

USER'S MANUAL

DIESEL GENSETS



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1. WELCOME

Thank you for purchasing a Grupos electrógenos EUROPA Genset

The purpose of this manual is to familiarize the user on how to use and work with the Genset, its components and maintenance.

We recommend carefully reading the manual prior to working with the equipment in order to ensure proper use.

Save this manual for future reference and if you ever decide to sell the Genset, be sure to include the manual along with the unit.

The following is a general description of the unit and the necessary information for installation, operation and preventive maintenance.

Additionally, you should have received a specific user manual for the Engine and Alternator, electrical setup, a set of keys, silencer or exhaust pipe and flexible tube (supplied separately for open-skid units).

Should you have any problem with the equipment provided, please contact the distributor directly.

GRUPOS ELECTRÓGENOS EUROPA, S.A., as part of its dedication to constant product improvement, will revise its manuals and incorporate the improvements made to supplied units. Thus the information contained in this document is subject to change without prior notice and without obligation to update.

2. BASIC SAFETY RULES

Safety precautions and recommendations for handling the Generator Set supplied by GESAN.

- 1) Do not allow the unit to be used by unauthorized personnel or by minors without adult supervision.
- 2) Use the necessary Individual Protection Equipment.
- 3) Ground the machine.
- 4) Ensure there is sufficient lighting illuminating the set and its control panels prior to starting it up. The minimum illumination level must be 20 lux.
- 5) Do not install the open-skid Genset outdoors; risk of electrocution and inoperability.
- 6) The supply line between the Generator Set and the consumers should be protected by means of a circuit breaker for protection against earth leakage (ELCB).
- 7) Under no circumstances shall the equipment be operated with the doors open. There is a risk of electric shock, burns or entrapment if the set is operated with the doors open. Ensure that the generator set's doors are closed and locked with key prior to starting it up.
- 8) The gases generated by the set's engine are highly toxic and may result in death. Never inhale the exhaust gases generated by the set. If the unit must be operated in an enclosed area or in a poorly ventilated area, the engine exhaust gases must be routed towards the exterior for a safe operation.
- 9) The exhaust system generates enough heat to ignite some materials. Therefore, never install the generator set near flammable materials or near materials that may ignite easily or in locations where the risk of a fire occurring is high.
- 10) Do not touch the engine or the exhaust during operation of the generator set: Severe burns may occur. The exhaust hot areas are protected against accidental contact. In areas where this type of protection is not feasible, the risk is indicated using appropriate signs.
- 11) Ensure proper ventilation in the area where the generator is installed in order to guarantee sufficient flow of cooling air.
- 12) Know how to stop the unit in case of emergency. take special care in handling and storage.
- 13) For refueling the engine, the generator set incorporates an exterior fuel filler neck and cap for filling the tank with diesel. Never refuel with the engine running or in poorly ventilated areas; remember that fuel vapors are toxic and flammable. Take the necessary safety precautions when handling fuel; the use of gloves and safety goggles is recommended.
- 14) The fuel used is flammable, volatile and toxic. Prevent any spill and carefully wash your hands after handling.
- 15) If you notice abnormal behavior by the Generator Set, stop the unit and locate, examine and resolve the potential failure of the unit prior to restarting. Contact our technical service if needed.

- 16) Keep the unit at least one meter away from buildings or other units.
- 17) Be cautious when switching or installing batteries as they contain acids which are highly hazardous. Avoid spills and use protection to avoid contact with the skin and eyes. In case of contact, rinse thoroughly with water and contact a doctor immediately.
- 18) In case of ingestion of battery acid, drink large amounts of water and milk and contact a doctor immediately.
- 19) Use only distilled water in the battery: tap water reduces its life cycle.
- 20) If a battery is filled above the maximum level, the electrolytes will spill out; if this happens, clean the area quickly to avoid corrosion of the parts it has come in contact with.
- 21) Frequently clean the unit to avoid obstructions or the entry of foreign elements into the unit (dust, moisture, etc.).
- 22) Regularly inspect the unit's electrical cords.
- 23) Engine oil is toxic and hazardous to the environment. Adopt the necessary safety measures when handling engine oil. Prolonged exposure to used engine oil may cause skin cancer. Carefully wash your hands after handling.
- 24) Avoid oil spills on both the inside and outside of the genset. In case of an oil spill on the inside of the unit, clean it properly as it could potentially become a flammable material.
- 25) Do not overfill the tank and make sure it is closed properly after filling. Use extreme precaution if fuel is spilled: the vapors and the fuel itself are flammable. Clean the area completely before starting up the unit.
- 26) Do not smoke or bring any flames or sparks in the vicinity of the electrical generator: risk of explosions.

3. GENSET OVERVIEW

General overview of the Genset and its different configurations manufactured by GRUPOS ELECTRÓGENOS EUROPA, S.A. (may be different from the equipment supplied).



Figure 1 – Genset with canopy and optional trailer



Figure 2-Genset without canopy

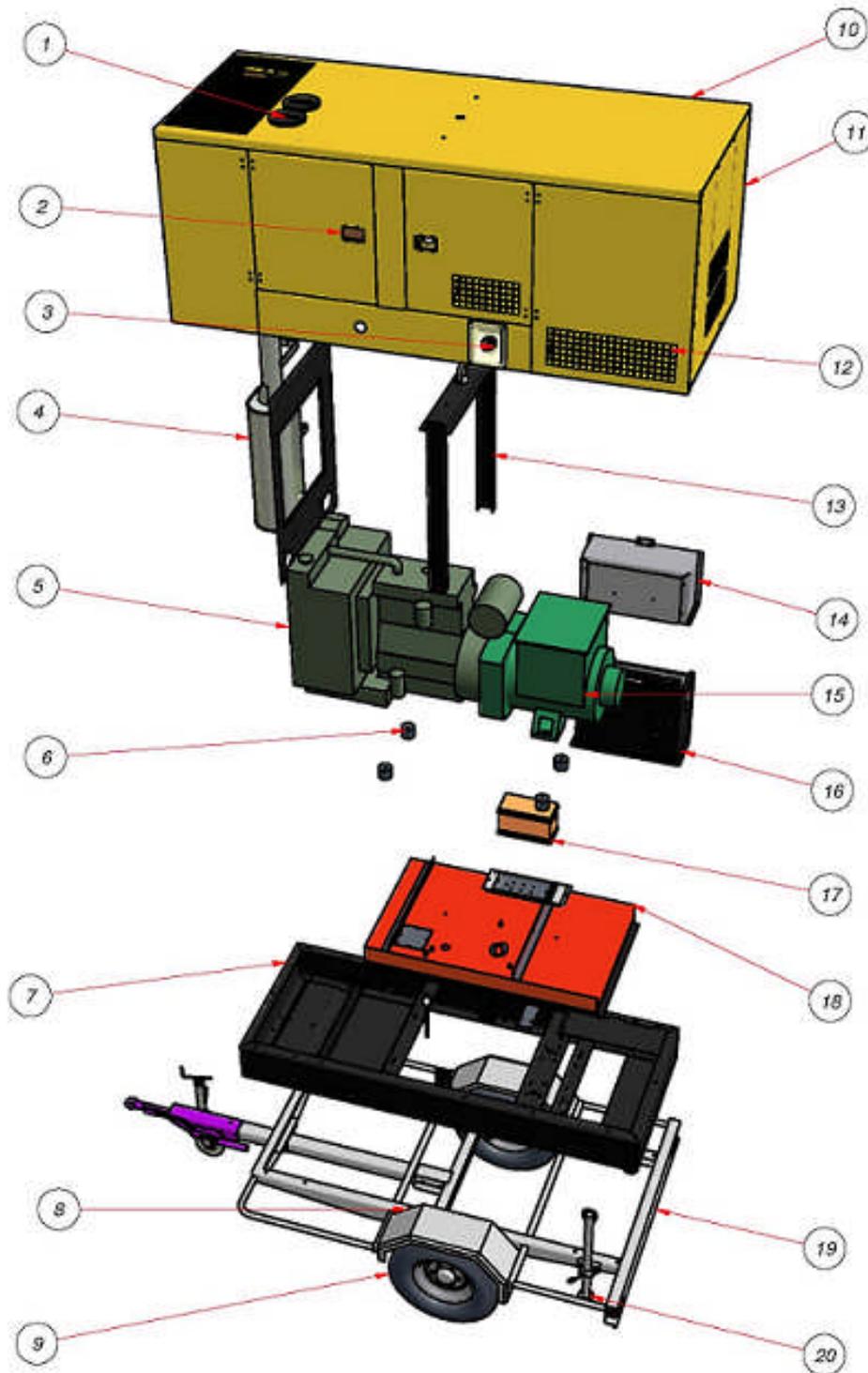


Figure 3 – Detailed view of insonorized DIESEL genset

- | | |
|-----------------------|-------------------------------|
| 1) Coolant tank hatch | 11) Electrical panel doors |
| 2) Side access door | 12) Ventilation grill |
| 3) Fuel tank cap | 13) Lifting frame and eyebolt |
| 4) Exhaust Silencer | 14) Electrical Control panel |
| 5) Engine | 15) Alternator |
| 6) Antivibration feet | 16) Electrical power panel |
| 7) Base frame | 17) Battery |
| 8) Base support | 18) Fuel tank |
| 9) Road tráiler | 19) vehicle registration |
| 10) Canopy | 20) Props |

3.1 SOUND INSULATION

The supplied unit may be:

- **Soundproofed.** Includes sound-insulating canopy.
- **Open skid.** Please keep in mind that compliance with current regulations requires that proper room sound insulation will be provided for this model. (See section 4.2 INSTALLATION)

Each Genset is provided with a sticker indicating the level of noise output produced.

		
<p><i>Noise output 90 dBA</i></p>	<p><i>Noise output 114 dBA</i></p>	<p><i>Mandatory hearing protection</i></p>

Figure 4-Noise output pictograms and hearing protection required

The noise level, on soundproofed units, has been measured according to the European directive 2000/14/EC and in compliance with the maximum levels established by the directive 2005/88/EC.

Local standards that may be more restrictive must be taken into consideration. In all cases it is the responsibility of the installer to comply with the current regulations.

3.2 CONTROL UNITS

The unit provided may be controlled by different modules depending on the type of function it has been designed to perform.

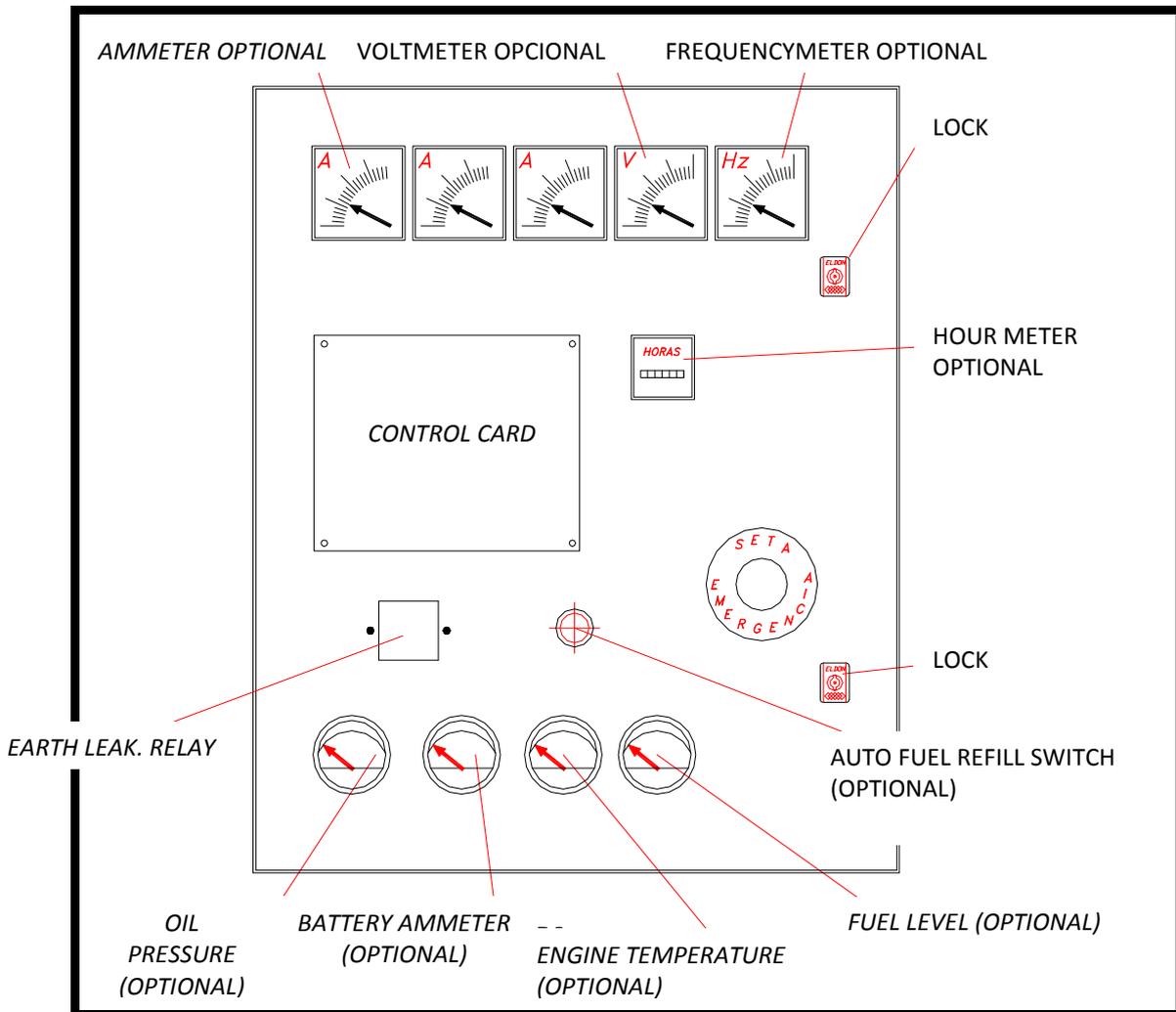


Figure 5 – Generic Control Panel

3.2.1. INTELIGEN Digital Control Module

If you purchased a generator set with an INTELIGEN control module, the electrical panel will look like the following diagram:

