CURSOR 9 SERIES

Power Generation Application

F2CE0685

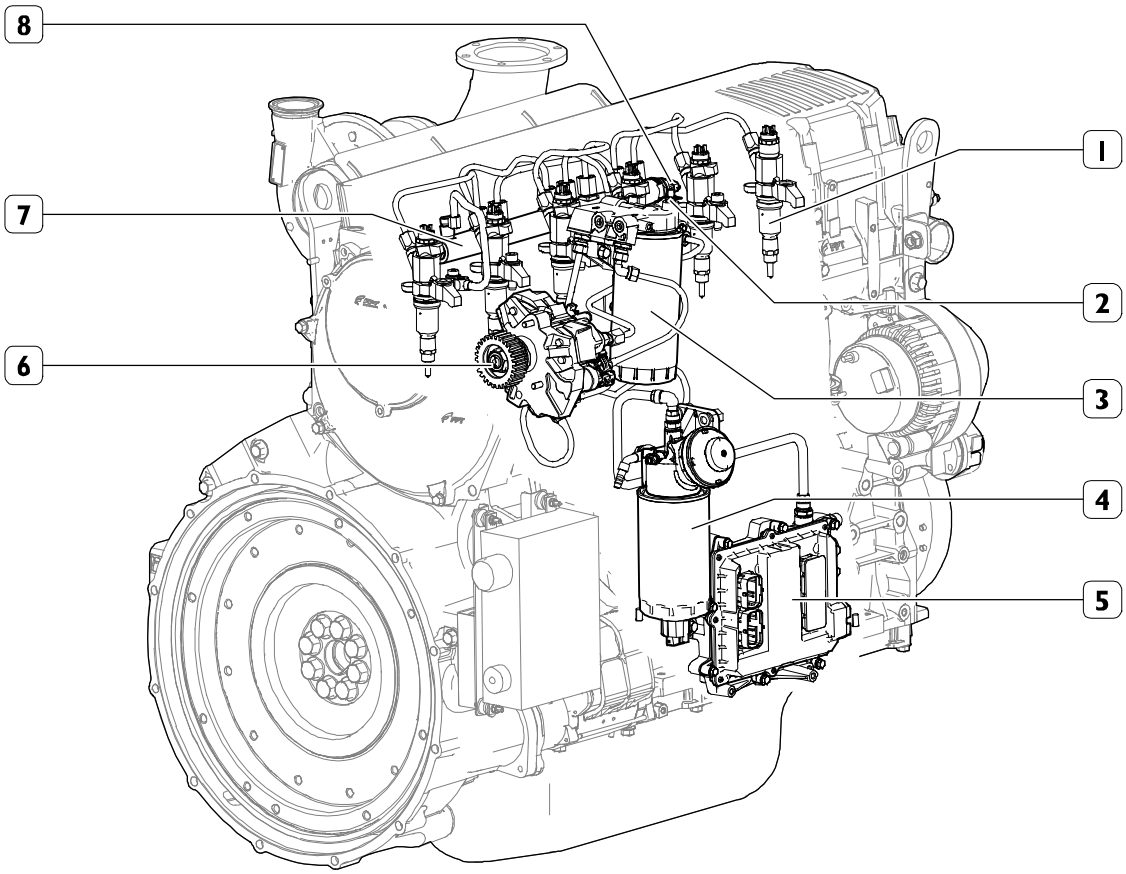
Technical repair manual

SUPPLY SYSTEM
Principles
The fuel supply system is composed of:

- ❑ Fuel tank
- ❑ Fuel delivery and return pipes
- ❑ Fuel pre-filter
- ❑ Fuel filter
- ❑ HP supply pump
- ❑ Electro-injector supply pipes
- ❑ Electro-injectors

ELECTRICAL SYSTEM

Figure 1



1. Electro-injector - 2. Fuel temperature sensor - 3. Fuel filter - 4. Fuel pre-filter - 5. E.C.U. (Electronic Control Unit) - 6. High-pressure pump - 7. Common Rail - 8. Rail pressure sensor

SENSORS

Engine coolant temperature sensor

It is located on the engine left side cylinder head water outlet manifold.

It determines the coolant temperature for the various control logics of operation of the engine when hot or cold and identifies the need to enrich the mixture when the engine is cold or reduce fuel injection when it is hot.

Fuel temperature sensor

It is identical to the coolant temperature sensor and is positioned on the fuel filter support.

It provides data that is helpful to determine the density of the fuel injected into the electro-injectors in order to adapt injection firing time to the actual amount that must be injected. The derating strategies, adopted to surpassing the fuel critical temperature, are due to the sensitive reduction of its lubricating action caused by temperature increase.

At times these strategies are evident given the engine's maximum performance limitations.

Timing system pulse transmitter

It is an inductive sensor located on the camshaft.

It generates signals obtained from changes in magnetic flux created by spaces between the teeth on the phonic wheel fitted to the crankshaft. Number of teeth 6 plus 1 for timing.

The signal generated by this sensor is used by the ECU as the injection timing signal.

Flywheel pulse transmitter

It is identical to the pulse transmitter fitted on the camshaft and mounted on the flywheel guard casing near the ring gear. It measures the flywheel rev/min.

Air press/temp sensor

It incorporates a temperature sensor and a pressure sensor.

It is fitted to the intake manifold so that, by measuring the maximum quantity of air taken in, it makes it possible to determine the exact amount of fuel to be injected at each cycle.

The output voltage is proportional to the pressure (or temperature) measured by the sensor.

Oil press/temp sensor

Identical to the air pressure/temperature sensor.

It is mounted on the crankcase.

It measures the engine oil temperature and pressure.

The signal received is relayed to the EDC ECU that, in turn, controls the instrument.

