Document Title: **Engine, description**	Function Group: **200**	Information Type: **Service Information**	Date: **2014/7/25**
Profile: **EXC, EC160C L [GB]**			

Engine, description

D6E - tier 3 compliant

The D6E configuration is a four stroke, straight six cylinder, turbocharged, direct injected diesel engine with charge air cooling and wet, replaceable cylinder liners.

The D6E engine uses a Common Rail Fuel System controlled by the engine electronic control (E-ECU) software.

Electronically controlled IEGR (Internal Exhaust Gas Recirculation) reduces NO_X 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.

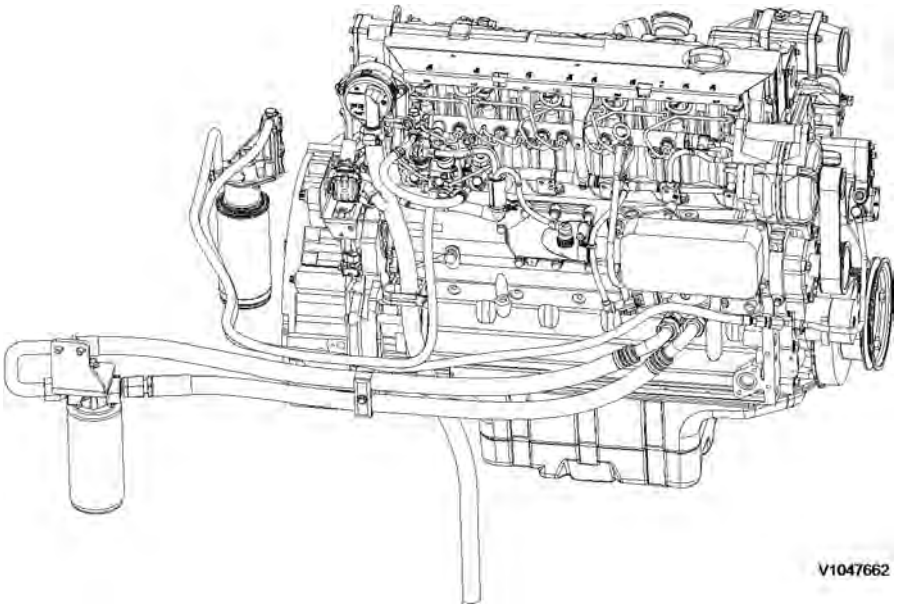

Figure 1
Engine, D6E

Document Title:	Function Group:	Information Type:	Date:
Engine, identification	**200**	**Service Information**	**2014/7/25**
Profile: **EXC, EC160C L [GB]**			

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.

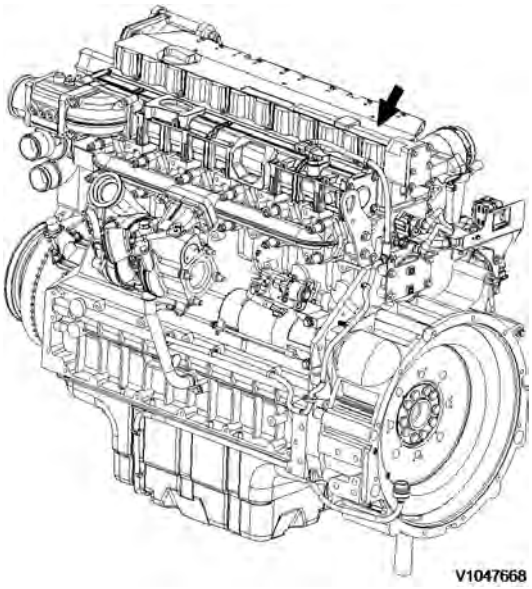

Figure 1
Engine identification, D6E

VOLVO
Construction Equipment

Service Information

Document Title: **Engine, tightening torques**	Function Group: **200**	Information Type: **Service Information**	Date: **2014/7/25**
Profile: **EXC, EC160C L [GB]**			

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)

VOLVO
Construction Equipment

Service Information

Document Title: **Component locations**	Function Group: **200**	Information Type: **Service Information**	Date: **2014/7/25**
Profile: **EXC, EC160C L [GB]**			

Component locations

Component position, engine D6E. The following figures show the position of a number of components on engine D6E.

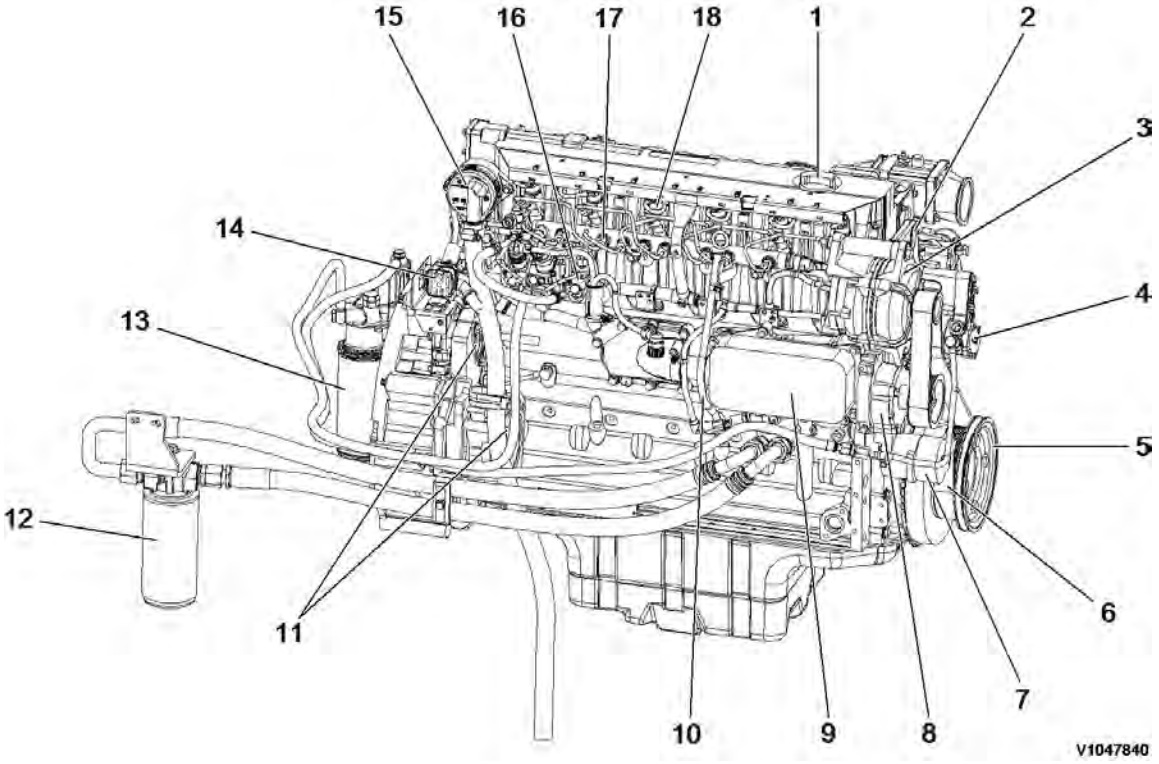

Figure 1
Component locations, front side

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

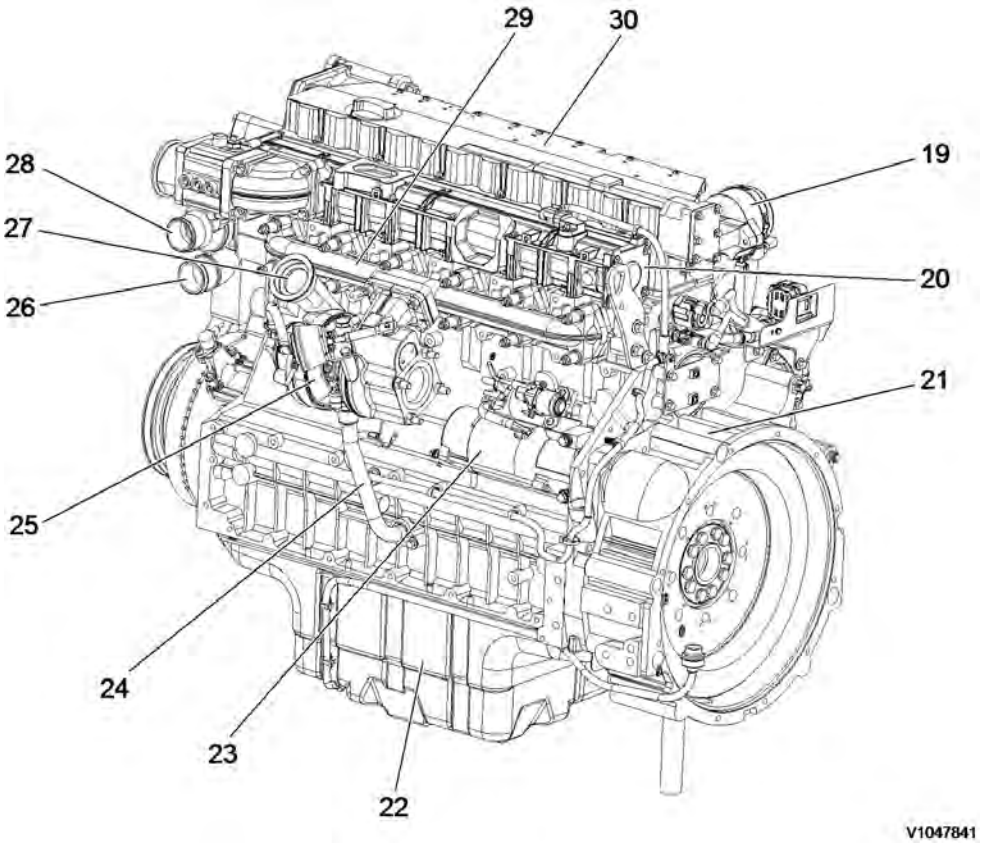

Figure 2
Component locations, flywheel side

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

VOLVO
Construction Equipment

Service Information

Document Title:	Function Group:	Information Type:	Date:
Engine characteristic curve	**210**	**Service Information**	**2014/7/25**
Profile: **EXC, EC160C L [GB]**			

