



DIESEL BACKUP DC GENERATOR in Vertical Enclosure with 54gal tank

Installation guide



English

CONTENTS

1.

Preface

Safety precautions for trained personnel and nomenclature per ISO/EN 7010	3
Codes and standards	7
DC generator set model numbers	9
Specifications	9

2.

Installation

Pre-installation	12
Transportation and placement	13
Proper cable connections	16
Wire schematics	17
Electrical connections	19
Alarm board configuration and connections	24
Polar Power software	26

3.

Information

Diesel unit information	29
Mechanical drawings and clearances	33
Ventilation and exhaust	36

PREFACE

Please use this document for safe installation of the DC generator set manufactured by Polar Power Inc.

Specifications of the components used to build this generator set may be different for each unit depending on customer requirements at the time of installation and the revision history of each generator set. Please refer to the service manuals from the original equipment manufacturers (OEM) for each component used inside this generator set. The customer is responsible for maintaining the generator set according to the periodic inspection and adjustment schedule as well as maintaining functional levels of fluid consumables such as the coolant, lube oil, and fuel.

The specifications and components used in this generator set may be subject to change without notice. If the contents in this manual are modified by Polar Power, customers who have registered their products will be notified with an update.

California
Proposition 65 Warning

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

SAFETY PRECAUTIONS FOR TRAINED PERSONNEL AND NOMENCLATURE PER ISO/EN 7010

SERVICE AREA



WARNING

- Sufficient Ventilation
Inhalation of exhaust fumes and dust particles may be hazardous to your health.
- Safety Equipment
Fire extinguisher(s), first aid kits and an eye wash / shower station should be close at hand (or easily accessible) in case of an emergency.

(2) WORK – WEAR (GARMENTS)



WARNING

- Safe Work Clothing

Appropriate safety wear (gloves, special shoes/boots, eye and ear protection, head gear, harnesses, clothing, etc.) should be used / worn to match the task at hand. Avoid wearing watches, jewelry, rings, unbuttoned cuffs, ties or loose fitting clothes around moving / rotating machinery. A serious accident may occur if clothing or jewelry is caught in moving/rotating machinery or completes an electrical circuit. The battery and Supercapacitor used in the generator set can deliver a jolt of energy in excess of 3000 amps at 50 volts which will instantaneously vaporize metal jewelry.



(3) TOOLS



WARNING

- Appropriate Lifting / Holding

When lifting a generator set, use only a lifting device (crane, backhoe etc.) with sufficient lifting capacity. Do not overload the device. Use only a chain, cable, or lifting strap as an attaching device. Do not use rope, serious injury may result. To hold or support a generator set, secure it to a cart designed to carry its weight. Do not overload this device, serious injury may result. Never run the generator set without it being properly secured, serious injury may result.

- Appropriate Tools

Always use tools that are designed for the task at hand. Incorrect usage of tools may result in damage to the generator set and/or serious personal injury.

(4) GENUINE PARTS AND MATERIALS



CAUTION

- Genuine Parts

Always use genuine Polar Power Inc. recommended parts and goods. Damage to the generator set, shortened service life, and/or personal injury may result from failure to do so.

(5) FASTENER TORQUE



WARNING

- Torque Specifications on Fasteners

Always follow the torque values and procedures as designated in the service manual OR referenced to in this installation manual. Incorrect torque values, procedures, and/or tools may cause damage to the generator set, and/or cause personal injury.

(6) ELECTRICAL



WARNING

- Short Circuits

Always disconnect the DC Generator from the battery bank and/or rectifiers before working on the electrical system or the generator itself. For -48 V systems disconnect the negative and for negative ground systems disconnect the +. Always re-confirm polarity of leads before reconnecting to terminals. An accidental "short circuit" or "reverse polarity" may cause damage, fire, and/or personal injury. Remember to connect the Positive (+) battery cable (back onto the battery) last. Fasten the terminals to the proper torque specification.



- Charging Batteries

Our systems incorporate different battery technologies, please confirm the type of battery chemistry before proceeding to work on any battery. Charging wet celled batteries produces hydrogen gas. Hydrogen gas is extremely explosive. Keep sparks, open flame and any other form of ignition away. Explosion may occur causing severe personal injury. Keep Lithium Batteries dry and stored away from all sources of water vapor, moisture, or condensation.

- Battery Electrolyte

Batteries contain different types of electrolytes please review the MSDS sheets before handling any type of electrolyte that may have leaked from the battery cell. Do NOT allow it to come in contact with clothing, skin, and/or eyes, severe burns will result.

(7) WASTE MANAGEMENT



WARNING

- Observe the following instructions with regard to hazardous waste disposal. Negligence of these regulations will have a serious impact on the environment.
1. Waste fluids such as lube oil, fuel, and coolant shall be carefully put into separate sealed containers and disposed of properly.
 2. Do NOT dispose of waste materials irresponsibly by dumping them into the sewer, overland, or into natural waterways.
 3. Waste materials such as oil, fuel, coolant, solvents, filter elements and batteries, must be disposed of properly according to local ordinances. Consult the local authorities or reclamation facility.



(8) FURTHER PRECAUTIONS



WARNING

- Fueling / Refueling
Keep sparks, open flames or any other forms of ignition (match, cigarette, etc.) away when fueling/refueling the unit.

FIRE AND/OR AN EXPLOSION MAY RESULT!!!



- Hot Surfaces
Do NOT touch the top of the generator set (or any of its components) while it is running or shortly after shutting it down. Scalding / serious burns may result. Allow the generator set to cool down before attempting to approach it.

- Rotating Parts
Be careful around moving/rotating parts. Loose clothing, jewelry, ties, or tools may become entangled causing damage to the engine and/or cause severe personal injury.

- Preventing burns from scalding
1. Never open the radiator filler cap shortly after shutting the engine down. Steam and hot water will spurt out and seriously burn you. Allow the engine to cool down before attempting to open the filler cap.
 2. Some radiator caps have a pressure release, after the engine is cool down carefully lift the release tab, keeping in mind that hot steam or water can spray from the lift tab.
 3. Securely tighten the filler cap after checking the radiator fluid level.

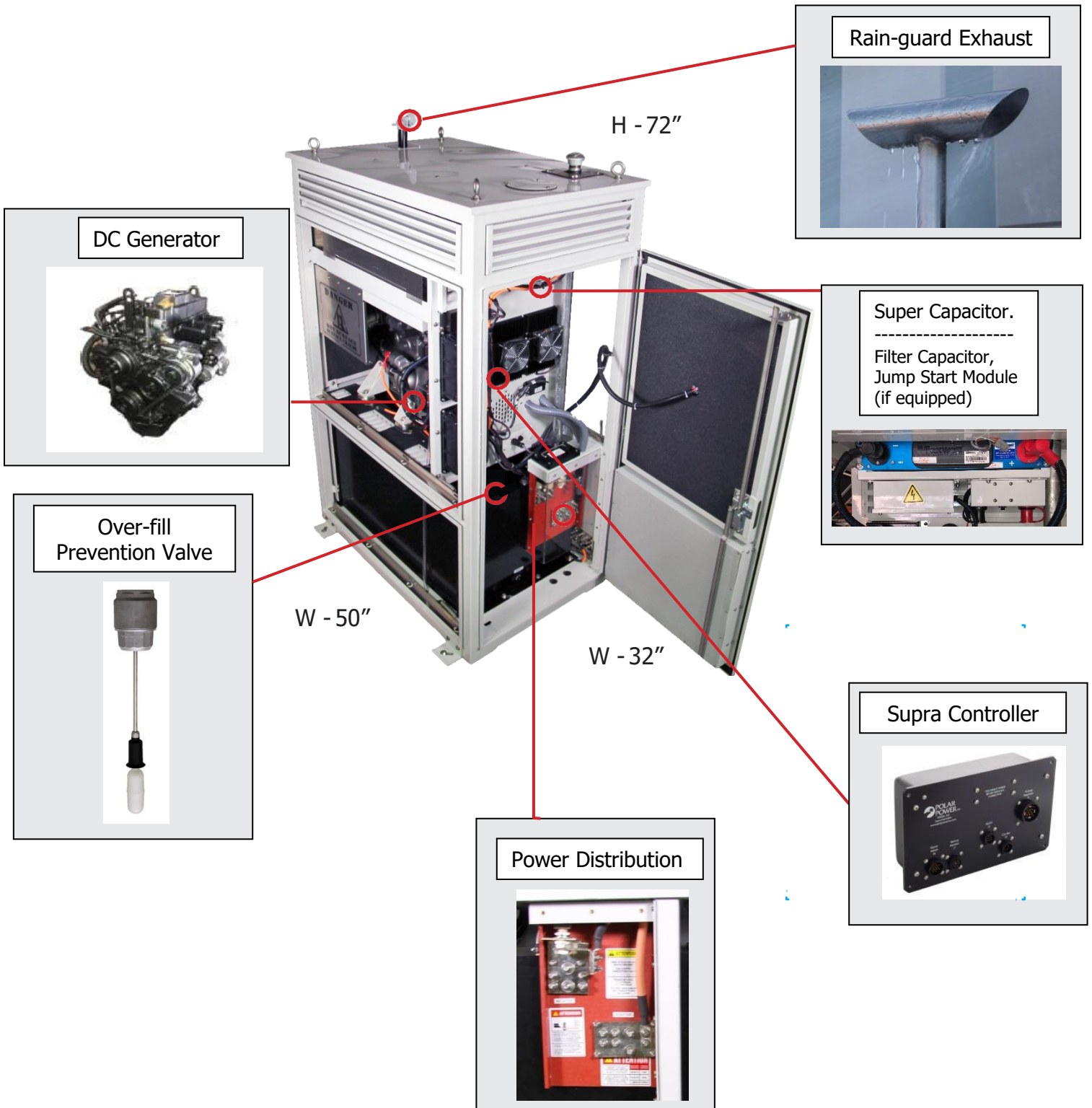


CODES AND STANDARDS

The following list of Codes and Standards applies to the installation and operation of the generator sets. This list is for reference only, and not intended to be inclusive of all applicable codes and standards. Codes and recommendations are subject to change and may vary by location over time.

