

Tigercat[®]

Tigercat FPT N67 Stage V ENGINE

SERVICE AND REPAIR MANUAL



ISSUE 1.0, MAY 2020

Tigercat Industries Inc.

P.O. Box 637
Brantford, Ontario
Canada N3T 5P9
Tel: (519) 753-2000
Fax: (519) 753-8272

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- The cables must be routed in such a way as to be parallel to the reference plane, as close as possible to the chassis/body.

Product identification - Commercial coding

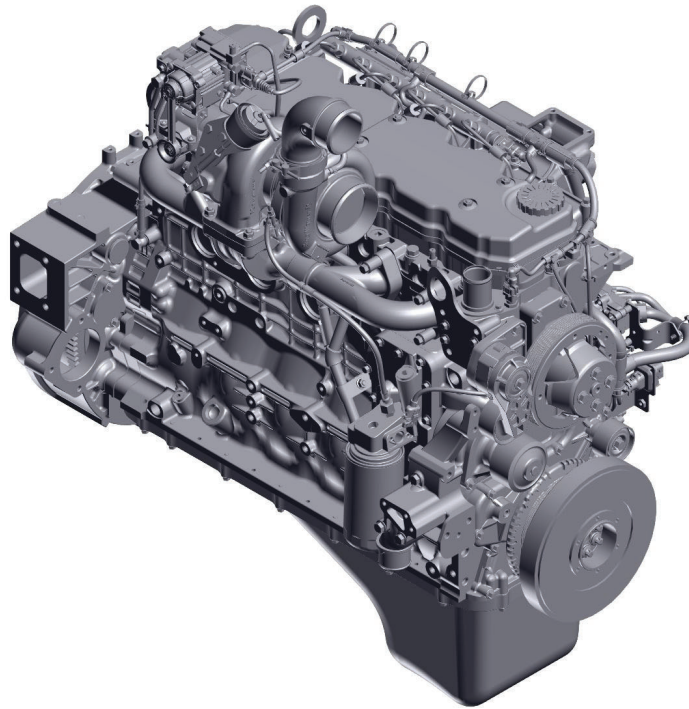
The purpose of the commercial name is to make the information regarding engine characteristics easy to understand, by joining engines from different families, origins and applications for which they are intended. The commercial code cannot be used for technical purposes in order to completely identify the parts that make up the engine, referring to the "serial number" otherwise indicated as "ENGINE S/N", as the identification.

N67ENTVP

- **(N)** 67ENTVP - ENGINE FAMILY IDENTIFICATION: N = NEF
- N **(67)** ENTVP- DISPLACEMENT: 67 = 6.700 c.c. NOMINAL
- N67 **(E)** NTVP - FUEL SUPPLY: E = ELECTRONICALLY CONTROLLED INJECTION
- N67E **(N)** TVP- ENGINE CRANKCASE: N = NON-STRUCTURAL (NORMAL DISTRIBUTION)
- N67EN **(T)** VP- AIR INTAKE: T = INTERCOOLED SUPERCHARGED
- N67ENT **(V)** P- EMISSION LEVEL: V = TIER 4 FULL / STAGE V
- N67ENTV **(P)** - ENGINE MANAGEMENT CONTROL UNIT: P = MD1CE101

Description	Type	Quantity	Step	Value
			4 studs M10 x 1.5 x 42	25 +/- 5 N·m
Turbocharger air outlet to intercooler		1 screw M6 x 1 x 55		10 +/- 1 N·m
Clamp for throttle valve to turbocharger		1 screw M6 x 1 x 50		6 +/- 1 N·m
Water return pipe from motorised throttle valve			1 fitting for lower section M10 x 1	25 +/- 2,5 N·m
			1 fitting for lower section M12 x 1.5	45 +/- 4,5 N·m
			1 screw for lower section M8x16	23 +/- 2,3 N·m
			2 screws for central section M8 x 20	23 +/- 2,3 N·m
			1 fitting for upper section M12 x 1.5	45 +/- 4,5 N·m
			1 fitting for upper section M10 x 1	25 +/- 2,5 N·m
Water delivery pipe to motorised throttle valve			1 fitting M10 x 1	20 N·m
			1 fitting M12 x 1.5	45 N·m
Bracket fixing motorized throttle valve to exhaust manifold		4 screws M8 x 1.25 x 25		25 N·m
Lubricant delivery pipe to turbocharger			2 fittings 11 / 16 - 16 M16	30 +/- 3 N·m
Lubricant oil outlet pipe from turbocharger			2 screws M8 x 1.25 x 25	24 +/- 4 N·m
			2 screws M8 x 1.25 x 16	24 +/- 4 N·m
Engine coolant inlet			2 screws M10x1.5x130	43 +/- 6 N·m
			1 screw M10 x 1.5 x 70	43 +/- 6 N·m
			2 screws M8 x 1.25 x 50	24 +/- 4 N·m
Engine coolant outlet / thermostat cover		3 screws M6 x 1 x 12		13,5 +/- 1,5 N·m
Water pump		2 screws M8 x 1.25 x 35		24 +/- 4 N·m
Crankshaft pulley with damper pulley		6 screws M12 x 1.25 x 78.5	Phase 1 Tightening	50 +/- 5 N·m
			Phase 2 Angle tightening	90°
Fan pulley mount		4 screws M8 x 1.25 x 45		30 +/- 5 N·m
Fan control pulley		4 screws M10 x 1.25		68 +/- 7 N·m
Automatic belt tensioner support		2 screws M8 x 1.25 x 30		24 +/- 4 N·m
Automatic belt tensioner		1 screw M10 x 1.5 x 80		45 +/- 5 N·m
Fixed belt tensioner		1 screw M10 x 1.5 x 60		45 +/- 5 N·m
Fuel filter bracket		2 screws M12x1.75x30		80 +/- 8 N·m
Fuel filter		1 adapter M20 x 1.5		20 +/- 2 N·m
Engine Control Unit			3 screws M8 x 1.25 x 45	14 +/- 1,4 N·m
Camshaft timing sensor		1 nut with stud M6 x 1		10 +/- 2 N·m
Engine crankshaft rpm sensor		1 screw M6 x 1 x 20		10 +/- 2 N·m
Coolant temperature sensor		M14 x 1.5		10 +/- 2 N·m
Oil temperature and pressure sensor		2 screws M6 x 1 x 20		10 +/- 2 N·m
Rail pressure sensor		M18 x 1.5		70 +/- 5 N·m
Fuel temperature sensor		M14 x 1.5		24 +/- 4 N·m
Boost pressure and air temperature sensor		1 screw M6 x 1 x 20		10 +/- 2 N·m
Oil level sensor	M12 x 1.5			10 +/- 2 N·m
Oil level dipstick retainer	M8 x 1.25			24 +/- 4 N·m
Alternator			1 screw M10 x 1.5 x 110	43 +/- 6 N·m

540110 ENGINE - Overview



279017 1

F4HGE613 engine

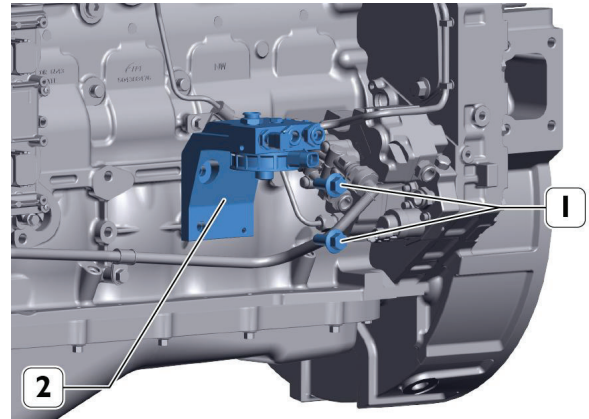
The F4HFE613 is an in-line 6-cylinder turbo engine with intercooler and 4 valves per cylinder; it belongs to the NEF series and operates according to a 4-stroke diesel cycle.

The engine supply system is electronically-controlled and it's based on the direct injection of the fuel in the combustion chamber by means of high-pressure pump and common rail.

The intake and exhaust valves are timed with the camshaft tappets, the push rods and the rocker arm assembly.

9. Undo the screws (1) and remove the fuel filter support (2).

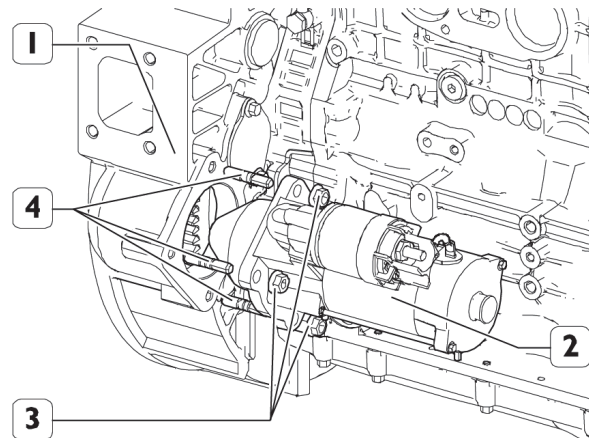
Description	Quantity	Value
Fuel filter bracket	2 screws M12x1.7 5x30	80 +/- 8 N·m



279031 4

10. Ensure that the electric starter motor (2) is suitably supported.
11. Unscrew the fastening nuts (3) and remove the electric starter motor (2).
12. Unscrew the studs (4) from the flywheel housing (1).

Description	Step	Value
Electric starter motor	3 screws M10 x 1.5 x 50	43 +/- 6 N·m
	3 nuts M10 x 1.5	43 +/- 6 N·m



215015 5

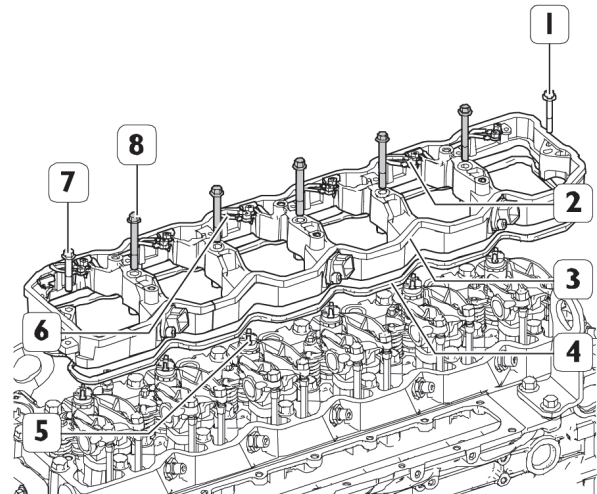
13. Fit the brackets to the crankcase and use these to secure the engine to the rotating stand. Drain the engine oil by removing the plug from the sump.

NOTICE: Collect and dispose of the engine oil according to applicable laws.

Tool / Material	
Brackets fixing engine to revolving stand 99322205	99361037
Assemblies overhaul revolving stand (bearing capacity 1000 daN, torque 120 daNm)	99322205

61. Remove the nuts (2) and disconnect the electrical cables (6) from the electro-injectors (5).
62. Unscrew the screws (1), (7) and (8) and remove the electro-injector wiring support (3) complete with gasket (4).

