OPERATION MANUAL

MQ POWER®

WHISPERWATT™ SERIES
MODEL
DCA70SSIU4F
60 Hz GENERATOR
DEEP SEA CONTROLLERS
DSE8610 MKII
DSE8610 MKII-U2
(ISUZU BR-4JJ1X DIESEL ENGINE)

Revision #2 (11/25/25)

To find the latest revision of this publication or associated parts manual, visit our website at:
www.mqpower.com

THIS MANUAL MUST ACCOMPANY THE EQUIPMENT AT ALL TIMES.


WARNING
CANCER &
REPRODUCTIVE HARM
www.P65Warnings.ca.gov
P/N 38707

DCA70SSIU4F 60 Hz Generator DSE8610 MKII/MKII-U2 Controller

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DISCLAIMER:

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SAFETY DECALS

Safety decals are attached to the generator as shown in Figure 1. Keep these safety decals clean at all times. When the safety decals become worn or damaged, contact your nearest dealer or the Multiquip Parts Department.

NOTICE

For safety decal part numbers, refer to the associated parts manual.

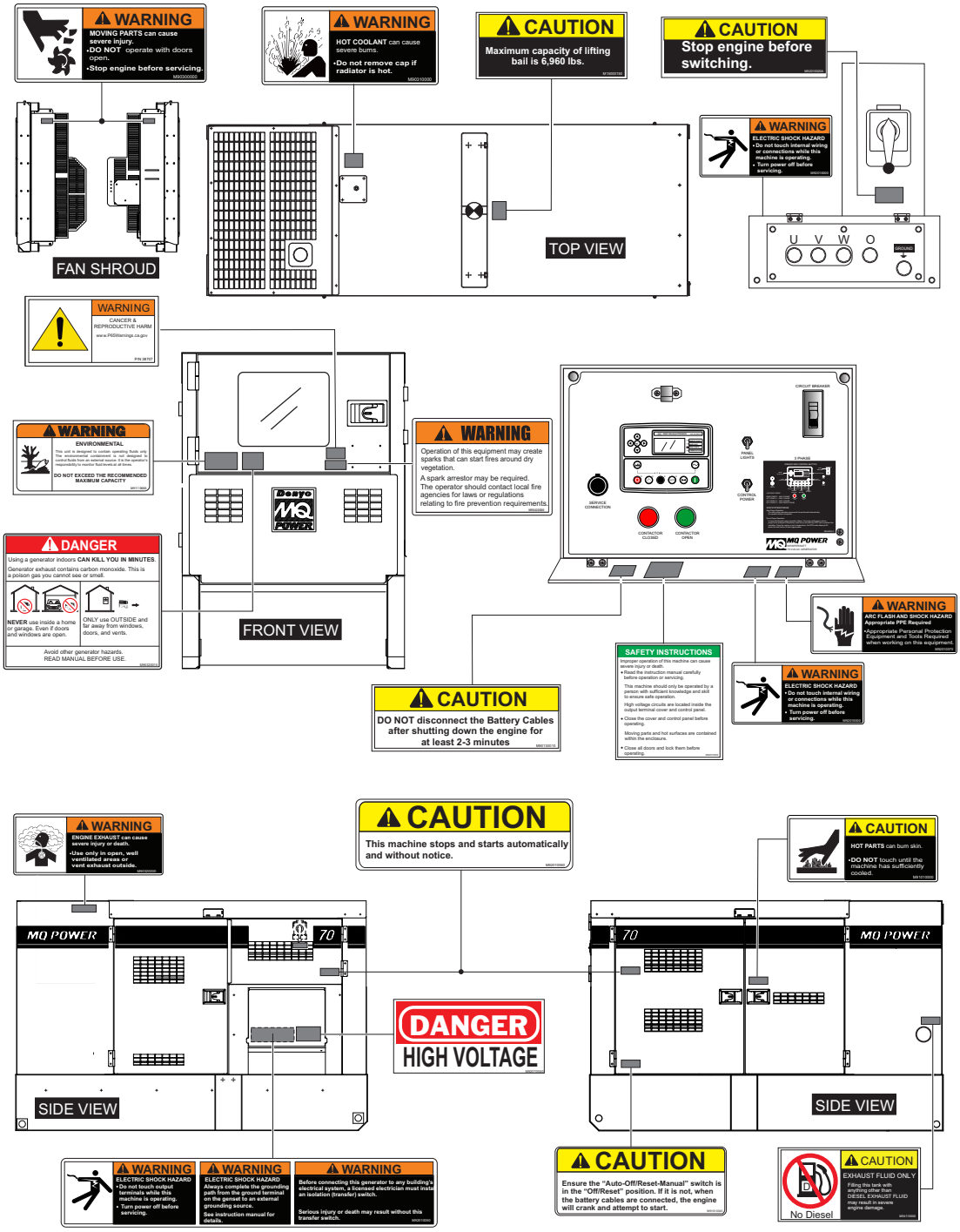


Figure 1. Safety Decals

Do not operate or service the generator before reading the entire manual. Safety precautions should be followed at all times when operating this generator. Failure to read and understand the safety messages and operating instructions could result in injury to yourself and others.

SAFETY MESSAGES

The four safety messages shown below will inform you about potential hazards that could injure you or others. The safety messages specifically address the level of exposure to the operator and are preceded by one of four words: **DANGER, WARNING, CAUTION** or **NOTICE.**

SAFETY SYMBOLS

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

Addresses practices not related to personal injury.

Potential hazards associated with the operation of this generator will be referenced with hazard symbols which may appear throughout this manual in conjunction with safety messages.

Symbol	Safety Hazard
	Lethal exhaust gas hazards
	Explosive fuel hazards
	Burn hazards
	Overspeed hazards
	Rotating parts hazards
	Pressurized fluid hazards
	Electric shock hazards

GENERAL SAFETY

⚠ CAUTION

- **NEVER** operate this generator without proper protective clothing, shatterproof glasses, respiratory protection, hearing protection, steel-toed boots and other protective devices required by the job or city and state regulations.

- **NEVER** operate this generator when not feeling well due to fatigue or illness, or when on medication.

- **NEVER** operate this generator under the influence of drugs or alcohol.

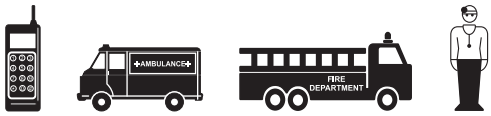
- **ALWAYS** check the generator for loosened threads or bolts before starting.
- **NEVER** use the generator for any purpose other than its intended purposes or applications.

NOTICE

- This generator should only be operated by trained and qualified personnel 18 years of age and older.
- Whenever necessary, replace nameplate, operation and safety decals when they become difficult to read.
- Manufacturer does not assume responsibility for any accident due to equipment modifications. Unauthorized modification of the generator will void all warranties.
- **NEVER** use accessories or attachments that are not recommended by MQ Power for this generator. Damage to the generator and/or injury to the user may result.
- **ALWAYS** know the location of the nearest **fire extinguisher.**

- **ALWAYS** know the location of the nearest **first aid kit.**

- **ALWAYS** know the location of the nearest phone or **keep a phone on the job site.** Also, know the phone numbers of the nearest **ambulance, doctor,** and **fire department.** This information will be invaluable in the case of an emergency.



GENERATOR SAFETY

⚠ DANGER

- **NEVER** operate the generator in an explosive atmosphere or near combustible materials. An explosion or fire could result causing **severe bodily harm or even death**.

⚠ WARNING

- **NEVER** disconnect any **emergency or safety devices**. These devices are intended for operator safety. Disconnection of these devices can cause **severe injury, bodily harm or even death**. Disconnection of any of these devices will void all warranties.

⚠ CAUTION

- **NEVER** lubricate components or attempt service on a **running** generator.

NOTICE

- **ALWAYS** ensure the generator is on level ground before use.
- **ALWAYS** keep the generator in proper running condition.
- Fix damage to the generator and replace any broken parts immediately.
- **ALWAYS** store the generator properly when it is not being used. The generator should be stored in a clean, dry location out of the reach of children and unauthorized personnel.

ENGINE SAFETY

⚠ DANGER

- The engine fuel exhaust gases contain poisonous carbon monoxide. This gas is colorless and odorless, and can cause **death** if inhaled.
- The engine of this generator requires an adequate, free flow of cooling air. **NEVER** operate this equipment in any enclosed or narrow area where free flow of the air is restricted. If the air flow is restricted it will cause injury to people and property and serious damage to the equipment or engine.

- When operating the generator outdoors, **DO NOT** place the generator near doors, windows or vents that could allow carbon monoxide to enter and build up in occupied spaces.

⚠ WARNING

- **NEVER** place hands or fingers inside the engine compartment when the engine is running.
- **NEVER** operate the engine with heat shields or guards removed.
- Keep fingers, hands, hair and clothing away from all moving parts to prevent injury.

- **NEVER** operate the generator with the doors open. Stop the engine before servicing.
- **DO NOT** remove the radiator cap while the engine is hot. High pressure boiling water will gush out of the radiator and severely scald any persons in the general area of the generator.

- **DO NOT** remove the coolant drain plug while the engine is hot. Hot coolant will gush out of the coolant tank and severely scald any persons in the general area of the generator.
- **DO NOT** drain the engine oil while the engine is hot. Hot oil will gush out and severely scald any persons near the generator.
- Operation of the generator may create sparks that can start fires around dry vegetation. A spark arrestor may be required. The operator should contact local fire agencies for laws or regulations relating to fire prevention requirements.

⚠ CAUTION

- **NEVER** touch the hot exhaust manifold, muffler or cylinder. Allow these parts to cool before servicing the generator.

NOTICE

- **NEVER** run the engine without an air filter or with a dirty air filter. Severe engine damage may occur. Service the air filter frequently to prevent engine malfunction.
- **NEVER** tamper with the factory settings of the engine or engine governor. Damage to the engine or generator can result if operating in speed ranges above the maximum allowable.

- Wet stacking is a common problem with diesel engines which are operated for extended periods with light or no load applied. When a diesel engine operates without sufficient load (less than 30-35% of the rated output), it will not operate at its optimum temperature. This will allow unburned fuel to accumulate in the exhaust system, which can foul the fuel injectors, engine valves and exhaust system, including turbochargers, and reduce the operating performance.

  In order for a diesel engine to operate at peak efficiency, it must be able to provide fuel and air in the proper ratio and at a high enough engine temperature for the engine to completely burn all of the fuel.

  Wet stacking does not usually cause any permanent damage and can be alleviated if additional load is applied to relieve the condition. It can reduce the system performance and increase maintenance. Applying an increasing load over a period of time until the excess fuel is burned off and the system capacity is reached usually can repair the condition. This can take several hours to burn off the accumulated unburned fuel.

FUEL SAFETY

⚠ DANGER

- **NEVER** start the engine near spilled fuel or combustible fluids. Diesel fuel is extremely flammable and its vapors can cause an explosion if ignited.
- **ALWAYS** refuel in a well-ventilated area, away from sparks and open flames.
- **ALWAYS** use extreme caution when working with **flammable** liquids.
- **NEVER** fill the fuel tank while the engine is **running** or **hot**.
- **NEVER** overfill the fuel tank. Spilled fuel can ignite if it comes into contact with hot engine parts or sparks from the ignition system.
- Store fuel in appropriate containers, in well-ventilated areas and away from sparks and flames.
- **NEVER** use fuel as a cleaning agent.
- **NEVER** smoke around or near the equipment. Fire or explosion could result from fuel vapors or if fuel is spilled on a hot engine.

TOWING SAFETY

⚠ CAUTION

- Check with your local county or state safety towing regulations, in addition to meeting ***Department of Transportation (DOT) Safety Towing Regulations***, before towing your generator.

- Refer to the MQ Power trailer manual for additional safety information.
- In order to reduce the possibility of an accident while transporting the generator on public roads, **ALWAYS** make sure that the trailer that supports the generator and the towing vehicle are both mechanically sound and in good operating condition.
- **ALWAYS** shut down the engine before transporting.
- Make sure the hitch and coupling of the towing vehicle are rated equal to or greater than the trailer **gross vehicle weight rating**.
- **ALWAYS** inspect the hitch and coupling for wear. **NEVER** tow a trailer with defective hitches, couplings, chains, etc.
- Check the tire air pressure on both the towing vehicle and the trailer. ***Inflate trailer tires as indicated on side wall of tire.*** Also check the tire tread wear on both vehicles.
- **ALWAYS** make sure the trailer is equipped with **safety chains**.
- **ALWAYS** properly attach the trailer's safety chains to the towing vehicle.
- **ALWAYS** make sure the vehicle and trailer directional, backup, brake, and trailer lights are connected and working properly.
- DOT requirements include the following:
  - Connect and test electric brake operation.
  - Secure portable power cables in cable tray with tie wraps.
- The maximum speed for highway towing is **55 MPH** unless posted otherwise. Recommended off-road towing is not to exceed **15 MPH** or less depending on the type of terrain.
- Avoid sudden stops and starts. These can cause skidding or jackknifing. Smooth, gradual starts and stops will improve towing.
- Avoid sharp turns to prevent rolling.
- The trailer should be adjusted to a level position at all times when towing.
- Raise and lock the trailer wheel stand in the upright position when towing.
- Place ***chock blocks*** underneath the wheels to prevent **rolling** while parked.
- Place **support blocks** underneath the trailer's bumper to prevent **tipping** while parked.
- Use the trailer's swivel jack to adjust the trailer height to a level position while parked.

ELECTRICAL SAFETY

⚠ DANGER

- **NEVER** touch the output terminals during operation. Contact with the output terminals during operation can cause **electrocution, electrical shock, or burn**.
- The electrical voltage required to operate the generator can cause **severe injury or even death** through physical contact with live circuits. Turn the generator and all circuit breakers **OFF** before performing maintenance on the generator or making contact with the output terminals.

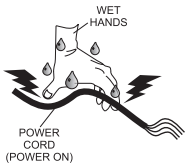
- **NEVER** insert any objects into the output receptacles during operation. This is extremely dangerous. The possibility exists of **electrical shock, electrocution or death**.

- Backfeed to a utility system can cause **electrocution** and/or property damage. **NEVER** connect the generator to a building's electrical system without a transfer switch or other approved device. All installations should be performed by a **licensed electrician** in accordance with all applicable laws and electrical codes. Failure to do so could result in electrical shock or burn, causing **serious injury or even death**.

Power Cord/Cable Safety

⚠ DANGER

- **NEVER** let power cords or cables **lay in water**.
- **NEVER stand in water** while AC power from the generator is being transferred to a load.
- **NEVER** use **damaged** or **worn** cables or cords when connecting equipment to the generator. Inspect the insulation for cuts.



- **NEVER** grab or touch a live power cord or cable with wet hands. The possibility exists of **electrical shock, electrocution or death**.
- Make sure power cables are securely connected to the generator's output receptacles. Incorrect connections may cause electrical shock and damage to the generator.

NOTICE

- **ALWAYS** make certain that the proper power or extension cord has been selected for the job. See the Cable Selection Chart in this manual.

Grounding Safety

⚠ DANGER

- **ALWAYS** make sure that electrical circuits are properly grounded to a suitable earth ground (ground rod) per the National Electrical Code (NEC) and local codes before operating the generator. **Severe injury or death by electrocution** can result from operating an ungrounded generator.
- **NEVER** use gas piping as an electrical ground.

BATTERY SAFETY

⚠ DANGER

- **DO NOT** drop the battery. There is a possibility that the battery will explode.

- **NEVER** expose the battery to open flames, sparks, cigarettes, etc. The battery contains combustible gases and liquids. If these gases and liquids come into contact with a flame or spark, an explosion could occur.

⚠ WARNING

- **ALWAYS** wear safety glasses when handling the battery to avoid eye irritation. The battery contains acids that can cause injury to the eyes and skin.
- Use well-insulated gloves when picking up the battery.
- **ALWAYS** keep the battery charged. If the battery is not charged, combustible gas will build up.
- **ALWAYS** recharge the battery in a well-ventilated environment to avoid the risk of a dangerous concentration of combustible gases.
- If the battery liquid (dilute sulfuric acid) comes into contact with **clothing or skin**, rinse skin or clothing immediately with plenty of water.

- If the battery liquid (dilute sulfuric acid) comes into contact with **eyes**, rinse eyes immediately with plenty of water and contact the nearest doctor or hospital to seek medical attention.

⚠ CAUTION

- **ALWAYS** disconnect the **NEGATIVE battery terminal** before performing service on the generator.
- **ALWAYS** keep battery cables in good working condition. Repair or replace all worn cables.

ENVIRONMENTAL SAFETY/DECOMMISSIONING

NOTICE

Decommissioning is a controlled process used to safely retire a piece of equipment that is no longer serviceable. If the equipment poses an unacceptable and unrepairable safety risk due to wear or damage or is no longer cost effective to maintain (beyond life-cycle reliability) and is to be decommissioned (demolition and dismantlement), be sure to follow the rules below:

- **NEVER** pour waste or oil directly onto the ground, down a drain, or into any water source.
- Contact your country's Department of Public Works or recycling agency in your area and arrange for proper disposal of any electrical components, waste or oil associated with this equipment.

- When the life cycle of this equipment is over, remove the battery and bring it to an appropriate facility for lead reclamation. Use safety precautions when handling batteries that contain sulfuric acid.
- When the life cycle of this equipment is over, it is recommended that the frame and all other metal parts be sent to a recycling center.

  Metal recycling involves the collection of metal from discarded products and its transformation into raw materials to use in manufacturing a new product.

  Recyclers and manufacturers alike promote the process of recycling metal. Using a metal recycling center promotes energy cost savings.

EMISSIONS INFORMATION

NOTICE

The diesel engine used in this equipment has been designed to reduce harmful levels of carbon monoxide (CO), hydrocarbons (HC), and nitrogen oxides (NOx) contained in diesel exhaust emissions.

This engine has been certified to meet US EPA evaporative emissions requirements in the installed configuration.

Attempting to modify or make adjustments to the engine emission system by unauthorized personnel without proper training could damage the equipment or create an unsafe condition.

Additionally, modifying the fuel system may adversely affect evaporative emissions, resulting in fines or other penalties.

Emission Control Label

The emission control label is an integral part of the emission system and is strictly controlled by regulations.

The label must remain with the engine for its entire life.

If a replacement emission label is needed, please contact your authorized engine distributor.

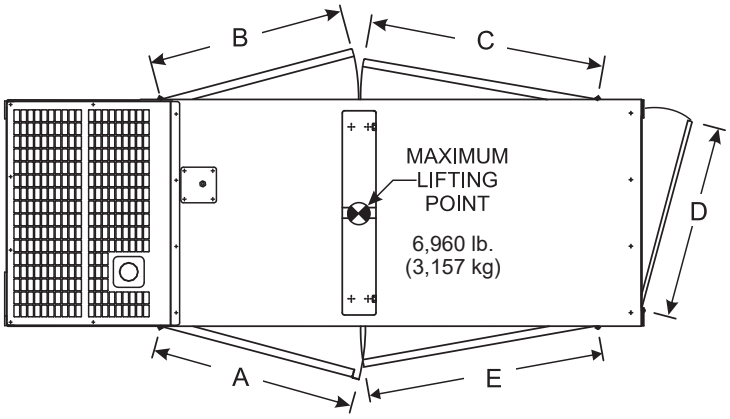
Table 1. Generator Specifications		
Model	DCA70SSIU4F	
Type	Revolving field, self-ventilated, protected type synchronous generator	
Armature Connection	**Star with Neutral**	**Zigzag**
Phase	3	1
Standby Output	62 kW (77 kVA)	44 kW
Prime Output	56 kW (70 kVA)	40 kW
3Ø Voltage (L–L/L–N) **Voltage Selector Switch at 3Ø 240/139**	208Y/120, 220Y/127, 240Y/139	N/A
3Ø Voltage (L–L/L–N) **Voltage Selector Switch at 3Ø 480/277**	416Y/240, 440Y/254, 480Y/277	N/A
1Ø Voltage (L–L/L–N) **Voltage Selector Switch at 1Ø 240/120**	N/A	240/120
Power Factor	0.8	1.0
Frequency	60 Hz	
Speed	1,800 rpm	
Aux. AC Power	Single phase, 60 Hz	
Subtransient	0.085	
Transient	0.203	
Synchronous	1.942	
Zero Sequence Reactance	0.0081	
Overload Protection	OCR/Main Circuit Breaker	
Aux. Voltage/Output	120V/4.8 kW (2.4 kW × 2)	
Dry Weight	3,329 lb. (1,510 kg)	
Wet Weight	4,211 lb. (1,910 kg)	

Table 2. Engine Specifications		
Model	Isuzu BR-4JJ1X Final Tier 4	
Type	4-cycle, water-cooled, direct injection, turbocharged and cooled EGR	
No. of Cylinders	4	
Bore × Stroke	3.76 in. × 4.13 in. (95.4 mm × 104.9 mm)	
Displacement	183 cu. in. (3.0 liters)	
Rated Output	86.5 hp at 1,800 rpm	
Starting	Electric	
Coolant Capacity	5.5 gal. (21.0 liters)[1]	
Lube Oil Capacity	3.96 gal. (15 liters)[2]	
Lube Oil Type	API service class CJ-4 SAE 15W-40 or JASO DH-2	
DEF Tank Capacity	7.4 gal. (28 liters)	
Fuel Tank Capacity	103 gal. (390 liters)	
Fuel Type	#2 diesel fuel (ultra-low sulfur diesel fuel only)	
Fuel Consumption	4.4 gal. (16.6 L)/hr. at **full load**	3.5 gal. (13.4 L)/hr. at **3/4 load**
	2.6 gal. (9.8 L)/hr. at **1/2 load**	1.7 gal. (6.4 L)/hr. at **1/4 load**
Battery	27D (CCA 0°F 800A) × 1	

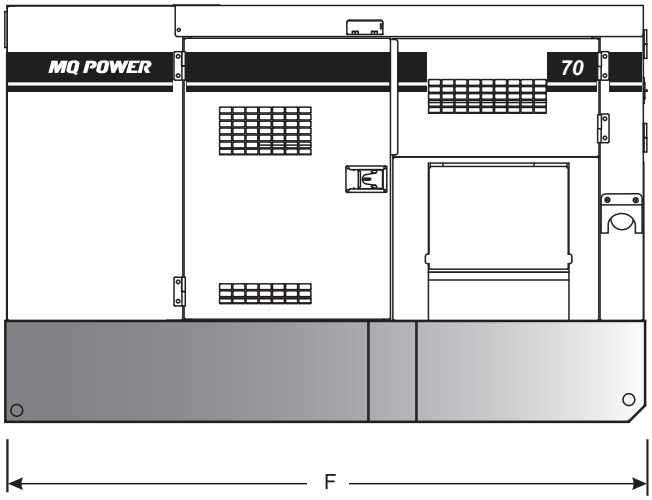
[1] Includes engine and radiator hoses

[2] Includes filters

TOP VIEW



SIDE VIEW



FRONT VIEW

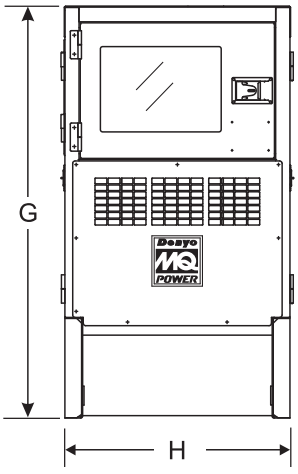


Figure 2. Dimensions

Table 3. Dimensions			
Reference Letter	Dimension in. (mm)	Reference Letter	Dimension in. (mm)
A	33.86 (860)	E	33.78 (858)
B	29.45 (748)	F	105.12 (2,670)
C	38.19 (970)	G	68.30 (1,735)
D	32.28 (820)	H	37.40 (950)

GENERATOR GROUNDING

ALWAYS refer to Article 250 (Grounding and Bonding) of the National Electrical Code (NEC).

> ***NOTICE***
>
> **ALWAYS** check with state, province, district, and municipalities for electrical grounding requirements before using the generator.

EXAMPLE of how to ground (Figure 3) the unit if the condition of use requires such a device:

Connecting The Ground

Consult with local electrical and safety codes for proper connection based on condition of use. Refer to the Conductor Grounding Table, Article 250 of the NEC handbook.

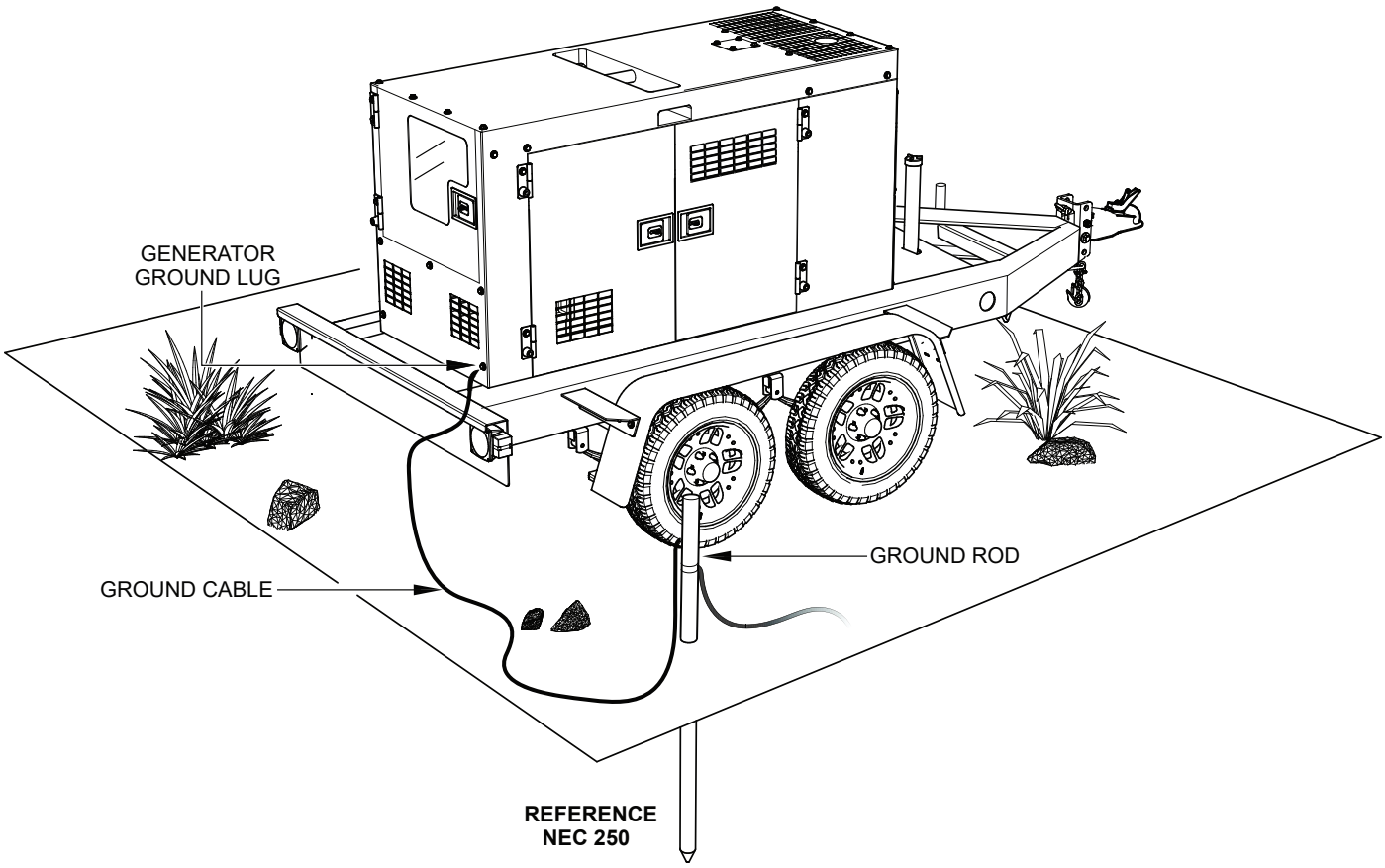


Figure 3. Typical Generator Grounding Application

> ***NOTICE***
>
> Trailer-mounted generators are the sole responsibility of MQ Power.

