

User and maintenance manual



TYPE: MARINE GENERATORS
MODEL: PAGURO P4MY - 5.5 MY
YEAR OF CONSTRUCTION: 2022



PAGURO GENERATORS

Revisions table

| CHAPTER | DESCRIPTION | REVISION | DATE |
|---------|---|----------|------------|
| WA | Warnings | 0.0 | 13.05.2022 |
| 1 | Technical specifications | 0.0 | 13.05.2022 |
| 2 | Operating conditions | 0.0 | 13.05.2022 |
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| 4 | Transport and handling | 0.0 | 13.05.2022 |
| 5 | Installation of the machine | 0.0 | 13.05.2022 |
| 6 | Installation errors | 0.0 | 13.05.2022 |
| 7 | Start and stop procedure | 0.0 | 13.05.2022 |
| 8 | Remote control pane | 0.0 | 13.05.2022 |
| 9 | General safety information | 0.0 | 13.05.2022 |
| 10 | Maintenance | 0.0 | 13.05.2022 |
| 11 | Types of risks and safety pictograms included | 0.0 | 13.05.2022 |

EC Declaration of Conformity (Annex IIA Machinery Directive 2006/42/EC)



The undersigned:

Volpi Tecno Energia srl

Via Luciano Lama, 5
33059 – Fiumicello Villa Vicentina (UD)
- Italy -

declares that the machine called *MARINE DIESEL GENERATOR* of own production:

Model.....PAGURO XXXXX
Serial no.....XXXXXX
Year of construction.....2022

to which this declaration relates is in accordance with the following directives:

- Machinery Directive 2006/42/EC
- Low Voltage Directive 2014/35/UE
- Electromagnetic Compatibility Directive 2014/30/UE

and to the following harmonized standards:

- UNI EN ISO 12100:2010 “Machine safety – General design principles - Risk assessment and risk reduction”
- CEI EN 60204-1 “Machine safety – Electric equipment of the machines. Part 1: General rules”

We also declare the machine is CE marked.

The person authorised to compile the Technical File:

Volpi Tecno Energia srl
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33059 – Fiumicello Villa Vicentina (UD) - Italy

The legal representative:

Fiumicello Villa Vicentina, GG.MM.2022

(Mr. Riccardo Snaidero)

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Warnings

PREMISE

This User and Maintenance Manual of the Marine Diesel Generator mod. Paguro 4 MY / 5.5 MY contains the instructions that allow the operator to use the machine to the best of its operational capabilities and provides all necessary information and instructions to operate in observance of the Machinery Directive 2006/42/EC.

Its accurate design eliminates or significantly reduces any risks to the user being the operator.

It is therefore possible to affirm that the *Marine diesel generator* is safe when used correctly.

The user is required to strictly follow the instructions provided herein and particularly those pertaining to safety regulations.

A single copy of the User and Maintenance Manual is provided when the machine is delivered and installed. If the operator is not able to keep the manual safe without ruining it, it is necessary to prepare a photocopied copy of it. In any case it is possible to contact the Manufacturer to ask for another copy.

This manual is an integral part of the machine and must be kept safe along with the machine with the utmost care and follow this last one in each and every eventual property passes.

The **VTE S.r.l** company will not be held liable for any inaccuracies in the instruction manual if due to printing errors or inadvertent errors.

Furthermore, the **VTE S.r.l** company reserves the right to make modifications to their machines as it deems necessary or useful without undermining the essential characteristics.

INTRODUCTION

Purpose and contents of the User and Maintenance Manual

This User and Maintenance Manual of the Marine Diesel Generator mod. Paguro 4 MY / 5.5 MY for the production of electricity on boats.

The machine can operate within the limits indicated in the cap. 1 "TECHNICAL SPECIFICATIONS".

For an easy consultation of the manual the Marine Diesel Generator will hereinafter simply be referred to as the "machine". The manual is written to put operators in a position to:

- gain knowledge of issues relating to the machine.
- work safely.

The manual contains therein the user instructions and maintenance advice, together with rules on safety and accident prevention.

General warnings

Before proceeding with the machine starting procedure the operator has to read carefully this manual and must have vested a deep knowledge of the technical specifications and of the machine commands.

They contain important information for:

- the safety of people involved in installation, start up and maintenance.
- the safety and efficiency of the machine.

Operation of the machine is not allowed if there is any doubt regarding the correct interpretation of the instructions. Contact the Manufacturer or service centre if further explanation is required.

The Manufacturer is willing to provide training courses for staff at the Customer's headquarters.

Requests, time, costs and arrangements must be agreed in advance.

- **WORK AREA:** The operating area is defined as the area for the installation of the machine.
- **INSTALLATION:** Installation is defined as the mechanical and plant integration of the machine on the boat.
- **COMMISSIONING:** Commissioning is defined as the functional verification of the installed system.
- **DEMOLITION AND DISPOSAL OF THE MACHINE:** Decommissioning is defined as the mechanical removal of the machine. Disposal of the machine is defined as the activity of demolition and disposal of the components that make up the machine.
- **MAINTENANCE AND REPAIR:** Maintenance and repair work is defined as the periodic inspection and/or replacement of parts or components of the machine to identify the cause of a failure that has occurred, which ends with the restoration of the functional conditions of the project.
- **IMPROPER USE:** Improper use is intended as the use of the machine outside the limits of the technical documentation.
- **DANGEROUS AREA:** Any area inside and/or near the machine where a person is exposed to a risk to their safety or health.
- **EXPOSED PERSON:** Any person who is wholly or partly in a hazardous area.
- **OPERATOR:** the person responsible for operating the machine each within the limits of the tasks assigned to it.
- **INSTALLER:** the person responsible for performing mechanical and plant installation, calibration, commissioning, each within the limits of the tasks assigned to it.
- **QUALIFIED TECHNICIAN:** a specialised person, employed by the Manufacturer or by the authorised service centre, specifically trained and authorised to make interventions of extraordinary maintenance (of electric or mechanical nature) or repairs which require a particular knowledge of the machine, their functioning, of the safety devices provided and of its modes of intervention.

In the following manual will be defined the tasks, the skills and the work limitations of the various operators.



Installers must not perform operations reserved for maintenance technicians or qualified technicians. The Manufacturer will not be held liable for damages arising from the failure of such prohibition.

Certain activities (such as installation and commissioning, initial calibration and registration, repair, overhaul, moving and decommissioning of the machine) require the presence of qualified technicians or the authorized service centre.

In order to understand the instructions (text and pictures), the machine operators must meet (or acquire, through training and instruction) at least the following requisites:

- a sufficient level of general and technical knowledge to read and understand the content of those parts of the manual that concern him/her, and to be able to interpret the drawings and diagrams correctly;
- ability to understand and interpret the symbols, safety pictograms;
- knowledge of the main accident prevention and technological regulations;
- Know what to do in an emergency, and how to use Personal Protective Equipment (PPE) correctly.

Maintenance technicians must possess the same requisites and also have a good level of technical knowledge obtained by a professional qualification and/or adequate experience in their field of work.

They must also have the specific and specialized technical knowledge (mechanical, electrical) that are required for the tasks proposed in the User and Maintenance Manual. Important! The MANUFACTURER must:

- verify that staff actually possess the required level of knowledge to read and fully understand the User and Maintenance Manual.
- carry out practical training and ensure, even through the use of tests, that the appointed operator is able to operate the machine properly and safely.

You must keep this manual and all attached documents in an easily accessible place, near the machine, and known to all operators.

The operators and maintenance staff must be able to quickly locate and consult, in any situation, the User and Maintenance Manual.

THE MANUAL IS AN INTEGRAL PART OF THE MACHINE FOR SAFETY REASONS. Therefore:

- it must be kept intact (in all its parts).
- it must follow the machine in each and every eventual change of ownership until its demolition (even when rented, etc.).

Manufacturer details

VTE S.r.l.

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33059 – Fiumicello Villa Vicentina (UD) - Italia
Telefono: +39 0431 96488
E-Mail: info@volpitemco.com
Sito web: www.volpitemco.com

Technical Assistance

The Technical Assistance Service is available for Customers to:

- provide clarifications and information;
- programme possible interventions at the Customer's premises, by sending specialized technical staff;
- send spare parts/components.

Requests can be made directly to the Manufacturer or to the competent assistance centre; they can be forwarded by email. For any technical service or spare parts order, always quote the serial number of the machine.



IMPORTANT!

- **the Customer-installer is always required to buy either original parts or the ones authorized in writing by the Manufacturer;**
- **the assembly and removal of parts must be entrusted and performed by qualified technicians, and carried out in accordance with the Manufacturer's instructions;**
- **the use of non-original parts and/or defective or incorrect assembly relieve the Manufacturer of any liability AND VOID THE WARRANTY.**

General safety notes

VTE S.r.l. cannot be held responsible for injuries and damages of any kind to persons/things or other, caused by the non-observance of the indications given in this document or by the improper use of the machine.

The modification/deletion of the apparatuses in the machine or the modification/deletion of the protections and safety devices provided with the machine, built by VTE S.r.l., involve the immediate warranty loss.

Warranty

The company **TE S.r.l.** guarantees the machine according to the terms and times provided on the sales contract.

The warranty does not cover wear parts such as brass, gaskets, etc.

The warranty is void if the failure/damage to the machine is caused by incorrect installation, tampering, unauthorized service or the use of non-genuine spare parts.

The company VTE S.r.l. has no other obligations or fulfilment than what above stated.

For any technical communication with VTE S.r.l., always use the contacts listed in this User and Maintenance Manual.

GENERAL SAFETY WARNINGS

The purpose of this section is to inform operators (installers and maintainers) of any risks and dangers of particular relevance and of general and specific precautions for their elimination or neutralisation.

This section contains information and instructions on:

- dangerous situations that may occur during installation and maintenance of the machine;
- guards and safety devices and their proper use;
- residual risks and procedures to adopt (general and specific precautions to eliminate or limit them).



For clarity of information, some illustrations in this manual show parts of the machine without protection guards. NEVER USE THE GENERATOR WITHOUT PROTECTION.

Operator instruction

Installers and maintainers must be familiar with the following before operating on the machine:

- the function and use of the controls;
- the position, the function and the use of all safety devices;
- the characteristics of the machine;
- this manual and how to consult it.

They also must:

- have received adequate training.
- have received written permission to use the machine.

If these requirements are not observed, the Manufacturer declines each responsibility.

Any tampering or unauthorized replacement of one or more parts of the machine, the use of accessories, tools, consumables other than those prescribed by the Manufacturer, can result in the risk of injury and accordingly relieves the Manufacturer of any civil or criminal liability.

Work area

- The work area must NEVER be occupied by boxes, machine tools, or other objects, which can create obstruction resulting in falling. Nothing should interfere with the freedom of movement of the operators; furthermore, in emergency situations, staff must have unrestricted and quick access to the machine.
- Access to the work area is forbidden to people who are not directly involved in installation or maintenance.
- The compartment in which the machine is installed must be kept clean and well ventilated.

It is responsibility of the operator to enforce the rules and to report any non-observance to those in charge.

ADDITIONAL WARNINGS

At this point in the User's and Maintenance Manual it is useful to provide a list of general safety requirements for the most common operating situations:

- respect the indications of the safety pictograms on the machine board;
- before starting the machine, make sure that no one is performing maintenance on the machine.
- maintenance must be entrusted only to authorized personnel who must first put the machine in maintenance status (see Chap. 10 "MAINTENANCE").
- under no circumstances should the guards (sound-absorbing enclosure) be removed while the machine is running;
- it is absolutely forbidden to anyone to use the machine for a purpose other than the one expressly intended.



Any other use of the machine not provided for in this operation and Maintenance Manual is considered "IMPROPER USE".

In this case, the Manufacturer declines all responsibility in relation to any damage caused to property and/or persons and considers that any warranty on the machine and the accessories supplied has lapsed.

DESCRIPTION OF THE MACHINE

The Marine diesel generator mod. Paguro 4 MY / 5.5 MY is a machine designed to produce electricity on board boats. This machine has been designed and built to be installed on a boat, (able to house the generator in terms of size and weight) that guarantees protection from the weather.

The Paguro generator consists essentially of:

- Soundproofing capsule made of reinforced fiberglass with composite stratification and covering in high-density sound-absorbing material for the reduction of the sound emission due to the internal combustion engine;
- Double anti-vibration system, internal with 4 soft supports and external with 4 semi-elastic supports;
- Endothermic engine, diesel-powered, with 1 cylinder, whose purpose is to transform the energy of the input fuel into mechanical energy (rotation of the shaft);
- Electric fuel pump;
- Permanent magnet alternator, water-cooled via heat exchanger, driven by the endothermic engine shaft. The alternator converts mechanical energy into electrical energy;
- Inverter installed on outside wall of the machine;
- Heat exchanger, sea water cooled, with tube bundle;
- Air endothermic engine cooling system;
- Self-priming water pump actioned by belt connected to motor shaft;
- Remote control panel with LCD display, for managing the operation of the machine;
- Sea water and gas exhaust terminal with overtemperature probe.

The generator is easy to manage in maintenance and cleaning operations, according to the latest accident prevention regulations.

The machine is supplied with a spare parts kit (impeller and impeller seal).

Operation principle

The operation of the machine, for the generation of energy, develops through the following phases:

1. The fuel arrives at the endothermic engine where, by means of the combustion process, it is transformed into mechanical energy;
2. Mechanical energy is converted by the alternator into electrical energy;
3. The self-priming water pump draws sea water for passage through the tube bundle of the heat exchanger;
4. The air leaving the heat exchanger is used for cooling the following components in succession:
 - Engine oil sump;
 - Alternator;
 - Coolant contained in the engine cooling exchanger;
 - Exhaust terminal.
5. Exhaust gases are expelled outside through the terminal.

PROTECTIONS OF THE MACHINE

The machine is protected by a multilayer fiberglass capsule, lined internally with sound-absorbing material, consisting of:

- 1 lower containment element of the machine equipped with anti-vibration system.
- 2 upper elements with interlocking profiles, held together by silicone elastic bands.



Lower protection of the machine



EXPLOSIVE ATMOSPHERE

This machine and its devices are made in standard version and can therefore not be installed and used in premises where the concentration of dust may exceed acceptable limits and create potentially explosive atmospheres.

DISPOSAL OF WASTE PRODUCTS

During normal operation, the generator generates waste or waste substances that must be collected, recycled or disposed of in accordance with current laws in the country in which it is installed and used. These substances are basically:

- engine oil;
- waste lubrication oils;
- replaceable wearable parts.

To proceed with the disposal of these substances, please refer to the Regulations in the Country of residence in accordance with the regulations in force and act accordingly.

DEMOLITION AND DISPOSAL OF THE MACHINE

Once the machine has reached the end of its technical life, it must be put out of service so it will not be used for the intended purpose, and it is not possible to reuse parts and materials. The machine must be safely disabled and demolished. VTE S.r.l. company assumes no liability for damages to things or people arising from the reuse of individual parts of the machine for functions other than the original.

1. Before proceeding with demolition, it is necessary to empty the generator from all liquids;
2. Inform the responsible authorities for this task by written communication in accordance with the regulations in force in the individual Country;
3. Dismount the machine depending on the various components, using tools and devices that can normally be found in maintenance stores. Separate potentially hazardous components such as:
 - Plastic materials, polymer-based materials, etc;
 - Electrical components, cables, etc...;
 - Metal parts by type, such as aluminium, steel, etc...

4. After having received the authorization from the above authorities, proceed to the disposal of the components in accordance with applicable laws and Regulations in this area.

Always keep in mind that the disposal of toxic and harmful waste is subject to special rules according to the country of affiliation. Before doing such operations, you must be aware of these rules.

Disposal of harmful substances

To proceed with the disposal of these substances, please refer to the Regulations in the Country of residence in accordance with the regulations in force and act accordingly.

Any irregularity committed by the Customer before, during or after the scrapping and disposal of the machine components, in the interpretation and application of the relevant Regulations in this matter, is solely responsible for the Customer himself.

If you have any questions or other information, please contact the technical assistance service of **VTE S.r.l.**

1. Technical specifications

1.1 "CE" IDENTIFICATION PLATE

The picture below illustrates the identification plate of the machine.

It is attached to the machine's outer guard and shows:

- Manufacturer identification data;
- CE mark;
- Model;
- Type;
- Serial number;
- Year of construction.

The plate bears the CE symbol, certifying that the machine is compliant with the main health and work safety regulations in the **European Community as well as with Machinery Directive 2006/42/EC.**

CE identification plate
Example

| | |
|--|----------------------|
|   | |
| VTE Srl Via Luciano Lama, 5 - 33059 Fiumicello Villa Vicentina (UD) - Italy Tel. +39 0431 96488 - info@volpitemcno.com | |
| MODEL | <input type="text"/> |
| TYPE | <input type="text"/> |
| SERIAL NUMBER | <input type="text"/> |
| YEAR OF CONSTRUCTION | <input type="text"/> |

1.2 TECHNICAL SPECIFICATIONS

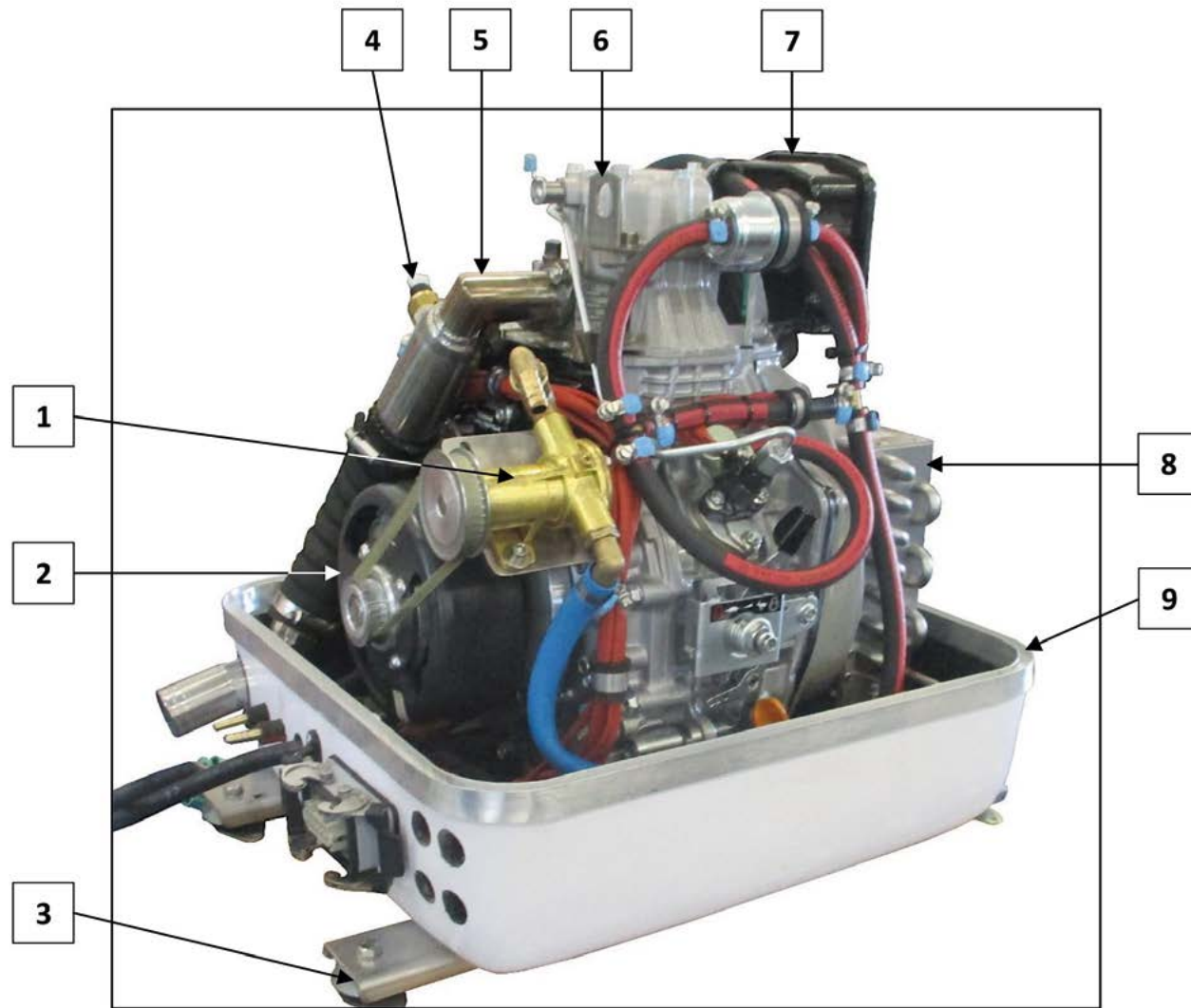
The following tables list the technical characteristics of the Machine in Your possession (please refer to the individual model):