Engine characteristic curve

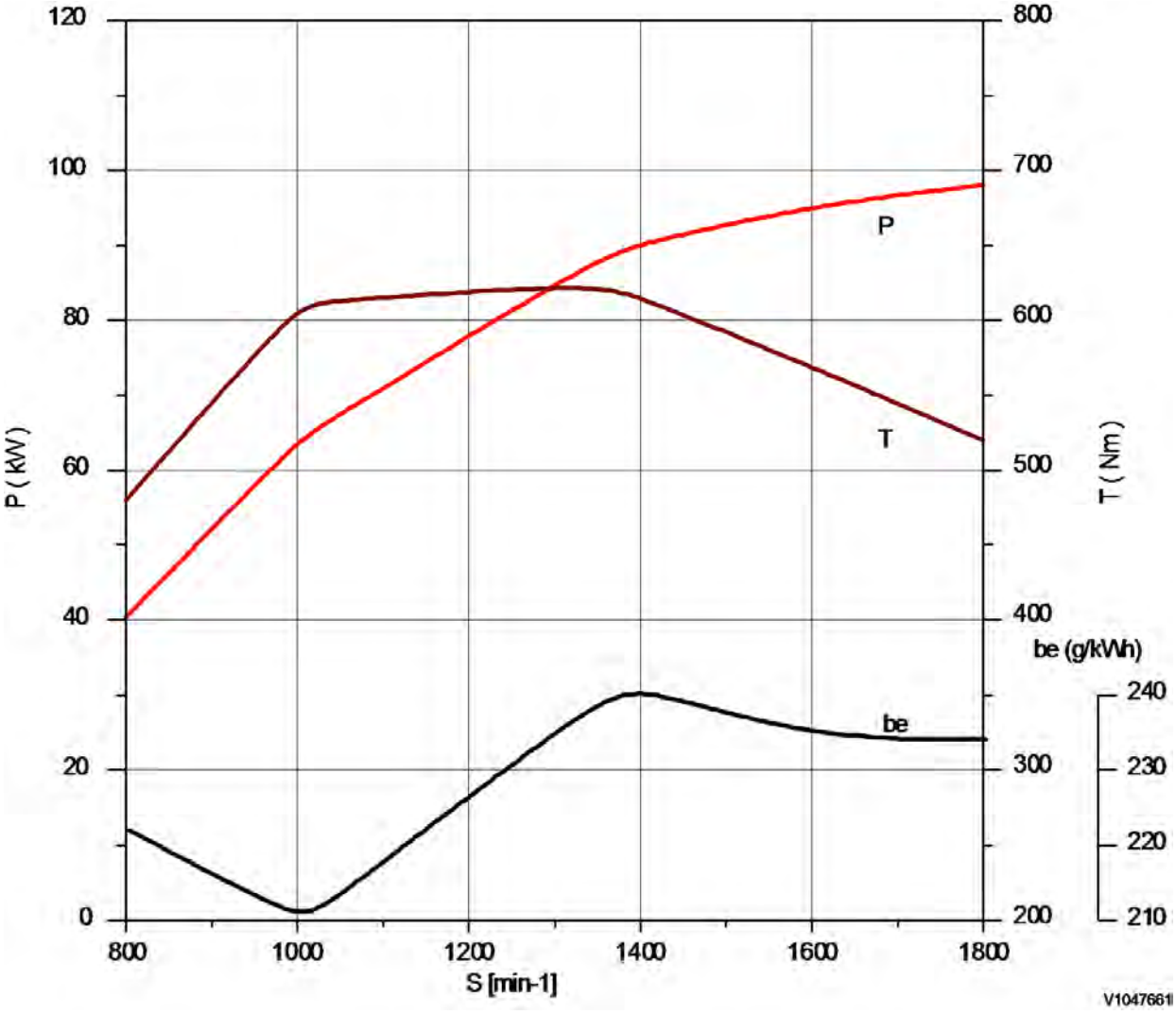

Figure 1
Engine, characteristic curve

P	Output power
S	Engine speed
T	Torque
be	Fuel consumption

Document Title:	Function Group:	Information Type:	Date:
Basic check, Engine	**210**	**Service Information**	**2014/7/25**
Profile: **EXC, EC160C L [GB]**			

Basic check, Engine

NOTE!

Certain tests and checks are performed with unlocked safety locking lever. Make sure that the machine cannot operate unexpectedly when the control lockout lever is unlocked.

Purpose of the basic check

The purpose of the basic check is to provide fast and accurate information about the general condition of the engine.

The basic check should be performed and evaluated according to instructions in the PC-tool VCADS Pro.

Tests included in the basic check

The basic check which is divided into the following tests should be performed after **reading out error codes and checking parameters**.

Tests:

1. **Cylinder compression, test**
   The purpose of the test is to show if any cylinder has a deviating compression pressure. The test replaces the old pressure check method but does not give any absolute values.
2. **Feed pressure, test**
   The purpose of the test is to check that the feed pressure is as per specification.
3. **Sensor, test**
   The purpose of the test is to check the function of all sensors.

Document Title: **Troubleshooting**	Function Group: **210**	Information Type: **Service Information**	Date: **2014/7/25**
Profile: **EXC, EC160C L [GB]**			

Troubleshooting

General about troubleshooting

When a malfunction is suspected or has been confirmed, it is important to identify the cause as soon as possible.

The starting point for all troubleshooting is that there is some type of trouble symptom or malfunction.

Malfunctions can be indicated by:

- generation of error codes
- detection of a malfunction symptom.

Troubleshooting work

The first step in troubleshooting is to gather information from the operator concerning the malfunction symptoms, see Electrical and information system, Collection of basic data. Then, attempt to pin-point the cause by checking in a certain order, for more information, see Electrical and information system, troubleshooting strategy.
The different checking steps are:

- Check error codes
- Check parameters
- Perform basic check

Troubleshooting information

The following is included in Electrical and information system and is used when troubleshooting:

1. **Troubleshooting strategy**
   Describes troubleshooting work, step by step.
2. **Troubleshooting, assistive devices**
   Brief summary of the assistive devices that are available for troubleshooting.
3. **Functional checks and tests, VCADS Pro**
   Brief description of VCADS Pro. For a detailed description, see VCADS Pro User's Manual.
4. **Error code information**
   Contains information regarding error code design, lists of all error codes and error code information about each error code.
5. **Components, troubleshooting and specifications**
   Contains methods and measuring values for troubleshooting of components. Also includes wiring diagrams and certain specifications.
6. **Parameters**
   Incorrectly set parameters may cause malfunction symptoms. The parameter list includes all limit and command values for parameters.
7. **Control units, functional description**
   Describes the functions of the control units, inputs and outputs as well as communication between the various control units.
8. **Control units, active and passive measuring**
   Contains measuring values for active and passive measuring of the ECUs.
9. **Software functions**
   Describes the pre-requisite conditions for the control and monitoring functions that are performed by the software in the ECUs.

VOLVO
Construction Equipment

Service Information

Document Title:	Function Group:	Information Type:	Date:
Camshaft and flywheel signals, checking with VCADS Pro and oscilloscope	**210**	**Service Information**	**2014/7/25**
Profile: **EXC, EC160C L, EC180C L, EC160C NL [GB]**			

Camshaft and flywheel signals, checking with VCADS Pro and oscilloscope

Op nbr 210-090

9990014 Break out harness
9990062 Cable
9998699 Adapter
88890040 Oscilloscope
VCADS Pro VCADS Pro Service Tool

1. Connect 88890040 Oscilloscope to the VCADS Pro computer and perform 28420-3, Flywheel and camshaft signals, test.
   NOTE!
   Instructions for how to connect the equipment are described in the VCADS Pro operation.

   NOTE!
   To be able to start the oscilloscope operation when USB-interface is default in VCADS Pro, then 88890180 Interface must be connected to the computer. However, in this case the interface does not have to be connected to the machine.

   For computers with only one USB-port, the interface configuration must be changed to 9998555. However, in this cases the interface does not have to be connected to the machine.

   Detailed user support is available under the the menu Help in the software.

