

OPERATION MANUAL



WHISPERWATT™ SERIES
MODEL
DCA600SSV4F3B
60 Hz GENERATOR
(VOLVO TWD1672GE DIESEL ENGINE)

INSTRUCTION MANUAL NO. C4844305204

Revision #2 (08/20/24)

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THIS MANUAL MUST ACCOMPANY THE EQUIPMENT AT ALL TIMES.

PROPOSITION 65 WARNING



DCA600SSV4F3B
60 Hz Generator

Proposition 65 Warning 2

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NOTICE

Specifications are subject to change without notice.

SAFETY DECALS

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.

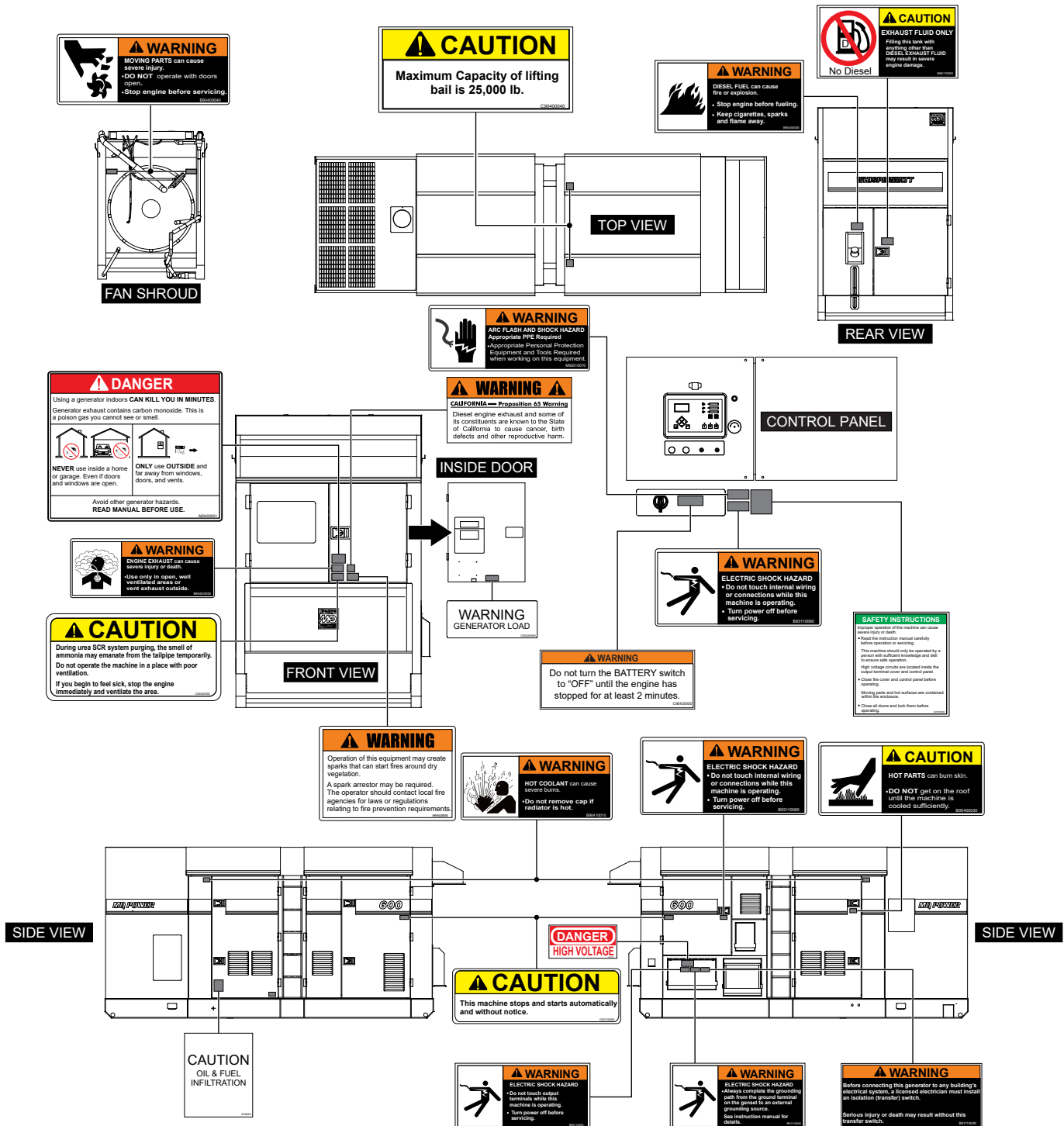


Figure 1. Safety Decals

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

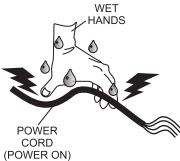
ELECTRICAL SAFETY

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 unrepairable safety risk due to wear or damage or is no longer cost effective to maintain (beyond life-cycle reliability) and is to be decommissioned (demolition and dismantlement), be sure to follow the rules below:

- **NEVER** pour waste or oil directly onto the ground, down a drain, or into any water source.
- Contact your country's Department of Public Works or recycling agency in your area and arrange for proper disposal of any electrical components, waste or oil associated with this equipment.
- When the life cycle of this equipment is over, remove the battery and bring it to an appropriate facility for lead reclamation. Use safety precautions when handling batteries that contain sulfuric acid.
- When the life cycle of this equipment is over, it is recommended that the frame and all other metal parts be sent to a recycling center.



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

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

EMISSIONS INFORMATION

NOTICE

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

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

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

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

Emission Control Label

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

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

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

SPECIFICATIONS

Table 1. Generator Specifications

Models	DCA600SSV4F3B
Type	Revolving field, self-ventilated, open protected type synchronous generator
Armature Connection	Star with Neutral
Phase	3
Standby Output	528 kW (660 kVA)
Prime Output	480 kW (600 kVA)
3Ø Voltage	208, 220, 240, 416, 440, 480V
1Ø Voltage	120, 127, 139, 240, 254, 277V
Power Factor	0.8
Frequency	60 Hz
Speed	1,800 rpm
Aux. AC Power	Single phase, 60 Hz
Pitch	2/3
Subtransient	0.067
Transient	0.171
Synchronous	1.451
Zero Sequence Reactance	0.007
Overload Protection	OCR / main circuit breaker
Aux. Voltage/Output	120V / 4.8 kW (2.4 kW × 2)
Dry Weight	17,574 lb. (7,971 kg)
Wet Weight	19,117 lb. (8,671 kg)

Table 2. Engine Specifications

Model	Volvo Penta TWD1672GE Tier 4 Final Certified	
Type	4-cycle, water-cooled, direct injection, turbocharged, with water-cooled charge air cooler	
No. of Cylinders	6	
Bore × Stroke	5.67 in. × 6.50 in. (144 mm × 165 mm)	
Displacement	984 cu. in. (16.12 liters)	
Rated Output	713 hp at 1,800 rpm	
Starting	Electric	
Coolant Capacity	26.1 gal. (99 liters) ¹	
Lube Oil Capacity	12.7 gal. (48 liters) ²	
Lube Oil Type	Volvo VDS-3	
DEF Tank Capacity	84.5 gal. (320 liters)	
Fuel Tank Capacity	52.8 gal. (200 liters)	
Fuel Type	No. 2 diesel fuel (ultra low sulfur diesel fuel only)	
Fuel Consumption	31.7 gal. (120.0 L)/hr. at full load	24.4 gal. (92.4 L)/hr. at 3/4 load
	17.9 gal. (68.0 L)/hr. at 1/2 load	11.3 gal. (42.7 L)/hr. at 1/4 load
Battery	12V 200Ah × 2 (24 VDC system)	

¹ Includes engine, radiator, reserve tank and hoses

² Includes filters

DIMENSIONS

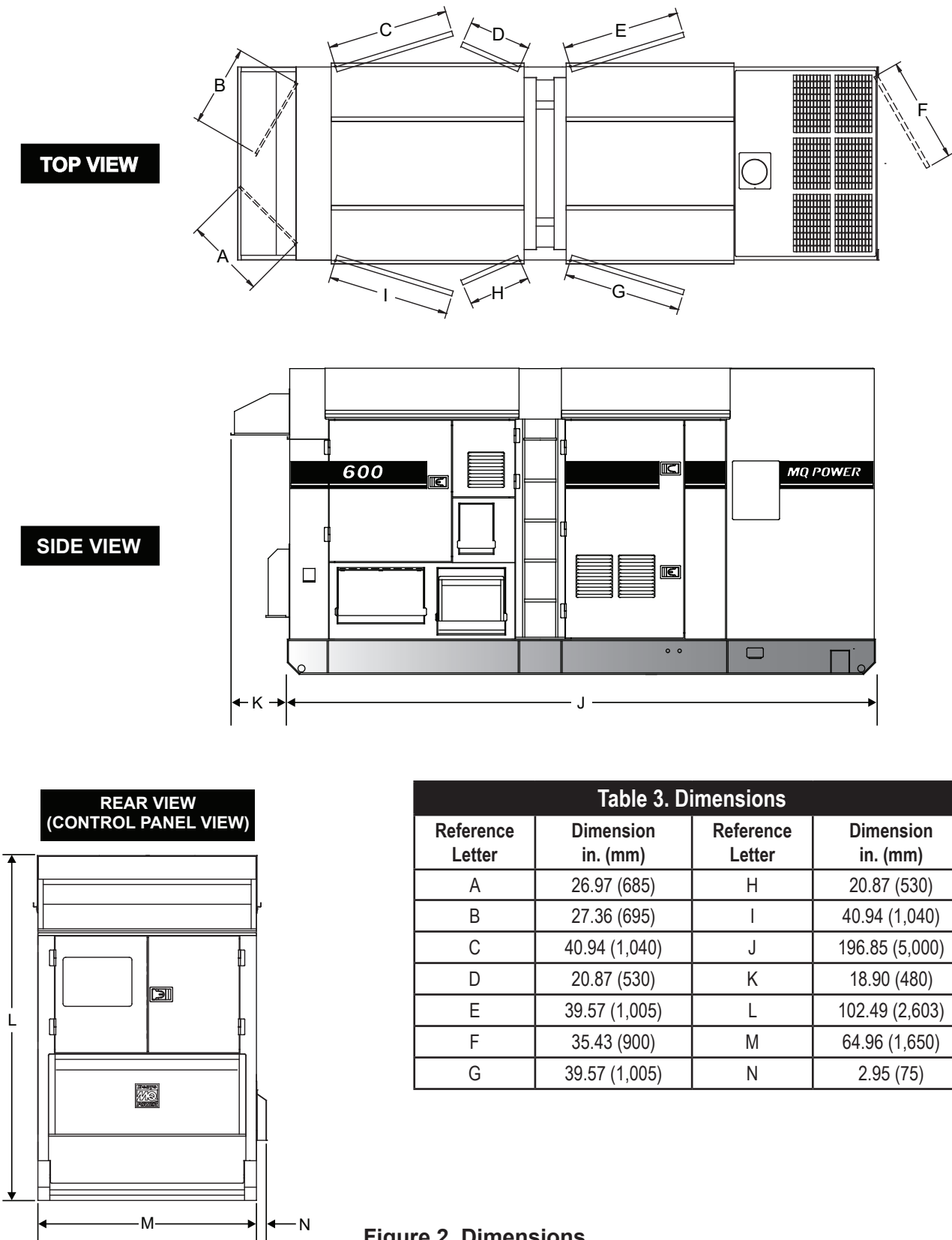


Figure 2. Dimensions

NOTES

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GENERATOR GROUNDING

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

NOTICE

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

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

Connecting The Ground

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

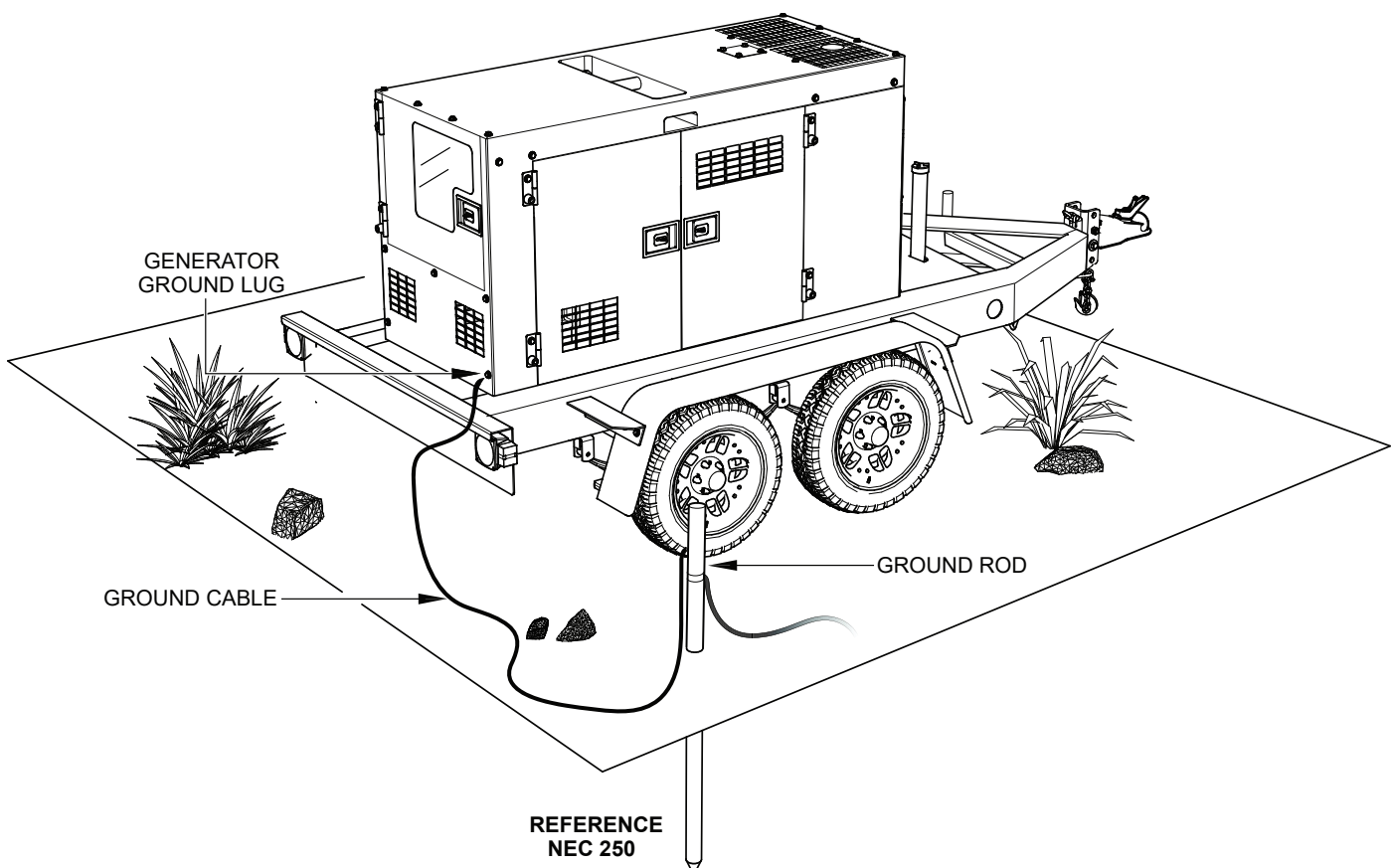


Figure 3. Typical Generator Grounding Application

NOTICE

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

OUTDOOR INSTALLATION

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

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

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

CAUTION

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

INDOOR INSTALLATION

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

MOUNTING

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

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

GENERATOR

This generator (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 AND OPERATION PANEL

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

- Basler DGC-2020 Digital Controller (Standard)
 - Liquid Crystal Display
 - Not In Auto Indicator
 - Alarm Indicator
 - Supplying Load Indicator
 - Alarm Silence Button
 - Lamp Test Button
 - Auto Button/Mode Indicator
 - Off Button/Mode Indicator
 - Run Button/Mode Indicator
 - Reset Button
 - Arrow Buttons (4)
 - Edit Button
- Circuit Breaker On Button
- Circuit Breaker Off Button
- Panel Light/Panel Light Switch
- Control Power Switch
- Voltage Regulator
- Battery Switch
- 3-Phase, 1600-Amp Main Circuit Breaker
- **Control Box** (located behind control panel)
 - Automatic Voltage Regulator
 - Current Transformer
 - Overcurrent Relay
 - Starter Relay
 - Voltage Change-Over Board
 - FT4 Display (CIM)

OUTPUT TERMINAL PANEL

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

- Two 120V Output Receptacles (GFCI), 20A
- Two GFCI Circuit Breakers, 20A
- Four Output Terminal Boards (3Ø Power)
- Ground Terminal
- Auto-Start Contact Terminal Block
- Cam-Lok Connectors (Option)
- Engine Block Heater (Option)
- Battery Charger (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 4-cycle, water-cooled, direct-injection, turbocharged, charged air-cooled, Volvo Penta TWD1672GE diesel engine. This engine is designed to meet every performance requirement for the generator. Refer to Table 2 for engine specifications.

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

MICROPROCESSOR CONTROL SYSTEM

The microprocessor controls the 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-2020 controller cannot be used for paralleling.

PARALLELING

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

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 remain running while the other generators will 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, these 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 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 10 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, pressing the **Alarm Silence button** will 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.

Pressing the Alarm Silence button will stop the toggling between the pre-alarm and the Overview screen.

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

GENERAL PARALLELING INFORMATION (OPTION)

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-lok 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.

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.

