

Engine - TD4 2.2L Diesel -

Lubricants, Fluids, Sealers and Adhesives

Description	Description and part number.
T' joints - ladder frame to engine block sealant	Three bond TB 1215J
Oil pan to block sealant	Three bond TB 1215J
Camshaft ladder sealant	Loctite 518 (8510302)
Engine Oil	SAE 5W-30 oils conforming to Ford WSS-M2C13B specification or ACEA A1 or B1

Capacities

Item	Capacity (liters/pints/US quarts)
Dry fill including filter	6.5/11.4/6.7
Service fill	5.9/10.4/6.2
Amount of oil required to bring level from the lower to the upper mark on the dipstick	1.5/2.6/1.6

Cylinder Head Gasket Selection

Piston Protusion	Thickness of Compressed Gasket	Number of holes at 'a'	Number of holes at 'b'
0.55 to 0.60 mm	1.25 ± 0.04 mm	1	1
0.61 to 0.65 mm	1.30 ± 0.04 mm	2	2
0.66 to 0.70 mm	1.35 ± 0.04 mm	3	3
0.71 to 0.75 mm	1.40 ± 0.04 mm	4	4

- 'a' and 'b' = Thickness identification

General Specification

Item	Specification
Type	2.2 litre, inline 4, turbocharged and intercooled diesel engine, twin overhead camshaft, 4 valves per cylinder
Cylinder arrangement	Inline 4
Cylinder numbering	No.1 from gearbox end
Bore - nominal	85.0 mm (3.346 in)
Stroke	96.0 mm (3.779 in)
Capacity	2179 cm ³ (132.9 in ³)
Firing order	1 - 3 - 4 - 2
Compression ratio	16.6:1
Direction of rotation	Clockwise viewed at FEAD
Maximum permissible cylinder head warp	0.03mm (0.00118 in)
Maximum power	
All markets except Belgium	118 kW (160 ps) @ 4000rpm
Belgium specification	110 kW (150 ps) @ 4000rpm
Maximum torque	400 Nm (295 lb-ft) @ 2000rpm
Engine oil pressure*:	
At 1750 rev/min	1.6 bar/160 kPa/23 lb/in ²
At 4000 rev/min	3.1 bar/310 kPa/45 lb/in ²
Balance shaft to crankshaft clearance**:	
Minimum	0.01mm
Maximum	0.07mm

* Prior to checking the engine oil pressure, a road test of 6 miles (10 kilometres) must be carried out. Do not attempt to attain normal engine operating temperature by allowing the engine to idle.

**If the backlash between the balance shaft and crankshaft is less than 0.01 mm or greater than 0.07 mm then the balance shaft assembly must be replaced.

Torque Specifications

Description	Nm	lb-ft
Accessory drive belt idler bolt	48	35
Accessory drive belt tensioner bolt	48	35
Camshaft pulley bolt		
Stage 1	20	15
Stage 2	60°	60°
Camshaft timing belt cover bolts	6	5
Camshaft timing chain tensioner bolts	7	5
Crankshaft pulley bolt:		
Stage 1	70	52
Stage 2	60°	60°
Crankshaft rear seal retainer plate	9	7
Coolant outlet elbow	9	7
Cylinder head bolts	A	A
Dipstick tube bolt	10	7
Engine insulator lower	110	81
Engine insulator lower heat shield	10	7
Engine insulator lower link brackets	110	81
Engine insulator upper	110	81

Description	Nm	lb-ft
Engine mount bracket LH:		
M8*	25	18
M12*	80	59
Engine mount bracket RH:		
M12*	80	59
M14*	175	129
Engine mount LH bolt	175	129
Engine mount RH bolts	80	59
Flywheel bolts	A	A
Fuel injector wiring harness bolt	10	7
Fuel filter bracket bolts	25	18
Intake manifold runner control (IMRC) actuator bolt	10	7
Intake manifold adaptor and throttle housing bolt	6	5
Intake manifold bolts	9	7
Lifting brackets	10	7
Oil cooler brackets	10	7
Oil cooler to cylinder block bolts	20	15
Oil filler tube	9	7
Oil pan drain plug	20	15
Oil pan bolts	9	7
Oil pan extension panel:		
Stage 1	10	7
Stage 2	16	12
Oil pump bolts:	9	7
Stage 1	7	5
Stage 2	9	7
Oil separator bolts	7	5
Oil level sensor	8	6
Piston cooling jet bolt	10	7
Timing belt tensioner bolt	25	18
Timing belt idler pulley bolt	60	44
Timing belt rear cover	6	4
Valve cover bolts	10	7
Vacuum pump bolts	9	7

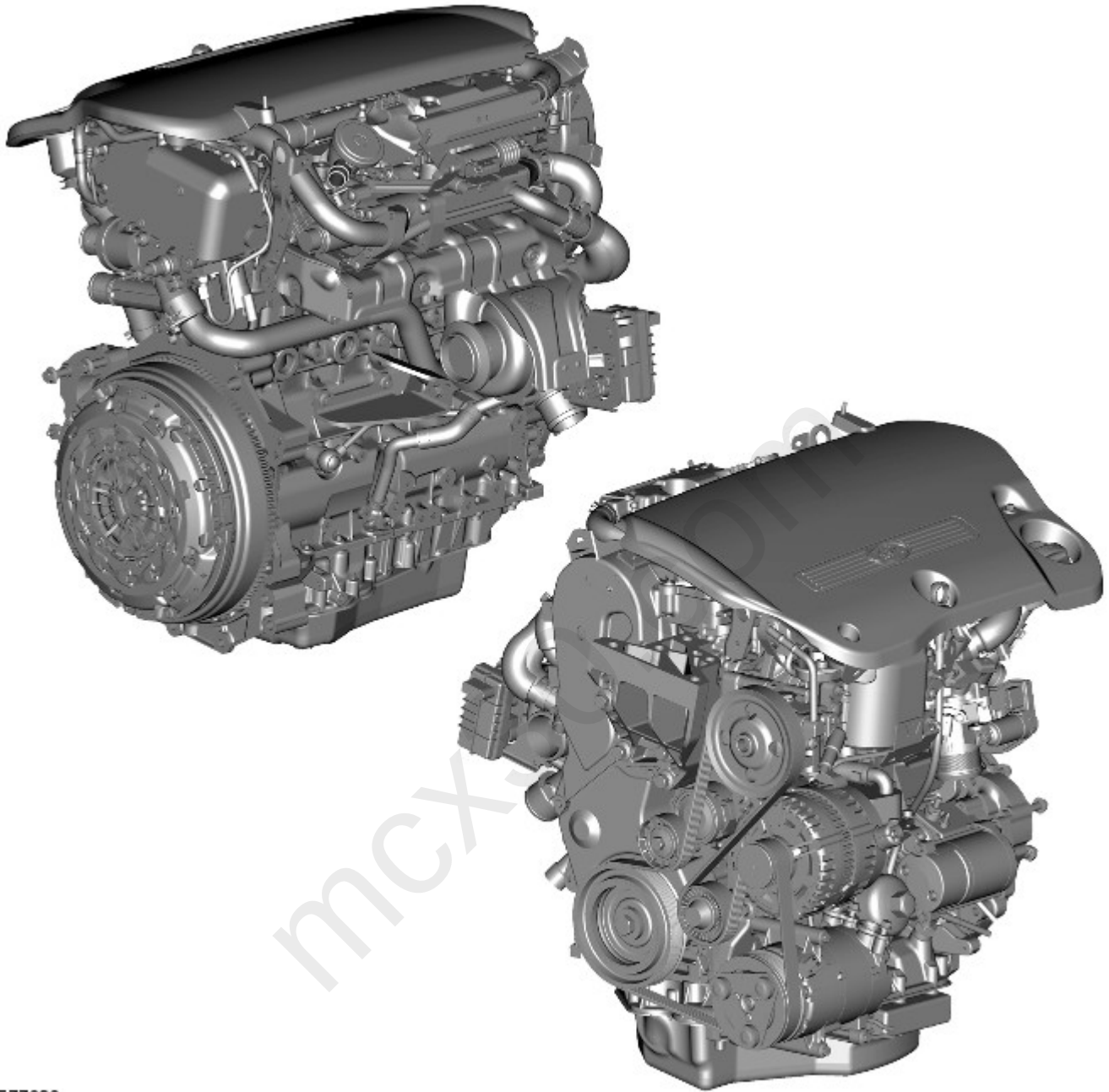
* New nuts/bolts must be fitted

A = refer to procedure for correct torque sequence

Engine - TD4 2.2L Diesel - Engine

Description and Operation

EXTERNAL VIEW



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OVERVIEW

- **NOTE:** Freelander 2 features a new TD4 diesel engine. This TD4 diesel engine is not previously used by Land Rover, and must not be mistaken for the Td4 diesel engine used with the previous Freelander model.

The new TD4 diesel engine may also be referred to, and appear in text as the 2.2L Duratorq-TDCi (DW) engine.

The TD4 diesel engine is a 2.2 liter in-line 4 cylinder assembly, comprising a Double Overhead Camshaft (DOHC) arrangement that operates 4 valves per cylinder. The valves are operated by roller-type finger rockers and hydraulic lash adjusters. Air and diesel fuel are delivered to the cylinders with an electronic controlled Variable Geometry Turbine (VGT) turbocharger, and Bosch Generation 3 common rail fuel system.

Engine operation is monitored, and optimum performance is achieved with an electronic engine management system and Bosch Engine Control Module (ECM).

The engine is a compact unit that occupies minimal space, and is designed to reduce produced levels of Noise, Vibration and Harshness (NVH). The reduced engine size allows the vehicle to achieve high levels of pedestrian protection, and meet the standards for high-speed crash performance.

Engine construction is formed with a precision machined, cast-aluminum alloy cylinder head and a laminated metal gasket,

securely bolted to the top of a machined cast-iron cylinder block. The cylinder head provides the location for the 16 valves (4 per combustion chamber), valve operating gear, camshafts and timing gear, fuel injectors and glow plugs. Drillings and galleries are formed within the cylinder head to provide lubricating oil and coolant flow.

The cylinder head is formed with the camshaft lower bearing cap castings, and is enclosed by a mating structural camshaft cover with sealing gasket. The camshaft cover is formed with the camshaft upper bearing cap castings, intake air filling tracts, and ports for the cylinder head cover, crankcase ventilation components.

An 'L' shaped cylinder head cover encloses the structural camshaft cover openings, and incorporates the Positive Crankcase Ventilation Valve (PCV), safety valve and crankcase ventilation connections.

An acoustic engine cover is installed above the engine, and comprises a polypropylene foam layer adhered to the underside of a thermo-plastic cover. The cover is tuned to absorb and reduce engine produced noise to acceptable NVH levels. A hole formed in the rear Left-hand (LH) side of the engine cover provides the location for the engine oil filler cap.

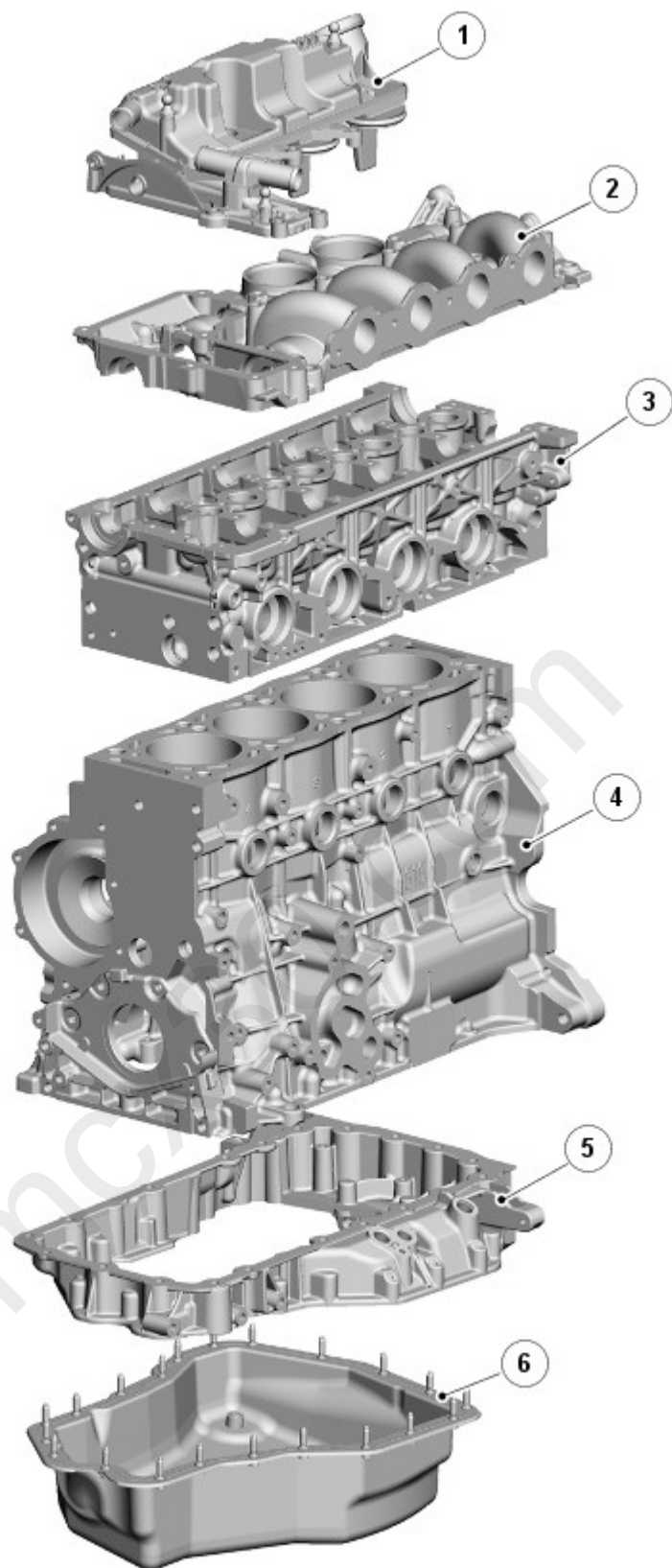
The cylinder block provides the location for the crankshaft and bearings, oil cooling jets, reciprocating components, and the counter-balance shaft housing. Galleries and drillings are formed in the cylinder block for lubricating oil and coolant flow. A counter-balance shaft housing is bolted to the underside of the cylinder block and is gear driven by the crankshaft. The counter-balance shaft assembly reduces engine NVH to provide a smooth power output.

An aluminum oil pan housing and a pressed steel oil pan are secured to the bottom of the cylinder block. The oil pan housing is sealed and bolted directly to the cylinder block. The oil pan is sealed with liquid sealant and attached to the oil pan housing to provide the lubrication system reservoir. The lubrication system oil pump is located inside the oil pan and is bolted to the underside of the cylinder block. The oil pump is chain driven by the crankshaft.

Engine cooling is achieved with a pressurized water-coolant system. An engine driven coolant pump distributes the coolant through galleries in the cylinder head and block.

Engine produced emissions comply with European Commission Directive (EUCD) Stage 4 legislative requirements. The limiting of resultant emission pollutants is achieved by use of an exhaust system catalytic converter, an optional Diesel Particulate Filter (DPF), advanced electronic engine management control, PCV, and Exhaust Gas Recirculation (EGR) system.

ENGINE STRUCTURE



E84622

Item	Part Number	Description
1	-	Cylinder head cover
2	-	Structural camshaft cover
3	-	Cylinder head
4	-	Cylinder block
5	-	Oil pan housing
6	-	Oil pan

Technical Features

The TD4 engine comprises the following key features:

- 16 valve DOHC arrangement, 4 valves per cylinder

- Fuel injectors centrally positioned to the combustion chamber
- Roller finger rockers with hydraulic lash adjusters
- Garrett Rotary Electronic Actuated (REA) variable geometry turbocharger
- Pierburg electronic controlled EGR valve with Visteon EGR cooler
- Bosch generation 3 fuel system with common fuel rail injection technology
- 7-hole piezo-electric type injectors (capable of 5 injections per stroke)
- Advanced Bosch EDC 16 engine management system
- Intake manifold incorporating variable swirl and port de-activation technology
- Electronic intake throttle for controlled engine shut-down
- Counter-balance shaft assembly
- Aluminum alloy cylinder head, and double wall cast-iron cylinder block
- Cylinder head design for optimum air swirl across the engine speed range
- Exhaust emission treatment with a diesel specific catalytic converter and an optional DPF
- Steel crankshaft with double damping flywheel and torsional vibration damper
- Emissions compliant with EUCD Stage 4 legislation.

Technical Details

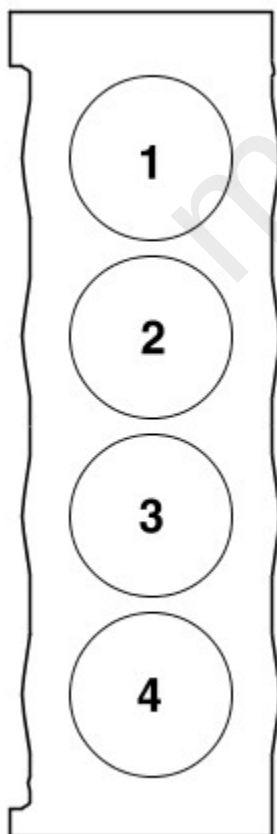
Technical details for the TD4 engine are shown below:

- **NOTE:** The TD4 engine cylinders are numbered from the rear of the engine (transmission end). Therefore, No. 1 cylinder is located at the rear of the engine.

Item	Detail
Engine type	DW12BTED4
Configuration	4 cylinder in-line
Cylinder numbering	No. 1 cylinder at rear of engine (transmission end)
Engine installation	Transverse mounted, tilted 12 degrees toward rear
Bore / stroke	85 mm / 96 mm
Cubic capacity	2179 cm ³
Compression ratio	16.6:1
Emissions compliance	EUCD Stage 4
Maximum power output (kW EU)	118 kW @ 4000 rpm
Maximum torque	400 Nm @ 2000 rpm
Engine idle speed:	Manual transmission 750 rpm Automatic transmission 795 rpm
Engine maximum speed	5000 rpm
Firing order	1-3-4-2
Oil capacity	5.4 liters (5.7 US quarts)

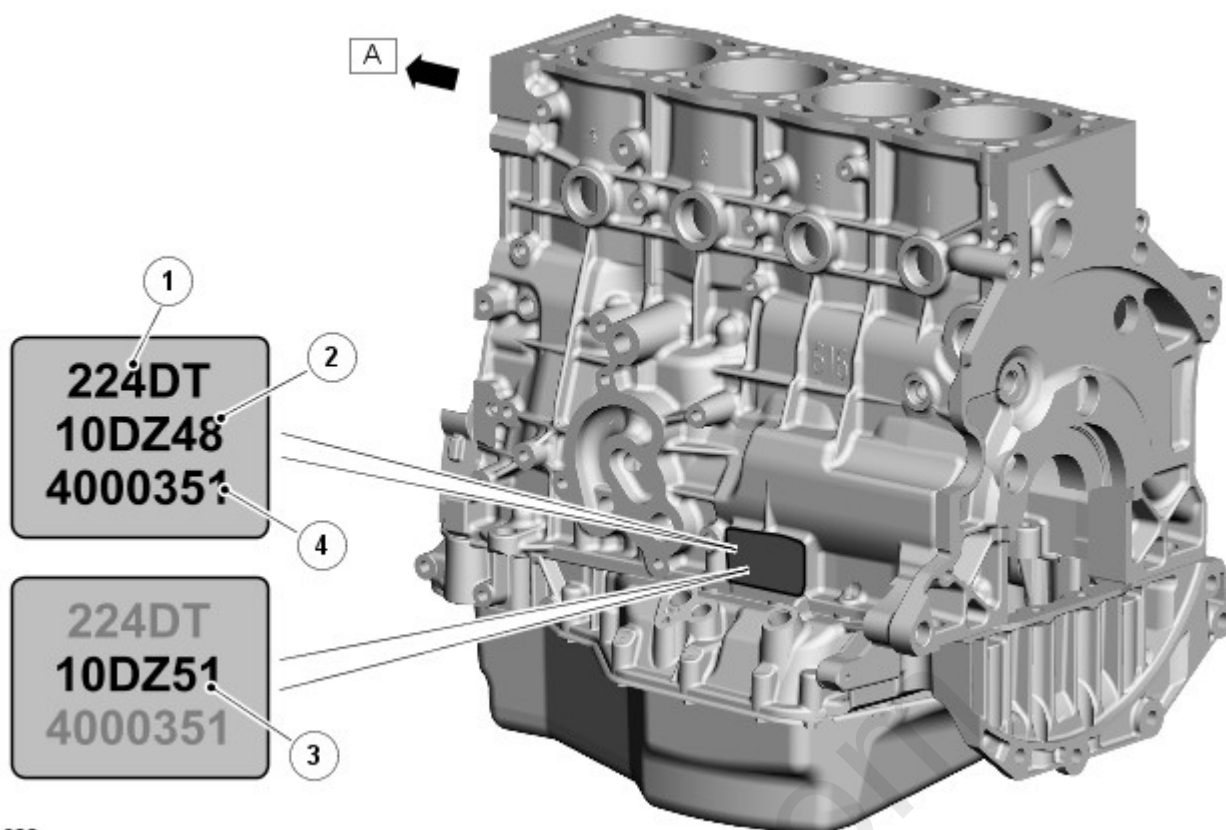
Cylinder Numbering

The cylinders are numbered as shown below, with cylinder 4 at the front of the engine.



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Engine Identification

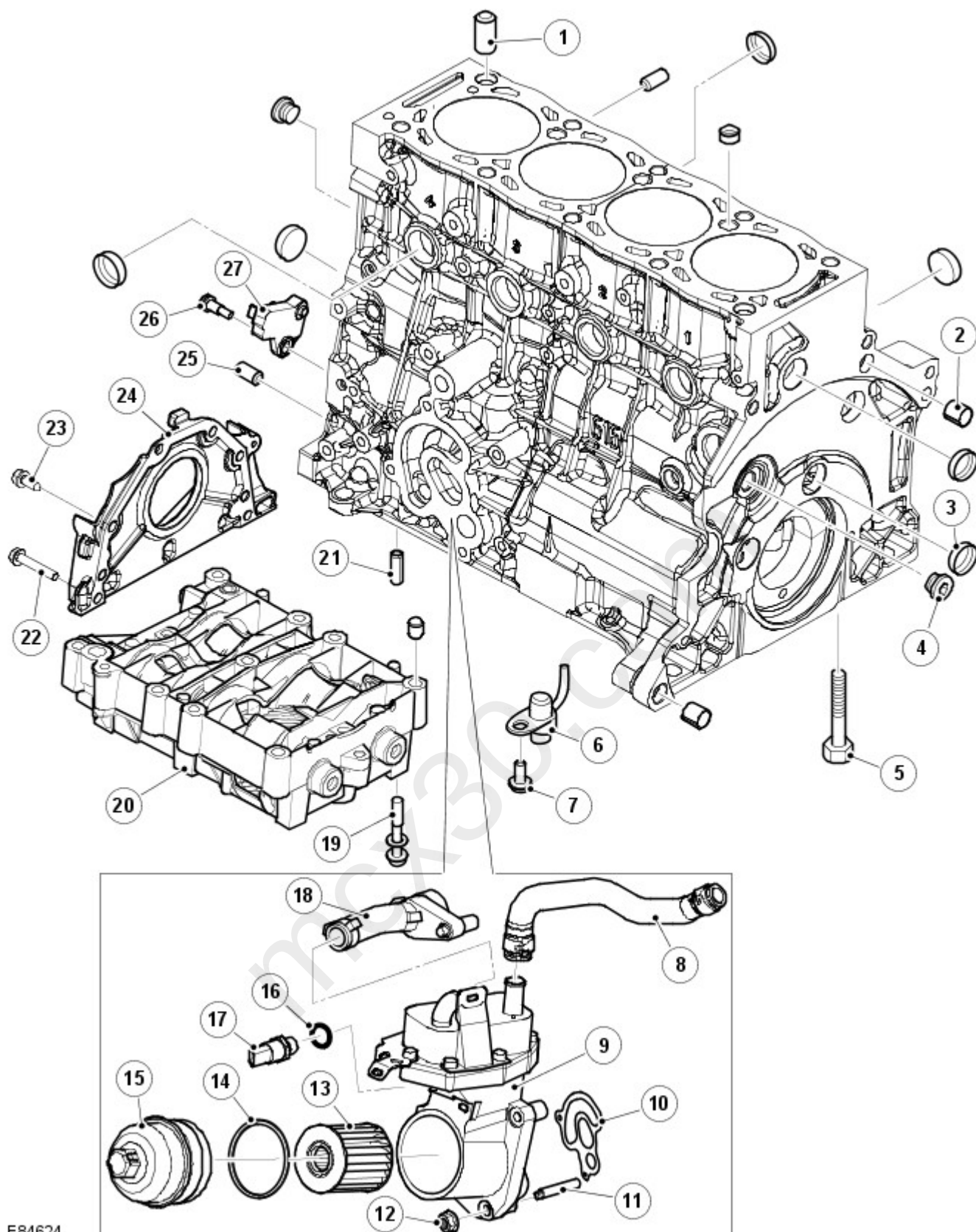


E84623

Item	Part Number	Description
A	-	Front of engine
1	-	Engine type
2	-	Engine variant (manual transmission)
3	-	Engine variant (automatic transmission)
4	-	Engine serial number

Engine identification details are located on the lower LH side (oil filter side) of the cylinder block.

CYLINDER BLOCK COMPONENTS



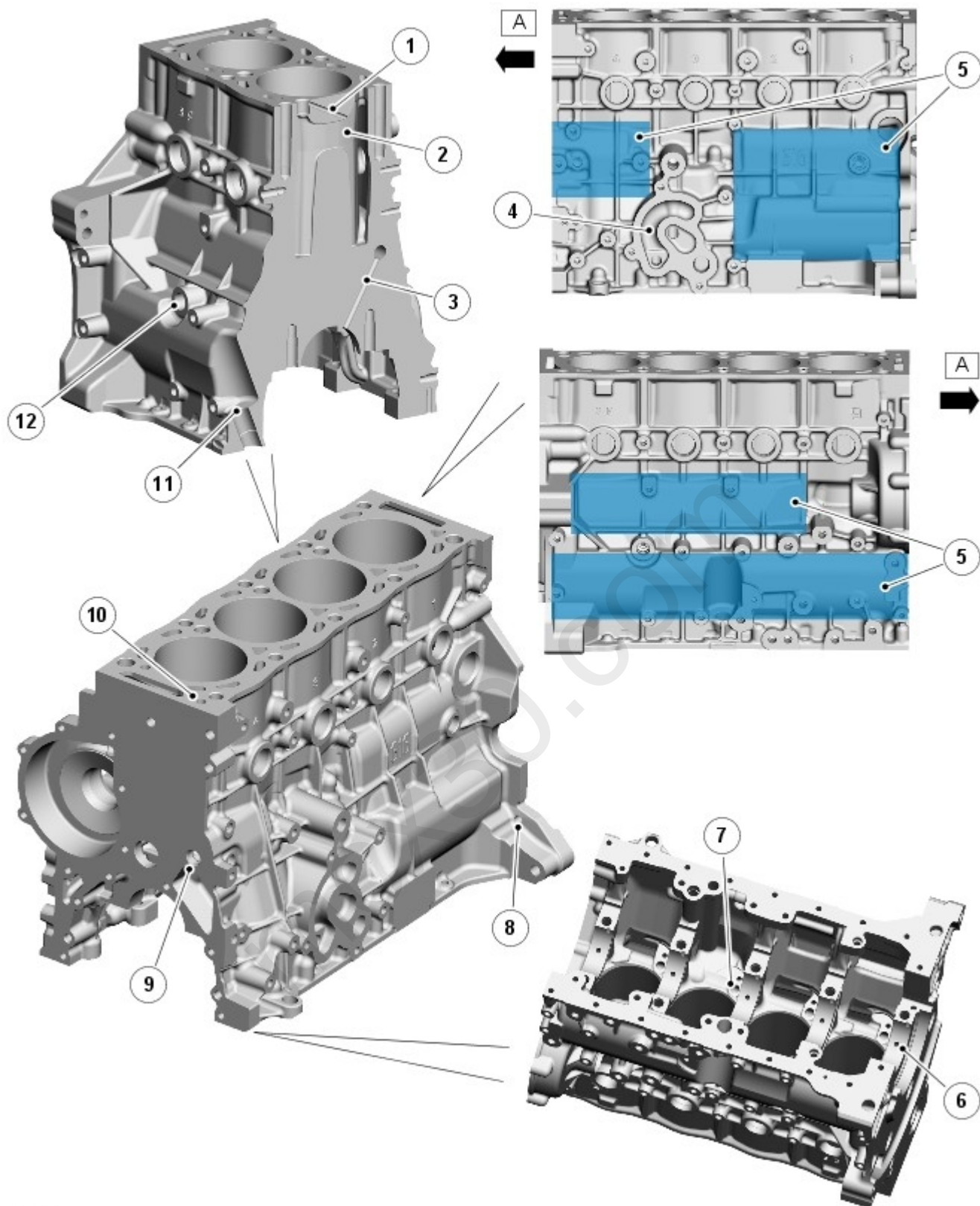
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Item	Part Number	Description
1	-	Cylinder head locating dowel (2 off)
2	-	Transmission housing locating dowels (2 off)
3	-	Core plug (12 off)
4	-	Main oil gallery sealing plug (2 off)
5	-	Main bearing cap bolt (10 off)
6	-	Oil spray jet (4 off)
7	-	Oil spray jet bolt (4 off)
8	-	Coolant return hose from oil cooler
9	-	Oil filter and cooler housing
10	-	Gasket
11	-	Stud (4 off)

12	-	Nut (4 off)
13	-	Oil filter element
14	-	O-ring
15	-	Oil filter cap
16	-	O-ring
17	-	Oil pressure switch
18	-	Coolant supply hose to oil cooler
19	-	Counter-balance shaft housing bolt (8 off)
20	-	Counter-balance shaft housing
21	-	Counter-balance shaft housing locating dowel (2 off)
22	-	Crankshaft front seal adaptor bolt (2 off)
23	-	Crankshaft front seal adaptor bolt (4 off)
24	-	Crankshaft front seal adaptor
25	-	Dowel (4 off)
26	-	Crankshaft position (CKP) sensor screw
27	-	CKP sensor

Cylinder Block

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E84625

Item	Part Number	Description
A	-	Front of engine
1	-	Expansion chamber drilling
2	-	Coolant chamber
3	-	Main bearing oil supply drilling
4	-	Oil filter housing
5	-	Double layer wall (shaded areas)
6	-	Main bearing oil supply port
7	-	Oil spray jet locating port
8	-	Engine timing special tool location
9	-	Main oil gallery
10	-	Cylinder head oil supply drilling

11	-	VGT oil return port
12	-	VGT oil supply port

The cylinder block is manufactured from cast-iron and features double layer walls that provide high strength and rigidity. An air cushion is formed between the layers and also acts to reduce the NVH levels produced by the engine. The block features 5 bolted main bearing journals that also provide high strength and rigidity to the lower end of the engine.

The cylinders are directly bored into the cylinder block and do not require cylinder liners. Two guide sleeves are located in the cylinder block, and provided to correctly align the cylinder head and gasket to the cylinder block.

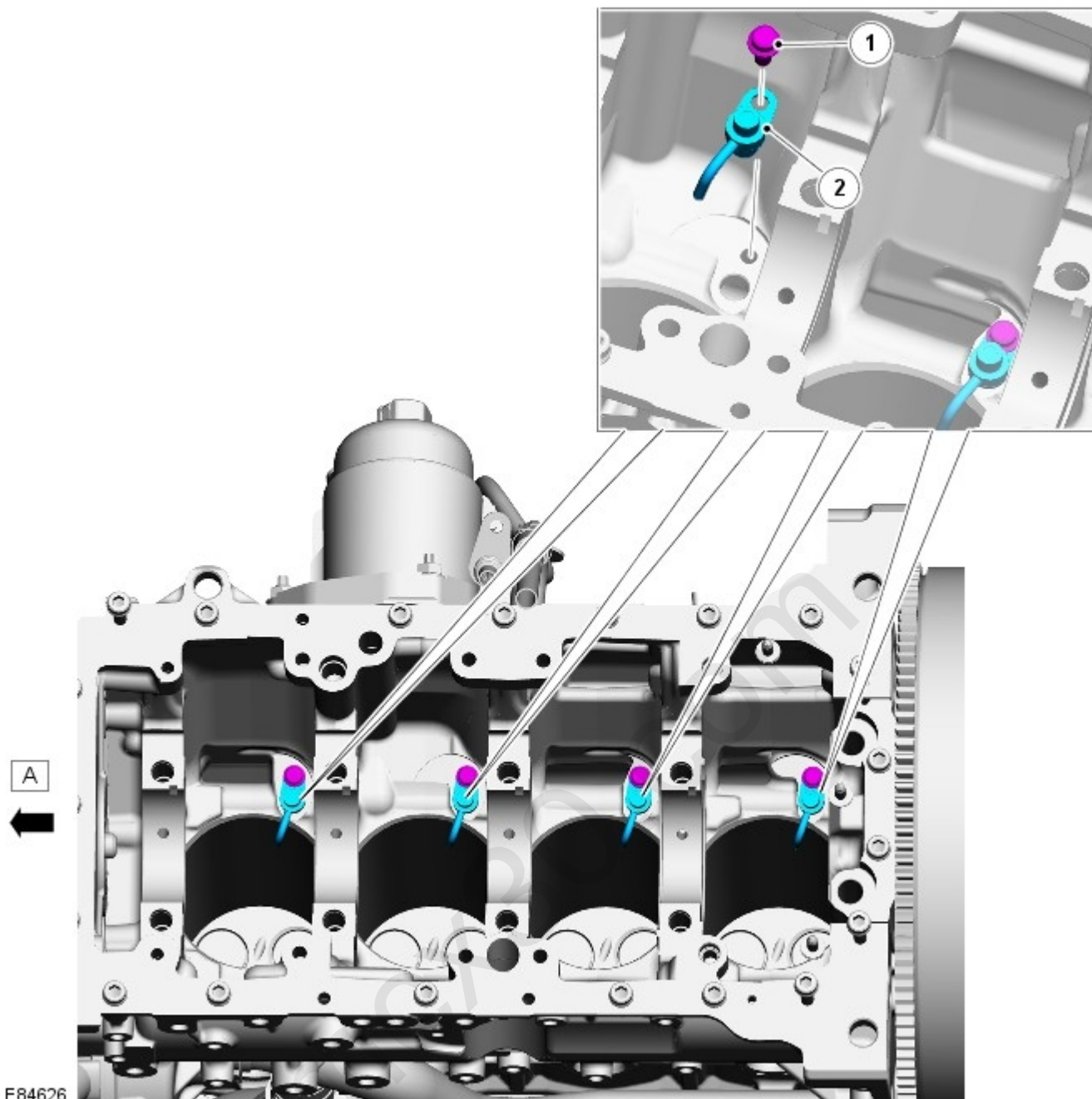
A hole formed in the LH rear of the cylinder block below the starter motor, provides the location for an engine timing special tool. When inserted, the special tool locates in a corresponding hole in the flywheel to temporarily hold the crankshaft with No. 1 piston at the Top Dead Center (TDC) position.

The oil filter and cooler housing, and main oil gallery are located on the LH side of the cylinder block. The main oil gallery is a longitudinal drilling that runs the length of the cylinder block, and supplies pressurized oil to all the engine moving components. Pressurized oil is diverted from the main oil gallery to supply the main and big-end bearings via diagonal oil drillings in the cylinder block, and in the crankshaft journals. The main oil gallery is sealed at each end with a screwed plug.

A cross drilling above No. 2 main bearing directs pressurized oil from the main oil gallery to a port at the Right-Hand (RH) side of the cylinder block. The port supplies pressurized oil via a banjo type connection to the VGT bearings. Return oil from the VGT is directed via a pipe and a connection at the RH side of the block, into the oil pan. A vertical drilling at the LH front of the cylinder block supplies pressurized oil from the main oil gallery, up to a corresponding oil gallery in the cylinder head.

Engine cooling is achieved with inter-cylinder coolant chambers and expansion chamber drillings, formed in the cylinder block coolant jacket. The coolant chambers direct coolant through openings in the block upper surface to the cylinder head. Core plugs seal the exterior openings formed in the cylinder block coolant jacket.

Oil Spray Jets

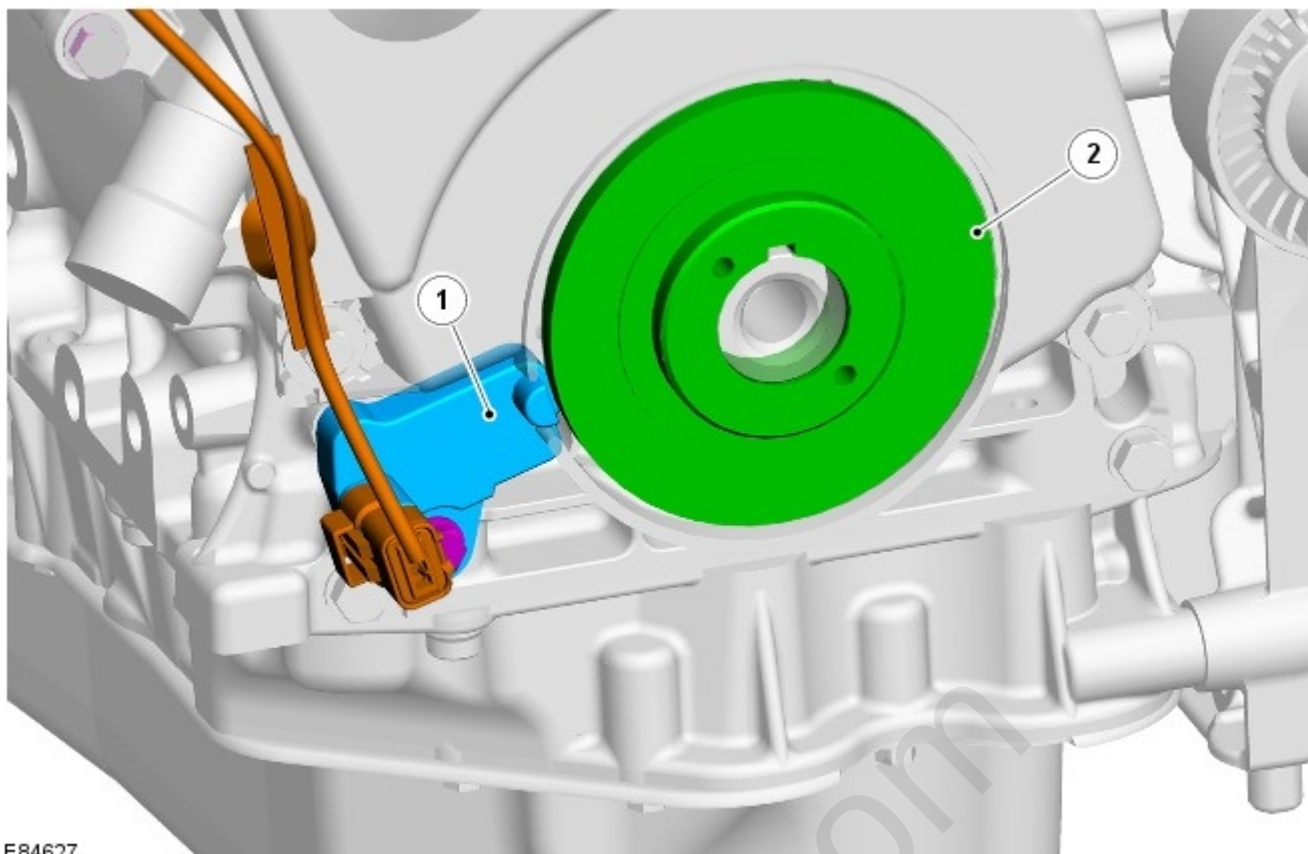


Item	Part Number	Description
A	-	Front of engine
1	-	Oil spray jet bolt (4 off)
2	-	Oil spray jet (4 off)

The 4 oil spray jets are installed in the LH side of cylinder block below each cylinder. The jet body is seated directly into the main oil gallery. Pressurized oil is sprayed beneath each piston to lubricate the cylinder wall and gudgeon pin, and to cool the piston crown. As the spray contacts the underside of the piston, the oil collects and flows around 2 formed cooling channels to cool the piston crown.

A valve installed in the spray jet body prevents oil spray, until the lubrication system pressure is greater than 0.5 bar (7.25 psi).

Crankshaft Position Sensor



E84627

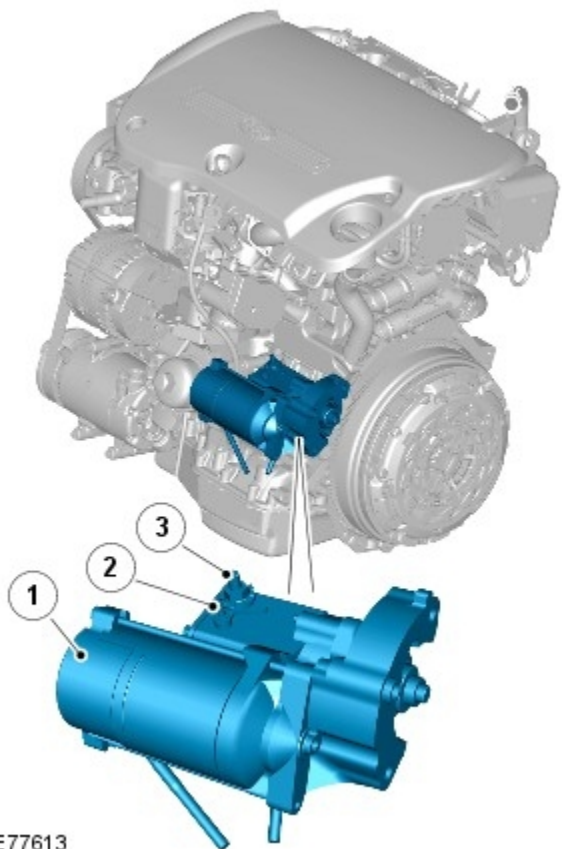
Item	Part Number	Description
1	-	CKP sensor
2	-	CKP sensor target ring

A CKP sensor is installed at the front of the engine, and is secured to the cylinder block with a locating dowel and screw. The position of the sensor is not adjustable. The sensor head is positioned close to a corresponding target ring located behind the crankshaft drive pulley. The target ring is keyed on to the crankshaft.

The sensor is a variable reluctance sensor that provides an input of engine crankshaft speed, and No. 1 piston position to the ECM. The information is used by the ECM to determine the quantity of fuel to be injected, start of fuel delivery, and quantity of exhaust gas to be recirculated.

For additional information, refer to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq - Td4, Description and Operation).

Starter Motor



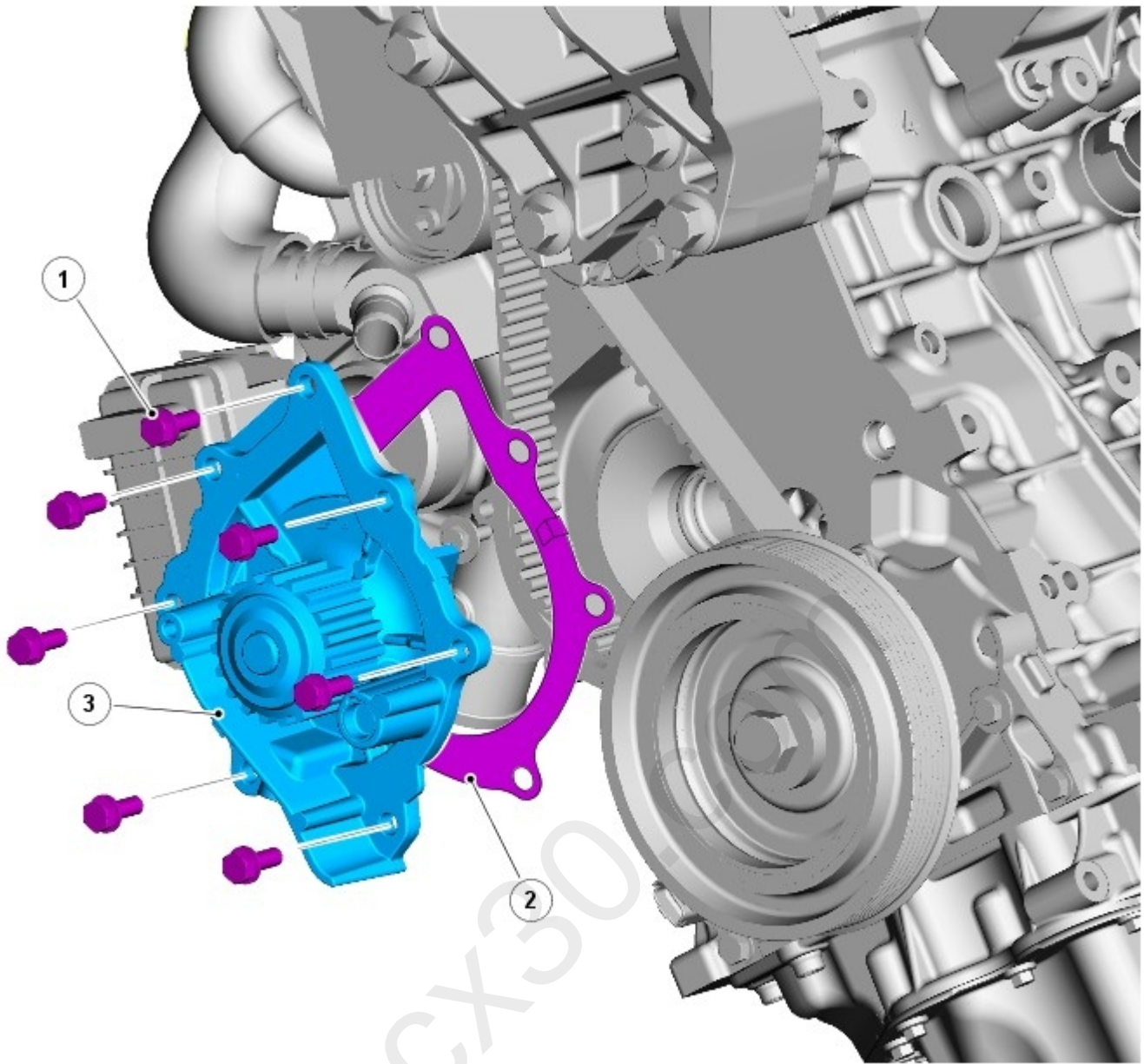
E77613

Item	Part Number	Description
1	-	Starter motor
2	-	Battery to solenoid connection
3	-	Battery positive connection

The starter motor is located on the rear LH side of the engine at the cylinder block to oil pan housing split line. The motor is attached to the transmission casing with 3 fixings.

For additional information, refer to: [Starting System](#) (303-06B Starting System - TD4 2.2L Diesel, Description and Operation).

Coolant Pump



E82907

Item	Part Number	Description
1	-	Bolt (7 off)
2	-	Gasket
3	-	Coolant pump

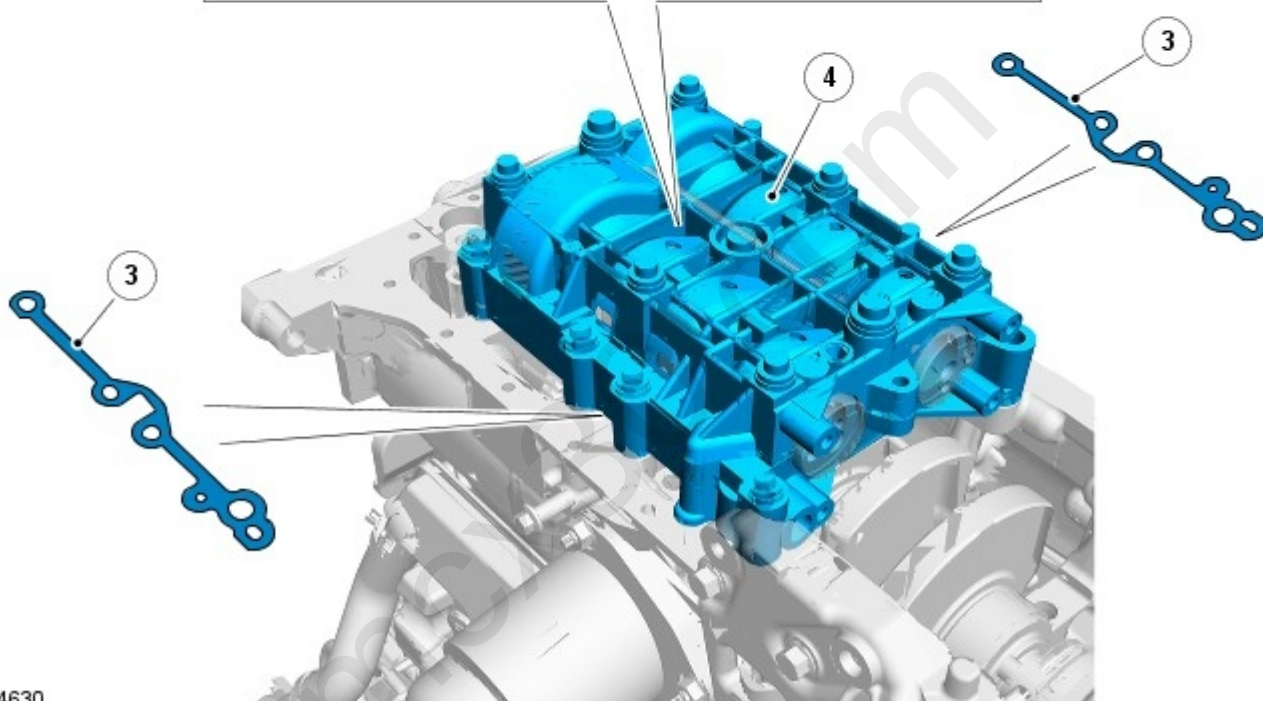
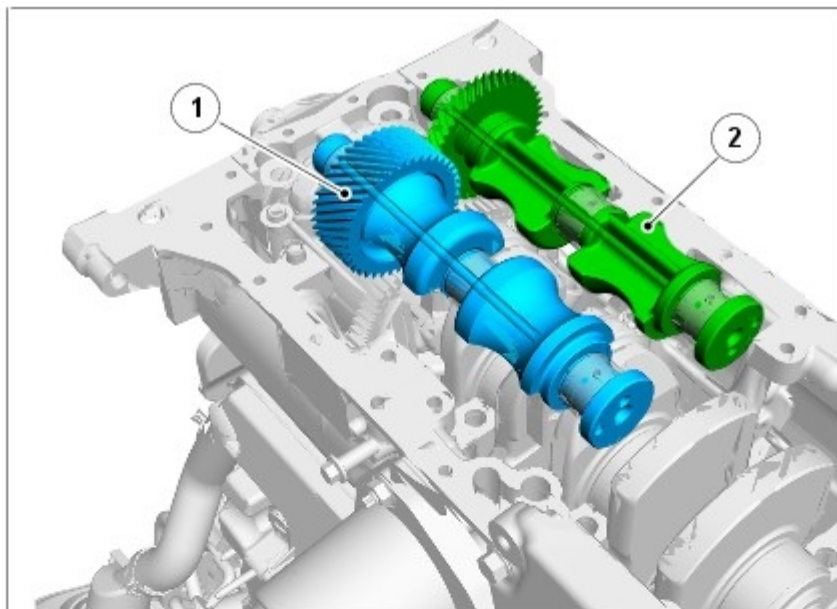
The engine coolant pump is a centrifugal type, and is directly driven by the toothed camshaft belt. A sealing gasket and 7 bolts secure the pump to the front RH side of the cylinder block.

For additional information, refer to: [Engine Cooling](#) (303-03B Engine Cooling - TD4 2.2L Diesel, Description and Operation).

Oil Filter and Cooler Assembly

A combined engine oil cooler and filter assembly is mounted on the LH side of the engine block, in-line with No. 3 cylinder. The filter housing contains a disposable paper filter element, and an oil pressure switch. For further information, refer to 'Lubrication System' within this section.

Counter-Balance Shaft Assembly



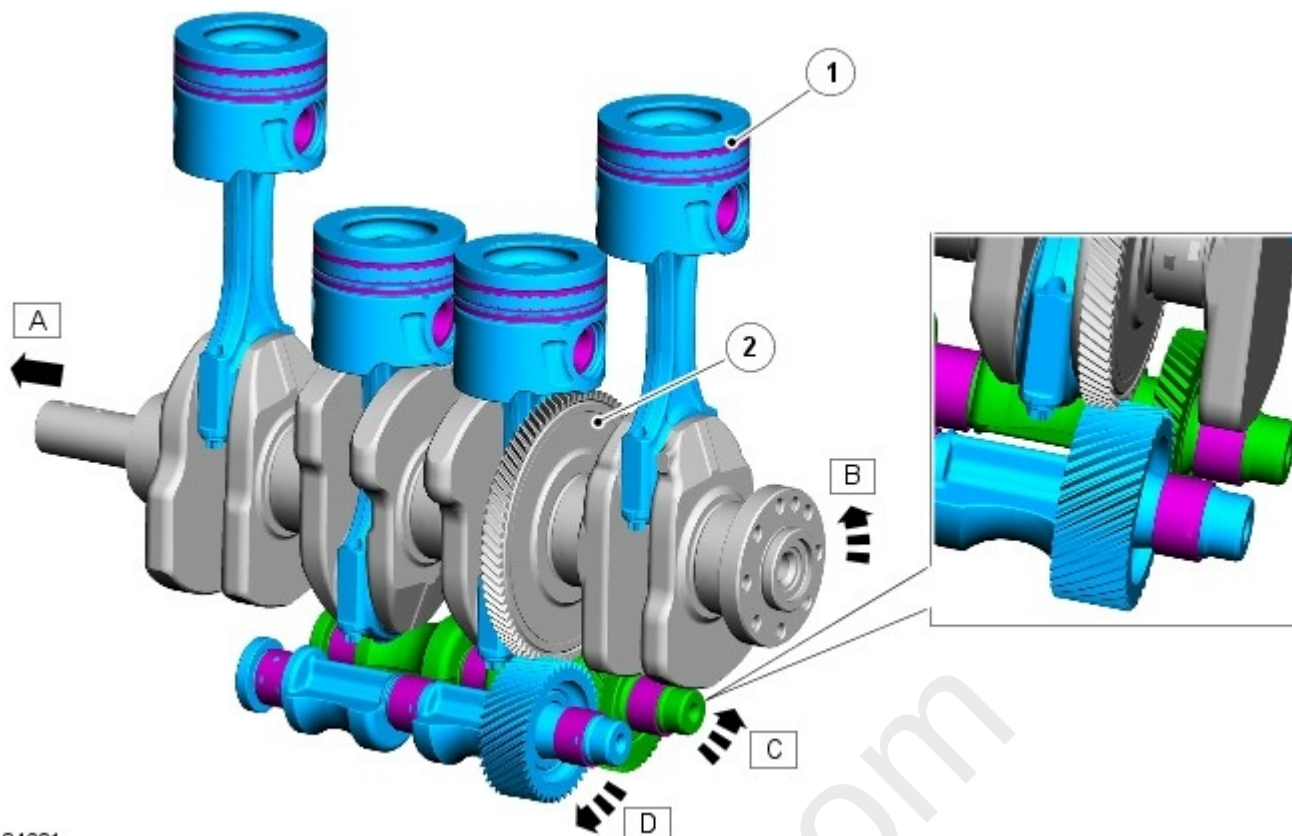
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Item	Part Number	Description
1	-	Contra-rotating balance shaft
2	-	Balance shaft
3	-	Shim plate
4	-	Counter-balance shaft housing

The counter-balance shaft assembly contains 2 balance shafts and is located below the crankshaft. The assembly is attached with 8 bolts to the bottom of the cylinder block. The 2 shafts are each formed with a single helical drive gear, and are accurately machined and balanced as a matched assembly. The counter-balance shaft assembly must not be separated.

