INTRODUCTION

We would like to thank you for buying an FPT product, and compliment you on your choice of engine.
Before you carry out any operation involving the engine or its fittings, please read the contents of this manual carefully; compliance with the instructions provided in the manual is the best way to guarantee trouble-free, long term operation of the engine.

The contents of this manual refer to the standard configuration of the engine, and the illustrations are purely indicative. Some instructions are provided by giving the sequence of operations to be carried out in order to allow the engine and/or its fittings to perform in a certain way. In some cases they will be dependent on the configuration of the commands and the set-up of the vessel on which the engine is installed; for any points that differ from the contents of this manual, please consult the instructions provided by the Boatbuilder or a specific manual.

The information provided below was current at the date of publication.
The Manufacturer reserves the right to make modifications at any time without prior notice, for technical or commercial reasons or to update the engines to comply with legal requirements in the various Countries.
The Manufacturer declines all liability for any errors or omissions.

Please remember that the FPT Technical Service Network is available to offer you its experience and professional skills, wherever you may be.
# CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>GENERAL INFORMATION</td>
<td>3</td>
</tr>
<tr>
<td>Guarantee</td>
<td>3</td>
</tr>
<tr>
<td>Spare Parts</td>
<td>3</td>
</tr>
<tr>
<td>Liability</td>
<td>3</td>
</tr>
<tr>
<td>Safety</td>
<td>3</td>
</tr>
<tr>
<td>Engine technical data C 78 ENT M30 / M50 / M55</td>
<td>4</td>
</tr>
<tr>
<td>Engine technical data C 78 ENS M20</td>
<td>6</td>
</tr>
<tr>
<td>Signs</td>
<td>8</td>
</tr>
<tr>
<td>USE</td>
<td>9</td>
</tr>
<tr>
<td>Preliminary checks</td>
<td>9</td>
</tr>
<tr>
<td>Starting and stopping the engine</td>
<td>9</td>
</tr>
<tr>
<td>Starting and stopping the engine from the analogue control panel</td>
<td>10</td>
</tr>
<tr>
<td>Recognising alarms</td>
<td>13</td>
</tr>
<tr>
<td>Starting and stopping the engine from the digital instrument panel</td>
<td>14</td>
</tr>
<tr>
<td>Digital monitor for reading engine parameters and displaying alarms</td>
<td>17</td>
</tr>
<tr>
<td>Safety and monitoring system</td>
<td>20</td>
</tr>
<tr>
<td>Managing the engine from the Relay box</td>
<td>28</td>
</tr>
<tr>
<td>For proper use of the engine</td>
<td>29</td>
</tr>
<tr>
<td>Special warnings</td>
<td>29</td>
</tr>
<tr>
<td>Running</td>
<td>30</td>
</tr>
<tr>
<td>Refuelling</td>
<td>31</td>
</tr>
<tr>
<td>CONTROLS AND MAINTENANCE</td>
<td>32</td>
</tr>
<tr>
<td>Maintenance personnel</td>
<td>32</td>
</tr>
<tr>
<td>Accident prevention</td>
<td>32</td>
</tr>
<tr>
<td>Frequency</td>
<td>33</td>
</tr>
<tr>
<td>Requirements</td>
<td>35</td>
</tr>
<tr>
<td>How to proceed</td>
<td>35</td>
</tr>
<tr>
<td>Moving the engine</td>
<td>46</td>
</tr>
<tr>
<td>Disposal of waste</td>
<td>46</td>
</tr>
<tr>
<td>LONG PERIODS OF INACTIVITY</td>
<td>47</td>
</tr>
<tr>
<td>Preparing the engine for a long period of inactivity</td>
<td>47</td>
</tr>
<tr>
<td>Restarting the engine after a long period of inactivity</td>
<td>47</td>
</tr>
<tr>
<td>Indications for initial start-up or start-up after a long period of inactivity</td>
<td>48</td>
</tr>
<tr>
<td>ENGINE MALFUNCTIONS</td>
<td>49</td>
</tr>
<tr>
<td>EMERGENCIES ON BOARD</td>
<td>50</td>
</tr>
<tr>
<td>IN APPENDIX</td>
<td></td>
</tr>
<tr>
<td>Oil viscosity level according to surrounding temperatures</td>
<td>52</td>
</tr>
<tr>
<td>On board panels requirements</td>
<td>53</td>
</tr>
<tr>
<td>Digital instrument panel - Previous version</td>
<td>54</td>
</tr>
<tr>
<td>Recognizing alarm statuses</td>
<td>56</td>
</tr>
</tbody>
</table>
GENERAL INFORMATION

GUARANTEE
In order to ensure that your engine gives the best possible performance and to take advantage of the FPT guarantee, you must follow the indications provided in this publication with great care; failure to do so may result in invalidation of the guarantee.

SPARE PARTS
Always use Original FPT Spare parts. This is essential to keep the engine in original running order. The use of non-original spare parts will not only invalidate the guarantee, but will mean that FPT will not be considered liable in any way during the whole working life of the engine.

LIABILITY
The Manufacturer will only be considered liable subject to performance of the control and maintenance operations indicated and described in this manual; to this effect, proof that these operations have been performed must be provided. Any special maintenance operations that may be necessary must be carried out by qualified technicians from Workshops in the FPT Network, using the instruments and equipped provided for the purpose.

SAFETY
The following information is intended to encourage caution when using the engine, so as to avoid damage to persons or property as a result of improper or incorrect behaviour.

- The engines must only be used for the purposes indicated by the Manufacturer.
- Any tampering, modification and use of non-original spare parts may compromise proper operation of the engine and safe navigation; never, under any circumstances make modifications to the wiring and to the units equipping the engine, or connect them to other power systems.
- Pay particular attention to moving parts of the engine, to high temperature components and to circuits containing pressurised fluids; its electrical equipped houses electrical currents and voltage.
- The exhaust fumes produced by the engine are bad for your health.
- The engine must only be moved using suitable lifting tackle, making use of the U-bolts provided on the engine for that purpose.
- The engine must not be started up and used until the vessel in which it installed has satisfied all necessary safety requirements, or until the vessel has been guaranteed to comply with local laws and regulations.
- The operations required to guarantee the best possible use and preservation of the engine must only be carried out by persons of proven experience, equipped with tools considered suitable by FPT.

For the purpose of safety, further recommendations are given in the chapter CONTROLS AND MAINTENANCE.
**ENGINE TECHNICAL DATA C78 ENT M30/M50/M55**

The technical code and serial number are indicated on a plate, which is located on different parts of the engine, according to the model: flywheel casing, tappet cover, coolant tank.

<table>
<thead>
<tr>
<th>Code</th>
<th>C78 ENT M30 / M50 / M55</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine family</td>
<td>F2B</td>
</tr>
<tr>
<td>Cycle</td>
<td>4-stroke diesel</td>
</tr>
<tr>
<td>Number and arrangement of cylinders</td>
<td>6, in line</td>
</tr>
<tr>
<td>Bore x stroke</td>
<td>115 x 125 mm</td>
</tr>
<tr>
<td>Total displacement</td>
<td>7,800 cm³</td>
</tr>
<tr>
<td>Air system</td>
<td>Supercharged aftercooled (TCA or TAA)</td>
</tr>
<tr>
<td>Injection type</td>
<td>Direct EUI electronically managed</td>
</tr>
<tr>
<td>Engine direction of rotation</td>
<td>Anticlockwise (seen from flywheel side)</td>
</tr>
<tr>
<td>Dry weight</td>
<td>910 kg</td>
</tr>
</tbody>
</table>

**Electrical system**

<table>
<thead>
<tr>
<th>Code</th>
<th>C78 ENT M30 / M50 / M55</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine family</td>
<td>F2B</td>
</tr>
<tr>
<td>Cycle</td>
<td>4-stroke diesel</td>
</tr>
<tr>
<td>Number and arrangement of cylinders</td>
<td>6, in line</td>
</tr>
<tr>
<td>Bore x stroke</td>
<td>115 x 125 mm</td>
</tr>
<tr>
<td>Total displacement</td>
<td>7,800 cm³</td>
</tr>
<tr>
<td>Air system</td>
<td>Supercharged aftercooled (TCA or TAA)</td>
</tr>
<tr>
<td>Injection type</td>
<td>Direct EUI electronically managed</td>
</tr>
<tr>
<td>Engine direction of rotation</td>
<td>Anticlockwise (seen from flywheel side)</td>
</tr>
<tr>
<td>Dry weight</td>
<td>910 kg</td>
</tr>
</tbody>
</table>

**Available settings (*) C78 ENT M30**

<table>
<thead>
<tr>
<th>Code</th>
<th>Available power</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>243 kW (330 CV) @ 2000 rpm</td>
</tr>
<tr>
<td>D</td>
<td>220 kW (300 CV) @ 2000 rpm</td>
</tr>
</tbody>
</table>

**Available settings (*) C78 ENT M50**

<table>
<thead>
<tr>
<th>Code</th>
<th>Available power</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>368 kW (500 CV) @ 2600 rpm</td>
</tr>
<tr>
<td>A2</td>
<td>331 kW (450 CV) @ 2600 rpm</td>
</tr>
<tr>
<td>B</td>
<td>290 kW (400 CV) @ 2600 rpm</td>
</tr>
<tr>
<td>C</td>
<td>257 kW (350 CV) @ 2600 rpm</td>
</tr>
</tbody>
</table>

**Available settings (*) C78 ENT M55**

<table>
<thead>
<tr>
<th>Code</th>
<th>Available power</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>405 kW (550 CV) @ 2600 rpm</td>
</tr>
<tr>
<td>A2</td>
<td>368 kW (500 CV) @ 2600 rpm</td>
</tr>
<tr>
<td>B</td>
<td>331 kW (450 CV) @ 2600 rpm</td>
</tr>
<tr>
<td>C</td>
<td>294 kW (400 CV) @ 2600 rpm</td>
</tr>
</tbody>
</table>

(*)Net power to the flywheel in compliance with ISO 3046-1. Test conditions: T 25 °C; atmospheric pressure 100 kPa; relative humidity 30%.

**WARNING**

Any alteration of the above mentioned characteristics, in particular modification of the data stored in the injection system electronic units or the characteristics of the engine and its fittings, is strictly prohibited, penalty invalidation of the guarantee and absence of all liability on the part of FPT.
C78 ENT M30 / M50 / M55 engine

C78 ENT MM30 / M50 / M55 engine
ENGINE TECHNICAL DATA C78 ENS M20

The technical code and serial number are indicated on a plate, which is located on different parts of the engine, according to the model: flywheel casing, tappet cover, coolant tank.