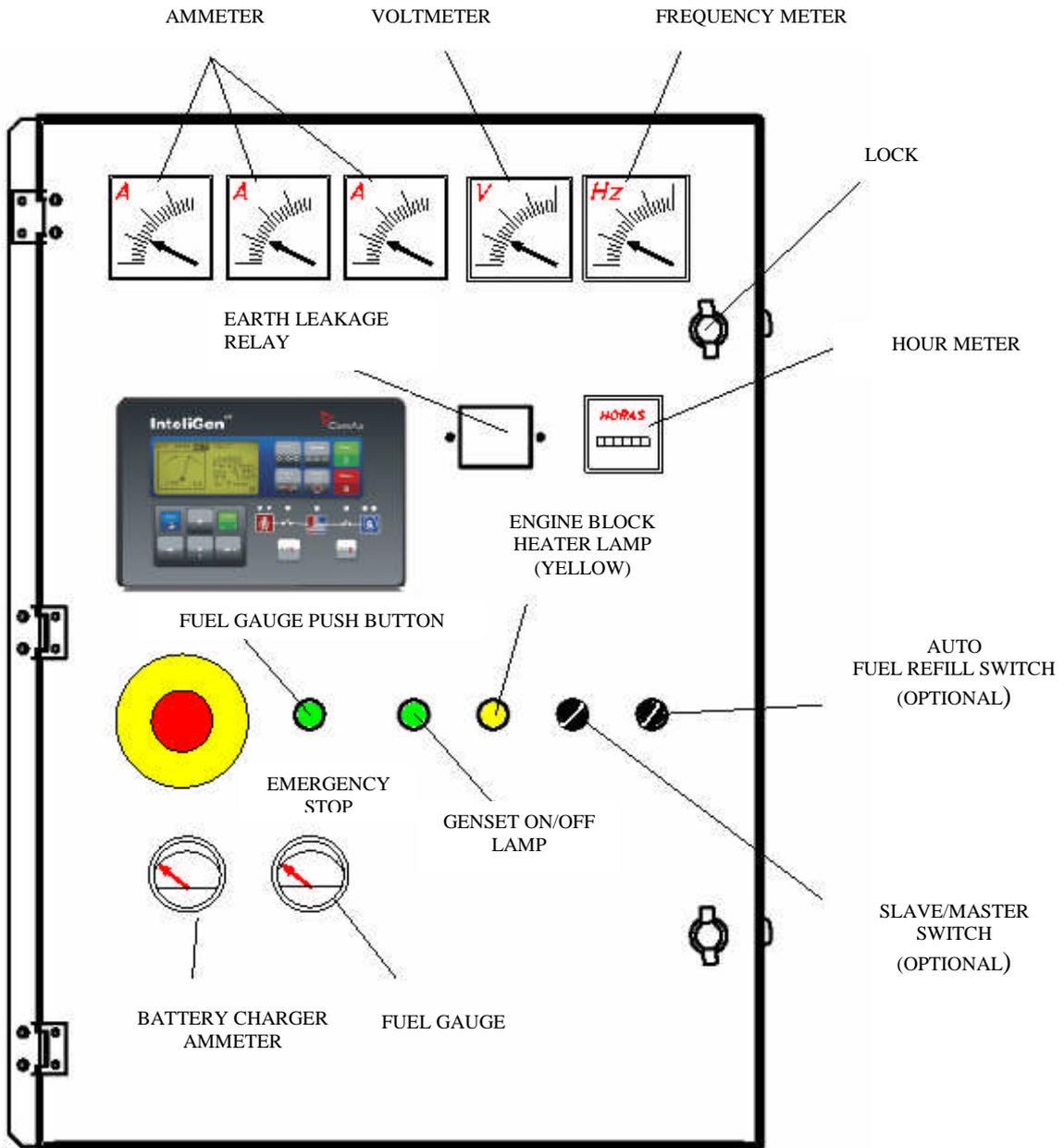


Figure 6 – Control Panel of the IntelliGen Control Module

3.3 TRAILER

The generator set be supplied with a trailer for transporting the unit.

- **Site Trailer:** for private-use areas only. Includes DIN hitch ring, safety brake and jockey wheel.



Figure 7 – Site trailer

- **Road trailer:** built for driving on public roads. Includes service brake and parking brake (exclusively for models weighing over 750 kg), a DIN or ball type hitch, nameplate with chassis number, jockey wheel, light kit and mudguards (provided separately).



Figure 8 – All Road trailer

- Note: In the European Community, those with drivers' licenses for vehicle types B, C and D are authorized to drive the vehicle with a trailer of maximum allowable weight not exceeding 750 kg, or greater in the case of holders of class B licenses as long as the maximum allowable weight of the trailer does not exceed the tare of the towing vehicle and the sum of the maximum allowable weights of both vehicles does not exceed 3,500 kg.

Check to make sure the Maximum Allowable Weight (MAW) of the Generator Set supplied by GRUPOS ELECTRÓGENOS EUROPA, S.A., is below the Maximum Trailer Weight (MTW) with or without a brake depending on the Trailer supplied.

It will not be necessary to obtain special insurance for towed loads weighing less than 750 kg; simply pointing this out to the company insuring the towing vehicle, with the towed equipment being covered by the original policy. In cases where the weight exceeds 750 kg, separate insurance will be required.

Once the Trailer has been purchased, GRUPOS ELECTRÓGENOS EUROPA, S.A., will provide you with the pertinent documentation. If the weight exceeds 750 kg, a Road Trailer will be needed, along with a license plate for trailers (red in Spain).

When choosing the hitch, be sure to consider the maximum speed at which the towing vehicle can travel.

It is the owner's responsibility to handle all of the steps required for proper towing. Once you have received the Generator Set, you must contact GRUPOS ELECTRÓGENOS EUROPA, S.A., in order to be sent the Technical Vehicle Inspection Card. Afterwards, you will need to carry out the steps required for obtaining a license for the vehicle and a permit for driving it on public roads (in Spain this is called ITV).

The table below shows the most relative data for those models that may include the certified trailer.

Perkins Models, which may include certified trailers

(W) = Width; (L) = Length; (H) = Height

Model	Weight	Dimensions (W)x(L)x(H)	Tire Size
DPS 9	612Kg	1.320x2.830x1.540	13" 145/80R 4J 04/58,5x98x14-E16 387Kg
DPS 13	693Kg	1.320x2.830x1.540	13" 145/80R 4J 04/58,5x98x14-E16 387Kg
DPS 20	813Kg	1.320x3.150x1.550	13" 165/80R 4J 04/58,5x98x14-E16 487Kg
DPS 30	1.432Kg	1.700x3.580x1.780	14" 185R 5J 05/94x140x18,5-E1 1200/850Kg
DPS 45	1.518Kg	1.700x3.580x1.780	14" 185R 5J 05/94x140x18,5-E1 1200/850Kg
DPS 60	1.577Kg	1.700x3.580x1.780	14" 185R 5J 05/94x140x18,5-E1 1200/850Kg
DPS80	1.821Kg	1.630x4.170x1.840	14" 215R 6J 06/161x205x21,5-B2 1120Kg
DPS 100	1840Kg	1.630x4.170x1.840	14" 215R 6J 06/161x205x21,5-B2 1120Kg
DPS 140	2.459Kg	1.710x5.000x2.090	14" 185R 5J 05/94x140x18,5-E1 1200/850Kg

Volvo Models that may include a certified trailer

(W) = Width; (L) = Length; (H) = Height

Model	Weight	Dimensions (W)x(L)x(H)	Tire Size
DVS 130	2.619Kg	1.710x5.000x2.090	14" 185R 5J 05/94x140x18,5-E1 1200/850Kg
DVS 150	2.671Kg	1.710x5.000x2.090	14" 185R 5J 05/94x140x18,5-E1 1200/850Kg

4. INSTALLATION OF THE GENSET

In this part of the manual it is described how to install a “generic” generator set composed of a diesel engine, alternator and electrical panel supplied by GRUPOS ELECTROGENOS EUROPA S.A. For other applications, our technical service will advise.

4.1 UNLOADING AND TRANSPORT

The unloading and transport of the unit should only be done by qualified personnel, observing certain minimum safety conditions.

- The ground must be capable of supporting the full weight of the Genset and the forklift.
- Make sure that the battery is disconnected.
- Make sure that the fuel tank is empty.
- Place the open arms of the forklift below the chassis at an equal distance with respect to the lifting frame.
- With a hoist, raise the unit using the lifting frame eyebolt.

The figure below shows a generator set that which includes a frame with a single lifting point.

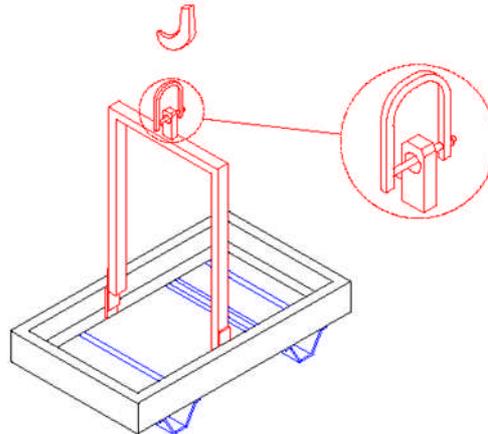


Figure 9 – Lifting frame

If your unit includes a trailer, one of the following may apply:

- **Trailer 1 - Site trailer:** Connected with a DIN hitch ring and safety chains to the rear of the towing vehicle. Use of this Trailer is not authorized on public roads. Use the safety brake whenever necessary.
- **Trailer 2 - Road trailer:** Keep in mind the legal considerations detailed in point 3.3.



Always perform the following precautionary steps:

- Make sure the hitch ring and coupling connecting the towing vehicle to the Trailer have the adequate towing capacity supporting a weight equal to or greater than the gross trailer weight.
- Make sure there is no wear or damage to the hitch system or coupling; never tow the genset if there is excessive wear or if any piece is damaged.
- Make sure the coupling is properly fastened to the towing vehicle.
- Check the condition of the trailer's tires.
- Connect the safety cable to the bumper or rear part of the towing vehicle; never attach it to the generator set or to the hitch ring itself.
- Check to make sure the brake systems on both the Trailer and towing vehicle are in perfect condition.
- Make sure the trailer's turn signal indicators and brake lights are correctly installed and functioning properly.
- After each transport, apply a light coat of grease to both the towing vehicle's coupling and the trailer's hitch ring. Before towing again, clean and grease both.
- Install safety chains on units with the Site Trailer.

4.2 INSTALLATION OF STATIONARY UNITS

This manual includes a detailed description of how to install a “generic” genset consisting of a diesel engine, alternator and electrical panel. For all specific applications, our technical services team will advise you.

4.2.1 Premises

Take into account the fuel supply, ventilation of the premises, output and direction of exhaust gases and noise produced.

- *Dimensions*

Dimensions must allow for execution of the various necessary maintenance and disassembly operations. Be sure to leave at least 1 meter on all sides of the Genset to allow doors to open.

- *Openings*

Premises must have doorways allowing genset to pass through and ventilation (fresh air intake, radiator hot air outlet, exhaust outlet) with a surface area suitable to the unit’s power rating, the premises’ cooling system and soundproofing system.

GRUPOS ELECTRÓGENOS EUROPA, S.A., does not recommend installing soundproofed units in enclosed areas.

If the unit has to be installed in an enclosed area, it is advisable to use open-skid units and soundproof the workroom, in compliance with current fire safety legislation.

The following Figure shows a typical installation of an open-skid unit in an enclosed area.

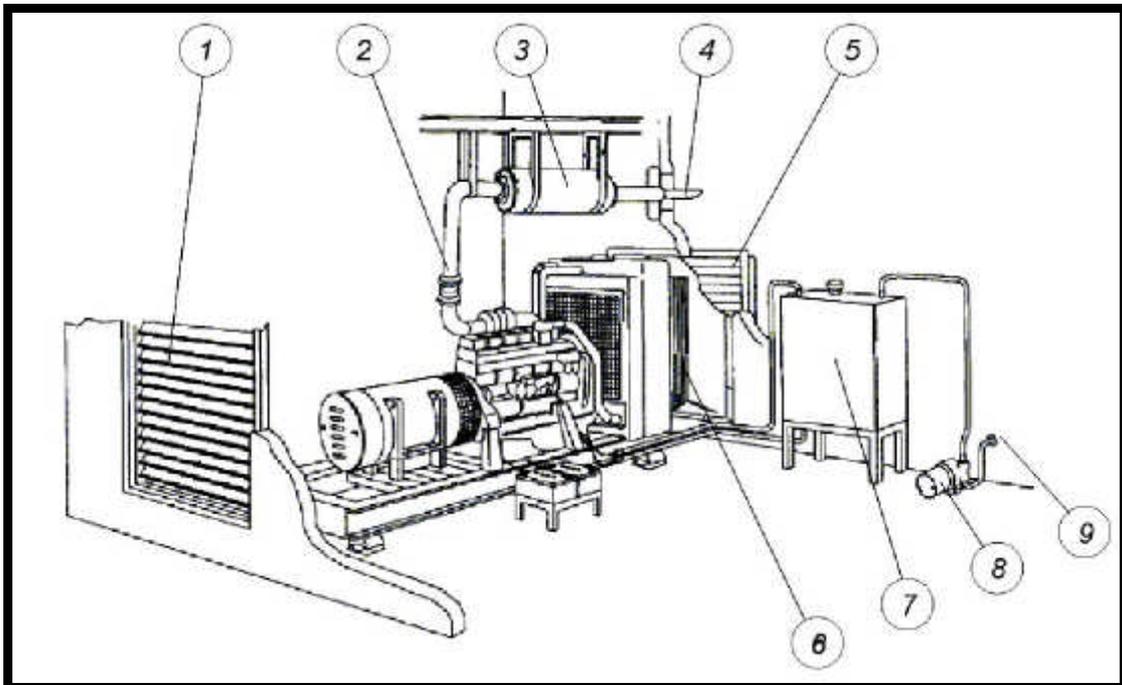


Figure 10 – Detailed view of installation of open-skid genset

- 1) Air intake grill. Shall be 1.4 times the surface area of the engine's radiator panel.
- 2) Exhaust smoke outlet. This will be explained in more detail later on.
- 3) Silent. Must be firmly installed and fixed to a stable structure.
- 4) Exterior smoke exhaust outlet. Smoke must flow out through a point which impedes its reentry into the area where the working unit is installed.
- 5) Radiator air outlet grill. Will be at least 1.25 times the surface area of the engine's radiator panel.
- 6) Cooling air channel. Prevents reentry of hot air into the space where the unit is installed.
- 7) Optional diary fuel tank.

4.2.2 Ventilation and Cooling

The heat generated by the unit must be evacuated from the premises.

The heat is generated by the cooling of the cylinders, radiation from the engine block, the exhaust passage, and the cooling of the alternator.

Insufficient ventilation could produce an increase in the atmospheric temperature of the premises and cause the generator set to lose engine power or even shut down.

4.2.3 Fuel

In keeping with current legislation, special attention should be paid to the storage of fuel, which is classified as a hazardous product. The installation of the Generator set will include a daily consumption tank and an optional fuel storage tank.

Depending on the output of the genset, the fuel tank may be external instead of being integrated into the unit's base frame.

4.2.4 Automatic fuel transfer system

The unit may include a self-suction, eccentric fuel transfer pump (SAB-BE) for the transfer of the fuel from an external fuel tank to the internal one. This pump will self-priming with self-adjusting blades. Includes a recirculation bypass valve. The pump has an internal removable filter, which must be used.



Figure 11- SAB-BE Pump

To install the pump, consult the manual supplied by the client.

Note: If unit is positioned beyond the recommended distance, pump should be dismantled and placed near external tank. Pump will function if the unit is running; it has an OFF/AUTO switch located on the door of the unit's electrical panel.

