CLEARANCE DATA – 4 CYL.

			F4BE0484		
	Type		G	F	F*D601
ϱ	Compression ratio		17 : 1		
	Max. output	kW (HP) rpm	74 100 2200	86 115 2200	88 120 2200
	Max. torque	Nm (kgm) rpm	– – –	435 43.5 1200	– – –
	Loadless engine idling	rpm	850	850	850
	Loadless engine peak	rpm	2450	2450	2450
	SUPERCHARGING		with intercooler		
	Turbocharger type		HOLSET HX25W		
	LUBRICATION		Forced by gear pump, relief valve single action oil filter		
bar	**Oil pressure (warm engine)**				
	– idling	bar	1.2		
	– peak rpm	bar	3.8		
	COOLING		By centrifugal pump, regulating thermostat, heat exchanger, intercooler		
	Water pump control		Through belt		
	Thermostat				
	– start of opening	°C	81 ± 2		
	FILLING				
15W40 ACEA E3	engine sump	liters	–		
	engine sump + filter	liters	–		

Data, features and performances 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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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.	

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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

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LUBRICATION

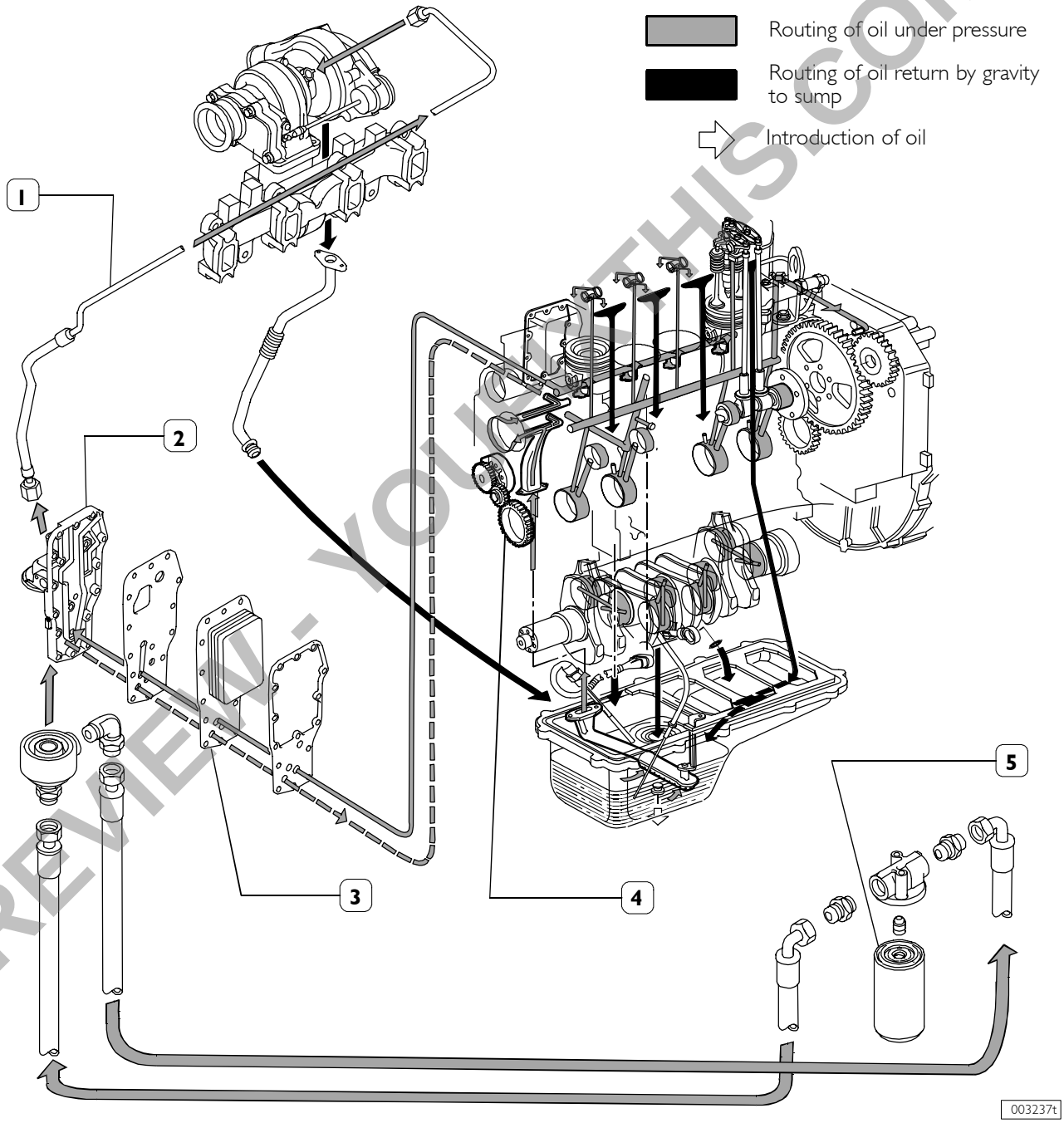
Lubrication by forced circulation is achieved through oil rotary expansion pump (4), placed in the front part of the basement, driven by the straight–tooth gear splined to the shaft's bar hold.

