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## Service Data

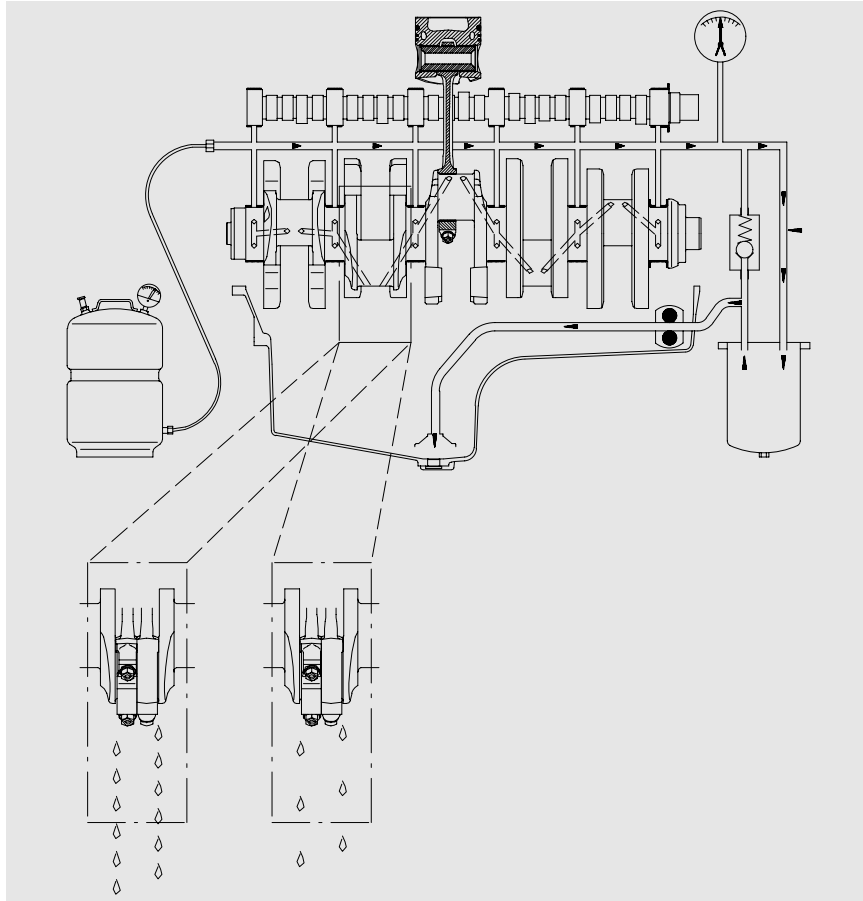
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Pressurising an engine affords the following advantages:

- All engine parts are lubricated before engine startup; a lubricating film can be built up inside the bearings as early as after the first few rotations of the crankshaft, thereby preventing damage to the bearing races
- Any loss of oil, be it the result of excessively large bearing play or leaks from the crankcase or from crankcase bores which may not be plugged, can be detected immediately. For this purpose, mount the engine on an assembly dolly, remove the oil pan and install a suitable oil collector under the crankcase in such a way that the bearings are visible



### Performance of pressurisation:

At least 30% of the total oil quantity is forced from the pressurisation container into the engine oil circuit. The operating pressure serves as the yardstick for the pressure to be forced in and must not be exceeded. The pressurisation container is connected up to the engine oil circuit at the oil filter (screw plug).





**Danger:**

Before starting the work, comply with “Special instructions when working on the common rail system” (see page 9).



**Caution:**

All connections and removed parts are to be closed **immediately** with suitable caps!

Dirt in the injection system causes:

- injectors to jam
- the high-pressure pump drive to break

The lines contain fuel.

Catch escaping fuel in a suitable container.

Fig. 1

Unscrew the union nuts ① of the high-pressure lines between the rail and high-pressure pump.

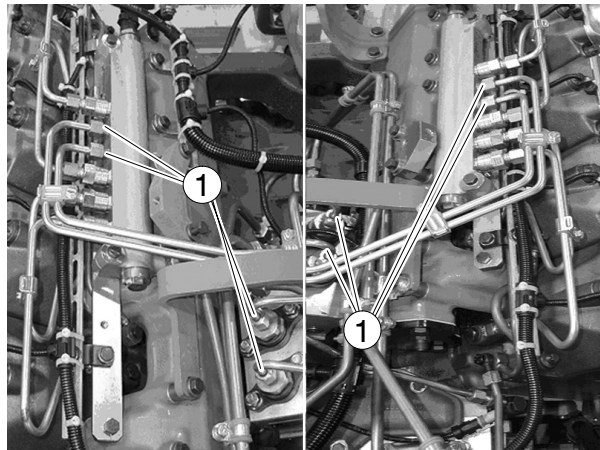
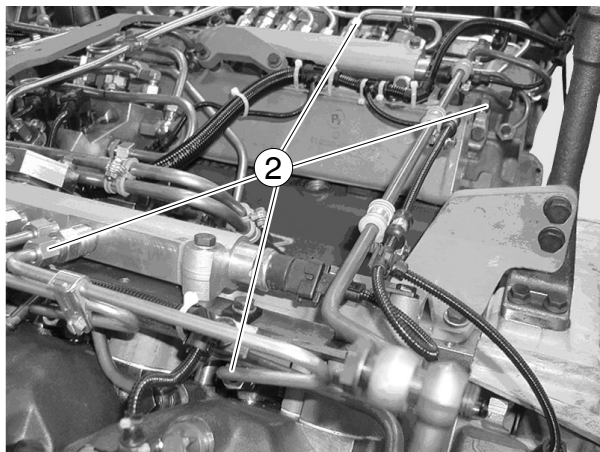


Fig. 2

Unscrew the union nuts ② of the high-pressure lines between the rail and injectors.

