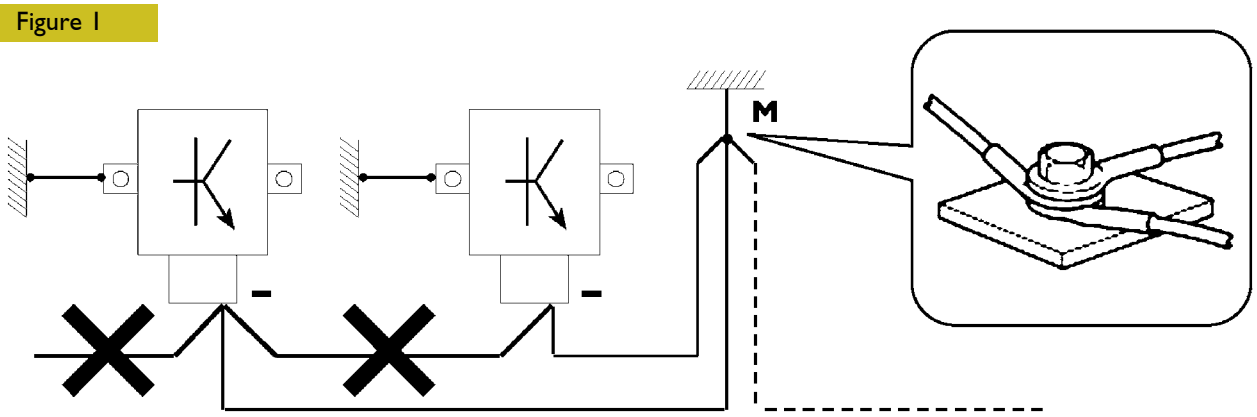
Bonding and screening

Negative leads connected to a system bonded point must be both as short and possible and "star"-connected to each other, trying then to have their centering tidily and properly made (Figure 1, re. M).

Further, following warnings are to be compulsorily observed for electronic components:

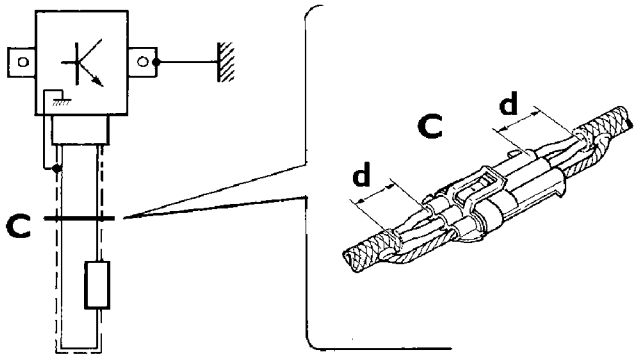
- Electronic central units must be connected to system bonding when they are provided with a metallic shell.
- Electronic central units negative cables must be connected both to a system bonding point such as the dashboard opening bonding (avoiding "serial" or "chain" connections), and to battery negative terminal.
- Analog bonding (sensors), although not connected to battery negative system/terminal bonding, must have optimal isolation. Consequently, particularly considered must be parasitic resistances in lugs: oxidising, clinching defects, etc.
- Screened circuits braiding must only electrically contact the end towards the central unit entered by the signal (Figure 2).
- If junction connectors are present, unscreened section **d**, near them, must be as short as possible (Figure 2).
- Cables must be arranged such as to result to be parallel to reference plane, i.e. as close as possible to chassis/body structure.

Figure 1



1. NEGATIVE CABLES "STAR" CONNECTION TO SYSTEM BONDING **M**

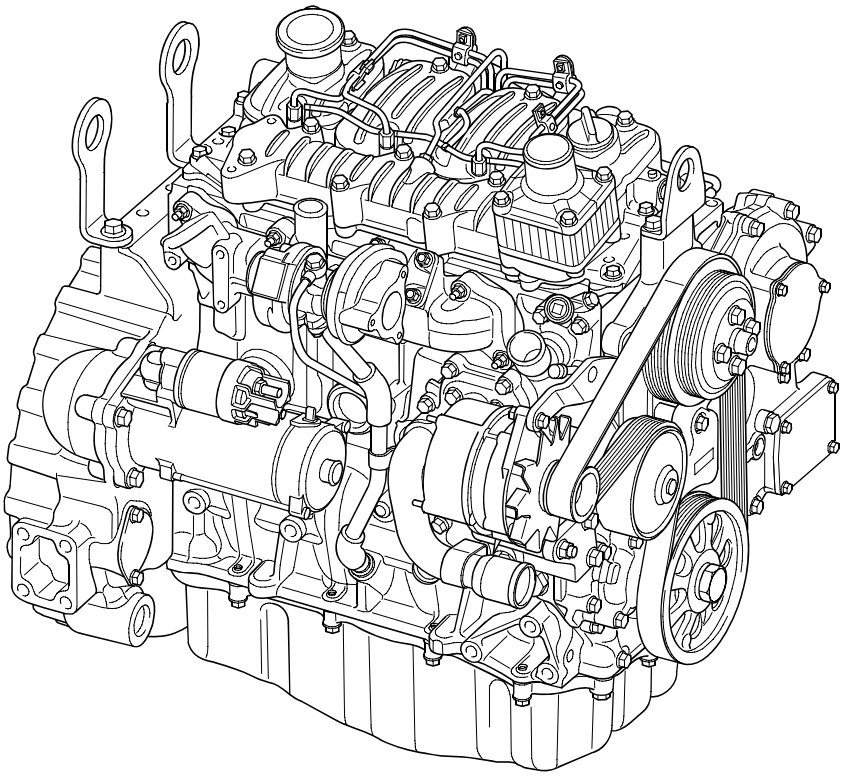
Figure 2



2. SCREENING THROUGH METALLIC BRAIDING OF A CABLE TO AN ELECTRONIC COMPONENT – **C.** CONNECTOR **d.** DISTANCE → 0

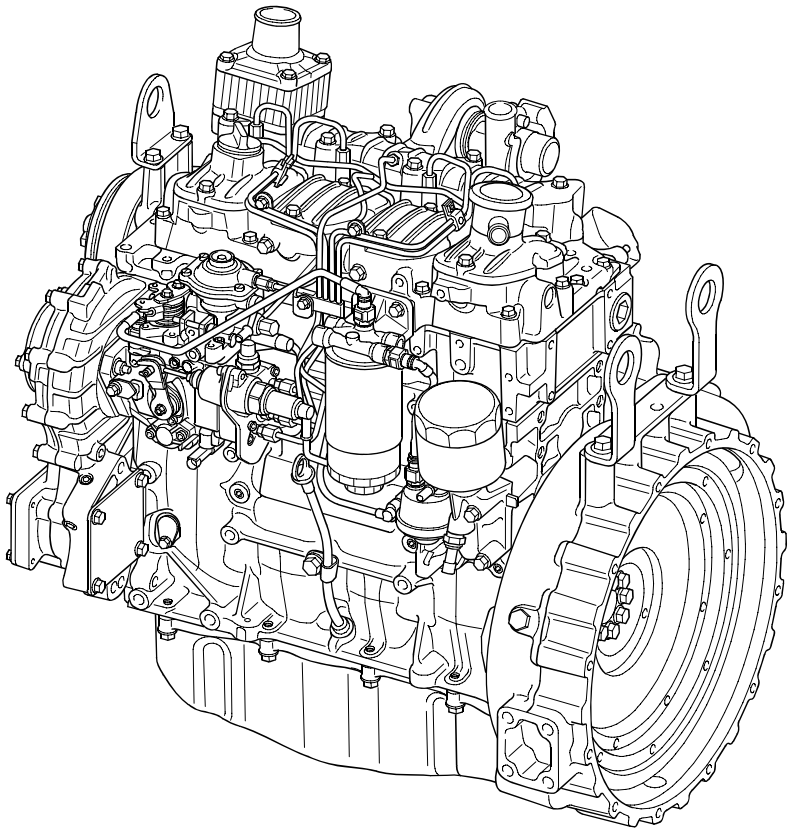
ENGINE VIEWS (for F5CE9454E*A005, F5CE9484D*A002 engines)

