

IVECO aifo

8361

marine engine

M16

■ use and maintenance ■ uso e manutenzione ■ emploi
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uso y manutención

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ATTENTION: this engine, like all internal combustion engines, has components and fluids which reach very high operating temperatures, and is provided with moving pulleys and belts: approach with caution. It is the responsibility of the builder of the boat using an IVECO AIFO engine to optimize the application in terms of maximum end user safety.

FOREWORD

Before putting to work your newly acquired engine, read carefully all the instructions provided in this Manual.

You will find all the information needed to use engine efficiently and perform routine servicing correctly.

WARRANTY

To ensure best possible engine efficiency and take avail of warranty benefits you must follow scrupulously all the instructions provided herein.

Remember that failure to comply with or incorrect performance of recommended service operations will invalidate the warranty.

SPARES

To ensure best operation and efficiency of all engine components, always use exclusively genuine spare parts.

Orders should specify:

- Engine technical code and serial number
- Part number (See Spare Parts Catalog).

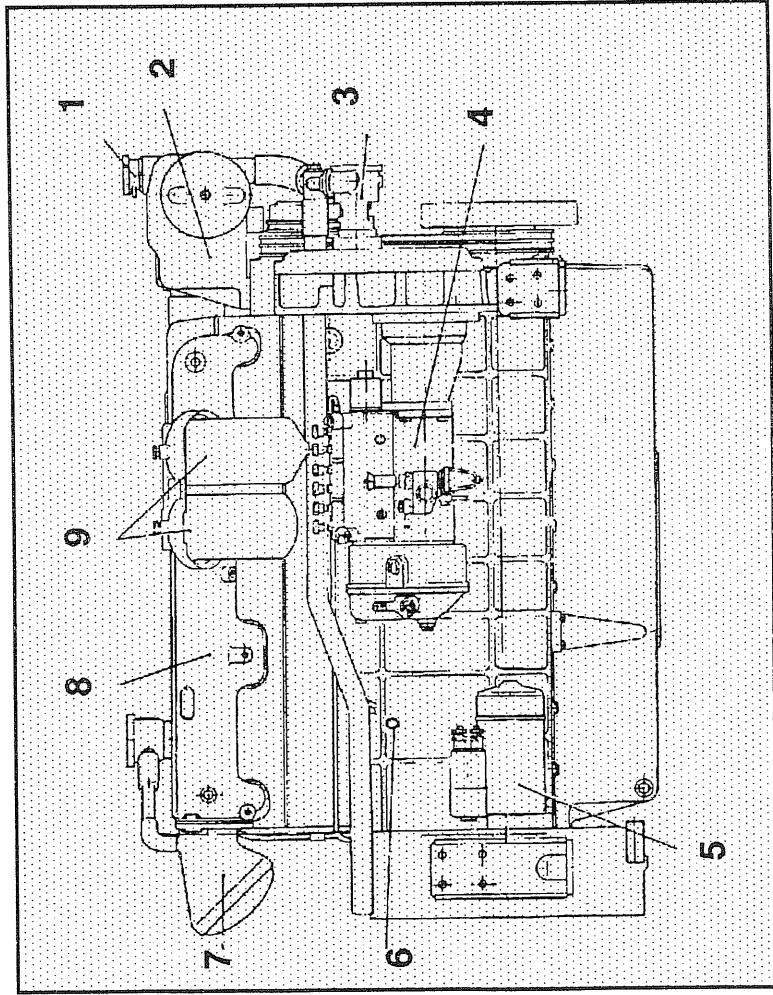
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ENGINE IDENTIFICATION DATA

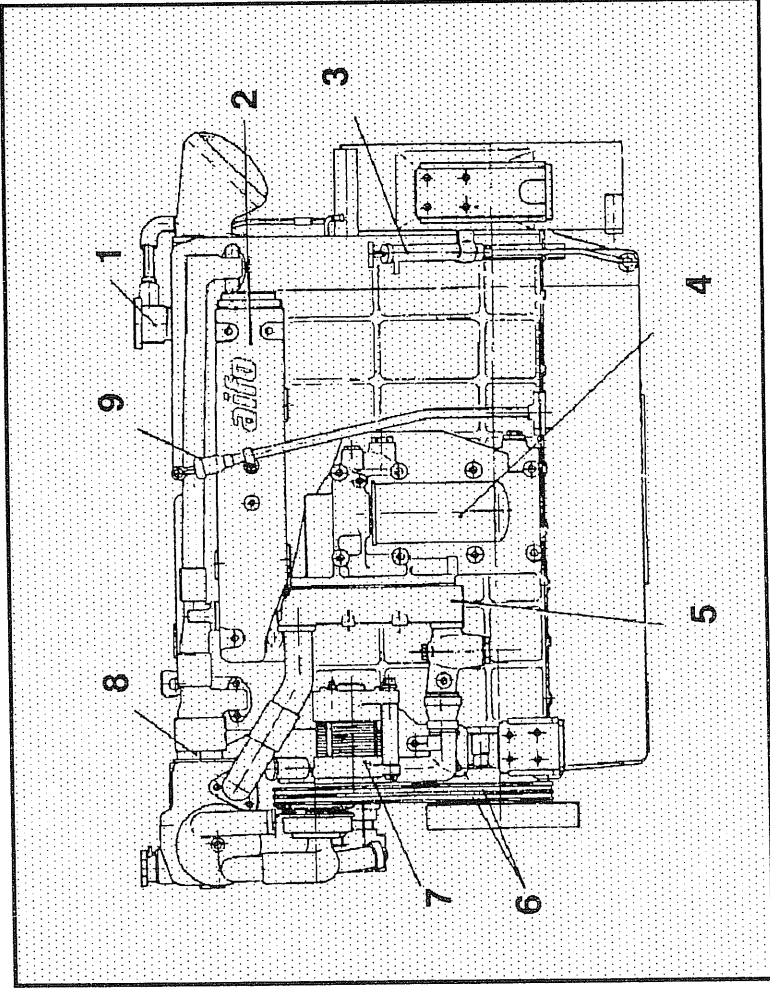
Engine technical code and serial number are punched on a plate located on the flywheel cover.

