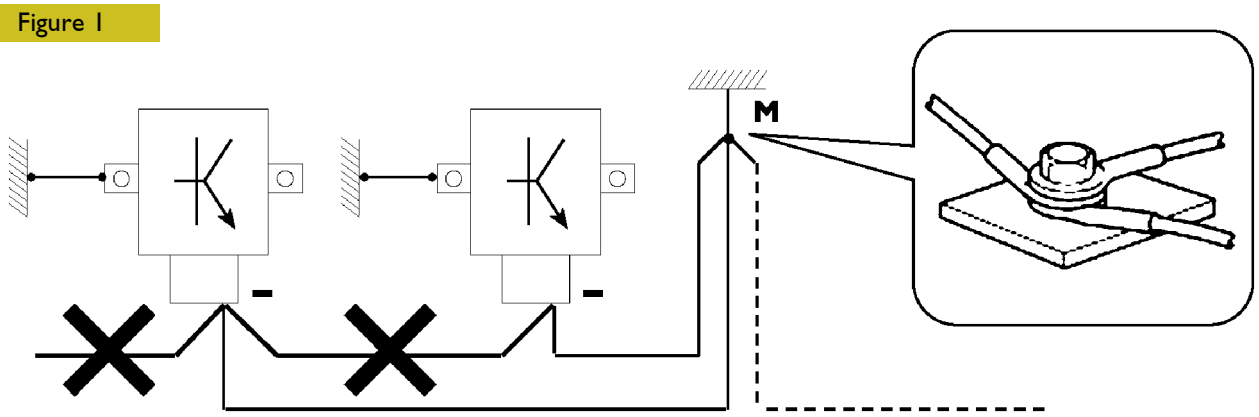
Bonding and screening

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:

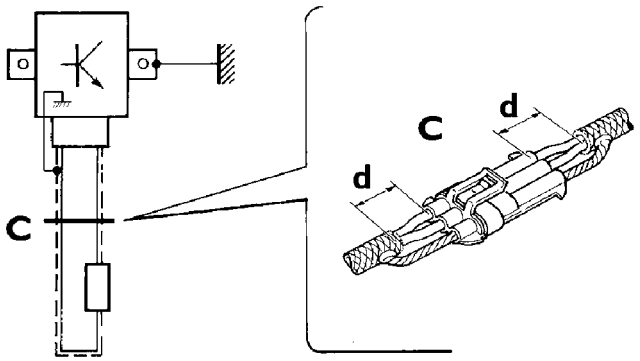
- Electronic central units must be connected to system bonding when they are provided with a metallic shell.
- Electronic central units negative cables must be connected both to a system bonding point such as the dashboard opening bonding (avoiding "serial" or "chain" connections), and to battery negative 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

LUBRICATION

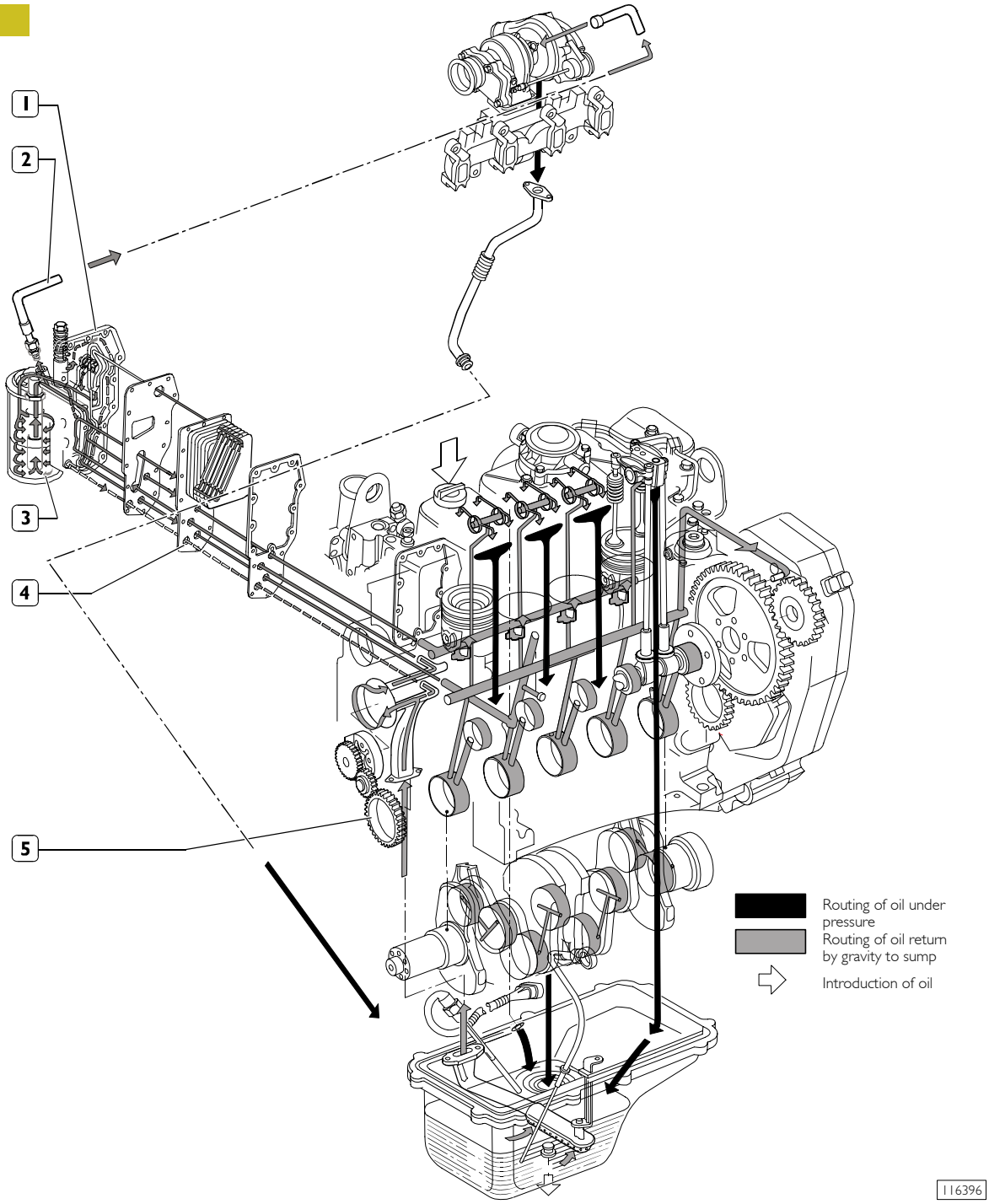
Lubrication by forced circulation is achieved through oil rotary expansion pump, placed in the front part of the basement, driven by the straight-tooth gear splined to the shaft's bar hold.

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), the turboblower for turbocompressed versions, and for any compressed air system.

