TECHNOLOGICAL EXCELLENCE

NEF ENGINE

N60 ENT M37

TECHNICAL AND REPAIR MANUAL

IVECO MOTORS

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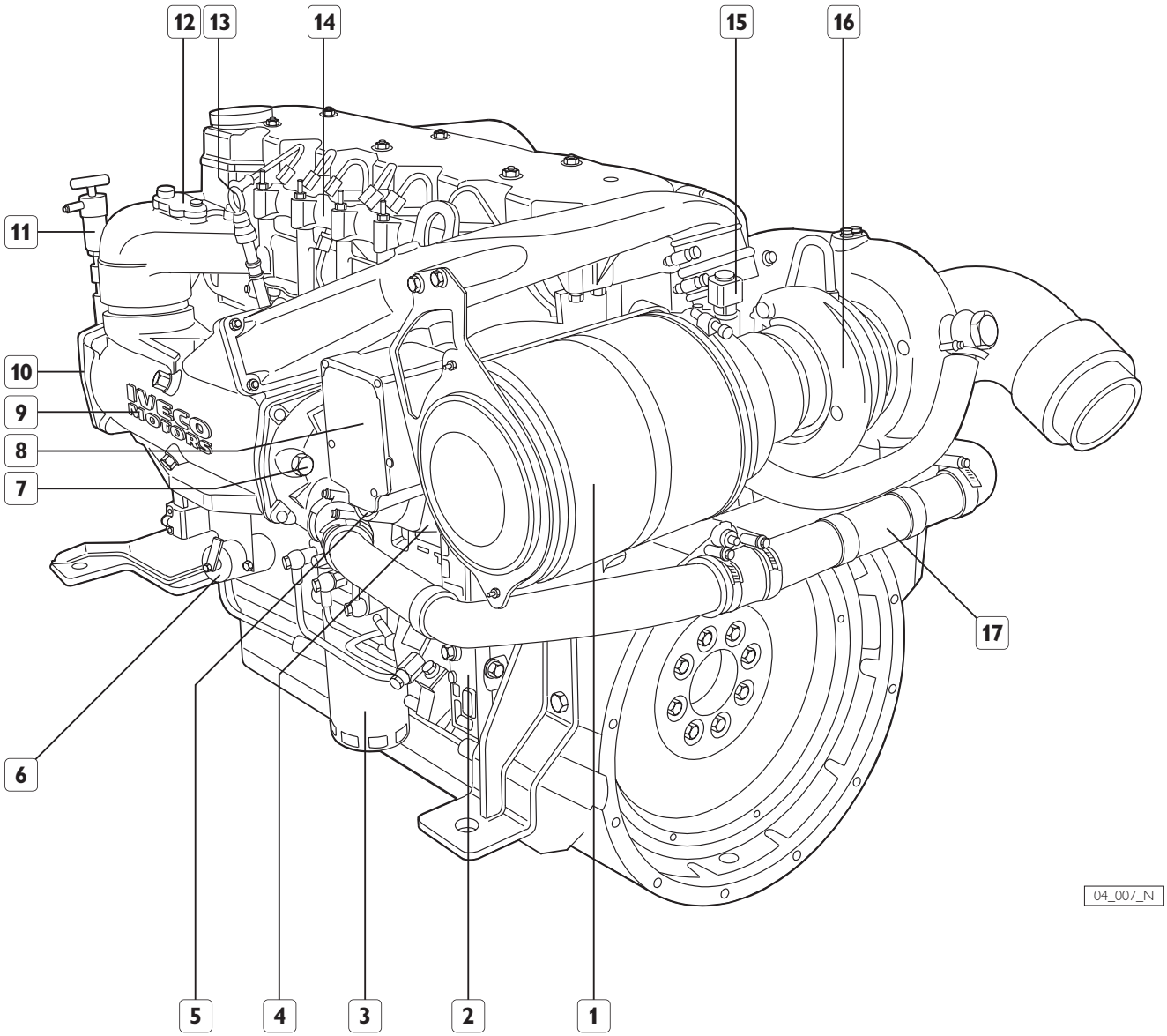
ENGINE PARTS AND COMPONENTS

