

OPERATION MANUAL



WHISPERWATT™ SERIES
MODEL
NGA100SSPUL
NATURAL GAS GENERATOR
(PSI 8.8L NA DUAL-FUEL ENGINE)

INSTRUCTION MANUAL NO. M3844300804

Revision #0 (11/28/23)

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THIS MANUAL MUST ACCOMPANY THE EQUIPMENT AT ALL TIMES.

PROPOSITION 65 WARNING



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Natural Gas Generator**

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NOTICE
Specifications are subject to change without notice.

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.

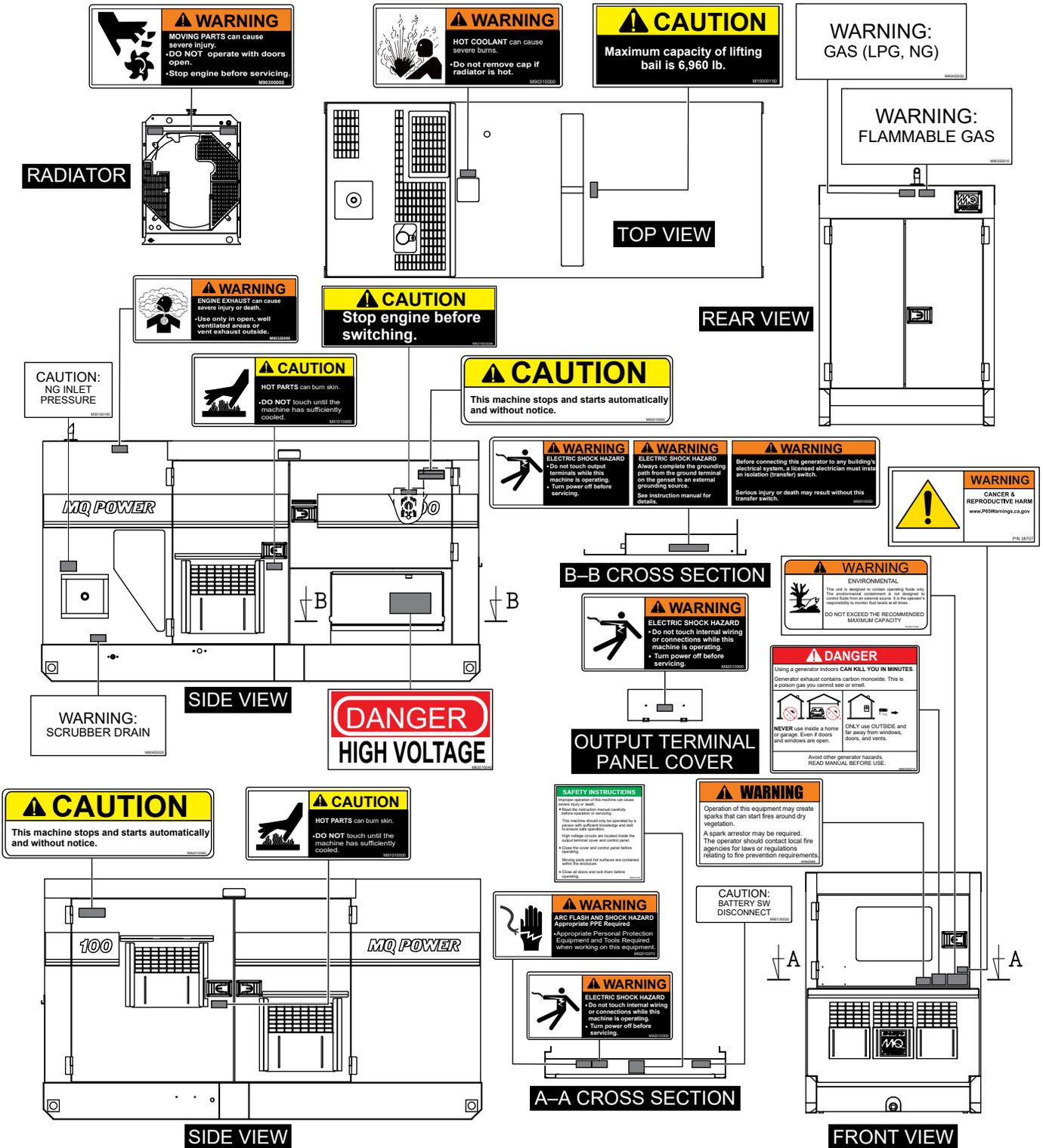


Figure 1. Safety Decals

SAFETY INFORMATION

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

SAFETY INFORMATION

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.

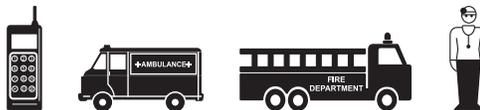


- **ALWAYS** check the generator for loosened threads or bolts before starting.
- **NEVER** use the generator for any purpose other than its intended purposes or applications.

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.

SAFETY INFORMATION

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.

SAFETY INFORMATION

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.

SAFETY INFORMATION

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**.



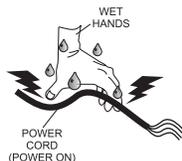
- Backfeed to a utility system can cause **electrocution** and/or property damage. **NEVER** connect the generator to a building's electrical system without a transfer switch or other approved device. All installations should be performed by a **licensed electrician** in accordance with all applicable 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

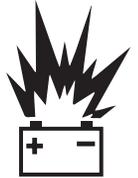
DANGER

- **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.



SAFETY INFORMATION

- 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 unreparable 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.

SPECIFICATIONS

Table 2. Generator Specifications

Model	NGA100SSPUL	
Type	Revolving field, self-ventilated, open protected type synchronous generator	
Armature Connection	Star with Neutral	Zigzag
Phase	3	Single
Standby Output	88 kW (110 kVA)	63 kW
Prime Output	80 kW (100 kVA)	58 kW
3Ø Voltage	208, 220, 240, 416, 440, 480V	N/A
1Ø Voltage	N/A	120, 127, 139, 240, 254, 277V
Power Factor	0.8	1.0
Frequency	60 Hz	
Speed	1,800 rpm	
Aux. AC Power	Single phase, 60 Hz	
Pitch	2/3	
Subtransient	0.117	
Transient	0.149	
Synchronous	1.583	
Zero Sequence Reactance	0.007	
Overload Protection	OCR / main circuit breaker	
Aux. Voltage/Output	120V / 4.8 kW (2.4 kW × 2)	
Dry Weight	4,652 lb. (2,110 kg)	

Table 3. Engine Specifications

Model	PSI 8.8L NA	
Type	V-type, 4-cycle, water-cooled, naturally aspirated, dual-fuel engine	
No. of Cylinders	8	
Bore × Stroke	4.35 in. × 4.50 in. (111 mm × 114 mm)	
Displacement	535 cu. in. (8.8 liters)	
Rated Output	Natural gas: 146 hp @ 1,800 rpm (prime power)	
	LPG: 167 hp @ 1,800 rpm (prime power)	
Starting Motor	12 V – 2 kW	
Charging Generator	12 V – 70 A	
Spark Plug	IFR7F-4D	
Coolant Capacity	6.34 gal. (24.0 liters) ¹	
Lube Oil Capacity	3.1 gal. (11.8 liters) ²	
Lube Oil Type	SAE 5W-30 API rating of SM or newer	
Fuel Type	Natural gas (NG) / liquid propane gas (LPG) ³	
Fuel Consumption	NG: 818 CFH (18.6 kg/hr.)	
	LPG: 259 CFH (14.0 kg/hr.)	
Battery	12V-904D (CCA 0°F 1,010 A)	

¹ Includes engine, radiator, and hoses.

² Includes oil filter.

³ Refer to Table 12.

DIMENSIONS

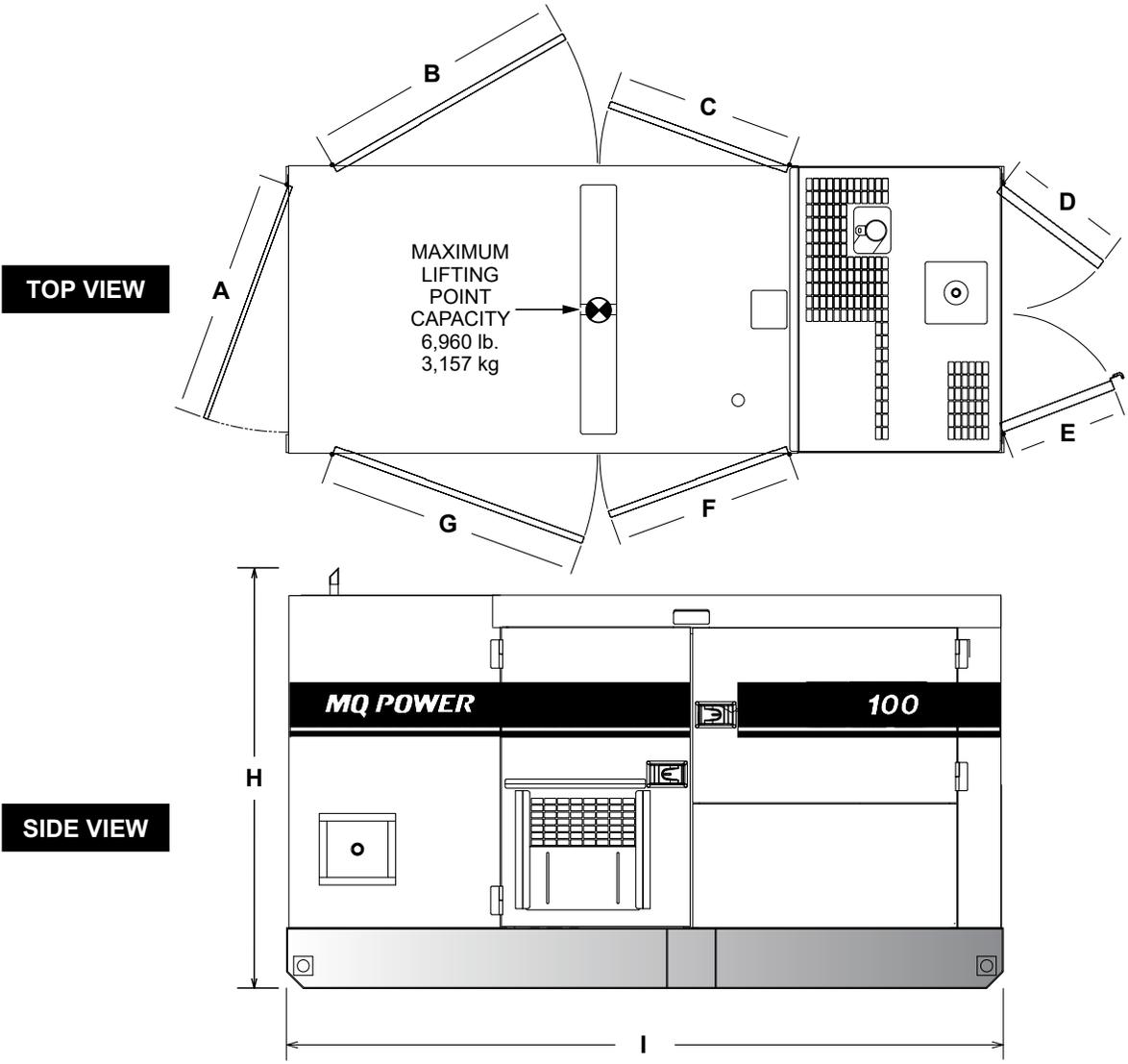


Figure 2. Dimensions

Table 4. Dimensions			
Reference Letter	Dimension in. (mm)	Reference Letter	Dimension in. (mm)
A	40.83 (1,037)	G	43.70 (1,110)
B	43.70 (1,110)	H	69.86 (1,774)
C	31.22 (793)	I	118.50 (3,010)
D	20.87 (530)	J	47.25 (1,200)
E	19.70 (500)	K	64.55 (1,640)
F	31.22 (793)		

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.

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.

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

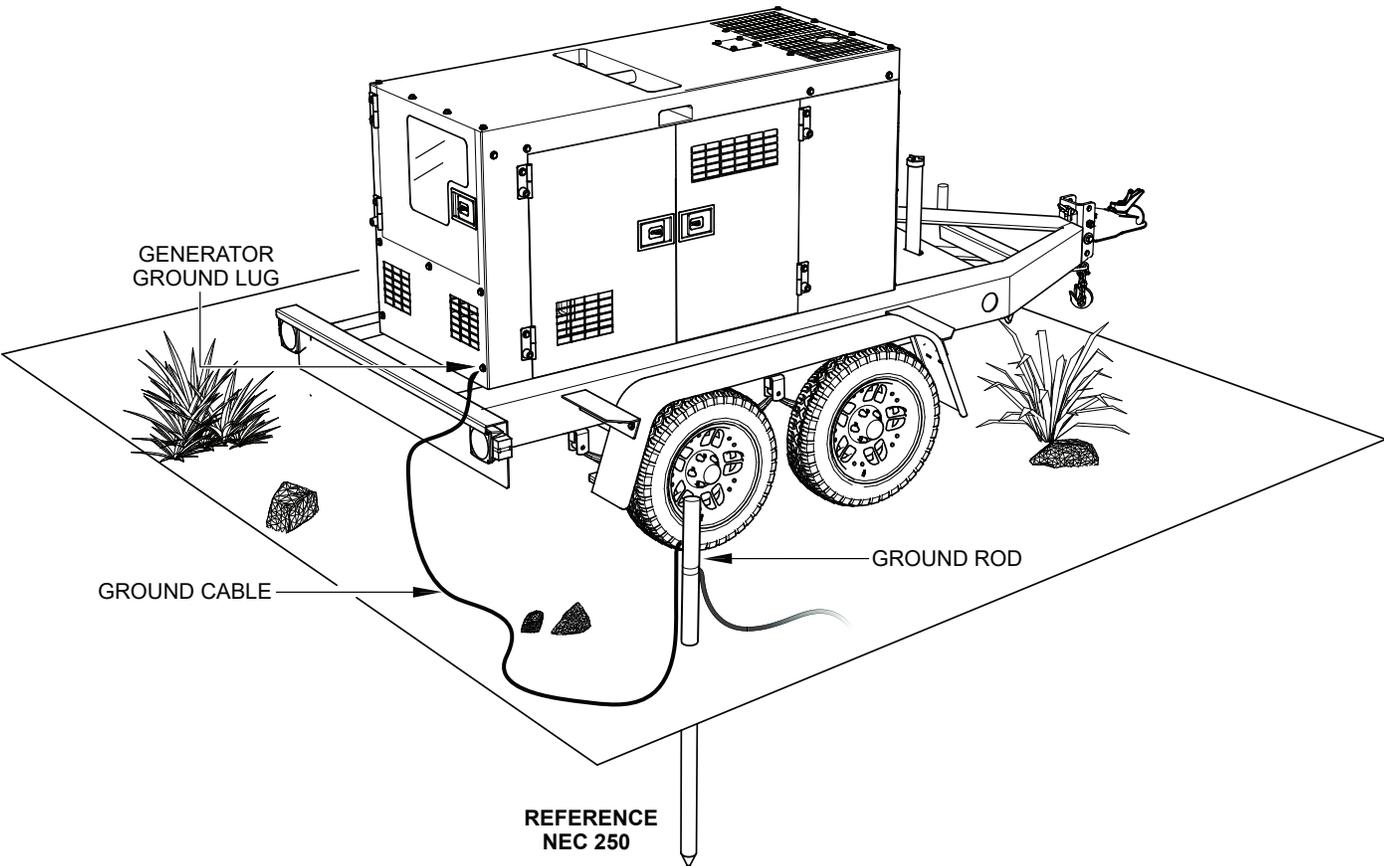


Figure 3. Typical Generator Grounding Application

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

The NGA100SSPUL generator (Figure 5) 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.

