FOREWORD

Thank you for choosing FPT and congratulations on your choice of engine.
Please read the instructions in this manual carefully before carrying out any operation concerned with this engine or its equipment. Adherence to these instructions is your best guarantee of efficient, durable engine service.

The contents of this manual refer only to the standard engine configuration and the illustrations are intended solely as a guide. Some instructions describe the operation sequence required to obtain the expected performance from the engine and/or its equipment. They are sometimes dependent on the configuration of the controls and the specification of the vessel to which the engine is fitted. Where these differ from the content of this manual, please refer to the boatbuilder’s instructions or the boat owner handbook.

The following information is up-to-date at the time of publication. The Manufacturer reserves the right to make any changes without notice and at any time for reasons of a technical or marketing nature and also to adapt our engines to legal requirements in the various countries. We cannot be held liable for any errors or omissions.

Remember that the FPT Technical Service Network is ready to help you with its expertise and professionalism, wherever you may be.
GENERAL REMARKS

WARRANTY
Carefully observe the instructions in this publication to get the best performance from your engine and benefit from FPT warranty cover. The warranty may be invalidated if you fail to observe the instructions or observe them incorrectly.

PARTS
The exclusive use of FPT Original Parts is an essential condition for maintaining your engine in its original condition. The use of non-original parts will render the warranty null and void and also exonerate FPT from any liability throughout the engine’s lifetime.

LIABILITY
The Manufacturer’s liability is dependent on you carrying out the check and maintenance operations set out and described in this handbook. You will have to produce evidence that this has been done to prove liability. Any repair operations that become necessary must be carried out by qualified staff employed by FPT Network authorised Workshops using tools and equipment designed for the purpose.

SAFETY
The following information is designed to make you aware of the way the engine should be used to prevent damage to people and things as a result of improper or incorrect use.

- Engines must be used solely for applications declared by the Manufacturer.
- Tampering, changes and the use of non-original parts could impair effective engine operation and safe boating; avoid under all circumstances any changes to the wiring and units fitted to the engine and also their connection to external electrical networks.
- Pay attention to moving engine parts, parts at high temperatures and circuits containing fluid under pressure. The electrical equipment in the engine contains live parts.
- Engine exhaust emissions are harmful to the health.
- The engine must be moved using appropriate lifting equipment, using the appropriate eyebolts on the engine.
- The engine must not be put into service and used before all the safety requirements for the vessel on which it is installed have been met and the vessel is compliant with local standards and laws.
- The operations required to guarantee the engine is used and maintained under the most effective conditions must be carried out solely by staff of proven expertise equipped with instruments approved by FPT.

More safety advice is given in the chapter CHECKS AND MAINTENANCE.
S30 ENT M23 ENGINE TECHNICAL DATA

The technical code and serial number are shown on a plate located on different parts of the engine, depending on the engine: flywheel guard, cam cover, coolant reservoir.

<table>
<thead>
<tr>
<th>Code</th>
<th>S30 ENT M23</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine family</td>
<td>F1 C</td>
</tr>
<tr>
<td>Cycle</td>
<td>Diesel 4 stroke</td>
</tr>
<tr>
<td>Number and arrangement of cylinders</td>
<td>4, in line</td>
</tr>
<tr>
<td>Bore x stroke</td>
<td>95.8 x 104 mm</td>
</tr>
<tr>
<td>Total displacement</td>
<td>2998 cm³</td>
</tr>
<tr>
<td>Air supply</td>
<td>Turbocharger and aftercooler (TCA or TAA)</td>
</tr>
<tr>
<td>Injection method</td>
<td>Common rail with electronic management</td>
</tr>
<tr>
<td>Engine direction of rotation</td>
<td>Anticlockwise (viewed facing flywheel)</td>
</tr>
<tr>
<td>Dry weight</td>
<td>320 kg</td>
</tr>
</tbody>
</table>

**Electrical equipment**  
12 V (24 V optional)

- Accumulator/s  
  - capacity 180 Ah or higher  
  - take-off current 800 A or higher

**Available settings (*)**

<table>
<thead>
<tr>
<th>Code</th>
<th>S30 ENT M23</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>169 kW (230 BHP) @ 4000 rpm</td>
</tr>
<tr>
<td>B</td>
<td>129 kW (175.5 BHP) @ 3500 rpm</td>
</tr>
<tr>
<td>C</td>
<td>85 kW (115.6 BHP) @ 3500 rpm</td>
</tr>
</tbody>
</table>

(*)& Net power at flywheel as per ISO standard 3046-1. Test conditions: T 25 °C; atmospheric pressure 100 kPa; relative humidity 30%.

**WARNING**

It is strictly forbidden to alter the above specifications and in particular to amend the data stored in the injection system electronic control units or the specifications of the engine and its equipment or the FPT warranty will be null and void and the company cannot be held liable.
**SOFIM S30 ENT M23 engine**

1. Mixer for exhaust gas and seawater outlet (riser) -

---

**SOFIM S30 ENT M23 engine**

**LABELS**

The meanings of the warning labels affixed to the engine are given below.