   NOTE!
   The function “Save” overwrites the original file. Therefore, choose “Save as...” to save the read-off.

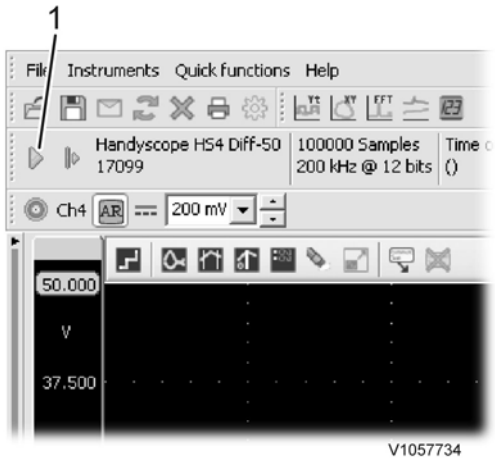

Figure 1

1. Click to start and stop the read-off

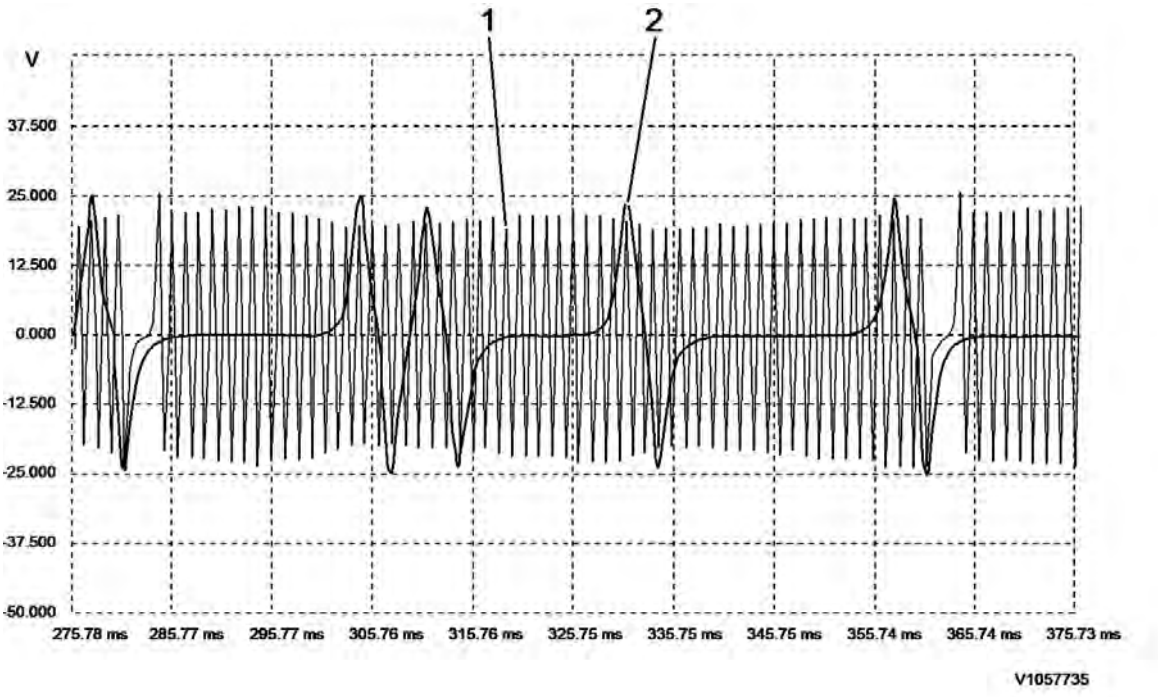

Figure 2
Example of read-off of sensor signals with oscilloscope

1. Signal from flywheel sensor
2. Signal from camshaft sensor

2. Check that the signal from the camshaft sensor's signal coincides with the signal from the flywheel sensor within the marked area in the figure.

   - If the signal for the camshaft sensor is displaced **to the left** the camshaft is displaced **one gear tooth in the camshaft's rotational direction**.
   - If the signal for the camshaft sensor is displaced **to the right** the camshaft is displaced **one gear tooth opposite to the camshaft's rotational direction**.

   For adjusting the camshaft's position, see service manual for respective engine.

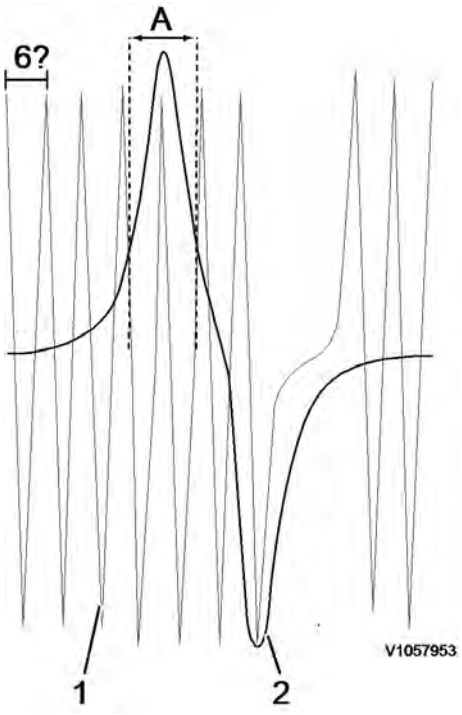

Figure 3
Relationship between camshaft signal and flywheel signal

A. Area where the signal from the camshaft shall coincide with the signal from the flywheel sensor

1. Flywheel sensor
2. Camshaft sensor

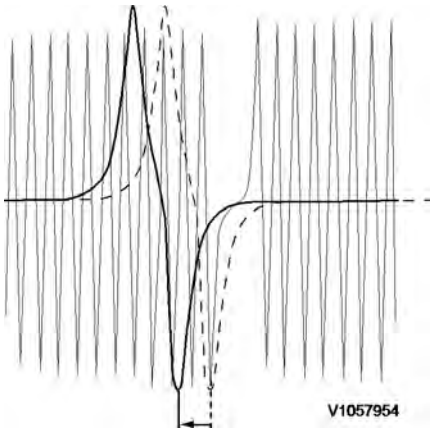

Figure 4
Example of incorrect signal
In this case, the signal for the camshaft sensor is displaced to the left.

3. Check that the curves are not mirror-imaged (see figure). If the curves are mirror-imaged:

   - Check the connection to the oscilloscope.
   - If the connection to the oscilloscope is correct, check that the connections for the crankshaft sensor are installed correctly. If needed, unplug the connector for the flywheel sensor and change place of the cable connections.

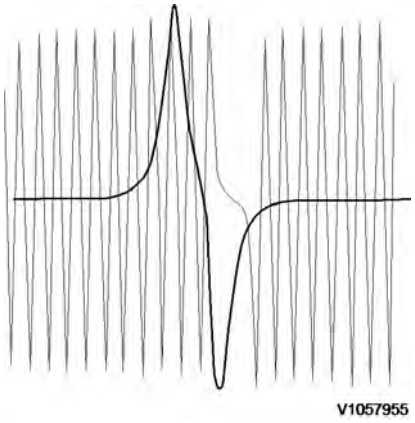

Figure 5
Example of incorrect signal
In this case, the signal for the flywheel sensor is mirror-imaged

4. Check the voltage across the camshaft sensor.
   To ensure reliable start and operation of the engine, the voltage across the sensors shall be according to 3021 SE2703, description and measuring .
   If the signal is too low:

   - Check that the sensor is correctly installed and adjusted.
   - Remove the sensor and check that it is not damaged. Check the distance between the sensor and the sensor ring gear is according to 386 Engine rotation speed sensor (camshaft), replacing. Install the sensor and check the signal again.
     If the sensor is damaged, rotate the crankshaft and check if the camshaft gear has any damage that has caused damage to the sensor.

