

**IVECO aifo**

**8210**  
**marine engines**  
**M22 - SRM36**

■ use and maintenance ■ uso e manutenzione ■ emploi  
et entretien ■ Betriebsanleitung ■ uso y manutención

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**IVECO aifo**

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**ENGLISH**

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..... 29

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..... 57

**DEUTSCH**

..... 85

**ESPAÑOL**

..... 115

**use and maintenance**  
**uso e manutenzione**  
**emploi et entretien**  
**Betriebsanleitung**  
**uso y manutención**

IVECO AIFO S.p.A. reserves the right to introduce, at any time and without obligation to update this publication, possible modifications of components or in the supply of accessories consequent to product qualitative evolution and constant search for improvement. For this reason, information and data contained in this publication are intended to be indicative and not binding.

**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).

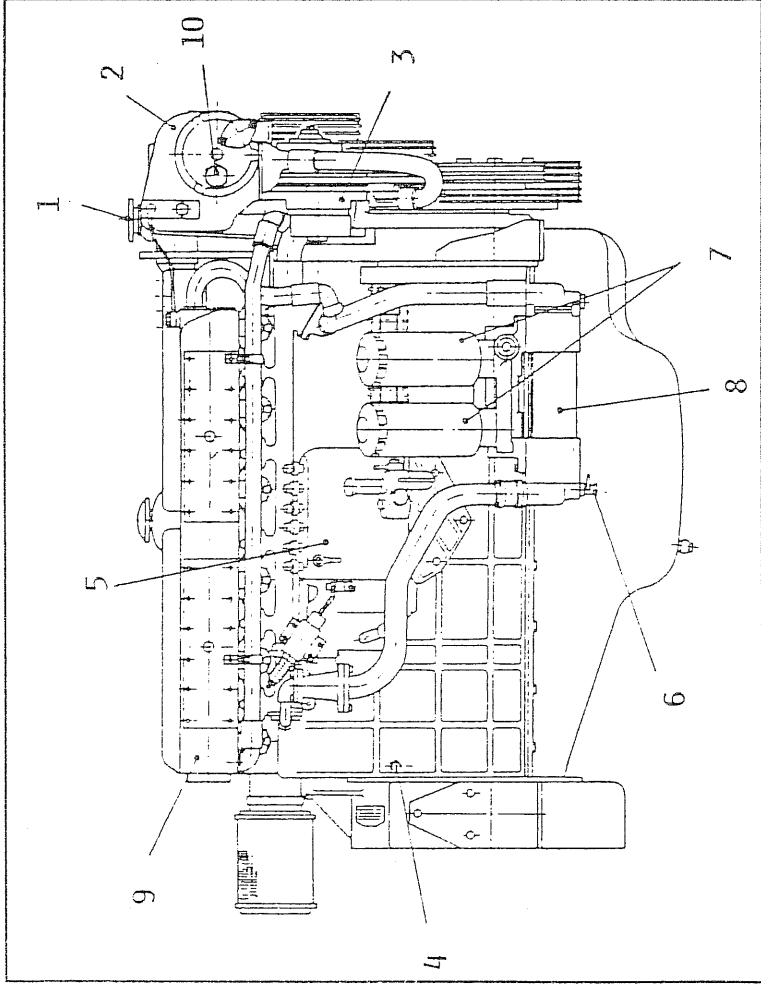
## TABLE OF CONTENTS

	Page
Engine identification data .....	2
Engine description 8210M22 .....	3
Engine description 8210SRM36 .....	4
Engine specifications 8210M22 .....	5
Engine specifications 8210SRM36 .....	7
Fillup data .....	9
Routine maintenance .....	15
pecial maintenance .....	23
Long inactivity instructions .....	25
Installation requirements .....	26

## ENGINE IDENTIFICATION DATA

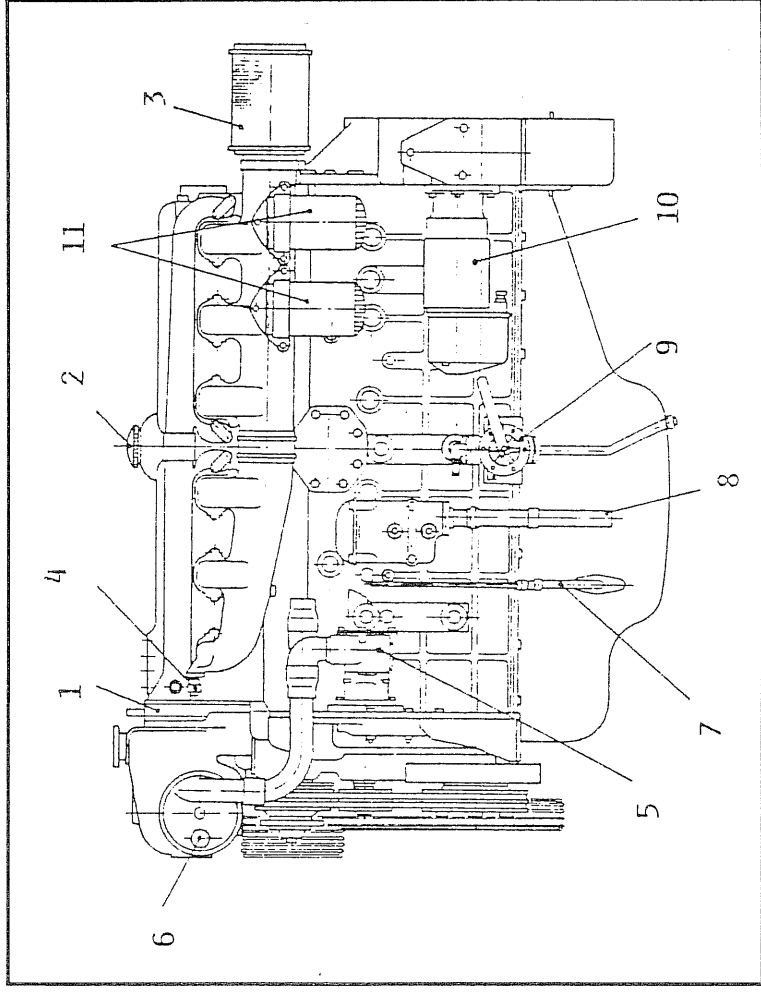
Engine technical code and serial number are punched on a plate located on the flywheel cover.

