

Document Title: <b>Engine, description</b>	Function Group: <b>200</b>	Information Type: <b>Service Information</b>	Date: <b>2015/3/6 0</b>
Profile: <b>EXC, EC140C LM [GB]</b>			

## Engine, description

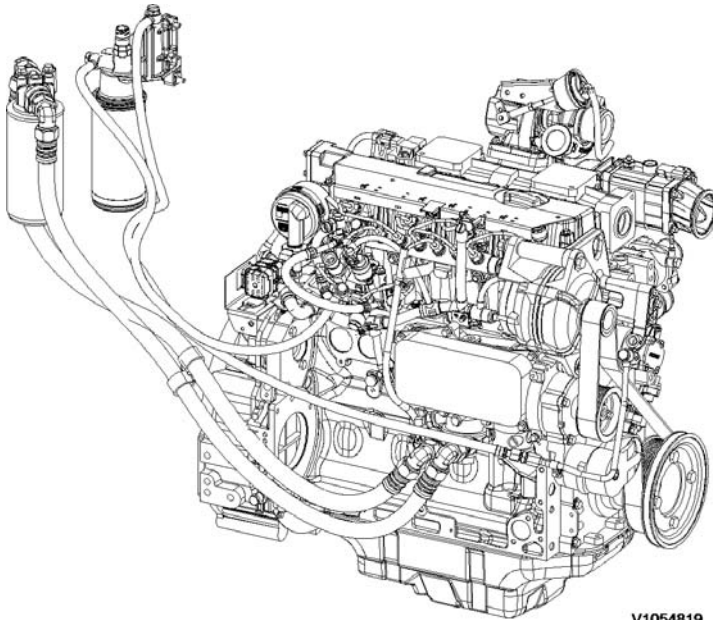
### D4E - tier 3 compliant

The D4E configuration is a four stroke, straight four cylinder, turbocharged, direct injected diesel engine with charge air cooling and wet, replaceable cylinder liners.

The D4E engine uses a Common Rail Fuel System controlled by the engine electronic control (E-ECU) software.

Mechanically controlled IEGR (Internal Exhaust Gas Recirculation) reduces NO<sub>x</sub> formation and lowers emissions without the need for exhaust after treatment. Volvo's latest engine management system, E-ECU is used to control all engine electronic functions.

The cylinders are numbered consecutively beginning at the flywheel end. Engine rotational direction is counterclockwise as seen from the flywheel end.



V1054819

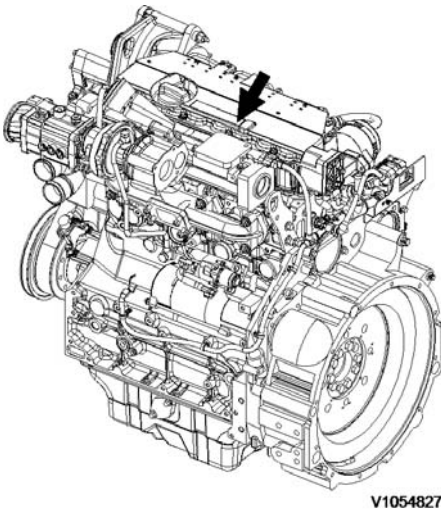
**Figure 1**  
**Engine, D4E**

Document Title: <b>Engine, identification</b>	Function Group: <b>200</b>	Information Type: <b>Service Information</b>	Date: <b>2015/3/6 0</b>
Profile: <b>EXC, EC140C LM [GB]</b>			

## Engine, identification

### Identification plate

The engine model, serial number and performance data are stamped on an identification plate which is attached on the cylinder head cover. The engine model designation and serial number must be indicated when ordering spare parts.



**Figure 1**  
**Engine identification, D4E**

Document Title: <b>Engine, tightening torques</b>	Function Group: <b>200</b>	Information Type: <b>Service Information</b>	Date: <b>2015/3/6 0</b>
Profile: <b>EXC, EC140C LM [GB]</b>			

## Engine, tightening torques

### NOTICE

Regarding bolted joints which are not listed here, see "Volvo standard tightening torques"

