Content

About this Workshop manual

General information

This Service Manual contains technical data, descriptions and maintenance and repair instructions for standard model Volvo Penta products. A list of these products may be found in the section ***Specifications***.

The product designation and the serial number and specification is indicated on the engine decal or type plate. This information must be included in all correspondence regarding the product.

The service manual is produced primarily for the use of Volvo Penta workshops and their qualified personnel. It is assumed that any person using the Service Manual has a fundamental knowledge of the product and is able to carry out mechanical and electrical work to trade standard.

Volvo Penta continually develops its products; we therefore reserve the right to make changes. All information in this manual is based on product data which was available up to the date on which the manual was printed. New working methods and significant changes introduced to the product after this date are communicated in the form of ***Service bulletins***.

Spare Parts

Spare parts for the electrical and fuel systems are subject to various national safety standards. Volvo Penta Original Spare Parts meet these standards. No damage of any kind caused by the use of spare parts not approved by Volvo Penta will be compensated by any warranty undertaking.

Certified engines

When carrying out service and repair on emission-certified engines, it is important to be aware of the following:

Certification means that an engine type has been inspected and approved by the relevant authority. The engine manufacturer guarantees that all engines of the same type are manufactured to correspond to the certified engine.
This places special demands on service and repair work, namely:

- Maintenance and service intervals recommended by Volvo Penta must be complied with.
- Only spare parts approved by Volvo Penta may be used.
- Service on injection pumps, pump settings and injectors must always be carried out by an authorized Volvo Penta workshop.
- The engine must not be converted or modified, except with accessories and service kits which Volvo Penta has approved for the engine.
- No changes to the exhaust pipe and engine air inlet duct installations may be made.
- No warranty seals (where present on the product) may be broken by unauthorized persons.

The general instructions in the Operator's Manual concerning operation, service and maintenance apply.

IMPORTANT!

Neglected or poorly-performed care/service and the use of spare parts not approved by Volvo Penta, will mean that AB Volvo Penta no longer guarantees that the engine conforms to the certified model.

Volvo Penta accepts no responsibility for damage or costs arising as a result of failure to follow the above mentioned standards.

Repair instructions

Introduction

The working methods described in this manual are based on a workshop scenario where the product is mounted in a holding fixture. Maintenance work is often carried out in situ, in which case – if nothing else is indicated – using the same working methods as the workshop.

Warning symbols that occur in the service manual. For significance, refer to ***Safety Information*** .

DANGER!

WARNING!

CAUTION!

IMPORTANT!, **NOTICE!**
are by no means comprehensive since not everything can be foreseen as service work is carried out in the most varied of circumstances. We call attention to risks that may occur due to incorrect handling during work in a well-equipped workshop using working methods and tools tried and tested by us.

The service manual describes work operations carried out with the aid of Volvo Penta Special Tools, where such have been developed. Volvo Penta Special Tools are designed to ensure the safest and most rational working methods possible. It is therefore the responsibility of anyone using tools or working methods other than those we recommend to ensure that no risk of personal injury or mechanical damage is present, or that malfunction can result.

In some cases, special safety regulations and user instructions may be in force for the tools and chemicals mentioned in the Service Manual. These regulations must always be followed, and no special instructions regarding this are to be found in the Service Manual.

By taking these basic precautions and using common sense it will be possible to guard against most elements of risk. A clean workplace and a clean product will eliminate many risks of personal injury and malfunction.

Above all, when working on fuel systems, hydraulic systems, lubrication systems, turbochargers, inlet systems, bearings and seals, it is of the utmost importance that dirt and foreign objects are kept away, as malfunctions or shortened service intervals may otherwise result.

Our mutual responsibility

Each product comprises a large number of interacting systems and components. A deviation from the technical specification may dramatically increase the environmental impact of an otherwise reliable system. It is therefore critical that the stated wear tolerances be adhered to, that systems which can be adjusted be correctly set up and that only Volvo Penta Original Parts are used. The intervals in the care and maintenance schedule must be followed.
Some systems, e.g. fuel systems, often require special expertise and test equipment. A number of components are factory-sealed, for among other things environmental reasons. Warranty-sealed components may not be worked on without authorization to perform such work.

