CURSOR TIER 3 SERIES

Industrial application

Бриз
Моторс

CURSOR G-DRIVE

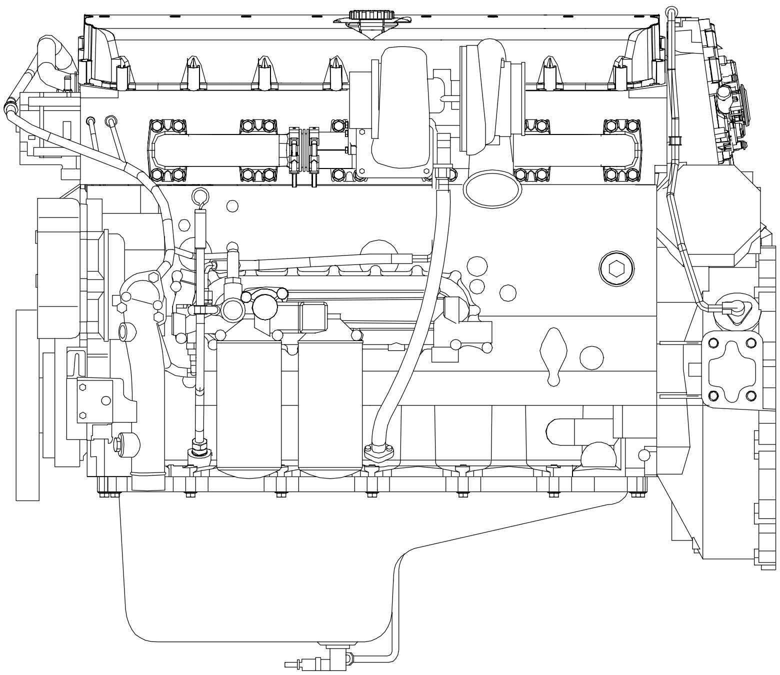
CURSOR 10 TE X
CURSOR 13 TE X

Technical and Repair manual

VIEWS OF ENGINES (DEMONSTRATION)

Figure 1

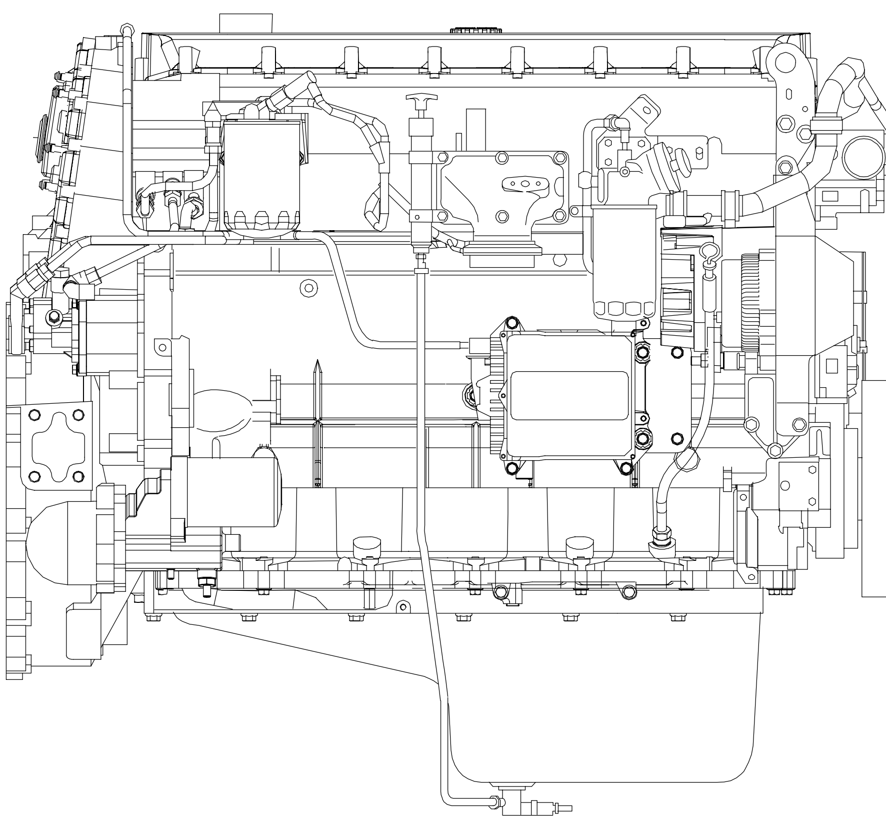
LEFT-HAND SIDE VIEW



107891

Figure 2

RIGHT-HAND SIDE VIEW



107892

Figure 3

FRONT VIEW

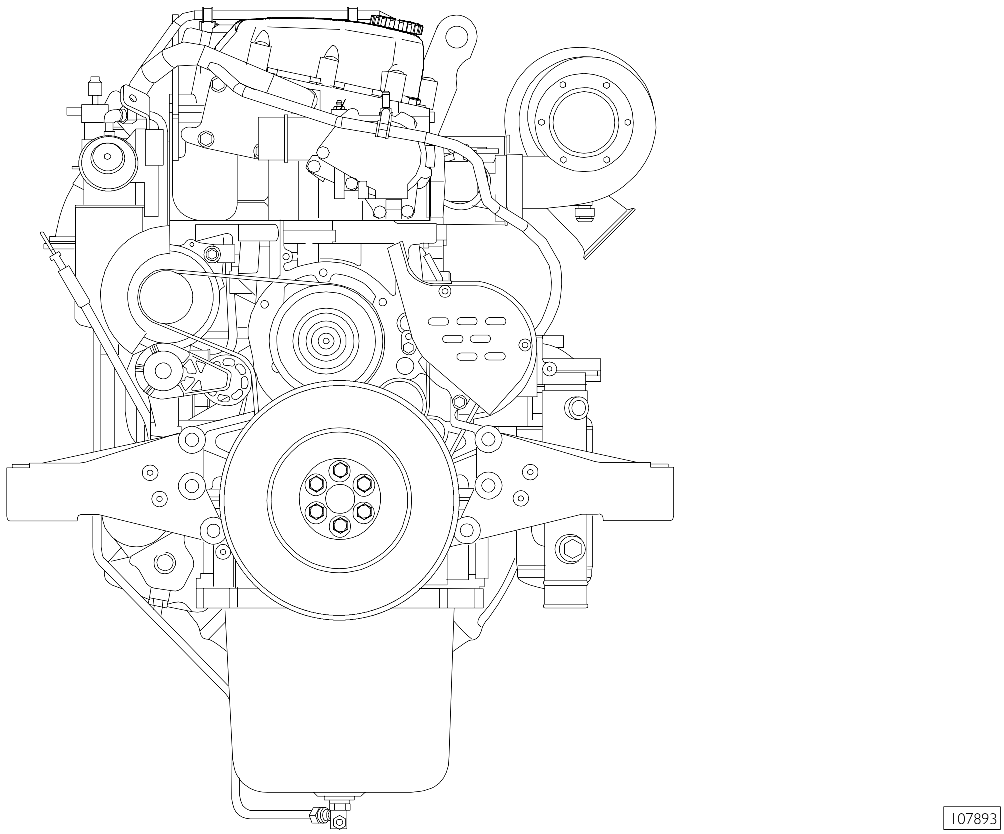


Figure 4

REAR VIEW

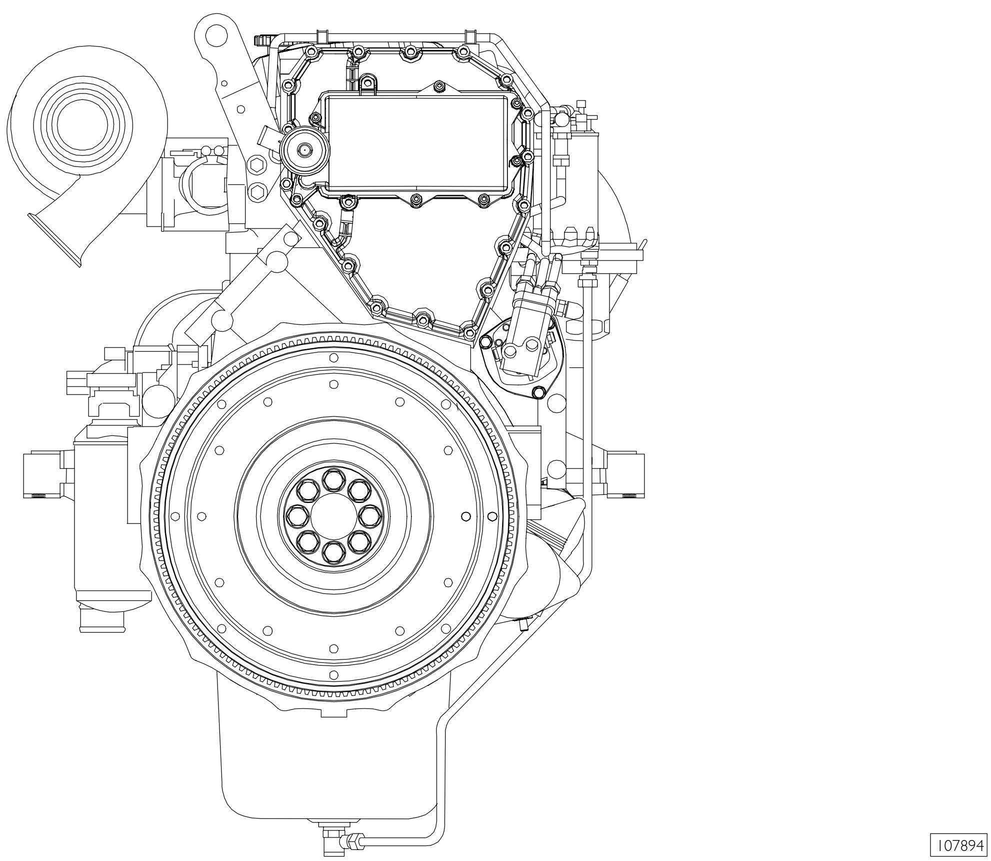
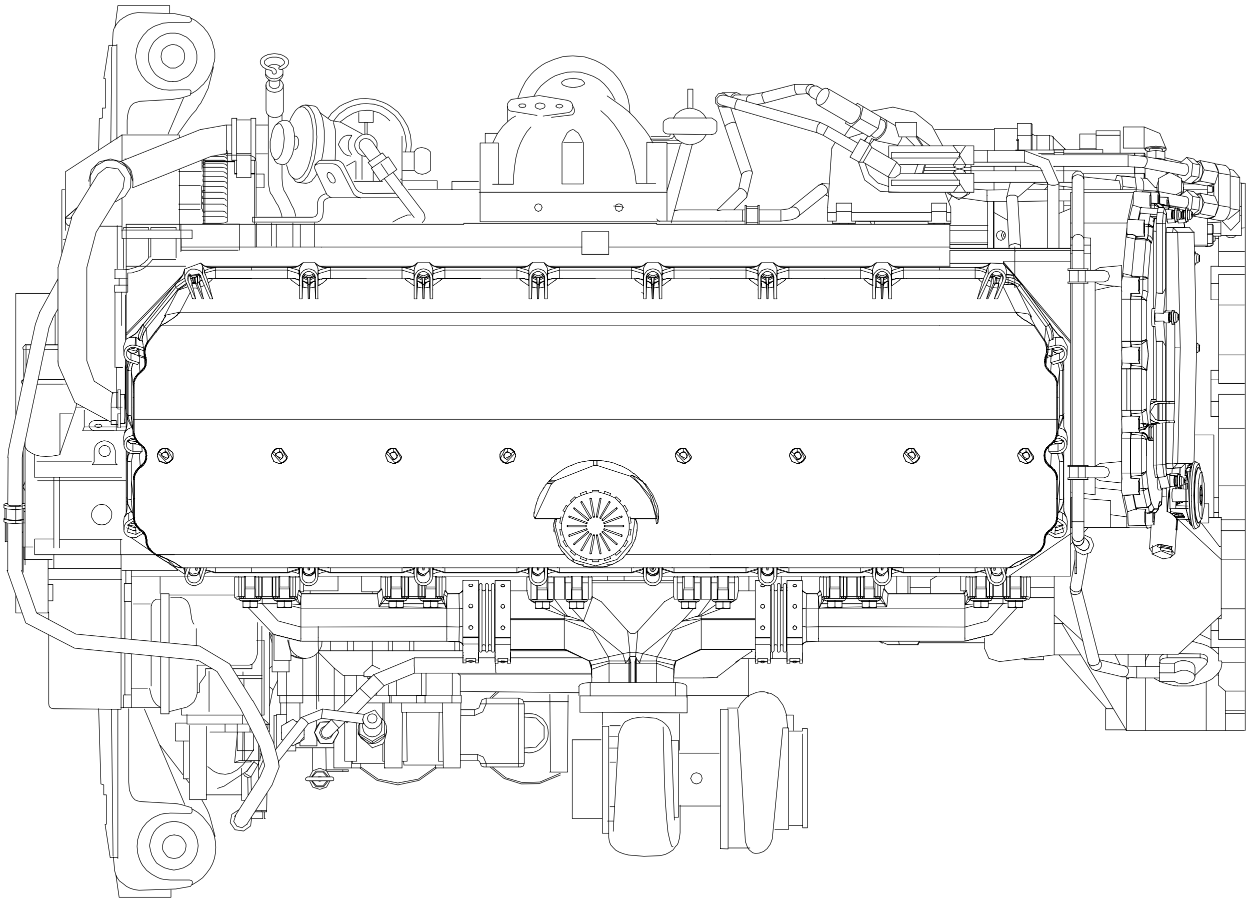


Figure 5

TOP VIEW



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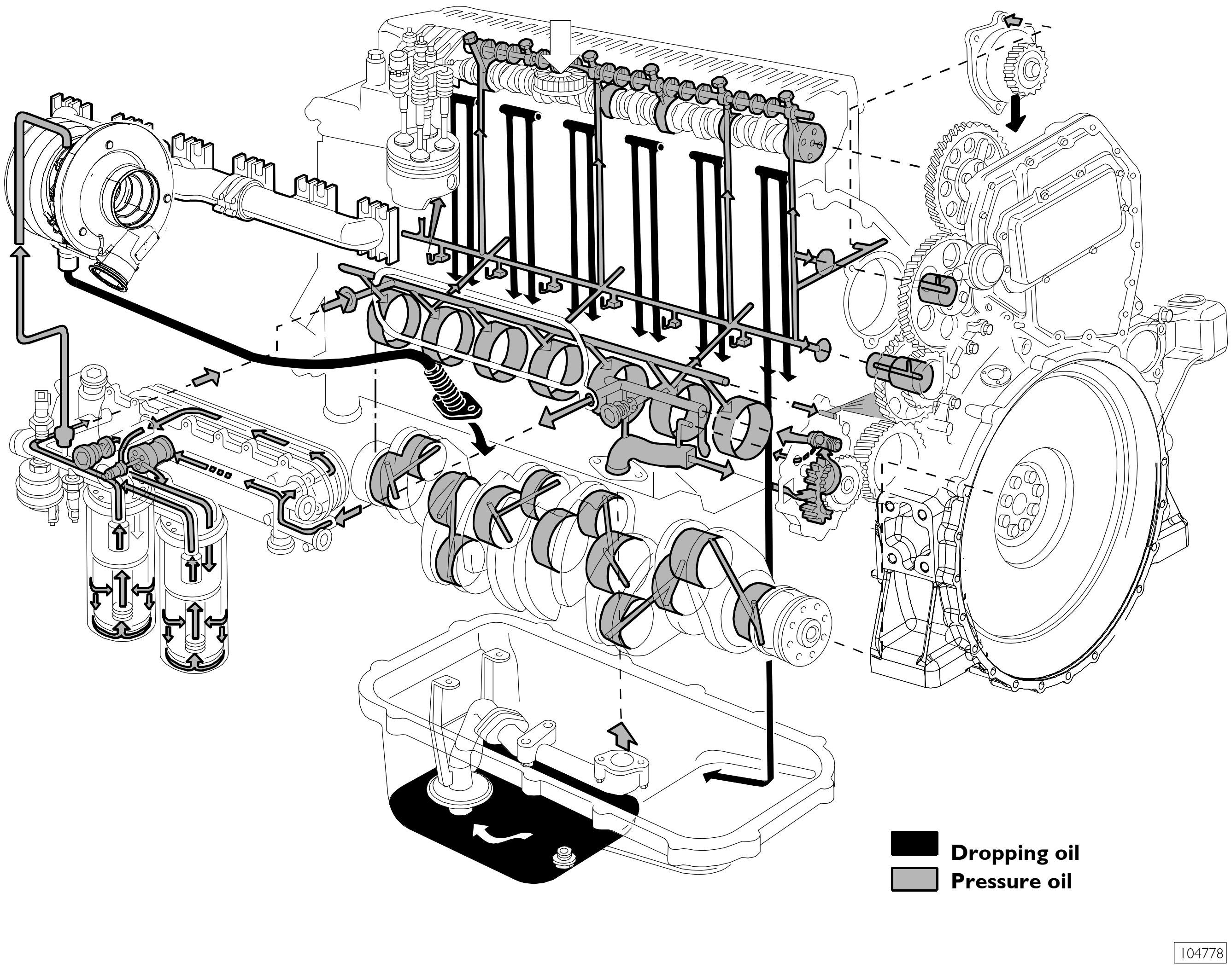
LUBRICATION

Engine lubrication is obtained with a gear pump driven by the crankshaft via gears.
A heat exchanger governs the temperature of the lubricating oil.
The oil filter, signalling sensors and safety valves are installed in the intercooler.