The counter-balance shaft housing provides the mounting location for the oil pump. A port at the front of the housing mates with an oil supply port from the oil pump. A further port at the top of the housing mates with a port in the cylinder block. Pressurized oil from the oil pump is directed through the counter-balance shaft housing port and cylinder block to the oil filter and cooler assembly.

Balance Shaft Drive



E84631

Item	Part Number	Description
A	-	Front of engine
B	-	Direction of crankshaft
C	-	Direction of balance shaft
D	-	Direction of contra-rotating balance shaft
1	-	No. 1 piston
2	-	Counter-balance shaft drive gear

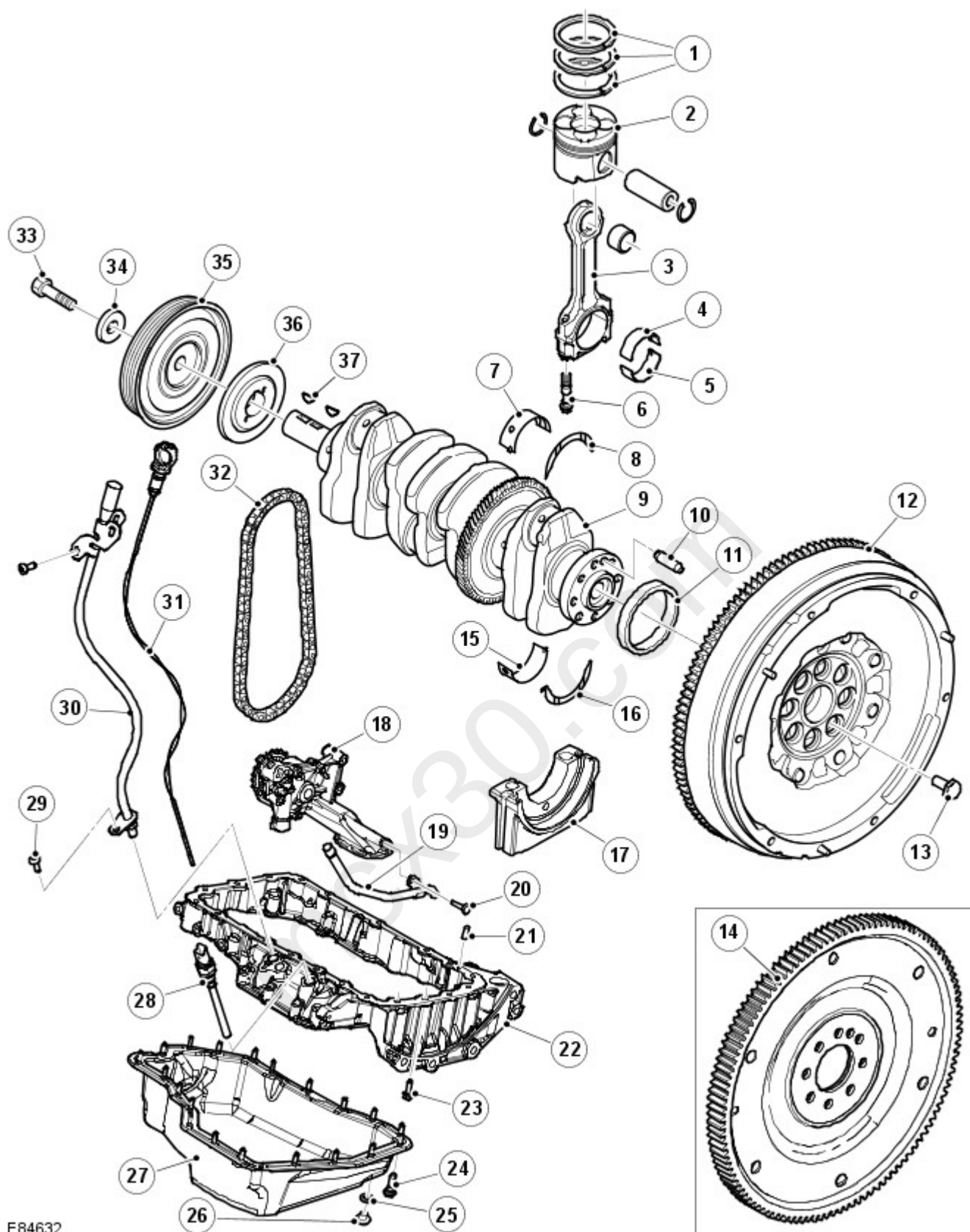
A formed helical drive gear on the crankshaft provides the drive to the counter-balance shaft assembly. The crankshaft drive gear contains twice the number of teeth as each of the balance shaft gears, and therefore drives the 2 balance shafts at twice crankshaft speed. The crankshaft gear drives the contra-rotating balance shaft in the opposite direction to the crankshaft. The remaining balance shaft is driven by the contra-rotating balance shaft in the direction of the crankshaft.

A shim plate is located between each side of the balance shaft housing and the cylinder block skirt. The shims are available in varying thickness and are used to provide the correct backlash between the crankshaft drive gear, and the contra-rotating shaft gear. The backlash between each balance shaft gear may be checked, but is not adjustable.

The rotating balance shafts create an opposing force to counter the imbalance forces produced by the engines reciprocating components. The imbalance is created in a 4 cylinder engine as pairs of pistons move in opposite directions during the engine strokes. To counter the opposing forces of the paired pistons, the balance shaft weights must be at Bottom Dead Center (BDC) when a piston pair is at TDC.

Lubrication of the counter-balance shaft assembly is by splash oil.

CRANKSHAFT AND OIL PAN COMPONENTS

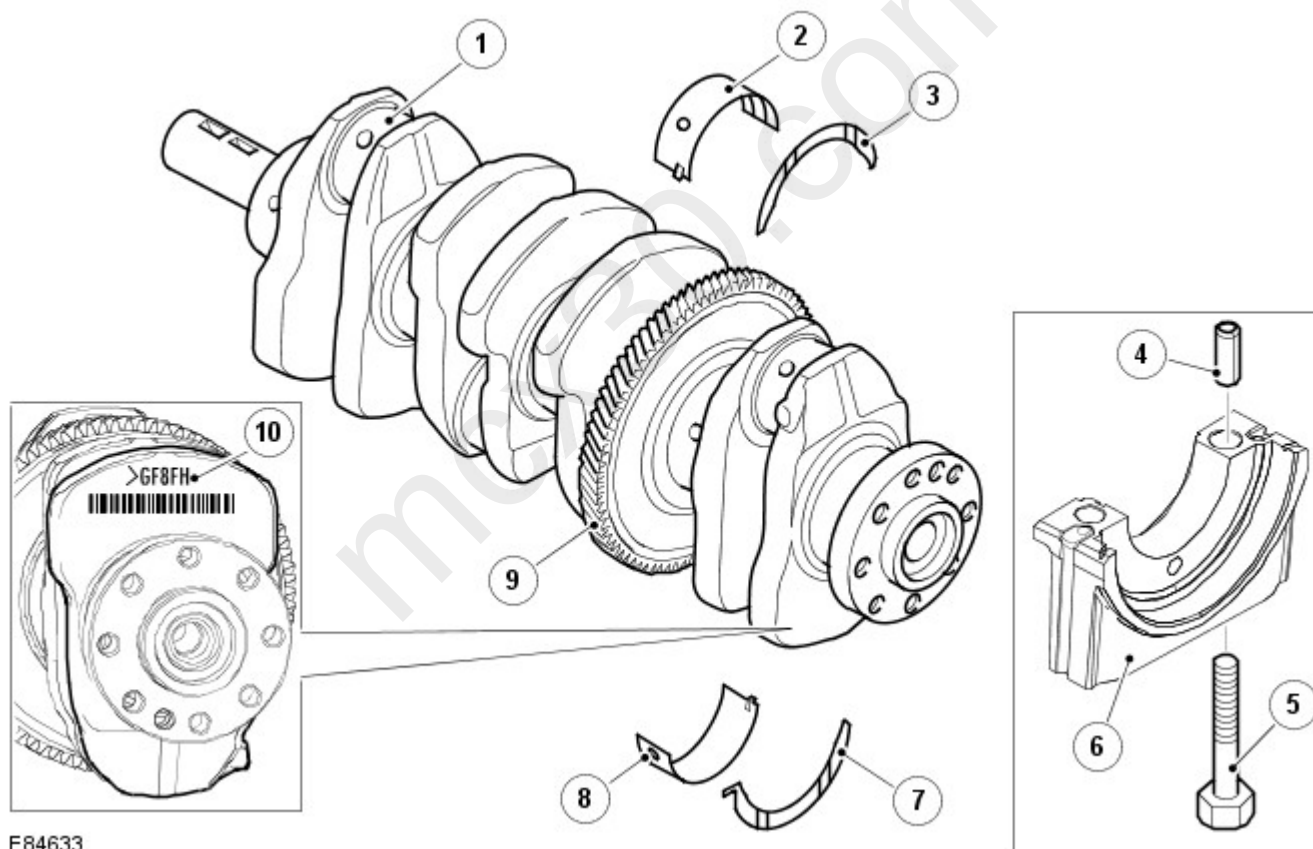


E84632

Item	Part Number	Description
1	-	Piston ring set (3 rings per piston)
2	-	Piston assembly
3	-	Connecting rod assembly
4	-	Big-end bearing upper half shell (4 off)
5	-	Big-end bearing lower half shell (4 off)
6	-	Big-end bearing half cap bolt (8 off)
7	-	Main bearing upper half shell (4 off)
8	-	Upper thrust washer (2 off)
9	-	Crankshaft
10	-	Locating dowel
11	-	Crankshaft rear oil seal

12	-	Dual mass flywheel (manual transmission vehicles)
13	-	Bolt (8 off)
14	-	Torque converter flex-plate (automatic transmission vehicles)
15	-	Main bearing lower half shell (4 off)
16	-	Lower thrust washer (2 off)
17	-	Main bearing half cap (5 off)
18	-	Oil pump
19	-	Oil level gage tube (lower)
20	-	Bolt
21	-	Locating dowel
22	-	Oil pan housing
23	-	Oil pan housing bolt (20 off)
24	-	Oil pan captive bolt (21 off)
25	-	Oil drain plug seal
26	-	Oil drain plug
27	-	Oil pan
28	-	Oil temperature sensor
29	-	Screw (2 off)
30	-	Oil level gage tube (upper)
31	-	Oil level gage
32	-	Oil pump drive chain
33	-	Crankshaft pulley bolt
34	-	Plain washer
35	-	Crankshaft pulley and torsional vibration damper
36	-	CKP sensor target ring
37	-	Woodruff key (2 off)

Crankshaft and Main Bearings



E84633

Item	Part Number	Description
1	-	Crankshaft
2	-	Main bearing upper half shell (4 off)
3	-	Upper thrust washer (2 off)
4	-	No. 1 main bearing cap locating dowel (2 off)
5	-	Main bearing cap bolt (10 off)
6	-	Main bearing half cap (5 off)
7	-	Lower thrust washer (2 off)
8	-	Main bearing lower half shell (4 off)
9	-	Counter-balance shaft drive gear
10	-	Main bearing classification markings

The crankshaft is manufactured from steel and formed with 5 main bearing and 4 connecting rod big-end journals. The main bearing journals locate in the cylinder block main bearing housings, and are clamped by the 5 main bearing half caps. Each main bearing half cap is stamped with the corresponding cylinder number for identification. The main bearing half cap identified with '1F' must be positioned at the transmission end of the engine (No. 1 end).

Lateral movement of the crankshaft is restricted by 4 half-round thrust washers, located on both sides of No. 2 main bearing. Lubrication grooves are formed on the thrust washers and must face toward the main bearing. The crankshaft end-float must be between 0.07 mm (0.003 in) and 0.32 mm (0.013 in).

Each main bearing housing and half cap contains an upper and lower bearing half shell manufactured from aluminum/tin. The upper half shells are formed with a drilling and annular groove to transfer pressurized oil from the main bearing, through crankshaft drillings to the connecting rod big-end bearings.

The main bearing half caps and the upper and lower bearing half shells are formed with a lug. The lug allows correct alignment of the bearing and cap, and prevents radial movement of the bearing.

To maintain the correct crankshaft main bearing clearance, the main bearing half shells are available in varying thickness. The upper main bearing half shell is only available in 1 size; the lower main bearing half shell is available in 5 sizes. Both the upper and lower main bearing half shells are color coded for identification. To determine the correct size of bearing half shell, classification markings on the crankshaft front face and on the cylinder block front face are used in conjunction with a bearing size chart.

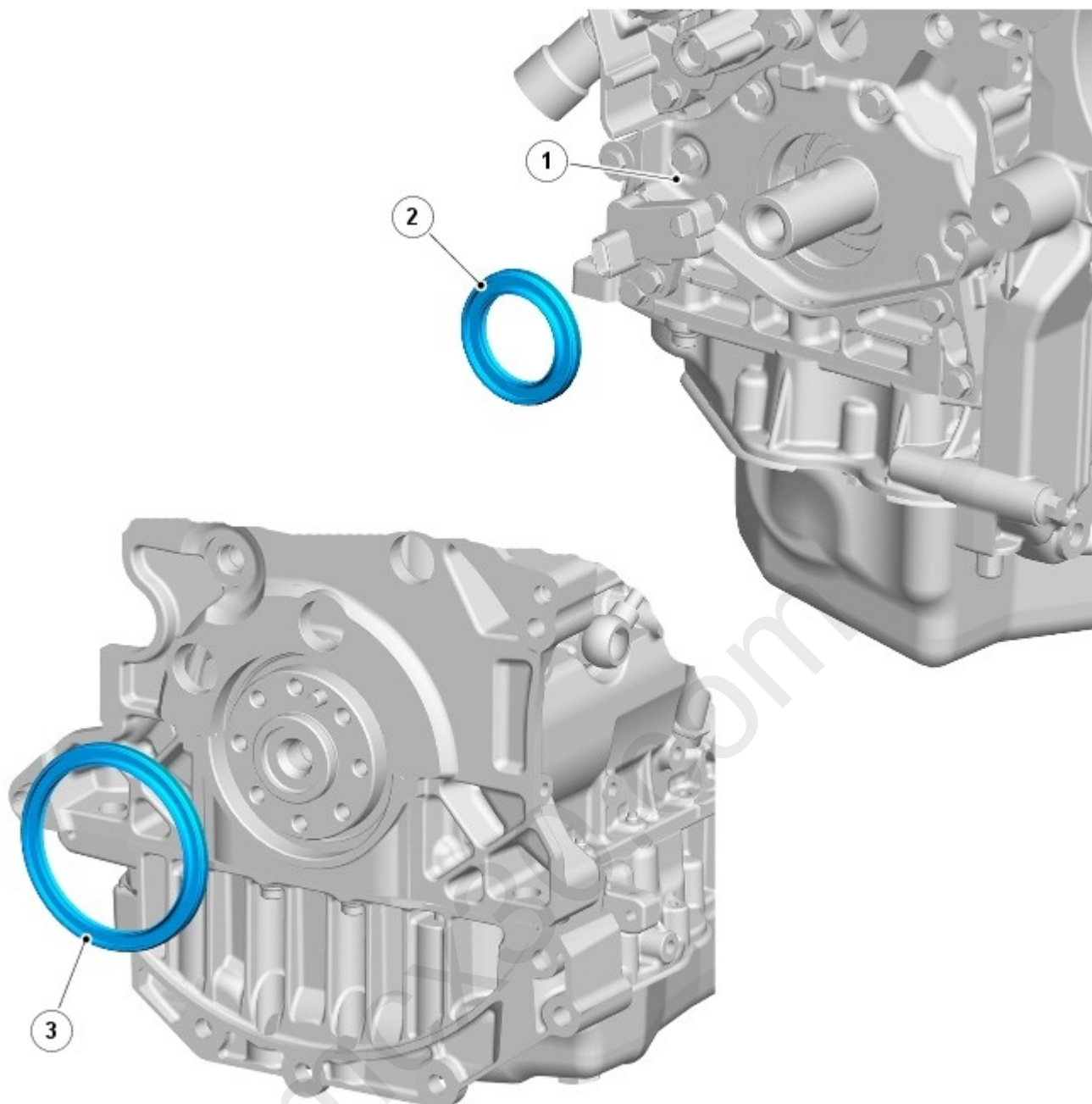
For further details on main bearing half shell installation, refer to the relevant Service Repair Procedures (SRP).

A drive gear is formed as a 'shrink-fit' on No. 3 crankshaft web, located between No. 2 main bearing journal and No. 2 connecting rod big-end journal. The drive gear is single helical cut and provides the drive to the counter-balance shaft gears. An 18 teeth spur gear is located on the front of the crankshaft, behind the front crankshaft sealing plate. The spur gear provides the drive to the oil pump assembly via a single row chain, and is locked to the crankshaft with a woodruff key.

A toothed gear mounted to the front of the crankshaft provides the drive for the camshaft timing belt. The drive gear contains 21 teeth and is keyed to the crankshaft with a woodruff key.

Crankshaft Oil Seals

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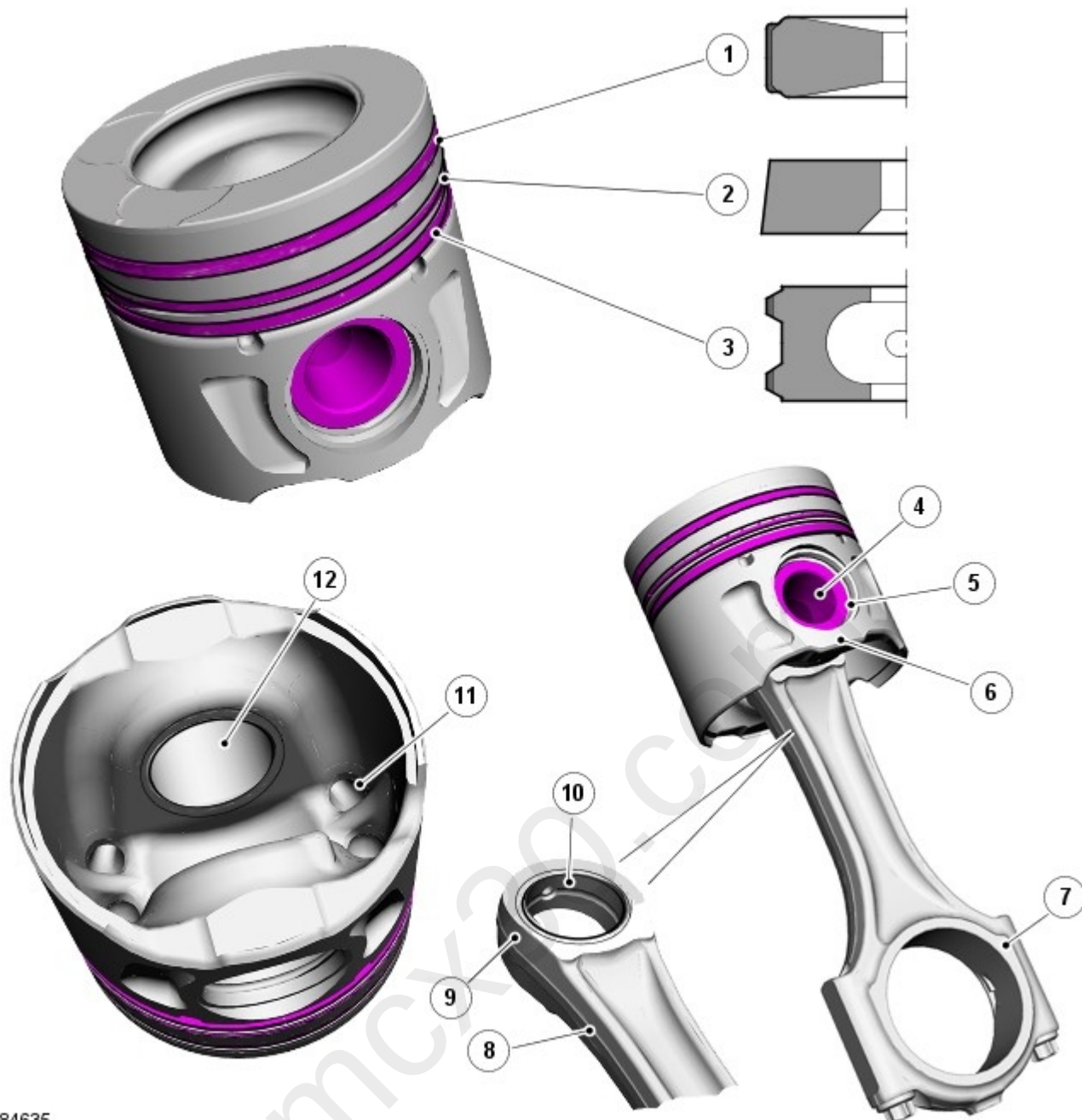


E84634

Item	Part Number	Description
1	-	Crankshaft front seal adaptor
2	-	Crankshaft front oil seal
3	-	Crankshaft rear oil seal

The crankshaft is sealed to the cylinder block at the front and rear ends with lip type oil seals. Each seal is pressed into the corresponding front and rear cylinder block housing, with the lip facing the crankshaft. Special tools are required for removal and installation of the crankshaft seals.

Connecting Rods and Pistons



E84635

Item	Part Number	Description
1	-	Upper compression ring
2	-	Lower compression ring
3	-	Oil control 'scraper' ring
4	-	Gudgeon pin
5	-	Gudgeon pin circlip (2 off)
6	-	Piston and connecting rod assembly
7	-	Connecting rod big-end
8	-	Connecting rod shaft
9	-	Connecting rod small-end
10	-	Small-end bush
11	-	Piston crown cooling channel
12	-	Piston bush (2 off per piston)

The connecting rods are manufactured from forged steel with an 'I' beam shaft construction to provide high strength and durability. The connecting rod small-end is narrowed on each side to form a tapered head. The taper improves the distribution of force between the piston and connecting rod during the combustion stroke. A bronze bush is installed in the small-end, and formed with an internal groove to allow the flow of lubricating oil around the bush.

The connecting rod big-end is cut and machined at the joint to form a bearing housing and bearing cap that is secured by 2 bolts. The cylinder position is stamped on adjoining sides of the joint to identify matching connecting rods and bearing caps. A half shell bearing is installed in each half of the connecting rod big-end. The connecting rod bearing housings and shell bearings are manufactured with a lug that correctly aligns the bearing in the housing, and prevents radial movement of the bearing shells. During installation the lugs must face toward the LH side (oil filter side) of the engine.

To maintain the correct crankshaft big-end bearing clearance, the half shell bearings are available in varying thickness. The lower bearing half shell is only available in 1 size; the upper bearing half shell is available in 3 sizes.

For further details on connecting rod big-end bearing installation, refer to the relevant Service Repair Procedures (SRP).

The pistons are manufactured from aluminum alloy and are installed with 2 compression rings, and an oil control ring with a spiral spring. A steel insert is installed in the piston upper ring groove to provide reinforcement. The piston crown is a toroidal design that forms a pronounced bowl in the center of the piston head. Recesses are also formed in the piston crown to provide clearance for the 4 valve heads. This design of combustion chamber promotes high levels of swirl and turbulence required for complete combustion of the air/fuel mixture, and also improves the engine emissions.

The 3 piston rings must be installed with the ring gaps spaced at 120° (with permissible tolerance of 15° to 20°) to each other, around the piston. The 2 upper compression rings are stamped with 'top' to aid installation. The gap of the double beveled oil control ring must also be opposite the spiral spring joint.

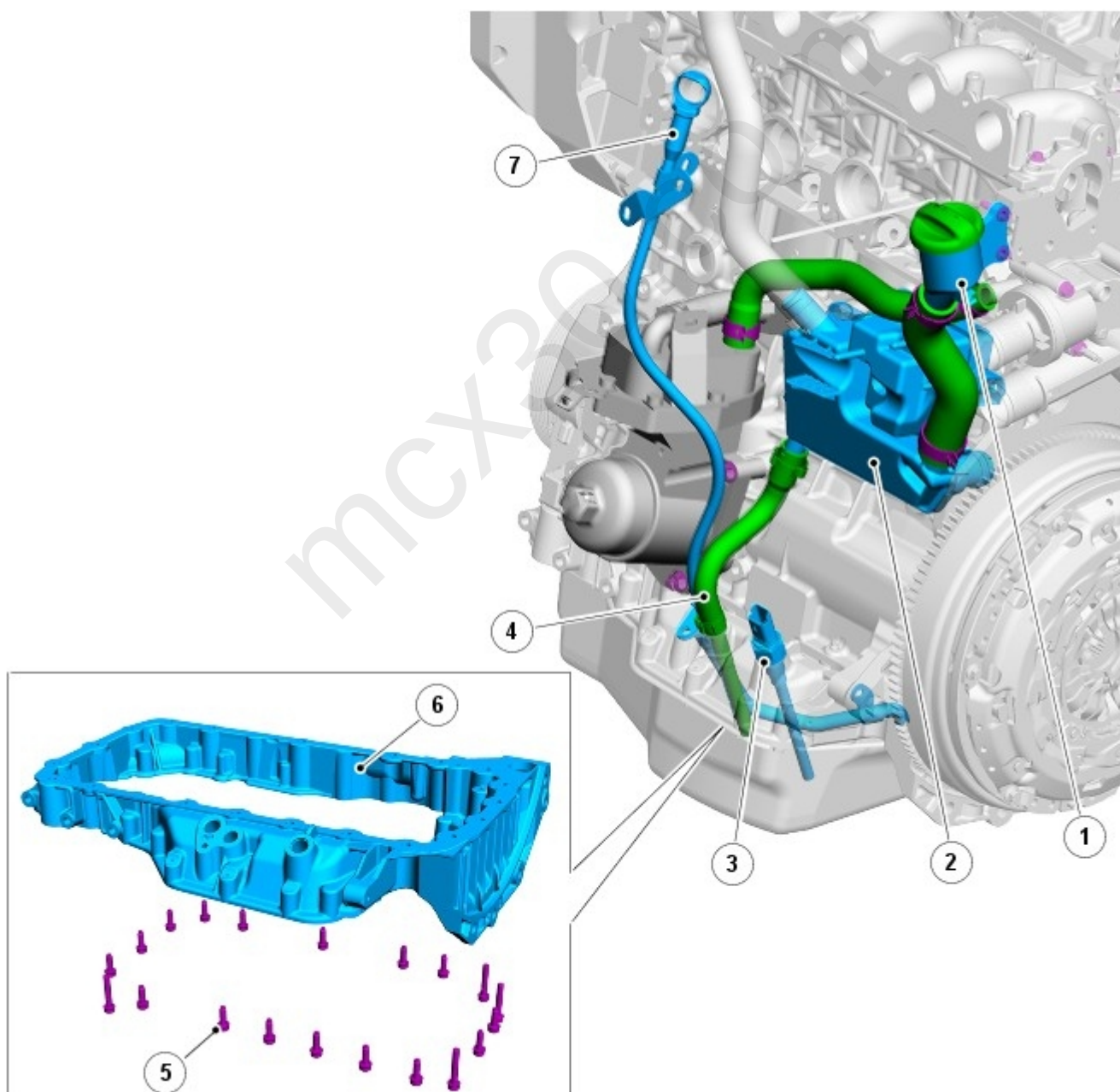
The full skirt piston is coated with a graphite based substance to reduce friction with the cylinder bore. The graphite based coating is especially important during the engine running in period and start-up. The piston also incorporates 2 oil cooling channels that are formed on the underside of the piston head.

Two bushed holes are formed at opposite sides of the piston skirt for installation of a fully floating gudgeon pin. The gudgeon pin passes through the piston bushed holes and connecting rod small-end, and is retained at each end with a circlip. The piston, gudgeon pin and connecting rod small-end are supplied with oil from an oil spray jet, located below each cylinder bore.

During installation of the pistons, the stamped direction arrow and 'DIST' on each piston crown must face toward the front of the engine (accessory drive end).

For further details on piston and piston ring installation, refer to the relevant Service Repair Procedures (SRP) manual.

Oil Pan Housing and Oil Separator



Item	Part Number	Description
1	-	Oil filler tube
2	-	Oil separator
3	-	Oil temperature sensor
4	-	Oil separator return pipe
5	-	Oil pan housing bolts (20 off)
6	-	Oil pan housing
7	-	Oil level gage

The aluminum oil pan housing is secured with 20 bolts to the bottom of the cylinder block, and forms an extension between the cylinder block and oil pan. The oil pan housing is required in order to increase the distance between the oil pump and oil pan, due to the installation of the counter-balance shaft assembly.

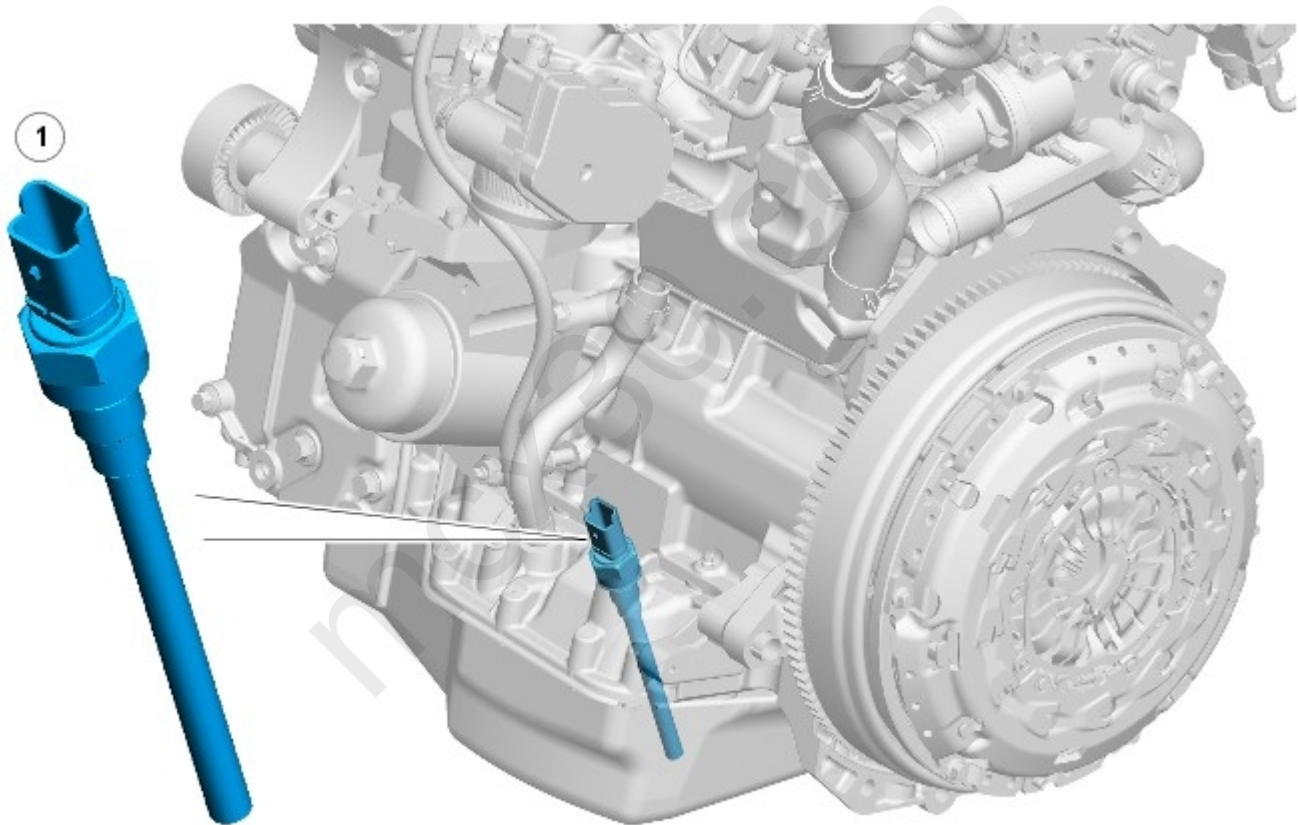
The rear of the oil pan housing provides the lower mounting points for the transmission casing. Drillings formed in the LH side of the housing provide the location for the oil level gage tube, oil temperature sensor, and the return hose from the crankcase ventilation oil separator.

The crankcase ventilation oil separator is also connected to the oil filler tube, located at the rear LH side of the engine. Oil for replenishing the system passes through the oil separator and return hose, and into the oil pan. An oil baffle plate is installed in the oil pan housing to reduce oil aeration and splash.

Oil Pump

The rotor type oil pump is located between the oil pan and oil pan housing, and attached with 5 bolts to the front of the counter-balance shaft assembly. The oil pump is driven by the crankshaft via a single row chain. For further information, refer to 'Lubrication System' within this section.

Oil Temperature Sensor



E84629

Item	Part Number	Description
1	-	Oil temperature sensor

The oil temperature sensor is located at the rear LH side of oil pan housing. The sensor body is screwed into the oil pan housing with the tip protruding into the oil pan. The sensor provides oil temperature information to the ECM. For additional information, refer to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq - Td4, Description and Operation).

Oil Pan



E84636

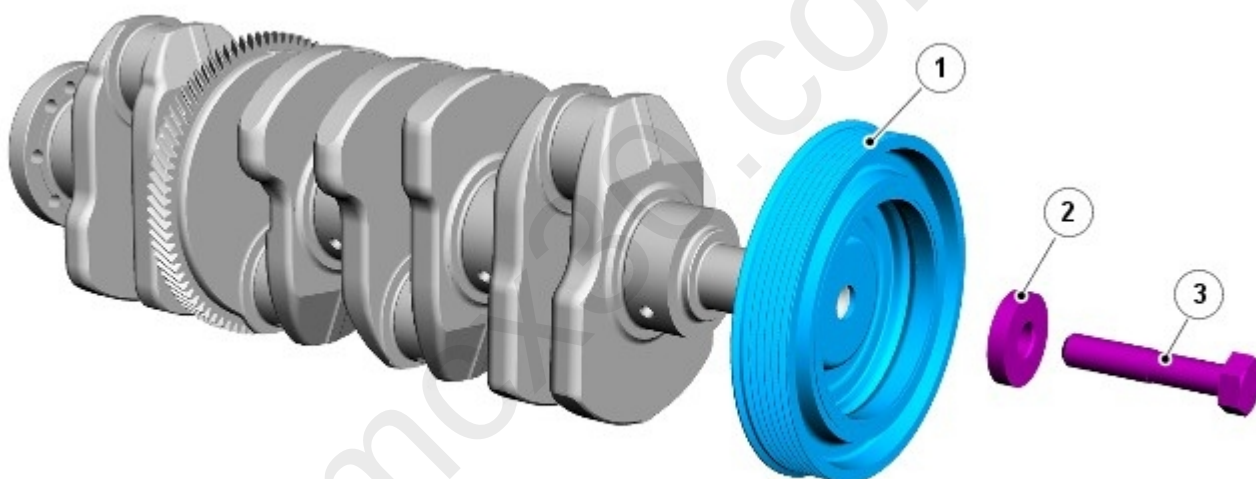
Item	Part Number	Description
1	-	Oil pan
2	-	Oil pan captive bolt (21 off)
3	-	Oil drain plug

The pressed steel oil pan is sealed with a liquid sealant, and secured with 21 captive bolts to the oil pan housing. An engine oil drain plug is located at the rear RH side of the oil pan.

• **NOTE:** The vehicle undertray must be removed to gain access to the oil pan drain plug.

The oil level gage is located on the LH side of the engine. Two notches in the end of the gage indicate the minimum and maximum oil levels. For further information, refer to 'Lubrication System' within this section.

Crankshaft Pulley and Torsional Vibration Damper



E84639

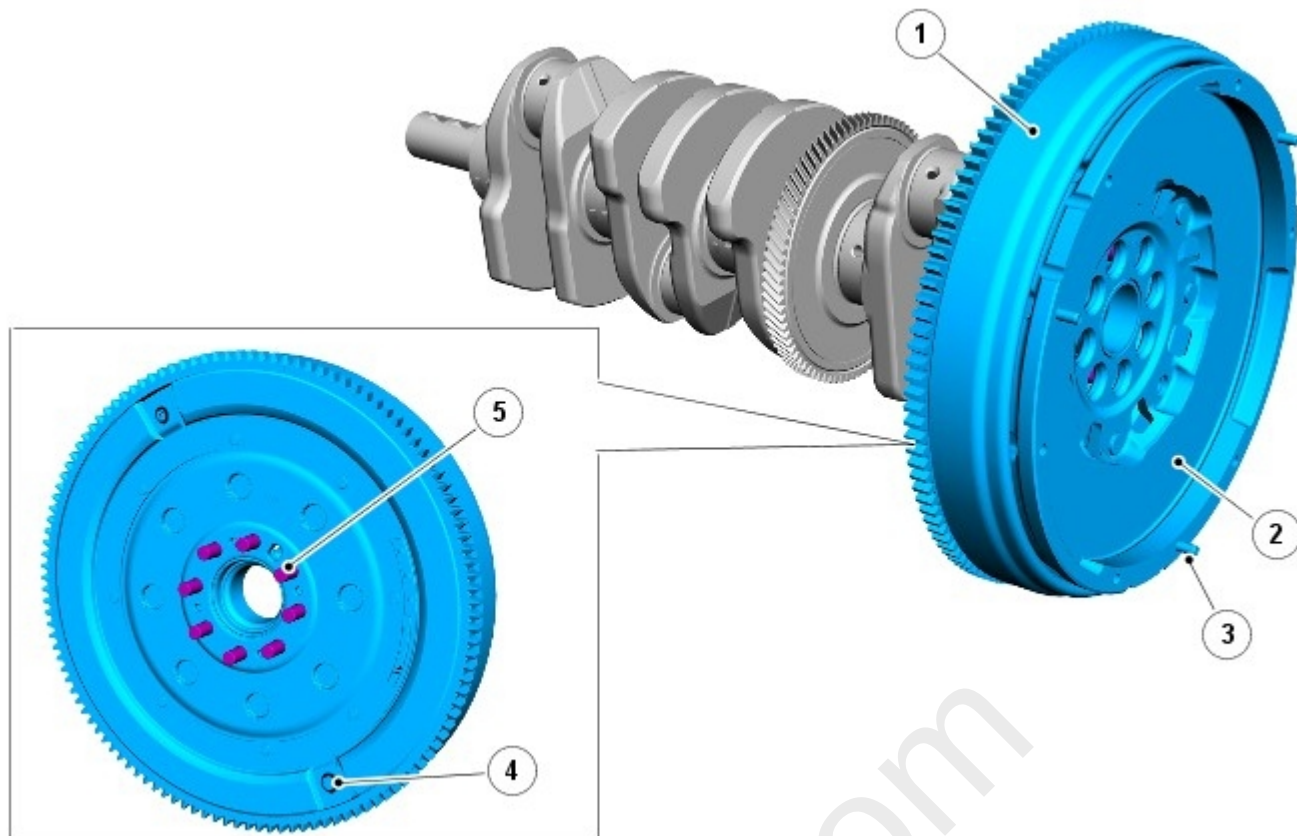
Item	Part Number	Description
1	-	Crankshaft pulley and torsional vibration damper
2	-	Plain washer
3	-	Crankshaft pulley bolt

The combined crankshaft pulley and torsional vibration damper provides drive from the crankshaft to the accessory components, via a 6 ribbed polyvee type drive belt.

The assembly is mounted to the front of the crankshaft in front of the CKP sensor ring, and is secured with a plain washer and bolt. The damper comprises a steel outer casing formed with drive belt grooves around the outer circumference, bonded to an inner rubber coupling and metal hub.

The torsional vibration damper acts to reduce vibrations produced by the engines reciprocal components.

Dual Mass Flywheel (Manual Transmission Vehicles Only)



E84638

Item	Part Number	Description
1	-	Dual mass flywheel
2	-	Clutch friction plate face
3	-	Clutch cover locating dowel (3 off)
4	-	Engine timing special tool location
5	-	Bolt (8 off)

The dual mass flywheel is installed on vehicles with manual transmission. On automatic transmission vehicles, a torque converter flex-plate is installed.

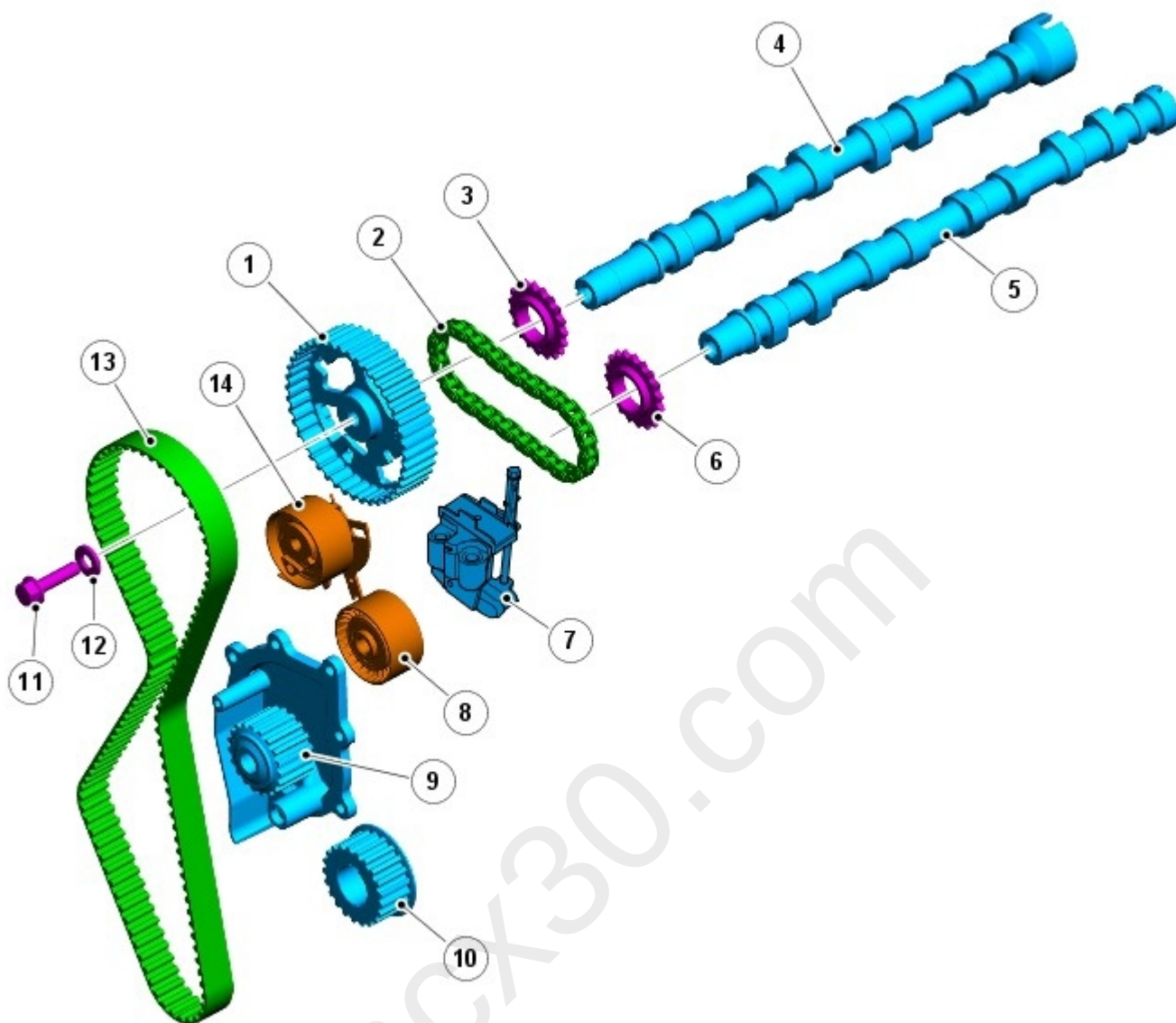
The dual mass flywheel comprises a primary mass and a secondary mass that transmits drive, via the clutch driven plate, to the gearbox. The secondary mass is supported on a roller bearing within the primary mass. The primary mass is secured to the flanged rear end of the crankshaft with 8 bolts. The drive between the primary and secondary masses is transmitted through a torsional spring damper. The flywheel provides a constant drive speed to the gearbox, without transmitting torsional and transient vibrations produced by the engine.

The outer face of the flywheel is machined to provide a smooth surface for the clutch friction plate to engage on. Three dowels are equally spaced around the outer edge of the secondary mass, and provide the location for the clutch cover assembly. The flywheel is dynamically balanced to eliminate vibrations from the rotating assembly.

A ring gear formed on the outer circumference of the primary mass allows the engagement of the starter motor.

Two holes are formed on the engine side of the dual mass flywheel. The larger diameter hole is provided to accept the insertion of an engine timing special tool.

CAMSHAFT TIMING COMPONENTS



E84640

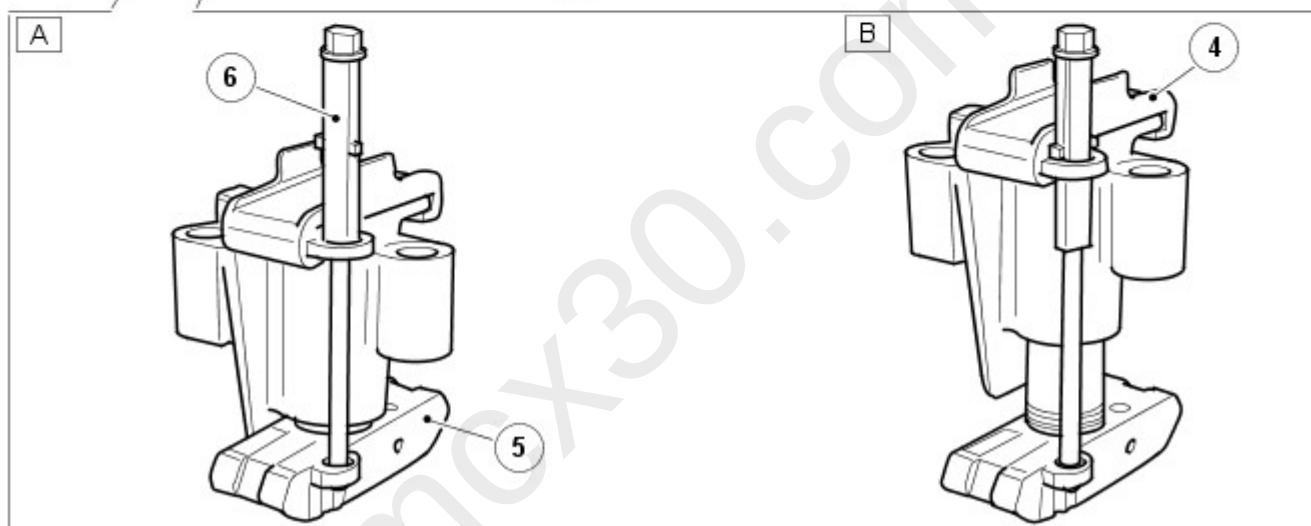
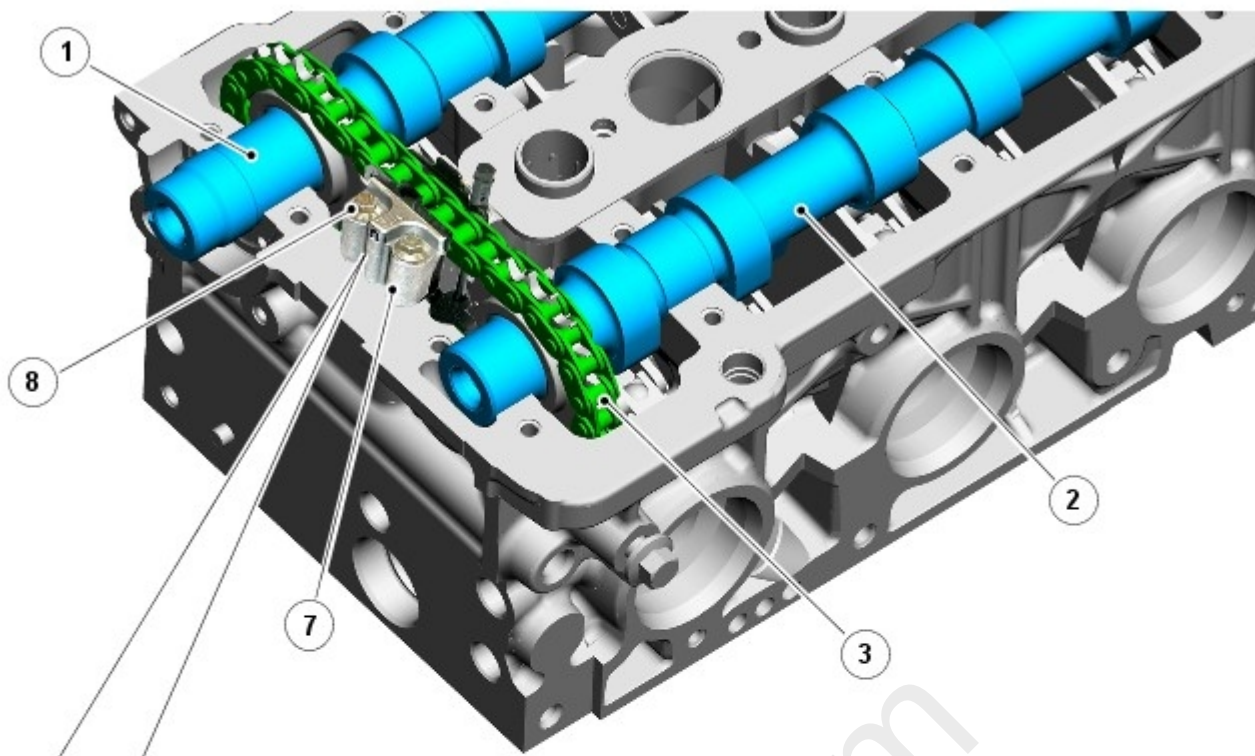
Item	Part Number	Description
1	-	Exhaust camshaft pulley
2	-	Camshaft timing chain
3	-	Exhaust camshaft drive gear
4	-	Exhaust camshaft
5	-	Intake camshaft
6	-	Intake camshaft drive gear
7	-	Timing chain hydraulic tensioner
8	-	Idler pulley
9	-	Coolant pump drive gear
10	-	Crankshaft drive gear
11	-	Bolt
12	-	Plain Washer
13	-	Camshaft drive belt
14	-	Automatic tensioner

Camshaft Drive

The crankshaft gear drives the exhaust camshaft via a toothed timing belt routed around the coolant pump, automatic tensioner and idler pulleys. The crankshaft and timing components rotate clockwise when viewed from the front of the engine. Correct belt tension is maintained by the spring loaded automatic tensioner, located on the RH front face of the cylinder block.

The tensioner also provides the means to remove the belt. The idler pulley is located behind the front engine mounting, and is secured to the cylinder block with the engine mounting lower bolt that passes through the center of the pulley.

Timing Chain Hydraulic Tensioner



E84641

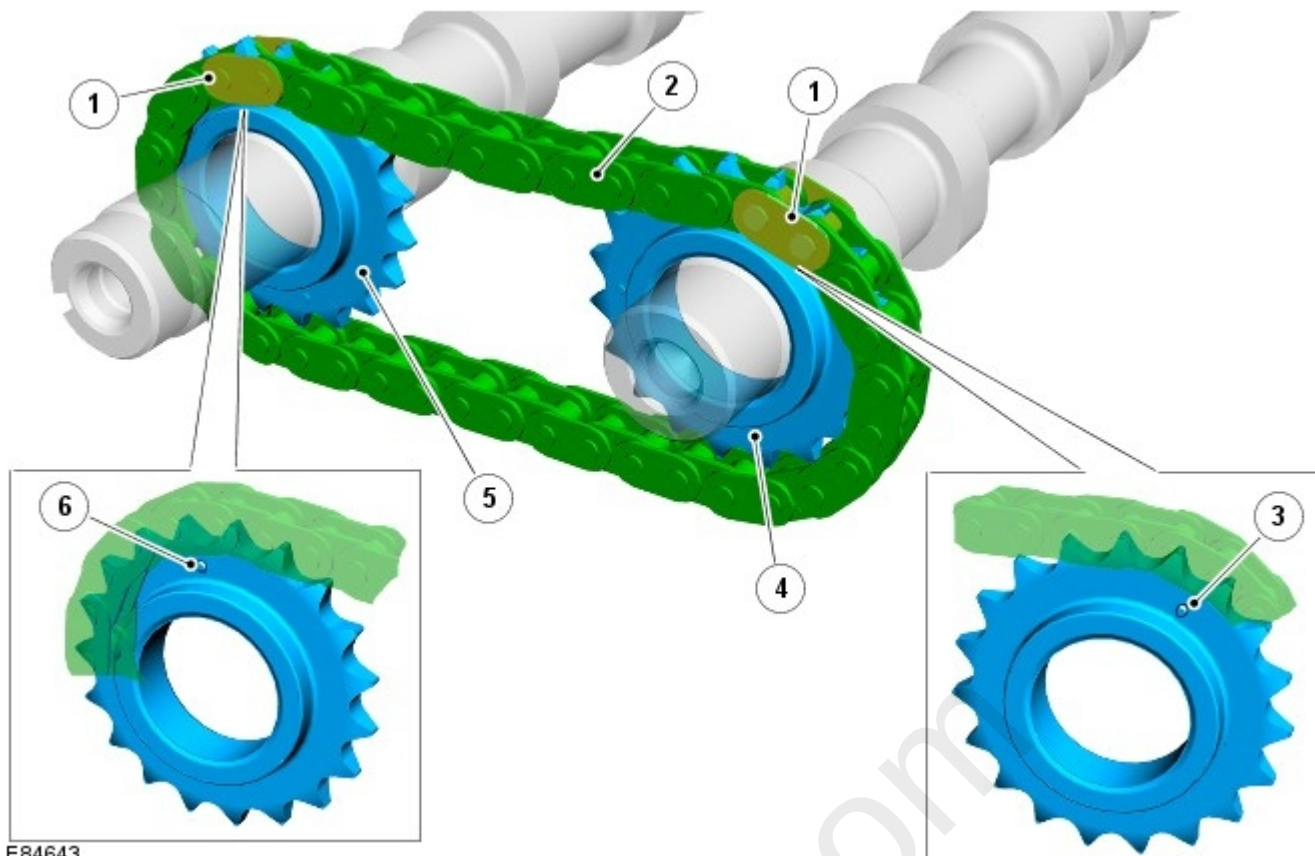
Item	Part Number	Description
A	-	Hydraulic tensioner - retained position
B	-	Hydraulic tensioner - released position
1	-	Exhaust camshaft
2	-	Intake camshaft
3	-	Camshaft timing chain
4	-	Upper chain guide
5	-	Tensioner head
6	-	Tensioner service pin
7	-	Hydraulic tensioner
8	-	Bolt (3 off)

The intake camshaft is driven by the exhaust camshaft via a short 40-link timing chain. The chain is routed around a drive gear formed on each of the camshafts. Chain tension is controlled by a hydraulic tensioner mounted between the camshafts, and secured with 3 screws to the cylinder head. The tensioner body is drilled with an oil passage that coincides with an oil port in the cylinder head.