**NOTE:** Labels with an exclamation mark highlight a potential hazard.

<table>
<thead>
<tr>
<th>![Icon]</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Hook]</td>
<td>Lift point (engine alone).</td>
</tr>
<tr>
<td>![Fuel]</td>
<td>Fuel filler cap (on tank, if present).</td>
</tr>
<tr>
<td>![Oil]</td>
<td>Lubricant oil filler cap.</td>
</tr>
<tr>
<td>![Dipstick]</td>
<td>Lubricant oil dipstick.</td>
</tr>
</tbody>
</table>

| ![Expulsion] | Burns hazard: Expulsion of hot water under pressure. |
| ![Hot Parts] | Burns hazard: Presence of high temperature parts. |
| ![Impact] | Danger of impact and snagging on moving parts: Presence of fans, pulley, belts etc. |
USE

PRELIMINARY CHECKS
Before each engine start-up:

- Ensure the seawater intake valve is open. Running the seawater pump dry would cause irreparable damage to the internal impeller within a few seconds.
- Check the level of technical fluids (fuel, engine oil and coolant).

ATTENTION!
Before starting the engine, ensure there is no fuel vapour or gas in the engine room.

ENGINE START-UP AND SHUT-DOWN
For vessels equipped with an instrument panel not produced by FPT
The start-up and shut-down procedures described below are applicable if an instrument panel produced by FPT is fitted on board. If the control panel on the vessel has been customised by the shipbuilder or body builder, these procedures may alter depending on the alternatives they have selected. In such cases, observe the start-up/shut-down sequences and the gauge interpretation shown on the shipbuilder's specific documentation.
ENGINE START-UP AND SHUT DOWN FROM AN FPT INSTRUMENT PANEL

Start-up procedure from main panel

Check the power supply system is efficient and then proceed as follows:

1. Raise the ignition protective cover (8), introduce the key and turn right to position 8B.

2. Check that the analogue instruments supply plausible readings that tally with the relevant physical parameters (temperature, battery voltage and oil pressure).

3. Wait for the acoustic alarm to stop and for the alarm warning lights on indicator module (5) to go off - with the exception of the "alternator fault" and "low oil pressure" warning lights. At the same time, check that the indicator test is successful (instructions for interpreting tests and module readings are given in the relevant paragraph).

4. Turn the key to position 8C and release once the engine has started. Avoid accelerating.

5. Check that the analogue instruments supply plausible readings that tally with the new values for the relevant physical parameters (temperature, battery voltage and oil pressure).

6. If the engine will not start, after releasing the key it will be possible to return to the start-up position only after restoring the ignition key to rest position 8A.
Start-up procedure from secondary panel or flybridge

1. Enable the secondary panel for operation by turning the main panel ignition key to 8B (see warning and procedure in previous paragraph).

2. Wait for the acoustic alarm to stop and for the alarm warning lights on indicator module (3) to go off - with the exception of the "alternator fault" and "low oil pressure" warning lights. At the same time, check that the indicator test is successful (instructions for interpreting tests and module readings are given in the relevant paragraph).

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

4. Check that the rpm gauge provides plausible readings.

**WARNING**

To ensure that the control panels perform their functions effectively during the voyage, the engine cannot be started until the warning light and horn test is complete.
**Stopping the engine**

Before stopping the engine, it is advisable to leave it running for a few minutes at idle speed with no load. This allows gradual temperature reduction and prevents damaging thermal shocks.

A. The engine is normally shut down from the main FPT panel by turning the ignition key to rest position 8A or operating the equivalent control where a customised panel is present.

B. The engine is shut down from the secondary FPT panel by pressing the red button (6) on the panel.

Shut down from the main FPT panel in engines equipped with an “excitation” device (optional or specified by Certification Bodies) is carried out by pressing red button (9).

**To restart the engine from the main panel:**

1. Restore the ignition key to rest position 8A to zero all the functions performed by the control panels.
2. Start as described in the relevant paragraph.

**To restart the engine from the secondary panel:**

1. Ensure the panel is enabled (main panel ignition key in position 8B).
2. Press the green button (5) and release once start-up has taken place, avoiding acceleration. Check that the rpm gauge provides plausible readings.
ALARM STATUS IDENTIFICATION

FPT control panels with analogue gauges are equipped with an electronic module that includes warning lights and interface, timer and alarm storage circuits.

The figure shows module synoptics and the key shows the meanings of the symbols on all the warning lights. Some engine types and outfits make available only some of the functions mentioned.

Different technical alternatives selected by the Shipyard may also change these instructions.

Operation

When the ignition switch is turned to position 8B, the indicator and alarm module runs an efficiency test on all warning lights for 5 seconds with the exception of the Prelubrication, Pre-postheating, EDC system failure warning lights. At the same time, the acoustic indicator emits an audible signal.

Sound emission may be inhibited in advance at the end of the test by operating the relevant button.

During the start-up stage and for the next 15 seconds, all the alarm functions are inhibited. Once this time interval has elapsed, every alarm status detected by specific sensors on the engine causes the relevant indicator to light up in flashing mode and an acoustic signal to sound simultaneously. Inhibition of the acoustic signal, achieved by pressing the relevant button, causes the indicator to light up in non-flashing mode and the alarm is stored until the engine is next shut down.


*Alarm functions not available with standard specification.
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.

B. For RINA homologated systems only: the engine is stopped by pressing the red STOP button in the main FTP panel.

C. 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.

**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.

<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. Monitor adjustment and contrast or, if pressed for 3 seconds, access to configuration menu</td>
<td></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>ELECTRICAL SECTION Volt or Ampere</td>
<td>J1939</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Battery voltage</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td></td>
<td>Fuel (L, Gal, lGal) o (L/h, Gal/h, lGal/h) o (km/L, MPG, o lMPG)</td>
<td>Residual fuel with GPS</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>Remaining distance with GPS</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).