From the pan, the lubrication oil flows to the driving shaft, to the camshaft and to the valve drive.

Lubrication involves the heat exchanger (2,3) as well, the supercharged (through pipe 1) and the eventual compressor for any eventual compressed air system.

All these components may often vary according to the specific duty.

Figure 1



LUBRICATION SYSTEM LAYOUT (4 cyl. engines)

1. Lubrication oil pipe to supercharger – 2. Heat exchanger body – 3. Heat exchanger – 4. Oil rotary expansion pump – 5. Oil filter

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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.

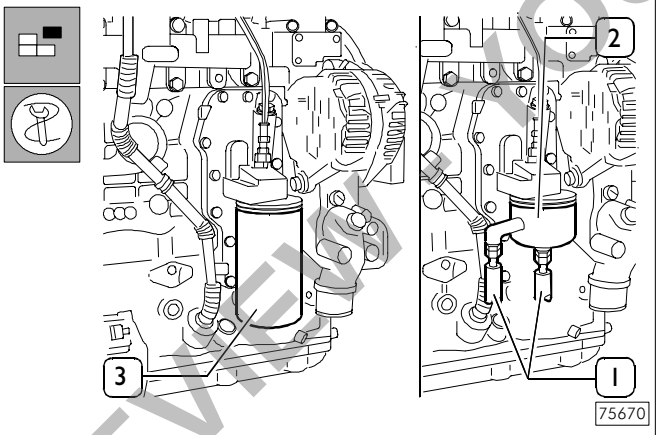
The following information relate to the engine overhaul operations only for what concerns the different components customising the engine, according to its specific duties.

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:

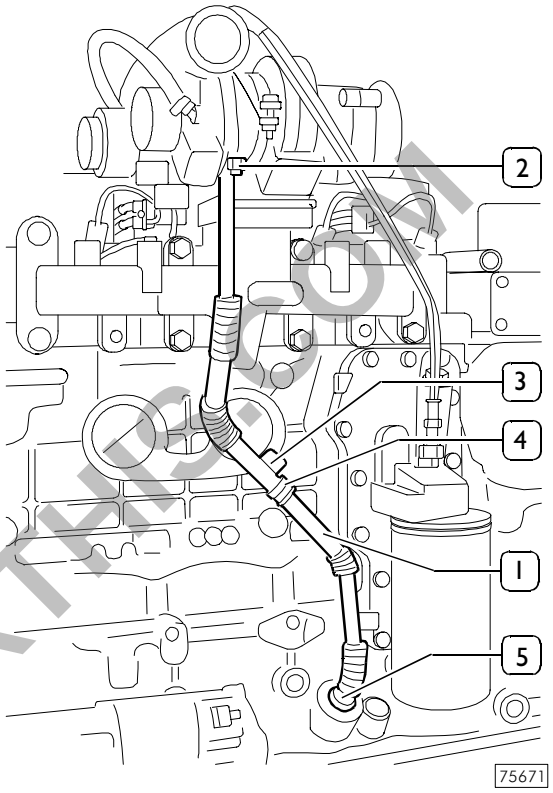
On the right hand side:

❑ 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.

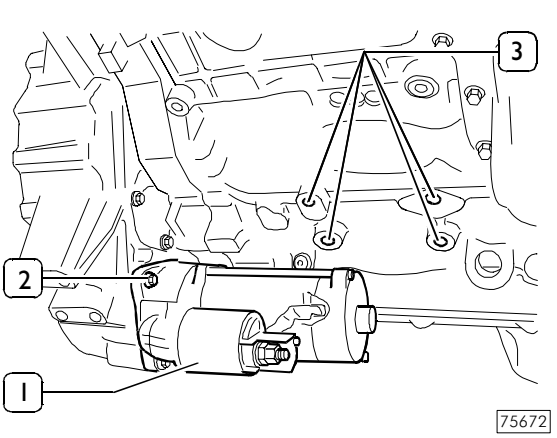
Warning: the oil filter contains inside aprx. 1 kg. of engine oil. Provide for oil recovery and disposal in compliance with the law and regulations in force.