| MACHINE SPECIFICATIONS | | | |
|---|-------|-------------|---------------|
| DESCRIPTION | U.M. | PAGURO 4 MY | PAGURO 5.5 MY |
| Length | mm | 470 | 550 |
| Width | mm | 420 | 460 |
| Height | mm | 520 | 600 |
| Weight (incl. capsule) | Kg | 60 + 5 | 75 + 5 |
| Acoustic output | dB(A) | 53 | 53 |
| Yanmar engine model | - | L70 | L100 |
| Number of cylinders | - | 1 | 1 |
| Oil sump capacity (upper dipstick mark) | l | 1.05 | 1.6 |
| Oil sump capacity (lower dipstick mark) | l | 0.65 | 1 |

| MACHINE SPECIFICATIONS | | | |
|----------------------------------|--------|-------------|---------------|
| DESCRIPTION | U.M. | PAGURO 4 MY | PAGURO 5.5 MY |
| Engine rotation speed | rpm | 3,100 | 3,100 |
| Continuous electrical power | 50 Hz | 3.5 | 4.5 |
| Single phase output voltage | V | 230 | 230 |
| Inrush current | A | 30 | 39 |
| Electric start and stop system | V | 12 | 12 |
| Specific diesel fuel consumption | l/kW/h | 0.35 | 0.35 |

| INTERNAL DIAMETERS SPECIFICATIONS | | | |
|-----------------------------------|----|-------------|---------------|
| DESCRIPTION | UM | PAGURO 4 MY | PAGURO 5.5 MY |
| Water inlet | mm | 13 | 13 |
| Exhaust line | mm | 40 | 40 |
| Diesel fuel supply | mm | 8 | 8 |
| Diesel fuel return | mm | 8 | 8 |
| Anti-siphon valve | mm | 10 | 10 |

| REMOTE CONTROL PANEL SPECIFICATIONS | | |
|---|-------|-------------------|
| DESCRIPTION | UM | VALORE |
| Dimensions (L x W x H) | mm | 99.9 x 69.6/108.4 |
| Weight | g | ≈ 290 |
| Electronic protection | IP | 65 |
| Electronic protection - connectors | IP | 65 |
| Operating temperature | °C | 10 + 60 |
| Power supply | Vdc | 8/30 |
| Consumption (pre alternator excitation) | mA | ≈ 122 |
| LCD screen resolution | pixel | 128 x 1/64 |



Interior Paguro 4 MY / 5.5 MY

Key:

- 1. Sea water self-priming pump;
- 2. Alternator;
- 3. Bracket with soft vibration supports;
- 4. Overtemperature safety switch;
- 5. Exhaust terminal;
- 6. Lifting eye bolt;
- 7. Air purifier;
- 8. Heat exchanger;
- 9. Lower capsule.



WARNING! All rights are reserved under the “INTERNATIONAL COPYRIGHT CONVENTIONS”, it is forbidden to reproduce any part of this manual in any form, without the express written permission of the Manufacturer TE S.r.l.

The contents of this guide are subject to change without notice. Every care has been taken to collect and verify the documentation contained in this manual in order to make the guide as complete and understandable as possible. Nothing in this publication shall be interpreted as warranty or explicit condition or implicit-included condition, but not limited to the warranty of suitability for a particular purpose. Nothing in this publication shall also be interpreted as modifying or asserting the terms of any purchase agreement.

2 Operating conditions

2. OPERATING CONDITIONS

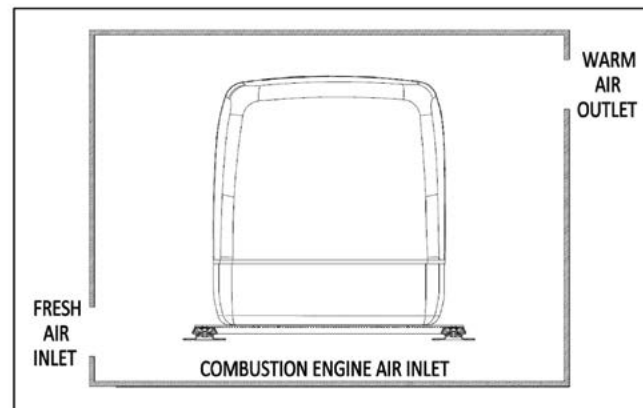
2.1 CONTAINMENT COMPARTMENT

This type of machine has been designed and manufactured to operate on board boats and in a well ventilated and closed compartment, where there are no danger of explosion or fire.

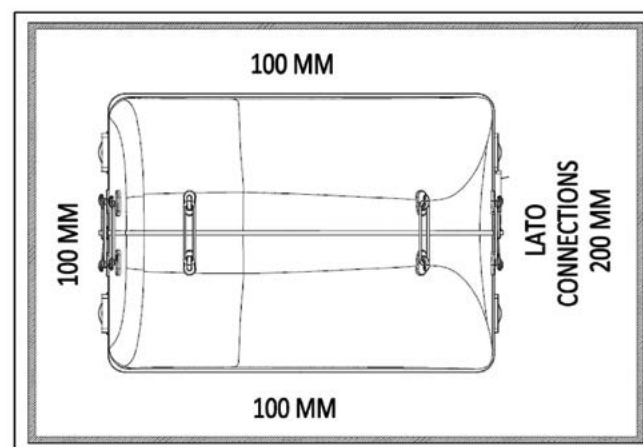
The Marine generator containment compartment must ensure minimum distances for correct air replacement.

2.2 MINIMUM AIR CHANGE DISTANCE

The image below shows the minimum recommended distances to be kept around the machine. The environment in which the machine is installed must be naturally ventilated and have more than one opening to the outside. Select a compartment that allows adequate air flow for the engine air intake.



Example - Generator compartment



Minimum air change distance

2.3 CHARACTERISTICS OF THE OPERATING ENVIRONMENT

This machine has been designed and realized to work only at the environmental conditions listed here below:

- Area temperature range: value between **+5 °C and +40 °C**.
- Maximum RH without condensation: **90% at 20°C**.

2.4 LIGHTING

The machine, once installed, must have sufficient natural light to ensure adequate visibility to the operator during maintenance.

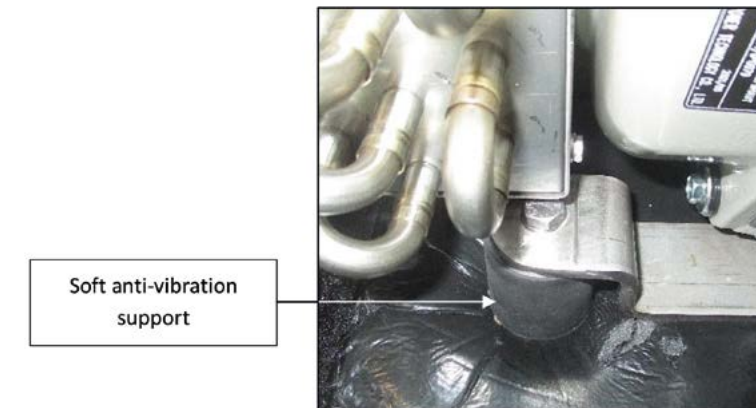
It is the task of the operator to equip the boat with suitable artificial lighting systems such as to ensure adequate lighting on the machine in case of maintenance work. The lighting must be uniform and ensure good visibility.

Work with insufficient natural light may require the use of local lighting fixtures. It is to be remembered that the devices must not be able to generate additional risks.

2.5 VIBRATION EMISSION

The entire machine has been designed and manufactured to limit the generation and distribution of vibrations produced during normal operation, which could compromise the stability and/or operation of the machine. In particular, Paguro generators use a dual system to minimize the vibrations transmitted to the hull:

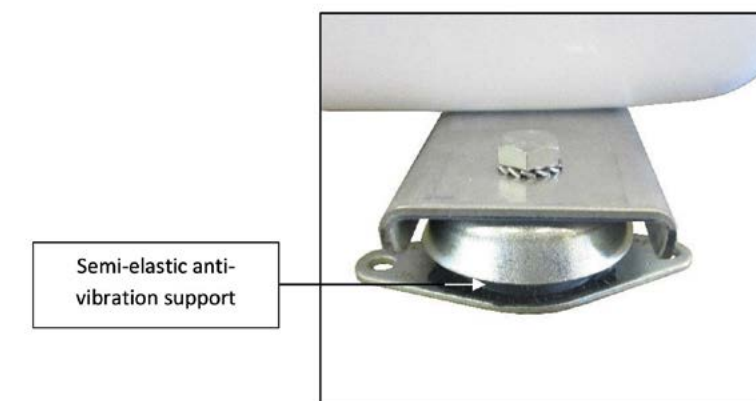
- 1 internal system consisting of:
 - 2 anti-vibration brackets.
 - 4 soft anti-vibration supports and respective anti-vibration fixing screws.



Soft anti-vibration support

Bracket and anti-vibration support (inside machine)

2. 1 external system consisting of:
 - 2 anti-vibration brackets on which the entire machine rests.
 - 4 anti-vibration semi-elastic supports and the respective anti-vibration fixing screws.



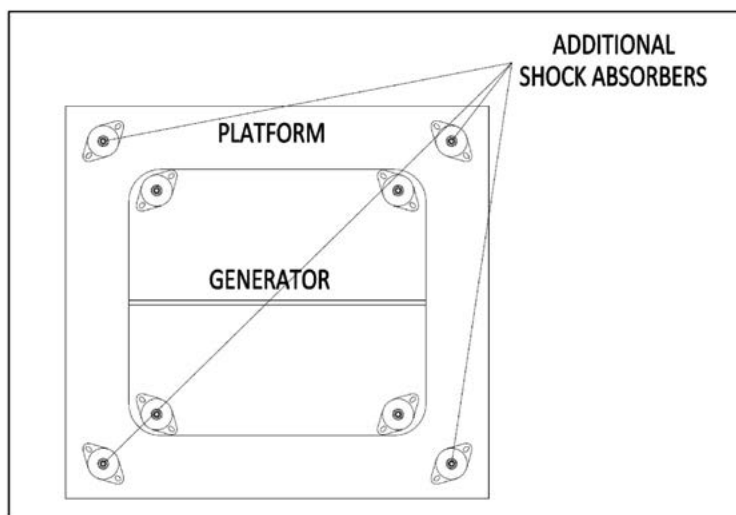
Semi-elastic anti-vibration support

Bracket and anti-vibration support (outside machine)

NOTE: The external anti-vibration supports already have holes for securing the machine to the boat. In addition, in order to attenuate the vibrations transmitted to the boat and consequently to reduce the sound level further, it is recommended to install, under the machine, a wooden platform, which in turn should be installed on soft anti-vibration supports.

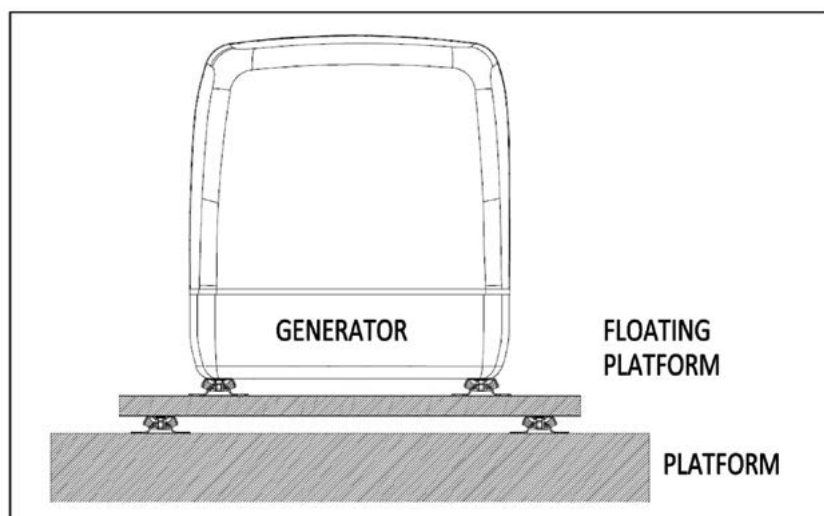
This platform must have the following requirements:

- At least 30 mm thickness.
- Own weight over 10 kg to behave like a mass in opposition to the vibrations induced by the engine.



Anti-vibration supports on platform

The vibration dampers of the oscillating platform (not included in supply) must not be aligned with the soft vibration dampers located under the machine. Depending on the available space, the greater the distance between the vibration dampers, the better the result is.



Abnormal vibrations reveal mechanical problems (e.g. loose belts). In this case you must intervene following the maintenance procedures described in this manual (in particular see Chap. 10 "Maintenance"). If the phenomena continue, contact the manufacturer or the service centre listed in Chapter **"WARNINGS" immediately and stop the generator from operating until the problem is resolved.**

2.6 NOISE POWER EMISSION

The Paguro generator has been designed and manufactured to significantly reduce the sound power level. In particular, the machine adopts a soundproofing capsule to limit the emission of the noise generated by the internal endothermic engine into the surrounding environment. The capsule is made of fiberglass and is internally coated with sound-absorbing material.



Example - Sound-absorbing coating (internal lower side)

The maximum sound pressure value detected during the various samplings is less than 70 dB (A). In any case, the factors determining the exposure level include the duration of the exposure, the characteristics of the installation point and other adjacent sources of noise.

Abnormal sounds reveal mechanical problems (e.g. loose belts).

In this case you must intervene following the maintenance procedures described in this manual (in particular see Chap. 10 "Maintenance"). If the phenomena continue, contact the Manufacturer or the service centre listed in chapter **"WARNINGS" immediately and stop the generator from operating until the problem is resolved.**

3 Operator

This chapter is an information and precautionary source of technical precautions that the operator must observe when performing his/her functions (installation and maintenance).

3.1 OPERATOR TRAINING

It is the responsibility of the employer to provide the operator with the necessary information for the installation and maintenance of all machine components and to provide the operator with appropriate Personal Protective Equipment. The User and Maintenance Manual is an essential document to operate in conditions of absolute safety, accordingly it is COMPULSORY to read the contents before using the machine.

3.2 CLOTHING

The operator must wear clothing that is appropriate to the operations he must carry out on the machine.



During the installation and maintenance operations of the machine it is essential to use:

- **Protective gloves;**
- **Overall;**
- **Ear protectors (where provided);**
- **Safety shoes.**

3.3 OPERATOR GENERAL TASKS

3.3.1 Installer

The main task assigned to the installer is to perform the mechanical and plant installation of the generator, to perform the calibrations, the routine maintenance, the commissioning and to verify that the process of production of electrical energy is correctly carried out.

3.3.2 Qualified technician

The qualified technician has an in-depth knowledge of how to install, operate, repair, extraordinary maintenance of the machine and has technical qualifications, such as:

- a technical training which authorizes to operate according to safety standards in relation to the dangers that the presence of electric current may represent;
- technical training or specific instruction relating to safe maintenance procedures;
- training in basic first-aid interventions.

3.4 CATEGORIES OF OPERATORS AUTHORISED TO WORK AND INTERVENE ON THE MACHINE

The following are the categories of operators that are authorized to operate on the machine for installation or maintenance purposes.

3.4.1 Installers

This category of operators must be instructed and authorized to install the machine.

Expected tasks:

- mechanical installation of the machine (positioning, fixing,..);
- plant installation of the machine;
- commissioning the machine.

3.4.2 Ordinary maintainers

They are trained and authorized technicians for ordinary maintenance, each for its (mechanical or electrical) skills:

- mechanical maintenance workers: they are technical workers, trained and authorized to perform the maintenance of mechanical parts and fluidic liquid/gaseous systems.
- electric maintenance workers: they are technical workers, trained and authorized to perform the maintenance of electric/electronic parts, apparatuses and systems.

They are authorized for operation, ordinary maintenance and cleaning, i.e.:

Tasks during operation:

- restoration of normal operating conditions after a breakdown stop;
- verification of the correct operation of the machine and of its process of production of electric energy;
- perform typical installer tasks.

Tasks foreseen during maintenance:

- Checking the parts subject to wear and carrying out the replacement operations.

3.4.3 Extraordinary maintainers

They are qualified and specialized technicians (dependent on the manufacturer or authorized service centre), trained and authorized for extraordinary maintenance and for operations of a complex and/or dangerous nature.

During maintenance and/or disassembly they perform:

- repair of electrical and/or mechanical faults;
- replacement of broken or worn parts;
- replacement of components and safety devices;
- any work on the electrical part (only necessary in the event of a breakdown);
- all the typical operations of installers and ordinary maintainers (conversely, an ordinary maintainer cannot perform the tasks assigned to an extraordinary maintainer).

3.5 EXPOSURE TO HAZARDS AND RISKS FROM MATERIALS

The materials used to build the machine do not create any hazards or risks for operators. On the other hand, the following materials used and/or generated by the machine during operation may be dangerous for the environment if they are not treated correctly:

- used lubricants (contact the appropriate disposal Consortium if necessary);
- replaceable wearable parts;
- waste engine oil;
- fuel.

3.6 OPERATORS TRAINING

The employer, the managers and the appointed members of staff, each according to their respective qualification and expertise, must ensure that each operator receives adequate training regarding safety and health, with particular reference to their tasks.

Training must be provided at the following occasions:

- when the individual is hired.
- when the individual is moved or assigned new duties.

Training must be periodically repeated as the risks evolve, i.e. when new risks arise due to changes in machine or components configuration.

4 Transport and handling

4.1 GENERAL NOTIONS

The lifting, handling, transport of the machine must be assigned exclusively to operators skilled in those types of operations (slingers, crane operators, forklift operators, signallers). Operators must also be:

- aware of the kind of loads that require lifting, the operations that need to be carried out and the procedures set forth in the User and Maintenance Manual.
- authorised.



WARNING! During the operations the workers must wear Personal Protective Equipment, helmets, gloves, accident-prevention shoes, overalls or other devices eventually needed by the law in force, according to the type of the operations to do.



WARNING! Operators must comply with the requirements and prohibitions required by law in force for lifting and transport; among these we underline the following general behaving rules:

- move away from loads before lifting and lowering them;
- prohibit the access of unauthorized people to the work;
- during operations, maintain the safety distance from the lifted load.



WARNING! Neglecting the precautions indicated above, can cause serious injuries and/or accidents resulting in damage to equipment and injury to operators. In severe cases, accidents can cause death of workers.



4.2 TRANSPORT AND HANDLING

Before being transported, the machine must be emptied of all the fluids contained in the machine in order to prevent the escape of any dangerous substances (e.g. engine oil).

The generator is sent assembled, anchored to a pallet by means of the fixing holes positioned on the plates of the machine itself and inserted in a wooden box, provided with lower crossbars.

Optional items are shipped in a cardboard box attached, by strapping, to the main box.



Machine packaging



Machine packaging + optional

The packaging ensures the preservation and integrity of the machine during transport, preserving it against mechanical, climatic and biological influences that may occur during transport.

Upon arrival, check that the generator has not been damaged during transport and that all components are included in the scope of delivery, including the User and Maintenance Manual if it is included in the packaging.

WARNING! All means employed for handling must be suitable for lifting the machine, having in mind:

- the shapes and sizes;
- the mass (weight) and its distribution;
- the lifting points provided.



