

OPERATION MANUAL



WHISPERWATT™ SERIES MODEL DCA70SSIU4F 60Hz GENERATOR (ISUZU BR-4JJ1X DIESEL ENGINE)

Revision #2 (01/16/18)

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publication, visit our website at:
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THIS MANUAL MUST ACCOMPANY THE EQUIPMENT AT ALL TIMES.



CALIFORNIA — Proposition 65 Warning

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

DCA70SSIU4F 60 Hz Generator

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NOTICE

Specifications are subject to change without notice.

NAMEPLATE/SAFETY INFORMATION

WARNING
MOVING PARTS can cause severe injury.
•DO NOT operate with doors open.
•Stop engine before servicing.

WARNING
HOT COOLANT can cause severe burns.
•Do not remove cap if radiator is hot.

CAUTION
Maximum capacity of lifting ball is 6,960 lbs.

CAUTION
Stop engine before switching.

WARNING
ELECTRIC SHOCK HAZARD
•Do not touch internal wiring or connections while this machine is operating.
• Turn power off before servicing.

FAN SHROUD

TOP VIEW

WARNING
ARC FLASH AND SHOCK HAZARD
Appropriate PPE Required
•Appropriate Personal Protection Equipment and Tools Required when working on this equipment.

WARNING
ENVIRONMENTAL
This unit is designed to operate safely both only the equipment components, it will depend on correct facts for under load capacity. In the center of control facts for under load capacity.
DO NOT EXCEED THE RECOMMENDED MAXIMUM CAPACITY.

FRONT VIEW

WARNING
Operation of this equipment 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
DO NOT disconnect the Battery Cables after shutting down the engine for at least 2-3 minutes

DANGER
Using a generator indoors CAN KILL YOU IN MINUTES.
Generator exhaust contains carbon monoxide. This is a poison gas you cannot see or smell.
NEVER use inside a home or garage. Even if doors and windows are open.
ONLY use OUTSIDE and far away from windows, doors, and vents.
Avoid other generator hazards. READ MANUAL BEFORE USE.

WARNING
ELECTRIC SHOCK HAZARD
•Do not touch internal wiring or connections while this machine is operating.
• Turn power off before servicing.

SAFETY INSTRUCTIONS
• Never operation of this machine can cause severe injury or death.
• Read the instruction manual carefully before operation or servicing.
This machine should only be operated by a person with sufficient knowledge and skill to make safe operation.
High voltage circuits are located inside the output terminal cover and control panel.
• Close the cover and control panel before operating.
Moving parts and hot surfaces are contained within the enclosure.
• Close all doors and lock them before operating.

WARNING
ENGINE EXHAUST can cause severe injury or death.
•Use only in open, well ventilated areas or vent exhaust outside.

CAUTION
This machine stops and starts automatically and without notice.

CAUTION
HOT PARTS can burn skin.
•DO NOT touch until the machine has sufficiently cooled.

WARNING
ELECTRIC SHOCK HAZARD
•Do not touch output terminals while this machine is operating.
• Turn power off before servicing.

WARNING
ELECTRIC SHOCK HAZARD
Always complete the grounding path from the ground terminal on the generator to an external grounding source.
See instruction manual for details.

WARNING
Before connecting this generator to any building's electrical system, a licensed electrician must install an isolation (transfer) switch.
Serious injury or death may result without this transfer switch.

DANGER
HIGH VOLTAGE

CAUTION
Ensure the "Auto-Off/Reset-Manual" switch is in the "Off/Reset" position. If it is not, when the battery cables are connected, the engine will crank and attempt to start.

SIDE VIEW

SIDE VIEW


SAFETY INFORMATION

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


SAFETY MESSAGES

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


SAFETY SYMBOLS

 **DANGER**

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

 **WARNING**

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








 **CAUTION**

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

NOTICE

Addresses practices not related to personal injury.

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

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

SAFETY INFORMATION

GENERAL SAFETY

CAUTION

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



- **NEVER** operate this generator when not feeling well due to fatigue, illness or when under medication.
- **NEVER** operate this generator under the influence of drugs or alcohol.



- **ALWAYS** check the generator for loosened threads or bolts before starting.
- **DO NOT** 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 read.
- Manufacturer does not assume responsibility for any accident due to generator modifications. Unauthorized generator modification 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 user may result.

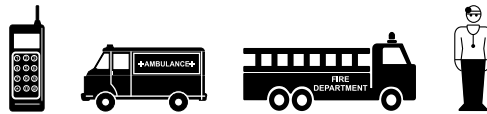
- **ALWAYS** know the location of the nearest **fire extinguisher**.



- **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 machine.

NOTICE

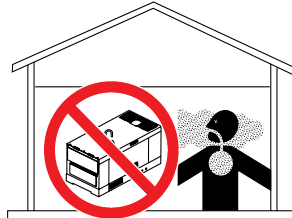
- **ALWAYS** ensure generator is on level ground before use.
- **ALWAYS** keep the generator in proper running condition.
- Fix damage to generator and replace any broken parts immediately.
- **ALWAYS** store generator properly when it is not being used. Generator should be stored in a clean, dry location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

SAFETY INFORMATION

ENGINE SAFETY

DANGER

- The engine fuel exhaust gases contain poisonous carbon monoxide. This gas is colorless and odorless, and can cause death if inhaled.
- The engine in this generator requires an adequate free flow of cooling air. **NEVER** operate this generator 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 generator or engine.



WARNING

- **DO NOT** place hands or fingers inside engine compartment when 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.
- **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** remove the engine oil drain plug while the engine is hot. Hot oil will gush out of the oil tank and severely scald any persons in the general area of the generator.



CAUTION

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



NOTICE

- **NEVER** run engine without an air filter or with a dirty air filter. Severe engine damage may occur. Service 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 40% 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.

- State Health Safety Codes and Public Resources Codes specify that in certain locations, spark arresters must be used on internal combustion engines that use hydrocarbon fuels. A spark arrester is a device designed to prevent accidental discharge of sparks or flames from the engine exhaust. Spark arresters are qualified and rated by the United States Forest Service for this purpose. In order to comply with local laws regarding spark arresters, consult the engine distributor or the local Health and Safety Administrator.

SAFETY INFORMATION

FUEL SAFETY

DANGER

- **DO NOT** 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.
- **DO NOT** fill the fuel tank while the engine is running or hot.
- **DO NOT** overfill tank, since spilled fuel could 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.
- **DO NOT** smoke around or near the generator. Fire or explosion could result from fuel vapors or if fuel is spilled on a hot engine.



ELECTRICAL SAFETY

DANGER

- **DO NOT** touch output terminals during operation. Contact with 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 generator and all circuit breakers **OFF** before performing maintenance on the generator or making contact with 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**.



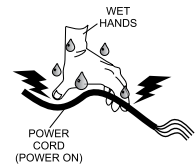
- Backfeed to a utility system can cause **electrocution** and/or property damage. **NEVER** connect the generator to a building's electrical system without a transfer switch or other approved device. All installations should be performed by a **licensed electrician** in accordance with all applicable 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 generator to generator. Inspect for cuts in the insulation.
- **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 proper power or extension cord has been selected for the job. See Cable Selection Chart in this manual.

SAFETY INFORMATION

Grounding Safety

DANGER

- This generator is equipped with a grounding terminal attached to the enclosure. Electrical grounding requirements can differ by State, Province, District, Municipality, and unique application settings.
- For portable and vehicle-mounted generators, Multiquip recognizes the guidance provided in NEC Handbook Article 250.34 Parts A and B, and 29 CFR 1926.404 (f) (3) (i). If a more definitive earth-to-ground safeguard is required, please consult a qualified electrician and reference appropriate National Electrical Code (NEC) guidelines in establishing an exterior grounding point generator.
- **NEVER** use gas piping as an electrical ground.

NOTICE

- There is a permanent conductor **bond** between generator (stator winding) and the frame.


BATTERY SAFETY

DANGER

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

SAFETY INFORMATION

ENVIRONMENTAL SAFETY/DECOMMISSIONING

NOTICE

Decommissioning is a controlled process used to safely retire a piece of generator that is no longer serviceable. If the generator 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 rules below.

- **DO NOT** 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 generator.
- When the life cycle of this generator is over, remove battery(s) and bring to an appropriate facility for lead reclamation. Use safety precautions when handling batteries that contain sulfuric acid.
- When the life cycle of this generator is over, it is recommended that the generator 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 generator 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 generator or create an unsafe condition.

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

Emission Control Label

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

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

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

SPECIFICATIONS

Table 1. Generator Specifications

Model	DCA70SSIU4F	
Type	Revolving field, self ventilated, open protected type synchronous generator	
Armature Connection	Star with Neutral	Zigzag
Phase	3Ø	3Ø
Standby Output	62 kW (77 kVA)	44 kW
Prime Output	56 kW (70 kVA)	40 kW
3Ø Voltage (L-L/L-N) Voltage Selector Switch at 3Ø 240/139	208Y/120, 220Y/127, 240Y/139	N/A
3Ø Voltage (L-L/L-N) Voltage Selector Switch at 3Ø 480/277	416Y/240, 440Y/254, 480Y/277	N/A
1Ø Voltage (L-L/L-N) Voltage Selector Switch at 1Ø 240/120	N/A	240/120
Power Factor	0.8	1.0
Frequency	60 Hz	
Speed	1800 rpm	
Aux. AC Power	Single Phase, 60 Hz	
Aux. Voltage/Output	4.8 Kw (2.4 kW x 2)	
Dry Weight	3,329 lbs. (1,510 kg)	
Wet Weight	4,211 lbs. (1,910 kg)	

Table 2. Engine Specifications

Model	Isuzu BR-4JJ1X Final Tier 4	
Type	Water-cooled, direct injection, turbo-charged charged air cooled, DOC and SCR	
No. of Cylinders	4 cylinders	
Bore x Stroke	3.76 in. x 4.13 in. (95.4 mm x 104.9 mm)	
Displacement	183 cu. in. (3.0 liter)	
Rated Output	86.5 HP at 1800 rpm	
Starting	Electric	
Coolant Capacity	5.5 gal. (21.0 liters) ¹	
Lube Oil Capacity	3.9 gal. (15 liters) ²	
Lubricating Type Oil	API service class CJ-4 SAE 15W-40	
Fuel Type	#2 Diesel Fuel (Ultra Low Sulfur Diesel Fuel Only)	
Fuel Tank Capacity	103 gal. (390 liters)	
DEF Tank Capacity	7.4 gal. (28 liters)	
Fuel Consumption	4.4 gal. (16.6 L)/hr at full load	3.5 gal. (13.4 L)/hr at 3/4 load
	2.6 gal. (9.8 L)/hr at 1/2 load	1.7 gal. (6.4 L)/hr at 1/4 load
Battery	27D (CCA 0°F 800A) X 1	