Figure 6 (Demonstration)



LUBRICATION DIAGRAM

COOLING

Description

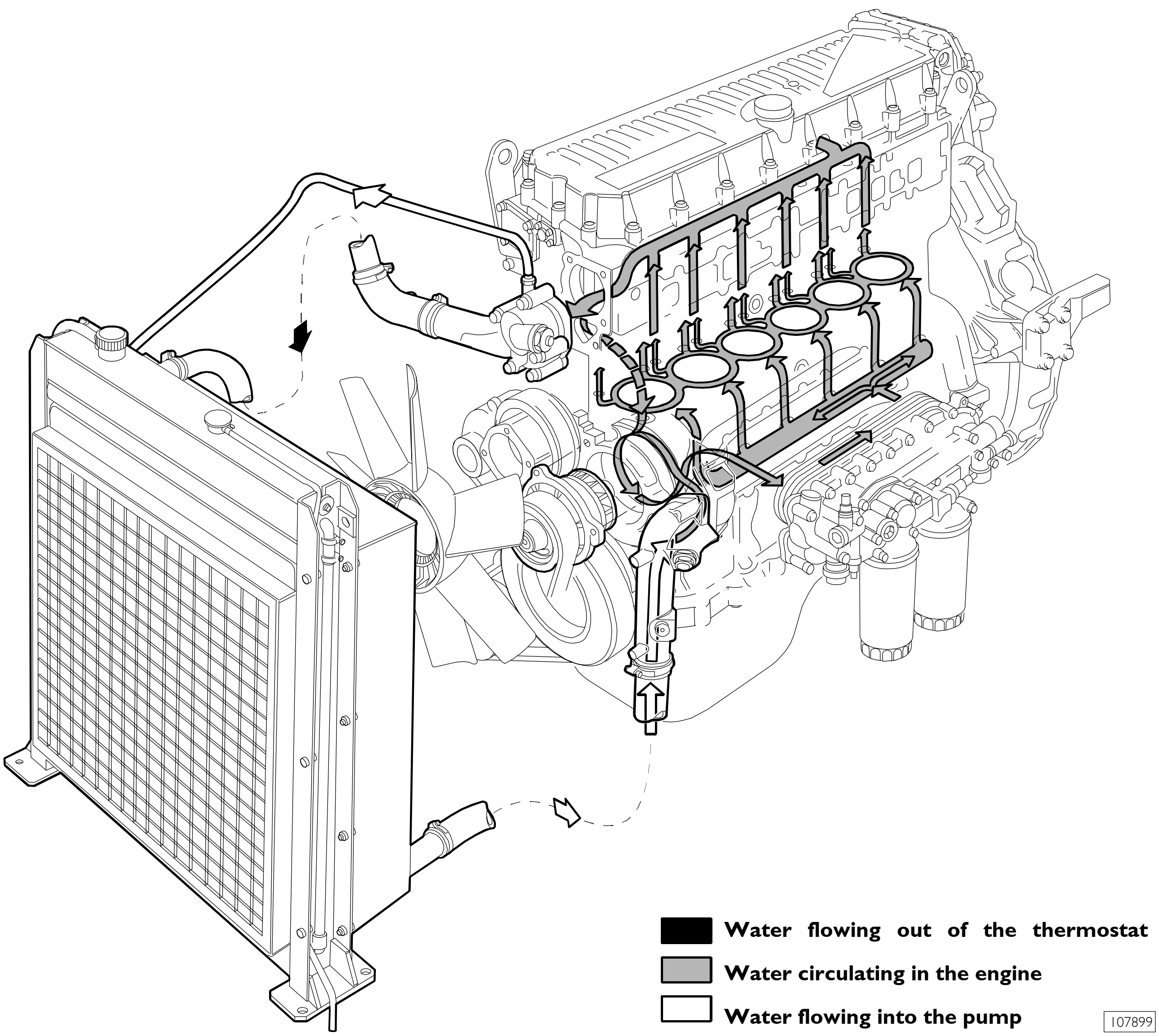
The engine cooling system is of the closed-circuit, forced circulation type.
It consists mainly of the following components:

- expansion tank,
- a heat exchanger to cool down lubrication oil;
- a water pump with centrifugal system incorporated in the cylinder block;
- fan;
- a 2-way thermostat controlling the coolant circulation.

Operation

The water pump is actuated by the crankshaft through a poli-V belt and sends coolant to the cylinder block, especially to the cylinder head (bigger quantity). When the coolant temperature reaches and overcomes the operating temperature, the thermostat is opened and from here the coolant flows into the radiator and is cooled down by the fan.

Figure 7 (Demonstration)

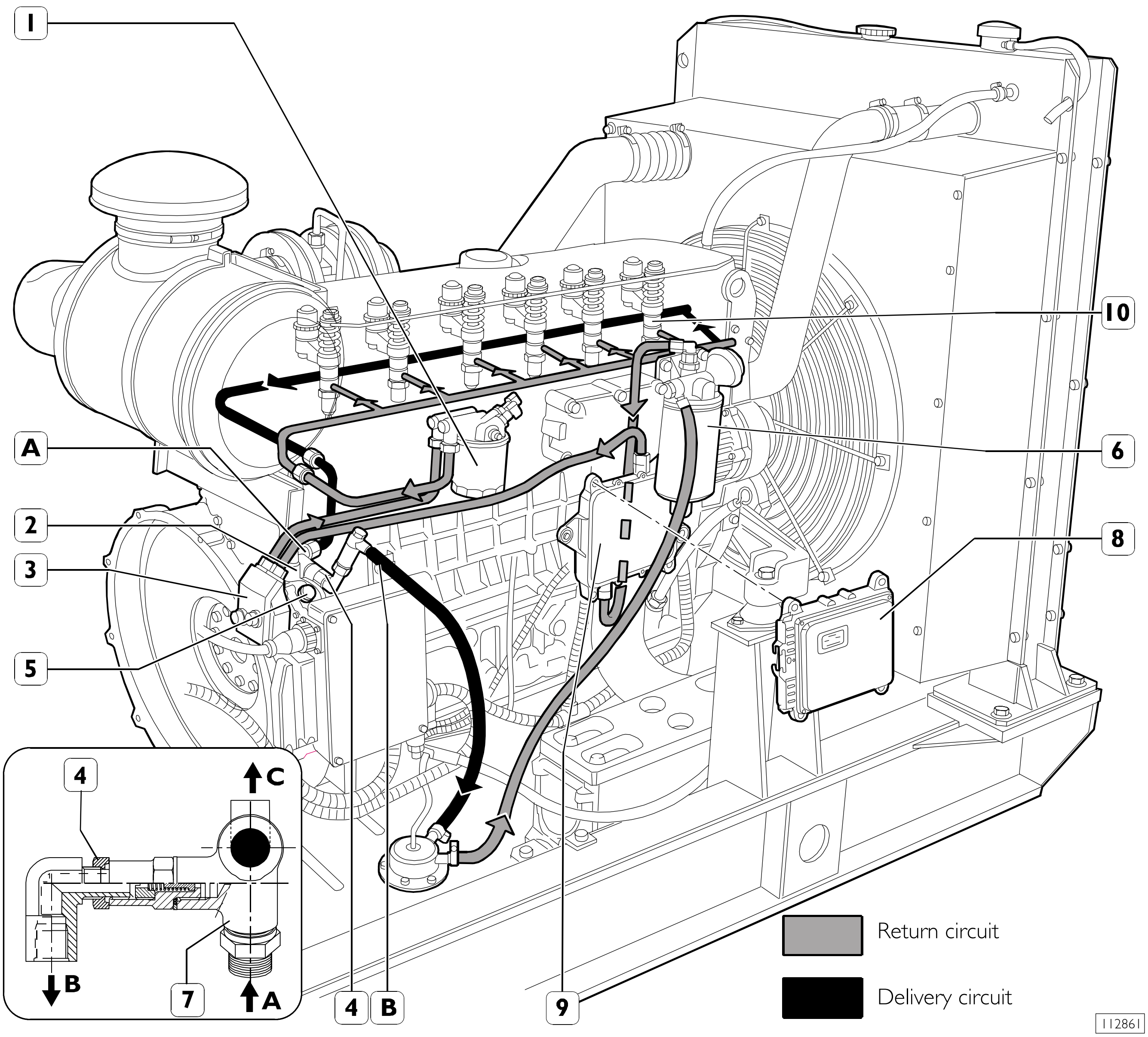


COOLING SYSTEM DIAGRAM

FUEL FEED

Fuel feed is obtained by means of a pump, fuel filter and pre-filter, 6 pump-injectors controlled by the camshaft by means of rockers and by the electronic control unit.

Figure 8 (Demonstration)



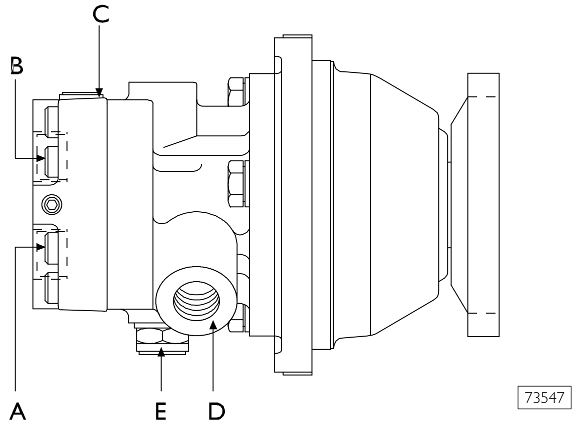
FEED SCHEME

1. Fuel filter - 2. Valve, to recirculate fuel from injectors, integrated in feed pump (start of opening at 3.5 bar) - 3. Feed pump - 4. Overpressure valve to return fuel to tank (start of opening at 0.2 bar) - 5. Pressure control valve (start of opening at 5 bar) - 6. Fuel pre-filter with priming pump - 7. Fitting - 8. Central unit - 9. Heat exchanger- 10. Pump injectors

A. Fuel arriving at injectors - B. Fuel returning to tank - C. Fuel entering from injectors into feed pump

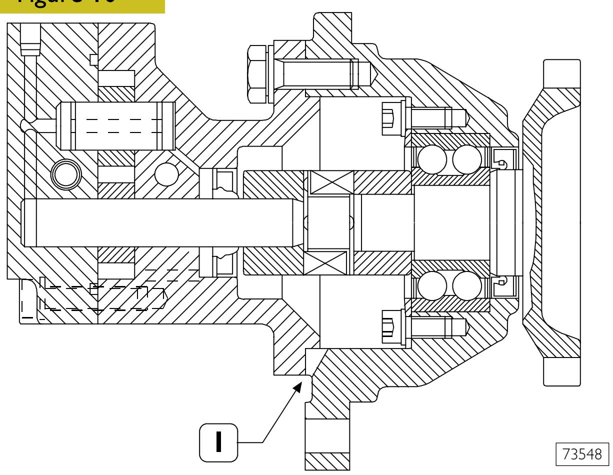
F3A engine fuel supply pump

Figure 9



A. Fuel inlet – B. Fuel delivery – C. By-pass nut –
D. Fuel return from the pump-injectors –
E. Pressure relief valve – Opening pressure: 5-8 bars.

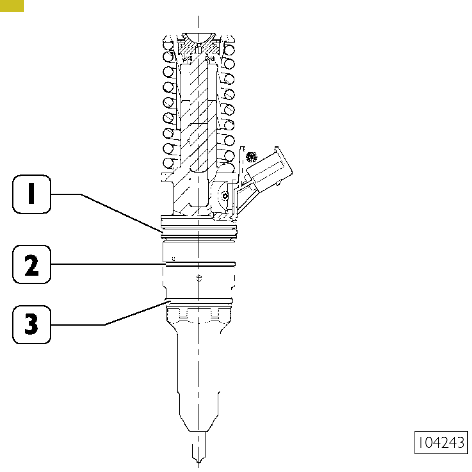
Figure 10



CROSS-SECTION OF THE FUEL PUMP
1. Oil and fuel leakage indicator.

Injector-pump

Figure 11



1. Fuel/oil seal – 2. Fuel/diesel seal – 3. Fuel/exhaust gas seal.

The injector-pump is composed of: pumping element, nozzle, solenoid valve.

Pumping element

The pumping element is operated by a rocker arm governed directly by the cam of the camshaft.
The pumping element is able to ensure a high delivery pressure. The return stroke is made by means of a return spring.

Nozzle

Garages are authorized to perform fault diagnosis solely on the entire injection system and may not work inside the injector-pump, which must only be replaced.
A specific fault-diagnosis program, included in the control unit, is able to check the operation of each injector (it deactivates one at a time and checks the delivery of the other five).
Fault diagnosis makes it possible to distinguish errors of an electrical origin from ones of a mechanical/hydraulic origin.
It indicates broken pump-injectors.
It is therefore necessary to interpret all the control unit error messages correctly.
Any defects in the injectors are to be resolved by replacing them.

Solenoid valve

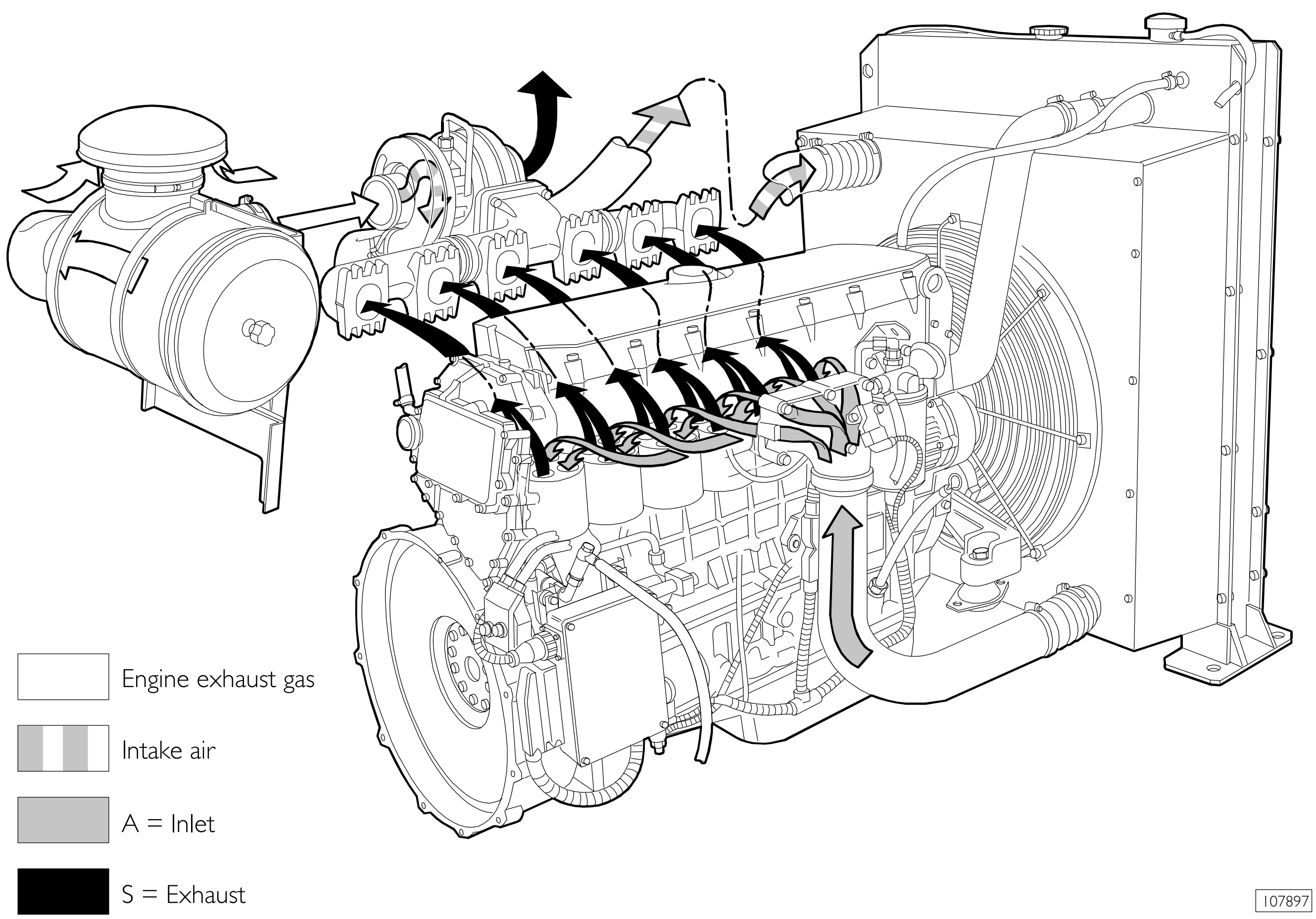
The solenoid, which is energized at each active phase of the cycle, via a signal from the control unit, controls a slide valve that shuts off the pumping element delivery pipe.
When the solenoid is not energized, the valve is open, the fuel is pumped but it flows back into the return pipe with the normal transfer pressure of approximately 5 bars.
When the solenoid is energized, the valve shuts and the fuel, not being able to flow back into the return pipe, is pumped into the nozzle at high pressure, causing the needle to lift.
The amount of fuel injected depends on the length of time the slide valve is closed and therefore on the time for which the solenoid is energized.
The solenoid valve is joined to the injector body and cannot be removed.
On the top there are two screws securing the electrical wiring from the control unit.
To ensure signal transmission, tighten the screws with a torque wrench to a torque of 1.36 – 1.92 Nm (0.136 – 0.192 kgm).