WARNING! Personnel trained for this reason must be employed for these operations (slingers, crane operators, lift truck drivers, etc.). Partnering to the operator one person in charge of the signalling, because the space of the machine transported or the packages might not allow a sufficient visibility to the driver.

4.2.1 Lifting and handling by crane or overhead crane

General recommendations:

- Check that the lifting hooks and ropes are suitable for the weight to be lifted.
- Make sure that there is enough space for lifting and handling with the crane.
- Take all necessary precautions when lifting and handling to prevent damage to persons and the unit to be handled.
- Check crane safety before use.
- Stay at a safe distance when lifting and handling.
- Lift the packaging slightly and make sure it is in balance and that the ropes/chains are tight.
- Lift the packaging as little as necessary for the unloading and move it avoiding any shock or impact.
- Place the packaging at the designated location.
- Remove the ropes/chains from the crane/overhead crane hook and from the packaging.

4.2.2 Lifting and handling with forklift

This type of handling is used to move the packed machine.



WARNING! Always check where the forks rest under the box.

To lift with a forklift, follow these steps:

- Insert the fork of the truck under the wooden box, taking care that they protrude from the opposite side.
- Lift the machine slightly and make sure that the load is in balance.
- Lift the machine to the minimum and move it away without jolts or shocks.
- Place the box at the designated location.
- Remove the forks from under the box.



Fork insertion



Fork insertion



WARNING!

- Unloading, lifting and handling operations must be carried out by qualified personnel specially prepared for these operations.
- Prevent multiple people from working on the machine at the same time without coordination, resulting in a hazardous situation.
- Make sure the dimensions, weight and centre of gravity of the machine and its packaging.



The packaging must be lifted with a forklift truck that has the capacity and length of the forks appropriate to the nature of the load to be handled.

During the use of the forklift truck the operator must also:

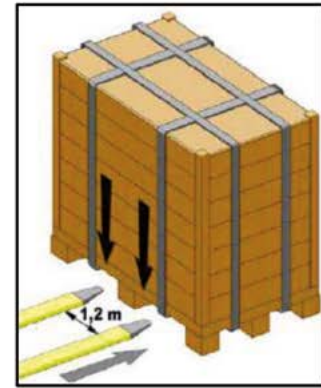
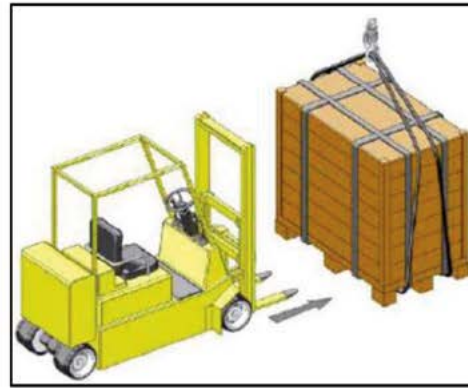
- check that the packaging is balanced.
- lift the packaging far enough to move it.

WARNING! During the transport, protect the packaging from overturning.

WARNING! In any case the packaging must never be transported, stocked or stationed in an oblique position.

| Slinging method | Type of sling | | | | |
|--------------------------------|------------------|--------|-----------------------|------------------|--------|
| | Sling single leg | | Sling of two legs (*) | Sling double leg | |
| | simple | double | | simple | double |
| VERTICAL | | | | | |
| CHOKER HITCH | | | | | |
| DOUBLE WRAP CHOKER HITCH | | | | | |
| SINGLE/TWO SINGLE BASKET HITCH | | | | | |
| DOUBLE WRAP BASKET HITCH | | | | | |

(*)the illustrations and definitions of the two-leg sling also apply to the three or four-leg sling



4.3 UNPACKING

Once the machine has been unloaded from the means of transport, unpack it according to the following procedure:

1. Remove the optional cardboard box strapping (if equipped);
2. Remove the top cover of the wooden case using a hammer with a nail puller;
3. Now remove the side covers;
4. Remove the screws that secure the machine to the pallet.



WARNING! Always wear hand protection gloves. Always pay close attention to any protruding nails.

All packaging elements must be collected and sent to collection points for proper recycling.

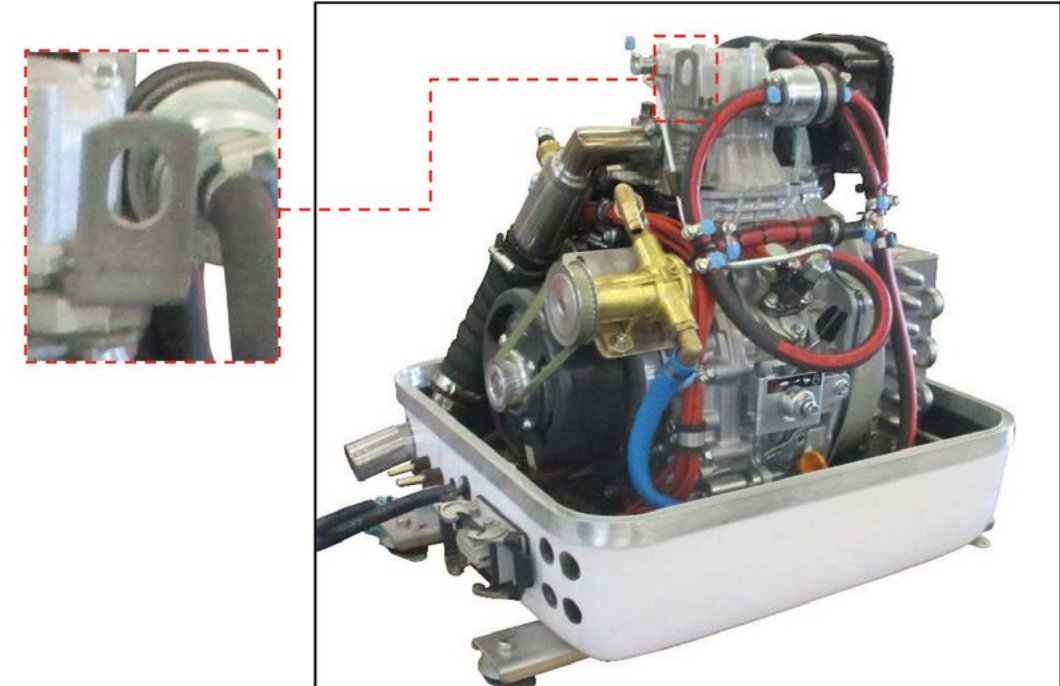


4.4 HANDLING THE UNPACKED MACHINE

Once unpacked, the machine can be moved with a suitable lifting device capable of withstanding its weight and dimensions (shown in the table in para. 1.2 "Technical specifications") in such a way as to avoid damage to the same, to persons or to surrounding things.

Follow these guidelines:

- Remove the silicone elastics on all sides of the machine.
- Remove the 2 upper guards and place them in a safe place.
- Sling the machine using a suitable lifting device (e.g. hoist) of suitable capacity, attaching the chain in the lifting eye provided on-board the machine.



Paguro 4 MY / 5.5 MY lifting points

- Tension the rope/chain slightly and check that it does not exert any pressure on the structure or components of the machine. Failure to wait for this point can cause serious damage to the machine.
- Slowly lift the unit.
- Place the machine at the designated installation point.



WARNING! The machine can ONLY be raised and moved using the eye bolt provided on the machine. Do not put ropes or forks under the machine. Risk of damage!

WARNING! When lifting, pay attention to load swaying.

4.5 STORAGE

If there is a possibility that the machine will not be installed immediately, but has to be warehoused for a prolonged period of time, the storage must take place in a sheltered environment, with a degree of protection appropriate for the installed components. It is especially necessary to:

- check that the surface on which the machine will be positioned is able to support it adequately and that it is completely level;
- always insert wooden platforms or other suitable platforms between the floor and the machine to prevent direct contact with the floor surface;
- cover the machine with a sheet of plastic in order to protect it from dust, humidity or other elements that could compromise its proper functioning;
- take the appropriate circulation and manoeuvring space to allow staff to carry out components harness and lifting operations of the machine comfortably and safely.

4.6 SHIPPING

Dispatch of the machine can be made choosing from these different solutions:

- Transport on wheels (truck).
- Air transport.
- Sea transport.
- Train transport.

Choose among the different means of transportation will be agreed between buyer and seller when they have stipulated the contract.



4.7 INSPECTION ON ARRIVAL

Upon delivery check that the packaging is intact and visually not damaged. If everything is intact, remove the packaging (unless otherwise instructed by VTE S.r.l. company). If you note damages or imperfections:

- Inform immediately the transport company and your agent, both by phone and written communication with return receipt.
- Acceptance of the material transported with reservation is to be carried out, since it is necessary to verify its integrity.
- Inform, for knowledge, the VTE S.r.l. company as mentioned above addressing your letter to:

VTE Srl

Via Luciano Lama, 5 - 33050 Fiumicello (UD) - Italy

Tel. +39 0431 96488 - info@volpitemcno.com

www.volpitemcno.com

5. Installation of the machine

5.1 SET UP FOR INSTALLATION



Installation and commissioning of the generator must be carried out by a qualified technician or an authorized company.

It is the task of the installer to provide an area suitable for the overall dimensions of the machine and to carry out the necessary interventions for the correct and safe installation of the machine.

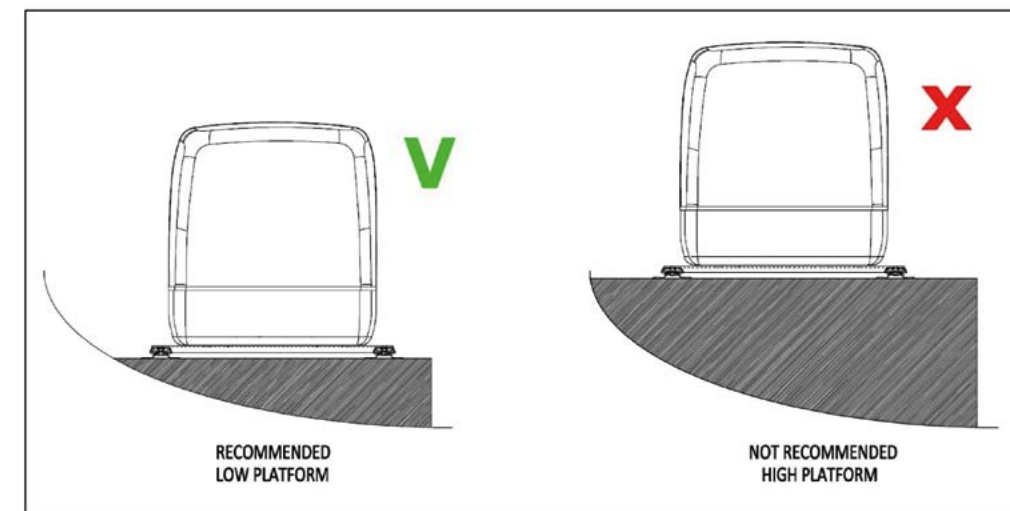


In the event of non-compliance with these indications, VTE S.r.l. will not be liable for any damage to the machine or any subsequent performance that does not meet the technical specifications provided.

5.2 FIXING THE MACHINE

For correct machine functionality, a solid support must be provided to allow the machine to be fixed on board the boat. The support can be made of metal, wood or glass fibre, and must meet the following conditions:

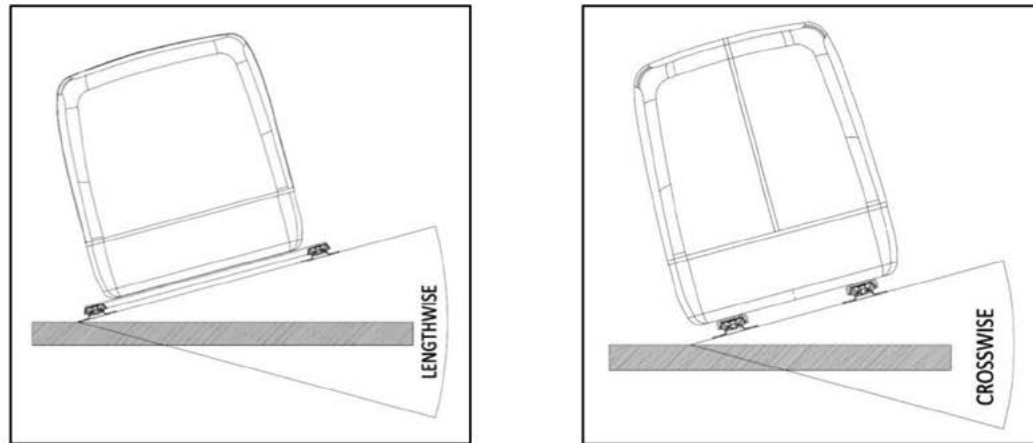
- being as low as possible, in order to avoid the occurrence of vibrations.



- maintaining the machine horizontal.

However, the following maximum inclinations are permitted if horizontal positioning is not possible due to lack of space on the boat:

- Longitudinal: 20°
- Transverse: 25°



If possible, position the machine away from any splashes of water and vapours.

Choose a location that allows proper ventilation and easy access for maintenance.
If necessary, in order to reduce the vibrations generated by the endothermic engine, install a wooden platform under the machine, which is in turn installed on soft anti-vibration supports (see par. 2.5 “Vibration emission”).

5.3 VENTILATION

Before proceeding with the installation of the machine, it is necessary to consider the need to allow a correct flow of combustion air to the engine.

The hot air tends to go upwards, therefore the introduction of fresh air must be ensured in a low area of the machine compartment and consequently the correct outflow of the hot air in a high area of the same compartment must be ensured.

The minimum distances to obtain correct ventilation of the machine are indicated in par. 2.2 “Minimum air change distance”.

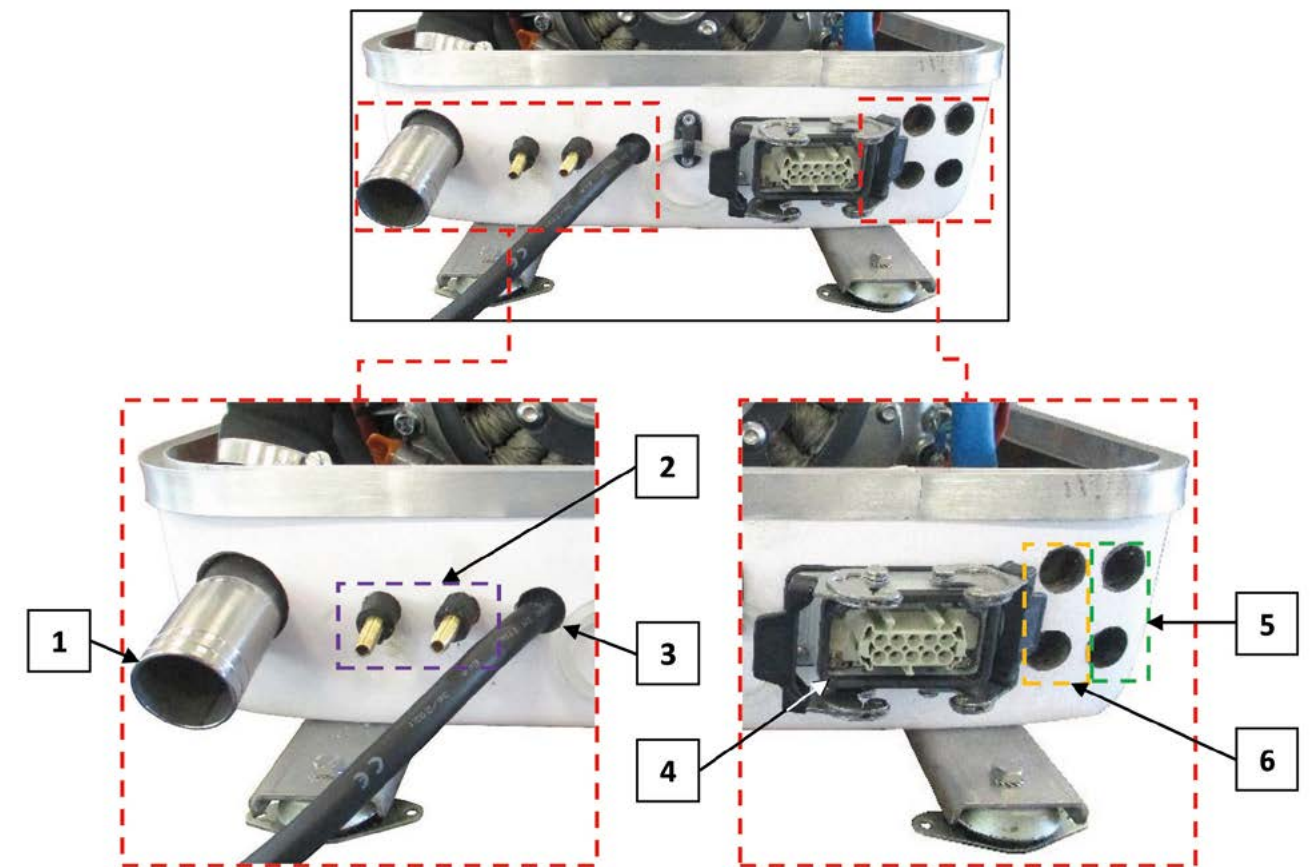
In order to ensure optimum air recirculation, it is also necessary to leave free the small ventilation holes provided on the bottom of the soundproofing capsule (lower protection) in order to allow the comburent air to pass from below.



Example - Lower capsule (internal side)

5.4 EXTERNAL CONNECTIONS

The location of the external connections is shown in the images below. The various connections must be made with suitable diameters (as indicated in Chap. 1 “TECHNICAL SPECIFICATIONS”) not only to avoid leaks and drips, but also to avoid unnecessary openings of the silencing capsule with



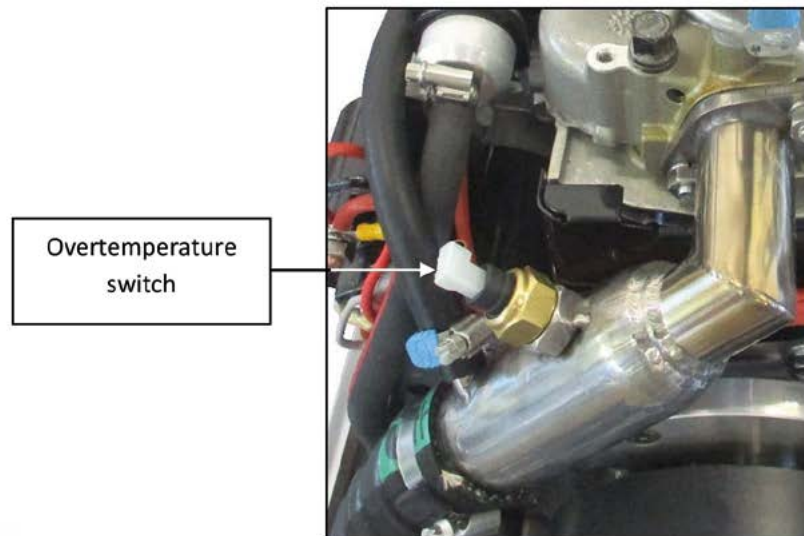
Connections Paguro 4 MT / 5.5 MY (front side)

Key:

1. Gas/water mixture exhaust;
2. Diesel fuel supply and return;
3. PMG (permanent magnet alternator) cable outlet;
4. Multipole connector external inverter;
5. Battery positive and negative;
6. Siphon-break output and input.

5.5 EXHAUST SYSTEM INSTALLATION (on request)

The machine is supplied as standard with an exhaust, combustion gas and sea water terminal, on which an overtemperature switch is installed.

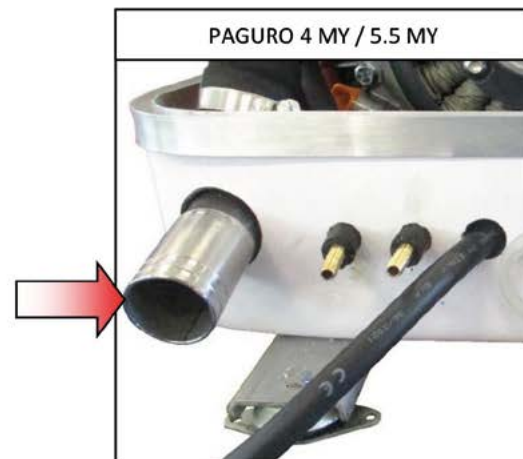


Exhaust terminal



It is the responsibility of the installer to design and install a suitable exhaust system in order to avoid water returning to the engine with any sea conditions and any inclination of the boat.