Code	Description
NFPA70 (NEC)	National Electric Code
NFPA110	Generators used by AT&T Mobility are classified as an optional standby source of power as defined in Article 702 of the NEC.
EPA Emissions	EPA Emissions Compliance. Supplier's unit spec sheet shall indicate current EPA tier rating of unit.
NFPA – 37	Standard for Stationary Combustion Engines
NFPA – 54	National Fuel Gas Code (Natural Gas)
NFPA – 58	LP Gas Code
U.L. 142	Diesel fuel tanks.
U.L. 2200	Stationary Engine Generator Assemblies
Current NEC	Compliance to the current National Electrical Code (NEC) (NFPA 70).

GENERATOR MAIN COMPONENTS



DC GENERATOR SET MODEL NUMBERS

Enclosure	Output	Diesel
88-25-0603	270A 360A	V015DYA270TEA V020DYA360TEC

88-25-0603 - Vertical enclosure (Outside installation ONLY)

The Vertical Unit is optimized for backup power. It is not recommended for placement within shelters because the hot air is exhausted on all four sides.

Weights and dimensions

Generator model	Dry weight (lbs.)	Size (in.)
V015DYA270TEA 8220-603-D-15-03	1,315	32 x 50 x 72
V020DTA360TEA 8220-603-D-20-03	1,315	32 x 50 x 72

SPECIFICATIONS

DC Alternator

Type	Permanent magnets, NdFeB
Weight (lb/kg)	46.5/21
Regulation type	Variable speed engine
Stator	3 phase / 32 poles
Overcurrent protection (A)	15KW - 350 20KW - 450
Disconnect means	Pull fuse block, sized for each generator KW
Voltage range (VDC)	44 to 62
Alternator exhaust flow (cfm/cmm)	130 to 180 / 3.7 to 5.1
MTBF (hr)	100,000+

Enclosure

Model	88-25-0603
Type	Weather protective
Materials	Marine grade aluminum
Door hardware	Three point with padlock hasp, and removable side panels
Mounting	Secure mounting tabs

Environmental

Operating temperature (°C/°F)	-40 to 72 / -40 to 162
Operating humidity %	100
Cold start aids	Glow plugs

Engine specification 270A and 360A Diesel

Engine model	Yanmar 3TNV88
Cylinders	3 in-line
Displacement (L)	1.642
Bore (in/mm)	3.4/88
Stroke (in/mm)	3.5/90
Intake air system	Naturally aspirated
Engine HP	36.8 at 3000RPM
Emission compliance	EPA and CARB certified
Variable RPM	1,500 to 1,850
Diesel fuel tank	
UL rated capacity (gal/L)	54/204
Tank alarms	Yes
Visual gages	Yes
Catch basin (gal/L)	5/19
Listings	UL 142 (double wall)

Power adjustment for ambient conditions

Temperature deration	1% derate for every 5.6 0C (10 0F) above 25 0C (77 0F)
-----------------------------	--

Altitude deration	3% derate for every 300 m (1000 ft) above 91 m (300 ft)
--------------------------	---

Engine lubrication system

Oil filter type	Full flow spin-on canister
------------------------	----------------------------

Oil capacity	3TNV88 - 6.7L
---------------------	---------------

Oil pressure switch	Yes
----------------------------	-----

Oil pressure transducer	Optional
--------------------------------	----------

PRE-INSTALLATION

Installing a generator set is an undertaking that requires detailed planning. Before moving the generator set to the installation site, it is recommended that the customer and their contractor(s) read this installation manual and verify the following:

- The accessibility from the service road to the installation site.
- A solid flat level floor/grate capable of supporting the operation of a 600 to 2000 lb generator set .
- Availability of a forklift of sufficient capacity and dexterity for operation over unimproved ground at the site or a mobile crane for transfer of the generator set off the transport vehicle to the slab or shelter.
- Customer supplied switchgear (circuit breakers and disconnects) as required by code.
- Customer supplied plumbing for Propane or Natural Gas with connections provided by local Gas Company.
- Sufficient space around the generator set for ingress and egress of installation and maintenance crews.
- Installation of a starting battery or Supercapacitor.
- Polar Power ships generator sets with or without lube oil and coolant in the engine.
- We do not ship with fuel in the tank.
- Verify that the model of generator arriving at the site includes or does not include a fuel tank.
- Fuel and lube oil system requirements: fittings and filter type as well as oil/coolant requirements, etc.

Before moving the generator to its permanent site it is recommended that the installer verify the presence of:

- Starting battery or Supercapacitor, charger for Supercap or battery.
- Oil in the engine – before starting the engine, use the dipstick (twice) to check that there is lube oil in the engine.
- Coolant in the radiator – before starting the engine, verify that there is coolant in the coolant reservoir.
- Fuel system requirements: secure all fittings, pressure regulators, fuel flow rates, filter requirements, etc.

SAE viscosity grade motor oil	Temperature conditions
0W-30	Below -25 °C (-13 °F)
5W-30	Below -18 °C (0 °F)
10W-40	Above -18 °C (0 °F)
20W-50	Above -7 °C (20 °F)
SAE 30	Above 5 °C (40 °F)
SAE 40	Above 16 °C (60 °F)

Always choose full synthetic oil for cold climates, very hot climates, or for high number of run hours.

GENERATOR SET INSTALLATION

The customer and their designated contractor(s) should read this installation manual as well as manuals for the Supra Controller, engine, and optional telecommunications equipment to familiarize themselves with the safe installation, operation, and maintenance of each subassembly **BEFORE** installing the generator set.

Prior to transporting the generator set to the customer's distribution center, every Polar Power generator set is fully tested and run under load. After the generator set is installed, it is commissioned at the customer site prior to acceptance. The goal of the commissioning process is to test and validate the successful integration of the customer's system configuration with Polar Power's software, modems, controls and other optional peripherals specified by the customer. In most configurations the generator requires a load battery to be connected to the output; the load bank battery provides the power to operate Supra Model 250 controller.

A 12 V or 24 V starting battery provides power for the Model 290 engine interface's operation and the starter motor.

Transportation and placement



DANGER

- This generator set is TOP HEAVY with a center of gravity (CG) at about 48 inches above ground level. This could be a LETHAL crush hazard if pushed on or off the skid/pallet. DO NOT drag, push or tip the generator set!
- NEVER tip the generator set beyond 15° from vertical (Fig. 1) on any vertical axis even when supported from an overhead crane. Doing so may result in oil spilling from the dipstick tube on the side of the crankcase or the engine detaching and falling off of the isolation mounts which are designed for vertical compressive loading only.

IF THE UNIT STARTS TO FALL GET OUT OF THE WAY! IT WILL CRUSH YOU!



Figure 1

A generator set can be transported over any level solid surface such as concrete or asphalt with a pallet jack. To facilitate transportation over unimproved surfaces such as crushed rock, loose dirt or soft landscaped surfaces, Polar Power suggests using a continuous plywood underlayment.

Lifting and moving the generator set



WARNING

- The vertical model generators are typically top heavy (high Center of Gravity). Dropping the generator set can cause severe personal injury or death. Keep feet and hands clear when lifting the generator set.
- Keep the generator set upright.

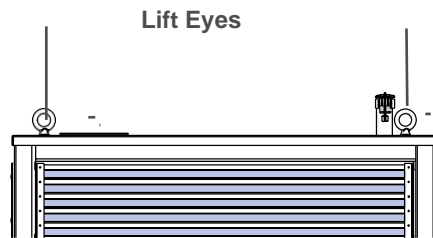


Figure 2

The generator set is heavy and must be handled with care. Use the lift eyes in order to pick up the generator set. Use a spreader bar to lift evenly and avoid damaging or breaking the lift eye, causing the generator set to fall.

When strapping down the generator set to be transported, use the lifting eyes. **Do not throw straps over the top of the generator as this will cause the top to deform.**

Vibrational isolators



ATTENTION

The model 8220-603-D-15, diesel 15 kW -48 VDC, requires vibrational isolators if the generator is mounted on a metal grate deck or structure. This would be installed in a similar fashion as an AC generator.

Polar does offer brackets and vibration mount kits. Any questions, please contact Polar Power Inc.

