ENGINE TYPE IDENTIFICATION AND SERIAL NUMBERS

NOTE. The terms RIGHT and LEFT refer to the engine as viewed from the timing end.

1. Europe version

The engine type and serial number (between the ☆symbols) are indicated on the identification plate fixed to the right-hand side of the crankcase in the vicinity of the starter motor.
In addition to the Manufacturer's symbol, the identification plate contains:

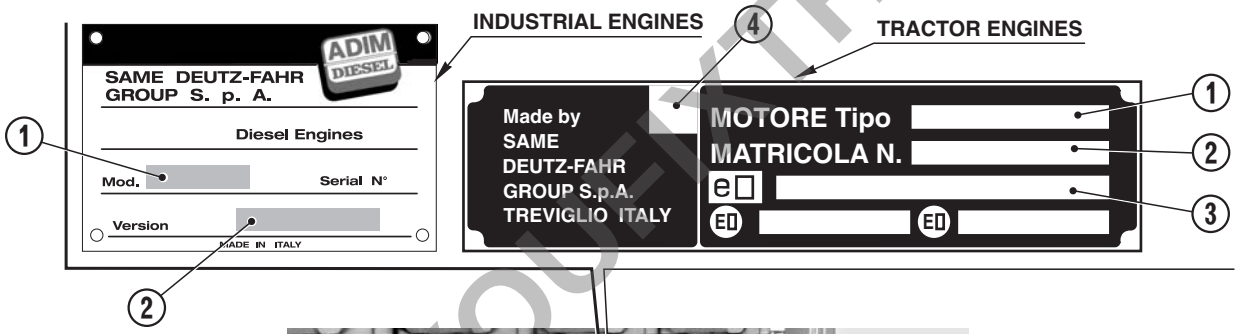
1 - Engine type

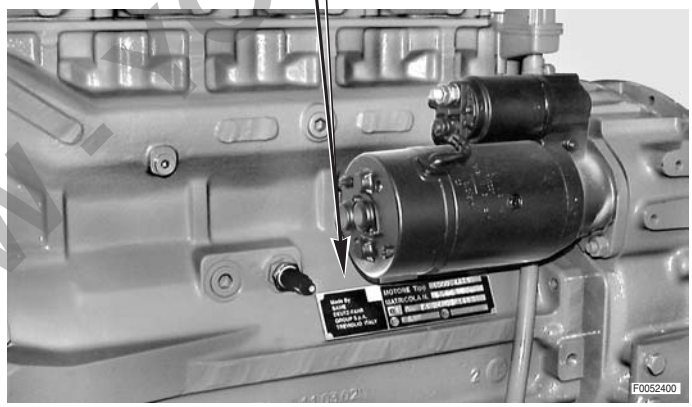
2 - Serial N° (between the☆symbols)

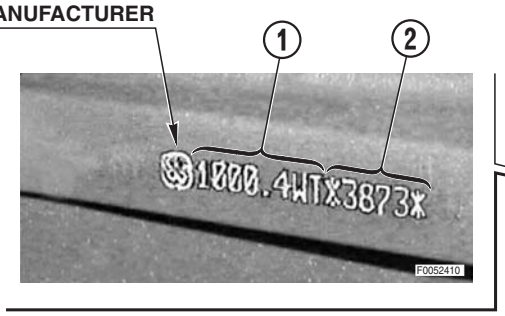
3 - Type approval N°

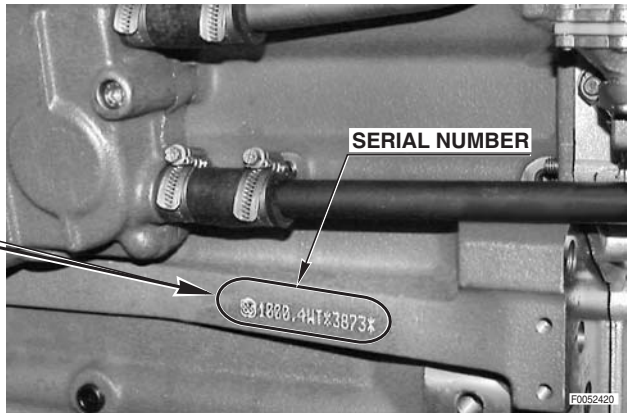
4 - Injection advance

The serial n° (between the ☆ symbols) is also stamped on the left-hand side of the crankcase.