Figure 1



128134

Figure 2



128135

ENGINE LUBRICATION SYSTEM

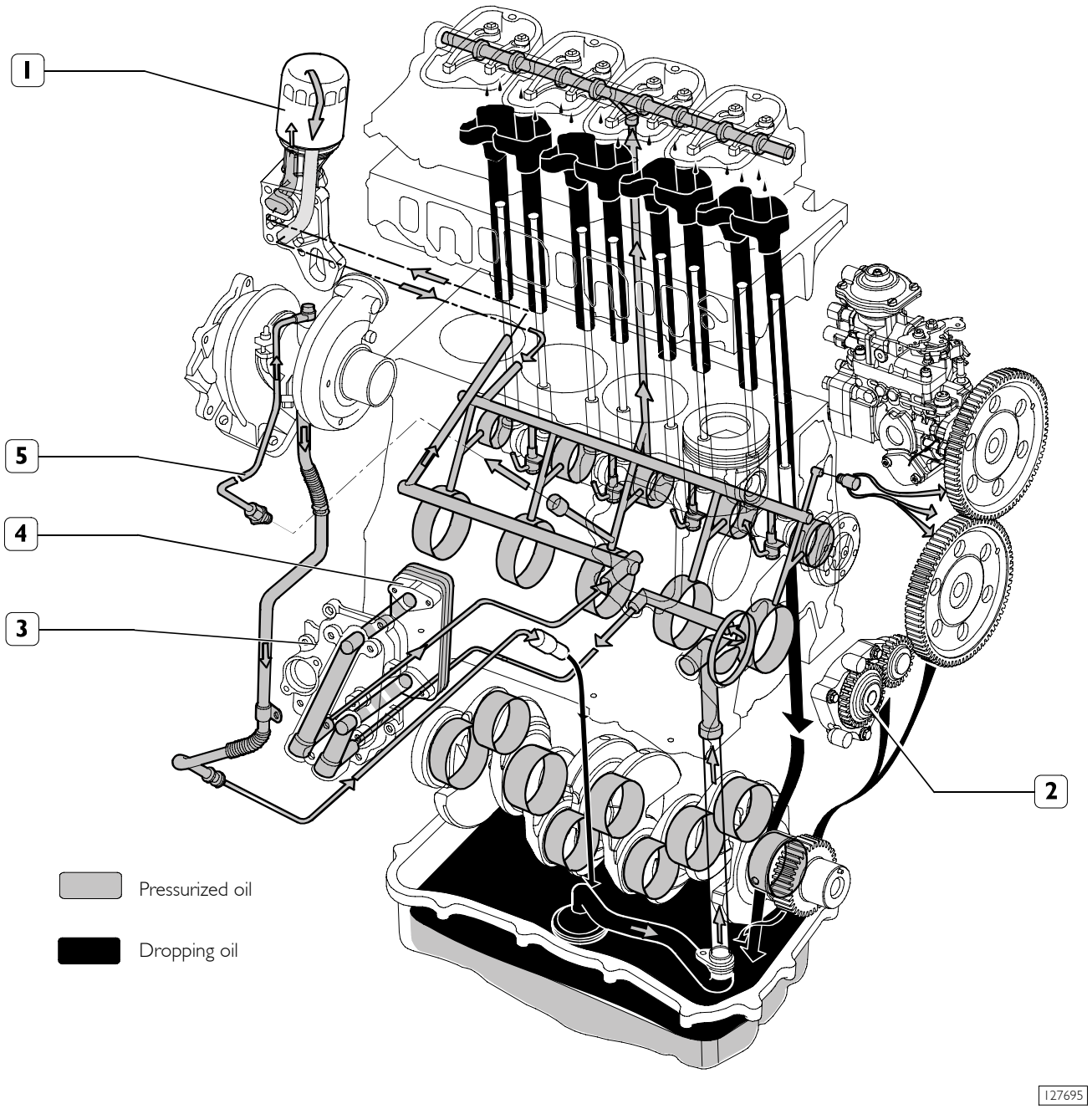
Forced circulation lubrication is controlled by the rotor oil pump housed in the front part of the engine basement and driven by the toothed gear splined on the shank of the engine drive shaft.

From the oil pan, the lubrication oil is distributed to the engine drive shaft, the camshaft and the valve control.

The lubrication system also comprises the heat exchanger, he centrifugal blower for the versions with turbosupercharger and eventually the compressor if the compressed air system is also fitted.

All the above mentioned components vary depending on their use and therefore will be illustrated in the specific section.