4.2.5 Exhaust

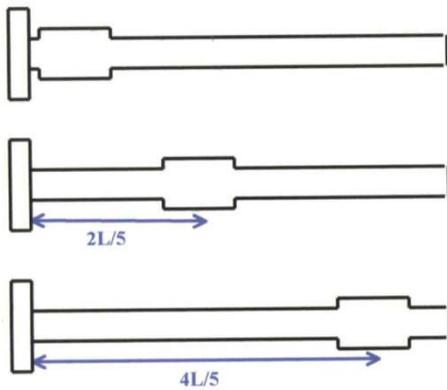
In the exhaust installation, pressure drop, insulation, suspension and sound levels should all be taken into account.

The compensators and flexible pipes used in the installation will absorb the displacement of the unit (due to dilations and vibrations).

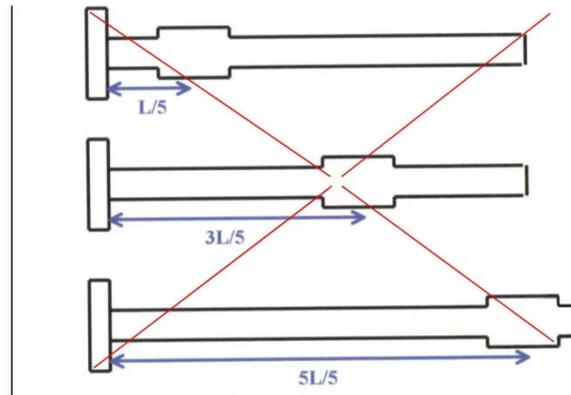
The units supplied by GRUPOS ELECTRÓGENOS EUROPA, S.A., may or may not include a rain cap. The units are equipped with two holes on the underside to prevent internal water accumulation.

The optimum muffler locations are, first, directly behind the exhaust manifold, and secondly at $2/5$ or $4/5$ of the total exhaust system length. The reason for this is the existing standing waves, especially for long exhaust systems, when the natural pipe frequency is in resonance with the fundamental engine frequency or one of its harmonics. The worst muffler locations in order of valve are $1/3$, $3/5$ or at the end of the system.

The best muffler locations in order of values are



The worst muffler locations in order of value are



L = total exhaust system length (elbows may be considered as straight portions).

Note: In installations where it is required, the exhaust pipe diameter must be increased. If the installation isn't correct, seriously engine damage can be caused.

In some models, the silencer is exactly symmetric, in this case, manufacturers often marks the exhaust side with an "S" mark.

4.2.6 Genset Startup

The startup system used by the generator set is electrical and consists of a 12 or 24 V electric engine powered by one or more batteries, usually lead.

Low temperatures make engine cranking difficult. Startup failure (three attempts without success) entails the stopping of the motor and, as a result, of the entire generator unit. In order to avoid it, and to ensure correct startup of the generator set at any external temperature, heating of the entire unit is made (heating of coolant water) by means of a boiler powered by mains. This system will work automatically, by a thermostat (setup in factory from 40 to 60°C) and it will be correctly indicated on the control panel by a lamp.

If the genset is supplied outside Spain, the batteries will be supplied charged.

The placement into service of these batteries should be done by removing the vent caps and filling each cell using sulfuric acid with a density of 1.28 (or 1.23 in tropical countries). Let it sit for at least 20 minutes and check the electrolyte level (25 mm above the plates; never fill to the brim). Finally put the caps back on.



It is recommended that protective eyewear and gloves be worn when adding battery acid. Make sure that there is nearby access to tap water in order to wash any areas that come into contact with the acid.



Caution should be performed indicated in this Manual. (Be especially careful with potential short circuits that could occur when coming in contact with the unit's metallic objects).

In the case that an MTU engine has been purchased, when a shutdown occurs due to continuous operation, the central unit uses a large amount of battery power, which may cause the battery to run out and not be able to restart the engine; therefore, a selector is available in the control panel, which allows disconnecting the battery in the case of a prolonged stoppage. For this purpose, we advise you carry out the following start-up process:

- 1) Place the switch in position 1.
- 2) Start the generator set.
- 3) Place the switch in position 0.

Note: Step 1 is strongly recommended, as if the selector is in position 0 once the generator set is running, the board will remain without a power supply.

It is recommended that the central unit not be set to position 1 for more than 2 days since the battery would completely discharge, which would not allow to restart the set.

If your generator set does not have an MTU engine installed, you will find an informative sticker warning you to disconnect the battery to avoid it discharging during extended stops.

4.2.7 Electrical Connection

These connections must be done according to the following safety instructions:

- 1) Use the appropriate Individual Protection Equipment (IPE) to ensure complete safety while performing the electrical installation.
- 2) Set the control module switch to the OFF position.
- 3) Make sure that the Emergency stop button has been pressed.
- 4) Open the battery isolator switch.
- 5) Switch off main power
- 6) Before beginning the installation of the unit provided, make sure that it meets your particular needs for voltage and frequency.
- 7) Check the cables are free-voltage.
- 8) You must carry out a proper installation of the Genset with the electrical grounding indicated on the unit by the following icon .

Antifreeze resistors, battery charger and heater connection:

Those connections are realized through L-N external power terminals.

4.3 INSTALLATION OF PORTABLE UNITS

Portable units are defined as those moved to different work sites at least twice yearly.

4.3.1 Placement

This type of unit must be installed in well ventilated areas in order to ensure sufficient flow of coolant air and preventing combustion smoke from sitting in the Engine's exhaust.

The unit must be placed in a location that can safely bear the full weight of the generator set and guarantee its stability both horizontally and vertically.

It should always remain at a distance that allows access to the interior of the Genset (at least 1 meter away from any building or wall).

Avoid installing in areas with moisture or where water could get into the interior of the unit.

4.3.2 Fuel

As diesel fuel is used, keep in mind the safety instructions previously mentioned in Section 2 - BASIC SAFETY RULES.

Before operating, check the fuel level to ensure that the tank has the amount needed by the genset for an entire workday.

4.3.3 Genset Startup

Before starting up the generator set, inspect the consumer power supply conductors to make sure they are in perfect condition and that the consumers are disconnected; the unit should always be started up at no load.

Make sure that there is nothing obstructing the ventilation ducts and that there are no foreign objects inside the unit.

Make sure the fluid levels of the Genset are adequate for the service the unit will be providing and that there are no leaks or spillage.

4.3.4 Electrical Connection

The connecting of cables that supply consumers must be performed by qualified personnel; these conductors should be connected to terminals U V W and N or L1 L2 L3 and N or to the socket panels.

In isolated power box gensets, mains cable installation could be realized by two ways:

-Lateral power cables outlet: This way, power cables come out by the trapdoor with protective rubber placed in the control box door, as shown in the image:

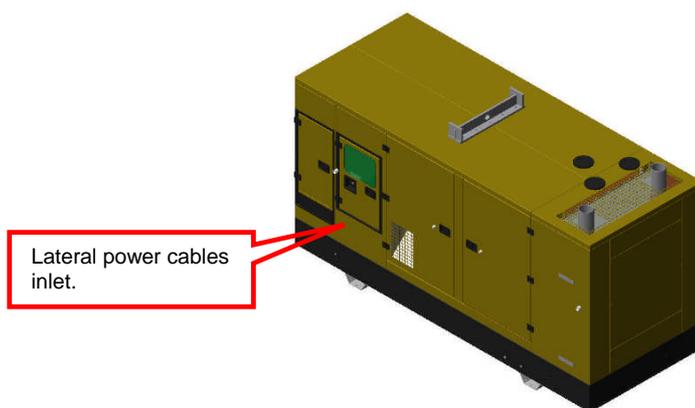


Image 12- Lateral power cables trapdoor entry

-Power cables lower exit: This way, the power cables enter directly from the bedplate lower part through the duct adapted in the base.

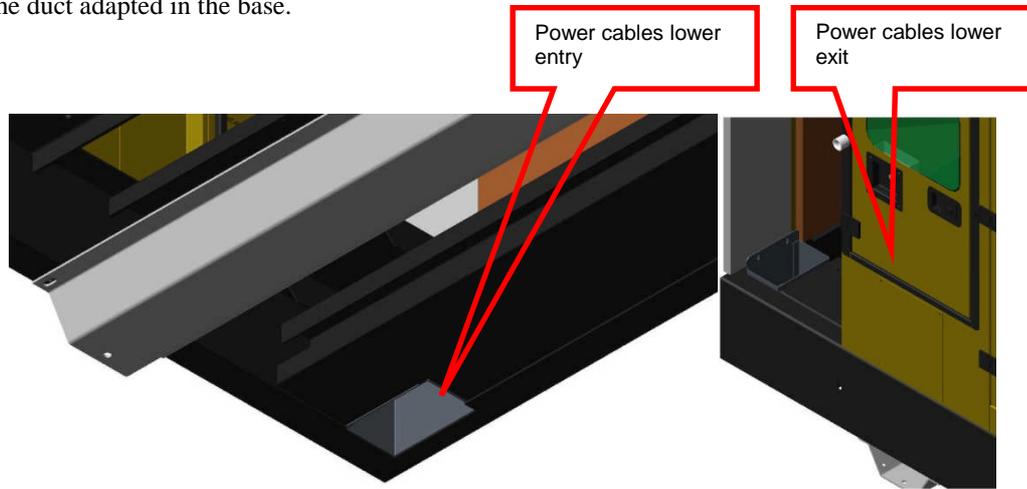


Image 13- Power cables entry by bedplate

In the installation drawing you could find the exact measures, and also relative positions.

4.4 STORAGE

If you think your generator set will be inactive for a long period of time, follow these instructions:

- 1) Press STOP on the control module.
- 2) Press the emergency stop button to avoid future involuntary startups when connecting.
- 3) Empty the fuel tank.
- 4) Leave the battery disconnected.
- 5) Avoid storing the unit in areas with high dust accumulation or excessive moisture.
- 6) Do not use pressurized water when cleaning the unit.
- 7) Check your Engine manual for care instructions; the manual has been provided along with this booklet.
- 8) For Alternator care instructions, please check your Alternator's manual, which has been provided along with the document you are now reading.

5. STARTING AND STOPPING THE UNIT

Once the installation of the generator set has been completed, or its location has been changed, follow these steps:

- 1) Check the unit is correctly balanced and supported on the ground.
- 2) Check and re-tighten the screws anchoring the engine-generator set to the bedplate if required.
- 3) Check and, if necessary, retighten the screws securing the radiator to the bedplate and engine.
- 4) Check and, if necessary, adjust the fan and battery charge alternator belts, and their alignment. If the power of the generator set exceeds 750 kVA, this recommendation is compulsory. Contact your distributor to request specific information to carry out this task.
- 5) Check the bodywork is sealed, especially the upper casing. Clean and reseal if necessary.
- 6) Check- the connections of the battery terminals, and retighten, clean and grease when necessary.

After checking the mechanical, in order to proceed to the genset shut down.

- 1) Check the levels: verify the levels of the oil, coolant and fuel in the control module.
- 2) Close the battery disconnecter.
- 3) Release the emergency button, if it has been pressed.
- 4) Supply the mains circuit and verify that the voltage indicator gives a suitable reading.
- 5) Verify the circuit breaker (the lever must be up).
- 6) Once the tasks prior to commissioning are finished, ensure the control module selector of the generator set is in the desired position. For this, duly read how your control module works in point 6 (OPERATION MANUAL).

To proceed with the genset stop:

- 1) Disconnect the batteries.
- 2) Disconnect the main switch.
- 3) Leave the engine running without load during 2 minutes in order to cool the genset.
- 4) Stop the engine completely, changing the control module switch to OFF position.

5.1 POWER FACTOR AND GENERATOR SETS

The power factor ($\cos \phi$) of the generator set loads must be determined. Lagging power factor below 0,8 can overload the generator. It can work properly from 0,8 to 1 lagging power factor.

Special attention must be given to installation with power factor corrections equipment (based on capacitors) in order to avoid leading power factor. This could prompt the generator set to voltage instability and could result in dangerous over voltages. Whenever generator set is supplying the load, any power factor correction equipment must be switched off.

5.2 LIGHT LOAD OPERATION ON DIESEL ENGINES

If an engine is operated on a load less than 25-30% of its rated output, certain symptoms will be observed which may be cause for concern. The engine is designed to run up to a maximum power and so the size of the piston, the wall loading of the piston rings, etc., is designed for this.

When an engine is run at light load then the energy put into the cylinder is low and consequently the cylinder pressure is lower and so is the temperature. The result is the piston to bore clearance is increased allowing more oil to pass the piston and be burnt, which is indicated by high oil consumption.

With lower pressures the sealing capacity of the rings is lower, also it is not ideal for bedding in the rings and can cause bore glazing, which reduces oil control.

Oil will start to appear from the manifolds from the bearing arrangement in the turbocharger.

Turbochargers are fitted to an engine to increase power by supplying more air to the cylinders. When running a turbocharger, air is sucked in, which can have vacuum levels up to 500 mm H₂O, with pressure ratios of 3:1. The compressor seals are designed to work most efficiently when the turbocharger compressor is operating at its' most efficient point. If the engine is running at low powers then the turbocharger is running at low speed (no energy from the exhaust because the fuel inlet to the engine is low) and the inlet vacuum is low resulting in poor turbocharger seal loading and pull over of oil from the bearing assembly. This oil is mixed with the air and pumped into the manifolds where some separates from the air when it collides with the inside of the manifold. The manifold gaskets will become impregnated with oil, eventually this will show as an oil leak from the manifold mating surfaces.

A further result is that of abnormal carbon build-up on the valves, piston crowns and exhaust ports. Thus the normal service interval of 2500 hours between top overhauls may be reduced. Fuel dilution of the lubricating oil will also occur.

It is therefore recommended that the following precautions are observed:

- Running on light load should be avoided or reduced to a minimum period. If weekly exercising on no load is carried out, the running period should be kept down to maximum 15 minutes or until the battery charge rate returns to normal.
- Every year the engine / generating set should be run on full load for four (4) hours, to burn off accumulations of carbon in the engine and exhaust system. This may require a "dummy" load. The load should be built-up gradually from zero over the four hour run.
- If you expect prolonged operation at low load is necessary to plan an additional charge through resistor banks

6. OPERATION MANUAL

Never, under no circumstance shall the generator adjustment parameters be modified. Consult with the Technical Service if the parameters need to be modified.

The following is a description of the different variable elements, according to the generator set chosen.

Never under no circumstance, modify the alternator parameters. In case you should require any modification check before the service center.

6.1 ELECTRICAL PANEL COMPONENTS



Ammeter:

Measures the Intensity (A), by means of a switch, of the different phases of the Genset.



Gauges indicating Engine parameters:

Oil Pressure

Intensity of Battery Voltage

Engine Temperature

Fuel Level



Frequency meter:

Indicates the Frequency of the Genset (Hz).



Voltmeter with ATS:

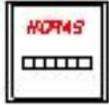
Indicates the Voltage (V), by means of a switch, of the different phases of the Genset.



Emergency stop button:

Pressing this button brings the Genset to an immediate stop. To cancel, turn to the left, when the end of the emergency situation has been confirmed.