CONTROL PANEL

The **control panel** is provided with the following:

- Basler DGC2020ES Digital Controller (Standard)
 - Liquid Crystal Display
 - Not In Auto Indicator
 - Alarm Indicator
 - Supplying Load Indicator
 - Auto Button / Mode Indicator
 - Off Button / Mode Indicator
 - Run Button / Mode Indicator
 - Back Button
 - Arrow Buttons (2)
 - Edit Button
- Panel Light / Panel Light Switch
- Control Power Switch
- Voltage Regulator
- Battery Switch
- 3-Phase, 250-Amp Circuit Breaker
- Natural Gas Lamp
- Liquid Propane Gas Lamp
- Fuel Selector Switch
- Emergency Stop Switch
- **Control Box** (located behind Control Panel)
 - Automatic Voltage Regulator
 - Overcurrent Relay
 - Starter Relay
 - Voltage Selector Switch

OUTPUT TERMINAL PANEL

The **output terminal panel** is provided with the following:

- Three 240/120V Output Receptacles (CS-6369), 50A
- Three Auxiliary Circuit Breakers, 50A
- Two 120V Output Receptacles (GFCI), 20A
- Two GFCI Circuit Breakers, 20A
- Four Output Terminal Lugs (3Ø Power)
- Ground Lug
- Battery Charger (Option)
- Cam-Lok Connectors (Option)

OPEN-DELTA EXCITATION SYSTEM

Each generator is equipped with a 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 V-type, 4-cycle, water-cooled, naturally aspirated, PSI 8.8L NA dual-fuel engine. This engine is designed to meet every performance requirement for the generator. Refer to Table 3 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 RPM of the engine. When the engine demand increases or decreases, the microprocessor system regulates the frequency variation to $\pm 0.25\%$.

EXTENSION CABLES

When electric 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 8) as a guide for selecting the proper extension cable size.

GENERAL PARALLELING INFORMATION (OPTION)

NOTICE

When the paralleling option is employed, the Basler DGC-2020HD controller must be installed. The factory-installed DGC-2020ES controller cannot be used for paralleling.

PARALLELING

Paralleling is the sharing of a load between two or more generator sets.

LOAD SHARING

Load sharing is defined as the proportional division of the kW and kVAR total load between multiple generator sets in a paralleled system.

Load sharing is essential to avoid overloading and stability problems on the system's generator sets.

ACTIVE POWER (KW) LOAD SHARING

When generator sets operate in parallel, the engine speed governor of each generator set determines the proportional sharing of the total active power requirements (kW) of the system.

The kW load sharing is achieved by increasing or decreasing fuel to the system's engines. As the fuel to the engine of one generator set in a group is increased, it will not lead to an increase in speed and hence frequency (as it would if it were operating alone), but it will lead to an increase in the proportion of the total kW load that it will deliver.

As the fuel to the engine of one generator set in a group is decreased, it will not lead to a decrease in speed and hence frequency (as it would if it were operating alone), but it will lead to a decrease in the proportion of the total kW load that it will deliver.

The control system of the generator sets (via the engine speed control system) monitors and controls the sharing of the total kW load in proportion to the relative rating of the engines on the system's generator sets.

REACTIVE POWER (KVAR) LOAD SHARING

When generator sets operate in parallel, the alternator field excitation system of each generator set controls the proportional sharing of the total reactive power requirements (kVAR) of the system.

The kVAR load sharing is achieved by increasing or decreasing the field excitation to the system's alternators.

As the field excitation of one generator set in a group is increased (i.e. over excited), it will not lead to an increase in voltage (as it would if it were operating alone), but it will lead to an increase in the proportion of the total kVAR load it will deliver and a decrease in its power factor.

As the field excitation of one generator set in a group is decreased (i.e. over excited), it will not lead to a decrease in voltage (as it would if it were operating alone), but it will lead to a decrease in the proportion of the total kVAR load it will deliver and an increase in its power factor.

An undesirable circulating reactive current (cross current) will flow in the system if the excitation of the alternators is not matched.

ETHERNET COMMUNICATION

Ethernet communication is the preferred method for paralleling. This method supports breaker negotiation to avoid simultaneous breaker closures, kW load sharing and kVAR sharing, soft load transfers, and on and off loading.

The ethernet ports are located at the output bus splash panel area. There are two ports which are identical so either one can be used. Using a standard ethernet cable, interconnect the units to be paralleled and/or sequenced.

LOAD MANAGEMENT

These generators are set up to automatically manage load based on demand. Load management is only functional in Auto mode. While in Auto mode, if the auto-start contacts are closed, load management is active by default. Load management will only run the number of units needed to support the load.

If the load demand is small, only one generator will run while the other generators remain in Standby mode. If the load increases above 80% of its capacity, it will start the next generator. The next generator priority is based on the time remaining on the maintenance timer.

Generators with more time until scheduled maintenance will take priority over units that are almost due for maintenance. Once the second unit starts, it will synchronize and parallel in, then ramp up to share the load. If the load levels drop below 35% of its combined rating, the generator that is no longer needed will ramp off, shut down, and wait in Standby mode.

GENERAL PARALLELING INFORMATION (OPTION)

SEQUENCING

NOTICE

Ethernet communication is required when the generators are configured for the sequencing mode of operation.

These generators are capable of sequencing for control of balanced maintenance schedules. As described above, the generators can start and stop as demand raises or lowers. In addition, if a unit gets to the point of maintenance, it will ramp off and start the next generator to relieve it based on the time remaining on the maintenance timer.

After maintenance is performed, the maintenance timers should be reset to the recommended service interval. This is usually 250 hours but may vary depending on the engine oil type.

MAINTENANCE INTERVAL

Maintenance intervals are factory set for 250 hours. The maintenance interval timer will count down to zero indicating that it is time for the unit to be serviced.

Once the timer counts down to zero, a pre-alarm will appear indicating that the unit is due for maintenance. To reset the maintenance interval back to the default time of 250 hours, press and hold the Reset button for ten seconds.

To reset the maintenance interval using the Reset button, the Maintenance Due pre-alarm must be active, and the Basler controller must display the Overview (main) screen.

If the maintenance timer has not yet expired and it is desired to reset the unit back to 250 hours, navigate back to the Settings menu: Settings Menu->System Parameters->Engine Statistics->Hours To Maintenance.

ALARM SILENCE

Pre-Alarm Silence allows the user to suppress the toggling of the Alarm screen when a new pre-alarm becomes active. While a pre-alarm is active, press the Alarm Silence button to suppress the fault display.

This is a very useful function when the Maintenance Interval pre-alarm occurs. Right after the pre-alarm occurs, it will begin toggling between the pre-alarm and the Overview screen.

While in this mode, pressing the Reset button does not reset the maintenance interval. In order to reset the maintenance interval, the Overview screen must be selected.

Press the Alarm Silence button to stop the toggling between the pre-alarm and the Overview screen.

Once the Overview screen is selected, reset the maintenance interval by pressing and holding the Reset button for 10 seconds.

THREE PHASE 480V/208V PARALLEL WIRING VIA OPTIONAL CAM-LOKS

Required Equipment (User Supplied)

- Conductor cables
- CAT5E or better shielded cable
- Power distribution panel

The following procedure is intended to assist the user with the parallel wiring configuration for the generator using the optional cam-lock connector panel.

NOTICE

Only a **qualified service technician** or **licensed electrician** with proper training should perform this installation. Follow all shop safety rules when performing this installation.

GENERAL PARALLELING INFORMATION (OPTION)

Preparation

1. Make sure the generator is turned **OFF** and the engine is cool.
2. Disconnect any loads connected to the generator.
3. Place the main circuit breaker in the **OFF** position.
4. Place the generator in an area free of dirt and debris. Make sure it is on secure, level ground.
5. Disconnect the negative battery cable from the battery.

3-Phase 480-Volt AC Parallel Wiring Configuration

Use appropriately sized cables when connecting two generators to the power distribution panel. Refer to the NEC handbook for correct sizing of cables. Contact a licensed electrician for correct electrical wiring configuration.

⚠ DANGER

To prevent arcing, make sure cables are securely tightened at the power distribution panel. The possibility exists of the unit catching on fire thus causing equipment damage and severe bodily harm.

NOTICE

When connecting load cables to the power distribution panel, be sure to select correctly sized load cables to handle the full-load amperage of both generators (in parallel).

3-Phase 208-Volt AC Parallel Wiring Configuration

Use appropriately sized cables when connecting two generators to the power distribution panel. Refer to the NEC handbook for correct sizing of cables. Contact a licensed electrician for correct electrical wiring configuration.

Ethernet Cable Connection

1. Connect a **shielded CAT5E ethernet cable** between **port 1** on both generators as shown in Figure 4.

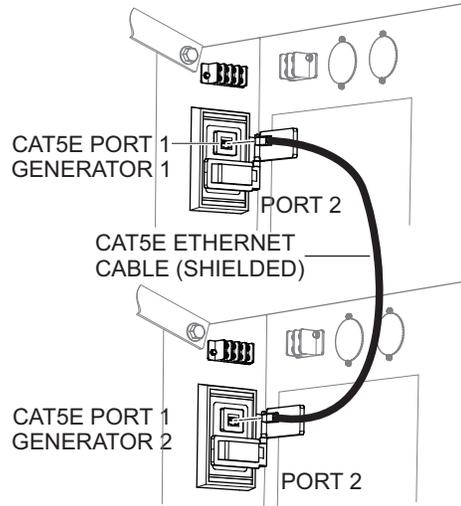


Figure 4. Ethernet Cable Connection

2. Refer to Table 5 for additional ethernet port connections.

Table 5. Ethernet Cable Connections	
Generator 1	Generator 2
Port 2	Port 1
Port 1	Port 2
Port 2	Port 2

3. Reconnect the battery.
4. Start the generator as shown in the **Generator Start-Up Procedure** section of this manual.

MAJOR COMPONENTS

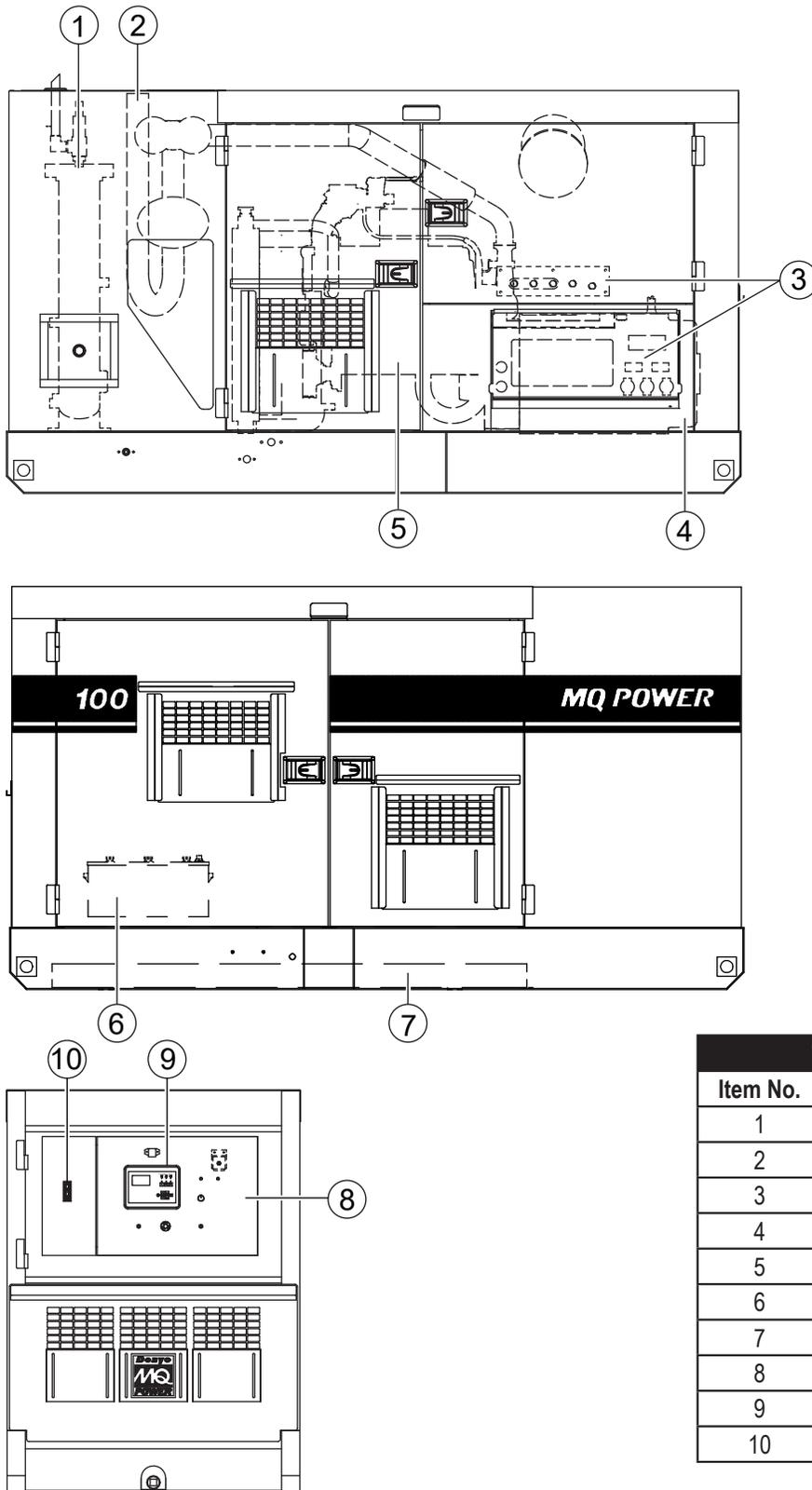


Figure 5. Major Components

GAS FILTER SEPARATOR

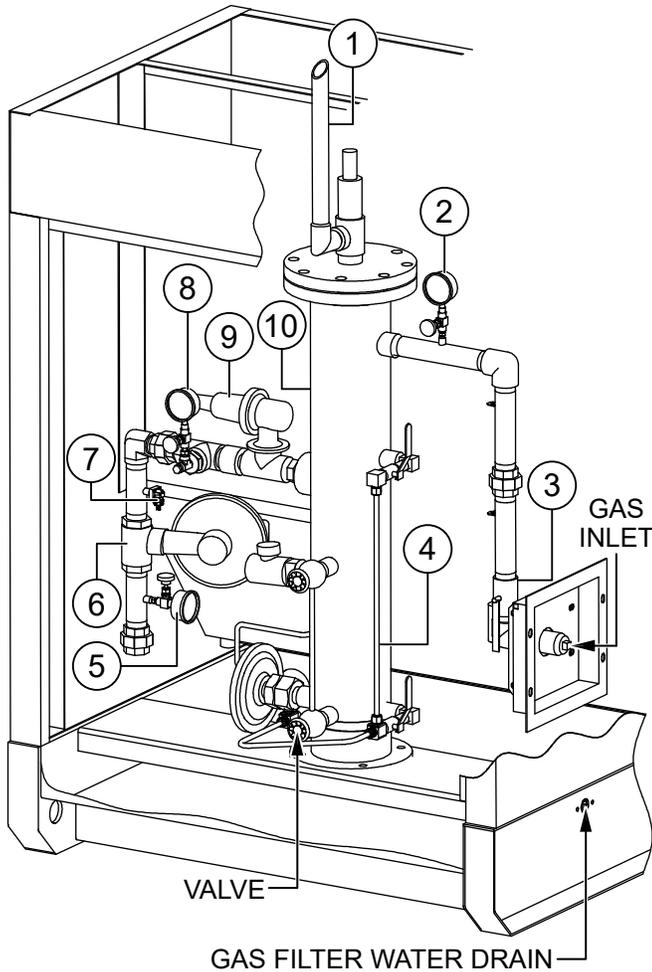


Figure 6. Gas Filter Separator

1. **Safety Valve** — This valve's pressure setting is 175 psi. In order to prevent damage to the internal plumbing and machinery, the gas will be released from the valve when the supplied gas pressure exceeds the pressure setting.

! WARNING

Natural gas is highly flammable and can cause fire and explosion. Gas may leak from the safety valve. Remove all sources of ignition before operating.

2. **Pressure Gauge (High-Pressure Side)** — Displays the gas inlet pressure. Make sure the pressure is between 20 and 150 psi before operation.
3. **Gas Inlet Valve** — Before opening the gas inlet valve, make sure the gas inlet supply pressure is between 20 and 150 psi. When this valve is opened, gas is supplied to the unit side. If a gas supply pipe is connected to the gas inlet, leave this valve closed.