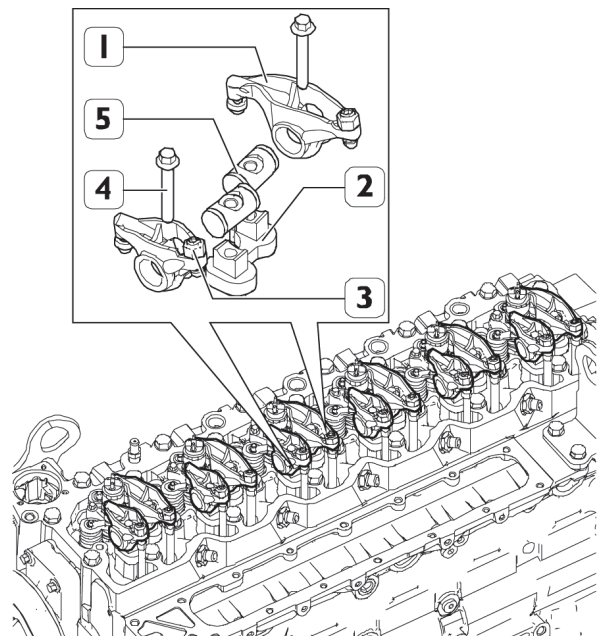
Description	Quantity	Value
Injector wiring mount	7 screws M8 x 1.25	24 +/- 4 N·m
Wiring on each electro-injector	12 nuts M4	1,5 +/- 0,25 N·m



212833 26

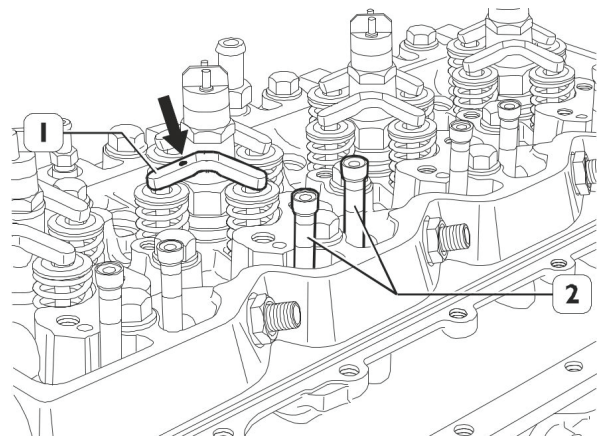
63. Loosen the tappet adjuster retaining nuts (3) and unscrew the tappet adjuster screws.
64. Unscrew the fastening screws (4) and remove the rocker unit from the cylinder head, including support (2), rockers (1) and shafts (5).

Description	Step	Value
Rocker assembly bracket	5 screws M8 x 1.25 x 70	24 +/- 4 N·m
	2 screws M8 x 1.25 x 50	24 +/- 4 N·m



212834 27

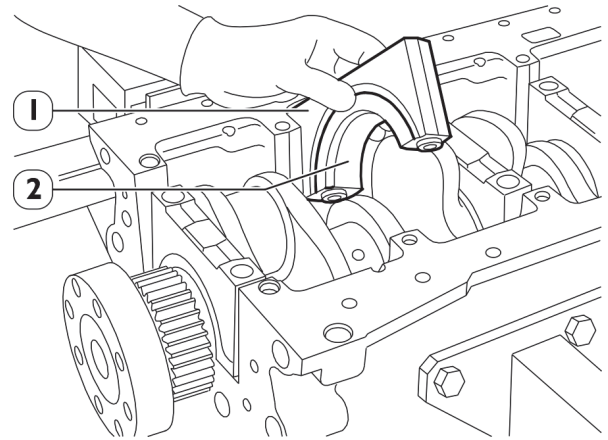
65. Remove the bridges (1) from the valves and the push rods (2) from the cylinder head and crankcase.



70345 28

108. The second last main bearing cap (1) and the relevant support are fitted with shoulder half-bearing (2).

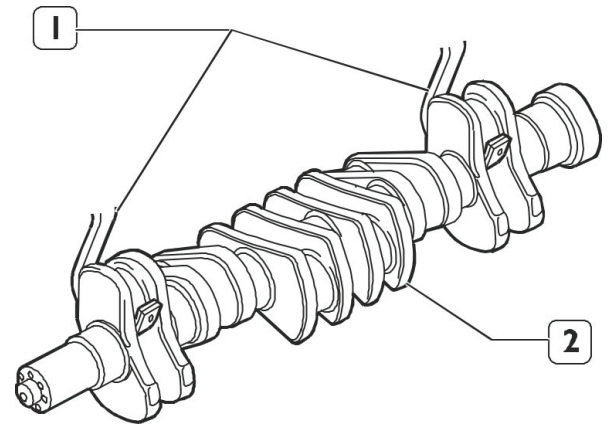
NOTE: Take note of lower and upper half bearing assembling positions since in case of reuse they shall be fitted in the same position found at removal.



70160 50

109. Remove the crankshaft (2) from the block by means of the tool (1).

Tool / Material	
Crankshaft lifting tackle	99360500

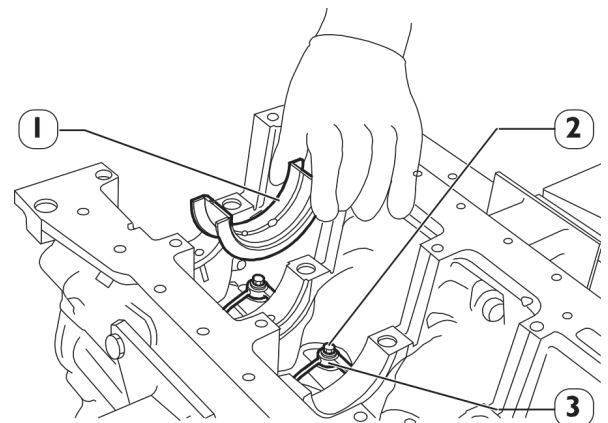


74774 51

110. Remove the main half-bearings (1).

111. Remove the screws (2) and disassemble the oil injectors (3).

Description	Quantity	Value
Cylinder liner lubrication nozzles	6 screws M8 x 1.25 x 20	15 +/- 3 N·m



70162 52

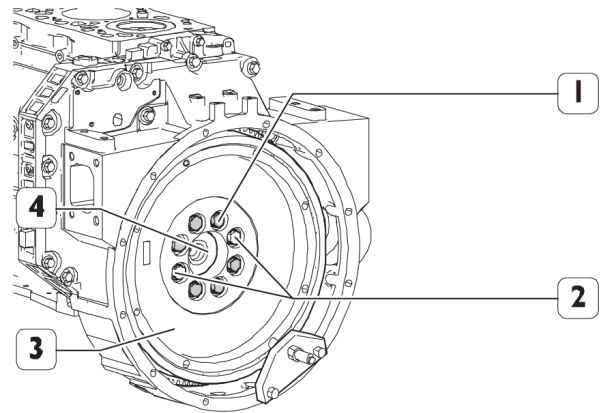
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33. Apply the tool on the flywheel housing in block the engine flywheel (3) rotation.

Tool / Material	
Flywheel restrainer	99360351

34. Remove the two withdrawal pins in the ports (see the previous picture).
35. Tighten the screws (1) and (2) securing the flywheel (3) to the crankshaft (4) in two steps.

NOTE: Use a suitable torque wrench for angle tightening. Before assembly, check that the thread on the holes and the screws shows no sign of wear or dirt.

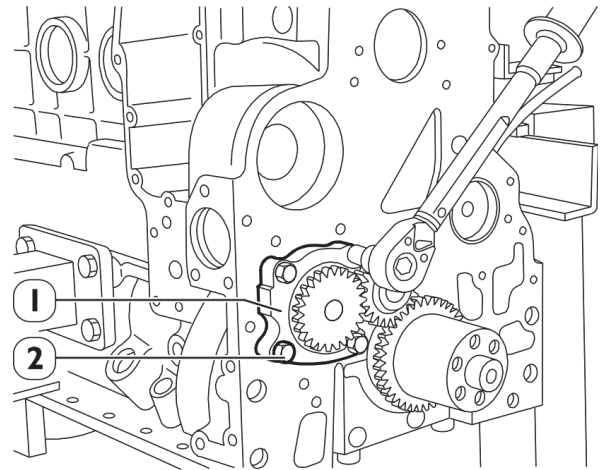


212844 12

Description	Quantity	Step	Value
Engine flywheel	8 screws M12 x 1.25	Phase 1 Tightening	30 +/- 4 N·m
		Phase 2 Angle tightening	60°

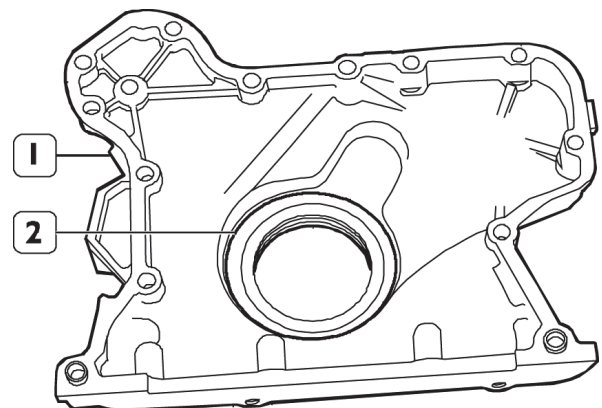
36. Fit the oil pump (1).
37. Insert fastening screws (2) and tighten them to the specified torque.

Description	Step	Value
Oil pump	4 screws M8 x 1.25 x 30	24 +/- 4 N·m



70220 13

38. Remove the sealing ring (2) from the front cover (1), carefully clean the coupling surfaces and smear them with **LOCTITE® 5205 (E IVECO STD. 18-1730)**.



106549 14

79. Rotate the crankshaft, balance the valves of cylinder no. 1 and adjust the valves marked with an asterisk as shown in the tables below:

cylinder No.	1	2	3	4	5	6
intake	—	—	*	—	*	*
exhaust	—	*	—	*	—	*

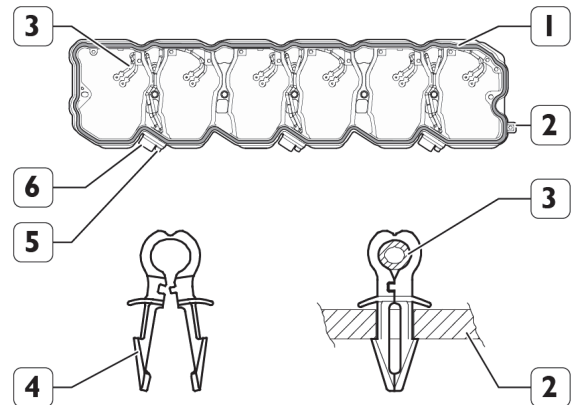
80. Rotate the crankshaft, balance the valves of cylinder no. 6 and adjust the valves marked with an asterisk as shown in the tables below:

cylinder No.	1	2	3	4	5	6
intake	*	*	—	*	—	—
exhaust	*	—	*	—	*	—

81. Check the condition of the wiring (3), if damaged, replace it by cutting the collars (4) and removing the screws (5) securing the support to the connectors (6).
82. Open a new collar (4), insert the new cable (3), close the collar and fit it into its seat on the support (2).
83. Tighten the screws (5) to the specified torque.

