

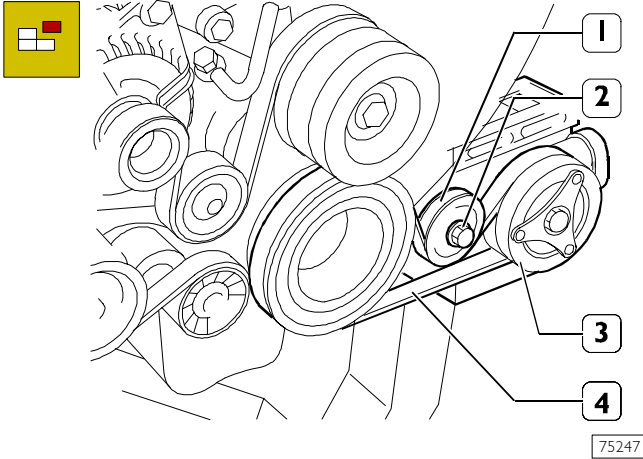
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REPLACING BELTS

543910 Replacing air-conditioning compressor drive belt (version with belt tensioner)

Disassembly

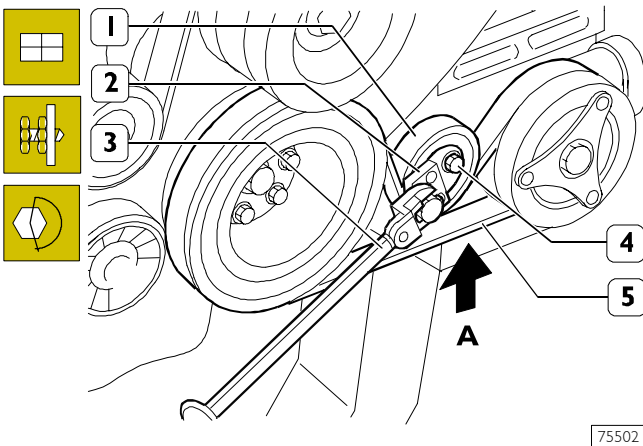
Figure 5



Set the vehicle on a lift or over a pit. From underneath the vehicle, detach the middle soundproofing guard. Loosen the screw (2) fixing the tightener (1) and remove the belt (4) driving the air-conditioner compressor (3).

Assembly and adjusting belt tension

Figure 6



Mount the drive belt, taking care to position its ribs properly in the respective races of the pulleys.

With the tool SP.2341 (2) inserted in the holes of the tightener (1) and a torque wrench (3), turn the tightener (1) with a torque of 8.2-10 Nm; in this condition, tighten the screw (4) to a torque of 25 Nm.

Turn the engine in its direction of rotation to have the belt (5) make two full turns.

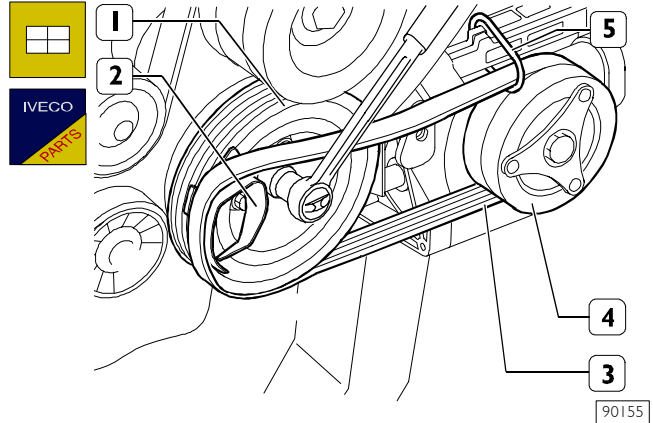
Using tool 99395849, measure the tension of the belt (5) in the section **A**, which must be 204 ± 10 Hz, corresponding to a load of 1010 ± 10 N on the tightener.

Fit the middle soundproofing guard back on.

543910 Replacing air-conditioning compressor drive belt (version with elastic belt)

Disassembly

Figure 7



Take elastic belt (3) off pulleys (1 and 4).

Assembly

Fit the flexible belt (3) equipped with tool 99360191 (2) on the pulley (4) and apply the tool on the pulley (1).

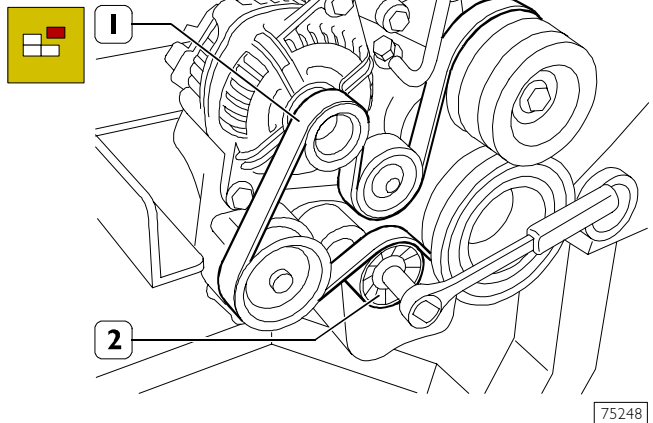
Fit the drive ring (5) on the flexible belt (3) and fasten the ring on the compressor support.

Turn the drive shaft clockwise until the belt fits perfectly on the pulley (1).