<table>
<thead>
<tr>
<th>Code</th>
<th>C78 ENS M20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine family</td>
<td>F2B</td>
</tr>
<tr>
<td>Cycle</td>
<td>4-stroke diesel</td>
</tr>
<tr>
<td>Number and arrangement of cylinders</td>
<td>6, in line</td>
</tr>
<tr>
<td>Bore x stroke</td>
<td>115 x 125 mm</td>
</tr>
<tr>
<td>Total displacement</td>
<td>7,800 cm³</td>
</tr>
<tr>
<td>Air system</td>
<td>Supercharged</td>
</tr>
<tr>
<td>Injection type</td>
<td>Direct EUI electronically managed</td>
</tr>
<tr>
<td>Engine direction of rotation</td>
<td>Anticlockwise (seen from flywheel side)</td>
</tr>
<tr>
<td>Dry weight</td>
<td>890 kg</td>
</tr>
</tbody>
</table>

**Electrical system**

<table>
<thead>
<tr>
<th></th>
<th>24 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accumulator/s capacity</td>
<td>120 Ah or above</td>
</tr>
<tr>
<td>discharge current</td>
<td>900 A or above</td>
</tr>
</tbody>
</table>

### Available settings (*)

<table>
<thead>
<tr>
<th>Code</th>
<th>C78 ENS M20</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>169 kW (230 CV) @ 2000 rpm</td>
</tr>
<tr>
<td>D</td>
<td>147 kW (200 CV) @ 2000 rpm</td>
</tr>
</tbody>
</table>

(*) Net power to the flywheel in compliance with ISO 3046-1. Test conditions: T 25 °C; atmospheric pressure 100 kPa; relative humidity 30%.

**WARNING**

Any alteration of the above mentioned characteristics, in particular modification of the data stored in the injection system electronic units or the characteristics of the engine and its fittings, is strictly prohibited, penalty invalidation of the guarantee and absence of all liability on the part of FPT.
C78 ENS M20 engine

C78 ENS M20 engine
**SIGNS**

Certain warning signs are affixed to the engine, and their meanings are indicated below.

**NOTE**: The signs with an exclamation mark on them underline a potential danger.

<table>
<thead>
<tr>
<th>Icon</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Lifting point" /></td>
<td>Lifting point (engine only).</td>
</tr>
<tr>
<td><img src="image" alt="Fuel Cap" /></td>
<td>Fuel Cap (on the fuel tank, if there is one).</td>
</tr>
<tr>
<td><img src="image" alt="Oil Cap" /></td>
<td>Oil Cap.</td>
</tr>
<tr>
<td><img src="image" alt="Oil dipstick" /></td>
<td>Oil dipstick.</td>
</tr>
<tr>
<td><img src="image" alt="Danger of burning" /></td>
<td>Danger of burning: Expulsion of hot water under pressure.</td>
</tr>
<tr>
<td><img src="image" alt="Danger of burning" /></td>
<td>Danger of burning: Presence of high temperature parts.</td>
</tr>
<tr>
<td><img src="image" alt="Danger of fire" /></td>
<td>Danger of fire: Fuel present.</td>
</tr>
<tr>
<td><img src="image" alt="Danger of impact or catching" /></td>
<td>Danger of impact or catching on moving parts: Presence of fans, pulleys, belts or the like.</td>
</tr>
</tbody>
</table>
USE

PRELIMINARY CHECKS
Before starting the engine each time:

- Make sure that the sea-water inlet valve is open. Operation of the sea water pump without water would cause irreparable damage to the internal rotor within a very few seconds.
- Check the level of technical fluids (fuel, engine oil and coolant).

CAUTION!
Before starting the engine, make sure that no combustible vapours or gasses are present in the engineroom.

STARTING AND STOPPING THE ENGINE
For boats equipped with instrument panel not manufactured by FPT

Start-up and shut-down modes described on the following pages are applicable if an FPT instrument panel is installed on board. Should the boat be equipped with a customized dashboard which has been manufactured at the Yard or by the Boat builder, such procedures may change based on the panel's specific features. In such cases please observe the Yard's startup/stop sequences and read the indication instruments as specified in the relevant documentation.

Engines equipped with pre-lubrication electric system

The pre-lubrication feature is started by acting on the power switch of the electrical system and the relevant warning light lits up. The engine startup sequence described in the following pages shall take place after the required pre-lubrication time has elapsed and the warning light is turned off or only after the warning light has gone out.

![Pre-lubrication diagram]

Electronic pre-lubrication and transfer unit -

Pre-lubrication of engine parts can also be carried out in manual mode. If necessary, proceed as follows:
1. Ensure that the ignition key switch is turned off (STOP).
2. Check that switch B on the pre-lubrication electronic unit is in “EV OFF” position, then press the adjacent pushbutton A towards “DISCHARGE”.
3. Keep the pushbutton pressed long enough to allow complete pre-lubrication.
4. Start the engine as described on the following pages.
STARTING AND STOPPING THE ENGINE FROM THE ANALOGUE CONTROL PANEL

Procedure for start-up from the main FPT control panel

Make sure that the electrical switch indicating ENGINE ROOM - BRIDGE on the Relay Box unit (normally located in the engine room) is in the BRIDGE position, then proceed as follows:

1. Lift the protective cover over the key switch (8), insert the key and turn it to the right to position 8B.
2. Make sure that the analogue instruments are showing values that conform with the relevant physical parameters (temperature, battery voltage and oil pressure).
3. Wait for the beeper to stop sounding and for the alarm indicator lights on the indicator module (5) to switch off, with the exception of the “alternator recharge” and “low oil pressure” indicators. At the same time, check that the indicator test has been performed successfully (information on how to interpret this test and indications on the module are given in the relevant paragraph).
4. Turn the key to position 8C; once the engine has started, release the key and do not accelerate.
5. Make sure that the analogue instruments are showing values that conform with the relevant physical parameters (temperature, battery voltage and oil pressure).
6. If the engine does not start, after releasing the key it will only be possible to turn it back to the start position after first returning the switch to the rest position 8A.
Procedure for start-up from FPT secondary or fly-bridge control panel

1. Enable the secondary control panel, by turning the key switch on the main panel to position **8B** (see requirements and procedure given in previous paragraph).

2. Wait for the beeper to stop sounding and for the alarm indicators on the indicator module (3) to switch off, with the exception of the “alternator malfunction” and “low oil pressure” indicators. At the same time, check that the indicator test has been performed successfully (information on how to interpret this test and indications on the module are given in the relevant paragraph).

3. Press the green button (5) and release it when the engine has started.

4. Check that the rev indicator shows a plausible value.

**WARNING**
For the onboard control panels to fully perform their relevant operations during navigation, it is essential that the engine startup is done only after the completion of warning lights and horn testing.

**Stopping the engine**

Before stopping the engine it is recommended you run it for a few minutes at minimum speed with no load; this will allow the temperature to drop evenly and will avoid harmful thermal shocks.

A. The engine is normally stopped from the main FPT control panel by turning the key switch to the rest position 8A or by turning a similar command on the customised control panel.

1. Turn the ignition to the rest position 8A (OFF);
2. Press the RINA stop button (red STOP button) (9) in the main FPT panel.

**NOTE:** In the case of emergency braking or dangerous situations, press the buttons to stop the engine. Then, to stop the supply to the engine control unit, turn the ignition switch to the OFF position and press the RINA stop button.

**For RINA homologated systems only:**
1. Turn the ignition to the rest position 8A (OFF);
2. Press the RINA stop button (red STOP button) (9) in the main FPT panel.

**WARNING**

*The stopping procedure for RINA homologated systems is different from standard systems.*

B. The FPT secondary control panel is stopped by pressing the red button (6) on the control panel.

**To re-start the engine from the main control panel:**
1. Return the key switch to the rest position 8A to reset all the onboard control panel functions.
2. Proceed as described.

**To re-start the engine from the secondary control panel:**
1. Make sure that the panel has been enabled (key switch on the main control panel turned to position 8B).
2. Press the green button (5) and release it when the engine has started, making sure that the rev indicator is showing a plausible reading.
RECOGNISING ALARMS

FPT on-board control panels with analogue instruments are fitted with an electronic module that includes the indicator lights and the interface, timer and alarm storage circuits.

The figure illustrates the dial and the key indicates the meaning of the alarm signals sent by all the indicator lights; some types of engine and relevant equipped only make some of the above mentioned functions available.

If the Boatyard uses different technical options there may be changes to the above.

Operation

When the key switch is turned to position 8B the signals and alarms module will perform an efficiency test on all the indicator lights, lasting 5 seconds, with the exception of the "Pre-lubrication", "Pre-post heating", "EDG system malfunction" indicators, and simultaneously the beeper sounds.

It is possible to stop the beeper before the end of the test, by pressing the relevant button.

During start-up and for the following 15 seconds, all alarm functions are disabled; after this period, each alarm detected by the sensors provided on the engine will result in the relevant indicator flashing and a simultaneous warning sound from the beeper. If the beeper is disabled by pressing the relevant button, the indicator light will turn on without flashing and the alarm will be stored until the engine is next stopped.

1. Maximum allowed rotation speed exceeded (on request)

*Alarm functions not available with standard setup.
STARTING AND STOPPING THE ENGINE FROM THE DIGITAL INSTRUMENT PANEL

Starting procedure from main FPT panel

Make sure that the electric switch with the words ENGINE ROOM - BRIDGE in the relay box (normally located in the machine room) is in the BRIDGE position, then proceed as follows:

1. Lift up the protective cover for the ignition switch (5), introduce the key and turn it to the right to position B.

2. Check that the panel readings are plausible with the physical parameter figures.

3. Wait for the acoustic alarm signal to stop, except for "Alternator faulty" and "Loe oil pressure" and, at the same time check that the outcome of the test is positive (see RECOGNITION OF ALARM STATES section).

4. Turn the key to position C; once the engine is started, release it avoiding accelerating.

5. Check that the readings are plausible with the new physical parameter figures (temperature, oil pressure and voltage).

6. If starting fails, after having released the key it will only be possible to return to the starting position after having placed the switch in rest position A.

The elements described above are supplied loose by FPT and it will be the responsibility of the Shipyard or the Fitter to position them in the instrument panel.
Starting procedure from secondary FPT panel or fly-bridge
(supplied on request)

1. Enable the secondary panel for operation by placing the ignition switch for the main panel in position B (instructions and procedure in the next paragraph).

2. Wait for the alarm to stop and the alarm indicators to go out except for the "Alternator faulty" and "Low oil pressure" (see RECOGNITION OF ALARM STATES section).

