8361 TURBO

MARINE ENGINES

Use and maintenance ■ Uso e manutenzione ■ Emploi
et entretien ■ Betriebsanleitung ■ Uso y manutención

IVECO aifo

IVECO aifo

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1a Edizione
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use and maintenance
uso e manutenzione
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uso y manutención

Thank you for deciding on Iveco Aifo and at the same time, we would like to congratulate you on your choice.

We request that you read the operating and maintenance instructions regarding your new engine.

If you follow these instructions, you can ensure that your engine will operate perfectly and have a long service life.

We would like to remind you that the Iveco Aifo Service Organization is always at your disposal whereever you may be, to provide you with a high degree of efficiency and professional advice.

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

The exclusive use of Iveco Original Parts is a prerequisite for excellent maintenance of the engine.

Orders should specify:

- engine technical code and serial number
- part number of the component (see Spare Parts Catalog).

Responsibility

The information contained in this manual is correct at the publication date.

The manufacturer reserves the right to make any modification without notice, at any time, for technical or commercial reasons or to comply with the laws of the different countries and disclaims all responsibility for any errors or omissions.

SAFETY REQUIREMENTS

Basic rules

The following recommendations indicate how to reduce the risk of damages to persons or goods when the system is either in/or out of service.

- The engines must never be used for any purpose other than that agreed by written with the manufacturer. Any other applications must be subject to a special agreement with the manufacturer and must include safety specifications.

- Any form of tampering, modification or the use of non-genuine parts may compromise safety standards.

- The present recommendations have to be applied considering the pertinent regulations of the various Countries.

Maintenance

- When working near the engine or any moving parts, do not wear baggy or loose-fitting clothes, rings or necklaces.

- Always wear protective gloves and goggles :

. when topping up the battery acid;

. when topping up the inhibitor agent or anti-freeze fluid;

. when either changing or tapping up oil (hot motor oil can cause burns, leave it to cool to a temperature of less than 60° C before draining);

. when using compressed air (the maximum air pressure which may be used for cleaning parts must be below 2 atm. or 30 psi, 2 kg/cm^2).

- Always wear a protective steel-cap whenever working in areas where there are overhanging loads or where the machinery is at head height.

- Always wear safety boots and overalls.

- Use protective creams for the hands.

- Immediately replace wet overalls.

- When working on components which may be carrying an electrical charge, always ensure that both the hands and feet are completely dry. When necessary, perform the work using a non-conducting work platform. In any case, it is mandatory that the person performing any of its kind of works is both experienced and qualified.

- No person should attempt to perform any maintenance operation nor adjustments if they are not familiar with the procedure. The instructions must always be closely followed and, in their absense, the supplier or qualified personnel should be contacted.

- Always keep the engine clean by removing all oil, diesel and/or coolant which may be splashed on it.

- Dispose of oil rags in fire proof containers.

- Never leave rags on the engine.

- Use containers of suitable size and safety for the disposal of old engine oil.

- When starting on engine after having carried out repairs, always take steps to stop air intake in case their should be a trouble-shutting during start-up.

Engine cooling system

- Never add coolant to an overheated engine-always wait for normal water degrees.

- Regularly check the coolant level and top up when necessary using only the recommended liquid.

The water used in the engine cooling system must be clean and as free as possible from corrosive chemical and materials.

Artificially softened water must never be used in the cooling system; it is possible to prevent the formation of rust and corrosion by adding rust inhibitor agents to the water as recommended by the manufacturer.

- During the colder months regularly measure the specific gravity of the anti-freeze mixture to ensure the adequate protection of the engine.

Always remove the radiator cap slowly. The cooling system is generally under pressure and, when hot, the coolant may violently blow-out if the pressure is released too rapidly.

- Regularly check the drive belts for correct tension and usage limits.

Lubrication system

Regularly check the level of the sump oil, topping up when necessary.

- Drain and refill the oil at the indicated intervals by the manufacturer using an oil of the recommended characteristics and viscosity as indicated in this publication.

Fuel system

- Try to keep the fuel tank as full as possible, in this way it is possible to reduce the condensation into the tank.

- Periodically drain the fuel tank to remove water and sediments.

- Renew the fuel filter periodically, mainly if there is a drop in the engine's pressure of performance.

- Never smoke nor light during refuelling.

Inlet and exhaust system

- Regularly check the condition of the air filter. The maintenance intervals will vary according to the weather and operating conditions. In particularly dusty locations it will be necessary to perform maintenance to the element more frequently.

- Visually check the exhaust system for the presence of oil, which may indicate oil leak, and immediately repair any malfunctions if detected to avoid the risk of fire.

Ignition system

- Periodically check the battery electrolyte level and top up when necessary using distilled water only.

- Keep the battery clean.

- To avoid risk of not necessary start-up, disconnect the battery earth terminal before working on the engine. Ensure that an eventual engine's automatic ignition system is not activated while work is on duty.

- Always disconnect one of the starter motor terminals when working on an eventual generating set alternator.

- Ensure that all connections are correct and tight and that the insulation on all electrical wires are in a satisfactory condition.

- During recharging, the battery gives off a certain amount of flammable gas, it is therefore mandatory that the area must be well ventilated, that no personnel smoke, and that there are no naked flames near the battery.

- To reduce the likelihood of arcing, it is good practice to always reconnect the battery's positive terminal first and then the negative (generally the earth).

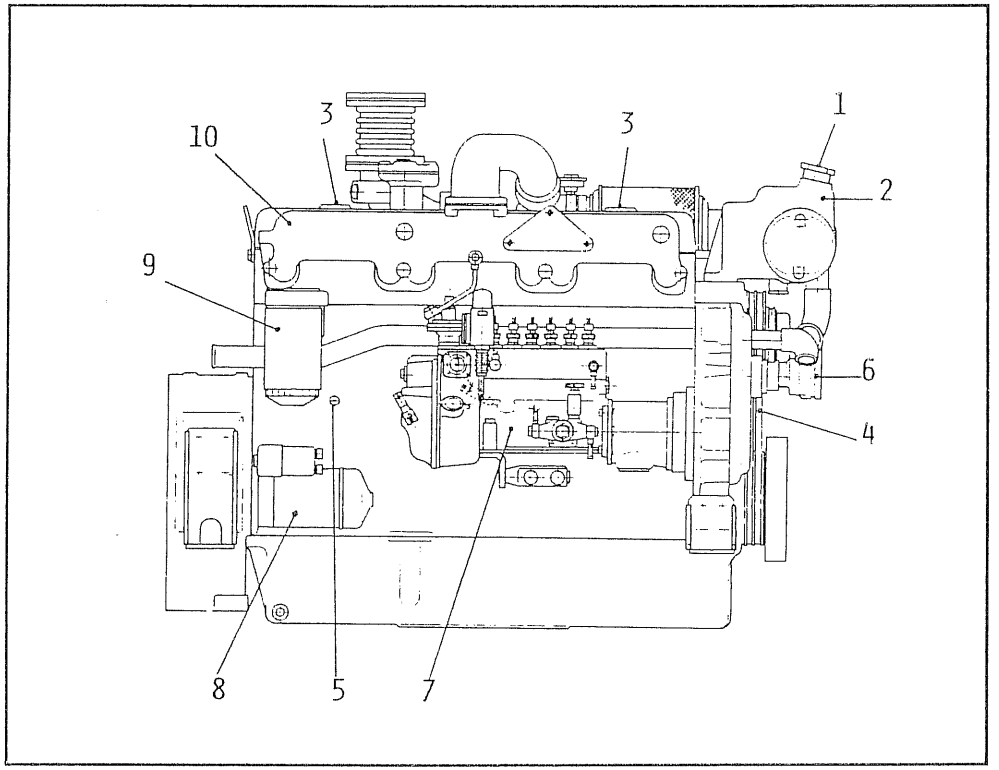
- Periodically check the alternator drive belts for correct tension.