543910 Power steering pump-alternator belt replacement

Disassembly

Figure 8



Disassemble the compressor drive belt, if there is one, as described under the relevant heading.

Slacken off the tension of the belt (1) using a specific wrench on the automatic tightener (2) and remove the belt.

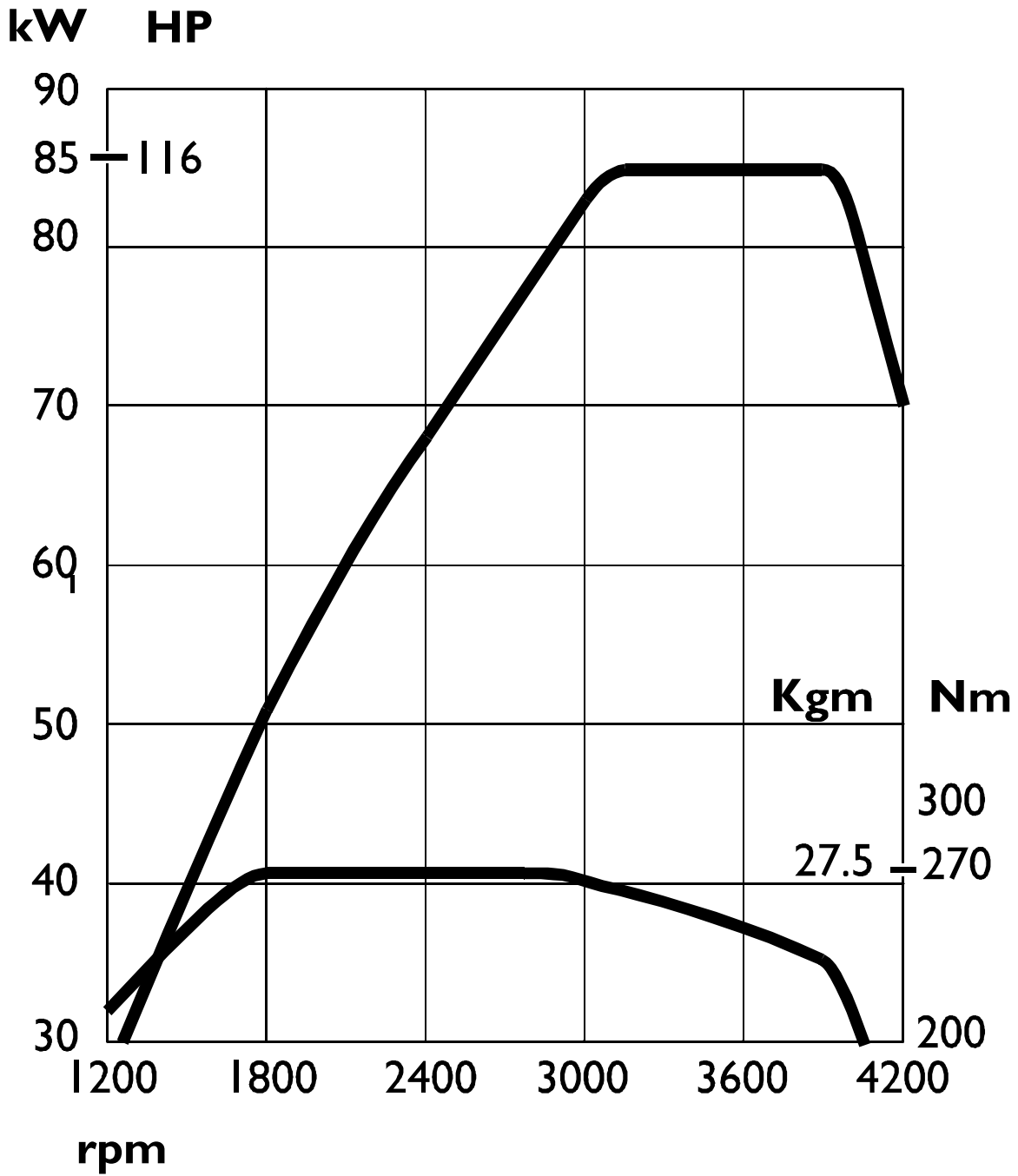
Assembly

Mount the drive belt (1) taking care to position its ribs correctly in the respective races of the pulleys. Release the automatic tightener (2). Turn the crankshaft by one turn to settle the belt.

Mount the compressor drive belt, if there is one, and adjust the tension as described under the relevant heading.

Fit the middle soundproofing guard back on.

