

CE

GENERATOR

mase
MARINE

I.S. 6.5 50 Hz

I.S. 7.6 60 Hz

POWERED BY
YANMAR

I - MANUALE DI USO E MANUTENZIONE

GB - USAGE AND MAINTANCE MANUAL

F - MANUEL D'INSTRUCTIONS ET D'ENTRETIEN

D - GEBRAUCHSANWEISUNG UND WARTUNGSVORSCHRIFTEN

E - MANUAL USO Y MANTENIMIENTO

NR.000000

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mase

GENERATORS

DICHIARAZIONE CE DI CONFORMITA'
EC DECLARATION OF CONFORMITY

Fabbricante/Manufacturer: MASE GENERATORS S.p.A.

Indirizzo /Address : Via Tortona 345, Pievesestina (FC)

Il sottoscritto Luigi Foresti in qualità di direttore generale della MASE GENERATORS S.p.A., dichiara sotto la propria responsabilità che il gruppo elettrogeno modello :

The undersigned Luigi Foresti as MASE GENERATORS S.p.A. general manager declares, under his sole responsibility, that the generators model is.....:

Codice / Code

Descrizione / Model

Matricola / Serial N.

E' conforme alle disposizioni delle Direttive di seguito elencate :

CEE 89/392 (come emendata delle Direttive CEE 91/368 e CEE 93/44)

CEE 89/336 (come emendata delle Direttive CEE 92/31)

CEE 73/23 modificata da CEE 93/68.

Corresponds to the requirements of the following EEC Directives :

89/392/EEC (as amended by the Directive 91/368/EEC and 93/44/EEC)

89/336/EEC (as amended by the Directive 92/31/EEC)

73/23/EEC as amended by 93/68/EEC.

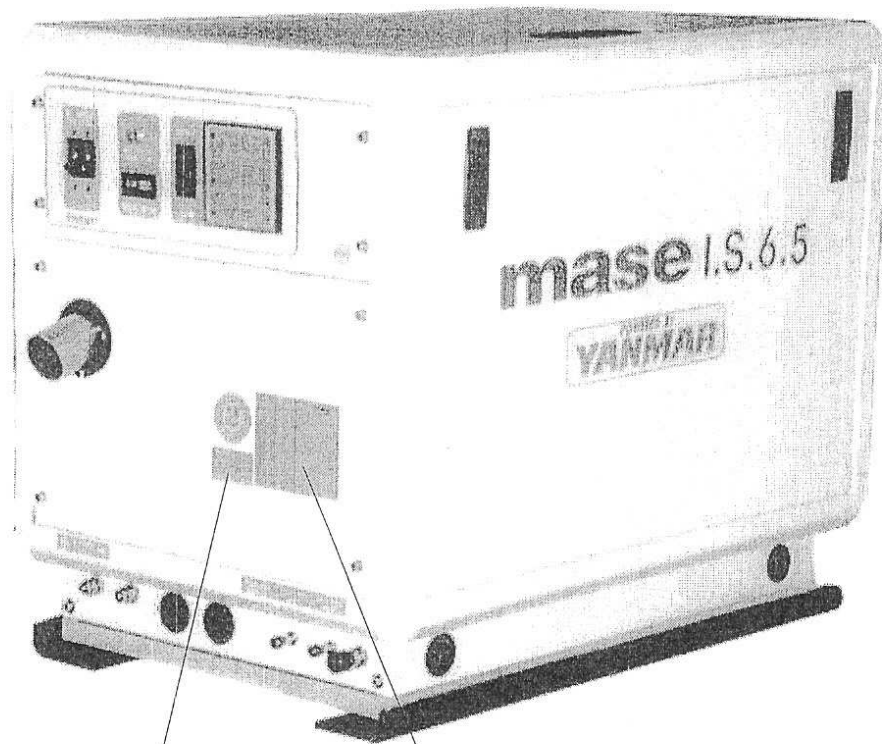
Cesena, / /

.....

Direttore Tecnico
Technical Director

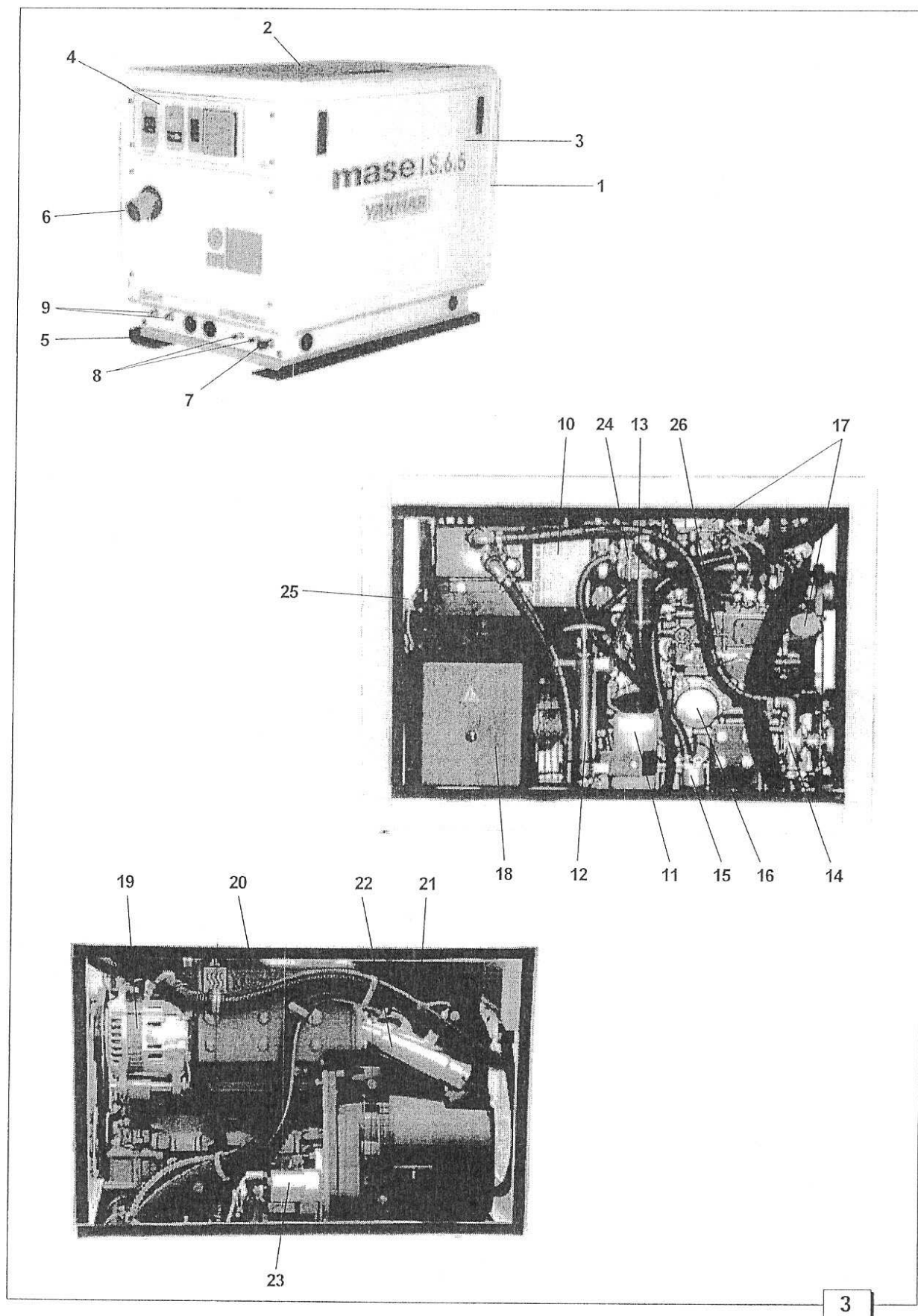
MASE GENERATORS S.p.A. Sede legale ed Amm.: 47023 CESENA (FC) ITALY - Via Tortona, 345 - C.F./P.I. 00687150409 Cap. Soc. milioni 1625 interamente versato - Registro Società Tribunale Forl' n. 6818 - CCIAA Forl' n.164063 - c.c.p. n. 11541471 - EXPORT FO n. 006368