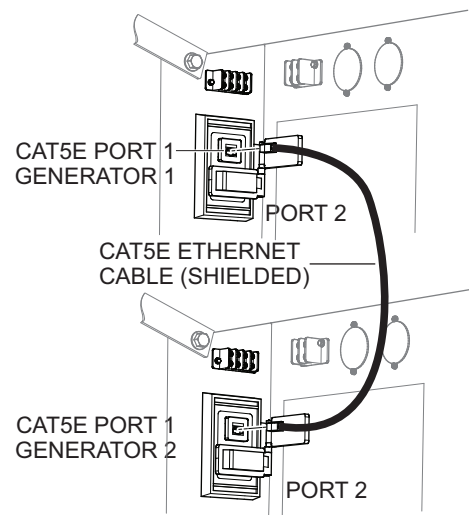


Figure 4. Ethernet Cable Connection

2. Refer to Table 4 for additional ethernet port connections.

Table 4. 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

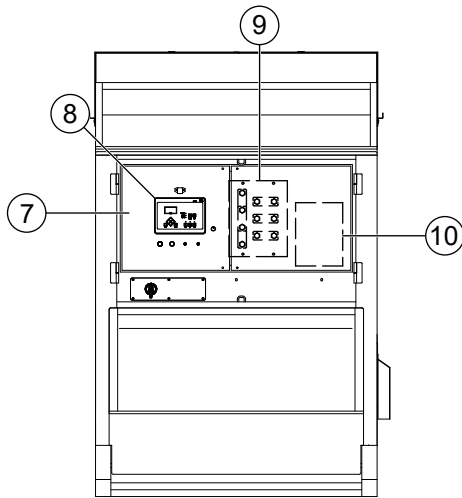
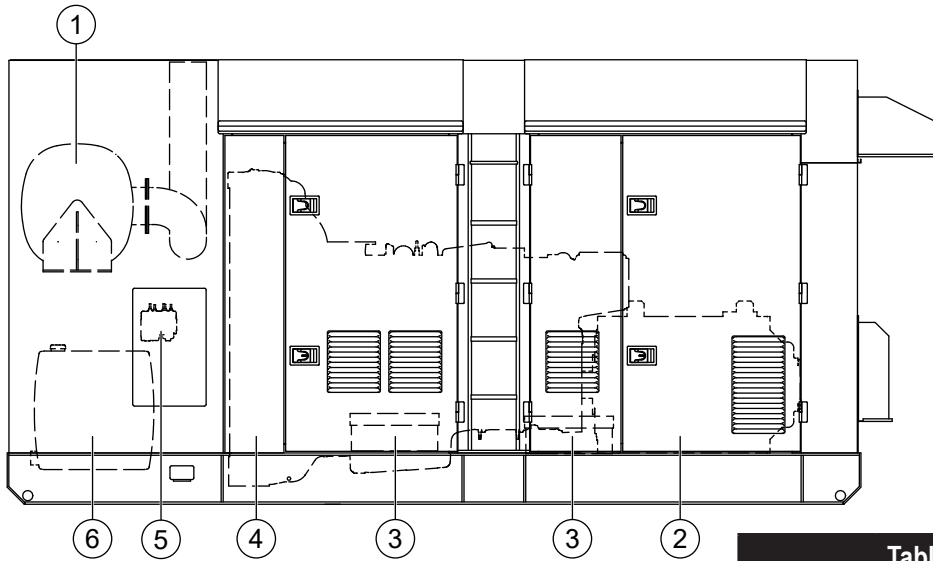
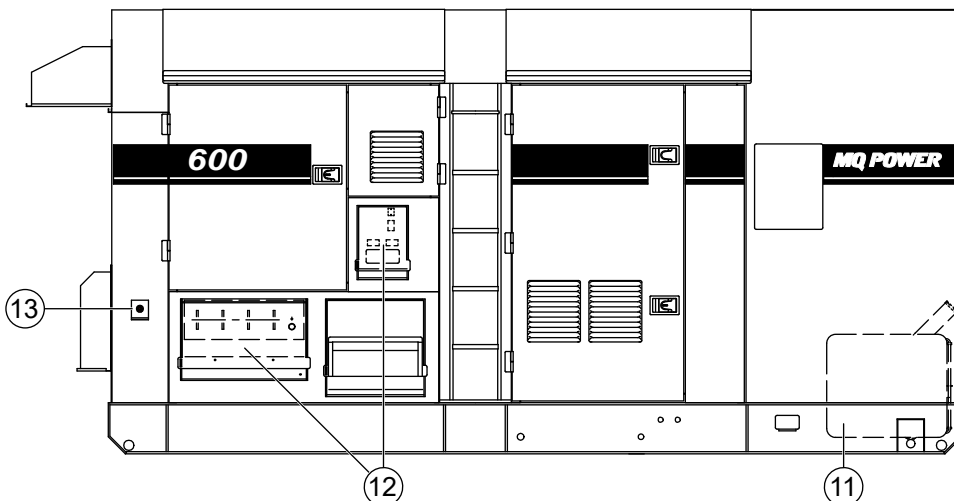


Figure 5. Major Components

Table 5. Major Components	
ITEM NO.	DESCRIPTION
1	Muffler Assembly
2	Generator Assembly
3	Battery Assembly
4	Engine and Radiator Assembly
5	Aftertreatment Control Module Assembly
6	DEF Tank Assembly
7	Control and Operation Panel Assembly
8	Digital Genset Controller Assembly
9	Voltage Change-Over Board Assembly
10	Main Circuit Breaker Assembly
11	Fuel Tank Assembly
12	Output Terminal Panel Assembly
13	Emergency Stop Switch Assembly



CONTROL AND OPERATION PANEL

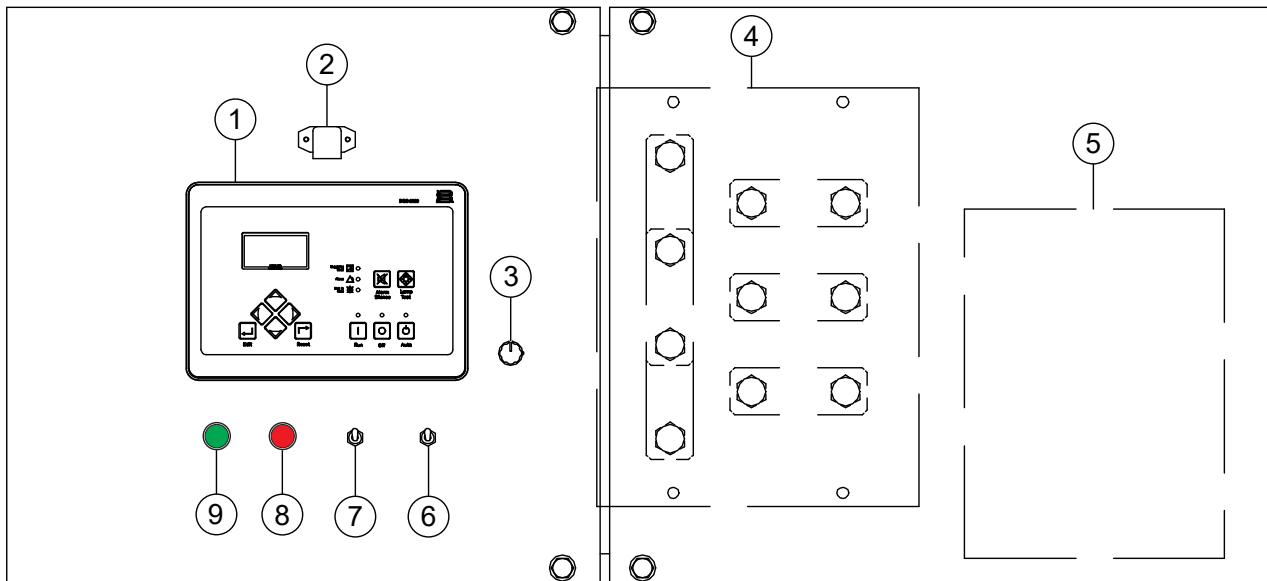


Figure 6. Control And Operation Panel

The definitions below describe the controls and functions of the **control and operation panel** (Figure 6).

1. **Basler DGC-2020 Digital Genset Controller** — Displays parameters (AC voltage, AC current, phase, frequency, fuel level, DEF level, 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.
2. **Panel Light** — Illuminates the control panel for operation in the dark.
3. **Voltage Regulator** — Allows fine manual adjustment of the generator's output voltage.
4. **Voltage Change-Over Board** — Consists of 6 jumper plates that allow the generator to be configured for either 240 or 480 VAC output. Located inside the control box.
5. **Main Circuit Breaker** — This 3-phase, 1600-amp, main circuit breaker connects or disconnects the generator output to or from the output terminals, and protects the unit from short circuits or overcurrent. Located inside the control box.
6. **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. This switch is disabled while the engine is running.
7. **Panel Light Switch** — Turns the panel light on/off. Make sure the panel light switch is in the **OFF** position when the panel light is not needed.
8. **Circuit Breaker OFF Button** — Press this button during manual operation to turn the main circuit breaker **OFF**. The button LED will turn **ON (red)** to indicate that the circuit breaker is **open**.
9. **Circuit Breaker ON Button** — Press this button during manual operation to turn the main circuit breaker **ON**. The button LED will turn **ON (green)** to indicate that the circuit breaker is **closed**.

BASLER DIGITAL GENSET CONTROLLER

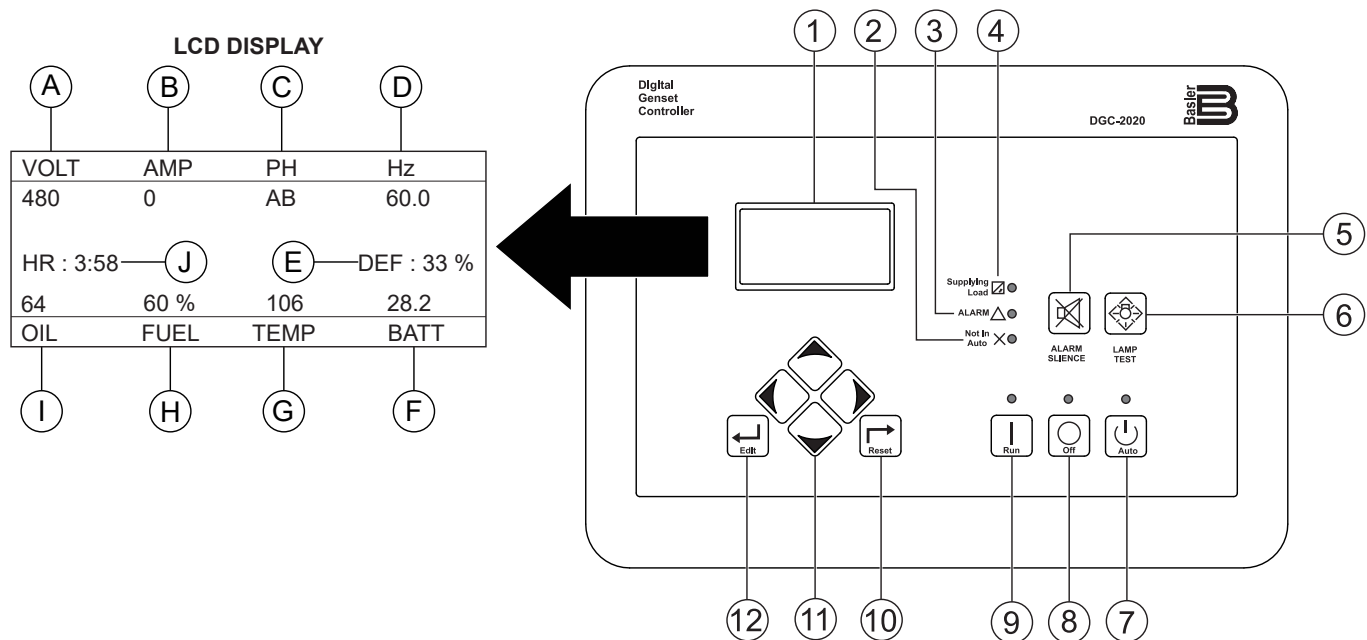


Figure 7. Basler DGC-2020

The definitions below describe the controls and functions of the **Basler DGC-2020 digital genset controller** (Figure 7). 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. **DEF Gauge** — Indicates the level (%) of DEF in the DEF tank.
 - F. **Battery Voltmeter** — During normal operation this gauge should indicate a minimum of 25 VDC.
 - G. **Water Temperature Gauge** — During normal operation this gauge should read between 167°–194°F (75°–90°C).
 - H. **Fuel Gauge** — Indicates the level (%) of diesel fuel in the fuel tank.
 - I. **Oil Pressure Gauge** — During normal operation this gauge should read between 56–100 psi (386–689 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.
 - J. **Run Hours Meter** — Indicates the engine run time.

BASLER DIGITAL GENSET CONTROLLER

2. **Not In Auto Indicator** — This red LED lights whenever the DGC-2020 is **not** operating in **Auto mode**.
3. **Alarm Indicator** — This red LED lights continuously during alarm conditions and flashes during pre-alarm conditions.
4. **Supplying Load Indicator** — This green LED lights whenever the generator current is greater than the emergency power supply (EPS) threshold current.
5. **Alarm Silence Pushbutton** — Press this button to open the relay output programmed as the horn output.
6. **Lamp Test Pushbutton** — Press this button to test the DGC-2020 indicators by exercising all LCD pixels and lighting all LEDs.
7. **Auto Pushbutton and Mode Indicator** — Press the **Auto pushbutton** to place the DGC-2020 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. **Off Pushbutton and Mode Indicator** — Press this button to place the DGC-2020 in **Off mode**. The red **Off Mode LED** lights whenever the DGC-2020 is in Off mode. This button also resets the **Breaker Management pre-alarms**.
9. **Run Pushbutton and Mode Indicator** — Press this button to place the DGC-2020 in **Run mode**. The green **Run Mode LED** lights whenever Run mode is active.
10. **Reset Pushbutton** — Press this button to cancel a settings editing session and discard any settings changes. When pressed momentarily, this button resets the **Breaker Management pre-alarms**. This button is also used to reset the maintenance interval when pressed for 10 seconds while viewing **Hours Until Maintenance** or the **Maintenance Due pre-alarm**.
11. **Arrow Pushbuttons** — These four buttons are used to navigate through the front panel display menus and to modify settings.
 - The **Left Arrow and Right Arrow buttons** are used to navigate through the menu levels. Press the **Right Arrow button** to move **downward** through the menu levels and press the **Left Arrow button** to move **upward** through the menu levels.
 - 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. The Right Arrow and Left Arrow buttons move to different digits.
12. **Edit Pushbutton** — Press the **Edit pushbutton** to start an editing session and enable changes to the DGC-2020 settings. At the conclusion of an editing session, press this button again to save the setting changes.

OUTPUT TERMINAL PANEL FAMILIARIZATION

OUTPUT TERMINAL PANEL

The **output terminal panel** (Figure 8) 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.

Table 6. Output Terminal Bolt Torque

U, V, W, O	221.3 lbf-in (25.0 N·m)
Ground	1,088.6 lbf-in (123.0 N·m)

OUTPUT TERMINAL FAMILIARIZATION

The output terminal panel is provided with the following:

- Two (2) 120-volt GFCI receptacles @ 20 amps
- Two (2) 20-amp GFCI circuit breakers
- Four (4) output terminal boards (U, V, W, O)
- Ground Terminal
- Auto-Start Contact Terminal Block

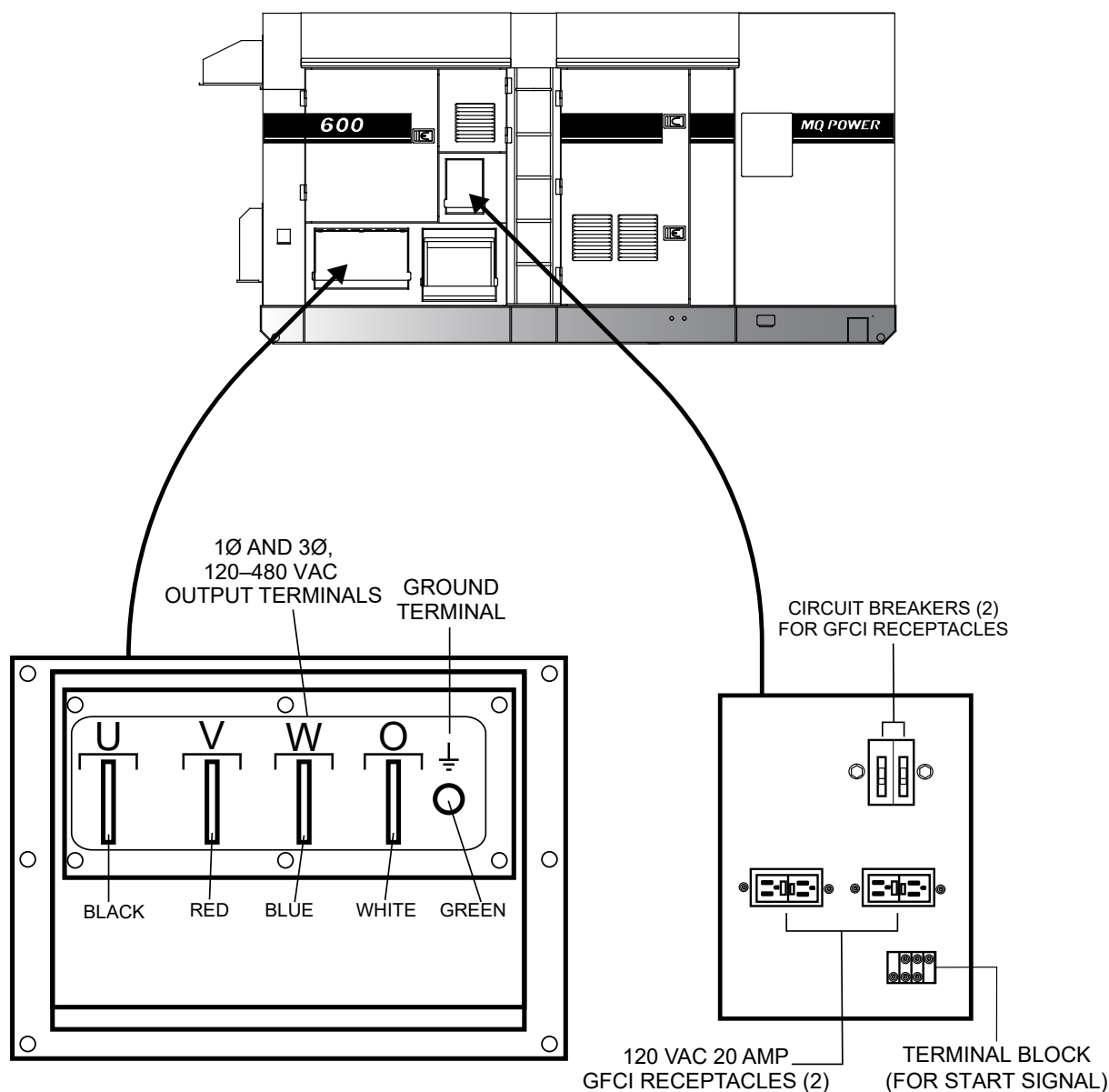


Figure 8. Output Terminal Panel

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 change-over board 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 9) 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. Reference the maintenance section in this manual for further testing of the GFCI receptacle.

