

SECTION I

General Specifications

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OVERHAUL OF ENGINE PROVIDED WITH MECHANICAL ROTARY PUMP

Preface

Part of the operations illustrated within this section can be partially executed while the engine is assembled on the vehicle, depending on the room available for access to the engine and on the equipment application as well.



With regard to the engine disassembly operations, please apply for information consulting the specific manual. All operations of engine disassembly operations as well as overhaul operations must be executed by qualified engineers provided with the specific tooling and equipment required.

The following information relate to the engine overhaul operations only for what concerns the different components customising the engine, according to its specific duties.

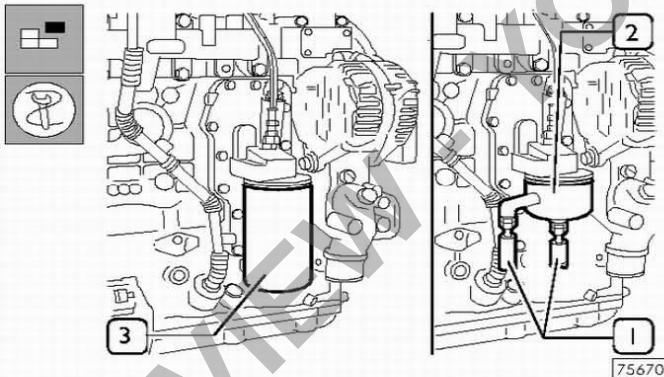


For specific application exigencies, some units can be assembled to the engine in different positions.

Within "General overhaul" section, all the operations of engine block overhaul have been contemplated. Therefore the above mentioned section is to be considered as following the part hereby described.

Engine setting operations for the assembly on turning stand

Figure 2



In order to apply the brackets to the engine block to fix it on to the stand for the overhaul, it is necessary to perform the following operations:

On the right hand side:

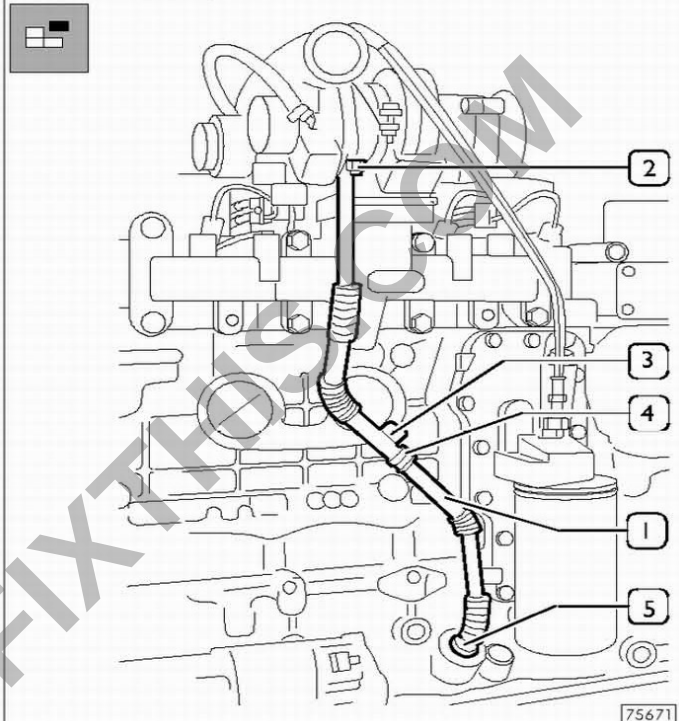
- disassemble pipes (1) from the union (2) fitting the lubrication oil filter (assembled on the opposite side): unlock the nuts fixing the pipes (1) and remove them from the union (2); drain the oil eventually still inside the pipes and plug them properly in order to avoid impurity inlet.



For some versions, the oil filter (3) is directly assembled on to the heat exchanger: in such case it shall be disassembled using acceptable tools.