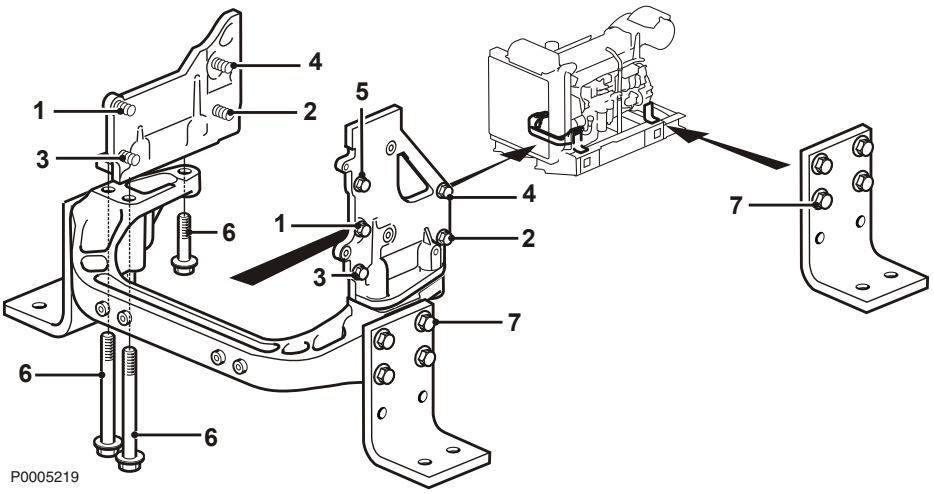
Remember that most chemical products, incorrectly used, are harmful to the environment. Volvo Penta recommends the use of biodegradable degreasers whenever components are cleaned, unless otherwise specified in the Service Manual. When working outdoors, take especial care to ensure that oils and wash residues etc. are correctly properly for destruction.

Tightening torques

Tightening torques for vital fasteners that must be applied using a torque wrench are indicated in the Service Manual, chapter ***Tightening torques*** and in the Manual's work descriptions. All torque indications apply to clean threads, bolt heads and mating faces. Indicated torque data apply to lightly-oiled or dry threads. If lubricants, locking fluids or sealants are required for fasteners, the correct type will be noted in the job description.

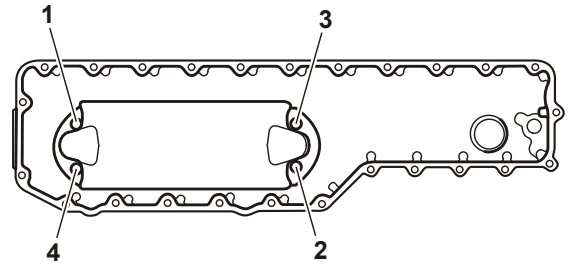
Special Tightening Torques

Group 21: Engine



Front engine mountings, engine block	
Stage 1: Tighten bolt (**1**)	85 ± 5 Nm (62.69 ± 3.69 lbf ft)
Step 2: Tighten the bolts **2**–**4**	105 ± 15 Nm (77.44 ± 11.06 lbf ft)
Stage 3: Angle tighten the bolts **2**–**4** in sequence	60° ± 5°
Stage 4: Tighten bolt (**1**)	105 ± 15 Nm (77.44 ± 11.06 lbf ft)
Stage 5: Angle tighten bolt **1**	60° ± 5°
Stage 6: Tighten bolt **5**	standard bolt torque
Tighten the upward-facing engine bolts **6**	275 ± 10 Nm (202.83 ± 7.376 lbf ft)
Front and rear L brackets	
Tighten the bolts **7**	220 ± 35 Nm (162.3 ± 25.8 lbf ft)
Main bearing caps	
Stage 1	150 ± 20 Nm (110.6 ± 14.75 lbf ft)
Stage 2 (angle tightening)	120° ± 5°
Big end bearing cap	
Stage 1	20 ± 3 Nm (14.75 ± 2.21 lbf ft)
Stage 2	60 ± 3 Nm (44.25 ± 2.21 lbf ft)
Stage 3 (angle tightening)	90° ± 5°

Oil Cooler



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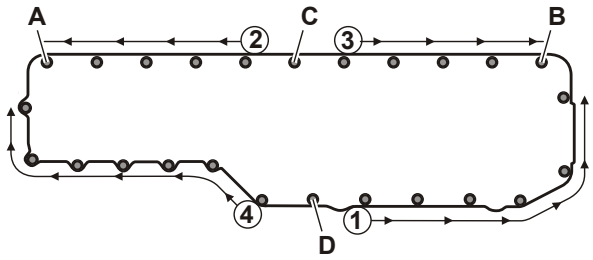
NOTICE! Tighten the bolts diagonally and finish off by tightening the first bolts again.

