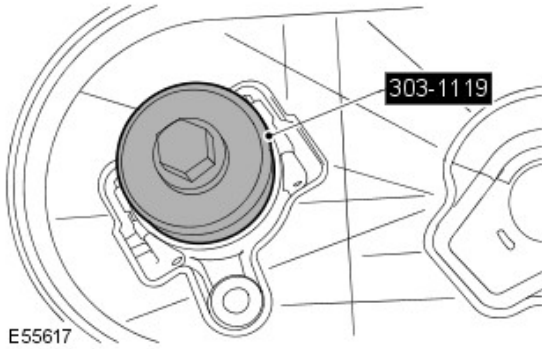
8. Release the secondary timing chain tensioner piston.

- Remove the locking pin.

**9.** Install the fuel injection pump belt rear cover.

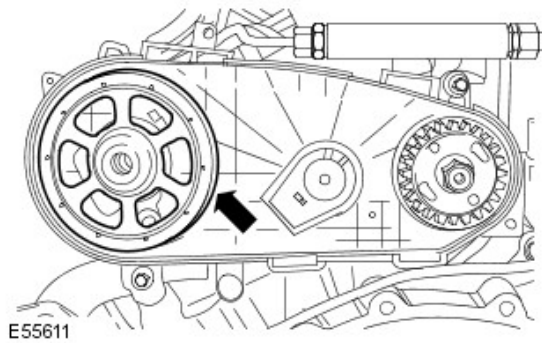
- Install the fuel injection pump belt rear cover retaining bolt.

**10.** Using the special tool, install the new camshaft rear seal.



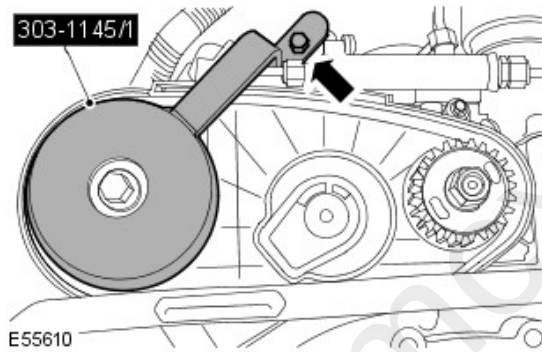
**11.** Install the camshaft rear pulley.

- Apply loctite 242 to the new camshaft pulley bolt.
- Install a new camshaft pulley retaining bolt.

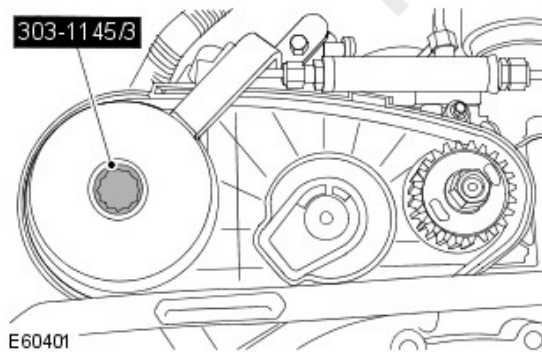


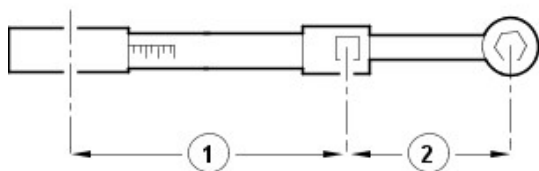
**12.** Install the special tool to the camshaft rear pulley.

- Install the special tool retaining bolt.

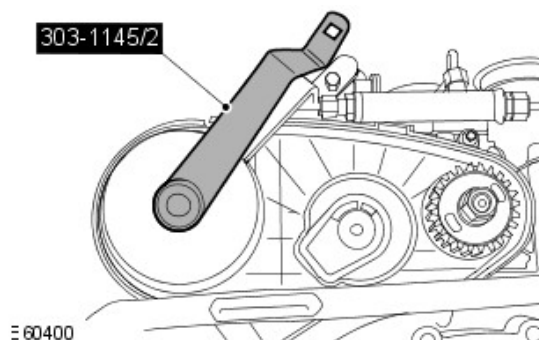


**13.** Install the special tool to the camshaft rear pulley retaining bolt.





E37107



**14.**  **CAUTION:** Make sure the torque wrench setting procedure is followed correctly. Failure to follow this instruction may result in damage to the vehicle.

Calculate the setting for the torque wrench.

- Stage 1: Multiply the required torque by the effective length of the torque wrench (1).
- Stage 2: Add the effective length of the special tool (2) to the effective length of the torque wrench.
- Stage 3: Divide the total of stage 1 by the total of stage 2.
- Stage 4: Set the torque wrench to the figure arrived at in stage 3.

**15.**  **CAUTION:** Make sure the torque wrench setting procedure is followed correctly. Failure to follow this instruction may result in damage to the vehicle.

Using the special tools, tighten the camshaft rear pulley retaining bolt to 40 Nm (30 lb.ft).

**16.**  **CAUTION:** Make sure the torque wrench setting procedure is followed correctly. Failure to follow this instruction may result in damage to the vehicle.

Using the special tools, tighten the camshaft rear pulley bolt a further 75 Nm (56 lb.ft).

- Rotate the crankshaft counter-clockwise to retain the camshaft rear pulley.

**17.** Remove the special tools.

**18.** Install the fuel injection pump belt.

For additional information, refer to: [Fuel Injection Pump Belt - VIN Range: SALLA000304->END OF 06 MY](#) (303-05A Accessory Drive - TDV6 2.7L Diesel, Removal and Installation).

**19.** Install the LH valve cover.

For additional information, refer to: [Valve Cover LH](#) (303-01A Engine - TDV6 2.7L Diesel, In-vehicle Repair).

**20.** Install the camshaft front seal.

For additional information, refer to: [Camshaft Front Seal](#) (303-01A Engine - TDV6 2.7L Diesel, In-vehicle Repair).

**21.** Connect the battery ground cable.

For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

# Engine - TDV6 2.7L Diesel - Engine Mount RH

In-vehicle Repair

## Removal

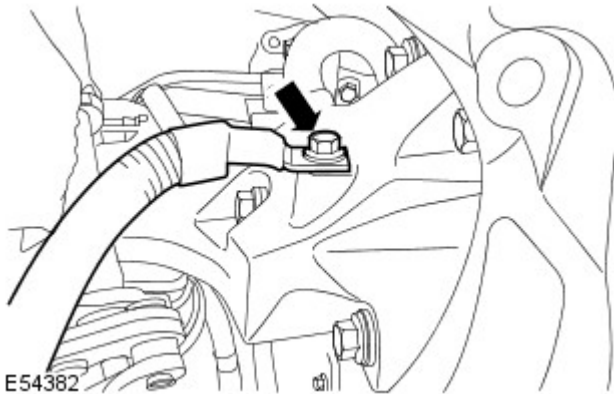
1. Disconnect the battery ground cable.  
For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).
2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

3. Remove the generator.  
For additional information, refer to: [Generator](#) (414-02A Generator and Regulator - TDV6 2.7L Diesel, Removal and Installation).

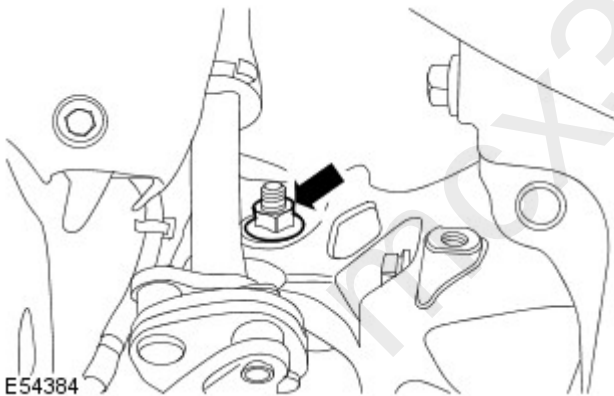
4. Disconnect the ground cable.

- Remove the ground cable retaining bolt.



5. Remove the engine mount bracket.

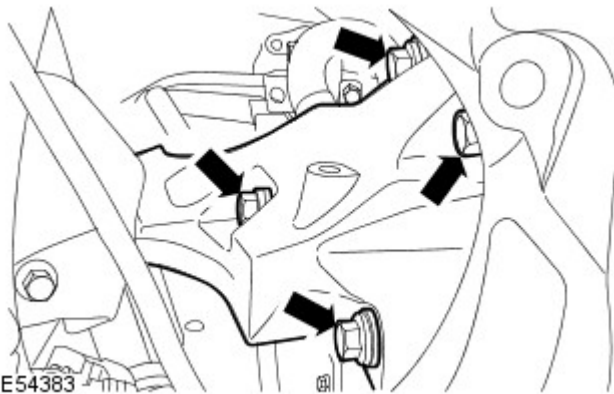
- Remove the nut.

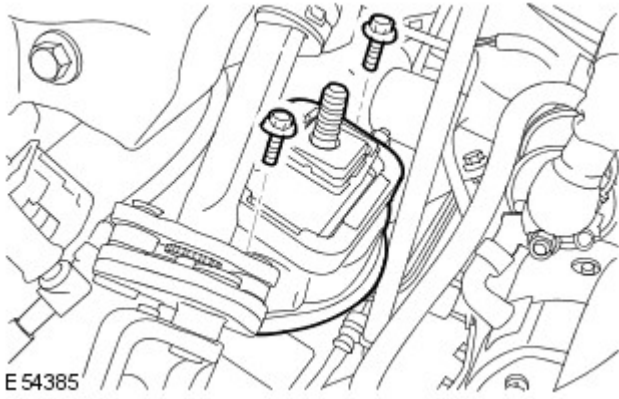


6.  **CAUTION:** Protect the engine during this operation.

Detach the engine mounting bracket.

- Support the engine.
- Remove the four retaining bolts.





**7. Remove the engine mount.**

- Remove and discard the two retaining bolts.

## **Installation**

**1. Install the engine mount.**

- Clean the component mating faces.
- Install new retaining bolts.
- Tighten the two new bolts to 45 Nm (33 lb.ft), then a further 60 degrees.

**2. Install the engine mount bracket.**

- Clean the component mating faces.
- Tighten the four retaining bolts to 80 Nm (59 lb.ft).

**3. Attach the engine mounting bracket.**

- Lower the engine onto its mount.
- Tighten the nut to 90 Nm (66 lb.ft).

**4. Connect the ground cable.**

- Install the retaining bolt.

**5. Install the generator.**

For additional information, refer to: [Generator](#) (414-02A Generator and Regulator - TDV6 2.7L Diesel, Removal and Installation).

**6. Connect the battery ground cable.**

For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

## Engine - TDV6 2.7L Diesel - Flywheel

In-vehicle Repair

### Removal

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

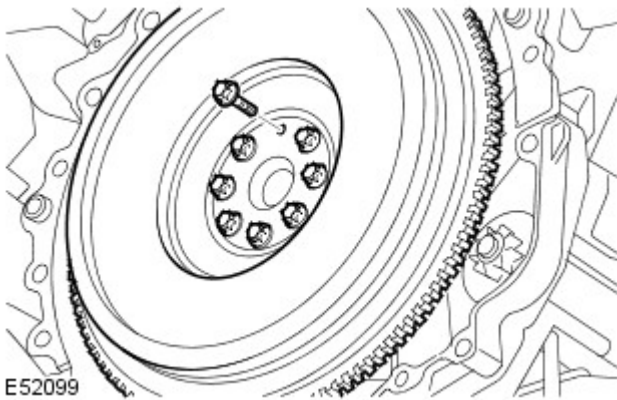
Raise and support the vehicle.

2. Remove the pressure plate and clutch disc.  
For additional information, refer to: [Clutch Disc and Pressure Plate](#) (308-01 Clutch - TDV6 2.7L Diesel, Removal and Installation).

3. **NOTE:** Prevent the flywheel from rotating.

Remove the flywheel.

- Remove the 8 Torx bolts.



### Installation

1.  **CAUTION:** Tighten the bolts in a diagonal sequence.

- **NOTE:** Prevent the flywheel from rotating.

Install the flywheel.

- Clean the component mating faces.
- Tighten the retaining bolts in three stages.
- Tighten the Torx bolts to 45 Nm (33 lb.ft).
- Tighten the Torx bolts by 45 degrees.
- Tighten the Torx bolts by a further 45 degrees.

2. Install the clutch disc and pressure plate.  
For additional information, refer to: [Clutch Disc and Pressure Plate](#) (308-01 Clutch - TDV6 2.7L Diesel, Removal and Installation).

# Engine - TDV6 2.7L Diesel - Flexplate

In-vehicle Repair

| Special Tool(s)                                                                                                |                                                            |
|----------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|
|  <p>303-947</p> <p>E55482</p> | <p>Flex plate locking tool (LRT-12-145)</p> <p>303-947</p> |

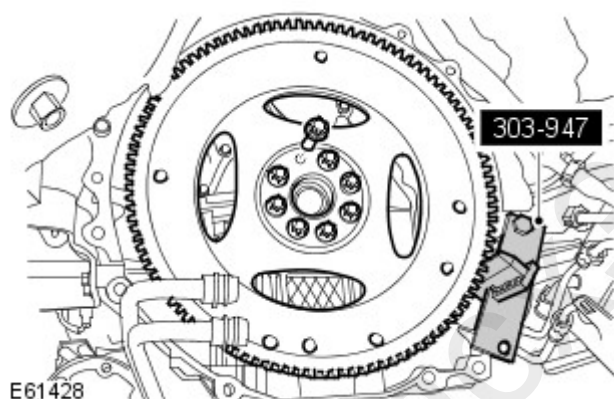
## Removal

1. Disconnect the battery ground cable.  
For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).
2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

3. Remove the transmission.  
For additional information, refer to: [Transmission](#) (307-01A Automatic Transmission/Transaxle - TDV6 2.7L Diesel, Removal and Installation).
4. Remove the torque converter flexplate.

- Using the special tool, lock the flexplate.
- Remove the 8 Torx bolts.

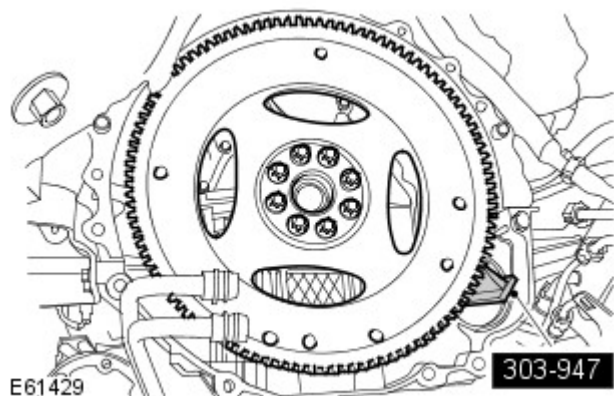


## Installation

1.  **CAUTION:** Tighten the bolts in a diagonal sequence.

Install the torque converter flexplate.

- Clean the component mating faces.
- Using the special tool, lock the flexplate.
- Tighten the Torx bolts progressively in 3 stages.
- Tighten the Torx bolts to 50 Nm (37 lb.ft).
- Tighten the Torx bolts by 45 degrees.
- Tighten the Torx bolts by a further 45 degrees.



2. Install the transmission.  
For additional information, refer to: [Transmission](#) (307-01A Automatic Transmission/Transaxle - TDV6 2.7L Diesel, Removal and Installation).
3. Connect the battery ground cable.  
For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information,

Specifications).

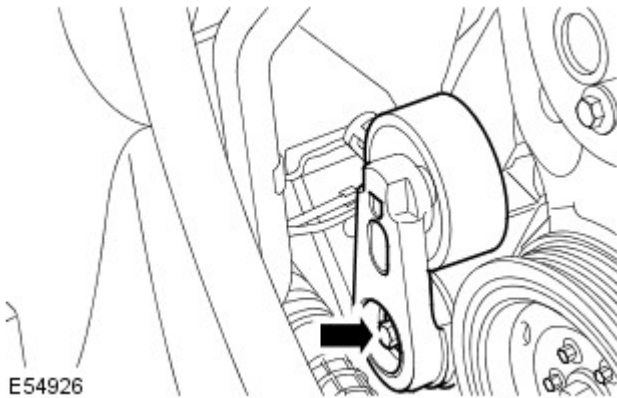
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# Engine - TDV6 2.7L Diesel - Oil Pump

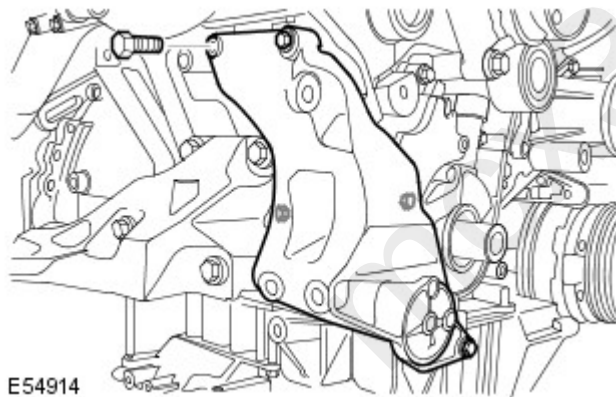
In-vehicle Repair

## Removal

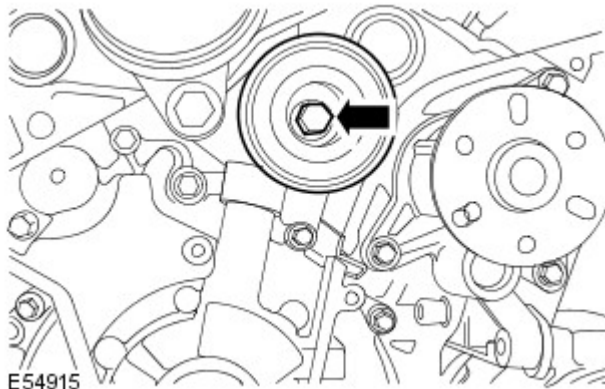
1. Disconnect the battery ground cable.  
For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).
2. Remove the generator.  
For additional information, refer to: [Generator](#) (414-02A Generator and Regulator - TDV6 2.7L Diesel, Removal and Installation).
3. Remove the accessory drive belt tensioner.
  - Remove the LH retaining bolt.



4. Remove the oil pan extension.
5. Remove the crankshaft front oil seal.  
For additional information, refer to: [Crankshaft Front Seal](#) (303-01A Engine - TDV6 2.7L Diesel, In-vehicle Repair).
6. Remove the generator mounting bracket.
  - Remove the five retaining bolts.



7. Remove the timing belt idler pulley.
  - Remove the LH retaining bolt.

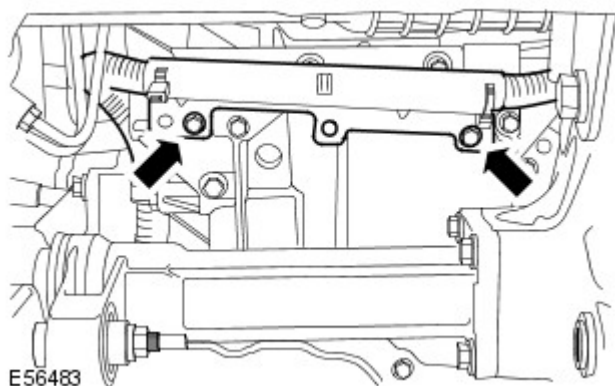


8.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

**9. Release the battery positive cable.**

- Remove the two retaining bolts.



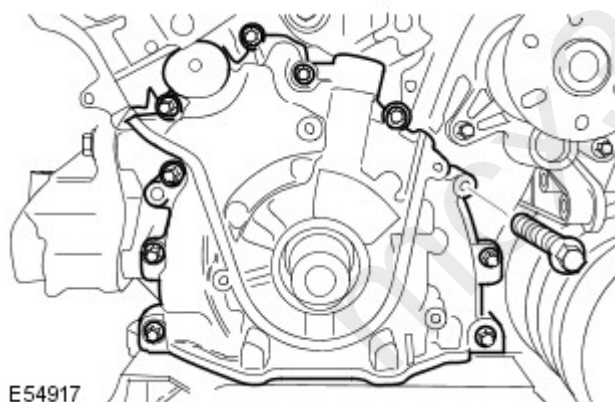
**10. Remove the oil pump lower retaining bolts.**

- Remove the four retaining bolts.



**11. Remove the oil pump.**

- Remove the ten retaining bolts.
- Remove the timing belt cover sealing strips.
- Remove and discard the gasket.



## Installation

**1. Prime the oil pump.**

- Fill the orifice shown with 20 ml of engine oil.
- Rotate the oil pump drive 2 complete turns.



E123911

## 2. CAUTIONS:



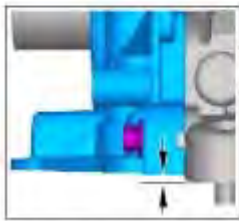
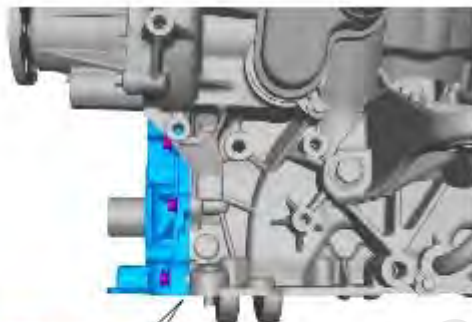
Make sure that the mating faces are clean and free of foreign material.



Make sure the gasket is installed correctly.

Install the oil pump.

- Clean the component mating faces.
- Install a new gasket.
- Lightly tighten the bolts in the position shown.

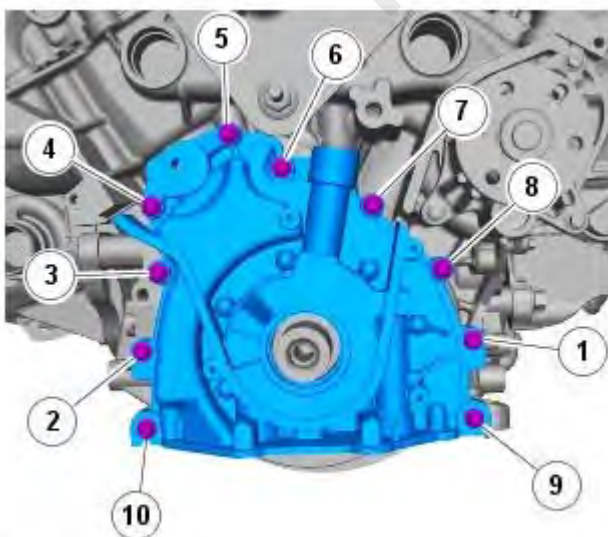


E123913

**3. CAUTION:** Make sure the base of the oil pump is aligned within 0.2 mm of the base of the engine block. Failure to follow this instruction may result in damage to the vehicle.

- NOTE: Vehicles fitted with oil pumps without dowels.

Check the oil pump to engine block alignment.



E123912

4. Secure the oil pump.

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

5. Install the oil pump lower retaining bolts.

- Tighten the 4 bolts to 10 Nm (7 lb.ft).
- 6.** Install the battery positive cable.
- Tighten the two retaining bolts to 10 Nm (7 lb.ft).
- 7.** Install the timing belt idler pulley.
- Tighten the bolt to 45 Nm (33 lb.ft).
- 8.** Install the crankshaft front oil seal.  
For additional information, refer to: [Crankshaft Front Seal](#) (303-01A Engine - TDV6 2.7L Diesel, In-vehicle Repair).
- 9.** Install the oil pan extension.
- 10.** Install the generator mounting bracket.
- Tighten the bolts to 22 Nm (16 lb.ft).
- 11.** Install the accessory drive belt tensioner.
- Tighten the bolt to 45 Nm (33 lb.ft).
- 12.** Install the generator.  
For additional information, refer to: [Generator](#) (414-02A Generator and Regulator - TDV6 2.7L Diesel, Removal and Installation).
- 13.** Connect the battery ground cable.  
For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

## Engine - TDV6 2.7L Diesel - Oil Pressure Switch

In-vehicle Repair

1. Refer to Engine Oil Pressure (EOP) Sensor.  
For additional information, refer to: [Engine Oil Pressure \(EOP\) Sensor](#) (303-14A Electronic Engine Controls - TDV6 2.7L Diesel, Removal and Installation).

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## Engine - TDV6 2.7L Diesel - Oil Cooler

In-vehicle Repair

### Removal

#### • WARNINGS:



Do not carry or operate cellular phones when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.



Do not carry out any repairs to the fuel system with the engine running. The fuel pressure within the system can be as high as 1650 bar (23,931 lb-sq-in). Failure to follow this instruction may result in personal injury.



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



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



Wait at least 30 seconds after the engine stops before commencing any repair to the high-pressure fuel injection system. Failure to follow this instruction may result in personal injury.

#### • CAUTIONS:



Before disconnecting or removing components, ensure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.



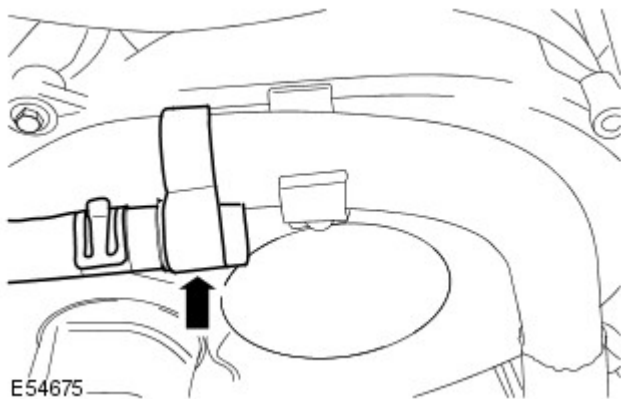
Diesel fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or lines. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

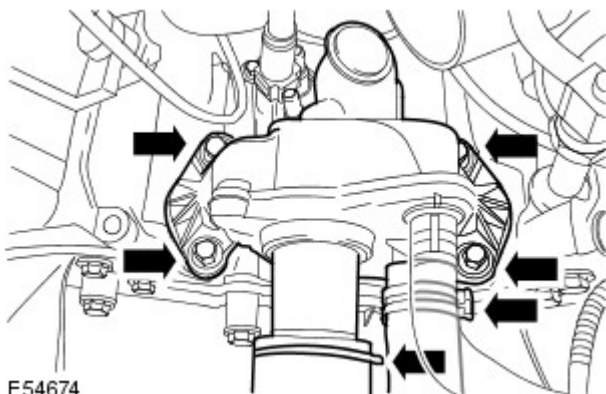


Make sure the workshop area in which the vehicle is being worked on is as clean and as dust free as possible. Foreign matter from work on clutches, brakes or from machining or welding operations can contaminate the fuel system and may result in later malfunction.

1. Disconnect the battery ground cable.  
For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).
2. Drain the cooling system.  
For additional information, refer to: [Cooling System Draining, Filling and Bleeding](#) (303-03A Engine Cooling - TDV6 2.7L Diesel, General Procedures).
3. Remove the crankcase vent oil separator.  
For additional information, refer to: Crankcase Vent Oil Separator (303-08, Removal and Installation).
4. Release the coolant bleed hose from the LH exhaust gas recirculation (EGR) coolant inlet hose.

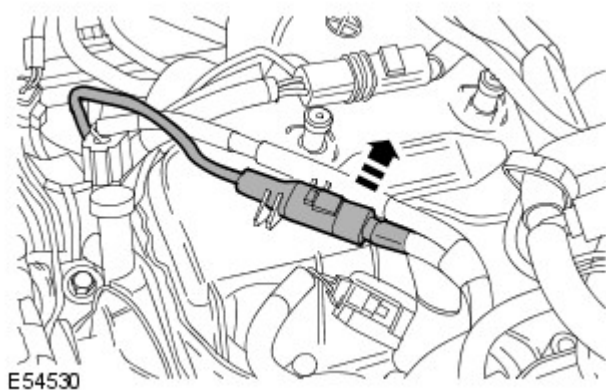
- Release the retaining clip.





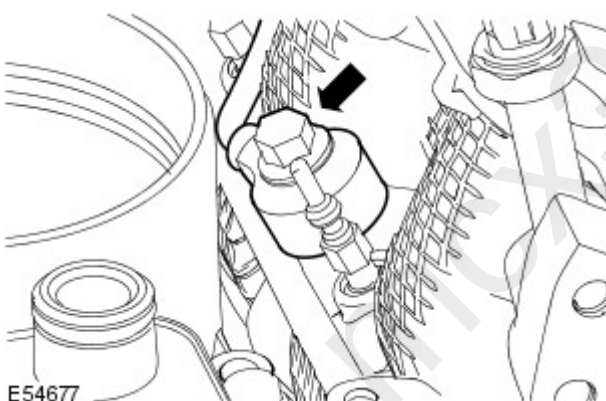
**5. Remove the cylinder head coolant elbow.**

- Release the two retaining clips and disconnect the hoses.
- Remove the four retaining bolts.
- Remove and discard the O-ring seals.



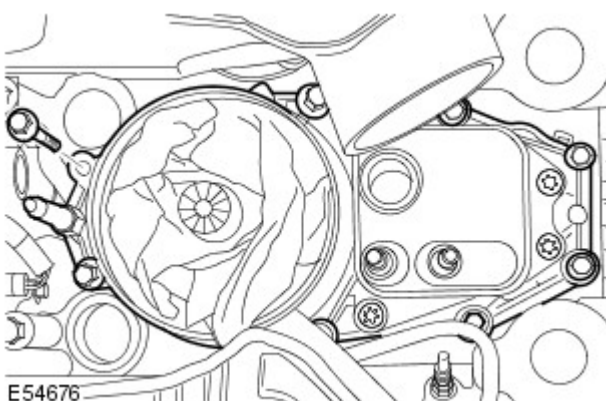
**6. Disconnect the knock sensors (KS) electrical connector.**

- Release the KS harness from the valve cover.



**7. Remove the LH KS.**

- Remove the retaining bolt.



**8. NOTE: Some fluid spillage is inevitable during this operation.**

Remove the oil cooler.

- Remove the eight retaining bolts.
- Remove and discard the gasket.
- Remove and discard the O-ring seal.

## Installation

1.  **CAUTION:** Make sure the gasket is installed correctly.

- **NOTE:** Make sure all component mating faces are clean.

Install the oil cooler.

- Install a new gasket.
- Install a new O-ring seal.
- Install the eight retaining bolts and tighten to 10 Nm (7 lb.ft).

**2. Install the LH KS.**

- Install the retaining bolt and tighten to 20 Nm (15 lb.ft).
- Connect the knock sensor electrical connector.
- Attach the KS harness to the valve cover.

**3. Install the cylinder head coolant outlet elbow.**

- Install new O-ring seals.
- Install the four retaining bolts and tighten to 10 Nm (7 lb.ft).
- Connect the hoses and secure with the clips.

**4. Secure the coolant bleed hose to the EGR coolant inlet hose.**

**5. Install the crankcase vent oil separator.**

For additional information, refer to: Crankcase Vent Oil Separator (303-08, Removal and Installation).

**6. Connect the battery ground cable.**

For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

**7. Refill and bleed the cooling system.**

For additional information, refer to: [Cooling System Draining, Filling and Bleeding](#) (303-03A Engine Cooling - TDV6 2.7L Diesel, General Procedures).

**8. Check and top-up the engine oil.**

# Engine - TDV6 2.7L Diesel - Oil Pump Screen and Pickup Tube

In-vehicle Repair

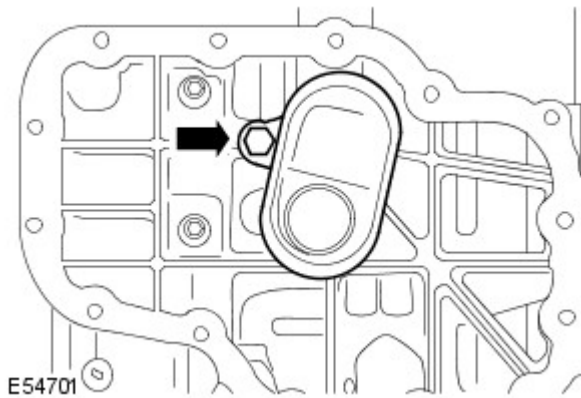
## Removal

1. Disconnect the battery ground cable.  
For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).
2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

3. Remove the oil pan.  
For additional information, refer to: [Oil Pan](#) (303-01A Engine - TDV6 2.7L Diesel, In-vehicle Repair).
4. Remove the oil pump screen and pickup tube.

- Remove the bolt.
- Remove and discard both O-ring seals.
- Clean the seal contact area.



## Installation

1. **NOTE:** Lubricate new seals with clean engine oil.

Install the oil pump screen and pickup tube.

- Clean the components.
- Install new O-ring seals.
- Tighten the bolt to 10 Nm (7 lb.ft).

2. Install the oil pan.  
For additional information, refer to: [Oil Pan](#) (303-01A Engine - TDV6 2.7L Diesel, In-vehicle Repair).
3. Connect the battery ground cable.  
For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

## Engine - TDV6 2.7L Diesel - Oil Pan

In-vehicle Repair

### Removal

1. Disconnect the battery ground cable.  
For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).
2. Remove the engine cover.  
For additional information, refer to: [Engine Cover - TDV6 3.0L Diesel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

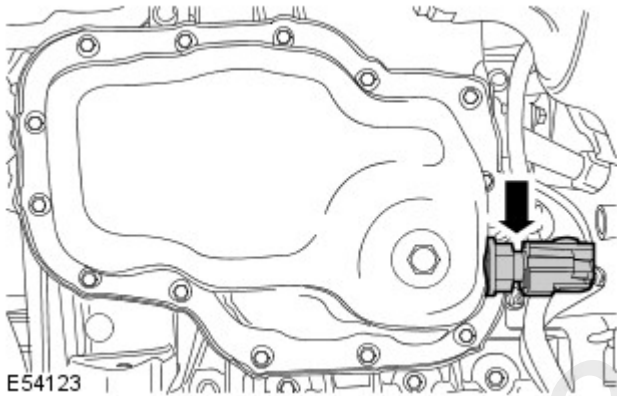
3.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

4. Drain the engine oil.  
For additional information, refer to: [Engine Oil Draining and Filling](#) (303-01A Engine - TDV6 2.7L Diesel, General Procedures).

5. Remove the oil temperature sensor.

- Disconnect the engine oil temperature sensor electrical connector.
- Remove and discard the O-ring seal.

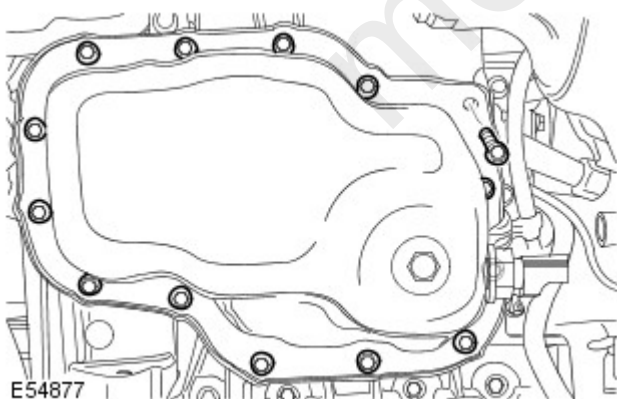


6. Disconnect the engine wiring harness.

- Release the engine wiring harness from the retaining bracket.

7. Remove the oil pan.

- Remove the 14 oil pan bolts.
- Remove and discard the gasket.



### Installation

1. Install the oil pan.

- Clean the component mating faces.
- Install a new gasket.
- Evenly and progressively tighten the bolts to 10 Nm (7 lb.ft).

2. Connect the engine wiring harness.

- Attach the engine wiring harness to the retaining bracket.
3. Install the oil temperature sensor.
    - Install a new O-ring seal.
    - Tighten the sensor to 10 Nm (7 lb.ft).
    - Connect the electrical connector.
  4. Fill the engine with oil.

For additional information, refer to: [Engine Oil Draining and Filling](#) (303-01A Engine - TDV6 2.7L Diesel, General Procedures).
  5. Install the engine cover.

For additional information, refer to: [Engine Cover - TDV6 3.0L Diesel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
  6. Connect the battery ground cable.

For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

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# Engine - TDV6 2.7L Diesel - Oil Pan Extension

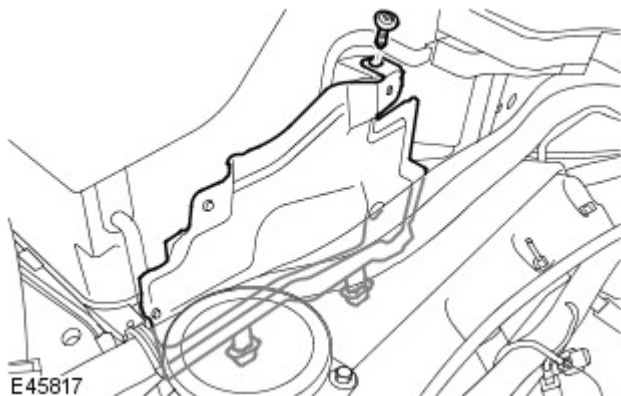
In-vehicle Repair

## Removal

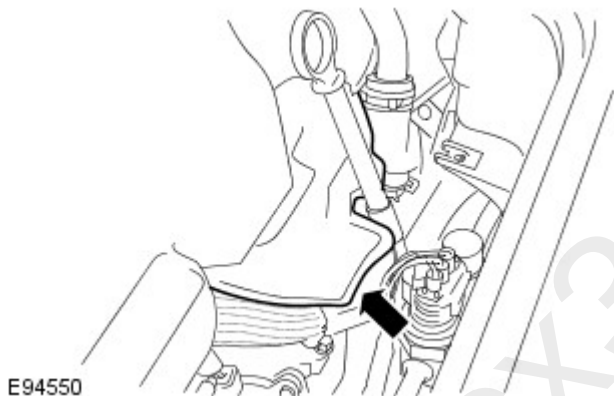
1. Disconnect the battery ground cable.  
For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

2. Remove the engine compartment upper heat shield.

- Remove the screw.

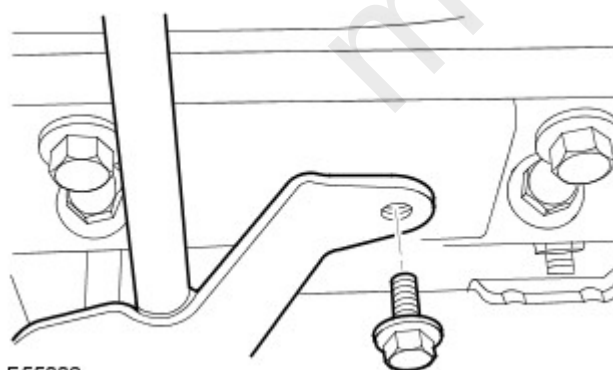


3. Reposition the injector sound proofing.



4. Release the oil level indicator and tube from the oil pan extension.

- Remove the bolt.
- Remove and discard the O-ring seal.



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

Raise and support the vehicle.

6. Remove the front wheels and tires.

7. Remove the front axle tube.

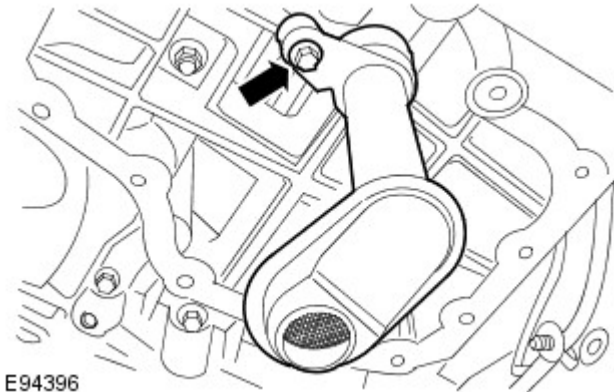
For additional information, refer to: [Axle Tube](#) (205-03 Front Drive Axle/Differential, In-vehicle Repair).

8. Remove the oil pan.

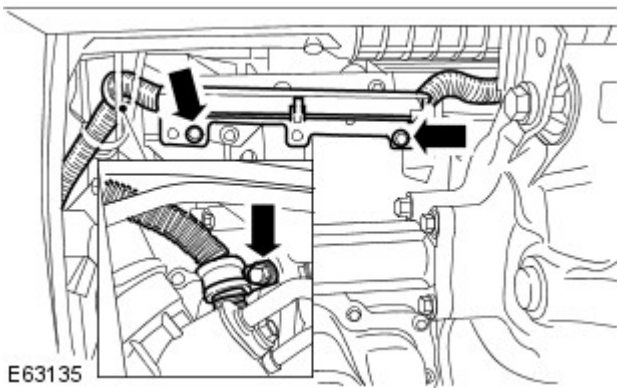
For additional information, refer to: [Oil Pan](#) (303-01A Engine - TDV6 2.7L Diesel, In-vehicle Repair).

9. Remove the starter motor.  
For additional information, refer to: [Starter Motor](#) (303-06A Starting System - TDV6 2.7L Diesel, Removal and Installation).
10. Remove the oil strainer pick-up assembly.

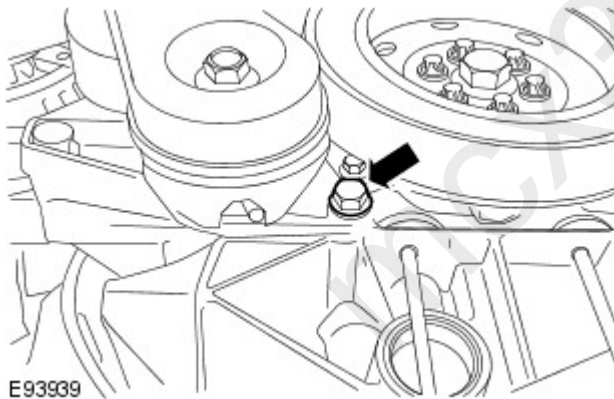
- Remove the bolt.
- Remove and discard the O-ring seal.



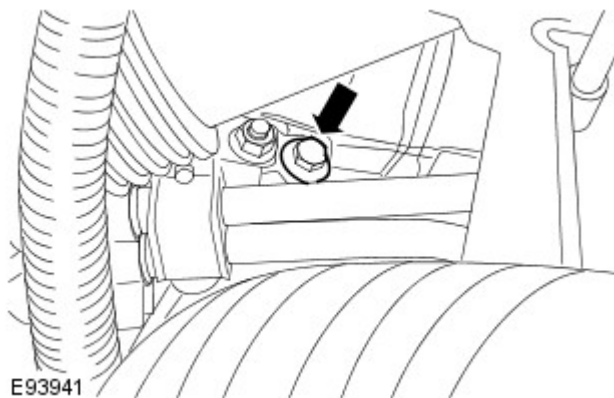
11. Remove the 3 bolts from the battery to starter motor solenoid cable.

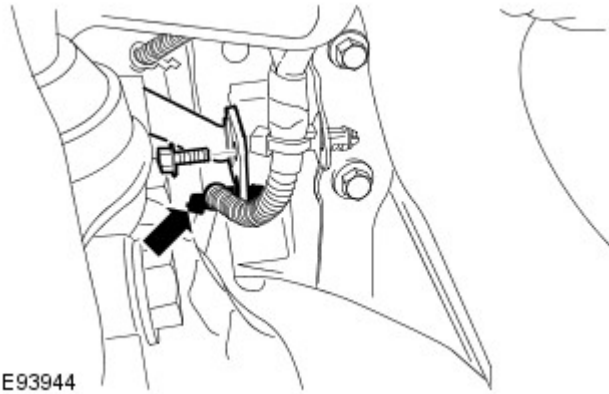


12. Remove the bolt from the accessory drive belt tensioner bracket.



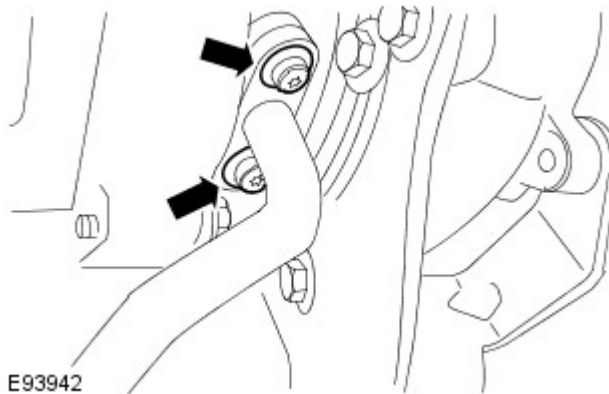
13. Remove the lower bolt from the air conditioning (A/C) compressor.





