

## **CURSOR MARINE**

Thank you for preferring Iveco Motors and may we compliment you on the choice you have made.

Before carrying out any work on the engine, read through the procedures set out in this manual carefully.

If you follow these instructions your engine will be guaranteed trouble-free operation and a long life.

Remember that, wherever you are, the Iveco Motors Service Network will be at your side to offer you highest levels of skill and professionalism.

### **Guarantee**

In order to get the best performance from your engine and benefit from the guarantee you must comply with the instructions contained in this publication.

Failure to carry out these operations correctly or not at all may invalidate the guarantee.

### **Spare parts**

It is essential to use only Original Iveco Spare Parts if the engine is to be kept in its original sound condition.

The use of non-original spare parts will invalidate the guarantee and release Iveco from any long-term liability.

## **Liability**

The manufacturer's liability is dependent on the execution of the "Checks and Maintenance" operations mentioned in this manual.

For this purpose, a record must be kept of the maintenance operations carried out, which, as far as extraordinary maintenance is concerned, must be performed by authorised workshops.

## **Warning**

The contents of this manual refer to the engine only; in particular, illustrations are approximate and some instructions are described in a purely functional manner, to permit the operations to be carried out on the engine.

The ways of executing the above instructions depend on the configuration of the controls and/or accessories of the boat on which the engine is installed and reference is made to the machine manual.

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

The Manufacturer reserves the right to make amendments without prior notice at any time for reasons of a technical or commercial nature as well as to comply with legal requirements in different countries. It declines any liability for any errors or omissions.

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## **SAFETY REQUIREMENTS**

### **Basic rules**

The following recommendations are given so as to reduce the risk to persons and property when an engine is in service or out of service. Engines must not be used for applications other than those declared by the manufacturer.

Incorrect handling, modifications and use of non-original parts may affect safety.

When handling the engine, take care to use suitable equipment to be applied to the points specially provided on the engine (see paragraph "Handling engine").

This publication refers to the engine component; the boat on which it is installed must meet the specific safety requirements.

Note that the engine has moving parts and parts at high temperatures containing fluids under pressure. In addition, it is equipped with an electrical system that may have high currents.

The engine emits exhaust gases that are harmful to health.

The engine must not be put into service and used until the boat on which it is installed has satisfied the standards and local laws.

Further recommendations, for safety purposes, are contained in the section "Checks and Maintenance" in the chapter "During Maintenance".

## WARNING LABELS

Warning labels are applied to the engine by the boats' builder. Their meanings are given below.

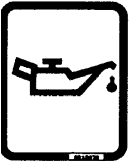
**N. B.** Labels which show an exclamation mark indicate that there is a possibility of danger.



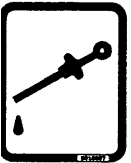
Lift point for engine only.



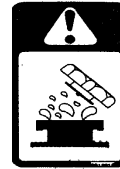
Fuel filler indication on tank  
(where present).



Lubricating oil filler indication.



Oil dipstick indication.



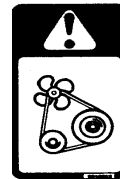
Danger of burns:  
Expulsion of pressurised hot water.



Danger of burns:  
Hot parts indication.



Risk of fire:  
Due to presence of fuel.



Risk of entangling and cutting:  
Indication of rotating parts  
(pulleys, belts).

## MAINTENANCE OPERATIONS

For the purposes of safety it is important that the maintenance operations indicated in this manual are carried out according to the following guidelines:

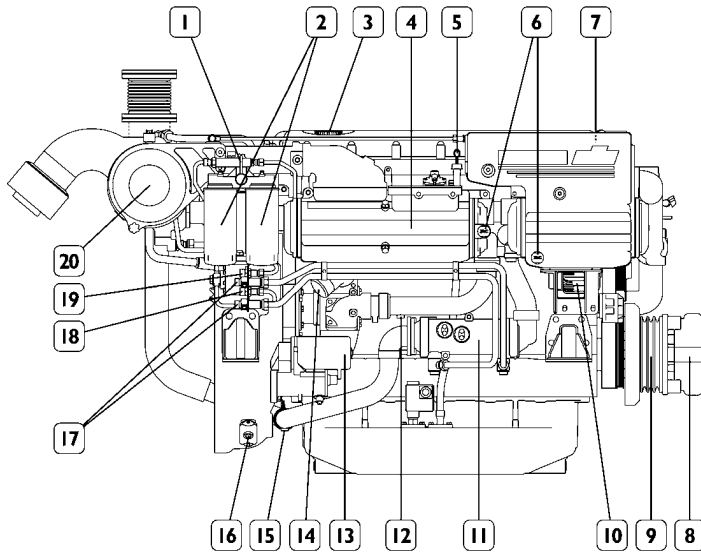
- **check operations**, can be carried out either by the repair shop or by the user of the boat;
- **routine maintenance checks**, marked by the spanner symbol (see diagram below), must be carried out by qualified persons using the appropriate equipment and protections;
- **non-routine maintenance operations**, given their particular nature, must be carried out by authorised workshops which are equipped with the appropriate tools and are in possession of the proper technical information.