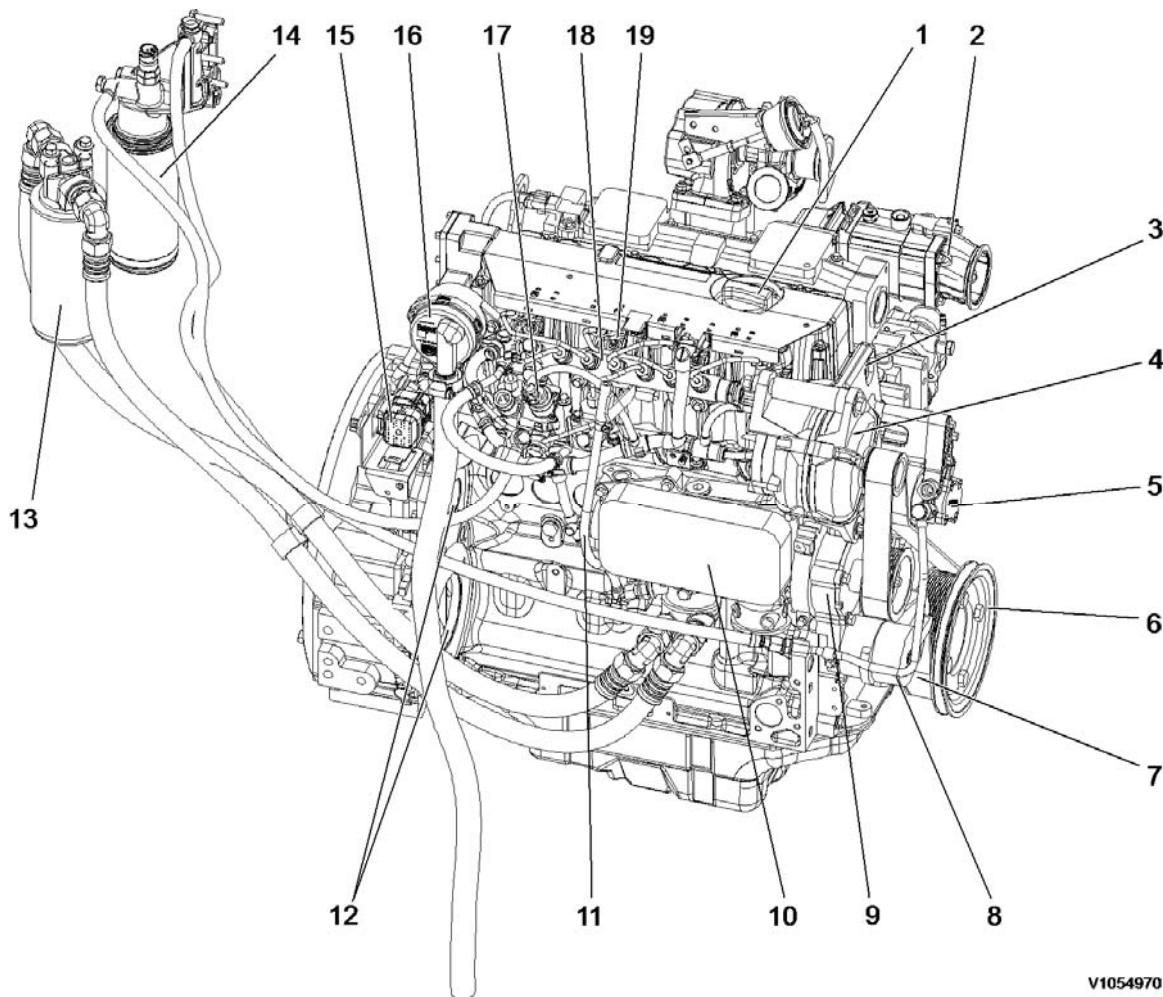
Engine, tightening torque	
Rocker arm bracket on cylinder head	30 Nm (22.2 lbf ft)
Cylinder head cover (M6) on cylinder head	13 Nm (9.6 lbf ft)
Exhaust return module on cylinder head	Step 1: 10 Nm (7.4 lbf ft) Step 2: 30 Nm (22.2 lbf ft)
Lock nut, valve adjusting screw	20 ±2 Nm (14.8 ±1.5 lbf ft)
Locking screw on cylinder head	34 Nm (25.2 lbf ft)
Solenoid valve on cylinder head	24 Nm (17.8 lbf ft)
Front cover on crankcase	Step 1: 3 Nm (2.2 lbf ft) Step 2: 21 Nm (15.5 lbf ft)
Drain plug on oil pan, M18	55 Nm (40.7 lbf ft)
Crankcase ventilation on cylinder head	21 Nm (15.5 lbf ft)
Return line to return stop valve	30 Nm (22.2 lbf ft)
Return stop valve to crankcase	80 Nm (59.2 lbf ft)
Impulse transmitter (crankshaft) on holder on front cover	9 Nm (6.7 lbf ft)
Impulse transmitter (camshaft) on gearcase	9 Nm (6.7 lbf ft)
Turbocharger on exhaust manifold	42 Nm (31.1 lbf ft)
Clamping shoe injector on cylinder head	16 Nm (11.8 lbf ft)
Injection lines on rail and injector, high pressure line on high-pressure pump	25 Nm (18.5 lbf ft)
Fuel supply pump on holder	22 Nm (16.3 lbf ft)
Holder fuel supply pump on holder	30 Nm (22.2 lbf ft)
V-belt pulley on fuel supply pump	27 Nm (20.0 lbf ft)
High pressure pump on crankcase, M10	Step 1: 10 Nm (7.4 lbf ft) Step 2: 50 Nm (37.0 lbf ft)
Fuel control valve	30 Nm (22.2 lbf ft)
Fuel pipe on high pressure pump	29 Nm (21.5 lbf ft)
Fuel pipe on control block	39 Nm (28.9 lbf ft)
Rail on cylinder head	30 Nm (22.2 lbf ft)
Pressure relief valve on rail	100 Nm (74.0 lbf ft)
Rail pressure sensor on rail	70 Nm (51.8 lbf ft)
Pipe clips, fuel line fastening	30 Nm (22.2 lbf ft)
Fuel line on control block, fuel filter console and rail	39 Nm (28.9 lbf ft)
Fuel pipe (return) on control block	49 Nm (36.3 lbf ft)
Fuel pipe (return) on cylinder head	29 Nm (21.5 lbf ft)
Fuel line on fuel filter8	39 Nm (28.9 lbf ft)
Fuel filter console/radiator tank on crankcase	30 Nm (22.2 lbf ft)

Fuel pressure sensor on fuel filter console	30 Nm (22.2 lbf ft)
Cover plate on cylinder cover, M6	30 Nm (22.2 lbf ft)

Document Title: <b>Component locations</b>	Function Group: <b>200</b>	Information Type: <b>Service Information</b>	Date: <b>2015/3/6 0</b>
Profile: <b>EXC, EC140C LM [GB]</b>			

## Component locations

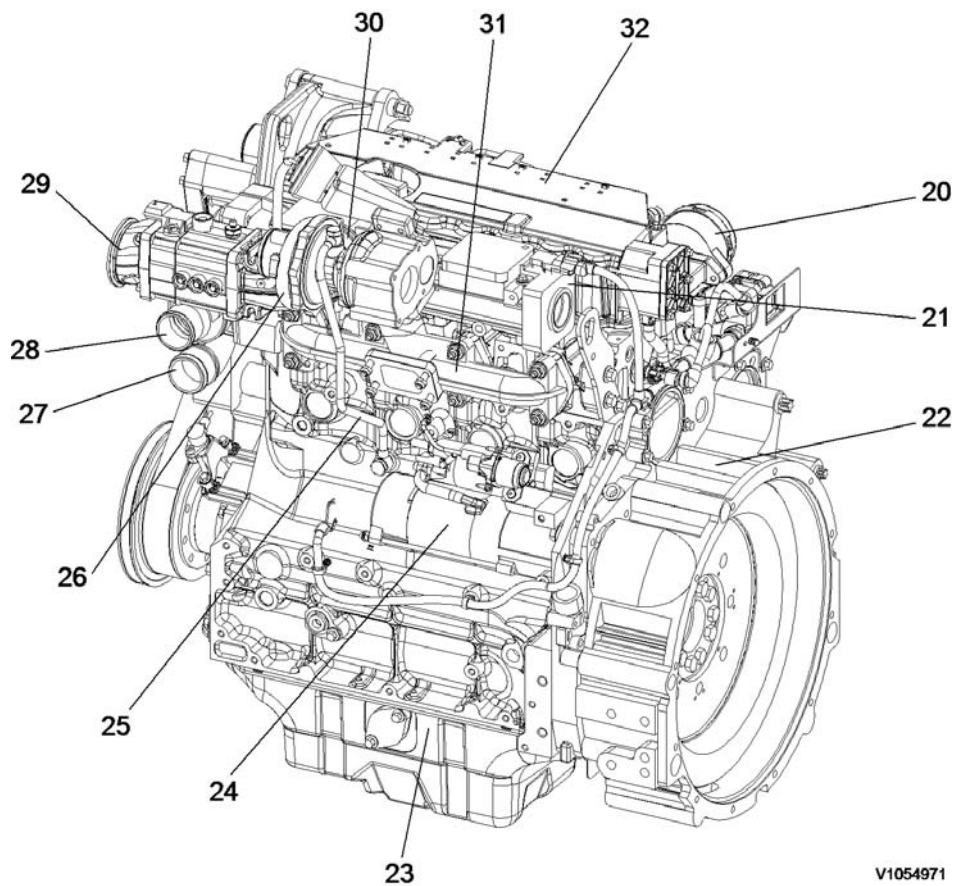
Component position, engine D4E. The following figures show the position of a number of components on engine D4E.