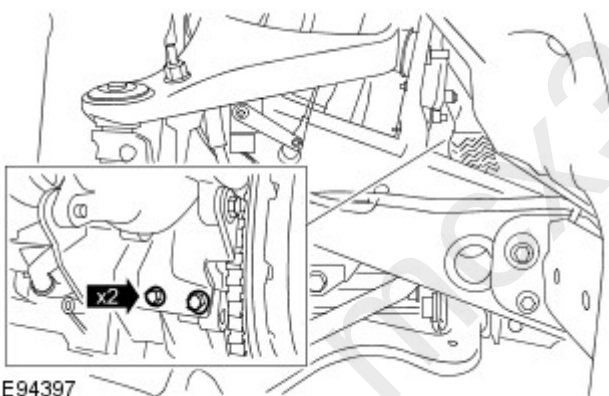
**14. Release the turbocharger oil return tube.**

- Release the wiring harness clip.
- Remove the bolt.

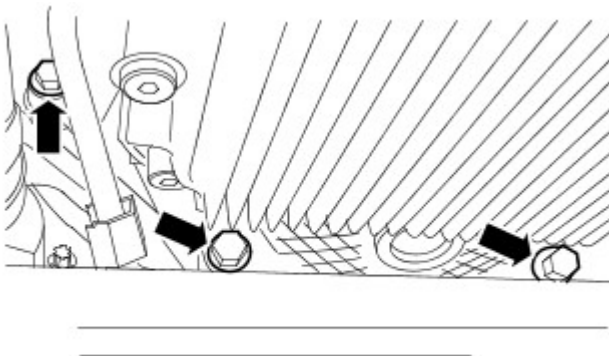


**15. Remove the turbocharger oil return tube.**

- Remove the 2 bolts.
- Remove and discard the gasket.
- Remove and discard the O-ring seals.
- Install blanking caps to the exposed ports.



**16. Remove the 2 bolts from the turbocharger support bracket.**

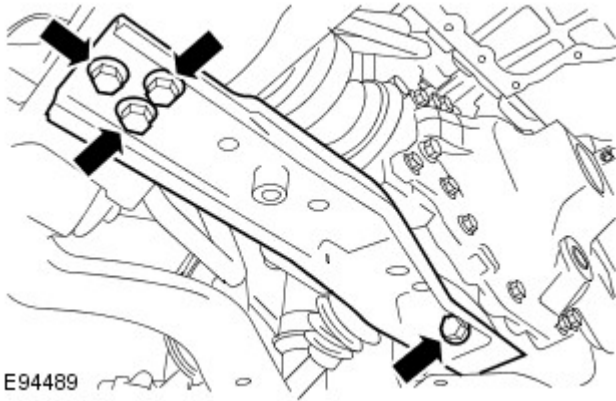


**17. Remove the 3 lower bolts from the transmission to the engine.**

E94398

**18.** Remove the front axle crossmember.

- Remove the 4 bolts.

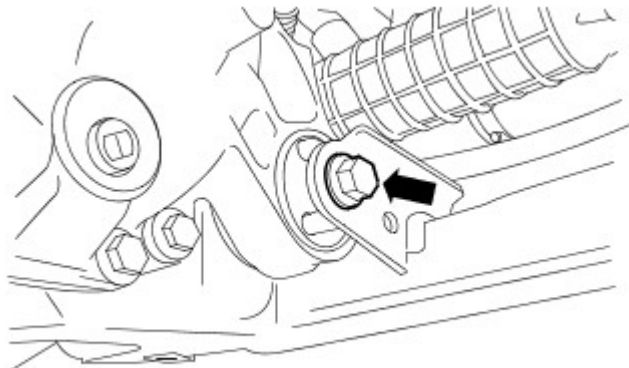


E94489

**19.** Using a transmission jack, support the front axle assembly.

**20.** Remove the front axle assembly front mounting bolt.

- Carefully lower the front axle assembly.

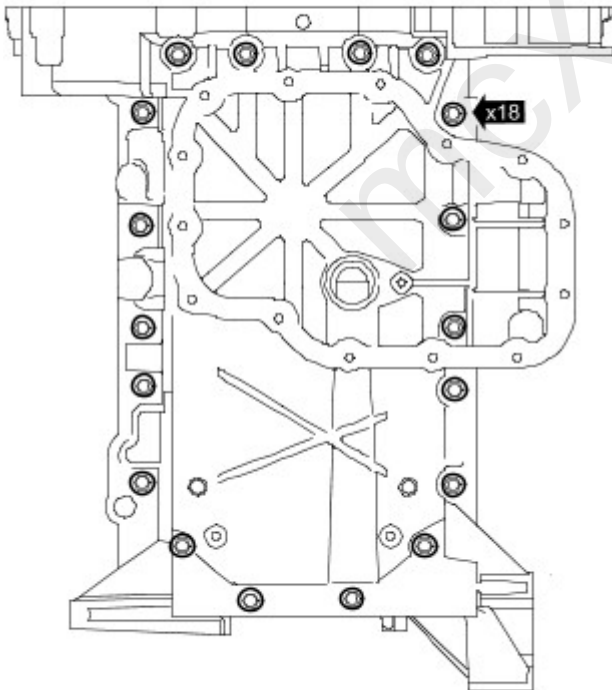


E94490

**21. NOTE:** Note the fitted position of the retaining bolts prior to removal.

Remove the oil pan extension.

- Remove the 18 bolts.
- Remove and discard the gasket.



E93945

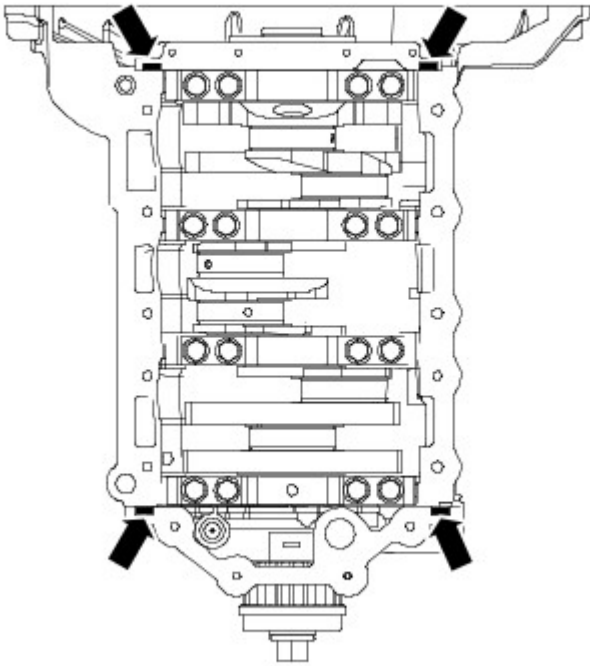
## Installation

1. NOTE: Make sure that all the component mating faces are clean.

• NOTE: It is important that the oil pan extension is bolted to the crankshaft main bearing carrier within twenty minutes of applying the sealant.

Apply an 8 mm bead of sealant to the cylinder block in the areas shown.

- Use WSS-M4G323-A4-RTV sealant.



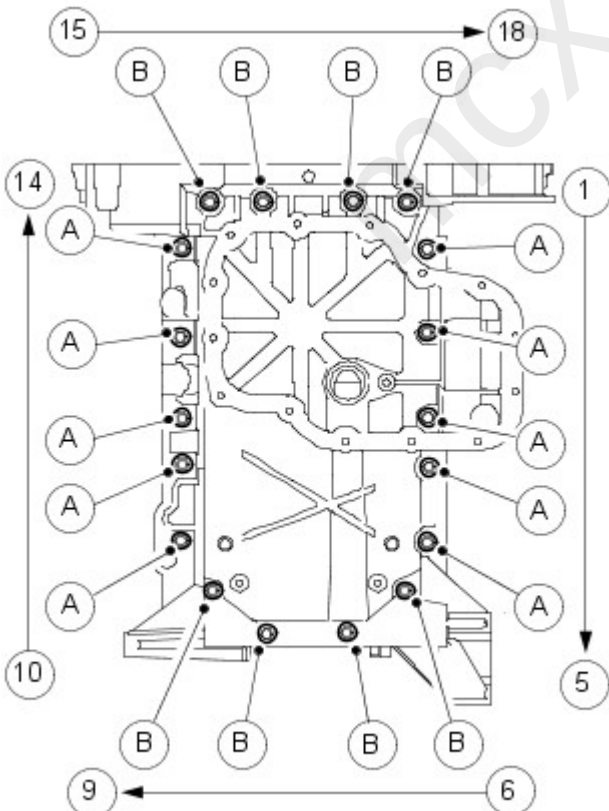
E93678

2. Install the oil pan extension.

- Install a new gasket.
- Loosely install all oil pan extension retaining bolts.

3. Tighten the retaining bolts in the sequence shown.

1. Tighten bolts A to 10 Nm (7 lb.ft). Tighten bolts B to 4 Nm (2 lb.ft).
2. Tighten bolts A to 24 Nm (18 lb.ft). Tighten bolts B to 10 Nm (7 lb.ft).



E93962

4. Align and secure the front axle assembly.

- Tighten the M14 bolt to 105 Nm (77 lb.ft).

5. Install the front axle crossmember.

- Tighten the 4 bolts to 115 Nm (85 lb.ft).

6. Install the 3 lower bolts from the transmission to the engine.

- Tighten the bolts to 45 Nm (33 lb.ft).

7. Install the 2 bolts to the turbocharger support bracket.

- Tighten the 2 bolts to 23 Nm (17 lb.ft).

8. **NOTE: Make sure that all the component mating faces are clean.**

- **NOTE: Remove and discard the blanking caps.**

Install the turbocharger oil return tube.

- Install new O-ring seals.
- Install a new gasket.
- Tighten the 2 bolts to 10 Nm (7 lb.ft).

9. Install the bolt to the turbocharger oil return tube.

- Secure the wiring harness to the turbocharger oil return tube.

10. Install the lower bolt to the A/C compressor.

- Tighten the bolt to 24 Nm (18 lb.ft).

11. Install the bolt to the accessory drive belt tensioner bracket.

- Tighten the new bolt to 24 Nm (18 lb.ft).

12. Secure the battery to starter motor solenoid cable.

- Tighten the M8 bolt to 22 Nm (16 lb.ft).
- Tighten the M6 bolts to 10 Nm (7 lb.ft).

13. **NOTE: Make sure that all the component mating faces are clean.**

Install the oil strainer pick-up assembly.

- Install a new O-ring seal.
- Tighten the bolt to 10 Nm (7 lb.ft).

14. Install the starter motor.

For additional information, refer to: [Starter Motor](#) (303-06A Starting System - TDV6 2.7L Diesel, Removal and Installation).

15. Install the oil pan.

For additional information, refer to: [Oil Pan](#) (303-01A Engine - TDV6 2.7L Diesel, In-vehicle Repair).

16. Install the front axle tube.

For additional information, refer to: [Axle Tube](#) (205-03 Front Drive Axle/Differential, In-vehicle Repair).

17. Install the front wheels and tires.

- Tighten the wheel nuts to 140 Nm (103 lb.ft).

18. **NOTE: Make sure that all the component mating faces are clean.**

Secure the oil level indicator and tube into the oil pan extension.

- Install a new O-ring seal.
- Install the bolt.

19. Reposition the injector sound proofing.

**20.** Install the engine compartment upper heat shield.

- Install the screw.

**21.** Connect the battery ground cable.

For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

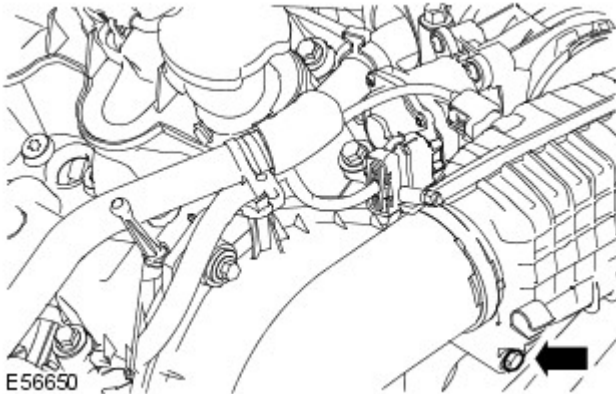
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# Engine - TDV6 2.7L Diesel - Timing Belt Cover

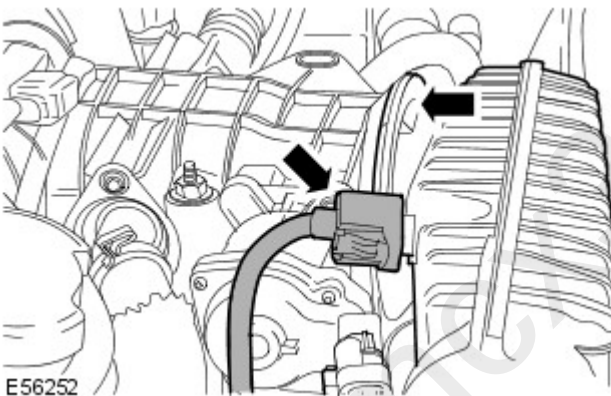
In-vehicle Repair

## Removal

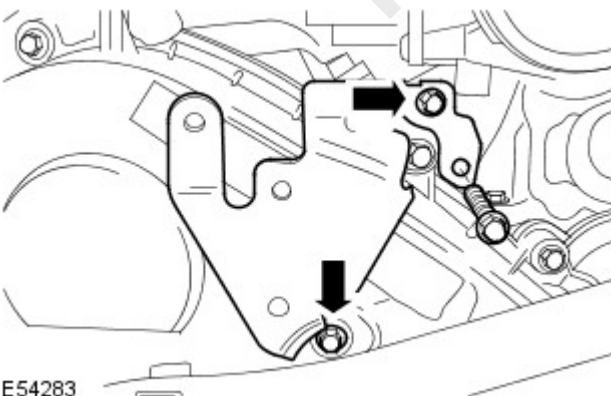
1. Disconnect the battery ground cable.  
For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).
2. Remove the engine cover.  
For additional information, refer to: [Engine Cover - TDV6 3.0L Diesel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
3. Release the intake air shutoff throttle elbow.
  - Remove the retaining bolt.



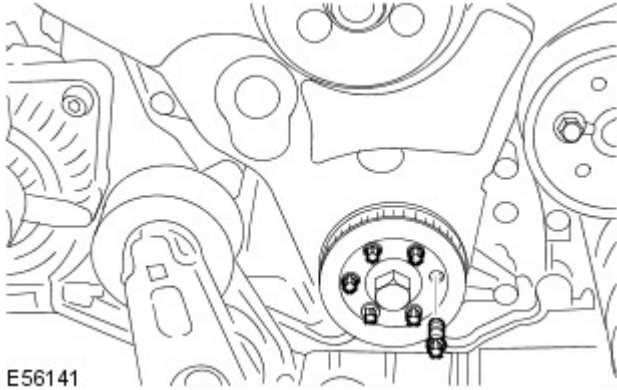
4. Release the intake air shutoff throttle elbow.
  - Release the retaining clip.
  - Disconnect the electrical connector.



5. Remove the intake air shutoff throttle elbow support bracket.
  - Remove the three retaining bolts.



6. Remove the fan cowl.  
For additional information, refer to: [Cooling Fan Shroud](#) (303-03A Engine Cooling - TDV6 2.7L Diesel, Removal and Installation).



**7. Remove the crankshaft damper.**

- Remove the six retaining bolts.

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

Raise and support the vehicle.

**9. Drain the cooling system.**

For additional information, refer to: [Cooling System Draining, Filling and Bleeding](#) (303-03A Engine Cooling - TDV6 2.7L Diesel, General Procedures).

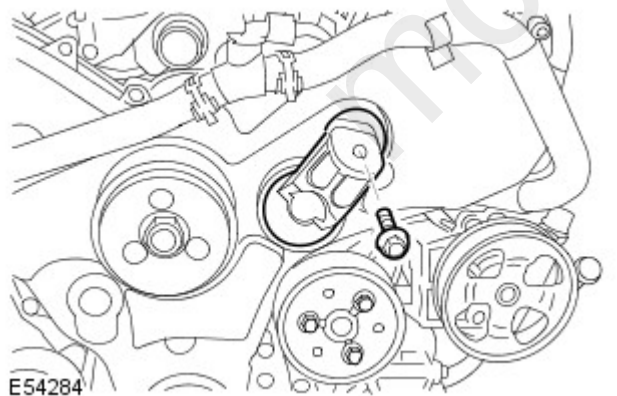
**10. Disconnect the coolant hose from the cylinder head coolant outlet elbow.**

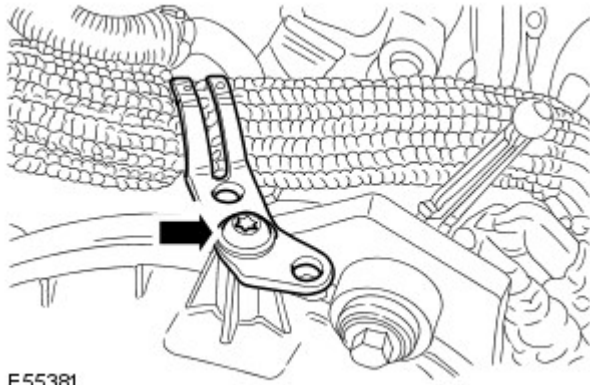
- Release the coolant hose retaining clip.
- Reposition the coolant top hose.



**11. Remove the accessory drive belt idler.**

- Remove the retaining bolt.



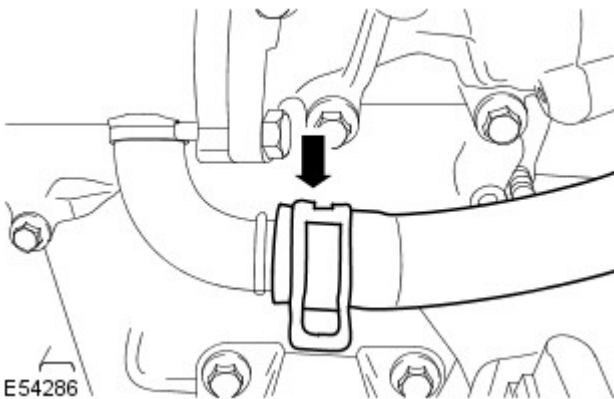


E55381

**12. NOTE: Right-hand shown, left-hand similar.**

Release the exhaust gas recirculation (EGR) valve outlet tube clamps from the timing cover.

- Remove the retaining bolt.



E54286

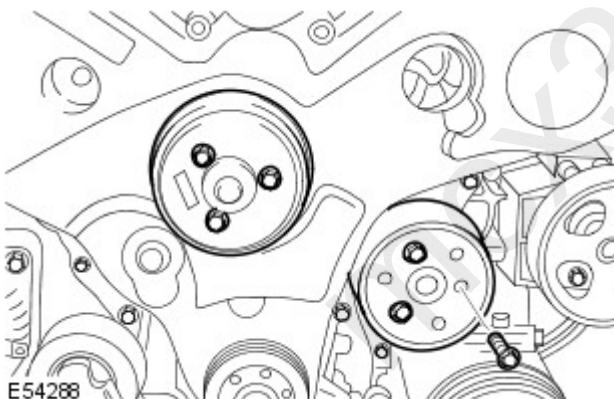
**13. Disconnect the right-hand EGR coolant inlet hose from the EGR cooler.**

- Release the coolant hose retaining clip.

**14. Position the EGR coolant hose aside for access.**

**15. Remove the coolant pump and accessory drive belt idler pulleys.**

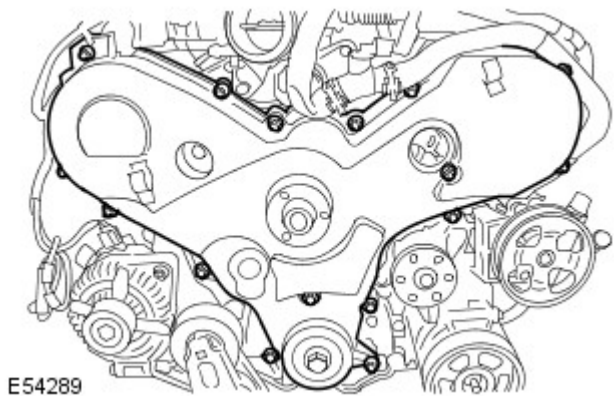
- Remove the six retaining bolts.



E54288

**16. Remove the timing belt cover.**

- Fully loosen the 16 timing belt cover retaining bolts.
- Release the 2 wiring harness clips.



E54289

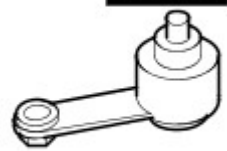
## Installation

**1. Install the timing belt cover.**

- Attach the 2 wiring harness clips.
  - Tighten the 16 timing belt cover retaining bolts to 10 Nm (7 lb.ft).
2. Install the coolant pump and accessory drive belt idler pulleys.
- Tighten the six retaining bolts to 23 Nm (17 lb.ft).
3. Connect the right-hand EGR coolant inlet hose to the EGR cooler.
- Install the coolant hose retaining clip.
4. Secure the EGR valve outlet tube clamps to the timing cover.
- Install the two retaining bolts.
5. Connect the coolant hose to the cylinder head coolant outlet elbow.
- Install the retaining clip.
6. Install the accessory drive belt idler.
- Install the retaining bolt and tighten to 47 Nm (35 lb.ft).
7. Install the crankshaft damper.
- Tighten the six retaining bolts to 23 Nm (17 lb.ft).
8. Install the fan cowl.  
For additional information, refer to: [Cooling Fan Shroud](#) (303-03A Engine Cooling - TDV6 2.7L Diesel, Removal and Installation).
9. Install the intake air shutoff throttle elbow support bracket.
- Install the three retaining bolts and tighten to 10 Nm (7 lb.ft).
10. Secure the intake air shutoff throttle elbow.
- Install the retaining clip.
  - Install the retaining bolt.
  - Connect the electrical connector.
11. Install the engine cover.  
For additional information, refer to: [Engine Cover - TDV6 3.0L Diesel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
12. Connect the battery ground cable.  
For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).
13. Refill and bleed the cooling system.  
For additional information, refer to: [Cooling System Draining, Filling and Bleeding](#) (303-03A Engine Cooling - TDV6 2.7L Diesel, General Procedures).

**Engine - TDV6 2.7L Diesel - Timing Belt**

In-vehicle Repair

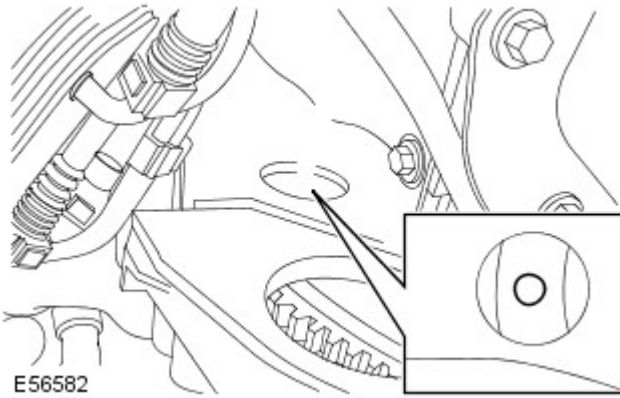
| <b>Special Tool(s)</b>                                                                                                   |                                                            |
|--------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|
|  <p><b>303-1132</b></p> <p>E54557</p>   | <p>Check Pin - Camshaft Pulleys</p> <p>303-1132</p>        |
|  <p><b>303-1126</b></p> <p>E54551</p>   | <p>Timing Pin - Camshaft Pulleys</p> <p>303-1126</p>       |
|  <p><b>303-1117</b></p> <p>E54540</p>   | <p>Timing Pin - Automatic Transmission</p> <p>303-1117</p> |
|  <p><b>303-1116</b></p> <p>E54539</p> | <p>Timing Pin - Manual Transmission</p> <p>303-1116</p>    |

**Removal**

All vehicles

1. Disconnect the battery ground cable.  
For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).
2. Remove the timing belt cover.  
For additional information, refer to: [Timing Belt Cover](#) (303-01A Engine - TDV6 2.7L Diesel, In-vehicle Repair).
3.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.  
  
Raise and support the vehicle.
4. Remove the starter motor.  
For additional information, refer to: [Starter Motor](#) (303-06A Starting System - TDV6 2.7L Diesel, Removal and Installation).
5. Remove the crankshaft timing alignment grommet from the engine block.
6. Rotate the crankshaft clockwise to align the crankshaft alignment hole in the flywheel or flexplate with the block aperture.

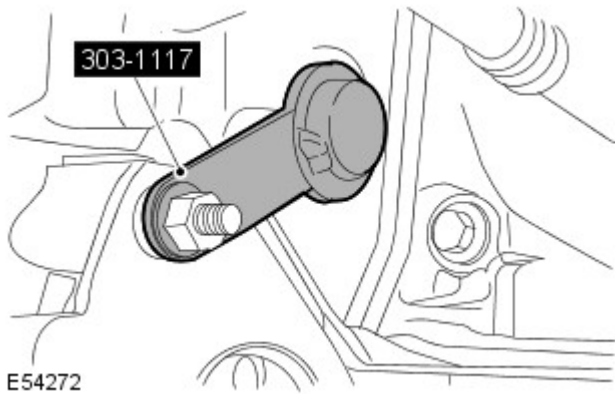
7. Check the camshaft pulley alignment holes are correctly aligned. If the alignment holes are not aligned, rotate the crankshaft one full turn clockwise.



#### Vehicles with automatic transmission

8. Using the special tool, lock the flexplate.

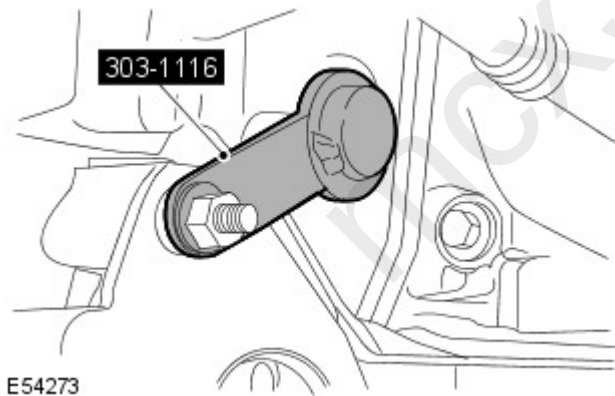
- Install a starter motor bolt to retain the special tool.



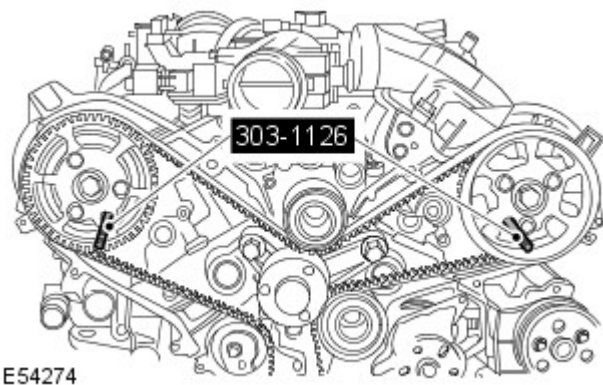
#### Vehicles with manual transmission

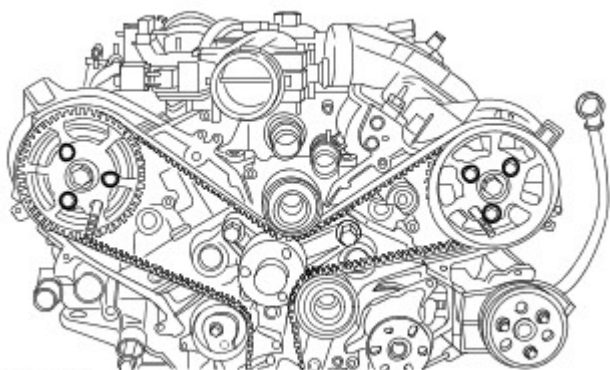
9. Using the special tool, lock the flywheel.

- Install a starter motor bolt to retain the special tool.



10. Install the special tools to the exhaust camshaft pulleys.



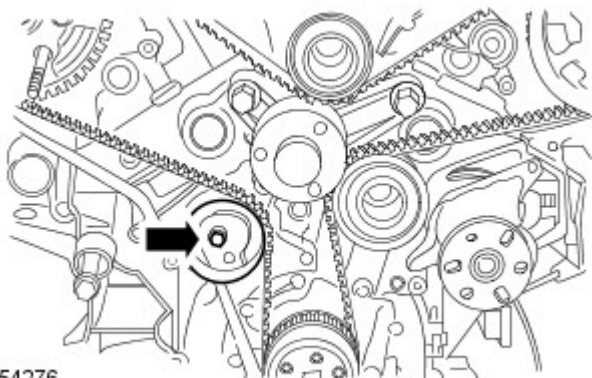


E54627

**11. ⚠ CAUTION:** Do not use the special tools to lock the camshafts. Failure to follow this instruction may result in damage to the engine or the special tools.

Loosen the six exhaust camshaft pulley damper retaining bolts.

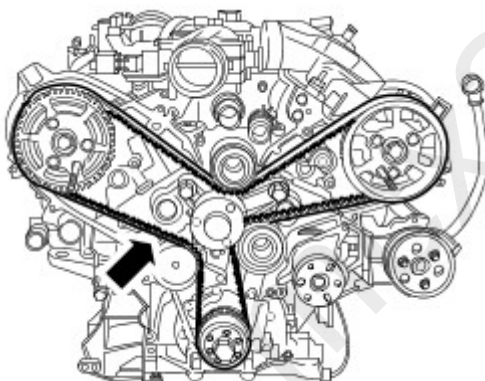
- Using a suitable tool, counterhold the camshaft pulley center retaining bolts.



E54276

**12.** Remove and discard the timing belt tensioner.

- Remove and discard the bolt.



E 54277

**13.** Remove and discard the timing belt.

## Installation

All vehicles

**1.** Rotate both camshaft pulleys clockwise.



E 54278

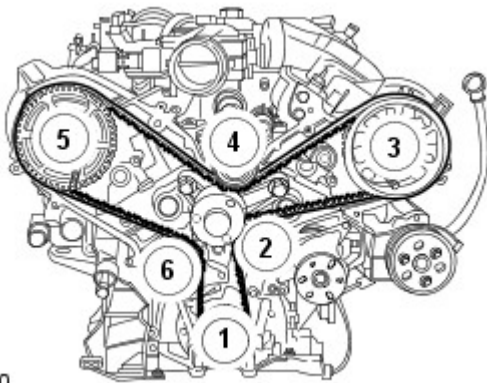
2. Install a new timing belt tensioner.

- Install a new bolt, but do not fully tighten at this stage.

3.  **CAUTION:** Make sure the camshaft pulleys remain in the clockwise position.

Install the new timing belt.

- Starting at the crankshaft pulley, install the timing belt in a counter-clockwise direction, in the sequence shown.
- Stage one: Attach the timing belt to the crankshaft pulley.
- Stage two: Attach the timing belt to the idler pulley.
- Stage three: Attach the timing belt to the left-hand camshaft pulley.
- Stage four: Attach the timing belt to the idler pulley.
- Stage five: Attach the timing belt to the RH camshaft pulley.
- Stage six: Attach the timing belt to the timing belt tensioner.

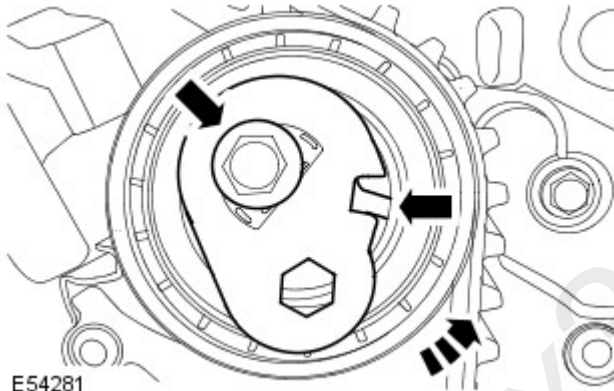


E54280

4.  **CAUTION:** Make sure the timing belt tensioner window is aligned with the groove.

Tension the timing belt.

- Rotate the tensioner assembly counterclockwise.
- Tighten to 24 Nm (18 lb.ft).

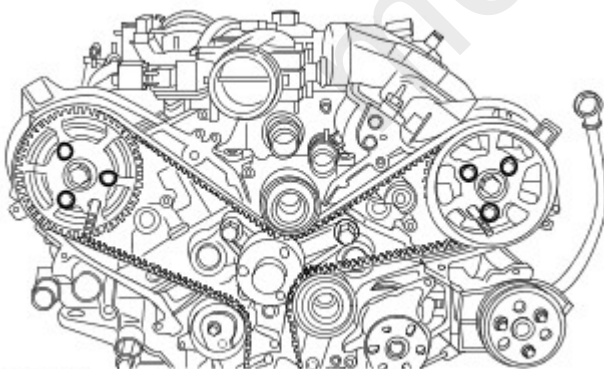


E54281

5.  **CAUTION:** Do not use the special tools to lock the camshafts. Failure to follow this instruction may result in damage to the engine or the special tools.

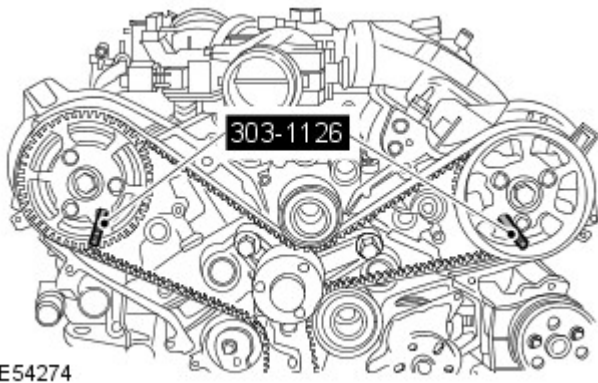
Using a suitable tool, counterhold the camshaft pulley center retaining bolts.

- Tighten the six exhaust camshaft pulley damper retaining bolts.
- Tighten the bolts to 23 Nm (17 lb.ft).



E54627

6. Remove the special tools from the camshaft pulleys.



E54274

Vehicles with manual transmission

7. Remove the special tool from the flywheel.

Vehicles with automatic transmission

8. Remove the special tool from the flexplate.

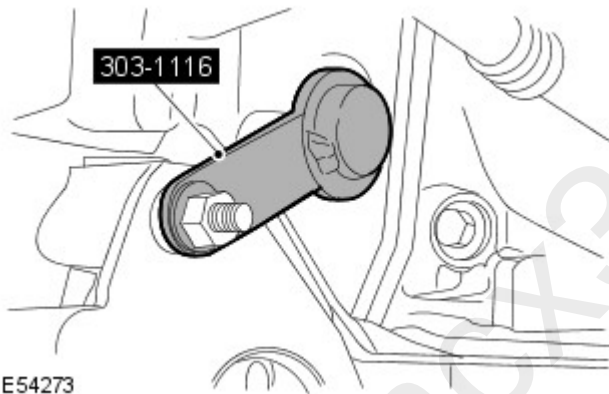
All vehicles

9. Rotate the engine two complete turns clockwise.

Vehicles with manual transmission

10. Using the special tool, lock the flywheel.

- Install a starter motor bolt to retain the special tool.

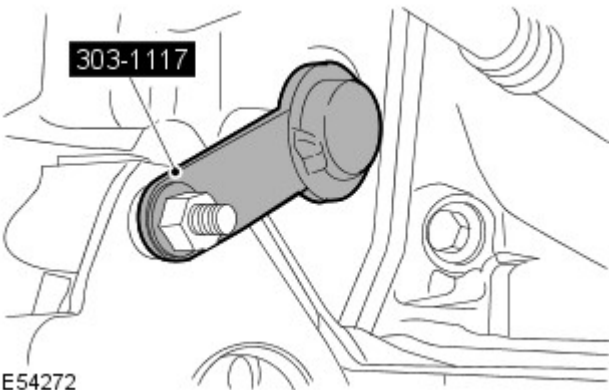


E54273

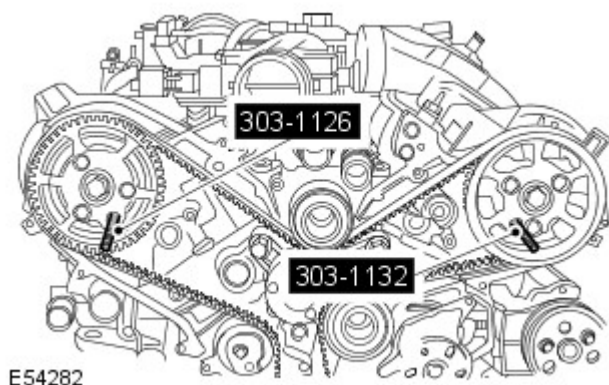
Vehicles with automatic transmission

11. Using the special tool, lock the flexplate.

- Install a starter motor bolt to retain the special tool.



E54272



**12.** Install the special tools to the exhaust camshaft pulleys.

- If the special tool does not fit correctly, repeat the timing belt installation procedure.
- Remove the special tools from the camshaft pulleys.

Vehicles with manual transmission

**13.** Remove the special tool from the flywheel.

- Install the grommet.

Vehicles with automatic transmission

**14.** Remove the special tool from the flexplate.

- Install the grommet.

All vehicles

**15.** Install the starter motor.

For additional information, refer to: [Starter Motor](#) (303-06A Starting System - TDV6 2.7L Diesel, Removal and Installation).

**16.** Install the timing belt cover.

For additional information, refer to: [Timing Belt Cover](#) (303-01A Engine - TDV6 2.7L Diesel, In-vehicle Repair).

**17.** Connect the battery ground cable.

For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

# Engine - TDV6 2.7L Diesel - Exhaust Manifold LH

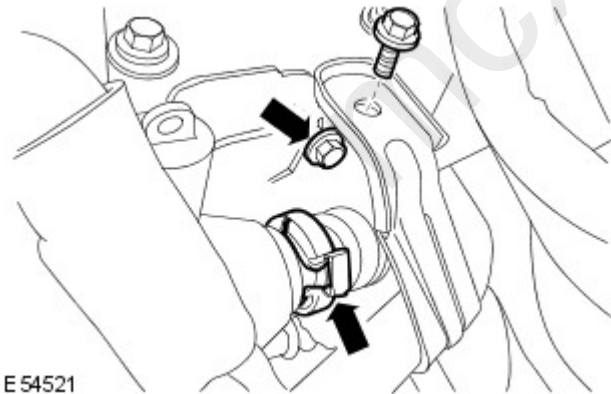
In-vehicle Repair

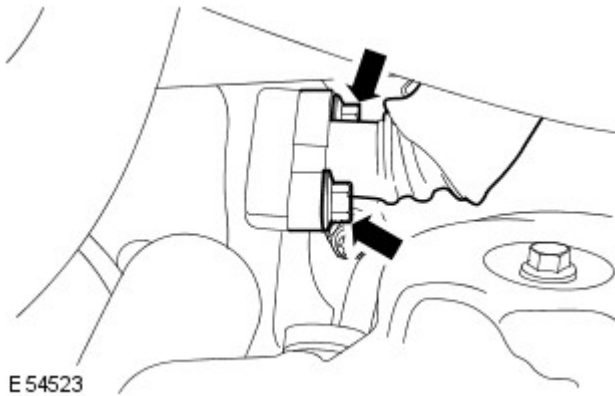
## Removal

1. Disconnect the battery ground cable.  
For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).
2. Remove the turbocharger.  
For additional information, refer to: [Turbocharger](#) (303-04B Fuel Charging and Controls - Turbocharger - TDV6 2.7L Diesel, Removal and Installation).
3. Drain the cooling system.  
For additional information, refer to: [Cooling System Draining, Filling and Bleeding](#) (303-03A Engine Cooling - TDV6 2.7L Diesel, General Procedures).
4. Remove the battery tray.  
For additional information, refer to: [Battery Tray](#) (414-01 Battery, Mounting and Cables, Removal and Installation).
5. Remove the LH EGR valve outlet tube.  
For additional information, refer to: [Exhaust Gas Recirculation \(EGR\) Valve Outlet Tube](#) (303-08A Engine Emission Control - TDV6 2.7L Diesel, Removal and Installation).
6. Disconnect the coolant outlet hose from the LH EGR valve.
  - Release the clip.



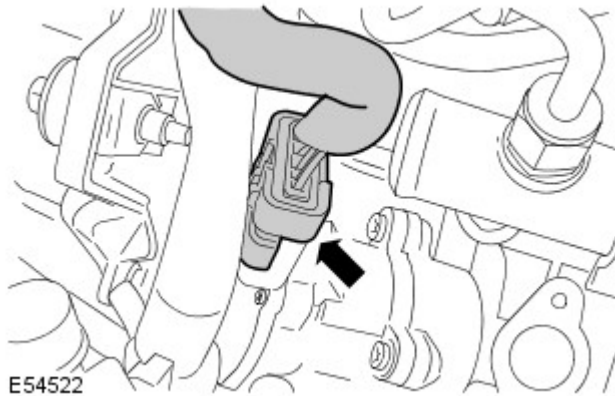
7. Release the LH EGR valve inlet tube.
  - Remove the two support bracket retaining bolts.
  - Remove the support bracket.
  - Remove and discard the retaining clip.



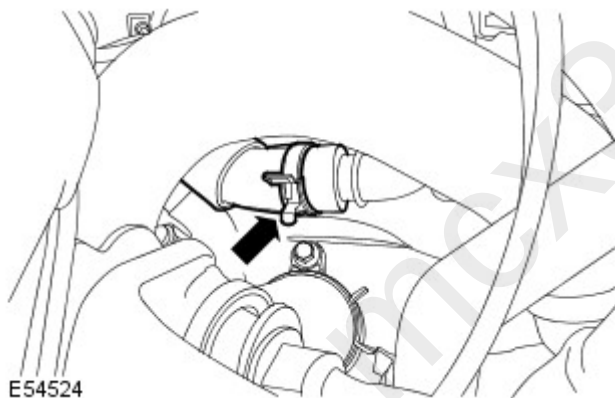


**8.** Remove the LH EGR valve inlet tube.

- Remove the two retaining bolts.
- Remove and discard the gasket.

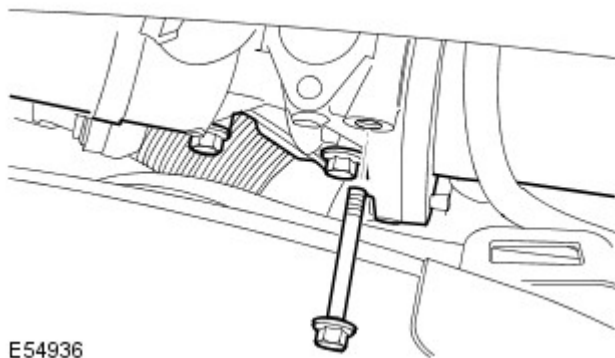


**9.** Disconnect the LH EGR valve electrical connector.



**10.** Disconnect the coolant inlet hose from the LH EGR valve.

- Release the clip.

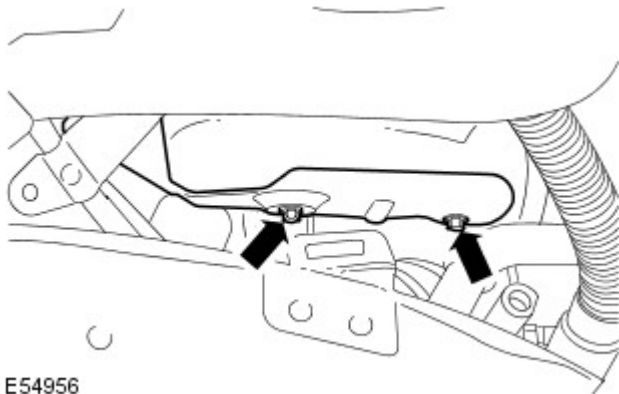


**11.** Remove the LH EGR valve.

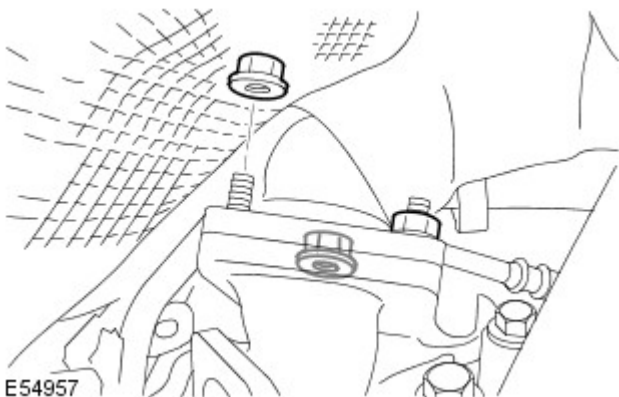
- Remove the three retaining bolts.