---

### WARNING

The seriousness of the alarm is displayed in the flashing window:

- **MS**: VERY SERIOUS
- **MOD**: MODERATELY SERIOUS
- **LS**: LESS SERIOUS

---

<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</td>
</tr>
<tr>
<td></td>
<td><strong>Pressure</strong> (kPa, PSI o bar)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>![Pressure symbol]</td>
<td>Barometric pressure</td>
<td>✓</td>
<td>✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>![Pressure symbol]</td>
<td>Turbocharging pressure</td>
<td>✓</td>
<td>✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>![Pressure symbol]</td>
<td>Engine oil pressure</td>
<td>✓</td>
<td>✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td></td>
<td><strong>Temperature</strong> (°C o °F)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>![Temperature symbol]</td>
<td>Engine coolant temperature</td>
<td>✓</td>
<td>✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>![Temperature symbol]</td>
<td>Fuel temperature</td>
<td>✓</td>
<td>✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>![Temperature symbol]</td>
<td>Exhaust gas temperature</td>
<td>✓</td>
<td>✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>![Percentage symbol]</td>
<td>Acceleration position</td>
<td>✓</td>
<td>✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>![Percentage symbol]</td>
<td>Refrigreant level</td>
<td>✓</td>
<td>✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>![Percentage symbol]</td>
<td>Engine torque current percentage</td>
<td>✓</td>
<td>✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>![Percentage symbol]</td>
<td>Engine torque at rpm</td>
<td>✓</td>
<td>✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>![Speed symbol]</td>
<td>Engine speed</td>
<td>✓</td>
<td>✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>![Time symbol]</td>
<td>Total hours of engine operation</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>
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.

Initial launch of engine control monitor

The FPT monitor for reading parameters can operate with 6 different types of engines. It 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
CORRECT USE OF THE ENGINE

- Do not extend the start-up command when the engine has started.
- Do not stay on the mooring waiting for the engine to warm up but start to move off slowly after start-up. The correct service temperature will be reached with the engine rotating at medium power speeds.
- Do not idle the engine for long periods because this promotes the production of harmful emissions by the engine and does not guarantee the best performance.
- Increase and decrease the engine speed gradually to allow even combustion and the effective operation of all engine components.
- Maximum cruising speed must not be greater than 90% of maximum power speed (see ENGINE TECHNICAL DATA section).
- While sailing, check that:
  - Engine coolant temperature does not reach alarm thresholds.
  - Oil pressure is maintained within the normal specified limits.

SPECIAL WARNINGS

High coolant temperature
If the gauge temperature reading is excessive or an alarm signal is present, reduce the speed and go into port to check the seawater intake and cooling circuit status. Also check, or have checked, the following:
- tension of the water pump and alternator drive belts.
- thermostatic valve operation.
- heat exchanger cleanliness.

ATTENTION!

The pressure set up inside the cooling circuits when the engine is warm is able to cause the very violent expulsion of hot fluid, giving rise to a danger of burns. Open the coolant reservoir filler plug only when necessary and solely with the engine cold.

Low lubricant oil pressure
If the pressure reading on the gauge is considered too low or the Low oil pressure warning light has come on, stop the engine and check the oil level. Top up if necessary (see CHECKS AND MAINTENANCE section).
If the reading persists, return at low speed and contact a Service Centre.

Presence of water in the fuel filter
It is good practice to drain water present in the filter before the warning light comes on.
Avoid using the engine when the tank contains only the reserve amount of fuel. This condition promotes the formation of condensate and the intake of sludge or air causing the engine to stall.
Air filter clogged and exhaust circuit inefficient
Inspect the cleanliness of the air intakes and exhaust ducts regularly. The maintenance intervals given in this handbook take into account only the performance of engine components and not operations carried out by the Shipyard and possible external events.

ATTENTION!
When refuelling, take the greatest care to ensure that no solid or liquid pollutants enter the tank. Remember that it is forbidden to smoke or use naked flames when refuelling.

Electrical system irregularity
At intervals, particularly in winter, check battery cleanliness and efficiency. Check and top up as described in the section CHECKS AND MAINTENANCE. In the event of replacement, respect the specifications given in the section ENGINE TECHNICAL DATA.

WARNING
If the voltmeter indicates a voltage reading below 11 V (for systems rated 12 V) or 22 V (for systems rated 24 V), contact the staff of a specialised workshop and have the batteries and recharging system checked.

RUNNING IN
Due to state-of-the-art engine construction methods, no particular running in procedures are required. It is nevertheless advisable to avoid using the engine at high power for long periods during the first 50 hours.

Alternator fault
Check the cleanliness, wear and tension of the drive belt at intervals.

ATTENTION!
Carry out a visual check to ensure the exhaust circuit is not blocked or damaged to prevent hazardous emissions inside the hull.