OUTDOOR INSTALLATION

Install the generator in an area that is free of debris, bystanders, and overhead obstructions. Make sure the generator is on secure, level ground so that it cannot slide or shift around. Also, install the generator in a manner so that the exhaust will not be discharged in the direction of nearby homes.

The installation site must be relatively free from moisture and dust. All electrical equipment should be protected from excessive moisture. Failure to do so will result in deterioration of the insulation and will result in short circuits and grounding.

Foreign materials such as dust, sand, lint, and abrasive materials have a tendency to cause excessive wear to engine and alternator parts.

⚠ CAUTION

Pay close attention to ventilation when operating the generator inside tunnels and caves. The engine exhaust contains noxious elements. Engine exhaust must be routed to a ventilated area.

INDOOR INSTALLATION

Exhaust gases from diesel engines are extremely poisonous. Whenever an engine is installed indoors the exhaust fumes must be vented to the outside. The engine should be installed at least two feet from any outside wall. Using an exhaust pipe which is too long or too small can cause excessive back pressure which will cause the engine to heat excessively and possibly burn the valves.

MOUNTING

The generator must be mounted on a solid foundation (such as concrete) and set firmly on the foundation to isolate vibration of the generator when it is running. The generator must be mounted at least 6 inches above the floor or grade level as referenced in the National Fire Protection Association handbook (NFPA 110, Chapter 7, Section 7.4).

DO NOT remove the metal skids on the bottom of the generator. They are to resist damage to the bottom of the generator and to maintain alignment.

GENERATOR

This generator is designed as a high-quality, portable (requiring a trailer for transport) power source for telecom sites, lighting facilities, power tools, submersible pumps and other industrial and construction machinery.

OPERATING CONTROL PANEL

The "Operating Panel" is provided with the following:

- DSE8610 MKII/MKII-U2 Controller (Monitors)
  - Alarms (Low Fuel, High Coolant Temperature)
  - Battery Charge
  - Battery Voltage
  - Fuel Level
  - Coolant Temperature
  - Engine Speed
  - Engine Run Time
  - Engine Fuel Temperature
  - Engine Fuel Pressure
  - Engine Inlet Pressure
  - Oil Pressure
  - DEF Level Gauge
  - Generator Load
  - Voltage Output
  - DEF Tank Level
- Panel Light/Panel Light Switch
- Control Power Switch
- USB Service Connection Port
- Contactor Closed Lamp
- Contactor Open Lamp
- 3-Pole, 200-Amp Main Circuit Breaker

CONTROL BOX

The "Control Panel" is provided with the following:

- Current Transformers
- Overcurrent Relay
- Starter Relay

OUTPUT TERMINAL PANEL

The "Output Terminal Panel" is provided with the following:

- Three 120/240V Output Receptacles (CS-6369), 50A
- Three Auxiliary Circuit Breakers, 50A
- Two 120V Output Receptacles (GFCI), 20A
- Two GFCI Circuit Breakers, 20A
- Five Output Terminal Lugs (3Ø power)
- Engine Block Heater
- Battery Charger (Option)

OPEN-DELTA EXCITATION SYSTEM

Each generator is equipped with the state-of-the-art **"Open-Delta"** excitation system. The open-delta system consists of an electrically independent winding wound among stationary windings of the AC output section.

There are four connections of the open delta—A, B, C and D. During steady-state loads, the power from the voltage regulator is supplied from the parallel connections of A to B, A to D, and C to D. These three phases of the voltage input to the voltage regulator are then rectified and are the excitation current for the exciter section.

When a heavy load such as a motor starting or a short circuit occurs, the automatic voltage regulator (AVR) switches the configuration of the open delta to the series connection of B to C. This has the effect of adding the voltages of each phase to provide higher excitation to the exciter section and thus better voltage response during the application of heavy loads.

The connections of the AVR to the AC output windings are for sensing only. No power is required from these windings.

The open-delta design provides virtually unlimited excitation current, offering maximum motor starting capabilities. The excitation does not have a **"fixed ceiling"** and responds according to the demands of the required load.

ENGINE

This generator is powered by a 4-cylinder, 4-cycle, water-cooled, direct injection, turbocharged, EGR, DOC, SCR, Isuzu BR-4JJ1X diesel engine. This engine is designed to meet every performance requirement for the generator. Refer to Table 2 for engine specifications.

In keeping with MQ Power's policy of constantly improving its products, the specifications quoted herein are subject to change without prior notice.

MICROPROCESSOR CONTROL SYSTEM

The microprocessor controls the speed (RPM) of the engine. When the engine demand increases or decreases, the microprocessor system regulates the frequency variation to ± 0.25%.

EXTENSION CABLES

When electrical power is to be provided to various tools or loads at some distance from the generator, extension cords are normally used. Cables should be sized to allow for distance in length and amperage so that the voltage drop between the generator and point of use (load) is held to a minimum. Use the cable selection chart (Table 6) as a guide for selecting the proper extension cable size.

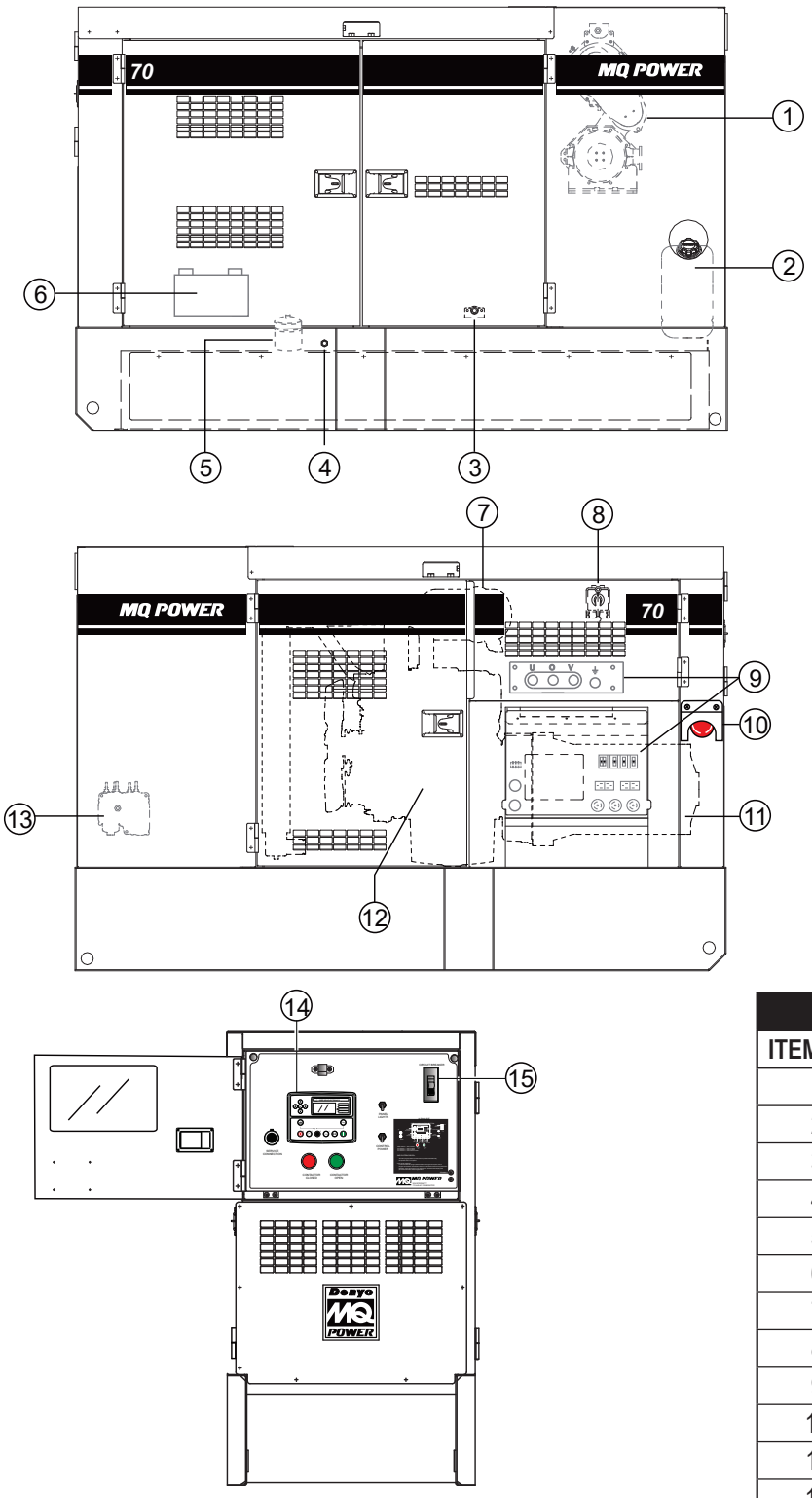


Figure 4. Major Components

Table 4. Major Components	
ITEM NO.	**DESCRIPTION**
1	DOC/SCR Assembly
2	DEF Tank Assembly
3	Coolant Drain Plug
4	Oil Drain With Valve
5	Fuel Tank Assembly
6	Battery Assembly
7	Air Cleaner Assembly
8	Voltage Selector Switch Assembly
9	Output Terminal Panel Assembly
10	Emergency Stop Switch
11	Generator Assembly
12	Engine Assembly
13	DEF Supply Module Assembly
14	DSE8610 MK II/MKII-U2 Controller Assembly
15	Main Circuit Breaker

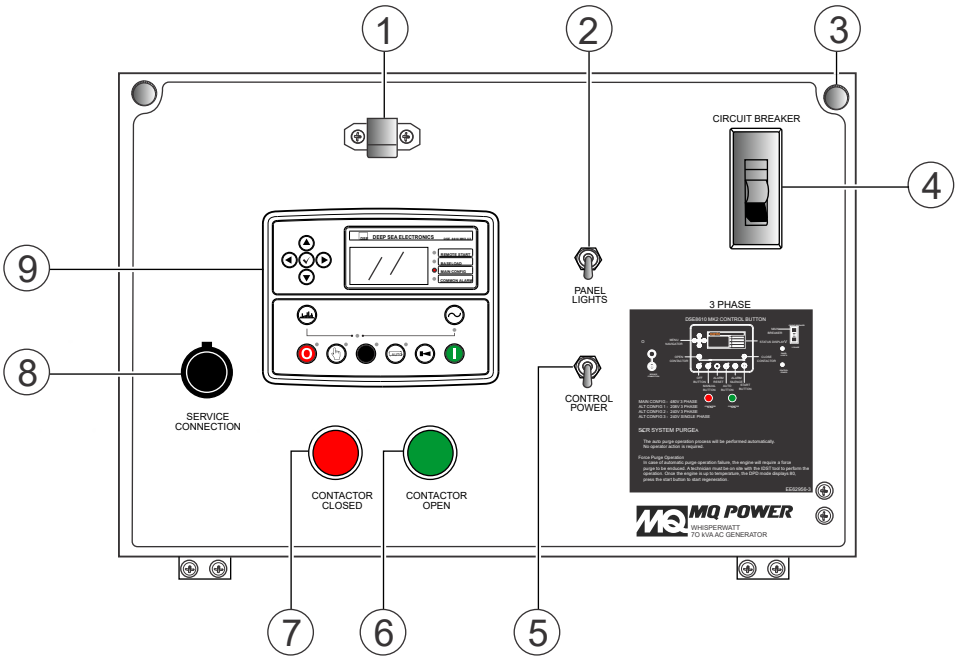


Figure 5. Control Panel

The definitions below describe the controls and functions of the control panel (Figure 5).

1. **Panel Light Switch** — When activated, will turn on the control panel light. Make sure the panel light switch is in the **OFF** position when the panel light is not needed.
2. **Panel Light** — For operation at night, the panel light illuminates the control panel for ease of reading meters and gauges.
3. **Panel Release Knobs** — Turn these knobs counterclockwise to open and lay down the control panel.
4. **Main Circuit Breaker** — This three-pole, 200-amp main breaker is provided to protect the **U**,**V**, **and W** output terminal lugs from overload.
5. **Control Power Switch** — Provides power to the DSE8610 MKII/MKII-U2 controller. Place switch in the **ON** position for normal operation. Place in the **OFF** position when the generator is not in use.
6. **Contactor Open Lamp** — When lit **(GREEN)**, indicates contactor switch is **OPEN**. Load is removed. Works in conjunction with the contactor open button located on the controller. Refer to Figure 6.
7. **Contactor Closed Lamp** — When lit **(RED)**, indicates contactor switch is **CLOSED**. Load is connected. Works in conjunction with the contactor closed button located on the controller. Refer to Figure 6.
8. **Service Connection Port** — A USB cable can be plugged into this port for testing/configuration of the DSE 8610 MKII/MKII-U2 controller via a remote computer.

   Additionally, the various operating parameters (such as coolant temperature, oil pressure, etc.) of the engine are available to be viewed or changed.
9. **DSE8610 MKII/MKII-U2 Controller** — This controller allows the operator to start, stop and synchronize the generator, and if required, transfer the load to the generator either manually or automatically.

   Synchronizing and load-sharing features are included within the controller, along with the necessary protections for such a system. The user also has the capability to view the system operating parameters via the LCD display.

   In addition, the controller will monitor engine operating parameters, indicating the operational status and engine fault conditions. Engine fault conditions will automatically shut down the engine, and the indicated fault will be shown on the LCD screen.

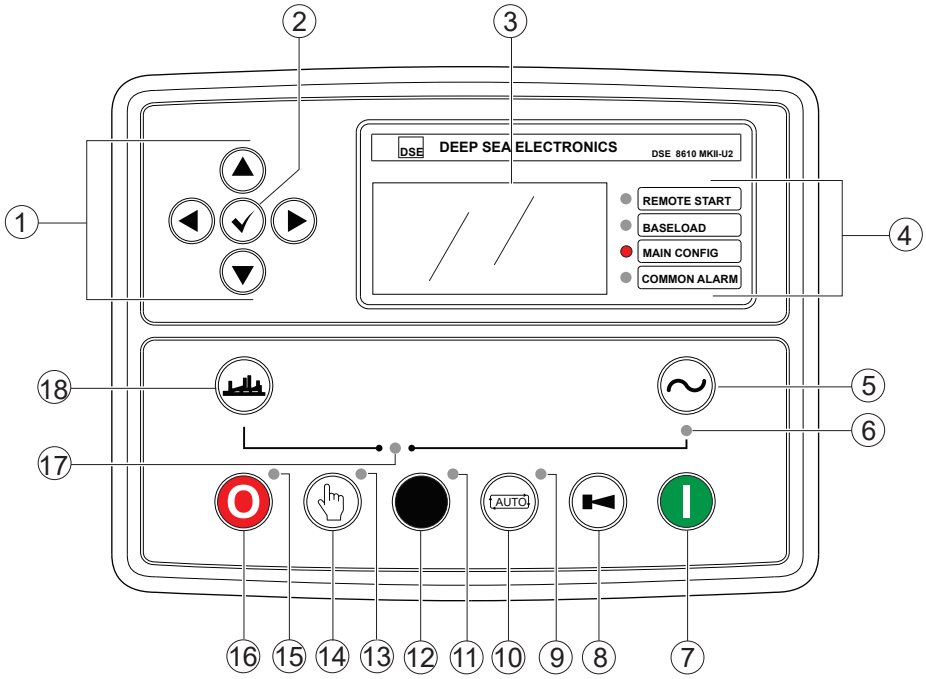


Figure 6. DSE8610 MKII/MKII-U2 Controller

The definitions below describe the controls and functions of the Deep Sea DSE8610 MKII/MKII-U2 controller (Figure 6).

1. **Arrow Pushbuttons** — Use these four buttons to navigate through the front panel display menus and modify settings.

   • Use the ***left*** and ***right*** arrow buttons to navigate through the menu levels. Press the right arrow button to move downward through the menu levels and press the left arrow button to move upward through the menu levels.

   • Use the ***up*** and ***down*** arrow buttons to move among items within a menu level. Press the down arrow button to move to items lower in the list. Press the up arrow button to move to items higher in the list.

   • During a settings editing session, use the up and down arrow buttons to raise and lower the value of the selected setting. The right and left arrow buttons move to different digits.

2. **Check Button** — When pressed, allows entry into the editor display menu. This pushbutton is used as a selection tool and to save changes.

3. **LCD Display** — This backlit display serves as the local information source for metering, alarms, pre-alarms, and protective functions. Display operation temperature is between –22°F to 122°F (−30°C to 50°C).

4. **Status LEDs** — These four status LEDs are user configurable.

5. **Close Contactor Button** — Controls the operation of the generator load switch and is only active in ***Manual Mode*** once the generator is available.

   Press the ***close contactor button*** when the generator is available and with no load applied to automatically command the generator to synchronize and apply the load. Close contactor output becomes active.

   If the generator bus is dead (no load) it will immediately close the contactor to connect the load. If the bus is already ***live*** and the MSE link is connected from another generator, it will first synchronize, then close its contactor, then slowly ramp up to share the load if a load is present. Further presses of the close generator button have no effect.

6. **Close Contactor LED** — Indicates contactor is **CLOSED**.

7. **Start Button** — Only active in the Stop/Reset and Manual modes. Pressing the Start button in Stop/Reset Mode powers up the engine's ECU but does not start the engine. This can be used to check the status of the CAN communication and to prime the fuel system.

   Press the **START** button in Manual Mode to start the generator and run it with no load applied.

8. **Alarm Mute/Lamp Test Button** — Press this button to silence the controller's audible alarm. If configured it will also disable the audible output. This button also functions as a lamp test and illuminates all of the LEDs on the controller's front panel.

9. **Auto Mode LED** — Indicates unit is in **AUTO** mode.

10. **Auto Mode Button** — This button places the controller into Auto Mode. This mode allows the controller to control the various functions of the generator automatically. The controller monitors numerous start requests via inputs on the Multi-Set Communications (MSC) link. The controller will initiate any start request automatically.

    While in **AUTO** mode the controller will be in standby awaiting a signal to start via the remote-start terminals. Closure of the auto-start contacts will immediately start the engine. Once the generator is up to speed and voltage it will compare its voltage to the bus.

    Once the generator is available, the controller automatically commands the generator to synchronize and apply the load. Close contactor output becomes active.

    Upon removal of the start signal, the controller starts the ***return delay timer*** and once expired, the load is automatically ramped down from the generator and then removed. Close contactor output becomes inactive. The generator then continues to run for the duration of the ***cooling timer*** until it stops. The controller then waits for the next start event.

11. **Spare LED** — User defined.

12. **Spare Button** — User defined.

13. **Manual Mode LED** — Indicates unit is in manual mode.

14. **Manual Mode Button** — Places the controller into ***manual mode***. Once in manual mode, the controller responds to the ***start button*** to start the generator and run it with no load applied.

    To run the generator with a load applied, use the ***close contactor*** button. Once the generator is stable, up to speed, and has the desired voltage, press the ***close contactor button*** to supply power to the load.

    During warmup or cool-down operations, when the engine is operating under no load, use the open contact button. The controller automatically ramps down the load from the generator and then removes load. Close contactor output becomes inactive.

15. **Stop/Reset Mode LED** — Indicates unit is in stop/reset mode.

16. **Stop/Reset Mode Button** — This button places the controller into ***Stop/Reset Mode***. This clears any alarm conditions for which the triggering criteria has been removed.

    If the engine is running and the ***Stop/Reset*** button is pressed, the controller commands the contactor to open and remove load. A ***five-minute*** cool-down period will begin, then the engine will shut down. To bypass the cool-down period, press the ***Stop/Reset*** button one more time.

17. **Open Contactor LED** — Indicates contactor is **OPEN**.

18. **Open Contactor Button** — Is only active in ***Manual Mode*** and allows the operator to open the generator load switch.

    Pressing the ***open contactor button*** when the generator has a load applied automatically ramps down the load from the generator and then removes the load. Close contactor output becomes inactive. Further presses of the open generator button have no effect.

OUTPUT TERMINAL PANEL

The Output Terminal Panel (Figure 7) shown below is located on the right-hand side (left from the control panel) of the generator. Lift up on the cover to gain access to receptacles and terminal lugs.

NOTICE

Terminal O is **neutral bonded** to the ground from the factory.

NOTICE

Output Terminal Bolt Torque: 554.9 lbf·in (62.7 N·m)

OUTPUT TERMINAL FAMILIARIZATION

The Output Terminal Panel is provided with the following:

- Three 240/120V Aux. Output Receptacles @ 50 amps
- Three Aux. Circuit Breakers @ 50 amps
- Two 120V GFCI receptacles @ 20 amps
- Two GFCI Circuit Breakers @ 20 amps
- Five Output Terminal Lugs (U, V, W, O, Ground)

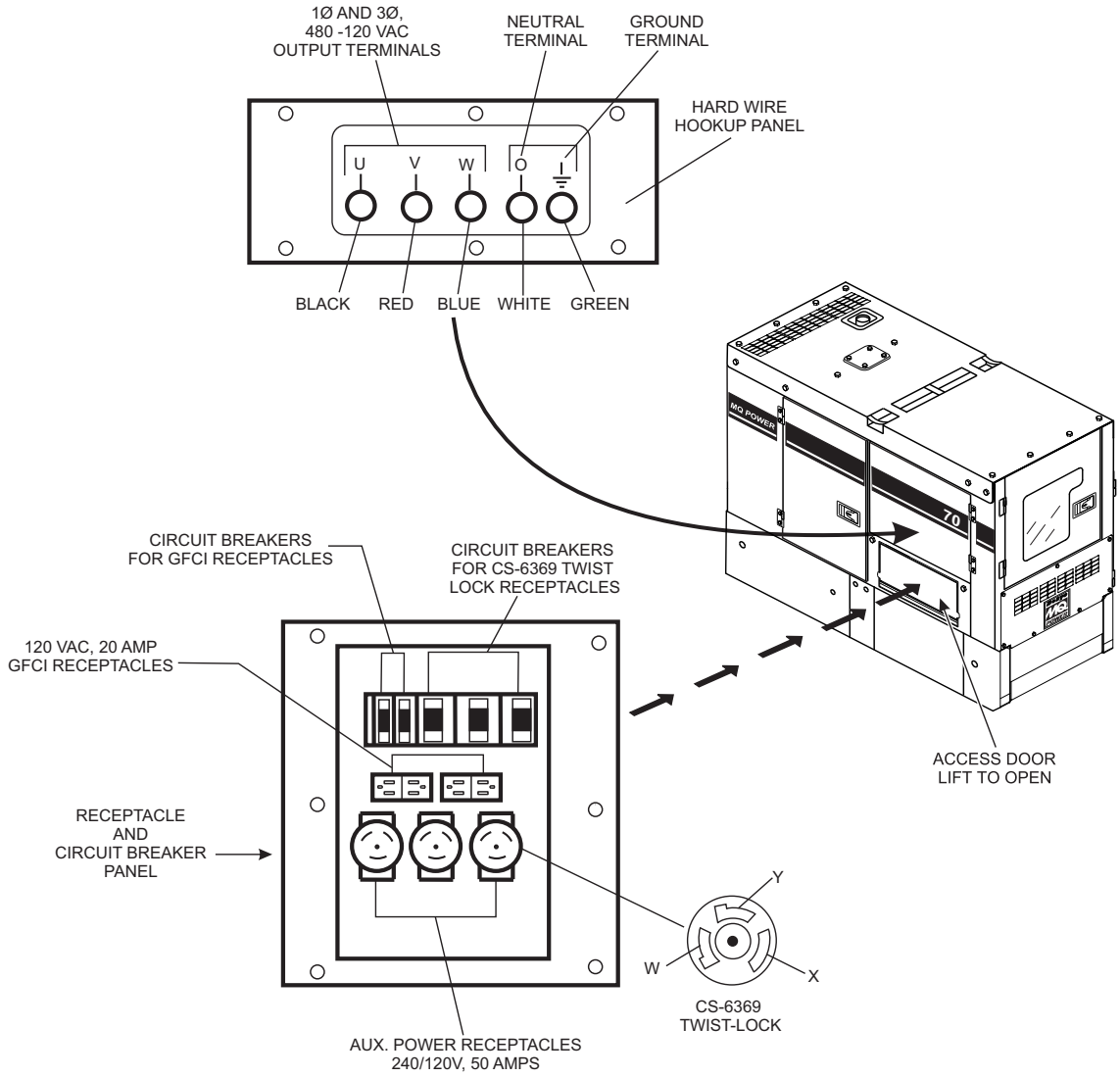


Figure 7. Output Terminal Panel

120 VAC GFCI Receptacles

NOTICE

It is recommended that the GFCI receptacles be tested when the generator is initially uncrated. The receptacles should then be tested daily at startup.

There are two 120 VAC, 20-amp GFCI (Duplex NEMA 5-20R) receptacles provided on the output terminal panel. These receptacles can be accessed in any ***voltage selector switch*** position. Each receptacle is protected by a 20-amp circuit breaker. These breakers are located directly above the GFCI receptacles. Remember the load output (current) of both GFCI receptacles is dependent on the load requirements of the U, V, and W output terminal lugs.

