INSTALLATION GUIDE

FPT - Iveco

[Image of a generator]
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1. SAFETY

1.1 General Safety Information

This manual provides information and procedures to safely operate and maintain your Hipower Generator Set. Read, understand and observe the safety instructions described in this manual before installing, operating and servicing the generator.

If you have questions about operation or service, please contact Hipower Systems. The information contained in this manual was based on machines in production at the time of publication. Himoinsa Power Systems reserves the right to change any portion of this information without notice.

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This manual is provided to assist in the maintenance and operation of the generator and is not to be used in any manner detrimental to the interests of Himoinsa Power systems.

Information in this manual represents components installed when product was manufactured based upon the best available information. Modifications made subsequent to initial delivery are not included. Always verify the parts required with Himoinsa Power Systems.

If you have any questions, please contact our Parts and Service Department.

Do not operate generator without an Operators Manual. Treat the Operators Manual as part of the generator. Replace the Operators Manual if it is lost, damaged or becomes unreadable.

All personnel that will be operating, maintaining and working around the generator must review these documents before interacting with the generator.

If you have any safety concerns or questions that are not covered by this manual, please contact Himoinsa Power Systems at 1-913-495-5557.

IMPORTANT SAFETY INSTRUCTIONS
SAVE THESE INSTRUCTIONS!

This manual contains important instructions that should be followed during installation and maintenance of the generator and batteries.

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and some other reproductive harm.

Battery posts, terminals and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and reproductive harm. Wash hands after handling.

The safety information in this manual is denoted by the safety alert symbol:

The level of risk is indicated by the following signal words:

![DANGER]
Indicates a hazardous situation, which, if not avoided, will result in death or serious injury.

![WARNING]
Indicates a hazardous situation, which, if not avoided, could result in death or serious injury.

![CAUTION]
Indicates a hazardous situation, which, if not avoided, could result in minor or moderate injury.

![NOTICE]
Indicates a situation that could result in damage to the equipment or other property.

Never go under raised equipment unless properly supported.

Use properly rated lifting equipment to lift heavy objects.

Extinguish all smoking material when adding fuel or working around generator. Engine must be stopped before adding fuel.

Clean up fluids and dispose of fluids, contaminated material etc. in accordance with local regulations.

Disconnect negative (-) battery cable before performing maintenance on generator set.

California Proposition 65 Warning
Allow components to cool before attempting any maintenance.

Do not operate generator set with safety guard(s) removed.

Seek medical attention immediately if your skin contacts high pressure fuel.

### 1.2 Installation And Transporting Hazards

**WARNING**

Crushing hazard.

Generator set is heavy.

Use properly rated lifting devices to move generator set.

Never enter the area under a raised generator set.

**WARNING**

The generator lifting points are designed to lift the generator only.

Do not lift the complete generating set by the generator lifting points.

**WARNING**

Incorrect installation and/or protective systems can result in injury and/or equipment damage.

Installers must be qualified to perform electrical installation work.

### 1.3 Operational Hazards

**WARNING**

Risk of death or serious injury.

Do not operate, work on or around this machine while under the influence of alcohol, drugs or if feeling ill.

**WARNING**

Entanglement hazard.

Loose fitting clothing and long hair can be come entangled in moving or rotating parts. Do not wear loose fitting clothing.

Long hair must be tied back or netted.

Remove neck ties.

Do not operate generator with a guard removed or access panel removed.

**WARNING**

Carbon monoxide hazard.

Do not operate the generator in an enclosed building or confined area.

Avoid actions or areas that expose you and others to carbon monoxide.

**WARNING**

Risk of death or serious injury.

Do not operate, work on or around this machine while under the influence of alcohol, drugs or if feeling ill.

You must adhere to local codes and regulations where your generator is being used.

Do not smoke while refueling. Do not refuel near sparks or an open flame.

Clean up fluid spills and contaminated material in accordance with local regulations.

**WARNING**

Ensure that all personnel operating, servicing, maintaining or working near this equipment are wearing appropriate Personal Protective Equipment (PPE) including eye and ear protection and are fully aware of the emergency procedures in case of any accidents.

**WARNING**

Generators emit noise.

Ensure appropriate ear protection is worn at all times. Maximum A-weighted emissions levels may reach 104 db.
1.4 Maintenance Hazards

Service and maintenance procedures must be carried out by experienced, qualified engineers, familiar with the procedures and the equipment. Before any intrusive procedures are carried out, ensure that the engine is inhibited and the generator is electrically isolated.

All electrical equipment can be dangerous if not operated correctly. Always service and maintain the generator in accordance with this manual. Always use genuine replacement parts.

**WARNING**

Hot engine and exhaust system can cause severe injury.

Do not touch hot engine parts.

Do not perform service or maintenance on generator until cool to the touch.

**WARNING**

Risk of severed digits or limbs.

Generator can be started from a remote switch.

Disconnect the negative (-) battery cable from generator battery before performing service or maintenance on generator set.

**WARNING**

Electrical shock can cause injury or death.

Ensure that all personnel operating, servicing, maintaining or working near this equipment are fully aware of the emergency procedures in case of accidents.

**WARNING**

Do not handle Permanent Magnet Generators (PMGs) if you have mechanically implanted devices; ie pacemakers.

**WARNING**

Service and fault finding procedures present hazards which can result in injury or death. Only personnel qualified to perform electrical and mechanical service should carry out these procedures. Ensure engine starting circuits are disabled before commencing service or maintenance procedures. Isolate any anticondensation heater supply.

**California Proposition 65 Warning**

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects and other reproductive harm. Battery posts, terminals and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer, birth defects and other reproductive harm. Wash hands after handling.
2. IDENTIFICATION

2.1 Generator Identification View

Open Skid Model
HJW-155 T6

1 - Engine Radiator
2 - Engine Exhaust Pipe
3 - Engine Turbocharger
4 - Alternator
5 - Control Box
6 - Fuel Fill

2.2 Data Plate

The genset data plate contains the following information:

- Manufacturer
- Model
- Serial Number
- Frequency
- R.P.M.
- Rated Power (KW) Rated
- Voltage (V) Phase
- Rated Current
- Rated Power Factor Insulation
- Class Dimensions
- Weight
3. INSTALLATION

3.1 General Information

**WARNING**

Crushing hazard.

Generator set is heavy.

Use properly rated lifting devices to lift generator set.

Lift only by the generator devices designed for lifting.

Never enter the area under a raised generator.

Use an adequate lifting device to unload and set the generator in place. Lift only by the lifting devices on the generator designed for lifting.

The generator set must be placed on level site designed to carry the weight of the generator set.

Ambient temperature range is 40° C.

Electrical wiring to and from the generator set must be performed by a qualified electrician and conform to all national and local code requirements.

Fuel supply to the generator set must be installed by a qualified technician. If a remote fuel tank is used, tank must be properly located and correct size fuel lines are installed. Contact the generator engine manufacturer for proper fuel tank location and fuel line size specifications.

3.2 Control Of Material

When the genset is delivered, check that the received material matches the order, and to compare it with the delivery note that is enclosed with the set. Also, check that the material is not damaged. Proceed to open the packages.

If any damage detected, contact the shipping company immediately in order to report the incident to the insurance company.

Himoinsa specifies that all deliveries are made at the customer’s complete risk.

Operations prior to the installation of the automatic genset.

During the operations prior to the installation of the automatically-driven gensets, or when connecting the electrical connections, or in order to avoid unfortunate startups, etc. the battery/batteries must be disconnected and the control panel switch must be set to the OFF position.