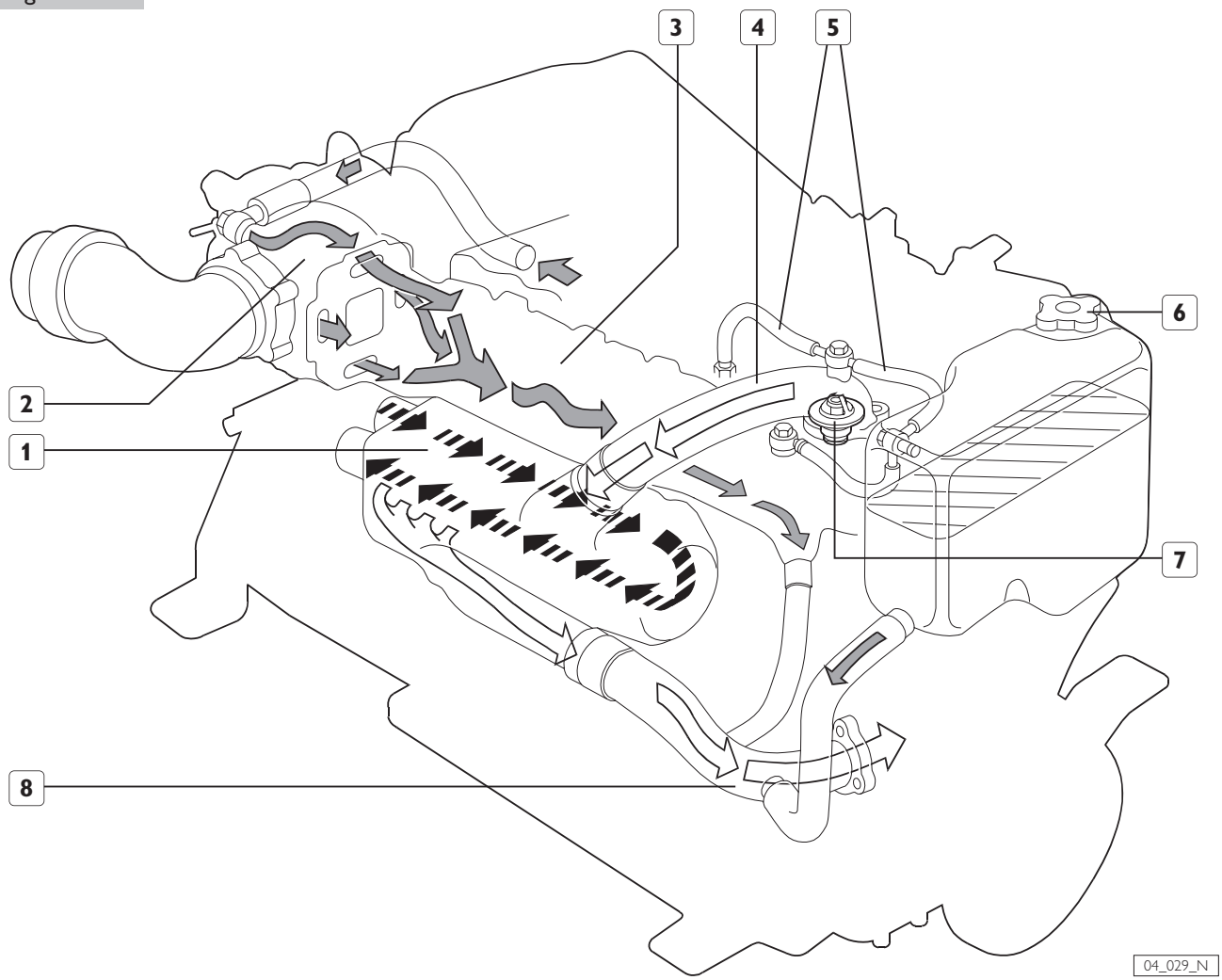
Figure 5



1. Combustion air filter - 2. Common rail high pressure injection pump -3. Fuel filter - 4. Sea water pump - 5. Sea water inlet - 6. Throttle potentiometer - 7. Sacrificial anode - 8. Oil vapor separator - 9. Combustion air-sea water heat exchanger - 10. Location of sea water discharge cap - 11. Manual lubricating oil extraction pump - 12. Combustion air pressure and temperature sensor - 13. Oil dipstick - 14. Common rail distributor - 15. Air filter clogging sensor - 16. Cooled turbocharger - 17. Sea water junction pipe from after-cooler to engine coolant/sea water heat exchanger.

Exhaust manifold cooling

Figure 21

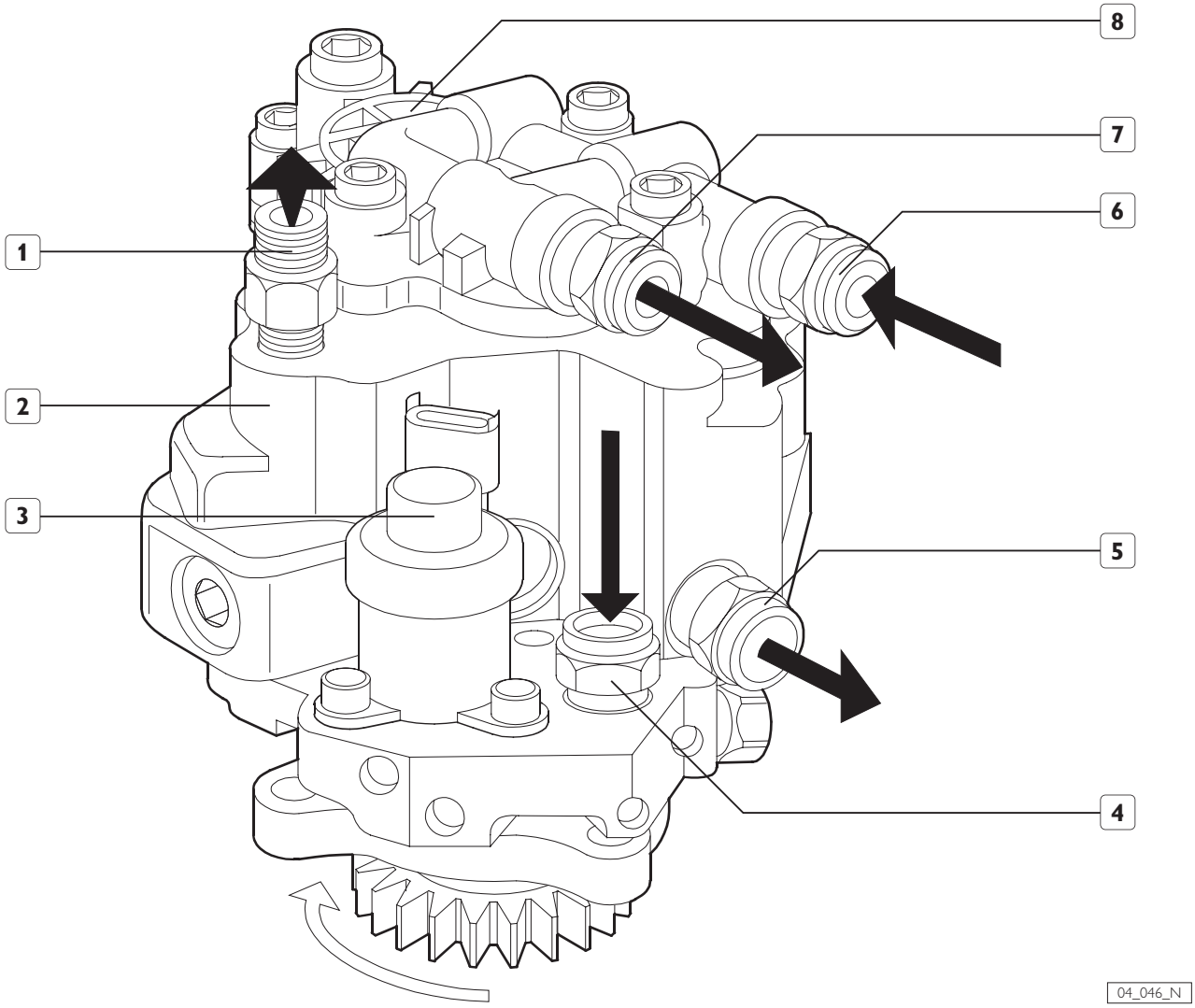


Engine coolant through exhaust manifold
Hot engine coolant through coolant exchanger
Sea water

1. Sea water/coolant exchanger - 2. Turbocompressor - 3. Exhaust manifold - 4. Thermostatic valve-exchanger water/water connector - 5. Degassing piping - 6. Plug with pressure valve - 7. Thermostatic valve - 8. Water pump manifold inlet.