Generator set footprint (top view)

INSTALLATION FOOTPRINT, BOTTOM VIEW

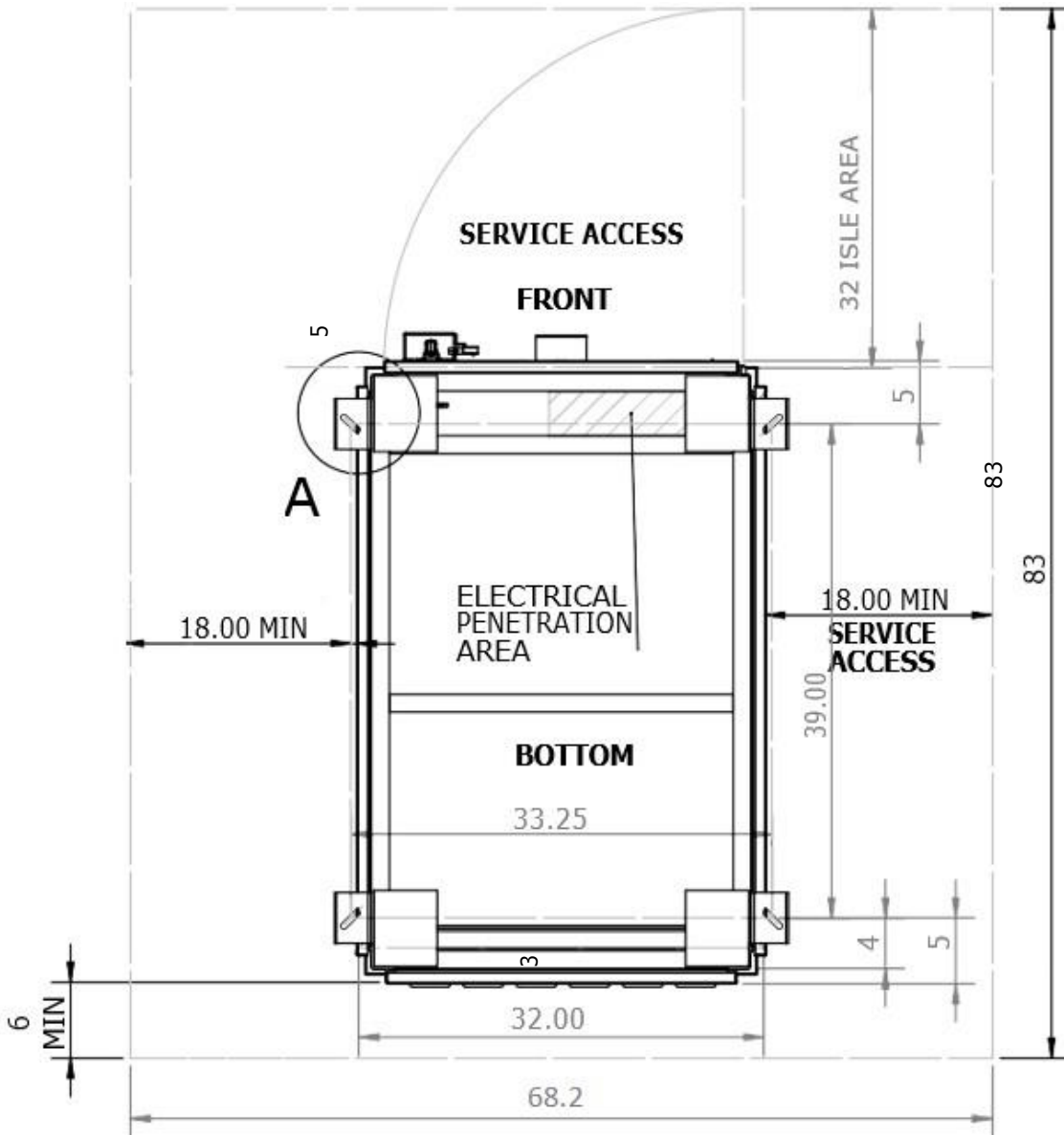


Figure 3

Initial service pre-startup

Before running the generator set, check the generator's oil and coolant (antifreeze).

Running a generator set with insufficient engine oil and/or coolant levels **WILL** result in overheating and damage.

Check for loose electrical connections

As soon as the generator set is in place and secured, check all internal crimped and bolted connections that may have loosened due to the vibrations encountered during shipping. Loose connections which carry heavy currents will generate excessive heat if they are not secure prior to startup. Check that all lug nuts, bolts, and electrical connections are tightened and torqued to the correct values as specified in their respective shop/service manuals.

Loose electrical connections can be the cause of faulty signals, system failure, and/or **fire**.

During the site commissioning, we recommend the generator set is run for at least one hour after which the engine is rechecked for leaks of engine oil and coolant.

On the standard oil sump, Polar Power recommends that the first oil change be performed after 50 - 80 hours of operation. Due to the high carbon content (soot) of compression ignition (CI) engines, diesel models will require more frequent oil changes and have shorter intervals between scheduled service after the initial break-in period compared to cleaner burning LPG and natural gas engines.

In most configurations, the generator set requires a connection to the customer battery bank array to provide the power to charge the Supercapacitor and operate the Supra Model 250 controller.

A 12 V or 24 V starting battery provides power for the Model 290 engine interface's operation and the starter motor. Depending on how the generator is ordered and shipped, it may arrive with or without a sealed battery.

Proper cable connections

CORRECT INSTALLATION OF CABLES

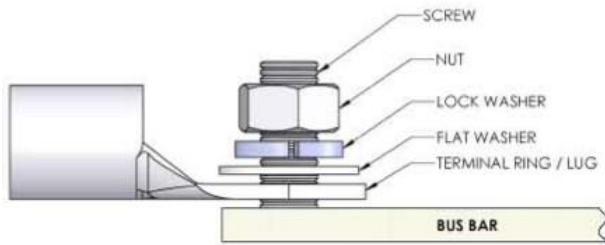


Figure 4

INCORRECT INSTALLATION
USE NO WASHER UNDER LUG

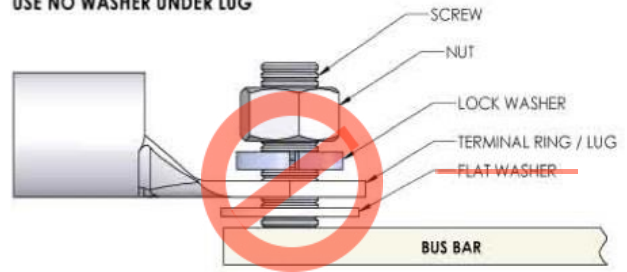


Figure 5

A proper cable connection means that the copper lug must be in direct contact with the copper bus bar, regardless of any plating present. **Do not place any nuts or washers between the lug and the bus bar.** Significant heat will be generated if the lug is not properly torqued down to the bus bar (periodically check the torque on all terminal connections).



WARNING

Improper cable connections will cause system failure or degradation, and is possibly a hazard.

WIRING SCHEMATICS 270A and 360A Gensets

General schematic for backup applications

The following two schematics show how the DC Generator can be connected/installed for a Backup Application. Next figure shows the three primary DC connections (labeled as Conduits).

DC Generator installation requires only three conduits:

- Conduit 1,2: DC Power cables (connected to DC Load Center)
- Conduit 3: Grounding connections
- Conduit 4: Alarms connections

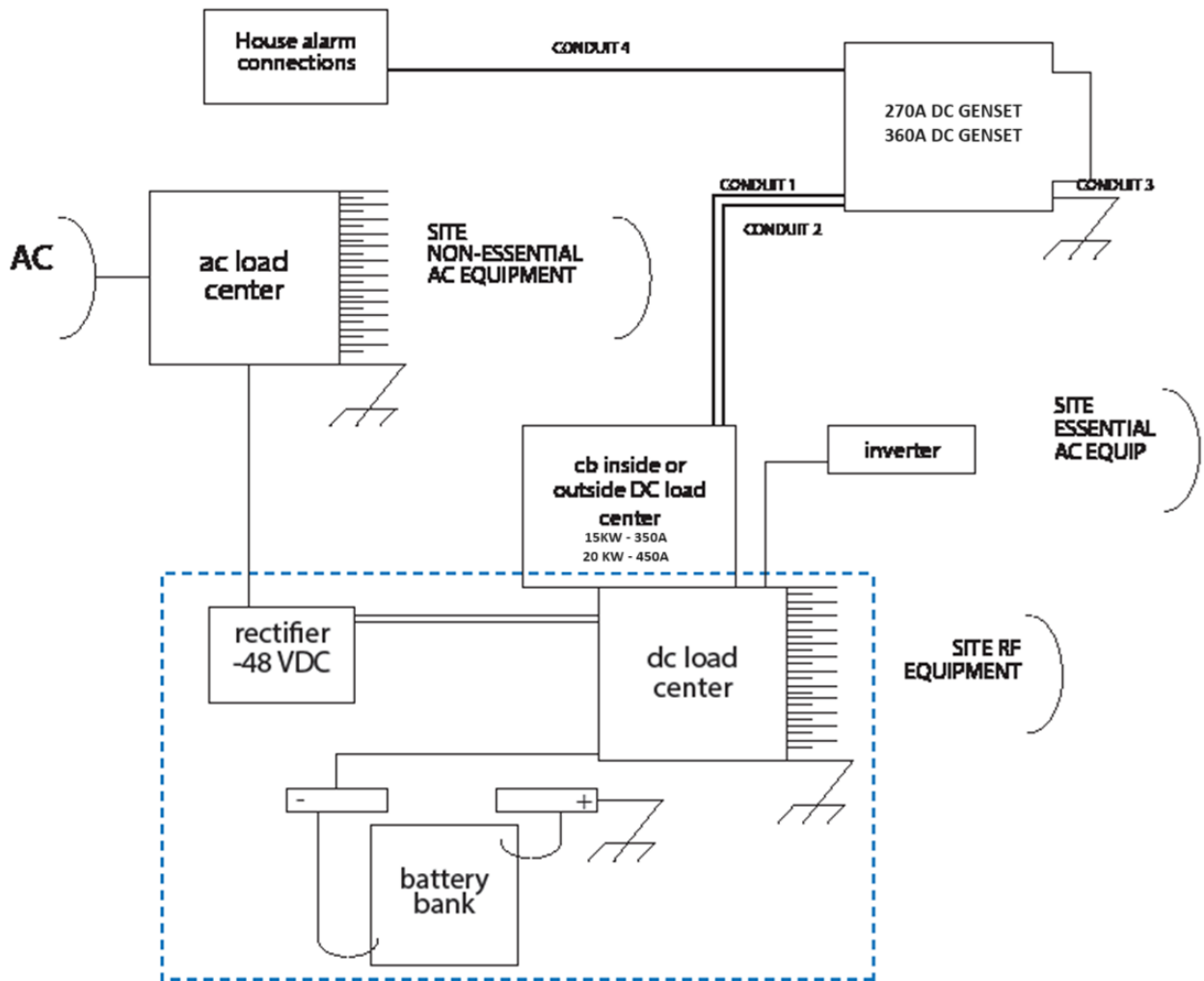
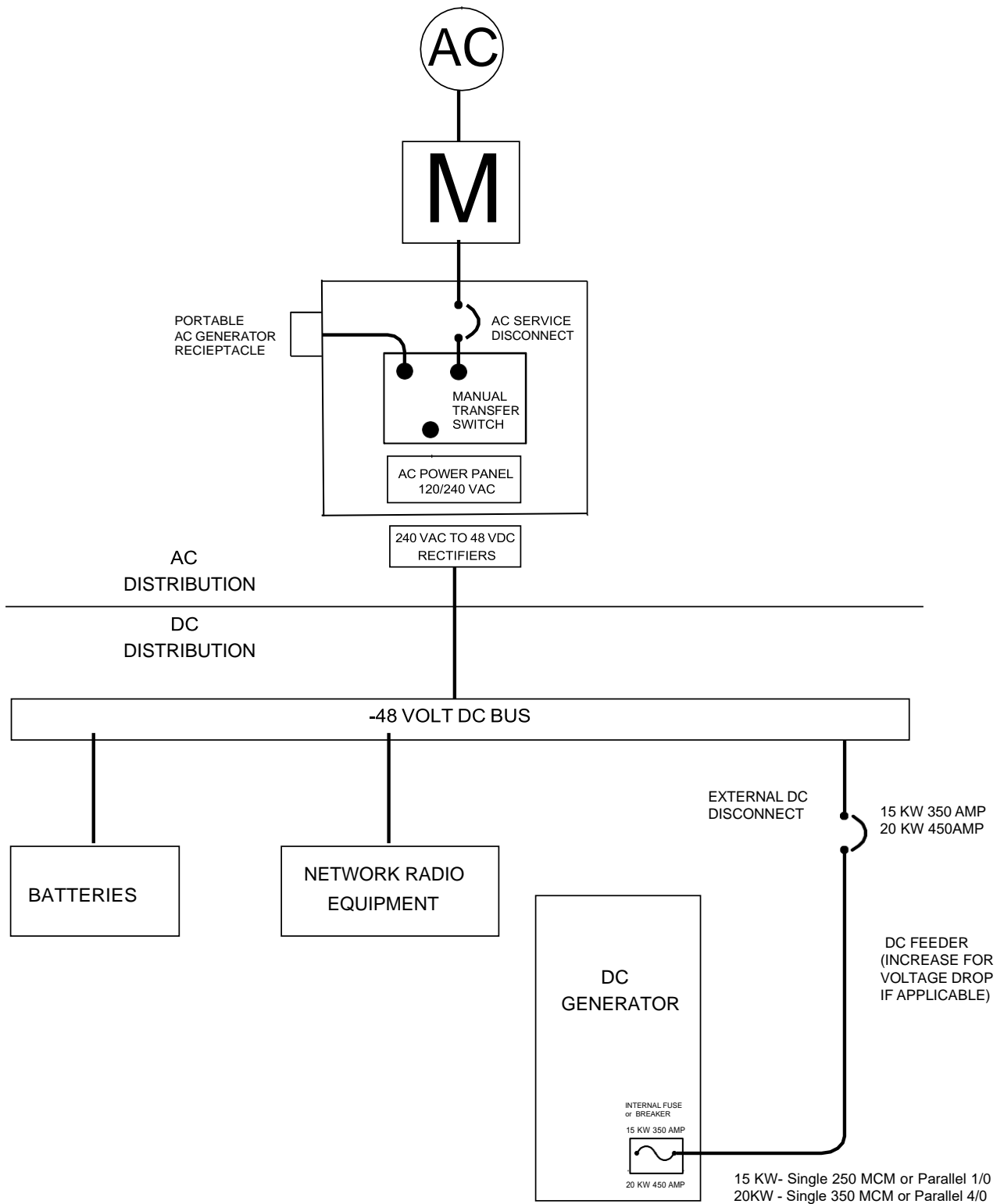