Safety rules for diesel gensets

The engine room and installation of the set (foundations, air intake, gas exhaust) must match the “Safety rules” that exist in the country where the genset will be installed.

**Installation**

For stationary gensets, two types of installation can be considered:

- Outdoor assembly
- Indoor assembly

3.3 Outdoor Installations

The generator set can be temporarily placed on a firm level surface. If possible, avoid direct exposure to the sun, rain and dirty conditions. It is recommended that the area around generator set be fenced to prevent unauthorized access.

For long-term installations, a concrete foundation designed by an engineer for the generator set is required. Foundation must be constructed to prevent generator set noise and vibration from surround areas and buildings.

Airflow is critical for the proper operation of the generator. Outdoor installation must allow adequate clearance to maintain the proper ventilation for generator cooling. Minimum clearance around generator set is 5 ft (1.5m).

**WARNING**

Carbon monoxide hazard.

Engine exhaust pipe(s) must be installed to carry exhaust gases to an area where they pose no danger.

Avoid actions or areas that expose you and others to carbon monoxide.

Engine exhaust pipe(s) must be installed to carry exhaust gases to an area where they pose no danger.

3.4 Indoor Installations

For the correct installation of a genset in closed premises, the size of the room must allow:

- The regular operation of the genset.
- An easy access to its components for maintenance and possible repairs.
- The possibility of installing the genset using the available means of transport. The door through which the genset will be installed must be centered, so that the set remains centered once it is inside, and there is no need of moving it.
- The existence of holes that allow oil replacement.
• The installation of the exhaust pipe with the minimum possible number of pipe elbows.
• The genset to be placed in the middle of the premises, with respect to perimeter walls, in order to facilitate access.
• The layout of the command panel (in case it is an automatic set) to be in a position that allows the operator to have complete visibility over the instruments when operating it.

The recommended room dimensions are displayed in the following pictures:

**Sound Attenuated Generator**

2. Control panel.
3. Air intake gap.
4. Air outlet tunnel.
5. Cable wireway.
6. Access door.
8. Exhaust pipe.
10. Exhaust silencer.

* May vary depending on the function of the outlet section of the model (see plans of the specific model to be installed).

**Open Skid Set**

1. Generator set.
2. Control panel.
3. Air intake gap.
4. Air outlet tunnel.
5. Tray for cable-running.
6. Access door.
7. Concrete base.
8. Exhaust pipe.
10. Exhaust silencer.

* May vary depending on the function of the outlet section of the model (see plans of the specific model to be installed).

The basic elements to be considered are:
• Foundations
• Exhaust installations
• Ventilation
• Fuel installation.
• Electrical connections
• Grounding.
• Heating

3.4.1 Foundation

The foundation must be designed by an engineer experienced in generator foundation design. The foundation must support the weight of the generator set and all fluids, and prevent the transmission of vibration and noise to other parts of the building.

The surface on which the set will be placed must be leveled in order to allow its correct operation. For cleaning reasons, it is recommended that the foundations are approximately 10 cm above the...
floor level, and covered with gres industrial sandstone tiles.

3.4.2 Exhaust Installation

⚠️ DANGER

Carbon monoxide hazard.

Generator exhaust gases must be routed to an outdoor area where they pose no danger.

Exhaust installation must be performed by a qualified technician, experienced in indoor generator installation.

Avoid actions or areas that expose you and others to carbon monoxide.

Exhaust pipe(s) must be routed to an outdoor area where exhaust gases pose no danger.

Exhaust pipe that passes through walls, must prevent the transmission of heat to the walls. Exhaust pipe connections must be sealed tight to prevent exhaust gas leaks and must end with a protection cap to protect them from water entry, or with a similar system (1) and (2).

In the part where they run through the walls, it is recommended to perform a thermal insulation of the pipes, in order to prevent heat expansion to the walls. (3)

The joints between the different pipes must be perfectly sealed so that there are no gas leaks. The connection between flange and gasket is the most critical one. It is also recommended to place a condensation collector, with drain valve, on the bottoms point of the pipes.

The connection between the engine’s collector outlet (or the turbocharger) and the pipe must be made by means of a flexible tube, so that the engine movement and the thermal expansions of the pipe are absorbed by the engine without damaging any elements. The use of flexible pipe also requires the placement of flanges in the exhaust pipe, independent of the genset. Therefore, the pipelines must be fixed to the walls or ceiling of the engine room, with supports that can bear the weight of the pipe to the engine outlet, so that it does not rest on the parts of the engine (collector, turbocharger), and allow its expansion.

When dealing with very long pipes, it is necessary to insert expansion joints made of sealed flexible pipes.
When establishing the trajectory of the exhaust pipe, it is necessary that the pipe is not near the engine air filters, in order to prevent the machine from drawing in hot air. Otherwise, it will be necessary to insulate it.

Whenever there are several gensets, it is advisable that all exhausts do not converge on a common pipe, as there can be problems when some gensets are in operation and others are not. The produced exhaust gases can penetrate in the conduits of the sets that are not in operation and may cause damage.

A. Exhaust pipes measurement for Standard Static Gensets

The engine’s exhaust backpressure has a remarkable influence on the produced power and on the thermal charge.

Excessive backpressure values (measured at the exhaust collector outlet for non-turbocharged engines, and at the turbine outlet on turbocharged engines) cause reductions in power, rise in temperature of exhaust gases, fumes, high fuel consumption, cooling water overheat, lubricant degradation, and the ensuing consequences on the engine parts.

The limits that must not be exceeded (referred to the delivery conditions of maximum power at full throttle) in HIMOINSA genets must be consulted with the factory.

Such limits can be observed considering the dimensions that are suitable for the exhaust installation, that is, the diameter of the pipe and type of silencer.

The pipes must be as short as possible, and with as few pipe elbows as possible. Whenever pipe elbows are necessary, they must be used with a very wide angle of curvature (from 2.5 to 3 times the diameter of the pipe).

Pipes with bends of angles lower than 2.5 times the diameter pose difficulties so they must be avoided. In order to calculate the total length of the pipe (which is crucial for the exhaust’s backpressure), the following considerations must be taken into account: The rectified length of the pipe elbows must be determined according to the chart and pictures:

The backpressure values due to the exhaust silencers may vary within a wide range, depending on the type of building, dimensions and noise abatement characteristics:

- If it is the one supplied by HIMOINSA, the length must be multiplied by a coefficient of safety, so that the total length to be considered due to backpressure will be: L=2 X l.

- If it has been provided by another supplier, it is recommended to check the value of backpressure derived from the silencer with the supplier.

Example: The exhaust pipe consists of the following parts:
- 5 metres of straight pipe stretches.
- Two pipe elbows type a)
- Three pipe elbows type c)
- A 1m long silencer.

If the inner diameter of the engine exhaust is 80mm, the total length of the exhaust pipe is calculated as follows:

a) for the inner diameter 80mm, according to the chart, l=1.2m.
b) total length of the pipe elbows type (a) is, 1X l=1X1.2=1.2m. as there are two pipe elbows, 2 x 1.2=2.4m.
c) the total length of the pipe elbows type c) is 5 X l=5 x 1.2= 6m. as there are three pipe elbows, 3 x 6 = 18m.
d) the total length of the exhaust silencer is L=2X l = 2X1 = 2m.
e) the total length of the exhaust pipe is: 5+2.4+18+2= 27.4metres
In order to calculate the diameter of the exhaust pipe it is possible to use the normogram below:

For calculation purposes, in this normogram we will use the following backpressure values:
- 800 mm H2O, for aspirated engines.
- 400 mm H2O, for supercharged engines.