On soundproofed units the emergency stop button is installed apart from the electrical panel (built into the canopy).



Hourmeter (optional):

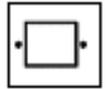
Leading indicator of hours worked on Genset.

The two digits to the right in red indicate hundredths of an hour. The hours are indicated after the third digit and are white.



Diagnostic Button:

Allows Engine parameters to be checked when Genset is stopped (electronically controlled Engines). Also gives a readout of the genset's different alarms.



Earth leakage circuit breaker (ELCB):

Protection against earth leakage of one phase, setting off the Genset's primary protection switch.

Configured to be activated when voltage is exceeded by 3 mA, with a time delay of 0s. Includes a TEST button for checking the state of the ELCB. It is the installer's responsibility to adjust and seal the ELCB according to the current regulations.



(Optional) DEEP SEA 3110, Control module.



(Optional) DEEP SEA 4420, Control module.



(Optional) ComAp INTELLIGENT (optional). Automatic control module.

6.2 DEEP SEA 3110 CONTROL MODULE

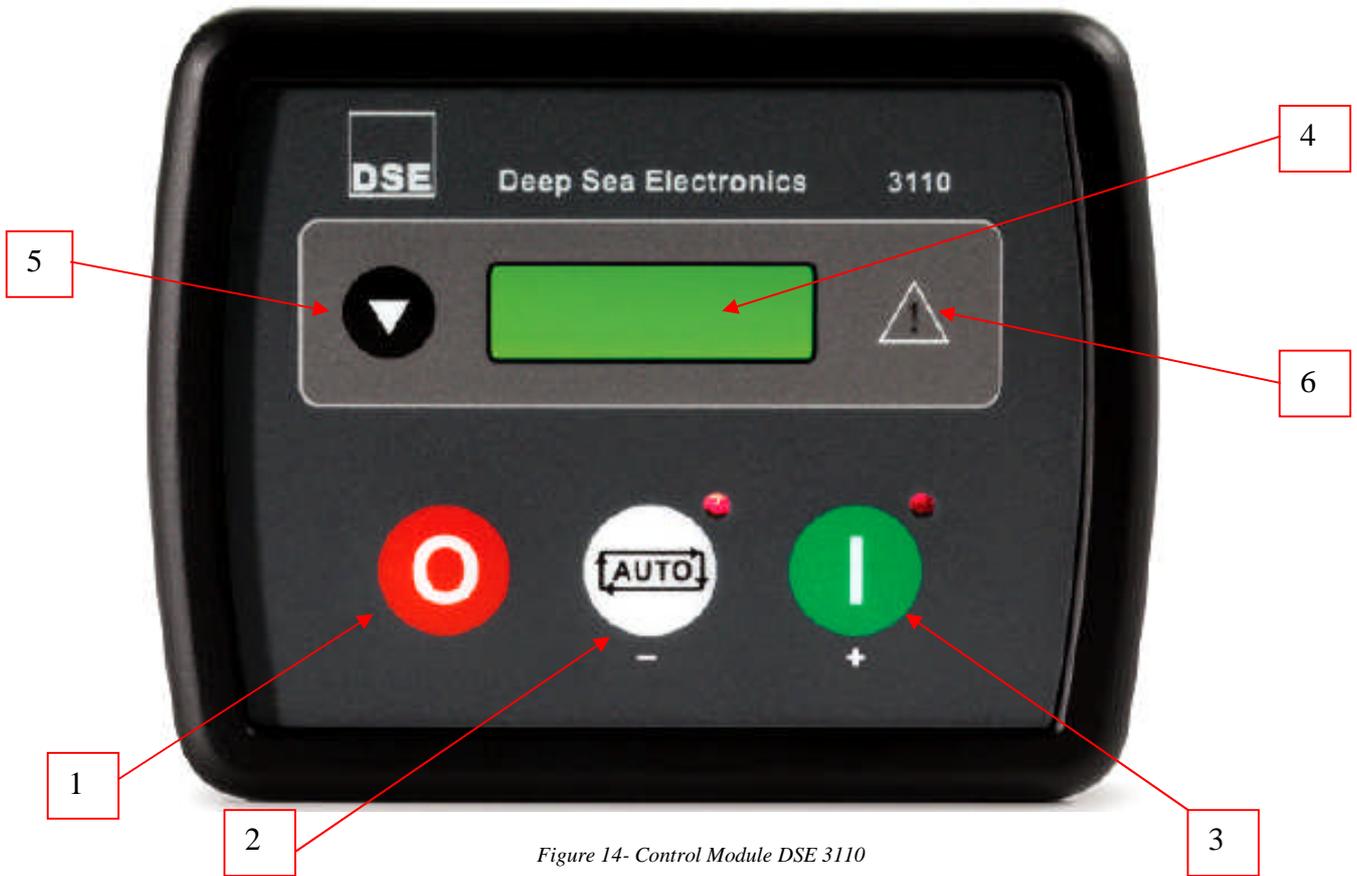


Figure 14- Control Module DSE 3110

	SYMBOL	DESCRIPTION		SYMBOL	DESCRIPTION
(1)		Stop button / Manual Mode / Reset	(4)		LCD Screen
(2)		Automatic mode button	(5)		Navigation Menu Button
(3)		Start button	(6)		Warning “!”.

The DSE 3110 is an automatic control module that governs the main power supply; if a mains failure occurs, the generator set will start up. This control module also gives the option of manual startup. The user can also control all of the generator unit's parameters as well as the status of mains power supply. This module is supplied with automatic generator sets with or without ATS.

OPERATION MODES

AUTOMATIC MODE OF OPERATION

NOTE: If a digital input configured to panel lock is active, changing module modes will not be possible. Viewing the instruments and event logs is NOT affected by panel lock.

Activate auto mode by pressing the  pushbutton. The  icon is displayed to indicate Auto Mode operation if no alarms are present.

Auto mode will allow the generator to operate fully automatically, starting and stopping as required with no user intervention.

WAITING IN AUTO MODE

If a starting request is made, the starting sequence will begin.

Starting requests can be from the following sources:

Activation of an auxiliary input that has been configured to remote start

Activation of the inbuilt exercise scheduler.

STARTING SEQUENCE

To allow for 'false' start requests, the start delay timer begins.

Should all start requests be removed during the start delay timer, the unit will return to a stand-by state.

If a start request is still present at the end of the start delay timer, the fuel relay is energized and the engine will be cranked.

NOTE: If the unit has been configured for CAN, compatible ECU's will receive the start command via CAN.

If the engine fails to fire during this cranking attempt then the starter motor is disengaged for the crank rest duration after which the next start attempt is made. Should this sequence continue beyond the set number of attempts, the start sequence will be terminated and the display shows  Fail to Start.

When the engine fires, the starter motor is disengaged. Speed detection is factory configured to be derived from the main alternator output frequency but can additionally be measured from a Magnetic Pickup mounted on the flywheel (Selected by PC using the 3000 series configuration software).

Additionally, rising oil pressure can be used to disconnect the starter motor (but cannot detect underspeed or overspeed).

NOTE: If the unit has been configured for CAN, speed sensing is via CAN.

After the starter motor has disengaged, the Safety On timer activates, allowing Oil Pressure, High Engine Temperature, Under-speed, Charge Fail and any delayed Auxiliary fault inputs to stabilize without triggering the fault.

ENGINE RUNNING

Once the engine is running and all starting timers have expired, the animated  icon is displayed. DSE3110 - The generator will be placed on load if configured to do so.

NOTE:-The load transfer signal remains inactive until the Oil Pressure has risen. This prevents excessive wear on the engine.

If all start requests are removed, the stopping sequence will begin.

STOPPING SEQUENCE

The return delay timer operates to ensure that the starting request has been permanently removed and isn't just a short term removal. Should another start request be made during the cooling down period, the set will return on load.

If there are no starting requests at the end of the return delay timer, the load is removed from the generator to the mains supply and the cooling timer is initiated.

The cooling timer allows the set to run off load and cool sufficiently before being stopped. This is particularly important where turbo chargers are fitted to the engine.

After the cooling timer has expired, the set is stopped.

MANUAL OPERATION

NOTE: If a digital input configured to panel lock is active, changing module modes will not be possible. Viewing the instruments and event logs is NOT affected by panel lock.

Manual mode allows the operator to start and stop the set manually, and if required change the state of the load switching devices. Module mode is active when the  button is pressed.

WAITING IN MANUAL MODE

To begin the starting sequence, press the  button. If 'protected start' is disabled, the start sequence begins immediately.

If 'Protected Start' is enabled, the  icon is displayed to indicate Manual mode and the manual LED flashes. The  button must be pressed once more to begin the start sequence.

STARTING SEQUENCE

NOTE: There is no start delay in this mode of operation.

The fuel relay is energized and the engine is cranked.

NOTE: If the unit has been configured for CAN, compatible ECU's will receive the start command via CAN.

If the engine fails to fire during this cranking attempt then the starter motor is disengaged for the crank rest duration after which the next start attempt is made. Should this sequence continue beyond the set number of attempts, the start sequence will be terminated and the display shows  **Fail to Start**.

When the engine fires, the starter motor is disengaged. Speed detection is factory configured to be derived from the main alternator output frequency but can additionally be measured from a Magnetic Pickup mounted on the flywheel (Selected by PC using the 3000 series configuration software).

Additionally, rising oil pressure can be used disconnect the starter motor (but cannot detect underspeed or overspeed).

NOTE: If the unit has been configured for CAN, speed sensing is via CAN.

After the starter motor has disengaged, the Safety On timer activates, allowing Oil Pressure, High Engine temperature, Under-speed, Charge Fail and any delayed Auxiliary fault inputs to stabilise without triggering the fault.

ENGINE RUNNING:

In manual mode, the load is not transferred to the generator unless a 'loading request' is made.

A loading request can come from a number of sources.

- Activation of an auxiliary input that has been configured to remote start on load
- Activation of the inbuilt exercise scheduler if configured for 'on load' runs.

NOTE:-The load transfer signal remains inactive until the Oil Pressure has risen. This prevents Excessive wear on the engine.

Once the load has been transferred to the generator, it will not be automatically removed. To manually transfer the load back to the mains either:

- Press the auto mode  button to return to automatic mode. The set will observe all auto mode start requests and stopping timers before beginning the Auto mode stopping sequence.
- Press the stop button 
- De-activation of an auxiliary input that has been configured to remote start on load

STOPPING SEQUENCE

In manual mode the set will continue to run until either:

- The stop button  is pressed – The set will immediately stop
- The auto button  is pressed. The set will observe all auto mode start requests and stopping timers before beginning the Auto mode stopping sequence.

FAULT ICONS

	AUXILIARY INPUTS	Auxiliary inputs can be user configured and will display the message as written by the user.
	FAIL TO START	The engine has not fired after the preset number of start attempts
	FAIL TO STOP	The module has detected a condition that indicates that the engine is running when it has been instructed to stop.  NOTE: 'Fail to Stop' could indicate a faulty oil pressure sensor - If engine is at rest check oil sensor wiring and configuration.
	LOW OIL PRESSURE	The module detects that the engine oil pressure has fallen below the low oil pressure pre-alarm setting level after the <i>Safety On</i> timer has expired.
	ENGINE HIGH TEMPERATURE	The module detects that the engine coolant temperature has exceeded the high engine temperature pre-alarm setting level after the <i>Safety On</i> timer has expired.
	UNDERSPEED	The engine speed has fallen below the underspeed pre alarm setting
	OVERSPEED	The engine speed has risen above the overspeed pre alarm setting
	CHARGE FAILURE	The auxiliary charge alternator voltage is low as measured from the W/L terminal.
	LOW FUEL LEVEL	The level detected by the fuel level sensor is below the low fuel level setting.
	BATTERY UNDER VOLTAGE / BATTERY OVER VOLTAGE	The DC supply has fallen below or risen above the low/high volts setting level.
	GENERATOR UNDER VOLTAGE	The generator output voltage has fallen below the pre-set pre-alarm setting after the <i>Safety On</i> timer has expired.
	GENERATOR OVER VOLTAGE	The generator output voltage has risen above the pre-set pre-alarm setting.
	GENERATOR UNDER FREQUENCY	The generator output frequency has fallen below the pre-set pre-alarm setting after the <i>Safety On</i> timer has expired.
	GENERATOR OVER FREQUENCY	The generator output frequency has risen above the pre-set pre-alarm setting.
	CAN ECU WARNING CAN ECU SHUTDOWN	The engine ECU has detected an alarm – CHECK ENGINE LIGHT Contact Engine Manufacturer for support.
	CAN DATA FAIL	The module is configured for CAN operation and does not detect data on the engine Can datalink.

	EMERGENCY STOP	<p>The emergency stop button has been depressed. This a failsafe (normally closed to battery positive) input and will immediately stop the set should the signal be removed. Removal of the battery positive supply from the emergency stop input will also remove DC supply from the Fuel and Start outputs of the controller.</p> <p>NOTE: The Emergency Stop Positive signal must be present otherwise the unit will shutdown.</p>
	MAGNETIC PICKUP FAILURE	<p>Pulses are no longer being detected from the magnetic pickup probe (3110-xxx-01 magnetic pickup version only)</p>
	INTERNAL MEMORY ERROR	<p>Either the configuration file or engine file memory is corrupted. Contact your supplier for assistance.</p>

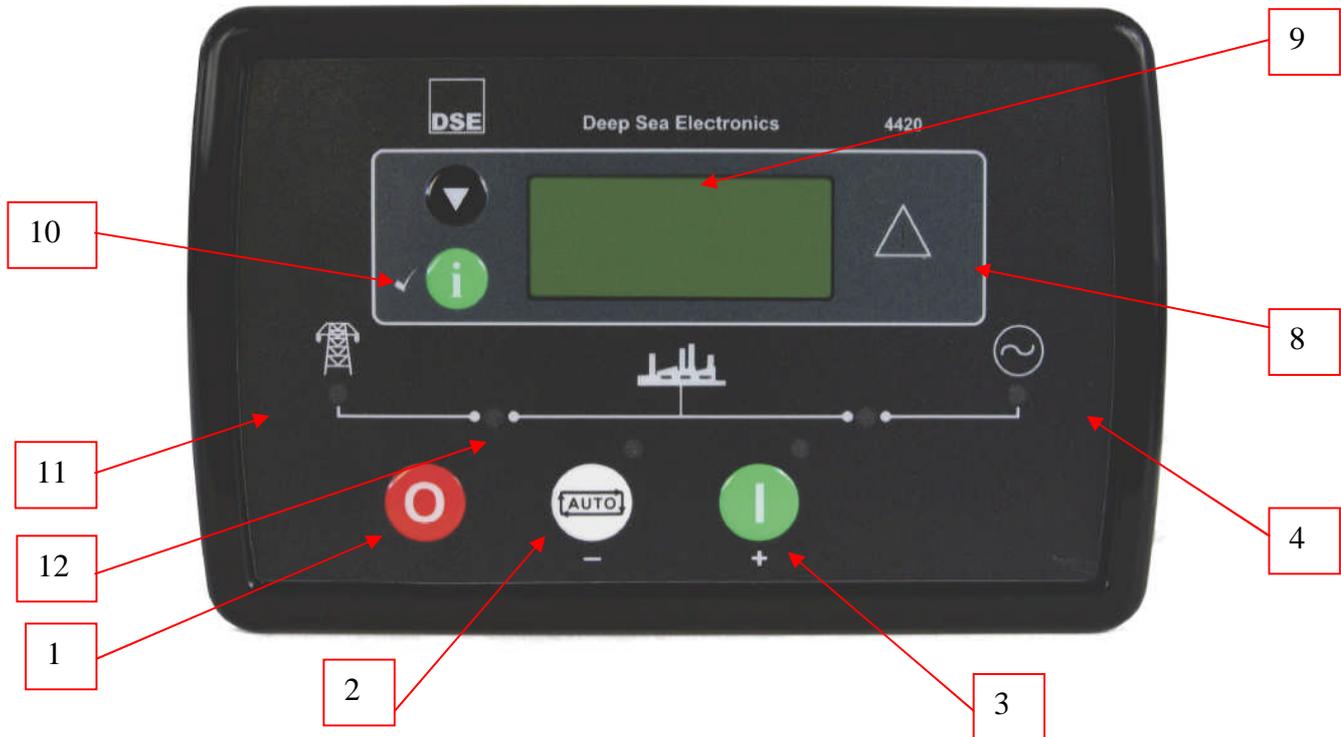
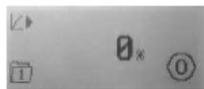
6.3 DEEP SEA 4420 DIGITAL CONTROL MODULE


Figure 15- Deep Sea 4420 Control Module

	SYMBOL	DESCRIPCIÓN		SYMBOL	DESCRIPCIÓN
(1)		Stop / Manual mode / Reset button	(9)		Status generator set display
(2)		AUTOMATIC mode button	(10)		Menu navigator
(3)		Generator set start up button	11)		Mains available
(4)		Generator led	(12)		Status of ATS for mains and generator set.
(8)		Warning "!".			