Connect the drain terminal with a water approved tubing and pass the drain system through the hole in the machine bottom capsule, as shown in the picture.



Holes for exhaust system piping passage



The installer MUST have a basic knowledge of the requirements of marine generator installations, safety systems and seawater cooling systems.

Incorrect installation and design of the exhaust line can cause severe damage to the generator, potentially causing the boat to sink.

The VTE S.r.l. warranty does not cover errors and inaccuracies in the installation of the exhaust line.

VTE S.r.l. recommends the installation of the exhaust line of the "in-line" mufflers.

The first (waterlock) anti-siphon muffler must be installed in a lower position than the machine, in order to prevent water from returning to the engine and to block the water in the subsequent pipes once the machine is stopped. It is necessary to design the exhaust line so that there is a suitable jump between the exhaust manifold and the boat passageway (end of the exhaust line).



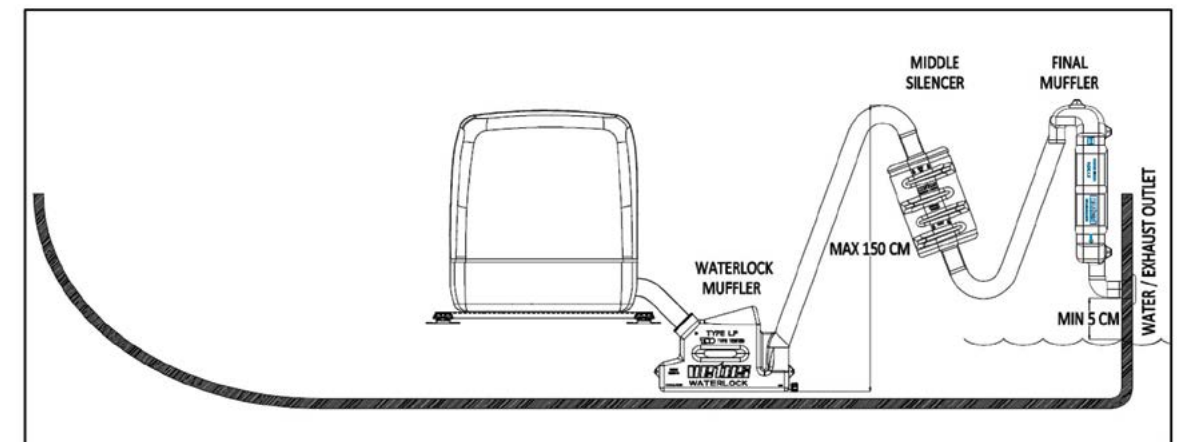
WARNING! An exhaust line that is too long and/or has an incorrect slope can cause water to return to the engine when the generator is switched off. The exhaust line connections must be secured in such a way as to avoid any dripping.

The exhaust gases are fatal. Install a carbon monoxide warning near the machine and in a clearly visible position.

5.5.1 Traditional system

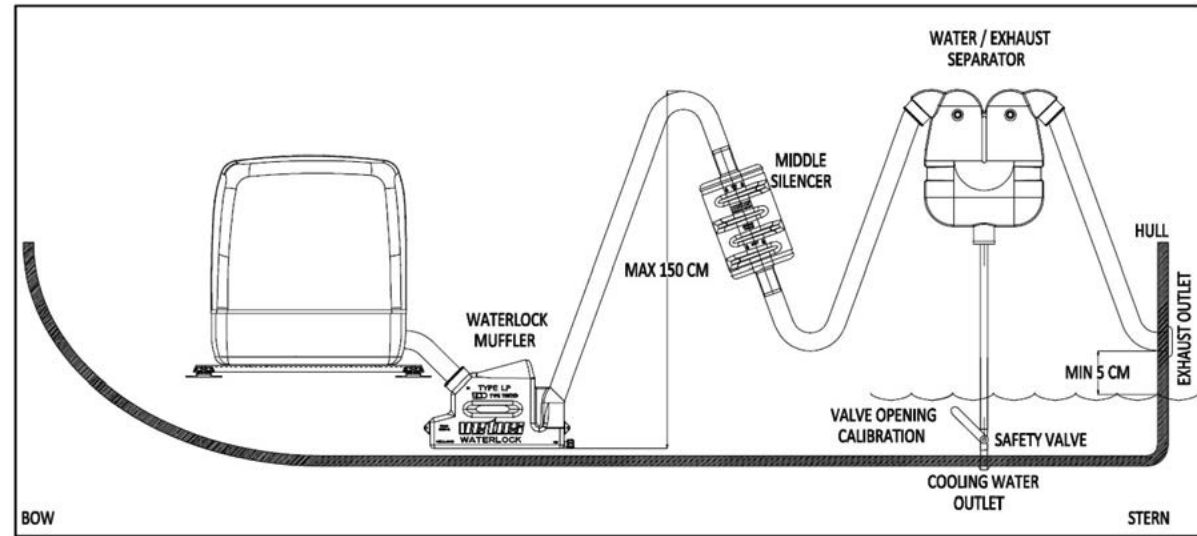
To achieve a good reduction in exhaust line noise, N.3 exhaust mufflers should be installed:

- the first, anti-siphon (waterlock) prevents the return of water to the machine and reduces the acoustic emission by 50%;
- the second, intermediate silencer, reduces the acoustic output by a further 20%. The intermediate silencer must be installed according to the slope shown in the diagram below in order to avoid excessive water return to the unit;
- the third, terminal, reduces the acoustic emission by 10% and prevents the entry of external water following waves and sprays, etc...



Traditional Plant diagram

An additional benefit to exhaust silencing at the outlet is obtained by installing the end separator according to the diagram on the following scheme. With the separation of the gas from the water to the discharge hole, the waste of water, which derives from the water sprayed in a discontinuous way from the traditional plants, is eliminated, eliminating the typical noise of the boats.



Traditional Plant diagram

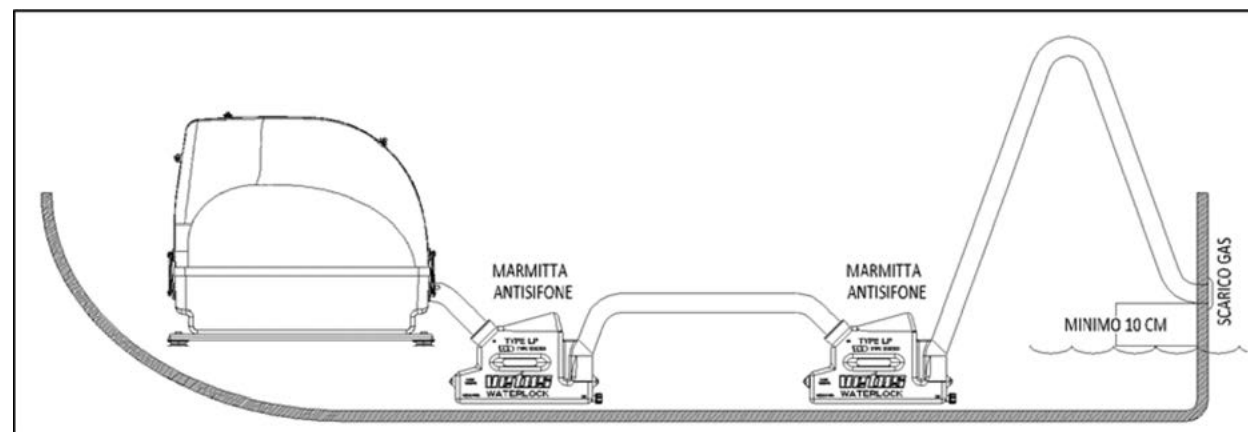
In order to prevent water from returning to the engine, the anti-siphon muffler must be installed in a lower position than the generator, so that the exhaust pipe between the machine and the muffler has a downward slope. It is in fact necessary that there is a slope and the flow of water from the machine has a natural and forced downward path, so that when the machine is switched off, the cooling water present flows back toward the muffler.



The pipe from the machine to the anti-siphon muffler must be as short as possible (but not less than 30 cm) in order to reduce exhaust noise.

5.5.2 On-board system with space shortage

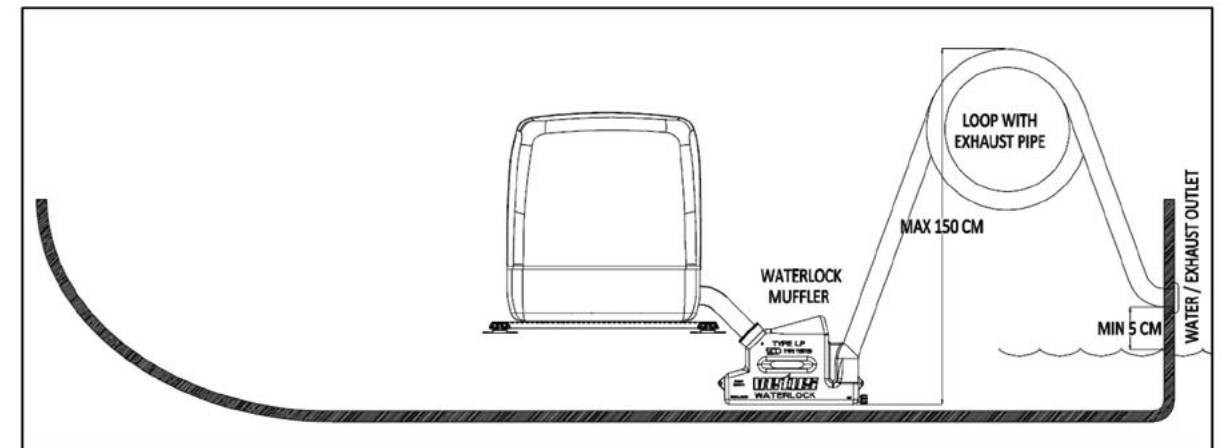
In case of absolute lack of space for the installation of the mufflers, the realization of the loop with the exhaust pipe (see figure below), and anti-siphon muffler, ensures a good reduction of the acoustic emission and at the same time protects the machine from sea water inlets.



System diagram with lack of space

5.5.3 On-board system with long exhaust line

In the case of a very long exhaust pipe, it is recommended to use an exhaust system with a double anti-siphon muffler (see picture below). Due to the large amount of water in the exhaust line, the second anti-siphon muffler protects the machine from water return.



System with long exhaust line diagram

5.6 INSTALLATION OF THE SUPPLY SYSTEM

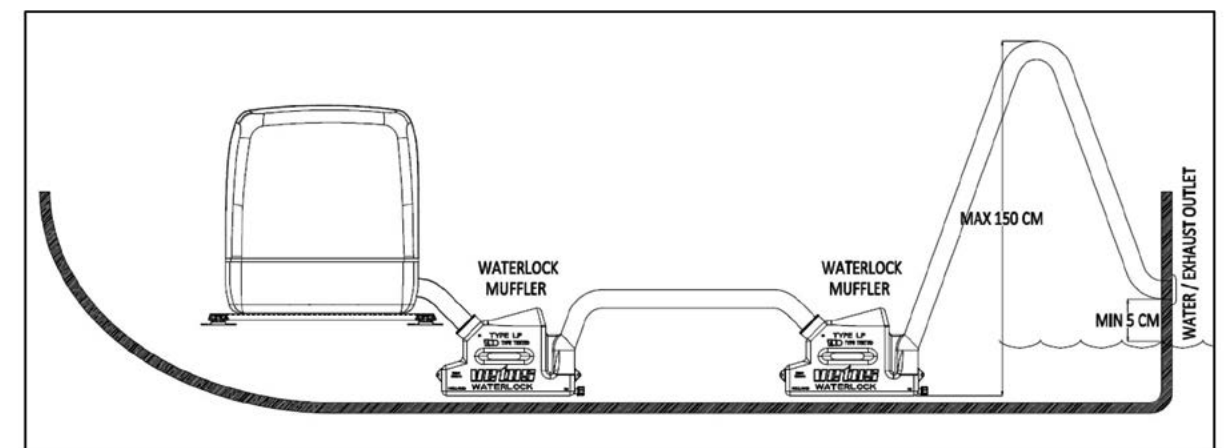
The machine is powered by diesel fuel via the two (FUEL IN - FUEL OUT) fuel supply pipes on the lower capsule. DO NOT use other types of fuel.

DIESEL FUEL SUPPLY:

The machine is usually connected to the main diesel tank of the boat. In this case, the machine supply line must come from its own connection on the tank and not through a T on the propulsion engine supply pipe. The pre-fuel pump on the engine is capable of drawing up diesel fuel to a height of 1 meter without length restrictions.

DIESEL FUEL RETURN:

The diesel return line must be connected to the top of the tank in the same way as the supply. This must be done when the tank is located under the machine. This precaution will help prevent starting difficulties due to deaeration of the system.



System with long exhaust line diagram

NOTE: The injection pump of the machine is a self-draining pump. This means that if the engine is shut down due to lack of fuel, after filling the tank, there is no need to purge the air manually, but it is sufficient to operate the lever of the pre-fuel pump.

NOTE: The engine is protected by a subtle fuel filter contained in the sound-absorbing enclosure. However, it is mandatory to fit an external filter with water separator to protect the life of the engine.



Use only clean diesel fuel. The tolerance of the injection pump components is very critical; invisible dirt particles, which may pass through the filter, may damage this element. It is important to only fill it with clean diesel fuel and to keep it clean.

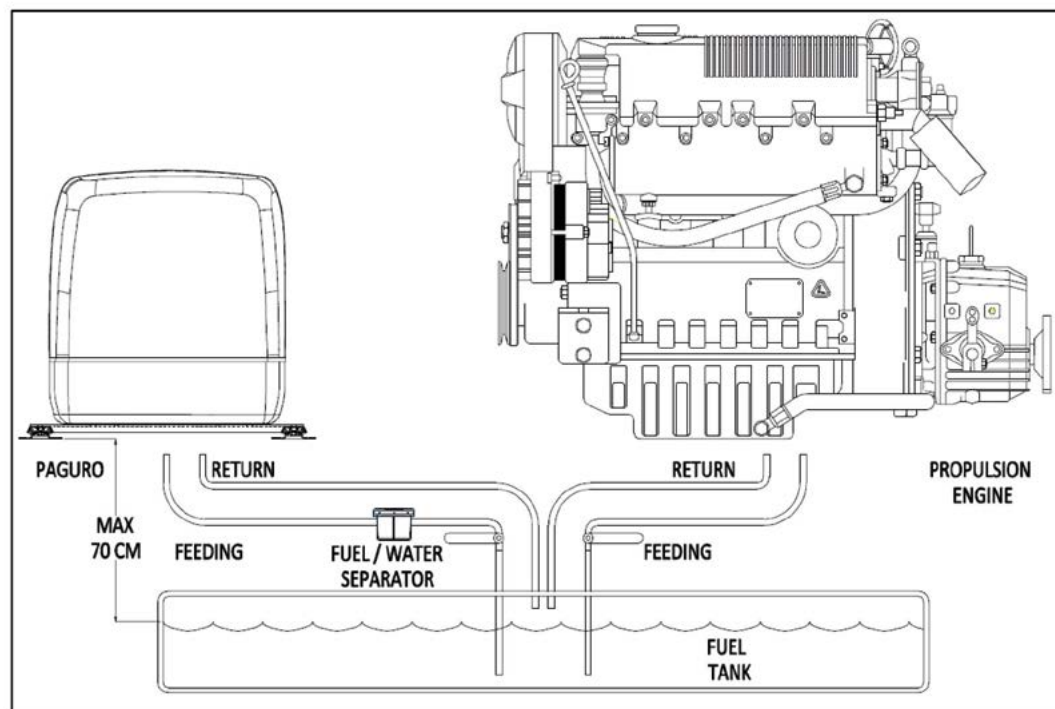


The best fuel can become harmful if used or stored in unsuitable tanks. To make sure that your diesel fuel is clean and pure, it is recommended that you purchase fuels from well-known brands.

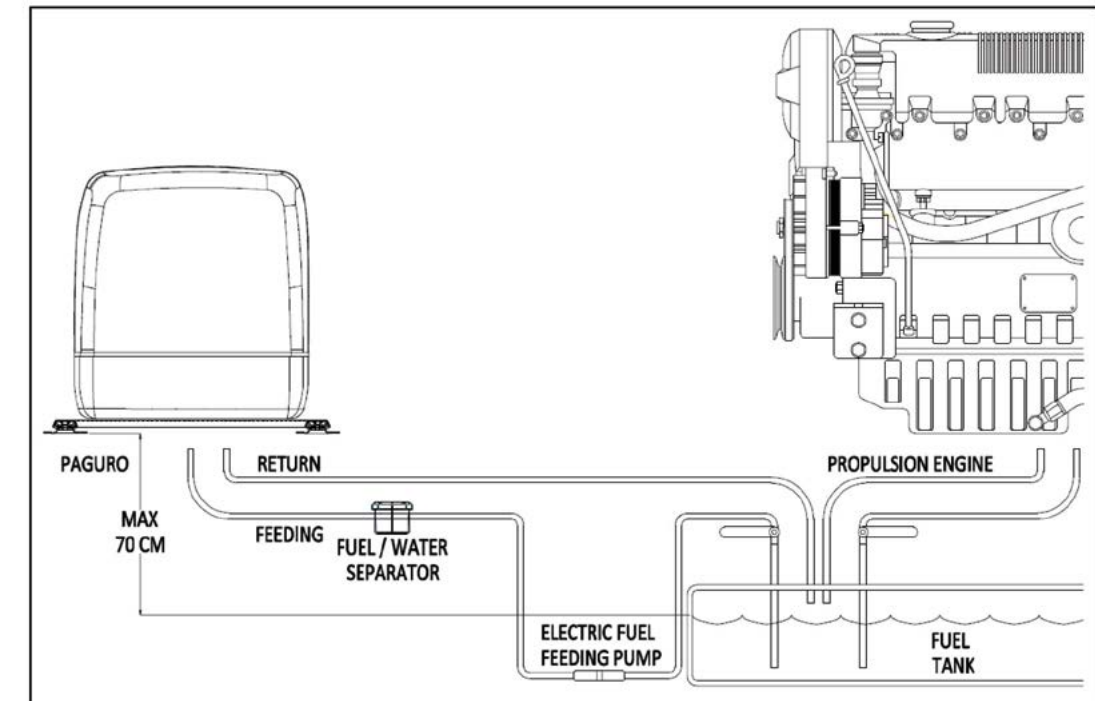


A good diesel/water separator filter must be installed between the tank and the machine and serviced regularly.

DIESEL SUPPLY AND RETURN DIAGRAM WITH MACHINE LEVEL IN RELATION TO TANK \leq 70 CM (example)



DIESEL SUPPLY AND RETURN DIAGRAM WITH MACHINE LEVEL IN RELATION TO TANK \geq 70 CM (example)

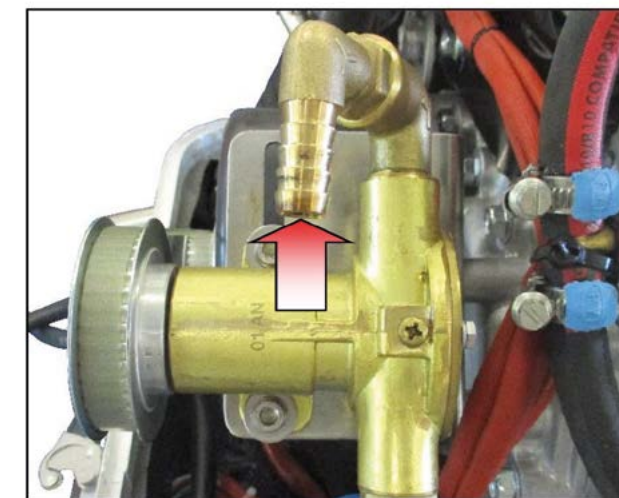


5.7 INSTALLATION OF THE COOLING SYSTEM

The water flow is generated by a belt-driven seawater pump connected to the drive shaft and pulley. The pump draws cooling water directly from the sea/lake/river through the sea water inlet.

