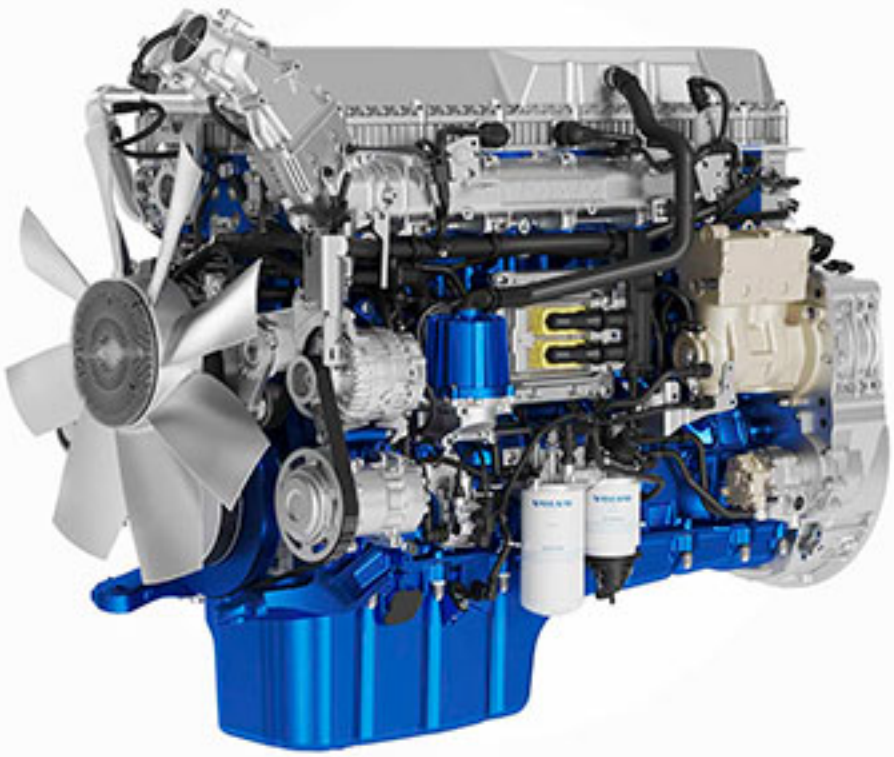
SERVICE MANUAL FOR ENGINE

VOLVO
D13F



- General information
- Engine
- Cylinder head
- Valve mechanism

MOTO RIST

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Tightening torque, cylinder head

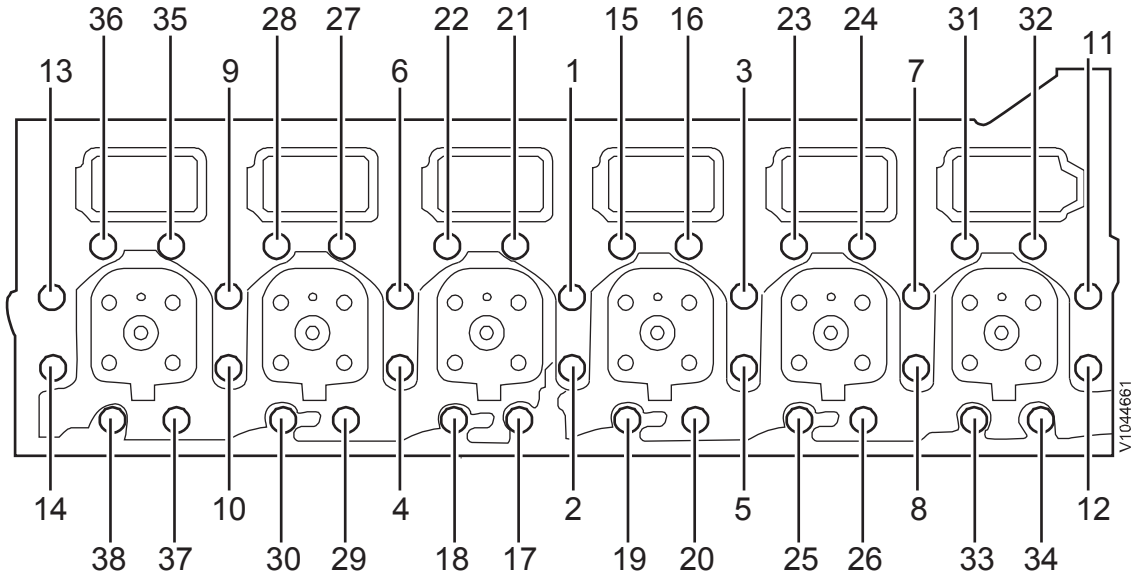

Fig.1 Cylinder head, D13

NOTE!
Tighten the bolts in the sequence shown in the figure.