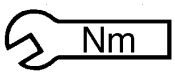






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STANDARD TIGHTENING TORQUES FOR NUTS AND BOLTS



⚠ The tightening torques for certain specific components and special tightening methods are indicated in the relative assembly paragraphs.

★ The tightening torques indicated below refer to bolts and nuts assembled without lubrication and, where applicable, with anaerobic threadlocking compound.
The values apply to tightening on steel or cast iron components; for soft materials such as aluminium, copper, plastic, sheet metal or panels, the indicated tightening torques must be reduced by 50%.

BOLT SIZE		BOLT CLASS					
		8.8		10.9		12.9	
		Nm	lb.ft.	Nm	lb.ft.	Nm	lb.ft.
COARSE THREAD	M6x1	8.0–8.8	5.9–6.5	11.8 – 13.0	8.7–9.6	13.8 – 15.2	10.2–11.2
	M8x1.25	19.4–21.4	14.3–15.8	28.5 – 31.5	21.0 – 23.2	33.3 – 36.9	24.5 – 27.2
	M10x1.5	38.4 – 42.4	28.3 – 31.2	56.4 – 62.4	41.6 – 46.0	67.4 – 74.4	49.7 – 54.8
	M12x1.75	66.5 – 73.5	49.0 – 54.2	96.9 – 107	71.4 – 78.9	115 – 128	84.8 – 94.3
	M14x2	106 – 117	78.1 – 86.2	156 – 172	115.0 – 126.8	184 – 204	135.6 – 150.3
	M16x2	164 – 182	120.9 – 134.1	241 – 267	117.6 – 196.8	282 – 312	207.8 – 229.9
	M18x2.5	228 – 252	168.0 – 185.7	334 – 370	246.2 – 272.7	391 – 432	288.2 – 318.4
	M20x2.5	321 – 355	236.6 – 261.6	472 – 522	347.9 – 384.7	553 – 611	407.6 – 450.3
	M22x2.5	441 – 487	325.0 – 358.9	647 – 715	476.8 – 527.0	751 – 830	553.5 – 611.7
	M24x3	553 – 611	407.6 – 450.3	812 – 898	598.4 – 661.8	950 – 1050	700.2 – 773.9
	M27x3	816 – 902	601.4 – 664.8	1198 – 1324	882.9 – 975.8	1419 – 1569	1045.8 – 1156.4
FINE THREAD	M8x1	20.8 – 23.0	15.3 – 17.0	30.6 – 33.8	22.6 – 24.9	35.8 – 39.6	26.4 – 29.2
	M10x1.25	40.6 – 44.8	29.9 – 33.0	59.7 – 65.9	44.0 – 48.6	71.2 – 78.6	52.5 – 57.9
	M12x1.25	72.2 – 79.8	53.2 – 58.8	106 – 118	78.1 – 87.0	126 – 140	92.9 – 103.2
	M12x1.5	69.4 – 76.7	51.1 – 56.5	102 – 112	75.2 – 82.5	121 – 134	89.2 – 98.8
	M14x1.5	114 – 126	84.0 – 92.9	168 – 186	123.8 – 137.1	199 – 220	146.7 – 162.1
	M16x1.5	175 – 194	129 – 143	257 – 285	189.4 – 210.0	301 – 333	221.8 – 245.4
	M18x1.5	256 – 282	188.7 – 207.8	375 – 415	276.4 – 305.9	439 – 485	323.5 – 357.4
	M20x1.5	355 – 393	261.6 – 289.6	523 – 578	385.5 – 426.0	611 – 676	450.3 – 498.2
	M22x1.5	482 – 532	355.2 – 392.1	708 – 782	521.8 – 576.3	821 – 908	605.1 – 669.2
	M24x2	602 – 666	443.7 – 490.8	884 – 978	651.5 – 720.8	1035 – 1143	762.8 – 842.4