Figure 5

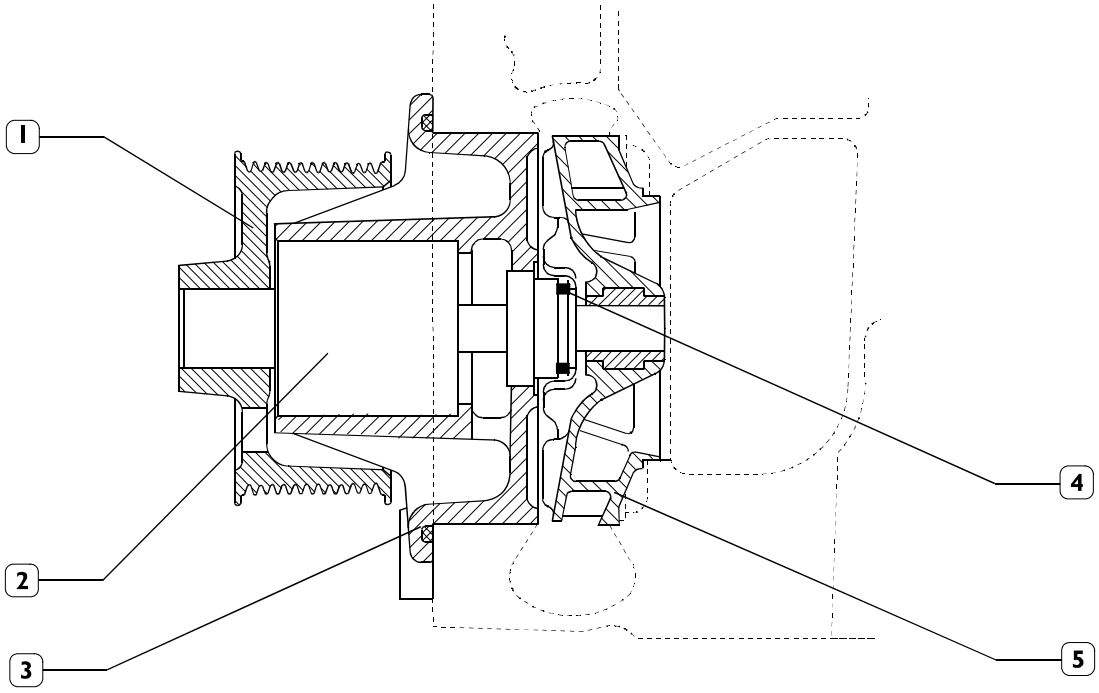


LUBRICATION SYSTEM DIAGRAM

1. Oil filter - 2. Oil pump - 3. Heat exchanging unit - 4. Heat exchanger - 5. Turbosupercharger lubrication feed pipe

WATER PUMP

Figure 11



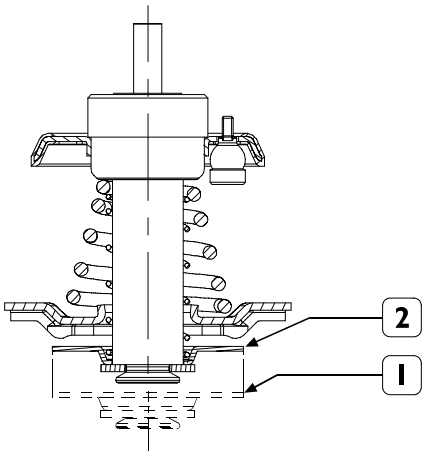
WATER PUMP SECTION

1. Hub - 2. Shaft with bearing - 3. Pump unit - 4. Sheath - 5. Impeller.

The water pump is a centrifugal blade turbine type pump. The pump's bearing (2) is connected to the impeller's shaft as a whole. Water tight between the pump unit (3) and the shaft (2) is ensured by the sheath (4).

THERMOSTAT

Figure 12



THERMOSTAT DIAGRAM

Working system

When the engine is cool, water output from the front part of the cylinder head flows into an inlet containing the thermostat, which cuts out water circulation to the radiator. This way, water circulation will only be possible in the pump-engine circuit, insofar allowing engine heat-up quickly. The thermostat valve starts opening at nearly 80 °C, allowing water circulation into the radiator and also obstructing direct return towards the engine. Check the thermostat efficiency and replace it in case of doubtful functioning.

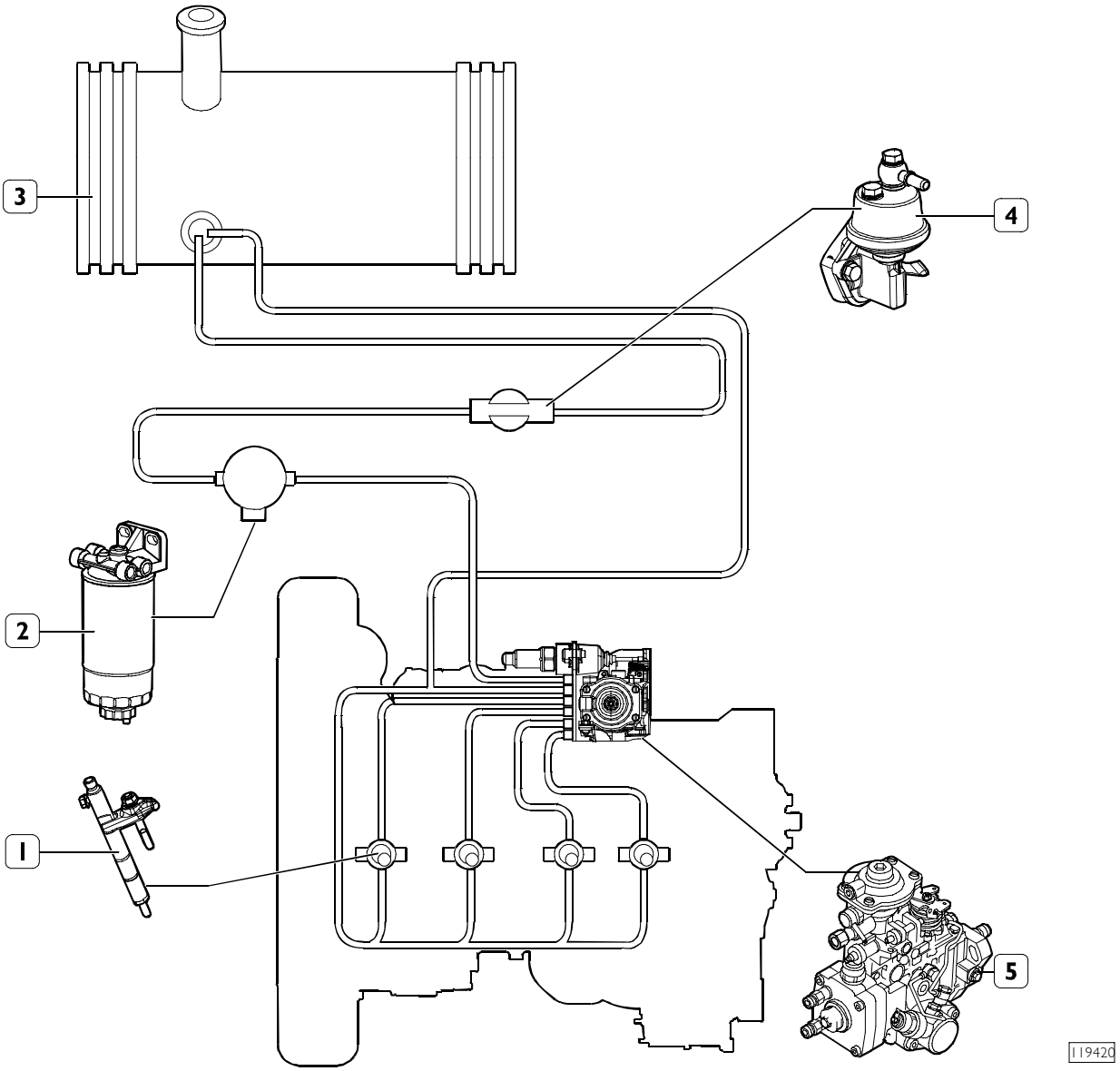
1. Stroke starts at 79° ± 2 °C
2. 7 mm stroke at 94°±2°C

SUPPLY

The engine supply system consists of the following components:

- ❑ Fuel tank (aboard the vehicle)
- ❑ Fuel delivery and return pipes
- ❑ Fuel pre-filter (if fitted, it is placed nearby the engine on the vehicle's chassis)
- ❑ Priming pump, fitted on the engine and driver by the engine camshaft
- ❑ Fuel filter (its position on the engine may vary depending on the outfit and use)
- ❑ Supply rotary pump
- ❑ Injector feed pipe (from the fuel supply pump to the fuel injectors)
- ❑ Injectors