V1054970

**Figure 1**  
**Component locations, front side**

1	Engine oil filler	11	Oil dipstick
2	Air inlet	12	Power take off
3	Transport eye	13	Engine oil filter
4	Alternator	14	Fuel filter
5	Fuel feed pump	15	Connection to E-ECU
6	V-rib belt drive on crankshaft	16	Crankcase bleeding valve
7	V-rib belt	17	High pressure fuel pump
8	Automatic belt tensioner	18	Common rail
9	Coolant pump	19	Injector
10	Engine oil cooler		



V1054971

**Figure 2**  
**Component locations, flywheel side**

20	Crankcase bleeding valve	27	Coolant inlet
21	Charge air manifold	28	Coolant outlet
22	Flywheel housing	29	Air inlet (from charge air cooler)
23	Oil pan	30	Air outlet (to charge air cooler)
24	Start motor	31	Exhaust manifold
25	Oil return line from turbocharger	32	Cylinder rocker arm cover
26	Turbocharger		

Document Title: <b>Valves, adjusting</b>	Function Group: <b>214</b>	Information Type: <b>Service Information</b>	Date: <b>2015/3/6 0</b>
Profile: <b>EXC, EC140C LM [GB]</b>			

## Valves, adjusting

Op nbr 214-012

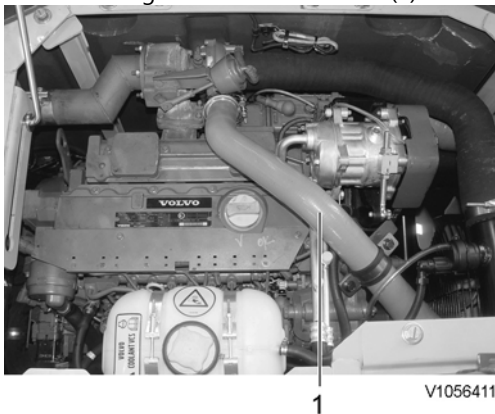
[9998681 Rotation tool](#)

[885812 Timing tool](#)

### **WARNING**

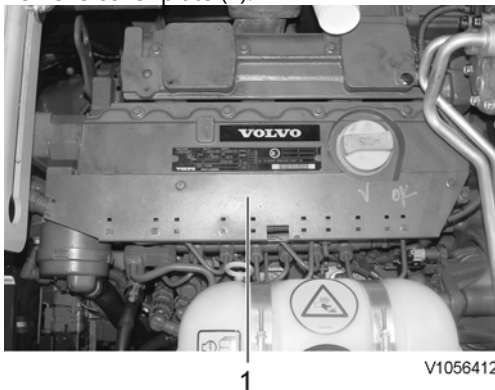
**Risk of burns - stop the diesel engine and allow it to cool down before starting any work.**

1. Place the machine in service position B. See [091 Service positions](#)
2. Open the engine hood.
3. Remove charge air cooler inlet hose (1).



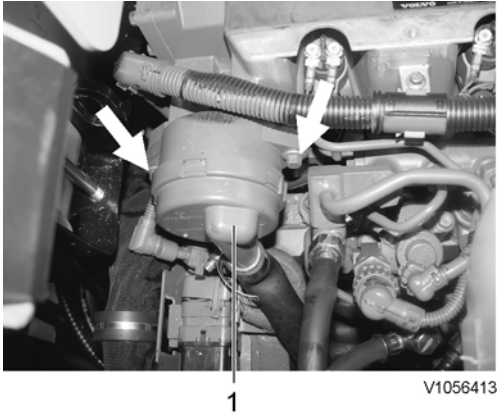
**Figure 1**

4. Remove cover plate (1).



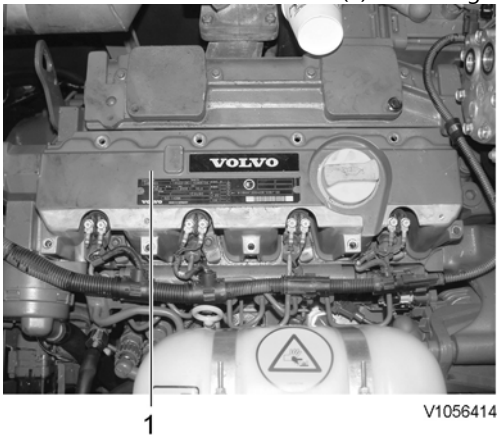
**Figure 2**

5. Remove screws (arrows) and remove crankcase ventilation duct (1).



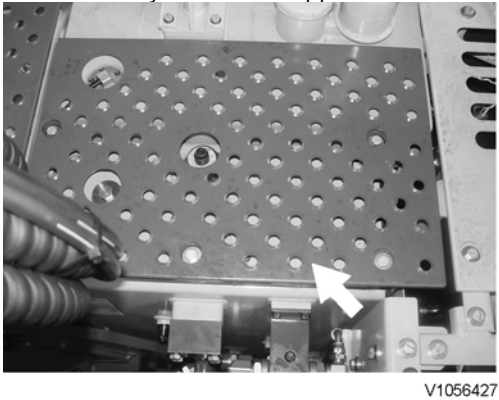
**Figure 3**

6. Remove rocker arm valve cover (1) with the gasket.



**Figure 4**

7. Remove the hydraulic tank upper cover.



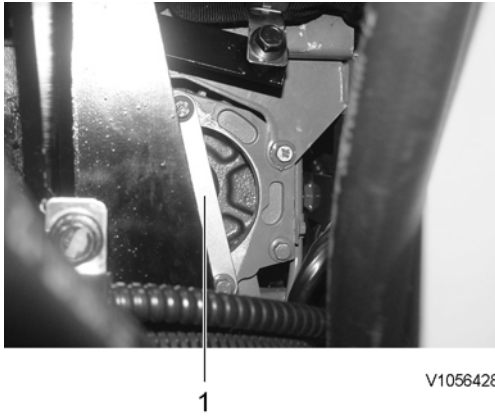
**Figure 5**

8. Remove the timing gear cover and install turning tool (1).

**NOTE!**

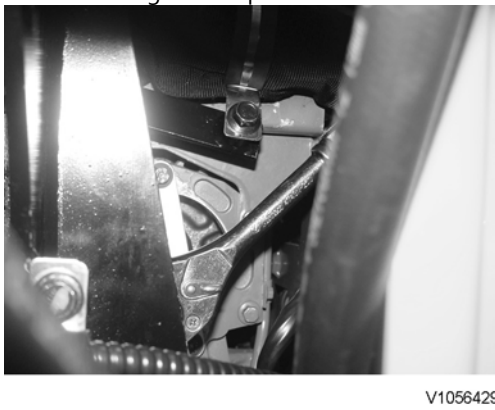
The teeth of the turning tool must mesh fully with the teeth of the camshaft gear.