4. **Liquid Level Gauge** — Release mist trapped in the gas filter separator periodically as indicated by this gauge.

! WARNING

Flammable gas is automatically emitted from the gas filter water drain. This gas can cause fire and explosion. The gas filter water drain must be connected to the plumbing system to prevent the release of gas.

! WARNING

Natural gas and LPG are highly flammable and can cause fire and explosion. To ensure safety, perform the gas pipeline and connection leak inspection regularly.

5. **Pressure Gauge (Low-Pressure Side)** — Displays the engine-side gas inlet pressure. Make sure the pressure is between 7 and 11 inH₂O when the engine is in operation.
6. **Regulator (Low-Pressure Side)** — Regulates gas pressure on the outlet side to 11 inH₂O.
7. **Pressure Switch** — This switch's pressure setting is 5 psi. When the Fuel Selector switch is set to the AUTO position, this switch automatically changes the fuel type used. Natural gas is used at 5 psi or greater; otherwise liquid propane gas is used.
8. **Pressure Gauge (Medium-Pressure Side)** — Displays the gas inlet pressure. Make sure the pressure is between 5 and 20 psi before operation.
9. **Regulator (High-Pressure Side)** — Regulates gas pressure on the outlet side to 15 psi.

! CAUTION

Natural gas inlet pressure must be within 20–150 psi. If the inlet pressure exceeds the allowable pressure, gas may be ejected from the safety valve's outlet, causing a dangerous hazard. Gas venting will not cause an emergency stop. Therefore, stop the engine and restore the pressure to the allowable range.

10. **Gas Filter Separator** — Protects secondary side machinery by filtering and removing solid and liquid contamination in Natural gas.

CONTROL PANEL

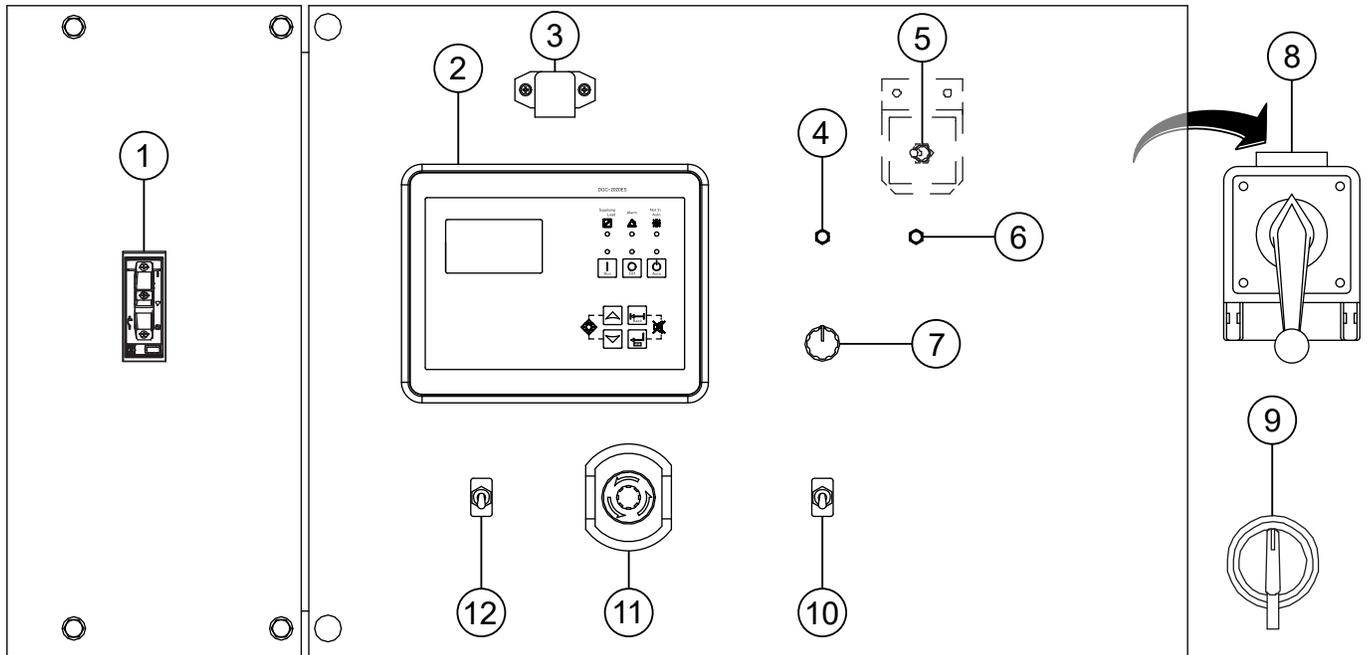


Figure 7. Control Panel

The definitions below describe the controls and functions of the **control panel** (Figure 7).

1. **Main Circuit Breaker** — 3-phase, 250-amp, main circuit breaker connects and disconnects generator output from the output terminal lugs, and protects the generator from short circuits or overcurrent.
2. **Basler DGC-2020ES Digital Genset Controller** — Displays parameters (AC voltage, AC current, phase, frequency, oil pressure, engine run hours, water/coolant temperature, and battery voltage), as well as diagnostic trouble codes and messages. Refer to the **Basler Digital Genset Controller** section for more information.
3. **Panel Light** — Illuminates the control panel for nighttime operation.
4. **LPG Lamp** — Illuminates when liquid propane gas (LPG) is selected as fuel.
5. **Fuel Selector Switch** — Place this switch in the NG position to use only natural gas as fuel. Place this switch in the LPG position to use only liquid propane gas as fuel. Place this switch in the Auto position to allow the unit to select fuel type automatically by reading the pressure inside the NG plumbing (5 psi or more will select NG fuel).
6. **NG Lamp** — Illuminates when natural gas (NG) is selected as fuel.

7. **Voltage Regulator** — Allows fine adjustment of the generator's output voltage.
8. **Voltage Selector Switch** — Use to select the output voltage: 3Ø 480/277V, 3Ø 240/139V, or 1Ø 240/120V. Located inside the control box.
9. **Battery Switch** — Connects and disconnects the battery. Place the switch in the **ON** position prior to starting the generator. When the generator is not in use, place the switch in the **OFF** position.

NOTICE

NEVER place the battery switch in the **OFF** position **while the engine is running**. The engine may not be able to be stopped by normal operation, and damage to the equipment may result.

10. **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.
11. **Emergency Stop Switch** — Push this button inward to stop the engine in the event of an emergency. **DO NOT** use this button as a normal means of stopping the engine.
12. **Control Power Switch** — Set this switch to the **ON** position prior to operation. The digital controller will turn **ON**. Make sure the switch is set to the **OFF** position when operation has ended.

BASLER DIGITAL GENSET CONTROLLER

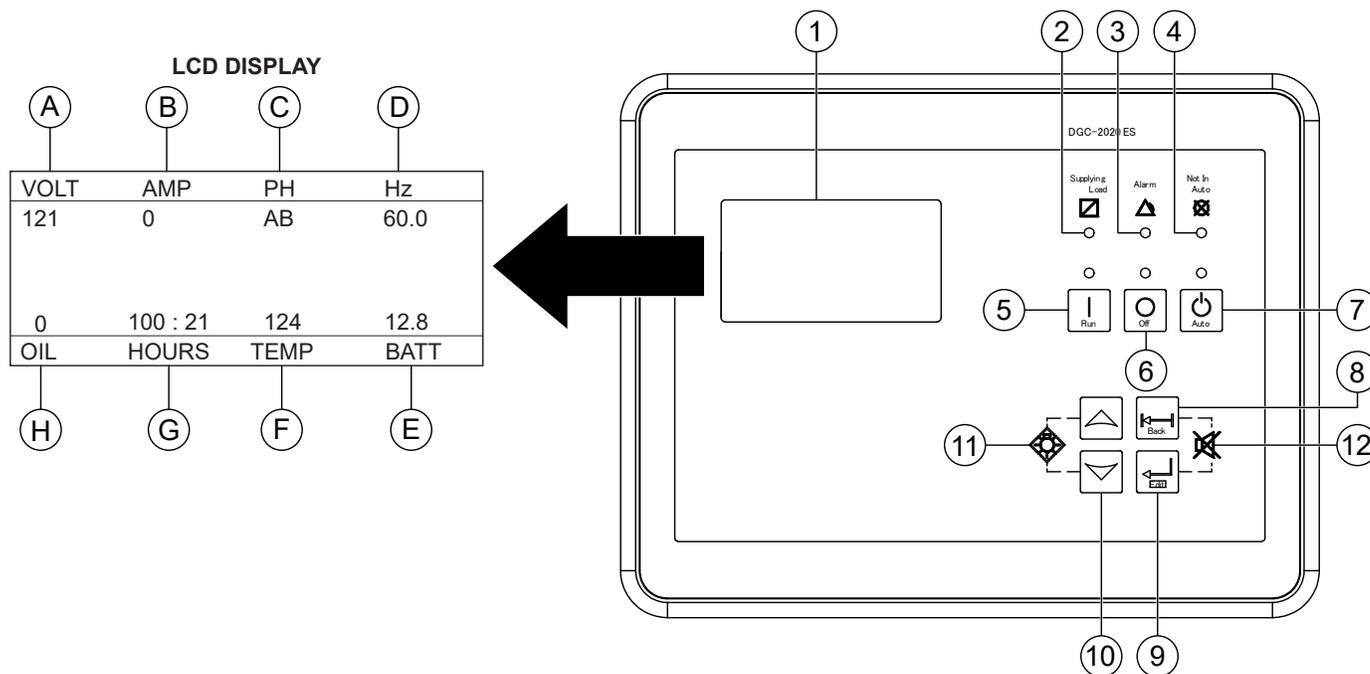


Figure 8. Basler DGC-2020ES

The definitions below describe the controls and functions of the **Basler DGC-2020ES digital genset controller** (Figure 8). Refer to the digital controller's instruction manual for more information.

1. **LCD Display** — Serves as the local information source for metering, alarms, pre-alarms, and protective functions.
 - A. **AC Voltmeter** — Indicates the phase-to-phase voltage of the output terminals.
 - B. **AC Ammeter** — Indicates the current flowing to the load connected to the output terminals.
 - C. **Phase Indicator** — Indicates the line at which the AC voltage is measured. A = U phase, B = V phase, C = W phase.
 - D. **Frequency Meter** — Indicates the output frequency of the generator in hertz (Hz). Normally 60 Hz.
 - E. **Battery Voltmeter** — During normal operation this gauge should indicate greater than 12 VDC.
 - F. **Water Temperature Gauge** — During normal operation this gauge should indicate approximately 167°–203°F (75°–95°C).
 - G. **Run Hours Meter** — Indicates the engine run time in hours and minutes (e.g. 100:21 = 100 hours and 21 minutes).
 - H. **Oil Pressure Gauge** — During normal operation this gauge should read between 35–65 psi (241–448 kPa). When starting the generator the oil pressure may read a little higher, but after the engine warms up the oil pressure should return to the correct pressure range.

BASLER DIGITAL GENSET CONTROLLER

2. **Supplying Load Indicator** — This green LED lights whenever the generator current is greater than the emergency power supply (EPS) threshold current.
3. **Alarm Indicator** — This red LED lights continuously during alarm conditions and flashes during pre-alarm conditions.
4. **Not In Auto Indicator** — This red LED lights whenever the DGC-2020ES is not operating in Auto mode. When the DGC-2020ES is operating in Run mode or Off mode, this LED is **ON**.
5. **Run Pushbutton and Mode Indicator** — Press this button to place the DGC-2020ES in Run mode. The green Run Mode LED lights whenever Run mode is active.
6. **Off Pushbutton and Mode Indicator** — Press this button to place the DGC-2020ES in Off mode. The red Off Mode LED lights whenever the DGC-2020ES is in Off mode. This button also resets the Breaker Management pre-alarms and all MTU ECU alarms.
7. **Auto Pushbutton and Mode Indicator** — Press the Auto pushbutton to place the DGC-2020ES in Auto mode. The green Auto Mode LED lights whenever Auto mode is active.

While in Auto mode, if the unit's auto-start contacts are connected to a transfer switch and the contacts between the terminals are closed, the unit will start and automatically close the circuit breaker.
8. **Back Pushbutton** — Press this button to cancel a settings editing session and discard any settings changes. When navigating through menus, press this button to move upward a level. When pressed momentarily, this button also resets the Breaker Management pre-alarms and all MTU ECU alarms. Also, this button will reset the maintenance interval when pressed for 10 seconds while viewing Hours Until Maintenance or the Maintenance Due Pre-Alarm.
9. **Edit Pushbutton** — Press this button to start an editing session and enable changes to the DGC-2020ES settings. At the conclusion of an editing session, press this button again to save the setting changes. When navigating through menus, pressing this button moves downward one level. When entering a string, such as a password, this button locks the selected character and moves to the next position. When finished, press Edit twice to submit the string.
10. **Arrow Pushbuttons** — These two buttons are used to navigate through the front panel display menus and to modify settings.
 - The Up-Arrow and Down-Arrow buttons are used to move among items within a menu level. Press the Down-Arrow button to move to items lower on the list. Press the Up-Arrow button to move to items higher on the list.
 - During a settings editing session, the Up Arrow and Down Arrow buttons are used to increase and decrease the value of the selected setting.
11. **Lamp Test Pushbutton Combination** — Press the Up-Arrow button and Down-Arrow button simultaneously to test the DGC-2020ES indicators by exercising all LCD pixels and lighting all LEDs for as long as both buttons are held.
12. **Alarm Silence Pushbutton Combination** — Press the Back button and Edit button simultaneously to open the relay output programmed as the horn output.

OUTPUT TERMINAL PANEL FAMILIARIZATION

OUTPUT TERMINAL PANEL

The **output terminal panel** (Figure 10) shown below is provided for the connection of electrical loads. 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.

OUTPUT TERMINAL FAMILIARIZATION

The **output terminal panel** (Figure 10) is provided with the following:

- Three (3) 240/120-volt, 50-amp output receptacles
- Three (3) 50-amp circuit breakers
- Two (2) 120-volt, 20-amp GFCI receptacles
- Two (2) 20-amp GFCI circuit breakers
- Five (5) output terminal lugs (U, V, W, O, Ground)

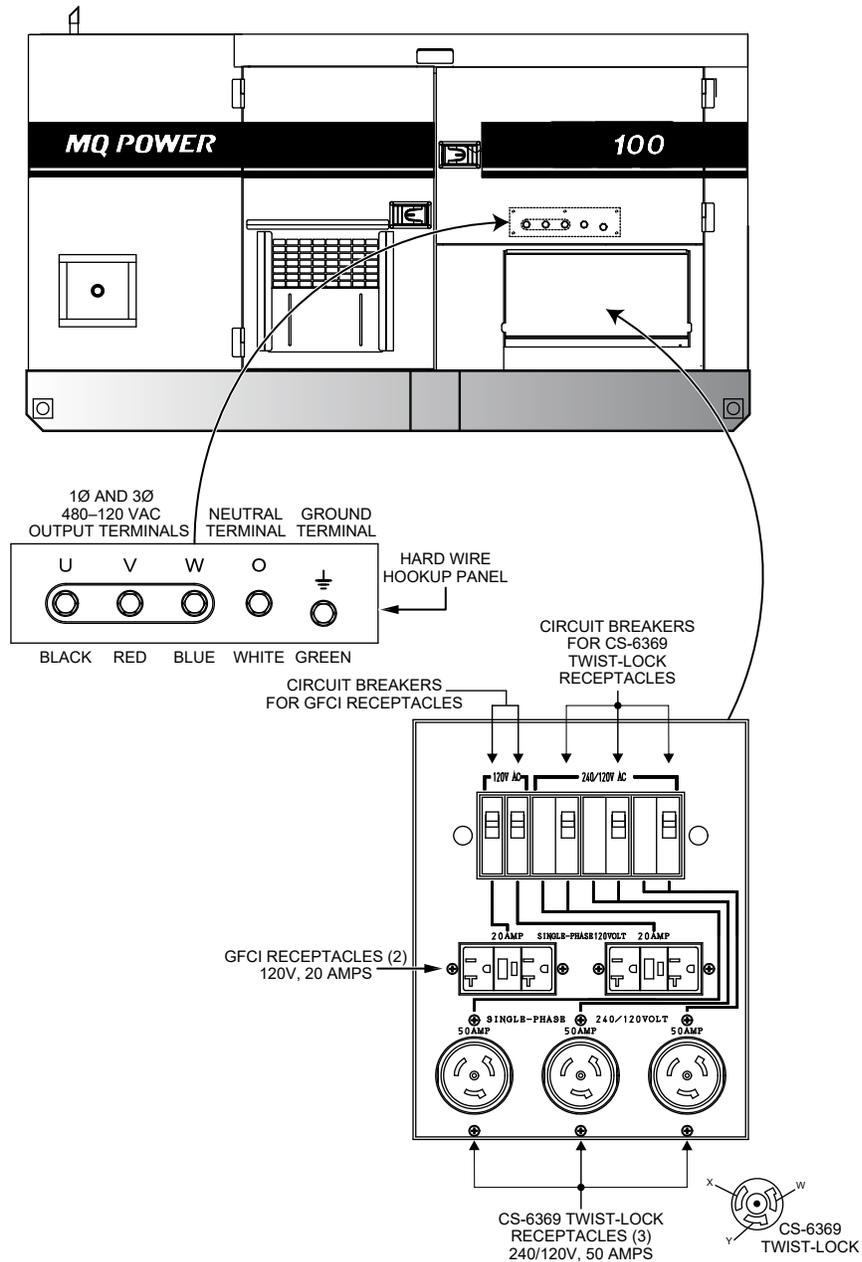


Figure 9. Output Terminal Panel

OUTPUT TERMINAL PANEL FAMILIARIZATION

120-Volt AC 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-volt, 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 that 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 10) to reset the GFCI receptacle after it has been tripped. Press the **Test button** in the center of the receptacle 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 receptacle.