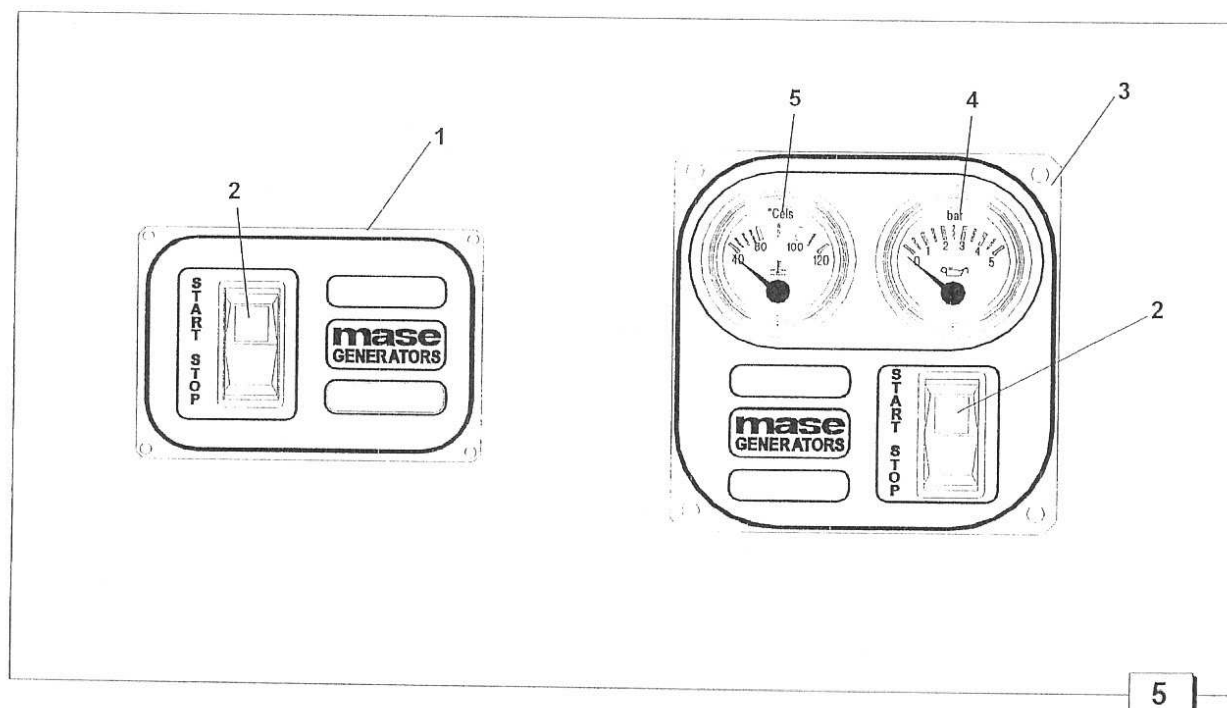
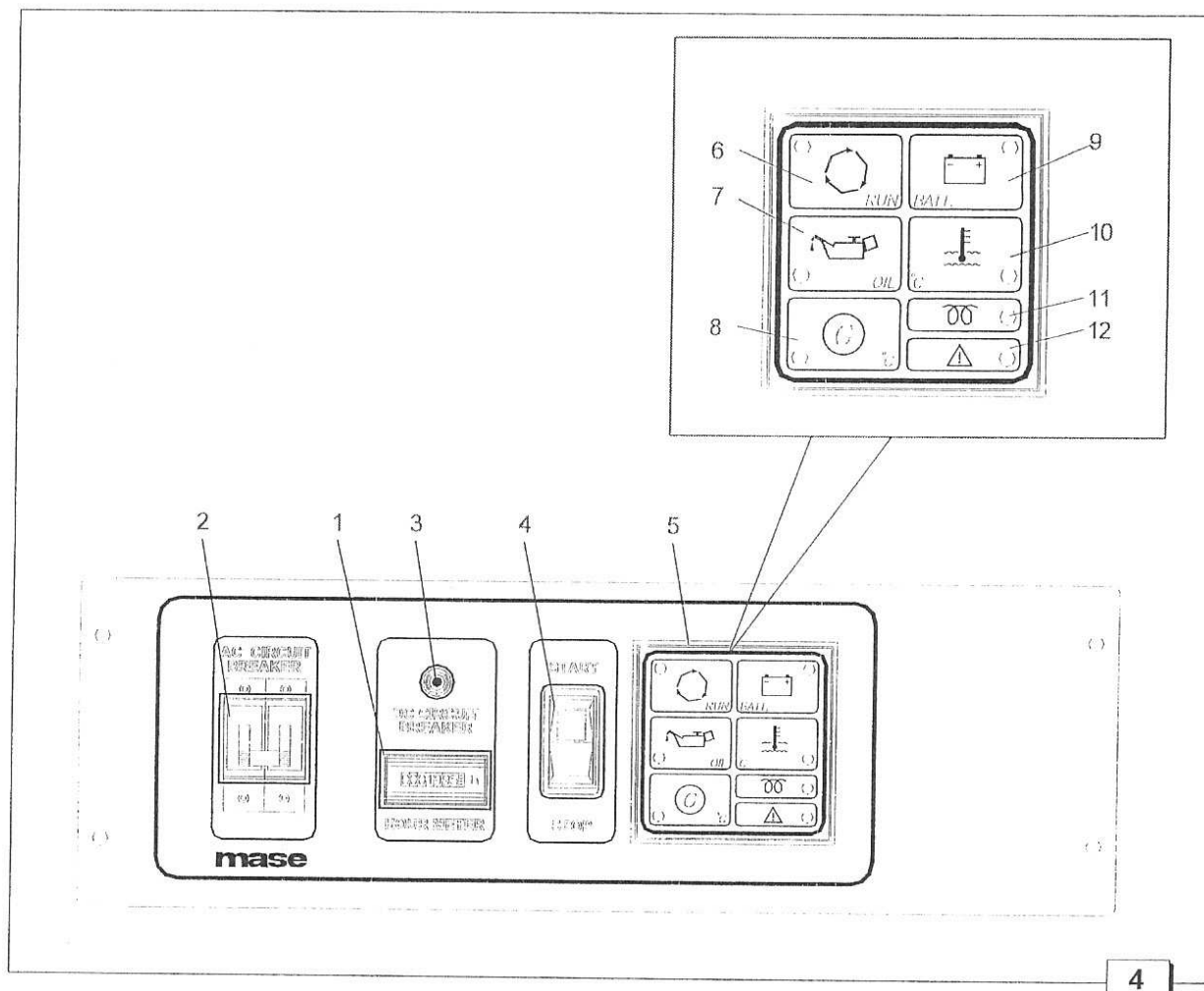
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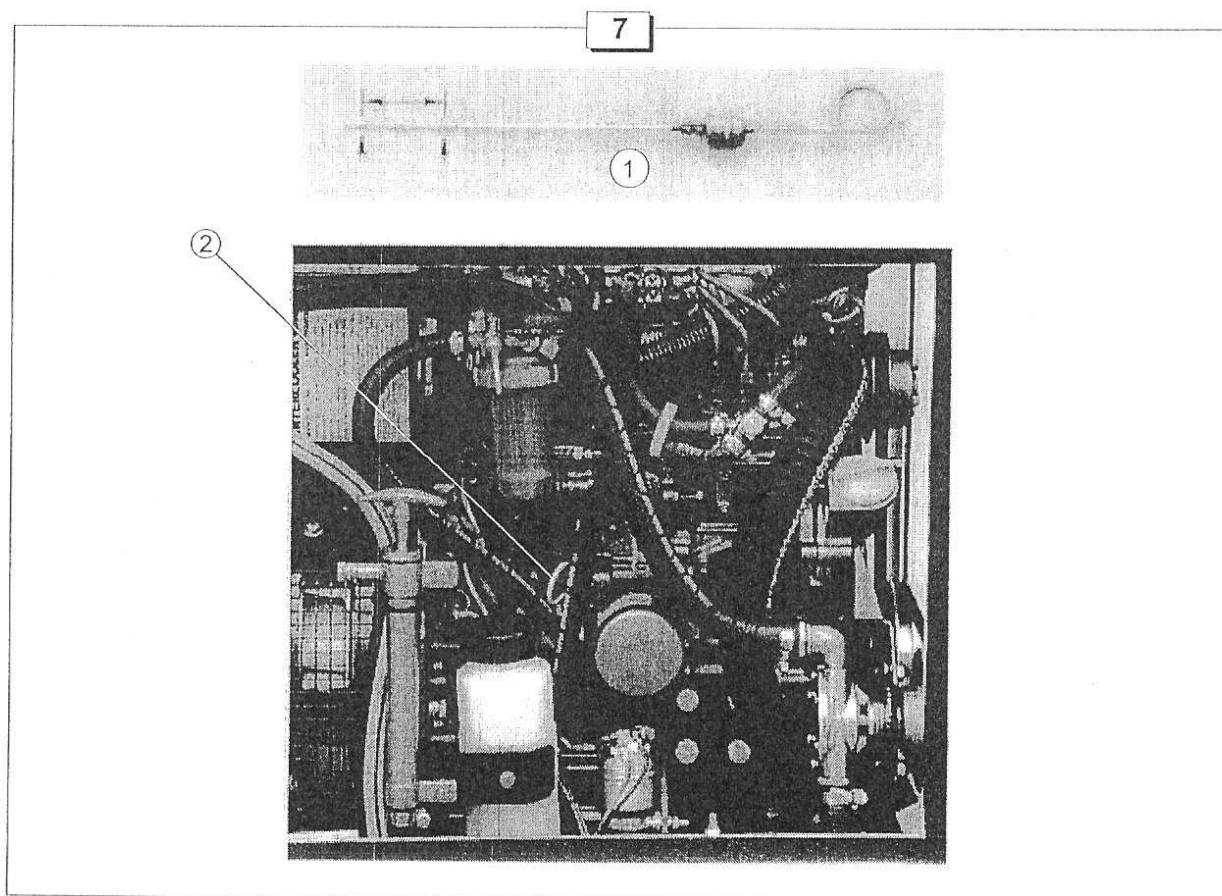
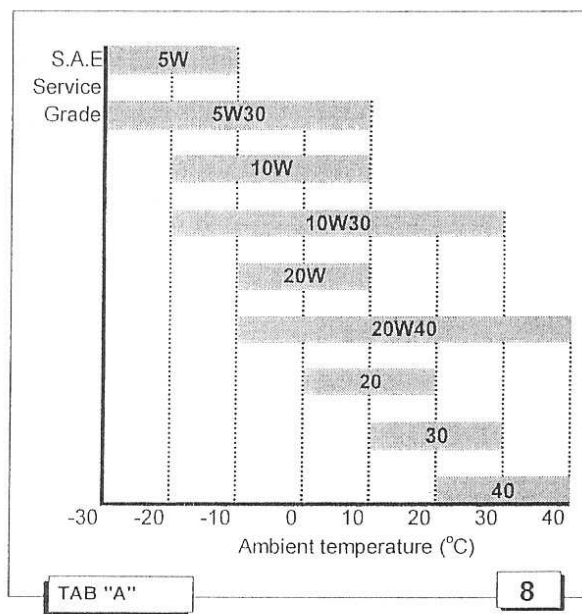
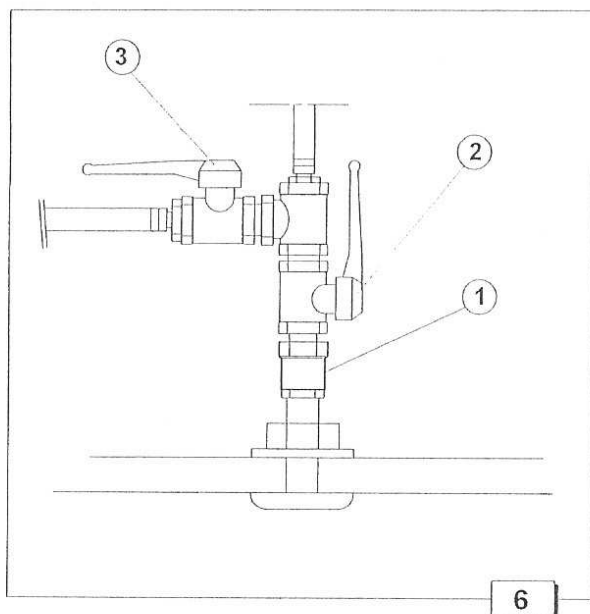