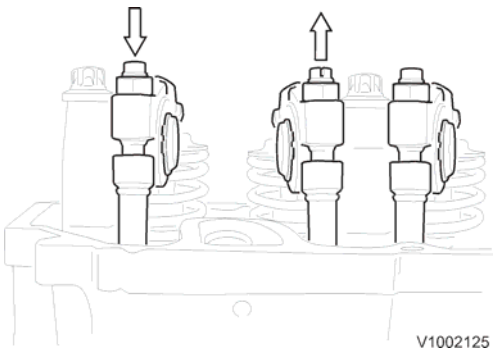
**Figure 6**

9. Rotate the engine to a position where the valves on cylinder 1 overlap. Mark the position on the vibration damper.

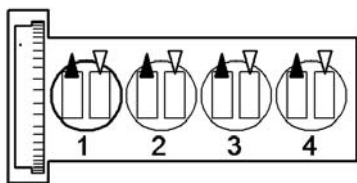


**Figure 7**

Overlapping means that the exhaust valve is about to open and the inlet valve is about to close. It should not be possible to rotate any push rods by hand for the cylinder in question in this position.



**Figure 8**  
**Overlapping**

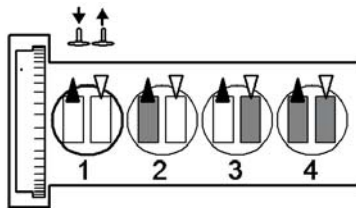


**Figure 9**  
**Cylinder orientation**

- White arrows = inlet valves
- Black arrows = exhaust valves

10. Adjust the valve clearance for each cylinder according to **the grey markings** in the figure. Procedure for adjusting:

1. Loosen the adjusting screw's lock bolt on the rocker arm.
2. Install the protractor on the adjusting screw.
3. Turn the adjusting screw until zero clearance is obtained between rocker arm and valve. Reset the protractor to zero.
4. Turn the adjusting screw according to [214 Valve system, specification](#).
5. Hold the adjusting screw and tighten the lock nut at the same time. Tightening torque: see [200 Engine, tightening torques](#).



V1055173

**Figure 10**

**Grey-marked valves can be adjusted when valves for cylinder 1 overlap.**

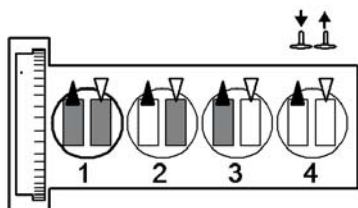


V1055178

**Figure 11**

1. 885812 Timing tool
2. Adjusting screw

11. Rotate the crankshaft another full turn until the valves for cylinder 6 overlap. Adjust the valve clearance for each cylinder according to **the grey markings** in the figure.



V1055174

**Figure 12**

**Grey-marked valves can be adjusted when valves for cylinder 6 overlap.**

12. For assembly, reverse disassembly procedure.

**NOTE!**

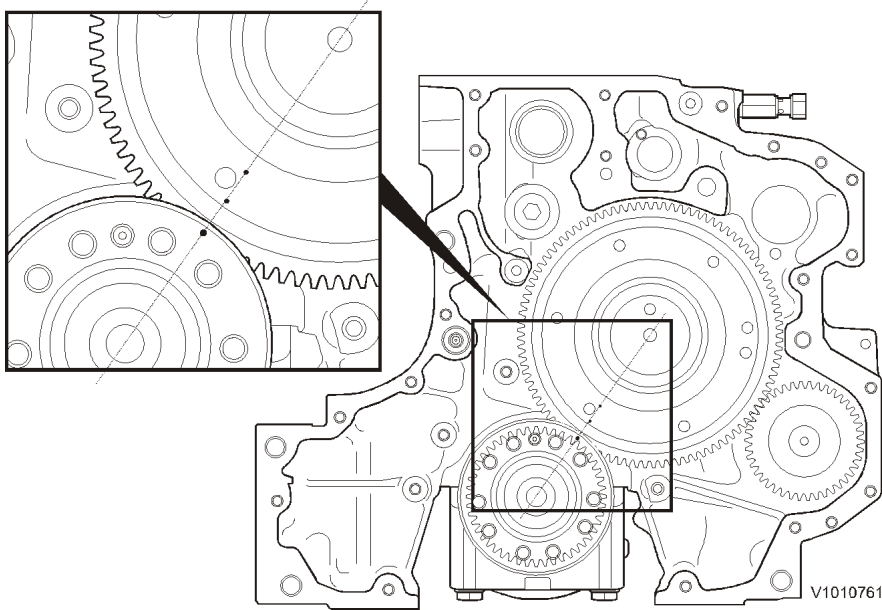
Do not reuse the O-rings and gasket.

13. After the completion of the work, start the engine and check for leaks and operating condition.

Document Title: <b>Engine timing gear, description</b>	Function Group: <b>215</b>	Information Type: <b>Service Information</b>	Date: <b>2015/3/6 0</b>
Profile: <b>EXC, EC140C LM [GB]</b>			

## Engine timing gear, description

On the engines, the timing gears are located at the flywheel end for the camshaft and power take-off. Stamped markings on the crankshaft and camshaft gears are used to facilitate correct setting.



**Figure 1**

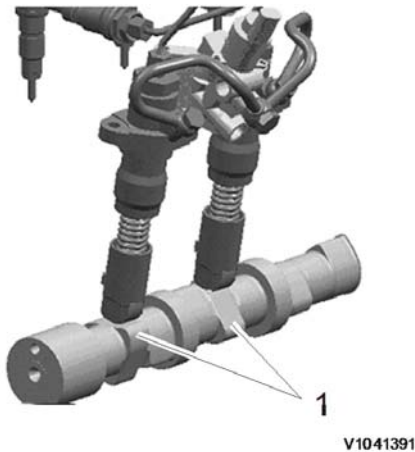
Document Title: <b>Camshaft, description</b>	Function Group: <b>215</b>	Information Type: <b>Service Information</b>	Date: <b>2015/3/6 0</b>
Profile: <b>EXC, EC140C LM [GB]</b>			

## Camshaft, description

The camshaft is carried in seven bearings. The axial stop for the camshaft is located in the timing gear casing's cover.

On the camshaft gear there are seven teeth pressed in for the cylinder position sensor.

Each bearing runs in a bearing bushing which is pressed into the cylinder block. There is an inlet cam and an exhaust cam for each cylinder. There are also two cams (1) with three cam lobes for the injection pumps.