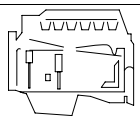
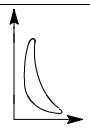
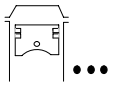
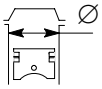
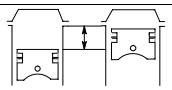
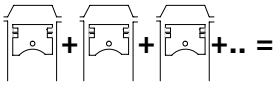
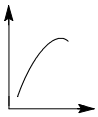
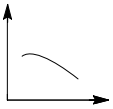
Figure 1



SUPPLY SYSTEM DIAGRAM

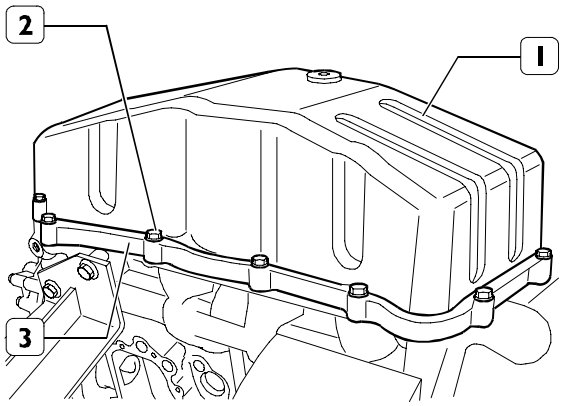
1. Injectors - 2. Fuel filter - 3. Tank - 4. Supply rotary pump - 5. Ignition pump.

MAIN SPECIFICATIONS

			F5CE9454E*A005	F5CE5454B*A004	F5CE9484D*A002
	Type				
	Cycle		Diesel 4 strokes		
	Feeding		Turbocharged	Turbocharged	Turbocharged - intercooler
	Injection		Direct		
	N. of cylinders		4 on-line		
	Diameter	mm	99		
	Stroke	mm	104		
	Total displacement	cm^3	3200		
	Compression ratio		17 ± 0.5 : 1		
	Max. power	kW (HP)	55 (75)	61 (83)	65 (88)
		rpm	2500	2500	2300
	Max. power	Nm (kgm)	281 (29)	310 (32)	340 (35)
		rpm	1250	1250	1400
	Loadless engine idling	rpm	750	750	750
	Loadless engine peak	rpm	3000	3000	3000
	EGR		Internal	External	Internal
	COOLING Water pump control **Thermostat** - start of opening	°C	Liquid Through belt 79 ± 2		
 SAE 15W40 T2 URANIA LD7	**OIL SUPPLY** Total quantity 1st filling MIN level (engine off) MAX level (engine off)	l (kg) l (kg) l (kg)	10.5 (9.2) 7.5 (6.6) 9.5 (8.4)		

NOTE Data, features and performances are valid only if the setter fully complies with all the installation prescriptions provided by FPT.
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.

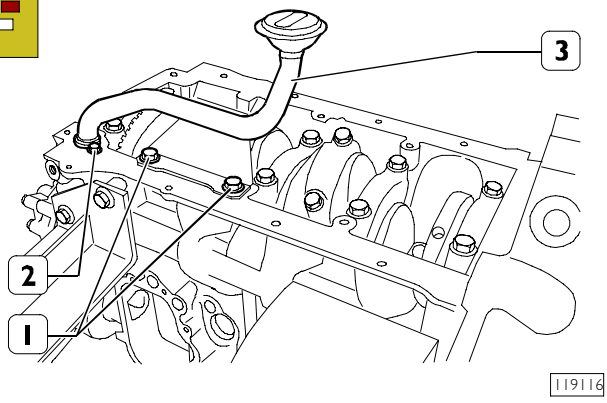
Figure 21



- ❑ Turn the engine upside down.
- ❑ Loosen the screws (2), disassemble the plate (3) and remove the oil pan (1).

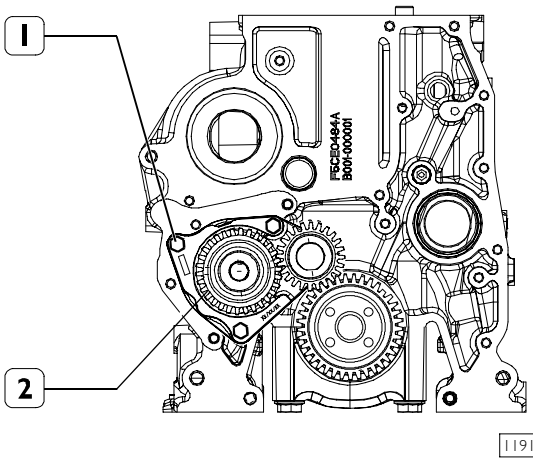
NOTE The shape and dimensions of the oil pan and the suction rose may vary depending on the engine appliance. Hence, the figures provide a general indication of the operation to be executed. Yet, the herein description of the procedures is exhaustive and applicable.

Figure 22



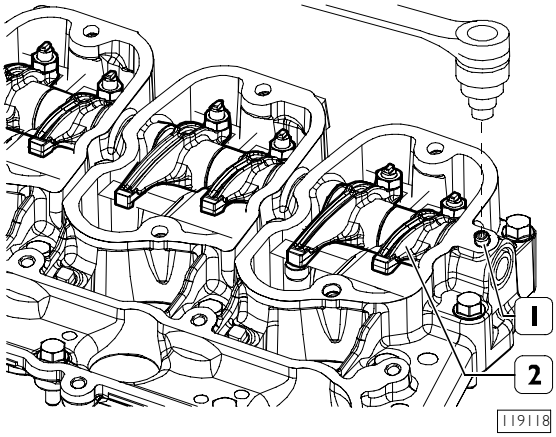
- ❑ Loosen the suction rose support fastening screws (1).
- ❑ Loosen the suction rose (3) fastening screws (3) and then remove the suction rose.

Figure 23



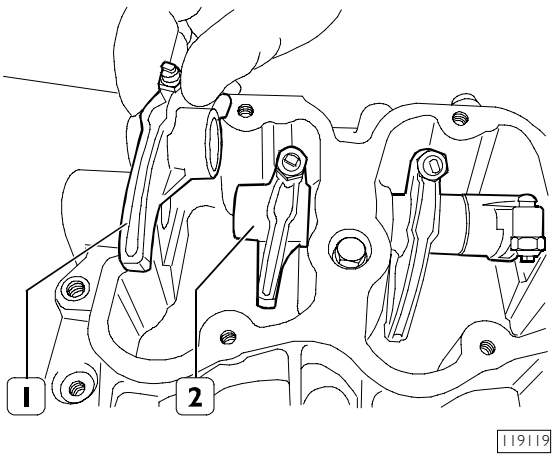
- ❑ Loosen the screws (1) and remove the oil pump (2).

Figure 24



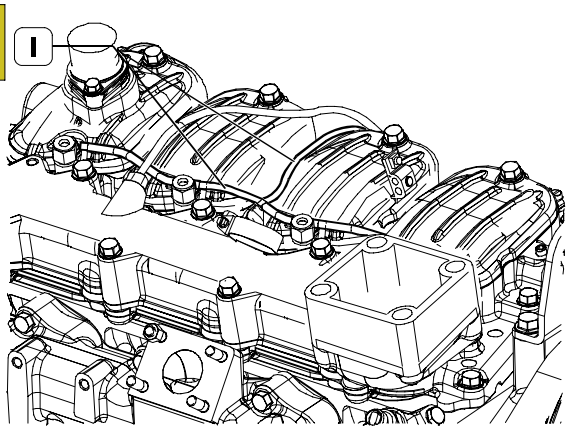
- ❑ Loosen the rocker arm fastening screw (1) from the disassembled rocker arm holding unit and then remove the rocker arm.