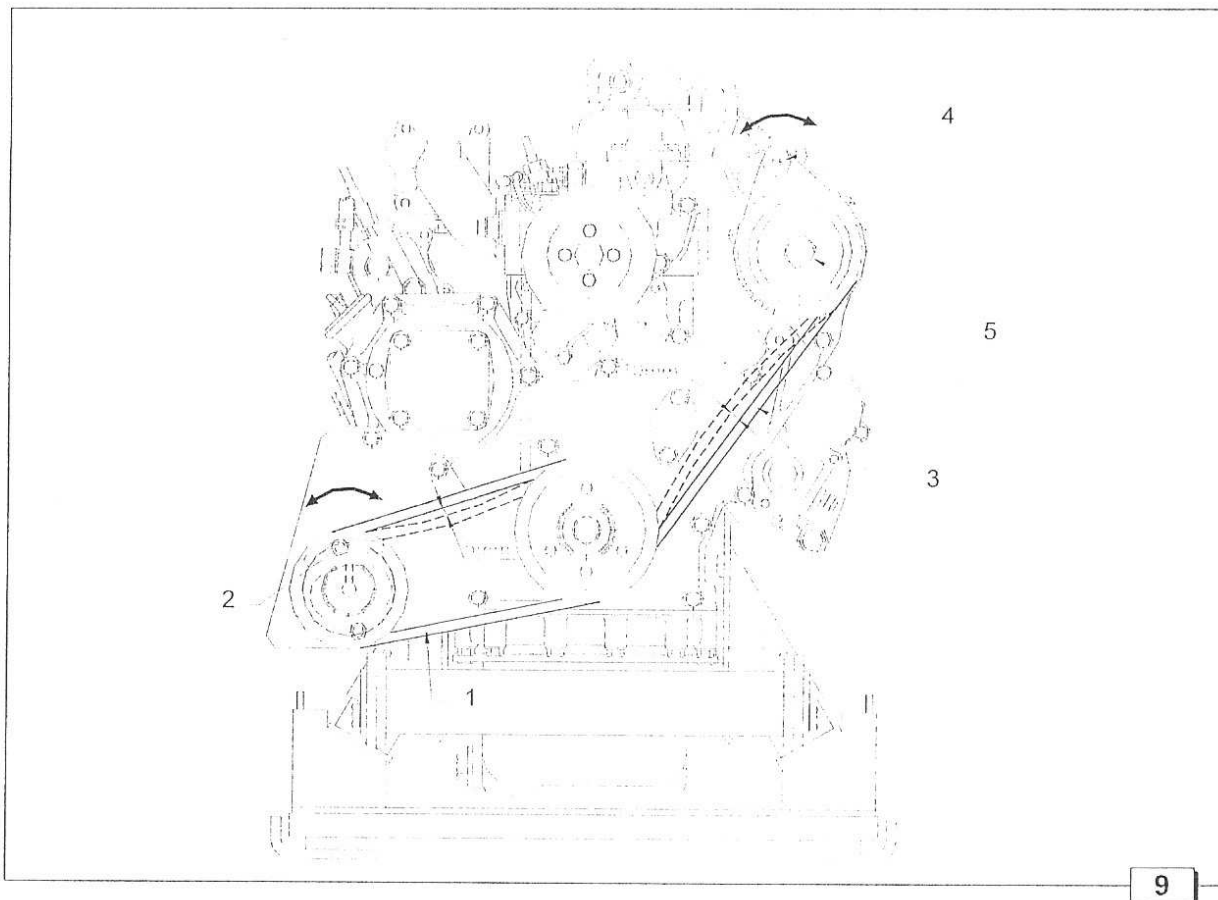
⑩
• SERIAL No. •

Code		①
Year of manufacture		②
Rated power factor		③
Declared frequency	Hz	④
Rated power		⑤
Rated voltage	V	⑥
Rated current	A	⑦
Rated power		⑧
Rated voltage	V	⑨
Rated current	A	
Mass	Kg	
Performance class		

