

USE AND MAINTENANCE
USO E MANUTENZIONE
UTILISATION ET ENTRETIEN
BETRIEB UND WARTUNG
USO Y MANTENIMIENTO

MARINE ENGINES

CURSOR 13 SERIES

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**IVECO
MOTORS**



CURSOR 13 SERIES

C13 ENT M50

C13 ENT M77

USE AND MAINTENANCE

FOREWORD

Thank you for choosing IVECO MOTORS and congratulations for your choice of engine.

Before carrying out any operation involving the engine and its equipment, please read carefully the instructions contained in this manual. Compliance with them is the best way to guarantee a perfect and durable operation of your engine.

The contents of this manual only refer to the standard configuration of the engine and the pictures are given only as an indication. Some instructions provided describe the sequence to be applied in order to obtain engine's and relevant equipment's expected performance. In some cases they depend upon the configuration of controls and fittings of the boat on which the engine is installed. Although they may differ from the contents of this manual, please refer to yard instructions or to a specific manual thereof.

The information contained herein are updated as of the date of their publishing.

The Manufacturer reserves the right of applying changes without notice and at any time, for technical or commercial reasons and in order to make engines compliant with the law requirements of the different countries.

The Manufacturer waives any liability for any errors or omissions.

The IVECO MOTORS Customer Service Network competence and professionalism of the Customer Service Network is always available wherever you are.

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■ GENERAL

GUARANTEE

In order to obtain the engine best performance and to make use of IVECO MOTORS guarantee it is necessary to strictly observe the instruction contained in this manual. Failure to do so may cause the guarantee to become invalid.

SPARE PARTS

In order to maintain the original integrity of the engine, it is essential to use only IVECO MOTORS genuine spare parts.

Using non genuine spare parts may cause the guarantee to decay and waives any IVECO MOTORS liability for the entire life of the engine.

LIABILITIES

The Manufacturer's liability is subject to the execution of the control and maintenance interventions contained and described in this manual, the performance of which shall be duly proven. Should any extraordinary maintenance intervention be required, it shall be carried out by qualified staff at IVECO MOTORS authorized shop, using the specific instruments and equipment.

SAFETY

The following information is provided in order to bring the attention to the use of the engine in order to prevent any damage to people and properties arising out of misconduct.

- ❑ Engines should be used exclusively for the applications stated by the manufacturer.
- ❑ Any tampering, modifications, or use of non-original parts may jeopardize the safety of service personnel and boat users; **absolutely avoid** any change to cables or units of the engine or to connect it to foreign electric networks.
- ❑ Pay attention to the moving parts of the engine, to those with high temperature and to the circuits with pressurized fluids, as the electric equipment is subject to voltage and electric currents.
- ❑ Engine exhaust gases can be dangerous for health.
- ❑ Engine displacement should take place with suitable lifting means, using the special eyelets provided.
- ❑ Do not commission the engine before having met the safety requirements provided for the boat on which it has been installed and observe local rules and regulations.
- ❑ Any required intervention in order to improve use and conservation of the engine should be carried out exclusively by IVECO MOTORS approved staff.

See INSPECTIONS AND MAINTENANCE for further safety recommendations.

C13 ENT M50 ENGINE TECHNICAL DATA

The technical acronym and the serial number are specified on the nameplate which - based on the model - can be found on different parts of the engine: flywheel casing, tappet cover, coolant pan.

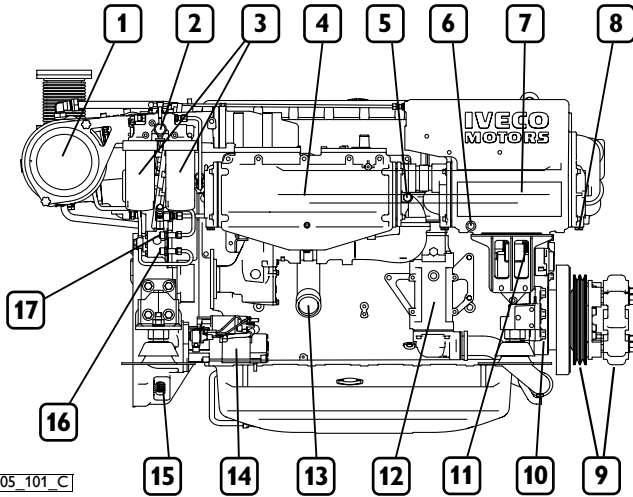
Acronym	C13 ENT M50
Engine family	F3B
Cycle	4-Stroke Diesel
Number and arrangement of cylinders	6, in line
Stroke boring	135 x 150 mm
Total displacement	12,800 cm ³
Air supply	Boosted and post-cooled (TCA or TAA)
Injection method Direct	EUI with electronic management
Engine rotation direction	Counterclockwise (from flywheel side)
Weight without liquids	2,965.22 lb

Electrical system	24 V
Battery/ies capacity	120 Ah or higher
breakaway current	900 A or higher

Available ratings (*)	C13 ENT M50
C	382 kW (520 CV) @ 2000 rpm
D	368 kW (520 CV) @ 2000 rpm

(*)Flywheel net power compliant with ISO 3046-1 standard. Testing conditions: T 25°C; atmospheric pressure 100 kPa; relative humidity 30%.

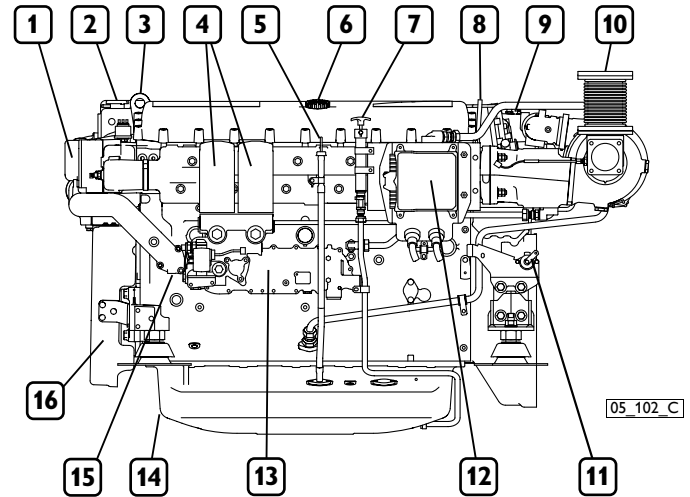
WARNING
<i>It is strictly forbidden to alterate the above mentioned features and more specifically to change the information stored in the electronic units of the injection system or the engine and relevant fitting features. Any non observance of the above shall null any warranty and IVECO MOTORS liability.</i>



05_101_C

CURSOR C13 ENT M50 Engine

1. Air filter - 2. Fuel filters switch lever (opt.) - 3. Fuel filter - 4. Air-sea water heat exchanger - 5. Sacrificial anode - 6. Sacrificial anode - 7. Coolant - sea water tube bundle heat exchanger - 8. Sea water drain plug - 9. Pulleys and joints for power take-offs coupling (opt.) - 10. Auxiliary elements tensioning belt - 11. Alternator location - 12. Inverter oil heat exchanger (opt.) - 13. Sea water pump intake - 14. Electrical starter motor - 15. Seat for flywheel tool insertion - 16. Engine fuel intake pipe - 17. Fuel pipe to tank.



05_102_C

CURSOR C13 ENT M50 Engine

1. Location of thermostatic valve - 2. Coolant refill cap - 3. Lifting padeye - 4. Oil filters - 5. Lubricating oil dipstick - 6. Lubricating oil refill cap - 7. Lubrication oil hand pump - 8. Lifting padeye - 9. Location of oil steam filter and filter clogging sensor - 10. Chimney exhaust gas (pot.) - 11. Accelerator potentiometer lever - 12. Electronic control unit - 13. Lubricating oil heat exchanger - 14. Lubricating oil drain plug - 15. Coolant drain plug - 16. Auxiliary items belt tensioner casing.

C13 ENT M77 ENGINE TECHNICAL DATA

The technical acronym and the serial number are specified on the nameplate which - based on the model - can be found on different parts of the engine: flywheel casing, tappet cover, coolant pan.