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

Figure 1

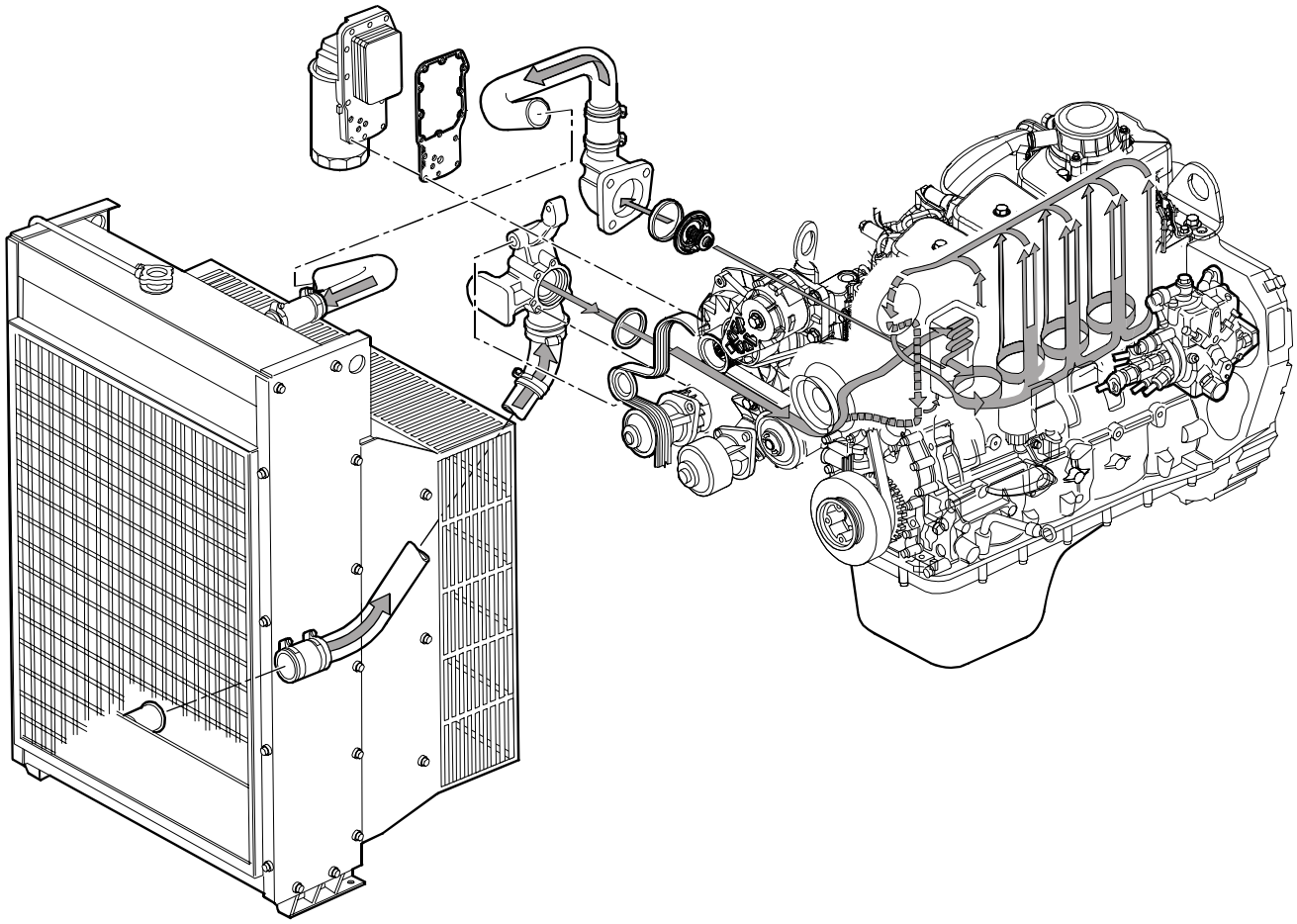


LUBRICATION SYSTEM LAYOUT (4 cylinder engine)

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

Version without turbocharger

Figure 7

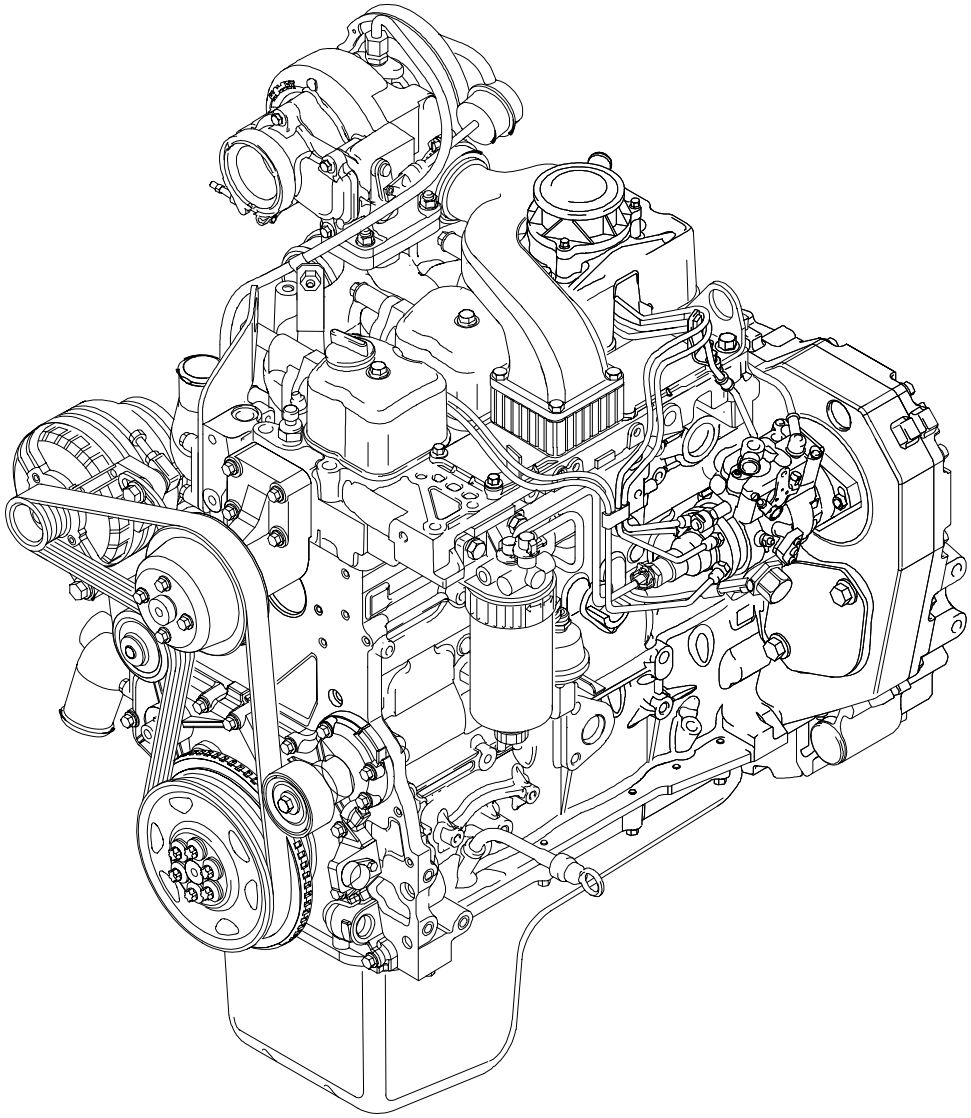


130199

COOLING SYSTEM LAYOUT

GENERAL INFORMATION

Figure 1



129270

F4GE9455A*J600 engine

F4GE

They are characteristed by diesel cycle 4 stroke atmospheric or supercharged 4 and 6 cylinders each with 2 valves.

Feed is provided by rotary mechanical pump or on line according to the equipment application.