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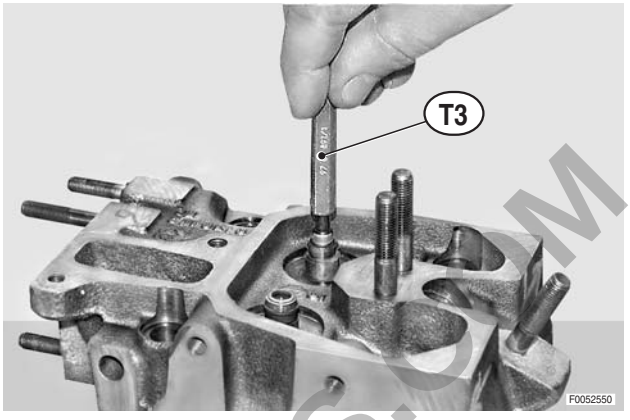
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16. TESTS - TECHNICAL DATA AND DIMENSIONS

16.1 CYLINDER HEADS - VALVES - ROCKER ASSEMBLIES

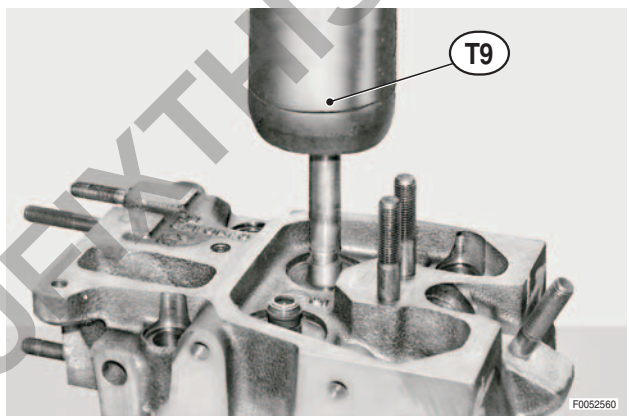
16.1.1 Inspection and renewal of valve guides

1 - Examine the valve guides for signs of scuffing or damage.
Check the inside diameter using a plug gauge T3 (code 5.9030.650.0); if the NP end of the plug gauges enters the guides, they must be renewed.



16.1.2 Renewal of the valve guides

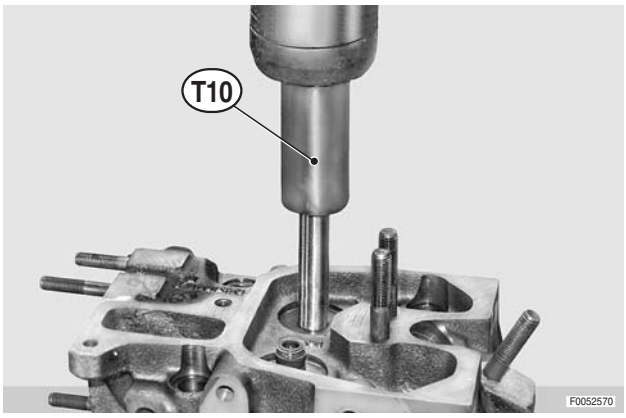
1 - Position the cylinder head on a perforated plate under a press; using drift T9 (code 5.9030.850.0) withdraw the valve guides.



2 - Carefully clean the valve guide seatings, lubricate the external surfaces of the guides and insert them using tool **T10** (code 5.9030.851.0).

Valve guides: engine oil

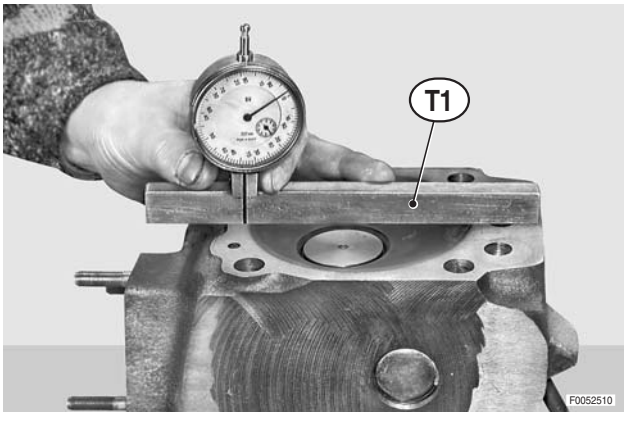
★ The correct insertion depth is determined by the full stroke of the insertion tool. (See «TECHNICAL DATA AND DIMENSIONS)



16.1.3 Inspecting the valve seats

1 - Using tool **T1** (code 5.9030.433.0) and a dial gauge, check the valve stand-in relative to the cylinder head surface.

