OPERATION MANUAL

WHISPERWATT™ SERIES
MODEL
DCA400SSI4F
DCA400SSI4F3
60 Hz GENERATOR
(ISUZU BQ-6WG1X DIESEL ENGINE)

INSTRUCTION MANUAL NO. C3844302104 (DCA400SSI4F)
INSTRUCTION MANUAL NO. C3844303234 (DCA400SSI4F3)

Revision #6 (04/01/25)

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

THIS MANUAL MUST ACCOMPANY THE EQUIPMENT AT ALL TIMES.


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

DCA400SSI4F
DCA400SSI4F3
60 Hz Generator

NOTICE

Specifications are subject to change without notice.

SAFETY DECALS

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

NOTICE

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

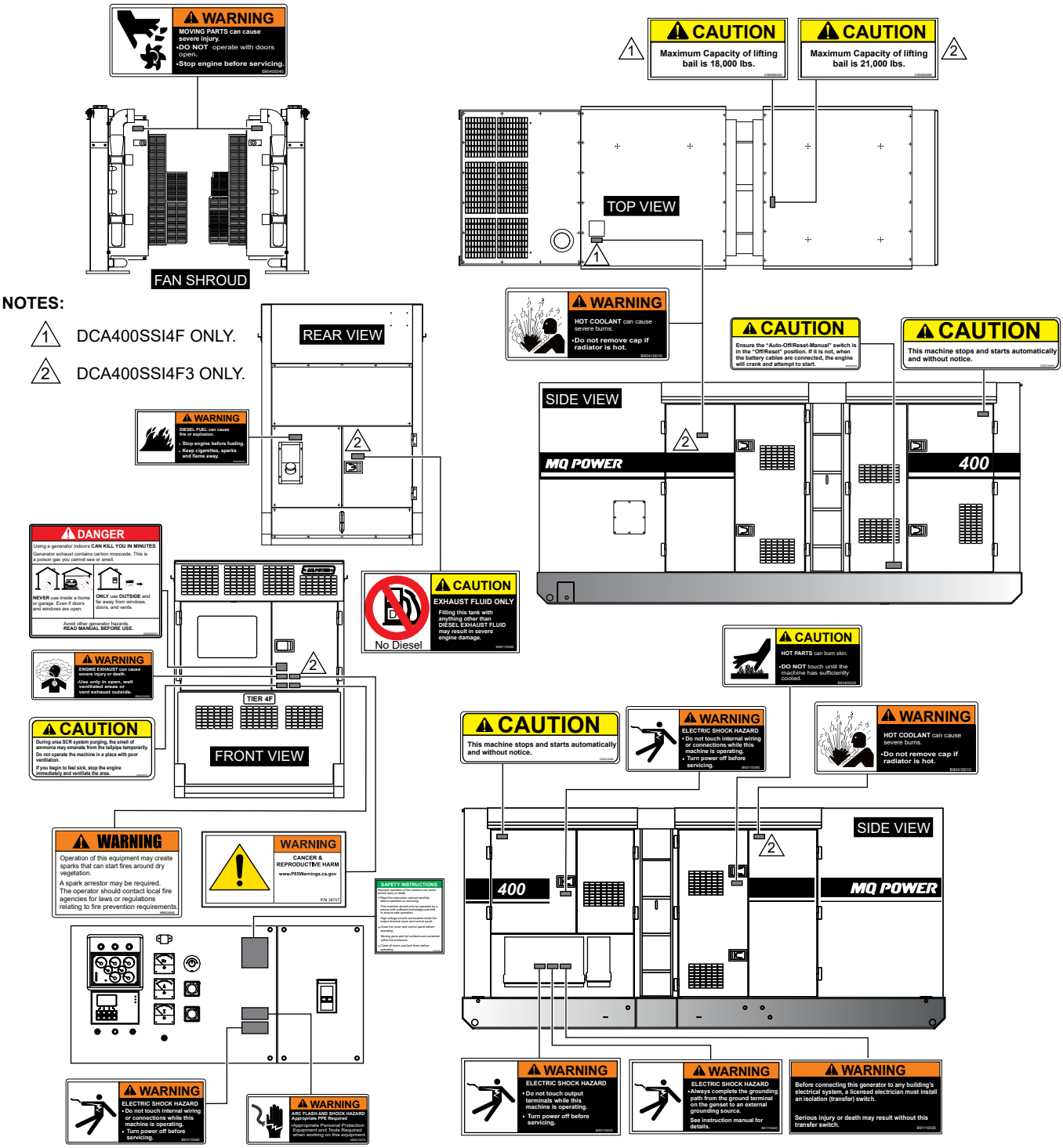


Figure 1. Safety Decals

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

SAFETY MESSAGES

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

SAFETY SYMBOLS

DANGER

Indicates a hazardous situation which, if not avoided, **WILL** result in **DEATH** or **SERIOUS INJURY**.

WARNING

Indicates a hazardous situation which, if not avoided, **COULD** result in **DEATH** or **SERIOUS INJURY**.

CAUTION

Indicates a hazardous situation which, if not avoided, **COULD** result in **MINOR** or **MODERATE INJURY**.

NOTICE

Addresses practices not related to personal injury.

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

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

GENERAL SAFETY

⚠ CAUTION

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

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

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

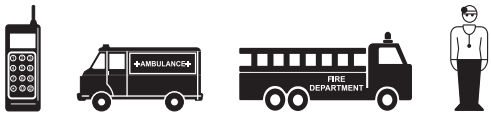
- **ALWAYS** check the generator for loosened threads or bolts before starting.
- **NEVER** use the generator for any purpose other than its intended purposes or applications.

NOTICE

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

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

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



GENERATOR SAFETY

⚠ DANGER

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

⚠ WARNING

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

⚠ CAUTION

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

NOTICE

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

ENGINE SAFETY

⚠ DANGER

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

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

⚠ WARNING

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

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

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

⚠ CAUTION

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

NOTICE

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

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

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

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

FUEL SAFETY

⚠ DANGER

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

TOWING SAFETY

⚠ CAUTION

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

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

ELECTRICAL SAFETY

⚠ DANGER

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

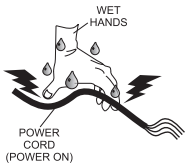
- **NEVER** insert any objects into the output receptacles during operation. This is extremely dangerous. The possibility exists of **electrical shock, electrocution or death**.

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

Power Cord/Cable Safety

⚠ DANGER

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



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

NOTICE

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

Grounding Safety

⚠ DANGER

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

BATTERY SAFETY

⚠ DANGER

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

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

⚠ WARNING

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

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

⚠ CAUTION

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

ENVIRONMENTAL SAFETY/DECOMMISSIONING

NOTICE

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

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

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

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

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

EMISSIONS INFORMATION

NOTICE

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

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

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

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

Emission Control Label

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

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

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

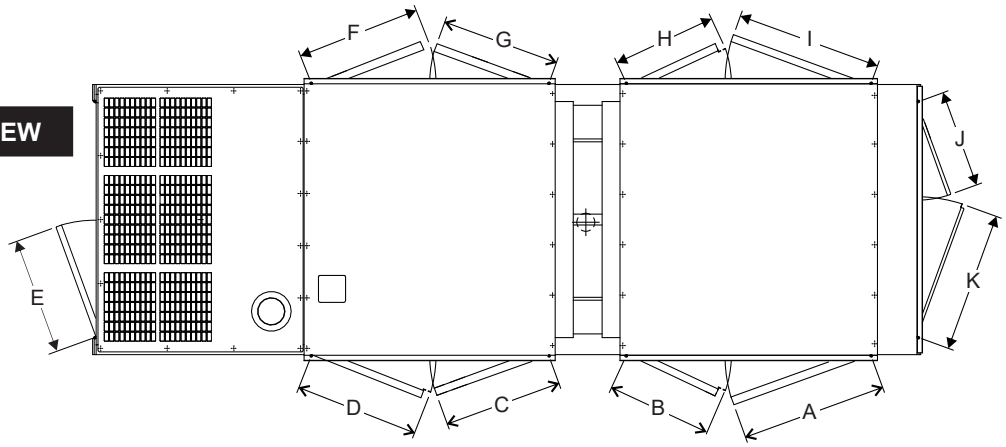
Table 1. Generator Specifications		
Models	DCA400SSI4F	DCA400SSI4F3
Type	Revolving field, self-ventilated, open protected type synchronous generator	
Armature Connection	**Star with Neutral**	
Phase	3	
Standby Output	352 kW (440 kVA)	336 kW (420 kVA)
Prime Output	320 kW (400 kVA)	
3Ø Voltage	208, 220, 240, 416, 440, 480V Reconnectable	
1Ø Voltage	120, 127, 139, 240, 254, 277V Adjustable	
Voltage Change-Over Board Tie Bolt Torque	554.9 lbf·in (62.7 N·m)	
Power Factor	0.8	
Frequency	60 Hz	
Speed	1,800 rpm	
Aux. AC Power	Single phase, 60 Hz	
Pitch	4/5	2/3
Subtransient	0.103	0.087
Transient	0.258	0.227
Synchronous	1.929	1.733
Zero Sequence Reactance	0.05	0.0087
Overload Protection	OCR / main circuit breaker	
Aux. Voltage/Output	120V / 4.8 kW (2.4 kW × 2)	
Dry Weight	12,280 lb. (5,570 kg)	
Wet Weight	13,184 lb. (5,980 kg)	

Table 2. Engine Specifications		
Model	Isuzu BQ-6WG1X Tier 4 Final Certified	
Type	4-cycle, water-cooled, direct injection, turbo-charged, charged air-cooled, EGR, DOC, and SCR	
No. of Cylinders	6	
Bore × Stroke	5.79 in. × 6.06 in. (147 mm × 154 mm)	
Displacement	957 cu. in. (15.68 liters)	
Rated Output	512.3 hp (382 kW)	
Starting	Electric	
Coolant Capacity	19.4 gal. (73.6 liters)[1]	
Lube Oil Capacity	15.1 gal. (57 liters)[2]	
Lubricating Type Oil	API service class CJ-4	
DEF Tank Capacity	14.5 gal. (55 liters)	
Fuel Tank Capacity	55.5 gal. (210 liters)	
Fuel Type	ASTM-D975, No.1 & No. 2 diesel fuel (ultra-low sulfur diesel fuel only)	
Fuel Consumption	27.63 gal. (104.58 L)/hr. at **full load**	20.35 gal. (77.04 L)/hr. at **3/4 load**
	13.4 gal. (50.76 L)/hr. at **1/2 load**	8.35 gal. (31.62 L)/hr. at **1/4 load**
Battery	12V 200Ah × 2 (24 VDC system)	

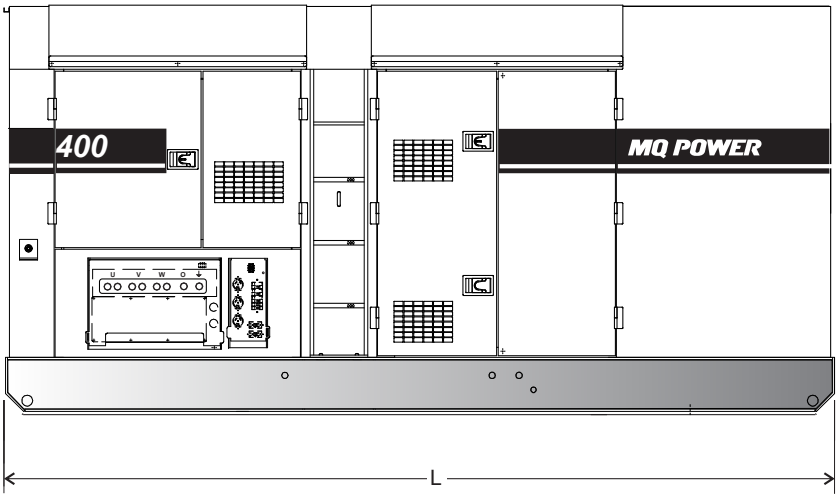
[1] Includes engine and radiator hoses

[2] Includes filters

TOP VIEW



SIDE VIEW



FRONT VIEW

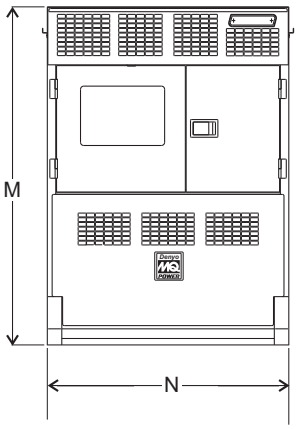


Figure 2. Dimensions

Table 3. Dimensions

Reference Letter	Dimension in. (mm)	Reference Letter	Dimension in. (mm)
A	31.89 (810)	H	22.83 (580)
B	22.83 (580)	I	31.89 (810)
C	26.00 (660)	J	21.46 (545)
D	27.16 (690)	K	30.71 (780)
E	25.59 (650)	L	181.10 (4,600)
F	27.16 (690)	M	88.58 (2,250)
G	26.00 (660)	N	59.06 (1,500)

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.

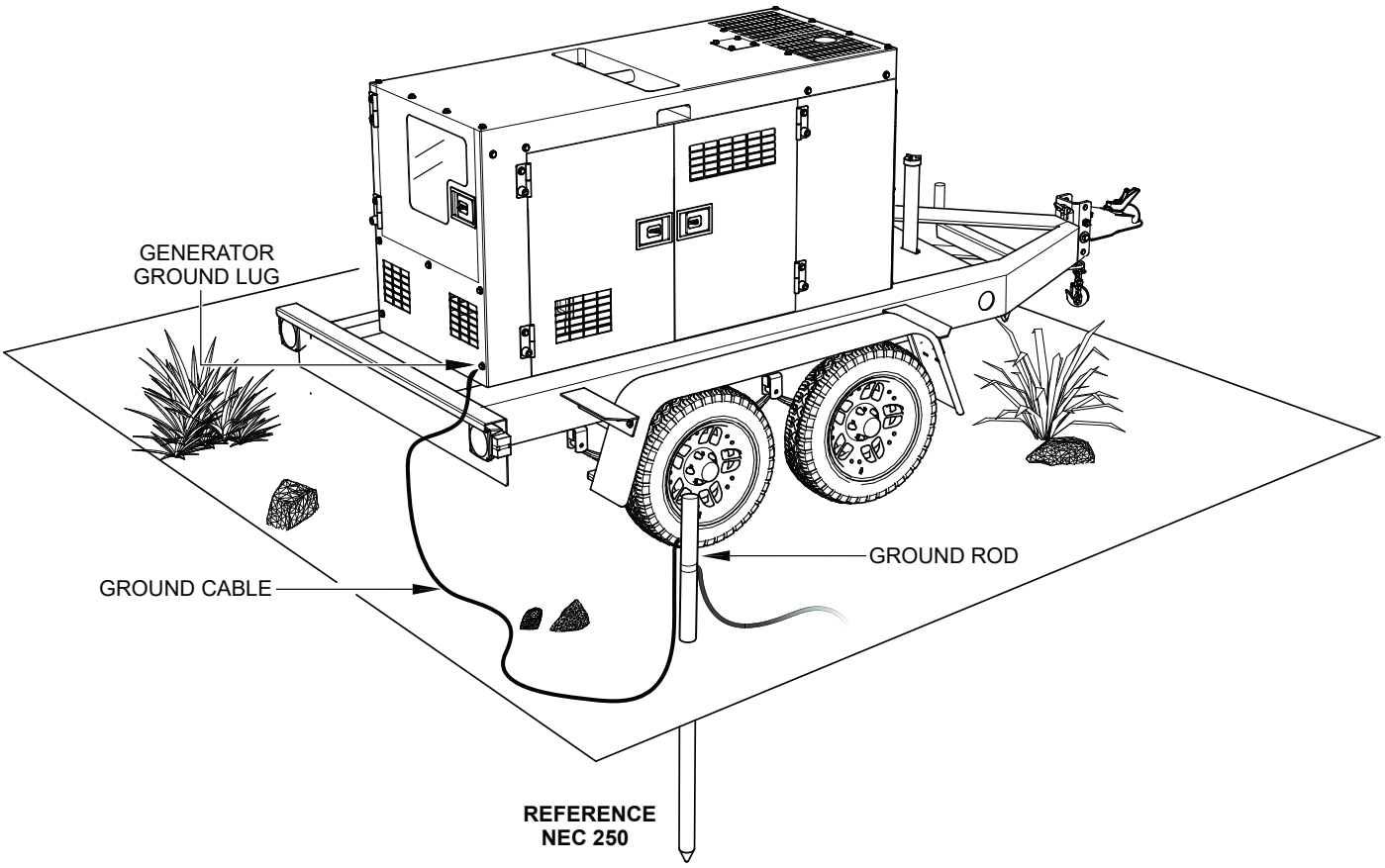


Figure 3. Typical Generator Grounding Application

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.

OPERATING PANEL

The "Operating Panel" is provided with the following:

- ECU Controller with Gauge Unit Assembly
  - Oil Pressure Gauge
  - Water Temperature Gauge
  - Charging Voltmeter
  - Fuel Gauge
  - Tachometer
- Panel Light/Panel Light Switch
- Hour Check Button
- Auto Start/Stop Switch
- Emergency Stop Button
- Basler DGC-2020HD Digital Controller (Option)

CONTROL PANEL

The "Control Panel" is provided with the following:

- Frequency Meter (Hz)
- AC Ammeter (Amps)
- AC Voltmeter (Volts)
- Ammeter Change-Over Switch
- Voltmeter Change-Over Switch
- Voltage Regulator
- 3-Pole, 600-Amp Main Circuit Breaker
- "Control Box" (located behind Control Panel)
  - Automatic Voltage Regulator
  - Current Transformer
  - Over-Current Relay
  - Starter Relay
  - Voltage Change-Over Board

OUTPUT TERMINAL PANEL

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

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

OPEN-DELTA EXCITATION SYSTEM

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

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

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

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

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

ENGINE

This generator is powered by a 6-cylinder, 4-cycle, water-cooled, direct injection, turbocharged, air-cooled EGR, Isuzu BQ-6WG1X diesel engine. This engine is designed to meet every performance requirement for the generator. Reference 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 ± 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 7) as a guide for selecting the proper extension cable size.

NOTICE

When the paralleling option is employed, the Basler DGC-2020HD controller ***must*** be installed. The factory-installed ECU-845 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, inter-connect 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 be 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.

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 ten seconds.

To reset the maintenance interval using the reset button, the Maintenance Due pre-alarm must be active, and the Basler controller must display the “Overview Screen” (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 happens to be a very handy 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.

THREE PHASE 480V/208V PARALLEL WIRING VIA OPTIONAL CAMLOCKS

REQUIRED EQUIPMENT (USER SUPPLIED)

- Conductor Cables
- CAT5E Shielded Cable or Better
- Power Distribution Panel

The following procedure is intended to assist the user with the parallel wiring configuration for generators using the optional camlock 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 generator is turned off and 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.

3Ø-480 VAC 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).

3Ø-208 VAC 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 CAT5E ethernet cable (shielded) between port 1 on both generators as shown in Figure 4.

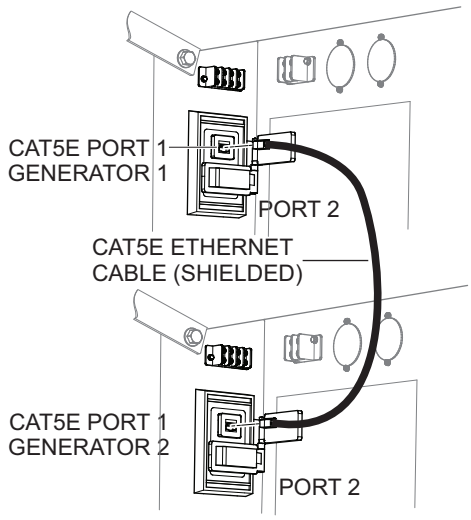


Figure 4. Ethernet Cable Connection

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 outlined in the start-up section of this manual.

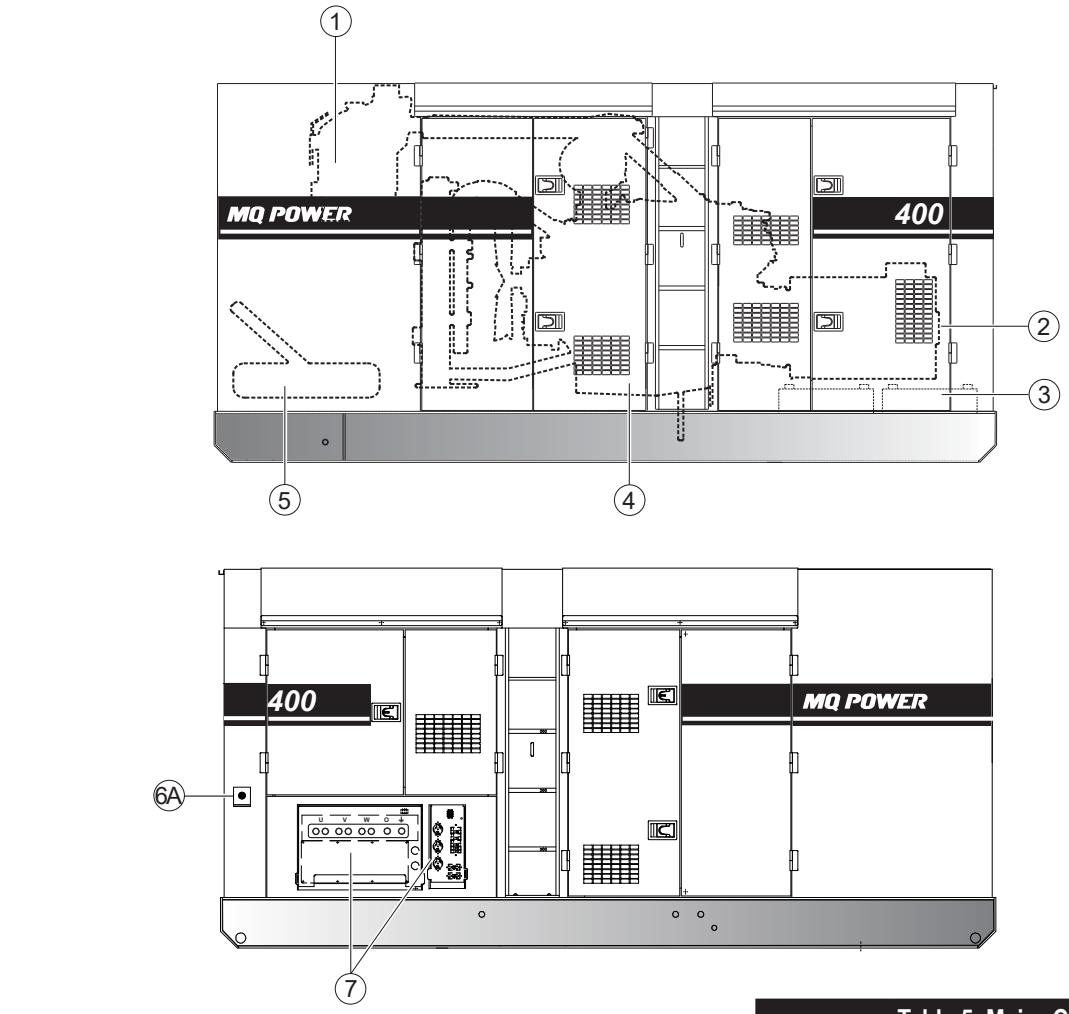


Table 5. Major Components	
Item No.	**Description**
1	Muffler Assembly
2	Generator Assembly
3	Battery Assembly
4	Engine Assembly
5	Fuel Tank Assembly
6A	Emergency Stop Switch (DCA400SSI4F3)
6B	Emergency Stop Switch (DCA400SSI4F)
7	Output Terminal Assembly
8	Circuit Breaker Assembly
9	Battery Switch
10	Engine-Generator Controller Assembly
11	Gauge Unit Assembly
12	Control Panel Assembly
13	Voltage Change-Over Board

Figure 5. Major Components

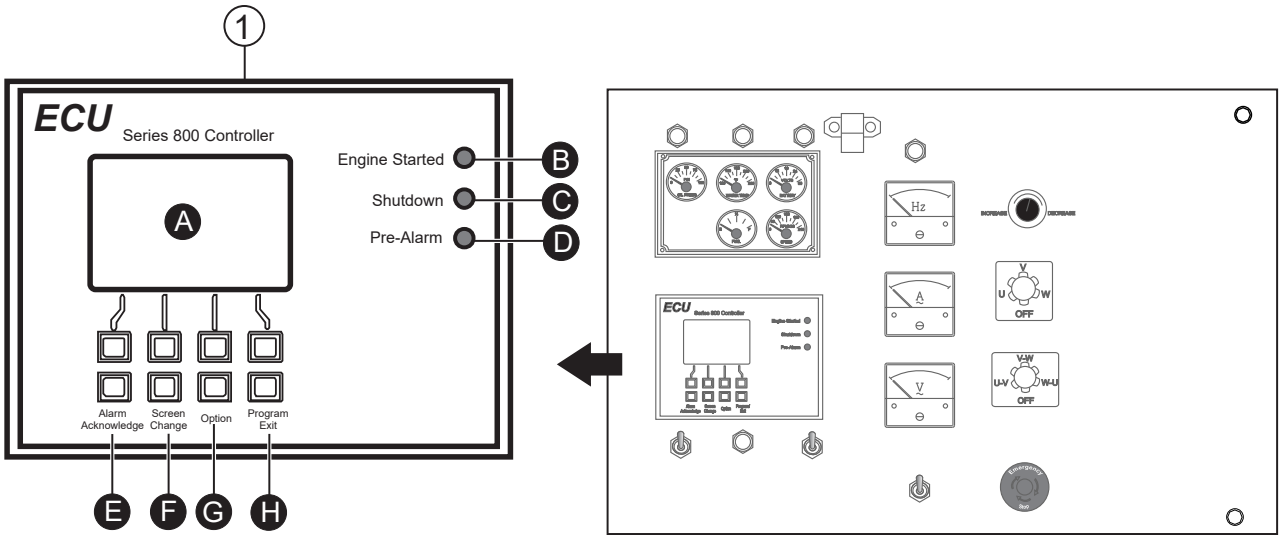


Figure 6. Engine Control Unit (ECU)

The definitions below describe the controls and functions of the Engine Control Unit (Figure 6).