Deep Sea 4420 is an automatic control module that monitors the main power supply; if a mains failure occurs, generator set will start up and loads are transferred. This control module also allows the option of manual startup. The user can also control all of the generator unit's parameters as well as the status of mains power supply. This model is supplied with standby generator sets with or without ATS.

Deep Sea 4410 control module is supplied with "stand-by by signal" type units.

- ***AUTOMATIC Mode (AUTO):***

This is the normal operating mode.

The automatic mode is activated by pressing the button  (4), at which point the LED at the top of the button will turn on, indicating that it is operational.

If the mains power supply fails for longer than the unit's programmed period, the LED  (11) indicating that the mains power is available will be turned off.

The engine will start; if it should fail, there will be a maximum number of startup attempts (3). If all three startup attempts have been unsuccessful, the information screen will display a startup alarm: 

When mains power is restored (or when the remote startup signal disappears) there will be a period of time in which the engine will continue operating at no load to cool down before stopping completely.

If a mains failure occurs or remote startup signal appears again during the no-load operating period (cool-down period), the generator set would begin the startup process again.

Press  (1) or the emergency stop button to intentionally stop the unit.

- ***MANUAL Mode:***

The manual mode is activated by pressing the button ,

To begin the starting sequence, press the button. 

If a mains failure occurs, a remote startup signal is received; loads will be transferred to the generator set. Once the load has been transferred to the generator, it will not be automatically transferred back to the mains supply.

To terminate this mode, press the  (2) button, once is pressed and there is adequate mains power supply (without the remote startup signal activated), the shutdown sequence will begin as described in the automatic mode.

Press  (1) or the emergency stop button to intentionally stop the unit.

- **MODE ICON**

An icon is displayed in the mode icon area of the display to indicate what mode the unit is currently in.

Icon	Graphic	Details
Stopped		Appears when the engine is at rest and the unit is in stop mode.
Auto		Appears when the engine is at rest and the unit is in auto mode.
Manual		Appears when the engine is at rest and the unit is in manual mode.
Timer animation		Appears when a timer is active, for example cranking time, crank rest etc.
Running animation		Appears when the engine is running, and all timers have expired, either on or off load. The animation will be rate is reduced when running in idle mode.
Front panel editor		Appears when the unit is in the front panel editor

- **INSTRUMENTATION ICONS**

When displaying instrumentation a small icon is displayed in the instrumentation icon area to indicate what value is currently being displayed. This is necessary to distinguish between mains and generator voltages, icons for oil pressure and coolant temperature are added for consistency.

Icon	Graphic	Details
Generator		Used for generator voltage and generator frequency
Mains		Used for mains voltages and mains frequency
Engine speed		Engine speed instrumentation screen
Hours Run		Hours run instrumentation screen
Battery voltage		Battery voltage instrumentation screen
Engine temperature		Coolant temperature instrumentation screen
Oil pressure		Oil pressure instrumentation screen
Flexible sensor		Flexible sensor instrumentation screen
Event log		Appears when the event log is being displayed

- ALARM ICONS**

Alarm	Icon
External input alarm	
Failed to start	
Failed to stop	
Low oil pressure	
Water temperature / Low coolant level	
Under speed	
Over speed	
Charge alternator	
Low fuel	
Plant battery volts (under/over)	

Alarm	Icon
Emergency stop	
Flexible sender alarms	
Generator contactor alarm	
Mains Failure	
Mains Return	
Under voltage	
Over voltage	
Under frequency	
Over frequency	

- WARNINGS ALARMS**

Warnings are non-critical alarm conditions and do not affect the operation of the generator system, they serve to draw the operators attention to an undesirable condition.

Note: The condition that provokes the warning must be solved before the reset. If the warning condition remains, could not be possible to start the group.

- SHUTDOWN ALARMS**

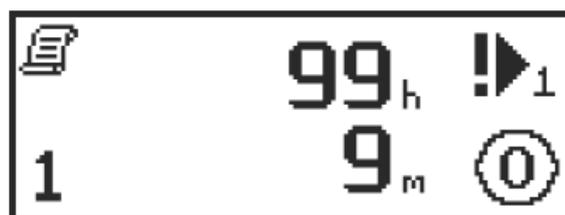
Shutdowns are latching alarms and stop the Generator. Clear the alarm and remove the fault then press Stop/Reset  to reset the module.

NOTE: The alarm condition must be rectified before a reset will take place. If the alarm condition remains, it will not be possible to reset the unit.

- EVENT LOG**

The info button  toggles between the display of the instrumentation and the event log. Pressing the down button will move to the previous event, the event log entry at position 1 being the most recent. On moving from the instrumentation value to the event log the unit will display the most recent entry.

Example of Auxiliary Input Shutdown Alarm.



6.4 DEEP SEA 7310 DIGITAL CONTROL MODULE

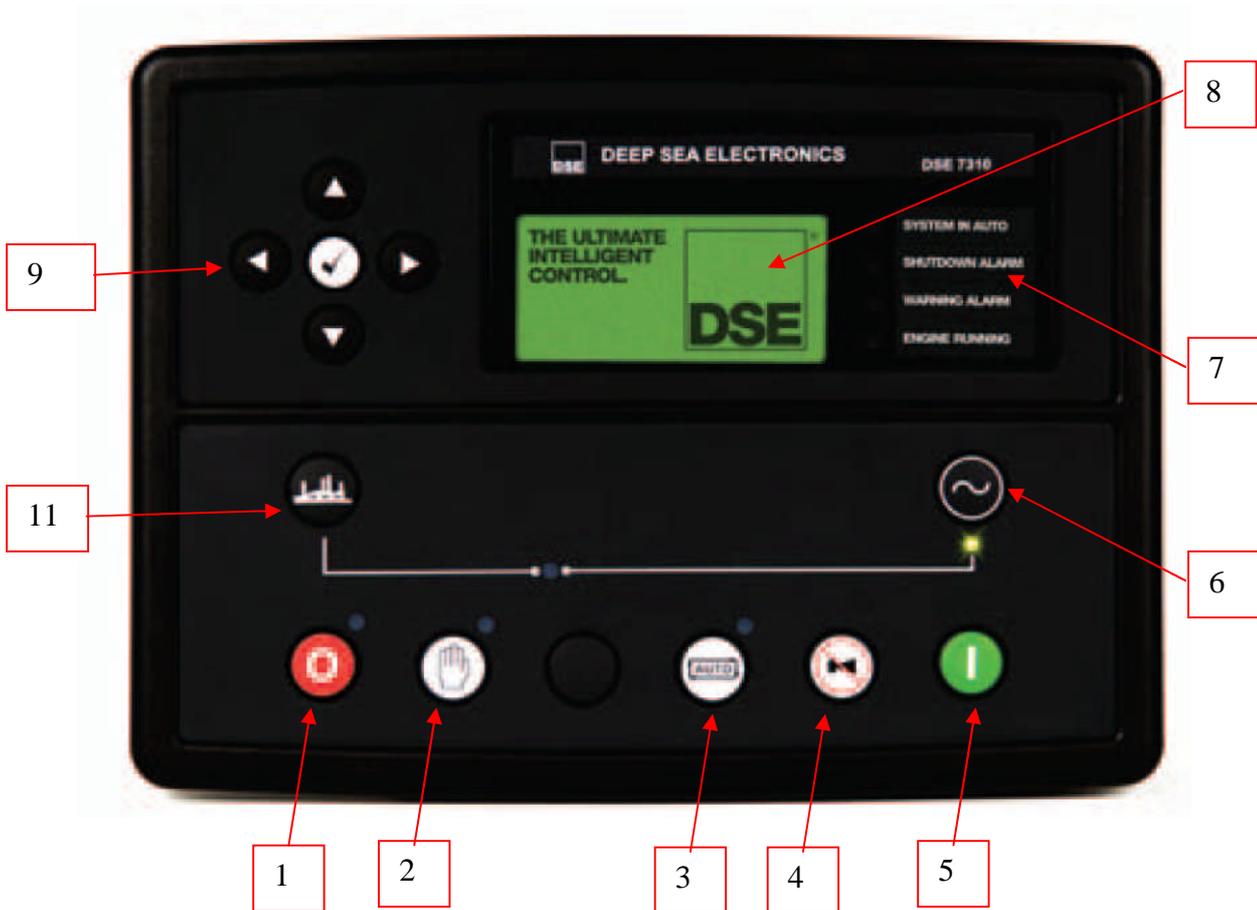
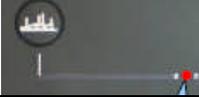


Figure 16 – Deep Sea 7310 Control Module

NUMBER	SYMBOL	DESCRIPTION	IDENTIFICATION
(1)		Stop button.	Red LED
(2)		MANUAL mode button	Red LED
(3)		AUTOMATIC mode button	Red LED
(4)		Mute alarm / Lamp test button	
(5)		Generator set start up button	
(6)		“Transfer to generator” button	Green LED on when generator set is available
(7)		Configurable LED indicators.	Red LED
(8)		Status generator set display.	
(9)		Menu navigator	
(11)		“Open generator” button	LED on: generator set is supplying loads.

Startup:

If battery is disconnected, press  (1) to connect the control module and then continue the process.

Manual startup is done by pressing the button  (2), at which point the LED at the top of the button (2) will turn on, indicating that it is operational.

Press  (5) to start up the unit.

There will be a maximum of 3 startup attempts, after which the information screen will display a

startup alarm: 

- **Stopping the unit:**

Press  (1) to intentionally stop the unit.

After sending an Engine stop command, there will be a period of operation at no load (cool-down period).

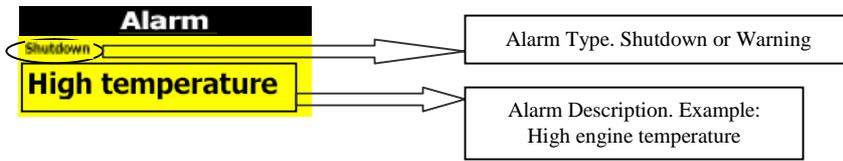
ALARMS:



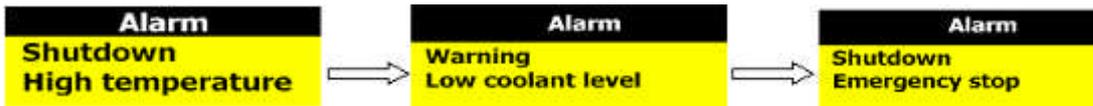
Press (5) to silence the audible alarm and the Common alarm LED.

Running in auto
Generator on load
L-N 230v 240A 50Hz
L-L 400v 133kw

By default, the information screen will display the following message:
and if an alarm occurs, the screen will display the following:



If shutdown occurs while a warning is active, the screen will cycle through the active alarms:



The alarms do not entail genset shutdown.

INCIDENT	ALARM DESCRIPTIONS
Alarm	
Warning Charge fail	Alternator voltage not detected
Alarm	
Warning Low battery volts	Battery voltage beyond established limits
Alarm	
Warning High battery volts	
Alarm	
Fail to stop	After shutdown command, Engine continues running. Could also indicate faulty oil pressure sender
Alarm	
Warning Low fuel level	Fuel level below established limits
Alarm	
Warning Low oil pressure	Low oil pressure, below established limit
Alarm	
Warning High temperature	
Alarm	
Warning Low Coolant Temp	Engine temperature beyond established limits
Alarm	
Warning Overspeed	
Alarm	
Warning Underspeed	Engine speed beyond established limits
Alarm	
Warning Over frequency	
Alarm	
Warning Under frequency	Alternator Frequency beyond established limits
Alarm	
Warning AC Overvolts	
Alarm	
Warning AC Undervolts	Alternator Voltage beyond established limit
Alarm	
Warning High current	Intensity of the Alternator output beyond established limits

INCIDENT	DESCRIPTION OF SHUTDOWNS
Alarm Shutdown Failed to start	Engine does not start, three attempts made.
Alarm Shutdown Emergency stop	Controlled shutdown of the unit. It will not be functional until the emergency stop button has been reset.
Alarm Shutdown Low oil pressure	Oil pressure below established limit
Alarm Shutdown High temperature	Engine Temperature above established limit
Alarm Shutdown Overspeed	Engine speed beyond established limits
Alarm Shutdown Underspeed	
Alarm Shutdown Over frequency	Alternator Frequency beyond established limits
Alarm Shutdown Under frequency	
Alarm Shutdown AC Overvolts	Alternator Voltage beyond established limit
Alarm Shutdown AC Undervolts	
Alarm Shutdown Oil pressure sender fault	Faulty oil pressure sender
Alarm Shutdown High current trip	Intensity of the Alternator output beyond established limits

Note: If the established limit for shutdown is exceeded, a corresponding alarm screen will be displayed and on the configurable LED indicator (8) the Common Shutdown alarm will appear.