Press the **Reset button** (Figure 8) in the center of the GFCI receptacle to reset the receptacle after it has been tripped. Press the **Test button** to check the GFCI function. Both receptacles should be tested at least once a month. Refer to the Maintenance section in this manual for further testing of the GFCI receptacles.

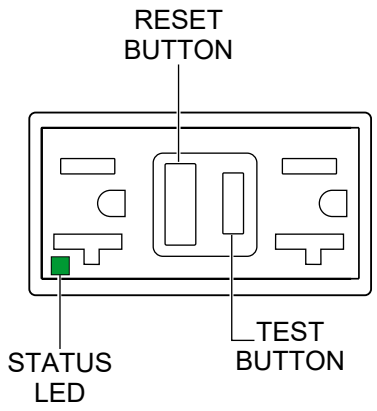


Figure 8. 120 VAC GFCI Receptacle

Twist-Lock Dual-Voltage 240/120 VAC Receptacles

There are three 240/120V, 50-amp, auxiliary twist-lock (CS-6369) receptacles (Figure 9) provided on the output terminal panel. These receptacles can **only** be accessed when the voltage selector switch is placed in the **single-phase 240/120V** position.

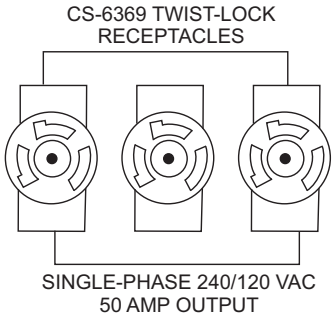


Figure 9. 240/120V Twist-Lock Auxiliary Receptacles

Each auxiliary receptacle is protected by a 50-amp circuit breaker. These breakers are located directly above the GFCI receptacles. Remember the load output (current) on both receptacles is dependent on the load requirements of the ***output terminal lugs***.

Removing The Plastic Face Plate (Hard Wire Hookup Panel)

The ***Output Terminal Lugs*** are protected by a plastic face plate cover (Figure 10). Unscrew the securing bolts and lift the plastic terminal cover to gain access to the terminal enclosure.

After the load wires have been securely attached to the terminal lugs, reinstall the plastic face plate.

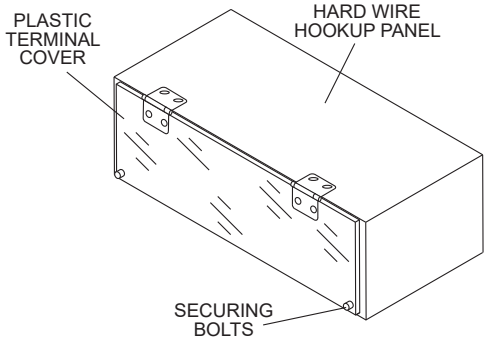


Figure 10. Plastic Face Plate (Output Terminal Lugs)

Connecting Loads

Loads can be connected to the generator via the output terminal lugs, cam-loks, or convenience receptacles (Figure 11). Make sure to read the operation manual before attempting to connect a load to the generator.

To protect the output terminals from overload, a 3-pole, 200-amp, **main** circuit breaker is provided. Make sure to switch **ALL** circuit breakers to the **OFF** position prior to starting the engine.

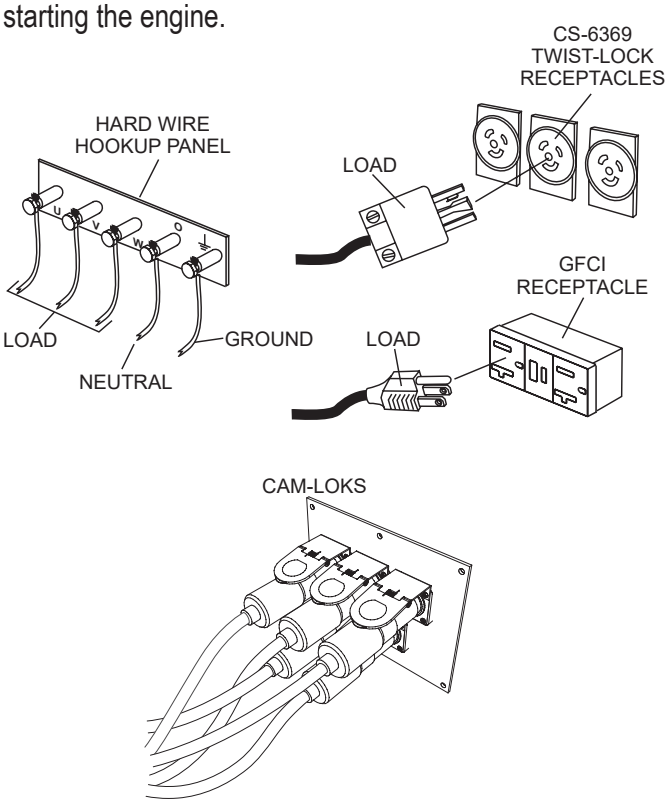


Figure 11. Connecting Loads

Overcurrent Relay

An **overcurrent relay** (Figure 12) is connected to the main circuit breaker. In the event of an overload, both the circuit breaker and the overcurrent relay may trip. If the circuit breaker can not be reset, the **reset button** on the overcurrent relay must be pressed. The overcurrent relay is located inside the control box.

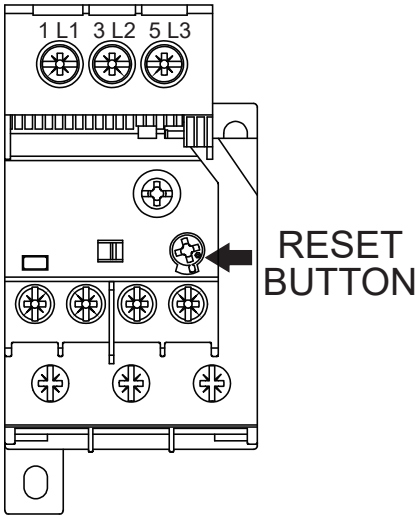


Figure 12. Overcurrent Relay

NOTICE

The **overcurrent relay** monitors the current flowing from the **U**,**V**, **and W output terminal lugs** to the load. In the event of a short circuit or overcurrent condition, it will automatically trip the 200-amp main circuit breaker.

To restore power to the **output terminal panel**, press the reset button on the overcurrent relay and place the **main** circuit breaker in the **closed (ON)** position.

SINGLE-PHASE LOAD

Always be sure to check the nameplate on the generator and equipment to ensure the wattage, amperage, frequency, and voltage requirements are satisfactorily supplied by the generator for operating the equipment.

Generally, the wattage listed on the nameplate of the equipment is its rated output. Equipment may require 130–150% more wattage than the rating on the nameplate, as the wattage is influenced by the efficiency, power factor and starting system of the equipment.

NOTICE

If wattage is not given on the equipment's nameplate, approximate wattage may be determined by multiplying nameplate voltage by the nameplate amperage.

WATTS = VOLTAGE × AMPERAGE

The power factor of this generator (single phase) is 1.0. See Table 5 below when connecting loads.

Table 5. Power Factor By Load

Type of Load	Power Factor
Single-phase induction motors	0.4–0.75
Electric heaters, incandescent lamps	1.0
Fluorescent lamps, mercury lamps	0.4–0.9
Electronic devices, communication equipment	1.0
Common power tools	0.8

Table 6. Cable Selection (60 Hz, Single-Phase Operation)

Current in Amperes	Load in Watts		Maximum Allowable Cable Length			
	At 120 Volts	At 240 Volts	#10 Wire	#12 Wire	#14 Wire	#16 Wire
2.5	300	600	1,000 ft.	600 ft.	375 ft.	250 ft.
5	600	1,200	500 ft.	300 ft.	200 ft.	125 ft.
7.5	900	1,800	350 ft.	200 ft.	125 ft.	100 ft.
10	1,200	2,400	250 ft.	150 ft.	100 ft.	
15	1,800	3,600	150 ft.	100 ft.	65 ft.	
20	2,400	4,800	125 ft.	75 ft.	50 ft.	
CAUTION: Equipment damage can result from low voltage.						

NOTICE

Cable selection table is a general guideline. **ALWAYS** consult local and national electrical codes when sizing cables.

THREE-PHASE LOAD

When calculating the power requirements for 3-phase power use the following equation:

$$KVA = \frac{VOLTAGE \times AMPERAGE \times 1.732}{1000}$$

NOTICE

If 3Ø load (kVA) is not given on the equipment nameplate, approximate 3Ø load may be determined by multiplying voltage by amperage by 1.732.

NOTICE

Motors and motor-driven equipment draw much greater current for starting than during operation.

An inadequately sized connecting cable which cannot carry the required load can cause a voltage drop which can burn out the appliance or tool and overheat the cable. See Table 6.

The power factor of this generator (3 phase) is 0.8.

- When connecting a resistance load such as an incandescent lamp or electric heater, a capacity of up to the generating set's rated output (kW) can be used.
- When connecting a fluorescent or mercury lamp, a capacity of up to the generating set's rated output (kW) multiplied by 0.6 can be used.
- When connecting an electric drill or other power tools, pay close attention to the required starting current capacity.
- When connecting ordinary power tools, a capacity of up to the generating set's rated output (kW) multiplied by 0.8 can be used.

DANGER

Before connecting this generator to any building's electrical system, a **licensed electrician** must install an **isolation (transfer) switch**. Serious damage to the building's electrical system may occur without this transfer switch.

PowerBalance® (Figure 13) is an optional load management solution that helps protect the engine generator from problems resulting from sustained low-load operations (defined as less than 30% of the generator full-load rating).

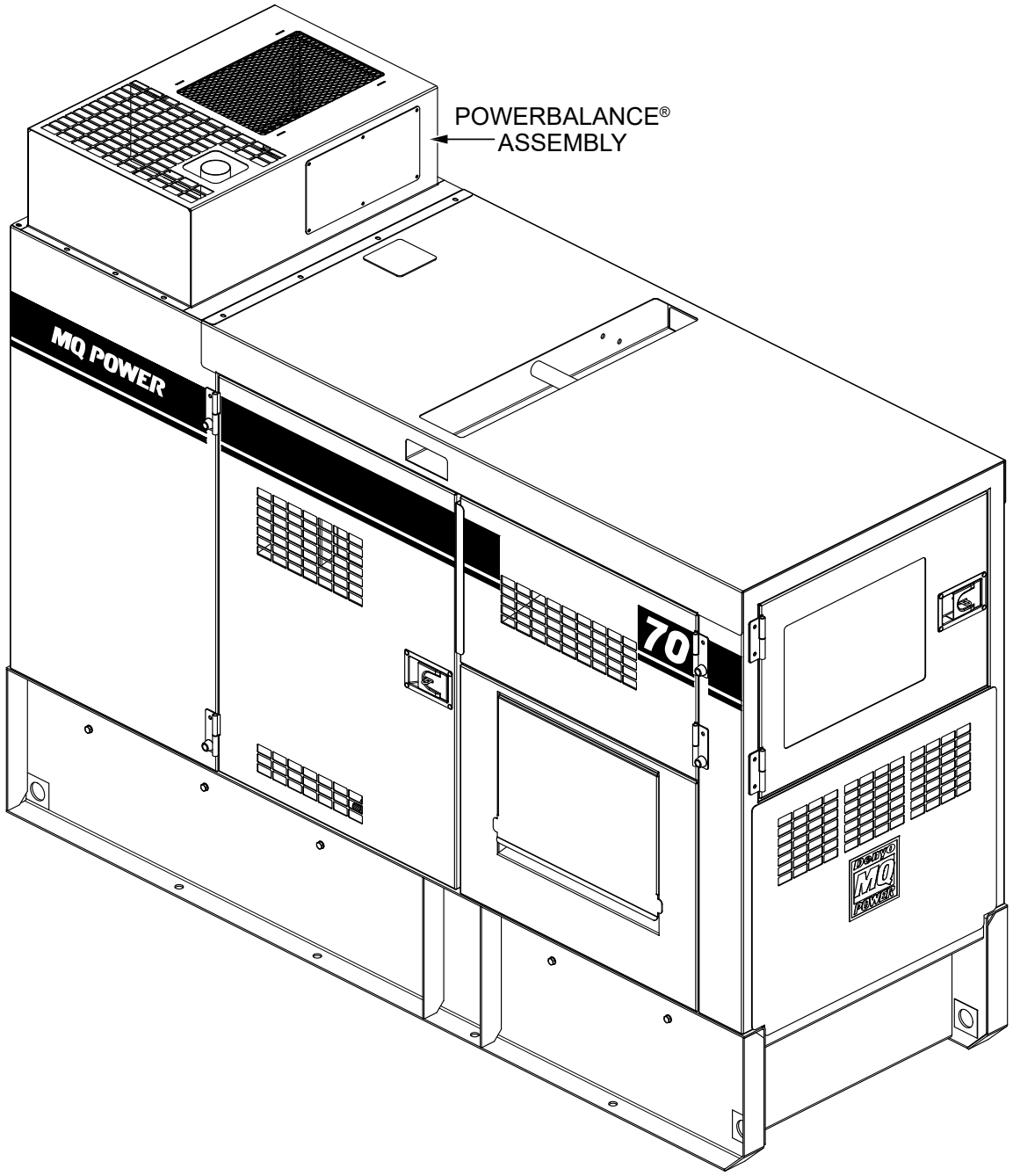


Figure 13. PowerBalance®

- PowerBalance® continuously monitors engine load. The load management controller senses and increases engine load automatically using resistive coils when the controller determines that the temperature and/or load is too low.
- When additional load demands are placed on the generator that bring it to an optimum level, PowerBalance® will automatically deactivate this additional load and remain ready for reactivation should exhaust temperatures drop.

GENERATOR OUTPUT VOLTAGES

A wide range of voltages are available to supply voltage for many different applications.

Table 7. Voltages Available

UVWO Output Terminal Lugs	Voltage Selector Switch 3-Phase 240/139V Position			Voltage Selector Switch 3-Phase 480/277V Position		
3Ø Line–Line	208V	220V	240V	416V	440V	480V
1Ø Line–Neutral	120V	127V	139V	240V	254V	277V
Voltage Selector Switch Single-Phase 240/120V Position						
1Ø Line–Neutral/ Line–Line	120V Line–Neutral	N/A	N/A	240V Line–Line	N/A	N/A

Voltage Selector Switch

Voltages are selected using the **voltage selector** switch (Figure 14) which is located above the output terminal panel's hard wire hook-up panel. This switch has been provided for ease of voltage selection.

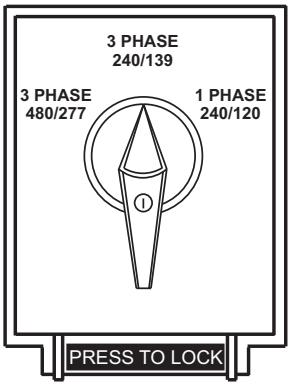


Figure 14. Voltage Selector Switch

⚠ CAUTION

NEVER change the position of the voltage selector switch while the engine is running. **ALWAYS** place the circuit breaker in the **OFF** position before selecting voltage.

Maximum Amps

Table 8 shows the **maximum** amps the generator can provide. **DO NOT** exceed the maximum amps as listed.

Table 8. Generator Maximum Amps

Rated Voltage	Maximum Amps
Single phase 120 volts	155.4 amps (4 wire) 168 amps × 2 (zigzag)
Single phase 240 volts	77.8 amps (4 wire) 168 amps (zigzag)
Three phase 240 volts	168 amps
Three phase 480 volts	84 amps
Main Line Circuit Breaker Rating	
200 amps	
Overcurrent Relay Trip Set Point (480V Mode Only)	
84 amps	

GFCI Receptacle Load Capability

The load capability of the GFCI receptacles is directly related to the voltage being supplied at either the output terminals or the three twist-lock auxiliary receptacles.

Table 9 and Table 10 show what amount of current is available at the GFCI receptacles when the output terminals and twist-lock receptacles are in use. Be careful that your load does not exceed the available current capability at the receptacles.

Table 9. 1Ø GFCI Receptacle Load Capacity

kW in Use Twist Lock (CS6369)	Available Load Current (Amps)
1Ø 240/120V	GFCI Duplex 5-20R 120V
40.4	0
39.2	5 amps/receptacle
38.0	10 amps/receptacle
36.8	15 amps/receptacle
35.6	20 amps/receptacle

Table 10. 3Ø Generator Maximum Amps

kVA in Use (UVWO Terminals)	Available Load Current (Amps)
3Ø 240/480V	GFCI Duplex 5-20R 120V
70.0	0 amps/receptacle
65.8	5 amps/receptacle
61.7	10 amps/receptacle
57.5	15 amps/receptacle
53.3	20 amps/receptacle

UVWO TERMINAL OUTPUT VOLTAGES

Various output voltages can be obtained using the UVWO output terminal lugs. The voltages at the terminals are dependent on the position of the **Voltage Selector Switch**.

NOTICE

ALWAYS make sure that the connections to the UVWO terminals are **secure** and **tight**. The possibility exists of arcing that could cause a fire. Torque tie bolts to 554.9 lbf·in (62.7 N·m).

3Ø-240V UVWO Terminal Output Voltages

1. Place the voltage selector switch in the 3Ø 240/139V position as shown in Figure 15.

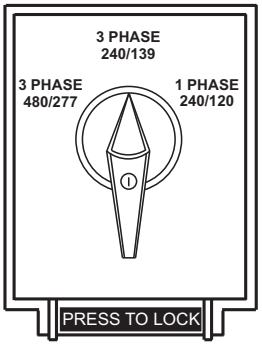


Figure 15. Voltage Selector Switch 3Ø-240/139V Position

2. Connect the load wires to the UVWO terminals as shown in Figure 16.

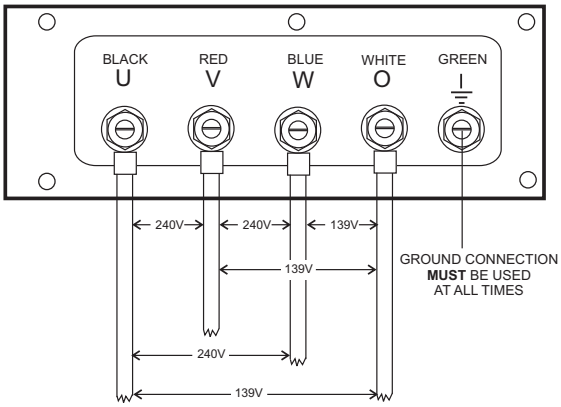


Figure 16. UVWO Terminal Lugs 3Ø-240/139V Connections

3Ø-208V/1Ø-120V UVWO Terminal Output Voltages

1. Place the voltage selector switch in the 3Ø 240/139V position as shown in Figure 15.
2. Connect the load wires to the UVWO terminals as shown in Figure 17.

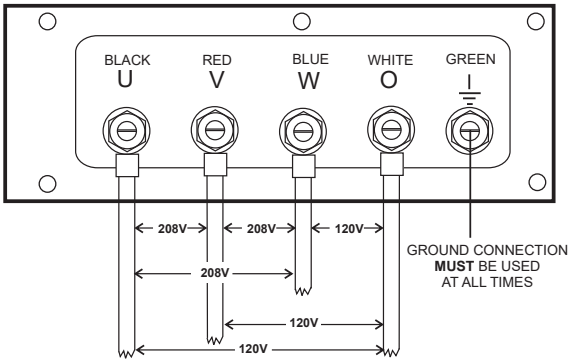


Figure 17. UVWO Terminal Lugs 3Ø-208/1Ø-120V Connections

NOTICE

To obtain 3Ø 208V output, the voltage selector switch must be in the 3Ø-240/139V position and the voltage must be adjusted to 208 volts on the digital controller.

3Ø-480/277V UVWO Terminal Output Voltages

1. Place the voltage selector switch in the 3Ø 480/277V position as shown in Figure 18.

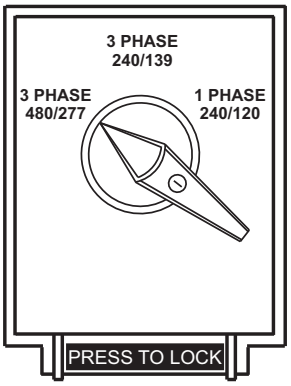


Figure 18. Voltage Selector Switch 3Ø-480/277V Position

2. Connect the load wires to the UVWO terminals as shown in Figure 19.

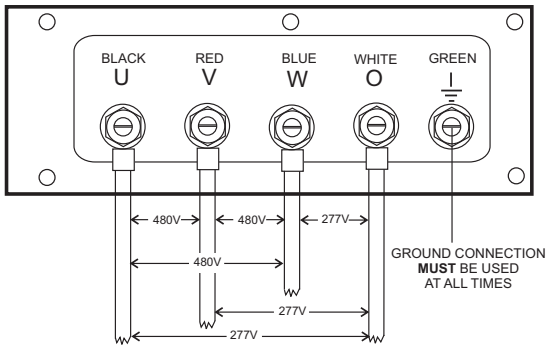


Figure 19. UVWO Terminal Lugs 3Ø-480V Connections

1Ø-240/120V UVWO Terminal Output Voltages

1. Place the voltage selector switch in the 1Ø 240/120V position as shown in Figure 20.

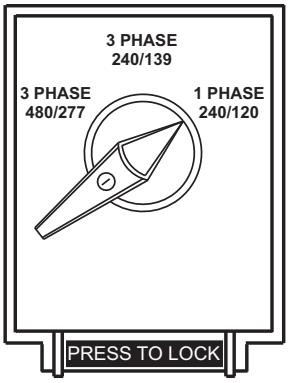


Figure 20. Voltage Selector Switch 1Ø-240/120V Position

2. Connect the load wires to the UVWO terminals as shown in Figure 21.

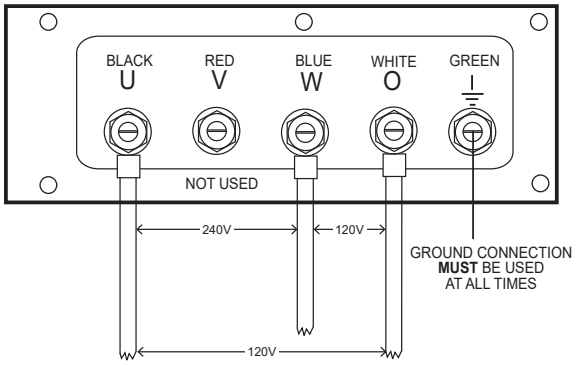


Figure 21. UVWO Terminal Lugs 1Ø-240/120V Connections

ENGINE OIL CHECK

1. To check the engine oil level, place the generator on secure, level ground with the engine stopped.
2. Remove the dipstick from its holder (Figure 22) and wipe it clean.

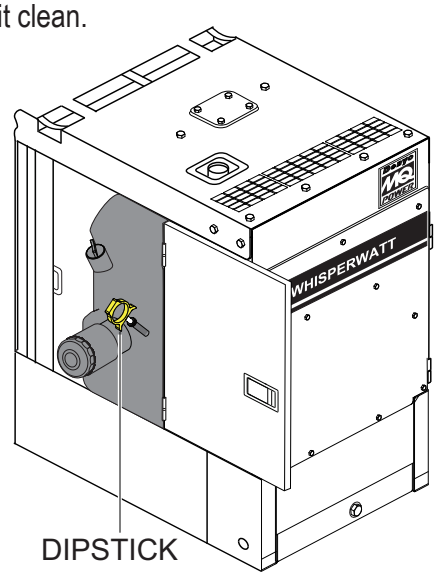


Figure 22. Engine Oil Dipstick

3. Reinsert the dipstick, then remove the dipstick from its holder. Check the oil level shown on the dipstick (Figure 23).

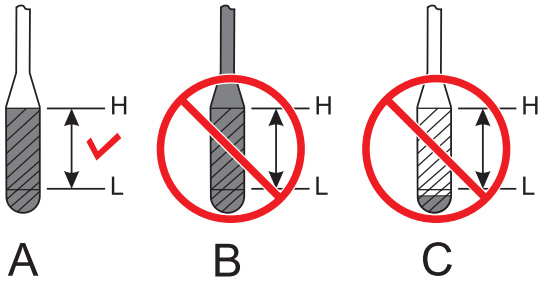


Figure 23. Engine Oil Level

4. Verify that the engine oil level is maintained between the **H** and **L** markings on the dipstick as shown in Figure 23**A**.
5. If the engine oil level is low (Figure 23**C**), remove the cap from the oil filler port (Figure 24) and fill to a safe operating level (max) as indicated by the dipstick (Figure 23**A**). Fill with recommended type oil as listed in Table 11. Maximum oil capacity is 15.8 quarts (15 liters).

NOTICE

When adding engine oil, **DO NOT** overfill (Figure 23**B**).

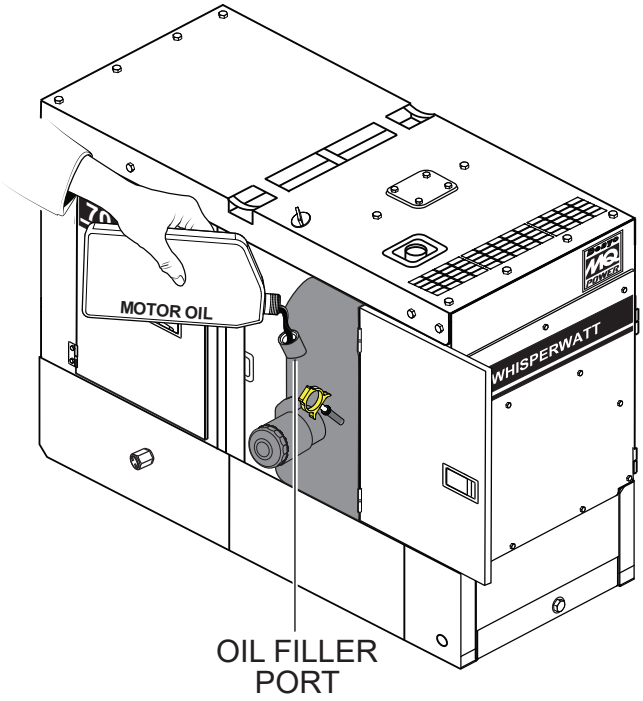
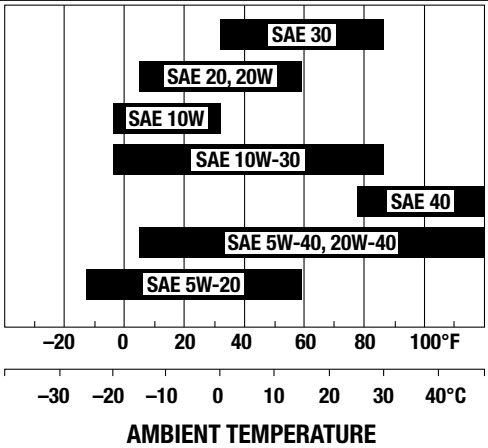


Figure 24. Engine Oil Filler Port

6. When checking the engine oil, be sure to check if the oil is clean. If the oil is not clean, drain the oil as described in the Maintenance section of this manual.
7. Allow enough time for any added oil to make its way to the oil pan before rechecking.

