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

■ GENERAL INFORMATION ........................................... 3
  Guarantee .................................................. 3
  Spare Parts ............................................... 3
  Liability ................................................ 3
  Safety ..................................................... 3
  Engine technical data N67 ENT M56 ....................... 4
  Signs ....................................................... 6

■ USE ............................................................. 7
  Preliminary checks ......................................... 7
  Starting and stopping the engine ........................... 7
  Starting and stopping the engine from the analogue control panel ......................................................... 8
  Recognising alarms ......................................... 11
  Starting and stopping the engine from the digital instrument panel ......................................................... 12
  Digital monitor for reading engine parameters and displaying alarms ....................................................... 15
  Managing the engine from the Relay box .................... 19
  For proper use of the engine .................................. 20
  Special warnings ............................................. 20
  Running in ..................................................... 21
  Refuelling ...................................................... 22

■ CONTROLS AND MAINTENANCE ................................ 23
  Maintenance personnel ....................................... 23
  Accident prevention ......................................... 23
  Frequency ................................................... 24
  Requirements ............................................... 26
  How to proceed .............................................. 26
  Moving the engine ........................................... 34
  Disposal of waste .......................................... 34

■ LONG PERIODS OF INACTIVITY ................................. 35
  Preparing the engine for a long period of inactivity .......... 35
  Restarting the engine after a long period of inactivity ...... 36

■ ENGINE MALFUNCTIONS ......................................... 37
■ EMERGENCIES ON BOARD ...................................... 38
■ IN APPENDIX ....................................................
  Oil viscosity level according to surrounding temperatures . 40
  Control panel user requirements ............................ 41
  Digital instrument panel - Previous version ............... 42
  Recognizing alarm statuses .................................. 44
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 equipment 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 equipment 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, equipment with tools considered suitable by FPT.

For the purpose of safety, further recommendations are given in the chapter CONTROLS AND MAINTENANCE.
**ENGINE TECHNICAL DATA N67 ENT M56**

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>N67 ENT M56</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine family</td>
<td>F4</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>104 x 132 mm</td>
</tr>
<tr>
<td>Total displacement</td>
<td>6,700 cm³</td>
</tr>
<tr>
<td>Air system</td>
<td>Supercharged aftercooled (TCA or TAA)</td>
</tr>
<tr>
<td>Injection type</td>
<td>Direct/Common rail 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>650 kg</td>
</tr>
</tbody>
</table>

**Electrical system** 12 V (24 V on request)

- Accumulator/s - capacity 180 Ah or above
- Accumulator/s - discharge current 800 A or above

**Available settings (*)**

<table>
<thead>
<tr>
<th>Code</th>
<th>Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>412 kW (560 CV) @ 3000 rpm</td>
</tr>
<tr>
<td>A2</td>
<td>368 kW (500 CV) @ 3000 rpm</td>
</tr>
<tr>
<td>B</td>
<td>331 kW (450 CV) @ 3000 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.
N67 ENT M56

N67 ENT M56
**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>Sign</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>![s]</td>
<td>Lifting point (engine only).</td>
</tr>
<tr>
<td>![fuel_cap]</td>
<td>Danger of burning: Expulsion of hot water under pressure.</td>
</tr>
<tr>
<td>![oil_cap]</td>
<td>Danger of burning: Presence of high temperature parts.</td>
</tr>
<tr>
<td>![oil_dipstick]</td>
<td>Danger of fire: Fuel present.</td>
</tr>
<tr>
<td>![fuel_dipstick]</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 engine room.

STARTING AND STOPPING THE ENGINE
For vessels equipped with instrument panels that are not manufactured by FPT

The start-up and shut-down operations described below apply to an on-board control panel manufactured by FPT; if the vessel is fitted with an instrument panel that has been customised by the Boatbuilder or Fitter, these operations may vary according to the various choices made during construction. In these cases, follow the start-up/shut-down sequence and use the instrument panel description provided by the Boatbuilder on specific documentation.
STARTING AND STOPPING THE ENGINE FROM THE ANALOGUE CONTROL PANEL

Procedure for start-up from the main FPT control panel (supplied on demand)

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 flybridge control panel (supplied on demand)

1. **Enable the secondary control panel, by turning the key switch on the main panel to position 8B** (see warnings 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 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).

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

4. Check that the rev indicator shows a plausible value.
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. You can choose between two different procedures to stop the motor from the main FPT panel:
   - Turn the key switch from + 15 to OFF (8A);
   - Press the motor stopping button (9) (the stop button cuts off the power supply to the coil of a relay), then turn the key switch to OFF. When the button is released the system checks all the functions connected to the panel.