¹ Includes engine and radiator hoses

² Includes filters

DIMENSIONS

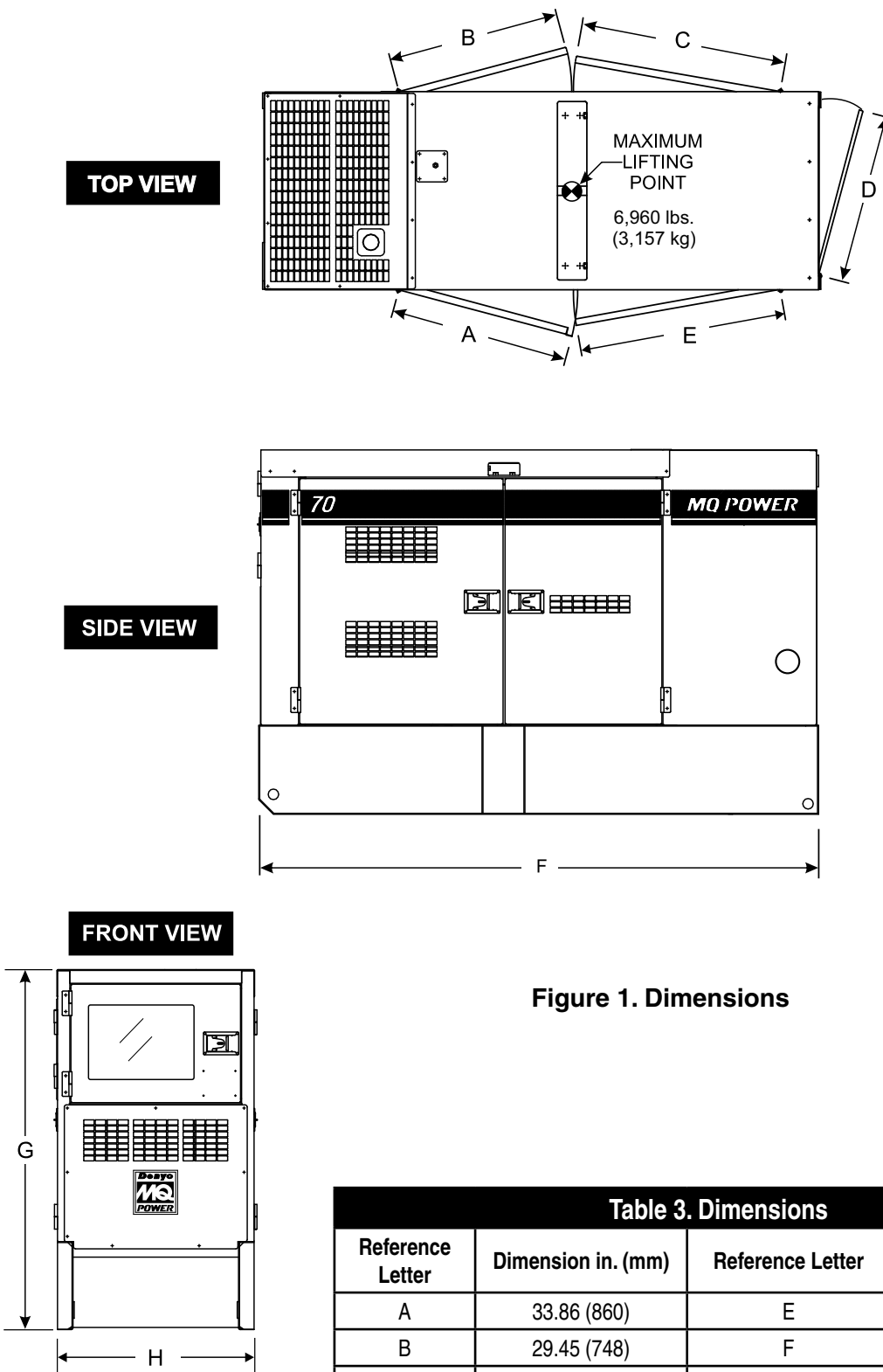


Figure 1. Dimensions

Table 3. Dimensions

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

INSTALLATION

CONNECTING THE GROUND

Consult with local Electrical and Safety Codes for proper connection based on condition of use.

EXAMPLE of how to ground the unit if the condition of use requires such a device:

The ground terminal on the generator should always be used to connect the generator to a suitable ground when required.

The ground cable should be #8 size wire (aluminum) minimum. If copper wire is used, #10 size wire minimum should be used.

Connect one end of the ground cable terminal to the generator ground point (Figure 2). Connect the other end of the ground cable to a suitable earth ground (ground rod).

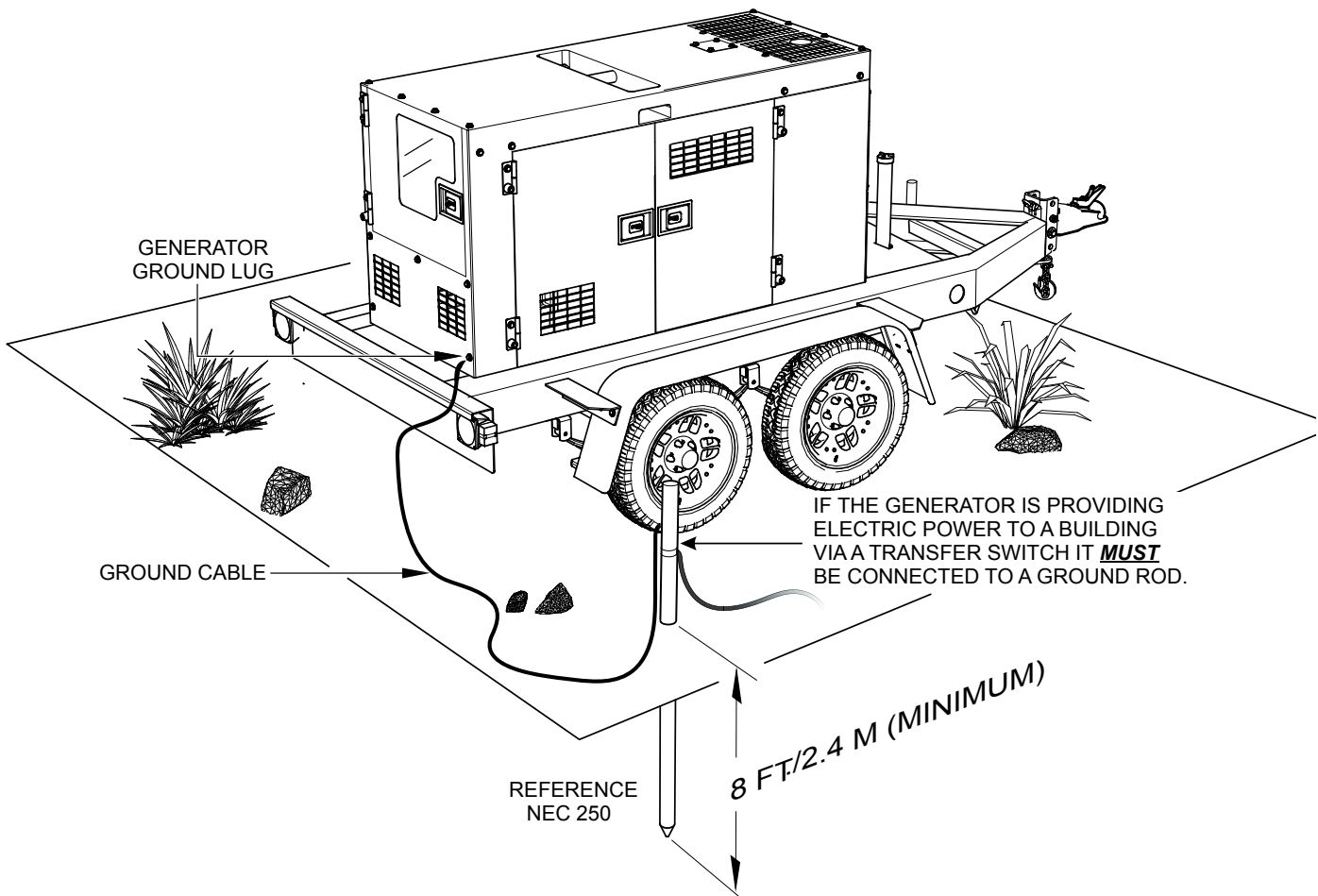


Figure 2. Typical Generator Grounding Application

OUTDOOR INSTALLATION

Install the generator in a 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 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 set at least 6 inches above the floor or grade level (in accordance to NFPA 110, Chapter 54.1). **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 GROUNDING

NOTICE

The Occupational Safety and Health Administration (OSHA) and the National Electrical Code (NEC) recommend that if the generator is providing electrical power to a structure (home, office shop, trailer or similar) it **must** be connected to a grounding electrode system, such a driven ground rod (Figure 2).

If applicable, to guard against electrical shock and possible damage to the equipment, it is important to provide a good **EARTH** ground, (Figure 2).

NOTICE

ALWAYS check with State, Province, District and Municipalities for electrical grounding requirements before using generator.

Article 250 (Grounding) of the NEC handbook provides guidelines for proper grounding and specifies that the cable ground shall be connected to the grounding system of the building as close to the point of cable entry as practical.

NEC article 250 specifies the following grounding requirements:

1. Use one of the following wire types to connect the generator to earth ground.
 - a. Copper 10 AWG (5.3 mm²) or larger.
 - b. Aluminum 8 AWG (8.4 mm²) or larger.
2. When grounding of the generator (Figure 2) is required, connect one end the ground cable to the ground lug on the generator. Connect the other end of the ground cable to the ground rod (earth ground).
3. NEC article 250 specifies that the earth ground rod should be buried a minimum of 8 ft. into the ground.

NOTICE

When connecting the generator to any buildings electrical system **ALWAYS** consult with a licensed electrician.

GENERAL INFORMATION

GENERATOR

This generator (Figure 3) is designed as a high quality portable (requires 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 835 Controller
- 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
- Engine Speed Switch
- Emergency Stop Switch (Option)
- Fuel Leak Detected Alarm Lamp

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, 200 amp Main Circuit Breaker
- “Control Box” (Located Behind Control Panel)
 - Automatic Voltage Regulator
 - Current Transformer
 - Over-Current Relay
 - Starter Relay

OUTPUT TERMINAL PANEL

The “Output Terminal Panel” is provided with the following:

- Three 240/120V output receptacles (CS-6369), 50A
- Three auxiliary circuit breakers, 50A
- Two 120V output duplex receptacles (GFCI), 20A
- Two duplex circuit breakers, 20A
- Five output terminal lugs (3Ø power)
- Battery Charger (Optional)
- Jacket Water Heater (Optional)

OPEN DELTA EXCITATION SYSTEM

Each generator is equipped with the state of the art “Open-Delta” excitation system. The open delta system consist 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 4 cylinder, 4-cycle water cooled, direct injection, turbocharged, air cooled EGR ISUZU BR-4JJ1X 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.

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 6) as a guide for selecting proper extension cable size.