"*Authorised workshops*" are understood to be the repair shops that belong to the Iveco Motors service organisation.



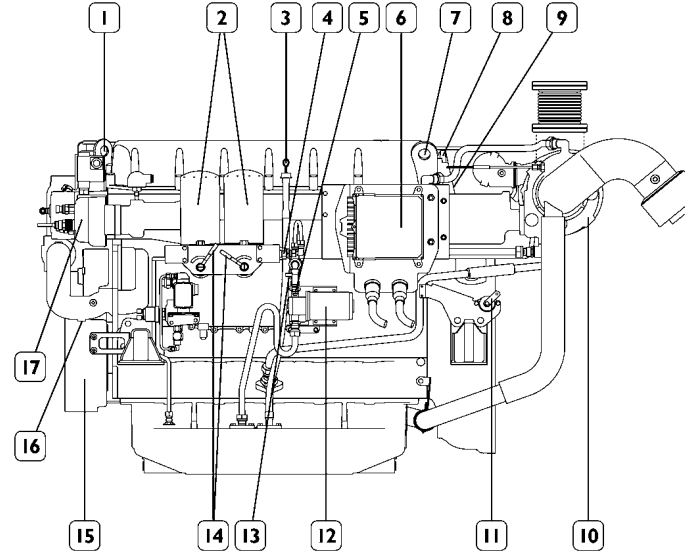
## ENGINE IDENTIFICATION DATA

The technical code and the serial number are stamped on a label positioned, depending on the model, on the flywheel housing or tappet cover.



### Cursor C78 ENT M50 - C78 ENT M30 : right hand view

1. Fuel filter selector lever (opt) - 2. Fuel filter or selectable filters (opt) - 3. Oil filler cap - 4. Air-seawater heat exchanger - 5. Oil dipstick (or on left hand side) - 6. Sacrificial anodes - 7. Coolant filler cap - 8. Power take-off coupling (opt) - 9. Power take-off pulley (opt) - 10. Alternator - 11. Marine gear oil cooler (opt) - 12. Seawater drain plug - 13. Electric starter motor - 14. Inlet to seawater pump - 15. Seawater drain plug - 16. Flywheel crank socket dust plug - 17. Marine gear oil cooler fittings (opt) - 18. Fuel tank feed line inlet fitting - 19. Fuel tank return line outlet fitting - 20. Air filter.



### Cursor C78 ENT M50 - C78 ENT M30 : left hand view

1. Engine lift eye - 2. Oil filters - 3. Oil dipstick (or on right hand side) - 4. Prelube check valve (opt) - 5. Lube oil fill and drain union (opt) - 6. Electronic control unit - 7. Engine lift eye - 8. Blow-by filter clogging indicator - 9. Location of blow-by filter cover - 10. Turbocharger - 11. Accelerator potentiometer arm - 12. Lube oil electric pump (opt) - 13. Manual oil fill/drain valve (opt) - 14. Fuel filter selector lever (opt) - 15. Housing for auxiliary equipment drive pulleys - 16. Coolant drain plug - 17. Location of thermostatic valve.

## GENERAL ENGINE DATA

- Diesel cycle, 4-stroke, injection.....pump injector
- Cylinders, number and layout .....6, in line
- Bore and stroke ..... 115 x 125 mm
- Total capacity ..... 7.8 l
- Direction of rotation (seen from flywheel side)..... anti-clockwise

## SPECIFIC ENGINE DATA

Description	Cursor C78 ENT M50	Cursor C78 ENT M30
- Intake	TCA	TCA
- Available ratings (*)		
A1	368 kW (500 CV) @ 2600 rpm	-
A2	331 kW (450 CV) @ 2600 rpm	-
B	294 kW (400 CV) @ 2600 rpm	-
C	257 kW (350 CV) @ 2600 rpm	243 kW (330 CV) @ 2000 rpm
D	-	220 kW (300 CV) @ 2000 rpm
- Dry weight kg	900	900

(\*) Net power at flywheel to ISO 3046-7; 25°C, 100 kPa; 30% relative humidity



### WARNING

*It is absolutely forbidden, at risk of invalidating the guarantee and the liability of Iveco Motors, to change the above characteristics, and in particular to change the adjustment of the electronic engine control unit.*

**It is strictly forbidden** to perform amendments or connections to electronic control units, and in particular, the data interconnection line between control units (CAN Line) is to be considered inviolable.

Any diagnosis and maintenance operations can be performed exclusively by authorised personnel, using Iveco Motors approved equipment.

## BEFORE STARTING

Every day, before starting the engine:

- Make sure that the sea water intake valve is open. Dry operation of the sea water pump would cause the impeller to deteriorate extremely quickly.
- Check the level of fluids (fuel, engine oil and cooling water).



### Attention!

*Before starting the engine, make sure that there are no combustible gases in the engine room (such as hydrocarbons).*

## ENGINE STARTING

### Equipped with Iveco Motors instrument panel (on request)

1. Enter the key into the changeover switch and turn it to the right to position 6B.

Wait till the alarm check is completed.