For RINA homologated systems only:

Turn the key switch to OFF (8A), then press the motor stopping button (the motor stopping button will excite the coil of a relay).

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 (8A) position and press the RINA (9) stop button.

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 indicated.

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.

WARNING

The stopping procedure for RINA homologated systems is different from standard systems.
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 equipment only make some of the above mentioned functions available. If the Boatyard uses different technical options there may also 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.


*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.

View of switch with key

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 5A.

<table>
<thead>
<tr>
<th>WARNING</th>
</tr>
</thead>
<tbody>
<tr>
<td>The stopping procedure for RINA homologated systems is different from standard systems.</td>
</tr>
</tbody>
</table>

For RINA homologated systems only:
Turn the key switch to OFF (5A), then press the motor stopping button (4) (the motor stopping button will excite the coil of a relay).

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 (5A) position and press the RINA (4) stop button.

B. From the secondary FPT panel: the engine is stopped by pressing the red STOP (5) 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.
DIGITAL MONITOR FOR READING ENGINE PARAMETERS AND DISPLAYING ALARMS

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.

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>ELECTRICAL SECTION Volt or Ampere</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Battery voltage</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Fuel (L, Gal, Gals) o (L/h, Gal/h, Gals/h) o (km/L, MPG, o lMPG)</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Residual fuel with GPS</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Instantaneous Fuel Economy</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Distance (km, milia, o Nmilia)</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></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>Screen windows</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pressure (kPa, PSI o bar)</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Barometric pressure</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Turbocharging pressure</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Engine oil pressure</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Reverse gear oil pressure</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Temperature (°C o °F)</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Engine coolant temperature</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Fuel temperature</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Exhaust gas temperature</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Percentage (%)</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Acceleration position</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Refrigerant level</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Engine torque current percentage</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Engine torque at rpm</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Speed (RPM, km/h, MPH o KTS)</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Engine speed</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Time (h)</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total hours of engine operation</td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>

N4-N6 MARINO ELET_ENG.fm  Page 16  Tuesday, September 27, 2011  11:56 AM
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 (нал). 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
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:

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

Start-up procedure

1. Turn switch 3 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 START position until the engine starts, then release it.

Running speed management procedure

Press button 2 in the START position, with the engine turning, to accelerate and decelerate; each time the button is pressed the engine will accelerate or decelerate in sequence.

1. To accelerate: press and hold button 2 in the START position until the required engine speed is achieved, then release it; the speed will be maintained.
2. To decelerate: press button 2 again in the START position until the required decrease in speed is achieved, then release it.

Stopping procedure

1. Press button 2 in the STOP position until the engine has come to a complete stop, then release it.
2. Return switch 3 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”.

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.

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 a Service Centre.

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.
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 taking due note of the WARNINGS provided. If it should be necessary to replace them, always comply with the characteristics indicated in the section ENGINE TECHNICAL DATA.

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>N67 ENT litres (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooling circuit (1)</td>
<td>24.5</td>
</tr>
<tr>
<td>Lubrication circuit (2)</td>
<td></td>
</tr>
<tr>
<td>total capacity (3)</td>
<td>16.5 (15)</td>
</tr>
<tr>
<td>Periodic changing:</td>
<td></td>
</tr>
<tr>
<td>oil sump at minimum level</td>
<td>9 (8)</td>
</tr>
<tr>
<td>oil sump at maximum level</td>
<td>14.5 (13)</td>
</tr>
<tr>
<td>Fuel tank (4)</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 E5 –(Shell Rimula SAE 5W30) (high power engines). The viscosity level of oil to be used depending on surrounding temperatures in 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).

**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**

EN 590 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 climatic 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 equipment and adequate means of protection. Operations marked by the key symbol (see illustration).
- **Special maintenance**: by qualified personnel from Service Centres who have detailed technical information and specific equipment. 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 where there are suspended loads or systems installed at head-height.
- Use protective hand cremes.
- 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.
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.

FREQUENCY

<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 (1)</td>
</tr>
<tr>
<td>Check/top up electrolyte level in batteries and clean terminals</td>
<td>300 hours</td>
</tr>
</tbody>
</table>