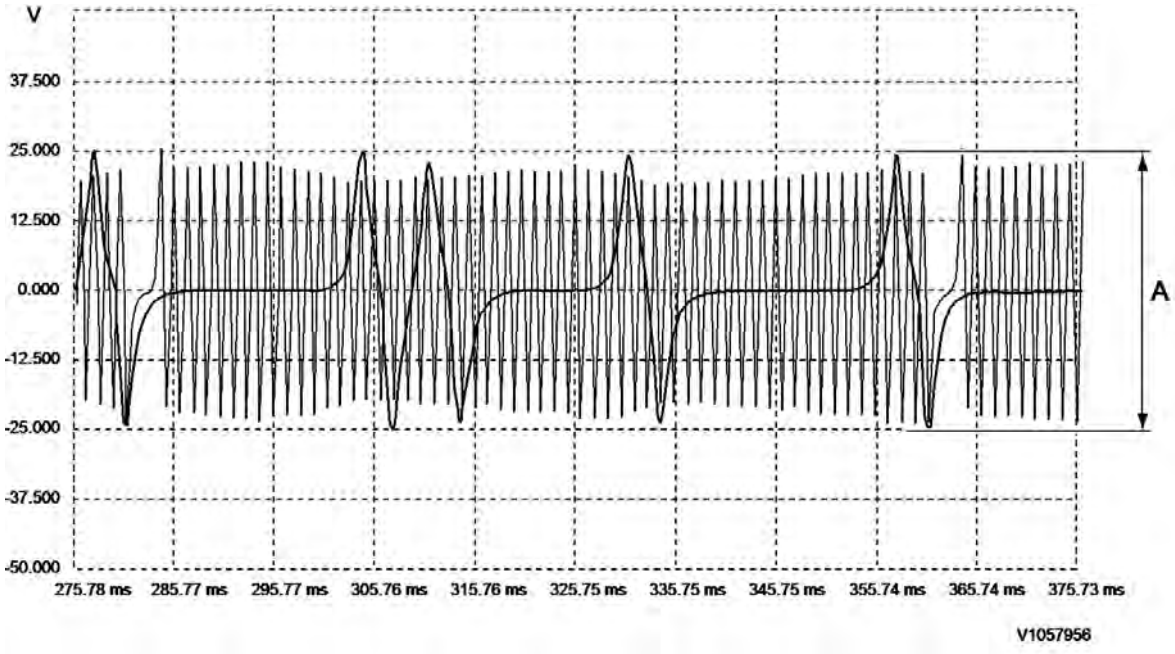

Figure 6

A. Signal voltage camshaft sensor (V)

5. Check the voltage across the flywheel sensor.
   To ensure reliable start and operation of the engine, the voltage across the sensors shall be according to

3021 SE2701, description and measuring .

If the signal is too low:

- Check that the sensor is correctly installed and adjusted.
- Remove the sensor and check that it is not damaged. Check the distance between the sensor and the sensor ring gear/flywheel is according to 386 Engine rotation speed sensor, replacing. Install the sensor and check the signal again.
  If the sensor is damaged, rotate the crankshaft and check if the flywheel has any damage that has caused damage to the sensor.

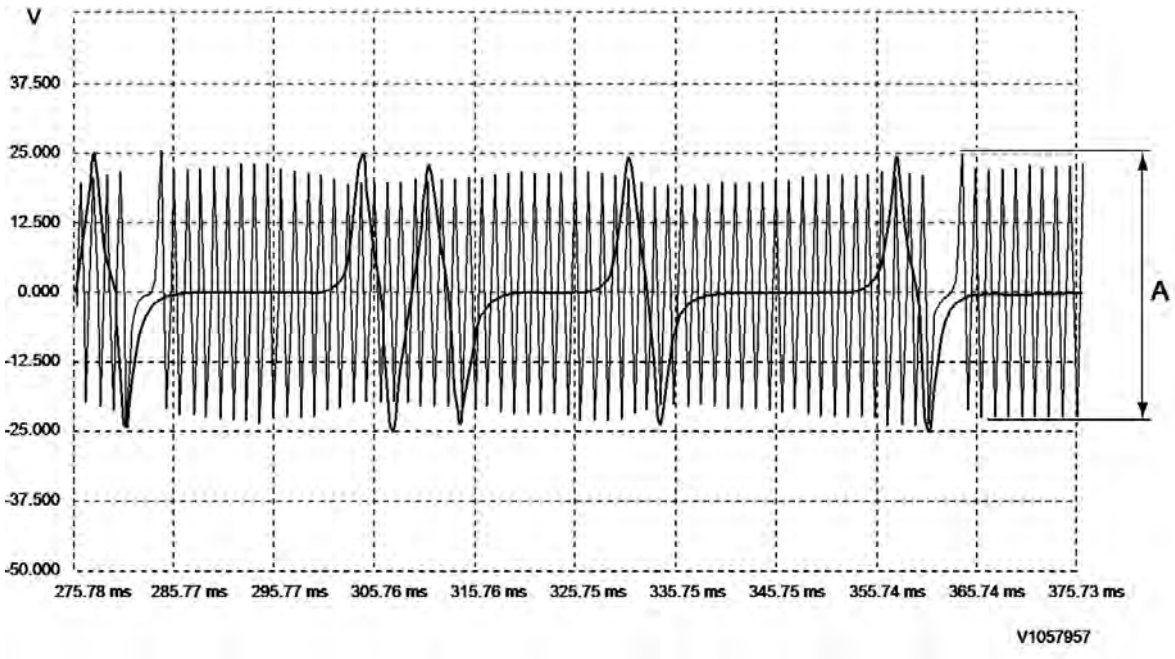

Figure 7

A. Signal voltage flywheel sensor (V)

More than one document matches chosen profile

- Cylinder head, description

  Product Line: EXC
  Model Variant: EC160C L (Volvo)

- Cylinder head, description

  Product Line: EXC
  Model Variant: EC160C L (Volvo)

VOLVO
Construction Equipment

Service Information

Document Title:	Function Group:	Information Type:	Date:
Cylinder head, description	**211**	**Service Information**	**2014/7/25**
Profile: **EXC, EC160C L [GB]**			

Go back to Index Page

Cylinder head, description

The cylinder head is made of grey cast iron and is common for all cylinders. The induction air enters vertically (A) and the exhausts leave horizontally (B). Inlets and exhaust outlets are located on the same side of the cylinder block. Inlet and exhaust valve size is increased to optimize the gas exchange and combustion process. Valve guides are replaceable. Coolant flow in the cylinder head is modified to accommodate an outlet controlled cooling system.
On order for the engine to fulfill governing emission standards, there are 3 cylinder head gaskets of different thicknesses between the cylinder head and the piston.

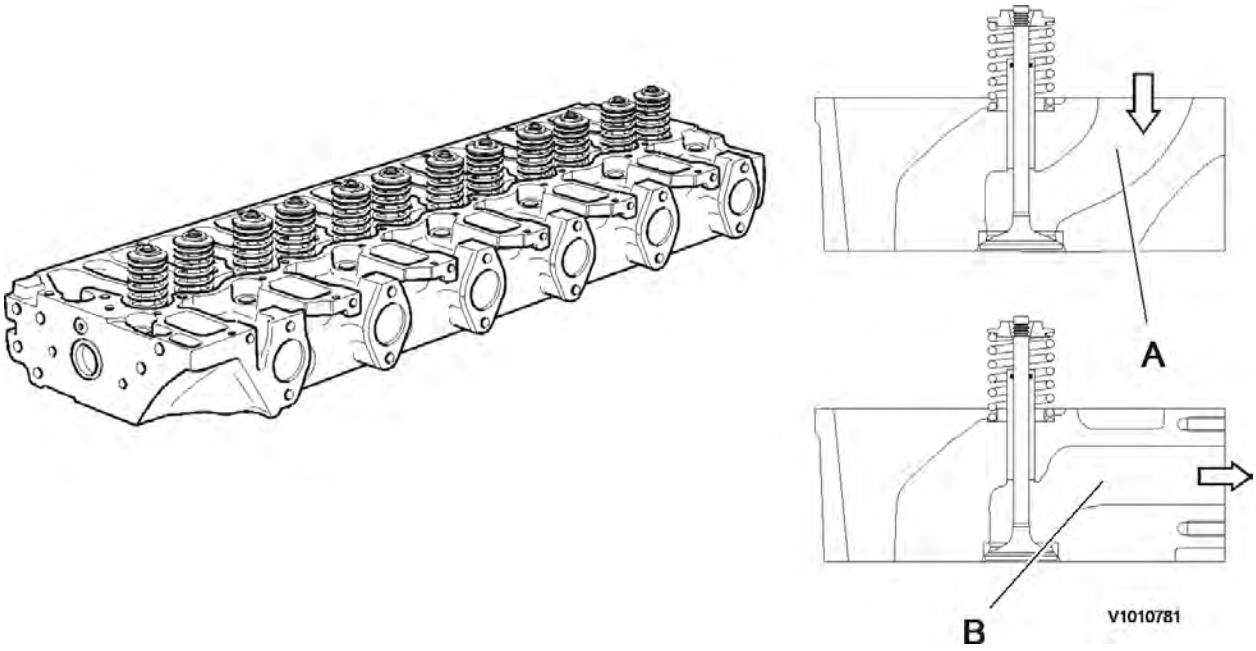

Figure 1

VOLVO
Construction Equipment

Service Information

Document Title:	Function Group:	Information Type:	Date:
Cylinder head, description	**211**	**Service Information**	**2014/7/25**
Profile: **EXC, EC160C L [GB]**			