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



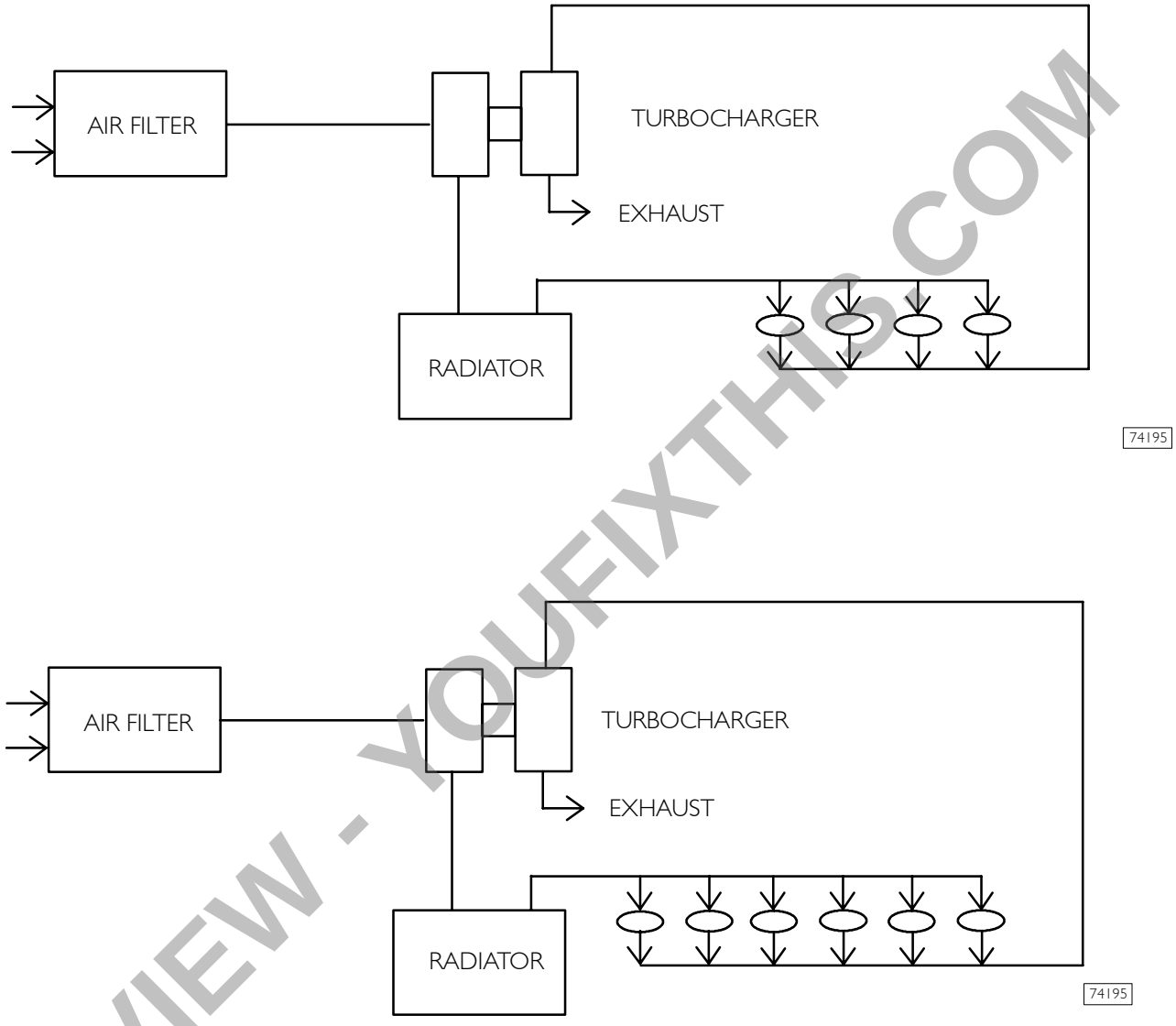
❑ Disassemble the starter;
Properly hold the starter (1) and loosen the two fixing screws (2); assemble the bracket bearing using the four screw threaded ports (3).