Figure 25



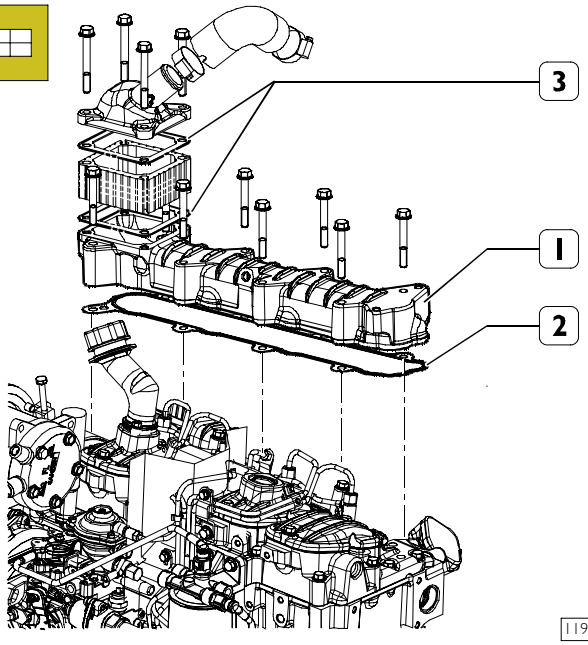
- ❑ Withdraw the rocker arm (1) from one side recovering the equalizers (2) from the other.

Figure 55



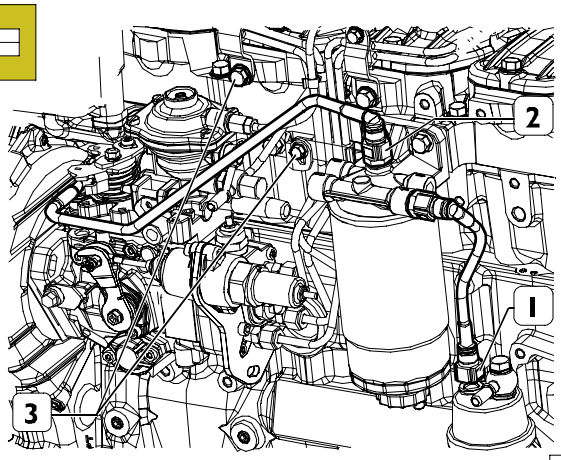
❑ Reassemble the fuel exhaust pipes (1).

Figure 56



❑ Reassemble the whole intake manifold (1) replacing the gasket (2) and (3).

Figure 57

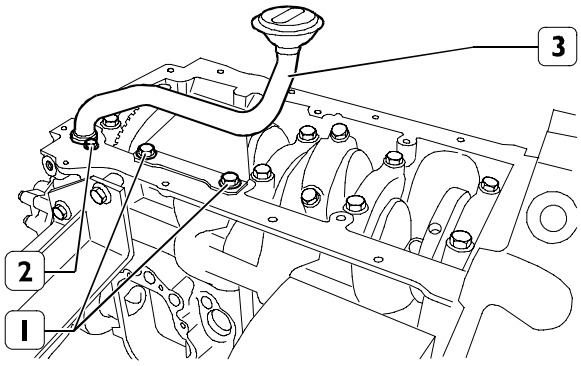


❑ Reassemble the pipe from the pump to the injector and tighten the brackets' fastening screws (3).

❑ Reassemble the pipe from the pump to the fuel filter (2) and from the fuel filter to the priming pump (1).

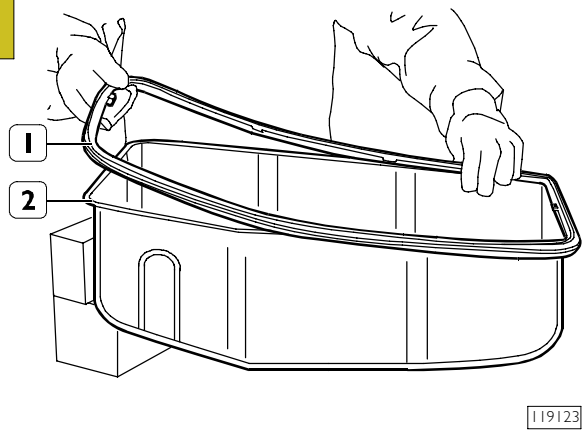
❑ Reassemble the L.D.A. pipe

Figure 58



❑ Reassemble the suction rose tightening the support fastening screws (1) and the screw fixing the suction rose (2) to the prescribed torque setting.

Figure 59



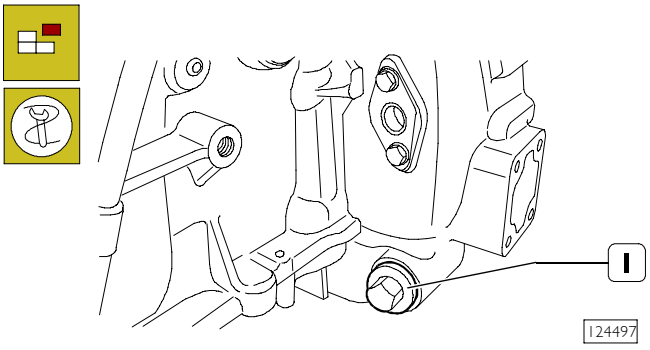
❑ Fit the new gasket (1) to the oil pan (2).

Rotary feed pump disassembly and assembly procedure

NOTE This procedure prescribes that:

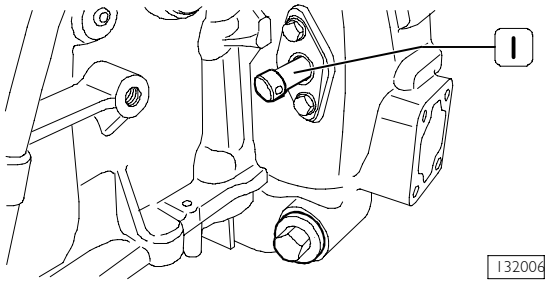
- ❑ the fuel pipes (from the pumping elements to the injectors, recovering blow-by from the injectors to the pump and the supply from the priming pump) have all been removed;
- ❑ the electrical connections have been disconnected.
- ❑ Accelerator cable shall be disconnected.