Note: Always specify engine technical code and serial number when ordering replacement parts and for after sales services.



Engine 8361M16 - Right hand view

- 1. Fresh water filler cap - 2. Fresh water-sea water heat exchanger - 3. Sea water pump - 4. Injection pump - 5. Starter motor - 6. Fresh water drain cock - 7. Air filter - 8. Intake manifold - 9. Fuel filters.



Engine 8361M16 -Left-hand view

- 1. Oil filler cap - 2. Exhaust manifold - 3. Oil extraction pump - 4. Oil filter - 5. Engine oil heat exchanger - 6. Water pump alternator drive belts - 7. Alternator - 8. Thermostat seat - 9. Oil dipstick.

ENGINE SPECIFICATIONS

Engine type	8361M16
4 - stroke Diesel with direct injection	
Cylinders, number and arrangement	6, in line
Bore x stroke	115x130 mm
Displacement	8,1 l
Compression ratio	17 : 1
Net power at flywheel (*):	
-Pleasure craft	118 kW (160 CV)
At	2600 rpm
-Light-duty commercial	107 kW(145 CV)
At	2400 rpm
- Continuous duty	96kW(130CV)
At	2300rpm
Engine rotation:	
(see from flywheel)	CCW
Dry weight (without marine gear)	~ 690 kg

(*) Net rating at flywheel according to ISO 3046-1

-Ambient reference conditions:

750mmHg; 25°C; 30% relative humidity

TIMING

Overhead valves controlled by pushrods and rockers with camshaft in crankcase.

Gear-driven camshaft.

Valve timing:

- Intake	
open: before T.D.C.	8 °
closes: after B.D.C.	60 °
- Exhaust	
opens: before B.D.C.	60 °
closes: after T.D.C.	8 °
Clearance between valve and rockers for timing checks	0,40 mm
Operating clearance between valves and rockers, cold engine:	
- intake	0,30 mm
- exhaust	0,50 mm

FUEL SYSTEM

Fuel filtration by replaceable cartridge filters and prefilter- settler supplied separately for installation by the customer.

Injection pump type Weber Altecna (Bosch lic.) with in line pistons and all-speed governor.

Fixed injection pump delivery start advance.....25 ° ± 1 °

Fuel injectors setting.....200 + 8 bar

Firing order..... 1-5-3-6-2-4

LUBRICATION

Forced-feed lubrication by gear-pump driven by crankshaft.

Pressure relief valve inserted in the circuit.

Total and continuous oil filtering by a replaceable cartridge filter.

Oil cooling with oil-fresh water heat exchanger.

Minimum oil pressure:

- at full throttle3,5 kg/cm²

- when idling0,8 kg/cm²

COOLING SYSTEM

Cooling by dual water circuit:

- The fresh water in the (closed) primary circuit, which cools the engine, the exhaust manifold and the engine oil, is cooled by the sea water in the secondary circuit (open) by means of a shell-and-tube water/water heat exchanger.

Water circulation by means of a centrifugal water pump with thermostat temperature control.

The fresh water is filtered by a rust and corrosion inhibiting PERRY-type filter.

- In addition to cooling the fresh water, the sea water in the secondary circuit also cools the marine gear oil.

Water circulation is provided by a selfpriming pump featuring a neoprene impeller.

Complete sea water circuit is protected from corrosion by replaceable sacrificial anodes.

STARTING

By starter motor.

ELECTRICAL SYSTEM

- Voltage24V(12V option)

- Self-regulated alternator 28V, 30 A

- Power of starter motor4 kW

- Battery (optional) 2, each Ah

MARINE GEAR (on request)

Hydraulic drive with integral thrust bearing and oil cooler.

- MPM 301A1

- MPM 301PL1

- TWIN DISC MG506-1

FILLUP DATA

Item	Quantity	Product
Water circuit	28 l kg	Water (1)
Engine sump and filters (total capacity)	24 l 18,5	Oil (3)
Engine sump only:		
- Min. level	10,5 l 9,5	
- Max. level (2)	16 l 14,5	
Fuel tank	-	Automotive Diesel oil (4)

1) Use water with 30% of FIAT PARAFLU 11 anti-freeze; use the same amount of anti-freeze even during the summer months to prevent corrosion.

As an option, products having similar-characteristics can be used, provided they comply with international standards SAE J 1034

2) This quantity relates to periodical oil changes.