Turn the key to position 6C; and then the engine starts.

### If the engine is fitted with pre-lubrication pump :

- Turn the key to position 6B, the pre-lubrication pump is activated for 10 seconds and then warning light 7A turns on. Wait until pilot light 7A is turned off, then turn the key to position 6C and start the engine. In an emergency, should be needed to start the engine during pre-lubrication, turn the key to position 6C and start the engine.

As soon as the engine has started, release the key without accelerating.

### For engines fitted with starting air heater (where applicable) :

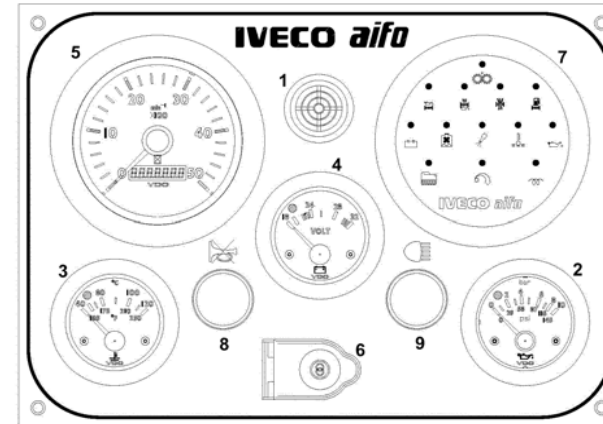
2. If temperature is below approx. 10°C, the air heater cuts in automatically and pilot light 7O is lit with a fixed light for a length of time that varies depending upon temperature.

3. During this phase (blinking) start up by turning the key to the starting position 6C without accelerating.

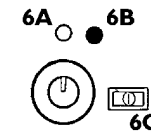
4. If the blinking time passes without starting, repeat the pre-heating procedure.

5. During the starting phase, the indicator light goes back to being a steady light.

*CAUTION: After starting up, the pre-heating glow plug indicator light could blink to signal the pre-heating function has activated.*



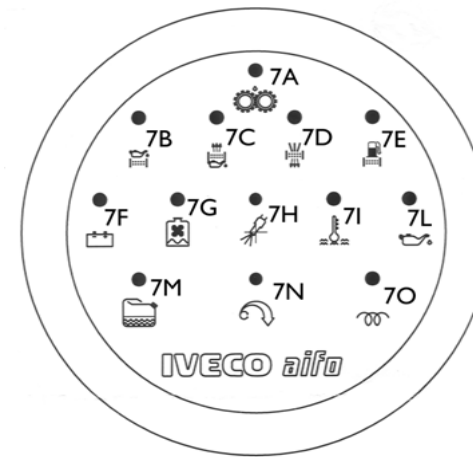
1. Buzzer
2. Oil gauge
3. Water temperature gauge
4. Voltmeter
5. Rev counter/hourmeter
6. Starter/stop switch
7. Alarm indicators
8. Buzzer silent
9. Day/Night lighting





## WARNING LIGHTS ACTIVE

- 7A (Yellow) - Pre-lubrication indicator
- 7B (Yellow) - Oil filter clogged warning light
- 7C (Yellow) - Blow-by filter clogged warning light
- 7D (Yellow) - Air filter clogged warning light
- 7E (Yellow) - Fuel filter clogged warning light
- 7F (Red) - Battery charge circuit fault warning light
- 7G (Red) - Low water level warning light
- 7H (Red) - Electronic injection system fault warning light
- 7I (Red) - High water temperature warning light
- 7L (Red) - Oil low pressure warning light
- 7M (Yellow) - Water presence in fuel filter warning light
- 7N (Red) - Engine rpm warning light
- 7O (Yellow) - Pre/post heating indicator light.



## **ENGINES WITHOUT IVECO MOTORS INSTRUMENT PANEL**

If the engines are not fitted with an Iveco Motors instrument panel, the starting instructions given previously are similar.

## **GENERAL GUIDELINES FOR STARTING**

If the engine fails to start immediately, do not operate the starter motor for any longer than 15 seconds. Do not insist on the start control with the engine started so as not to damage the engine and the starter motor.

Remember that in order to reach working temperature, it is not effective to keep the engine idling.

Approximately 1 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!

To obtain a good engine operation and a reduction of harmful exhaust emissions, avoid engine idling for too long a time.

## **STOPPING THE ENGINE**

1. Before stopping the engine, let it idle for a few minutes with no load; this allows a uniform reduction in the water and oil temperature, avoiding serious damage to the engine caused by thermal shock.
2. The engine is stopped by turning the key anticlockwise to the 6A position.



### **WARNING!**

*Never stop the engine with the battery isolator in order to avoid damaging the electronic engine control unit.  
Furthermore, the battery must not be disconnected until at least 20 seconds after the engine has stopped.*

## PRECAUTION FOR NORMAL OPERATION OF THE ENGINE

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 turbocharged Diesel engine merely causes a high degree of smoke from the exhaust.