Acronym	C13 ENT M77
Engine family	F3B
Cycle	4-Stroke Diesel
Number and arrangement of cylinders	6, in line
Stroke boring	135 x 150 mm
Total displacement	12,800 cm ³
Air supply	Boosted and post-cooled (TCA or TAA)
Injection method Direct	EUI with electronic management
Engine rotation direction	Counterclockwise (from flywheel side)
Weight without liquids	1380 kg

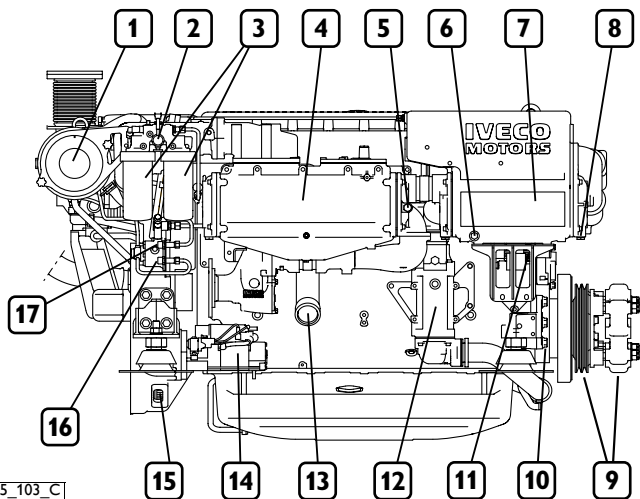
Electrical system	24 V
Battery/ies capacity	120 Ah or higher
breakaway current	900 A or higher

Available ratings (*)	C13 ENT M77
A1	567 kW (770 CV) @ 2300 rpm
A2	515 kW (700 CV) @ 2300 rpm
B	442 kW (600 CV) @ 2300 rpm
C	397 kW (540 CV) @ 2300 rpm

(*)Flywheel net power compliant with ISO 3046-1 standard. Testing conditions: T 25 °C; atmospheric pressure 100 kPa; relative humidity 30%.

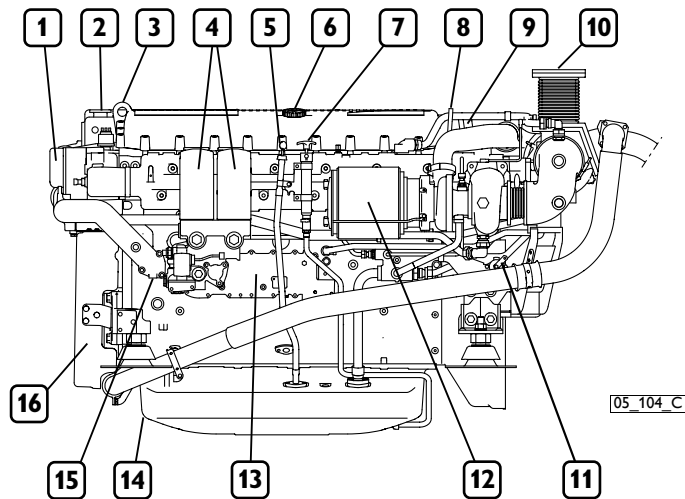
WARNING

It is strictly forbidden to modify the above mentioned features and more specifically to change the information stored in the electronic units of the injection system or the features of the engine and relevant fittings. Any non observance of the above shall null any warranty and IVECO MOTORS liability.



CURSOR C13 ENT M77 Engine

1. Air filter - 1. Fuel filters switch lever (opt.) - 3. Fuel filter - 4. Air-sea water heat exchanger - 5. Sacrificial anode - 6. Sacrificial anode - 7. Coolant - sea water tube bundle heat exchanger - 8. Sea water drain plug - 9 Pulleys and joints for power take-offs coupling (opt.) - 10. Auxiliary elements tensioning belt - 11. Alternator location - 12. Inverter oil heat exchanger (opt.) - 13. Sea water pump intake - 14. Electrical starter motor - 15. Seat for flywheel tool insertion - 16. Engine fuel intake pipe - 17. Fuel pipe to tank.



CURSOR C13 ENT M77 Engine

1. Location of thermostatic valve - 1. Coolant refill cap - 2. Lifting padeye - 3. Oil filters - 4. Lubricating oil dipstick - 5. Lubricating oil refill cap - 6. Lubrication oil hand pump - 7. Lifting padeye - 8. Location of oil steam filter and filter clogging sensor - 9. Chimney exhaust gas (pot.) - 11. Accelerator potentiometer lever - 12. Electronic control unit - 13. Lubricating oil heat exchanger - 14. Lubricating oil drain plug - 15. Coolant drain plug - 16. Belt tensioner carenatura.

LABELS

Below you can find the explanation of the caution labels located on the engine.

NOTE: Labels with an exclamation point highlight a potential danger.



Lifting point (engine only).



Fuel refill plug
(on tank, if available).



Lubricant refill plug.



Lubricating oil dipstick.



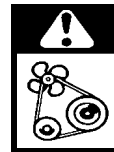
Burn hazard:
Pressurised hot water expulsion.



Burn hazard:
High temperature parts.



Fire hazard:
Fuel presence.



Hazard of collision and contact
with moving parts:
Presence of fans, pulleys, belts or other.

■ USE

PRELIMINARY TESTING

Before each engine startup:

- ❑ Make sure that the sea water intake valve is open. Dry operation of the pump would cause in few seconds irreparable damages to the internal rotor.
- ❑ Check technical fluids level (fuel, engine oil and coolant).

WARNING!



Before starting up the engine make sure no comburent vapour or gas is in the engine room.

STARTING AND STOPPING THE ENGINE

For boats equipped with instrument panel not manufactured by IVECO MOTORS

Startup and stop procedures described below are provided assuming a genuine IVECO MOTOR instrument panel is assembled on board. Should the boat be equipped with a customized dashboard which has been manufactured at the Yard or by the Boat builder, such procedures may change based on the panel's specific features. In such cases please observe the Yard's startup/stop sequences and read the indication instruments as specified in the relevant documentation.

Engines equipped with pre-lubrication electric system

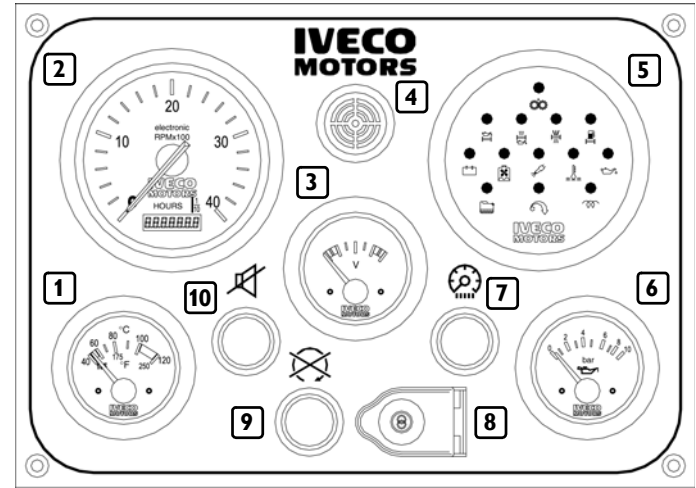
The pre-lubrication feature is started by acting on the power switch of the electrical system and the relevant warning light lits up. The engine startup sequence described in the following pages shall take place after the required pre-lubrication time has elapsed and the warning light is turned off.

STARTING AND STOPPING THE ENGINE FROM AN ANALOG INSTRUMENT PANEL

Startup procedure from IVECO MOTORS main panel (provided upon request)

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:

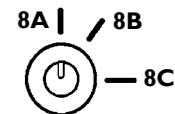
1. Lift the key switch safety cover (8), insert the key and turn it to the right, to **8B** position.
2. Check that the analog instruments provide acceptable reading with the values of the relevant physical parameters (temperature, battery voltage and oil pressure).
3. Wait for the acoustic alarm to stop and that the alarm warnings (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 as regards test reading and module indication instructions).
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 the stop position.



04_354_N

1. Coolant temperature indicator - 2. Tachometer and hour counter - 3. Voltmeter - 4. Horn - 5. Alarms and signaling module 6. Engine oil pressure indicator - 7. Panel instruments light switch - 8. Key switch for engine startup/stop - 9. Engine stop push button - 10. Horn silencing push button.

Switch key detail



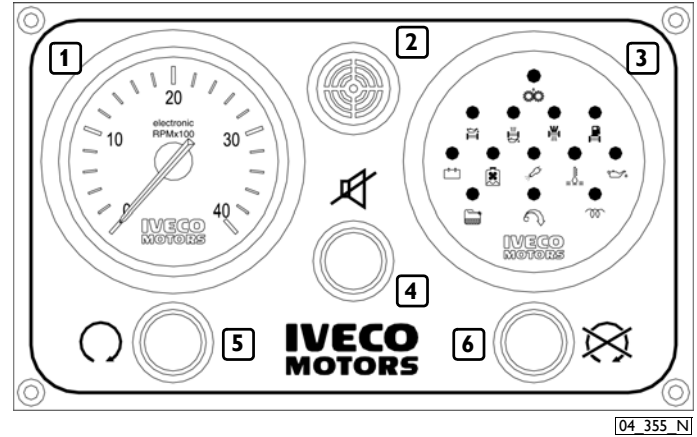
04_356_N

WARNING

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

Startup procedure from IVECO MOTORS secondary panel or fly-bridge (provided upon request)

- 1 **Enable the secondary panel operation by turning the key switch on the main panel to 8B position** (see instructions and procedure 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 recharge" and "oil low pressure"). At the same time check that testing of indicators is successful (see relevant section as regards test reading and module indication instructions).
3. Press the green push button (5) and release it upon startup.
4. Check that the revolution indicator reading is acceptable.