Oil Cooler, attachment bolts	27 ± 4 Nm (19.91 ± 2.95 lbf ft)



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Oil cooler cover

Install the cover on the engine block and fasten bolt **A** in the oval hole.
Press the cover toward the water pump housing with an installation tool and install bolt **B**.
Check that the cover is in position; refer to the service instruction.

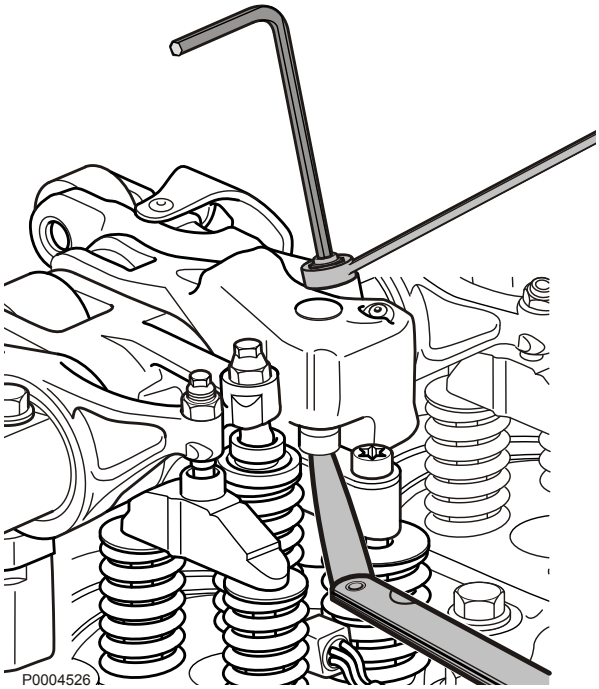
Install bolts **C** and **D** and torque them	24 ± 4 Nm (17.7 ± 2.95 lbf ft)
Tighten the cover bolts outwards from the center in the sequence **1**–**4** as illustrated above	24 ± 4 Nm (17.7 ± 2.95 lbf ft)
Finish off by checking the torque of bolts **C** and **D**	24 ± 4 Nm (17.7 ± 2.95 lbf ft)

Valve clearance, cold engine, setting value:

Inlet	0.2 mm (0.00787 in)
Exhaust	0.8 mm (0.0315 in)
Exhaust, EGR	Counter clockwise adjustment, 1 ¾ turns, (630°)

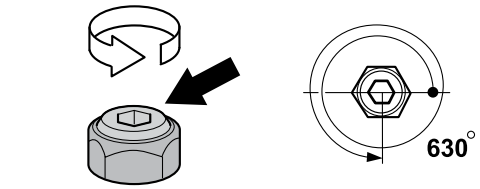
Rocker arm, EGR

TAD1350GE, TAD1351GE, TAD1352GE, TAD1353GE, TAD1354GE, TAD1355GE



Rocker arm, EGR, adjustment:
Allow the feeler gauge to remain in place after adjusting the valve clearance and adjust the EGR rocker arm by loosening the locking nut and adjusting the screw until no clearance is attained.

Check by rotating the rocker arm roller at the camshaft.



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Undo the adjuster screw 1 ¾ turns, (630°). Tighten the lock nut. Remove the feeler gauge from the exhaust valve.

Always use protective glasses or goggles when carrying out work where a risk of splinters, grinding sparks, splashes from acid or other chemicals is present. Your eyes are extremely sensitive; injury may cause blindness!

Never use start gas or similar products as a starting aid. They may cause an explosion in the inlet manifold. Danger of personal injury.

All fuels, as well as many chemicals, are flammable. Do not allow open flames or sparks in their vicinity. Gasoline, some thinners, and hydrogen gas from batteries are extremely flammable and explosive when mixed with air in the correct proportions. **No Smoking!** Ensure that the work area is well ventilated and take the necessary safety precautions before welding or grinding work is begun. Always ensure that there are fire extinguishers close at hand in the work area.

Batteries must never be exposed to open flames or electric sparks. Never smoke in the vicinity of the batteries; they generate hydrogen gas when charged, which is explosive when mixed with air. This gas is easily ignited and highly explosive. A spark, which can be caused by incorrect battery connection, is sufficient to cause a battery to explode and cause damage.