The water is conveyed from the pump to the heat exchanger, where it is used to cool the air. The cooled air is then let circulating to cool the generator components. Lastly, the water passes to the internal jacket of the terminal where it mixes with the exhaust gases and then is expelled.

The installer provides for the connection of the tube, which adheres the sea water, to the pump by means of the attachment indicated in the figure below.



Sea water pump

5.7.1 Anti-siphon valve

If the generator is installed below or near the waterline (refer to external anti-vibration dampers), an anti-siphon valve must be installed between the cooling water supply and the water-cooled drain terminal.

The anti-siphon valve prevents water from entering the engine through the water pump when the engine is installed near or below the waterline, even considering the boat moving.

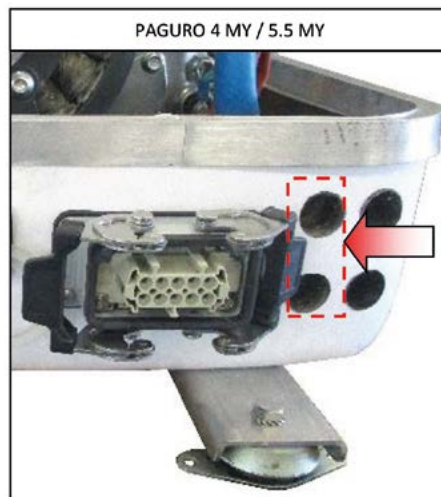


Failure to use the anti-siphon valve, when the external vibration dampers are close to or below the water line, causes water to enter the engine, resulting in damage and possible flooding of the boat. If in doubt about the position of the external anti-vibration dampers, install an anti-siphon valve.

The anti-siphon valve SHALL BE INSTALLED ABOVE THE WATERLINE at a minimum height of at least 50 cm; 2 pipes of a diameter of 19 mm and of the appropriate width shall be connected thereto, of which:

- one, coming from the sea water pump outlet.
- the other, to be connected to the oil refrigerant.

The connection pipes enter and exit the soundproofing capsule through the holes provided for this purpose.



Holes for passage of anti-siphon valve supply and return lines



The anti-siphon valve requires periodic inspections and cleaning to ensure proper operation. Failure to maintain the anti-siphon valve properly can result in irreversible damage to the machine.



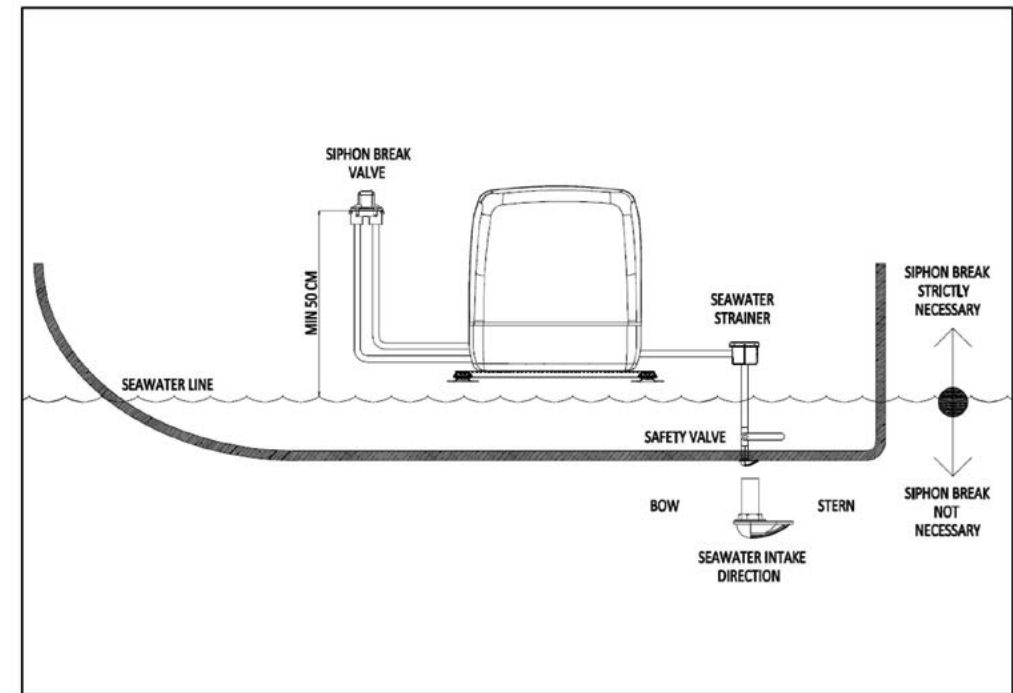
Consult the manufacturer of the anti-siphon valve for proper scheduled maintenance.

5.7.2 Sea water inlet (on request)

VTE S.r.l. recommends the "grid" type of sea inlet.

This inlet must be installed in the NON-DYNAMIC direction, i.e., façades of grids in the stern direction and round-off side closed toward the bow, on the hull, under the waterline, considering all possible inclinations of the boat.

NOTE: If the water inlet is installed in the DYNAMIC direction, pressure is generated inside the circuit, causing the drainpipe to be filled with water and consequently in the engine.



Sea inlet diagram



The machine can also be installed completely below the waterline; in this case the siphon-release valve must be inserted from the capsule and connected with pipes to the delivery of the cooling pump.

5.8 ELECTRICAL CONNECTION

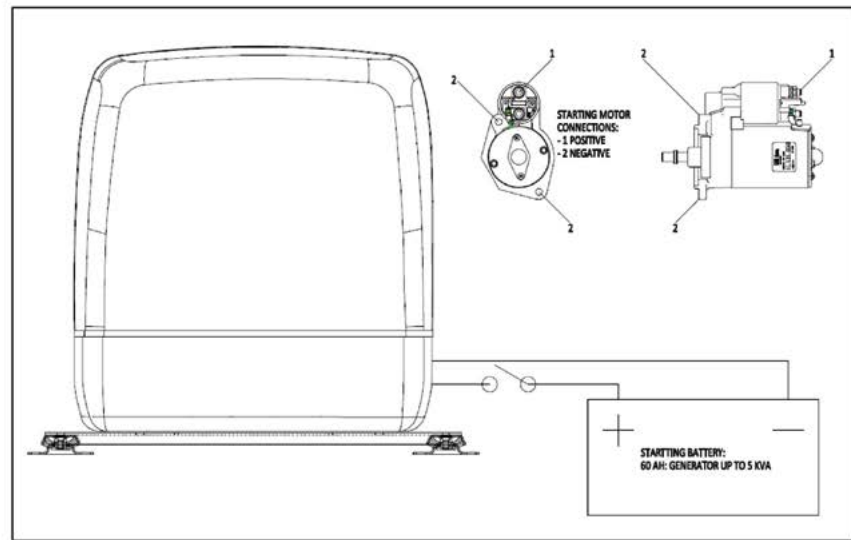
5.8.1 Connection to start-up battery

The machine must be connected to a dedicated start-up battery.

The standard supply is for the negative pole connected to ground. The dedicated 12 V battery for starting the machine must not be less than 60 Ah.

Connect the positive (+) battery cable to the positive of the starter solenoid where a thin red cable is already attached, and the negative (-) cable to one of the two screws securing the starter motor to the motor bell housing, where a lifting eye is already provided.

The machine has a secondary output voltage for charging the start-up battery (max. 8 A).



Start-up battery diagram

5.8.2 External Installation - Main voltage connection

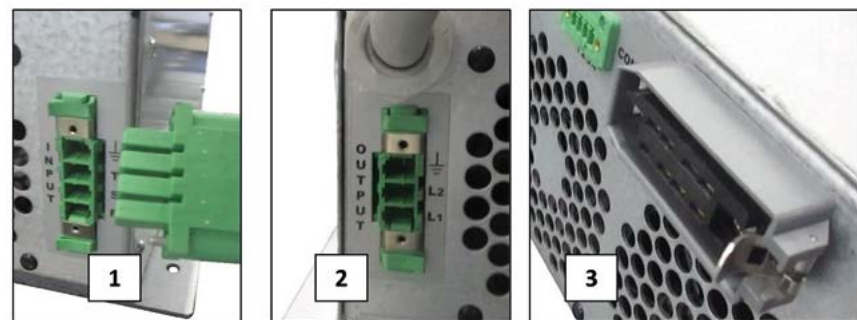
The main voltage is connected to the inverter installed outside the generator (recommended distance from the generator: 1.5 m).

The installation of the inverter on the bulkhead is done by fastening with suitable anchor bolts on brackets (as shown in the figure below). The mechanical installation is of the vertical wall type, as shown in the figure.



Inverter

The following pictures show the connections available on the equipment.



Key:

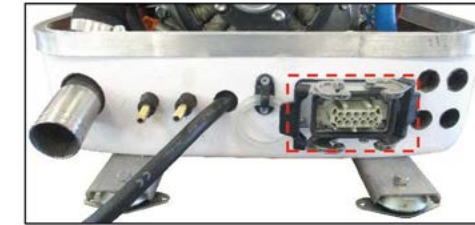
1. Inverter input socket;
2. 220 V output socket;
3. 8-pin socket for remote control panel connector.

The electrical connection of the generator with the inverter requires:

- a. Plugging the multipolar connector of the inverter into the corresponding socket installed on the generator;

Multipolar socket on-board the machine

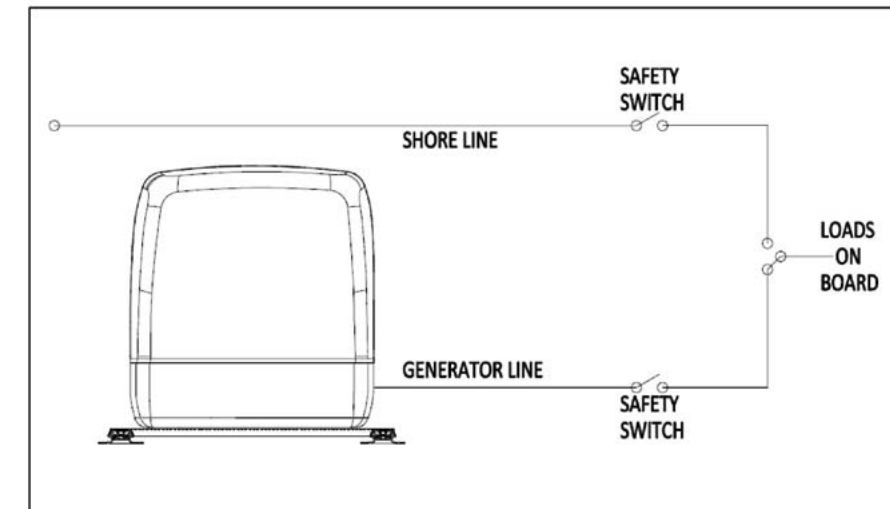
- b. Inserting the three-phase cable into the inverter input socket (1);
- c. Inserting the supplied connector into the inverter output socket (2); this connection allows connection to the on-board system;
- d. Inserting the connector of the remote control panel into the inverter socket (3).



Inverter Paguro 4 MY / 5.5 MY (lower side)

5.8.3 Power system 220 V

Since most boats have a 220 V system that is also designed to be powered by the quay's current, it is absolutely essential to prevent the machine line and the ground line from being connected at the same time, otherwise the alternator will be severely damaged.



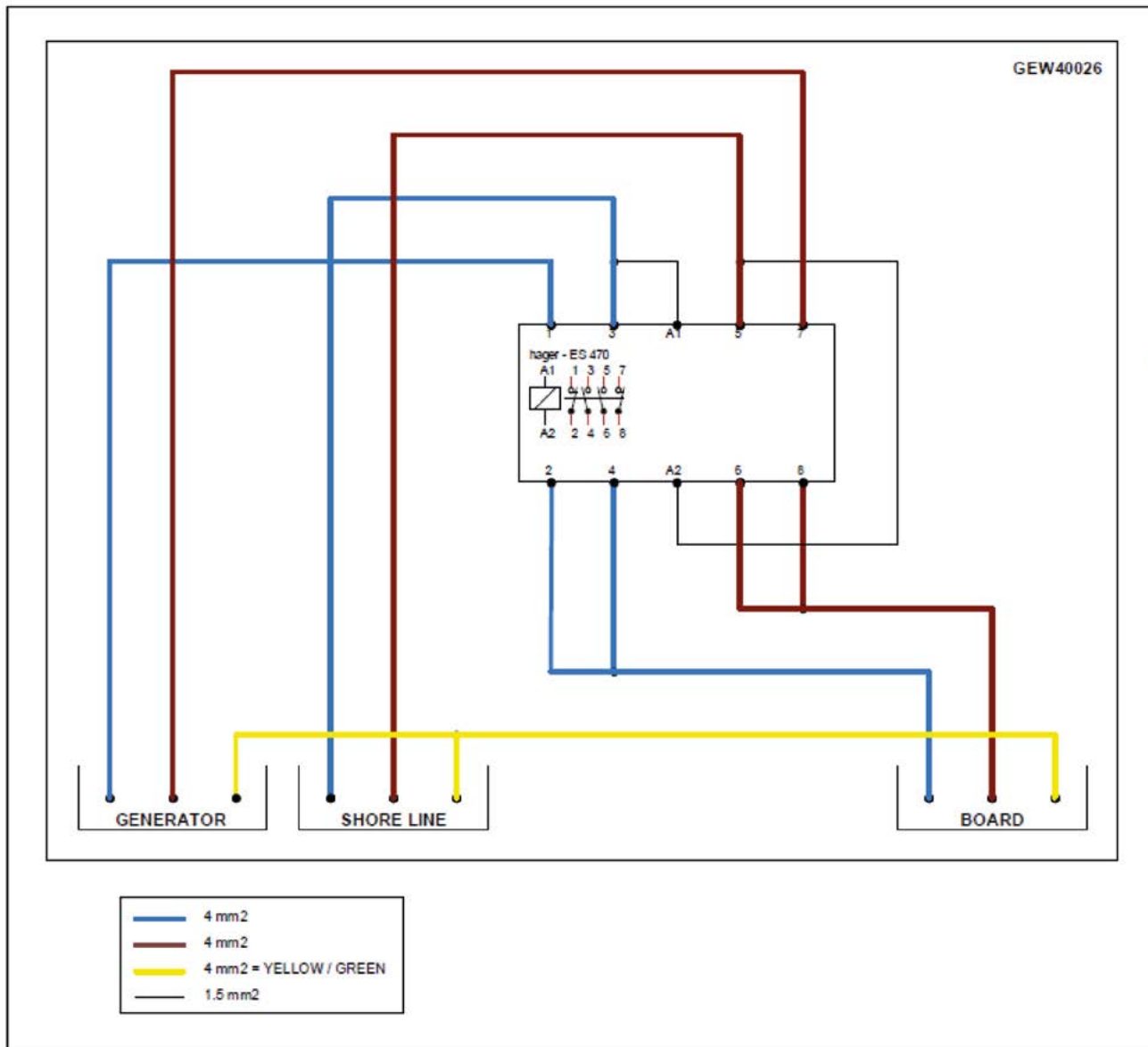
Electrical connections

A manual or automatic switch must be installed between the two inputs to separate and alternate the two supplies. This allows you to select whether to power on-board electrical loads from the machine or from the quay network.

| | Tension (220 V) |
|---------------|-----------------|
| PAGURO 4 MY | 15 A |
| PAGURO 5.5 MY | 19 A |



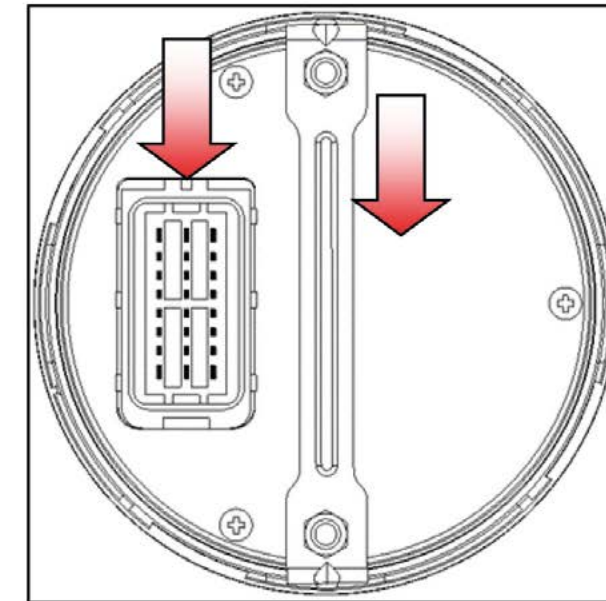
When switching between the quay current and the machine (and/or vice versa) switch off the AC loads to avoid damaging the machine itself.



Both entries, or at least that of the machine, must be protected by a safety magnetothermal circuit breaker installed on the main distribution board.

5.8.4 Remote control connection

The standard supply is a remote control panel with a 15 m cable, so that it can be used in any part of the boat provided it is protected from weather. The cable has a quick connector on both sides. To connect the remote control to the machine, insert the multipolar socket on the remote panel to the corresponding socket on the lower guard of the machine.



Control panel multipolar socket – Rear side



8-pole connector socket

For a description of the functions on the operator panel, refer to Chap. 8 "REMOTE CONTROL PANEL".

5.9 PRELIMINARY CHECKS

After installation, and before commissioning the generator, a series of checks must be carried out in order to prevent errors and accidents:

- Check that the machine has not been damaged during transport and installation;
- Make sure that there are no loose or missing parts, disconnected cables, or disconnected pipes;
- Check that the machine is correctly secured to the support on board the boat;
- Check that the inverter is correctly secured to the external wall;
- Check that the connections are secure;
- Check the engine oil level. If necessary, add oil to maintain the maximum level on the dipstick.
- Check that the following shut-off valves are open:
 - Cooling sea water;
 - Fuel intake;
 - Fuel return.
- Open the diesel supply and examine the diesel/water separator filter for contamination;
- Check that there are no fuel leaks;
- Check the DC electric system. Check the cable and battery connections;
- Check that the on-board main switch is off;
- Check that the switch is in the GENERATOR position;
- Open the sea inlet valve;
- Check that the exhaust system is safe and that all connections are secured;
- Ensure that there is good ventilation and the correct amount of air;
- Make sure that the external vibration dampers of the machine are well aligned;
- Ensure that the 220 V voltage cables are properly connected;
- Ensure that no other machinery or energy sources are connected in the same line;
- Check the integrity of the pictograms and signals on the machine;
- Check the integrity of the remote control panel with particular care.

5.10 TESTING

The test was carried out at the company VTE S.r.l., where all the mechanical calibrations and the size measurements were made.

6 Installation errors

Very frequently, during the first period of operation of marine generators of all makes, models and sizes, seawater backflow into the engine oil sump can be observed, resulting in damage of varying degrees. The repair of such damages is not covered by the warranty, as they are caused by an incorrect on-board installation that does not take into account certain general physics rules.

The following paragraphs list the most common errors that can occur and that are recommended to avoid.

6.1 SEA INLET

- The sea inlet of the cooling circuit, oriented in the direction of travel of the boat, causes a dynamic pressure of the water when the boat is moving, such as to overcome the cooling pump. As a result, the water fills the drain tube, reaches the engine head and flows into the lubricating oil.

- If the hull is planing, or in any case reaches high speeds, or tends to go down the stern, even a neutral sea inlet can cause a certain dynamic pressure that triggers water entry.

NOTE: To avoid these risks, the sea inlet must be positioned in such a way as to cause vacuum in the cooling system, but in critical cases it is always advisable to close the safety valve when the machine is not in operation.

6.2 WATERLINE

- Installation below the waterline without the fitting of an appropriate siphon-de-priming valve.