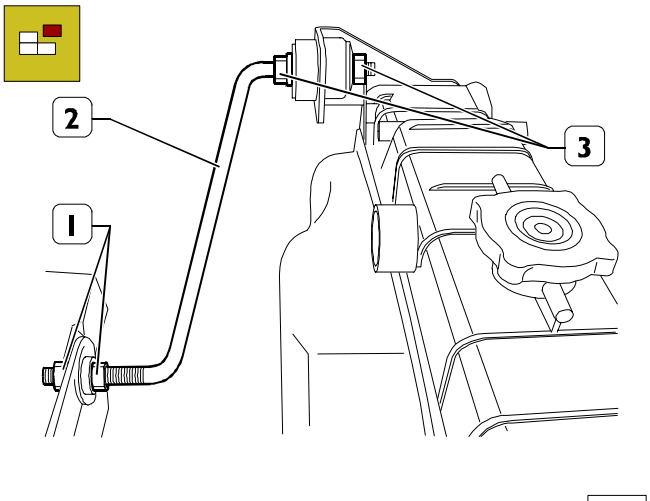
NOTE Data, technical specifications and performances granted shall be valid only if the Setter will follow and comply with all installation prescriptions provided by FPT.

Furthermore, the expanders assembled by the Setter must always comply with couple, power and number of revolutions based on which the engine has been designed.

The section herein described is composed or four directories:

- directory of mechanical overhaul prescribed in accordance to the engine's specific duty, illustrating all necessary operations to remove and assembly the external components of the engine, including cylinder heads, gearbox of the timing system and of the front part cover;
- electrical directory, describing the connections of the different components, of the pre-post heating gearbox (only for some versions) and of the sensors assembled to the engine;
- troubleshooting directory;
- directory of preventive and regular maintenance operations, providing instructions for the execution of the main operations.

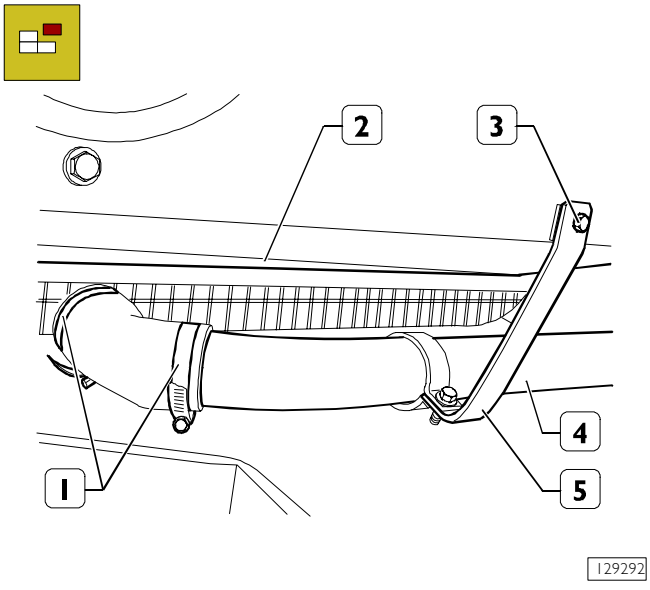
Figure 5



❑ Undo the nuts (1) and (3) and remove the bracket (2). Repeat the operation for the second bracket.

For 6 cylinder engines

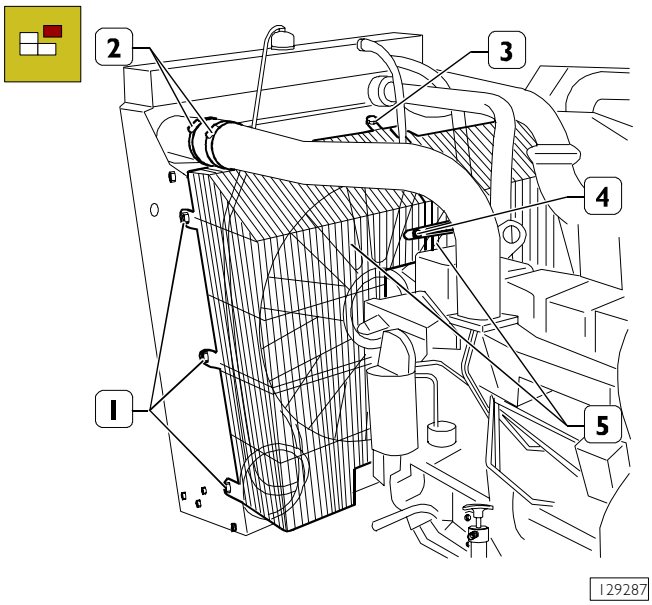
Figure 6



❑ Have a special container ready by the pipe (4) for collecting the coolant. Disconnect the pipe (4) adjusting the bands (1).

❑ Undo the bolt (3) and release the pipe (4) complete with bracket (5) from the radiator assembly (2).

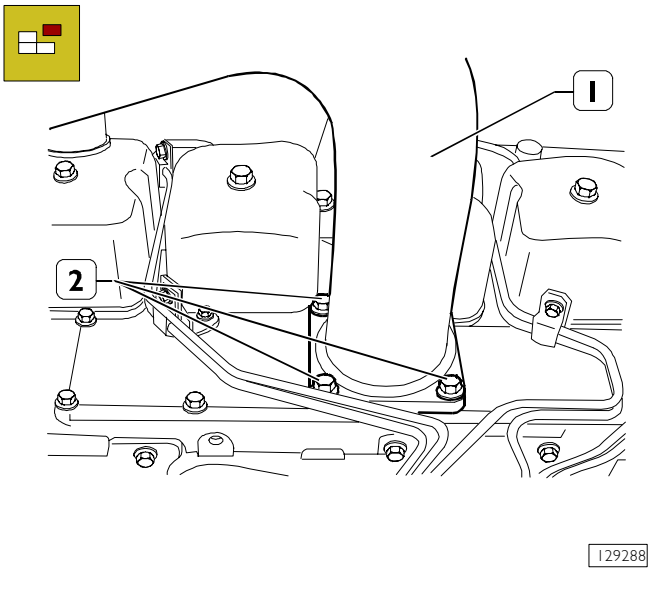
Figure 7



❑ Remove the protective grilles (5) for the fan adjusting the fastenings (1), (3) and (4).

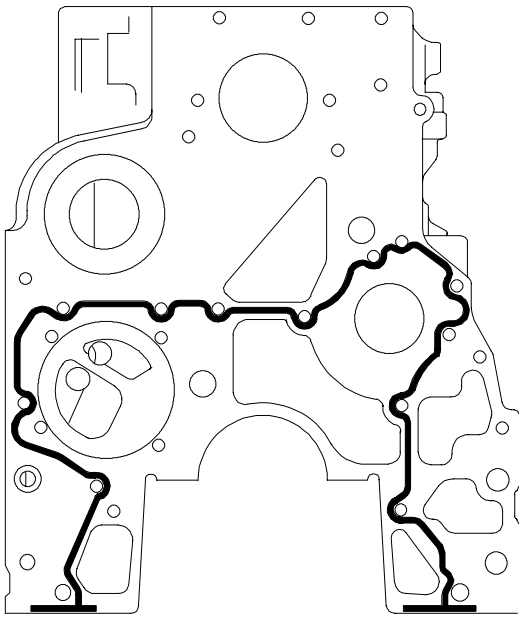
❑ Open the bands (2).

Figure 8



❑ Undo the bolts (2) and remove the pipe (1) from the intake manifold.