1. Tachometer and hour counter - 2. Horn - 3. Alarms and signaling module - 4. Horn silencing push button - 5. Engine Start push button - 6. Engine stop push 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. To stop the engine from IVECO MOTORS main panel, turn the key switch to the stop position **8A** or act on any similar control if your boat is equipped with a customized dashboard.
- B. To stop the IVECO MOTORS secondary panel press the red push button (6) located on it.

To stop the IVECO MOTORS main panel for the engines equipped with "in eccitazione" device (available upon request or prescribed by certification authorities), press the red push button(9).

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.

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 push button (5) and release it when it has started, making sure that the revolution indicator reading is acceptable.

RECOGNIZING ALARM STATUSES

IVECO MOTORS onboard panels equipped with analog instruments include an electronic module with indicator lights and interface circuits, timing and saving of alarms.

The figure shows the module quadrant and the legend contains the meaning of the alarm pictorial corresponding to each light indicator; in some engine type and relevant fitting are not equipped with all of the features mentioned herein.

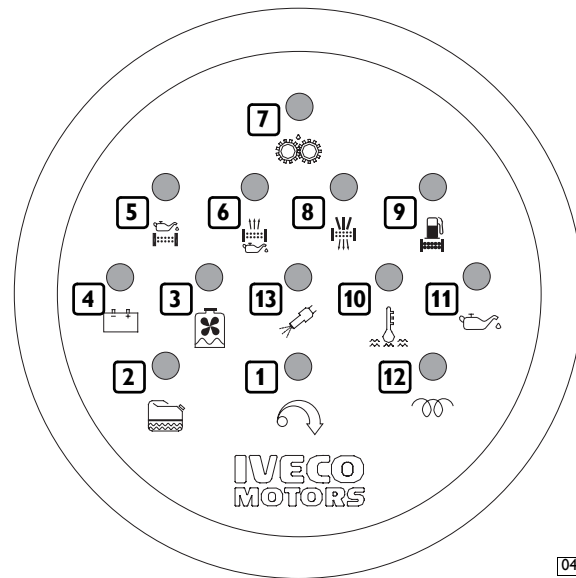
Moreover these instructions may change based on the technical features provided by the boat manufacturer.

Operation

By rotating the key switch to **8B** position the alarms and signaling 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 horn 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.



04_234_N

1. Maximum allowed speed (on request) - 2. Water in the fuel pre-filter- *3. Engine coolant low level - 4. Alternator anomaly - *5. Oil filter clogging - *6. Oil vapors filter clogging - *7. Pre-lubrication running - 8. Air filter clogging - *9. Fuel filter clogging - 10. Coolant high temperature - 11. Oil low pressure - *12. Pre-post heating - 13. EDC injection system fault.

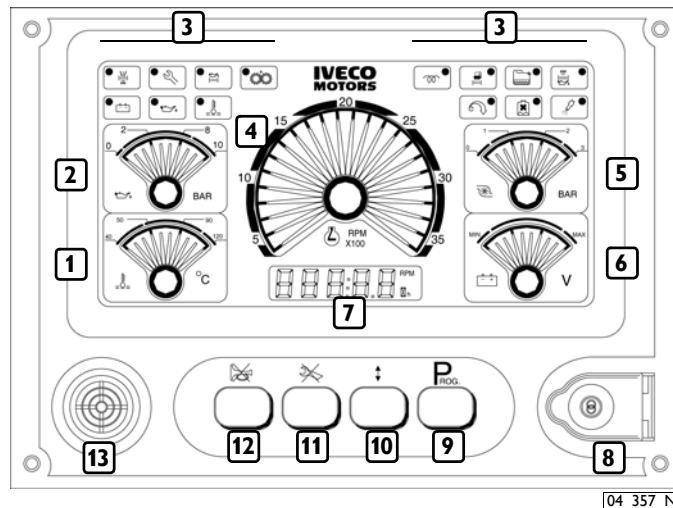
*Alarm features not available with standard fitting.

STARTING AND STOPPING THE ENGINE FROM A DIGITAL INSTRUMENT PANEL (C13 ENT M50 engine only)

Startup procedure from IVECO MOTORS main panel (provided upon request)

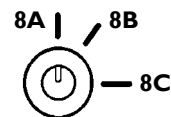
Make sure that the electric switch with ENGINE ROOM - BRIDGE label on the Relay box unit, (usually located in the engine room) is turned to BRIDGE, then proceed as follows:

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



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 start/stop key switch - 9. Accessory functions programming key - 10. Additional information slide selection key - 11. "Programmed maintenance" reset key - 12. Horn silencer - 13. Horn.

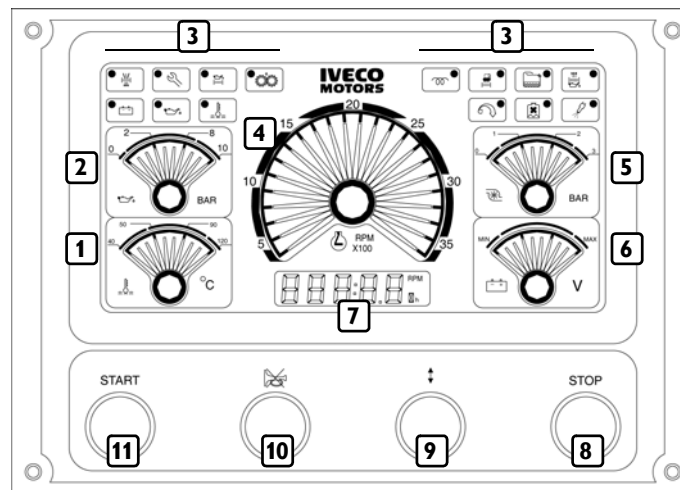
Switch key detail



04_356_N

Startup procedure from IVECO MOTORS secondary panel or fly-bridge (provided upon request)

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.



04_358 N

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 IVECO MOTORS main panel:** rotate the key switch to the stop **8A** position.
- B. **From the IVECO MOTORS 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

04_359_N

* 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.

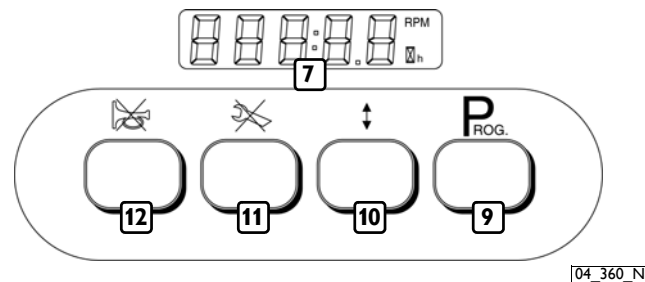
Alphanumeric display

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



7. Alphanumeric display - 9. Accessory functions programming button - 10. Accessory information slide selector - 11. "Programmed maintenance" reset button - 12. Horn silencer.

(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.

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 tale below.
- In case it does not correspond, you can change it by repeatedly pressing the "Slide selection" (10) button until the required one it 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.

C13 ENT M50

Maximum power(CV)	Maximum insertion (mg/strk)
520	
500	

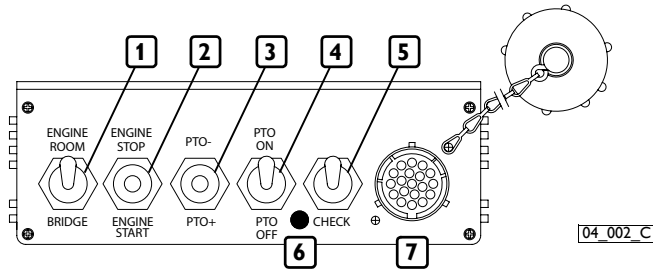
C13 ENT M77

Maximum power(CV)	Maximum insertion (mg/strk)
770	
700	
600	
540	

ENGINE MANAGEMENT FROM RELAY BOX (C13 ENT M50 engine only)

The engine fitting includes a "Box relay" unit which is usually located near the engine room and which provides management of the following functions:

- ❑ Start and stop.
- ❑ Control post selection: bridge or engine room.
- ❑ Revolution speed increasing and decreasing.
- ❑ Self-diagnosis test (only for Customer Service Network).



1. Control post selection - 2. Start/stop control - 3. Manual accelerator - 4. Accelerator push button enabling (3) - 5. Blink code emission push button - 6. EDC fault signaling led and blink code - 7. Diagnosis tool connector.

WARNING!



When the engine is rotating, do not operate the ENGINE ROOM / BRIDGE switch.