Figure 20/2



102409

CHARACTERISTIC CURVES OF ENGINE FIAE 0481B

Max OUTPUT 85 kW

116 HP

at 3000 ÷ 3900 rpm

Max TORQUE 270 Nm

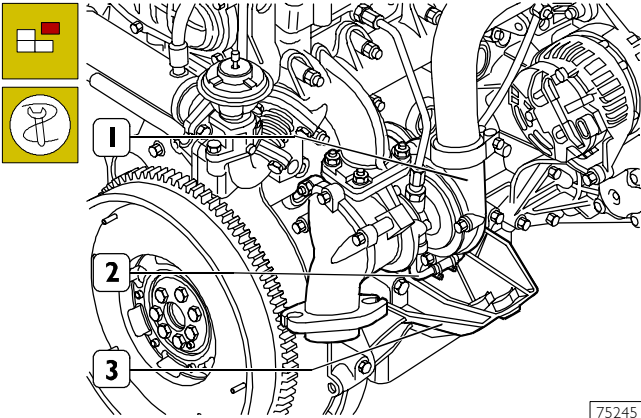
27.5 kgm

at 1800 ÷ 2800 rpm

OVERHAULING ENGINE FIA

540110 DISASSEMBLING THE ENGINE AT THE BENCH

Figure 25



75245

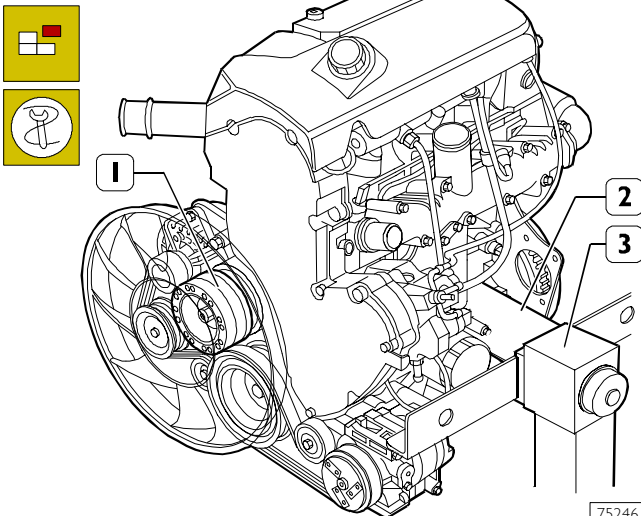
If the following parts have not already been removed, do so now:

- top soundproofing cover;
- rail guard;
- engine cable, disconnecting its electrical connections from: thermostat temperature sensor, timing sensor, engine speed sensor, pressure regulator, rail pressure sensor, intake manifold air temperature/pressure sensor.

To be able to fit the brackets 99361038 onto the crankcase to secure the engine to the stand for overhauling, it is necessary to remove the left and right engine mounts (3) and disconnect the oil pipe (2) from the turbocharger (1) and from the crankcase.

NOTE Block the turbocharger air/exhaust gas inlets and outlets to prevent foreign bodies getting inside.

Figure 26

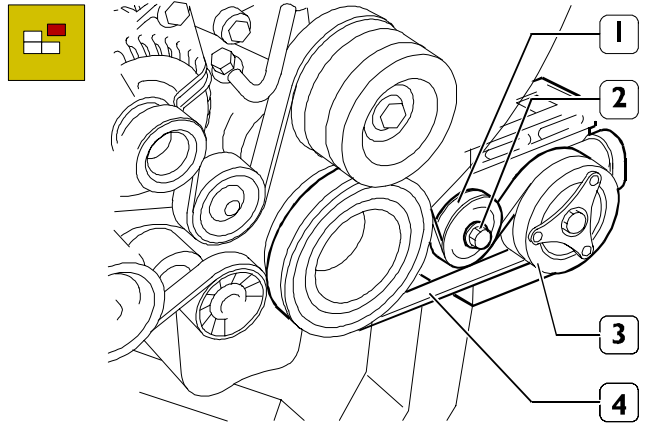


75246

Fit the brackets 99361038 (2) to the crankcase and use these to secure the engine to the rotary stand 99322205 (3). Drain the oil from the engine by removing the plug from the oil sump.

Disconnect the fan from the electromagnetic coupling (1).

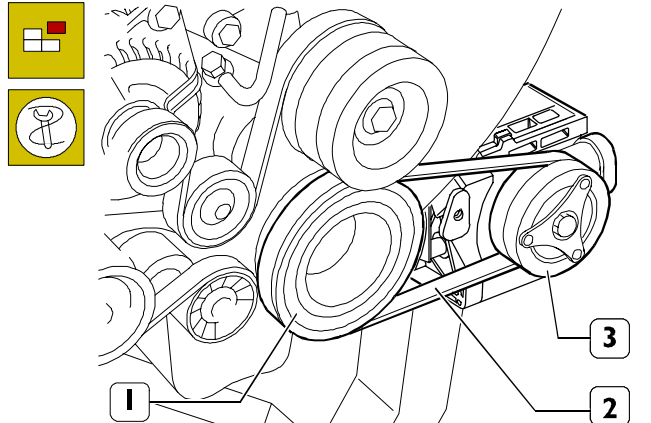
Figure 27



75247

Take off screw (2), if present, and dismount belt tensioner (1). Take off the belt (4) driving the air-conditioner compressor (3).

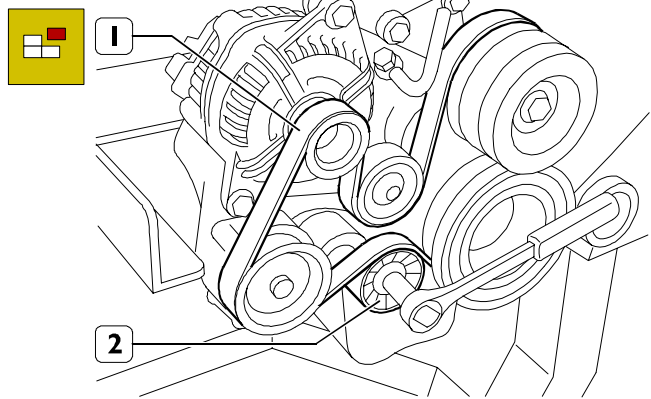
Figure 28



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Or, on the engines with elastic belt (2), with a suitable tool, take the belt off pulleys (1 and 3).