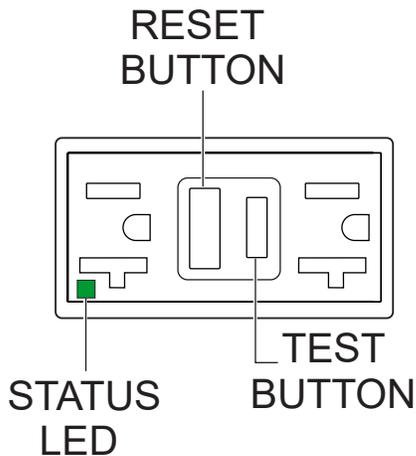


Figure 10. 120-Volt GFCI Receptacle

Twist-Lock Dual-Voltage 240/120-Volt AC Receptacles

There are three 240/120-volt, 50-amp, auxiliary twist-lock (CS-6369) receptacles (Figure 11) provided on the output terminal panel. These receptacles can only be accessed when the voltage selector switch is configured for single-phase, 240/120-volt operation.

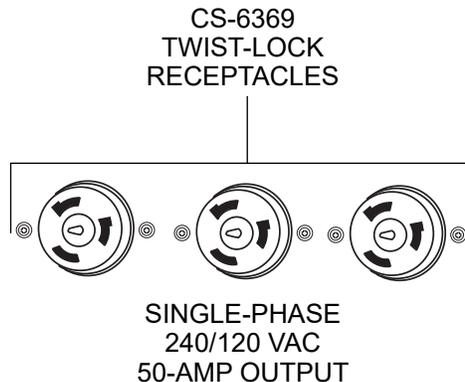


Figure 11. 240/120-Volt Twist-Lock Auxiliary Receptacles

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

The output terminal lugs are located behind a **protective cover** (Figure 12). Unscrew the **retaining bolts** and lift the cover to gain access to the output terminal lugs.

After the load wires have been securely attached to the output terminal lugs, lower the protective cover and reinstall the retaining bolts.

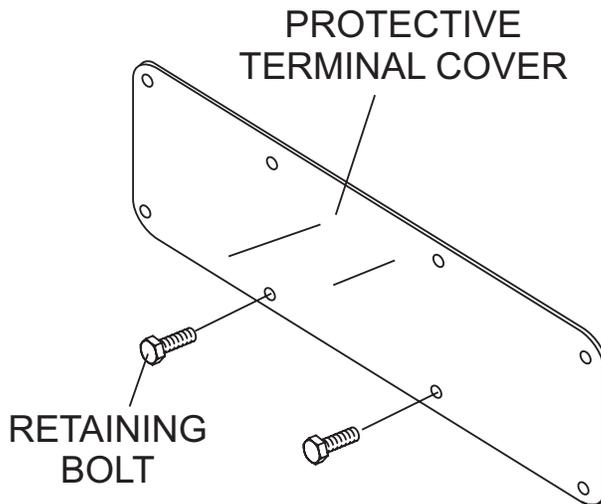


Figure 12. Protective Terminal Cover (Output Terminal Lugs)

OUTPUT TERMINAL PANEL FAMILIARIZATION

Connecting Loads

Loads can be connected to the generator via the **output terminal panel**, **convenience receptacles**, or **optional cam-locks** (Figure 13). 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, 250-amp, main circuit breaker is provided. Make sure to switch **ALL** circuit breakers to the **OFF** position prior to starting the engine.

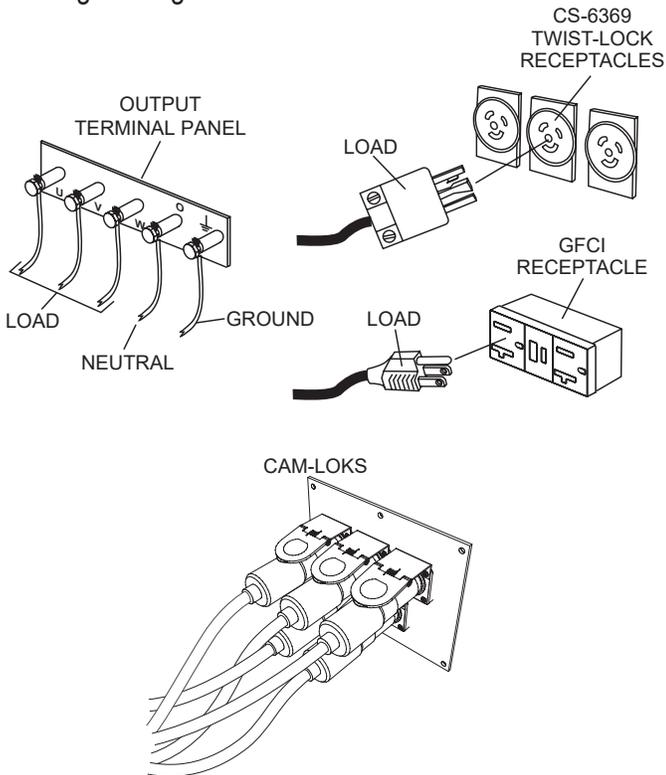


Figure 13. Connecting Loads

OVERCURRENT RELAY

An **overcurrent relay** (Figure 14) 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 cannot be reset, the **Reset button** on the overcurrent relay must be pressed. The overcurrent relay is located inside the control box.

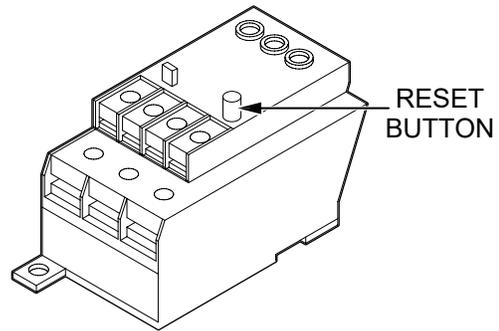


Figure 14. Overcurrent Relay

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 250-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.

LOAD APPLICATION

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 the nameplate voltage by the nameplate amperage.

$$\text{WATTS} = \text{VOLTAGE} \times \text{AMPERAGE}$$

The power factor of this generator (single phase) is 1.0. See Table 7 below when connecting loads.

Table 7. 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 8. Cable Selection (60 Hz, Single-Phase Operation)

Current in Amperes	Load in Watts		Maximum Allowable Cable Length			
	At 100 Volts	At 200 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:

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

NOTICE

If 3-phase load (kVA) is not given on the equipment nameplate, approximate 3-phase 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.

GENERATOR OUTPUTS

GENERATOR OUTPUT VOLTAGES

A wide range of voltages (Table 9) is available for many different applications.

Table 9. Voltages Available						
UVW 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
3Ø Line-Neutral	120V	127V	139V	240V	254V	277V
Voltage Selector Switch Single-Phase 240/120V Position						
1Ø Line-Line	N/A	N/A	N/A	240V	N/A	N/A
1Ø Line-Neutral	120V	N/A	N/A	N/A	N/A	N/A

Voltage Selector Switch

Voltages are selected using the **Voltage Selector switch** (Figure 15) which is located inside the control box. This switch has been provided for ease of voltage selection.

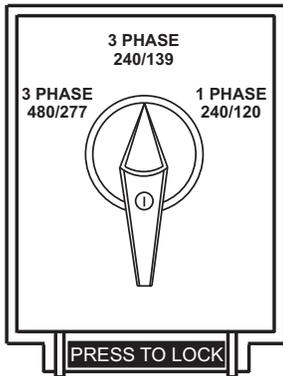


Figure 15. Voltage Selector Switch

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.

Voltage Regulator

To obtain some of the voltages listed in Table 9 will require a fine voltage adjustment using the **voltage regulator** (Figure 16) located on the control panel.



Figure 16. Voltage Regulator

MAXIMUM AMPS

Table 10 shows the maximum amps the generator can provide. **DO NOT** exceed the maximum amps as listed.

Table 10. Generator Maximum Amps	
Rated Voltage	Maximum Amps
Single Phase 120 Volts	241 amps × 2 (zigzag)
Single Phase 240 Volts	241 amps (zigzag)
Three Phase 208 Volts	241 amps
Three Phase 240 Volts	241 amps
Three Phase 480 Volts	120 amps
Main Line Circuit Breaker Rating	250 amps
Overcurrent Relay Trip Set Point 480V Mode Only	120 amps

SIMULTANEOUS POWER

Table 11 shows available power at various voltage and phase combinations. **DO NOT** exceed the maximum available simultaneous power.

Table 11. Simultaneous Power	
Power In Use	Available Receptacle Power
3-Phase 240/480V	GFCI Duplex 5-20R 120V
kVA	kW
100	0
95.8	1.2
91.7	2.4
87.5	3.6
83.4	4.8

OUTPUT TERMINAL PANEL CONNECTIONS

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 and the adjustment of the voltage regulator.

Remember the Voltage Selector switch determines the range of the output voltage. The voltage regulator allows the user to increase or decrease the selected voltage.

3-Phase 240-Volt UVWO Terminal Output Voltages

1. Place the **Voltage Selector switch** in the **3-phase 240/139-volt position** as shown in Figure 17.

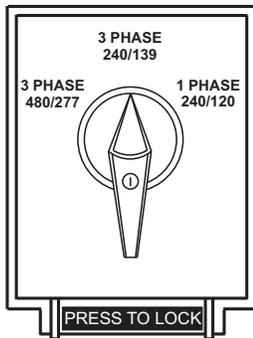


Figure 17. Voltage Selector Switch (3-Phase 240/139-Volt Position)

2. Connect the load wires to the **UVWO terminal lugs** as shown in Figure 18.

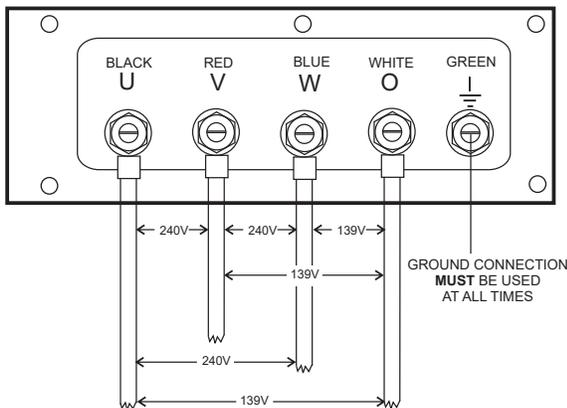


Figure 18. UVWO Terminal Lugs (3-Phase 240-Volt Connections)

3. Turn the **voltage regulator** (Figure 19) clockwise to increase voltage output, and counterclockwise to decrease voltage output. Use the voltage regulator whenever fine tuning of the output voltage is required.



Figure 19. Voltage Regulator

3-Phase 208-Volt / Single-Phase 120-Volt UVWO Terminal Output Voltages

1. Place the **Voltage Selector switch** in the **3-phase 240/139-volt position** as shown in Figure 17.
2. Connect the load wires to the **UVWO terminal lugs** as shown in Figure 20.

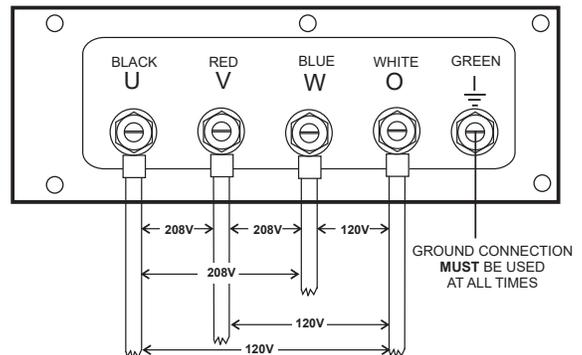


Figure 20. UVWO Terminal Lugs (3-Phase 208-Volt / 1-Phase 120-Volt Connections)

NOTICE

To achieve 3-phase 208-volt output, the Voltage Selector switch must be in the 3-phase 240/139-volt position and the voltage regulator must be adjusted to 208 volts.

OUTPUT TERMINAL PANEL CONNECTIONS

3-Phase 480/277-Volt UVWO Terminal Output Voltages

1. Place the **Voltage Selector switch** in the **3-phase 480/277-volt position** as shown in Figure 21.

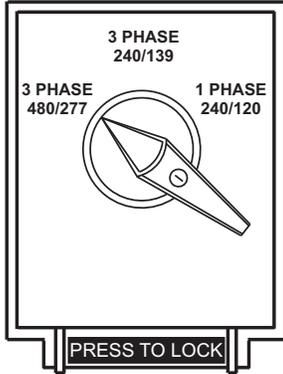


Figure 21. Voltage Selector Switch (3-Phase 480/277-Volt Position)

2. Connect the load wires to the **UVWO terminal lugs** as shown in Figure 22.

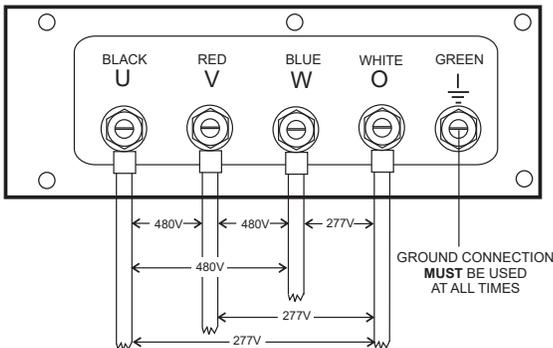


Figure 22. UVWO Terminal Lugs (3-Phase 480-Volt Connections)

NOTICE

ALWAYS make sure that the connections to the UVWO terminals are **secure and tight**. The possibility of arcing exists that could cause a fire.

Single-Phase 240/120-Volt UVWO Terminal Output Voltages

1. Place the **Voltage Selector switch** in the **1-phase 240/120-volt position** as shown in Figure 23.

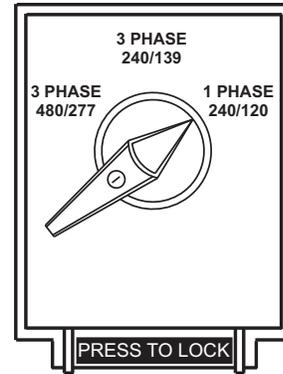


Figure 23. Voltage Selector Switch (Single-Phase 240/120-Volt Position)

2. Connect the load wires to the **UVWO terminal lugs** as shown in Figure 24.

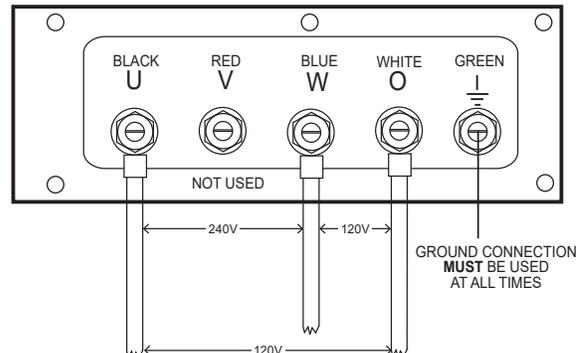


Figure 24. UVWO Terminal Lugs (Single-Phase 240/120-Volt Connection)

3. Turn the **voltage regulator** (Figure 19) clockwise to increase voltage output, and counterclockwise to decrease voltage output. Use the voltage regulator whenever fine tuning of the output voltage is required.

