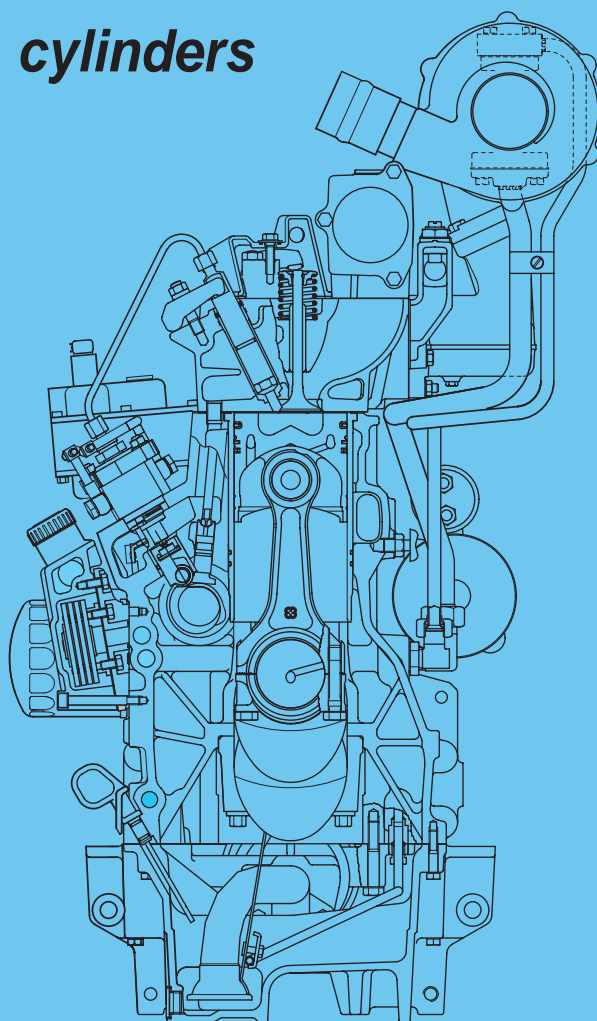
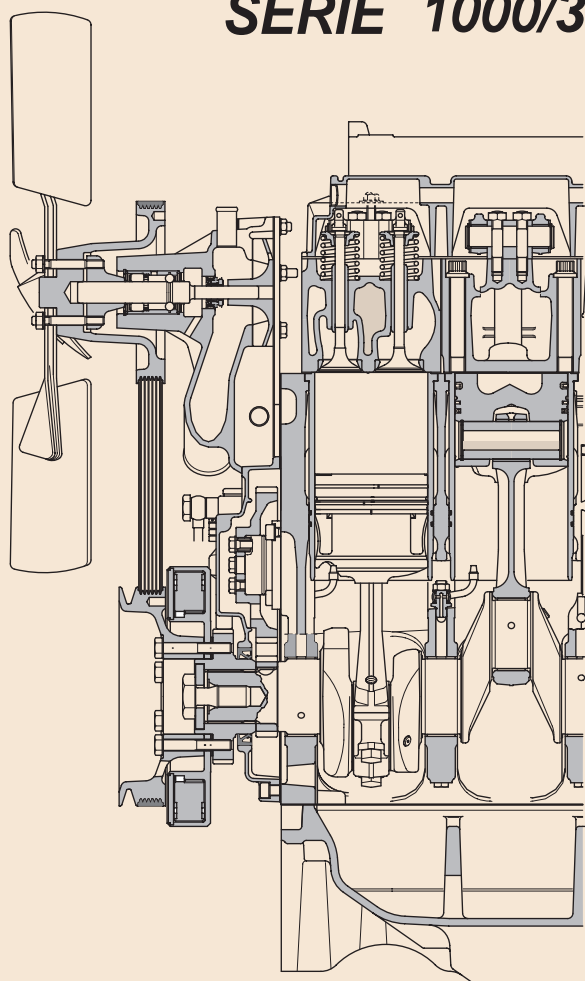




SAME DEUTZ-FAHR
ITALIA S.p.A.

ENGINE **EURO 2**

SERIE 1000/3-4-6 cylinders



WORKSHOP MANUAL

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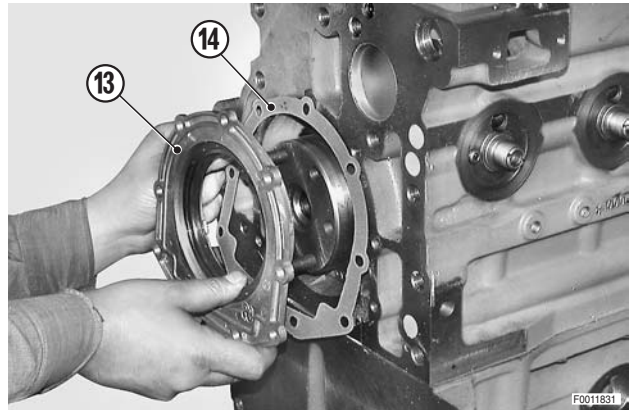
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THREADLOCKERS, ADHESIVES, SEALANTS AND LUBRICANTS

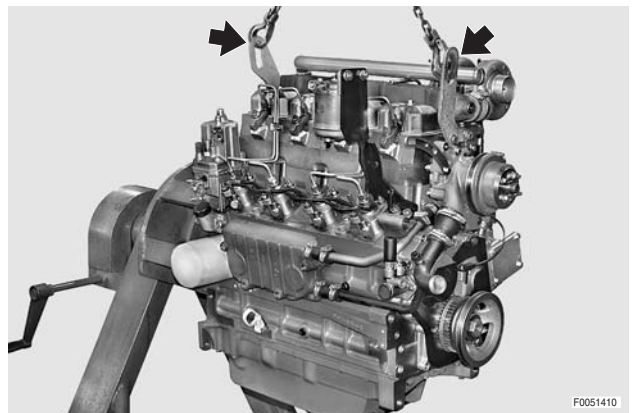


FUNCTION	DESIGNATION	DESCRIPTION
THREADLOCKER	Loctite 222 Colour: opaque fluorescent purple	Anaerobic product suitable for low-strength locking of retaining, adjustment and precision fasteners. All traces of lubricant must first be removed using the specific activator.
	Loctite 242 Colour: fluorescent blue	Anaerobic product that prevents loosening of all types of nut and bolt; used in place of conventional mechanical locking systems. Used for medium-strength locking. All traces of lubricant must first be removed using the specific activator.
	Loctite 243 Colour: opaque fluorescent blue	Alternative product to 242; oil tolerant and so can be used on lightly lubricated surfaces without prior use of activator.
	Loctite 270 Colour: fluorescent green	Anaerobic product for high-strength locking of bolts and studs that do not normally require disassembly. Parts must be heated to approximately 80°C for removal. All traces of lubricant must first be removed using the specific activator.
DEGREASERS AND ACTIVATORS	Loctite 703	Product used for degreasing and cleaning parts prior to application of Loctite anaerobic products; after drying, promotes uniform curing of threadlockers.
	Loctite 747	Product used specifically for treatment of passive metals prior to use of slow-cure anaerobic threadlockers (series 5 and 6). Can also be used to increase cure speed at low temperatures or in applications where there are large gaps between the parts.
SEALANTS (for faces and flanges)	Loctite 510 Colour: red	Super-rapid anaerobic sealant for sealing between rigid metal faces; can eliminate the need for conventional gaskets as it can fill gaps up to 0.4 mm. Does not shrink and therefore fasteners do not need re-tightening to specified torque values after curing.
	Loctite 542 Colour: brown	Anaerobic product used as a liquid sealant for threaded fittings up to 3/4" gas; rapid curing and parts may be disassembled with ordinary tools.
	Loctite 554 Colour: red	Anaerobic sealant and locking compound used for sealing cooling and industrial fluid circuits. Slow curing, also suitable for use on non-ferrous alloys.
	Loctite 572 Colour: white	Anaerobic sealant and locking compound used for sealing pipes and threaded fittings up to 2" in diameter. Very slow curing on most metal surfaces.
	Loctite 573 Colour: green	Thixotropic anaerobic product used for sealing joints between metal faces. Ensures total contact between surfaces with maximum tolerance of 0.10 mm, filling microvoids caused by flatness errors. Very slow curing on most metal surfaces and requires prior application of an activator.
	Loctite 576 Colour: brown	Anaerobic product used as a liquid thread sealant for large diameter threaded fittings (up to 2"). Very slow curing; also suitable for non-ferrous alloys and parts requiring subsequent removal.