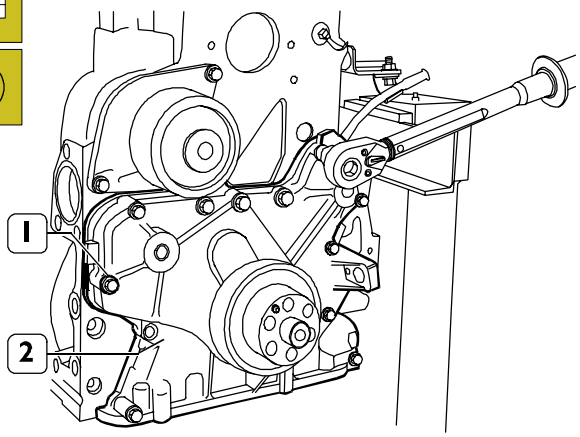
Figure 76



75710

❑ Accurately clean the contact surface of engine block and apply sealing LOCTITE 5205 on it in order to form a uniform and continuous kerbstone with no crumbs.

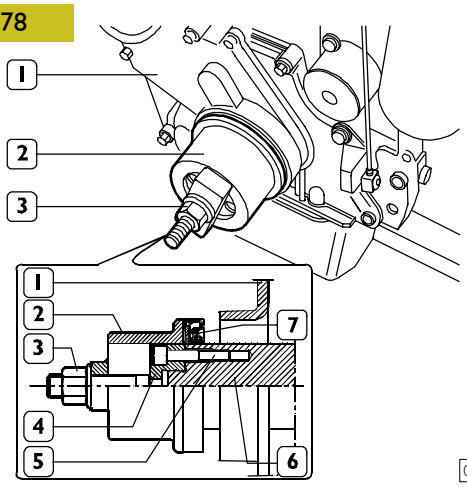
Figure 77



106550

❑ Assemble the front cover (2) to the block and tighten the screws (1) fixing them to the prescribed couple.

Figure 78



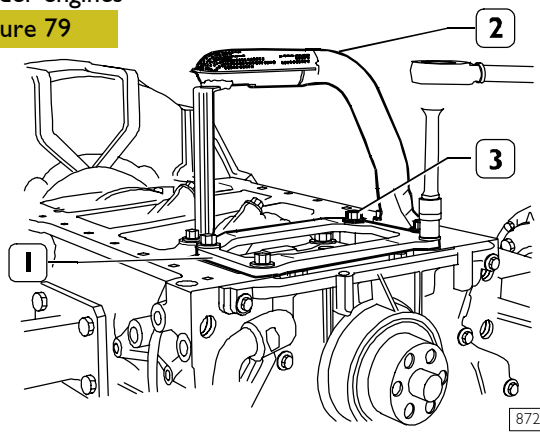
00902t

❑ Apply on engine drive shaft front tang (6) the detail (4) of the tool 99346252, fix it with the screws (5) and key the new holding ring on it (7).

❑ Place the detail (2) on the detail (4), screw-up the threaded nut until carrying out the complete assembly of the holding ring (7) to the front cover.

4 cylinder engines

Figure 79

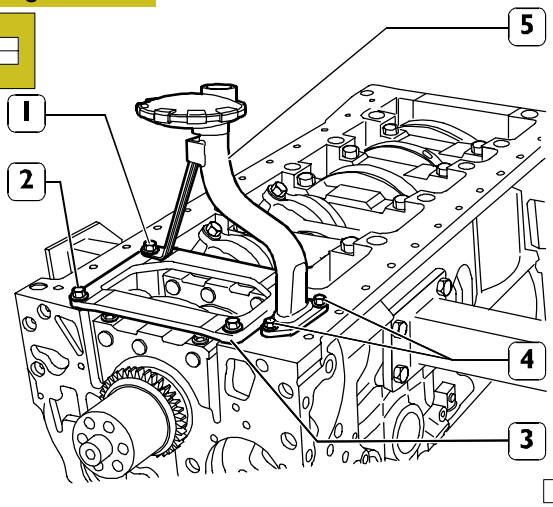


87260

❑ Assemble the plate (1), the rose pipe (2), tighten the fixing screws (3) and fix them to the prescribed couple.

6 cylinder engines

Figure 80

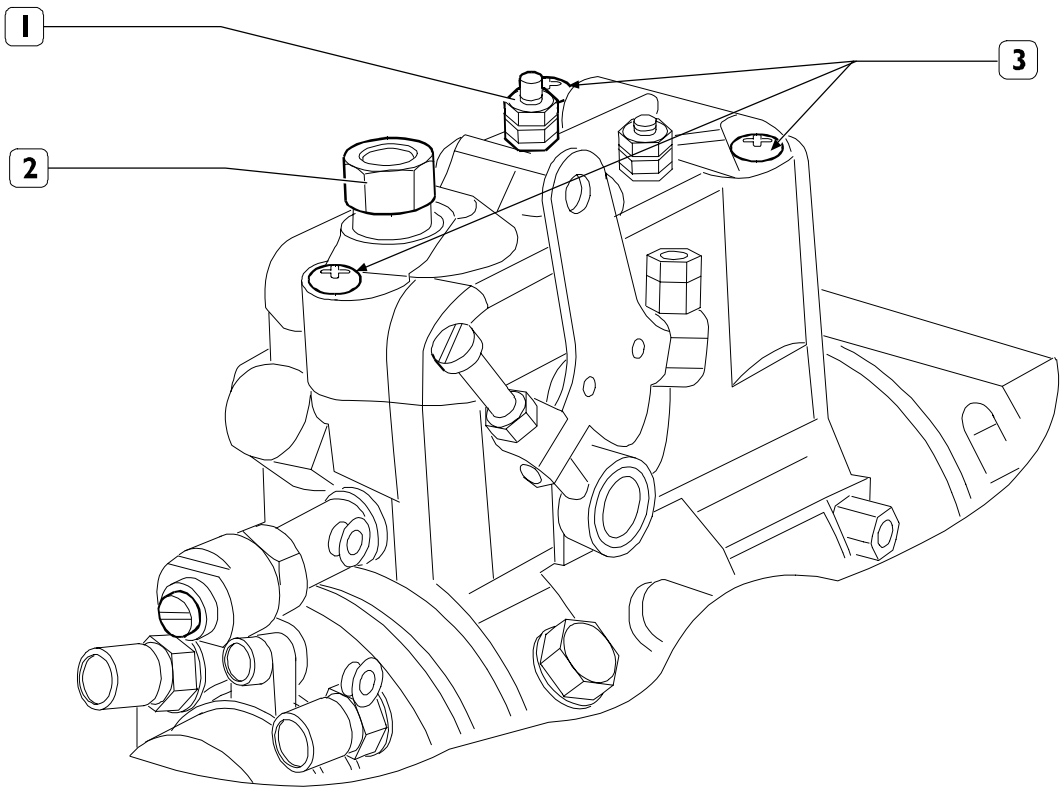


86516

❑ Assemble the plate (3), the suction rose (5) and tighten the fixing screws (1, 2 and 4) to the prescribed torque.

ASSEMBLY PROCEDURE OF THE "ADC100" ELECTRONIC ACTIVATOR ON STANADYNE SERIES "D" INJECTION PUMPS

Figure 151



116978

Before proceeding in the removal of the Injection Pump cover and then to the replacement with the electronic actuator, it is important to clean the external part of the pump, if necessary, using solvents. This prevents contamination of the internal part of the pump.