- If the base of the machine is positioned below the waterline, it is necessary to provide a siphon-de-priming valve which is formed by the effect of communicating vessels; otherwise, the natural cooling pump blow-by allows the exhaust pipe to fill and enter the engine. The waterline must be considered when navigating, the position of which at the stern can rise significantly compared to the position of the boat at standstill.

NOTE: The valve must be positioned outside the machine in the highest position possible, but in any case, at least 50 cm above the waterline and must be connected, by interposing it to any pipe of the cooling circuit, in the delivery zone of the pump, suitably extending the relative pipes. The soundproofing capsule must be drilled in the most suitable position to allow the pipes to come out. Each model of Paguro generator may require a different optimal position, but any piping in the pressure zone is suitable for the purpose.

6.3 EXHAUST LINE

- An excessive length, or unfavourable slope of the drain line, holds and flows toward the engine, during stopping, an excessive amount of water that the anti-siphon well cannot contain and block.

- The anti-siphon/muffler well is constructed to retain a return of water of a couple of litres, but larger amounts can overflow to reach the engine. In this case, an alternative way should be sought to reduce the length of the exhaust, or a larger well installed.

- When determining the drain path, the slope which allows spontaneous drainage toward the external outlet of the contained water must be preferred.

- In any case, to ensure that the installation has been carried out correctly, especially during the first season of the generator operation, it is recommended to check the integrity of the lubricating oil frequently by checking the dipstick.

Regardless of the quantity, which must obviously be correct, the colour of the oil indicates whether water is present:

- Transparent yellow indicates that the oil is new.
 - Black indicates that the oil has turned for a few hours.
 - White opaque milk indicates the emulsion with water; in this case the level indicated by the dipstick may also rise.
- A further indication of the presence of water in the engine comes from starting difficulties, since the exhaust valve forms a film of rust which reduces its sealing by decreasing compression.
- During the starting phase, by spraying a small amount of lubricating oil through the intake of the engine, it is almost always possible to start it, after which, due to the effect of the operation, rust, if superficial, is cleaned spontaneously. The operation is more likely to be successful if starting with the oil is carried out with the automatic decompression system engaged, since the engine performs a series of idle revolutions before compression, allowing the oil to be distributed over the whole area concerned.

If the engine is not started, the water has been left in the engine for too long, blocking one or more piston rings.

- In some cases, the engine will not start for external reasons such as:

- Lack of fuel;
- Air bubbles in the pipes;
- Clogged filter;
- Low battery;
- Etc...

During these attempts, the cooling pump sends water to the drain, which is not conveyed to the outside, thus missing engine outbreaks. If the engine eventually starts, everything will be resolved with a strong initial water leak. However, if the start-up attempts are unsuccessful, the drain tube must be drained and completely emptied of trapped water.

- When the installation is carried out correctly without compromise and the system is kept under control especially in the first season of operation, the necessary maintenance is reduced when the seasonal oil is changed and, when necessary, the diesel filter and the pump impeller.

- However, there are definable operations of "wintering" useful even when the machine remains inactive for several months which prolong its operating life and the maintenance of performances over time. Due to the difference in temperature between day and night, the residual water in the drain forms condensation which, in the long run, is deposited on the valves and piston of the engine, favouring blockages and loss of compression.

- By spraying oil into the engine intake, before idle periods, and turning the starter crank idle, care should be taken against these risks.

It should be considered that on marine engines used for such constructions, there are no critical areas between circuits crossed by the water and the blast zone, without an air gap communicating with the outside being interposed; in the event of a leak, water drips or spits out but cannot enter the engine.



IMPORTANT! The Manufacturer VTE S.r.l. is available to answer any question concerning particular installation situations, suggesting the safest method also with alternative conditions to the traditional marine ones.

7 Start and stop procedure

7.1 CHECKS TO BE CARRIED OUT BEFORE STARTING

Before starting, the following checks must be carried out:

1. Check that all connections inside the soundproofing capsule are not dripping/leaking;
2. Check that the cooling water is drained in the correct manner;
3. Check for strange and unusual noises.

Once these checks have been carried out and the correct operation has been verified, the upper guards of the capsule can be closed, making sure to make the 2 halves fit together correctly and to lock them in place using the appropriate silicone rubber bands.



Control panel

7.2 START-UP PROCEDURE

Keeping the "START" button pressed, the machine starts automatically. Release the "START" button only when the machine starts.

WARNING! All AC loads must be disconnected before starting. This precaution is used to prevent possible damage to the application of loads when the engine is cold.

NOTE

If a start attempt fails, reset the circuit by pressing the "STOP" button.

Apply 1/3 load to the machine and allow the engine to warm up before applying heavy loads.



WARNING! Repeated attempts to start without cranking result in water filling in the exhaust line, resulting in engine damage.

This is caused by the sea water pump which circulates the cooling water, but since the burned gases are not present, the water fills the exhaust line until it enters the engine.

Prevent the problem by emptying the exhaust line at the level of the anti-siphon muffler.

The warranty does not cover damage to the machine caused by water entry and return.

After the machine has been started, apply small loads for heating. If possible, apply loads not all at once.



WARNING! It is recommended that the machine is not operated for extended periods without any load applied.

7.3 RUNNING-IN OF THE MACHINE

After the machine has been started, check for correct operation and then promote rapid warm-up. Operate the machine no more than 70% of the load for the first 50 hours.



WARNING! Do not run-in the machine while operating it without electrical loads.

After the first 10 hours of machine operation, loads can be increased to the maximum. Then periodically vary the loads. Avoid overloads at all times. An overload is indicated by:

- the red LED of the load indicator on the remote control lights up;
- black smoke from the exhaust;
- abnormal voltage (V) and frequency (Hz) values.

It is recommended to monitor the electrical current produced by the machine and keep it within the stated limits.

To protect the machine from accidental overloads, a safety thermal switch must be installed on the main distribution board.

7.3.1 Check list

Follow the following check-list every day before starting the machine:

- Record the number of hours on the hour counter installed on the remote control (operating hours in relation to the maintenance table);
- Visually inspect the machine for diesel fuel, oil or water leaks/drips;
- Check the engine oil level through the dipstick;
- Check the fuel system;
- Check the condition of the starter batteries (weekly);
- Pay attention to any strange or unusual noises or vibrations;

- Check the colour of the smoke:
 - WHITE SMOKE: When the engine is cold;
 - LITTLE SMOKE: When the engine is warm;
 - BLACK SMOKE: When the engine is overloaded.
- Check that the cooling water is drained outside the boat in the correct manner.



After the first 20 hours of operation of the machine, check the maintenance table (par. 10.2.7) for the correct maintenance operations to be carried out.

7.4 STOP OF THE MACHINE

To shut down the machine, follow this procedure:

1. Disconnect the AC loads one at a time and keep the machine running for a further 3-5 minutes in order to stabilize the temperature;
2. Press the "STOP" button on the remote control to stop the machine. The shutdown is automatic;
3. Check the oil level a few minutes after the engine is switched off, because the engine oil in the system continues to drain into the oil sump. Neglecting this operation and not maintaining the correct oil level can lead to overfilling of the oil sump, causing overheating of the engine and fluid leakage;
4. Once shut down, inspect the machine for drips from all internal connections.



Control panel

8 Remote control panel

8.1 CONTROL PANEL DESCRIPTION

The machine is supplied with the remote-control panel. The panel has 15 m of cable with multipolar sockets at its ends for connection to the external inverter generator.

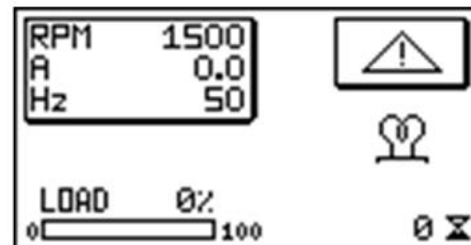
The operator panel is a device that allows you to start, stop and manage the generator functions. Each function is described below.



Remote control panel

1. LCD DISPLAY

LCD display with white backlight. As soon as the operating panel is electrically powered, the display will show the Manufacturer's logo "VTE" and then the screen below will appear.



The parameters displayed on the screen are described as follows:

- Engine speed: RPM
- Supplied current: A
- Frequency: Hz
- Hour counter: hourglass icon
- Load indicator: %

An icon will also appear on the display to help you quickly identify any alarm generated by the machine.

2. START

Button to start the machine.

Press and hold the button until the machine starts.

3. ALARMS ICON

Red LED indicator. The indicator lights up when an alarm is generated.

4. STOP

Button to stop the machine.

Press the button once and release.

5. UP ARROW

Button to move the cursor up in the display menu.

Keep the button pressed to obtain the "ESC" function.

6. DOWN ARROW

Button to move the cursor down in the display menu.

Keep the button pressed to obtain the "INVIO" function.

8.2 ALARM MANAGEMENT

The operator panel checks several parameters to detect any faults on the machine and, if necessary, stop the machine to prevent serious damage.

Alarms generated:

- Over temperature / Low oil pressure:

If an over temperature or low oil pressure situation occurs, the machine will shut down. The red LED light will light up and the alarm will appear on the display.

The temperature sensors are:

- 1 near the exchanger.
- 1 on the exhaust terminal.

- Electrical overload:

In case of electrical overload, the machine will not stop. The red LED light will light up and the alarm will appear on the display.

8.2.1 Reset alarms

To reset the alarm, proceed as follows:

1. Clear the alarm icon from the LCD by pressing the UP or DOWN ARROW button.
2. Turn off the red LED by pressing and holding the UP or DOWN ARROW button for 5 seconds.

8.3 ELECTRICAL CONNECTIONS (8 WIRES BLUE CABLE / CONTROL PANEL)

The table below shows the electrical connections between the machine, the 8-wire cable and the control panel.

| Connector 8 PINS | 15 m cable | Connector 24 PINS | Description |
|---------------------|------------|----------------------|--------------------------|
| 1A | red | 8A and 4C | Battery positive |
| 2A | brown | 1A | Fuel shut-off valve |
| 3A | grey | 3C | Starting motor |
| 4A | green | 3B | Sensors (temp. / press.) |
| 1B | black | 8C | Battery negative |
| 2B | yellow | 1B | Pre-heating |
| 3B | white | 5A | Load indicator |
| 4B | blue | 7C | Machine running |

8.4 AUTOMATIC STARTING DEVICE (on request)

The remote-control panel can be supplied with a normally open (NO) contact.

When the contact is closed the machine starts, when the contact is opened the machine stops. Contacts available on the 24-pin connector between pin 3A and pin 8C.

9 General safety informations

Before carrying out maintenance operations on the machine, read the instructions in this chapter carefully.

9.1 PREVENTING ELECTRIC SHOCK

Do not touch the electrical power (AC) connections and cables when the machine is operating or when the electrical system is connected to the quay socket. There is a current in these connections that can be fatal when touching.

- Do not operate the machine without proper safety devices.
- Disconnect other electrical sources when operating the machine.
- Use insulating materials when working on electrical equipment/elements.
- Make sure clothing and skin are dry, not damp (especially shoes) when working on accessories/electrical equipment.
- Remove earrings or other jewellery when working on accessories/electrical equipment.
- Contact with a charged condenser can cause electrical shock. Before handling, discharge the condenser by shorting the terminals with an insulated tool.

9.2 PREVENTING FIRE

Do not touch hot engine parts or exhaust parts. A running engine reaches very high temperatures!

- Steam can cause injury or death!
- If the engine overheats, allow the engine to cool before touching it.
- Avoid sparks. Do not smoke, avoid flames or sparks near the fuel system, filters, diesel fuel pump, and any other sources of diesel fuel or gas. Use a suitable diesel container when emptying the fuel system.
- Keep the compartment and machine clean and free of debris to minimize the possibility of fire. Clean any diesel and/or oil leaks.
- Remember that diesel fuel is flammable.

9.3 PREVENTING EXPLOSIONS

Explosions caused by diesel gases can cause injury or death!

- Follow the safety instructions for refuelling. Keep the boat doors closed when refuelling. Open and ventilate the cabins after refuelling. Check for fumes and/or vapours after refuelling. Operate the blower at least 4 minutes before turning on the machine.
- All combustible vapours are highly explosive. Be very careful when transporting or storing fuel.
- Store the fuel in a well-ventilated area, away from equipment that can create sparks and away from children.
- Do not fill the diesel tank with the generator running.
- Close the engine fuel service valve when servicing the fuel system. Be careful of any escaping fuel. DO NOT leave cigarette butts, flames, or any other source of fire near the fuel system or machine when working on the fuel system. Properly ventilate the compartment when working on the machine.
- Do not alter or modify the fuel system.
- Make sure that all diesel lines have shut-off valves.
- Make sure that the fuel system is correctly installed and free from drips.
- Make sure a fire extinguisher is installed nearby.

9.4 ACCIDENTAL POWER ON

• Accidental start can cause injury or death!

- Disconnect the battery cables before operating the machine. Disconnect the negative first and reconnect it last after you have done the work.
- Make sure operators are away from the machine before switching on.
- Make sure that all covers, guards, and parts of the soundproofing shell are reinstalled in the correct manner before starting the generator.

9.5 EXPLOSION OF BATTERIES

• Explosion of batteries can cause injury or death!

- Do not smoke or keep naked flames near the batteries during maintenance. Lead batteries emit hydrogen, an explosive gas, which can be ignited by sparks or cigarette butts. Disconnect nearby electrical consumers to prevent sparks during service.
- Never connect the battery negative (-) to the positive (+) of the solenoid valve. Do not test the battery condition by shorting the terminals. Sparks could ignite battery gases or combustible vapours. Ventilate each compartment that contains batteries to prevent explosive gas build-up. To avoid sparks, do not operate the battery charger when functioning.
- Avoid contact of terminals with tools to prevent fire or sparks that could cause explosion. Remove earrings, rings, and any other jewellery before working on the batteries.
- Always switch off the battery charger before disconnecting the battery cables. Disconnect the negative first and reconnect it last after you have done the work.

9.6 BATTERY ACID

- Sulphuric acid from batteries can cause injury or death!
- Wear rubber gloves, rubber apron and eye protection when servicing batteries or checking the fluid level. Batteries contain sulphuric acid, a destructive acid. If it comes into contact with skin, rinse immediately with water. The acid may accidentally splash over the skin or eyes when removing the battery caps.

9.7 HIGH NOISE

• A high level of noise can cause damage to your hearing!

- Do not operate the machine with the silencers disconnected.
- Do not keep the machine running for a long time without the soundproofing capsule closed.



WARNING! Do not operate the machine when you are mentally or physically unempowered by fatigue.

It is also strictly forbidden to:

- Tampering or by-passing safety devices;
- Use of inappropriate tools/equipment;
- Modify command and control devices.

10 Maintenance

The term "MAINTENANCE" includes the following fields of activity:

1. Inspection: it includes measures designed to recognize the actual condition, i.e. to identify the reasons and ways in which the wear reserve is reduced.
2. Restoration: it includes measures designed to achieve the desired condition, i.e. to compensate for the reduction in performance and to restore the wear reserve.

The personnel authorized to install and carry out the machine maintenance must be well trained and must have a thorough knowledge of safety regulations.



Unauthorized personnel must remain distant of work area during maintenance operations.

Safety precautions must be always strictly respected during the installation and machine maintenance in order to avoid any injury to personnel and any damage to machinery.

10.1 CUTTING OF THE ENERGY SOURCES



The ordinary or extraordinary maintainers workers are required to work on the machine to perform maintenance, lubrication, and repairs only when the machine is not enabled and/or under voltage.

Before performing any maintenance, cleaning, and repair work it is necessary to put the machine in safety mode, so:

- disconnect the machine from the electric supply.
- wait for the parts subject to extreme temperatures to cool.

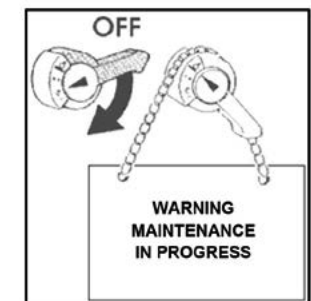


WARNING! FAILURE TO FOLLOW THESE PRECAUTIONS CAN LEAD TO SERIOUS DAMAGE TO PEOPLE, THE MACHINE AND PROPERTY. IN MORE SEVERE CASES, IT CAN CAUSE DEATH (ELECTRIC SHOCK, FUEL-RELATED FIRE, ETC.).

The safety condition is achieved by implementing the "Maintenance state" procedure, described in paragraph 10.2 "Ordinary maintenance".

Before starting the maintenance:

1. Display the "MAINTENANCE IN PROGRESS" sign on the machine.



2. Access to the machine is allowed only to authorized personnel;
 3. Do not modify or tamper with the machine structure without a written statement to the company **VTE S.r.l.**;
 4. Record the maintenance operations on the "SHEET OF MAINTENANCE INTERVENTIONS" attached to the manual, which shows the date, group of the machine, type of work and signature of the person who performed the operation. Keep the updated table close to the machine.
- Any maintenance operation should refer to what is written in this chapter.

10.2 ORDINARY MAINTENANCE

10.2.1 Maintenance state

MAINTENANCE STATUS and maintenance operations are the exclusive responsibility of the maintainers, each for their skills, as defined in Chap. 3 "OPERATOR":

The procedure requires insulation from electrical energy:

- press the "STOP" key on the remote control to stop the machine.
- the service technician disconnects the battery cables using suitable Personal Protective Equipment and electrically insulated tools. For Paguro 4 MY / 5.5 MY models it is necessary to wait for the discharge time of the condensers before intervening. DANGER OF ELECTROCUTION!

Before servicing the machine, use protective gloves and always wait until all components of the machine are at room temperature (< 50°C).



The maintainer, once the maintenance work has been completed and before returning the machine to operation, must always check that:

- **any parts replaced and/or tools used have been removed from the machine.**
- **all the guards removed during the operation are refitted, correctly positioned and secure with their elastic bands.**

Only at the end of the maintenance intervention and after having made the appropriate checks can the operating conditions be restored.

10.2.2 General safety warnings

Machine and operator safety in particular also depend on the regularly scheduled maintenance procedures, in accordance with the Manufacturer instructions. Maintenance workers have to:

- observe the limits of their qualifications (mechanical or electrical);
- in accordance with their own competencies, follow the User and Maintenance Manual procedures and the warnings associated with it;
- respect the indicated times and frequency of scheduled maintenance procedures.



GENERAL WARNINGS applicable to any situation:

- risk of electrocution by direct contact with power supply terminal boards and junction boxes in the electrical system;
 - **it is prohibited to open terminal boards and junction boxes when the generator is powered;**
- Carefully inspect the machine before starting it again and check that all guards are correctly refitted and secure.**

10.2.3 Functional checks on safety devices

The primary task of the ordinary maintenance technician is to check the efficiency of the safety devices after every maintenance operation and before putting the machine back into operation:

- machine guards, which prevent the contact of dangerous parts through the human body;
- magnetothermal circuit breaker, which acts to protect the machine in case of overload;
- in general, of all safety devices present on the system.



The installer and maintenance technician must not modify or circumvent the safety devices with which the machine is equipped.

10.2.4 Maintenance of the electrical system

Definition of tasks and competences of the personnel.

Maintenance of the electrical parts and the general electrical system of the machine must always be entrusted to operators (installers and maintainers), in accordance with their competencies, as defined in the following paragraphs. The Manufacturer declines all responsibility if these instructions are not followed.

Skills of the machine installation operator:

The installer is only authorized to perform mechanical and plant installation of the machine.

Skills of the ordinary maintenance electrician technician:

The electrician in charge of ordinary maintenance is the operator in charge of ordinary maintenance of the electrical system. This person must have technical skills in the field, specialized experience, knowledge of the machine and of the User and Maintenance Manual.

The ordinary maintenance technician is authorised to:

- restore the operating conditions prevented by the intervention of electrical protective devices (e.g. thermal-magnetic circuit breakers tripped);
- make minor repairs to the system within the limitations and in accordance with the instructions in the User and Maintenance Manual;
- replace failed signalling devices;
- change broken or defective parts.