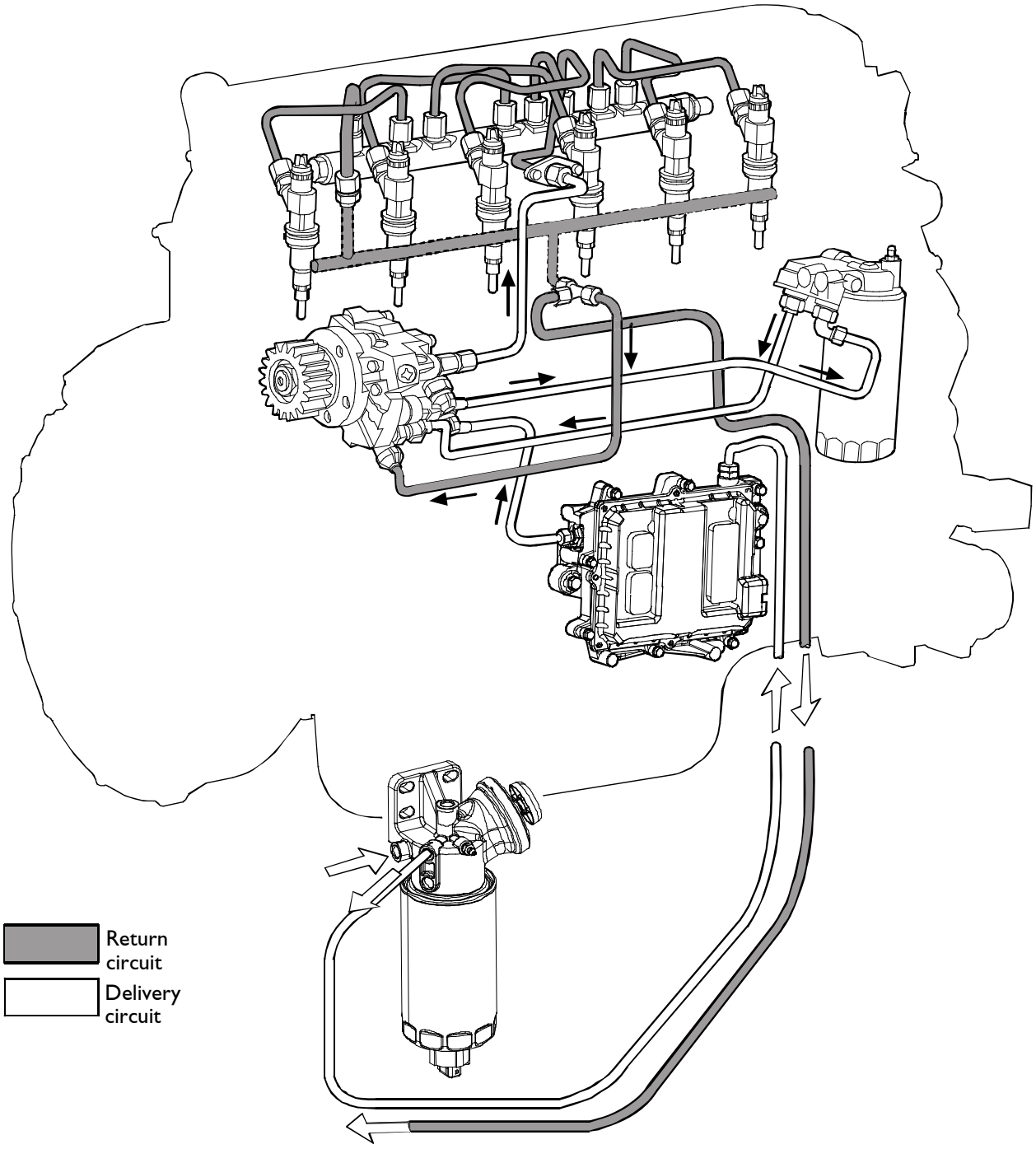
Fuel pressure on rail sensor

Fitted to one end of the rail, this sensor measures the pressure of the fuel so as to determine injection pressure.

The value of injection pressure is used to keep the pressure level under control and to determine the time duration of the injection electronic command.

HYDRAULIC SYSTEM

Figure 2



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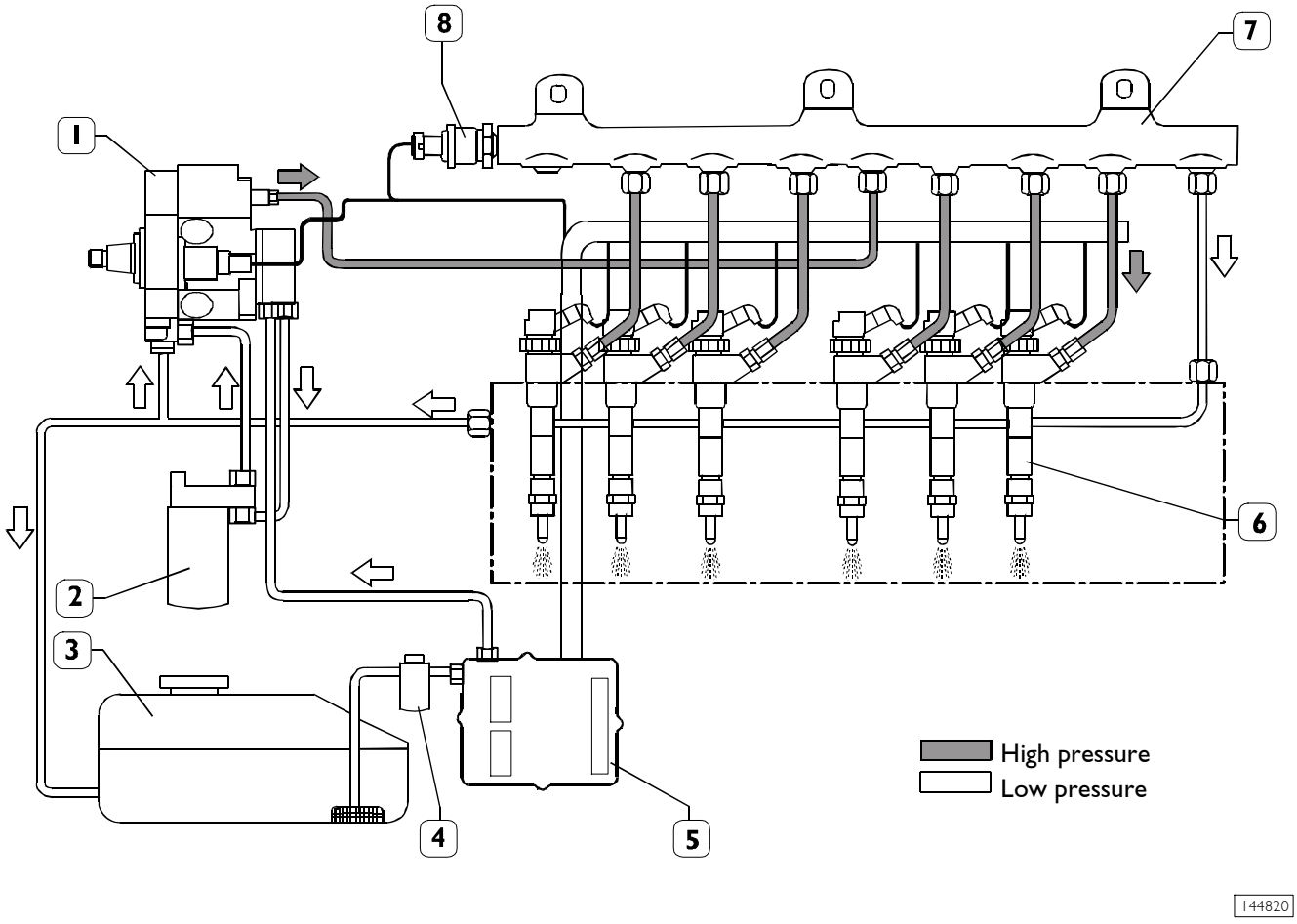
SUPPLY DIAGRAM

Figure 3



1. High-pressure pump - 2. Fuel filter - 3. Tank - 4. Fuel pre-filter - 5. E.C.U. (Electronic Control Unit) - 6. Electro-injectors - 7. Common Rail - 8. Pressure sensor

After fitting the high pressure pipes, during the next 20 hours of operation, frequently check the engine oil level. (IT MUST NOT INCREASE).

The Common Rail fuel system has a special pump that continuously keeps fuel at high pressure, independently from the stroke and the cylinder which is to receive the injection and accumulates fuel in a common duct for all injectors.