MAJOR COMPONENTS

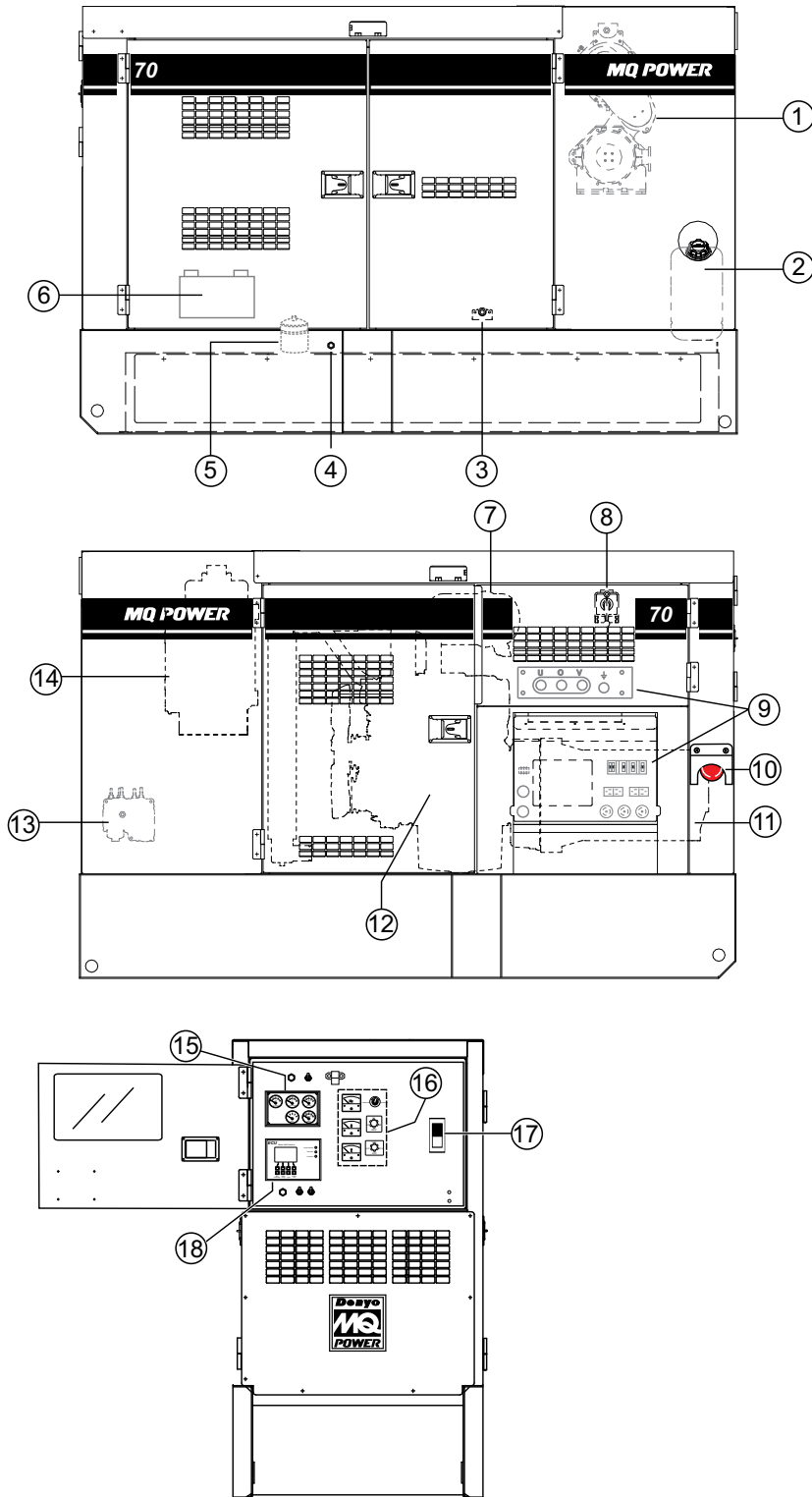


Table 4. Generator Major Components

ITEM NO.	DESCRIPTION
1	DOC/SCR Assembly
2	DEF Tank Assembly
3	Coolant Drain Plug
4	Oil Drain With Valve
5	Fuel Tank Assembly
6	Battery Assembly
7	Air Filter Assembly
8	Voltage Selector Switch Assembly
9	Output Terminal Panel Assembly
10	Emergency Stop Switch (Option)
11	Generator Assembly
12	Engine Assembly
13	DEF Supply Module Assembly
14	Muffler Assembly
15	Gauge Unit Assembly
16	Generator Operating Panel Assembly
17	Main Circuit Breaker Assembly
18	Auto Start/Stop Controller Assembly

Figure 3. Major Components

ENGINE CONTROL UNIT (ECU)

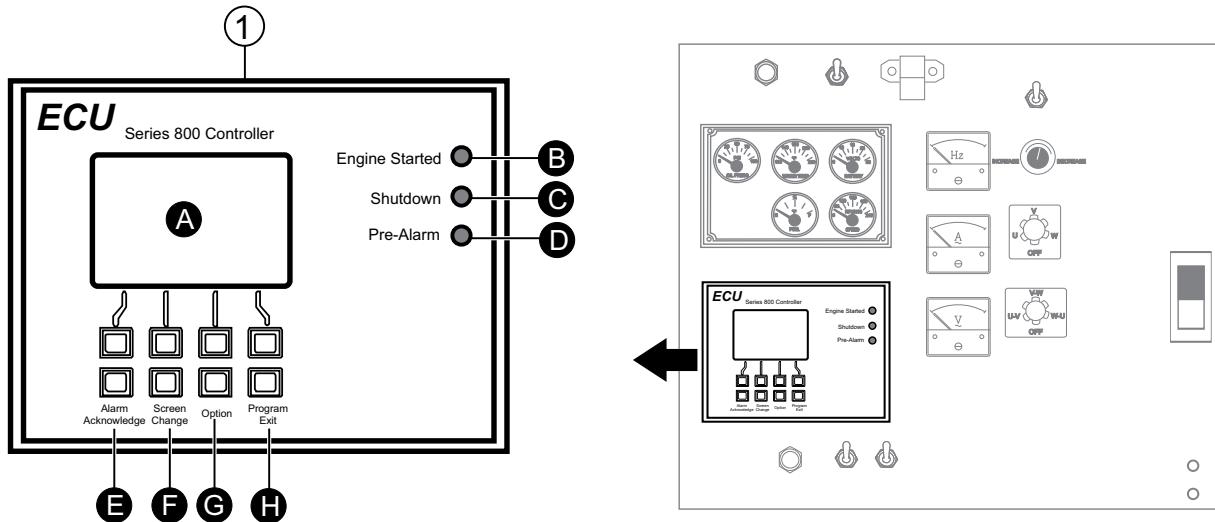


Figure 4. Engine Control Unit (ECU)

The definitions below describe the controls and functions of the Engine Control Unit (Figure 4).

1. **ECU Controller** — This auto start/stop 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** — This lamp when lit indicates engine is operating normally.
- C. **Engine Shutdown Lamp** — When an engine failure has occurred this lamp will blink. Indicating the engine has been shutdown. The diagnostic fault message will be displayed on the LCD screen.
- D. **Pre Alarm Lamp** — When an engine failure has occurred 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 from the home screen to enter the main menu.

ENGINE/GENERATOR CONTROL PANEL

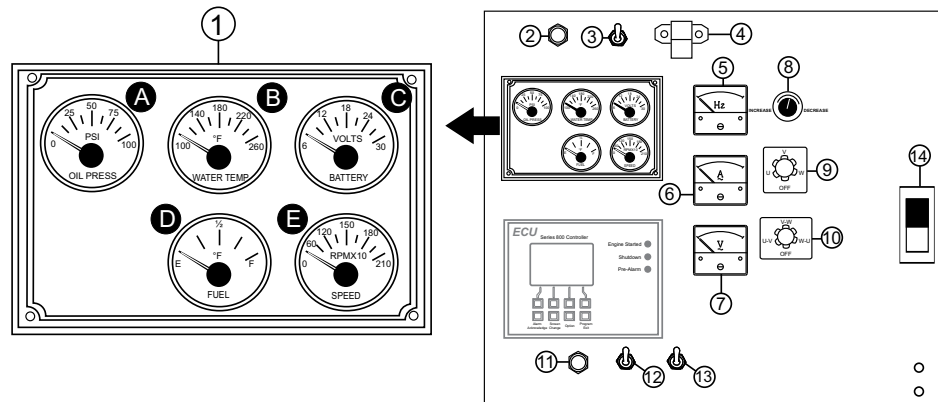


Figure 5. Gauge Unit Assembly

The definitions below describe the controls and functions of the Engine/Generator Control Panel (Figure 5).

1. **Gauge Unit Assembly** — This assembly houses the various engine monitoring gauges. These gauges indicate: oil pressure, water temperature, charging voltmeter, fuel and engine speed RPM (tachometer).
 - A. **Oil Pressure Gauge** — During normal operation this gauge should read between 35 to 65 psi. (241~448 kPa). When starting the generator the oil pressure may read a little higher, but after the engine warms up the oil pressure should return to the correct pressure range.
 - B. **Water Temperature Gauge** — During normal operation this gauge should read between 180° and 225°F (82°~107°C).
 - C. **Charging Voltmeter Gauge** — During normal operation this gauge indicate minimum 26 VDC
 - D. **Fuel Gauge** — Indicates amount of diesel fuel available.
 - E. **Tachometer** — Indicates engine speed in RPM's for 60 Hz operation. This meter should indicate 1800 RPM's when the rated load is applied.
2. **Fuel Leak Detected Alarm Lamp** — This lamp when ON indicates that fluids in the containment area have reach a high level.
3. **Panel Light Switch** — When activated will turn on control panel light.
4. **Panel Light** — For operation at night, panel light illuminates control panel for ease of reading meters and gauges. Make sure panel light switch is in the **OFF** position when light is not in use.
5. **Frequency Meter** — Indicates the output frequency in hertz (Hz). Normally 60 Hz
6. **AC Ammeter** — Indicates the amount of current the load is drawing from the generator per leg selected by the ammeter phase-selector switch.
7. **AC Voltmeter** — Indicates the output voltage present at the **U, V, and W Output Terminal Lugs**.
8. **Voltage Regulator Control** — Allows $\pm 15\%$ manual adjustment of the generator's output voltage.
9. **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 effect the generator output in any fashion, it is for current reading only.
10. **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.
11. **Hour Check Button** — With the engine stopped, press and hold this button. The total running hours, fuel level, and battery voltage will be displayed.
12. **Auto/Start Switch** — This switch selects either manual or automatic operation. Center position is **OFF** (reset).
13. **Engine Speed Switch** — This switch controls thespeed of the engine low or high.
14. **Main Circuit Breaker** — This three-pole, 200 amp main breaker is provided to protect the **U, V, and W output terminal lugs** from overload.