Startup procedure

1. Turn the switch to **1** ENGINE ROOM. The START-STOP (2) push button nearby is enabled; **this action disables any function of on boardpanels located on the bridge and fly-bridge.**
2. Press the **2** push button to ENGINE START position and release it upon startup.

Speed management procedure

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

Stop procedure

1. Press the **2** push button to STOP position until the engine is completely stopped.
2. Bring the switch **1** back to BRIDGE position to allow for the use of controls located on the on board panels and to inhibit the use of the START-STOP button of the "Relay box".

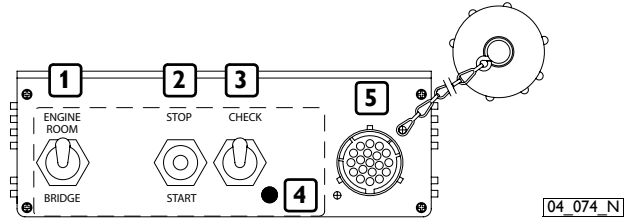
Self-diagnosis procedure

The use of the CHECK (5) push button allows the Customer Service Network to read the self-diagnosis information save in the Engine electronic control unit. The **6** LED will show the code by blinking.

ENGINE MANAGEMENT FROM RELAY BOX (C13 ENT M50 engine only)

The engine fitting includes a "Box relay" unit which is usually located near the engine room and which provides management of the following functions:

- Start and stop.
- Control post selection: bridge or engine room.
- Revolution speed increasing and decreasing.
- Self-diagnosis test (only for Customer Service Network).



1. Control post selection - 2. Start/stop and manual speed-up control - 3. This button is not active - 4. Led not used with this fitting - 5. Diagnosis tool connector.

WARNING!



When the engine is rotating, do not operate the ENGINE ROOM / BRIDGE switch.

Startup procedure

1. Turn the switch to **1** ENGINE ROOM. The START-STOP (2) push button nearby is enabled; **this action disables any function of on board panels located on the bridge.**
2. Press the **2** push button to START position and release it until startup is obtained.
3. To speed down: press and hold the **2** button in the START position until the required speed is reached, then release; if repeated action toggles speed up and speed down. The speed reached at each change will be maintained until the next change or the engine stop.

Stop procedure

1. Press the **2** push button to STOP position until the engine is completely stopped.
2. Bring the switch **1** back to BRIDGE position to allow for the use of controls located on the on board bridge panels and to inhibit the use of the START-STOP button of the "Relay box".

FOR A CORRECT USE OF THE ENGINE

- ❑ Do not extend the startup control when the engine is started.
- ❑ Do not remain at the quay to wait for engine warm-up. After startup slowly start navigation. The correct operating temperatures are reached with the engine running at medium power.
- ❑ Do not proceed too long at slow speed as it enhances the production of harmful engine emissions and does not guarantee its better performance.
- ❑ Engine speed-up and speed-down should be performed gradually in order to allow a regular combustion and a better performance of all engine organs.
- ❑ Cruising maximum speed should not exceed 90% of maximum power (see ENGINE TECHNICAL DATA).
- ❑ During navigation check that:
 - Engine coolant temperature does not reach alarm thresholds.
 - Oil pressure is kept within the normal values provided.

SPECIAL WARNINGS

Coolant high temperature

In case the temperature on the instrument is excessive or an alarm is off, reduce speed and return to the harbor and check the sea water intake and cooling circuits status. The following should also be checked:

- water and alternator belts tensioning.
- thermostatic valve operation.
- cleaning of heat exchangers.

WARNING!



When the engine is hot, inside the cooling circuits a pressure is generated which can cause the sudden exit of the hot liquid, generating burn hazards. Open the coolant pan refill cap only if necessary and exclusively when the engine is cold.

Low lubricant pressure

In case the pressure reading on the instrument is considered not sufficient or if a "Low oil pressure" led turns on, stop the engine and check the oil level. Refill if necessary (see section CHECKS and MAINTENANCE).

Should signaling persist, return at low speed and contact an authorized Customer Care Center.

Water in the fuel pre-filter

It's a good habit to drain the water inside filters before the relevant led turns on.

Avoid using the engine when the tank contains only the reserve fuel; such condition fosters the formation of condensation and the suction of sludge or air, causing the engine to stop.

WARNING!



Use the utmost care when refueling and avoid liquid or solid polluting agents to enter the tank. It is reminded that smoking or ignition of flames is prohibited during refueling.

Air filter clogging and inefficient exhaust circuit

Regularly inspect the cleaning of air suction inlets and exhaust piping. Maintenance intervals contained in this manual only take into account the performances of the engine parts and not of those parts manufactured at the Yard or any other external intervention.

WARNING!



Visually check that the exhaust circuit is not obstructed or damaged in order to avoid formation of hazardous fumes inside the hull.

Alternator anomaly

Periodically check or have checked the cleaning, wear and tensioning condition of the tensioning belt.

WARNING!



Tensioning parts are protected with safety casing. Remove them only when the engine is not running.

Anomalies in the electrical system

Periodically check, especially during the winter, the cleaning and efficiency condition of batteries. Proceed by checking and refilling as detailed in the CHECK AND MAINTENANCE section and observe the warning therein. In case batteries are replaced, observe the features detailed in GENERAL section.

RUNNING-IN

Thanks to the engine construction advanced technology, non special running-in procedure is required. However it is recommended to avoid at least for the first 50 hours, using the engine at high speeds for extended periods of time.

REFUELING

Parts to be refueled	C13 ENT liters (kg)
Cooling circuit ⁽¹⁾	45
Cooling circuit ⁽²⁾ ; Total capacity ⁽³⁾	42 (38)
Periodical replacement	38,5 (35)
Oil pan at minimum level	29 (26,3)
Oil pan at maximum level	36 (32,6)
Fuel tank ⁽⁴⁾	-

- (1) Use a water and PARAFLU 11 mixture at 50% also during summer. As an alternative to PARAFLU 11, use a product complying with SAE J 1034 international standards.
- (2) Use lubricants complying with the following international specifications: ACEA E3 - E5 (high power engines), API CF - CH4 (associated to fuels with a sulfide percentage of < 0,5%), MIL - L - 2104 F.
The viscosity degree to be used in relation to the ambient temperature is contained in the appendix tables.
The oil consumption is considered as acceptable up to a quantity equal to 0.5% of fuel consumption.
- (3) The quantities shown refer to the first refueling and concern the refilling of engine, oil pan and filter.
- (4) Use only commercially available diesel oil (complying with EN 590 standard). Use of additives is recommended. Use of fuel derived

from the synthesis of organic substances and vegetable oils (Biodiesel) is not allowed.

WARNING

Refuelling from drums or tanks may pollute diesel oil and therefore damage the injection system. If necessary filter or settle impurities before refueling.

Low temperature diesel oil

The EN590 distinguished different classes of diesel oil and identified the characteristics of those more suitable for being used at low ambient temperatures.

It is the Oil company's responsibility to observe the regulations governing the distribution of fuels suitable to the climatic and geographic conditions in the different countries.

Marine gear oil refueling

For the quantity and type of oil to be used in the marine gear, see the Manufacturer's manual supplied with the product.

■INSPECTIONS AND MAINTENANCE

MAINTENANCE STAFF

Engine inspection and maintenance interventions described in the following section require training, skills and the observance of the safety regulations provided. Therefore only specialized staff can perform them as specified below.

❑ **Inspections:** shop operators or boat user if necessary.

❑ **Periodical maintenance:** qualified staff, equipped with suitable tools and protection gear. Interventions marked with a wrench (see picture).



❑ **Extraordinary maintenance:** Authorized Servicing Centers' qualified staff having the specific technical know-how and equipment. Interventions marked with a wrench (see picture).



Authorized Servicing Centers are members of IVECO MOTORS Customer Care Network.

ACCIDENT PREVENTION

- ❑ Always wear safety shoes and gear.
- ❑ Do not wear loose garments, rings, bracelets and/or necklaces near the engines or moving parts.
- ❑ Wear safety gloves and goggles when:
 - refilling batteries with acid solution
 - refueling with inhibitors or deicers

- replacement or refueling of lubricant (hot engine oil can cause burns. Proceed with interventions only when it has reached a temperature lower than 50°C).
- ❑ When performing interventions inside the engine housing, use utmost care when moving in order to avoid contact with rotating or high temperature items.
- ❑ Wear safety goggles when using compressed air (the maximum cleaning air pressure is 00 kPa (2 bar, 30 psi, 2 kg/cm²).
- ❑ Wear a hard safety hat if you work in an area with suspended loads.
- ❑ Use protective hand cream.
- ❑ Immediately replace wet overalls.
- ❑ Keep the engine always clean and eliminate oil, diesel and coolant stains.
- ❑ Place greasy rags in fireproof containers.
- ❑ Do not leave foreign bodies on the engine.
- ❑ Use suitable and safety container for exhaust oil.
- ❑ When the repair is finished, take the necessary steps to stop engine air suction in case, after start-up, an unrestrained increase of engine revolution occurs.