At the electro-injector inlet therefore, there is always fuel at the injection pressure calculated by the ECU.

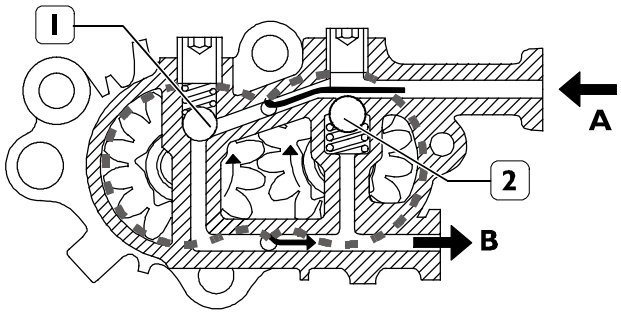
When an injector solenoid valve is energised by the electronic control unit, the injection of fuel directly taken from the rail takes place in the corresponding cylinder.

SUPPLY SYSTEM COMPONENTS
Mechanical supply pump

Gear pump, fitted on the rear side of the high pressure pump and used to supply it. It is driven by the high pressure pump shaft.

Normal operating conditions

Figure 4



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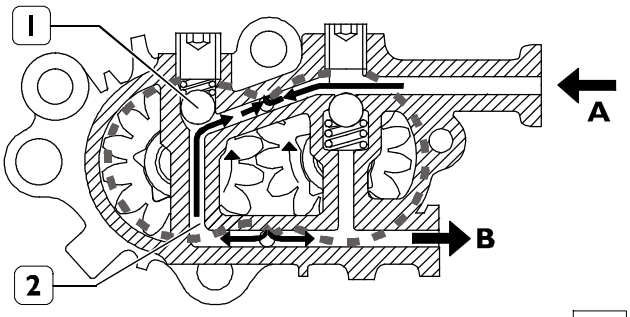
A. Fuel inlet from tank, B. fuel outlet to filter, 1-2 by-pass valves in close position.

Overpressure condition at outlet

Figure 5



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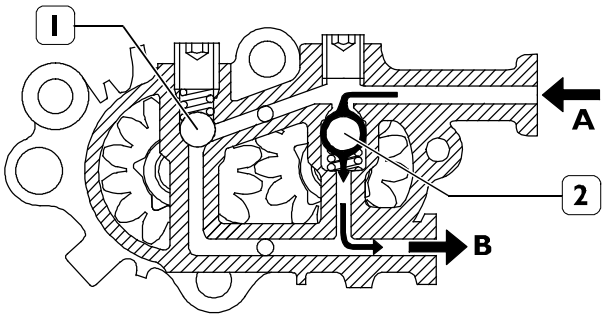
By-pass valve (1) opens in the presence of overpressure at the outlet B. The pressure of the fuel overcomes the force exerted by the spring of the valve (1), thereby placing the pump outlet in communication with the inlet by way of passage (2).

Air bleeding conditions

Figure 6



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The by-pass valve (2) cuts in when, with engine off, the fuel system shall be filled through the priming pump. In this situation the by-pass valve (1) stays closed, the by-pass valve (2) opens due to inlet pressure and fuel is drained out through **B**.

NOTE The mechanical supply pump cannot be replaced individually, therefore it cannot be removed from the high pressure pump.

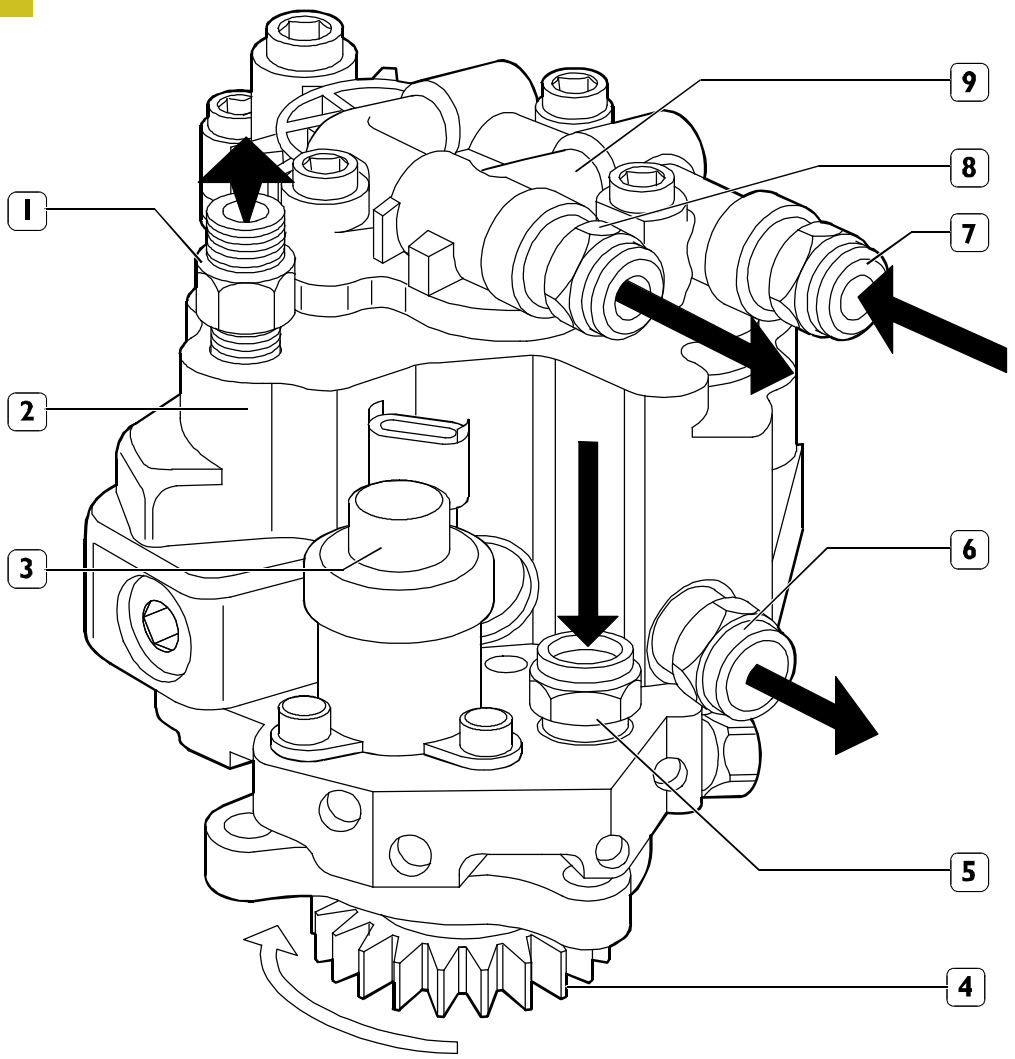
High pressure pump CP3

Pump with 3 radial pistons controlled by the timing gear, without needing any setting. The mechanical supply pump controlled by the high pressure pump shaft is fitted on the rear side of the high pressure pump.

The following work must be carried out on the feed pump / high-pressure pump assembly:

- ❑ replacing the drive gear;
- ❑ replacing the pressure regulator.