TURBOCHARGING

The turbocharging system consists of:

- air filter;
- Turbocharger.

Figure 12 (Demonstration)



SUPERCHARGING SYSTEM DIAGRAM

SECTION 2

G-Drive application

F3A ENGINE CLEARANCE DATA

			F3AE9685	
	Type		A*E001	B*E002
ϱ	Compression ratio		16.5 to 1	
	Europe market Max. output	kW (HP) rpm	- - -	300 (407.8) 1500/50 Hz
	Max. torque	Nm (kgm) rpm	- - -	- - -
	USA market Max. output	kW (HP) rpm	335 (455.4) 1800/60 Hz	- - -
	Max. torque	Nm (kgm) rpm	- - -	- - -
	Bore x stroke Displacement	mm cm^3	125 x 140 10300	
	SUPERCHARGING Turbocharger type		Intercooler Direct injection HOLSET HX455	
bar	LUBRICATION Oil pressure (warm engine) - idling - peak rpm	 bar bar	Forced by gear pump, relief valve single action oil filter - -	

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.

F3B ENGINE CLEARANCE DATA

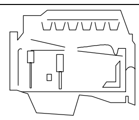
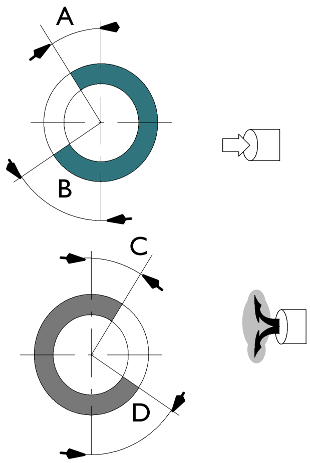
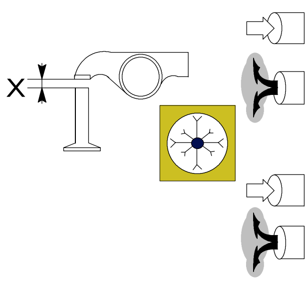
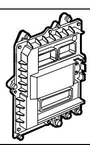
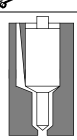
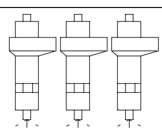
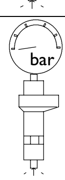
Type		**F3BE9685A*E001**
Compression ratio		16.5 to 1
Europe market Max. output	kW (HP) rpm	- - -
Max. torque	Nm (kgm) rpm	- - -
USA market Max. output	kW (HP) rpm	395 (537) 1800/60 Hz
Max. torque	Nm (kgm) rpm	- - -
Bore x stroke Displacement	mm cm^3	135 x 150 12880
SUPERCHARGING Turbocharger type		Direct injection HOLSET HX60W
LUBRICATION Oil pressure (warm engine) - idling - peak rpm	 bar bar	Forced by gear pump, relief valve single action oil filter - -
COOLING Water pump control **Thermostat** - start of opening	 °C	Liquid Through belt -

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

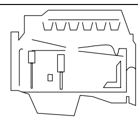
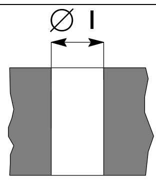
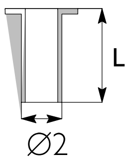
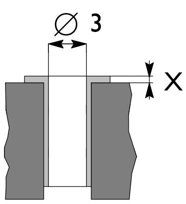
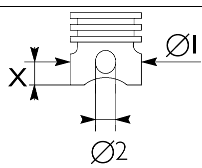
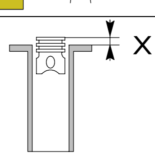
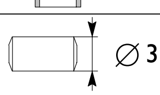
Furthermore, the users assembled by the setter shall always be in conformance to couple, power and number of turns based on which the engine has been designed.

F3A GENERAL CHARACTERISTICS

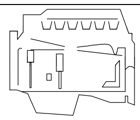
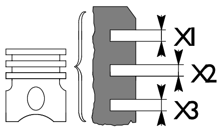
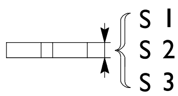
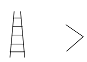
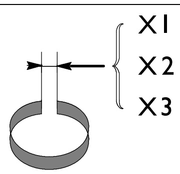
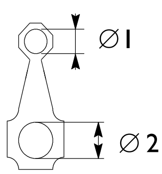
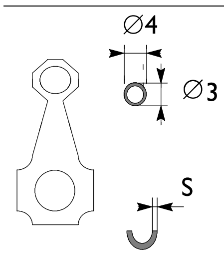
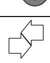
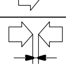
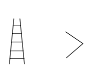
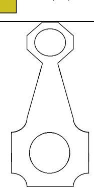
Type		**F3A**
Cycle		Diesel 4 strokes
Feeding		Turbocharged
Injection		Direct
N. of cylinders		6 on-line
Diameter	mm	125
Stroke	mm	140
Total displacement	cm^3	10300
Europe market Max. output	kW (HP) rpm	300 (407.8) 1500/50 Hz
Max. torque	Nm (kgm) rpm	- - -
USA market Max. output	kW (HP) rpm	335 (455.4) 1800/60 Hz
Max. torque	Nm (kgm) rpm	- - -

	Type	**F3A**
	VALVE TIMING	
	opens before T.D.C. A	17°
	closes after B.D.C. B	4°
	opens before B.D.C. D	56°
	closes after T.D.C. C	9°
	For timing check	
	X mm	–
	X mm	–
	Running	
	X mm	0.35 to 0.45
	X mm	0.45 to 0.55
	FEED	Through fuel pump - filters
	Injection type: Bosch	With electronically regulated injectors PDE/N3 pump injectors controlled by overhead camshaft
	Nozzle type	-
	Injection order	1 - 4 - 2 - 6 - 3 - 5
	Injection pressure bar	1800
	Injector calibration bar	296 to 6

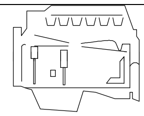
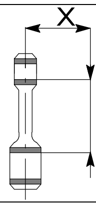
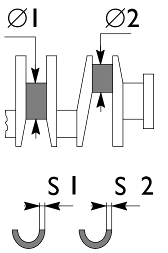
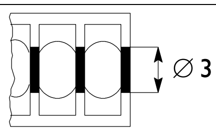
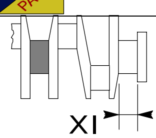
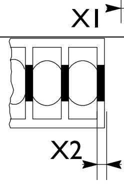
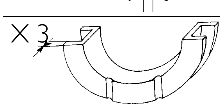
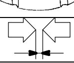
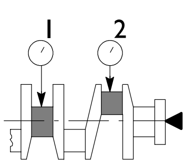
F3A ASSEMBLY CLEARANCE DATA

	Type	**F3A**
CYLINDER BLOCK AND CRANK MECHANISM COMPONENTS		mm
	Cylinder sleeve bore upper Ø 1 lower	 142.000 to 142.025 140.000 to 140.025
	Cylinder liners: outer diameter: upper Ø 2 lower length L	 141.961 to 141.986 139.890 to 139.915
	Cylinder sleeve - crankcase bore upper lower	 0.014 to 0.064 0.085 to 0.135
IVECO PARTS	Outside diameter Ø 2	
* Available dia. class	Cylinder sleeve inside diameter Ø3 A* inside diameter Ø3 B* Protrusion X	 125.000 to 125.013 125.011 to 125.024 0.045 to 0.075
	Pistons: measuring dimension X outside diameter Ø I A• outside diameter Ø I B•• outside diameter Ø 2	 18 124.884 to 124.896 124.896 to 124.907 50.010 to 50.018
* Available dia. class	Piston - cylinder sleeve A* B*	 0.104 to 0.129 0.104 to 0.128
IVECO PARTS	Piston diameter Ø I	_
	Pistons protrusion X	0.23 to 0.53
	Gudgeon pin Ø 3	49.994 to 50.000
	Gudgeon pin - pin housing	0.010 to 0.024

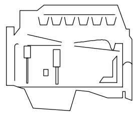
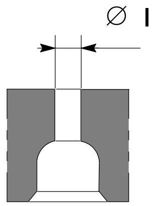
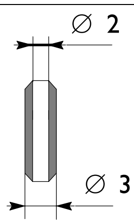
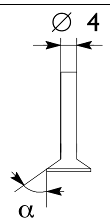
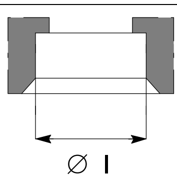
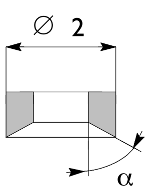
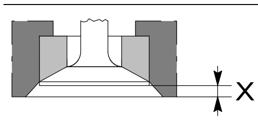
• Class A pistons supplied as spares.
•• Class B pistons are fitted in production only and are not supplied as spares.

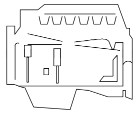
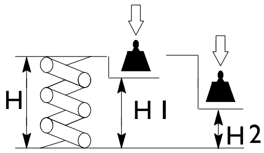
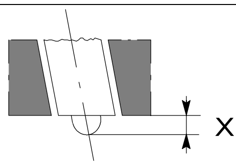
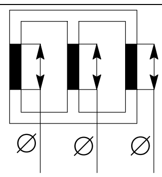
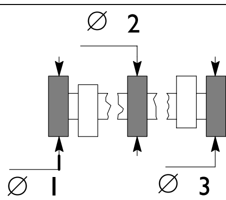
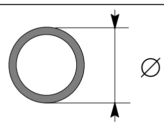
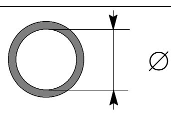
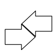
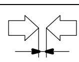
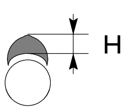
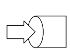
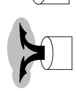
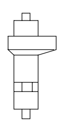
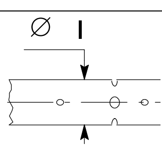
	Type	**F3A** mm
	Piston ring grooves X1 X2 X3	3.620 to 2.640 1.550 to 1.570 4.020 to 4.040
	Piston rings: trapezoidal seal S1 lune seal S2 milled scraper ring with slits and internal spring S3	2.500 1.470 to 1.500 3.970 to 3.990
	Piston rings - grooves 1 2 3	0.120 to 0.140 0.050 to 0.100 0.030 to 0.070
IVECO PARTS 	Piston rings	-
	Piston ring end gap in cylinder liners X1 X2 X3	0.35 to 0.50 0.60 to 0.75 0.35 to 0.65
	Small end bush housing ∅1 Big end bearing housing ∅2 Selection classes { 1 2 3	54.000 to 54.030 87.000 to 87.030 87.000 to 87.010 87.011 to 87.020 87.021 to 87.030
	Small end bush diameter outside ∅4 inside ∅3 Big end bearing shell S Red Green Yellow ●	54.085 to 54.110 50.019 to 50.035 1.970 to 1.980 1.981 to 1.990 1.991 to 2.000
	Small end bush - housing	0.055 to 0.110
	Piston pin - bush	0.019 to 0.041
IVECO PARTS 	Big end bearing	0.127 - 0.254 - 0.508
	Connecting rod weight A	g. 3973 to 4003
	Connecting rod weight Class A B C	g. 3973 to 4003 g. 4004 to 4034 g. 4035 to 4065

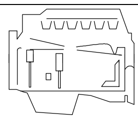
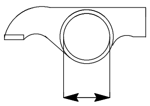
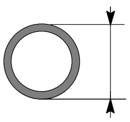
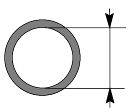
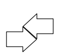
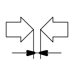
● Fitted in production only and not supplied as spares

	Type		F3A mm
	Measuring dimension	X	125
	Max. connecting rod axis misalignment tolerance	—	0.08
	Main journals	Ø1	
	- nominal		92.970 to 93.000
	- class	1	92.970 to 92.979
	- class	2	92.980 to 92.989
	- class	3	92.990 to 93.000
	Crankpins	Ø2	
	- nominal		82.970 to 83.000
	- class	1	82.970 to 82.979
	- class	2	82.980 to 82.989
	- class	3	82.990 to 83.000
	Main bearing shells	S1	
	Red		2.965 to 2.974
	Green		2.975 to 2.984
	Yellow*		2.985 to 2.995
	Big end bearing shells	S2	
	Red		1.970 to 1.980
	Green		1.981 to 1.990
	Yellow*		1.991 to 2.000
	Main bearing housings	Ø3	
	- nominal		99.000 to 99.030
	- class	1	99.000 to 99.009
	- class	2	99.010 to 99.019
	- class	3	99.020 to 99.030
	Bearing shells - main journals		0.050 to 0.090
	Bearing shells - big ends		0.040 to 0.080
	Main bearing shells		0.127 - 2.254 - 0.508
	Big end bearing shells		0.127 - 2.254 - 0.508
	Main journal, thrust bearing	X1	45.95 to 46.00
	Main bearing housing, thrust bearing	X2	38.94 to 38.99
	Thrust washer halves	X3	3.38 to 3.43
	Crankshaft end float		0.10 to 0.30
	Alignment	1 - 2	≤ 0.025
	Ovalization	1 - 2	- 0.010
	Taper	1 - 2	0.010

* Fitted in production only and not supplied as spares

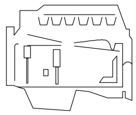
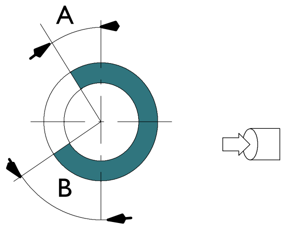
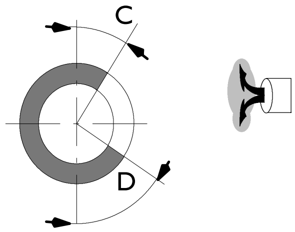
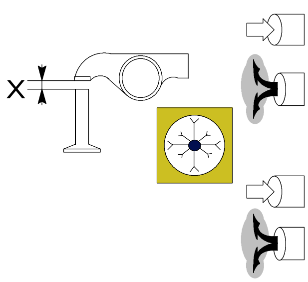
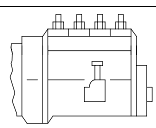
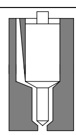
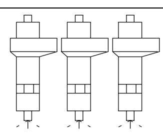
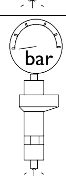
	Type	**F3A**
CYLINDER HEAD - VALVE TRAIN		mm
	Valve guide housings in cylinder head Ø1	14.980 to 14.997
	Valve guide Ø2 Ø3	9.015 to 9.030 15.012 to 15.025
	Valve guides - housings in the cylinder heads	0.015 to 0.045
IVECO PARTS	Valve guide	0.2 - 0.4
	Valves: Ø4 α Ø4 α	8.960 to 8.975 60° 30′ ± 7′ 30″ 8.960 to 8.975 45° 30′ ± 7′ 30″
	Valve stem and its guide	0.040 to 0.070
	Valve seat in head Ø1 Ø1	44.185 to 44.220 42.985 to 43.020
	Outside diameter of valve seat; angle of valve seat in cylinder head: Ø2 α Ø2 α	44.260 to 44.275 60° - 30′ 43.060 to 43.075 45° - 30′
	Recessing of valve X X	0.65 to 0.95 1.8 to 2.1
	Between valve seat and head	0.040 to 0.090