The hydraulic tensioner assembly is positioned between the upper and lower sides of the chain, with the tensioner head acting on the lower side of the chain. The tensioner head and upper end of the tensioner are manufactured from molded plastic, and are formed with chain guides.

The tensioner body houses an integral plastic service pin that locates in the hydraulic tensioner head. The service pin remains integral with the tensioner and is used during maintenance to withdraw and lock the hydraulic tensioner in the retained position.

Camshaft Timing Chain



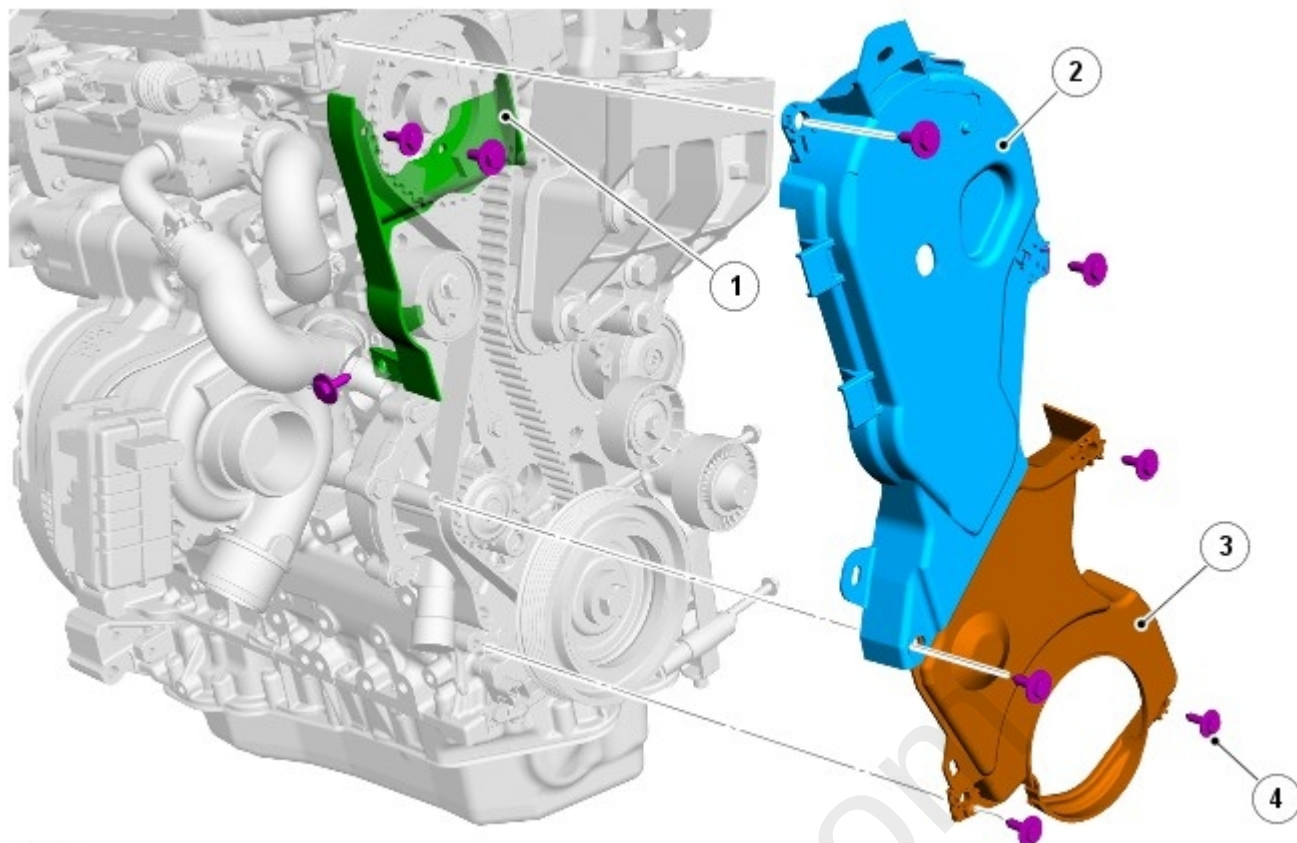
E84643

Item	Part Number	Description
1	-	Timing chain colored link
2	-	Camshaft timing chain
3	-	Intake camshaft timing mark
4	-	Intake camshaft drive gear
5	-	Exhaust camshaft drive gear
6	-	Exhaust camshaft timing mark

The chain is provided with 2 colored timing links that coincide with a timing mark on the front face of each camshaft drive gear. The timing marks are provided for correct setting of the camshaft and valve timing. For further details on setting the valve timing, refer to the relevant Service Repair Procedures (SRP) manual.

The timing chain and camshaft gears are splash lubricated with oil from the hydraulic tensioner.

Camshaft Drive Component Covers

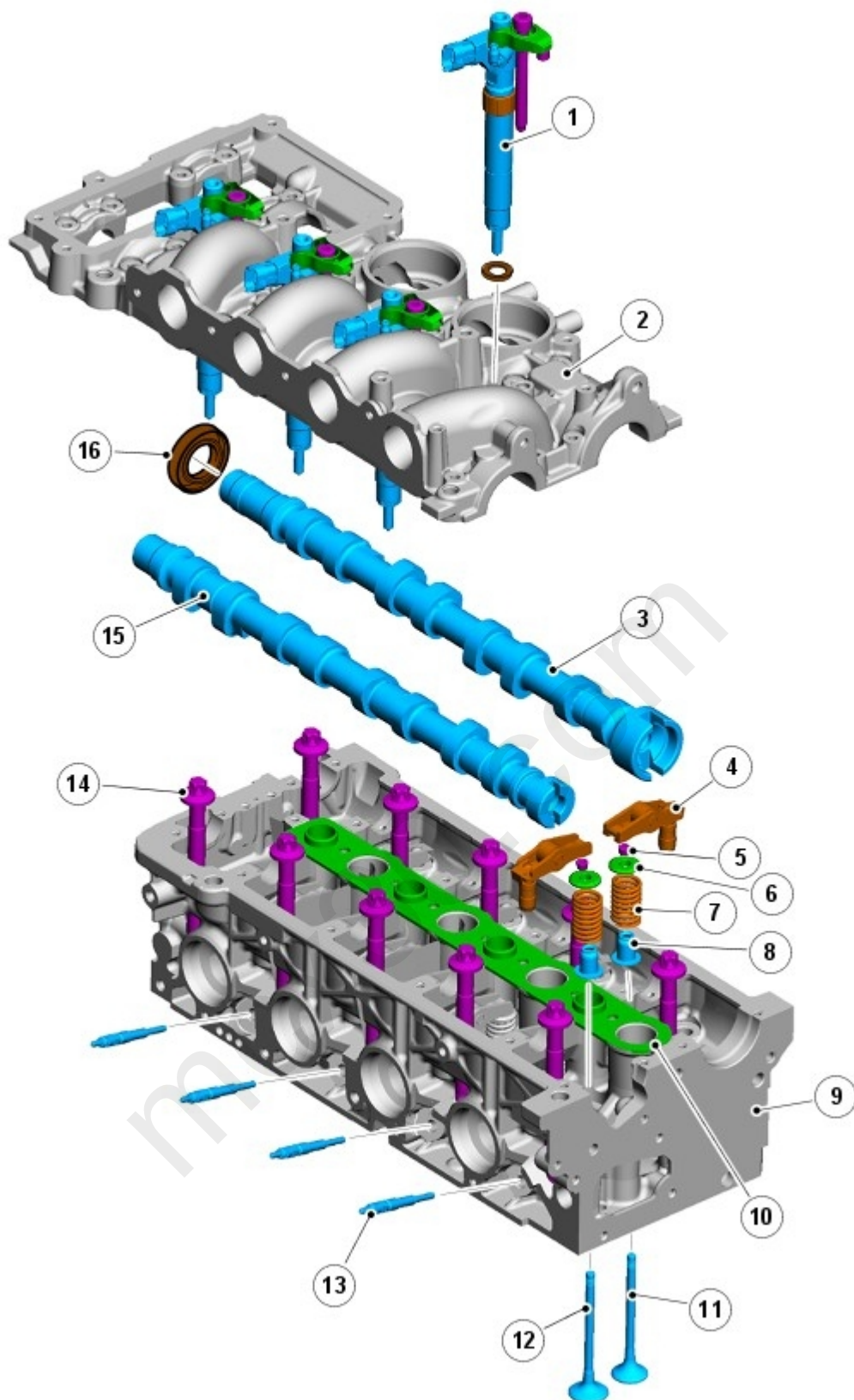


E84644

Item	Part Number	Description
1	-	Rear timing belt cover
2	-	Upper timing belt cover
3	-	Lower timing belt cover
4	-	Screw (9 off)

A 1-piece rear and 2-piece front timing belt cover encloses the camshaft drive components. The plastic timing covers are secured to the cylinder block and cylinder head with 9 screws. A hole is formed in the upper front timing belt cover, and is provided to allow the insertion of a special tool used to lock the exhaust camshaft pulley.

CYLINDER HEAD COMPONENTS

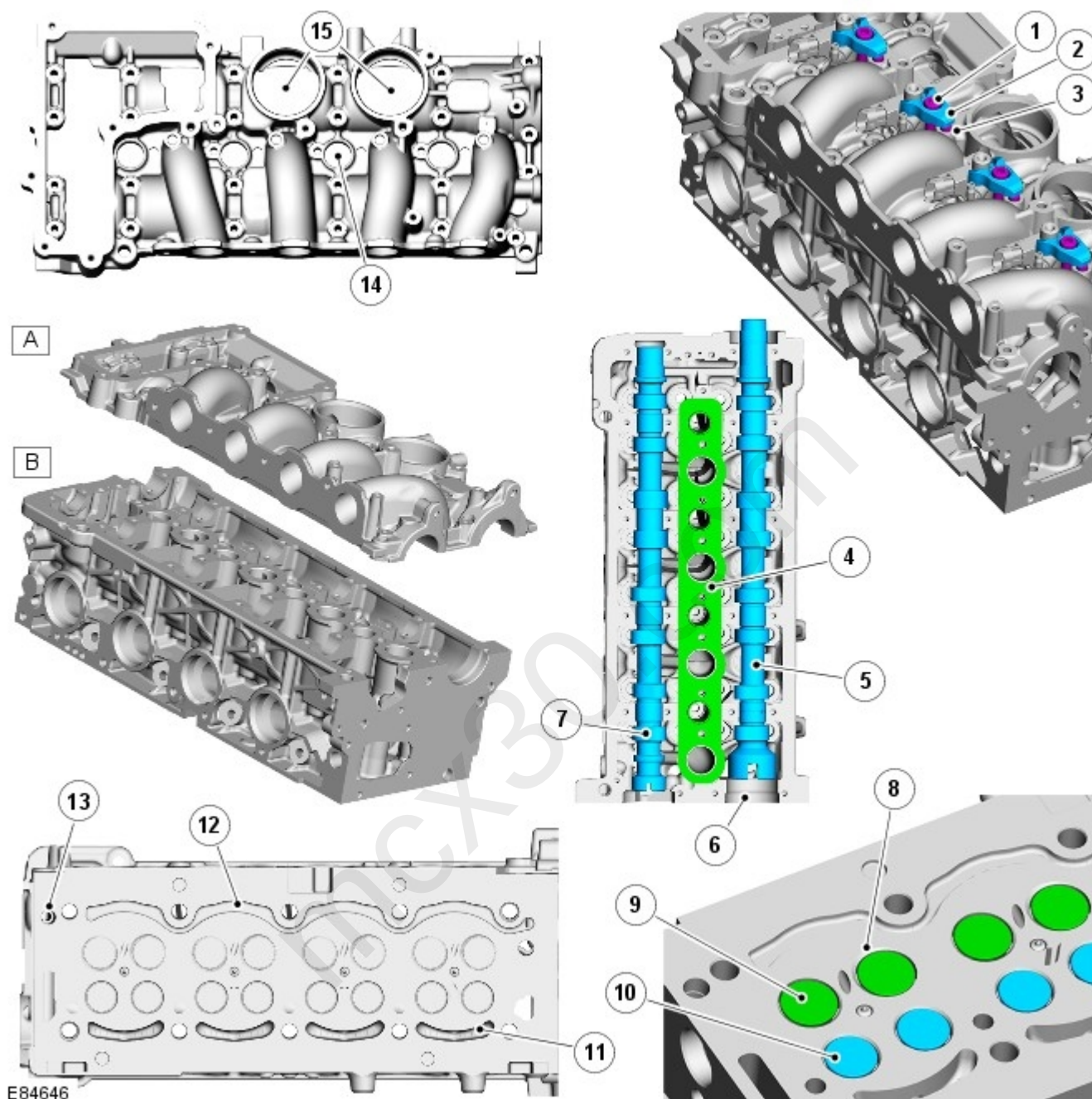


E84645

Item	Part Number	Description
1	-	High Pressure (HP) fuel injector (4 off)
2	-	Structural camshaft cover
3	-	Exhaust camshaft
4	-	Hydraulic lash adjuster and roller finger rocker (16 off)
5	-	Split taper collets (32 off)
6	-	Upper spring guide (16 off)
7	-	Valve spring (16 off)
8	-	Lower spring guide (16 off)
9	-	Cylinder head
10	-	Gasket
11	-	Exhaust valve (8 off)

12	-	Intake valve (8 off)
13	-	Glow plug (4 off)
14	-	Cylinder head bolt (10 off)
15	-	Intake camshaft
16	-	Cylinder head front oil seal

Cylinder Head and Structural Camshaft Cover



Item	Part Number	Description
A	-	Structural camshaft cover
B	-	Cylinder head
1	-	Injector mounting clamp bolt (4 off)
2	-	Injector mounting clamp (4 off)
3	-	Dowel (4 off)
4	-	Gasket
5	-	Exhaust camshaft
6	-	Camshaft bearing housing (5 per camshaft)
7	-	Intake camshaft
8	-	Intake port raised profile (at each intake port)
9	-	Intake valve
10	-	Exhaust valve
11	-	Cooling channel
12	-	Cooling channel
13	-	Oil supply port
14	-	Injector bore
15	-	PCV ports

The cylinder head and structural camshaft cover are manufactured to form mating parts. The parts are milled in a single operation and accurately positioned with 2 alignment sleeves. The 2 components must always be installed together, and not renewed as separate components. The cylinder head and camshaft cover are sealed to each other during manufacture with a gasket and silicone based sealant, and are secured with 27 bolts. An oil seal installed at the front of the cylinder head provides sealing of the exhaust camshaft housing. The open ports at the rear of the cylinder head are sealed with the vacuum pump and high-pressure fuel pump sealing rings.

Two alignment sleeves correctly locate the cylinder head and gasket to the cylinder block. The cylinder head is secured to the cylinder block with 10 deep-seated bolts.

• **NOTE:** The cylinder head bolts are not accessible with the structural camshaft cover installed.

• **NOTE:** The cylinder head is not to be reworked.

The cylinder head is manufactured from aluminum alloy, having valve seats and guides made of sintered steel. The cylinder head is precisely machined and milled to incorporate the 4 combustion chambers, camshaft lower bearing housings, oil drillings and coolant galleries, and the air intake, valve timing and fuel system component bores and housings.

The design of the cylinder head maximizes air flow and swirl in the combustion chambers. The 2 intake valve seats are machined with raised profiles that act to promote swirl of the intake air flow. Combined with the action of the intake manifold helical port, the swirl effect of the 2 intake port profiles allows the air and injected fuel to completely mix, and reach the outer edge of the combustion chamber.

The structural camshaft cover is manufactured from aluminum alloy, and is machined on the upper surface with the camshaft upper bearing housings. The cover is also formed with 4 intake air filling tracts, fuel injector bores and orifices for the cylinder head cover PCV components. The intake air tracts join the intake air manifold to the cylinder head intake filling ports.

The cylinder head also provides the mounting locations for the following:

- Front engine mounting
- Front and rear engine lifting eyes
- Intake and exhaust manifolds
- EGR valve and cooler
- Fuel filter support bracket
- Thermal control module
- Vacuum pump and high-pressure fuel pump.

Cylinder Head Gasket



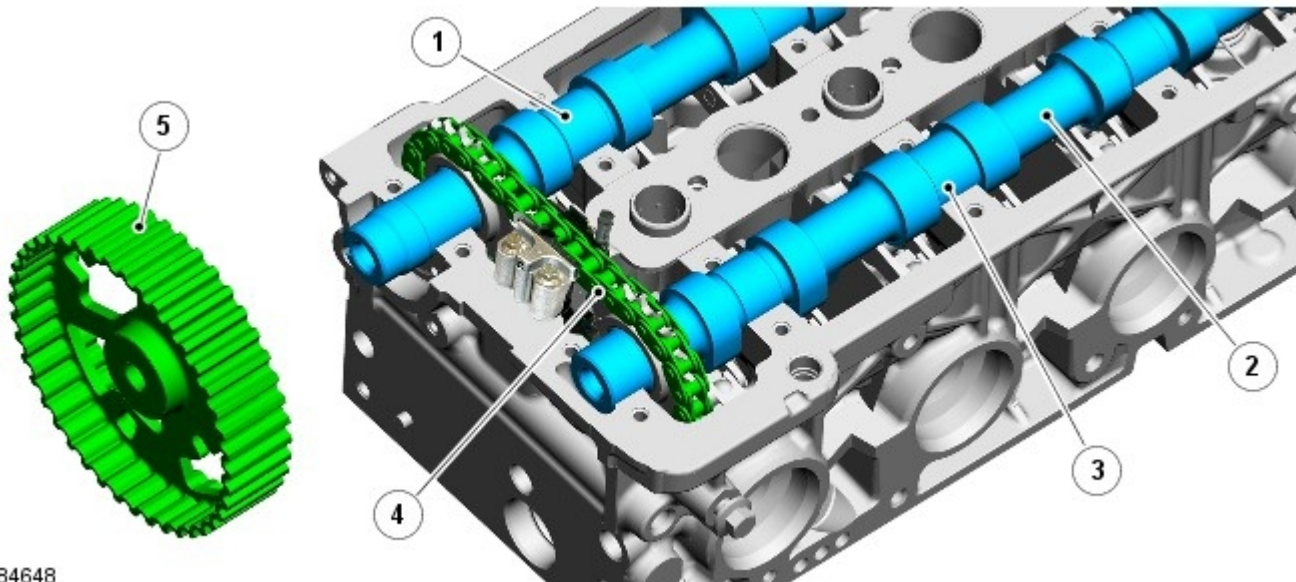
E84647

Item	Part Number	Description
1	-	Engine type identification
2	-	Gasket thickness identification
3	-	Gasket thickness identification

The cylinder head gasket is made from laminated metal and is available in 4 different thicknesses. Lugs formed on the side of the gasket are 'dot' marked to identify the engine type, and the thickness of the gasket installed. A new gasket is selected based on the piston protrusion measurement from the cylinder block.

For further details on cylinder head gasket selection, refer to the relevant Service Repair Procedures (SRP) manual.

Camshafts



E84648

Item	Part Number	Description
1	-	Exhaust camshaft
2	-	Intake camshaft
3	-	No. 3 bearing (end-float control)
4	-	Single row timing chain
5	-	Exhaust camshaft pulley

The intake and exhaust camshafts are manufactured from cast-iron. The 2 camshafts are mounted between the structural camshaft cover and cylinder head, with each camshaft located in 5 machined bearing housings. Shell bearings are not used in the bearing housings, the camshafts run directly in the aluminum bearing. Lateral movement of the camshafts is controlled by No. 3 camshaft bearing, and is not adjustable. The bearing is manufactured on both camshafts to provide the correct end-float.

• **NOTE:** In production, the camshaft end-float is 0.070 mm to 0.168 mm (0.003 in to 0.007 in). In service, if the end-float is out of specification the camshaft(s) and/or cylinder head and structural camshaft cover may require renewal.

Each camshaft has 8 machined lobes formed in pairs along the length of the camshaft. The camshaft lobes operate the inlet and exhaust valves through hydraulic lash adjusters and roller-type finger levers

A spur gear with 19 teeth is formed on the front end of each camshaft. The 2 gears are joined by a 40-link single row timing chain. The 2 camshaft gears are marked with a timing mark that coincides with the 2 colored links on the camshaft timing chain. A drive slot is formed in the rear end of each camshaft to provide the drive to the flange mounted vacuum pump and high-pressure fuel pump. The vacuum pump is driven by the inlet camshaft; the high-pressure fuel pump is driven by the exhaust camshaft.

The exhaust camshaft is driven by the crankshaft drive gear via a toothed timing belt. The exhaust camshaft pulley contains 42 teeth and is keyed and bolted to the front of the exhaust camshaft. The intake camshaft is driven by the exhaust camshaft via the single row chain.

The exhaust camshaft pulley is manufactured with cut-outs and a notch in the center hub. The cut-outs form the target area for the CMP sensor. The notch provides the location for a camshaft timing pin special tool. The special tool is used in conjunction with other special tools to set the exhaust camshaft during engine timing.

For further details on setting the engine valve timing, refer to the relevant Service Repair Procedures (SRP) manual.

Engine Valve Timing

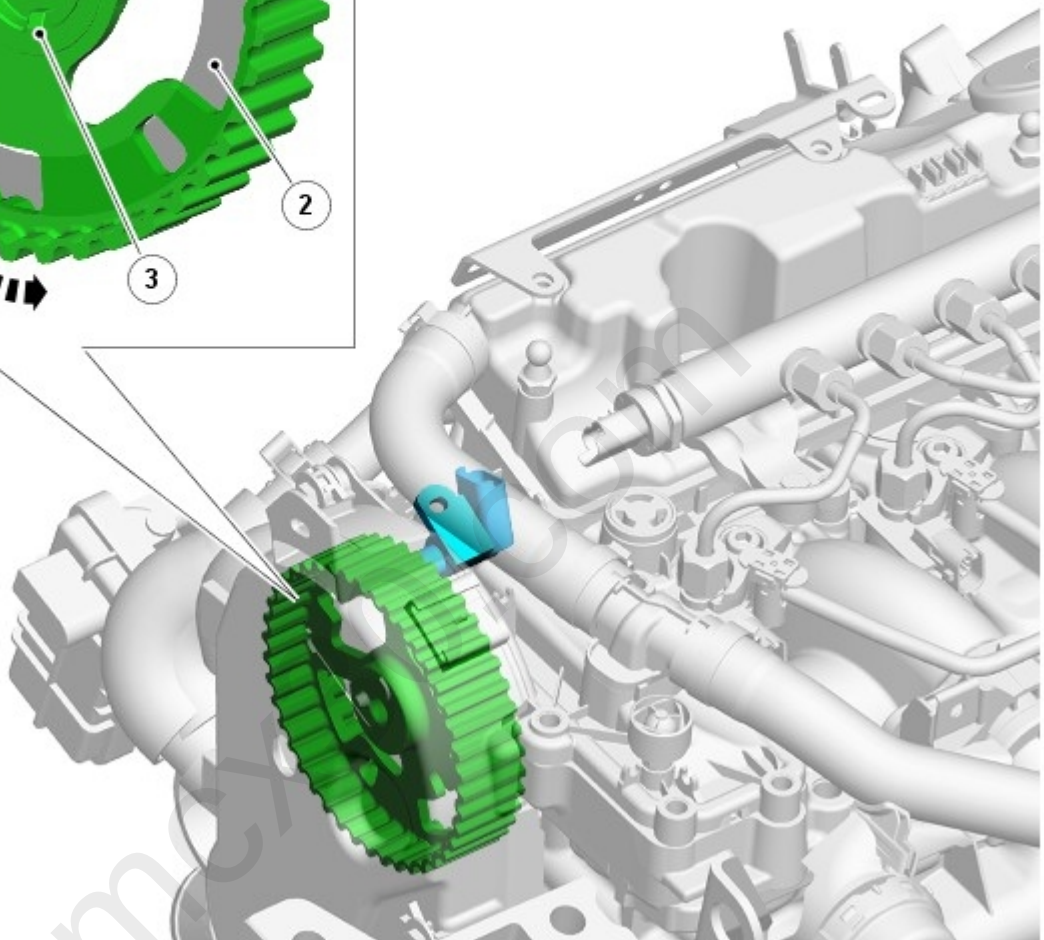
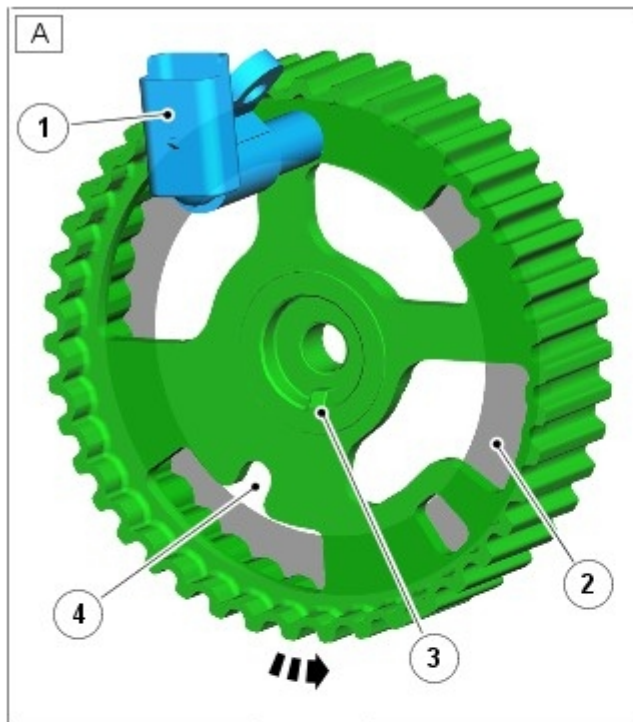
The valve timing values are shown in the following table:

Valve	Position
Inlet valve opens	15 degrees BTDC
Inlet valve closes	12 degrees ABDC
Exhaust valve opens	23 degrees BBDC
Exhaust valve closes	17 degrees ATDC

Key:

- BTDC = Before Top Dead Center
- ABDC = After Bottom Dead Center
- BBDC = Before Bottom Dead Center
- ATDC = After Top Dead Center.

Camshaft Position (CMP) Sensor



E84649

Item	Part Number	Description
A	-	Rear view of exhaust camshaft pulley
1	-	CMP sensor
2	-	CMP target area
3	-	Camshaft pulley key slot
4	-	Camshaft timing pin location

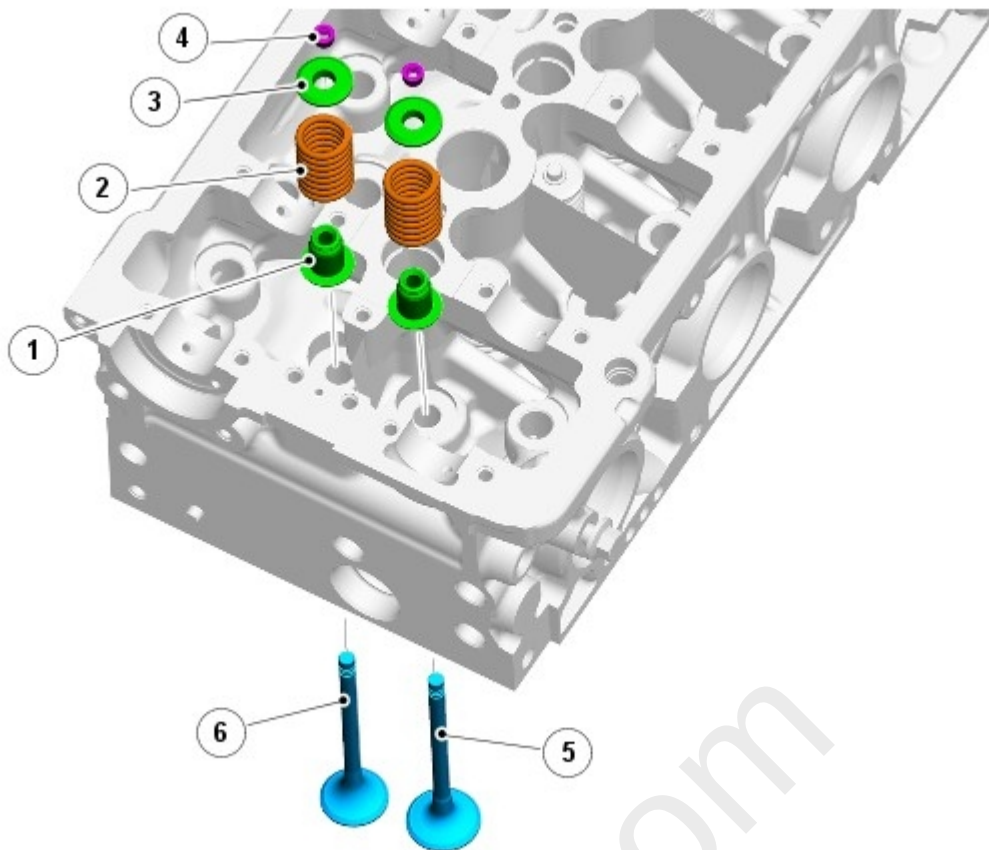
The CMP sensor is mounted at the front of the engine behind the exhaust camshaft drive pulley. The sensor tip protrudes through a hole in the cylinder head cover, and is positioned close to the camshaft pulley target area. The position of the sensor to the camshaft pulley is adjustable.

For further details on setting the CMP sensor gap, refer to the relevant Service Repair Procedures (SRP) manual.

The sensor is a variable reluctance sensor that provides a signal of No. 1 cylinder camshaft position to the ECM. The information is used by the ECM to determine the precise moment for injection during engine cranking.

For additional information, refer to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq - Td4, Description and Operation).

Intake and Exhaust Valves



E84650

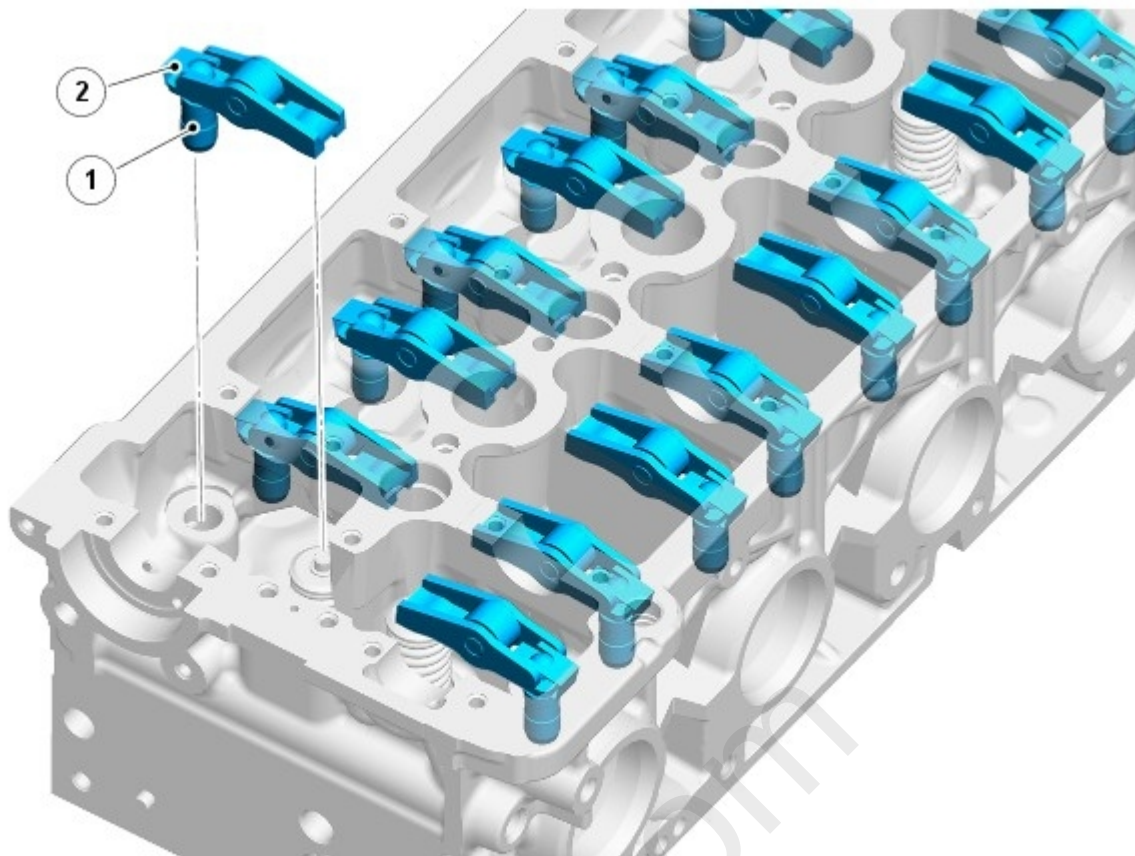
Item	Part Number	Description
1	-	Lower spring guide
2	-	Valve spring
3	-	Upper spring guide
4	-	Split taper collets
5	-	Intake valve
6	-	Exhaust valve

The cylinder head incorporates 2 overhead camshafts operating 4 valves per cylinder, via steel roller rockers with hydraulic lash adjusters.

The intake valve is produced from a single material having a head diameter of 24.70 mm (0.972 in). The exhaust valve head and stem are produced from different materials that are friction welded together. The exhaust valve head diameter is 22.33 mm (0.879 in). Both the intake and exhaust valve stem diameters are 6.0 mm (0.236 in).

The 16 valve springs are single helical-coil type, and manufactured from 3 mm (0.118 in) spring steel. Each spring is installed over a valve stem, with the spring located in a lower spring guide that seats against the cylinder head. The spring upper end locates in an upper spring guide that is attached to the valve stem with 2 split taper collets. The 2 taper collets are formed with grooves on the internal bore and locate in formed grooves in the upper valve stem. The lower spring guide also forms the valve stem seal and is installed with an O-ring.

Hydraulic Lash Adjusters and Roller Finger Rockers

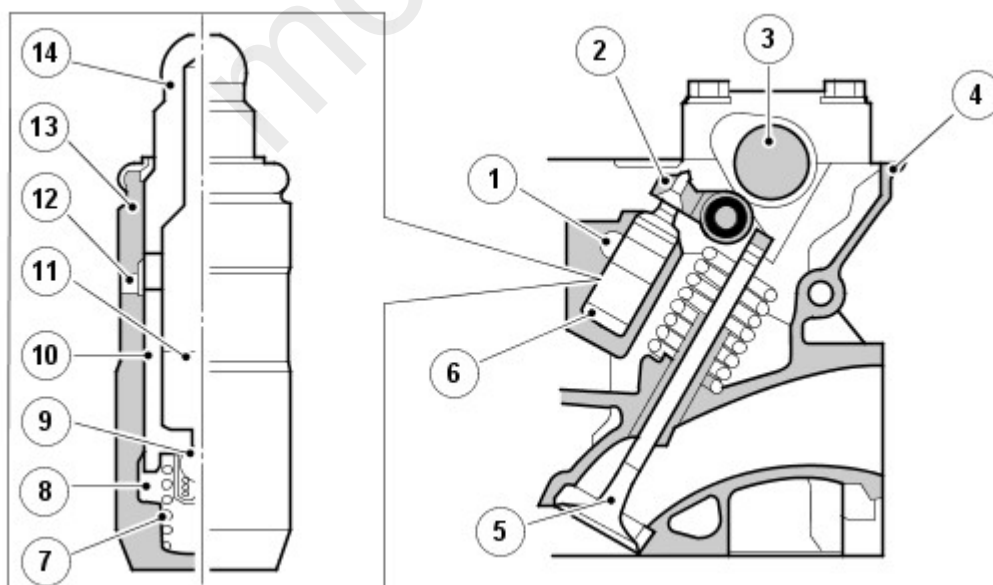


E84651

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

The 16 valves are operated with roller-type finger rockers and hydraulic lash adjusters, actuated by the camshaft lobes. One end of the finger rocker rests on the end of the valve stem; the other end is attached to a hydraulic lash adjuster. The center of the finger rocker is formed with a roller that remains in contact with the camshaft lobe.

Typical Hydraulic Lash Adjuster



E83037

Item	Part Number	Description
1	-	Oil passage
2	-	Roller finger rocker
3	-	Camshaft
4	-	Cylinder head
5	-	Valve

6	-	Hydraulic lash adjuster
7	-	Plunger spring
8	-	High-pressure chamber
9	-	Ball valve
10	-	Plunger
11	-	Reservoir chamber
12	-	Oil passage
13	-	Hydraulic lash adjuster body
14	-	Plunger cap

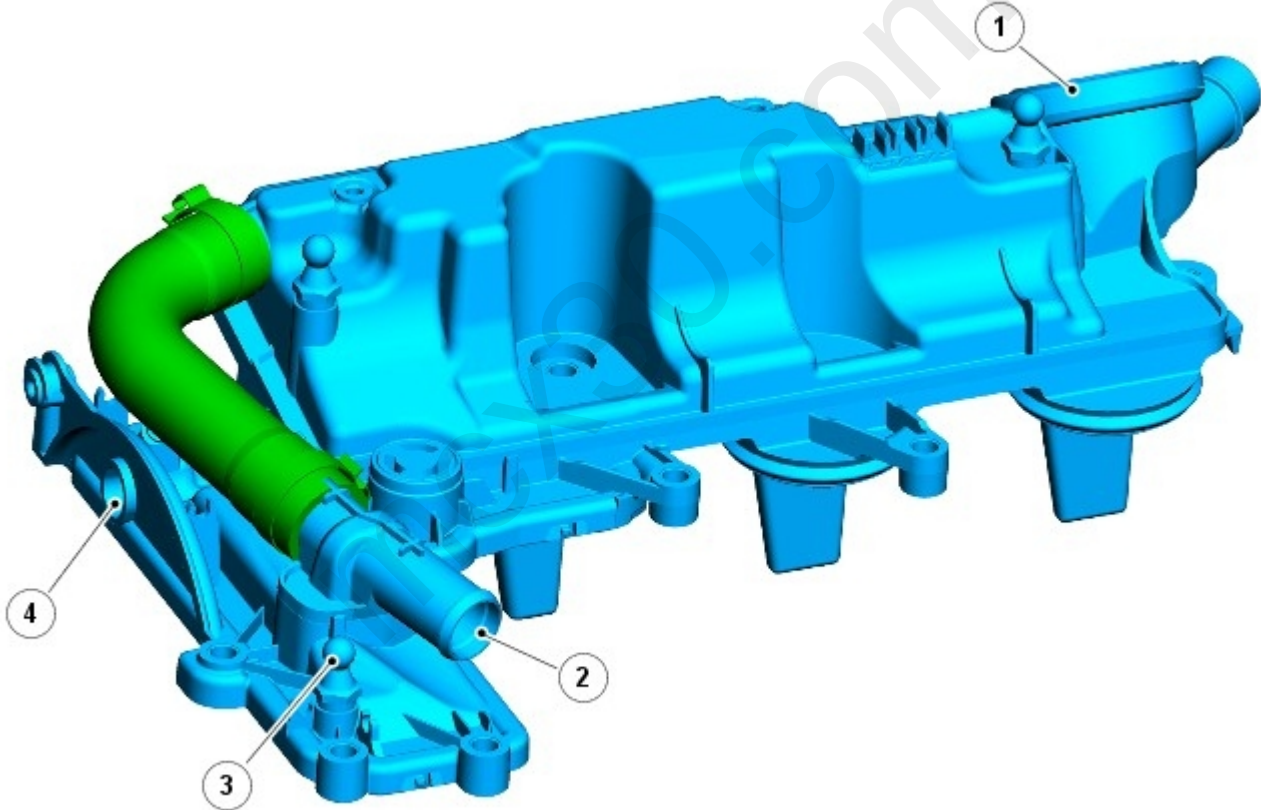
Movement of the camshaft lobe presses down on the finger rocker roller, and consequently, the hydraulic lash adjuster and valve mechanism are forced down together. The respective valve is forced down against valve spring pressure, and the hydraulic plunger is also forced into an oil chamber in the cylinder head. This type of valve actuation minimizes friction between the valve operating components, and also eliminates the requirement for manual adjustment.

The body of the hydraulic lash adjuster contains a plunger, and 2 chambers for oil feed and pressurized oil. The pressurized oil is supplied to the lash adjuster via the cylinder head oil gallery, and through a hole in the side of the lash adjuster body. The oil passes into a feed chamber within the lash adjuster, and then through to a separate pressure chamber via a one-way ball valve.

Oil flow from the pressure chamber is determined by the clearance between the lash adjuster outer body and the center plunger. Oil escapes up the side of the plunger each time the lash adjuster is operated. The downward pressure on the plunger forces a corresponding amount of oil in the lash adjuster body to be displaced.

As the camshaft lobe rotates further, downward pressure on the camshaft and finger rocker is removed. The lash adjuster plunger is forced up by the oil pressure contained in the pressure chamber. The pressure is not sufficient to affect valve operation, but is sufficient to eliminate the clearance between the finger rocker and top of the valve stem.

Cylinder Head Cover



E84652

Item	Part Number	Description
1	-	PCV valve
2	-	Crankcase ventilation hose connection
3	-	Engine cover fixing
4	-	CMP sensor location

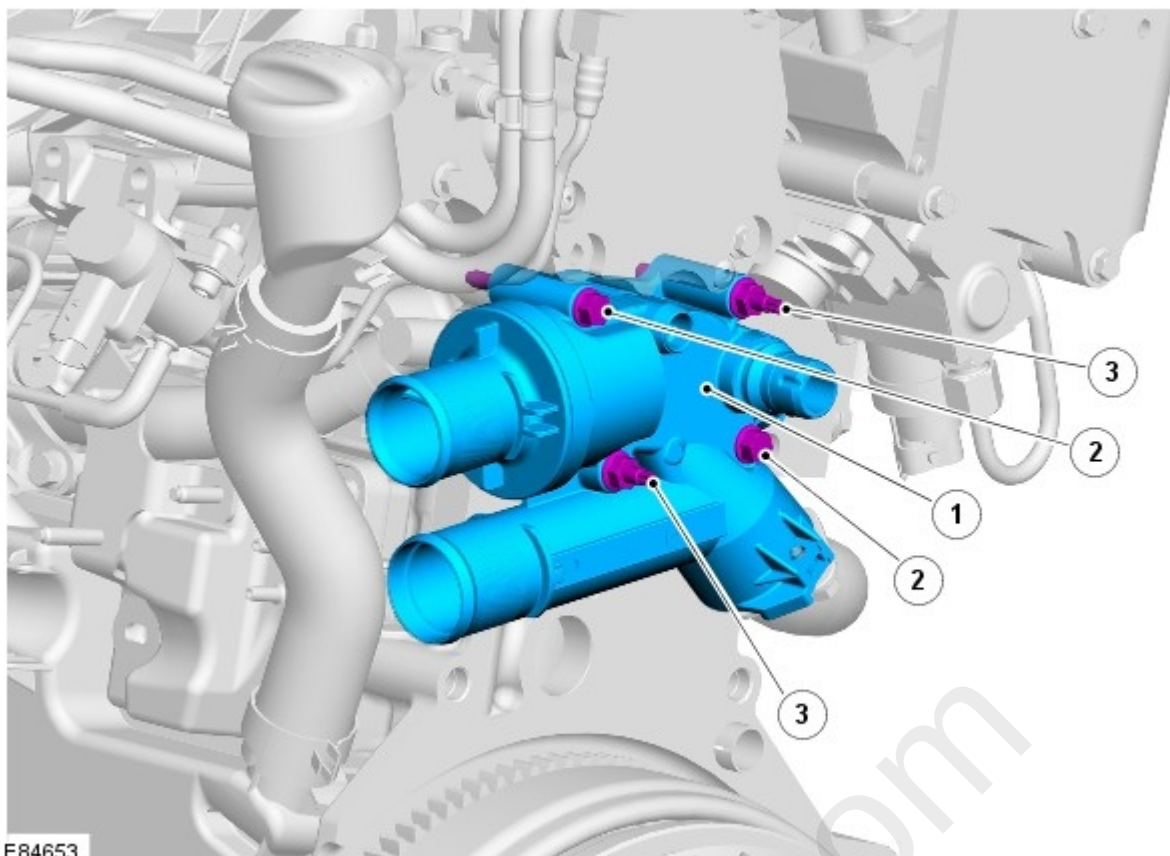
The 'L' shaped cylinder head cover is installed over the structural camshaft cover and encloses the exhaust camshaft, and the intake and exhaust camshaft drive openings. A preformed gasket and the PCV component O-rings provide the seal between the 2 covers.

The cylinder head cover is manufactured from composite materials, and incorporates the Positive Crankcase Ventilation Valve (PCV), safety valve and crankcase ventilation connections.

For additional information, refer to: [Engine Emission Control](#) (303-08B Engine Emission Control - TD4 2.2L Diesel, Description and Operation).

The cylinder head cover provides the location for the CMP sensor, and 3 of the acoustic engine cover fixings.

Thermal Control Module



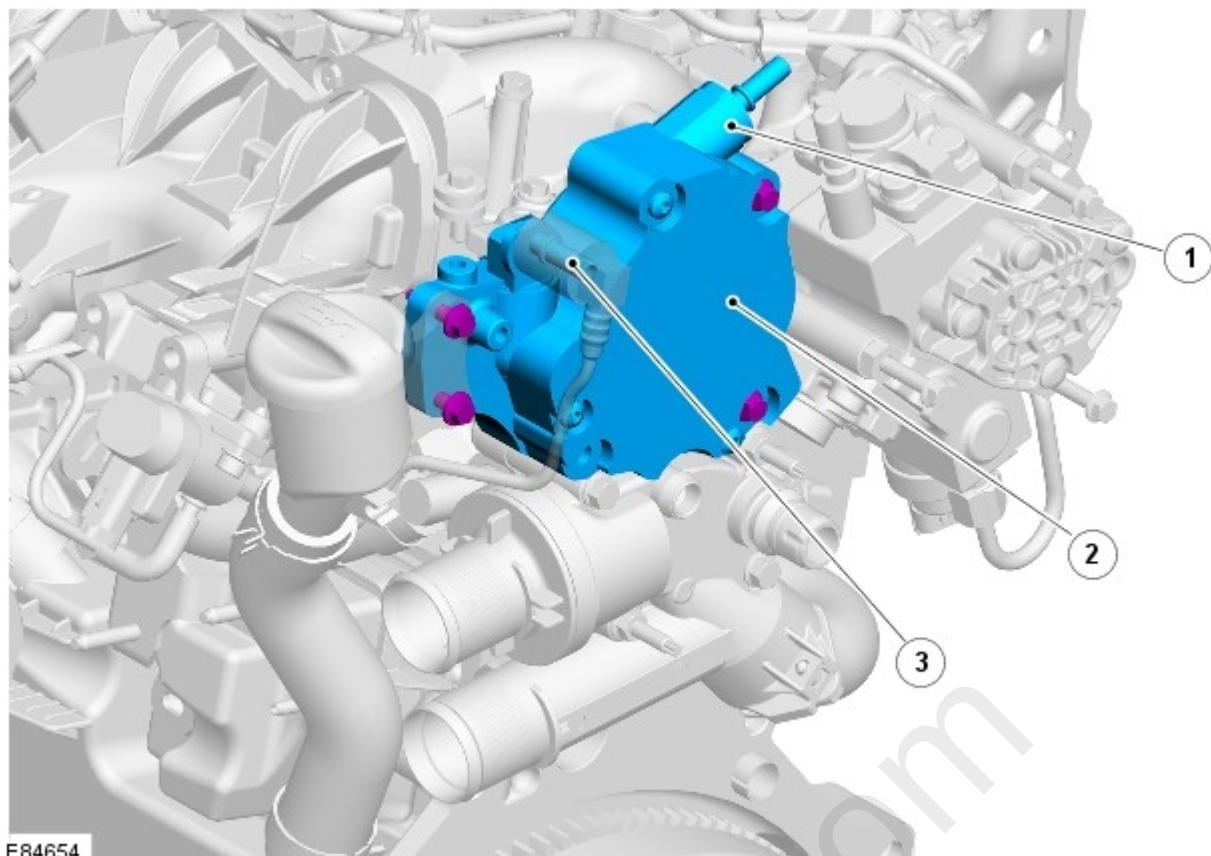
E84653

Item	Part Number	Description
1	-	Thermal control module
2	-	Securing bolt (2 off)
3	-	Securing stud and nut (2 off)

The cooling system thermal control module is secured to the rear of the cylinder head by 2 studs with nuts and 2 bolts, and is sealed to the head with an O-ring. The module contains the cooling system thermostat and forms the junction for the cooling system hoses.

For additional information, refer to: [Engine Cooling](#) (303-03B Engine Cooling - TD4 2.2L Diesel, Description and Operation).

Vacuum Pump



E84654

Item	Part Number	Description
1	-	Connection to brake booster
2	-	Vacuum pump
3	-	Connection to port de-activation valve

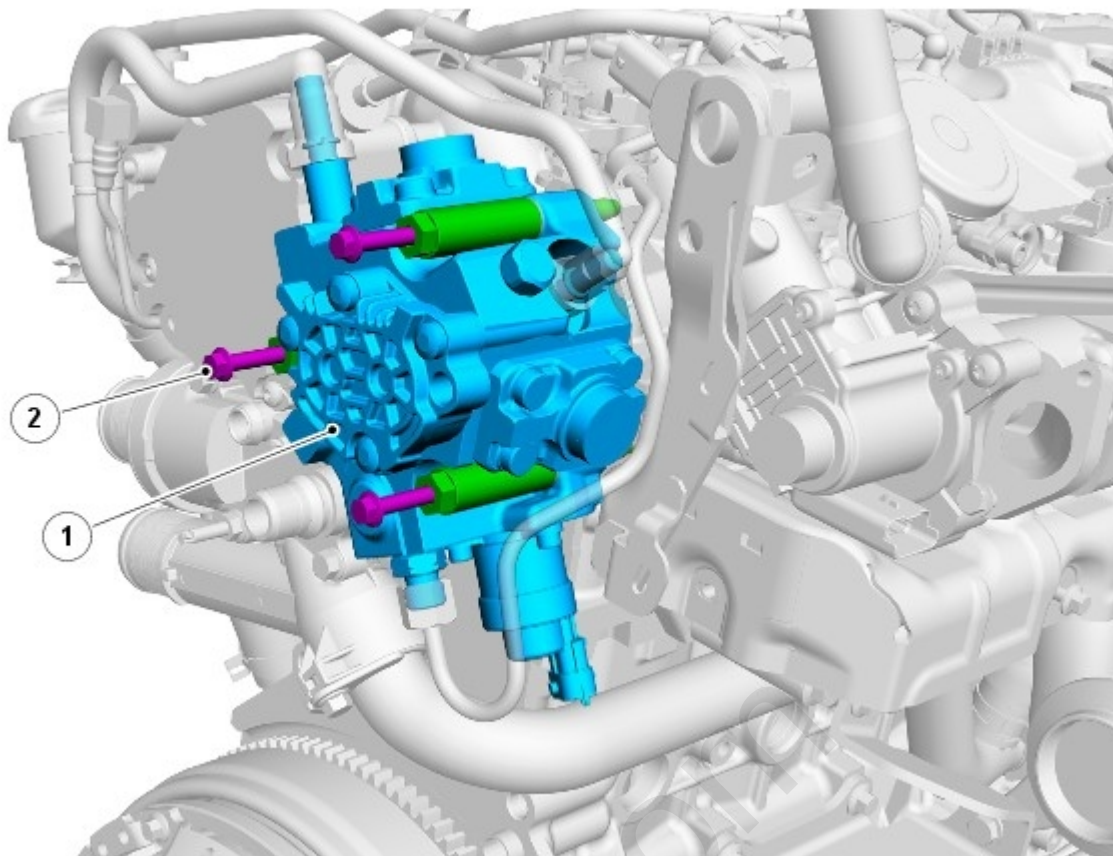
The vacuum pump is mounted with 3 bolts to the rear LH side of the cylinder head, and is driven by the intake camshaft. The pump housing is manufactured with a flanged face and a cylindrical housing that contains the pump drive shaft. The drive shaft housing protrudes into the cylinder head housing and is sealed with an O-ring. The end of the drive shaft is formed with a drive lug that locates in a corresponding slot formed in the end of the intake camshaft.

The vacuum pump is used for brake booster operation, and actuation of the intake manifold port de-activation device. For additional information, refer to:

[Brake Booster](#) (206-07 Power Brake Actuation, Description and Operation),
[Electronic Engine Controls](#) (303-14 Electronic Engine Controls - 2.2L Duratorq - Td4, Description and Operation),
[Intake Air Distribution and Filtering](#) (303-12B Intake Air Distribution and Filtering - TD4 2.2L Diesel, Description and Operation).

High-Pressure Fuel Pump

- NOTE: HP pump protective crash shield not shown.



E84655

Item	Part Number	Description
1	-	High-pressure fuel pump
2	-	Bolt (3 off)

The high-pressure fuel pump is mounted with 3 bolts to the rear RH side of the cylinder head, and is driven by the exhaust camshaft. The pump housing is manufactured with a flanged face, and a cylindrical housing containing the pump drive shaft. The drive shaft housing protrudes into the cylinder head housing and is sealed with an O-ring.