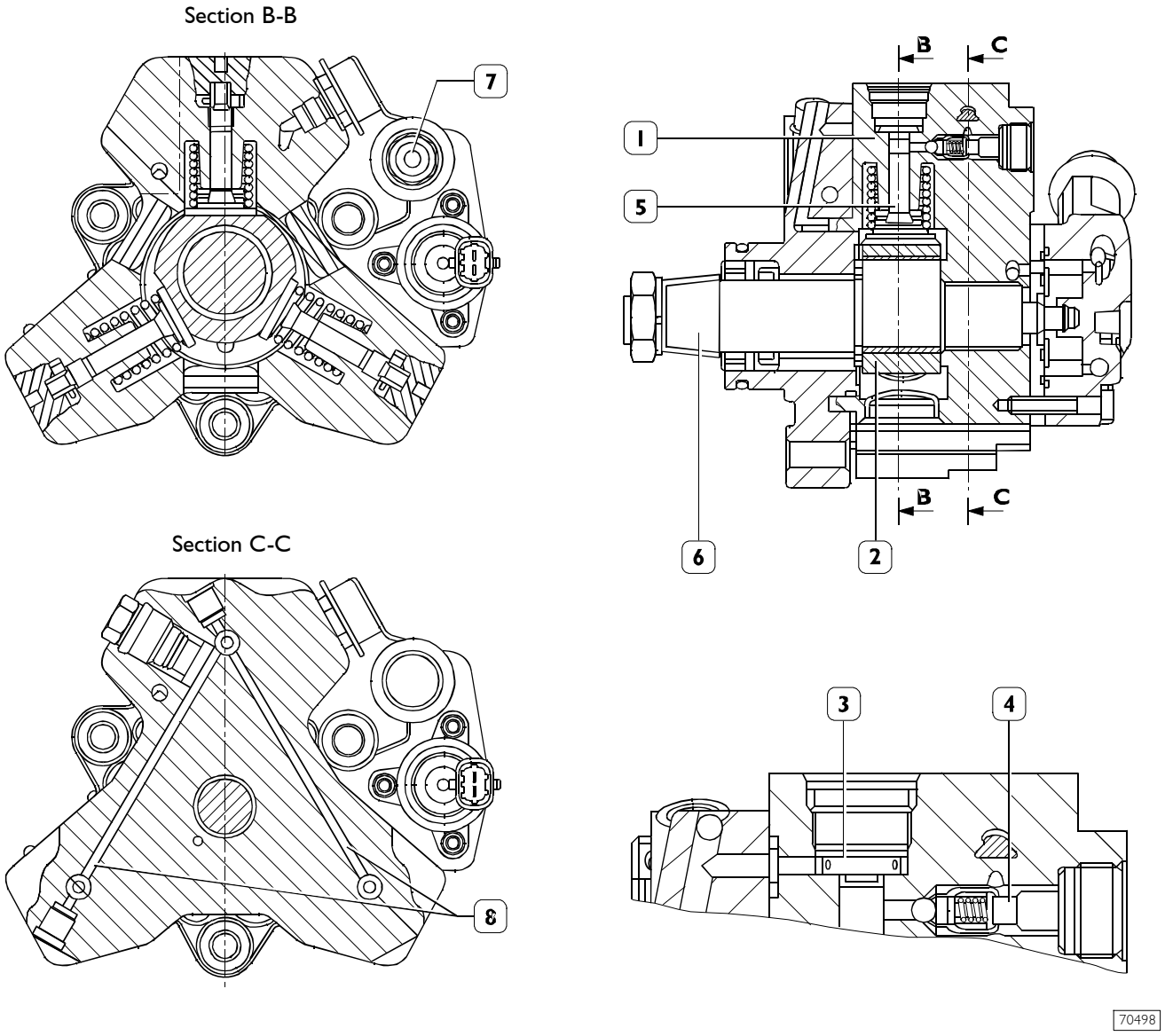
Figure 7



1. Connection between fuel outlet and rail - 2. High pressure pump - 3. Pressure regulator - 4. Drive gear - 5. Filter fuel inlet union - 6. Connection between fuel outlet and filter bracket - 7. Connection for fuel inlet from control unit heat exchanger - 8. Connection between fuel outlet from mechanical pump and filter - 9. Mechanical supply pump.

HIGH-PRESSURE PUMP - INSIDE STRUCTURE

Figure 8



1. Cylinder. - 2. Triple-lobe element - 3. Cap intake valve. - 4. Ball delivery valve. - 5. Piston. - 6. Pump shaft. - 7. Low-pressure fuel inlet. - 8. Plungers supplying fuel ducts.

Every plunger unit is composed of:

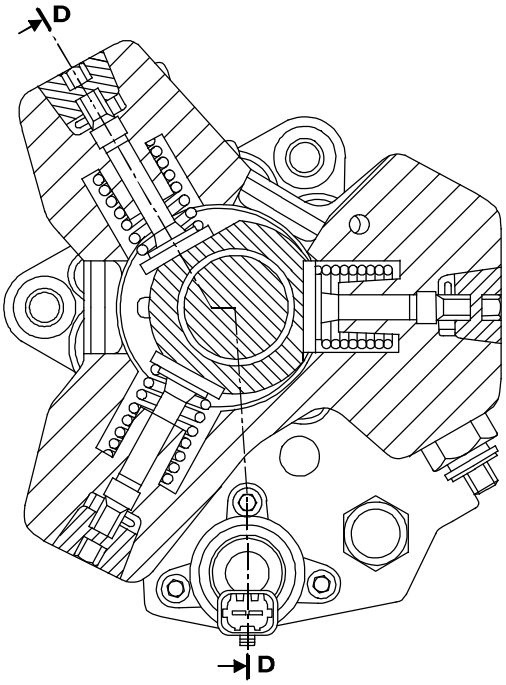
- a piston (5) actuated by a three-lobe element (2) floating on the pump shaft (6). The element (2) **floats** on a misaligned part of the shaft (6), therefore, when the shaft rotates, it does not rotate with it but is only moved in a circular movement along a wider radius, with the result of alternatively activating the three pumping elements.

translated in a circular movement along a wider radius, with the resulting alternate actuation of the three pumping elements;

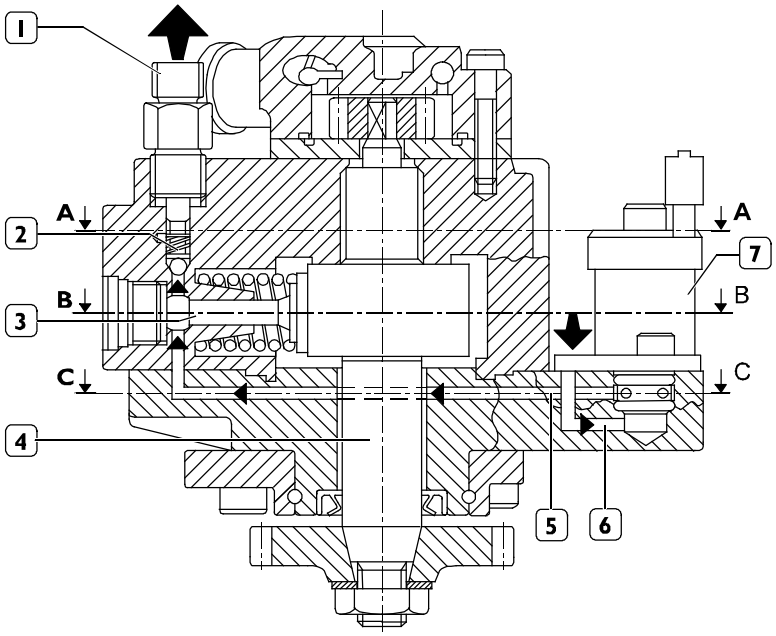
- cap intake valve (3);
- ball delivery valve (4).