Step 1	100±5**Nm**(74±3.7 lbf ft)
Step 2	120±5° **Angle-tightening**
Step 3	90±5° **Angle-tightening**

Engine, specification

General

	D13 F
Number of cylinders	6
Cylinder bore	131 mm (5.16 in)
Stroke	158 mm (6.22 in)
Displacement	12.78 litres (3.38 US gal)
Injection order	1–5–3–6–2–4
Compression ratio	18, 5:1
Low idle EXC WLO	 13.33 r/s (800 rpm) 11.67 r/s (700 rpm)
High idle EXC WLO	 28.33 r/s (1700 rpm) 31.67 r/s (1,900 rpm)
Max. full load rpm EXC WLO	 31.67 r/s (1,900 rpm) 35 r/s (2,100 rpm)
Weight, engine EXC WLO	 1,330 kg (3,042 lbs) 1,330 kg (3,042 lbs)
Total length EXC WLO	 1 585 mm (62.4 in) 1460 mm (57.5 in)

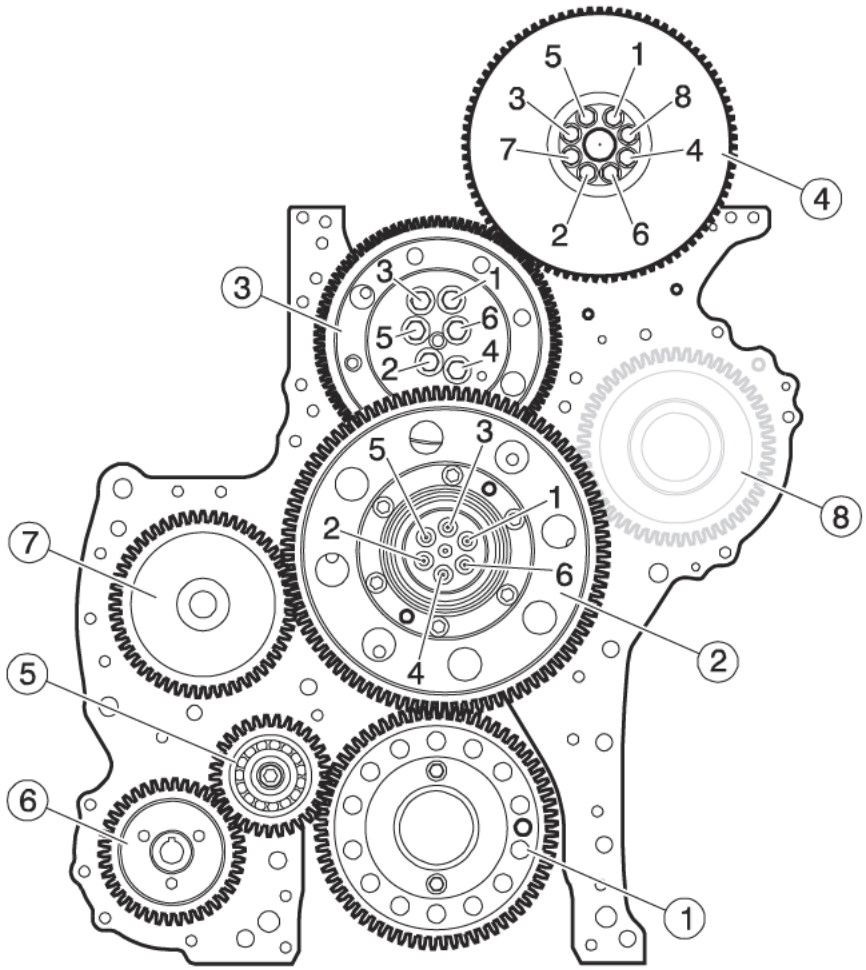

Fig.2

Gears:	Tightening torque:
1. Drive gear, crankshaft	24±4 Nm (18±3 lbf ft)
2. Transfer gear, outer gear:	
step 1:	25±3 Nm (18.4±2.2 lbf ft)
step 2:	angle-tightening 110±5°
3. Transfer gear, adjustable:	
step 1:	35±4 Nm (25.8±2.95 lbf ft)
step 2:	angle-tightening 120° ±5°
4. Gear, camshaft: Vibration damper's 8.8-bolts may not be reused.	
temporarily:	10 Nm (7.5 lbf ft)
step 1:	45±5 Nm (33±4 lbf ft)
step 2: Angle-tightening	90° ±5°
5. Transfer gear	140±10 Nm (103±7.4 lbf ft)
6. Drive gear, lubrication oil pump for power take-off and fuel feed pump	100±10 Nm (74±7.4 lbf ft)