With a new vessel the top speed must be 50 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 is maintained normal.

If temperature is too high check and have sea water circulation checked, also check for :

a) vee-belt tension on water pump-alternator

b) proper functioning of thermostat

c) heat exchanger, cleaning condition

2. Oil pressure to be kept at normal values

3. Battery voltage to be kept above 21V (for 24 V systems) or 10 V (for 12 V systems).



### Attention!

*Never open the water filler plug when the engine is hot. The cooling system is pressurised and the hot liquid will be expelled violently if the pressure is released too violently, causing burns.*

**Lubrication system** - Low oil pressure is signalled by the special pilot light 7L. Should the pilot light be lit, stop the engine under safety conditions and check oil level, and top it up if necessary. If the anomaly persists see an authorised workshop.

The engine is fitted with pilot lamp 7B, warning about oil filter clogging.

**Fuel system** - Avoid working with the fuel tank at minimum reserve levels so as to prevent the formation of condensation and failure of the system due to intake of air, which causes the engine to stop.

The engine is fitted with pilot lamp 7E, warning about fuel filter clogging.



### Attention!

*When filling up with fuel be particularly careful that the solid or liquid pollutants do not enter the tank with the fuel. Do not smoke or use naked flames.*

**Intake and exhaust system** - Check regularly that the air intake system is clean. The maintenance intervals change according to the working conditions.



### Attention!

*Visually inspect that the exhaust system is not blocked or damaged so as to prevent dangerous fumes.*

**Electrical starter system** - Check the battery state of charge regularly, particularly during the winter months. When topping up the electrolyte level in the batteries, follow the instructions set out in the paragraph "Checks and maintenance".



**Attention!**

*Do not smoke or bring naked flames in the vicinity of the batteries to avoid explosions.*

**PRECAUTIONS FOR USING THE ENGINE IN THE EARLY STAGES (50 hours)**

Modern engine construction technologies require no particular running in procedures, however it is advisable to avoid using the engine for prolonged periods at high power.

**ADDITIONAL PRECAUTIONS**

1. Never disconnect the battery supply with the engine running.
2. Never turn off the engine with the battery isolator.
3. Do not arc welding without first removing the electrical circuit of the battery pack.
4. After any maintenance requiring battery disconnection, make sure that the terminals are firmly connected when refitting.
5. Never use a battery charger to start up the engine.
6. Disconnect the battery from the on-board system when it is being charged.
7. Remove the electronic control units if any particular operations require temperatures over 80°C.
8. Never paint the control unit or the electrical equipment of the engine.
9. Before installing any electronic equipment (transmitters/receivers), contact the yard.
10. Disconnect the batteries before doing any work on the electrical system.

**WARNING**

Accelerator control is performed by a potentiometer. Should there be a failure the control unit automatically starts a safety procedure and two engine speeds:

1. Minimum accelerated speed (approx. 750 rpm) at which the engine is to be set in case of failure.

At this speed, it is possible to operate slowly **without** moving the accelerator lever, by using only the marine gear clutch and declutch.

2. High speed (approx. 1700/1800 rpm), can be obtained by shifting the accelerator lever by at least half the travel. The engine accelerates progressively until it reaches the mentioned speed which enables to proceed at cruising speed: this speed is to be exclusively used **outside** the harbour and in any case **not** when manoeuvring.

Setting the accelerator lever back to slow position, the engine rapidly returns to the condition in item 1).

N.B. : Under some potentiometer failure modes only condition 1) is operating.



**Warning!**

*Should the safety procedure be activated pay the maximum attention when performing manoeuvres specially inside the harbour and/or in reduced sea room; it is moreover advised to check whether people on board are secured to strong holds.*

## CHECKS AND MAINTENANCE

### INTRODUCTION

The digital control panel is fitted with a pilot lamp warning about the scheduled maintenance intervals (oil replacement, filters replacement etc.)

The **checks** indicated in this section can be carried out either by the workshop or by the boat user.

The **routine maintenance operations**, identified by the key symbol, must be carried out by qualified personnel who have the appropriate equipment and protections.

The **non-routine maintenance operations** identified by the spanner symbol, given their particular nature, must be carried out by authorised workshops equipped with appropriate equipment and with the proper technical information.

### DURING MAINTENANCE

- Never wear loose clothing, rings, bracelets and/or chains when working next to engines or moving parts.
- Use protective gloves and goggles:
  - when topping up batteries with acid
  - when topping up with inhibitors or anti-freeze
  - when changing or topping up the lubricating oil (hot engine oil can cause burns when it is drained. Let it cool down to under 50°C).

Use goggles if compressed air is used (in this case the maximum pressure of the air, used for cleaning, must be under 2 Atm (30 psi, 2 kg/cm<sup>2</sup>)).

- Use the protective helmet if working in an area with suspended loads or with installations at head height.
- Always wear safety shoes and overalls.
- Use protective cream for the hands.
- Always change out of wet overalls.