Do not touch the connections during start attempts. Sparking hazard! Do not lean over batteries.

Never transpose the positive (+) and negative (-) battery posts when installing batteries. Such a transposition can result in serious damage to electrical equipment. Refer to the wiring diagram.
Always use protective goggles when charging and handling the batteries. Battery electrolyte contains sulfuric acid which is highly corrosive. Should the battery electrolyte come into contact with unprotected skin, wash it off immediately using soap and copious amounts of water. If you get battery acid in your eyes, flush at once with copious amounts of water and seek medical assistance immediately.

Never start the engine with the valve cover removed. There is a risk of personal injury.

Stop the engine before working on the cooling system.
Marine engines: Close the sea cock / cooling water inlet valve before work on the cooling system is begun.

Make sure that oil, fuel-soaked rags, and used fuel and oil filters are stored in a safe manner. Rags soaked in oil can spontaneously ignite under certain circumstances. Used fuel and oil filters are environmentally hazardous waste and must be handed to an approved waste management facility for destruction, as must any used lubrication oil, contaminated fuel, paint residue, solvents, degreasers and wash residue.

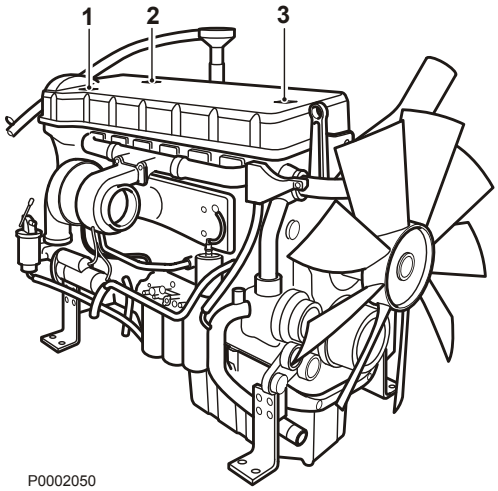
Never work alone when removing heavy components, even when using lifting devices such as locking tackle lifts. When using a lifting device, two people are usually required to do the work - one to take care of the lifting device and the other to ensure that components are lifted clear and not damaged during the lifting operations.

The existing lugs on the engine should be used for lifting. Always check that the lifting equipment used is in good condition and has the load capacity to lift the engine (engine weight including gearbox or extra equipment). For safe handling and to avoid damaging components fitted to the top of the engine, the engine must be lifted with a correctly adjusted lifting boom. All chains or wires must run parallel to each other and as perpendicular to the engine as possible. If other equipment attached to the engine has altered its center of gravity, special lifting devices may be needed to obtain the correct balance for safe handling. Never perform any work on an engine that is only suspended from the lifting equipment.

20-0 Engine Information, General

Design and Function

Identification Numbers



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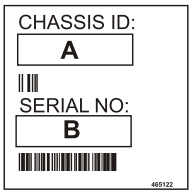

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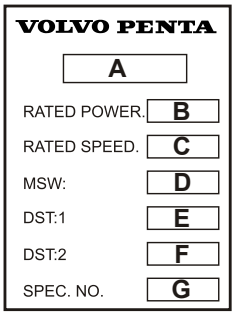
1

A Chassis number

B Serial number



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2

A Engine designation

B Engine power, net, (without fan)