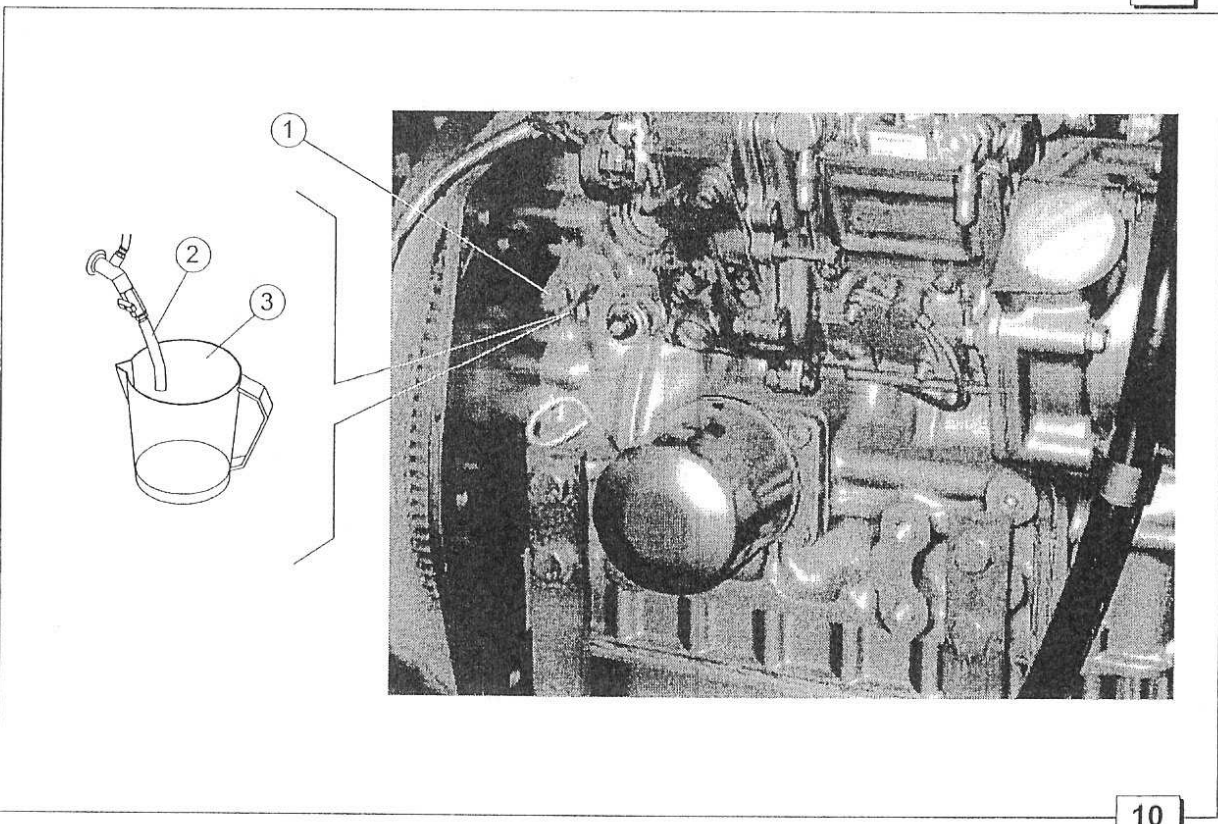




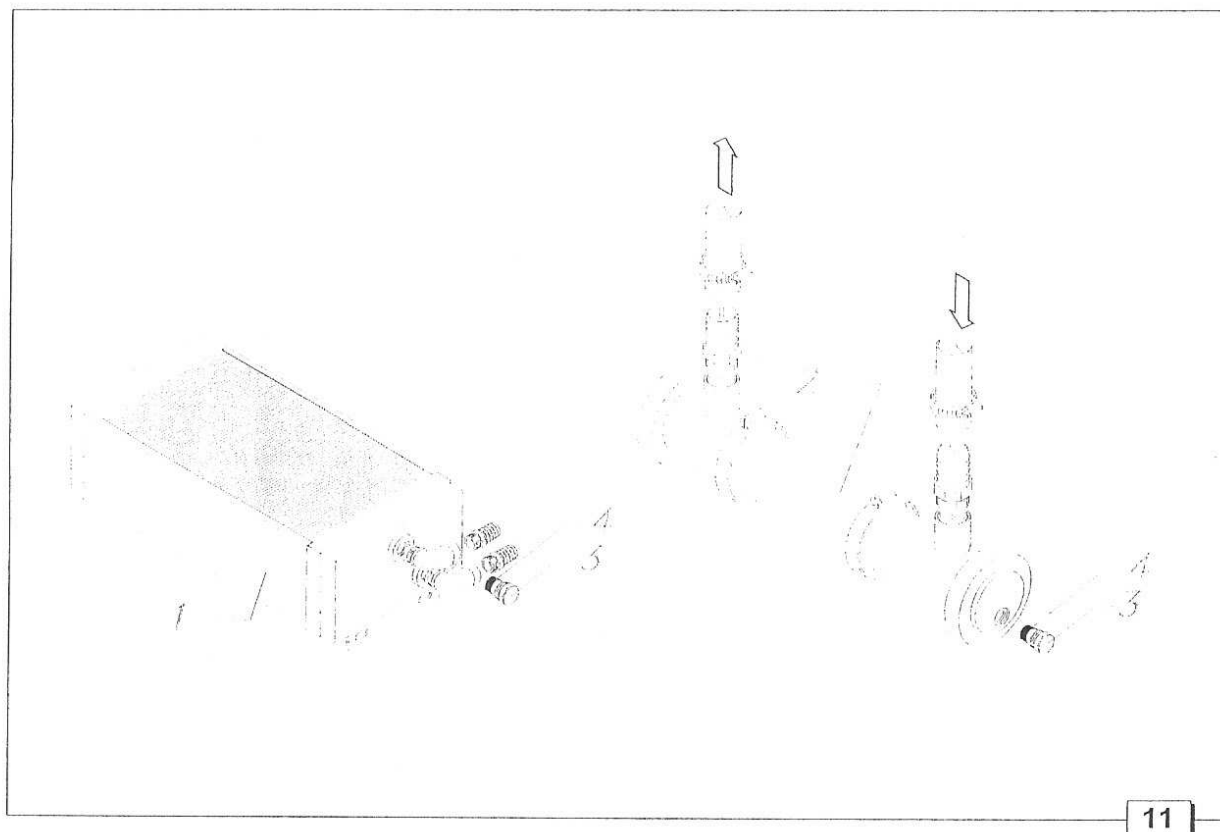




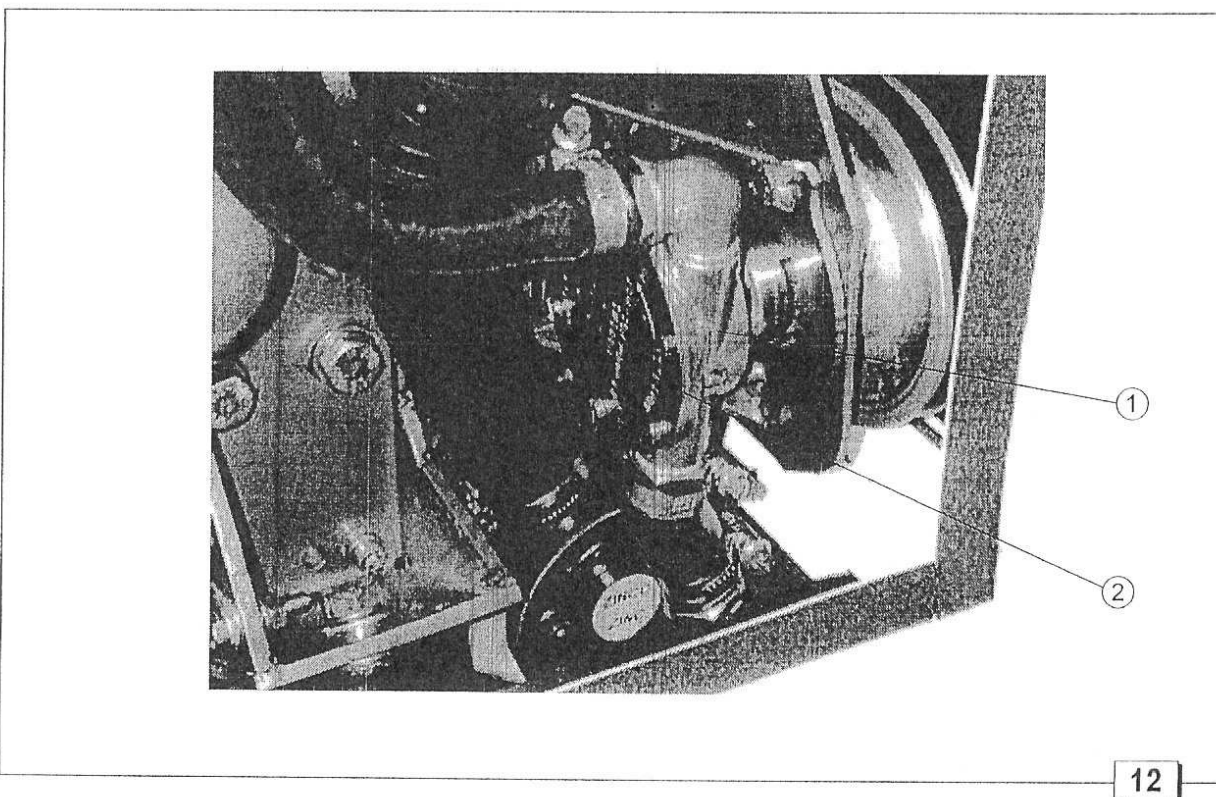
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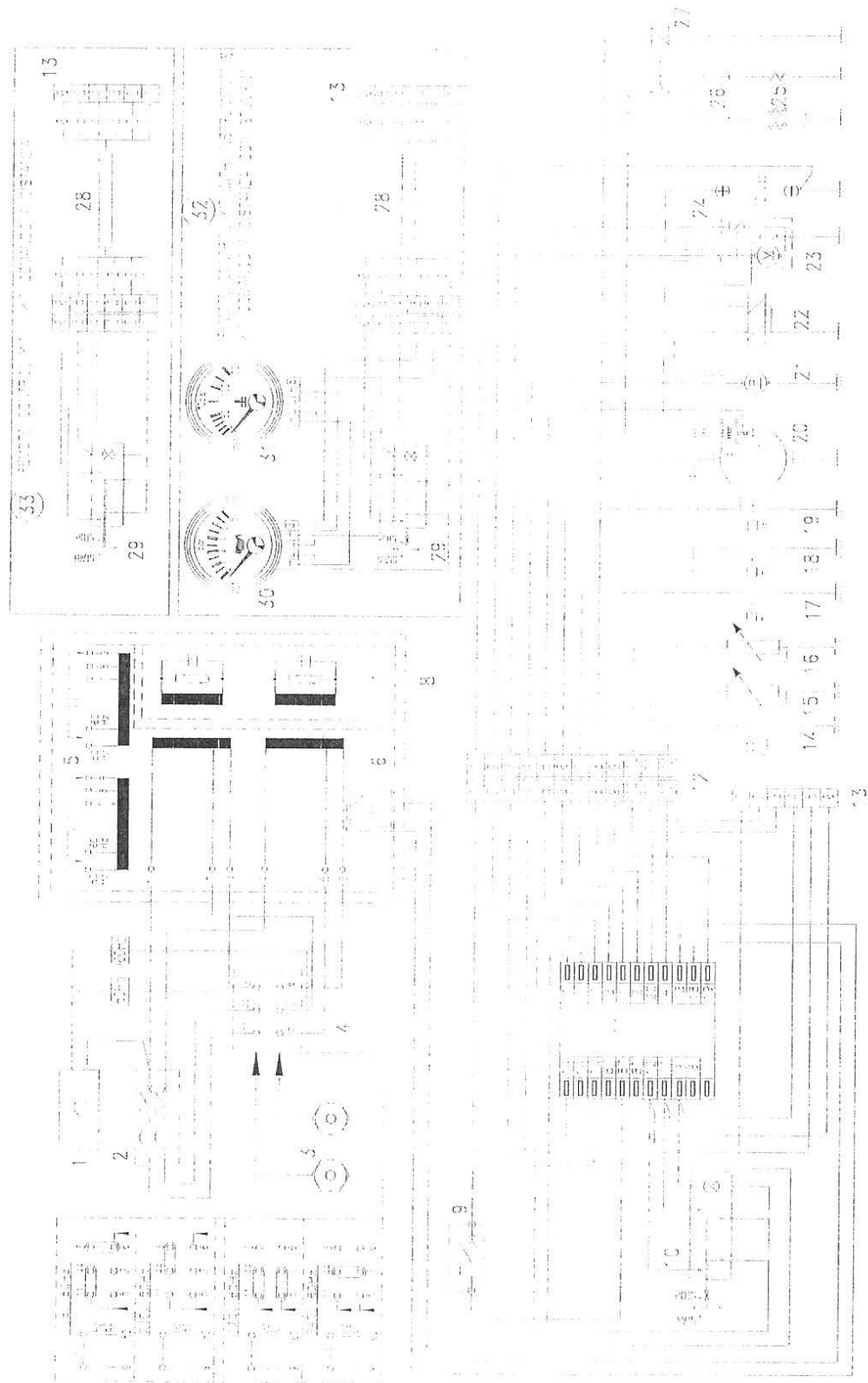
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WIRING DIAGRAM