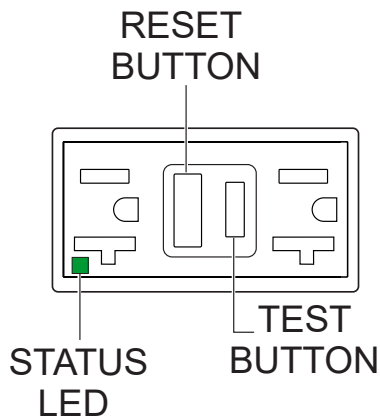


Figure 9. 120-Volt GFCI Receptacle

CONNECTING LOADS

Loads can be connected to the generator (Figure 10) via the **UVWO** terminal lugs or the convenience receptacles. Be sure to read the operation manual before attempting to connect a load to the generator.

To protect the UVWO output terminals from overload, a 3-pole, 1600-amp, main circuit breaker is provided. Be sure to switch **all** circuit breakers to the **OFF** position prior to starting the engine.

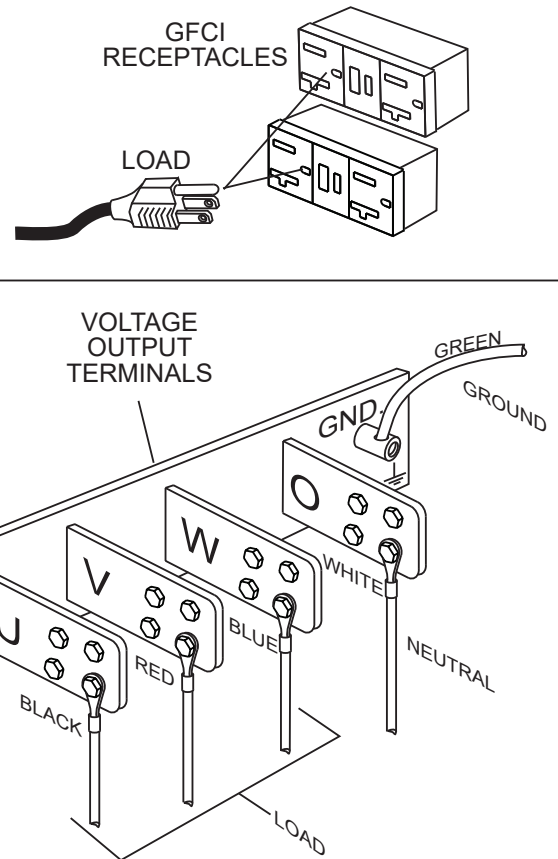


Figure 10. Connecting Loads

OVERCURRENT RELAY

An **overcurrent relay** (Figure 11) 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.

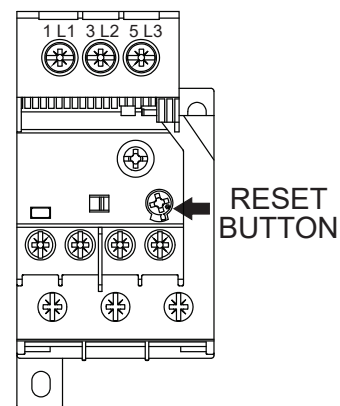


Figure 11. Overcurrent Relay

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 is 0.8. 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.

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

DANGER

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

PowerBalance® (Figure 12) is an optional load management solution that helps protect the engine generator from problems resulting from sustained low-load operations (defined as less than 30% of the generator full-load rating).

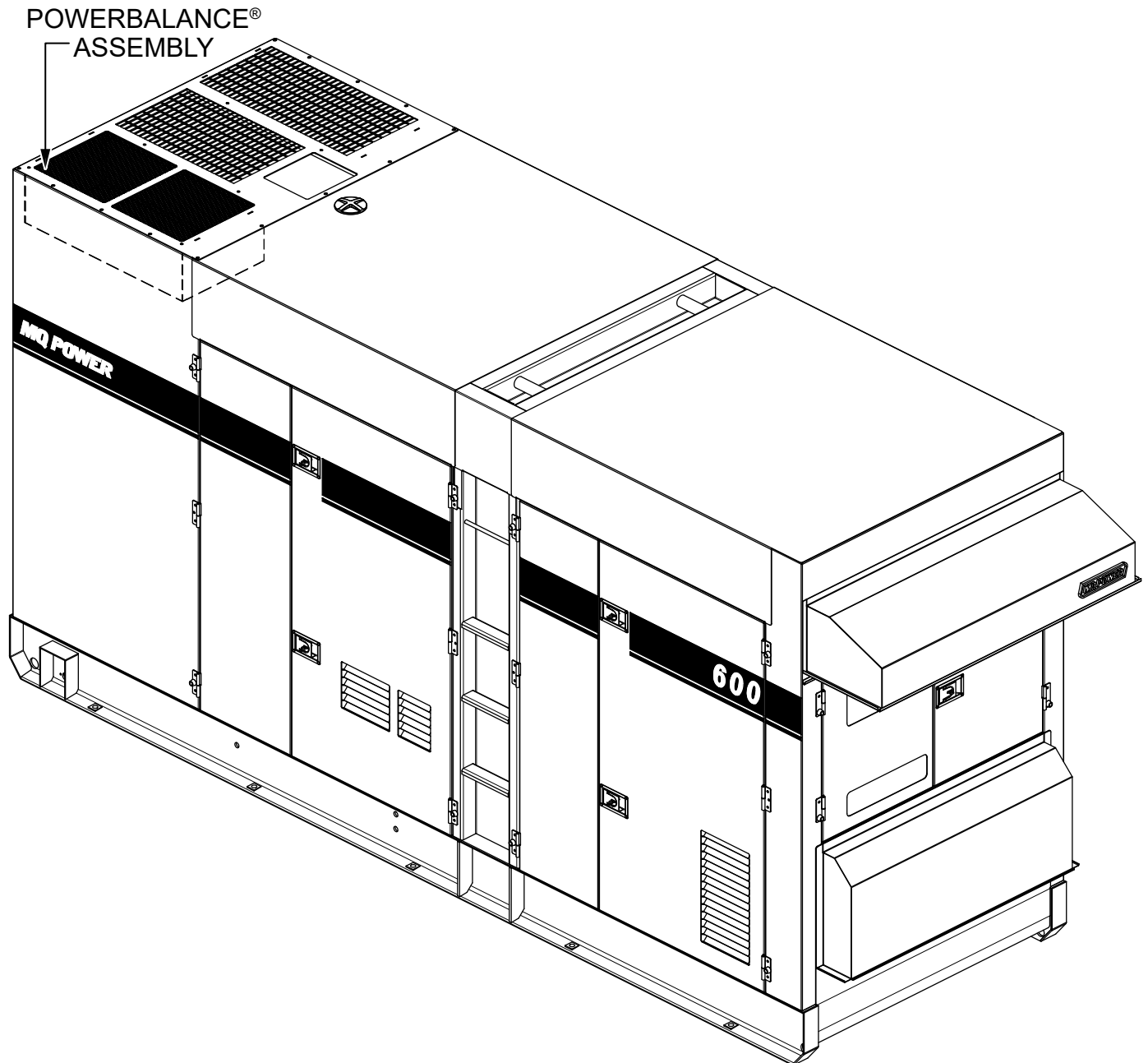


Figure 12. PowerBalance®

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

GENERATOR OUTPUTS

GENERATOR OUTPUT VOLTAGES

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

Table 9. Available Voltages						
UVWO Output Terminal Lugs	Voltage Change-Over Board 3-Phase 240/139V Position			Voltage Change-Over Board 3-Phase 480/277V Position		
3Ø Line-Line	208V	220V	240V	416V	440V	480V
1Ø Line-Neutral	120V	127V	139V	240V	254V	277V

Voltage Change-Over Board

Voltages are selected by applying six jumper plates to the **voltage change-over board** (Figure 13), which is located inside the control box behind the generator control panel. This board has been provided for ease of voltage selection.

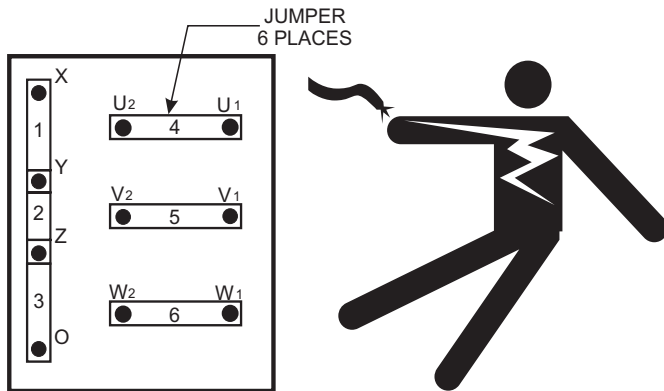


Figure 13. Voltage Change-Over Board

WARNING

NEVER attempt to place jumper plates on the **voltage change-over board** while the generator is in operation. There exists the possibility of **electrocution, electrical shock, or burn, which can cause severe bodily harm or even death!**

VOLTAGE REGULATOR

To obtain some of the voltages listed in Table 9 will require a fine voltage adjustment using the **voltage regulator** (Figure 14) located on the control panel.

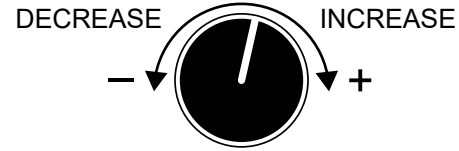


Figure 14. Voltage Regulator

Turn the voltage regulator to obtain the desired voltage. Turning the knob **clockwise** will **increase** the voltage. Turning the knob **counterclockwise** will **decrease** the voltage.

GENERATOR AMPERAGE

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	1,333.3 amps (4 wire)
Single Phase 240 Volts	666.7 amps (4 wire)
Three Phase 208 Volts	1,443.4 amps
Three Phase 240 Volts	1,443.4 amps
Three Phase 480 Volts	721.7 amps
Main Line Circuit Breaker Rating	1,600 amps
Overcurrent Relay Trip Set Point	1,443.4 amps (240V) 720 amps (480V)

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 placement of the jumper plates (6) on the **voltage change-over board** (Figure 15) and the adjustment of the **voltage regulator**.

The voltage change-over board determines the range of the output voltage and can be configured in two different positions that provide 6 different output voltages at the UVWO output terminals. The generator is shipped from the factory in the 240-volt configuration. The voltage regulator allows the user to increase or decrease the selected voltage.

NOTICE

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

3-Phase 240-Volt UVWO Terminal Output Voltages

1. Jumper the voltage change-over board for 240-volt operation as shown in Figure 15.

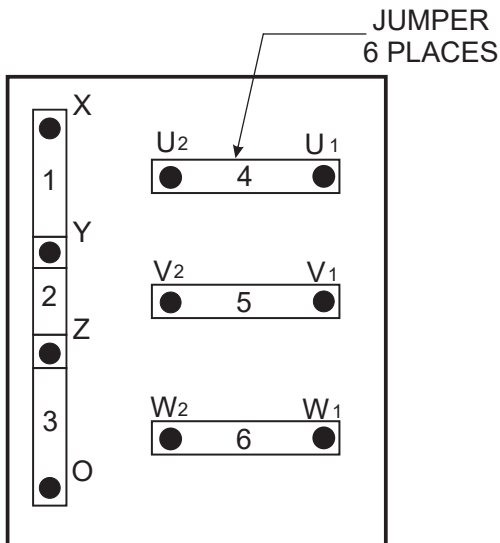


Figure 15. Voltage Change-Over Board (240-Volt Configuration)

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

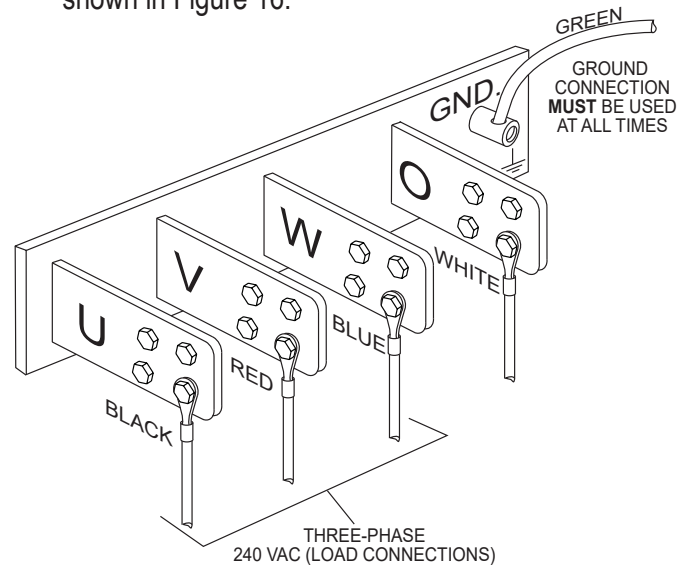


Figure 16. UVWO Terminal Lugs (3-Phase 240-Volt Connections)

3. Turn the **voltage regulator** (Figure 17) clockwise to increase voltage output as needed. Turn counterclockwise to decrease voltage output.

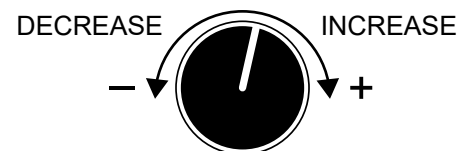
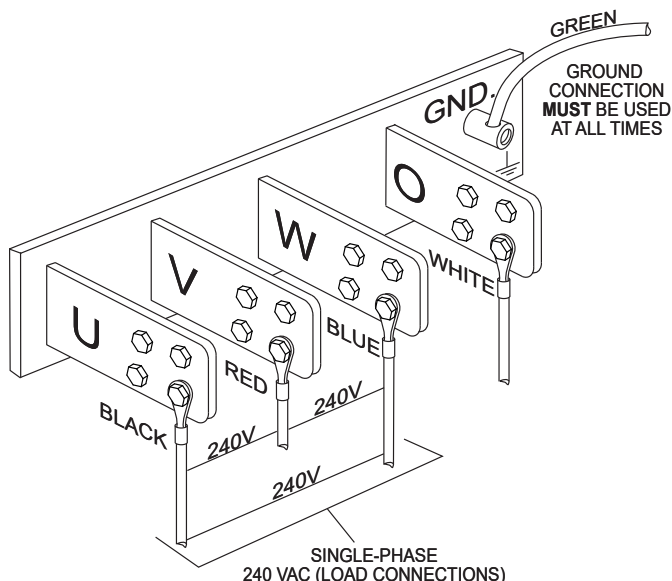


Figure 17. Voltage Regulator

OUTPUT TERMINAL PANEL CONNECTIONS

Single-Phase 240-Volt UVWO Terminal Output Voltages

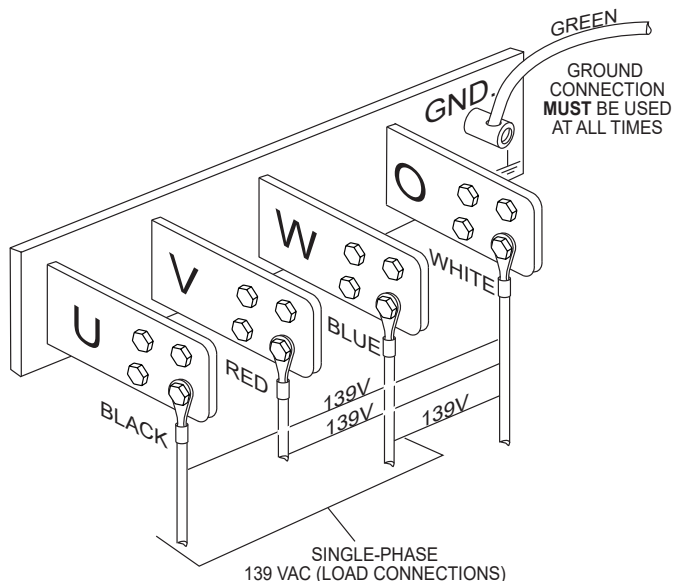
1. Make sure the voltage change-over board is jumpered for 240-volt operation as shown in Figure 15.
2. Connect the load wires to the UVWO terminals as shown in Figure 18.



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

Single-Phase 139-Volt UVWO Terminal Output Voltages

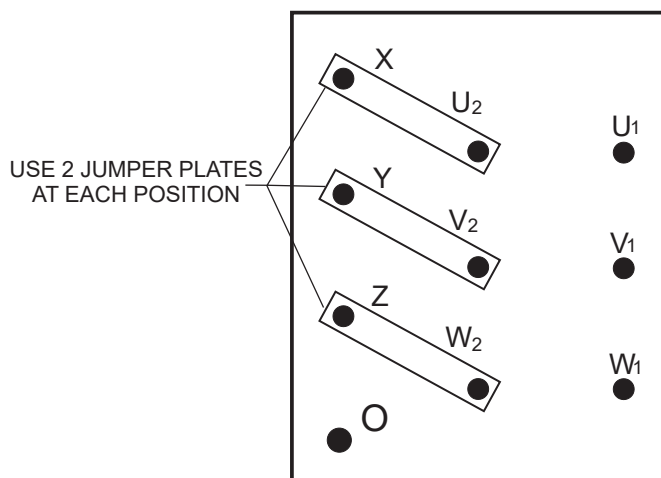
1. Make sure the voltage change-over board is jumpered for 240-volt operation as shown in Figure 15.
2. Adjust the voltage regulator (Figure 17) for an output of 208 volts to obtain 120 volts at the UVWO terminals.
3. Connect the load wires to the UVWO terminals as shown in Figure 19.



**Figure 19. UVWO Terminal Lugs
(Single-Phase 139-Volt Connections)**

3-Phase 480-Volt UVWO Terminal Output Voltages

1. Jumper the voltage change-over board for 480-volt operation as shown in Figure 20. This configuration uses 6 jumper plates in 3 different positions. Remember that there are 2 jumper plates at every position. Every jumper plate *must* be used.