**12.** Remove the LH exhaust manifold heat shield.

- Remove the two retaining bolts.

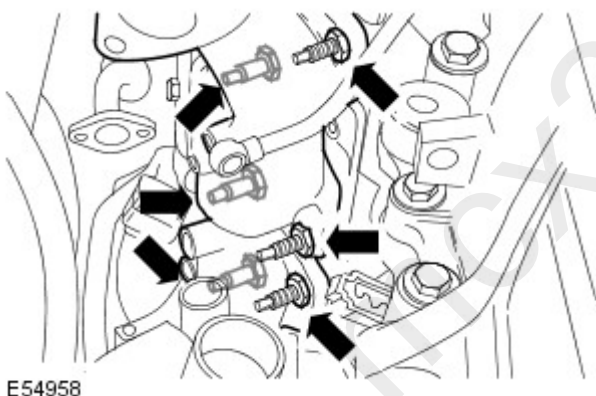


**13.** Remove the three exhaust cross-over pipe retaining nuts.



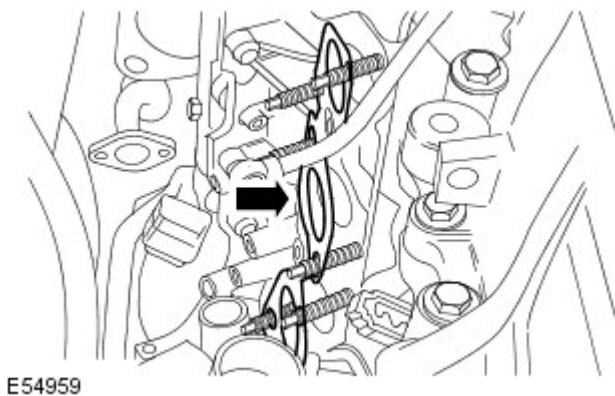
**14.** Remove the LH exhaust manifold.

- Remove the six retaining nuts.



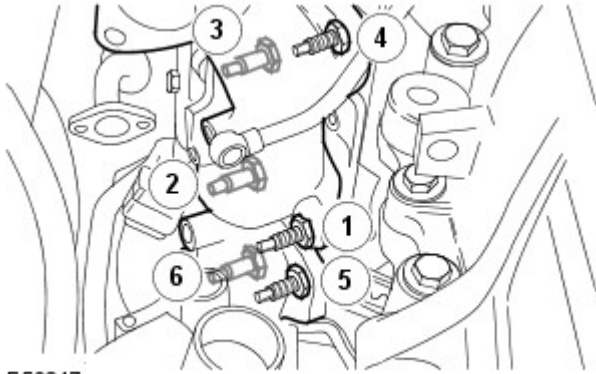
**15.** Remove and discard the LH exhaust manifold gasket.

- Remove and discard the studs.



## Installation

1. Tighten the LH exhaust manifold retaining studs to 13 Nm (10 lb.ft.).



E56247

- Install a new gasket.

**2. NOTE: Tighten the retaining nuts in the sequence shown.**

Install the LH exhaust manifold.

- Tighten the nuts to 24 Nm (18 lb.ft).

**3. Install the three exhaust cross-over pipe retaining nuts.**

- Tighten the nuts to 24 Nm (18 lb.ft).

**4. Install the LH exhaust manifold heat shield.**

- Install the two retaining bolts and tighten to 10 Nm (7 lb.ft).

**5. Install the LH EGR valve.**

- Install the three EGR valve retaining bolts, but do not fully tighten at this stage.

**6. NOTE: Do not fully close the retaining clip at this stage.**

Install the LH EGR valve inlet tube.

- Install a new retaining clip.
- Install a new gasket.
- Loosely install the two EGR valve inlet tube retaining bolts.

**7. Fully close the retaining clip.**

**8. Tighten the two EGR valve inlet tube retaining bolts to 10 Nm (7 lb.ft).**

**9. Tighten the three EGR valve retaining bolts to 10 Nm (7 lb.ft).**

**10. Install the support bracket.**

- Tighten the two retaining bolts to 10 Nm (7 lb.ft).

**11. Connect the coolant inlet hose to the LH EGR valve.**

**12. Connect the LH EGR valve electrical connector.**

**13. Connect the coolant outlet hose to the LH EGR valve.**

**14. Install the LH EGR valve outlet tube.**

For additional information, refer to: [Exhaust Gas Recirculation \(EGR\) Valve Outlet Tube](#) (303-08A Engine Emission Control - TDV6 2.7L Diesel, Removal and Installation).

**15. Install the battery tray.**

For additional information, refer to: [Battery Tray](#) (414-01 Battery, Mounting and Cables, Removal and Installation).

**16. Install the turbocharger.**

For additional information, refer to: [Turbocharger](#) (303-04B Fuel Charging and Controls - Turbocharger - TDV6 2.7L Diesel, Removal and Installation).

**17. Connect the battery ground cable.**

For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

**18. Refill and bleed the cooling system.**

For additional information, refer to: [Cooling System Draining, Filling and Bleeding](#) (303-03A Engine Cooling - TDV6 2.7L Diesel, General Procedures).

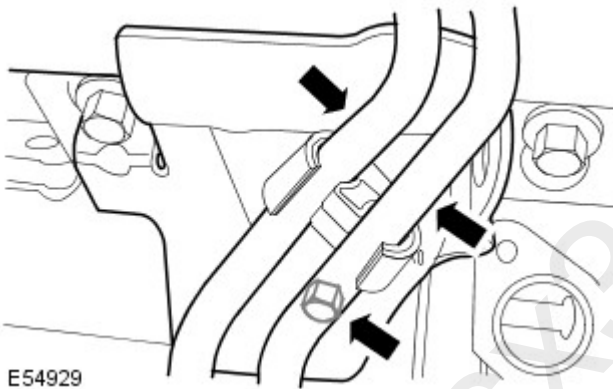


# Engine - TDV6 2.7L Diesel - Exhaust Manifold RH

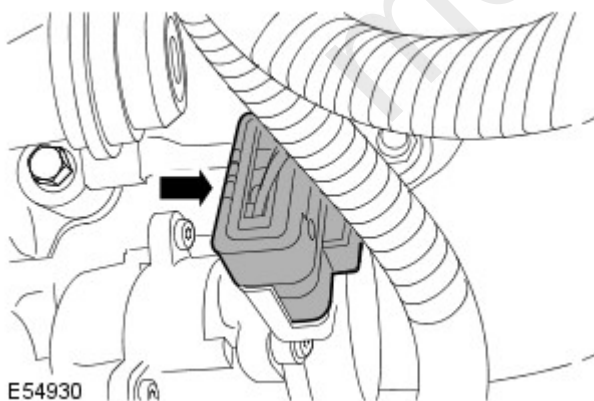
In-vehicle Repair

## Removal

1. Disconnect the battery ground cable.  
For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).
2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.  
  
Raise and support the vehicle.
3. Drain the cooling system.  
For additional information, refer to: [Cooling System Draining, Filling and Bleeding](#) (303-03A Engine Cooling - TDV6 2.7L Diesel, General Procedures).
4. Remove the auxiliary battery tray.  
For additional information, refer to: [Auxiliary Battery Tray](#) (414-01 Battery, Mounting and Cables, Removal and Installation).
5. Remove the RH exhaust gas recirculation (EGR) valve outlet tube.  
For additional information, refer to: [Exhaust Gas Recirculation \(EGR\) Valve Outlet Tube](#) (303-08A Engine Emission Control - TDV6 2.7L Diesel, Removal and Installation).
6. Remove the fuel line bracket.
  - Release the fuel lines.
  - Remove the bolt.

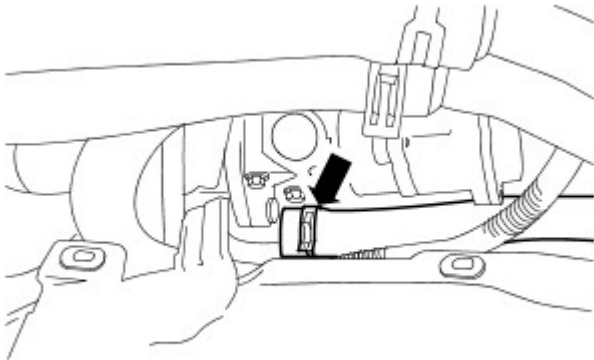


7. Disconnect the EGR valve electrical connector.



**8.** Disconnect the coolant inlet hose from the EGR valve.

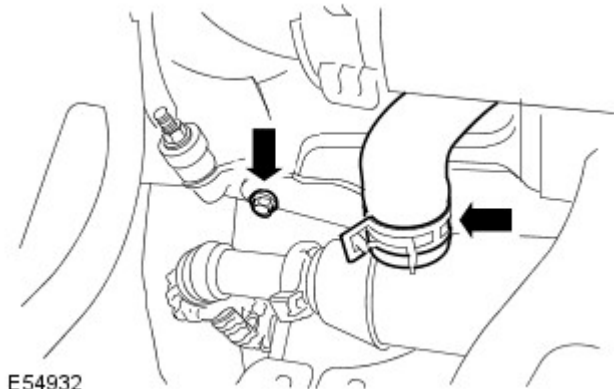
- Release the clip.



E54931

**9.** Disconnect the coolant outlet hose from the EGR valve.

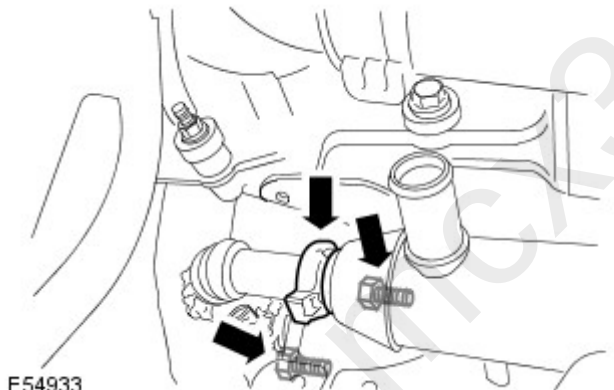
- Remove the bolt.
- Release the clip.



E54932

**10.** Remove the EGR valve inlet tube.

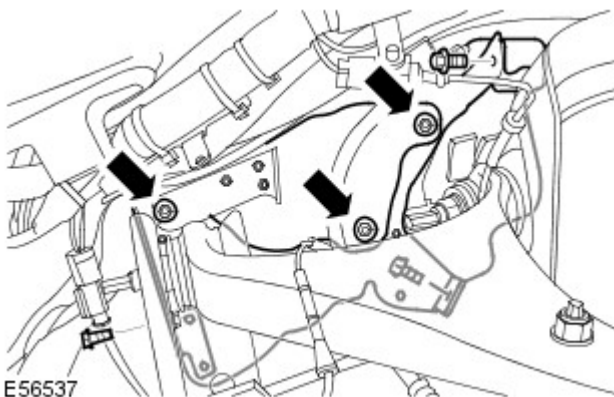
- Release the clip.
- Remove the 2 bolts.
- Remove and discard the gasket.
- Remove and discard the clip.



E54933

**11.** Remove the RH front wheel and tire.

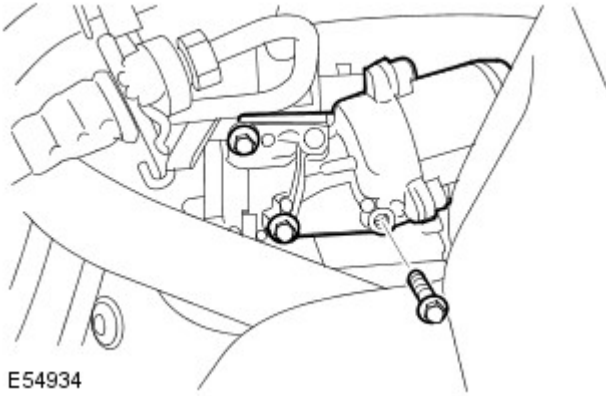
**12.** Remove the upper suspension arm and brake line heat shields for access.



E56537

**13.** Remove the RH EGR valve and cooler assembly.

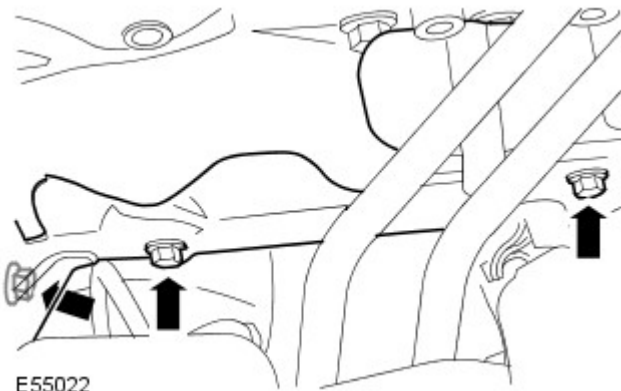
- Remove the 3 bolts.



E54934

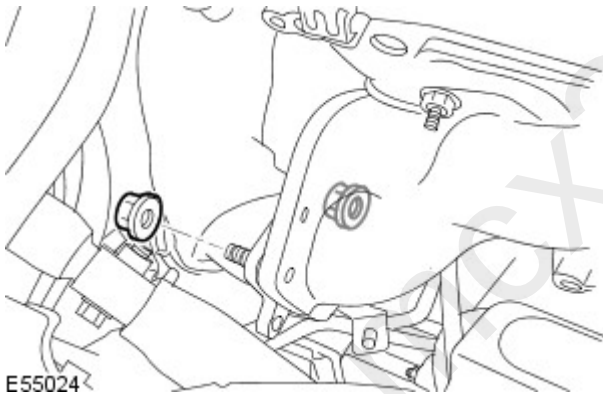
**14.** Remove the RH exhaust manifold heat shield.

- Remove the 3 bolts.



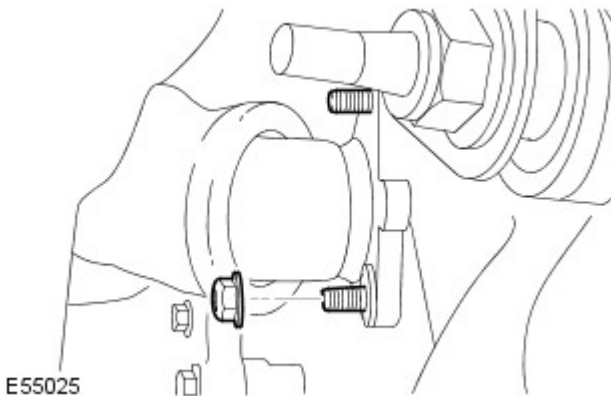
E55022

**15.** Remove the 2 exhaust cross-over pipe nuts.

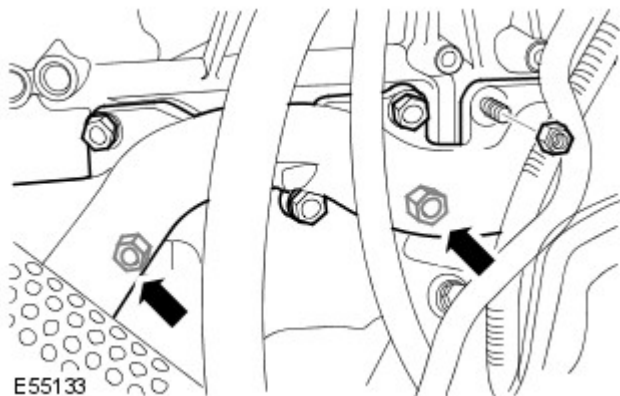


E55024

**16.** Remove the remaining exhaust cross-over pipe nut.



E55025



**17. Remove the RH exhaust manifold.**

- Remove the 6 nuts.
- Remove and discard the gasket.
- Remove and discard the studs.

**Installation**

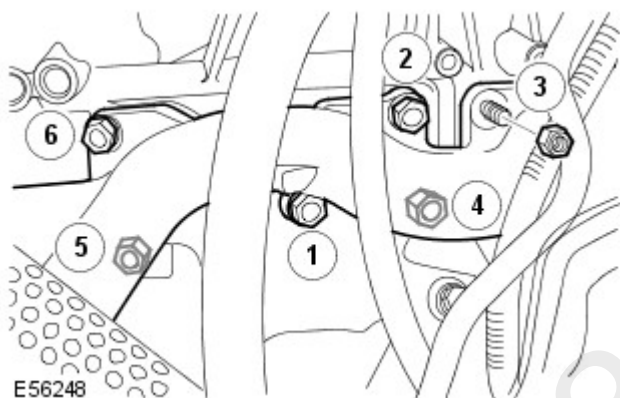
**1. Tighten the exhaust manifold studs to 13 Nm (10 lb.ft).**

- Install a new gasket.

**2. NOTE: Tighten the retaining nuts in the sequence shown.**

Install the RH exhaust manifold.

- Tighten the nuts to 24 Nm (18 lb.ft).



**3. Tighten the exhaust cross-over pipe nut to 24 Nm (18 lb.ft).**

**4. Tighten the 2 exhaust cross-over pipe nuts to 24 Nm (18 lb.ft).**

**5. Install the RH exhaust manifold heat shield.**

- Install the bolts and tighten to 10 Nm (7 lb.ft).

**6. Install the RH EGR valve and cooler assembly.**

- Install the EGR valve bolts, but do not fully tighten at this stage.

**7. NOTE: Do not fully close the retaining clip at this stage.**

Install the EGR valve inlet tube.

- Install a new gasket.
- Install a new clip.
- Loosely install the 2 EGR valve inlet tube bolts.

**8. Fully close the clip.**

**9. Tighten the two EGR valve inlet tube bolts to 10 Nm (7 lb.ft).**

**10. Tighten the three EGR valve bolts to 10 Nm (7 lb.ft).**

**11. Install the upper suspension arm and brake line heat shields.**

**12. Install the wheel and tire.**

**13. Tighten the EGR valve bolt to 10 Nm (7 lb.ft).**

**14. Connect the coolant outlet hose to the EGR valve.**

**15. Connect the coolant inlet hose to the EGR valve.**

**16. Connect the EGR valve electrical connector.**

**17. Install the fuel line bracket.**

- Install the fuel line retaining bracket bolt and tighten to 10 Nm (7 lb.ft).
- Secure the fuel lines.

**18.** Install the RH EGR valve outlet tube.

For additional information, refer to: [Exhaust Gas Recirculation \(EGR\) Valve Outlet Tube](#) (303-08A Engine Emission Control - TDV6 2.7L Diesel, Removal and Installation).

**19.** Install the auxiliary battery tray.

For additional information, refer to: [Auxiliary Battery Tray](#) (414-01 Battery, Mounting and Cables, Removal and Installation).

**20.** Connect the battery ground cable.

For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

**21.** Fill and bleed the cooling system.

For additional information, refer to: [Cooling System Draining, Filling and Bleeding](#) (303-03A Engine Cooling - TDV6 2.7L Diesel, General Procedures).

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## Engine - TDV6 2.7L Diesel - Oil Filter Housing

In-vehicle Repair

1. Refer to oil cooler.

For additional information, refer to: [Oil Cooler](#) (303-01A Engine - TDV6 2.7L Diesel, In-vehicle Repair).

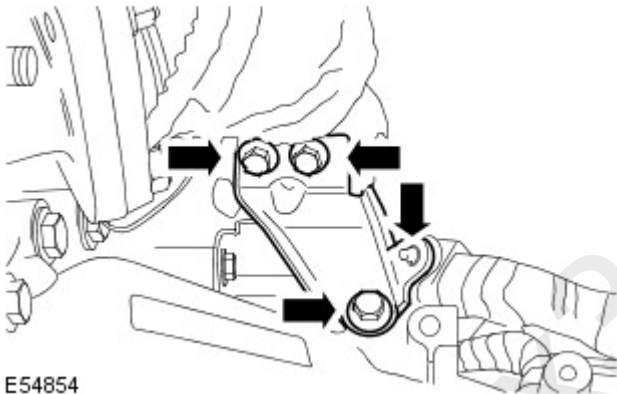
mcx30.com

# Engine - TDV6 2.7L Diesel - Exhaust Manifold Crossover Pipe

Removal and Installation

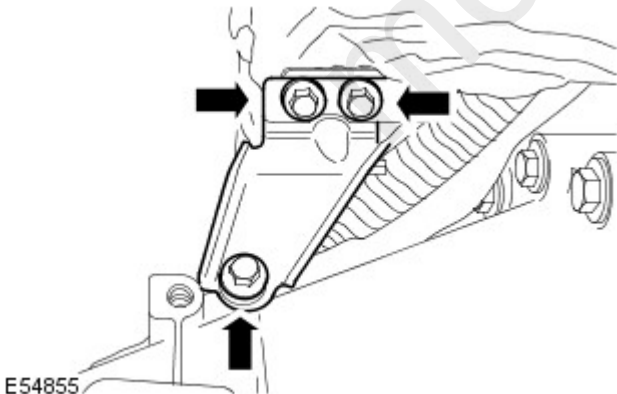
## Removal

1. Disconnect the battery ground cable.  
For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).
2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.  
  
Raise and support the vehicle.
3. Remove the transmission support crossmember.  
For additional information, refer to: [Transmission Support Crossmember - V6 4.0L Petrol/TDV6 2.7L Diesel](#) (502-02 Full Frame and Body Mounting, Removal and Installation).
4. Remove the exhaust system. For additional information, refer to: (309-00A Exhaust System - TDV6 2.7L Diesel)  
  
[Exhaust System - Vehicles Without: Diesel Particulate Filter \(DPF\)](#) (Removal and Installation),  
[Exhaust System - Vehicles With: Diesel Particulate Filter \(DPF\)](#) (Removal and Installation).
5. Lower the rear of the transmission for access.
6. Remove the exhaust manifold crossover pipe LH support bracket.
  - Release the wiring harness.
  - Remove the 3 bolts.



E54854

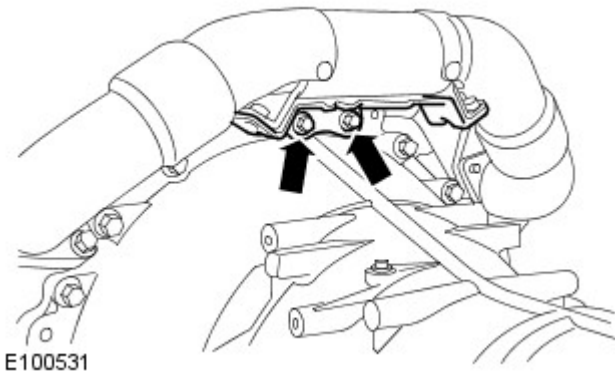
7. Remove the exhaust manifold crossover pipe RH support bracket.
  - Remove the 3 bolts.



E54855

8. Remove the exhaust manifold crossover pipe center support bracket.

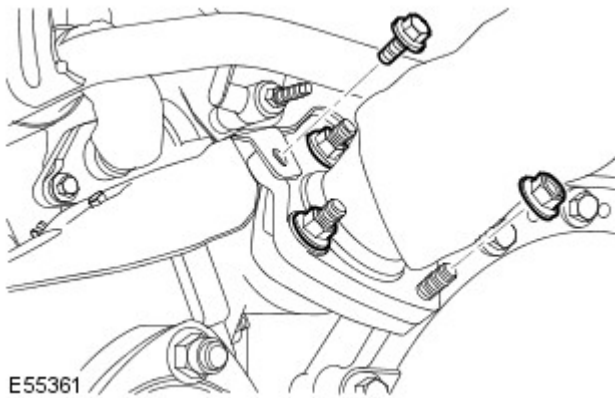
- Remove the 2 bolts.



9.  **CAUTION:** Take care when handling the crossover pipe as damage to the insulating material may occur.

Release the exhaust manifold crossover pipe from the turbocharger.

- Remove the turbocharger heat shield bolt.
- Remove and discard the 3 nuts.

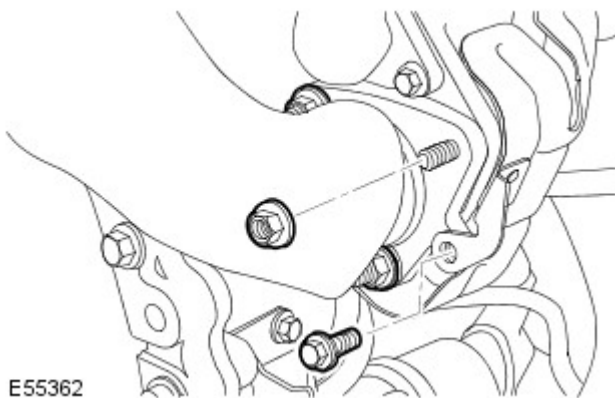


10. Remove the RH exhaust manifold heat shield.



11. Remove the exhaust manifold crossover pipe.

- Remove and discard the 3 nuts.
- Remove and discard the 2 gaskets.



## Installation

1. Install new exhaust manifold studs.
2. Install new turbocharger studs.

3.  **CAUTION:** Take care when handling the crossover pipe as damage to the insulating material may occur.

Install the exhaust manifold crossover pipe.

- Clean the component mating faces.
- Install new gaskets.
- Install new nuts.
- Tighten the 6 nuts to 24 Nm (18 lb. ft).

4. Install the exhaust manifold crossover pipe center support bracket.

- Loosely install the 2 bolts.

5. Install the exhaust manifold crossover pipe RH support bracket.

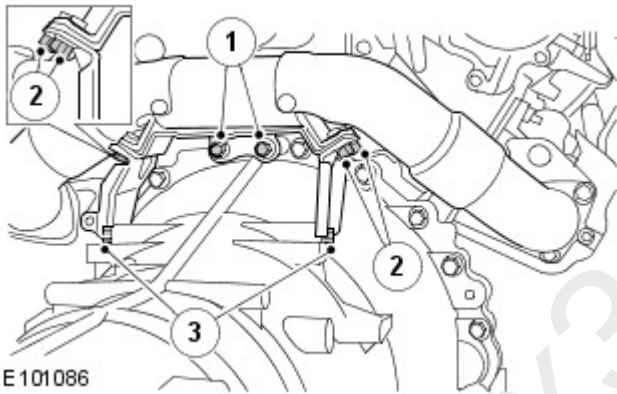
- Loosely install the 3 bolts.

6. Install the exhaust manifold crossover pipe LH support bracket.

- Loosely install the 3 bolts.

7. Tighten the exhaust manifold crossover pipe mounting bracket bolts in the following sequence.

- Tighten the 2 bolts marked 1 to 10 Nm (7 lb.ft).
- Loosen the 2 bolts by 90 degrees.
- Tighten the 2 bolts marked 3 to 10 Nm (7lb.ft).
- Loosen the 2 bolts by 90 degrees.
- Tighten the 4 bolts marked 2 to 25 Nm (18 lb. ft).
- Tighten the 2 bolts marked 1 to 25 Nm (18 lb. ft).
- Tighten the 2 bolts marked 3 to 25 Nm (18 lb. ft).
- Attach the wiring harness.



8. Install the RH exhaust manifold heat shield.

- Tighten the 3 bolts to 10 Nm (7 lb.ft).

9. Install the turbocharger heat shield.

- Tighten the bolt to 10 Nm (7 lb.ft).

10. Install the exhaust system. For additional information, refer to: (309-00A Exhaust System - TDV6 2.7L Diesel)

[Exhaust System - Vehicles Without: Diesel Particulate Filter \(DPF\)](#) (Removal and Installation),  
[Exhaust System - Vehicles With: Diesel Particulate Filter \(DPF\)](#) (Removal and Installation).

11. Install the transmission support crossmember.

For additional information, refer to: [Transmission Support Crossmember - V6 4.0L Petrol/TDV6 2.7L Diesel](#) (502-02 Full Frame and Body Mounting, Removal and Installation).

12. Connect the battery ground cable.

For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

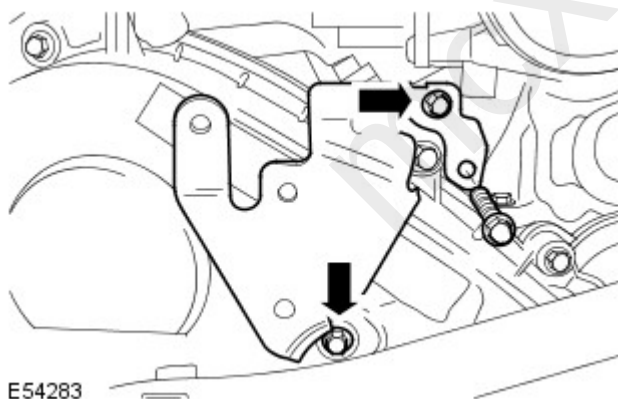
# Engine - TDV6 2.7L Diesel - Engine Vehicles With: 6HP28 6-Speed Automatic Transmission / 6HP26 6-Speed Automatic Transmission

## Removal

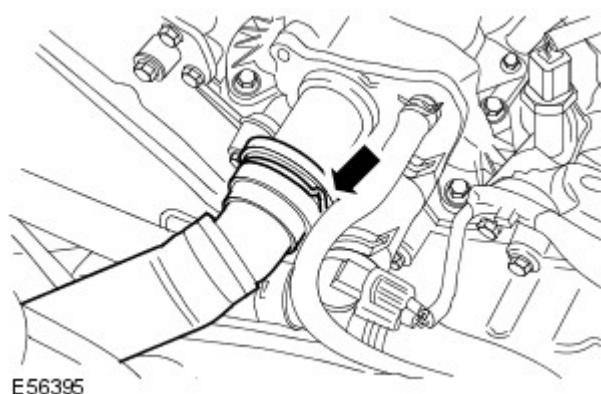
| Special Tool(s)                                                                             |                       |
|---------------------------------------------------------------------------------------------|-----------------------|
| <br>E56716 | Engine lifting cradle |
|                                                                                             | 303-1141              |

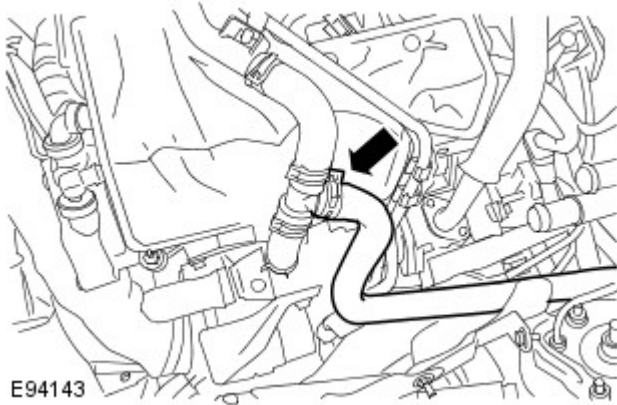
## Removal

1. Disconnect the battery ground cable.  
For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).
2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.  
  
Raise and support the vehicle.
3. Remove the wheels and tires.
4. Remove the body.  
For additional information, refer to: [Body - TDV6 3.0L Diesel/TDV6 2.7L Diesel](#) (502-02 Full Frame and Body Mounting, Removal and Installation).
5. Remove the cooling fan shroud.  
For additional information, refer to: [Cooling Fan Shroud](#) (303-03A Engine Cooling - TDV6 2.7L Diesel, Removal and Installation).
6. Remove the intake air shutoff throttle.  
For additional information, refer to: [Intake Air Shutoff Throttle](#) (303-04A Fuel Charging and Controls - TDV6 2.7L Diesel, Removal and Installation).
7. Remove the intake air shutoff throttle elbow support bracket.
  - Remove the 3 bolts.



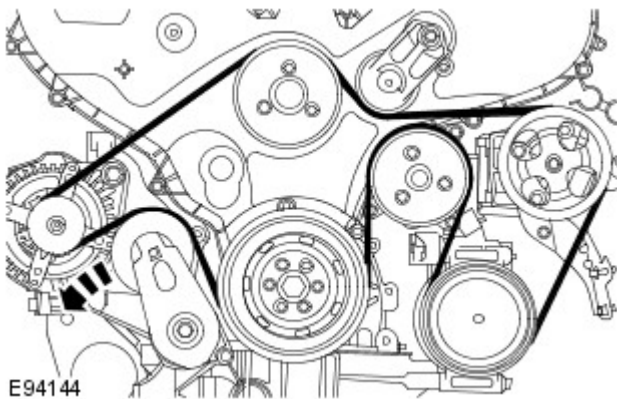
8. Disconnect the upper coolant hose from the coolant distribution manifold.
  - Remove the clip.





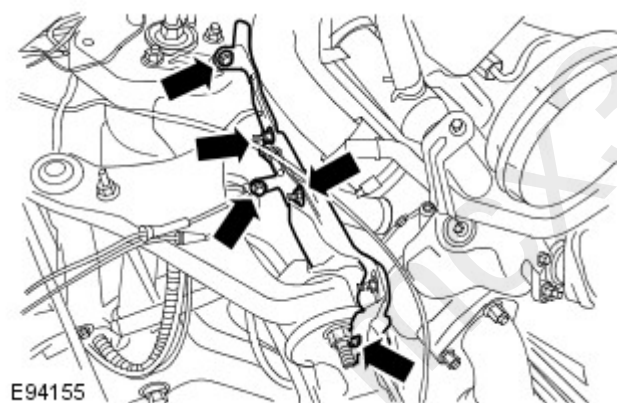
**9.** Disconnect the RH exhaust gas recirculation (EGR) coolant hose.

- Release the clip.



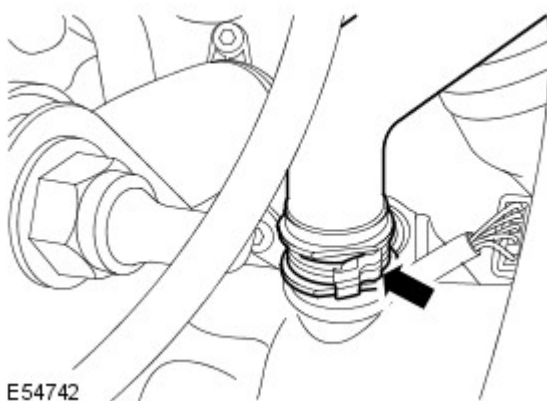
**10.** Remove the accessory drive belt.

- Rotate the accessory drive belt tensioner counter-clockwise.



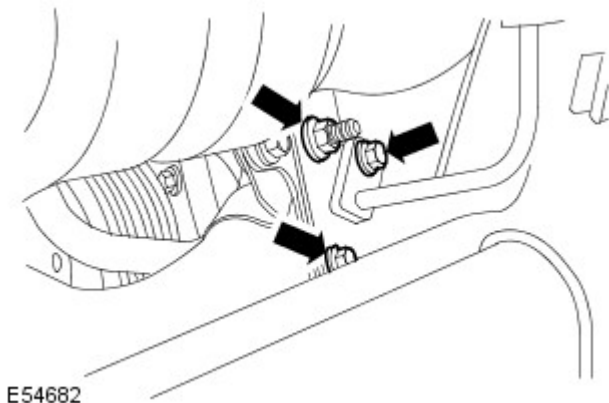
**11.** Remove the 2 LH upper suspension arm and brake line heat shields.

- Remove the 2 nuts.
- Remove the 3 bolts.



**12.** Disconnect the breather hose.

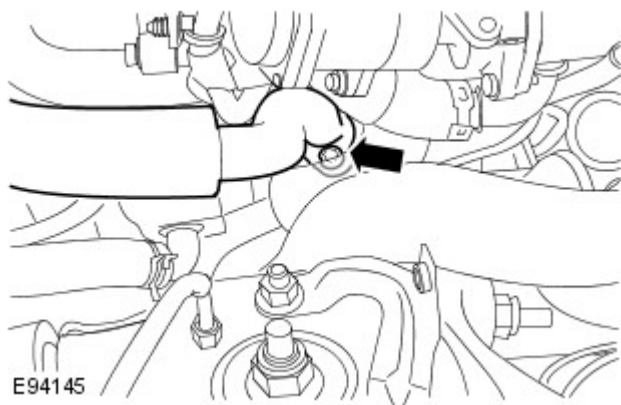
- Release the clip.



E54682

**13. Release the charge air cooler inlet pipe.**

- Remove the nut.
- Remove the 2 bolts.

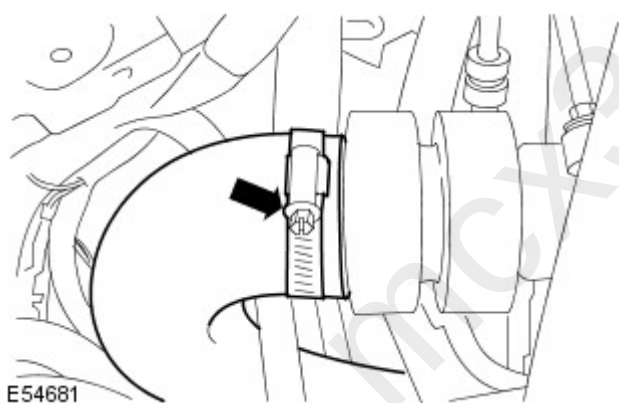


E94145

**14.  CAUTION: Make sure that all openings are sealed. Use new blanking caps.**

Disconnect the air conditioning (A/C) compressor low-pressure line.

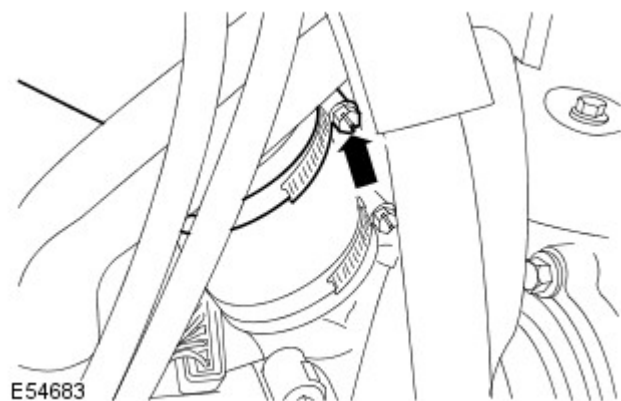
- Remove the bolt.
- Remove and discard the O-ring seal.



E54681

**15. Disconnect the charge air cooler inlet hose.**

- Loosen the clip.



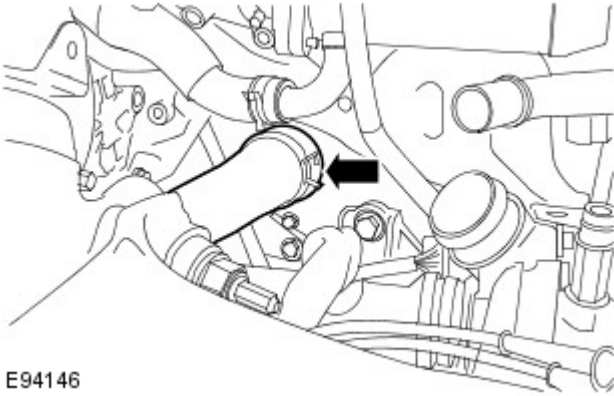
E54683

**16. Disconnect the charge air cooler inlet hose.**

- Loosen the clip.

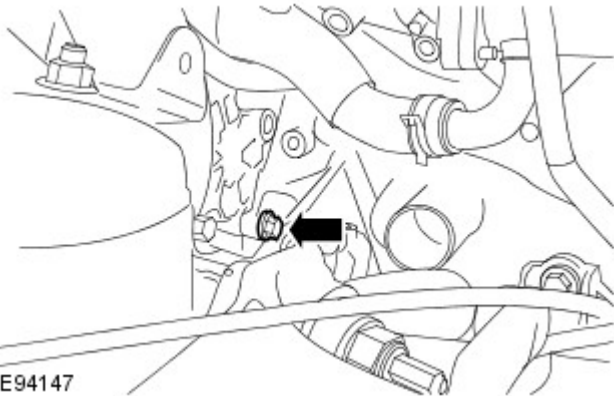
**17.** Disconnect the coolant lower hose.

- Release the clip.



E94146

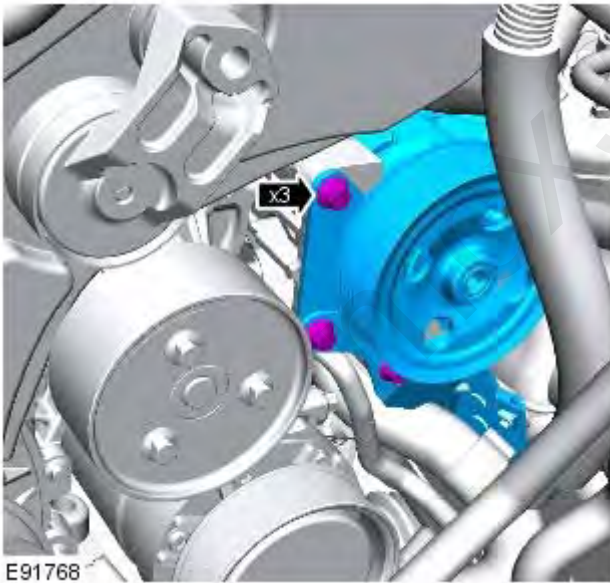
**18.** Remove the power steering pump rear bolt.



E94147

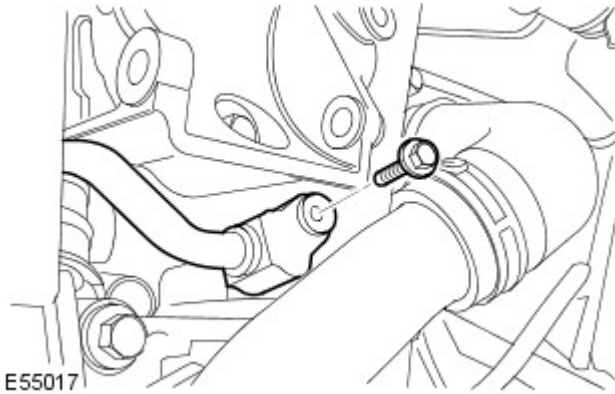
**19.** Reposition the power steering pump.

- Remove the 3 bolts.



E91768

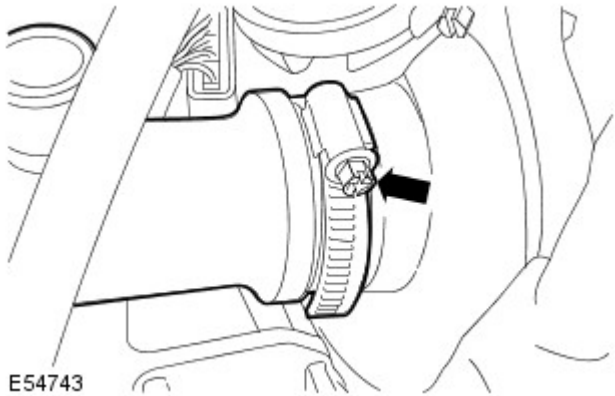
**20.** Remove the charge air cooler inlet pipe.



**21.**  **CAUTION:** Make sure that all openings are sealed. Use new blanking caps.

Disconnect the A/C compressor high-pressure pipe.

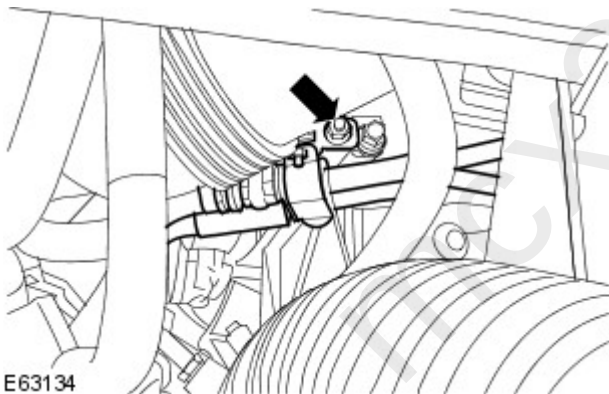
- Remove the bolt.
- Remove and discard the O-ring seal.



**22.** Reposition the lower coolant hose.

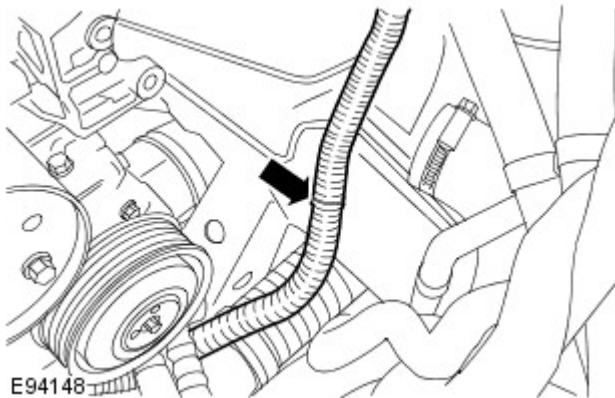
**23.** Remove the turbocharger intake tube.