ATTENTION!
The drive components are positioned beneath protective covers. They should be removed only when the engine is not turning.
CAPACITIES

<table>
<thead>
<tr>
<th>Parts to be topped up</th>
<th>litres (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooling circuit (1)</td>
<td>14</td>
</tr>
<tr>
<td>Lubrication circuit (2)</td>
<td></td>
</tr>
<tr>
<td>total capacity (3)</td>
<td>7.5 (6.8)</td>
</tr>
<tr>
<td>Periodic replacement:</td>
<td></td>
</tr>
<tr>
<td>sump at minimum level</td>
<td>5.3 (4.8)</td>
</tr>
<tr>
<td>sump at maximum level</td>
<td>6.8 (6.2)</td>
</tr>
<tr>
<td>Fuel tank (4)</td>
<td>-</td>
</tr>
</tbody>
</table>

(1) Use a 50% mixture of water and PARAFLU 11, even in summer. As an alternative to PARAFLU 11, use a product to international specifications SAE J 1034.

(2) Use lubricants to international specifications ACEA E3 - E5 (for high powers), API CF - CH4 (associated with fuels with sulphur content < 0.5%), MIL - L - 2104 F.

The viscosity level to be used in relation to environmental temperature is shown in the table in the appendix.

Oil consumption is considered acceptable to a quantity up to 0.5% of fuel consumption.

(3) The quantities given refer to the first filling and relate to the filling of the engine, oil sump and filter.

(4) Use only diesel available normally on the market (Standard DIN EN 590). It is inadvisable to use additives. It is not permitted to use fuels derived from the synthesis of organic substances and vegetable oils (Biodiesel).

WARNING

Refuelling from drums or tankers may cause contamination of the diesel with the consequent risk of damage to the injection system. If necessary, filter or sediment out the impurities before refuelling.

Diesel oil for low temperatures

The standard DIN EN 590 distinguishes different diesel categories, identifying the properties of those that are most suitable for use at low environmental temperatures.

The oil companies are solely liable for observing the regulations that require the distribution of fuels suited to the climatic and geographical conditions of the different countries.

Hydraulic reverser fluid

Consult the handbook supplied by the Manufacturer for the fluid types and quantities to be used in the hydraulic reverser.
# CHECKS AND MAINTENANCE

## MAINTENANCE STAFF

The engine checking and maintenance operations described in the following chapter require training, skill and respect for the safety regulations. They must therefore be performed by responsible staff as indicated below.

- **Checks**: by workshop staff or by the vessel user if necessary.
- **Periodic maintenance**: by qualified staff equipped with appropriate working instruments and appropriate protective equipment. Operations identified by a key symbol (illustration alongside).
- **Extraordinary maintenance**: by qualified staff or by the Service Centres in possession of specific technical information and specific equipment. Operations identified by a key symbol (illustration alongside).

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

## ACCIDENT PROTECTION

- Always wear accident prevention footwear and overalls.
- Do not wear flimsy garments, rings, bracelets and/or necklaces near engines or moving parts.
- Wear protective gloves and goggles during the following operations:
  - filling batteries with acid solution
  - filling with inhibitors or antifreeze
  - changing or topping up lubricant oil (hot engine oil may cause burns. It is advisable to carry out operations only when the oil temperature has dropped lower than 50 °C).
  - When working inside the engine compartment, move with the greatest care to avoid contact with rotating parts or parts at high temperatures.
  - Wear goggles when using compressed air (the maximum air pressure used for cleaning is 200 kPa (2 bar, 30 psi, 2 kg/cm²).
  - Wear a protective helmet when working in an area with suspended loads or with systems at head height.
  - Use protective hand cream.
  - Replace wet overalls immediately.
  - Keep the engine clean at all times, removing oil, diesel and coolant stains.
  - Replace greasy rags in flameproof containers.
  - Do not leave foreign objects on the engine.
  - Use appropriate, safe containers for waste oil.
  - At the end of a repair, take appropriate measures to stop the intake of air by the engine if an uncontrolled increase in engine speed occurs after start-up.
**ATTENTION!**

Avoid maintenance operations on live electrical parts: check that equipment is effectively earthed. During diagnosis and maintenance operations, ensure your hands and feet are dry and use insulating platforms whenever possible.

---

**INTERVALS**

<table>
<thead>
<tr>
<th>Checks during periods of use</th>
<th>Intervals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check engine lubricant oil level</td>
<td>Daily</td>
</tr>
<tr>
<td>Check oil level in hydraulic reverser</td>
<td>Daily</td>
</tr>
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The intervals shown below take into account usage factors typical of different engine applications. The most suitable maintenance operation duration for the various applications will be indicated by the staff responsible for operations based on engine applications and operating conditions.

---

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</table>
1) Maximum period for the use of good quality fuel (EN 590 specification); reduced according to fuel contamination and alarm signals due to filter blockage and presence of water in filter. The filter blocked signal and failure of the water in fuel warning light to go off after drainage are reasons for replacement.

2) The intervals depend on environmental conditions and product efficiency/wear. Carry out the check before starting up when the engine has been out of use for long periods.

3) N.C.

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

5) Intervals apply to lubricants as specified in the CAPACITIES table.

6) Combustion air/seawater heat exchanger: clean both air and water sections; engine cooling/seawater heat exchanger: clean the seawater section; hydraulic reverser fluid/seawater heat exchanger (if fitted): clean the seawater section.

7) Carry out yearly even if the specified service hours are not completed.

8) Use only filters with the following specifications:
   - filter level < 12 μm
   - β filtering efficiency > 200.