Exhaust gases airflow in kg/h. In order to convert into m3/h, the data must be divided by the exhaust gases density. Request these data from the manufacturer.

Example: If we take the exhaust pipe from the previous example, with a total length of 27.4 metres (taking into account the rectified length of the pipe elbows and the length equivalent to the exhaust silencer). From the following data of the installation:
- 5 pipe elbows at 90° (2x type A and 3x type C).
- Set model: HIW-210
- Working rate: 50 Hz
- Motor: 8361 SRi 26 (supercharged).
- Insulated pipe.

a) Start from the lower part, with a total pipe length of 27.4m (straight stretches + rectified elbow length), until crossing the straight line relative to the total number of pipe elbows in the installation (5 elbows).

b) Continue and follow a horizontal direction to the right until crossing again the straight line relative to the number of pipe elbows (5 elbows).

c) Continue upwards until crossing the straight line relative to the flow of the exhaust gases, which according to the chart is 1120 kg/h. To convert kg/h into m3/h divide the flow expressed in kg/h by the density of the exhaust gases. As a first approximation we can take the density of the exhaust gases with a value of 0.42 kg/ m3. 1120x0.42=2667 m³/h.

d) Continue horizontally to the left. After crossing the straight line, continue upwards until crossing the straight line relative to the overpressure of the pipe, 400 mmH2O.

e) Continue upwards until crossing the straight line.

f) Continue to the right until the straight line relative to the insulated pipe. After crossing this last straight line, the pipe diameter, 122 mm, is determined on the right top part. The commercial diameter right above is the one to be considered.

The exhaust pipe cannot have a lower diameter than the collector pipe of the engine exhaust, and also, the straight stretches must have a slight inclination in order to prevent the return of condensates, as shown on the location plan of the genset in the room.

When the diameter of the pipe is higher, the engine joint must have a conic connection element with a conicity below 30° in order to avoid excessive load losses.

B. Exhaust pipes measuring for Sound Attenuated Static Gensets.

Check with the HIMOINSA engineering department. There is backpressure in the outlet of the genset which is caused by the internal pipes. It is necessary to know this value so as not to exceed the recommended backpressure when designing the rest of the installation.

Exhaust silencer
The exhaust silencer is usually attached to the stretch of pipe that remains inside the room where the genset is located. Whenever possible, it can be separated from the genset. The silencer used in industrial applications performs a 15 to 20 decibels noise reduction.

In order to reduce the noise, the position of the silencer can be altered, by reducing the length of the tube that goes into the engine. For example, for a 10m long pipe, the optimal position would be halfway through the distance in relation to the outlet. In the cases of private installations, such as hospitals...
or residential areas, where a higher noise reduction is required, special silencers can be used, with a reduction of 25 to 30 decibels, and whenever possible, using special quiet chambers.

3.4.3 Ventilation
Adequate ventilation is essential for proper operation and durability of the generator set.

The generator set room must:

1. Allow the dissipation of the heat produced when the genset is in operation by irradiation and convection.
2. Provide sufficient air flow for combustion and engine cooling.
3. Allow the engine cooling by means of the radiator, keeping the operating room temperature within the safety limits in order to guarantee a good aspiration of the supply air.

A good ventilation solution applicable to most cases is the one indicated in the charts of the sections of the installation, in which the engine fan draws in the cooling air from the engine room, whereas the hot air is expelled through the expulsion tunnel placed between the radiator and the room window.

The expulsion window must be bigger or same size as the radiator in case of standard static gensets, and bigger or same as the expulsion grid in case of sound attenuated sets.

Prevent the radiator exhaust hot air from coming back to the engine room, making sure the expulsion conduits are leakproof. Therefore, the air in the engine room is constantly renovated, and the dimensions of intake grilles must be big enough for the cooling and combustion.

In order to achieve a correct air flow, the cool air must be introduced through the grilles that are located on the lower part of the engine room wall. This wall should be the one located opposite the radiator, so that the air flows all over the set before being expelled through the fan.

Make sure there are no areas in the engine room where the air is deposited. This usually happens in rooms with several engines. In those cases, and whenever possible, each group should have its own air intake grille.

In case you need more details about the air flow required for the different types of HIMONSA gensets, please contact the manufacturer. For safety reasons, in those premises where there are sets in continuous operation, or in those areas where the room temperature is high, it is advisable to use an auxiliary extractor fan that has enough power to achieve a suitable ventilation. Such extractor fan must be located on top of the room, as close to the radiator as possible.

3.4.4 Diesel Fuel

<table>
<thead>
<tr>
<th>DIESEL FUEL</th>
<th>Generator Model</th>
<th>Inlet Pressure Minimum</th>
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<th>Flow Rate Maximum</th>
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3.4.5 Remote Fuel Tank
The generator set is supplied with an integrated fuel tank.

In some situations, a remote fuel tank may be required. The remote fuel tank must be properly connected to the engine so the fuel transfer pump can draw fuel properly.

The remote tank must be located no more than 65.5 ft (20 m) from the engine and no more than 16.5 ft (5 m) below the engine.

Generator sets supplied by HIMONSA include a complete fuel installation, since the fuel tank is located on the bedplate of the genset.

The fuel tank is connected through flexible tubes in order to guarantee their operating durability, depending on the model.

The fuel tank is connected through flexible tubes in order to guarantee their operating durability, depending on the model.

For longer run times, and in order to satisfy special demands, it may necessary to use a special tank that is fitted separately. It will be necessary to connect the engine to the new tank, and install flexible connections and new suitable pipes that must be firmly connected. The new fuel tank must be located according to the following criteria, so
that the engine injection pump is able to draw in fuel from the new tank:
• Closer than 20m from the engine, in case they are both at the same level.
• Less than 5m deep.

The usual connections are:
• For fuel injections to the engine injection pump.
• For fuel excess returns from the injection pump.
• For drain return of the injectors.

The pipes must not have any welds. They can be made of steel, iron or cast iron. Galvanized steel pipelines must not be used. Flexible connections must be fitted in order to isolate the static parts of the plant from the new fuel tank, in order to avoid the possible vibrations caused by the engine.

Depending on the type of engine, these can be made using the following:
Stretches with a suitable length made of reinforced rubber pipes with flexible insertions that are resistant to gas oil. For the connections with the terminal rubber holders with edges and screw clamps.

Flexible low-pressure type tubes, suitable for gas oil, protected with metal mesh and with screwed terminals for tightly-sealing. Synthetic resins must be avoided.

In complementary areas of the plant, maximum attention must be paid to the following issues:
- Fix pipes by means of holders, at regular intervals in a way that vibrations and inflexions caused by pipes weight are avoided, especially those made of copper tube.
- Couplings must be avoided. In case of using them they must be tightly-sealed, especially in depression conditions parts (fuel aspiration intake), in order to avoid air filtrations that make the startup more difficult.
- Aspiration pipes below the fuel level must be placed at a distance of 20-30mm from the bottom, in order to avoid a possible deactivation of the circuit due to insufficient air. Also, these must be conveniently separated from each other, in a way that the fuel return flow does not block the supply due to the gas oil impurities from the bottom of the tank or mixed air.
- Thorough cleaning of the used pipes.
- Avoid abrupt variations in the tube section and the use of elbows with wide angles in pipes.

3.4.6 Heating
In cold climates, automatic starting generator sets may need an engine room heater to keep the engine room above 50° F (10° C) to ensure the generator starts when needed.