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



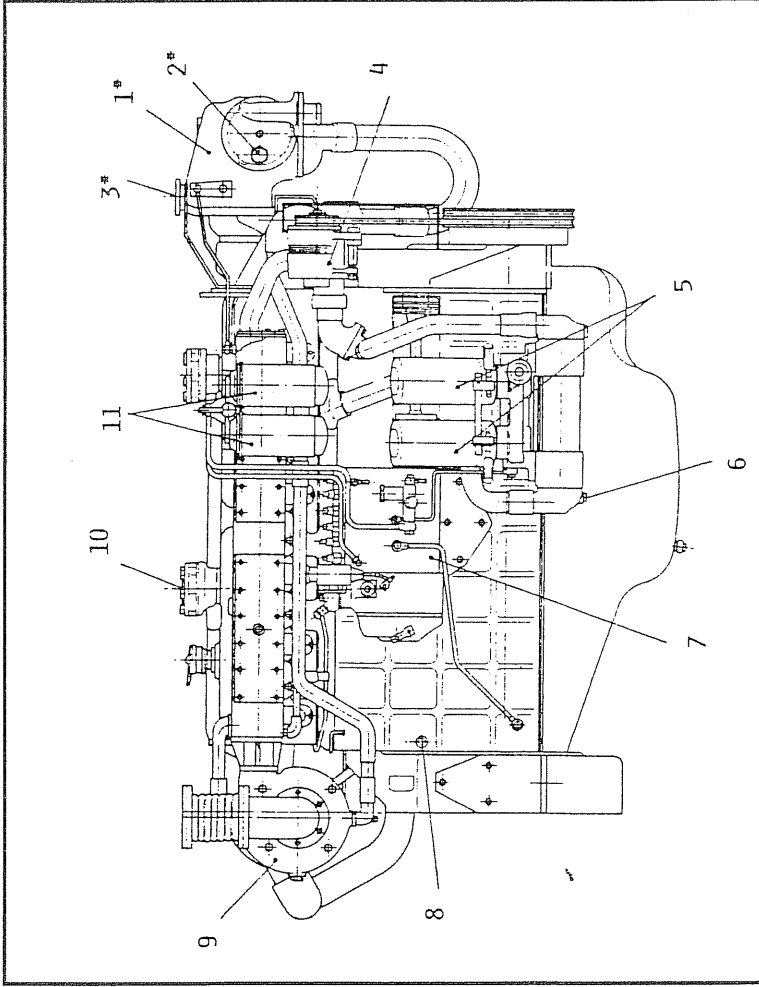
**Engine 8210M22 - Right hand view**

1. Fresh water filler cap - 2. Raw water - Fresh water heat exchanger - 3. Alternator - 4. Fresh water drain plug - 5. Injection pump - 6. Fresh water drain cock - 7. Oil filters - 8. Engine oil heat exchanger - 9. Exhaust manifold - 10. Sacrificial anode.



**Engine 8210M22 - Left-hand view**

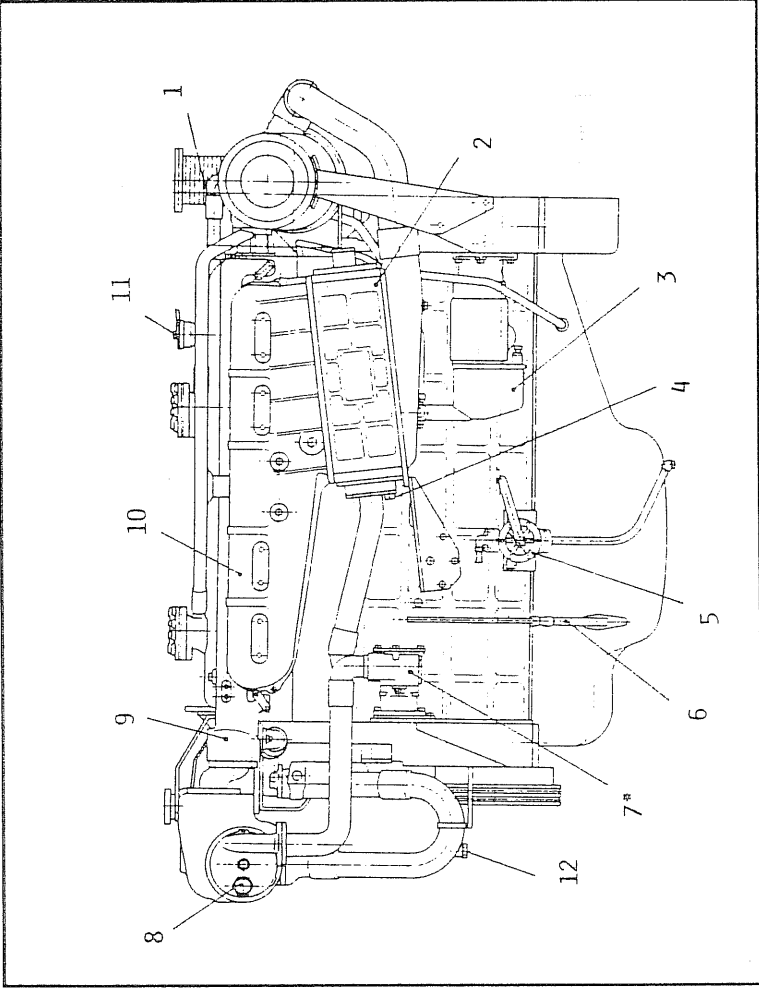
1. Thermostat socket - 2. Oil filler cap - 3. Wet air cleaner - 4. Air filter restriction indicator - 5. Raw water pump - 6. Sacrificial anode - 7. Oil dipstick - 8. Engine breather - 9. Oil drain pump - 10. Starter motor - 11. Fuel filters.