Warning: the oil filter contains inside aprx. 1 kg. of engine oil. Provide for oil recovery and disposal in compliance with the law and regulations in force.

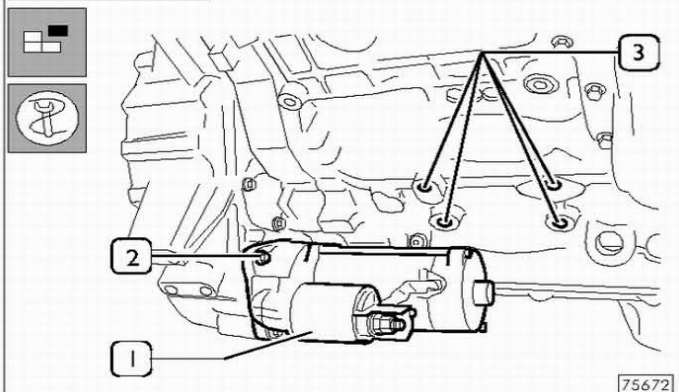
Figure 3



- disassemble lubrication oil exhaust pipe from the turbo - blower:

Underneath the turbo - Blower loosen the two screws (2), loosen the screw (3) fixing the pipe throughout the stop collar (4) fixing the block; finally loosen and remove the union (5) from the block; plug the pipe ends and the exhaust of the turbo - blower.

Figure 4



- Disassemble the starter; Properly hold the starter (1) and loosen the two fixing screws (2); assemble the bracket bearing using the four screw threaded ports (3).

TIGHTENING TORQUE (FOR 4 AND 6 CYL.)

COMPONENT		TORQUE	
		Nm	kgm
Cooling Nozzles (M8x1.25x10)		15 ± 3	1.5 ± 0.3
Main bearing cap	1st stage	50 ± 6	5.0 ± 0.6
	2nd stage	80 ± 6	8.0 ± 0.6
	3rd stage	90° ± 5°	
Rear gear housing assembly (M8x1.25x40)		24 ± 4	2.4 ± 0.4
(M8x1.25x25)		24 ± 4	2.4 ± 0.4
(M10x1.5)		49 ± 5	4.9 ± 0.5
Oil pump (M8x1.25x30)		8 ± 1	0.8 ± 0.1
Front cover assembly (M8x1.25x45)		24 ± 4	2.4 ± 0.4
(M8x1.25x30)		24 ± 4	2.4 ± 0.4
Connecting rod bolts (M11x1.25)	1st stage	30 ± 3	3.0 ± 0.3
	2nd stage	60 ± 5	6.0 ± 0.5
	3rd stage	60° ± 5°	
Ladder frame assembly (M10x1.25x25)		43 ± 5	4.3 ± 0.5
Oil rifle plugs (M10x1)		6 ± 1	0.6 ± 0.1
(M14x1.5)		11 ± 2	1.1 ± 0.2
Assemble oil suction tube (M8x1.25x20)		24 ± 4	2.4 ± 0.4
Oil pan assembly (M8x1.25x25)		24 ± 4	2.4 ± 0.4
(M18x1.50)		60 ± 9	6.0 ± 0.9
Set timing pin		5 ± 1	0.5 ± 0.1
Fuel pump assembly			
M8 screw		24 ± 4	2.4 ± 0.4
M6 screw		10 ± 1	1.0 ± 0.1
M6 nut		10 ± 1	1.0 ± 0.1
M10x1.5 flange head nuts	pre-torque	10 – 15	1.0 – 1.5
		50 – 55	5.0 – 5.5
Fuel pump gear (drive gear nut)	Snug torque	15 – 20	1.5 – 2.0
	Final torque	85 – 90	8.5 – 9.0
Timing pin cap of fuel pump		30 – 35	3.0 – 3.5
Rocker assys (M8)		24 ± 4	2.4 ± 0.4
Cylinder head bolts (M12x70)		50 + 90°	5.0 + 90°
(M12x140)		40 + 180°	4.0 + 180°
(M12x180)		70 + 180°	7.0 + 180°
Assy rocker covers (M8x1.25x25)		24 ± 4	2.4 ± 0.4
Intake manifold (M8x1.25)		24 ± 4	2.4 ± 0.4
Assy air intake connection (M8x1.25)		24 ± 4	2.4 ± 0.4
Oil bypass valve into lube filter head (M22x1.5x10)		80 ± 8	8.0 ± 0.8
Plug (M12x1.5x12)		10 ± 1	1.0 ± 0.1
Exhaust manifold (M10x1.5x65)		43 ± 6	4.3 ± 0.6
Water pump (M8x1.25x25)		24 ± 4	2.4 ± 0.4
Water outlet connection (M8x1.25x35)		24 ± 4	2.4 ± 0.4
(M8x1.25x70)		24 ± 4	2.4 ± 0.4
Fan support (M10x1.5x20)		33 ± 5	3.3 ± 0.5
Fan pulley (M6)		10 ± 2	1.0 ± 0.2
(M10)		43 ± 6	4.3 ± 0.6