Figure 6

Detailed schematic for backup applications



15 KW DC GENERATOR: NOMINAL 270 AMPS @ -51.5 VOLTS
 20 KW DC GENERATOR NOMINAL 360 AMPS@ -51.5 VOLTS

ELECTRICAL CONNECTIONS

Main power connections

Connect the appropriate output terminals of the generator to the appropriate load battery terminals (negative to negative, positive to positive). Figure below shows the locations of the positive and negative terminals on the fuse box.

The positive and negative terminal block includes connections for:

- One two-holed lug for a maximum wire size of 500 MCM with 1 ¾" distance between the holes.
- Two two-holed lugs for a maximum wire size of 1/0 with 1" distance between the holes.

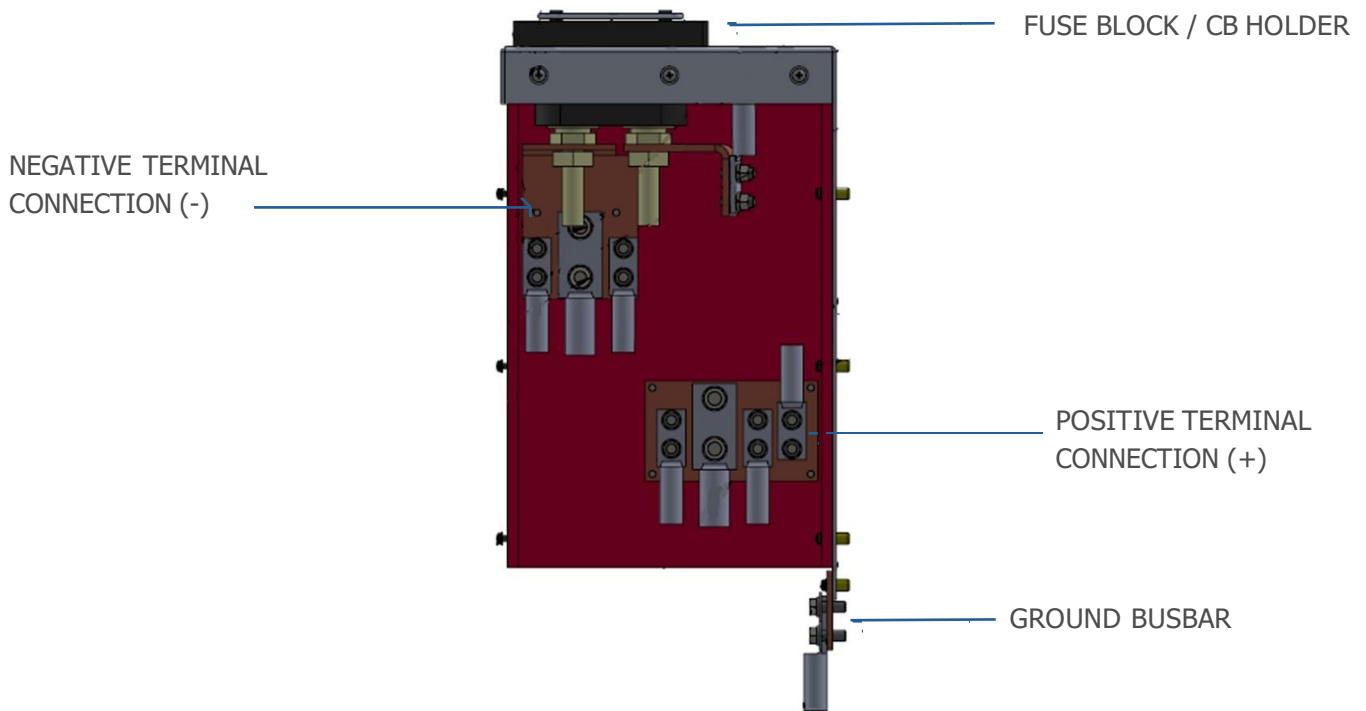


Figure 8

BEFORE connecting any power cables **REMOVE** the fuse block/fuse holder in order to avoid any damage to the unit (See Figure 9).