1. **ECU 835/845 Controller** — This engine-generator controller displays the parameters and the diagnostic troubleshooting messages of the engine.

   A. **ECU Display Screen** — Engine fault diagnostic messages are shown on this LCD display screen.

   B. **Engine Started Lamp** — When lit, this lamp indicates the engine is operating normally.

   C. **Engine Shutdown Lamp** — When an engine failure has occured this lamp will blink, indicating the engine has been shut down. The diagnostic fault message will be displayed on the LCD screen.

   D. **Pre Alarm Lamp** — When an engine failure has occured this lamp will blink, indicating a pre-fault engine condition and the possibility of engine shutdown.The diagnostic fault message will be displayed on the LCD screen.

   E. **Alarm Acknowledge Button** — When the engine experiences a fault, the “Pre-Alarm Lamp” or the “Shutdown Lamp” will start blinking. Pushing this button will confirm the fault message and the blinking lamp will change to a solid lamp display. The fault message will be displayed on the screen. When multiple engine faults occur, the lamp will continue blinking until all fault messages are confirmed. The blinking lamp will change to a solid lamp display. All current confirmed fault messages will scroll across the screen.

   F. **Screen Change Button** — When this button is pushed during operation, the screen will cycle through each parameter screen.

   G. **Option Button** — This button is not active. Do not use.

   H. **Program/Exit Button** — Push this button to confirm diagnostic code.

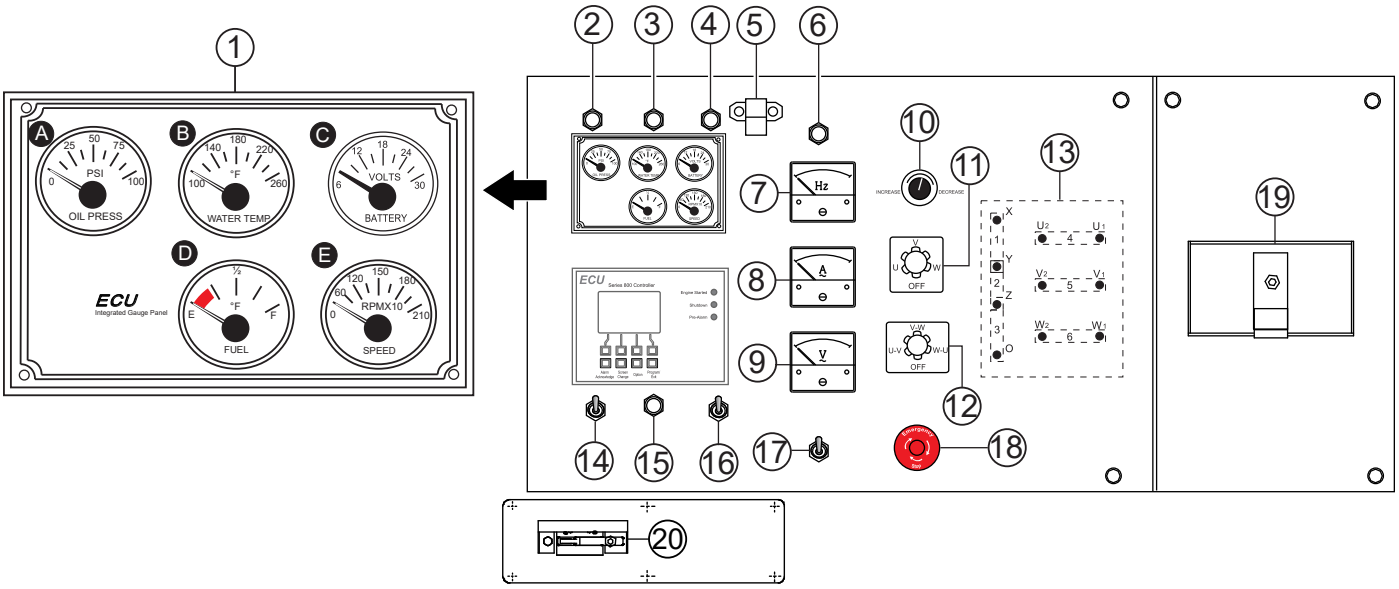


Figure 7. Engine/Generator Control Panel (DCA400SSI4F)

The definitions below describe the controls and functions of the DCA400SSI4F Engine/Generator Control Panel (Figure 7).

1. **ECU 650 Gauge Unit Assembly** — This assembly houses the various engine monitoring gauges: oil pressure, water temperature, charging voltmeter, fuel level, and engine speed (tachometer).

   A. **Oil Pressure Gauge** — During normal operation this gauge should read between 57–100 psi. (393–689 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.

   B. **Water Temperature Gauge** — During normal operation this gauge should read between 167°–194°F (75°–90°C).

   C. **Charging Voltmeter Gauge** — During normal operation this gauge indicates a minimum of 26 VDC.

   D. **Fuel Gauge** — Indicates the amount of diesel fuel available.

   E. **Tachometer** — Indicates engine speed in RPM for 60 Hz operation. This meter should indicate 1,800 RPM when the rated load is applied.

2. **Coolant Level Alarm Lamp** — Lamp illuminates when the coolant level has dropped below the normal operating level. If the lamp turns on during normal operation the engine will shut down automatically.

3. **Pre-Alarm Lamp** — Lamp illuminates when engine failures occur during normal operation. Confirm the alarm by pressing the “Alarm Acknowledge Button” on the ECU controller.

4. **Engine Shutdown Alarm Lamp** — Lamp illuminates when an engine failure occurs during normal operation. If the lamp turns on during normal operation the engine will shut down automatically.

5. **Panel Light** — For operation at night, the panel light illuminates the control panel for ease of reading meters and gauges. Make sure the panel light switch is in the OFF position when the light is not in use.

6. **Pilot Lamp** — Illuminates when an engine fault has been detected.

7. **Frequency Meter** — Indicates the output frequency in hertz (Hz). Normally 60 Hz.

8. **AC Ammeter** — Indicates the amount of current the load is drawing from the generator per leg selected by the ammeter phase-selector switch.

9. **AC Voltmeter** — Indicates the output voltage present at the U,V, and W Output Terminal Lugs.

10. **Voltage Regulator Control Knob** — Allows ± 15% manual adjustment of the generator's output voltage.
11. **Ammeter Change-Over Switch** — This switch allows the AC ammeter to indicate the current flowing to the load connected to any phase of the output terminals, or to be switched off. This switch does not affect the generator output in any fashion, it is for current reading only.
12. **Voltmeter Change-Over Switch** — This switch allows the AC voltmeter to indicate phase-to-phase voltage between any two phases of the output terminals or to be switched off.
13. **Voltage Change-Over Board** — 6 jumper plates that allow the generator to be configured for either 240 or 480 VAC output.
14. **Panel Light Switch** — When activated will turn on the control panel light.
15. **Hour Check Button** — With the engine stopped, press and hold this button. The total running hours, fuel level, and battery voltage will be displayed.
16. **Auto Start/Stop Switch** — This switch selects either manual or automatic operation. Center position is OFF (reset).
17. **Engine Speed Switch** — This switch controls the speed of the engine, low or high.
18. **Emergency Stop Switch Button** — In the event of an emergency press this button to shut down the generator.
19. **Main Circuit Breaker** — This 3-pole, 1000-amp main circuit breaker is provided to protect the U,V, and W Output Terminal Lugs from overload.
20. **Battery Switch** — Connects and disconnects the battery. Place the switch in the **ON** position prior to starting the generator. When the generator is not in use, place the switch in the **OFF** position.

NOTICE

NEVER 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.

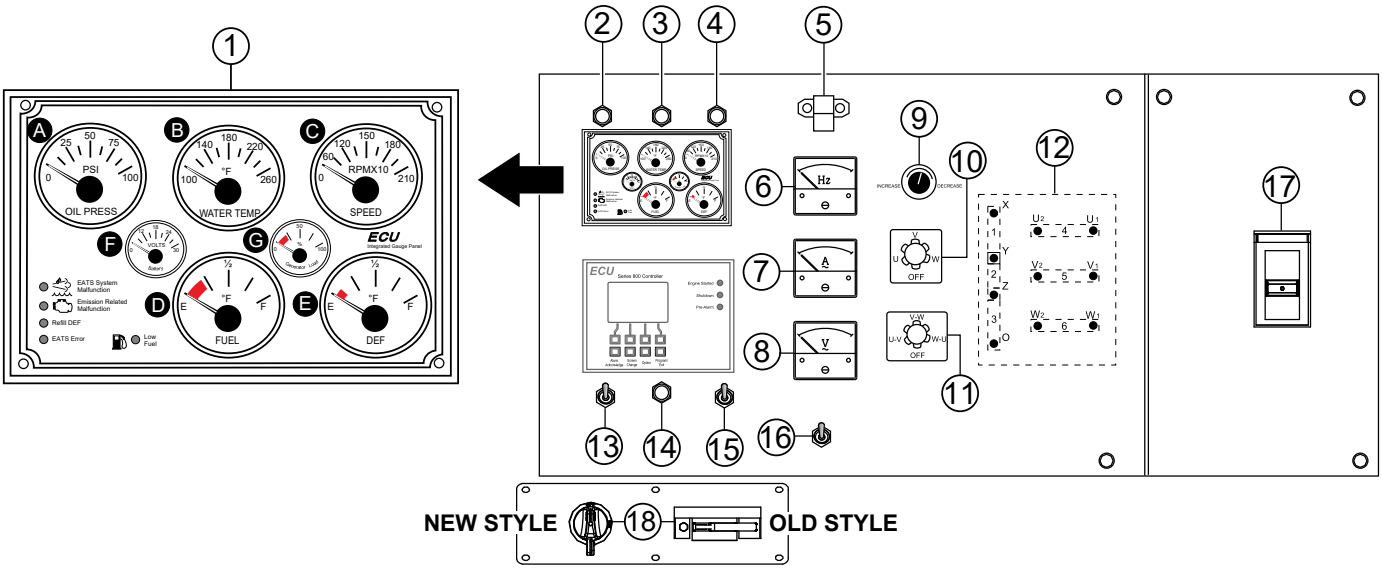


Figure 8. Engine/Generator Control Panel (DCA400SSI4F3)

The definitions below describe the controls and functions of the DCA400SSI4F3 Engine/Generator Control Panel (Figure 7).

1. **ECU 670 Gauge Unit Assembly** — This assembly houses the various engine monitoring gauges: oil pressure, water temperature, charging voltmeter, fuel level, DEF level, generator load, and engine speed (tachometer).

   A. **Oil Pressure Gauge** — During normal operation this gauge should read between 57–100 psi. (393–689 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.

   B. **Water Temperature Gauge** — During normal operation this gauge should read between 167–194°F (75°–90°C).

   C. **Tachometer** — Indicates engine speed in RPM for 60 Hz operation. This meter should indicate 1,800 RPM when the rated load is applied.

   D. **Fuel Gauge** — Indicates the amount of diesel fuel available.

   E. **DEF Gauge** — Indicates the amount of diesel exhaust fluid available. The red area in the gauge indicates a low DEF level (10%).

   F. **Charging Voltmeter Gauge** — During normal operation this gauge indicates a minimum of 26 VDC.

   G. **Generator Load Gauge** — Indicates the generator load rate. It is recommended the load be above the red area (20%) for maintaining sufficient exhaust temperature.

2. **Coolant Level Alarm Lamp** — Lamp illuminates when the coolant level has dropped below the normal operating level. If the lamp turns on during normal operation the engine will shut down automatically.

3. **Pre-Alarm Lamp** — Lamp illuminates when engine failures occur during normal operation. Confirm the alarm by pressing the “Alarm Acknowledge Button” on the ECU controller.

4. **Engine Shutdown Alarm Lamp** — Lamp illuminates when an engine failure occurs during normal operation. If the lamp turns on during normal operation the engine will shut down automatically.

5. **Panel Light** — For operation at night, the panel light illuminates the control panel for ease of reading meters and gauges. Make sure the panel light switch is in the OFF position when the light is not in use.

6. **Frequency Meter** — Indicates the output frequency in hertz (Hz). Normally 60 Hz.
7. **AC Ammeter** — Indicates the amount of current the load is drawing from the generator per leg selected by the ammeter phase-selector switch.
8. **AC Voltmeter** — Indicates the output voltage present at the U,V, and W Output Terminal Lugs.
9. **Voltage Regulator Control Knob** — Allows ± 15% manual adjustment of the generator's output voltage.
10. **Ammeter Change-Over Switch** — This switch allows the AC ammeter to indicate the current flowing to the load connected to any phase of the output terminals, or to be switched off. This switch does not affect the generator output in any fashion, it is for current reading only.
11. **Voltmeter Change-Over Switch** — This switch allows the AC voltmeter to indicate phase-to-phase voltage between any two phases of the output terminals or to be switched off.
12. **Voltage Change-Over Board** — 6 jumper plates that allow the generator to be configured for either 240 or 480 VAC output.
13. **Panel Light Switch** — When activated will turn on control panel light.
14. **Hour Check Button** — With the engine stopped, press and hold this button. The total running hours, fuel level, and battery voltage will be displayed.
15. **Auto Start/Stop Switch** — This switch selects either manual or automatic operation. Center position is OFF (reset).
16. **Engine Speed Switch** — This switch controls the speed of the engine, low or high.
17. **Main Circuit Breaker** — This 3-pole, 1000-amp main circuit breaker is provided to protect the U,V, and W Output Terminal Lugs from overload.
18. **Battery Switch** — Connects and disconnects the battery. Place the switch in the **ON** position prior to starting the generator. When the generator is not in use, place the switch in the **OFF** position.

NOTICE

NEVER 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.

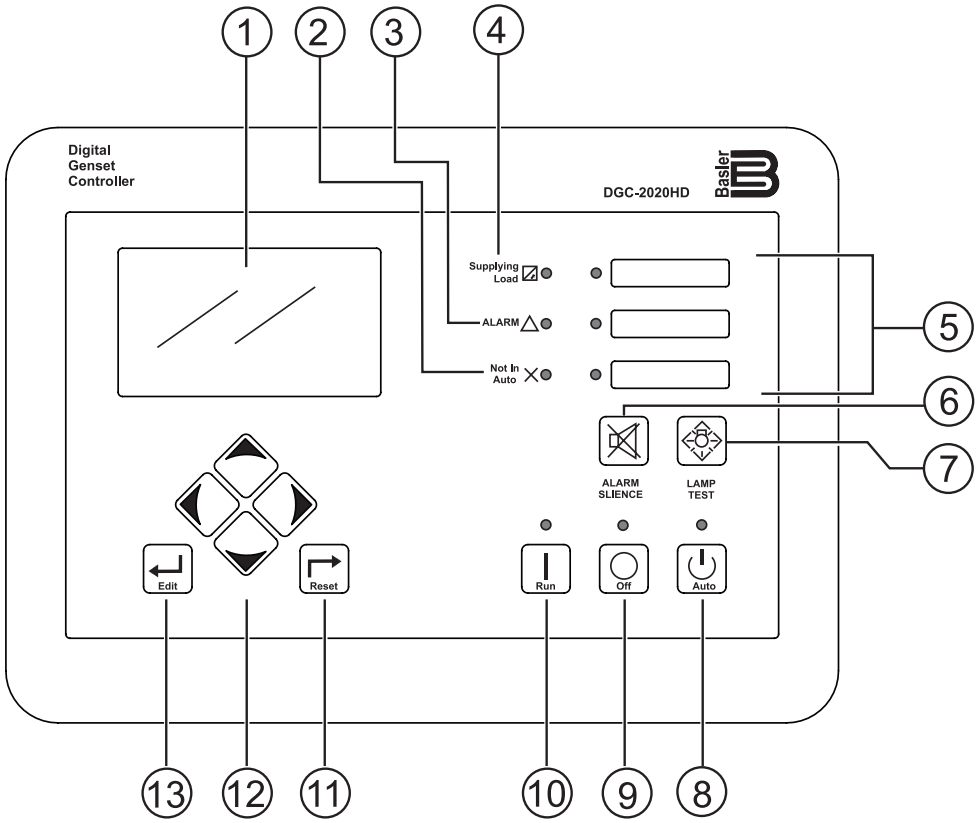


Figure 9. Basler DGC-2020HD

NOTICE

The Basler DGC-2020HD controller is an ***option***. It replaces the standard ECU-845 controller when the paralleling option is employed.

The definitions below describe the controls and functions of the Digital Genset Controller (Figure 9).

1. **LCD Display** — Backlit, 272 × 480-pixel LCD color touch screen serves as the local information source for metering, alarms, pre-alarms, and protective functions. Touch screen capability provides convenient navigation through metering and settings. Display operation is maintained down to –4°F (−20°C).
2. **Not In Auto Indicator** — This ***red*** LED lights when the DGC-2020HD 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 when the generator current is greater than the emergency power supply (EPS) threshold current.
5. **Voltage Selection Indicators** — These three LEDs light to indicate the selected voltage. The **upper** lamp indicates **3-phase, 480-volt** operation. The **middle** lamp indicates **3-phase, 240-volt** operation. The **lower** lamp indicates **idle running** operation.
6. **Alarm Silence Pushbutton** — Press this button to open the relay output programmed as the horn output.
7. **Lamp Test Pushbutton** — Press this button to test the DGC-2020HD indicators by exercising all LCD pixels and lighting all LEDs.
8. **Auto Pushbutton and Mode Indicator** — Press the **Auto button** to place the DGC-2020HD in **Auto mode**. The green **Auto Mode LED** lights when 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.

   If running in parallel, the Basler controller will command the unit to start and close the breaker based on load demand. If a failure occurs with another generator in the paralleled system, the controller will start and synchronize, then close the motorized breaker to electrically lock the unit in parallel.

   If the bus is dead it will immediately close the circuit breaker to provide power to the load(s). If the bus is already hot from another generator it will first synchronize, then close its breaker, then slowly ramp up to share load if load is present.
9. **Off Pushbutton and Mode Indicator** — Pressing this button places the DGC-2020HD in Off mode.The ***red Off*** mode LED lights when the DGC-2020HD is in ***Off*** mode.
10. **Run Pushbutton and Mode Indicator** — Pressing this button places the DGC-2020HD in ***Run*** mode. The ***green Run*** mode LED lights when Run mode is active.
11. **Reset Pushbutton** — This button is pressed 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 Maintenance Due Pre-Alarm.
12. **Arrow Pushbuttons** — These four buttons are used to navigate through the front panel display menus and modify settings.
    - The ***left*** and ***right*** arrow buttons are used to navigate through the menu levels. The right arrow button is pressed to move downward through the menu levels and the left arrow button is pressed to move upward through the menu levels.
    - Within a level, the ***up*** and ***down*** arrow buttons are used to move among items within the menu level. Pressing the down arrow button moves to items lower in the list. Pressing the up arrow button moves to items higher in the list.
    - During a settings editing session, the up and down arrow buttons are used to raise and lower the value of the selected setting. The right and left arrow buttons move to different digits.
13. **Edit Pushbutton** — Pressing this button starts an editing session and enables changes to DGC-2020HD settings. At the conclusion of an editing session, the ***Edit*** pushbutton is pressed again to save the setting changes.

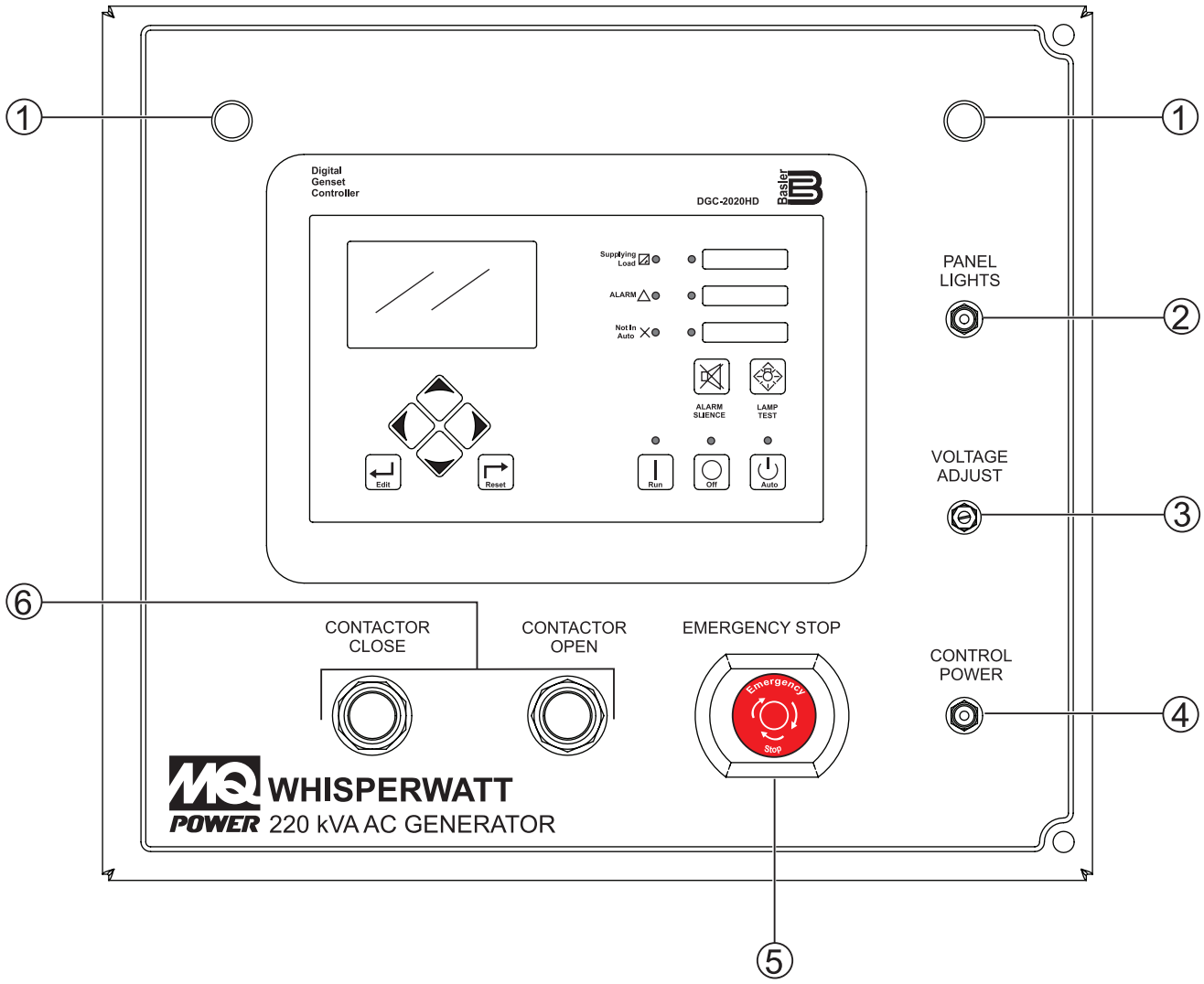


Figure 10. Paralleling Panel Components

The definitions below describe the controls and functions of the Paralleling Panel (Figure 10).