Figure 29

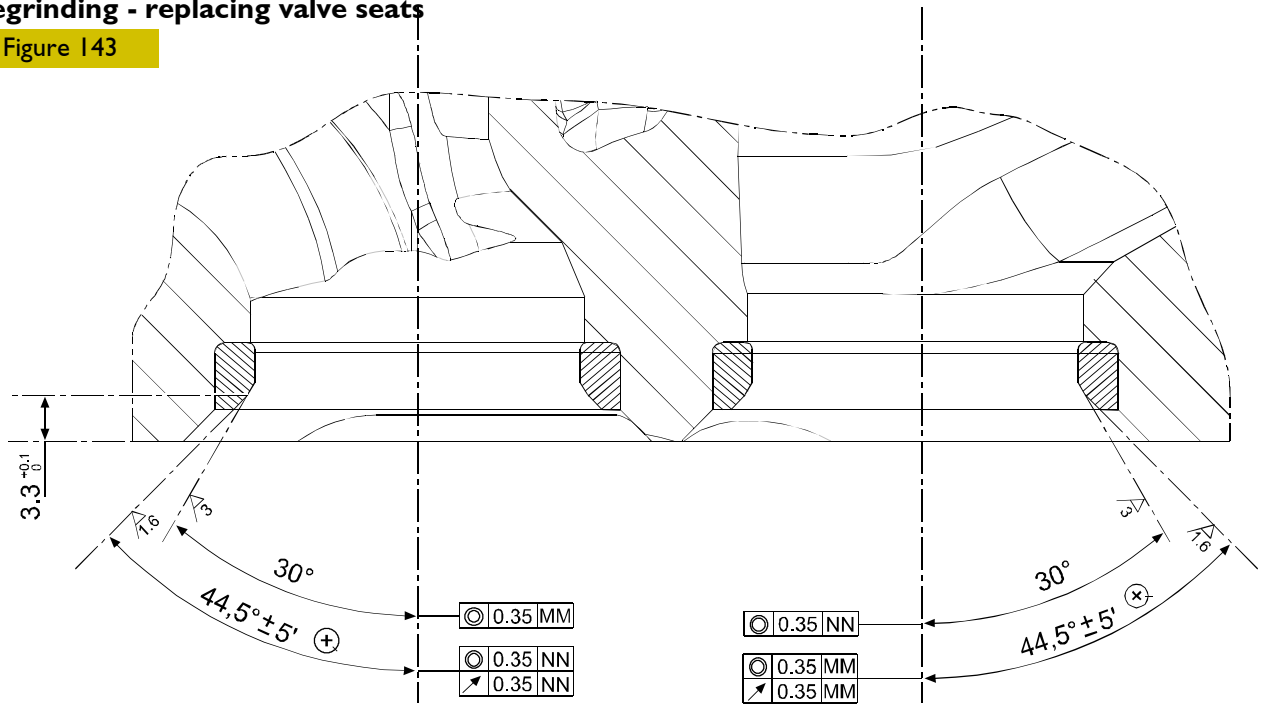


75248

Using the specific wrench on the automatic tightener (2), slacken the tension of the belt (1) and remove it.

540661 VALVE SEATS
Regrinding - replacing valve seats

Figure 143



75458

Check the valve seats. On finding any slight scoring or burns, regrind them with an appropriate tool according to the angles given in Figure 143.

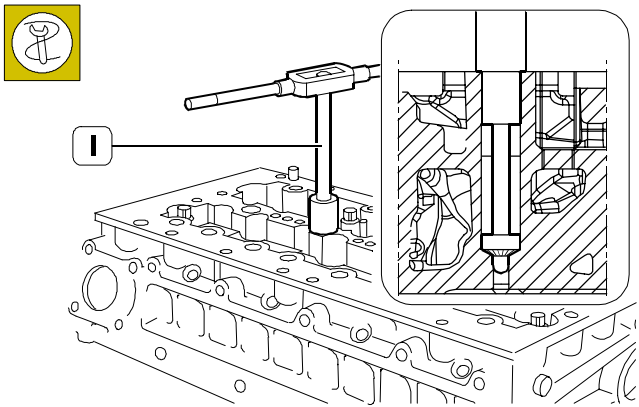
Having to replace them, with the same tool and taking care not to affect the cylinder head, remove as much material from the valve seats as possible until, with a punch, it is possible to extract them from the cylinder head.

Heat the cylinder head to $80 \pm 100^\circ\text{C}$ and, using a suitable drift, fit in it the new valve seats, previously chilled in liquid nitrogen.

Using a specific tool, regrind the valve seats according to the angles given in Figure 143.

Mount the valves, block the seat of the electro-injectors and glow plugs; using a suitable tool, check the seal of the valves/seats.

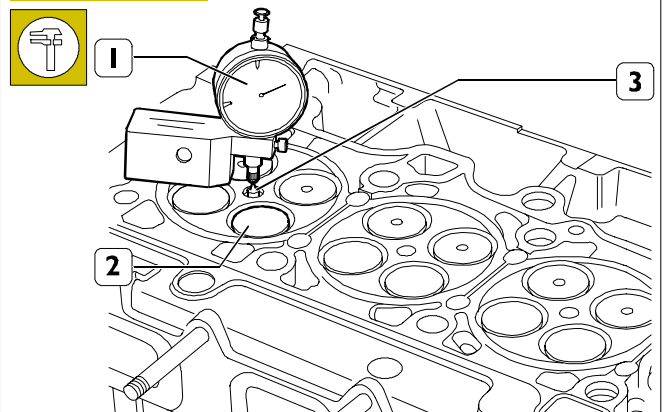
Figure 144



75459

Using the milling cutter 99394038 (1), clean the injector seat of any deposits.