The lines are installed in reverse order.



**Danger:**

High-pressure lines with **WAF 17 union nuts must be replaced!**

High-pressure lines with **WAF 19 union nuts may be reused!**

Injection lines must be fitted without tension.

Tightening torques for high-pressure lines:

**Initial fit:**

Pretightening 10 Nm

Final tightening 60°

**Reuse:**

Pretightening 10 Nm

Final tightening 30°

Fig. 8

Use a support bridge ① and extractor tool ② (see page 172) to pull out the injector and pressure flange.

- Push the extractor tool ② through the support bridge ① over the injector, making sure that the clamping sleeve is turned back far enough
- Tension the clamping sleeve and pull the injector with knurled nut out of the cylinder head



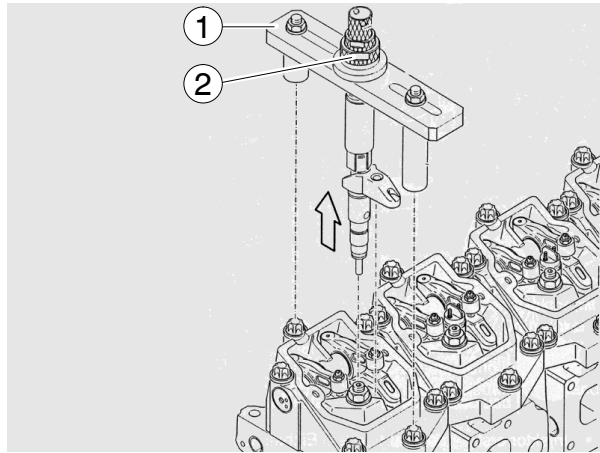
**Danger:**

Injectors must **not** be opened!



**Caution:**

**Immediately** close off the connection openings of the injector with suitable caps (see page 172) and place in the storage sleeve.



8

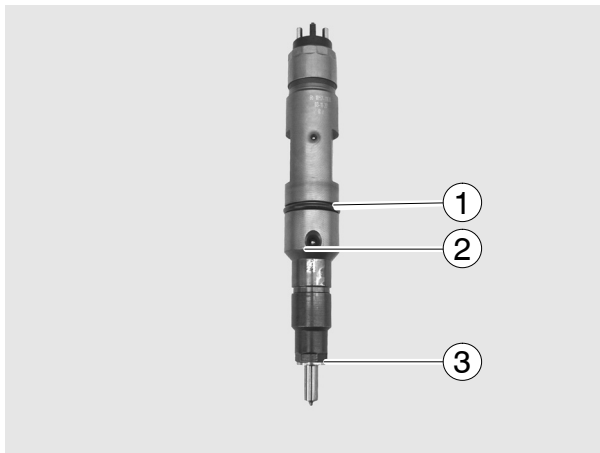
Clean the injector seat in the nozzle bushing.

### Fitting injectors

Fig. 9

Insert new O-ring ① and new copper sealing ring ③.

Grease the O-ring.



9

Figs. 10 and 11

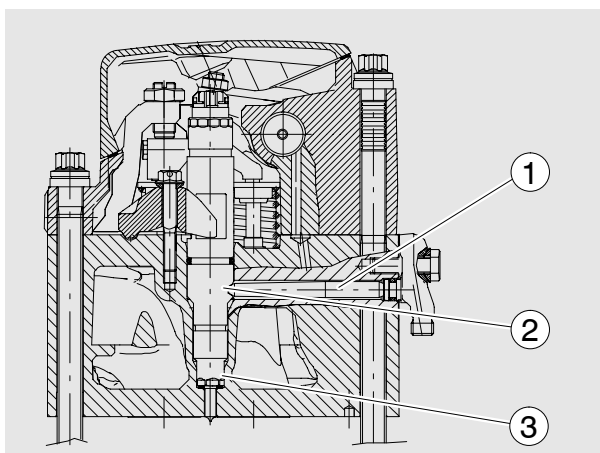
Insert the injector with pressure flange into the nozzle bushing in such a way that the feed bore hole ② (see also item ② on Fig. 9) points to the bore hole for the pressure pipe ① in the cylinder head.

Press in the injector by hand as far as it will go.

Pretighten the mounting bolt for pressure flange with **1.5 Nm**.



10



11

## Reassembling coolant pump

Fig. 8

Press in water pump bearing.

Fit the circlip.



**Note:**

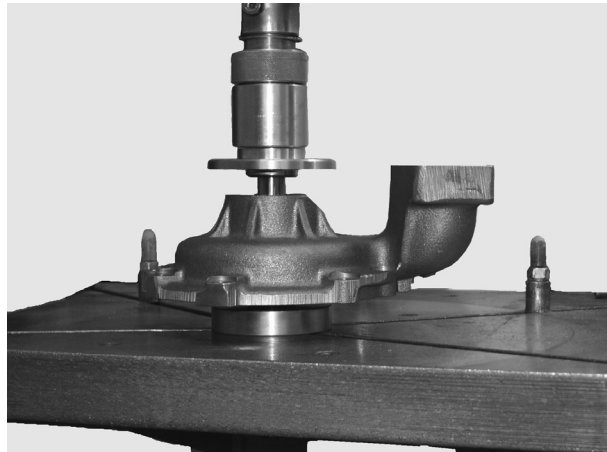
If you change the seals always install a new shaft and axial face seals.



8

Fig. 9

Press boss flush on to bearing shaft.