– Typical Information Screen Messages:

<p>Waiting in auto Mains on load</p>		<p>Indicates that the Genset will respond to either a mains failure or an active remote start.</p>
<p>Starting in auto 10s Mains on load Cranking attempt 1</p>		<p>Indicates that Genset is in automatic mode and has been initiated after a mains failure has been detected.</p>
<p>Running in auto Generator on load L-N 230v 240A 50Hz L-L 400v 133kW</p>		<p>Indicates Genset running normally in Automatic Mode. Also indicates the average line to neutral voltage (L-N), the highest of the three phase currents, the nominal frequency, average line-to-line voltage (L-L) and total kilowatts.</p>

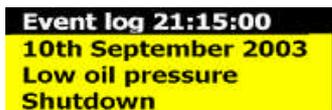
– Measurement Parameter Display Screens:

<p>Coolant temperature 60 °C 140 °F</p>		<p>Coolant Temperature in degrees (°C) Celsius and Fahrenheit (°F)</p>
<p>Oil pressure 6 Bar 87 PSI 600 kPa</p>		<p>Displays Engine oil pressure in Bar, PSI and kPa.</p>
<p>Generator Amps L1 L2 L3 238 241 241</p>		<p>All three genset line currents.</p>

Event Log:

To view the event log, press the following button repeatedly  (11).

Register of Shutdown alarms occurring in the generator set; the most recent occurrences can be stored. A screen similar to this is shown:



“On September 10, 2003, at 21:15, the system detected that the Oil pressure was below the minimum level and shut down the genset.”

To scroll from one event to the next, press  (10).

To exit the Main Screen, press  (11).

Note: Warning alarms are not logged.

– Displaying Information:

Press this button:  (11).

Page order:

- Status display
- Instrument display
- Alarms display
- Event Log

It is possible to scroll through the different display screens by pressing the Next Page button:  (10). Once selected, the instrument will remain on the screen until the user selects a different instrument or after a period of inactivity for the Control module, at which point the default display appears.

Alternatively, by holding down on  (10) the user can autoscroll through all of the instruments on a particular screen. To disable scrolling, stop pressing the page down button then either press it again for

a few seconds or press  (11). When autoscroll is disabled, if no buttons are pressed the display will return to the Alarms page.

If an alarm becomes activated while viewing instruments, the Alarms page will be automatically displayed.

Instrument page content:

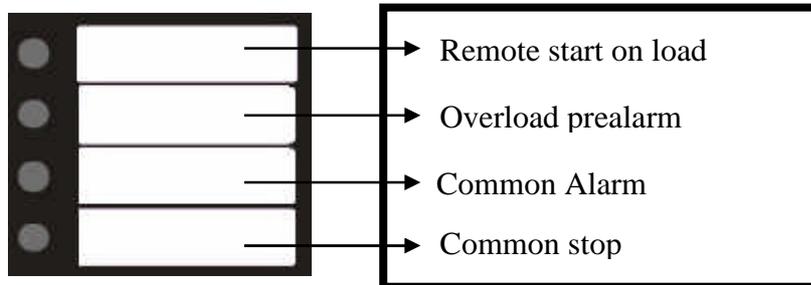
- Engine speed
- Oil pressure
- Coolant temperature
- Engine hours run
- Number of starts
- DC battery voltage
- Genset AC voltage L-N
- Genset AC voltage L-L
- Generator set Output
- Fuel level (%)
- Nominal voltage L-N
- Nominal voltage L-L
- Nominal frequency (Hz)

If the following appears in an instrument display: ***** , this means that the Engine cannot provide this parameter; the Control Module, however, can display this instrument.

If the following appears in an instrument display: # # # # # with the Generator set in OFF/AUTOMATIC Mode (with the Engine stopped), this means that the Control Module is not connected to the Engine.

Press this button  (6) to display the given value.

– **Alarm LED:**



– **Editing the current Date and Time:**

The date and time are adjustable. When the battery is disconnected, the date and time are frozen; when the battery is reconnected, the date and time shown will be from the time the battery was disconnected.

The date and time reflected in the Event Log will be taken from the configuration according to the following steps:

Press  (1) and  (11) simultaneously, then enter the correct PIN number.

Press  (3) until the Date and Time screen appears.

When Date and Time screen appears, press the  button (4). The minutes will start to flash.

Press  (3) or  (2) to adjust to the desired setting.

Press the  (10) button to confirm the value entered. The hour will begin to flash. Press 

(3) or  (2) again to adjust to the desired setting.

Press the  button (10) to confirm the value entered and select the day. The day will begin to

flash. Press  (3) or  (2) again to adjust to the desired setting.

Press the  (10) button to confirm the selection made and select the month. The value will start

to flash. Press  (3) or  (2) again to adjust the month.

Lastly, set the correct year by pressing the  (10) button. The year will start to flash. Press

 (3) or  (2) again to adjust to the desired setting.

Press  (4) to save the changes made to Date and Time.

The screen will display the date and time entered.



6.5 INTELIGEN DIGITAL CONTROL MODULE

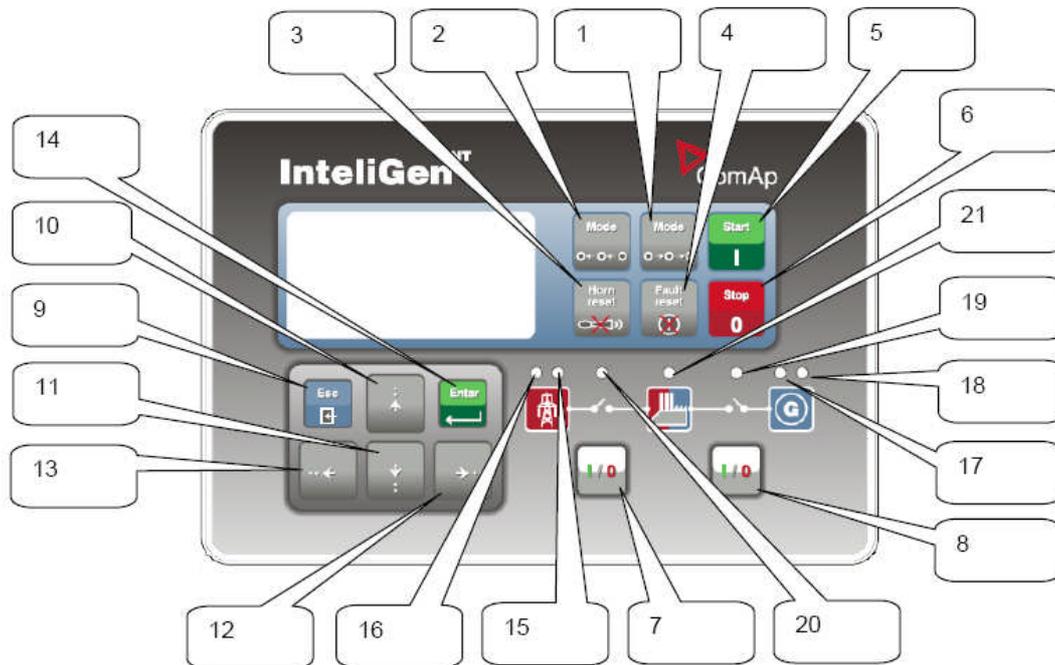


Figure 17- INTELIGEN^{NT} Digital Control Module

#	SYMBOL	DESCRIPTION	IDENTIFICATION
(1)		Scrolls through different operating modes	OFF←MAN←AUT←TEST
(2)			OFF→MAN→AUT→TEST
(3)		Deactivates audible alarm	
(4)		Fault reset	Acknowledges faults and alarms
(5)		Start button	In manual mode
(6)		Stop button	In manual mode
(7)		MCB ON/OFF	Opens and closes MCB in manual mode
(8)		GCB ON/OFF	Opens and closes GCB in manual mode
(9)		Exit from actual screen (without save changes if editing)	
(10)		Selects on-screen value, set point, history record or increase/decrease set point value	Increases value
(11)			Decreases value

(12)		Moves history record displayed columns to the right/left, 5% increase/decrease of edited set point, a value or go out/into alarm list.	Increases value
(13)			Decreases value
(14)		Enter button	Confirms on-screen value
(15)		Mains power status	Green if mains power correct
(16)		Mains failure	Red light flashes if mains failure occurs and generator set doesn't run; continuous if generator is operating, turns off when Mains power restored.
(17)		Generator voltage present	Green led is on if unit voltage is present and within limits.
(18)		Generator set failure	Flashing Red LED indicates alarm
(19)		State of GCB	Green led is on if GCB is closed. Flashes during synchronization with mains.
(20)		State of MCB	Green led is on if MCB is closed Flashes during reverse synchronization with mains.
(21)		State of bus	Green led is on if bus voltage is correct

NOTE: GCB = Generator Circuit Breaker; MCB = Mains Circuit Breaker.

The IntelliGen^{NT} module contains a main menu screen and the following seven submenu screens:

- Alarmlist
- Measurement
- Measurement I/O
- History
- Setpoints
- User/Password
- Languages

Pressing several times the main menu is displayed. To enter in a submenu, scroll up and down using

 (10) or  (11) buttons and press  (14) button. To display the different instruments

or parameters on each screen menu, press  (10) or  (11) buttons. To come back to a previous menu screen, press  (9) button.

The alarmlist screen display the alarms detected by the module. Pressing  button (4) faults and alarms are acknowledged.

The measurement screen displays the parameters measured on the engine; if the engine uses an electronic management system, many additional parameters can be displayed. In addition to these parameters, measurements can be displayed for fuel level, oil pressure, current, voltage, frequency, run hours and battery charge level.

The measurement I/O screen display the status of digital inputs and outputs and the measured parameter of analogue inputs (senders).

The history screen menu displays the log of alarms that have occurred in the generator unit. It also logs the opening and closing of the mains circuit breaker as well as the starting and shutting down of the generator unit.

The set points menu screen displays the adjustment parameters already configured; it is not necessary to edit any of these.

The users/password screen allows to define users and passwords. The languages screen allows to change the display language

- ***AUTOMATIC mode (AUTO):***

If a mains failure is detected, the IntelliGen^{NT} module will open the MCB (main circuit breaker). Startup command is issued to generator set. If generator voltage is within the established limits, the LED

indicator  (17) will be on and the control module closes the GCB (generator circuit breaker). Once mains power has been restored, synchronization between mains and generator occurs; then the MCB is closed, causing the generator to discharge, followed by the opening of the GCB. When mains power is restored, there will be a period of time during which the engine continues operating at no load to cool down before stopping completely.

Note: If  (4) is pressed following a disconnection alarm, the engine could automatically start without any warning.

- **NO-LOAD TEST mode (MANUAL):**

Press the START button  (5) to start up the generator set. When the generator voltage is within the established limits, the LED indicator  (17) will be on. To stop the unit, press STOP  (6).

- **LOAD TEST mode (TEST):**

This operating mode is used for generator set start test is the mains is OK or to transfer the load to the generator set when a mains failure is announced in advance. To stop this mode, change to another mode by

means of the buttons  (1) or (2).

- **OFF mode:**

The generator set will not start. Even if we press the buttons START  (5), STOP , GCB ON/OFF  (8), the generator will not respond.

ALARMS:

The IntelliGen^{NT} control module includes the following warnings:

INCIDENT	STORED IN HISTORY RECORD
Startup sequence initiated	Startup of Gen-Set
Shutdown of the Gen-Set	Gen-Set stops
Electrical Generator circuit breaker closed	GCB connected
Electrical Generator circuit breaker opened	GCB disconnected
Some GCB in group was opened (in MINT)	Other GCB trip
Mains circuit breaker closed	MCB connected
Mains circuit breaker opened	MCB disconnected
Time mode has been changed	TimeModeChngd
STARTUP INFO	
AMF Startup	GenSetMF start
AMF Stop	GenSetMF stop
Remote startup by binary input (SPM, SPtM)	GenSetRemStart
Remote stop by binary input (SPM, SPtM)	GenSetRemStop
System startup by binary input (MINT, MEXT)	GenSetSysStart
System stop by binary input (MINT, MEXT)	GenSetSysStop
Peak start (SPtM)	GenSet PKstart
Peak stop (SPtM)	GenSet PKstop

ENGINE		
EVENT SPECIFICATION	ALARM	HISTORY
Electrical Generator Startup failure	Sd Start Fail	Sd Start Fail
Electrical Generator Overspeed	Sd Overspeed	Sd Overspeed
Electrical Generator Underspeed	Sd Underspeed	Sd Underspeed
SD Stop fail	Sd Stop Fail	Sd Stop Fail
Emergency Stop	Emergency Stop	Emergency Stop
RPM Pickup fail	SdPickupFail	SdPickupFail
Battery voltage warning	Wrn Batt volt	Wrn Batt volt
Battery is discharged	Sd Batt flat	0

GENERATOR	
EVENT SPECIFICATION	HISTORY
Generator phase 1 overvoltage	Unl Vg1 Over
Generator phase 1 undervoltage	Unl Vg1 Under
Generator phase 2 overvoltage	Unl Vg2 Over
Generator phase 2 undervoltage	Unl Vg2 Under
Generator phase 3 overvoltage	Unl Vg3 Over
Generator phase 3 undervoltage	Unl Vg3 Under
Generator Overfrequency	Unl Fgen Over
Generator Underfrequency	Unl Fgen Under
Generator voltage unbalance	Unl Vgen Unbal
Generator overload	UnlGen Overload
Load surge protection	LoadSurge
Reverse power	Unl Rev Pwr
Synchronization timeout	Stp SyncTO
Ground fault protection	Unl EarthFltC
Failure of generator circuit breaker	GCB fail
Generator short circuit protection	Unl Short Igen
Generator IDMT protection	Unl IDMT
Generator current unbalance	Unl Igen Unbal
Voltage on mains terminals (SPM)	UnlCounterVolt
Bus voltage error (MINT)	Unl BusMeasErr

PHASE SEQUENCE		
EVENT SPECIFICATION	ALARM	HISTORY
Generator phase L1 is inverted	GEN L1 neg	0
Generator phase L2 is inverted	GEN L2 neg	0
Generator phase L3 is inverted	GEN L3 neg	0
Wrong generator phase sequence	G ph opposed	0
Wrong generator phase sequence and phase L1 is inverted	G ph + L1 neg	0
Wrong generator phase sequence and phase L2 is inverted	G ph + L2 neg	0
Wrong generator phase sequence and phase L3 is inverted	G ph + L3 neg	0
Mains phase L1 is inverted	B L1 neg	0
Mains phase L2 is inverted	B L2 neg	0
Mains phase L3 is inverted	B L3 neg	0
Wrong mains phase sequence	B ph opposed	0
Wrong mains phase sequence and phase L1 is inverted	B ph + L1 neg	0
Wrong mains phase sequence and phase L2 is inverted	B ph + L2 neg	0
Wrong mains phase sequence and phase L3 is inverted	B ph + L3 neg	0

7. MAINTENANCE OF GENSET

You must make sure that the person who will perform this duty is qualified to do so and utilizes the appropriate individual protection equipment.

7.1 PRIOR TO MAINTENANCE

You must first:

- Switch Control Module to the STOP position.
- Press the emergency stop button.
- Open the battery discharger.

7.2 DURING MAINTENANCE

Preventive maintenance tasks are necessary to preserve the unit; doing so will result in optimum performance. Be sure to verify the following items:

- 1) While the engine is cold, the oil level should be between the minimum and maximum values. If it is below the minimum, add Engine oil.