- ❑ Disconnect the wire of the stop electro-valve from the clamp (1) positioned on the pump cover, being careful to isolate it.
- ❑ Remove the fuel return pipe from the connection (2)
- ❑ Remove the three screws (3) of the pump cover. The screws will then be replaced assembling the screws supplied with the ADC100 actuator
- ❑ Remove the cover of the injection pump very carefully so that the dirt won't penetrate inside the pump.
- ❑ Remove the connection (2) of the fuel return pipe and the sealing from the injection pump cover. Keep the connection (2) and the sealing that will have to be assembled on the electronic actuator.

ANOMALY	POSSIBLE CAUSE	REMEDY	NOTE
The engine overheats	Faulty water pump.	Check the unit and replace if necessary. Replace the gasket.	
	Malfunctioning thermostat.	Replace the thermostat.	
	Fouling in coolant openings in the cylinder head and cylinder groups.	Wash following the standards specified for the type of descaling product used.	
	Water pump drive belt slack.	Check and adjust the tightness of the belt.	On applications provided with automatic tensioner, check corret worching of such device.
	Coolant level too low.	Top-up radiator with coolant.	
	Incorrect engine timing.	Check timing and tune correctly.	
	Incorrect calibration of injection pump.	Correct the delivery rate of the pump on a bench so that the injection is at the specified rate.	See your FPT dealer.
	Dry air cleaner blocked.	Clean the air filter or replace if necessary.	
Engine operation is irregular and lacks power	Incorrect timing of injection pump.	Check timing and correctly set pump.	
	Faulty automatic advance variator.	Check operation on injection pump test setup; if values found do not correspond to requirements, change variator spring.	See your FPT dealer.
	K.S.B. automatic cold advance device malfunctioning.	Check or replace injection pump.	
	Excessive piston wear.	Overhaul the engine and replace any worn parts.	
	Incorrect calibration of speed regulator.	Check and correctly calibrate the regulator.	See your FPT dealer.

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Base - November 2008

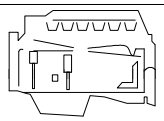
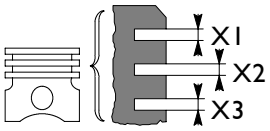
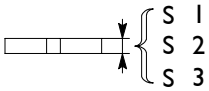
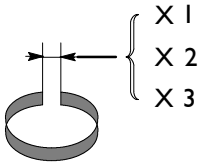
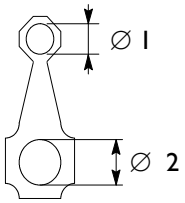
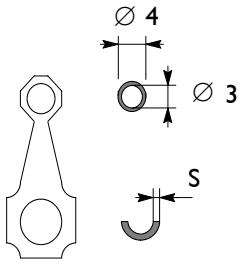
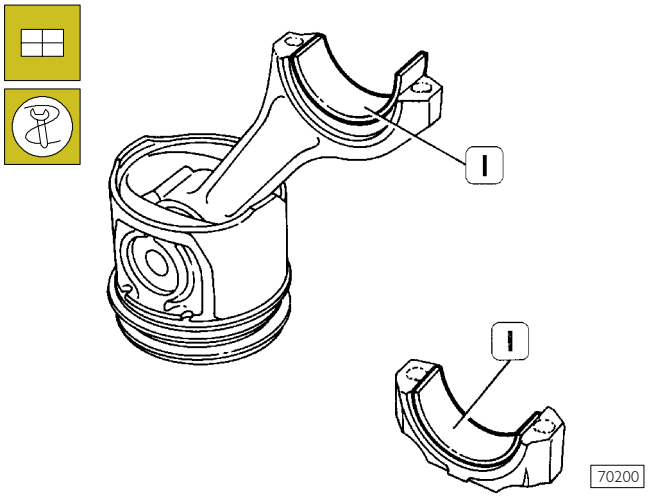
	Type		F4GE0405A*F650	F4GE0455	
				A*F650	C*F650
CYLINDER UNIT AND CRANKSHAFT COMPONENTS			mm		
	Split ring slots * measured on a Ø of 99.00 mm	X1* X 2 X 3	2.705 to 2.735 2.440 to 2.460 4.030 to 4.050		
	Split rings	S 1* S 2 S 3	2.575 to 2.615 2.350 to 2.380 3.970 to 3.990		
	Split rings - slots	1 2 3	0.090 to 0.160 0.060 to 0.110 0.040 to 0.080		
	Split rings		0.4		
	Split ring end opening in cylinder barrel:	X 1 X 2 X 3	0.30 to 0.45 0.60 to 0.80 0.30 to 0.55		
	Small end bush housing Big end bearing housing	Ø 1 Ø 2	40.987 to 41.013 72.987 to 73.013		
	Small end bush diameter Inside Big end half bearings	Ø 3 S	38.019 to 38.033 1.955 to 1.968		
	Piston pin – bush		0.019 to 0.039		
	Big end half bearings		0.250 to 0.500		

Figure 245

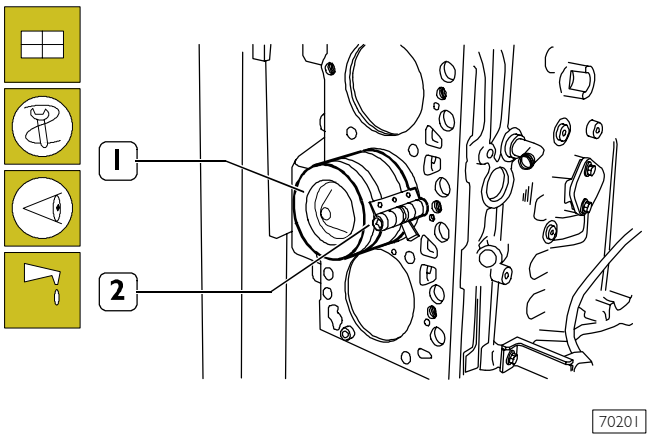


Fit half bearings (1) on connecting rod and cap.

NOTE Refit the main bearings that have not been replaced, in the same position found at removal. Do not try to adapt the half bearings.

Fitting connecting rod-piston assembly into cylinder barrels

Figure 246



Lubricate accurately the pistons, including the split rings and the cylinder barrel inside.

Use band 99360605 (2) to fit the connecting rod-piston assembly (1) into the cylinder barrels and check the following:

- ❑ the number of each connecting rod shall correspond to the cap coupling number.

Figure 247

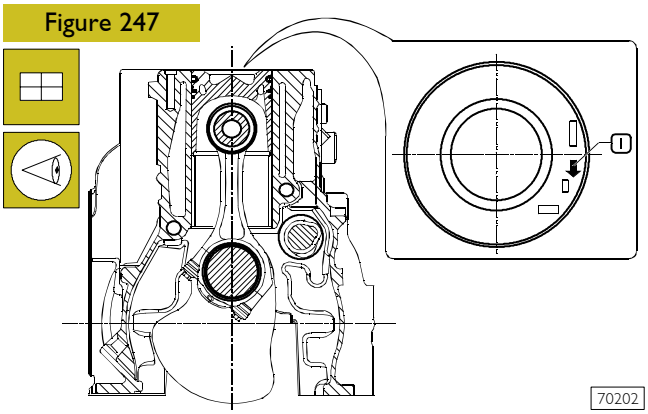
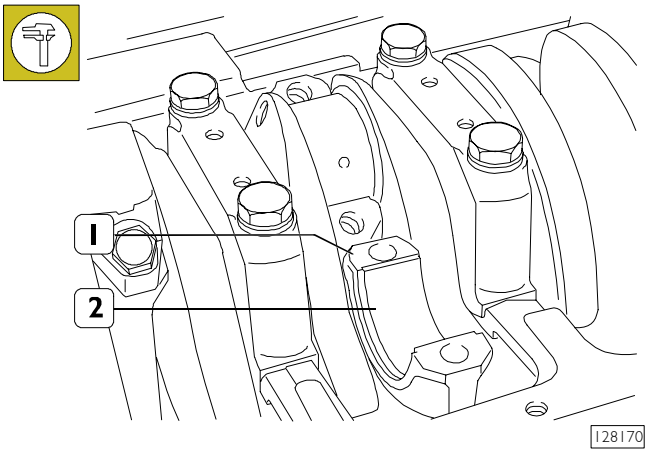


DIAGRAM FOR CONNECTING ROD-PISTON ASSEMBLY FITTING INTO BARREL

- ❑ Split ring openings shall be displaced with each other by 120°;
- ❑ connecting rod-piston assemblies shall have the same weight;
- ❑ the arrow marked on the piston crown shall be facing the front side of the engine block or the slot obtained on the piston skirt shall be corresponding to the oil nozzle position.