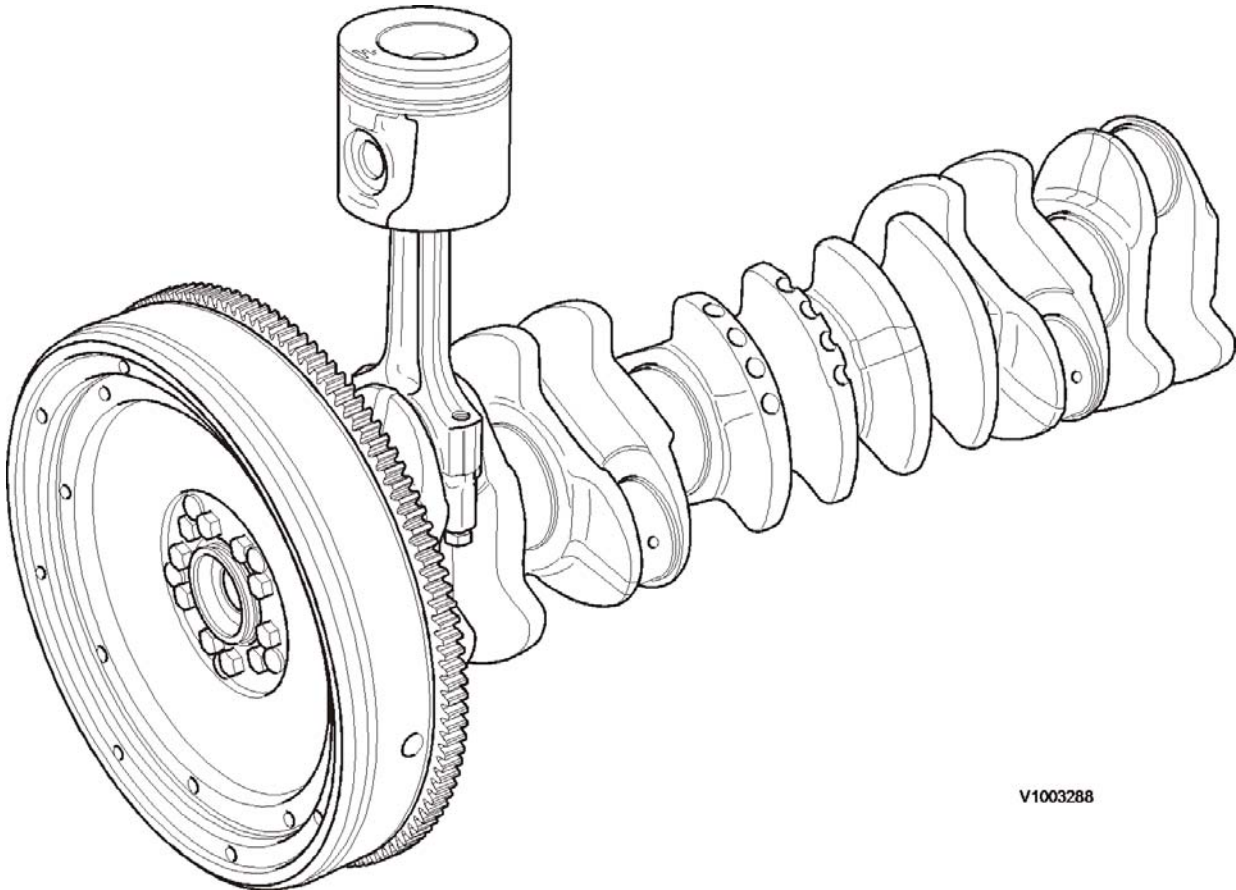


**Figure 1**

Document Title: <b>Crankshaft, description</b>	Function Group: <b>216</b>	Information Type: <b>Service Information</b>	Date: <b>2015/3/6 0</b>
Profile: <b>EXC, EC140C LM [GB]</b>			

## Crankshaft, description

The forged crankshaft is provided with integrated balancing weights. The gear that drives the engine's timing gear and the flange for the flywheel are shrink-mounted on the crankshaft.