**Engine 8210SRM36.10/30 (\*) - Right-hand view**

1. Raw water - Fresh water heat exchanger - 2. Sacrificial anode - 3. Fresh water filler cap - 4. Alternator - 5. Oil filters - 6. Water drain plug from heat exchanger - 7. Injection pump - 8. Fresh water drain plug - 9. Turbocharger - 10. Engine breather - 11. Fuel filters.

(\*) Items not included in the version 8210SRM36.30 (Keel cooling).



**Engine 8210SRM36.10/30(\*) - Left-hand view**

1. Air bleeding plug - 2. Air water heat exchanger - 3. Starter motor - 4. Raw water drain plug from heat exchanger - 5. Oil drain pump - 6. Oil dipstick - 7. Raw water pump - 8. Sacrificial anode - 9. Thermostat socket - 10. Intake manifold - 11. Oil filler cap - 12. Fresh water drain plug.

## ENGINE SPECIFICATIONS

Engine type	8210M22
4 - stroke Diesel with direct injection	
Cylinders, number and arrangement	6, in line
Bore x stroke	137 x 156 mm
Displacement	13.8 l
Compression ratio	16 : 1
Net power at flywheel (*):	
-Continuous duty	162kW (220 CV)
At	2200 rpm
Engine rotation:	
(see from flywheel)	CCW
Dry weight (without marine gear)	~ 1130 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.	16 °
closes: after B.D.C.	52 °

- Exhaust	
opens: before B.D.C.	58 °
closes: after T.D.C.	18 °
Clearance between valve and rockers for timing checks	0.55 mm
Operating clearance between valves and rockers, cold engine:	
- intake	0.30 mm
- exhaust	0.40 mm

## FUEL SYSTEM

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

Fuel supply by double diaphragm pump.

Injection pump type Weber Altecna (Bosch lic.) with in line plungers; all-speed governor and piston fuel feed pump.

Fixed injection pump delivery start advance 22 ° ± 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 two full-flow replaceable cartridge filters.

Oil cooling with oil-fresh water heat exchanger.

Minimum oil pressure:

- at full throttle	4 - 5.5 kg/cm <sup>2</sup>
- when idling	1.5 kg/cm <sup>2</sup>



## COOLING SYSTEM

Cooling by dual water circuit:

- The fresh water in the (closed) primary circuit, which cools the engine 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.

- In addition to cooling the fresh water, the sea water in the secondary circuit also cools the exhaust manifold and 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

- Voltage ..... 24V
- Self-regulated alternator ..... 24V, 30 A
- Power of starter motor ..... 6.6 kW
- Battery (optional) ..... 2, each 190 Ah

## MARINE GEAR (on request)

Hydraulic drive with integral thrust bearing and oil cooler.

- T.D. MG 509
- P. à.M .NFB
- ZF-MPM 320
- ZF-MPM 350P

## ENGINE SPECIFICATIONS

Engine type ..... 8210SRM36  
 4 - stroke Diesel with direct injection  
 Cylinders, number and arrangement..... 6, in line  
 Bore x stroke..... 137 x 156 mm  
 Displacement ..... 13.8 l  
 Compression ratio ..... 16 : 1  
 Net power at flywheel (\*):  
 Light-duty commercial ..... 265 kW (360 CV)  
 At ..... 1800 rpm  
 Engine rotation:  
 (see from flywheel) ..... CCW  
 Dry weight (without marine gear).....  
 - 8210SRM36.10 ..... ~ 1290 Kg  
 - 8210SRM36.30 ..... ~ 1265 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. .... 16 °  
 closes: after B.D.C. .... 40 °

- Exhaust  
 opens: before B.D.C. .... 58 °  
 closes: after T.D.C. .... 18 °  
 Clearance between valve and rockers for timing checks ..... 0.55 mm  
 Operating clearance between valves and rockers, cold engine:  
 - intake ..... 0.30 mm  
 - exhaust ..... 0.40 mm

## FUEL SYSTEM

Fuel filtration by replaceable cartridge filter and prefilter-settler supplied separately for installation by the customer.  
 In-line fuel injection pump type WEBER-ALTECNA Bosch lic. with all speed mechanical governor, and piston fuel pump.  
 Boost control (LDA) on injection pump.  
 Pump lubricated with engine oil.  
 Fixed injection pump delivery start advance ..... 22° ± 1°  
 Fuel injectors setting ..... 250 + 8 bar  
 Firing order ..... 1-5-3-6-2-4

## TURBOCHARGING

The engine is supercharged by turbocharger driven by the exhaust gases.  
 Cooling intake air with air-water heat exchanger.  
 The turbocharger is lubricated with the engine oil under pressure.

## LUBRICATION

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

Pressure relief valve inserted in the circuit.

Total and continuous oil filtering by two full-flow replaceable cartridge filters.

Oil cooling with oil-sea water heat exchanger.

Minimum oil pressure:

- at full throttle ..... 4 kg/cm<sup>2</sup>

- when idling ..... 1.5 kg/cm<sup>2</sup>

## STARTING

By starter motor.

## ELECTRICAL SYSTEM

- Voltage ..... 24V

- Self-regulated alternator ..... 28V, 40 A

- Starting motor power ..... 6.6 kW

- Battery (optional) ..... 2, each 176 Ah

## COOLING SYSTEM

Cooling by dual water circuit:

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

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

- The sea water in the secondary circuit cools the turbocharging air and the oil in marine gear.

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

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

The sea water outlet can be made to flow into the exhaust gas discharge pipe: the exhaust gas is cooled rapidly by means of a mixer (option).

## MARINE GEAR (option)

Hydraulic drive with integral thrust bearing and oil cooler.

- T.D. 5111A

- ZF-MPM 320

- ZF-MPM 350A/350P

- P.à.M. NFA/NFB

## FILLUP DATA

Item	Quantity l      kg	Product
Water circuit		Water <sup>(1)</sup>
8210M22/SRM36.30	~ 46      -	
8210SRM36.10	~ 60      -	
Engine sump and filters (total capacity)	29      26.5	
Engine sump only:		Oil <sup>(2)</sup>
- Min. level	13.2    12	
- Max. level <sup>(2)</sup>	22      20	
Fuel tank	-      -	Automotive Diesel oil <sup>(4)</sup>

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.