#### Attention!

*Avoid carrying out maintenance when there is live voltage; always check that the equipment is properly earthed. During regulation operations make sure that you have dry hands and feet and use insulating platforms.*



**Do not connect/disconnect EDC control unit connectors when engine is running or when the control unit is live.**

- Never carry out repairs with which you are unfamiliar. Always follow the instructions and, if these are not available, contact the supplier or qualified personnel as described above.
- Always keep the engine clean, eliminating oil, diesel and/or coolant stains.
- Place dirty rags inside flameproof containers.
- Do not leave rags on the engine.
- Use suitable secure containers for used oil.
- When you start an engine after a repair, take steps to stop the intake of air in case of over-rewinding on starting.

## CHECKS

	<b>Regularity</b>
Check oil level in sump .....	daily
Check oil level in marine gear .....	daily
Check cooling liquid level .....	daily
Check electrolyte level in the batteries (1) (2) _____	300 hours
Check blow-by filter condition __ by means of the clogging indicator	



## ROUTINE MAINTENANCE

Remember to have these operations carried out by specialist/authorised workshops, keeping to the specified intervals and bearing in mind that the intervals may change depending on engine use and the ambient conditions in which it operates.

	<b>Regularity</b>
Clean Dry air filter _____	300 hours
Inspect sacrificial anode corrosion (5) _____	300 hours
Change engine oil (2) _____	600 hours
Change oil filters (2) _____	600 hours
Change fuel filter (2) _____	600 hours (3)
Change fuel prefilter (2) _____	600 hours (3)
Inspect sea water pump impeller(2) _____	1200 hours
Adjust valve clearance _____	1200 hours
Change blow-by filter _____	1800 hours
Change oil in the marine gear _____	(6)



## NON-ROUTINE MAINTENANCE

	<b>Regularity</b>
Clean turbocharger _____	1200 hours
Clean air-water heat exchanger (2) _____	1200 hours
Clean water-water heat exchanger (2) _____	1200 hours
Clean marine gear water-oil heat exchanger (when fitted) (2) _____	1200 hours
Replace water pump/alternator drive belt _____	1800 hours

(1) The regularity of these operations can vary depending on engine use and the ambient conditions in which it operates.

(2) These operations must be carried out annually even when the specified operating hours have not been reached. The frequency applies to lubricants conforming with specifications ACEA E3, E5 API CH4; for lubricants conforming with ACEA E2 or API CF4, the frequency is reduced to every 300 hours.

(3) Maximum period, with high-quality fuel; it may vary depending on fuel contamination. The filter is equipped with a clogging and moisture indicator. In the event of clogging, replace the filter; if there is water, run it off via the specific drainage cock. Should the pilot light remain lit, change the filter.

To change the fuel filter, see the "Checks and maintenance work"

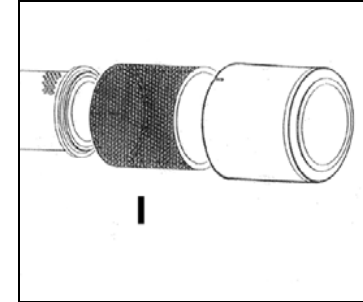
(5) Zinc corrosion must be no greater than 50%. Otherwise, replace.

(6) Refer to the marine gear manufacturer's manual.

## CHECKS AND MAINTENANCE OPERATIONS

### DRY AIR FILTER CLEANING

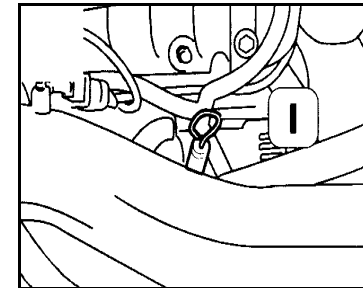
- Blow dry compressed air from inside to outside of the element 1 (pressure should not be over 2 bar in order not to damage the filtering element).
- **Do not clean the filter with gasoil**
- If the filter is cracked, replace it with a new one.
- Anyway, it should be changed every two years.




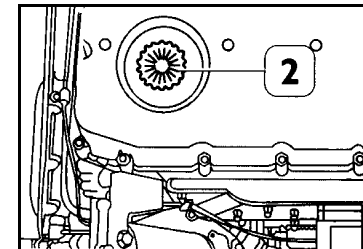
### ENGINE OIL LEVEL CHECK

Carry out the check with the engine off and cold.

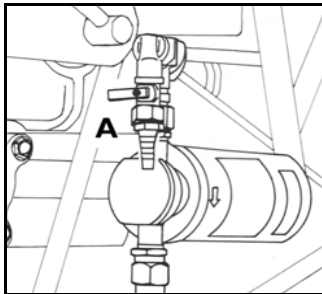
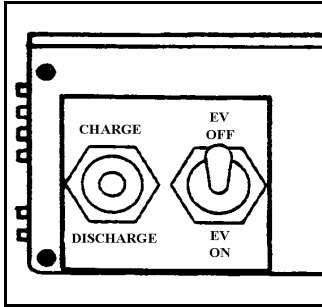
Check that the oil level falls between the "Min" and "Max" limits etched on the dipstick. If necessary, top up through the oil filler, after turning the cap anti-clockwise.