UNIT INSPECTION

Perform an overall inspection of the unit to check for any damage or loosening of hardware components that may have occurred during shipment.

ENGINE OIL CHECK

1. To check the engine oil level, place the generator on secure, level ground with the engine stopped.
2. Remove the engine oil dipstick from its holder and wipe it clean.
3. Reinsert the dipstick, then remove the dipstick from its holder. Check the oil level shown on the dipstick (Figure 25).

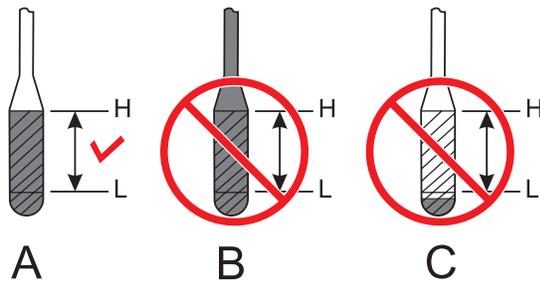


Figure 25. Engine Oil Dipstick

4. Verify that the engine oil level is maintained between the H and L markings on the dipstick as shown in Figure 25A.
5. If the engine oil level is low (Figure 25C), remove the cap from the oil filler port and fill to a safe operating level (max) as indicated by the dipstick (Figure 25A). Fill with SAE 5W-30 viscosity, synthetic-blend oil that meets Dexos1 standards. Maximum oil capacity is 3.1 gallons (11.8 liters).

NOTICE

When adding engine oil, **DO NOT** overfill (Figure 25B).

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.

FUEL CONNECTION

Properly connect the gas supply pipe to the gas inlet valve.

CAUTION

Natural gas inlet pressure **must be within 20–150 psi**. When the inlet pressure exceeds the allowable pressure, it is dangerous because the gas may blow out from the safety valve's outlet. **Gas venting will not cause an emergency stop**. Therefore, stop the engine and restore the pressure to the allowable pressure range.

Fuel Type

PSI heavy-duty engines are designed and certified on commercially available pipeline-quality gas. Table 12 is intended to define pipeline-quality gas. If the gas is not commercially available pipeline-quality gas that meets these specifications, it is the end user's responsibility to understand and comply with the certification regulations.

Before starting the unit, perform an analysis of the gas to be used. Contact the engine maker, and provide the results of that test to confirm that there will be no problems using that gas.

Table 12. Standards For Pipeline-Quality Gas

Fuel Constituent	Chemical Formula	Natural Gas			Propane		
		Low	High	Average	Low	High	Average
Methane	CH ₄	92	94.5	93.25	0	1.23	0.615
Ethane	C ₂ H ₆	1	4.5	2.75	2.22	10.12	6.17
Propylene	C ₃ H ₆			0			0
Propane	C ₃ H ₈	0.09	0.44	0.265	87.68	96.7	92.19
i-Butane	C ₄ H ₁₀	0	0.06	0.03	0.56	1.87	1.215
n-Butane	C ₄ H ₁₀	0	0.12	0.06	0.04	1.28	0.66
i-Pentane	C ₅ H ₁₂	0	0.02	0.01	0	0	0
n-Pentane	C ₅ H ₁₂	0	0.01	0.005	0	0	0
Hexane+	C ₆ H ₁₄	0	0.02	0.01	0	0	0
n-Heptane	C ₇ H ₁₆						
n-Octane	C ₈ H ₁₈						
n-Nonane	C ₉ H ₂₀						
n-Decane	C ₁₀ H ₂₂						
Hydrogen Sulfide	H ₂ S						
Carbon Dioxide	CO ₂	0.05	0.25	0.15	0.11	0.01	0.06
Nitrogen	N ₂	1.5	1.5	1.5	0.76	0.17	0.465
Oxygen	O ₂						
Water (Gas)	H ₂ O						
Specific Gravity (S _g =M _{gas} /M _{air} where M _{air} =28.964g/mol)		0.537	0.600	0.568	1.379	1.649	1.514
Wobbe Index (I _w =HHV/sqrt(S _g) where HHV=BTU/SCF)		1295	1359	1328	1930	2125	2030
Wobbe Index (MJ/Sm ³ 1000Btu/scf=37.3MJ/Sm ³)		47.92	50.28	49.12	71.40	78.61	75.09
LHV (Btu/ft ³)		857	952	904	2116	2563	2338
HHV (Btu/ft ³)		949	1053	1001	2266	2728	2497

WARNING

Natural gas and LPG supply pressure can cause gas leaks which can lead to **fire** and **severe personal injury or death**. Gas supply pressure must be adjusted to inside the specified range by qualified personnel. For natural gas, the maximum allowable gas supply pressure is 30 psi and the recommended minimum pressure is 4 psi.

NOTICE

If there are acidic sulfur compound gases in the composition of the gas, remove it using acidic gas removal equipment. Sulfuric compounds will corrode the gas piping and gas machinery, causing damage.

Gas Leak Inspection (Bubble Leak Test)

1. Make sure the unit is stopped and the engine is **OFF**.
2. Open the gas inlet to supply gas to the piping.
3. Apply test liquid (gas leak detector: e.g. Big Blu, Cal-Blue, etc.) to the gas pipe joints etc. and watch for longer than 10 seconds.
4. If bubbles appear on the tested areas, this means that a gas leak is occurring. To repair this, tighten the affected joint or remove the joint, reapply the sealing, and retighten.
5. After the repairs, apply the test liquid again to check for gas leaks.
6. After checking, wipe the test liquid off the hose joints with a rag.

WARNING

DO NOT perform a gas leak test while the unit is operating.

COOLANT CHECK

The PSI 8.8L engine requires the use of a 50/50 mixture of DEX-COOL coolant (or any PSI-approved alternative coolant) and distilled water. This mixture will not vary depending on ambient temperature; the mixture will always remain 50% DEX-COOL and 50% distilled water.

WARNING



When 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 13 for engine, radiator, and reserve tank coolant capacities.

Table 13. Coolant Capacity

Engine and Radiator	6.34 gal. (24.0 liters)
Reserve Tank	See markings

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.

1. To check the coolant level, place the generator on secure, level ground with the engine stopped.
2. Check the level of the coolant in the **coolant reserve tank** (Figure 26):
 - When checking the level while the **engine is cold**, the coolant level should be between the **COLD MIN** and **COLD MAX** marks.
 - When checking the level while the **engine is hot**, the coolant level should be at the **COLD MAX** mark (near the top of the reserve tank).

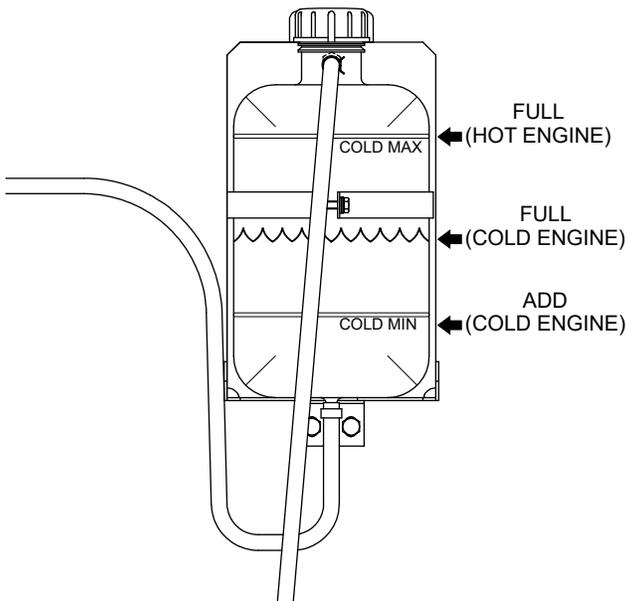


Figure 26. Coolant Reserve Tank

Coolant Contamination

Coolant color can help indicate the condition of the coolant:

- Coolant color should be orange (clear — not cloudy).
- Coolant must not have floating debris or visible oil.
- At times, DEX-COOL may begin to change to a pink color tone. This is normal and should not be a concern as long as it remains clear.

Cleaning The Radiator

The engine may overheat if the radiator cooling fins (Figure 27) 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.

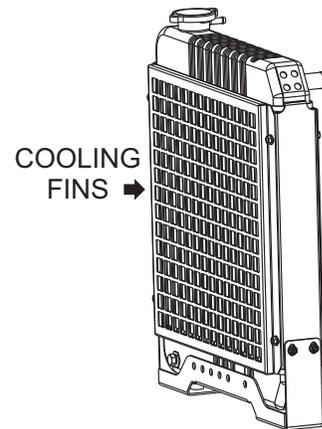


Figure 27. Radiator (Cooling Fins)

ENGINE AIR CLEANER

Periodic cleaning and replacement of the **engine air cleaner** is necessary. Inspect the air cleaner in accordance with the **PSI engine owner's manual**.

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 **PSI engine owner's manual**.

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 the battery fluid level between the specified marks. Battery life will be shortened if the fluid level is 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 only with the recommended type battery (Table 3). The battery type used in this generator is BCI Group Size 4D.

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 make sure the battery cables are properly connected to the battery terminals as shown in Figure 28. 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**.

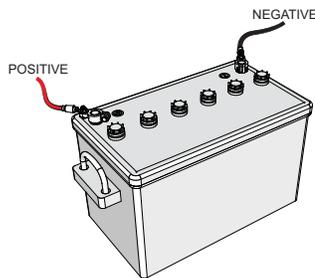


Figure 28. Battery Connections

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 cables.
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 and other malfunctions.

Battery Switch

The **Battery switch** (Figure 29) connects and disconnects the battery. Place the switch in the **ON** position prior to starting the generator. When the generator is not in use, place the switch in the **OFF** position.

NOTICE

NEVER set the battery switch to the **OFF** position **while the engine is running**. The engine may not be able to be stopped by normal operation, and damage to the equipment may result.

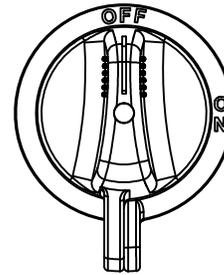


Figure 29. Battery Switch

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)

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.

WARNING

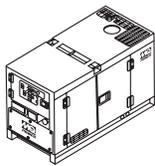
Natural gas is highly flammable and can cause fire and explosion. Gas may leak from the safety valve. Remove all sources of ignition before operating.

1. Open the gas inlet valve and make sure the pressure gauge (high-pressure side) is within the allowable range (20–150 psi).

CAUTION

If the pressure exceeds the allowable range, gas leakage is detected, or any gas-related fault is detected, close the valve immediately.

2. Make sure all circuit breakers are in the **OFF** position.
3. Close all engine enclosure doors (Figure 30).



CORRECT



INCORRECT

Figure 30. Engine Enclosure Doors

4. Make sure the **Voltage Selector switch** has been set to the desired output voltage.

CAUTION

Never change the position of the Voltage Selector switch while the engine is running. Switching the voltage while the engine is running will damage the selector switch, the generator, and any electrical devices connected to the generator.

5. Place the **Battery switch** (Figure 31) in the **ON** position.

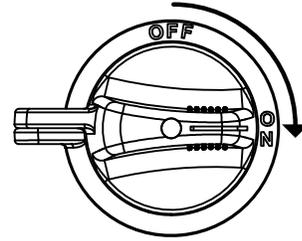


Figure 31. Battery Switch (ON)

6. Place the **Control Power switch** (Figure 32) in the **ON** position.



Figure 32. Control Power Switch (ON)

7. Connect the load to the **receptacles** or the **output terminal lugs** as shown in Figure 13. These load connection points can be found on the output terminal panel and the output terminal panel's hard wire hookup panel.
8. Tighten terminal nuts securely to prevent load wires from slipping out.

STARTING (MANUAL)

1. To start the engine, press the **Run button** (Figure 33) on the digital controller.

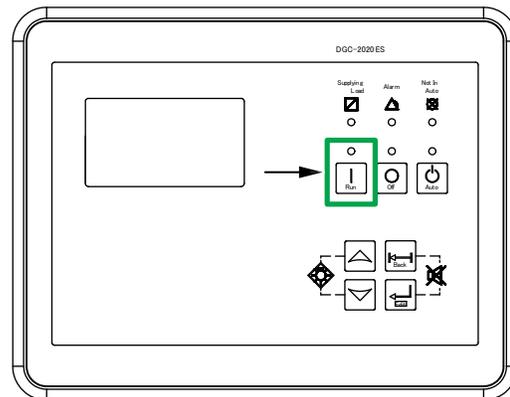


Figure 33. Digital Controller (Run Button)

GENERATOR START-UP PROCEDURE (MANUAL)

- Once the engine starts, the engine will run at low idle (1,000 rpm) for approximately 30 seconds. During the warmup process, check for any abnormal noise, vibration, or fluid leakage. If any abnormalities exist, shut down the engine and correct the problem.

NOTICE

Once the engine has warmed up, engine speed will automatically increase to 1,800 rpm.

NOTICE

If the Run button is pressed again during low idle operation, the engine will switch to high-speed operation (1,800 rpm).

- The controller display will indicate the 60-cycle output frequency in **HERTZ** (Figure 34C).

A	B	C	
VOLT	AMP	PH	Hz
121	0	AB	60.0
0	100 : 21	124	12.8
E	D		
OIL	HOURS	TEMP	BATT

Figure 34. Controller Display

- The controller display will indicate the generator's output in **VOLTS** (Figure 34A).
- If the voltage is not within the specified tolerance, use the **voltage regulator** (Figure 35) to increase or decrease the desired voltage.



Figure 35. Voltage Regulator

- The controller display will indicate **zero amps** with no load applied (Figure 34B). When a load is applied, the display will indicate the amount of current that the load is drawing from the generator.

- The controller display will indicate the **oil pressure** of the engine (Figure 34E). Under normal operating conditions the oil pressure should be between 35 and 65 psi (241–448 kPa).

NOTICE

Oil pressure readings may be higher immediately after starting, especially in cold weather conditions, but should return to normal as the engine temperature increases.

- The controller display will indicate the **coolant temperature** (Figure 34D). Under normal operating conditions the coolant temperature should be 167°–203°F (75°–95°C).
- Place all circuit breakers in the **ON** position. Power will be supplied to the output terminals and receptacles.
- Observe the amperage reading on the controller display (Figure 34B) and verify that it is the anticipated amount of current with respect to the load. The ammeter will only display a current reading if a load is in use.
- The generator will run until manually stopped or an abnormal condition occurs.

GENERATOR START-UP PROCEDURE (AUTO MODE)

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.

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.

WARNING

When running the generator in **Auto mode**, remember 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 the **Auto button** is pressed, the engine glow plugs will be warmed and the engine will start automatically after a start signal is received from the auto-start contacts.

When starting the generator in **Auto mode** use the manual start-up procedure except where noted (see below).

1. Perform steps 1 through 8 in **Before Starting** found in the **Generator Start-Up Procedure (Manual)** section.
2. Place all circuit breakers in the **ON** position.
3. Press the **Auto button** (Figure 36) on the digital controller. When a start signal is received from the auto-start contacts, the engine will start automatically after the preheating process has completed.