Cylinder block, tightening torques

Engine mount incl. bracket

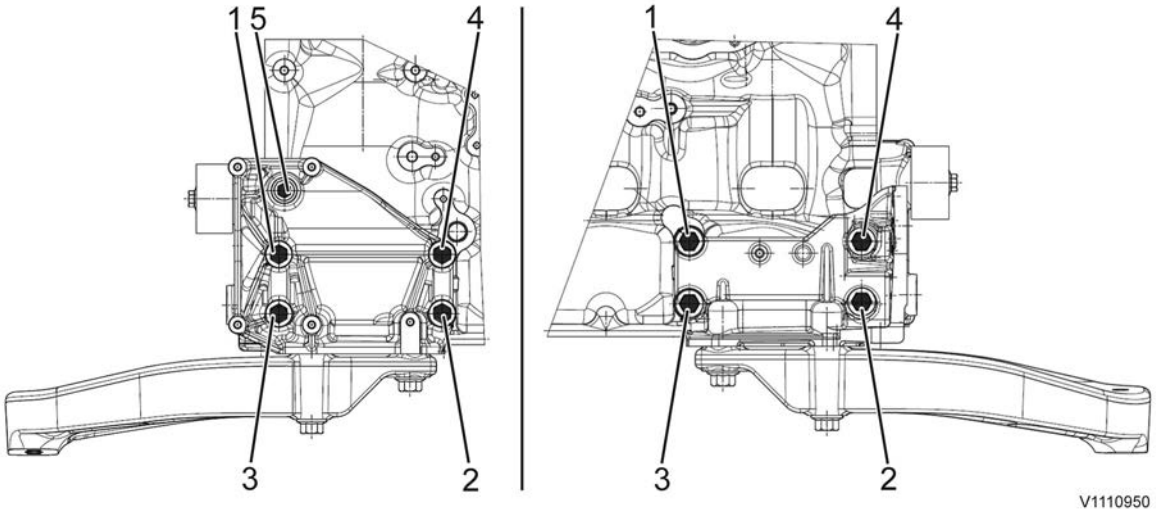

Fig.14 Front engine mount bracket

Front engine mount bracket, cylinder block:	
Step 1: Tighten bolt 1.	80 ±15 Nm (59 ±11 lbf ft)
Step 2: Tighten bolts 2 — 4.	105±15 Nm (77.4±11 lbf ft)
Step 3: Angle-tighten bolts 2 — 4 in numerical order	60 ±5°
Step 4: Tighten bolt 1	105±15 Nm (77.4±11 lbf ft)
Step 5: Angle-tighten bolt 1	60 ±5°
Step 6: Tighten bolt 5	Standard bolt tightening torque
Front engine mount to frame	140±25 Nm (103.3±18.4 lbf ft)
Rear engine mount, flywheel housing:	
EXC	262±26 Nm (193.2±19 lbf ft)

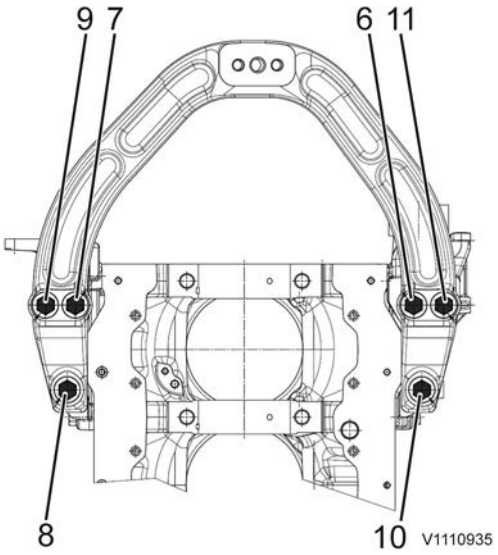

Fig.15 Front engine mount

Front engine mount to engine mount bracket	
Step 1: Tighten bolts 6 – 11	5 ±2 Nm (3.7 ±1.5 lbf ft)
Step 1: Tighten bolts 6 – 11	275 ±45 Nm (203 ±33 lbf ft)

Ladder frame

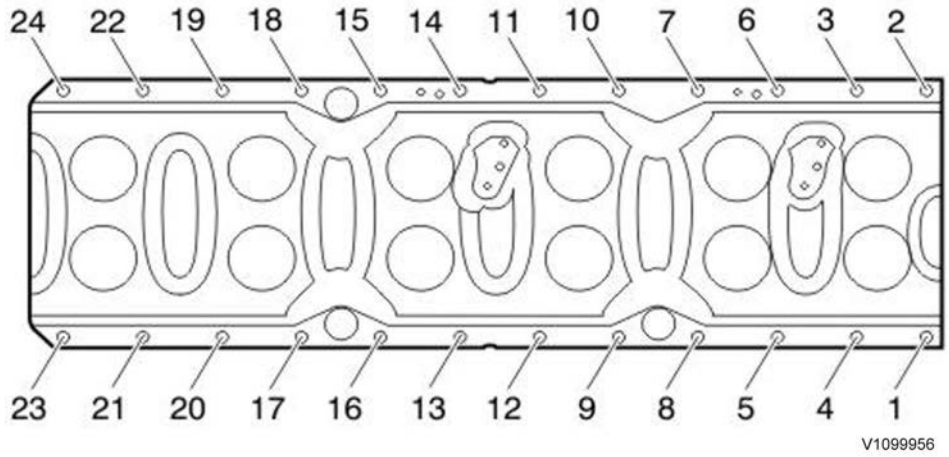

Fig.16 Ladder frame

Ladder frame	
Step 1: Tighten bolts 1 — 24 in numerical order	45±5 Nm (33.19±3.69 lbf ft)
Step 2: Tighten bolts in numerical order 1 — 24 (angle-tightening)	60 ±5°