MACHINE CODE: 001060 - 001096 - 001135 - 001134 - 001129 - 001137



No. FILE: 22.28.043.00

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*(missing pages
were in Italian)
Sandy
you have the complete
English manual*

1 GENERAL INFORMATION



Carefully consult this manual before proceeding with any operation on the generator.

FAILURE TO RESPECT THE SPECIFICATIONS CONTAINED IN THIS USE AND MAINTENANCE
MANUAL WILL RESULT IN FORFEITURE OF THE GUARANTEE ON THE PRODUCT

1.1 Purpose and field of application of the manual

Thank you for choosing a **mase** product.

This manual has been drawn up by the manufacturer with the purpose of providing essential information and instructions for proper use and maintenance in conditions of safety and constitutes an integral part of the generator equipment. The manual must be kept safely, protected from any agent which might damage it, for the entire life of the generator and must accompany the generator if transferred to another user or owner.

The information contained in the manual is addressed to all those persons involved in the operating life cycle of the generator, and is necessary to inform both those who effectively carry out the different operations and those who coordinate the activities, arrange the necessary logistics and regulate access to the place where the generator will be installed and operated.

The manual defines the purpose for which the generator was constructed and contains all the information necessary to guarantee safe and proper use.

Constant observance of the instructions contained in this manual guarantees the safety of the operator, operating economy and a longer life of the generator.

It is warmly recommended to carefully read the contents of this manual and the reference documents; only thus can regular functioning and reliability of the generator be guaranteed over time, and protection against damage to persons or things.

The drawings are provided by way of example. Even if the generator in your possession differs considerably from the illustrations contained in this manual, the safety of the generator and the information provided are nevertheless guaranteed.

To facilitate consultation, it has been divided into sections identifying the main concepts; for a quick look at the topics, consult the index.

Note: the information contained in this publication is correct at the time of printing. The manufacturer in his pursuit of a policy of constant development and upgrading of the product reserves the right to make modifications without prior notice.

1.2 Symbols

Those parts of the text not to be ignored are highlighted in bold type preceded by a symbol, as illustrated and defined below.

**DANGER**

Indicates that particular attention must be paid in order to prevent running into serious danger which could lead to death or possible hazards to the health of personnel.

**WARNING**

A condition which may occur during the lifetime of a product, system or plant considered at risk regarding damage to persons, property, the environment or economic loss.

**CAUTION**

Indicates that particular attention must be paid in order to prevent serious consequences which could result in damage to tangible goods, such as the resources or the product.

**INFORMATION**

Instructions of particular importance.

1.3 Reference documents

The instructions for use provided with each generator are made up of a collection of documents of which this manual represents the General Part.

Normally, the following documents are provided:

- a - CE declaration of conformity.
- b - Instruction manual for use and maintenance of the generators (this manual).
- c - Installation manual of the generators.
- d - Wiring diagrams of the control panels and power board.
- e - Engine use and maintenance manual
- f - Use and maintenance manual issued by the alternator manufacturer.
- g - Any other manuals for the optional accessories issued by the respective manufacturers.
- h - List of Mase Service Centres
- i - Certificate of guarantee
- l - Guarantee card

1.4 Facsimile of CE declaration of conformity

The generators constructed by **mase**, intended for countries in the European Community, are in conformity with the applicable EEC Directives (see 1.5) and are furnished with an EC declaration of conformity (Fig. 1).

1.5 Reference regulations and legislative provisions

All the **mase** diesel generators are designed and manufactured in compliance with the legislation in force. The generator and its components are constructed in accordance with the following applicable regulations and directives:

EN 292-1/2: Machine safety regulations.
General design principles.

EN 294: Machine safety regulations.
Safety distances to prevent contact of dangerous parts with the upper limbs.

ISO 3046: Alternate internal-combustion engines.

IEC 34-1: Rotary electric machines.

ISO 8528-1: Alternate current generators driven by alternate internal-combustion engines.

EN 60204-1 (CEI 44-5):

- Machine safety.
- Electrical equipment of machines.

EN 60439-1 (CEI 17-13/1): Assembled protection and manoeuvring equipment for low voltage (low-voltage panels).

EN 50081-1/2 (Electromagnetic compatibility):

General regulation on emission

- Part 1: Residential, commercial and light-industry environments.
- Part 2: Industrial environment.

EN 50082-1/2 (Electromagnetic compatibility):

General regulation on immunity.

- Part 1: Residential, commercial and light-industry environments.
- Part 2: Industrial environment.

89/392/EEC and subsequent amendments contained in the Directives **91/368/EEC**, **93/44/EEC** and **93/68/EEC**: Essential machine requirements for safety and health protection ("Machine" directive).

73/23/EEC and subsequent amendments contained in the Directive **93/68/EEC**: Guarantee of safety of electrical material intended for use within certain voltage limits ("Low Voltage" directives).

1.6 Machine identification

See Fig.2

- 1 - Manufacturer
- 2 - Machine code
- 3 - Year of construction
- 4 - Power factor
- 5 - Declared frequency
- 6 - Continuous power
- 7 - Rated voltage
- 8 - Rated current
- 9 - Weight
- 10 - Serial number

The machine code number, the serial number and the year of construction must always be quoted when contacting the manufacturer for information, requests for spare parts, etc.

1.8 Instrument panel

See Fig.4

Each generators is fitted with an instrument panel for the controls with the following components

- 1- Hour counter
- 2- Magnetothermal switch
- 3- DC current thermal switch
- 4- START/STOP-Preheat button
- 5- Engine protection module
- 6- "RUN" light – engine running
- 7- "OIL" light – low oil pressure
- 8- "°C" light – high engine temperature
- 9- "BATT" light – battery charger operating
- 10- "°C" light – high alternator temperature
- 11- Preheat ligh - preheat is operating
- 12- Fuel leak (version "RINA")

1.7 Generetors composition

See Fig.3

The generators are essentially composed of the following components:

- 1- Soundproof casing
- 2- Top access door
- 3- Side access door
- 4- Instrument panel
- 5- Anchoring brackets
- 6- Exhaust and cooling water pipe fitting
- 7- Seawater intake connection pipe fitting
- 8- Connection pipe fittings to fuel tank
- 9- Connection terminals to battery
- 10- Engine air filter
- 11- Coolant expansion tank
- 12- Engine oil extraction pump
- 13- Diesel fuel filter cartridge
- 14- Seawater pump
- 15- Fuel pump
- 16- Oil filter cartridge
- 17- Oil fillercap
- 18- Electric line connection box
- 19- Battery charger alternator
- 20- Coolant tank
- 21- Water/air heat exchanger
- 22- Exhaust manifold
- 23- Starter motor
- 24- Fuel cock
- 25- Remote control panel connector
- 26- RPM adjusting screw of engine

2. GENERATOR CHARACTERISTIC

2.1 General characteristic

The IS 6.5 and IS 7.6 generators were designed for easy installation on boats.