- Loosen the clip.



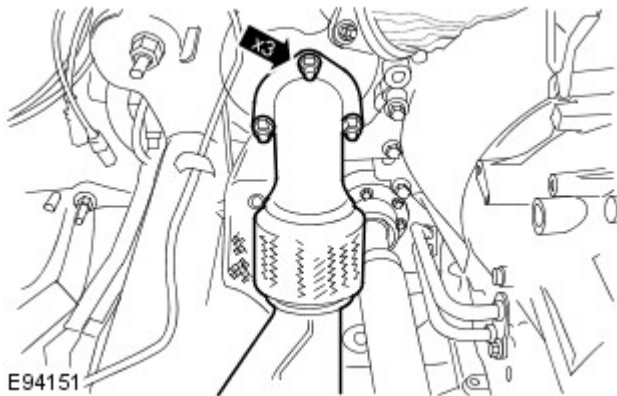
**24.** Release the transmission fluid lines.

- Remove the nut.



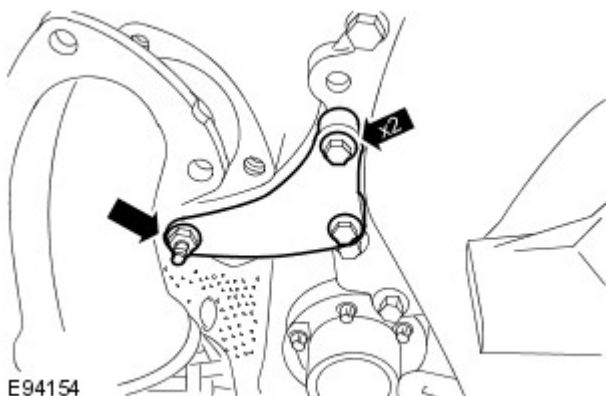
**25.** Release the battery positive cable.

- Release the clip.



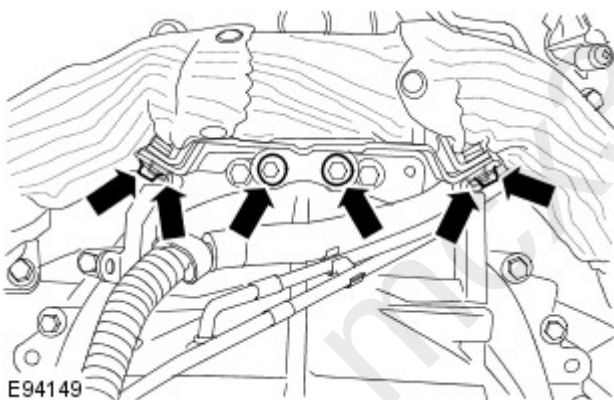
**26.** Release the exhaust from the turbocharger.

- Remove and discard the 3 nuts.
- Remove and discard the gasket.



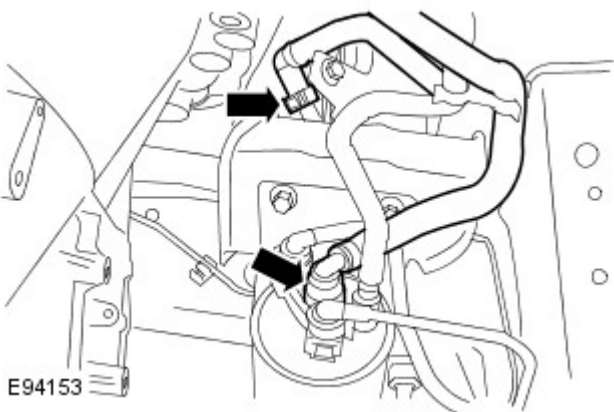
**27.** Remove the turbocharger support bracket.

- Remove the 2 bolts.
- Remove the nut.



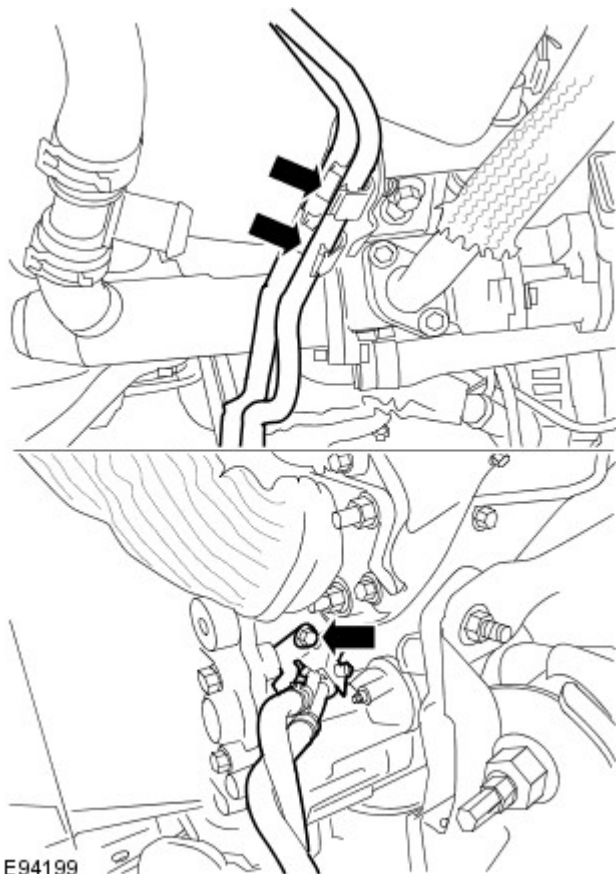
**28.** Release the exhaust cross-over pipe bracket.

- Remove the 6 bolts.



**29.**  **CAUTION:** Make sure that all openings are sealed. Use new blanking caps.

Disconnect the 2 fuel lines.



E94199

**30. Release the 2 fuel lines.**

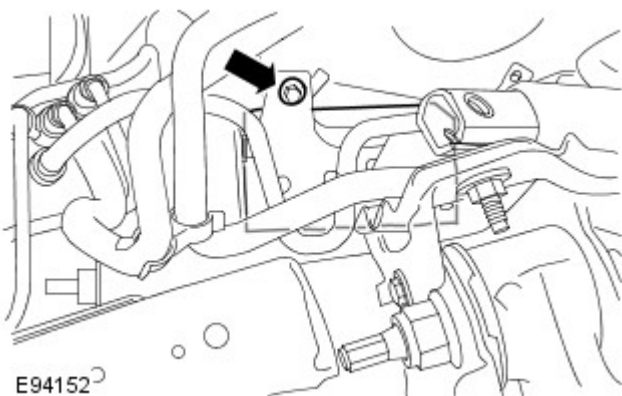
- Remove the bolt.
- Release from the 2 clips.



E94150

**31. Release the transmission breather lines.**

- Remove the bolt.



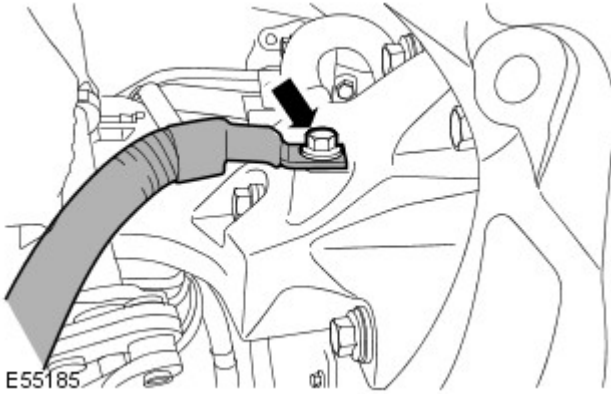
E94152

**32. Release and reposition the fuel cooler.**

- Remove the bolt.

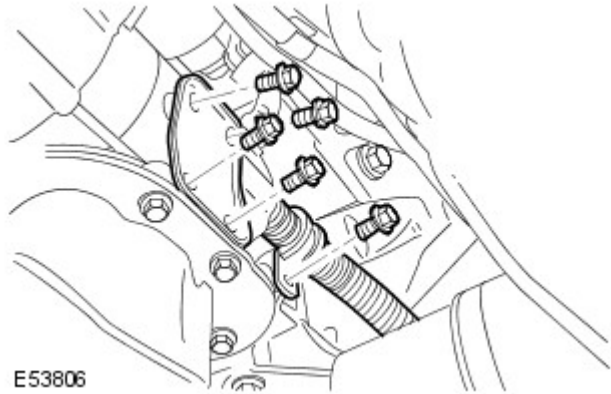
**33.** Release the engine ground cable.

- Remove the bolt.



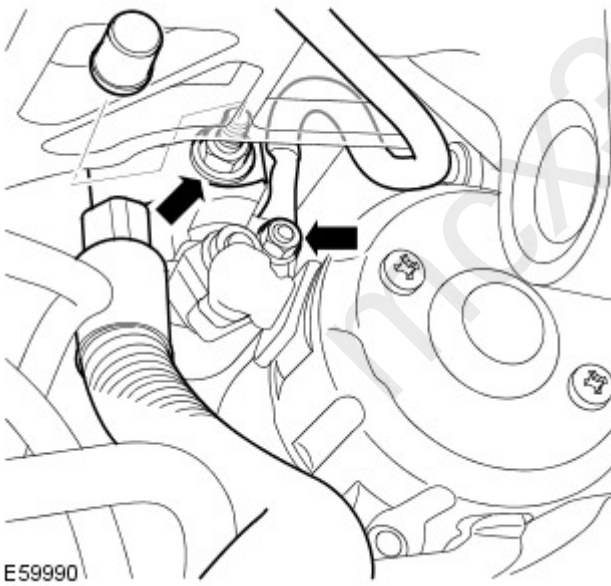
**34.** Remove the starter motor support bracket.

- Remove the 4 bolts.



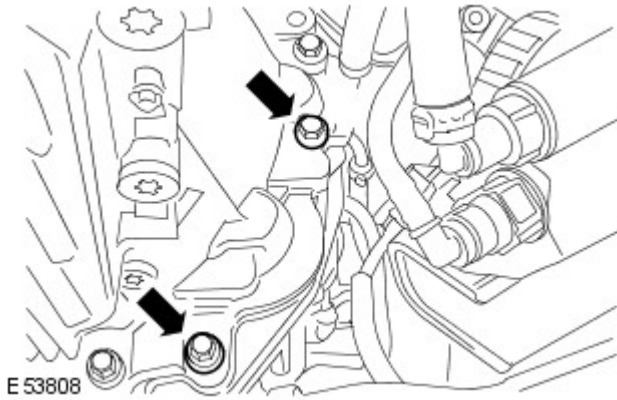
**35.** Disconnect the 2 starter motor wiring harness connectors from the starter motor solenoid.

- Remove the rubber insulator.
- Remove the 2 nuts.



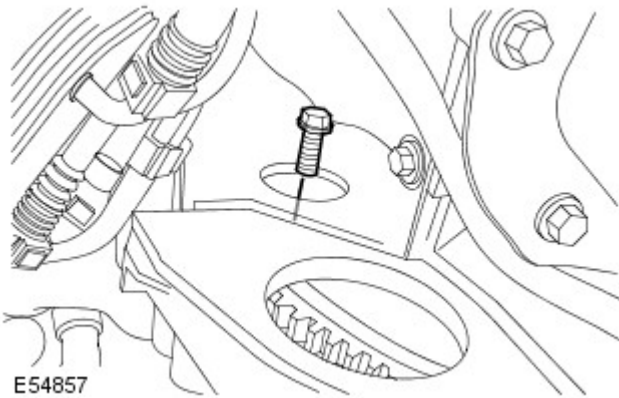
**36. Remove the starter motor.**

- Remove the 2 bolts.



**37. Release the flexplate.**

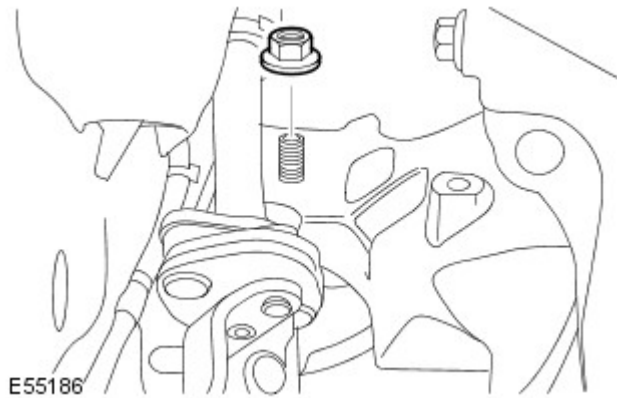
- Remove the access plug.
- Remove and discard the 4 bolts.



**38. Remove the LH engine mount nut.**

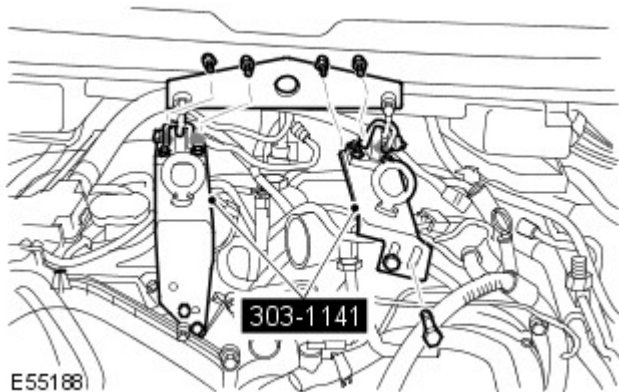


**39. Remove the RH engine mount nut.**



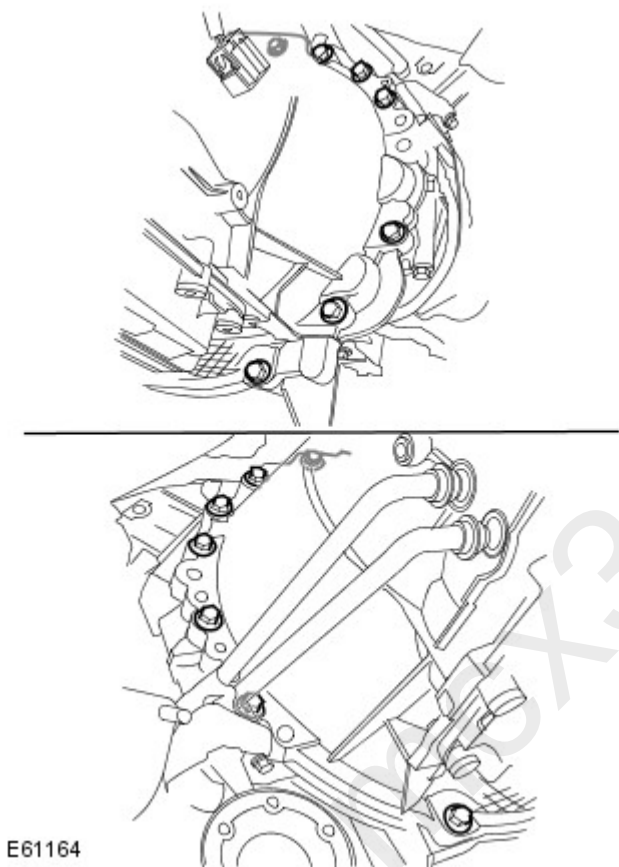
**40.** Install the special tool.

- Install and tighten the bolts.



**41.** Release the transmission from the engine.

- Remove the 14 bolts.



**42.** NOTE: Note the routing of the battery positive cable.

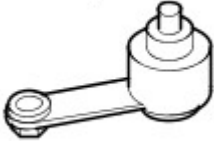
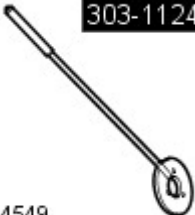
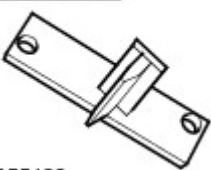
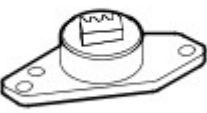
- NOTE: Note the routing of the transmission wiring harness.

With assistance, carefully remove the engine.

- Using a suitable hydraulic jack, support the transmission.
- Carefully guide the transmission wiring harness out as the engine is being removed.
- Carefully guide the battery positive cable out as the engine is being removed.

**Engine - TDV6 2.7L Diesel - Engine**

## Disassembly

| <b>Special Tool(s)</b>                                                                                    |                                                 |
|-----------------------------------------------------------------------------------------------------------|-------------------------------------------------|
| <br>303-1117<br>E54540   | Timing Pin - Automatic Transmission<br>303-1117 |
| <br>303-1116<br>E54539   | Timing Pin - Manual Transmission<br>303-1116    |
| <br>303-1145/1<br>E60399 | Camshaft pulley holding tool<br>303-1145/1      |
| <br>303-1124<br>E54549 | Holder - Camshaft Pulleys Front<br>303-1124     |
| <br>303-947<br>E55482  | Flex plate locking tool<br>303-947              |
| <br>303-1123<br>E54546 | Locking Tool - Flywheel<br>303-1123             |

**Disassembly**

All vehicles

1. Disconnect the battery ground cable.  
For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

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

Raise and support the vehicle.

**3. Drain the engine oil.**

For additional information, refer to: [Engine Oil Draining and Filling](#) (303-01A Engine - TDV6 2.7L Diesel, General Procedures).

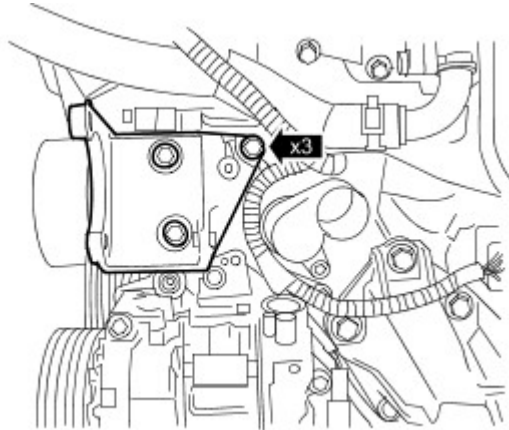
**4. Remove the engine.**

For additional information, refer to: [Engine - Vehicles With: 6HP28 6-Speed Automatic Transmission/6HP26 6-Speed Automatic Transmission](#) (303-01A Engine - TDV6 2.7L Diesel, Removal) / [Engine - Vehicles With: Manual Transmission](#) (303-01 Engine - 2.7L Diesel, Removal).

**5. Install the engine to a suitable engine stand.**

**6. Remove the power steering pump bracket.**

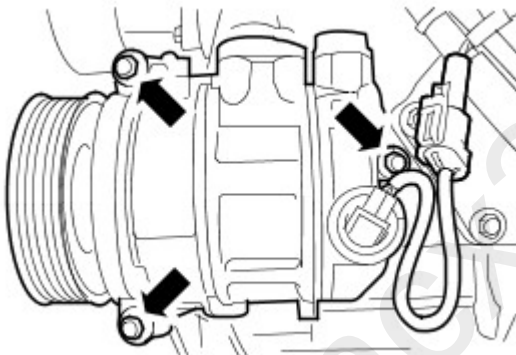
- Remove the 3 bolts.



E96773

**7. Remove the air conditioning (A/C) compressor.**

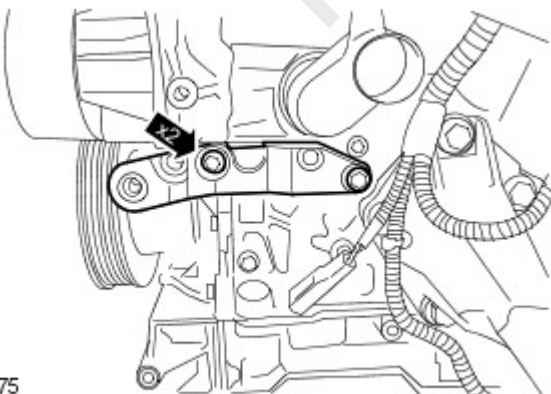
- Disconnect the electrical connector.
- Remove the 3 bolts.



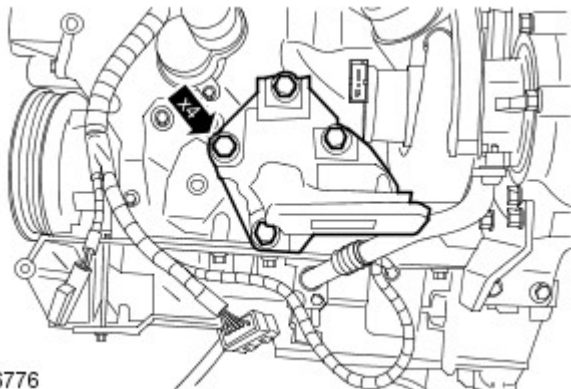
E96774

**8. Remove the A/C compressor bracket.**

- Remove the 2 bolts.



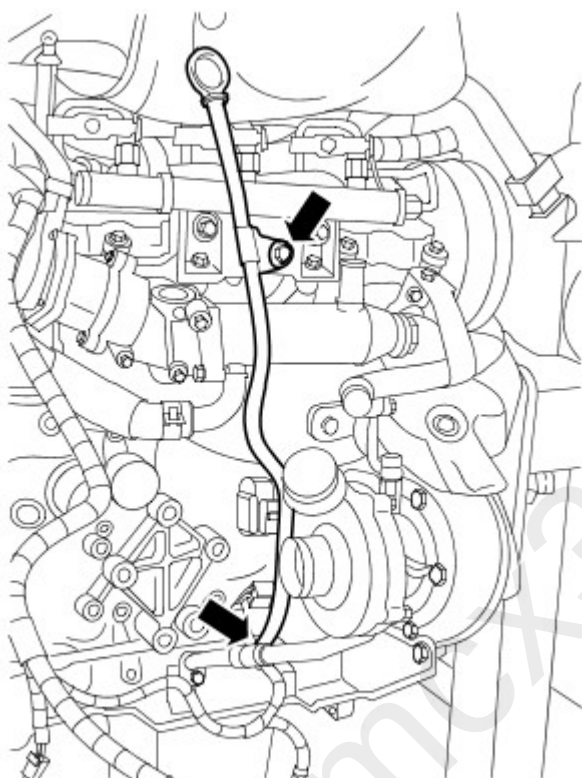
E96775



E96776

**9. Remove the LH engine mount bracket.**

- Remove the 4 bolts.

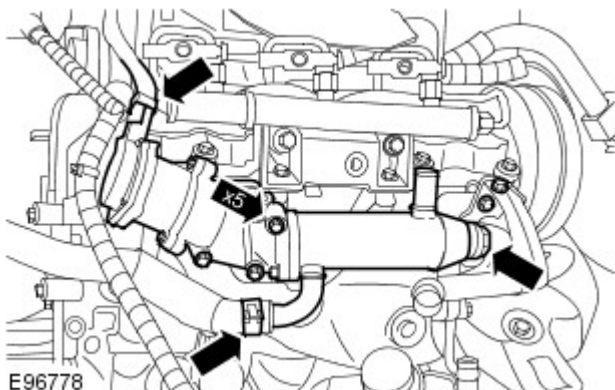


E96777

**10.  CAUTION: Make sure that all openings are sealed. Use new blanking caps.**

Remove the oil level indicator and tube.

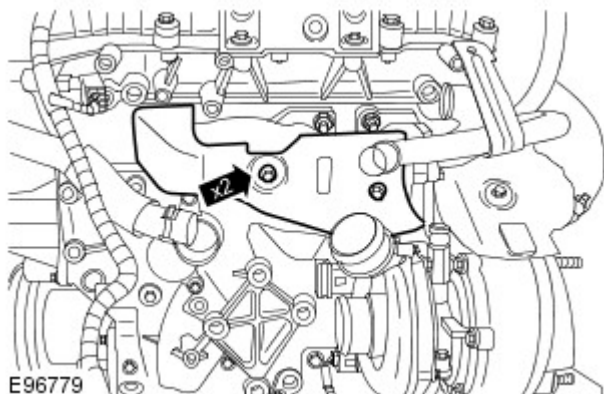
- Release the wiring harness clip.
- Remove the bolt.
- Remove and discard the O-ring seal.



E96778

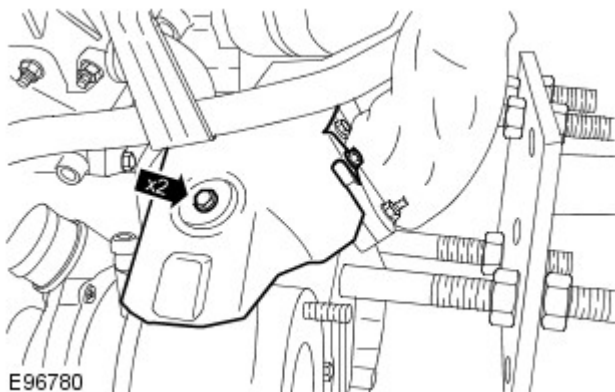
**11. Remove the LH exhaust gas recirculation (EGR) valve and cooler assembly.**

- Disconnect the electrical connector.
- Remove and discard the clip.
- Release the clip and disconnect the coolant hose.
- Remove the 5 bolts.
- Collect the bracket.



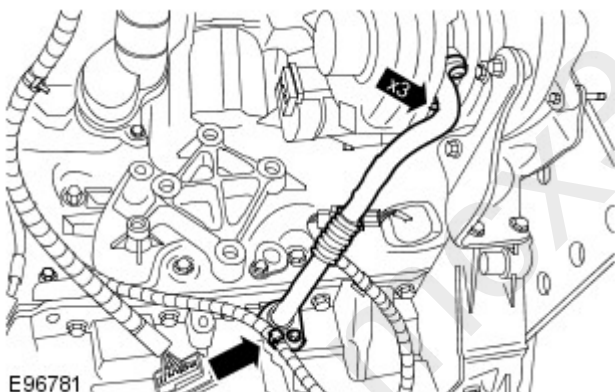
**12. Remove the LH exhaust manifold heat shield.**

- Remove the 2 bolts.



**13. Remove the turbocharger heat shield.**

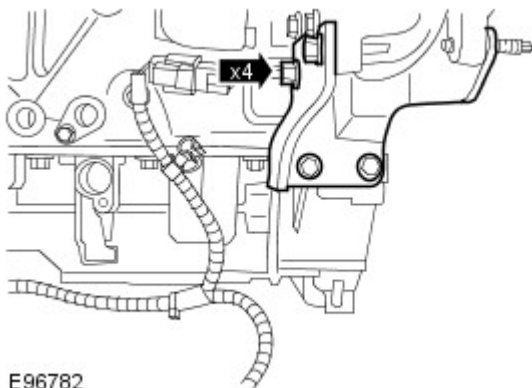
- Remove the 2 bolts.



**14. ⚠ CAUTION: Make sure that all openings are sealed. Use new blanking caps.**

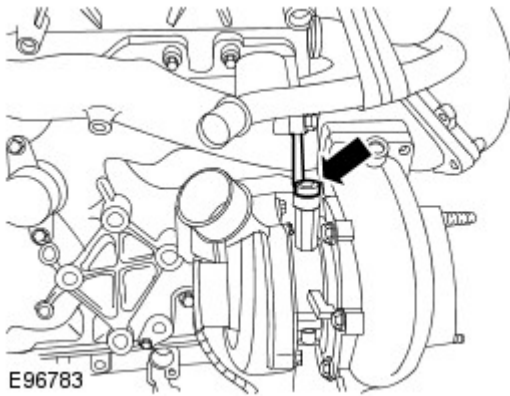
Remove the turbocharger oil return tube.

- Release the wiring harness clip.
- Remove the 3 bolts.
- Remove and discard the gasket.
- Remove and discard the O-ring seal.



**15. Release the turbocharger support bracket.**

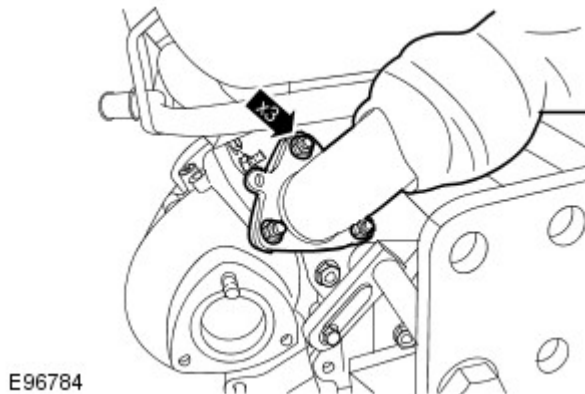
- Remove the 4 bolts.



**16.**  **CAUTION:** Make sure that all openings are sealed. Use new blanking caps.

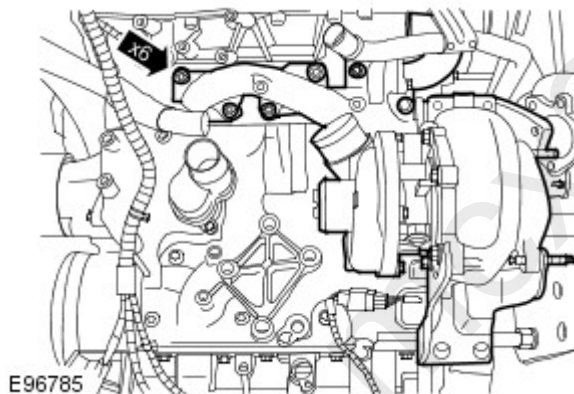
Disconnect the turbocharger oil supply tube.

- Remove the banjo bolt.
- Remove and discard the 2 sealing washers.



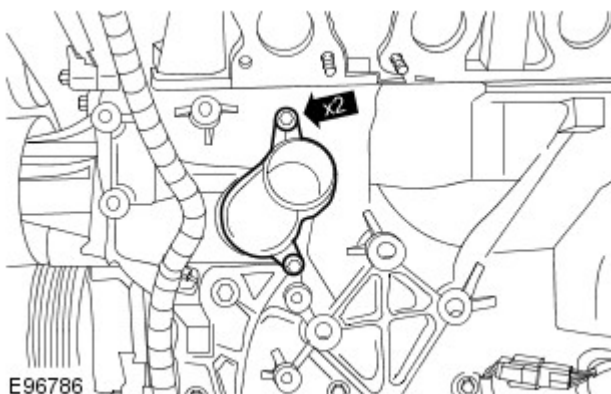
**17.** Release the exhaust cross-over pipe from the LH exhaust manifold.

- Remove and discard the 3 nuts.
- Remove and discard the gasket.



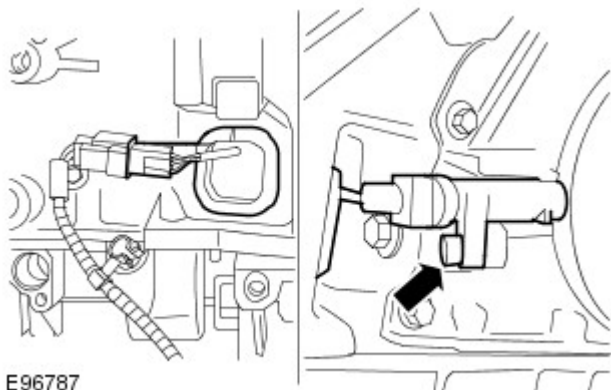
**18.** Remove the LH exhaust manifold and turbocharger assembly.

- Remove and discard the 6 nuts.
- Remove and discard the gasket.



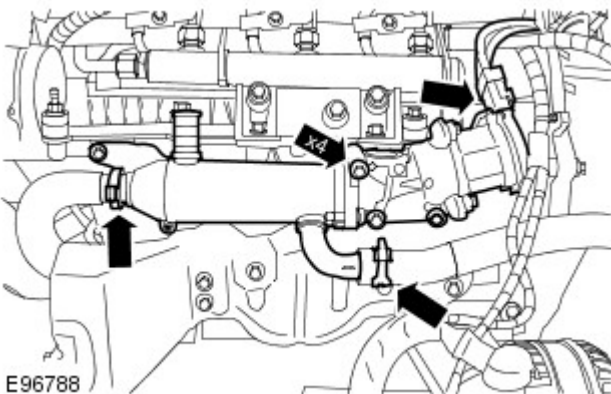
**19.** Remove the cylinder block coolant inlet pipe.

- Remove the 2 bolts.
- Remove and discard the O-ring seal.



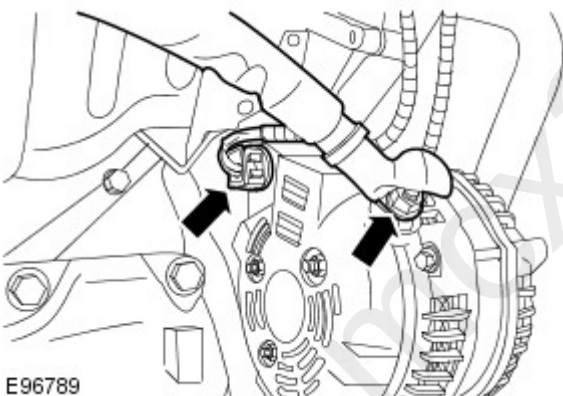
**20. Remove the crankshaft position (CKP) sensor.**

- Disconnect the electrical connector.
- Reposition the access cover.
- Remove the bolt.



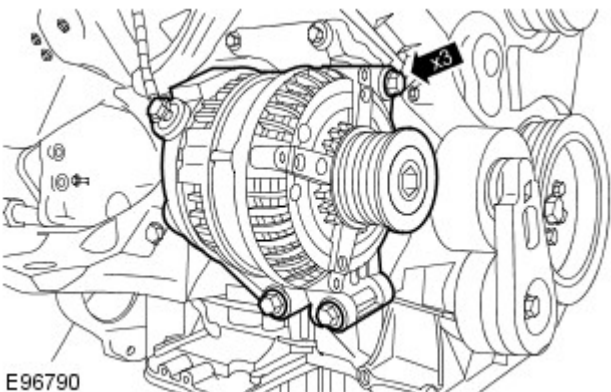
**21. Remove the RH EGR valve and cooler assembly.**

- Disconnect the electrical connector.
- Remove and discard the clip.
- Release the clip and disconnect the coolant hose.
- Remove the 4 bolts.



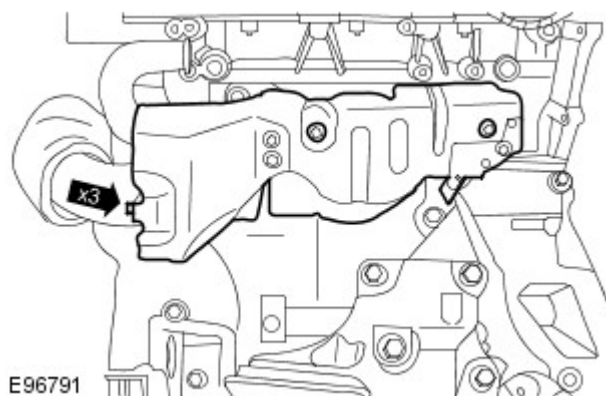
**22. Disconnect the generator electrical connectors.**

- Reposition the rubber insulator.
- Remove the nut.



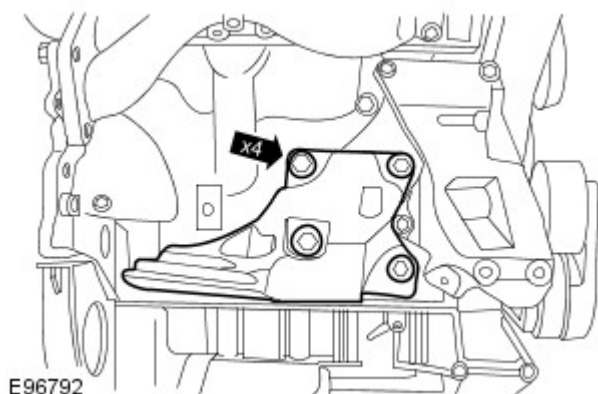
**23. Remove the generator.**

- Remove the 3 bolts.



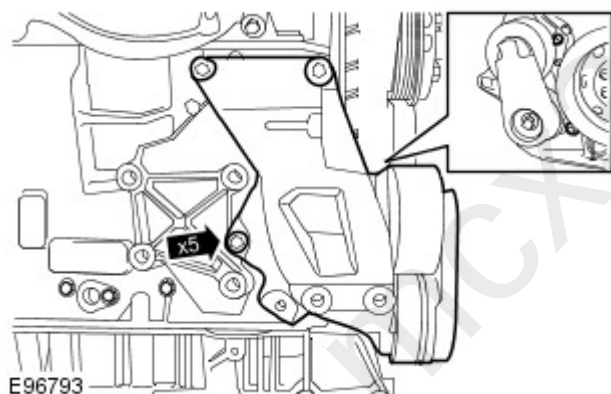
**24. Remove the RH exhaust manifold heat shield.**

- Remove the 3 bolts.



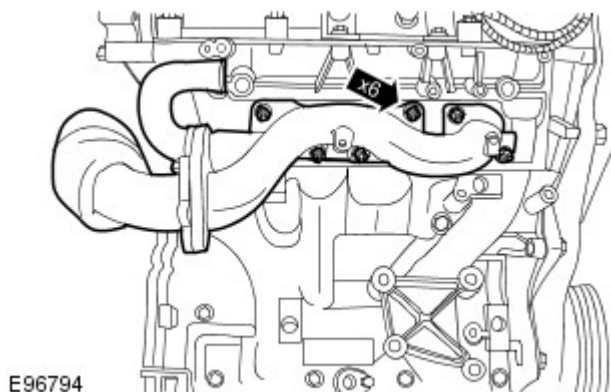
**25. Remove the RH engine mount bracket.**

- Remove the 4 bolts.



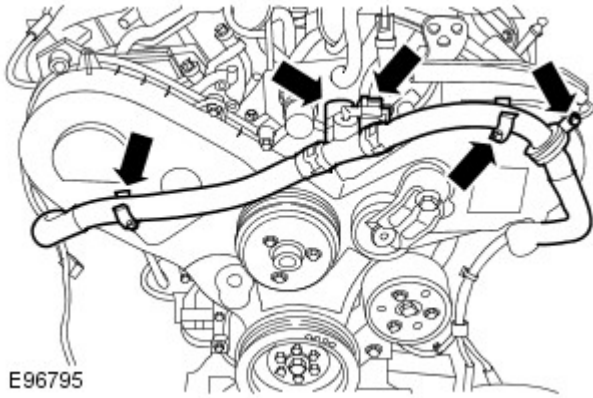
**26. Remove the generator bracket.**

- Remove the 5 bolts.



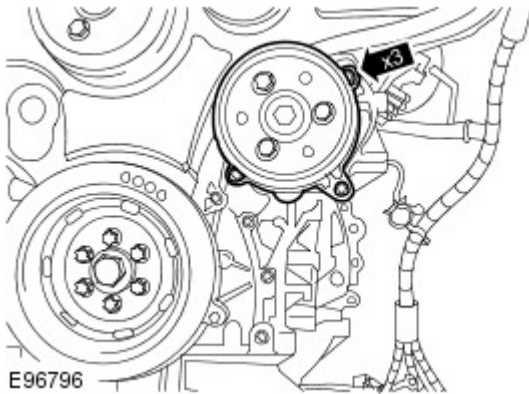
**27. Remove the RH exhaust manifold and exhaust cross-over pipe assembly.**

- Remove and discard the 6 nuts.
- Remove and discard the gasket.



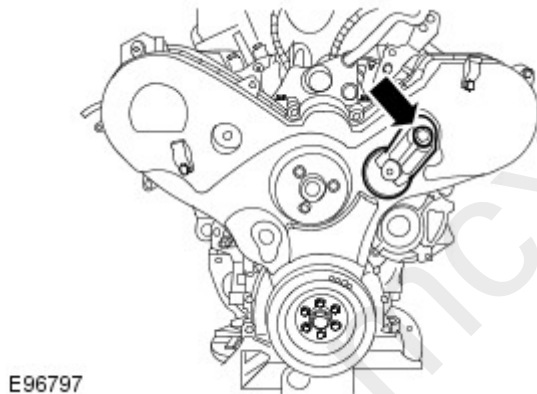
**28. Remove the EGR valve coolant pipe.**

- Remove the bolt.
- Disconnect the electrical connector.
- Release from the 2 clips.
- Release the clip.



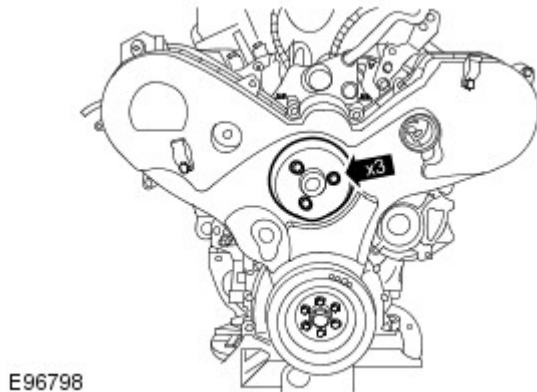
**29. Remove the coolant pump.**

- Remove the 3 bolts.
- Remove and discard the O-ring seal.



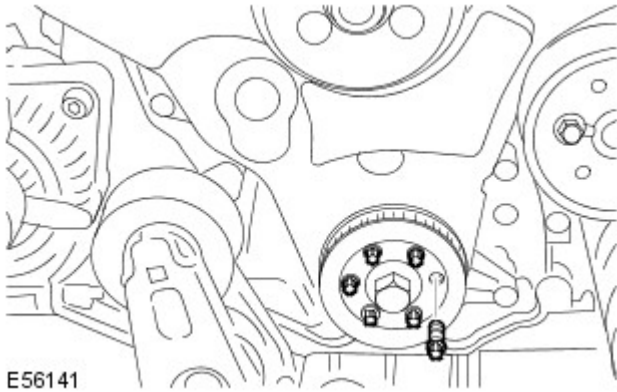
**30. Remove the accessory drive belt idler pulley.**

- Remove the bolt.



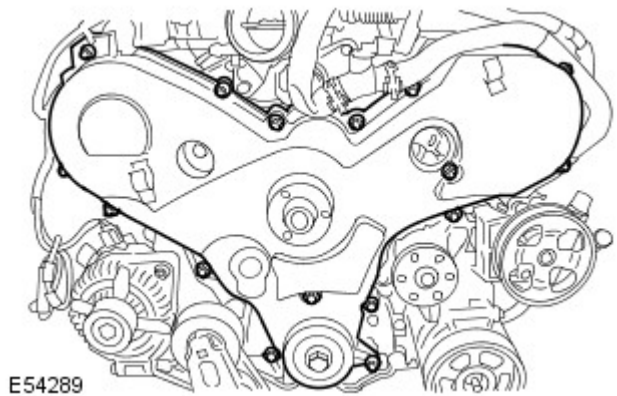
**31. Remove the cooling fan pulley.**

- Remove the 3 bolts.



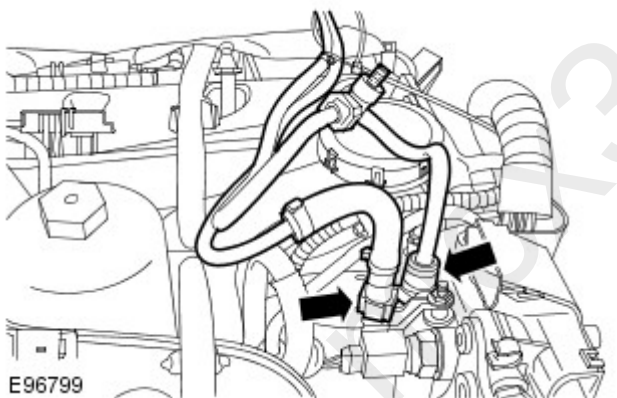
**32. Remove the crankshaft pulley.**

- Remove the 6 bolts.



**33. Remove the timing belt cover.**

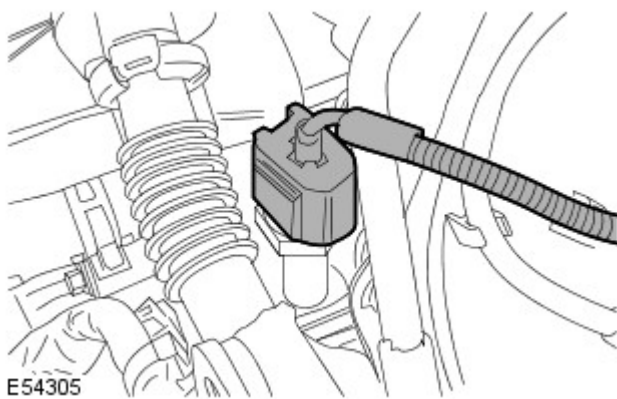
- Fully loosen the 16 bolts.