V1003288

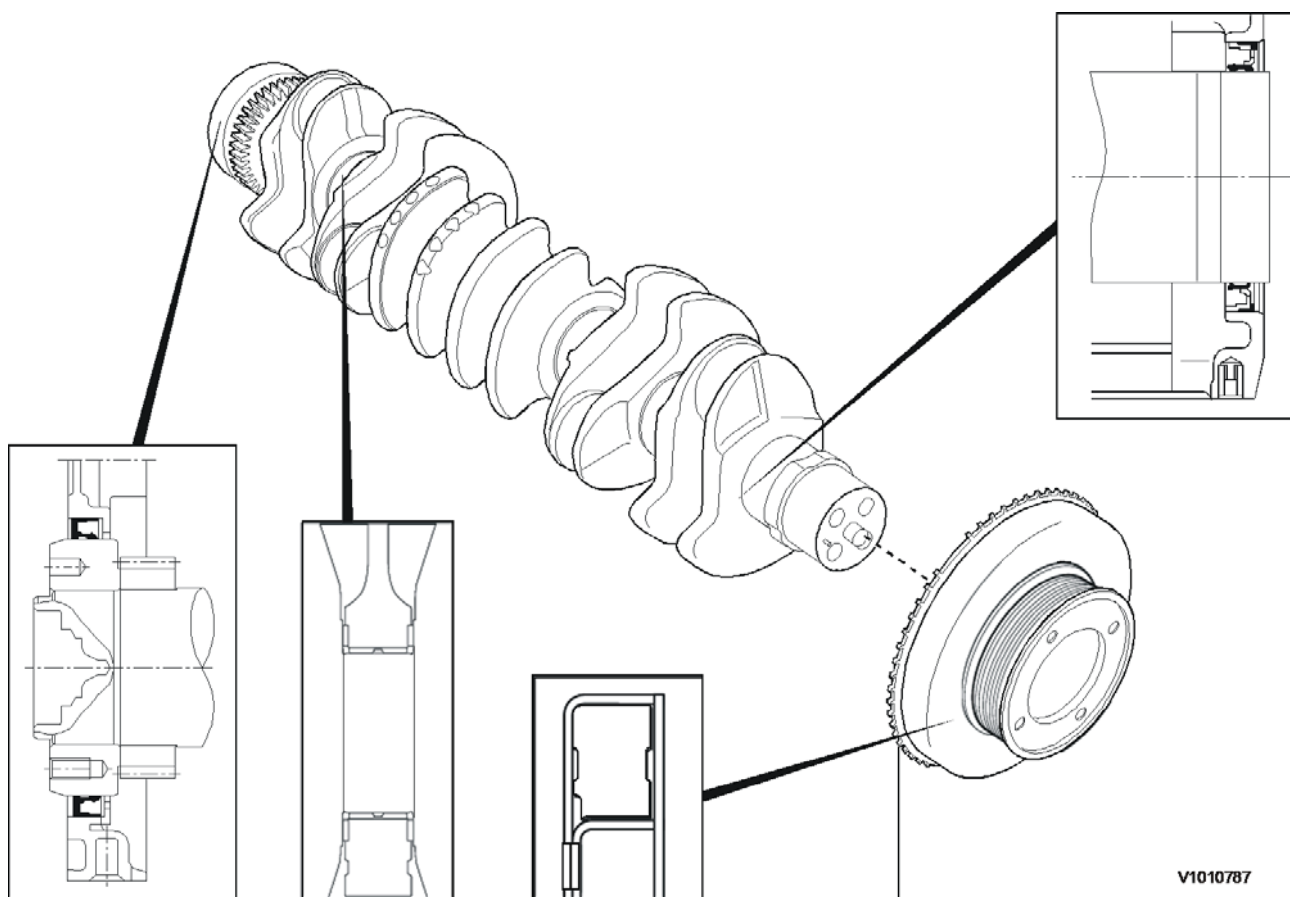
**Figure 1**

Document Title: <b>Vibration description</b>	damper,	Function Group: <b>216</b>	Information Type: <b>Service Information</b>	Date: <b>2015/3/6 0</b>
Profile: <b>EXC, EC140C LM [GB]</b>				

## Vibration damper, description

The engines are standard-equipped with a vibration damper.

The vibration damper is hydraulic and has a steel ring damper body. The damper's steel ring is not mechanically connected to the damper's housing and thus rotates freely. The space between the steel ring and the housing is filled with viscous oil. When the shaft rotates, the force pulses are transmitted from the pistons and converted to vibrations (oscillations) in the crankshaft. The viscous oil achieves an equalization of the crankshaft's pulsing rotation. The uniform rotation of the steel ring contributes to damping the vibrations.



V1010787

**Figure 1**  
**Principle illustration**

Document Title: <b>Connecting rod, description</b>	Function Group: <b>rod, 216</b>	Information Type: <b>Service Information</b>	Date: <b>2015/3/6 0</b>
Profile: <b>EXC, EC140C LM [GB]</b>			

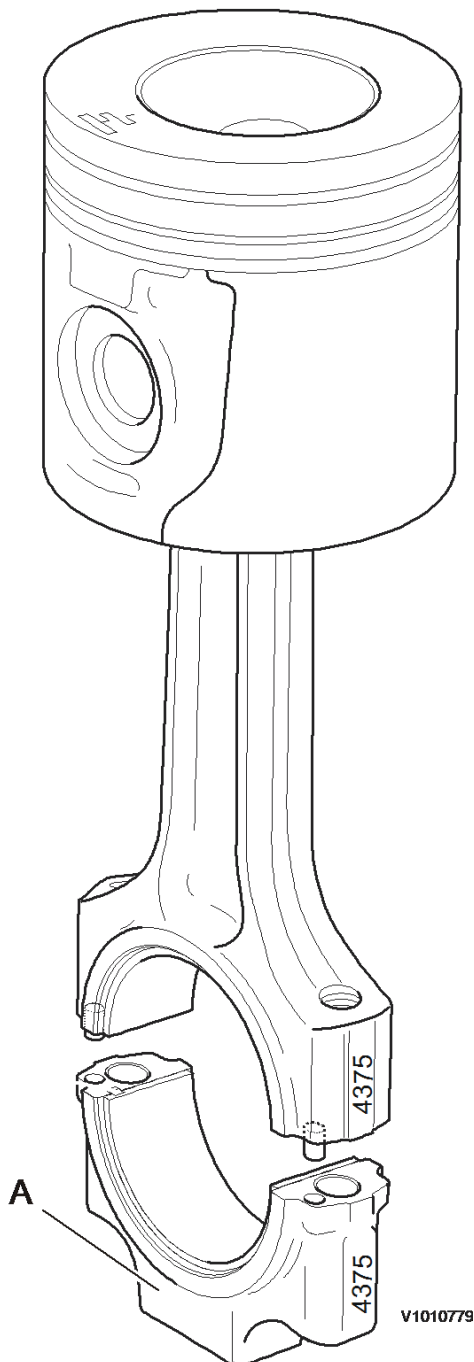
## Connecting rod, description

The connecting rod, made of forged steel, is provided with a balancing weight (A) at the crankshaft bearing (big-end) to compensate for manufacturing tolerances with regards to weight and the position of the centre of gravity.

The number markings at the crankshaft (big-end) bearing end and on the crankshaft bearing cap must face in the same direction and must have the same number.

Guide lugs in the upper and lower bearing shells prevent rotation in the bearing position.

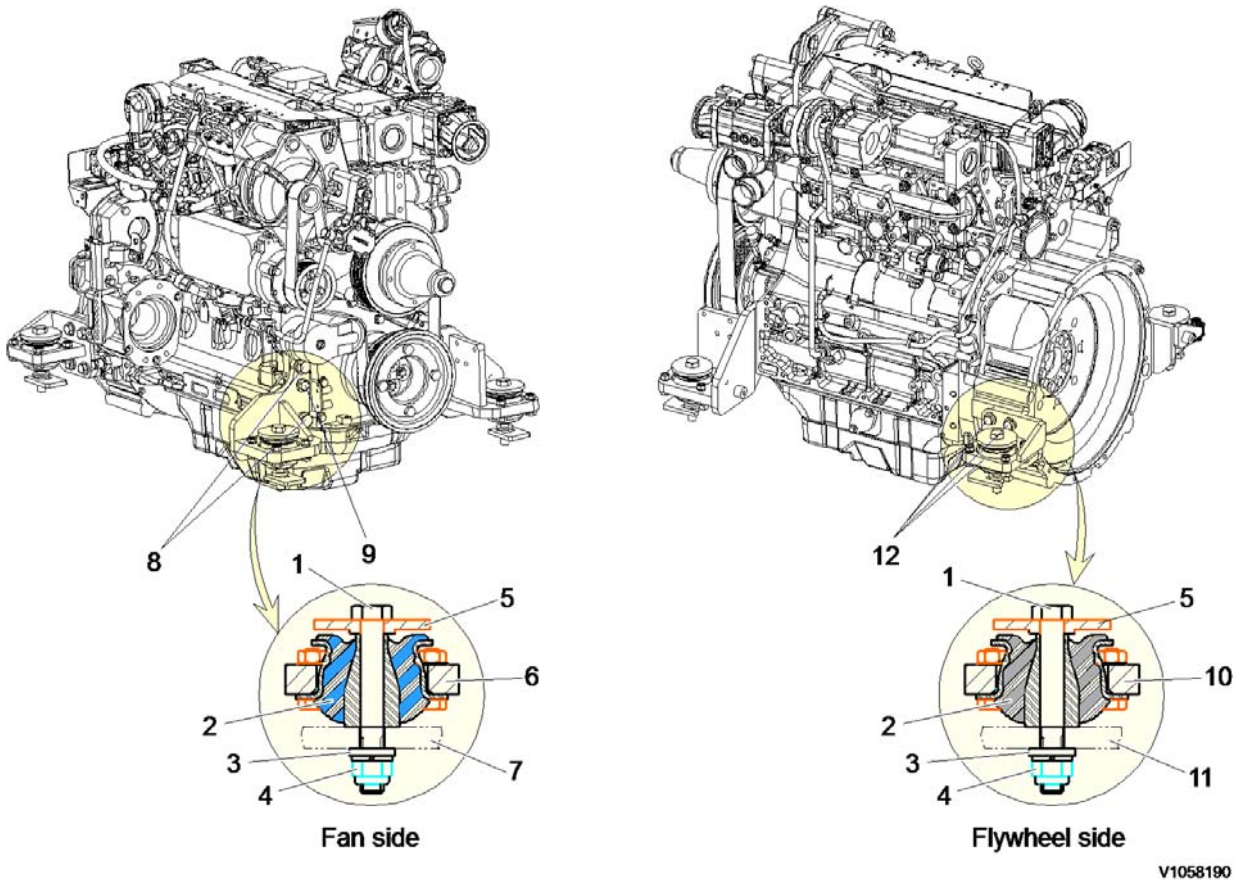
The piston must be fitted so that the flywheel symbol on the piston top faces the flywheel.