 **WARNING**  
*The level must never exceed the "Max" mark etched on the dipstick. After the check, reposition the dipstick correctly and fully tighten the filler cap, turning it clockwise as far as it will go. It is a must that the oil level be maintained between the Min. and the Max. during the operation, especially during long operations.*







## OIL CHANGE IN THE SUMP

(For engines with electronic control)

- **When the engine is off** turn the solenoid valve switch (EV) to “ON” .
- Open cock “A” (after connecting up to a pipe conveying the oil into a container).
- Turn the pump selector to position “DISCHARGE” and maintain this position until the exhaust oil is completely discharged.
- In order to refill new oil, turn the pump selector to position “CHARGE” and maintain this position until the wished filling is reached.
- Close cock “A” and turn the solenoid valve switch “EV” to “OFF”.

## CHECK THE LEVEL OF COOLING LIQUID IN THE FILLER TANK

Perform the check with the engine cold.

Take the pressurised cap off the filler tank unscrewing it anti-clockwise and visually check the level of the liquid , if necessary, top up the filler tank completely, making sure that with the engine cold the level of liquid in the expansion tank is at minimum.

## CHECK THE OIL LEVEL IN THE MARINE GEAR

Check the level of oil in the marine gear according to the indications given in the manual supplied by the marine gear manufacturer.

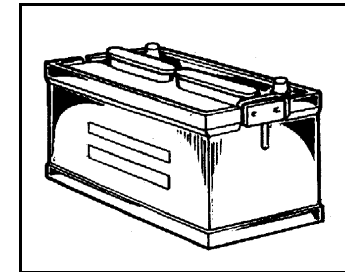
## BATTERY ELECTROLYTE LEVEL CHECK

With the batteries out of service and cold, check that the electrolyte level falls between the "Max" and "Min" limits; if the level is below the minimum, top up with distilled water.

During the summer months, check the level more frequently.

If the engine is unused, check the electrolyte monthly and, if the battery needs to be recharged, consult a specialist workshop.

Also check that the terminals and clamps are clean, tightened and protected with vaseline.



### Attention!

*The batteries contain highly corrosive sulphuric acid; when topping up with distilled water wear protective gloves and goggles. Where possible, have the above operations carried out by qualified personnel.*

*Do not smoke or bring naked flames within the vicinity of the batteries to avoid explosions.*

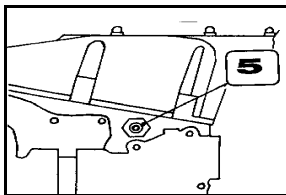
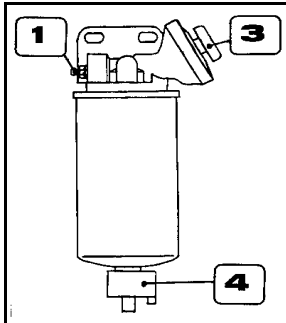
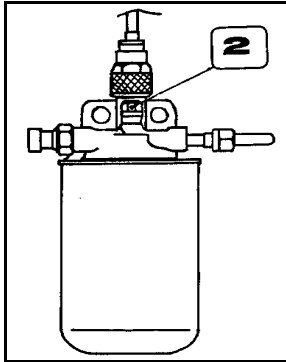
*With battery voltage under 21V (for 24 V systems) or 10 V (for 12 V systems) check the condition of the battery and electrical system.*



*Any battery replacement must exclusively be performed by qualified personnel.*

## Battery specifications

- min. capacity : 2 x 120 Ah
- cold cranking capacity : 900 A



### CHANGING FUEL FILTER

- Unscrew the fuel filter and replace it.
- Before fitting the new filter the gasket should be wetted with diesel fuel or engine oil.
- Screw the filter on by hand until there is contact with the support and then tighten by a further 3/4 of a turn.

#### Important!

When renewing fuel filter this should not be pre-filled and prevent foreign matters from entering the system and damaging engine components pump injectors.

#### Water in fuel prefilter

If warning lamp 7M lights up, unscrew tap 4 to drain the water.

### CHANGING FUEL PRE-FILTER

- Unscrew fuel pre-filter and replace it.
- Before fitting the new filter the gasket should be wetted with diesel fuel or engine oil.
- Screw the filter on by hand until there is contact with the support and then tighten by a further 3/4 of a turn.

### AIR-BLEED FUEL SYSTEM (Risk of fire!)

- Undo the bleed screws. Air-bleed residues should be drained into suitable containers via special pipes connected to the bleed screws:

1 = assembled on prefilter mounting .

2 = assembled on filter mounting (engine).

5 = assembled on the cylinder head front side.

- Operate the hand pump 3 (on prefilter) until you see that the fuel issuing from bleed screw 1 is thoroughly free from air (screw in the screw when this operation is over).

Continue pumping until the fuel is noticed to issue thoroughly free from air from bleed screw 2 and 5 also (the latter is assembled on the cylinder head from side).

Close both screws.

Now the circuit is thoroughly air-bled.