WARNING!



Avoid performing maintenance near a power source: check that the equipment is efficiently grounded. During diagnosis and maintenance operations make sure hands and feet are dry and always use insulating footboards.

FREQUENCY

Inspections	Frequency
Engine lubricant level inspection	Daily
Inverter lubricant level inspection	Daily
Engine coolant level inspection	Daily
Exhaust pipe/s integrity inspection	Daily
Water drain from fuel pre-filter	150 hours ⁽¹⁾
Inspection/restoring battery electrolyte solution level and cleaning of terminals	Every six months

The following frequencies take into account use factors that are typical of the different uses of the engine. The most suitable maintenance frequency will be specified by the maintenance staff based on the use and operating conditions of the engine.



Periodical maintenance:

Frequency

Air filter/s cleaning	300 hours ^{(2) (7)}
Zinc anodes corrosion	300 hours ^{(4) (7)}
Oil vapor filter status (an indicator may be available)	300 hours ⁽⁷⁾
Condensation draining/suction from fuel tank/s	300 hours ^{(1) (7)}
Engine lubricant replacement	600 hours ^{(5) (7)}
Unidirectional valve efficiency check pre-lubrication system	at each replacement lubricant
Oil filter/s replacement	600 hours ^{(5) (7) (8)}
Fuel filter/s replacement	600 hours ^{(1) (7) (8)}
Fuel pre-filter/s replacement	600 hours ^{(1) (7)}
Marine gear oil replacement	see relevant information
Sea water intake inspection	every year
Check belt tension and conditions	every year
Coolant replacement	1200 hours or 2 years
Air filter replacement	2 years
Oil vapor filter replacement	2 years ⁽⁵⁾



Extraordinary maintenance Frequency

Check sea water pump rotor wear	1200 hours
Check the efficiency of the pre-post heating system (if available)	1200 hours
Valve-rocker arms play adjustment	1200 hours
Auxiliary elements belt replacement	1200 hours or 2 years
Cleaning of heat exchangers	2 years ⁽⁶⁾
Supercharger cleaning	2 years ⁽⁵⁾

- 1) Maximum period for using good quality fuel (EN 590 standard). It is reduced based on the dependency on fuel contamination and on the alarm signals for filter clogging and/or water in the filter. The filter clogging warning requires its replacement. If the water in pre-filter alarm is not disabled after draining, the filter needs to be replaced.
- 2) Frequency is based on ambient and efficiency/wear conditions of the product. If the engine remains unused for long periods, perform the inspection before startup.
- 3) N.C.
- 4) Replace the anode only if corrosion exceeds 50% of zinc volume.
- 5) Frequency applicable to lubricants as provided in REFUELLING table.

- 6) Comburent air/sea water exchanger: clean both air and water sections; engine coolant/sea water exchanger: clean the sea water section; inverter oil/sea water exchanger (if available): clean the sea water section.
- 7) To be performed every year even if the operating hours expected are not met.
- 8) Use only filters with the following features:
 - filtering degree < 12 μm
 - filtering efficiency $\beta > 200$.

WARNING

In case fuel sulfur percentage exceeds 0,5% or oils not meeting the specifications provided in refueling table are used, oil, engine oil filter and oil vapor filter frequencies will have to be halved, based on the use and operating conditions of the engine. For more information please refer to maintenance staff.

PRESCRIPTIONS

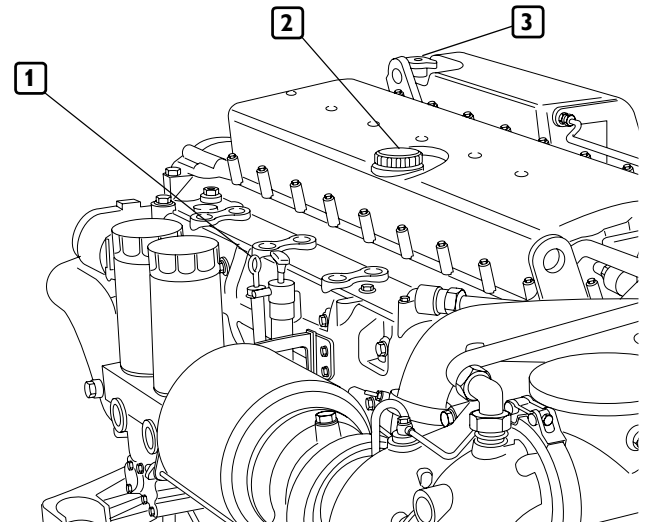
1. Do not disconnect battery power when the engine is running.
2. Do not perform arch soldering near the engine without having removed all electric connections and electronic units.
3. After each maintenance involving disconnection of battery clamps, make sure they have been securely tightened on the relevant poles.
4. Do not start the engine using the battery charger.
5. Disconnect batteries from on board power source while they are being recharged.
6. Do not paint equipment, components and electrical connectors of the engine fitting.
7. Disconnect batteries from power source before any electrical intervention.
8. Before on board installation of any electronic equipment, contact the Yard (two-way radio, echo sounder).

HOW TO

Engine lubricant level inspection

Proceed only with engine stopped and at low temperature to avoid any risk of burns.

- Using the dip stick (1), that the oil quantity is included between "Min" and "Max" limits.
- Refill if level is insufficient, using the hole on top of cylinder head. Remove the cap (2).



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WARNINGS

- ❑ After refilling make sure oil level does not exceed "Max" on the stick.
- ❑ Insert the dip stick all the way down and tighten the cap by turning it clockwise until it comes to a full stop.

Marine gear lubricant level inspection

Check oil level in the marine gear. Follow the instructions provided in the manual provided by the marine gear manufacturer.

Coolant level inspection

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

- ❑ Remove the filling pan pressure cap (3 in the previous page)
- ❑ Visually inspect oil level.
- ❑ Refill if necessary using a 50% mixture with clear water (not distilled) and Paraflù 11. (See REFUELLING table).

Exhaust pipe/s integrity inspection

Visually check that the discharge system of exhaust gases is not clogged not damaged.

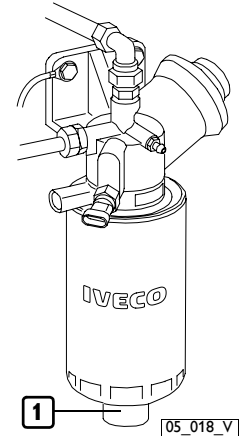
- ❑ Make sure there is no dangerous fumes inside the hull. Contact the Yard if necessary.

Water drain from fuel pre-filter

The high risk of refueling with fuel polluted with foreign bodies and water requires inspections to be performed even if no alarm is triggered on the on board panel.

Proceed with engine not running.

- ❑ Place a basin under the pre-filter in order to collect liquids.
- ❑ Unscrew the cock plug (1) located in the pre-filter lower section; in some fittings the plug includes the diesel oil water sensor.
- ❑ Drain the liquid until it is detected as "diesel oil" only.
- ❑ Manually close the plug by screwing completely.
- ❑ Dispose drained liquids observing current regulations in force.



Check the electrolyte solution level in batteries

Proceed by placing the batteries on an horizontal plane.

- ❑ Visually inspect that the liquid level is included between "Min" and "Max". If no reference marks is available, check that the liquid covers the lead plates in the elements by approximately 5 mm (0.20 in).
- ❑ If necessary refill only with distilled water those elements whose level is lower than the minimum.
- ❑ Contact a specialized shop in case the battery needs recharging.

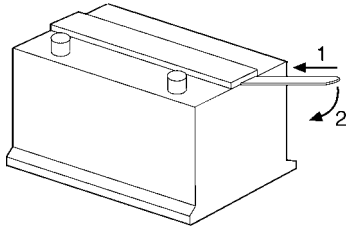
- ❑ Request an efficiency diagnosis of the battery recharge system if when the engine is running the voltage is lower than 22 V.
- ❑ Check that terminals and clamps are clean, securely tight and protected with petroleum oil.

WARNING!



- ❑ Batteries contain sulfuric acid which is highly caustic and corrosive. Wear safety gloves and goggles when refilling. If possible, request specialized staff to perform the check.
- ❑ Do not smoke nor start flames near the batteries during checks and make sure the room is suitably ventilated.

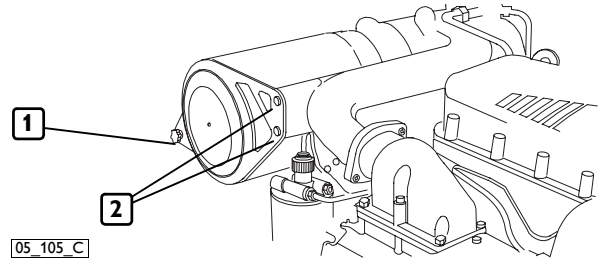
Some battery types are equipped with single cover for inspection plugs. To access the items, use a lever as shown in the figure.