---

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<td>Adjusting valve-rocker clearance</td>
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</table>

---

**WARNING**

If the sulphur percentage in the fuels used is greater than 0.5% or the oil used does not correspond to the requirements in the capacities table, the oil, engine oil filter and oil vapour filter change intervals will alter according to the engine use and service conditions. Consult the service staff for this purpose.
INSTRUCTIONS
1. Do not disconnect the battery power supply with the engine running.
2. Do not carry out arc welding without previously removing the electric wiring and the electronic units.
3. After each maintenance interval requiring battery removal, ensure that the terminals have again been tightened in place.
4. Do not use a battery charger to start the engine.
5. Disconnect the battery/ies from the on-board network during recharging.
6. Do not paint the engine equipment, components and electrical connectors.
7. Disconnect the battery/ies electrically before any operations of an electrical nature.
8. Contact the Boatyard before installing electronic equipment on board (radio transmitters, echo-sounders etc.).

HOW TO PROCEED
Check engine lubricant oil level
Proceed only with the engine not turning and at low temperature to avoid the risk of burns.
- Use a dipstick (1) to check that the oil is between "Min" and "Max" limits.
- If the level is too low, top up through the filler hole on the timing cover after removing the relevant plug (2).
Checking fluid level in hydraulic reverser
Check the fluid level in the hydraulic reverser by following the instructions in the handbook supplied by the reverser manufacturer.

Checking the coolant level
Proceed only with the engine not turning and at low temperature to avoid the risk of burns.
- Remove the expansion tank pressurisation plug, (3 -figure on previous page).
- Check for fluid visually.
- Top up if necessary, using a mixture as described in the CAPACITIES table, taking care to ensure that the level does not fill the tank completely.

ATTENTION!
Open the coolant reservoir plug only with the engine running at low temperature.

WARNINGS
- After topping up, ensure that the fluid level does not exceed the "Max" limit on the dipstick.
- After topping up, ensure that the dipstick is fully inserted and the filler hole plug is fully tightened clockwise.

Check condition of exhaust duct/s
Check by sight that the exhaust gas system is not obstructed or damaged.
- Ensure there is no possibility of dangerous emissions inside the hull. If necessary, contact the Boatyard.

Drain water from the fuel filter.
The high risk of refuelling with fuel polluted by foreign agents and water makes drainage advisable even if no alarm signal is present on the control panel.
Proceed with the engine not turning over.
- Position a container for fluid collection beneath the filter.
- Unscrew the plug with tap (1) located in the rear part of the filter cartridge, taking care to remove the electrical connector of the sensor for detecting water in the fuel located at the end of the plug.
- Wait for the water and condensate to finish draining until only diesel is detected.
- Close the plug by tightening fully by hand.
Connect the water presence sensor wiring until the retaining element is fully attached.

Dispose of the drained fluid in accordance with the current regulations.

At the end of the operation, check the efficacy of the filter mount electrical earth connection (2).

Check the level of the electrolyte solution in the batteries

Continue after placing the batteries on a horizontal surface.

- Check by sight that the fluid level is between the "Min" and "Max" limits. If no references are provided, check through the inspection plugs that the fluid covers the lead plates inside the elements by about 5 mm.
- If necessary, top up elements with levels below minimum.
- Check in this eventuality that the terminals and clamps are clean, tight and protected by Vaseline.

Some battery types are fitted with a single cover for the inspection plugs. Use a lever to gain access to the elements as shown in the figure.

**ATTENTION!**

- The batteries contain highly caustic and corrosive sulphuric acid. Wear protective gloves and goggles when topping-up. Where possible, it is advisable to have the check carried out by qualified staff.
- During the checks, do not smoke or take naked flames near the batteries. Ensure that the working area is sufficiently well ventilated.

**WARNING**

*Contact specialised workshop staff if all battery elements require topping up with a considerable amount of distilled water and have the efficiency of the recharging system and batteries diagnostically checked.*
Cleaning or replacing the air filter

Proceed only with the engine not turning over.
- Remove the filter by loosening the retaining elements (1).
- Blow the filter element (2) with dehumidified compressed air, working from the inside out (maximum pressure 200 kPa) or wash with water only.
- Avoid the use of cleaning agents; do not use diesel.
- Replace if tears are found. Replace the filter element at least every 2 years.
- Restore correct operating conditions after placing the filter in its housing.

Checking zinc anode corrosion status

Proceed only with the engine not turning and at low temperature:
- Use appropriate containers to ensure that no water spills inside the hull when the anodes are removed.
- Remove the anodes by unscrewing from their housing (3 - figure on page, plus information given in ENGINE TECHNICAL DATA).
- Ensure the corrosion does not affect more than 50% of the zinc volume. Otherwise replace.
- Replace the anodes in their seats and tighten to the specified torque.

Replace the engine lubricant oil (figure on page)

Proceed only with the engine not turning and at low temperature to avoid the risk of burns.
- Place a container for spent oil beneath the hand pump outlet pipe (5).
- Unscrew the filler plug (6) and operate the hand pump (4) provided for removing the oil until the oil sump is completely emptied.
- Refill with oil through the filler hole (6), using oil of the type and quantity indicated in the CAPACITIES table. Tighten the filler hole plug fully.
- Use a dipstick to check that the oil is between "Min" and "Max" limits.
- Dispose of the spent oil in accordance with the current regulations.
Changing the engine oil filter

Proceed only with the engine not turning and at low temperature to avoid the risk of burns. Use only filters with the same level of filtration as previously (see INTERVALS section).