C Max. engine speed

D Main software

E Dataset 1

F Data set 2

G Product number

P0002053

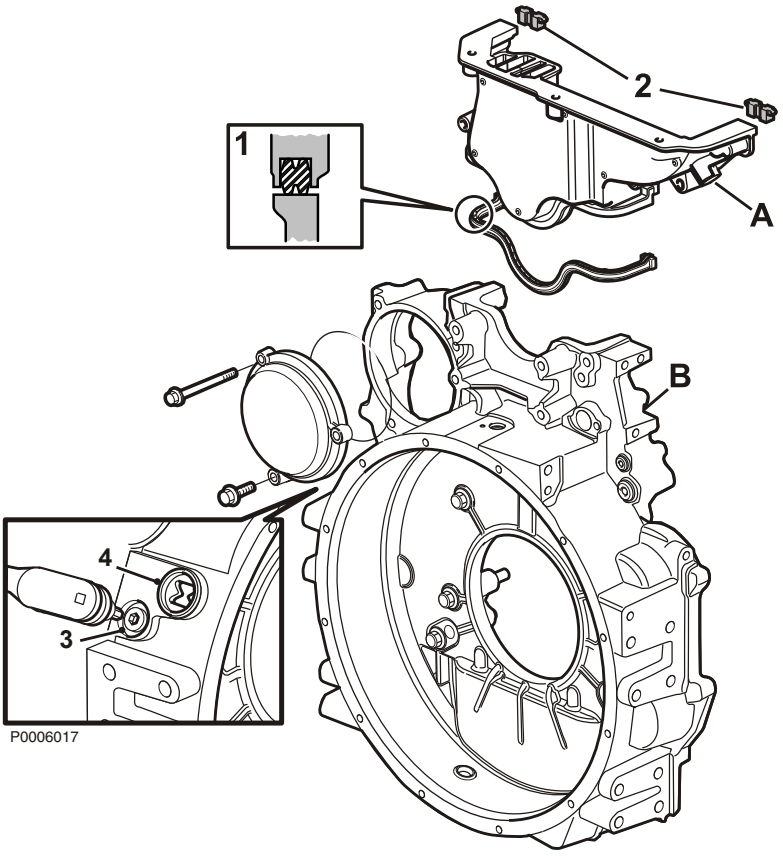
3

A Engine designation

B Specification number

C Serial number

Covers



There are two engine timing gear covers. The upper timing gear cover (**A**) has an integral oil trap for crankcase ventilation. The lower (**B**) is a combined timing and flywheel housing and has attachment points for the rear engine suspension. The flywheel housing has two locating sleeves that position it against the timing plate.

Both covers are sealed against the timing plate with sealant. The seal between the two covers is by a rubber strip (**1**) placed in a groove in the upper cover.

The upper timing gear cover seals against the timing plate with two rubber sealings (**2**). The upper timing gear cover is also sealed with sealant in the join between the rubber strip and the timing plate.

There are two holes in the flywheel housing. One hole is intended for a cranking tool (**3**) for cranking the engine, and the flywheel position marking can be read through the other hole (**4**).

Reason code

1 Discharged batteries

2 Poor contact/open circuit in electrical wiring

3 Main switch turned off

4 Main fuse faulty

5 Faulty ignition lock

6 Faulty main relay

7 Faulty starter motor/-solenoid

8 No fuel:
– fuel cocks closed
– fuel tank empty/wrong tank connected

9 Blocked fuel fine-filter/pre-filter (due to contaminations, or stratification in the fuel at low temperature)

10 Air in the fuel system

11 Water/contamination in fuel

12 Faulty unit injectors

13 In sufficient air supply to the engine:
– blocked air filter
– air leakage between the turbo and the engine's intake manifold
– dirty compressor part in the turbocharger
– faulty turbo compressor
– poor engine room ventilation