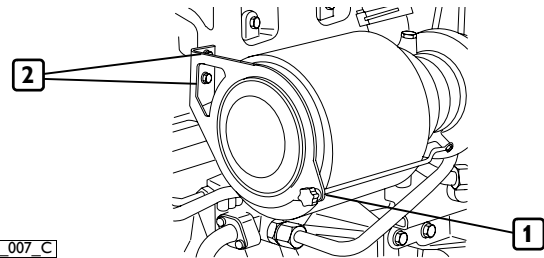
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Air filter/s cleaning

- ❑ Remove the filter by removing the rod (1) and loosening the screws (2) shown in the figure.
- ❑ Blow the filter with compressed and dehumidified air, from inside to outside (maximum pressure 200 kPa), or wash only with water. Avoid using detergents; **do not use diesel oil**.
- ❑ Replace if tearing is found.
- ❑ Restore regular operating conditions after having placed the filter in its housing.



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05_007_C

Zinc anodes corrosion inspection

Proceed with engine not running and at low temperature:

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

Oil vapor filter status

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

With choke sensor:

- ❑ Refer to the indication provided by the sensor.

Without choke sensor:

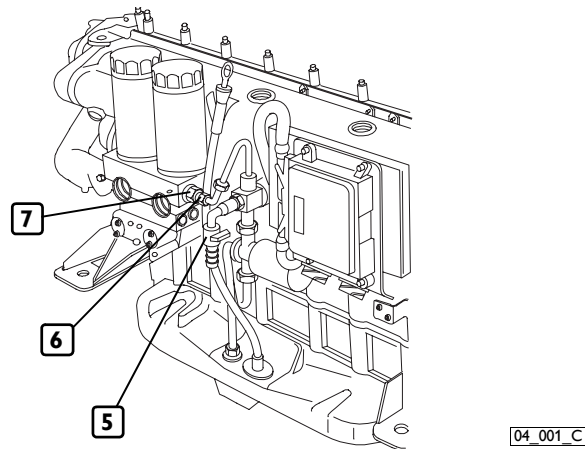
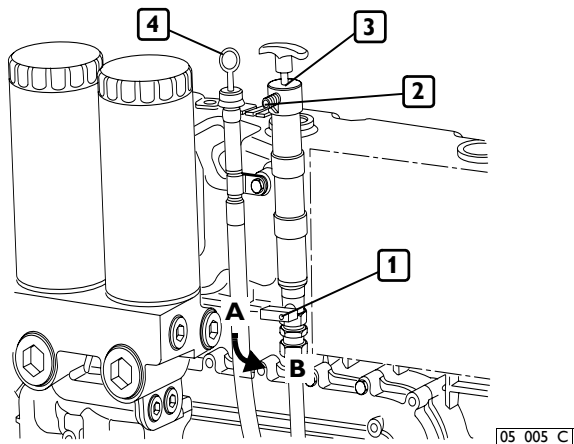
- ❑ Check that the filtering item is free from crusting and replace as directed in the following pages.

Engine lubricant replacement

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

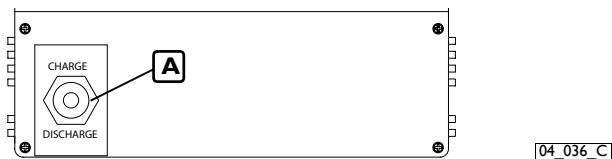
Only with one hand pump:

- ❑ Place a container to collect the exhaust oil under the hand pump (3) exit piping (2).
- ❑ Open the extraction cock by vertically lifting the lever (1) **B**..
- ❑ Unscrew the refilling cap, act on the special hand pump (3), provided for the extraction of the oil, until the oil pan is completely empty.
- ❑ Refill oil through the hole provided on the cover. Refer to REFILLING table for the correct oil type. Tighten the plug.
- ❑ Using the dip stick (4), that the oil quantity is included between "Min" and "Max" limits.
- ❑ Close the cock by lowering back the lever (1) to **A** position.
- ❑ Dispose oil observing current regulations in force.



With transfer electric system (optional)

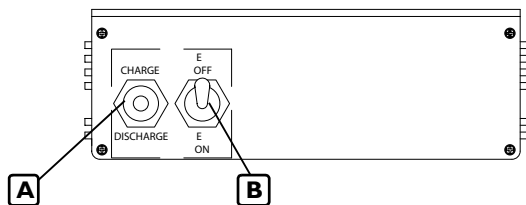
The above operations can be performed by acting on the push button located on the electronic module. For safety reasons controls are enabled only when the key switch is turned to **8A** (stop).



- Place under the cock (5) a container to collect the exhaust oil.
- Open the cock (1) and press (A) towards DISCHARGE, until it is fully empty.
- Connect the cock to the new oil container and press the button towards CHARGE until filling is completed.
- Dispose oil observing current regulations in force.
- Close the plug (1).

With transfer and pre-lubrication electric system (optional)

The above operations can be performed by acting on the push button located on the electronic module. Fore safety reasons controls are enabled on only when the key switch is turned to **8A** (stop).



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- Place under the cock (5 on next page) a container to collect the exhaust oil.
- Turn the EV OFF/EV ON (B) switch to EV/ON, to the electric pump will be connected to the cock.
- Open the cock (1) and press (A) to DISCHARGE, until it is fully empty.
- Connect the cock to the new oil container and press the button towards CHARGE until filling is completed.
- Turn the EV OFF/EV ON (B) to EV/OFF, to allow operation of the pre-lubrication system.
- Dispose oil observing current regulations in force.

Efficiency testing of one-way valve in the pre-lubrication system (image page 32)

Proceed with engine not running.

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

WARNING!



Proceed with utmost care, considering the fluid high temperature and the presence of moving parts. Always wear suitable personal protection equipped.

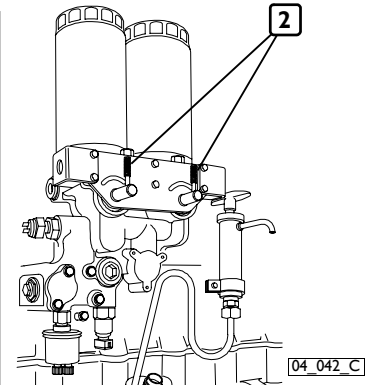
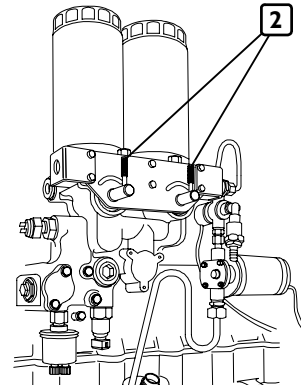
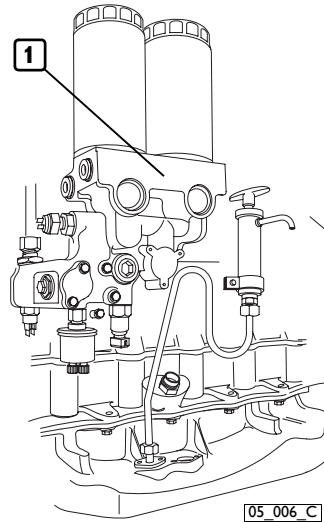
Oil filter replacement

Use only filters with filtering degree equal to the above ones (see FREQUENCY).

With traditional filter support

Proceed only with engine not running and at low temperature to avoid any risk of burns, after emptying exhaust oil.

- ❑ Place under the cock (1) a container to collect the exhaust oil.
- ❑ Remove filters.
- ❑ Accurately clean surfaces.
- ❑ Moist seals of the new filters with some oil.
- ❑ Manually tighten until contact is made, then tighten again for 3/4 of turn.
- ❑ Dispose drained liquids observing current regulations in force.



Rotate handle (2) corresponding to the filter to be replaced, to CLOSED as shown on the relevant plates.

- ❑ Proceed as with the traditional filter.

With filter support and exclusion levers (optional)

The support with exclusion lever allows replacing the filter also with running engine.

WARNING!



Proceed with utmost care, considering the fluid high temperature and the presence of moving parts. Always wear suitable personal protection equipped.

WARNING!



Do not exclude both filters at the same time to avoid any damage.

Fuel filter/s replacement

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

Use only filters with filtering degree equal to the above ones (see FREQUENCY).