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BOOST FEEDING DIAGRAM

Figure 6



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Description

The turbocharger is composed by the following main parts: one turbine, one transforming valve to regulate the boost feeding pressure , one main body and one compressor.

During engine working process, the exhaust emission flow through the body of the turbine, provoking the turbine disk wheel's rotation.

The compressor rotor, being connected by shaft to the turbine disk wheel, rotates as long as this last one rotates, compressing the sucked air through the air filter.

The above mentioned air is then cooled by the radiator and flown through the piston induction collector.

The turbocharger is equipped with a transforming valve to regulate the pressure , that is located on the exhaust collector before the turbine and connected by piping to the induction collector.

It's duty is to choke the exhaust of the emissions , releasing part of them directly to the exhaust tube when the boost feeding pressure, over the compressor, reaches the prescribed bar value.

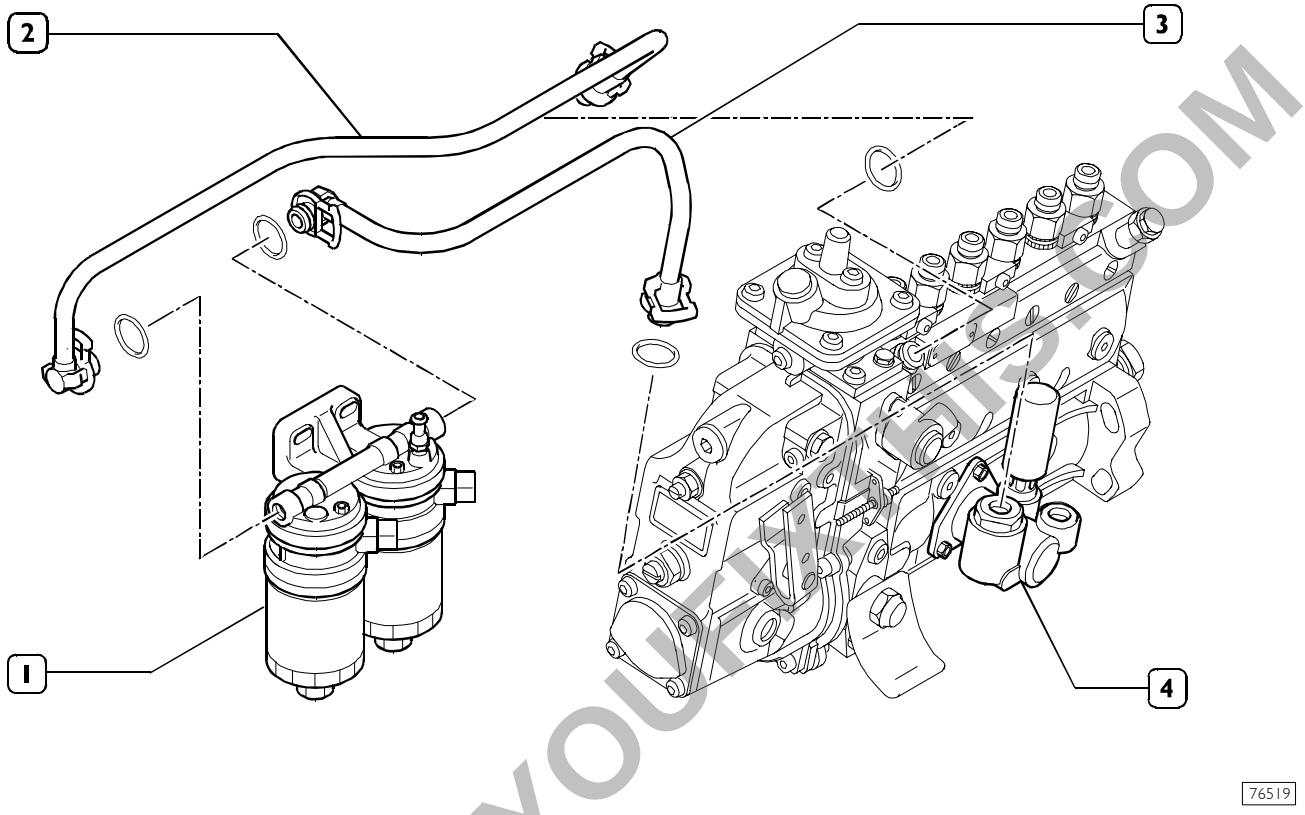
The cooling process and the lubrication of the turbocharger and of the bearings is made by the oil of the engine.