1. **Panel Lights** — For operation at night or in dark areas, panel lights illuminate the paralleling panel for ease of reading.

2. **Panel Lights Switch** — When activated will turn on control panel lights.

3. **Voltage Adjust Potentiometer** — The ***voltage adjust potentiometer*** is a way to adjust the voltage up or down for fine tuning. The adjustment sends a signal to the controller to offset the system-rated voltage (Trim Voltage). It is important that all machines are set to the same value when paralleling.

   When first turning on the control power, the controller will begin its boot sequence much like a computer does. After completing the boot sequence the unit will be ready to run or be placed in auto for auto-start applications.

4. **Control Power Toggle Switch** — The control power switch is a master power switch for the digital controller. The control power switch has a latch feature that prevents powering down control power while the engine is running.

5. **Emergency Stop Button Switch** — The Emergency Stop pushbutton switch is used to stop the engine in case of emergency or to lock out operation during service. The emergency stop button ***should not be used for routine stopping of the engine***.

   Actuation of the Emergency stop button while the control power is on will illuminate the light on the button as well as display “Emergency Stop” on the controller display. Actuating the Emergency stop button will de-energize all controller outputs and cause the engine to stop as well as trip the circuit breaker. This condition is a latched condition that must be reset prior to restarting the engine.

   The procedure for resetting the emergency stop requires several actions. Rotate the emergency stop button to release the spring latch. To clear the latch, the controller must be placed into off mode by pressing the “OFF” button. While in “OFF” mode, the “RESET” button must be pressed to clear the E-STOP fault.

   For units with manually operated breakers, the breaker will need to be reset by toggling the handle down, then turning back to the “ON” position. On models with spring-charged breakers resetting the breaker is not necessary.

6. **Contactor Operation (Manual Mode)** — For manual run applications, user action is required to get the generator power to the output bus. Depending on the model, some utilize contactors in series with toggle handle circuit breakers and others have spring-charged automatic circuit breakers.

   On the spring-charged types, the buttons on the breaker itself are not intended for circuit breaker operation. For instructional purposes both will be referred to as “contactor.”

   There are two pushbuttons on the control panel for controlling the contactor. There is a green “CLOSE CONTACTOR” button to close the contactor and a red “OPEN CONTACTOR” button to open the contactor. These buttons illuminate to show the contactor status. If the contactor is open, the red “OPEN CONTACTOR” button will be illuminated. If the contactor is closed the green “CLOSE CONTACTOR” button will be illuminated.

   These buttons can sometimes be multifunctional depending on the situation. For stand-alone operation the buttons simply close and open the contactor as expected. For paralleling the buttons can act a little different.

   When the bus is already hot from another generator, pressing the green online button will initiate a synchronizing sequence before closing the contactor. There will be an image of a synchroscope on the controller display and when the voltage and phases are matched, the contactor will close.

   If there was already load on the bus the unit will slowly ramp up load until it is sharing equally with the other generator(s). While sharing load with other generators, pressing the red “OPEN CONTACTOR” button once will initiate a ramp-down sequence. The unit will begin to ramp down and when at a low level of load it will automatically open its contactor. Pressing the red “OPEN CONTACTOR” button twice will immediately open the contactor.

OUTPUT TERMINAL PANEL

The Output Terminal Panel (Figure 12) 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.

NOTICE

Output Terminal Bolt Torque: 1,088.6 lbf·in (123.0 N·m)

OUTPUT TERMINAL FAMILIARIZATION

The "Output Terminal Panel" (Figure 12) is provided with the following:

- Three (3) 240/139V Output Receptacles @ 50 amps
- Three (3) Circuit Breakers @ 50 amps
- Two (2) 120V GFCI Receptacles @ 20 amps
- Two (2) GFCI Circuit Breakers @ 20 amps
- Eight (8) Output Terminal Lugs (U, V, W, O, Ground)

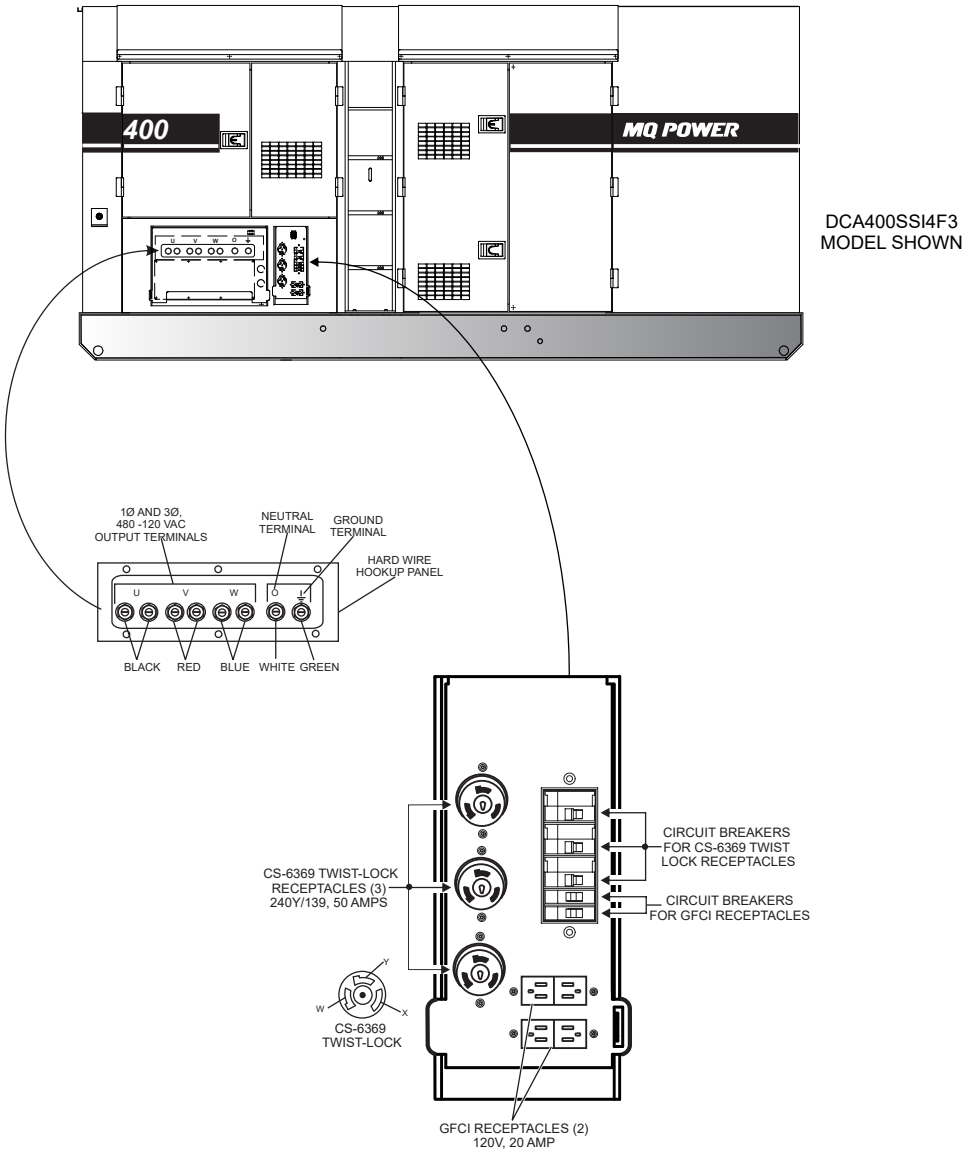


Figure 11. Output Terminal Panel

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 changeover 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 12) 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.

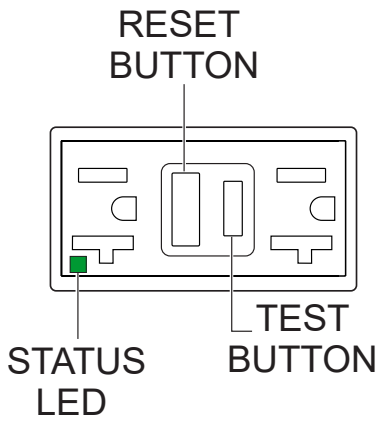


Figure 12. 120 VAC GFCI Receptacle

Twist-Lock Dual-Voltage 240/139-Volt AC Receptacles

There are three 240/139-volt, 50-amp, auxiliary twist-lock (CS-6369) receptacles (Figure 13) provided on the output terminal panel. For 240/139-volt usage, these receptacles can be used at any time during operation. For 208/120-volt usage:

- With the voltage change-over board configured for 480-volt output, use the voltage regulator to adjust the output voltage to 416V, *or*
- With the voltage change-over board configured for 240-volt output, use the voltage regulator to adjust the output voltage to 208V.

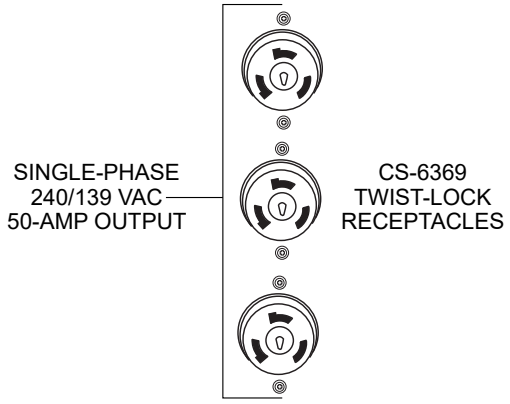


Figure 13. 240/139-Volt Twist-Lock Auxiliary Receptacles

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

The output terminal lugs are protected by a **protective cover** (Figure 14). Unscrew the retaining bolts (8) and remove the cover to gain access to the output terminal lugs.

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

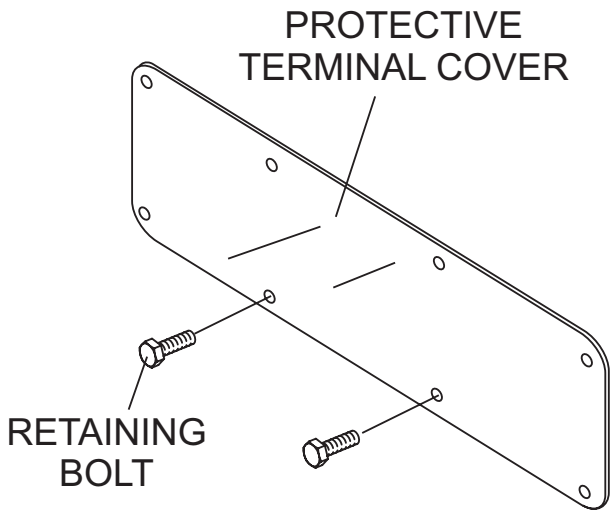


Figure 14. Protective Terminal Cover (Output Terminal Lugs)

Connecting Loads

Loads can be connected to the generator by the output terminal lugs, convenience receptacles, or optional cam-loks (Figure 15). Make sure to read the operation manual before attempting to connect a load to the generator.

To protect the output terminals from overload, a 3-pole, 1000-amp, main circuit breaker is provided. Make sure to switch **ALL** circuit breakers to the **OFF** position prior to starting the engine.

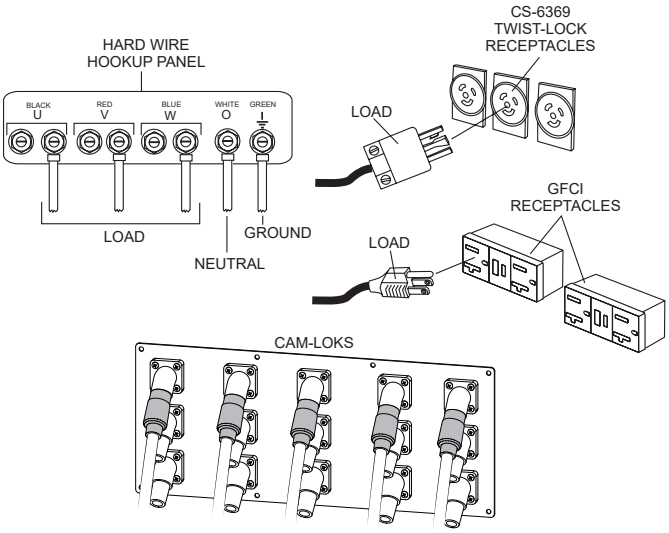


Figure 15. Connecting Loads

Overcurrent Relay

An **overcurrent relay** (Figure 16) 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.

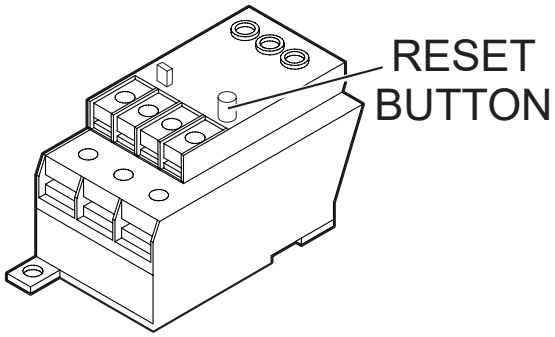


Figure 16. Overcurrent Relay

NOTICE

The **overcurrent relay** monitors the current flowing from the U,V, and W output terminal lugs to the load. In the event of a short circuit or overcurrent condition, it will automatically trip the 1000-amp main circuit breaker.

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

SINGLE-PHASE LOAD

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

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

NOTICE

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

WATTS = VOLTAGE × AMPERAGE

The power factor of this generator is 0.8. See Table 6 below when connecting loads.

Table 6. 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 7. 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:

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

NOTICE

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

NOTICE

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

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

- 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 17) 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).

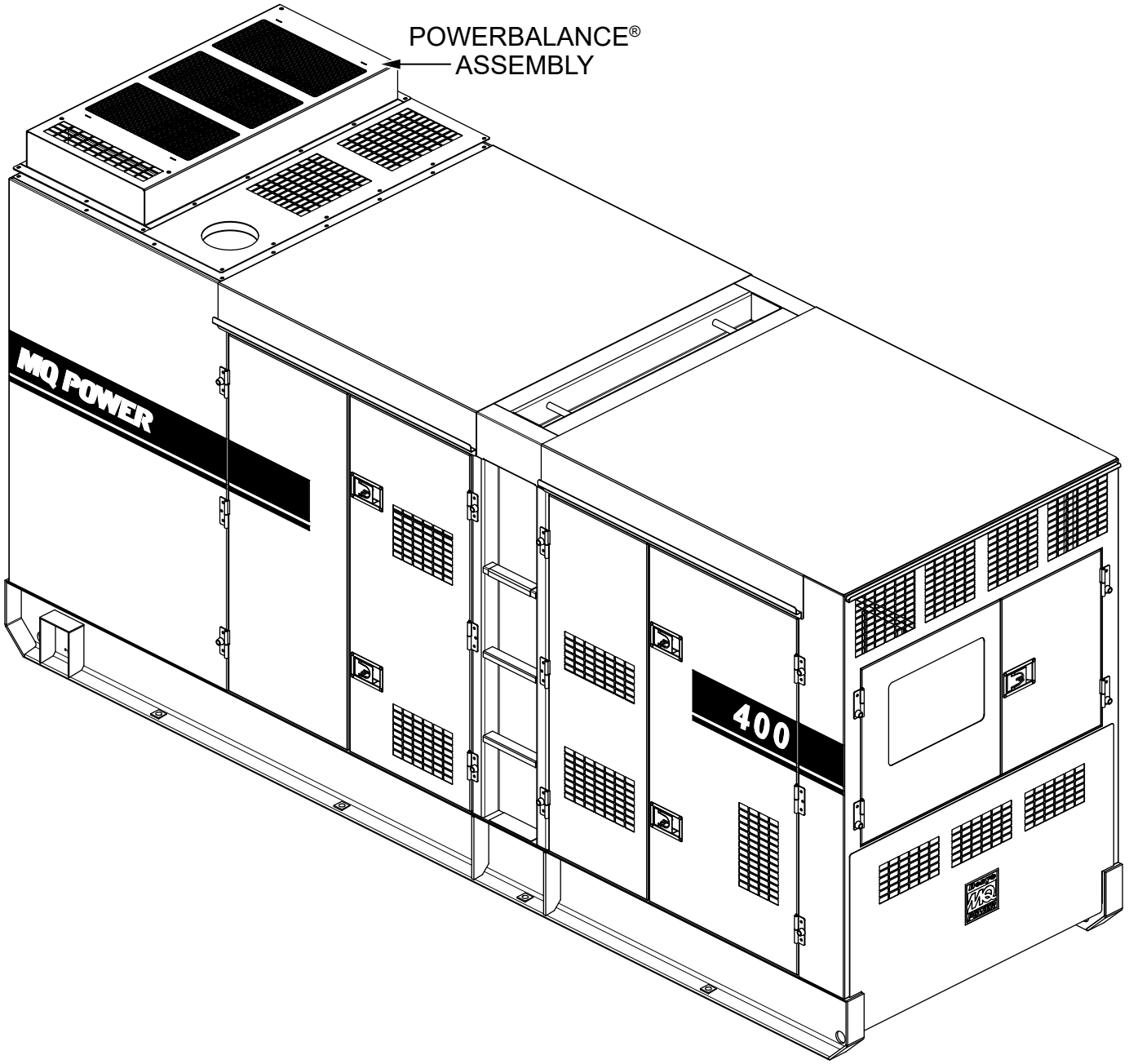


Figure 17. PowerBalance®

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

GENERATOR OUTPUT VOLTAGES

A wide range of voltages (Table 8) is available for many different applications.

Table 8. 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 18), which is located inside the control box behind the generator control panel. This board has been provided for ease of voltage selection.

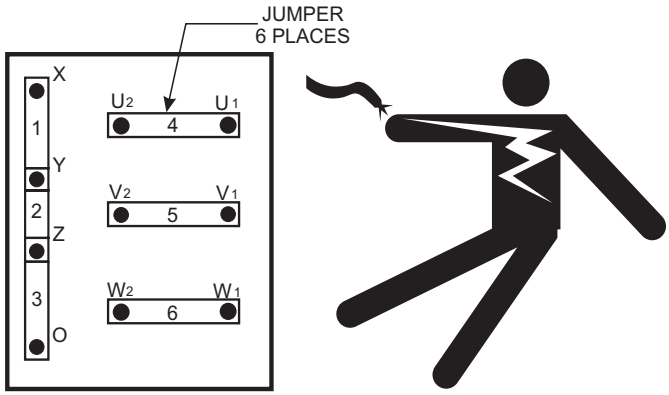


Figure 18. Voltage Change-Over Board

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!**

NOTICE

Make sure the tie bolts securing the voltage change-over board bus bars are **secure** and **tight**. The possibility exists of arcing that could cause a fire. Torque bolts to 554.9 lbf·in (62.7 N·m).

VOLTAGE REGULATOR

To obtain some of the voltages listed in Table 8 will require a fine voltage adjustment using the **voltage regulator** (Figure 19) located on the control panel.

Figure 19. Voltage Regulator

Maximum Amps

Table 9 shows the **maximum** amps the generator can provide. **DO NOT** exceed the maximum amps as listed.

Table 9. Generator Maximum Amps

Rated Voltage	Maximum Amps
Single Phase 120 Volts	888.9 amps (4 wire)
Single Phase 240 Volts	444.4 amps (4 wire)
Three Phase 208 Volts	962.3 amps
Three Phase 240 Volts	962.3 amps
Three Phase 480 Volts	481.1 amps
Main Line Circuit Breaker Rating	1,000 amps
Overcurrent Relay Trip Set Point	480 amps

HOW TO READ THE AC AMMETER AND AC VOLTMETER GAUGES

The AC ammeter and AC voltmeter gauges are controlled by the AC ammeter and AC voltmeter change-over switches.

Both of these switches are located on the control panel and **DO NOT** affect the generator output. They are provided to help observe how much power is being produced at the UVWO terminal lugs.

Before taking a reading from either gauge, configure the ***Voltage Change-Over Board*** (Figure 20) for the desired output voltage.

NOTICE

Make sure the tie bolts securing the voltage change-over board bus bars are **secure** and **tight**. The possibility exists of arcing that could cause a fire. Torque bolts to 554.9 lbf·in (62.7 N·m).

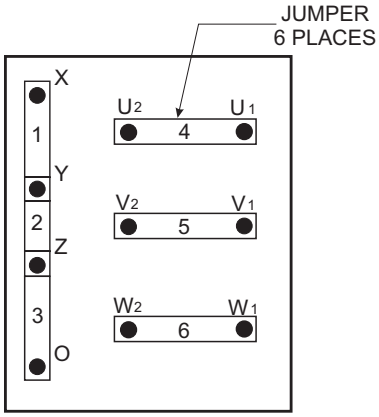


Figure 20. Voltage Change-Over Board 240/3Ø Position

AC Voltmeter Gauge Reading

Place the ***AC Voltmeter Change-Over Switch*** (Figure 21) in the W-U position and observe the phase-to-phase voltage reading between the W and U terminals as indicated on the ***AC Voltmeter Gauge*** (Figure 22).

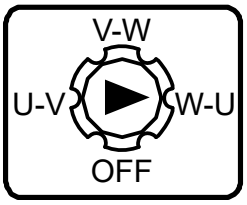


Figure 21. AC Voltmeter Change-Over Switch

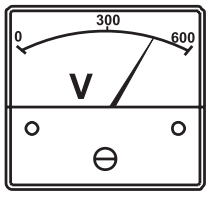


Figure 22. AC Voltmeter Gauge (Volt Reading On W-U Lug)

AC Ammeter Gauge Reading

Place the ***AC Ammeter Change-Over Switch*** (Figure 23) in the U position and observe the current reading (load drain) on the U terminal as indicated on the ***AC Ammeter Gauge*** (Figure 24). This process can be repeated for terminals V and W.

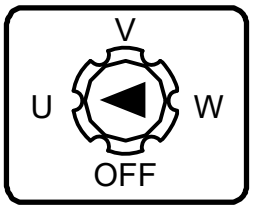


Figure 23. AC Ammeter Change-Over Switch

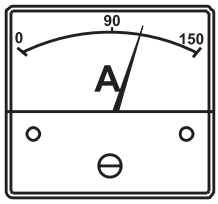


Figure 24. AC Ammeter (Amp Reading On U Lug)

NOTICE

The ***ammeter*** gauge will only show a reading when the ***output terminal lugs*** are connected to a load and in use.

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** 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 (VR) allows the user to increase or decrease the selected voltage.

NOTICE

Make sure the tie bolts securing the voltage change-over board bus bars are **secure** and **tight**. The possibility exists of arcing that could cause a fire. Torque bolts to 554.9 lbf·in (62.7 N·m).

NOTICE

ALWAYS make sure that the connections to the UVWO terminals are **secure** and **tight**. The possibility exists of arcing that could cause a fire. Torque tie bolts to 1,088.6 lbf·in (123.0 N·m).