3. Press the green START button (3) and after starting release it checking that the readings are plausible with the new physical parameters.


The elements described above are supplied loose by FPT and it will be the responsibility of the Shipyard or the Fitter to position them in the instrument panel.
Stopping the engine

Before stopping the engine it is advisable to keep it turning over for several minutes idling in no load conditions; this will allow a uniform reduction of the temperature and prevent damaging thermal shock.

A. From the main FPT panel: on standard systems the engine is stopped by turning the ignition key to the rest position A.

For RINA homologated systems only:

1. Turn the ignition to the rest position A (OFF);
2. Press the RINA stop button (red STOP button) in the main FPT panel.

NOTE: In the case of emergency braking or dangerous situations, press the buttons to stop the engine. Then, to stop the supply to the engine control unit, turn the ignition switch to the OFF position and press the RINA stop button.

B. From the secondary FPT panel: the engine is stopped by pressing the red STOP button.

To restart the engine from the main panel:

1. Turn the ignition key to the rest position A to reset all the functions carried out by the control panels.
2. Proceed as described in the appropriate paragraph.

To restart the engine from the secondary panel:

1. Make sure that the panel is enabled (main panel ignition switch in position B).
2. Press the green START button (3) and after starting release it checking that the readings are plausible.

WARNING
The stopping procedure for RINA homologated systems is different from standard systems.
The digital monitor for reading the engine operating parameters has an instrument bar at the bottom of the screen that summarizes the structure displayed by each individual button in the form of a symbol. The choice of function is made by pressing the corresponding button, from left to right. The instrument bar disappears after 5 seconds of inactivity.

<table>
<thead>
<tr>
<th>Button 1</th>
<th>Button 2</th>
<th>Button 3</th>
<th>Button 4</th>
<th>Button 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display of parameters in three independent windows</td>
<td>Display of parameters in four independent windows</td>
<td>Graphic display of parameters time progress in one single window</td>
<td>Alarm display.</td>
<td>Monitor adjustment and contrast or, if pressed for 3 seconds, access to configuration menu</td>
</tr>
</tbody>
</table>

When the display is turned on an initial screen with the FPT logo appears for about 7 seconds. The display will carry out an autodiagnosis at the same time. If the display gives a "beep" for more than a second this means that the autodiagnosis has failed.

As soon as the initial screen with the FPT logo disappears, the monitor will show the readings of its virtual indicators (Tri screen). A few moments later the last screen displayed before switching off will appear.
**Display of engine version parameters (in standard configuration)**

The table lists the parameters transmitted by the CAN line (J1939) and displayed on the control monitor in the modes described previously: screen with one, three or four windows. The DB in the table indicates the internal data base that stores all the data transmitted by the engine. The complete list of the internal data base can be consulted, on the monitor, by means of the configuration menu under the item "DB Viewer". If the parameter requested is not available it will not be possible to select it and if it becomes unavailable during the display the following will be shown on the monitor "- - -".

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>PARAMETER</th>
<th>Datalinks</th>
<th>Screen windows</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>J1939</td>
<td>3  4  1  DB</td>
</tr>
<tr>
<td></td>
<td><strong>ELECTRICAL SECTION Volt or Ampere</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Battery symbol" /></td>
<td>Battery voltage</td>
<td>✓</td>
<td>✓  ✓  ✓  ✓</td>
</tr>
<tr>
<td><img src="image" alt="Fuel symbols" /></td>
<td>Fuel (L, Gal, lGal) o (L/h, Gal/h, lGal/h) o (km/L, MPG, o lMPG)</td>
<td>✓</td>
<td>✓  ✓  ✓  ✓</td>
</tr>
<tr>
<td><img src="image" alt="Residual fuel symbol" /></td>
<td>Residual fuel with GPS</td>
<td>✓</td>
<td>✓  ✓  ✓</td>
</tr>
<tr>
<td><img src="image" alt="Instantaneous Fuel Economy" /></td>
<td>Instantaneous Fuel Economy</td>
<td>✓</td>
<td>✓  ✓  ✓</td>
</tr>
<tr>
<td><img src="image" alt="Distance" /></td>
<td>Distance (km, milia, o Nmilia)</td>
<td>✓</td>
<td>✓  ✓  ✓</td>
</tr>
<tr>
<td><img src="image" alt="Remaining distance" /></td>
<td>Remaining distance with GPS</td>
<td>✓</td>
<td>✓  ✓  ✓</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>PARAMETER</th>
<th>Datalinks</th>
<th>Finestre schermo</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>J1939</td>
<td>3  4  1  DB</td>
</tr>
<tr>
<td></td>
<td><strong>Pressure (kPa, PSI o bar)</strong></td>
<td>✓</td>
<td>✓  ✓  ✓  ✓</td>
</tr>
<tr>
<td><img src="image" alt="Barometric symbol" /></td>
<td>Barometric pressure</td>
<td>✓</td>
<td>✓  ✓  ✓  ✓</td>
</tr>
<tr>
<td><img src="image" alt="Turbocharging symbol" /></td>
<td>Turbocharging pressure</td>
<td>✓</td>
<td>✓  ✓  ✓  ✓</td>
</tr>
<tr>
<td><img src="image" alt="Engine oil symbol" /></td>
<td>Engine oil pressure</td>
<td>✓</td>
<td>✓  ✓  ✓  ✓</td>
</tr>
<tr>
<td><img src="image" alt="Temperature symbol" /></td>
<td>Temperature (°C o °F)</td>
<td>✓</td>
<td>✓  ✓  ✓  ✓</td>
</tr>
<tr>
<td><img src="image" alt="Engine coolant symbol" /></td>
<td>Engine coolant temperature</td>
<td>✓</td>
<td>✓  ✓  ✓  ✓</td>
</tr>
<tr>
<td><img src="image" alt="Fuel temperature symbol" /></td>
<td>Fuel temperature</td>
<td>✓</td>
<td>✓  ✓  ✓</td>
</tr>
<tr>
<td><img src="image" alt="Exhaust gas symbol" /></td>
<td>Exhaust gas temperature</td>
<td>✓</td>
<td>✓  ✓  ✓  ✓</td>
</tr>
<tr>
<td><img src="image" alt="Percentage" /></td>
<td>Acceleration position</td>
<td>✓</td>
<td>✓  ✓  ✓  ✓</td>
</tr>
<tr>
<td><img src="image" alt="Refrigreant level symbol" /></td>
<td>Refrigerant level</td>
<td>✓</td>
<td>✓  ✓  ✓  ✓</td>
</tr>
<tr>
<td><img src="image" alt="Engine torque current percentage" /></td>
<td>Engine torque current percentage</td>
<td>✓</td>
<td>✓  ✓  ✓  ✓</td>
</tr>
<tr>
<td><img src="image" alt="Engine torque at rpm" /></td>
<td>Engine torque at rpm</td>
<td>✓</td>
<td>✓  ✓  ✓  ✓</td>
</tr>
<tr>
<td><img src="image" alt="Speed symbol" /></td>
<td>Speed (RPM, km/h, MPH o KTS)</td>
<td>✓</td>
<td>✓  ✓  ✓  ✓</td>
</tr>
<tr>
<td><img src="image" alt="Engine speed" /></td>
<td>Engine speed</td>
<td>✓</td>
<td>✓  ✓  ✓  ✓</td>
</tr>
<tr>
<td><img src="image" alt="Time symbol" /></td>
<td>Time (h)</td>
<td>✓</td>
<td>✓  ✓  ✓</td>
</tr>
<tr>
<td><img src="image" alt="Total hours of engine operation" /></td>
<td>Total hours of engine operation</td>
<td>✓</td>
<td>✓  ✓  ✓</td>
</tr>
</tbody>
</table>
Alarm display

When an active alarm is received by the monitor a flashing window or a general alarm symbol appears depending on the control unit setting, superimposed on the screen in use at the time with the failure warning. A warning sound is activated at the same time.

The list of active alarms is accessed by pressing any of the buttons. The alarms that have not yet been recognized are grey on a black background.

After recognizing the alarms the screen returns to black characters on a grey background and the possibility of exiting the screen returns ("door open" symbol).

Memorizing alarms

When accessing the list of alarms memorized the display automatically shows the most recent alarm. It is possible to scroll through the list using buttons 1 and 2 under the arrows (↓ and ↑). It is not possible to exit this screen until all the alarms have been recognized. Recognition of the alarms takes place by pressing button 3 (under the HOLD RESET symbol). The alarms are automatically cancelled when no alarm signal is transmitted to the monitor for a long time.

The alarms memorized can be displayed by pressing button 4. If no alarm is memorized an error message is displayed.

All the alarms memorized in the monitor can be deleted by pressing button 3.

**WARNING**

The seriousness of the alarm is displayed in the flashing window:
- **MS**: VERY SERIOUS
- **MOD**: MODERATELY SERIOUS
- **LS**: LESS SERIOUS
**Initial launch of engine control monitor**

The FPT monitor for reading parameters can operate with 6 different types of engines. If will be the fitter or the rigger's job to programme the correct operating modes for the specific type of engine. The information relating to fuel consumption requires the correct programming of the maximum introduction data relating to the performance of the engine. Proceed as follows:

Using the buttons underneath the arrows (↓ and ↑) select the engine control unit. Once it is set, the screen for the engine control unit will not be displayed during the normal operation of the monitor.

Keep the standard basic set value

---

**SAFETY AND MONITORING SYSTEM**

In compliance with certification authority regulations, some vehicles are equipped with a security system made up of specific sensors located on the engine and of a synoptic panel. The system monitors engine operating parameters. Together with the monitoring function, system electronics sound an alarm when the thresholds considered to be safe limits are exceeded and bring about emergency engine shut-down in the event of possible danger to those on board.

System unit use and interpretation procedures refer to the equipment in the standard FPT configuration. Information associated with functions that require connection to external equipment, such as echosounding devices and GPS, is intentionally displayed in brief. Programming procedures that are the responsibility of the Supplier or Assistance Service technicians are not shown. Refer to the equipment Supplier's manuals for information not given in the present document.

**Monitoring**

The display unit allows constant checking of engine parameters as required by type approval regulations for rapid detection of arising faults. Information contained in the unit memory permits events to be analysed for a long period preceding an enquiry. Alarms triggered by exceeding the thresholds treated as the limit value of each parameter are signalled by a warning sound and the frame surrounding the box containing information on the faulty parameter flashes.
Press the "<<" and ">>" keys to display in sequence the pages containing monitoring parameter information, including service intervals and optional information such as that shown below.