ANOMALY	POSSIBLE CAUSE	REMEDY	NOTE
The engine does not start	Battery flat or faulty	Check and recharge battery. Replace battery if necessary.	
	Connections to battery terminals corroded or loose.	Clean, examine and tighten the nuts on the battery terminals. Replace the cable terminals and the nuts if excessively corroded.	
	Incorrect timing of injection pump.	Check and correctly time the injection pump.	See your dealer.
	Deposits or water in the fuel tank.	Disconnect the hoses and clean them using a jet of compressed air. Dismantle and clean the injection pump. Remove water from tank and refuel.	Drain feed system.
	No fuel in tank.	Refuel.	
	No power supply.	Overhaul or replace the fuel or transfer pump.	
	Air bubbles in the fuel lines or injection pump.	Check the hoses to ensure that air is in fact present and also check the fuel pump. Eliminate the air from the injection pump by unscrewing the cap and working the fuel pump by hand.	
	Faulty starter motor.	Repair or replace the starter motor.	

MAINTENANCE PLANNING

Recovery

To ensure optimised working conditions, in the following pages we are providing instructions for the overhaul control interventions, checks and setting operations that must be performed on the engine at due planned dates.

The frequency of the maintenance operations is just an indication since the use of the engine is the main characteristic to determine and evaluate replacements and checks.

It is not only allowed but recommended that the staff in charge of the maintenance should also carry out the necessary maintenance and controlling operations even if not being included in the ones listed here below but that may be suggested by common sense and by the specific conditions in which the engine is run.

Planning of controls and periodical intervention

Controls and periodical intervention	Frequency (hours)
Visual check of engine	Daily
Check presence of water in fuel filter or pre-filter	Daily
Check of belt wear status	–
Check and setting of tappet clearance	4000
Replacement of engine's oil and filter	500
Replacement of fuel pre-filter	1000
Replacement of fuel filter	500
Replacement of belt	1500



The frequency of the maintenance operations is just an indication since the use of the engine is the main characteristic to determine and evaluate replacements and checks.

The maintenance operations are valid only if the setter fully complies with all the installation prescriptions.

Furthermore, the users assembled by the setter shall always be in conformance to couple, power and number of turns based on which the engine has been designed.

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PREFACE TO USER'S GUIDELINE MANUAL

Section 1 describes the engine illustrating its features and working in general.

Section 2 describes the type of fuel feed.

Section 3 relates to the specific duty and is divided in four separate parts:

1. Mechanical part, related to the engine overhaul, limited to those components with different characteristics based on the relating specific duty.
2. Electrical part, concerning wiring harness, electrical and electronic equipment with different characteristics based on the relating specific duty.
3. Maintenance planning and specific overhaul.
4. Troubleshooting part dedicated to the operators who, being entitled to provide technical assistance, shall have simple and direct instructions to identify the cause of the major inconveniences.