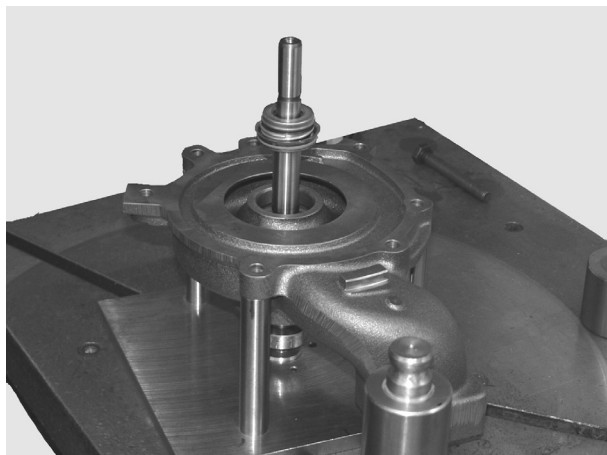


9

Fig. 10

Turn water pump housing over Press in new mechanical seal with press-fitting sleeve (special tool) until it stops.

Observe installation note for seal on page 50.

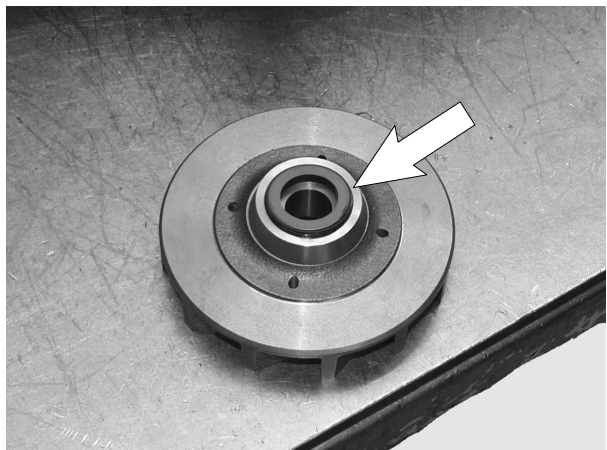


10

Fig. 11

Press in counterring (arrow) with a suitable pressing tool (may be possible by hand).

Install mechanical seal while "wet", i.e. to install it, coat holding sleeve and water pump shaft with a mixture of either 50% water and 50% cleaning spirit or 40% to 50% antifreeze agent as per MAN 324 and water.



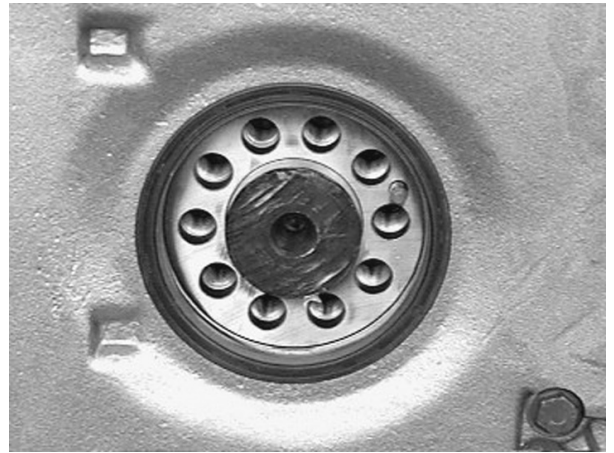
11

### Removing shaft sealing ring

Fig. 1

Remove flywheel, see page 65.

Prisey out the insulation ring with the special tool or a screwdriver



1

### Fit shaft sealing ring

Fig. 2

When fitting a new shaft seal, you should also exchange the bearing race of the flywheel.

Insert the new shaft sealing ring into the flywheel housing.

Use mandrel (special tool) to drive in sealing ring until flush.

Refer to the comments and assembly instructions on page 69.



3



## Removing the exhaust pipe

- Removing the turbocharger, see page 75

Fig. 1

Remove the guard plates.

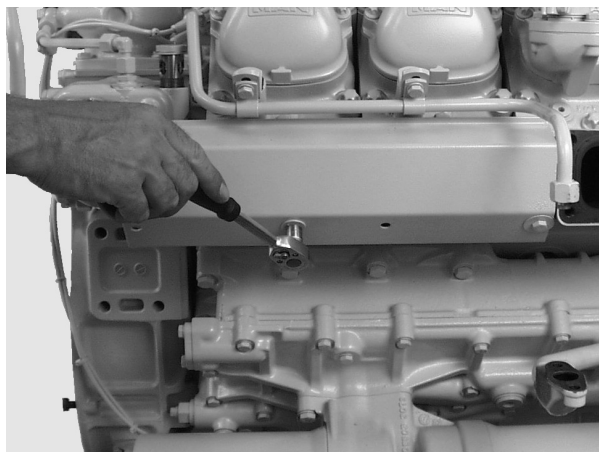




Fig. 2

 **Note:**  
The exhaust-gas pipe can be removed along with the attached turbocharger.

Loosen the securing bolts of the exhaust pipe.

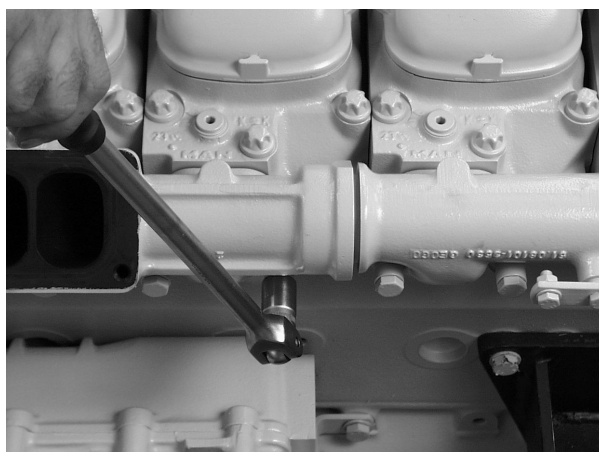
 **Danger:**  
The exhaust pipe is heavy.

Before unscrewing all securing bolts, if appropriate replace 2 bolts by stud bolts as guides.

The stud bolts with thread M10 have been produced by MAN.