Pump assembly

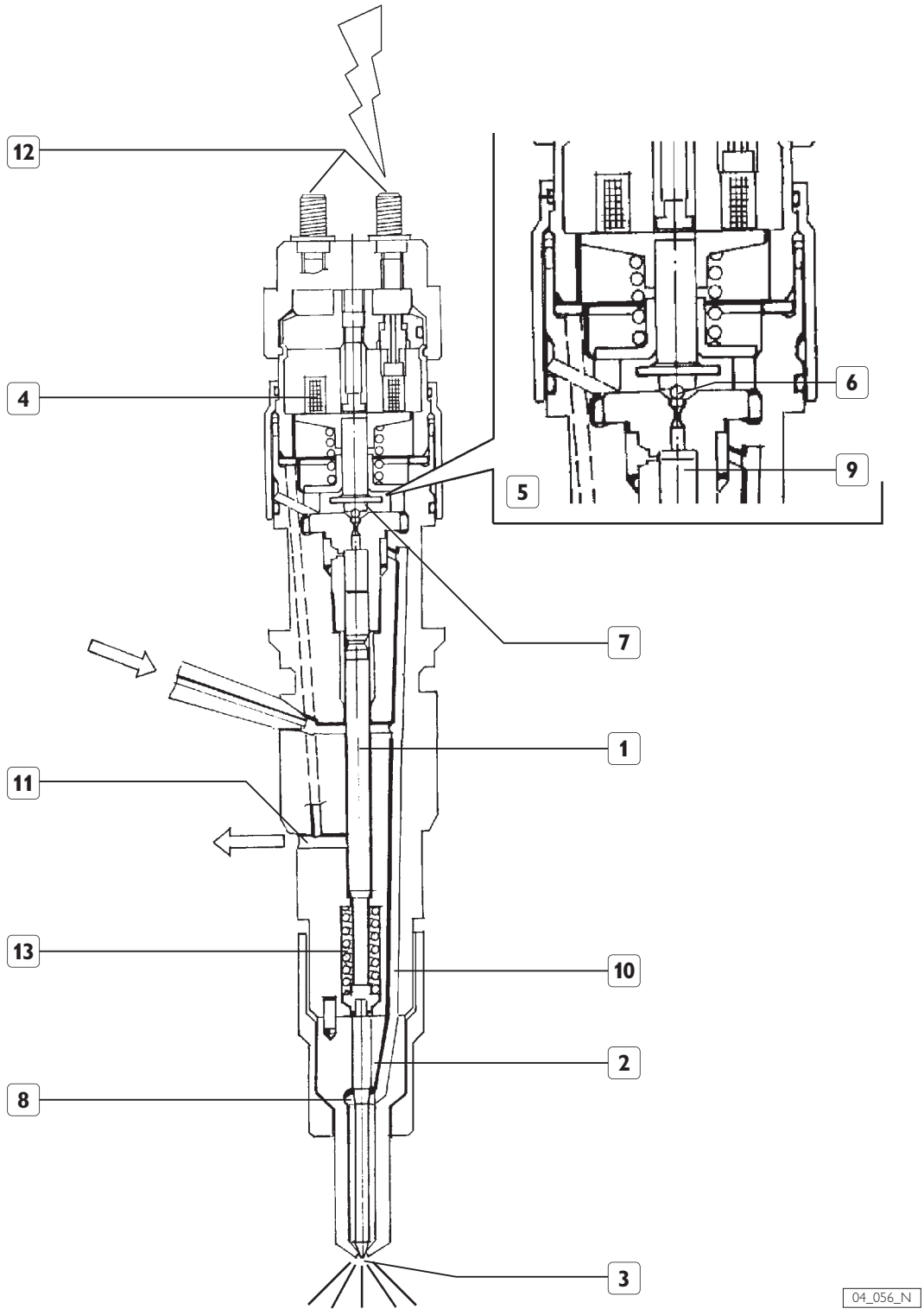
Figure 36



1. Connector fuel outlet to rail - 2. High pressure pump - 3. Pressure control solenoid - 4. Fuel inlet connector from filter - 5. Fuel outlet connector to recirculation manifold - 6. Fuel inlet from tank - 7. Fuel outlet connector from low pressure pump to filter - 8. Low pressure pump.

The high pressure pump is made up by three radial pumping elements driven by a tappet set into rotation by a gear of the timing shaft. In the rear part the feed mechanical pump,driven by the radial pump,is fitted.
On its side the pressure control solenoid valve is located.
The positioning of the pump does not require timing as the injections management is entirely electronically controlled.

Figure 51



1. Pressure rod - 2. Metering rod - 3. Nozzle - 4. Coil - 5. Pilot Valve - 6. Ball valve - 7. Control area - 8. Pressure chamber - 9. Control volume - 10. Feed duct - control - 11. Control fuel outlet - 12. Electric connection - 13. Spring.

The fuel that is in the control volume, backflows towards the reflux duct causing a pressure decrease in the control volume itself.
At the same time the fuel pressure in the pressurized chamber causes the rise of the metering rod and consequently the injection of the fuel into the cylinder. The injection ceases by disenergizing the coil. The ball valve goes back into the rest position, to recreate an equilibrium of forces such as to make the metering rod going back to close position and stop the injection.