WARNING!

- **Broken parts must be replaced with original parts (or with equivalent parts, with written authorization from the machine Manufacturer).**
- **Replacement must be carried out in accordance with the original connections and functionality.**
- **The parts that require calibration (such as magnetothermal switches, etc.) must be calibrated with the same values as the original part that was replaced.**

The ordinary maintenance technician is PROHIBITED from:

- changing the electrical connections in the machine system.
- modifying the machine wiring.

IMPORTANT! Repairs and procedures that require modifications to the system are the exclusive responsibility of the Manufacturer or authorised service centres.

10.2.5 General advice

To carry out the maintenance operations safely:

- respect the timescale for scheduled maintenance as stated in the User and Maintenance Manual (preventive and periodic);
 - the distance (indicated by time or by work cycles) between one procedure and another is to be understood as the maximum acceptable; therefore, it shouldn't be exceeded; it can however be abbreviated;
 - good preventive maintenance requires constant attention and continuous supervision of the machine.
- Promptly check the cause of any abnormalities such as excessive noise, overheating, fluid leakage, etc. and fix them. In case of doubt, contact the Manufacturer or the authorised service centre. Always refer to the attached documents such as manuals for installed equipment for maintenance.

10.2.6 Maintenance plan

From a construction point of view, these interventions concern the mechanical and electrical parts.

From an operational point of view, for the maintenance technician, these operations fall into two categories:

- planned, scheduled maintenance (or preventive).
- scheduled maintenance according to the condition.

The planned, scheduled maintenance (periodic or preventive) involves inspections, checks and other operations to prevent downtime and breakdowns, and keep under systematic control:

- the mechanical conditions of the machine and particularly of the drives.
- the state of lubrication of the machine.

Ordinary maintenance according to condition concerns components or machine parts for which it is not possible to predetermine wear or intervention times. These components must be kept under control and replaced when they are too worn out to be suitable for use.

10.2.7 Ordinary maintenance table

To keep the machine running smoothly it is necessary to observe the maintenance schedule provided by the Manufacturer. Failure to comply with the above will release the Manufacturer from any responsibility for the effects of the warranty.

IMPORTANT! The timeframes refer to normal operating conditions, i.e. compliant with the envisioned conditions for use established by contract.

Refer to the relevant manual for maintenance of the endothermic engine (see attachments).

OPERATIONS TO BE CARRIED OUT AFTER THE FIRST 50 HOURS OF OPERATION

- Change engine oil;
- Clean and check the engine oil filter.
- Check the backlash of the engine valve and adjust it if necessary.

OPERATIONS TO BE CARRIED OUT AFTER THE FIRST 50 HOURS OF OPERATION AND WEEKLY

- Check that there are no leaks;
- Check the operation of the anti-siphon valve;
- Check that all connections are well secured;
- Check the exhaust terminal for clogging or corrosion. If necessary, clean.

OPERATIONS TO BE CARRIED OUT AFTER THE FIRST 50 HOURS OF OPERATION AND EVERY 100 HOURS

- Check that the connections and the electric cables are well secured.
- Control the condition of the sea inlet filter. If necessary, clean.

OPERATIONS TO BE CARRIED OUT DAILY

- Check the engine oil level. If the level does not exceed the minimum level, top up;
- Check the coolant level. If the level is below the mark, it must be topped up;
- Check the integrity of the fuel system and that there are no drips;
- Check that there is no water or dirt in the fuel. Otherwise, replace the fuel/water separator filter;
- Check that there are no leaks;
- Check the exhaust system for leaks around the terminal, seals and welds;
- Check the integrity of the exhaust system insulation. Replace if damaged or deteriorated;
- Check the fuel level;
- Check that there are no leaks of engine oil;
- Check that there are no fuel leaks;
- Check that no engine parts are damaged or missing;
- Check that no fastener is loose, missing or damaged;
- Check the absence of cracks, abrasion and damaged or corroded connectors in the electrical wiring;
- Check that there are no cracks or abrasion in the piping and that the clamping is not damaged, loose or corroded.

OPERATIONS TO BE CARRIED OUT WEEKLY

- Check the condition of the batteries and ensure that the connections are well secured;
- Clean any corrosion on the batteries;
- Perform a thorough cleaning of the machine. A dirty, oil-filled surface prevents the machine from cooling.

OPERATIONS TO BE PERFORMED EVERY 50 HOURS

- Clean the inlet fuel filter.

OPERATIONS TO BE PERFORMED EVERY 200 HOURS

- Clean the air purification element;
- Change engine oil;
- Clean and check the engine oil filter;
- Check the engine speed command;
- Empty the fuel tank and replace the outlet fuel filter.

OPERATIONS TO BE PERFORMED EVERY 250 HOURS

- Squeeze the cooling system hoses to assess wear. Replace them if worn;
- Replace the excitation condenser with the original one. Dispose of it in the designated collection centres;
- Check the starter solenoid for corrosion. If necessary, lubricate;
- Check that the alternator belt is correctly tensioned;
- Check the plug of the electrolytic zincs for wear. If necessary, replace with the original;
- Verify the wear of the sea water pump impeller. If necessary, replace with the original.

IMPORTANT! It is recommended to always carry a spare kit consisting of impeller and impeller seal.

OPERATIONS TO BE PERFORMED EVERY 400 HOURS

- Adjust the engine intake and exhaust valve.



Impeller and seal

OPERATIONS TO BE PERFORMED EVERY 500 HOURS

- Clean the heat exchanger tube bundle.
- Adjust the rocker arm clearance at a Service Centre authorized by the Manufacturer **VTE S.r.l.**
- Change the reverser reduction gear oil.

OPERATIONS TO BE PERFORMED EVERY 1000 HOURS

- Perform calibration and cleaning of injectors at a Service Centre authorized by the Manufacturer **VTE S.r.l.**
- Check the engine compression.

OPERATIONS TO BE PERFORMED EVERY 1500 HOURS

- Check, clean and test the fuel injection nozzle.

OPERATIONS TO BE PERFORMED EVERY 2000 HOURS

- Check and replace the fuel hoses.

OPERATIONS TO BE PERFORMED EVERY 2500 HOURS

- Perform partial overhaul of the machine at a Service Centre authorized by the Manufacturer **VTE S.r.l.**

OPERATIONS TO BE PERFORMED EVERY 5000 HOURS

- Perform general overhaul of the machine at a Service Centre authorized by the Manufacturer **VTE S.r.l.**

10.3 EXTRAORDINARY MAINTENANCE

Extraordinary maintenance operations concern breakages of parts and components where specific knowledge of the fault is required.

In this case contact the Manufacturer.



WARNING! All the interventions of extraordinary maintenance must be performed only with the machine not working and in safety conditions (machine in “maintenance state”).

The operations of extraordinary maintenance must be performed by personnel authorized and trained by the manufacturer.

Competences of the technical electrician, extraordinary maintenance technician.

The extraordinary maintenance electrician is a technician employed by the Manufacturer or by his authorized service centres.

He is the operator responsible for the extraordinary maintenance of the electrical system. This individual must have a technical training and qualification, a specialized experience, a knowledge of the machine and of the User and Maintenance Manual.

Furthermore, he/she must be continuously updated, through specific training courses at the headquarters of the Manufacturer and must possess the knowledge and the required documentation to safely carry out complicated procedures on the systems.

The extraordinary maintenance technician is authorised to:

- intervene on parts of the system that are critical to safety;
- make any changes to the connections and wiring on the machine;
- replace devices and components with others that may be different to the originals;
- make changes to the software of the machine;
- change the parameters set on the electronic devices.

The extraordinary maintenance technician shall document any modifications and/or replacements in writing and shall provide a copy of the documentation to the ordinary maintenance technician and a copy to the Manufacturer.

The ordinary maintenance technician must update every copy of the User and Maintenance Manual in the customer's possession; the changes must be highlighted and marked in writing on every copy of the User and Maintenance Manual of the modified machine (directly on the original pages and inserting, if necessary, new update sheets).

10.4 INCONVENIENCES AND BREAKDOWNS

This paragraph lists, in a table, the most common inconveniences that can arise, possible causes and the most suitable solutions to fix them.



WARNING! WHEN THE DESCRIBED SOLUTIONS ARE NOT ENOUGH TO SOLVE THE PROBLEM, THE USER MUST NOT PROCEED OF HIS/HER OWN INITIATIVE BUT MUST CONTACT THE MANUFACTURER FOR FURTHER INFORMATION.

Read the “Ordinary maintenance” chapter very carefully before carrying out any maintenance procedure.







Two symbols are provided in the table below, identifying the OPERATOR and MANUFACTURER respectively:

















: an operation that can be carried out by the operator.













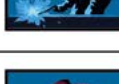





: contact the Manufacturer for detailed information.

| | PROBLEM | POSSIBLE CAUSES | | SOLUTION |
|---|--|---|---|--|
| 1 | The machine does not enable for operation. | Lack of power supply. |  | Check the integrity of the electric system (batteries, electric connections, devices). |
| | | Temperature inside engine compartment too high. |  | Wait for the machine to cool down and reactivate the machine. If the problem persists, contact technical assistance. |
| | | No fuel. |  | Fill. |
| | | Thermal intervention. |  | Reactivate. |
| | | Low battery. |  | Replace. |
| 2 | The machine does not energize. | Engine speed reduced. |  | Check the revolutions and bring them to the nominal value. |

| | | | | |
|---|------------------------------|----------------------|---|---------------------------------------|
| | | Condenser faulty. |  | Replace. |
| | | Demagnetized fields. |  | Apply a high load. |
| | | Faulty windings. |  | Check the resistance of the windings. |
| 3 | The engine starts and stops. | Clogged air filter. |  | Replace. |
| | | Defective fuel pump. |  | Replace. |
| | | Clogged fuel filter. |  | Replace. |

| | PROBLEM | POSSIBLE CAUSES | | SOLUTION |
|---|--|---|---|---|
| 4 | The engine does not run according to specifications (low power). | The lever (located near the oil plug) was pressed during installation, which caused the black lever (located above the pressed lever) to disengage. |  | Check the positioning of the black lever. Push the black lever completely to the right. |
| 5 | High no load voltage (over 240 V). | Engine speed too high. |  | Check the revolutions and adjust. |
| | | High capacitance condenser. |  | Check and replace. |
| 6 | Low no load voltage (over 230 V). | Engine speed too low. |  | Check the revolutions and adjust. |
| | | Faulty rotating diodes. |  | Check and replace. |
| | | Damaged windings. |  | Check the resistance of the windings. |
| | | Condenser with Insufficient capacity. |  | Check and replace with a higher value. |
| 7 | Normal voltage at no load but low at load. | Engine speed reduced at load for fuel filter clogged. |  | Replace. |
| | | Load too high. |  | Reduce loads. |

| | | | | |
|----|-------------------------------------|---|---|--|
| | | Rotating diodes faulty. |  | Check and replace. |
| 8 | Unstable voltage. | Loose contacts. |  | Check the connections. |
| | | Clogged fuel filter. |  | Replace. |
| 9 | Low engine oil pressure. | Worn oil pump. |  | Replace. |
| | | Adjustment valve not registered. |  | Record. |
| 10 | Noisy machine | Damaged bearings. |  | Replace. |
| | | Loose coupling. |  | Check and repair. |
| 11 | Fluid leaks found. | Loose lines or fittings. |  | Position and tighten properly. |
| | | Faulty lines or fittings. |  | Replace. Contact Technical Support. |
| 12 | High cooling water temperature. | Defective thermostat |  | Replace. |
| | | Dirty tube bundle. |  | Clean. |
| | | Worn seawater pump impeller. |  | Replace. |
| | | Clogged pipes. |  | Check and release. |
| 13 | The machine makes an unusual noise. | Mechanical parts or components of the machine may be loose or faulty. |  | If the problem persists, contact Technical assistance. |
| | | Exhaust system fault. |  | Shut down the machine immediately, inspect the system, and contact Technical Support if necessary. |
| 14 | Excessive vibration. | Mechanical parts or components of the machine may be loose or faulty. |  | Identify the problem and contact Technical assistance if necessary. |

10.5 MAINTENANCE PROCEDURES

The following paragraph provides specific procedures for servicing the machine. Maintenance operations must be carried out with the machine in maintenance state by authorized technical personnel.



WARNING! Replaced oils and wear elements (filters, etc.) must be disposed of in accordance with the regulations in force. NEVER disperse in the environment.



WARNING! During the operations the maintainers must wear Personal Protective Equipment, gloves, accident-prevention shoes, overalls or other devices eventually needed by the law in force, according to the type of the operations to do.

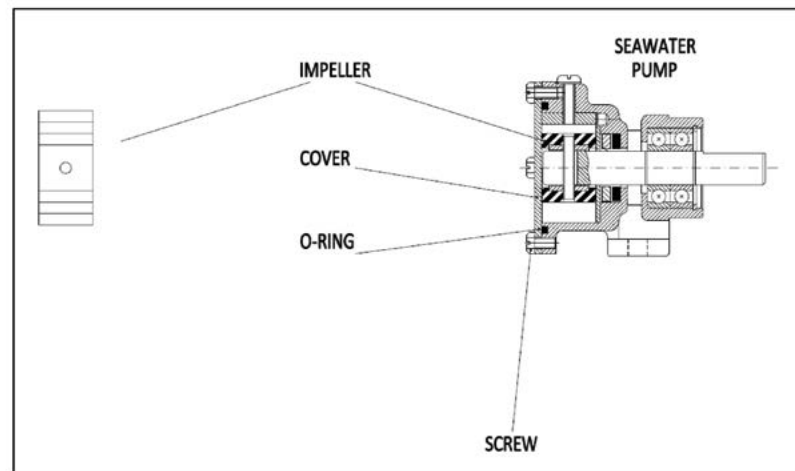
10.5.1 Replacing the sea water pump impeller

The sea water pump is a self-priming type with neoprene impeller. The impeller has flexible vanes which, by rotating around its own axis, create the pump flow.

Under no circumstances should the pump run dry, as the water acts as a refrigerant-lubricant. If there is no adequate water flow, and the engine is running, the impeller will be damaged. In this case, check the cause of the lack of cooling in the system (plug restriction, sea water filter clogged, damaged impeller, exhaust line blockage, etc...).

If the impeller is damaged, replace it using the following procedure:

1. Close the sea water inlet valve;
2. Remove the fixing screws and the pump cover;
3. Pull out the damaged impeller;



Impeller

4. Position the new impeller close to the pump body;
 5. Move the fins to form the housing and push the impeller as far as it will go;
- NOTE:** Add some lubricant to the impeller and seal during assembly;
6. When the operation is complete, reopen the sea water inlet valve.

10.5.2 Cleaning the sea inlet filter

The sea inlet filter is one of the fundamental components of the machine cooling system. Check the condition of the filter frequently. The internal water must be clear and clean and there must be no impurities on the retina.

To clean the filter properly and safely, follow these steps:

1. Close the sea water inlet valve;
2. Remove and clean the filter;
3. Clean the transparent cover of the filter;
4. Assemble the filter;
5. Open the sea water inlet valve;
6. Start the machine and check for drips.

NOTE: Cleaning of the filter is also necessary after a machine shutdown due to overtemperature, as algae, leaves and other material may obstruct the regular passage of the cooling water flow.

10.5.3 Checking engine oil

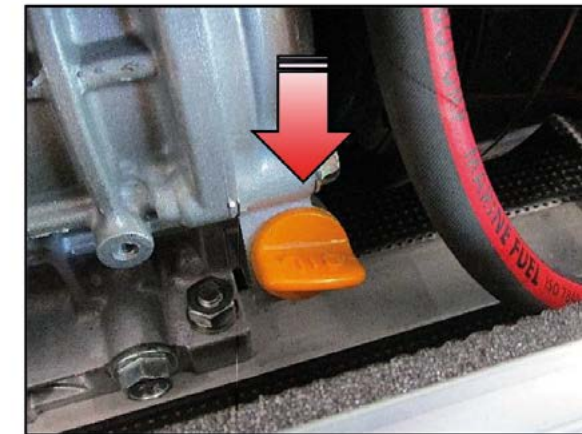
Check the engine oil level every day before starting the machine, following the procedure described below:

1. Remove the oil dipstick from its respective position and wipe with a clean cloth;
2. Fully reinsert the oil dipstick without tightening it;
3. Remove the oil dipstick. The oil level must be between the upper and lower mark on the dipstick;
4. Reinsert the oil dipstick completely and tighten it manually. Be aware that over-tightening will result in damage to the dipstick.

10.5.4 Filling engine oil

Add the new oil through the top-up point on the engine (yellow cap) following the procedure described below:

1. Remove the oil dipstick;
2. Add the specified amount of engine oil for each topping-up point;
3. Wait a minute and check the oil level;
4. If necessary, add more new oil;
5. Reinsert the oil dipstick completely and tighten it manually. Be aware that over-tightening will result in damage to the dipstick.

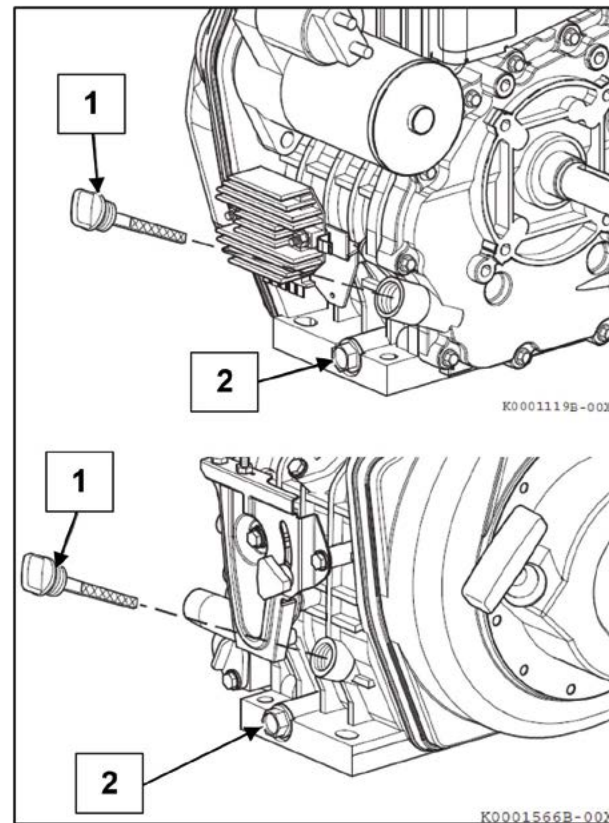


Engine oil check and filling

10.5.5 Replacing engine oil

Carry out the engine oil change according to the following procedure:

1. Start the engine and bring it up to operating temperature;
2. Stop the engine;
3. Remove oil dipstick 1 to allow the engine oil to drain more easily;
4. Place a container underneath the engine to collect the used oil;
5. Remove the replacement plug located at the bottom of the cylindrical block 2, allowing the oil to be changed;
6. After all oil has been replaced, insert replacement plug 2 and tighten it to 19.6-23.5 N*m (2.0-2.4 kgf*m);
7. Dispose of used oil appropriately.