The standard FPT configuration will identify the following information:

- Engine coolant pressure
  (FRESHWATER PRESS)
- Low engine coolant level
  (LOW WATER LEVEL)
- Low engine coolant pressure
  (FRESHWATER LOW P)
- High engine coolant temperature
- Engine oil pressure
- Absence of engine oil pressure
  (LOW OIL PRESS)
- Engine oil temperature (OIL TEMP)
- Oil filter clog (OIL FILTER CLOG)
- Presence of water in fuel (WATER IN FUEL)
- Fuel pressure
- Fuel filter clog (FUEL FILTER CLOG)
- Injection system damage
- Failed battery recharging (BATTERY WARNING)
- Pre-lubrication in progress (PRELUBRICATING)*
- System power supply voltage (VOLTMETER)
- Exhaust gas temperature (EX GAS TEMP)
- Engine revolution speed, from EDC system (ENGINE E)


Information on pages displayed may vary according to the number and type of engine installed.

Key function varies according to the different displays.
Setting display mode

Interface options permit adjustment of brightness, contrast and image presentation mode, featuring reversal of light/dark.

1. Press the key “MENU” to display the quick choice window.
2. Press the “<<” and “>>” keys to highlight setting display mode. “BRIGHTNESS”, “CONTRAST”, “DAY/NIGHT”.
3. Press the “OK” key to confirm choice.
4. Use the “<<” and “>>” keys to change parameter settings.
5. Press the key “OK” again to confirm choice.
6. To exit “MENU” press the “CLR” key.

Advanced functions

Monitored parameters can be presented in different modes including a graph with a time plot.

Proceed as follows to select the mode:

1. Press the key “MENU” to display the quick choice window.
2. Use the “<<” and “>>” keys to select option “DATALOGGER”, inside the window.
3. Press the “OK” key to confirm and a second window will appear with the options.
4. Select the required display mode by pressing the “<<” and “>>” keys (see below for the different options)
5. Press “OK” to confirm.
Display mode
- "GRAPHICS": displays the parameter trend versus time; the "ZOOM" key allows the time interval shown on the display to be altered.
- 1. Press the "<<" and ">>" keys to display the different parameter graphs.
- 2. Press the "CLR" key to exit current mode.

- "SAVE": memorises the parameters detected by the system at specific engine service intervals. The data is saved when the "OK" key is pressed. If pressed again, the data will be uploaded again. Memorised values can be displayed in all available forms.
- "AUTO REC.": modifies information registration modes; changes cannot be made.
- "HOURCOUNTER": mode used to manage recording of effective power unit service time; information is displayed in the form of hours (ENGINE) or statistics (STATISTIC). Data input is password protected. The information can be used by Service Centre personnel to adjust the scheduling of servicing intervals. When in this mode it is possible to select the "SERVICE RESET" option, displayed in the "Service interval display" section.
- "FUELCOUNTER": (not programmed)
- "SERVICE ONLY": mode used for programming restricted to Technical Assistance Centre personnel, password-protected.

Service interval display
A list showing the number of engine service hours permitted before servicing is required is displayed with the basic functions. The page sequence may be displayed using the "<<" and ">>" keys. The unit’s internal timer gives plenty of notice when services are due by counting down through actual hours to reach negative values. After each service, the vessel user or vessel crew responsible for maintenance must reset the initial data display used for the countdown (see "Servicing interval reset" procedure). Only Technical Service personnel can amend the various time intervals in hours.
1. Number of engine service hours - 2. Service hours remaining before service is due (a minus sign indicates servicing is overdue)

**Service interval reset**

At the end of a service the calculation information referring to the number of service hours before the next service should be reset; proceed as follows:

1. Press the key “MENU” to display the quick choice window.
2. Use “<<” and “>>” keys to select option “DATLOGGER”, inside the window.
3. Press the “OK” key to confirm and a second window will appear with the options.
4. Select “HOURCOUNTER” mode by pressing the “<<” and “>>” keys and confirm with the “OK” key.
5. Use the “<<” and “>>” keys to select the “SERVICE RESET” option inside the new window.
6. Press “OK” to confirm and the list of scheduled services with the number of service hours left before servicing will appear, if a minus sign (-) is displayed, servicing is overdue.
7. Use the “<<” and “>>” keys to highlight the entry relating to the last service.
8. Press “OK” twice to confirm.
9. Check that the number of hours indicated as the maximum period is displayed. If not, repeat the final steps of the procedure.
Alarm and safety management

The system electronics check all the parameters for which monitoring is required in sequence, irrespective of the page displayed. There are 2 lower and 2 upper pre-alarm and alarm thresholds for each parameter, which sometimes coincide. The programmed thresholds are displayed on the analogue bar indicator for the parameter (see diagram). Only Technical Service Assistance personnel can modify threshold settings.

When the value of a parameter exceeds the programmed threshold a warning sound is activated and the associated indicator boxes is highlighted by a dark flashing border (light in “NIGHT” mode). Pressing the “CLR” pushbutton stops the warning sound and the frame stops flashing but remains present. The alarm status is highlighted until normal status is reset and the “ACK” pushbutton is pressed.

**WARNING**

When the alarm is triggered it can be useful to press the “ACK” pushbutton in order to check that a fault is really present. If the threshold is only exceeded momentarily the alarm will stop immediately. If it persists, diagnosis must be carried out to determine the cause. Having found the cause, normal display status cannot be reset until the “ACK” pushbutton is pressed.

**ATTENTION!**

In order to keep the engine undamaged and prevent serious risk to equipment, the Electronic Unit is programmed to stop the engine automatically if the following conditions occur:
- Low engine oil pressure (LOW OIL PRESS)
- High engine coolant temperature (HIGH WATER TEMP)
- High engine revolution speed (ENGINE S).
Monitoring the route and voyage

When the interface is connected to a GPS or autopilot system a tracking graphic useful for navigation will appear among the monitoring pages.

Key to abbreviations:
RNG – Distance from the next waypoint
BRG – Direction of the next waypoint
VMG – True speed to waypoint
ETE – Estimated time of arrival
TRN – Direction of route through waypoint
XTE – Off route error


Depth monitoring (Echosounder)

When the interface is connected to an echosounder, the monitoring pages will display a graph showing seabed depth changes and the relative value in metres associated with a temperature value.
Low engine oil pressure sensor efficiency test

In compliance with certification authority regulations, system equipment includes devices that check alarm operating efficiency. An example is the oil shut-off tap (2) on the “Low oil pressure” (WA) sensor fitting, used to check the efficiency of the associated function.

Replacing the engine control unit

To offer a higher level of safety during voyages on vessels equipped with a single engine, it is necessary to provide a second auxiliary electronic engine control unit (1, figure in the previous page), alongside the electronic control unit to allow rapid replacement in case of damage. The connectors removal and insertion procedure required for using the auxiliary Electronic Unit is the following:

![Diagram of ECU connectors]

**REMOVAL OF ECU CONNECTORS**

**INSERTION OF ECU CONNECTORS**
MANAGING THE ENGINE FROM THE RELAY BOX

The engine fittings include a unit known as the “Relay box” and normally installed in the engine room, using which it is possible to manage the following functions:

- Starting and stopping.
- Selection of the control panel: bridge or engine room.
- Increase and decrease of the engine speed.
- Self-diagnosis (only to be used by Technical Service Network staff).


Start-up procedure

1. Turn switch 1 to the ENGINE ROOM position to enable the adjacent START-STOP button (2): this operation disables all the on-board control panel functions on the bridge and fly-bridge.
2. Press button 2 in the ENGINE START position until the engine starts, then release it.

Running speed management procedure

1. Turn switch 4 to the PTO ON position;
2. To accelerate: press and hold button 3 in the PTO+ position; release it on achieving the required engine speed.
3. To decelerate: press and hold button 3 in the PTO- position; release it on achieving the required engine speed.
Once the required running speed has been reached, it will be maintained until the switch 4 is turned to the PTO OFF position or the engine is stopped.

Stopping procedure

1. Press button 2 in the STOP position until the engine has come to a complete stop.
2. Return switch 1 to the BRIDGE position to allow use of the commands on the on-board control panels and prevent use of the START-STOP button in the “Relay box”.

Self-diagnosis procedure

Use of the CHECK button (5) enables Technical Service Network staff to obtain the self-diagnosis information stored in the electronic Unit controlling the engine; the LED indicator 6 indicates the code by emitting flashes of light.

CAUTION!

Never switch the ENGINE ROOM / BRIDGE selector when the engine is turning.
FOR PROPER USE OF THE ENGINE

- Do not continue to press the starter when the engine has started.
- Do not remain in dock while waiting for the engine to warm up, but after starting, commence navigation at low speed; the working temperature will be reached properly with the engine running at medium speeds.
- Do not operate the engine at minimum speed for long periods, as this encourages the production of harmful exhaust and does not guarantee optimum performance.
- The engine speed must be increased and decreased gradually, to allow regular combustion and proper operation of all engine components.
- The maximum cruising speed must not be more than 90% of the speed corresponding to maximum power (see section on ENGINE TECHNICAL DATA).
- During navigation, check that:
  - The engine coolant temperature does not reach the alarm threshold.
  - The oil pressure remains within normal values.

SPECIAL WARNINGS

Coolant temperature high

If the temperature indicated on the instrument is considered too high, or if the alarm is displayed, reduce speed and return to port to check the state of the sea water intake and cooling system circuits; also check and have checked:
- tension of the water pump and alternator command belts.
- operation of the thermostat valve.
- whether or not the heat exchangers are clean.

CAUTION!

When the engine is warm, a pressure liable to cause hot liquid to be expelled with extreme violence is created within the cooling circuits. This results in a danger of burning. Only open the coolant tank cap if strictly necessary, and only when the engine is cold.

Low lubricant pressure

If the pressure indicated by the instrument is considered insufficient, or if the “low oil pressure” indicator lights up, stop the engine and check the oil level. Top up if necessary (see CONTROL AND MAINTENANCE section).

If the condition persists, return to port at low speed and contact an Service Centre.
**Water in the fuel pre-filter**

It is a good rule to drain the water from the filters, before the relevant indicator comes on. Avoid using the engine with the fuel tank only a small reserve of fuel; this encourages the formation of condensation and makes it more likely you will suck up dirt or air, resulting in engine stoppage.

---

**CAUTION!**

When refuelling, always pay great care to ensure that no solid or liquid pollutants enter the fuel tank; you must also remember that smoking and live flames are prohibited when refuelling.

---

**Air filter blocked and exhaust circuit inefficient**

Inspect the cleanliness of the air intakes and discharge pipes on a regular basis. The maintenance intervals indicated in this manual only take into account the performance of engine components, and not any additional fittings installed by the Boatbuilder and any external events.