	Type		F3A mm
	Valve spring height: free height under a load of: N 500 ±25 N 972 ±48	 H H1 H2	 75 61 47.8
	Injector protrusion	X	0.14 to 1.4
	Camshaft bushing housing in the cylinder head: 1 ⇒ 7	∅	88.000 to 88.030
	Camshaft bearing journals: 1 ⇒ 7	∅	82.950 to 82.968
	Outer diameter of camshaft bushings:	∅	88.153 to 88.183
	Inner diameter of camshaft bushings:	∅	83.018 to 83.085
	Bushings and housings in the cylinder head		0.123 to 0.183
	Bushings and bearing journals		0.050 to 0.135
	Cam lift:   		 9.30 9.45 11.21
	Rocker shaft	∅1	41.984 to 42.000

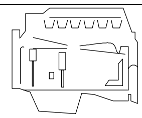
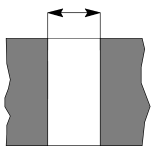
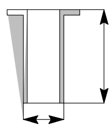
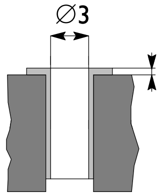
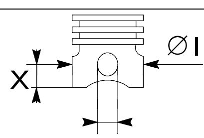
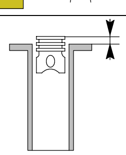
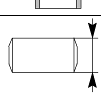
		F3A
	Type	mm
 ∅	Bushing housing in rocker arms	45.000 to 45.016 59.000 to 59.019 46.000 to 46.016
 ∅	Bushing outer diameter for rocker arms	45.090 to 45.130 59.100 to 59.140 46.066 to 46.091
 ∅	Bushing inner diameter for rocker arms	42.025 to 42.041 56.030 to 56.049 42.015 to 42.071
	Between bushings and housings	0.074 to 0.130 0.081 to 0.140 0.050 to 0.091
	Between bushings of rocker arms and shaft	0.025 to 0.057 0.025 to 0.057 0.015 to 0.087
TURBOCHARGER		
Type		HOLSET HX55
End float		-
Radial play		-

F3B GENERAL CHARACTERISTICS

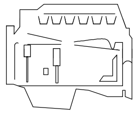
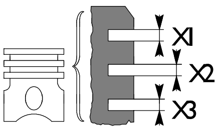
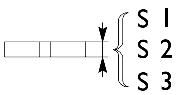
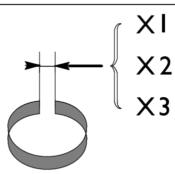
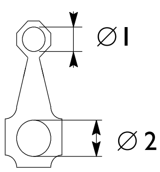
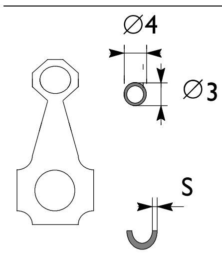
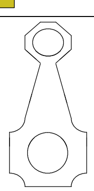
Type		F3BE9685A*E001
Cycle		4-stroke Diesel engine
Fuel feed		Turbocharged
Injection		Direct
No. of cylinders		6 in line
Bore	mm	135
Stroke	mm	150
Total displacement	cm^3	12880
Compression ratio		16.5 ± 1
Europe market		
Max. output	kW	-
	(HP)	-
	rpm	-
Max. torque	Nm	-
	(kgm)	-
	rpm	-
USA market		
Max. output	kW	395
	(HP)	(537)
	rpm	1800/60Hz
Max. torque	Nm	-
	(kgm)	-
	rpm	-

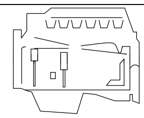
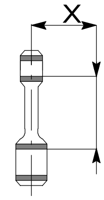
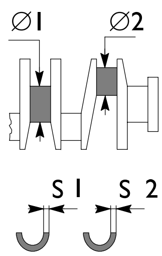
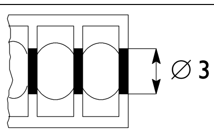
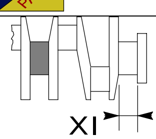
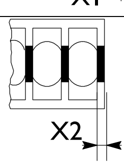
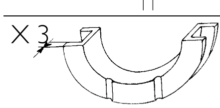
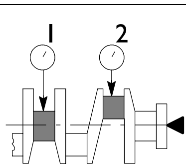
	Type	**F3B**
 	VALVE TIMING opens before T.D.C. A closes after B.D.C. B opens before B.D.C. D closes after T.D.C. C	 17° 30° 50° 9°
	For timing check X { mm mm Running X { mm mm	 - - 0.35 to 0.45 0.55 to 0.65
	FEED	Through fuel pump - filters
	Injection type: Bosch	With electronically regulated injectors PDE N3 pump injectors controlled by overhead camshaft
	Nozzle type	–
	Injection order	1 - 4 - 2 - 6 - 3 - 5
	Injection pressure bar Injector calibration bar	1800 296 ± 6

F3B ASSEMBLY CLEARANCE DATA

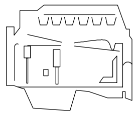
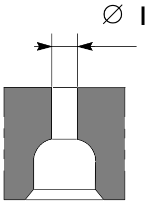
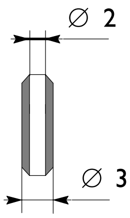
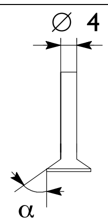
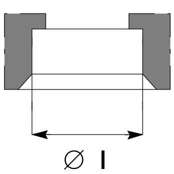
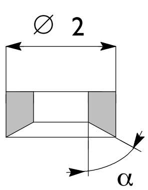
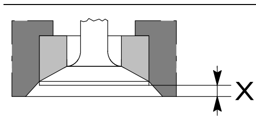
	Type		F3B
CYLINDER BLOCK AND CRANKMECHANISM COMPONENTS			mm
Ø1 	Bores for cylinder liners: Ø1	upper	153.500 to 153.525
		lower	152.000 to 152.025
 Ø2	Cylinder liners: external diameter: Ø2	upper	153.461 to 153.486
		lower	151.890 to 151.915
	length	L	-
	Cylinder liners - crankcase bores	upper	0.014 to 0.039
		lower	0.085 to 0.135
IVECO PARTS	External diameter	Ø2	-
Ø3 	Cylinder sleeve inside diameter	Ø3A*	135.000 to 135.012
	inside diameter	Ø3B*	135.011 to 135.023
	Protrusion	X	0.045 to 0.075
* Selection class * Under a load of 800 N			
 Ø2	Pistons: measuring dimension	X	18
	external diameter	Ø1A●	134.861 to 134.873
	external diameter	Ø1B●●	134.872 to 134.884
	pin bore	Ø2	54.010 to 54.018
	Piston - cylinder sleeve	A*	0.127 to 0.151
* Selection class		B*	0.127 to 0.151
IVECO PARTS	Piston diameter	Ø1	-
	Pistons protrusion	X	0.12 to 0.42
 Ø3	Gudgeon pin	Ø3	53.994 to 54.000
	Gudgeon pin - pin housing		0.010 to 0.024

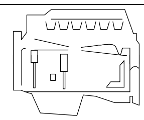
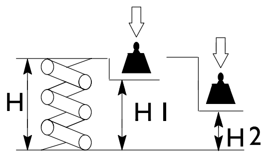
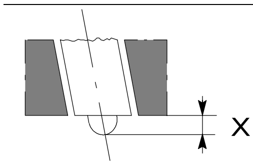
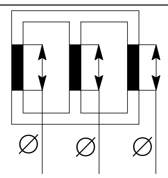
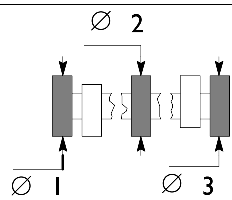
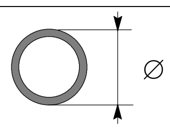
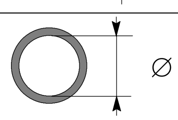
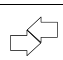
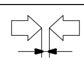
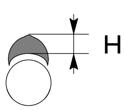
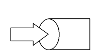
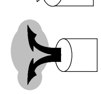
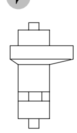
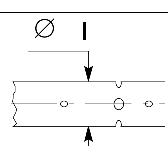
● Class A pistons supplied as spares.
●● Class B pistons are fitted in production only and are not supplied as spares.

	Type		F3B
			mm
	Piston ring grooves	X1 X2 X3	3.100 to 3.120 1.550 to 1.570 5.020 to 5.040
	Piston rings: trapezoidal seal lune seal milled scraper ring with slits and internal spring * measured on Ø of 130 mm	 S1* S2 S3	 3.000 1.470 to 1.500 4.970 to 4.990
	Piston rings - grooves	1 2 3	0.100 to 0.120 0.050 to 0.100 0.030 to 0.070
IVECO PARTS	Piston rings		-
	Piston ring end gap in cylinder liners	X1 X2 X3	0.40 to 0.50 0.65 to 0.80 0.40 to 0.75
	Small end bush housing nominal Big end bearing housing nominal - Class - Class - Class	Ø1 Ø2 1 2 3	59.000 to 59.030 94.000 to 94.030 94.000 to 94.010 94.011 to 94.020 94.021 to 94.030
	Small end bush diameter outside inside Big end bearing shell Red Green Yellow	 Ø4 Ø3 S	 59.085 to 59.110 54.019 to 54.035 1.965 to 1.975 1.976 to 1.985 1.986 to 1.995
	Small end bush - housing		0.055 to 0.110
	Piston pin - bush		0.019 to 0.041
IVECO PARTS	Big end bearing		0.127 - 0.254 - 0.508
	Connecting rod weight		g.
	Class	A B C	4661 to 4694 4695 to 4728 4729 to 4762

	Type		F3B
			mm
	Measuring dimension	X	125
	Max. connecting rod axis misalignment tolerance	=	0.08
	Main journals	Ø1	
	- rated value		99.970 to 100.000
	- class	1	99.970 to 99.979
	- class	2	99.980 to 99.989
	- class	3	99.990 to 100.000
	Crankpins	Ø2	
	- rated value		89.970 to 90.000
	- class	1	89.970 to 89.979
	- class	2	89.980 to 89.989
	- class	3	89.990 to 90.000
	Main bearing shells	S1	
	Red		3.110 to 3.120
	Green		3.121 to 3.130
	Yellow*		3.131 to 3.140
	Big end bearing shells	S2	
	Red		1.965 to 1.975
	Green		1.976 to 1.985
	Yellow*		1.986 to 1.995
	Main bearing housings	Ø3	
	- rated value		106.300 to 106.330
	- class	1	106.300 to 106.309
	- class	2	106.310 to 106.319
	- class	3	106.320 to 106.330
	Bearing shells - main journals		0.060 to 0.100
	Bearing shells - big ends		0.050 to 0.090
IVECO PARTS	Main bearing shells		0.127 - 2.254 - 0.508
	Big end bearing shells		0.127 - 2.254 - 0.508
	Main journal, thrust bearing	X1	47.95 to 48.00
	Main bearing housing, thrust bearing	X2	40.94 to 40.99
	Thrust washer halves	X3	3.38 to 3.43
	Crankshaft end float		0.10 to 0.30
	Alignment	1 - 2	≤ 0.025
	Ovalization	1 - 2	0.010
	Taper	1 - 2	0.010

* Fitted in production only and not supplied as spares

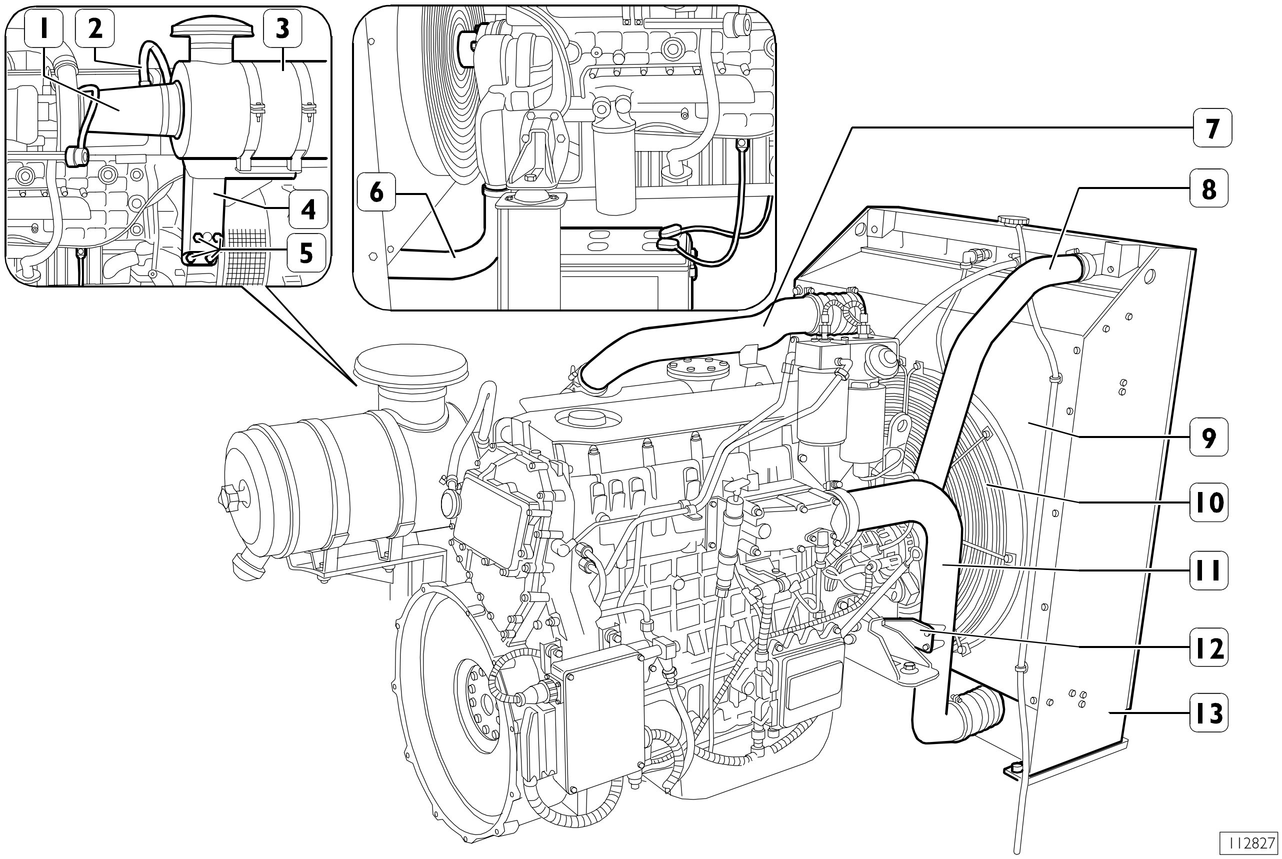
	Type		**F3B**
CYLINDER HEAD - VALVE TRAIN			mm
	Valve guide housings in cylinder head	Ø1	15.980 to 15.997
	Valve guide	Ø2 Ø3	10.015 to 10.030 16.012 to 16.025
	Valve guides - housings in the cylinder heads		0.015 to 0.045
IVECO PARTS	Valve guide		-
	Valves:	Ø4 α Ø4 α	9.960 to 9.975 60° 30′ ± 7′ 30″ 9.960 to 9.975 45° 30′ ± 7′ 30″
	Valve stem and its guide		0.040 to 0.070
	Valve seat in head	Ø1 Ø1	49.185 to 49.220 46.985 to 47.020
	Outside diameter of valve seat; angle of valve seat in cylinder head:	Ø2 α Ø2 α	49.260 to 49.275 60° - 30′ 47.060 to 47.075 45° - 30′
	Recessing of valve	X X	0.54 to 0.85 1.75 to 2.05
	Between valve seat and head		0.040 to 0.090

			F3B
	Type		mm
	Valve spring height: free height under a load of: 575 ± 28 N 1095 ± 54 N	 H H1 H2	 72,40 58 45
	Injector protrusion	X	0.53 to 1.34
	Camshaft bushing housing in the cylinder head: 1 ⇒ 7	Ø	88.000 to 88.030
	Camshaft bearing journals: 1 ⇒ 7	Ø	82.950 to 82.968
	Outer diameter of camshaft bushings:	Ø	88.153 to 88.183
	Inner diameter of camshaft bushings:	Ø	83.018 to 83.085
	Bushings and housings in the cylinder head		0.123 to 0.183
	Bushings and bearing journals		0.050 to 0.135
	Cam lift:   		9.231 9.231 11.216
	Rocker shaft	Ø1	41.984 to 42.000

Type	F3B
	mm
Bushing housing in rocker arms	45.000 to 45.016 59.000 to 59.019 46.000 to 46.016
Bushing outer diameter for rocker arms	45.090 to 45.130 59.100 to 59.140 46.066 to 46.091
Bushing inner diameter for rocker arms	42.025 to 42.041 56.030 to 56.049 42.015 to 42.071
Between bushings and housings	0.074 to 0.130 0.081 to 0.140 0.050 to 0.091
Between bushings of rocker arms and shaft	0.025 to 0.057 0.025 to 0.057 0.015 to 0.087
TURBOCHARGER	
Type	HOLSET HX55
End float	-
Radial play	-

ENGINE CONNECTION AND DISCONNECTION FROM THE RADIATOR

Figure 1 (Demonstration)



Removal

To prearrange a suited container near the sleeve (6) to recover the cooling liquid. Disconnect and remove the sleeve (6) and (8) by means of suited hose clamps.
To disconnect and to remove pipes (7) and (11) from engine and radiator by means of the suited collars hanger. (12).
To remove the protection grids (10) and the ventilator guard (9) by means of clamps.
To block the radiator unit (13) and to release it form the mounting by means of the clamps operating by both sides. Detach the air filter (3) form the engine complete with support (4) by means of clamps(5) after disconnecting the oil vapour pipes (2) and the sleeve (1) from the turbocompressor.
To remove the engine fixing screws from the mounting and to disconnect the engine.