3Ø-240V UVWO Terminal Output Voltages

1. Jumper the voltage change-over board for 240V operation as shown in Figure 25.

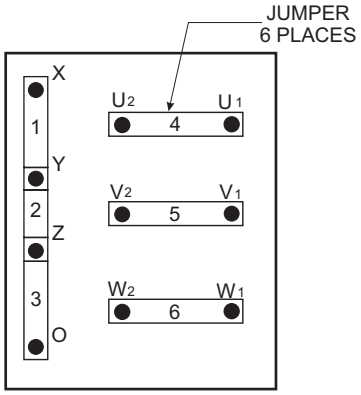


Figure 25. Voltage Change-Over Board 3Ø-240/139V Configuration

2. Connect the load wires to the UVWO terminals as shown in Figure 26.

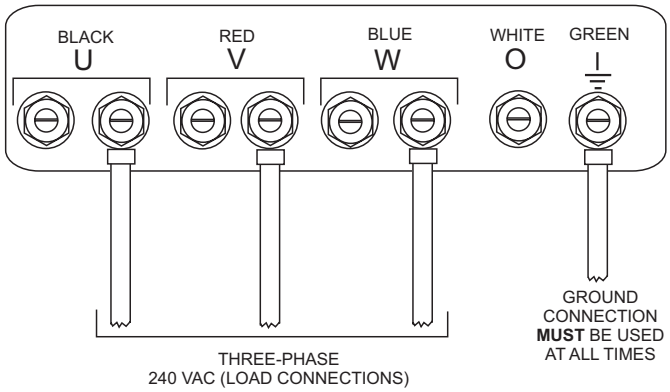


Figure 26. UVWO Terminal Lugs 3Ø-240/1Ø-139 Connections

3. Turn the voltage regulator (Figure 27) clockwise to increase voltage output, turn counterclockwise to decrease voltage output. Use the voltage regulator whenever fine tuning of the output voltage is required.

Figure 27. Voltage Regulator

1Ø-240V UVWO Terminal Output Voltages

1. Make sure the voltage change-over board is jumpered for 240V operation as shown in Figure 25.
2. Connect the load wires to the UVWO terminals as shown in Figure 28.

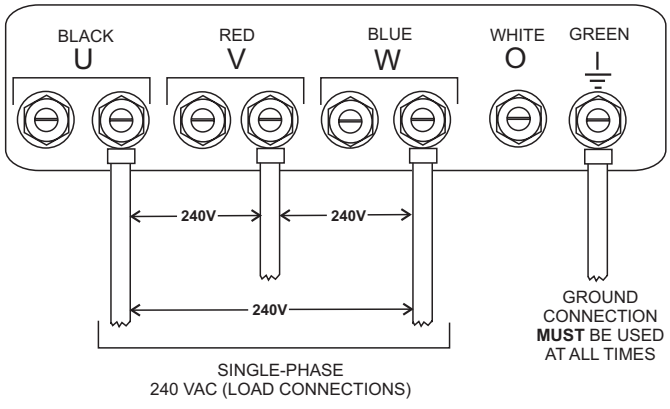


Figure 28. UVWO Terminal Lugs 1Ø-240V Connections

1Ø-120V UVWO Terminal Output Voltages

1. Make sure the voltage change-over board is jumpered for 240V operation as shown in Figure 25.
2. Adjust the voltage regulator (Figure 27) for an output of 208V to obtain 120V at the UVWO terminals.
3. Connect the load wires to the UVWO terminals as shown in Figure 29.

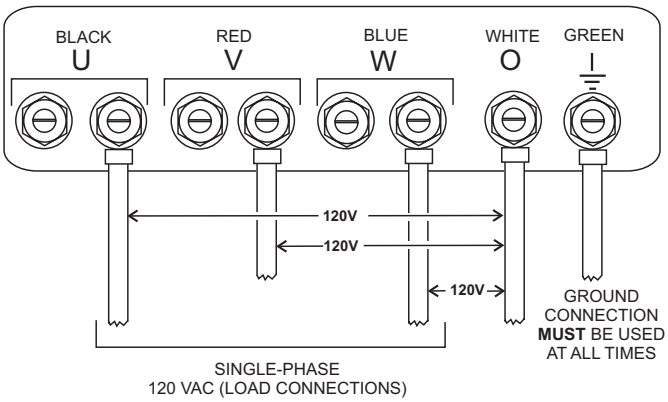


Figure 29. UVWO Terminal Lugs 1Ø-120V Connections

3Ø-480V UVWO Terminal Output Voltages

1. Jumper the voltage change-over board for 480V operation as shown in Figure 30. This configuration uses 6 jumper plates in 3 different positions. Remember there are 2 jumper plates at every position. Every jumper plate **must** be used.

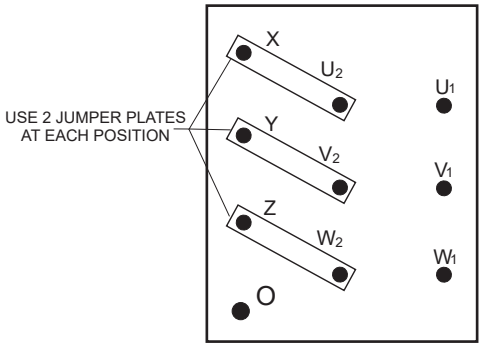


Figure 30. Voltage Change-Over Board 3Ø 480/277V Configuration

2. Connect the load wires to the UVWO terminals as shown in Figure 31.

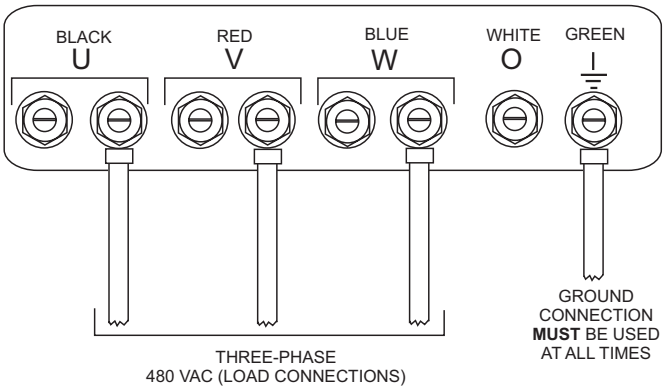


Figure 31. UVWO Terminal Lugs 3Ø-480V Connections

1Ø-480V UVWO Terminal Output Voltages

1. Make sure the voltage change-over board is jumpered for 480V operation as shown in Figure 30.
2. Connect the load wires to the UVWO terminals as shown in Figure 32.

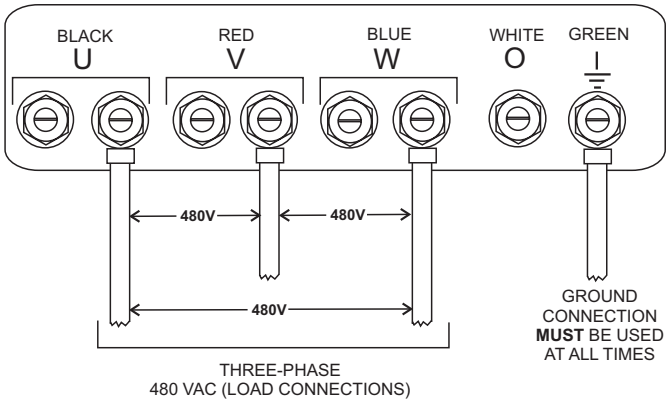


Figure 32. UVWO Terminal Lugs 1Ø-480V Connections

1Ø-277V UVWO Terminal Output Voltages

1. Make sure the voltage change-over board is jumpered for 480V operation as shown in Figure 30.
2. Connect the load wires to the UVWO terminals as shown in Figure 33.

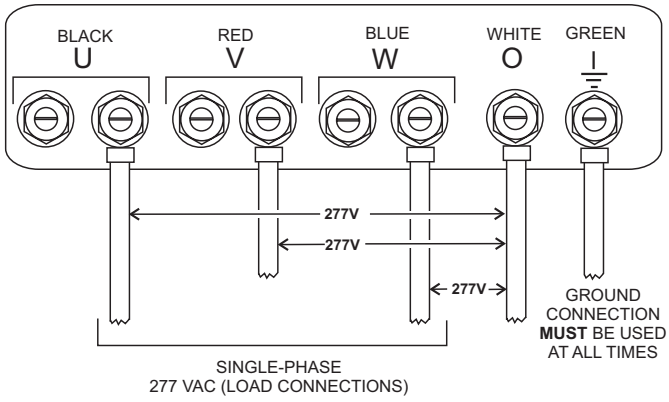


Figure 33. UVWO Terminal Lugs 1Ø-277V Connections

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 34) and wipe it clean.

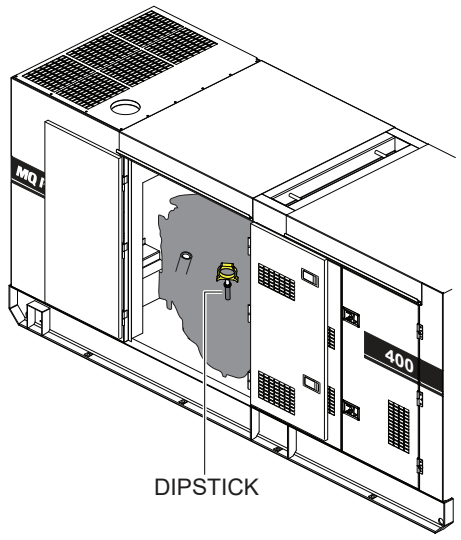


Figure 34. Engine Oil Dipstick Location

3. Reinsert the dipstick, then remove the dipstick from its holder. Check the oil level shown on the dipstick (Figure 35).

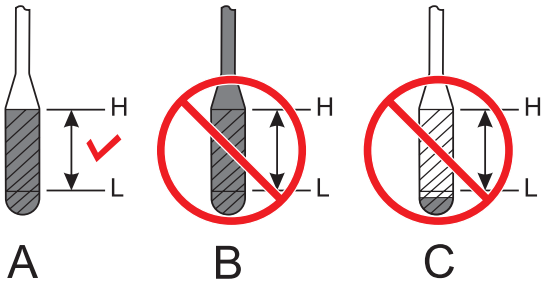


Figure 35. Engine Oil Dipstick Level

4. Verify that the engine oil level is maintained between the H and L markings on the dipstick as referenced in Figure 35**A**.
5. If the engine oil level is low (Figure 35**C**), remove the cap from the **oil filler port** (Figure 36) and fill to a safe operating level (max) as indicated by the dipstick (Figure 35**A**). Fill with recommended type oil as listed in Table 10. Maximum oil capacity is 15.1 gallons (57 liters).

NOTICE

When adding engine oil, **DO NOT** overfill (Figure 35**B**).

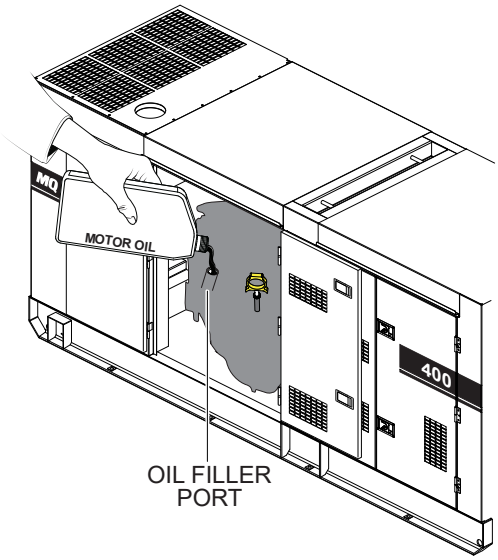
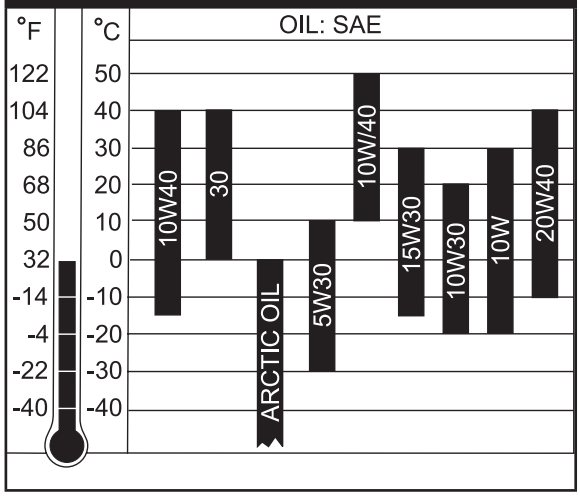


Figure 36. Engine Oil Filler Port

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 10. Oil Selection Chart



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.

NOTICE

ALWAYS check the DEF tank level when adding fuel.

Refilling The Fuel System

CAUTION

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

This generator has an internal fuel tank located inside the enclosure (Figure 37). **ALWAYS** fill the fuel tank with clean, fresh **#2 diesel fuel**. **DO NOT** fill the fuel tank beyond its capacity. Some units may be equipped with a fuel cell mounted inside the trailer frame.

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

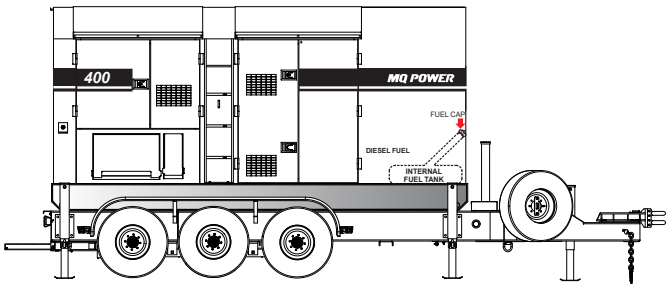


Figure 37. Fuel Tank

Refueling Procedure

WARNING

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

1. **Level Tanks** — Make sure fuel cells are level with the ground. Failure to do so will cause fuel to spill from the tank before reaching full capacity (Figure 38).

CAUTION

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

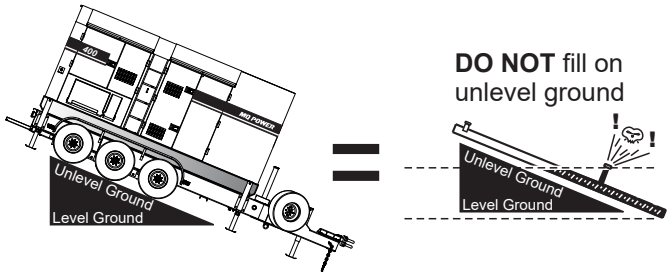


Figure 38. Only Fill On Level Ground

NOTICE

ONLY use **#2 diesel fuel** (ultra-low sulfur diesel fuel) when refueling.

2. Remove the fuel cap and fill the tank as shown in Figure 39.

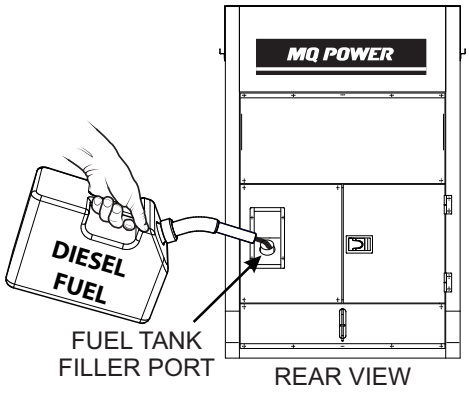


Figure 39. Fueling The Generator

3. **NEVER overfill the fuel tank** — It is important to read the fuel gauge when filling the trailer fuel tank. **DO NOT** wait for fuel to rise in the filler neck (Figure 40). Fuel expands when heated (Figure 41).

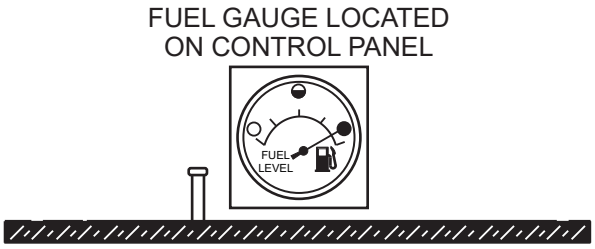


Figure 40. Full Fuel Tank

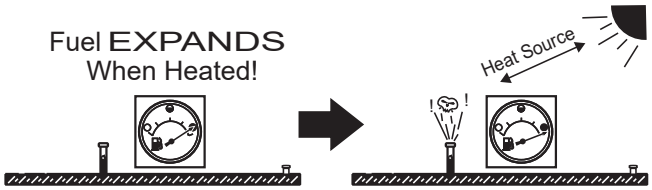


Figure 41. Fuel Expansion

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.

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

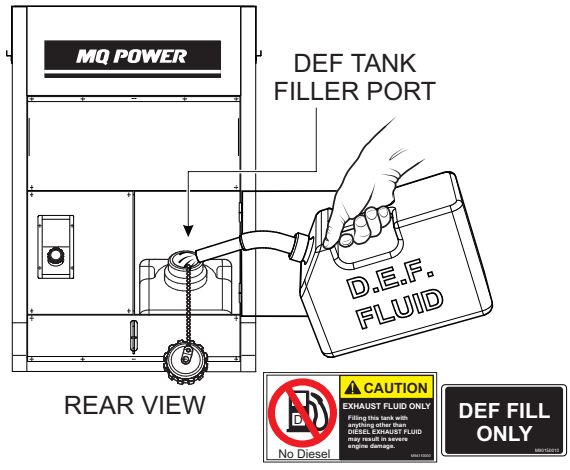


Figure 42. Filling The DEF Tank

DEF Refilling

NOTICE

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

1. Make sure the engine is **OFF**.
2. Remove the cap from the DEF tank filler port (Figure 42).
3. Add diesel exhaust fluid to the tank. **DO NOT** overfill.
4. Reinstall the DEF tank cap. Tighten securely.

DEF Refilling (Continuous Operation)

It is recommended to **shut down the engine** prior to refilling the DEF tank. However, 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 (ANTIFREEZE/SUMMER COOLANT/WATER)

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

⚠ WARNING

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 recovery tank. When adding coolant to the radiator, **DO NOT** remove the radiator cap until the unit has completely cooled. See Table 11 for engine, radiator, and recovery tank coolant capacities.

Table 11. Coolant Capacity

Engine and Radiator	19.4 gal. (73.6 liters)
Reserve Tank	See markings

NOTICE

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

Verify that the coolant level in the **coolant reserve tank** is between the **FULL** and **LOW** markings as shown in Figure 43.

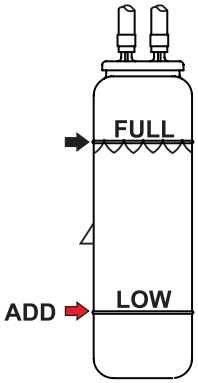


Figure 43. Coolant Reserve Tank

Operation In Freezing Weather

When operating in freezing weather, be certain the proper amount of antifreeze (Table 12) has been added.

Table 12. Coolant Capacity

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

NOTICE

When the antifreeze is mixed with water, the antifreeze mixing ratio **must be** less than 50%.

Cleaning The Radiator

The engine may overheat if the radiator cooling fins (Figure 44) become overloaded with dust or debris. Periodically clean the radiator fins with compressed air. Cleaning inside the machine is dangerous, so clean only with the engine turned **OFF** and the negative battery terminal disconnected.

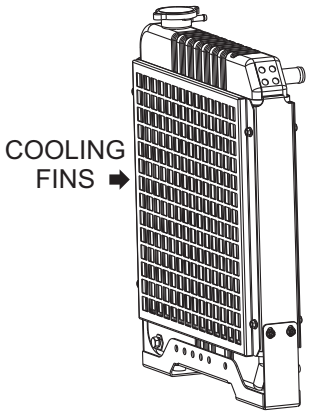


Figure 44. Radiator (Cooling Fins)

ENGINE AIR CLEANER

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

FAN BELT TENSION

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

The fan belt tension is proper if the fan belt bends 10 to 15 mm when depressed with the thumb as shown in Figure 45.

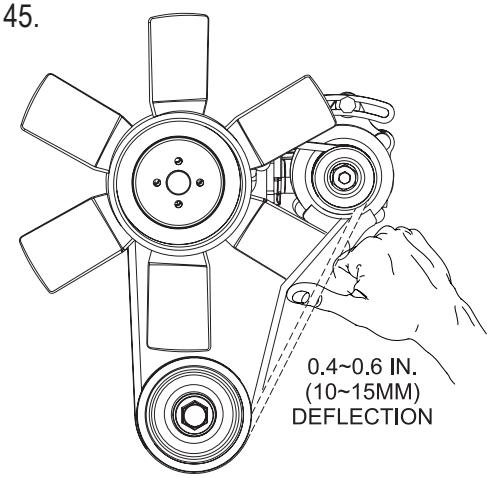


Figure 45. Fan Belt Tension

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 the battery fluid level between the specified marks. Battery life will be shortened if the fluid level is not properly maintained. Add only **distilled water** when replenishment is necessary.

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

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

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

Battery Cable Installation

Connect the two 12-volt batteries **in series** (24-volt system) as shown in Figure 46. 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.

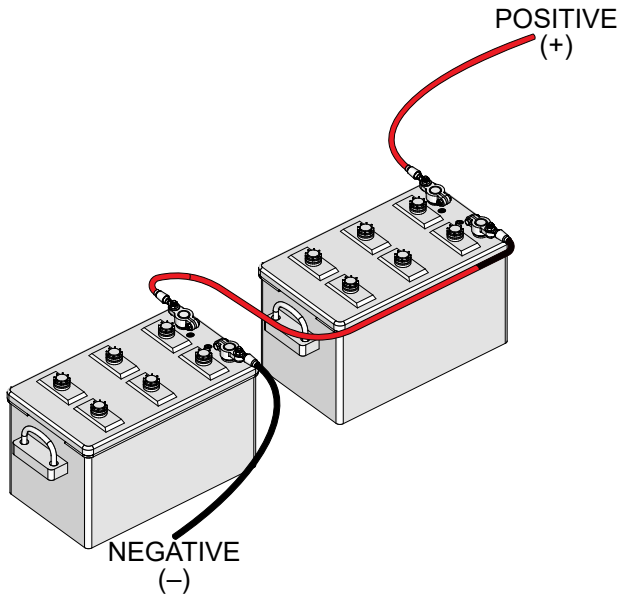


Figure 46. Battery Connections

When connecting the batteries:

1. **NEVER** connect the battery cables to the battery terminals while the **Auto Start/Stop switch** is in either the **AUTO** or **MANUAL** 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

The **Battery switch** (Figure 47) 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.

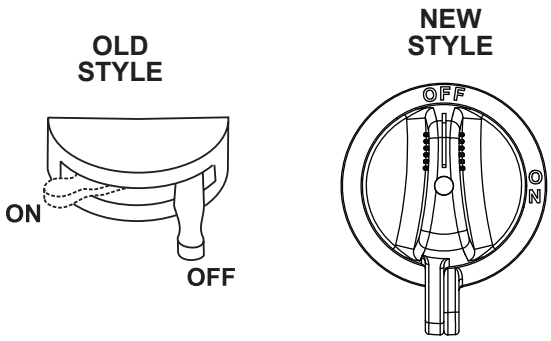


Figure 47. Battery Switch

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 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.

BEFORE STARTING

⚠ CAUTION

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

⚠ WARNING

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

1. Place the **battery switch** (Figure 48) in the **ON** position.

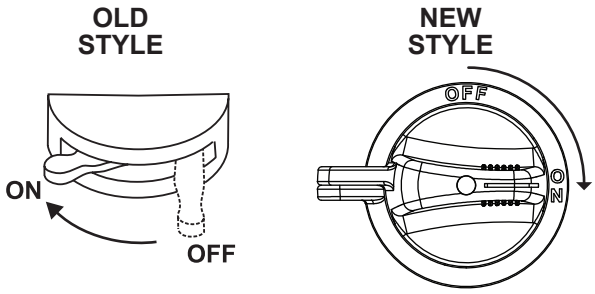


Figure 48. Battery Switch (ON)

2. Place the **main**, **auxiliary**, **and GFCI** circuit breakers (Figure 49) in the **OFF** position prior to starting the engine.