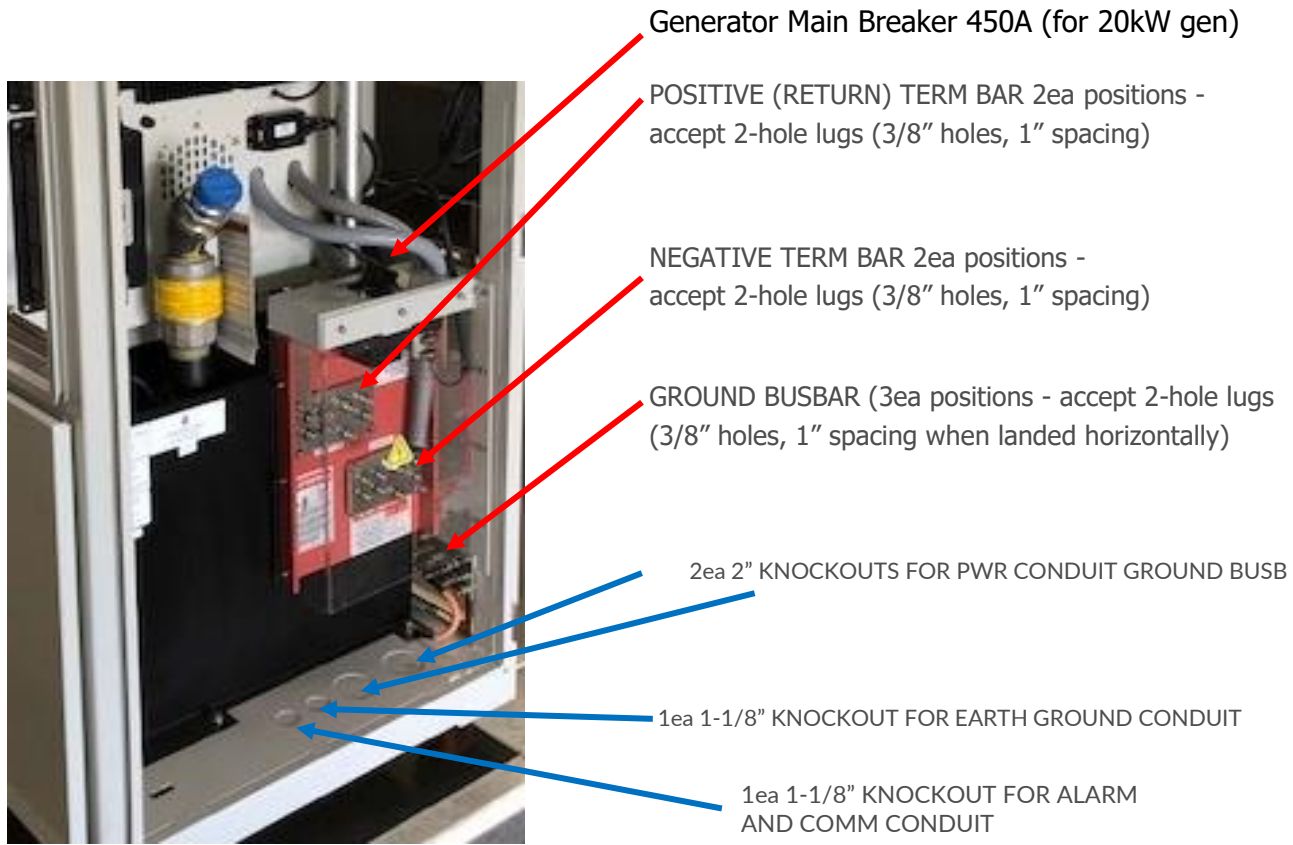


Figure 12

Use a multi-meter to check polarity between the positive and negative terminal blocks. Once polarity has been verified, proceed to make power connections.

Make sure to torque terminal connections to the battery manufacturers' specifications.

The copper lug must be in direct contact with the copper BUS BAR.

DO NOT PLACE ANYTHING between the TERMINAL RING/LUG and the BUS BAR. Neither washers nor grease are good conductors of electricity and should **NOT** be placed between the TERMINAL RING/LUG and the LOCK WASHER. Resistance between the BUS BAR and TERMINAL LUG will create a substantial amount of heat when high current passes through the stacked elements.

Using corrosion inhibiting grease (NO-OX-ID) to protect your connections is a good idea. Do not use the grease between the lug and the bus bar. After the lug is properly torqued down to the bus bar, apply the grease on top of the connection.



WARNING

System failure or fire may result if the nut on the lug is not torqued down properly. A loose connection will result in high resistance which will generate a significant amount of heat at all high current connections.

DC cable type and sizing (2 V drop)

Ampacity per the NEC at 52 VDC (minimum normal operating voltage):

Generator size	Current output regulation (Max FLA)	kW at stop Voltage point (51.5 VDC)	100% continuous FLA per NEC 215.2 Exception #1	Generator output fuse	DC plant input breaker	MINIMUM feeder conductors Evaluate to determine if an increase for voltage drop is required when in excess of 100 feet (RHW/RHH 90°C) GR-347 CORE (NEC 310) AMPACITY 1/0 = 170 A 2/0 = 195 A 3/0 = 225 A 4/0 = 230 A 250 MCM = 290 A 350 MCM = 350 A 500 MCM = 430 A Paralleled 1/0 is the smallest size that can be paralleled per NEC	Frame ground Evaluate per NSTD33 to determine if an increase is warranted if in excess of 150 feet
15 kW	270A	14.4 kW	270A	350A	350A Or 400A	Single 250 MCM Or Paralleled 1/0	#2 RHH/RHW (green)
20 kW	360A	18.5 kW	360A	450A	400A	Single 500 MCM or Paralleled 4/0	

Figure 10

1. Listed feeder conductors are MINIMUMS. Larger conductors are permitted if the associated lugs / terminals will accept them. Verify sizes on runs in excess of 100 feet to address voltage drop.

Bonding and grounding

Poor electrical grounds are major reason for generator and electronic equipment failure. Too often the earth grounds for the generator are overlooked or the installation has too much resistance between the generator set and the earth ground.

If the standby DC generator set is fewer than six feet from the cell or hub equipment, see Figure 11 for guidance on bonding and grounding. If greater than 6 feet from the cell or hub equipment, see Figure 12. All bonding and grounding shall use #2 bare, tinned solid copper wires. Terminations shall employ approved connectors and lugs and/or welds. In both cases, if other metallic structures such as tower legs, bollards, fuel tanks, and the like are closer than 6 feet, bonding wires shall be run between them.

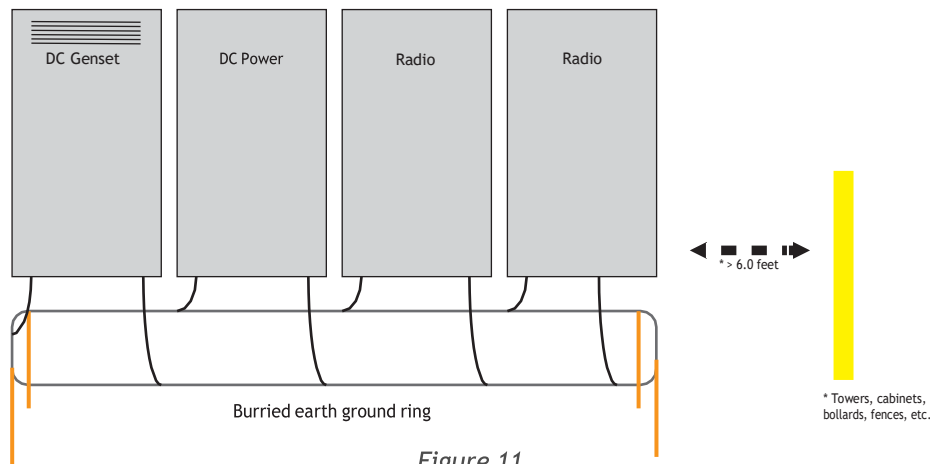


Figure 11

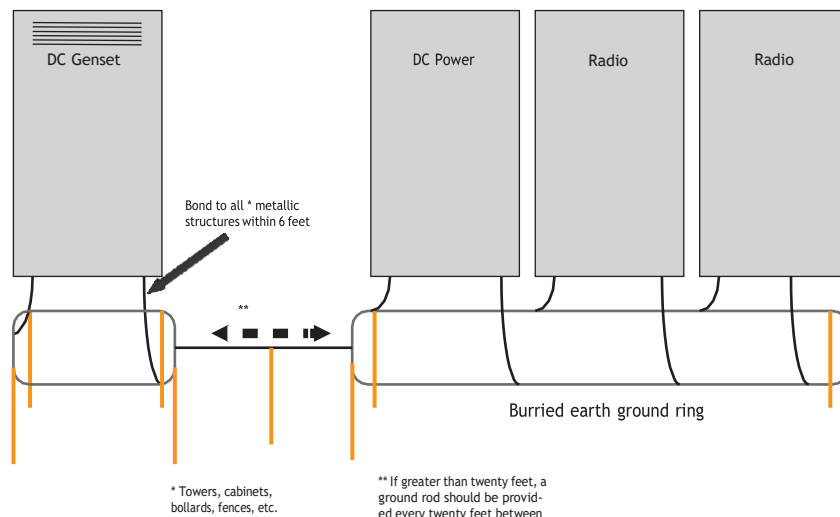


Figure 12

Circuit breakers / fuses

Fuses and circuit breakers must be carefully sized to prevent damage to the generator and to all electrical components connected to the circuit. A fuse / circuit breaker too large in current trip point provides limited protection and too small the trip point can actually cause more damage.

The current limiting device should be at a minimum 25% higher than the rating of, or the current limit set point in, the generator set. This will also affect the cable sizing between the generator set and the load / distribution busbar / power panel.

Precautions should be taken when any DC generator, AC generator, transformers, and power supplies are under load.

A circuit may suddenly open, creating high-voltage spikes which can damage the generator or anything connected to it. The voltage / current spike (or surge) can travel in both directions of the open circuit (upstream and downstream of the fuse / circuit breaker). There are numerous conditions that will affect the energy behind the voltage spike, including:

1. The length of the wire runs and whether or not the wires are twisted or running parallel. There is more induction in the circuit when the wires are run in parallel as opposed to twisted; the higher the induction the greater the voltage / current spike.
2. The amount of load on the generator or electrical circuit, obviously when a circuit breaker / fuse opens the circuit is under the highest current levels.
3. The amount of over-voltage protection circuit.

Grounding connections

Two-holed lugs are used to connect between the positive busbar and the ground. There will be up to five lugs with two-holes for the ground wire with a 1" distance between the holes. Figure below shows the location of the ground busbar relative to the fuse box.



CAUTION

When power is fully configured, -48V from the DC Power Plant will always be present in the DC disconnect at the pull-out fuse terminal inside the generator engine compartment. The DC generator controller relies on power from the DC plant in order to command the generator into service and to maintain charge on the super-capacitor bank that supplies the engine's starting power.

If working inside the generator engine compartment, it is necessary to first open the DC Disconnect in order to remove -48V from the generator enclosure. If working inside the generator cabinet, it is necessary to open the associated circuit breaker inside the DC plant in order to remove -48V from the DC pull-out fuse Disconnect. Note that opening the DC Disconnect or the breaker in the DC plant will force the generator into manual mode (an out-of-auto alarm will result). Once power is fully restored, it will be necessary to use the control panel at the front of the generator to put it back in automatic mode.