TABLE OF CONTENTS

ENGINE IDENTIFICATION DATA

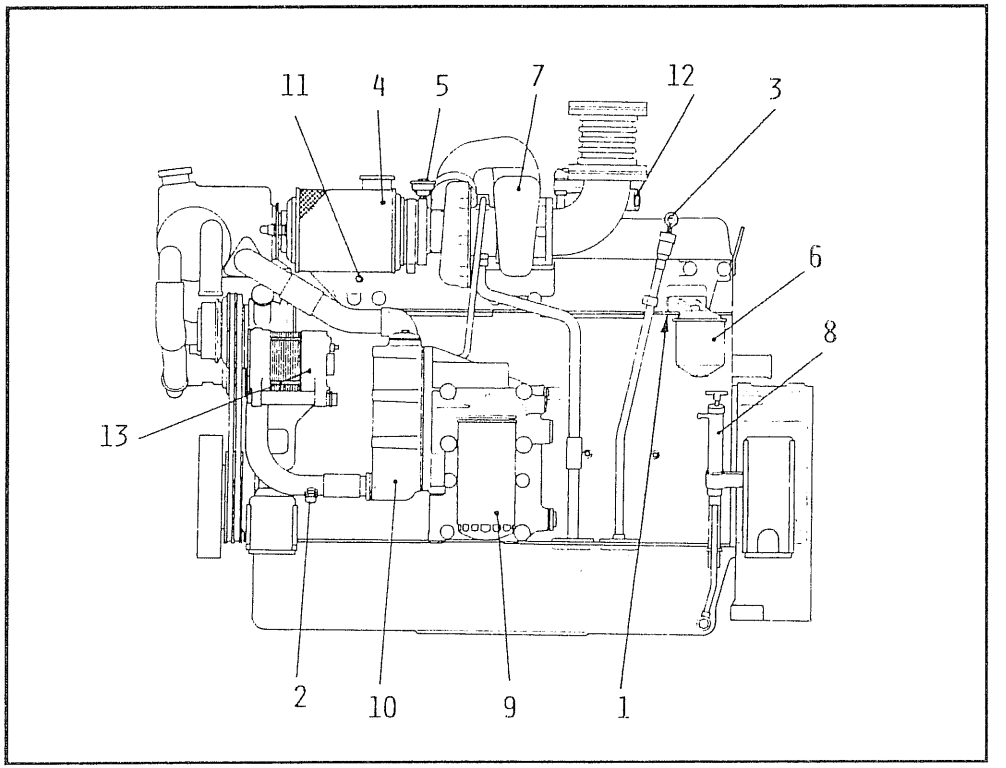
Engine technical code and serial number are punched on a plate located on the flywheel cover.

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



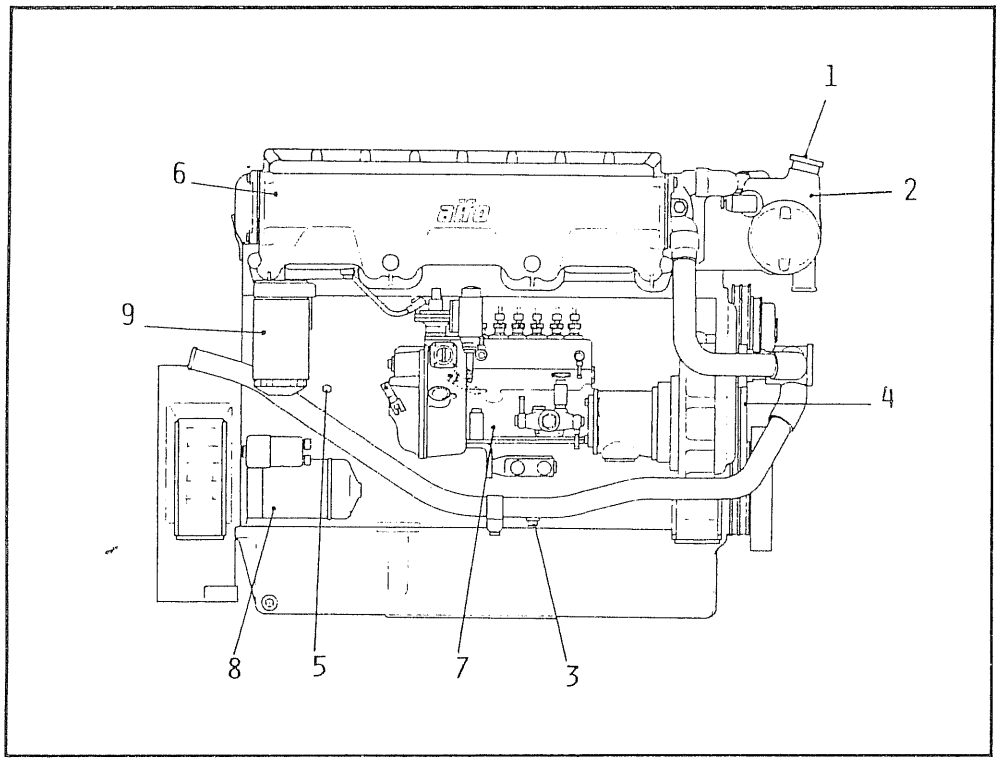
Engine 8361SM21 - Right hand view

1. Fresh water filler cap - 2. Sea water-fresh water heat exchanger - 3. Oil filler cap - 4. Water pump-alternator drive belt - 5. Fresh water drain plug - 6. Sea water pump - 7. Injection pump - 8. Starter motor - 9. Fuel filter - 10. Intake manifold.