Description	Quantity	Value
Engine cable connector on injector wiring mount	3 screws M6 x 1 x 16	5 +/- 1 N·m

84. Fit a new gasket (1) on the support (2).

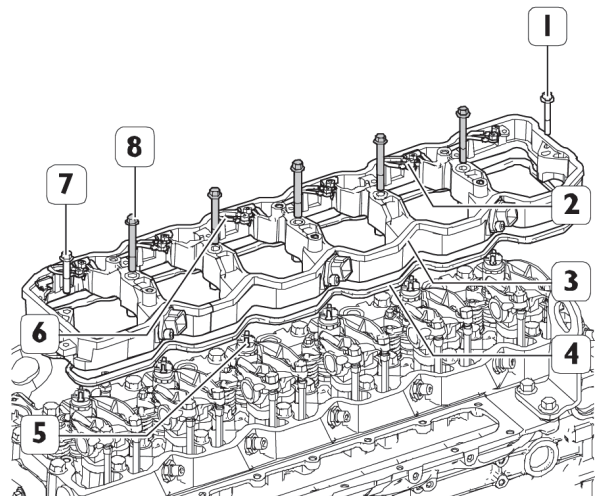


267944 37

85. Fit the injector wiring mount (3) complete with a new gasket (4) and tighten the screws (1), (7) and (8) to the specified torque.
86. Connect the electrical wiring (6) to the electro-injectors (5) and using a torque wrench tighten the securing nuts (2) to the specified torque.

NOTE: Before assembly, check that the thread on the holes and the screws shows no sign of wear or dirt.

Description	Quantity	Value
Injector wiring mount	7 screws M8 x 1.25	24 +/- 4 N·m
Wiring on each electro-injector	12 nuts M4	1,5 +/- 0,25 N·m



212833 38

141. Use a hoist with the tool to support the engine and loosen the screws securing the brackets to the rotating stand.

Tool / Material	
Rocking sling for removing/installing engine	99360595
Brackets fixing engine to revolving stand 99322205	99361037
Assemblies overhaul revolving stand (bearing capacity 1000 daN, torque 120 daNm)	99322205

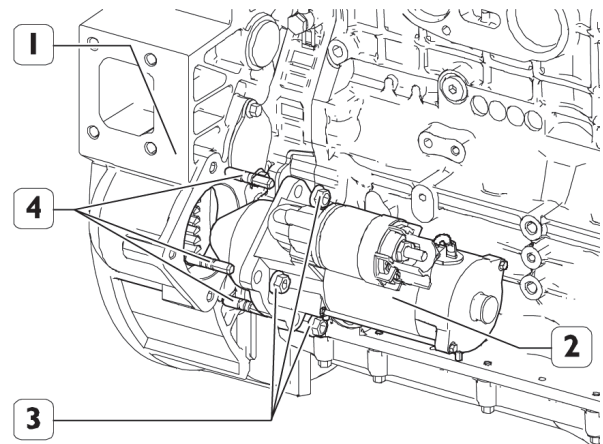
142. Disassemble the brackets from the engine after having placed it correctly on a suitable support.

Tool / Material	
Brackets fixing engine to revolving stand 99322205	99361037

COMPLETING ENGINE ASSEMBLY

143. Screw in the studs (4) and fit the electric starter motor (2) into the flywheel housing (1). Tighten the fastening nuts (3) to the specified torque.

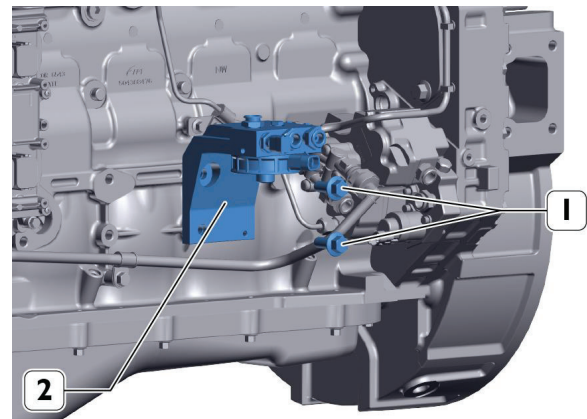
Description	Step	Value
Electric starter motor	3 screws M10 x 1.5 x 50	43 +/- 6 N·m
	3 nuts M10 x 1.5	43 +/- 6 N·m



215015 61

144. Fit the fuel filter bracket (2) and tighten the screws (1) to the specified torque.

Description	Quantity	Value
Fuel filter bracket	2 screws M12x1.7 5x30	80 +/- 8 N·m



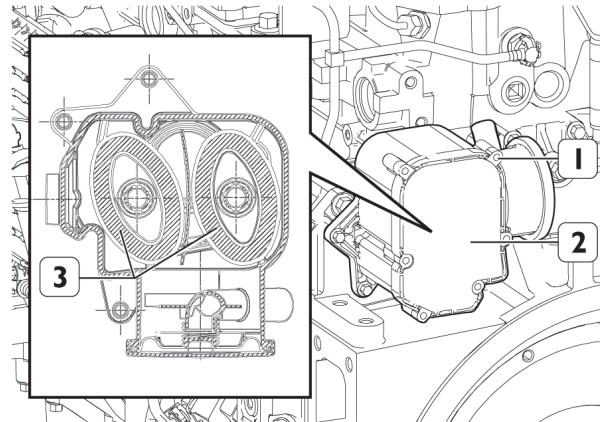
279031 62

145. Correctly position the engine cable and close the clips retaining the engine cable to the crankcase. Connect the engine cable to the control unit (8), to the motorised throttle valve actuator connector (2) and to all the sensors and senders indicated in the electrical equipment section.

540480 ENGINE BREATHER - Replace**Crankcase ventilation filter replacement**

1. The crankcase ventilation filter was devised and designed for collect- ing, filtering and condensing lubricant oil vapours.
2. Only proceed with the engine stopped and at low temperature, in order to avoid the risk of burning.
3. Unscrew the fastening screws **(1)** and remove the crankcase ventilation filter cover **(2)**.
4. Replace and install the two cartridge filters **(3)** included in the filtering unit **(2)**.
5. Fit the crankcase ventilation filter cover **(2)** and tighten the fastening screws **(1)** to the specified torque.

NOTE: The crankcase ventilation filter was designed to collect, filter and condensate the lubricant vapours. Carry out the procedure only while the engine is OFF and at a low temperature to prevent the risk of burns.



209217 1

Description	Quantity	Value
Crankcase ventilation filter	3 screws M6 x 1	10 +/- 2 N·m

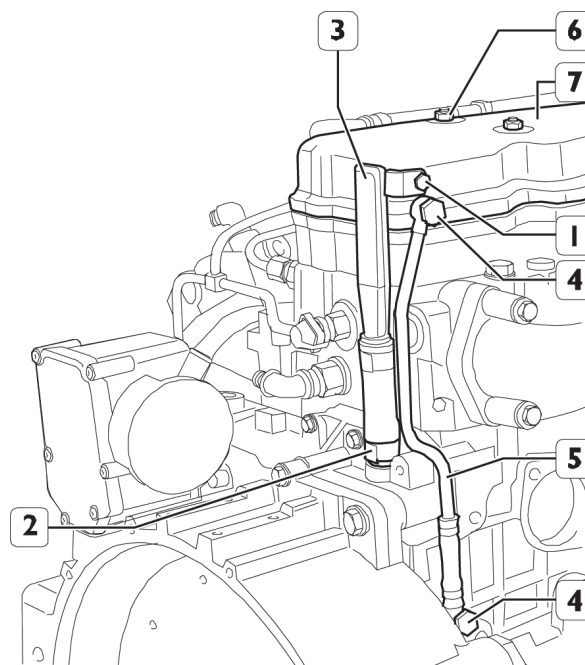
540630 ROCKER COVER - Remove

1. Unscrew the screw (1). Loosen the flexible clip (2) and remove the oil vapour recirculation pipe (3).

Description	Quantity	Value
Crankcase ventilation breather pipe bracket	1 screw M6 x 1	10 +/- 2 N·m

2. Unscrew the fittings (4) and remove the pipe (5).

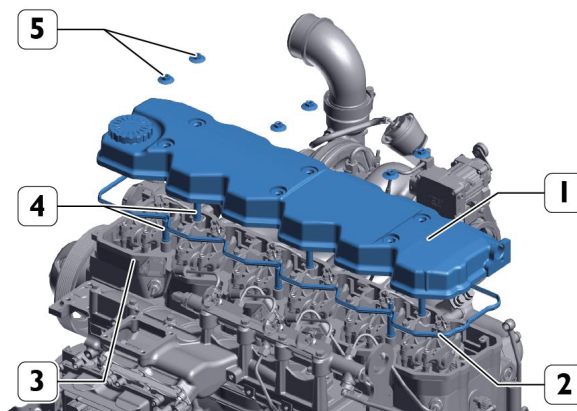
Description	Quantity	Value
Oil vapour recovery pipe	2 fittings M12 x 1.5	20 +/- 4 N·m



166630 1

3. Unscrew the fastening nuts (5) and remove the tappet cover (1) from the wiring support (3), retrieving the relative gasket (2).
4. Unscrew the threaded double-shank screws (4) from the wiring support (3).

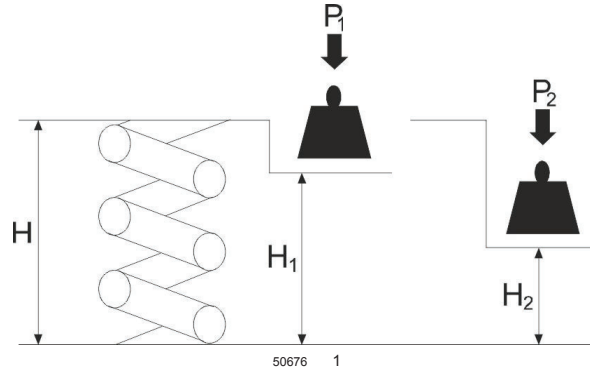
Description	Step	Value
Tappet cover	6 nuts M8 x 1.25	20 +/- 2 N·m
	6 double stem screws M8 x 1.25 x 20	11 +/- 3 N·m