Electric heaters with thermostatic controls ranging from 500 to 1500W, depending on the genset, have also been supplied with those sets. They maintain the water temperature within acceptable values in case a sudden start or power input may damage the engine.

3.4.7 Electrical Connections

WARNING

Electrical shock hazard.

Electrical connections must be performed by a qualified electrician and conform to local electrical codes.

Refer to the following electrical schematics for your generator for the proper electrical connection. The generator frame must be grounded.

There are no special tools required for this installation.

The gensets are ready for user connections. When making the connections, you must comply with the conditions specified in the diagrams enclosed with the genset.

Manual Genset
The user cables must be connected to the line terminals which, for standard static gensets, are located inside the electrical panel, on the rail terminals or at the bottom of the magnetothermal switch, either inside the panel or in the moldeada box (check the electrical diagrams included in the manual of the panel). For sound attenuated sets, the connection to the grounding terminals is easily accessible and protected with a methacrylate sheet.

Automatic Genset
The cables that come from the genset, the external power supply and user shall be connected to their respective terminals, located in the command panel. The power cables of the genset shall be connected directly to alternator terminals of the genset.

The connection to auxiliary services between the set and the command panel shall be made with a multiple cable and using the multiple connectors plugs provided with the set.

Cable dimensions
The choice and dimensions of the cables is responsibility of the person who carries out the installation.

Cable positioning
Power cables, for both manual and automatic sets, must be placed in suitable channeling, tunnels or protective conduct-holder. Do not include 400V and 12V (or 24V) cables in the same channeling.
3.4.8 Ground Connections

**WARNING**

Electrical shock hazard.

Electrical connections must be performed by a qualified electrician and conform to local electrical codes.

Refer to the following electrical schematics for your generator for the proper electrical connection. The generator frame must be grounded.

There are no special tools required for this installation.

The gensets are ready for user connections. When making the connections, you must comply with the conditions specified in the diagrams enclosed with the genset.

Metal parts of installations which are exposed to human contact, and due to an insulation flaw or other reasons, may get in contact with voltage, must be connected to land-dispersion device.

The gensets and panels have been equipped with their respective grounding terminals. The connection of these to the land-dispersion must be made with bare copper wires conductors with a minimum section of 16mm², or if not available, galvanized iron with a 50 mm² section. The resistance of such conductor, including the contact resistance, must not exceed 0.15 Ohm.

3.4.9 Symbols

- Ground
- OFF
- ON
- Positive
- Negative

3.4.10 Fuses

**MDA Type**
- Fuse 1 2 amp 250 volt
- Fuse 2 10 amp 250 volt
- Fuse 3 15 amp 250 volt

**189020 Type**
- Fuse 4 2 amp 500 volt
- Fuse 5 2 amp 500 volt
- Fuse 6 2 amp 500 volt

3.4.11 Open Bottom Installation

When an open bottom is used, the generator assembly shall be installed over non-combustible materials. Also, the generator assembly is located such that it prevents combustible materials from accumulating under the generating set.
3.3.12 Three Phase Generator Sets
3.3.13 Single Phase Generator Sets
3. PRESTART CHECKS

Before starting the generator set engine, perform the following prestart checks:

Verify all guards and covers are in place and fastened tight.

Check entire machine for loose hardware. Tighten all loose hardware.

Fill fuel tank with fuel.

Check engine coolant hoses for damage and loose clamps.

Check level of engine oil on dipstick (1). Oil must be between the min and max levels on dipstick. Add the recommended oil if necessary.

Check fuel filter/water separator (3) for water or contaminants.

Drain if necessary.

Check coolant level in radiator (2). Add coolant to proper level if low.

Verify battery cables are properly connected and tight.

Once engine is started, warm engine with a reduced load before applying full load. This does not apply to emergency power generators.

Check the engine and alternator for any signs of damage, water, oil or fuel leaks.

Verify intake and outlet air vents and grills are not obstructed or blocked.

Verify that there are no obstructions in engine intake air filter tube.
4. DSE 7310 CONTROL PANEL

5.1 Introduction

The DSE 7310 digital control panel is a monitoring system for the genset electrical signal and also manages the genset engine.

The DSE 7310 is designed to provide differing levels of functionality across a common platform. This allows the generator OEM greater flexibility in the choice of controller to use for a specific application.

The DSE 7310 module has been designed to allow the operator to start and stop the generator, and if required, transfer the load to the generator either manually (via fascia mounted push-buttons) or automatically.

The user also has the facility to view the system operating parameters via the LCD display.

The DSE 7310 module monitors the engine, indicating the operational status and fault conditions, automatically shutting down the engine and giving a true first up fault condition of an engine failure by a COMMON AUDIBLE ALARM. The LCD display indicates the fault.

The powerful ARM microprocessor contained within the module allows for incorporation of a range of complex features:

- Text based LCD display (supporting multiple languages).
- True RMS Voltage, Current and Power monitoring.
- Engine parameter monitoring.
- Fully configurable inputs for use as alarms or a range of different functions.
- Engine ECU interface to electronic engines.

Using a PC and the 7000 series configuration software allows alteration of selected operational sequences, timers and alarm trips.

Additionally, the module’s integral fascia configuration editor allows adjustment of a subset of this information.
5.2 Control Panel
The control panel has a backlit display and different LED’s to control the device status. Different push buttons allow the user to command and program the control panel.

NOTE: The display turns off the backlighting (low consumption mode) after 10 minutes without any detectable pulse on the keyboard.

A - Menu Navigation Buttons
B - Main Status and Instrumentation Display
C - Four Configurable LEDs
D - Close Generator (Manual Mode Only)
E - Generator Available LED
F - Start Engine (When in Manual Mode)
G - Mute Alarm / Lamp Test
H - Select Auto Mode
I - Close Generator LED
J - Select Manual Mode
K - Select Stop Mode
L - Open Generator (Manual Mode Only)

NOTE:- “Generator on load” LED has two modes of operation depending upon the configuration of the controllers digital inputs.

1. Digital input configured for “Generator closed auxiliary” – The LED illuminates when the generator closed auxiliary input is active – The LED shows the state of the auxiliary contact.

2. There is NO input configured for “Generator closed auxiliary” (factory default setting) – The LED illuminates when the 7310 gives the loading signal to the generator – The LED shows the state of the 7310’s loading request.
5.3 Control Panel Push Buttons

5.3.1 Stop / Reset

This button places the module into its Stop/Reset mode. This will clear any alarm conditions for which the triggering criteria have been removed. If the engine is running and the module is in Stop mode, the module will automatically instruct the changeover device to unload the generator (‘Close Generator’ becomes inactive (if used)). The fuel supply de-energizes and the engine comes to a stand still. Should a remote start signal be present while operating in this mode, a remote start will not occur.

5.3.2 Manual

This mode allows manual control of the generator functions. Once in Manual mode the module will respond to the start button, start the engine, and run off load. If the engine is running off-load in the Manual mode and a remote start signal becomes present, the module will automatically instruct the changeover device to place the generator on load (‘Close Generator’ becomes active (if used)). Upon removal of the remote start signal, the generator remains on load until either selection of the ‘STOP/RESET’ or ‘AUTO’ modes. For further details, please see the more detailed description of ‘Manual operation’ elsewhere in this manual.