Finding crankpin clearance

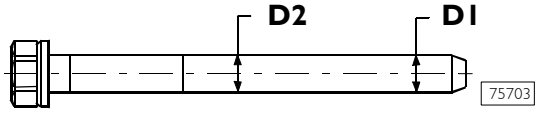
Figure 248



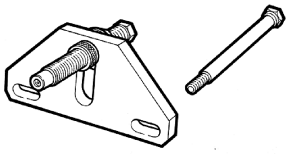
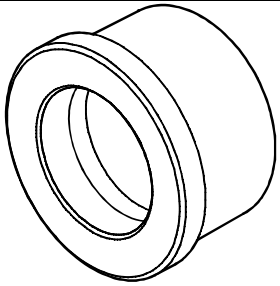
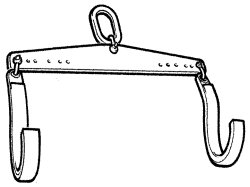
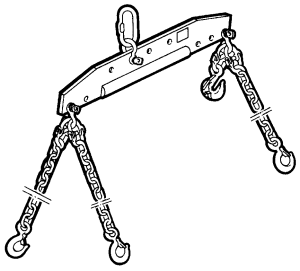
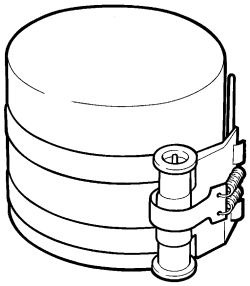
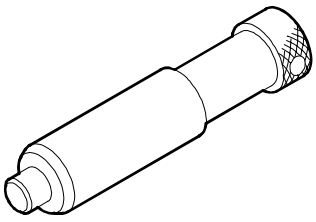
To measure the clearance proceed as follows:

- ❑ clean the parts accurately and remove any trace of oil;
- ❑ fit the connecting rod caps (1) with the relevant half bearings (2).

NOTE 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.



TOOLS

TOOL NO.		DESCRIPTION
99360351		Tool for stopping the engine flywheel
99360362		Beater for removing/refitting camshaft bushes (to be used with 993700069)
99360500		Tool for lifting the output shaft
99360595		Lifting rig for engine removal/refitting
99360605		Band for fitting piston into cylinder barrel (60 – 125 mm)
99360616		Band for fitting piston into cylinder barrel (60 – 125 mm)

Fuel pressure sensor

Assembled on a rail end, it measures the fuel pressure in the rail in order to determine the injection pressure.

The injection pressure value is used to control the pressure and to determine the electric injection control length.

Fuel temperature sensor

It is a sensor that is equal to the previous one.

It measures fuel temperature to provide the control unit with an index of the diesel fuel thermal state.

Coolant temperature sensor

It is a variable-resistance sensor suitable to measure the coolant temperature to provide the control unit with an index of the engine thermal state.

Output shaft sensor

It is an inductive sensor placed on the front engine part. Signals generated through the magnetic flow that is closed on the phonic wheel, change their frequencies depending on output shaft rotation speed.

Timing sensor

It is an inductive sensor placed on the engine rear left part. It generates signals obtained from magnetic flow lines that are closed through holes obtained on the keyed gear on the camshaft. The signal generated by this sensor is used by the ECU as injection phase signal.

Though being equal to the flywheel sensor, it is NOT interchangeable since it has a different outside shape.

System functionality

Self-diagnosis

The ECU self-diagnostic system checks signals coming from sensors by comparing them with threshold data.

IVECO Code recognition

The EDC7 control unit communicates with the Immobilizer control unit (if fitted) to obtain the startup consent.

Engine pre-heating resistance check

The pre-post heating is activated when even only one of the water, air or fuel temperature sensors signals a temperature that is less than 5 °C.

Phase recognition

By means of signals coming from camshaft sensor and flywheel sensor, the cylinder on which fuel must be injected is recognised upon startup.

Injection control

The control unit, depending on information coming from sensors, controls the pressure regulator, and changes pre-injection and main injection modes.

Closed-loop control for injection pressure

Depending on engine load, measured by processing signals coming from various sensors, the control unit controls the regulator in order to always have the optimum pressure.

Pilot and main injection spark advance control

The control unit, depending on signals coming from various sensors, computes the optimum injection point according to an internal mapping.

Idle speed control

The control unit processes signals coming from various sensors and adjusts the amount of injected fuel.
It controls the pressure regulator and changes the injection time of injectors.
Within certain thresholds, it also takes into account the battery voltage.

Maximum speed limiting

At 2700 rpm, the controlunit limits fuel flow-rate by reducing the injectors opening time.
Over 3000 rpm it deactivates the injectors.

Cut Off

Fuel cut off upon release is controlled by the control unit performing the following logics:

- ❑ it cuts off injectors supply;
- ❑ it re-activates the injectors shortly before idle speed is reached;
- ❑ it controls fuel pressure regulator.

Smoke control upon acceleration

With strong load requests, the control unit, depending on signals received by air inlet meter and engine speed sensor, controls the pressure regulator and changes the injectors actuation time, in order to avoid exhaust smoke.

Fuel temperature control

When the fuel temperature exceeds 75 °C (measured by the sensor placed on fuel filter) the control unit intervenes by reducing injection pressure.
If the temperature exceeds 90 °C, the power is reduced to 60%.

AC compressor engagement control (if fitted)