Operating principle

Figure 9



Sect. B - B



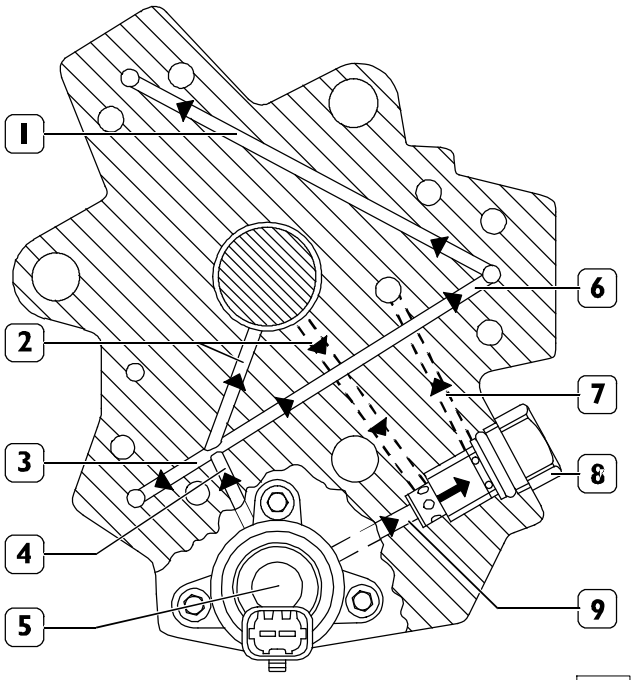
Sect. D - D

72597

1. Connection between fuel outlet and rail - 2. Delivery valve to rail - 3. Plunger - 4. Pump shaft - 5. Plunger supply pipe - 6. Pressure regulator supply pipe - 7. Pressure regulator.

Plunger (3) is oriented to pump shaft (4) cam. During intake, the plunger is supplied through supply duct (5).
The fuel amount to be sent to the plunger is set by the pressure regulator (7). The pressure regulator meters fuel flow to plunger according to the flow of fuel to the pumping element. During plunger compression stage, fuel reaches the pressure required to open the delivery valve to common rail (2) and to feed it through outlet (1).

Figure 10



Sect. C - C 72598

1. Plunger inlet - 2. Pump lubrication pipes - 3. Plunger inlet - 4. Main plunger supply pipe - 5. Pressure regulator - 6. Plunger inlet - 7. Regulator drain pipe - 8. Pressure limiting valve 5 bar - 9. Fuel drainage from regulator inlet.

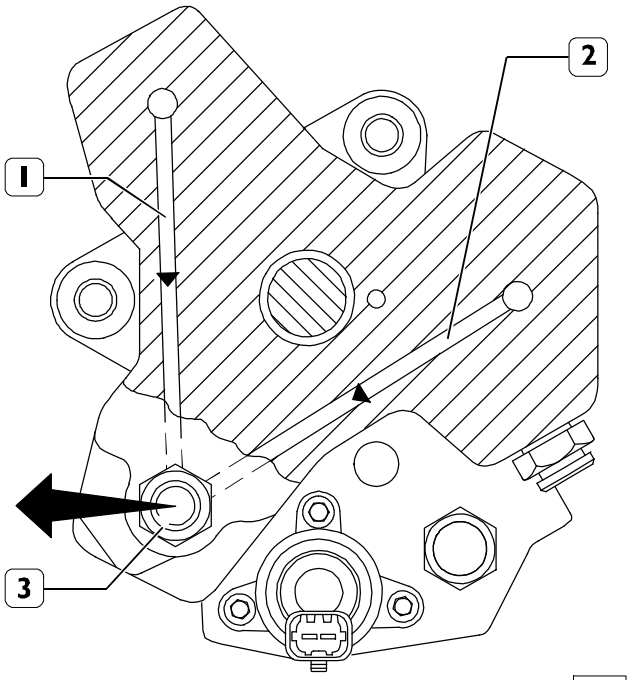
Figure 10 shows the routes of the fuel at low pressure inside the pump; it shows the main supply pipe of the pumping elements (4), the pumping element supply pipes (1 - 3 - 6), the pipes used to lubricate the pump (2), the pressure regulator (5), the 5-bar pressure relief valve (8) and the fuel discharge (7).

Pump shaft is lubricated by fuel through delivery and return ducts (2).

The pressure regulator (5) establishes the quantity of fuel to be supplied to the plungers; The excess fuel flows off through the pipe (9).

5 bar pressure relief valve acts as fuel return collector and keeps 5 bar constant pressure at regulator inlet.

Figure 11



Sect. A - A 72601

1. Fuel outlet pipe - 2. Fuel outlet pipe - 3. Fuel outlet from pump with connector for high-pressure pipe for the common rail.

Figure 11 shows high pressure fuel flow through plunger outlet ducts.

Operation

The cylinder is filled through the cap intake valve only if the supply pressure is suitable to open the delivery valves set on the plungers (about 2 bars).

The amount of fuel that supplies the high pressure pump is metered by the pressure regulator, positioned on the low pressure system; the pressure regulator is controlled by the EDC 7 control unit through a PWM signal.

When fuel is sent to a plunger, the related piston is moving downwards (suction stroke). When the piston stroke is reversed, the intake valve closes and the remaining fuel in the plunger chamber, not being able to come out, is compressed above the supply pressure value existing in the rail.

The thereby-generated pressure makes the exhaust valve open and the compressed fuel reaches the high-pressure circuit.

The plunger compresses the fuel till the top dead centre (delivery stroke) is reached. Afterwards, the pressure decreases till the exhaust valve is closed.

The plunger piston goes back towards the bottom dead centre and the remaining fuel is decompressed.

When the plunger chamber pressure becomes less than the supply pressure, the intake valve is again opened and the cycle is repeated.

The delivery valves must always be free in their movements, free from impurities and oxidation.

The pressure delivered to the rail is modulated by the electronic unit by means of the pressure regulator solenoid valve.

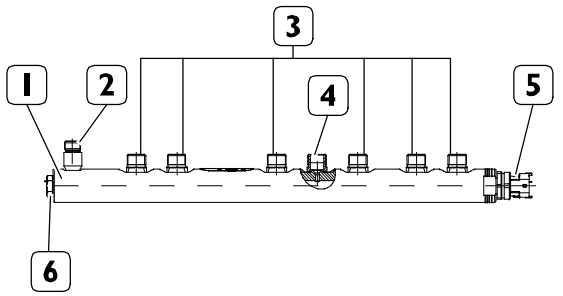
The pump is lubricated and cooled by the fuel.