279034 2

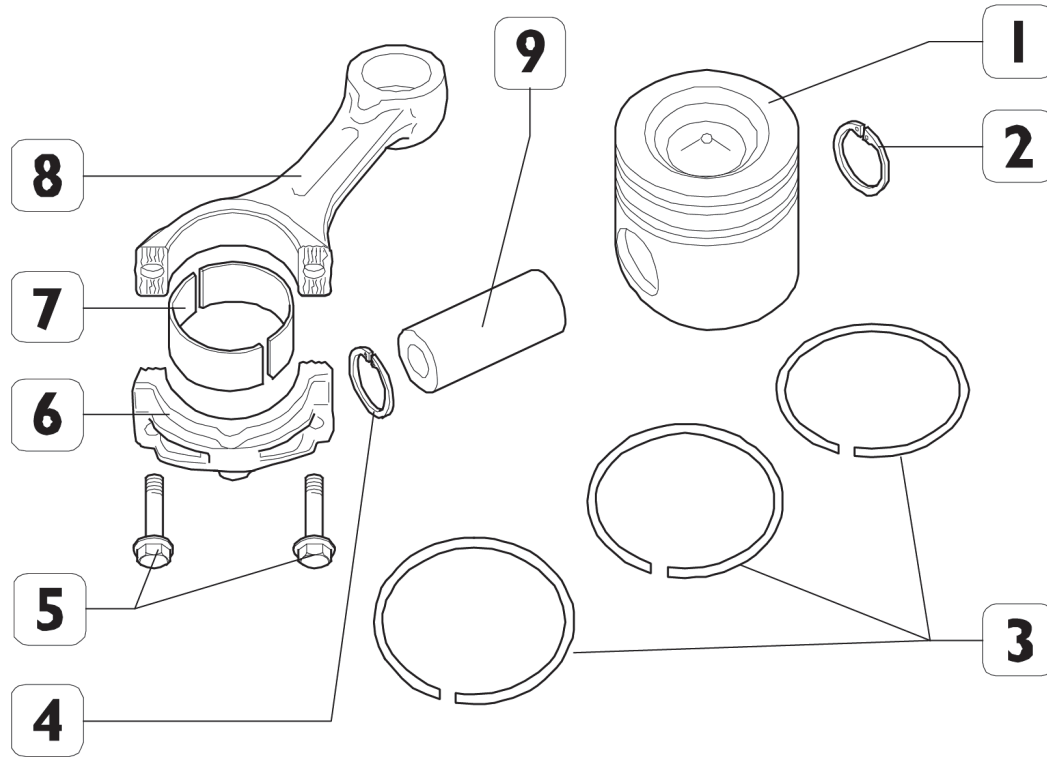
540665 VALVE SPRING - Check

Prior operation:
VALVES - Disassemble (54.06)

Valve spring check**KEY DATA FOR CHECKING INTAKE AND EXHAUST VALVE SPRINGS**

1. Before refitting use tool to check spring flexibility. Compare load and elastic deformation data with those of the new springs shown in the following table.

Height		Under a load of:	
H	47,75 mm	Spare	
H1	35,33 mm	P1	339,8 +/- 19 mm
H2	25,2 mm	P2	741 +/- 39 mm

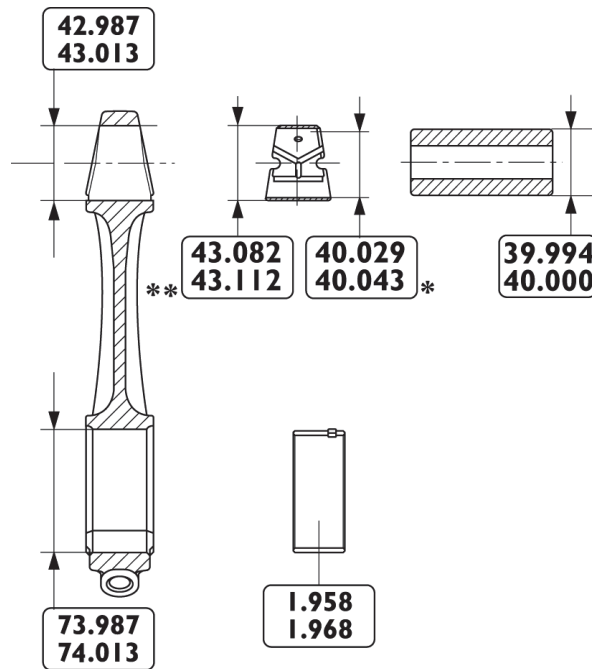
5408 ENGINE COMPONENTS - Overhaul**OVERHAULING THE CONNECTING ROD-PISTON ASSEMBLY**

214627 1

1. Piston
2. Retaining ring
3. Piston rings
4. Retaining ring
5. Connecting rod cap fastening screws
6. Connecting rod cap
7. Half bearings
8. Rod
9. Pin

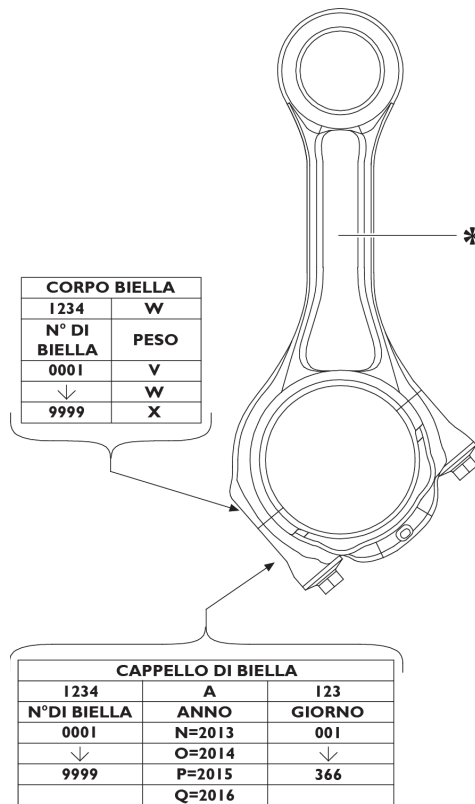
540830 CONNECTING ROD - Check

Connecting rods



MAIN DATA FOR CONNECTING ROD, BUSH, PISTON PIN AND HALF-BEARINGS (*)Value for inside diameter to be obtained after driving in connecting rod small end and grinding.

NOTE: To obtain best coupling the connecting rod cap coupling surfaces are knurled. It is therefore recommended to not remove the knurling.



279983 2

540840 PISTON - Check

Tool / Material	
Base,dial gauge,countershaft bearing adjustment(use with 99395604)	99370415
Dial gauge(0-5mm)	99395603

Prior operation:

PISTON - Assemble (54.08)

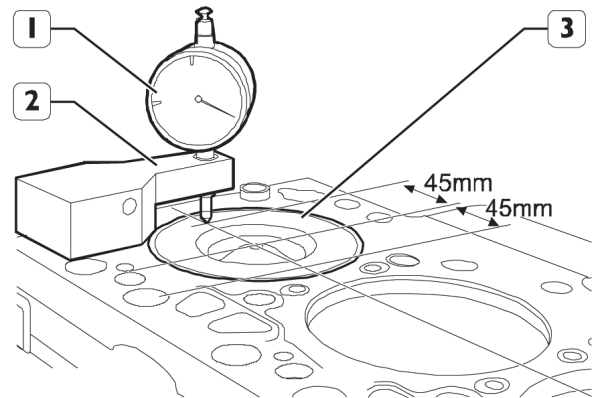
Piston protrusion check

- Once refitting of the connecting rod-piston assemblies is complete, use a dial gauge (1) together with a base (2) to check the protrusion of the pistons (3) at T.D.C. in relation to the top of the engine block, carrying out the following operations:

Tool / Material	
Dial gauge(0-5mm)	99395603
Base,dial gauge,countershaft bearing adjustment(use with 99395604)	99370415

- On piston 1, as indicated in the Figure and measuring at a distance of **45 mm** from the centre, measure protrusions S1 and S2 of the piston in relation to the top surface of the crankcase and then calculate the average: $Scyl1 = (S1 + S2) / 2$.

- repeat the operation to calculate the average protrusion of pistons 2, 3, 4, 5 and 6 and calculate the average: $S = (Scyl1 + Scyl2 + Scyl3 + Scyl4 + Scyl5 + Scyl6) / 6$.



166655 1

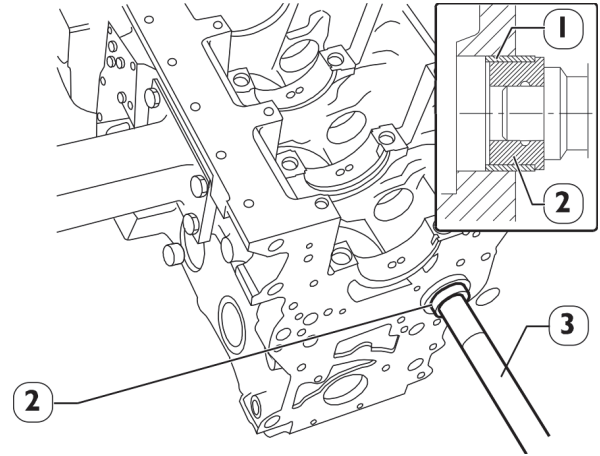
541213 BUSHES - Replace

Tool / Material	
Camshaft bush assembly and disassembly punch (use with 99370006)	99360362
Handle, interchangeable driver	99370006

Camshaft bushes replacement

- To replace the rear bushing (1) use the same drift (2) and grip (3) as for the disassembly and assembly.

Tool / Material	
Camshaft bush assembly and disassembly punch (use with 99370006)	99360362
Handle, interchangeable driver	99370006



70174 1

NOTE: Bushing (1) for assembly must be oriented so that the lubrication holes match with those on the seat of the crankcase.

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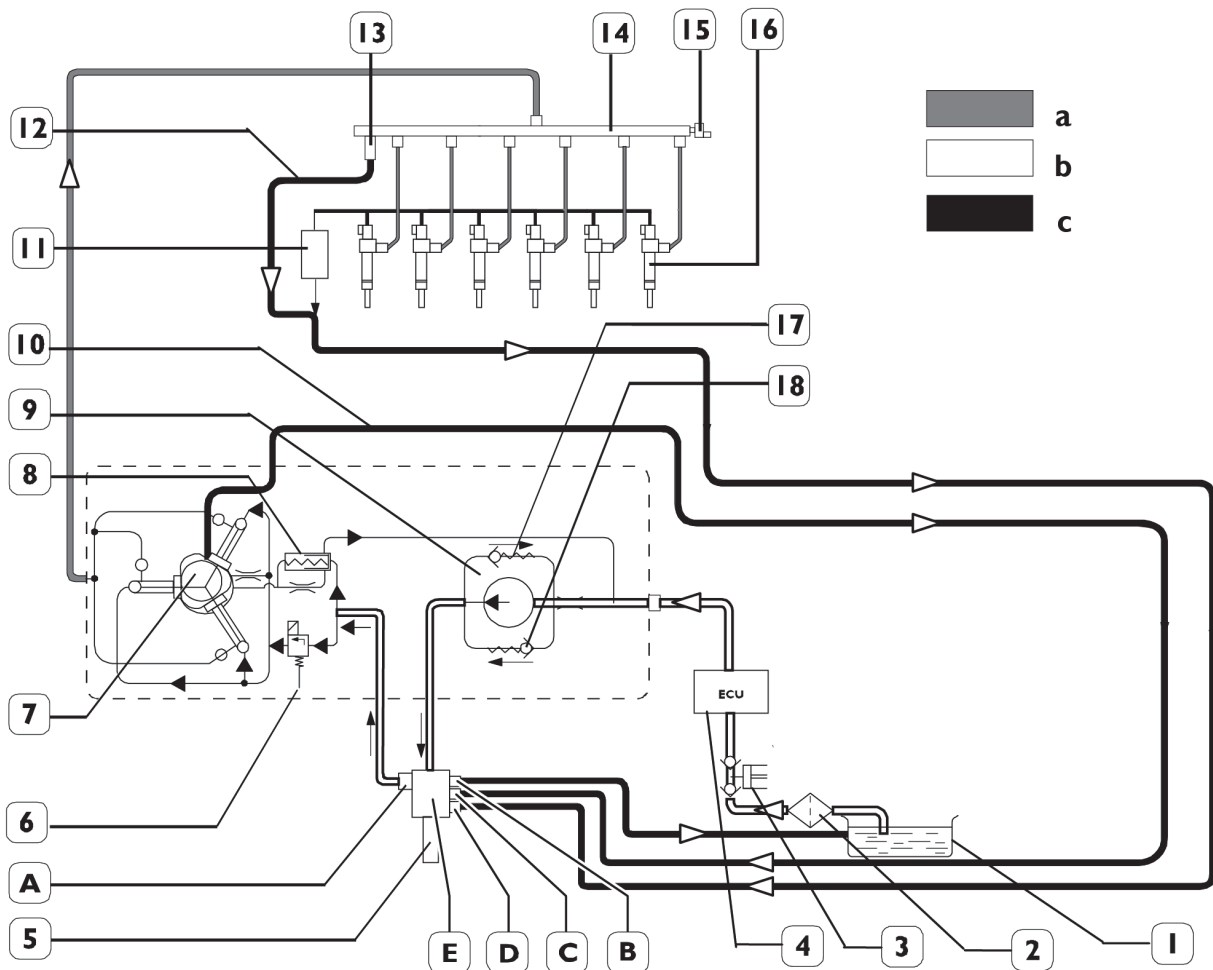
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Fuel system diagram