FUSE BLOCK / FUSE HOLDER

GROUND BUSBAR

Figure 13

Connections to the alarm board

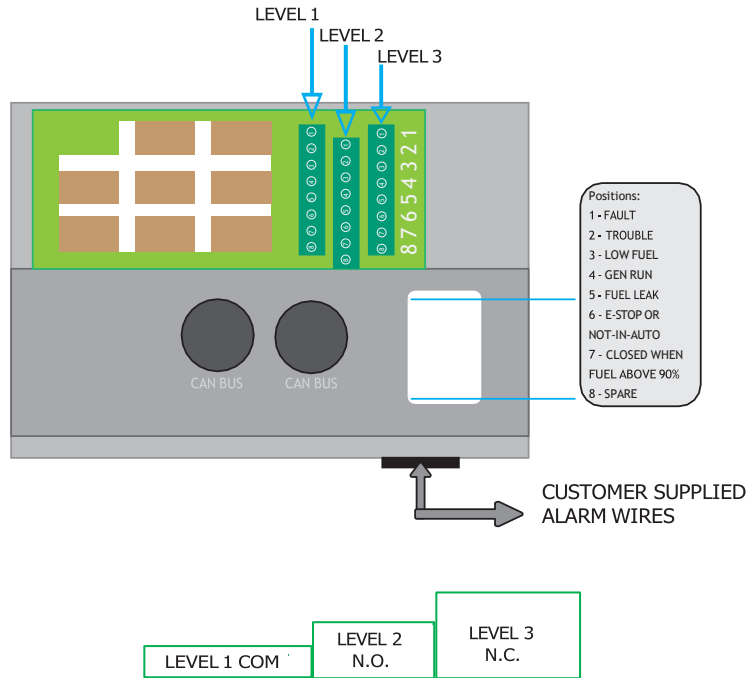


Figure 14

Alarm board configuration (Daisy chain/jumper connection)

The jumper is used to connect the fault and trouble on the relay board in series, as shown. The table below shows the various conditions of the relay alarm board. Figure 15 and 16 shows the customer specific interconnection between Fault and Trouble.

Figure 17 shows the conditions that will trigger a fault alarm or a trouble alarm from the relay alarm board.

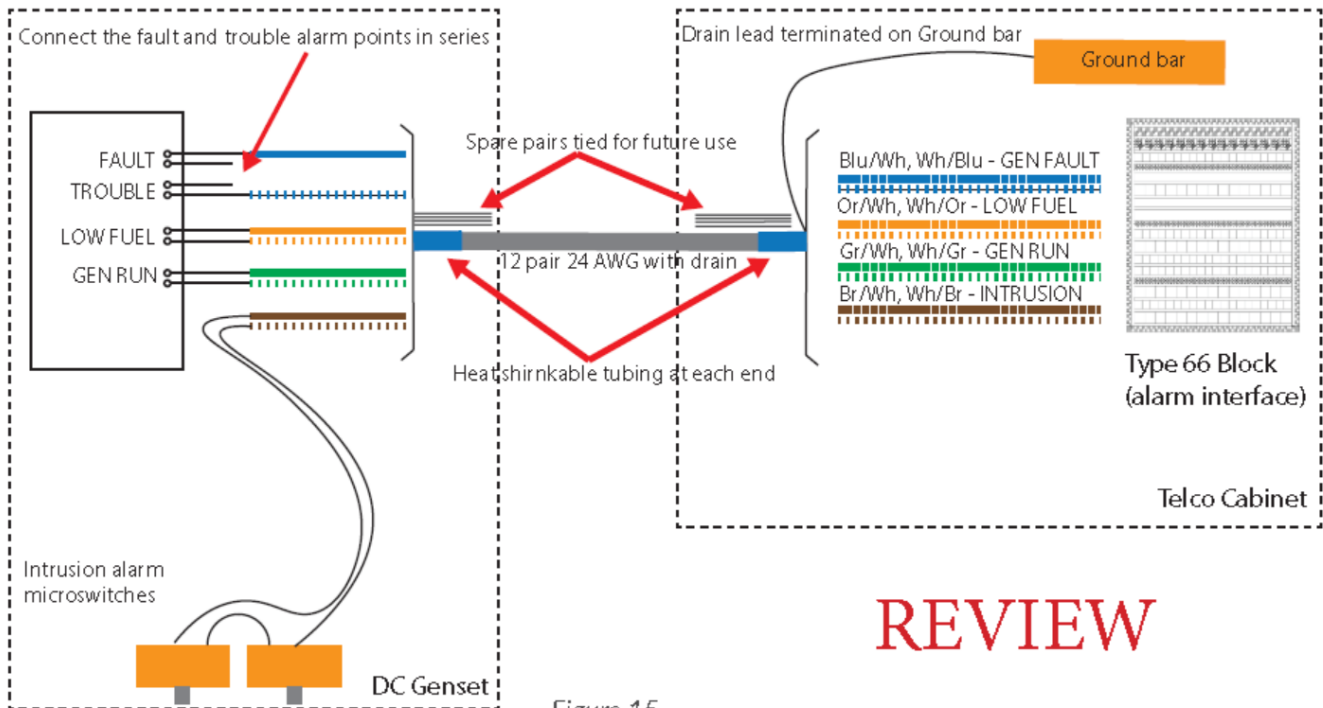


Figure 15

RBS GENERATOR RUNNING = Alarm Point 4, Position 1 &3
RBS GENERATOR FUEL LOW = Alarm Point 3, Position 1 &3
RBS GENERATOR MJ = Alarm Point 2, Position 1 &3
RBS GENERATOR FAIL = Alarm Point 1, Position 1 &3
RBS GENERATOR FUEL LEAK = Alarm Point 5, Position 1 &3

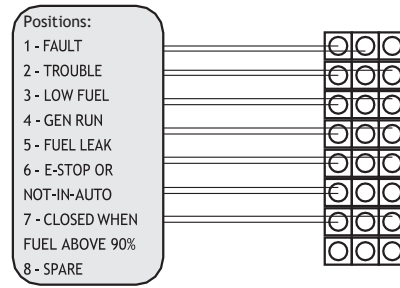
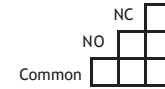


Figure 16



Relay position	Description	Input positions to trigger	Alarm relay power during fault	Terminal position
1	Fault	Overcrank (fail to start)	Off	Level 1, Level 2 (NO)
1	Fault	High engine temperature shutdown	Off	Level 1, Level 2 (NO)
1	Fault	Low oil pressure	Off	Level 1, Level 2 (NO)
1	Fault	Overspeed	Off	Level 1, Level 2 (NO)
1	Fault	Not in auto	Off	Level 1, Level 2 (NO)
1	Fault	E-Stop depressed	Off	Level 1, Level 2 (NO)
2	Trouble	High engine temp. pre alarm temp. above 95%	On	Level 1, Level 3 (NC)
2	Trouble	Low fuel below 15%	On	Level 1, Level 3 (NC)
2	Trouble	Low coolant level controller switch 2	On	Level 1, Level 3 (NC)
2	Trouble	High starting battery voltage (above 15 Volts)	On	Level 1, Level 3 (NC)
2	Trouble	Low starting battery voltage (below 8 Volts)	On	Level 1, Level 3 (NC)
2	Trouble	Fan fail	On	Level 1, Level 3 (NC)
2	Trouble	Air flow restriction	On	Level 1, Level 3 (NC)
3	Low fuel	Fuel level below low fuel level (45%)	On	Level 1, Level 3 (NC)
4	Generator running	Generator running variable	On	Level 1, Level 3 (NC)
5	Fuel leak	Controller switch 1	On	Level 1, Level 3 (NC)
6	E-Stop or not in Auto	E-Stop depressed or not in Auto	On	Level 1, Level 3 (NC)
7	Fuel level over 90%	Fuel level over 90%	On	Level 1, Level 2 (NO)
8				

Figure 17

Polar Power software download

The Polar Power Software required for the Supra Controller can be downloaded from the following website.

The software is a graphical user interface that allows the user to observe the Generator and Engine status, such as the Engine Temperature, Alternator Voltage, and Alternator Current along with various other options. The website has instructions on how to download the software and install it into the user's computer or laptop. Verify that the correct firmware is installed and restart your computer or laptop after each installation.

Latest version software can be found on the website.

polarpowerinc.net

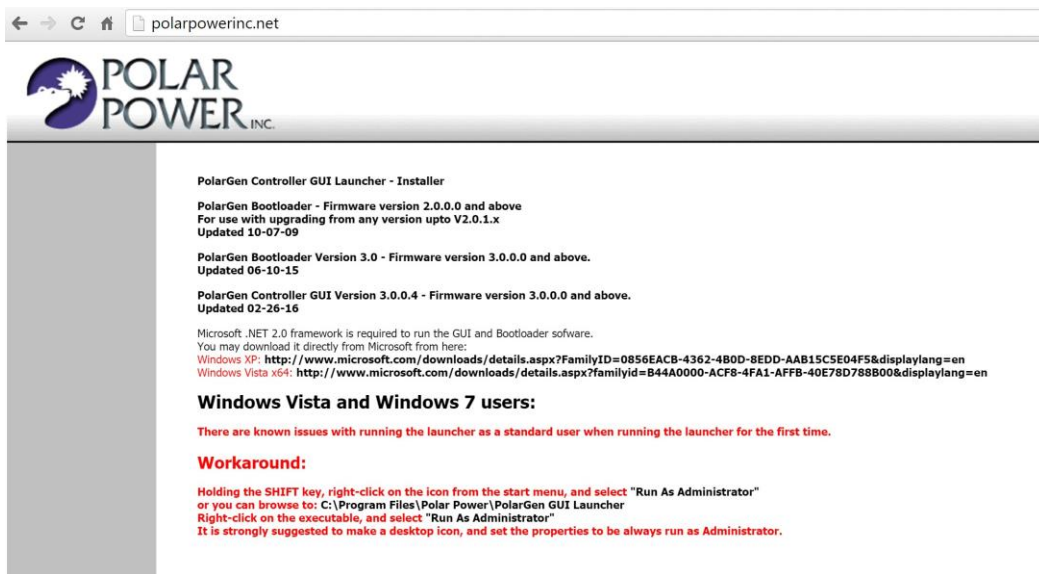


Figure 18

The following are brief instructions on what to download and how to run the Polar Power GUI.