The radialjet pump removal - refitting time on the engine is highly reduced in comparison with traditional injection pumps, because it does not require setting.

If the pipe between fuel filter and high-pressure pump is to be removed-refitted, be sure that hands and components are absolutely clean.

Rail (pressure accumulator)

Figure 12



1. Rail - 2. Fuel return - 3. Pipes to injectors - 4. Fuel inlet from high pressure pump - 5. Pressure sensor - 6. Overpressure valve.

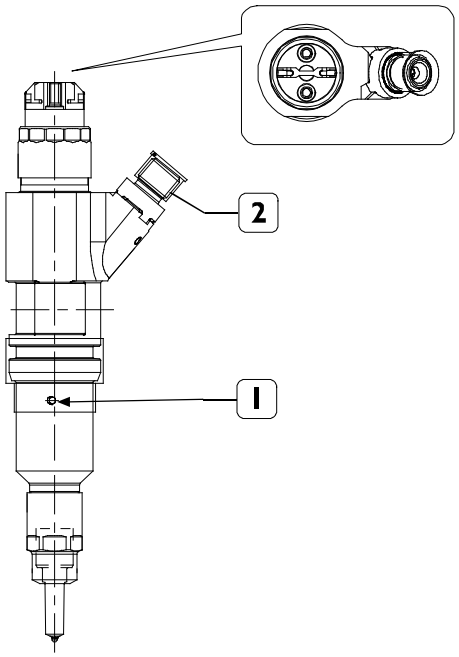
The rail volume is of reduced sizes to allow a quick pressurisation at startup, at idle and in case of high flow-rates.

It anyway has enough volume as to minimise pulsations caused by injectors openings and closings and by the high-pressure pump operation. This function is further enabled by a calibrated hole being set downstream of the high-pressure pump.

A fuel pressure sensor (5) is screwed to the rail. The signal sent by this sensor to the electronic control unit is a feedback information, depending on which the rail pressure value is checked and, if necessary, corrected.

Electro-injector

Figure 13



1. Fuel return hole - 2. Fuel delivery

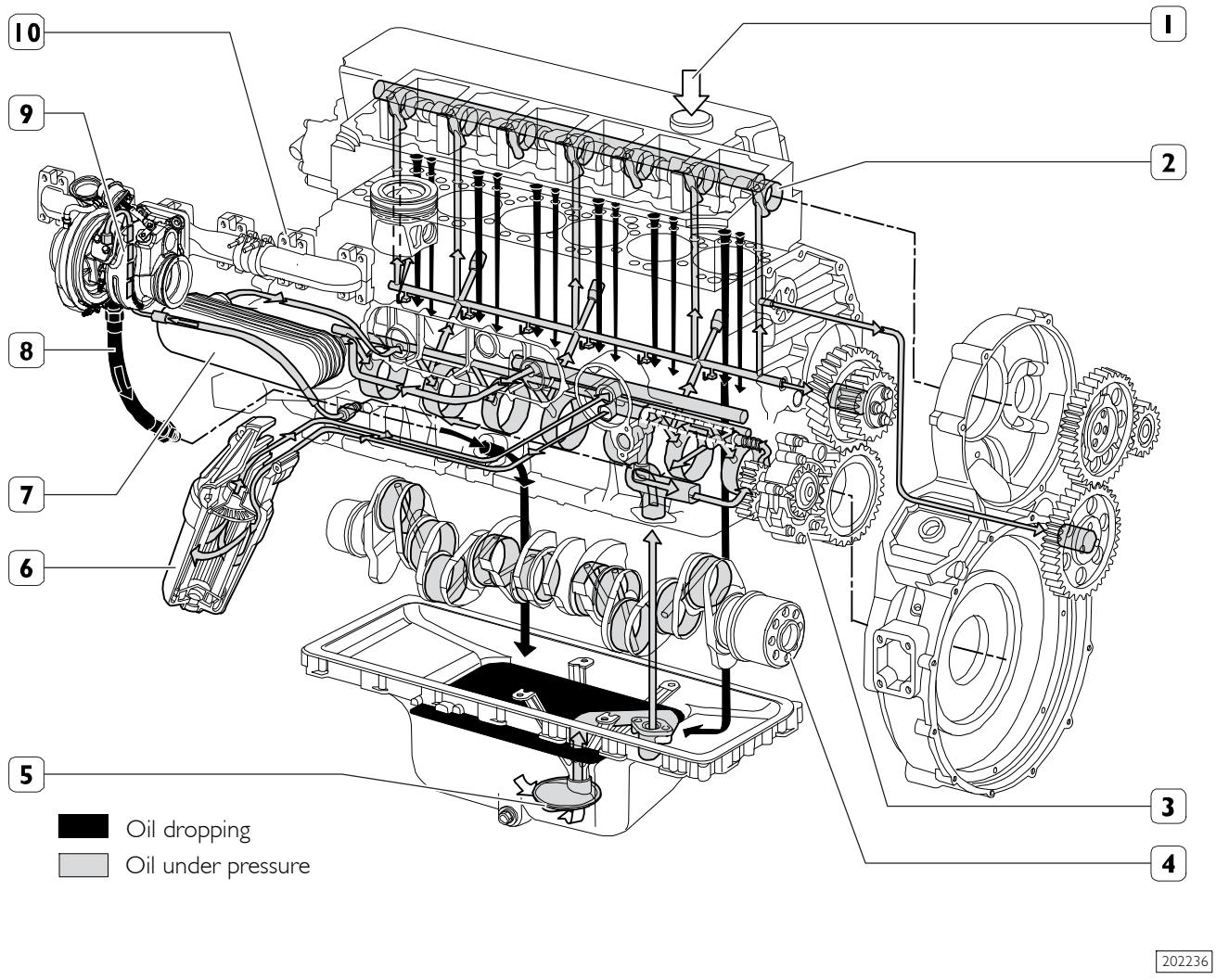
LUBRICATION

Principles

The lubrication circuit includes components such as the heat exchanger, turbocharger for the turbocharged models, oil filter, oil pump and pressure control valves.

All these components often vary depending on use and are therefore dealt with in the specific part of the manual.