Remove exhaust pipe.

1



2

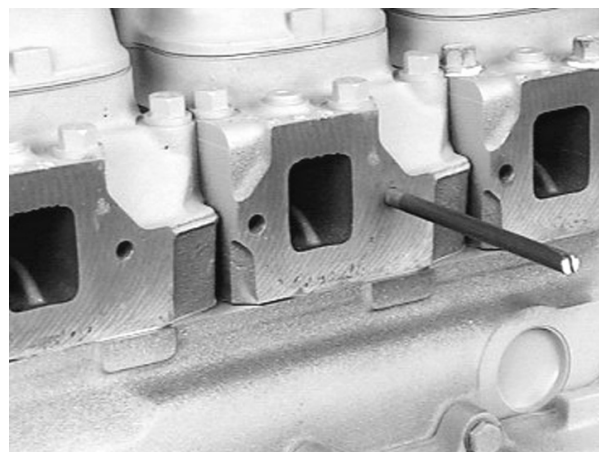
## Installing the exhaust pipe

Fig. 3

Before fitting the exhaust pipe, screw in 2 stud bolts as a guide.

Position the exhaust pipe with new gaskets.

Ensure that the gaskets are correctly seated.

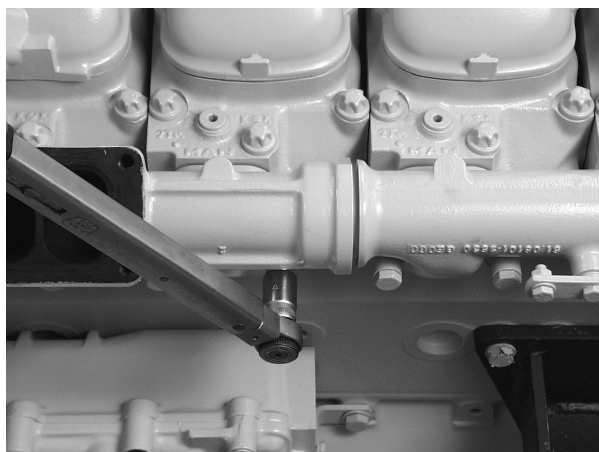


3

Fig. 4

Tighten the securing bolts with the prescribed torque (see "Service Data").

- Installing turbocharger



4



Adjust the valves only when engine is cold (max. coolant temperature 50°C).

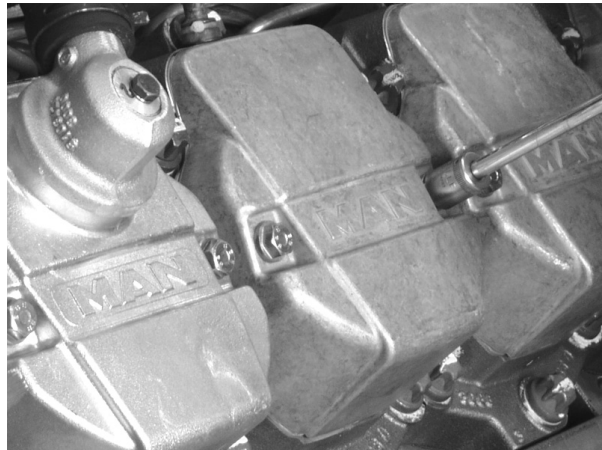
Fig. 1

Remove the cylinder head covers.



**Caution:**

Here, oil residues can escape.  
Old oil is hazardous waste.  
Observe safety instructions for the prevention of environmental damage.

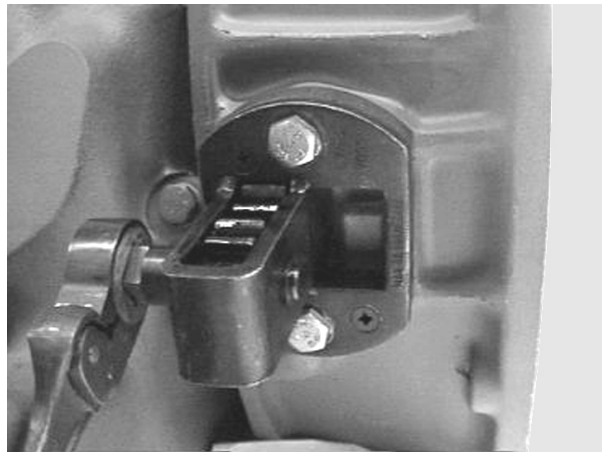


1

Fig. 2

Turn the engine using the barring gear until the piston of the cylinder to be set is at ignition TDC and the rocker arms are relieved of load.

The valves of the synchronised cylinder are then on overlap.



2

Fig. 3

D 2842 LE 620

Valves overlap in cylinder

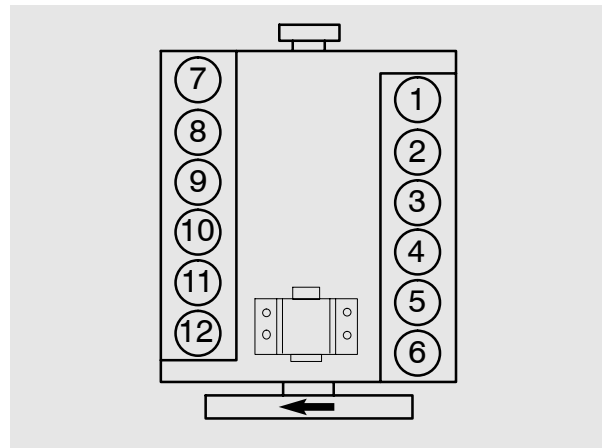
1	12	5	8	3	10	6	7	2	11	4	9
6	7	2	11	4	9	1	12	5	8	3	10