---

**CAUTION!**

Visually check that the exhaust circuit is not blocked or damaged, so as to prevent dangerous fumes within the vessel.

---

**Alternator malfunction**

Check it or have it checked periodically for cleanliness, wear and proper tensioning of the drive belt.

---

**CAUTION!**

The drive members are located under protective casings. These must only be removed when the engine is not turning.

---

**Irregularities in the electrical system**

Periodically check, particularly during the winter, to ensure that the batteries are clean and in full working order, checking and topping up as indicated in the section CONTROLS AND MAINTENANCE; always comply with the warning notices provided. If it should be necessary to replace them, always comply with the characteristics indicated in the section GENERAL INFORMATION.

---

**WARNING!**

Contact a specialised office and check battery and recharging system efficiency if the voltmeter indicates a voltage below 11 V (for 12 V rated systems), or 22 V (for 24 V rated systems).

---

**RUNNING IN**

Thanks to modern engine construction technology, no particular running in procedure is required. However, it is recommended that, for the first 50 hours, you do not use the engine at high power for long periods.
## REFUELLING

<table>
<thead>
<tr>
<th>Parts to be supplied</th>
<th>C78 ENT - C78 ENS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>litres (kg)</td>
</tr>
<tr>
<td>Cooling circuit</td>
<td>40 (*)</td>
</tr>
<tr>
<td>Lubrication circuit</td>
<td>31 (28)</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>total capacity</td>
<td></td>
</tr>
<tr>
<td>Periodic changing:</td>
<td></td>
</tr>
<tr>
<td>oil sump at minimum level</td>
<td>18 (16,3)</td>
</tr>
<tr>
<td>oil sump at maximum level</td>
<td>25 (22,7)</td>
</tr>
<tr>
<td>Fuel tank</td>
<td>-</td>
</tr>
</tbody>
</table>

(1) Use a mixture of water and 50% PARAFLU 11 even during the summer months. As an alternative to PARAFLU 11, you can use another product that complies with international specifications SAE J 1034.

(2) Use lubricants that comply with international specifications ACEA E3 - E5 (high power engines), API CF - CH4 (associated with fuels with a percentage sulphur < 0.5%), MIL - L - 2104 F.

The viscosity level of oil to be used depending on surrounding temperatures is given in the table provided in the appendix.

Oil consumption is considered acceptable when it reaches a maximum of 0.5% of fuel consumption.

(3) The amounts indicated refer to initial refuelling, and include filling the engine, sump and filter.

(4) Only use normal commercial diesel fuel (EN 590 standards). Do not use additives. Do not use fuels derived from the synthesis of organic substances and vegetable oils (Biodiesel).

(*) With the exception of the C78 ENS M20 engine.

## WARNING

Refuelling from drums or tanks may result in pollution of the diesel fuel, with the risk of damage to the injection system; if necessary, filter the fuel in a suitable manner or allow sedimentation of the impurities before refuelling.

### Low temperature diesel

DIN EN590 specifications distinguish different classes of diesel fuel, identifying the characteristics of those best suited to low temperatures. It is entirely up to the Oil companies to comply with these regulations, which foresee that fuels suited to the climactic and geographic conditions of the various Countries be distributed.

### Filling up with marine gear oil

For the amount and types of oil to be used in the marine gear, please see the manual provided by the Manufacturer.
CONTROLS AND MAINTENANCE

MAINTENANCE PERSONNEL
The engine control and maintenance operations described in the following chapter require training, experience and compliance with current safety regulations; for this reason they must be carried out by special technicians, as indicated below.

- **Controls**: by workshop technicians or the vessel user if necessary.
- **Periodic maintenance**: by qualified personnel equipped with suitable equipped and adequate means of protection. Operations marked by the key symbol (see illustration).
- **Special maintenance**: by qualified Service Centre staff with specific technical information and equipped. Operations marked by the key symbol (see illustration).

The most qualified Assistance Centres are those which make up the FPT Technical Assistance Network.

ACCIDENT PREVENTION
- Always wear heavy-duty footwear and overalls.
- Never wear loose, flapping garments, rings, bracelets and/or necklaces in the vicinity of engines or moving parts.
- Always wear protective gloves and goggles when:
  - filling up batteries with acid solution
  - refuelling with inhibitors or antifreeze
  - replacing or topping up lubricant (hot engine oil may cause burns and scalds. Only carry out these operations when the oil has dropped to a temperature of below 50°C).
- When working in the engine compartment, pay particular attention to how you move, to avoid contact with moving parts or high temperature components.
- Wear goggles and use high pressure air jets (maximum air pressure used to clean is 200 kPa (2 bar, 30 psi, 2 kg/cm²).
- Wear a protective helmet when working in an area were there are suspended loads or systems installed at head-height.
- Use protective hand cresses.
- Immediately replace wet overalls.
- Always keep the engine clean, removing oil, grease and coolant stains.
- Store cloths in flame-proof containers.
- Do not leave foreign bodies on the engine.
- Use suitable, safe containers for used oil.
- When completing a repair, make suitable provisions to stop the engine taking in air if, after start-up, an uncontrolled increase in engine speed were to occur.
The maintenance intervals indicated below take into account the typical working factors for various types of engine use; the most suitable interval for maintenance operations for the various applications will be indicated by the maintenance staff, according to the way and working conditions in which the engine is used.

<table>
<thead>
<tr>
<th>Controls</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check oil level in engine</td>
<td>Daily</td>
</tr>
<tr>
<td>Check oil level in marine gear</td>
<td>Daily</td>
</tr>
<tr>
<td>Check engine coolant level</td>
<td>Daily</td>
</tr>
<tr>
<td>Check exhaust pipe/s for damage</td>
<td>Daily</td>
</tr>
<tr>
<td>Drain water from the fuel pre-filter</td>
<td>150 hours</td>
</tr>
<tr>
<td>Check/top up electrolyte level in batteries and clean terminals</td>
<td>Half-yearly</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Planned maintenance</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clean air filter/s</td>
<td>300 hours</td>
</tr>
<tr>
<td>Check corrosion of zinc anodes</td>
<td>300 hours</td>
</tr>
<tr>
<td>Check state of oil vapour filter</td>
<td>300 hours</td>
</tr>
<tr>
<td>(indicator may be present)</td>
<td></td>
</tr>
<tr>
<td>Drain/suck condensation from fuel tank/s</td>
<td>300 hours</td>
</tr>
<tr>
<td>Replace engine oil</td>
<td>600 hours</td>
</tr>
<tr>
<td>Check one-way valve efficiency</td>
<td>each time it</td>
</tr>
<tr>
<td>pre-lubrication system</td>
<td>is changed oil</td>
</tr>
<tr>
<td>Change oil filter/s</td>
<td>600 hours</td>
</tr>
<tr>
<td>Change fuel filter/s</td>
<td>600 hours</td>
</tr>
<tr>
<td>Change fuel pre-filter</td>
<td>600 hours</td>
</tr>
<tr>
<td>Change oil in the marine gear</td>
<td>see relevant details</td>
</tr>
<tr>
<td>Inspect sea chest</td>
<td>yearly</td>
</tr>
<tr>
<td>Check tension and state of belt</td>
<td>yearly</td>
</tr>
<tr>
<td>Change coolant</td>
<td>1200 hours or 2 years</td>
</tr>
<tr>
<td>Change air filter</td>
<td>2 years</td>
</tr>
<tr>
<td>Change oil vapour filter</td>
<td>2 years</td>
</tr>
</tbody>
</table>

**CAUTION!**

Do not carry out maintenance operations when the electric power supply is turned on: always check to ensure that the appliances are properly earthed. During diagnosis and maintenance operations, make sure that your hands and feet are dry, and whenever possible use insulating stands.
1) Maximum period when using good quality fuel, (EN 590 standard); this is reduced if the fuel is contaminated and alarms are triggered due to blockage of the filters and presence of water in the pre-filter. When blockage of the filter is indicated, it must be replaced. If the water in pre-filter indicator does not go out after drainage, the pre-filter must be replaced.

2) The frequency with which operations are carried out will depend on the working conditions and efficiency/wear of the product. If the engine is not used for long periods of time, check it before you start it.

3) N.C.

4) The anode must be replaced if corrosion has exceeded 50% of the volume of zinc.

5) Replace lubricants according to the frequency indicated in the REFUELLING table.

6) Sea water/combustion air heat exchanger: clean both the air and water sections; engine coolant/sea water heat exchanger: clean the sea water section; optional sea water/marine gear oil heat exchanger: clean the sea water section.

7) Must be performed annually, even if the required number of working hours are not reached.

8) Only use filters with the following characteristics:
   - filtration level < 12 μm
   - filtering efficiency β > 200.

---

**Special maintenance**

<table>
<thead>
<tr>
<th>Special maintenance</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check wear in sea water pump rotor</td>
<td>900 hours</td>
</tr>
<tr>
<td>Check the efficiency of the pre-post heating system (if there is one)</td>
<td>1200 hours</td>
</tr>
<tr>
<td>Adjusting play in valves-rocker arms</td>
<td>1200 hours</td>
</tr>
<tr>
<td>Replace belt</td>
<td>1200 hours or 2 years</td>
</tr>
<tr>
<td>Clean heat exchangers</td>
<td>2 years (6)</td>
</tr>
<tr>
<td>Cleaning the turbocharger</td>
<td>2 years (5)</td>
</tr>
</tbody>
</table>

---

**WARNING**

When using fuel with a percentage sulphur exceeding 0.5%, or when using oils that do not comply with the specifications provided in the refuelling table, the times at which the engine oil, engine oil filter and oil vapour filter must be changed will vary according to the use and working conditions of the engine itself; for further information, please consult the technicians responsible for maintenance.
REQUIREMENTS

1. Do not disconnect the batteries with the engine running.
2. Do not carry out arc welding operations in the vicinity of the engine without first removing electrical cables and electronic units.
3. After each maintenance operation involving disconnection of the battery/batteries, make sure that the terminals have been properly locked onto the poles.
4. Do not use battery chargers to start the engine.
5. Disconnect the on-board network battery/batteries when recharging.
6. Do not paint the appliances, components and electrical connectors equipping the engine.
7. Disconnect the battery/batteries before any electrical operations.
8. Contact the Boatyard before installing electronic equipped on board (two-way radios, echo-sounding equipped, etc.).

HOW TO PROCEED

Check oil level in engine

Only proceed with the engine stopped and at a low temperature, so as to avoid the risk of burning.