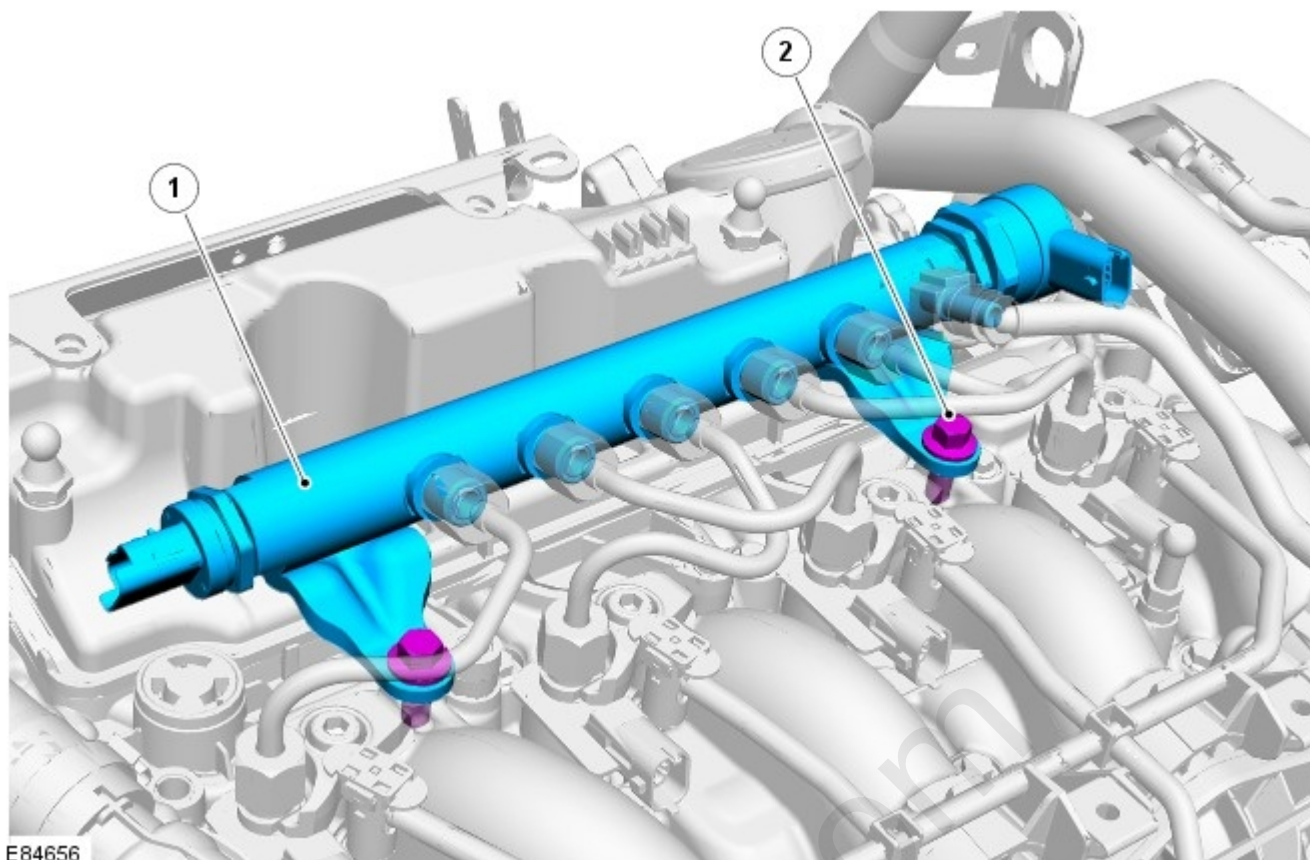
A drive plate is installed over the drive shaft end, and connects to a corresponding slot formed in the end of the exhaust camshaft.

A crash shield is installed to the front of the HP fuel pump to provide protection during a frontal impact.

The fuel pump is a 3 radial piston type that delivers fuel to the common fuel rail, under the control of the ECM. For additional information, refer to:

[Fuel Charging and Controls](#) (303-04B Fuel Charging and Controls - TD4 2.2L Diesel, Description and Operation),
Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq - Td4, Description and Operation).

High-Pressure Common Fuel Rail



E84656

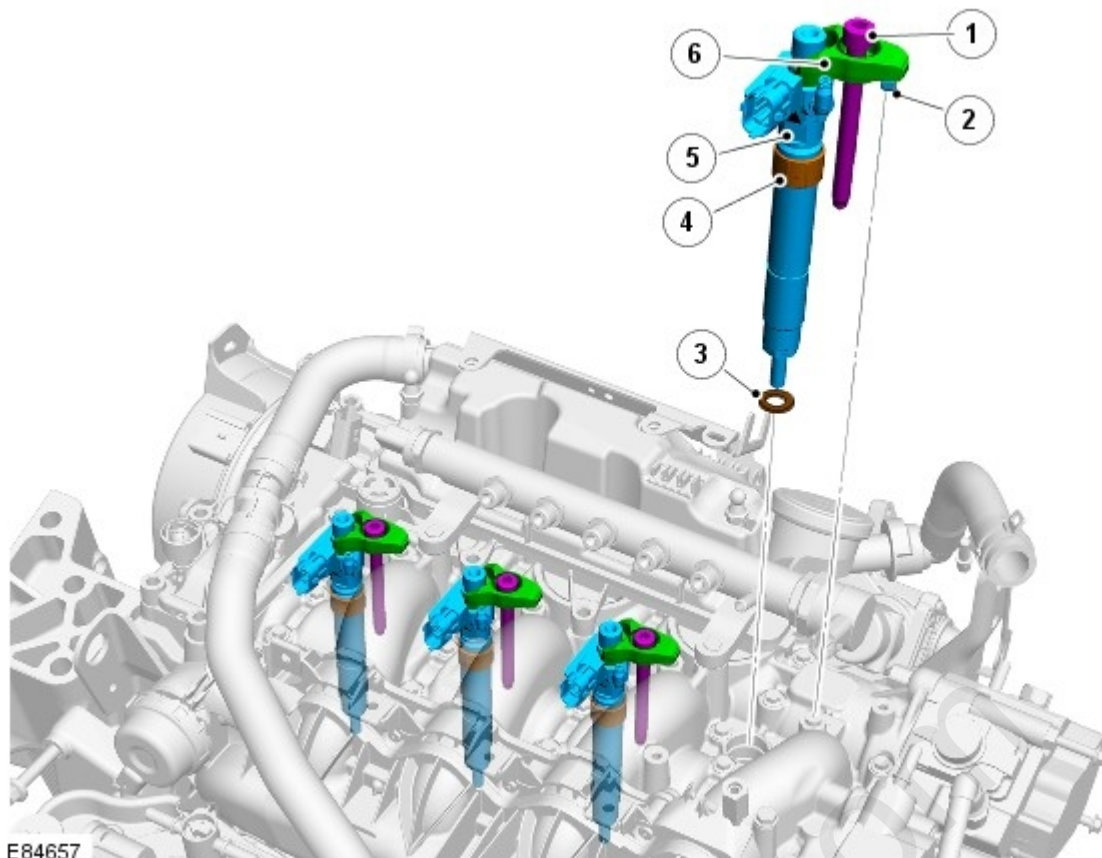
Item	Part Number	Description
1	-	High-pressure common fuel rail
2	-	Bolt (2 off)

The common fuel rail is manufactured from forged steel and is secured with 2 bolts to the cylinder head, above the line of the exhaust camshaft. The fuel rail stores pressurized fuel from the high-pressure fuel pump and delivers the fuel to the fuel injectors.

The fuel rail pressure is regulated by a Pressure Control Valve (PCV) located at the fuel pump end of the fuel rail, under the control of the ECM. A fuel pressure sensor installed in the opposite end of the fuel rail provides the actual fuel pressure signal to the ECM. For additional information, refer to:

[Fuel Charging and Controls](#) (303-04B Fuel Charging and Controls - TD4 2.2L Diesel, Description and Operation),
[Electronic Engine Controls](#) (303-14 Electronic Engine Controls - 2.2L Duratorq - Td4, Description and Operation).

Fuel Injectors



E84657

Item	Part Number	Description
1	-	Injector mounting clamp bolt
2	-	Dowel
3	-	Copper washer
4	-	Centering ring
5	-	Injector
6	-	Injector mounting clamp

The 4 piezo-electric operated fuel injectors are centrally mounted above each cylinder combustion chamber. Each injector is sealed against the base of the injector bore with a copper washer. A centering ring installed over the injector body makes sure the injector is correctly positioned within the injector bore.

• **NOTE:** A new copper washer must be installed and the old washer discarded, whenever an injector is removed from the cylinder head. The centering ring may be re-used during injector removal.

The injector pipes are single use only, and must be renewed whenever a pipe connection is released.

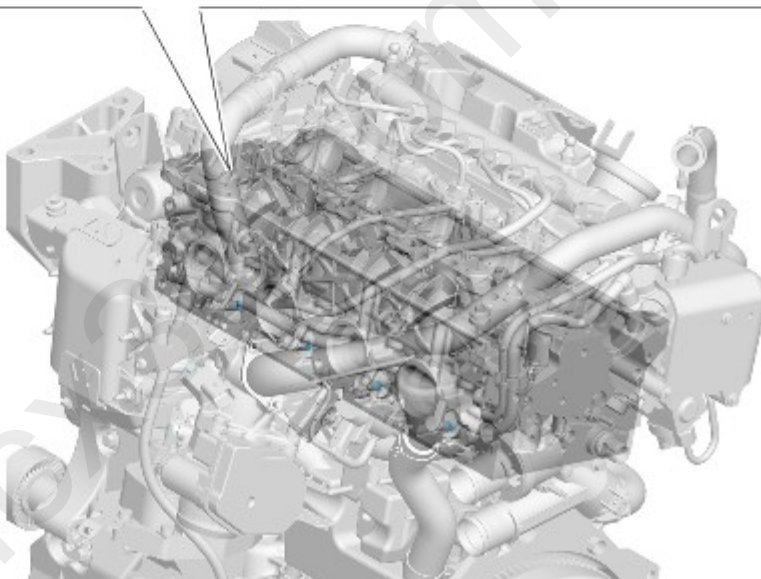
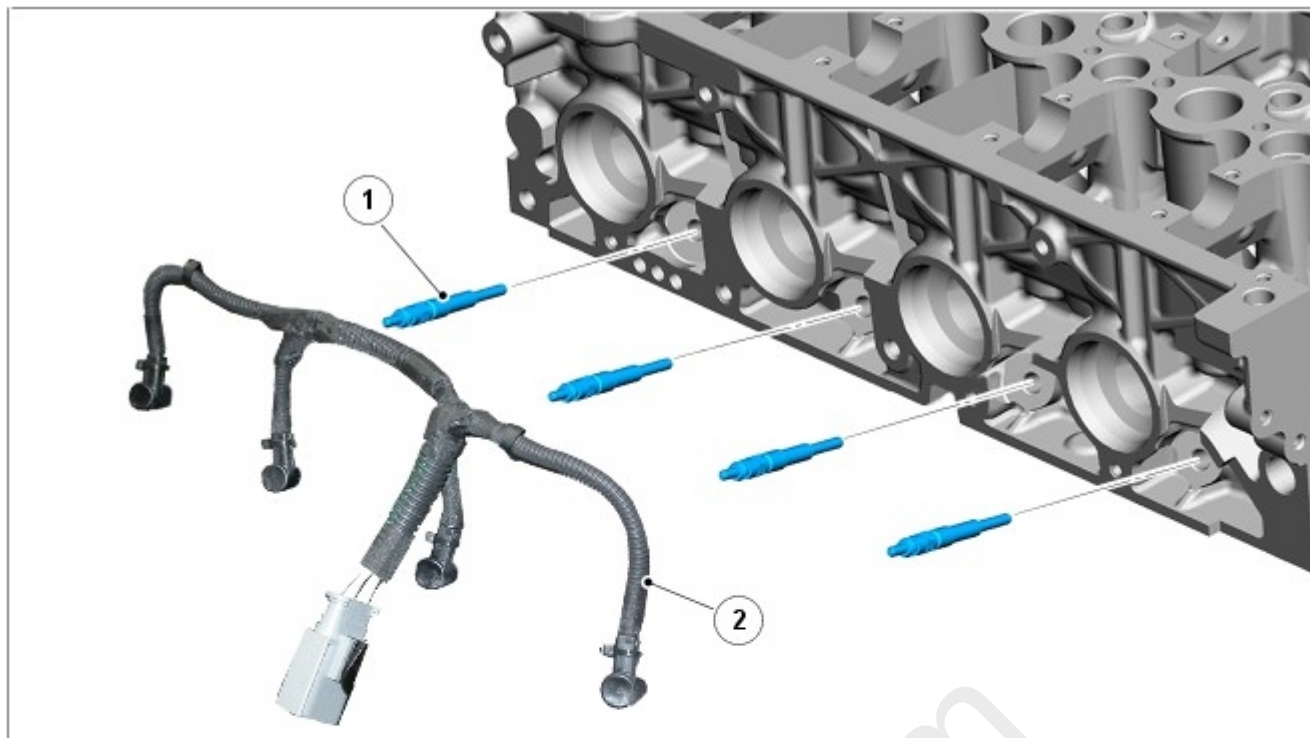
The injector is secured to the structural camshaft cover with an injector mounting clamp and bolt. A dowel that is a loose fit in the camshaft cover provides the anchor point for the opposite end of the injector mounting clamp.

• **NOTE:** Care must be taken when removing the structural camshaft cover or injectors to prevent accidental loss of the injector mounting clamp dowels.

Operation of the injectors is controlled directly by the ECM. For additional information, refer to:

[Fuel Charging and Controls](#) (303-04B Fuel Charging and Controls - TD4 2.2L Diesel, Description and Operation),
[Electronic Engine Controls](#) (303-14 Electronic Engine Controls - 2.2L Duratorq - Td4, Description and Operation).

Glow Plugs



E84658

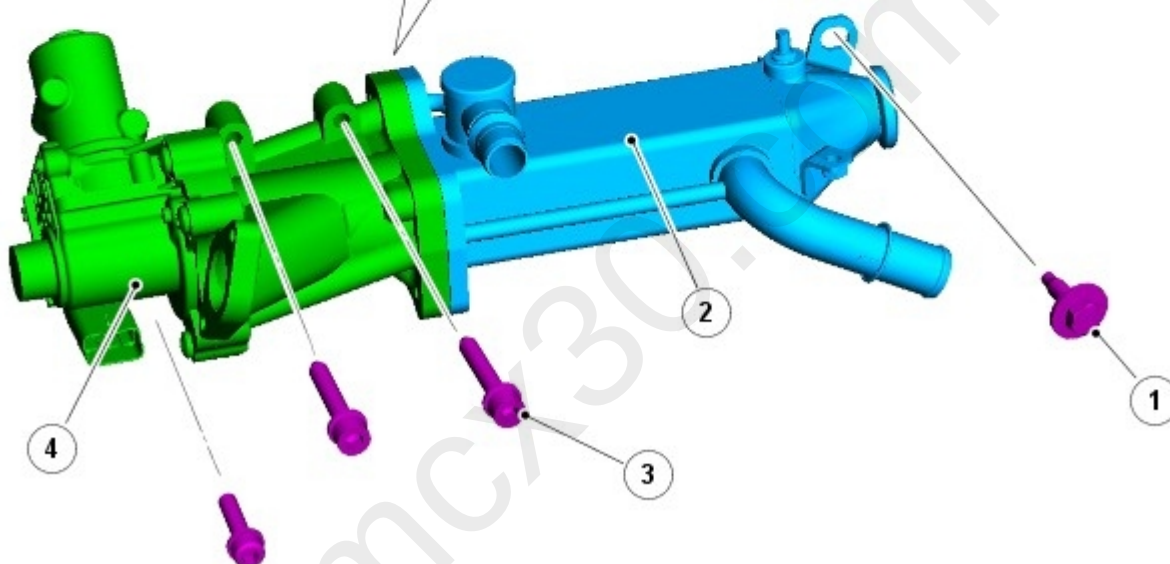
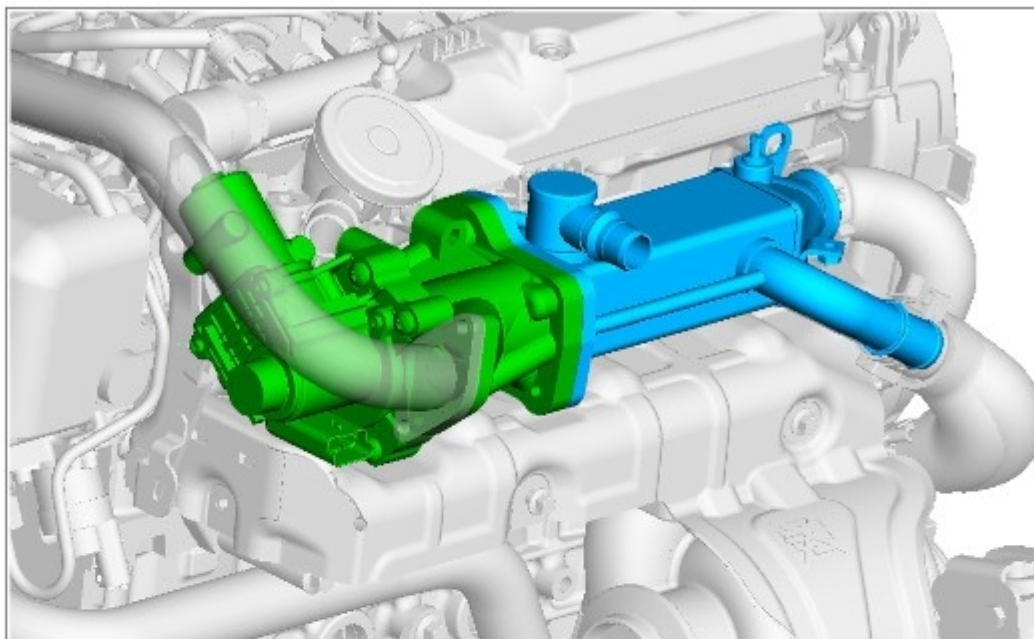
Item	Part Number	Description
1	-	Glow plug
2	-	Glow plug harness

The 4 glow plugs are installed at the lower RH side of the cylinder head, adjacent to each intake helical port. Each glow plug seats in a formed drilling with the tip protruding into the combustion chamber. The glow plugs are connected by a common electrical harness, and are controlled by the ECM.

The glow plugs pre-heat the combustion chamber before and during engine cranking to promote combustion. The glow plugs are essential for aiding engine starting, and also reduce emissions and engine noise of a cold engine. For additional information, refer to:

Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq - Td4, Description and Operation),
[Glow Plug System](#) (303-07B Glow Plug System, Description and Operation).

Exhaust Gas Recirculation (EGR) Valve and Cooler Assembly



E84659

Item	Part Number	Description
1	-	Fixing to camshaft cover
2	-	EGR cooler
3	-	Bolt (3 off)
4	-	EGR valve

The EGR valve and cooler assembly is located on the RH side of the cylinder head above the exhaust manifold, and secured with 4 fixings. An inlet pipe connects the EGR cooler to the exhaust manifold. A gas transfer tube is routed across the engine and connects the EGR valve outlet to the intake manifold housing.

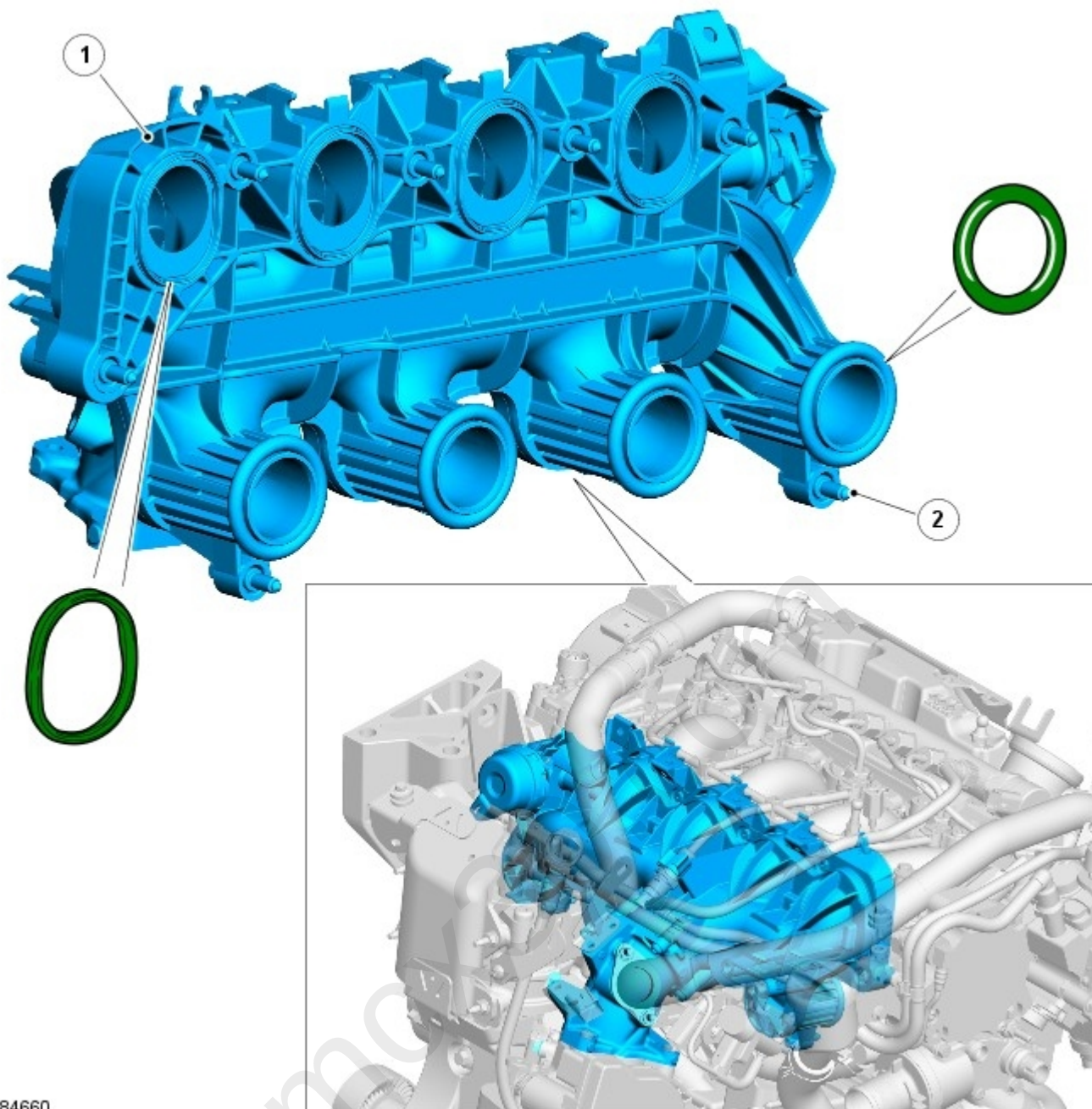
A pipe on the EGR cooler body connects to the climate control heater outlet hose, and provides the coolant supply to the EGR cooler. The EGR cooler outlet connects to the coolant rail, located on the RH side of the engine. The coolant rail is connected between the thermal control module and the coolant pump rear housing.

For additional information, refer to: [Engine Cooling](#) (303-03B Engine Cooling - TD4 2.2L Diesel, Description and Operation).

The EGR is controlled by the ECM, and is enabled when the engine is at normal operating temperature and under cruising conditions.

For additional information, refer to: [Engine Emission Control](#) (303-08B Engine Emission Control - TD4 2.2L Diesel, Description and Operation).

Intake Manifold



E84660

Item	Part Number	Description
1	-	Intake manifold
2	-	Bolt (7 off)

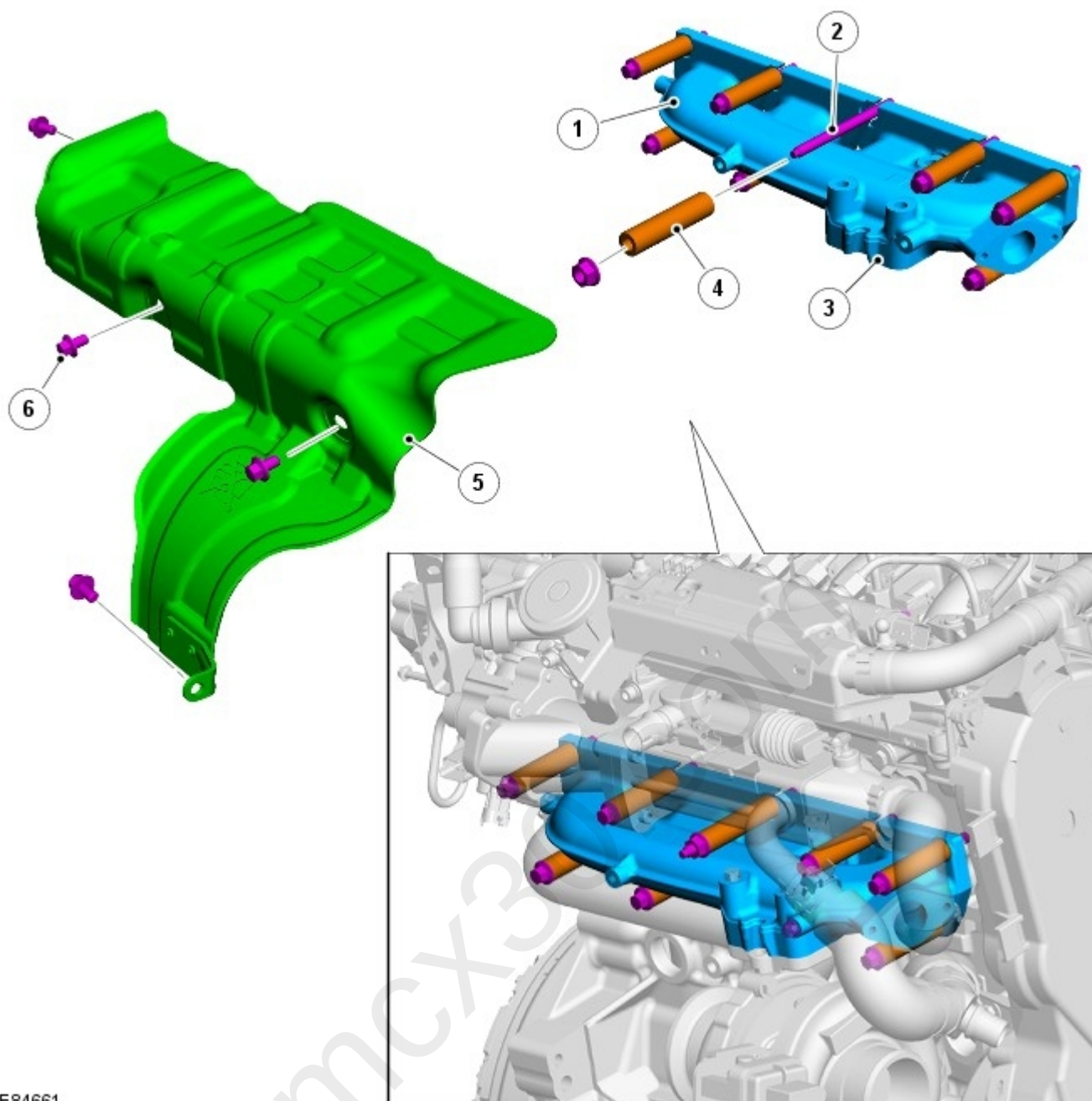
The intake manifold is located on the LH side of the engine, and attached to the cylinder head with 7 bolts. The 4 lower helical swirl ports and 4 upper filling ports are sealed to the cylinder head and structural camshaft cover with a shaped sealing ring. Care must be taken when installing the intake manifold that the sealing rings are correctly seated within the ports.

• **NOTE:** A small quantity of grease may be used to retain the sealing rings in the intake manifold ports during installation of the intake manifold.

The intake manifold provides the location for the electronic throttle assembly, and the port de-activation device components. A port on the RH side of the intake manifold provides the connection for the EGR gas transfer tube. For additional information, refer to:

Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq - Td4, Description and Operation),
[Intake Air Distribution and Filtering](#) (303-12B Intake Air Distribution and Filtering - TD4 2.2L Diesel, Description and Operation).

Exhaust Manifold



E84661

Item	Part Number	Description
1	-	Exhaust manifold
2	-	Stud and nut (9 off)
3	-	Turbocharger mounting flange
4	-	Spacer (9 off)
5	-	Exhaust heat shield
6	-	Exhaust heat shield fixing (4 off)

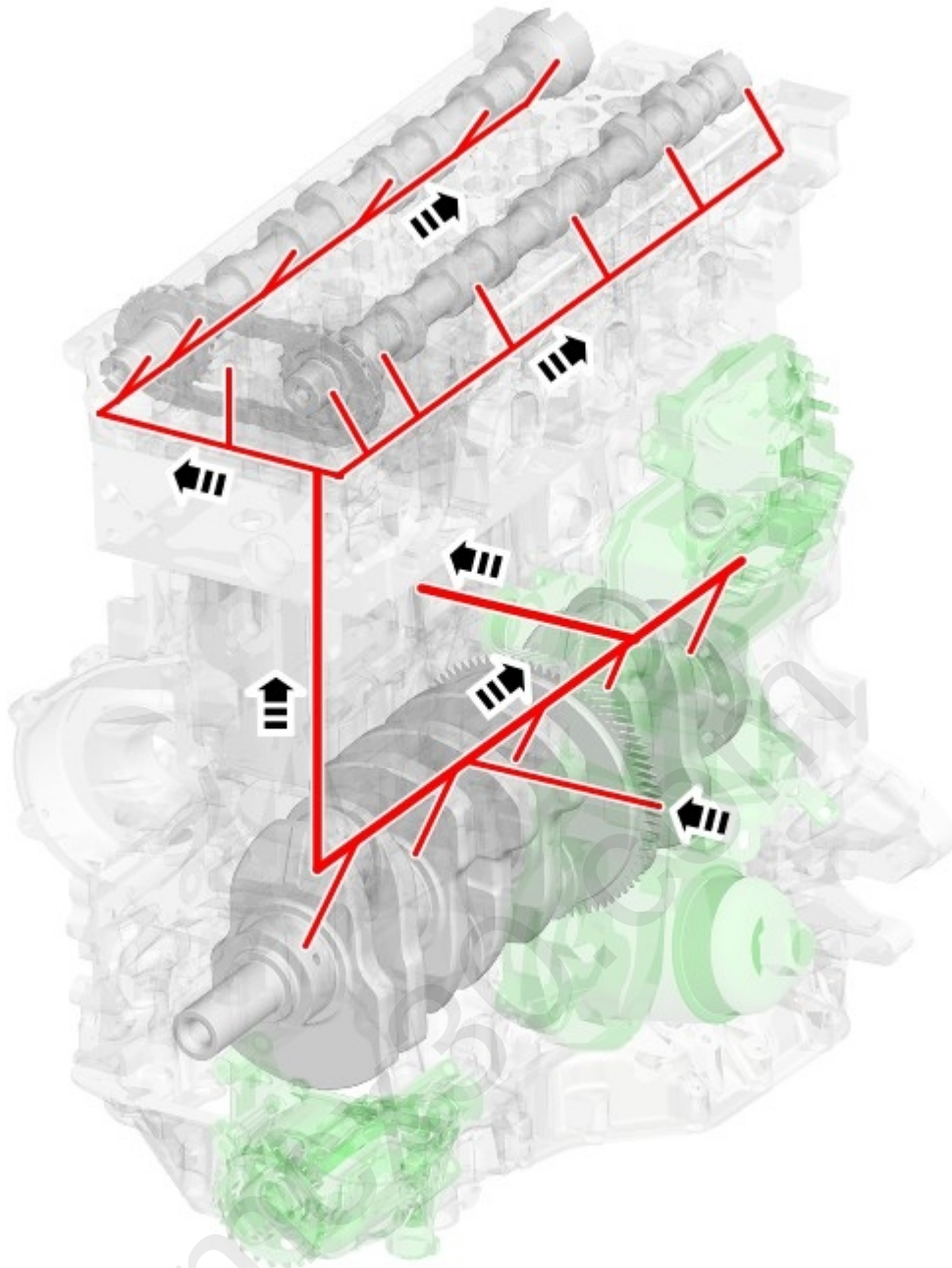
The exhaust manifold is attached to the RH side of the cylinder head with a gasket and 9 fixings. Spacers are installed on the fixings to allow for expansion and contraction of the manifold, while maintaining the clamping loads.

The manifold provides the mounting location for the Variable Geometry Turbocharger (VGT) assembly, and a connection to the EGR gas transfer tube. A heat shield is installed with 4 fixings over the exhaust manifold and VGT to protect other components, and to prevent accidental contact with the hot exhaust components.

The electronically controlled VGT is attached to the exhaust manifold outlet flange with 3 bolts. For additional information, refer to:

[Turbocharger](#) (303-04C Fuel Charging and Controls - Turbocharger - TD4 2.2L Diesel, Description and Operation),
[Engine Emission Control](#) (303-08B Engine Emission Control - TD4 2.2L Diesel, Description and Operation),
 Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq - Td4, Description and Operation).

LUBRICATION SYSTEM



E84662

The lubrication system is a wet sump, pressure fed type. The oil lubricates the engine sliding surfaces, dissipates heat, absorbs fuel combustion residue and seals off the gap between the cylinder and piston.

The engine is lubricated by a force-fed oil circulation system comprising a full-flow oil filter and cooler assembly. The oil filter and cooler form an integral assembly mounted on the LH side of the cylinder block, in close proximity to the oil pump. Engine oil is cooled by the engine cooling system, and eliminates the requirement for an additional remotely mounted engine oil cooler.

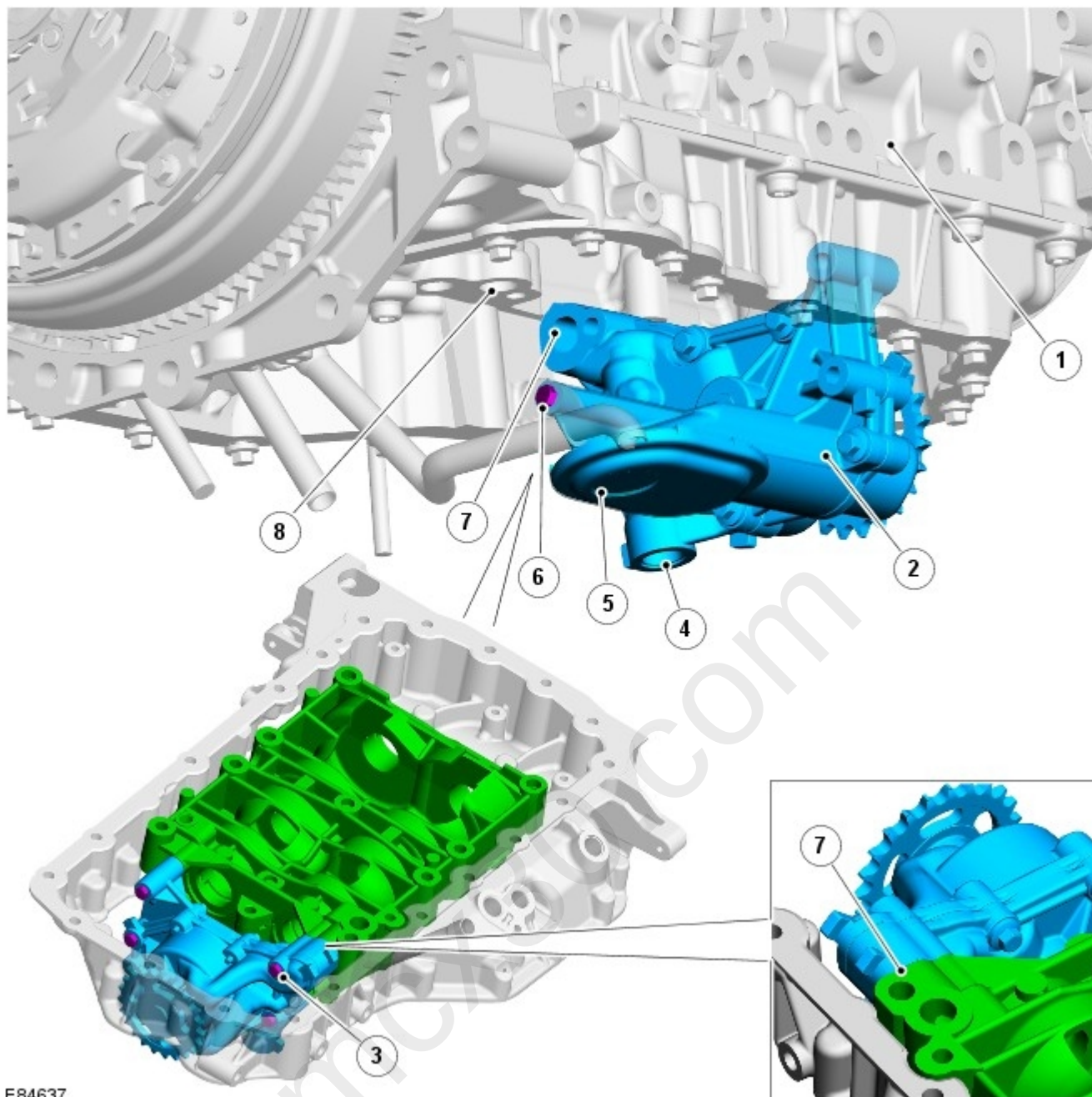
Oil is drawn out of the oil pan and pressurized by the crankshaft driven oil pump. The output from the oil pump is filtered and cooled before being distributed to the cylinder block main oil gallery. Drillings and galleries connected to the main oil gallery deliver pressurized oil to the cylinder block and cylinder head reciprocal component bearings. A drilling above No. 3 main bearing cap directs pressurized oil to a port at the rear RH side of the cylinder block. The port provides pressurized oil through a banjo connection and pipe to the turbocharger bearings.

All the engine moving parts are lubricated by pressure or splash oil. Pressurized oil is also provided for operation of the hydraulic lash adjusters and timing chain tensioner.

Oil is returned to the oil pan under gravity. Large drain holes cast in the cylinder head and cylinder block allow a quick return of the oil.

The lubrication system is replenished through the oil filler cap, located on the engine acoustic cover. An oil level gage is located on the LH side of the oil pan. Two marks at the end of the gage indicate the minimum and maximum oil levels. The difference between the minimum and maximum marks is approximately 1.5 liters (1.58 US quarts) of oil.

Oil Pump



E84637

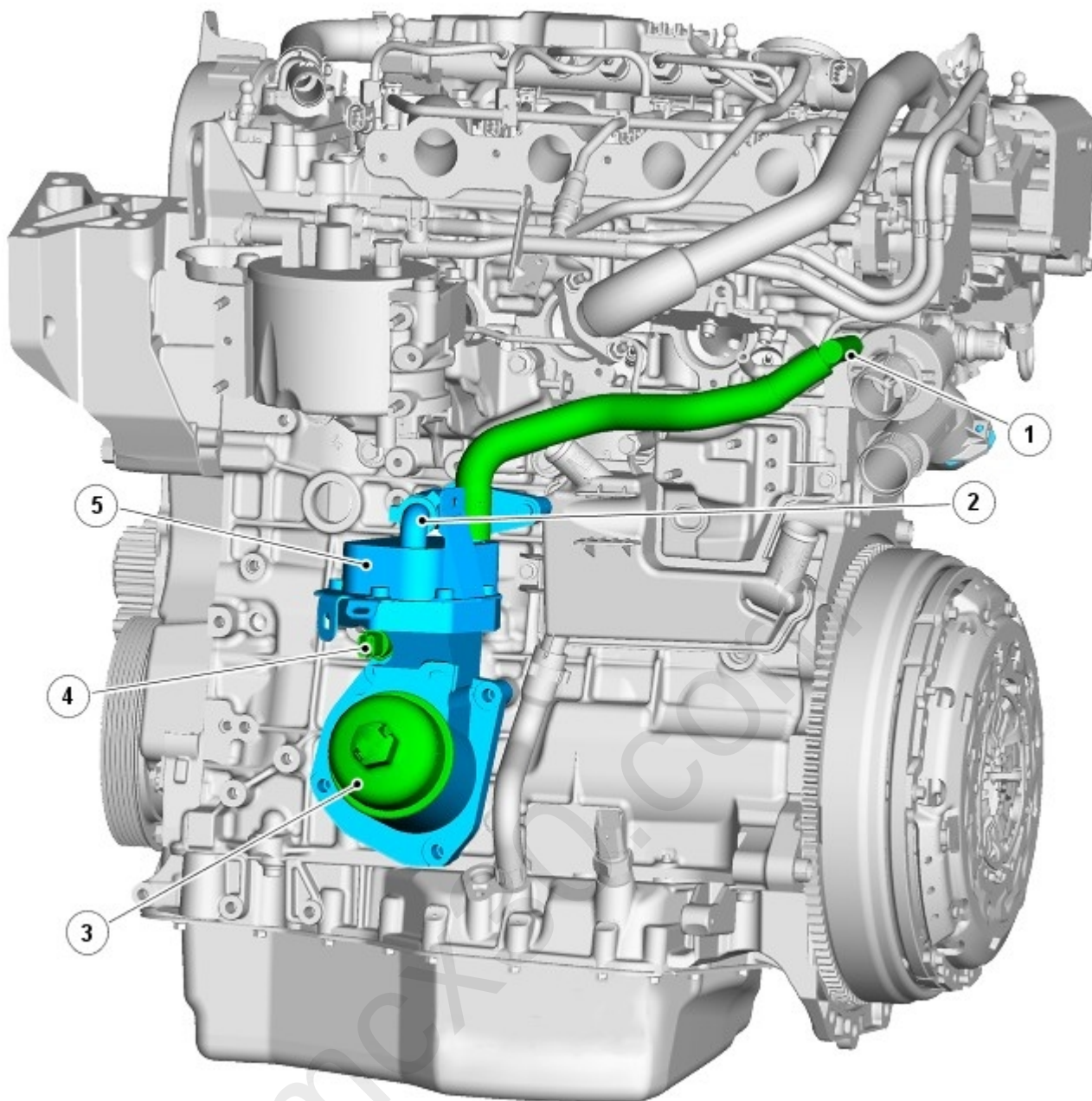
Item	Part Number	Description
1	-	Cylinder block
2	-	Oil pump
3	-	Mounting bolts (4 off)
4	-	Pressure relief valve housing
5	-	Oil pick up and strainer
6	-	Mounting bolt (1 off)
7	-	Oil pump outlet port
8	-	Oil pump supply to cylinder block

The rotor type oil pump is located between the oil pan and oil pan housing, and is attached with 4 bolts to the rear of the counter-balance shaft assembly. A further bolt at the oil strainer secures the oil pump to the oil level gage tube. The oil pump spur gear contains 21 teeth and is driven by the 18 teeth crankshaft gear, via a 48-link single row chain without tensioner.

The oil pick up and strainer protrude beneath the counter-balance shaft assembly and are immersed in the reservoir of oil. A connection between the oil pump outlet, a port in the counter-balance shaft housing, and the cylinder block directs pressurized oil from the oil pump to the oil filter and cooler assembly.

The oil pump creates a maximum oil pressure of 6.5 bar (94.3 psi) at 4500 rpm, with a delivery rate capable of 50 liters (53 US quarts) per minute. A pressure relief valve within the oil pump outlet protects the oil pump and lubrication system components from system over-pressure. The valve will open at approximately 8 bar (116 psi) to relieve excess oil pressure, directing the relieved oil back into the oil pan.

Oil Filter and Cooler Assembly



E82910

Item	Part Number	Description
1	-	Coolant return hose from oil cooler
2	-	Coolant supply hose from cylinder block
3	-	Oil filter housing
4	-	Oil pressure switch
5	-	Oil cooler

A combined engine oil cooler and filter assembly is mounted on the LH side of the engine block, in-line with No. 3 cylinder. The filter housing contains a disposable paper filter element that is accessed by unscrewing the filter housing cap.

The filter housing face mates with cylinder block outlet ports for the oil supply and return through the filter housing. A short hose connects the oil cooler to the cylinder block, and provides the coolant supply to the oil cooler. A hose connected between the oil cooler and front of the cylinder head provides the coolant return to the cooling system thermal control module.

The oil filter housing comprises an integral thermostatic valve to control oil flow through the oil cooler, dependent on the oil temperature. Oil from the cylinder block passes through the oil filter housing, and a partial flow is directed through the oil cooler before returning to the cylinder block.

An oil pressure switch with a screw type connection is installed in the oil filter housing, and is hardwired to the ECM. For additional information, refer to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq - Td4, Description and Operation).

Engine - TD4 2.2L Diesel - Engine

Diagnosis and Testing

Principle of Operation

For a detailed description of the 2.2L Diesel engine, refer to the relevant Description and Operation section in the workshop manual.

REFER to: [Engine](#) (303-01B Engine - TD4 2.2L Diesel, Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

• **NOTE:** If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

1. Verify the customer concern. Concerns have been separated into **Leaks** and **Noise Vibration and Harshness (NVH)** for ease of use.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical
● Intake air system leaks/damage ● Fuel leaks ● Coolant level ● Coolant leaks. REFER to: Engine Cooling (303-03B Engine Cooling - TD4 2.2L Diesel, Diagnosis and Testing). ● Oil level ● Oil leaks ● Visibly damaged or worn parts ● Loose or missing nuts or bolts

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

Symptom Charts

Symptom Chart, Leaks

Symptom	Possible Cause	Action
External coolant leaks	● Damaged hose(s) ● Damaged expansion tank ● Damaged radiator ● Leaking seals/gaskets ● Cracked/damaged casings	For cooling system checks. REFER to: Engine Cooling (303-03B Engine Cooling - TD4 2.2L Diesel, Diagnosis and Testing).
Internal coolant leaks. Note: This may be indicated by the production of white smoke from the exhaust	● Leaking seals/gaskets ● Cracked/damaged casings	Check for cross contamination of cooling system and engine oil. Check for exhaust gases being emitted through header tank. For additional cooling system checks. REFER to: Engine Cooling (303-03B Engine Cooling - TD4 2.2L Diesel, Diagnosis and Testing).
Engine overheats	● Insufficient coolant ● Insufficient engine oil ● Cooling system pressure cap fault ● Thermostat not opening ● Coolant pump failure ● Cooling fan failure	Check for correct coolant/engine oil levels. For cooling system checks. REFER to: Engine Cooling (303-03B Engine Cooling - TD4 2.2L Diesel, Diagnosis and Testing).
Engine takes too long to reach operating temperature	● Thermostat stuck open	For cooling system checks. REFER to: Engine Cooling (303-03B Engine Cooling - TD4 2.2L Diesel, Diagnosis and Testing).
External oil leaks	● Gaskets ● Seals ● Hoses ● Oil filter ● Oil cooler ● Damaged/Cracked	Clean and confirm the area of the leak. Visually check the condition of oil carrying components. Check the crankcase ventilation system. REFER to: Engine Emission Control (303-08B Engine Emission Control - TD4 2.2L Diesel, Diagnosis and Testing).

Symptom	Possible Cause	Action
	- casings ● Crankcase ventilation system ● Piston ring blow-by	Carry out a compression test, GO to Pinpoint Test A .
Internal oil leaks (leaks into coolant or combustion chamber) Note: This may be indicated by the production of blue smoke from the exhaust	● Gaskets ● Seals ● Hoses ● Damaged/Cracked casings ● Worn valve guides ● Worn cylinder bores/pistons ● Broken piston rings	Check for traces of oil in the coolant. Check for evidence of oil in the combustion chambers (deposits on the glow plugs, etc). Confirm oil consumption and vehicle usage with the owner/driver. Carry out an oil consumption test, GO to Pinpoint Test B .

• NOTE: As the checks suggested here are open to interpretation, they should be used as a guide only. Descriptions of noises, etc, are in general terms, so depend on a degree of experience on the part of the technician.

Symptom Chart, NVH

Symptom	Possible Cause	Action
Rattle/ticking from top of engine	● Valve gear noise ● Camshaft bearing noise ● Camshaft chain noise ● Tensioner noise ● Vacuum pump noise ● High pressure fuel pump noise ● Injector leaking	Check the engine oil level and pressure, GO to Pinpoint Test C . Check the function of the hydraulic tappets and condition of camshaft lobes and bearings. Check the camshaft chains and tensioners, vacuum pump and high pressure fuel pump. Carry out injector leak test
Squeaking/Creaking/Squeal from front of engine	● Accessory drive belt ● Accessory drive belt tensioner ● Driven components on accessory drive belt	Check the accessory drive belt and driven components. REFER to: Accessory Drive (303-05B Accessory Drive - TD4 2.2L Diesel, Diagnosis and Testing).
Whine/Slap/Growl from front of engine	● Accessory drive belt ● Accessory drive belt tensioner ● Driven components on accessory drive belt ● Timing belt noise ● Timing belt tensioner noise	Check the accessory drive belt and driven components. REFER to: Accessory Drive (303-05B Accessory Drive - TD4 2.2L Diesel, Diagnosis and Testing). Check the timing belt and tensioners for noise/damage
Knock from lower half of engine (often worse with a cold engine)	● Engine oil level/pressure low ● Piston slap ● Piston pin noise ● Connecting rod bearing noise	Check the engine oil level and pressure, GO to Pinpoint Test C . Check for debris in the engine oil, check condition of engine components
Knock/Rumble from lower half of engine (often worse on overrun)	● Engine oil level/pressure low ● Main bearing noise	Check the engine oil level and pressure, GO to Pinpoint Test C . Check for debris in the engine oil, check condition of engine components
Whine/Whistle	● Intake air system leaks ● Damaged turbocharger (when noise emanating from rear of engine)	Check for loose/damaged intake air system components. Check for excessive turbocharger shaft float Note: a small amount of turbocharger shaft float is normal/acceptable. Check for general damage to turbocharger
Misfire/Rough running	● Electronic engine controls ● Fuel charging and controls ● Intake air system leaks ● Exhaust gas recirculation (EGR) system ● Burnt/sticking valves ● Worn valve guides ● Worn cylinder bores/pistons ● Broken piston rings ● Damaged/Cracked casings	For electronic engine controls. REFER to: Electronic Engine Controls (303-14B Electronic Engine Controls - TD4 2.2L Diesel, Diagnosis and Testing). For fuel charging and controls systems tests. REFER to: Fuel Charging and Controls (303-04B Fuel Charging and Controls - TD4 2.2L Diesel, Diagnosis and Testing). Check intake air system for damage/leaks. For EGR system tests. REFER to: Engine Emission Control (303-08B Engine Emission Control - TD4 2.2L Diesel, Diagnosis and Testing). Check for damaged engine components. Carry out a compression test, GO to Pinpoint Test A .

Pinpoint Tests

• NOTE: Where reference is made to 'suitable equipment', this refers to standard workshop equipment. Refer to the operating instructions for your own equipment when performing any tests.

PINPOINT TEST A : CHECK THE CYLINDER COMPRESSIONS



WARNING: Only compression testers able to read the higher compression pressures found in diesel engines should be used. Failure to follow this instruction may result in personal injury.

• NOTE: Where possible, compression testing should be carried out on an engine at normal operating temperature.	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
A1: CARRY OUT A DRY CYLINDER COMPRESSION TEST	
	1 Make sure the parking brake is applied and that the selector lever is in neutral (or park for vehicles with automatic transmission). 2 Set the ignition status to OFF. 3 Remove the starter relay. 4 Disconnect the starter motor solenoid connector. 5 Connect a suitable remote starter device to the starter motor solenoid. 6 Remove the glow plugs. REFER to: Glow Plugs (303-07B Glow Plug System, Removal and Installation). 7 Install suitable adaptor in place of the glow plug in the first cylinder to be tested. 8 Connect a suitable compression tester to the adaptor. See warning above. 9 Using the remote starter device, crank the engine a minimum of five revolutions. 10 Record the compression figure and the number of revolutions taken to reach it. 11 Repeat steps 7 - 10 above for the remaining cylinders, cranking the engine for a similar number of revolutions each time. 12 Compare the compression figures across all the cylinders.
	Are the compression figures within 10% of each other? Yes Unless the compression figures are universally very low (experience will indicate this), check for other causes for the customer complaint. No GO to A2.
A2: CARRY OUT A WET CYLINDER COMPRESSION TEST	
 CAUTION: If engine oil is introduced into the cylinders, run the engine at 2,000 rpm for a minimum of ten minutes after completing testing to prevent damage to the catalytic converters. Failure to follow this instruction may result in damage to the vehicle.	
• NOTE: There is a combustion chamber in the top of each piston. Make sure that the oil is not allowed to run into this chamber.	
	1 Using a suitable oil can with a flexible spout, introduce a small amount of clean engine oil into the cylinder just before testing, such that the oil is able to run between the piston and the cylinder bore. 2 Repeat steps 7 - 10 from the test above, introducing oil into each cylinder just before testing. 3 Compare the compression figures across all the cylinders.
	Is the compression figure higher than the dry test? Yes A higher figure following the introduction of oil may indicate a worn or damaged cylinder bore, piston and/or piston rings. Disassembly would be required to confirm this. No If the compression figure is unaffected by the introduction of oil, but the figure is still less than 90% of the other cylinders, this may indicate a burnt and/or sticking valve, leaking head gasket, etc. Disassembly would be required to confirm this. Clear any DTCs which may have been induced by the test.

PINPOINT TEST B : OIL CONSUMPTION TEST

• NOTE: Oil consumption will vary, depending on a number of factors. New engines will normally use more oil than 'run-in' engines, once a consumption figure has been determined contact Dealer Technical Support for further assistance.

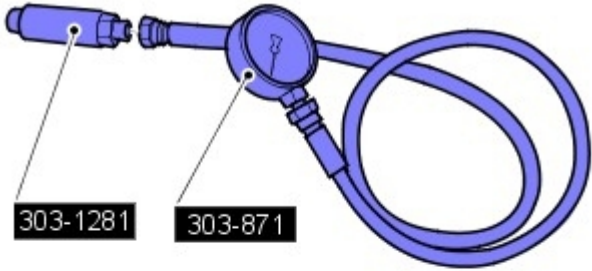
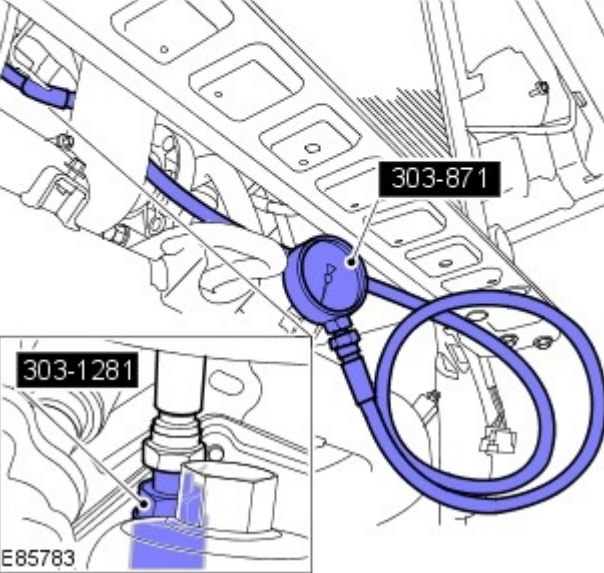
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
B1: CHECK FOR EXCESSIVE OIL CONSUMPTION	
	1 Start the engine and allow it to run until it reaches normal operating temperature. 2 Make sure the vehicle is parked on a level surface and switch off. 3 Allow to settle for at least five minutes. 4 Check the oil level. 5 Correct the level, if necessary, and record the reading and mileage in the vehicle history. 6 Make sure that the owner/driver is aware that a test is being carried out, and that they should not top-up their oil level for the duration of the test, but should check the level every 160-240 Km (100-150 miles). 7 When the oil level reaches the ADD mark, the customer should bring the vehicle in to be checked. 8 Top-up the oil to the level at the beginning of the test and record the amount of oil needed to do so, and the mileage covered in the course of the test. 9 From this, the consumption can be calculated, and a decision made as to whether or not the consumption is considered excessive.
	Is the consumption excessive for the mileage and/or use? Contact Dealer Technical Support for further assistance. Yes Disassembly will be required to check the components indicated in the symptom chart. No No further action is necessary.