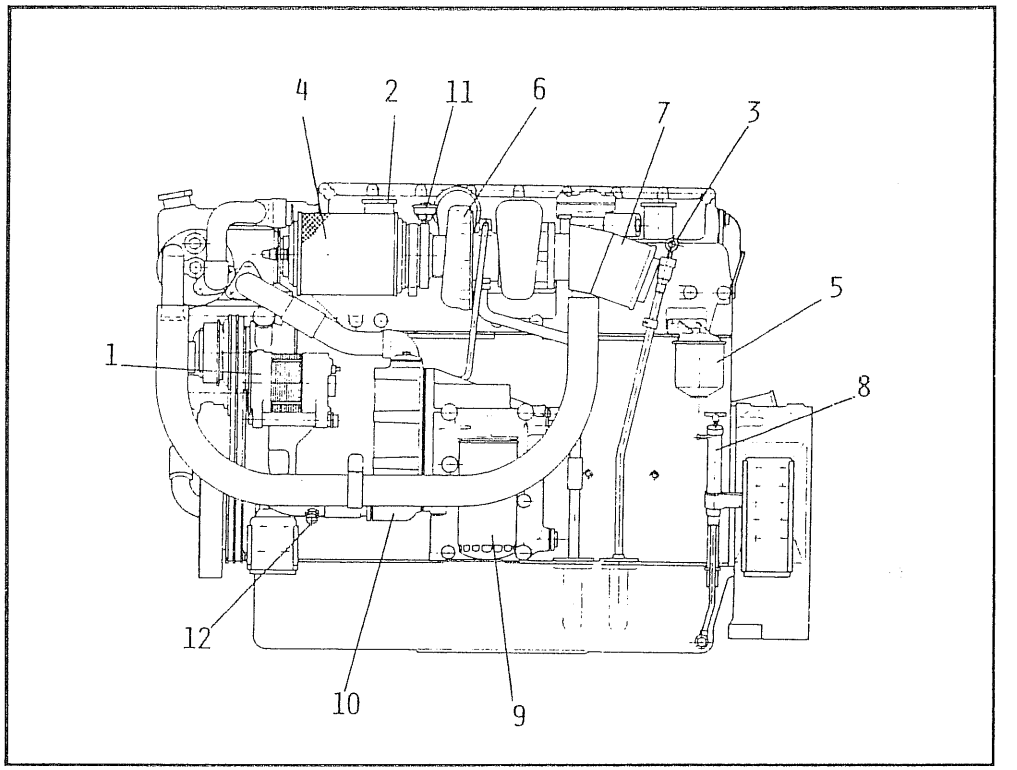
Engine 8361SM21 -Left-hand view

1. Exhaust manifold - 2. Fresh water drain plug - 3. Oil dipstick - 4. Wet air cleaner - 5. Dry air filter restriction indicator - 6. Water filter - 7. Turbocharger - 8. Oil drain pump - 9. Oil filter - 10. Engine oil heat exchanger - 11. Exhaust manifold - 12. Oil smoke exhaust - 13. Alternator.



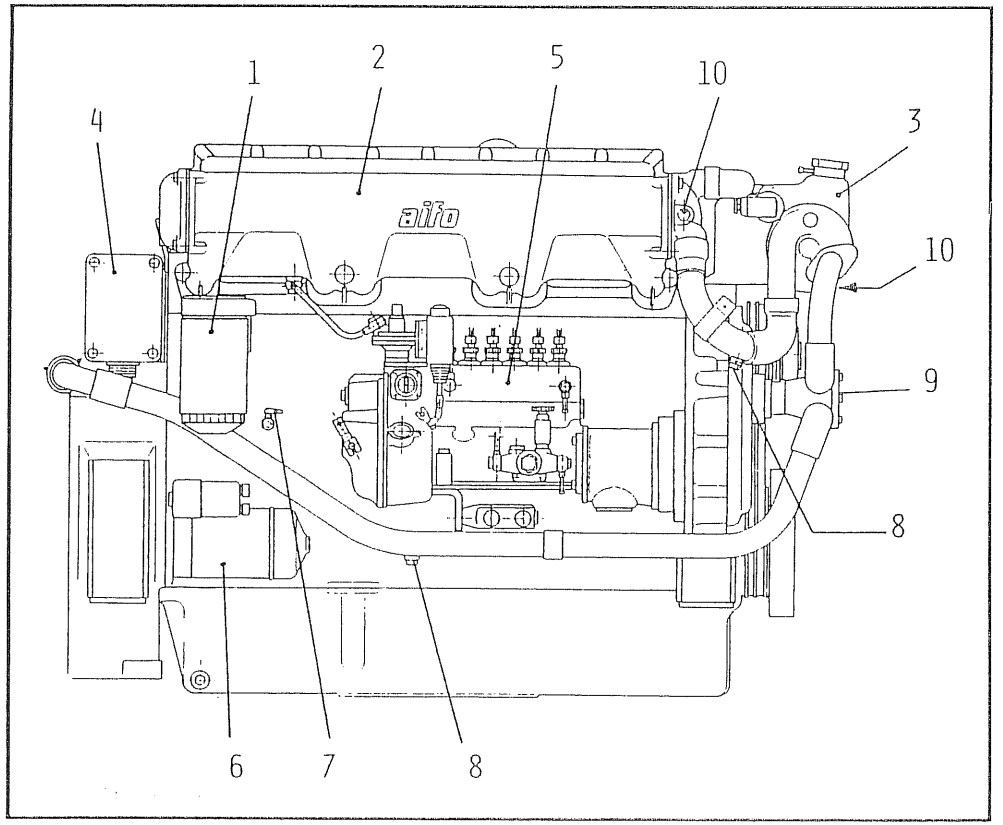
Engine 8361SRM32 - Right-hand view

1. Fresh water filler cap - 2. Sea water-fresh water heat exchanger - 3. Sea water drain plug - 4. Water pump-alternator drive belt - 5. Fresh water drain cock - 6. Intake manifold - 7. Injection pump - 8. Starter motor - 9. Fuel filter .