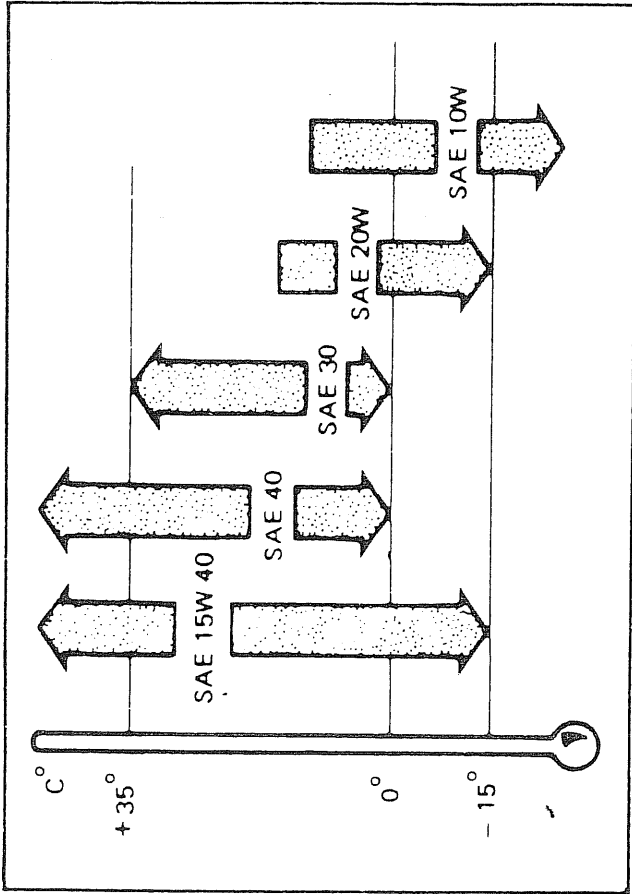
3) Recommended oil: Fiat Urania ° Oil, which meets all international MIL-L-2104 C Service API CD specifications.

Quality of oil requires in relation to outdoor temperature, see table.

4) For filling fuel tank use funnel with a very fine metal strainer to prevent filter clogging caused by impurities in the fuel.

MARINE GEAR OIL REQUIREMENTS

For the type of oil to use, and the quantities necessary, please refer to the handbook supplied by the Manufacturer.



Atmospheric temperature	FIAT Oil
Minimum below -15°C	URANIC ^C 10W (SAE 10W)
Minimum between -15°C and 0°C	URANIA ^C 20W (SAE 20W)
Minimum above 0°C	URANIA ^C 30 (SAE 30)
	URANIA ^C 40 (SAE 40)

URANIA^C 15W/40 (*)
(SAE 15W 40)

(*) Multigrade oil suitable for all seasons

RUNNING-IN (50 hours)

- After starting, slowly warm up the engine when running, without reaching full throttle.
- Do not run engine for a long period at full throttle.
- Check oil level frequently.

After the running- in period the following operations must be performed:

- replace the oil in the engine sump
- replace the oil filter cartridge
- replace the fuel pre-filter cartridge

STARTING UP

- Energize solenoid booster device.
- Shift the accelerator lever 3/4 of the way along its entire stroke.
- to start the engine, turn the ignition switch, releasing it as soon as the engine has started up.
- After having started up the engine, press down on the accelerator without reaching full throttle immediately.
- About one minute after starting, stop warming up the engine at the shipside and start the vessel moving at low speed: this is the only way to warm up the engine!

STOPPING THE ENGINE

Before turning off the engine, shift the accelerator control lever to minimum and allow the engine to idle at low speed for at least one minute.

BEFORE STARTING

When the engine has been out of action for long periods:

- check the level of the lubricants
 - bleed the air from the fuel circuit
 - check the condition of the impeller in the sea water pump filling it with water to prevent dry running when the engine is started.
- Dry running will damage the impeller irreparably.

Every day:

- check the level of the fuel, engine oil and fresh cooling water
- check to ensure that the air filter on the intake pipe is not clogged.
- Ensure sea water intake valve is open. Dry running of the sea water pump will quickly wear out the impeller.

PRECAUTIONS FOR PROPER ENGINE FUNCTIONING

Run engine from idle to full throttle and vice versa gradually to ensure satisfactory combustion and proper functioning of all components.

With a new vessel the top speed must be 50 - 100 rpm higher than the rated speed of the engine, measured when the vessel is loaded and with an appropriate propeller.

With an old vessel, the cruising speed must be at least 10% lower than the corresponding rpm at maximum power: the speed must be measured when the vessel is fully loaded.

When the engine is running make sure that:

1- Fresh cooling water temperature are maintained normal.

If temperature is excessive, check:

- a) vee-belt tension on water pump-alternator
 - b) proper functioning of thermostat,
 - c) heat exchanger, cleaning condition,
 - d) unrestricted sea water circulation.
- 2) correct oil pressure

COLD CLIMATE PRECAUTIONS

When temperatures approximate 0°C , make sure water is mixed with proper amount of FIAT Parafiu 11 which prevents oxidation, corrosion, foaming, fouling and freezing down to -20°C with Parafiu 11 admixed to 30%.

Do not remove the fluid in the other seasons but renew it every 3 years.

Even if the engine is used in hot seas, it is recommended to mix the water with Fiat Parafiu 11 fluid in order to ensure good protection against the formation of calcareous deposits already on initial filling.