Timing gear plate:	
M8-bolts	28±4 Nm (20.7±2.95 lbf ft)
Main bearing caps:	
Step 1 Step 2 (angle-tightening)	150±20 Nm (110.6±14.8 lbf ft) 120 ±5°
Connecting rod (big-end) caps:	
Step 1 Step 2 Step 3 (angle-tightening)	20±3 Nm (14.8±2.2 lbf ft) 60±3 Nm (44.3±2.2 lbf ft) 90 ±5°
Press tool for measuring liner height	40 Nm (29.5 ft lbf)

Inlet

NOTE!
Tighten the bolts according to the numerical order in the figure.
The bolts shall not be reused.

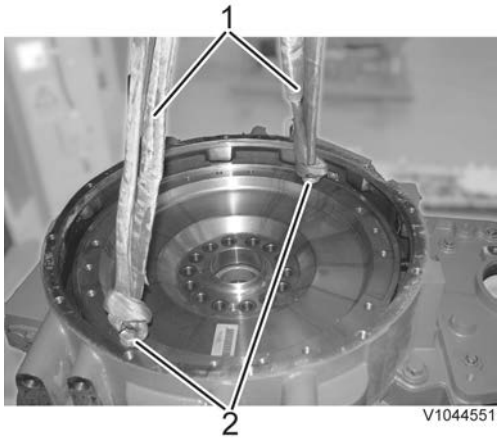

Fig.38
1 Sling 1 metre
2 M10 Lifting eye

19 Remove the flywheel.
Weight:
WLO **approx. 40 kg (88 lbs)**
EXC **approx. 75 kg (165 lbs)**

20 Install lifting eyes on the flywheel housing and secure it.

21 Loosen the bolts on the flywheel housing and then lift away the flywheel housing.
Flywheel housing, weight: **approx. 200 kg (441 lbs)**

22 Rotate the engine 180°.

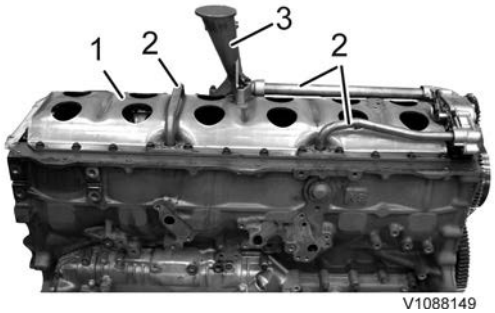

Fig.39
1 Ladder frame
2 Pipes for lubrication oil pump
3 Strainer

23 - Remove the strainer and the pipes for the lubrication oil pump.
- Remove the ladder frame.

24 Rotate back the engine 180°.

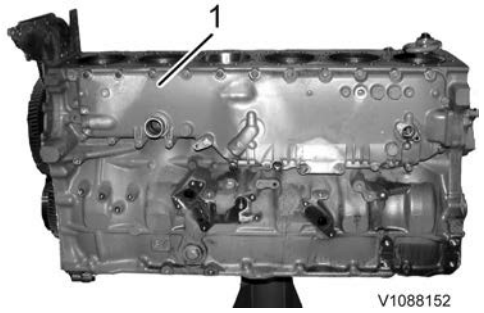

Fig.40
1 Oil cooler

25 Remove the oil cooler.

26 Rotate the engine 180°.

27 Remove the casing with the front crankshaft seal.

28 Remove the lubrication oil pump.

29 Remove the transfer gear for the fuel pump.

Fig.41

30 Loosen and remove the bolts that hold the double gear (6 pcs.). Remove the double gear.

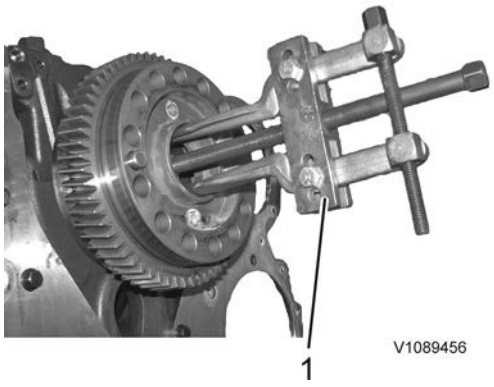

Fig.42
1 Internal puller

31 - Remove the rest of the bolts for the crankshaft gear.
- Install an internal puller as shown in the figure.
- Pull out and remove the gear.