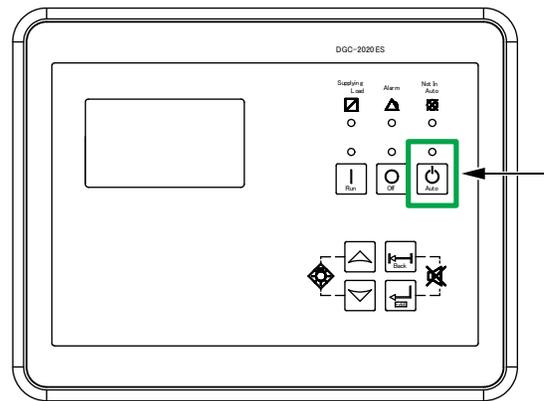


Figure 36. Digital Controller (Auto Button)

WARNING

NEVER stop the engine suddenly except in an emergency.

GENERATOR SHUTDOWN PROCEDURES

NORMAL SHUTDOWN PROCEDURE (MANUAL)

1. Place the load's ON/OFF switch in the **OFF** position.
2. Place all circuit breakers in the **OFF** position.
3. Press the **OFF button** on the digital controller (Figure 37) to stop the engine, then allow the unit to cool down for a few minutes.

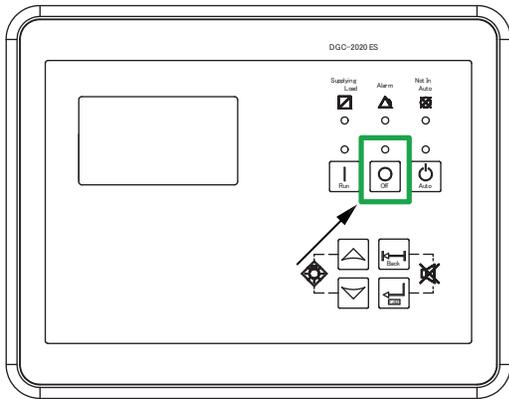


Figure 37. Digital Controller (OFF Button)

4. After the engine has stopped completely, place the **Control Power switch** in the **OFF** position (Figure 38).



Figure 38. Control Power Switch (OFF)

5. After placing the Control Power switch in the OFF position, wait 30 seconds, then place the **Battery switch** (Figure 39) in the **OFF** position.

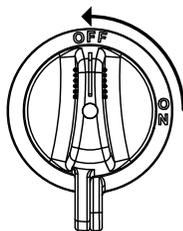


Figure 39. Battery Switch (OFF)

6. Allow sufficient time for adequate cooling, then inspect the entire generator for any damage or loosening of components that may have occurred during operation.

NORMAL SHUTDOWN PROCEDURE (AUTO)

When the remote contacts are opened, the engine will stop. To exit Auto mode, press the **OFF button** on the digital controller (Figure 37). The circuit breaker will automatically turn **OFF** and the engine will stop after a 1-minute cool-down process.

EMERGENCY SHUTDOWN PROCEDURE

1. To stop the engine in the event of an emergency, press the **Emergency Stop switch** (Figure 40).

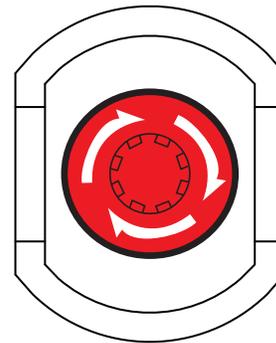


Figure 40. Emergency Stop Switch

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 cannot be restarted until the contact is released (closed).
3. Press the **OFF button** on the digital controller (Figure 37).

AUTOMATIC SHUTDOWN SYSTEM

This unit is equipped with safety devices to automatically stop the engine in the event of a fault. Refer to **Protection Devices** in the **Troubleshooting (Diagnostics)** section for more information.

NOTICE

Although the unit is equipped with engine protection devices, regularly scheduled preventive maintenance is strongly advised. Refer to Table 14.

MAINTENANCE

Table 14. Inspection/Maintenance		Daily	After First 50 Hours	Every 200 Hours	Every 500 Hours	Every 1,000 Hours
Engine	Visual Check for Fluid Leaks (or Monitoring)	X				
	Check Engine Oil Level (or Monitoring)	X				
	Check Coolant Level (or Monitoring)	X				
	Change Engine Oil and Filler* ¹		X	X		
	Change Crankcase Ventilation Filters			X		
	Clean Debris from Radiator Core			X		
	Check and Clean Air Cleaner* ²			X		
	Inspect and Adjust Belt Tension	X			X	
	Check and Adjust Intake and Exhaust Valve Clearance	X			X	
	Inspect Gas Piping and Hoses for Leaks or Damages				X	
	Inspect Electrical System Wiring for Cuts, Abrasions or Corrosion					X
	Grease Fan Tensioner Pulley					X
	Flush and Replace Engine Coolant					X
	Inspect Coolant Hoses for Cracks, Swelling or Deterioration					X
	Replace Air Cleaner Element					X
	Replace Spark Plugs					X
	Inspect Ignition Coils and Harness					X
	Inspect Shut-Off Valve for Leaks and Closing					X
	Inspect Exhaust Manifold for Leaks					X
	Inspect Exhaust Piping for Leaks					X
Inspect Catalyst for Mechanical Damage					X	
Check LPG Vaporizer					X	
Service Battery				X		
Check Engine Mounts				X		
Engine Overhaul		Every 8,000 hours				
Clean Unit, Inside and Outside		As required				
Generator	Measure Insulation Resistance Over 3M Ohms* ³			X		
	Check Rotor Rear Support Bearing				X	

*1 Every 200 hours or every 3 months, whichever occurs first.

*2 Every 100 hours in a dusty environment.

*3 Make sure to disconnect the O – Ground line and CN11 – CN12 before performing the measurement. Refer to the **Generator Wiring Diagram (M3814001303) on page 50.**

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 14 as a general maintenance guideline. For more detailed engine maintenance instructions, refer to the engine owner's manual.

ENGINE AIR CLEANER

The air cleaner of this PSI dual-fuel engine is equipped with a replaceable air filter element (Figure 41) and an inner (safety) filter that acts as a backup filter should the primary filter become damaged. Check the air cleaner daily or before starting the engine.

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 filters more frequently if these conditions exist.

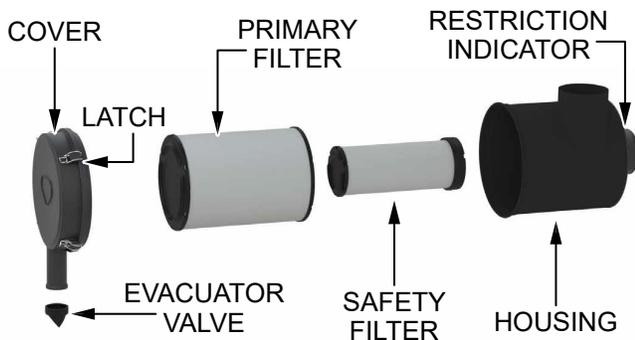


Figure 41. Engine Air Cleaner Components

NOTICE

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

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 42). 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. Replace the primary filter as needed according to the restriction indicator. Replace the safety filter every three primary filter changes.

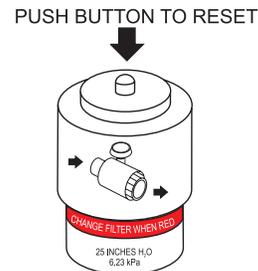


Figure 42. Air Cleaner Restriction Indicator

After replacing the air cleaner element, press the **restriction indicator button** (Figure 42) to reset the 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.

DRAINING ENGINE OIL

1. Run the engine until the engine coolant reaches a temperature of 140°F (60°C).
2. Turn the engine **OFF**.
3. Remove the oil dipstick from its holder.
4. Remove the **oil drain cap** (Figure 43).

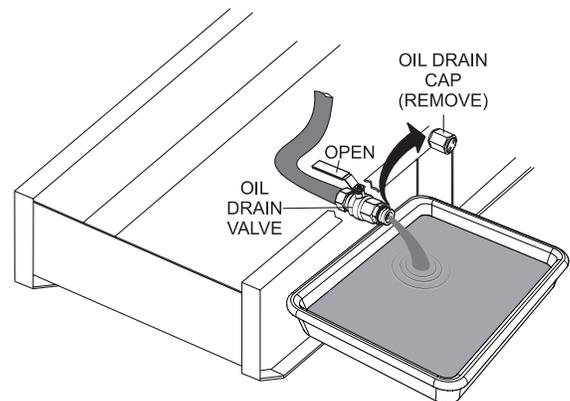


Figure 43. Draining Engine Oil

- Place the **oil drain valve** in the open position (Figure 43) and allow the oil to drain into a suitable container.
- After the engine oil has completely drained, reinstall the oil drain cap and tighten securely.
- Place the oil drain valve in the closed position.

ENGINE OIL FILTER REPLACEMENT

NOTICE

Filter head appearance may vary.

- Clean the area around the **oil filter head** (Figure 44).

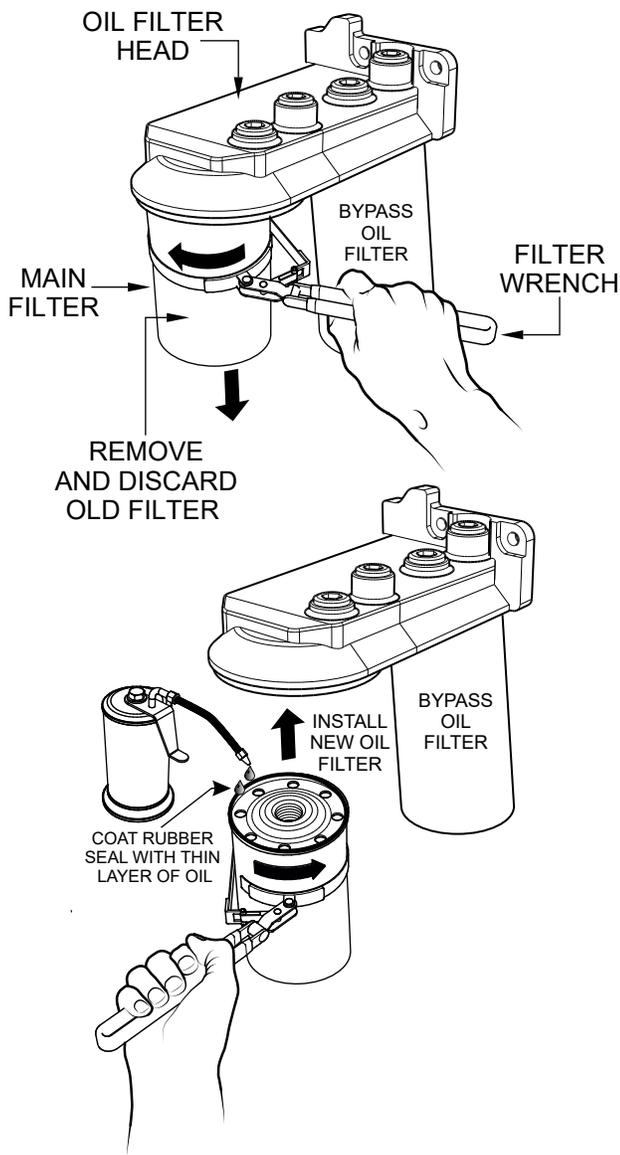


Figure 44. Engine Oil Filter Removal

- Using an **oil filter wrench**, remove the **main engine oil filter** (Figure 44).
- Coat the rubber seal (gasket) surface of the new oil filter with clean 15W-40 engine oil (Figure 44).
- Install the new (main) oil filter first by hand until it makes contact with the filter head surface. Tighten it another 3/4 turn using a filter wrench.
- Fill the engine crankcase with a high-quality detergent oil from API Service Category SM or newer. Fill to the upper limit of the dipstick. **DO NOT** overfill. Refer to Table 3 for engine oil capacity.
- 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.
- Repeat this procedure for the **bypass oil filter**.

DRAINING 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.

- Remove the **radiator pressure cap** (Figure 45) only when the coolant temperature is below 120°F (50°C).

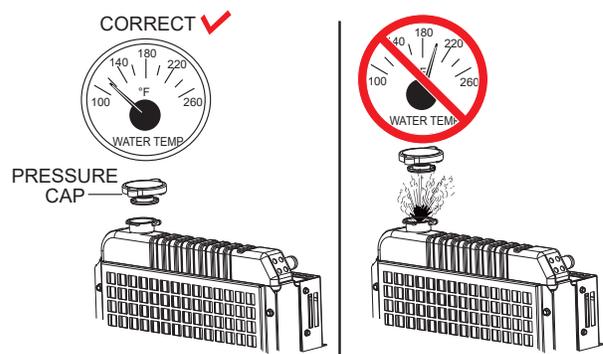


Figure 45. Radiator Pressure Cap Removal

- Place the **coolant drain valve** in the **OPEN** position (Figure 46) and allow the coolant to drain into a suitable container.

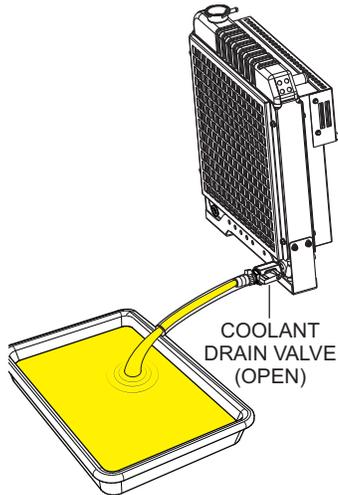


Figure 46. Draining Engine Coolant

- After the coolant has completely drained, place the coolant drain valve in the **CLOSED** position.
- Reinstall the radiator pressure cap and tighten securely.

RADIATOR CLEANING

The radiator (Figure 47) 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 47. Radiator Cleaning

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 PSI engine owner's manual.

Drive Belt Inspection

Inspect the **drive belt** (Figure 48) for damage and wear. Horizontal cracks (across the belt) are acceptable. Vertical cracks (direction of belt ribs) that intersect with horizontal cracks are not acceptable.

Also, 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.

If the drive belt exhibits any of the above wear conditions, replace the drive belt immediately.

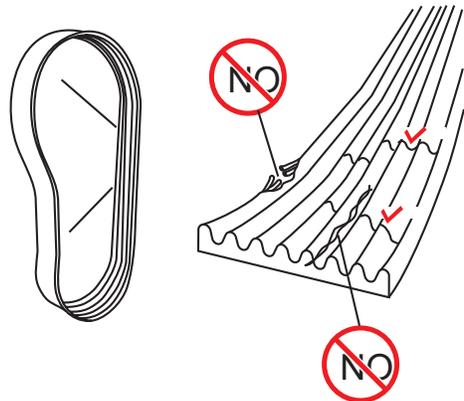


Figure 48. Drive Belt Inspection

TESTING THE GFCI RECEPTACLES

NOTICE

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

1. Start the generator as shown in the start-up procedure in this manual.
2. Place a **GFCI circuit breaker** (Figure 49) in the **ON** position.

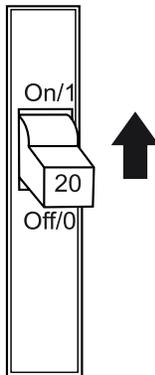


Figure 49. GFCI Circuit Breaker

3. Verify that the status LED on the corresponding GFCI receptacle (Figure 50) is **ON (GREEN)**.

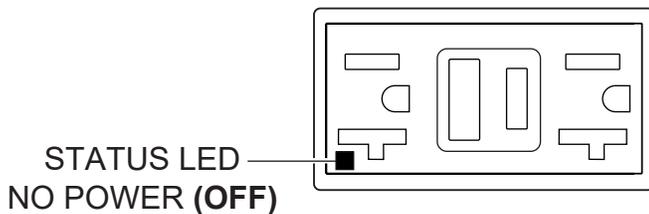


Figure 50. GFCI Receptacle (ON)

4. Press the **TEST** button (Figure 51) on the GFCI receptacle and verify that the status LED turns **OFF**.

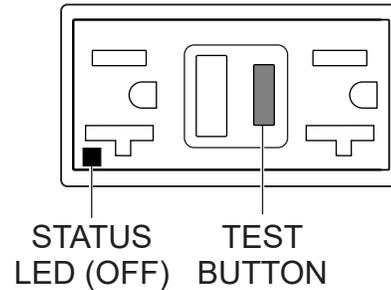


Figure 51. GFCI Receptacle (OFF)

5. Press the **RESET** button (Figure 52) to restore power to the GFCI receptacle and verify that the status LED is **ON (GREEN)**.