- 12 - Remove the screws and remove the rear oil seal cover (13) complete with its gasket (14).
 - ★ Fit a new oil seal on reassembly.



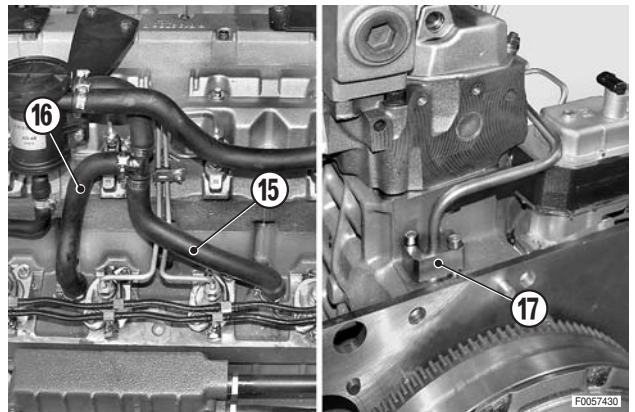
- 13 - Attach the lifting brackets of the engine to a hoist and mount the engine on a suitable engine stand capable of supporting and rotating the engine.



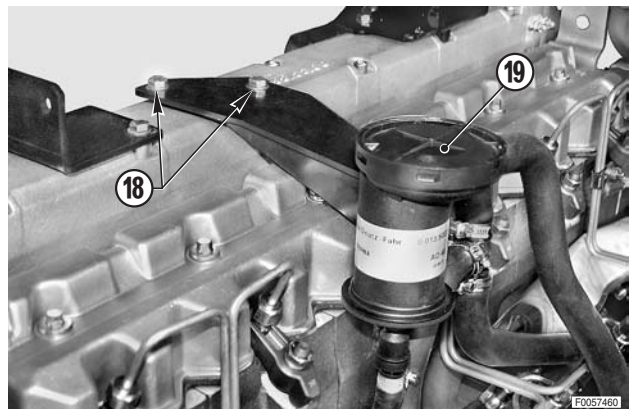
Removal of the blow-by assembly

! The blow-by assembly illustrated is just one of the solutions adopted; assemblies fitted to other engine models may differ from that shown, but the removal procedure is the same.

- 14 - Loosen the clamps and disconnect the oil vapour recovery pipes (15) and (16).
- 15 - Unscrew and remove the screws and remove the oil recovery flange (17).
 - ★ Renew the oil seal on reassembly.

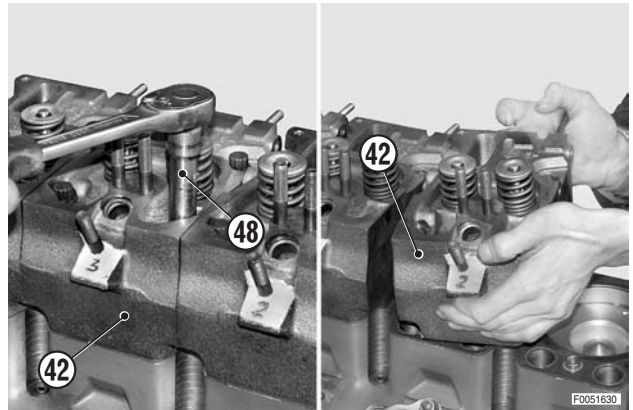


- 16 - Remove the screws (18) and remove the blow-by assembly (19) complete with pipes.



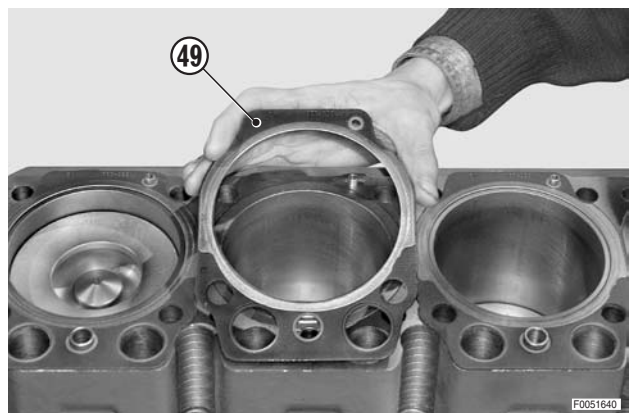
26 - Loosen and remove the retaining bolts (48) of the cylinder heads (42).

27 - Remove the complete cylinder head assemblies (42).

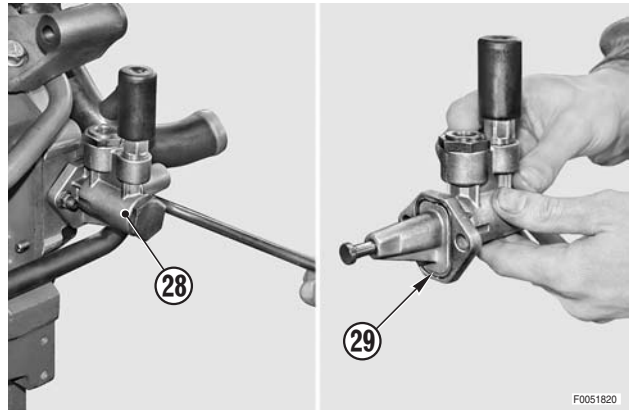


28 - Remove the head gaskets (49).

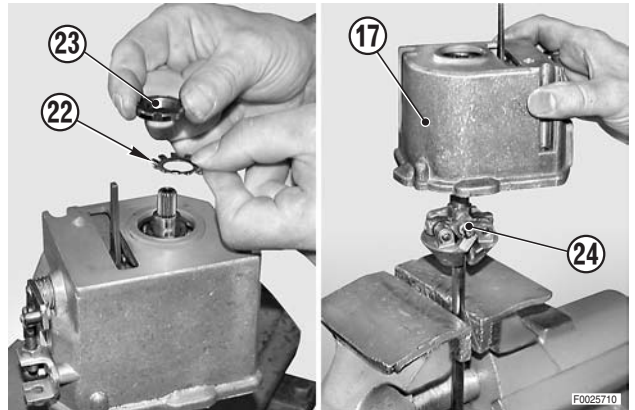
- ★ If the cylinder heads are to be refitted without renewing the cylinder liners, make a note of the type of gasket used for each cylinder head. The thicknesses of the head gaskets can be determined by the presence or absence of identification holes punched in the tab with central oil hole. (For details, see «22 DETERMINING GASKET THICKNESS AND CYLINDER HEAD ASSEMBLY»).