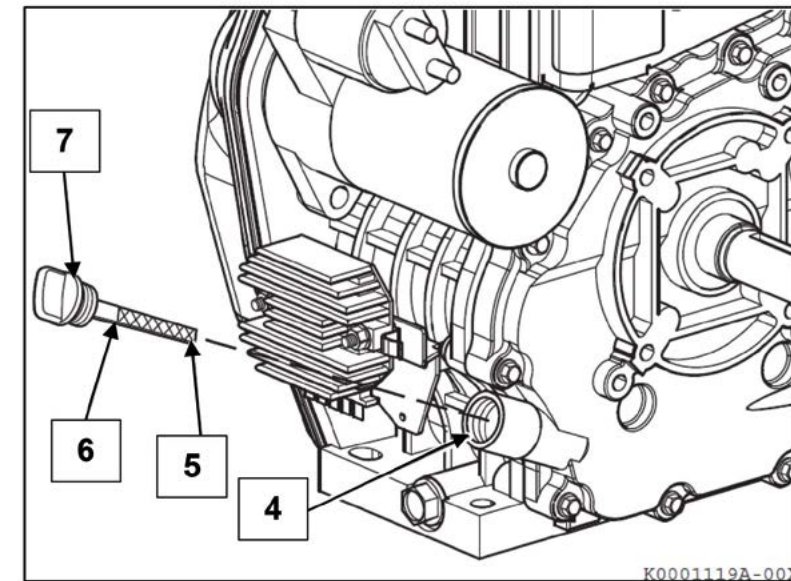
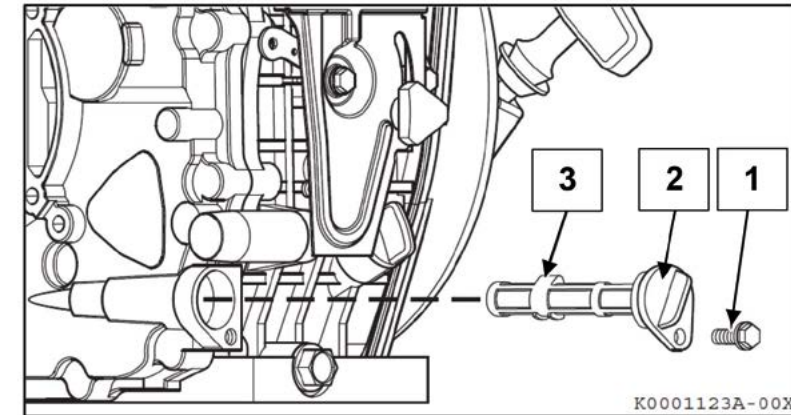


Engine oil change

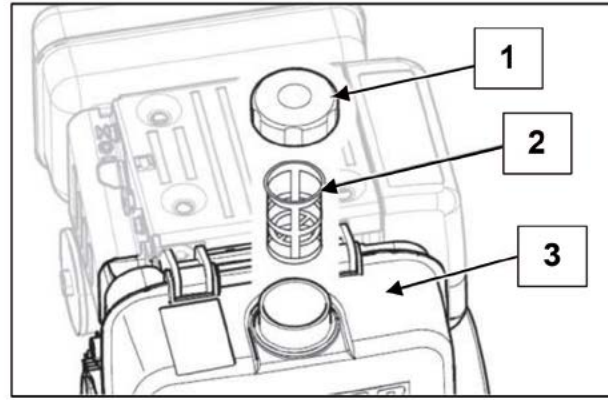
10.5.6 Cleaning and checking engine oil

Clean and check the engine oil filter according to the following procedure (see figure on next page):

1. Remove the oil filter retaining bolt 1;
2. Pull out oil filter plug 2 and remove oil filter 3;
3. Clean the oil filter and replace it if damaged;
4. Install oil filter 3;
5. Take care that the oil filter plug 2 is correctly positioned;
6. Insert and tighten the retaining bolt 1;
7. Add new engine oil (as specified in 10.5.4);
8. Warm up the engine by switching it on for 5 minutes and check for any oil leaks;
9. After the engine has been warmed up, switch it off and do not restart it for 10 minutes;
10. Recheck the oil level by fully inserting the dipstick without screwing it in;
11. Add oil at point 4 until the level is between the upper mark 6 and the lower mark 5 on the dipstick;
12. Reposition dipstick 1 and tighten it manually. Be aware that over-tightening will result in damage to the dipstick. If oil has been spilled, wipe it up with a clean cloth.



Cleaning and checking of engine oil filter

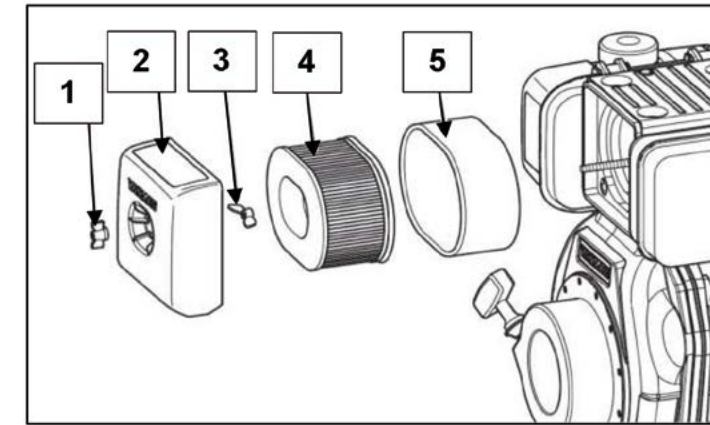


Cleaning of the air purification element

10.5.7 Cleaning the air purification element

To clean the air-purifying element correctly and safely, follow the steps below:

1. Remove wingnut 1;
2. Remove air-purifier cover 2;
3. Remove wingnut 3;
4. Remove air-purifying element 4 and outer foam element 5;
5. Blow air through both elements using compressed air at 0.29-0.49 Mpa (3.0-5.0 kgf/ cm²) to remove particles. Use low air pressure, if possible, to remove dust without damaging the elements;
6. If each element is damaged, replace both (not sold individually);
7. Clean the inside of the air purifier cover 2;
8. Install the air purification element 4 in its housing and carefully check that the air purification cartridge is inserted correctly and aligned with its housing;
9. Install wingnut 3 and tighten it by hand. Be aware that over-tightening will result in damage to the purifier assembly;
10. Slide the outer foam element 5 over the air purification element 4;
11. Install the air purifier cover 2;
12. Install wingnut 1 manually. Be aware that over-tightening will result in damage to the purifier assembly.



Cleaning of the air purification element

10.5.8 Machine cleaning

Perform a thorough cleaning of the machine.

- If not well maintained, various parts may become damaged or even corroded;
- Clogging of the combustion air holes can compromise machine performance;
- For exceptionally difficult conditions, anti-rust and/or anti-corrosion spray is recommended;
- In addition to periodic cleaning, all connections must be checked for leaks and there is no evidence of overheating or damaged cables.

10.5.9 Maintenance of the batteries

In the standard configuration the machine is supplied with the negative to ground (machine body). The start-up battery (not supplied) must be 60Ah and is charged directly from the generator. Refer to the recommendations of the battery manufacturer and then schedule a systematic maintenance of the batteries on board, including:

- Monitoring the voltmeter for proper charging when the machine is running;
- Checking that the battery cables are clean and connected to the poles (+/-) and to the positive and negative of the machine;
- Cleaning the batteries from corrosion;
- Checking the start-up battery voltage. The battery must have a voltage between 13 and 14 volts when the machine is running. If not, check cables and connections, solenoid, battery switch, and battery.



WARNING! Sulphuric acid in lead batteries can cause burns on the skin and damage clothing. Wear protective gloves before working on the batteries.

A 5 AMP fuse on the remote control protects the battery charging circuit. The lack of illumination in the remote control may be due to the blown fuse.



WARNING! Use gloves, rubber aprons, and protective goggles when working on batteries. Lead batteries emit hydrogen, an explosive gas, which can be ignited by sparks or cigarette, cigar and pipe butts. Do not smoke or ignite a naked flame near a battery that is being serviced.



Switch off any electrical equipment near the batteries in order to avoid ignition sources of flames/sparks during maintenance.

10.5.10 Maintenance of the endothermic engine

Refer to the procedures in Attachment 1 for all other endothermic engine maintenance information not listed in this manual.

10.6 MACHINE INACTIVITY

If the machine is to be stored for 1 to 6 months, carry out the following operations:

- Drain sea water from the pump.
- Close the engine exhaust and intake properly with adhesive tape.
- Replace oil and the engine oil filter.
- Replace the fuel filter.
- Cover the machine with a nylon cloth and place it on a wooden floor.

NOTE: For storage more than 6 months please contact the Manufacturer of **VTE S.r.l.**

11 Types of risks and safety pictograms included

11.1 RISKS OF A MECHANICAL NATURE

This paragraph describes the mechanical risks that can arise during installation or maintenance operations on the machine, the risks that they can generate and the protections that have been adopted. Normally these risks do not affect the operator, since protections are enabled during ordinary operation and the risks have been eliminated or reduced.

During maintenance, the risks are partially reduced if the safe method of intervention is implemented by placing the MACHINE in maintenance state. Any special circumstances will be indicated in the following points. When carrying out repairs or other extraordinary work, the risks outlined in the following points must be taken into account.

11.1.1 Machine stability

The machine correctly installed has not instability or overturning risks. Observe the instructions given in par. 5.2 “Fixing the machine” for correct installation.

11.1.2 Breakage dangers during the functioning of the machine

The safety of the machine depends proportionally by the respect of the times and the modes required for the periodic check, the maintenance, the cleaning and the replacement of the worn parts.



WARNING! It is necessary to:

- respect the scheduled times (see par. 10.2.7 “Ordinary maintenance table”);
- use original spare parts;
- follow the procedures indicated in the User and Maintenance Manual and/or by the manufacturer of the specific spare parts;
- assign skilled staff to perform the procedures (maintainers).

Failure to do so relieves the Manufacturer of all liability. No mechanical parts are exposed to corrosion or stress that could lead to dangerous.



WARNING! IT IS FORBIDDEN TO:

- place objects on the machine.
- use the soundproofing capsule as a support or work surface.

11.1.3 Dangers and risks caused by flying objects

The parts that can be a source of danger are normally protected by protective carter, in order to guarantee safety conditions.

Lack of maintenance or failure to observe the maintenance schedules indicated by the Manufacturer may cause the fluid circuit elements (pipes, fittings, etc.) to wear early and also cause fluid leakage.

Sudden leaks from the fluidic circuits can damage the machine and compromise its operation.



WARNING! IT is always mandatory to secure all guards in place before operating the generator.

11.2 DESIGN AND PHYSICAL FEATURES OF SAFETY GUARDS

The machine is protected by a multilayer fiberglass capsule, lined internally with sound-absorbing material, consisting of:

- 1 lower containment element of the machine equipped with anti-vibration system.
- 2 upper elements with interlocking profiles, held together by silicone elastic bands.

The guards ensure safe disassembly without the use of tools.

The guards used are of robust construction, are suitable to withstand normal working stress and do not allow the contact of dangerous parts through the human body.



After any operation and before starting the generator, it is essential to refit and secure the removed guards.

11.3 SAFETY PICTOGRAMS ON-BOARD THE MACHINE

The table on the following page lists the safety pictograms applied to the machine in the vicinity of the most dangerous areas.



IMPORTANT! This safety signs shall not be removed in any case. If the pictogram is damaged so that it is unreadable, it is obligatory to replace it with another one having the same dimensions, images and colour.

| SAFETY PICTOGRAM | BEHAVIOURAL STANDARD |
|------------------|---|
| | Danger of extreme temperatures. Pay attention to parts that generate or are subjected to extreme temperatures. Wear suitable Personal Protective Equipment. |
| | No protection removal. Do not remove the protections installed when the machine is functioning. |

11.4 ELECTRICAL RISKS

The electric system project, the connections to the protective circuit, the quality and the arrangement of the components assure the prevention from the risks arising from the electric supply. The machine is protected against overloads by a magnetothermal circuit breaker.

11.5 OTHER NATURE RISKS OR RESIDUAL RISKS

11.5.1 Risk of fire

The machine uses diesel fuel and engine oil, which can cause fire if it comes into contact with parts that are generating or subjected to extreme temperatures. The safety of the machine against fire is closely linked to maintenance operations and to the observance of the timing. In the event of a fire, switch off using suitable fire extinguishers.



With the machine in operation it is absolutely forbidden stop the fire with water.

11.5.2 Risk of explosion

The machine uses diesel and batteries which, in the event of contact with open flames, could cause an explosion. The safety of the machine from explosions is closely linked to the maintenance operations and to the compliance with the procedures indicated in this manual (see chap. 9 "GENERAL SAFETY INFORMATION").

11.5.3 Dangers and risks from toxic exhaust gases

Although the exhaust gases of diesel engines are not as toxic as those of petrol engines, carbon monoxide is also present in the exhaust gases of diesel engines. Some of the symptoms or signs of Carbon Monoxide inhalation/poisoning are as follows:

- Vomiting;
- Muscle spasms;
- Nausea;
- Delayed movements;
- Dizziness;
- Weakness and drowsiness;
- Migraine;
- Inability to think correctly.



WARNING! If these symptoms occur, go out to the open air immediately. If symptoms persist, seek medical attention. Switch off the machine and do not operate it again until it is inspected and repaired.

To prevent the risk of exhaust fumes, follow these guidelines:

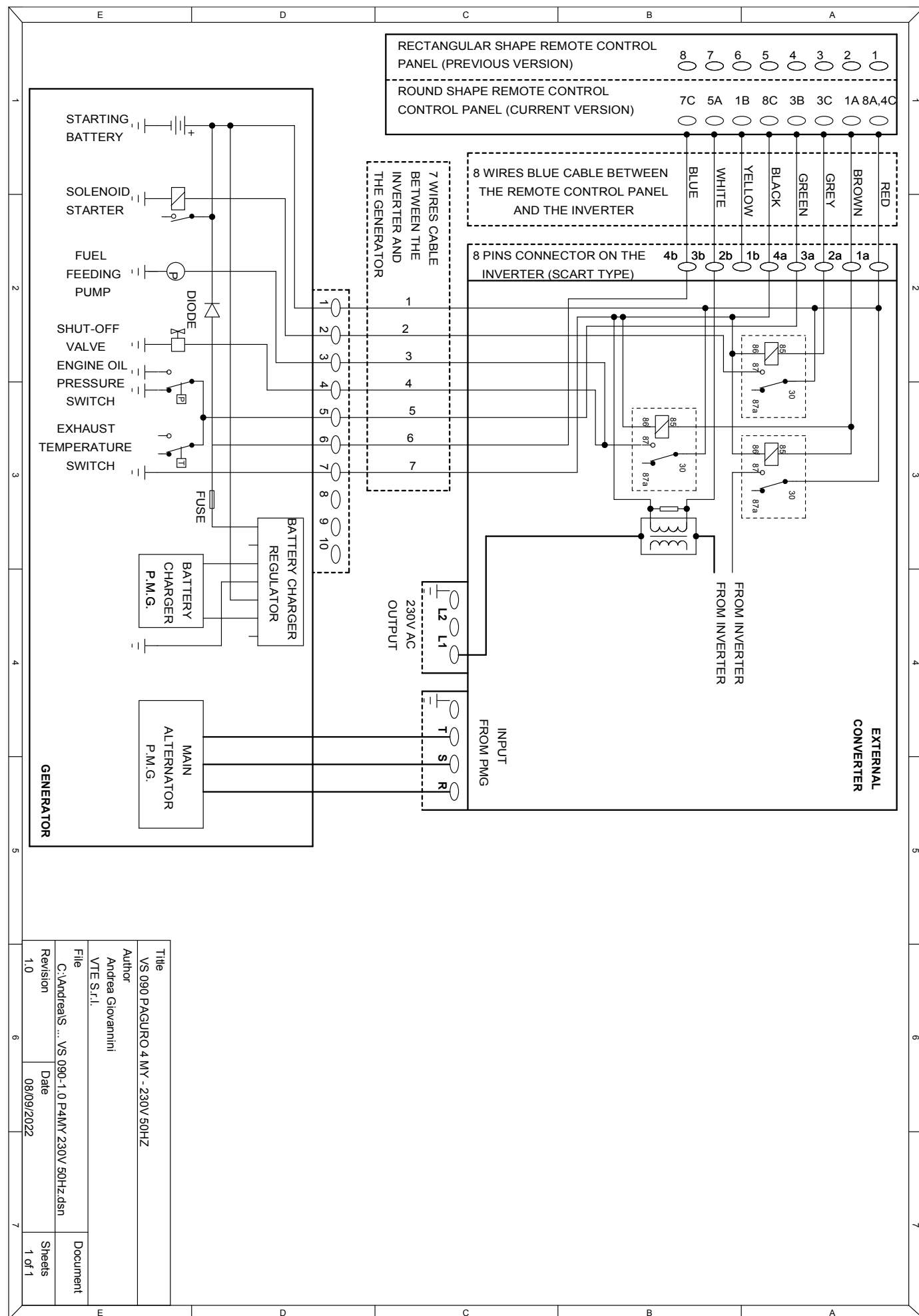
- Do not use copper pipes in the exhaust system. Diesel fumes can quickly destroy copper pipes in exhaust systems.
- Do not install the exhaust gas outlet near doors, portholes, or air conditioning. If the exhaust gas outlet is near the waterline, the water in the exhaust line may block or restrict the flow of gases to the outside. Do not overload the boat.



WARNING! In addition to regular exhaust line checks, install a Carbon Monoxide detector. Consult your boat Manufacturer for detector selection.

11.5.4 Dangers and risk arising from parts subject to extreme temperatures

The endothermic engine can reach high temperatures, particularly in particularly hot environments. Possible risks of burns and burns are considered negligible as during operation the machine is protected by safety guards that prevent the body from coming into contact with parts subject to extreme temperatures.



| | |
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| Title | VS 090 PAGURO 4 MY - 230V 50HZ |
| Author | Andrea Giovannini |
| File | VTE S.r.l. |
| Revision | C:\Andreas ... VS 090-1.0 P4MY 230V 50Hz.dsn |
| Date | 08/09/2022 |
| Revision | 1.0 |
| Document | 1 of 1 |

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| | R&D Department | |
| | MANUAL | Microtec - Inverter 4 kVA |
| Written by: L. Micheli | Date: 15/06/2020 | Page 1 of 2 |
| Last revision: 1.00 (15-06-2020) | | |

DESCRIPTION OF MODELS

4kVA inverters are available in “Open Version” (without enclosure) and “Box Version”. Open version are suitable to be inserted directly inside a generator box with engine and alternator. Box version are suitable where is not possible or useful to have a complete generator inside a box. It is possible to connect the output of two inverters in parallel (via an external synchronism cable) to obtain double power.

NOTE

To obtain Voltage AC at the output you have to connect PMG three-phase generator and an external 12V battery.

SPECIFICATIONS

| | | | |
|------------------------------|------------------------------|--------------------|--------|
| Storage temperature | -20...+55°C | | |
| Operating temperature | -10...+40°C | | |
| Humidity | 5...85% without condensation | | |
| Altitude | Max. 2000m | | |
| Sealing protection | IP21 | | |
| Dimension L x W x D - Weight | OPEN VERSION | 232 x 186 x 95 mm | 3.5 kg |
| | BOX VERSION | 326 x 315 x 142 mm | 5.0 kg |

| Model | Continuous Power | Input Voltage (line to line) | Input Frequency | Continuous Output Current | Limited Time Power | Peak Current | Output Voltage | Air Flow Speed @ T <= 40°C |
|---------------|------------------|-----------------------------------|-----------------|---------------------------|--------------------|---------------|----------------|----------------------------|
| 4kw open 230V | 4kVA | 3*260..450 Vrms DC link = 410V | 200...500Hz | 17.5Arms | 8kVA 1s | 50Apk - 600ms | 200...240V AC | 8m/s |
| 4kw box 230V | 4kVA | 3*260..450 Vrms DC link = 410V | 200...500Hz | 17.5Arms | 8kVA 1s | 50Apk - 600ms | 200...240V AC | Internal |

DC-LINK and PMG alternator

Voltage generation start after proper DCbus charging by external voltage source (PMG).

230V – version

Nominal DCbus voltage is 410Vdc and 340Vdc is required to start output generation. 290Vrms line to line are required to guarantee a stable output voltage AC (nominal voltage at full load). The power limit is set in current; you can adjust the output voltage between 210 – 240 volts.

| | |
|--|---|
| | Not exceed 450Vrms phase to phase for input voltage in any case |
| | Not exceed 500Hz for input voltage in any case |



SHEET OF MAINTENANCE INTERVENTIONS

All repair, recording, replacement and overhaul work must be recorded in the "SHEET OF MAINTENANCE INTERVENTIONS". The authorized maintainer must record any changes.

| DATE | GROUP | WORK PERFORMED | TECHNICIAN SIGNATURE |
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Notes:

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