**Figure 20. Voltage Change-Over Board
(480-Volt Configuration)**

OUTPUT TERMINAL PANEL CONNECTIONS

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

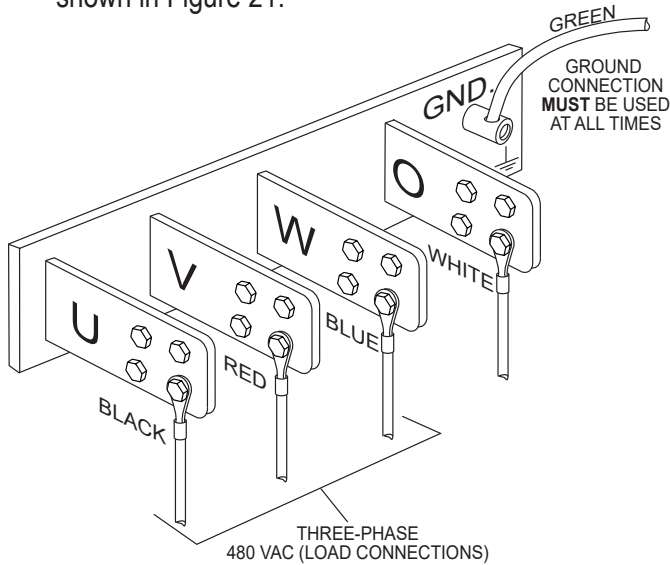


Figure 21. UVWO Terminal Lugs (3-Phase 480-Volt Connections)

Single-Phase 480-Volt UVWO Terminal Output Voltages

1. Make sure the voltage change-over board is jumpered for 480-volt operation as shown in Figure 20.
2. Connect the load wires to the UVWO terminals as shown in Figure 22.

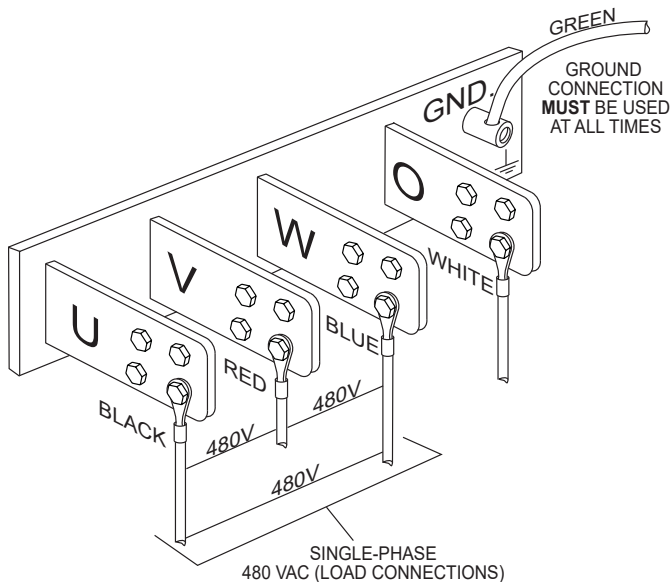


Figure 22. UVWO Terminal Lugs (Single-Phase 480-Volt Connections)

Single-Phase 277-Volt UVWO Terminal Output Voltages

1. Make sure the voltage change-over board is jumpered for 480-volt operation as shown in Figure 20.
2. Connect the load wires to the UVWO terminals as shown in Figure 23.

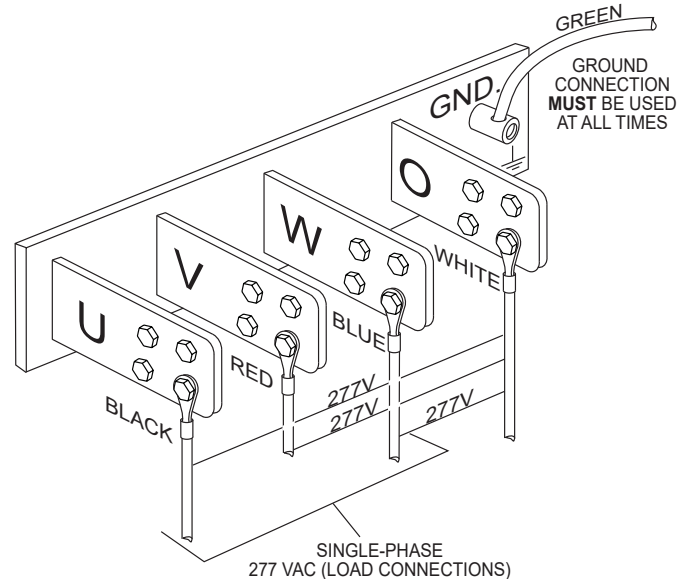


Figure 23. UVWO Terminal Lugs (Single-Phase 277-Volt Connections)

ENGINE OIL CHECK

1. To check the engine oil level, place the generator on secure, level ground with the engine stopped.
2. Remove the **dipstick** from its holder (Figure 24) and wipe it clean.

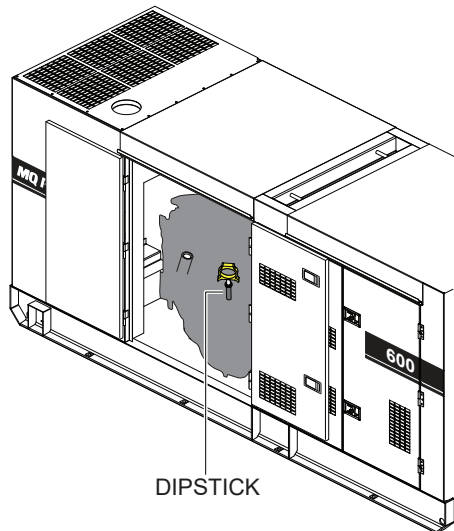


Figure 24. Engine Oil Dipstick

3. Reinsert the dipstick, then remove the dipstick from its holder. Check the oil level shown on the dipstick (Figure 25).

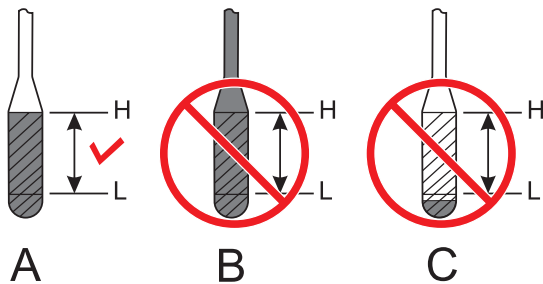


Figure 25. Engine Oil Level

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** (Figure 26) and fill to a safe operating level (max) as indicated by the dipstick (Figure 25A). Fill with the recommended oil type listed in Table 11. Maximum oil capacity is 12.7 gallons (48 liters).

NOTICE

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

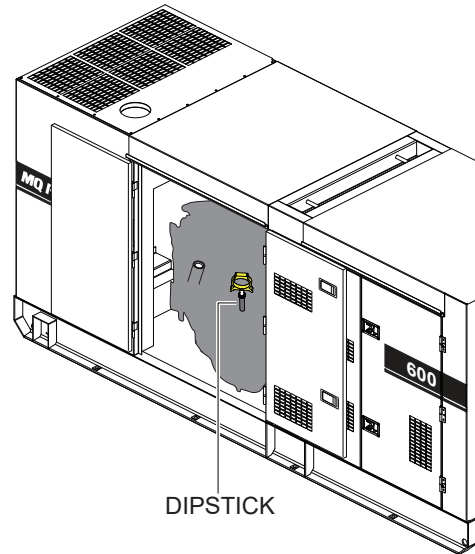


Figure 26. Engine Oil Filler Port

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

Table 11. Recommended Engine Oil

		OIL: SAE	
°F	°C		
122	50		
104	40	10W/40	30
86	30		
68	20		
50	10	10W/40	15W/30
32	0	5W/30	10W/30
14	-10	ARCTIC OIL	10W
-4	-20		
-22	-30		
-40	-40		20W/40

FUEL CHECK

DANGER



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

NOTICE

ALWAYS check the DEF tank level when adding fuel.

Refilling The Fuel System

NOTICE

DO NOT refuel while the engine is running.

CAUTION

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

When equipped with a trailer or skid, the generator may have a **double fuel tank system** (Figure 27), which consists of an **internal fuel tank** and a **trailer-mounted fuel tank**.

ALWAYS fill the fuel tank with clean, fresh, **#2 diesel fuel**. Pay attention to the fuel tank capacity when replenishing fuel. **DO NOT** fill the fuel tank beyond its capacity.

Close the **fuel filler cap** (Figure 27) tightly after filling. Handle fuel in a safety container. If the container does not have a spout, use a funnel. Wipe up any spilled fuel **immediately**.

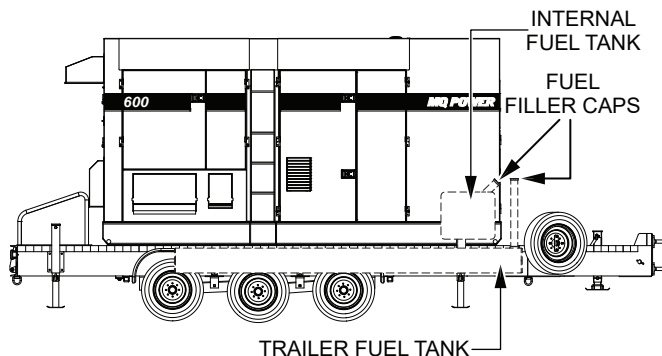


Figure 27. Double Fuel Tank System

Refueling Procedure

NOTICE

ALWAYS fill the fuel tank with clean, fresh **#2 diesel fuel**. **NEVER** fill the fuel tanks beyond their capacities.

WARNING



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

1. **Level the tanks.** Make sure fuel tanks are level with the ground. Failure to do so will cause fuel to spill from the tank before reaching full capacity (Figure 28).

CAUTION

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

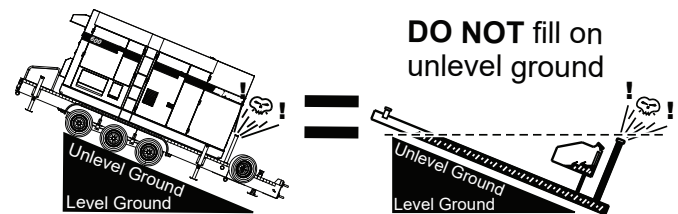


Figure 28. Only Fill On Level Ground

NOTICE

ALWAYS fill the trailer tank first with **#2 diesel fuel** before filling the secondary internal tank. Fuel from the secondary internal tank will eventually drain into the primary trailer tank.

INSPECTION/SETUP

2. **Fill the trailer fuel tank first.** The trailer fuel tank is the primary fuel tank and has a larger fuel capacity. The fuel in the trailer will be filtered and sent to the engine. **ALWAYS** fill the trailer fuel tank first (Figure 29).

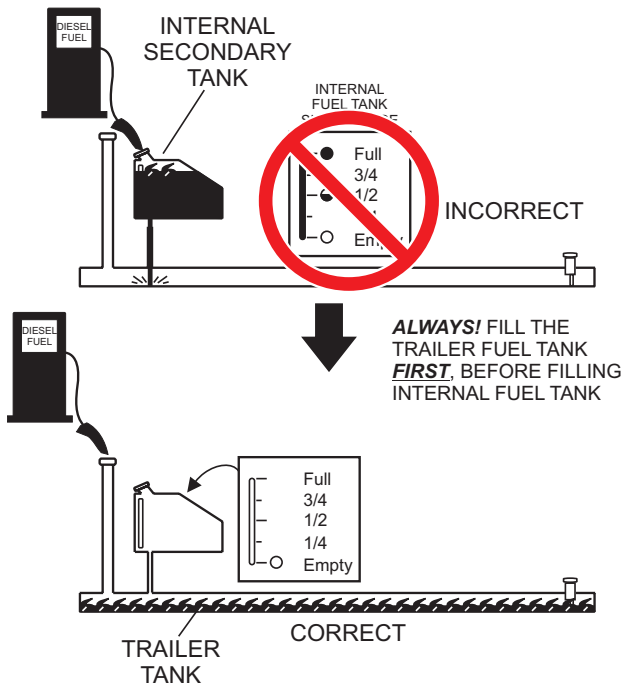


Figure 29. Fuel Tank Fill Order

3. **NEVER** overfill the fuel tank. It is important to read the fuel gauge (Figure 30) while filling the trailer fuel tank. **DO NOT** wait for fuel to rise inside the filler neck.



Figure 30. Trailer Fuel Gauge

CAUTION

DO NOT overfill the fuel system. Leave room for fuel expansion. Fuel expands when heated (Figure 33).

4. Once the trailer tank is full, the secondary, internal tank can be filled (Figure 31). Notice how the level rises inside the trailer filler tube when the internal tank is filled. Figure 32 illustrates a full fuel system.

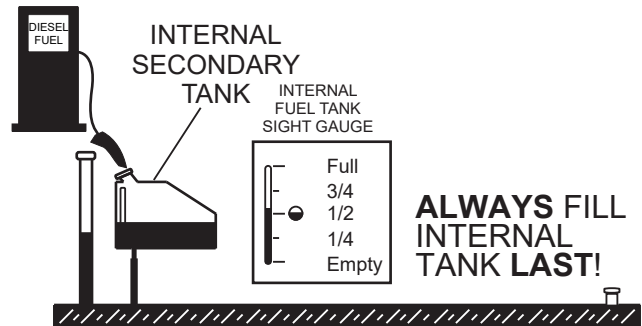


Figure 31. Filling Internal Secondary Fuel Tank

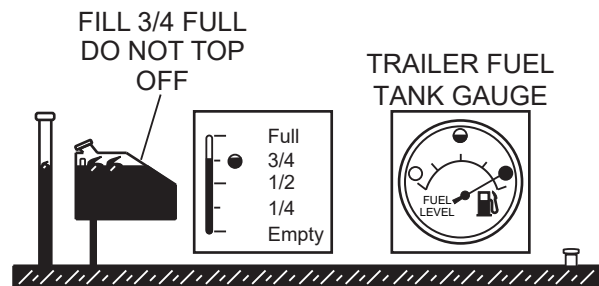


Figure 32. Full Fuel System

5. Fuel from the engine return line will drain into the secondary internal fuel tank. This fuel will eventually drain into the primary trailer tank in order to return to the engine.

CAUTION

It is recommended to only fill the internal secondary tank to 3/4 full in order to avoid spillage and to allow for fuel return and fuel expansion (Figure 33).

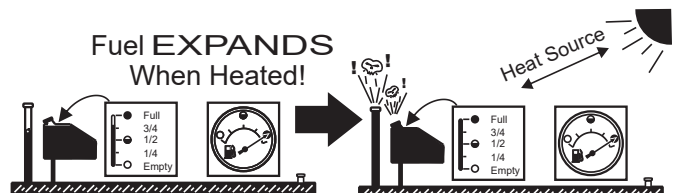


Figure 33. Fuel Expansion

DIESEL EXHAUST FLUID

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

DEF Refilling

NOTICE

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

1. Make sure the engine is **OFF**.
2. Remove the **filler cap** from the DEF tank (Figure 34).

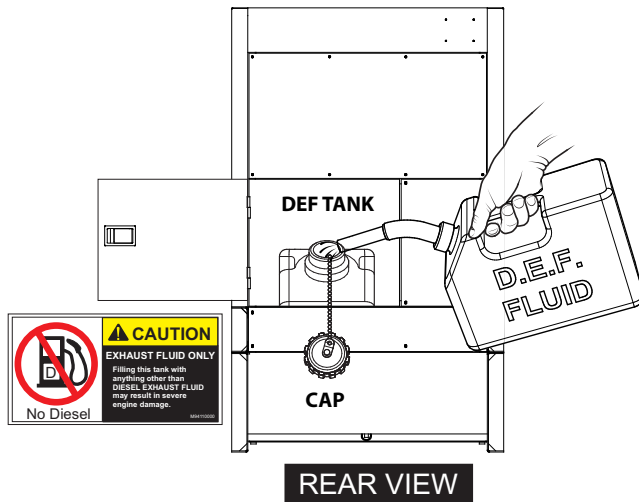


Figure 34. DEF Tank Filling

3. Add diesel exhaust fluid to the tank. **DO NOT** overfill.
4. Prior to initial startup, **completely fill** the DEF tank with DEF fluid. **DO NOT** overfill.
5. Reinstall the DEF tank cap. Tighten securely.

DEF Refilling (Continuous Operation)

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

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

COOLANT

Volvo recommends pre-diluted Volvo Penta Coolant VCS (yellow). See the **Volvo engine owner's manual** for further details.

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 12 for engine/radiator and reserve tank coolant capacities.

Table 12. Coolant Capacity

Engine and Radiator	26.1 gallons (99 liters)
Reserve Tank	2 quarts (1.9 liters)

NOTICE

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

Verify that the coolant level in the coolant reserve tank is between the **MIN** and **MAX** markings on the sight glass as shown in Figure 35.

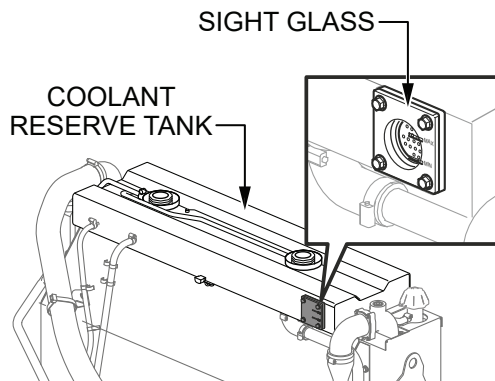


Figure 35. Coolant Reserve Tank

Operation In Freezing Weather

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

Table 13. Antifreeze Operating Temperatures		
Volume % Antifreeze	Freezing Point	
	°C	°F
40	-24	-11
50	-37	-34

CLEANING THE RADIATOR

WARNING

Cleaning inside the machine is dangerous, so clean the radiator only with the engine turned **OFF** and the **negative** battery terminal disconnected.

The engine may overheat if the radiator becomes overloaded with dust or debris. Clean the radiator with water and a mild detergent. Remove guards as necessary to access the radiator. Use a **soft brush** (Figure 36) for cleaning. Be careful to not damage the radiator vanes. Reinstall all removed parts when finished.

NOTICE

NEVER use a high-pressure power washer to clean the radiator.

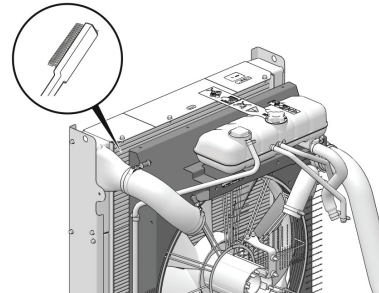


Figure 36. Cleaning The Radiator

ENGINE AIR CLEANER

Periodic cleaning/replacement of the air cleaner is necessary. Inspect the air cleaner in accordance with the **Maintenance** section of this manual.

FAN BELT TENSION

A slack fan belt may contribute to overheating or insufficient charging of the battery. Inspect the fan belt for damage and wear and adjust it in accordance with the **Volvo engine owner's manual**.

The fan belt tension is correct if the belt bends 3 to 4 mm when depressed with the thumb as shown in Figure 37.