(1) Fuel tank – (2) Pre-filter – (3) Manual pump – (4) Control unit – (5) Fuel filter – (6) Flow rate modulator – (7) High-pressure pump – (8) Limiting valve on high-pressure pump 5 bar – (9) Mechanical supply pump – (10) High-pressure pump reflux pipe – (11) Quick coupler for fuel return from the injectors – (12) Return pipe – (13) Common rail excess pressure valve – (14) Common rail – (15) Pressure sensor – (16) Injector – (17) By-pass valve – (18) By-pass valve (a) High pressure – (b) Low pressure – (c) Fuel outlet

Fuel filter connections:

- A. Outlet connection to the high-pressure pump
- B. Outlet connection for the fuel drain in the tank
- C. Inlet connection for the fuel drain from the high-pressure pump
- D. Inlet connection for the fuel drain from the common rail and injectors
- E. Inlet connection from the mechanical fuel pump

The flow regulator (6), located upstream of the high-pressure pump, regulates the flow of fuel needed in the low-pressure system. The high-pressure pump then ensures that fuel reaches the rail correctly.

This solution, by only pressurizing the necessary fuel, improves the energy efficiency and restricts system fuel heating.

The function of the relief valve (8), mounted on the high-pressure pump, is to maintain the flow rate, at the flow regulator inlet, constant at **5 bar**, regardless of the efficiency of the fuel filter and of the system situated upstream.

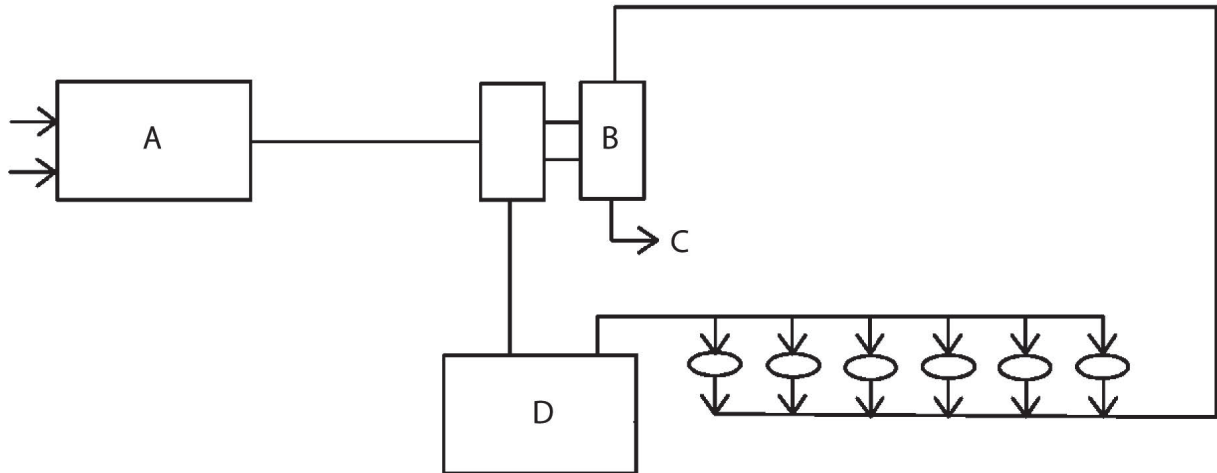
The quick coupling for the fuel return pipe (11) housed on the cylinder head, fit on the injector return, limits the return flow from the injectors.

542010 FILTER ASSEMBLY - Check

Checking for water in fuel filter or pre-filter

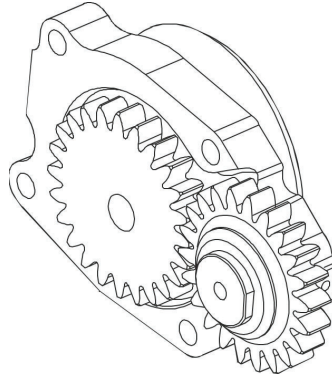
NOTE: The components of the common rail system can be quickly damaged if the fuel contains water or other impurities.

Act quickly on the pre-filter (not available on the engine block) to drain any water from inside the fuel circuit.



74195 2
(A) Air filter — (B) Turbocharger — (C) Exhaust — (D) Intercooler

543010 OIL PUMP - Overview



70576 1

Housed in the front of the crankcase, the oil pump is a rotary pump commanded by a spur gear fitted to the stub of the crankshaft.

NOTE: *The oil pump shall not be overhauled. If faults are found, replace it.*

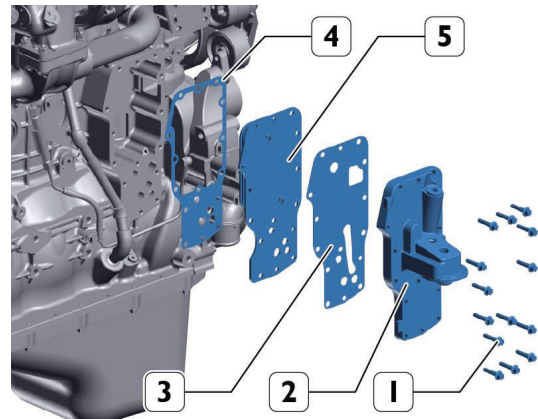
543110 HEAT EXCHANGER - Install

Description	Quantity	Step	Value
Lubricant delivery pipe to turbocharger		2 fittings 11 / 16 - 16 M16	30 +/- 3 N·m
Oil filter bracket and heat exchanger	15 screws M8 x 1.25 x 35		26 +/- 4 N·m
Oil temperature and pressure sensor	2 screws M6 x 1 x 20		10 +/- 2 N·m

- Fit the following to the crankcase: a new gasket (4), the heat exchanger (5) a new gasket (3) and the oil filter bracket (2).
- Fasten the screws (1) and tighten them to the specified torque.

NOTE: Before assembly, check that the thread on the holes and the screws shows no sign of wear or dirt.

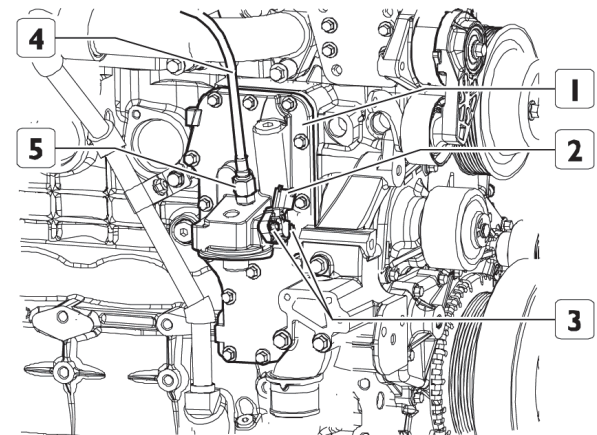
Description	Quantity	Value
Oil filter bracket and heat exchanger	15 screws M8 x 1.25 x 35	26 +/- 4 N·m



279970 1

- Place the oil temperature/pressure sensor (2) in position (1) with a new seal ring, then screw in the retaining screws (3) and tighten them to the specified torque.

Description	Quantity	Value
Oil temperature and pressure sensor	2 screws M6 x 1 x 20	10 +/- 2 N·m



166652 2

- Fit the oil delivery pipe to the turbocharger (1) and tighten the fitting (2) to the specified torque.

Description	Step	Value
Lubricant delivery pipe to turbocharger	2 fittings 11 / 16 - 16 M16	30 +/- 3 N·m

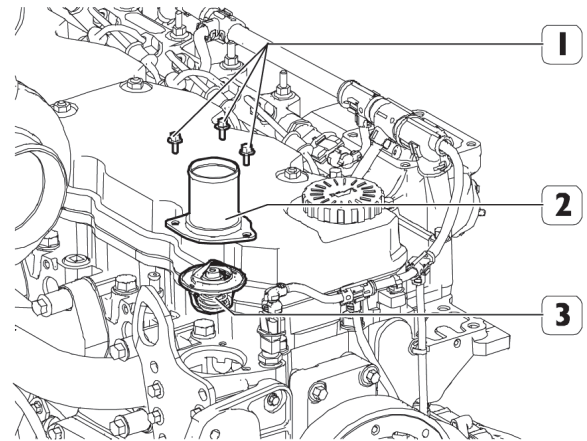
- Fit the engine oil filter as described in the procedure **ENGINE OIL FILTER CARTRIDGE - Replace (54.30)**.
- Fit the alternator as described in the procedure **ALTERNATOR ASSEMBLY - Install (76.03)**.
- Fit the auxiliary unit drive belt as described in the procedure **WATER PUMP DRIVE BELT - Replace (54.34)**.
- Check the oil level using the dipstick: the level must come close to the MAX notch which can be seen on the dipstick.
- If this is not the case, top-up as necessary.

543250 THERMOSTAT - Install

Description	Quantity	Value
Thermostat	3 screws M6 x 1 x 12	13,5 +/- 1,5 N·m

1. Fit the thermostat (3) complete with the gasket and the engine coolant delivery pipe (2). Tighten the fastening screws (1) to the specified torque.