The soundproof casing, obtained with insulated, painted marine aluminium panels, allows easy access to the engine and the alternator for maintenance and inspection operations, and at the same time strongly reduces noise.

The 4-stroke, direct-injection, diesel engine, built by Yanmar, is extremely reliable and robust. Exhaust emission is in conformity with CARB regulations.

The alternator is a synchronous, 4-pole brushless type, and is fitted with two excitation capacitors. The high pickup capacity of the alternator makes the generator particularly suitable for the power supply of electric motors of air conditioners, desalination plants, compressors, etc.

The generator has a local control panel [Fig. 3 Ref. 4] on which the controls and control instruments are housed.

2.2 Cooling system

The generator engine is cooled by closed-circuit circulation of coolant which yields heat to the seawater by means of a heat exchanger [Fig. 3, Ref. 20].

This heat exchanger built of cupronickel was specially designed by **mase** to make the engine suitable for use at sea.

A second heat exchanger cools the air inside the soundproof casing and the air necessary for alternator ventilation.

At the time of installation a seawater feed circuit for cooling must be installed and an exhaust system to convey the combustion gas and the water used for cooling to the outside, as indicate in the installation manual.

2.3 Control panel

A control panel is positioned on the generator for running checks and to start and stop the generator. An engine protection module [Fig. 4 Ref. 5] controls the generator protections, stopping the engine in case of a fault and signalling the fault detected by means of special warning lights.

- Green "RUN" pilot light [Fig. 4 Ref. 6], when on, indicates that the generator is running and no operating fault has been detected.
- Red "BATT" pilot light [Fig. 4 Ref. 9], when on, indicates that the alternator battery charger is faulty.
- Red "OIL" pilot light [Fig. 4 Ref. 7], when on, indicates that the engine oil pressure is insufficient.
- Red [Fig. 4 Ref. 10] pilot light, when on, indicates

that the temperature of the coolant or the water circulating in the heat exchangers is too high.

- Red [Fig. 4 Ref. 8] pilot light, when on, indicates that the alternator windings have reached too high temperatures.
- Yellow [Fig. 4, Ref. 11] pilot light, when on, indicates that the glow plugs are active.

The following may also be found on the control panel:

- A bipolar magnetothermal switch [Fig. 4 Ref. 2] which cuts the power in case of an overload or short-circuit.
- A thermal switch (Fig. 4 Ref. 3) to protect the low-voltage electric system against short-circuit.
- An hour counter (Fig. 4 Ref. 1).
- The generator start/stop button [Fig. 4 Ref. 4].

The generator can be connected with a connector to the remote starting panel, supplied by **mase** as an optional, and can be installed on the dashboard.

Two different remote starting panels are available as shown in Fig. 5.

The most simple version has a start/stop button [Fig. 5 Ref. 1] and a green pilot light [Fig. 5 Ref. 2] which, when on, indicates that the generator is running.

The second version of the remote starting panel [Fig. 5 Ref. 3] has, in addition to the start/stop button, an instrument which indicates the engine oil pressure value (Fig. 5 Ref. 4) and an instrument which indicates the coolant temperature value [Fig. 5, Ref. 5].



DANGER

When carrying out maintenance operations on the generator, disconnect the negative pole of the starter battery to prevent accidental starting.

2.4 Data sheet

Engine	50 Hz	60Hz
Model	Yanmar 3TNE74A	
Type	Diesel 4 stroke	
Cylinders (nr.)	3	
Cylinder block material	Cast iron	
Bore (mm. - in.)	74 - 2.9	
Stroke (mm. - in.)	78 - 3.07	
Displacement (cc. - CID)	1006 - 61.3	
Power (hp)	11.5	14
RPM	1500	1800
Compression ratio	23:1	
Combustion system	Indirect injection	
Engine head material	Cast iron	
Speed governor	Centrifugal mechanical	
Lubrication system	Forced	
Oil sump capacity with filter(l - gal)	2.3 - 0.5	
Engine stop system	Fuel solenoid	
Fuel pump	Electric	
Fuel pump discharge (cm. - ft)	70 - 2.3	
Fuel consumption (l/hp)	2.5 - 0.54	2.6 - 0.57
Air intake (l/min. - gal/min.)	651 - 143	765 - 168
Starting battery (Ah-V)	70 - 12	
Battery charger (Ah-V)	40 - 12	
Starter (KW-V)	0.8 - 12	
Max. inclination	30°	
Water pump flow (l/min. - gal/min.)	25 - 5.4	28 - 6.1

Generator	50 Hz	60Hz
Type	Synchronous, 4-poles, self-excited	
Cooling	Air/water (Intercooler W/A)	
Voltage (V)	115 - 230	120 - 240
Frequency (Hz)	50	60
Rated current (A)	24.8	55 - 27.5
Max. power (KW)	6.5	7.6
Continuous power (KW)	5.7	6.6
Power factor (cos ø)	1	
Insulating class	H	
Voltage stability	±10%	
Frequency stability	±5%	

3 SAFETY REGULATIONS

3.1 General precautions

Before starting the generator and before starting any lubrication or maintenance operation, it is indispensable for the staff responsible to read and understand all the WARNINGS and all the CAUTION and DANGER indications listed in this manual and in the supplementary documentation furnished.

Nevertheless, the manufacturer cannot foresee all the possible circumstances which may lead to potential risks in the effective conditions of use of the generator. Any operations and/or procedures for maintenance not expressly recommended or indicated in the user manuals must always be notified to and approved by the manufacturer.

In the event that a procedure not specifically recommended needs to be applied, the user is responsible for assuring that such procedure is safe and does not cause harm to persons or things.


The manufacturer declines all responsibility for damage to persons or things deriving from inobservance of the safety regulations.


Carefully examine the safety warning plates on the machine and respect the relevant instructions.

- Do not permit incompetent persons or without adequate training to use the generator.
- Do not permit children or animals to approach the generator when it is in operation.
- Do not access the generator with wet hands, since it is a potential source of electric shock if improperly used.
- Any inspections of the generator must be carried out with the engine off. Inspections with the engine on are to be carried out by specialised personnel only.
- Do not inhale the combustion smoke since it contains substances hazardous to health.
- Use the generator with the access doors closed.
- Never touch the engine or alternator body with the hands when the generator is running or still hot.


DANGER

- *When carrying out maintenance operations on the generator, disconnect the negative pole of the starter battery to prevent accidental starting.*
- *In the event of oil or fuel leaks, clean off thoroughly to prevent creating fire hazard conditions.*
- *In the event of fire, use a homologated fire extinguisher – never use water.*
- *Do not allow access to persons wearing a pacemaker because of possible electromagnetic interference with the device.*

 **INFORMATION** Should any problem arise or should you have any questions, please contact the Mase SERVICE department.

 **WARNING** *When using the generator always bear in mind that in wet or very humid places and in confined conduction spaces it is obligatory to comply with articles 313 and 318 of Presidential Decree No. 547 27/04/55, as well as Chap. 11 Section IV of the CEI 64-8 regulation.*

3.2 Prescriptions for safety during installation and setup

-  **DANGER**
- *The personnel in charge of installation and starting of the generator must always wear a protective helmet, safety shoes and overalls.*
 - *Use protective gloves.*
 - *Do not leave disassembled parts, tools or anything else not forming part of the system on or near the engine.*
 - *Never leave inflammable liquids or cloths soaked in inflammable liquids in proximity of the generator, near electric equipment (including lamps) or parts of the electrical system.*
 - *Take the necessary precautions to prevent the danger of electrocution.*
 - *Check that the earthing system has been installed and constructed in accordance with regulations.*

4 USING THE GENERATOR

4.1 Preliminary checks

Before beginning with any starting procedure, it is extremely important to become "familiar" with the generator and its controls. Furthermore, a visual inspection must be carried out on the machine and the installation.

Any source of potential or real danger must be eliminated before proceeding.

- Identify the position of the emergency stop buttons, switches and other emergency systems on the generator.
- Learn the special emergency procedures relative to the installation in question.
- the oil level by means of the dipstick [Fig. 7 Ref. 2] (see table "A" for recommended oils [Fig. 8]).
- that all the anchoring points of the generator are properly tightened.
- that all the electrical utilities are off to prevent starting the generator on load
- that the water and fuel pipes are properly connected
- that all the electrical connections have properly been carried out and that there are no electrical connections in a bad state.
- that the water cock is open [Fig. 6 Ref. 2]
- that the section of the water circuit from the pump to the

valves has been filled manually if a non-return valve has been mounted on the sea intake (as recommended in the installation manual) [Fig. 4 Ref. 1].

4.2 Bleeding the fuel system

The presence of air bubbles in the fuel system is caused by irregular functioning of the engine or the incapacity to reach the nominal number of revolutions. Air might enter the fuel circuit through a not perfectly tight seal (pipes, filters, tank) or when the fuel in the tank is at minimum level. The fuel system has been designed in such a way as to autonomously eliminate air bubbles that have penetrated the circuit. Automatic bleeding is obtained by activating the fuel pump for a few minutes before starting the engine.