14 Coolant temperature too high

15 Coolant temperature too low

16 Oil level too low

17 Coolant level too low

18 Air in the coolant system

19 Faulty circulation pump

20 Defective thermostat

21 Blocked charge air cooler

22 Oil level too high

23 Alternator drive belt slips

24 Water entry into engine

25 High back pressure in the exhaust system

26 Break in ”Pot+” cable to throttle

27 High temperature, charge air cooler

28 Blocked radiator

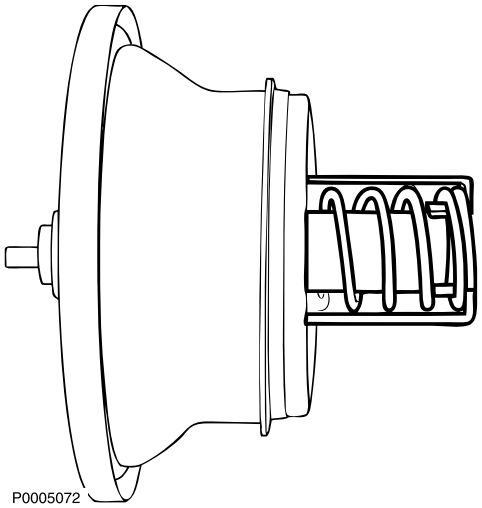
29 No pressure in cooling system

30 Check wastegate function

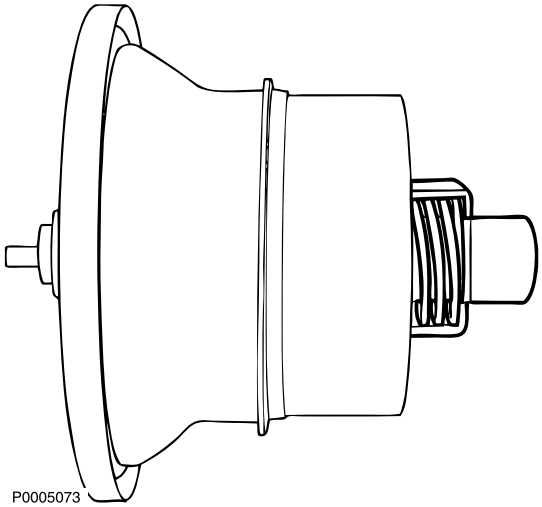
Thermostat, Function Check

Remove the thermostat, see *Thermostat, Change page 288*.

1 Place the thermostat in a big pot with water and heat it to the opening temperature as specified in *Engine, General page 26*.



Closed thermostat.

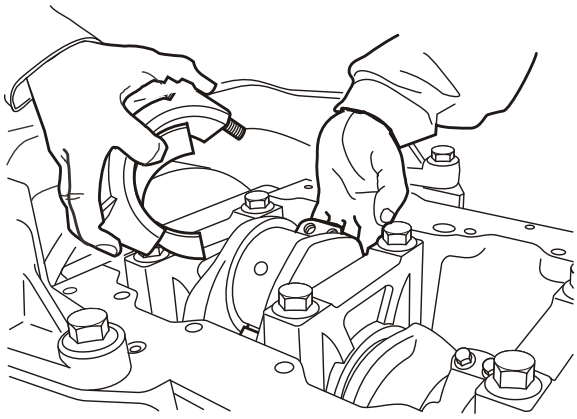


Open thermostat.

2 If the thermostat does not open at specified temperature, it should be replaced.

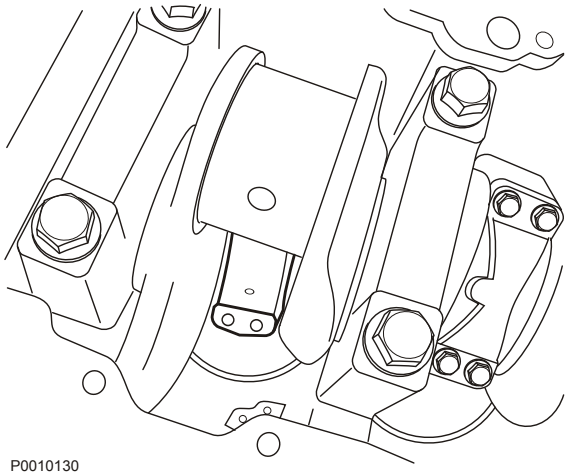
3 Install the thermostat, see *Thermostat, Change page 288*.

NOTICE! Always use a new seal, even if the thermostat is not replaced.



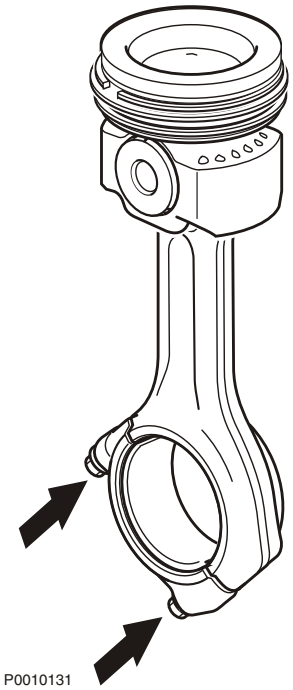
P0010129

5 Remove the bolts entirely. Hold the connecting rod in place and lift the bearing cap away at the same time. Take care of the bearing cup if it does not stay in place in the cap.