Refitting

For the connection operation repeat the described operations for the disconnection on the contrary and apply the following instructions:

- ❑ to control the engine elastic supports and to replace them in case of deterioration ;
- ❑ to control that the exhaust pipes are not deteriorated or are going to deteriorate; in this case you shall replace them;
- ❑ to clamp the screws and/or nuts to the described couple;
- ❑ to fill the cooling system with cooling liquid;
- ❑ to carry out bleeding operation from the fuel supply system as described in the suited paragraph.
- ❑ to control engine oil level;
- ❑ to carry out the tests and controls as described in the suited chapter.

IVECO PARTS

ENGINE ASSEMBLY/DISASSEMBLY
F3A engine disassembly

Handle all parts extremely carefully. Never get your hands or fingers between pieces.
Wear the required safety clothing such as goggles, gloves and safety shoes.

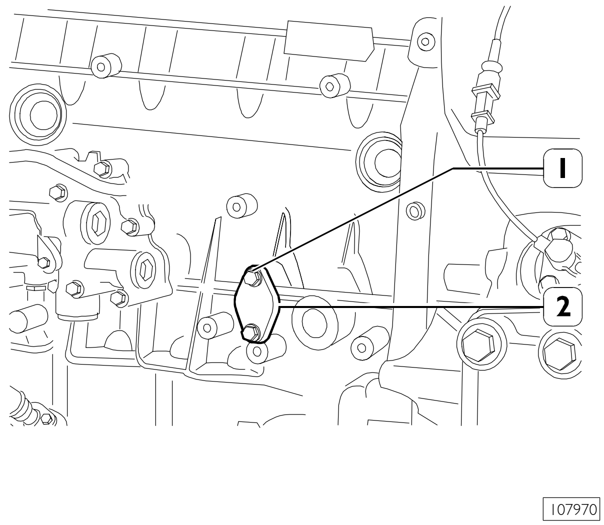
Protect the electric parts before doing any washing with high-pressure jets.

Here are described and illustrated the engine disassembly operation which are different form the operations for the industrial or agricultural applications engines.

Before securing the engine on the rotary stand, remove:

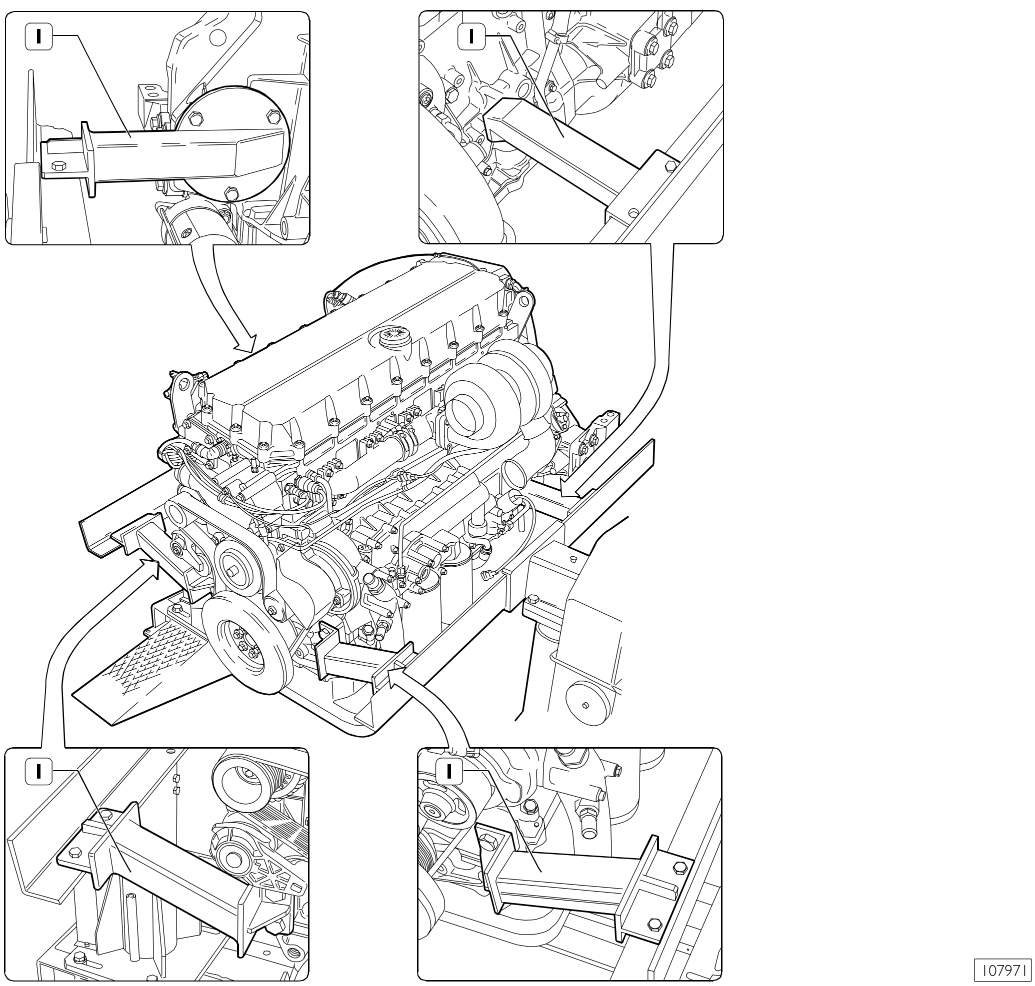
- the electric engine cable (1) by disconnecting it from the control unit and all the sensors/transmitters to which it is connected;
- the starting motor;
- air compressor (if available).

Figure 2



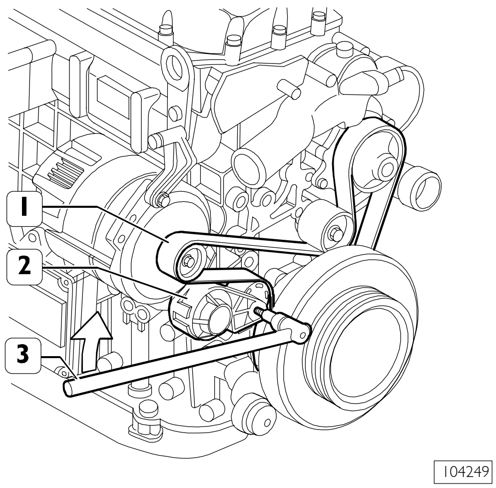
Remove screws (1) and remove oil pressure adjustment valve (2).

Figure 3



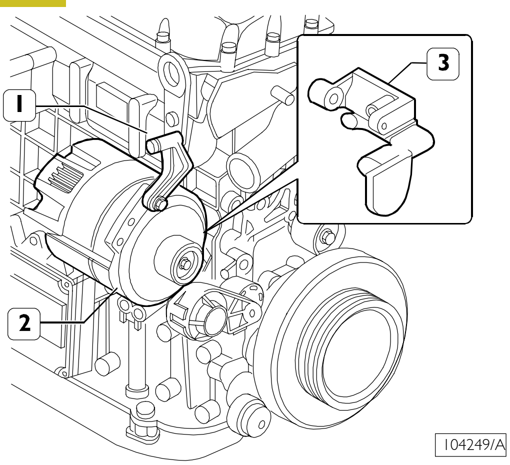
Secure the engine to the rotary stand with the brackets 99361036 (1).
To release the lubrication oil from the pan.

Figure 4



Use specific tool (3) to operate on belt tensioner (2) in direction of arrow, remove water pump alternator and ventilator control belt (1).

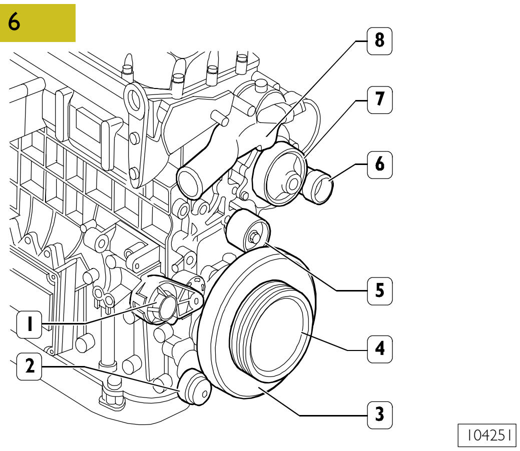
Figure 5



Disassemble:

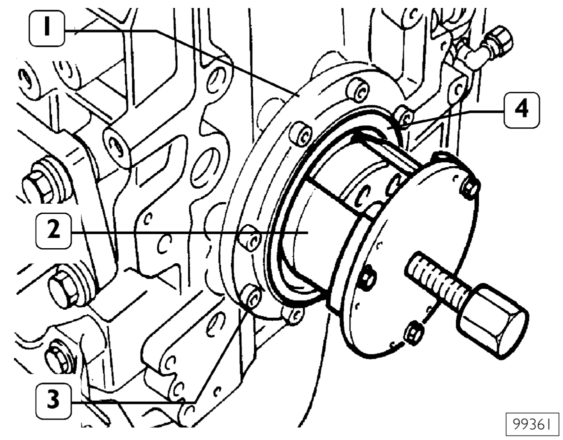
- the alternator (2);
- the supports (1 and 3).

Figure 6



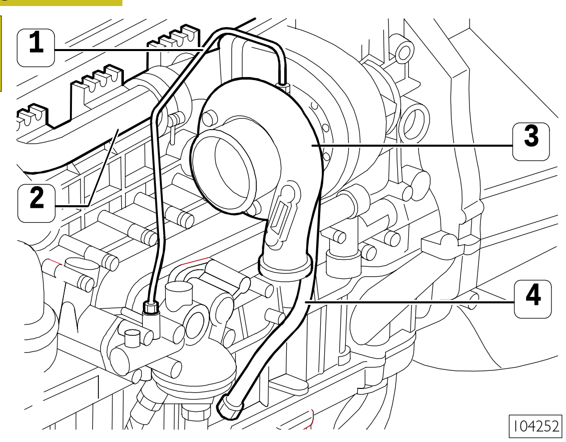
Disassemble: the thermostat group (8), the tubing together with the coolant (6), the pulley (4), the water pump (7), the automatic belt tightener (1), the fixed belt tightener (5), the silent flywheel (3) and the pulley below, the automatic belt tightener (2).

Figure 7



Apply the extractor 99340053 (2) as is illustrated in the figure and take off the sealing ring (4). Undo the screws (3) and take off the lid (1). Disconnect all the electrical connections and sensors.

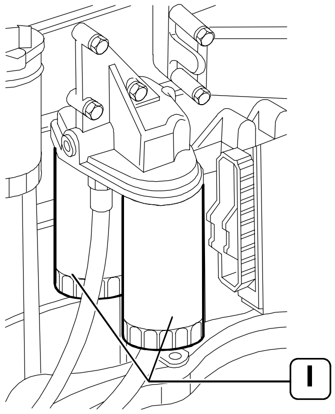
Figure 8



From the side of the engine exhaust, disassemble the following details:

- clutch oil pipe (1);
- return oil pipe (4);
- turbo-compressor (3);
- discharge manifold (2).

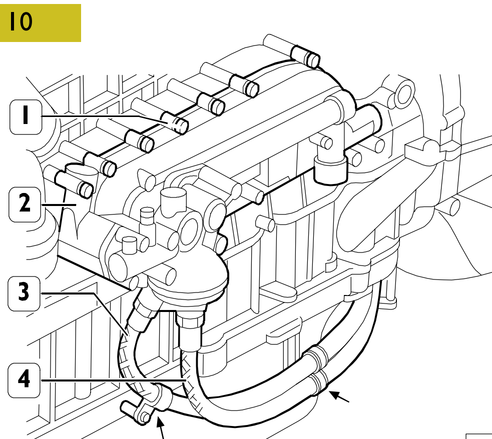
Figure 9



101960

Unscrew the oil filters (1) by tool 99360314.

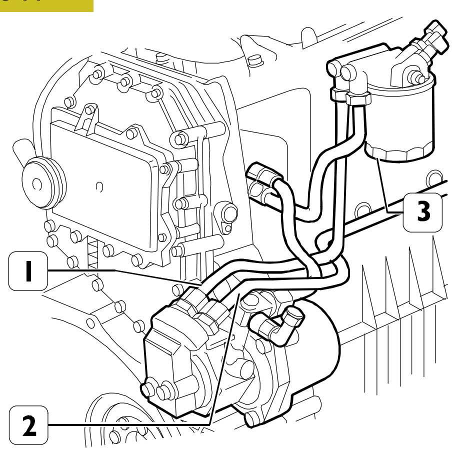
Figure 10



99258

- disconnect the oil piping (3) and (4) and take off the clips (←);
- undo the fixing screws (1) and disassemble the heat exchanger (2).

Figure 11



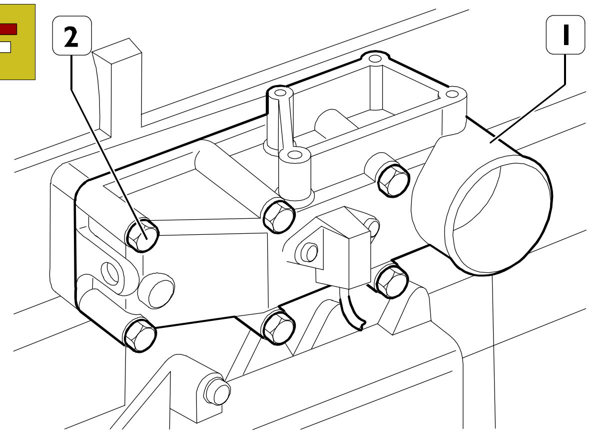
104254

Disconnect the fuel piping (1) from the feeding pump (2).

Disassemble:

- the feeding pump (2);
- the fuel filter group (3) and the piping (1).

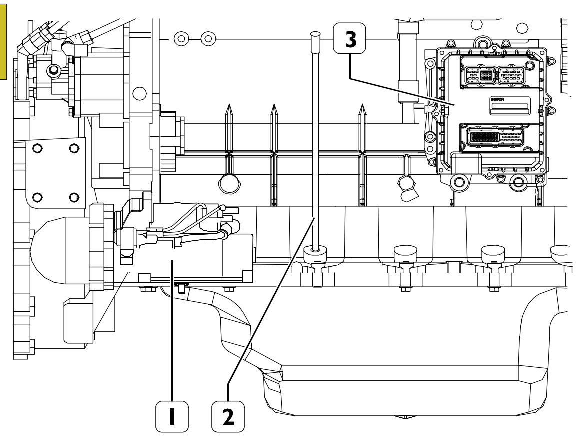
Figure 12



104253

Take out the screws (2) and remove the intake manifold (1).