Step 1 – Click on the first link "PolarGen Controller GUI Launcher – Installer"

Step 2 – For Windows 8 users, once the executable file has been downloaded and installed the only way to properly run it is to press Shift and Right-click on the mouse and "Run As Administrator"

Few additional instructions

- When Open GUI 3.0.0.4 – run it as Administrator
- After connecting cables from PC to Male connector in the genset:
 1. Make sure you choose: Direct Connections in Communications Page:
 2. Please set COM 3 in Edit, Preference, Communications.
 3. Select Connect on Communications Page.

Connecting through the Serial RS232

One of the connections that can be used in order to see the status of the generator is a serial RS232 female connection. On the generator set it is the serial RS232 cable with the label "2" written on it (See Figure 19).

The serial RS232 cable has a male connector (See Figure 19) and NEEDS to be purchased by the customer. A proper male connector that leads to a USB connector will work if a PC or laptop needs to be directly plugged in. The two Figures below show the proper female and male RS232 serial port connectors that are required.

The serial port connection is a direct way of connecting to the Ethernet module.

If a serial port connection is needed the proper male and female RS232 serial connectors are required.

Female RS232 serial connector



Figure 19

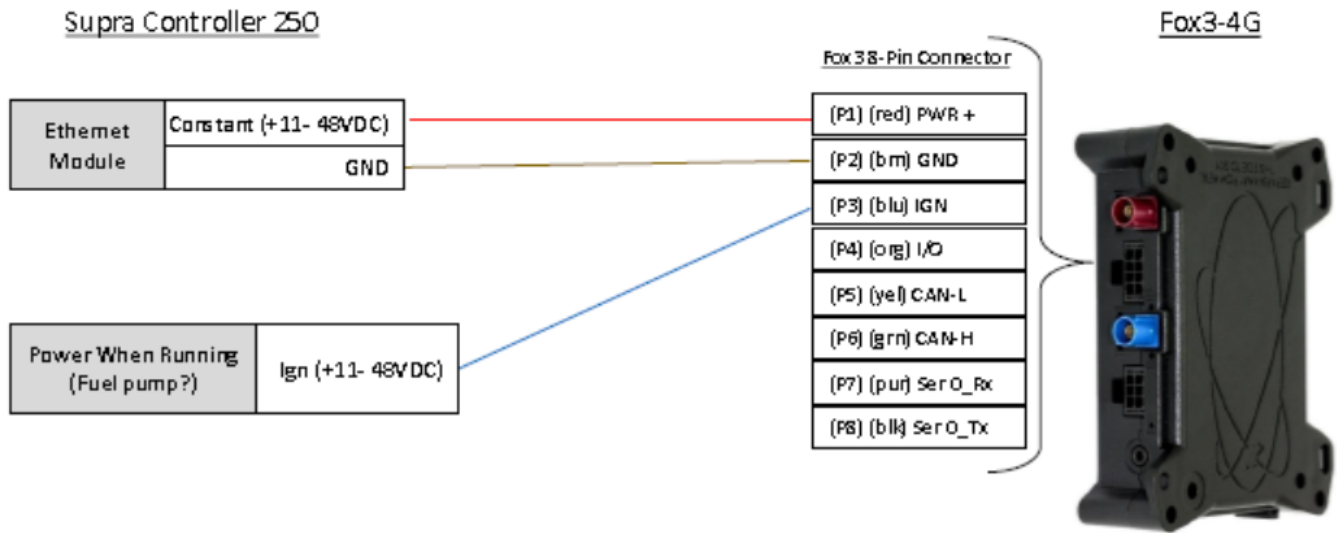
Male RS232 serial connector

Connecting through the IoT module

FOX3-4G is a compact, all-in-one cellular telematics gateway combining a rich connectivity choice with our powerful Edge intelligence. This IoT device provides secure real time data monitoring and remote diagnostics via CANBUS, RS232, and Edge compute abilities.



Power Connection – Polar Power Supra 250 to Fox3-4G



Connecting through the Ethernet module

The Ethernet Module (See Figure 20) is powered by the Supra Controller and has two connections. A serial male connection and either a Cat6 or Cat5e cable connection. Typically the Ethernet module is already installed in the Generator and wired with a serial RS232 cable labeled "1".

The Ethernet module allows the user to access the Generator and Engine status.



Figure 20

CAT6 or
CAT5e Cable

Remote login information

Polar Power also offers remote connectivity through a cellular router using Virtual Private Network (VPN) software. Below are the instructions on how to install the VPN software and connect to the Polar Power generator set. The following procedure applies only to the cellular router MultiConnect rCell 100 Series.



Figure 21

VPN Credentials

Go to <https://vpnlab.aeris.net/> and follow the prompt to download and install the VPN software.

Example:

Username: polarpower

Password: R6Yx7C3j

Polar Power Generator Login

Example:

IP: 10.192.147.120

Port: 8071

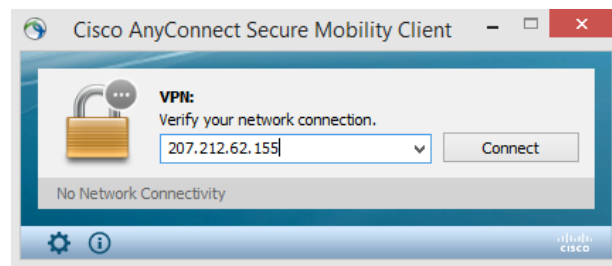


Figure 22

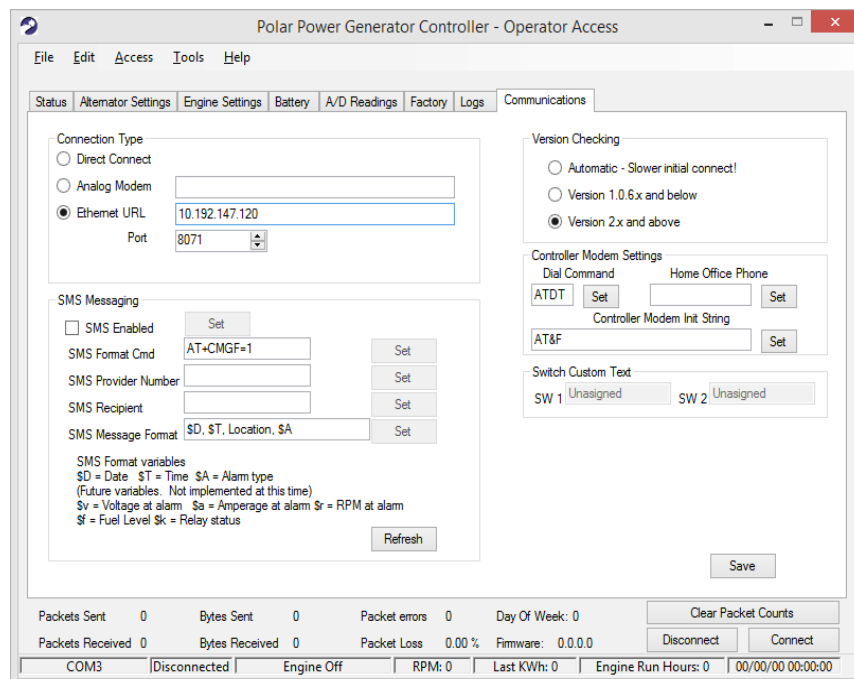


Figure 23

Diesel unit information

Diesel systems with injectors use a mechanically driven fuel pump to directly inject the fuel into the combustion chambers driven by a precision geared, mechanically timed, high pressure fuel pump. Figure 24 shows the relative fuel consumption of a diesel engine.

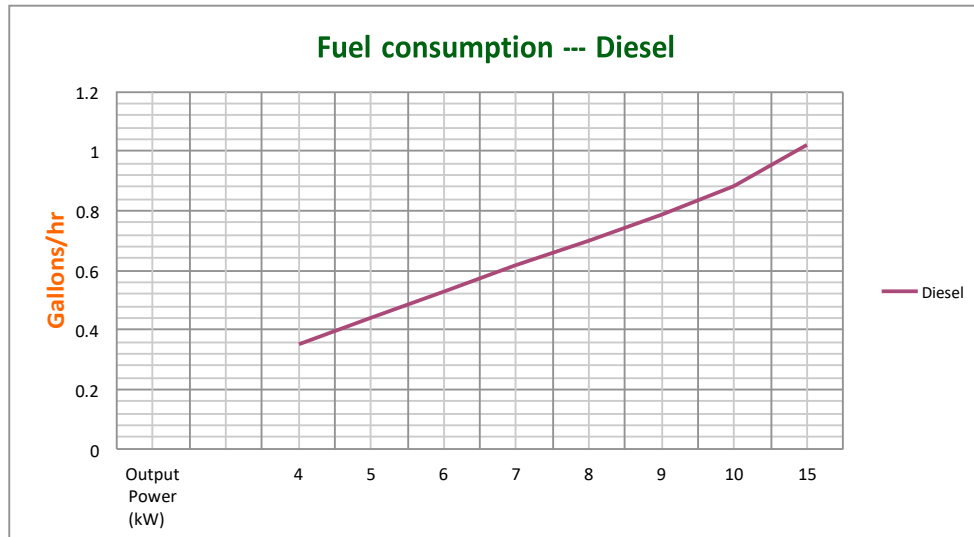


Figure 24

Diesel fuel tank information

Standard Tank 54 Gallon

The diesel generator set in the vertical enclosure includes an internal 54 gallon fuel tank installed in the base of the cabinet. Depending on shipping rules regarding flammable and toxic substances, the generator sets may be shipped to the customer's temporary storage site without any fluids, dry, with or without coolant, and with or without lube oil. It is critical that the installer verify the presence of operating fluids, coolant, lube oil, and fuel.