P0010130

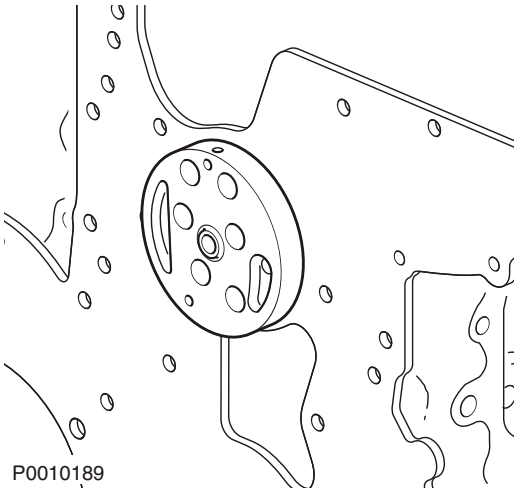
6 Press out the piston with the connecting rod and catch it under the engine. Make sure it does not fall out and become damaged.
The connecting rod separation plane surface is very sensitive and must not be exposed to impact or knocks.



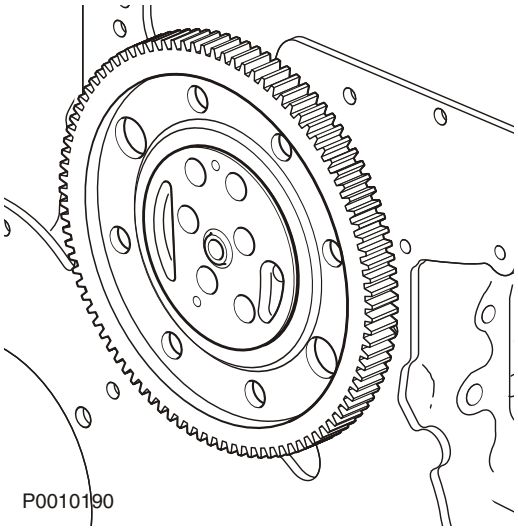
P0010131

7 Replace the bearing cap on the connecting rod immediately to protect the separation plane surfaces.

8 Remove the remaining pistons the same way.

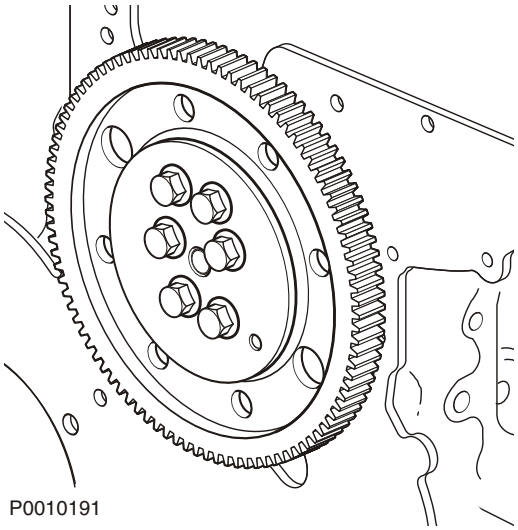

P0010189

6 Fit the hub onto the engine by aligning the locator sleeve. Lubricate the thrust bearing with engine oil.

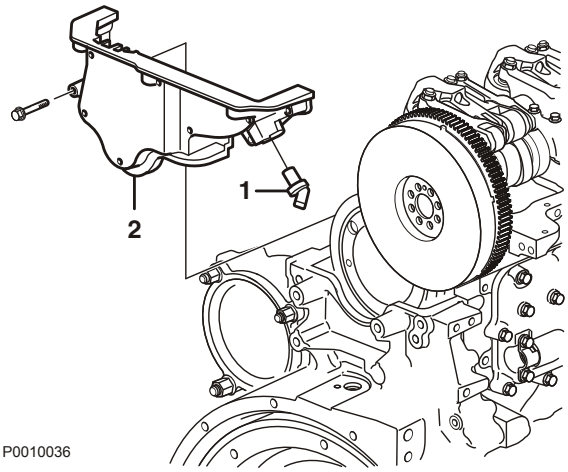

P0010190

7 Check that the bearing is fault free. Lubricate the bearing with engine oil.
Install the intermediate gear turned so that the bearing is located outward.

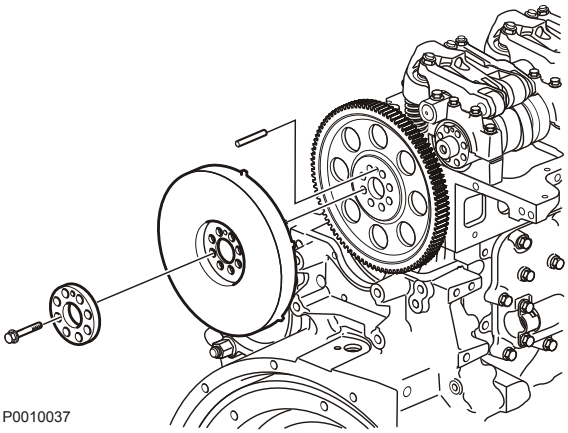
8 Check that the plate lubricating hole is open. Lubricate the rear of the plate.