OUTPUT TERMINAL PANEL FAMILIARIZATION

OUTPUT TERMINAL PANEL

The Output Terminal Panel (Figure 6) 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 legs "O" and "Ground" are considered bonded grounds

OUTPUT TERMINAL FAMILIARIZATION

The "Output Terminal Panel" (Figure 6) is provided with the following:

- Three (3) 240/139V output receptacles @ 50 amp
- Three (3) Circuit Breakers @ 50 amps
- Two (2) 120V GFCI receptacles @ 20 amp
- Two (2) Duplex Circuit Breakers @ 20 amp
- Five (5) Output Terminal Lugs (U, V, W, O, Ground)

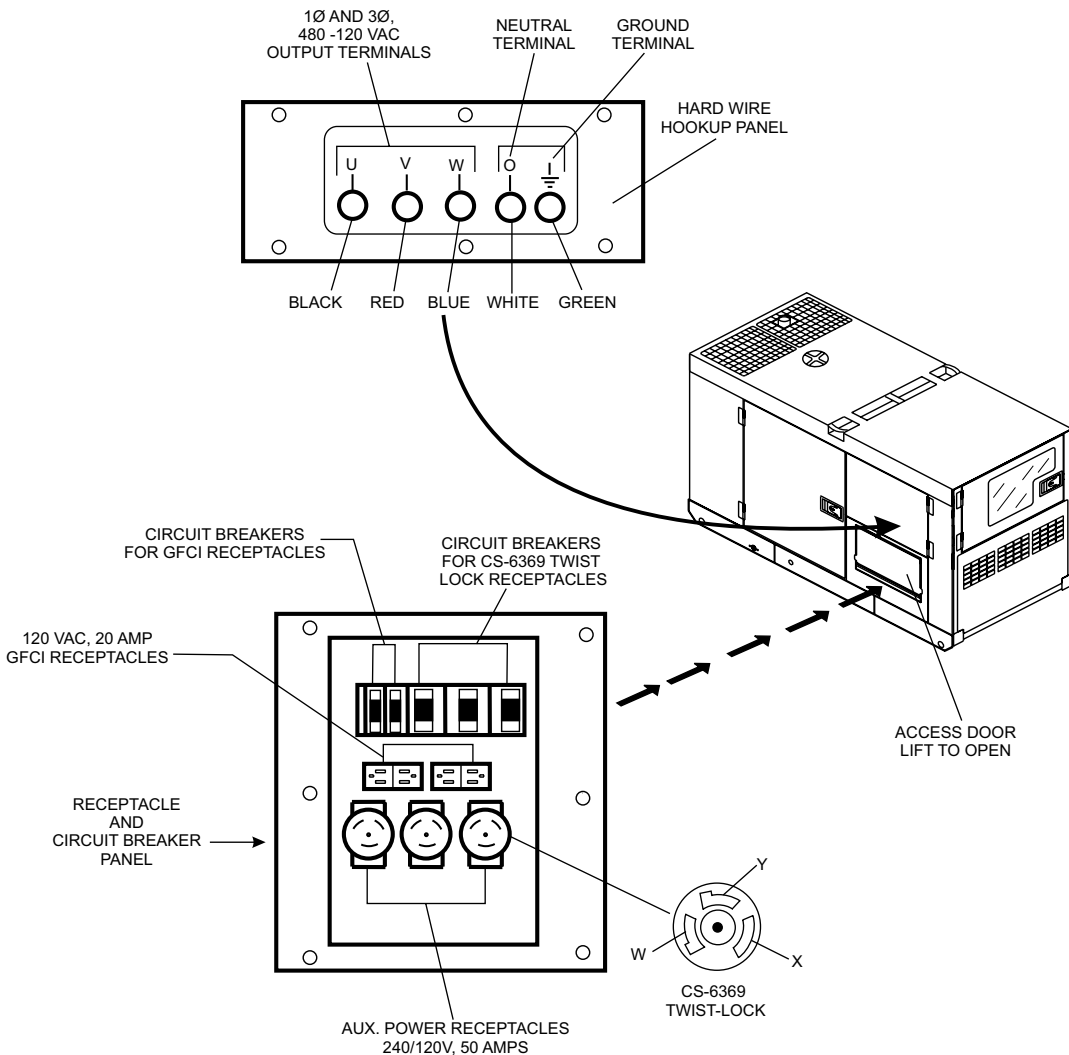


Figure 6. Output Terminal Panel

OUTPUT TERMINAL PANEL FAMILIARIZATION

120 VAC GFCI Receptacles

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

Pressing the **reset** button resets the GFCI receptacle after being tripped. Pressing the **test button** (See Figure 7) in the center of the receptacle will check the GFCI function. Both receptacles should be tested at least once a month.

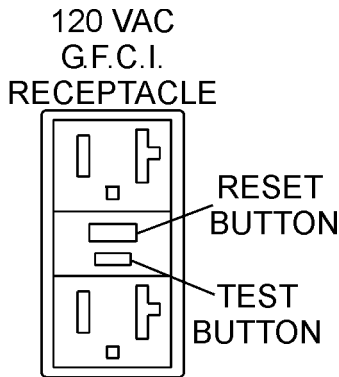


Figure 7. G.F.C.I. Receptacle

Twist Lock Dual Voltage 120/240 VAC Receptacles

There are three 240/139V, 50 amp auxiliary twist-lock (CS-6369) receptacles (Figure 8) provided on the output terminal panel. These receptacles can **only** be accessed when the voltage selector switch is configured for **single-phase 240/120** application

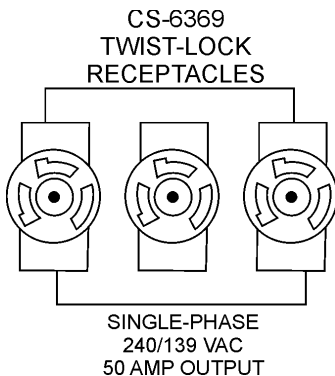


Figure 8. 240/139V Twist-Lock Auxiliary Receptacles

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**.

Turn the **voltage regulator control knob** (Figure 9) on the control panel to obtain the desired voltage. Turning the knob clockwise will **increase** the voltage, turning the knob counter-clockwise will **decrease** the voltage.

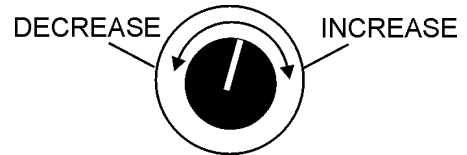


Figure 9. Voltage Regulator Control Knob

Removing the Plastic Face Plate (Hard Wire Hookup Panel)

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

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

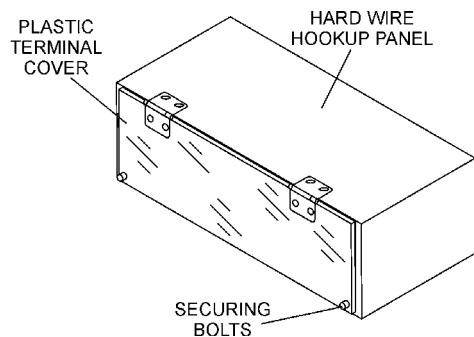


Figure 10. Plastic Face Plate (Output Terminal Lugs)

OUTPUT TERMINAL PANEL FAMILIARIZATION

Connecting Loads

Loads can be connected to the generator by the **Output Terminal Lugs** or the convenience receptacles (Figure 11). Make sure to read the operation manual before attempting to connect a load to the generator.

NOTICE

Figure 11 is a typical example of receptacles that ***may be installed*** on the generator.

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

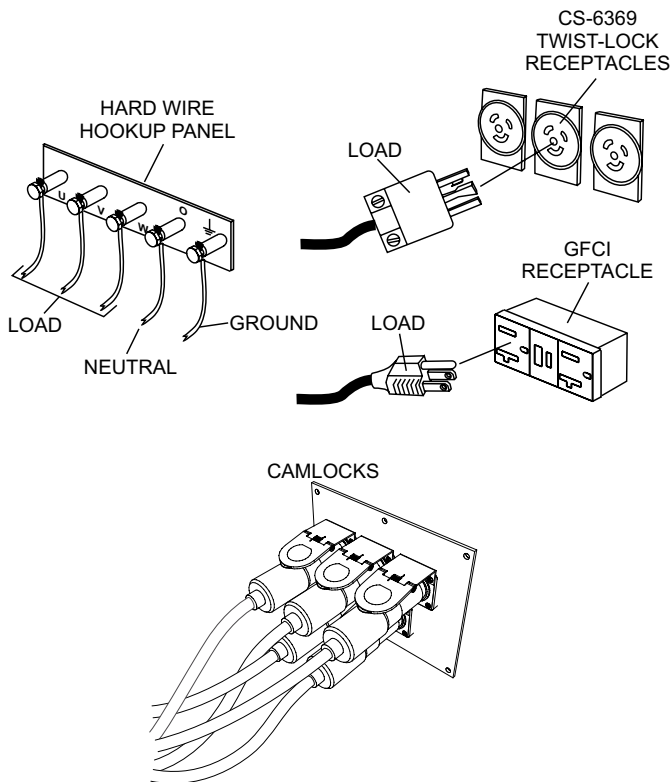


Figure 11. Connecting Loads

Over Current Relay

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

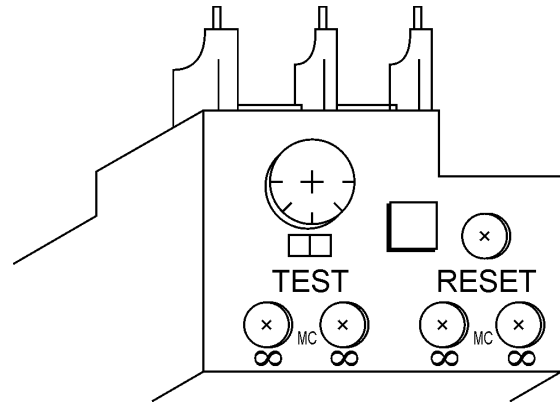


Figure 12. Over Current Relay

NOTICE

Remember 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 over current condition, it will automatically trip the 200 amp main 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** position (**ON**).

LOAD APPLICATION

SINGLE PHASE LOAD

Always be sure to check the nameplate on the generator and equipment to insure 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 name plate, approximate wattage may be determined by multiplying nameplate voltage by the nameplate amperage.

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

The power factor of this generator is 0.8. See Table 5 below when connecting loads.

Table 5. Power Factor By Load

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

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

Current in Amperes	Load in Watts		Maximum Allowable Cable Length			
	At 100 Volts	At 200 Volts	#10 Wire	#12 Wire	#14 Wire	#16 Wire
2.5	300	600	1000 ft.	600 ft.	375 ft.	250 ft.
5	600	1200	500 ft.	300 ft.	200 ft.	125 ft.
7.5	900	1800	350 ft.	200 ft.	125 ft.	100 ft.
10	1200	2400	250 ft.	150 ft.	100 ft.	
15	1800	3600	150 ft.	100 ft.	65 ft.	
20	2400	4800	125 ft.	75 ft.	50 ft.	

CAUTION: Equipment damage can result from low voltage

THREE PHASE LOAD

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

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

NOTICE

If 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 inadequate size 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.

GENERATOR OUTPUTS

GENERATOR OUTPUT VOLTAGES

A wide range of voltages are available to supply voltage for many different applications. Voltages are selected by using the **voltage selector switch** (Figure 13). To obtain some of the voltages as listed in Table 7 (see below) will require a fine adjustment using the **voltage regulator (VR) control knob** located on the control panel.

Voltage Selector Switch

The voltage selector switch (Figure 13) is located above the output terminal panel's Hard Wire Hook-up Panel. It has been provided for ease of voltage selection..

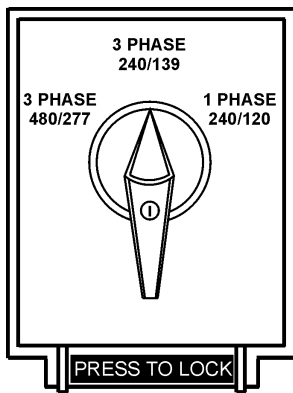


Figure 13. Voltage Selector Switch

CAUTION

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

Table 7. Voltages Available						
UVW Output Terminal Lugs	Voltage Selector Switch 3-Phase 240/139V Position			Voltage Selector Switch 3-Phase 480/270V Position		
	3Ø Line-Line	208V	220V	240V	416V	440V
1Ø Line-Neutral	120V	127V	139V	240V	254V	277V
Voltage Selector Switch Single-Phase 240/120V Position						
1Ø Line-Neutral/Line-Line	120V Line-Neutral	N/A	N/A	240V Line-Line	N/A	N/A

NOTICE

This generator can provide variable output voltages via the voltage regulator control knob.