The fuel pump is activated by pressing the START button for a second.

Should the engine still function irregularly after this operation, consult a technician for a thorough inspection of the fuel system.


4.3 Starting

Before starting the generator, ensure that the preliminary checks described in paragraph 4.1 have been carried out.

Proceed with starting as follow:


- Press the button (Fig.4, Ref.4) located on the control panel in the STOP-Preheating position for 15-20 seconds in order to activate the preheating glow plugs; During this operation the LED on the engine protection module comes on (Fig.4, Ref.11).
- Invert the position of the button from the STOP-Preheating position to the START position and release it when the generator has started, taking care not to exceed 15 seconds for each attempt and respecting an interval of at least 30 seconds between one attempt and the next.

Once the generator has started, all the warning lights of the engine protection module [Fig. 4, Ref. 5] will come on for a few seconds and if there are no engine or generator faults, only the green RUN light [Fig. 4, Ref.6] will remain on to indicate that the generator has been started and that functioning is regular.

 **CAUTION** *Repeated attempts at starting with negative outcome may cause excess accumulation of water in the exhaust system with possible serious damage to the engine.*
If it is difficult to start the engine, do not insist for too long without first having closed the sea intake cock [Fig. 6 Ref. 2].

4.4 Stopping

The generator is stopped by pressing the button [Fig.4, Ref.4] on the control panel in "STOP" position.

 **WARNING** Before stopping the generator it is recommended to let it run for a few minutes without drawing electric current, in order to allow the engine and the alternator to cool down.

5. PROTECTIONS

The generators are equipped with a series of protections which safeguard it against improper use and faults which may compromise integrity.

When the generator stops because a protection has tripped, on the engine protection module [Fig. 5, Ref. 5] of the control panel the warning light relative to the fault will come on.

5.1 Low oil pressure protection

Intervenes switching off the generator when the engine oil pressure is insufficient. Its intervention is signalled by the "OIL" light [Fig., 4, Ref. 7] coming on. Normally it is sufficient to top up with the lacking quantity of oil to be able to restart the generator.

CAUTION

- *The low oil pressure protection does not give an indication of the level of engine oil in the sump. Therefore, check this level daily.*
- *The engine functions properly if it does not exceed an inclination of maximum 30° for less than 3 minutes, 25° without time limit, both on the longitudinal and the transverse axis. If the engine is operated at a greater inclination, the risk is insufficient lubrication or aspiration of engine oil through the air filter.*

5.2 High water temperature protection

Intervenes switching off the generator when the engine coolant temperature is too high or there is no circulation of seawater.


Its intervention is signalled by the "°C" light [Fig. 4, Ref. 10] coming on.

Only restart the generator after the cause of the fault has been identified and removed.

5.3 Alternator overheating protection

Intervenes switching off the generator when there is a thermal overload on the alternator.

Its intervention is signalled by the "°C" light [Fig. 4, Ref. 8] coming on. The generator can be restarted after a few minutes when the temperature of the alternator windings has returned to normal values. It is, however, recommended to find and remove the causes of the intervention.

 **INFORMATION** In the event of one of the above described protections intervening, after ascertaining and removing the cause of the intervention, press the "STOP" button to reset the control panel (otherwise the signal would remain in memory preventing the engine from starting).

5.4 Protection against short-circuit and overload

The generator is protected against short-circuit and overload. A bipolar magnetothermal switch [Fig. 4 Ref. 2] cuts the supply of electric current when a short-circuit occurs or when the electric current delivered exceeds the nominal value.

Before restoring the contact by lifting the lever of the magnetothermal switch, disconnect the utilities.


5.5 Protection against short-circuit of the low-voltage electric system

In the event of a short-circuit in the low-voltage electric system, a thermal switch [Fig. 4, Ref. 3] breaks the circuit stopping the generator. In this case the warning lights of the engine protection module will all be off and it will not be possible to re-attempt starting.

Before restoring the electric circuit by pressing the button located on the thermal switch [Fig. 4 Ref. 3], have a specialised technician find and remove the cause of the short-circuit.

6 MAINTENANCE


6.1 Preamble

 **DANGER** Any maintenance operation on the generator must be carried out with the engine off and leaving it to cool down sufficiently, and must only be carried out by authorised and suitably trained personnel.

It is recommended to scrupulously follow the instructions in the manual provided by the engine Manufacturer with each generator.

It is important to regularly inspect and carry out maintenance on the generator. The frequency of maintenance should be decided on the basis of the number of hours of operation.

To proceed with maintenance the side and top doors must be removed.

 **CAUTION** Before accessing the generator, disconnect one pole of the starter battery in order to prevent accidental starting.

6.2 Ordinary engine maintenance

The periodic maintenance to be carried out on the engine is listed in TABLE "B".

For more detailed information consult the manual provided with each generator by the engine manufacturer.

INFORMATION Check the oil level by means of the graduated dipstick [Fig. 7, Ref. 2]. The level must always be between the MAX and MIN notches on the dipstick [Fig. 7 Ref. 1].

6.3 Engine oil and oil filter change

The engine oil sump capacity is 2.3 litres.

Top-ups and filling with engine oil is carried out through the hole [Fig. 3, Ref. 17].

To change the oil in the oil sump, remove the dipstick [Fig. 7, Ref. 2] and operate the special extraction pump [Fig. 3, Ref. 12] after having removed the screw which functions as plug.

It is recommended to drain the oil when it is still sufficiently warm to flow easily.

For recommended oils see table "A", Fig. 8.

INFORMATION

- The first engine oil change must be carried out after 50 hours of generator operation. For the second and subsequent oil changes, every 200 hours is sufficient.
- For more detailed information on engine lubrication, consult the engine use and maintenance manual attached to the generator.
- Dispose of the used oil or fuel in an appropriate manner as they are polluting products. Take the used engine oil to special collection centres responsible for disposal.

CAUTION Avoid contact of engine oil with the skin. During maintenance operations use gloves and protective glasses. In case of contact with engine oil, immediately and thoroughly wash the affected part with soap and water.

To replace the engine oil filter cartridge [Fig. 3, Ref. 16], unscrew it from its support, using suitable tools normally found on the market. Reposition the new cartridge, taking care to lubricate the rubber ring gasket. The first replacement must be carried out after 50 hours of generator operation. For the second and subsequent replacements, respect an interval of 400 hours. For further information consult the engine use and maintenance manual.

INFORMATION For the safety of the engine, use only original spare parts.

CAUTION When the operation has been completed, thoroughly wipe off all oil and fuel from the engine parts.

6.4 Air filter cleaning

The generators of the IS series have a dry air filter which prevents foreign bodies from entering the combustion chamber. For its maintenance it is sufficient to clean the filtering mass with diesel fuel once a year to remove any impurities.

CAUTION Dispose of the liquids used for air filter washing in an appropriate manner. Take them to special collection centres.

6.5 Fuel filter replacement

To guarantee long life and proper functioning of the engine, it is extremely important to periodically replace the fuel filter cartridge, respecting the frequency indicated by the engine manufacturer as listed in the table in Paragraph 6.15.

This operation is carried out in the following steps:


- Close the fuel cock [Fig. 3, Ref. 24]
 - Completely unscrew the ring nut of the support [Fig. 3, Ref. 13]
 - Remove the old cartridge and position the new one.
 - For remounting repeat the operations in reverse order.
- When the filter has been replaced, bleed the fuel system carrying out the operations described in Paragraph 4.2.

CAUTION Avoid contact of the fuel oil with the skin. During maintenance operations use gloves and protective glasses. In case of contact with fuel, immediately and thoroughly wash the affected part with soap and water.

CAUTION When the operation has been completed, thoroughly wipe off all traces of fuel and take the used cloths to special collection centres.

6.6 Coolant check

Periodically check the coolant level in the closed-circuit cooling system. The reference index for this check is printed on the expansion tank [Fig. 3, Ref. 11]. If the level is insufficient, pour coolant into the expansion tank, taking care not to exceed the maximum level index.

 **DANGER** *Never open the cap of the expansion tank [Fig. 3, Ref. 11] or coolant tank [Fig. 3, Ref. 20] when the engine is hot to prevent dangerous coolant leaks.*

6.7 V-belt tension check

A V-belt is used to transmit the rotary motion from the drive shaft pulley to that of the seawater pump [Fig. 9 Ref. 1].

Excessive belt tension accelerates wear, while a slack belt makes the pulleys idle and does not allow sufficient water circulation.

Adjust the belt tension as follows:

Loosen the two adjusting screws [Fig. 9, Ref. 2] and move the seawater pump outwards to increase the tension or inwards to decrease it. Lock the screws and check the tension.


The correct belt tension is such as to allow a yield of about 5 mm [Fig. 9] under a thrust force of 8 kg.


A second belt is used to transmit the rotary motion from the drive shaft pulley to that of the closed-circuit coolant pump and the battery charger DC alternator [Fig. 9 Ref. 3].