Figure 14



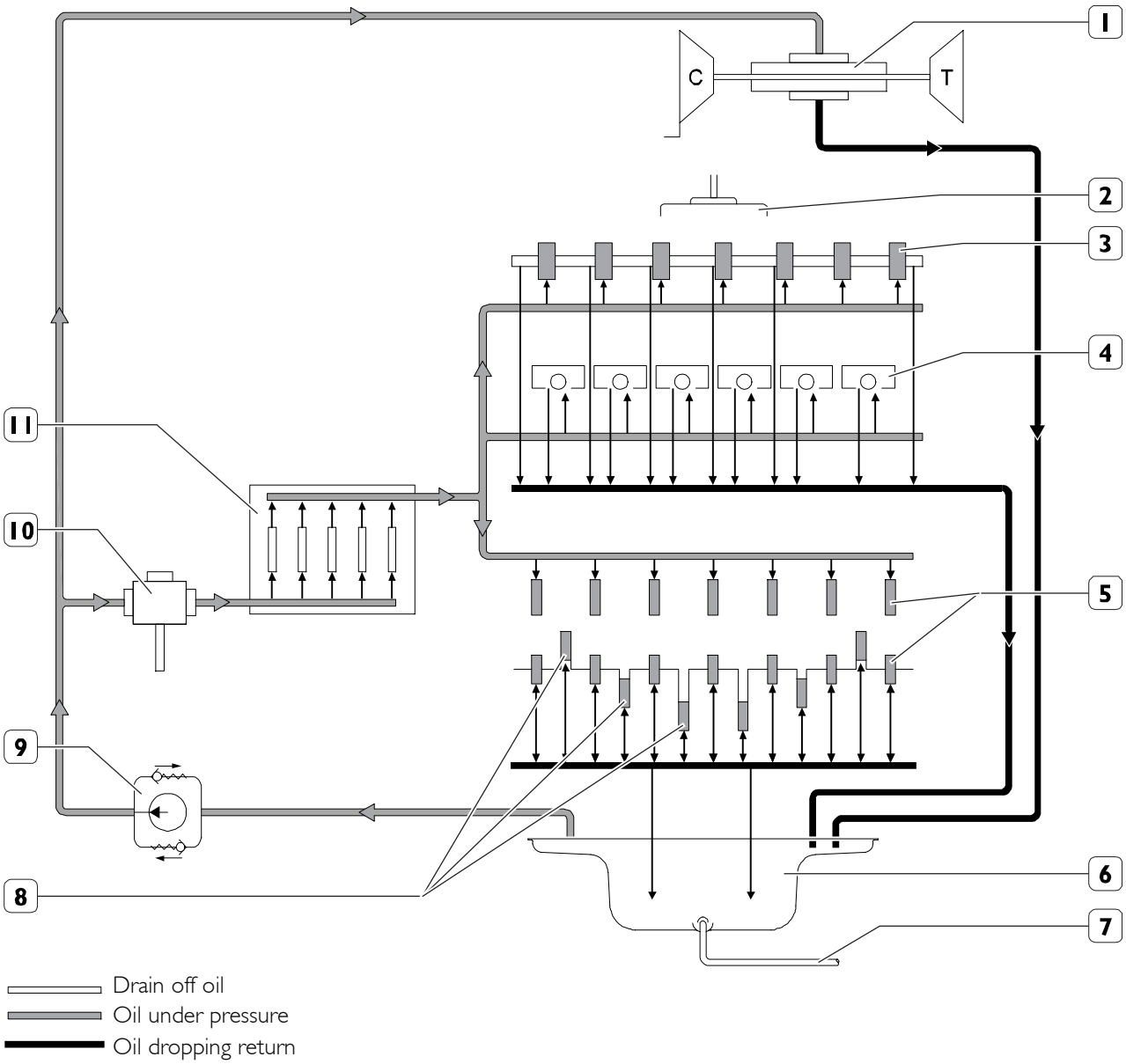
1. Oil inlet - 2. Camshaft - 3. Oil pump - 4. Crankshaft - 5. Suction strainer - 6. Oil filter - 7. Heat exchanger - 8. Oil return from turbocharger - 9. Turbocharger - 10. Exhaust manifold.

The forced circulation lubrication is performed by the rotary oil pump, housed in the rear of the crankcase, driven by a gear with straight teeth keyed on the crankshaft stub.

The lubricant oil is sent from the sump to camshaft and valve control wing.

LUBRICATION DIAGRAM

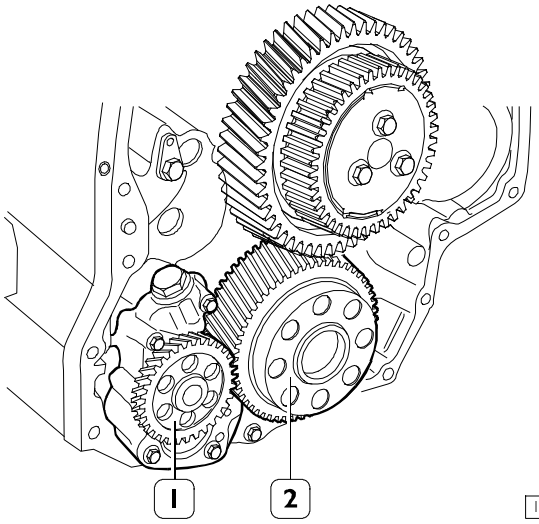
Figure 15



1. Turbocharger shaft - 2. Oil filling plug - 3. Camshaft mounts - 4. Piston cooling nozzles - 5. Crankshaft main bearings - 6. Oil sump - 7. Oil drain plug - 8. Big-end bearings - 9. Oil pump - 10. Oil filter - 11. Heat exchanger.

LUBRICATION CIRCUIT COMPONENTS
Oil pump

Figure 16

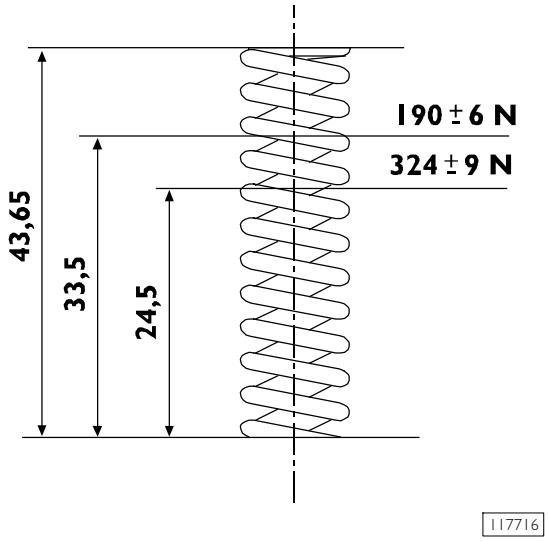


The oil pump (1) shall not be overhauled. If you find any damage, replace the entire oil pump.

To change the gearing (2) of the crankshaft, see the relevant section.