Adjust valves in cylinder

**Valve clearance:**

Intake: 0.5 mm

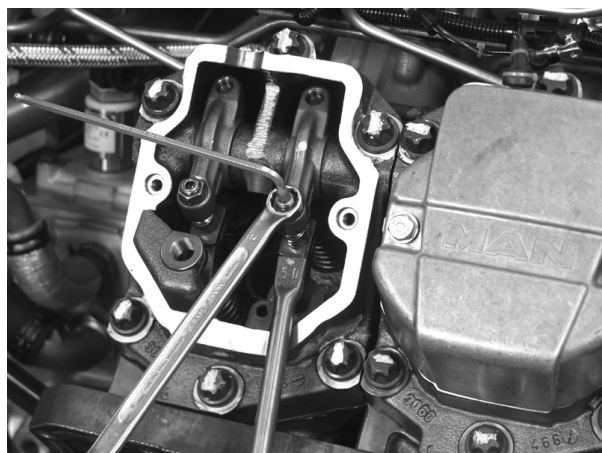
Exhaust: 0.6 mm



3

Fig. 4

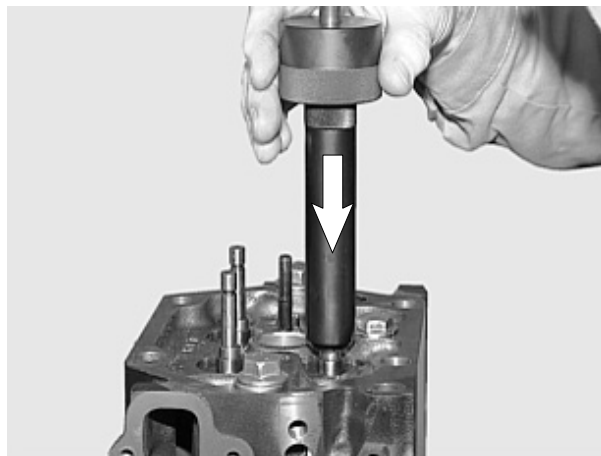
- Slide the feeler gauge between the valve bridge and the rocker arm
- Loosen lock nut and turn adjusting screw with screwdriver until feeler gauge can be moved with slight resistance
- Tighten the lock nut
- **Tightening torque: 40 Nm**
- Check the clearance once again
- Fit the cylinder head covers:  
Screw in the bolts by hand and then tighten



4

Fig. 17

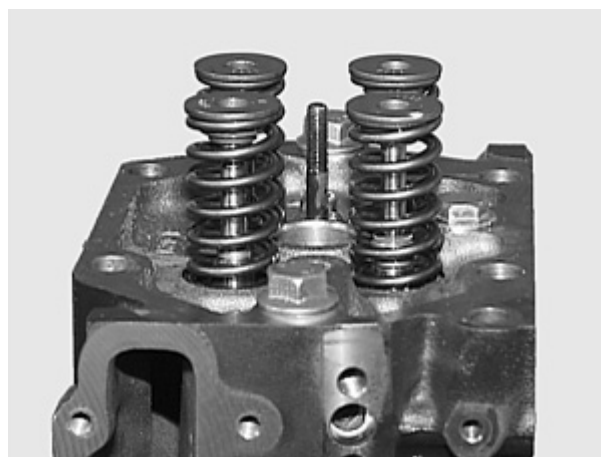
Press in the valve stem seal as far as it will go.  
Remove the guide sleeve.



17

Fig. 18

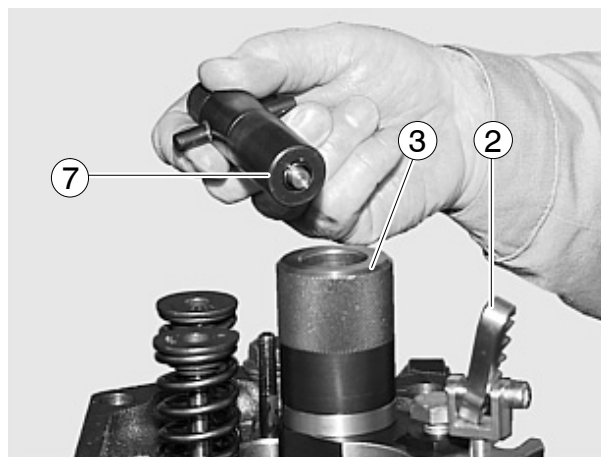
Mount the valve springs and spring seats.



18

Fig. 19

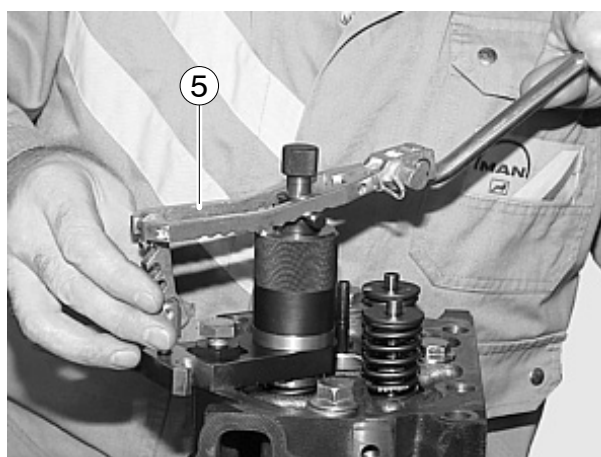
Fit guide sleeve ④ over the valve spring for centring.  
Mount anchor plate ② and guide sleeve ③ from the special tool kit.  
Insert the retaining wedges in mounting cartridge ⑦.