PINPOINT TEST C : CHECK THE ENGINE OIL PRESSURE

• NOTE: The vehicle must be driven a minimum of 6 miles (10 kilometers) prior to testing the oil pressure. Do not attempt to attain normal engine operating temperature by allowing the engine to idle.

• NOTE: Check and, if necessary, top-up the engine oil level before beginning this test.

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
C1: CHECK FOR LOW ENGINE OIL PRESSURE	

	1 Remove the oil pressure sensor. REFER to: Engine Oil Pressure (EOP) Sensor (303-14B Electronic Engine Controls - TD4 2.2L Diesel, Removal and Installation).
	2 Connect the oil pressure gauge and adaptor in place of the oil pressure sensor.
	3 Start the engine and check for leaks at the gauge connection. 4 Allow the engine to idle and monitor the oil pressure. 5 Raise the engine speed to 4000 rpm and monitor the oil pressure.
	Is the oil pressure approximately 1.6 bar (23 lb/in²) at idle, and 3.1 bar (45 lb/in²) at 4000 rpm? Yes No fault is indicated at these pressures, oil pressure is considered normal. No Low pressure may indicate a problem with: oil pump, filtering, clearances within the engine. Check if there are any other indications of engine faults (noise, etc). High pressure may indicate a blockage in the lubrication system. If this is not resolved, high oil pressure will lead to engine oil leaks and other failures.

Engine - TD4 2.2L Diesel - Engine Oil Draining and Filling

General Procedures

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

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

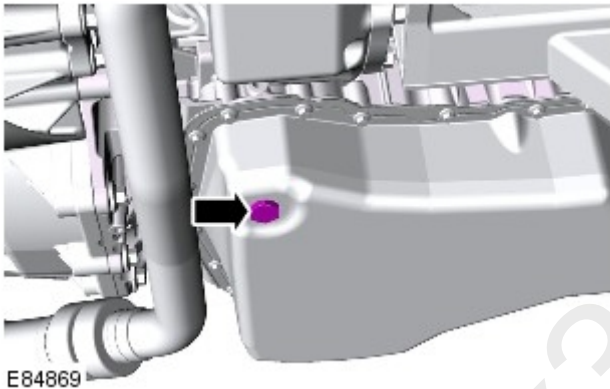
Raise and support the vehicle.

2. Remove the engine undershield.

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

3. Remove the oil filter.

Refer to: [Oil Filter Element](#) (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).



4.  **WARNING:** Avoid skin contact with the specified material.

- CAUTIONS:



Hot fluid.



Be prepared to collect escaping fluids.

- Torque: 20 Nm
- Remove and discard the sealing washer.

5. **CAUTIONS:**



Make sure that the component is clean, free of foreign material and lubricant.



Make sure that new sealing washers are installed.

To install, reverse the removal procedure.

6. Check and top-up the engine oil.

Engine - TD4 2.2L Diesel - Camshaft Timing

General Procedures

Special Tool(s)

 303-1270 E85706	303-1270 Timing Pin, Crankshaft
 303-1277 E85707	303-1277 Timing Pin, Camshaft

1. Remove the cover and disconnect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

2.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

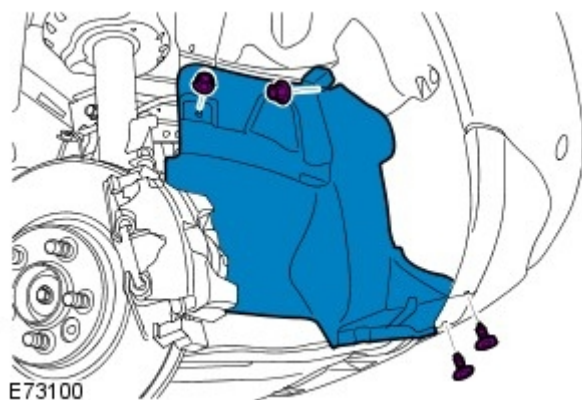
3. Remove the RH front wheel and tire.

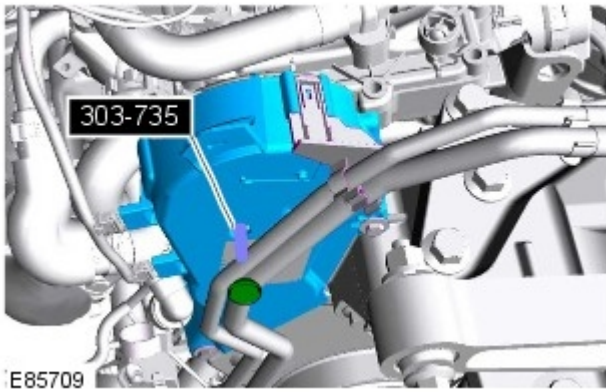
Refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).

4. Remove the starter motor.

Refer to: [Starter Motor](#) (303-06B Starting System - TD4 2.2L Diesel, Removal and Installation).

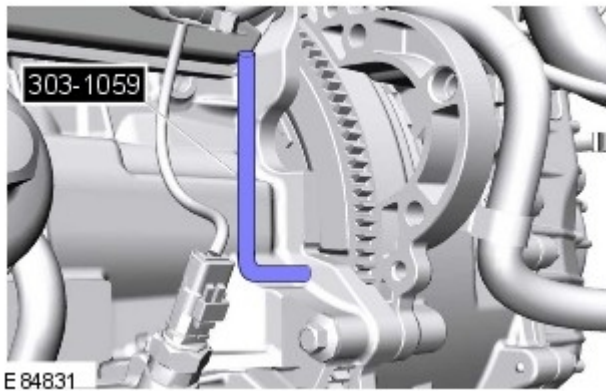
- 5.





6.  **CAUTION:** Only rotate the crankshaft clockwise.
- Remove the grommet.
 - Install the camshaft timing tool.

Special Tool(s): [303-1277](#)



- 7.
- Install the crankshaft timing tool.

Special Tool(s): [303-1270](#)

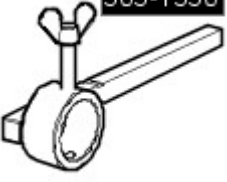
8. If the camshaft timing is found to be incorrect, proceed with the adjustment.

Refer to: [Timing Belt](#) (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).

Engine - TD4 2.2L Diesel - Balance Shaft Backlash

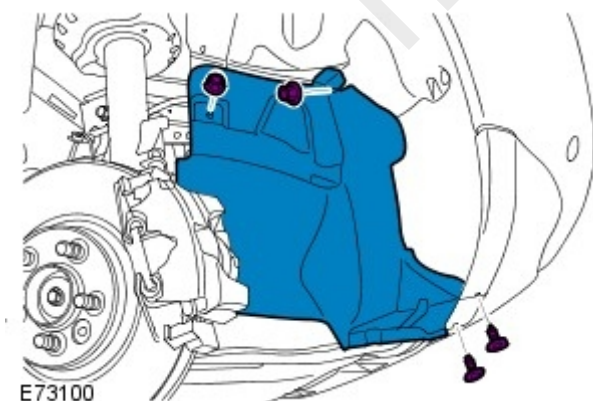
General Procedures

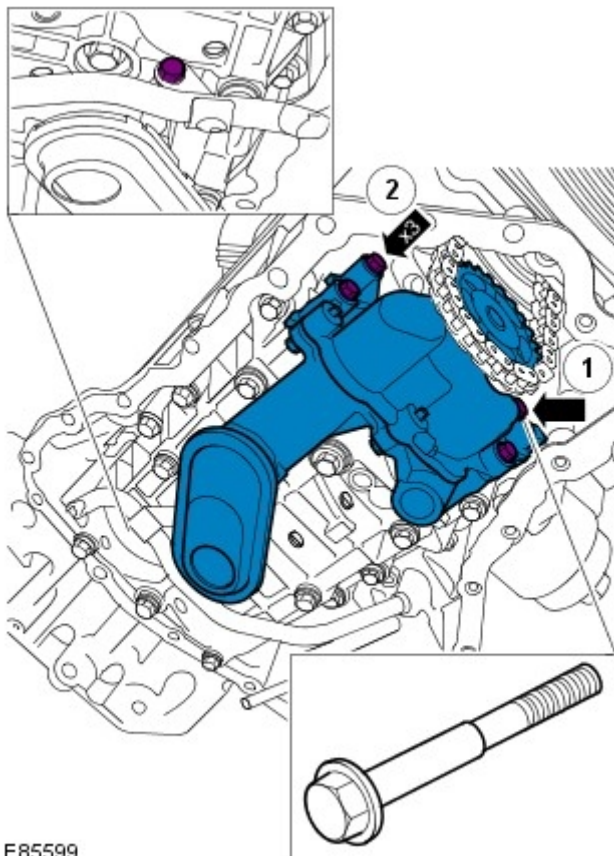
Special Tool(s)

 303-1270 E85706	303-1270 Timing Pin, Crankshaft
 303-1328 E89978	303-1328 Timing Plate, Balance Shafts
 303-1329 E 89979	303-1329 Locking Tool, Balance Shafts
 303-1330 E89980	303-1330 Backlash Lever, Balance Shafts

• NOTE: The backlash can only be adjusted between the crankshaft and balance shaft assemblies. Incorrect backlash between the balance shafts will require the replacement of the balance shaft assembly.

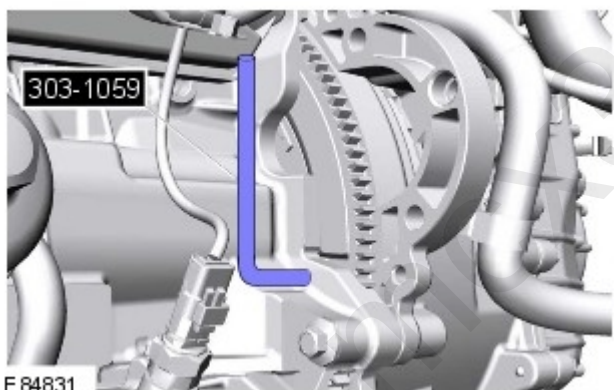
1.





E85599

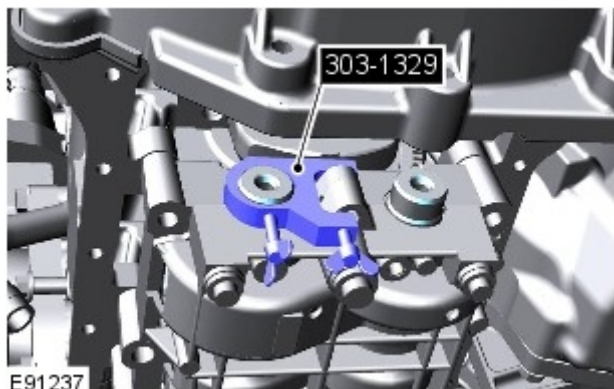
2.  **CAUTION:** Note the fitted position of the component prior to removal.
 - **NOTE:** The shouldered bolt in position 1 locates the oil pump.



E 84831

3. Rotate the crankshaft and install the crankshaft timing tool.

Special Tool(s): [303-1270](#)



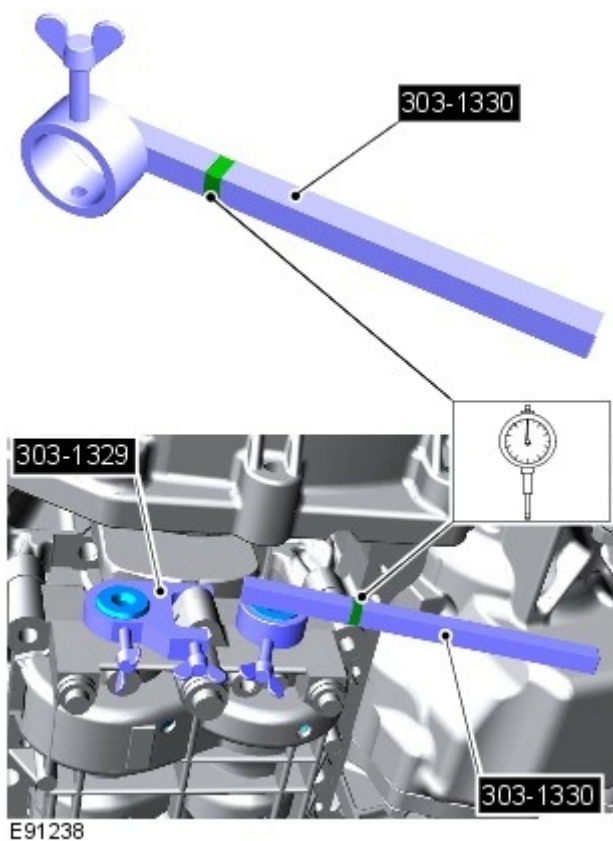
E91237

4. Lock the balance shafts.

Special Tool(s): [303-1329](#)

5. For balance shaft data, refer to engine specification section.

Refer to: [Specifications](#) (303-01B Engine - TD4 2.2L Diesel, Specifications).

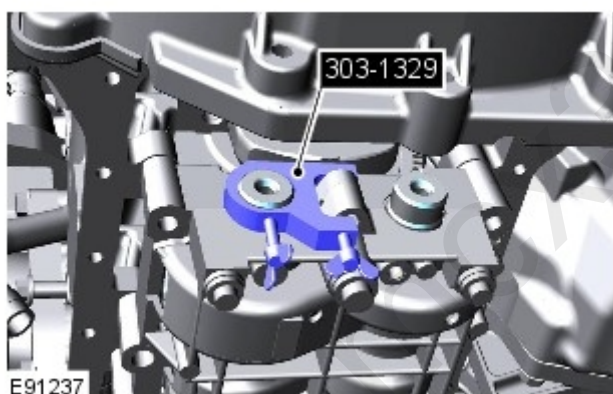


6.

- Measure the backlash between the balance shafts.

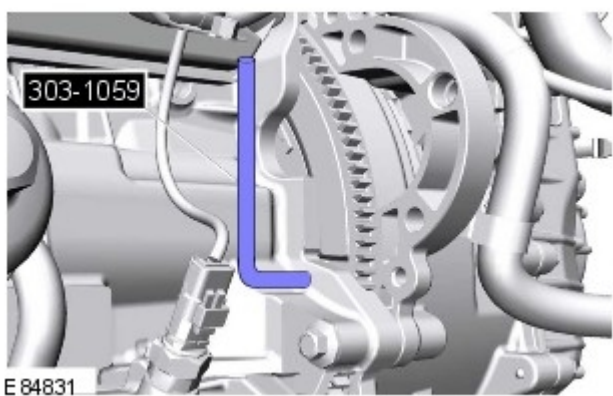
Special Tool(s): [303-1330](#)

- Install and position a dial test indicator (DTI) to the measurement position on the special tool.
- If the backlash between the balance shafts is less than 0.01 mm or greater than 0.07 mm then the balance shaft assembly must be replaced.
- If a balance shaft assembly replacement is required, go to step 11.



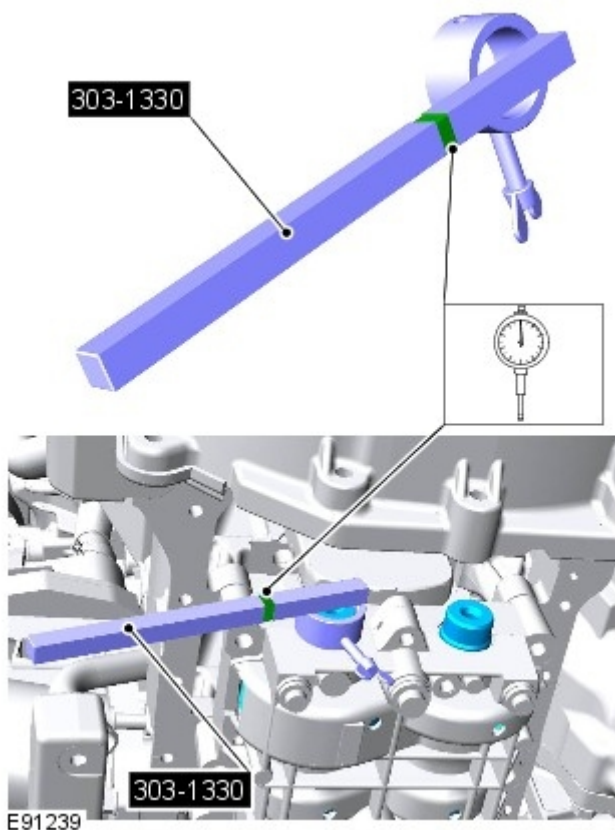
7. Remove the balance shaft locking tool.

Special Tool(s): [303-1329](#)



8. Remove the crankshaft timing tool.

Special Tool(s): [303-1270](#)

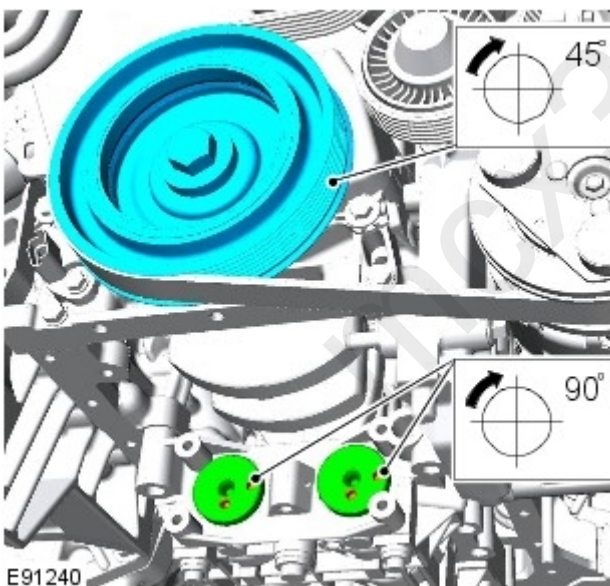


9.

- Measure the backlash between the balance shaft and crankshaft.

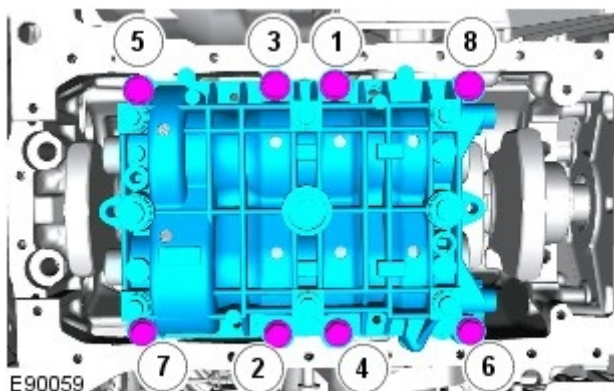
Special Tool(s): [303-1330](#)

- Install and position a dial test indicator (DTI) to the measurement position on the special tool.



10.

- Turn the crankshaft in the normal direction of rotation, measure and record the backlash on every quarter rotation of the balance shafts, until 8 readings are taken and the crankshaft has completed 1 revolution.
- Calculate the average backlash.
- If the backlash is out of tolerance, go to step 12.



11. **11. CAUTIONS:**

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

 Make sure the locating dowels are installed correctly.

• **NOTE:** Make sure that this component is installed to the noted removal position.

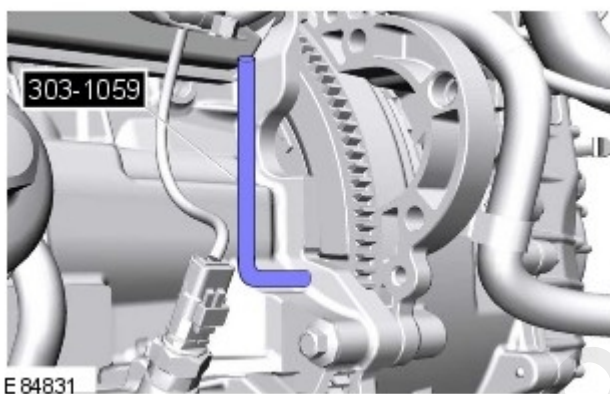
- When a new balance shaft assembly is required.
- Remove the balance shaft assembly.
- Select and install the largest available shims.
- Install the new balance shaft assembly, tighten the bolts evenly in 2 stages to the sequence shown.

Torque:

Stage 1: 5 Nm

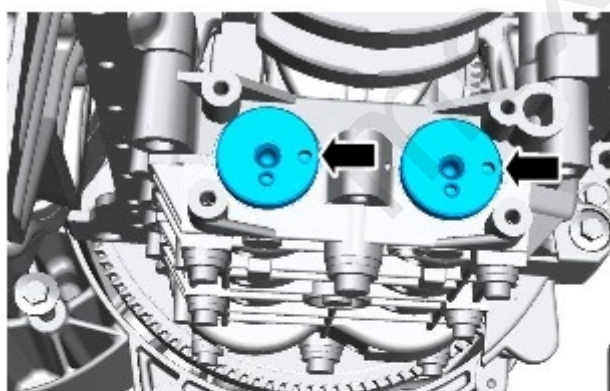
Stage 2: 22 Nm

- Repeat the backlash checking process.



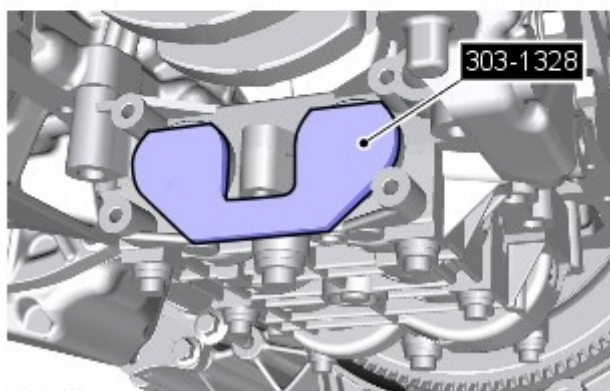
12. Rotate the crankshaft and install the crankshaft timing tool.

Special Tool(s): [303-1270](#)



13. Install the balance shaft timing tool.

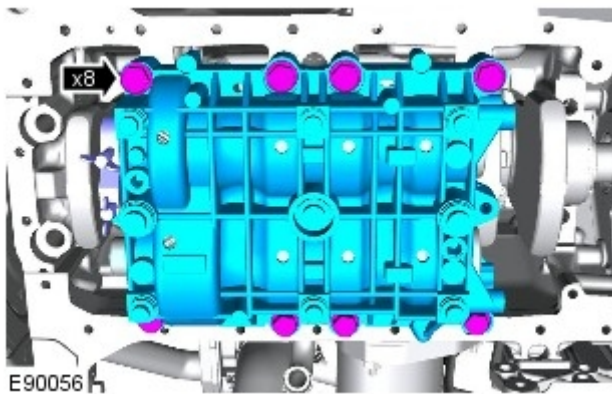
Special Tool(s): [303-1328](#)





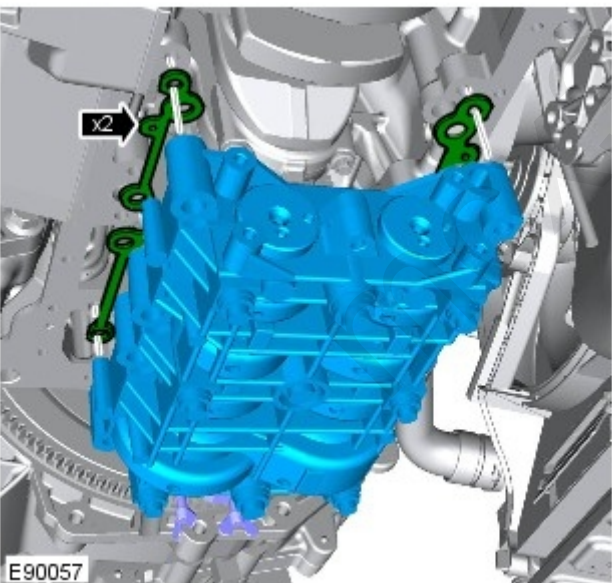
14. Install the balance shaft locking tool.

Special Tool(s): [303-1329](#)



15. **15.**  CAUTION: Note the fitted position of the component prior to removal.

Remove the balance shaft assembly.



16. **16.** CAUTIONS:



Make sure that these components are installed to the noted removal position.



Extreme cleanliness must be exercised when handling these components.

Remove the 2 shims.

17. **17.** CAUTIONS:

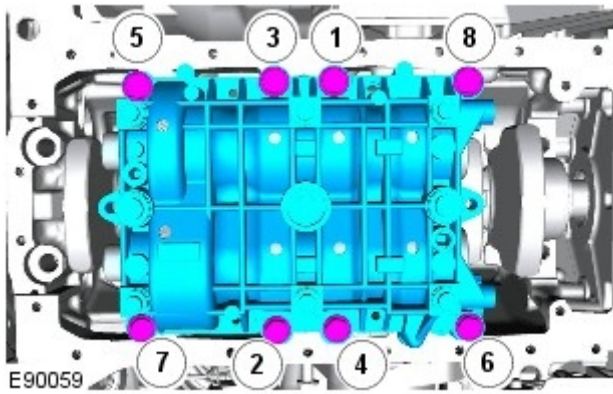


Make sure that these components are installed to the noted removal position.



Extreme cleanliness must be exercised when handling these components.

- Select and install the new shims.



18. **18.**  **CAUTION:** Make sure that the mating faces are clean and free of corrosion and foreign material.
- **NOTE:** Make sure that this component is installed to the noted removal position.

Tighten the bolts evenly in 2 stages to the sequence shown.

Torque:

Stage 1: 5 Nm
Stage 2: 22 Nm

19. Remove the balance shaft timing and locking tools.

Special Tool(s): [303-1329](#), [303-1328](#)

20. Repeat the backlash checking process.

21. Install the fender splash shield extension panel.

Engine - TD4 2.2L Diesel - Intake Manifold

Removal and Installation

Removal

1. Disconnect the battery ground cable.

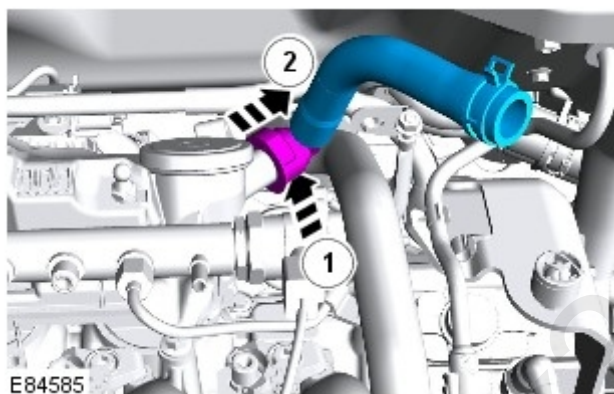
Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

2.  **WARNING:** Make sure to support the vehicle with axle stands.

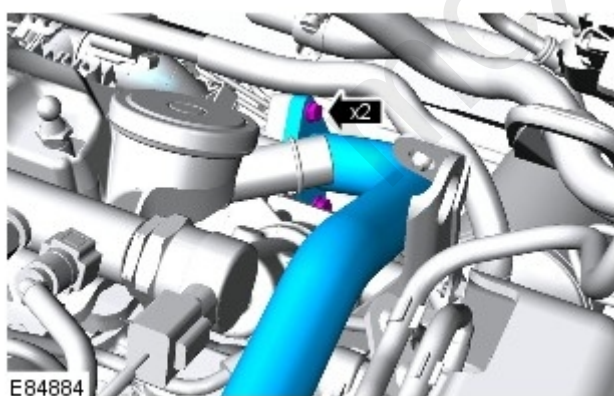
Raise and support the vehicle.

3. Remove the fuel filter.

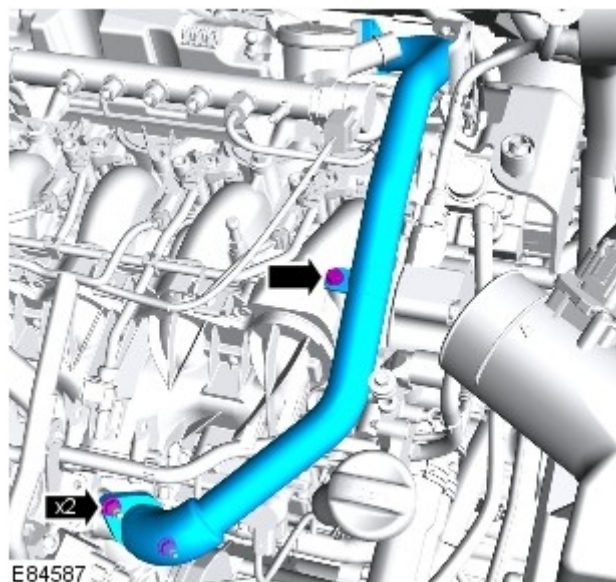
Refer to: [Fuel Filter](#) (310-01B Fuel Tank and Lines - TD4 2.2L Diesel, Removal and Installation).



4.



5.



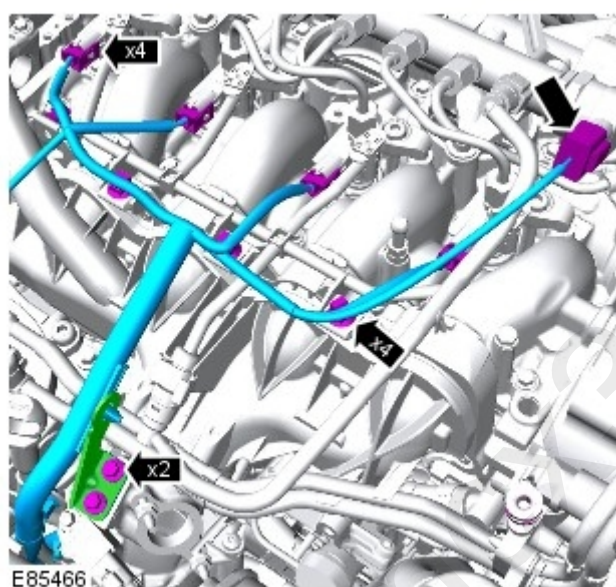
6. **CAUTIONS:**



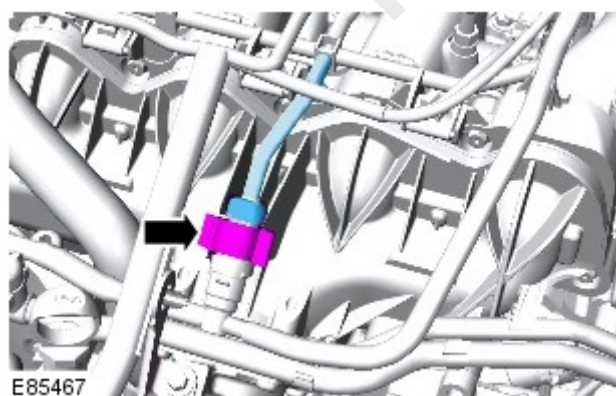
Discard the component.



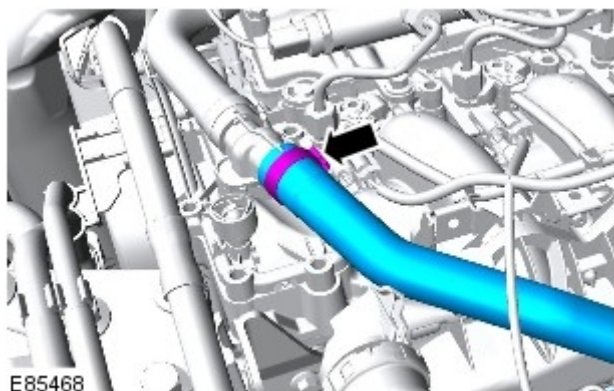
Make sure that all openings are sealed.



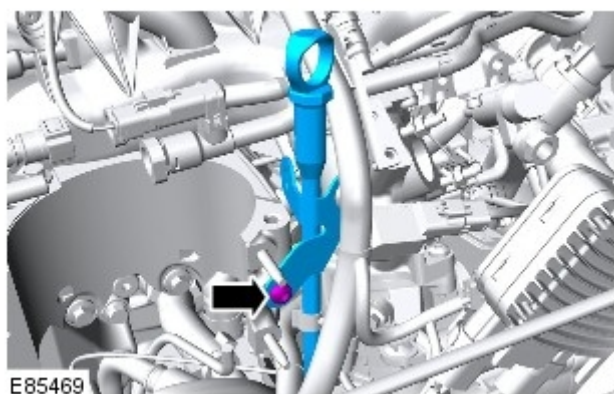
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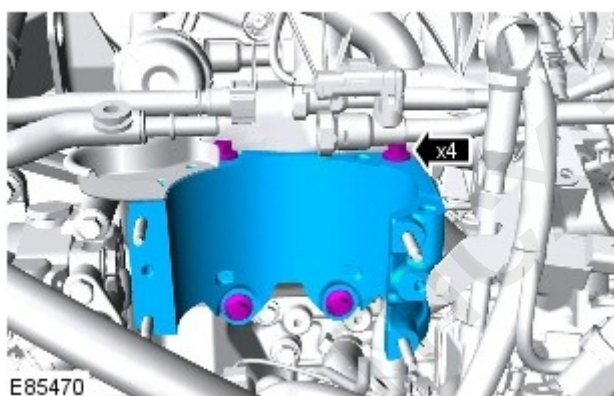
8.



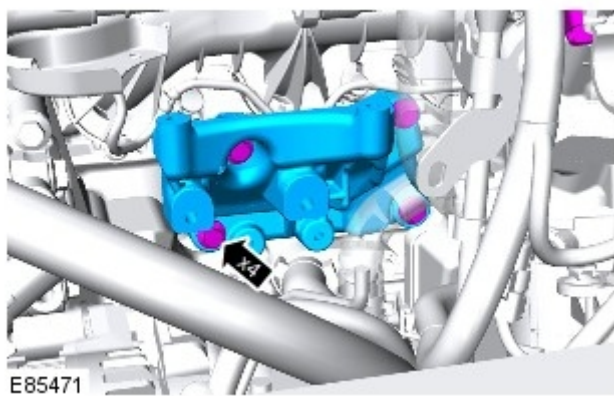
9.  **CAUTION:** Make sure that all openings are sealed. Use new blanking caps.



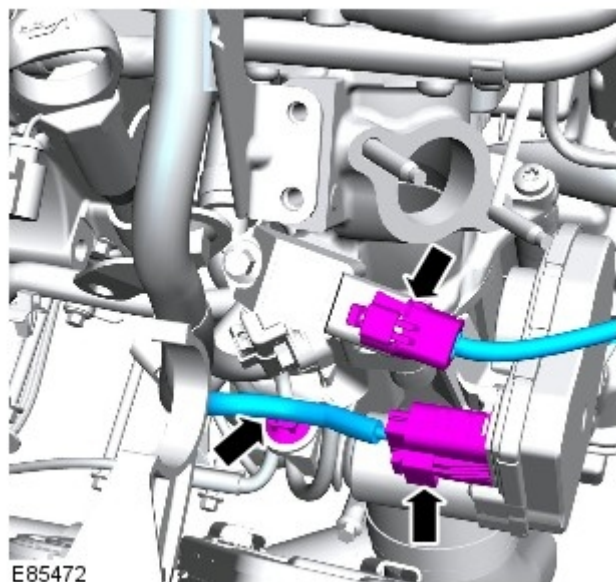
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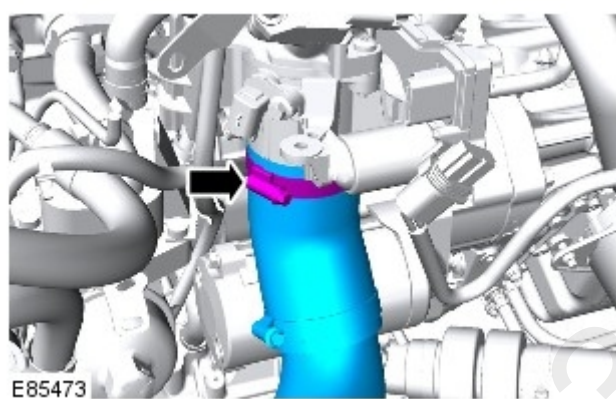
11.



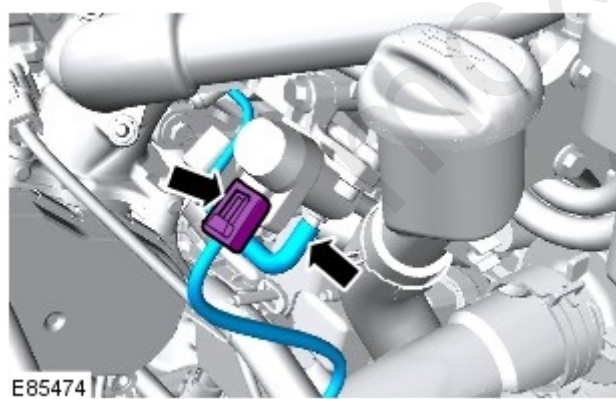
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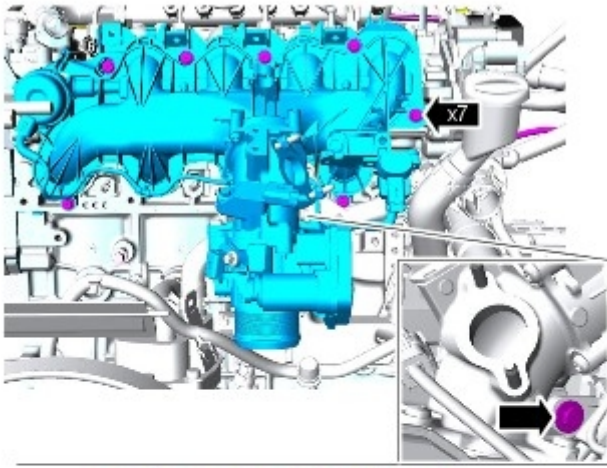
13.



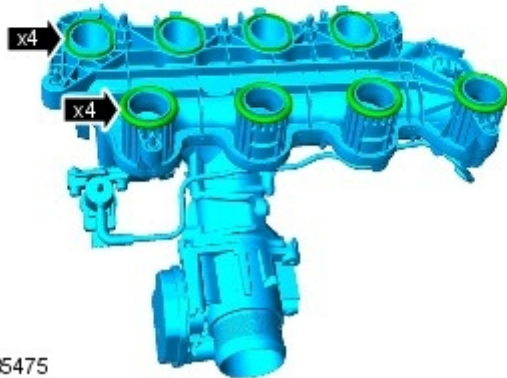
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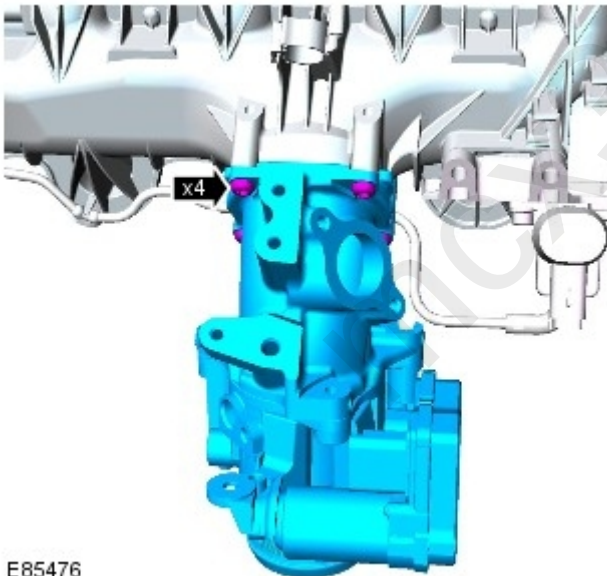
15.



16. **16.**  **CAUTION:** Discard the seals.



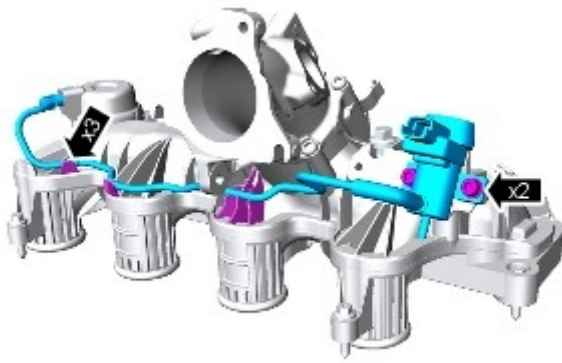
E 85475



E85476

17. **17.** **NOTE:** Do not disassemble further if the component is removed for access only.
Remove the intake manifold adaptor and throttle housing.

18.



E85477

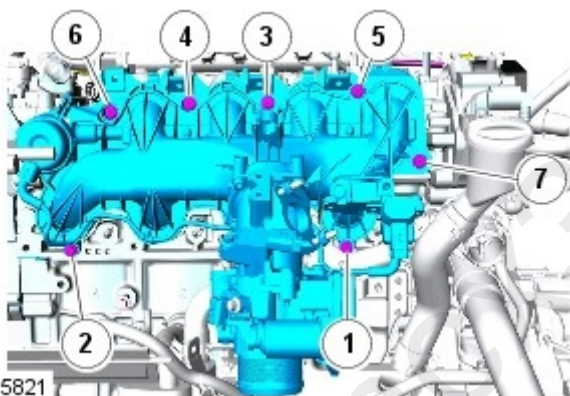
Installation

1. Install the intake manifold runner control (IMRC) actuator.

Torque: 10 Nm

2. Install the intake manifold adaptor and throttle housing.

Torque: 6 Nm



E85821

3.  **CAUTION:** Install the new seals.
Install the intake manifold.

Torque: 9 Nm

- 4.

- Connect the IMRC actuator electrical connector.
- Connect the vacuum hose.

5. Connect the turbocharger outlet pipe.

- 6.

- Connect the manifold absolute pressure (MAP) sensor electrical connector.
- Connect the throttle position (TP) sensor electrical connector.

7. Install the fuel filter brackets.

Torque: 25 Nm

8. Attach the oil level indicator tube.

Torque: 10 Nm

10. **NOTE:** Install a new retaining clip.
CAUTION: Connect the crankcase vent hose.



"Make sure that a new component is installed. "



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

Install the EGR pipe.

Torque: 10 Nm

11. Attach the spill return line.

12. Connect and secure the fuel injector wiring harness electrical connectors.

Torque: 10 Nm

13. Install the breather line.

14. Install the fuel filter.

Refer to: [Fuel Filter](#) (310-01B Fuel Tank and Lines - TD4 2.2L Diesel, Removal and Installation).

15. Connect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

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Engine - TD4 2.2L Diesel - Crankshaft Pulley

Removal and Installation

Special Tool(s)

 303-1270 E85706	303-1270 Timing Pin, Crankshaft
 303-1272 E84830	303-1272 Locking Tool, Flywheel
 303-1277 E85707	303-1277 Timing Pin, Camshaft

Removal

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

1. Remove the cover and disconnect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

2.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

3. Remove the starter motor.

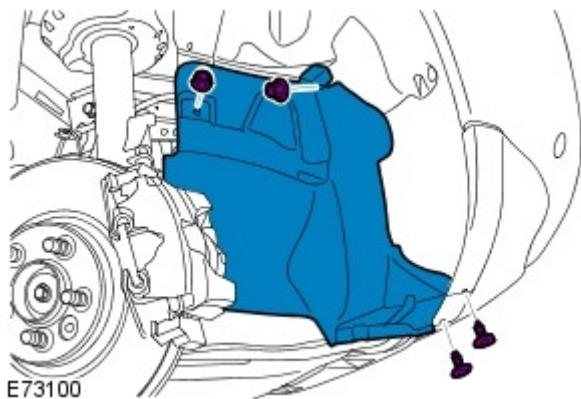
Refer to: [Starter Motor](#) (303-06B Starting System - TD4 2.2L Diesel, Removal and Installation).

4. Remove the accessory drive belt.

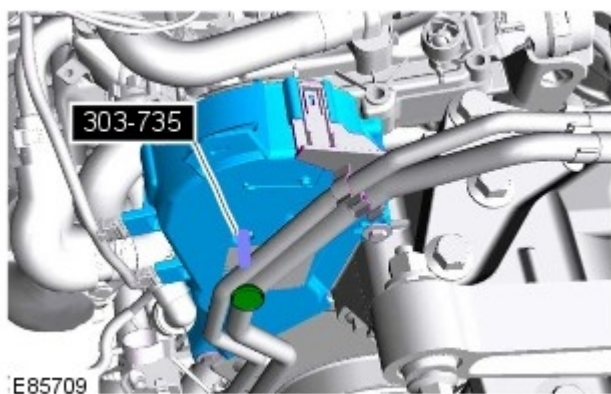
Refer to: [Accessory Drive Belt](#) (303-05B Accessory Drive - TD4 2.2L Diesel, Removal and Installation).

5. Remove the front wheel.

Refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).



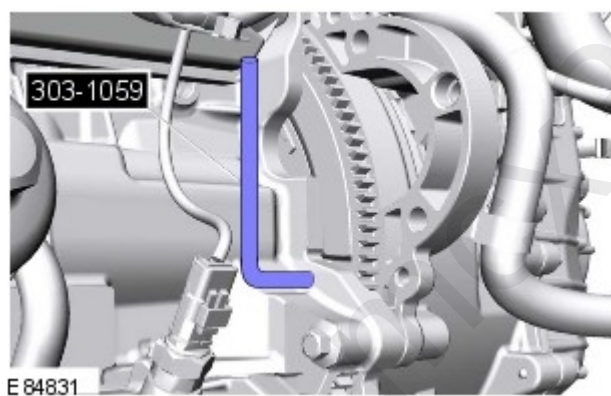
6.



7.

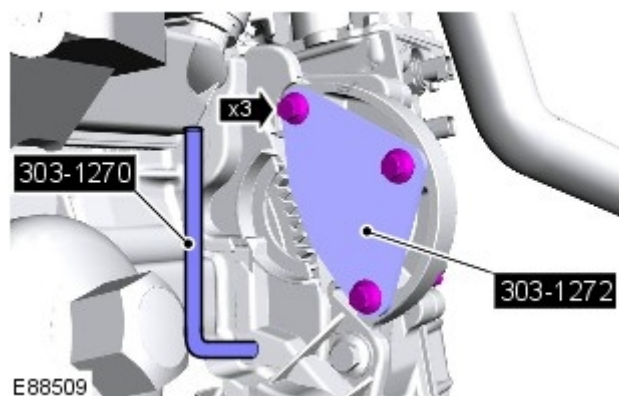
- Remove the grommet.
- Install the camshaft timing tool.

Special Tool(s): [303-1277](#)



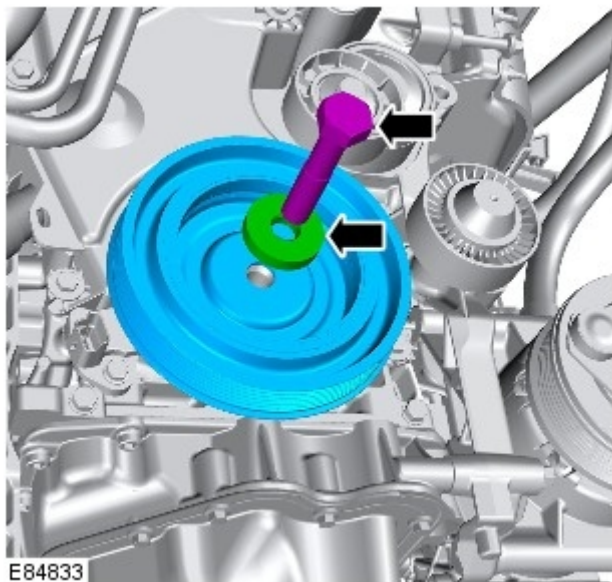
8. Install the crankshaft timing tool.

Special Tool(s): [303-1270](#)



9. Install the crankshaft locking tool.

Special Tool(s): [303-1272](#)



10. **10.**  **CAUTION:** Make sure that a new crankshaft pulley bolt is installed.

Torque:

Stage 1: 70 Nm

Stage 2: 82°

Installation

1. **1.**  **CAUTION:** Make sure that the mating faces are clean and free of foreign material.

To install, reverse the removal procedure.

Engine - TD4 2.2L Diesel - Crankshaft Front Seal

Removal and Installation

Special Tool(s)

 E85577	303-1274 Installer, Crankshaft Front Seal
 E85567	303-1300 Remover, Crankshaft Seal

Removal

1.  **WARNING:** Make sure to support the vehicle with axle stands.

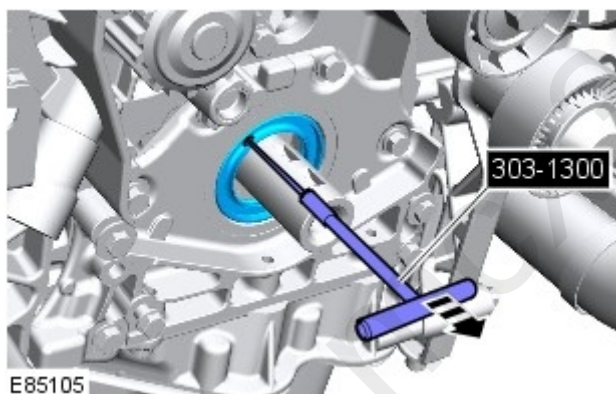
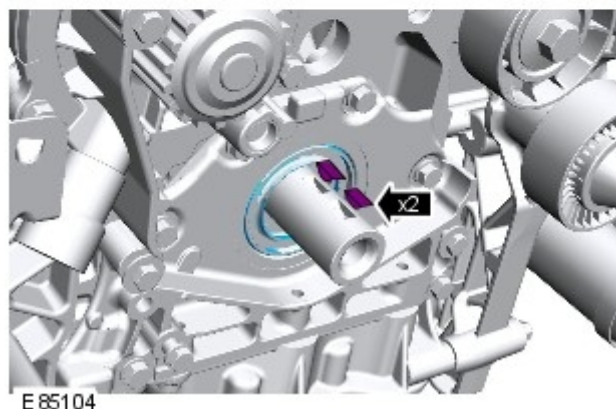
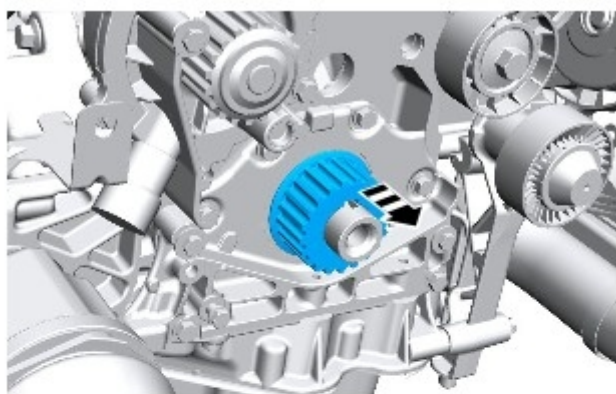
Raise and support the vehicle.

2. Remove the cover and disconnect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

3. Remove the timing belt.

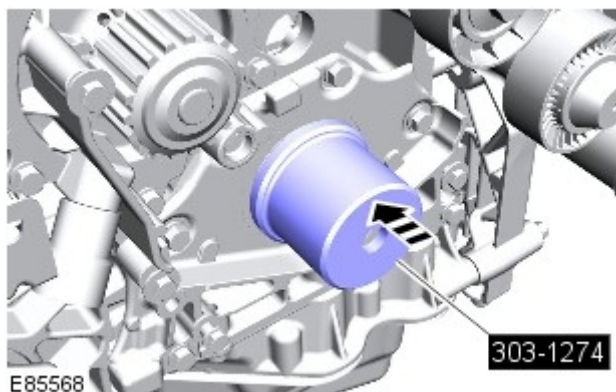
Refer to: [Timing Belt](#) (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).



4. **4.** NOTE: Make sure that the component is installed to the position noted on removal.

5. *Special Tool(s):* [303-1300](#)

Installation



1. **1.**  CAUTION: Extreme cleanliness must be exercised when handling these components.

Special Tool(s): [303-1274](#)

2. **2.** CAUTIONS:



Make sure that the component is clean, free of foreign material and lubricant.



Make sure that these components are installed to the noted removal position.

Install the crankshaft key and sprocket.

3. Install the new timing belt.

Refer to: [Timing Belt](#) (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).

4. Connect the battery ground cable and install the cover.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

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Engine - TD4 2.2L Diesel - Crankshaft Rear Seal

Removal and Installation

Special Tool(s)

 100-012 Slide Hammer E54135	
 303-1271 Installer, Seal E86890	
 303-538 Remover/Installer, Crankshaft Oil Seal E46616	
 308-615 Remover, Seals E86871	

Removal

1. Disconnect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

2.  **WARNING:** Make sure to support the vehicle with axle stands.

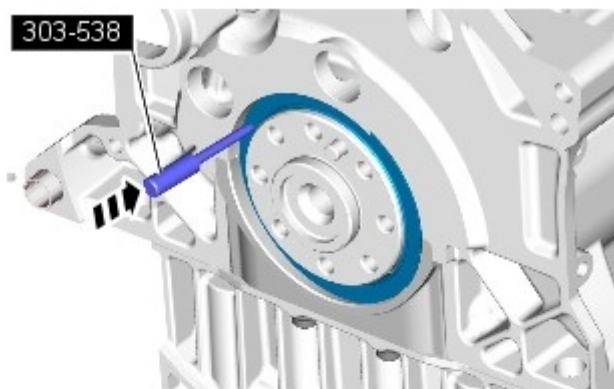
Raise and support the vehicle.

3. Manual models: Remove the flywheel.

Refer to: [Flywheel](#) (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).

4. Automatic models: Remove the flexplate.

Refer to: [Flexplate](#) (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).

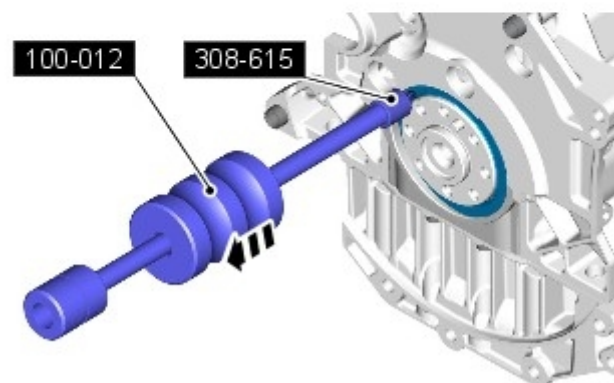


5. CAUTIONS:

 Make sure that the area around the component is clean and free of foreign material.

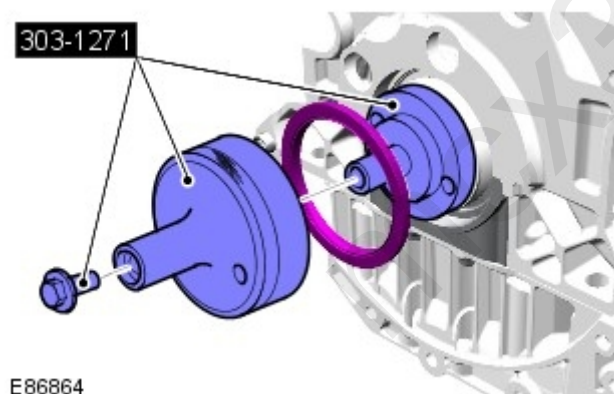
 Take extra care not to damage the mating faces.