Recovery

It is a special way of control and management characterised by the adoption of a number of strategies which enable the system to operate even in the case selfdiagnosis has recognized the presence of anomalies. In the majority of cases seafaring can be continued regularly or with reduced performance. Adopting a recovery strategy entails the storing of an anomaly code and the corresponding limitation of the maximum power rating delivered by the engine.
The power rating limitation due to recovery strategy is active up to the stopping of the engine even if the anomaly detected is not there anymore. The blink code light on the instrument and control panel coming on is foreseen only for the most serious events.

After run

The stage following after every engine stop.It is characterised by the delay in deenergizing the main supply solenoid contained inside ECU EDC. During this phase the central unit is still powered for some seconds during which,the data that have characterised the optimized management of the engine up to that moment are transferred from the main volatile memory into the EEPROM non volatile memory; these data will then be available for the next starting.
These data can be summarised into:

- Management modes (idle speed, torque delivery balance, smoke limit…).
- Threshold setting min/max of signal recognition.
- Fault memory.

It is important to be able at every start up to have available the data that optimize the management and the engine behaviour in terms of TORQUE AND POWER DELIVERY.It is therefore MANDATORY to use engine stopping strategies (e.g. accummulator disconnection) not different from those foreseen by the manufacturer (key in OFF position) or which may prevent the correct execution of the after run function.

SECTION 3

ELECTRICAL EQUIPMENT

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Relay box connectors

(1st version to 10/2003)

Figure 12

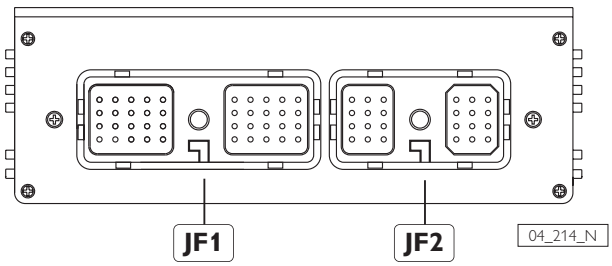
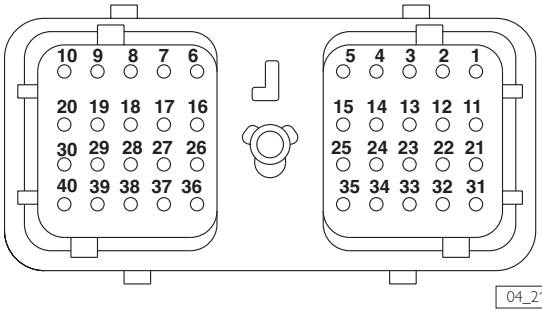
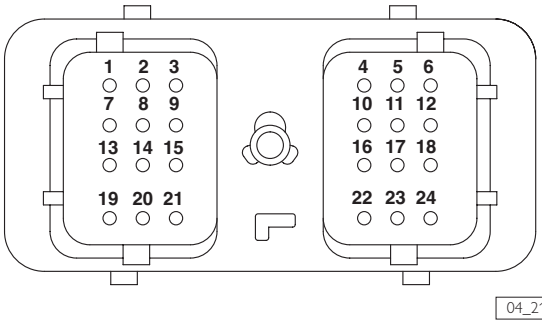


Figure 13



JF1 CONNECTOR
(view of the wire harness terminal, coupling side)

Figure 14



JF2 CONNECTOR
(view of the wire harness terminal, coupling side)

(2st version from 11/2003)

Figure 15

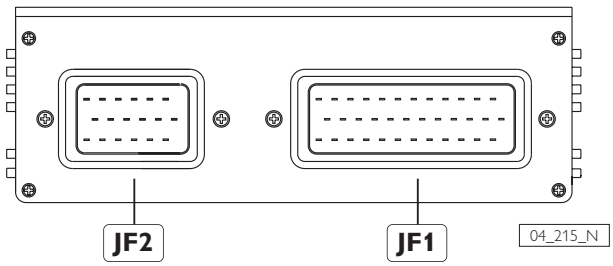
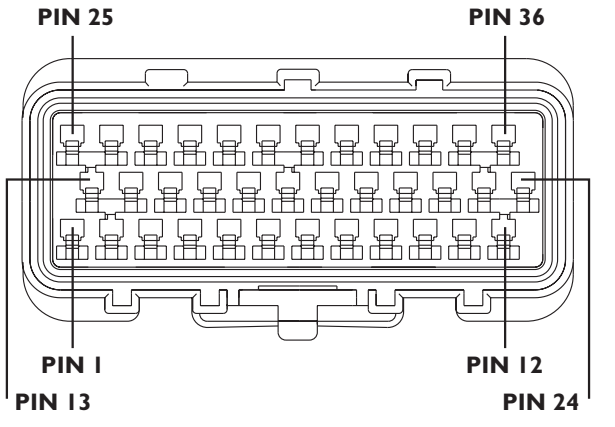
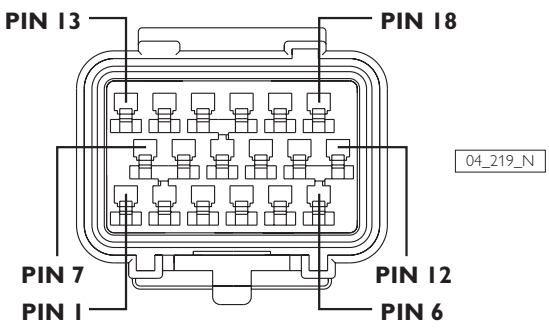


Figure 16



JF1 CONNECTOR
(view of the wire harness terminal, coupling side)