19

Fig. 20

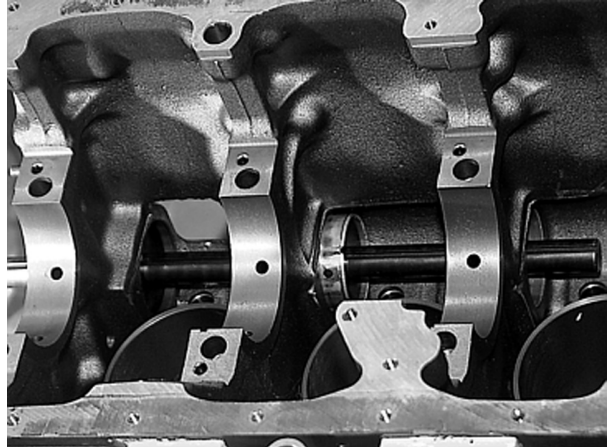
Insert the mounting cartridge in the guide sleeve and press down with pressure fork ⑤ as far as it will go.  
Release the pressure fork and remove the mounting cartridge.



20

Fig. 5

Use a soft hammer (plastic or copper) to knock out camshaft bearing bushes 2, 3 and 4 in succession.



### Press out the camshaft bearing bush, bearing 7

Fig. 6

Use the impact extractor (special tool) to pull out the cam bearing bush of bearing 7 from the fly-wheel side.

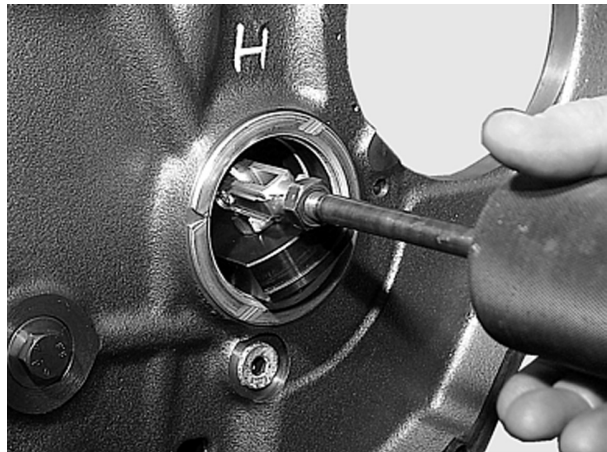
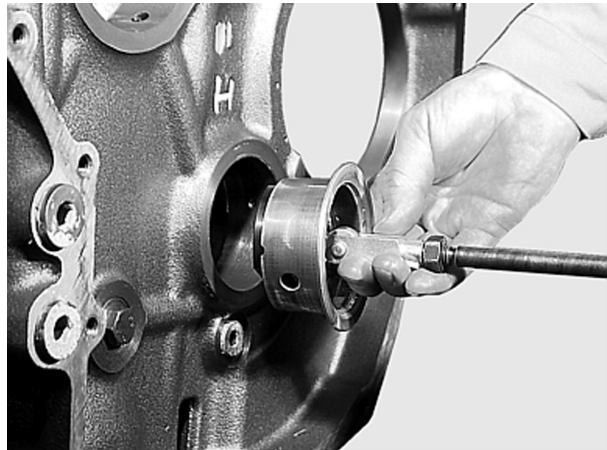


Fig. 7

Pull out the bearing bush.



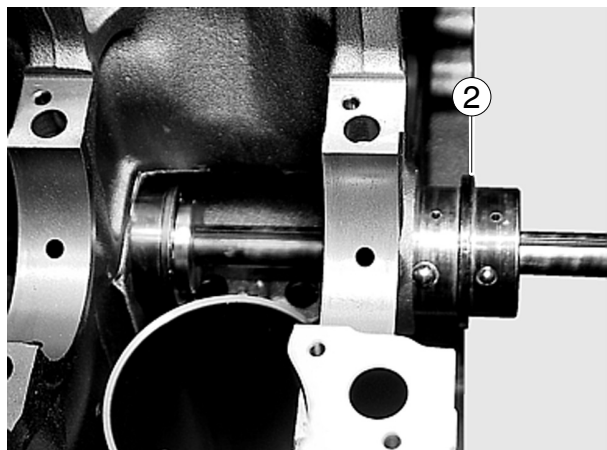
### Press out camshaft bearing bushes of bearings 5 and 6

Fig. 8

Press out the bearing bushes of bearings 5 and 6 from the flywheel side.

Place the guide bush ② on the shaft with groove, ensuring that you have the correct bush side (the sides have different diameters!).

The spring-loaded balls lock into the oil holes.



## Removing crankshaft

- Remove oil pan and oil pump, see page 55
- Remove timing case, see page 100
- Remove front cover of crankshaft seal, see page 61
- Remove all pistons with connecting rods, see page 118

Fig. 1

Remove the bolts from the conrod bearing covers, take out the conrods with pistons and set them down in order of installation.

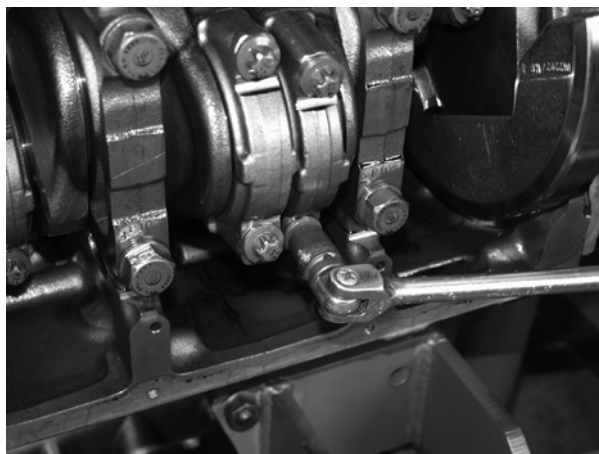


Fig. 2

Undo the side bolts of the crankshaft bearing cover.



**Note:**

Crankshaft bearing no. 1 is located on the opposite side of the flywheel.