- 16 - Undo the nuts and remove the fuel lift pump (28).
★ Carefully inspect the condition of the gasket (29).

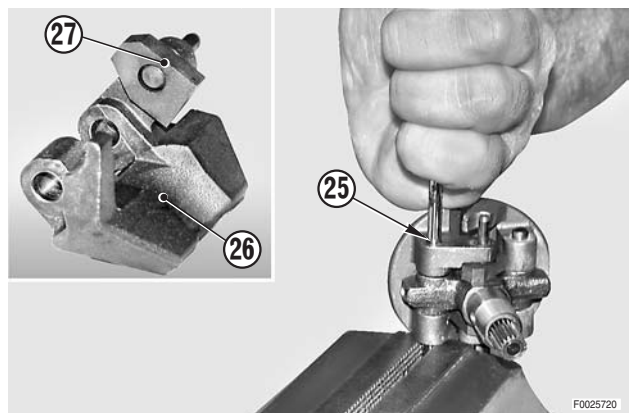


- 16 - Remove the ringnut (23), the lock washer (22) and withdraw the lower housing (17) from the shaft.



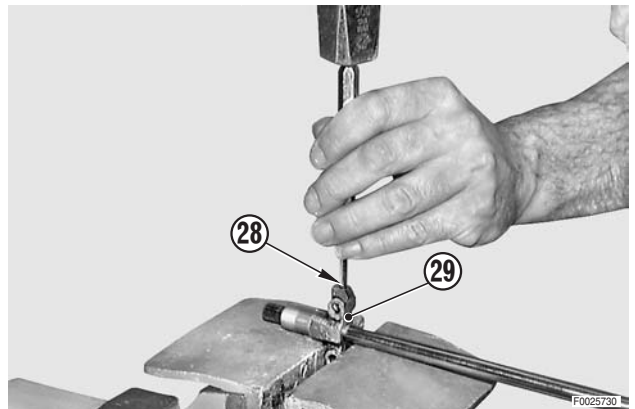
- 17 - Using a pin punch, withdraw the pivot pins (25) and remove the flyweights (26).

★ Note which way round the counter blocks are installed (27).



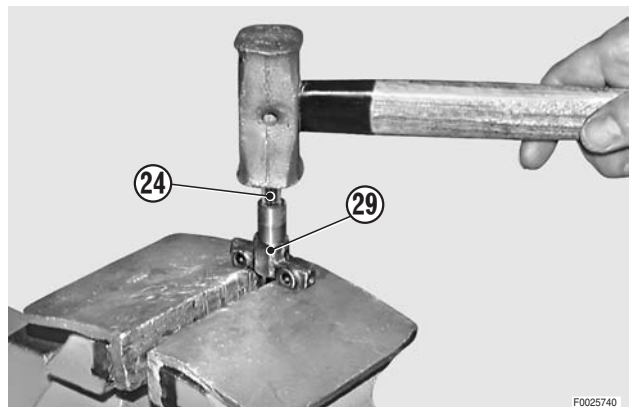
- 18 - Using a pin punch of suitable diameter, remove the spring pin (28) securing the flyweight support (29).

⊠ 2



- 19 - Using a soft-face mallet (aluminium or copper), drive out the shaft (24) from the support (29).

⊠ 3

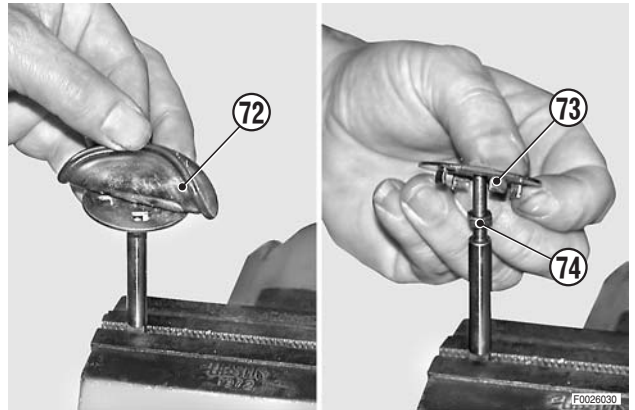


7 - Remove the membrane (72).

★ Note which way round the membrane is installed.

8 - Raise the guide plate (73) and tighten the nut (74) by about 2 turns.

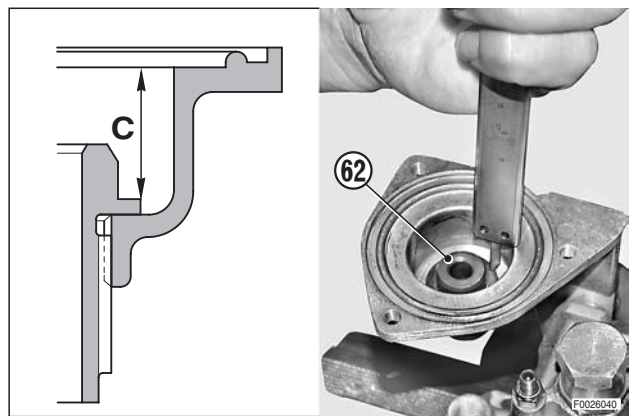
⚠ This operation is to be carried out **only** when it is necessary to check that the membrane stroke is centred correctly; in the case of renewal only, this operation is not necessary **because the position of the lower nut (74) does not change.**



8.2.3 Completion of the disassembly

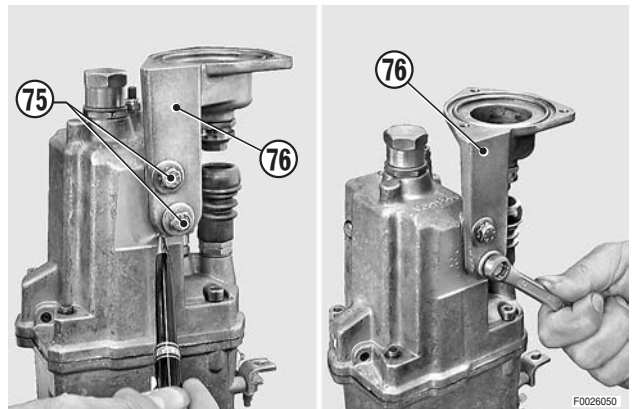
9 - **Only in the case of renewal of the membrane guide bush or the valve body:** measure the distance "C" between the surface of the guide disc and the face of the spring support bush (62). ✖ 1

⚠ Make a note of this distance, which must be restored on reassembly.