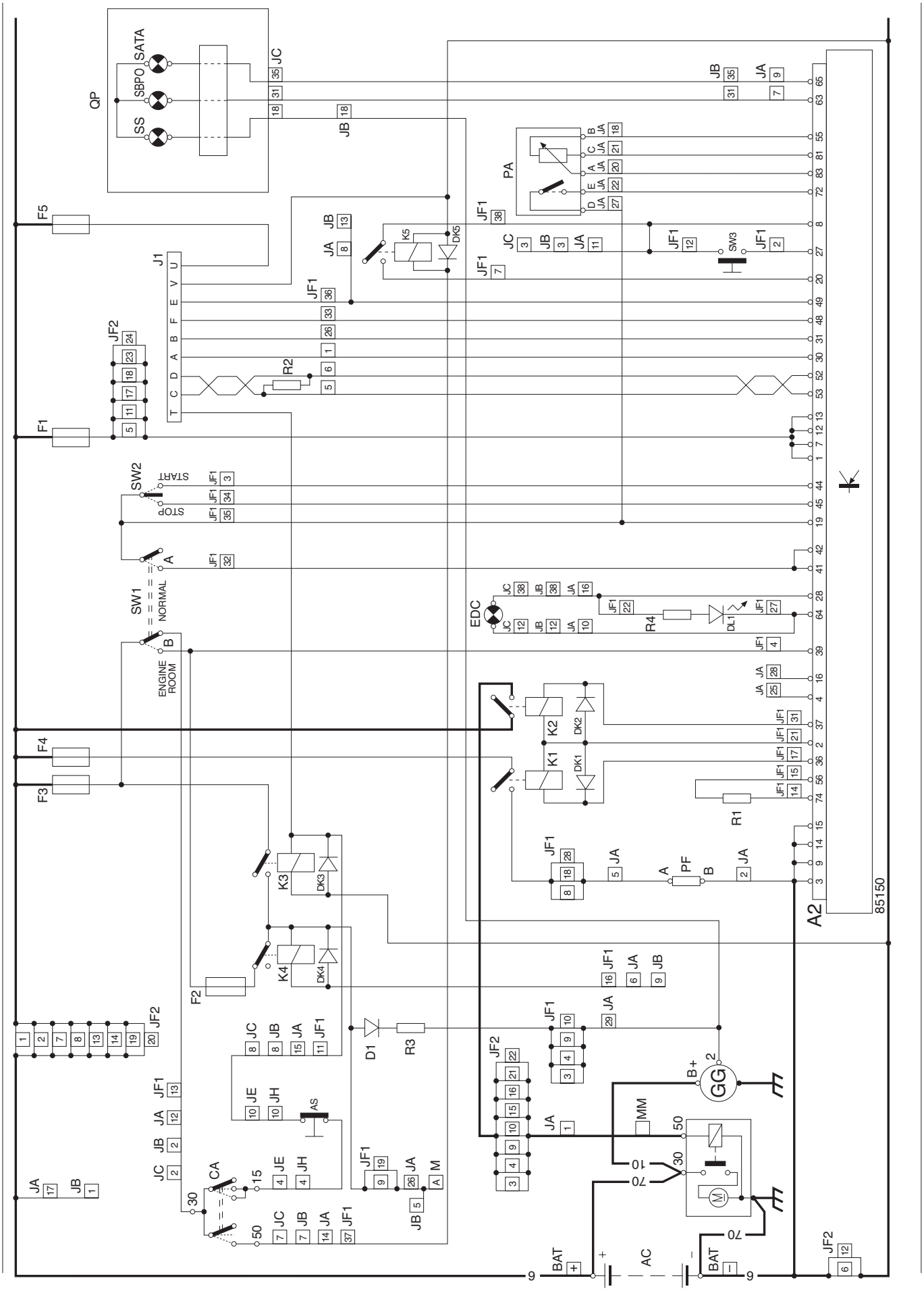
Figure 17



JF2 CONNECTOR
(view of the wire harness terminal, coupling side)

EDC connector A2

VERSION TO 10/2003



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SECTION 4

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REFERENCE VALUES

For wired sensors powered by the ECU

Component	ECU connection	Test conditions	Minimum - maximum value
Combustion air temperature sensor signal	A21 A29	Panel key ON	0,5 ÷ 4,5 Vcc
Coolant temperature sensor signal	A18 A36	Panel key ON	0,5 ÷ 4,5 Vcc
Fuel oil temperature sensor signal	A17 A34	Panel key ON	0,5 ÷ 4,5 Vcc
Flywheel position and rotation sensor signal	A24 A25	Engine running 600 giri/min	> 0,8 Vac
Camshaft position and rotation sensor signal	A23 A30	Engine running 600 giri/min	> 0,2 Vac
Combustion air absolute pressure sensor signal	A21 A28	Engine running 600 giri/min	0,9 ÷ 1,1 Vcc
Combustion air absolute pressure sensor power supply	A10 A21	Panel key ON	4,5 ÷ 5,5 Vcc
Fuel pressure sensor power supply	A12 A20	Panel key ON	4,5 ÷ 5,5 Vcc
Lubrication oil pressure sensor power supply	A9 A19	Panel key ON	4,5 ÷ 5,5 Vcc
Safety signal from throttle position sensor	A2-19 A2-72	Lever in position 0	> 4 Vcc
		Lever in position ≠ 0	< 1 Vcc
Throttle lever position sensor power supply	A2-55 A2-81	Panel key ON	4,5 ÷ 5,5 Vcc
Position signal from throttle position sensor	A2-83 A2-81	Lever in position 0	0,3 ÷ 0,5 Vcc
		Lever in position ≠ 0	> 3 Vcc

GUIDE TO BLINK CODE DIAGNOSING

Blink Code	EDC light	System reactions	Possible cause	Recommended tests or action	Notes
9.7 Sensor supply anomaly	On	Possible power reduction.	Electronic control unit fault.	Delete the fault memory and try again: if the error remains, call IVECO MOTORS and follow their instructions	Possible association with error codes of sensor powered by EDC central unit.