Table 11. Recommended Motor Oil



FUEL CHECK

DANGER

Fuel spillage on a **hot** engine can cause a **fire** or **explosion**. If fuel spillage occurs, wipe up the spilled fuel completely to prevent fire hazards. **NEVER** smoke around or near the generator. **ALWAYS** shut down the engine prior to cleaning up any spilled fuel.

NOTICE

ALWAYS check the DEF tank level when adding fuel.

Refilling The Fuel System

NOTICE

DO NOT refuel while the engine is running.

CAUTION

ONLY properly trained personnel who have read and understand this section should refill the fuel tank system.

ALWAYS fill the fuel tank (Figure 25) with clean, fresh **#2 diesel fuel**. **DO NOT** fill the fuel tank beyond its capacity.

Pay attention to the fuel tank capacity when replenishing fuel. The fuel tank cap must be closed tightly after filling. Handle fuel in a safety container. If the container does not have a spout, use a funnel. Wipe up any spilled fuel immediately.

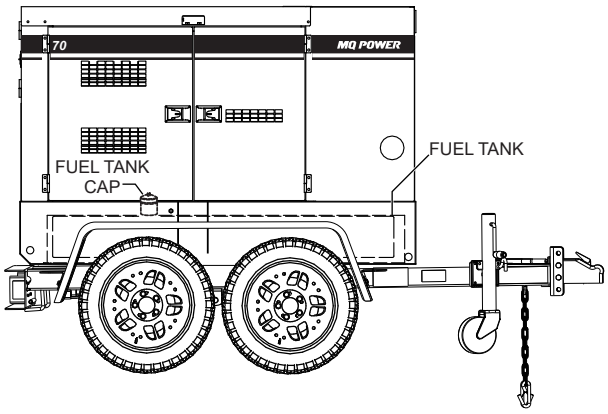


Figure 25. Fuel Tank

REFUELING PROCEDURE

WARNING

Diesel fuel and its vapors are dangerous to your health and the surrounding environment. Avoid inhalation of fumes and contact with skin.

1. **Level Tanks** — Make sure fuel cells are level with the ground. Failure to do so will cause fuel to spill from the tank before reaching full capacity (Figure 26).

CAUTION

ALWAYS place the trailer on firm, level ground before refueling to prevent spilling and to maximize the amount of fuel that can be pumped into the tank.

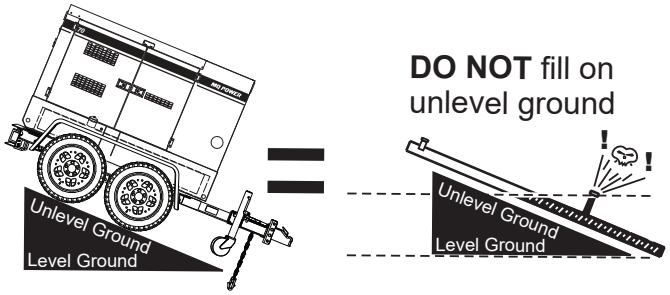


Figure 26. Only Fill On Level Ground

NOTICE

ONLY use **#2 diesel fuel** when refueling.

2. Open cabinet doors on the "right side" of the generator (from the generator control panel position). Remove the fuel cap and fill the tank (Figure 27).

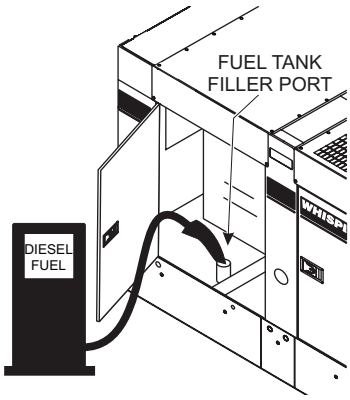


Figure 27. Fueling The Generator

3. **NEVER overfill the fuel tank.** When refueling, **DO NOT** wait for fuel to rise inside the filler neck (Figure 28). Leave room for fuel expansion. Fuel expands when heated (Figure 29).

Figure 28. Full Fuel Tank

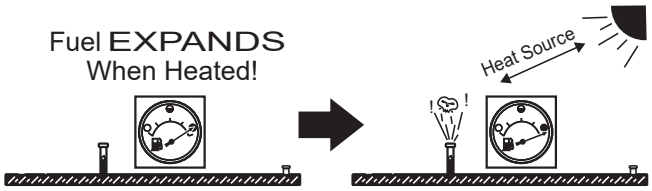


Figure 29. Fuel Expansion

DIESEL EXHAUST FLUID

Diesel exhaust fluid (DEF) is an aqueous solution made with 32.5% high-purity urea (carbamide) and 67.5% deionized water. DEF is used as a consumable in selective catalytic reduction (SCR) in order to lower NO_x concentration from diesel exhaust emissions.

ALWAYS check the DEF level when refueling. Before initial start-up, completely fill the DEF tank with DEF fluid. **DO NOT** overfill.

DEF Refilling

NOTICE

ONLY fill the DEF tank with ***diesel exhaust fluid***. Any other type of fluid may cause severe engine damage.

1. Make sure the engine is **OFF**.
2. Remove the cap from the DEF tank filler port (Figure 30).

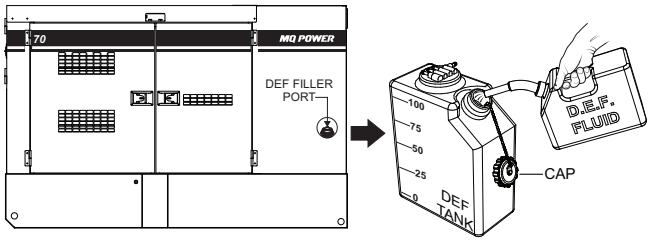


Figure 30. Filling The DEF Tank

3. Add diesel exhaust fluid to the tank. **DO NOT** overfill.
4. Reinstall the DEF tank cap. Tighten securely.

DEF Refilling (Continuous Operation)

It is recommended to ***shut down the engine*** prior to refilling the DEF tank. However, in special applications where shutdown is not possible, it is recommended to **ONLY** refill the DEF tank when the fluid level has been consumed down to 50%.

The DEF level sending unit requires a gradual DEF level decrease during continuous operation to validate proper operation. Failure of this sensor to report the decrease could result in an engine shutdown. An engine service technician would be required to remedy the shutdown.

COOLANT (ANTIFREEZE/SUMMER COOLANT/WATER)

Isuzu recommends antifreeze/summer coolant for use in their engines, which can be purchased in concentrate (and mixed with 50% demineralized water) or pre-diluted. See the **Isuzu Engine Owner's Manual** for further details.

WARNING

If adding coolant/antifreeze mix to the radiator, **DO NOT** remove the radiator cap until the unit has completely cooled. The possibility of **hot!** coolant exists which can cause severe burns.

Day-to-day addition of coolant is done from the reserve tank. When adding coolant to the radiator, **DO NOT** remove the radiator cap until the unit has completely cooled. See Table 12 for engine, radiator, and reserve tank coolant capacities.

Table 12. Coolant Capacity

Engine and Radiator	5.5 gal. (21 liters)
Reserve Tank	0.29 gal. (1.1 liters)

NOTICE

Normally, only the coolant level in the reserve tank needs to be checked. However, the radiator cap should be opened once a week to verify that coolant is visible (full) inside the radiator.

Verify that the coolant level in the coolant reserve tank is between the **FULL** and **LOW** markings as shown in Figure 31.

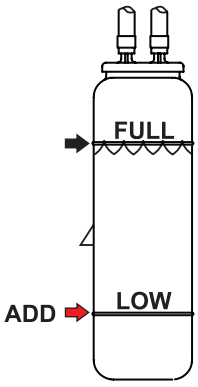


Figure 31. Coolant Reserve Tank

Operation In Freezing Weather

When operating in freezing weather, be certain the proper amount of antifreeze (Table 13) has been added.

Table 13. Coolant Concentration

Climate	Outside Temperature	Long-Life Coolant Concentration
Warm	10°F (–12°C) or Above	30%
Cold	–22°F (–30°C) or Above	50%

Cleaning The Radiator

The engine may overheat if the radiator cooling fins (Figure 32) become overloaded with dust or debris. Periodically clean the radiator fins with compressed air. Cleaning inside the machine is dangerous, so clean only with the engine turned off and the **negative** battery terminal disconnected.

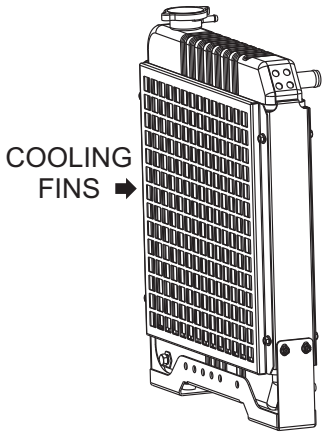


Figure 32. Radiator (Cooling Fins)

ENGINE AIR CLEANER

Periodic cleaning/replacement of the engine air cleaner is necessary. Inspect the air cleaner (Figure 33) in accordance with the Maintenance section of this manual or the **Isuzu Engine Owner's Manual**.

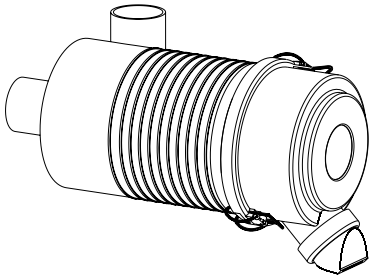


Figure 33. Engine Air Cleaner

FAN BELT TENSION

A slack fan belt may contribute to overheating, or to insufficient charging of the battery. Inspect the fan belt for damage and wear and adjust it in accordance with the maintenance section of this manual or the **Isuzu Engine Owner's Manual**.

The fan belt tension is proper if the fan belt bends 0.17–0.20 in. (4.2–5.0 mm) when pressed with the thumb as shown in Figure 34.

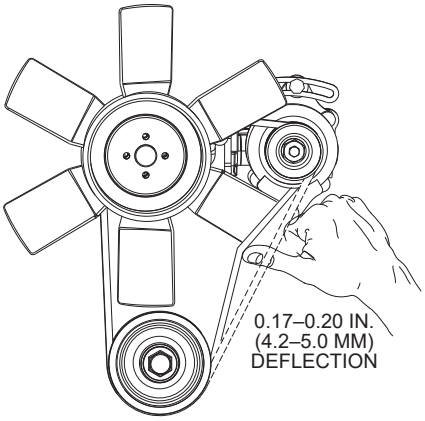


Figure 34. Fan Belt Tension

Table 14. Fan Belt Deflection

Belt	Standard Value (Amount of Deflection)	Standard Value (Vibration Frequency)
New	0.17–0.20 in. (4.2–5.0 mm)	220–244 Hz
Used	0.26–0.29 in. (6.6–7.4 mm)	182–206 Hz

⚠ CAUTION

NEVER place hands near the belts or fan while the generator set is running.

BATTERY

This unit is of negative ground. **DO NOT** connect in reverse. Always maintain battery fluid levels between the specified marks. Battery life will be shortened if the fluid levels are not properly maintained. Add only distilled water when replenishment is necessary.

DO NOT overfill. Check to see whether the battery cables are loose. Poor contact may result in poor starting or malfunctions. **ALWAYS** keep the terminals firmly tightened. Coat the terminals with an approved battery terminal treatment compound. Replace the battery with only the recommended type battery. The battery type used in this generator is BCI Group 27.

The battery is sufficiently charged if the specific gravity of the battery fluid is 1.28 (at 68°F). If the specific gravity should fall to 1.245 or lower, it indicates that the battery is dead and needs to be recharged or replaced.

Before charging the battery with an external electrical source, be sure to disconnect the battery cables.

Battery Cable Installation

ALWAYS be sure the battery cables (Figure 35) are properly connected to the battery terminals as shown below. The **red cable** is connected to the positive terminal of the battery, and the **black cable** is connected to the negative terminal of the battery.

⚠ CAUTION

ALWAYS disconnect the negative terminal **FIRST** and reconnect the negative terminal **LAST**.

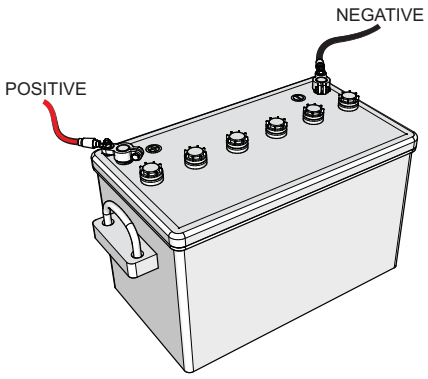


Figure 35. Battery Connections

When connecting the battery do the following:

1. **NEVER** connect the battery cables to the battery terminals while the **Control Power switch** is in the **ON** position. **ALWAYS** make sure that this switch is in the **OFF** position when connecting the battery.
2. Place a small amount of battery terminal treatment compound around both battery terminals. This will ensure a good connection and will help prevent corrosion around the battery terminals.

NOTICE

If the battery cables are connected incorrectly, electrical damage to the generator will occur. Pay close attention to the polarity of the battery when connecting the battery.

NOTICE

Inadequate battery connections may cause poor starting of the generator or other malfunctions.

ALTERNATOR

The polarity of the alternator is negative grounding type. When an inverted circuit connection takes place, the circuit will be in short circuit instantaneously resulting in alternator failure.

DO NOT put water directly on the alternator. Entry of water into the alternator can cause corrosion and damage the alternator.

WIRING

Inspect the entire generator for bad or worn electrical wiring or connections. If any wiring or connections are exposed (insulation missing) replace wiring immediately.

PIPING AND HOSE CONNECTIONS

Inspect all piping, oil hose, and fuel hose connections for wear and tightness. Tighten all hose clamps and check hoses for leaks.

If any fuel or oil hose lines are defective, replace them immediately.

GENERATOR START-UP PROCEDURE (MANUAL MODE)

BEFORE STARTING

⚠ CAUTION

The engine's exhaust contains harmful emissions. **ALWAYS have adequate ventilation when operating.** Direct exhaust away from nearby personnel.

⚠ WARNING

NEVER manually start the engine with the **main, GFCI or auxiliary** circuit breakers in the **ON** (closed) position.

1. Place the **main**, **auxiliary**, **and GFCI** circuit breakers (Figure 36) in the **OFF** position prior to starting the engine.

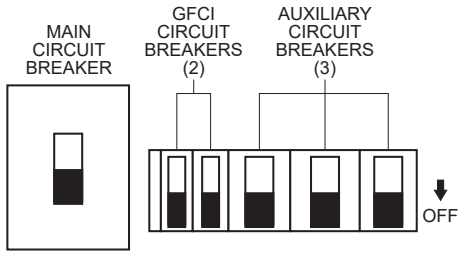


Figure 36. Main, Auxiliary, And GFCI Circuit Breakers (OFF)

2. Connect the load to the **receptacles** or the **output terminal lugs** as shown in Figure 11. These load connection points can be found on the output terminal panel and the output terminal panel's hard wire hookup panel.

NOTICE

ALWAYS make sure that the connections to the UVWO terminals are **secure** and **tight**. The possibility exists of arcing that could cause a fire. Torque tie bolts to 554.9 lbf·in (62.7 N·m).

3. Close all engine enclosure doors (Figure 37).

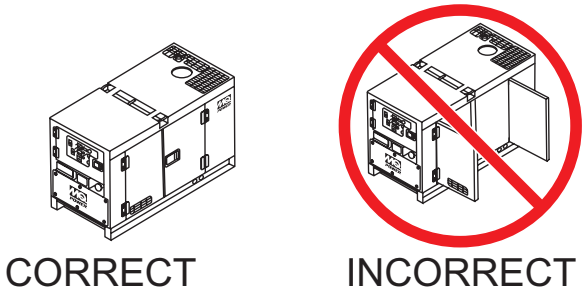


Figure 37. Engine Enclosure Doors

STARTING (MANUAL)

1. Place the main circuit breaker in the **ON** position.

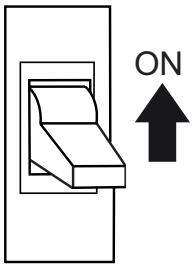


Figure 38. Main Circuit Breaker (ON)

2. Make sure the ***voltage selector switch*** has been configured for the desired output voltage.

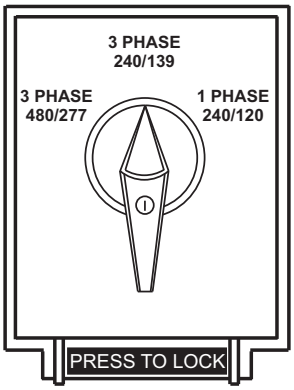


Figure 39. Voltage Selector Switch

3. Place the ***control power switch*** (Figure 40) on the control panel in the **ON** position (UP) and allow the controller to boot up.

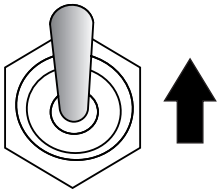


Figure 40. Control Power Switch (ON)

4. On the digital controller, press the **OFF** and **CHECK** buttons simultaneously to enter the ***configuration*** display menu.

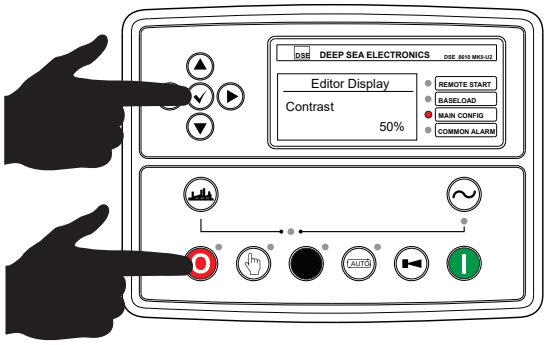


Figure 41. OFF/Check Buttons

5. Press the right arrow ***once*** to access the **"Alt Config Menu"**.

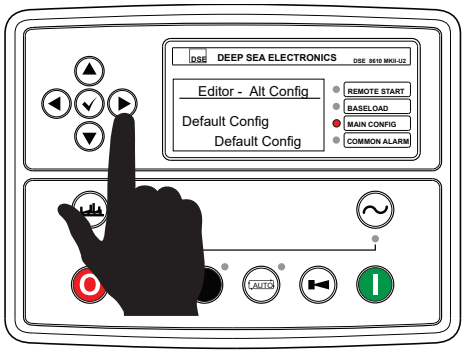


Figure 42. Alt Config Menu

6. Verify that the **"VOLTAGE CONFIG"** screen (Figure 43) is displayed.

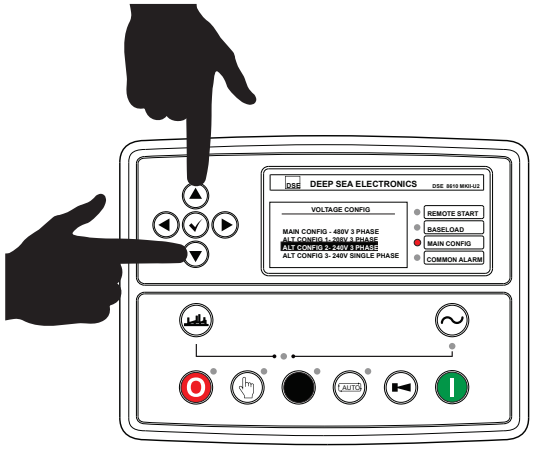


Figure 43. Voltage Config Screen

7. Use the **UP/DOWN** arrows (Figure 43) to select the desired output voltage.

8. Verify that the selected voltage being displayed on the Voltage Config screen (Figure 43) is the same voltage indicated by the voltage selector switch (Figure 39).

9. If the voltages do not agree, select the voltage that is indicated by the voltage selector switch.

10. When the two voltage settings are the same, press the **CHECK** button (Figure 44) to enter the selection.

Figure 44. Check Button

11. Press the **MANUAL** button (Figure 45) on the controller.

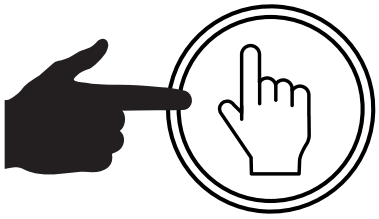


Figure 45. Manual Mode Button

12. Press the **START** button (Figure 46) and verify that the engine has started.

Figure 46. Start Button (Manual Mode)

> ***NOTICE***
>
> If the engine fails to start within 3 attempts, a warning on the controller will be displayed. Refer to the Troubleshooting section of this manual to correct the problem.

13. After starting, allow the engine to ramp up to rated speed. Allow the safety delay countdown sequence to finish. Once the countdown sequence has been completed, the generator is available for use.

> ***NOTICE***
>
> In cold weather conditions, let the engine idle longer before use.

14. Listen for any abnormal noises. If any abnormalities exist, shut down the engine and correct the problem. Also, check the generator for any fluid leaks and the controller display for any possible errors.
15. Make sure the ***voltage*** and ***frequency*** are set to the desired setting.
16. Press the contactor **CLOSE** button (Figure 47).

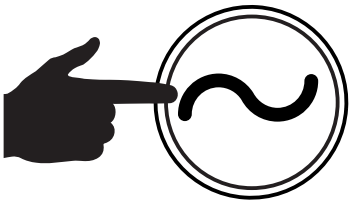


Figure 47. Contactor Close Button (Manual Mode)

17. Verify that the contactor **CLOSED** lamp (Figure 48) is lit **(RED)**.

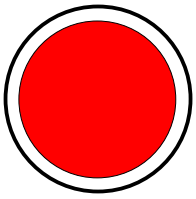


Figure 48. Contactor Closed Lamp

18. Verify that the ***main status screen*** (Figure 49) is displayed.

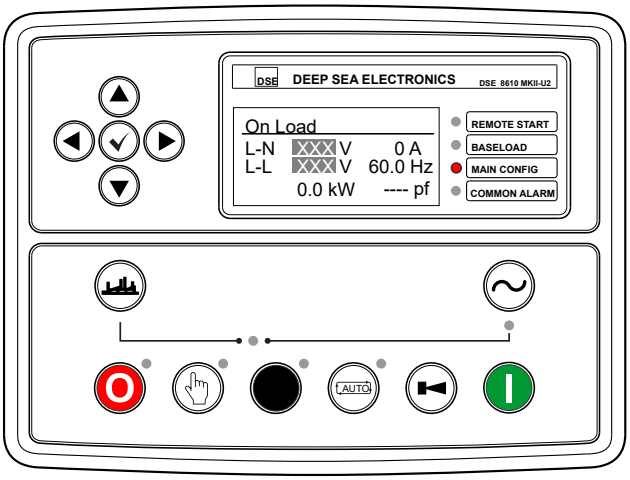


Figure 49. Main Status Screen

Frequency Verification

Press the ***right arrow button twice*** and verify that the "Generator" screen is displayed, then press the ***down arrow button three times*** and verify that the 60-cycle output frequency is displayed in **HERTZ** as shown in Figure 50.

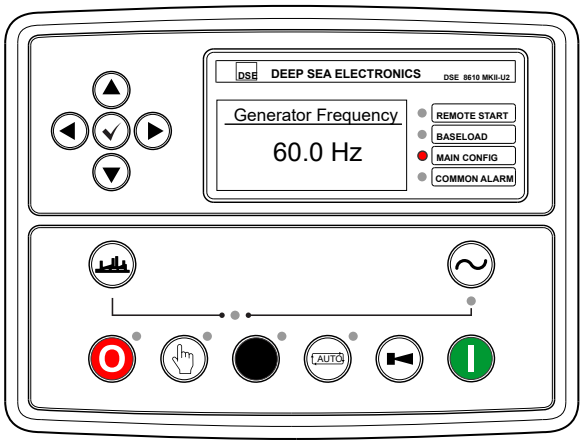


Figure 50. Frequency Screen

Voltage Verification

From the main status screen, press the ***right arrow button twice*** and verify that the "Generator" screen is displayed, then press the ***down arrow button one time*** and verify that the generator's voltage output is displayed in **VOLTS** as shown in Figure 51.

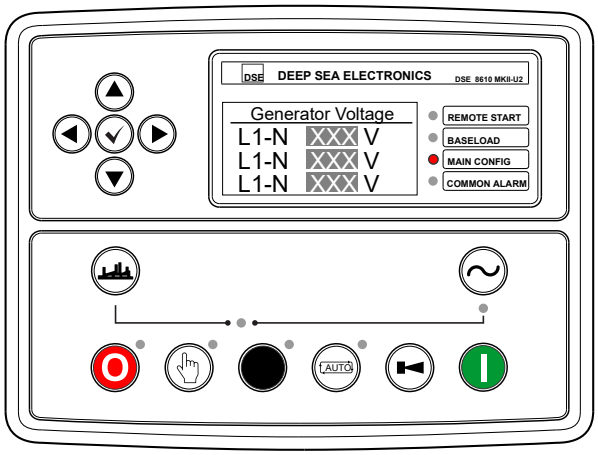


Figure 51. Output Voltage Screen

Load Current Verification

From the main status screen, press the ***right arrow button twice*** and verify that the "Generator" screen is displayed, then press the ***down arrow button four times*** and verify that the generator's load current screen is displayed in **AMPS** as shown in Figure 52.

> ***NOTICE***
>
> The load current value (Figure 52) will indicate **zero amps** with no load applied. When a load is applied, the value on the LCD screen will indicate the amount of current that the load is drawing from the generator.

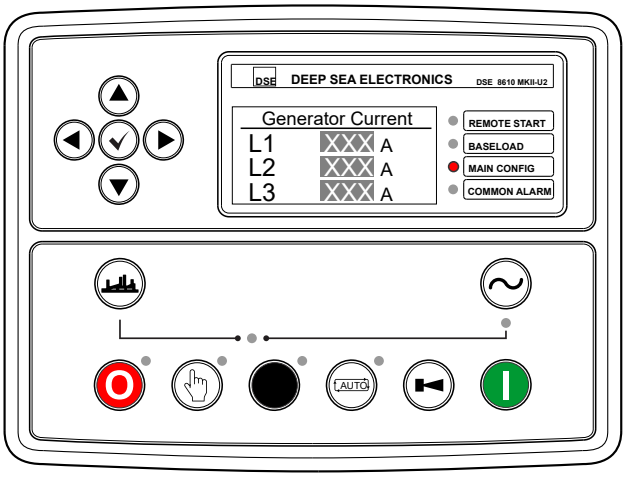


Figure 52. Output Current Screen (Load)

Engine Oil Pressure Verification

From the main status screen, press the ***right arrow button once*** and verify that the "Engine" screen is displayed, then press the ***down arrow button twice*** and verify that the engine's oil pressure screen is displayed as shown in Figure 53.