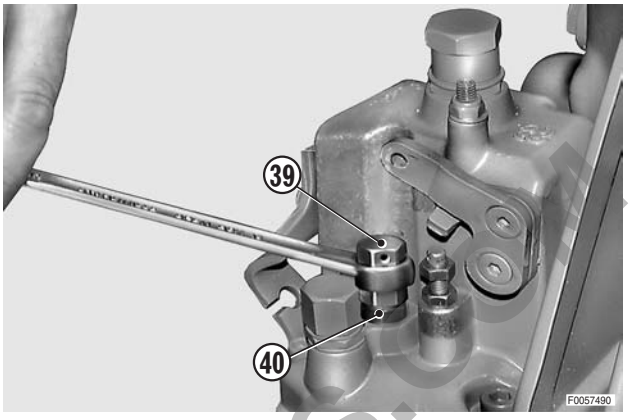
2 - If the stand-in of even a single valve is not within the tolerance limits indicated in «TECHNICAL DATA AND DIMENSIONS», all the valve seats will have to be renewed by a specialised engineering shop.



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7 - While holding screw (41) in position, tighten nut (40).

8 - Fit the safety cap (39) and secure with nut (40).



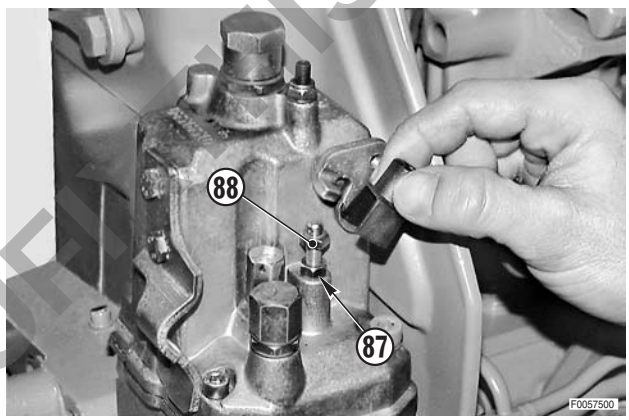
8.4.3 Adjusting the maximum speed

1 - Loosen the nut (87) and adjust the maximum speed as specified in the calibration table by turning the adjuster screw (88).

★ Check the speed using an accurate tachometer.

2 - While holding the screw (88) in position, tighten nut (87).

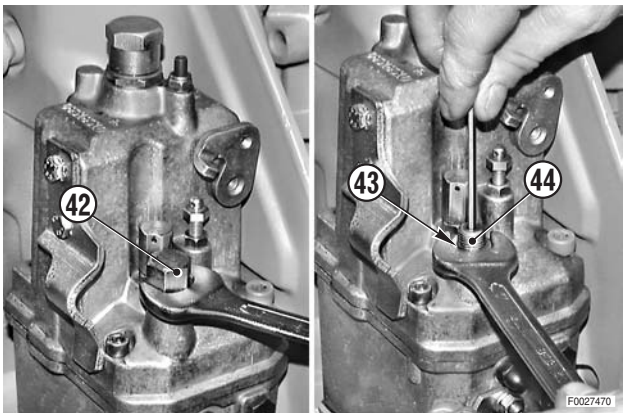
3 - Apply the tamper-proof seal.



8.4.4 Hunting adjustment

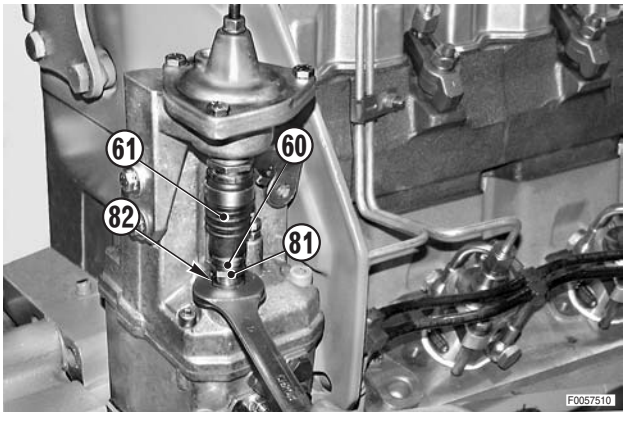
1 - **For standard governor only:** remove the safety cap (42).

2 - For standard governor only: loosen nut (43) and unscrew the adjuster screw (44) by several turns.