PREPARING THE ENGINE FOR LONG IDLE PERIODS

To prevent oxidation to the internal parts of the engine and to some components of the injection system, if idle periods exceeding two months are expected, the engine needs to be prepared **with six-months periodicity**, proceeding as follows:

1. Drain the lubricating oil from the sump, after heating the engine.
2. Pour 30/M protective oil (alternatively, oil conforming with MIL 2160B Type 2 specifications) into the engine to the "minimum" level marked on the dipstick.
   Start the engine and let it run for about 5 minutes.
3. Drain the fuel from the injection line and from the filter, taking care to avoid letting the fuel come in contact with the auxiliaries belt.
4. Connect the fuel line to a tank containing CFB protective liquid (ISO 4113) and assist the inflow of the liquid by pressurizing the line and turning the engine over for about 2 minutes, after excluding the operation of the injection system.The required operation may be carried out by directly polarizing the terminal 50 of the electric starter motor with positive voltage 12 V, using a conductor prepared for the occasion.
5. Nebulize 30/M protective oil at the rate of about 60 g (10 g per liter of displacement) into the turbocharger intake, while the engine is turning over as described above.
6. Close with suitable stoppers or seal with adhesive tape all engine intake, exhaust, aeration and venting ports.
7. Drain the residual 30/M protective oil from the sump; it may be re-used for 2 more engine preparation operations.
8. Apply tags with the inscription "ENGINE WITHOUT OIL" on the engine and onboard panel.
9. Drain the coolant, if it has not been mixed with antifreeze and corrosion inhibiting agents, affixing tags to indicate that the operation has been carried out.

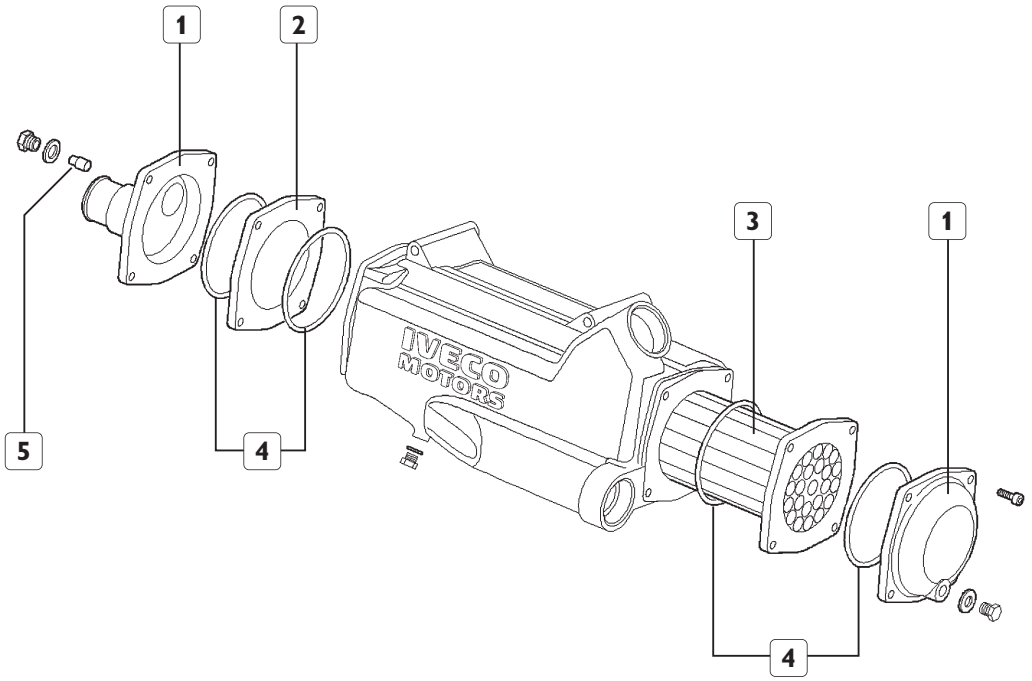
If external parts of the engine are to be protected, spray protective liquid OVER 19 AR onto unpainted metal parts, such as flywheel, pulleys and others; avoid spraying belts, connector cables and electrical equipment.

ENGINE'S FIRST START / RESTORING NORMAL OPERATING CONDITIONS

1. Drain the residual protective oil type 30/M from the sump.
2. Pour lubricating oil into the engine, as provided by the specifications and in the quantities set out in the Table of Refills.
3. Drain the CFB protective liquid from the fuel line, completing the operations set out in item 3 of ". PREPARING THE ENGINE FOR LONG IDLE PERIODS".
4. Remove the caps and/or the seals from the engine's intake, exhaust, aeration and vent ports, restoring normal operating conditions. Connect the turbocharger intake to the air filter.
5. Attach the fuel lines to the vessel's fuel tank, completing the operations set out in item 4 of ". PREPARING THE ENGINE FOR LONG IDLE PERIODS".
   During the filling operations, attach the fuel tank return pipe to a collecting container to prevent residues of CFB protective liquid from flowing into the vessel's fuel tank.
6. Verifiy the quantity of cooling liquid and refill as provided by the specifications.
7. Start the engine and keep it running until idling speed has completely stabilized.
8. Shut the engine down and delete the "errors" which may have been stored in the injection system ECU during the operation stabilization phases. For reset operation, see "Blink code" paragraph in Section 4.
9. Remove the tags with the inscription "ENGINE WITHOUT OIL" from the engine and from the panel.

CLEANING THE ENGINE COOLANT / SEA WATER HEAT EXCHANGER

Figure 11

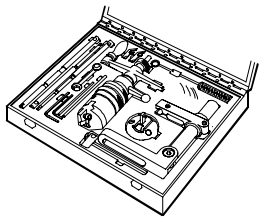
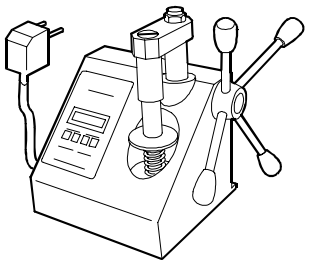
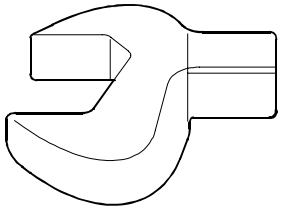
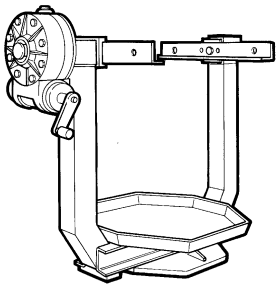
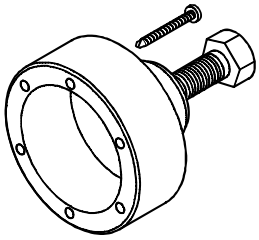
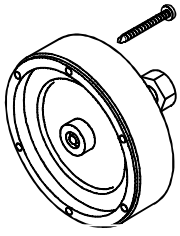


1. Cover - 2. Spacer - 3. Tube bundle - 4. Sealing rings - 5. Zinc sacrificial anode.

In order to guarantee a perfect operation of the heat exchanger, regularly clean the tube bundle. If the surfaces of the heat exchanger come into contact with salted water, they may be subjected to biological fouling and to hydrocarbon deposit which may be present in harbors' waters.