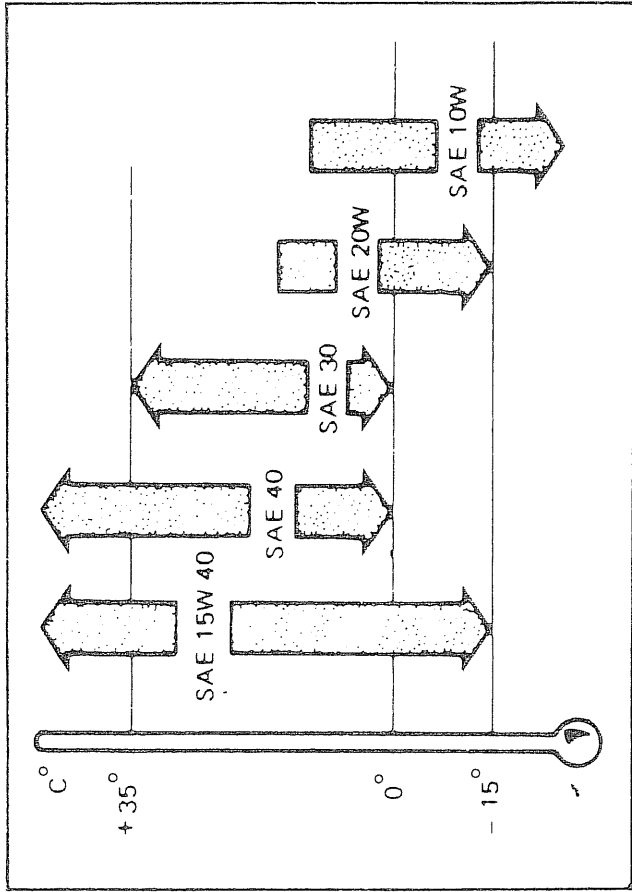
3) Recommended oil: Fiat Urania ° Oil, which meets all international MIL-L-2104 C Service API CD specifications.

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 <sup>C</sup> 10W (SAE 10W)
Minimum between -15°C and 0°C	URANIA <sup>C</sup> 20W (SAE 20W)
Minimum above 0°C	URANIA <sup>C</sup> 30 (SAE 30)
	URANIA <sup>C</sup> 40 (SAE 40)
URANIA <sup>C</sup> 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

## **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.
- The engines are provided with a mechanical detector, located on the intake to the turbine, which displays a red signal when the air filter is completely clogged. It is advisable however not to allow the air filter to become completely clogged, but to clean it regularly in order to ensure peak efficiency.
- Ensure sea water intake valve is open. Dry running of the sea water pump will quickly wear out the impeller.

## **STARTING UP**

- Operate the enrichment solenoid 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.

## PRECAUTION IN THE USE OF TURBOCHARGED ENGINES

The turbocharger is an integral part of the engine.

Very often faults are attributed to the turbocharger when the real trouble lies with the engine or with one of the fittings.

To avoid pointless downtimes and to extend turbocharger life and efficiency, some basically important instructions are given below.

1- Possible causes of turbocharger trouble are essentially three:

- a) Lack of lubricant: causes bearing failure with consequent seizure of rotary components.
- b) introduction of foreign matter: poor servicing of air cleaner will involve the introduction of solid particles which will damage the compressor-impeller blades: fragments would then be carried to the cylinders.
- c) Lubricant contamination: this causes scoring of journals and bearings, clogs oil passages, wears the seals, with consequent leakages and seizures.

Important: It is therefore recommended that you take utmost care in cleaning the air cleaner and air ductings: also, renew engine oil supply and filters at the specified servicing intervals.

2- Turbocharger construction simplicity is only apparent: in fact many of its parts are machined to 1/1000mm tolerances. It is therefore recommended that you entrust any servicing to skilled personnel having availability of special equipment provided by the service network.

3- Preventing faults increases the life and the efficiency of the turbocharger: in the event of oil leaks, vibration or unusual noises it is advisable to check immediately for faults and proceed with caution.

4- Turbocharged engines impose simple though essential precautions during engine starts and shutdowns, as follows:

a) **STARTING:** After starting the engine let it tick over for at least 30 seconds before increasing the speed; this ensures a constant flow of oil to the shaft and bearings of the turboblower and thus prevents undue wear and tear.

b) **STOPPING:** Before stopping the engine run it at minimum speed for at least one minute: this allows the speed and the temperature of the turbocharger to decrease so that it is almost at a standstill and as cool as possible when the flow of lubricating oil is cut out.

## 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.

It should be borne in mind that sudden acceleration of a turbosupercharged Diesel engine merely causes a high degree of smoke from the exhaust.

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  $0^{\circ}\text{C}$ , make sure water is mixed with proper amount of FIAT Parafu 11 which prevents oxidation, corrosion, foaming, fouling and freezing down to  $-20^{\circ}\text{C}$  with Parafu 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 Parafu 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 level mixed with antifreeze liquid over the heat exchanger.