- Place a container under filter mount (1) to collect the spent oil.
- Unscrew and remove the filter.
- Thoroughly clean the mount surfaces in contact with the filter gasket.
- Moisten the new filter gasket with a layer of oil.
- Hand tighten the new filter onto the mount until in contact with the gasket, then tighten through 3/4 turn.
- Dispose of the old fluid in accordance with the current regulations.

Changing the fuel filter

Proceed only with the engine not turning and at low temperature:

- Position a container for fluid collection beneath the filter.
- Unscrew the plug with tap (1) located in the rear part of the filter cartridge, taking care to remove the electrical connector of the sensor for detecting water in the fuel located at the end of the plug.
- Remove the filter by unscrewing.
- Check that the performance of the new filter meet the engine requirements by comparing with those of the previous filter or the data given in the INTERVALS section.
- Moisten the new filter gasket with diesel or engine oil.
- Hand tighten the new filter onto the mount until in contact with the gasket, then tighten through 3/4 turn.
- Place the plug in its seat and tighten by hand.
- Connect the water presence sensor wiring until the retaining element is fully attached.

Fill the filter and bleed air from the circuit as follows:

- Loosen bleed screw (1) on the filter mount and turn the ignition key to position 8B to bring about timed operation of the electric
fuel pump and fill the filter and bleed air from the circuit. If necessary, repeat the operation until diesel only emerges.

- After filling and bleeding, tighten the bleed screw (1) fully and restore the ignition key to position 8A.
- Dispose of the filter and drained fuel in accordance with the current regulations.

To eliminate any residual air, start the engine and idle for some minutes.

**ATTENTION!**

Avoid any attempt to bleed the high pressure circuit because it is pointless and extremely dangerous. Loosening the high pressure circuits can also have negative effects on start-up.

**WARNING**

Do not fill the new filter before positioning on the mount to avoid introducing damaging impurities into the circuit and injection system.

**Changing the fuel pre-filter**

Proceed with the engine not turning over. Replace the prefilter located on the fuel suction pipe from the tank whenever the main filter is replaced.

The high risk of refilling with fuel contaminated with foreign agents is a reason for checking the cleanliness of the prefilter and replacing it more frequently if necessary.

**Check auxiliary drivebelt tension and conditions.**

Proceed only with the engine not turning and at low temperature to avoid the risk of burns.

- Remove the pulley protection fairing.
- Check that the belts do not show signs of tearing, evident wear or contamination with lubricants or fuels. Replace them if this is the case.
- Check the efficiency of the water pump belt tensioner and alternator by adjusting as shown in the figure. The seawater pump flexible drive belt does not require tensioning parts.
- Refit the protective fairing in its seat and tighten the retainers correctly.
Changing coolant

Proceed only with the engine not turning and at low temperature to avoid the risk of burns.

- Use appropriate containers to ensure that the coolant is not disposed of into the environment.
- Remove the expansion tank plug and the plugs on the circuit components and wait until completely empty (plug location is shown in the ENGINE TECHNICAL DATA section). Once empty, refit the plugs in their seats taking care not to damage the gaskets.
- Fill the circuit as specified in the CAPACITIES table.
- Start the engine and keep idling for a few minutes, until the circuit is completely degassed.
- Start the engine and tighten the expansion tank fully after topping up.

Changing the oil vapour condenser

The element shown in the figure (1), present on certain specifications, promotes the condensation of oil vapours (blow by vapours) in the crankcase, allowing the liquid part to flow back into the sump and the non-condensed part to flow toward the intake duct.

Proceed only with the engine not turning and at low temperature to avoid the risk of burns.

- Loosen the retaining elements of the condenser vapour input-output pipes.
- Remove the condenser after loosening the anchorage on the engine.
  Take care to ensure that no impurities enter the vapour input-output pipes.
- Position the new part in its seat and restore conditions for correct operation.
Draining/aspirating condensate from the fuel tank/s
Inspecting the seawater intake
Checking seawater pump impeller wear
Cleaning heat exchangers
Cleaning the turbocharger
Adjusting valve-rocker clearance

The reverser fluid replacement procedures are shown in the relevant documentation from the reverser manufacturer.

ENGINE HANDLING

Engine disembarkation and embarkation operations are the exclusive responsibility of skilled staff, Boatyard staff or FPT Service Centre operators.
To lift the engine along use the goggles indicated in this manual under ENGINE TECHNICAL DATA and marked on the engine by appropriate labels.
Lift using a rocker that keeps the metal cables supporting the engine parallel, using all the eyebolts provided at the same time. It is not permitted to use a lower number of eyebolts.
The capacity and size of the engine lift system must be appropriate for the engine weight and bulk. Check there is no interference between the lift system and the engine components.
Do not lift the engine before removing the attached transmission components.

DISPOSING OF USED MATERIALS

The engine is made up of parts and components that could cause environmental damage if dispersed into the environment.
The materials listed below must be delivered to appropriate authorised collection centre. The laws in force in different countries impose severe penalties for breaking the law:
- Starting batteries.
- Spent lubricant oil.
- Water and antifreeze mixtures.
- Filters.
- Auxiliary cleaning material (e.g. damp rags or rags soaked in fuel).
**LONG PERIODS OF ENGINE INACTIVITY**

**PREPARING THE ENGINE FOR A LONG PERIOD OF INACTIVITY**

To prevent oxidisation of internal engine parts and some injection system components, prepare the engine as follows if the engine is to be inactive for longer than two months.