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>Planned maintenance</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clean air filter/s</td>
<td>300 hours (2) (7)</td>
</tr>
<tr>
<td>Check corrosion of zinc anodes</td>
<td>300 hours (4) (7)</td>
</tr>
<tr>
<td>Check state of oil vapour filter</td>
<td>300 hours (7)</td>
</tr>
<tr>
<td>Drain/suck condensation from fuel tank/s</td>
<td>600 hours (1) (7)</td>
</tr>
<tr>
<td>Change engine oil</td>
<td>300 hours (5) (7)</td>
</tr>
<tr>
<td>Change oil filter/s</td>
<td>300 hours (5) (7) (8)</td>
</tr>
<tr>
<td>Change fuel filter/s</td>
<td>500 hours (1) (7) (8)</td>
</tr>
<tr>
<td>Change fuel pre-filter</td>
<td>500 hours (1) (7)</td>
</tr>
<tr>
<td>Change oil in the marine gear</td>
<td>Consult the manufacturer’s data</td>
</tr>
<tr>
<td>Inspect sea chest</td>
<td>300 hours (7)</td>
</tr>
<tr>
<td>Check tension and state of belt</td>
<td>600 hours</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/s</td>
<td>2 years (5)</td>
</tr>
</tbody>
</table>
I) 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 $< 10 \mu m$
   - filtering efficiency $\beta > 200$.

---

### Special maintenance

<table>
<thead>
<tr>
<th>Operation</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check wear in sea water pump rotor</td>
<td>300 hours $^{(7)}$</td>
</tr>
<tr>
<td>Replace belt</td>
<td>1200 hours or 3 years</td>
</tr>
<tr>
<td>Clean heat exchangers</td>
<td>300 hours $^{(6)} (7)$</td>
</tr>
<tr>
<td>Clean the turbocharger</td>
<td>300 hours $^{(5)} (7)$</td>
</tr>
<tr>
<td>Adjust play in valves-rocker arms</td>
<td>3000 hours</td>
</tr>
</tbody>
</table>

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### 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 equipment on board (two-way radios, echo-sounding equipment, 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).

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 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 Parafax 11 (see REFUELLING table).

CAUTION!
Only open the coolant tank cap when the engine is cold.

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.

Checking the level of electrolyte solution in the batteries
Place the batteries on a level surface, then proceed as follows.
- Visually check that the fluid level is between the "Min" and "Max" limits; in the absence of references, check that the fluid covers the Lead plates inside the elements by approximately 5 mm.
- If necessary, top up with distilled water only those elements in which the level is below minimum.
- Contact specialised technical staff if the battery needs recharging.
Have the efficiency of the battery recharging system tested if a voltage of less than 11 V (for 12 V rated systems) or 22 V (for 24 V rated systems) is detected with the engine running.

On this occasion, make sure that the terminals and clamps are clean, properly locked and protected by vaseline.

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 collar (1) shown in picture then remove the filter.
- 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 breakages are found.
- Replace the filter once every 2 years.
- Restore normal operating conditions after positioning the filter in its housing.

---

**CAUTION!**

- 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.
- 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.

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.
Check corrosion of zinc anodes

Only proceed with the engine stopped and at a low temperature:

- Provide suitable containers to ensure that no water is dispersed inside the vessel during removal of the anodes.
- Remove the anodes, unscrewing them from their housings (see location in the section ENGINE TECHNICAL DATA).
- Make sure that corrosion has not exceeded 50% of the volume of zinc. If this is the case, change them.
- Replace the anodes in their housings, locking them to the prescribed torque.

Check state of oil vapour filter

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

- Unfasten the screws and remove the cover (1) to the filter compartment.
- Remove the two filters and check them for deposits; if any deposits are found, replace them.
- Replace the cover in its housing.
Changing engine oil

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

- Place a container under the hand pump (1) outlet pipe (2), to collect the used oil.
- Unscrew the filler cap, turn the hand pump provided (2), which is set up to extract the oil only, until the oil sump is completely empty.
- Fill up with fresh oil through the feeder hole (3) on the timer cover, using the types and amounts of oil indicated in the table REFUELLING. Screw down the filler cap.
- Using the dipstick (4), check that the oil level is between the "Min" and "Max" levels.
- Dispose of used oil according to current requirements.
Changing the engine oil filter

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

- Place a container under the filter support (1), to collect the used oil.
- Unscrew the filter and remove it.
- Carefully clean the surfaces of the support that are in contact with the filter seal.
- Damp the new filter seal with a thin layer of oil.
- Hand screw the new filter into place until the seal gasket touches the support, then lock by a further 3/4 of a turn.
- Dispose of the old filter according to current requirements.

Changing the fuel filter

Only proceed with the engine stopped and at a low temperature

- Remove the filter by unscrewing it.
- Check that the new filter has performance levels that satisfy the needs of the engine (e.g. by comparing them with the old one. See section on FREQUENCY).
- Damp the new filter seal with diesel or engine oil.
- Hand screw the new filter into place until the seal gasket touches the support, then lock by a further 3/4 of a turn.

WARNING

Do not fill up the new filter before fitting it to the support, to avoid introducing harmful impurities into the injection system and circuit.

CAUTION!