Figure 78



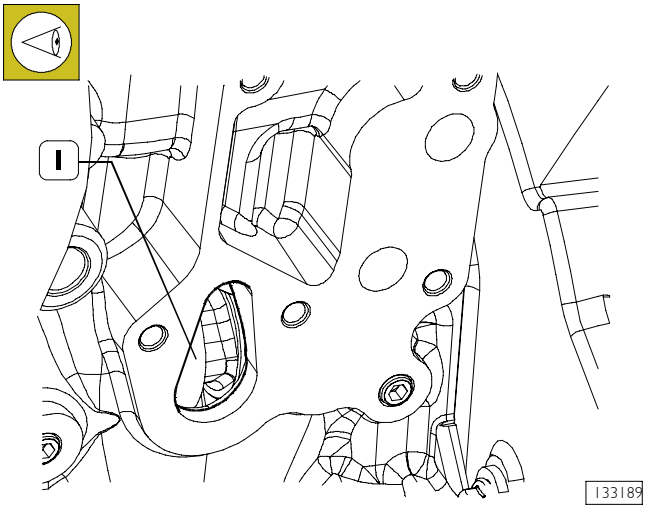
- ❑ Fit tool (1) 99360330 to flywheel housing to rotate the flywheel (must be used with a suitable wrench).

Figure 79



- ❑ Loosen the screws of the plate in which tool 99360612 (1) is to be fitted.

Figure 80

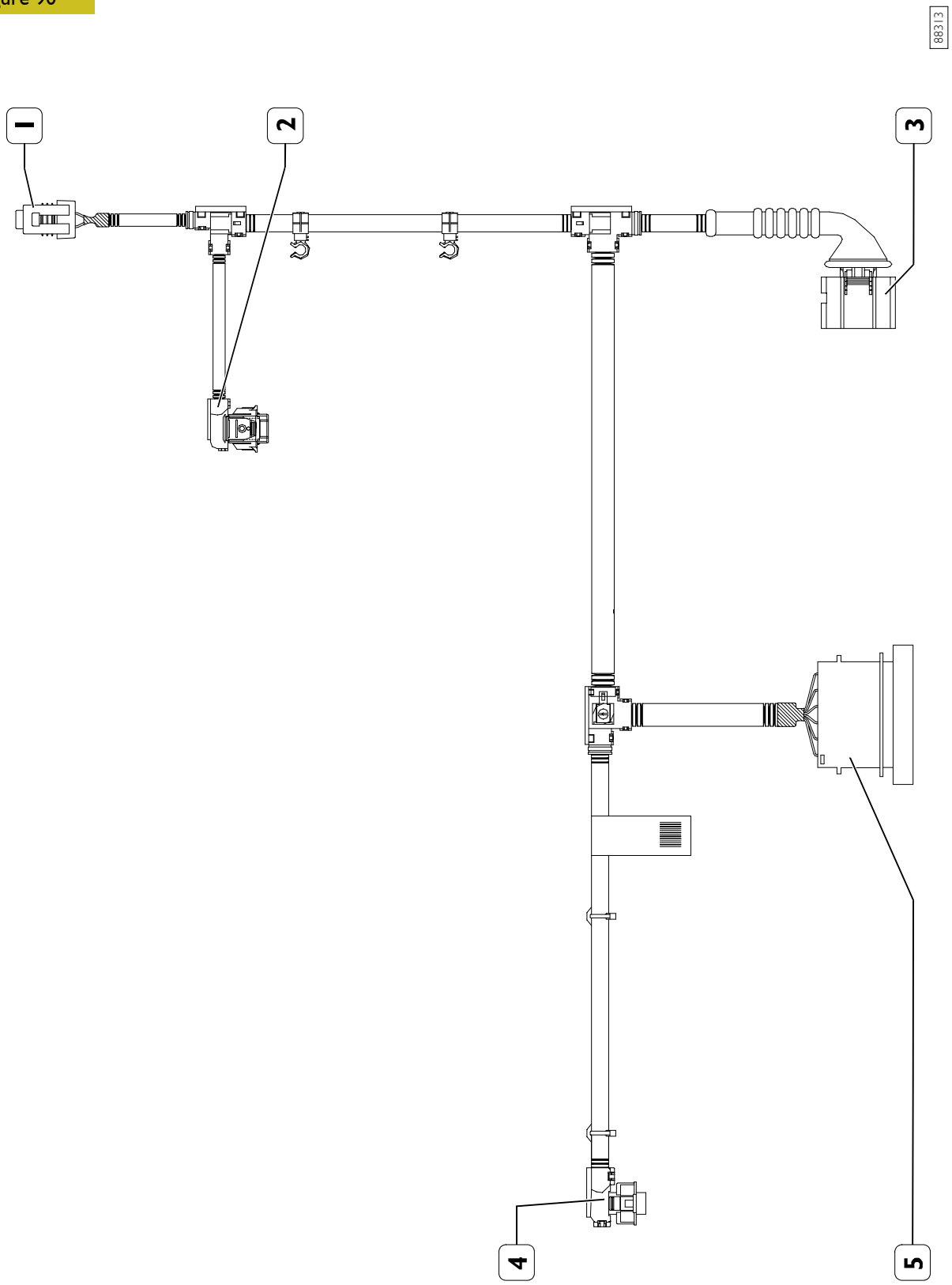


Position the engine drive shaft at T.D.C. of cylinder 1 rotating the flywheel until achieving the following conditions:

- ❑ the notch (1) is visible from the inspection hole;
- ❑ tool 99360612 should be fitted through the carter into the port on the flywheel.

ENGINE CABLE FOR EXTERNAL EGR SYSTEM (for F5CE5454 engines)