**34. NOTE: Note the fitted position.**

Remove the 2 low pressure fuel pipes.

- Disconnect the 2 quick release connectors.



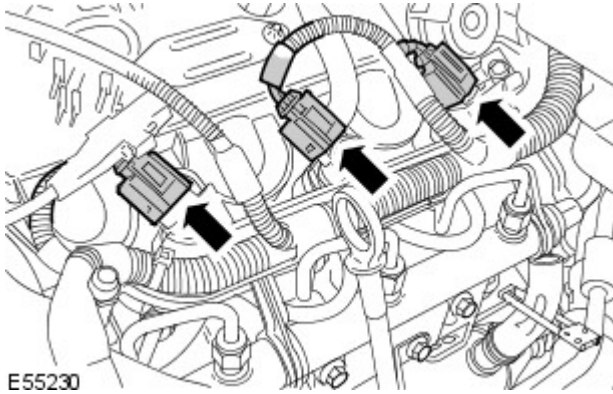
**35. Disconnect the engine oil pressure (EOP) sensor electrical connector.**

- Release the wiring harness clip.

**36. NOTE: LH shown, RH is similar**

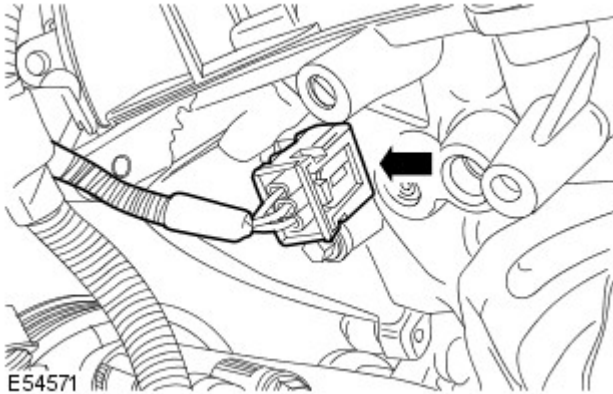
Disconnect the 6 fuel injector electrical connectors.

- Release the 4 wiring harness clips.



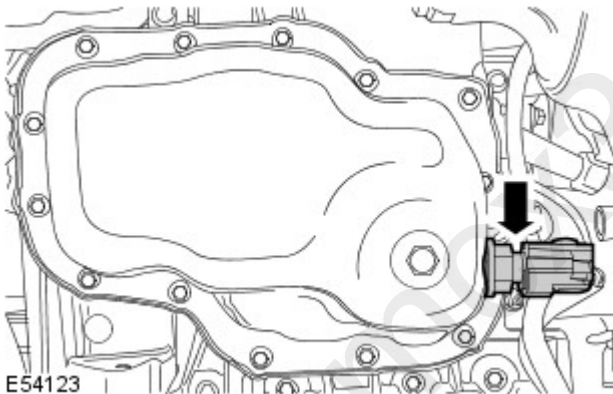
**37. Disconnect the camshaft position (CMP) sensor electrical connector.**

- Release the wiring harness clip.



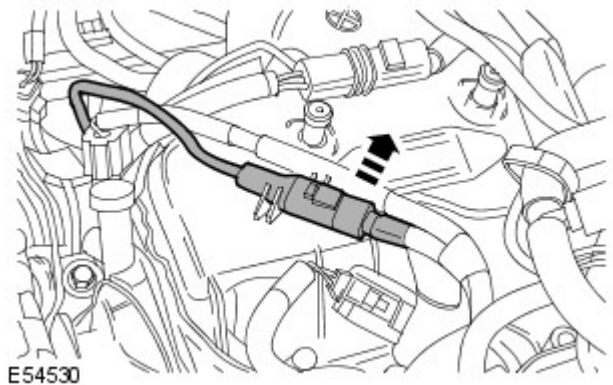
**38. Disconnect the engine oil temperature sensor electrical connector.**

- Release the wiring harness clip.

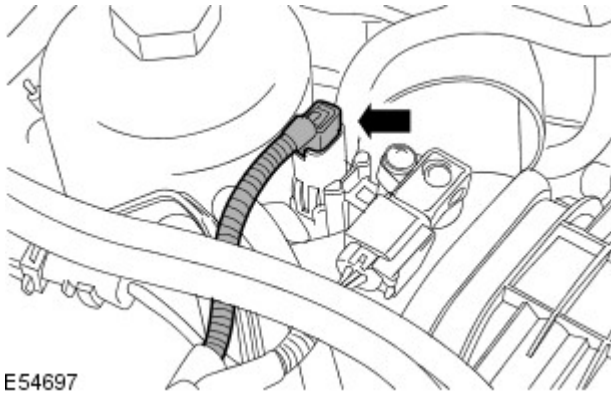


**39. NOTE: LH shown, RH is similar.**

Disconnect the 2 knock sensor (KS) electrical connectors.

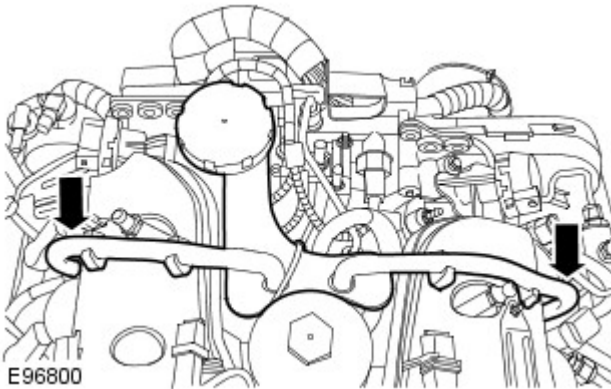


**40.** Disconnect the fuel temperature sensor electrical connector.

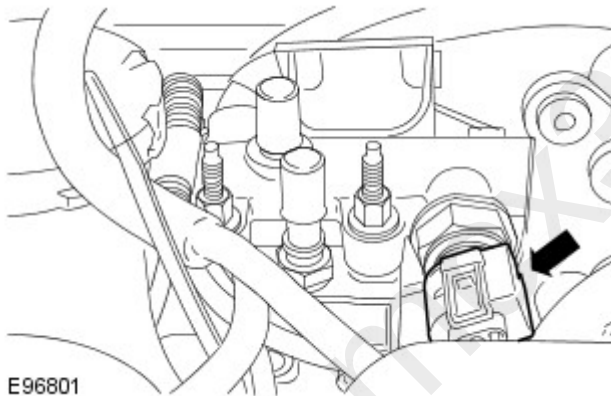


**41.** Remove the crankcase vent oil separator.

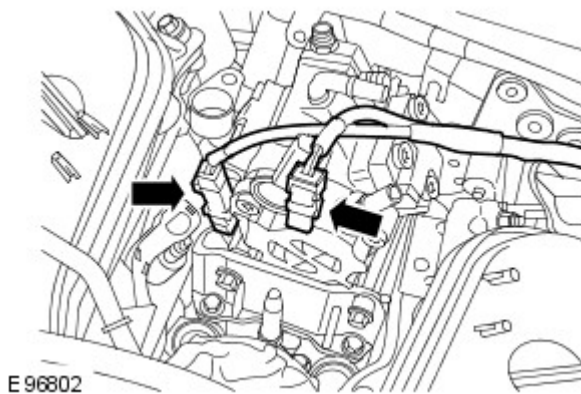
- Disconnect and release the 2 breather hoses.

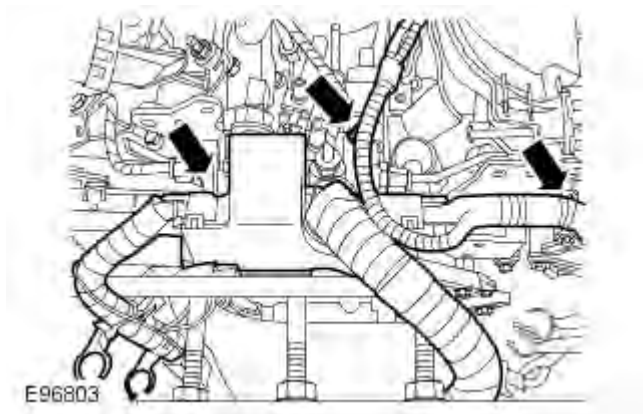


**42.** Disconnect the fuel rail pressure (FRP) sensor electrical connector.



**43.** Disconnect the 2 fuel injection pump electrical connectors.

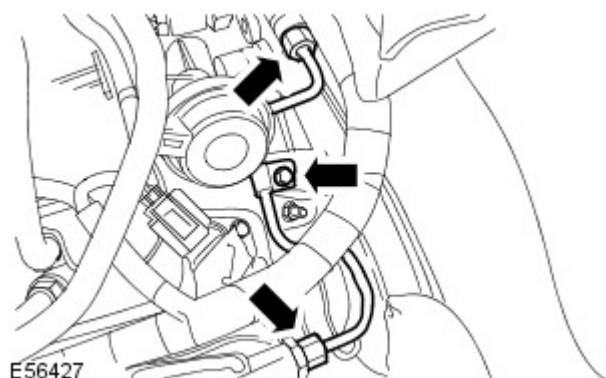




44. Remove the engine wiring harness.

- Remove the nut.
- Release the 2 clips.

Vehicles built up to 12/2006

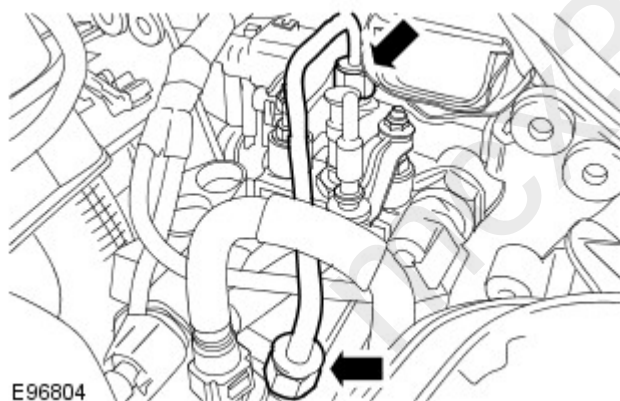


45.  CAUTION: Make sure that all openings are sealed. Use new blanking caps.

- NOTE: RH shown, LH is similar

Remove and discard the 2 high-pressure fuel rail supply lines.

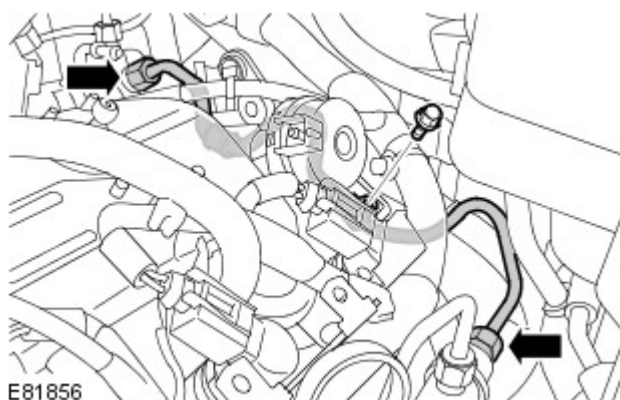
- Release the 2 clips.



46.  CAUTION: Make sure that all openings are sealed. Use new blanking caps.

Remove and discard the high-pressure fuel diverter rail supply line.

Vehicles built 01/2007 onwards



47.  CAUTION: Make sure that all openings are sealed. Use new blanking caps.

- NOTE: LH shown, RH is similar

Remove and discard the 2 high-pressure fuel rail supply lines.

- Release the clip.

All vehicles

**48. CAUTIONS:**



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

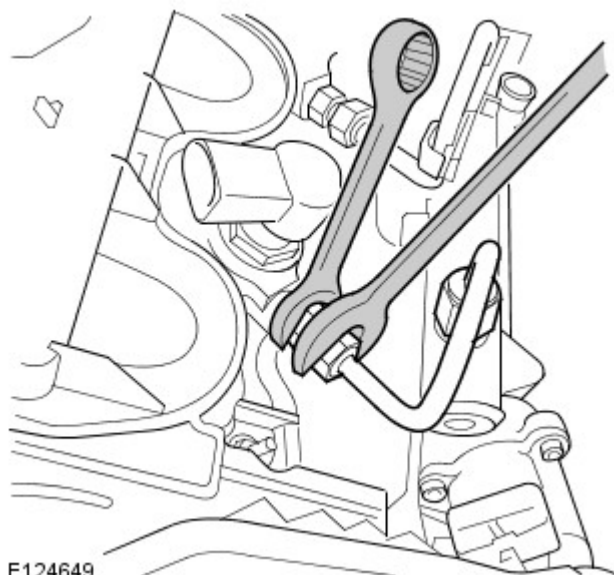


Make sure that the fuel injector adaptor union does not move when loosening the high-pressure fuel supply lines. Failure to follow this instruction may result in damage to the fuel injector or the fuel injector adaptor union.



Make sure that all openings are sealed. Use new blanking caps.

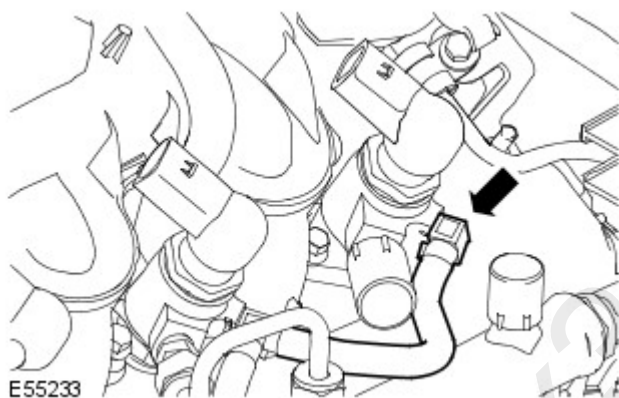
Remove and discard the 6 high-pressure fuel supply lines.



E124649

**49. Disconnect the fuel return line from the fuel injectors.**

- Remove and discard the 6 clips.



E55233

**50. Remove the two fuel injector bolts.**



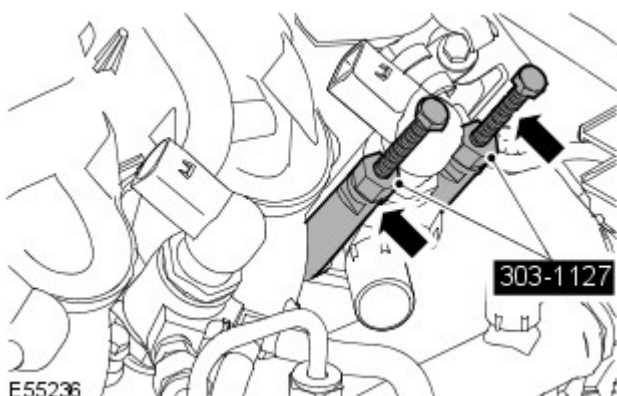
E55234

51. Install the special tool studs.



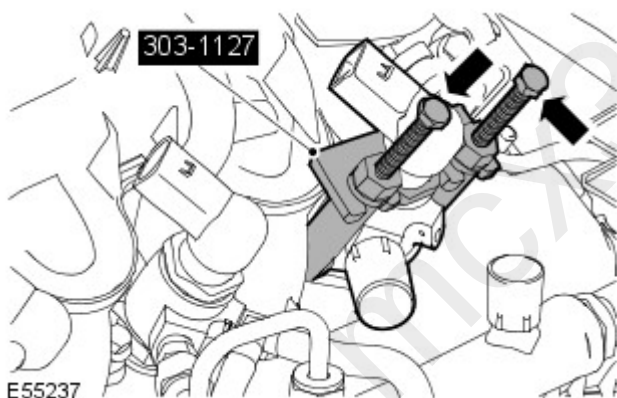
52.  **CAUTION:** Make sure the fuel injector remover legs are correctly engaged to the fuel injector. Failure to follow this instruction may result in damage to the component.

Install the special tool remover legs to the studs.



53. Remove the fuel injector.

- Rotate the special tool bolts evenly, in a clockwise direction.
- Remove the special tool.
- Remove and discard the fuel injector clamp.
- Remove and discard the sealing washer.

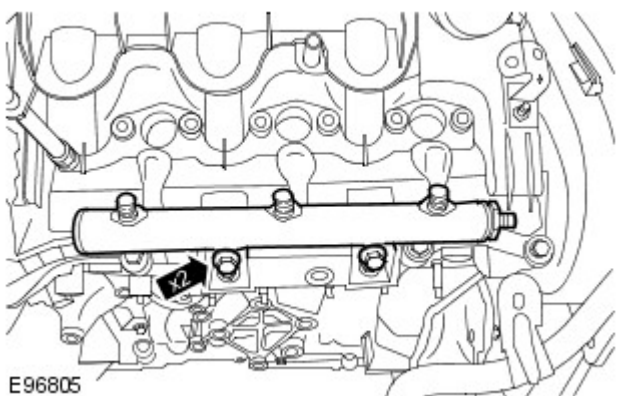


54. Remove the remaining fuel injectors.

55. **NOTE:** LH shown, RH is similar.

Remove the 2 fuel rails.

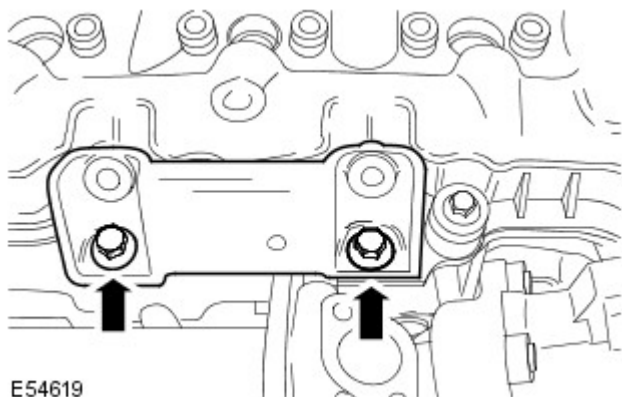
- Remove the 4 bolts.



**56. NOTE: RH shown, LH is similar**

Remove the 2 fuel rail brackets.

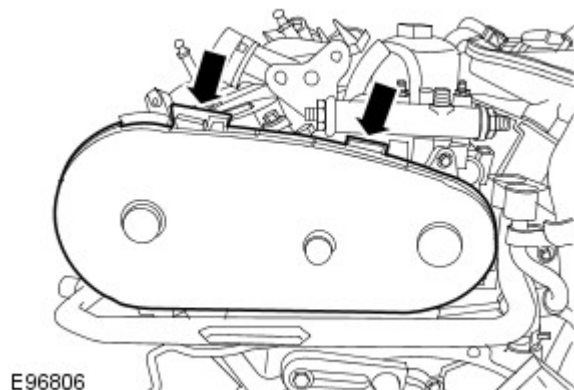
- Remove the 4 bolts.



E54619

**57. Remove the fuel injection pump belt cover.**

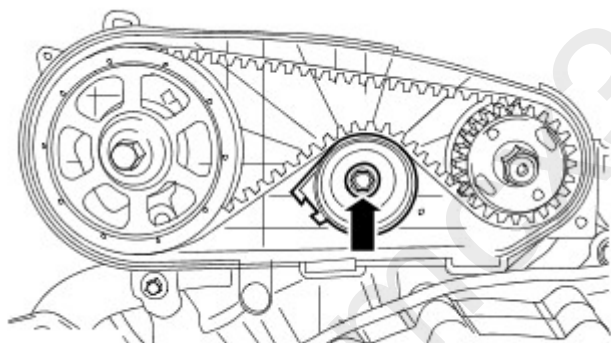
- Release the 2 clips.



E96806

**58. Remove and discard the fuel injection pump belt tensioner.**

- Remove the bolt.

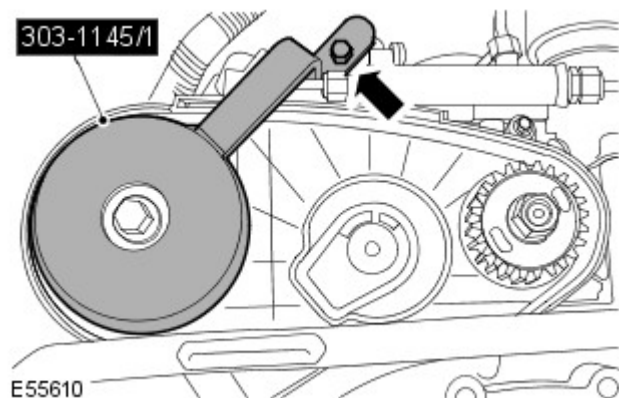


E82035

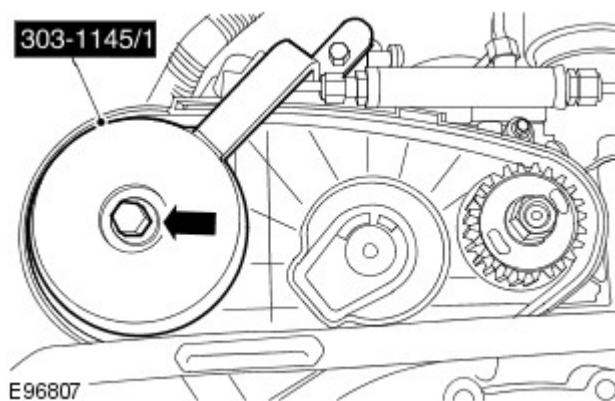
**59. Remove and discard the fuel injection pump belt.**

**60. Install the special tool to the camshaft rear pulley.**

- Rotate the crankshaft to align the special tool to the engine lifting bracket.
- Install and tighten the bolt.

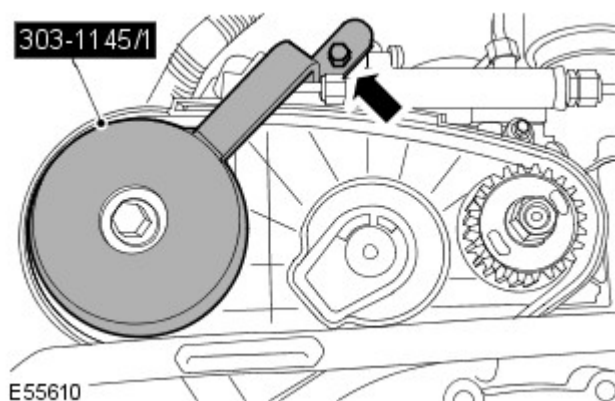


E55610



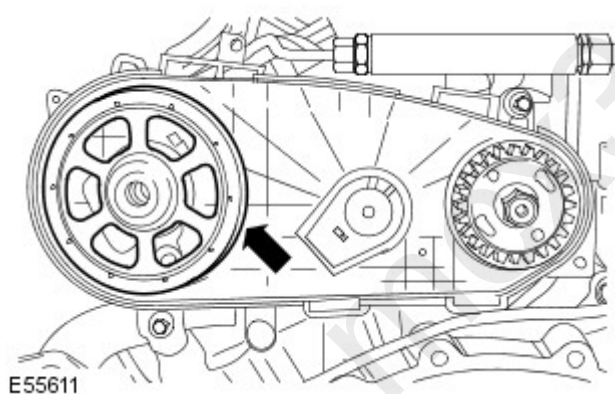
**61. NOTE: Discard the bolt.**

Using the special tool, remove the camshaft rear pulley bolt.

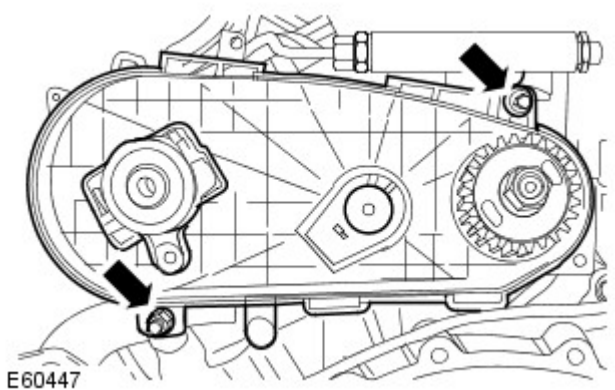


**62. Remove the special tool.**

- Remove the bolt.



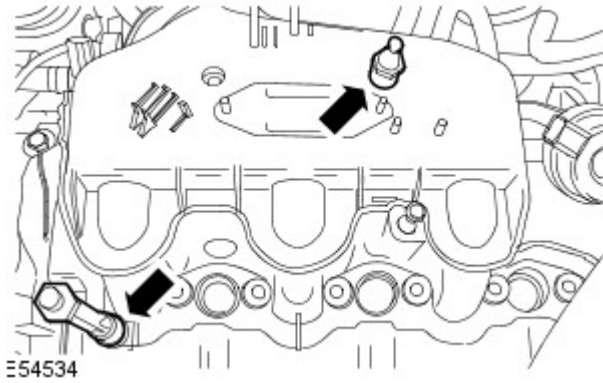
**63. Remove the camshaft rear pulley.**



**64. Remove the fuel injection pump belt rear cover.**

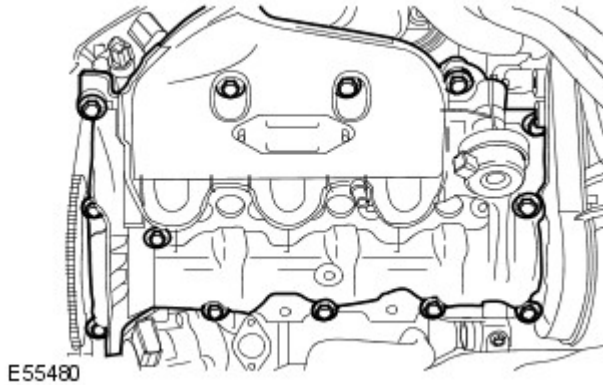
- Fully loosen the 2 bolts.

**65.** Remove the LH engine cover locating studs.



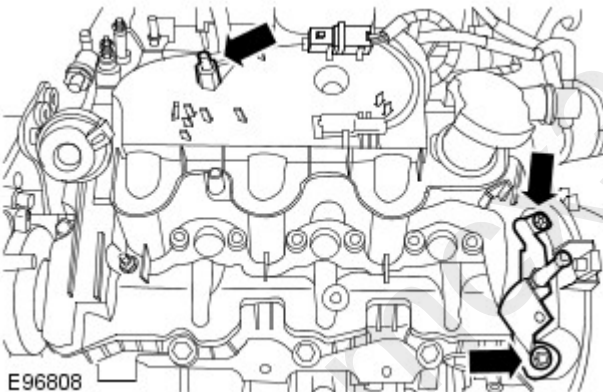
**66.** Remove the LH valve cover.

- Release the KS electrical connector from the valve cover.
- Fully loosen the 13 bolts.
- Remove the fuel line support bracket.
- Remove and discard the gasket.



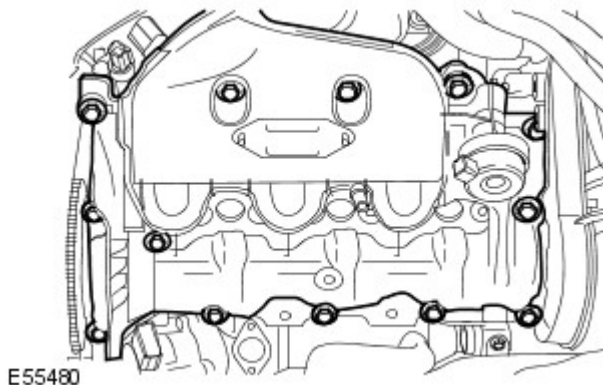
**67.** Remove the RH engine cover locating studs.

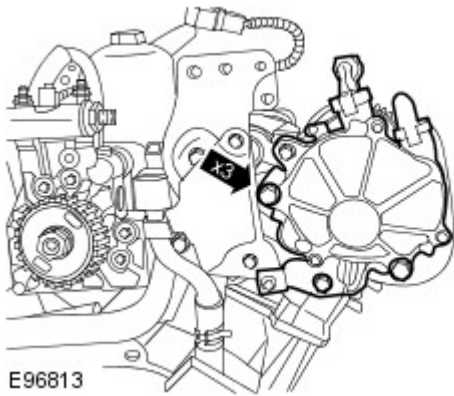
- Remove the nut.
- Remove the bolt.
- Remove the bracket.



**68.** Remove the RH valve cover.

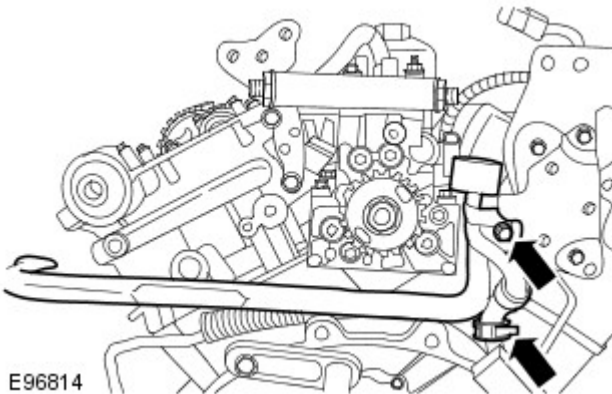
- Release the glow plug electrical connector from the valve cover.
- Release the KS electrical connector from the valve cover.
- Fully loosen the 13 bolts.
- Remove and discard the gasket.





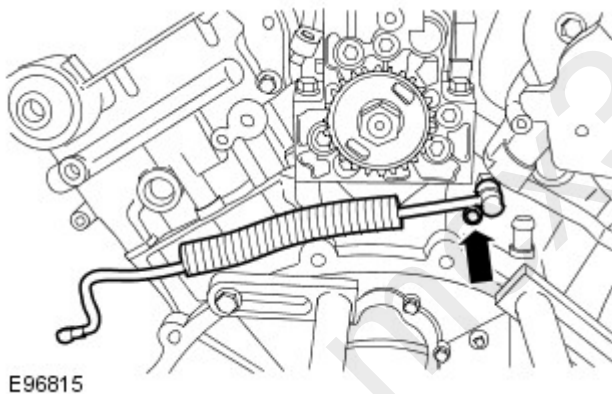
**69.** Remove the brake vacuum pump.

- Remove the 3 bolts.
- Remove the bracket.
- Remove and discard the gasket.



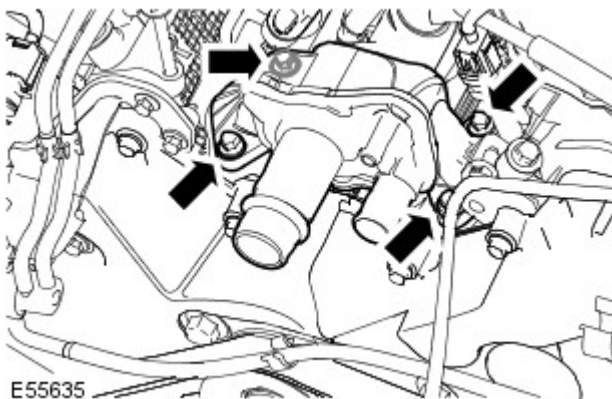
**70.** Remove the breather line.

- Remove the bolt.
- Release the clip.



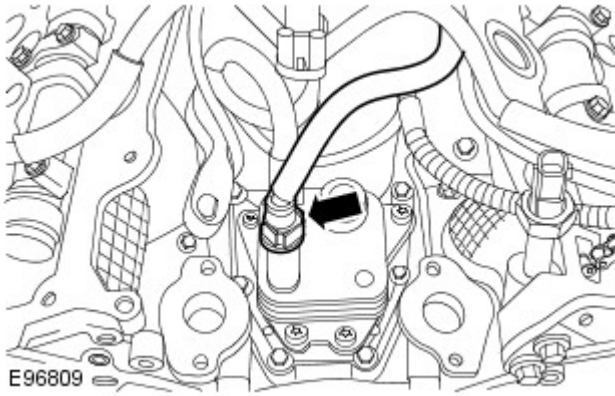
**71.** Remove the turbocharger oil supply line.

- Remove the bolt.
- Remove and discard the 2 O-ring seals.



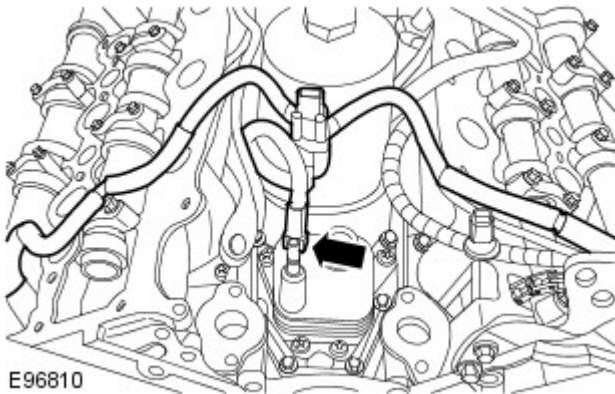
**72.** Remove the cylinder head coolant outlet assembly.

- Remove the 4 bolts.
- Remove and discard the O-ring seal.



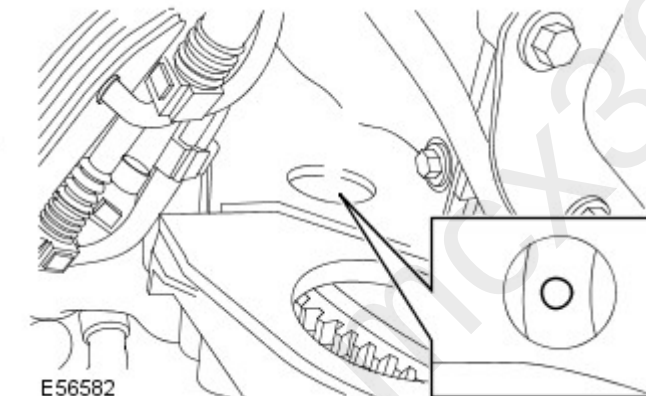
**73.**  **CAUTION:** Make sure that all openings are sealed. Use new blanking caps.

Disconnect the fuel pipe from the fuel cooler.



**74.**  **CAUTION:** Make sure that all openings are sealed. Use new blanking caps.

Remove and discard the fuel injector return line.



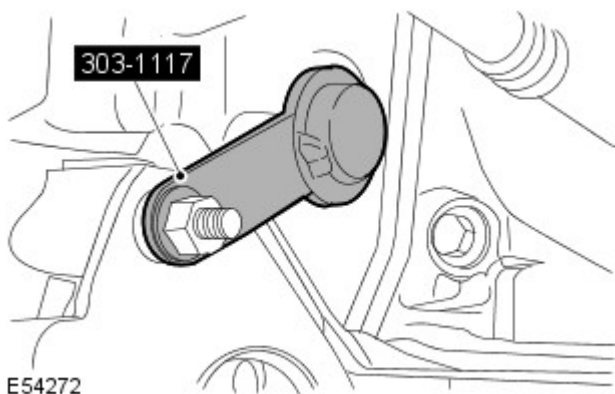
**75.** Rotate the crankshaft clockwise to align the crankshaft alignment hole in the flywheel or flexplate with the cylinder block aperture.

**76.** Check the camshaft pulley alignment holes are correctly aligned. If the alignment holes are not aligned, rotate the crankshaft one full turn clockwise.

Vehicles with automatic transmission

**77.** Using the special tool, lock the flexplate.

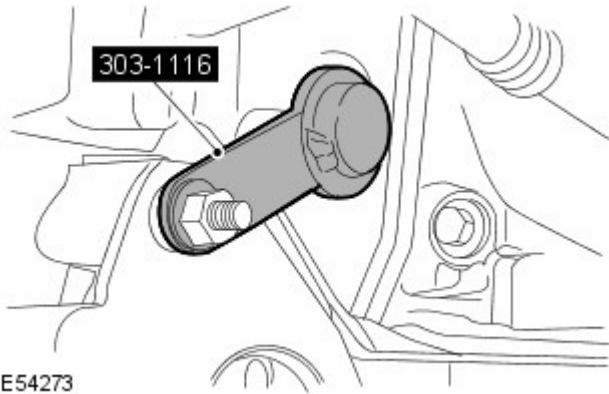
- Install a starter motor bolt to retain the special tool.



Vehicles with manual transmission

**78.** Using the special tool, lock the flywheel.

- Install a starter motor bolt to retain the special tool.

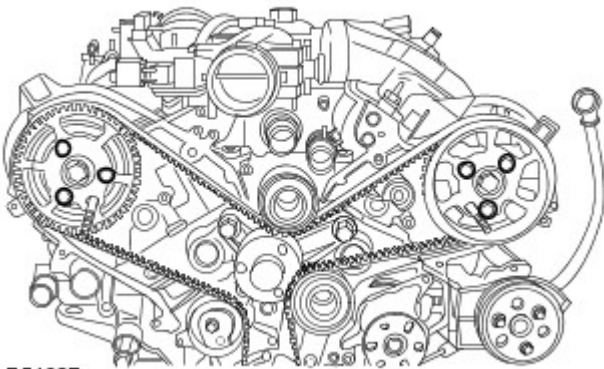


E54273

All vehicles

**79.**  **CAUTION:** Do not use the special tools to lock the camshafts. Failure to follow this instruction may result in damage to the engine or the special tools.

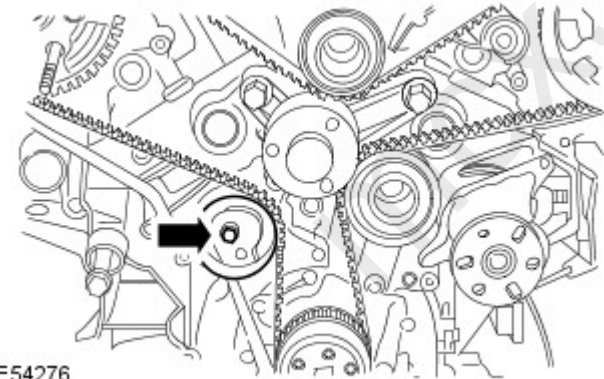
Loosen the 6 exhaust camshaft pulley bolts.



E54627

**80.** Remove and discard the timing belt tensioner.

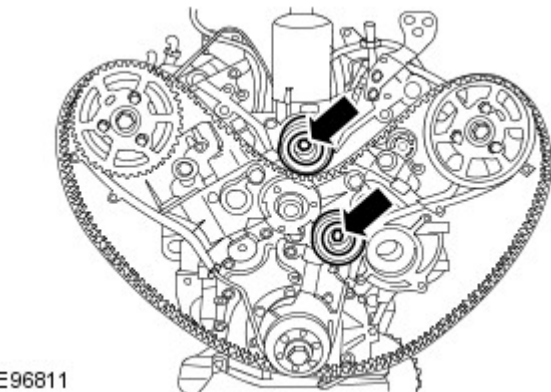
- Remove the bolt.



E54276

**81.** Remove the 2 timing belt idler pulley's.

- Remove the 2 bolts.
- Collect the plastic shield from behind the upper idler pulley.



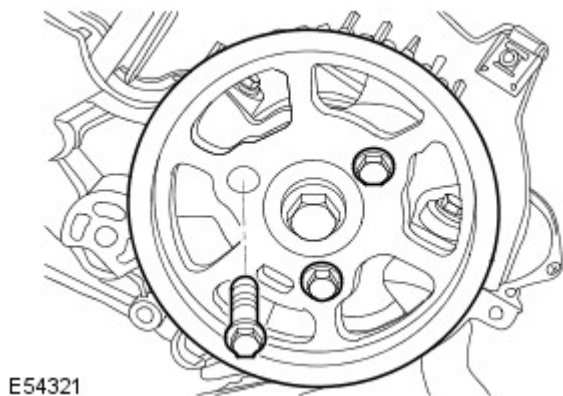
E96811

**82.** Remove and discard the timing belt.

**83. NOTE: LH shown, RH is similar.**

Remove the 2 camshaft pulleys.

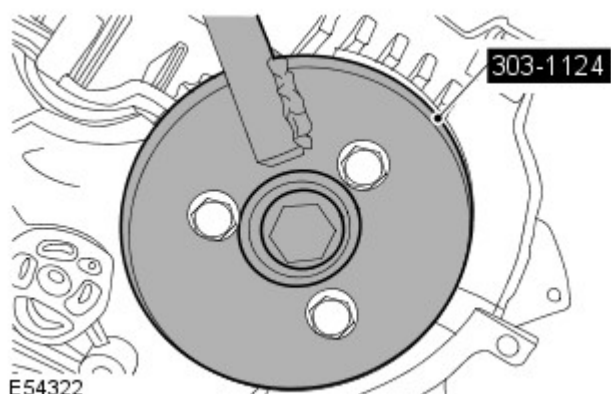
- Remove the 6 bolts.



E54321

**84. Using the special tool, remove the 2 camshaft pulley hubs.**

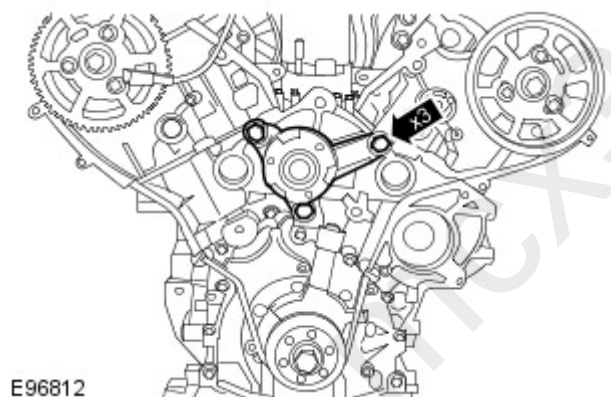
- Remove and discard the 2 bolts.



E54322

**85. Remove the cooling fan drive hub bearing.**

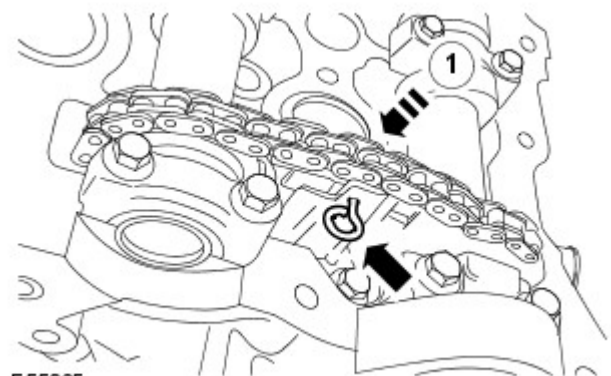
- Remove the 3 bolts.



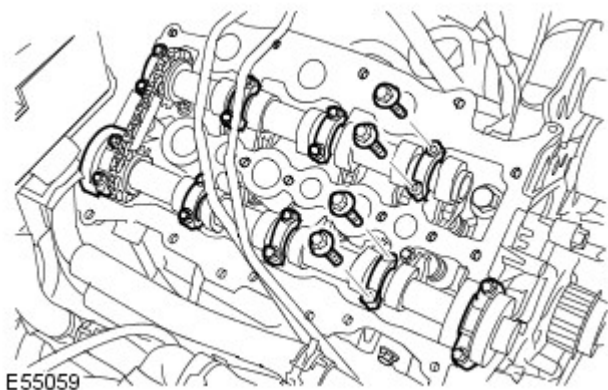
E96812

**86. Retain the RH secondary timing chain tensioner piston.**

- Reposition the secondary timing chain tensioner.
- Install a 1.5 mm (0.060 in.) diameter pin into the secondary timing chain tensioner piston.



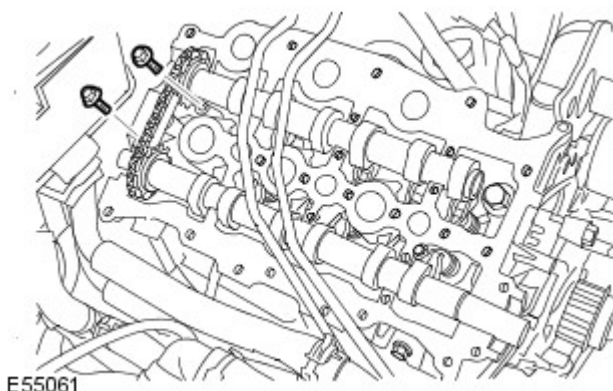
E55065



**87.**  **CAUTION:** Evenly and progressively, release the camshaft bearing caps.

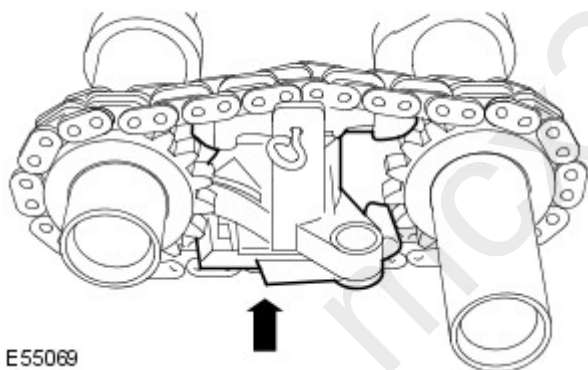
Remove the RH bank camshaft bearing caps.