With traditional filter support

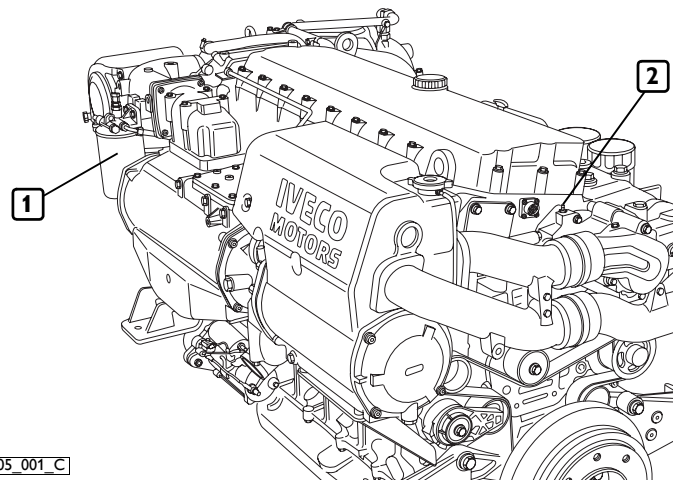
- Remove filter (1) by unscrewing it.
- Moist seals of the new filters with diesel or engine oil.
- Manually tighten until contact is made, then tighten again for 3/4 of turn.
- Loosen the bleeding connection on the filter support and act on the hand pump of the pre-filter until fuel flows out without air.
- Tighten the connection and start the engine acting on the pump, also during the first startup phases.

WARNING

Do not fill the new filter before placing in on the support, to avoid allowing impurities to enter and damage the circuit and the injection system.

NOTE: in case you need to speed up residual air bleeding, proceed with first startup steps, by loosening the connection on the cylinder head (2) and closing it.

Do not disperse the fuel in the environment.

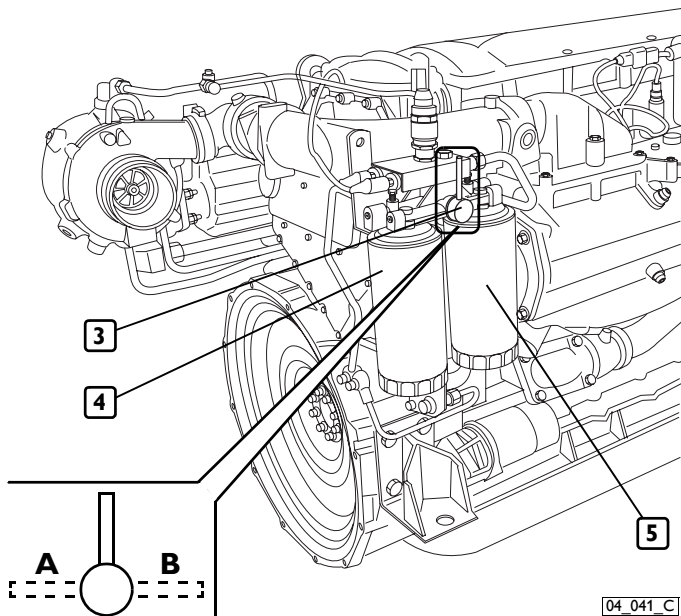


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With filter support and switching lever (optional)

The support with switching lever allows replacing the filter also with running engine.

- Switch the lever (3, on next page) to A and replace the filter (5, on next page).
- Switch the lever (3, on next page) to B and replace the filter (4, on next page).
- Proceed as with the traditional filter.
- Bring the lever back to central position to avoid limiting the fuel delivery to the injection system.



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Bleed by observing the warnings provided for the traditional filter support.

WARNING!

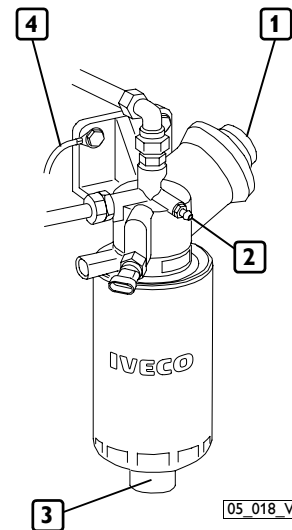


Proceed with utmost care, considering the fluid high temperature and the presence of moving parts. Always wear suitable personal protection equipped.

Fuel pre-filter/s replacement

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

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

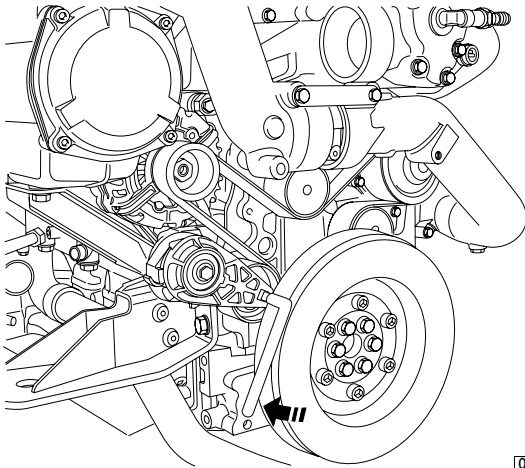


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Check tension and conditions of auxiliary parts belt

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

- Remove pulley protection.
- Check belt for brakes, wear, oil or fuel presence. Replace if necessary.
- Check tensioning as shown in the picture.
- Replace casing and tighten fastenings.



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Coolant replacement

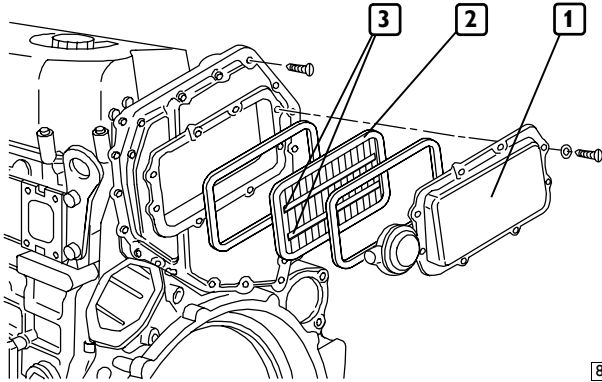
Proceed only with engine not running and at low temperature to avoid any risk of burns.

- Use basins to avoid coolant dispersion in the environment.
- Remove plugs on the circuit and wait for it to bleed completely (see ENGINE TECHNICAL DATA for location). Replace when empty. Watch sealing integrity.
- Refill the circuit as described in REFILLING table.
- Degas and refill the circuit as instructed in section PRESCRIPTIONS FOR FIRST START-UP.

Oil vapor filter replacement

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

- Remove engine fittings to access filter housing.
- Loosen screws, remove filter housing cover (1).
- Remove and dispose the filter (2) observing current regulations in force.
- Slide the new filter, observing the assembling direction. Reinforcing items (3) should be visible.
- Place the cover back into its housing.



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WARNING!



The filter (2) has unidirectional efficiency and should be placed with the two reinforcing items visible (3) as shown in the picture.



WARNING

Only IVECO MOTORS Servicing Centers or Yard staff may perform the following operations.
Please refer to the relevant technical and repair manuals.

- Condensation draining/suction from fuel tank/s
- Sea water intake inspection
- Check sea water pump rotor wear
- Check the efficiency of the pre-post heating system
- Valve-rocker arms play adjustment
- Cleaning of heat exchangers
- Supercharger cleaning

See the marine gear Manufacturer's handbook.

MOVING THE ENGINE

Only Authorized Servicing Center staff can perform such operations. To lift **only the engine** use the eyelets specified herein in the ENGINE TECHNICAL DATA section. Lift using a rocker arm and keep ropes parallel, using the eyelets provided simultaneously. Do not use one eyelet only. The engine lifting system should be suited to the engine weight and clearance. Make sure there is no interference between the lifting system and engine organs. Do not lift the engine before removing its transmission organs.

EXHAUST PARTS DISMISSAL

The engine assembly includes parts and items which may cause ecological damages if released in the environment. The materials listed should be delivered to special collection centers. Current regulations in different countries provide for severe punishment of transgressors.

- Start-up batteries.
- Exhaust lubricant oils.
- Water and deicer mixtures.
- Filters.
- Cleaning auxiliary material (ex. greaser rugs or soaked with fuel).

■ LONG ENGINE INACTIVITY

ENGINE PREPARATION FOR LONG INACTIVITY PERIODS

In case of prolonged inactivity and order to avoid oxidation of internal parts of the engine and of some components of the injection system, prepare the engine as follows:

1. Drain the lubricant oil from the pan, after warming up the engine.
2. Fill with 30/M protective oil (or an oil compliant with MIL 2160B type 2 specifications) until "minimum" level is reached on the dip stick. Start the engine and keep it running for 5 minutes.
3. Bleed the fuel from the injection circuit, the filter and from the injection pump piping.
4. Connect the fuel circuit to a tank containing protective liquid CFB (ISO 4113) and run the engine for 2 minutes after cutting out the injection system. This can be done by energizing terminal 50 on the starter with positive voltage equal to the system rate voltage, using a conductor.
5. Spray approximately 80 g of protective oil 30/M (10 g per liter of swept volume) on the supercharger suction intake, during the above motoring.
6. Close with plugs or seal any opening.
7. Drain any residual 30/M oil. Store for future use (enough for 2 preparations).
8. Apply ENGINE WITH NO OIL labels to the engine and on board panel.