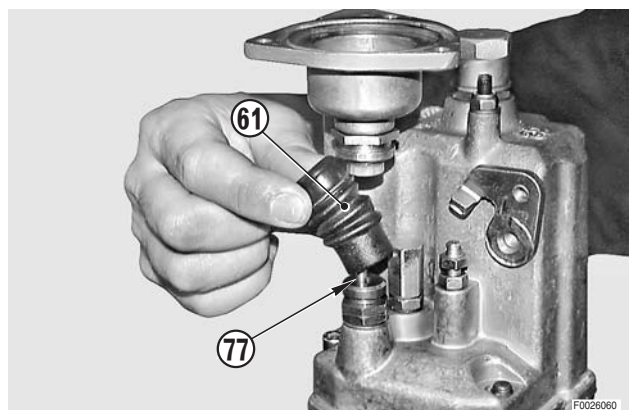
10 - **Only in the case of renewal of the valve body:** mark the position of the L.D.A. valve body on the upper governor housing and remove the screws (75) and valve body (76). ✖ 2

★ **Only where present:** mark the positions of any shims installed between the valve body and the governor housing to avoid confusion on reassembly.



11 - Remove the gaiter (61).

★ Take care not to deform the rod (77) controlling the stroke of the injection pump control rod.



9.1 CALIBRATION OF ELECTRONIC ACTUATORS

Engine type	Rated power kW (hp)	Engine speed			Fuel control screw
		Minimum rpm'±20	Maximum (without load) rpm(±)	Speed at max. power rpm±5	n° of screw turns at 2100 rpm±10



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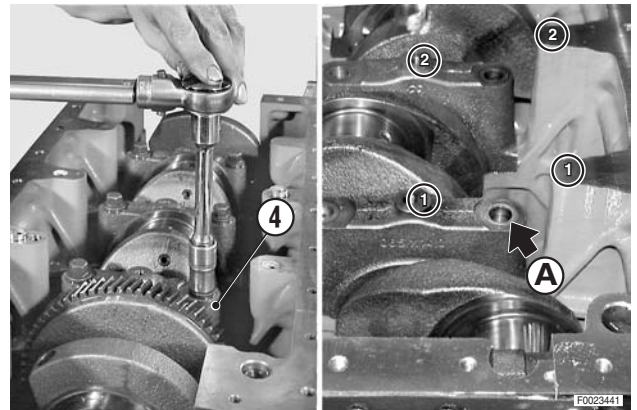


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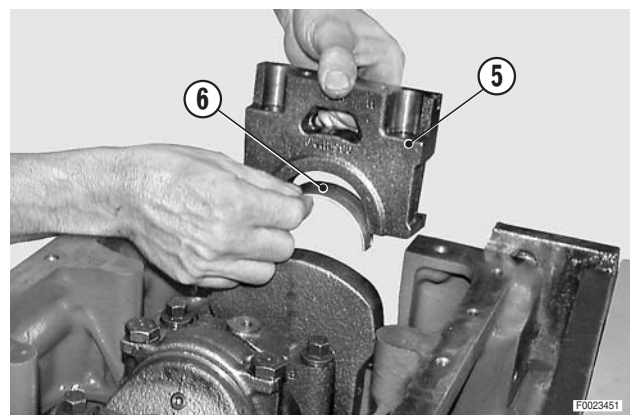
3 - Remove the bolts and the central main bearing caps (4) complete with the half shells.

- ★ Mark the half shells with the relative main bearing caps for subsequent dimensional checks.
- ★ Note that the central main bearing caps and their relative crankcase positions are stamped with the same number. The symbol "A" points towards the injection pump side of the engine.



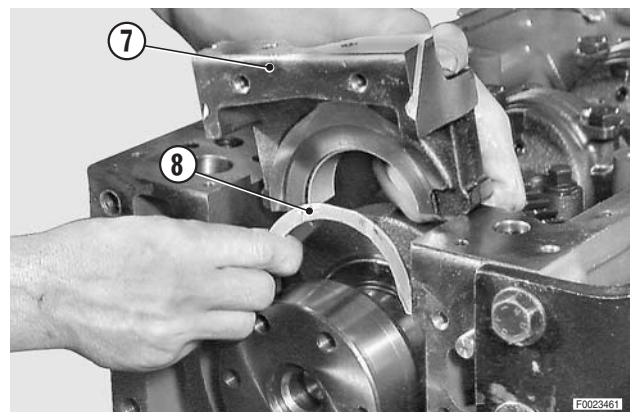
4 - Remove the cap bolts and remove the front main bearing cap (5) complete with the half shell (6).

- ★ Mark the front bearing half shell and the corresponding main bearing cap for subsequent dimensional checks.
- ★ Along with the main bearing are also removed the triangular seals that must be renewed at each re-assembly.

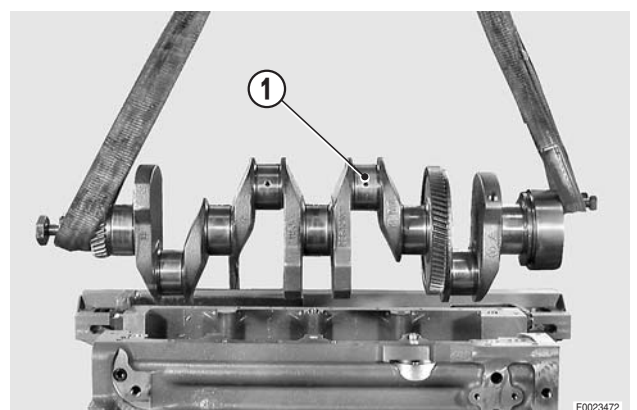


5 - Remove the bolts and the rear main bearing cap (7) complete with the half shell and thrust washers (8).

- ★ Mark the half shell and the rear main bearing cap for subsequent dimensional checks
- ★ Note which way round the thrust washers are installed. The oil grooves are oriented towards the crankshaft.
- ★ Along with the main bearing are also removed the triangular seals that must be renewed at each re-assembly.



6 - Attach the slings of hoist to the crankshaft (1) and lift it clear of the crankcase.



16.1.8 Renewal of the copper bushes

★ These operations should be carried out by a specialised machine shop.

1 - Ream out the old bush mechanically using a system with swarf extraction; remove enough material from the inside diameter so that the bush can be easily deformed and thus withdrawn.

2 - Remove all traces of old sealant and metal particles from the groove "C".

★ Take care not to damage the bush seating bore.

3 - Thoroughly degrease the bush seating bore and the new bush.

4 - Apply silicone sealant to groove "C".

 Sealant: DIRKO TRANSPARENT

★ Once the sealant has been applied, the new bush must be inserted within 10-15 minutes; if this time period elapses without inserting the bush, the sealant must be removed and fresh silicone applied.

5 - Insert the bush in the bore in the cylinder head and press it fully home against seat "D".

6 - While maintaining the pressure, widen the bush to improve the axial seal to a depth "A" of 31 mm (1.22 in.) from the face.

7 - Calibrate the nozzle seat using a

★ Ball calibration tool:

Ø 7.3 \pm 1 mm (0.288 \pm 0.0394 in.)

8 - Check the measure "B" correspond to that indicated in «TECHNICAL DATA AND DIMENSIONS».