- ❏ Remove the tube bundle (3) from the exchanger body and immerse it for a few minutes in a solution prepared with water and a degreasing scale-remover detergent, observing the detergent manufacturer's directions for use. The cleansing solution should not damage copper, brass, aluminum and tin.
- ❏ Complete tube cleaning by rinsing thoroughly with fresh water, until detergent residuals are entirely removed.
- ❏ Reassemble the tube bundle (3) by correctly positioning spacer (2), sealing rings (4) and covers (1).
- ❏ Check the zinc anode corrosion level (5); replace the anode if corrosion exceeds 50% of the volume.

TOOLS

TOOL No.		DEFINITION
99305018		Kit for valve seat regrinding
99305047		Spring load tester
99317915		Set of 3 pin wrenches (14 - 17 - 19 mm)
99322205		Revolving stand for overhauling units (700 daN/m capacity, 120 daN/m torque)
99340055		Tool to remove output shaft front gasket
99340056		Tool to remove output shaft rear gasket

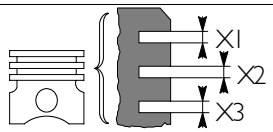
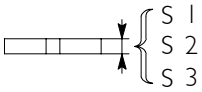
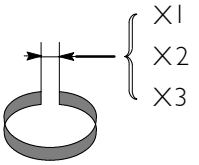
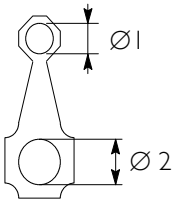
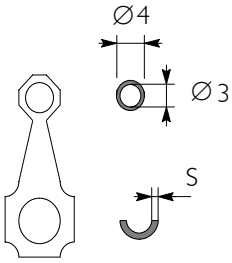
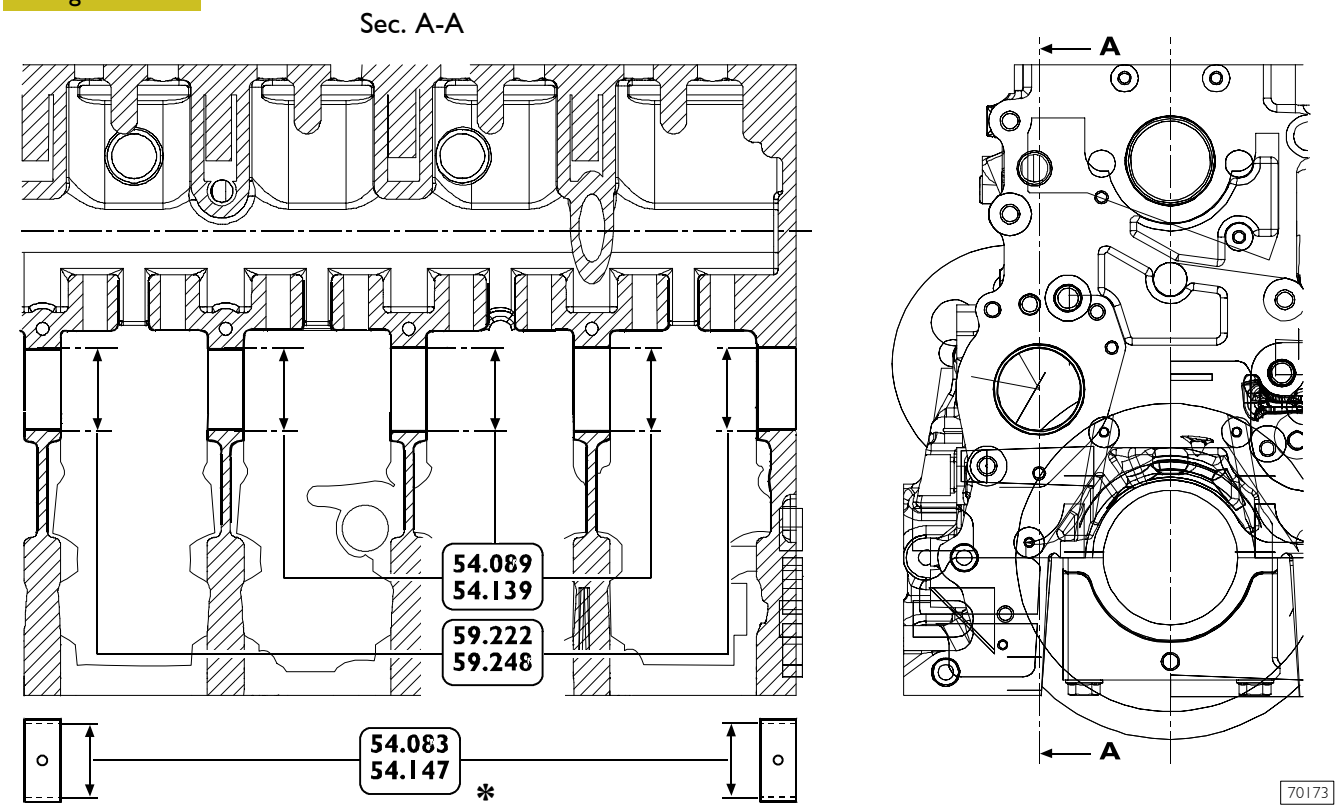
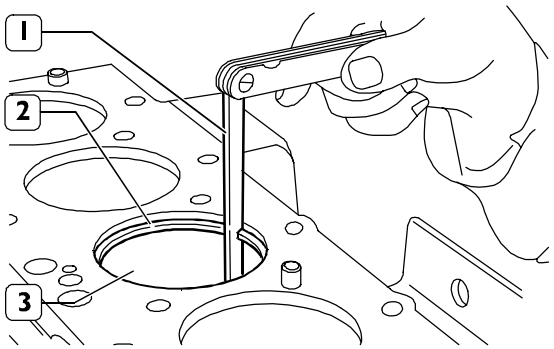
Type		6 CYLINDER
CYLINDER UNIT AND CRANKSHAFT COMPONENTS		**mm**
	Split ring slots X1* X 2 X 3	2.705 to 2.735 2.420 to 2.440 4.020 to 4.040
	Split rings S 1* S 2 S 3 * measured on 98 mm Ø	2.560 to 2.605 2.350 to 2.380 3.975 to 4.000
	Split rings - slots 1 2 3	0.100 to 0.175 0.040 to 0.900 0.020 to 0.065
IVECO PARTS >	Split rings	0.5
	Split ring end opening in cylinder barrel: X 1 X 2 X 3	 0.22 to 0.32 0.60 to 0.85 0.25 to 0.55
	Small end bush housing Ø 1 Big end bearing housing Ø 2	 42.987 to 43.013 72.987 to 73.013
	Small end bush diameter Outside Ø 4 Inside Ø 3 Spare big end half bearings S	 43.279 to 43.553 40.019 to 40.033 1.955 to 1.968
	Small end bush – housing	0.266 to 0.566
	Piston pin – bush	0.0362 to 0.0158
IVECO PARTS >	Big end half bearings	0.250 to 0.500