Sections 4 and 5 illustrate the overhaul operations of the engine overhaul on stand and the necessary equipment to execute such operations.

Installation general prescriptions are reported within the appendix.

Such prescriptions shall be strictly followed by the operators in-charge of installation to avoid incorrect working as well as serious failures which may reduce performance and life of the engine.

Furthermore, the appendix reports general safety prescriptions to be followed by all operators whether being in-charge of installation or maintenance, in order to avoid serious injury.

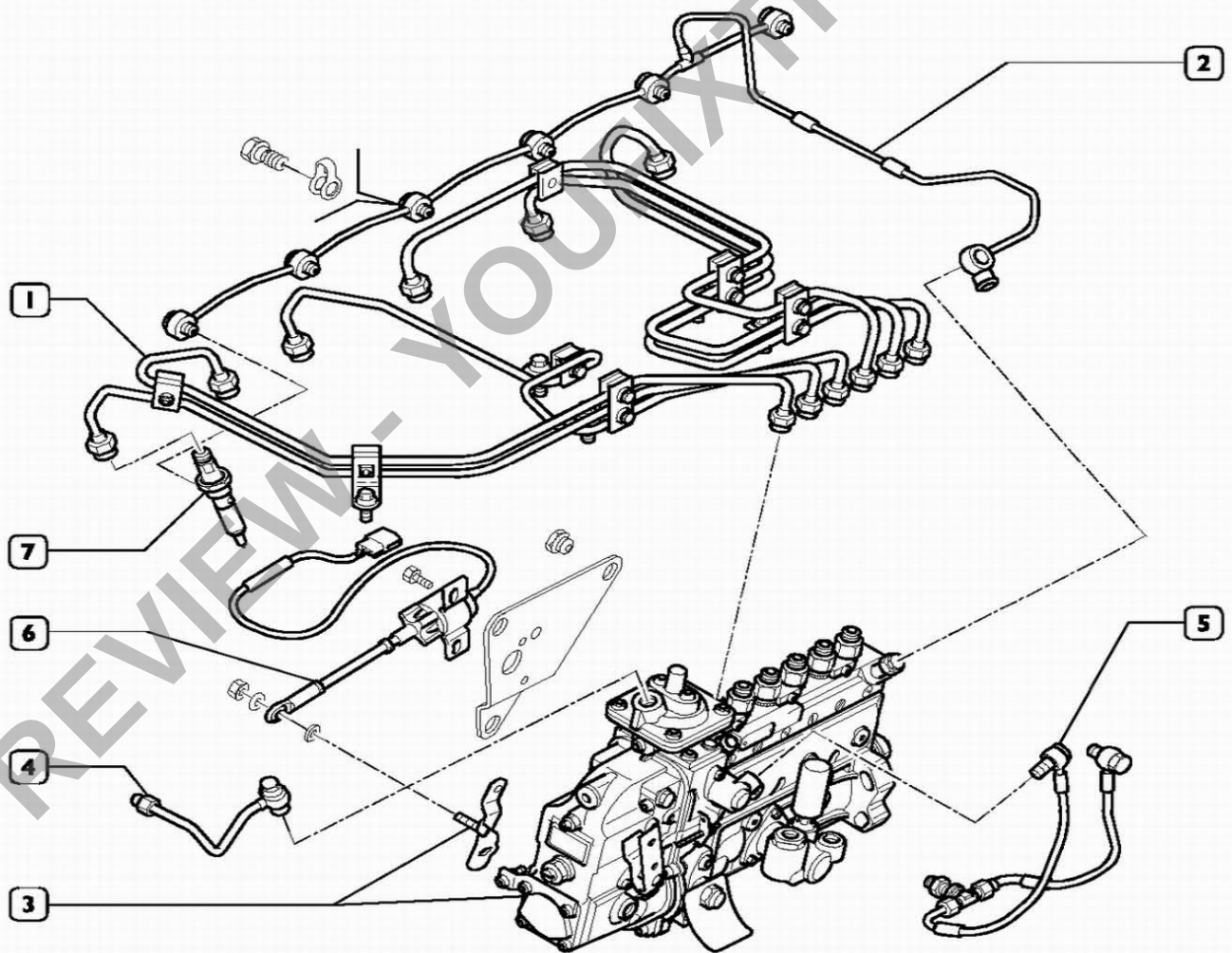
INJECTION FEED SYSTEM BY MECHANICAL PUMP UNIT

General information

Fuel feed system is composed by:

- ☐ Fuel tank (placed on the machine)
- ☐ Fuel delivery and back-flow to tank
- ☐ Fuel pre-filter (if available, it is usually placed close to the engine on the machine frame)
- ☐ Priming pump, assembled to the pump body
- ☐ Fuel filter (assembled to the engine in different positions according to equipment application and duty)