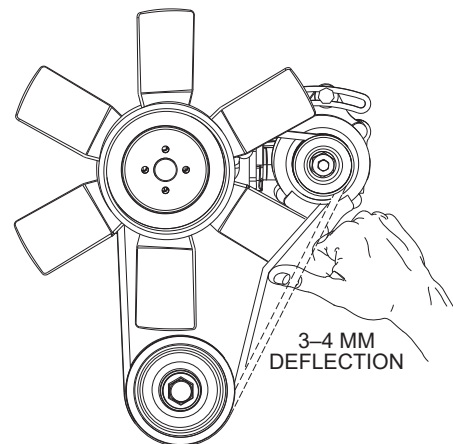


Figure 37. Fan Belt Tension

CAUTION



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

BATTERY

This unit is of negative ground. **DO NOT** connect in reverse. **ALWAYS** maintain battery fluid 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 malfunctions or poor starting. **ALWAYS** keep the terminals firmly tightened. Coat the terminals with an approved battery terminal treatment compound. Replace the battery only with the recommended type of battery.

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, the battery is dead and needs to be recharged or replaced.

Be sure to disconnect the battery cables before charging the battery with an external electrical source.

Battery Cable Installation

Connect the two 12-volt batteries **in series** (24-volt system) as shown in Figure 38. Make sure the battery cables are properly connected to the battery terminals. Connect the **red cable** to the **positive terminal** of one battery, and connect the **black cable** to the **negative terminal** of the other battery.



CAUTION

ALWAYS disconnect the negative terminal first and reconnect the negative terminal last.

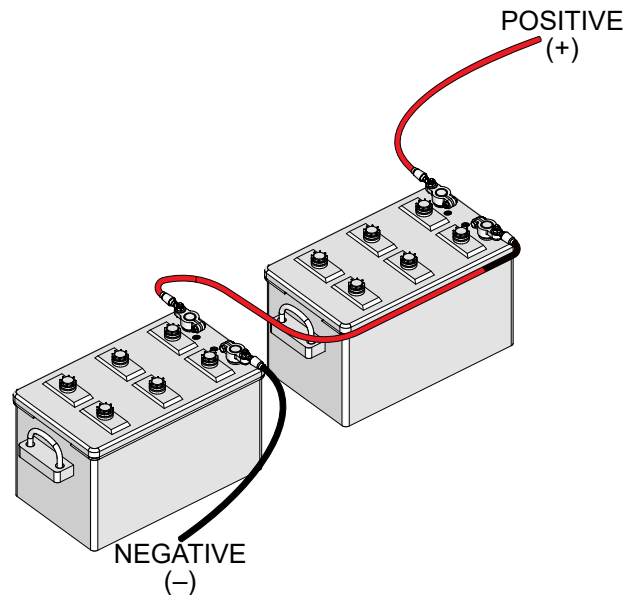


Figure 38. Battery Connections

When connecting the batteries:

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 batteries.
2. Place a small amount of battery terminal treatment compound around each battery terminal. This will ensure a good connection and help prevent corrosion around the battery terminals.

NOTICE

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

NOTICE

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

Battery Switch

Located in the engine compartment, the **Battery switch** (Figure 39) 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.

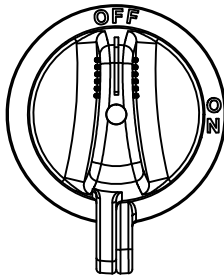


Figure 39. Battery Switch

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.

NOTICE

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

1. Make sure all circuit breakers are in the **OFF** position.
2. Make sure the **voltage change-over board** has been configured for the desired output voltage.
3. Place the **Battery switch** (Figure 40) in the **ON** position.

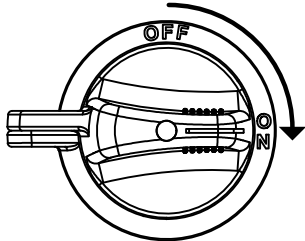


Figure 40. Battery Switch (ON)

4. Place the **Control Power switch** (Figure 41) in the **ON** position.



Figure 41. Control Power Switch (ON)

5. Make sure the **Circuit Breaker OFF button LED** is **ON (red)**. See Figure 42.

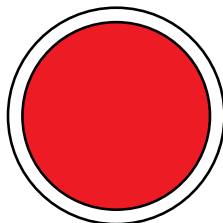
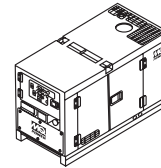
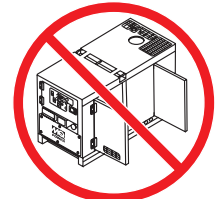


Figure 42. Circuit Breaker OFF Button (ON/RED)

6. Connect the load to the **receptacles** or the **output terminal lugs** as shown in Figure 10. These load connection points can be found on the **output terminal panel** and the output terminal panel's hard wire hookup panel.
7. Tighten terminal nuts securely to prevent load wires from slipping out.
8. Close all engine enclosure doors (Figure 43).



CORRECT



INCORRECT

Figure 43. Engine Enclosure Doors

STARTING (MANUAL)

1. To start the engine, press the **Run button** (Figure 44) on the digital controller.

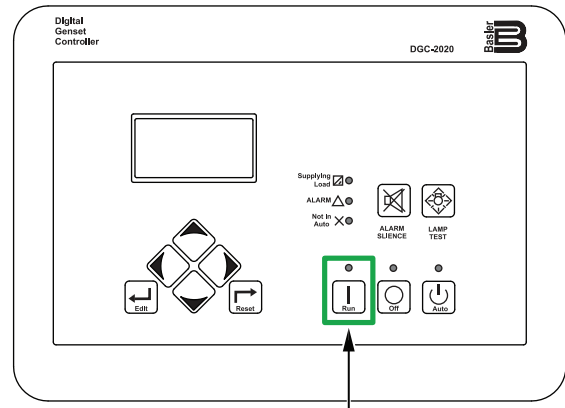


Figure 44. Digital Controller (Run Button)

NOTICE

If the engine fails to start in the specified number of attempts, press the **OFF button** on the controller and place the battery switch in the OFF position. Wait for at least 1 minute before repeating the starting process.

NOTICE

The engine will pre-heat automatically in cold weather conditions. The message "**Glow Plug Hold**" will be shown on the controller display and the engine will start automatically after pre-heating.

GENERATOR START-UP PROCEDURE (MANUAL)

2. Once the engine starts, the engine will run at low idle (900 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.

3. The controller display will indicate the 60-cycle output frequency in **HERTZ** (Figure 45C).

A		B		C	
VOLT	AMP	PH	Hz		
480	0	AB	60.0		
HR : 3:58		DEF : 33 %			
64	60 %	106	28.2		
OIL	FUEL	TEMP	BATT		
E		D			

Figure 45. Controller Display

4. The controller display will indicate the generator's output in **VOLTS** (Figure 45A).
5. If the voltage is not within the specified tolerance, use the **voltage regulator** (Figure 46) to increase or decrease the desired voltage.



Figure 46. Voltage Regulator

6. The controller display will indicate **zero amps** with no load applied (Figure 45B). When a load is applied, the display will indicate the amount of current that the load is drawing from the generator.
7. The controller display will indicate the **oil pressure** of the engine (Figure 45E). Under normal operating conditions the oil pressure should be between 44 and 94 psi. (303–648 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.

8. The controller display will indicate the **coolant temperature** (Figure 45D). Under normal operating conditions the coolant temperature should be 167°–194°F (75°–90°C).
9. Press the **Circuit Breaker ON button** (Figure 47). The button LED will turn **ON (green)** and power will be supplied to the output terminals and receptacles.

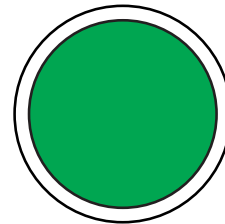


Figure 47. Circuit Breaker ON Button (ON/GREEN)

10. Observe the amperage reading on the controller display (Figure 45B) and verify that it is the anticipated amount of current with respect to the load. The ammeter will only display an amperage reading if a load is in use.
11. 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 that the generator can start up at any time without warning. **NEVER** attempt to perform any maintenance while the generator is in Auto mode.

NOTICE

When 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 7 in **Before Starting** found in the **Generator Start-Up Procedure (Manual)** section.
2. Press the **Auto button** (Figure 48) 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.

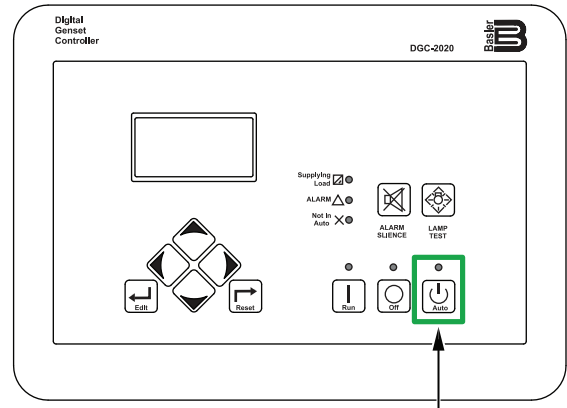


Figure 48. Digital Controller (Auto Button)

3. The main circuit breaker will automatically turn **ON** after the engine starts. Observe that the LED on the **Circuit Breaker ON button** has turned **ON (green)**. See Figure 47.

GENERATOR SHUTDOWN PROCEDURES

WARNING

NEVER stop the engine suddenly except in an emergency.

NORMAL SHUTDOWN PROCEDURE (MANUAL)

1. Place the load's ON/OFF switch in the **OFF** position.
2. Press the **Circuit Breaker OFF button**. The button LED will turn **ON (red)**.

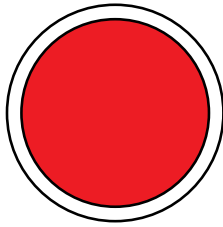


Figure 49. Circuit Breaker OFF Button (ON/RED)

3. Press the **OFF button** on the digital controller (Figure 50) to stop the engine. The engine will stop after a 1-minute cool-down process.

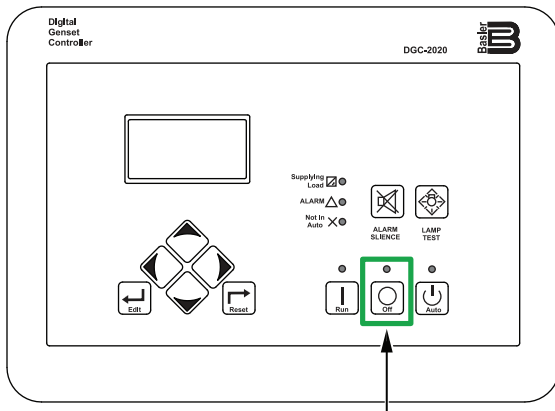


Figure 50. Digital Controller (OFF Button)

4. After the engine has stopped completely, place the **Control Power switch** in the **OFF** position (Figure 51).



Figure 51. Control Power Switch (OFF)

5. Place the **Battery switch** (Figure 52) in the **OFF** position.

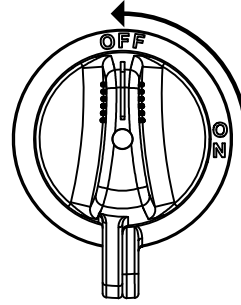


Figure 52. Battery Switch (OFF)

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 50). The circuit breaker will automatically turn **OFF** and the engine will stop after a 1-minute cool-down process.

GENERATOR SHUTDOWN PROCEDURES

EMERGENCY SHUTDOWN PROCEDURE

1. To stop the engine in the event of an emergency, push the **Emergency Stop switch** (Figure 53). This switch is located on the side of the generator next to the output terminal panel.

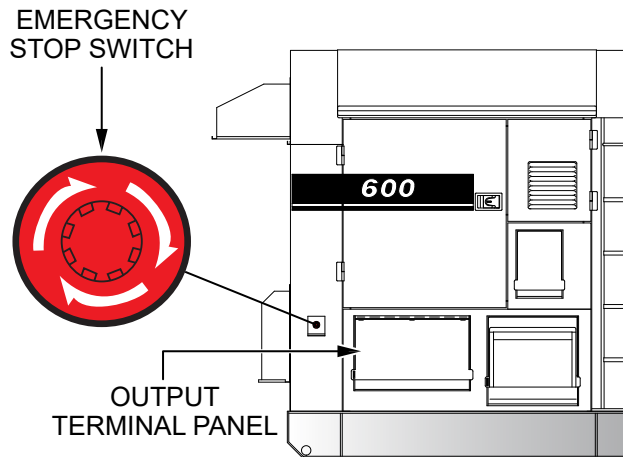


Figure 53. Emergency Stop Switch

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 50).

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.

Table 14. Inspection/Maintenance		Daily	Every 500 Hours	Every 1,000 Hours	Every 2,000 Hours
Engine	Check Engine Oil and Coolant Levels	X			
	Check Fuel Filter / Water Bowl	X			
	Check Battery Fluid Level	X			
	Check Air Cleaner	X			
	Check for Leaks	X			
	Visual Walk-Around Inspection	X			
	Check Coolant Antifreeze Mixture		X		
	Clean Air Cleaner Element		X		
	Drain Bottom of Fuel Tank		X		
	Drain Bottom of Fuel Pre-Filter		X		
	Replace Engine Oil and Oil Filter*1		X		
	Check Drive Belt, Belt Tensioner and Idler Wheels	X	X		
	Replace Fuel Filter Elements			X	
	Check Electrical Ground Connection			X	
	Clean Radiator and Check Cooling System			X	
	Clean Inside Fuel Tank			X	
	Check All Hoses and Clamps			X	
	Check Engine Mounts			X	
	Replace Air Cleaner Element*2			X	
	Check and Adjust Engine Valve Clearance			(X)	X
	Replace Drive Belts				X
	Check/Correct DEF Leakage	X			
	Replace DEF Filter (in Supply Module, Def Tank)*3				X
	Replace DEF Tank Breather Filter				X
	Flush and Refill Cooling System	Every 4 years or 8,000 hours			
Generator	Measure Insulation Resistance Over 3M Ohms*4		X		
	Check Rotor Rear Support Bearing			X	

*1 During the initial operation of a new engine, change oil and filter between a minimum of 100 hours and a maximum of 200 hours. Service interval depends on type of oil.

*2 Replace the air cleaner element when the restriction indicator shows a vacuum of 635 mm (25 in.) H₂O.

*3 When replacing the DEF tank's filter, make sure to disconnect all harnesses and hoses, and pull out the DEF tank.

*4 Make sure to disconnect the O – Earth line and turn off the SW2 before performing the measurement. Refer to the **Generator Wiring Diagram**.

*5 Accumulation of carbon (soot, unburned fuel) in the exhaust pipeline and muffler could cause not only system derates but also could lead to a fire incident. To destroy the soot and unburned fuel, run the unit at rated power for some period of time until the exhaust gas becomes mostly colorless every 250 hours of operation time. The carbon will be generated more easily when the unit operates at less than 40% of rated power. In this case, perform the above procedures at a shorter interval time.

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

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

GENERAL INSPECTION

Prior to each use, the generator should be cleaned and inspected for deficiencies. Check for loose, missing, or damaged nuts, bolts, or other fasteners. Also check for fuel, oil, and coolant leaks. Use Table 14 as a general inspection and maintenance guideline. For more detailed engine maintenance instructions, refer to the Volvo engine owner's manual.

ENGINE AIR CLEANER

This Volvo diesel engine is equipped with a replaceable, high-density, paper air cleaner element (Figure 54). The air cleaner is also equipped with an inner (secondary) element that is used as a backup filter should the primary element become damaged. Check the air cleaner daily or before starting the engine. Replace the air cleaner as needed.

NOTICE

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

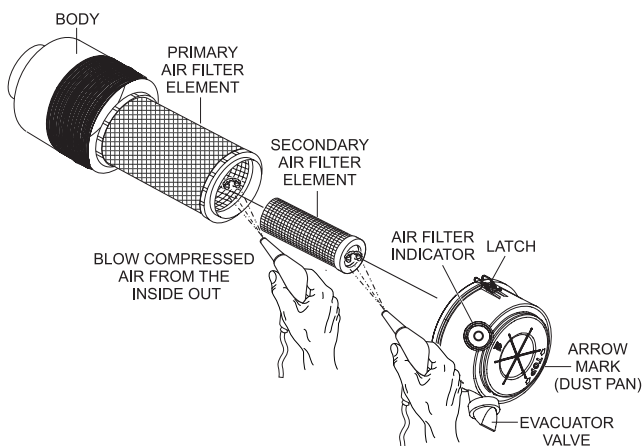


Figure 54. Engine Air Cleaner

Primary And Secondary Air Cleaner Elements

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

CAUTION



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

1. Release the latches that secure the cover to the air cleaner body (Figure 54).
2. Remove the **air cleaner cover** (Figure 54) and set it aside.
3. Remove both the primary and secondary air cleaner elements (Figure 54).
4. Check for and correct heavy buildup of dirt and debris along with loose or damaged components.

NOTICE

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

5. To clean the **primary element** (paper air filter) as shown in Figure 54, tap the filter element several times on a hard surface to remove dirt, or blow compressed air, not to exceed 30 psi (207 kPa, 2.1 kgf/cm²), through the filter element from the inside out.
6. Clean the **secondary element** (paper air filter) as described in step 5.
7. Replace both elements if they are damaged or excessively dirty.
8. Clean the inside of the **air cleaner body** (Figure 54).
9. Reinstall the primary and secondary air filter elements back into the air cleaner body.
10. Reinstall the air cleaner cover and secure it with latches.

NOTICE

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

Air Cleaner Restriction Indicator

The air cleaner is equipped with a **restriction indicator** (Figure 55). As the air cleaner element becomes clogged, air intake restriction increases and the indicator signal shows **RED**, indicating that the element needs to be replaced. After replacing the air cleaner element, press the restriction indicator button to reset the indicator.

PUSH BUTTON TO RESET

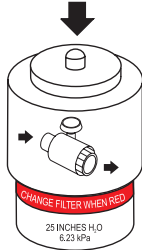


Figure 55. Air Cleaner Restriction Indicator

NOTICE

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

ENGINE FUEL FILTER

! DANGER



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

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

Draining Fuel Filter Condensate

1. Place an appropriate container underneath the fuel filter to collect the condensate (water) and fuel as it drains.
2. Loosen the **drain nipple** (Figure 56) in the base of the **fuel prefilter** to begin draining.