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Figura 7



1. Fuel filter – 2. Feed pipeline from filter to fuel pump – 3. Feed pipeline from priming pump to filter – 4. Priming pump

Description of working principles

Fuel is sucked from the fuel tank by the priming pump. This last one is placed on the engine basement and is driven by the camshaft.

Throughout the filter/s, the fuel is piped to the union fitting vacuum chamber of the transfer pump. (For applications to be equipped in cold climate areas, the fuel filter is provided with heater).

Transfer pump is placed inside the feed pump, and is bladed type; its duty is to increase fuel pressure in correspondence with the increase of the number of revolutions.

Fuel is delivered to the pressure gauge valve within feed pump.

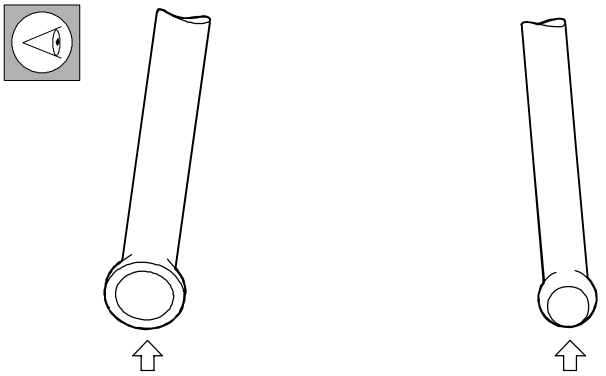
Timing plungers further increase the pressure and deliver fuel to the injectors throughout the delivery pipe fittings.

Fuel bleeding from the injectors is recovered and piped back to the pump.

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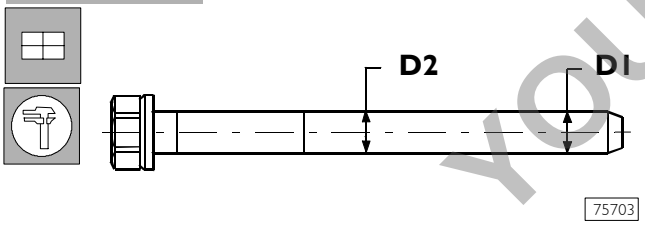
Figure 71



32655

Before executing assembly, check the Rocker Arm driving rods: these shall not be deformed; the spherical ends in contact with the Rocker Arm adjustment screw and with the tappet (arrows) shall not present evidence of seizure or wear: in case of detection proceed replacing them.
The rods driving the suction and exhaust valves are identical and therefore interchangeable.

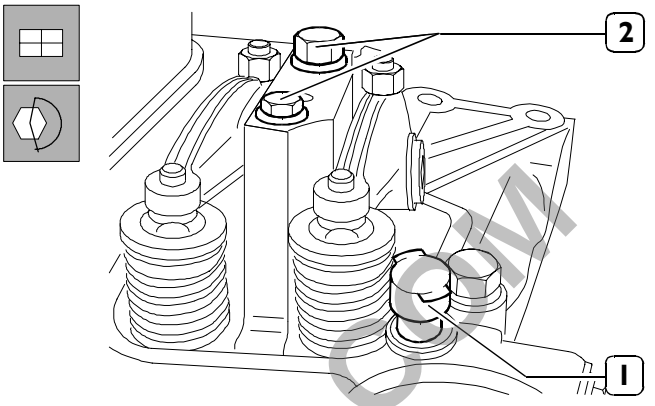
Figure 72



75703

❑ Insert the tappet driving rods and the Rocker Arm unit. Before using the fixing screws again, measure them twice as indicated in the picture, checking D1 and D2 diameters:
if D1 – D2 < 0,1 mm the screw can be utilised again;
if D1 – D2 > 0,1 mm the screw must be replaced;

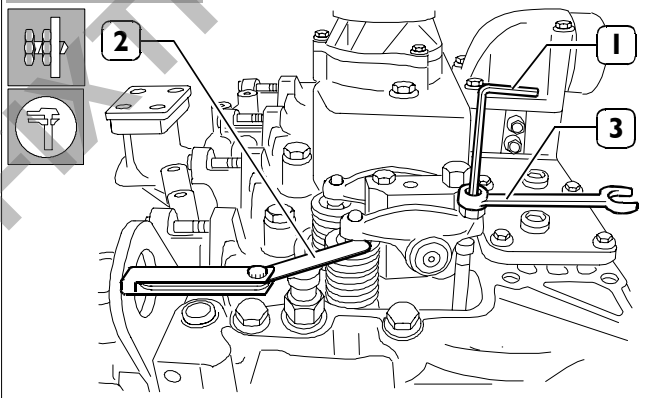
Figure 73



75683

❑ Tighten the screws (2) to the prescribed couple and assemble water temperature sensor (1).