5.2.3 Auto

This button places the module into its ‘Automatic’ mode. This mode allows the module to control the function of the generator automatically. The module will monitor the remote start input and mains supply status and once a start request is made, the set will be automatically started and placed on load. Upon removal of the starting signal, the module will automatically transfer the load from the generator and shut the set down observing the stop delay timer and cooling timer as necessary. The module will then await the next start event. For further details, please see the more detailed description of ‘Auto operation’ elsewhere in this manual.

5.3.4 Start

This button is only active in STOP/RESET or MANUAL mode. Pressing this button in manual or test mode will start the engine and run off load (manual) or on load (test). Pressing this button in STOP/RESET mode will turn on the CAN engine ECU (when correctly configured and fitted to a compatible engine ECU).

5.3.5 Mute / Lamp Test

This button silences the audible alarm if it is sounding and illuminates all of the LEDs as a lamp test feature. When correctly configured and fitted to a compatible engine ECU, pressing this button in STOP/RESET mode after pressing the START button (to power the ECU) will cancel any “passive” alarms on the engine ECU.

5.3.6 Transfer to Generator

Allows the operator to transfer the load to the generator (when in Manual mode only)

5.3.7 Open Generator

Allows the operator to open the generator (when in Manual mode only)
5.3.8 Menu navigation

Used for navigating the instrumentation, event log and configuration screens. For further details, please see the more detailed description of these items elsewhere in this manual.

5.4 User Configurable Indicators

The User Configurable LEDs (A) can be configured by the user to indicate any one of 100+ different functions based around the following:

- **Indications** - Monitoring of a digital input and indicating associated functioning user’s equipment - Such as Battery Charger On or Louver’s Open, etc.
- **WARNINGS and SHUTDOWNS** - Specific indication of a particular warning or shutdown condition, backed up by LCD indication - Such as Low Oil Pressure Shutdown, Low Coolant level, etc.
- **Status Indications** - Indication of specific functions or sequences derived from the modules operating state - Such as Safety On, Preheating, Panel Locked, Generator Available, etc.

5.5 Quickstart Guide

This section provides a quick start guide to the module’s operation.

5.5.1 Starting The Engine

1. Select manual mode (A).
2. Press the start button (B) to crank the engine.

Note: See the Operation section for more information.
5.5.2 Stopping The Engine

Select stop button (A).

Note: See the Operation section for more information.

5.6 Viewing The Instructions

It is possible to scroll to display the different pages of information by repeatedly operating the next page button.

Once selected the page will remain on the LCD display until the user selects a different page or after an extended period of inactivity, the module will revert to the status display.

If no buttons are pressed upon entering an instrumentation page, the instruments will be displayed automatically subject to the setting of the Scroll Delay.

Alternatively, to scroll manually through all instruments on the currently selected page, press the scroll or buttons. The ‘autoscroll’ is disabled.

To re-enable ‘autoscroll’ press the buttons to scroll to the ‘title’ of the instrumentation page (ie Engine).

When scrolling manually, the display will automatically return to the Status page if no buttons are pressed for the duration of the configurable LCD Page Timer.

If an alarm becomes active while viewing the status page, the display shows the Alarms page to draw the operator’s attention to the alarm condition.

Page order:
Status, Engine, Generator, Mains, Alarms, ECU DTCs (electronic engines only), Event log, Scheduler (if enabled), About.
5.6.1 Instrument Page Content

**Engine**

- Engine Speed
- Oil Pressure
- Coolant Temperature
- Engine Battery Volts
- Run Time
- Oil Temperature*
- Coolant Pressure*
- Inlet Temperature*
- Exhaust Temperature*
- Fuel Temperature*
- Turbo Pressure
- Fuel Pressure*
- Fuel Consumption*
- Fuel Used*
- Fuel Level*
- Auxiliary Sensors (If fitted and configured)
- Engine Maintenance Due (If configured)
- Engine ECU Link*

* When connected to suitably configured and compatible engine ECU. For details of supported engines see ‘Electronic Engines and DSE wiring’ (DSE Part number 057-004)

**Generator**

- Generator Voltage (ph-N)
- Generator Voltage (ph-ph)
- Generator Frequency
- Generator Current
- Generator Earth Current
- Generator Load (kW)
- Generator Load (kVA)
- Generator Power Factor
- Generator Load (kVAR)
- Generator Load (kWh, kVAh, kVARh)
- Generator Phase Sequence

**About**

- Module Type
- Application Version
- USB ID – unique identifier for PC USB connection
5.6.2 Can Error Messages

When connected to a suitable CAN engine the 7310 controller displays alarm status messages from the ECU.

- Type of alarm as reported by the ECU
- Type of alarm that is triggered in the DSE module (i.e., Warning or Shutdown)

Press to access the list of current active Engine DTCs (Diagnostic Trouble Codes).

The code interpreted by the module shows on the display as a text message. Additionally, the manufacturer code is shown.

NOTE: For details on these code meanings, refer to the ECU instructions provided by the engine manufacturer, or contact the engine manufacturer for further assistance.

NOTE: For further details on connection to electronic engines please refer to Electronic engines and DSE wiring. Part No. 057-004

5.7 Viewing The Event Log

- Event log 1/50
- Number of present alarms.
  This is event 1 of a total of 50 logged events.

The 7310 module maintains a log of the last 50 shutdown alarms to enable the operator or engineer to view the past alarms history.

The event log only includes shutdown and electrical trip alarms logged;
The event log does not contain Warning alarms.
Once the log is full, any subsequent shutdown alarms will overwrite the oldest entry in the log. Hence, the log will always contain the most recent shutdown alarms. The module logs the alarm, along with the date and time of the event in the format shown in this example.

To view the event log, repeatedly press the next page button until the LCD screen displays Event log.

Press down to view the next most recent shutdown alarm:

Continuing to press down cycles through the past alarms after which the display shows the most recent alarm and the cycle begins again.

To exit the event log and return to viewing the instruments, press the next page button.

**5.8 Operation**

The following description details the sequences followed by a module containing the standard ‘factory configuration’.

Remember that if you have purchased a completed generator set or control panel from your supplier, the module’s configuration will probably have been changed by them to suit their particular requirements.

Always refer to your configuration source for the exact sequences and timers observed by any particular module in the field.

A - Menu Navigation Buttons
B - Main Status / Instrumentation Display
C - Four Configurable LEDs
D - Close Generator (Manual Mode Only)
E - Generator Available LED
F - Start Engine (When in Manual Mode)
G - Mute Alarm / Lamp Test
H - Select Auto Mode
I - Close Generator LED
J - Select Manual Mode
K - Select Stop Mode
L - Open Generator (Manual Mode Only)
5.8.1 ECU Override

NOTE: Depending upon system design, the ECU may be powered or unpowered when the module is in STOP mode. ECU override is only applicable if the ECU is unpowered when in STOP mode.

When the ECU powered down (as is normal when in STOP mode), it is not possible to read the diagnostic trouble codes or instrumentation. Additionally, it is not possible to use the engine manufacturers' configuration tools.

As the ECU is usually unpowered when the engine is not running, it must be turned on manually as follows:

- Select STOP mode button (K) on the DSE controller.
- Press and hold the START button (F) to power the ECU. As the controller is in STOP mode, the engine will not be started.
- Continue to hold the start button for as long as you need the ECU to be powered.
- The ECU will remain powered until a few seconds after the START button is released.

This is also useful if the engine manufacturer’s tools need to be connected to the engine, for instance to configure the engine as the ECU needs to be powered up to perform this operation.

5.8.2 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 AUTO button (H). An LED indicator beside the button confirms this action.