Under normal operating conditions, the engine oil pressure reading should be between 42.1 and 85.6 psi (290–590 kPa).

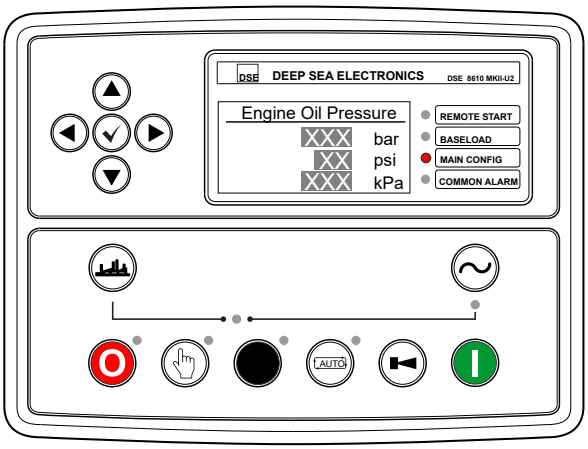


Figure 53. Engine Oil Pressure Screen

Engine Coolant Temperature Verification

From the main status screen, press the ***right arrow button once*** and verify that the "Engine" screen is displayed, then press the ***down arrow button three times*** and verify that the engine's coolant temperature screen is displayed as shown in Figure 54.

Under normal operating conditions, the engine coolant temperature should be between 167°–194°F (75°–90°C).

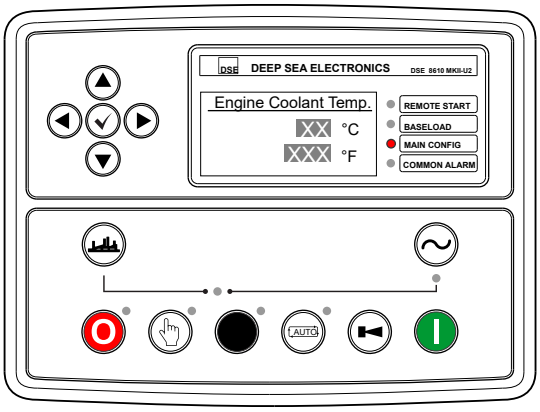


Figure 54. Engine Coolant Temperature Screen

Engine Speed Verification

From the main status screen, press the ***right arrow button once*** and verify that the "Engine" screen is displayed, then press the ***down arrow button one time*** and verify that the engine's speed screen is displayed as shown in Figure 55.

Under normal operating conditions, engine speed is approximately 1,800 rpm.

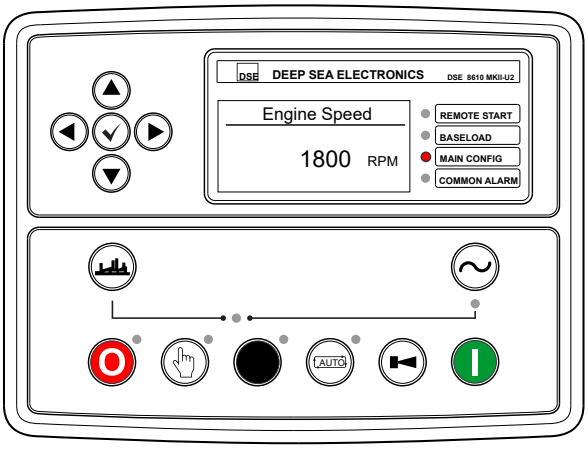


Figure 55. Engine Speed Screen

Engine Fuel Level Verification

From the main status screen, press the ***right arrow button once*** and verify that the "Engine" screen is displayed, then press the ***down arrow button six times*** and verify that the engine's fuel level screen is displayed as shown in Figure 56.

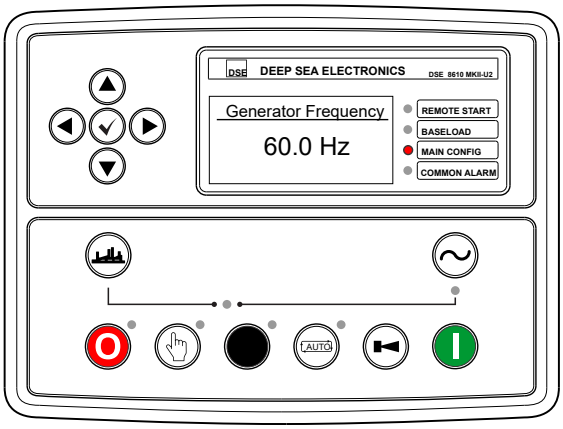


Figure 56. Engine Fuel Level Screen

DEF Level Verification (If Applicable)

From the main status screen, press the ***right arrow button once*** and verify that the "Engine" screen is displayed, then press the ***down arrow button sixteen times*** and verify that the engine's DEF tank level screen is displayed as shown in Figure 57.

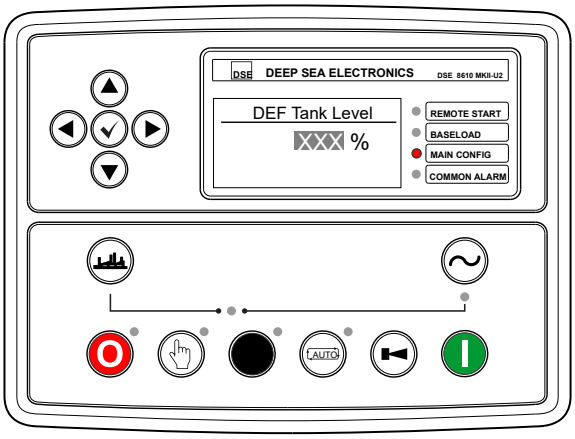


Figure 57. Engine DEF Tank Level Screen

Alarm Screen

From the main status screen, press the ***right arrow button four times*** and verify that the "Alarm" screen is displayed.

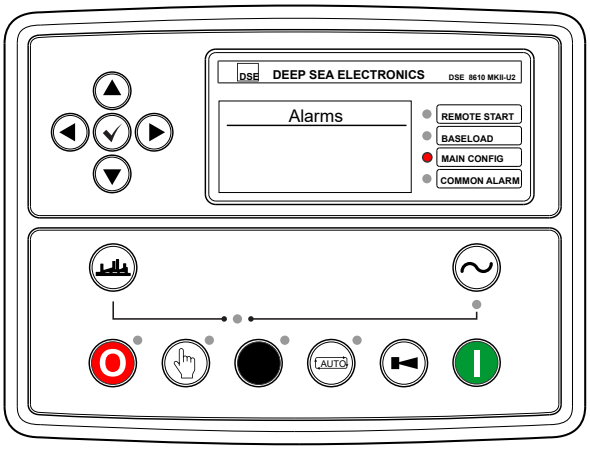


Figure 58. Alarm Screen

Additional Engine Operating Parameters

From the main status screen, press the ***right arrow button once*** and verify that the "Engine" screen is displayed.

Additional engine parameters such as the ones shown below can be accessed by pressing the ***down arrow button***.

- Battery Voltage
- Engine Run Time
- Engine Inlet Temperature
- Engine Fuel Temperature
- Engine Turbo Pressure
- Engine Fuel Pressure
- Engine Percent Torque
- Inter-Cooler Temperature
- Atmospheric Pressure
- Electrical Potential
- Percent Heat Status

Auxiliary/GFCI Circuit Breakers

1. Place ***auxiliary*** and ***GFCI*** circuit breakers in the **ON** position (Figure 59).

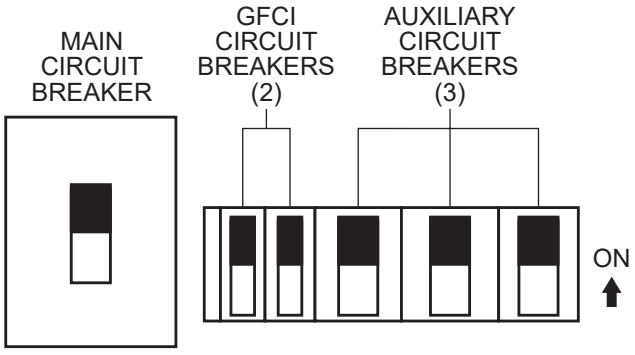


Figure 59. Auxiliary And GFCI Circuit Breakers (ON)

2. The generator will run until manually stopped or an abnormal condition occurs.

STARTING (AUTO MODE)

DANGER

Before connecting this generator to any building's electrical system, a **licensed electrician** must install an **isolation (transfer) switch.** Serious damage to the building's electrical system may occur without this transfer switch.

WARNING

When operating the generator in **AUTO** mode, remember that the generator can start up at any time without warning. **NEVER** attempt to perform any maintenance while the generator is in Auto mode.

NOTICE

When connecting the generator to an isolation (transfer) switch, **ALWAYS** have power applied to the generator's internal battery charger. This will ensure that the engine will not fail due to a dead battery.

NOTICE

When the generator is set to **AUTO** mode, the generator will **automatically start** in the event of commercial power falling below a prescribed level by means of a contact closure that is generated automatically by a transfer switch.

NOTICE

When the generator is placed in **AUTO** mode, the engine glow plugs will be warmed and the engine will start automatically.

When starting the generator in **AUTO** mode, use the "Manual Start-Up" procedure except where noted (see below).

1. Perform steps 1 through 3 in the "Before Starting" section and steps 1 through 3 in the "Manual Starting" section.
2. Press the **AUTO** button (Figure 60) on the controller.

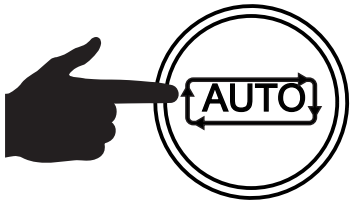


Figure 60. Auto Button

3. Once in **AUTO** mode, the controller monitors the auto-start contacts awaiting a closure. A closed contact signal will start the engine, automatically closing the contactor. Refer to Figure 48.

   If an open contact signal is transmitted this will cause the engine to shut down and the **OPEN** contactor lamp will be lit **(GREEN)**.

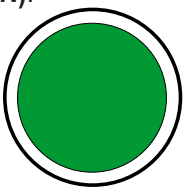


Figure 61. Contactor Open Lamp

4. Continue operating the generator as outlined in the Manual Start-Up procedure (start at step 15).

NORMAL SHUTDOWN PROCEDURE

WARNING

NEVER stop the engine suddenly except in an emergency.

To shut down the generator, use the following procedure:

1. Place the load's **ON/OFF** switch in the **OFF** position.
2. Press the **contactor OPEN** button (Figure 62).

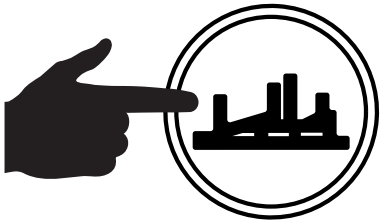


Figure 62. Contactor Open Button

3. Verify that the **OPEN** contactor lamp (Figure 63) is lit **(GREEN)**.

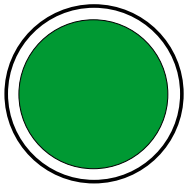


Figure 63. Contactor Open Lamp

4. Place the **main**, **auxiliary**, **and GFCI circuit breakers** in the **OFF** position as shown in Figure 64.

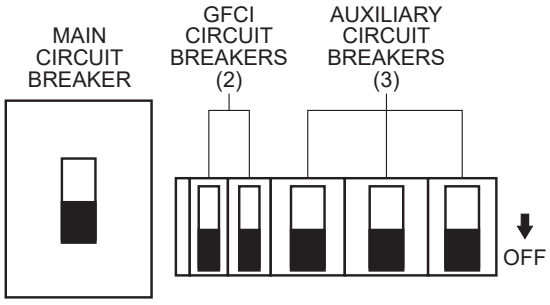


Figure 64. Main, Auxiliary, And GFCI Circuit Breakers (OFF)

5. With no load applied, allow the engine to cool down for 5 minutes.
6. Press the **OFF** button (Figure 65) to shut down the generator.

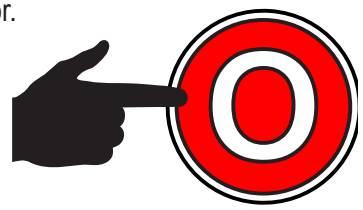


Figure 65. Off Button (Manual Mode)

7. Remove all loads from the generator.
8. Allow adequate time for cooling, then inspect the entire generator for any damage or loosening of components that may have occurred during operation.

EMERGENCY SHUTDOWN PROCEDURE

NOTICE

The Emergency Stop switch should only be used to stop the engine in case of an emergency or to lock out operation during service. The emergency stop switch should **NEVER** be used for routine stopping of the engine.

1. To stop the engine in the event of an emergency, press the **Emergency Stop switch** (Figure 66). Activating the Emergency Stop switch will cause the contacts on the main breaker to **OPEN**.

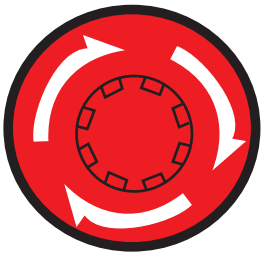


Figure 66. Emergency Stop Switch

2. The emergency stop switch is a push-locked type switch. The switch contact can only be released by rotating the button in the clockwise direction. The engine can not be restarted until the contact is released ***(closed)***.

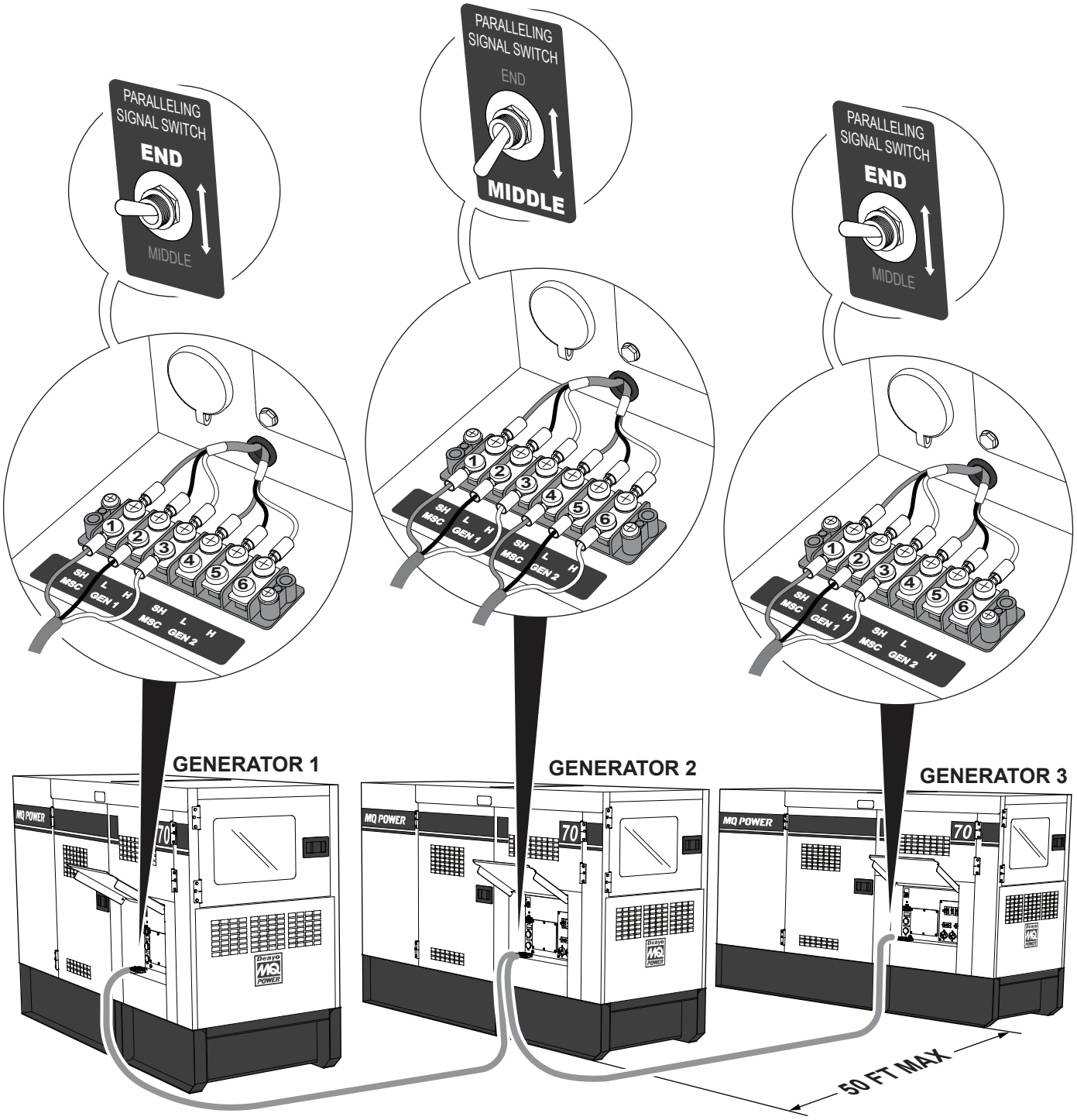


Figure 67. MSC Communication Cable Connections (Three Or More Generators)

MANUAL PARALLEL OPERATION (2 OR MORE UNITS)

NOTICE

To ensure stable operation of multiple generator units connected in parallel and working as one unit, it is necessary to maintain equal voltage, frequency, and engine governor characteristics between them.

For this reason, it is necessary to perform parallel operation using generator units with identical alternator pitch and brand-compatible controllers. **Therefore, using multiple units of the same model generator for paralleling is recommended.**

NOTICE

If the preset voltage (set on the voltage selector switch) is different between the paralleling units, the main circuit breakers **will not turn on**.

Preparation

NOTICE

Make sure the engines of all generator units in the system are turned **OFF** before connecting the units.

1. Make sure the spacing between each generator output terminal panel does not exceed **50 ft. (15.14 m)**. Refer to Figure 67.
2. For parallel operation, a Multi-Set Communication (MSC) cable must be connected between the generators being paralleled.
3. Connect the ***three wires*** from the MSC cable between the generators in accordance with Figure 67 and Table 15 via the 6-position terminal block located on the output terminal panel.
4. Continue connecting all remaining generators in the same manner, until all of the generators in the system are connected via the MSC cable.

Table 15. MSC Cable Connections

CONNECTIONS		GENERATOR 2 Terminal #					
		1	2	3	4	5	6
GENERATOR 1 Terminal #	1	SH					
	2		L (BLK)				
	3			H (WHT)			
	4						
	5						
	6						
GENERATOR 3 Terminal #	1				SH		
	2					L (BLK)	
	3						H (WHT)
	4						
	5						
	6						

5. For the two outermost generators, place the parallel signal switch (Figure 68) in the **END** position.

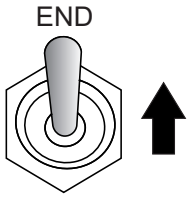


Figure 68. Parallel Signal Switch (End)

6. For the innermost generator(s), place the parallel signal switch (Figure 69) in the **MIDDLE** position.

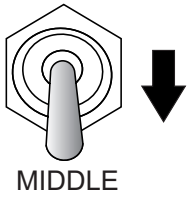


Figure 69. Parallel Signal Switch (Middle)

7. Connect the **output terminals** on each paralleled unit to the load using properly sized power cables.

8. Place the ***control power switch*** (Figure 70) on the control panel to the **ON** position (UP) and allow the controller to boot up.

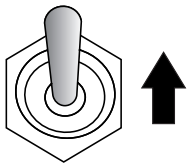


Figure 70. Control Power Switch

9. Make sure the ***voltage selector switch*** has been configured for the desired output voltage.

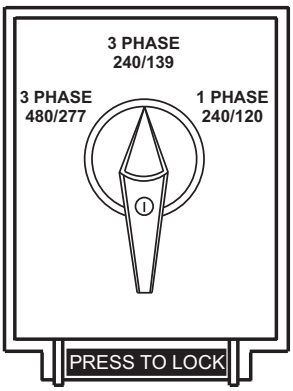


Figure 71. Voltage Selector Switch

10. From the **"Alt Config Menu"** (Figure 42), verify that the **"VOLTAGE CONFIG"** screen (Figure 72) is displayed.

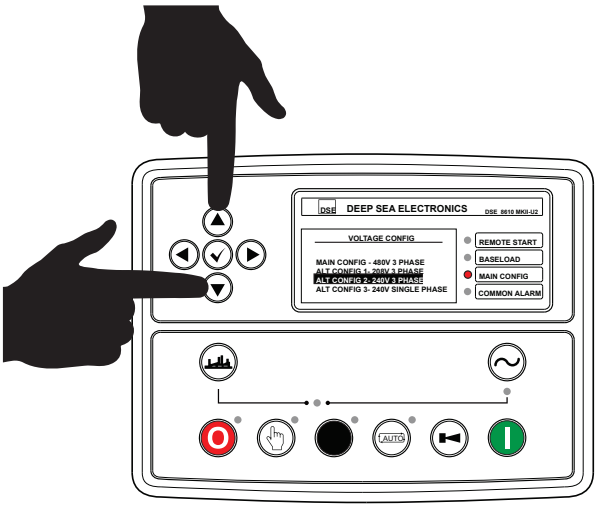


Figure 72. Voltage Config Screen

11. Verify that the selected voltage being displayed on the Voltage Config Screen (Figure 72) is the same voltage indicated by the voltage selector switch (Figure 71).

12. If the voltages do not agree, select the voltage that is indicated by the voltage selector switch.

13. When the two voltage settings are the same, press the **CHECK** button (Figure 73) to enter the selection.

Figure 73. Check Button

14. Operate the generator as outlined in the "Manual Starting Procedure" referencing steps 9 through 13.

15. Repeat steps 7 through 13 in this section for all remaining generators.

16. On generator #1, press the close contactor button.

17. On generator #2, press the close contactor button and verify that the initializing synchroscope screen (Figure 74) is displayed as it closes the contactor.

18. Repeat step 17 for all remaining generators.

19. Allow all generators to synchronize. This synchronization process will be repeated for all remaining generators.

20. Shut down the generators as described in the “Normal Shutdown Procedure” section.

SYNCHROSCOPE

Initially the synchroscope screen shows the difference between the bus and generator supplies. Figure 74 indicates a frequency mismatch of +0.9 Hz and a voltage mismatch of +0.2 V.

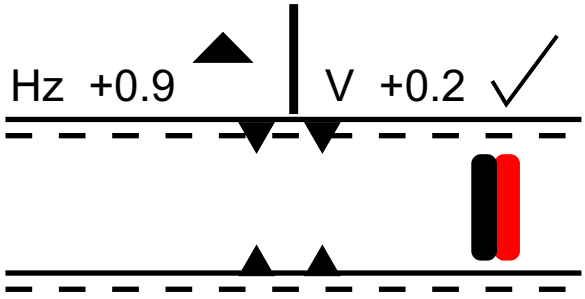


Figure 74. Frequency/Voltage Mismatch

Figure 74 also indicates that the generator frequency is ***too high*** as shown by the arrow mark and must be reduced. The voltage is high, but is within the limits set for synchronizing, indicated by the check mark.

When both the frequency and the voltage differences are within acceptable limits, the phase matching begins (Figure 75). The ***moving bar*** shows the phase difference between the two supplies. The engine speed is automatically adjusted, altering the phase until the moving bar enters the center of the scope (Figure 76).

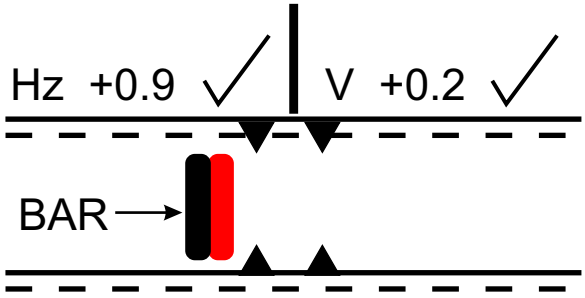


Figure 75. Phase Matching Initialization

The engine speed is automatically adjusted, altering the phase until the moving bar enters the center of the scope (Figure 76).

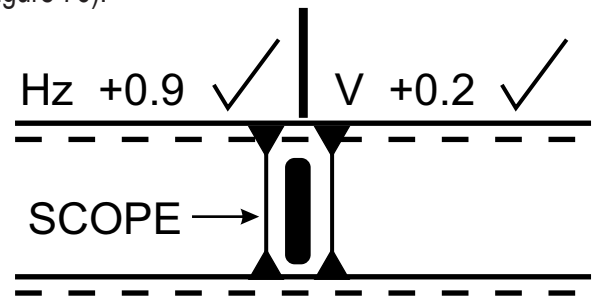


Figure 76. Frequency/Voltage In Sync

AUTO PARALLEL OPERATION (2 OR MORE UNITS)

1. Operate the generator as outlined in the “Manual Starting Procedure” referencing steps 1 through 5.
2. Verify that the ***auto-start contacts*** on all generators are jumpered as shown in Figure 77. If the auto-start contacts are not jumpered, ***add jumper wire***.