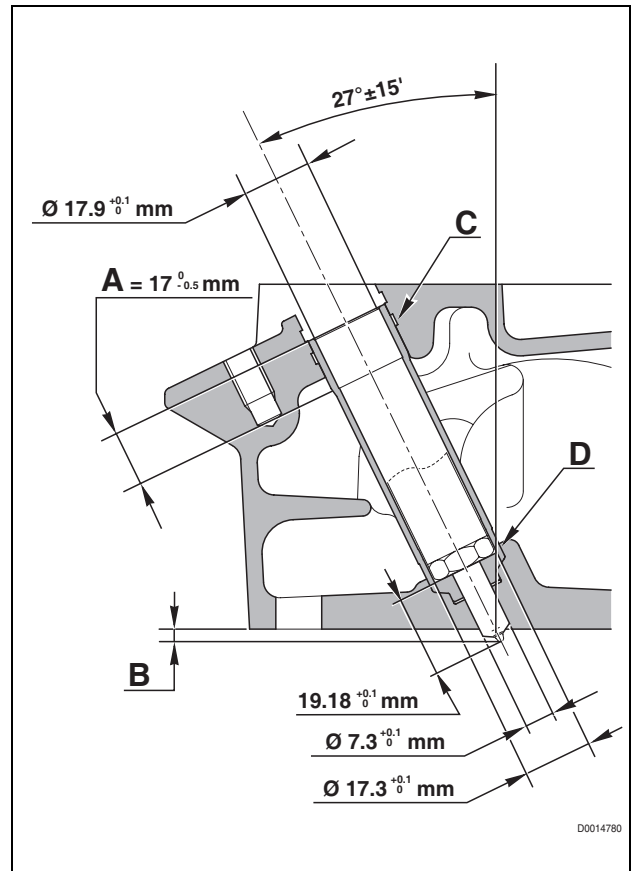
16.1.9 Inspecting the rocker arms and pivot posts

1 - Measure the inside diameters of the rocker bushes and the diameters of the pivot posts.

Use a dial bore gauge and a micrometer.

If the wear exceeds the tolerance limits indicated in «TECHNICAL DATA AND DIMENSIONS», renew the rocker bushes and the pivot posts.

★ When renewing rocker bushes, take great care that oil holes and grooves are correctly oriented (see «TECHNICAL DATA AND DIMENSIONS»).



TESTING THE INJECTION PUMPS

Injection pump testing and calibration must be carried out by a specialised service centre equipped with a pump test bench and the necessary test and calibration equipment.

The service centre must be given the technical specifications indicated in this section.

PUMP CHARACTERISTICS code 2.4619.190.0

Injection pump	type	BOSCH PFM1A 90S 2503
Pumping element code (BOSCH)		0 414 396 004
Identification plate	colour	Blue
Control rod stop position at point X	mm (in.)	9.5 (0.374)
Full stroke	mm (in.)	19 (0.749)
Nominal pre-lift for delivery start	mm (in.)	4.2 (0.165)
Constant pressure reflux valve calibrated to	bar (psi)	70 (1015.2)
BDC Cam Box	mm (in.)	56 (2.206)
Cam lift	mm (in.)	10 (0.394)

TEST METHOD

• Cam Box	BOSCH D 412 010 466 - 3 247 5 0133
• Engine injector:	Dis. 1.688.901.031
• Pressure	172 bar (2494 psi)
• High-pressure fuel pipe:	Ø 6x1.5x267 mm (0.236x0.059x10.512 in.)
• Supply pressure:	0.4 ± 0.05 bar (5.8 ± 0.725 psi)
• Cam:	BOSCH C 412 010 658 - 3 247 5 0133 003

INJECTION PUMP CALIBRATION

	Rotation speed rpm	Control rackstroke mm	Delivery (mm ³ /shot)	
			Calibration	Test
Calibration	375	- 1.0 (- 0.0394)	14.0-15.0	9.5-19.5
1st test	700	4.8 (0.189)	109.0-115.0	108.0-116.0
2nd test	1175	4.8 (0.189)	99.0-105.0	98.0-106.0
3rd test	100	9.0 (0.355)	119.5-137.5	118.5-138.5

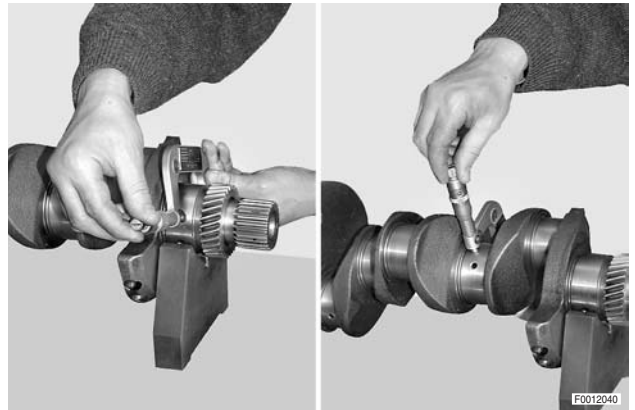
CALIBRATION METHOD

- 1 - Position the pump on the Cambox, with the lever in the STOP position.
- 2 - Set the measuring instrument to zero.
- 3 - Move the control lever from the STOP position to the full stroke position (19 mm).
- 4 - Lock the control lever in position with a BOSCH lock pin.
- 5 - Fix the pump to the plunger assembly.
- 6 - Release the control lever by removing the BOSCH pin and move the plunger assembly to the STOP position (the control lever stroke should return to "zero")
- 7 - Check that stroke distance from the STOP position to the full-stroke position is 19 mm.
- 8 - Check that injection starts at a plunger stroke position of 5.5 – 5.65 mm with a control rod stroke of 2 mm.

16.5 CRANKSHAFT

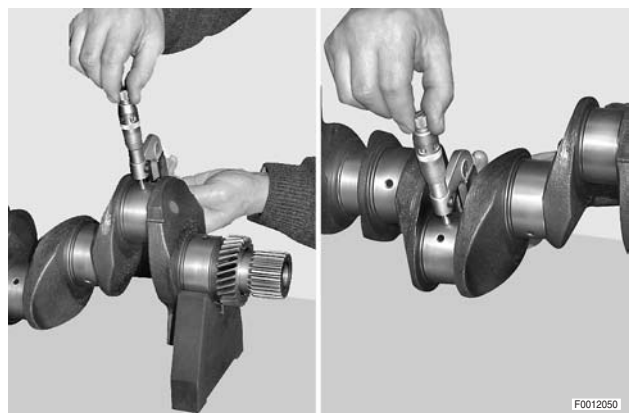
1 - Using a micrometer, measure the diameters of the main bearing journals and the crankpins.

- ★ Measure the diameter of each journal at several points around the entire circumference to detect taper and out-of-round errors.



2 - If the dimensional errors of even just one journal exceed the tolerance limits specified in the «TECHNICAL DATA AND DIMENSIONS» the entire crankshaft will have to be reground, and the diameters of the journals reduced to one of the specified undersizes.

- ★ If the crankshaft is reground, it will be necessary to fit new big-end and main shell bearings.