3 - **For governors with L.D.A. valve:** remove the clamp (60) and lift the rubber cover (61).

4 - Loosen the nut (82) and unscrew the bush (81) by several turns.



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ENGINE ASSEMBLY

1 - All engine assembly operations must be carried out on a clean bench in a clean environment.

2 - Before proceeding with assembly, remove all carbon deposits, old sealant, etc.. from the parts to be reused; clean out the oil ways with compressed air.

3 - Lightly lubricate all parts with engine oil prior to assembly, except for the bolts unless otherwise indicated.

⚠ This rule does not apply to the cylinder liners and the relative O-rings and seal seats; the cylinder liners are to be inserted into the block dry and in accordance with the specific assembly instructions.

4 - When positioning the bearing shells of the main bearings, big-end bearings and camshaft bearings make sure that oil holes are correctly oriented.

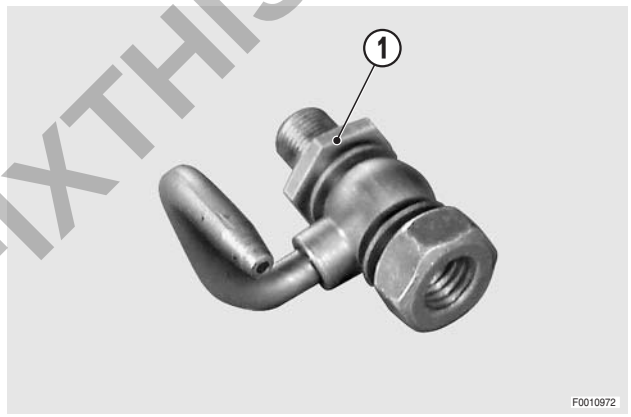
5 - Always remove excess sealant.

17. FITTING THE PISTON COOLING NOZZLES

1 - **Only if the sprayer nozzles have been removed.** Apply sealant to the root of threaded fitting (1), screw into the block and tighten.

Fittings: Loctite 242

Fittings: 30±5 Nm (22.1± 3.7 lb.ft.)

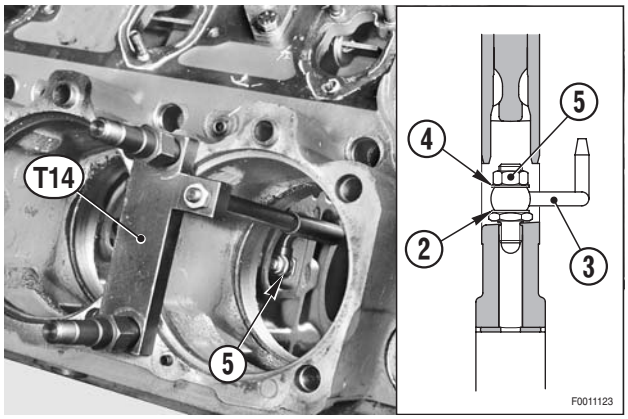


2 - Rotate the engine block and apply the special engine overhaul tool to cylinder n. 1; fit in the order given: the first copper gasket (2), the oil jet (3), the second gasket (4) and then the nut (5).
With the jet inserted in tool **T14,** tighten the nut (5).

For pistons without oil way:
tool (code 5.9030.731.4)
For pistons with oil way:
tool (code 5.9030.732.4)

Nut: 25±4 Nm (18.4±2.9 lb.ft.)

3 - Repeat the operation for the remaining cylinders.