- Using the dipstick (1), check that the oil level is between the “Min” and “Max” levels.
- If the level is too low, top up through the inlet on the cylinder head, after first removing the relevant cap (2).
**Check oil level in marine gear**
Check the oil level in the marine gear following the indications provided in the marine gear Manufacturer’s manual.

**Check coolant level**
Only proceed with the engine stopped and at a low temperature, so as to avoid the risk of burning.
- Remove the loading tank pressurisation cap (3 - previous page).
- Visually check the coolant level.
- Top up the tank if necessary, using a mixture of 50% clean water (not distilled) and Paraflù 11. (See REFUELLING table).

**For engine with external heat exchanger**
If the engine is set up to use external heat exchangers (e.g. on the keel), the information regarding checks to be carried out on the cooling circuit must be provided by the Boatbuilder who constructed the vessel.

**WARNING**
- After topping up, make sure that the oil level does not exceed the "Max" limit marked on the dipstick.
- Make sure that the dipstick is inserted properly and the filler cap is turned in a clockwise direction until it stops turning completely.

**Check exhaust pipe/s for damage**
Visually check that the exhaust system is not blocked or damaged.
- Make sure that there is no risk of dangerous fumes within the vessel. Contact the Boatyard if necessary.

**Draining water from the fuel pre-filter**
The high risk of refuelling with fuel that is polluted by foreign bodies and water means that it is necessary to perform this control even if no alarm is shown on the on-board control panel.
Proceed with the engine stopped.
- Place a container under the pre-filter to collect the fluid.
- Unscrew the tap plug (1) in the bottom part of the pre-filter; in some lay-outs the plug includes a sensor to detect the presence of water in the diesel.
- Drain off liquid until only “diesel” can be seen”.
- Close the plug again, tightening it completely by hand.
- Dispose of the drained fluids according to current requirements.
Check the electrolyte solution level in batteries

Proceed by placing the batteries on an horizontal plane.

- Visually inspect that the liquid level is included between "Min" and "Max". If no reference marks is available, check that the liquid covers the lead plates in the elements by approximately 5 mm (0.20 in).
- If necessary refill only with distilled water those elements whose level is lower than the minimum.
- Check that terminals and clamps are clean, securely tight and protected with petroleum oil.

<table>
<thead>
<tr>
<th>WARNING!</th>
</tr>
</thead>
<tbody>
<tr>
<td>If all battery elements need topping up with a considerable quantity of distilled water, contact a specialised office and check battery and recharging system efficiency.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CAUTION!</th>
</tr>
</thead>
<tbody>
<tr>
<td>The batteries contain sulphuric acid, which is extremely caustic and corrosive; always wear protective gloves and goggles when topping them up. Whenever possible it is recommended that this control be carried out by specialised personnel.</td>
</tr>
<tr>
<td>Do not smoke or use live flames near the batteries during controls, and make sure that the room you are working in is adequately ventilated.</td>
</tr>
</tbody>
</table>

Some types of battery have a single cover for all the inspection plugs. To access the elements, use a lever as shown in the figure.
Cleaning the air filter

- Remove the filter after removing retaining rod (1) and loosening the screws (2) shown in the diagram.
- Blow dehumidified compressed air through the filter element, from the inside outward (maximum pressure 200 kPa), or wash with water only. Do not use detergents; **do not use diesel**.
- Replace the filter if any tears are found.
- Replace the filter once every 2 years.
- Restore normal operating conditions after positioning the filter in its housing.

Zinc anodes corrosion inspection

Proceed with engine not running and at low temperature:

- Place the necessary basins in order to avoid water to spill off during removal of anodes.
- Unscrew and remove anodes (see relevant location in ENGINE TECHNICAL DATA).
- Make sure corrosion does not involve over 50 % of zinc volume. Otherwise replace them.
- Replace anodes in their housing and tighten to the required torque.

Oil vapor filter status

Proceed only with engine not running and at low temperature to avoid any risk of burns.

**With choke sensor:**

- If the sensor indicates that the filter is clogged, replace the filter as indicated in this document.

**Without choke sensor:**

- Carry out disassembly as instructed for replacement.
- Check that the filter element is free of deposits. Replace with a new element if deposits are present.
- Refit the filter in its seat as described for replacement.
Engine lubricant replacement
Proceed only with engine not running and at low temperature to avoid any risk of burns.

Only with one hand pump:

- Place a container to collect the exhaust oil under the hand pump (3) exit piping (2).
- Open the extraction cock by vertically lifting the lever (1) B.
- Unscrew the oil filler cap and operate the appropriate hand pump (3), provided for the extraction of the oil, until the oil pan is completely empty.
- Refill oil through the hole provided on the cover. Refer to REFILLING table for the correct oil type. Tighten the plug.
- Using the dip stick (4), that the oil quantity is included between "Min" and "Max" limits.

- Close the cock by lowering back the lever (1) to A position.
- Dispose oil observing current regulations in force.

With transfer electric system (optional)

The above operations can be performed by acting on the push button located on the electronic module. Fore safety reasons controls are enabled on only when the key switch is turned to 8A (stop).
Connect the cock to the new oil container and press the button towards CHARGE until filling is completed.

Close again the charge/discharge tap and check - using the oil dipstick - that the oil level in the oil sump is between the range MIN and MAX.

Dispose oil observing current regulations in force.

Close the plug (1).

Place under the cock (5) a container to collect the exhaust oil.

Open the cock (1) and press (A) towards DISCHARGE, until it is fully empty.

With transfer and pre-lubrication electric system (optional)
The above operations can be performed by acting on the push button located on the electronic module. For safety reasons controls are enabled on only when the key switch is turner to 8A (stop).

Place under the cock (5 on next page) a container to collect the exhaust oil.

Turn the EV OFF/EV ON (B) switch to EV/ON, to the electric pump will be connected to the cock.

Open the cock (1) and press (A) to DISCHARGE, until it is fully empty.

Connect the cock to the new oil container and press the button towards CHARGE until filling is completed.

To allow efficient operation of the pre-lubrication system, close the filler/drainage tap and return switch B to the EV/OFF position.

Use the dipstick to check that the sump oil level is between the “MIN” and “MAX”.

Dispose oil observing current regulations in force.
Check the efficiency of the pre-lubrication system one-way valve (picture on page 39)

Start the check with the engine stopped

- Loosen the connection (6) and wait for the complete oil drain from the pre-lubrication piping.
- Start the engine and check that no oil flows out of the valve (7).
- Stop the engine and tighten the connection (6).
- Replace the valve in case of oil leaks.

![Diagram of the pre-lubrication system]

<table>
<thead>
<tr>
<th>CAUTION!</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proceed with extreme caution, given the presence of moving parts. Always wear suitable personal protection equipped.</td>
</tr>
</tbody>
</table>

Change oil filters

Only use filters with a filtration level equivalent to the ones you are replacing (see section FREQUENCY).

In the presence of traditional filter supports

Only proceed with the engine stopped and at a low temperature, so as to avoid the risk of burning, and preferably after having drained the used oil.

- Place a container under the filter support (1), to collect the used oil.
- Unscrew and remove the filters.
- Clean all surfaces carefully.
- Damp the new filter seals with a thin layer of oil.
- Hand screw the new filters into place until the seal gasket touches the support, then lock by a further 3/4 of a turn.
- Dispose of the used filters according to current requirements.

In the presence of filter supports with disable levers (opt.)

The support with disable levers means that, if necessary, a filter can be replaced even with the engine turning.

<table>
<thead>
<tr>
<th>CAUTION!</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proceed with extreme caution, given the high temperature of the fluid and the presence of moving parts. Always wear suitable personal protection equipped.</td>
</tr>
</tbody>
</table>

41
Changing the fuel filter

Only proceed with the engine stopped and at a low temperature, so as to avoid the risk of burning.

Only use filters with a filtration level equivalent to the ones you are replacing (see section FREQUENCY).

In the presence of traditional filter supports

- Turn the handle (2) corresponding to the filter you wish to replace to the “CLOSED” position, as shown in the plates provided.
- Proceed as illustrated above for the traditional filter support.

CAUTION!

Simultaneous disabling of both filters must be avoided at all costs.

- Remove filter (1) by unscrewing it.
- Moist seals of the new filters with diesel or engine oil.
- Manually tighten until contact is made, then tighten again for 3/4 of turn.
- Loosen the bleeding connection on the filter support and act on the hand pump of the pre-filter until fuel flows out without air.
- Tighten the connection and start the engine acting on the pump, also during the first startup phases.
NOTE: should it be necessary to accelerate the automatic bleeding phase, loosen the manifold on the cylinder head (2) during the initial phases of start-up. Ensure that any fuel coming out of the manifold is not dispersed into the environment.

In the presence of filter supports with switching lever (opt.)
The support with switching lever means that, if necessary, the filters can be replaced even with the engine turning.
- Switch the lever (3) to position A and replace filter (5).
- Switch the lever (3) to position B and replace filter (4).

- The instructions for replacement are similar to those illustrated above for the traditional filter support.
- Return the lever (3) to the central position.

WARNING

Do not fill up the new filter before it is fitted to the support: this avoids the risk of inserting harmful impurities into the injection system and circuit.

CAUTION!

Proceed with extreme caution, given the high temperature of the fluid and the presence of moving parts. Always wear suitable personal protection equipped.
Changing the fuel pre-filter

Only proceed with the engine stopped and at a low temperature, so as to avoid the risk of burning.

- Remove water presence sensor (3).
- Unscrew the water sensor (3) from the old pre-filter.
- Check that the new filter matches the engine requirements.
- Moist seals of the new filters with diesel or engine oil.
- Manually tighten until contact is made, then tighten again for 3/4 of turn.
- Replace the water sensor and check that threads match.
- Unscrew the bleeding connection (2) act on the manual pump (1) on the pre-filter support until the circuit is full.
- Start the engine and keep it running at idle to remove air excess.
- Check pre-filter support (4) grounding.

**NOTE:** The system does not require bleeding.

Check tension and state of the auxiliary member drive belt

Only proceed with the engine stopped and at a low temperature, so as to avoid the risk of burning.

- Remove the casing protecting the pulleys.
- Check that the pulleys are not torn or worn, and that there are no lubricants or fuel on them. If this is not the case, replace them.
- At the same time, make sure that the tensioning device is working properly, proceeding as indicated in the figure.
- Replace the guard casing in its housing, and lock all the seal elements.
**Replace coolant**

Only proceed with the engine stopped and at a low temperature, so as to avoid the risk of burning.