- ☐ Injector feed pipeline (from fuel feed pump to injectors)
- ☐ Injectors

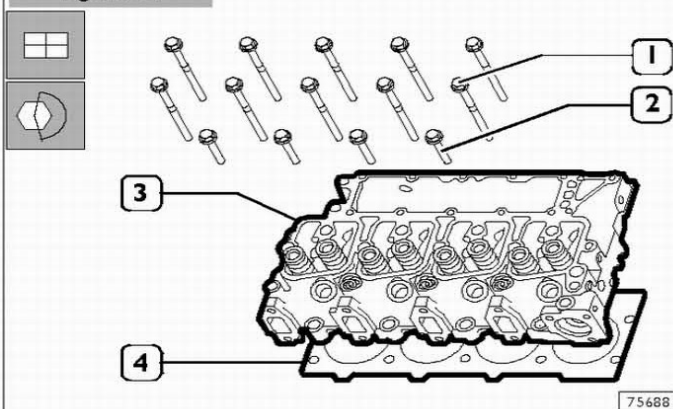
Figura 6



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1. Injector feed pipes – 2. Fuel exhaust pipes from injectors – 3. Fuel feed pump – 4. Connector for LDA pressure gauge pipe within suction collector – 5. Lubrication pipes – 6. Engine stop – 7. Injector

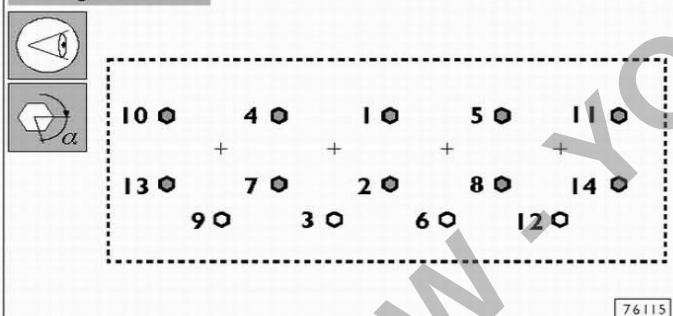
Figure 66



- Place the head (3) over the block and insert screws (1) and (2).

! If the valves have been removed from the head, it is necessary to assemble them before assembling the head itself on the engine block.

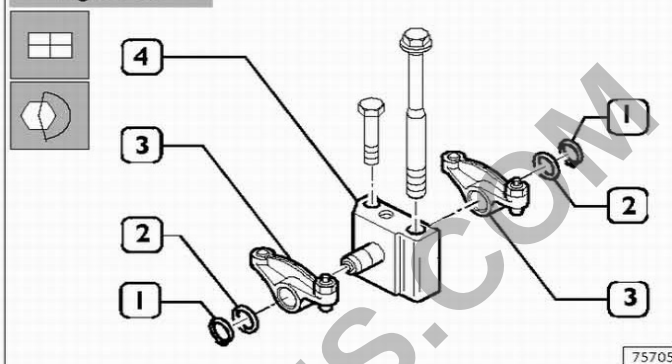
Figure 67



- Lubricate cylinder head bolts and install to head.
- Bolts must be torqued using stitching pattern starting with the centre bolts and moving out. Bolts to be torqued in stages: all bolts torqued to snug torque, then 90 degrees rotation for all bolts. Then a further 90 degrees for the M12 x 140 and M12 x 180.