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 such as mains brownouts, 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 7000 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, the Warm Up timer, if selected, begins, allowing the engine to stabilize before accepting the load.

The generator will be placed on load.

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 transferred back 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.

5.8.3 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.

Activate Manual mode be pressing the pushbutton (J). An LED indicator beside the button confirms this action.

Manual mode allows the operator to start and stop the set manually, and if required change the state of the load switching devices.

Waiting In Manual Mode
When in manual mode, the set will not start automatically.

To begin the starting sequence, press the button (F).

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 7000 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 stabilize 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.

- Pressing the transfer to generator button (D)
- 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 transferred back to the mains supply. To manually transfer the load back to the mains either:

- Press the Open Generator button (L)
- Press the auto mode button (H) to return to automatic mode.

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

- The stop button (K) is pressed – The set will immediately stop
- The auto button (H) is pressed. The set will observe all auto mode start requests and stopping timers before beginning the Auto mode stopping sequence.
<table>
<thead>
<tr>
<th>Display</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHARGE FAILURE</td>
<td>The auxiliary charge alternator voltage is low as measured from the W/L terminal.</td>
</tr>
<tr>
<td>BATTERY UNDER VOLTAGE</td>
<td>The DC supply has fallen below the low volts setting level for the duration of the low battery volts timer.</td>
</tr>
<tr>
<td>BATTERY OVER VOLTAGE</td>
<td>The DC supply has risen above the high volts setting level for the duration of the high battery volts timer.</td>
</tr>
<tr>
<td>FAIL TO STOP</td>
<td>The module has detected a condition that indicates that the engine is running when it has been instructed to stop.</td>
</tr>
<tr>
<td>NOTE: ‘Fail to Stop’ could indicate a faulty oil pressure sensor or switch - If the engine is at rest check oil sensor wiring and configuration.</td>
<td></td>
</tr>
<tr>
<td>FUEL USAGE</td>
<td>Indicates the amount of fuel measured by the fuel level sensor is in excess of the Fuel Usage alarm settings. This often indicates a fuel leak or potential fuel theft.</td>
</tr>
<tr>
<td>AUXILIARY INPUTS</td>
<td>Auxiliary inputs can be user configured and will display the message as written by the user.</td>
</tr>
<tr>
<td>LOW FUEL LEVEL</td>
<td>The level detected by the fuel level sensor is below the low fuel level setting.</td>
</tr>
<tr>
<td>CAN ECU ERROR</td>
<td>The engine ECU has detected a warning alarm and has informed the DSE module of this situation. The exact error is also indicated on the module’s display.</td>
</tr>
<tr>
<td>kW OVERLOAD</td>
<td>The measured Total kW is above the setting of the kW overload warning alarm.</td>
</tr>
<tr>
<td>EARTH FAULT (DSE7310 V2.0 or above only)</td>
<td>The measured Earth Fault Current has been in excess of the earth fault trip and has surpassed the IDMT curve of the Earth Fault alarm.</td>
</tr>
<tr>
<td>LOADING VOLTAGE NOT REACHED</td>
<td>Indicates that the generator voltage is not above the configured loading voltage. The generator will not take load when the alarm is present after the safety timer.</td>
</tr>
<tr>
<td>LOADING FREQUENCY NOT REACHED</td>
<td>Indicates that the generator frequency is not above the configured loading frequency. The generator will not take load when the alarm is present after the safety timer.</td>
</tr>
<tr>
<td>PROTECTIONS DISABLED</td>
<td>Shutdown and electrical trip alarms can be disabled by user configuration. In this case, Protections Disabled will appear on the module display; The alarm text will be displayed but the engine will continue to run. This is ‘logged’ by the module to allow DSE Technical Staff to check if the protections have been disabled on the module at any time. This feature is available from V4 onwards.</td>
</tr>
<tr>
<td>LOW OIL PRESSURE</td>
<td>The module detects that the engine oil pressure has fallen below the low oil pressure pre-alarm setting level after the Safety On timer has expired.</td>
</tr>
<tr>
<td>ENGINE HIGH TEMPERATURE</td>
<td>The module detects that the engine coolant temperature has exceeded the high engine temperature pre-alarm setting level after the Safety On timer has expired.</td>
</tr>
<tr>
<td>ENGINE LOW TEMPERATURE</td>
<td>The module detects that the engine coolant temperature has fallen below the high engine temperature pre-alarm setting level.</td>
</tr>
<tr>
<td>OVERSPEED</td>
<td>The engine speed has risen above the overspeed pre alarm setting.</td>
</tr>
<tr>
<td>UNDERSPEED</td>
<td>The engine speed has fallen below the underspeed pre alarm setting.</td>
</tr>
<tr>
<td>GENERATOR OVER FREQUENCY</td>
<td>The generator output frequency has risen above the pre-set pre-alarm setting.</td>
</tr>
<tr>
<td>GENERATOR UNDER FREQUENCY</td>
<td>The generator output frequency has fallen below the pre-set pre-alarm setting after the Safety On timer has expired.</td>
</tr>
<tr>
<td>GENERATOR OVER VOLTAGE</td>
<td>The generator output voltage has risen above the pre-set pre-alarm setting.</td>
</tr>
<tr>
<td>GENERATOR UNDER VOLTAGE</td>
<td>The generator output voltage has fallen below the pre-set pre-alarm setting after the Safety On timer has expired.</td>
</tr>
<tr>
<td>ECU WARNING</td>
<td>The engine ECU has detected a warning alarm and has informed the DSE module of this situation. The exact error is also indicated on the module’s display.</td>
</tr>
<tr>
<td>Symptom</td>
<td>Possible Remedy</td>
</tr>
<tr>
<td>---------</td>
<td>-----------------</td>
</tr>
<tr>
<td>Unit is inoperative</td>
<td>Check the battery and wiring to the unit. Check the DC supply. Check the DC fuse.</td>
</tr>
<tr>
<td>Read/Write configuration does not operate</td>
<td>Check DC supply voltage is not above 35 Volts or below 9 Volts. Check the operating temperature is not above 70°C. Check the DC fuse.</td>
</tr>
<tr>
<td>Unit shuts down</td>
<td>If no Emergency Stop Switch is fitted, ensure that a DC positive signal is connected to the Emergency Stop input. Check emergency stop switch is functioning correctly. Check Wiring is not open circuit.</td>
</tr>
<tr>
<td>Unit locks out on Emergency Stop</td>
<td>Ensure that Magnetic pick-up screen only connects to earth at one end, if connected at both ends, this enables the screen to act as an aerial and will pick up random voltages. Check pickup is correct distance from the flywheel teeth.</td>
</tr>
<tr>
<td>Intermittent Magnetic Pick-up sensor fault</td>
<td>Check engine oil pressure. Check oil pressure switch/sensor and wiring. Check configured polarity (if applicable) is correct (i.e. Normally Open or Normally Closed) or that sensor is compatible with the 73x0 Module and is correctly configured.</td>
</tr>
<tr>
<td>Low oil Pressure fault operates after engine has fired</td>
<td>Check engine temperature. Check switch/sensor and wiring. Check configured polarity (if applicable) is correct (i.e. Normally Open or Normally Closed) or that sensor is compatible with the 7310 module.</td>
</tr>
<tr>
<td>High engine temperature fault operates after engine has fired.</td>
<td>Check relevant switch and wiring of fault indicated on LCD display. Check configuration of input.</td>
</tr>
<tr>
<td>Shutdown fault operates</td>
<td>Check relevant switch and wiring of fault indicated on LCD display. Check configuration of input.</td>
</tr>
<tr>
<td>Warning fault operates</td>
<td>Check wiring to engine heater plugs. Check battery supply. Check battery supply is present on the Pre-heat output of module. Check pre-heat configuration is correct.</td>
</tr>
<tr>
<td>Fail to Start is activated after preset number of attempts to start</td>
<td>Check wiring to starter solenoid. Check battery supply. Check battery supply is present on the Starter output of module. Ensure that the Emergency Stop input is at Positive. Ensure oil pressure switch or sensor is indicating the “low oil pressure” state to the 7310 controller.</td>
</tr>
<tr>
<td>Continuous starting of generator when in AUTO</td>
<td>Check that there is no signal present on the “Remote Start” input. Check configured polarity is correct.</td>
</tr>
<tr>
<td>Generator fails to start on receipt of Remote Start signal.</td>
<td>Check signal is on “Remote Start” input. Confirm correct configuration of input. Check that the oil pressure switch or sensor is indicating low oil pressure to the controller. Depending upon configuration, then set will not start if oil pressure is not low.</td>
</tr>
<tr>
<td>Pre-heat inoperative</td>
<td>Check wiring to engine heater plugs. Check battery supply. Check battery supply is present on the Pre-heat output of module. Check pre-heat configuration is correct.</td>
</tr>
<tr>
<td>Starter motor inoperative</td>
<td>Check Warm up timer has timed out. Ensure generator load inhibit signal is not present on the module inputs. Check connections to the switching device. Note that the set will not take load in manual mode unless there is an active remote start on load signal.</td>
</tr>
<tr>
<td>Engine runs but generator will not take load</td>
<td>Check engine is operating correctly. Check sensor and wiring paying particular attention to the wiring to terminal 47 (refer to appendix). Check that sensor is compatible with the 7310 module and that the module configuration is suited to the sensor.</td>
</tr>
<tr>
<td>Incorrect reading on Engine Gauges</td>
<td>Check that sensor is compatible with the 7310 module and that the module configuration is suited to the sensor.</td>
</tr>
<tr>
<td>Fail to stop alarm when engine is at rest</td>
<td>Check that sensor is compatible with the 7310 module and that the module configuration is suited to the sensor.</td>
</tr>
</tbody>
</table>
## 5.10 Fault Finding