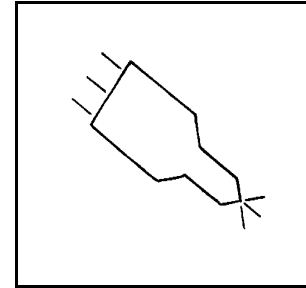
Start the engine and let it idle for a few minutes in order to eliminate any air residue.

## ENGINE FAULT DIAGNOSIS

The electronic engine control system has a self-diagnosis function indicated with the alarm indicator light 7H on steady/blinking.

**A steady light** indicates trouble that does not affect engine performance, but must anyhow be removed as soon as possible.

**A blinking light** indicates trouble for which the engine control unit trips, automatically lowering engine performance to make it possible to reach the nearest harbour and call in an authorised repair shop.



## **PREVENTIVE MAINTENANCE IN CASE OF PROLONGED ENGINE INACTIVITY**

To prevent oxidation to the inner parts of the engine and some components of the injection system, if periods of inactivity exceeding two months are expected, **every 6 months**, the engine must be prepared by proceeding as follows:

1. Drain the lubricating oil from the sump, after heating the engine.
2. Fill the engine with protective oil type 30/M (or MIL 2160B type 2) up to the "minimum" level indicated on the dipstick.  
Start the engine and let it run for about 5 minutes.
3. Drain the fuel from the injection line, from the filter and from the ducts in the cylinder heads. To do so, loosen the drain cap in the front part of the cylinder head and the fuel inlet junction with the cylinder head, taking care to prevent the fuel from coming in contact with the auxiliaries belt.
4. Connect the fuel line with a tank containing CFB protective liquid (ISO 4113) and let the liquid enter in by pressurizing the line and turning the engine over for about 2 minutes, after excluding the operation of the injection system. The required operation can be completed by directly polarizing the terminal 50 of the electric starter motor with 24 V positive voltage, by means of a conductor prepared for the occasion.
5. Nebulize about 80 gr. (10 gr. per liter of displacement) of protective oil type 30/M into the intake mouth of the turbocharger, while turning the engine over as described in the previous paragraph.
6. Close all the engine's intake, exhaust, aeration and vent ports with appropriate caps or seal with adhesive tape.
7. Drain from the oil sump the residual protective oil type 30/M, which may be reused for 2 more engine lay-ups.

8. Apply tags bearing the inscription "ENGINE WITHOUT LUBE OIL" on the engine and on the panel.

If exterior parts of the engines are to be protected as well, spray OVER 19 AR protective liquid on unpainted metal parts, such as flywheel, pulleys and others, taking care not to spray it on belts, connecting cables and electrical equipment.

## **RESTORING THE NORMAL OPERATING CONDITIONS**

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

## FAULTS DETECTION

### Fault Indicator Light

The ECU continuously monitors its own operating conditions as well as those of the components connected to it and of the engine itself, with complex self-diagnostics routines.

If faults are detected, the fault indicator light on the indications and control panel is lit in ways that provide an initial indication of the severity of the problem.

Light off: no fault detected or minor fault that does not compromise operating safety.

Light on: significant fault, allowing to proceed to a diagnostics center.

Blinking light: severe fault, requiring immediate servicing. If circumstances allow shutting the engine down.

### A. Blink code

The emission of the fault codes detected by the self-diagnostics routines and stored in the ECU starts after the push-button located on the relay and fuse board is pressed and released.

The LED to the side of the push-button and the EDC indicator light on the indications and control panel will simultaneously signal the codes by blinking two series of emissions at different frequency, reproducing the digits indicating the fault with decimal numbering.

Slow blinking indicates the area of the fault (engine, injectors,...), fast blinking indicates a specific fault.

Every time the push-button is pressed and released, only one of the stored codes is emitted; therefore, the procedure needs to be repeated until the system emits the same error data as the first one: this will mean

that the entire fault memory has been analyzed.

If no anomalies are stored, the light comes on when push-button is pressed and comes off about 1 second after it is released, without blinking.

Note:

The blink code diagnostic procedure provides indications about faults that are currently present but also about other faults, which arose in the past and are no longer present at the time of the diagnostic procedure.

Therefore, it is absolutely necessary, at the end of each servicing operation, to reset the error memory to prevent the system from signaling faults, in the future, whose cause has already been removed.

### B. Fault memory reset

In current applications, the reset operation is carried out keeping the blink code push-button pressed down with the key switch in the OFF position and keeping it pressed for 5 more seconds after setting the switch to ON.

Confirmation of the reset will be obtained by turning the key switch from OFF to ON and requesting blink codes again: at that point, no codes should be produced.

## CAPACITIES

Parts	Quantity		Product
	l	kg	
Cooling system	~40	-	Mixture of water and 50% Paraflu II (1)
Engine sump and filter (total capacity)	31	28.4	Lubricating oil ACEA E3 - E5 (3)
Sump only			
- min. level	18	16.4	
- max level (2)	28.5	26	
Fuel tank	-	-	Diesel (4)

1) Use a mixture of water and 50% Paraflu II in the summer months as well to provide optimal protection of the cooling system. As an alternative to PARAFU II, a similar product can be used provided that it corresponds to international specifications SAE J 1034.