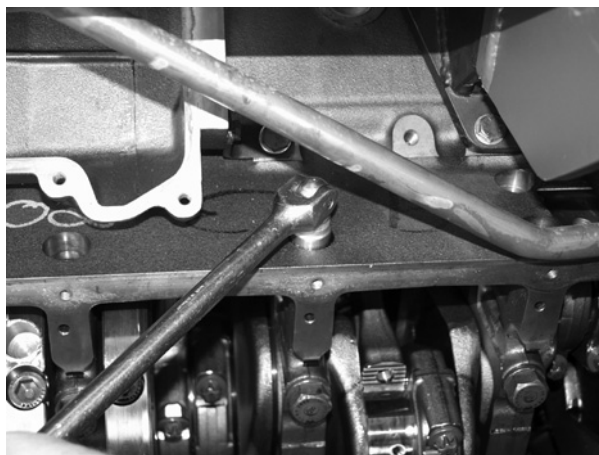


Fig. 3

Gradually loosen the securing bolts of the crankshaft bearing cover from inside to out and unscrew. Remove the bearing caps and place to one side in the order of installation.

Remove the bearing shell halves from the bearing caps and place to one side assigned to the bearing caps.

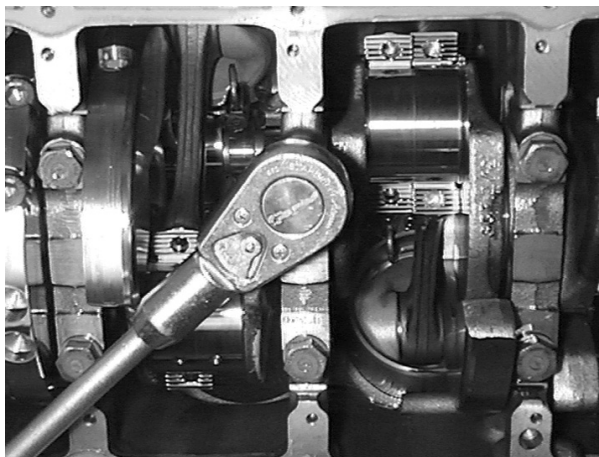


Fig. 4

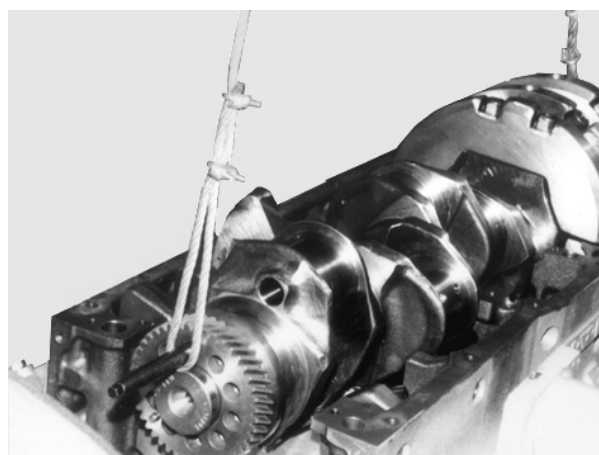
Lever out the crankshaft.



**Caution:**

Do not damage the bearing surfaces of the crankshaft bearing pins.

Remove the bearing bushes from the crankcase and place to one side in the order of installation. Clean the parts and check for wear; replace if necessary.



## Removing pistons from conrod and fitting

Fig. 1

Remove pistons with conrods.

Clamp the conrod in a vice using protective jaws.

Disengage piston pin fastening.



1

Fig. 2

Press out the gudgeon pin, in doing so, hold the piston. Remove piston and place to one side.



2

### Measure conrod foot bore (base hole)

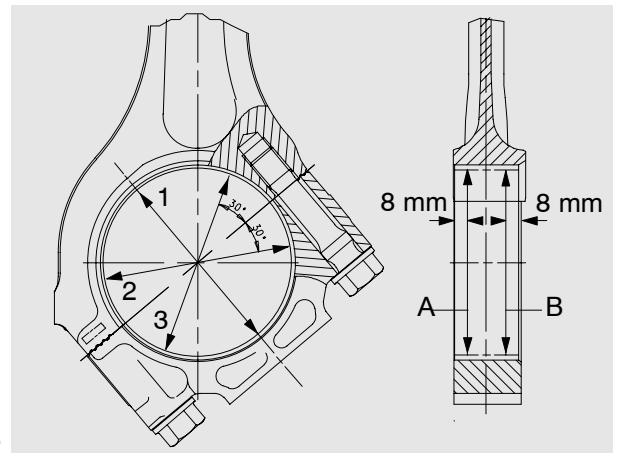
Fig. 3

Insert the new conrod bearing and fit the cap.  
Tighten bolts according to regulation.

Measure bearing bore hole with an internal micrometer in measuring directions 1, 2 and 3 as well as planes a and b.

Max. permitted values, see "Service Data".

In the case of deviations beyond the tolerance range, replace conrod.



3

Fig. 4

Piston pin sockets are not available.

In the case of worn sockets, fit exchange conrods.



4



Fig. 1

Disconnect the negative lead from the battery or, if fitted, switch off the battery master switch.  
Disconnect connection cable terminal 31 (negative pole, thick cable), connection cable terminal 30 (positive pole, thick cable) and terminals 48 and 50 from the starter.