- Provide suitable containers to ensure that no coolant is dispersed into the environment.
- Remove the plugs on the circuit components and wait until the circuit has drained completely (the location of plugs is given in the section ENGINE TECHNICAL DATA). After emptying, replace the plugs in their housings, making sure that the seal rings are all undamaged.
- Fill up the circuit as indicated in the table REFUELLING.
- Bleed the circuit and top-up if necessary, as indicated in the section INDICATIONS FOR INITIAL START-UP.

**Change oil vapour filter**

Proceed only with engine not running and at low temperature to avoid any risk of burns.

- Remove engine fittings to access filter housing.
- Loosen screws, remove filter housing cover (1).
- Remove and dispose the filter (2) observing current regulations in force.
- Slide the new filter, observing the assembling direction. Reinforcing items (3) should be visible.
- Replace the cover on its housing and replace the components removed to restore the engine to its original specification.

---

**CAUTION!**

The filter (2) only filters effectively in one direction, and it must be fitted into its housing with the two metal reinforcements (3) facing out, as shown in the figure.
Drain/suck condensation from fuel tank/s
Inspect sea chest
Check wear in sea water pump rotor
Check the efficiency of the pre-post heating system
Adjust play in valves-rocker arms
Clean the heat exchangers
Clean the turbocharger

The method used to change the oil in the marine gear is indicated in the relevant documentation supplied by the Manufacturer of the marine gear itself.

**WARNING**

The operations listed below must only be carried out by qualified staff from the FPT Service Centres or by staff from the Boatbuilders. The methods used to perform them are described in the Technical and Repair Manuals.

**MOVING THE ENGINE**

The operations necessary to embark and disembark the engine must only be carried out by technicians from Authorised Service Centres. When lifting the **engine only**, use the U-bolts indicated in this manual in the section ENGINE TECHNICAL DATA and marked on the engine with special stickers.

Lifting must be carried out using a rocker arm that keeps the metal cables supporting the engine parallel, using all the U-bolts provided simultaneously; the use of a single U-bolt only is not allowed. The engine lifting system must have a capacity and size suited to the weight and dimensions of the engine; check that there is no interference between the lifting system and the engine components.

Do not lift the engine before removing the transmission members that are coupled to it.

**DISPOSAL OF WASTE**

The engine unit is made up of parts and elements that, if discarded, may cause damage to the environment.

The materials listed below must be handed over to specialised Collection Centres; the laws in force in the various Countries foresee severe penalties for transgressors:

- Starter batteries.
- Used lubricants.
- Mixtures of water and antifreeze.
- Filters.
- Additional cleaning materials (e.g. greasy or fuel-soaked cloths).
LONG PERIODS OF INACTIVITY

PREPARING THE ENGINE FOR A LONG PERIOD OF INACTIVITY

In order to prevent oxidation of the internal parts of the engine and of certain components in the injection system, when the engine is expected to be inoperative for periods of more than two months, the following operations must be carried out in preparation for this:

1. Drain the lubricant from the sump, after first warming up the engine.
2. Fill the engine with protective oil type 30/M (or alternatively oil that complies with MIL 2160B type 2 specifications), up to the "minimum" level indicated on the dipstick. Start the engine and keep it running for approximately 5 minutes.
3. Drain the fuel from the injection circuit, from the filter and from the injection pump pipes.
4. Connect the fuel circuit to a tank containing CFB (ISO 4113) protective fluid, and feed in the fluid by putting the circuit under pressure and running the engine for approximately 2 minutes, after first disabling the injection system. This operation can be performed by polarising terminal 50 of the starter motor with a positive voltage equivalent to the rated voltage of the system, using a conductor provided for that purpose.
5. Nebulise approximately 80 g of 30/M protective oil (10 g per litre displacement) into the turbocharger suction inlet, during the pressurised filling operation described in the previous point.
6. Close all the suction, delivery, ventilation and bleeder openings in the engine with suitable plugs, or seal them with adhesive tape.
7. Drain the residual 30/M protective oil from the sump. This oil can be used again for a further 2 preparation operations.
8. Fit signs reading ENGINE WITHOUT OIL to the engine and to the on-board control panel.
9. Drain the coolant, if it has not been mixed with suitable antifreeze and corrosion inhibitors, and affix a sign to indicate the fact.

In the event of prolonged inactivity, the operations described must be repeated every 6 months, following the procedure given below:

A) drain the 30/M protective oil from the sump;
B) repeat the operations described from point 2 onward

Should you intend to protect external parts of the engine, proceed by spraying OVER 19 AR protective liquid on unpainted metal parts, such as the flywheel, pulleys and the like, avoiding belts, connector cables and electrical equipped.

RESTARTING THE ENGINE AFTER A LONG PERIOD OF INACTIVITY

1. Drain the residual 30/M protective oil from the sump.
2. Fill the engine, as prescribed, with lubricant of the type and amount indicated in the table REFUELLING.
3. Drain the CFB protective fluid from the fuel circuit, carrying out this operation as indicated under point 3 of PREPARING THE ENGINE FOR A LONG PERIOD OF INACTIVITY.
4. Remove the plugs and/or seals from the suction, delivery, ventilation and bleeder openings in the engine, restoring it to a
normal state of use. Connect the turbocharger suction inlet to the air filter.

5. Connect the fuel circuits to the vessel’s fuel tank, completing the operations as indicated in point 4. of PREPARING THE ENGINE FOR A LONG PERIOD OF INACTIVITY. During filling operations, connect the fuel return pipe to a collection tank, so as to prevent any residual CFB protective fluid from flowing into the vessel’s fuel tank.

6. Check the engine and fill it up with coolant as prescribed.

7. Start the engine and keep it running until the idling speed rate has stabilised completely.

8. Check that the instruments on the on-board control panel/s are showing plausible values, and that no alarms are shown.

9. Stop the engine.

10. Remove the ENGINE WITHOUT OIL signs from the engine and from the on-board control panel.

**INDICATIONS FOR INITIAL START-UP AND START-UP AFTER A LONG PERIOD OF INACTIVITY**

1. Fill up the engine as prescribed in the table REFUELLING.

2. Remove the sacrificial anode (1) and pour 1.5 litres of water into the hole. This is necessary to allow the sea water pump to draw (valid for engines with a centrifugal type pump).

3. Replace the sacrificial anode in its housing, locking it to the prescribed torque.

4. Bleed the cooling circuit as follows: Keeping the engine running at minimum speed, carefully loosen the screw (2) on the coolant tank alongside the cap, and the two screws (3) on the drainage manifold, to encourage any air bubbles to escape. When the operation has been completed, tighten the screws to the prescribed torque, stop the engine and check the coolant level again, topping up if necessary. Ensure that any fluid coming out is not dispersed into the environment.
ENGINE MALFUNCTIONS

The electronic unit overseeing management and control of all operation of the engine is capable of recognising any malfunctions that may occur, and of adopting strategies that will allow you to navigate in full safety.

The event, signalled by light-up of the EDC MALFUNCTION indicator on the on-board control panels, results in programmed limitation of power within certain thresholds, set according to the severity of the case.

In the case of temporary malfunctions the reduction in performance will remain in force until the engine is stopped.

Accelerator electronic circuit malfunction

Recognition by the CENTRAL ELECTRONIC UNIT of certain problems in the accelerator electrical circuit involves the adoption of strategies known as “Accelerated minimum speed running” that will enable navigation to continue in emergency mode.

The possible operating modes are as follows:

A. The accelerator lever does not “respond”: the running speed stabilises at 750 rpm. to allow the vessel to proceed slowly and be manoeuvred simply by turning the marine gear on and off, without accelerating.

B. The accelerator lever “responds partially”: the minimum running speed is set to 750 rpm. When the accelerator lever is moved to approximately half way, the speed gradually increases up to 2000 rpm.; when the lever is returned to minimum the speed rapidly decreases to 750 rpm.

NOTE: In mode “A” it is possible to proceed at speeds higher than the accelerated minimum, managing start/stop, acceleration and deceleration functions as illustrated in the section MANAGING THE ENGINE FROM THE RELAY BOX. Should it be necessary to operate the engine as above, always comply with the accident prevention rules provided in the Section “Controls and maintenance.

CAUTION!

The engine electronic control unit can adopt safety strategies at any time during navigation, should conditions arise that are considered to put the engine at risk. When conditions of this kind occur, proceed with the greatest possible care and attention, first making sure that all those on board are secure and holding on to safe hand-holds.

CAUTION!

Management of the engine from the “Relay box” involves inhibition of the bridge controls; as a result of this, when running the vessel from the bridge, the only way to stop propeller thrust in the engine quickly is using the marine gear disengagement lever.
EMERGENCIES ON BOARD

The user of a vessel that has been constructed according to safety regulations, when following the instructions provided in this manual and the indications given on the engine labels, will be working in safe conditions.

Should improper conduct result in accidents, always request the intervention of trained first aid specialists immediately.

In an emergency and while awaiting the arrival of first aid specialists, follow the instructions given below.

Engine malfunctions

When navigating with a malfunctioning engine, take the greatest possible care when manoeuvring and make sure that all those aboard are holding firmly to safe hand-holds (see section on ENGINE MALFUNCTIONS).

In case of fire

Extinguish the fire using the fire-fighting equipped provided aboard, and in the manner indicated by Fire prevention authorities (the fire-fighting equipped required on board is compulsory under current safety legislation).

Burns and scalds

1. Extinguish any flames on the burned person's clothing, by:
   • throwing water over them;
   • using a powder fire-extinguisher, without directing the jet at the person's face;
   • covering with blankets or rolling the victim on the ground.

2. Do not attempt to remove pieces of clothing that may have stuck to the skin.

3. In the case of scalding, immediately but carefully remove any clothing that may be soaked in the hot liquid.

4. Cover the burn with a special burn dressing or sterile bandage.

Carbon monoxide intoxication (CO)

Carbon monoxide from the engine exhaust is without smell, and is dangerous both because it causes intoxication, and because when combined with air it forms an explosive mixture.

In closed rooms, carbon monoxide is extremely dangerous, as it can reach critical concentrations within a very short time.

When assisting an intoxicated person in a closed room:

1. Ventilate the room immediately, to reduce the concentration of gas.

2. When entering the room, hold your breath, do not light flames, lights or ring electric doorbells or phones, to avoid the risk of explosion.

3. Carry the intoxicated person out into the fresh air or into a well ventilated room, resting him on one side if he is unconscious.
Electrocution
The engines' electrical 12 V or 24 V electrical system does not involve the risk of electrocution, however, in the event of a short-circuit caused, for example, by a metal tool, there is a risk of burning due to overheating of the object through which the electrical current runs in these circumstances:

1. Remove the object that caused the short-circuit, using means that provide sufficient heat insulation.
2. Switch off the power at the main switch, if there is one.