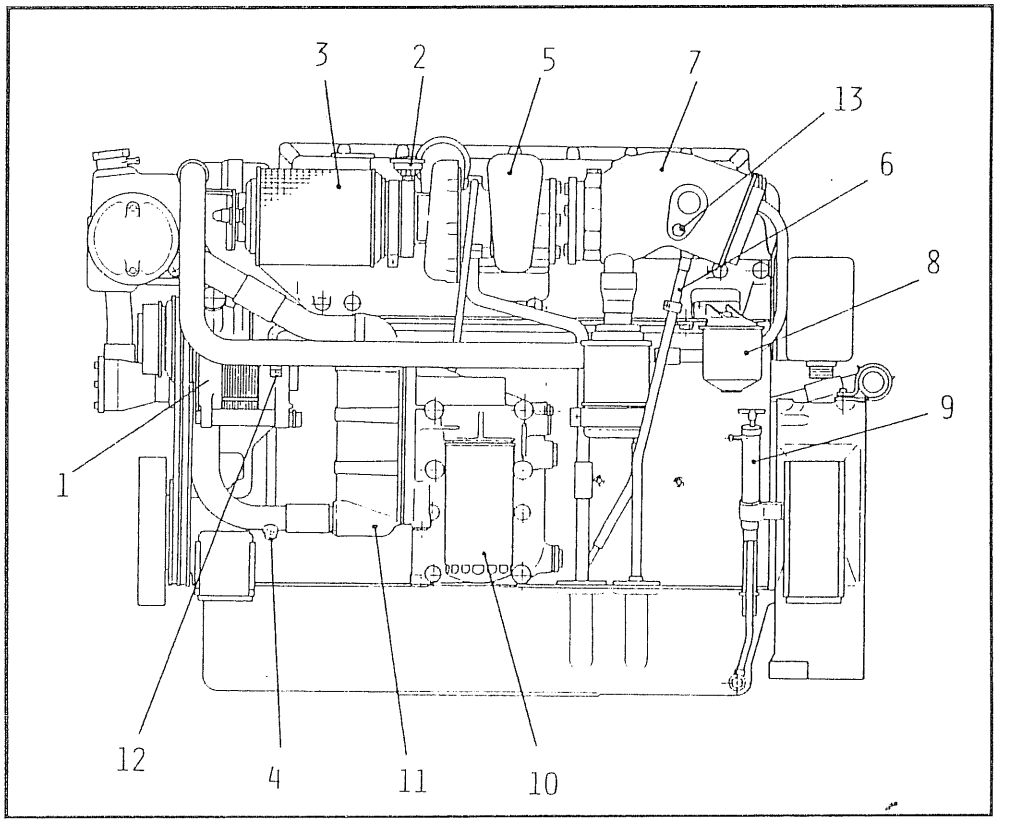
Engine 8361SRM32- Left-hand view

1.Alternator - 2. Oil filler cap - 3. Oil dipstick - 4. Wet air cleaner - 5. Water filter - 6. Turbocharger - 7. Exhaust water cooled elbow - 8. Oil drain pump - 9. Oil filter - 10. Engine oil heat exchanger - 11. Dry air filter restriction indicator - 12. Fresh water drain plug.



Engine 8361SRM40 - Right-hand view

1. Fuel filter - 2. Intake manifold - 3. Sea water-fresh water heat exchanger - 4. Engine starting and stopping device - 5. Injection pump - 6. Starter motor - 7. Fresh water drain cock - 8. Sea water drain plug - 9. Sea water pump - 10. Sacrifical anode.



Engine 8361SRM40 - Left-hand view

1. Alternator - 2. Dry air filter restriction indicator - 3. Wet air cleaner - 4. Fresh water drain plug - 5. Turbocharger - 6. Oil dipstick - 7. Exhaust water cooled elbow - 8. Water filter - 9. Oil drain pump - 10. Oil filter - 11. Engine oil heat exchanger - 12. Fresh water drain plug - 13. Sacrifical anode.

ENGINE SPECIFICATIONS

Engine type 8361SM21

4 - stroke Diesel with direct injection

Cylinders, number and arrangement ..... 6, in line

Bore x stroke ..... 115 x 130 mm

Displacement ..... 8.1 l

Compression ratio ..... 15.5 : 1

Net power at flywheel (*):

-Pleasure craft ..... 155 kW (210 CV)

At ..... 2000 rpm

-Light-duty commercial ..... 140 kW(190 CV)

At ..... 2700 rpm

-Continuous duty ..... 192kW (175 CV)

At ..... 2000 rpm

Engine rotation:

(see from flywheel) ..... CCW

Dry weight (without marine gear) ..... ~715 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. ..... 11 °

closes: after B.D.C. ..... 27 °

- Exhaust

opens: before B.D.C. ..... 55 °

closes: after T.D.C. ..... 17 °

Clearance between valve and rockers for timing checks ..... 0.44 mm

Operating clearance between valves and rockers, cold engine:

- intake ..... 0.30 mm

- exhaust ..... 0.50 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 Bosch with in line plungers; all-speed governor and piston fuel feed pump.

Boost control (LDA) on injection pump.

Fixed injection pump delivery start advance ..... 23 ° ± 1 °

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

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

TURBOCHARGER

The engine is supercharged by turbocharger driven by the exhaust gases.

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 a dualfiltration replaceable cartridge filter.

Oil cooling with oil-fresh water heat exchanger.

Minimum oil pressure:

- at full throttle ..... 3.5 kg/cm^2
- when idling ..... 0.8 kg/cm^2

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 sacrifical 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.

STARTING

By starter motor.

ELECTRICAL SYSTEM

- Voltage 24V
- Self-regulated alternator ..... 28 V, 30 A
- Power of starter motor ..... 4 kW
- Battery (optional) ..... 2, each 110 Ah

MARINE GEAR (on request)

Mechanical or hydraulic drive with integral thrust bearing and oil cooler.

ENGINE SPECIFICATIONS

Engine type 8361SRM32
4 - stroke Diesel with direct injection
Cylinders, number and arrangement ..... 6, in line
Bore x stroke ..... 115 x 130 mm
Displacement ..... 8.1 l
Compression ratio ..... 15.5 : 1
Net power at flywheel (*):
Pleasure craft ..... 236 kW (320 CV)
At ..... 2400 rpm
Light-duty commercial ..... 184 kW(250 CV)
At ..... 2200 rpm
Engine rotation:
(see from flywheel) ..... CCW
Dry weight (without marine gear) ..... ~ 755 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. ..... 11 °
closes: after B.D.C. ..... 27°
- Exhaust
opens: before B.D.C. ..... 55 °
closes: after T.D.C. ..... 17°
Clearance between valve and rockers for timing checks ..... 0.44 mm
Operating clearance between valves and rockers, cold engine:
- intake ..... 0.30 mm
- exhaust ..... 0.50 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 Bosch 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 ..... 18° ± 1°
Fuel injectors setting ..... 215 + 5 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 a dualfiltration replaceable cartridge filter.

Oil cooling with oil-sea water heat exchanger.

Minimum oil pressure:

- at full throttle ..... 3.5 kg/cm^2
- when idling ..... 0.8 kg/cm^2

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

- 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 protectet from corrosion by replaceable sacrifical 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).

STARTING

By starter motor.

ELECTRICAL SYSTEM

- Voltage 24V
- Self-regulated alternator ..... 28 V, 30 A
- Starting motor power ..... 4 kW
- Battery (optional) ..... 2, each 110 Ah

MARINE GEAR (option)

Hydraulic drive with integral thrust bearing and oil cooler.

ENGINE SPECIFICATIONS

Engine type 8361SRM40

4 - stroke Diesel with direct injection

Cylinders, number and arrangement .....6, in line

Bore x stroke ..... 115 x 130 mm

Displacement..... 8.1 l

Compression ratio ..... 15.5 : 1

Net power at flywheel (*):

Pleasure craft ..... 294 kW (400 CV)

At .....2400 rpm

Engine rotation:

(see from flywheel) ..... CCW

Dry weight (without marine gear) ..... ~763 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 timimg:

- Intake

open: before T.D.C. ..... 11 °

closes: after B.D.C. ..... 27 °

- Exhaust

opens: before B.D.C. .....55° '

closes: after T.D.C.....17 °

Clearance between valve and rockers for timing checks ..... 0.44 mm

Operating clearance between valves and rockers, cold engine:

- intake ..... 0.30 mm

- exhaust ..... 0.50 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 Bosch 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..... 21 ° ± 30'

Fuel injectors setting.....220 +5 bar

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

TURBOCHARGING

The engine is supercharged by turbocharger driven by the exhaust gases.

The turbocharger is lubricated with the engine oil under pressure.

The turbine housing is cooled with fresh water.

LUBRICATION

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

Pressure relief valve inserted in the circuit.

Total and continuous oil filtering by a dualfiltration replaceable cartridge filter.

Oil cooling with oil water heat exchanger.

Minimum oil pressure:

- at full throttle ..... 3,5 kg/cm ^{2}
- when idling ..... 0.8 kg/cm ^{2}

COOLING SYSTEM

(Cooling by dual water circuit:)

- Fresh water primary circuit (closed) for cooling engine, exhaust manifold and the turbine housing, 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 fresh water is filtered by a rust and corrosion inhibiting PERRY type filter.