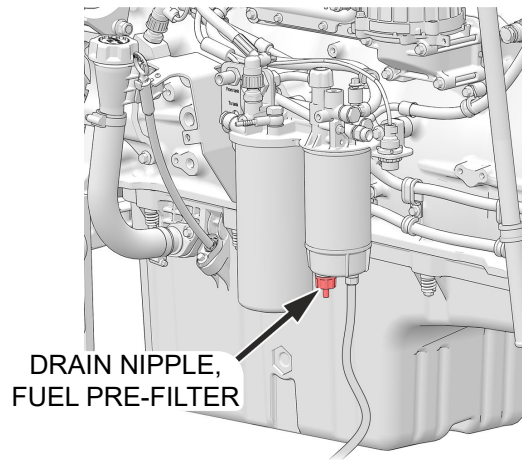


Figure 56. Fuel Prefilter Drain Nipple

3. Tighten the drain nipple when fuel without water starts to drain out.

Fuel Filter Replacement

NOTICE

DO NOT fill the new fuel filter with fuel before assembly. There is a risk of system contamination that can cause malfunctions or damage.

1. Clean around the **fuel filter** (Figure 57).

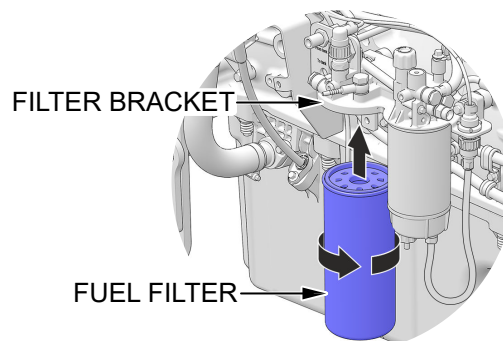


Figure 57. Fuel Filter Replacement

2. Using a filter wrench, remove the fuel filter. Collect any spilled fuel in an appropriate container.

3. Clean the filter mating surface on the **filter bracket** (Figure 57).
4. Lubricate the seal on the new fuel filter with diesel fuel and install the new fuel filter. Tighten the fuel filter in accordance with the instructions on the fuel filter.
5. If necessary, vent the fuel system. Refer to the **Bleeding the Fuel System** section.
6. Lubricate the seal with diesel fuel. Screw the filter onto the filter bracket by hand until the rubber seal just touches the mating surface. Then tighten another 1/2 turn. **DO NOT** overtighten.
7. Connect the cable to the water trap sensor.
8. If necessary, vent the fuel system. Refer to the **Bleeding the Fuel System** section.

Fuel Prefilter Replacement

1. Remove the **cable** (Figure 58) from the **water trap sensor**.

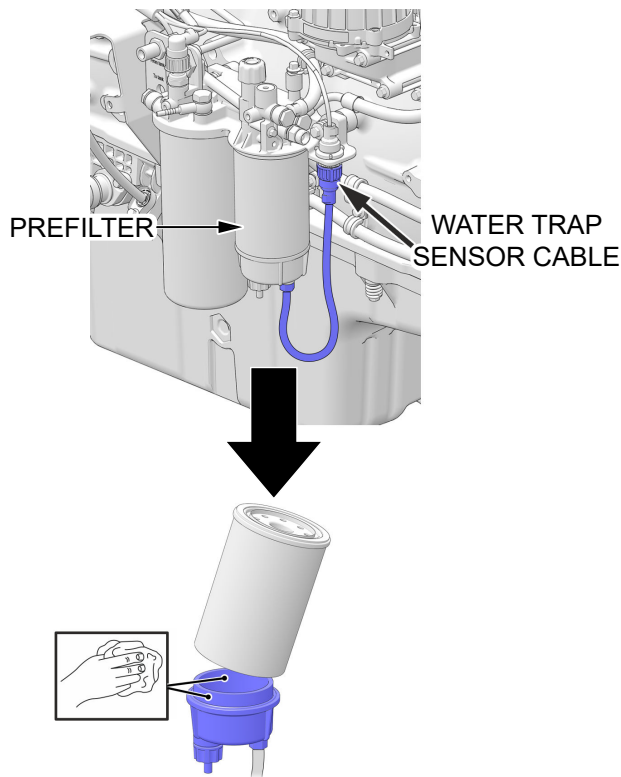


Figure 58. Fuel Prefilter Replacement

2. Remove the **prefilter** (Figure 58) from the filter housing. Collect any spilled fuel in a suitable container.
3. Remove the lower part of the water trap from the prefilter.
4. Clean the lower part of the water trap with a soft rag. Check that the drain hole in the lower part is not blocked.
5. Install a new seal on the lower part and lubricate the seal with diesel fuel. Reinstall the lower part of the filter.

Bleeding The Fuel System

1. Check that there is sufficient fuel in the tank, and that any fuel taps are open.
2. Release the **hand pump** (Figure 59) on the fuel bracket by pushing down and twisting the plastic handle.

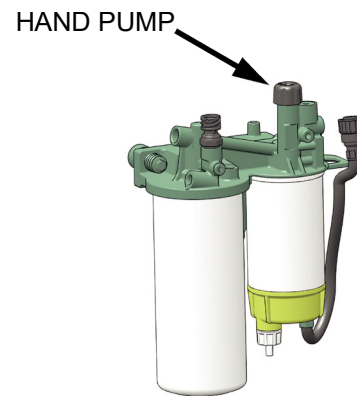


Figure 59. Bleeding The Fuel System

3. Vent the fuel system by pumping with the hand pump. Air is vented to the tank via the fuel return pipe. No breathing nipples need to be opened.
4. Lock the hand pump by pushing down and twisting the plastic handle.
5. Start the engine and allow it to idle fast for about 10 minutes.
6. Perform a leakage and function check.

CLEANING INSIDE THE FUEL TANK

If necessary, drain the fuel inside the fuel tank completely. Using a spray washer (Figure 60), wash out any deposits or debris that have accumulated inside the fuel tank.

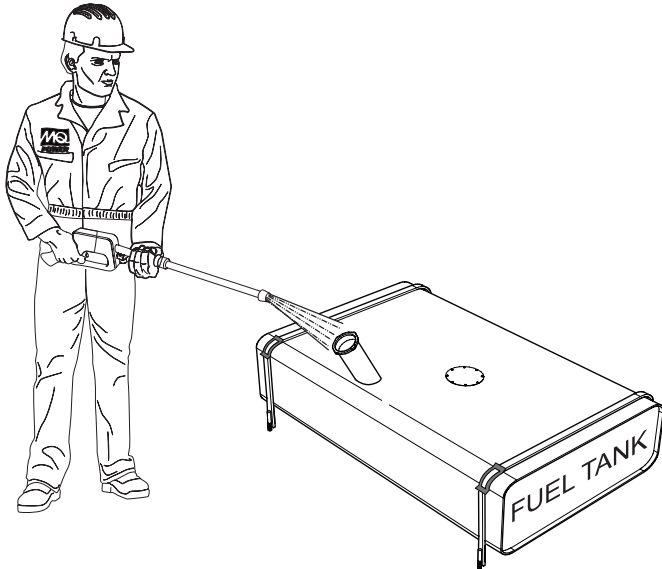


Figure 60. Cleaning The Fuel Tank

FUEL TANK INSPECTION

In addition to cleaning the fuel tank, inspect the following components for wear:

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

DRAINING THE ENGINE OIL

1. Run the engine until the engine coolant reaches a temperature of 140°F (60°C). Turn the engine off.
2. Remove the oil dipstick from its holder.
3. Remove the **oil drain plug** (Figure 61).

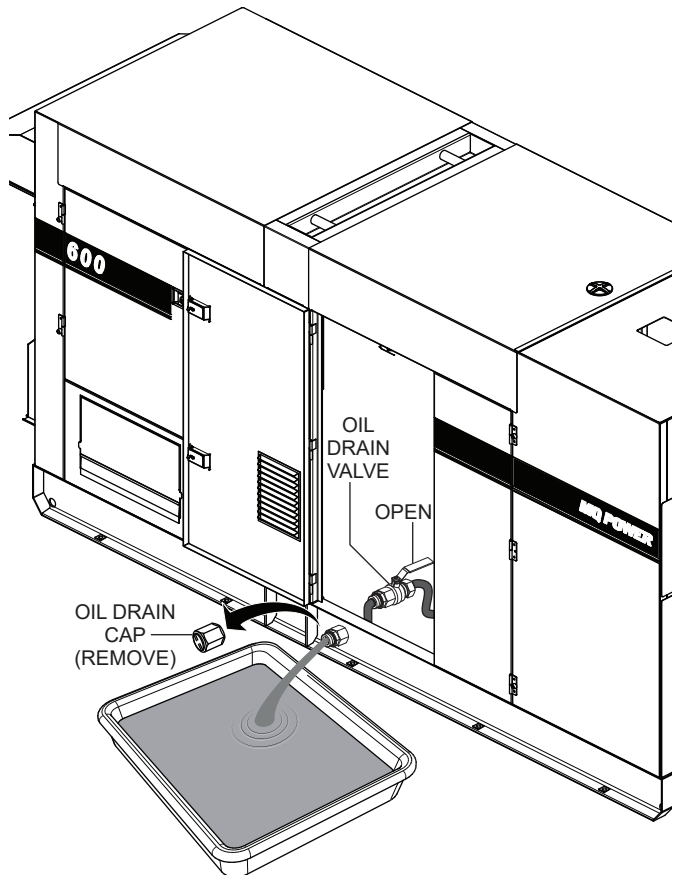


Figure 61. Draining The Engine Oil

4. Place the **oil drain valve** in the **OPEN** position and allow the oil to drain into a suitable container (Figure 61).
5. After the engine oil has been completely drained, reinstall the oil drain plug and tighten securely.
6. Place the oil drain valve in the **CLOSED** position.

ENGINE OIL FILTER REPLACEMENT

1. Clean the area around the **oil filter bracket** (Figure 62).

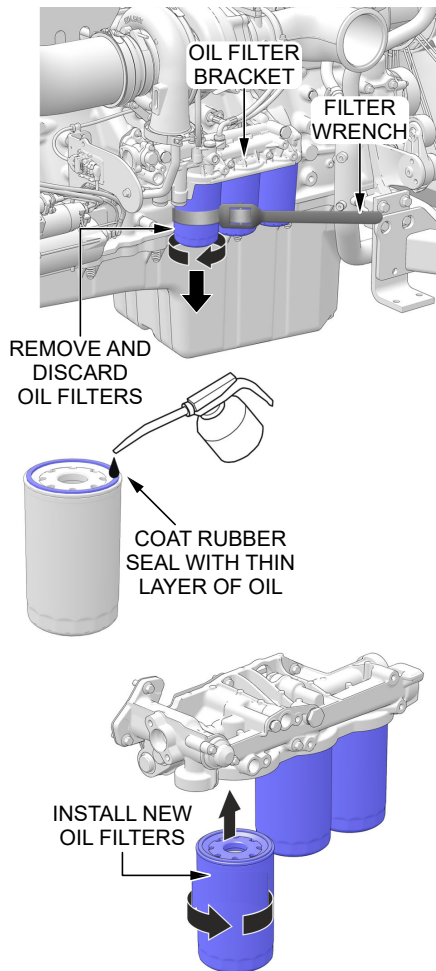


Figure 62. Oil Filter Replacement

2. Using a **filter wrench**, remove all engine oil filters (Figure 62).
3. Clean the mating surface of the oil filter bracket. Make sure that no pieces of old oil seal are left behind. Carefully clean around the inside of the protective rim on the oil filter bracket.
4. Coat the rubber seal (gasket) surface of the new oil filters with clean 15W-40 engine oil (Figure 62).
5. Install the new oil filters first by hand until they make contact with the filter head surface. Tighten another 3/4 turn using a filter wrench.

6. Fill the engine crankcase with high-quality detergent oil classified "For Service CI-4." Fill to the upper limit of the dipstick. **DO NOT** overfill. Refer to Table 2 for engine oil capacity.
7. Run the engine for several minutes. Watch for oil leakage. Shut the engine down and allow it to sit for several minutes. Top off the oil to the upper limit on the dipstick.

DRAINING THE ENGINE COOLANT

WARNING

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

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

1. Remove the **radiator pressure cap** (Figure 63) and both **expansion tank caps** only if the coolant temperature is below 120°F (50°C).

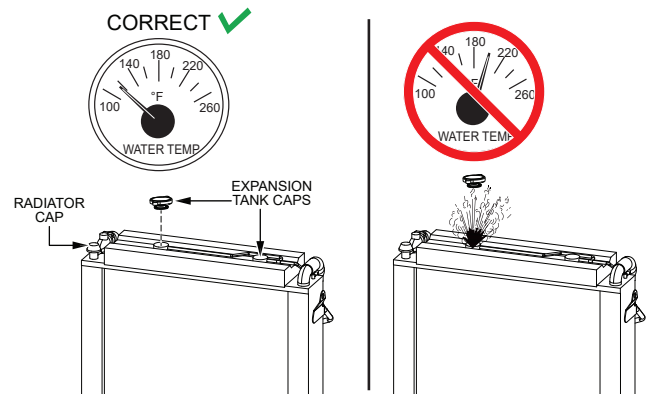


Figure 63. Radiator And Expansion Tank Caps

2. Open the cabinet door and remove the **coolant drain bolt** and **O-ring** (Figure 64), then allow the coolant to drain into a suitable container.

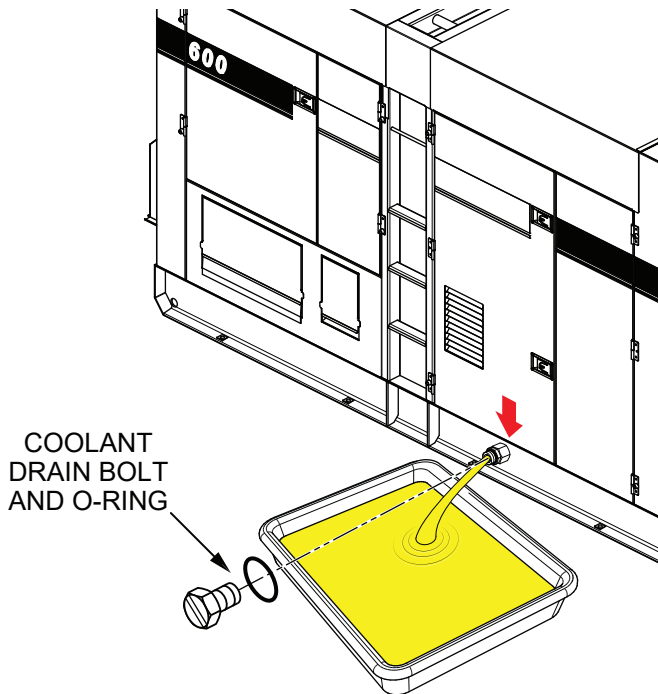


Figure 64. Draining The Engine Coolant

FLUSHING OUT THE RADIATOR AND REPLACING COOLANT



WARNING



Allow the engine to **cool** before flushing out the radiator. Flushing the radiator while it is hot can cause serious burns from hot water or steam.

- Open both cocks located at the crankcase side and the lower part of the radiator, and drain the coolant. Open the radiator cap while draining. Remove the overflow tank and drain.
- Check hoses for softening and kinks. Check clamps for signs of leakage.
- Tighten both cocks and replace the overflow tank.
- Replace with coolant recommended by the engine manufacturer.
- Close the radiator cap tightly.
- Flush the radiator by running clean tap water through the radiator until signs of rust and dirt are removed. **DO NOT** clean the radiator core with any objects such as a screwdriver.

Cleaning The Radiator

The radiator should be cleaned with water and a mild detergent when excessive amounts of dirt and debris have accumulated on the cooling fins or tubes. Use a soft brush. Be careful to not damage the radiator fins.

NOTICE

DO NOT use a high-pressure power washer (Figure 65) to clean the radiator.

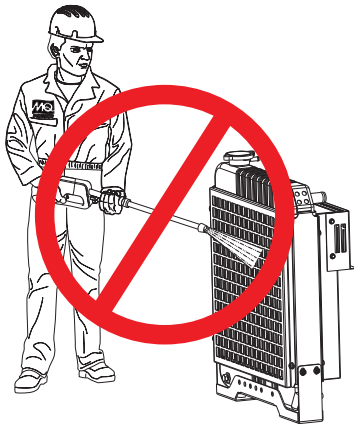


Figure 65. No High-Pressure Power Washing

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 Volvo engine owner's manual.

Drive Belt Inspection

Inspect the **drive belt** (Figure 66) for damage or wear. Horizontal cracks (across the belt) are acceptable. Vertical (direction of belt ribs) cracks that intersect with horizontal cracks are not acceptable.

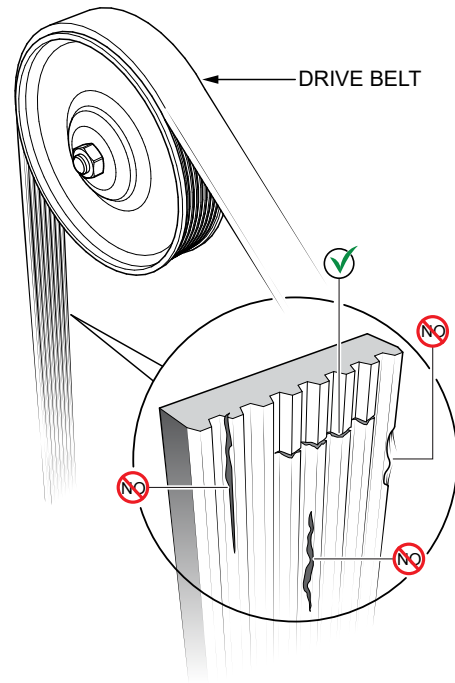


Figure 66. Drive Belt Inspection

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 possibility of it breaking.

Replace the drive belt immediately if it exhibits any of the above wear conditions.

TESTING THE GFCI RECEPTACLE

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 67) in the **ON** position.