Document Title: <b>Engine mounting</b>	Function Group: <b>218</b>	Information Type: <b>Service Information</b>	Date: <b>2015/3/6 0</b>
Profile: <b>EXC, EC140C LM [GB]</b>			

## Engine mounting



**Figure 1**  
**Engine mounting**

- |                                   |                                   |
|-----------------------------------|-----------------------------------|
| 1 Screw                           | 7 Frame                           |
| 2 Cushion                         | 8 Screw                           |
| 3 Washer                          | 9 Screw                           |
| 4 Nut                             | 10 Engine mounting bracket (rear) |
| 5 Plate                           | 11 Frame                          |
| 6 Engine mounting bracket (front) | 12 Screw                          |

**NOTE!**

Check the color markings for cushion installation.

- Front (fan end): Blue color
- Rear (flywheel end): Beige color

**Screw tightening torque, unit: Nm (kgf m, lbf ft)**

No.	Tightening torque
-----	-------------------

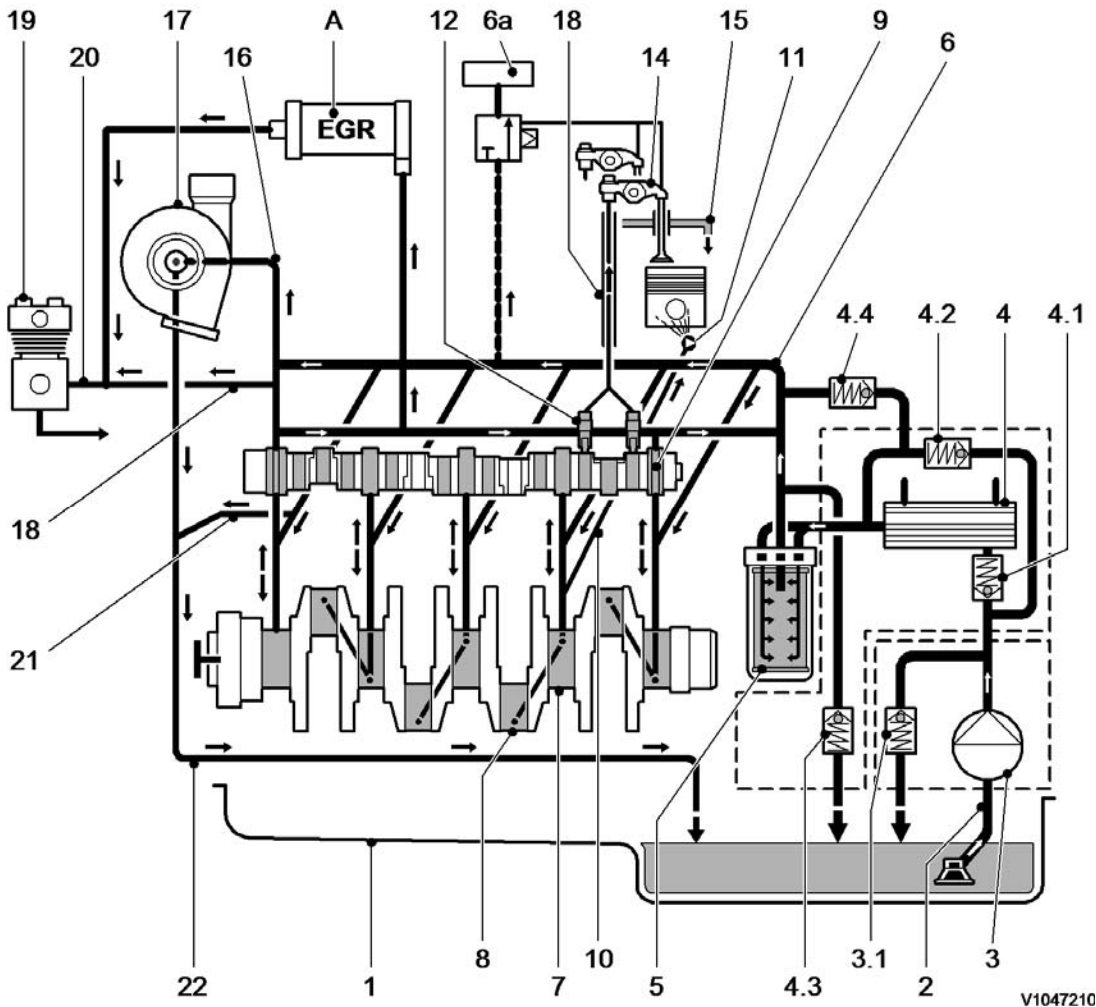
1	142 ±15 (14.5 ±1.5, 105 ±11)
8	262 ±66 (26.7 ±6.7, 193 ±48) <b>Assembling after coated with Loctite.</b>
9	110 ±12 (11.2 ±1.2, 81 ±8.5)
12	<b>Assembling after coated with Loctite.</b>

Document Title: <b>Lubrication description</b>	system,	Function Group: <b>220</b>	Information Type: <b>Service Information</b>	Date: <b>2015/3/6 0</b>
Profile: <b>EXC, EC140C LM [GB]</b>				

## Lubrication system, description

Engine lubricating oil is supplied to the contact faces of rotating components such as turbocharger, crankshaft, camshaft, piston, inlet/exhaust valve, rocker arm and timing gear by means of forced lubrication from the oil pump.