Figure 13

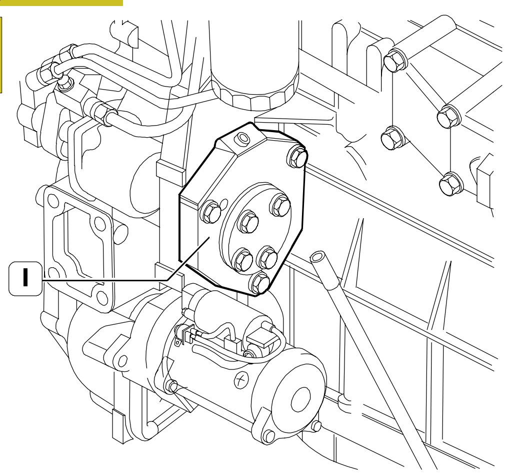


104255

Disassemble:

- the starting engine (1);
- the power unit (2) and its relative support;
- the oil gauge dip stick (3) from the crankshaft.

Figure 14



104247

- Disassemble the drive (1).

To go on with the engine disassembly as described for the industrial/agricultural applications engines.

F3A engine assembly

To assembly again the engine inverting the described operations for the disassembly.

F3B engine disassembly

Handle all parts extremely carefully. Never get your hands or fingers between pieces.
Wear the required safety clothing such as goggles, gloves and safety shoes.

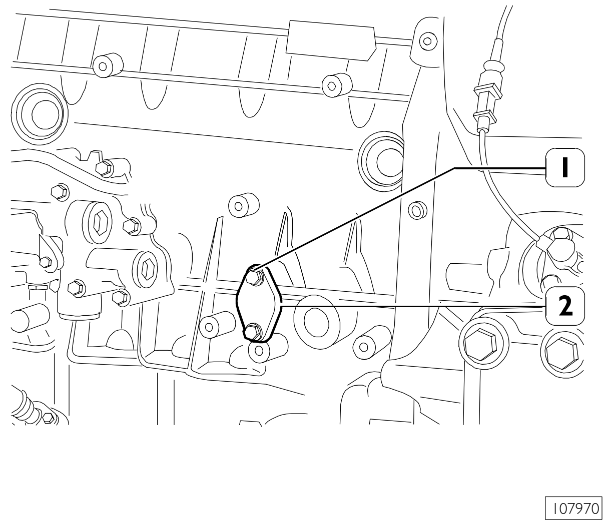
Protect the electric parts before doing any washing with high-pressure jets.

Here are described and illustrated the engine disassembly operations which are different from the operations for the industrial application engines.

Before securing the engine on the rotary stand, remove:

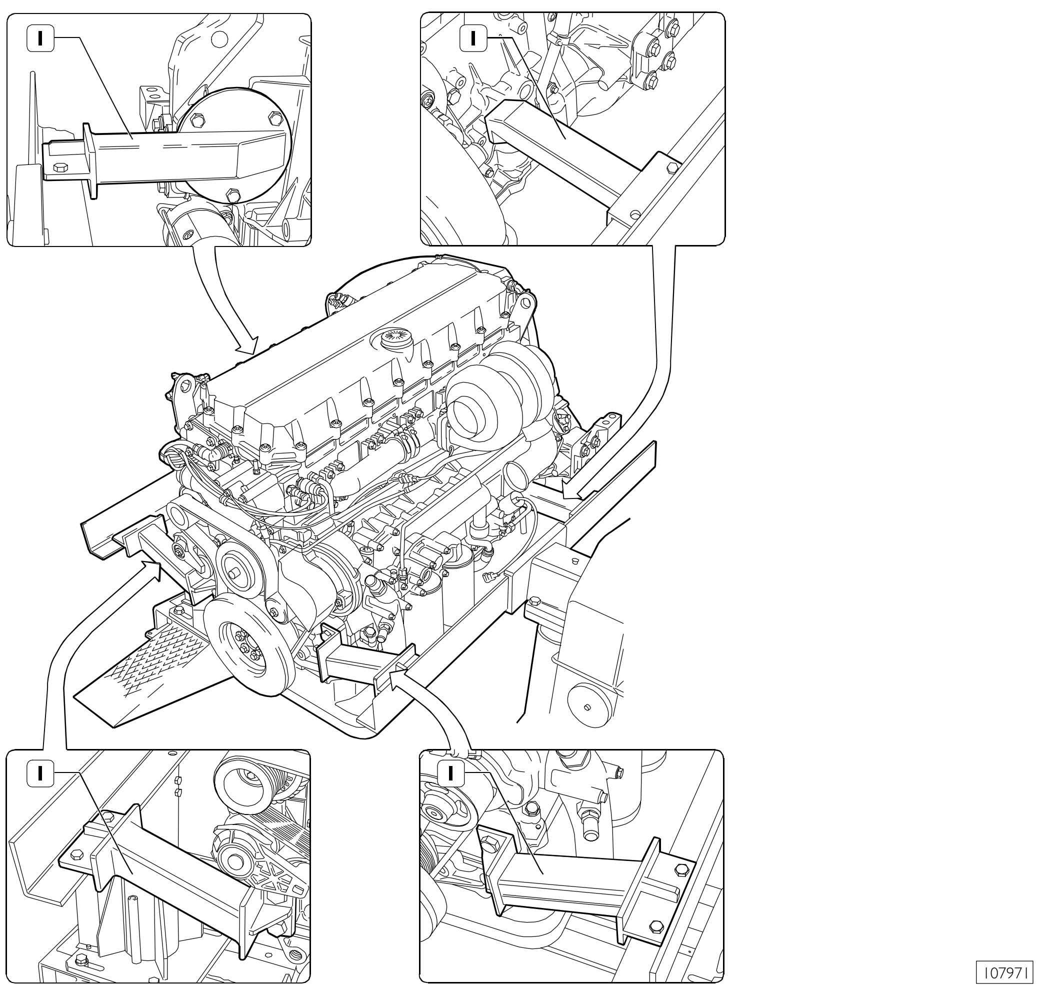
- the electric engine cable (1) by disconnecting it from the control unit and all the sensors/transmitters to which it is connected.
- Remove the engine supports.

Figure 15



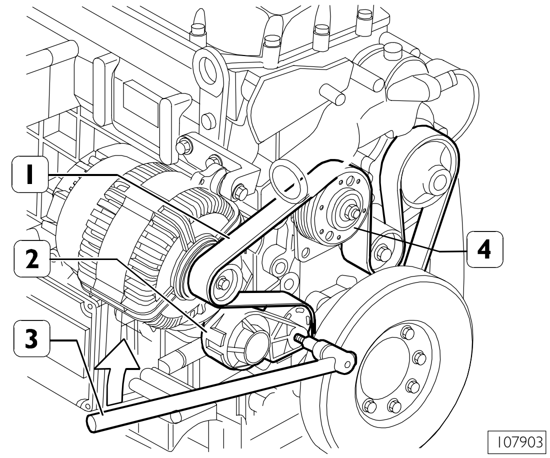
Remove screws (1) and remove oil pressure adjustment valve (2).

Figure 16



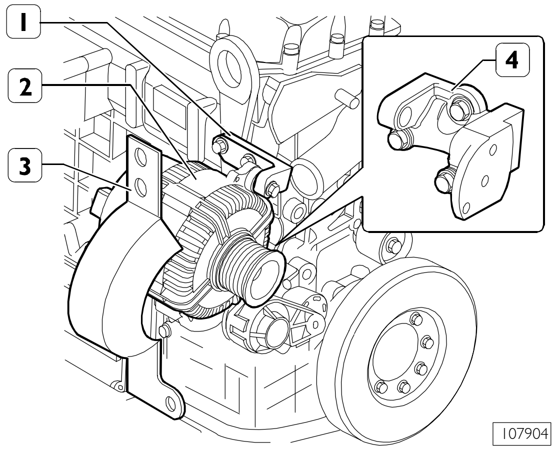
Secure the engine to the rotary stand with the brackets 99361036 (1).
To release the lubrication oil from the pan.

Figure 17



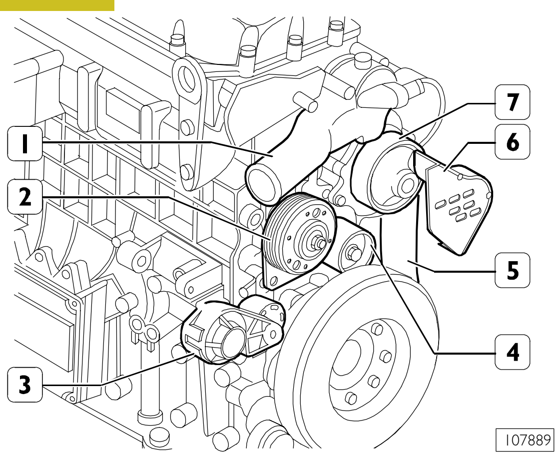
Use specific tool (3) to operate on belt tensioner (2) in direction of arrow, remove water pump alternator and ventilator control belt (1). Remove screws and disconnect electromagnetic ventilator coupling (4).

Figure 18



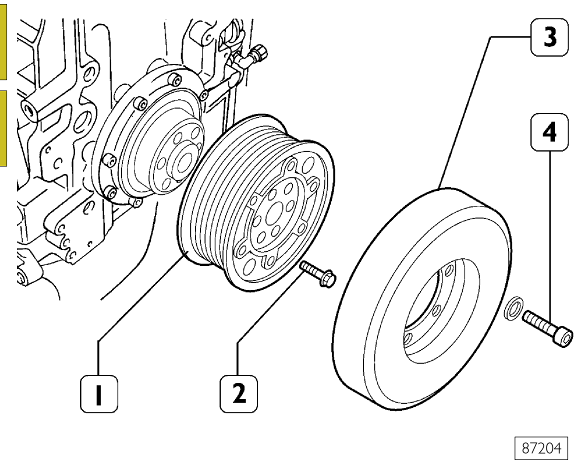
Remove guard (3).
Remove retaining screws and remove alternator (2) from bracket (1) and from support (4), then remove the latter from block.

Figure 19



Remove thermostat (1), ventilator support (2), automatic belt tensioner (3), fixed belt tensioner (4), pipeline (5),guard (6), water pump (7).

Figure 20

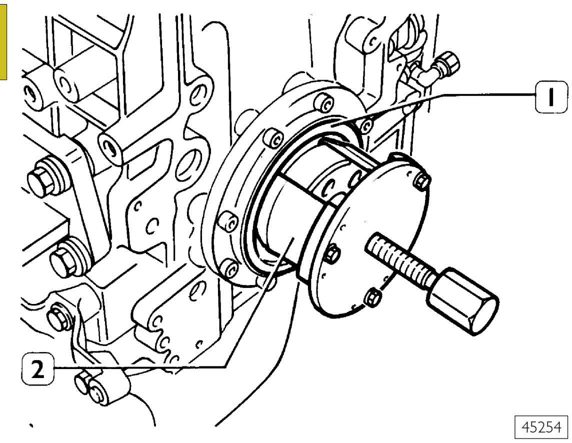


Block the flywheel rotation with tool 99360351.

Remove screws (4), then disassemble damper flywheel (3).

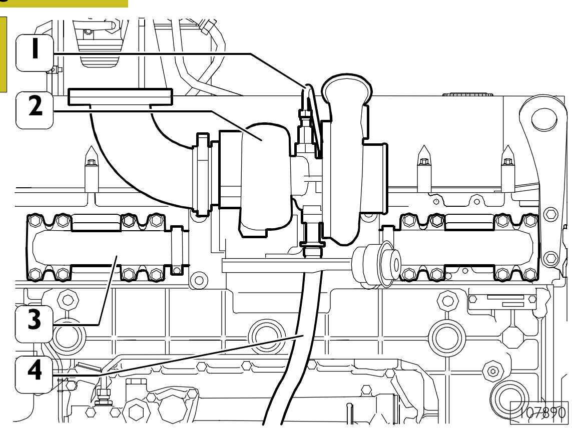
Remove the screws (2) and the pulley (1).

Figure 21



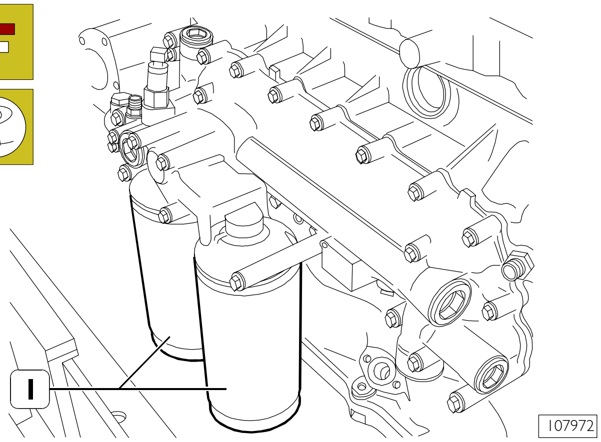
Install extractor 99340051 (2) and remove the seal gaskets (1). Unscrew the screws and remove the cover.
Disconnect all electric connections and sensors.

Figure 22



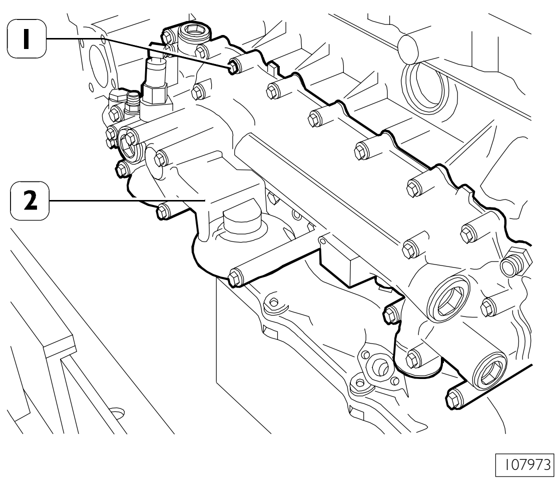
Disconnect oil pipes (1 and 4) of turbo compressor (2).
Disconnect turbo compressor (2) from exhaust manifold (3).

Figure 23



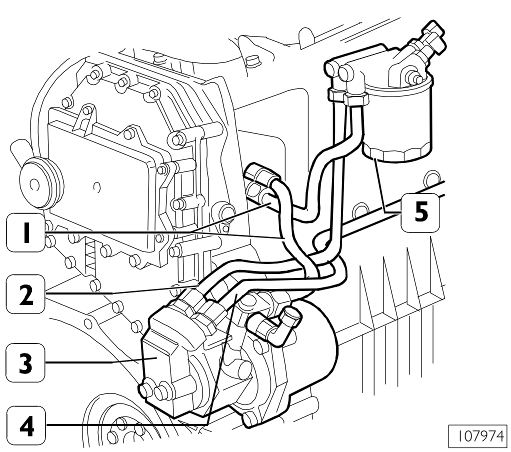
Unscrew the oil filter (1) by tool 99360314.

Figure 24



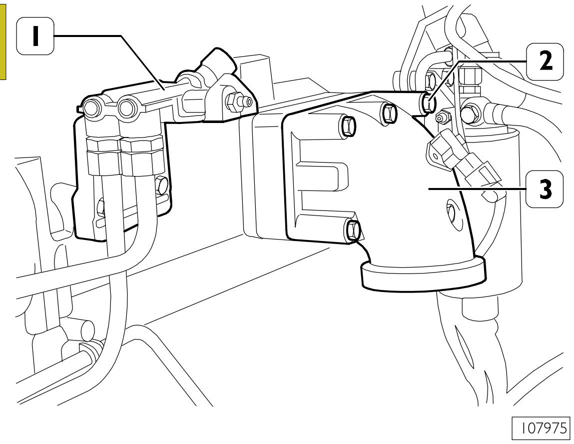
Unscrew the screws (1) and remove the heat exchanger (2).

Figure 25



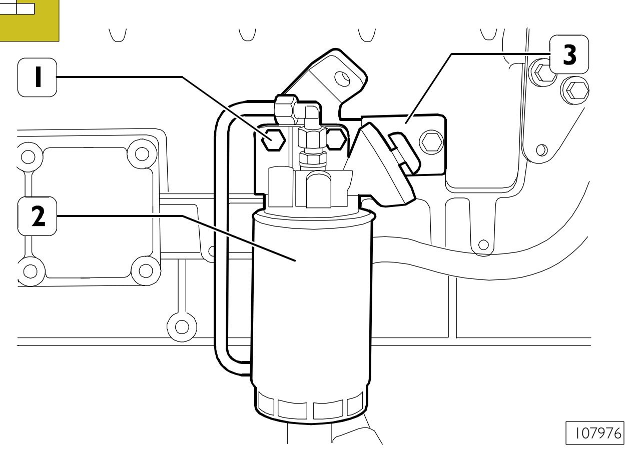
Disconnect the fuel pipes (1 and 4) from the fuel pump (2).
Remove supply pump (3) and fuel filter (5).