Go back to Index Page

Cylinder head, description

The cylinder head is made of grey cast iron and is common for all cylinders. The induction air enters vertically (A) and the exhausts leave horizontally (B). Inlets and exhaust outlets are located on the same side of the cylinder block. Inlet and exhaust valve size is increased to optimize the gas exchange and combustion process. Valve guides are replaceable. Coolant flow in the cylinder head is modified to accommodate an outlet controlled cooling system.
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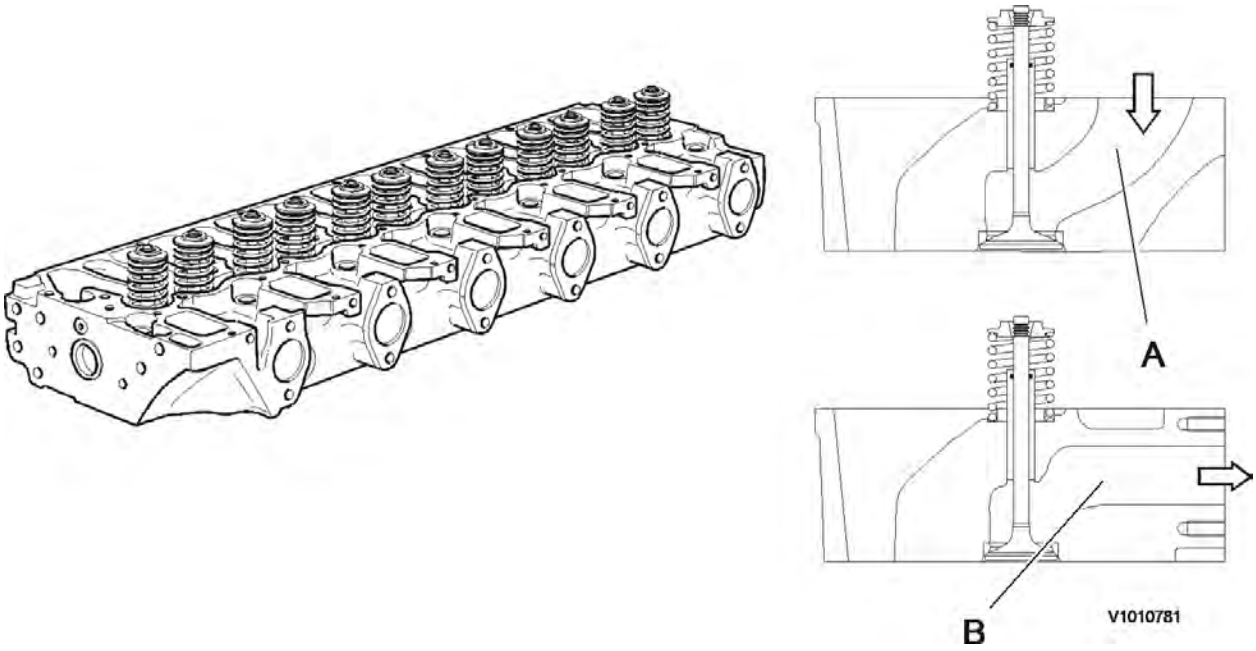


Figure 1

Document Title: **Cylinder head gasket, description**	Function Group: **211**	Information Type: **Service Information**	Date: **2014/7/25**
Profile: **EXC, EC160C L [GB]**			

Cylinder head gasket, description

The cylinder head gasket is a multi layered gasket with 1, 2 or 3 identification holes to indicate three different thicknesses available. Selection of the proper thickness of gasket is determined by the measurement of piston projection above the cylinder block sealing surface. Recalibration for the correct gasket thickness would be required if new pistons or a new cylinder block were installed.

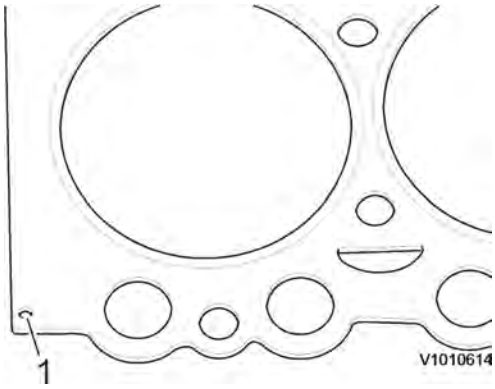


Figure 1

1. Cylinder head gasket, marking

Document Title:	Function Group:	Information Type:	Date:
Cylinder block, description	**212**	**Service Information**	**2014/7/25**
Profile: **EXC, EC160C L [GB]**			

Cylinder block, description

The cylinder block is cast in one piece and has wet, replaceable cylinder linings. Combustion pressure tensile breaking strength in cylinder head screws is led through stiffened sections of the cylinder block wall directly to the main bearings.

The cylinder block surface should not be ground as the distance between the pistons and the valve heads may become too small. There is also a risk that injector tips will be incorrectly placed in relation to the pistons and that exhaust values will worsen.

Document Title: **Cylinder, description**	Function Group: **213**	Information Type: **Service Information**	Date: **2014/7/25**
Profile: **EXC, EC160C L [GB]**			

Cylinder, description

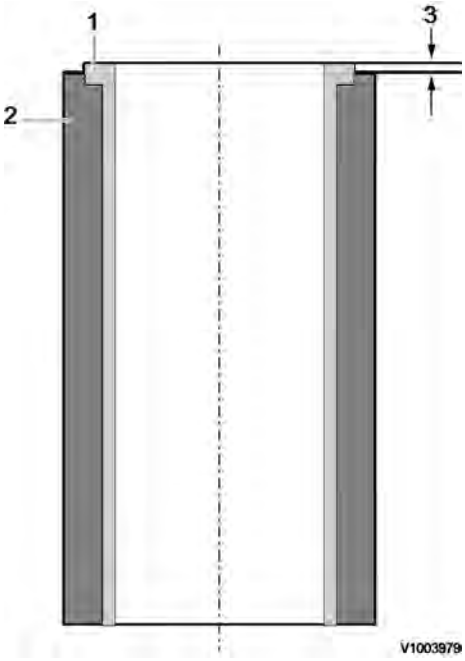


Figure 1
Cylinder liner

1	Cylinder liner
2	Crankcase
3	Liner projection: 0.07 - 0.12 mm

D6E engine with a bore about 98 mm (3.86 in) is provided with dry, plateau-honed slip-fit cylinder liners. In case of damage, the cylinders of the D6E series are repaired by replacing the slip-fit liners.

Document Title:	Function Group:	Information Type:	Date:
Pistons, description	**213**	**Service Information**	**2014/7/25**
Profile: **EXC, EC160C L [GB]**			

Pistons, description

D6E Engine

The pistons are made of special alloy aluminium. The piston's combustion compartment has a somewhat off-center (eccentric) position in relation to the piston pin.
The pistons are provided with 3 piston rings. The first ring has a ring carrier made of cast iron.
The piston is cooled with oil sprayed up on the inside of the piston top.
The piston cooling nozzles are made of plastic and are mounted in the cylinder head by the main bearing positions.
The first piston ring has an asymmetric cross-section area (A). The cross-section area for piston ring number two (compression ring) is tapered. When installing the piston rings, the marking TOP by the opening in the rings must face up. The third ring is an oil ring with bevelled edge.

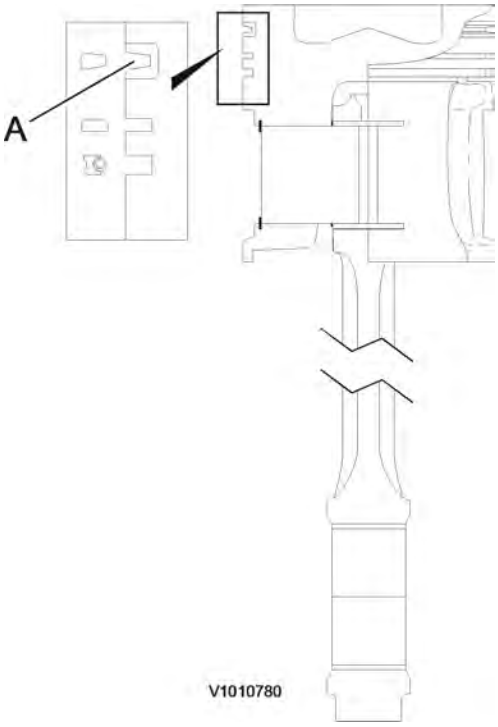


Figure 1

Document Title:	Function Group:	Information Type:	Date:
Piston rings, description	**213**	**Service Information**	**2014/7/25**
Profile: **EXC, EC160C L [GB]**			

Piston rings, description

Each piston is equipped with two compression rings and one oil ring. The uppermost compression ring is of the "Keystone" type (dual trapezoid-formed cross section). Compressions rings should be placed with the text facing upwards.
The oil ring is equipped with two scraping edges, which are pressed against the cylinder wall using the spring tension in the ring and an expander spring placed on the inside of the ring. The oil ring can be placed on either side but should be placed with expander spring and oil ring openings 180° from one another.