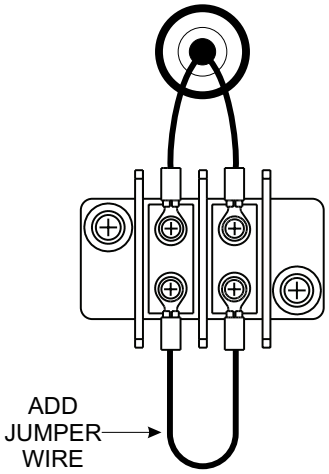


Figure 77. Auto-Start Contacts (Jumpered)

3. Press the **CHECK** button to enter the ***editor*** display menu (Figure 78).

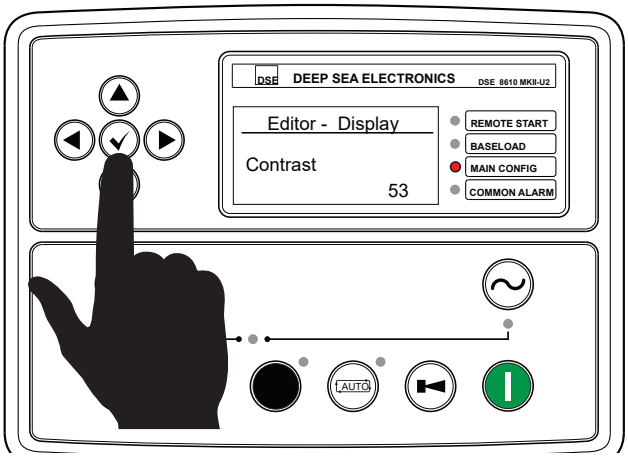


Figure 78. OFF/Check Buttons

4. Using the down arrow button, scroll down to the ***load demand priority*** page (Figure 79).

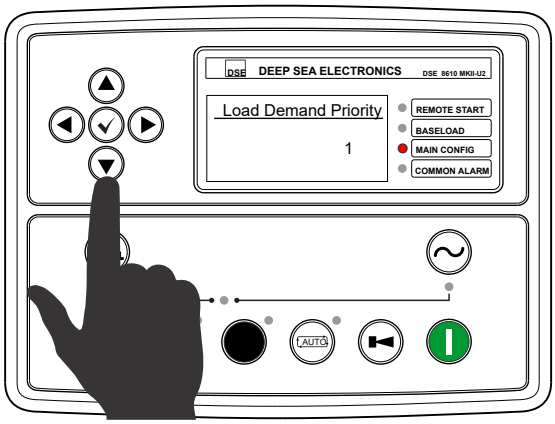


Figure 79. Load Priority Page

5. On generator #1 (master), set the priority to 1 (Figure 79). On generator #2, set the priority to 2. Repeat this procedure for all the remaining generators.

6. To exit, press the check button (Figure 80).

Figure 80. Check Button

7. Press the **AUTO** button (Figure 81) on ***all*** controllers in the system.

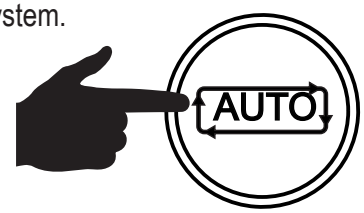


Figure 81. Auto Button

8. Priority 1, generator #1 (master) will start and close the contactor. The remaining generators will start and sync automatically based on power (load) demand.

9. Prior to opening the auto-start contacts, shut down the generators as described in the "Normal Shutdown Procedure" section.

10. Remove the auto-start jumper wire (Figure 77).

Table 16. Inspection/Maintenance		10 Hours or Daily	Every 250 Hours	Every 500 Hours or 12 Months	Every 3,000 Hours or 36 Months	Other
Engine	Check Engine Oil and Coolant Levels	X				
	Check Fuel Filter/Water Separator Bowl	X				
	Check Air Cleaner/Element	X				
	Clean Air Cleaner/Element		X			
	Check for Leaks/Hoses/Clamps	X				
	Check for Loosening of Parts	X				
	Change Engine Oil and Oil Filter * [1]		X			
	Clean Unit, Inside and Outside		X			
	Replace Fuel Filter Elements			X		
	Check Engine Mounts			X		
	Service Battery			X		
	Check Air Intake Hoses			X		
	Check Fan Belt Condition (Replace if Necessary)	X				
	Check Automatic Belt Tensioner	X		X		
	Check Electrical Ground Connection			X		
	Clean Radiator, Check Cooling System			X		
	Coolant Solution Analysis, Add SCAs as Required			X		
	Pressure Test Cooling System			X		
	Check Engine Speed			X		
	Test Thermostats				X	
	Check and Adjust Engine Valve Clearance					1,000 hr.
	Test Glow Plugs				X	
	Replace DEF Filter (In Supply Module)					3,000 hr.
	Check SCR System*[2]					4,500 hr.
	Inspect Dosing Module (SCR System)					4,500 hr.
	Flush and Refill Cooling System*[3]					1 yr. or 2,000 hr.
	Clean Inside of Fuel Tank					1,000 hr.
	Clean DEF Tank					As Required
	Replace Air Cleaner Elements *[4]					As Required
Generator	Measure Insulation Resistance Over 3M Ohms		X			
	Check Rotor Rear Support Bearing			X		
Complete Machine	Inspect Acoustic Insulation			X		

*1 During initial operation of a new engine, change oil and filter between a minimum of 100 hours and a maximum of 250 hours. Service interval depends on type of oil.

*2 Perform inspection and maintenance of urea SCR system every 4,500 hours. The system does not need to be replaced/exchanged if no problem is found. Do not make any modifications or changes, nor remove the emission control system and related parts. Please contact your nearest dealer or Multiquip Service Department for SCR maintenance.

*3 Use fully formulated antifreeze/coolant.

*4 Replace primary air filter element when restriction indicator shows a vacuum of 635 mm (25 in. H_20).

*5 Add “Supplemental Coolant Additives” (SCAs) to recharge the engine coolant.

*6 Accumulation of carbon (soot, unburned fuel) in the exhaust pipe line and muffler could cause not only system derates but also could lead to fire incident. To destroy the soot and unburned fuel, run the unit at rated power for some period of time until the exhaust gas becomes mostly colorless every 250 hours of operation time. The carbon will be easier to be generated when the unit operates at less than 30% of rated power. In this case, perform the above procedures at a shorter interval time.

*7 Applying a large load at one time to the unit when carbon deposits have accumulated in the exhaust system could produce fire/sparks which could lead to abnormal combustion. Therefore it is recommended to ***appy the load gradually*** and observe the exhaust gas color (colorless) during the process.

*8 Fire or sparks may emit from the exhaust gas outlet during the ***carbon emission accumulation check*** (load). Make sure the area surrounding the unit is free from any ***flammable*** material.

GENERAL INSPECTION

Prior to each use, the generator should be cleaned and inspected for deficiencies. Check for loose, missing or damaged nuts, bolts or other fasteners. Also check for fuel, oil, and coolant leaks. Use Table 16 as a general inspection and maintenance guideline. For more detailed engine maintenance instructions, refer to the engine owner's manual.

ENGINE AIR CLEANER

The air cleaner (Figure 82) provided with this Isuzu diesel engine is equipped with a replaceable, high-density, paper air filter element. The air cleaner is also equipped with an inner (secondary) element that is used as a backup filter should the primary element become damaged. Check the air cleaner daily or before starting the engine. Replace the air cleaner as needed.

NOTICE

If the engine is operating in very dusty or dry grass conditions, a clogged air cleaner will result. This can lead to a loss of power, excessive carbon buildup in the combustion chamber, and high fuel consumption. Change the air cleaner more frequently if these conditions exist.

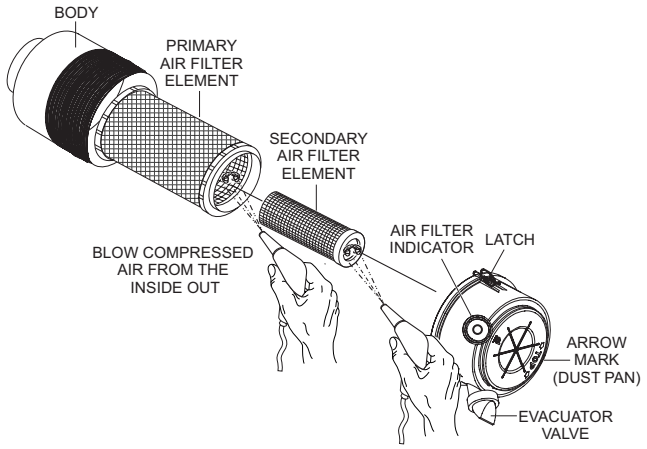


Figure 82. Engine Air Cleaner

Primary And Secondary Air Cleaner Elements

Every 250 hours: Remove the air cleaner elements and clean them with a light spray of compressed air.

⚠ CAUTION

Wear protective equipment such as approved safety glasses or face shields and dust masks or respirators when cleaning air filters with compressed air.

1. Release the latches (Figure 82) that secure the cover to the air cleaner body.
2. Remove the air cleaner cover (Figure 82) and set it aside.
3. Remove both the primary and secondary air cleaner elements (Figure 82).
4. Check for and correct heavy buildup of dirt and debris along with loose or damaged components.

NOTICE

Operating the engine with loose or damaged air cleaner components could allow unfiltered air into the engine causing premature wear and failure.

5. To clean the primary element (paper air filter) as shown in Figure 82, tap the filter element several times on a hard surface to remove dirt, or blow compressed air, not to exceed 30 psi (207 kPa, 2.1 kgf/cm^2), through the filter element from the inside out.
6. Clean the secondary element (paper air filter) as described in step 5.
7. Replace both elements if they are damaged or excessively dirty.
8. Clean the inside of the air cleaner body (Figure 82).
9. Reinstall the primary and secondary air filter elements back into the air cleaner body.
10. Reinstall the air cleaner cover and secure with latches.

NOTICE

DO NOT run the engine with the air cleaner removed or without an element.

Air Cleaner Restriction Indicator

The air cleaner is equipped with a **restriction indicator** (Figure 83). As the air cleaner element becomes clogged, air intake restriction increases and the indicator signal shows **RED**, indicating that the element needs to be replaced. After replacing the air cleaner element, press the restriction indicator button to reset the indicator.

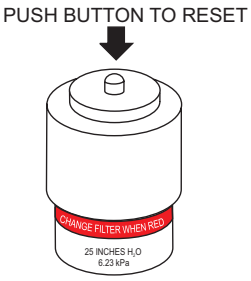


Figure 83. Air Cleaner Restriction Indicator

NOTICE

The air cleaner element should not be changed until the indicator displays **RED**. Dispose of the old element. It cannot be cleaned or reused.

ENGINE FUEL FILTER

Inspect the engine fuel filter daily. If the fuel filter has collected a significant amount of water and sediment at the bottom of the cup, it should be drained off immediately.

Draining The Fuel Filter

1. Loosen the air bleeder plug (Figure 84) on the fuel filter body.

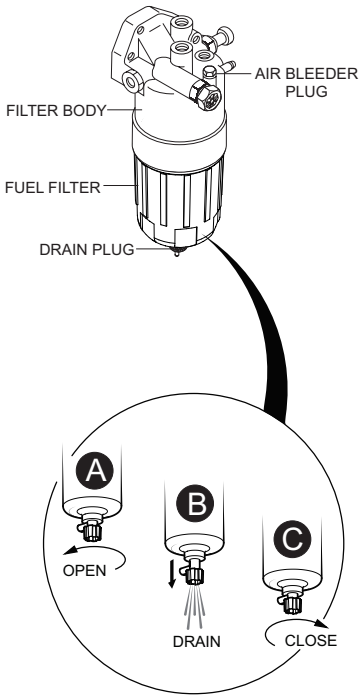


Figure 84. Draining The Fuel Filter

2. To discharge the fuel inside the fuel filter, **OPEN** the drain valve on the fuel filter by turning the knob ***counterclockwise*** (Figure 84**A**) approximately 3½ turns until the valve drops down 1 inch (25.4 mm) and draining occurs (Figure 84**B**).
3. Let the residue or foreign substances inside the case flow into a suitable container.
4. At completion of draining, **CLOSE** the drain valve (Figure 84**C**).

Fuel Filter Element Replacement

1. Use a filter wrench to remove the element case (Figure 85) from the fuel filter body.

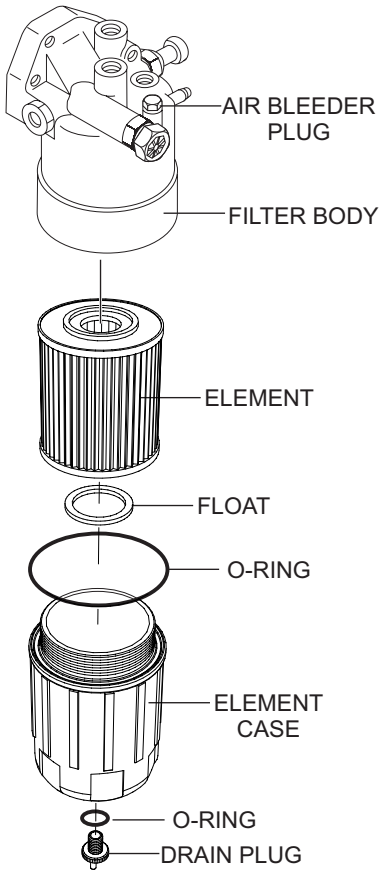


Figure 85. Fuel Filter Replacement

2. Wipe the inside of the filter body with a clean cloth to remove any foreign matter or debris that may have accumulated.
3. Insert the new fuel filter element into the element case.
4. Replace both O-rings. Coat each O-ring with a small amount of clean 15W-40 engine oil.
5. Reinstall the element case first by hand until it makes contact with the fuel filter body surface.
6. Torque the element case to 22.4 lbf·ft (30 N·m).
7. Torque the drain plug to 1.4 lbf·ft (2.0 N·m).
8. Remove the air from the fuel system. Refer to the Isuzu Owner's Manual, "Bleeding the Fuel System."

ELECTROMAGNETIC FUEL PUMP (500 HOURS)

The filter inside the fuel pump (Figure 86) is either a paper type or steel-mesh type depending on the fuel pump type. Clean or replace the fuel pump filter as follows:

1. Disconnect any electrical connections that are attached to the fuel pump.
2. Prepare a fuel collector to drain the fuel into. Secure any fuel lines to prevent fuel from spilling.
3. Remove the fuel pump from the generator enclosure.
4. Remove the filter and gasket from the fuel pump housing.

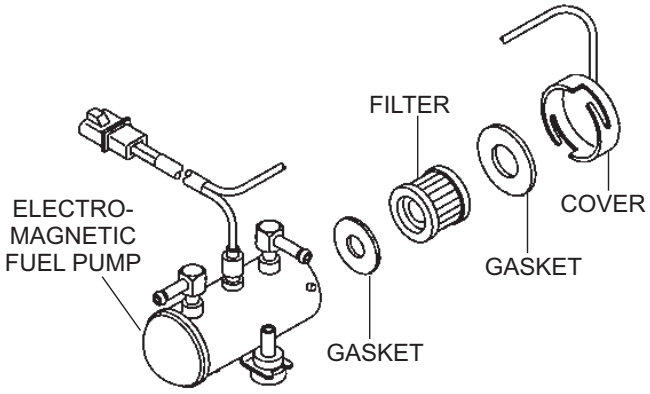


Figure 86. Electromagnetic Fuel Pump

> ***NOTICE***
>
> When the fuel pump filter is removed, always make sure to replace both gaskets and clean the magnet portion inside the cover.

5. Clean or replace the fuel pump filter. Replace both gaskets.
6. Reassemble the fuel pump and mount it back onto the generator enclosure.
7. Reconnect all fuel lines and electrical components.
8. Check for fuel leaks.

DRAINING THE CONTAINMENT TANK

1. This generator is equipped with an environmental containment tank. Inspect this tank regularly.
2. If the tank becomes full with fluids, remove the drain bolt (Figure 87), then allow the fluids to drain into a suitable container.

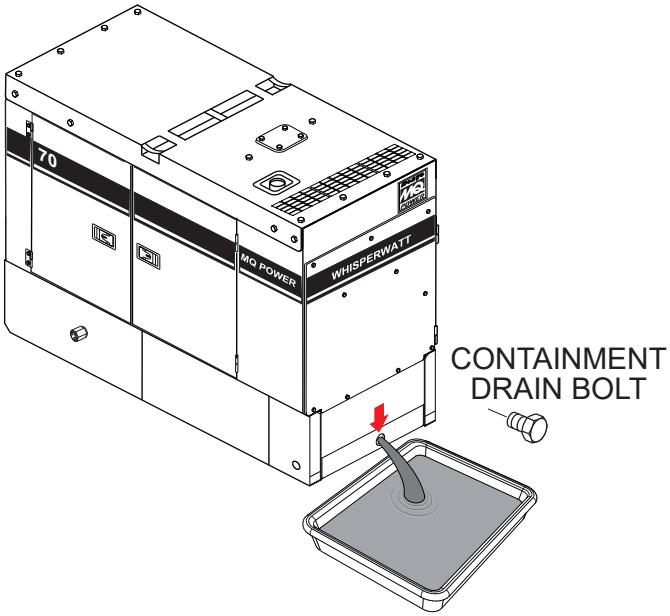


Figure 87. Draining The Containment Tank

CLEANING INSIDE THE FUEL TANK

If necessary, drain the fuel inside the fuel tank completely. Using a spray washer (Figure 88) wash out any deposits or debris that have accumulated inside the fuel tank.

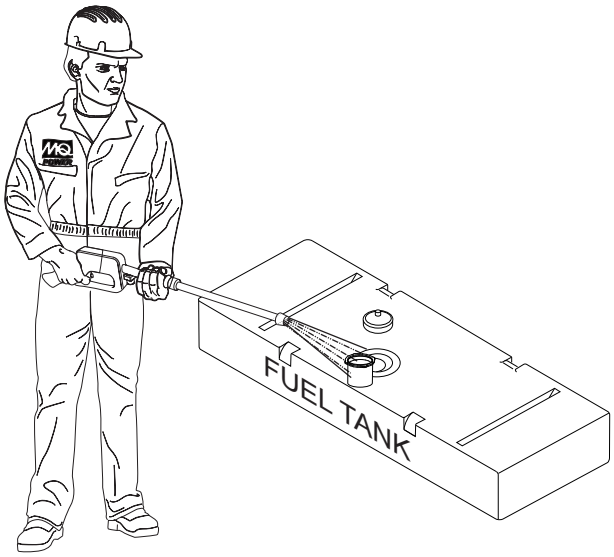


Figure 88. Cleaning The Fuel Tank

FUEL TANK INSPECTION

In addition to cleaning the fuel tank, the following components should be inspected for wear:

- **Rubber Suspension** — Look for signs of wear or deformity due to contact with oil. Replace the rubber suspension if necessary.
- **Fuel Hoses** — Inspect nylon and rubber hoses for signs of wear, deterioration or hardening.
- **Fuel Tank Lining** — Inspect the fuel tank lining for signs of excessive amounts of oil or other foreign matter.

DRAINING THE ENGINE OIL

1. Run the engine until the engine coolant reaches a temperature of 140°F (60°C). Turn the engine off.
2. Remove the oil dipstick from its holder.
3. Remove the ***oil drain cap*** (Figure 89).
4. Place the ***oil drain valve*** in the **OPEN** position and allow the oil to drain into a suitable container.

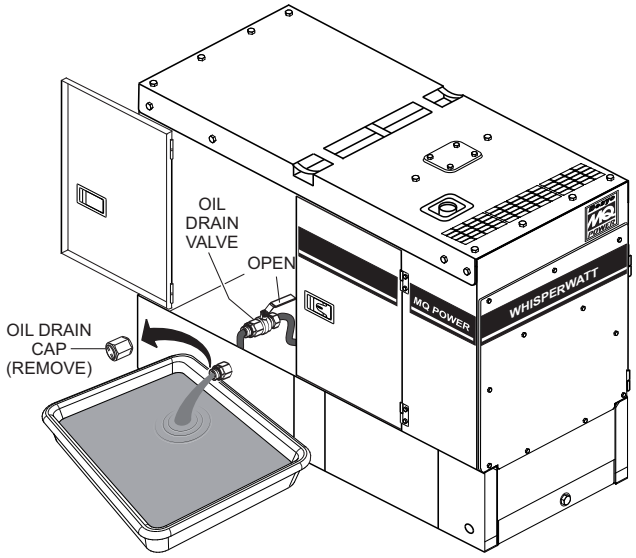


Figure 89. Draining The Engine Oil

5. After the engine oil has been completely drained, reinstall the oil drain cap and tighten securely.
6. Place the ***oil drain valve*** in the **CLOSED** position.

ENGINE OIL FILTER REPLACEMENT

1. Clean the area around the lubricating oil filter head.
2. Using an oil filter wrench (Figure 90), remove the engine oil filter.

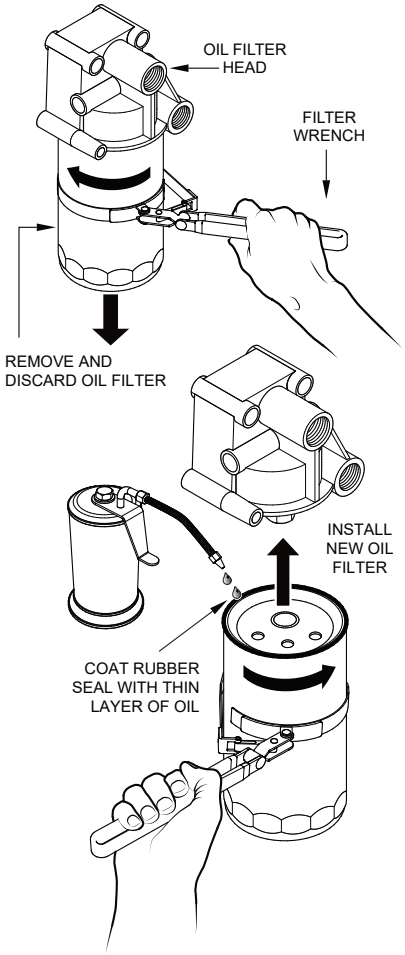


Figure 90. Oil Filter Removal

3. Coat the rubber seal (gasket) surface of the oil filter (Figure 90) with clean 15W-40 engine oil.
4. Install the new oil filter first by hand until it makes contact with the filter head surface. Tighten it another 3/4 turn using the filter wrench.
5. Fill the engine crankcase with high-quality detergent oil classified “For Service CI-4.” Fill to the upper limit of the dipstick. **DO NOT** overfill. Refer to Table 2 for engine crankcase oil capacity.
6. Run the engine for several minutes. Watch for oil leakage. Shut the engine down and allow it to sit for several minutes. Top off the oil to the upper limit on the dipstick.

DRAINING THE ENGINE COOLANT

WARNING

DO NOT remove the pressure cap from the radiator when the engine is hot! Wait until the coolant temperature is below 120°F (50°C) before removing the pressure cap.

Heated coolant spray or steam can cause severe scalding and personal injury.

1. Remove the radiator pressure cap (Figure 91) only if the coolant temperature is below 120°F (50°C).

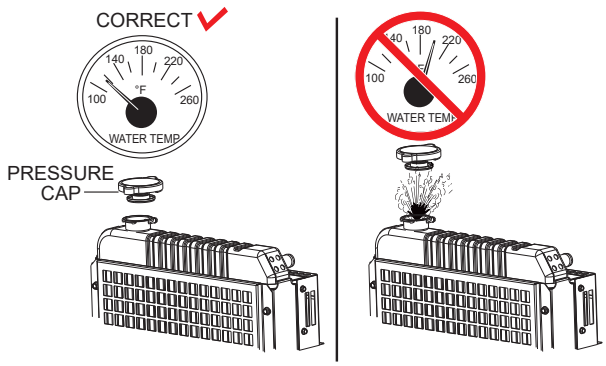
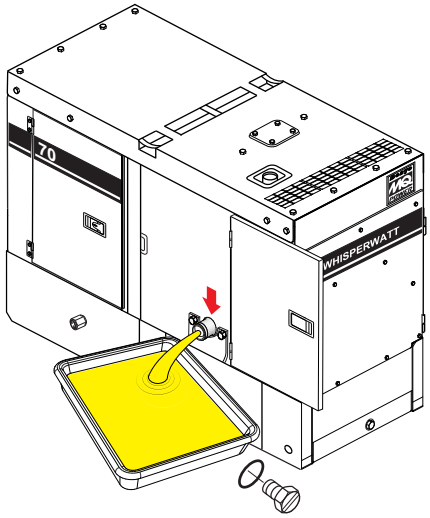


Figure 91. Radiator Pressure Cap Removal

2. Open the cabinet door and remove the coolant drain bolt and O-ring (Figure 92), then allow the coolant to drain into a suitable container.



COOLANT
DRAIN BOLT
AND O-RING

Figure 92. Draining The Radiator Coolant

3. Flush out the radiator and replace the coolant. Refer to ***Cleaning the Coolant Passages*** and ***Filling the Coolant System*** in the Isuzu engine owner's manual.

WARNING

Allow the engine to **cool** when flushing out the radiator. Flushing the radiator while hot could cause serious burns from water or steam.

RADIATOR CLEANING

The radiator (Figure 93) should be sprayed (cleaned) with a high-pressure washer when excessive amounts of dirt and debris have accumulated on the cooling fins or tube. When using a high-pressure washer, stand at least 5 feet (1.5 meters) away from the radiator to prevent damage to the fins and tube.

NOTICE

It may be necessary to remove additional generator components in order to access the radiator for cleaning.

Figure 93. Cleaning The Radiator

DRIVE BELT

Drive Belt Tension

A slack drive belt may contribute to overheating or insufficient charging of the battery. Adjust the drive belt in accordance with the Isuzu Operator's manual.

Drive Belt Inspection

1. Inspect the drive belt (Figure 94) for damage and wear. Horizontal cracks (across the belt) are acceptable. Vertical (direction of belt ribs) cracks that intersect with horizontal cracks are not acceptable.

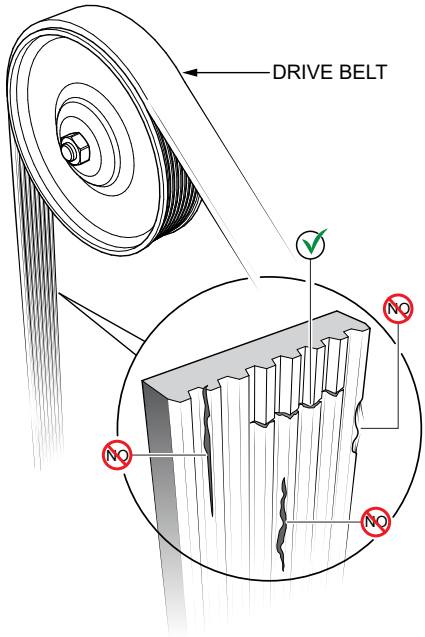


Figure 94. Drive Belt Inspection

2. Examine the belt and determine if it is ***oil soaked*** or ***glazed*** (a hard shiny appearance on the sides of the belt). Either of these two conditions can cause the belt to run hot, which can weaken it and increase the danger of it breaking.
3. If the drive belt exhibits any of the above wear conditions, replace the drive belt immediately.

TESTING THE GFCI RECEPTACLES

NOTICE

The GFCI receptacles are designed to interrupt power when a ground fault exists to prevent injuries and shock hazards. **DO NOT** use a GFCI receptacle if the test below fails. Consult a qualified electrician for repair or replacement of the GFCI receptacle. Test the GFCI receptacles ***at least once a month***.

1. Start the generator as outlined in the start-up procedure in this manual.
2. Place a GFCI circuit breaker (Figure 95) in the **ON** position.