Maximum Amps

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

Table 8. Generator Maximum Amps	
Rated Voltage	Maximum Amps
1Ø 120 Volt	155.4 X 2 amps (4 wire) 168 amps X 2 (Zigzag)
1Ø 240 Volt	77.8 amps (4 wire) 168 amps (Zigzag)
3Ø 240 Volt	168 amps
3Ø 480 Volt	84 amps

GFCI Receptacle Load Capability

The load capability of the GFCI receptacles is directly related to the voltage being supplied at either the output terminals or the 2 twist lock auxiliary receptacles.

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

Table 9. 1Ø GFCI Receptacle Load Capacity	
KW in Use Twist Lock (C6369)	Available Load Current (Amps)
1Ø 240/120V	GFCI Duplex 5-20R 120V
40.4	0
39.2	5 amps/receptacle
38.0	10 amps/receptacle
38.6	15 amps/receptacle
35.6	20 amps/receptacle

Table 10. 3Ø Generator Maximum Amps	
KVA in Use (UVW Terminals)	Available Load Current (Amps)
3Ø 240/480V	GFCI Duplex 5-20R 120V
70	0 amps/receptacle
65.8	5 amps/receptacle
61.7	10 amps/receptacle
57.5	15 amps/receptacle
53.3	20 amps/receptacle

GENERATOR OUTPUTS/GAUGE READING

HOW TO READ THE AC AMMETER AND AC VOLTAGE 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** effect the generator output. They are provided to help observe how much power is being supplied, produced at the UVWO terminals lugs.

Before taking a reading from either gauge, set the **Voltage Selector Switch** (Figure 14) to the position which produces the required voltage. Example, for 3Ø 240V, choose the center 3Ø 240/139V position on the voltage selector switch.

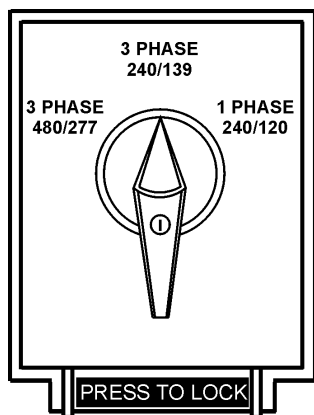


Figure 14. Voltage Selector Switch- 240/3Ø Position

AC Voltmeter Gauge Reading

Place the **AC Voltmeter Change-Over Switch** (Figure 15) 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 16).

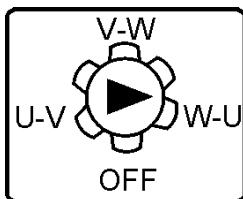


Figure 15. AC Voltmeter Change-Over Switch

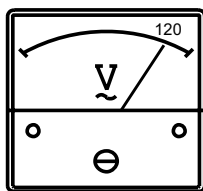


Figure 16. AC Voltmeter Gauge (Volt reading on W-U Lug)

AC Ammeter Gauge Reading

Place the **AC Ammeter Change-Over Switch** (Figure 17) in the U position and observe the current reading (load drain) on the U terminal as indicated on the **AC Ammeter Gauge** (Figure 18). This process can be repeated for terminals V and W.

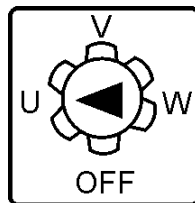


Figure 17. AC Ammeter Change-Over Switch

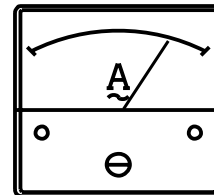


Figure 18. AC Ammeter (Amp reading on U Lug)

NOTICE

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

OUTPUT TERMINAL PANEL CONNECTIONS

UVWO TERMINAL OUTPUT VOLTAGES

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

Remember the voltage selector switch determines the **range** of the output voltage. The voltage regulator (VR) allows the user to increase or decrease the selected voltage.

3Ø-240V UVWO Terminal Output Voltages

1. Place the voltage selector switch in the 3Ø 240/139 position as shown in Figure 19.

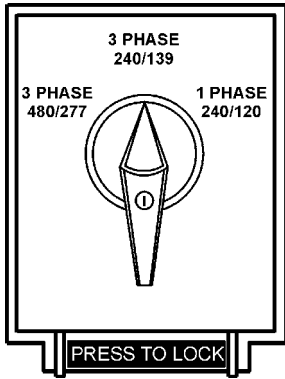


Figure 19. Voltage Selector Switch 3Ø-240/139V Position

2. Connect the load wires to the UVWO terminals as shown in Figure 20.

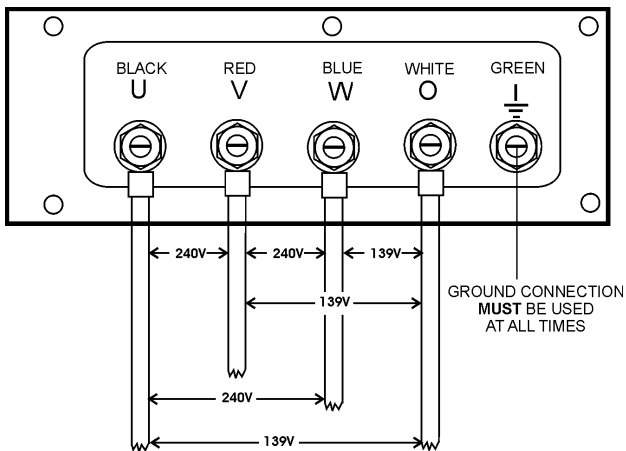


Figure 20. UVWO Terminal Lugs 3Ø-240/1Ø-139 Connections

3. Turn the voltage regulator knob (Figure 21) clockwise to increase voltage output, turn counterclockwise to decrease voltage output. Use voltage regulator adjustment knob whenever fine tuning of the output voltage is required.



Figure 21. Voltage Regulator Knob

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

1. Place the voltage selector switch in the 3Ø 240/139 position as shown in Figure 19.
2. Connect the load wires to the UVWO terminals as shown in Figure 22.

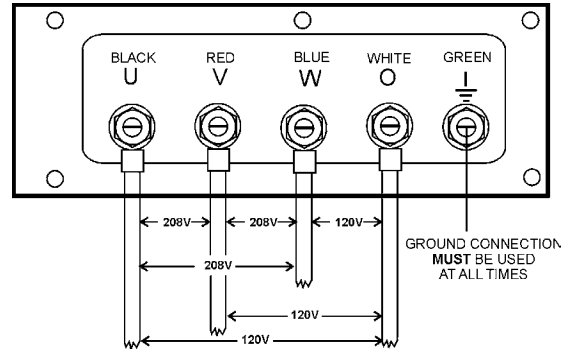


Figure 22. UVWO Terminal Lugs 3Ø-208/1Ø-120V Connections

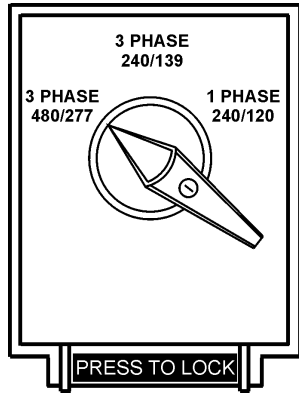
NOTICE

To achieve a 3Ø 208V output the voltage selector switch must be in the 3Ø-240/139 position and the voltage regulator must be adjusted to 208V.

OUTPUT TERMINAL PANEL CONNECTIONS

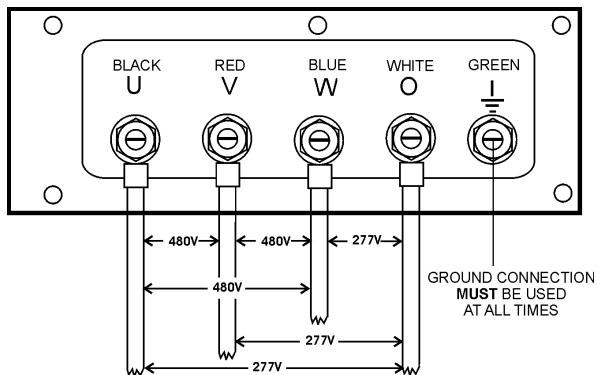
3Ø-480/277V UVWO Terminal Output Voltages

1. Place the voltage selector switch in the 3Ø 480/277 position as shown in Figure 23.



**Figure 23. Voltage Selector itch
3Ø-480/277V Position**

2. Connect the load wires to the UVWO terminals as shown in Figure 24.



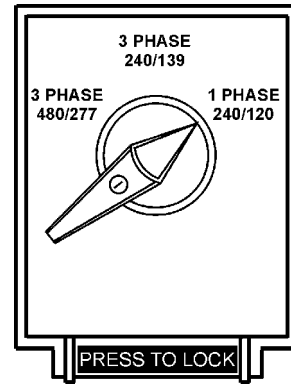
**Figure 24. UVWO Terminal Lugs 3Ø-480V
Connections**

NOTICE

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

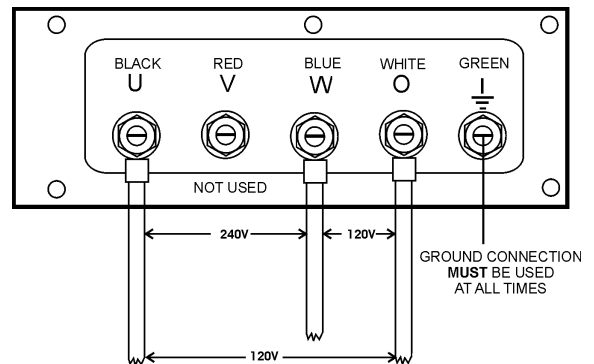
1Ø-240/120V UVWO Terminal Output Voltages

1. Place the voltage selector switch in the 1Ø 240/120 position as shown in Figure 25.



**Figure 25. Voltage Selector itch
1Ø-240/120V Position**

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



**Figure 26. UVWO Terminal Lugs
1Ø-240/120V Connection**

3. Turn the voltage regulator knob (Figure 21) clockwise to increase voltage output, turn counterclockwise to decrease voltage output. Use voltage regulator adjustment knob whenever fine tuning of the output voltage is required.

CIRCUIT BREAKERS

To protect the generator from an overload, a 3-pole, 200 amp, main circuit breaker is provided to protect the **U, V, and W Output Terminals** from overload. In addition two single-pole, 20 amp **duplex** circuit breakers are provided to protect the GFCI receptacles from overload. Three 50 amp **load** circuit breakers have also been provided to protect the auxiliary receptacles from overload. Make sure to switch **ALL** circuit breakers to the **OFF** position prior to starting the engine.

LUBRICATION OIL

Fill the engine crankcase with lubricating oil through the filler hole, but **DO NOT** overfill. Make sure the generator is level and verify that the oil level is maintained between the two notches (Figure 27) on the dipstick. See Table 11 for proper selection of engine oil.

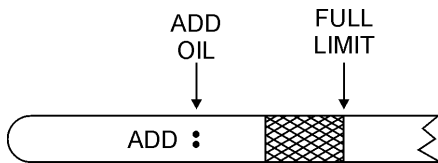


Figure 27. Engine Oil Dipstick

When checking the engine oil, be sure to check if the oil is clean. If the oil is not clean, drain the oil by removing the oil drain plug, and refill with the specified amount of oil as outlined in the **Isuzu Owner's Manual**. Oil should be warm before draining.

Delo® engine oil is the recommended engine oil for this generator. When replacing engine oil please refill using Delo® 400 LE SAE 15W-40 (API CJ-4) engine oil.