Figure 26



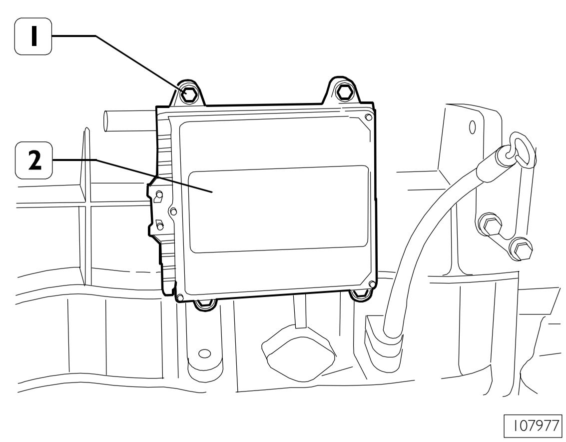
Remove retaining screws and support (1) of fuel filter.
Remove screws (2) and remove intake manifold (3).

Figure 27



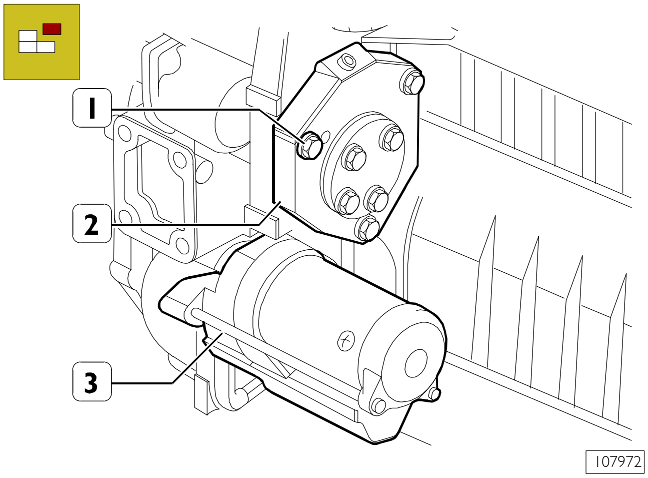
Remove screws (1) and bracket (3) supporting sedimentation tank prefilter (2).

Figure 28 (Demonstration)



Remove screws (1) and disconnect ECU (2).

Figure 29



Remove screws (1) and remove power takeoff (2).
Remove screws and remove starter motor (3).
Therefore, continue with the disassembly of the engine as described for engines used for industrial applications.

F3B engine assembly

To assembly again the engine inverting the described operations for the disassembly.

MAINTENANCE PLANNING

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.

NOTE Here are described the F3A engines control and/or maintenance operations which are similar to the operations for F3B engines. For this reason they are valid for F3B engines as well.

Inspection and/or maintenance interventions

Intervention type	Frequency (hours)
Engine	
Engine visual inspection	Daily
Check presence of water in fuel prefilter	Daily
Engine oil change	-
Engine oil filter change	-
Fuel prefilter change	-
Fuel filter change	-
Check Blow-by filter condition by clogging indicator	-
Check condition of water pump/alternator control belt	-
Check-up of EDC system by diagnostics tool	-
Check valve lash and adjust, if required	-
Dry air filter change and container cleaning	-

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

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)

- Checking the coolant level.

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).

Draw off the rod 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.

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

Refill through upper tappet cover plug. During refill, remove dipstick for easier oil drain.

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.

Check of fuel system

The check must be executed both when the engine disconnected and when it is running.
The check is made by observing the fuel pipes from the tank to the fuel pump and to the injectors.

Cooling system check

The check must be executed both when the engine disconnected and when it is running.
Check the pipes from the engine to the radiator and vice versa; note any seepage and the state of the pipes especially near the coupling clamps.
Verify that the radiator is clean, the correct working of the fan flywheels, the presence of any leakage from the connectors, from the manifold and from the radiating unit.

Due to the high temperatures achieved by the system, do not operate immediately after the engine's disconnection, but wait for the time deemed necessary for the cooling.
Protect the eyes and the skin from any eventual high pressure jet of cooling liquid.

The density of the cooling liquid must be checked any how every year before winter season and be replaced in any case every two year.

NOTE In case of new filling, proceed bleeding system, through the bleeds on the engine.

If bleeding of the system is not carried out, serious inconvenience might be caused to the engine due to the presence of air pockets in the engine's head.

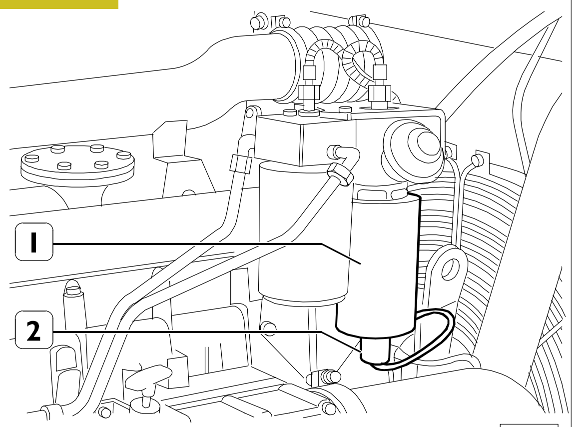
Lubricating system check

The check must be executed both when the engine disconnected and when it is running.
Verify the presence of any oil leakage or blow-by from the head, from the engine pan of from the heat exchanger.

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.

Replace fuel sedimentation tank prefilter

Figure 30



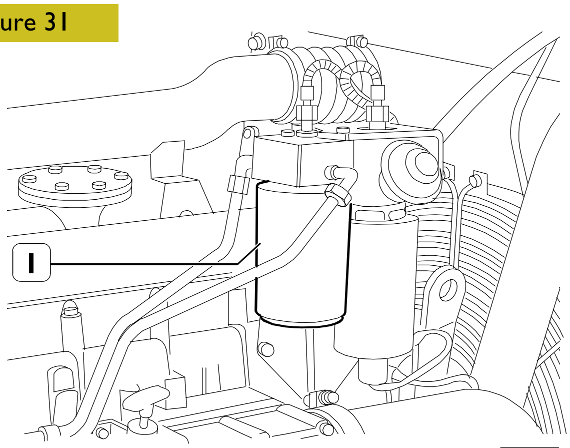
108395

Disconnect electric connector. Unlock prefilter (1) and change it. Before refitting a new cartridge, wet seal with fuel oil or engine oil. Lock cartridge by hand till in contact with support, then lock it by ¾ of a rev. at predefined tightening torque.

At change, filter cartridge must not be prefilled to prevent circulating dirt that could damage injector/pump system components. Bleed air from fuel filter as described in previous pages.

Fuel filter change

Figure 31



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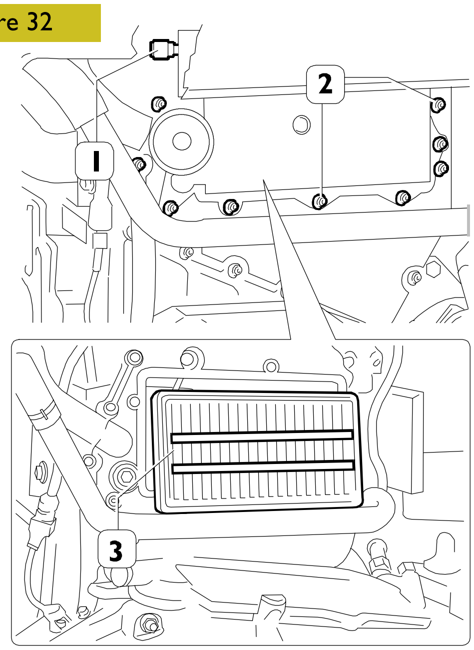
Use tool 99360314 to remove fuel filter (1).
Before fitting the new cartridge, wet seal with fuel oil or engine oil. Lock the new one by hand and carefully check that rubber seal and contact surface are clean and in perfect conditions. Lock cartridge by hand till contact with support and then lock it for ¾ of a rev. at prescribed tightening torque. Bleed air from supply system as described in paragraph below:

Check Blow-by filter conditions by means of a clogging indicator

Figure 32

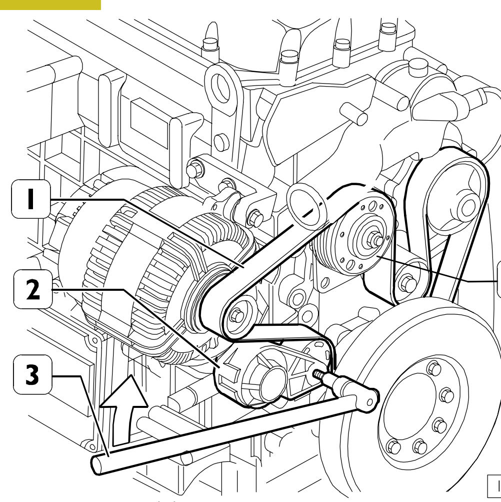


72563

- ❑ Check filter (3) conditions by means of a clogging indicator (1). In case the red area appears, change it.
- ❑ For screw (2) change, remove carter, pull out filter (3) and replace it with a new one. Filter has a one-way operation, therefore it must be installed with the two reinforcement bars visible, as shown in the picture.

Check of water pump/alternator control belt condition

Figure 33



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Visually check that belt (1) is not worn out or broken; change it as described below, if required.

Water pump/alternator control belt change

In order to remove and refit belt (1), operate using a specific tool (3) on belt tensioner (2) in direction shown by arrow.

NOTE Belt tensioner is automatic and requires no adjustment.

Check for any water in the fuel filter

The components of the system can be damaged very quickly in presence of water or impurity within the fuel.

Take prompt action on the filter to drain off the water in the fuel circuit.

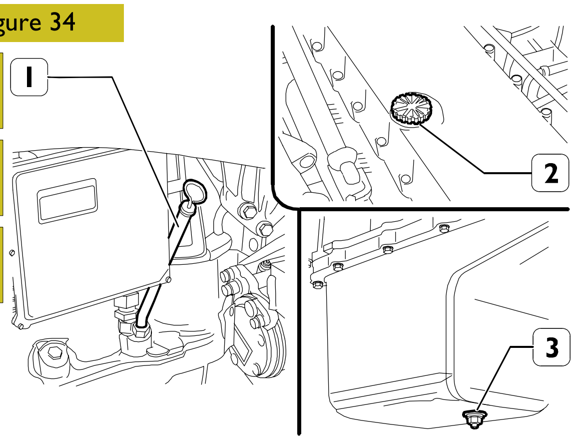
Fuel filter is equipped with pump screw-valve to drain the water eventually mixed with fuel.

Place a container underneath the filter and slightly loosen the screw. Drain the water eventually contained in the filter's bottom.

Lock the screw (max 0.5 Nm locking couple) as soon as fuel starts bleeding.

Engine oil change

Figure 34



85493

We recommend to carry out the oil drainage when the motor is hot.

Warning: We recommend to wear proper protections because of high motor service temperature.

The motor oil reaches very high temperature: you must always wear protection gloves.

- ❑ Place a proper container for the oil collecting under the pan connected with the drain plug (3).
- ❑ Unscrew the plug (3) and then take out the control dipsick (1) and the inserting plug (2) to ease the downflow of the lubrication oil.

The oil motor is very pollutant and harmful.

In case of contact with the skin, wash with much water and detergent.

Protect properly skin and eyes: operate according to safety rules.

Dispose of the residual properly following the rules.

Lock plus (3) under oil sump at predefined tightening torque. Pour oil in prescribed quantity and quality in engine through filler (2) of tappet cover.

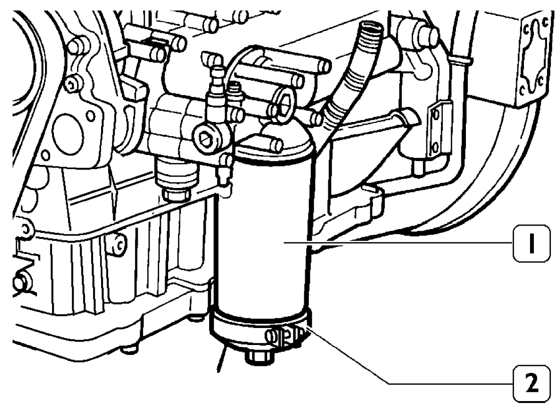
- ❑ After the complete drainage, screw the plug and carry out the clean oil filling.

NOTE Use only the recommended oil or oil having the requested features for the corrrect motor functioning.
In case of topping up, don't mix oils having different features.
If you don't comply with theses rules, the service warranty is no more valid.

- ❑ Check the level through the dipsick until when the filling is next to the maximum level notch indicated on the dipsick.

Engine oil filter change

Figure 35



107940

Drain oil as described in "Engine oil change" chapter.
By means of 99360314 tool (2) to disassemble oil filter (1) or filters for F3B engine .

NOTE Warning: the oil filter contains inside a quantity of oil of about 1 kg.

Place properly a container for the liquid.

Warning: avoid the contact of skin with the motor oil: in case of contact wash the skin with running water.

The motor oil is very pollutant: it must be disposed of according to the rules.

NOTE Before refitting the new cartridge, wet seal using engine oil.

Lock oil filter (1) by hand till contact to support and then lock by ¾ of a rev. at prescribed tightening torque; pour oil in engine ad described in "Engine oil change" chapter.

Valve lash check a adjustment

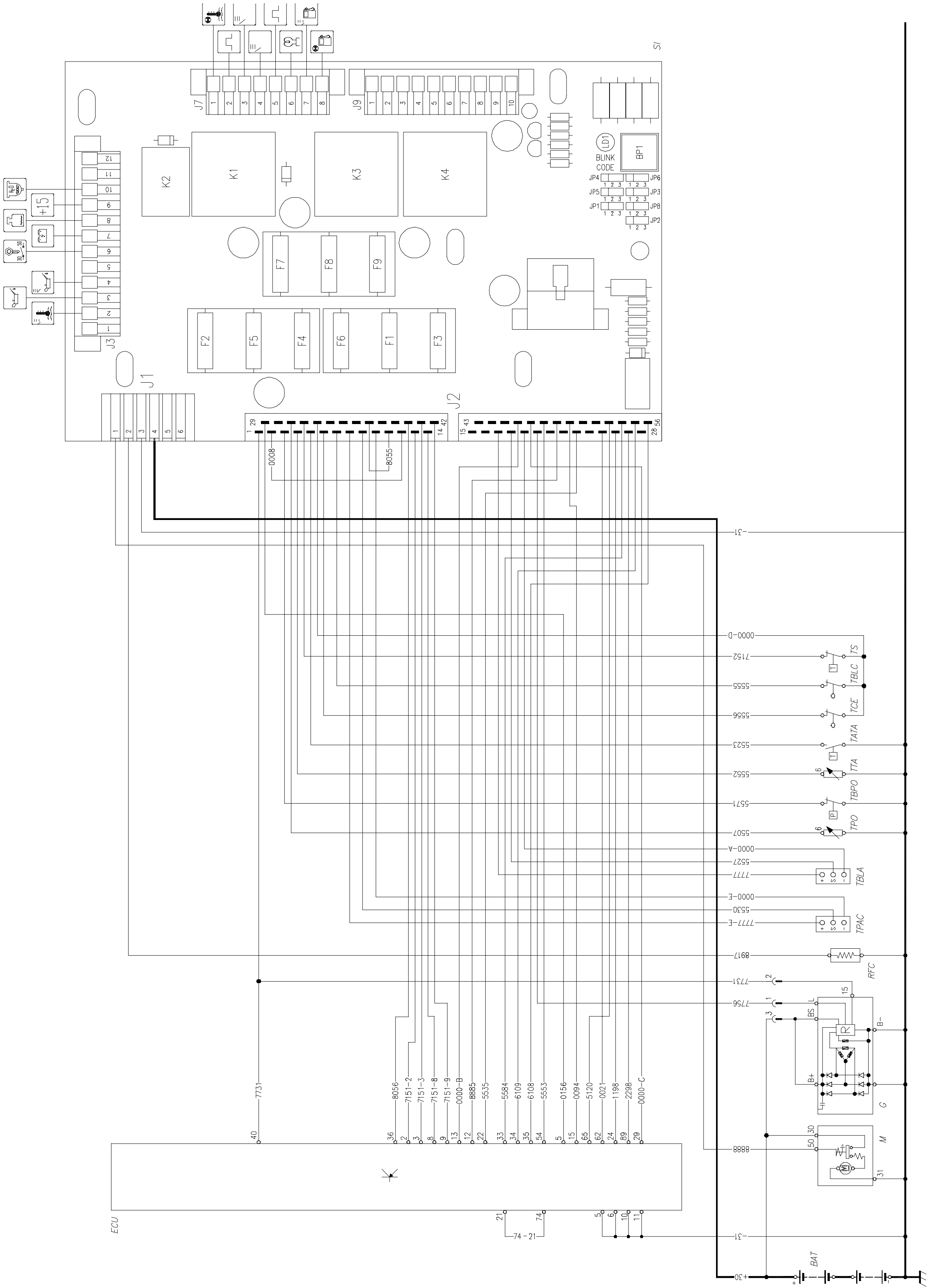
For correct operation, follow instructions contained in related chapter in section 3 – Industrial Application.