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

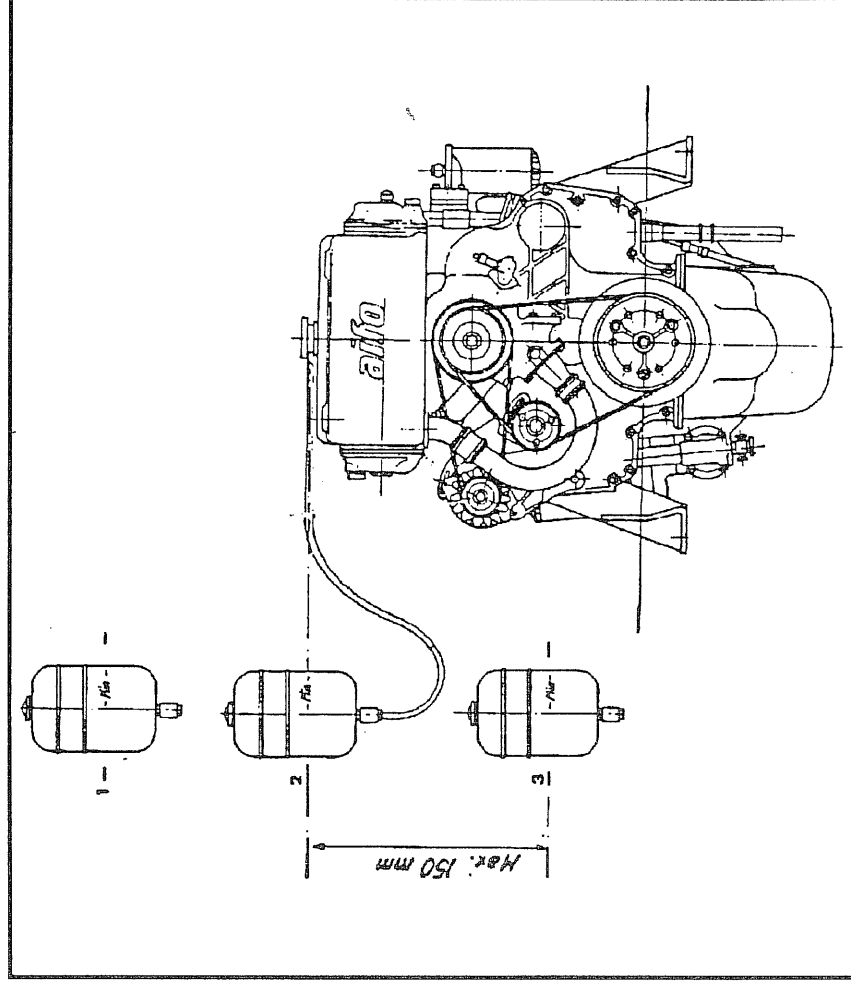
The installation positions recommended are the no. 1 and 2.

The no. 3 position is admitted as an exception on condition that the dimension "Max 150 mm" is respected.

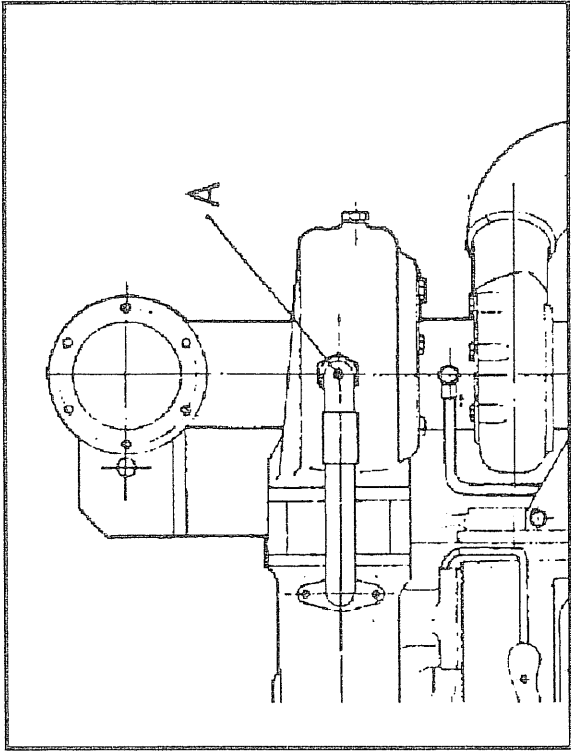
The scheme shows the dimensions of the plastic tube type CAVIS-BENZ  $\varnothing 7 \times 12$  mm to use for the connection tank-heat exchanger.

We underline that the liquid level in the tank has not to 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.







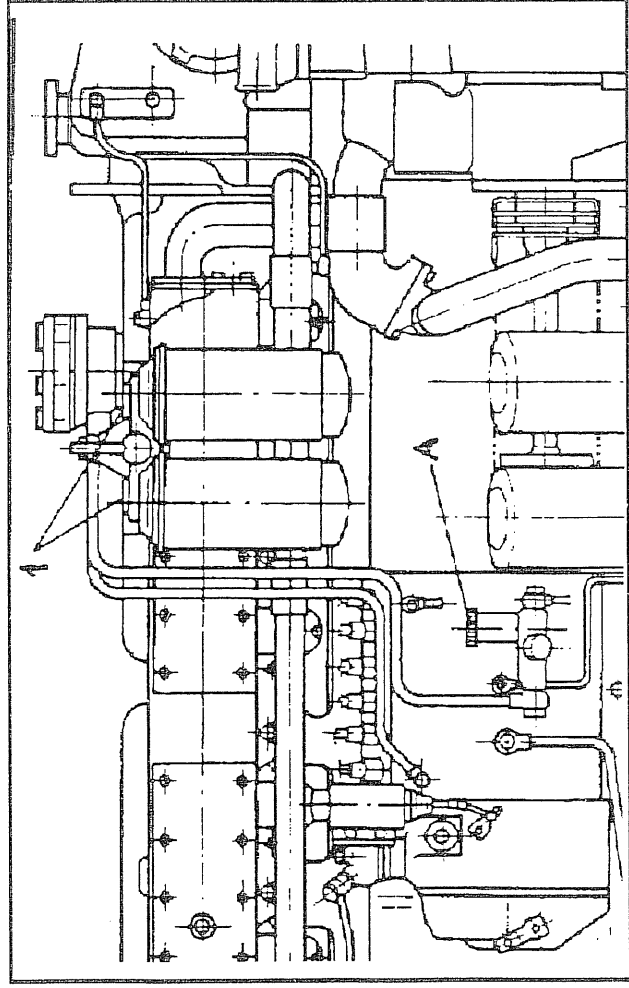
## BLEEDING THE AIR FROM THE COOLING WATER CIRCUIT (AT EACH REFILLING)

The engine has automatic, continuous air bleed devices to ensure that the air is let out whenever the cooling system is filled.

The only point that needs to be bled by hand is the cooled casing of the turbocharger.

To achieve this open the cap A on the upper cooling elbow of the turbine casing while the circuit is being filled.