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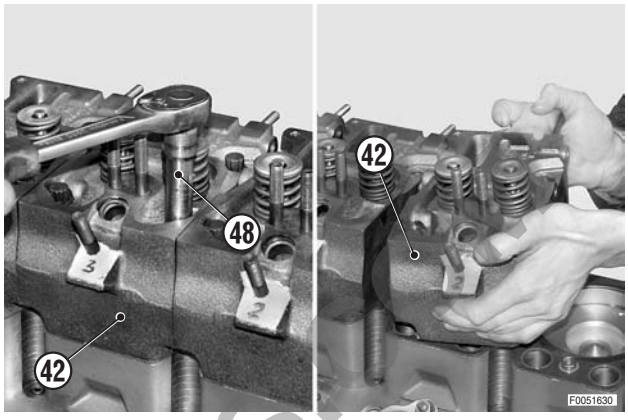
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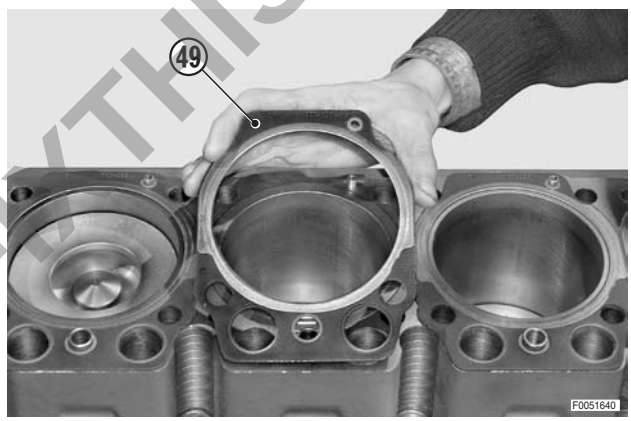
26 - Loosen and remove the retaining bolts (48) of the cylinder heads (42).

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



28 - Remove the head gaskets (49).

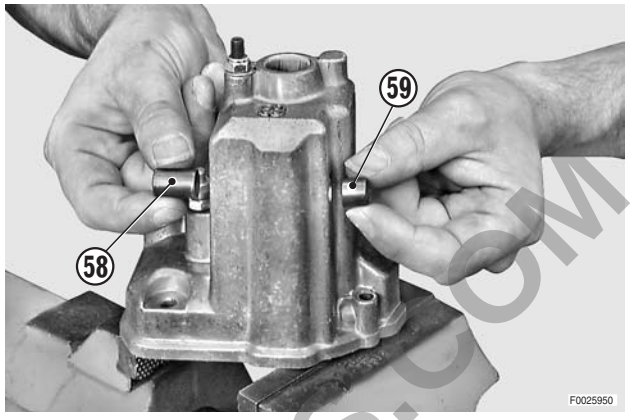
★ If the cylinder heads are to be refitted without renewing the cylinder liners, make a note of the type of gasket used for each cylinder head.
The thicknesses of the head gaskets can be determined by the presence or absence of identification holes punched in the tab with central oil hole. (
(For details,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



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14 - Renew the plain bearings (58) and (59) of the accelerator lever pivot pin. ※ 6

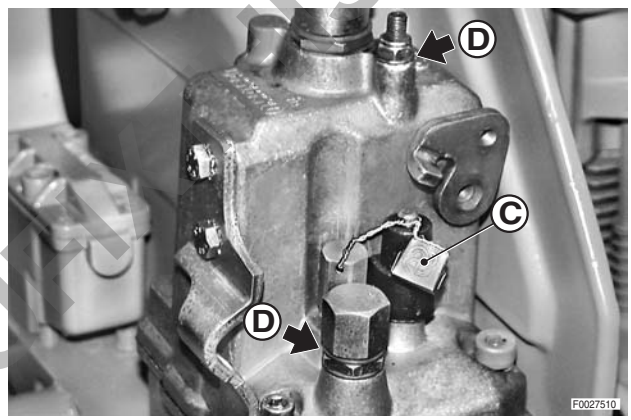


8.1.5 Assembly of the upper housing

★ Assembly is the reverse of disassembly.

※ 1

★ After the final calibration operations on the engine, affix the tamper-proof seals "**C**" and apply a touch of light coloured paint "**D**" to the adjustment screws.

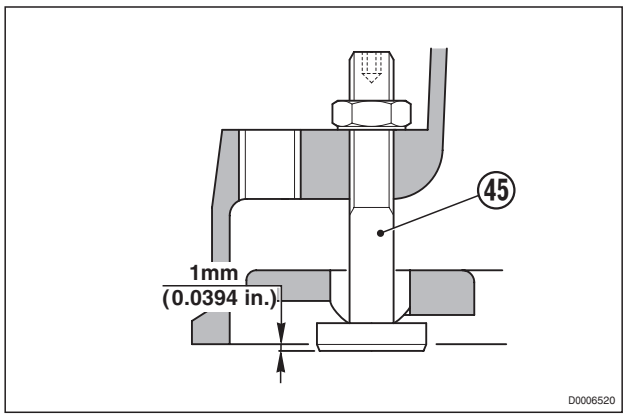


※ 2

★ Restore the correct protrusion of the injection stroke limit screw.