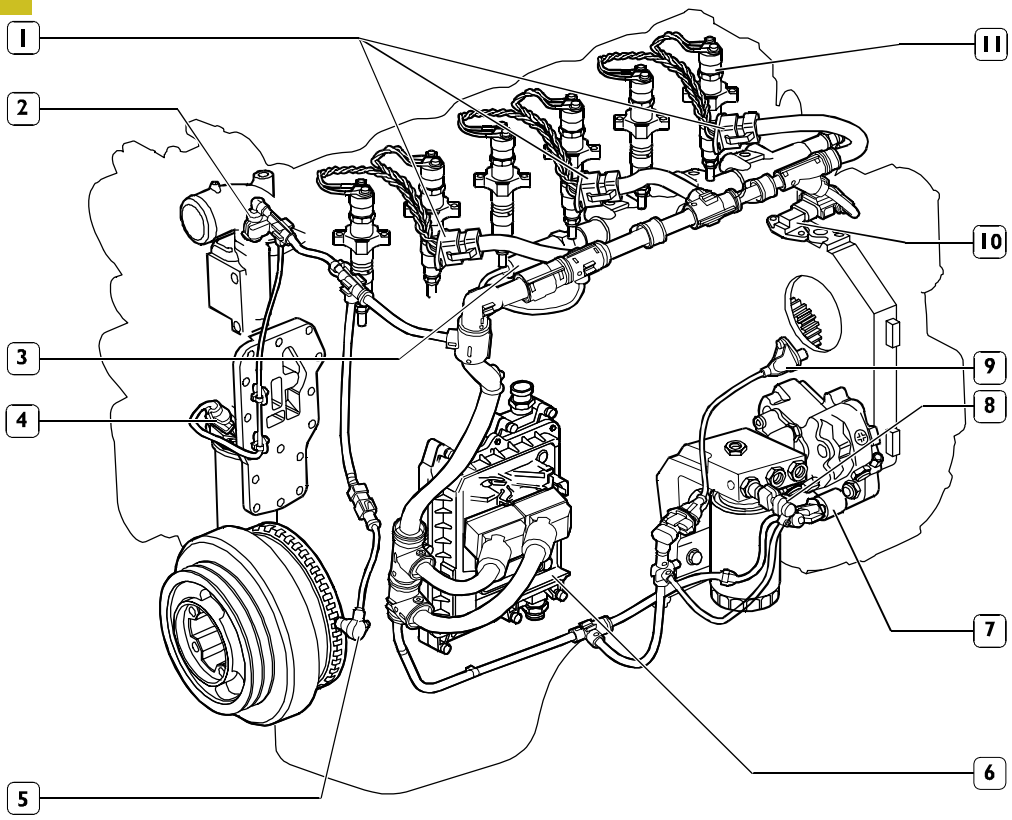
The control unit is able to drive engagement and disengagement of the electromagnetic compressor clutch depending on coolant temperature.
If the coolant temperature reaches about 105 °C, it disengages the clutch.

After Run

The control unit microprocessor allows storing certain EPROM data, among which failure memory and Immobilizer information, in order to make them available upon the following startup.

Disassembly of application components

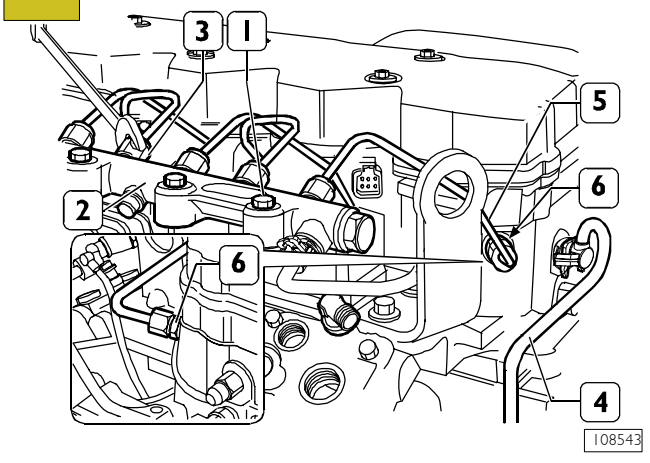
Figure 18



1. Connections for Electro-injectors - 2. Engine cooling liquid temperature's sensor - 2. Cable of the fuel pressure sensor - 4. Sensor of engine's oil temperature and pressure - 5. Driving shaft sensor - 6. EDC 7 gearbox - 7. Temperature - air pressure sensor - 8. Timing system sensor - 9. Cable of fuel heater and fuel temperature's sensor - 10. Cable of pressure regulating gauge - 11. Electro-injector.

Disconnect the engine's cable from the connectors wiring harness to
Electro-injectors (1); (10) air pressure/temperature sensor; (3) fuel pressure sensor;
(6) engine control module; (9) timing system sensor; (2) Thermostat sensor of engine cooling liquid's temperature; (5) sensor of engine's revolutions.

Figure 19

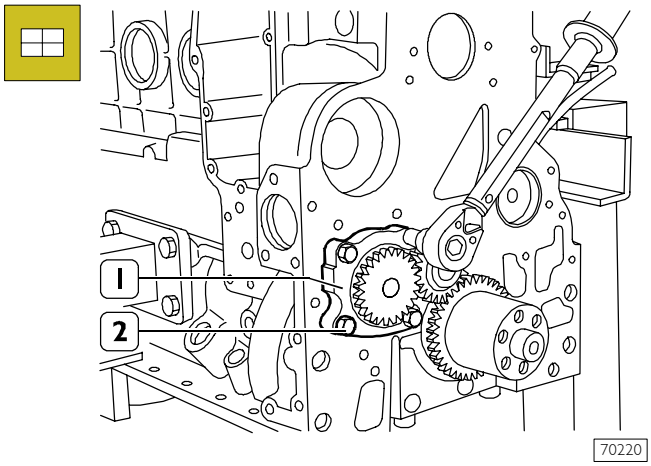


Disconnect from the rail (2): the fuel pipe (7) according to procedures described in Figure 3. Disconnect fuel pipes (5) from rail (2) and injector manifolds (6).

NOTE When releasing pipe (6) connections (4) to rail (2), use the proper wrench to avoid rotation of flow limiters (3).

Remove the screws (1) and disconnect the rail (2).

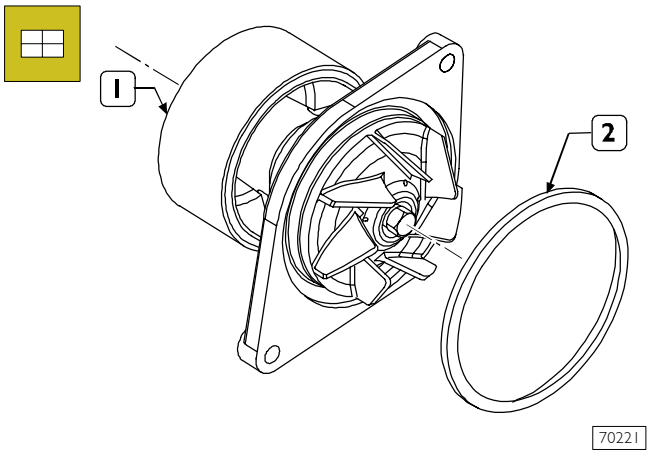
Figure 61



Fit the oil pump (1).

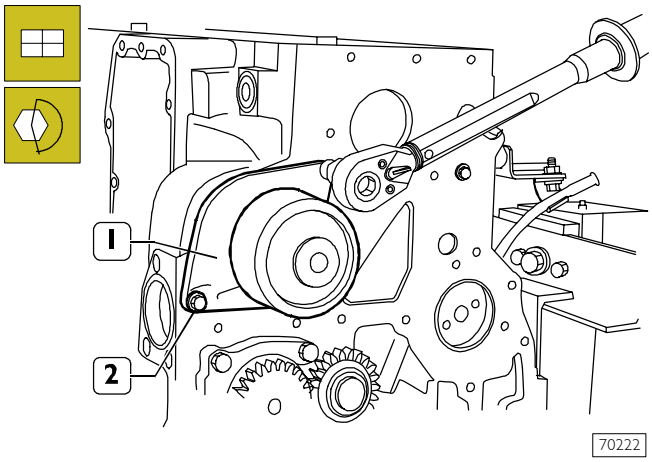
Tighten the fastening screws (2) to the specified torque.

Figure 62



Apply a new sealing ring (2) to the water pump (1).