Description	Quantity	Value
Thermostat	3 screws M6 x 1 x 12	13,5 +/- 1,5 N·m

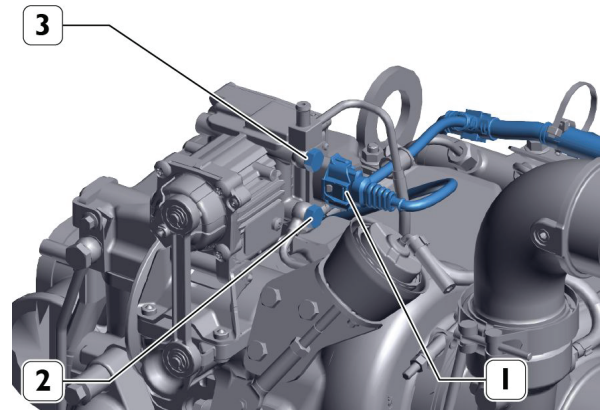


209202 1

543712 BUTTERFLY VALVE - Remove

Description	Quantity	Value
Bracket fixing motorized throttle valve to exhaust manifold	4 screwsM8 x 1.25 x 25	25 N·m

1. Disconnect the electrical connection of the motorised throttle valve (1).
2. Unscrew the fitting (2) and disconnect the water delivery pipe to the motorised throttle valve.
3. Unscrew the fitting (3) and disconnect the water return pipe from the motorised throttle valve.

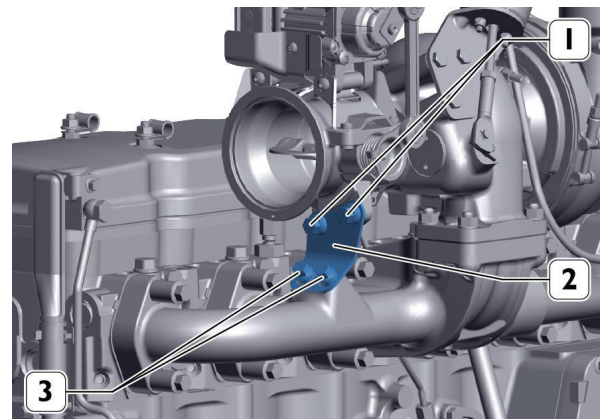


279035 1

Description	Step	Value
Water delivery pipe to motorised throttle valve	1 fitting M10 x 1	20 N·m
	1 fitting M12 x 1.5	45 N·m
Water return pipe from motorised throttle valve	1 fitting for lower section M10 x 1	25 +/- 2,5 N·m
	1 fitting for lower section M12 x 1.5	45 +/- 4,5 N·m
	1 screw for lower section M8x16	23 +/- 2,3 N·m
	2 screws for central section M8 x 20	23 +/- 2,3 N·m
	1 fitting for upper section M12 x 1.5	45 +/- 4,5 N·m
	1 fitting for upper section M10 x 1	25 +/- 2,5 N·m

4. Unscrew the screws (1), (3) and remove the bracket (2).

Description	Quantity	Value
Bracket fixing motorized throttle valve to exhaust manifold	4 screwsM8 x 1.25 x 25	25 N·m

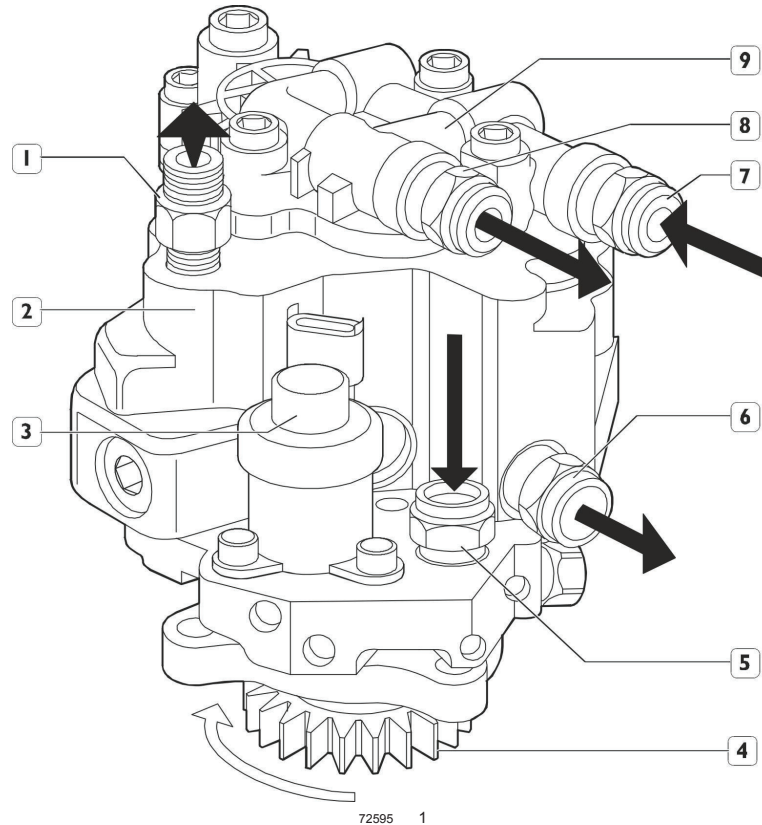


279059 2

771010 INJECTION PUMP ASSY - Overview CP3 HIGH-PRESSURE PUMP

The CP3 high pressure pump with three radial plungers controlled by the timing gears, does not require timing. The mechanical supply pump controlled by the high pressure pump shaft is mounted on the rear side of the high pressure pump.

NOTE: The high pressure pump cannot be overhauled and should not therefore be removed. The fastening screws should not be tampered with. The only possible service operation is the replacement of the drive gear.



72595 1

1. Connection between fuel outlet and rail
2. High-pressure pump
3. Fuel flow regulator
4. Drive gear
5. Fuel inlet fitting from filter
6. Fuel outlet to filter support fitting
7. Fuel inlet from control unit heat exchanger fitting
8. Fuel outlet from mechanical pump to filter fitting
9. Mechanical supply pump

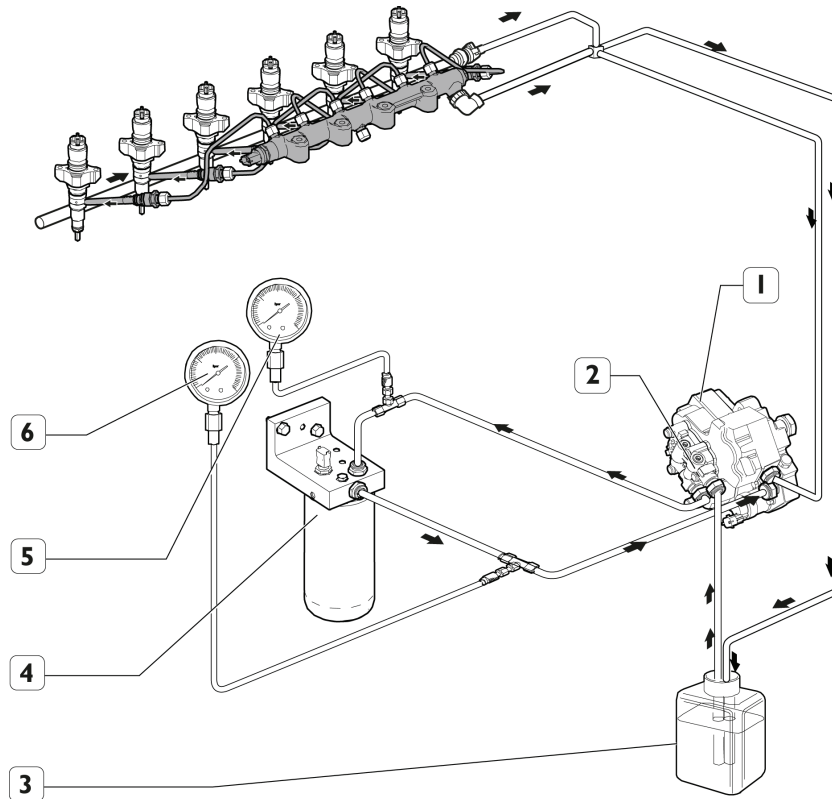
771010 INJECTION PUMP ASSY - Pressure test

Tool / Material

Tool to check the diesel supply circuit and the common-rail injection system

99305453

Mechanical fuel pump check



254331 1

1. The mechanical pump (2) supplies the CP3.3 high pressure pump (1). It is controlled by the high pressure pump shaft and is fitted on the rear of the shaft.
2. Keeping the instruments of the kit inserted as shown in the figure above and with the battery charged at **24,7 V**, the engine must start within **20 s** after activation of the starter motor, extracting diesel from an external container (3) positioned less than **1 m** below the engine.

Tool / Material

Tool to check the diesel supply circuit and the common-rail injection system

99305453

3. If the pump does not suck the diesel fuel within the time specified, therefore the engine does not start, replace pump.

NOTE: If the test was performed with a new mechanical fuel pump from Spare Parts, before doing the test, a first start-up is necessary in order to restore normal operation conditions.

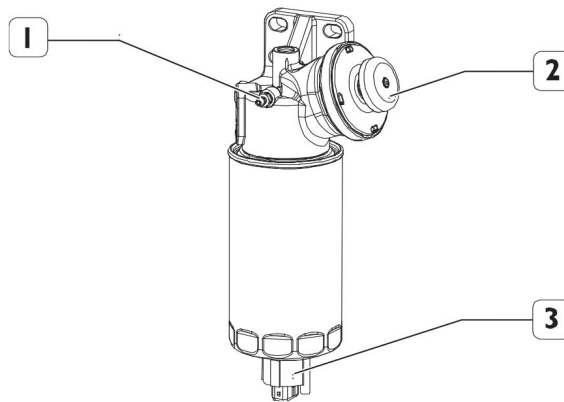
4. After engine start-up, check that at **1500 RPM** the pressure on the pressure gauge (6) is between **6 – 9 bar**.

773110 FUEL PRE-FILTER - Bleed

Water drainage from the fuel pre-filter (if present)

NOTE: This fuel filter/water separator is not used on this machine. Refer to the machine operators and service manuals for the fuel filter/water separator supplied with the machine

1. The high risk of refuelling with fuel polluted with foreign bodies and water requires inspections to be performed even if no alarm is triggered on the control panel.
2. Proceed with the engine off.
3. Place a basin under the pre-filter to collect liquids.
4. Unscrew the cock plug (3) located in the pre-filter lower section; in some versions, the plug includes the water in diesel sensor.
5. Drain the liquid until only "diesel oil" can be seen.
6. Manually close the plug (3) screwing it in fully.
7. Dispose of drained liquids in full compliance with current regulations in force.