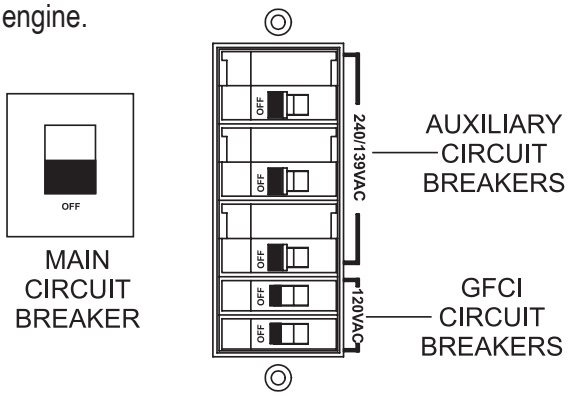


Figure 49. Main, Auxiliary, And GFCI Circuit Breakers (OFF)

3. Make sure the voltage change-over board has been configured for the desired output voltage.

NOTICE

Make sure the tie bolts securing the voltage change-over board bus bars are **secure** and **tight**. The possibility exists of arcing that could cause a fire. Torque bolts to 554.9 lbf·in (62.7 N·m).

4. Connect the load to the **receptacles, output terminal lugs,** or optional **cam-loks** as shown in Figure 15. These load connection points can be found on the output terminal panel and the output terminal panel's hard wire hookup panel.

NOTICE

ALWAYS make sure that the connections to the UVWO terminals are **secure** and **tight**. The possibility exists of arcing that could cause a fire. Torque tie bolts to 1,088.6 lbf·in (123.0 N·m).

5. Close all engine enclosure doors (Figure 50).

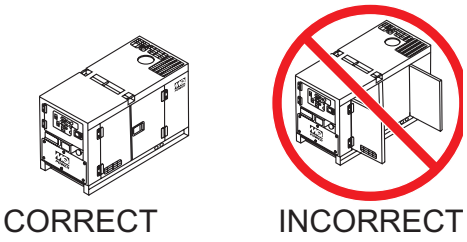


Figure 50. Engine Enclosure Doors

STARTING (MANUAL)

1. Place the **Engine Speed switch** in the **LOW** position (Figure 51).

Figure 51. Engine Speed Switch (Low Position)

2. To start the engine, place the **Auto Start/Stop switch** in the **MANUAL** position (Figure 52).

Figure 52. Auto Start/Stop Switch (Manual Position)

NOTICE

If the engine fails to start after three attempts, the shutdown lamp will illuminate and the Auto Start/Stop Switch must be placed in the Off/Reset position before the engine can be restarted.

NOTICE

Engine will pre-heat automatically in cold weather conditions."Glow Plug Hold" message will be displayed and the engine will start automatically after pre-heating.

3. Once the engine starts, let the engine run for 1–2 minutes. Let the engine idle longer in cold weather conditions. Listen for any abnormal noises. If any abnormalities exist, shut down the engine and correct the problem.
4. After the warmup process has completed, place the **Engine Speed switch** in the **HIGH** (up) position. The engine speed will increase to 1,800 rpm and the unit is now ready for operation.

Figure 53. Engine Speed Switch (High Position)

5. The generator's **frequency meter** (Figure 54) should be displaying the 60-cycle output frequency in **HERTZ**.

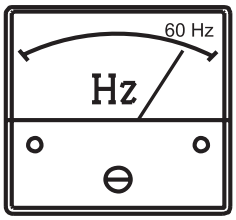


Figure 54. Frequency Meter

6. The generator's **AC voltmeter** (Figure 55) will display the generator's output in **VOLTS**.

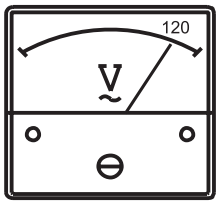


Figure 55. Voltmeter

7. If the voltage is not within the specified tolerance, use the **voltage regulator** (Figure 56) to increase or decrease the desired voltage.

Figure 56. Voltage Regulator

8. The **ammeter** (Figure 57) will indicate **zero amps** with no load applied. When a load is applied, the ammeter will indicate the amount of current that the load is drawing from the generator.

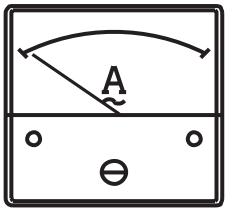


Figure 57. Ammeter (No Load)

9. The **engine oil pressure gauge** (Figure 58) will indicate the oil pressure of the engine. Under normal operating conditions the oil pressure should be between 57–100 psi (393–689 kPa).

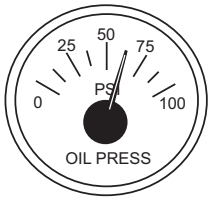


Figure 58. Oil Pressure Gauge

10. The **coolant temperature gauge** (Figure 59) will indicate the coolant temperature. Under normal operating conditions the coolant temperature should be between 167°–194°F (75°–90°C).

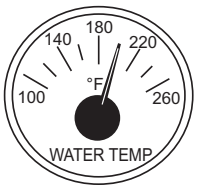


Figure 59. Coolant Temperature Gauge

11. The **tachometer** (Figure 60) will indicate the speed of the engine when the generator is operating. Under normal operating conditions, this gauge should indicate 1,000 rpm when the Engine Speed switch is the LOW position, and 1,800 rpm when the Engine Speed switch is in the HIGH position.

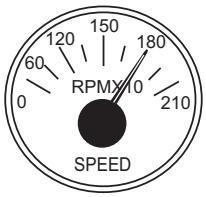


Figure 60. Engine Tachometer Gauge

12. Place the **main**, **auxiliary**, and **GFCI** circuit breakers in the **ON** position (Figure 61).

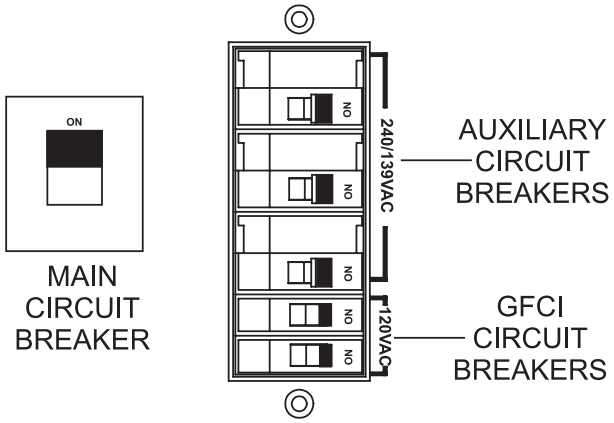


Figure 61. Main, Aux. and GFCI Circuit Breakers (ON)

13. Observe the generator's ammeter (Figure 62) and verify it reads the anticipated amount of current with respect to the load. The ammeter will only display a current reading if a load is in use.

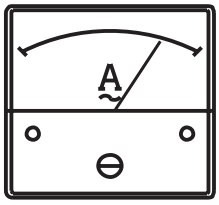


Figure 62. Ammeter (Load)

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

STARTING (AUTO MODE)

DANGER

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

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

CAUTION

The Engine Speed switch **must** be set to the **High position** when running in **Auto mode**. Failing to set the switch in the proper position can result in damage to the generator when it turns on.

NOTICE

When the **Auto Start/Stop switch** is placed in the **AUTO** position, the engine glow plugs will be warmed and the engine will start automatically.

1. Perform steps 1–5 under ***Before Starting*** in the ***Generator Start-Up Procedure (Manual)*** section.
2. Place the **Engine Speed switch** in the **HIGH** position (Figure 63).

Figure 63. Engine Speed Switch (High Position)

3. Place the **Auto Start/Stop Switch** (Figure 64) in the **AUTO** position.

Figure 64. Auto Start/Stop Switch (Auto Position)

4. Once the start signal is received (the remote-start contacts are closed), the pre-heating process will begin. When the pre-heating process has completed, the engine will start automatically and accelerate to rated speed. When the remote-start contacts are opened, the engine will stop.
5. If the engine fails to start, perform the manual starting procedure.

NORMAL SHUTDOWN PROCEDURE

WARNING

NEVER stop the engine suddenly except in an emergency.

1. Place the load's ON/OFF switch in the **OFF** position.
2. Place the **main**, **auxiliary**, **and GFCI** circuit breakers (Figure 65) in the **OFF** position.

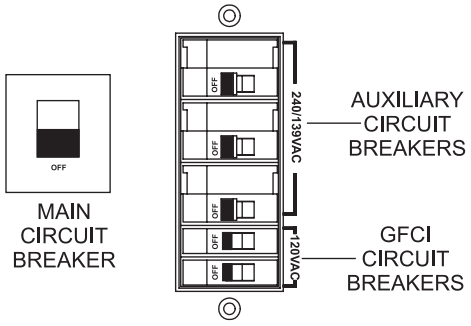


Figure 65. Main, Auxiliary, And GFCI Circuit Breakers (OFF)

3. Place the **Engine Speed switch** in the **LOW** position (Figure 66).

Figure 66. Engine Speed Switch (Low Position)

4. Let the engine cool by running it at low speed for 3–5 minutes with no load applied.
5. Place the **Auto Start/Stop switch** (Figure 67) in the **OFF/RESET** position.

Figure 67. Auto Start/Stop Switch (Off/Reset Position)

6. Place the **battery switch** (Figure 68) in the **OFF** position.

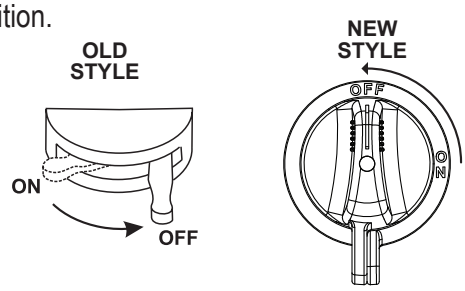


Figure 68. Battery Switch (OFF)

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

EMERGENCY SHUTDOWN PROCEDURE

NOTICE

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

1. To stop the engine in the event of an emergency, press the **Emergency Stop switch** (Figure 69).

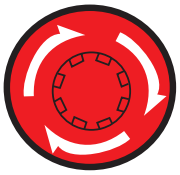


Figure 69. Emergency Stop Button

2. Place the **main**, **auxiliary**, **and GFCI circuit breakers** in the **OFF** position as shown in Figure 65.
3. 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).

AUTOMATIC SHUTDOWN SYSTEM

This unit is equipped with safety devices that will automatically shut down the engine when a fault occurs. The Shutdown lamp on the controller will illuminate and diagnostic trouble codes will be displayed to signify the reason for the shutdown. Refer to the ***Troubleshooting (Diagnostics)*** section of this manual for more information.

NOTICE

Before inspecting the generator after an automatic shutdown, place the Auto Start/Stop switch in the **OFF/RESET** position, and place all circuit breakers in the **OFF** position. Allow adequate time for cooling before troubleshooting. When all faults have been cleared, restart the engine according to the ***Generator Startup Procedure*** section of this manual.

Table 13. Inspection/Maintenance		Daily	Every 250 Hours	Every 500 Hours	Every 1,000 Hours	Other
Engine	Check Engine Oil and Coolant Levels	X				
	Check Fuel Filter/Water Separator Bowl	X				
	Check Battery Fluid Level	X				
	Check Air Cleaner	X				
	Check for Leaks	X				
	Visual Walk Around Inspection	X				
	Clean Air Cleaner Element		X			
	Drain Bottom of Fuel Tank		X			
	Replace Engine Oil and Oil Filter*1		(X)	X		
	Replace Fuel Filter Elements		(X)	X		
	Check Fan Belt Condition	X		X		
	Check Electrical Ground Connection			X		
	Clean Radiator and Check Cooling System			X		
	Check and Adjust Engine Valve Clearance				X	
	Clean Inside Fuel Tank				X	
	Check All Hoses and Clamps*4				X	
	Check Engine Mounts				X	
	Replace Air Cleaner Elements*5				X	
	Inspect Air Filter Case for Damage, Replace If Necessary					1,500 hours
	Check/Correct DEF Leakage	X				
	Replace DEF Filter (in Supply Module)				X	
	Check SCR System*2					4,500 hours
	Inspect Dosing Module (SCR System)*2					4,500 hours
	Flush and Refill Cooling System*3					1 year or 2,000 hours
	Inspect Turbocharger					4,500 hours (blower cleaning as necessary)
	Inpsect and Clean EGR Valve and Cooler					4,500 hours
Generator	Measure Insulation Resistance Over 3M Ohms*6		X			
	Check Rotor Rear Support Bearing			X		
	Inspect Voltage Change-Over Board Bus Bars and Tie Bolts and Re-Torque Tie Bolts*7			X		

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

*2 Perform inspection and maintenance of urea SCR system every 4,500 hours. The SCR system does not need to be replaced if no problems are found. DO NOT make modifications/changes or remove the emission control system and related parts. Please contact your nearest dealer or Multiquip for SCR maintenance.

*3 Please use fully formulated antifreeze/coolant.

*4 If blowby hose needs to be replaced, make sure that the slope of the blowby hose is at least 1/2 inch per foot, with no sags or dips that could collect moisture and oil.

*5 Replace the primary air filter element when the restriction indicator shows a vacuum of 625 mm (25 in. H_20).

*6 **DCA400SSI4F3 only:** Make sure to disconnect the O–Ground line and CN9–CN10 before performing the measurement. Refer to the Generator Wiring Diagram (DCA400SSI4F3).

*7 Torque bolts to 554.9 lbf·in (62.7 N·m).

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

ENGINE AIR CLEANER

This Isuzu diesel engine is equipped with a replaceable, high-density, paper air cleaner element (Figure 70). 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.

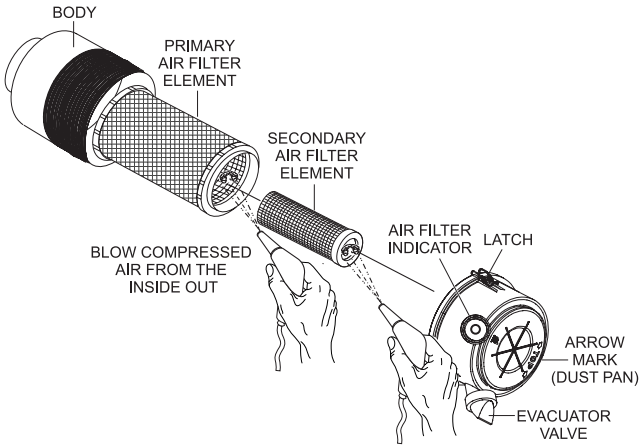


Figure 70. Engine Air Cleaner

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 70).
2. Remove the **air cleaner cover** (Figure 70) and set it aside.
3. Remove both the primary and secondary air cleaner elements (Figure 70).
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 70, tap the filter element several times on a hard surface to remove dirt, or blow compressed air, not to exceed 30 psi (207 kPa, 2.1 kgf/cm^2), through the filter element from the inside out.
6. Clean the **secondary element** (paper air filter) as described in step 5.
7. Replace both elements if they are damaged or excessively dirty.
8. Clean the inside of the **air cleaner body** (Figure 70).
9. Reinstall the primary and secondary air filter elements back into the air cleaner body.
10. Reinstall the air cleaner cover and secure with latches.

NOTICE

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

Air Cleaner Restriction Indicator

The air cleaner is equipped with a **restriction indicator** (Figure 71). As the air cleaner element becomes clogged, air intake restriction increases and the indicator signal shows **RED**, indicating that the element needs to be replaced. After replacing the air cleaner element, press the restriction indicator button to reset the indicator.

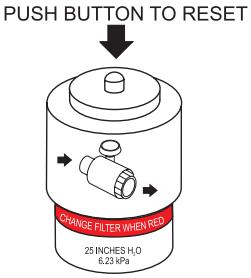


Figure 71. Air Cleaner Restriction Indicator

NOTICE

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

ENGINE FUEL FILTER

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

Draining The Fuel Filter

1. Loosen the **air bleeder plug** (Figure 72) on the fuel filter body.

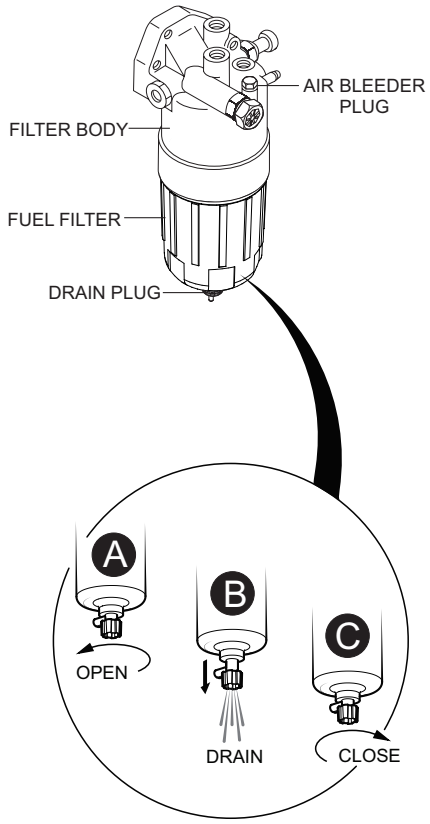


Figure 72. Draining The Fuel Filter

2. To discharge the fuel inside the fuel filter cartridge, open the **drain valve** on the fuel filter by turning the knob **counterclockwise** (Figure 72**A**) approximately 3-1/2 turns until the valve drops down 1 inch (25.4 mm) and draining occurs (Figure 72**B**).
3. Let the residue or foreign substances inside the fuel filter flow into a suitable container.
4. At completion of draining, close the drain valve (Figure 72**C**).

Fuel Filter Element Replacement

1. Using a **filter wrench**, remove the **element case** from the **fuel filter body** (Figure 73).

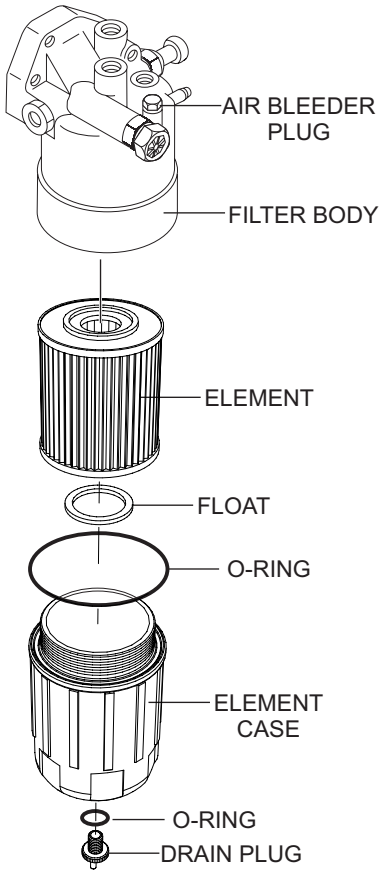


Figure 73. Fuel Filter Replacement

2. Wipe the inside of the **filter body** (Figure 73) with a clean cloth to remove any foreign matter or debris that may have accumulated.
3. Insert the new fuel filter element into the element case.
4. Replace both **O-rings**. Coat each O-ring with a small amount of clean 15W-40 engine oil.
5. Reinstall the element case first by hand until it makes contact with the fuel filter body surface.
6. Torque the element case to 22.4 lbf·ft (30 N·m).
7. Torque the drain plug to 1.4 lbf·ft (2.0 N·m).
8. Remove the air from the fuel system. Refer to ***Bleeding the Fuel System*** in the Isuzu engine owner's manual.

REMOVING WATER FROM THE FUEL TANK

After prolonged use, water and other impurities accumulate in the bottom of the fuel tank. Occasionally inspect the fuel tank for water contamination and drain the contents if required.

During cold weather, the more empty volume inside the tank, the easier it is for water to condense. This can be reduced by keeping the tank full with diesel fuel.

CLEANING INSIDE THE FUEL TANK

If necessary, drain the fuel inside the fuel tank completely. Using a spray washer (Figure 74), wash out any deposits or debris that have accumulated inside the fuel tank.

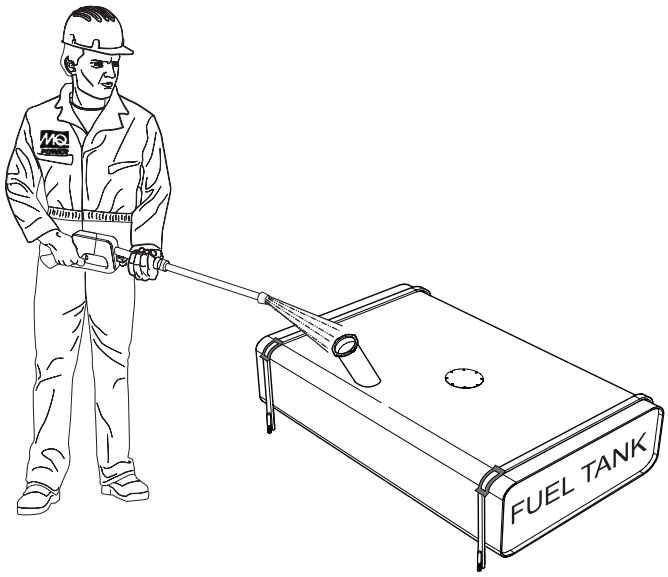


Figure 74. Cleaning The Fuel Tank

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).
2. Turn the engine **OFF**.
3. Remove the oil dipstick from its holder.
4. Remove the **oil drain cap** (Figure 75).

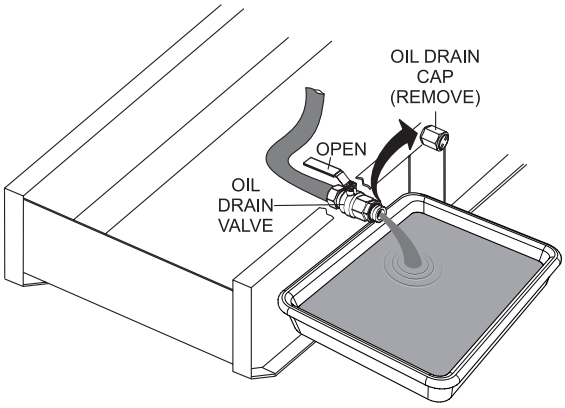


Figure 75. Draining The Engine Oil

5. Place the **oil drain valve** in the **OPEN** position (Figure 75) and allow the oil to drain into a suitable container.
6. After the engine oil has been completely drained, reinstall the oil drain cap and tighten securely.
7. Place the oil drain valve in the **CLOSED** position.

ENGINE OIL FILTER REPLACEMENT

NOTICE

Filter head appearance may vary.

1. Clean the area around the **oil filter head** (Figure 76).

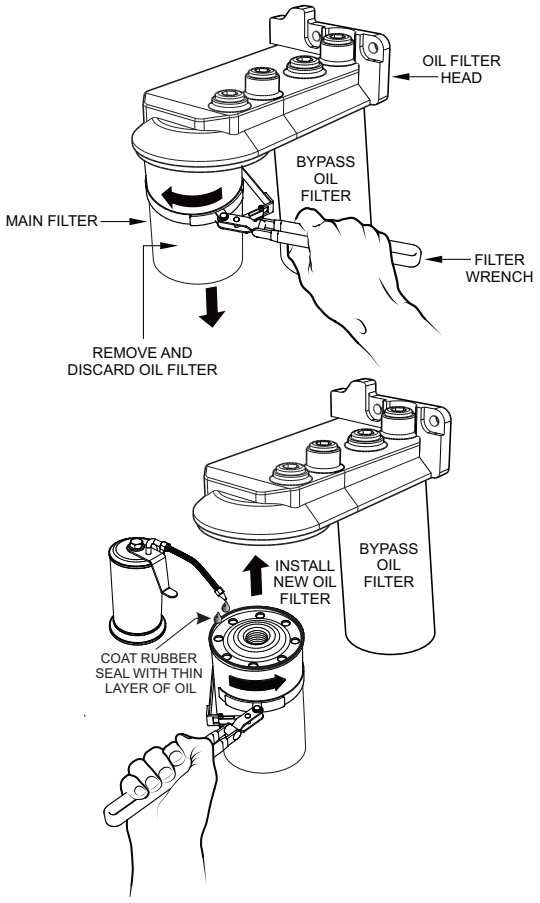


Figure 76. Engine Oil Filter Replacement

2. Using an **oil filter wrench** (Figure 76), remove the engine oil filter.
3. Coat the rubber seal (gasket) surface of the new oil filter (Figure 76) with clean 15W-40 engine oil.
4. Install the new oil filter (main) first by hand until it makes contact with the filter head surface. Tighten it another 3/4 turn using the filter wrench.
5. Fill the engine crankcase with high-quality detergent oil classified “For Service CI-4.” Fill to the upper limit of the dipstick. **DO NOT** overfill. Reference Table 2 for engine crankcase oil capacity.