Table 11. Recommended Motor Oil		OIL: SAE	
°F	°C		
122	50	10W/40	10W/40
104	40	30	15W/30
86	30	ARCTIC OIL	10W/30
68	20	5W/30	10W
50	10		20W/40
32	0		
-14	-10		
-4	-20		
-22	-30		
-40	-40		

FUEL CHECK

! DANGER



Fuel spillage on a **hot** engine can cause a **fire** or **explosion**. If fuel spillage occurs, wipe up the spilled fuel completely to prevent fire hazards. **NEVER** smoke around or near the generator. Make sure engine is **OFF** before refueling.

Refilling the Fuel System

! CAUTION

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

This generator has an internal fuel tank located inside the trailer frame and may also be equipped with an environmental fuel tank (Figure 28). **ALWAYS** fill the fuel tanks with clean fresh **#2 diesel fuel**. **DO NOT** fill the fuel tanks beyond their capacities.

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.

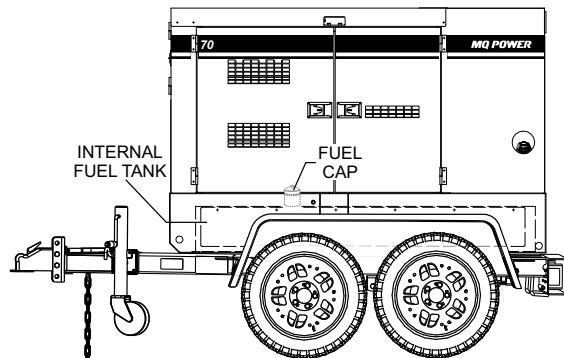


Figure 28. Internal Fuel Tank System

NOTICE

DO NOT add fuel while engine is running. Stop engine and let cool before adding fuel.

Refueling Procedure:

WARNING



Diesel fuel and its vapors are dangerous to your health and the surrounding environment. Avoid skin contact and/or inhaling fumes.

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 29).

CAUTION

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

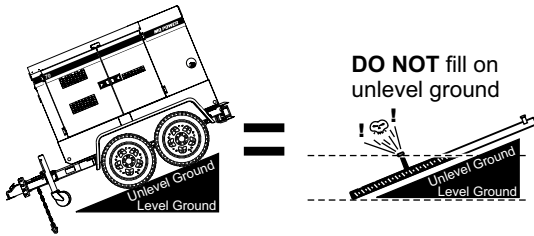


Figure 29. Only Fill on Level Ground

NOTICE

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

2. Remove fuel cap and fill tank as shown in Figure 30.

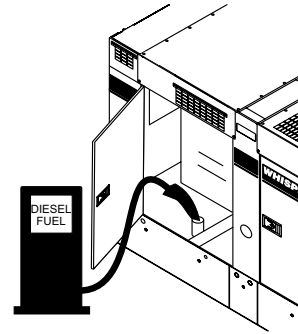


Figure 30. Fueling the Generator

3. **NEVER overfill fuel tank** — It is important to read the fuel gauge when filling the fuel tank. (Figure 31). The ECU controller must be powered **ON** in order to read the fuel gauge.

FUEL GAUGE LOCATED
ON CONTROL PANEL

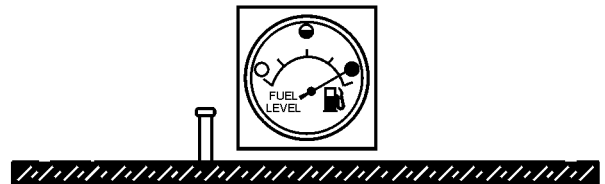


Figure 31. Full Fuel Tank

CAUTION

DO NOT OVERFILL fuel system. Leave room for fuel expansion. Fuel expands when heated (Figure 32).



Figure 32. Fuel Expansion

DEF Refueling

NOTICE

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

Diesel exhaust fluid 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.

1. Make sure engine is **OFF**.
2. Remove the filler cap from the DEF tank (Figure 33).
3. Upon initial start up, **completely fill** the DEF tank with DEF fluid. **DO NOT** overfill.

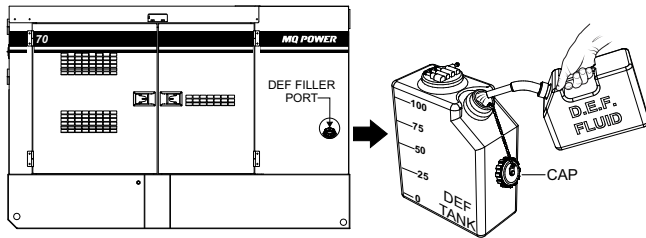


Figure 33. DEF Tank Filling

DEF Refueling (Continuous Operation)

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

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

COOLANT (ANTIFREEZE/SUMMER COOLANT/WATER)

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

WARNING



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

Day-to-day addition of coolant is done from the recovery tank. When adding coolant to the radiator, **DO NOT** remove the radiator cap until the unit has completely cooled. See Table 12 for engine, radiator, and recovery tank coolant capacities. Make sure the coolant level in the recovery tank is always between the "H" and the "L" markings.

Table 12. Coolant Capacity	
Engine and Radiator	5.5 gal (21 liters)
Reserve Tank	N/A

Operation in Freezing Weather

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

Table 13. Coolant Capacity		
Climate	Outside Temperature	Longlife Coolant Concentration
Warm	10°F (-12°C) or Above	30%
Cold	-22°F (30°C) or Above	50%

Cleaning the Radiator

The engine may overheat if the radiator fins 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.

AIR CLEANER

Periodic cleaning/replacement is necessary. Inspect 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**.

Fan belt tension is proper if the fan belt bends as represented in Figure 34 when depressed with the thumb as shown below. Adjust fan belt tension as required.

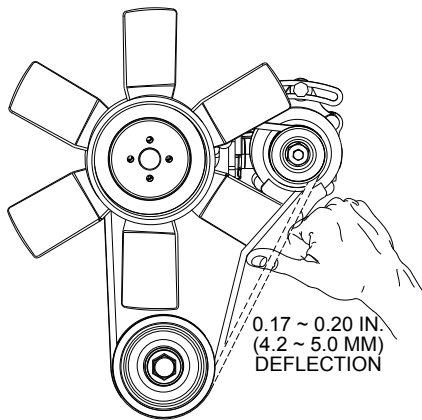


Figure 34. Fan Belt Tension

Table 14. Fan Belt Deflection

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

CAUTION



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

BATTERY

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

DO NOT over fill. Check to see whether the battery cables are loose. Poor contact may result in poor starting or malfunctions. **Always** keep the terminals firmly tightened. Coating the terminals with an approved battery terminal treatment compound. Replace battery with only 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

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

CAUTION

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

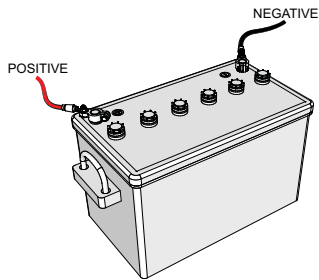


Figure 35. Battery Connections

When connecting battery do the following:

1. **NEVER** connect the battery cables to the battery terminals when the **Auto-Off/Reset-Manual Switch** is in either the **AUTO** or **MANUAL** position. **ALWAYS** make sure that this switch is in the **OFF/RESET** position when connecting the battery.
2. Place a small amount of battery terminal treatment compound around both battery terminals. This will ensure a good connection and will help prevent corrosion around the battery terminals.

NOTICE

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

CAUTION

Inadequate battery connections may cause poor starting of the generator, and create other malfunctions.

ALTERNATOR

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

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

WIRING

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

PIPING AND HOSE CONNECTION

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

If any hose (**fuel or oil**) lines are defective replace them immediately.

GENERATOR START-UP PROCEDURE (MANUAL)

BEFORE STARTING

CAUTION

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

WARNING

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

- Place the **main, aux. and duplex** circuit breakers (Figure 36) in the **OFF** position prior to starting the engine.

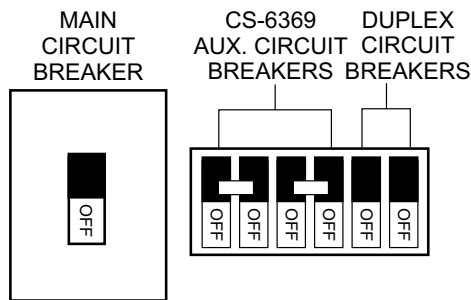


Figure 36. Main, Aux. and Duplex Circuit Breakers (OFF)

- Make sure the **voltage selector switch** has been configured for the desired output voltage.
- Connect the load to the **receptacles** or the **output terminal lugs** as shown in Figure 11. These load connection points can be found on the output terminal panel and the output terminal panel's hard wire hookup panel.
- Tighten terminal nuts securely to prevent load wires from slipping out.
- Close all engine enclosure doors (Figure 37).

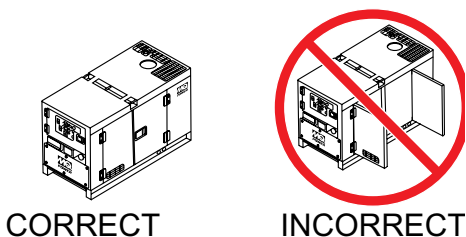


Figure 37. Engine Enclosure Doors

STARTING (MANUAL)

- Place the **Auto-Off/Reset Manual Switch** in the **MANUAL** position to start the engine (Figure 38).

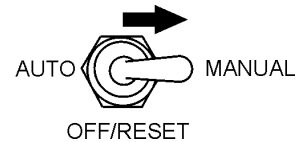


Figure 38. Auto-Off/Reset Manual Switch (Manual Position)

NOTICE

If engine fails to start in a specified number attempts, the shutdown lamp will illuminate and the Auto-Off/Reset 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..

- Once the engine starts, let the engine run for 1-2 minutes. Let engine idle longer in cold weather conditions. Listen for any abnormal noises. If any abnormalities exist, shut down the engine and correct the problem.
- The generator's frequency meter (Figure 39) should be displaying the 60 cycle output frequency in **HERTZ**.

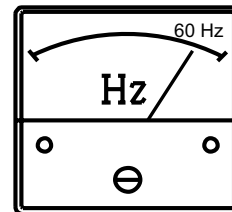


Figure 39. Frequency Meter

- The generator's AC-voltmeter (Figure 40) will display the generator's output in **VOLTS**. If the voltage is not within the specified tolerance,

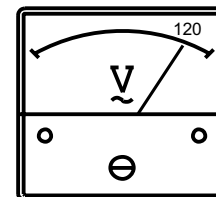


Figure 40. Voltmeter

GENERATOR START-UP PROCEDURE (MANUAL)

5. Use the voltage adjustment control knob (Figure 41) to increase or decrease the desired voltage.



Figure 41. Voltage Adjust Control Knob

6. The ammeter (Figure 42) 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.

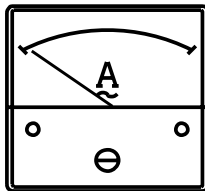


Figure 42. Ammeter (No Load)

7. The engine oil pressure gauge (Figure 43) will indicate the oil pressure of the engine. Under normal operating conditions the oil pressure is approximately 42 to 86 psi. (290~590 kPa).

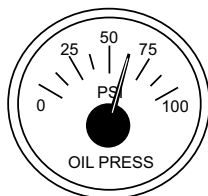


Figure 43. Oil Pressure Gauge

8. The **coolant temperature gauge** (Figure 44) will indicate the coolant temperature. Under normal operating conditions the coolant temperature should be between 167°~194°F (75°~90°C).