Figure 145



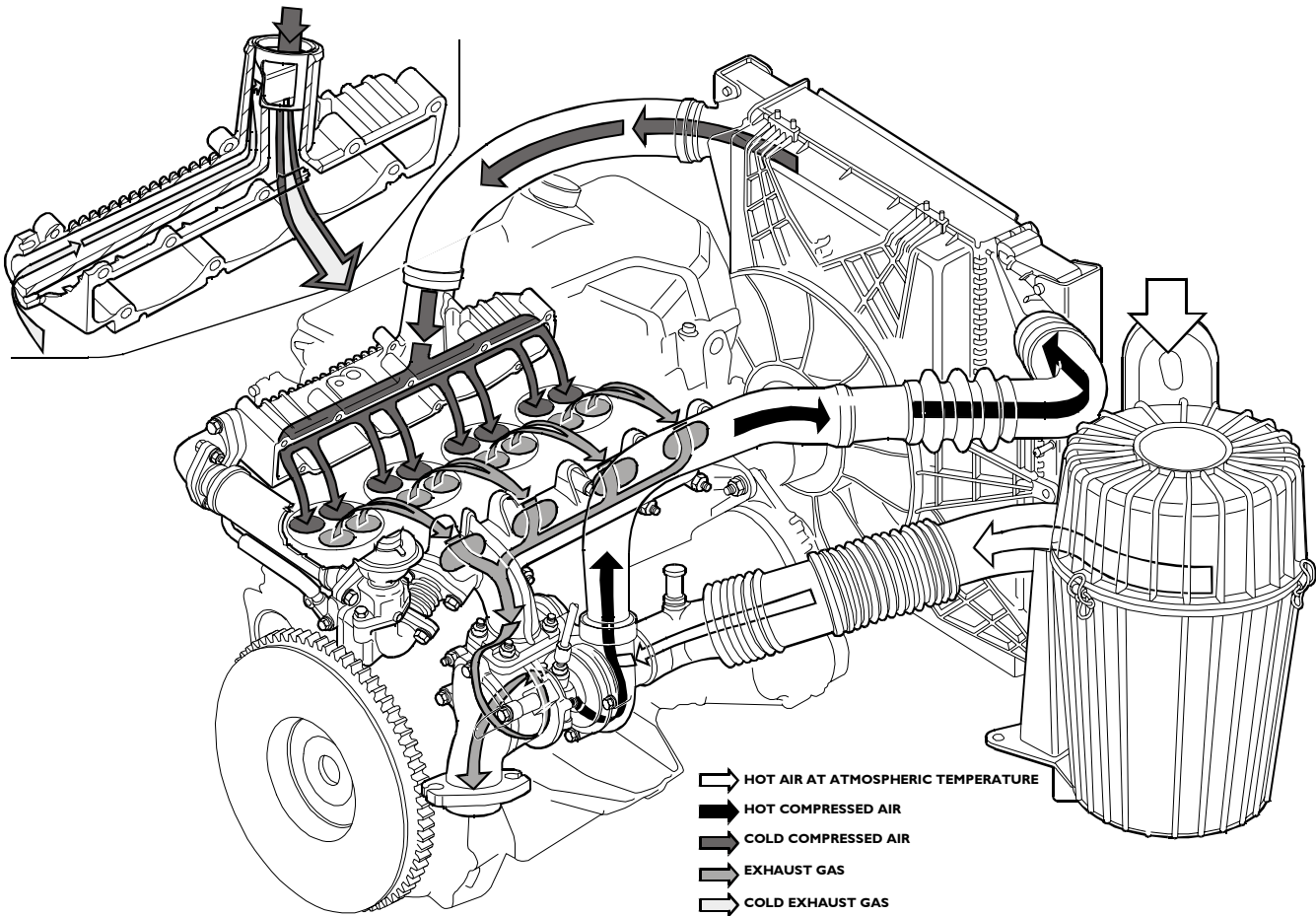
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Using a dial gauge (1), check that, from the plane of the cylinder head, the valve recessing (2) and the protrusion of the injector (3) and of the glow plug have the prescribed value:

- Valve recessing: 0.5 ± 0.8 mm.
- Injector protrusion: 2.77 ± 3.23 mm.
- Glow plug protrusion: 3.78 mm.

TURBOCHARGING

Figure 235



75531

TURBOCHARGING DIAGRAM

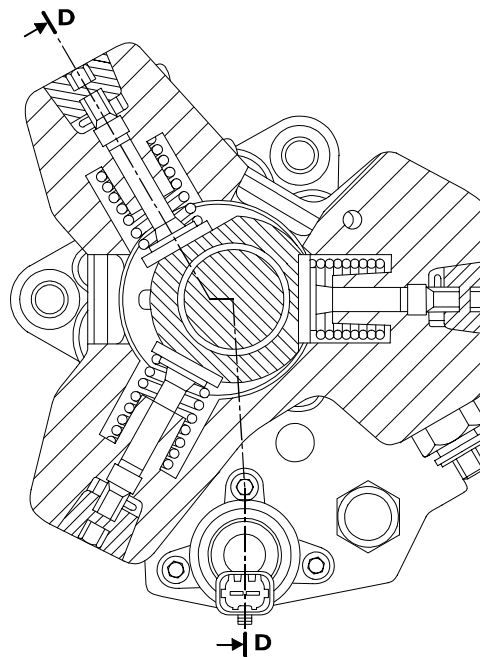
Description

The turbocharging system comprises an air filter, turbocharger and intercooler. The air filter is the dry type comprising a filtering cartridge to be periodically replaced.