6. Run the engine for several minutes. Watch for oil leakage. Shut the engine down and allow it to sit for several minutes. Top off the oil to the upper limit on the dipstick.

7. Repeat this procedure for the bypass oil filter.

DRAINING THE ENGINE COOLANT

WARNING

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

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

1. Remove the **radiator pressure cap** (Figure 77) only when the coolant temperature is below 120°F (50°C).

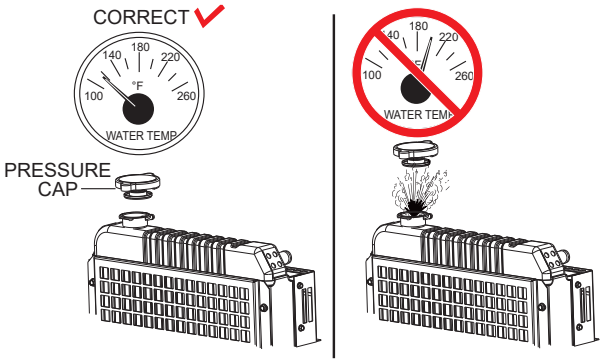


Figure 77. Radiator Pressure Cap Removal

2. Place the **coolant drain valve** in the **OPEN** position (Figure 78) and allow the coolant to drain into a suitable container.

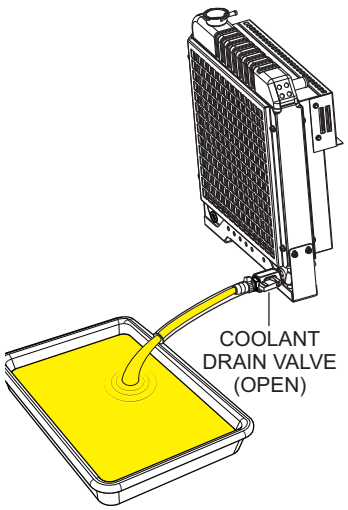


Figure 78. Draining The Engine Coolant

3. After the coolant has completely drained, place the coolant drain valve in the **CLOSED** position.

4. Reinstall the radiator pressure cap and tighten securely.

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

CLEANING THE RADIATOR

The radiator (Figure 79) should be sprayed (cleaned) with a high-pressure washer when excessive amounts of dirt and debris have accumulated on the cooling fins or tube. When using a high-pressure washer, stand at least 5 feet (1.5 meters) away from the radiator to prevent damage to the fins and tube.

NOTICE

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

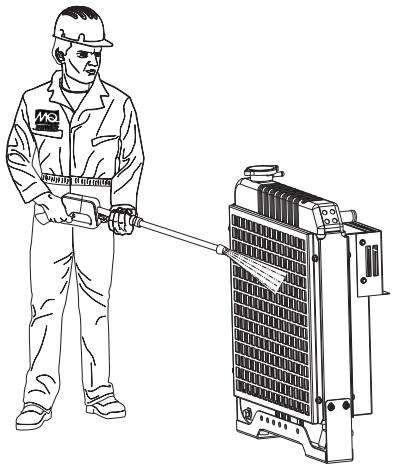


Figure 79. Cleaning The Radiator

DRIVE BELT

Drive Belt Tension

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

Drive Belt Inspection

Inspect the **drive belt** (Figure 80) for damage and wear. Horizontal cracks (across the belt) are acceptable. Vertical cracks (direction of belt ribs) that intersect with horizontal cracks are not acceptable.

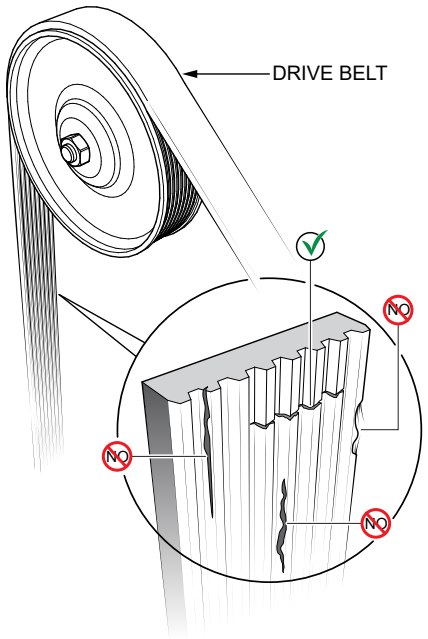


Figure 80. Drive Belt Inspection

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 danger of it breaking.

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

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 outlined in the start-up procedure in this manual.
2. Place a **GFCI circuit breaker** (Figure 81) in the **ON** position.

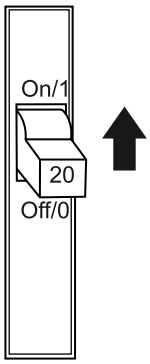


Figure 81. GFCI Circuit Breaker

3. Verify that the **status LED** on the corresponding GFCI receptacle (Figure 82) is **ON (GREEN)**.

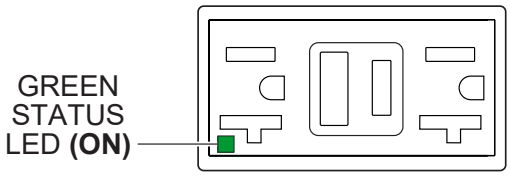


Figure 82. GFCI Receptacle (ON)

4. Press the **TEST** button (Figure 83) on the GFCI receptacle and verify that the status LED turns **OFF**.

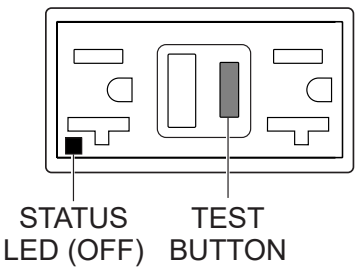


Figure 83. GFCI Receptacle (OFF)

5. Press the **RESET** button (Figure 84) to restore power to the GFCI receptacle and verify that the status LED is **ON (GREEN)**.

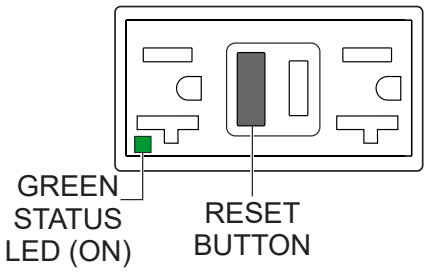


Figure 84. GFCI Receptacle (ON/Restore)

6. If the **status LED** (Figure 85) is **flashing (RED)**, **DO NOT** use the GFCI receptacle. Replace it immediately.

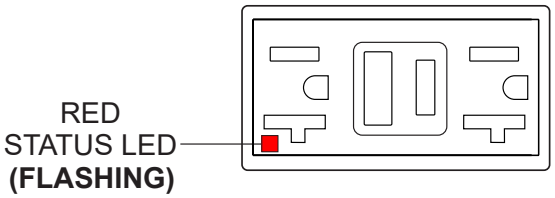


Figure 85. GFCI Receptacle (Red Flashing LED)

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

GENERATOR STORAGE

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

- 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.

ENGINE BLOCK HEATER AND INTERNAL BATTERY CHARGER 120 VAC INPUT RECEPTACLES (OPTIONAL)

This generator can be equipped as an ***option*** with an ***engine block heater*** and an ***internal battery charger***. They are provided with electric cords to connect to a commercial power source.

The engine block heater and internal battery charger both require 120 VAC in order to operate. Two power receptacles (Figure 86) 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 7 for the correct size and length.

When using the generator in **hot** climates there is no need to apply power to the engine block heater. However, if the generator will be used in **cold** climates, it is best 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, and to ensure adequate starting capability, always have power applied to the generator's internal battery charger.

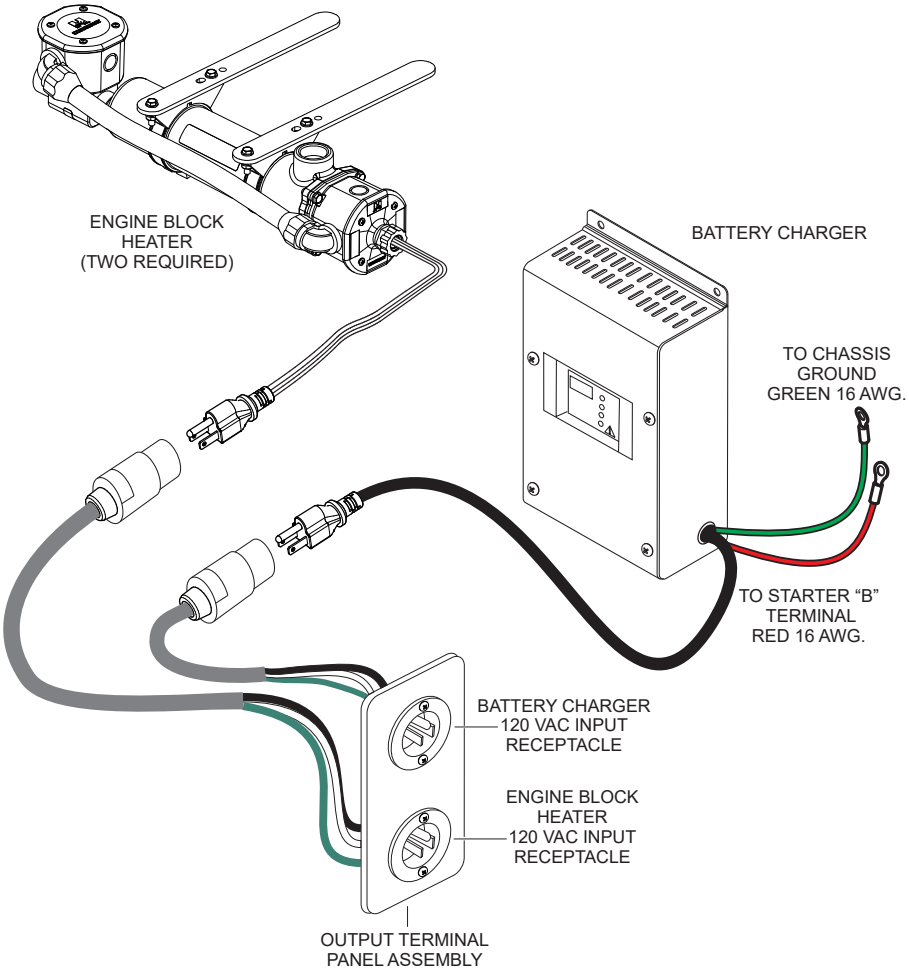


Figure 86. Engine Block Heater And Battery Charger (Options)

EMISSION CONTROL

The emission control system employed with this **ISUZU** 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 the particulate matter produced from the exhaust gas to meet the requirement for EPA Tier 4 (Final) regulations.

The DOC device (Figure 87) helps in filtering out large amounts of harmful ***Nitrogen Oxides*** (NOx) and ***Particulate Matter*** (PM) which are emitted by diesel engines. These exhaust emissions pose serious environmental and health risks. 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/burns accumulated particulates. The DOC contains palladium and platinum which serve as catalysts to oxidize hydrocarbons and carbon monoxide.

PREVENTIVE MAINTENANCE PROGRAMS

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

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

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

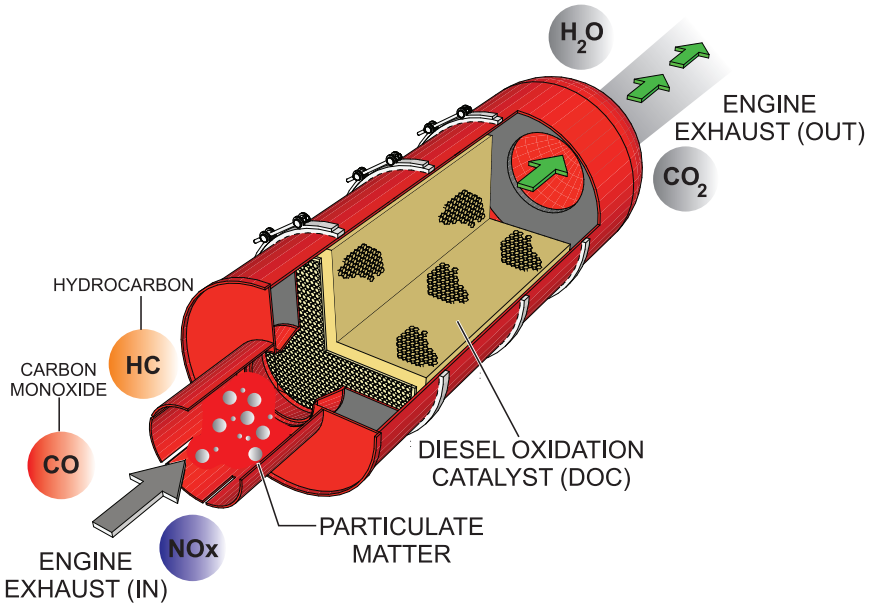


Figure 87. Diesel Oxidation Catalyst (DOC)

SELECTIVE CATALYTIC REDUCTION (SCR)

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

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

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

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

The SCR Purge symbol (Figure 88) will be displayed on the ECU controller during operation when either an ***automatic*** or ***forced*** system purge operation is in process.

The pre-alarm lamp is only **ON** during SCR forced system purging and **OFF** during automatic system purging.

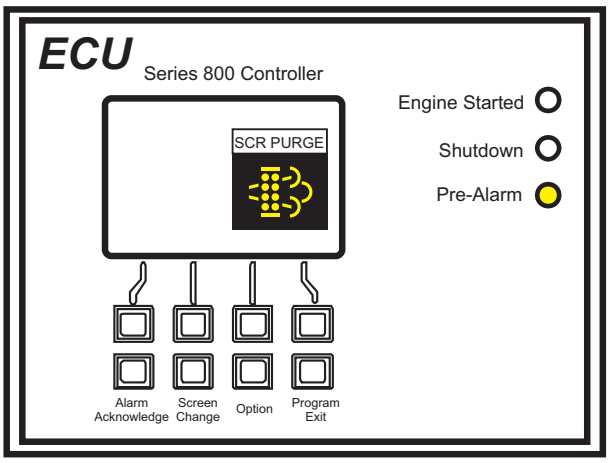


Figure 88. SCR Purge Symbol

Refer to Table 14 for digital controller messages displayed during SCR Purge operation.

Table 14. SCR Purge Controller Messages

SCR Purge Type	Automatic Purge	Forced Purge
Controller Message	SCR Purge Active	SCR Forced Purge Active
SCR Purge Indicator		
Pre-Alarm Lamp	—	

System Purging Guidelines

For the safe operation of equipment, protection of the surrounding area, and prevention of bodily harm, use the guidelines below when a purge operation is required:

- **DO NOT** perform purge operations in conditions where it may be unsafe due to high exhaust temperatures.
- **DO NOT** operate the unit in an area with poor ventilation.
- If operating the engine indoors, install exhaust/ventilation equipment and ensure that there is sufficient ventilation.
- If you begin to feel sick, stop the unit immediately and ventilate the area.
- **Remember** — Due to the emission reduction functions of the exhaust system, exhaust emissions from the tailpipe have a different smell than those emitted from engines without urea SCR systems.
- During the purge operation, the area above and around the generator should be free of any type of debris or flammable/combustible materials, as temperatures during the purge process can reach as high as 1,022°F (550°C).
- If a purge operation is performed while the unit is operating under a light load (0–30%), unusual sounds may be produced. This should not be considered a problem.
- During SCR purge operations, white smoke may be temporarily emitted from the exhaust tailpipe. This shoud not be considered a failure. In addition, the smell of ammonia during the purge process should not be considered a failure.

Automatic Purge Operation

The purging operation is automatically performed every 30 hours. The SCR Purge symbol will appear on the controller screen with the message “SCR Purge Active” while the purge operation is in progress.

Forced Purge Operation

NOTICE

Only a qualified service technician with proper training should perform a Forced Purge operation.

If the Automatic Purge operation is interrupted by an engine shutdown or otherwise cannot be completed, a Forced Purge operation must be performed by a trained service technician utilizing the Isuzu Diagnostic Service Tool (IDST).

While a Forced Purge operation is in progress, the Pre-Alarm lamp will turn **ON** (red) and the SCR Purge symbol will appear on the controller screen with the message “SCR Forced Purge Active”.

If the Forced Purge operation is interrupted by an engine shutdown, it will not be completed automatically when the engine fault is cleared and the engine is restarted. The Forced Purge operation must still be performed manually by a trained service technician using the IDST.

DIESEL EXHAUST FLUID (DEF)

If the ***diesel exhaust fluid*** (DEF) symbol (Figure 89) is displayed during ECU controller operation, it indicates the following:

- DEF tank level is below 10%. Reference Table 15, DEF Level System Action.
- DEF quality is poor. Check DEF tank level and check active ***diagnostic trouble codes*** (DTC).

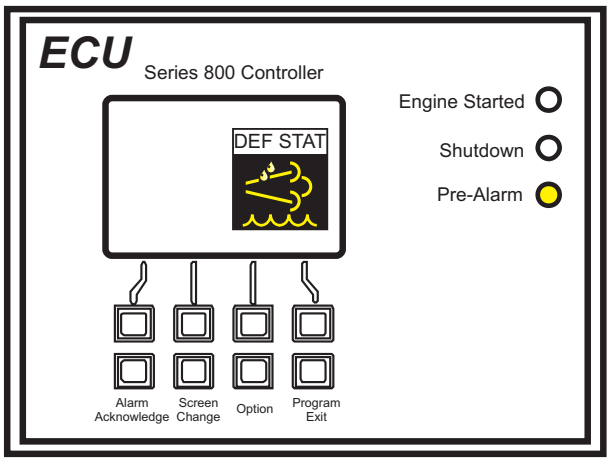


Figure 89. ECU DEF State Pre-Alarm

NOTICE

The unit will enter emergency shutdown when the DEF level has reached 0% and emergency protective measures are necessary. When this condition exists, the unit can only be restarted after ESCAPE MODE is activated and the unit will run for 30 minutes. Reference the “Escape Mode” section in this manual.

The amount of fluid in the DEF tank will be shown on the ECU Controller main screen during operation. The symbol shown in Figure 90 will be shown on the ECU monitor indicating the level of fluid in the DEF tank.

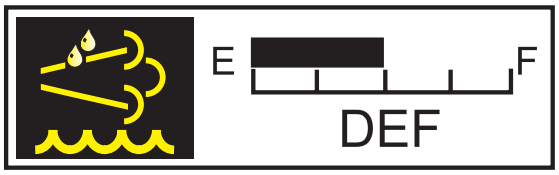


Figure 90. DEF Tank Level Gauge

Table 15. DEF Level System Action

DEF Level	Over 10%	Below 10%	Below 5%	0%
Controller Message	—	DEF TANK < 10% REFILL DEF	DEF TANK < 5% REFILL DEF	DEF TANK < 0% SD REFILL DEF
SCR System Pop-Up	—	REFILL DEF	REFILL DEF	REFILL DEF
DEF Indicator	—	ON	Slow Blinking	Fast Blinking
Pre-Alarm Lamp	—	ON	ON	ON
Shutdown Lamp	—	—	—	ON (Engine Shutdown)

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 referenced in Table 16:

NOTICE

Replace the DEF filter (located in the urea SCR system supply module) every 1,000 hours of operation. Refer to the ***Replacement of DEF Filter*** section in the Isuzu engine owner's manual.

Table 16. DEF Inducement

Stage	Controller Message	SCR System Pop-Up	DEF Indicator	Pre-Alarm Lamp	Shutdown Lamp
Stage 1 Warning Level 1	SCR SYSTEM MALFUNCTION	SCR SYS ERR		ON	—
Stage 2 Warning Level 2	SCR SYSTEM MALFUNCTION	SCR SYS ERR	 Slow Blinking	ON	—
Stage 3 Shutdown[1]	SCR SYSTEM MALFUNCTION	SCR SYS ERR	 Fast Blinking	ON	ON

[1]When emergency shutdown occurs, inspection and repair should generally be performed promptly. However, if emergency protective measures are necessary, the unit will enter **ESCAPE MODE** and may require as long as 30 minutes to restart.

HOW TO ACTIVATE ESCAPE MODE

If the ECU displays any messages referenced in Table 16, it may be necessary to restart via ESCAPE MODE.

Starting

1. Start Diagnostic Mode as referenced in the "Troubleshooting Diagnostics" section in this manual.
2. Exit the Status Check Screen by pressing the **[EXIT]** button (Figure 91).