- The sea water in the secondary circuit cools also the engine oil (water-oil heat exchanger) and oil in marine gear.

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

Complete sea water circuit is protectet from corrosion by replaceable sacrifical 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).

STARTING

By starter motor.

ELECTRICAL SYSTEM

- Voltage 24V
- Self-regulated alternator ..... 28V, 30 A
- Starting motor power ..... 4 kW
- Battery (optional) ..... 2, each 110 Ah

MARINE GEAR (option)

Hydraulic drive with integral thrust bearing and oil cooler.

FILLUP DATA

Item	Quantity l	Quantity kg	Product
Water circuit			Water (1)
8361SM21/SRM32	28	-	
8361SRM40	32	-	
Engine sump and filters (total capacity)	20	18.5	Oil (3)
Engine sump only: - Min. level	10.5	9.5	
- Max. level (2)	16	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.

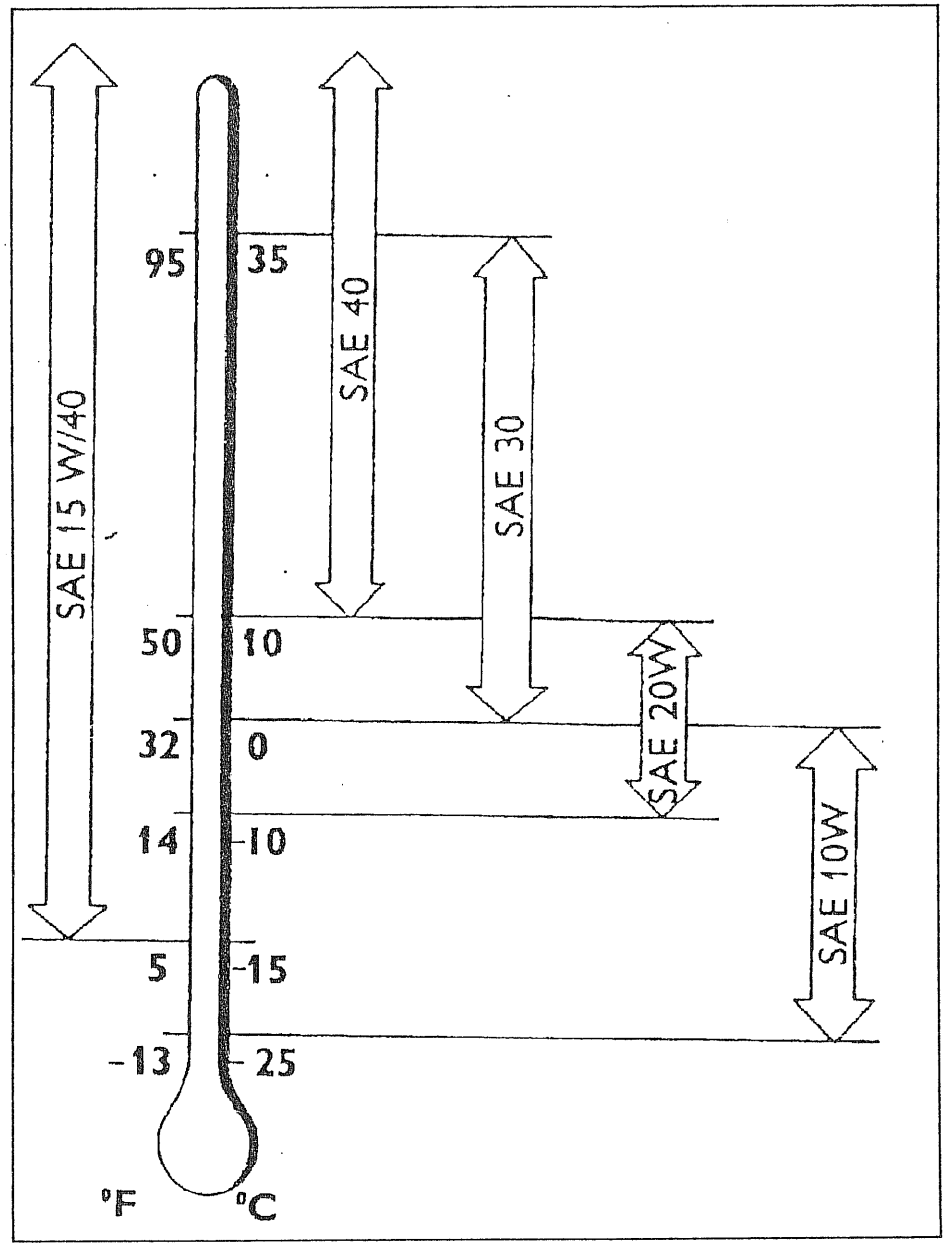
3) Recommended oil: Fiat Urania ^{C} Oil, which meets all international MIL-L-2104 C Service API CD specifications.

Qualitity 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.



USE OF ENGINE OIL

URANIA

For efficient engine operation SAE viscosity should be as indicated in relation to outdoor temperature.

URANIA TURBO (SAE 15W40)

This is an all-season oil for temperatures ranging between - 15° C and +35° C.

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. to prevent dry run

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, wich 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 effeciency.

- 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 minut 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 attribuited 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.

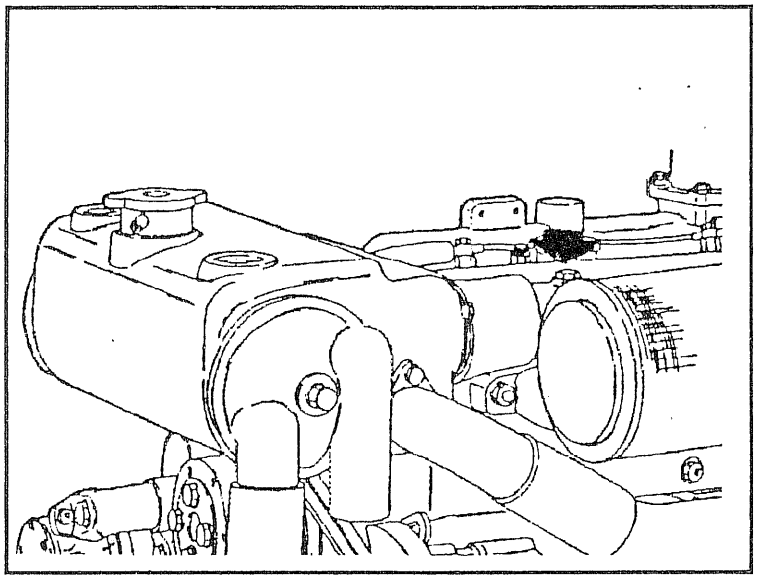
2) correct oil pressure

COLD CLIMATE PRECAUTIONS

When temperatures approximate 0° C, make sure water is mixed with proper amount of FIAT Paraflu 11 which prevents oxidation, corrosion, foaming, fouling and freezing down to - 20 ° C with Paraflu 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 Paraflu 11 fluid in order to ensure good protection against the formation of calcareous deposits already on initial filling.