After running the diesel generator for a few hours, check all the fittings for traces of diesel fuel.

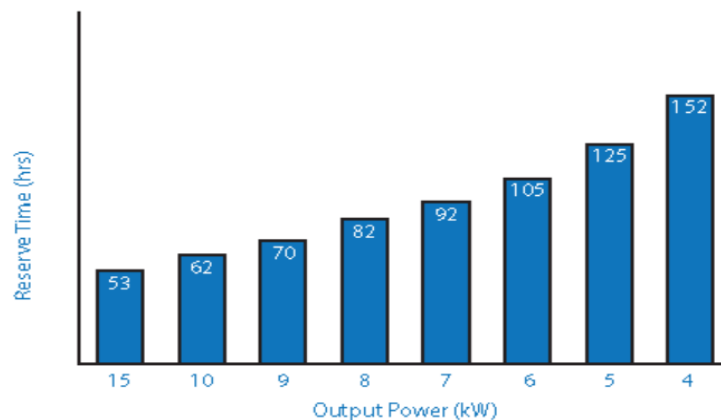
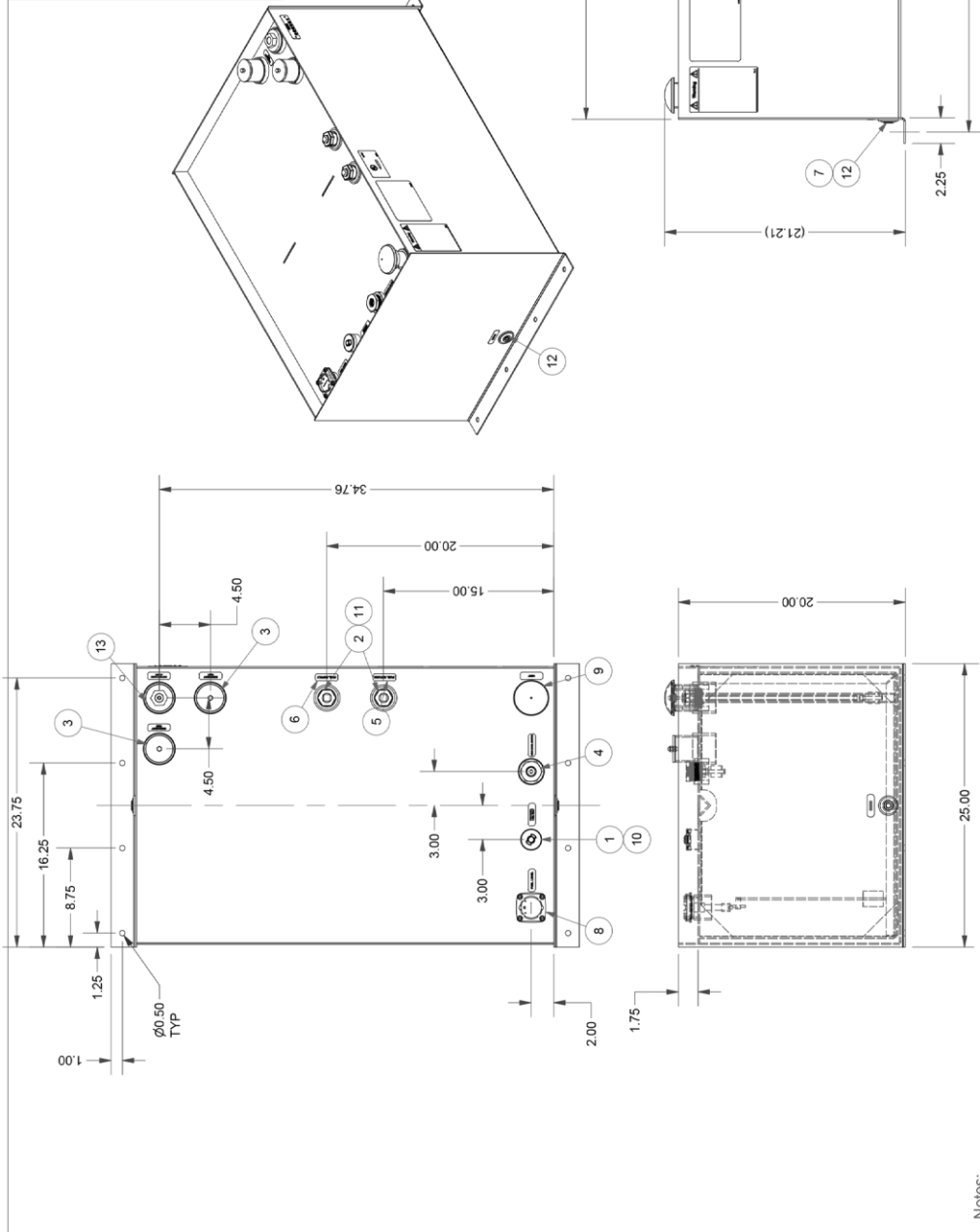


Figure 25

ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	CI-26818	CAP, TWIST OFF 1.78" I.D.
2	2	DBT 1X1/2	BUSH, DBL TAP 1" NPT X 1/2"
3	2	EV 02 - LP MODIFIED	EMERGENCY VENT 2" NPT LOW
4	1	HLS 000-MODIFIED	LEVEL SWITCH, 95% HIGH
5	1	LA 00009	LABEL, FUEL RETURN
6	1	LA 00010	LABEL, FUEL SUPPLY
7	2	LA 00012	LABEL, DRAIN
8	1	LG 100019-MODIFIED	LEVEL GAUGE, VISUAL
9	1	MV 0125	VENT, MUSHROOM 1-1/4" FEMALE
10	1	NI-1205 FILLER NECK	NI-PLE, 1/2" NPT X 17.25" T.O.E
11	2	NP 1050017251	PLUG, 1/2" NPT ALLEN HEAD
12	2	PPS 1500AH	SWITCH, TOP MOUNT RUPTURE BASIN
13	1	RBA TM119	



- Notes:
- Oil fog interior with Protecto Cote 150
 - Pressure test at 3 psi
 - Use diesel fuel resistant sealant on all threads
 - Affix UL 142, UPP, and warning labels
 - All fittings to be plugged before paint
 - Powder coat black
 - Tank capacities
Actual: 56 gallons (212 L)
Usable: 54 gallons (204 L)
 - Tank weight approx. 120 lbs
 - Tank is min 110% rupture basin containment

Figure 26

Diesel generator environmental considerations

- 1) Double walled, 54 gallon tank to allow for 72 hr. backup time
- 2) Fuel Tank complies with UL 142
- 3) Special fuel leak sensor placed between the tank walls in order to detect any possible leaks
- 4) The tank is equipped with spill proof design on the top of the tank to contain possible spills during re-fueling.
- 5) Ultra-low permeability rubber hoses, designed specifically to withstand high corrosive fuels.
- 6) The fuel hoses are inside of Stainless Steel braids, for additional protection
- 7) In case of possible hose leaks after or before the fuel boost pump, the generator will shut down due to lack of fuel once the fuel in the small fuel filter/separator tank is burned.
- 8) In the case of hose leaks there are two areas where the fuel will be collected:
 - Inside generator compartment- tray will hold up to 3.7 gallons of fuel
 - Above the main tank – the tray will hold up to 5 gallons of fuel

Exhaust

In many locations, the exhaust has to be relocated and moved away from the generator, sometimes at great distances. The installation issues to overcome are:

1. Additional tubing should not increase the back pressure on the engine as measured from the 1 1/2" exhaust pipe outlet by 0.5 psi.
2. Water condensation filling up the muffler and possibly draining into the engine. Water is a byproduct of combustion, the combustion process can produce a lot of water. Water exiting the generator exhaust (or automobile) is quite pronounced when the engine is first started. As the engine and exhaust lines warm-up, it no longer condenses and exits as hot vapor. Many exercise routines don't allow the generator to warm up long enough to remove condensed water. Having long exhaust runs provides a means of cooling the exhaust and condensing water in the exhaust; therefore long exhaust pipe runs should be installed with a slight incline to drain the water at the pipe exit and does allow water to flow back to the generator.
3. Provide a means to prevent people /animals from getting burns or combustible materials coming in contact with the exhaust pipe. The smaller the diameter of the pipe the higher the pipe surface temperature. Larger diameter pipes run cooler because of the lower gas pressure.
4. Exhaust gas is corrosive, the metal used for the pipe should have resistance to corrosion. If black iron pipe or galvanized pipe is used, replacement may be required at some point in time. Provisions should be made for future replacement.

Gas volumes exiting the engine are dependent on electrical load and temperature of the exhaust. Nominal volume flows to use are 90 cfm at 10 kW, 54 cfm at 6 kW, 135 cfm at 15 kW.

As the temperature decreases the volume of gas decreases. Long runs of pipe will have a significant impact on lowering the exhaust temperature, decreasing the volume of exhaust gas. Temperatures exiting the engine are around 1200°F and temperatures exiting the exhaust muffler is around 900°F.

The type of pipe/tube: the radius is in the pipe bends, plumbing fittings all have a significant effect on pressure drop. The most pronounced effect on pressure drop is the use of corrugated / metal hose, this type of hose creates significant turbulence causing high pressure drops. For this reason, this material should be limited to very short lengths (under 4 feet).

Given all the conditions affecting pressure drop you should be conservative in your sizing. In the final outcome, you should measure the pressure drop with a 0 to 5 psi gauge.



249 E. Gardena Blvd, Gardena CA 90248
Tel.: +1(310)8309153 • Fax: +1(310)7192385
info@polarpowerinc.com • www.polarpower.com

Copyright 202 Polar Power Inc., All Rights Reserved