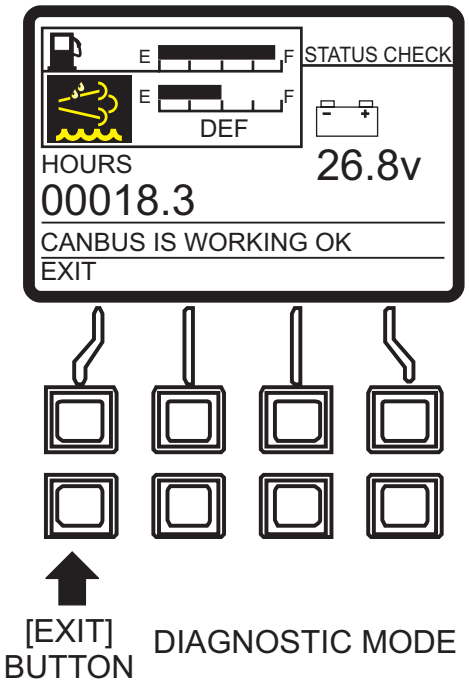


Figure 91. Status Check Screen (Diagnostic Mode)

3. Press the **[Program/Exit]** button (Figure 92) to enter the Main Menu.

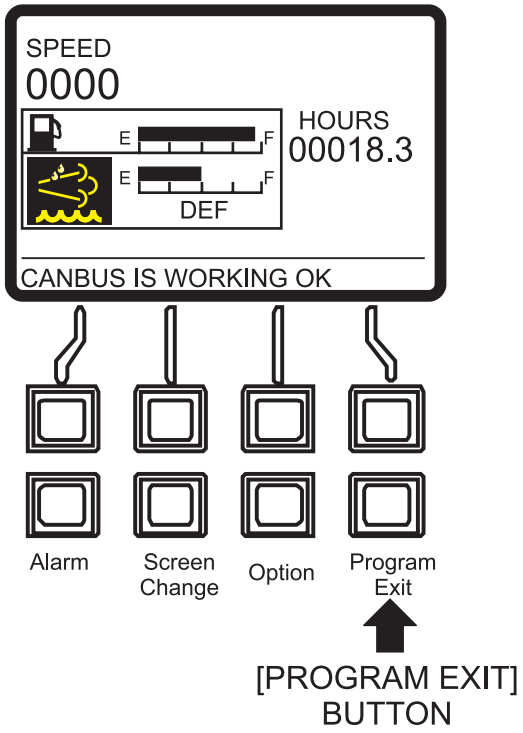


Figure 92. Main Screen

4. Press the **[DOWN]** button (Figure 93) to scroll to the Escape Mode item.

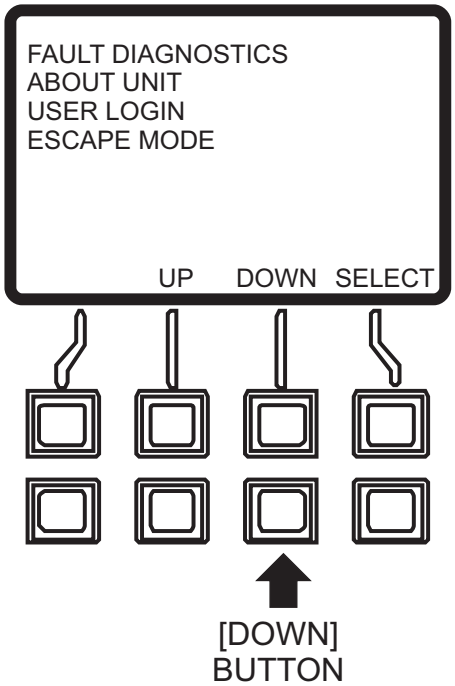


Figure 93. Main Menu (Down Button)

5. Press the **[SELECT]** button (Figure 94) to enter the "Escape Mode" menu.

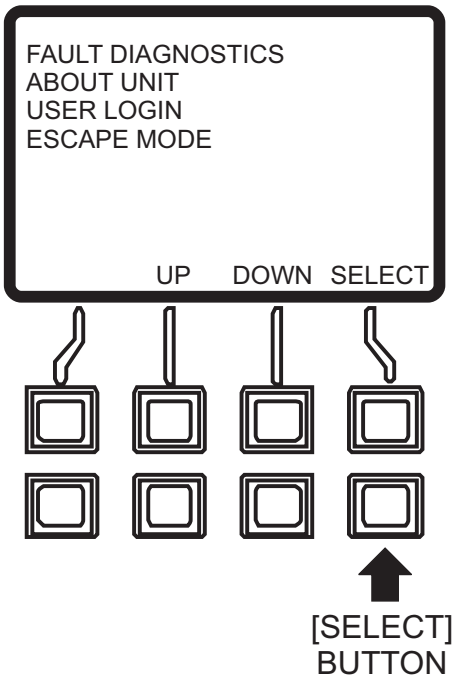


Figure 94. Main Menu (Select Button)

6. Press the **[REQUEST]** button (Figure 95) to send "Escape Mode Request" signal to ECM.

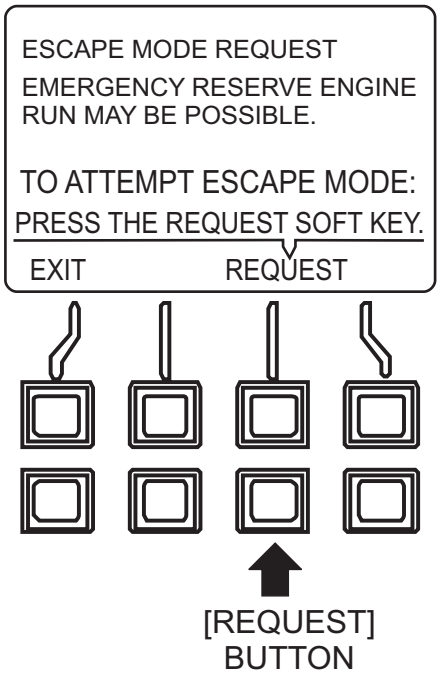


Figure 95. Escape Mode Menu Screen

7. Place the **Auto Start/Stop switch** (Figure 96) in the **OFF/RESET** position.

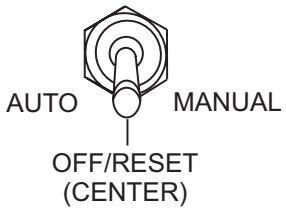


Figure 96. Auto Start/Stop Switch (Off/Reset)

8. Place the **Auto Start/Stop switch** (Figure 97) in the **MANUAL** position to start the engine.

Figure 97. Auto Start/Stop Switch (Manual)

9. The **Escape Mode timer** (Figure 98) will appear on the main screen. This timer displays the remaining Escape Mode operation time.

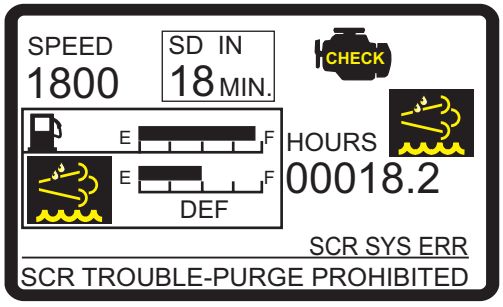


Figure 98. Escape Mode Timer

- Escape mode operation will be available until around 30 minutes after operation has been stopped. If Escape mode is temporarily suspended before the end of the 30-minute period, it is not necessary to request Escape mode again when the unit is restarted. The 30-minute countdown from before the last shutdown will resume automatically once the unit is restarted.
- Once time expires on the 30-minute Escape Mode timer, the engine will stop automatically. Please perform maintenance to return the unit to proper operating condition.
- If the unit returns to Warning Level 1 while Escape mode is running, Escape mode will be cancelled, the Escape Mode timer display will close, and normal operation will resume.

PROTECTION DEVICES

Automatic Shutdown System

This generator is equipped with safety devices to shut down the engine in the event of the following conditions:

- **Low Oil Pressure** — Engine oil pressure has fallen below 14.2 psi (98 kPa). The oil pressure is detected using variable resistive values from the oil pressure sending unit. This is considered a major fault and the engine will be shut down.
- **High Coolant Temperature** — Engine temperature has exceeded 212°F (100°C). The engine temperature is detected using variable resistive values from the temperature sending unit. This is considered a major fault and the engine will be shut down.
- **Low Coolant Level** — Engine coolant level is low. This is considered a major fault and the engine will be shut down.
- **Overspeed Shutdown** — Engine is running at an unsafe speed (+15%). This is considered a major fault and the engine will be shut down.

NOTICE

Before inspecting the cause of the engine shutdown be sure to place the Auto Start/Stop switch in the **OFF/RESET** position and also place all circuit breakers and the battery switch in the **OFF** position.

NOTICE

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

DIAGNOSTIC MODE

The engine controller of this generator diagnoses problems that may arise from the engine control system and the engine itself.

1. With the engine stopped **(OFF)**, press and hold the ***Hour Check Button*** (Figure 99) located on the control panel.

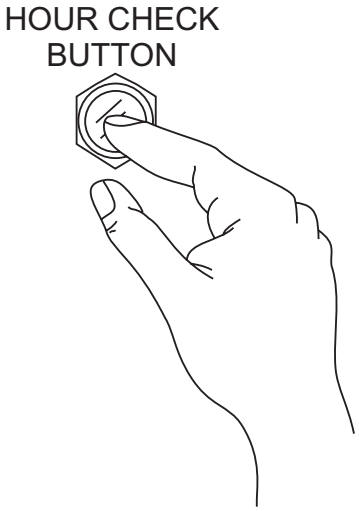


Figure 99. Hour Check Button

2. While keeping the ***Hour Check Button*** pressed, place the ***Auto Start/Stop Switch*** (Figure 100) in the **MANUAL** position.

Figure 100. Auto Start/Stop Switch (Manual Position)

3. The ***Hour Check Menu Screen*** will be displayed on the ECU controller.

4. Release the ***Hour Check button*** and press the ***Program Exit button*** on the ECU controller to return the controller to the main screen.

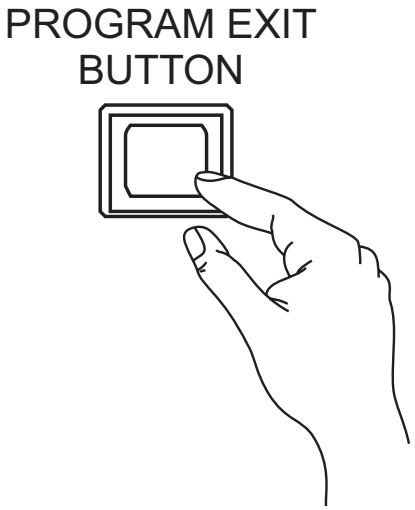


Figure 101. Program Exit Button

5. Press the ***Program/Exit Button*** on the ECU controller and select ***Fault Diagnostics*** mode. This mode enables the ability to carry out the fault diagnostics as listed below:

- **DM1 Active Faults** — Displays active fault messages and codes.
- **DM2 Messages and Codes** — Displays messages and codes which previously occurred that are recorded in the Engine Control Module (ECM).
- **Last Shutdown** — Displays the messages and codes that caused the most recent shutdown.

6. After perfoming diagnostic tests, place the ***Auto Start/Stop Switch*** in the **OFF** position.

Practically all breakdowns can be prevented by proper handling and maintenance inspections, but in the event of a breakdown, use Table 17 shown below for diagnosis of the generator. If the problem cannot be remedied, consult our company's business office or service plant.

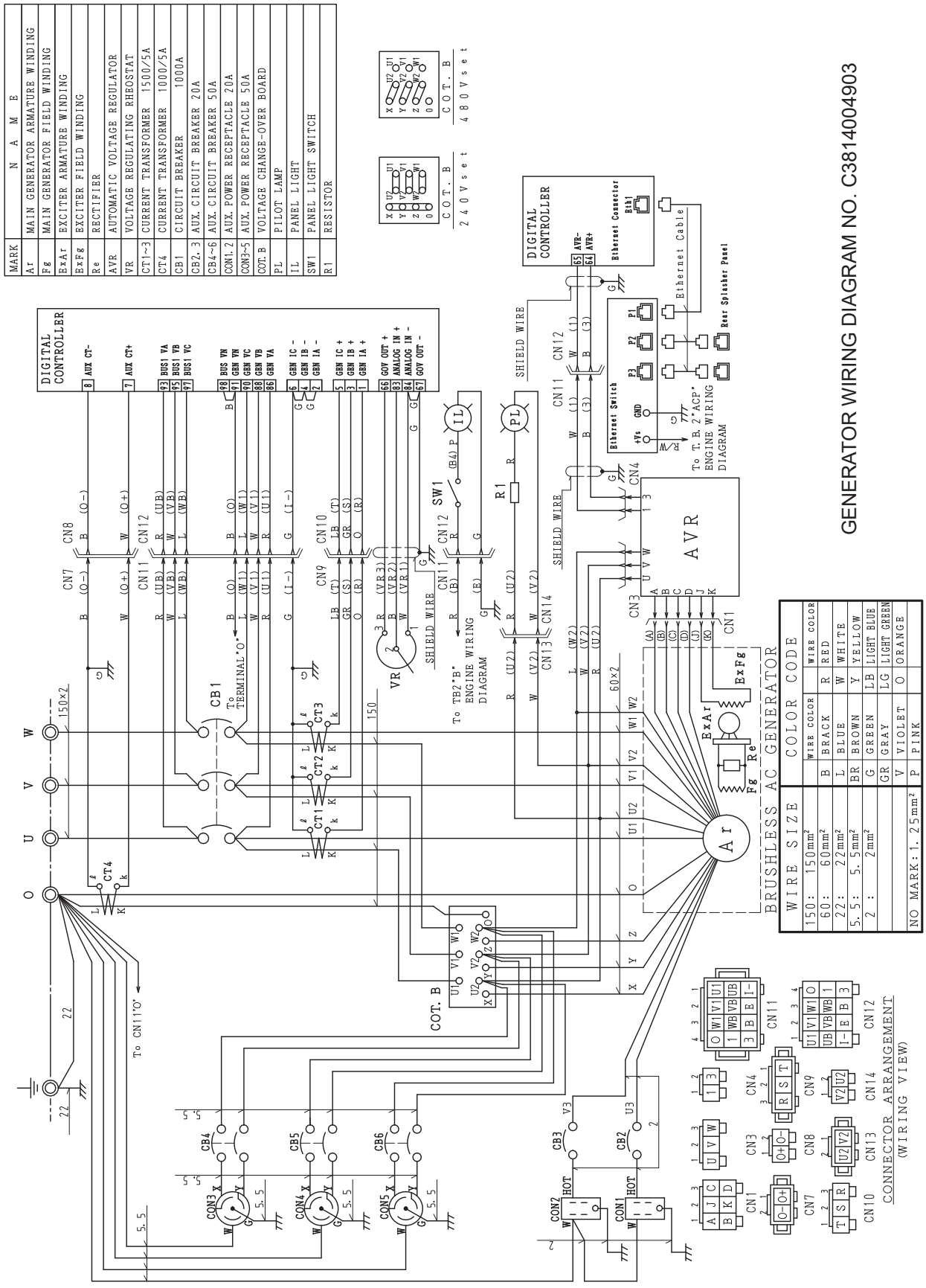
Table 17. Generator Troubleshooting

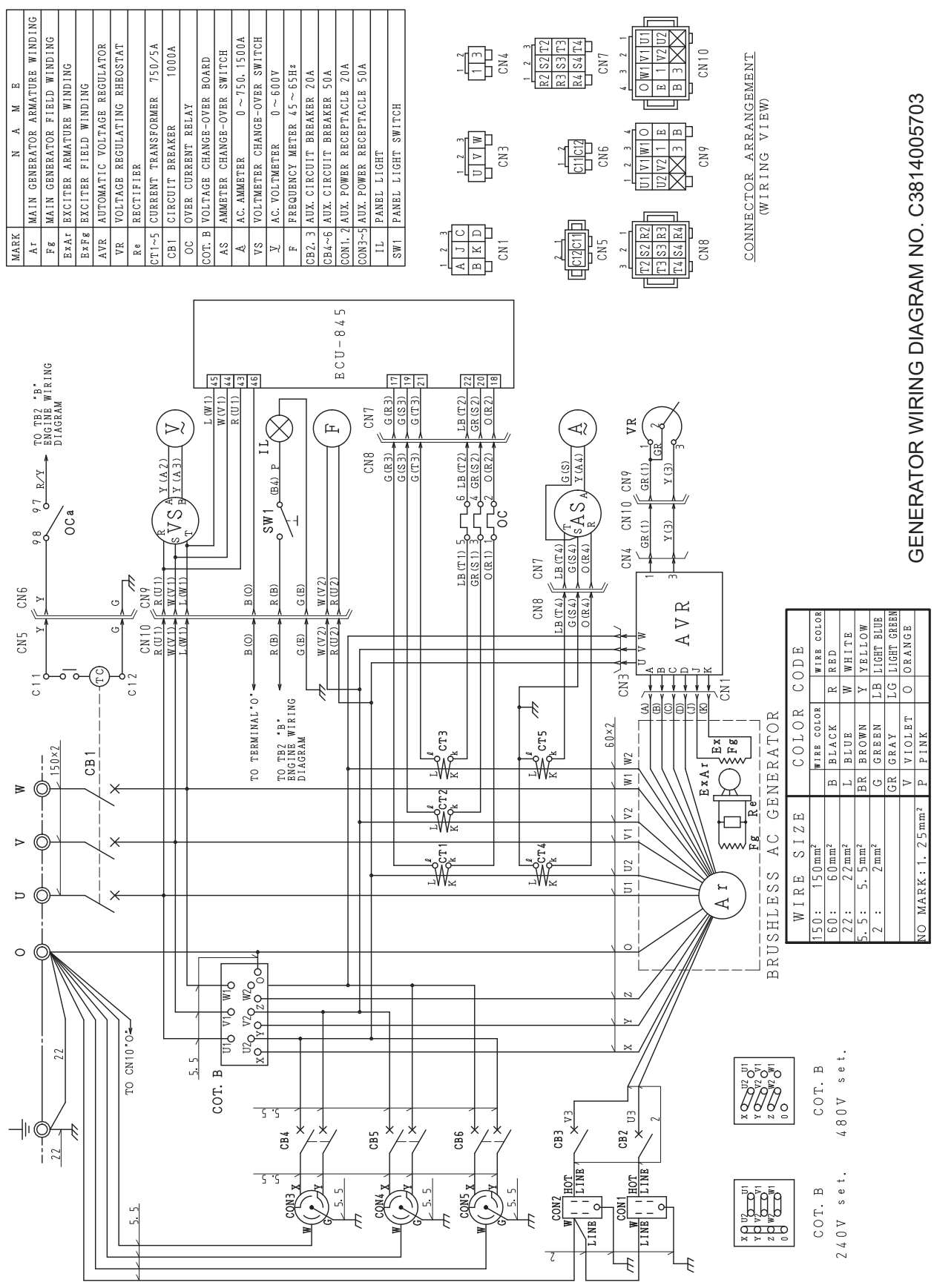
Symptom	Possible Problem	Solution
No Voltage Output	Defective AC voltmeter?	Check output voltage and replace if necessary.
	Loose wiring connections?	Check wiring and repair.
	Defective AVR?	Replace if necessary.
	Defective rotating rectifier?	Check and replace.
Low Voltage Output	Low engine speed?	Check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

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

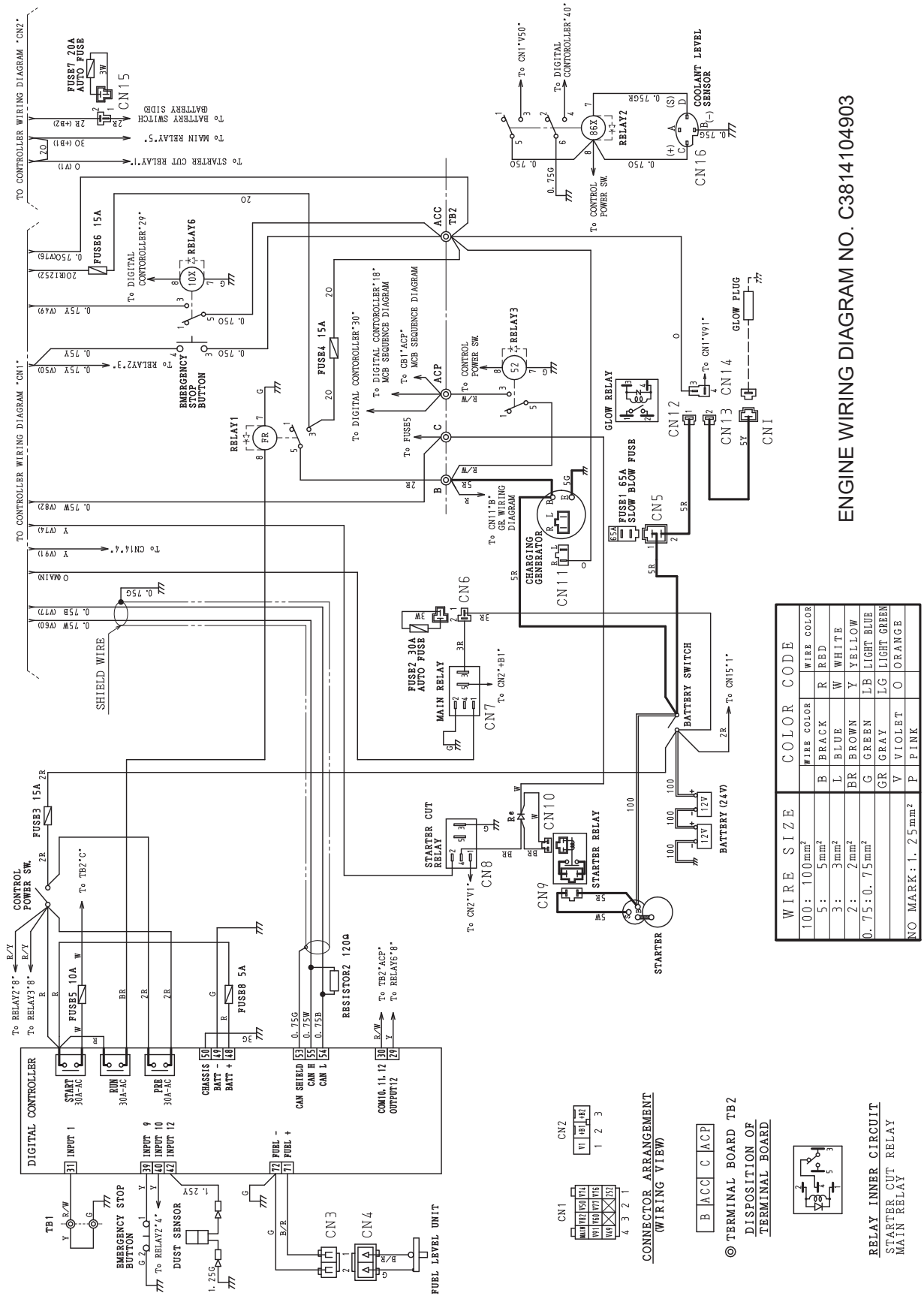
Troubleshooting (Engine) - continued		
Symptom	**Possible Problem**	**Solution**
Low engine power output and low speed, black exhaust smoke.	Air filter blocked?	Clean or replace air filter.
	Incorrect valve clearances?	Adjust valves per engine specification.
	Malfunction at injector?	See engine manual.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

GENERATOR WIRING DIAGRAM (DCA400SSI4F/C3814004903)

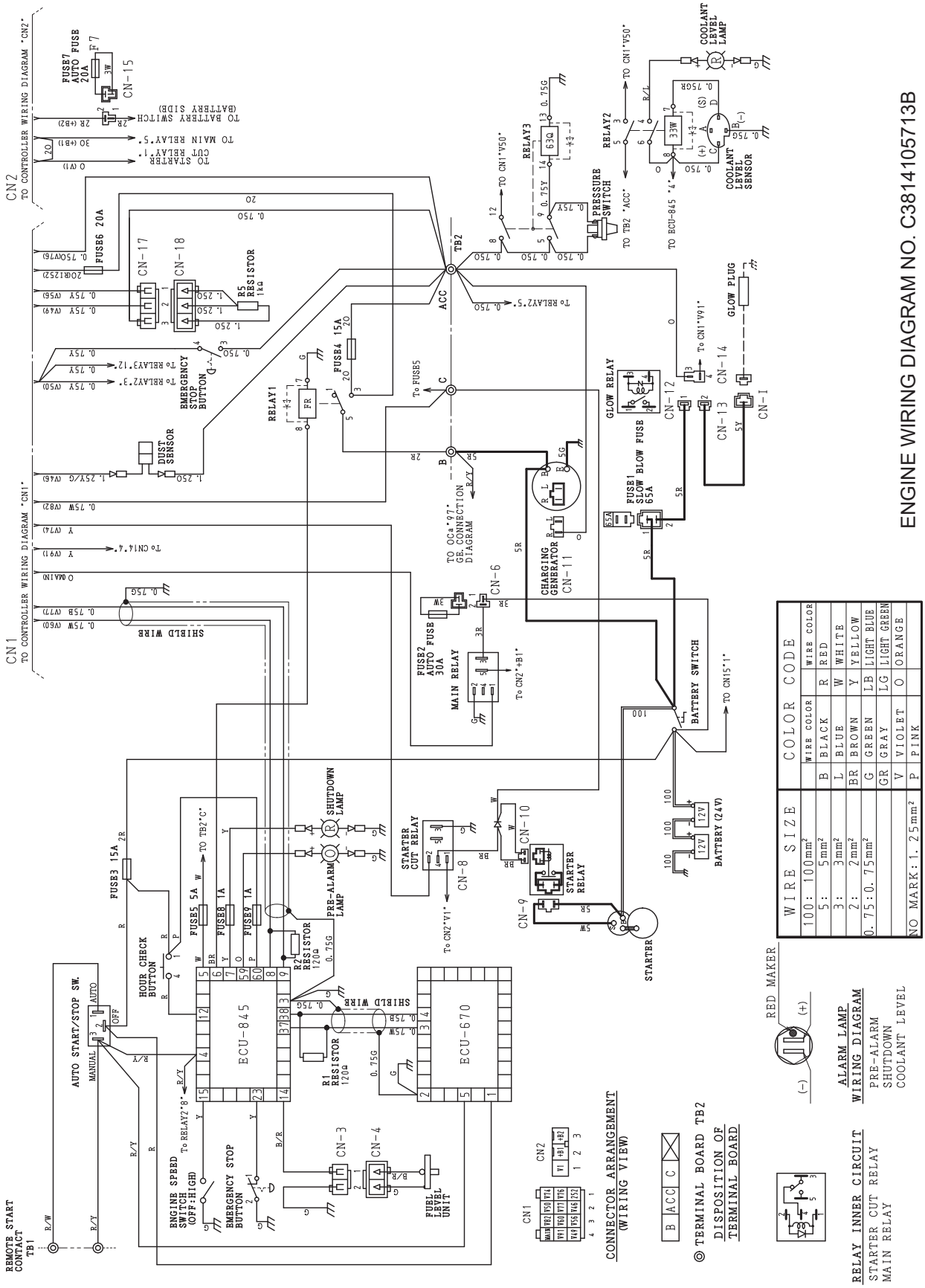



MARK
NAME
Ar MAIN GENERATOR ARMATURE WINDING
Fg MAIN GENERATOR FIELD WINDING
ExAr EXCITER ARMATURE WINDING
ExFg EXCITER FIELD WINDING
AVR AUTOMATIC VOLTAGE REGULATOR
VR VOLTAGE REGULATING RHEOSTAT
Re RECTIFIER
CT1~5 CURRENT TRANSFORMER 750/5A
CB1 CIRCUIT BREAKER 1000A
OC OVER CURRENT RELAY
COT. B VOLTAGE CHANGE-OVER BOARD
AS AMMETER CHANGE-OVER SWITCH
A AC. AMMETER 0~750, 1500A
VS VOLTMETER CHANGE-OVER SWITCH
V AC. VOLTMETER 0~600V
F FREQUENCY METER 45~65Hz
CB2, 3 AUX. CIRCUIT BREAKER 20A
CB4~6 AUX. CIRCUIT BREAKER 50A
CON1, 2 AUX. POWER RECEPTACLE 20A
CON3~5 AUX. POWER RECEPTACLE 50A
IL PANEL LIGHT
SW1 PANEL LIGHT SWITCH
CONNECTOR ARRANGEMENT
(WIRING VIEW)
ECU-845
AVR
BRUSHLESS AC GENERATOR
TO TB2 "B" ENGINE WIRING DIAGRAM
TO TERMINAL "O"
TO CN10 "O"
COT. B
240V set.
480V set.
WIRE SIZE
150: 150mm²
60: 60mm²
22: 22mm²
5.5: 5.5mm²
2: 2mm²
COLOR CODE
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
NO MARK: 1.25mm²
GENERATOR WIRING DIAGRAM NO. C3814005703