Special Tool(s): [303-538](#), [308-615](#), [100-012](#)



E86863

Installation



E86864

1.  **CAUTION:** Take extra care not to damage the seal.

Special Tool(s): [303-1271](#)

2. Manual models: Install the flywheel.

Refer to: [Flywheel](#) (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).

3. Automatic models: Install the flexplate.

Refer to: [Flexplate](#) (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).

4. Connect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

Engine - TD4 2.2L Diesel - Timing Cover

Removal and Installation

Removal

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

1. Remove the cover and disconnect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

2.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

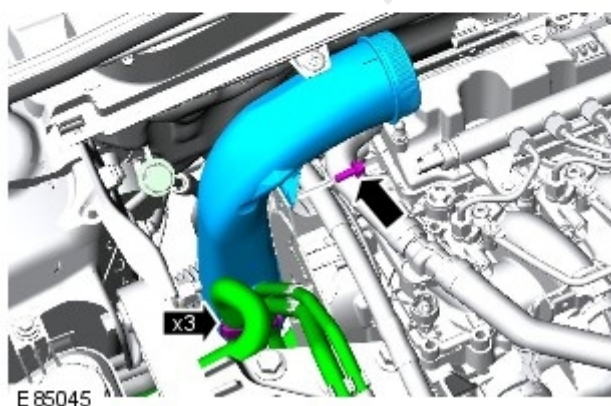
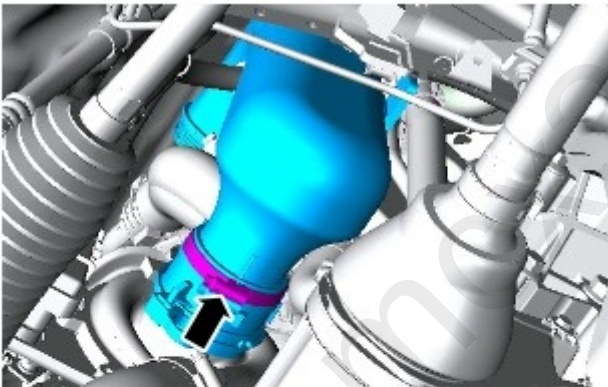
3. Remove the reluctor ring.

Refer to: [Crankshaft Position \(CKP\) Sensor Ring](#) (303-14B Electronic Engine Controls - TD4 2.2L Diesel, Removal and Installation).

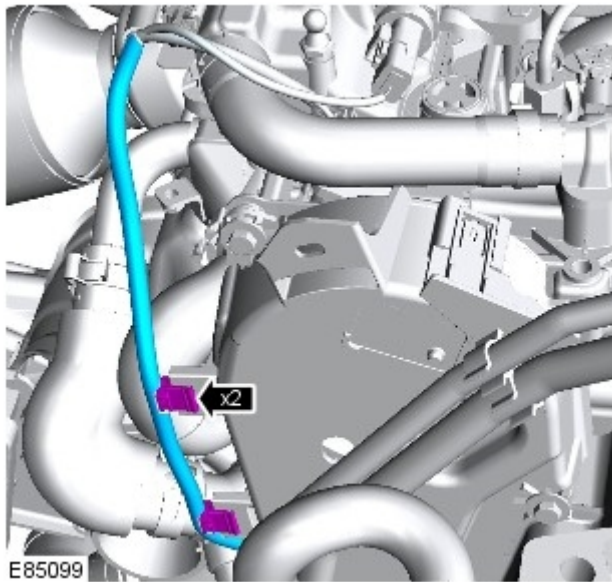
4. Remove the engine cover.

Refer to: [Engine Cover - TD4 2.2L Diesel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

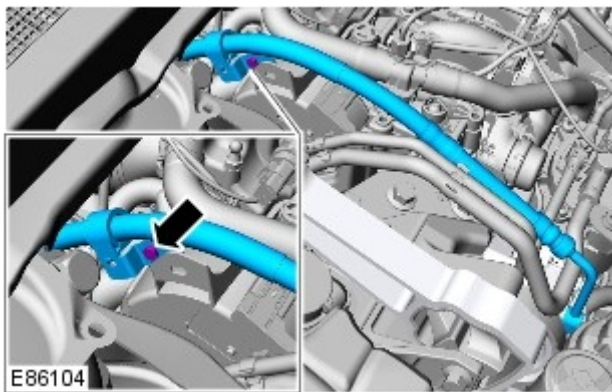
- 5.



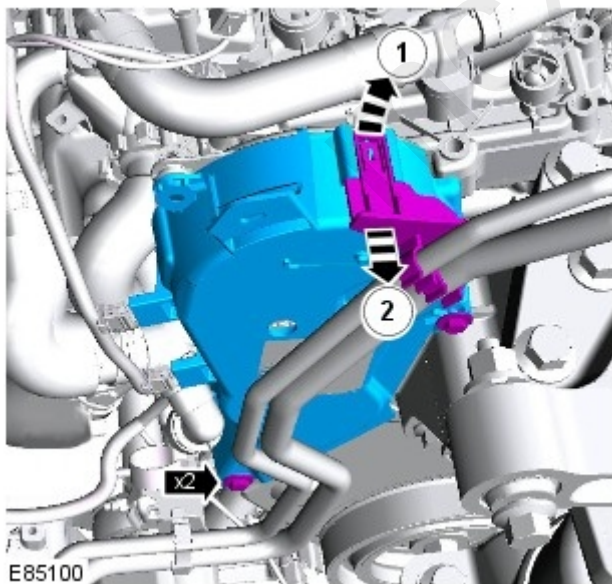
6.

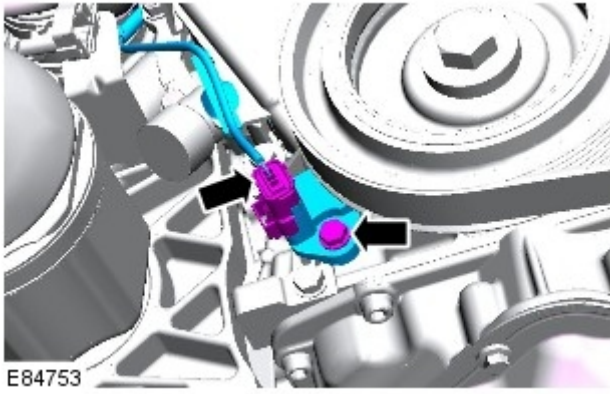


7. Torque: 7 Nm

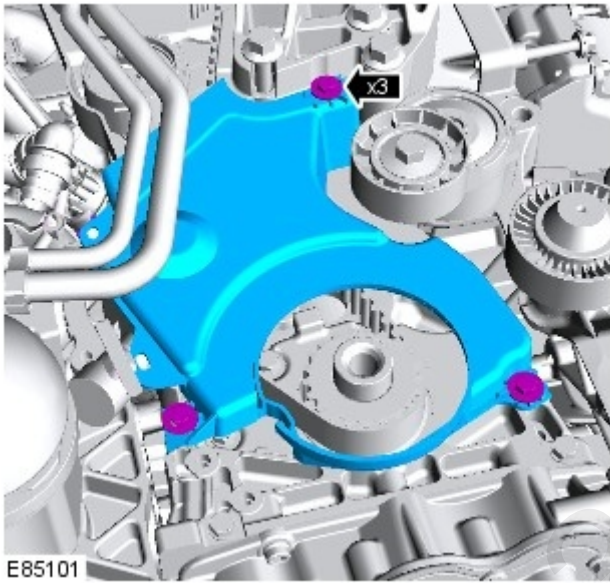


8. Torque: 7 Nm





9. **9.**  **CAUTION:** Make sure that the wiring harnesses are correctly located.
- Torque: 6 Nm



10. Torque: 6 Nm



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

Installation

1. To install, reverse the removal procedure.

Engine - TD4 2.2L Diesel - Valve Cover

Removal and Installation

Special Tool(s)

 303-1270 E85706	303-1270 Timing Pin, Crankshaft
 303-1277 E85707	303-1277 Timing Pin, Camshaft

Removal

- NOTE: The valve cover and cylinder head is machined as an assembly and cannot be serviced separately.

1. Remove the cover and disconnect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

2. Remove the air cleaner assembly.

Refer to: [Air Cleaner](#) (303-12A Intake Air Distribution and Filtering - I6 3.2L Petrol, Removal and Installation).

3.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

4. Remove the camshaft seal.

Refer to: [Camshaft Seal](#) (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).

5. Remove the fuel rail.

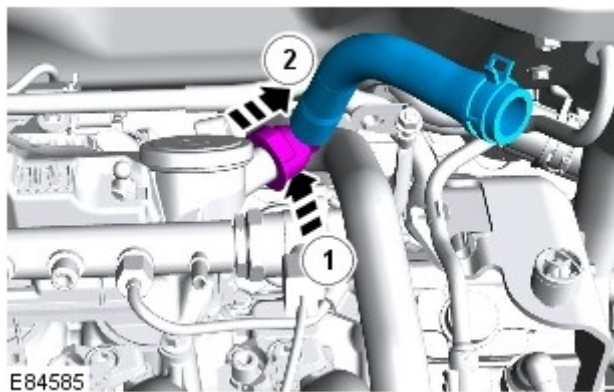
Refer to: [Fuel Rail](#) (303-04B Fuel Charging and Controls - TD4 2.2L Diesel, Removal and Installation).

6. Remove the fuel injectors.

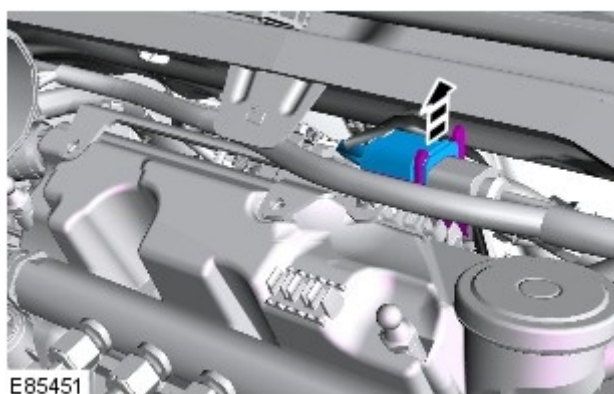
Refer to: [Fuel Injector](#) (303-04B Fuel Charging and Controls - TD4 2.2L Diesel, Removal and Installation).

7. Remove the intake manifold.

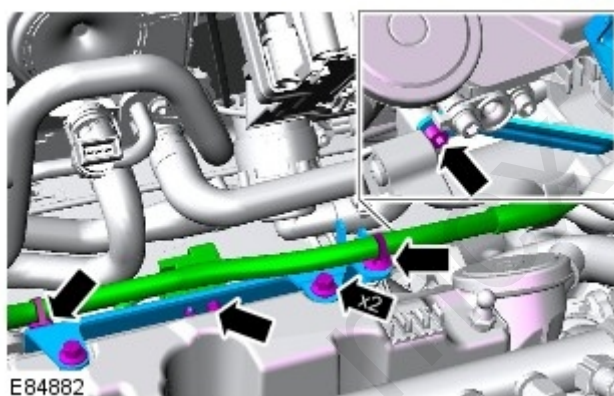
Refer to: [Intake Manifold](#) (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).



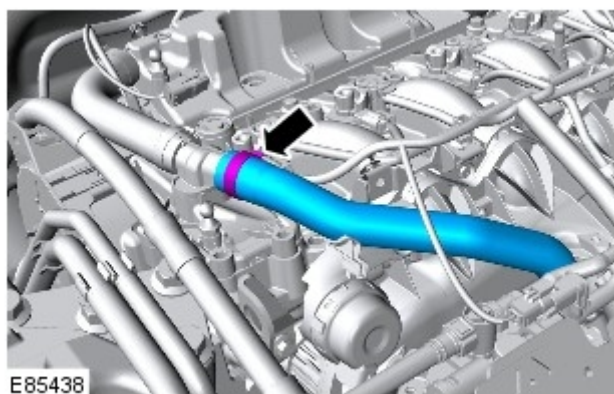
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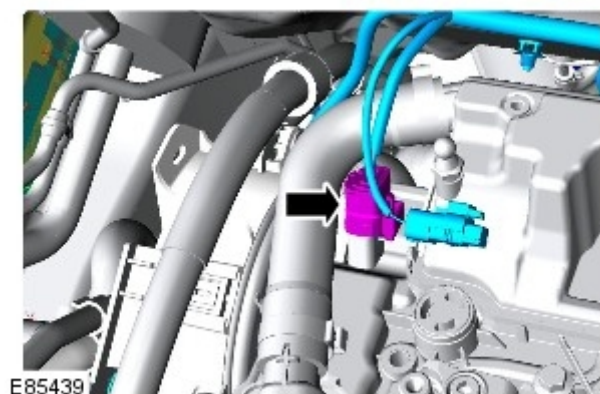
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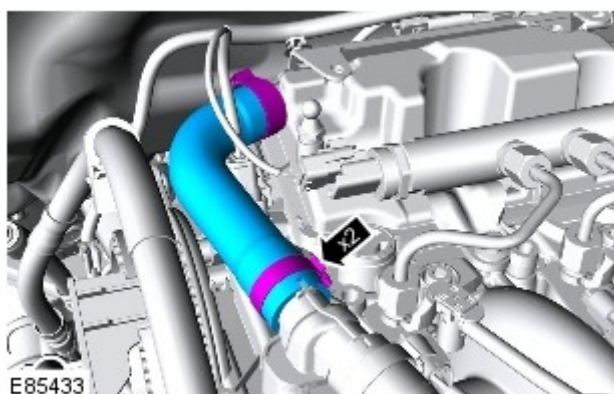
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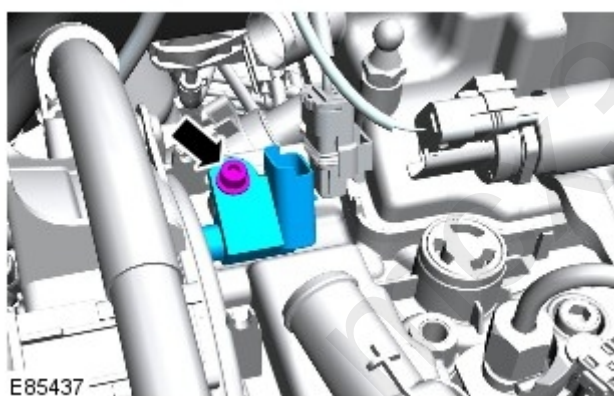
11. **11.** NOTE: Discard the retaining clip.



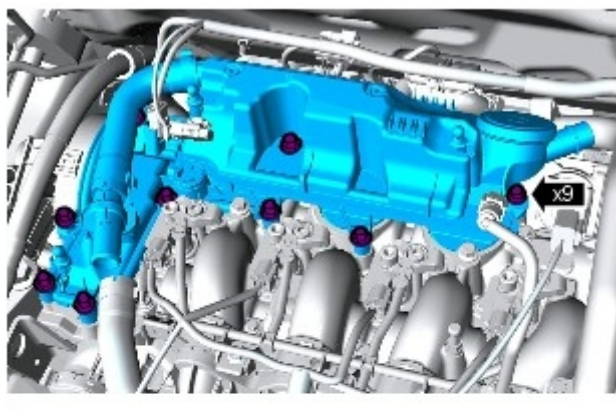
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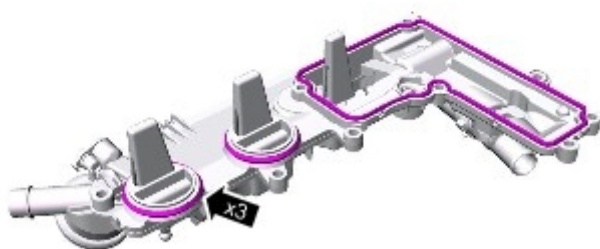
13. Remove and discard the hose clips.



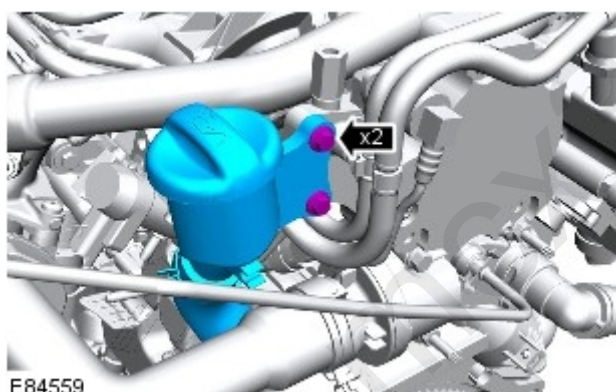
14.



15. **15.**  **CAUTION:** Discard the seals.

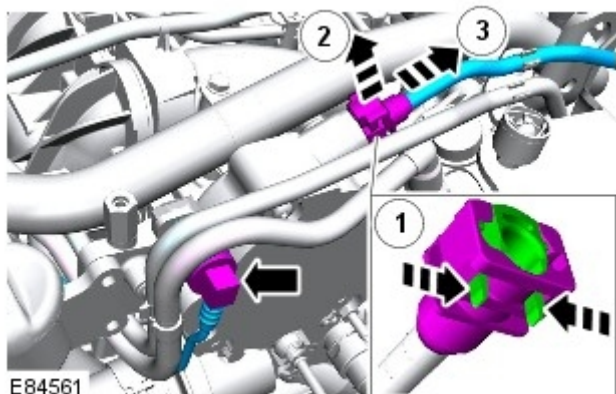


E 85814



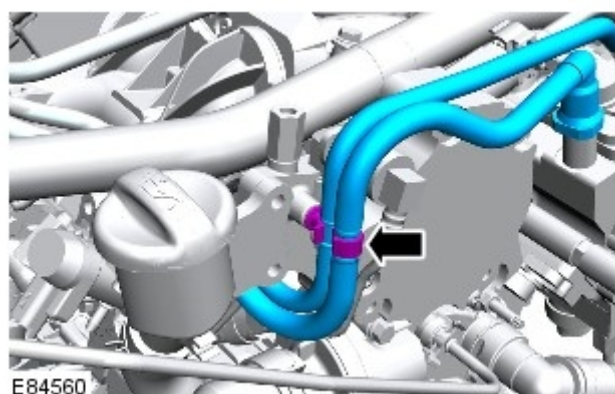
E84559

- 16.

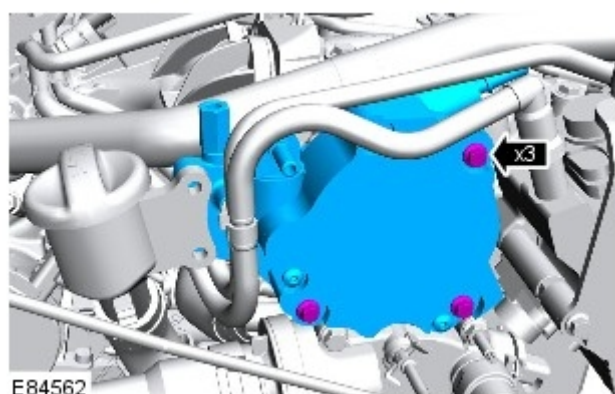


E84561

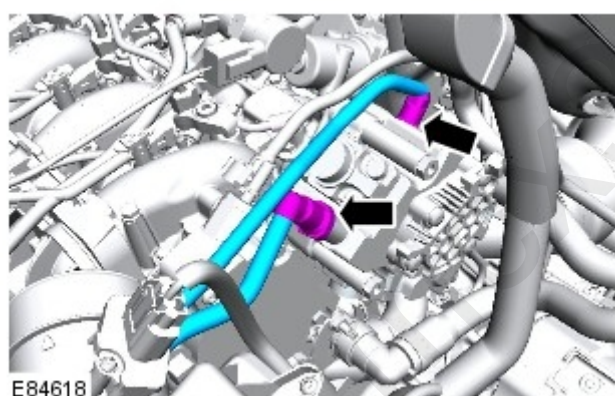
17. **17.**  **CAUTION:** Make sure that all openings are sealed.



18.



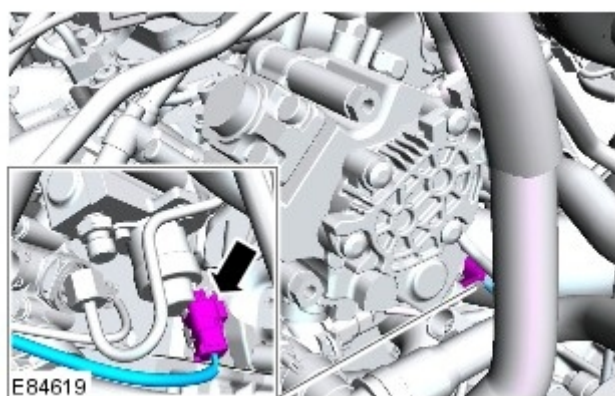
19. **19.**  **CAUTION:** Discard the seal.



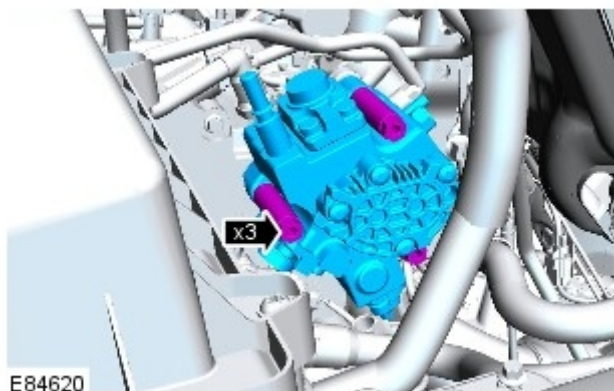
20. **20.** **CAUTIONS:**

 Make sure that the area around the component is clean and free of foreign material.

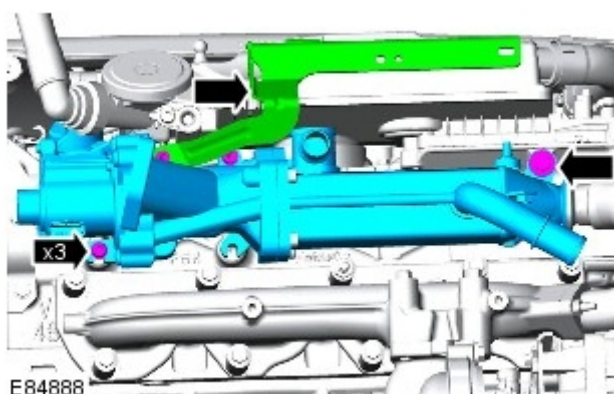
 Make sure that all openings are sealed. Use new blanking caps.



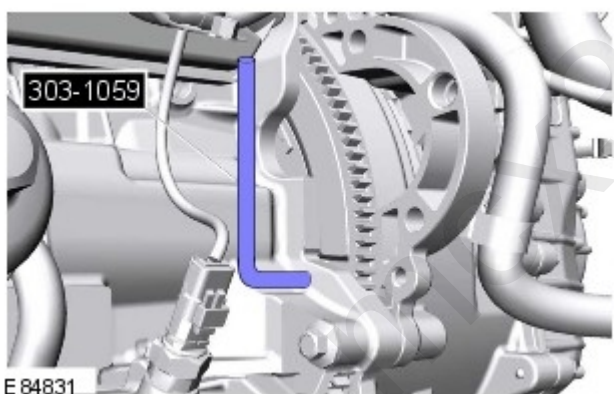
21.



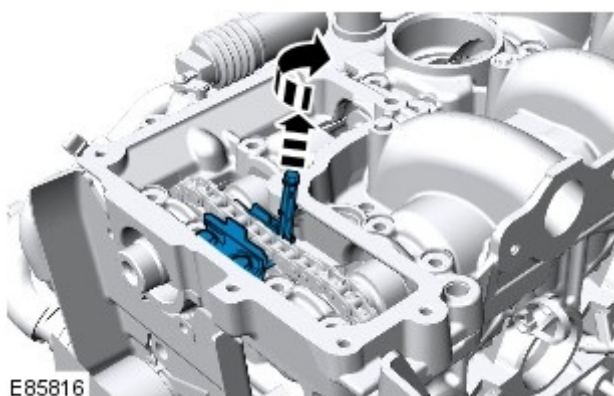
22. **22.**  **CAUTION:** The O-ring seal is to be reused unless damaged.
- **NOTE:** Make sure the fuel pump drive remains captive when removing the fuel pump.



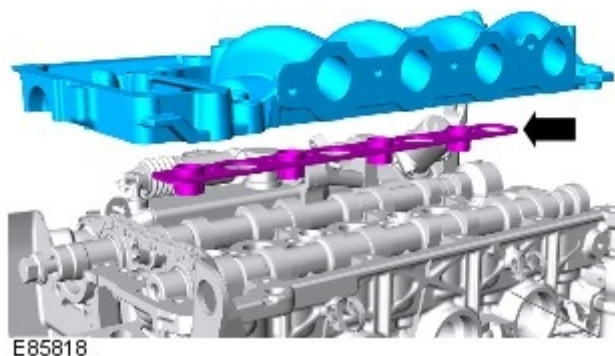
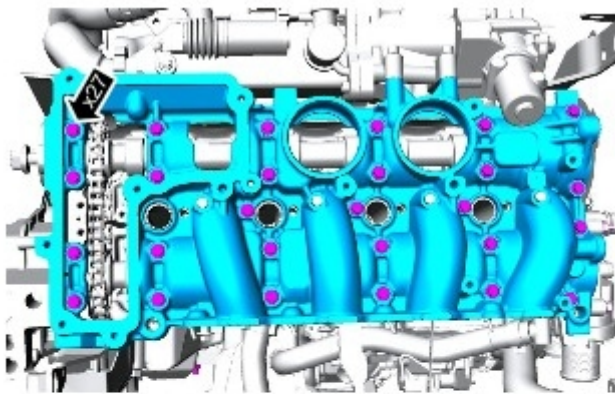
23.



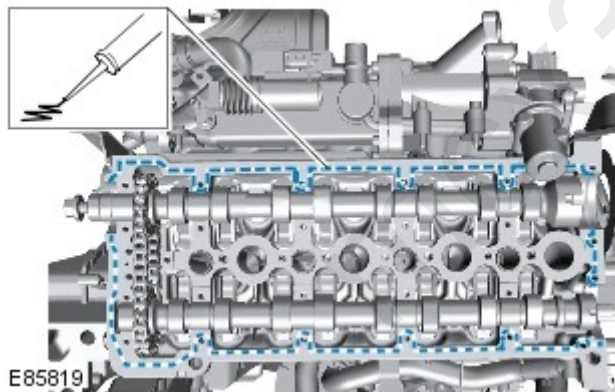
24. **24.** **NOTE:** The engine is now in the **SAFE** position.
- Remove the crankshaft timing tool.
 - *Special Tool(s):* [303-1270](#)
 - Rotate the crankshaft through 90 degrees.



25. Retract and lock the camshaft drive chain tensioner.



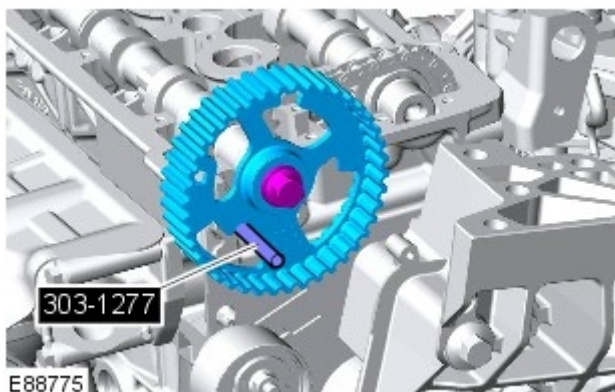
Installation



1.  **CAUTION:** Make sure that the mating faces are clean and free of foreign material.

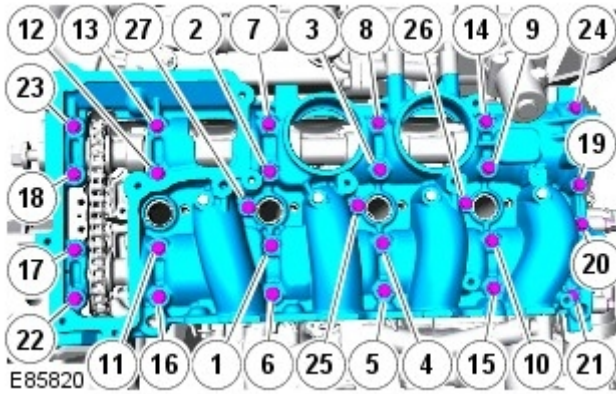
Apply a continuous bead of sealant to one surface.

Refer to: [Specifications](#) (303-01B Engine - TD4 2.2L Diesel, Specifications).



2. Temporarily install the camshaft pulley and the pulley timing pin

Special Tool(s): [303-1277](#)



3. **3.**  **CAUTION:** Lubricate the bearing surfaces with clean engine oil.

• **NOTE:** Install a new gasket.

- Install and lightly tighten bolts in sequence illustrated.
- Tighten the bolts in the sequence illustrated.

Torque: 10 Nm

4. Release the chain tensioner

5. Rotate the crankshaft and install the crankshaft timing tool.

Special Tool(s): [303-1270](#)

6. Remove the camshaft pulley.

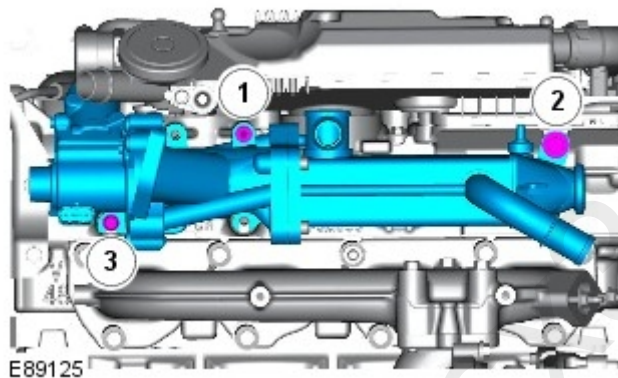
7.

- Secure the EGR cooler.
- Install the nuts, bolts and washers, do not tighten at this stage.
- Tighten the nuts in the sequence shown.

Torque: 6 Nm

- Tighten the bolt in the sequence shown.

Torque: 10 Nm



8. **8.** **CAUTIONS:**



Extreme cleanliness must be exercised when handling this component.



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



Make sure that the seal is correctly located.

Install the fuel pump.

Torque: 22 Nm

9. Connect the fuel shut off electrical connector.

10. **10.**  **WARNING:** Before installing the components, ensure the area around the joint faces and connections are clean.

Connect the fuel pump feed and return connectors.

11. **11.** **CAUTIONS:**

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

 Make sure that the seal is correctly located.

Install the vacuum pump.

Torque: 9 Nm

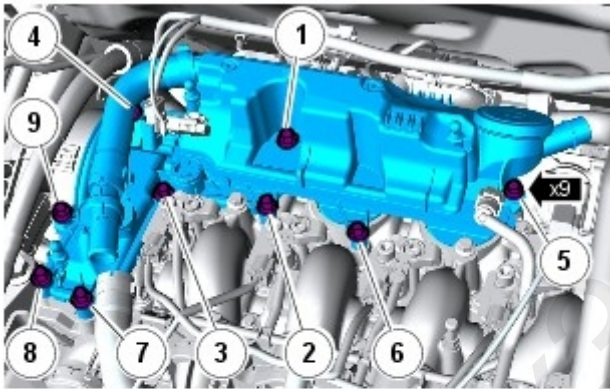
12. Secure the oil filler tube.

Torque: 9 Nm

13.  **CAUTION:** Make sure that the mating faces are clean and free of foreign material.

Connect the vacuum lines to the vacuum pump.

14. Secure the fuel lines.

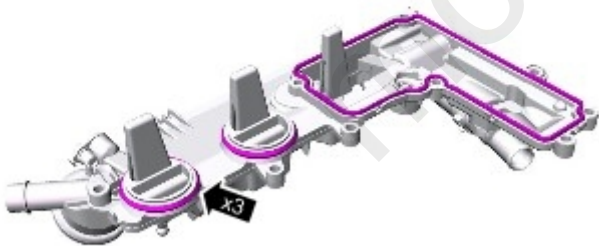


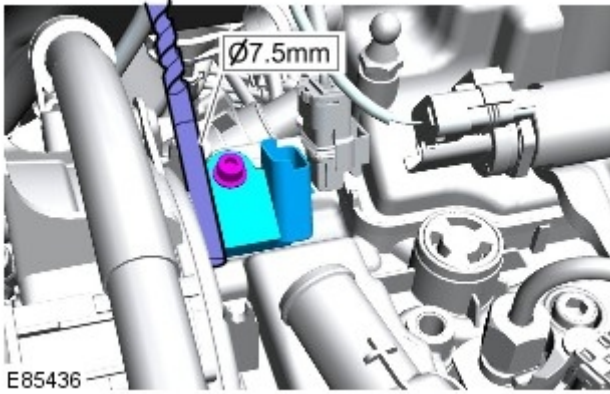
15.  **CAUTION:** Tighten the bolts in the sequence shown.

- **NOTE:** Install new seals.

Install the valve cover vent oil separator.

Torque: 9 Nm





16. **16.**  **CAUTION:** Incorrect installation of the camshaft position (CMP) sensor could result in engine damage.

- Insert a 7.5 mm diameter drill between the valve cover and the CMP sensor as shown, to achieve the correct alignment of the CMP sensor.
- *Torque:* 4 Nm

17. **17.** **NOTE:** Install new retaining clips.

Install the valve cover breather hose.

18. Connect the CMP sensor electrical connector.

19. **19.** **NOTE:** Install a new retaining clip.

Connect and secure the engine breather line.

20. Install the oxygen sensor (HO2S) harness bracket.

Torque: 9 Nm

21. Secure the HO2S harness.

22. Install the breather line.

23. Install the intake manifold.

Refer to: [Intake Manifold](#) (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).

24. Install the fuel injectors.

Refer to: [Fuel Injector](#) (303-04B Fuel Charging and Controls - TD4 2.2L Diesel, Removal and Installation).

25. Install the fuel rail.

Refer to: [Fuel Rail](#) (303-04B Fuel Charging and Controls - TD4 2.2L Diesel, Removal and Installation).

26. Install the camshaft seal.

Refer to: [Camshaft Seal](#) (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).

27. Install the air cleaner.

Refer to: [Air Cleaner](#) (303-12A Intake Air Distribution and Filtering - I6 3.2L Petrol, Removal and Installation).

28. Connect the battery ground cable and install the cover.

Refer to: [Specifications](#) (414-00 Battery and Charging System -

Engine - TD4 2.2L Diesel - Camshafts

Removal and Installation

Removal

1. Remove the cover and disconnect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

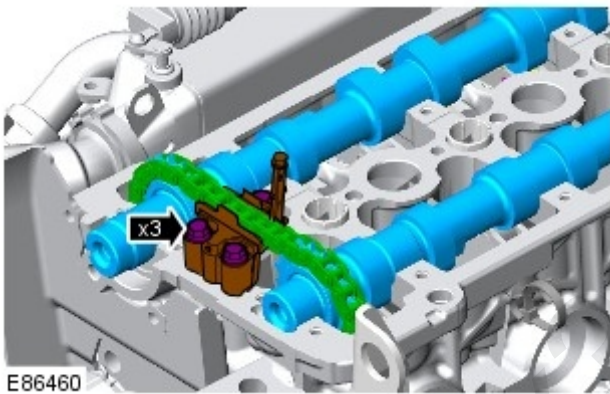
2.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

3. Remove the valve cover.

Refer to: [Valve Cover](#) (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).

4.



Installation

1. **CAUTIONS:**

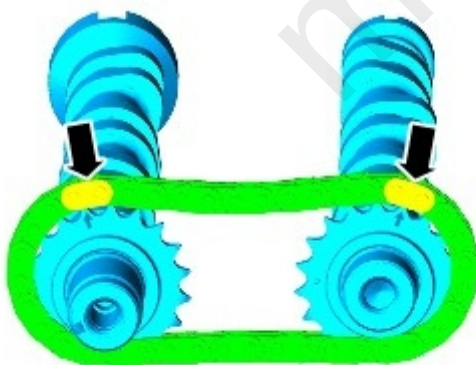


Make sure that the mating faces are clean and free of foreign material.



Lubricate the bearing surfaces with clean engine oil.

Install the camshafts with the timing chain and tensioner. Align the chain timing links with the timing marks on the camshaft sprocket as shown.



2. Tighten the tensioner bolts.

Torque: 7 Nm

3. Install the valve cover.

Refer to: [Valve Cover](#) (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).

4. Connect the battery ground cable and install the cover.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

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Engine - TD4 2.2L Diesel - Camshaft Seal

Removal and Installation

Special Tool(s)

 205-053 Retainer, Drive Flange E54574	
 205-053-04 Adapter, Drive Flange E85580	
 303-1276 Installer, Camshaft Seal E85581	
 303-935 Remover, Camshaft Seal E85579	

Removal

1.  **WARNING:** Make sure to support the vehicle with axle stands.

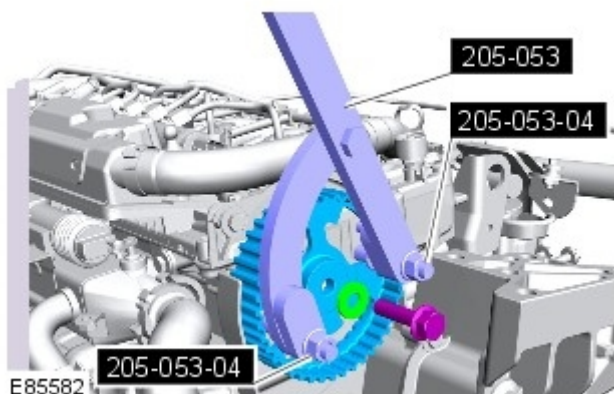
Raise and support the vehicle.

2. Remove the cover and disconnect the battery ground cable.

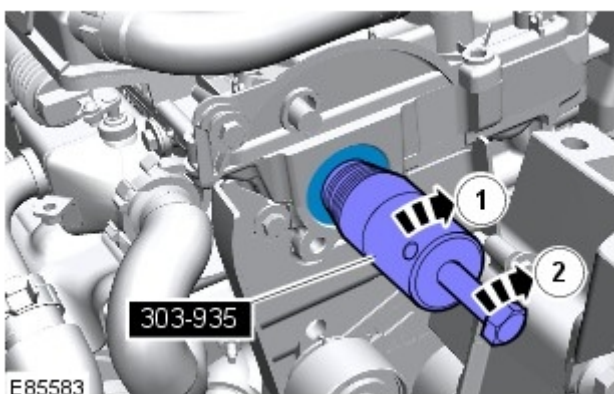
Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

3. Remove the timing belt.

Refer to: [Timing Belt](#) (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).



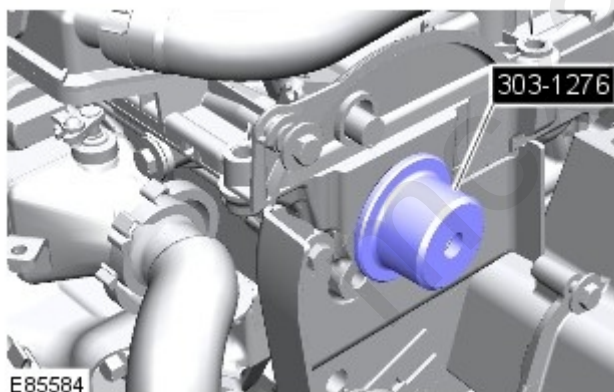
4. *Special Tool(s):* [205-053](#), [205-053-04](#)



5. Remove the camshaft front seal.

Special Tool(s): [303-935](#)

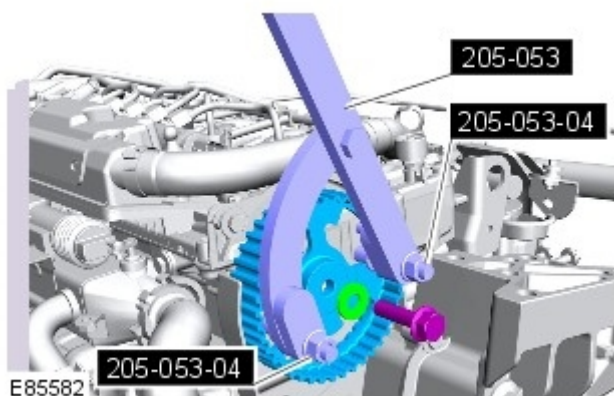
Installation



1.  **CAUTION:** Extreme cleanliness must be exercised when handling these components.

Install the new seal.

Special Tool(s): [303-1276](#)



2.  **WARNING:** Make sure that a new bolt is installed.

• CAUTIONS:

 Make sure that the component is clean, free of foreign material and lubricant.

 Make sure that the component is correctly located on the locating dowels.

- *Torque:*
 - Stage 1: 20 Nm
 - Stage 2: 60°
- *Special Tool(s):* [205-053](#), [205-053-04](#)

3. Install the new timing belt.

Refer to: [Timing Belt](#) (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).

4. Connect the battery ground cable and install the cover.

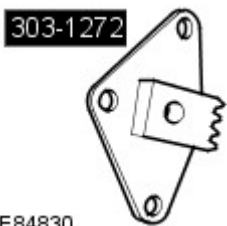
Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

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Engine - TD4 2.2L Diesel - Timing Belt

Removal and Installation

Special Tool(s)

 E85706	303-1270 Timing Pin, Crankshaft
 E84830	303-1272 Locking Tool, Flywheel
 E85707	303-1277 Timing Pin, Camshaft

Removal

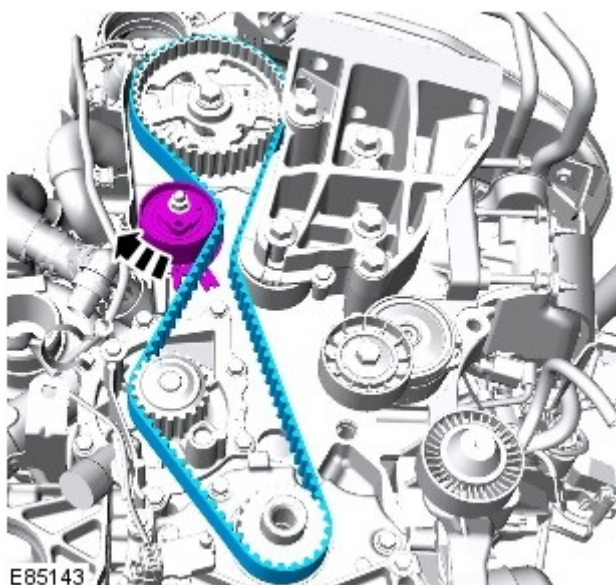
• **NOTE:** The timing and locking tools are installed to allow the timing cover to be removed. All tools must be left installed to allow the timing cover installation procedure to be followed.

1. Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

2.  **WARNING:** Make sure to support the vehicle with axle stands.

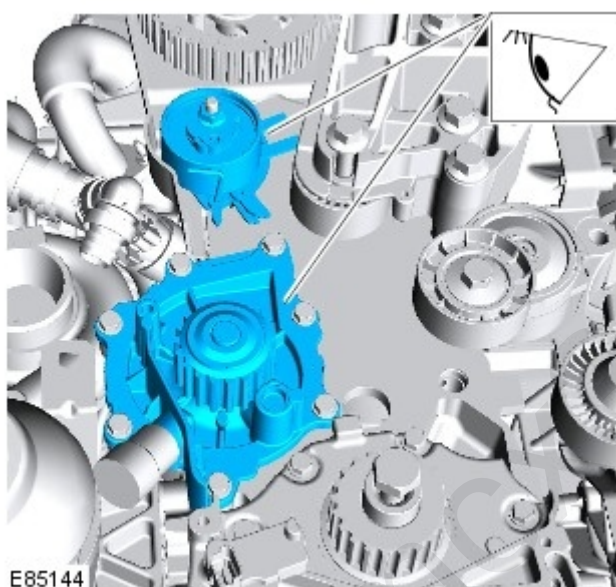
- Raise and support the vehicle.

3. Refer to: [Timing Cover](#) (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).



4.

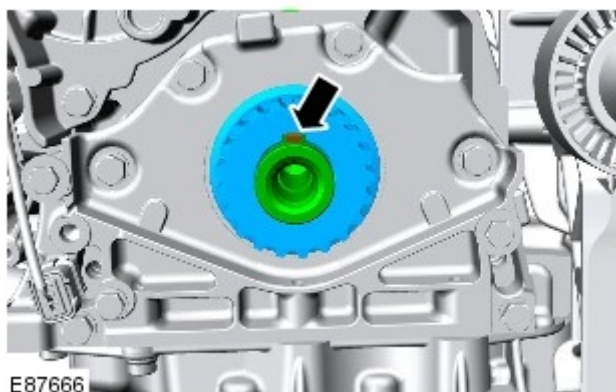
- Release the timing belt tension.
- Remove the timing belt.



5.

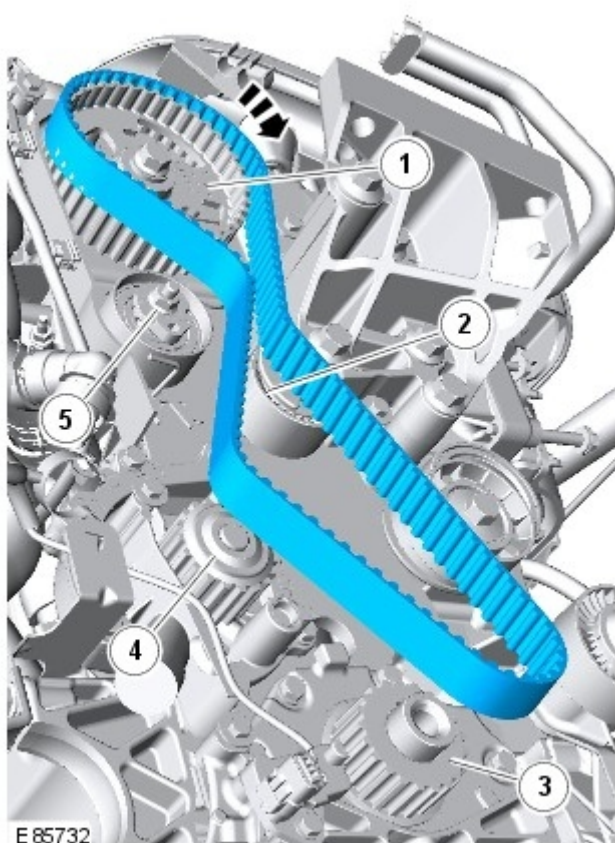
- Check the condition of the roller and tensioner.
- Check the condition of the coolant pump.
- Install any of the above as necessary.

Installation



1.

- Make sure that the key is centered within the keyway.

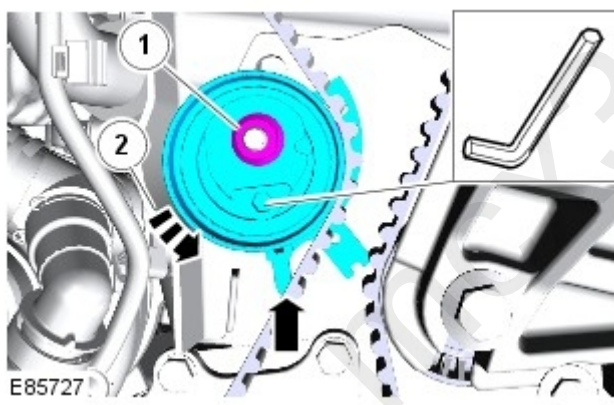


2. 2. CAUTIONS:

 The crankshaft or camshafts must not be rotated while the timing belt is removed.

 Make sure that the timing belt is not folded to produce a loop with a diameter less than 35 mm.

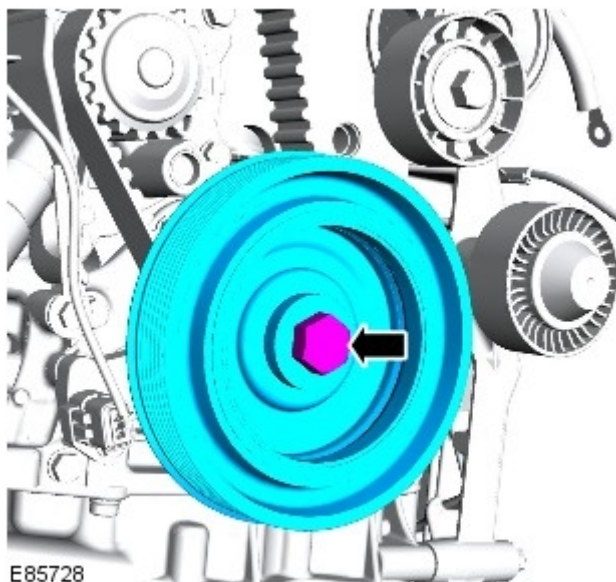
- Install the new timing belt.
- Starting at the camshaft pulley, install the timing belt in a clockwise direction, in the sequence shown.



3.

- Lightly tighten the timing belt tensioner bolt.
- Using an Allen key, adjust the tension counter-clockwise until the pointer is in the position illustrated.
- Tighten the tensioner bolt.

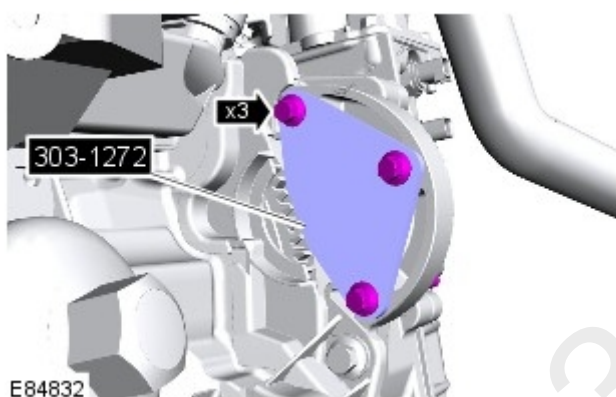
Torque: 25 Nm



4.

- Install the reluctor ring.
- Install the crankshaft damper using the original bolt.

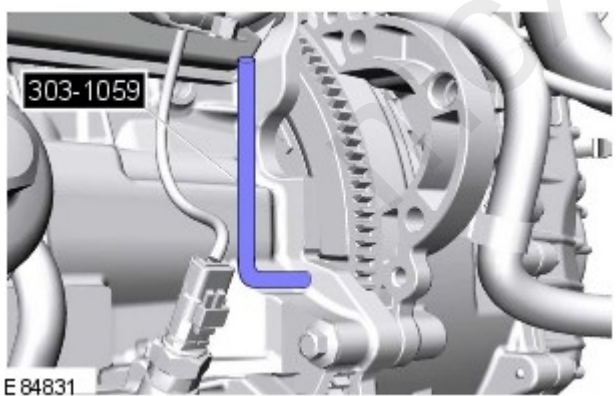
Torque: 70 Nm



5.

- Remove the crankshaft locking tool.

Special Tool(s): [303-1272](#)



6.

- Remove the crankshaft timing tool.

Special Tool(s): [303-1270](#)



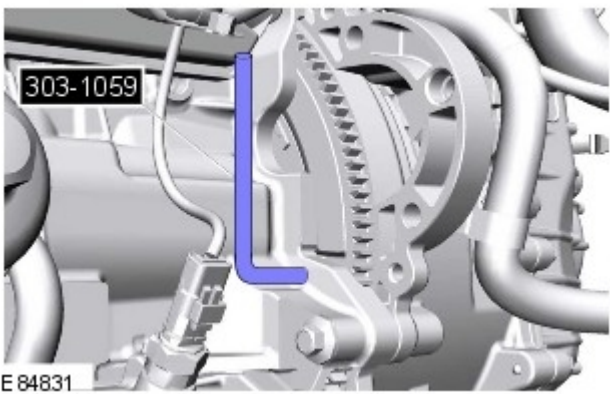
7.

- Remove the camshaft sprocket timing tool.

Special Tool(s): [303-1277](#)

8.

- Rotate the engine ten complete turns clockwise.



9.

- Install the crankshaft timing tool.

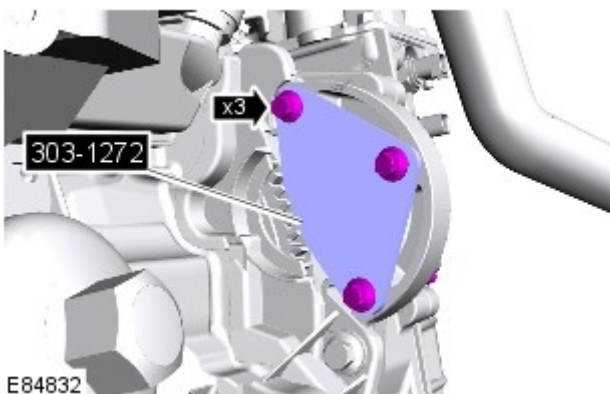
Special Tool(s): [303-1270](#)



10.

- Install the camshaft sprocket timing tool.

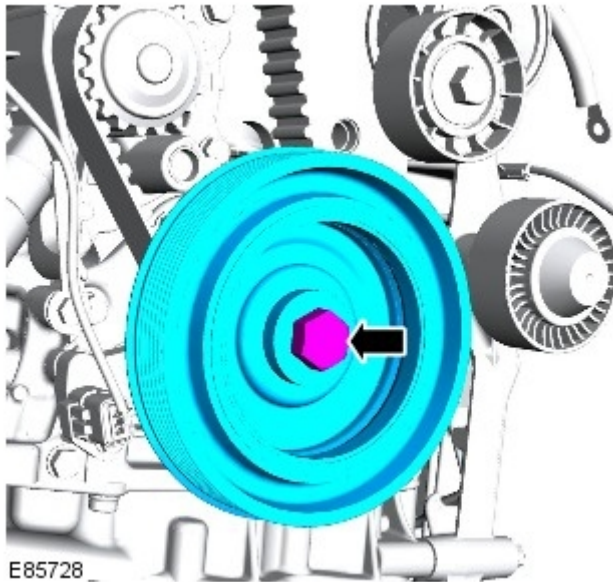
Special Tool(s): [303-1277](#)



11.

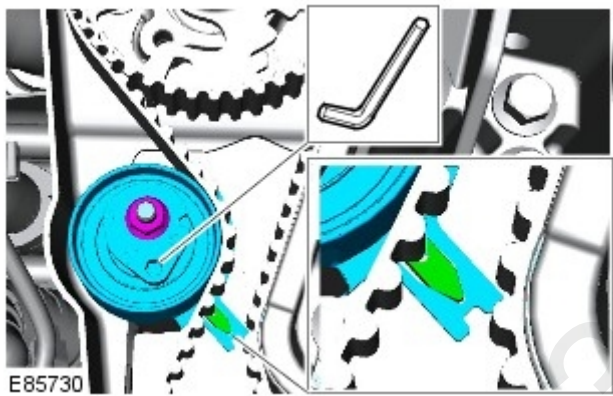
- Install the crankshaft locking tool.