1. Drain the lubricant oil into the sump after heating the engine beforehand.

2. Add 30/M type protective oil to the engine (or alternatively oil to MIL 2160B type 2 specifications), to the "minimum" level on the dipstick. Start the engine and keep turning for approximately 5 minutes.

3. Drain the fuel from the injection circuit, from the filter and from the injection pump channels.

4. Connect the fuel circuit to a tank containing protectant CFB (ISO 4113) and promote the intake of fluid by pressurising the circuit and cranking the engine for approximately 2 minutes after excluding injection system operation. The required operation may be completed by directly polarising terminal 50 of the electric starter motor with a positive voltage equal to the rated system voltage by means of a specially prepared wire.

5. Spray a quantity of 30 g (10 g per litre of capacity) of 30/M protective oil into the turbocharger intake during the cranking described under the previous point.

6. Close all engine intake, exhaust, ventilation and breather holes using plugs or seal with adhesive tape.

7. Drain the residual 30/M protective oil from the sump, which may be reused for 2 more preparations.

8. Apply signs bearing the wording ENGINE WITHOUT OIL on the the engine and control panel.

9. Drain the coolant if it has not been mixed with antifreeze and corrosion inhibitors as required. Affix a sign to indicate that the operation has been carried out.

In the event of prolonged inactivity, repeat the operations described every 6 months in accordance with the following procedure:

A) drain the protective 30/M oil from the sump;

B) repeat the operations from point 2 to point 7.

When necessary to protect external engine parts, spray protective fluid OVER 19 AR on unpainted metal parts such as the flywheel, pulleys and other parts. Avoid spraying on belts, connector cables and electrical equipment.
STARTING THE ENGINE AFTER A LONG PERIOD OF INACTIVITY

1. Drain the residual 30/M protective oil from the sump.
2. Add lubricant oil of the type and quantity described in the CAPACITIES table to the engine.
3. Drain the CFB protective fluid from the fuel circuit, completing the operations as indicated under point 3 of PREPARING THE ENGINE FOR PROLONGED INACTIVITY.
4. Remove the plugs and/or seals from the engine intake, exhaust, ventilation and breather ports, restoring normal service conditions. Connect the turbocharger intake opening to the air filter.
5. Connect the fuel circuits to the vessel tank, completing the operations as described under point 4 of PREPARING THE ENGINE FOR PROLONGED INACTIVITY. During filling operations, connect the fuel return pipe to the tank to a collection container to prevent the remaining CFB protective fluid from flowing into the vessel tank.
6. Check and refill the engine with coolant following the instructions shown in this document.
7. Start the engine and leave turning over until idle speed has completely stabilised.
8. Check that the control panel gauge readings are plausible and there are no alarm signals.
9. Stop the engine.
10. Remove signs bearing the wording ENGINE WITHOUT OIL from the engine and control panel.
ENGINE FAULTS

The Central Electronic Unit that governs the management and control of engine service as a whole is able to detect the onset of faults and adopt strategies that allow the boat to be sailed in complete safety. The event, indicated by the lighting up of the gauge EDC fault on the control panels, leads to programmed power limitation between thresholds established on the basis of case severity. In the event of temporary faults, performance will be reduced until the engine is shut down.

**ATTENTION!**

The adoption of safety strategies by the engine electronic control unit may take place at any time of the trip, on the occurrence of conditions considered to lead to the risk of engine damage.

When such conditions occur, proceed with the greatest care and attention, checking that the crew are firmly secured to supports.

Fault in the accelerator electronic circuit

Detection of certain faults in the electronic accelerator circuit leads the engine central control unit to adopt strategies defined as "accelerated idle rpm", which allow the vessel to continue on its voyage. Possible operating modes are as follows:

A. The accelerator lever "does not fully respond". rotating speed is partly accelerated to allow the boat to proceed slowly and manoeuvre by simply engaging and releasing the hydraulic reverser, avoiding acceleration.

A. The accelerator lever "responds partly". with the accelerator lever idling, the rotation speed is partly accelerated to allow the vessel to manoeuvre by simply engaging and releasing the hydraulic reverser, without accelerating.

When the lever is moved about half way along its travel, the speed increases steadily to allow emergency navigation.

When the lever is returned to idle position, the speed quickly returns to partial acceleration.
The engine’s electrical equipment includes a unit identified as a relay box (1), normally installed in the engine compartment. This contains relays and fuses protecting the lines to which the main electrical components are connected.

The relays are connected to the following components:

- **K 1**: ignition key for system power supply
- **K 2**: wiring for emergency shut-down button
- **K 3**: engine electronic control unit (main relay)
- **K 4**: electric starter motor electromagnet
- **K 5**: electric fuel feed pump
- **K 6**: fuel preheating element (on filter)

The fuses are connected to the following components:

- **F 1**: electric fuel pump (15A)
- **F 2**: fuel heating element (15A)
- **F 3**: glow plug control unit (15A)
- **F 4**: engine electronic control system EDC (10A)
- **F 5**: engine electronic control system EDC (25A)

Another fuse, protecting the glow plug electrical circuit, is positioned by the Boatyard near the electrical devices equipping the engine. The current rating is 60A.

The multipolar connector to which the FPT tester is connected is located near the relay box.

Use of the diagnostic tester allows data recorded during engine service and stored in the electronic control unit to be obtained; interpretation of the data will provide useful information for more effective planning of service intervals.
**ON-BOARD EMERGENCIES**

Users of vessels produced in accordance with safety regulations who follow the instructions in this handbook and observe the instructions on the engine labels operate under safe conditions.