M12 x 70	50 Nm + 90 deg's
M12 x 140	40 Nm + 180 deg's
M12 x 180	70 Nm + 180 deg's

Figure 68

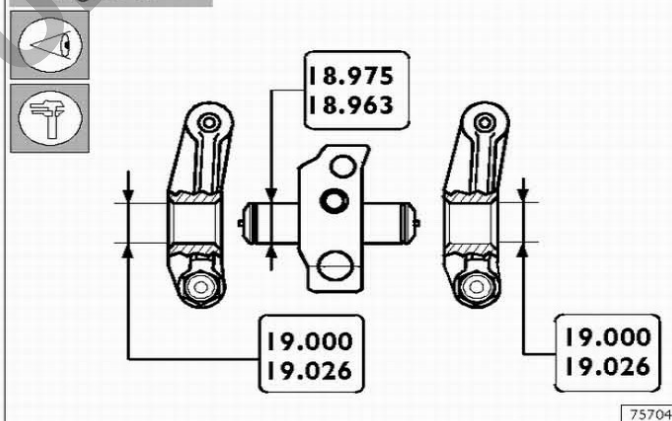


- Carry out the assembly of the rocker arms after previous check of the components.

ROCKER ARM UNIT COMPONENTS:

1. Elastic ring – 2. Spacer – 3. Rocker arms – 4. Support.

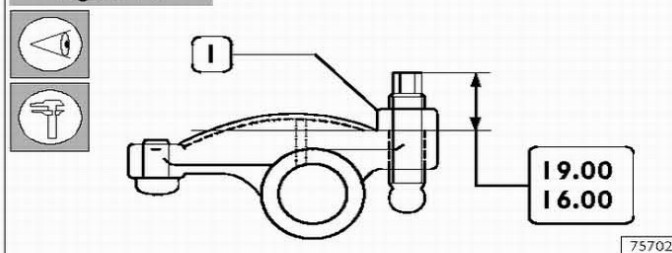
Figure 69



SHAFT AND ROCKER ARM BASIC DATA

Check the coupling surfaces of bearing and shaft: no evidence of excessive wear shall be detected or damages. Replace if necessary.

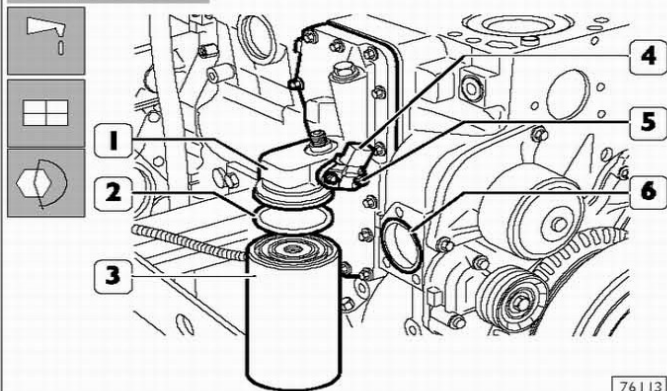
Figure 70



ROCKER ARM ADJUSTMENT SCREW

If unscrewed, check adjustment quota. Tighten the screw-threaded nut (1) to the 0.25 – 0.75 Nm couple.