Special Tool(s): [303-1272](#)



12.

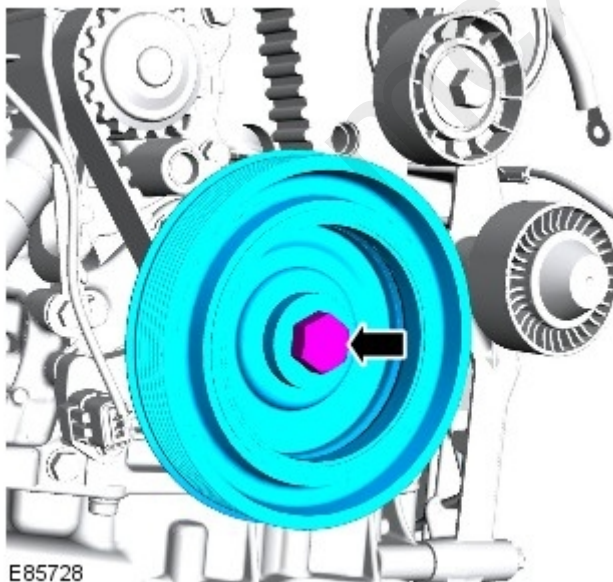
- Loosen the crankshaft damper bolt.



13. **13.**  **CAUTION:** If the pointer position is incorrect, repeat the timing belt tensioning operation.

- Loosen the timing belt tensioner bolt.
- Using an Allen key, adjust the tensioner clockwise until the pointer is in the position illustrated.
- Tighten the tensioner bolt.

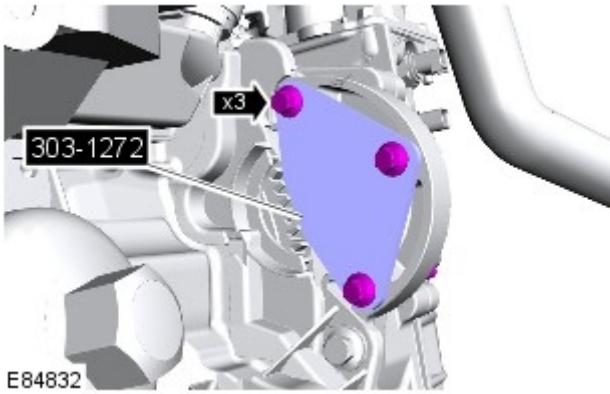
Torque: 25 Nm



14.

- Tighten the crankshaft damper.

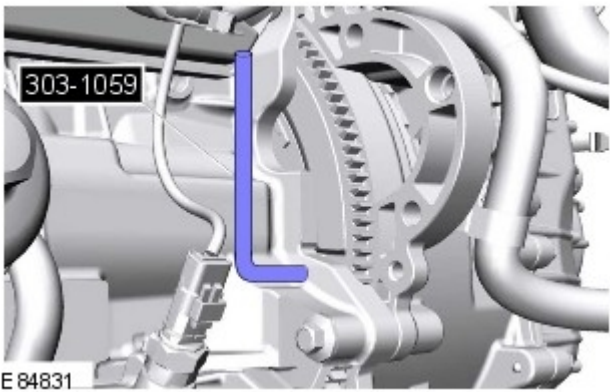
Torque: 70 Nm



15.

- Remove the crankshaft locking tool.

Special Tool(s): [303-1272](#)



16.

- Remove the crankshaft timing tool.

Special Tool(s): [303-1270](#)



17.

- Remove the camshaft sprocket timing tool.

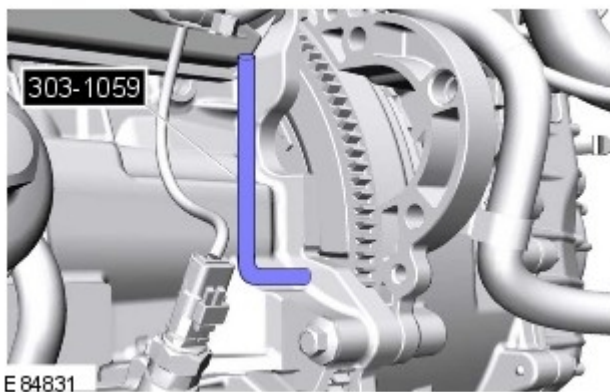
Special Tool(s): [303-1277](#)

18.

- Rotate the engine two complete turns clockwise.

19.

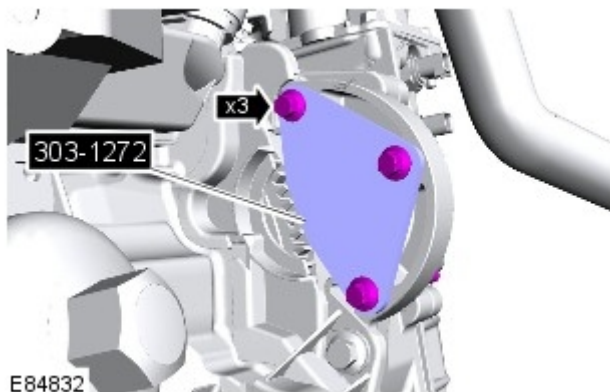
- Check the timing belt tensioner is in the correct position. If not repeat the setting procedure.



20.

- Install the crankshaft timing tool.

Special Tool(s): [303-1270](#)



21.

- Install the crankshaft locking tool.

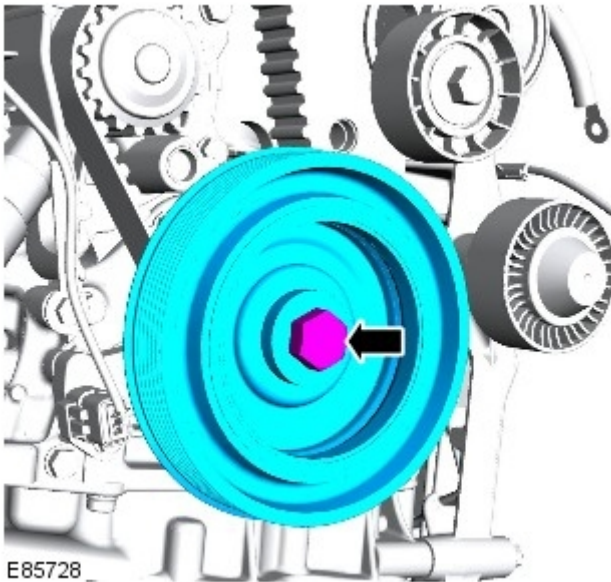
Special Tool(s): [303-1272](#)



22.

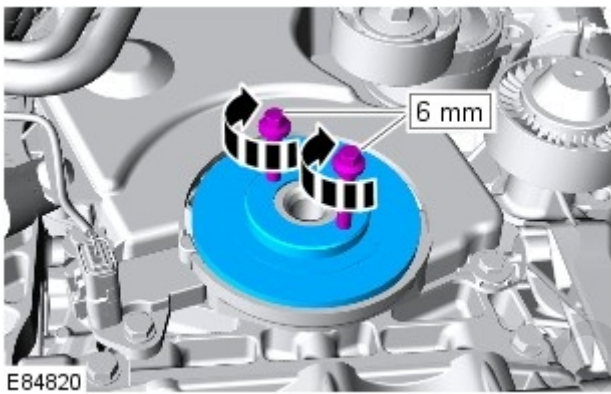
- Install the camshaft sprocket timing tool.

Special Tool(s): [303-1277](#)



23. **23.**  **CAUTION:** Make sure that a new bolt is installed.

- Remove the crankshaft damper.



- 24.
- Remove the reluctor ring.

25. Refer to: [Timing Cover](#) (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).

26. Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

Engine - TD4 2.2L Diesel - Exhaust Manifold

Removal and Installation

Removal



WARNING: Observe due care when working near a hot exhaust system.

1.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

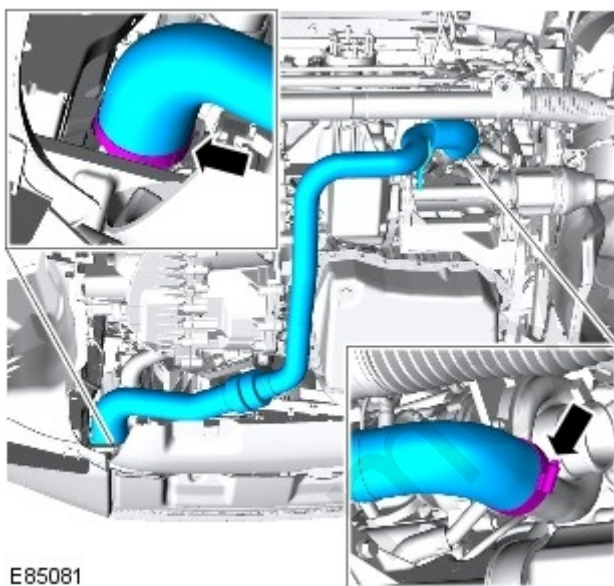
2. Remove the exhaust gas recirculation (EGR) cooler.

Refer to: [Exhaust Gas Recirculation \(EGR\) Cooler](#) (303-08B Engine Emission Control - TD4 2.2L Diesel, Removal and Installation).

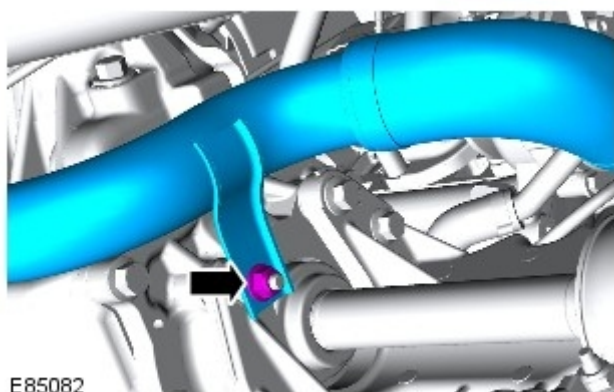
3. Remove the catalytic converter.

Refer to: [Catalytic Converter - Vehicles Without Diesel Particulate Filter \(DPF\)](#) (309-00B Exhaust System - TD4 2.2L Diesel, Removal and Installation).

4. **NOTE:** Make sure that all openings are sealed.

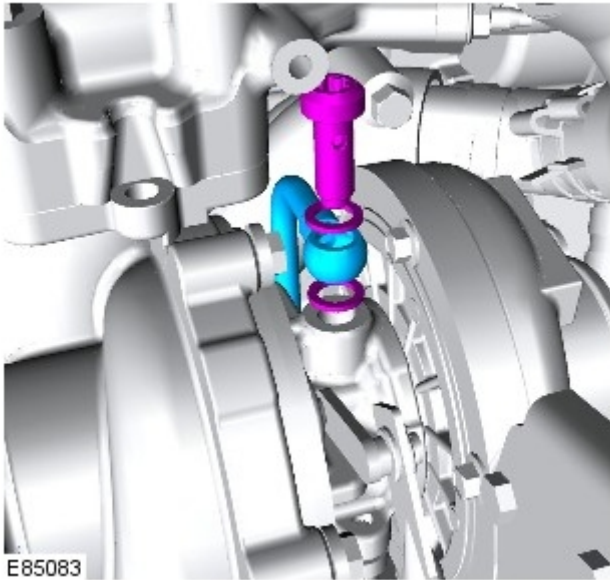


E85081



E85082

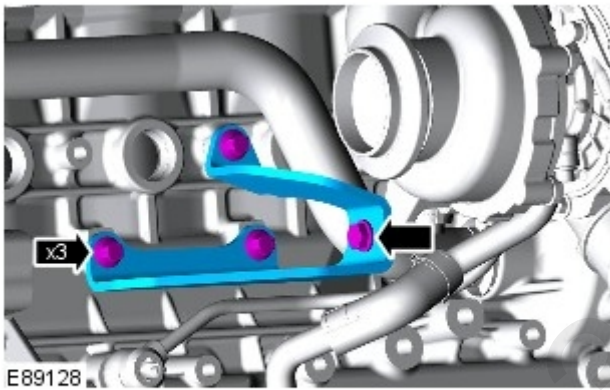
- 5.



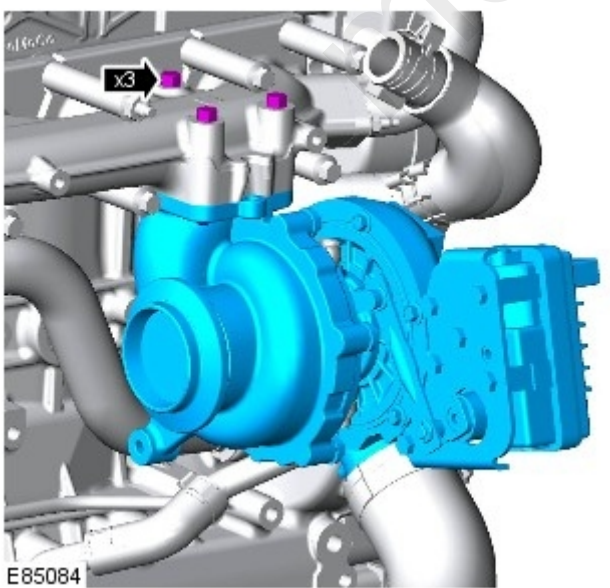
6. **CAUTIONS:**

 Make sure that the area around the component is clean and free of foreign material.

 Make sure that all openings are sealed. Use new blanking caps.

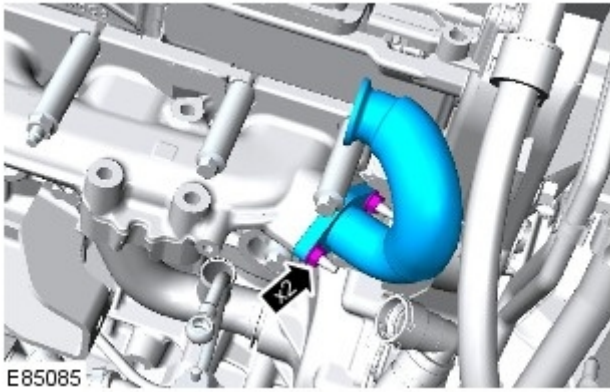


7.

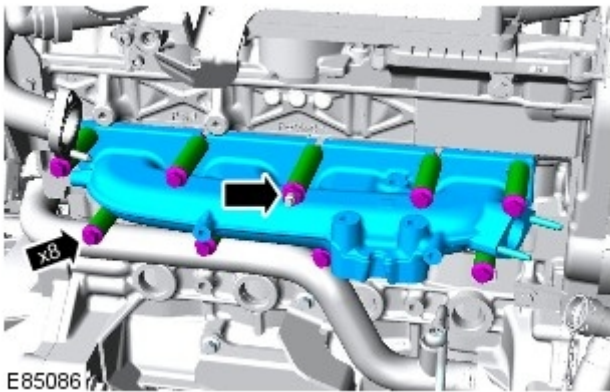


8.  **CAUTION:** Make sure that all openings are sealed. Use new blanking caps.

Release the turbocharger.

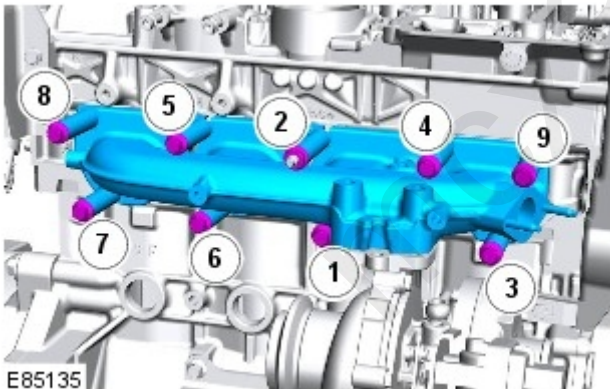


9. Remove the EGR cooler to exhaust manifold elbow.



10. **10.** **CAUTION:** Make sure that all openings are sealed. Use new blanking caps.
- **NOTE:** Discard the gasket.

Installation



1. **1.** **CAUTION:** Make sure that the area around the component is clean and free of foreign material.
 - Install a new gasket.
 - Install the exhaust manifold.
 - Evenly and progressively, tighten the bolts in the sequence shown.

Torque: 25 Nm

2. Install the EGR cooler to exhaust manifold elbow.

Torque: 10 Nm

3. **3.** **CAUTIONS:**



Make sure that new bolts are installed.



Extreme cleanliness must be exercised when handling this component.



Carbon deposits must be carefully removed from both faces of the turbocharger and exhaust manifold prior to assembly.

Install the turbocharger.

Torque: 24 Nm

4.
 - Install the turbocharger support bracket, but do not fully tighten at this stage.
 - Tighten the support bracket to turbocharger bolt.

Torque: 24 Nm

- Tighten the support bracket to cylinder block bolts.

Torque: 24 Nm

5. **5. CAUTIONS:**



Make sure that the area around the component is clean and free of foreign material.



Make sure that new sealing washers are installed.

Connect the turbocharger oil feed line.

Torque: 24 Nm

6. Install the turbocharger outlet pipe.

Torque: 25 Nm

7. Install the catalytic converter.

Refer to: [Catalytic Converter - Vehicles Without: Diesel Particulate Filter \(DPF\)](#) (309-00B Exhaust System - TD4 2.2L Diesel, Removal and Installation).

8. Install the EGR cooler.

Refer to: [Exhaust Gas Recirculation \(EGR\) Cooler](#) (303-08B Engine Emission Control - TD4 2.2L Diesel, Removal and Installation).

9. Check and top-up the engine oil.

Engine - TD4 2.2L Diesel - Cylinder Head

Removal and Installation

Removal

- **NOTE:** The valve cover and cylinder head is machined as an assembly and cannot be serviced separately.

1. Remove the cover and disconnect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

2.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

3. Remove the exhaust manifold.

Refer to: [Exhaust Manifold](#) (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).

4. Remove the camshafts.

Refer to: [Camshafts](#) (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).

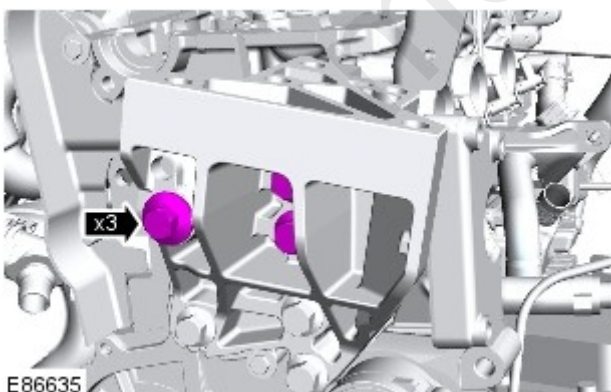
5. Remove the thermostat.

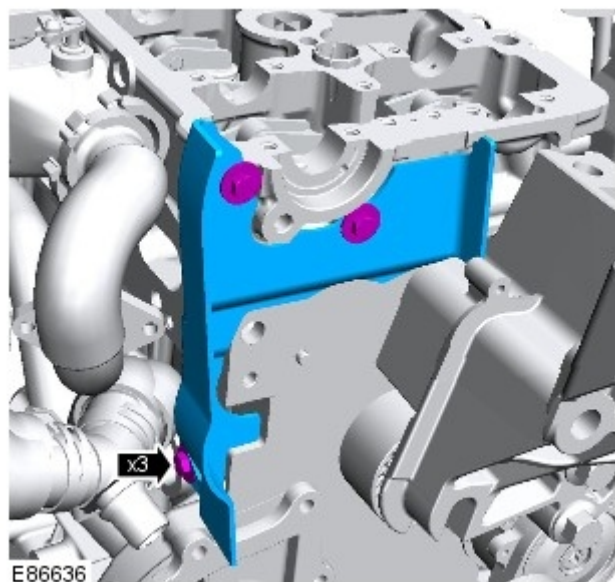
Refer to: [Thermostat](#) (303-03B Engine Cooling - TD4 2.2L Diesel, Removal and Installation).

6. Remove the RH engine mount.

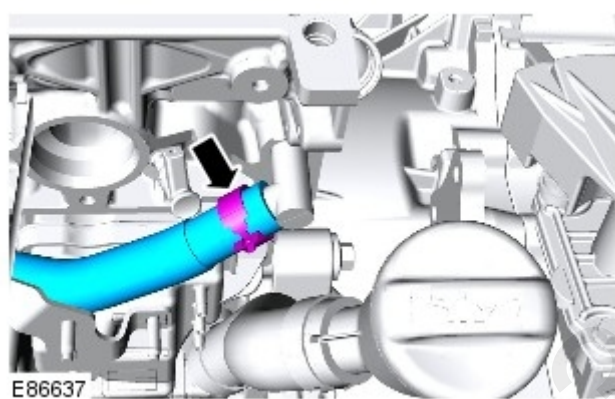
Refer to: [Engine Mount RH](#) (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).

- 7.

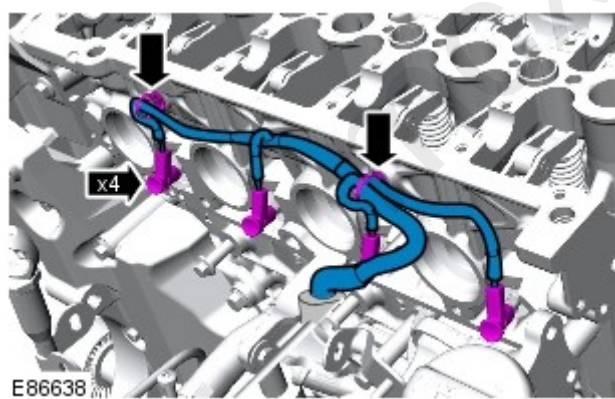




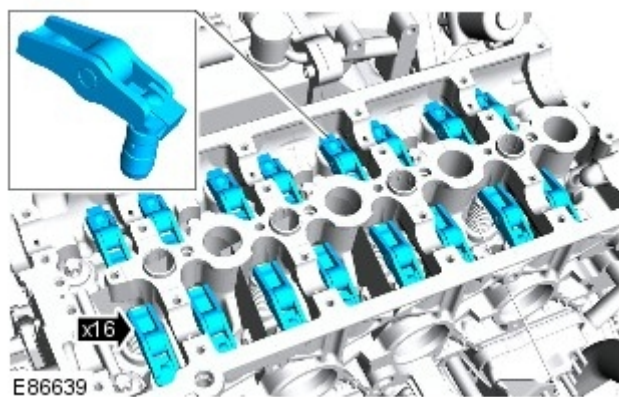
8.



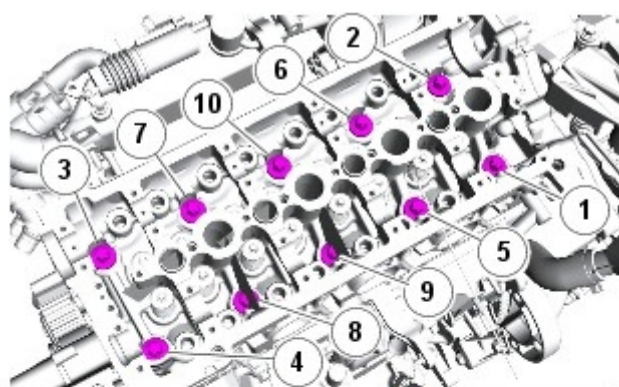
9.



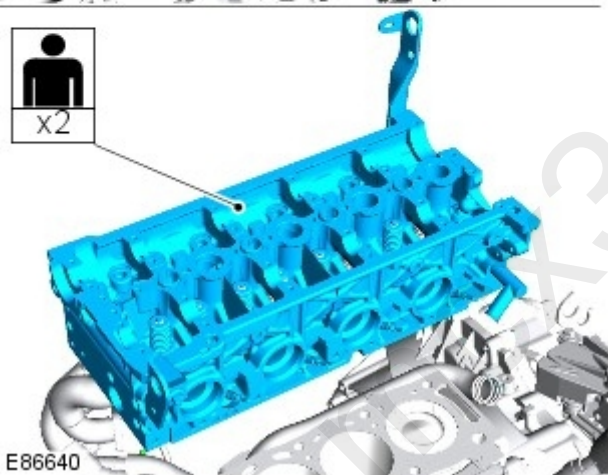
10.

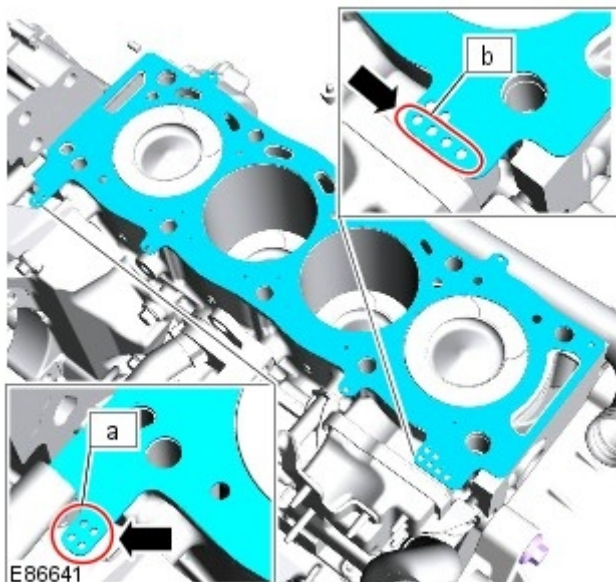


11. **11.**  **CAUTION:** Note the fitted position of the component prior to removal.



12. **12.**  **WARNING:** This step requires the aid of another technician.
- Discard the bolts.





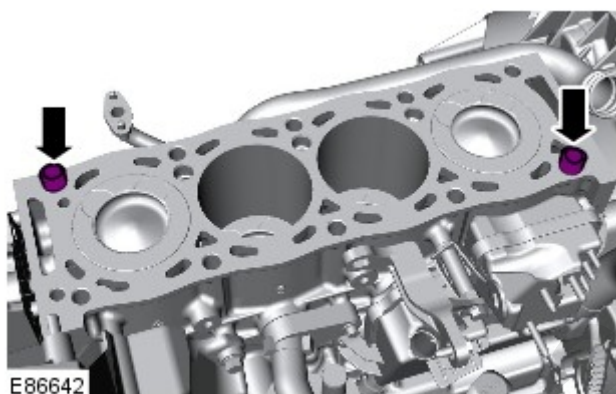
13. **13. CAUTIONS:**



Note the thickness of the gasket removed.



The gasket thickness is identified by the number of holes (1 to 4) at either of the locations shown.

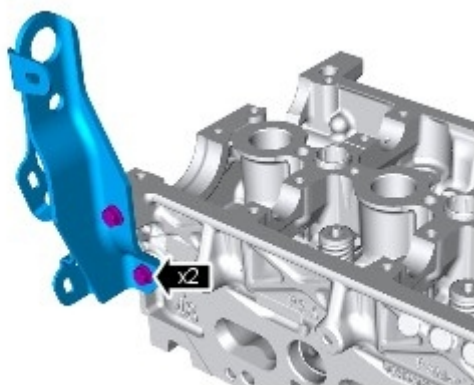


14.



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

16.



E86644

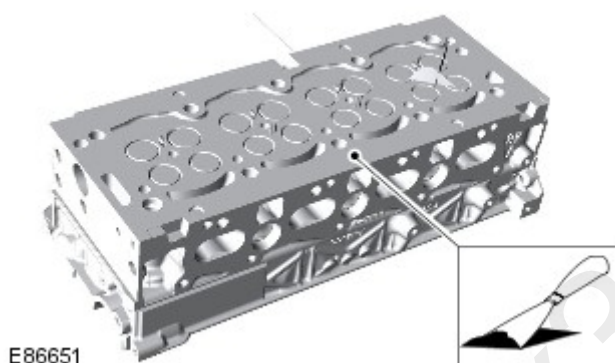
Installation

1. Install the lifting brackets and tighten the bolts.

Torque: 10 Nm

2.  **CAUTION:** Only use a plastic scraper to clean off the old gasket.

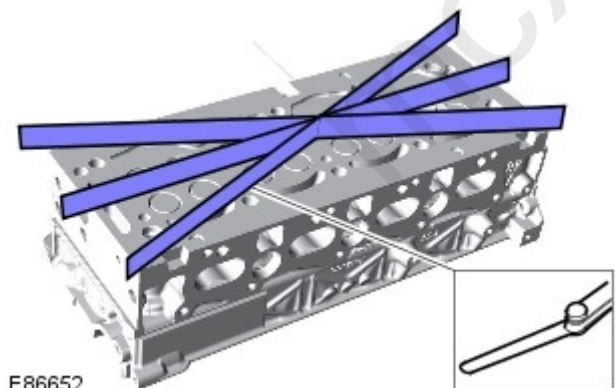
Clean and inspect the cylinder head and cylinder block.



E86651

3. Check cylinder head face for distortion, across the center and from corner to corner.

Refer to: [Specifications](#) (303-01B Engine - TD4 2.2L Diesel, Specifications).



E86652

4. If necessary, select the correct thickness cylinder head gasket.

Refer to: [Cylinder Head Gasket Selection - TD4 2.2L Diesel](#) (303-00 Engine System - General Information, General Procedures).

5. **CAUTIONS:**



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



Make sure the locating dowels are installed correctly.



Make sure to install a gasket of the correct thickness



Make sure that the gasket is correctly located.

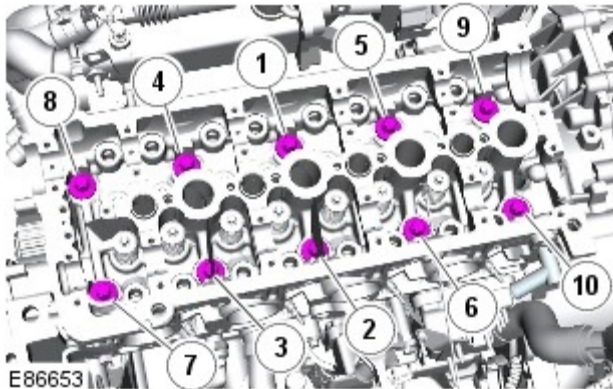
Install a new cylinder head gasket.

6.  **WARNING:** This step requires the aid of another technician.



CAUTION: Make sure that the component is correctly located on the locating dowels.

Install the cylinder head.



7.  **CAUTION:** Make sure that new cylinder head bolts are installed.

Tighten the cylinder head bolts in three stages to the sequence shown.

Torque:

Stage 1: 20 Nm

Stage 2: 60 Nm

Stage 3: 220°

8. **8. CAUTIONS:**



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



Lubricate the bearing surfaces with clean engine oil.



Make sure that these components are installed to the noted removal position.

Install the camshaft roller followers.

9. Connect the glow plug electrical connectors and secure the harness to the cylinder head.

10. Connect and secure the coolant hose.

11. Install the timing belt rear cover, tighten the bolts.

Torque: 5 Nm

12. Install the engine RH mount bracket bolts.

Torque:

M12 80 Nm

M10 60 Nm

13. Install the RH engine mount.

Refer to: [Engine Mount RH](#) (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).

14. Install the thermostat.

Refer to: [Thermostat](#) (303-03B Engine Cooling - TD4 2.2L Diesel, Removal and Installation).

15. Install the camshafts.

Refer to: [Camshafts](#) (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).

16. Install the exhaust manifold.

Refer to: [Exhaust Manifold](#) (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).

17. Connect the battery ground cable and install the cover.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

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Engine - TD4 2.2L Diesel - Oil Pan

Removal and Installation

Removal

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

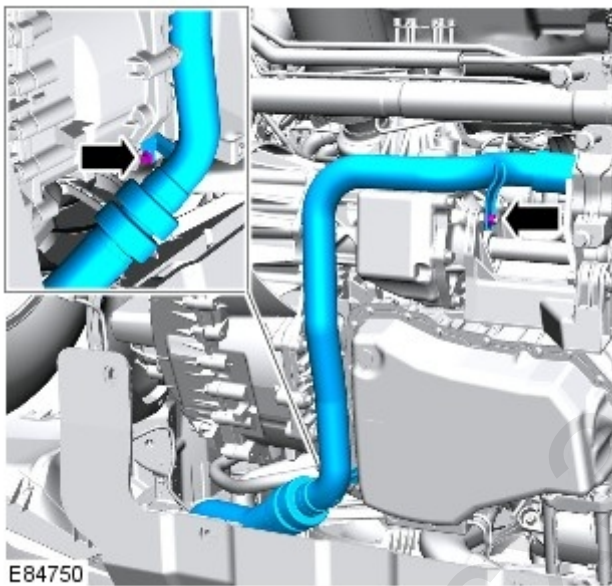
1.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

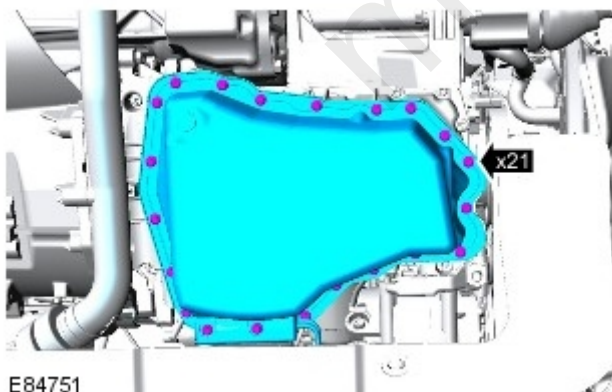
2. Drain the engine oil.

Refer to: [Engine Oil Draining and Filling](#) (303-01B Engine - TD4 2.2L Diesel, General Procedures).

- 3.



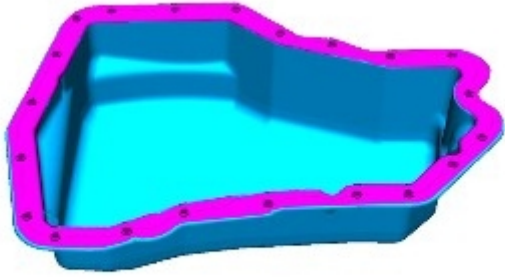
4. Torque: 9 Nm



5. For sealant information, refer to the engine specification section.

Refer to: [Specifications](#) (303-01B Engine - TD4 2.2L Diesel, Specifications).

6.



E84752

Installation

1. To install, reverse the removal procedure.

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Engine - TD4 2.2L Diesel - Oil Pump

Removal and Installation

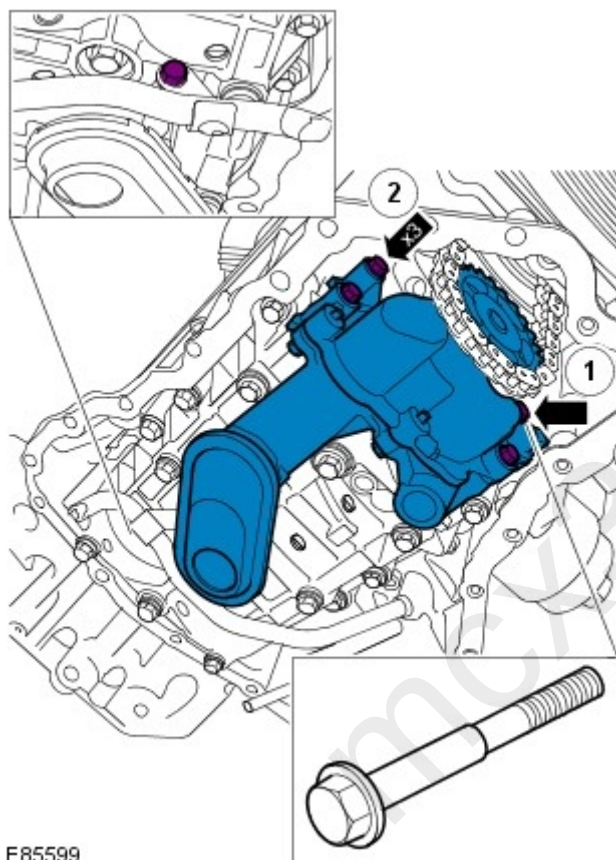
Removal

1.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

2. Remove the oil pan.

Refer to: [Oil Pan](#) (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).

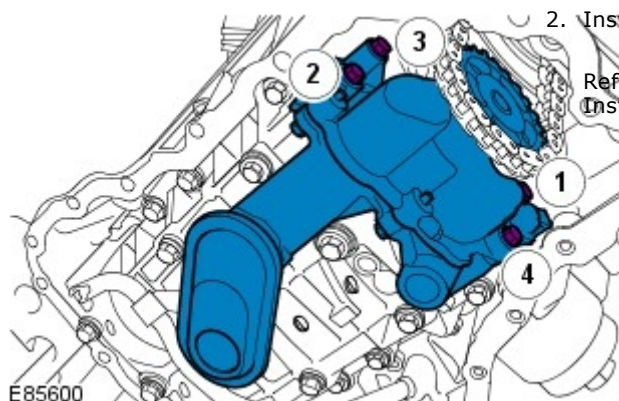


E85599

3.  **CAUTION:** Note the fitted position of the component prior to removal.

- **NOTE:** The shouldered bolt in position 1 locates the oil pump.

Installation



E85600

2. Install the oil pan.

Refer to: [Oil Pan](#) (303-01B Engine - TD4 2.2L Diesel, Removal and Installation). **CAUTION:** Make sure that the mating faces are clean and free of foreign material.

-  **CAUTION:** Make sure that these components are installed to the noted removal position.

- **NOTE:** The shouldered bolt in position 1 locates the oil pump.

Tighten the bolts evenly in 2 stages to the sequence shown.

Torque:

Stage 1: 7 Nm

Stage 2: 9 Nm

Engine - TD4 2.2L Diesel - Oil Cooler

Removal and Installation

Removal

1. Disconnect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

2.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

3. Drain the coolant.

Refer to: [Cooling System Draining, Filling and Bleeding](#) (303-03B Engine Cooling - TD4 2.2L Diesel, General Procedures).

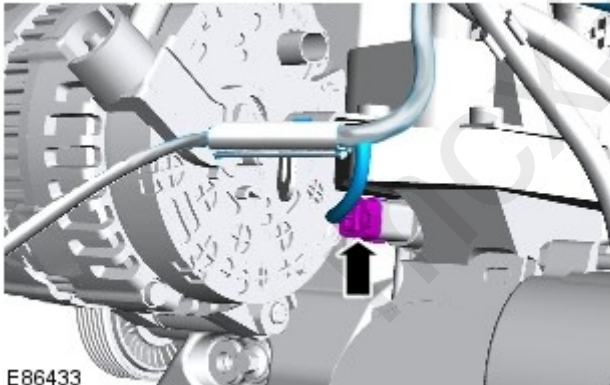
4. Remove the air conditioning (A/C) compressor.

Refer to: [Air Conditioning \(A/C\) Compressor - TD4 2.2L Diesel](#) (412-01 Climate Control, Removal and Installation).

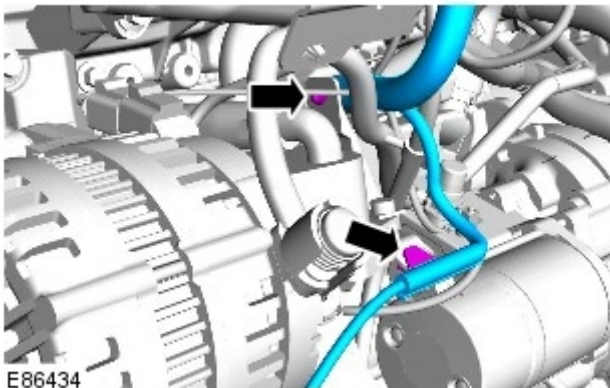
5. Remove the throttle body.

Refer to: [Throttle Body](#) (303-04B Fuel Charging and Controls - TD4 2.2L Diesel, Removal and Installation).

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

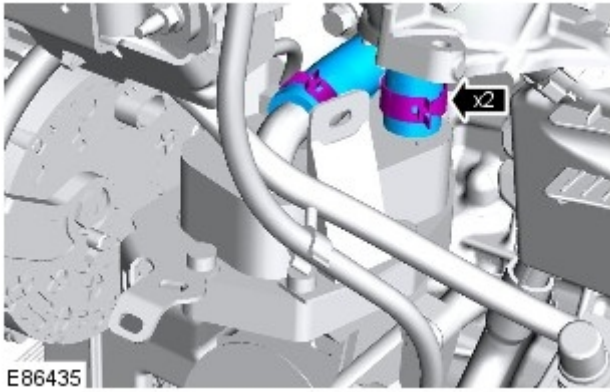


E86433

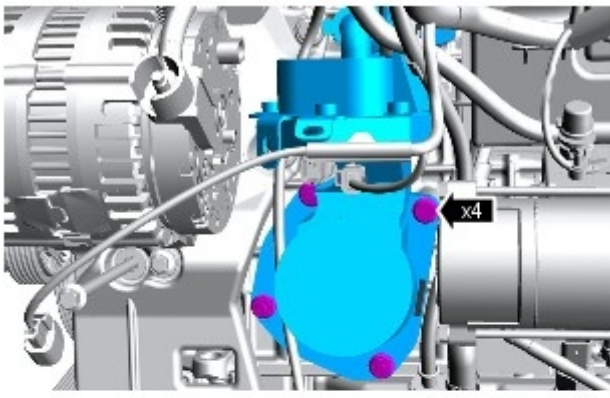


E86434

- 7.



8.

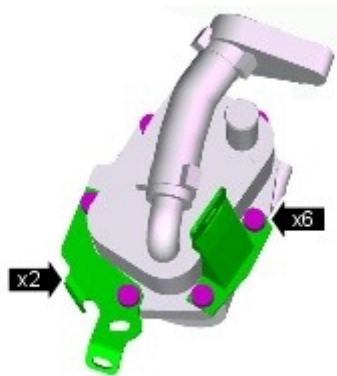
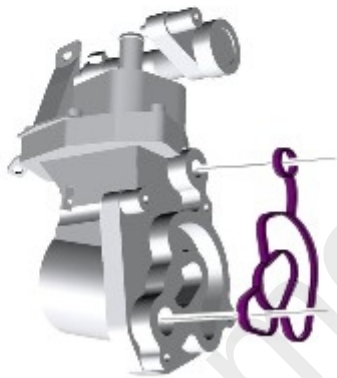


9. **9. CAUTIONS:**

 Be prepared to collect escaping fluids.

 Discard the seal.

Torque: 20 Nm



10. **10. CAUTION:** Discard the seal.

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

Torque: 10 Nm

Installation

1. To install, reverse the removal procedure.

Engine - TD4 2.2L Diesel - Oil Filter Element

Removal and Installation

Removal

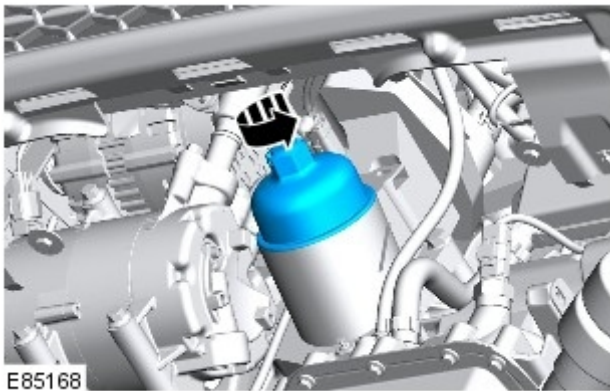
- NOTE: Removal steps in this procedure may contain installation details.

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

Raise and support the vehicle.

2. Remove the engine undershield.

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



3.  **WARNING:** Fluid loss is unavoidable, use absorbent cloth or a container to collect the fluid.

- CAUTIONS:



Make sure that the area around the component is clean and free of foreign material.



Discard the seal.

Torque: 25 Nm

Installation

1. To install, reverse the removal procedure.
2. Check and top-up the engine oil.

Engine - TD4 2.2L Diesel - Engine Mount LH

Removal and Installation

General Equipment

Transmission jack

Removal

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

1.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

2. Remove the engine undershield.

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

3. Support the transmission.

General Equipment: [Transmission jack](#)

4. Remove the air cleaner assembly.

Refer to: [Air Cleaner](#) (303-12A Intake Air Distribution and Filtering - I6 3.2L Petrol, Removal and Installation).

5. Remove the battery tray.

Refer to: [Battery Tray](#) (414-01 Battery, Mounting and Cables, Removal and Installation).

E77995

6.  **WARNING:** Make sure that new nuts are installed.

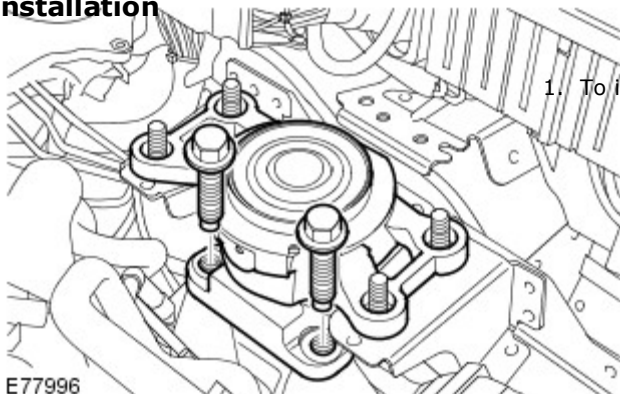
- NOTE: Vehicles with automatic transmission have a breather pipe attached to the mounting.

Remove the bracket.

Torque:

M12 80 NmM8 25 Nm

Installation



E77996

7. Remove the engine mount LH.

Torque: 175 Nm

1. To install, reverse the removal procedure.

Engine - TD4 2.2L Diesel - Engine Mount RH

Removal and Installation

Removal

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

1.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

2. Remove the engine undershield.

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

3. Support the engine.

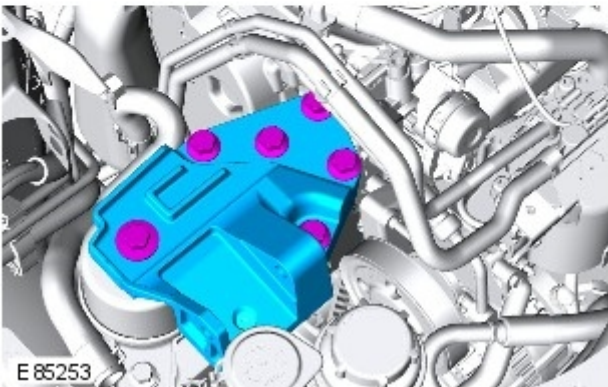
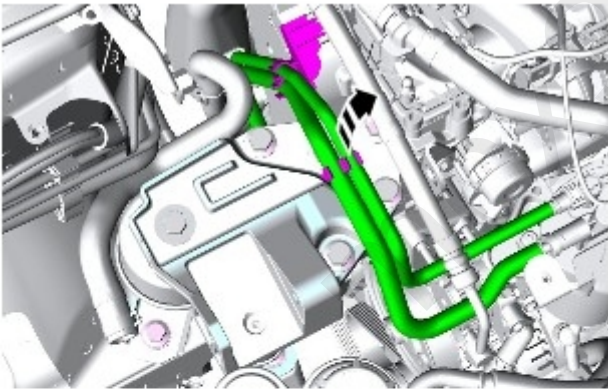
4. Remove the engine cover.

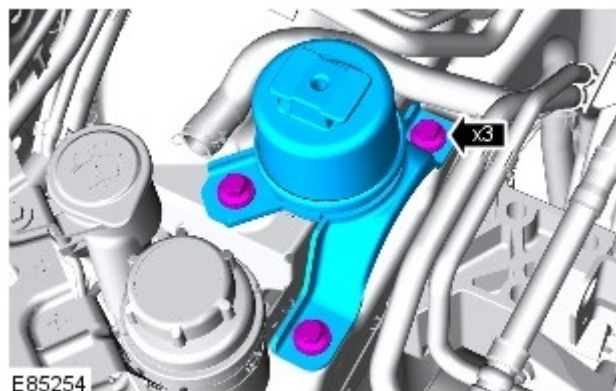
Refer to: [Engine Cover - TD4 2.2L Diesel](#) (501-05 Interior Trim and Ornammentation, Removal and Installation).

5. Remove the engine upper support insulator.

Refer to: [Engine Upper Support Insulator](#) (303-01A Engine - I6 3.2L Petrol, Removal and Installation).

6. *Torque:*
M14 175 Nm
M12 80 Nm





7. Torque: 80 Nm

Installation

1. To install, reverse the removal procedure.

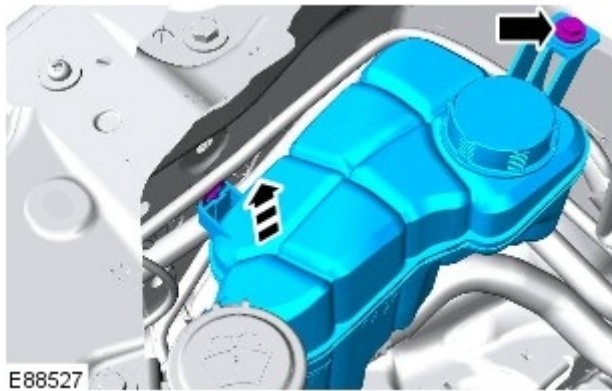
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Engine - TD4 2.2L Diesel - Engine Upper Support Insulator

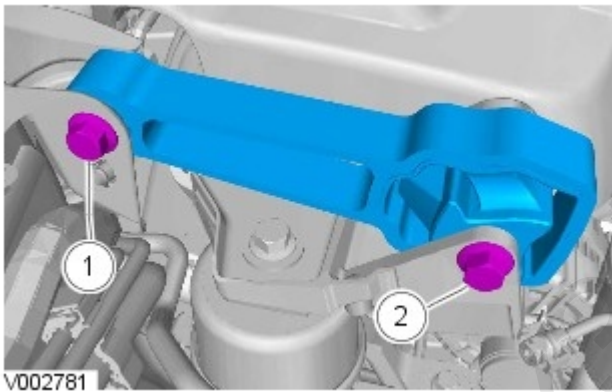
Removal and Installation

Removal

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



1. Torque: 10 Nm



2. Torque: 110 Nm

Installation

1. To install, reverse the removal procedure.

Engine - TD4 2.2L Diesel - Engine Lower Support Insulator

Removal and Installation

Removal

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

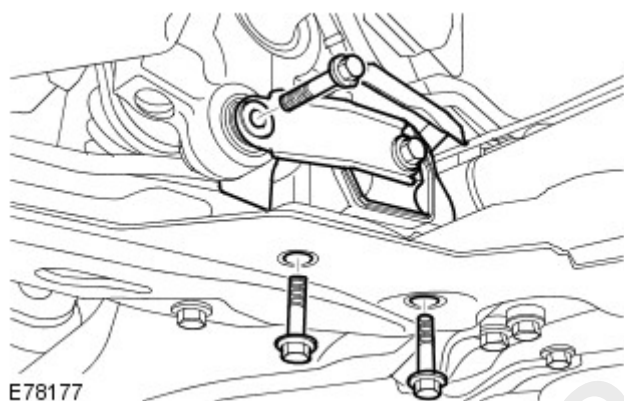
All vehicles

1.  WARNING: Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

2. Remove the engine undershield.

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



E78177

3.  CAUTION: Make sure that these components are installed to the noted removal position.

Remove the lower support insulator.

Torque: 110 Nm

Vehicles with petrol engine



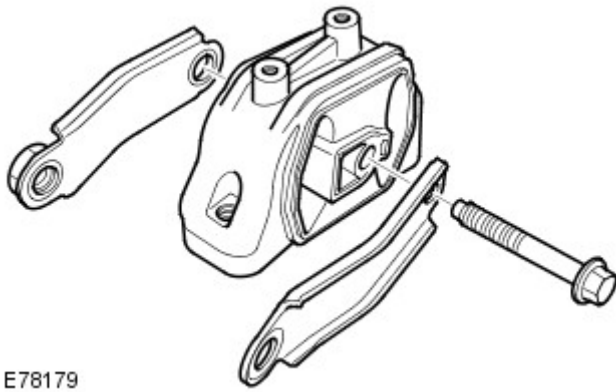
E78178

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

Remove the heat shield.

Torque: 10 Nm

All vehicles



E78179

5. Remove the engine mount link brackets.

Torque: 110 Nm

Installation

1. To install, reverse the removal procedure.

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Engine - TD4 2.2L Diesel - Oil Pan Extension

Removal and Installation

Removal

1.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

2. Remove the engine cover.

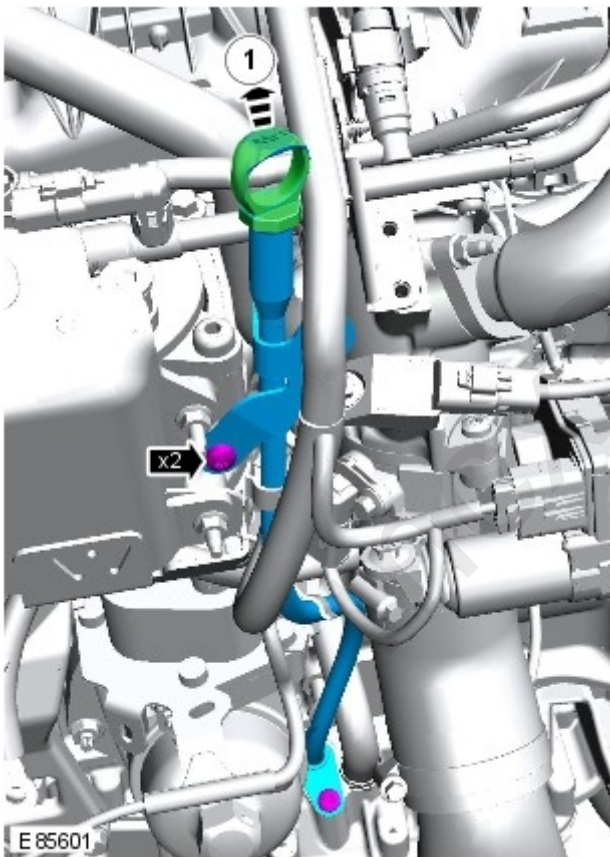
Refer to: [Engine Cover - TD4 2.2L Diesel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

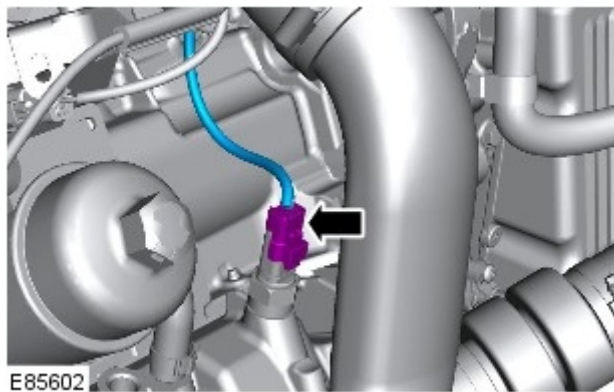
3. Remove the oil pan.

Refer to: [Oil Pan](#) (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).