Figure 16



CAMSHAFT BUSH AND HOUSING MAIN DATA
* Value to be obtained after driving the bushes.

Figure 50

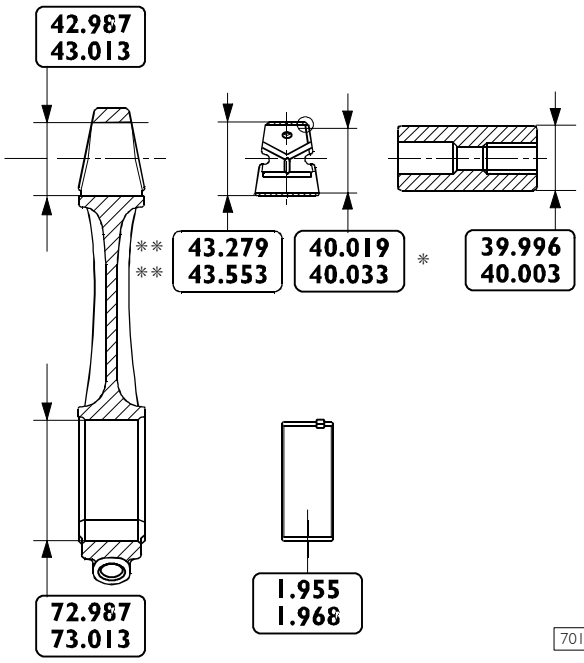


70194

Use feeler gauge (1) to measure the clearance between the ends of the split rings (2) fitted into the cylinder barrel (3).

Connecting rods

Figure 51



70195

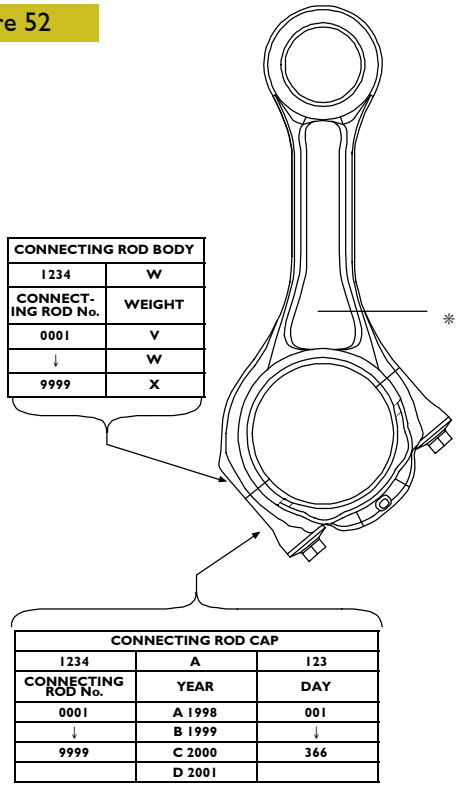
MAIN DATA FOR CONNECTING ROD, BUSH, PISTON PIN AND HALF BEARINGS

* Value for inside diameter to be obtained after driving in connecting rod small end and grinding.
** Value not measurable in released condition

CAUTION

The surface of connecting rod and rod cap are knurled to ensure better coupling.
Therefore, it is recommended not to smooth the knurls.

Figure 52



CONNECTING ROD BODY	
1234	W
CONNECT-ING ROD No.	WEIGHT
0001	V
↓	W
9999	X

CONNECTING ROD CAP		
1234	A	123
CONNECTING ROD No.	YEAR	DAY
0001	A 1998	001
↓	B 1999	↓
9999	C 2000	366
	D 2001	

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CAUTION

Every connecting rod is marked as follows:

- On body and cap with a number showing their coupling and the corresponding cylinder.
  In case of replacement it is therefore necessary to mark the new connecting rod with the same numbers of the replaced one.
- On body with a letter showing the weight of the connecting rod assembled at production:
  - V, 1820 to 1860 (yellow marking);
  - W, 1861 to 1900 (green marking);
  - X, 1901 to 1940 (blue marking);

Spare connecting rods are of the W class with green marking *.

Material removal is not allowed.

Bushes

Check that the bush in the connecting rod small end is free from scoring or seizing and that it is not loosen. Otherwise replace.

Removal and refitting shall be performed using the proper beater.

When refitting take care to make coincide the oil holes set on the bush with those set on the connecting rod small end. Grind the bush to obtain the specified diameter.

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