Figure 168



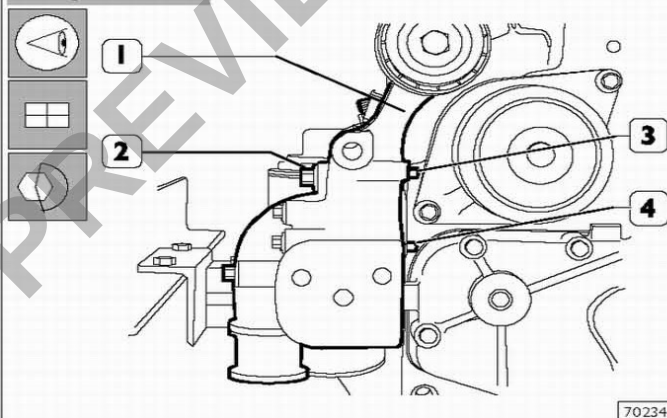
- ☐ Lubricate the fixing ring (2) using engine oil and place it on the oil filter (3).
- ☐ Manually start the oil filter (3) on the bearing union (1) until counter-boring, further screw up the oil filter (3) by 3/4 turn.
- ☐ Apply, (if needed) new fixing ring on the oil temperature/pressure sensor (4) and assemble it to the bearing (1) tightening the fixing screws to the prescribed couple.
- ☐ Tighten the screw (5) and lock it to the prescribed couple.



In some applications, the bearing of the exchanger shall be assembled to a screw threaded union connected to the filter on the opposite side of the engine, throughout two pipelines (see Figure 105).

- ☐ Place a new fixing ring on the block housing (6).

Figure 169

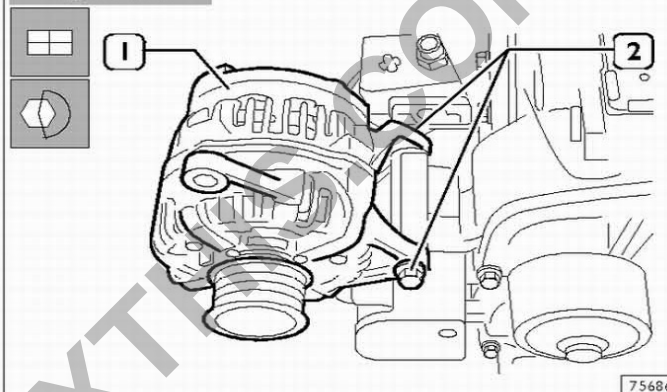


- ☐ Assemble the alternator bearing (1) ensuring that the pins (3 and 4) are against the engine block.
- ☐ Tighten the screws (2) and lock them to the prescribed couple.



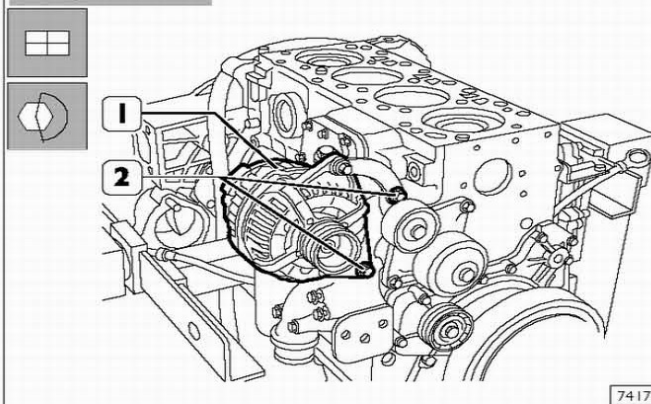
Before assembly, always check that the threads of the ports and of the screws have no evidence of tear and wear nor dirt.

Figure 170



- ☐ Reassemble the alternator (1).
- ☐ Tighten the screw (2) and lock it to the prescribed couple.