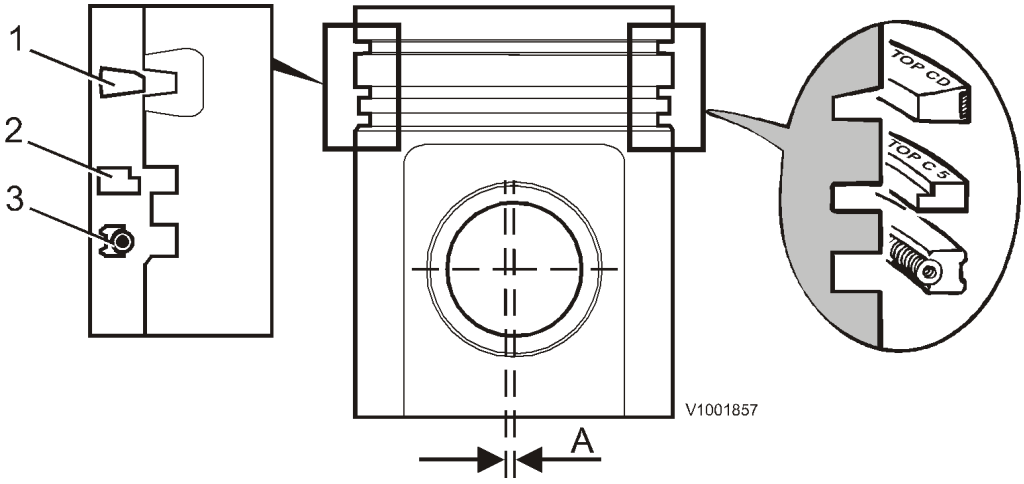


Figure 1

Document Title:	Function Group:	Information Type:	Date:
Piston cooling	**213**	**Service Information**	**2014/7/25**
Profile: **EXC, EC160C L [GB]**			

Piston cooling

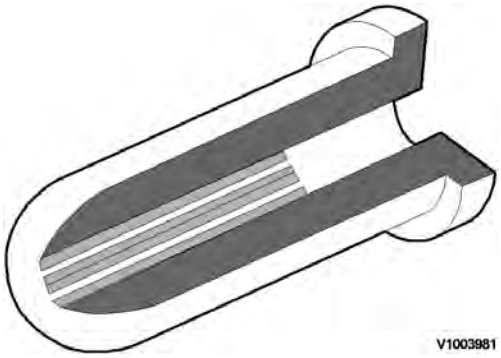


Figure 1
Piston cooling

The piston is cooled by spraying lube oil against the inside of the piston top.

The 2-hole piston cooling nozzles made of plastic are fitted in the main bearing pedestals.

Document Title:	Function Group:	Information Type:	Date:
Valves, description	**214**	**Service Information**	**2014/7/25**
Profile: **EXC, EC160C L [GB]**			

Valves, description

The engines are equipped with one inlet and one exhaust valve per cylinder.
At the upper end of the valve guide, there is an O-ring seal (A) against the valve spindle to prevent major oil consumption and to reduce the amount of hydrocarbons in the exhausts.
The valves are rotated by the eccentric action of the rocker arms.
The new compressed tapered shape enables the valves to turn easily despite loading.
Rocker arm lubrication is part of the engine force-feed lubrication system. The oil is supplied via the tappets and push rods.
If the valve guides are replaced, they are obtained in another version (B) to facilitate installation.
Figure 1 shows a valve guide installed in production and figure 2 shows a replacement guide.

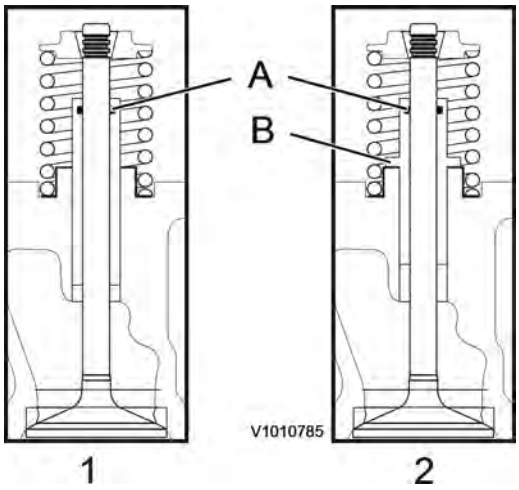


Figure 1

Document Title: **Internal Exhaust Gas Recirculation (IEGR), description**	Function Group: **214**	Information Type: **Service Information**	Date: **2014/7/25**
Profile: **EXC, EC160C L [GB]**			

Internal Exhaust Gas Recirculation (IEGR), description

A system for IEGR (**I**nternal **E**xhaust **G**as **R**ecirculation) is used as part of V-ACT (Volvo Advanced Combustion Technology). On D6E and D7E this takes place by an IEGR-opening piston, controlled by the lubrication oil's system pressure, acting on the exhaust rocker arm which enables a second opening of the exhaust valves. When activated, the secondary piston will give a limited valve opening of the exhaust valves during the induction phase, which leads exhausts back into the cylinder.

Included components

IEGR-unit

The hydraulic mechanism is housed in two interconnected IEGR-units, located on the rocker arm holders. Lubrication oil is routed from the cylinder head via the solenoid valve to the high-pressure channel in the IEGR-unit through a channel in one of the rocker arm holders.

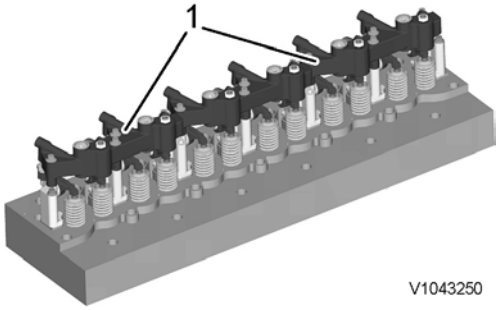


Figure 1

1. IEGR-unit

Solenoid valve

The solenoid valve is located in the cylinder head on the flywheel side and is activated by the EECU via the control system EMS 2. When IEGR is not activated, the solenoid valve is closed and no oil flow is allowed into the IEGR-unit. At activation of IEGR, the solenoid valve opens the channel from the engine's lubrication system to the IEGR-unit.

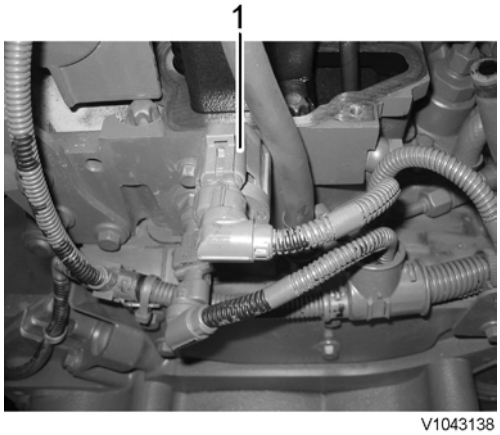


Figure 2

1. Solenoid valve

Control valve
The control valve is located in the IEGR-unit between the high-pressure circuit and low-pressure circuit. When the low-pressure circuit is supplied from the lubrication oil system, the control valve is lifted and closes the high-pressure circuit. The ball in the control valve enables filling of the high-pressure circuit when IEGR is activated.
The lubrication oil is drained through the control valve.

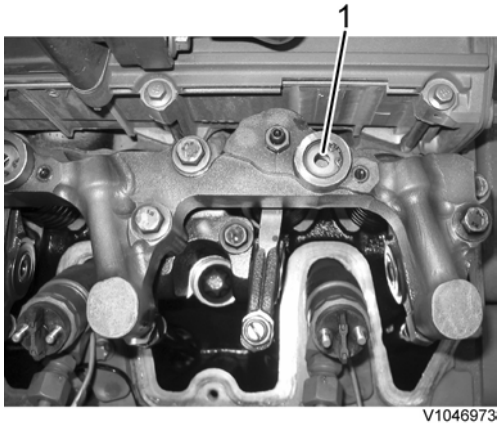


Figure 3

1. Control valve

Main piston
The main piston is acted on by the adjusting screw on the inlet valve's rocker arm, and affects the oil pressure in the IEGR-unit's high-pressure channel. At the end of the IEGR-phase, a pressure of 100 bar is generated in the high-pressure circuit.

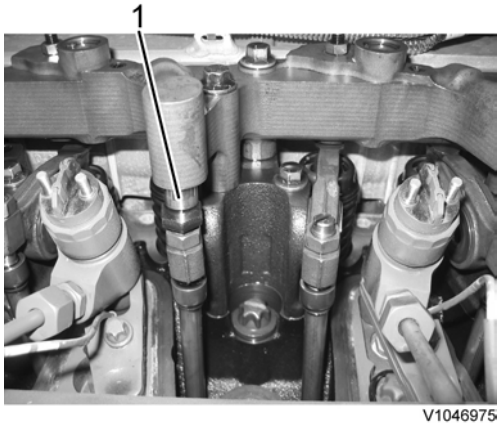


Figure 4

1. Main piston

Servo piston
The servo piston is activated by the hydraulic pressure from the main piston via a channel in the IEGR-unit when the IEGR-function is active/on (solenoid valve in open position). Then the servo piston opens the exhaust valves via the rocker arm an extra time during the induction stroke.

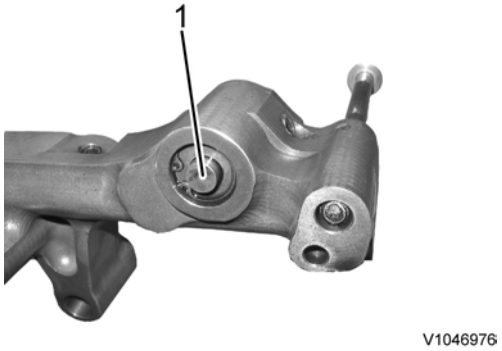


Figure 5

1. Servo piston

Function

IEGR is activated by the system being supplied with full lubrication oil system pressure via the solenoid valve. The solenoid valve is activated by the E-ECU.
The control valve closes the high-pressure circuit and the ball inside the valve enables filling of the system.
With the same movement as the inlet valve's rocker arm opens the valve, the main piston is forced upward. The pressure in the IEGR-unit's high-pressure channel (up to 100 bar) overcomes the spring force in the servo piston. the servo piston forces down the rocker arm, which results in the exhaust valve being open for a short time at the end of the induction stroke. Exhausts from the exhaust manifold are sucked into the cylinder by vacuum from the other cylinders.
The breather hole between the low-pressure channel and the high-pressure channel in the IEGR-unit enables longer exhaust recirculation at high engine speed.