EXPANSION TANK

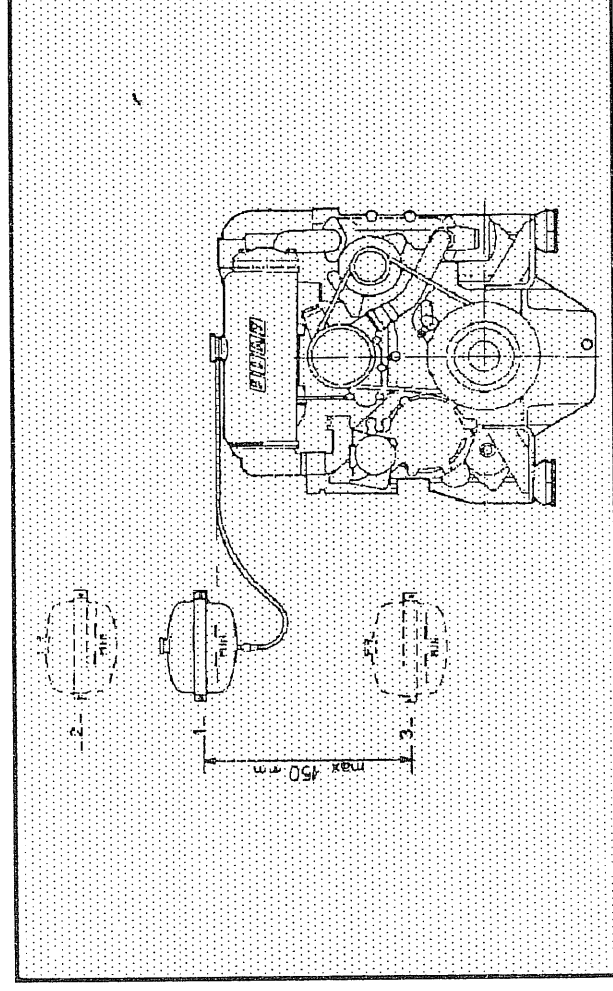
With the engine is supplied an expansion tank (loose) made of transparent plastic having the function to keep always the water mixed with anti-freeze liquid over the heat exchanger tubes.

It is compulsory to fit this tank to assure a good engine running.

The installation positions recommended are the no.1 and 2. The no.3 position is admitted as an exception on condition that the dimension "Max 150mm" is respected.

The scheme shows the dimensions of the plastic tube type CAMS-BENZ \emptyset 7x12mm to use for the connection tank-heat exchanger. We underline that the liquid level in the tank has not exceed the "Min" to allow the water expansion when the engine is warm.

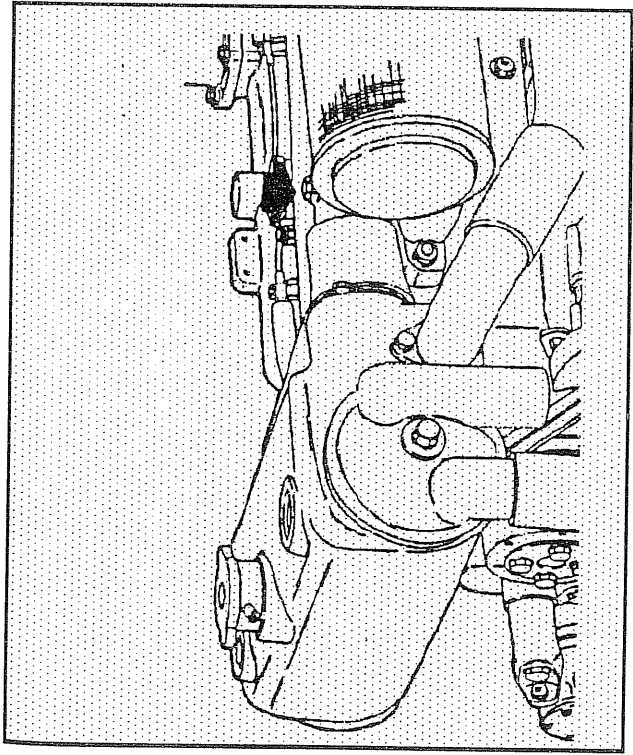
Control periodically the seals between the heat exchanger and the expansion tank.



BLEEDING THE AIR FROM THE COOLING WATER CIRCUIT (AT EACH REFILLING)

The air bleeding is manually by means of the plug above the thermostat inlet elbow (see illustration).

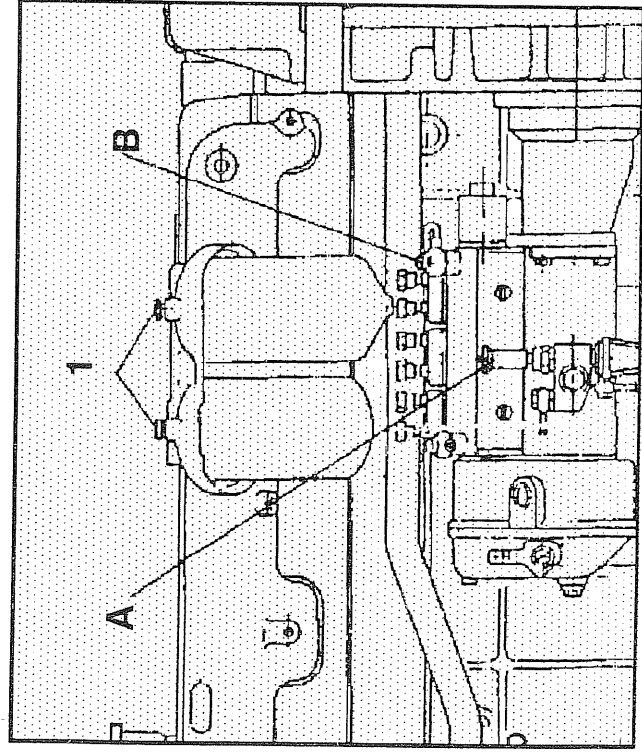
IMPORTANT: fill the circuit gradually in order to allow the automatic bleeding system to operate correctly.