215045 1

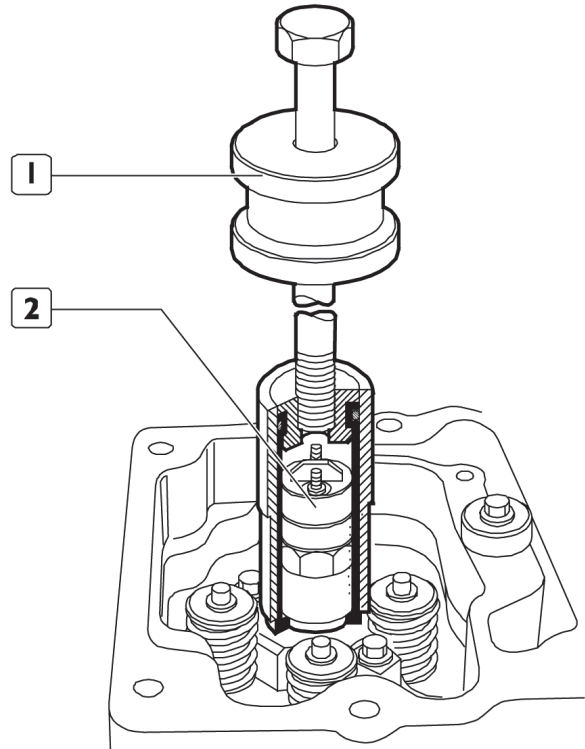


General prescriptions

The components of the common rail system will be quickly damaged if the fuel contains water or other impurities. Immediately carry out the operation on the pre-filter to drain the water in the supply circuit. Failure to comply completely or partially with these requirements may result in the risk of serious damage to the engine and may even, on occasion, invalidate the warranty

5. Remove injector fastening screws and use the tool (1) to remove the injectors (2) from the cylinder head.

Tool / Material	
Tool to remove injectors	99342101



181861 3



Risk of burns

Open the filler cap of the coolant tank only if necessary and only when the engine is cold.

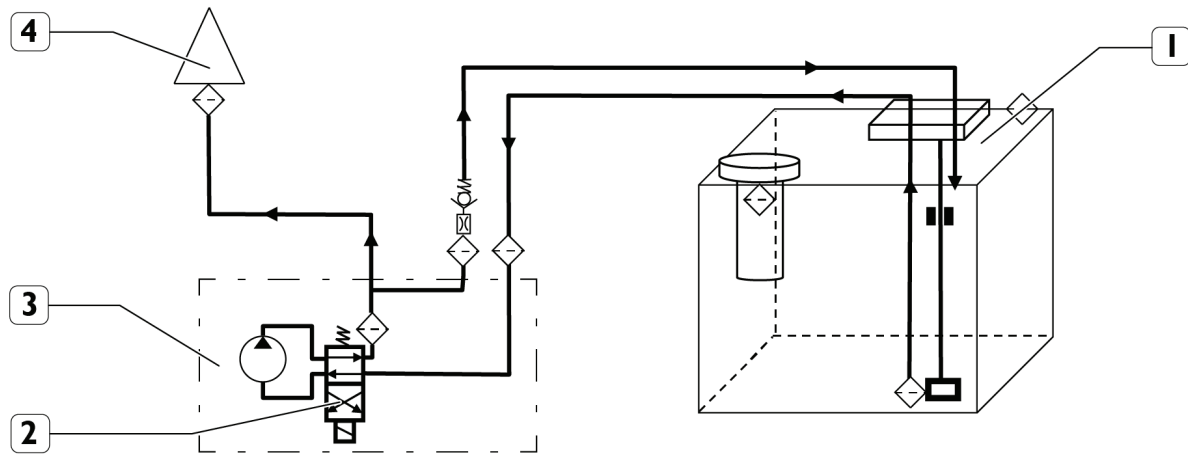
Failure to comply with these prescriptions can result in the risk of serious injury and serious damages to the vehicle

module - (20) Exhaust gas temperature sensor downstream of the DOC - (21) Diesel oxidation catalyst (DOC)
 - (22) Exhaust gas temperature sensor upstream of the DOC - (23) NOx sensor upstream of the ATS - (24)
 Throttle valve - (25) Flap valve position control unit - (26) Engine coolant 3-way valve.

- A. AdBlue
- B. Electrical cable
- C. Engine coolant

The NOx sensors, the urea quality sensor and the throttle valve position sensor (Exhaust flap) communicate with the control unit via the CAN line.

AdBlue system



(1) AdBlue tank - (2) Reverting valve - (3) DNOx 6HD Supply Module - (4) Dosing module

The system is managed by the engine control unit in three steps:

- Filling the system. When the ATS reaches the ideal temperature, the control unit activates the DNOx 6HD Supply Module (3) which takes AdBlue from the (1) tank. The system is filled to **9 bar** (system pressure is detected by the pressure sensor in the Supply Module).
- Operation at full capacity. When the system is pressurised to **9 bar**, the dosing module (4) is able to intermittently introduce nebulised AdBlue into the exhaust gas.
- Emptying the system. When the engine stops, the After-run procedure is launched, namely the (2) reverting valve inside the (3) Supply Module changes position allowing the pump to empty the system. At this point the AdBlue in the system is conveyed into the (1) tank. During this process the (4) dosing module is opened allowing the system to be emptied. When the pressure sensor detects a vacuum, the (4) dosing module closes, the (3) Supply Module switches off and the position of the (2) reverting valve is inverted.

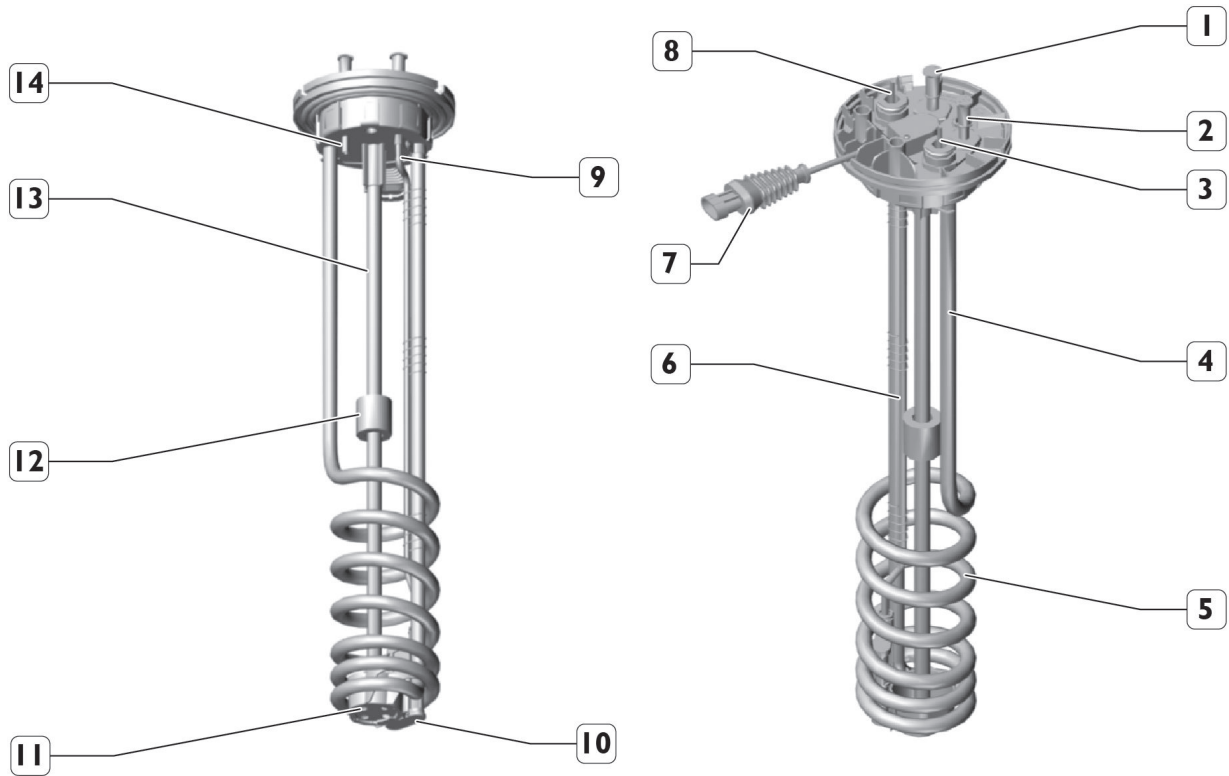


Risk of damage

After switching off the engine using the key switch (Key off), wait for 10 minutes before acting on the electrical system of the engine and/or the power supply batteries. After the "Key off", the power supply must be ensured in order for the AFTER-RUN procedure to be completed. Partial or complete non observance of these prescriptions can lead to serious damages to the vehicle

507424 AD-BLUE INDICATOR - Overview

AdBlue level gauge control



263960 1

(1) AdBlue delivery fitting - (2) AdBlue return fitting - (3) Engine coolant outlet fitting - (4) Hot engine coolant outlet pipe - (5) AdBlue heating coil - (6) Engine coolant inlet pipe - (7) Connector - (8) Engine coolant inlet - (9) AdBlue intake pipe - (10) Filter - (11) Lower plate (AdBlue NTC temperature sensor) - (12) Float (AdBlue level sensor) - (13) Comb pipe - (14) AdBlue return pipe

The indicator control for the AdBlue liquid level is a device consisting of:

- a float (level sensor);
- an NTC temperature sensor;
- a coil for heating the liquid in low temperatures.

It informs the ECU of changes in the current due to the resistance, caused by the position of the float in relation to the level of the AdBlue liquid.

Frozen AdBlue can be melted by means of a coolant heater (5).

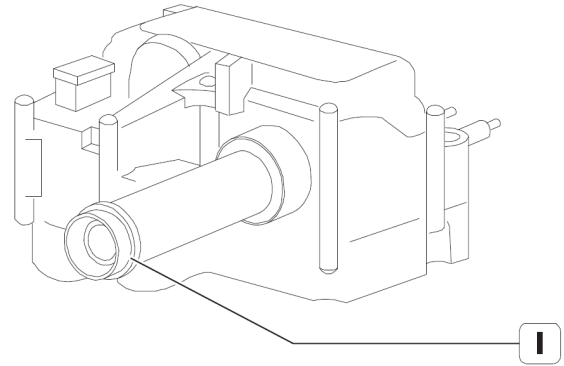
A solenoid operated by the control unit regulates the flow of fuel in the AdBlue tank heater/circuit.

The Urea quality sensor is integrated in the tank to meet the anti-tampering requirements.

NOTE: Seal the connectors with a water tight seal before checking the AdBlue tank for leaks.

Temperature sensor:	NTC type
	1 +/- 5% kΩ at 25 °C
Recommended level sensor specifications:	70 Ω at low level
	20 Ω at high level

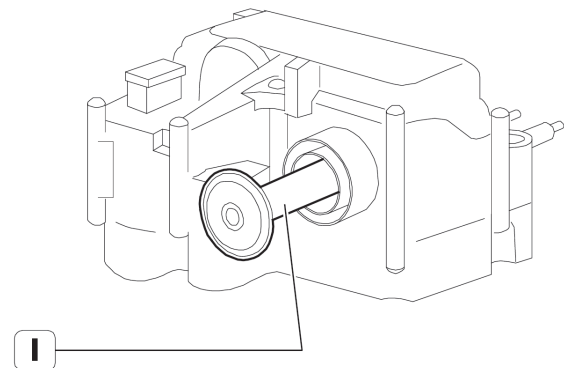
7. Moisten the gaskets and insert the new filter (1).