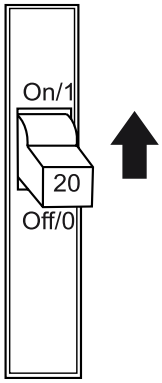


Figure 95. GFCI Circuit Breaker

3. Verify that the status LED on the corresponding GFCI receptacle (Figure 96) is **ON (GREEN)**.

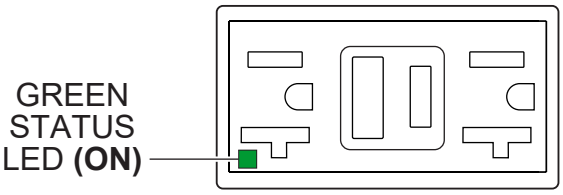


Figure 96. GFCI Receptacle (ON)

4. Press the **TEST** button (Figure 97) on the GFCI receptacle and verify that the status LED turns **OFF**.

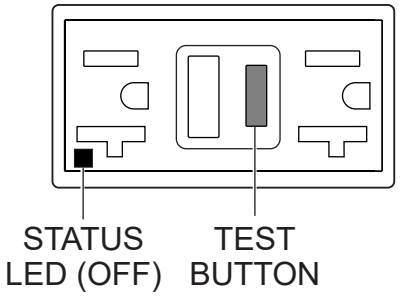


Figure 97. GFCI Receptacle (OFF)

5. Press the **RESET** button (Figure 98) to restore power to the GFCI receptacle and verify that the status LED is **ON (GREEN)**.

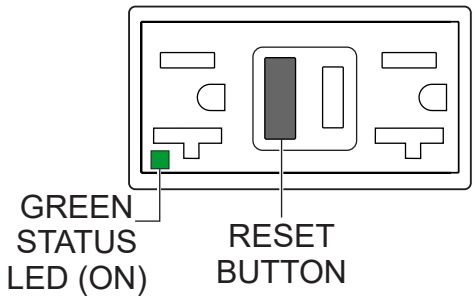


Figure 98. GFCI Receptacle (ON/Restore)

6. If the status LED (Figure 99) is **flashing (RED)**, **DO NOT** use the GFCI receptacle and replace it immediately.

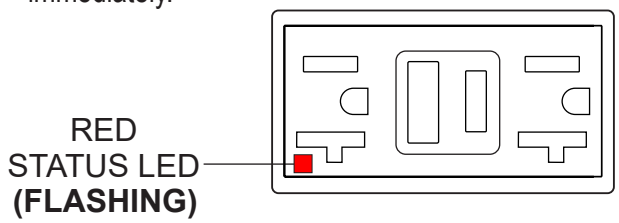


Figure 99. GFCI Receptacle (RED Flashing LED)

7. Repeat the above procedure for the other GFCI receptacle.

GENERATOR STORAGE

For long-term storage of the generator the following is recommended:

- Drain the fuel tank completely. Treat with a fuel stabilizer if necessary.
- Completely drain the oil from the crankcase and refill if necessary with fresh oil.
- Clean the entire generator, interior and exterior.
- Cover the generator and store in a clean, dry place.
- Disconnect the battery.
- Make sure engine coolant is at the proper level.
- If the generator is mounted on a trailer, jack the trailer up and place it on blocks so the tires do not touch the ground, or block and completely remove the tires.

ENGINE BLOCK HEATER AND INTERNAL BATTERY CHARGER 120 VAC INPUT RECEPTACLES

This generator comes equipped with an ***engine block heater***. An ***internal battery charger*** is available as an ***option***. These components are provided with electrical power cords to connect to a commercial power source.

The engine block heater and internal battery charger both require 120 VAC in order to operate. A receptacle (Figure 100) has been provided on the output terminal panel to allow commercial power to be applied.

These units will **ONLY** function when commercial power has been supplied to them. When using extension cords, refer to Table 6 for the correct size and length.

When using the generator in **hot** climates there is no reason to apply power to the engine block heater. However, if the generator will be used in **cold** climates it is always a good idea to apply power to the engine block heater at all times.

If the generator will be used daily, the battery should normally not require charging. If the generator will be idle (not used) for long periods of time, apply power to the battery charger receptacle via commercial power using a power cord of adequate size.

NOTICE

If the generator will be idle (not used) for long periods of time and to ensure adequate starting capability, always have power applied to the generator's internal battery charger.

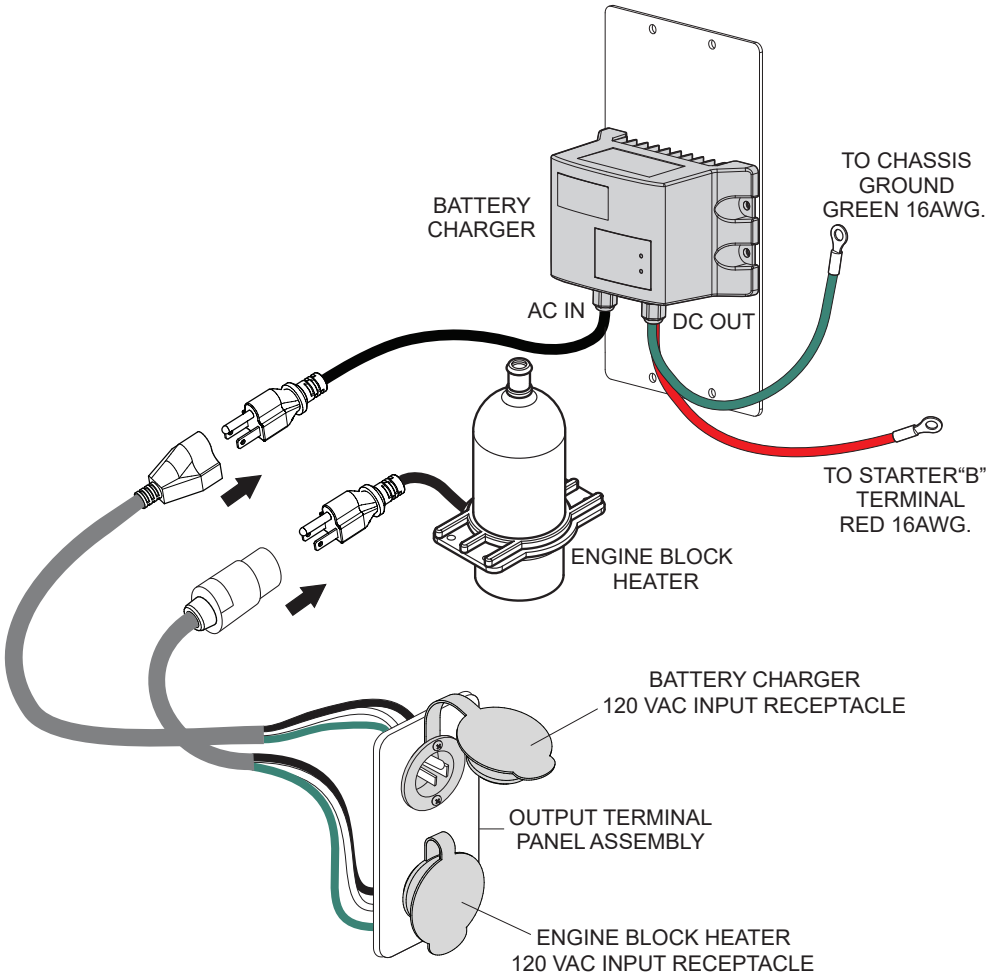


Figure 100. Engine Block Heater And Optional Battery Charger

EMISSION CONTROL

The emission control system employed with the Isuzu BR-4JJ1X diesel engine consists of a Diesel Oxidation Catalyst (DOC).

This device oxidizes large amounts of harmful nitrogen oxides (NOx) and particulate matter (PM) which are emitted by diesel engines. These exhaust emissions pose serious environmental and health risks. No maintenance or service is required for the DOC device used on this generator.

Diesel Oxidation Catalyst (DOC)

The DOC (Figure 101) does not filter particles, it oxidizes them. This catalyst (honeycomb-like structure) uses a chemical process to break down pollutants in the exhaust stream into less harmful components. In general this catalyst collects/burns accumulated particulates. The DOC contains palladium and platinum which serve as catalysts to oxidize hydrocarbons and carbon monoxide.

PREVENTIVE MAINTENANCE PROGRAMS

Most challenging to a rental organization is the fact that a customer's power assumptions may not meet the minimum load requirements of the power equipment selected. When in doubt, it is always recommended to apply a **load bank application** to the equipment following a longer rental period.

Equipment on extended, long-term contracts needs periodic on-site inspection. If possible, interview the operator and survey the equipment hooked up to the generator to estimate load conditions.

Preventive maintenance and a few extra steps prevent downtime and protect your investment and business. A well-planned preventive maintenance program will reward you with years of service.

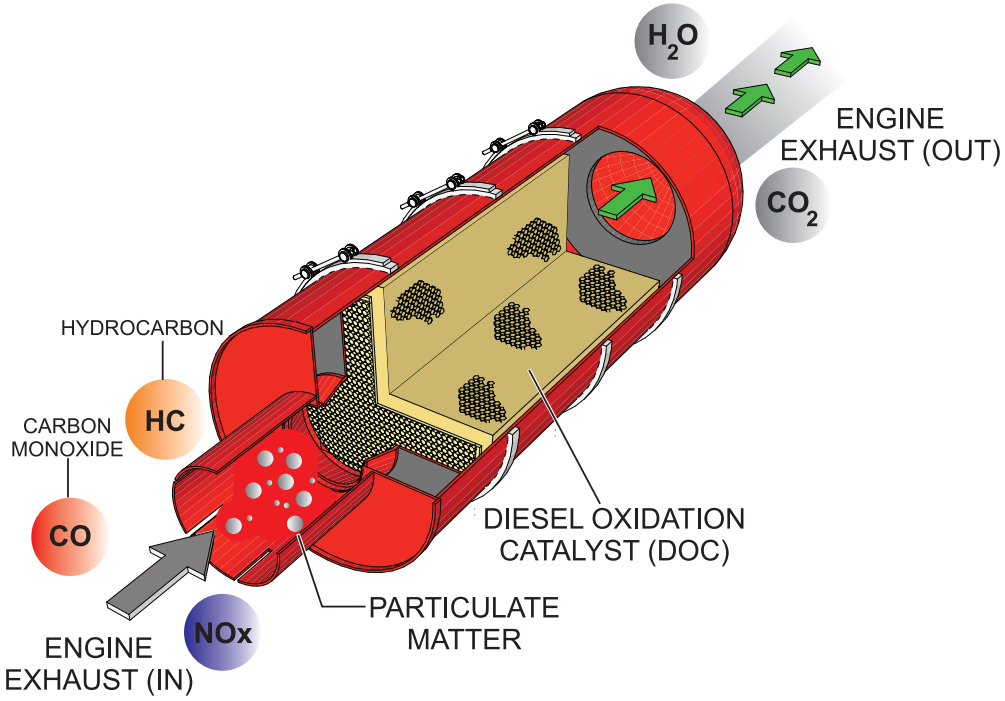


Figure 101. Diesel Oxidation Catalyst (DOC)

SELECTIVE CATALYTIC REDUCTION (SCR)

Diesel engines can be run with a lean burn air-to-fuel ratio, to ensure the full combustion of soot and to prevent the exhaust of unburnt fuel. The excess of air necessarily leads to generation of nitrogen oxides (NO_x), which are harmful pollutants, from the nitrogen in the air. ***Selective Catalytic Reduction*** is used to reduce the amount of NO_x released into the atmosphere.

Diesel Exhaust Fluid (DEF) from a separate tank is injected into the exhaust pipeline, where the aqueous urea vaporizes and decomposes to form ammonia and carbon dioxide. Within the SCR catalyst, the NO_x are catalytically reduced by the ammonia (NH_3) into water (H_2O) and nitrogen (N_2), which are both harmless; these are then released through the exhaust.

The SCR system creates a certain amount of ammonia (NH_3) that is stored in SCR catalyst. During purging operations the increase in temperature at regular intervals eliminates the stored ammonia.

The process of keeping accurate ammonia storage amounts is by counting urea injection quantities from the Dosing Control Unit (DCU).

The SCR active symbol (Figure 102) will be displayed on the Deep Sea controller during operation when either an ***automatic*** or ***forced*** system purge operation is in process.

Figure 102. SCR Symbol

> ***NOTICE***
>
> During urea SCR system purging, ***white smoke*** may be temporarily emitted from the exhaust tailpipe. This should not be considered a failure. In addition, the smell of ***ammonia*** during the purging process should not be considered a failure.
>
> If the purging process is underway while running a light load (0–30%) the unit may produce unusual sounds. This should not be considered a failure or malfunction.

SCR SYSTEM PURGE GUIDELINES

Auto Purge Operation

The ***auto purge*** operation process will be performed automatically. No operator intervention is required.

Forced Purge Operation

When an auto purge operation has failed, the engine will require a ***forced purge*** to be induced. A qualified technician must be on-site with an ***Isuzu Diagnostic Service Tool*** (IDST) to perform the operation.

Once the engine has reached the proper operating temperature, the ***Diesel Particulate Diffuser*** (DPD) mode will display 80. Press the start button on the Deep Sea controller to begin the purge process.

> ***NOTICE***
>
> **DO NOT** perform purging in conditions where it may be unsafe due to high exhaust temperatures.

For safe operation of equipment, safety of the surrounding area, and the prevention of bodily harm, use the guidelines below when system purging is required:

> ***NOTICE***
>
> The area above and around the generator during the purging process should be free of any type of debris, flammable or combustible materials, as temperatures during the purging process can reach as high 1,022°F (550°C).

- **DO NOT** operate the unit in an area with poor ventilation.
- If operating the engine indoors, install exhaust/ventilation equipment and ensure that there is sufficient ventilation.
- If you begin to feel sick, stop the unit immediately and ventilate the area.
- Due to the exhaust emission reduction functions of the exhaust system, exhaust emissions from the tailpipe have a different smell from those emitted from engines without urea SCR systems.

Shown below in Table 17 are the purge symbols. These symbols show the various ECU functions. The symbols flash at different rates to show the status of the ECU function. For more detailed information, refer to the engine manufacturer owner's manual.

Table 17. Engine Symbols

SYMBOL	DESCRIPTION
	**Check Engine Symbol (Yellow)** This symbol is displayed when an engine fault occurs. Check active ***Diagnostic Trouble Codes*** (DTC).
	**Check Engine Symbol (Red)** This symbol is displayed when an engine fault occurs. The engine will undergo an emergency stop. Check active ***Diagnostic Trouble Codes*** (DTC).
	**HEST Symbol** This symbol indicates that the ***High Exhaust System Temperature*** is active.
	**DEF Warning Symbol** This symbol is displayed when the DEF tank level is low (less than 10%) or the DEF quality is poor. Refer to the Diesel Exhaust Fluid (DEF) Maintenance section for more information.
	**SCR Purge Symbol** This symbol is displayed during both automatic and forced purge operation.

DIESEL EXHAUST FLUID (DEF)

If the ***diesel exhaust fluid*** (DEF) symbol (Figure 103) is displayed during Deep Sea controller operation, it indicates one or more of the following:

- DEF tank level is below 10%.
- DEF quality is poor. Check DEF tank level and check active ***diagnostic trouble codes*** (DTC).

Figure 103. DEF Level Symbol

The amount of fluid in the DEF tank will be displayed on the Deep Sea controller screen (Figure 104).

From the main status screen, press the ***right arrow button once*** and verify that the "Engine" screen is displayed, then press the ***down arrow button sixteen times*** and verify that the engine's DEF tank level screen is displayed.

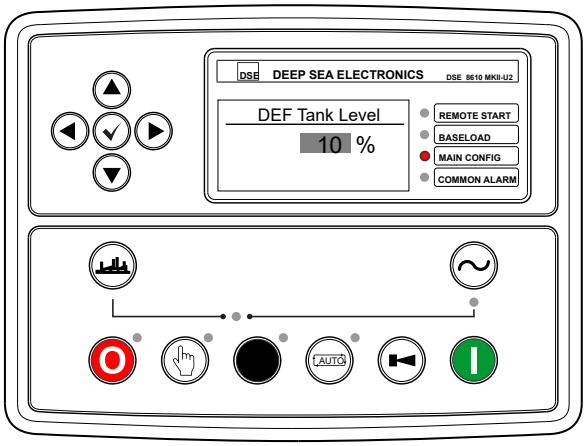


Figure 104. DEF Tank Level Screen

NOTICE

The unit will enter emergency shutdown when the DEF level has reached 0% and emergency protective measures are necessary. When this condition occurs, inspection and repair should generally be performed promptly.

NOTICE

Inducement — when the system senses improper usage such as no supply of DEF, use of poor quality DEF, problems with DEF dosing, or disconnection of sensors — a warning will be issued before the situation becomes critical. If the warnings are ignored and the unit enters intermittent operation, the emergency shutdown will activate.

PROTECTION DEVICES

Automatic Shutdown System

This unit is equipped with engine protection devices that automatically shut down the engine if any of the faults shown in Table 18 occur. A message will be displayed on the Deep Sea controller screen indicating the cause of the shutdown.

After the automatic shutdown, check all Diagnostic Trouble Codes (DTC) displayed on the Deep Sea controller screen. Refer to the Troubleshooting (Diagnostics) section in this manual.

Before attempting to restart the generator, press the **OFF** button on the Deep Sea controller and place all circuit breakers in the **OFF** position.

Allow sufficient time for adequate cooling of the generator before troubleshooting. Perform an overall inspection of the generator and correct the problem that caused the shutdown before restarting the generator. If necessary, contact your nearest Multiquip dealer for additional technical support.

Restart the generator as described in the Generator Start-Up Procedure (Manual Start) section of this manual.

NOTICE

Although the unit is equipped with engine protection devices, regularly scheduled ***preventative maintenance*** is strongly advised.

Table 18. Automatic Engine Shutdown System

Operating Parameter	Operating Condition/Set Point
Low Oil Pressure[1]	Set Point: 14.2 psi (98 kPa)
High Water Temperature	Set Point: 212°F (100°C)
Low Coolant Level	Falls Below Specified Level
Exhaust System Severe Malfunction	Refer to Exhaust System, DEF, Purge Sections
Over Voltage	Set Point: 110%
Under Voltage	Set Point: 75%
High Power (kW)	Set Point: 115%
Over Frequency (Hz)	Set Point: 110%
Under Frequency (Hz)	Set Point: 90%
Overspeed	Approximately +15%
Over Current[2]	Load Capacity Exceeded
[1] Refer to Deep Sea controller screen for cause of shutdown with associated DTC.	
[2] Main circuit breaker will trip.	

Practically all breakdowns can be prevented by proper handling and maintenance inspections, but in the event of a breakdown, use Table 19 for diagnosis of the generator. If the problem cannot be remedied, consult our company's business office or service plant.

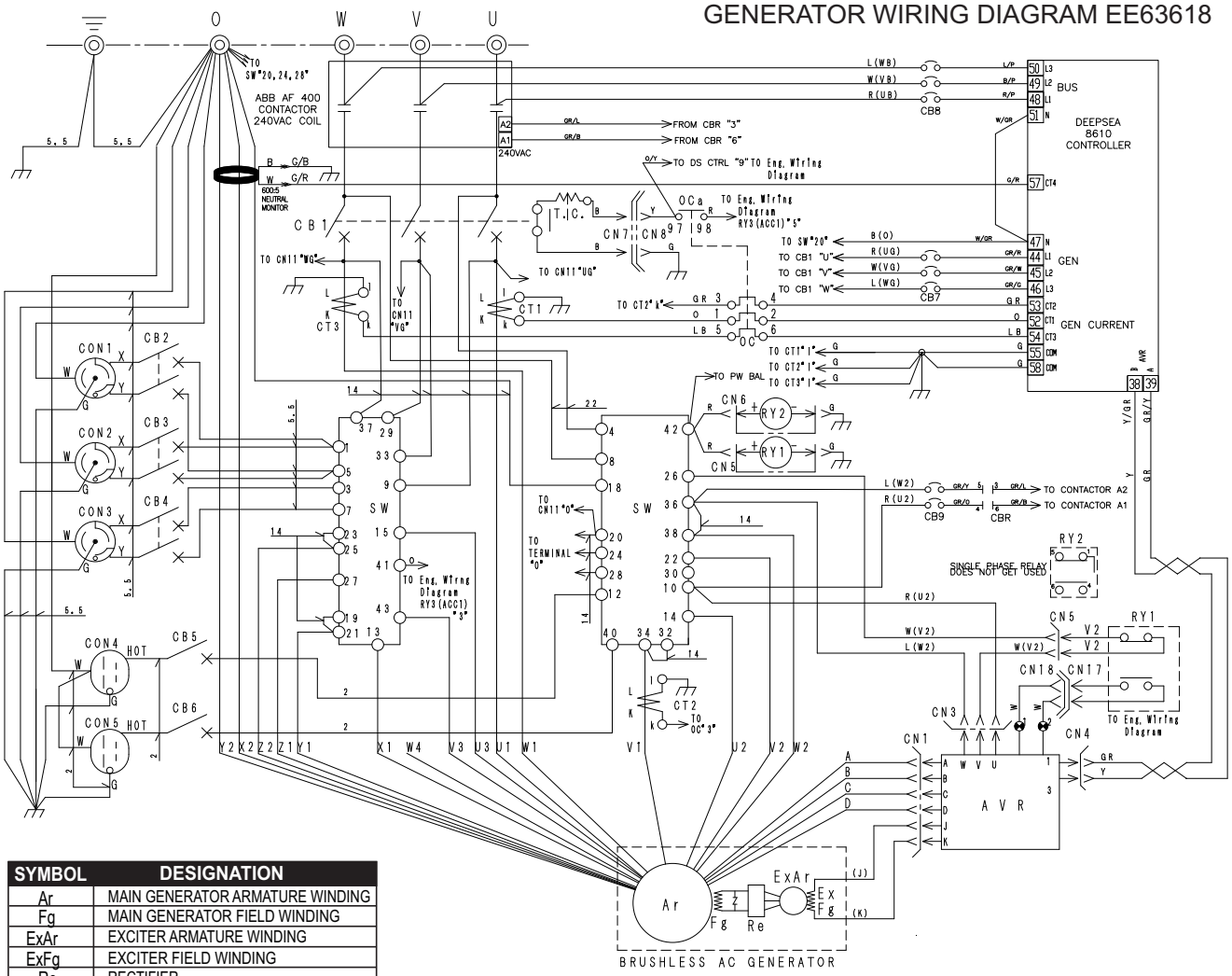
Table 19. Generator Troubleshooting

Symptom	Possible Problem	Solution
No Voltage Output	Loose wiring connections?	Check wiring and repair.
	Defective AVR?	Replace if necessary.
	Defective rotating rectifier?	Check and replace.
Low Voltage Output	Low engine speed?	Check and adjust.
	Loose wiring connections?	Check wiring and repair.
	Defective AVR?	Replace if necessary.
High Voltage Output	Loose wiring connections?	Check wiring and repair.
	Defective AVR?	Replace if necessary.
Circuit Breaker Tripped	Short circuit in load?	Check load and repair.
	Over current?	Confirm load requirement and reduce.
	Defective circuit breaker?	Check and replace.
	Overcurrent relay actuated?	Confirm load requirement and reset.

Troubleshooting (Engine)		
Symptom	**Possible Problem**	**Solution**
Engine will not start or start is delayed, although engine can be turned over.	No fuel reaching injection pump?	Add fuel. Check entire fuel system.
	Defective fuel pump?	Replace fuel pump.
	Fuel filter clogged?	Replace fuel filter and clean tank.
	Faulty fuel supply line?	Replace or repair fuel line.
	Compression too low?	Check piston, cylinder and valves. Adjust or repair per engine repair manual.
	Fuel pump not working correctly?	Repair or replace fuel pump.
	Oil pressure too low?	Check engine oil pressure.
	Low starting temperature limit exceeded?	Comply with cold starting instructions and proper oil viscosity.
	Defective battery?	Charge or replace battery.
	Air or water mixed in fuel system?	Check carefully for loosened fuel line coupling, loose cap nut, etc.
At low temperatures engine will not start.	Engine oil too thick?	Refill engine crankcase with correct type of oil for winter environment.
	Defective battery?	Replace battery.
Engine fires but stops as soon as starter is switched off.	Fuel filter blocked?	Replace fuel filter.
	Fuel supply blocked?	Check the entire fuel system.
	Defective fuel pump?	Replace fuel pump.
Engine stops by itself during normal operation.	Fuel tank empty?	Add fuel.
	Fuel filter blocked?	Replace fuel filter.
	Defective fuel pump?	Replace fuel pump.
	Mechanical oil pressure shutdown sensor stops the engine due to low oil?	Add oil. Replace low oil shutdown sensor if necessary.
Low engine power, output and speed.	Fuel tank empty?	Add fuel.
	Fuel filter clogged?	Replace fuel filter.
	Fuel tank venting is inadequate?	Ensure tank is adequately vented.
	Leaks at pipe unions?	Check threaded pipe unions. Tape and tighten unions as required.
	Speed control lever does not remain in selected position?	See engine manual for corrective action.
	Engine oil level too full?	Correct engine oil level.
	Injection pump wear?	Use No. 2-D diesel fuel only. Check the fuel injection pump element and delivery valve assembly and replace as necessary.

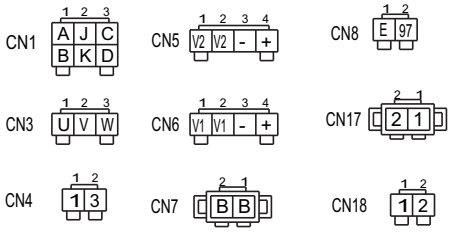
Troubleshooting (Engine) - continued		
Symptom	**Possible Problem**	**Solution**
Low engine power output and low speed, black exhaust smoke.	Air filter blocked?	Clean or replace air filter.
	Incorrect valve clearances?	Adjust valves per engine specification.
	Malfunction at injector?	See engine manual.
Engine overheats.	Too much oil in engine crankcase?	Drain off engine oil down to upper mark on dipstick.
	Entire cooling air system contaminated or blocked?	Clean cooling air system and cooling fin areas.
	Fan belt broken or elongated?	Change belt or adjust belt tension.
	Coolant insufficient?	Replenish coolant.
	Radiator net or radiator fin clogged with dust?	Clean net or fin carefully.
	Fan, radiator, or radiator cap defective?	Replace defective part.
	Thermostat defective?	Check thermostat and replace if necessary.
	Head gasket defective or water leakage?	Replace parts.