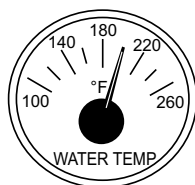


Figure 44. Coolant Temperature Gauge

9. The **tachometer gauge** (Figure 45) will indicate the speed of the engine when the generator is operating. Under normal operating conditions this speed is approximately 1800 RPM's (high speed) and 1000 RPM's (low speed)

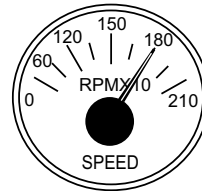


Figure 45. Engine Tachometer Gauge

10. Place the **main, aux, and duplex** circuit breakers in the **ON** position (Figure 46).

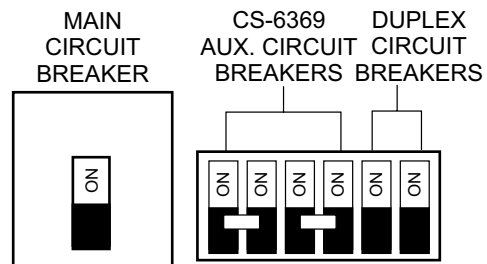


Figure 46. Main, Aux. and Duplex Circuit Breakers (ON)

11. Observe the generator's ammeter (Figure 47) 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.

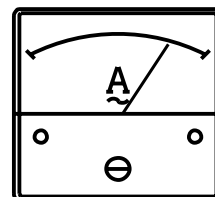


Figure 47. Ammeter (Load)

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

GENERATOR START-UP PROCEDURE (AUTO MODE)

STARTING (AUTO MODE)

DANGER



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

CAUTION

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

WARNING

When running the generator in the **AUTO** mode, remember the generator can start up at any time without warning. **NEVER** attempt to perform any maintenance when the generator is in the auto mode.

NOTICE

When the **Auto Off/Reset Manual Switch** is placed in the **AUTO** position, the engine glow plugs will be warmed and the engine will start automatically.

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

1. Perform steps 1 through 5 in the Before Starting section as outlined in the Manual Starting Procedure.
2. Place the **Auto Off/Reset Manual Switch** (Figure 48) in the **AUTO** position.



Figure 48. Auto Off/Reset Manual Switch (AUTO)

3. Continue operating the generator as outlined in the Manual Start-up procedure (step 2).

WARNING

NEVER stop the engine suddenly except in an emergency.

GENERATOR SHUT-DOWN PROCEDURES

NORMAL SHUTDOWN PROCEDURE

To shutdown the generator, use the following procedure:

1. Place both the **main, aux. and duplex** circuit breakers as shown in Figure 49 to the **OFF** position.

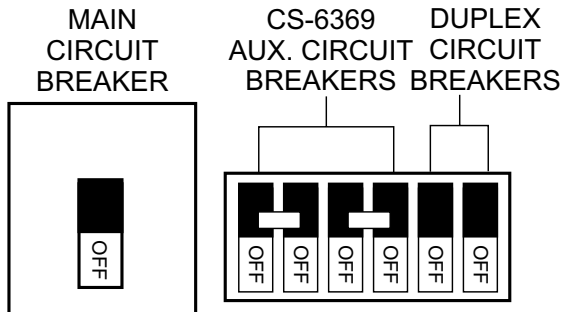


Figure 49. Main, Aux. and Duplex Circuit Breakers (OFF)

2. Let the engine cool by running it at low speed for 3-5 minutes with no load applied.
3. Place the **Auto Off/Reset Manual Switch** (Figure 50) in the **OFF/RESET** position.

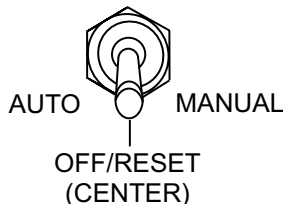


Figure 50. Auto Off/Reset Manual Switch (Off/Reset Position)

4. Remove all loads from the generator.
5. Inspect entire generator for any damage or loosening of components that may have occurred during operation.

EMERGENCY SHUTDOWN PROCEDURE

1. If equipped (option), push the **Emergency Stop Pushbutton Switch** (Figure 51).

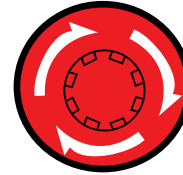


Figure 51. Emergency Stop Switch (Option)

2. If generator is not equipped with an emergency stop pushbutton switch, place the **Auto Off/Reset Manual Switch** (Figure 52) in the **OFF/RESET** position.

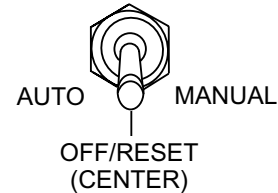


Figure 52. Auto Off/Reset Manual Switch (OFF)

MAINTENANCE

Table 15. Inspection/Maintenance		10 Hrs DAILY	250 Hrs	500 Hrs or Every 12 Months	3000 Hrs or Every 36 Months	OTHER
Engine	Check Engine Oil and Coolant Levels	X				
	Check Fuel Filter	X				
	Check Air Cleaner/Element	X				
	Clean or Replace Air Cleaner/Element		X			
	Check for Leaks/Hoses/Clamps	X				
	Check for Loosening of Parts	X				
	Change Engine Oil and Oil Filter * 1		X			
	Clean Unit, Inside and Outside		X			
	Replace Fuel Filter Elements			X		
	Check Engine Mounts			X		
	Service Battery			X		
	Check Air Intake Hoses			X		
	Check Fan Belt Condition			X		
	Check Automatic Belt Tensioner			X		
	Check Electrical Ground Connection			X		
	Clean Radiator, Check Cooling System			X		
	Coolant Solution Analysis, Add SCA's As Required			X		
	Pressure Test Cooling System			X		
	Check Engine Speed			X		
	Test Thermostats				X	
	Check and Adjust Engine Valve Clearance					1000 hrs.
	Test Glow Plugs				X	
	Replace DEF Filter (In Supply Module)					3000 hrs.
	Check SCR System*2					4500 hrs.
Inspect Dosing Module (SRC System)					4500 hrs	
Flush and Refill Cooling System*3					1 yr. or 2000 hrs.	
Clean Inside of Fuel Tank					1000 hrs.	
Clean DEF Tank					As Required	
Replace Air Cleaner Elements *4					As Required	
Generator	Measure Insulation Resistance Over 3M ohms		X			
	Check Rotor Rear Support Bearing			X		

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

*2 Perform inspection and maintenance of Urea SCR system every 4500 hours. The system does not need to replace/exchange if no problem is found. Do not make any modification, changes or remove the emission control system and related parts. Please contact your nearest dealer or Multiquip Service Dept. for SCR maintenance.

*3 Use fully formulated antifreeze/coolant.

*4 Replace primary air filter element when restriction indicator shows a vacuum of 625 mm (25 in. H₂O).

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 15 as a general maintenance guideline **Engine Side** (Refer to the Engine Instruction Manual)

Air Filter Dust Indicator

NOTICE

The air filter should not be changed until the indicator reads “**RED**”. Dispose of old air filter. It may not be cleaned or reused.

The air filter indicator (Figure 53) is attached to the air filter. When the air filter element is clogged, air intake restriction becomes greater and the air filter indicator signal shows **RED**. When indicator is red, replace filter immediately. After changing the air filter, **press** the air filter indicator button to reset.

PUSH BUTTON TO RESET

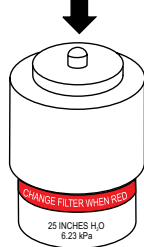


Figure 53. Air Filter Dust Indicator

AIR CLEANER

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 air cleaner more **frequently** if these conditions exist.

Every 250 hours: Remove air cleaner element (Figure 54) and clean the heavy duty paper element with light spray of compressed air. Replace the air cleaner as needed.

This Isuzu diesel engine is equipped with a replaceable, high-density paper air cleaner element. This air cleaner is also equipped with an inner element (secondary) that is used as a backup filter should the primary element becomes damaged.

CAUTION



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

Primary and Secondary Air Cleaner Elements

1. Release the latches (Figure 54) that secures the cover to the air cleaner body.
2. Remove the air cleaner cover and set aside.
3. Remove both the primary and secondary air cleaner elements.
4. Check the air cleaner daily or before starting the engine
5. 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.

6. To clean the primary element (paper air filter) as referenced in (Figure 54), tap the filter element several times on a hard surface to remove dirt, or blow compressed air (not to exceed 30 psi (207 kPa, 2.1 kgf/cm²) through the filter element from the inside out.

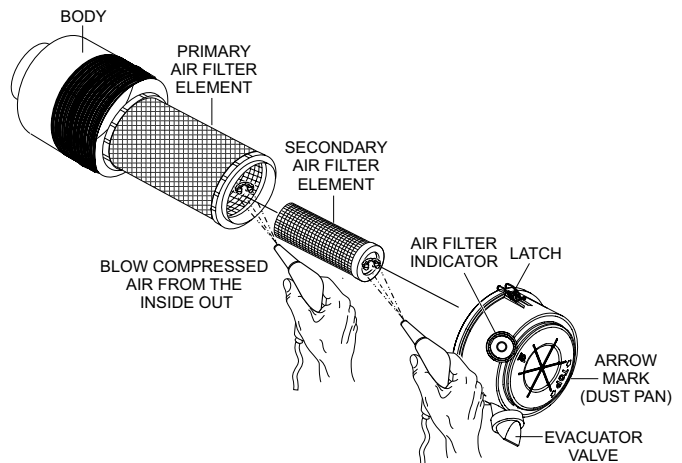


Figure 54. Air Cleaner

7. Clean the secondary element (paper air filter) as referenced in step 6.
8. Replace both elements if they are damaged or excessively dirty.

9. Clean the inside of the air cleaner body.
10. Reinstall the primary and secondary air filter elements back into air cleaner body.
11. Reinstall the air cleaner cover, and secure with latches.

DRAINING FUEL FILTER ELEMENT

NOTICE

Inspect the fuel filter **daily**. If the fuel filter (Figure 55) has collected a significant amount of water and sediment at the bottom of the cup, it should be drained off immediately.

1. Loosen the air bleeder plug (Figure 55) on the fuel filter body.
2. To discharge the fuel inside the fuel filter **OPEN** the drain valve on the fuel filter by turning the knob **counterclockwise (A)** approximately 3-1/2 turns until the valve drops down 1-inch (25.4 mm) and draining occurs **(B)**.