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

For engines 8361SRM40

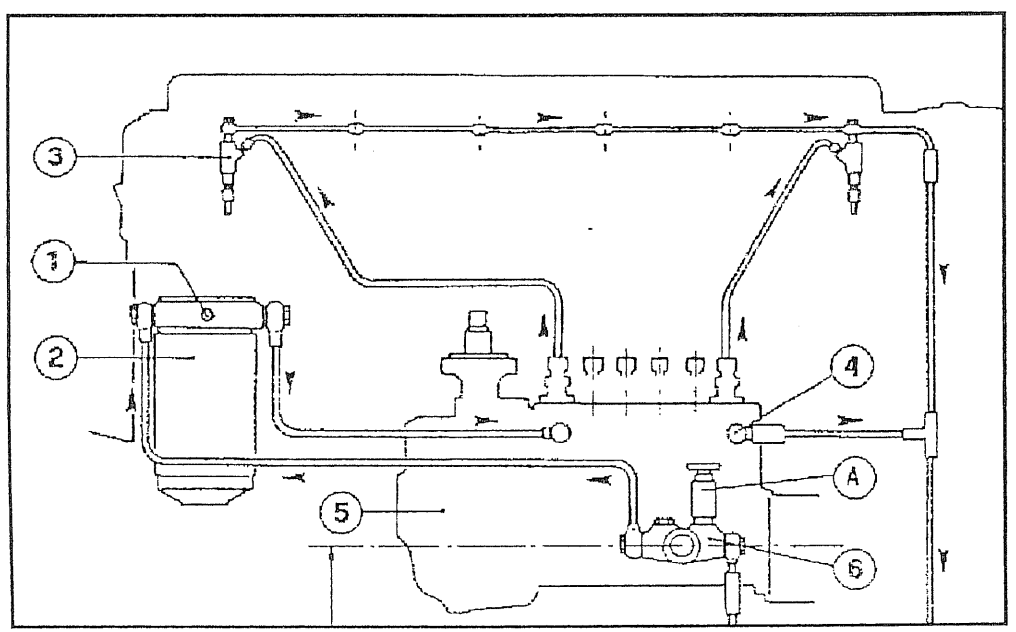
The air is automatically bled from 2 bleed points connected to the filling tank:

1) on the engine

2) on the turbine box

For engines 8361SM21 and 8361SRM32, equipped with an aluminium pressurized expansion tank above the fresh water/sea water heat exchanger, the air bleed is manually performed through 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 OF THE FUEL SYSTEM

Loosen the bleed plugs 1 of the fuel filter 2, then operate repeatedly the knob A of the fuel pump 6 : when the fuel flows without air bubbles, tighten plug 1.

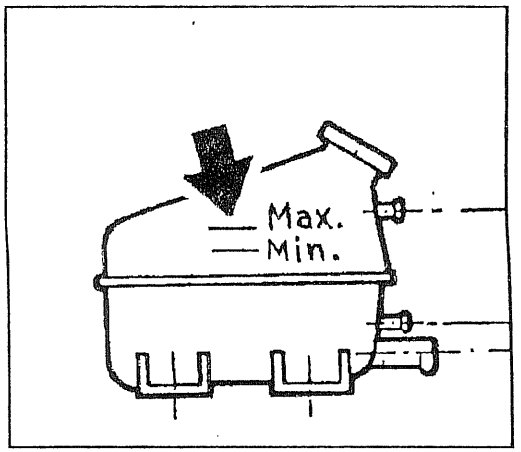
Proceed in same way to bleed the injection pump 5 , loosening the connector 4 of the fuel return line to the tank: when the fuel flows without air bubbles, tighten the connector.

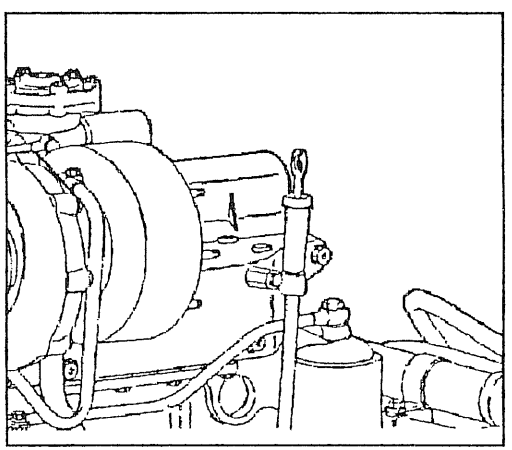
ROUTINE MAINTENANCE

Operations	Daily	Every 100 h	Every 200 h	Every 400 h	Every 800 h	Every year
Cecking sump oil level	●					
Checking fresh water level	●					
Checking oil level in marine gear	●					
Draining water from the fuel prefilter		●				
Changing water filter				●		Y
Cleaning air filter		●				
Clean the oil fumes condensate pipe			●			Y
Changing engine sump oil			●			Y
Checking drive belt tension and hose clamps			●			Y
Checking sacrifical 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
Checking condition of impeller in sea water pump					●	Y
Cleaning turbocharger					●	
Cleaning the turbocharger air heat exchanger					●	
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

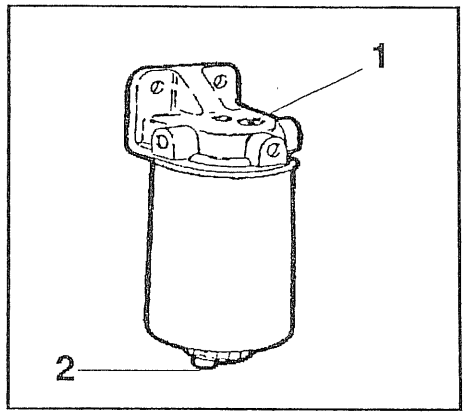
N.B.: Check level with engine running at idle.

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.

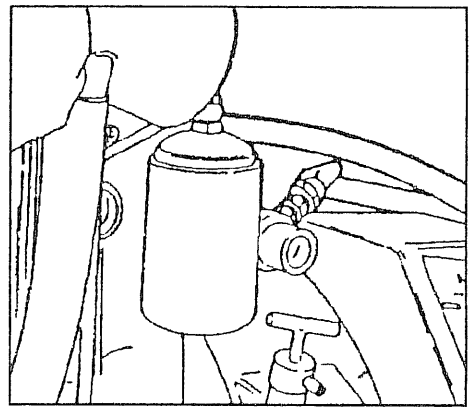
In order to perform the above operation it may be necessary to loosen the screw (2) very slightly. At the end of the operation screw the cap and the ring nut back on, remembering that it may be necessary to bleed the air from the fuel circuit.



CHANGING COOLANT FILTER

Replace the integral filter.

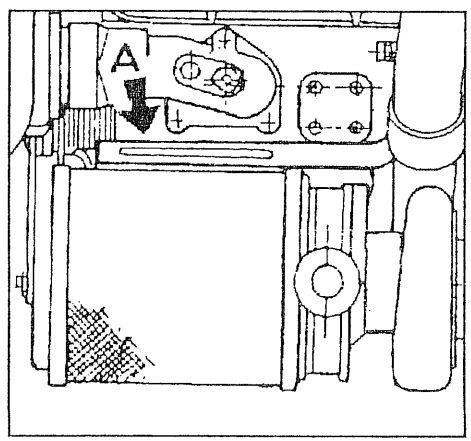
N.B. : First change must be made not later than after 50 hours; then proceed as above.