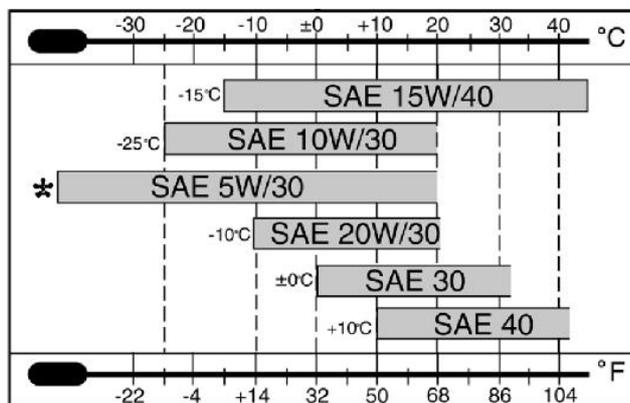


Figure 18 - Recommended types of oil as a function of temperature

NOTE: With the DEEP SEA and IntelliGen^{NT} modules, at 50 hours run notice will be given to change the oil. The recommended oil is 15W40.

- 2) The Engine oil level shall also be checked periodically. This will be accomplished by pulling out the dipstick. It shall be carried out with the engine cold and in a horizontal position. If you wish to check the oil level upon shutting down the Engine, wait for the housing to drain prior to checking the oil level.

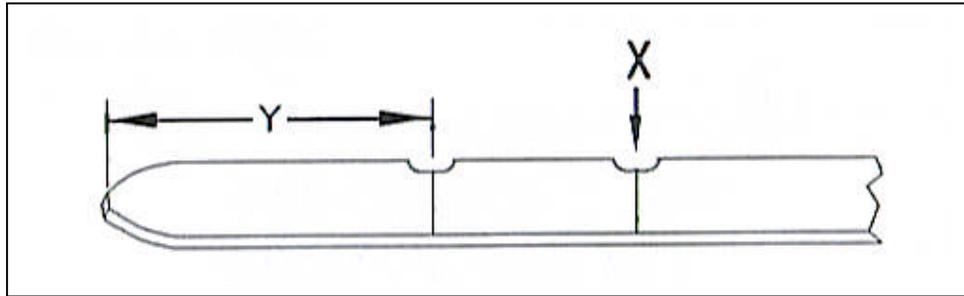


Figure 19 - Oil level dipstick.

The dipstick has two markings; a minimum oil level marking (Y) and a maximum oil level marking (X). The recommended service level is between both markings.

If the oil level is below the minimum, the engine oil must be serviced. However, the oil level shall never exceed the maximum level.

Unscrew the Engine's oil filler plug; completely remove the plug in order to have free access to the oil tank. Once serviced with oil, clean the oil tank cover and reinstall the oil filler plug. If the engine oil must be replaced, first the engine oil must be drained. To accomplish this, the generator set may include an external connection with a plug, from which the engine oil can be drained; otherwise, the generator set must be opened and the engine oil shall be drained through the lower plug located under the engine housing (refer to the engine manual delivered separately). Once the engine oil is drained, re-install the plug that was removed and service the engine oil as indicated for checking the oil level (refer to the engine manual, which is delivered separately for this task).

Take into account the capacity of the tank where the used fluid is going to be poured and be careful not to spill any fluid. Remember that the fluid is hazardous to the environment. Adopt the necessary protective measures for handling the fluid; especially the use of protective goggles. If fluid comes in contact with the skin, immediately wash the affected area.

- 3) The radiator water level should be adequate.
- 4) The fuel level in the tank should be sufficient for the service to be performed. The generator control panel is equipped with a fuel gauge, which will be functional whenever the electrical panel is receiving power. The generator set's fuel tank incorporates a lower plug to drain the tank if required. Be careful to not spill fuel when carrying out this task and adopt the necessary protective measures for handling fuel; especially the use of protective goggles. If fuel comes in contact with the skin, immediately wash the affected area.
- 5) Always refuel in a well ventilated area with the engine stopped.
- 6) Closely inspect the connections and the electrical circuit, for both the mechanical and electrical sections.
- 7) The air inlet and outlet vents should be completely unobstructed to allow for free circulation of cooling air.
- 8) Check the state of the unit's radiator and clean if necessary. The Engine cooling fluid levels shall be checked periodically, and shall be serviced if found below the minimum. The cooling fluid used will be 50% ethylene glycol with a corrosion inhibitor (BS 658: 1992 or MOD AL39) and 50% distilled water. To drain the engine cooling circuit, depending on the model, the generator set may incorporate an external connection with a drain plug for that circuit; otherwise, the draining must be carried out through the bottom part of the radiator. Servicing with coolant once the circuit has been drained will be accomplished through the top part of the radiator, through the radiator's top plug, which is accessible through the covered openings arranged on the generator set's fairing. Take into account the capacity of the tank where the used fluid is going to be poured and be careful not to spill any fluid. Remember that the fluid is hazardous to the environment. Adopt the necessary protective measures for handling the fluid; especially the use of protective goggles. If fluid comes in contact with the skin, immediately wash the affected area.
For further information, refer to the engine manual, which is delivered separately.
- 9) Make sure the exhaust tube is not obstructed.
- 10) Check the battery's connection terminals and electrolyte level (if necessary, add demineralized or distilled water). Acid should never be added. The battery should be recharged if the terminal voltage is below 12.3 V.

- 11) If the battery needs recharging after being taken out of the unit, remove the vent caps and charge battery with direct current only. Connect the charger's positive (+) cable to the battery's positive (+) terminal and the charger's negative (-) cable to the battery's negative (-) terminal. Recharge battery with a current equivalent to 1/10 the rated capacity (Ah). Battery is fully charged when acid density is 1.28. Before completing recharging process: turn off charger before disconnecting battery and check electrolyte level.
- 12) Visually inspect for leaks. If you detect any, investigate their origin and remedy the problem originated.
- 13) If the battery is discharged and you want to perform an emergency startup with the battery from another generator, first check the tightness of the discharged battery's terminals. Stop the engines of both units and connect the two positive terminals of the batteries first and then connect the negative terminal of the charged battery to a metal area on the disabled unit (ground). Start up the auxiliary unit and then the unit being repaired. Disconnect the cables in reverse order to avoid a short circuit. Finally, fully charge the battery.



While performing preventive maintenance tasks it is advisable to wear protective eyewear and gloves during all operations involving the handling of battery acid. Make sure there is nearby access to tap water in order to wash all potentially affected areas.



Remember to always perform all operations with the utmost precaution and safety as indicated in this Manual. (Pay special attention to the risk of short circuits that could be caused by coming in contact with the unit's metallic objects.)

7.3 MAINTENANCE CHART

FREQUENCY	MAINTENANCE OPERATION
MONTHLY	Perform a mains failure simulation; the unit should supply power to consumers for one hour. For parallel units, check the connection and the load sharing. Review the connections of the startup battery, clean and cover with Vaseline. Make sure the battery charger is functioning properly. Make sure fuel pump is functioning properly. Check fuel level on the main fuel tank. Check coolant and oil levels. Make sure smoke extractor is functioning properly.
EVERY 150 HRS. QUARTERLY	Make sure all of the electrical panel lights are functioning properly. Make sure the ATS functions properly in transfers.
EVERY 6 MONTHS	Check the state of all of the gauges and indicators on the electrical panel. Check the engine manufacturer's manual for specific tasks. Start up the engine manually three times, noting each time the voltage and density readings for each of the battery's elements. If any of the voltage readings varies significantly from those of the battery's other elements, do not perform the remaining manual engine startups. Fully charge the battery and check the electrolyte level.
EVERY 500 HRS. EVERY 6 MONTHS YEARLY	Make sure there are no leaks in the coolant tubes. Make sure that all of the unit's alarms display correctly. Check the engine manufacturer's manual for specific tasks. Clean the outside of the fuel tank and check the diesel pipes. Clean radiator, change antifreeze.
EVERY 1,000 HRS. YEARLY	Clean and lube the water pump and fan. Make sure meters are correct. Clean control panel and tighten the panel's connections. Verify that the antivibration feet, fittings and belts are in proper condition. Make sure that vibration and noise levels comply with the current regulations.
EVERY 2,000 HRS. BIANNUAL EVERY 3 YEARS	Make sure noise emission level is compliant with the current regulations. Check the engine manufacturer's manual for specific tasks. In case you had a soundproofed group, clean and grease the lock of the access and panel door. Replace startup batteries.

8. TROUBLESHOOTING

INCIDENT		LIKELY CAUSE	SOLUTION	
In the electrical panel	Engine does not start	1.-Defective battery	1.-Replace battery	
		2.-Defective starting system	2.-Replace starting system 3.-Contact technical service.	
	Starter functioning properly	1.-Faulty voltage detector on control module	1.-Contact technical service.	
		2.-Low fuel level	2.-Refill fuel tank	
	Engine starts	Stops with cause	1.-Emergency has occurred	1.-Take appropriate measures
		Stops for no apparent reason	1.-Emergency not indicated due to faulty LED indicator	1.-Contact technical service.
		Does not stop when emergency occurs	1.-Defective stopping system	1.-Press emergency stop button 2.-Contact technical service.
			Generator does not stop when in stop position	1.-Faulty control unit 2.-Defective Stopping System
Originating in engine's interior	High voltage at no load	1.-Overspeed	1.-Contact technical service.	
		2.-Alternator failure		
	Low voltage at no load	1.-Underspeed	1.-Contact technical service.	
		2.-Alternator failure		
	Correct voltage but low when on load	1.-Heavy load	1.-Reduce power of loads	
		2.-Underspeed on load	2.-Contact technical service.	
		3.-Alternator failure		
Voltage unstable	1.-Voltage meter damaged	1.-Contact technical service.		
	2.-Engine unsteady			
	3.-AVR damaged			
Strange noise inside the unit	1.-Various causes	1.-Make sure nothing is preventing the unit from functioning properly.		
		2.-Contact technical service.		

9. PROTECTION FROM THE ENVIRONMENT

Once the Generator Set has been installed, it is necessary to clean the packaging, accessories, electrical tools, etc., that were used during the installation process.

When it is time to dispose of the batteries, in keeping with Environmental Regulations it is advisable to take them to an authorized recycling center.

For a cleaner environment, recycle all possible items and be sure to not throw electrical components in with the regular garbage so as to comply with European Directive 2002/96/EC. These items should be stored separately until being taken for ecological recycling.

10. WARRANTY

- The warranty of the generator set is extended for a calendar year from the date it is commissioned. This must be reported to GRUPOS ELECTRÓGENOS EUROPA S.A., (hereafter the manufacturer) in writing, whether by fax, or e-mail. The data that must be communicated is the MODEL NUMBER, SERIAL NUMBER AND COMMISSIONING DATE.
- If the manufacturer is not notified of the commissioning within a maximum period of sixty days from the invoice date, then the invoice date itself will be used as the effective start date of the warranty period. If for any reason the commissioning cannot be performed in the sixty days following the invoice date, the manufacturer must be informed of this in writing. This extension of the warranty is subject to the acceptance of the end supplier of the engine and alternator. This shall never exceed 120 days from the invoice date. This acceptance shall be sent by staff of GRUPOS ELECTRÓGENOS EUROPA S.A.
- The warranty covers defects in components and assembly, not due to improper use, manipulation, modification or insufficient maintenance. The warranty does not cover failures caused by use of the generator set with other devices that have not been installed or supplied by the manufacturer. Also excluded are any failures and damages caused by prolonged or improper storage. In this last case, refer to the manufacturer's user manuals.
- The warranty for the generator set ONLY covers spare parts and labor required for operating the set by personnel authorized by the manufacturer. Travel, and other expenditures derived from the repairing of a set under warranty are excluded from the warranty coverage therefore, under no circumstance shall the manufacturer cover these expenses, which must be paid for in full.
- The decision to accept or deny a warranty claim will be made by the manufacturer. Regarding engine and alternator failures, the warranty will be granted by the supplier of these components in accordance with their warranty conditions. The manufacturer reserves the right to require that the faulty component be returned to them. In this case, all expenses arising from this recovery shall be covered by the customer until the resolution of the warranty. If the warranty is accepted, the transport costs of this return shall be paid provided the cost is not greater than that caused by shipping the material in advance.
- Any repair made within the warranty period shall not lead to the modification of expiry date for the generator set warranty.
- The warranty does not cover damages caused by terrorist acts, natural disasters, sabotages or similar occurrences.

If any of the stated provisions does not comply with the legislation of a specific country, the importer is required to notify the manufacturer prior to executing the purchasing-sale operation.

- This warranty expressly replaces all other warranties, explicit or implicit, including any warranty that is commercial or suitable for personal use. The warranty presented here is for exclusive use in resolving claims based on defects and non-conformities in generator sets, regardless of whether the claim is based on a contract or grievance, and replaces other resolutions, responsibilities or rights, whether or not they arise by law.

11. NOISE LEVEL

EUROPA Generator Sets produce different acoustic levels depending on the output and soundproofing of the Generator Set. The noise output is indicated on a sticker affixed to the unit's base frame.

Note: If you work near the unit for any extended period of time, it is advisable to use hearing protection.

12. DECLARATION OF CONFORMITY

GRUPOS ELECTRÓGENOS EUROPA, S.A., shall deliver a CE "Declaration of Conformity" form along with the unit, in compliance with the referenced regulations or standardized documents.