185434A 8

8. Insert the new equalising element (1).

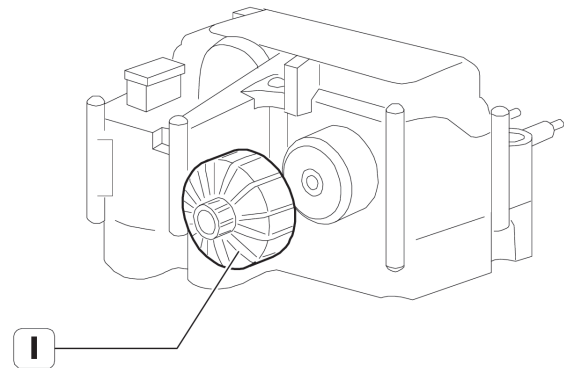
NOTE: Make sure that the filter cover and the contact surface of the supply module show no signs of being cracked or damaged. Replace any damaged elements.



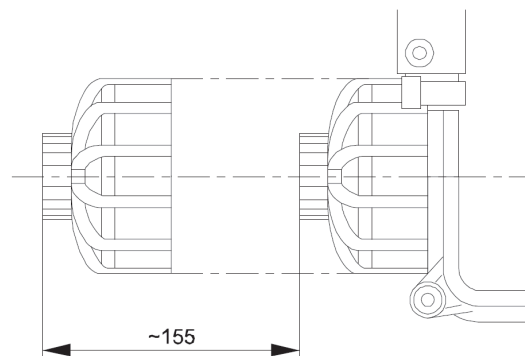
185429A 9

9. Thoroughly clean the filter cover (1).

10. Fit the filter cover and tighten to torque of $20 \pm 5 \text{ N}\cdot\text{m}$.



185428A 10



185435A 11

NOTE: During installation of the supply module, bear in mind the minimum clearance for replacing the filter.

762010 BATTERY - Check**Risk of damage**

The batteries contain sulphuric acid which is highly caustic and corrosive. Always wear gloves and protective glasses while topping up. If possible, ensure that the check is carried out by specialised personnel.

Failure to comply with these prescriptions can result in the risk of serious injury and serious damages to the vehicle

**Risk of burns**

Do not smoke or bring open flames near the batteries during the check and make sure that the room in which the work is performed is suitably ventilated.

Failure to comply with these prescriptions can result in the risk of serious injury and serious damages to the vehicle

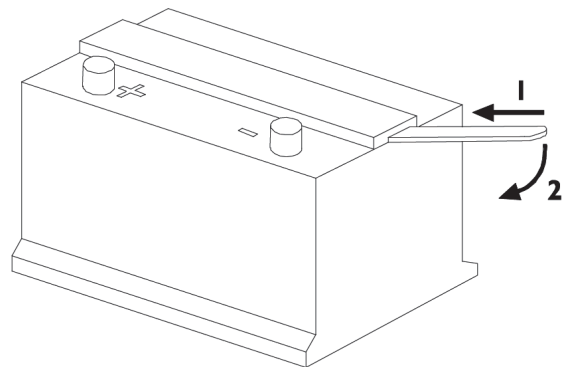
Check/top-up electrolyte level in batteries

NOTE: Refer to the machine manuals for the batteries supplied with the machine.

1. Place the batteries on a flat surface and proceed as follows.
2. Visually check that the level of the electrolyte is between the "Min" and "Max" levels; if there are no references, check that the electrolyte covers the lead plates inside the elements.
3. Only use distilled water to top up the elements whose level is below the minimum.
4. To charge the battery, contact specialised personnel.
5. If, with the engine running, there is a voltage of less than **22 V**, check the efficiency of the battery recharging system.
6. On this occasion, make sure that the poles and terminals are clean, correctly blocked and protected with petroleum jelly.

NOTE: If all the battery elements need to be topped-up with a significant amount of distilled water, contact specialised technical personnel to carry out a diagnostics check on the efficiency status of the battery and the charging system.

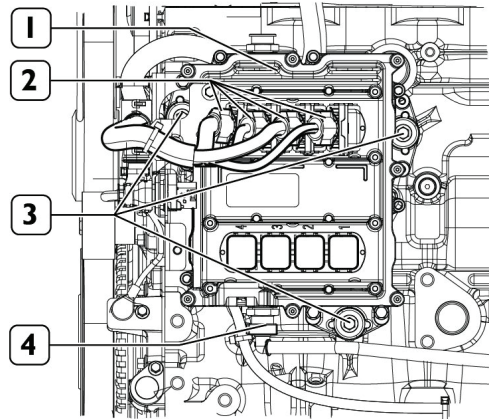
7. Some batteries have a single cover for all of the inspection plugs.
8. To access the elements, use a lever as shown in the figure.



225112 1

766161 ENGINE CONTROL UNIT - Remove

1. Disconnect the engine cable (2) from the control unit (1), as described in the procedure **ENGINE CABLES - Remove (76.91)**.
2. Position a suitable container to catch any fuel.
3. Disconnect the retainer and remove the low-pressure fuel pipe that connects the fuel pre-filter to the heat exchanger of the engine management control unit.
4. Disconnect the retainer (4) and remove the low-pressure fuel pipe connecting the engine control unit heat exchanger to the mechanical pump, as described in the procedure **PIPES - Remove (54.20)**.
5. Unscrew the supporting screws (3) and remove the ECU (1) together with the heat exchanger.



265947 1

Description	Step	Value
Engine Control Unit	3 screws M8 x 1.25 x 45	14 +/- 1,4 N·m

Pin	From	Wire	Description	Color-Size	Frame
27	X-F09 (Receptacle) pin 1 - Pressure sensor on the rail [B-F09] (1C1013187)	HN	Pressure sensor on the rail	none - 0.5	SHEET 01 SH01 - ECU
28			Not used		
29			Not used		
30	X-F09 (Receptacle) pin 2 - Pressure sensor on the rail [B-F09] (1C1013187)	ZB	Pressure sensor on the rail	none - 0.5	SHEET 01 SH01 - ECU
31			Not used		
32	X-F09 (Receptacle) pin 3 - Pressure sensor on the rail [B-F09] (1C1013187)	HR(1)	Pressure sensor on the rail	none - 0.5	SHEET 01 SH01 - ECU

X-F04 - Temperature sensor in the fuel filter [B-F04] (504147380) (Receptacle)

Pin	From	Wire	Description	Color-Size	Frame
1	X-F02E_6 (Receptacle) pin 26 - Engine control unit [A-F02]	C	Temperature sensor in fuel filter	none - 0.5	SHEET 01 SH01 - ECU
2	X-F02E_6 (Receptacle) pin 16 - Engine control unit [A-F02]	L(1)	Temperature sensor in fuel filter	none - 0.5	SHEET 01 SH01 - ECU

X-F07 - Fuel pressure regulating solenoid valve [Y-F07] (1C0004687) (Receptacle)

Pin	From	Wire	Description	Color-Size	Frame
1	X-F02E_6 (Receptacle) pin 5 - Engine control unit [A-F02]	CN(1)	Fuel pressure regulating solenoid valve	none - 0.75	SHEET 01 SH01 - ECU
2	X-F02E_6 (Receptacle) pin 4 - Engine control unit [A-F02]	BV	Fuel pressure regulating solenoid valve	none - 0.75	SHEET 01 SH01 - ECU

X-F09 - Pressure sensor on the rail [B-F09] (1C1013187) (Receptacle)

Pin	From	Wire	Description	Color-Size	Frame
1	X-F02E_8 pin 27 - Engine control unit [A-F02]	HN	Pressure sensor on the rail	none - 0.5	SHEET 01 SH01 - ECU
2	X-F02E_8 pin 30 - Engine control unit [A-F02]	ZB	Pressure sensor on the rail	none - 0.5	SHEET 01 SH01 - ECU
3	X-F02E_8 pin 32 - Engine control unit [A-F02]	HR(1)	Pressure sensor on the rail	none - 0.5	SHEET 01 SH01 - ECU

X-F11_1 - Injector 1 [Y-F11_1] (26407.212.179)

Pin	From	Wire	Description	Color-Size	Frame
1	X-F11-2 (Bulkhead) pin 3 - Injector connector (47987405)	B	Injector 1	none - 1.5	SHEET 01 SH01 - ECU
2	X-F11-2 (Bulkhead) pin 4 - Injector connector (47987405)	L	Injector 1	none - 1.5	SHEET 01 SH01 - ECU

X-F11_2 - Injector 2 [Y-F11_2] (26407.212.179)

Pin	From	Wire	Description	Color-Size	Frame
1	X-F11-2 (Bulkhead) pin 2 - Injector connector (47987405)	G	Injector 2	none - 1.5	SHEET 01 SH01 - ECU
2	X-F11-2 (Bulkhead) pin 1 - Injector connector (47987405)	H	Injector 2	none - 1.5	SHEET 01 SH01 - ECU

X-F11_3 - Injector 3 [Y-F11_3] (26407.212.179)

Pin	From	Wire	Description	Color-Size	Frame
1	X-F11-4 (Bulkhead) pin 3 - Injector connector (47987405)	M	Injector 3	none - 1.5	SHEET 01 SH01 - ECU
2	X-F11-4 (Bulkhead) pin 4 - Injector connector (47987405)	N	Injector 3	none - 1.5	SHEET 01 SH01 - ECU

X-F11_4 - Injector 4 [Y-F11_4] (26407.212.179)

Pin	From	Wire	Description	Color-Size	Frame
1	X-F11-4 (Bulkhead) pin 2 - Injector connector (47987405)	CB	Injector 4	none - 1.5	SHEET 01 SH01 - ECU
2	X-F11-4 (Bulkhead) pin 1 - Injector connector (47987405)	CL	Injector 4	none - 1.5	SHEET 01 SH01 - ECU

769130 CONNECTIONS - Solenoid description***Y-F07 - Fuel pressure regulating solenoid valve (Solenoid)***

Component Type	Solenoid
Wiring frames	SHEET 01 SH01 - ECU
Connectors	X-F07 (Receptacle) - Fuel pressure regulating solenoid valve [Y-F07] (1C0004687)

Y-F11_1 - Injector 1 (Solenoid)

Component Type	Solenoid
Wiring frames	SHEET 01 SH01 - ECU
Connectors	X-F11_1 - Injector 1 [Y-F11_1] (26407.212.179)

Y-F11_2 - Injector 2 (Solenoid)

Component Type	Solenoid
Wiring frames	SHEET 01 SH01 - ECU
Connectors	X-F11_2 - Injector 2 [Y-F11_2] (26407.212.179)

Y-F11_3 - Injector 3 (Solenoid)

Component Type	Solenoid
Wiring frames	SHEET 01 SH01 - ECU
Connectors	X-F11_3 - Injector 3 [Y-F11_3] (26407.212.179)

Y-F11_4 - Injector 4 (Solenoid)

Component Type	Solenoid
Wiring frames	SHEET 01 SH01 - ECU
Connectors	X-F11_4 - Injector 4 [Y-F11_4] (26407.212.179)

Y-F11_5 - Injector 5 (Solenoid)

Component Type	Solenoid
Wiring frames	SHEET 01 SH01 - ECU
Connectors	X-F11_5 - Injector 5 [Y-F11_5] (26407.212.179)

Y-F11_6 - Injector 6 (Solenoid)

Component Type	Solenoid
Wiring frames	SHEET 01 SH01 - ECU
Connectors	X-F11_6 - Injector 6 [Y-F11_6] (26407.212.179)

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