CLEANING THE OIL FUMES CONDENSATE PIPE

The engine breathes in oil fumes.

Since condensate from the fumes forms in the oil pipe, the pipe is designed to hold in the condensate to prevent it dripping onto the bilgs. There is a special slot A in the pipe to enable it to be cleaned at regular intervals.



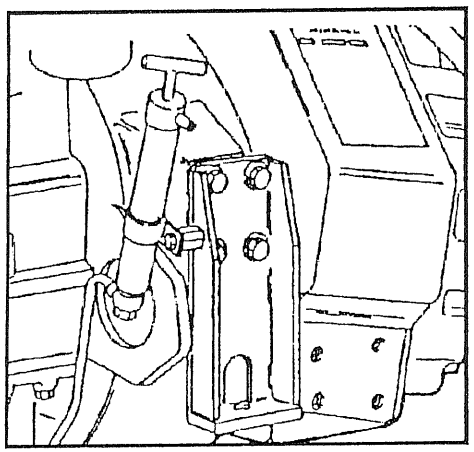
CLEANING AIR FILTER

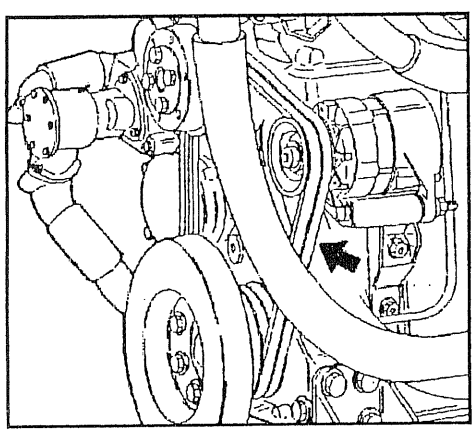
If the filter is dirty, it must be washed out with diesel oil.

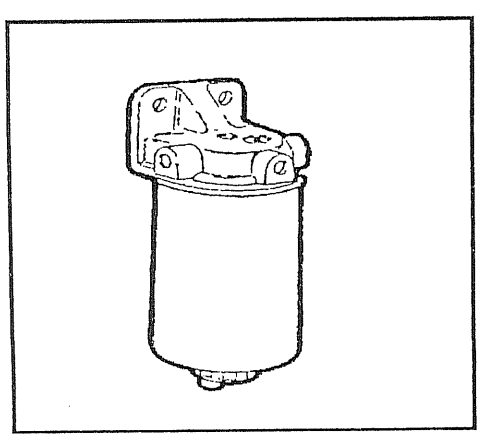
After washing, dry the filter by blowing air from the inside towards the outside and then moisten with oil, leaving it for some time to drip throughly until dry.

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 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 A and B;
- Move alternator outward and retighten nuts.

CHECKING SACRIFICAL ANODES FOR CORROSION

Make sure sacrifical anodes for protecting the complete seawater circuit are not corroded by more than 50%($\geq$ 15mm); 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.

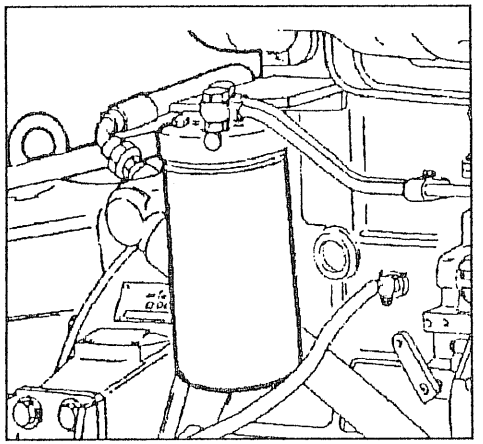
N.B.: Make sure that the new cartridge is of the same type as the old one.

REPLACING THE FUEL CARTRIDGE FILTER

Replace the filter cartridge, making sure that the new one is already full of fuel in order to facilitate bleeding operations.

Bleed the air.

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

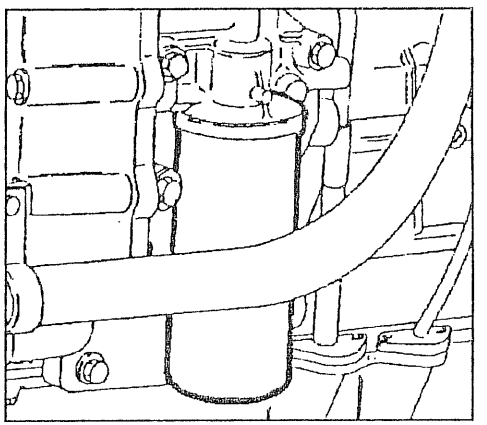


CHANGING OIL FILTER CARTRIDGE

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 are of the same type as the old ones.



CHECKING BATTERY ELECTROLYTE LEVEL AND CHARGE

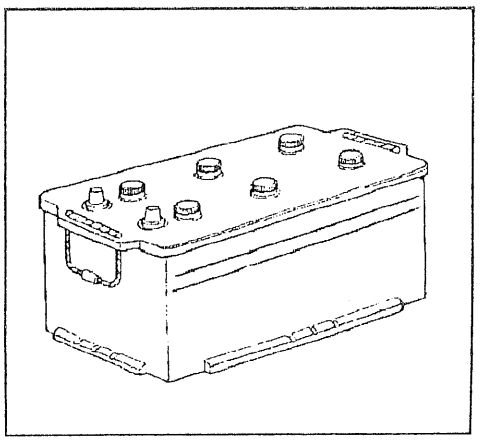
With the batteries rested and cold remove the plugs and make sure that the electrolyte level lies between the Min and Max limites.

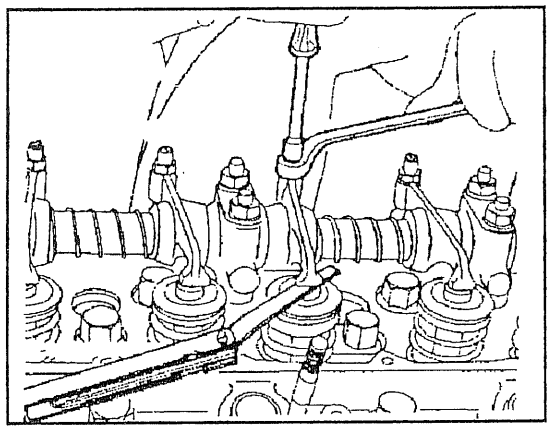
Top up with distilled water if necessary.

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 only 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.

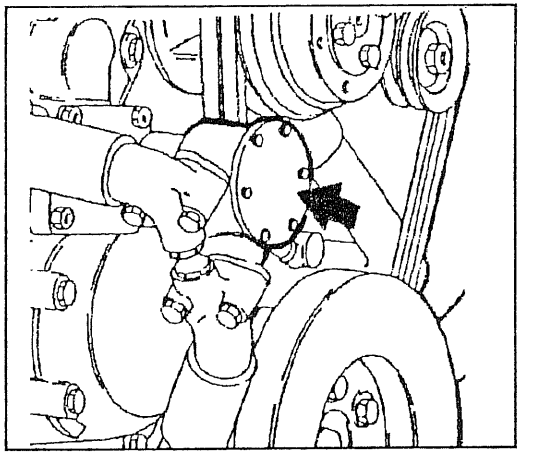
IT IS IMPORTANT that fuel injector maintenance is accomplished by a trained mechanic using the proper tools so as not to detriment proper functioning.