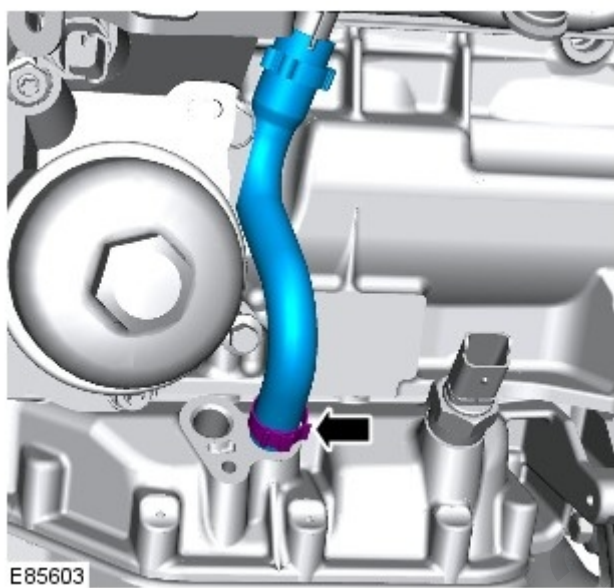
4. **NOTE:** Remove and discard the O-ring seal.

Remove the dipstick tube.

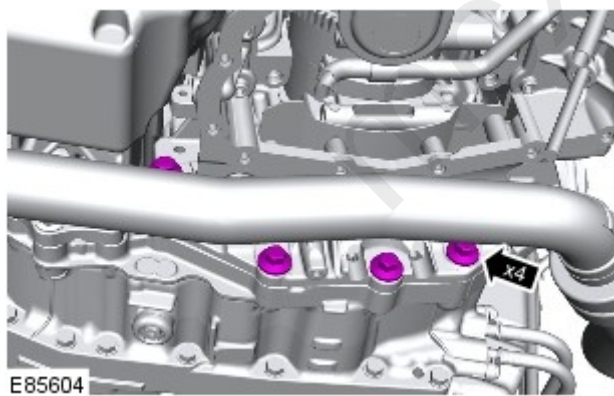




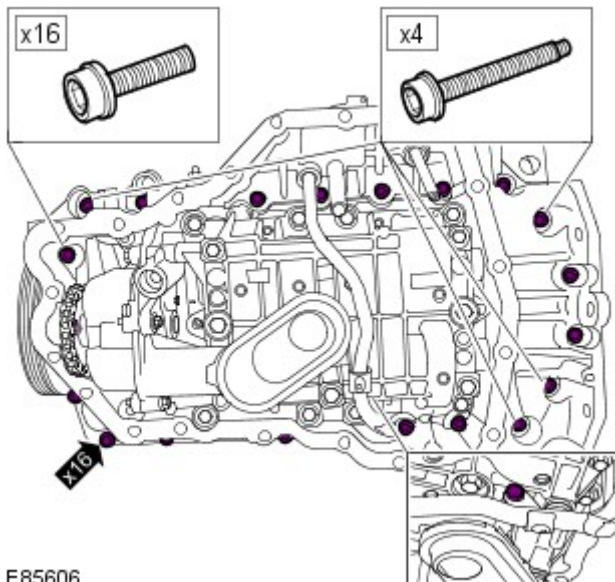
5. Disconnect the oil level sensor electrical sensor.



6. Release the crankcase vent oil separator drain tube.

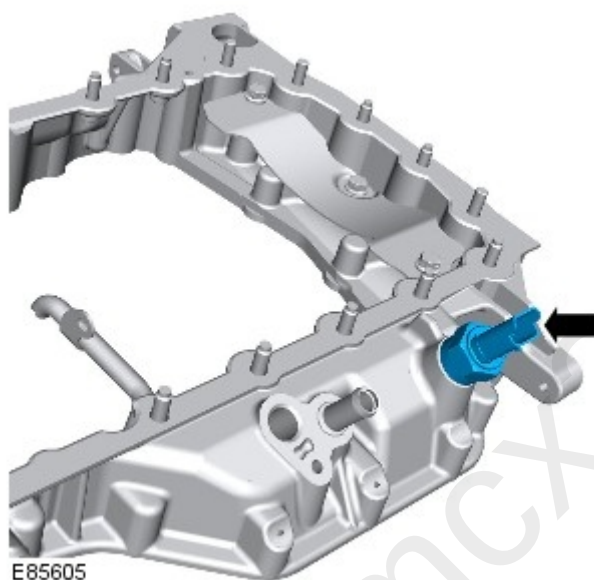


7. Remove the 4 transmission bolts.



E85606

8. Remove the oil pan extension panel.



E85605

9. Remove the oil level sensor.

10. Remove the gasket.

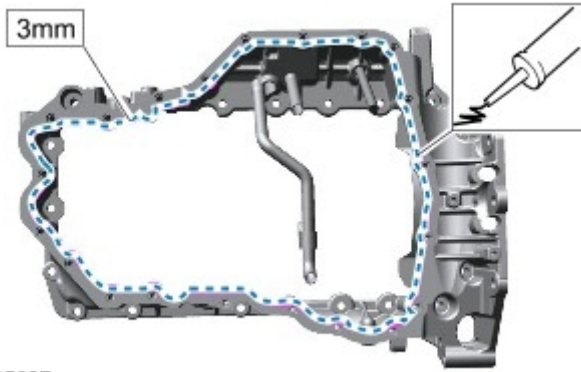
Installation

1. Install the oil level sensor.

Torque: 8 Nm

2. For sealant specification, refer to the specifications section.

Refer to: [Specifications](#) (303-01B Engine - TD4 2.2L Diesel, Specifications).



E85607

3. Apply a bead of sealant, 3 mm diameter, to the area indicated.

4. Install the oil pan extension panel.

Torque:
Stage 1: 10 Nm
Stage 2: 16 Nm

5. Install the transmission retaining bolts.

Torque: 47 Nm

6. Connect the crankcase vent oil separator drain tube.

7. Connect the oil level sensor electrical connector.

8. Install the dipstick.

9. Install the dipstick tube.

Torque: 10 Nm

10. Install the oil pan.

Refer to: [Oil Pan](#) (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).

11. Install the engine cover.

Refer to: [Engine Cover - TD4 2.2L Diesel](#) (501-05 Interior Trim and Ornementation, Removal and Installation).

Engine - TD4 2.2L Diesel - Flywheel

Removal and Installation

Removal

1. Disconnect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

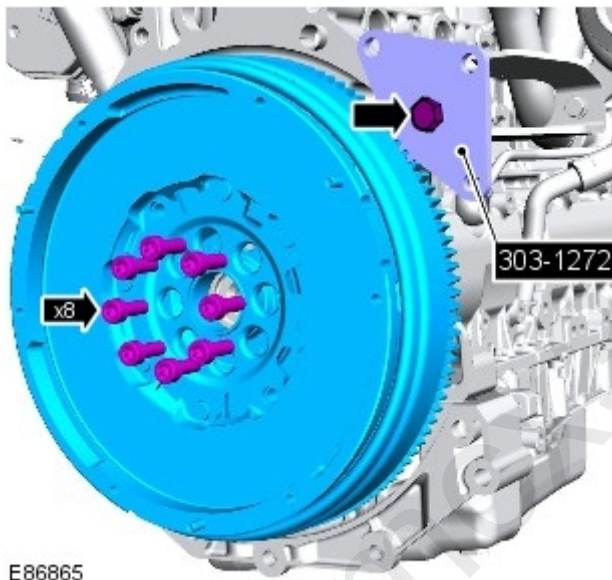
2.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

3. Remove the pressure plate and clutch disc.

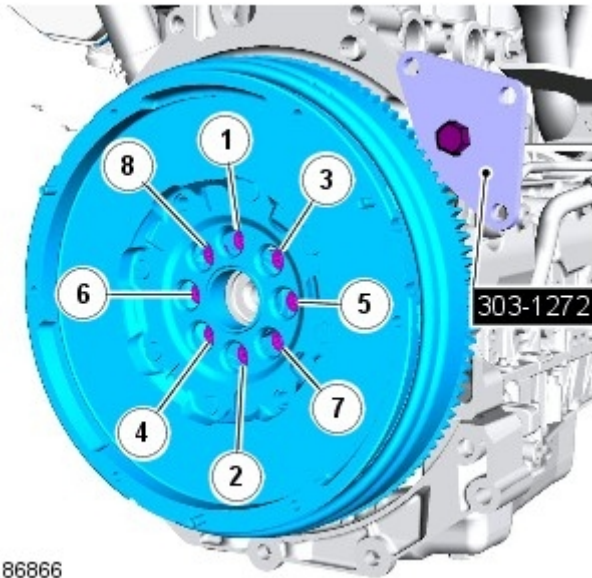
Refer to: [Clutch Disc and Pressure Plate](#) (308-01 Clutch, Removal and Installation).

4. **NOTE:** Restrain the flywheel.



E86865

Installation



E86866

1. **1. CAUTIONS:**



Tighten the bolts in the sequence shown.



Make sure that new bolts are installed.

Torque:

Stage 1: 33 Nm

Stage 2: 34°

2. Install the clutch disc and pressure plate.

Refer to: [Clutch Disc and Pressure Plate](#) (308-01 Clutch, Removal and Installation).

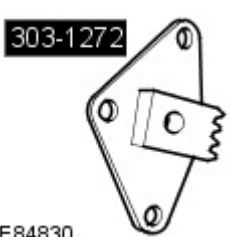
3. Connect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

Engine - TD4 2.2L Diesel - Flexplate

Removal and Installation

Special Tool(s)

	303-1272 Locking Tool, Flywheel
---	------------------------------------

Removal

- NOTE: The flywheel illustration is used, the flexplate tightening sequence and bolt positions are the same.

1. Remove the cover and disconnect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

2.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

3. Remove the transmission and converter.

Refer to: [Transmission - TD4 2.2L Diesel](#) (307-01 Automatic Transmission/Transaxle, Installation).

4. **CAUTIONS:**



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



Make sure that new bolts are installed.



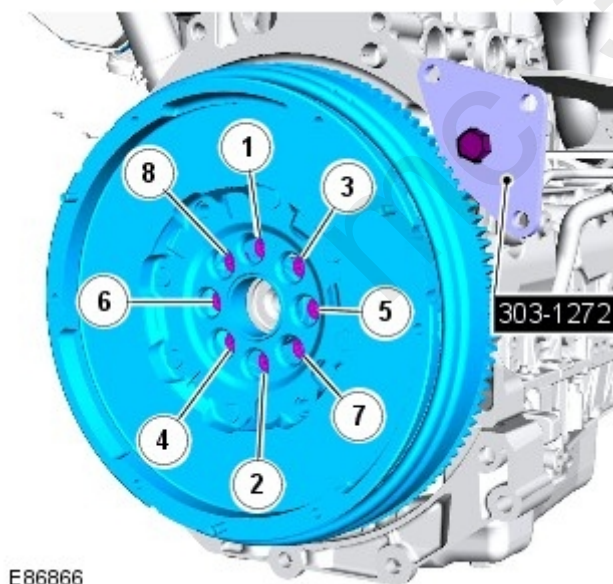
Tighten the bolts in the sequence shown.

- *Special Tool(s):* [303-1272](#)

- *Torque:*

Stage 1: 33 Nm

Stage 2: 34°



Installation

1. To install, reverse the removal procedure.

Engine - TD4 2.2L Diesel - Balance Shaft Assembly

Removal and Installation

Special Tool(s)

 303-1270 E85706	303-1270 Timing Pin, Crankshaft
 303-1328 E89978	303-1328 Timing Plate, Balance Shafts
 303-1329 E 89979	303-1329 Locking Tool, Balance Shafts

Removal

• **NOTE:** This procedure contains removal and installation details only, if a back lash check is required it must be carried out before the balance shaft assembly is removed from the engine block.

1. Remove the cover and disconnect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

2.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

3. Remove the RH front wheel and tire.

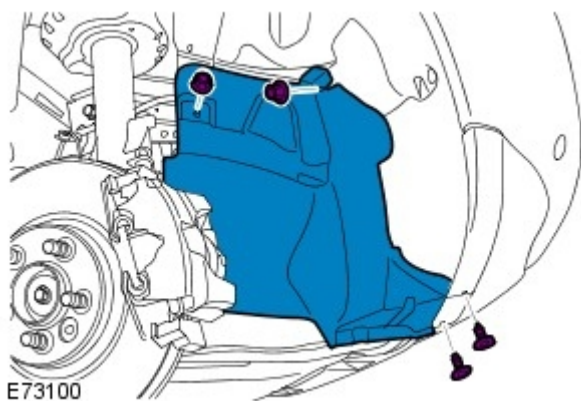
Refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).

4. Remove the oil pan extension.

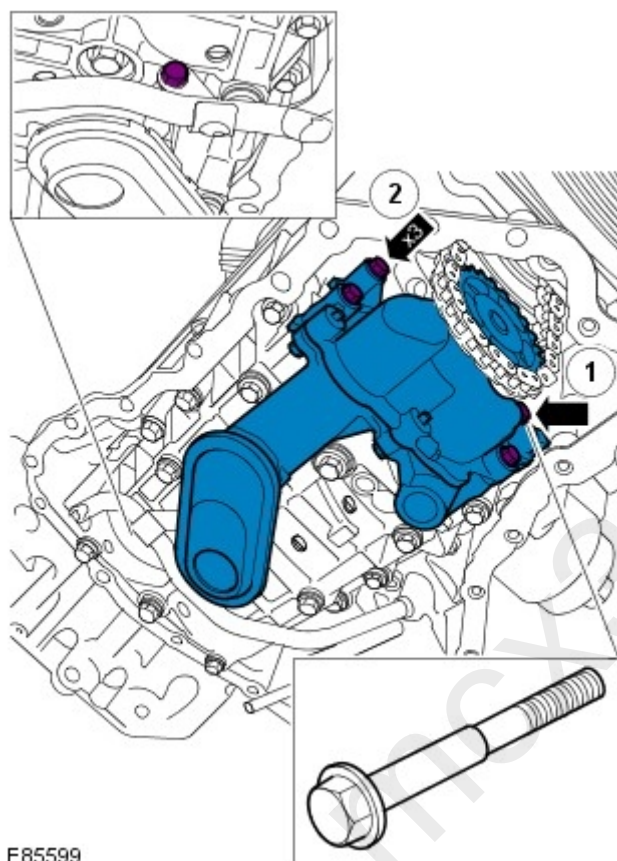
Refer to: [Oil Pan Extension](#) (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).

5. Remove the starter motor.

Refer to: [Starter Motor](#) (303-06B Starting System - TD4 2.2L Diesel, Removal and Installation).

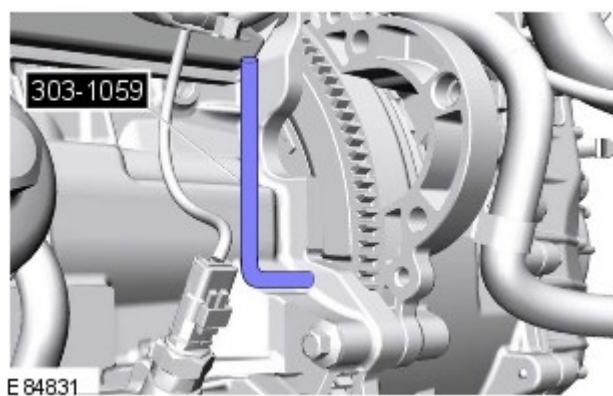


6.



7.  **CAUTION:** Note the fitted position of the component prior to removal.

- **NOTE:** The shouldered bolt in position 1 locates the oil pump.

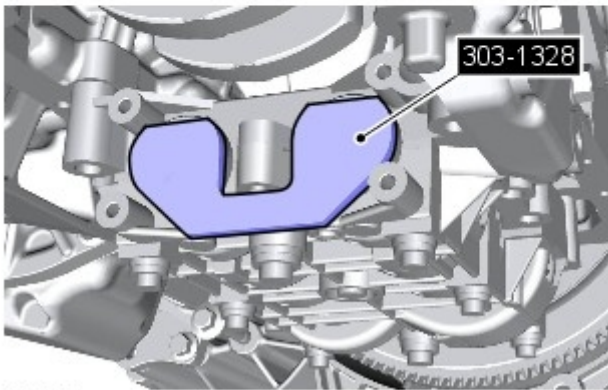
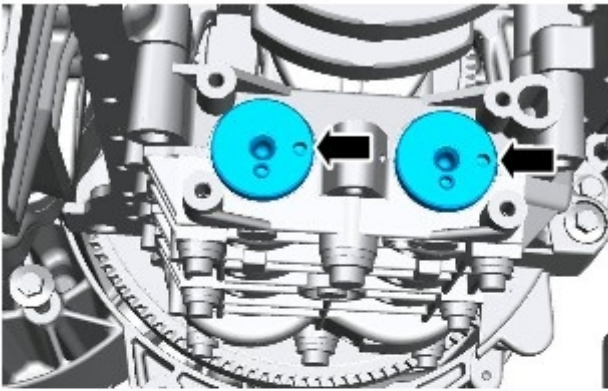


8. Rotate the crankshaft and install the crankshaft timing tool.

Special Tool(s): [303-1270](#)

9. Install the balance shaft timing tool.

Special Tool(s): [303-1328](#)



E90054

10. Install the balance shaft locking tool.

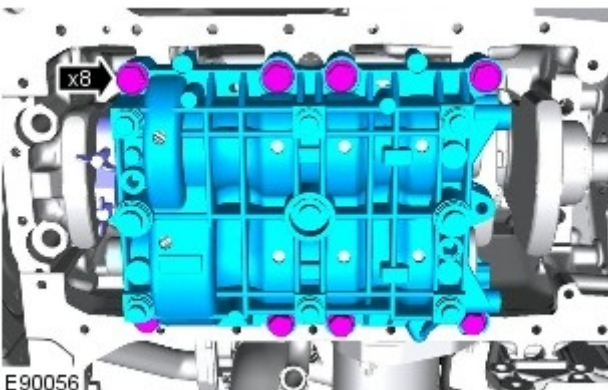
Special Tool(s): [303-1329](#)



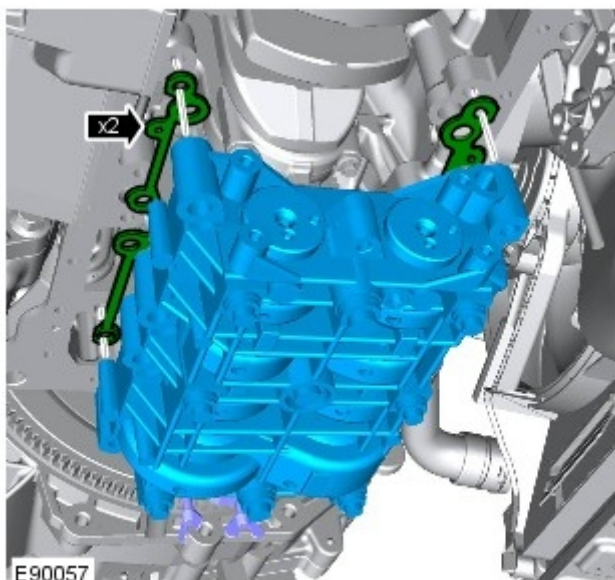
E90055

11. **11.**  **CAUTION:** Note the fitted position of the component prior to removal.

Remove the balance shaft assembly.



E90056



E90057

12. **12. CAUTIONS:**



Make sure that these components are installed to the noted removal position.



Extreme cleanliness must be exercised when handling these components.

Remove the 2 shims.



E90058

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

Remove the dowels.

Installation

1. Install the dowels.

2. **2. CAUTIONS:**

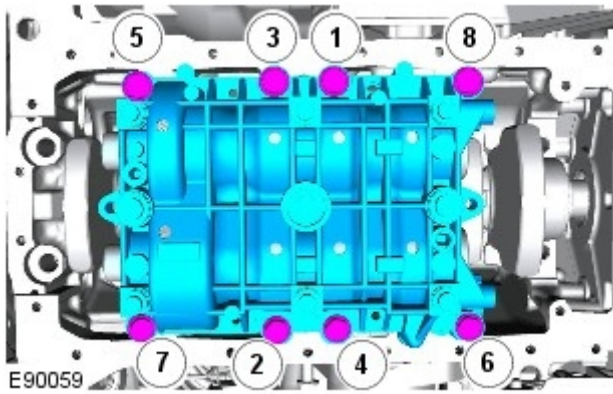


Make sure that these components are installed to the noted removal position.



Extreme cleanliness must be exercised when handling these components.

Install the shims.



3.  **CAUTION:** Make sure that the mating faces are clean and free of corrosion and foreign material.

• **NOTE:** Make sure that this component is installed to the noted removal position.

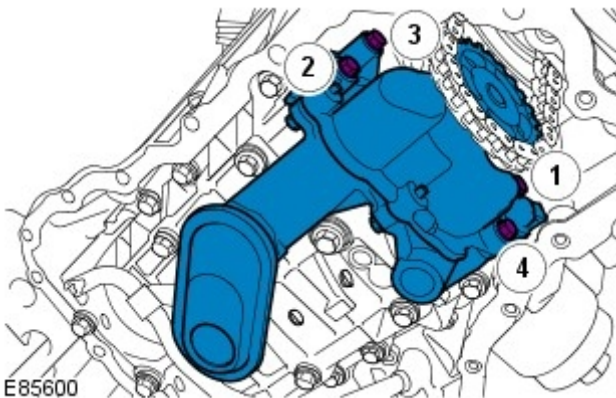
Tighten the bolts evenly in 2 stages to the sequence shown.

Torque:

Stage 1: 5 Nm

Stage 2: 22 Nm

4. Remove the balance shaft timing and locking tools.



5. **CAUTIONS:**



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



Make sure that these components are installed to the noted removal position.

Tighten the bolts evenly in 2 stages to the sequence shown.

Torque:

Stage 1: 7 Nm

Stage 2: 9 Nm

6. Remove the crankshaft timing tool.

Special Tool(s): [303-1270](#)

7. Install the oil pan extension.

Refer to: [Oil Pan Extension](#) (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).

8. Install the fender splash shield extension panel.

9. Install the starter motor.

Refer to: [Starter Motor](#) (303-06B Starting System - TD4 2.2L Diesel, Removal and Installation).

10. Install the front wheel and tire.

Refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).

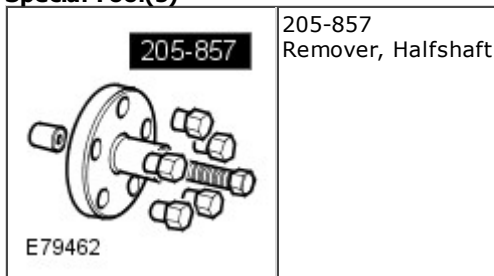
11. Connect the battery ground cable and install the cover.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

Engine - TD4 2.2L Diesel - Engine

Removal

Special Tool(s)



General Equipment

Powertrain Jack

- NOTE: In this procedure the engine is removed with the transmission.

1.  **WARNING:** Make sure to support the vehicle with axle stands.
Raise and support the vehicle.
2. Remove the cover and disconnect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).
3. Remove the engine cover.

Refer to: [Engine Cover - TD4 2.2L Diesel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
4. Remove the plenum box access panel.

Refer to: [Plenum Chamber](#) (412-01 Climate Control, Removal and Installation).
5. Remove the battery tray.

Refer to: [Battery Tray](#) (414-01 Battery, Mounting and Cables, Removal and Installation).
6. Remove the air cleaner assembly.

Refer to: [Air Cleaner](#) (303-12A Intake Air Distribution and Filtering - I6 3.2L Petrol, Removal and Installation).
7. Drain the coolant.

Refer to: [Cooling System Draining, Filling and Bleeding](#) (303-03B Engine Cooling - TD4 2.2L Diesel, General Procedures).
8. Remove the catalytic converter.

Refer to: [Catalytic Converter - Vehicles Without: Diesel Particulate Filter \(DPF\)](#) (309-00B Exhaust System - TD4 2.2L Diesel, Removal and Installation).
9. Recover the A/C refrigerant.

Refer to: [Air Conditioning \(A/C\) System Recovery, Evacuation and](#)

[Charging](#) (412-00 Climate Control System - General Information, General Procedures).

10. Remove the lower engine stabilizer bar.

Refer to: [Engine Lower Support Insulator](#) (303-01A Engine - I6 3.2L Petrol, Removal and Installation).

11. Remove the front subframe assembly.

Refer to: [Front Subframe](#) (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).

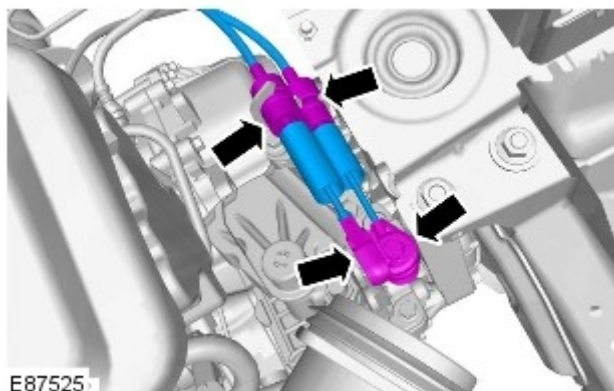
12. Siphon the fluid from the power steering reservoir.

13. Disconnect the engine control module (ECM).

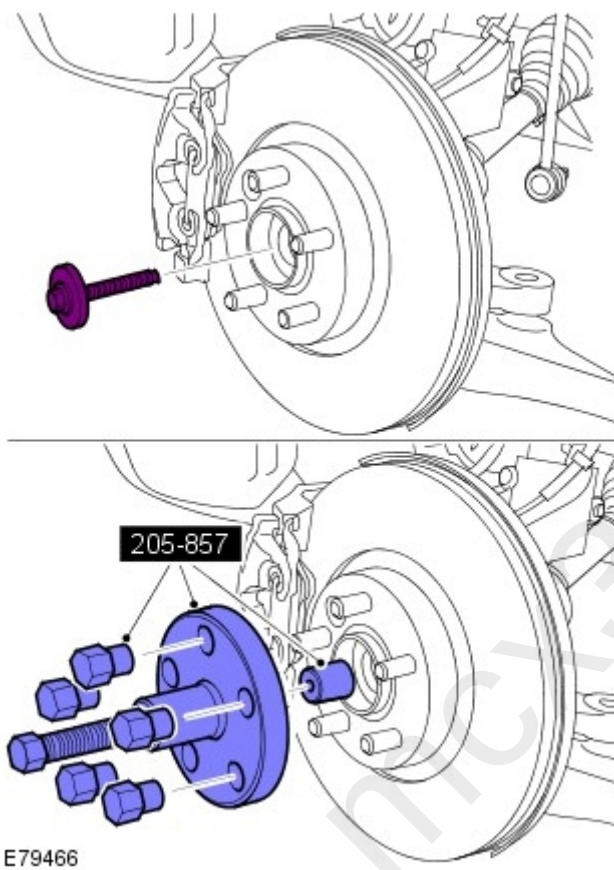


- 14.



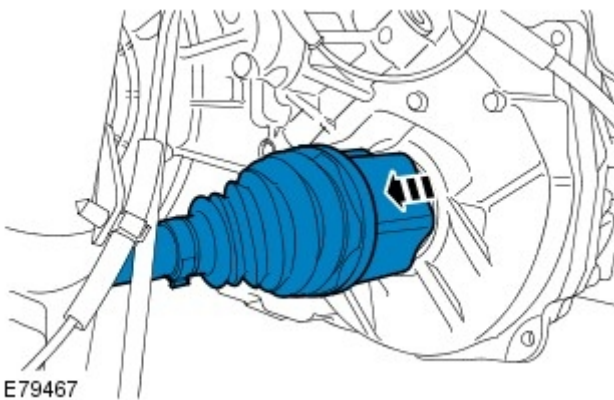


15.

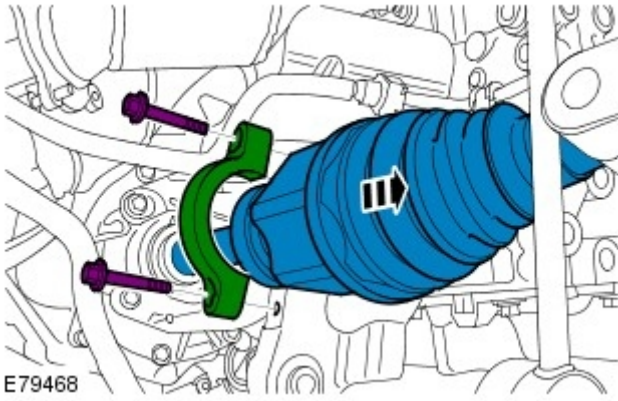


16. Release the LH and RH halfshafts.

Special Tool(s): [205-857](#)



17. Remove the LH halfshaft.

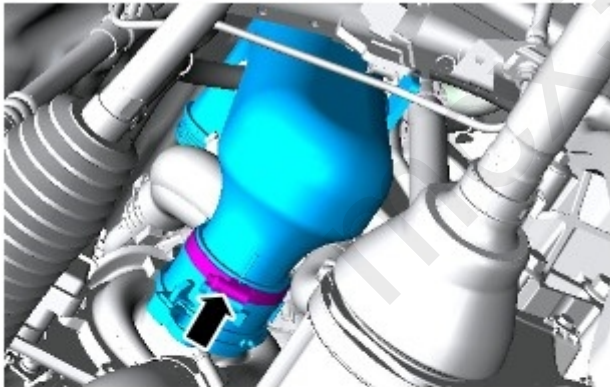


18. Remove the RH halfshaft.

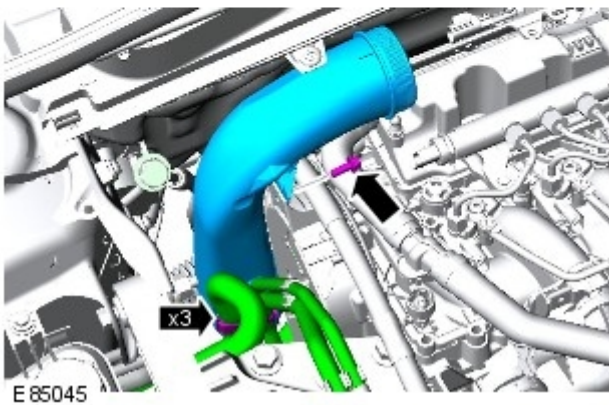
19. Tie the suspension arms aside for access.

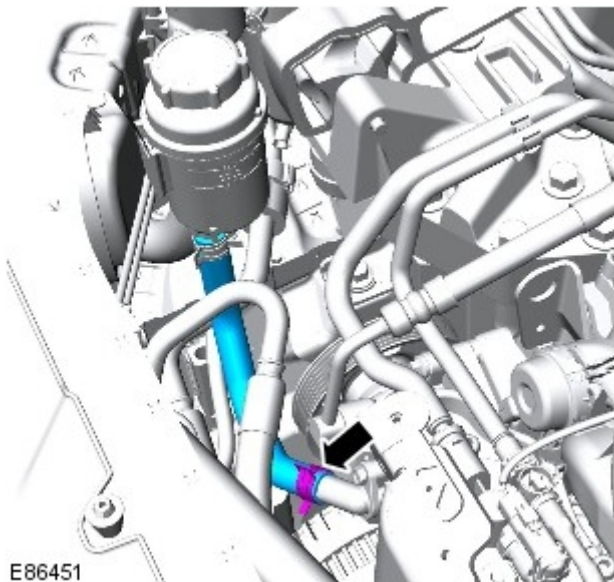


20. Disconnect the cooling fan control electrical connector.



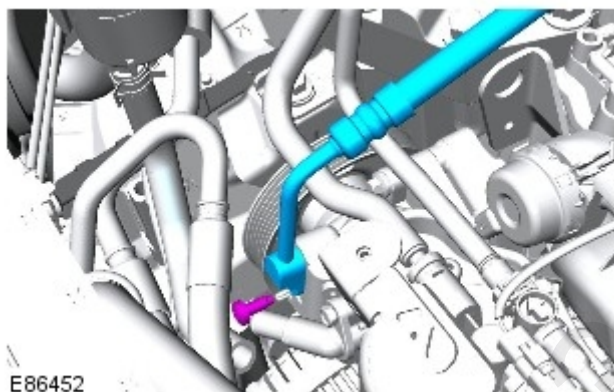
21. Remove the intake air duct.



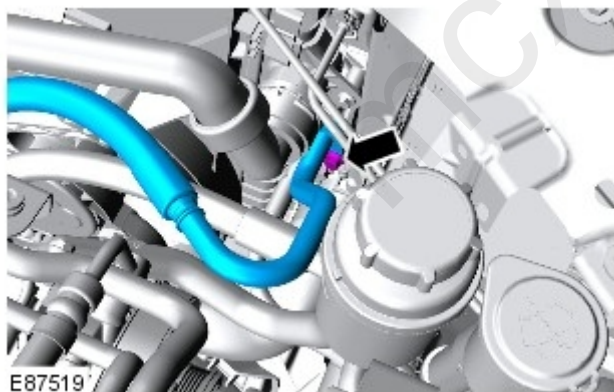


22. **22.**  **CAUTION:** Be prepared to collect escaping fluids.

Disconnect the low pressure line from the power steering pump.



23. Release the power steering high-pressure pipe.



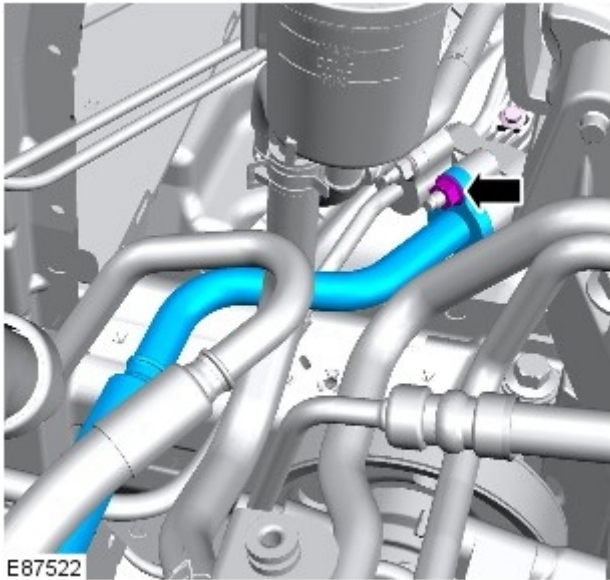
24. **24.** **CAUTIONS:**



Discard the seal.



Make sure that all openings are sealed.



25. **25. CAUTIONS:**

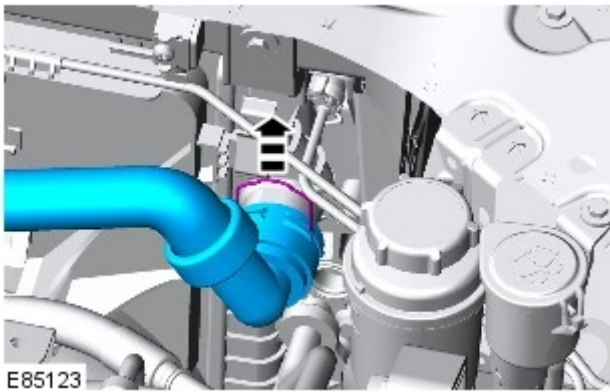


Discard the seal.



Make sure that all openings are sealed.

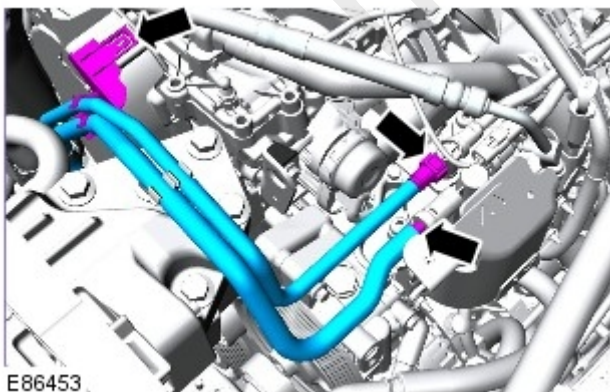
Disconnect the A/C compressor low-pressure refrigerant line.



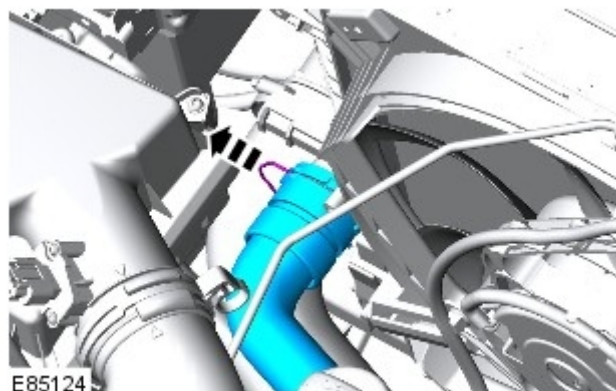
26. Remove the top hose.

27. **27. CAUTION:** Be prepared to collect escaping fuel.

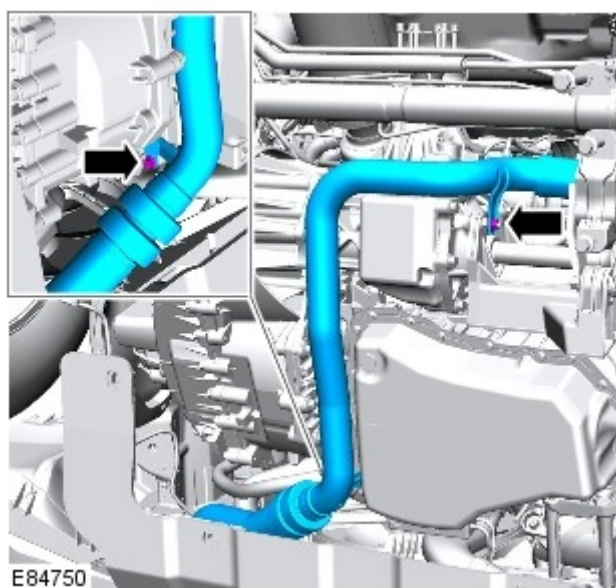
Disconnect the 2 fuel lines.



28. Release the 2 fuel lines.



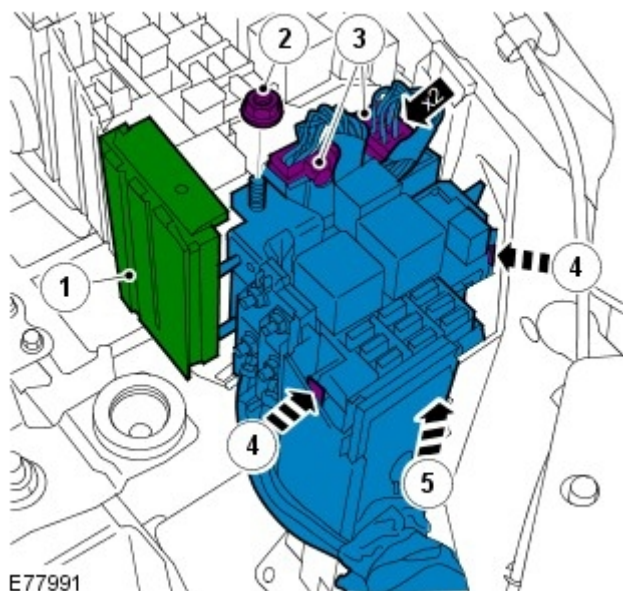
29. Disconnect the bottom hose.



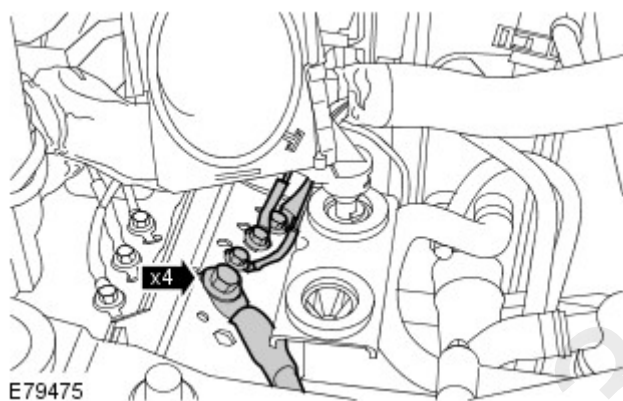
30. Remove the charge air cooler inlet pipe.



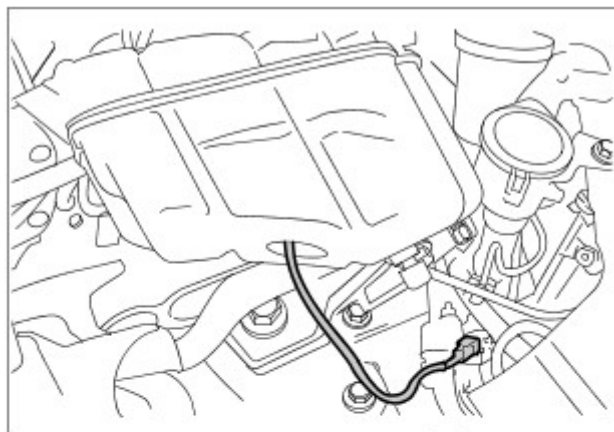
31. Disconnect the charge air cooler outlet hose.



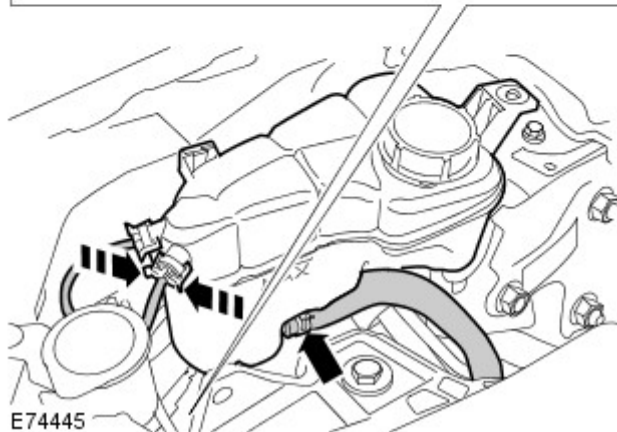
32. Disconnect the engine wiring harness.



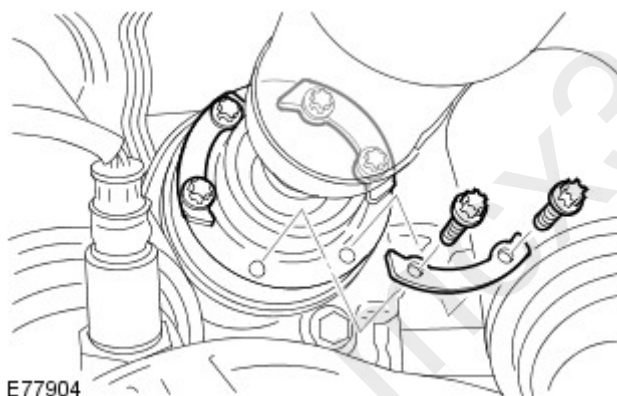
33. LH side: Release 4 engine compartment ground cables.



34. Remove the coolant expansion tank.

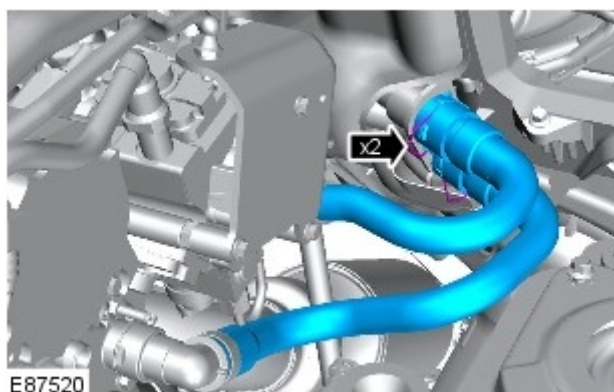


E74445



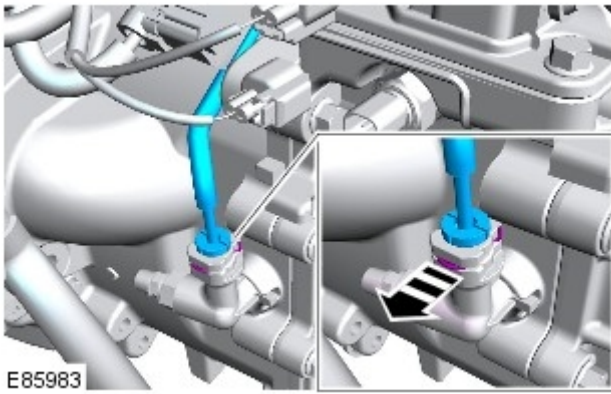
E77904

35. Release the driveshaft from the transmission drive flange.



E87520

36. Disconnect 2 heater hoses from the bulkhead.

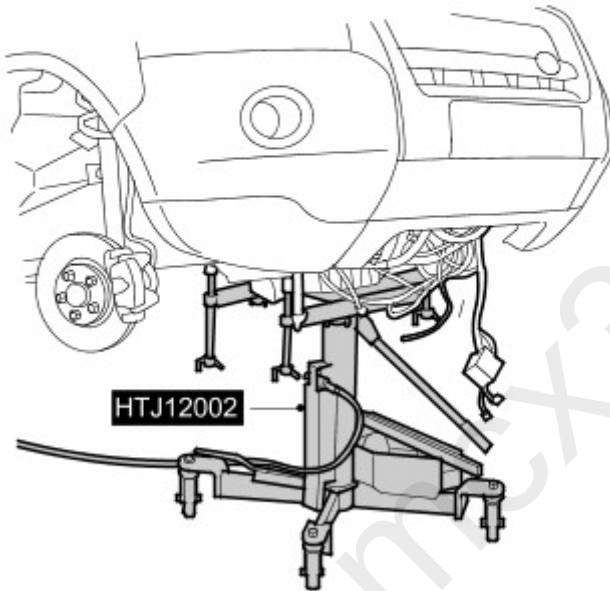


37. **37.**  **CAUTION:** If brake fluid is spilt on the paintwork, the affected area must be immediately washed down with cold water.

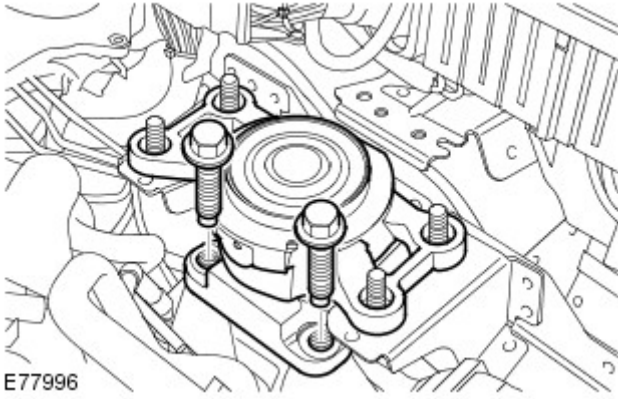
Disconnect the clutch fluid hose.

38. Support the engine.

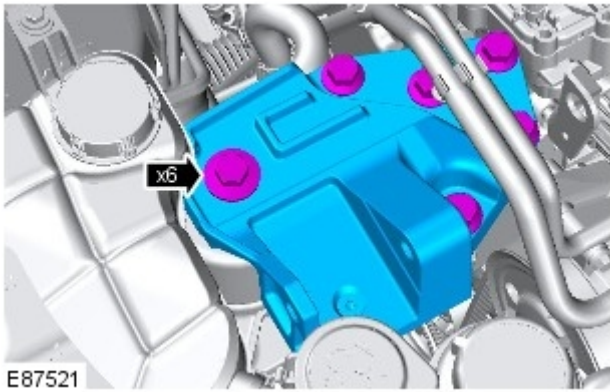
General Equipment: [Powertrain Jack](#)



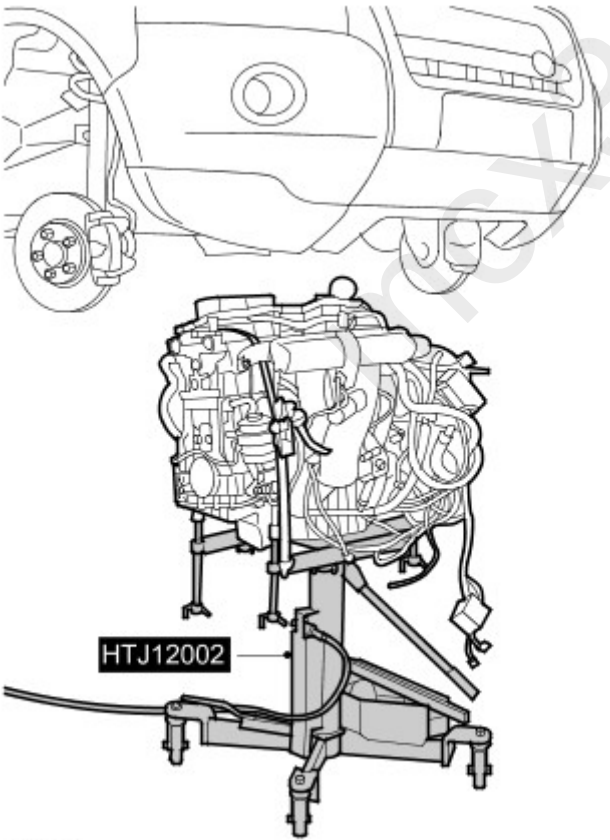
39. Remove the LH engine mount bracket.



40. Remove the LH engine mount.



41. RH side: Release the engine mount.



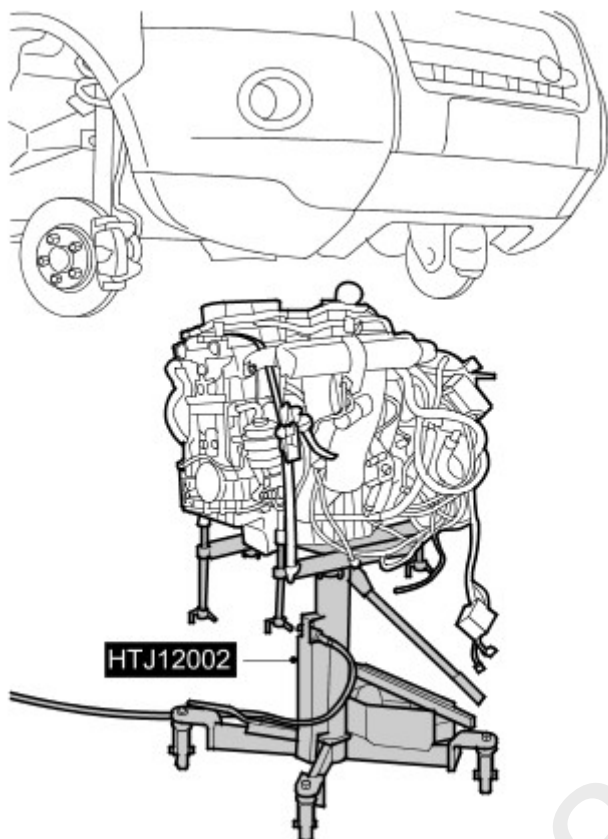
42. With assistance, carefully remove the engine and transmission.

Engine - TD4 2.2L Diesel - Engine

Installation

General Equipment

Powertrain Jack



E83039

1. With assistance, carefully install the engine and transmission.

General Equipment: [Powertrain Jack](#)

2. RH side: Install the engine mount.

Torque: 80 Nm

3. Install the LH engine mount.

Torque: 175 Nm

4. Install the bracket.

Torque:
M12 80 Nm
M8 25 Nm

5. Remove the engine support.

6. Connect the clutch fluid hose.

7. Connect the bulkhead heater hoses.

8. **8. CAUTIONS:**



Make sure that the component is clean, free of foreign material and lubricant.



Make sure that new bolts are installed.

Install the driveshaft.

Torque: 40 Nm

9. Install the coolant expansion tank.

Torque: 10 Nm

10. Secure the engine wiring harness.

Torque: 10 Nm

11. **11.**  **CAUTION:** Extreme cleanliness must be exercised when handling these components.

Connect the fuel lines.

12. Connect the coolant top hose.

13. Connect the coolant bottom hose.

14. Connect the cooling fan electrical connector.

15. Install the RH halfshaft and support bracket.

Torque: 25 Nm

16. Install the LH halfshaft.

17. With assistance, install the halfshaft to the hub.

18. Install the halfshafts.

Torque:
Stage 1: 45 Nm
Stage 2: 80°

19. **19.**  **CAUTION:** A new O-ring seal is to be installed.

- **NOTE:** Lubricate the O-ring seals with clean refrigerant oil.

Connect the A/C compressor high-pressure refrigerant line.

Torque: 24 Nm

20. **20.**  **CAUTION:** A new O-ring seal is to be installed.

- **NOTE:** Lubricate the O-ring seals with clean refrigerant oil.

Connect the A/C compressor low-pressure refrigerant line.

Torque: 24 Nm

21. Connect the low pressure line to the power steering pump.

22. **22.**  **CAUTION:** A new O-ring seal is to be installed.

Connect the high-pressure power steering line to the power steering pump.

Torque: 24 Nm

23. Secure the power steering high-pressure line.

Torque: 10 Nm

24. Install the gear selector cables.

25. Connect the brake booster vacuum hose.

26. Connect the ECM electrical connectors.

27. Install the intake air duct.

28. Install the charge air cooler inlet pipe.

Torque: 10 Nm

29. Install the front subframe.

Refer to: [Front Subframe](#) (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).

30. Install the lower engine stabilizer bar.

Refer to: [Engine Lower Support Insulator](#) (303-01A Engine - I6 3.2L Petrol, Removal and Installation).

31. Install the catalytic converter.

Refer to: [Catalytic Converter - Vehicles Without: Diesel Particulate Filter \(DPF\)](#) (309-00B Exhaust System - TD4 2.2L Diesel, Removal and Installation).

32. Refill and bleed the cooling system.

Refer to: [Cooling System Draining, Filling and Bleeding](#) (303-03B Engine Cooling - TD4 2.2L Diesel, General Procedures).

33. Install the air cleaner assembly.

Refer to: [Air Cleaner](#) (303-12A Intake Air Distribution and Filtering - I6 3.2L Petrol, Removal and Installation).

34. Install the battery tray.

Refer to: [Battery Tray](#) (414-01 Battery, Mounting and Cables, Removal and Installation).

35. Install the plenum chamber access panel.

Refer to: [Plenum Chamber](#) (412-01 Climate Control, Removal and Installation).

36. Install the engine cover.

Refer to: [Engine Cover - TD4 2.2L Diesel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

37. Carry out the low-pressure fuel system bleeding.

Refer to: [Fuel System Bleeding - TD4 2.2L Diesel](#) (310-00 Fuel System - General Information, General Procedures).

38. Bleed the clutch system.

Refer to: [Clutch System Bleeding](#) (308-00 Manual Transmission/Transaxle and Clutch - General Information, General Procedures).

39. Connect the battery ground cable and install the cover.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

40. Recharge the A/C system.

Refer to: [Air Conditioning \(A/C\) System Recovery, Evacuation and Charging](#) (412-00 Climate Control System - General Information, General Procedures).

41. Refill and bleed the power steering.

Refer to: [Power Steering System Bleeding](#) (211-00 Steering System - General Information, General Procedures).

42. Carry out the final halfshaft and suspension tightening with the vehicle on its wheels.