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



## BLEEDING OF THE FUEL SYSTEM

Loosen fuel filter bleed plugs (1), unscrew knob A of pump and stroke it repeatedly; when the fuel flows without containing air bubbles, tighten plugs.

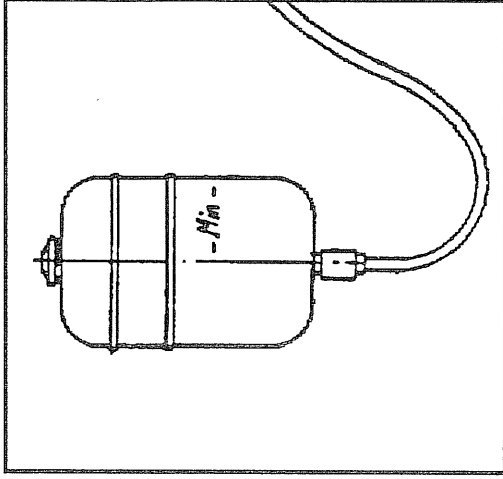
Proceed in same way to bleed the fuel injection pump slightly loosening the connector of the fuel return line to the tank.

# 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		●				
Cleaning air filter		●				
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 cartridge			M			Y
Checking battery electrolyte level and charge			●			Y
Changing oil filter cartridges				●		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
Cleaning turbocharger (engines SRM)					●	
Cleaning the turbocharger air heat exchanger (engines SRM)					●	
Changing oil in marine gear				●		Y

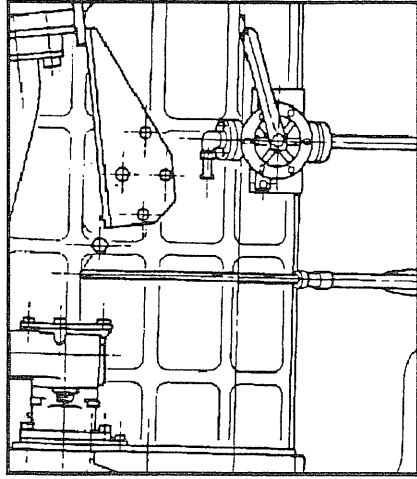
M = Maximum operating time with high quality fuel.

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



## CHECKING FRESH WATER LEVEL

With engine cold check water level in load tank and top up as necessary. This level must not exceed the mark "Max".



## 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

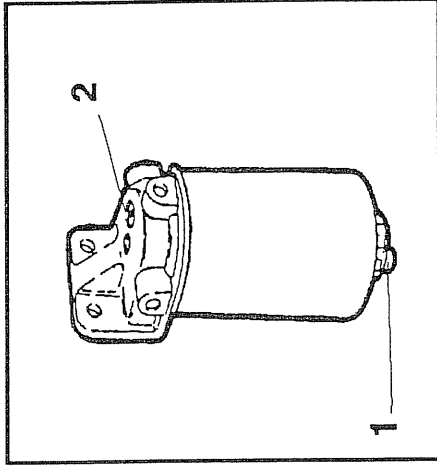
N.B.: Check level with engine running at idle.

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.



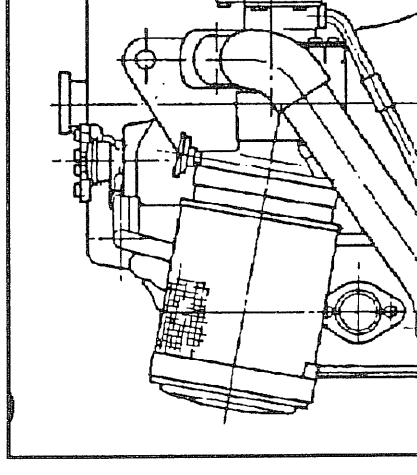
## CLEANING AIR FILTER

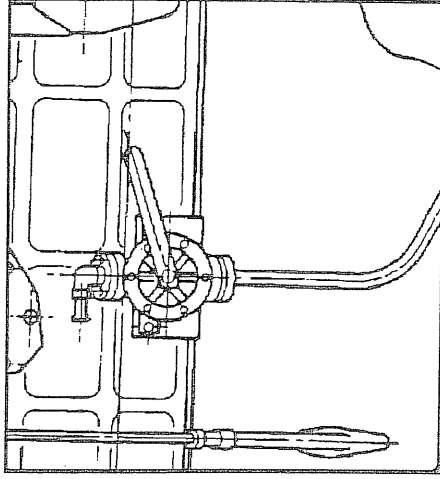
If the filter is dirty, it must be washed out with diesel oil.

After washing, dry the filter by blowing air from the inside towards the outside and then moisten with oil, leaving it for some time to drip thoroughly until dry.

**N.B.:** If the filter is not left to dry thoroughly the engine could suck in oil, which would cause it to race dangerously.

If the filter is clogged so much that it cannot be cleaned, or if any parts of it are broken, it must be replaced.





## 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.

## CHECKING DRIVE BELT TENSION AND CONDITIONS

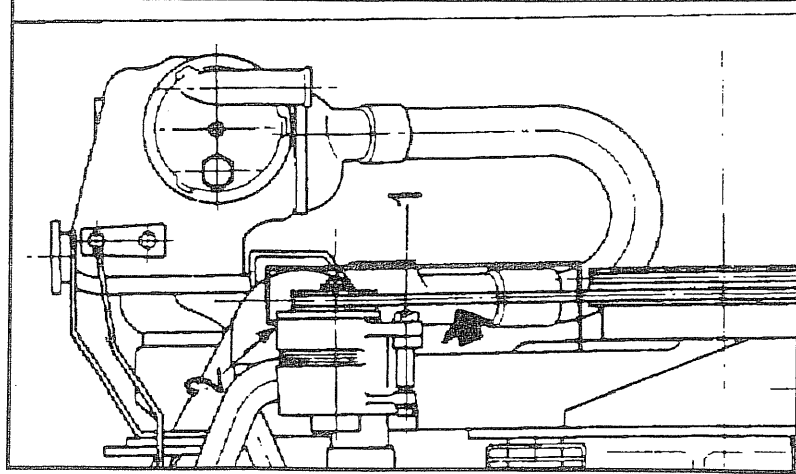
Check V-belts tension as indicated by the arrows:

Alternator control V-belt.