Figure 74



75806

Adjust the slack between rocker arms and valves using socket wrench (1), point wrench (3) and feeler gauge (2).

Correct working slack is:
– suction valves 0.30 ± 0.05 mm
– exhaust valves 0.55 ± 0.05 mm.

In order carry out a quicker adjustment of the working slack between rocker arms and valves, proceed as following:
Rotate the engine drive shaft, balance the valves of cylinder 1 and adjust the valves identified by star symbol, as indicated in the following table:

Cylinder n	1	2	3	4
Suction	*	–	–	–
Exhaust	*	*	*	–

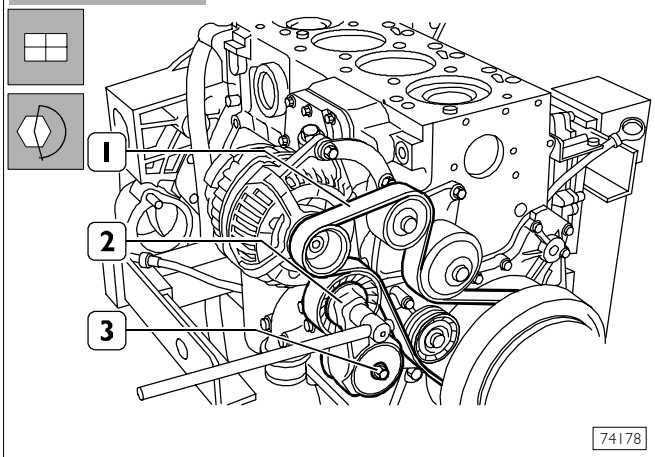
Rotate the engine drive shaft of 360 deg., balance the valves of cylinder 4 and adjust the valves identified by star symbol, as indicated in the following table:

Cylinder n°	1	2	3	4
Suction	–	*	*	*
Exhaust	–	–	–	*

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Figure 172

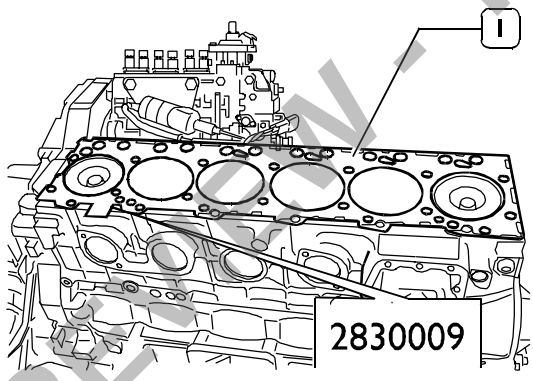


74178

- ❑ Refit the automatic belt tensioner (2).
- ❑ Tighten the screw (3) to the specified torque.
- ❑ Turn the automatic belt tensioner (2) to fit the belt (1) on pulleys and guide rollers.
- ❑ Assemble alternator safety guard.

In case the same belt priory removed is assembled again, proceed examining it carefully to check there

Figure 173



76153

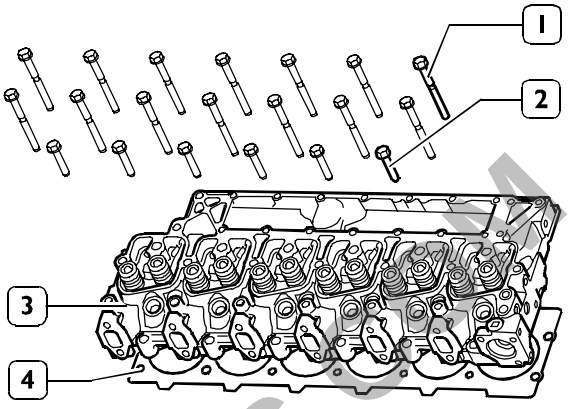
- ❑ Place the gasket (1) over the block.
  The choice of the gasket's thickness shall be made in consideration of the cylinder protrusion measured with respect to the block's upper surface.