### Lubrication oil flow diagram



V1047210

**Figure 1**  
**Lubrication oil flow**

1	Oil pan	9	Camshaft bearing
2	Intake pipe	10	line to injection nozzle
3	Lube oil pump	11	Injection nozzle for piston cooling
3-1	Safety valve	12	Tappet with rocker arm pulse lubrication
4	Lube oil cooler	13	Stop rod, oil supply for rocker arm lubrication
4-1	Reverse lock valve	14	Rocker arm
4-2	Bypass valve	15	Return line to oil pan

4-3	Bypass valve	16	Oil line to exhaust turbocharger
4-4	Control valve	17	Exhaust turbocharger
5	Exchangeable lube oil filter	18	Return line from hydraulic pump
6	Main oil pipe	19	Hydraulic pump
6a	Engine brake lubrication	20	Oil line to hydraulic pump
7	Crankshaft bearing	21	Return line from cylinder head
8	Con rod spring	22	Exhaust turbocharger return to crankcase

**Thank you very much  
for your reading.**

**Please click here and go  
back to the website.**

**Then, you can  
download the complete  
manual instantly.**

**No waiting.**

Document Title: <b>Lubrication system, principle of operation</b>	Function Group: <b>220</b>	Information Type: <b>Service Information</b>	Date: <b>2015/3/6 0</b>
Profile: <b>EXC, EC140C LM [GB]</b>			

## Lubrication system, principle of operation

### Lube oil ducts

The engine is provided with forced-fed circulation lubrication with lube oil cooler and lube oil filter arranged in full flow. The lube oil is supplied by the lube oil pump through the oil cooler to the oil filter. Both components are mounted to the lube oil cooler housing which is flanged to the crankcase. Downstream of the filter the lube oil flows into the main oil gallery and secondary oil gallery. From here the oil is ducted to the lubricating points.

The main oil gallery supplies:

- Crankshaft
- Camshaft
- Valve tappets
- Roller tappets

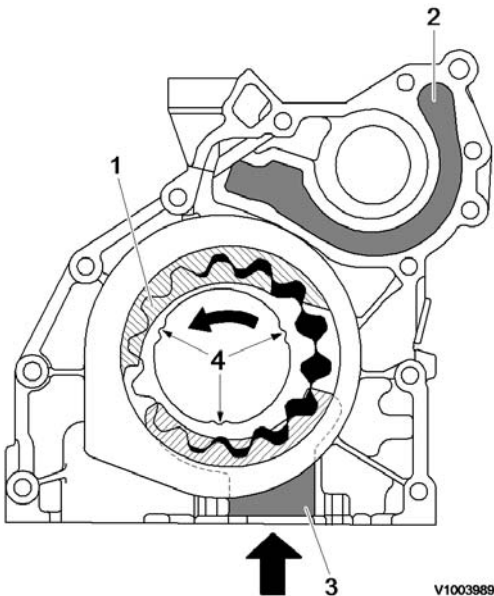
The secondary oil gallery supplies:

- Exhaust turbocharger

Lubrication of the rockers is effected via the tappets and the push rods.

### Lube oil pump

The lube oil rotary pump is installed in the front cover. The inner rotor (1) is seated on the crankshaft and is driven by same. Its driver contour (4) has no 120° partition, i.e. the rotor can only be slid onto the crankshaft in a specific position. This is attributable to deviating rotor widths.



**Figure 1**  
**Lube oil pump, sectional view**

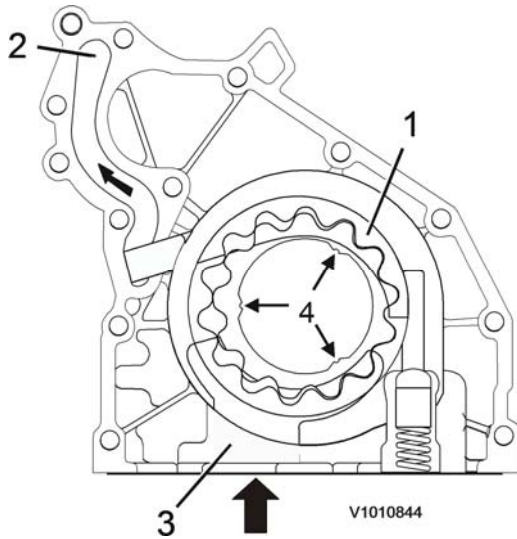
1	Inner rotor	3	Suction chamber
2	Delivery chamber towards crankcase	4	Driver contour

	Unit	Specification
Rotor width	mm (in)	12.3 (0.48)

Minimum oil pressure at 120 °C (248 °F) oil temperature, measured at oil filter bracket.

The lubrication oil pump is designed as a rotor pump and is mounted in the front cover. The inner rotor (1) is located on the crankshaft (4), by which it is driven.

Its flange profile has an irregular shape, that is, it can only be fitted on the crankshaft in a certain position.



**Figure 2**

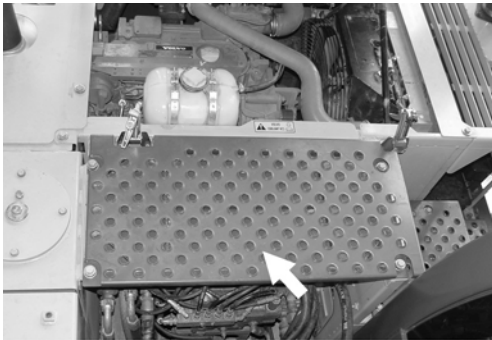
1. Rotor
2. Pressure chamber
3. Suction chamber
4. Crankshaft

Document Title: <b>Oil cooler, replacing</b>	Function Group: <b>223</b>	Information Type: <b>Service Information</b>	Date: <b>2015/3/6 0</b>
Profile: <b>EXC, EC140C LM [GB]</b>			

## Oil cooler, replacing

### Op nbr 223-006

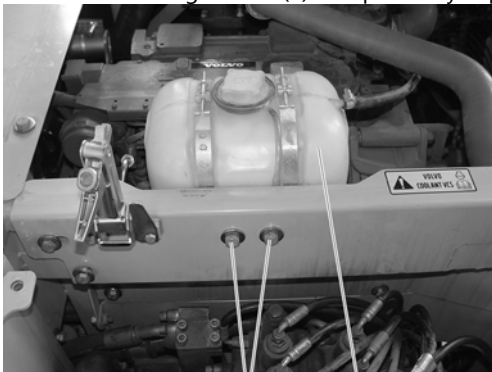
1. Place the machine in service position, see [091 Service positions](#).
2. Open the engine hood.
3. Drain the coolant from the engine, see [261 Coolant, changing](#).
4. Remove the MCV cover.



V1076671

**Figure 1**

5. Remove mounting screws (1) and put away expansion tank (2).



V1076661

**Figure 2**

6. Remove mounting screws (1) on the clamps.