※ 3

★ Screw the screw (45) into the upper housing to obtain a distance of approx.1 mm (0.0394 in.) between the housing face and the head of the screw.



※ 4

Pin thread: Loctite 242

※ 5

Bush: Loctite 601

※ 6

Plain bearings: Loctite 601

★ Position the plain bearings flush with the inside face of the governor housing.

8.1.6 Assembly of the governor housing

1 - Lubricate the pivot points for all the levers and the weights in the lower housing.

Pivot points: engine oil

2 - Lubricate the flyweight shaft, the bushes and all sliding elements.

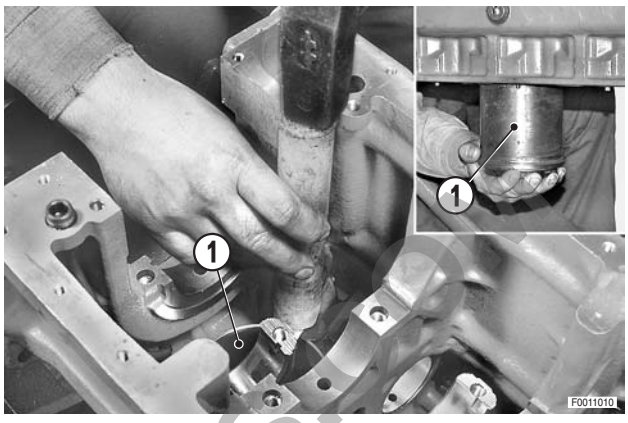
Bushes and sliding elements: Molikote

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14. REMOVAL OF THE PISTONS AND CYLINDER LINERS

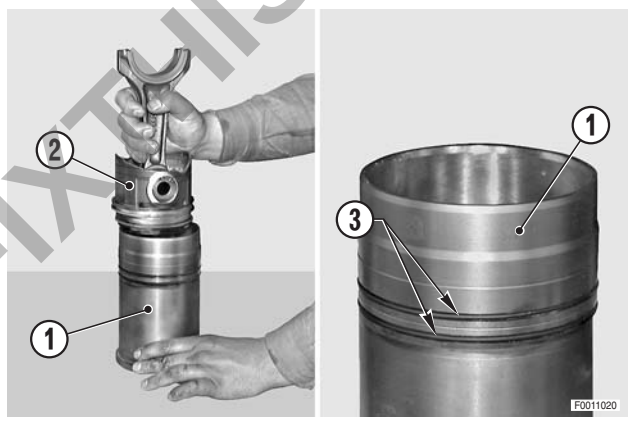
1 - Use a mallet and a plastic drift to loosen and withdraw the cylinder liners (1) along with the pistons and connecting rods.



2 - Withdraw the piston-connecting rod assembly (2) from the bottom end of the liner (1).

3 - Remove the O-ring seals (3) from the cylinder liner (1).

★ The O-rings must be renewed at each re-assembly.

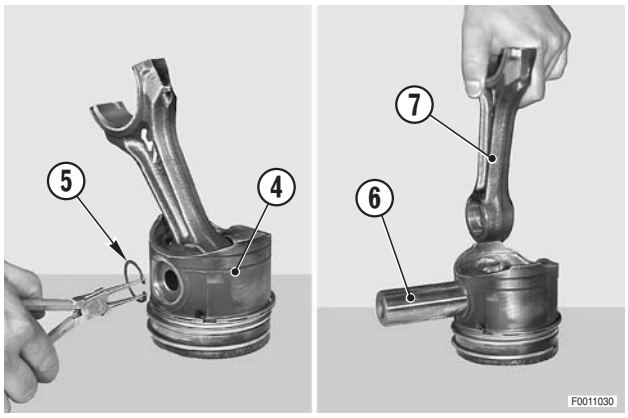


14.1 SEPARATING THE PISTON-CONNECTING ROD ASSEMBLY

1 - Remove the circlip (5) from the piston (4).