9. Drain coolant, and place a label stating the operation has been completed.

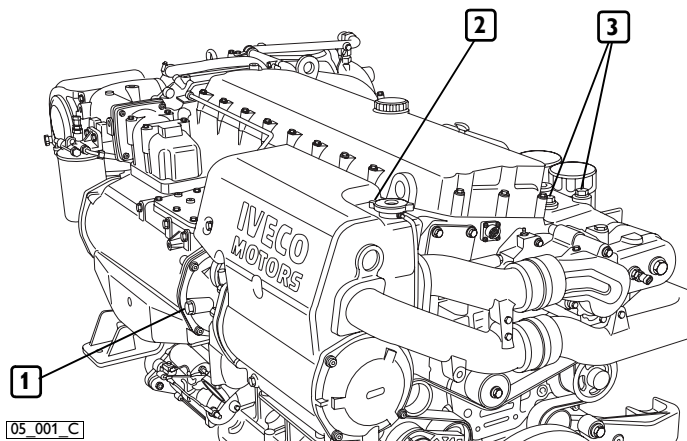
In case of extended inactivity, repeat the above every 6 month, as follows:

- A) Drain from 30/M protective oil;
- B) Repeat from step 2.

In case protection of engine external parts is required, spray all unpainted surfaces with OVER 19 AR protection liquid, avoiding belts, cable connections and electric parts.

COMMISSIONING AFTER AN EXTENDED PERIOD OF INACTIVITY

1. Drain any residual 30/M protective oil.
2. Fill the engine with lubricating oil as provided in REFUELLING table.
3. Drain any protective liquid from the fuel circuit and follow the instructions provided in point 3 ENGINE PREPARATION FOR LONG INACTIVITY PERIODS.
4. Remove any closing and/or sealant. Connect the supercharger intake to the air filter.
5. Connect fuel circuits to the boat tank and follow the instructions provided in point 4 in ENGINE PREPARATION FOR LONG INACTIVITY PERIODS.
6. Check and refill the engine with coolant, as instructed.
7. Start the engine and keep it running until idle speed is stable.
8. Check that readings are acceptable and that no alarm is on.
9. Stop the engine.
10. Remove ENGINE WITH NO OIL labels from the engine and on board panel.



FIRST START-UP AFTER LONG INACTIVITY PERIODS

1. Refill the engine as provided in REFUELLING table.
2. Remove the sacrificial anode (1) and fill with 1.5 liters of water, in order to start the sea water pump.
3. Place the anode back into its housing and tighten as provided.
4. Degas the cooling circuit as follows:
Keep the engine running at idle speed, carefully loosen the screw (2) and screws (3) located on the coolant pan and on the drain manifold respectively. Tighten and stop the engine. Check coolant level, refill if necessary. Do not disperse in the environment any liquid.

■ENGINE FAULTS

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 threshold, 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.

Fault in the accelerator electronic circuit

When the CENTRAL ELECTRONIC UNIT detects any fault, the strategies specified in "Accelerated minimum idle speed" section should be adopted, in order to proceed with emergency navigation.

Available operating modes are:

- A.** Accelerator lever "not responding": revolution sets to 750 rpm to allow slow navigation and maneuvering operating only on the inverter, **without accelerating**.
- B.** Accelerator lever "partially responding": revolution sets to 750 rpm. If you bring the accelerator to half way of its travel, the speed progressively increases to 2000 rpm. If you bring back the lever, speed will go rapidly back to 750 rpm.

WARNING!



The engine electronic unit may adopt safety strategies any time during navigation, whenever any risk condition for the engine is detected.

When such conditions arise, proceed with utmost care, and check that everyone on board is holding on securely.

NOTE: The "A" mode allows using higher speeds and managing start/stop functions as detailed in ENGINE OPERATION FROM RELAY BOX.

Always, **observe accident prevention** precautions detailed in INSPECTIONS AND MAINTENANCE.

WARNING!



*Engine operation from "Relay box" disables bridge controls; therefore **from the bridge the only way to stop the engine** is to act on the inverter disconnect lever.*

■ EMERGENCY ON BOARD

The boat user, if observing the instructions contained in this manual, will always be acting in safe conditions.

In case of accident, always request the immediate intervention of rescue staff.

The following is to be observed in case of emergency while waiting for rescue staff to arrive.

Engine breakdown

When navigating with broken engine, use utmost care when maneuvering and check that people on board are holding on securely. (see ENGINE BRAKEDOWN).

Fire

Extinguish using the equipment on board as required by competent authorities (current safety regulations provide for fire equipment on board).

Burns

1. Extinguish flames on clothing using:
 - water;
 - dust fire extinguisher;
 - blankets or rolling the victim on the floor.
2. Do not remove pieces of fabric from skin.
3. In case of burning from liquids, immediately but carefully remove soaked clothes.
4. Cover the burn with special sterile bandaging.

Carbon oxide intoxication (CO)

Carbon oxide contained in exhaust gases can be very dangerous. In closed rooms it is very dangerous because it can reach dangerous concentration in a short time.

In case of intoxication in a closed environment:

1. Immediately vent the room.
2. Hold your breath when entering the room, do not turn on light, or activate any electric device including phones, to avoid explosions.
3. Bring the injured person outside.

Electrocution

The electric system does not involve electrocution however in case of short circuit, some risk of burn may arise. In such case:

1. Turn away the tool causing the short circuit using suitably thermally insulated means.
2. Turn off the mains, if available.

Injures or fractures

Seek for immediate medical help.

1. In case of strong bleeding, press the wound until first aid arrives.
2. In case of fractures, do not move the part of the body involved and transfer the patient very carefully, and only if extremely necessary.

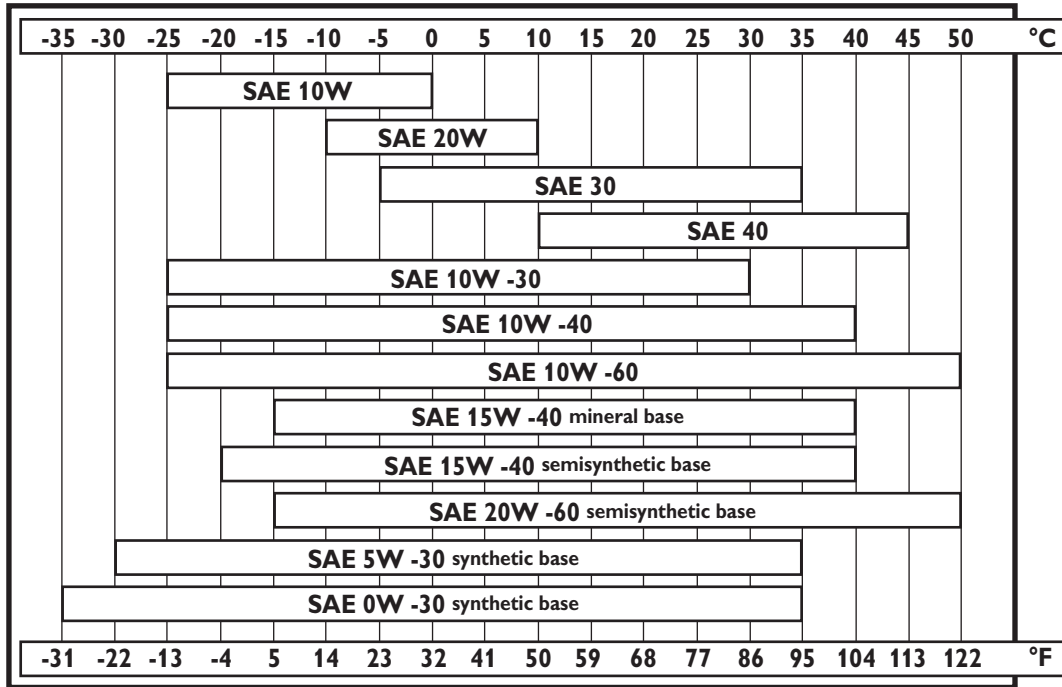
Skin burns

This may result from contact with acid substances.

This usually happens when liquid flows out of the battery. In such case:

1. Remove any soaked clothing.
2. Wash thoroughly with water only the parts involved.

In case of eye contact with battery acid or lubricant or diesel oil: wash the eye with water for at least 20 minutes keeping your eyelids wide shut to that water flows over the ocular bulb (move the eye to every direction for better washing).



ON BOARD PANELS REQUIREMENTS

The following refers to the original configuration of IVECO MOTORS equipment.

The requirements and technical features of customizations may be different. Refer to the original manufacturer for further information.

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

(*) min. 9 V/max. 16 V referring to equipment for which only 12 V nominal voltage is provided.