- Remove the 18 bolts.

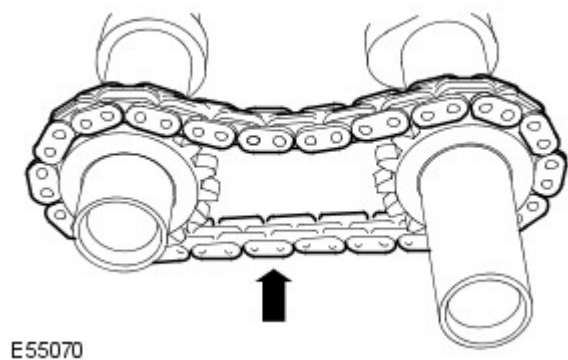


**88.** Remove the RH bank camshafts and secondary timing chain tensioner assembly.

- Remove the 2 bolts.
- Release the RH secondary timing chain tensioner.

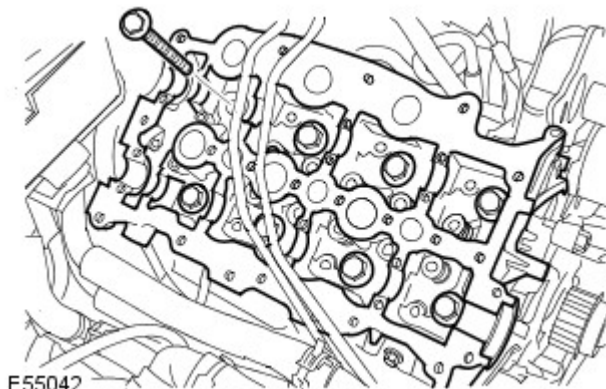


**89.** Remove the RH bank secondary timing chain tensioner.



**90.** Remove the RH bank camshafts.

- Release the secondary timing chain from the RH camshafts.
- Remove and discard the seal.



#### 91. CAUTIONS:



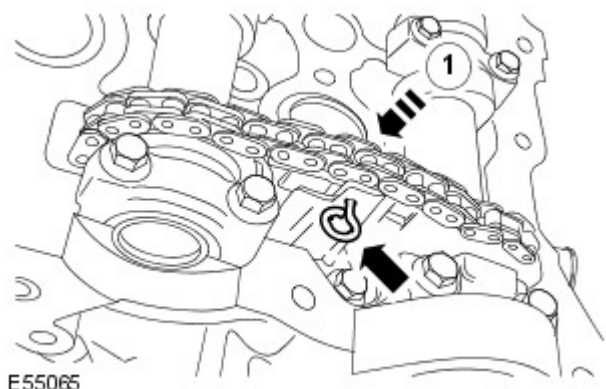
The cylinder head must not be placed mating face down. Failure to follow this instruction may result in damage to the vehicle.



Only use a plastic scraper to clean off the old gasket.

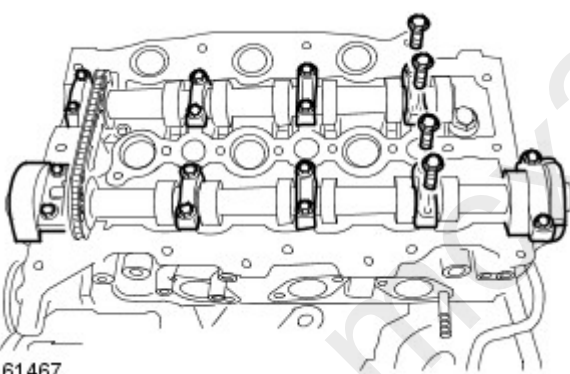
Remove the RH cylinder head assembly.

- Remove and discard the 8 bolts.
- Remove and discard the gasket.



#### 92. Retain the LH secondary timing chain tensioner piston.

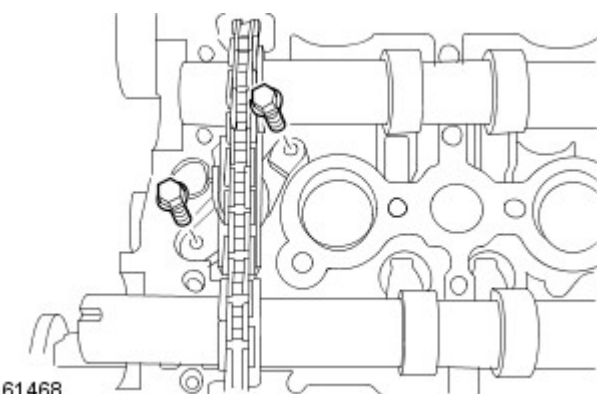
- Reposition the secondary timing chain tensioner.
- Install a 1.5 mm (0.060 in.) diameter pin into the secondary timing chain tensioner piston.



**93. CAUTION:** Evenly and progressively, release the camshaft bearing caps.

Remove the LH bank camshaft bearing caps.

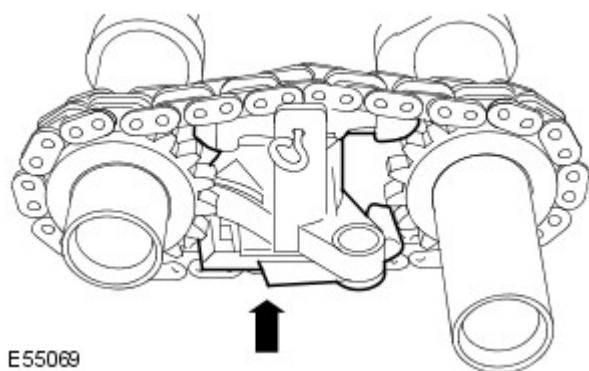
- Remove the 18 bolts.



#### 94. Remove the LH bank camshafts and secondary timing chain tensioner assembly.

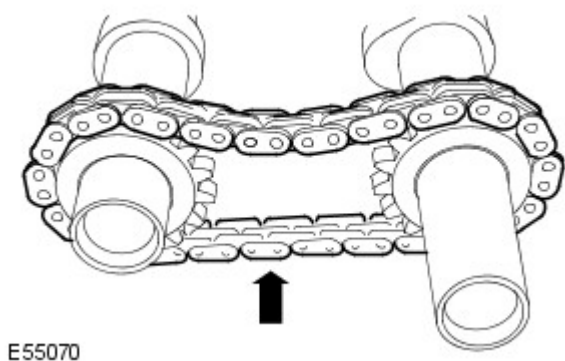
- Release the LH secondary timing chain tensioner.
- Remove the 2 bolts.

**95.** Remove the LH bank secondary timing chain tensioner.



**96.** Remove the LH bank camshafts.

- Release the secondary timing chain from the LH camshafts.
- Remove and discard the 2 seals.



**97. CAUTIONS:**



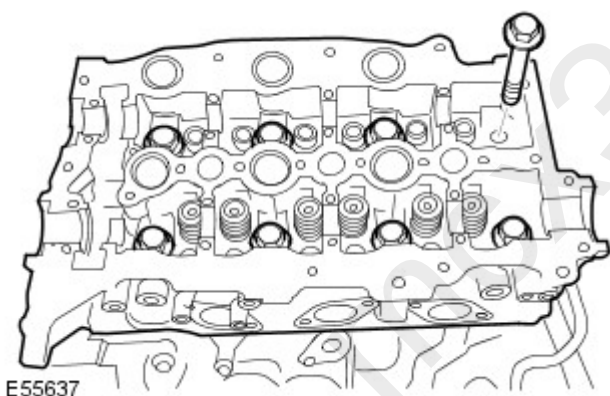
The cylinder head must not be placed mating face down. Failure to follow this instruction may result in damage to the vehicle.



Only use a plastic scraper to clean off the old gasket.

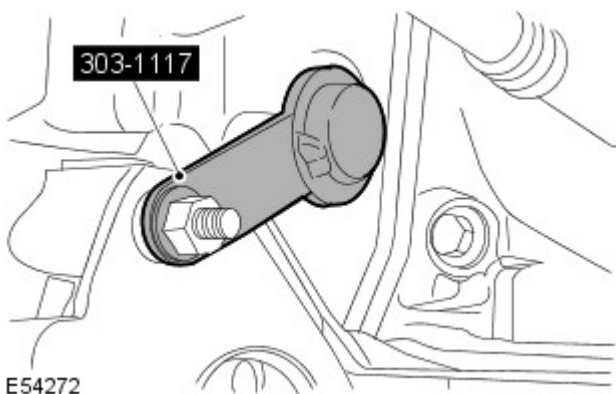
Remove the LH cylinder head assembly.

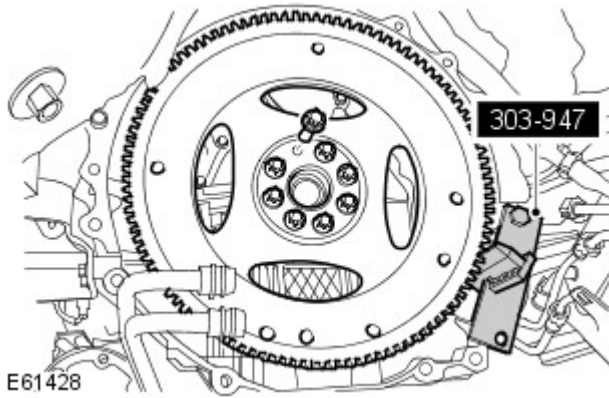
- Remove and discard the 8 bolts.
- Remove and discard the gasket.



Vehicles with automatic transmission

**98.** Remove the special tool from the flexplate.



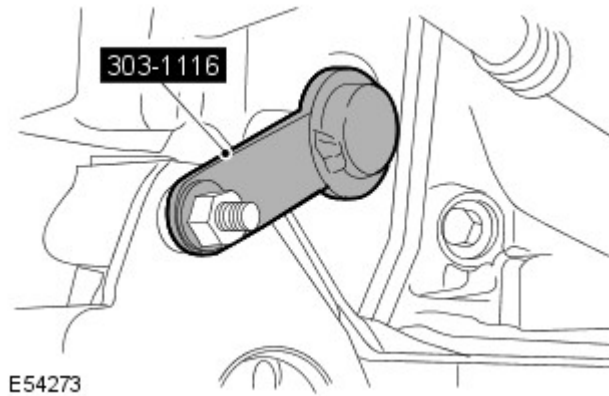


**99.** Remove the flexplate.

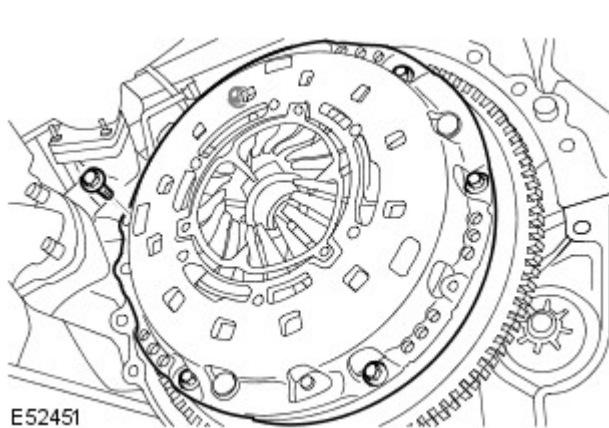
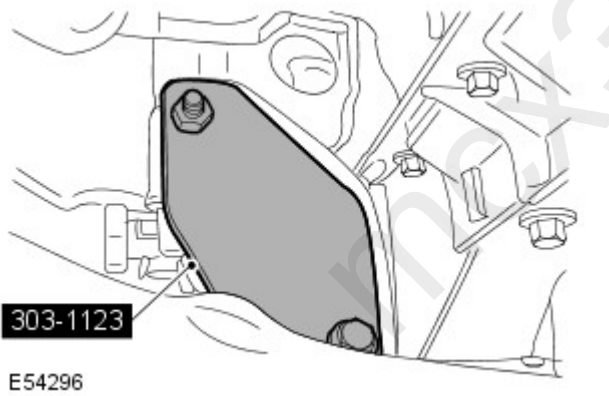
- Using the special tool, lock the flexplate.
- Remove the 8 bolts.

Vehicles with manual transmission

**100.** Remove the special tool from the flexplate.



**101.** Install the special tool.

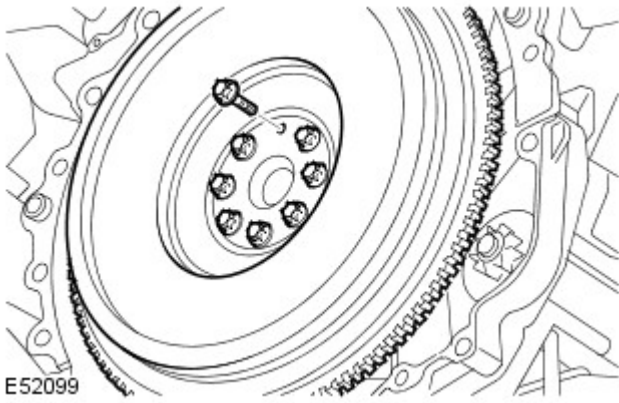


**102.**  **CAUTION:** Working in a diagonal sequence, progressively loosen the bolts.

- **NOTE:** Restrain the flywheel.

Remove the clutch disc and pressure plate.

- Remove the 6 bolts.



**103. NOTE: Restrain the flywheel.**

Remove the flywheel.

- Remove the 8 bolts.

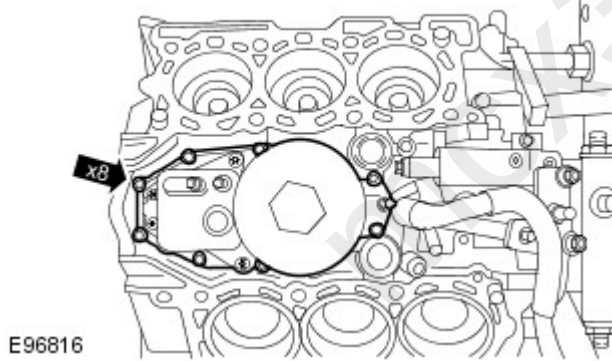


**104. Remove the special tool.**

All vehicles

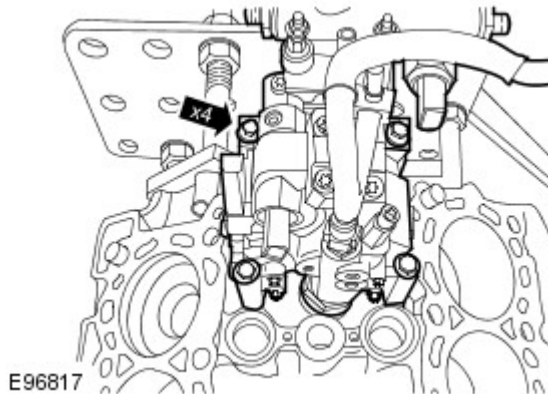
**105. Remove the oil cooler assembly.**

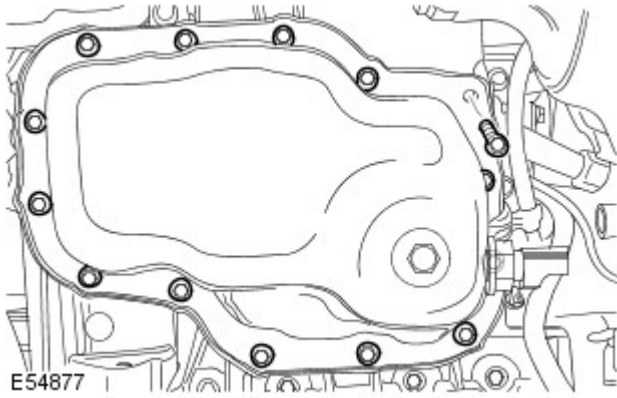
- Remove the 8 bolts.
- Remove and discard the gasket.



**106. Remove the fuel injection pump.**

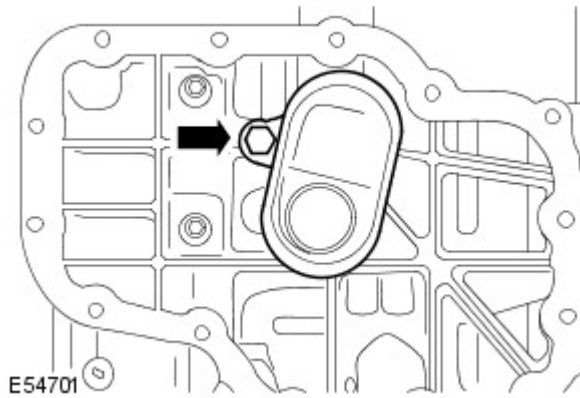
- Remove the 4 bolts.





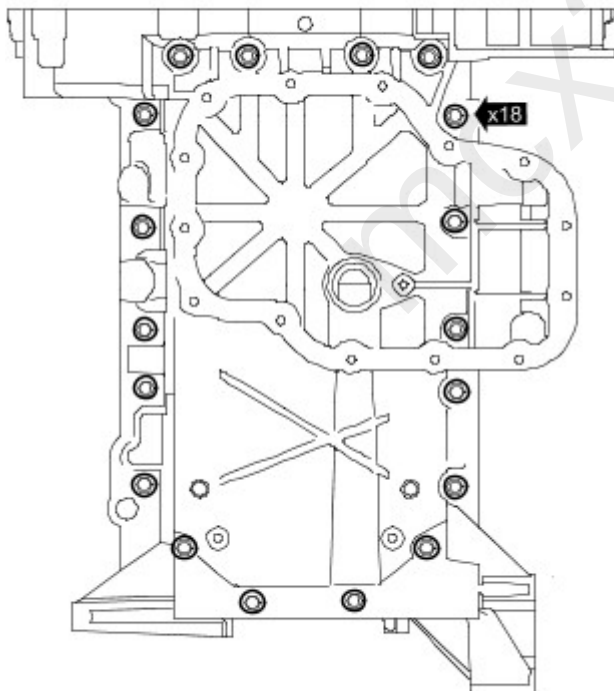
**107.** Remove the oil pan.

- Remove the 14 bolts.
- Remove and discard the gasket.



**108.** Remove the oil pump screen and pickup tube.

- Remove the bolt.
- Remove and discard the 2 O-ring seals.



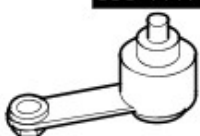
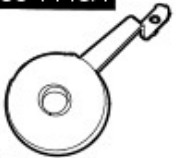
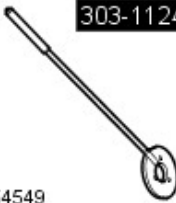
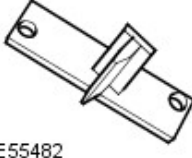
**109.** Remove the oil pan extension.

- Remove the 18 bolts.
- Remove and discard the gasket.

E93945

**Engine - TDV6 2.7L Diesel - Engine**

Assembly

| <b>Special Tool(s)</b>                                                                                             |                                                            |
|--------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|
|  <p>303-1117</p> <p>E54540</p>    | <p>Timing Pin - Automatic Transmission</p> <p>303-1117</p> |
|  <p>303-1116</p> <p>E54539</p>    | <p>Timing Pin - Manual Transmission</p> <p>303-1116</p>    |
|  <p>303-1145/1</p> <p>E60399</p>  | <p>Camshaft pulley holding tool</p> <p>303-1145/1</p>      |
|  <p>303-1124</p> <p>E54549</p>   | <p>Holder - Camshaft Pulleys Front</p> <p>303-1124</p>     |
|  <p>303-947</p> <p>E55482</p>   | <p>Flex plate locking tool</p> <p>303-947</p>              |
|  <p>303-1123</p> <p>E 54546</p> | <p>Locking Tool - Flywheel</p> <p>303-1123</p>             |
|  <p>303-1126</p> <p>E54551</p>  | <p>Timing Pin - Camshaft Pulleys</p> <p>303-1126</p>       |

**Assembly**

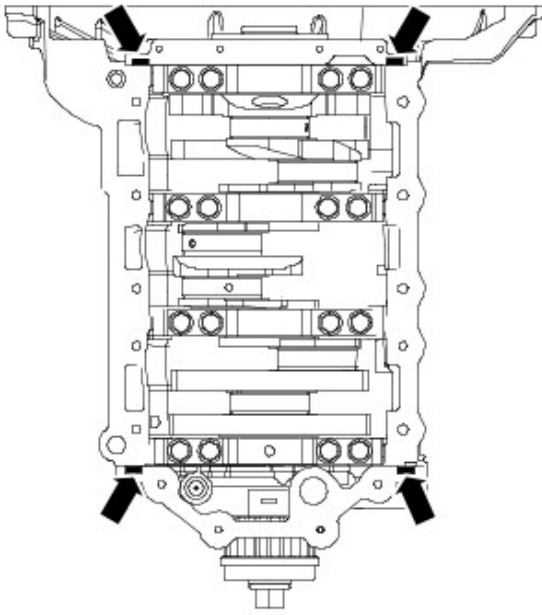
All vehicles

1. NOTE: Clean the component mating faces.

- NOTE: It is important that the oil pan extension is bolted to the crankshaft main bearing carrier within twenty minutes of applying the sealant.

Apply an 8 mm bead of sealant to the cylinder block in the areas shown.

- Use WSS-M4G323-A4-RTV sealant.

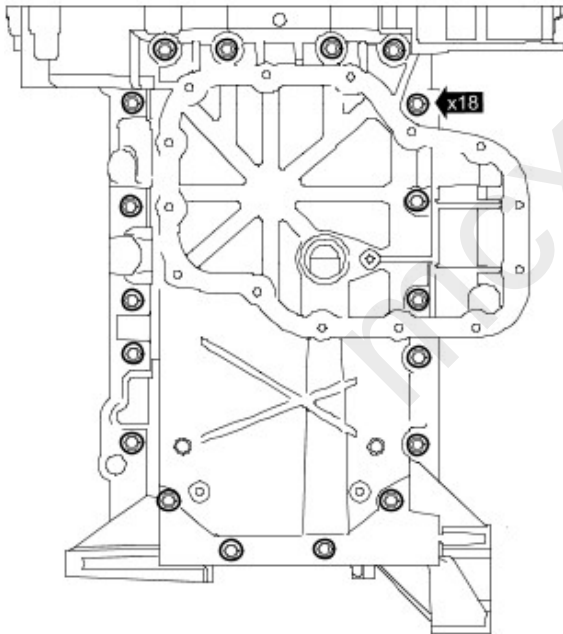


E93678

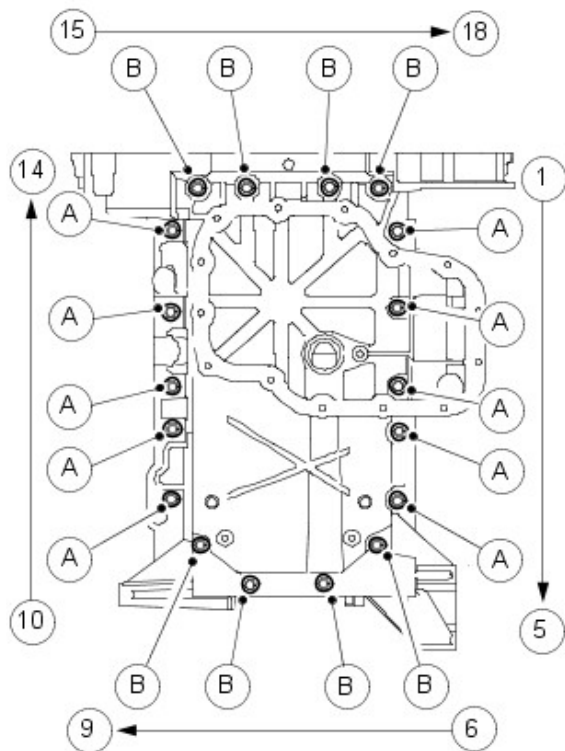
2. NOTE: Clean the component mating faces.

Install the oil pan extension.

- Install a new gasket.
- Loosely install the bolts.



E93945

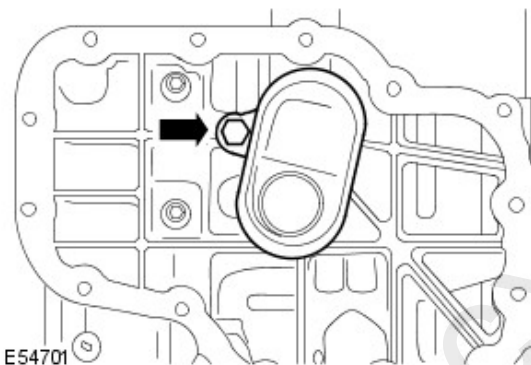


E93962

**3. ⚠ CAUTION:** Tighten the bolts in the indicated sequence in 2 stages.

Secure the oil pan extension.

1. Tighten bolts A to 10 Nm (7 lb.ft). Tighten bolts B to 4 Nm (2 lb.ft).
2. Tighten bolts A to 24 Nm (18 lb.ft). Tighten bolts B to 10 Nm (7 lb.ft).



E54701

**4. NOTE:** Lubricate the new seals with clean engine oil.

• **NOTE:** Clean the components.

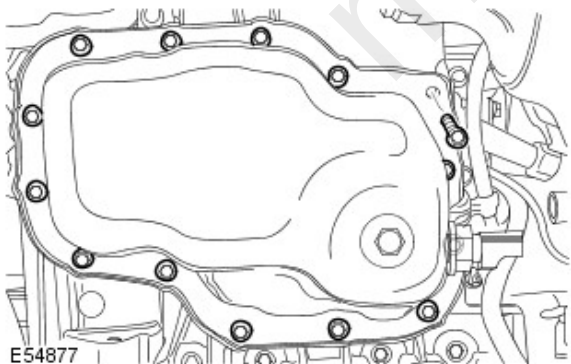
Install the oil pump screen and pickup tube.

- Clean the components.
- Install new O-ring seals.
- Tighten the bolt to 10 Nm (7 lb.ft).

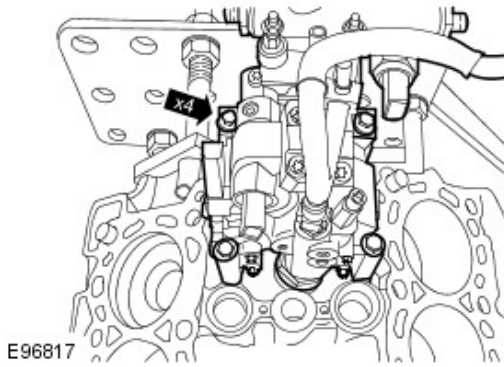
**5. NOTE:** Clean the component mating faces.

Install the oil pan.

- Install a new gasket.
- Evenly and progressively tighten the bolts to 10 Nm (7 lb.ft).

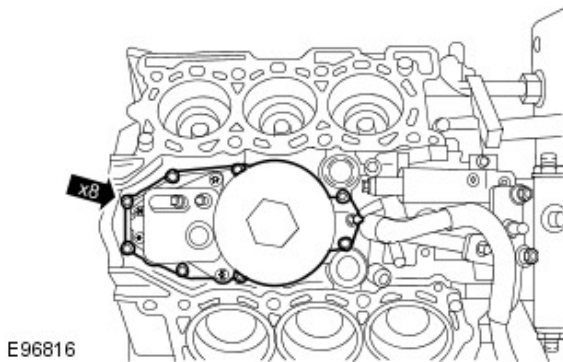


E54877



**6. Install the fuel injection pump.**

- Tighten the bolts to 23 Nm (17 lb.ft).

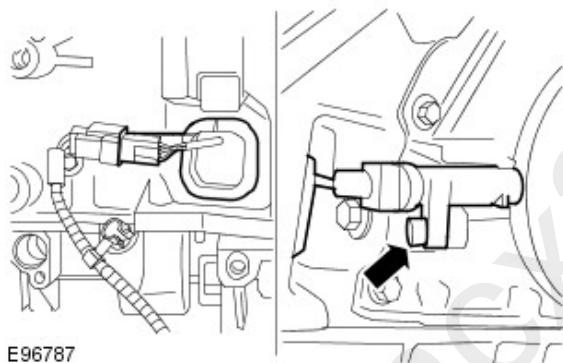


**7.  CAUTION:** Make sure the gasket is installed correctly.

- **NOTE:** Clean the component mating faces.

Install the oil cooler assembly.

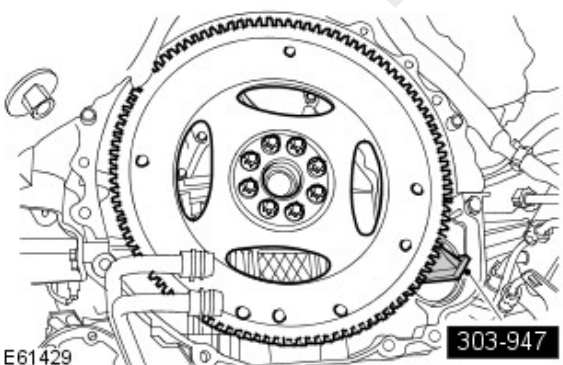
- Install a new gasket.
- Install a new O-ring seal.
- Tighten the bolts to 10 Nm (7 lb.ft).



**8. Install the crankshaft position (CKP) sensor.**

- Tighten the bolt to 5 Nm (4 lb.ft).
- Connect the electrical connector.
- Reposition the access cover.

Vehicles with automatic transmission



**9. CAUTIONS:**

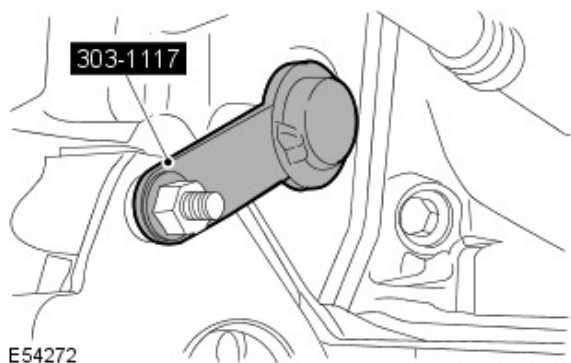
- ** Tighten the bolts in a diagonal sequence.

- ** Tighten the bolts in the stages shown.

- **NOTE:** Clean the component mating faces.

Install the flexplate.

- Using the special tool, lock the flexplate.
- Stage 1: Tighten the bolts to 50 Nm (37 lb.ft).
- Stage 2: Tighten the bolts 45 degrees.
- Stage 3: Tighten the bolts a further 45 degrees.
- Remove the special tool.

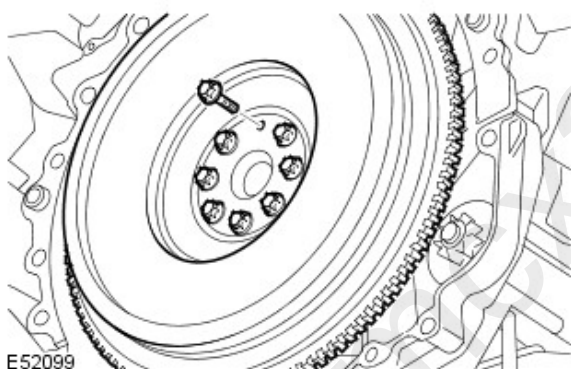
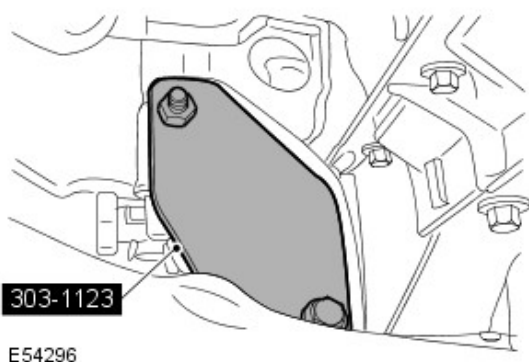


10. Using the special tool, lock the flexplate.

- Rotate the crankshaft clockwise to align the crankshaft alignment hole in the flywheel or flexplate with the cylinder block aperture.
- Install a starter motor bolt to retain the special tool.

Vehicles with manual transmission

11. Install the special tool.



12. CAUTIONS:



Tighten the bolts in a diagonal sequence.

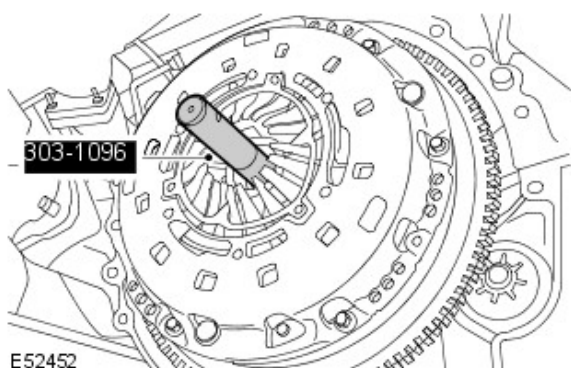


Tighten the bolts in the stages shown.

- NOTE: Clean the component mating faces.

Install the flywheel.

- Stage 1: Tighten the bolts to 50 Nm (37 lb.ft).
- Stage 2: Tighten the bolts 45 degrees.
- Stage 3: Tighten the bolts a further 45 degrees.



13. CAUTIONS:



Install the clutch disc with 'TRANSMISSION SIDE' marking against the clutch cover.



Use the special tool to align the components.



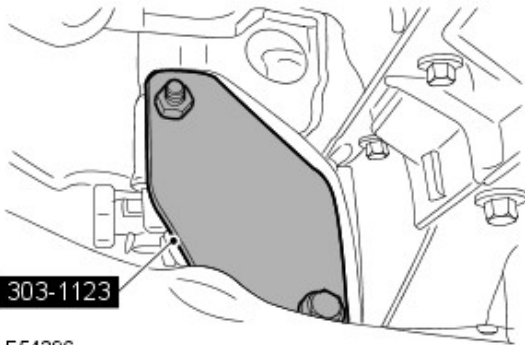
Working in a diagonal sequence, progressively tighten the bolts.

- NOTE: Clean the component mating faces.

Using the special tool, install the clutch disc and pressure plate.

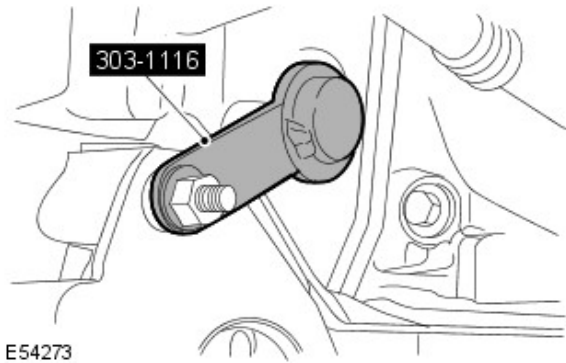
- Tighten the bolts to 25 Nm (18 lb.ft).

14. Remove the special tool.



15. Using the special tool, lock the flywheel.

- Rotate the crankshaft clockwise to align the crankshaft alignment hole in the flywheel or flexplate with the cylinder block aperture.
- Install a starter motor bolt to retain the special tool.



All vehicles

16. Check the LH cylinder head face for distortion, across the center and from corner to corner.

17. NOTE: The cylinder head gasket must be installed over the cylinder head to cylinder block dowels.

- NOTE: Clean the component mating faces.

Install a new LH cylinder head gasket.

18. CAUTIONS:

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

 Make sure that new bolts are installed.

- NOTE: The cylinder head gasket must be installed over the cylinder head to cylinder block dowels.
- NOTE: Make sure the cylinder head is installed in its original position.
- NOTE: Tighten the bolts in the indicated sequence in 4 stages.
- NOTE: Clean the component mating face.

Install the LH cylinder head assembly.

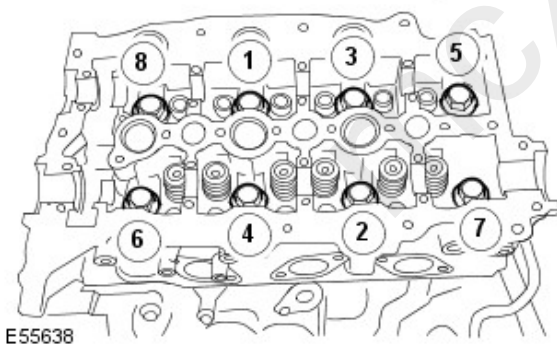
- Stage 1: Tighten the bolts to 20 Nm (15 lb.ft).
- Stage 2: Tighten the bolts to 40 Nm (30 lb.ft).
- Stage 3: Tighten the bolts to 80 Nm (59 lb.ft).
- Stage 4: Tighten the bolts a further 180 degrees.

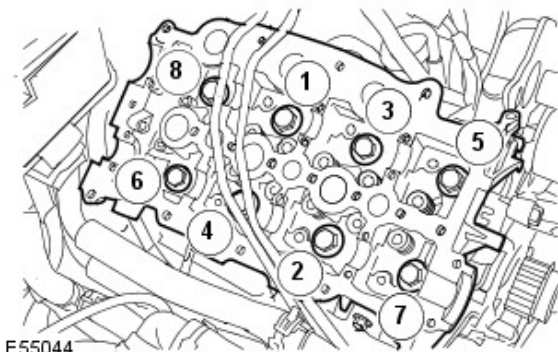
19. Check the RH cylinder head face for distortion, across the center and from corner to corner.

20. NOTE: The cylinder head gasket must be installed over the cylinder head to cylinder block dowels.

- NOTE: Clean the component mating faces.

Install a new RH cylinder head gasket.





E55044

## 21. CAUTIONS:



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



Make sure that new bolts are installed.

- NOTE: The cylinder head gasket must be installed over the cylinder head to cylinder block dowels.
- NOTE: Make sure the cylinder head is installed in its original position.
- NOTE: Tighten the bolts in the indicated sequence in four stages.

Install the RH cylinder head assembly.

- Stage 1: Tighten to 20 Nm (15 lb.ft).
- Stage 2: Tighten to 40 Nm (30 lb.ft).
- Stage 3: Tighten to 80 Nm (59 lb.ft).
- Stage 4: Tighten a further 180 degrees.

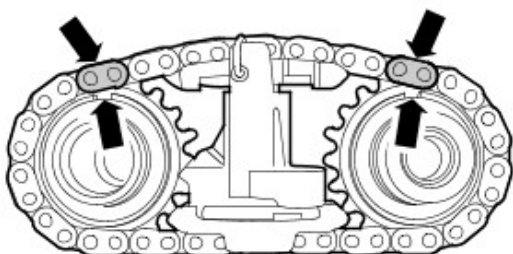
22. Install the secondary timing chain to the RH bank camshafts.



23. CAUTION: Do not release the secondary timing chain tensioner locking pin until all of the camshaft bearing caps have been installed.

Install the RH bank secondary timing chain tensioner.

- Align the marks on the camshafts with the marks on the secondary timing chain.



E55062

24. NOTE: Clean the components.

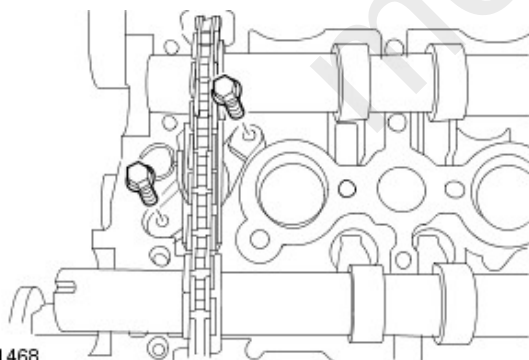
- NOTE: Install a new seal.

Install the RH bank camshafts and secondary timing chain tensioner assembly.

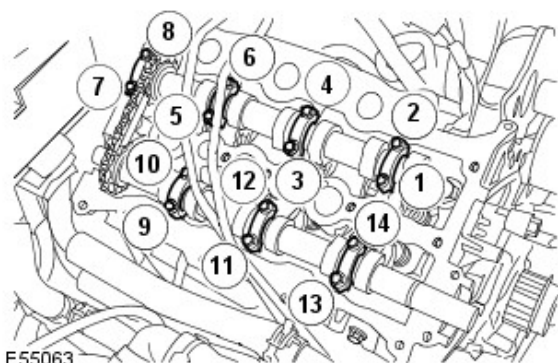
- Lubricate the journals and camshaft lobes.

25. Secure the RH bank secondary timing chain tensioner.

- Tighten the bolts to 10 Nm (7 lb.ft).



E61468



E55063

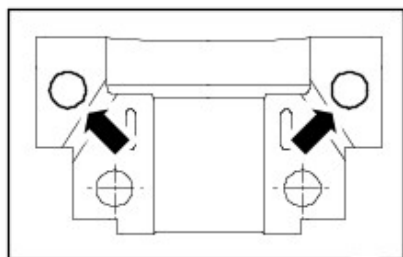
**26.**  **CAUTION:** Tighten the bolts evenly in 3 stages in the sequence shown.

• **NOTE:** Do not install the two exhaust camshaft end bearing caps at this stage.

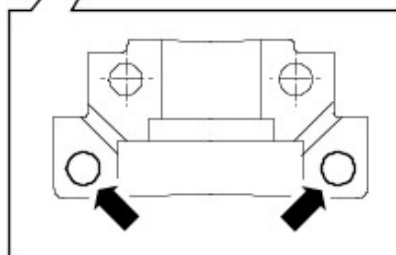
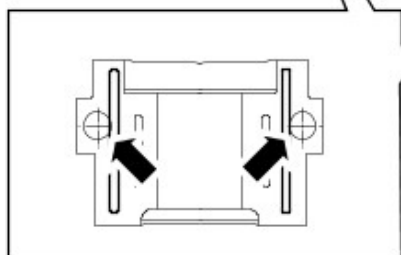
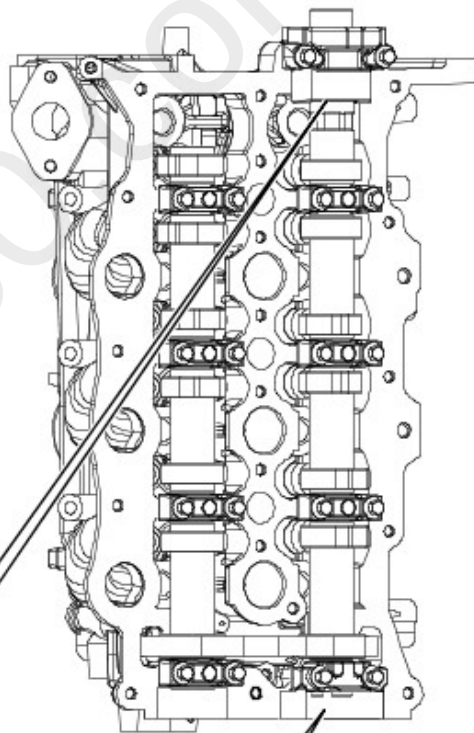
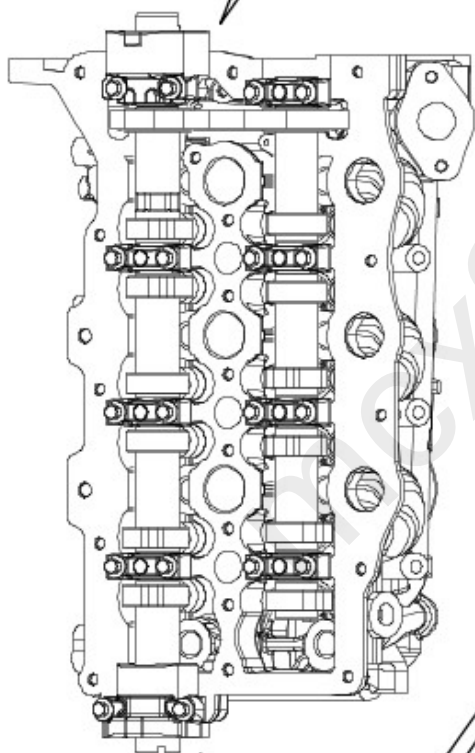
• **NOTE:** Clean the component mating faces.

Install the RH bank camshaft bearing caps.