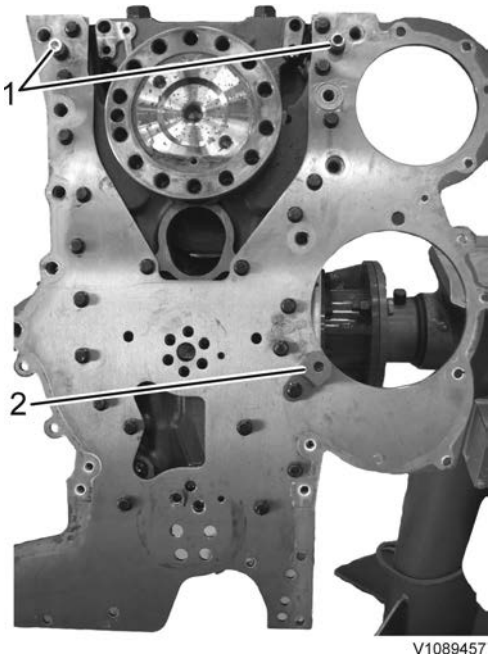

Fig.43
1 9998267 Guide.
2 Bracket

32 - Install 9998267 Guide (2 pcs.) and remove the bracket and bolts (23 pcs.) that hold the timing gear plate.
- Carefully remove the timing gear plate.

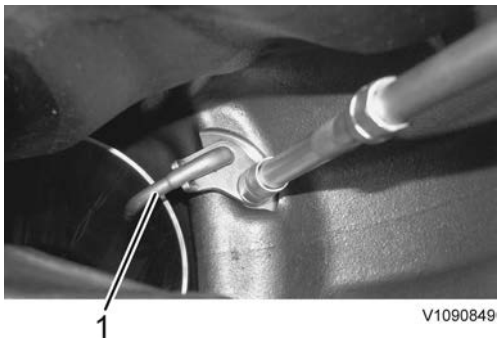

Fig.44
1 Piston cooling nozzle

33 Remove the piston cooling nozzles.

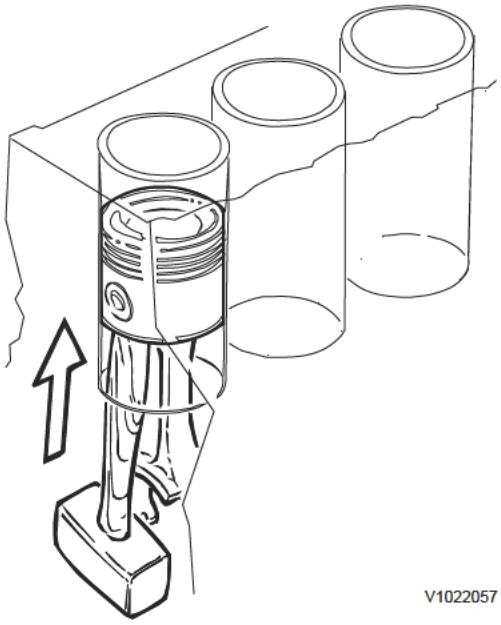

Fig.45

34 - Remove the bolts (4 pcs.), the caps, and carefully tap loose the piston and connecting rod.

NOTE!
Avoid striking on the connecting rod's mating surfaces.

- Repeat for the rest of the pistons and connecting rods.

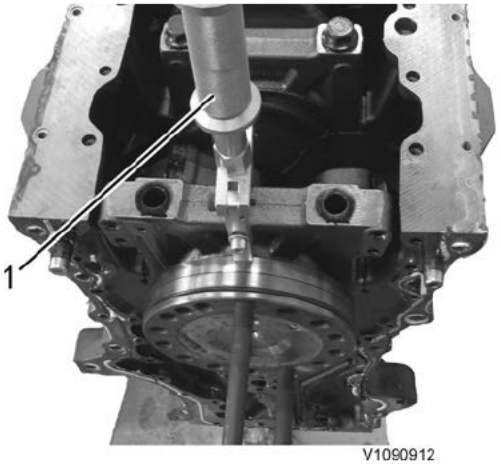

Fig.46
1 9996400 Impact puller, 9990114 Puller and 9990262 Adapter

35 - Remove the bolt and remove the main bearing cap.
- Repeat for the rest of the main bearing caps. Note position of the main bearing caps for reinstalling later on.

NOTE!
Save and keep track of the thrust bearings located on the 4th cylinder's main bearing.

Fig.47

36 Turn the crankshaft so that the 1st cylinder's and 6th cylinder's bellcranks are positioned straight up. Secure with lift slings in the lifting device and lift away the shaft. Crankshaft, weight: **approx. 125 kg (275 lbs)**.
Remove the main bearings.