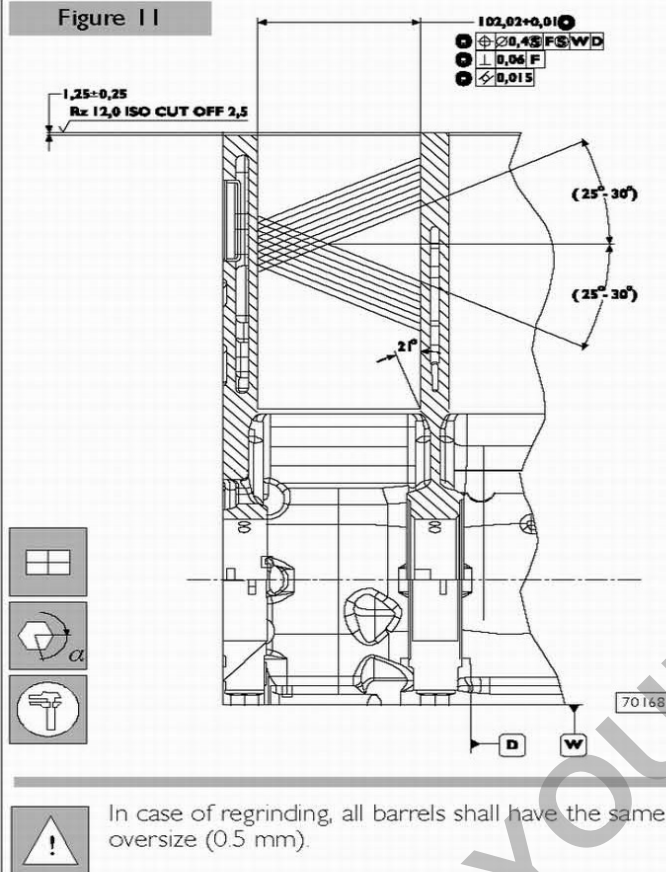
Figure 171



- ☐ Refit the alternator (1).
- ☐ Tighten the screw (2) to the specified torque.

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Figure 11



Check main bearing housings as follows:

- ☐ fit the main bearings caps on the supports without bearings;
- ☐ tighten the fastening screws to the specified torque;
- ☐ use the proper internal gauge to check whether the housing diameter is falling within the specified value.

Replace if higher value is found.

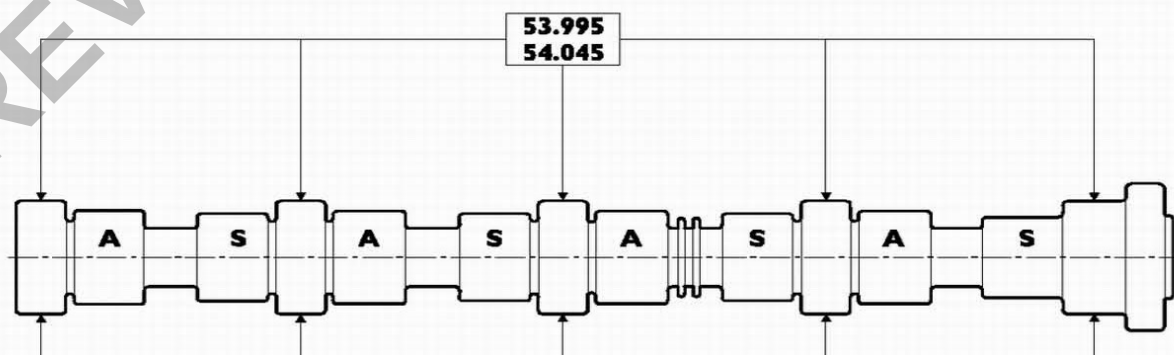
Checking head supporting surface on cylinder unit

When finding the distortion areas, replace the cylinder unit. Planarity error shall not exceed 0.075 mm.

Check cylinder unit operating plug conditions, replace them in case of uncertain seal or if rusted.

TIMING SYSTEM Camshaft

Figure 12



CAMSHAFT MAIN DATA (4 CYL)
Specified data refer to pin standard diameter

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