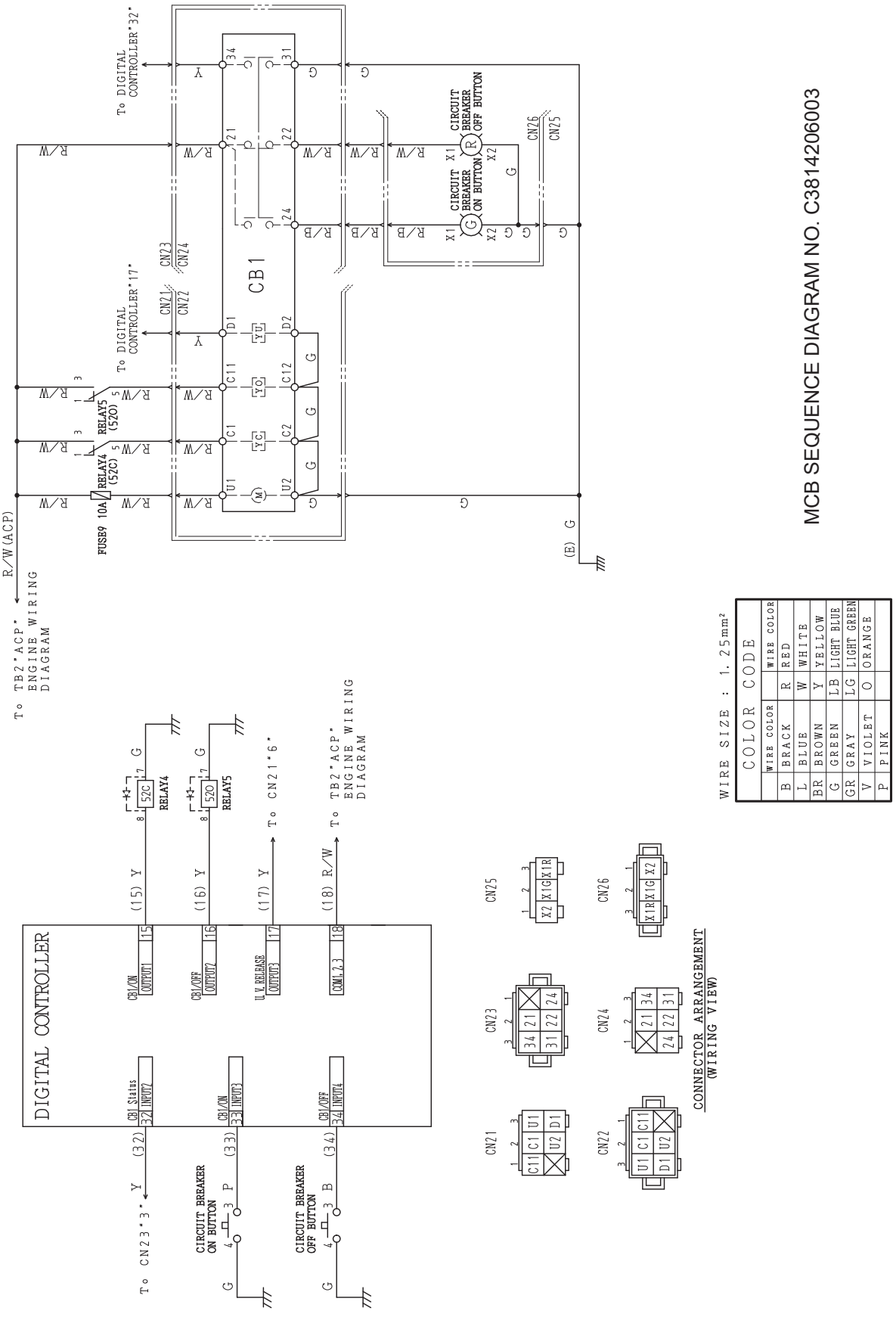
ENGINE WIRING DIAGRAM (DCA400SSI4F/C3814104903)



ENGINE WIRING DIAGRAM (DCA400SSI4F3/C3814105713B)



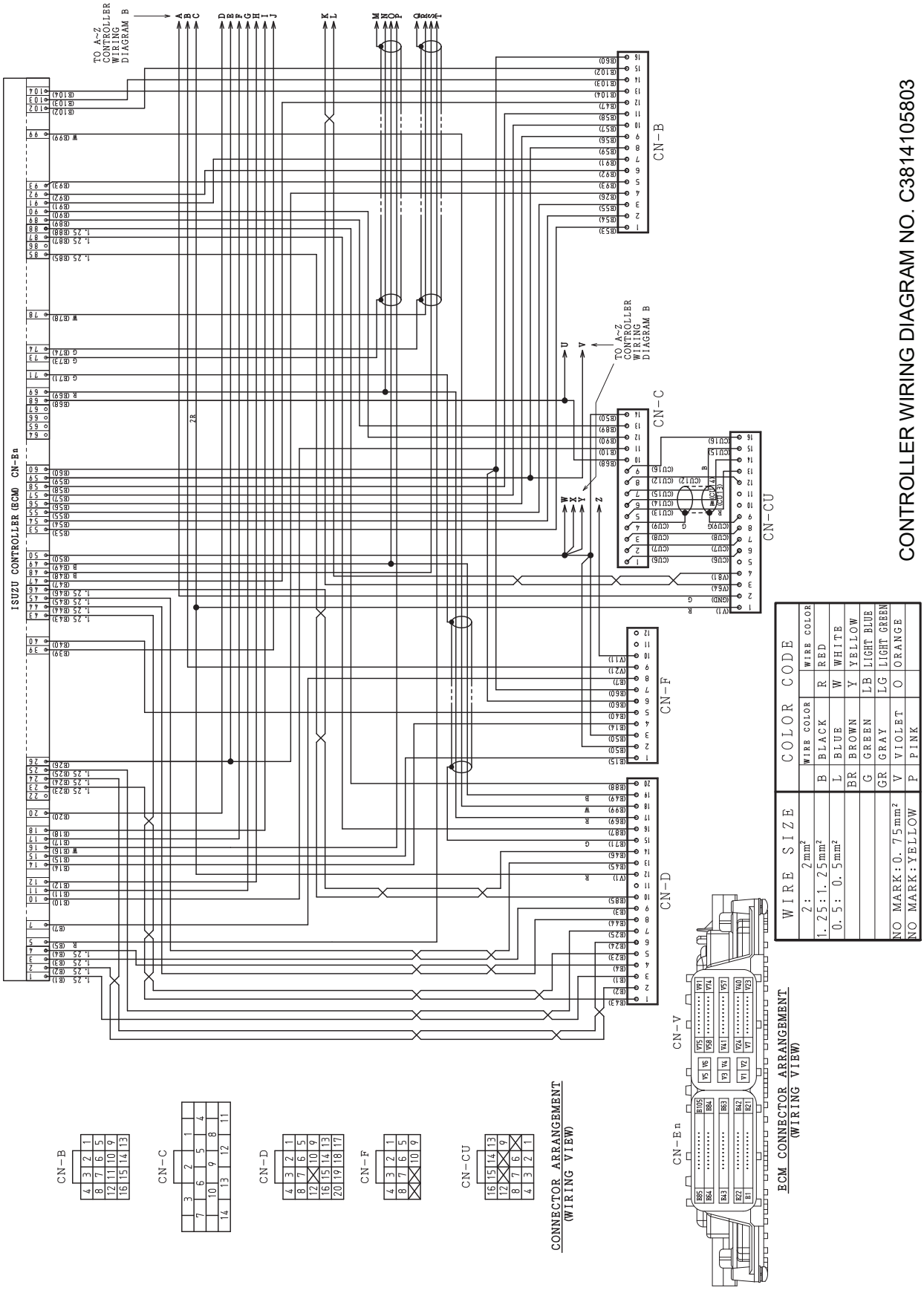
MCB SEQUENCE DIAGRAM (DCA400SSI4F/C3814206003)



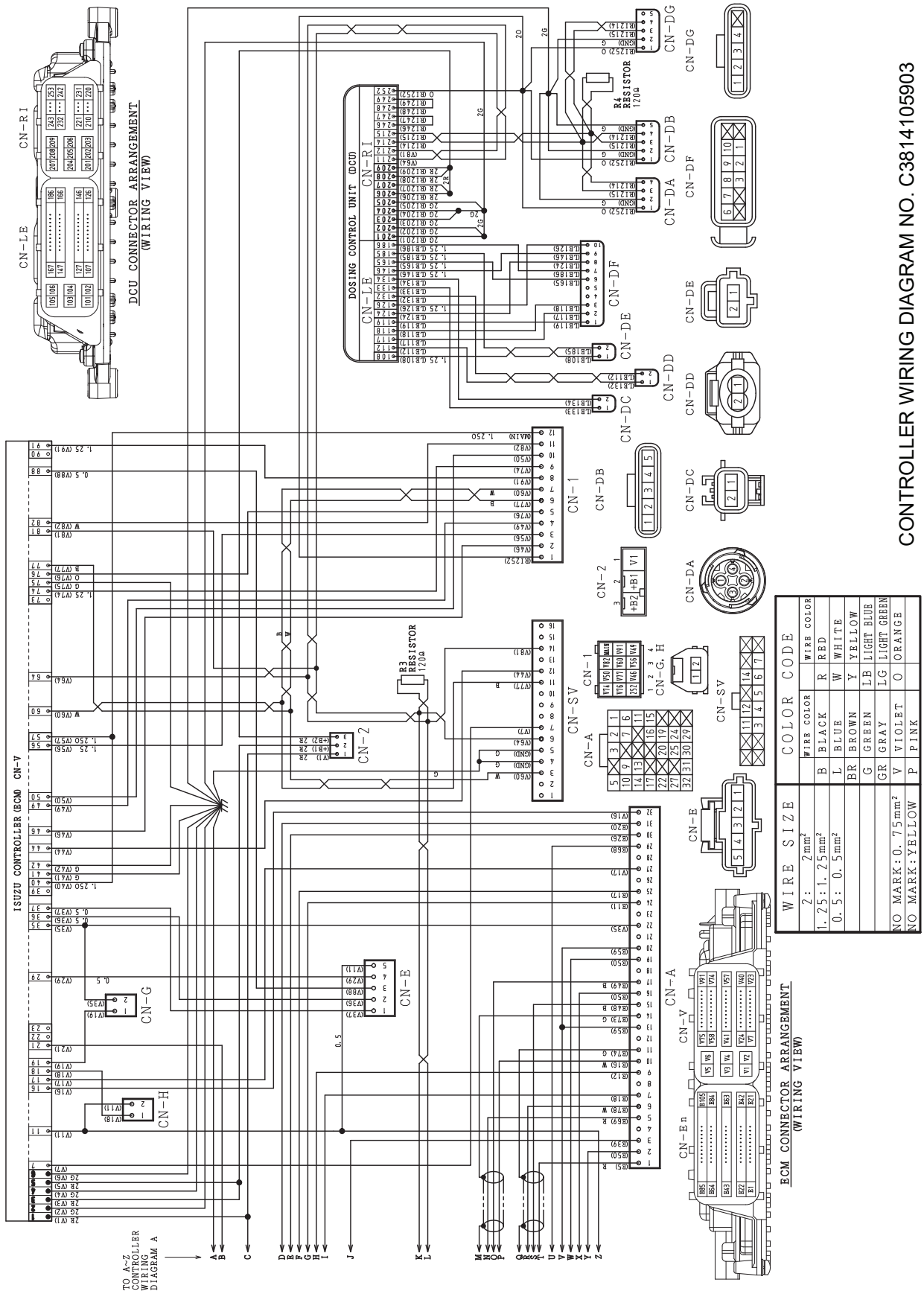
MCB SEQUENCE DIAGRAM NO. C3814206003

WIRE SIZE : 1.25mm²

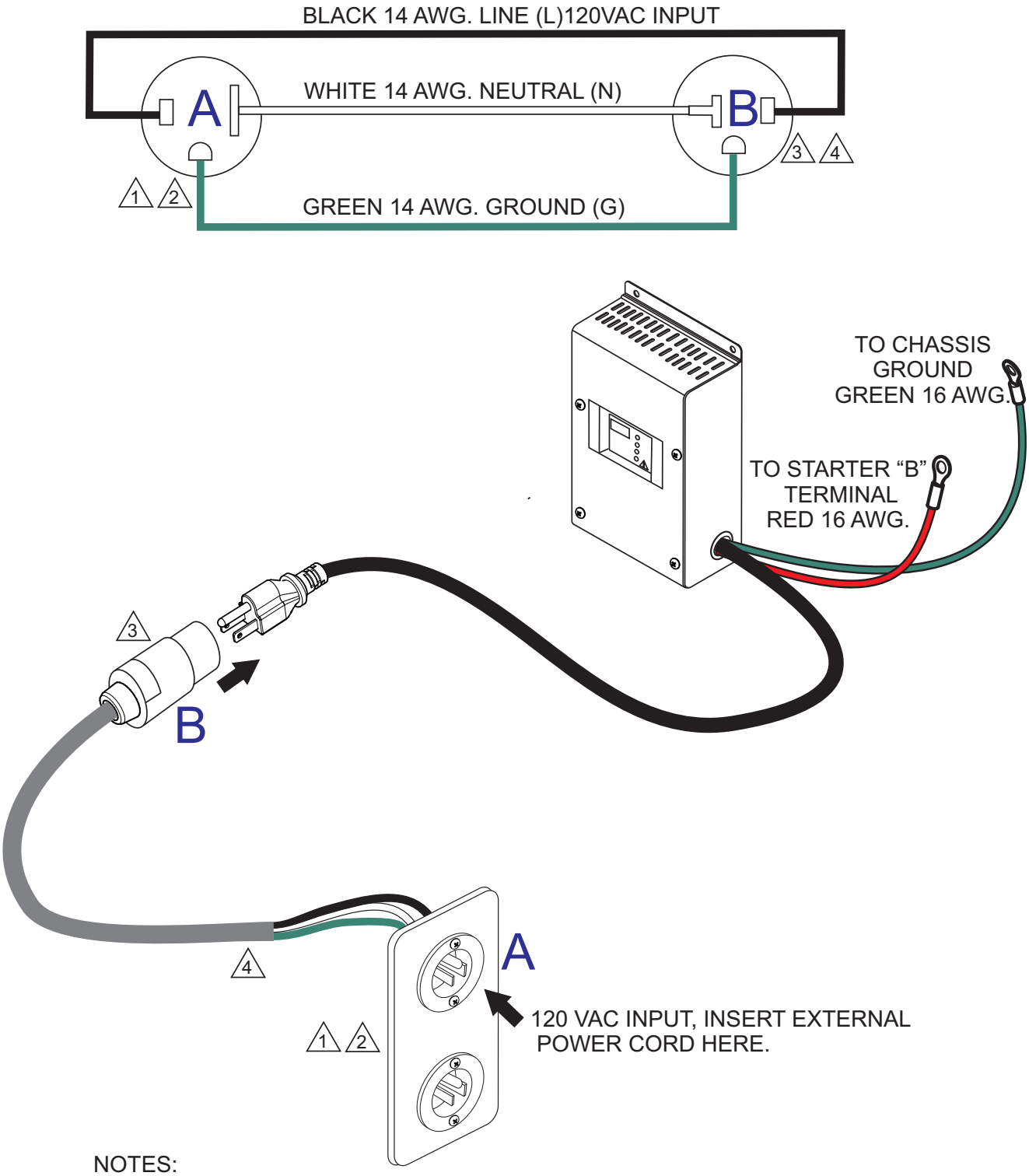
COLOR CODE			
	WIRE COLOR		WIRE COLOR
B	BRACK	R	RED
L	BLUE	W	WHITE
BR	BROWN	Y	YELLOW
G	GREEN	LB	LIGHT BLUE
GR	GRAY	LG	LIGHT GREEN
V	VIOLET	O	ORANGE
P	PINK		


CONTROLLER WIRING DIAGRAM NO. C3814105803
ISUZU CONTROLLER (ECM) CN-En
TO A~Z CONTROLLER WIRING DIAGRAM B
CN-B
CN-C
CN-CU
CN-D
CN-F
CN-V
CN-En
CONNECTOR ARRANGEMENT (WIRING VIEW)
ECM CONNECTOR ARRANGEMENT (WIRING VIEW)
WIRE SIZE
2: 2mm²
1.25: 1.25mm²
0.5: 0.5mm²
NO MARK: 0.75mm²
NO MARK: YELLOW
COLOR CODE
B BLACK
L BLUE
BR BROWN
G GREEN
GR GRAY
V VIOLET
P PINK
R RED
W WHITE
Y YELLOW
LB LIGHT BLUE
LG LIGHT GREEN
O ORANGE
WIRE COLOR

CONTROLLER WIRING DIAGRAM (B) (C3814105903)



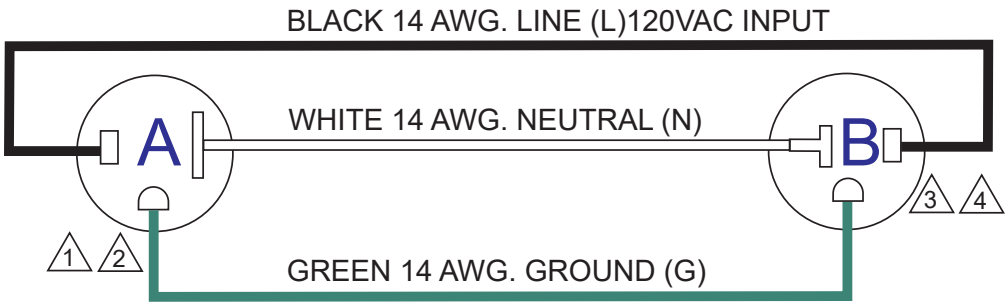
BATTERY CHARGER WIRING DIAGRAM (OPTION)

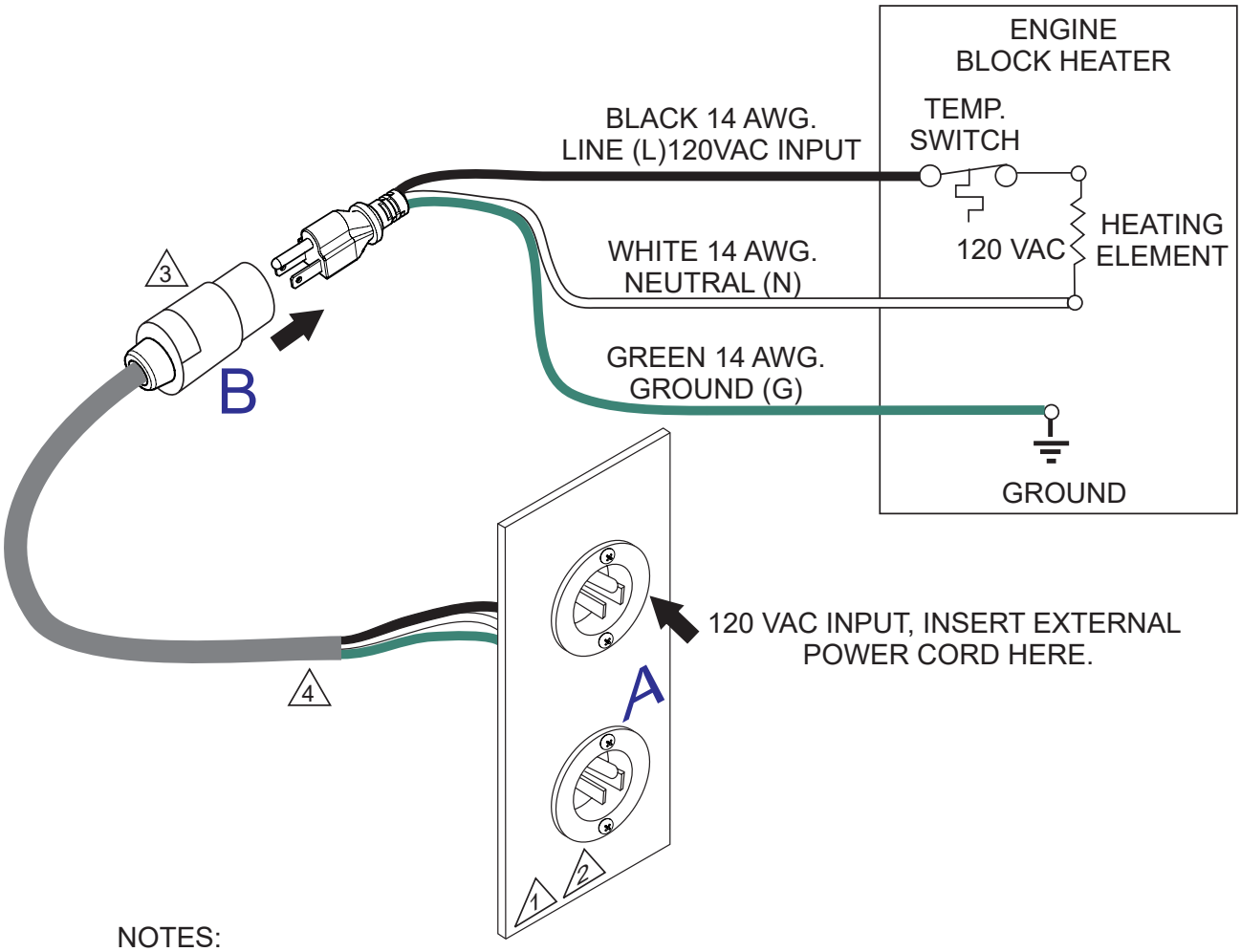


NOTES:

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.

ENGINE BLOCK HEATER WIRING DIAGRAM (OPTION)





NOTES:

1. NEMA 5-15, 15A, 120 VAC, P/N HBL5278C/HUBBLE RECEPTACLE.
2. RECEPTACLE IS MOUNTED ON OUTPUT TERMINAL PANEL ASSY.
3. 20 AMP, 5-20R RECEPTACLE, P/N 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.

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6141 Katella Avenue Suite 200
Cypress, CA 90630
E-MAIL: mq@multiquip.com
WEBSITE: www.multiquip.com

CANADA

Multiquip

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

UNITED KINGDOM

Multiquip (UK) Limited Head Office

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

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

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