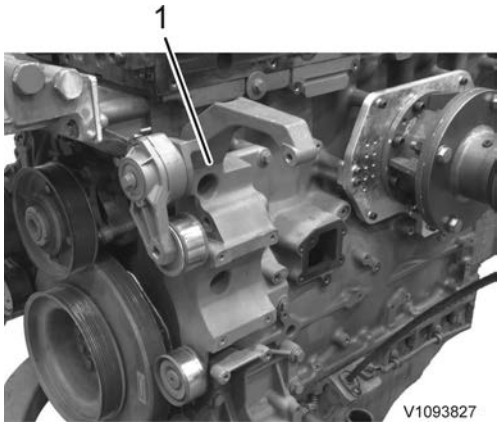

Fig.93
1 Bracket for AC-compressor and alternator

66 Install the bracket for the AC-compressor and the alternator.

67 Change seals and install the fuel pump.

Fig.94
1 Seal

68 Change seal on the inlet manifold.
Install the inlet manifold and connect to the mixing chamber.
Tightening torques, see *Cylinder block, tightening torques page 18*

69 Install the oil filler pipe and oil dipstick.

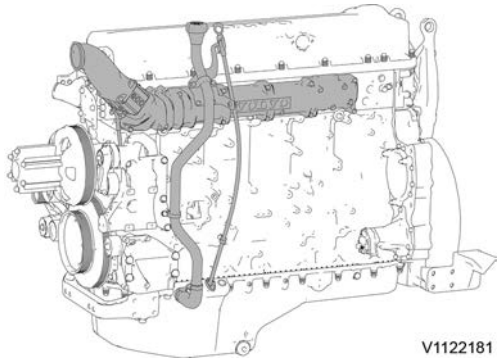

Fig.95 Inlet manifold with preheating coil, oil filler pipe, oil dipstick.

70 Remove the engine from the work stand according to *Engine, removing from work stand page 56*.

Engine, removing from work stand

Op. no. 210-082

Tools:
9986485 Support
88800345 Fixture
88800123 Fixture

Lifting eye, 2 pcs.
Sling 3 m (118 in)
Ratchet block 1,500 kg (3307 lbs)

NOTE!
Since the engine illustrations in the service publications are reused for different engine versions, some parts may vary from the version in question. However, the essential information in the illustrations is always correct.

Engine D13F, weight:
WLO **approx. 1,330 kg (3,932 lbs)**

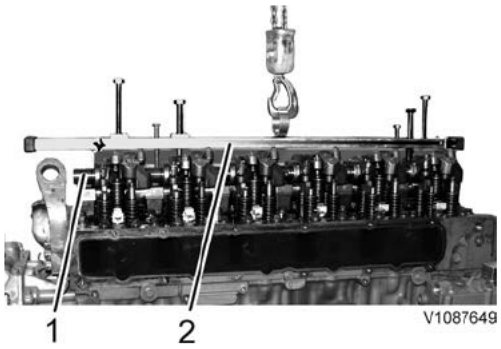

Fig.102
1 Rocker arm bridge
2 88800352 Lifting tool

3 Connect 88800352 Lifting tool and remove the rocker arm bridge.
Rocker arm bridge, weight: **approx. 48 kg (106 lbs)**.

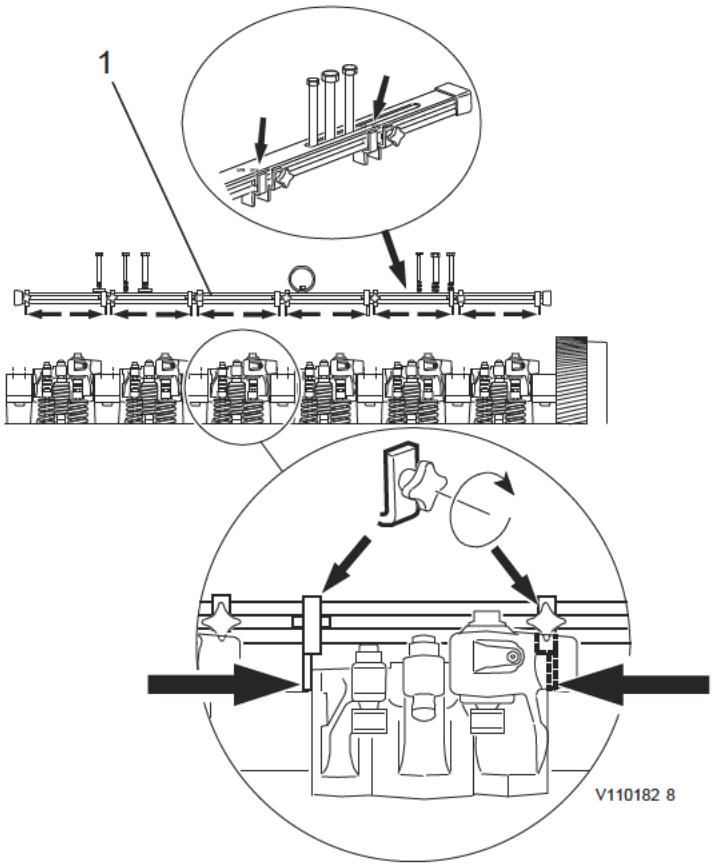

Fig.103
1. Lifting tool

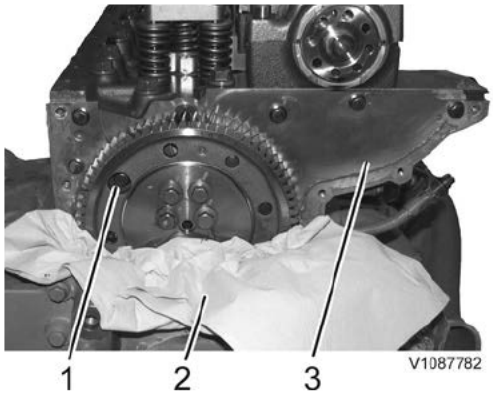

Fig.104
1 Bolt behind adjustable transfer gear
2 Paper
3 Plate

4
- Rotate the engine to reach the bolt behind the adjustable transfer gear.
- Put some paper in place to prevent dropping bolts down in the timing gear.
- Remove the bolts from the plate.
- Remove the bolts from the adjustable transfer gear.