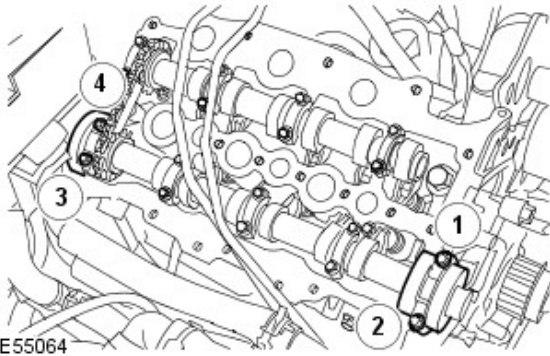
- Stage 1: Tighten to 1 Nm (1 lb.ft).
- Stage 2: Tighten to 5 Nm (4 lb.ft).
- Stage 3: Tighten to 10 Nm (7 lb.ft).



**27.** Apply sealant to the RH exhaust camshaft end bearing cap at the positions shown.



E55072



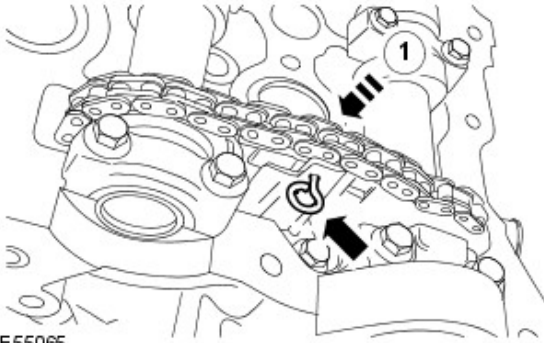
E55064

**28.**  **CAUTION:** Tighten the bolts in the sequence shown.

• **NOTE:** Clean the component mating faces.

Install the RH bank exhaust camshaft end bearing caps.

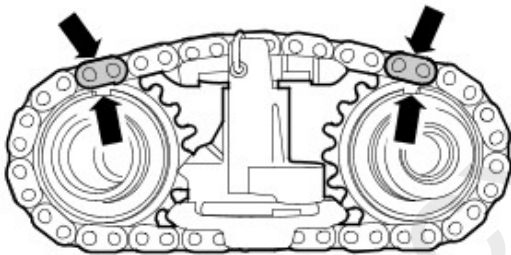
- Stage 1: Tighten to 1 Nm (1 lb.ft).
- Stage 2: Tighten to 5 Nm (4 lb.ft).
- Stage 3: Tighten to 10 Nm (7 lb.ft).



E55065

**29.** Release the RH bank secondary timing chain tensioner piston.

- Remove the locking pin.



E55062

**30.** Install the secondary timing chain to the LH bank camshafts.

**31.**  **CAUTION:** Do not release the secondary timing chain tensioner locking pin until all of the camshaft bearing caps have been installed.

Install the LH bank secondary timing chain tensioner.

- Align the marks on the camshafts with the marks on the secondary timing chain.

**32.** **NOTE:** Clean the components.

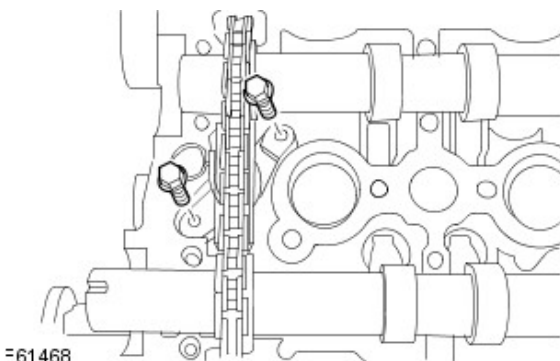
• **NOTE:** Install new seals.

Install the LH bank camshafts and secondary timing chain tensioner assembly.

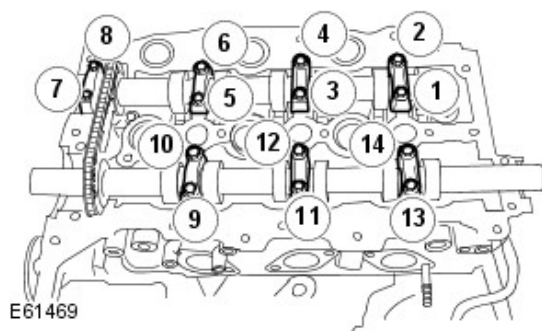
- Lubricate the journals and camshaft lobes.

**33.** Secure the LH bank secondary timing chain tensioner.

- Tighten the bolts to 10 Nm (7 lb.ft).



E61468



**34.**  **CAUTION:** Tighten the bolts evenly in 3 stages in the sequence shown.

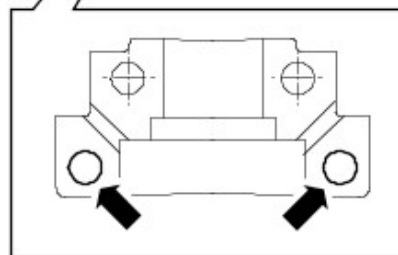
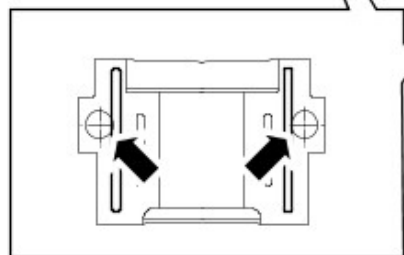
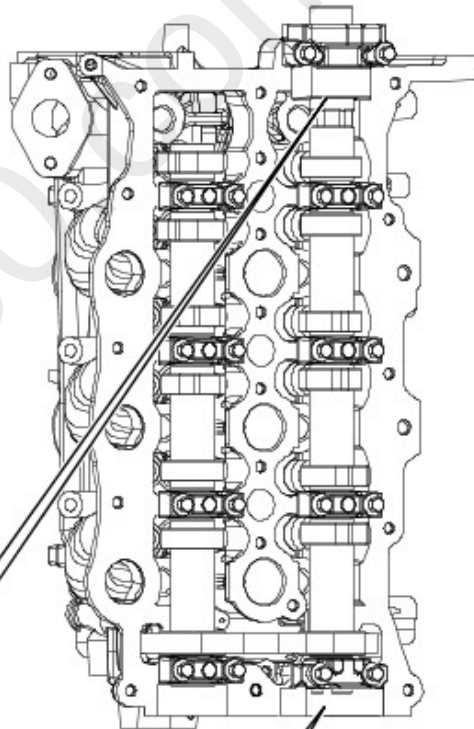
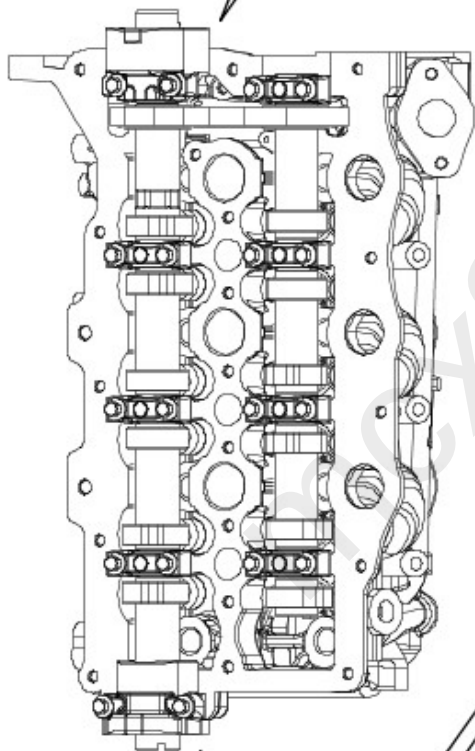
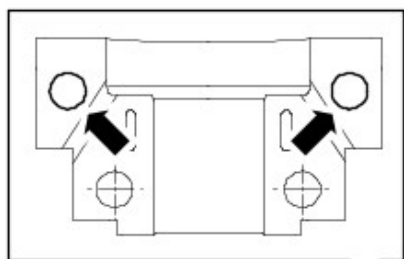
• **NOTE:** Do not install the two exhaust camshaft end bearing caps at this stage.

• **NOTE:** Clean the component mating faces.

Install the LH bank camshaft bearing caps.

- Stage 1: Tighten to 1 Nm (1 lb.ft).
- Stage 2: Tighten to 5 Nm (4 lb.ft).
- Stage 3: Tighten to 10 Nm (7 lb.ft).

**35.** Apply sealant to the 2 LH exhaust camshaft end bearing caps at the positions shown.

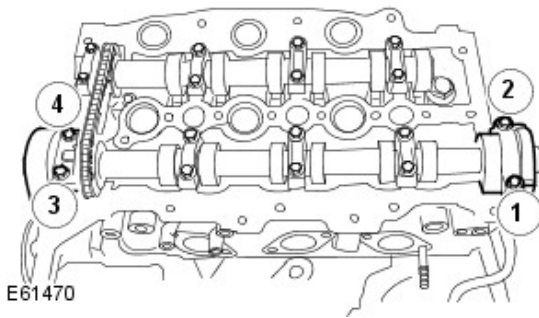


**36.**  **CAUTION:** Tighten the bolts in the sequence shown.

• **NOTE:** Clean the component mating faces.

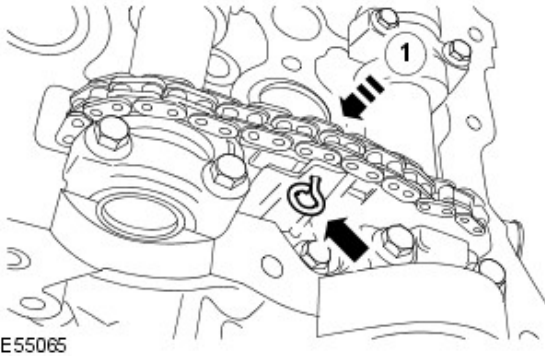
Install the LH bank exhaust camshaft end bearing caps.

- Stage 1: Tighten the bolt to 1 Nm (1 lb.ft).
- Stage 2: Tighten the bolt to 5 Nm (4 lb.ft).
- Stage 3: Tighten the bolt to 10 Nm (7 lb.ft).



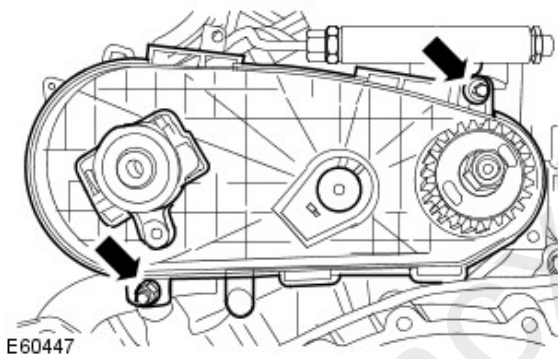
**37.** Release the LH bank secondary timing chain tensioner piston.

- Remove the locking pin.



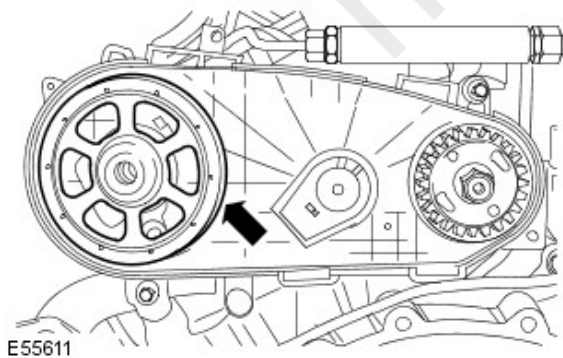
**38.** Install the fuel injection pump belt rear cover.

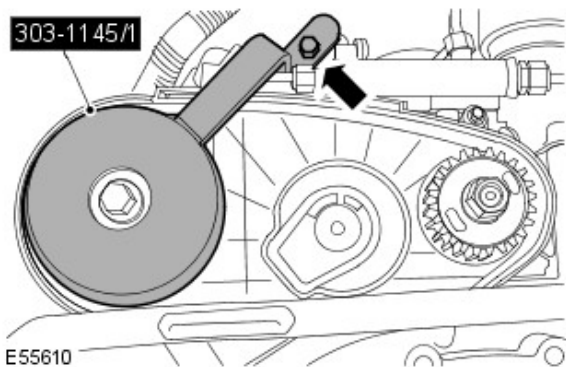
- Tighten the bolts to 10 Nm (7 lb.ft).



**39.** Install the camshaft rear pulley.

- Install a new camshaft pulley bolt.





40. Install the special tool to the camshaft rear pulley.

- Install and tighten the bolt.

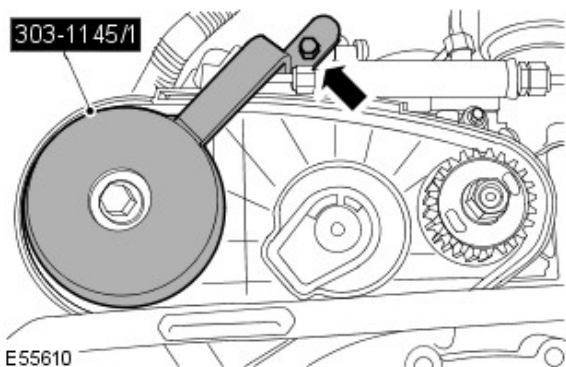
41.  **CAUTION:** Tighten the bolts in the stages shown.

Secure the camshaft rear pulley.

- Stage 1: Tighten the bolt to 40 Nm (30 lb.ft).
- Stage 2: Tighten the bolt to 75 Nm (56 lb.ft).

42. Remove the special tools.

- Remove the bolt.



43.  **CAUTION:** Do not install the new fuel injection pump belt to the pulleys with the fuel pump belt tensioner installed. Failure to follow this instruction may result in damage to the fuel pump belt.

• **NOTE:** The fuel injection pump rotates in a counter-clockwise direction when viewed from the rear of the engine.

Install the new fuel injection pump belt.

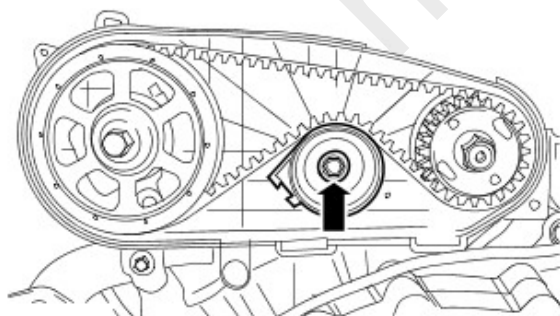
44. **CAUTIONS:**

 Make sure that the fuel injection pump belt tensioner locking pin is not removed until the fuel injection pump belt tensioner is fully installed.

 Make sure that the fuel injection pump belt tensioner tang is correctly located to the fuel injection pump belt rear cover. Failure to follow this instruction may result in damage to the engine.

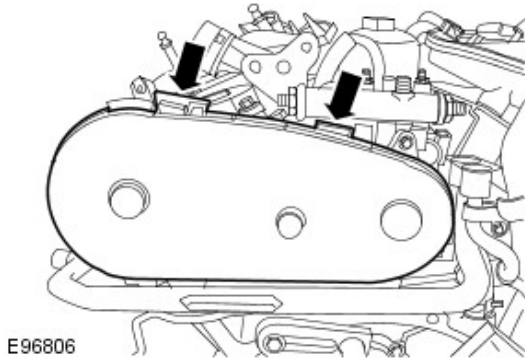
Install a new fuel injection pump belt tensioner.

- Locate the tang on the new fuel injection pump belt tensioner into the fuel injection pump rear cover.
- Tighten the bolt to 25 Nm (18 lb.ft).
- Remove and discard the fuel injection pump belt tensioner locking pin.



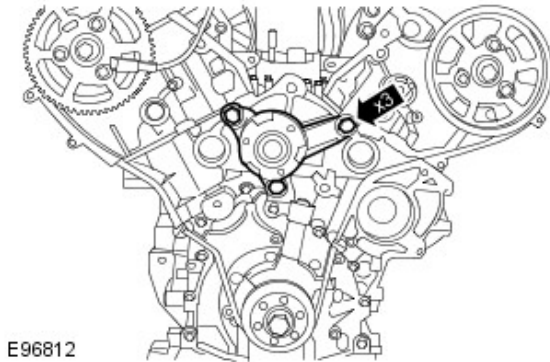
E82035

45. Install the fuel injection pump belt cover.



46. Install the cooling fan drive hub bearing.

- Tighten the bolts to 90 Nm (66 lb.ft).

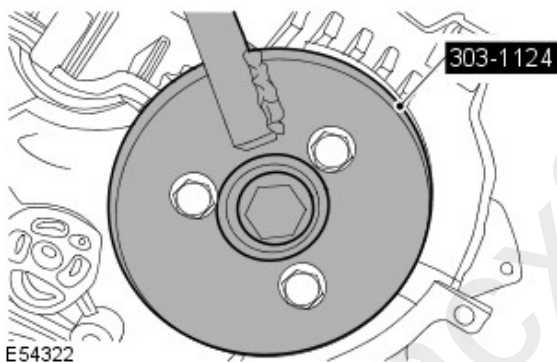


47.  CAUTION: Make sure that new bolts are installed.

- NOTE: LH is shown, RH is similar.
- NOTE: Clean the component mating faces.

Using the special tool, install the 2 camshaft pulley hubs.

- Stage 1: Tighten to 80 Nm (59 lb.ft).
- Stage 2: Tighten a further 90 degrees.

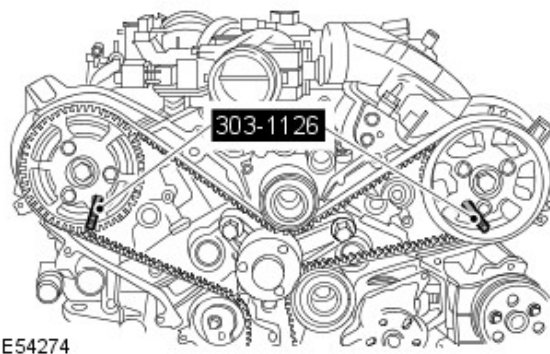


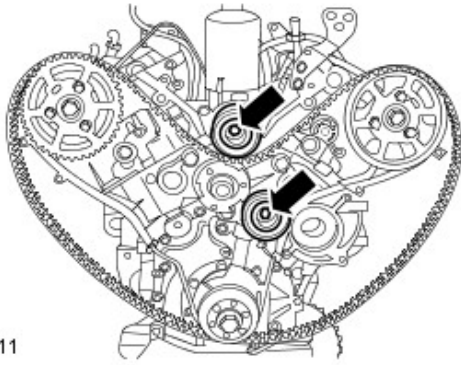
48. Install the 2 exhaust camshaft pulleys.

- Install the bolts, but do not tighten fully at this stage.

49. Install the special tools.

- Rotate the camshafts.

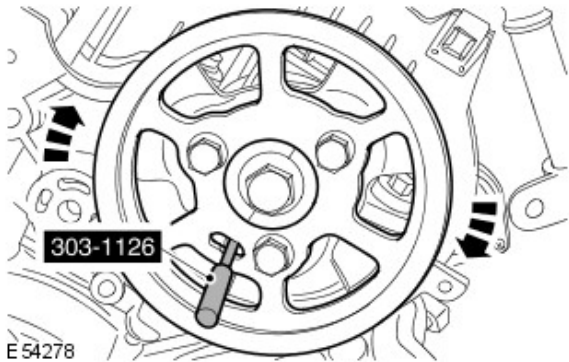




E96811

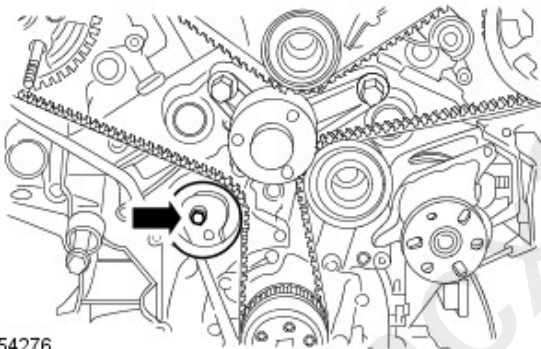
50. Install the 2 timing belt idler pulleys.

- Install the plastic shield behind the upper idler pulley.
- Tighten the bolts to 45 Nm (33 lb.ft).



E 54278

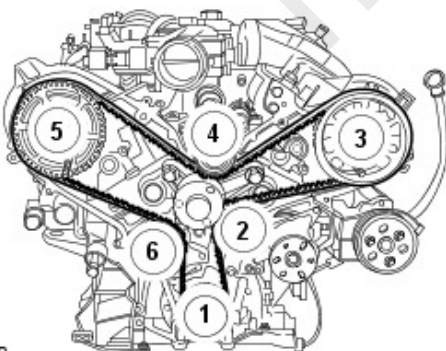
51. Rotate both camshaft pulleys clockwise.



E54276

52. Install a new timing belt tensioner.

- Install a new bolt, but do not fully tighten at this stage.

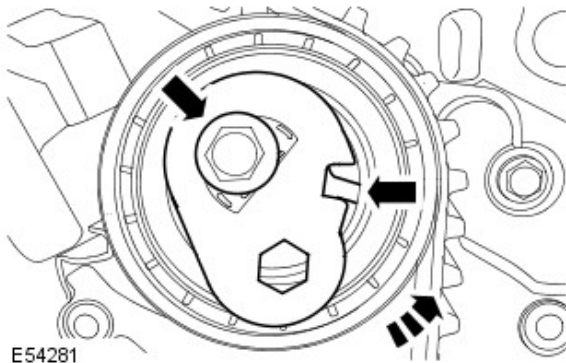


E54280

53.  **CAUTION:** Make sure the camshaft pulleys remain in the clockwise position.

Install the new timing belt.

- Starting at the crankshaft pulley, install the timing belt in a counter-clockwise direction, in the sequence shown.
- Stage 1: Attach the timing belt to the crankshaft pulley.
- Stage 2: Attach the timing belt to the idler pulley.
- Stage 3: Attach the timing belt to the left-hand camshaft pulley.
- Stage 4: Attach the timing belt to the idler pulley.
- Stage 5: Attach the timing belt to the RH camshaft pulley.
- Stage 6: Attach the timing belt to the timing belt tensioner.

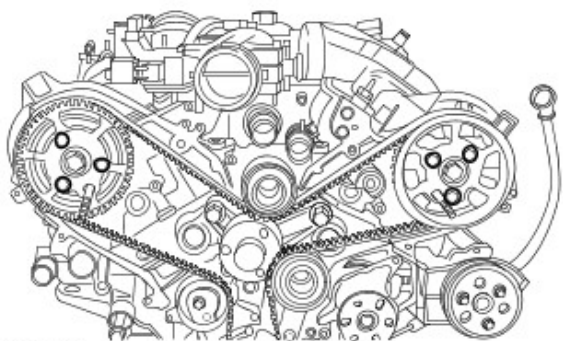


E54281

**54.**  **CAUTION:** Make sure the timing belt tensioner window is aligned with the groove.

Tension the timing belt.

- Rotate the tensioner assembly counter-clockwise.
- Tighten the bolt to 24 Nm (18 lb.ft).

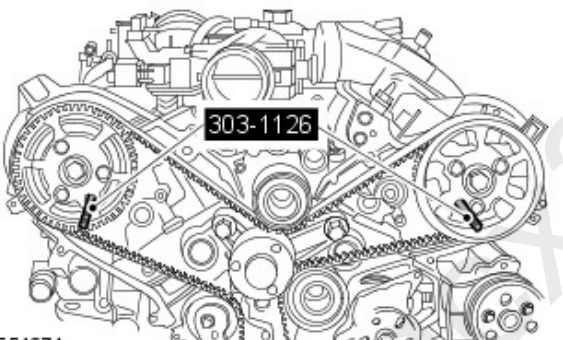


E54627

**55.**  **CAUTION:** Do not use the special tools to lock the camshafts. Failure to follow this instruction may result in damage to the engine or the special tools.

Secure the camshaft pulleys.

- Using a suitable tool, hold the camshaft pulley center bolts.
- Tighten the bolts to 23 Nm (17 lb.ft).



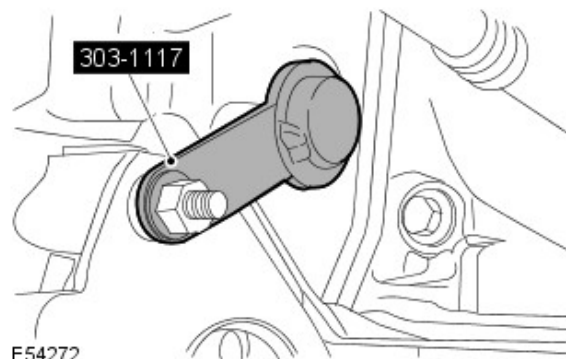
E54274

**56.** Remove the special tools.

Vehicles with automatic transmission

**57.** Remove the special tool.

- Remove the bolt.

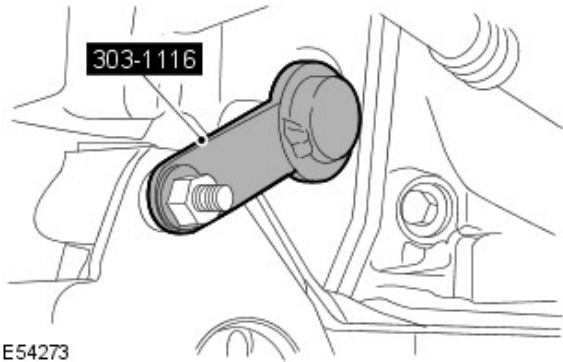


E54272

Vehicles with manual transmission

**58.** Remove the special tool.

- Remove the bolt.



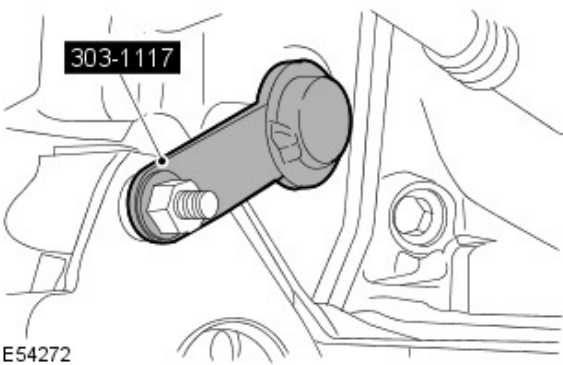
All vehicles

**59.** Rotate the engine two complete turns clockwise.

Vehicles with automatic transmission

**60.** Using the special tool, lock the flexplate.

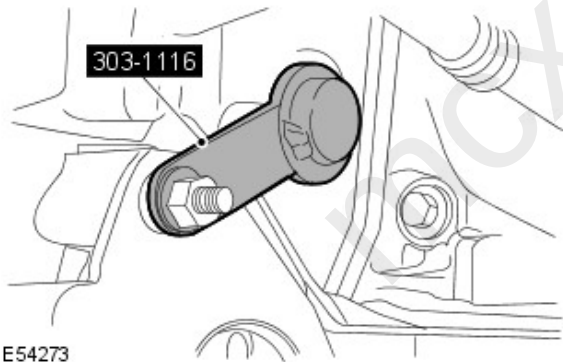
- Install a starter motor bolt to retain the special tool.



Vehicles with manual transmission

**61.** Using the special tool, lock the flywheel.

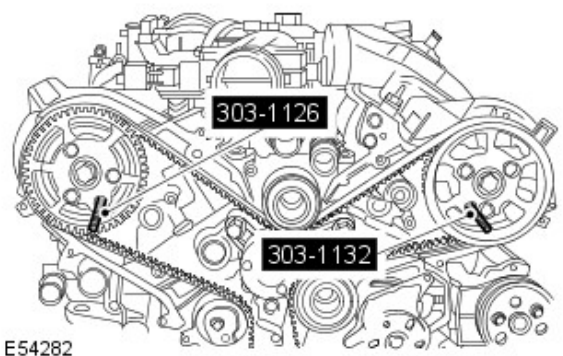
- Install a starter motor bolt to retain the special tool.



All vehicles

**62.** Install the special tools to the exhaust camshaft pulleys.

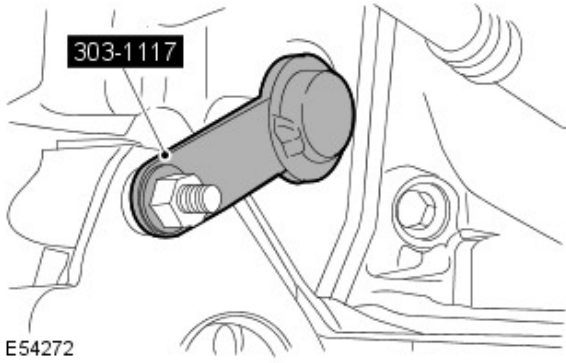
- If the special tool does not fit correctly, repeat the timing belt installation procedure.
- Remove the special tools from the camshaft pulleys.



Vehicles with automatic transmission

**63.** Remove the special tool.

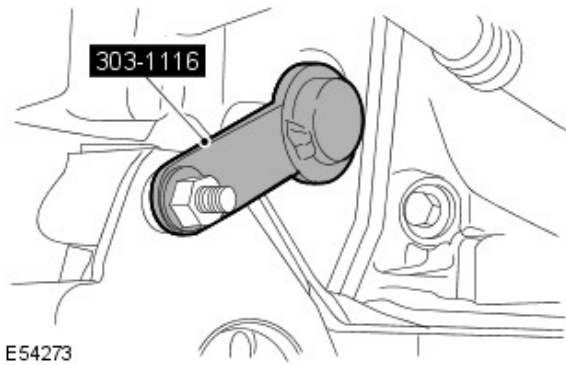
- Remove the bolt.



Vehicles with manual transmission

**64.** Remove the special tool.

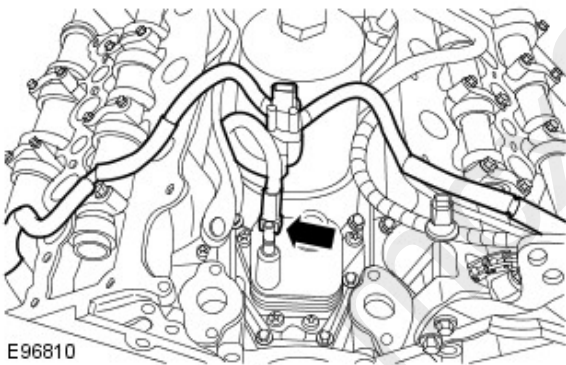
- Remove the bolt.



All vehicles

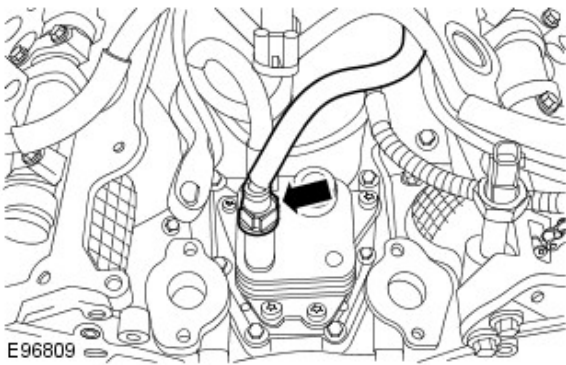
**65.** NOTE: Remove and discard the blanking caps.

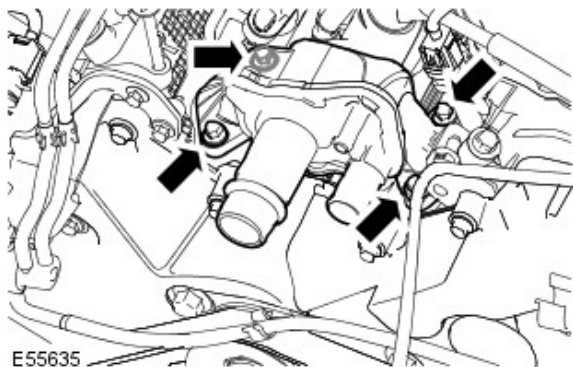
Install a new fuel injector return line.



**66.** NOTE: Remove and discard the blanking caps.

Connect the fuel pipe to the fuel cooler.





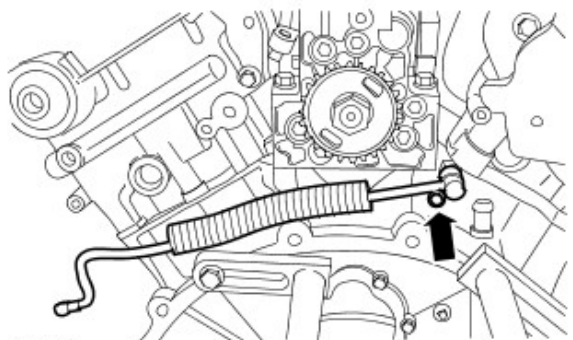
E55635

**67. NOTE:** Install new O-ring seals.

• **NOTE:** Clean the component mating faces.

Install the cylinder head coolant outlet assembly.

- Tighten the bolts to 10 Nm (7 lb.ft).

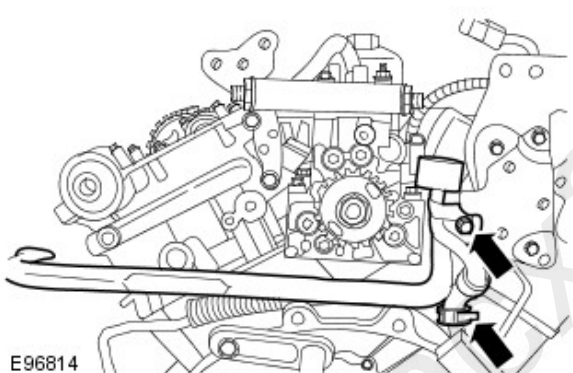


E96815

**68. NOTE:** Install new O-ring seals.

Install the turbocharger oil supply line.

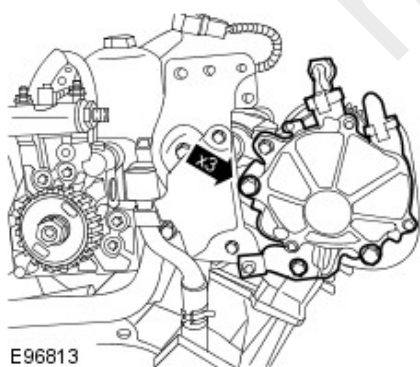
- Tighten the bolts to 10 Nm (7 lb.ft).



E96814

**69.** Install the breather line.

- Secure the clip.
- Tighten the bolt to 10 Nm (7 lb.ft).



E96813

**70. NOTE:** Clean the component mating faces.

• **NOTE:** Install a new gasket.

Install the brake vacuum pump.

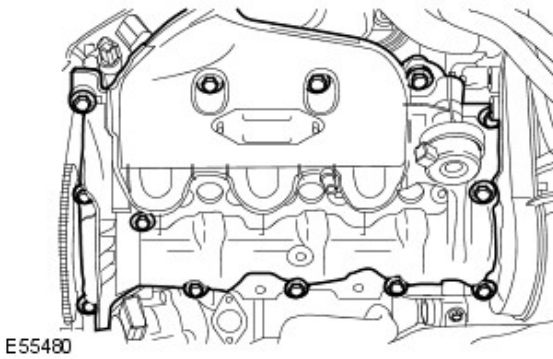
- Install the bracket.
- Tighten the bolts to 23 Nm (17 lb.ft).

**71. NOTE:** Clean the component mating faces.

- **NOTE:** Install a new gasket.

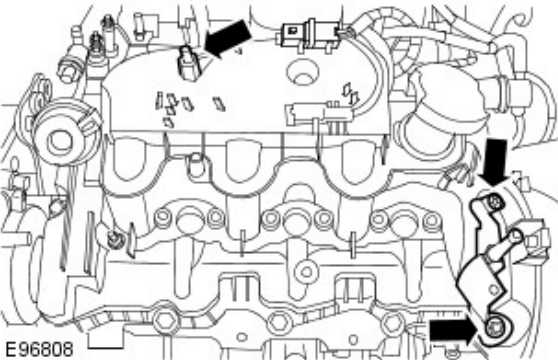
Install the RH valve cover.

- Tighten the bolts to 10 Nm (7 lb.ft).
- Secure the glow plug electrical connector in the valve cover.
- Secure the knock sensor (KS) electrical connector in the valve cover.



**72. Install the RH engine cover locating studs.**

- Install the bracket.
- Tighten the nut to 10 Nm (7 lb.ft).
- Tighten the bolt to 10 Nm (7 lb.ft).

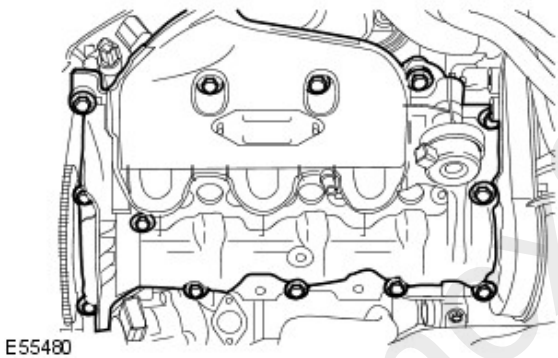


**73. NOTE:** Clean the component mating faces.

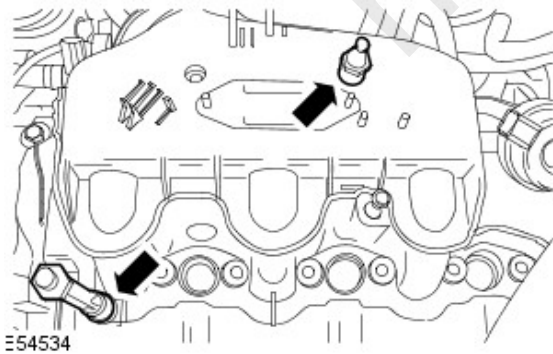
- **NOTE:** Install anew gasket.

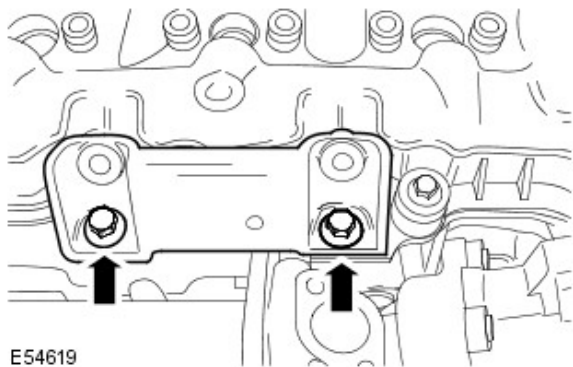
Install the LH valve cover.

- Tighten the bolts to 10 Nm (7 lb.ft).
- Secure the KS electrical connector in the valve cover.



**74. Install the LH engine cover locating studs.**

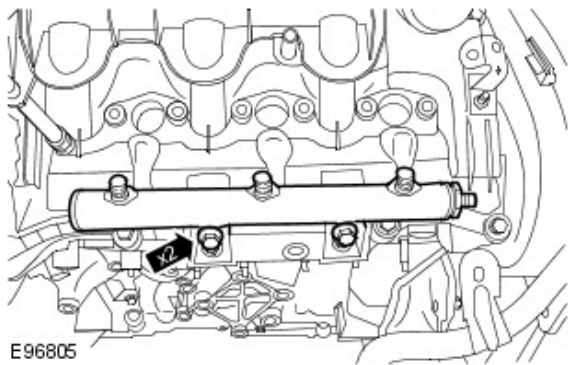




E54619

**75.** Install the fuel rail brackets.

- Tighten the bolts to 23 Nm (17 lb.ft).



E96805

**76.** Install the fuel rails.

- Install the bolts, but do not tighten fully at this stage.

Vehicles built up to 12/2007

**77. NOTE:** Remove and discard the blanking caps.

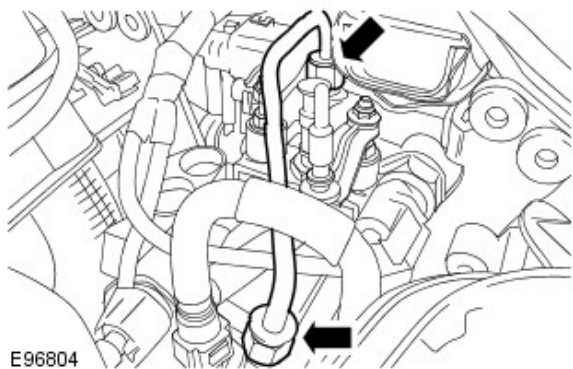
Install the new RH fuel rail high-pressure supply line.

- Tighten the fuel injection supply manifold retaining bolts to 23 Nm (17 lb.ft).
- Stage 1: Tighten the high-pressure fuel supply line union at the fuel injection diverter rail to 15 Nm (11 lb.ft).
- Stage 2: Tighten the high-pressure fuel supply line union at the fuel rail to 15 Nm (11 lb.ft).
- Stage 3: Tighten the high-pressure fuel supply line union at the fuel injection diverter rail to 30 Nm (22 lb.ft).
- Stage 4: Tighten the high-pressure fuel supply line union at the fuel rail to 30 Nm (22 lb.ft).
- Secure the clip.

**78. NOTE:** Remove and discard the blanking caps.

Install the new LH fuel rail high-pressure supply line.

- Tighten the fuel injection supply manifold retaining bolts to 23 Nm (17 lb.ft).
- Stage 1: Tighten the high-pressure fuel supply line union at the fuel injection diverter rail to 15 Nm (11 lb.ft).
- Stage 3: Tighten the high-pressure fuel supply line union at the fuel injection diverter rail to 30 Nm (22 lb.ft).
- Stage 2: Tighten the high-pressure fuel supply line union at the fuel rail to 15 Nm (11 lb.ft).
- Stage 4: Tighten the high-pressure fuel supply line union at the fuel rail to 30 Nm (22 lb.ft).
- Secure the clip.



**79. NOTE: Remove and discard the blanking caps.**

Install the new fuel diverter rail high-pressure supply line.

- Stage 1: Tighten the high-pressure fuel supply line union at the fuel injection pump to 15 Nm (11 lb.ft).
- Stage 2: Tighten the high-pressure fuel supply line union at the fuel injection diverter rail to 15 Nm (11 lb.ft).
- Stage 3: Tighten the high-pressure fuel supply line union at the fuel injection pump to 30 Nm (22 lb.ft).
- Stage 4: Tighten the high-pressure fuel supply line union at the fuel injection diverter rail to 30 Nm (22 lb.ft).

Vehicles built 01/2007 onwards

**80. NOTE: Remove and discard the blanking caps.**

Install the new RH fuel rail high-pressure supply line.

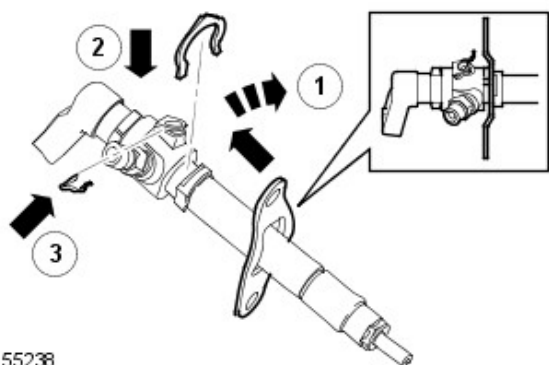
- Tighten the fuel injection supply manifold retaining bolts to 23 Nm (17 lb.ft).
- Stage 1: Tighten the high-pressure fuel supply line union at the fuel injection pump to 15 Nm (11 lb.ft).
- Stage 2: Tighten the high-pressure fuel supply line union at the fuel rail to 15 Nm (11 lb.ft).
- Stage 3: Tighten the high-pressure fuel supply line union at the fuel injection pump to 30 Nm (22 lb.ft).
- Stage 4: Tighten the high-pressure fuel supply line union at the fuel rail to 30 Nm (22 lb.ft).
- Secure the clip.

**81. NOTE: Remove and discard the blanking caps.**

Install the new LH fuel rail high-pressure supply line.

- Tighten the fuel injection supply manifold retaining bolts to 23 Nm (17 lb.ft).
- Stage 1: Tighten the high-pressure fuel supply line union at the fuel injection pump to 15 Nm (11 lb.ft).
- Stage 2: Tighten the high-pressure fuel supply line union at the fuel rail to 15 Nm (11 lb.ft).
- Stage 3: Tighten the high-pressure fuel supply line union at the fuel injection pump to 30 Nm (22 lb.ft).
- Stage 4: Tighten the high-pressure fuel supply line union at the fuel rail to 30 Nm (22 lb.ft).
- Secure the clip.