BLEEDING FUEL SYSTEM

Loosen fuel filters bleed plugs (1), unscrew knob A of pump and stroke it repeatedly; when the fuel flows without containing air bubbles, tighten plugs. Proceed in same way to bleed the fuel injection pump slightly loosening the connector B of the fuel return line to the tank.

When the fuel flows without air bubbles, tighten the connector.

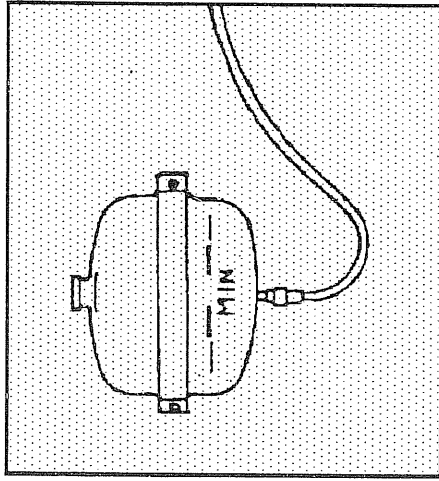


ROUTINE MAINTENANCE

Operations	Daily	Every 100 h	Every 200 h	Every 400 h	Every 800 h	Every year
Checking sump oil level	●					
Checking fresh water level	●					
Checking oil level in marine gear	●					
Draining water from the fuel prefilter		●				
Changing engine sump oil			●			Y
Checking drive belt tension and hose clamps			●			Y
Checking sacrificial anodes for corrosion			●			Y
Changing fuel pre-filter			M			Y
Changing fuel filter cartridges			M			Y
Checking battery electrolyte level and charge			●			Y
Changing oil filter cartridge				●		Y
Checking valve clearance				●		
Checking fuel injector setting					●	Y
Cleaning and checking alternator and starter motor					●	Y
Checking condition of impeller in sea water pump					●	Y
Changing oil in marine gear				●		Y

M = Maximum operating time with high quality fuel.

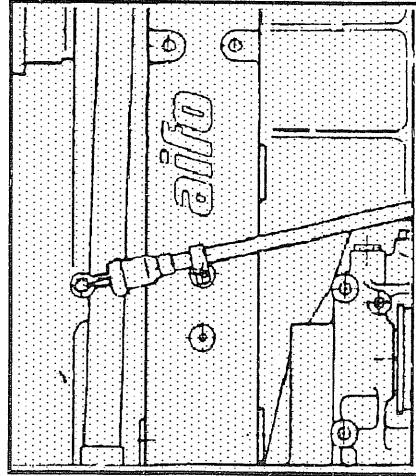
Y = Operations to be accomplished at least every year regardless of operating hours.



CHECKING FRESH WATER LEVEL

With engine cold check water level in expansion tank and top up as necessary.

This level must not exceed the mark "Min".



CHECKING SUMP OIL LEVEL

Check and top up if necessary the sump oil level.

This level must always be between the dipstick marks Min and Max.

CHECKING OIL LEVEL IN MARINE GEAR

Check oil level in marine gear using dipstick and top up, if necessary.

The level must not exceed the mark "Max" on the dipstick

N.B.: Check level with engine running at idle.

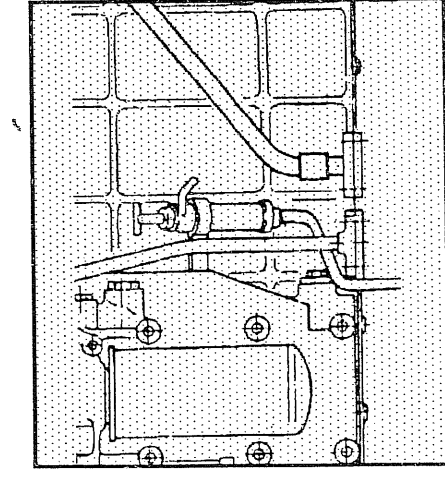
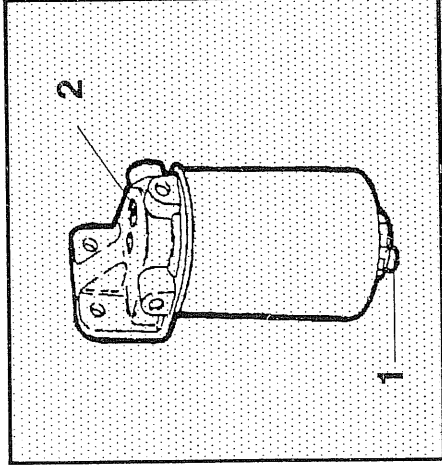
The first oil change must be performed after the first 50 hours of operation.

CHECKING AND DRAINING THE WATER FROM THE FUEL PREFILTER

Check to see how much water there is in the prefilter and when necessary drain it off by turning the ring nut (1), (see the figure) beneath the filter and screwing it up again when the fuel coming out contains no water.

In order to perform the above operation it may be necessary to loosen the screw (2) very slightly.

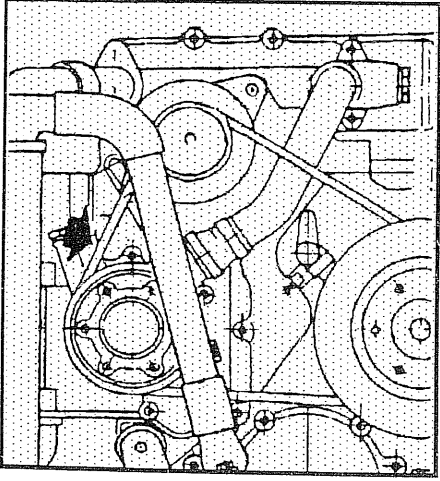
At the end of the operation screw the cap and the ring nut back on, remembering that it may be necessary to bleed the air from the fuel circuit.