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Possible Remedy</th>
</tr>
</thead>
</table>
| Module appears to ‘revert’ to an earlier configuration                 | When editing a configuration using the PC software it is vital that the configuration is first ‘read’ from the controller before editing it. This edited configuration must then be “written” back to the controller for the changes to take effect.  
When editing a configuration using the fascia editor, be sure to press the Accept button to save the change before moving to another item or exiting the fascia editor |
| Set will not take load                                                 | Ensure the generator available LED is lit.                                                                                                                                                                    |
|                                                                        | Check that the output configuration is correct to drive the load switch device and that all connections are correct.                                                                                           |
|                                                                        | Remember that the set will not take load in manual mode unless a remote start on load input is present or the close generator button is pressed.                                                              |
| Inaccurate generator measurements on controller display                | Check that the CT primary, CT secondary and VT ratio settings are correct for the application.                                                                                                                    |
|                                                                        | Check that the CTs are wired correctly with regards to the direction of current flow (p1,p2 and s1,s2) and additionally ensure that CTs are connected to the correct phase (errors will occur if CT1 is connected to phase 2). |
|                                                                        | Remember to consider the power factor. Ie (kW = kVA x power factor)                                                                                                                                            |
|                                                                        | The 7310 controller is true RMS measuring so gives more accurate display when compared with an ‘averaging’ meter such as an analogue panel meter or some lower specified digital multimeters. |
|                                                                        | Accuracy of the controller is better than 1% of full scale. I.e. Gen volts full scale is 333V ph-n so accuracy is ±3.33V (1% of 333V).                                                                               |

NOTE: The above fault finding is provided as a guide check-list only. As the module can be configured to provide a wide range of different features, always refer to the source of your module configuration if in doubt.
6. ROUTINE MAINTENANCE

6.1 Maintenance

**WARNING**
Hot engine and exhaust system can cause severe injury.

Do not touch hot engine parts.

Do not perform service or maintenance on generator until cool to the touch.

**WARNING**
Risk of severed digits or limbs.

Generator can be started from a remote switch.

Disconnect the negative (-) battery cable from generator battery before performing service or maintenance on generator set.

**WARNING**
Electrical shock can cause injury or death.

Ensure that all personnel operating, servicing, maintaining or working near this equipment are fully aware of the emergency procedures in case of accidents.

Maintenance must be performed on a regular basis to ensure the generator set performs properly and to extend the life of the generator set.

Generator set routine maintenance will depend on the installed location environment and application for which the generator set is used. Consider these factors when planning the maintenance schedule.

Stand-by generator sets installed in a clean and dry location will require at least a visual inspection once a month.

Stand-by generator sets installed in a dusty, damp or humid locations will require inspections and maintenance more frequently.

Refer to the engine manufacturer’s manual for the scheduled maintenance on the engine.

Refer to the alternator manufacturer’s manual for the scheduled maintenance on the alternator.

Standby generator set must be exercised at least once per month at a minimum of 70% load for one hour.
### 6.2 Lubrication and Maintenance Service Interval Chart - Standard Applications

<table>
<thead>
<tr>
<th>Item</th>
<th>Daily</th>
<th>500 Hour/12 Month</th>
<th>2000 Hour/24 Month</th>
<th>As Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check Engine Oil and Coolant Level</td>
<td>•</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check Fuel Filter/Water Bowl</td>
<td>•</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check Air Cleaner Dust Unloader Valve &amp; Restriction Indicator</td>
<td>•</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gauge³</td>
<td>•</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Visual Walk Around Inspection</td>
<td>•</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Service Fire Extinguisher</td>
<td>•</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check Engine Mounts</td>
<td>•</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Service Battery</td>
<td>•</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check Manual Belt Tensioner and Belt Wear</td>
<td>•</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Change Engine Oil And Replace Oil Filter b,c</td>
<td>•</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check Crankcase Vent System</td>
<td>•</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check Air Intake Hoses, Connections, &amp; System</td>
<td>•</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Replace Fuel Filter Elements</td>
<td>•</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check Automatic Belt Tensioner and Belt Wear</td>
<td>•</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check Engine Electrical Ground Connection</td>
<td>•</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check Cooling System</td>
<td>•</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coolant Solution Analysis-Add SCAs as required</td>
<td>•</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pressure Test Cooling System</td>
<td>•</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check Engine Speeds</td>
<td>•</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flush and Refill Cooling Systemd</td>
<td></td>
<td>•</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test Thermostats</td>
<td>•</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check and Adjust Engine Valve Clearance</td>
<td>•</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Add Coolant</td>
<td>•</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Replace Air Cleaner Elements</td>
<td>•</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Replace Fan and Alternator Belts</td>
<td>•</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check Fuses</td>
<td>•</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check Air Compressor (If Equipped)</td>
<td>•</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bleed Fuel System</td>
<td>•</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- a Replace primary air cleaner element when restriction indicator shows a vacuum of 625 mm (25 in.) H2O.

- b During engine break-in, change the oil and filter for the first time before 100 hours of operation.