The normal yeild of the belts is 1 cm at a depression of  $42 \pm 6 \text{ N}$  ( $4.2 \pm 0.6$  kg).

To increase the tension of the V-belts.

- loosen locknut 2;
- move alternator outwards and loc nuts tightly.



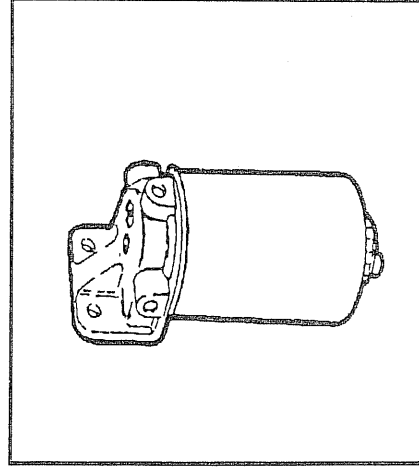
## CHECKING SACRIFICIAL ANODES FOR CORROSION

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 FILTERS

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

For 8210 SRM 36 only

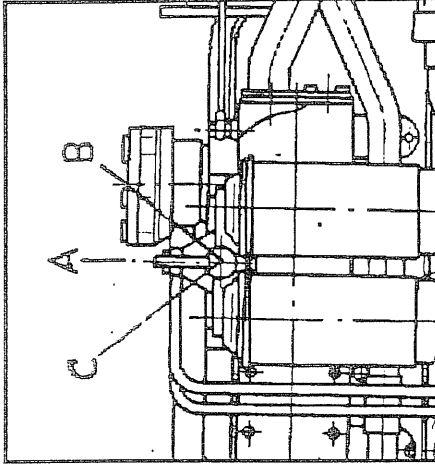
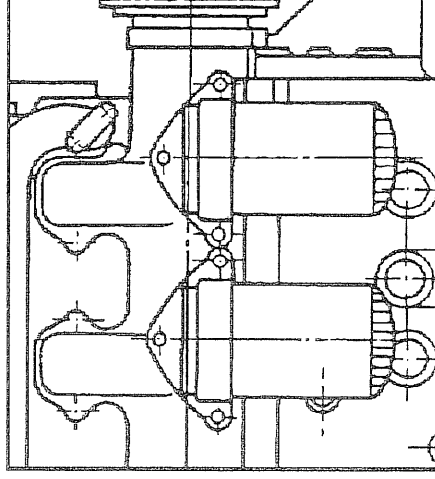
In the event of an emergency the filters can be replaced one at a time, using lever A to switch over the fuel supply.

Lever position A : filters operating.

Lever position B : left-hand filter not operating.

Lever position C : right-hand filter not operating.

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

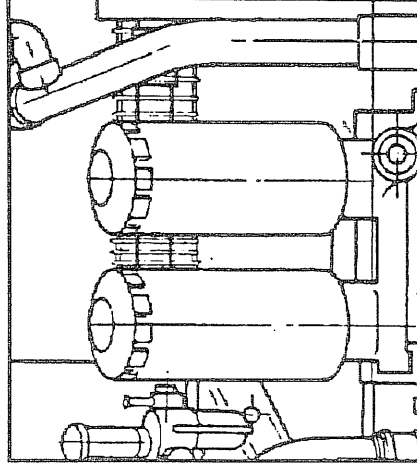


## CHANGING OIL FILTER CARTRIDGES

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 cartridges after the running-in period.

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



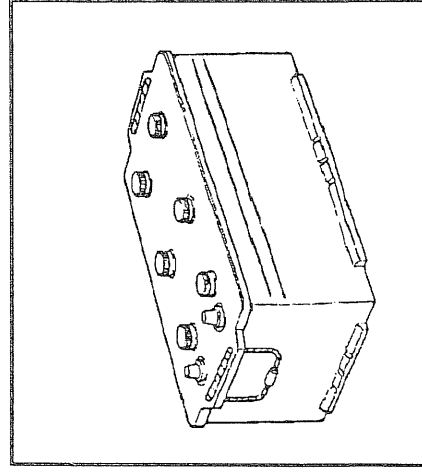
## CHECKING BATTERY ELECTROLYTE LEVEL AND CHARGE

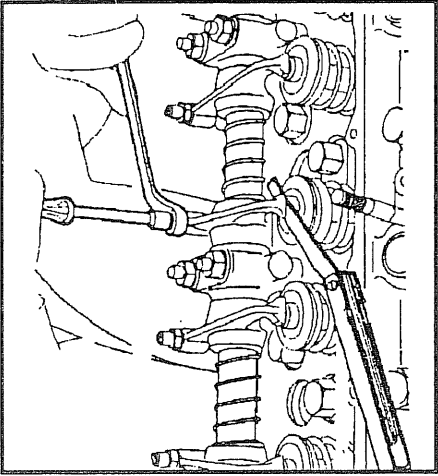
With the batteries rested and cold remove the plugs and make sure that the electrolyte level lies between the Min and Max limiters.

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 0.40 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 requirements:

- 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.