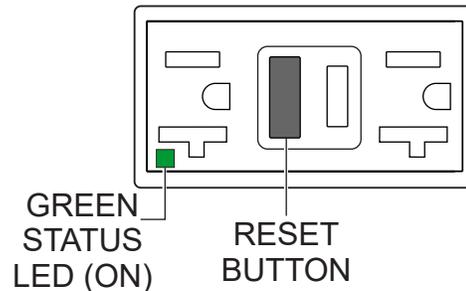


Figure 52. GFCI Receptacle (ON/Restore)

6. If the status LED (Figure 53) is **flashing (RED)**, **DO NOT** use the GFCI receptacle. Replace it immediately.

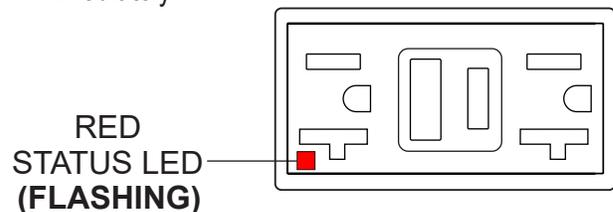


Figure 53. GFCI Receptacle (Red Flashing LED)

7. Repeat the above procedure for all other GFCI receptacles.

GENERATOR STORAGE

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

- Clean the entire generator, inside and outside.
- Disconnect and remove the battery. Charge and store the battery in a separate location.
- Check the unit for any damage or missing parts. Repair if necessary.
- Refer to the PSI engine owner's manual for details on storing the engine.
- Cover the generator and store it in a clean, dry location.
- 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.

OPTIONAL INTERNAL BATTERY CHARGER 120 VAC INPUT RECEPTACLE

This generator can be equipped with an **internal battery charger** as an **option**. This component is provided with an electrical power cord to connect to a commercial power source.

The internal battery charger (Figure 54) requires 120 VAC in order to operate. A power receptacle is provided on the output terminal panel to allow commercial power to be applied.

This unit will **ONLY** function when commercial power has been supplied to it. When using an extension cord, refer to Table 8 for the correct size and length.

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, **ALWAYS** keep power supplied to the generator's internal battery charger to ensure adequate starting capability.

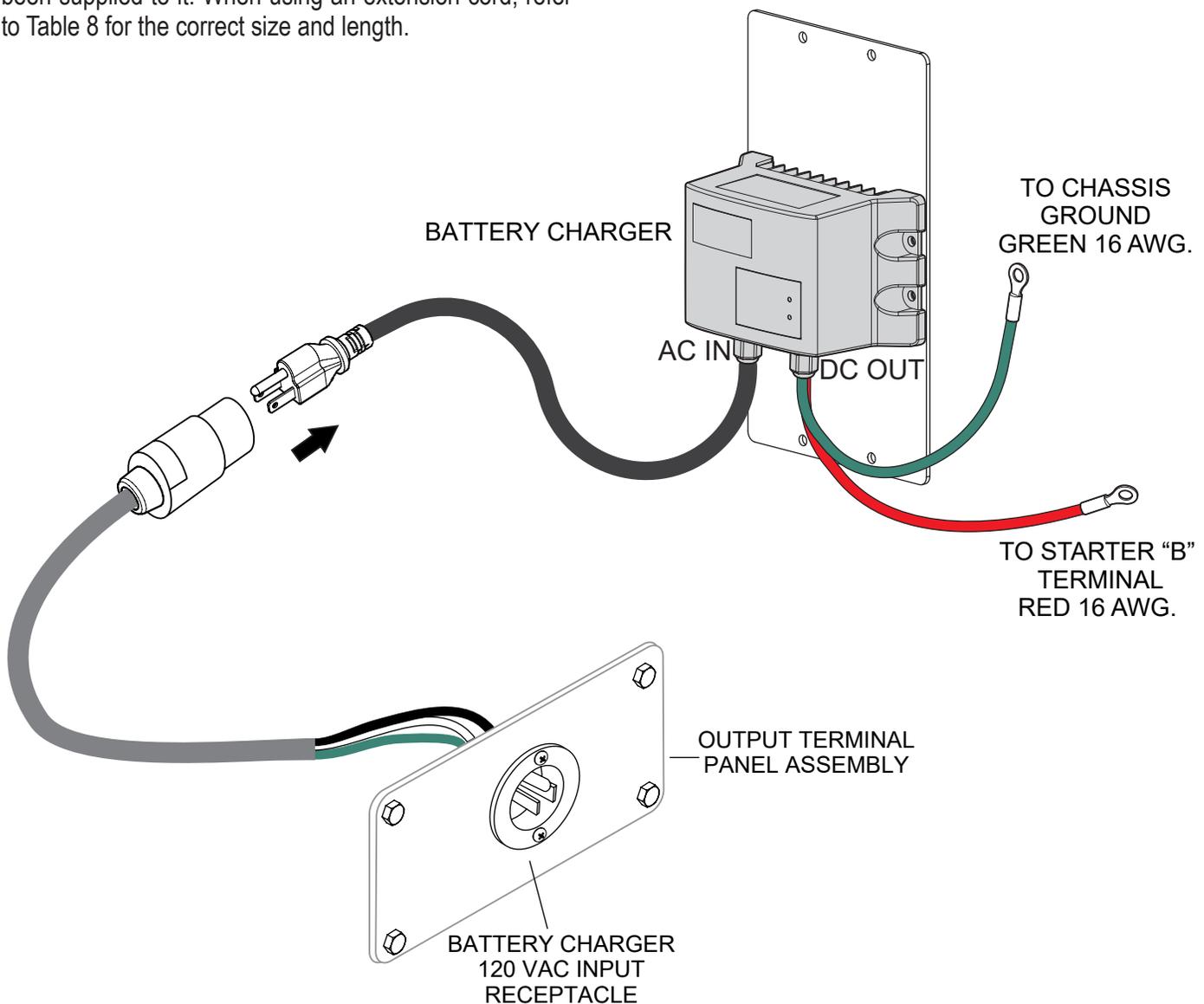


Figure 54. Optional Battery Charger

TROUBLESHOOTING (DIAGNOSTICS)

DIAGNOSTIC MODE

The digital controller can be placed in **Diagnostic mode** to allow the operator to perform fault diagnostics. To place the unit in Diagnostic mode, the engine must be turned **OFF**.

1. Press and hold the **Back button** and the **Edit button** simultaneously (Alarm Silence) for 3 seconds. See Figure 55.

NOTICE

When Diagnostic mode is enabled, the message “**DIAGNOSTIC MODE**” will be displayed on the Active Pre-Alarms screen.

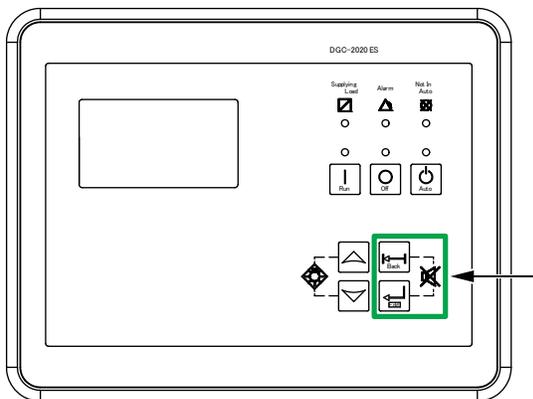


Figure 55. Digital Controller (Alarm Silence Button)

2. Use the Arrow buttons (Figure 56) to navigate to the **J1939 DTC menu** (Metering->Alarms-Status->J1939 DTC). This will allow the operator to perform the following fault diagnostics:

- **DTC Active Data** — Displays active fault messages and codes.
- **DTC Previous Data** — Displays messages and codes which previously occurred that are recorded in the engine control module (ECM).

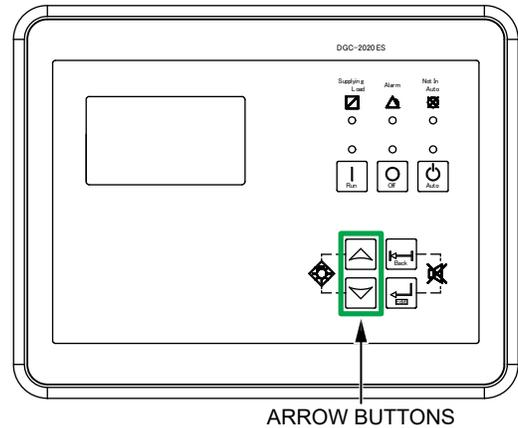


Figure 56. Digital Controller (Arrow Buttons)

3. After performing the diagnostic test, press the **OFF button** on the digital controller to exit Diagnostic mode.

TROUBLESHOOTING (DIAGNOSTICS)

PROTECTION DEVICES

Automatic Shutdown System

This generator is equipped with engine protection devices that will automatically shut down the engine and provide a warning to the operator when a fault occurs. Table 15 contains a complete list of engine protection devices and fault codes.

When a fault is detected, the **Alarm lamp** on the digital controller will illuminate (**red**), and an alarm message and diagnostic trouble code (DTC) will appear on the controller display. When this occurs:

1. Check any DTCs that appear on the digital controller screen.
2. Press the OFF button on the digital controller.
3. Place the Control Power switch in the **OFF** position.
4. Place all circuit breakers in the **OFF** position.
5. Allow a sufficient cooling period, then inspect the unit and repair the problem(s) before restarting operation. If necessary, contact your nearest MQ Power dealer for additional technical support.
6. When the unit is ready to restart, make sure the Control Power switch is turned **OFF** and all circuit breakers are in the **OFF** position.
7. Restart the generator as shown in the **Generator Start-Up Procedure (Manual)** section of this manual. Make sure all fault messages have been cleared from the digital controller display.

Table 15. Automatic Engine Shutdown System

Operating Parameter	Circuit Breaker OFF	Engine Shutdown	Digital Controller Display Message	Operating Condition/ Set Point
Low Oil Pressure	—	✓	Low oil press.	Set point: 8 psi (55 kPa)
High Water Temperature	—	✓	High water temp.	Set point: 227°F (108°C)
Over Speed	—	✓	Over speed	Set point: 1,980 rpm
Gas Filter Separator Water Level	—	✓	High water level	When the water level runs high
Low Coolant Level	—	✓	Low coolant level	When the engine coolant level falls
Over Current	✓	—	—	Performed by OCR
Under Voltage	—	✓*	27 UndVolt Trip	When under voltage occurs
Over Voltage	—	✓*	59 OvrVolt Trip	When over voltage occurs
Under Frequency	—	✓*	81U UndFreq Trip	When under frequency occurs
Over Frequency	—	✓*	81O OvrFreq Trip	When over frequency occurs

* After a 1-minute cool-down period.

NOTICE

Although the unit is equipped with engine protection devices, regularly scheduled preventive maintenance is strongly advised. Refer to Table 14.

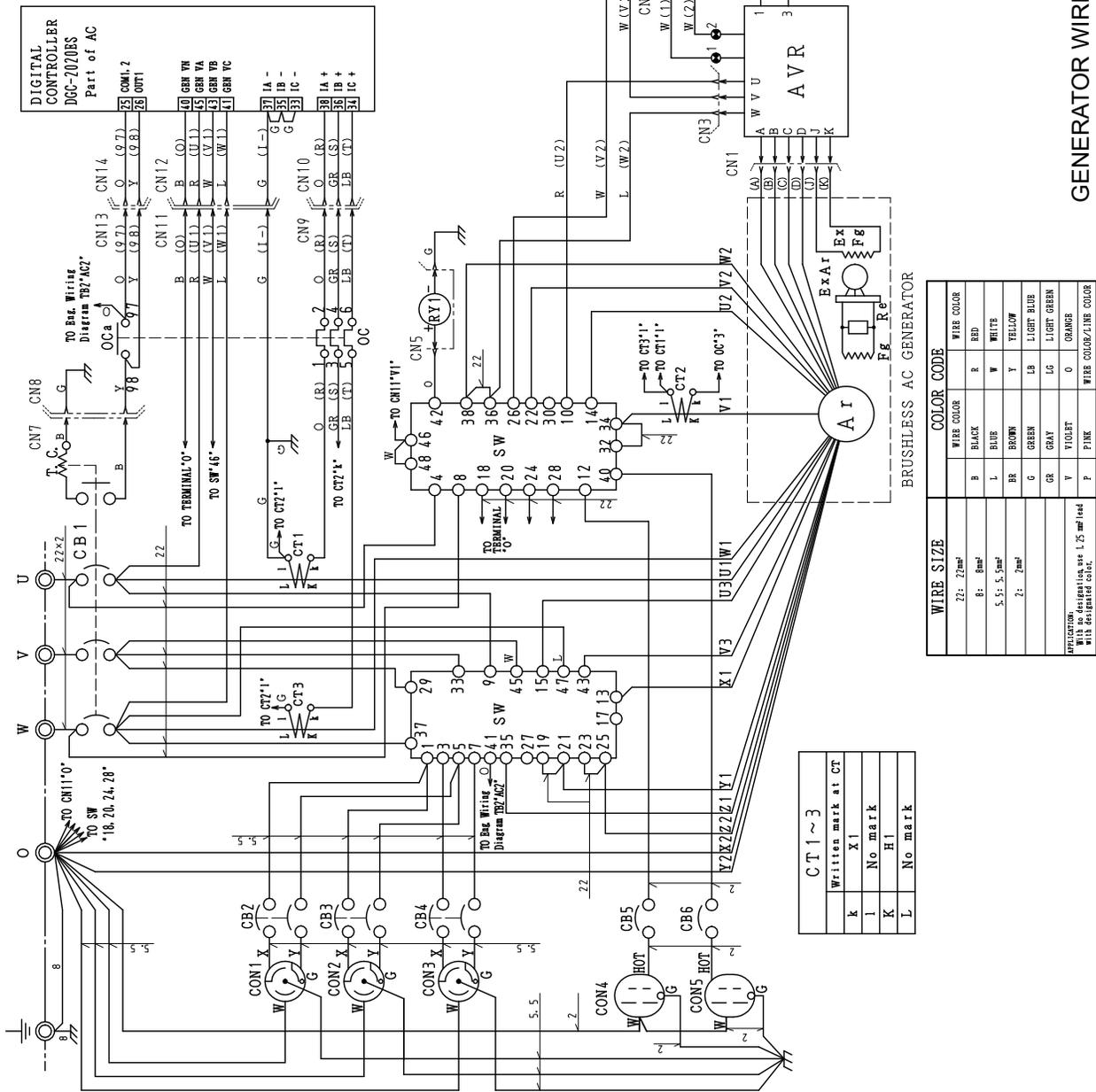
TROUBLESHOOTING (GENERATOR)

Practically all breakdowns can be prevented by proper handling and maintenance inspections, but in the event of a breakdown, use Table 16 shown below for diagnosis of the generator. If the problem cannot be remedied, consult our company's business office or service plant.

Table 16. Generator Troubleshooting		
Symptom	Possible Problem	Solution
No Voltage Output	Defective AC voltmeter?	Check output voltage and replace if necessary.
	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.