P0010191

9 Fit the plate onto the centering guide and install the bolts. Tighten the bolts until they touch. Check that the gearwheel rotates easily.



14 Remove the camshaft sensor (1) and then the upper timing cover (2).

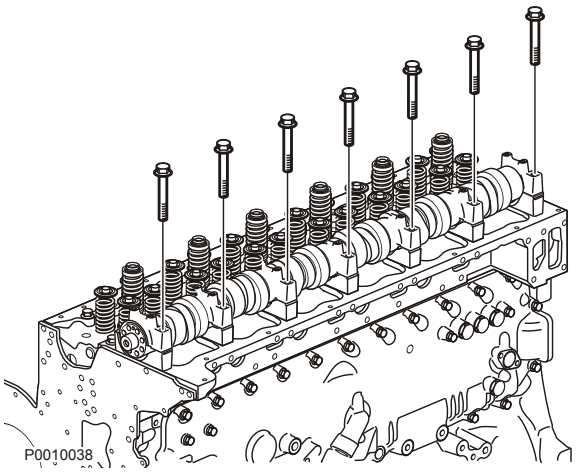


15 Remove the camshaft gear and vibration damper bolts.
Lift away the vibration damper.

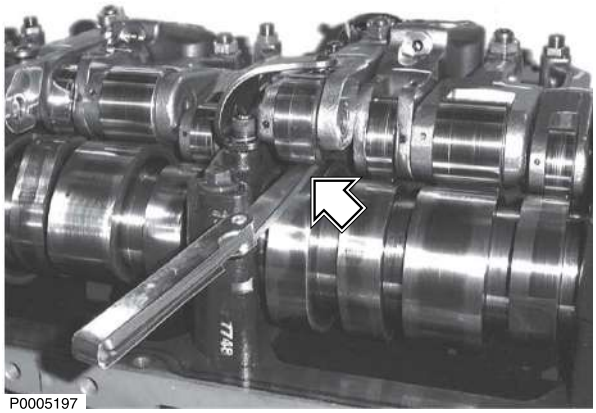
IMPORTANT!

make sure the vibration damper is protected from impact and shocks.

Remove the camshaft gear.

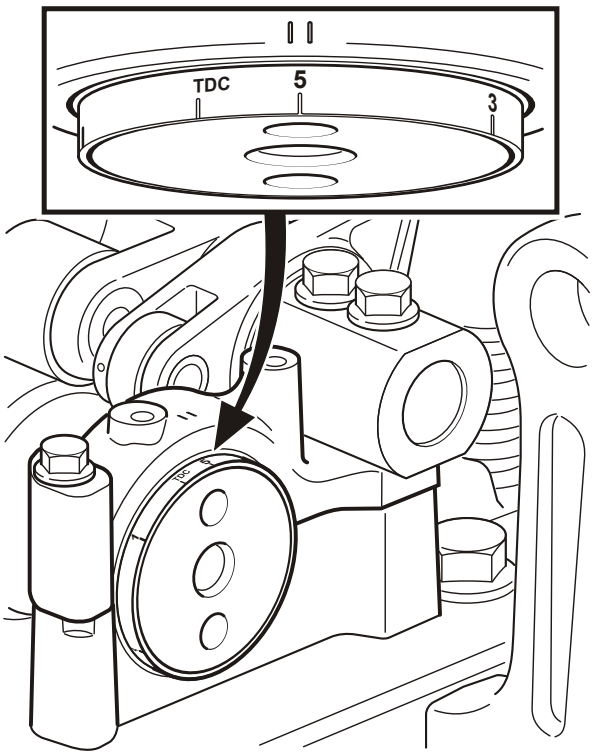


16 Remove the camshaft cap bolts. Check that the caps are marked.



P0005197

12 Where necessary, check the EGR rocker arm adjustment with a feeler gauge.
Check the play between the camshaft and the roller on the EGR rocker arm.
The play must be between **3.7 mm** (0.146”) and **3.9 mm** (0.154”).



P0002568

13 Rotate the crankshaft to the next camshaft mark and adjust the remaining valves in the same manner.