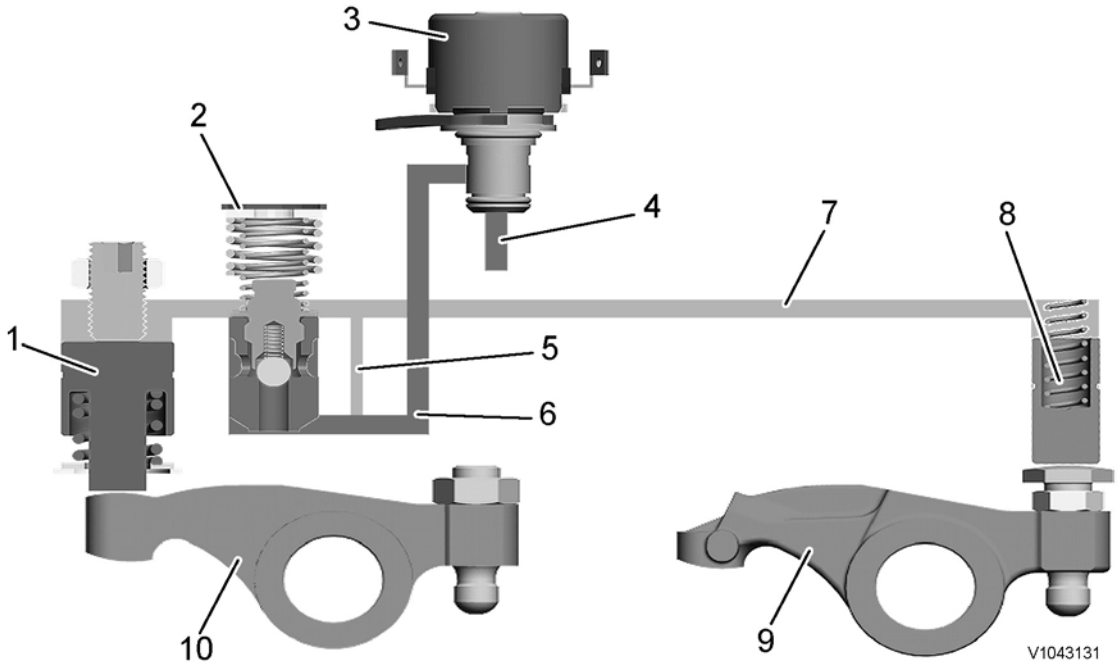


Figure 6
IEGR-system (inactive)

1. Servo piston
2. Control valve
3. Solenoid valve
4. 2–5 Bar lubrication oil pressure
5. Breather hole
6. Oil channel, low-pressure

7. Oil channel, high-pressure
8. Main piston
9. Induction rocker arm
10. Exhaust rocker arm

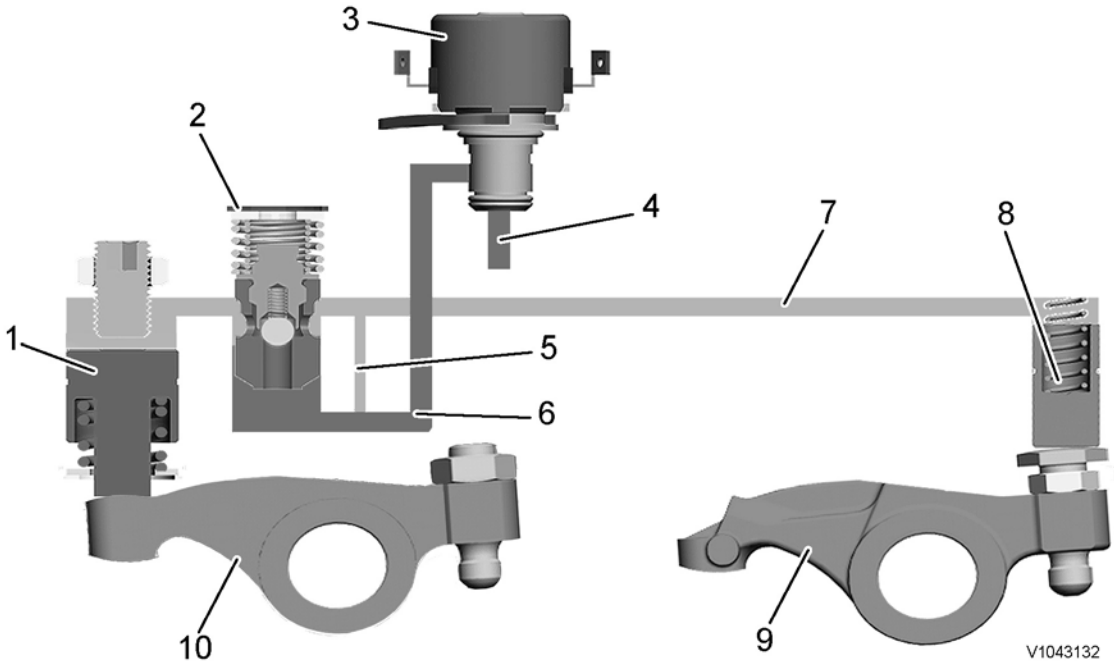


Figure 7
IEGR-system activated

1. Servo piston
2. Control valve
3. Solenoid valve
4. 2–5 Bar lubrication oil pressure
5. Breather hole
6. Oil channel, low-pressure
7. Oil channel, high-pressure
8. Main piston
9. Induction rocker arm
10. Exhaust rocker arm

Checking and adjusting

Checking and adjusting of the IEGR-opening piston's clearance against the exhaust rocker arm should be done in connection with checking and adjusting valves according to 214 Valves, adjusting.

Software

The function monitors the EGR valve for return of combustion gases and informs the operator if the function is not ensured or if there is a system malfunction.

The function is also used as input signal for Engine protection.

Document Title: **Valves, adjusting**	Function Group: **214**	Information Type: **Service Information**	Date: **2014/7/25**
Profile: **EXC, EC160C L [GB]**			

Valves, adjusting

Op nbr 214-012

9998681 Rotation tool
885812 Timing tool

Feeler gauge

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 cover plate (1).