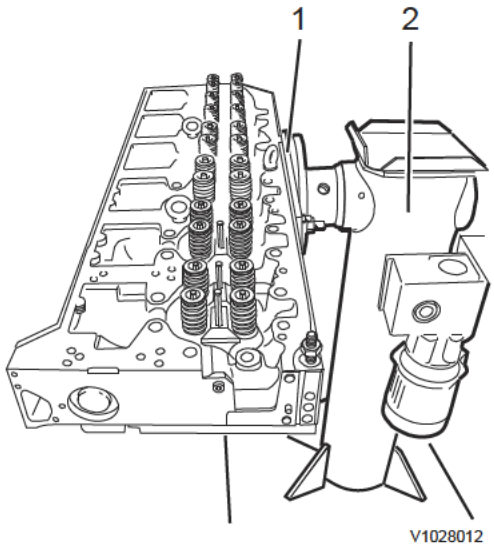

Fig.106
1 88800058 Fixture
2 9986485 Support

2 **WARNING**

Risk of crushing injuries

Lift up the cylinder head with 9996239 Lifting chain and secure it to 9986485 Support.
Cylinder head, weight **approx. 240 kg (530 lbs)**

NOTICE

It is important that the greatest cleanliness is exercised when working with the cylinder head.
Dirt particles in fuel and oil ducts may cause breakdown of the unit injectors.

3 Connect 9998264 Lifting tool to the camshaft and lift away the camshaft.
Camshaft, weight: **approx. 34 kg (75 lbs)**.

4 Remove the thermostat cover and the thermostat.

5 Remove the unit injectors.

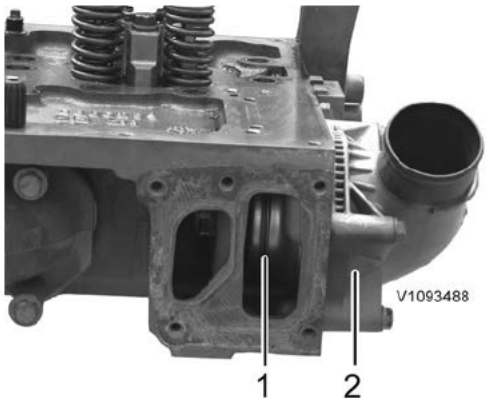

Fig.107
1 Thermostat
2 Thermostat cover

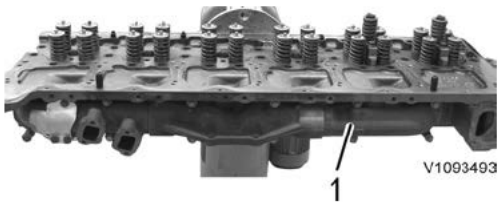

Fig.108
1 Manifold

6 Remove the manifold.
Manifold, weight: **approx. 15 kg (33 lbs)**

Valves, removing

7 Remove 9998251 Sealing plug from the cylinder head.

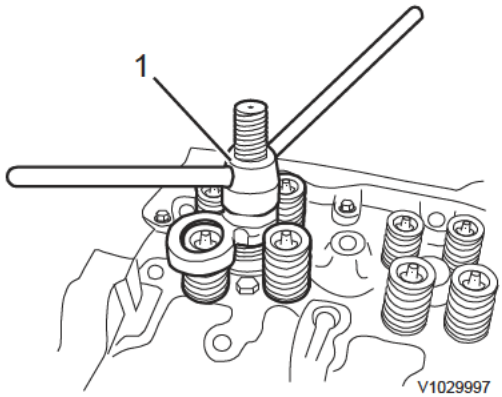

Fig.109
1 9990210 Valve spring compressor

8 Install 9990210 Valve spring compressor in the sleeve and fasten it in the holes for the unit injector's attaching bolts.

9 Press down the valve washer and remove the collets.

10 Remove the valve washer, springs, and valves.

11 Remove the rest of the valves in the same way.

NOTE!
Place the valves together with their associated springs so that they can be reinstalled in the same place in the cylinder head when assembling.