Figure 90

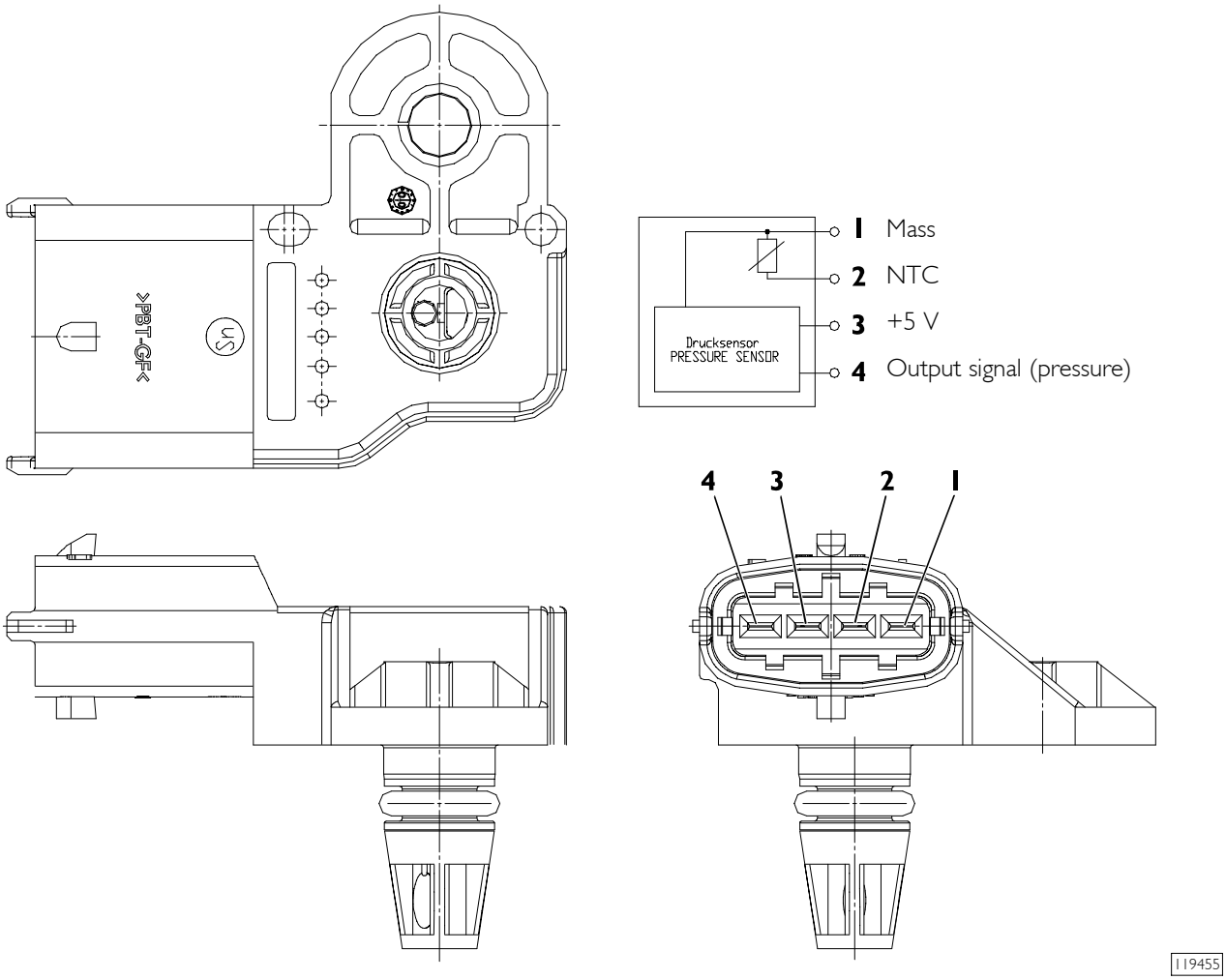


1. Water temperature sensor - 2. Air temperature pressure sensor - 3. EGR Valve - 4. Engine drive shaft revolutions sensor - 5. Sectioning

Air pressure temperature sensor (for F5CE5454 engines)

It consists of an NTC temperature sensor and a pressure sensor, both integrated in a single device.

Figure 97



DIAGNOSIS BY FAILURE

NOTE In case of external EGR system failure, its operation is disabled and the related EGR failure indicator lamp flashes (if applicable).

FAILURE	POSSIBLE ROOT CAUSE	RECOMMENDED TESTS OR REMEDY	NOTES
The engine does not start	Discharged of damaged battery	Check the battery and recharge it. Replace the battery if necessary	
	Battery terminal connections corroded or loose	Clean, check and tighten the battery terminal screw nuts. Replace the terminals and the screw nuts if excessively corroded.	
	Incorrect timing of the ignition pump	Check the ignition pump timing.	Apply to FPT Technical Service.
	Deposits or water presence in the fuel tank	Disconnect the pipes and clean them with compressed air jet. Disassemble the ignition pump and clean it. Eliminate any presence of water in the fuel tank and refuel.	Always bleed the supply system.
	Insufficient fuel reserve	Refuel	
	No supply	Overhaul or replace the supply or transfer pumps	
	Air bubbles in the fuel pumps or in the ignition pump	Check the pipes to ascertain the cause of air presence and the supply pump. Eliminate any air from the ignition pump interior loosing the specially provided cap and manually operating the supply pump.	
	Defective starter	Repair or replace the starter	

Checks not included in maintenance planning-daily checks

It is a good habit to execute, before engine start, a series of simple checks that might represent a valid warranty to avoid inconveniences, even serious, during engine running. Such checks are usually up to the operators and to the vehicle's drivers.

- Level controls and checks of any eventual leakage from the fuel, cooling and lubricating circuits.
- Notify the maintenance if any inconvenience is detected of if any filling is necessary.

After engine start and while engine is running, proceed with the following checks and controls:

- check presence of any eventual leakage from the fuel, cooling and lubricating circuits.
- Verify absence of noise or unusual rattle during engine working.
- Verify, using the vehicle devices, the prescribed pressure temperature and other parameters.
- Visual check of fumes (colour of exhaust emissions)
- Visual check of cooling liquid level, in the expansion tank.

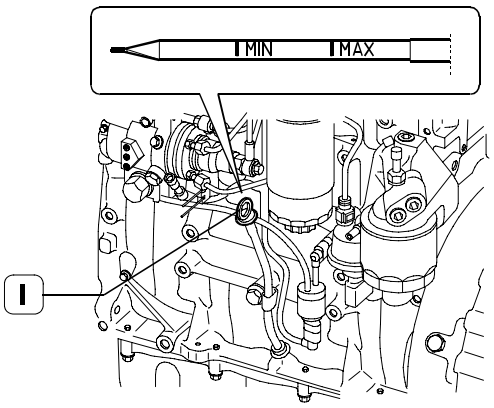
MAINTENANCE PROCEDURES
Checks and controls

Engine oil level check

The check must be executed when the engine is disconnected and possibly cool.

The check can be made using the specially provided flexible rod (1).

Figure 105

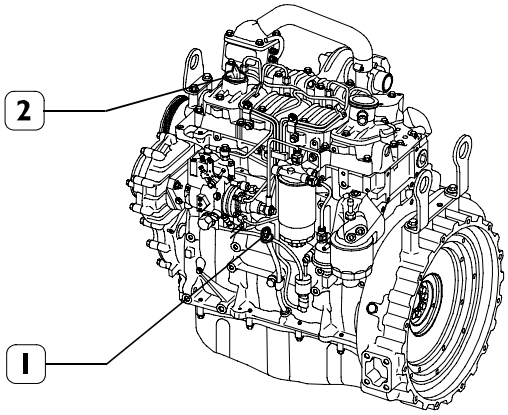


Draw off the rod (1) from its slot and check that the level is within the etched tags of minimum and maximum level.

Whether it should be difficult to make the evaluation, proceed cleaning the rod using a clean cloth with no rag grinding and put it back in its slot. Draw it off again and check the level.

In case the level results being close to the tag showing minimum level, provide filling lubrication of the engine's components.

Figure 106



To provide filling, operate through the upper top (2) or through the lateral top (1). During filling operation, the tops must be removed as well as the rod in order to make the oil flow easier".

Some applications are equipped with a level transmitter alerting dashboard instruments in case of insufficient lubrication oil within the pan.

The engine oil is highly polluting and harmful.
In case of contact with the skin, rinse well with water and detergent.

Adequately protect the skin and the eyes, operate in full compliance with safety regulations.

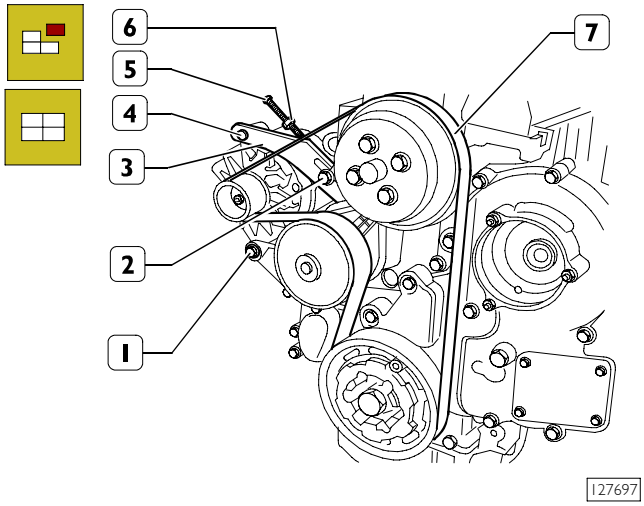
Disposal must be carried out properly, and in full compliance with the law and regulations in force.