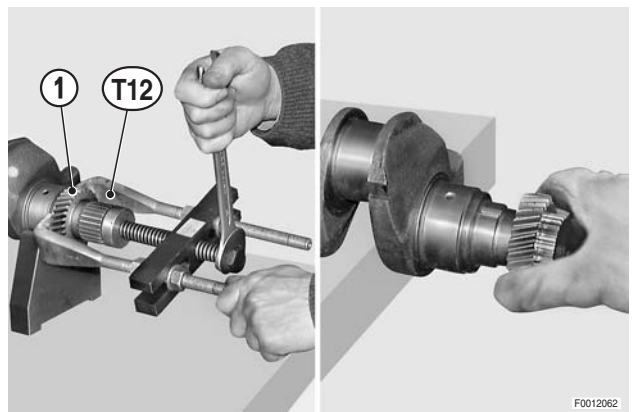


Only if necessary

3 - Using puller **T12** (code 5.9030.008.4/10) remove the timing gear (1) from the crankshaft

4 - Heat the new timing gear on a hot plate and fit it on the crankshaft, ensuring that it is positioned up against the shoulder.

- ★ Check the condition of the key.

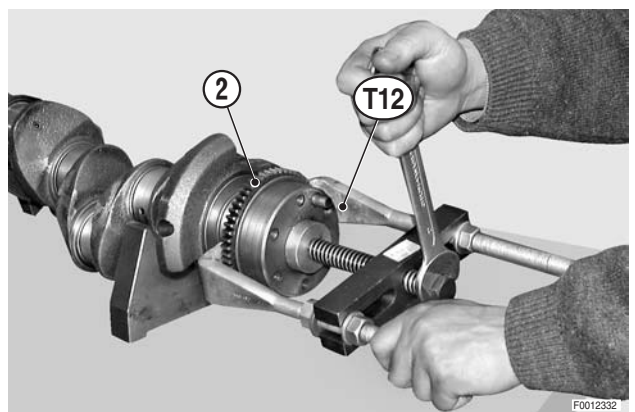


6-cylinder version

If necessary, replace the lubrication oil pump drive gear.

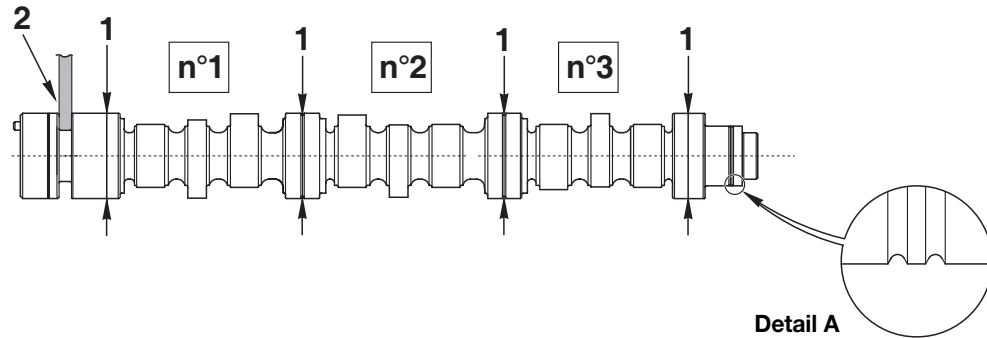
5 - Using puller **T12** (code 5.9030.008.4/10), remove the oil pump drive gear (2).

- ★ Remove all traces of old sealant from the crankshaft.

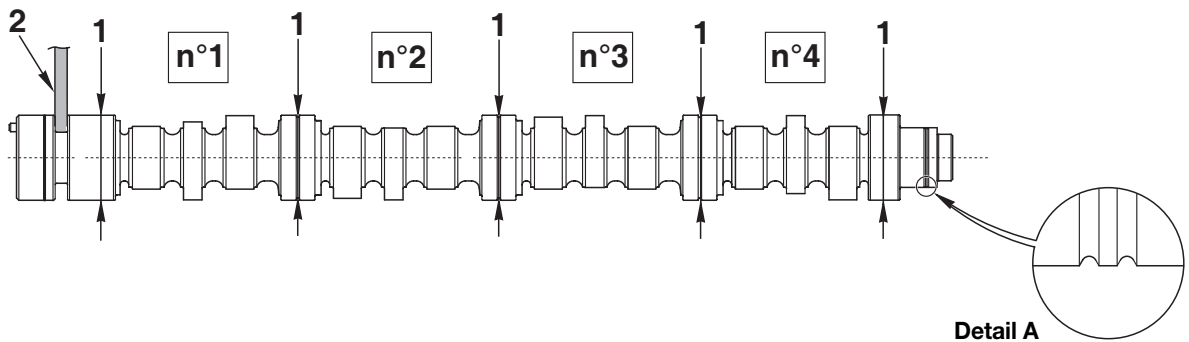


CAMSHAFT (16° STATIC ADVANCE)

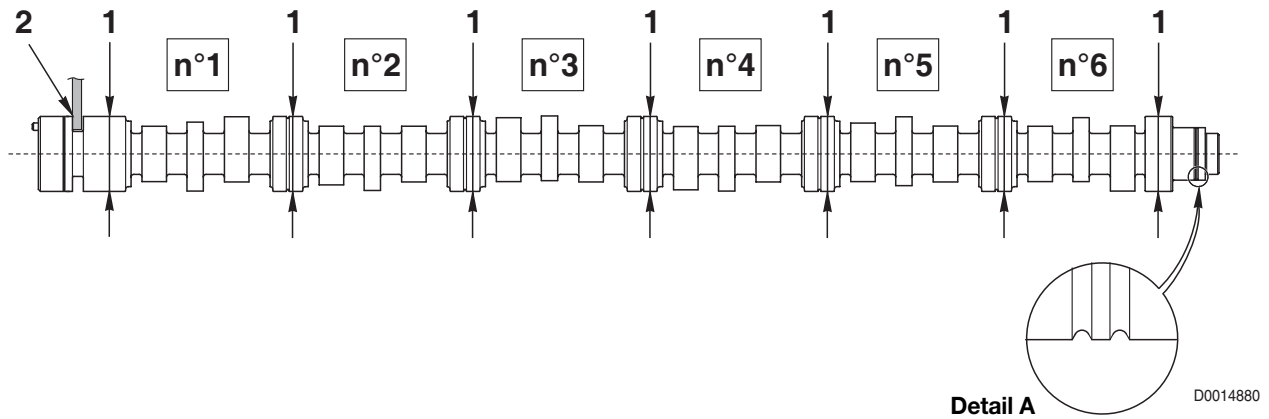
3-CYLINDERS



4-CYLINDERS




6-CYLINDERS

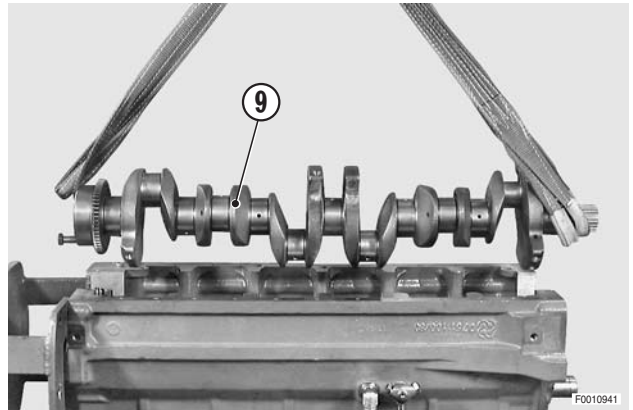


Unit of measurement: mm (in.)