The function of the turbocharger is to use the energy of the engine's exhaust gas to send pressurized air to the cylinders. The intercooler comprises a radiator included in the engine coolant radiator and its function is to lower the temperature of the air leaving the turbocharger to send it to the cylinders.

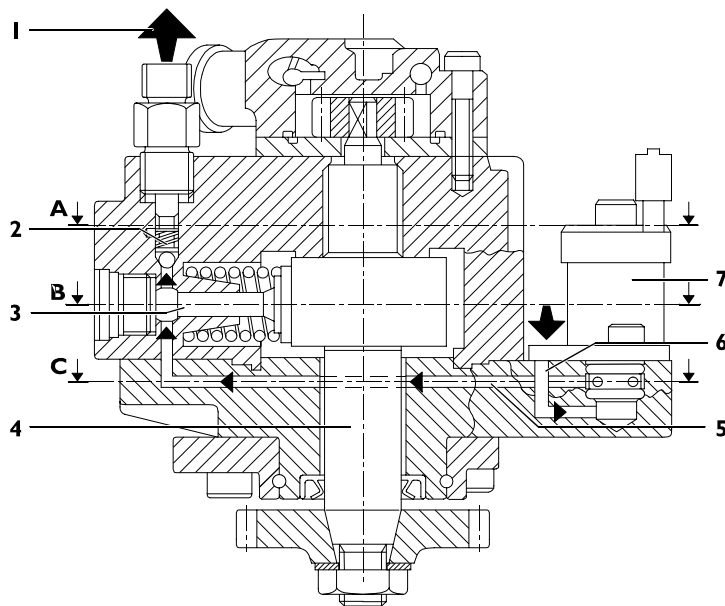
Working principle

Figure 252



Sec. B - B

Figure 253



Sec. D - D

72597

1. Outlet for delivery to rail – 2. Delivery valve to rail – 3. Pumping element – 4. Pump shaft – 5. Pumping element supply duct – 6. Pressure regulator supply duct – 7. Pressure regulator.

The pumping element (3) is arranged on the cam on the pump shaft. In the suction phase, the pumping element is supplied through the supply duct (5). The amount of fuel to send to the pumping element is determined by the pressure regulator (7). The pressure regulator, on the basis of the PWM command

received from the control unit, chokes the flow of fuel to the pumping element. During the compression phase of the pumping element, the fuel, on reaching such a pressure as to open the delivery valve to the common rail (2), supplies it through the outlet (1).

BLINK CODE	EDC LAMP	POSSIBLE CAUSE	POSSIBLE TROUBLE	TESTS OR RECOMMENDED ACTION	NOTES
9.5	Off	After Run broken off several times.	Fault memory and other working data are not corrected saved in EEPROM. EDC inhibits starting the engine after a certain number of unsuccessful After Runs.	Check the control unit power supply wiring for any intermittent false contacts. If the wiring is good, replace the main relay.	Investigate any incorrect use of the vehicle.
9.6	Blinking	Failure of the internal test procedure that takes place in the control unit every time the engine stops.	The engine fails to stop in the set time when the +15 key is turned onto OFF.	This could occur if the engine is turned off but it continues to be driven (vehicle moving with gear engaged). Check the wiring between the key +15 and the control unit connector pin B20. Delete the fault memory: if in normal conditions of turning off the engine the error signal persists, call the Help Desk to have the control unit replaced if necessary.	
9.7	Blinking	Internal defect of the control unit in the sensor power supply circuit.	Reduction in power (and noise because pre-injection is not implemented). Irregular engine operation due to sensors not being powered correctly.	Call the Help Desk and follow their instructions to replace the control unit if necessary.	Defects may be signalled for various sensors powered by the control unit.

DTC	FMI	Failing component	Type of Failure	Visible failure	Possible Cause	Repair action	Checks to be performed	Measuring conditions	Values to be detected	Remarks
1E	08	VEHICLE CLUTCH SIGNAL SUSPECT	SIGNAL NOT PLAUSIBLE	Clutch switch: signal either not plausible or not present. Cruise Control / PTO not working or engine revs up to maximum speed when clutch pedal is pressed and Cruise control / PTO is on.	Gear shift detected without pressing brake pedal.	Check wiring and connections. Replace sensor if required.				The anomaly caused by incomplete clutch operation if everything is OK.
20	01	EGR - EGR POWER SHORT TO BATT.	EXCEEDED UPPER LIMIT		EGR solenoid valve short-circuit to battery.	1) Check integrity of solenoid valve with multimeter. 2) Check wiring between solenoid valve and EDC connector.				EGR either not working or always working. Emissions not compliant with law. No reaction perceivable by driver.
21	02	EGR - SHORT CIRCUIT TO GROUND ON EGR VALVE	BELOW LOWER LIMIT		Solenoid valve short-circuit to ground.	1) Check integrity of solenoid valve with multimeter. 2) Check wiring between solenoid valve and EDC connector.				EGR either not working or always working. Emissions not compliant with law. No reaction perceivable by driver.
22	04	EGR - OPEN CIRCUIT ON EGR VALVE	NO SIGNAL		EGR solenoid valve short-circuit or open circuit.	1) Check integrity of solenoid valve with multimeter. 2) Check wiring between solenoid valve and EDC connector.				EGR either not working or always working. Emissions not compliant with law. No reaction perceivable by driver.