Change dry air filter and clean its container

Refit container cover, remove cartridge from air filter. Carefully clean container inside, insert new cartridge and refit cover.

PRINCIPLE ELECTRICAL DIAGRAM

Figure 36



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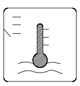
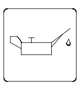
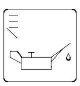
Key to components

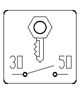
BAT	Starter battery 12V
M	Starter motor
G	Battery charger alternator
RFC	Fuel filter heating resistor
TRFC	Fuel filter heating thermostat
TPAC	Water in the fuel filter transmitter
TBLA	Low engine water level transmitter
TPO	Engine oil pressure switch
TBPO	Low engine oil level pressure switch
TTA	Engine water temperature transmitter
TCE	No fuel transmitter (option)
TBLC	Float for fuel level
TS	Engine water heater thermostat
EDC	Engine electronic control unit
TATA	High engine water temperature thermostat
SI	Control panel - engine interface box

Function symbols for the control panel

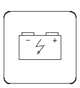

ENGINE WATER TEMPERATURE THERMOMETER

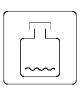

LOW ENGINE OIL PRESSURE VISUAL WARNING

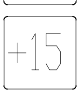

ENGINE OIL PRESSURE GAUGE



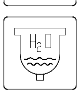
STARTING THE ENGINE (+50)


NO BATTERY CHARGING VISUAL WARNING

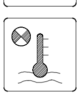

LOW ENGINE WATER LEVEL VISUAL WARNING

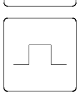


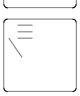
CAPTIVE KEY POSITIVE (+15)

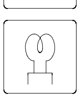


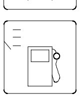
WATER IN THE FUEL FILTER VISUAL WARNING

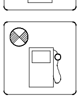

HIGH ENGINE WATER TEMPERATURE VISUAL WARNING


CAN LINE


CONTROL PANEL POWER SUPPLY


ENGINE PRE-HEATING

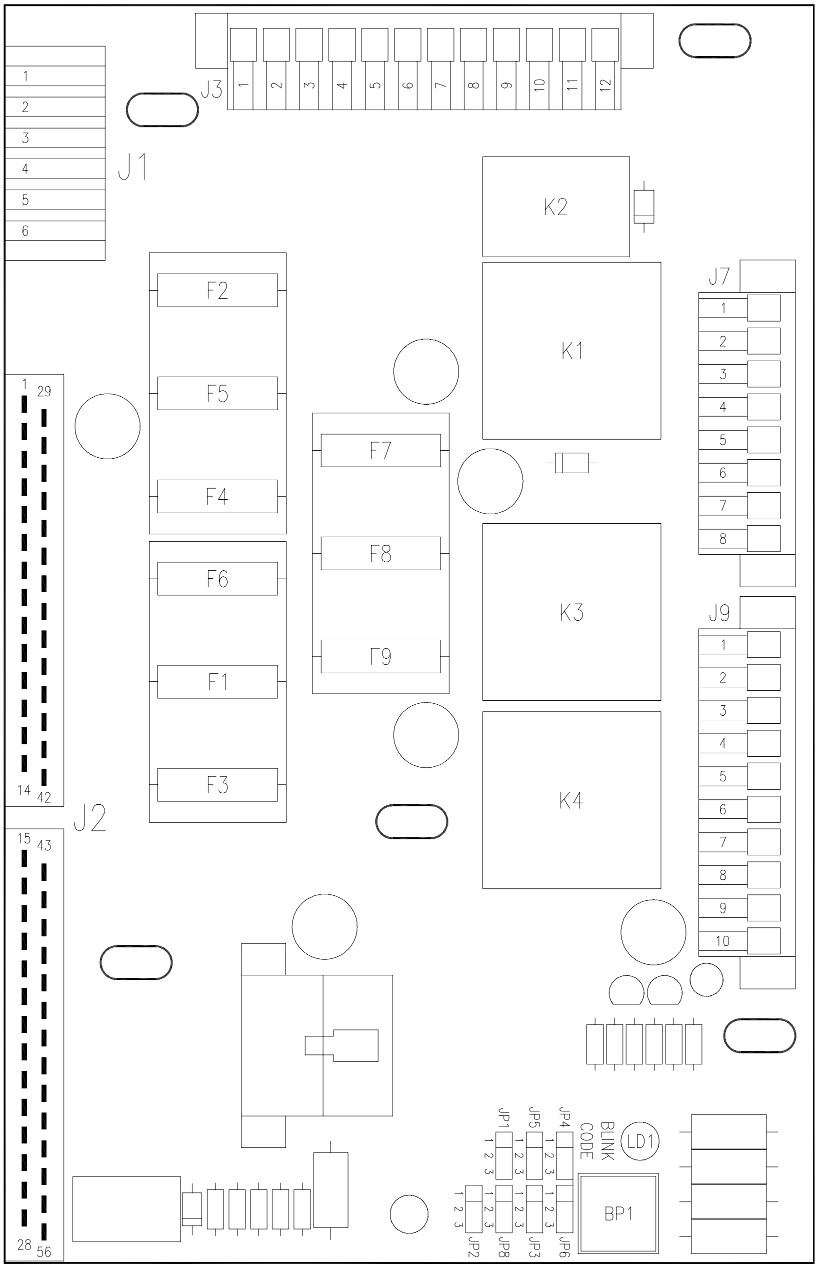

FUEL LEVEL VISUAL WARNING


NO FUEL VISUAL WARNING (OPTION)

ENGINE INTERFACE BOX

Description

Figure 37



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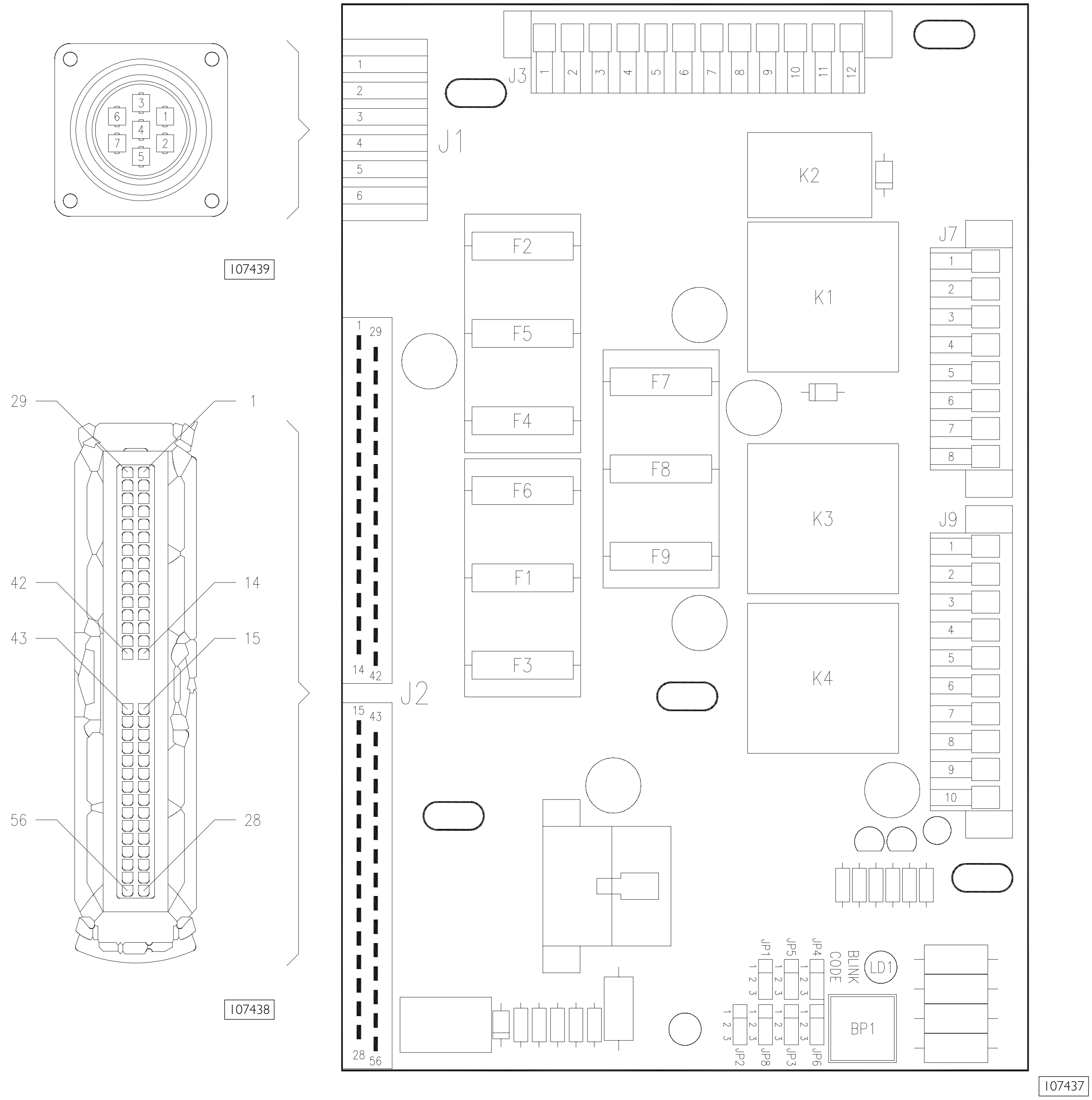
LIST OF COMPONENTS

K1. Power relay with key inserted (+15) - K2. Starting phase signal relay - K3. Starting relay - K4. Relay for pre-heating resistance enabling - JP1. Jumper to select frequency (jumper on 1-2= 60Hz - jumper on 2-3= 50Hz) - JP2. Jumper for operating mode selection (bond on 1-2= diagnosis - bond on 2-3= normal operation) - JP3. Jumper to select cold start signal connection (1-2= connected - 2-3= disconnected) - JP4. Jumper to select heat. function for cold starting (1-2= connected - 2-3= disconnected) - JP5. Jumper for Can Line selection (1-2= Can Line connected - 2-3= Can Line not connected) - JP6. Not used - JP8. Not used - BP1. Switch for blink-code signal request - LD1. LED signalling blink/code - F1. 10A fuse for starting engine - F2. 3A fuse for diagnostics - F3. 20A protection fuse for pre-heating resistance - F4. 30A fuse for electronic control unit - F5. 10A fuse for control panel - F6. 5A fuse for cut-in +15 ON ECU - F7. 20A protection fuse for fuel filter heater - F8. Not used - F9. Not used - J1. Connector for power connections - J2. Connector for interface with engine control unit - J3. Connector for interface with control panel - J7. Connector for interface with control panel - J9. Connector for interface with control panel.

Connectors

Figure 38



CONNECTOR J1 on engine – control panel interface box for power supply (GECURSOR300E/350E/400E)

1	To terminal 50 of starter motor
2	Supply from F3 for fuel filter heating resistance
3	Battery negative
4	Direct positive to battery
5	Spare
6	Spare

CONNECTOR J2 on engine – control panel interface box for EDC ECU connections

1	Key- on positive (+15) for EDC ECU supply
2	Connection with J2 pin 12
3	Signal from engine oil low pressure switch for visual indication on panel (to connector J3 pin 3)
4	Signal from engine water temp. transmitter for thermometer on panel (to connector J3 pin 2)
5	Signal from engine water high temp thermostat for visual indication on panel (al connector J7 pin 1)
6	Signal from out of fuel transmitter (optional) to connector J7 pin 8)
7	Signal from comb. Level floater for visual indication on control panel (to connector J7 pin 7)
8	Positive for water present in fuel filter transmitter
9	Signal from water present in comb. Filter transmitter for visual ind. on panel (to conn. J3 pin 10)
10	Negative for water present in fuel filter transmitter
11	Connection with J2 pin 37
12	Connection with J2 pin 2
13	Battery positive for EDC supply (pin 2)
14	Battery positive for EDC supply (pin 8)
15	Spare
16	Spare
17	Positive for engine water low level transmitter
18	Signal from engine water low level transm. for visual indication on control panel (to connector J3 pin 8)
19	Negative for engine water low level transmitter
20	From alternator D+ for no battery recharge visual indication on control panel (to connector J3 pin 7)
21	Spare
22	Negative from EDC ECU (pin 30) for ”BLINK-CODE”
23	Positive from EDC unit (pin 22) for ”Blink-Code” optic indicator
24	Spare
25	From resistor module to EDC ECU (pin 62)
26	Spare
27	To diagnostics connector (line K) from EDC ECU (pin 89)
28	Spare
29	”Blink-Code” switch signal from EDC (pin 85)
30	Spare
31	Signal from engine oil pressure switch for pressure gage on control panel (to connector J3 pin 4)
32	Signal from engine water heater thermostat (to connector J7pin 6)
33	Negative for finished fuel transmitter (opt), for fuel level float and low engine oil level indication pressure switch and heater
34	Spare
35	Spare - Jumper with pin 6 of connector J9
36	Spare
37	Spare
38	Spare - Jumper with pin 11 of connector J3
39	Spare
40	Positive for diesel fuel heating relay from EDC unit (pin 36)
41	Battery positive for EDC unit (pin 3)
42	JBattery positive for EDC unit (pin 9)
43	Spare
44	Spare
45	Spare - Jumper with pin 5 of connector J9
46	Cold start signal positive from EDC (pin 13) (opt)
47	Connected with EDC (pin 29)
48	Negative for preheating visual indication from EDC ECU (pin 56)
49	Positive for pre-heating enabling relay from EDC (pin 13)
50	Negative for hearing on relay from EDCECU EDC (pin 16)
51	Spare
52	Spare
53	From resistor module to EDC ECU (pin 87)
54	To diagnostics connector (engine rpm signal) from EDC ECU (pin 33)
55	To diagnostics connector (line CAN L) from EDC ECU (pin 34)
56	To diagnostics connector (line CAN H) from EDC ECU (pin 35)

NOTA **Pins 1 and 2 of EDC ECU are connected to battery negative**

CONNECTOR J3 inside the engine interface box for signals to control panel

1 Free
2 From the engine water temperature transmitter for signal to thermometer on control panel
3 From the low engine oil pressure switch for visual warning on control panel
4 From engine oil pressure switch for signal to pressure gauge on control panel
5 Free
6 To the key switch (+50) on control panel
7 From the alternator for battery charging visual indicator on control panel
8 From the low engine water level transmitter for visual warning on control panel
9 +15
10 From the water in fuel filter transmitter for visual warning on control panel
11 Free
12 Free

CONNECTOR J7 inside the engine interface box for signals to control panel

1 From the engine coolant high temp. thermostat (connector J2 - pin5) for visual signal on control panel
2 CAN line L to the control panel
3 Positive to power control panel
4 Negative to power control panel
5 CAN line H to the control panel
6 From the engine water heater thermostat (connector J2 - pin32) to the control panel
7 From the fuel level transmitter (connector J2 - pin7) for visual warning on control panel
8 From the no fuel transmitter (opt) (connector J2 - pin6)

CONNECTOR J9 inside the engine interface box

1 Cold start signal (option) if jumper JP3 set on 1-2
2 Cold start signal (option) if jumper JP3 set on 1-2
3 Cold start heater relay (option) if jumper JP4 set on 1-2
4 Cold start heater relay (option) if jumper JP4 set on 1-2
5 Free
6 Free
7 Free
8 Free
9 Free
10 Free