Pos.	Dimensions	Normal measurement	Maximum tolerance limit	NOTES
1	Camshaft journal	54.970 – 55.000 (2.1658 – 2.1670)	54.950 (2.1650)	
2	Endfloat	0.08 – 0.206 (0.0032 – 0.0081)	Max. 0.25 (Max. 0.001)	

- 7 - Liberally oil the main bearing shells (7) and the thrust washers (8) and lower the crankshaft (9) into position.

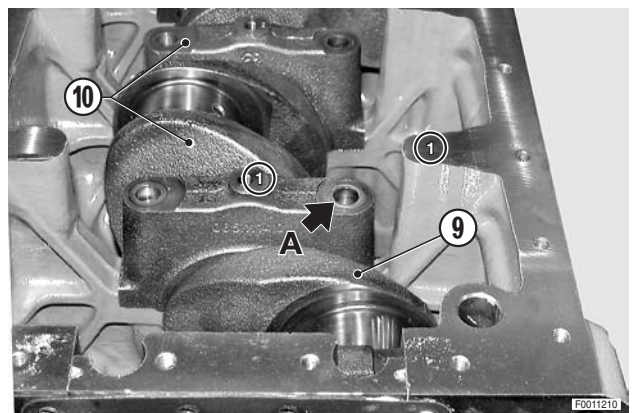
 Bearing shells and thrust washers: Engine oil



- 8 - Liberally oil the crankshaft (9) and fit the main bearing half shells and caps (10).

 Crankshaft: Engine oil

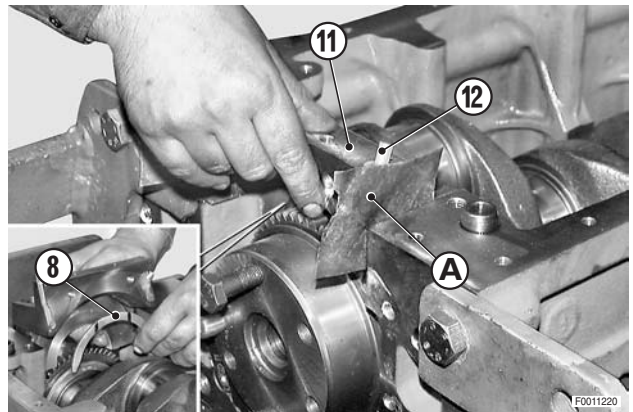
- ★ Make sure that the caps (10) are fitted the right way round; the smaller diameter spot face "A" should be on the injection pump side of the block. The main bearing caps are numbered and must be fitted in the correct sequence in accordance with the numbers marked on the block.



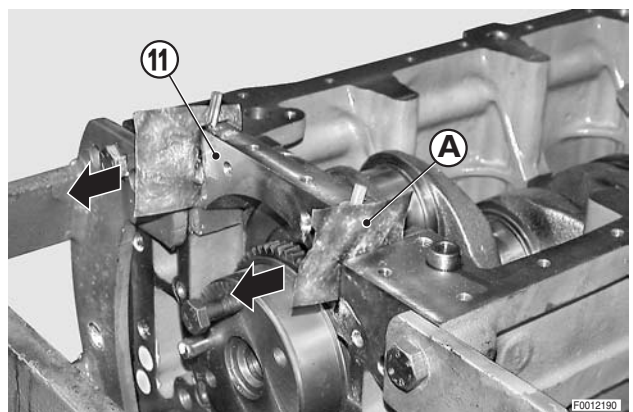
- 9 - Fit the upper semi-circular thrust washers (8) and the triangular seals (12) to the rear main bearing cap (11).

- ★ Apply grease to the thrust washers and seals to stick them in position; also apply grease to the outer surfaces of the seals.

- 10 - Position two guide sheets in soft material "A" (thickness 0.3 mm (0.012 in.)) and fit the rear main bearing cap.



- 11 - Insert the cap bolts and hand tighten to hold the bearing cap (11) in position; withdraw the guide sheets "A" by pulling them in a crosswise direction relative to the seal.




25. REFITTING THE MECHANICAL GOVERNOR DRIVE AND THE ELECTRONIC GOVERNOR SUPPORT

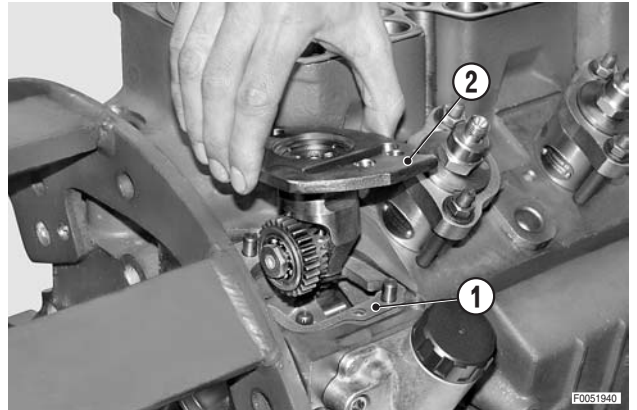
3-, 4- and 6-cylinder versions with mechanical governor

3-, 4-cylinder versions with electronic actuator

1 - Position the gasket (1) and fit the drive gear (2) centering the oil pump drive shaft (for 3- and 4-cylinder versions) or guide shaft (for 6-cylinder versions).


★ Lubricate the drive gears and the shaft.

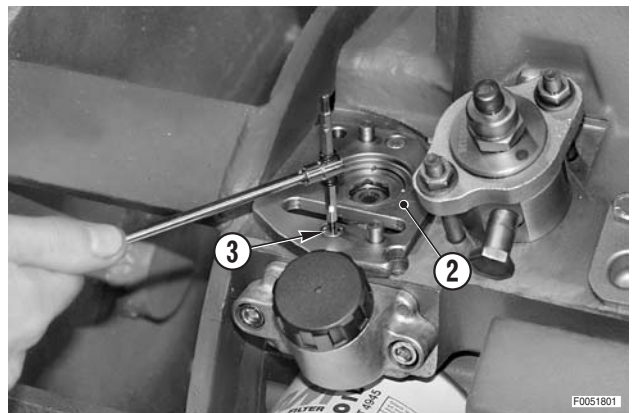
 Gears: engine oil



2 - Fix the drive gear (2) with bolts (3).

3 - Lubricate the gears and the bearings pouring approx. 30 cm³ of oil in the flange.