DTC	FMI	Failing component	Type of Failure	Visible failure	Possible Cause	Repair action	Checks to be performed	Measuring conditions	Values to be detected	Remarks
39	02	ENGINE 1 - AIR TEMPERATURE SENSOR	BELOW LOWER LIMIT	Problematic cranking, smoke, problematic acceleration.	Short-circuit to ground, excessively high temperature is detected.	Check wiring and connections. Replace sensor if required.	Measure type: Resistance (KOhm) Measure point 1: Sensor Pin: 1 Measure point 2: Sensor Pin: 2	Connector Not connected; Key +15 OFF;	Typical Value: 2,5 KOhm;	Air temperature sensor and built-in pressure sensor. The sensor is fitted on flow meter in engines with EGR.
3A	02	ELECTRONIC CONTROL UNIT - IMMOBILISER	BELOW LOWER LIMIT	The engine fails to start	Communication with Immobilizer ECU problems on CAN Line.	Check integrity of CAN Line, run Immobilizer ECU diagnostics and wait for indications provided.	Measure type: Resistance (Ohm) Measure point 1: Diagnostic socket. Pin: 21 Measure point 2: Diagnostic socket. Pin: 22	Connector Connected; Key +15 OFF;	Typical Value: 60 Ohm Ohm;	
3C	01	INJECTOR BENCH 1	EXCEEDED UPPER LIMIT	Engine not working properly, possible power reduction.	Injector wiring short-circuit.	Check wiring and connections. Replace injector if required.				Only two cylinders running.
3C	02	INJECTOR BENCH 1	BELOW LOWER LIMIT	Engine not working properly, possible power reduction.	Short-circuit to ground.	Check wiring and connections.				Only two cylinders running.
3C	08	INJECTOR BENCH 1	SIGNAL NOT PLAUSIBLE	Engine not working properly, possible power reduction.	Injector electrical system failure.	Check wiring and connections. Replace injector if required.				Only two cylinders running.
3D	04	INJECTOR BENCH 1	NO SIGNAL	Engine not working properly, possible power reduction.	Injector wiring disconnected.	Check wiring and connections. Replace injector if required.				Only two cylinders running.
3E	01	INJECTOR BENCH 2	EXCEEDED UPPER LIMIT	Engine not working properly, possible power reduction.	Injector wiring short-circuit.	Check wiring and connections. Replace injector if required.				Only two cylinders running.

DTC	FMI	Failing component	Type of Failure	Visible failure	Possible Cause	Repair action	Checks to be performed	Measuring conditions	Values to be detected	Remarks
63	01	FUEL PRESSURE - FAULT ON THE FUEL DRUCK CONTROL OF THE RAIL (NEGATIVE DEVIATION)	EXCEEDED UPPER LIMIT		MPROP adjuster open movement jammed.	Check efficiency of MPROP adjuster.				Fuel management and pressure failure in rail.
64	01	FUEL PRESSURE - RAIL PRESSURE ERROR: TOO LOW	EXCEEDED UPPER LIMIT		High pressure circuit fuel leakage.	Check high pressure system. Replace high pressure pump if required.				Fuel management and pressure failure in rail.
65	01	FUEL PRESSURE - RAIL PRESSURE ERROR: TOO HIGH	EXCEEDED UPPER LIMIT		MPROP regulator jammed.	Check MPROP regulator, replace if required.				
66	01	FUEL PRESSURE - ERROR ON THE RAIL PRESSURE (EXCESSIVE DUTY CYCLE)	EXCEEDED UPPER LIMIT	Negative vehicle reaction with smoke in exhaust during acceleration.	High pressure circuit fuel leakage.	Check fuel feed system, replace high pressure pump if required. Faulty fuel feed system (fuel pump and filter jammed).				
67	01	FUEL PRESSURE - ERROR ON THE RAIL PRESSURE (EXCESSIVE)	EXCEEDED UPPER LIMIT	Engine off.	MPROP regulator jammed.	Check MPROP regulator, replace if required.				Replace pressure relief valve.