GENERATOR WIRING DIAGRAM EE63618



SYMBOL	DESIGNATION
Ar	MAIN GENERATOR ARMATURE WINDING
Fg	MAIN GENERATOR FIELD WINDING
ExAr	EXCITER ARMATURE WINDING
ExFg	EXCITER FIELD WINDING
Re	RECTIFIER
AVR	AUTOMATIC VOLTAGE REGULATOR
CT 1,2,3	CURRENT TRANSFORMER
CB1	CIRCUIT BREAKER, 3P 200A
CB2, 3, 4	CIRCUIT BREAKER, 2P 50A
CB5, 6	CIRCUIT BREAKER, 1P 20A
CB7, 8	CIRCUIT BREAKER, 3P 10A, UL ABB
CB9	CIRCUIT BREAKER, 2P 10A, UL ABB
CONTACTOR	CONTACTOR, UL ABB AF40, 240 COIL
CON1, 2, 3	RECEPTACLE, CS6369, 250 VAC@ 50 AMPS
CON4, 5	RECEPTACLE, GFCI, 125 VAC @ 20 AMPS X 2
OC	OVER CURRENT RELAY
SW	SELECTOR SWITCH
RY1	RELAY UNIT
RY2	RELAY UNIT

CONNECTOR ARRANGEMENT
(WIRING VIEW)



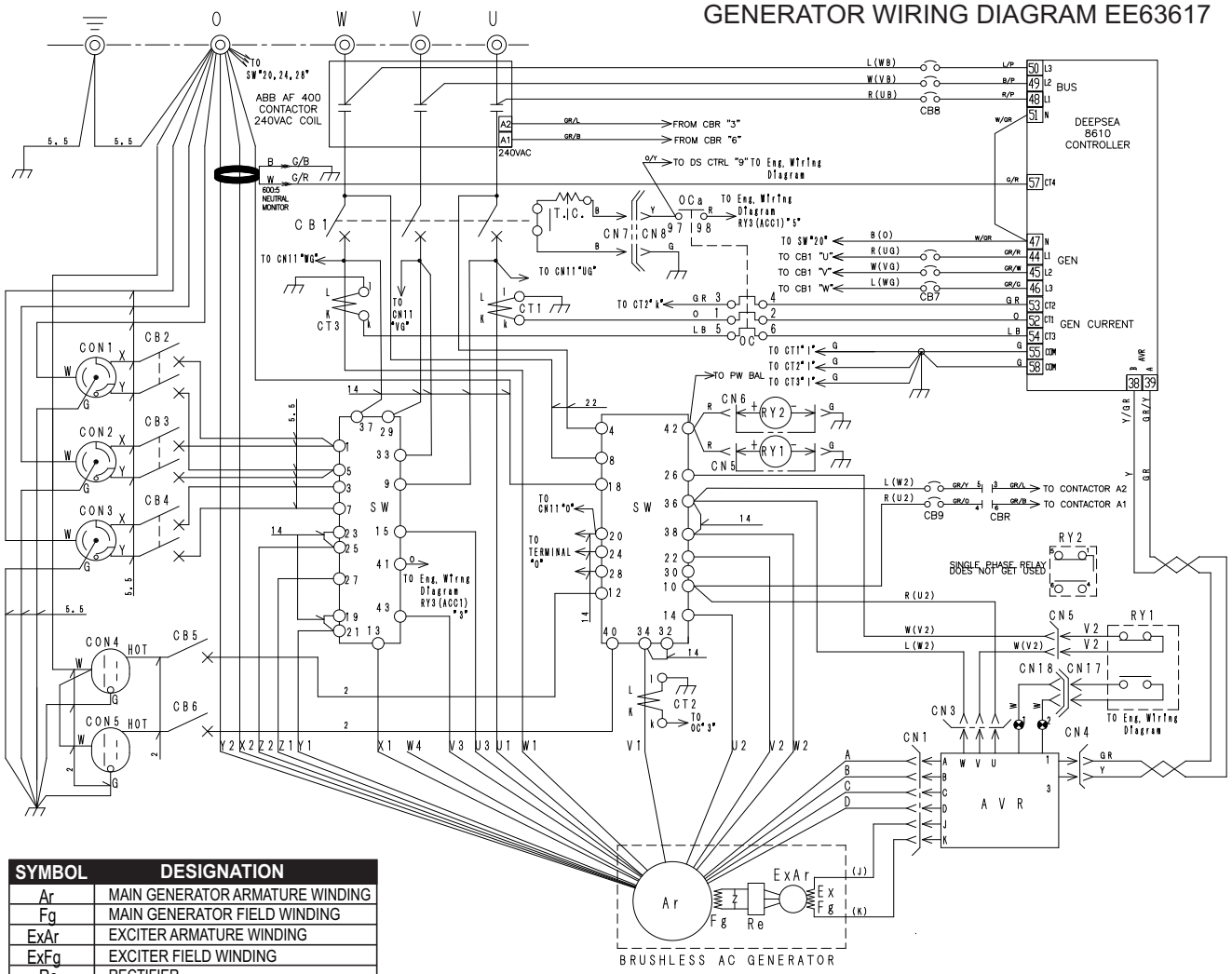
NOTE:

REFERENCE L1038-KVCR WIRING DIAGRAM FOR POWERBALANCE APPLICATIONS.

CURRENT TRANSFORMERS (CT1 ~ 3)	
REF. DES.	MARK AT CT
k	X1
l	NO MARK
K	H1
L	NO MARK
NOTE: EACH CABLE IS PASSED TWICE THROUGH CURRENT TRANSFORMERS CT1, CT2 AND CT3.	

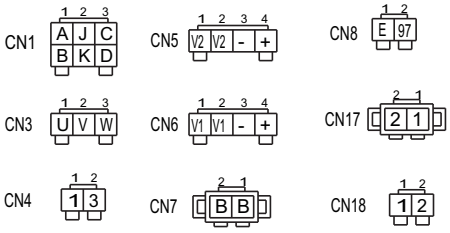
WIRE SIZE	CODE/WIRE COLOR			
125: 125 mm^2	B	BLACK	R	RED
100: 100 mm^2	L	BLUE	W	WHITE
80: 80 mm^2	BR	BROWN	Y	YELLOW
22: 22 mm^2	G	GREEN	LB	LIGHT BLUE
14: 14 mm^2	GR	GRAY	LG	LIGHT GREEN
8: 8 mm^2	V	VIOLET	O	ORANGE
5.5: 5.5 mm^2	P	PINK		
NO MARK WIRE SIZE: 1.25 mm^2				

GENERATOR WIRING DIAGRAM EE63617



SYMBOL	DESIGNATION
Ar	MAIN GENERATOR ARMATURE WINDING
Fg	MAIN GENERATOR FIELD WINDING
ExAr	EXCITER ARMATURE WINDING
ExFg	EXCITER FIELD WINDING
Re	RECTIFIER
AVR	AUTOMATIC VOLTAGE REGULATOR
CT 1,2,3	CURRENT TRANSFORMER
CB1	CIRCUIT BREAKER, 3P 200A
CB2, 3, 4	CIRCUIT BREAKER, 2P 50A
CB5, 6	CIRCUIT BREAKER, 1P 20A
CB7, 8	CIRCUIT BREAKER, 3P 10A, UL ABB
CB9	CIRCUIT BREAKER, 2P 10A, UL ABB
CONTACTOR	CONTACTOR, UL ABB AF40, 240 COIL
CON1, 2, 3	RECEPTACLE, CS6369, 250 VAC@ 50 AMPS
CON4, 5	RECEPTACLE, GFCI, 125 VAC @ 20 AMPS X 2
OC	OVER CURRENT RELAY
SW	SELECTOR SWITCH
RY1	RELAY UNIT
RY2	RELAY UNIT

CONNECTOR ARRANGEMENT
(WIRING VIEW)

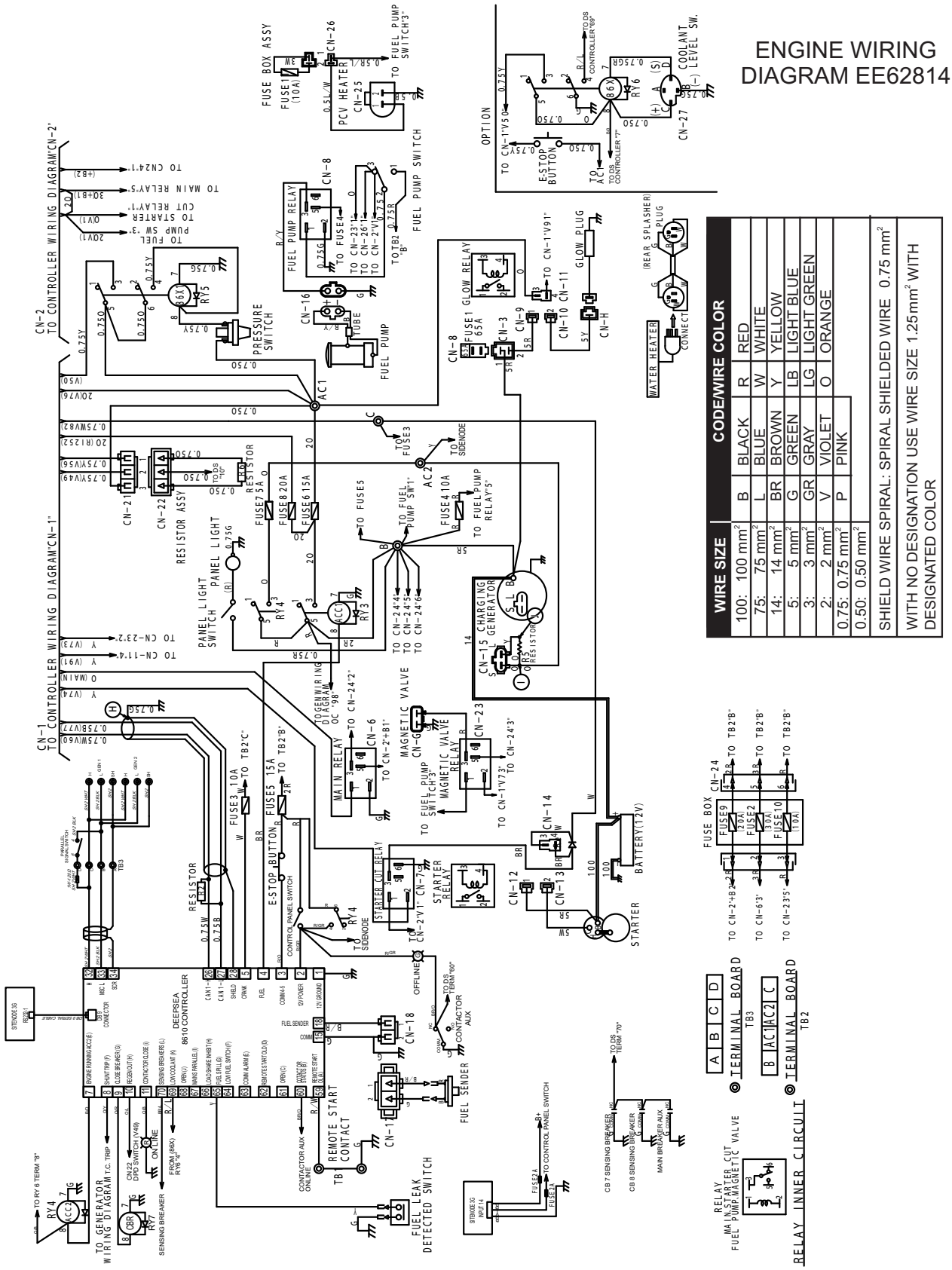


NOTE:

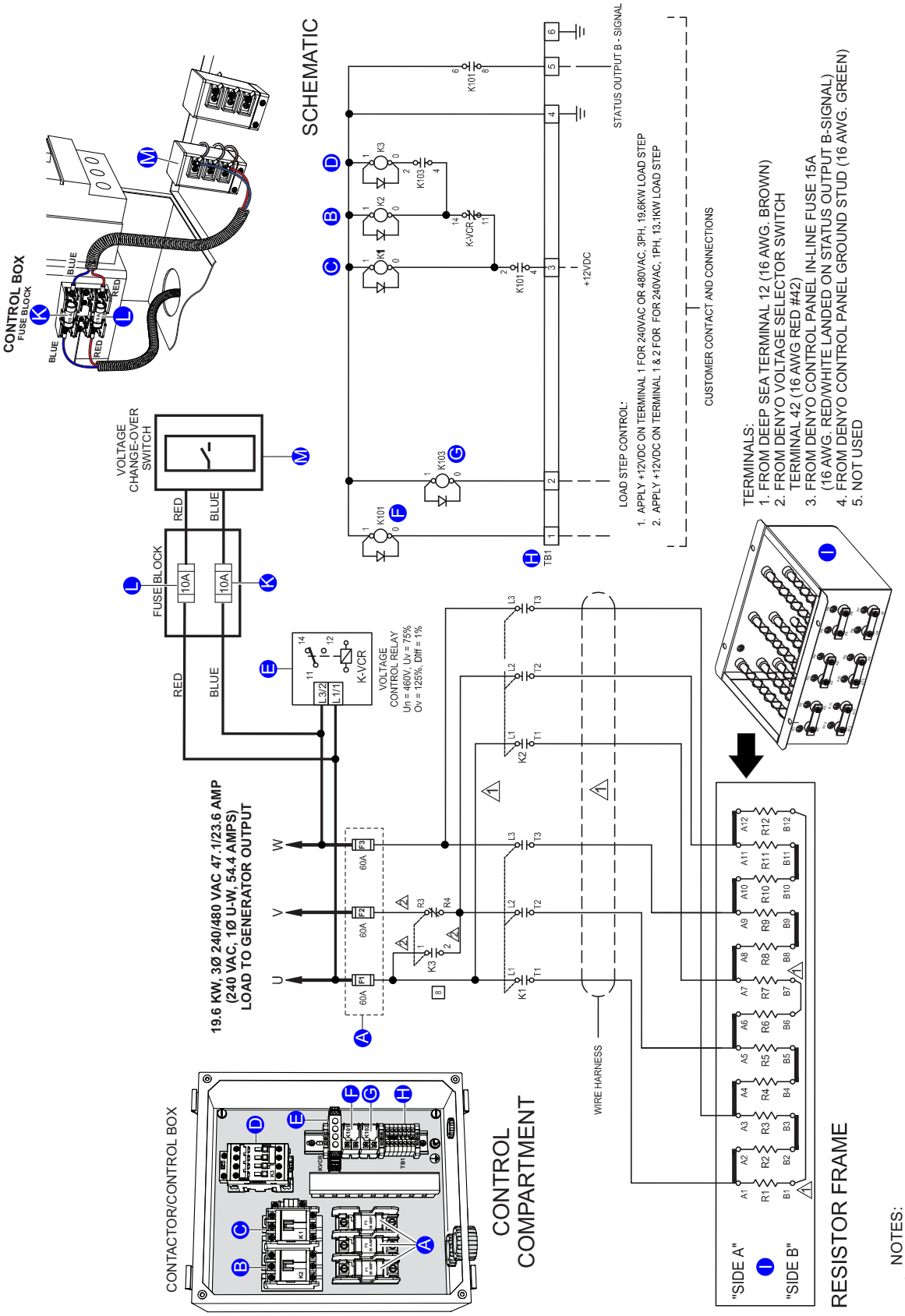
REFERENCE L1038-NVCR WIRING DIAGRAM FOR POWERBALANCE APPLICATIONS.

CURRENT TRANSFORMERS (CT1 ~ 3)	
REF. DES.	MARK AT CT
k	X1
l	NO MARK
K	H1
L	NO MARK
NOTE: EACH CABLE IS PASSED TWICE THROUGH CURRENT TRANSFORMERS CT1, CT2 AND CT3.	

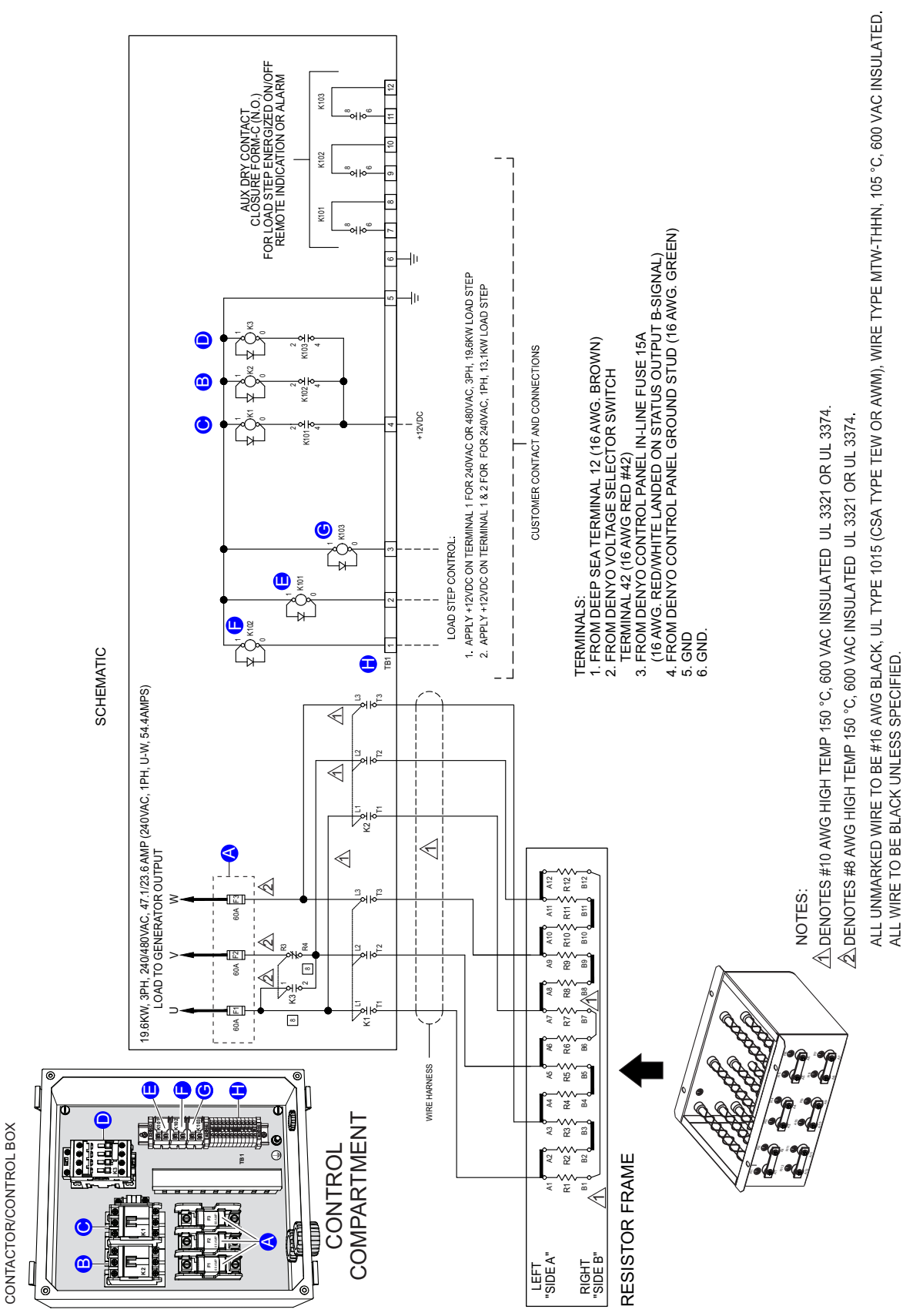
WIRE SIZE	CODE/WIRE COLOR			
125: 125 mm^2	B	BLACK	R	RED
100: 100 mm^2	L	BLUE	W	WHITE
80: 80 mm^2	BR	BROWN	Y	YELLOW
22: 22 mm^2	G	GREEN	LB	LIGHT BLUE
14: 14 mm^2	GR	GRAY	LG	LIGHT GREEN
8: 8 mm^2	V	VIOLET	O	ORANGE
5.5: 5.5 mm^2	P	PINK		
NO MARK WIRE SIZE: 1.25 mm^2				


ENGINE WIRING
DIAGRAM EE62814
WIRE SIZE | CODE/WIRE COLOR
100: 100 mm² B BLACK R RED
75: 75 mm² L BLUE W WHITE
14: 14 mm² BR BROWN Y YELLOW
5: 5 mm² G GREEN LB LIGHT BLUE
3: 3 mm² GR GRAY LG LIGHT GREEN
2: 2 mm² V VIOLET O ORANGE
0.75: 0.75 mm² P PINK
0.50: 0.50 mm²
SHIELD WIRE SPIRAL: SPIRAL SHIELDED WIRE 0.75 mm²
WITH NO DESIGNATION USE WIRE SIZE 1.25mm² WITH DESIGNATED COLOR
DEEPSEA 8610 CONTROLLER
TERMINAL BOARD TB3
TERMINAL BOARD TB2
RELAY INNER CIRCUIT
FUEL LEAK DETECTED SWITCH
REMOTE START CONTACT
PRESSURE SWITCH
FUEL PUMP
FUEL PUMP SWITCH
PCV HEATER
FUSE BOX ASSY
COOLANT LEVEL SW.
E-STOP BUTTON
OPTION
PANEL LIGHT SWITCH
PANEL LIGHT
RESISTOR ASSY
CHARGING GENERATOR
GLOW PLUG
MAGNETIC VALVE
MAIN RELAY
STARTER
BATTERY(12V)
FUSE BOX
RESISTOR
E-STOP BUTTON
CONTROL PANEL SWITCH
FUEL PUMP SWITCH
MAGNETIC VALVE RELAY
STARTER RELAY
STARTER CUT RELAY
GENERATOR WIRING DIAGRAM
SENSING BREAKER
MAIN BREAKER AUX
CONTACTOR AUX
FUEL SENDER
OFFLINE
ONLINE

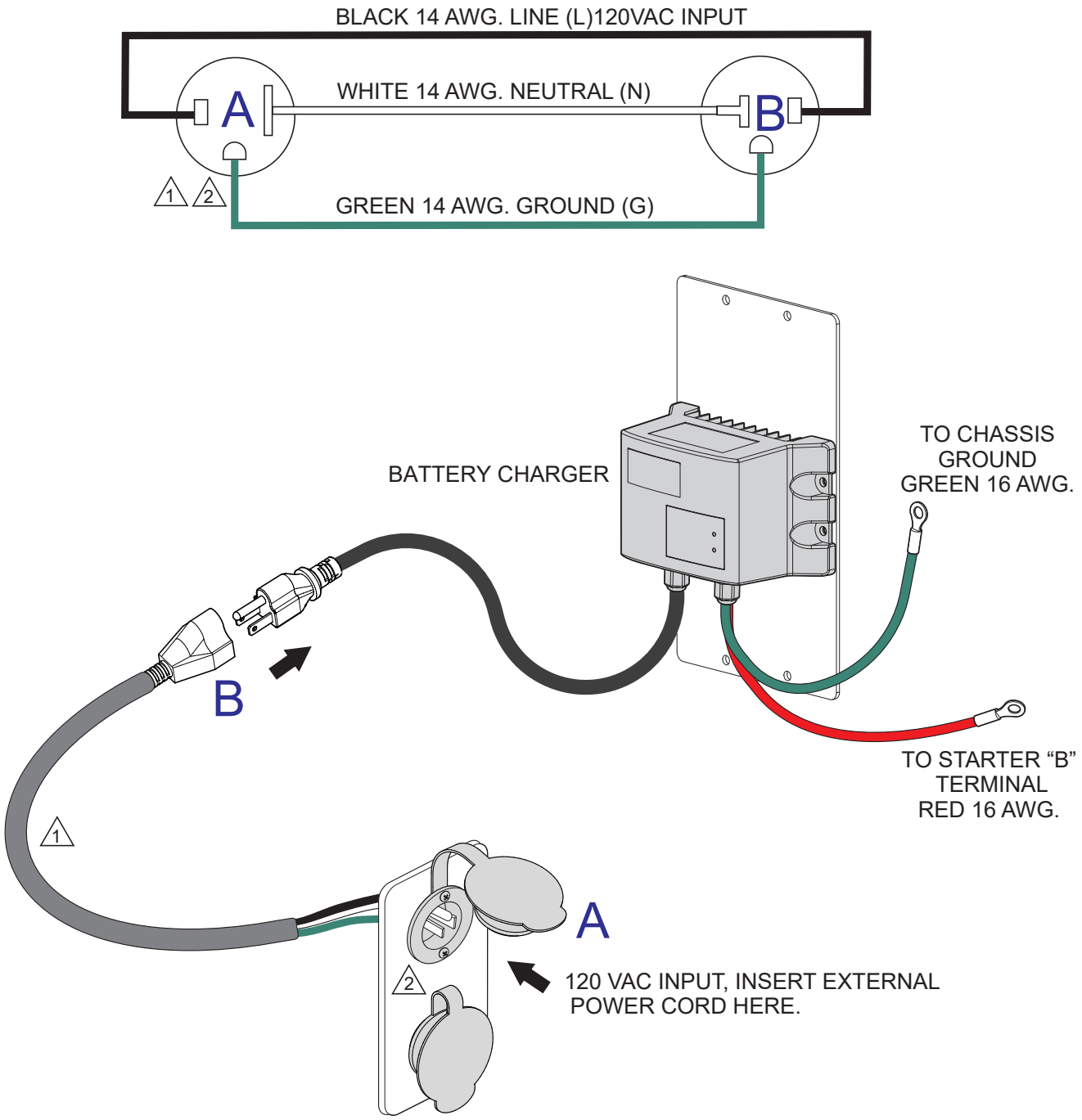
POWERBALANCE® L1038-KVCR WIRING DIAGRAM



POWERBALANCE® L1038-NVCR WIRING DIAGRAM



BATTERY CHARGER WIRING DIAGRAM (OPTION)



NOTES:

1. INLET RECEPTACLE & CORD, NEMA 5-15P,15 AMP,125V, P/N EE62076
2. RECEPTACLE IS MOUNTED ON OUTPUT TERMINAL PANEL ASSY.

OPERATION MANUAL

HERE'S HOW TO GET HELP

PLEASE HAVE THE MODEL AND SERIAL NUMBER ON HAND WHEN CALLING

UNITED STATES

Multiquip Inc.

(310) 537- 3700
6141 Katella Avenue Suite 200
Cypress, CA 90630
E-MAIL: mq@multiquip.com
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E-MAIL: infocanada@multiquip.com

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Multiquip (UK) Limited Head Office

0161 339 2223
Unit 2, Northpoint Industrial Estate, Globe Lane,
Dukinfield, Cheshire SK16 4UJ
E-MAIL: sales@multiquip.co.uk

This manual MUST accompany the equipment at all times. This manual is considered a permanent part of the equipment and should remain with the unit if resold.

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MQ Power Inc.
by
DENYO MANUFACTURING CORP.