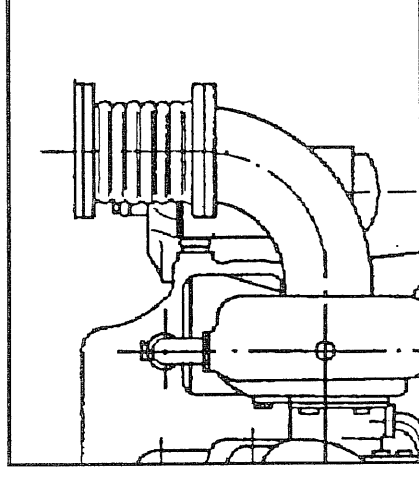
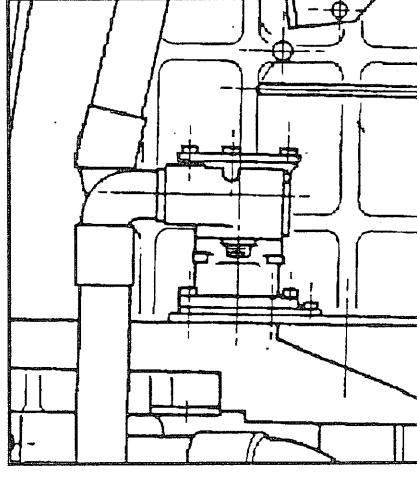
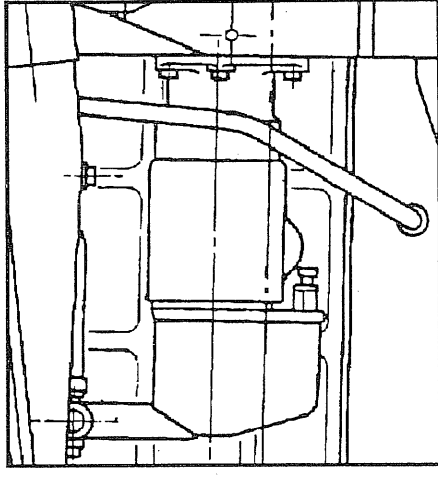
Make sure to fill the pump with water to prevent damage due to dry running of impeller.

## CLEANING THE TURBOCHARGER

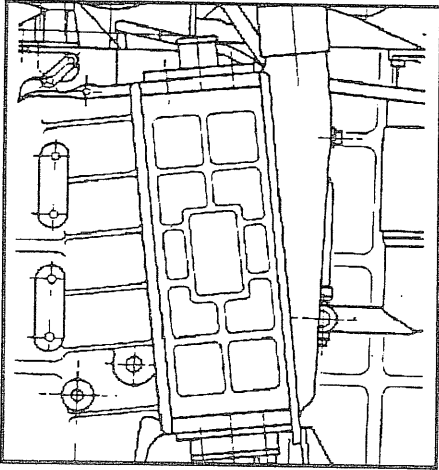
When the turbocharger appears not to be working properly clean it as follows:

- disassemble the aluminium casing enclosing the rotor and immerse it in diesel oil until all the dirt is removed; then dry it and reassemble;
  - to clean even more thoroughly use a plastic brush or scraper.
- It is not advisable to use steam since this could cause damage to the bearings and the shaft.

**N.B.:** After a complete disassembly when the turbocharger is reassembled make sure to prime it with engine oil to prevent damage due to dry running.







## **CLEANING THE TURBOCHARGER AIR HEAT EXCHANGER**

Disassemble the intake manifold and remove the exchanger element and wash it in Diesel oil. To clean the sea-water side, use a mild anti-fouling agent to remove any fouling.

## **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.

<b>Operations</b>	<b>Page</b>
Valve regrounding and cylinder head bolt torque requirement .....	24
Torque requirement for main engine components .....	24

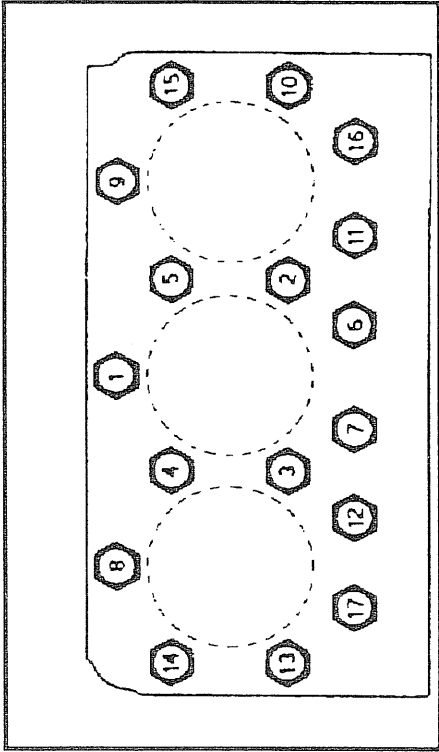
## VALVE REGRINDING AND CYLINDER HEAD BOLT TORQUE REQUIREMENTS

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
	Pre-torque	Pre-torque check	Torque angle
All models	180 Nm (18.5 kgm)	200 Nm (20.5 kgm)	120 °

## TORQUE REQUIREMENTS FOR MAIN ENGINE COMPONENTS

Big end cap	275 Nm
Journal cap	412 Nm
Nut securing pulley hub/vibration damper	931 Nm
Bolt securing flywheel(*)	102 Nm + 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 (8210 M 22)
- 12 ° longitudinal (8210 SRM 36)
- 30 ° transversal

### WATER CIRCUIT WITH KEEL COOLING

The keel cooling circuit requires the installation of a balancing tank (supplied with the engine). This tank serves to fill the circuit, to guarantee that the system is kept pressurized and to provide the expansion volume needed by the water in the system.

To compensate the pressure loss in the keel circuit and to allow the air to be bled efficiently from the engine and the circuit, the balancing tank must be installed at the highest possible point in the circuit.

### 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.

## **ELECTRICAL CONNECTION (8210 SRM 36)**

THE ENGINE IS EQUIPPED WITH INSULATED POLE SYSTEM. MAKE SURE THAT THE ENGINE IS CORRECTLY EARTHED TO THE BOAT OR TO THE ZINC ANODES IN ORDER TO AVOID CORROSION.

## **INTAKE AND VENTILATION AIR**

In the engine room an air flow of the following capacity must be assured:

820 m<sup>3</sup> / h (8210 M 22)

1540 m<sup>3</sup> / h (8210 SRM 36)

for intake and:

4180 m<sup>3</sup> / h (8210 M 22)

4160 m<sup>3</sup> / h (8210 SRM 36)

for the engine ventilation.

For engine air intake from the outside, the connecting canalizations must be such so as not to cause a depression at the inlet of the admission manifold or at the turbocharger, at full power engine, of more than 300 mm H<sub>2</sub>O.

## **EXHAUST PIPES (8210 SRM 36)**

After being used to drive the turbocharger, the exhaust gases from the engine are conveyed to the outside through a gas-water mixer (optional) or a dry exhaust pipe.

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

# **IVECO aifo** **DIESEL ENGINES**

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