DTC	FMI	BLINK CODE	Failing component	Type of Failure	Visible failure	Possible Cause	Repair action	Checks to be performed	Measuring conditions	Values to be detected	Remarks
01	01	19	VEHICLE - AIR-CONDITIONER COMPRESSOR RELAY (DTC 1)	EXCEEDING NORMAL RANGE	A/C compressor always on.	Short-circuit to positive.	Check wiring and connections. Replace relay if required.				
01	02	19	VEHICLE - AIR-CONDITIONER COMPRESSOR RELAY (DTC 1)	EXCEEDING NORMAL RANGE	Check correct operation of warning light using "Active diagnostic" procedure.	Short-circuit to ground.	Check wiring and connections. Replace relay if required.				
01	04	19	VEHICLE - AIR-CONDITIONER COMPRESSOR RELAY (DTC 1)	NO SIGNAL	A/C compressor not working.	Open circuit, relay disconnected.	Check wiring and connections. Replace relay if required.				
01	08	19	VEHICLE - AIR-CONDITIONER COMPRESSOR RELAY (DTC 1)	SIGNAL NOT PLAUSIBLE	A/C compressor not working.	Open circuit, relay disconnected.	Check wiring and connections. Replace relay if required.				
02	04	19	VEHICLE - AIR-CONDITIONER COMPRESSOR RELAY (DTC 2)	NO SIGNAL	A/C compressor not working.	No CAN line signal.	Check wiring and connections. Replace relay if required.				
02	08	19	VEHICLE - AIR-CONDITIONER COMPRESSOR RELAY (DTC 2)	SIGNAL NOT PLAUSIBLE	A/C compressor not working.	Non plausible CAN line signal.	Check wiring and connections. Replace relay if required.				
03	01	97	ELECTRONIC CONTROL UNIT - INTERNAL ECU FAULT (DTC 3)	EXCEEDING NORMAL RANGE		Wrong ECU programming. Probable electromagnetic interference. Faulty ECU.	Switch key on/off and wait for a few seconds, clear failure memory. If the error persists, call the Help Desk for instructions on how to replace the ECU.				

DTC	FMI	BLINK CODE	Failing component	Type of Failure	Visible failure	Possible Cause	Repair action	Checks to be performed	Measuring conditions	Values to be detected	Remarks
14	08	21	ENGINE 1 - COOLANT TEMPERATURE SENSOR	SIGNAL NOT PLAUSIBLE	Problematic cold cranking. Possible power reduction.	Faulty sensor, interrupted wiring.	Check wiring and connections. Replace sensor if required.	<p>1- Measure type: Resistance (KOhm) Measure point 1: Sensor Pin: 1 Measure point 2: Sensor Pin: 2</p> <p>2- Measure type: Resistance (Ohm) Measure point 1: ECU Pin: A58 Measure point 2: Sensor Pin: 1</p> <p>3- Measure type: Resistance (Ohm) Measure point 1: ECU Pin: A41 Measure point 2: Sensor Pin: 2</p>	<p>1- Connector Not connected; Key +15 OFF;</p> <p>2- Connector Not connected; Key +15 OFF;</p> <p>3- Connector Not connected; Key +15 OFF;</p>	<p>1- Min. value: 0,11 KOhm; Max. value: 48,3 KOhm; Typical Value: 2,5 KOhm;</p> <p>2- Typical Value: 0,1 Ohm;</p> <p>3- Typical Value: 0,1 Ohm;</p>	

DTC	FMI	BLINK CODE	Failing component	Type of Failure	Visible failure	Possible Cause	Repair action	Checks to be performed	Measuring conditions	Values to be detected	Remarks
33	01	92	ELECTRONIC CONTROL UNIT - INTERNAL ECU FAULT (DTC 51)	EXCEEDING NORMAL RANGE	The engine switching off-data are not memorized. The failures memory is lost, only the present failures and not the intermittent ones can be read, the idling speed, which can be eventually set by the Cruise Control commands, remains not memorized.	Faulty ECU EEPROM.	Switch key on/off and wait for a few seconds, clear failure memory. If the error persists, call the Help Desk for instructions on how to replace the ECU.				
33	02	92	ELECTRONIC CONTROL UNIT - INTERNAL ECU FAULT (DTC 51)	EXCEEDING NORMAL RANGE	The engine switching off-data are not memorized. The failures memory is lost, only the present failures and not the intermittent ones can be read, the idling speed, which can be eventually set by the Cruise Control commands, remains not memorized.	Faulty ECU EEPROM.	Switch key on/off and wait for a few seconds, clear failure memory. If the error persists, call the Help Desk for instructions on how to replace the ECU.				

DTC	FMI	BLINK CODE	Failing component	Type of Failure	Visible failure	Possible Cause	Repair action	Checks to be performed	Measuring conditions	Values to be detected	Remarks
6A	02	97	ELECTRONIC CONTROL UNIT - SENSOR POWER SUPPLY (DTC 106)	EXCEEDING NORMAL RANGE	Anomalous engine operation due to incorrectly powered sensors. Reduced power.	Sensor power circuit fault in ECU.	Switch key on/off and wait for a few seconds, clear failure memory. If the error persists, call the Help Desk for instructions on how to replace the ECU.				Possible fault indications of various sensors powered by ECU.
6B	01	97	ELECTRONIC CONTROL UNIT - SENSOR POWER SUPPLY (DTC 107)	EXCEEDING NORMAL RANGE	Anomalous engine operation due to incorrectly powered sensors. Reduced power.	Sensor power circuit fault in ECU.	Switch key on/off and wait for a few seconds, clear failure memory. If the error persists, call the Help Desk for instructions on how to replace the ECU.				Possible fault indications of various sensors powered by ECU.
6B	02	97	ELECTRONIC CONTROL UNIT - SENSOR POWER SUPPLY (DTC 107)	EXCEEDING NORMAL RANGE	Anomalous engine operation due to incorrectly powered sensors. Reduced power.	Sensor power circuit fault in ECU.	Switch key on/off and wait for a few seconds, clear failure memory. If the error persists, call the Help Desk for instructions on how to replace the ECU.				Possible fault indications of various sensors powered by ECU.