If incorrect behaviour should cause accidents, immediately request the assistance of crew specialised in first aid.

In emergencies, while awaiting the arrival of rescue crew, the following instructions are provided.

**Engine faults**

If sailing with engine failure, pay the greatest attention to manoeuvres and ensure that crew are firmly secured to supports (see ENGINE FAULTS section).

**Fire**

Put out the fire using the specified on-board equipment following the procedures laid down by the competent Authorities (the user of on-board firefighting equipment is enforced by current safety regulations).

**Burns**

1. Put out the flames on the burn victim’s garments by:
   - pouring on water;
   - use of powder extinguishers, avoiding directing the jet against the victim’s face;
   - covers or rolling the victim on the ground.
2. Do not remove strips of clothing fabric adhering to the skin;
3. In the event of scalding by liquids, quickly but carefully remove the clothing soaked with hot fluid;
4. Cover the burn with a special anti-burn pack or sterile bandages.

**Carbon monoxide poisoning (CO)**

The carbon monoxide contained in limited percentages in engine exhaust gas is odourless and hazardous because it causes poisoning and because it forms an explosive mixture with air. Carbon monoxide is highly dangerous in closed areas because it can reach a critical concentration in a short time.

When rescuing someone poisoned by carbon monoxide in a closed area:
1. Immediately ventilate the area to reduce the gas concentration.
2. When entering the area, rescuers should hold their breath, not light flames or lights and avoid activating electric bells or telephones to prevent explosions.
3. Take the carbon monoxide poisoning victim to a safe ventilated place or outside in the open air. Lie them on one side if they are unconscious.

**Explosion**

The 12V or 24V engine electrical system does not involve a risk of explosion. In the event of a short circuit caused by a metal tool for example, there are risks of burns caused by the item carrying the electric current overheating. In this event:
1. Remove the item that gave rise to the short circuit using methods that permit proper thermal insulation.
2. Operate the master switch, if present, to cut off the electrical power supply.
Wounds and fractures
The large number of cases and the specificity of the actions required necessarily requires action by medical facilities.
1. In the case of bleeding wounds, compress the wound from the outside until rescuers arrive.
2. In cases of suspected fracture, do not move the affected body part and transfer the patient with the greatest care, only in cases of extreme necessity.

Corrosion
Skin corrosion is caused by contact with highly acid or basic substances.
A typical injury suffered by electrical equipment maintenance staff is that caused by the emergency of battery acid. In this case, proceed as follows:
1. Remove garments soaked in the caustic substance.
2. Wash in abundant running water, avoiding wetting unaffected parts. If the eyes are affected by battery acid, lubrication oil or diesel: wash the eyes in water for at least 20 minutes, keeping the eyelids open so that the water runs over the eyeball (facilitate washing by moving the eyes in all directions).
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
CONTROL PANEL USER REQUIREMENTS

The following data refer to FPT 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.

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<td>from -10°C to +60°C;</td>
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<td>min. -20°C / max. +75°C</td>
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<td>IEC 60068-2-52</td>
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<td></td>
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<tr>
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<td>min. 9 V / max. 32 V (*)</td>
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<td>60 V for 1 ms</td>
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<td>IEC 945</td>
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<td>MIL 1344/1001</td>
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<td>Wiring requirements (reference Standard)</td>
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<tr>
<td>Vibration resistance (expressed as acceleration due to gravity)</td>
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<td>2 g max. eff. -25-500 Hz</td>
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<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>
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(*) 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 STATUSSES).
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.

1. Engine coolant temperature indicator  
2. Lubrication circuit pressure indication  
3. Service and alarm signals  
4. Revolution counter  
5. Air booster pressure indicator  
6. Voltmeter  
7. Alphanumeric display  
8. Engine stop button  
9. Additional information slide selection key  
10. Horn silencer  
11. Engine start button.
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
Maintenance interval expiry
Alternator anomaly
* Clogging oil filter
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.

**(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**

In case the information set does not correspond to what provided for the type of oil used (see REFUELLING and FREQUENCY), proceed as follows:

- After having displayed the hour information previously set, release the push buttons and repeatedly press only the "Slide selection" (10) button until the required information blinks (as detailed in FREQUENCY section), then press "Prog" (9) to confirm the information and start a new count.

(B) The information regarding the immediate fuel consumption require the correct programming of the maximum information entered relating to the engine performances. To check proceed as follows:

- Press and hold the "Prog" key (9) until the display reads the maximum value entered (ex.: 195 mg/trk), then release it and compare the information with those provided in the table below.
- In case it does not correspond, you can change it by repeatedly pressing the "Slide selection" (10) button until the required one is displayed (blinking mode).
- Press and hold the "Prog" (9) button until the engine revolution speed is displayed, meaning that the information has been saved.

In case of any mistake in the programming procedure, the display reading will be "Pr. Err.". You will need to repeat the procedure.

<table>
<thead>
<tr>
<th>Maximum power (CV)</th>
<th>Maximum insertion (mg/trk)</th>
</tr>
</thead>
<tbody>
<tr>
<td>169</td>
<td>89</td>
</tr>
<tr>
<td>129</td>
<td>78</td>
</tr>
<tr>
<td>85</td>
<td>67.4</td>
</tr>
</tbody>
</table>