Adjust the belt tension as follows:

Loosen the adjusting screw [Fig. 9 Ref. 4] and move the battery charger DC alternator [Fig. 9, Ref. 5] outwards to increase the tension and inwards to decrease it.

The correct belt tension is such as to allow a yield of about 10 mm [Fig. 9] under a thrust force of 8 kg.


 **INFORMATION** *To prevent the belt from slipping, do not dirty it with oil. Clean the belt with petrol if any oil is spilled.*

 **DANGER** *Keep hands away from the V-belt or the pulleys when the engine is running.*

6.8 Emptying the cooling system

To carry out maintenance on the water/air exchanger or on the cooling system the seawater must be drained from the intake circuit. This operation is carried out as follows:

- Close the sea intake cock [Fig. 6, Ref. 2]
- Open the drain tap [Fig. 6, Ref. 3] until all the water has run out
- Close the drain tap.


 **CAUTION** *Reopen the seawater intake cock before starting the generator.*

6.9 Coolant replacement

Yearly change the coolant in the closed-circuit cooling system.

Connect a 20-30 cm long rubber tube [Fig. 10, Ref. 2] to the drain tap [Fig. 10, Ref. 1] located on the engine base to facilitate collection of the used coolant in a collection receptacle [Fig. 10, Ref. 3]. Open the tap and completely drain the closed-circuit cooling system.

When the operation has been completed, close the tap and fill the circuit with new coolant.

 **INFORMATION** *Dispose of the used coolant in an appropriate manner as it is a polluting product. Take the used coolant to special collection centres responsible for disposal.*

6.10 Zinc anode replacement

To protect the water/air heat exchanger [Fig. 11, Ref. 1] and the water/coolant heat exchanger [Fig. 11, Ref. 2] against galvanic current, two sacrificial zinc anodes [Fig. 11, Ref. 4] have been inserted inside them. Periodically check their state of wear and, if necessary, replace them in order to prevent that the galvanic current irreparably corrodes the heat exchanger. It is recommended to check the zinc anodes at least once a month when the generator is new to check how fast consumption is, to then be able to act accordingly.

It is, however, opportune to replace the zinc anodes at least once a year.

Fig. 11 shows the points where the zinc anodes are positioned.

6.11 Seawater pump maintenance

At least once a year check the integrity of the rubber rotor of the seawater pump [Fig. 12, Ref. 1].

Before opening the seawater pump to inspect the rotor, drain the seawater from the cooling system as described in Paragraph 6.8.

To access the rotor, remove the cover [Fig. 12, Ref. 2] and with the aid of a pair of pliers extract the rotor pulling it out with force.

To remount a new rotor, repeat the operations described above in reverse order.


6.12 Alternator maintenance

The alternator used on this model of generator is type synchronous, self-energised, with electronic voltage regulation. This model alternator, without manifold and brushes, does not require particular maintenance operations. The periodic checks and maintenance are limited to removing any traces of damp and oxidation which might damage it.


6.13 Battery maintenance


For starting all the generator models, it is recommended to use an 70 A/h battery for ambient temperatures exceeding 0°C, and 100 A/h for lower temperatures. Before installing a new battery it is important that it undergoes a full charging cycle.

At least once a month check the level of the electrolyte and, if necessary, top up with distilled water. If the generator is not to be used for a long period, it is recommended to disconnect the battery and store it in a dry place at a temperature over 10°C and to carry out a full charging cycle once a month.


 **CAUTION** *If the battery is left completely flat for long periods, there is a risk of irreparably damaging it.*

The positive terminal of the battery must be protected with Vaseline to prevent corrosion and the formation of oxide.

 **WARNING** *For top-ups with sulphuric acid, ready solutions must be used.*

 **CAUTION** *The battery top-up operations with distilled water or with acid must be carried out with rubber gloves and protective glasses to prevent accidental contact of the sulphuric acid with the skin.*

In the event of accidental contact, thoroughly wash the part affected with soap and water and consult a doctor.

 **INFORMATION** *Before recharging the battery check the level of the electrolyte and, if necessary, fill up with distilled water. This operation must be repeated when the recharging cycle has been completed.*

6.14 Periods of inactivity

Start up the generator at least once a month.

If the generator is not to be used for a long time, the following operations must be carried out:

- Change the engine oil
- Replace the oil filter cartridge (see par. 6.3)
- Replace the fuel filter cartridge (see par. 6.5)
- Remove the injectors and pour 2 cc engine oil into each cylinder and let the engine turn over a few times, manually operating the drive shaft pulley. Remount the injectors.
- Replace the zinc anodes (see par. 6.10)
- Through the seawater intake pipe aspirate some anti-freeze whose function is to protect the heat exchangers against low temperatures and to lubricate the seawater pump rotor and the metallic parts in the cooling

system.

- Disconnect the starter battery and store it in a dry place (see par. 6.13)
- Disconnect the sea exhaust pipe from the engine manifold.
- Clean the seawater filter.
- Close the seawater intake cock.
- Drain the seawater from the exhaust.
- Clean and lubricate the antisiphon valve, if installed (siphon break).

6.15 Table of scheduled maintenance

OPERATION	HOURS
Check engine oil level	10
Check coolant	10
Check for oil leaks	20
Check for fuel leaks	20
Check for coolant leaks	20
Adjust V-belt tension	100
Check battery charger	100
Clean fuel filter	200
Adjust belt tension	200
*Change engine oil	200
Check seawater pump rotor	400
Check engine rpm	400
Check integrity of electrical connections	400
Replace fuel filter	400
* Replace oil filter	400
Check injectors	400
Check injector timing	400
Adjust play on intake/exhaust valve	400
Check the fuel injection pump	1000
Check battery electrolyte level	monthly
Clean and deoxidise the metallic parts	yearly
Clean air filter	yearly
Replace coolant completely	yearly
Replace zinc anodes	yearly

Carry out the first maintenance operation after 50 hours, subsequently according the required intervals.

TABLE "B"

6.16 Troubleshooting

The starter motor turns but the main engine does not start

- Check that there is fuel in the tank (fill up)
- Check if the stop electromagnet is in the firing position (consult Service Centre)
- Bleed the air bubbles from the fuel circuit (see par. 4.2)

The engine protection module is not activated when the START button is pressed

- battery, and the electrical connections (reconnect).
- Check integrity of the battery (recharge or replace).

The generator switches off during the operating period

- Check if a protection has been activated with the relevant light coming on (remove the cause and retry starting).
- Check if there is fuel in the tank (fill up).

There is a high grade of smoke at the engine exhaust

- Check that the oil level in the sump does not exceed the MAX index (restore level).
- Check that the generator is not in overload.
- Check calibration of the injectors (consult Service Centre).

The engine runs irregularly

- Check the fuel filters (replace).
- Bleed the air bubbles from the fuel circuit (see par. 4.2).

The alternator voltage is too low

- Check the engine rpm:
1560 rpm without utilities connected at 50Hz
1860 rpm without utilities connected at 60Hz
- Excitation capacitors damaged (replace).

Starter battery flat

- Check the electrolyte level in the battery (restore the level).
- Check functioning of the DC alternator.
- Check integrity of the battery.

The generator does not deliver power

- Check that the magnetothermal switch [Fig. 4, Ref. 2] is in the "ON" position. If not, contact an authorised Service Centre.

7 TRANSPORT AND HANDLING

For transport, all the generators are fixed to a pallet by means of screws.

For handling on the boat use the engine lifting hooks located under the top access door [Fig.3, Ref.2]. Hook the generator carefully and lift it slowly without sudden movements.



DANGER

- *Hooking the generator at points different from that indicated may cause damage to the generator or be dangerous to the operators.*
- *During lifting all personnel must keep a safe distance and the operators must wear protective helmets.*

8 SCRAPPING

At the end of its lifetime the generator must be taken to official scrapyards.

INFORMATION *Do not dispose of the generator at household refuse disposal sites, as many of its parts are polluting.*

9 WIRING DIAGRAM REFERENCES (Fig.7)

- 1 - Hours counter
- 2 - Magnetothermal switch
- 3 - Isolator
- 4 - Power terminal board
- 5 - Capacitors
- 6 - Stator
- 7 - Rotor
- 8 - Alternator
- 9 - Thermal switch
- 10 - START / STOP-Preheating button
- 11 - Engine protection module
- 12 - Terminal board
- 13 - Connector for remote control panel
- 14 - Fuel level gauge
- 15 - Oil pressure gauge
- 16 - Water temperature gauge
- 17 - High water temperature sensor
- 18 - High coolant temperature sensor
- 19 - Oil pressure switch
- 20 - Battery charger alternator
- 21 - Fuel pump
- 22 - Stop electromagnet
- 23 - Starter motor
- 24 - Battery connection terminals
- 25 - Preheating
- 26 - Fuses
- 27 - Preheating relay
- 28 - Remote control panel connection cable
- 29 - START / STOP-Preheating button
- 30 - Oil pressure gauge instrument
- 31 - Coolant temperature gauge instrument
- 32 - Remote control kit with instrumentals
- 33 - Remote control kit