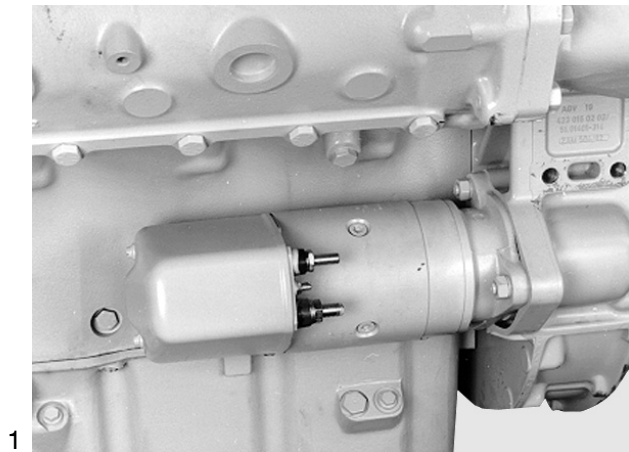


Fig. 2

Remove mounting nuts.



**Caution:**

An angle spanner is an advantage for accessing the inner screws (see illustration).

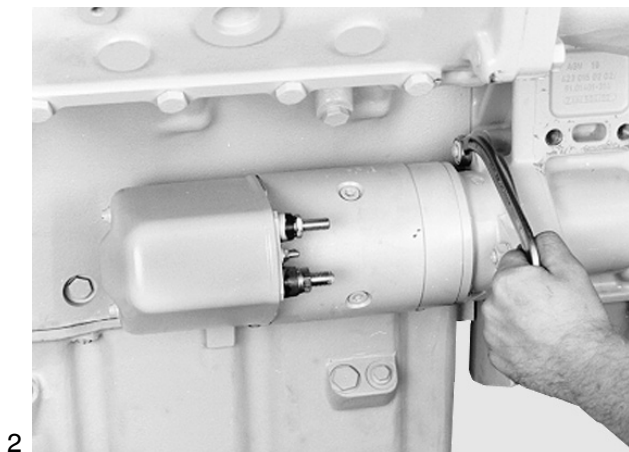


Fig. 3

Remove the starter motor.  
Check the starter pinion for wear and whether it can move freely. If necessary, clean piston using a brush dipped in fuel and regrease it.



Check the flywheel ring gear for wear and damage.

Turn over engine by hand once, paying particular attention to the positions at which the engine finally stops; i. e. when the engine is switched off it always stops in certain positions.

The starter pinion engages in these positions when the engine is started.


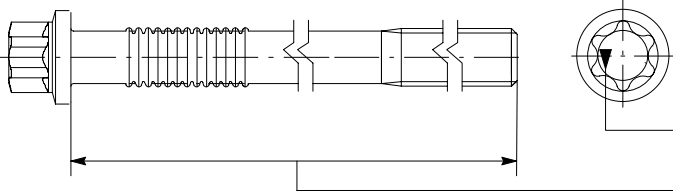
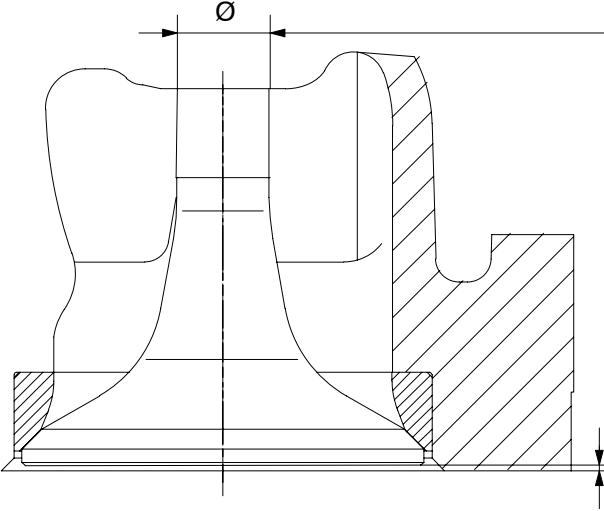
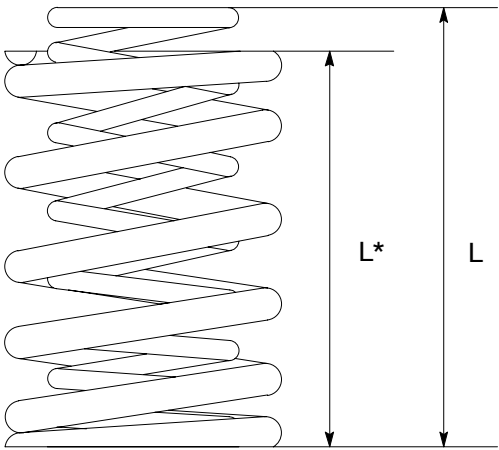
Replacing the starter ring gear, see page 66.

The starter motor is installed in reverse order to its removal; when doing so, connect the cables correctly and tighten the bolts as specified.

Connect the battery or turn on the battery master switch.

Check the function of the starter motor after installation.



Service Data	Dimensions Limit values	
<p><b>Cylinder-head bolts</b></p> 	<p>Length With each tightening, the bolts are deliberately stressed beyond the stretch limit and each tightening thus extends their length permanently. When the max. length has been reached, the bolt may no longer be used.</p> <p>Angle of rotation symbol</p> <p>51.90490-0041 / 0070: new: 259-259.5 mm, max. 261.5 mm</p> <p>51.90490-0042 / 0071: new: 197,5-198 mm, max. 200 mm</p>	
<p><b>Valve recess</b></p> 	<p>Intake valve: 8,963-8,977 mm</p> <p>Exhaust valve: 8,950-8,964 mm</p> <p>Valve recess: 0,70-1,00 mm</p>	
<p><b>Valve springs</b></p> 	<p>Inner spring: Free length (L), approx. 64,8 mm Spring force at L 46,38 mm: 142-158 N Spring force at L = 26 mm: 213-239 N</p> <p>Outer spring: Free length (L), approx. 63,3 mm Spring force at L 46,45 mm: 410-470 N Spring force at L = 33 mm: 714-790 N</p> <p>The lowest spring force is at the same time the wear limit value.</p>	