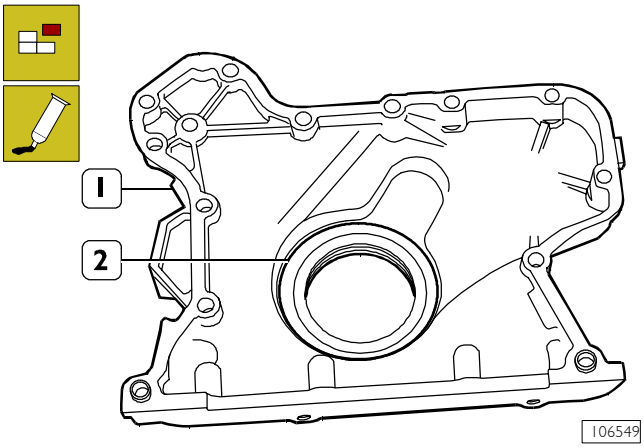
Figure 63



Fit the water pump (1).

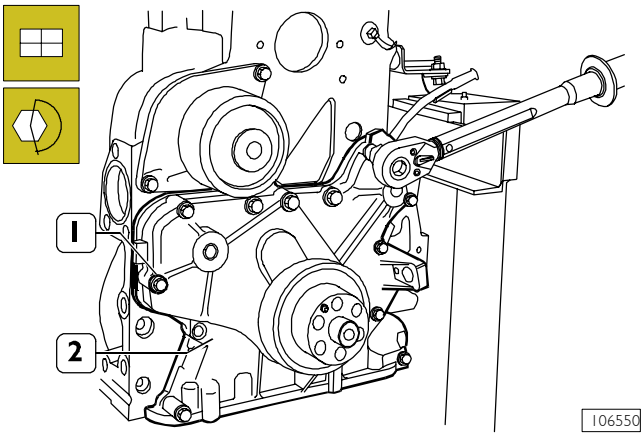
Tighten the screws (2) to the specified torque.

Figure 64



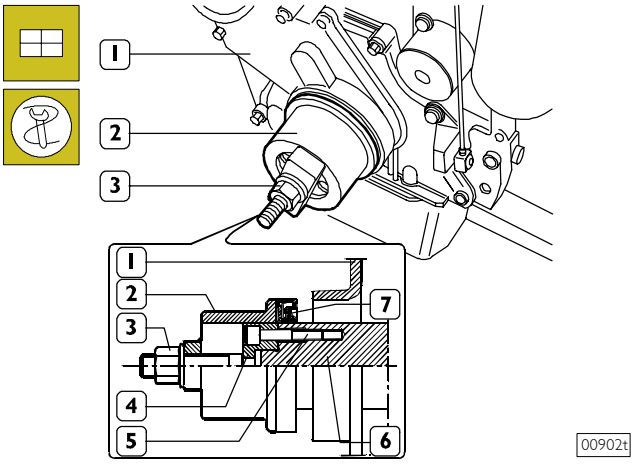
Remove the sealing ring (2) from the front cover (1), clean accurately the coupling surfaces and smear them with LOCTITE 5205.

Figure 65



Clean accurately the front cover (2) surface and refit it. Tighten the screws (1) to the specified torque.

Figure 66

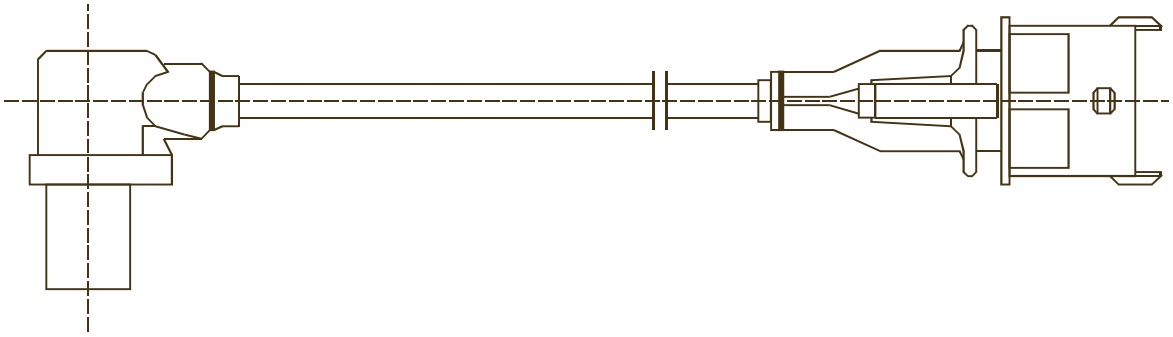


Apply tool 99346252 part (4) to the front output shaft tang (6), secure it by screws (5) and fit the new sealing ring (7). Position part (2) on part (4), screw nut (3) until completing sealing ring (7) fitting into front cover (1).

Crankshaft sensor

This is an inductive sensor located at the front left hand side of the engine. The crankshaft sensor produces signals obtained from a magnetic flux field closing through the openings in a phonic wheel fitted on the crankshaft.
The crankshaft sensor is connected to the control unit on pins 19C - 23C. The sensor impedance is ~900 Ω.

Figure 122

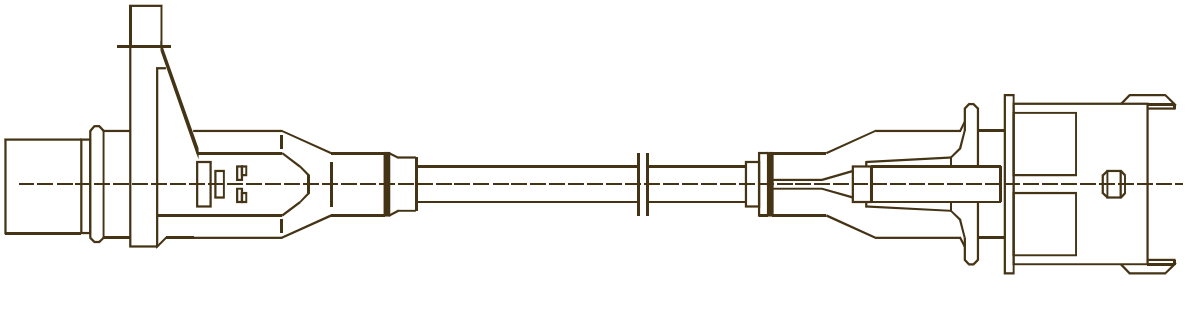


Crankshaft sensor

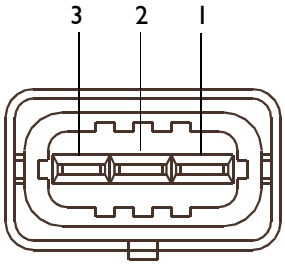
Timing sensor

This is an inductive sensor located at the rear left hand side of the engine. The timing sensor generates signals obtained from a magnetic flux field closing through the holes in the timing gear on the camshaft. The signal generated by this sensor is utilized by the electronic control unit as an injection phase signal.
Although it is similar to the flywheel sensor, these two devices are NOT interchangeable because of the different external shape.
The timing sensor is connected to the control unit on pins 9C - 10C. The sensor impedance
is ~900 Ω.

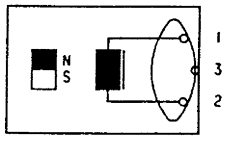
Figure 123



Timing sensor



Connector



Wiring diagram

Ref.	Description	ECU pin	
		Camshaft sensor	Timing sensor
1	Signal	19C	10C
2	Signal	23C	9C
3	Shield		