GENERATOR WIRING DIAGRAM (M3814001303)

SYMBOL	DESIGNATION
A r	MAIN GENERATOR ARMATURE WINDING
F g	MAIN GENERATOR FIELD WINDING
ExAr	EXCITER ARMATURE WINDING
ExFg	EXCITER FIELD WINDING
AVR	AUTOMATIC VOLTAGE REGULATOR
VR	VOLTAGE REGULATOR REHOBSTAD
CT1~3	CURRENT TRANSFORMER 200:5A
CB1	CIRCUIT BREAKER 3P 250A
CB2~4	CIRCUIT BREAKER 1P 50A
CB5, 6	CIRCUIT BREAKER 1P 20A
CON1~3	RECEPTACLE 250V 50A
CON4, 5	RECEPTACLE 125V 20A x 2 (G. F. C. I.)
OC	OVER CURRENT RELAY
SW	SELECTOR SWITCH
RY1	RELAY UNIT



DIGITAL CONTROLLER DGC-7020ES Part of AC

25	COM1, 2
26	OP1
10	GEN W
11	GEN V
12	GEN U
13	GEN Y
14	GEN B
15	GEN C
16	GEN D
17	GEN E
18	GEN F
19	GEN G
20	GEN H
21	GEN I
22	GEN J
23	GEN K
24	GEN L

1	A
2	B
3	C
4	D
5	E
6	F
7	G
8	H
9	J
10	K

1	IA
2	IB
3	IC
4	IA
5	IB
6	IC

1	GR
2	LB
3	CT
4	GR
5	LB
6	CT

1	GR
2	LB
3	CT
4	GR
5	LB
6	CT

1	GR
2	LB
3	CT
4	GR
5	LB
6	CT

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6	CT

1	GR
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3	CT
4	GR
5	LB
6	CT

1	GR
2	LB
3	CT
4	GR
5	LB
6	CT

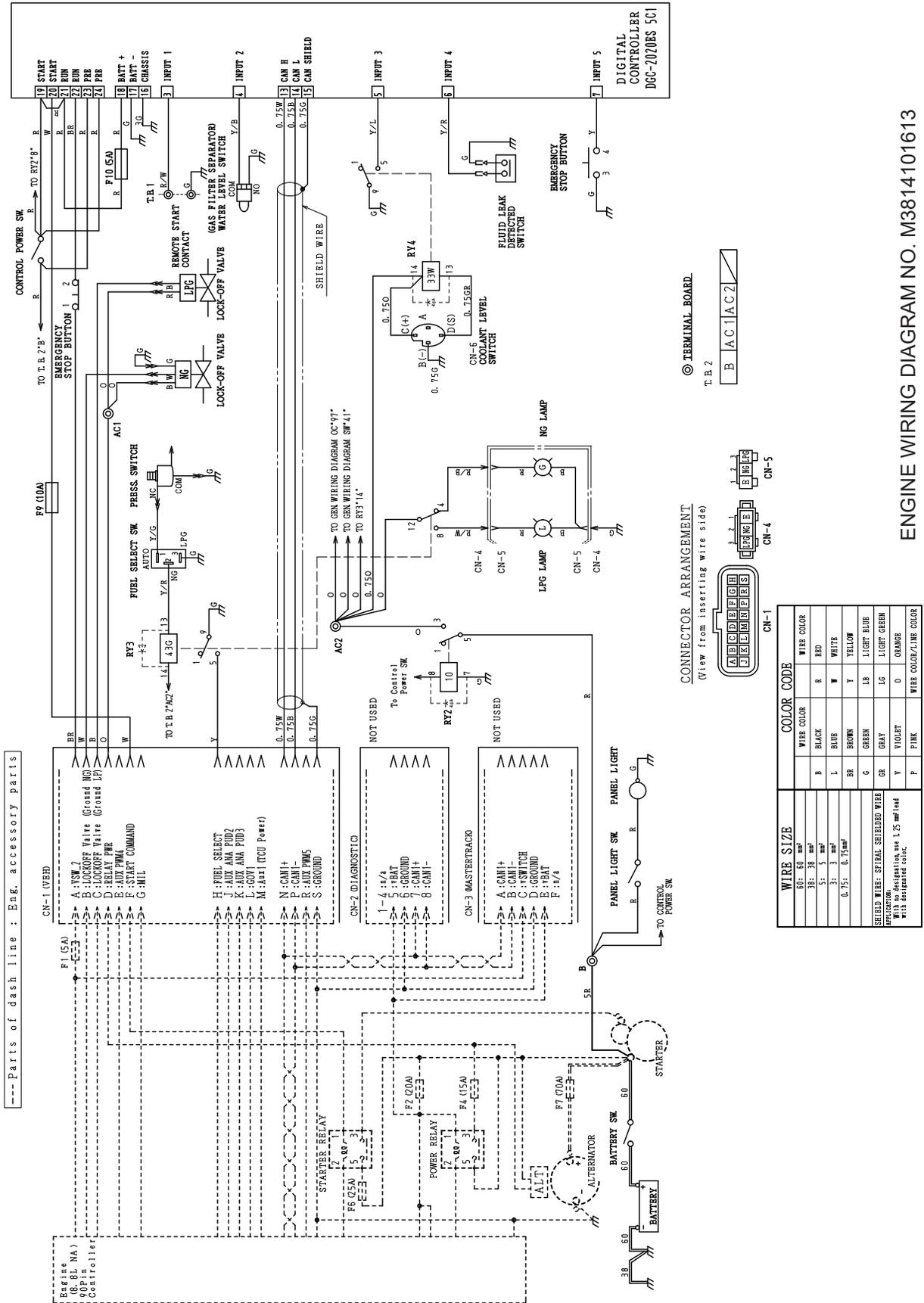
WIRE SIZE	WIRE COLOR	WIRE COLOR
ZZ: 27mm ²	BLACK	R
B: 6mm ²	RED	W
S: 5.5mm ²	WHITE	Y
Z: 7mm ²	BROWN	LG
	GREEN	O
	GRAY	P
	VIOLET	
	PINK	
	ORANGE	

IMPEDANCE: All impedances are 1.25 mΩ/lead with designated color.

CT 1~3	Written mark at CT
K	X 1
L	No mark
K	H 1
L	No mark

GENERATOR WIRING DIAGRAM NO. M3814001303

ENGINE WIRING DIAGRAM (M3814101613)



--- Parts of dash line : Eng. accessory parts

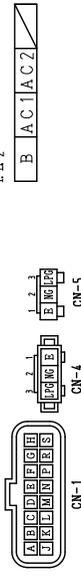
- Engine Controller
- 1: 08: BL MA
 - 2: 09: BR MA
 - 3: 10: W
 - 4: 11: B
 - 5: 12: W
 - 6: 13: W
 - 7: 14: W
 - 8: 15: W
 - 9: 16: W
 - 10: 17: W
- Engine Controller
- A: YSW-7
 - B: Lockoff Valve (Ground NG)
 - C: Lockoff Valve (Ground LP)
 - D: Lockoff Valve (Ground LP)
 - E: Lockoff Valve (Ground LP)
 - F: Lockoff Valve (Ground LP)
 - G: MIL
- Engine Controller
- H: FUEL SELECT
 - I: FUEL SELECT
 - J: FUEL SELECT
 - K: FUEL SELECT
 - L: FUEL SELECT
 - M: FUEL SELECT (DCU Power)
 - N: CAN+H
 - O: CAN+L
 - P: CAN-
 - Q: CAN-
 - R: CAN-
 - S: GROUND
- Engine Controller
- 1: 4: 1/A
 - 2: 5: 1/B
 - 3: 6: GROUND
 - 4: 7: CAN+
 - 5: 8: CAN-
- Engine Controller
- A: CAN+
 - B: CAN-
 - C: SWITCH
 - D: GROUND
 - E: 1/A
 - F: 1/A

WIRE SIZE	WIRE COLOR	WIRE COLOR	WIRE COLOR
60: 60 mm ²			
38: 38 mm ²	B	BLACK	R
5: 5 mm ²	L	BLUE	W
3: 3 mm ²	BR	BROWN	Y
0.75: 0.75 mm ²	G	GREEN	LB
	GR	GRAY	LG
	P	PINK	O
			ORANGE

WIRE SIZE	WIRE COLOR	WIRE COLOR	WIRE COLOR
60: 60 mm ²			
38: 38 mm ²	B	BLACK	R
5: 5 mm ²	L	BLUE	W
3: 3 mm ²	BR	BROWN	Y
0.75: 0.75 mm ²	G	GREEN	LB
	GR	GRAY	LG
	P	PINK	O
			ORANGE

SHIELD WIRE: SPECIAL SHIELDED WIRE
 APPLICATION: With no designation use 1.5 mm² lead with designated color.

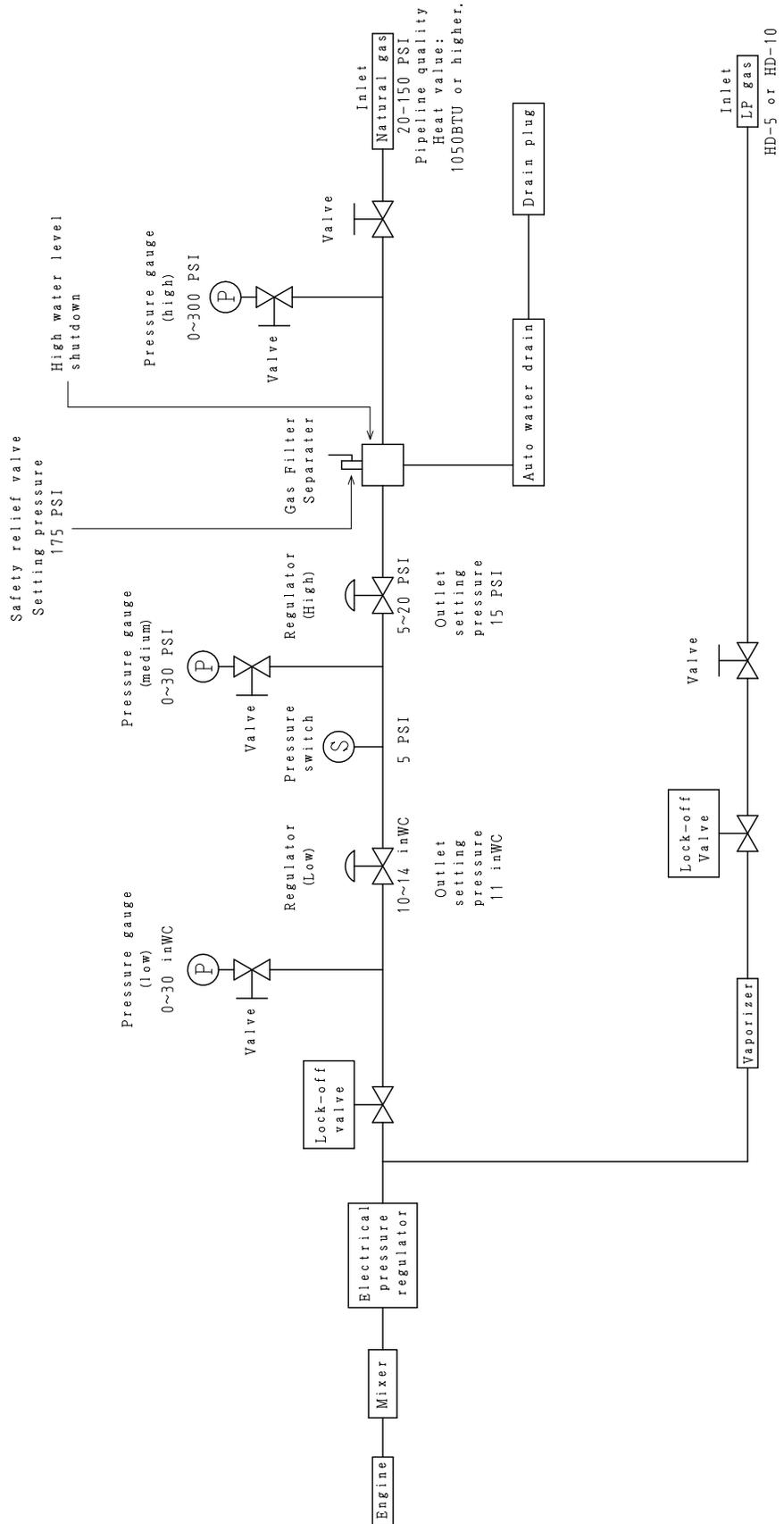
CONNECTOR ARRANGEMENT
 (View from inserting wire side)



T.B.2

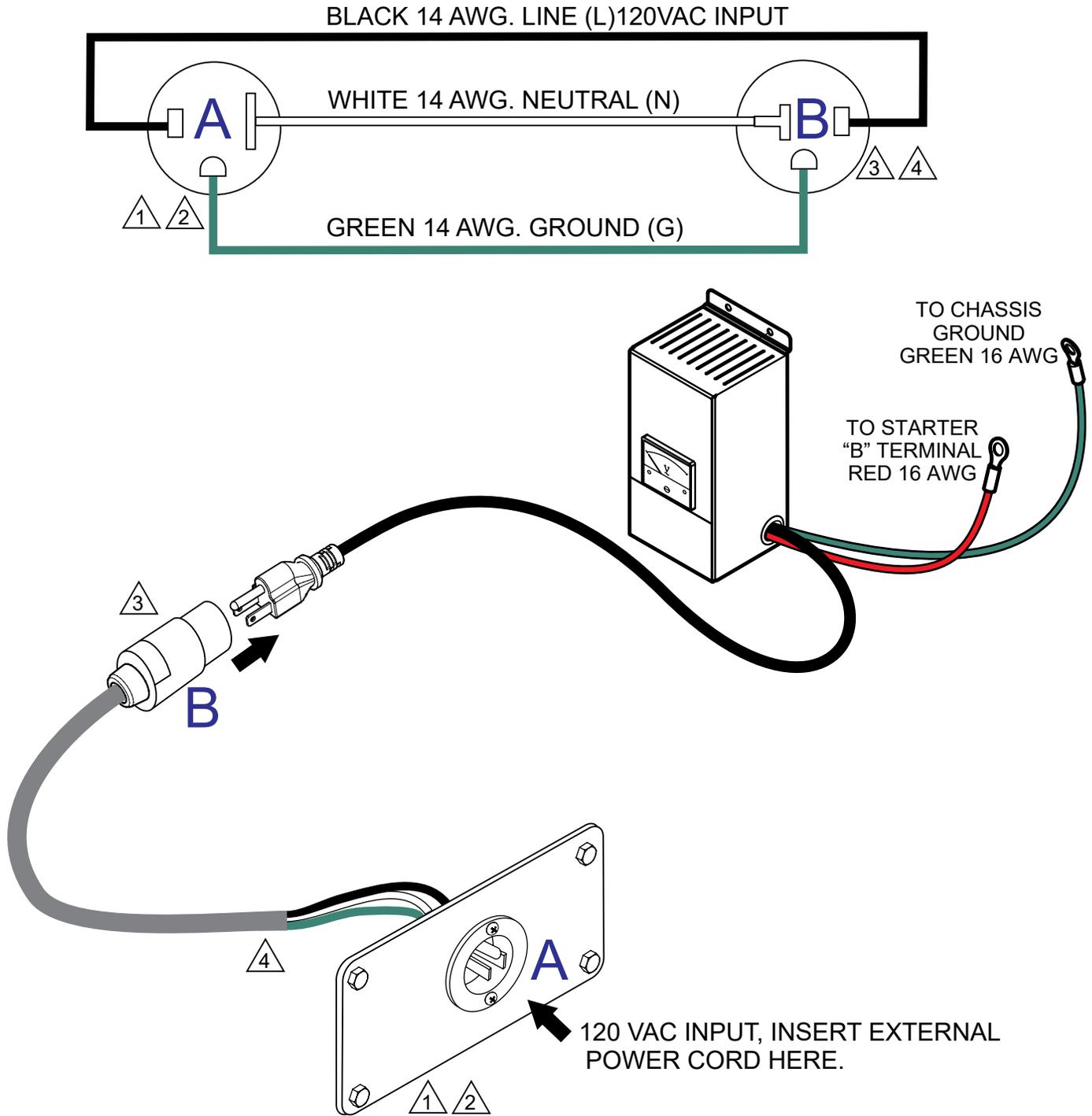
ENGINE WIRING DIAGRAM NO. M3814101613

PLUMBING SYSTEM DIAGRAM (M3824300303)



PLUMBING SYSTEM DIAGRAM NO. M3824300303

BATTERY CHARGER WIRING DIAGRAM (OPTION)



NOTES:

- ① NEMA 5-15, 15A, 120 VAC, P/N EE6176 (HBL5278C/HUBBLE RECEPTACLE).
- ② RECEPTACLE IS MOUNTED ON OUTPUT TERMINAL PANEL ASSY.
- ③ 20 AMP, 5-20R RECEPTACLE, P/N EE6131 (HBL5369C/HUBBLE RECEPTACLE).
- ④ CORD, CAROL 3/C 14 AWG., P/N EE56557.

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
WEBSITE: www.multiquip.com

CANADA

Multiquip

(450) 625-2244
4110 Industriel Boul.
Laval, Quebec, Canada H7L 6V3
E-MAIL: infocanada@multiquip.com

UNITED KINGDOM

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

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MQ Power Inc.
by
DENYO MANUFACTURING CORP.