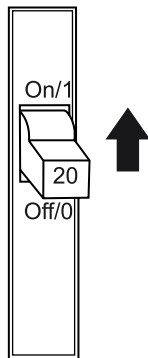


Figure 67. GFCI Circuit Breaker

3. Verify that the **status LED** on the corresponding **GFCI receptacle** (Figure 68) is **ON (GREEN)**.

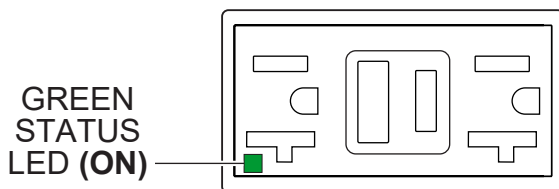


Figure 68. GFCI Receptacle (ON)

4. Press the **TEST** button (Figure 69) on the GFCI receptacle and verify that the status LED turns **OFF**.

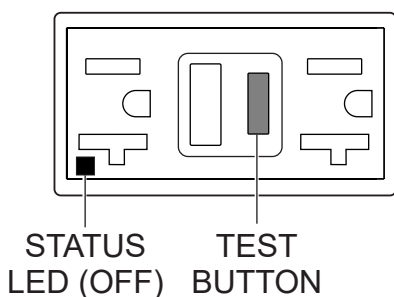


Figure 69. GFCI Receptacle (OFF)

5. Press the **RESET** button (Figure 70) to restore power to the GFCI receptacle and verify that the status LED is **ON (GREEN)**.

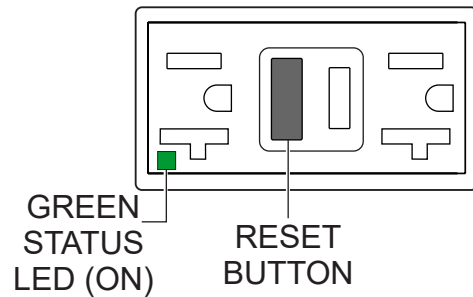


Figure 70. GFCI Receptacle (ON/Restore)

6. If the status LED (Figure 71) is **flashing (RED)**, **DO NOT** use the GFCI receptacle and replace it immediately.

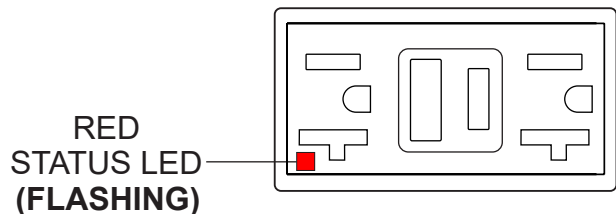


Figure 71. GFCI Receptacle (Red Flashing LED)

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

GENERATOR STORAGE

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

- Drain the fuel tank completely. Treat with a fuel stabilizer if necessary.
- Completely drain the oil from the crankcase and refill if necessary with fresh oil.
- Clean the entire generator, internal and external.
- Disconnect the battery.
- Make sure engine coolant is at the proper level.
- Cover the generator and store it in a clean, dry place.
- 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 ENGINE BLOCK HEATER AND INTERNAL BATTERY CHARGER 120 VAC INPUT RECEPTACLES

This generator can be equipped with an **engine block heater** and an **internal battery charger** as **options**. These components are provided with electrical power cords to connect to a commercial power source.

The engine block heater and internal battery charger (Figure 72) both require 120 VAC in order to operate. Two power receptacles are provided on the output terminal panel to allow commercial power to be applied.

These units will **only** function when commercial power has been supplied to them. When using extension cords, refer to Table 8 for the correct size and length.

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

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

NOTICE

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

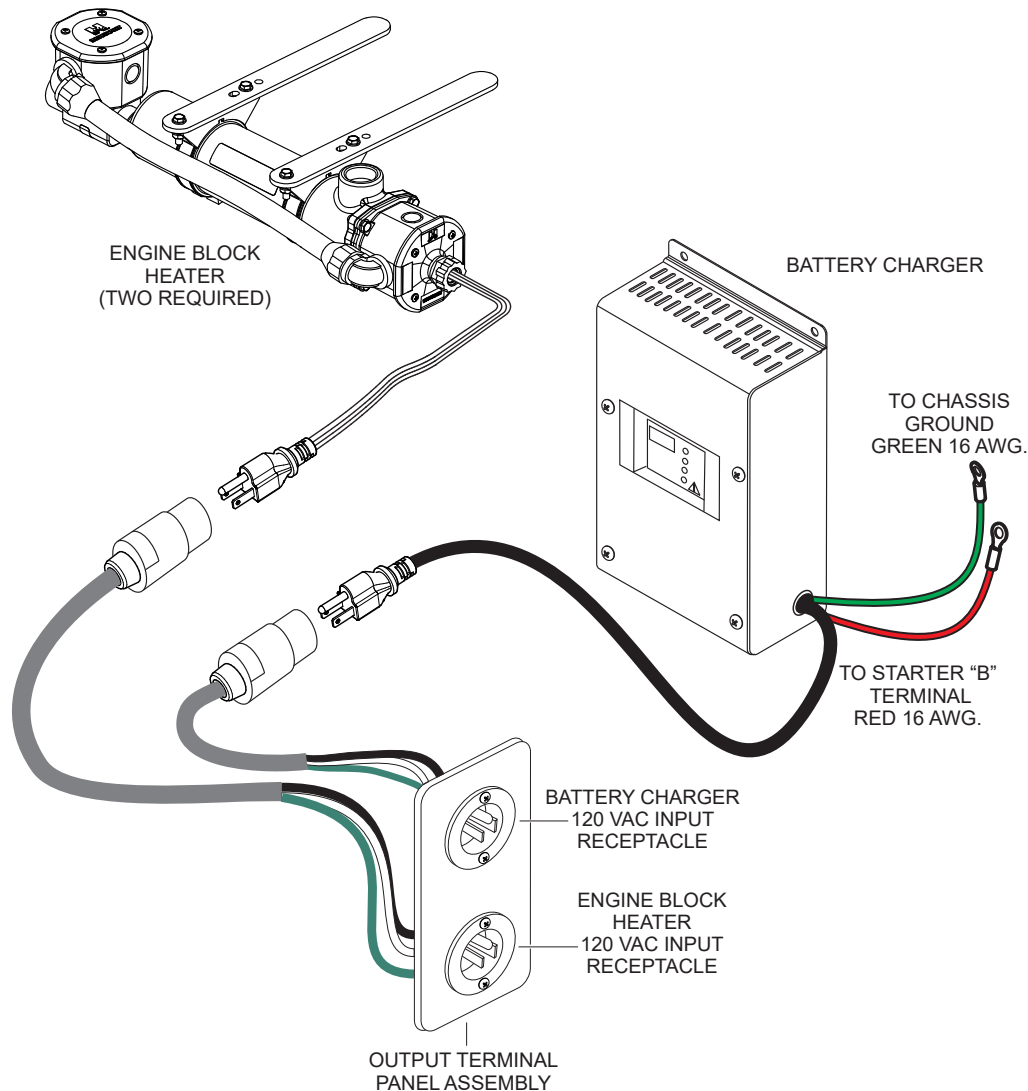


Figure 72. Battery Charger And Engine Block Heater (Options)

EMISSION CONTROL

The emission control system employed with this diesel engine consists of a **diesel oxidation catalyst (DOC)** and a **selective catalytic reduction (SCR)** catalyst as an exhaust gas after-treatment system that helps reduce harmful gases and destroy the organic fraction of particulate matter produced from the exhaust gas to meet the requirement for EPA Tier 4 (Final) regulations.

The DOC device (Figure 73) helps filter out large amounts of harmful nitrogen oxides (NO_x) and particulate matter (PM) which are emitted by diesel engines. These exhaust emissions pose serious environmental and health risks. It is important to maintain and service the DOC emission safety device on a periodic basis.

Diesel Oxidation Catalyst (DOC)

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

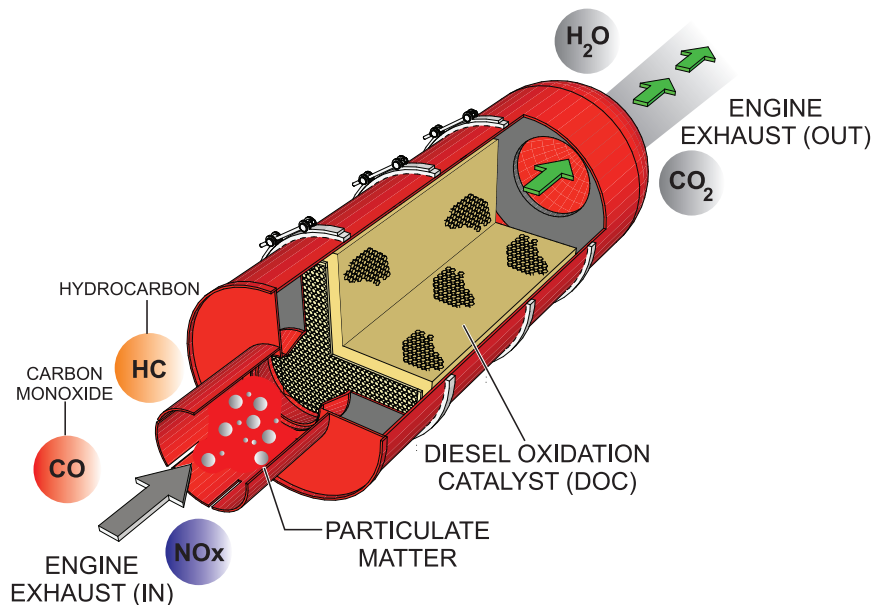


Figure 73. Diesel Oxidation Catalyst (DOC)

PREVENTIVE MAINTENANCE PROGRAMS

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

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

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

SELECTIVE CATALYTIC REDUCTION (SCR)

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

DIESEL EXHAUST FLUID (DEF)

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

The engine control unit calculates the optimum amount of solution to be added in relation to engine load and engine speed, to achieve efficient reduction of nitrogen oxides.

The red Alarm lamp will turn on or begin flashing and the **Diesel Exhaust Fluid (DEF) indicator** (Figure 74) will be displayed next to a diagnostic message on the digital controller during either of the following operating conditions:

- DEF tank level is below 20%. Refer to Table 15, DEF Level System Action.
- DEF quality is poor. Check the DEF tank level and check active **diagnostic trouble codes (DTC)**.

The amount of fluid in the DEF tank will be displayed on the digital controller during operation (Figure 75).

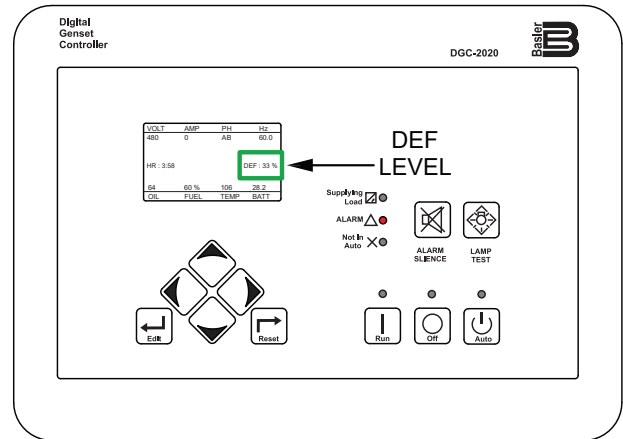


Figure 75. DEF Level Gauge

NOTICE

When the DEF level falls to 10%, the engine will shut down, but will still be able to restart. When the DEF level falls to 5%, the engine will shut down, and will not be able to restart until the DEF has been replenished.

NOTICE

The unit will enter emergency shutdown 30 minutes after the DEF level has reached 10% or when other emergency protective measures are necessary. When this condition exists, the unit can only run at low idle.

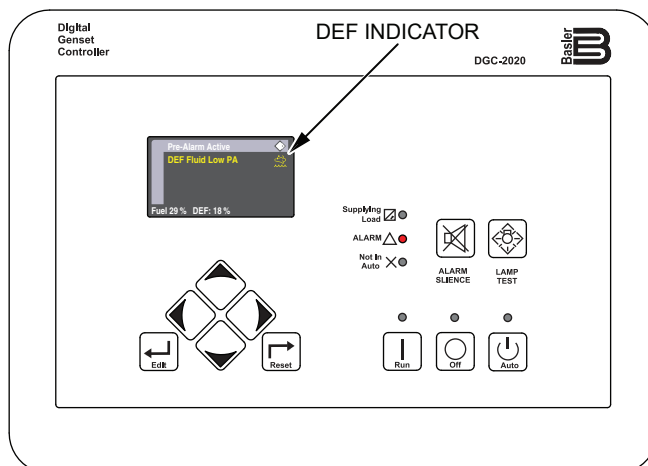















Figure 74. Digital Controller (DEF Indicator)








Table 15. DEF Level System Action

DEF Level	Below 20%	Below 15%	Below 10%	30 Minutes After Below 10%	Below 5%
Pre-Alarm Screen Message	DEF Fluid Low	DEF Fluid Low DEF Low 15%	DEF PRESVR INDUCMT	DEF SEVERE INDUCMT	DEF PRESVR INDUCMT
Alarm Screen Message	—	—	DEF Low 10%	DEF Low 10%	DEF Low 5%
DEF Indicator	 ON	 ON	 ON	 ON	 ON
Alarm Lamp	 Flashing	 Flashing	 Flashing	 ON	 ON
Engine Shutdown	—	—	 ON (Restart available)	 ON (Low idle only)	 ON (Restart unavailable)

INDUCEMENT

When the system senses improper usage such as no supply of DEF, use of poor quality DEF, problems with DEF dosing, or disconnection of sensors, a warning will be issued before the situation becomes critical. If the warnings are ignored and the unit enters intermittent operation, the emergency shutdown will activate. The three warning levels are shown in Table 16:

Table 16. DEF Inducement

Stage	Controller Message	Controller Message	Malfunction Indicator	Alarm Lamp	Shutdown Lamp
Stage 1 Warning Level 1	INCORRECT REAGENT QUALITY	DEF QUALITY POOR		 Flashing	—
	ABSENCE OF REAGENT DOSING	DEF CONSUMPTN ERR			
	TAMPERING	DEF TAMPERING			
Stage 2 Warning Level 2	INCORRECT REAGENT QUALITY	DEF QUALITY POOR		 Flashing	—
	ABSENCE OF REAGENT DOSING	DEF CONSUMPTN ERR			
	TAMPERING	DEF TAMPERING			
Stage 3 Shutdown ¹	INCORRECT REAGENT QUALITY	DEF QUALITY POOR		 ON	 ON
	ABSENCE OF REAGENT DOSING	DEF CONSUMPTN ERR			
	TAMPERING	DEF TAMPERING			

¹When emergency shutdown occurs, inspection and repair should be performed promptly before the engine is restarted.

TROUBLESHOOTING (DIAGNOSTICS)

DIAGNOSTIC MODE

The digital controller can be placed in **Diagnostic mode**, which will keep the key switch on for service tool purposes. To place the unit in Diagnostic mode the engine must be turned **OFF**.

1. Press and hold the **Alarm Silence button** and the **Lamp Test button** (Figure 76) simultaneously for 5 seconds.

NOTICE

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

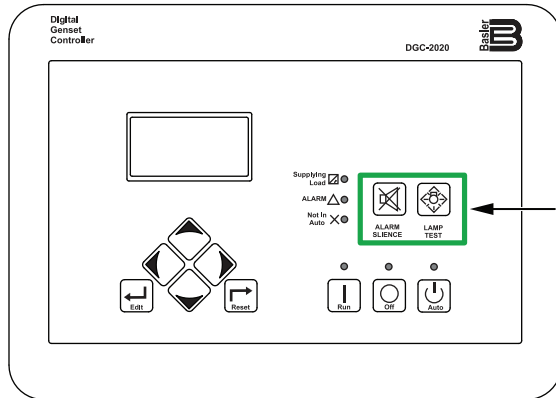


Figure 76. Digital Controller (Alarm Silence And Lamp Test Buttons)

2. Use the **Arrow buttons** (Figure 77) to navigate to the **Alarms Status menu** (METERING->ALARM-STATUS). This will allow the operator to perform the following diagnostics:

- **J1939 Active DTC** — Displays active fault messages and codes.
- **J1939 Previous DTC** — Displays messages and codes which previously occurred that are recorded in the engine control module (ECM).

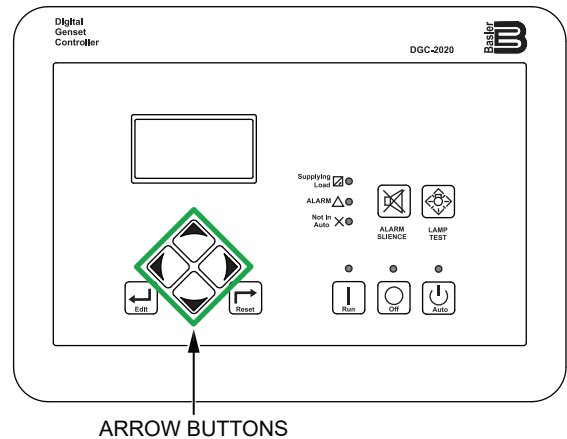


Figure 77. Digital Controller (Arrow Buttons)

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

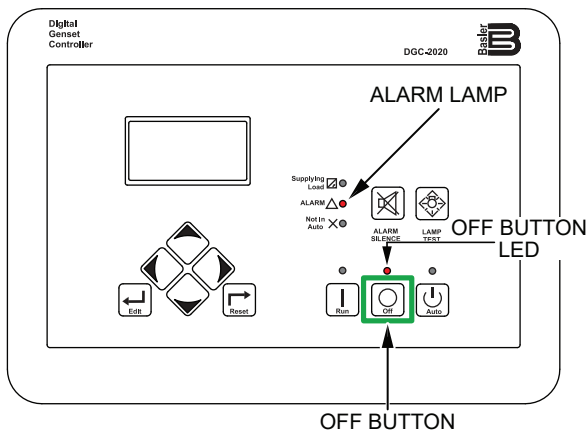
TROUBLESHOOTING (DIAGNOSTICS)

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.

When a fault is detected or an automatic shutdown has occurred, the **Alarm lamp** (Figure 78) on the digital controller will illuminate and/or begin flashing (**red**), and an alarm message will appear on the controller display. When this occurs, confirm the alarm message(s) on the display and press the **Off button** on the digital controller. Allow a sufficient cooling period, then inspect the unit and repair the problem before restarting operation.



**Figure 78. Digital Controller
(Alarm And Off Button LEDs)**

Refer to Table 17 for a complete list of engine protection devices and fault codes. If necessary, contact your nearest MQ Power dealer for additional technical support.

When the unit is ready to restart, press the Off button on the digital controller. The **Off button LED** (Figure 78) will turn **ON (red)**.

Make sure all fault messages have been cleared from the digital controller display, then restart the generator as shown in the **Generator Start-Up Procedure (Manual)** section.