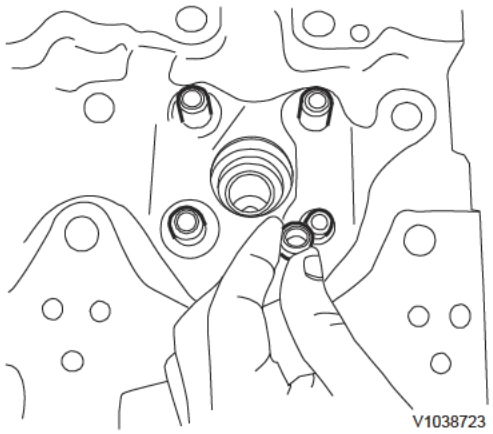

Fig.110

12 Remove the valve seals.

Sleeve for unit injector, removing

NOTE!
The injector sleeve must be free from soot.

There are two methods for removing the injector sleeve.
1. Tap out with drift
2. Pull out with 88800342 Puller and 9986173 Puller.

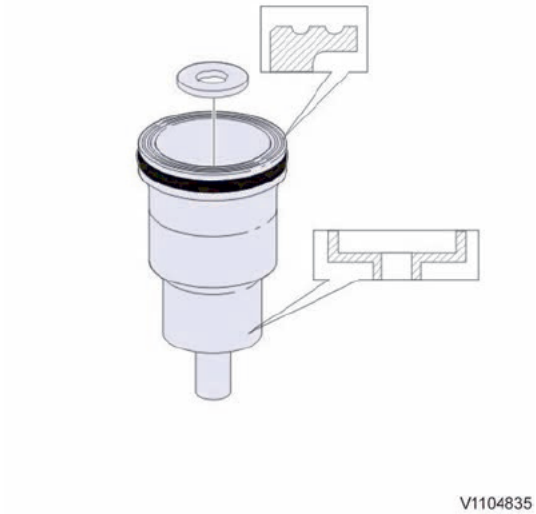

Fig.111
Sleeve for unit injector

Tap out with drift

13 Tap out the injector sleeve with a **10 mm (0.394 in) drift**.

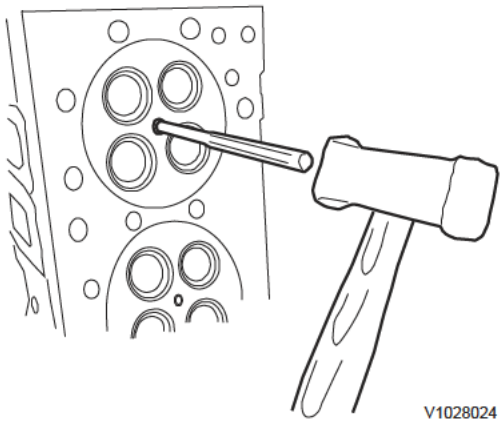

Fig.112

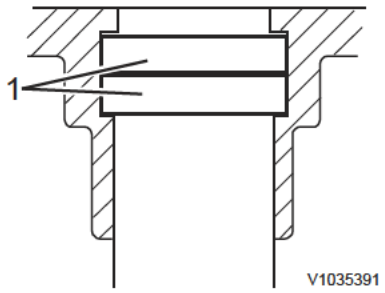

Fig.113
1 9998250 Ring

14 Install two 9998250 Ring in the cylinder head's fuel channel to protect against dirt.

Pull out with puller

15 Install 88800342 Puller and press down so that it bottoms out in the sleeve, a 'click' sound can be heard. On the tool there is a line marking at a depth of 66 mm. If the tool sinks down so deep that the line cannot be seen, it may be difficult to pull up the sleeve since it indicates that it has been deformed. Tighten down the tool. Tighten the expander by tightening the nut until it stops.

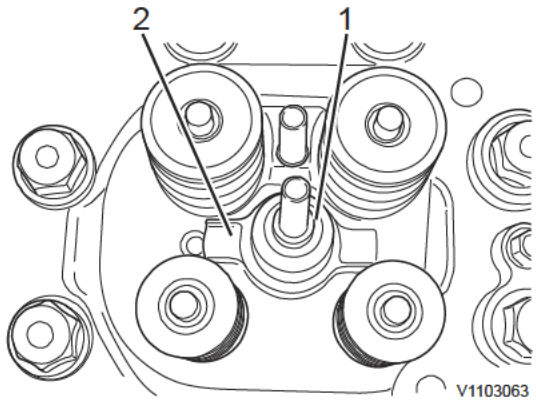

Fig.114
1 Puller, included in kit 88800342 Puller.
2 Support ring, included in kit 88800342 Puller.


V1092175

Fig.168 Centring roller

5 Press down the lock clamp and place the centring roller against the liner seat's wall, where the distance to the wall is the longest.

6 Lock the lock clamp and set the switch between position 1 and 2.


V1092150

Fig.169

7 Centre the tool by turning the crank clockwise while holding the horizontal feed ring in place.

8 The centring roller shall always have contact with the liner position's wall.
If the tool loses contact with the wall:
Turn the crank backwards (counter-clockwise) while holding the horizontal feed ring in place.

9 The tool is centred when it stops moving.

10 Then set the switch to position 1.

11 Press down the lock clamp.


V1092151

Fig.170

12 Move the cutter so that is passes over the liner shelf without touching the liner wall.