CHANGING OIL IN ENGINE SUMP

Drain oil with engine hot by priming the system and filling fresh oil according to table.

When engine is new, make first oil change after the first 50 hours of operation.

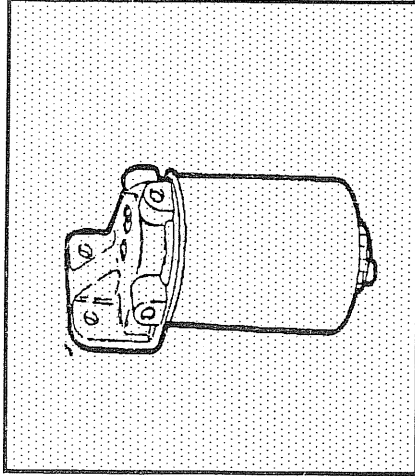


CHANGING DRIVE BELT TENSION AND CONDITIONS

Check belt tension: give at arrow must be 1 to 1.5 cm with a pressure of 10 Kg.

To increase tension of the water pump driving belts:

- Unloose alternator check nuts.
- Move alternator outward and retighten nuts.



CHECKING SACRIFICIAL ANODES FOR CORROSION

Make sure sacrificial anodes for protecting the complete seawater circuit are not corroded by more than 50% ($\geq 15\text{mm}$); otherwise they must be replaced.

CHANGING THE FUEL PREFILTER

Change the filter cartridge, taking care to fit the new one already filled with fuel in order to facilitate the bleeding.

Bleed the air.

N.B.: Make sure that the new cartridge is of the same type as the old one.

REPLACING THE FUEL CARTRIDGE FILTER

Replace the filter cartridges, making sure that the new ones are already full of fuel in order to facilitate bleeding operations.

Bleed the air.

N.B.: Make sure that the new cartridges are of the same type as the old ones.

CHANGING OIL FILTER CARTRIDGE

Do not exceed the specified limit. With plugged filter all the oil in the circuit is no longer filtered.

On a new or overhauled engine replace the cartridge after the running-in period.

N.B: Make sure that the new cartridges is of the same type as the old ones.

CHECKING BATTERY ELECTROLYTE LEVEL AND CHARGE

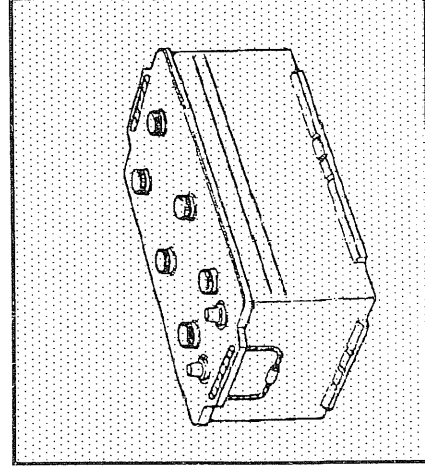
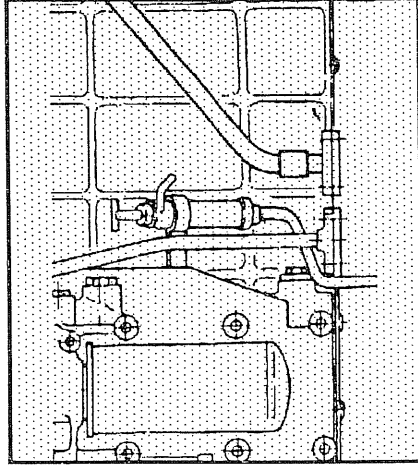
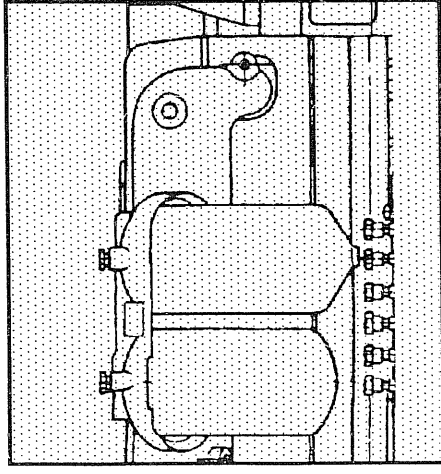
With the batteries rested and cold remove the plugs and make sure that the electrolyte level lies between the Min and Max limites.

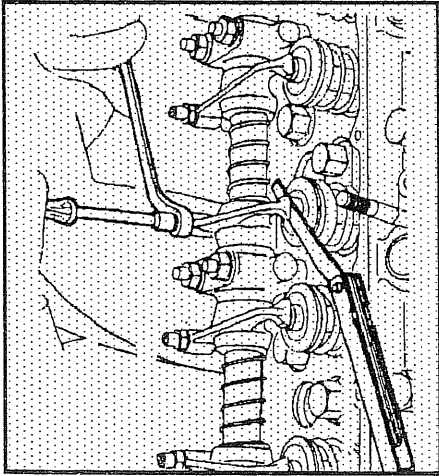
Top up with distilled water if necessary.

Check more often in summer.

If the engine is to remain at standstill check the level once every month and recharge the batteries if required.