NOTICE

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

TROUBLESHOOTING (DIAGNOSTICS)

Table 17. Automatic Engine Shutdown System

Operating Parameter	Circuit Breaker OFF	Engine Shutdown	Digital Controller Display Message	Operating Condition/ Set Point
Under Voltage	—	—	27-1 UndVolt TRP (Pre-Alarm)	When under voltage occurs
Under Voltage	●	●	27-2 UndVolt TRP (Alarm)	When under voltage occurs
Over Voltage	—	—	59-1 OvrVolt TRP (Pre-Alarm)	When over voltage occurs
Over Voltage	●	●	59-2 OvrVolt TRP (Alarm)	When over voltage occurs
Under Frequency	●	●	81U UndFreq (Alarm)	Set point: 54 Hz
Over Frequency	●	●	81O OvrFreq (Alarm)	Set point: 66 Hz
Over Current	●	●	Over Current (Alarm)	When overcurrent occurs
High Battery Voltage	—	—	Hi Batt Volt (Pre-Alarm)	Set point: 30 V
Low Battery Voltage	—	—	Low Batt Volt (Pre-Alarm)	Set point: 22 V
Weak Battery Voltage	—	—	Weak Battery Volt (Pre-Alarm)	Set point: 17 V
Low Fuel Level	—	—	Fuel Level U1 (Pre-Alarm)	Set point: 20%
Low Fuel Level	●	●	LOW FUEL LEVEL (Alarm)	Set point: 5%
Low Oil Pressure	—	—	LOW OIL PRES (Pre-Alarm)	Set point: 42.8 psi (295 kPa)
Low Oil Pressure	●	●	LOW OIL PRES (Alarm)	Set point: 39.2 psi (270 kPa)
High Coolant Temperature	—	—	HI COOLANT TMP (Pre-Alarm)	Set point: 217°F (103°C)
High Coolant Temperature	●	●	HI COOLANT TMP (Alarm)	Set point: 230°F (110°C)
Over Speed	●	●	OverSpeed	Set point: 2,070 rpm

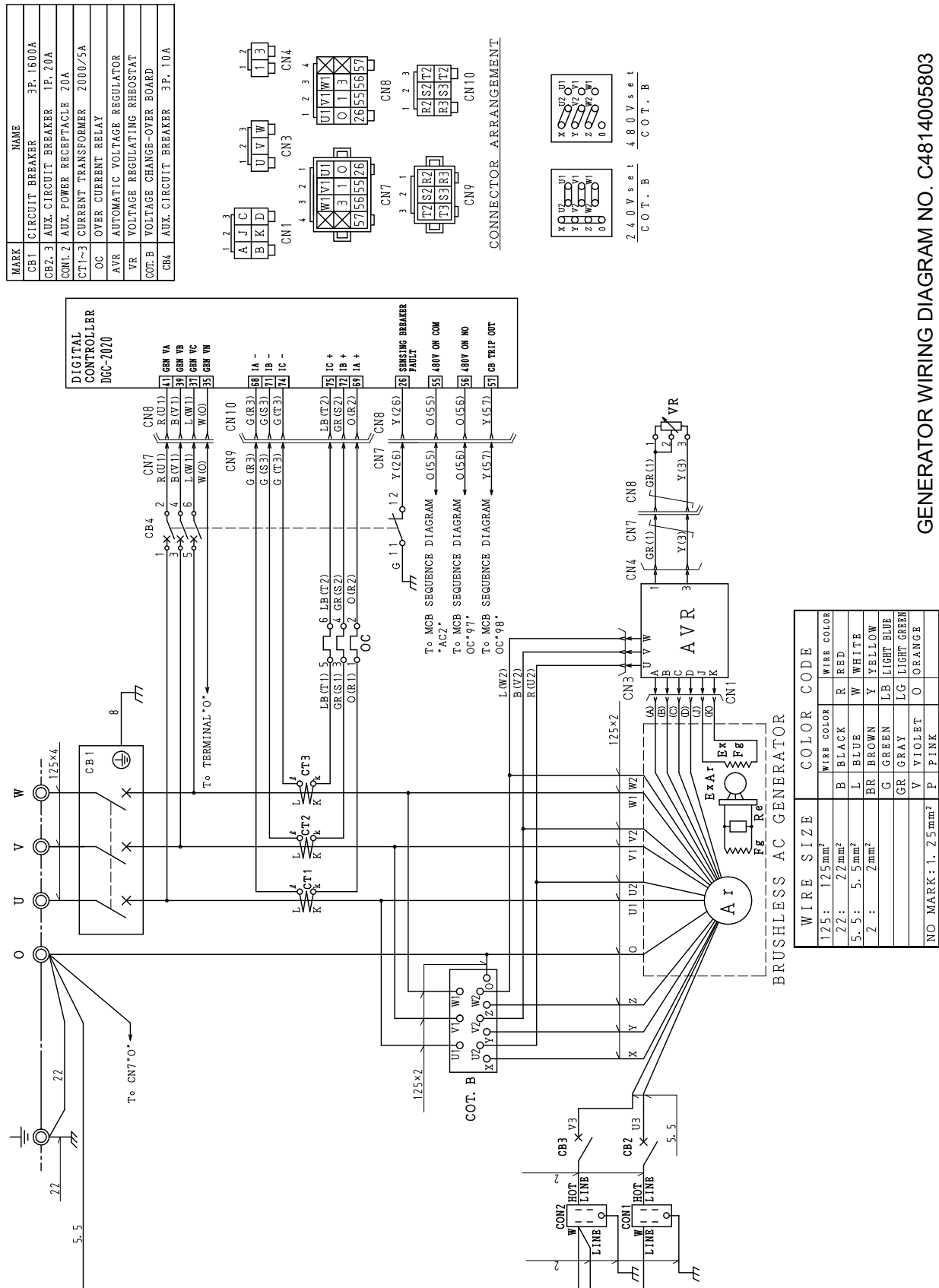
● = Activated

TROUBLESHOOTING (GENERATOR)

Practically all breakdowns can be prevented by proper handling and maintenance inspections, but in the event of a breakdown, use Table 18 shown below for diagnosis of the generator. If the problem cannot be remedied, consult our company's business office or service plant.

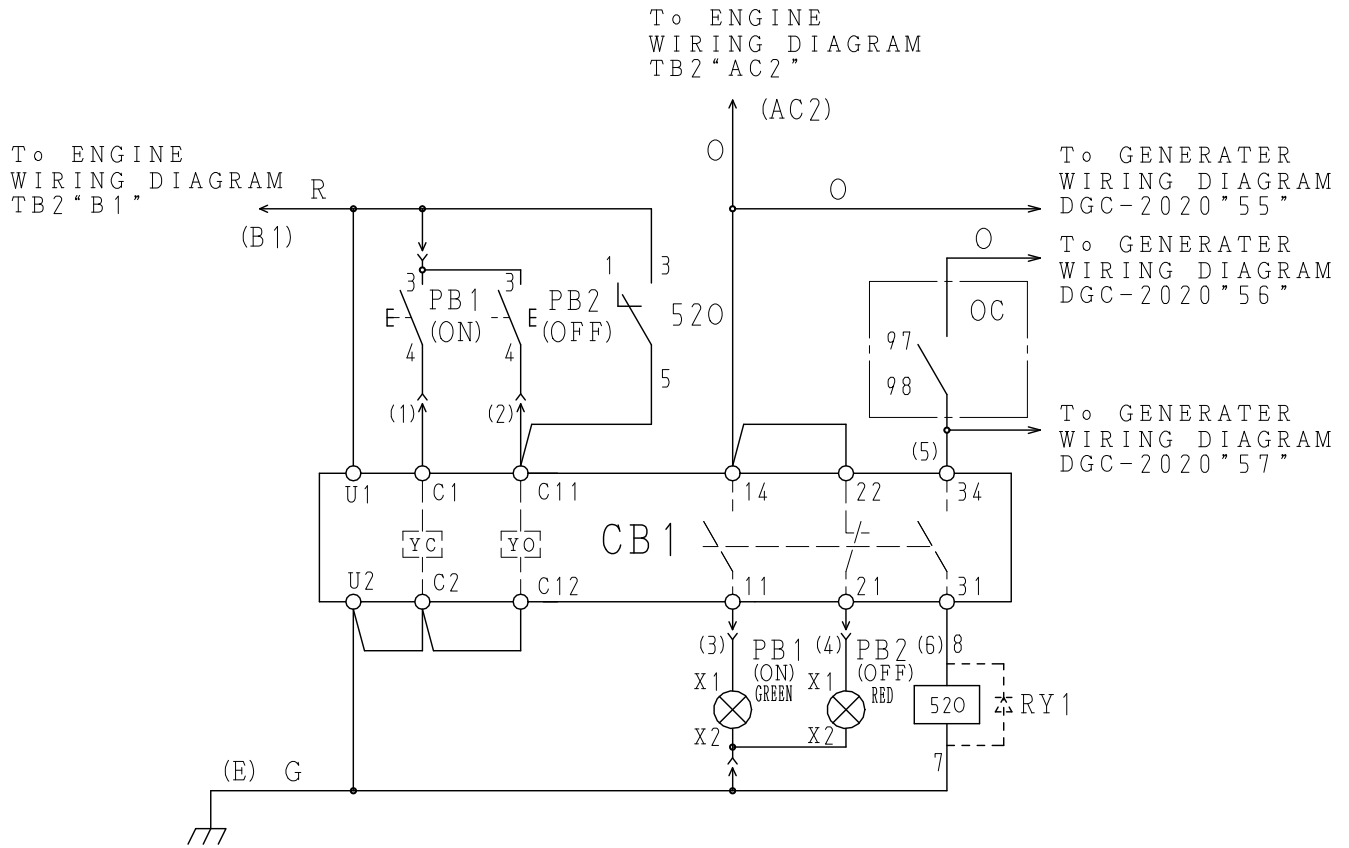
Table 18. Generator Troubleshooting		
Symptom	Possible Problem	Solution
No Voltage Output	Loose wiring connection?	Check wiring and repair.
	Defective AVR?	Replace if necessary.
	Defective rotating rectifier?	Check and replace.
Low Voltage Output	Low engine speed?	Check and adjust.
	Loose wiring connection?	Check wiring and repair.
	Defective AVR?	Replace if necessary.
High Voltage Output	Loose wiring connection?	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 (C4814005803)



GENERATOR WIRING DIAGRAM NO. C4814005803

MCB SEQUENCE DIAGRAM (C4814211504)



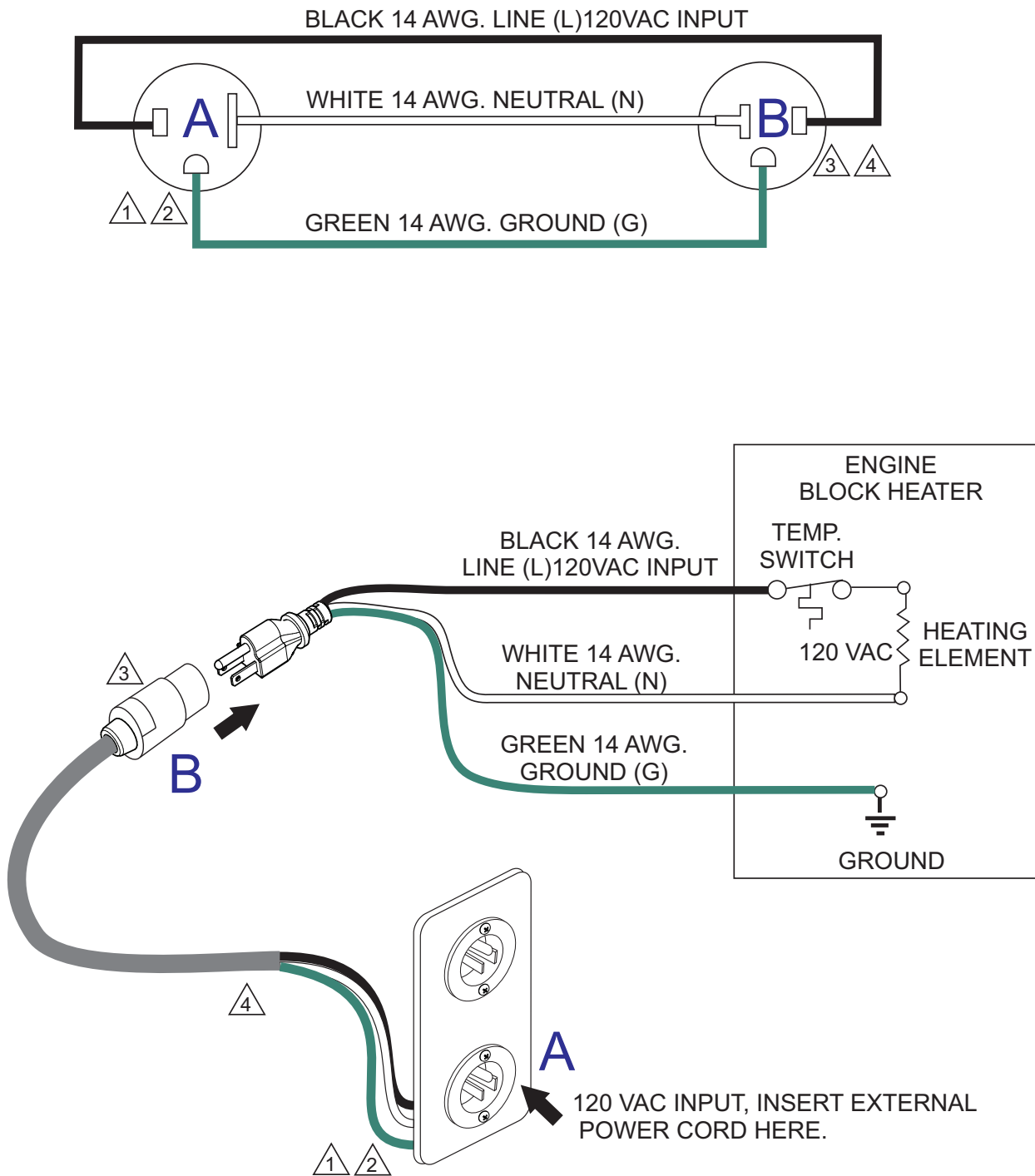
CONNECTOR ARRANGEMENT
(WIRING VIEW)

WIRE SIZE : 1.25mm²

COLOR CODE			
	WIRE COLOR		WIRE COLOR
B	BLACK	R	RED
L	BLUE	W	WHITE
BR	BROWN	Y	YELLOW
G	GREEN	LB	LIGHT BLUE
GR	GRAY	LG	LIGHT GREEN
V	VIOLET	O	ORANGE
P	PINK		

MCB SEQUENCE DIAGRAM NO. C4814211504

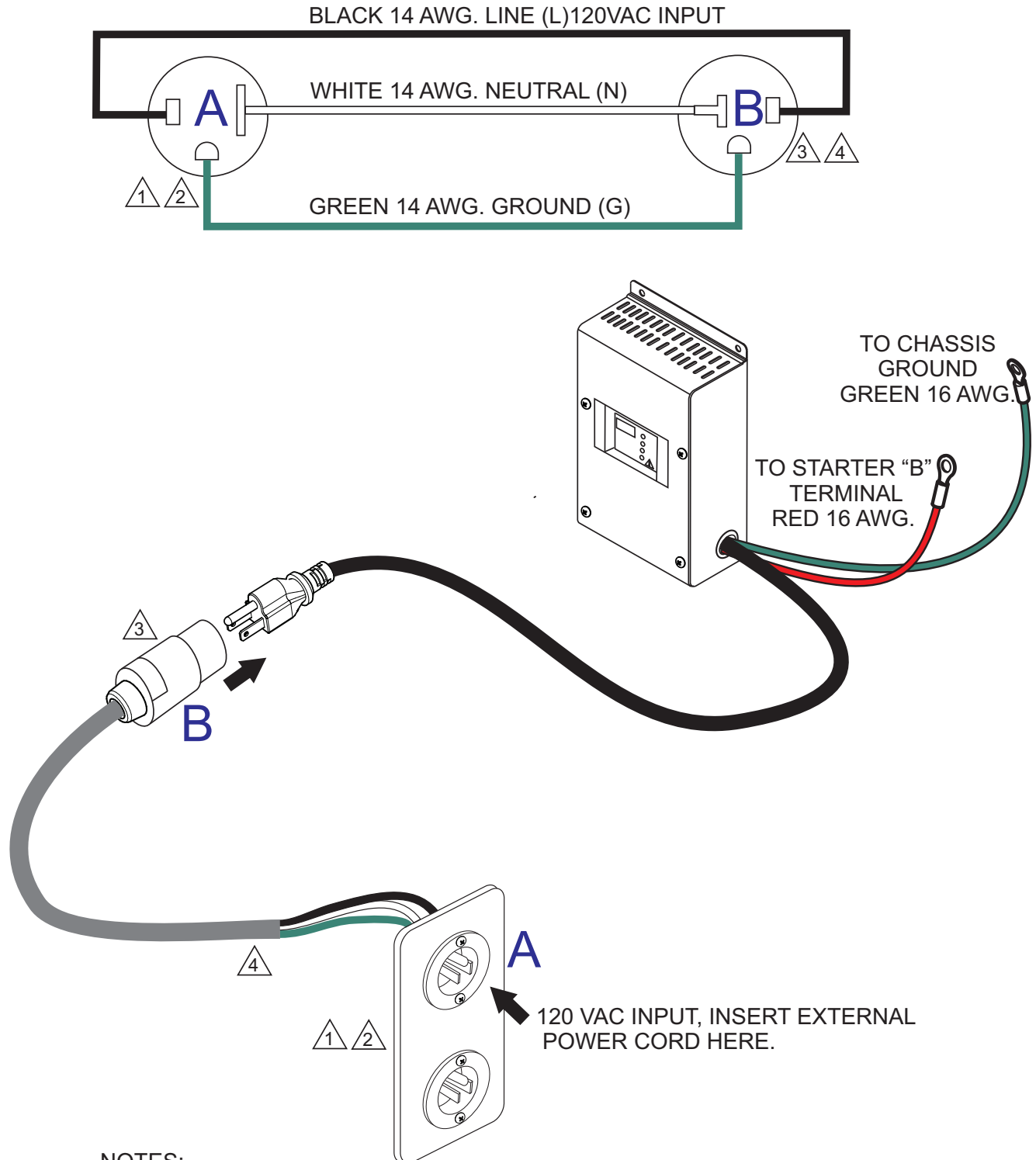
ENGINE BLOCK HEATER WIRING DIAGRAM (OPTION)



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.

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

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