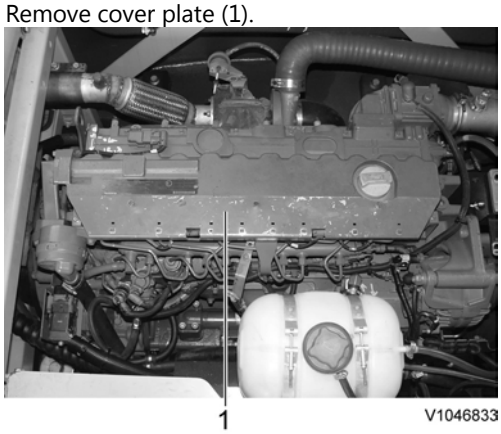


Figure 1
Removal, cover plate

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

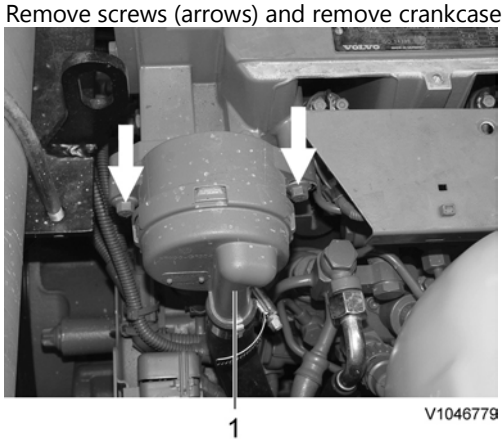


Figure 2
Removal, crankcase ventilation duct

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

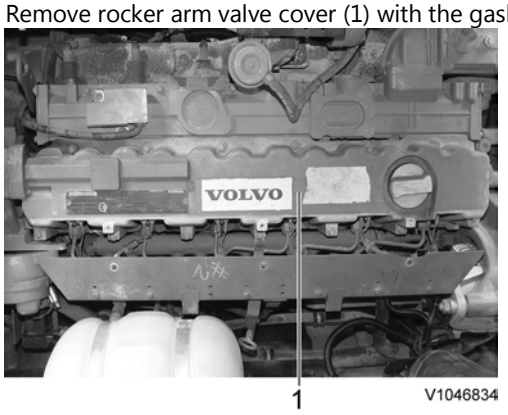


Figure 3
Removal, rocker arm cover

6. Remove the camshaft gear cover and install turning gear (1).

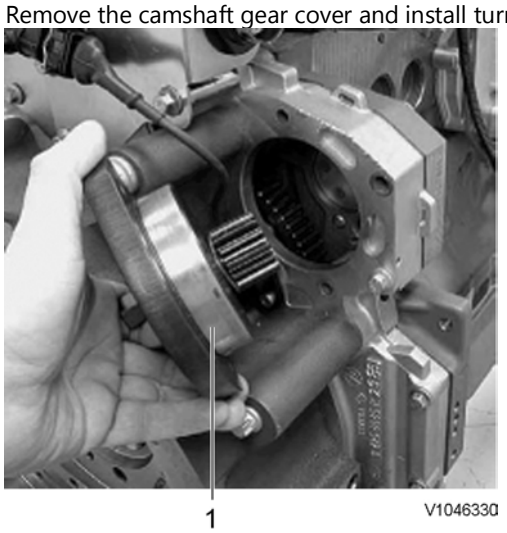


Figure 4

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

7. Remove the IEGR unit.
Install M 8 x 75 mm – 10.9 screws in the holes for the IEGR unit on the rocker arm holders.

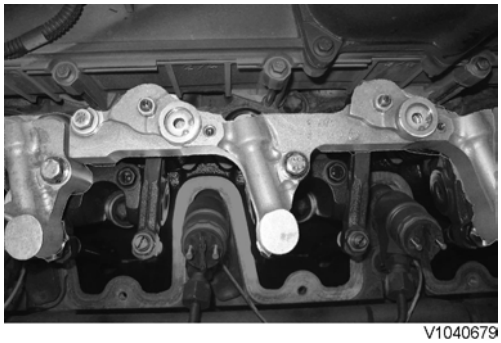
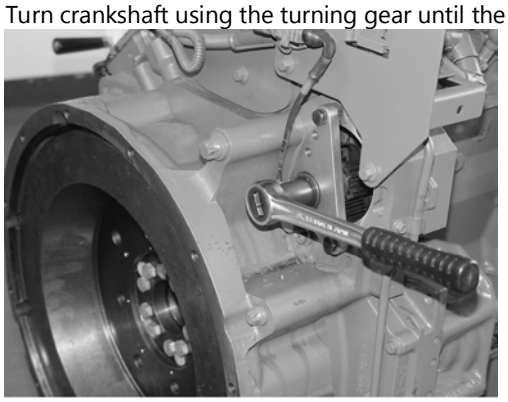


Figure 5

8. **Setting engine to valve overlap**

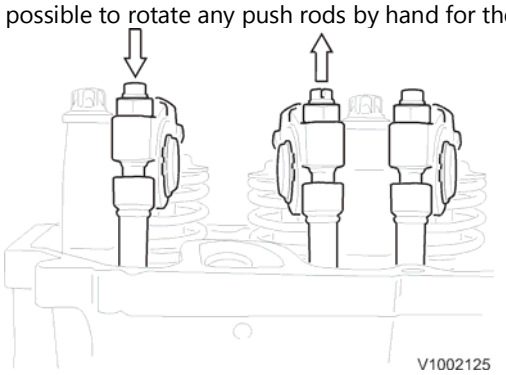
Turn crankshaft using the turning gear until the valve overlap of cylinder 1 is reached.



V1046331

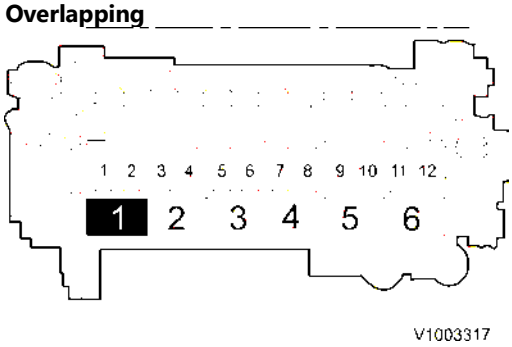
Figure 6

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.



V1002125

Figure 7
Overlapping

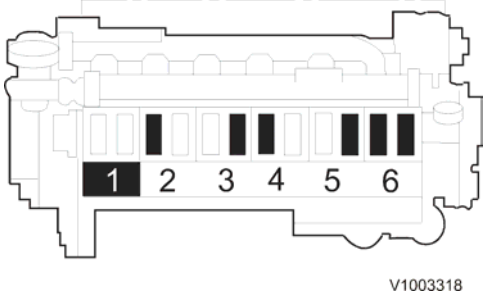


V1003317

Figure 8

1, 3, 5, 7, 9 and 11 are exhaust valves
2, 4, 6, 8, 10 are 12 inlet valves

9. Adjust the valve clearance for each cylinder according to the black markings in the figure. Procedure for adjusting:



V1003318

Figure 9

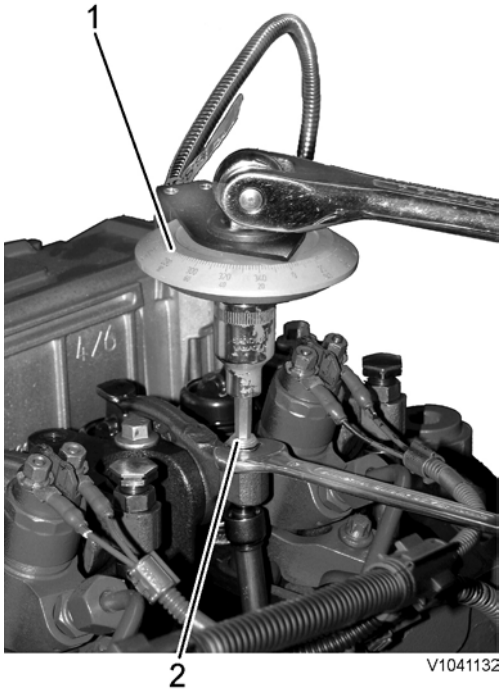


Figure 10

1. 885812 Timing tool
2. Adjusting screw

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 counterclockwise 75° for inlet valve and 120° for exhaust valve.
5. Hold the adjusting screw and tighten the lock nut at the same time. Tightening torque: see 200 Engine, tightening torques

10. Rotate the crankshaft another full turn until the valves for cylinder 6 overlap. Adjust the valve clearance for each cylinder according to the black markings in the figure.
    NOTE!
    When all valves are adjusted, do not rotate the engine. Continue directly with installing and adjusting the IEGR unit.

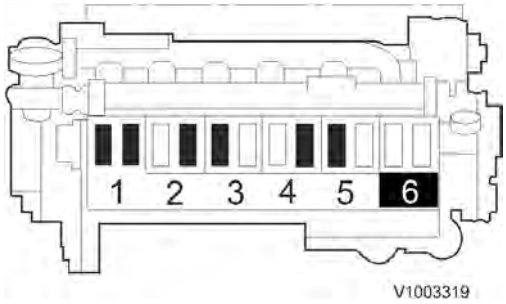


Figure 11

Installing and adjusting IEGR unit

11. Change the O-rings on the pipe between the two IEGR sections. Lubricate the O-rings.

12. Remove the replacement bolts from the IEGR unit's installation holes.

13. Install the IEGR unit.

14. With overlapping valves for cylinder 6, adjust IEGR-opening piston for cylinder 1, 3 and 5. Procedure for adjusting IEGR-opening piston:

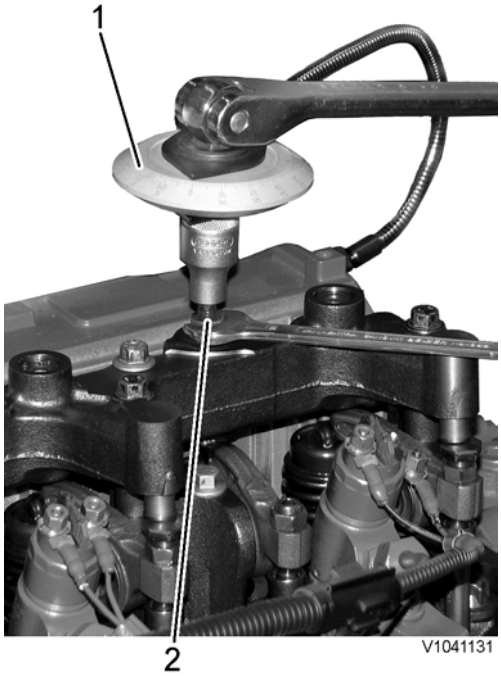


Figure 12

1. 885812 Timing tool
2. Adjusting screw

1. Loosen the adjusting screw's lock bolt on the IEGR unit.
2. Install the protractor on the adjusting screw.
3. Turn the adjusting screw until zero clearance is obtained between the IEGR-opening piston and exhaust rocker arm. Reset the protractor to zero.
4. Turn the adjusting screw counterclockwise 144°.
5. Hold the adjusting screw and tighten the lock nut at the same time. Tightening torque: see 200 Engine, tightening torques

15. Rotate the crankshaft another full turn until the valves for cylinder 1 overlap. Adjust IEGR-opening piston for cylinder 2, 4 and 6.

16. Install the new gasket on the valve cover.
    NOTE!
    Make sure that the tab (1) on the gasket is positioned correctly.