Check that the terminals and terminal clamps are clean, tight, and protected with vaseline oil. If "no-maintenance" batteries are used the level of the electrolyte need not be checked so often.





CHECKING VALVE CLEARANCE

The operating clearance between valves and rockers should be 0.30 mm for the inlet and 0.50 mm for the exhaust. Adjust the clearance when the engine is cold by means of the screw with stop nut located on the head of each rocker.

New engines should be checked after the first 200 hrs of operation.

Apart from the prescribed periods, the clearance only requires checking if the rocker cover is unusually noisy.

CHECKING FUEL INJECTION SETTING

Remove fuel injectors from cylinder heads and have them cleaned. This job must be carried out by a trained mechanic using special tools.

An efficient fuel injector must have the following requirement:

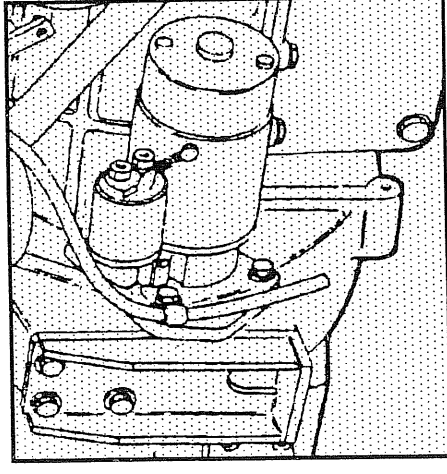
- each nozzle hole must produce a jet;
- each jet must be regular and efficient;
- each nozzle hole must produce the specified spray pattern;
- fuel injector must neither leak or dribble;
- fuel injector needle must lift only at setting pressure.

When reassembling fuel injectors torque the nuts of the fixing brackets with a torque wrench to 2.3 kgm.

IT IS IMPORTANT that fuel injector maintenance is accomplished by a trained mechanic using the proper tools so as not to detriment proper functioning.

CLEANING AND CHECKING ALTERNATOR AND STARTER MOTOR

Carefully clean the alternator slip rings and the starter motor commutator, check the wear and contact of the brushes and, if necessary, replace the brush-holders as such. Make sure that the new parts are of the same make as those replaced.

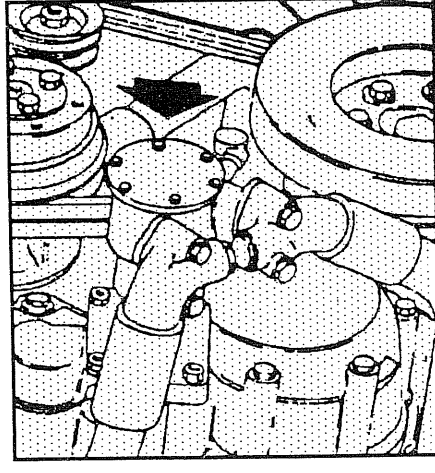


CHECKING CONDITION OF IMPELLER IN SEA WATER PUMP

Remove cover from pump, extract neoprene impeller and make sure that it is neither cracked, chipped nor showing signs of excessive wear, otherwise it must be replaced.

When mounting the impeller grease it with vaseline to stop it breaking when the engine is first started up.

Make sure to fill the pump with water to prevent damage due to dry running of impeller.



CHANGING OIL IN THE MARINE GEAR

To change the oil and, when necessary, the filter, consult the handbook for the marine gear.

SPECIAL MAINTENANCE

Introduction: The operations indicated in special maintenance have no given frequency since they are necessary whenever the engine is not functioning properly and must only be carried out by skilled engine maintenance mechanics.

Operations	Page
Valve regrinding and cylinder head bolt torque requirement	22
Torque requirement for main engine components	22

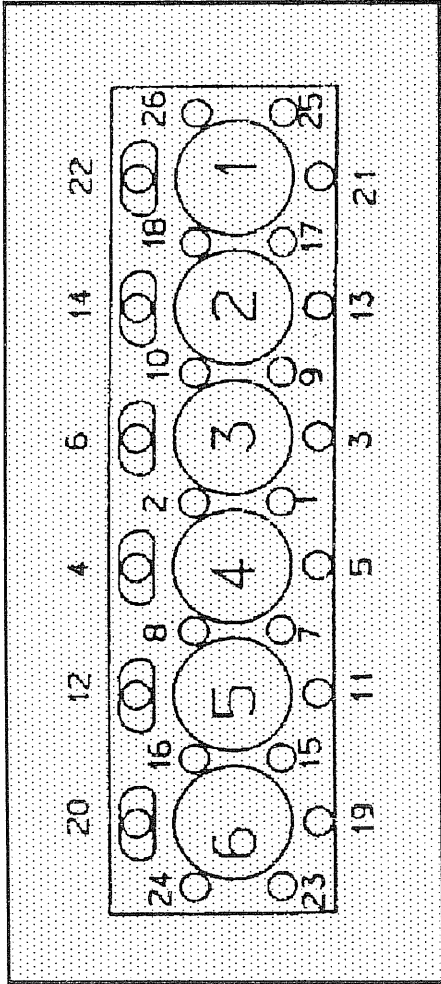
VALVE REGRINDING AND CYLINDER HEAD BOLT TORQUE REQUIREMENTS

Should the compression of a cylinder be lacking disassemble cylinder head from the cylinder block and dress the valve seats and valves.

When bolting the cylinder head, clean thoroughly the contact faces and fit the head gasket as described:

- position the gasket to the block and make sure the ALTO (high) writing on it is brought to contact the cylinder head.