Alternator belt replacement

Warning: with switched off motor (but still hot) the belt can operate without advance notice.

Wait for the motor temperature lowering to avoid very serious accidents.

Figure 112



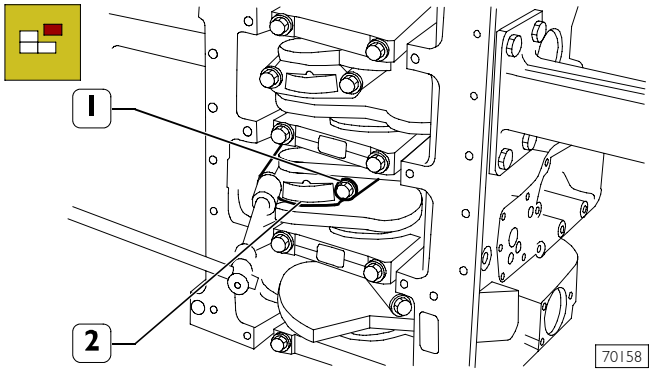
- ❑ Loosen screw (4) and the relevant nut on belt stretching bracket (3).
- ❑ Loosen the screws (1, 2, 5) and the screw nut (6) in order to withdraw the belt (7).
- ❑ Fit the new belt (7) on the pulleys and guide rollers.
- ❑ Tighten the driving belt (7) screwing up screw (5) until the screw (2) reaches the end of the groove which is on the bracket (3). Tighten the nut (6) and the screw (1).
- ❑ Tighten the screw (4) and the bolt (1) that fixes the alternator to the support.

ENGINE OVERHAUL
ENGINE DISASSEMBLY ON BENCH

To execute the operations described here following, it is necessary to fit the engine on the rotary stand after having removed all the appliance's specific components (see Section 3 of the herein manual).

This section illustrates all the more important procedures of engine bock overhaul.

Figure 1

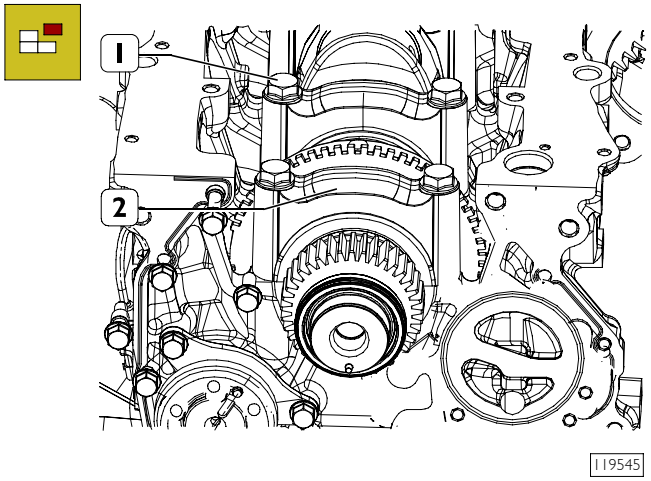


Loosen the screws(1) fastening the connecting rod caps (2) and remove the fastening the connecting rod caps.

Withdraw the pistons with the connecting rods from the upper part of the crankcase.

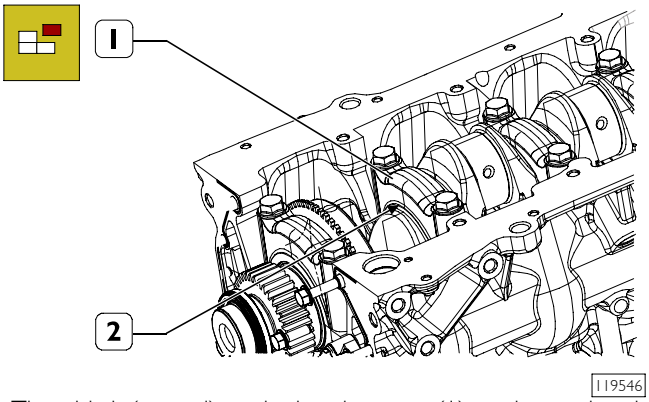
NOTE Keep the half bearings in their respective housings since, in case of reuse after the overhaul, they will have to be reassembled in the same position.

Figure 2



Loosen the screws (1) and disassemble the crankshaft bearing caps (2).

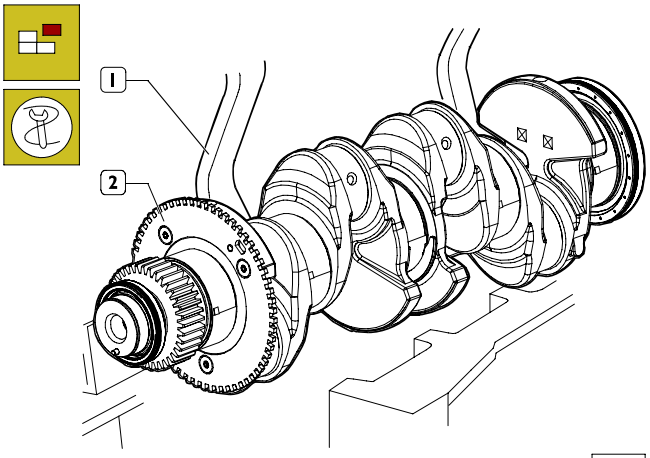
Figure 3



The third (central) main bearing cap (1) and associated support have a bearing-half (2) equipped with thrust.

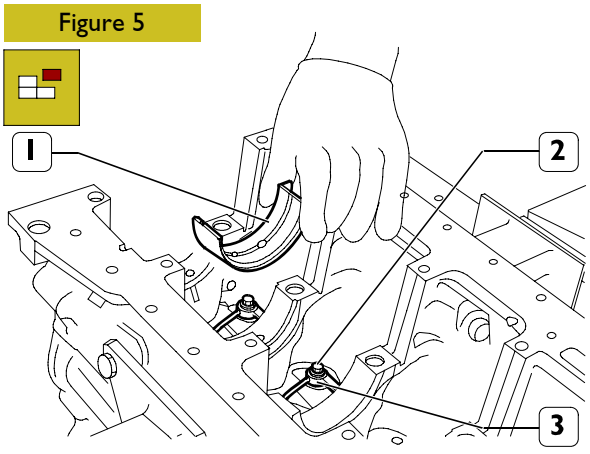
NOTE Note down the assembly position of the upper and lower half bearings since, in case of reuse after the overhaul, they will have to be reassembled in the same position.

Figure 4



Using tool 99360500 (1) and a hoister, remove the engine drive shaft (2) from the crankcase.

Figure 5



Disassemble the crankshaft half bearings (1).
Loosen the fastening screws (2) and disassemble the oil nozzles (3).