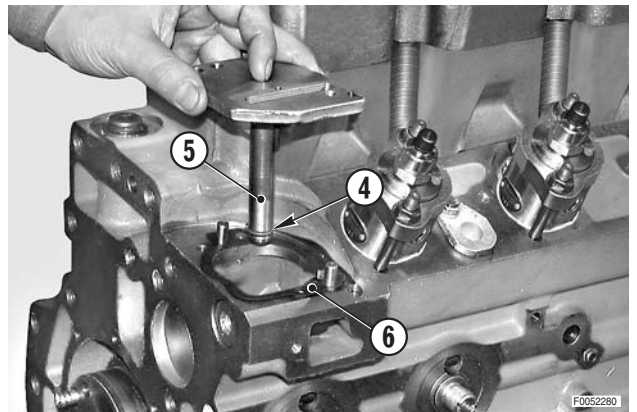
 Gears: engine oil



6-cylinder version with electronic actuator

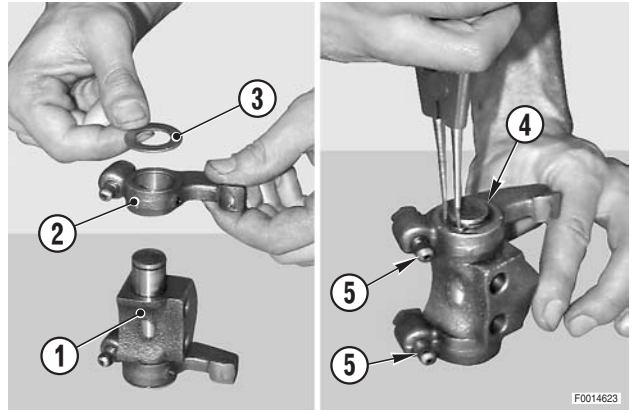
4 - Position the gasket (6) and fit the actuator support (5).

★ Check that the O-ring (4) is present.




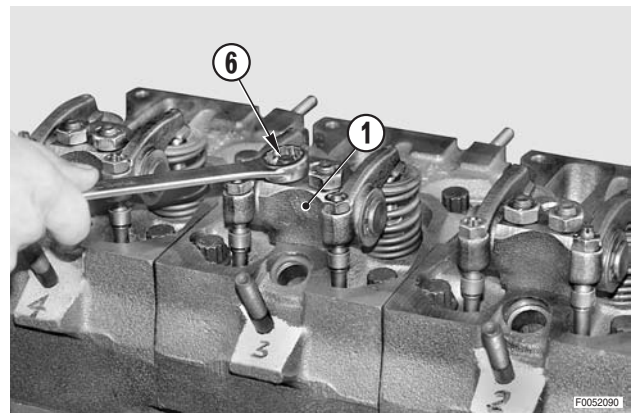
29. REFITTING THE ROCKER ASSEMBLIES

- 1 - Re-assemble the rockers by fitting the rocker arms (2), thrust washers (3) and circlips (4) to the support pivots (1).
- 2 - Loosen off completely the valve clearance adjuster screws (5).

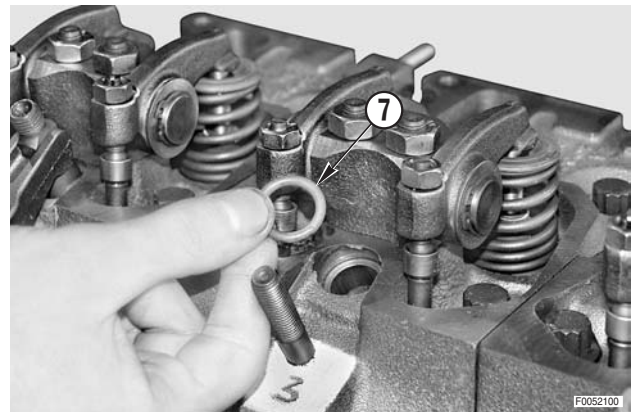


- 3 - Lubricate the pivot pins and fit the complete rocker supports.
- 4 - Fix the supports with nuts (6).

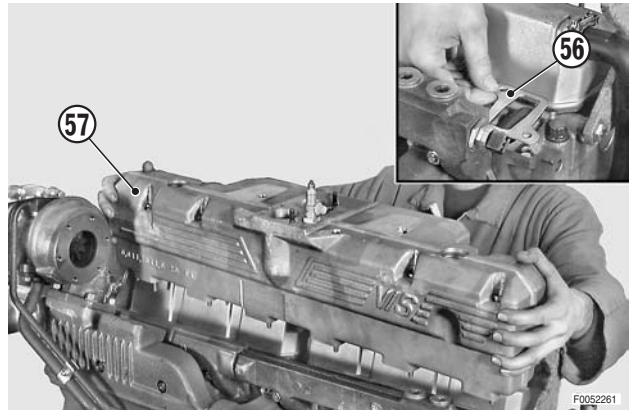
 Nuts 39 Nm (28.7 lb.ft.)



- 5 - Insert new injector O-ring seals (7) in the cylinder heads.
- 6 - Adjust the valve clearances following the procedure given below.



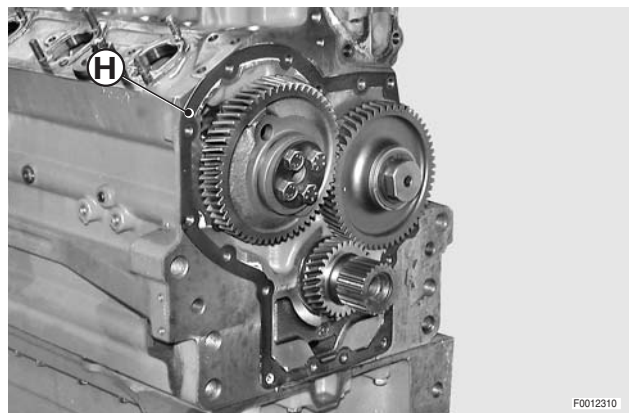
35 - Fit the gaskets (56) and fit the complete manifold (57).



For all engines

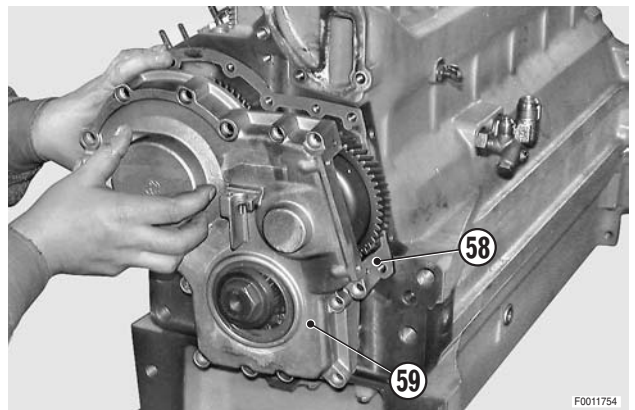
36 - Apply sealant to the contact surfaces in zones "H" of the timing cover.

 Surfaces: Silastic 738



37 - Position the gasket (58) and fit the timing cover (59), holding it in position with the relative fixing bolts and washers.

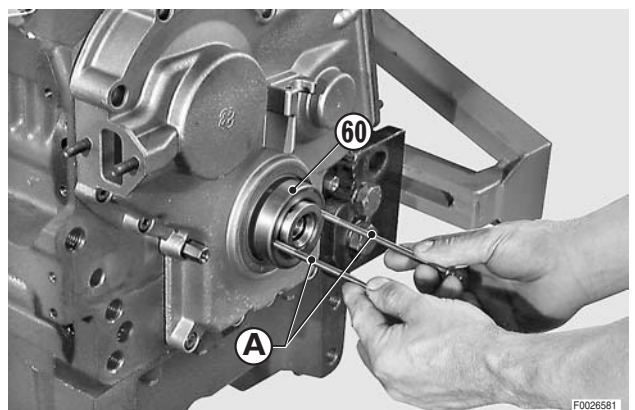
★ Do not tighten the bolts at this stage.



3- and 4-cylinder versions

38 - Lubricate the lips of the oil seal and fit the spacer (60).

★ Use two screws "A" to drive it home.



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