Note: Torquing down of the cylinder head bolts should be performed in four steps (a 15 sec. step-to-step interval is needed). Strictly comply with the operation sequence indicated in the figures and on table here below.



Step	1	2	3	4
	Pre-torque	Pre-torque check	Torque angle	
All models	88 Nm (9 kgm)	88 Nm (9 kgm)	90°	90°

TORQUE REQUIREMENTS FOR MAIN ENGINE COMPONENTS

Big end cap	4,1 Kgm + 35°
Journal cap	5,6 Kgm + 75°
Nut securing pulley hub/vibration damper	57 Kgm
Bolt securing flywheel(*)	10 Kgm + 60°

(*) Use Loctite type 576 HVX

LONG INACTIVITY INSTRUCTIONS

When the engine is to be taken out of service for lengthy periods, it must be protected from corrosion and damage by proceeding as follows:

- On new engines, carry out operations as indicated in Preservation.
- On engines already in operation, carry out operations as indicated in Purging and Preservation.

5. Take off the neoprene impeller of the sea water pump, wash it and grease with vaseline oil.

6. Do not remove the fresh water from the engine to avoid introducing additional calcareous deposits. Make certain that the system is protected from the dangers resulting from frost (see paragraph Fillup data).

7. Make certain that the entire sea-water circuit is drained.

N.B.: Failure to lubricate the injection pump with CFB fuel could result in seizure of important parts of the pump itself, with consequent dangerous racing of the engine when starting up after prolonged periods of inactivity.

PURGING

1. Drain engine oil and refill with oliofiat L20 for purging.
2. Run engine at moderate speed for 5 minutes, shut down and drain purging oil.

PRESERVATION

1. Protect the engine by filling the oil sump up to the normal level with OLIOFIAT PROT 30/M and letting the engine run idle for 10 minutes on FIAT CFB fuel which serves to protect the components of the injection system; then stop the engine and drain off all the oil.
2. Bleed the fuel tanks to eliminate any water present.
3. Loosen alternator Vee-belts.
4. Close off all access ports to internal parts of the engine (breather port, air filter, exhaust muffler, oil level detector, etc.) using wax paper and adhesive tape.

INSTALLATION REQUIREMENTS

ENGINE MOUNTING

For greater comfort the engine should be installed on elastic suspensions, with elastic inserts between the keelsons and the base of the engine.

In this way the thrust of the propeller is supported by inserts which are able to withstand tangential thrust or by thrust bearings on the shafting.

INCLINATION

The engine must be installed as horizontally as possible; this is made possible by the use of marine gears with output shafts at an angle.

The maximum slant admitted for normal operation of the engine is:

16° longitudinal

- 20° transversal

SEA WATER CIRCUIT

Sea water intake: this must be of a suitable type to prevent the entry of foreign objects into the intake piping. A strainer must be inserted between the intake and the piping in conjunction with suitably dimensioned sacrificial anodes designed for facilitated replacement. The sea water circuit of the engine must be fitted out with protective anodes for regular replacement.

The pipe connected to the engine seawater intake must have an internal diameter for at least 40mm (this may vary according to the distance between the engine and the seawater intake) in order to ensure that the maximum loss of pressure on intake is kept under 0.5 m w.c.

The rubber sleeves located along the piping must be sufficiently rigid so as not to restrict the flow by collapsing. Suitable shutters which will close in case of emergency or lengthy halts must be inserted between the sea water intake and the sea water pump of the engine.

- Sea water outlet: for sea outlet connection, see paragraph Exhaust gas pipes if water is mixed with the exhaust gases.

FUEL PIPES

Fuel supply and fuel return pipes connecting the tank must be made in 10mm x 8 mm dia. copper with a flexible section for isolating vibration from the piping fixed to the engine. Fuel injector drains can be connected with a flexible piping to the fuel return line or directly to the fuel tank.

The fuel tank should be positioned at a lesser height than that of the injector drainage (should this not be possible, a maximum height of 1.5m is permissible), and as near as possible to the height of the injection pump, bearing in mind that the maximum intake height of the fuel pump, which is incorporated in the latter, is 800mm, otherwise an auxiliary fuel pump and a corresponding auxiliary fuel pump and a corresponding auxiliary tank must be provided.

A fuel strainer must be located as near as possible to the tank in the intake line.

The fuel-return pipe from the pump to the tank must terminate in the proximity of the tank's bottom so as to avoid defusing the circuit when the engine is shut off.

N.B.: Should it be necessary to fit a thermostat (used for very cold climates), the injector drainage system should be connected to the thermostat.

The thermostat return pipe to the tank must be separate from that of the injection pump and must lead up the upper part of the tank.

BREATHER PIPE

The oily vapour emitted by the breather pipe is conveyed over the air intake filter, thereby recycling the oil vapour and automatically dampening the filter.

INTAKE AND VENTILATION AIR

In the engine room an air flow of the following capacity must be assured: 650 m³/h for intake and 1600 m³/h for the engine ventilation.

Note: Special requirements not covered by the Installation requirements must be considered and approved as the case may be.

IVECO aifo **DIESEL ENGINES**

IVECO AIFO S.p.A. - 20010 Pregnana M. (Italy) - Tel. 02/93269.1 - Fax 93292029 - Telex 35.23.28 AIFO I
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IVECO AIFO FRANCE S.A. - CHASSIEU 69680 (France) - Tel. 7.8901715 - Fax 78905990 - Telex 900873 AIFO F
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