13. APPENDIX 1: FIGURES

Generator set

Class	DPS 100
Prime Power	80 kW
Power Factor	0,8
Frequency	50 Hz
Voltage	400/230 V
Current	144,3 A
Performance Class	G3
Gross weight	1.708 kg
Serial N°	169216
Manufacturing date	30/03/06



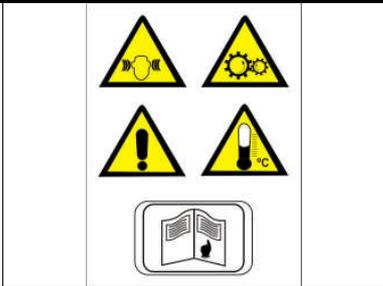
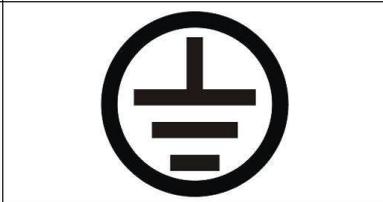
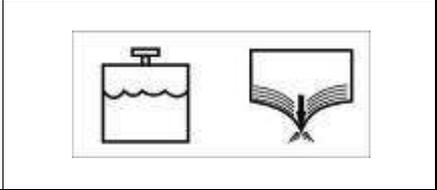
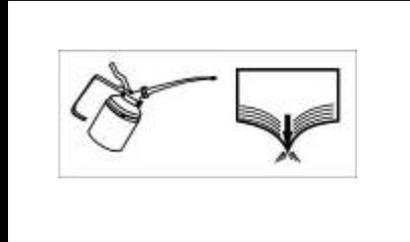
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Polígono Pitarco II, Parcela 20, 50450 Muel (ZARAGOZA) SPAIN

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Figure 20 – Nameplate

NUM	LABELED ITEM	DESCRIPTION
(1)	DPS 100	D => Engine fuel is Diesel P => Engine manufacturer is Perkins A => The Genset is Soundproofed 100 => Commercial name
(2)	Nominal Output 80 kW	Nominal Output of Engine expressed in kW.
(3)	Power Factor 0.8	Indicates Power Factor of Alternator
(4)	Nominal Frequency 50 Hz	Nominal Frequency of Generator Set (Hertz)
(5)	Nominal Voltage 400/230 V	Nominal Frequency of Generator Set (Volts)
(6)	Performance class G1	When withstanding an overload, engine will perform according to catalogued response times per ISO 8528
(7)	Weight 1,640 kg	Gross weight of Generator Set
(8)	Serial no. 169216	Serial Number of Generator Manufacture
(9)	Manufacture Date 30/03/06	Manufacture Date of Generator Set
(10)		CE Marking indicates that Generator Set complies with Relevant Standards

		
<p>Figure 21 – Caution with genset startup</p>	<p>Figure 22 – General warning</p>	<p>Figure 23 – Undefined Warning Notice</p>
		
<p>Figure 24 – Electrical Hazard 230 Volts</p>	<p>Figure 25 – Electrical Hazard 400 Volts</p>	<p>Figure 26 – Lifting point</p>
		
<p>Figure 27 – Possible battery leakage</p>	<p>Figure 28 – Electrical grounding</p>	<p>Figure 29 – Noise output 90 dB</p>
		
<p>Figure 30 – Noise output 114 dB</p>	<p>Figure 31 – Use of hearing protection required.</p>	<p>Figure 32 – Coolant Flush</p>
		
<p>Figure 33 – Oil draining</p>	<p>Figure 34 – Battery isolator</p>	<p>Figure 35 – High temperature</p>

On hot surfaces where it has not been possible to minimize the risk of burns, the following warning pictogram will be installed .

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15. ANNEX 3: DERATING OF ENGINE POWER RATING:

Engine power rating is declared for the following conditions in accordance with the norms ISO-8528-1:2005 and ISO-3046-1:2002.

- Air pressure: 100 kPa
- Temperature: 25°C
- Relative humidity: 30%

If site ambient conditions are different from standard, derating of engine power rating is possible. This derating depends on the characteristics of every engine. Please consult those derating in his technical sheets.

According to norm ISO-3046-1:2002, the derating of engine power rating could be found are:

15.1 DERATING OF POWER RATING OF TTURBOCHARGED ENGINES WITHOUT CHARGE AIR COOLING:

Altitude from sea	Barometric pressure	Temperature (°C)											
		-10	0	5	10	15	20	25	30	35	40	45	50
m	kPa												
0	101,3	1,33	1,23	1,18	1,13	1,09	1,05	1,01	0,97	0,94	0,90	0,87	0,84
100	100,1	1,32	1,22	1,17	1,12	1,08	1,04	1,00	0,96	0,93	0,90	0,86	0,83
200	99,5	1,31	1,21	1,16	1,12	1,08	1,03	1,00	0,96	0,92	0,89	0,86	0,83
300	98,7	1,31	1,20	1,16	1,11	1,07	1,03	0,99	0,95	0,92	0,89	0,85	0,82
400	96,7	1,29	1,18	1,14	1,09	1,05	1,01	0,97	0,94	0,90	0,87	0,84	0,81
500	95,5	1,27	1,17	1,13	1,08	1,04	1,00	0,96	0,93	0,89	0,86	0,83	0,80
600	94,4	1,26	1,16	1,12	1,07	1,03	0,99	0,96	0,92	0,89	0,85	0,82	0,79
700	93,2	1,25	1,15	1,11	1,06	1,02	0,98	0,95	0,91	0,88	0,85	0,82	0,79
800	92,1	1,24	1,14	1,10	1,05	1,01	0,97	0,94	0,90	0,87	0,84	0,81	0,78
900	90,9	1,23	1,13	1,08	1,04	1,00	0,96	0,93	0,89	0,86	0,83	0,80	0,77
1000	89,9	1,22	1,12	1,07	1,03	0,99	0,96	0,92	0,88	0,85	0,82	0,79	0,76
1100	88,8	1,20	1,11	1,06	1,02	0,98	0,95	0,91	0,88	0,84	0,81	0,78	0,76
1200	87,7	1,19	1,10	1,05	1,01	0,97	0,94	0,90	0,87	0,84	0,80	0,78	0,75
1300	86,7	1,18	1,09	1,04	1,00	0,96	0,93	0,89	0,86	0,83	0,80	0,77	0,74
1400	85,6	1,17	1,08	1,03	0,99	0,96	0,92	0,88	0,85	0,82	0,79	0,76	0,73
1500	84,5	1,16	1,07	1,02	0,98	0,95	0,91	0,87	0,84	0,81	0,78	0,75	0,73
1600	83,5	1,15	1,06	1,01	0,97	0,94	0,90	0,87	0,83	0,80	0,77	0,75	0,72
1700	82,4	1,14	1,05	1,00	0,96	0,93	0,89	0,86	0,82	0,79	0,77	0,74	0,71
1800	81,5	1,13	1,04	1,00	0,96	0,92	0,88	0,85	0,82	0,79	0,76	0,73	0,70
1900	80,5	1,12	1,03	0,99	0,95	0,91	0,87	0,84	0,81	0,78	0,75	0,72	0,70
2000	79,5	1,11	1,02	0,98	0,94	0,90	0,87	0,83	0,80	0,77	0,74	0,72	0,69
2200	77,6	1,08	1,00	0,96	0,92	0,88	0,85	0,82	0,79	0,76	0,73	0,70	0,68
2400	75,6	1,06	0,98	0,94	0,90	0,87	0,83	0,80	0,77	0,74	0,71	0,69	0,66
2600	73,7	1,04	0,96	0,92	0,88	0,85	0,81	0,78	0,75	0,73	0,70	0,67	0,65
2800	71,9	1,02	0,94	0,90	0,86	0,83	0,80	0,77	0,74	0,71	0,68	0,66	0,63
3000	70,1	1,00	0,92	0,88	0,85	0,81	0,78	0,75	0,72	0,70	0,67	0,64	0,62
3200	68,4	0,98	0,90	0,87	0,83	0,80	0,77	0,74	0,71	0,68	0,66	0,63	0,61
3400	66,7	0,96	0,88	0,85	0,81	0,78	0,75	0,72	0,69	0,67	0,64	0,62	0,60
3600	64,9	0,94	0,87	0,83	0,80	0,76	0,73	0,71	0,68	0,65	0,63	0,60	0,58
3800	63,2	0,92	0,85	0,81	0,78	0,75	0,72	0,69	0,66	0,64	0,61	0,59	0,57
4000	61,6	0,90	0,83	0,80	0,76	0,73	0,70	0,68	0,65	0,62	0,60	0,58	0,56

Note: Environmental conditions of $T=298\text{ K}$ y $P=100\text{ kPa}$.

In order to know the particular engine power rating derating, refer to manufacturer technical specifications.

15.2 DERATING OF ENGINE POWER RATING OF TURBOCHARGED ENGINES WITH CHARGE AIR COOLING:

Altitude from sea	Barometric pressure	Temperature (°C)											
		-10	0	5	10	15	20	25	30	35	40	45	50
m	kPa												
0	101,3	1,28	1,22	1,19	1,16	1,13	1,11	1,08	1,06	1,04	1,01	0,99	0,97
100	100,1	1,27	1,21	1,18	1,15	1,12	1,10	1,07	1,05	1,03	1,00	0,98	0,96
200	99,5	1,26	1,20	1,17	1,14	1,12	1,09	1,07	1,04	1,02	1,00	0,98	0,96
300	98,7	1,25	1,19	1,16	1,14	1,11	1,09	1,06	1,04	1,02	0,99	0,97	0,95
400	96,7	1,23	1,17	1,15	1,12	1,09	1,07	1,04	1,02	1,00	0,98	0,96	0,94
500	95,5	1,22	1,16	1,13	1,11	1,08	1,06	1,03	1,01	0,99	0,97	0,95	0,93
600	94,4	1,21	1,15	1,12	1,10	1,07	1,05	1,02	1,00	0,98	0,96	0,94	0,92
700	93,2	1,20	1,14	1,11	1,09	1,06	1,04	1,01	0,99	0,97	0,95	0,93	0,91
800	92,1	1,19	1,13	1,10	1,08	1,05	1,03	1,01	0,98	0,96	0,94	0,92	0,90
900	90,9	1,18	1,12	1,09	1,07	1,04	1,02	0,99	0,97	0,95	0,93	0,91	0,89
1000	89,9	1,17	1,11	1,08	1,06	1,03	1,01	0,99	0,96	0,94	0,92	0,90	0,88
1100	88,8	1,15	1,10	1,07	1,05	1,02	1,00	0,98	0,96	0,93	0,91	0,89	0,88
1200	87,7	1,14	1,09	1,06	1,04	1,01	0,99	0,97	0,95	0,92	0,90	0,89	0,87
1300	86,7	1,13	1,08	1,05	1,03	1,00	0,98	0,96	0,94	0,92	0,90	0,88	0,86
1400	85,6	1,12	1,07	1,04	1,02	0,99	0,97	0,95	0,93	0,91	0,89	0,87	0,85
1500	84,5	1,11	1,06	1,03	1,01	0,98	0,96	0,94	0,92	0,90	0,88	0,86	0,84
1600	83,5	1,10	1,05	1,02	1,00	0,97	0,95	0,93	0,91	0,89	0,87	0,85	0,83
1700	82,4	1,09	1,04	1,01	0,99	0,96	0,94	0,92	0,90	0,88	0,86	0,84	0,82
1800	81,5	1,08	1,03	1,00	0,98	0,96	0,93	0,91	0,89	0,87	0,85	0,83	0,82
1900	80,5	1,07	1,02	0,99	0,97	0,95	0,92	0,90	0,88	0,86	0,84	0,83	0,81
2000	79,5	1,06	1,01	0,98	0,96	0,94	0,92	0,89	0,87	0,86	0,84	0,82	0,80
2200	77,6	1,04	0,99	0,96	0,94	0,92	0,90	0,88	0,86	0,84	0,82	0,80	0,79
2400	75,6	1,02	0,97	0,95	0,92	0,90	0,88	0,86	0,84	0,82	0,80	0,79	0,77
2600	73,7	1,00	0,95	0,93	0,90	0,88	0,86	0,84	0,82	0,80	0,79	0,77	0,75
2800	71,9	0,98	0,93	0,91	0,89	0,87	0,85	0,83	0,81	0,79	0,77	0,75	0,74
3000	70,1	0,96	0,91	0,89	0,87	0,85	0,83	0,81	0,79	0,77	0,76	0,74	0,72
3200	68,4	0,94	0,89	0,87	0,85	0,83	0,81	0,79	0,77	0,76	0,74	0,72	0,71
3400	66,7	0,92	0,88	0,86	0,83	0,81	0,80	0,78	0,76	0,74	0,73	0,71	0,69
3600	64,9	0,90	0,86	0,84	0,82	0,80	0,78	0,76	0,74	0,73	0,71	0,69	0,68
3800	63,2	0,88	0,84	0,82	0,80	0,78	0,76	0,74	0,73	0,71	0,69	0,68	0,66
4000	61,6	0,87	0,82	0,80	0,78	0,76	0,75	0,73	0,71	0,70	0,68	0,66	0,65

Note: Environmental conditions of $T=298\text{ K}$ y $P=100\text{ kPa}$.

Intercooler reference conditions: $T=330\text{ K}$, $T_c=300\text{ K}$ y $P=70\text{ kPa}$.

In order to know the particular engine power rating derating, refer to manufacturer technical specifications.

15.3 DERATING OF ENGINE POWER RATING OF NATURALLY ASPIRED ENGINES:

Altitude from sea	Barometric pressure	Humidity: 30%											
		Temperature (°C)											
		-10	0	5	10	15	20	25	30	35	40	45	
0	101,30	1,14	1,10	1,09	1,07	1,05	1,03	1,02	1,00	0,98	0,97	0,95	
100	100,00	1,12	1,09	1,07	1,05	1,03	1,02	1,00	0,98	0,97	0,95	0,93	
200	98,90	1,11	1,07	1,05	1,04	1,02	1,00	0,99	0,97	0,95	0,94	0,92	
400	96,70	1,08	1,04	1,03	1,01	0,99	0,98	0,96	0,94	0,93	0,91	0,90	
600	94,40	1,05	1,01	1,00	0,98	0,96	0,95	0,93	0,92	0,90	0,88	0,87	
800	92,10	1,02	0,98	0,97	0,95	0,93	0,92	0,90	0,89	0,87	0,86	0,84	
1000	89,90	0,99	0,95	0,94	0,92	0,91	0,89	0,88	0,86	0,85	0,83	0,82	
1200	87,70	0,96	0,92	0,91	0,89	0,88	0,86	0,85	0,83	0,82	0,80	0,79	
1400	85,60	0,93	0,90	0,88	0,87	0,85	0,84	0,82	0,81	0,79	0,78	0,76	
1600	83,50	0,90	0,87	0,85	0,84	0,82	0,81	0,80	0,78	0,77	0,75	0,74	
1800	81,50	0,87	0,84	0,83	0,81	0,80	0,79	0,77	0,76	0,74	0,73	0,72	
2000	79,50	0,85	0,82	0,80	0,79	0,77	0,76	0,75	0,73	0,72	0,71	0,69	
2200	77,60	0,82	0,79	0,78	0,76	0,75	0,74	0,72	0,71	0,70	0,68	0,67	
2400	75,60	0,79	0,76	0,75	0,74	0,72	0,71	0,70	0,69	0,67	0,66	0,65	
2600	73,70	0,77	0,74	0,73	0,71	0,70	0,69	0,67	0,66	0,65	0,64	0,62	
2800	71,90	0,74	0,72	0,70	0,69	0,68	0,66	0,65	0,64	0,63	0,62	0,60	
3000	70,10	0,72	0,69	0,68	0,67	0,65	0,64	0,63	0,62	0,61	0,59	0,58	
3200	68,40	0,70	0,67	0,66	0,64	0,63	0,62	0,61	0,60	0,59	0,57	0,56	
3400	66,70	0,67	0,65	0,63	0,62	0,61	0,60	0,59	0,58	0,57	0,55	0,54	
3600	64,90	0,65	0,62	0,61	0,60	0,59	0,58	0,57	0,55	0,54	0,53	0,52	
3800	63,20	0,62	0,60	0,59	0,58	0,57	0,56	0,55	0,53	0,52	0,51	0,50	
4000	61,50	0,60	0,58	0,57	0,56	0,55	0,53	0,52	0,51	0,50	0,49	0,48	

Note: Environmental conditions of $T=298\text{ K}$ y $P=100\text{ kPa}$. Relative humidity 30%

In order to know the particular engine power rating derating, refer to manufacturer technical specifications.



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