Do not attempt to bleed in any way, as this is unnecessary and extremely dangerous, and also, if the high pressure circuit connectors are loosened there will be negative effects on start-up of the engine.
Changing the fuel pre-filter

Only proceed with the engine stopped and at a low temperature

- Remove the pre-filter by unscrewing it.
- Check that the new filter has performance levels that satisfy the needs of the engine (e.g. by comparing them with the old one).
- Damp the new filter seal with diesel or engine oil.
- Hand screw the new filter into place until the seal gasket touches the support, then lock by a further 3/4 of a turn.
- Loosen the bleeder screw (2) on the pre-filter support and activate the hand pump (1) until the supply circuit is full. Ensure that any fuel coming out is not dispersed into the environment.
- Lock the bleeder screw tightly.
- Start the engine and run it at minimum speed for a few minutes to eliminate any residual air.

**NOTE:** should it be necessary to accelerate the bleeding phase, the hand pump can be used during start-up.

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.

Drain/suck condensation from fuel tank/s
Inspect sea chest
Check sea water pump rotor
Clean heat exchangers
Clean the turbocharger
Adjust play in valves-rocker arms

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.
MOVING THE ENGINE
The operations necessary to embark and disembark the engine must only be carried out by technicians from 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 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 60 g of 30/M protective oil (10 g per litre displacement) into the turbocompressor 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 to point 7.

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 equipment.
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.
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

When certain problems in the accelerator electric circuit are recognised, the Electronic Unit controlling the engine adopts a strategy 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.

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 handholds.

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!

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 equipment provided aboard, and in the manner indicated by Fire prevention authorities (the fire-fighting equipment 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 engine’s 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
**CONTROL PANEL USER REQUIREMENTS**

The following data refer to branded equipment in its original configuration. The requirements and technical features of conversions may differ from these specifications and specific information must be supplied by those responsible for the conversion.

<table>
<thead>
<tr>
<th>Control panels</th>
<th>With analogue instruments</th>
<th>With digital instruments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Environmental operating conditions</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating temperature range</td>
<td>from -10°C to +60°C;</td>
<td>from -10°C to +60°C;</td>
</tr>
<tr>
<td>Temperature limits while moored</td>
<td>min. -20°C / max. +75°C</td>
<td>min. -20°C / max. +75°C</td>
</tr>
<tr>
<td>Protection level against dust and rain (front)</td>
<td>IP 65 – DIN 40050 – IEC 529</td>
<td>IP 66</td>
</tr>
<tr>
<td>Salt spray resistance (reference Standard)</td>
<td>IEC 60068-2-52</td>
<td>IEC 60068-2-52</td>
</tr>
<tr>
<td><strong>Electrical and electromagnetic properties</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating voltage (excluding polarity reversals)</td>
<td>min. 9 V / max. 32 V (*)</td>
<td>min. 9 V / max. 32 V (*)</td>
</tr>
<tr>
<td>Maximum permitted over-voltage</td>
<td>60 V for 1 ms</td>
<td>60 V for 1 ms</td>
</tr>
<tr>
<td>Maximum current uptake by main panel</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>Maximum current uptake by secondary panel</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>Wiring connector requirements (reference Standard)</td>
<td>MIL 1344/1001</td>
<td>MIL 1344/1001</td>
</tr>
<tr>
<td>Wiring requirements (reference Standard)</td>
<td>CEI 20/22 - CEI 20/38 - CEI 2000/532/CE</td>
<td></td>
</tr>
<tr>
<td><strong>Mechanical properties</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vibration resistance (expressed as acceleration due to gravity)</td>
<td>1 g max. eff. -25-500 Hz</td>
<td>2 g max. eff. -25-500 Hz</td>
</tr>
<tr>
<td>Impact resistance (expressed as acceleration due to gravity)</td>
<td>15 g - 1.5 ms - sinusoidal wave</td>
<td>15 g - 1.5 ms - sinusoidal wave</td>
</tr>
</tbody>
</table>

(*) 16 V max. with reference to equipment for which power is required only at rated voltage of 12 V.
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 STATUS).
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.

* Clogging air filter  * Clogging oil vapor filter  
* Clogging oil filter  * Alternator anomaly  
Maintenance interval expiry  Low oil pressure  
* Pre-lubrication running  High temperature of coolant  
* Pre-post heating  Overrun  
* Clogging fuel filter  * Low level of coolant  
Water in the fuel filter  EDC engine control system failure

* 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.

Detail of the main 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.
If the set value does not correspond with the one foreseen for the type of oil being used (see requirements in the sections 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:

- If the value does not correspond, modify it by pressing and holding the “Prog” button (9) until the display shows the maximum input value (e.g. 131 mg/strk), 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.