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.



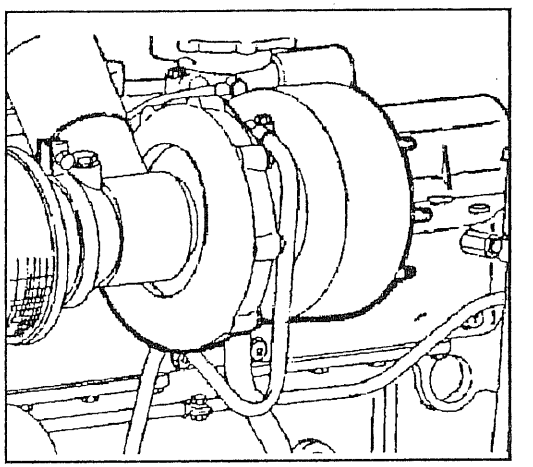
CLEANING THE TURBOCHARGER

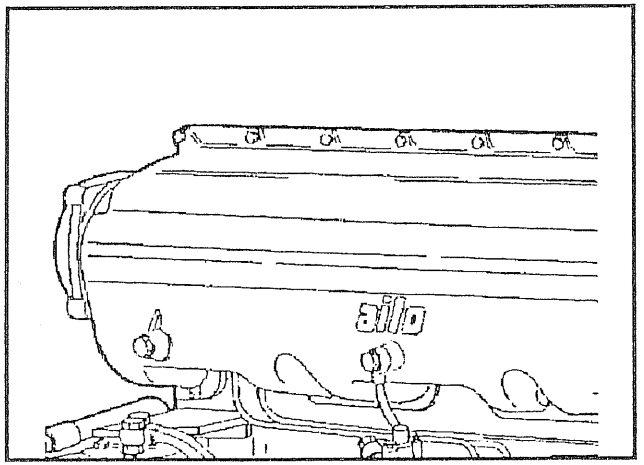
When the turbocharger appears not to be working properly clean it as follows:

- 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

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.

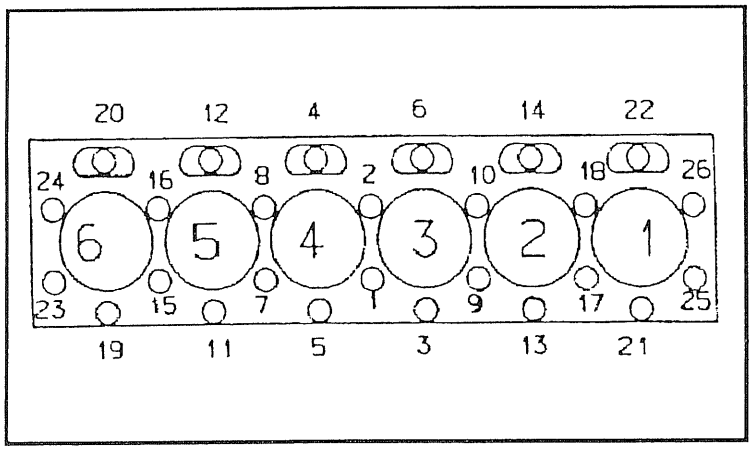
CHANGING OIL IN THE MARINE GEAR

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.

Operations Page



CRANKSHAFT DAMPER REPLACEMENT

We point out that the torsional damper (viscous type or made of rubber) fitted on the crankshaft, when is weared, can cause the breaking of the crankshaft.

The wear level of this part depends on the power, RPM and ambient conditions.

The damper must be replaced at each general overhauling of the engine.

Moreover we suggest to replace the damper, meanly, after :

- 10.000 hours ..... for engine 8361SM21
- 2.000 hours ..... for engine 8361SRM32
- 1.500 hours ..... for engine 8361SRM40

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 throughly 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 fours 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	130 Nm (13.2 kgm)	130 Nm (13.2 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 an over 1 month period, it is necessary to protect it from the corrosion and damages by proceeding as follows :

1. Drain the oil from the engine sump and refill it with purging oil (i.e. oil FIAT L20).

2. Let the engine run for 15 min. at 500 - 800 RPM ; stop the engine and drain the oil.

3. Drain the oil from the in-line injection pump.

4. Fill the engine sump with oil FIAT Prot. 30/M up to the level "Min" marked on the oil dipstick.

If the oil Prot. 30/M is not available, tse an oil according to the specifications MIL-2160B - type 2.

5. Fill the in-line injection pump with oil Prot. 30/M.

6. After emptying the fuel filters, disconnect the pipe of the injection system feeding, upstream the fuel pump, and link it to a tank containing oil CFB (ISO 4113).

7. Let the engine run for 15 min. at 500 - 800 RPM; then, using a syringe, nebulize slowly (1 min. about) into the air induction manifold the following quantity of oil Prot. 30/M :

- 60 g. for 3 - 4 cylinders engines
- 120 g. for 6 cylinders engines
- 200 g. for 8 cylinders engines (equally divided in each bank).

8. Drain, with hot engine, the oil Prot. 30/M from the engine sump; the oil can be used again twice or 3 times.

Slacken the trapezoidal belts.

Take out the impeller of the sea water pump wash it and grease with vaseline.

9. Disconnect the pipe of the injection system feeding from the oil CFB tank and link it to the fuel tank.

10. Seal, using adhesive tape, on the engine and exhaust manifold, all ports of access, induction and breather.

11. Put on the engine a visible card, specifying "ENGINE WITHOUT OIL".

12. Disconnect the batteries and stock them in a dry site, keeping them charged always.

13. Drain the cooling water if it is not mixed with anti-freeze liquid/corrosion inhibitor.

14. Drain the sea water circuit.

IMPORTANT : THIS TREATMENT MUST BE REPEATED EVERY 6 MONTHS.

RESTORATION OF THE RUNNING CONDITIONS

To restore the normal running conditions of the engine, carry out the following operations :

1. Drain the oil PROT. 30/M from the injection pump.

2. Fill the engine sump and the injection pump with the normal utilized oil, at the required level.

3. Stretch the trapezoidal belts.
Fit the impeller of the sea water pump.

4. Take away the seals from the parts of access, induction and breather.

5. Remove the card "ENGINE WITHOUT OIL".

6. Open the cock of the sea water scoop.

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 sacrifical 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 thermostarter (used for very cold climates), the injector drainage system should be connected to the thermostarter.

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

BREATHER PIPE (SRM32 and SRM40)

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

ELECTRICAL CONNECTION

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 for intake and exhaust ventilation :

4000 m^3 / h (8361SM21)

5300 m^3 / h (8361SRM32)

6300 m^3 / h (8361SRM40)

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_2O.

EXHAUST PIPES

After being used to drive the turbocharger, the exhaust gases from the engine are convoyed 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.