Verify that the engine block stand is clean.

Do not grease the gasket. It is recommended to keep the gasket inside packaging until assembly to the cylinder head.

Gasket assembly shall be made following the direction of wording printed on the gasket itself so that this will be readable as indicated in the picture.

Figure 174

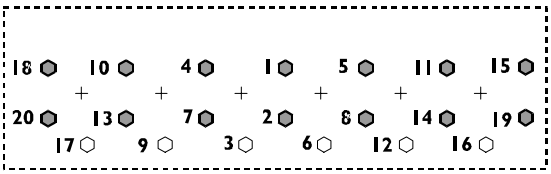


76152

- ❑ 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 175



76214

- ❑ 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

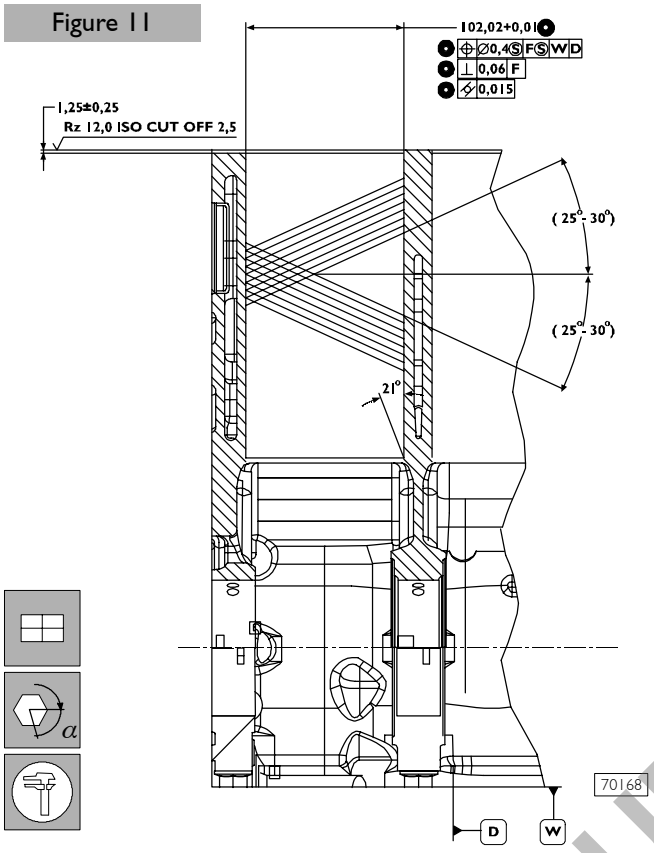
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Figure 11



In case of regrinding, all barrels shall have the same oversize (0.5 mm).

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

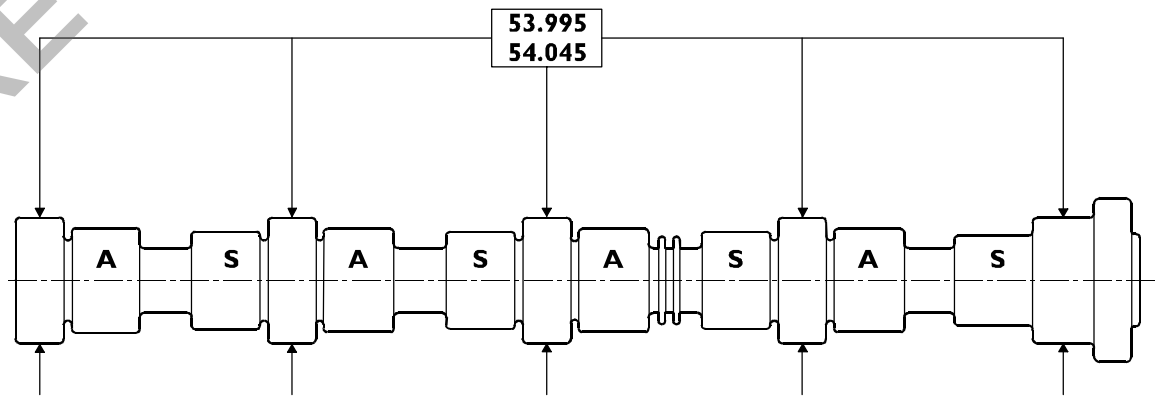
When finding the distortion areas, replace the cylinder unit.

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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