All vehicles



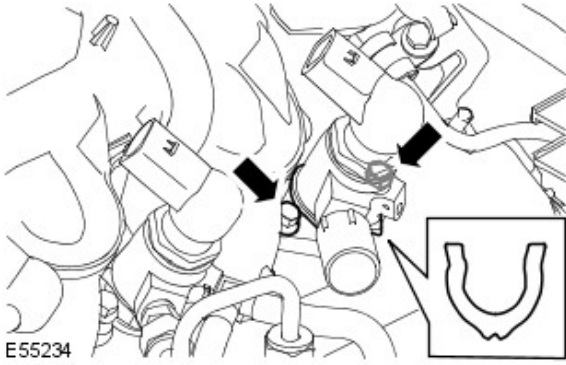
**82. CAUTIONS:**

**⚠** Do not disassemble the fuel injectors or clean the nozzles, even with an ultrasonic cleaner. Always install new fuel injectors when required.

**⚠** Do not use tools to install the new fuel return line retaining clip. Failure to follow this instruction will result in damage to the retaining clip.

Install a new fuel injector clamp.

- 1. Install the fuel injector retaining clamp spacer.
- 2. Install a new fuel return line retaining clip.
- 3. Install a new sealing washer.



**83.** Install the fuel injector.

- Tighten the bolts to 10 Nm (7 lb.ft).

**84.** Install the remaining fuel injectors.

**85. CAUTIONS:**

**⚠** Do not allow the unions to hit the olive ends of the high-pressure fuel supply line as this may damage the ends of the line and allow foreign matter to enter the fuel injection system.

**⚠** Maintain pressure on the high-pressure fuel supply lines to keep the olives in contact with the fuel injectors and the fuel rail cones while installing the unions.

**⚠** Do not use any aggressive cleaning fluid or a wire brush to clean the fluid injector nozzle.

- **NOTE:** Remove and discard the blanking caps.

Install new high-pressure fuel supply lines.

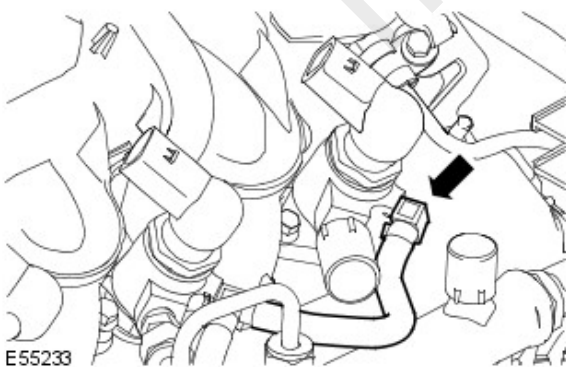
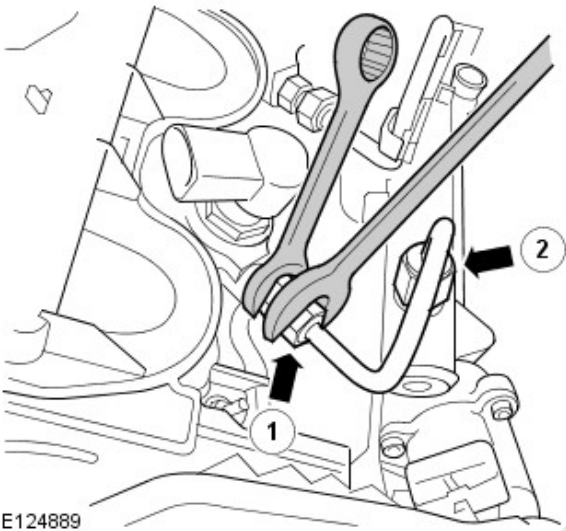
1. Install the new high-pressure fuel supply line, tighten the fuel supply line unions finger tight.

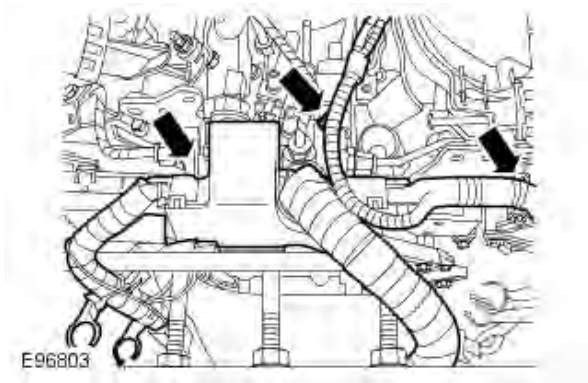
- Tighten the high-pressure fuel supply line in the sequence shown:
- Tighten the high-pressure fuel supply line union 1 to fuel injector to 15 Nm.
- Tighten the high-pressure fuel supply line union 2 to fuel rail to 15 Nm.
- Tighten the high-pressure fuel supply line union 1 to fuel injector to 30 Nm.
- Tighten the high-pressure fuel supply line union 2 to fuel rail to 30 Nm.

**86. ⚠ CAUTION:** Make sure the fuel return line retaining clip is correctly installed to the fuel injector before installing the return line.

Connect the fuel return line to the fuel injectors.

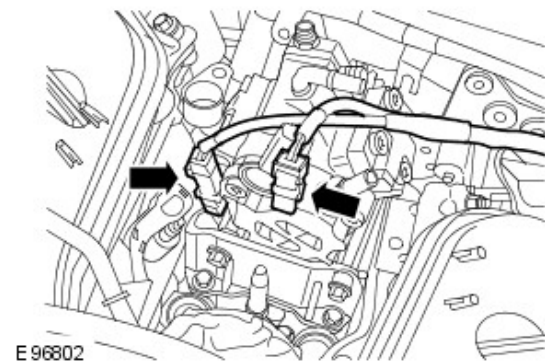
- Apply a light coating of petroleum jelly to the fuel return line O-ring seals.



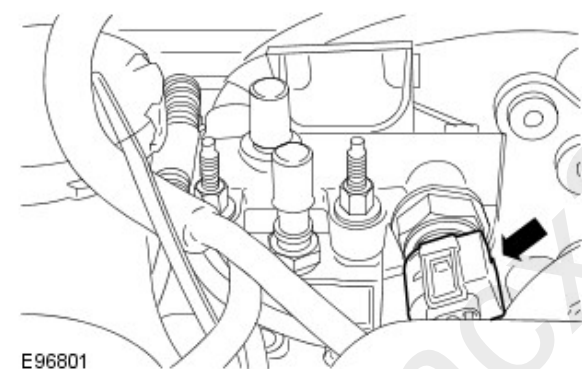


**87.** Install the engine wiring harness.

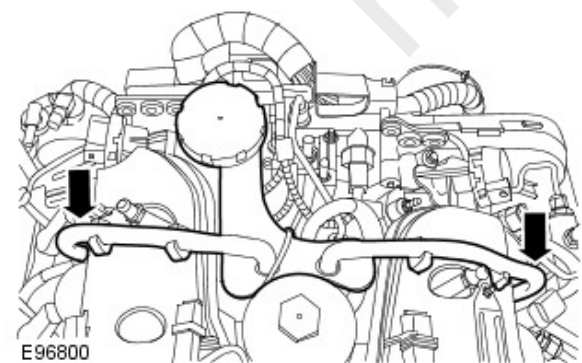
- Tighten the nut to 10 Nm (7 lb.ft).
- Secure the clips.



**88.** Connect the fuel injection pump electrical connectors.

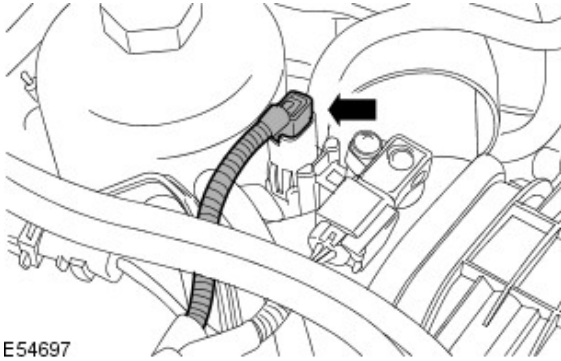


**89.** Connect the fuel rail pressure (FRP) sensor electrical connector.

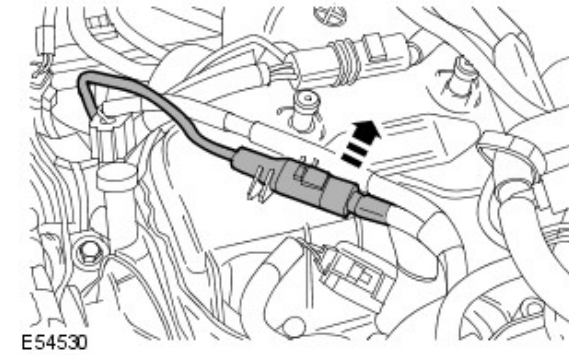


**90.** Install the crankcase vent oil separator.

- Connect and secure the 2 breather hoses.

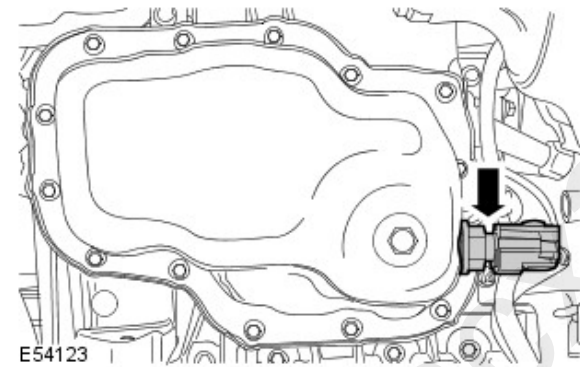


**91.** Connect the fuel temperature sensor electrical connector.



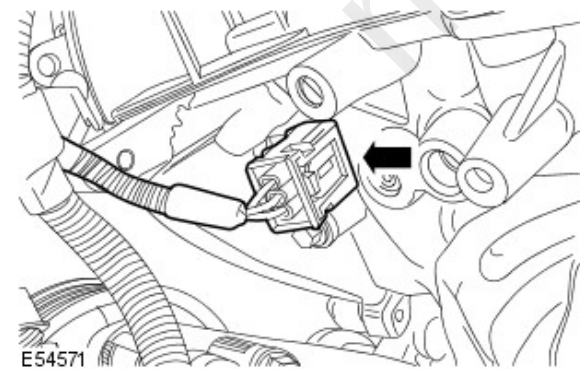
**92.** NOTE: LH shown, RH is similar.

Connect the 2 KS electrical connectors.



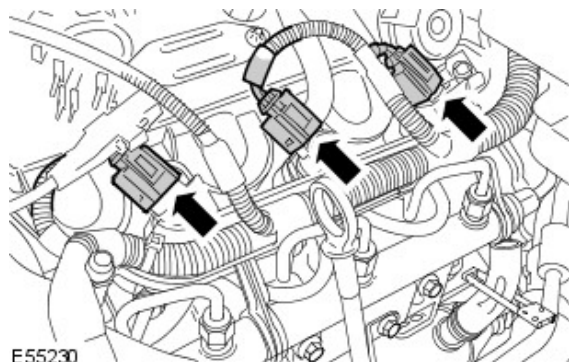
**93.** Connect the engine oil temperature sensor electrical connector.

- Secure the wiring harness clip.



**94.** Connect the camshaft position (CMP) sensor electrical connector.

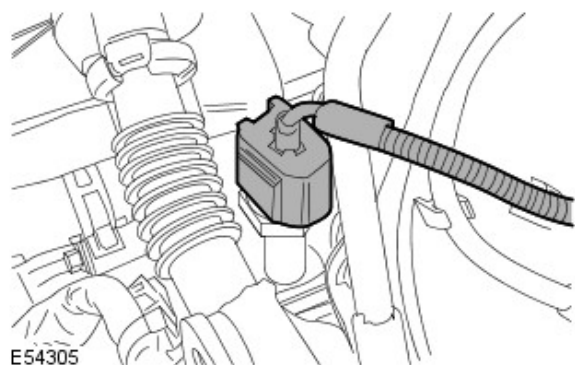
- Secure the wiring harness clip.



**95. NOTE: RH shown, LH is similar**

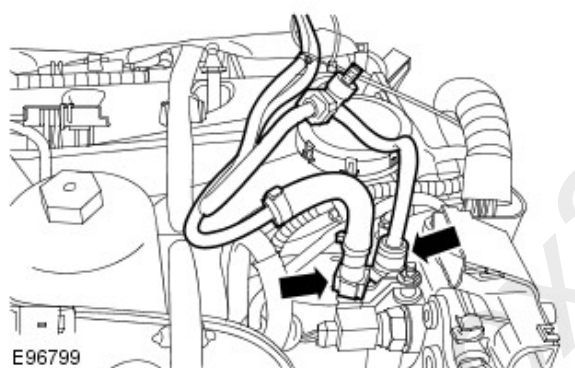
Connect the 6 fuel injector electrical connectors.

- Secure the 4 wiring harness clips.

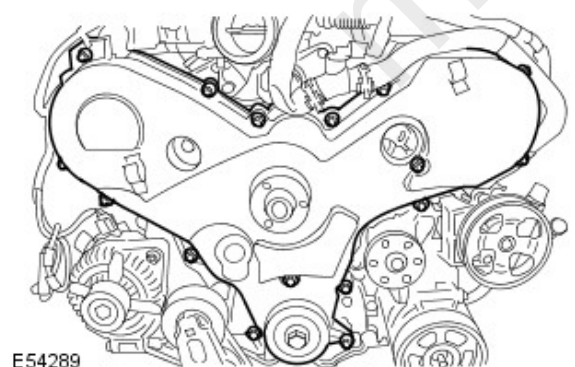


**96. Connect the engine oil pressure (EOP) sensor electrical connector.**

- Secure the wiring harness clip.

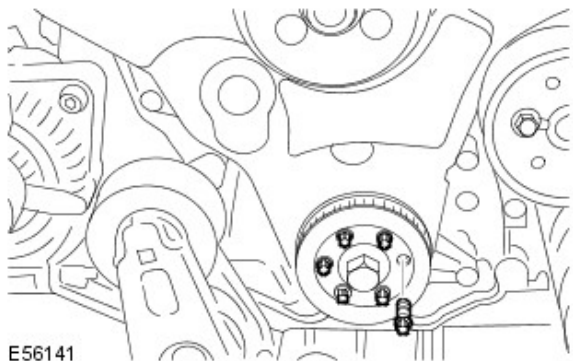


**97. Install the 2 low pressure fuel pipes.**



**98. Install the timing belt cover.**

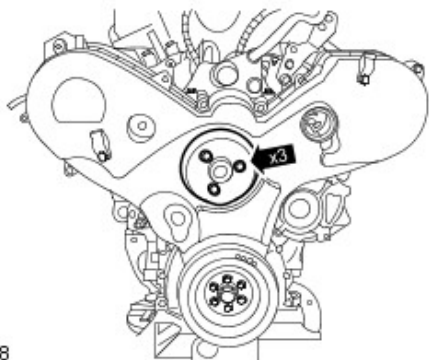
- Tighten the bolts to 10 Nm (7 lb.ft).



**99.** Install the crankshaft pulley.

- Tighten the bolts to 14 Nm (10 lb.ft).

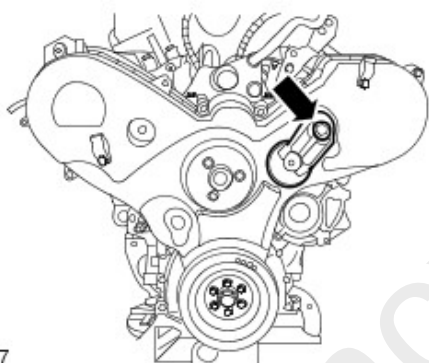
E56141



**100.** Install the cooling fan pulley.

- Tighten the bolts to 23 Nm (17 lb.ft).

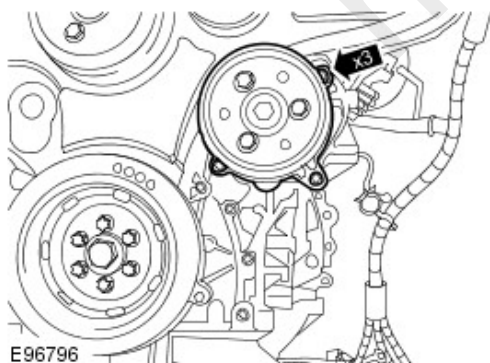
E96798



**101.** Install the accessory drive belt idler.

- Tighten the bolt to 47 Nm (35 lb.ft).

E96797



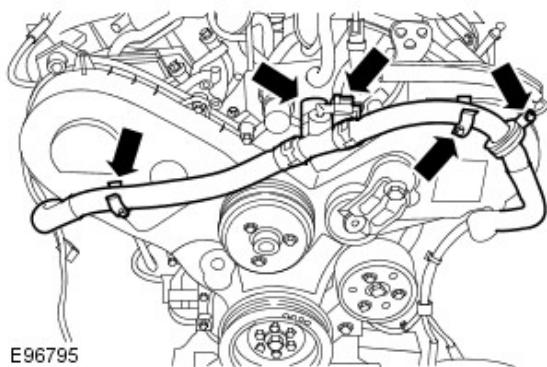
**102.** NOTE: Clean the component mating faces.

- NOTE: Install a new O-ring seal.

Install the coolant pump.

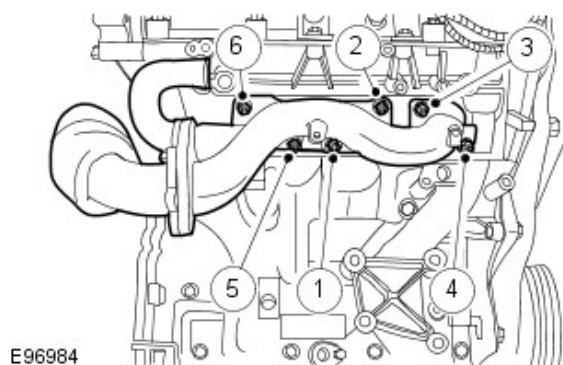
- Tighten the bolts to 10 Nm (7 lb.ft).

E96796



**103.** Install the exhaust gas recirculation (EGR) valve coolant pipe.

- Install the bolt.
- Connect the electrical connector.
- Secure in the 2 clips.
- Secure the clip.

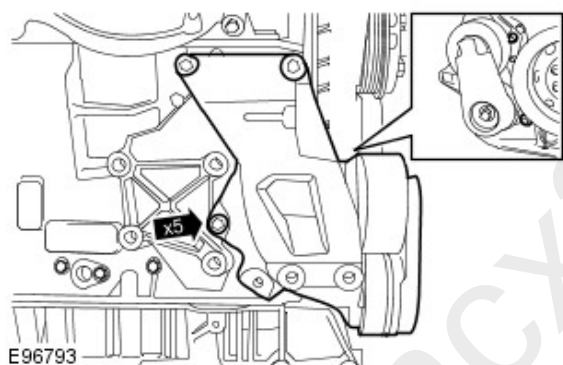


**104.**  **CAUTION:** Make sure that new nuts are installed.

- **NOTE:** Tighten the nuts in the sequence shown.
- **NOTE:** Install a new gasket.

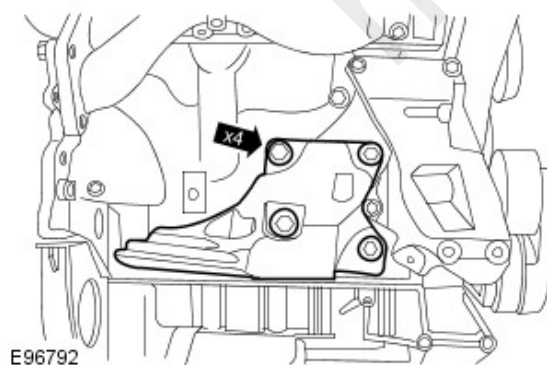
Install the RH exhaust manifold and exhaust cross-over pipe assembly.

- Tighten the nuts to 24 Nm (18 lb.ft).



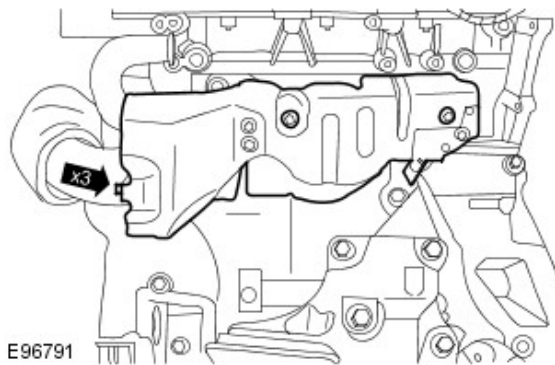
**105.** Install the generator bracket.

- Tighten the bolts to 23 Nm (17 lb.ft).



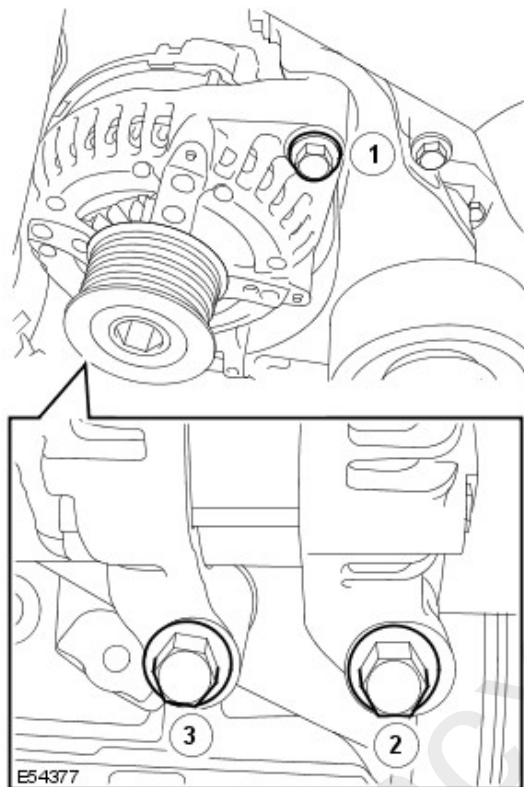
**106.** Install the RH engine mount bracket.

- Tighten the bolts to 110 Nm (81 lb.ft).



**107.** Install the RH exhaust manifold heat shield.

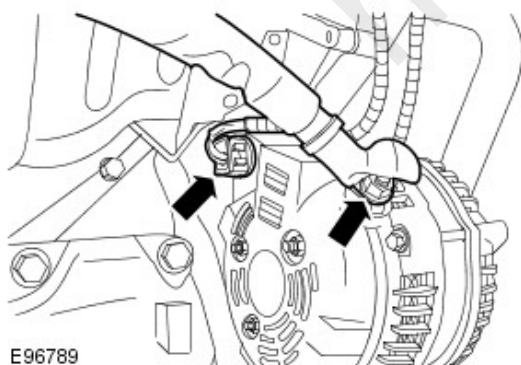
- Tighten the bolts to 10 Nm (7 lb.ft).



**108.**  **CAUTION:** Tighten the bolts in the sequence shown.

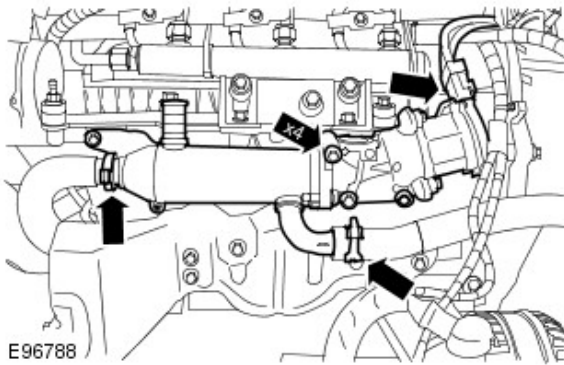
Install the generator.

- Tighten the bolts to 47 Nm (35 lb.ft).



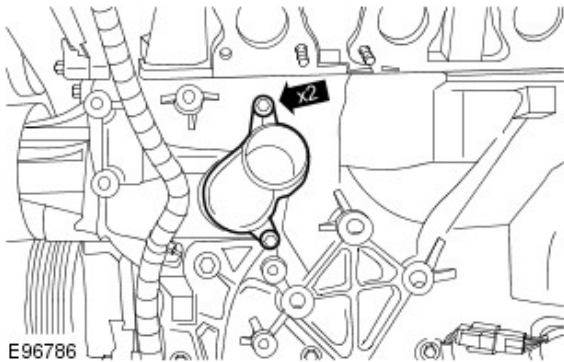
**109.** Connect the generator electrical connectors.

- Tighten the nut to 12 Nm (9 lb.ft).
- Reposition the rubber insulator.



**110.** Install the RH EGR valve and cooler assembly.

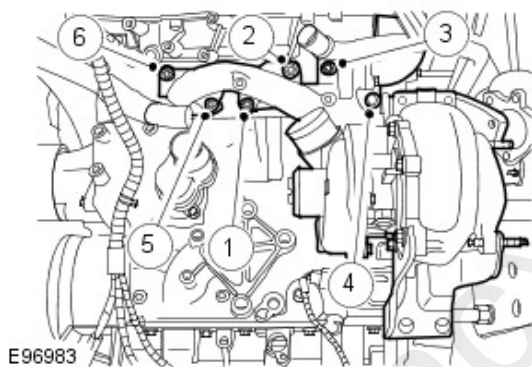
- Tighten the bolts to 10 Nm (7 lb.ft).
- Connect the coolant hose and secure with the clip.
- Connect the electrical connector.
- Install and secure the new clip.



**111. NOTE:** Install a new O-ring seal.

Install the cylinder block coolant inlet pipe.

- Tighten the bolts to 10 Nm (7 lb.ft).

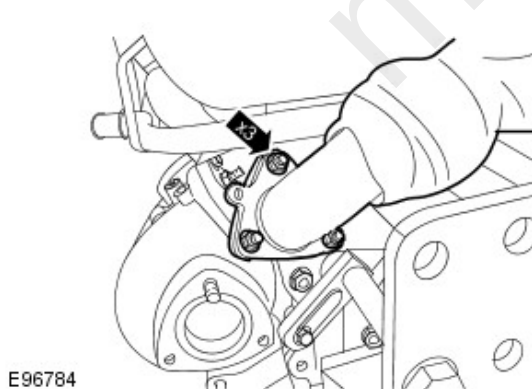


**112.**  **WARNING:** Make sure that new nuts are installed.

- **NOTE:** Tighten the nuts in the sequence shown.
- **NOTE:** Install a new gasket.

Install the LH exhaust manifold and turbocharger assembly.

- Tighten the nuts to 24 Nm (18 lb.ft).

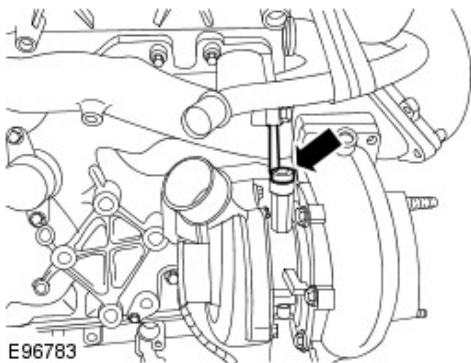


**113.**  **CAUTION:** Make sure that new nuts are installed.

- **NOTE:** Install a new gasket.

Secure the exhaust cross-over pipe to the LH exhaust manifold.

- Tighten the nuts to 24 Nm (18 lb.ft).

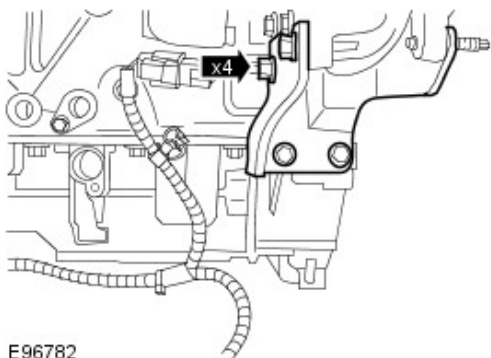


**114.** NOTE: Remove and discard the blanking caps.

- NOTE: Install new sealing washers.

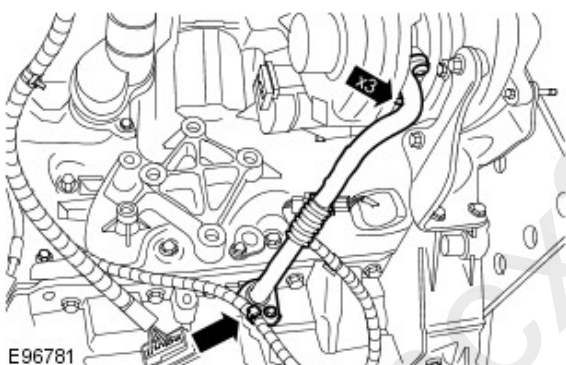
Connect the turbocharger oil supply tube.

- Tighten the banjo bolt to 30 Nm (22 lb.ft).



**115.** Secure the turbocharger support bracket.

- Tighten the bolts to 23 Nm (17 lb.ft).



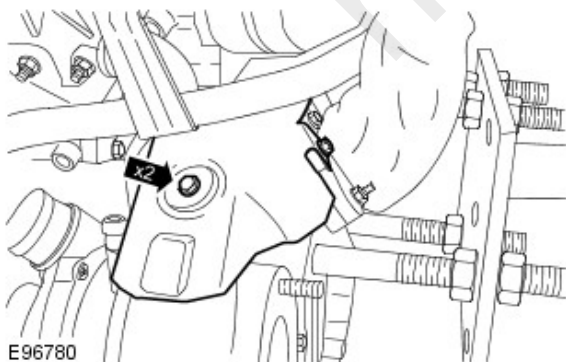
**116.** NOTE: Remove and discard the blanking caps.

- NOTE: Install a new O-ring seal.

- NOTE: Install a new gasket.

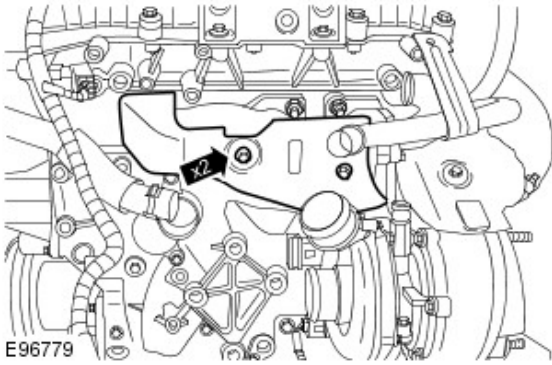
Install the turbocharger oil return tube.

- Tighten the bolts to 10 Nm (7 lb.ft).



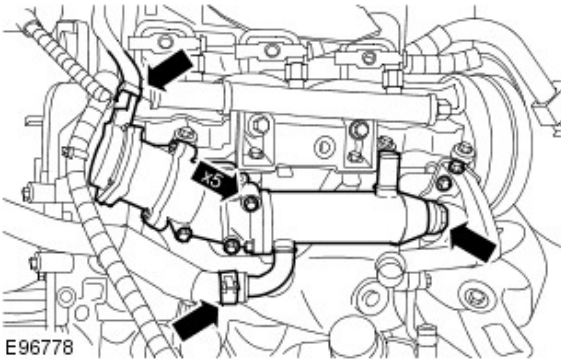
**117.** Install the turbocharger heat shield.

- Tighten the bolts to 10 Nm (7 lb.ft).



**118.** Install the LH exhaust manifold heat shield.

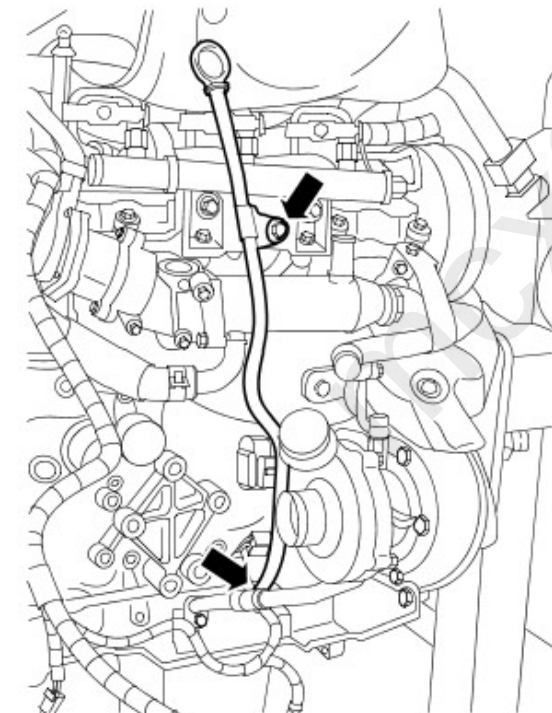
- Tighten the bolts to 10 Nm (7 lb.ft).



**119.** NOTE: Install a new clip.

Install the LH EGR valve and cooler assembly.

- Install the support bracket.
- Tighten the bolts to 10 Nm (7 lb.ft).
- Connect the coolant hose and secure with the clip.
- Connect the electrical connector.
- Install and secure the clip.

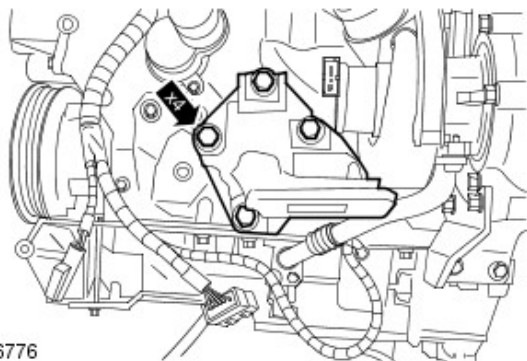


**120.** NOTE: Remove and discard the blanking caps.

• NOTE: Install a new O-ring seal.

Install the oil level indicator and tube.

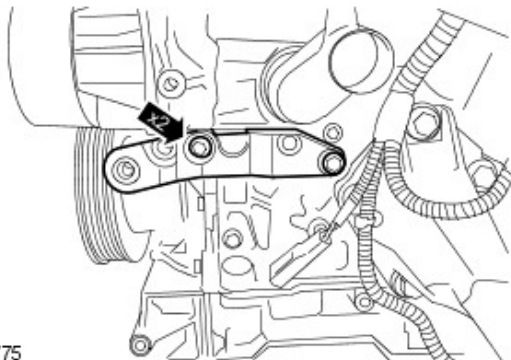
- Tighten the bolt to 10 Nm (7 Lb.ft).
- Secure the wiring harness clip.



E96776

**121.** Install the LH engine mount bracket.

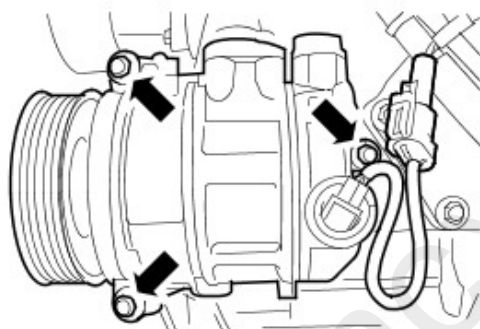
- Tighten the bolts to 110 Nm (81 lb.ft).



E96775

**122.** Install the air conditioning (A/C) compressor bracket.

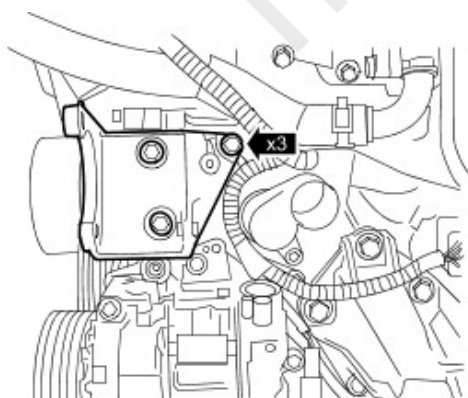
- Tighten the bolts to 23 Nm (17 lb.ft).



E96774

**123.** Install the A/C compressor.

- Tighten the bolts to 23 Nm (17 lb.ft).
- Connect the electrical connector.



E96773

**124.** Install the power steering pump bracket.

- Tighten the bolts to 23 Nm (17 lb.ft).

**125.** Remove the engine from the engine stand.

**126.** Install the engine.

For additional information, refer to: [Engine - Vehicles With: 6HP28 6-Speed Automatic Transmission/6HP26 6-Speed Automatic Transmission](#) (303-01A Engine - TDV6 2.7L Diesel, Installation) / [Engine - Vehicles With: Manual Transmission](#) (303-01 Engine - 2.7L V6 - TdV6, Installation).

**127.** Fill the engine with the recommended oil to the correct level.

For additional information, refer to: [Engine Oil Draining and Filling](#) (303-01A Engine - TDV6 2.7L Diesel, General Procedures).



# Engine - TDV6 2.7L Diesel - Engine Vehicles With: 6HP28 6-Speed Automatic Transmission / 6HP26 6-Speed Automatic Transmission

## Installation

| Special Tool(s)                                                                                                 |                       |
|-----------------------------------------------------------------------------------------------------------------|-----------------------|
|  <p>303-1141</p> <p>E56716</p> | Engine lifting Cradle |
|                                                                                                                 | 303-1141              |

## Installation

### 1. CAUTIONS:



Apply grease of the correct specification to the torque converter spigot.



Make sure the torque converter is fully located into the oil pump drive.

With assistance, carefully install the engine.

- Clean the component mating faces.
- Carefully guide the transmission wiring harness in as the engine is being installed.
- Carefully guide the battery positive cable in as the engine is being installed.



**2. CAUTION:** Make sure the torque converter remains connected to the transmission.

Secure the engine to the transmission.

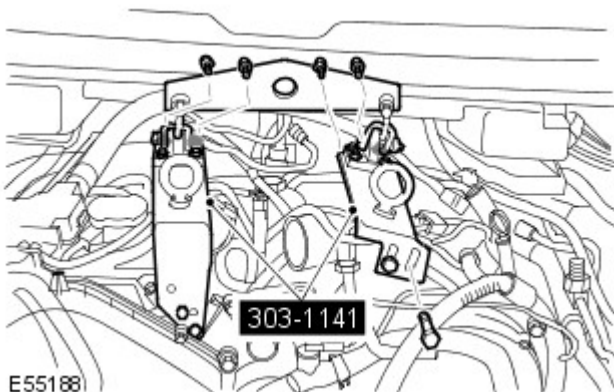
- Tighten the bolts to 45 Nm (33 lb.ft).
- Remove the jack supporting the transmission.

### 3. Secure both the LH and the RH engine mounts.

- Lower the engine onto its mounts.
- Tighten the nuts to 90 Nm (66 lb.ft).

### 4. Remove the special tool.

- Remove the bolts.



### 5. NOTE: Make sure that new bolts are installed.

### 6. Install the starter motor.

Secure the flexplate to the torque converter.

- Tighten the bolts to 45 Nm (33 lb.ft).

- Tighten the bolts to 45 Nm (33 lb.ft).

### 7. Connect the 2 starter motor wiring harness connectors to the starter solenoid plug.

- Install the solenoid plug.

- Tighten the solenoid terminal integral connector nut to 8 Nm (6 lb.ft).
- Tighten the battery positive cable nut to 11 Nm (8 lb.ft).
- Install the rubber insulator.

**8.** Install the starter motor support bracket.

- Tighten the bolts to 10 Nm (7 lb.ft).

**9.** Secure the engine ground cable.

- Tighten the bolt to 22 Nm (16 lb.ft).

**10.** Secure the fuel cooler.

- Tighten the bolt to 10 Nm (7 lb.ft).

**11. NOTE:** Remove and discard the blanking caps.

Connect the fuel lines.

**12.** Secure the fuel lines.

- Tighten the bolt to 22 Nm (16 lb.ft).
- Secure in the clips.

**13.** Secure the transmission breather lines.

- Tighten the bolt to 7 Nm (5 lb.ft).

**14.** Install the turbocharger support bracket.

- Tighten the bolts to 48 Nm (35 lb.ft).
- Tighten the nut to 22 Nm (16 lb.ft).

**15. NOTE:** Make sure that new nuts are installed.

• NOTE: Make sure that all the component mating faces are clean.

Secure the exhaust to the turbocharger.

- Install a new gasket.
- Tighten the nuts to 48 Nm (35 lb.ft).

**16.** Install the exhaust manifold crossover pipe center support bracket.

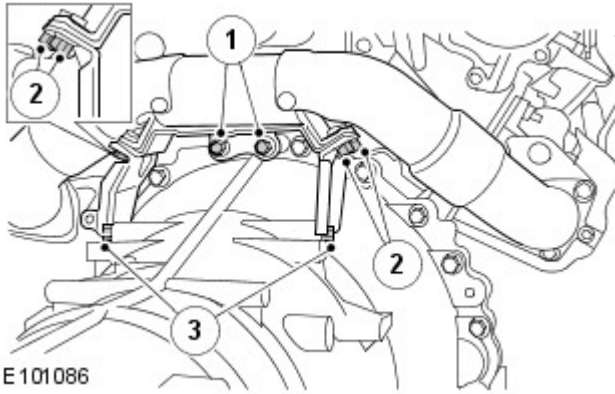
- Loosely install the 2 bolts.

**17.** Install the exhaust manifold crossover pipe RH support bracket.

- Loosely install the 3 bolts.

**18.** Install the exhaust manifold crossover pipe LH support bracket.

- Loosely install the 3 bolts.



**19.** Tighten the exhaust manifold crossover pipe mounting bracket bolts in the following sequence.

- Tighten the 2 bolts marked 1 to 10 Nm (7 lb.ft).
- Loosen the 2 bolts by 90 degrees.
- Tighten the 2 bolts marked 3 to 10 Nm (7lb.ft).
- Loosen the 2 bolts by 90 degrees.
- Tighten the 4 bolts marked 2 to 25 Nm (18 lb. ft).
- Tighten the 2 bolts marked 1 to 25 Nm (18 lb. ft).
- Tighten the 2 bolts marked 3 to 25 Nm (18 lb. ft).
- Attach the wiring harness.

**20.** Secure the battery positive cable.

- Secure with the clip.

**21.** Secure the transmission fluid lines.

- Tighten the nut to 10 Nm (7 lb.ft).

**22.** Install the turbocharger intake tube.

- Tighten the clip.

**23.** Reposition the lower coolant hose.

**24. NOTE: Remove and discard the blanking caps.**

Connect the A/C compressor high-pressure line.

- Install a new O-ring seal.
- Tighten the bolt to 9 Nm (7 lb.ft).

**25.** Install the charge air cooler inlet pipe.

**26.** Position the power steering pump to the power steering pump bracket.

- Loosely install the rear bolt.

**27.** Secure the power steering pump.

- Tighten the 3 front bolts to 22 Nm (16 lb.ft).
- Loosen the 3 front bolts by a quarter of a turn.
- Tighten the rear bolt to 22 Nm (16 lb.ft).
- Tighten the 3 front bolts to 22 Nm (16 lb.ft).

**28.** Connect the coolant lower hose.

- Secure with the clip.

**29.** Connect the charge air cooler inlet hoses.

- Tighten the clips.

**30. NOTE: Remove and discard the blanking caps.**

Connect the A/C compressor low-pressure pipe.

- Install a new O-ring seal.
- Tighten the bolt to 9 Nm (7 lb.ft).

**31.** Secure the charge air cooler inlet pipe.

- Tighten the bolts to 10 Nm (7 Lb.ft).
- Tighten the nut to 10 Nm (7 lb.ft).

**32.** Install the LH upper suspension arm and brake line heat shields.

- Secure with the clip.

- Tighten the bolts to 10 Nm (7 Lb.ft).
- Tighten the nuts to 10 Nm (7 lb.ft).

**34.** Install the accessory drive belt.

- Rotate the accessory drive belt tensioner counter-clockwise.

**35.** Connect the RH EGR coolant hose.

- Secure with the clip.

**36.** Connect the upper coolant hose to the coolant distribution manifold.

- Install the clip.

**37.** Install the intake air shutoff throttle elbow support bracket.

- Tighten the bolts to 10 Nm (7 Lb.ft).

**38.** Install the intake air shut off valve.

For additional information, refer to: [Intake Air Shutoff Throttle](#) (303-04A Fuel Charging and Controls - TDV6 2.7L Diesel, Removal and Installation).

**39.** Install the cooling fan shroud.

For additional information, refer to: [Cooling Fan Shroud](#) (303-03A Engine Cooling - TDV6 2.7L Diesel, Removal and Installation).

**40.** Install the body.

For additional information, refer to: Body - 2.7L V6 - TdV6 (502-02 Full Frame and Body Mounting, Removal and Installation).

**41.** Install the wheels and tires.

- Tighten the wheel nuts to 140 Nm (103 lb.ft).

**42.** Connect the battery ground cable.

For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).