- c If the recommended engine oils, ACEA-E7 or ACEA E6 are not used, the oil and filter change interval is reduced. (see DIESEL ENGINE OIL AND FILTER INTERVALS chart). If diesel fuel with a sulfur content greater than 0.05% is used, the oil and filter change interval is also reduce.
### 6.3 Lubrication and Maintenance Service Interval Chart - Standby Applications

<table>
<thead>
<tr>
<th>Item</th>
<th>Daily</th>
<th>500 Hour/12 Month</th>
<th>2000 Hour/24 Month</th>
<th>As Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operate Engine at Rated Speed and 50%–70% Load a Minimum of 30 Minutes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check Engine Oil and Coolant Level</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check Fuel Filter/Water Bowl</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check Air Cleaner Dust Unloader Valve &amp; Restriction Indicator Gauge</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Visual Walk Around Inspection</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Service Fire Extinguisher</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check Engine Mounts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Service Battery</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check Manual Belt Tensioner and Belt Wear</td>
<td></td>
<td></td>
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<tr>
<td>Change Engine Oil And Replace Oil Filter b, c</td>
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<td>Replace Fuel Filter Elements</td>
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<td></td>
<td></td>
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<tr>
<td>Check Automatic Belt Tensioner and Belt Wear</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Check Engine Electrical Ground Connection</td>
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<tr>
<td>Check Cooling System</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coolant Solution Analysis-Add SCAs as required</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pressure Test Cooling System</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check Engine Speeds</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjust Variable Speed (Droop)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flush and Refill Cooling System</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test Thermostats</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check and Adjust Engine Valve Clearance</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Add Coolant</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Replace Air Cleaner Elements</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Replace Fan and Alternator Belts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check Fuses</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check Air Compressor (If Equipped)</td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

*a Replace primary air cleaner element when restriction indicator shows a vacuum of 625 mm (25 in.) H2O.

*b During engine break-in, change the oil and filter for the first time before 100 hours of operation.

*c If the recommended engine oils, ACEA-E7 or ACEA E6, are not used, the oil and filter change interval is reduced (see DIESEL ENGINE OIL AND FILTER INTERVALS chart). If diesel fuel with a sulfur content greater than 0.05% is used, the oil and filter change interval is also reduced.
9. Battery

9.1 Batteries

Servicing of batteries are to be performed or supervised by personnel knowledgeable of batteries and the required precautions. Keep unauthorized personnel away from batteries.

When replacing batteries, use the same number and battery type. See Battery Specifications table on the following page for details.

Provide enough ventilation to ensure that gases generated by vented batteries during charging, or caused by equipment malfunction are removed.

9.1.1 Battery Safety

CAUTION
Do not dispose of battery or batteries in a fire. The battery is capable of exploding.

CAUTION
Do not open or mutilate the battery or batteries. Released electrolyte has been known to be harmful to the skin and eyes and to be toxic.

CAUTION
Do not dispose of battery or batteries in a fire. The battery is capable of exploding.

CAUTION
A battery presents a risk of electrical shock and high short circuit current.

The following precautions are to be observed when working on batteries:
1. Remove watches, rings, or other metal objects,
2. Use tools with insulated handles,
3. Wear rubber gloves and boots,
4. Do not lay tools or metal parts on top of batteries,
5. Disconnect charging source prior to connecting or disconnecting battery terminals, and
6. Determine the battery is inadvertently grounded. When inadvertently grounded, remove source of ground. Contact with any part of a grounded battery is capable of resulting in electrical shock. The risk of such shock is reduced when such grounds are removed during installation and maintenance (applicable to a generator not having a grounded supply circuit).

9.1.2 Vented Battery Safety

The installation of the engine generator shall provide enough ventilation to ensure that gases generated by vented batteries during charging or caused by equipment malfunction are removed.

CAUTION
The electrolyte is a dilute sulfuric acid that is harmful to the skin and eyes. It is electrically conductive and corrosive. The following procedures are to be observed:
1. Wear full eye protection and protective clothing,
2. Where electrolyte contacts the skin, wash it off immediately with water,
3. Where electrolyte contacts the eyes, flush thoroughly and immediately with water and seek medical attention, and
4. Spilled electrolyte is to be washed down with an acid neutralizing agent. A common practice is to use a solution of one pound (500 grams) bicarbonate of soda to one gallon (4 liters) of water. The bicarbonate of soda solution is to be added until the evidence of reaction (foaming) has ceased. The resulting liquid is to be flushed with water and the area dried.

CAUTION
Lead-acid batteries present a risk of fire because they generate hydrogen gas. The following procedures are to be followed:
1. DO NOT SMOKE when near batteries,
2. DO NOT cause flame or spark in battery area, and
3. Discharge static electricity from body before touching batteries by first touching a grounded metal surface.
9.1.3 Remove Battery(s)

1. Turn generator controls to OFF position. Always unplug, turn off, or disconnect any battery chargers before attempting to remove battery cables.
2. Remove negative (-) cable.
3. Remove positive (+) cable.
4. Remove battery.

9.1.4 Install Battery(s)

1. Install battery.
2. Connect positive (+) cable.
3. Connect negative (-) cable.
4. Connect, turn on, or plug in battery charger to restore power to it.

### 9.2 Battery Specifications

<table>
<thead>
<tr>
<th>Engine</th>
<th>Number of Batteries</th>
<th>Battery Voltage</th>
<th>Connected In:</th>
<th>Minimum CCA</th>
<th>Battery Cable Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>HFW60T6</td>
<td>1</td>
<td>12</td>
<td>B+/B-</td>
<td>730</td>
<td>70mms- 2/0 AWG</td>
</tr>
<tr>
<td>HFW80T6</td>
<td>1</td>
<td>12</td>
<td>B+/B-</td>
<td>730</td>
<td>70mms- 2/0 AWG</td>
</tr>
<tr>
<td>HFW90T6</td>
<td>1</td>
<td>12</td>
<td>B+/B-</td>
<td>730</td>
<td>70mms- 2/0 AWG</td>
</tr>
<tr>
<td>HFW100T6</td>
<td>1</td>
<td>12</td>
<td>B+/B-</td>
<td>730</td>
<td>70mms- 2/0 AWG</td>
</tr>
<tr>
<td>HFW130T6</td>
<td>1</td>
<td>12</td>
<td>B+/B-</td>
<td>730</td>
<td>70mms- 2/0 AWG</td>
</tr>
<tr>
<td>HFW160T6</td>
<td>1</td>
<td>12</td>
<td>B+/B-</td>
<td>975</td>
<td>95mms- 3/0 AWG</td>
</tr>
<tr>
<td>HFW180T6</td>
<td>1</td>
<td>12</td>
<td>B+/B-</td>
<td>975</td>
<td>95mms- 3/0 AWG</td>
</tr>
<tr>
<td>HFW200T6</td>
<td>2</td>
<td>24</td>
<td>B+/B-</td>
<td>815</td>
<td>70mms- 2/0 AWG</td>
</tr>
<tr>
<td>HFW230T6</td>
<td>2</td>
<td>24</td>
<td>B+/B-</td>
<td>815</td>
<td>70mms- 2/0 AWG</td>
</tr>
<tr>
<td>HFW250T6</td>
<td>2</td>
<td>24</td>
<td>B+/B-</td>
<td>815</td>
<td>70mms- 2/0 AWG</td>
</tr>
<tr>
<td>HFW300T6</td>
<td>2</td>
<td>24</td>
<td>B+/B-</td>
<td>815</td>
<td>70mms- 2/0 AWG</td>
</tr>
<tr>
<td>HFW350T6</td>
<td>2</td>
<td>24</td>
<td>B+/B-</td>
<td>815</td>
<td>70mms- 2/0 AWG</td>
</tr>
</tbody>
</table>