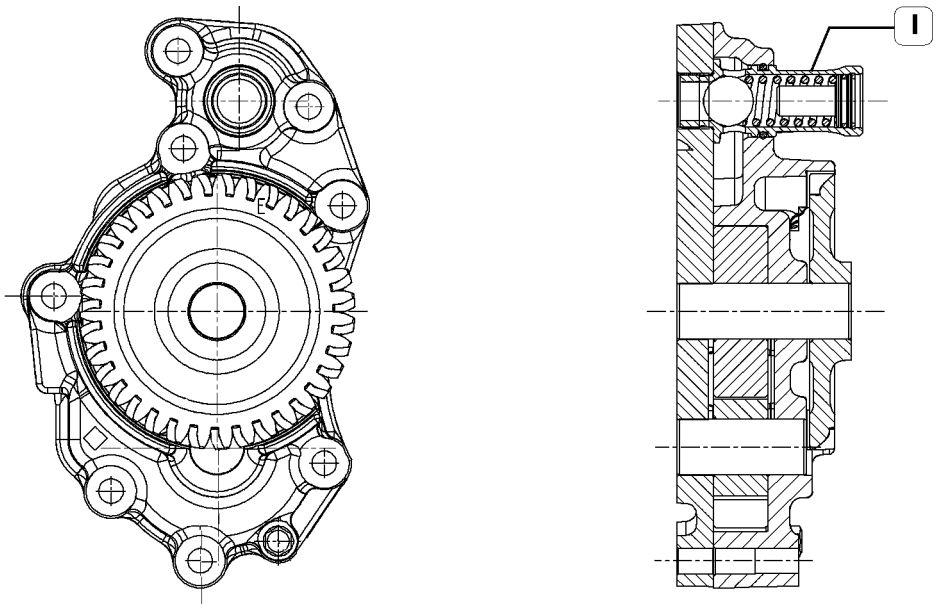
Safety valve

Figure 18



MAIN DATA TO CHECK THE SAFETY VALVE SPRING

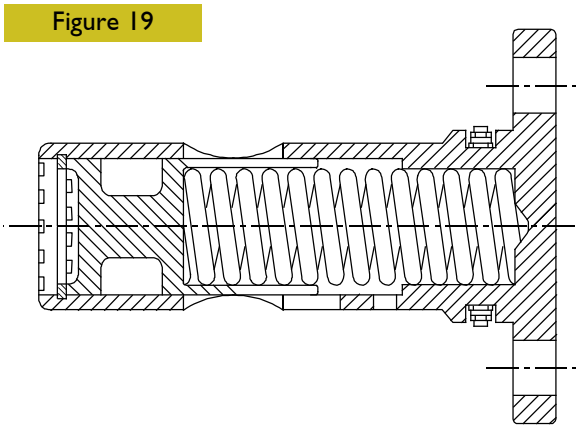
Figure 17



OIL PUMP SECTION
1. Overpressure safety valve - Initial opening pressure 10.1 ± 0.7 bar.

Oil pressure regulator valve

Figure 19



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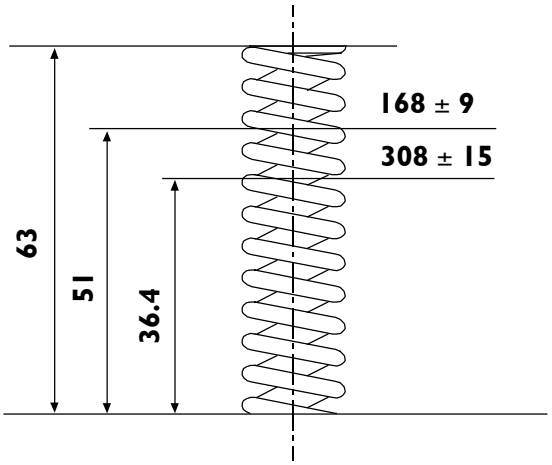
The oil pressure relief valve is located on the left-hand side of the crankcase.
Start of opening pressure 5 bar.

Figure 20



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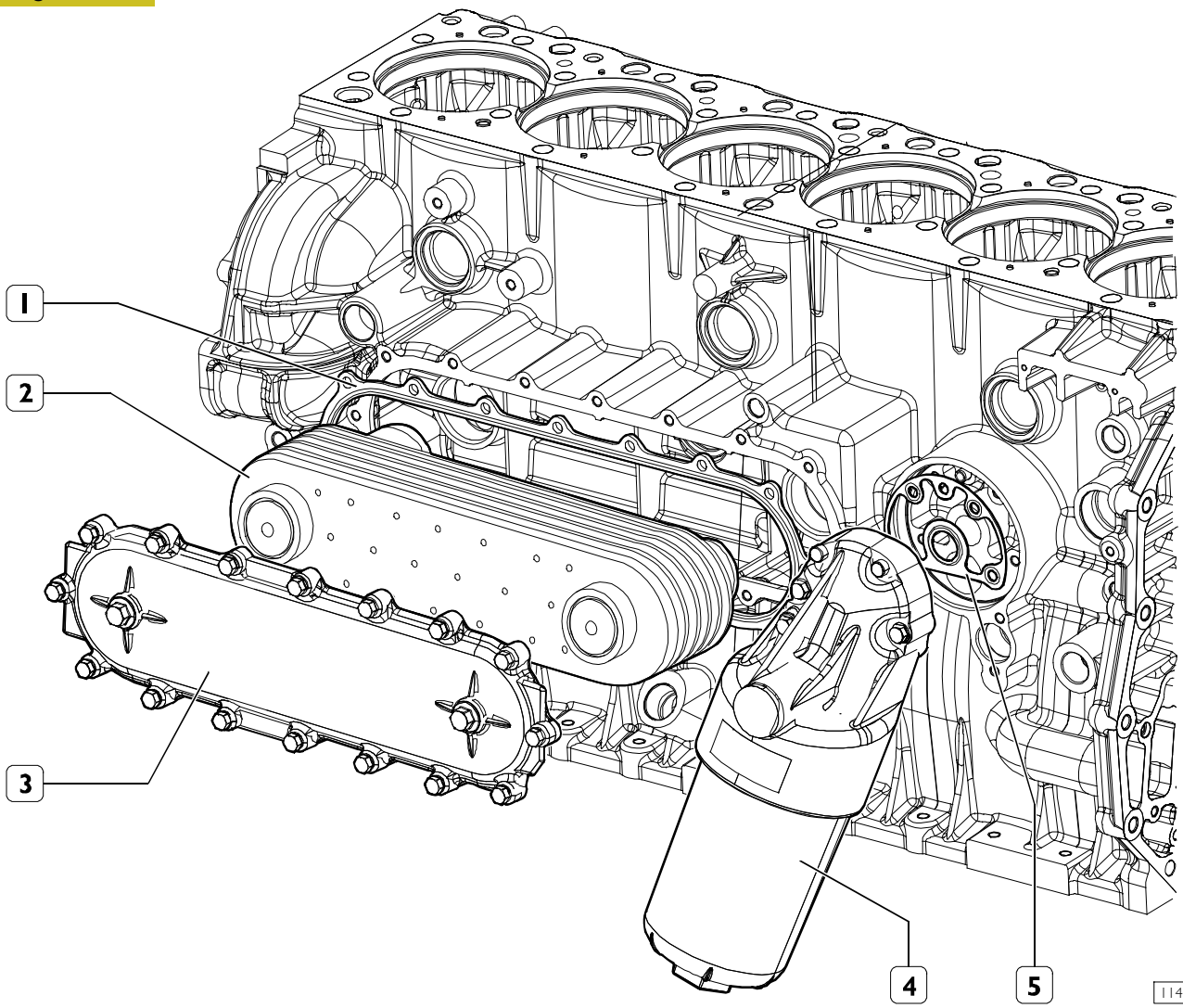
MAIN DATA TO CHECK THE PRESSURE RELIEF VALVE SPRING

Heat exchanger

Figure 21



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1. Heat exchanger gasket - 2. Heat exchanger internal element - 3. Cover - 4. Oil filter - 5. Oil filter gasket

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