Injuries and fractures
The vast number of possible circumstances and the specific nature of operations required means that the intervention of a medical team is necessary.

1. In the event of bleeding, keep the edges of the wound pressed together until help arrives.
2. If there is any suspicion of a fracture, do not move the injured part and only move the patient if absolutely necessary.

Caustic burns
Caustic skin burns are caused by contact with extremely acid or alkaline substances.
For electric maintenance technicians these are typically caused by acid from batteries; in these circumstances, proceed as follows:

1. Remove any clothing soaked in the caustic substance.
2. Wash the area with lots of running water, avoiding parts that have not been burned.

If either battery acid, lubricants or diesel come into contact with the eyes: wash the eyes with water for at least 20 minutes, keeping the eyelids open so that the water flows over the eyeball (move the eye in all directions to wash more thoroughly).
OIL VISCOSITY LEVEL ACCORDING TO SURROUNDING TEMPERATURES

-35 -30 -25 -20 -15 -10 -5 0 5 10 15 20 25 30 35 40 45 50 °C

SAE 10W
SAE 20W
SAE 30
SAE 40

SAE 10W -30
SAE 10W -40

SAE 10W -60

SAE 15W -40 mineral base
SAE 15W -40 semisynthetic base

SAE 20W -60 semisynthetic base

SAE 5W -30 synthetic base
SAE 0W -30 synthetic base

-31 -22 -13 -4 5 14 23 32 41 50 59 68 77 86 95 104 113 122 °F
ON BOARD PANELS REQUIREMENTS

The following refers to the original configuration of FPT equipment. The requirements and technical features of customizations may be different. Refer to the original manufacturer for further information.

<table>
<thead>
<tr>
<th>FPT on board panels</th>
<th>With analog instruments</th>
<th>With digital instruments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Operating ambient conditions</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating temperature range</td>
<td>-10°C to +60°C</td>
<td>-10°C to +60°C</td>
</tr>
<tr>
<td>Temperature limits during parking</td>
<td>min. -20°C / max. +75°C</td>
<td>min. -20°C / max. +75°C</td>
</tr>
<tr>
<td>Dust and rain protection degree (frontal)</td>
<td>IP 65 – DIN 40050 – IEC 529</td>
<td>IP 66</td>
</tr>
<tr>
<td>Salt mist resistance (reference standard)</td>
<td>IEC 60068-2-52</td>
<td>IEC 60068-2-52</td>
</tr>
<tr>
<td><strong>Electric and electromagnetic characteristics</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating voltage (excluding polarity inversions)</td>
<td>min. 9 V / max. 32 V (*)</td>
<td>min. 9 V / max. 32 V (*)</td>
</tr>
<tr>
<td>Maximum allowed over-voltage</td>
<td>60 V per 1 ms</td>
<td>60 V per 1 ms</td>
</tr>
<tr>
<td>Main panel maximum absorbed power</td>
<td>1.1 A (12 V) – 1 A (24 V)</td>
<td>310 mA (12 V) – 200 mA (24 V)</td>
</tr>
<tr>
<td>Secondary panel maximum absorbed power</td>
<td>400 mA (12 V) – 400 mA (24 V)</td>
<td>310 mA (12 V) – 200 mA (24 V)</td>
</tr>
<tr>
<td>Electromagnetic compatibility (reference standard)</td>
<td>IEC 945</td>
<td>IEC 945</td>
</tr>
<tr>
<td>Cabling connectors requirements (reference standard)</td>
<td>MIL 1344/1001</td>
<td>MIL 1344/1001</td>
</tr>
<tr>
<td>Cables requirements (reference standard)</td>
<td>CEI 20/22 - CEI 20/38 - CEI 2000/532/CE</td>
<td></td>
</tr>
<tr>
<td><strong>Mechanical features</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resistance to vibrations (expressed in gravity acceleration)</td>
<td>1 g eff. max. -25-500 Hz</td>
<td>(2g) 0.07 oz eff. max. -25-500 Hz</td>
</tr>
<tr>
<td>Resistance to shocks (expressed in gravity acceleration)</td>
<td>15 g - 1,5 ms - semi-sinusoidal wave</td>
<td>15 g - 1,5 ms - semi-sinusoidal wave</td>
</tr>
</tbody>
</table>

(*) min. 9 V/max. 16 V referring to equipment for which only 12 V nominal voltage is provided.
DIGITAL INSTRUMENT PANEL - PREVIOUS VERSION

Engine start-up and shut-down from FPT digital instrument panel

Startup procedure from main panel

Make sure that the electric switch with ENGINE ROOM - BRIDGE label on the Relay box unit, (usually located in the engine room) is turned to BRIDGE, then proceed as follows:

1. Lift the key switch safety cover (8), insert the key and turn it to the right, to 8B position.
2. Check that the analog instruments provide acceptable reading with the new values of the relevant physical parameters.
3. Wait for the acoustic alarm to stop and that the warning lights (5) on the signaling module are switched off (except for "alternator anomaly" and "oil low pressure"). At the same time check that testing of indicators is successful (see relevant section RECOGNIZING ALARM STATUSES).
4. Turn the key to 8C position and release it without accelerating when the engine has started.
5. Check that the analog instruments provide acceptable reading with the new values of the relevant physical parameters (temperature, battery voltage and oil pressure).
6. In case startup fails, you can resume startup position only after releasing the key and after turning the switch 8A to stop position.

Switch key detail

Startup procedure from secondary panel or fly-bridge

1. Enable the secondary panel operation by turning the key switch on the main panel to 8B position (see instructions described in the previous paragraph).

2. Wait for the acoustic alarm to stop and that the warning lights (5) on the signaling module are switched off (except for "alternator anomaly" and "oil low pressure"). At the same time check that testing of indicators is successful (see relevant section RECOGNIZING ALARM STATUSES).

3. Press the green START (11) push button and release it when the engine has started. Check that instruments and analogic reading are acceptable.

Engine stop
Before stopping the engine it is recommended to keep it running at idle and unloaded for few minutes; this will allow for a uniform reduction of temperature and avoid harmful thermal shocks.

A. From the main panel: rotate the key switch to the stop 8A position.

B. From the secondary panel: press the red STOP push button (8) located on it.

To restart the engine from the main panel:
1. Turn the key switch to the stop position 8A to reset any panel operation enabled.
2. Proceed as shown in the relevant paragraph.

To restart the engine from the secondary panel:
1. Make sure the panel is enabled (key switch on the main panel turned to 8B).
2. Press the green START (11) push button and release it when the engine has started. Check that instruments and analogic reading are acceptable.

RECOGNIZING ALARM STATUSES
The following the legend contains the meaning of the alarm pictorial corresponding to each light indicator on the main and secondary panel; in some engine type and relevant fitting are not equipped with all of the features mentioned herein. Moreover these instructions may change based on the technical features provided by the boat manufacturer.

* Alarm features not available with standard fitting.
**Operation**

By rotating the key switch to **8B** position the module performs a 5 seconds efficiency test of all light indicators, except for those concerning “Pre-lubrication”, “Pre-post heating”, “EDC system fault”, and the horn beeps. The beep may be silenced before the end of the test, by pushing the relevant button.

During the startup phase and for the next 15 seconds, any alarm function is inhibited; after such time interval each alarm condition detected by sensors on the engine causes the relevant indicator to blink and a simultaneous sound signal. The sound alarm silencing obtained by pressing the relevant push button causes the non-blinking indicator to turn on and saves the alarm until the next engine stop.

**Alphanumeric display**

The information provided by this indicator are:

- engine revolution speed
- total hours of operation (see note A)
- exhaust gases temperature (upon request)
- instant fuel consumption (see note B)

To select the requested information, press the "Slide selection" push button available on the main and secondary panel.

(A) The electronics inside the panel is programmed in order to combine the hours of operation to the release of the warning when the ordinary maintenance hours limit has been reached. This feature requires that after each maintenance intervention, the count is reset from the main panel as follows:

- Press and hold the "Prog" (9) and "Slide selection" (10) buttons, turn the key switch from **8A** position to **8B** and wait for the display to show the previous data set (ex.: 600 hours). Release the buttons and press only once the "Prog" button (9) to restart the new count.

**Detail of the main panel**

If the set value does not correspond with the one foreseen for the type of oil being used (see requirements in the paragraphs on REFUELLING and FREQUENCY) proceed as follows:

- After displaying the value in hours set previously, release the buttons and press just the “Scroll select” button (10) repeatedly until the prescribed value (as indicated in the section FREQUENCY) is shown and flashes, after which press the “Prog” button (9) to confirm the value and start the new count.

(B) The information on instant fuel consumption requires the maximum input value to be correctly programmed with respect to the performance of the engine fitted on the vessel; to check this, proceed as follows:

- Press and hold the “Prog” button (9) until the display shows the maximum input value (e.g.: 195 mg/trk), then release the button and compare the value with the ones provided in the table below.
- If the value does not correspond, modify it by pressing the “Scroll select” button (10) repeatedly until the prescribed value is displayed (flashing).
- Press and hold the “Prog” button (9) until the display shows the engine running speed, which indicates that the value has been stored.

If the programming operations have not been carried out correctly the display will indicate “P.Err”; in this case, it will be necessary to repeat the procedure from the beginning.

<table>
<thead>
<tr>
<th>C78 ENS M20</th>
<th>Maximum power (CV)</th>
<th>Maximum input (mg/trk)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>230</td>
<td></td>
</tr>
<tr>
<td></td>
<td>200</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C78 ENT M30</th>
<th>Maximum power (CV)</th>
<th>Maximum input (mg/trk)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>330</td>
<td></td>
</tr>
<tr>
<td></td>
<td>300</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C78 ENT M50</th>
<th>Maximum power (CV)</th>
<th>Maximum input (mg/trk)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>500</td>
<td>195</td>
</tr>
<tr>
<td></td>
<td>450</td>
<td>179</td>
</tr>
<tr>
<td></td>
<td>400</td>
<td>170</td>
</tr>
<tr>
<td></td>
<td>400</td>
<td>154</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C78 ENT M55</th>
<th>Maximum power (CV)</th>
<th>Maximum input (mg/trk)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>550</td>
<td>218</td>
</tr>
<tr>
<td></td>
<td>500</td>
<td>218</td>
</tr>
<tr>
<td></td>
<td>450</td>
<td>218</td>
</tr>
<tr>
<td></td>
<td>400</td>
<td>210</td>
</tr>
</tbody>
</table>