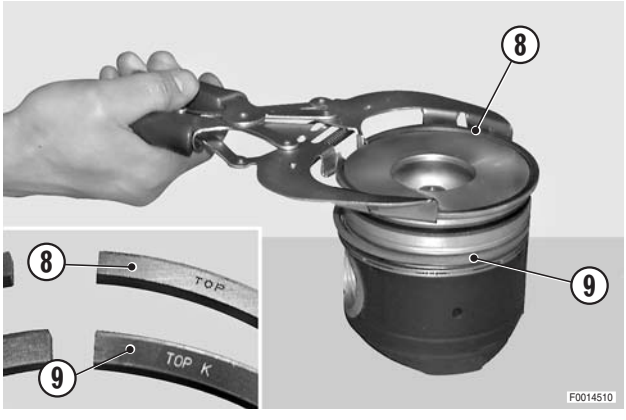
2 - Withdraw the gudgeon pin (6) and remove the connecting rod (7).

★ Note that the arrow stamped on the piston crown points in the opposite direction to the number on the connecting rod.



3 - Using piston ring pliers, remove the top and second rings (8) and (9) from the piston (4).

★ Note that the word TOP is stamped on the uppermost face of the piston rings.



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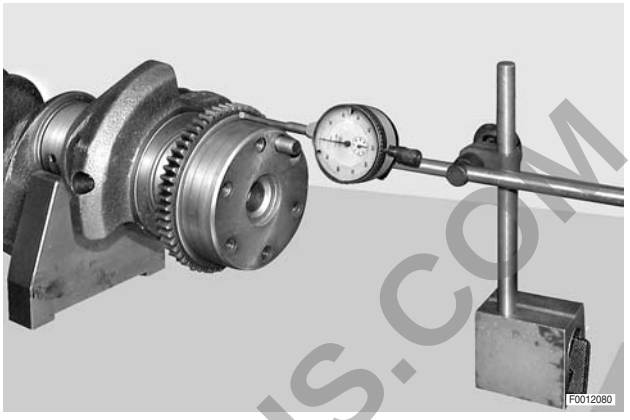
6 - Heat the new gear on a thermostatic hotplate to a temperature 100°C greater than that of the crankshaft.

7 - Apply sealant to the gear contact surfaces of the crankshaft.

Crankshaft: Loctite 648

8 - Fit the gear (2) onto the crankshaft (3) so that it is a distance "**A**" from the crankshaft shoulder (3).

★ **A** = 0.2–0.5 mm (0.079–0.197 in.).



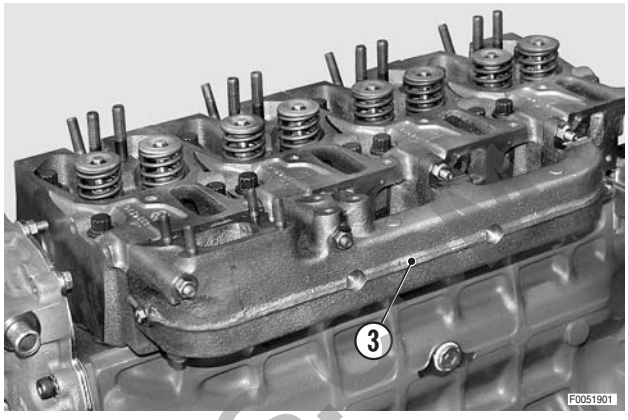
9 - When the gear has cooled, remove the excess sealant and check that the **side play** of the gear does not exceed 0.1 mm (0.004 in.) when measured in correspondence with the Ø116 mm (4.56 in.).

★ If the side play exceeds 0.1 mm (0.004 in.), using a soft metal punch (copper, aluminium, brass), move the gear to within the tolerance limits.

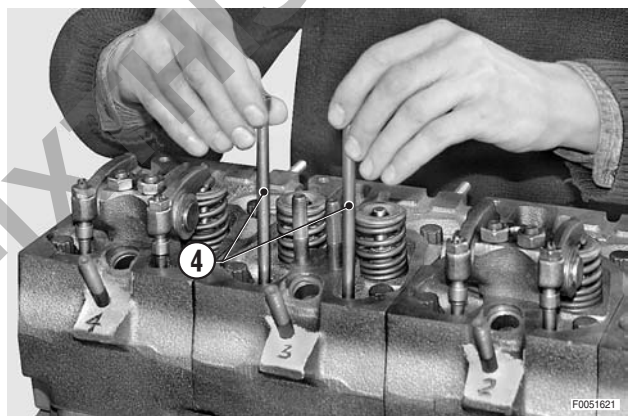
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6 - Remove the exhaust manifolds (3).



7 - Fit the push-rods (4).



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