2) The quantity indicated is that required for routine oil changes.

3) Use lubricants corresponding to the following international specifications: ACEA E3-E5 (MIL L 2104E/F).

Allowable oil consumption : max 0.2% of fuel consumption.

4) With atmospheric temperature below freezing, use a winter-type fuel.



### WARNING

If fuel is used with a percentage of sulphur above 0.5% or if lubricants corresponding to the specifications ACEA E2 (MIL L 2104E/F), are used the oil change intervals must be reduced to 300 hours.

### Refueling

Use standard type diesel oil only (EN 590 standard).

Fuel additives are not recommended. The use of fuel additives could restrict the warranty conditions provided for by the vehicle's manufacturer.

Refueling from barrels or cans can lead to fuel pollution resulting in irregular operation of the fuel feed system. If so, either filter the fuel by means of the suitable equipment or let possible impurities settle, as required.

### Low temperature fuel:

To low temperatures the fuel's fluidity rate can be lower than specified owing to the separation of the paraffin wax. This process may result in filter restriction.

The EN 590 standard provides for several fuel classes to be adhered to at low ambient temperatures.

Complying with the regulations in force depending on climate conditions (yearly seasons and different countries' geographical position) is the oil companies' full responsibility.



### REPLENISHING MARINE GEAR OIL

For the grade and amount of oil to use, refer to the manual supplied by the marine gear manufacturer.

### HANDLING THE ENGINE

If the engine is dismantled and then reassembled on the boat, the appropriate operations must be carried out solely by authorised workshops which are equipped with the appropriate lifting and handling equipment.

The eyes to be used to lift only the engine are indicated in this manual in the section "Engine views" and, on the engine, by special labels.

All the lifting eyes available must be used at the same time; **the use of just one eye is forbidden.**

It is not permitted to lift the engine before removing the transmission components connected to it.

The capacity and size of the engine lifting system must be adequate for the weight and size of the engine; in particular, check that there is no fouling between the lift system and the engine components.

It is important to use a lift balance to hold the metal lift cables parallel.



## **DISPOSAL**

Please note that the engine and its components contain material necessary for its operation which, if dispersed in the environment, may cause ecological damage.

The following materials must be consigned to special authorised collection centres:

- starter batteries
- used lubricating oils
- mixtures of water and anti-freeze
- filters
- auxiliary cleaning material (e.g. dirty or fuel-soaked rags)

Severe penalties are envisaged for transgressors, in accordance with the laws in force in every country.

## **WHAT TO DO IN AN EMERGENCY**

Any user of the boat, constructed according to safety regulations and who follows the instructions set out in this manual and complies with the instructions on the labels affixed to the engine is working in safe conditions.

If operating mistakes cause accidents call for help immediately from the emergency services.

In the event of an emergency, and whilst awaiting the arrival of the emergency services, the following general advice is given for the provision of first aid.

### **Fire**

Put out the fire with the outfit envisaged by current safety regulations.

### **Burns**

1) Put out the flames on the clothing of the burns victim by means of:

- drenching with water
- use of powder extinguisher, making sure not to direct the jets onto the face
- blankets or rolling the victim on the ground.

2) Do not pull off strips of clothing which are sticking to the skin

3) In the case of scalding with liquids, remove the soaked clothing quickly but carefully;

4) cover the burn with a special anti-burn packet or with a sterile bandage.

### **Carbon monoxide poisoning (CO)**

Carbon monoxide contained in engine exhaust gases is odourless and dangerous because it is poisonous and because, with the air, it forms an explosive mixture.

Carbon monoxide is very dangerous in enclosed premises because it can reach a critical concentration in a short time.

When attending a person suffering from CO poisoning in enclosed premises, ventilate the premises immediately to reduce the gas concentration.

When accessing the premises, the person providing the aid must hold his breath, not light flames, turn on lights or activate electric bells or telephones so as to avoid explosions.

Take the victim to a ventilated area or into the open air, placing him on his side if he is unconscious.

### **Caustic burns**

1) Caustic burns to the skin are caused by acid escaping from the batteries:

- remove the clothes
- wash with running water, being careful not to affect injury-free areas

2) Caustic burns to the eyes are caused by battery acid, lubricating oil and diesel fuel.

- wash the eye with water for at least 20 minutes, keeping the eyelids open so that the water runs over the eyeball and moving the eye in all directions.

### **Electrocution**

The electrical system of the 12 V or 24 V engine has no risk of electrocution. However, in the case of short-circuiting caused, for example by a metal tool, there is the risk of fire and burns.

In these cases, disconnect the power supply via the switch.

### **Wounds and fractures**

The wide range of possible injuries and the specific nature of the help needed means that the medical services must be called.

If the person is bleeding, compress the wound externally until help arrives.

In the case of fracture do not move the part of the body affected by the fracture. Move the injured person with extreme care and then only if strictly necessary.