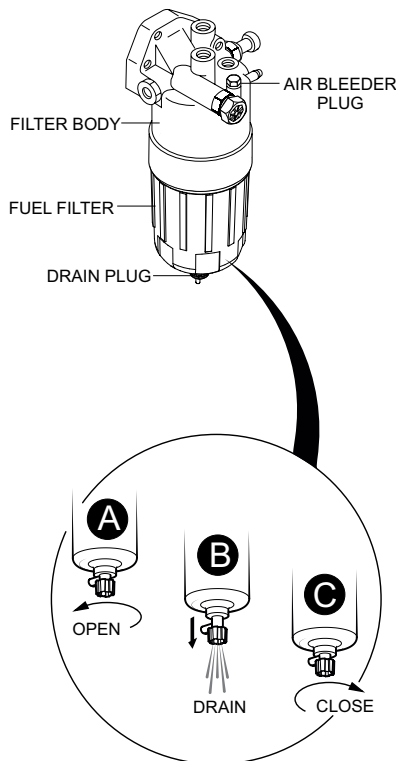


Figure 55. Draining Fuel Filter

3. Let the residue or foreign substances inside the case flow into a suitable container.

FUEL FILTER ELEMENT REPLACEMENT

1. Use a filter wrench to remove the element case (Figure 56) from the fuel filter body.

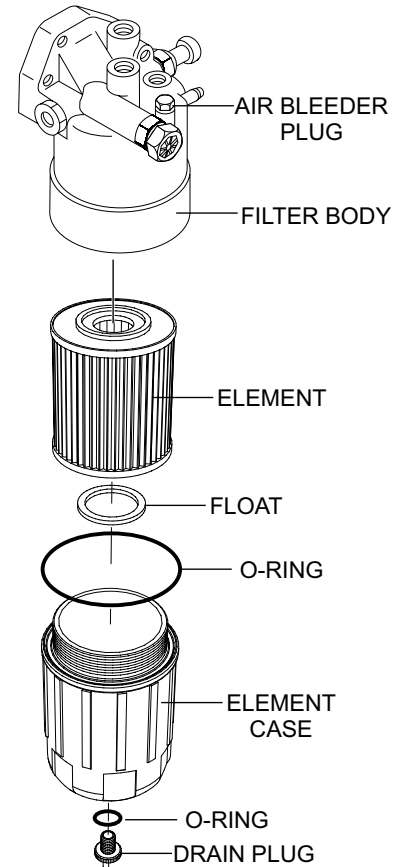


Figure 56. Fuel Filter Replacement

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

ELECTROMAGNETIC FUEL PUMP (500 HOURS)

The filter inside the fuel pump (Figure 57) is either a paper type or steel mesh type depending on fuel pump type. Clean or replace the fuel pump filter as follows:

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

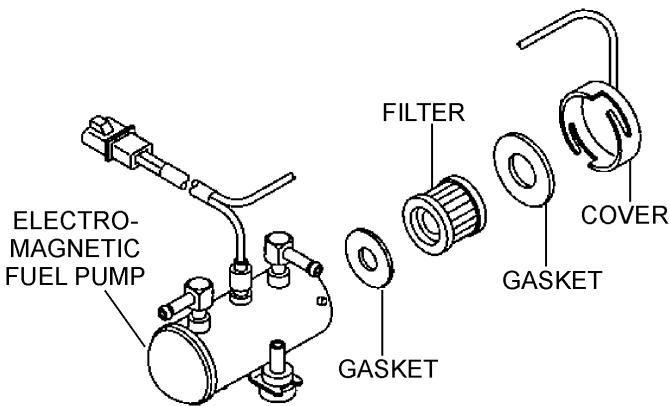


Figure 57. Electromagnetic Fuel Pump

NOTICE

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

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

Removing Water from the Fuel Tank

After prolonged use, water and other impurities accumulate in the bottom of the 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 58) wash out any deposits or debris that have accumulated inside the fuel tank.

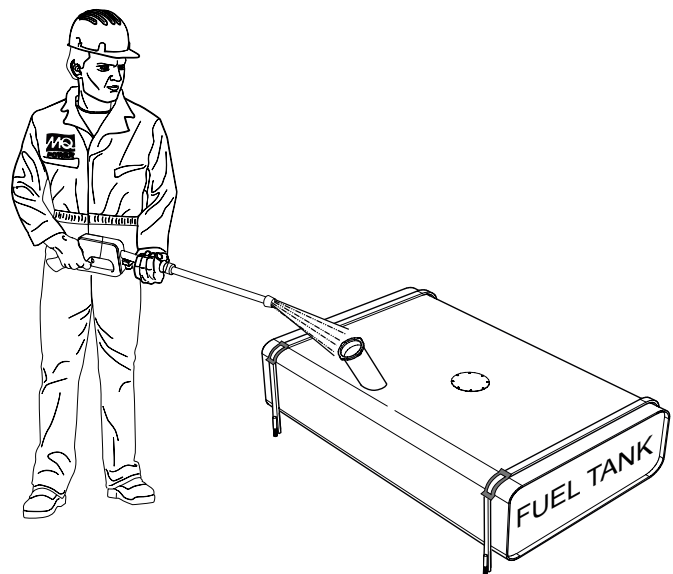


Figure 58. Fuel Tank Cleaning

FUEL TANK INSPECTION

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

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

DRIVE BELT (DAILY)

Drive Belt Tension

A slack drive belt (Figure 59) may contribute to overheating, or to insufficient charging of the battery, adjust drive belt in accordance with the Isuzu Operator's manual

Drive Belt Inspection

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

Also, examine the belt and determine if it is **oil soaked** or **"glazed"** (hard shiny appearance on the sides of the belt). Either of these two conditions can cause the belt to run hot, which can weaken it and increase the danger of it breaking.

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

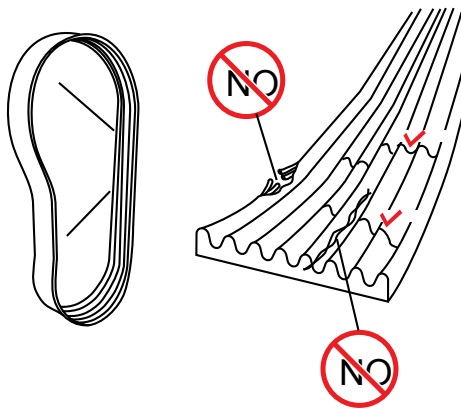


Figure 59. Drive Belt Inspection

ENGINE OIL (CHECK DAILY)

1. When checking or adding oil, place the machine so the engine is level.
2. Pull the engine oil dipstick from its holder.
3. Determine if engine oil is low. Oil level should be between the upper and lower limit (Figure 60) on the dipstick.

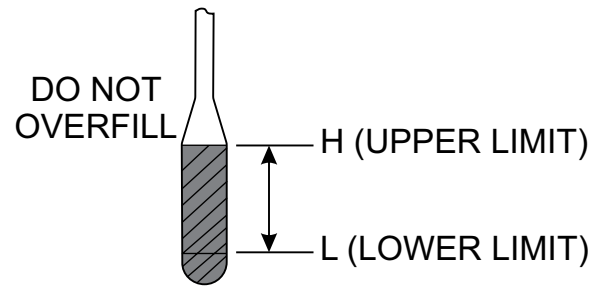


Figure 60. Dipstick Engine Oil Level

4. If oil level is low, add correct amount of engine oil to bring oil level to a normal safe level (See Recommended Viscosity Grades).
5. Allow enough time for any added oil to make its way to the oil pan before rechecking.

		Table 16. Oil Selection Chart	
		OIL: SAE	
°F	°C		
122	50		
104	40		
86	30	5W/30	5W/40
68	20	10W	10W/30
50	10	10W/40	15W/40
32	0	20W/20	30
-14	-10		40
-4	-20		
-22	-30		
-40	-40		

DRAINING ENGINE OIL

1. Run the engine until the engine coolant reaches a temperature of 140° (60°C) Turn the engine off.
2. Remove the oil dipstick from its holder.
3. Next, remove **oil drain cap** (Figure 61)
4. Place the **oil drain valve** in then **OPEN** position and allow the oil to drain into a suitable container.

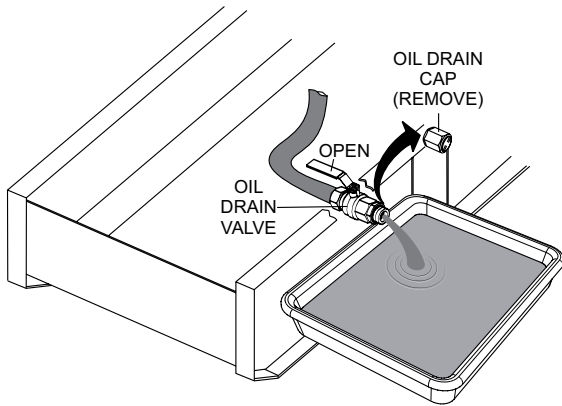


Figure 61. Draining Engine Oil

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

ENGINE OIL FILTER REPLACEMENT

1. Clean the area around the lubricating oil filter head.
2. Using an oil filter wrench (Figure 62), remove engine oil filter.

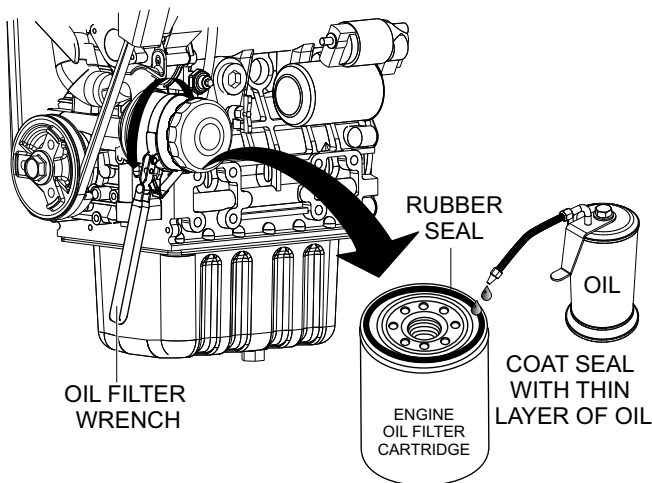


Figure 62. Engine Oil Filter Removal

3. Coat the rubber seal (gasket) surface of oil filter (Figure 62) with clean 15W-40 engine oil.
4. Install new oil filter first by hand until it makes contacts with the filter head surface. Tighten it another 3/4 turn using the filter wrench.
5. Fill engine crankcase with high quality detergent oil classified "For Service CI-4. Fill to the upper limit of 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.

FLUSHING OUT RADIATOR AND REPLACING 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 pressure cap.

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

1. Place the **coolant drain valve** in the **OPEN** position (Figure 63) and allow the coolant to drain into a suitable container.

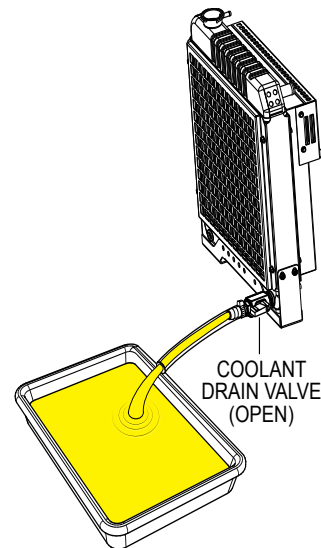


Figure 63. Draining Engine Coolant

2. Check hoses for softening and kinks. Check clamps for signs of leakage.
3. Remove and inspect radiator cap.
4. Flush the radiator by running clean tap water through radiator until signs of rust and dirt are removed. **DO NOT** clean radiator core with any objects, such as a screwdriver.

5. Tighten water cock and replace the overflow tank.
6. Place the coolant drain valve in the **CLOSED** position.
7. Replace with coolant as recommended by the engine manufacturer.
8. Reinstall radiator cap. Tighten securely.

RADIATOR CLEANING

The radiator (Figure 64) 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.



Figure 64. Radiator Cleaning

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.
- Cover the generating set and store in a clean, dry place.
- Disconnect the battery.
- Make sure engine coolant is at proper level.
- If generator is mounted on a trailer, jack trailer up and place on blocks so tires do not touch the ground or block and completely remove the tires.

JACKET WATER HEATER AND INTERNAL BATTERY CHARGER 120 VAC INPUT RECEPTACLES (OPTIONAL)

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

The engine block heating element and internal battery charger both require 120 VAC in order to operate. A receptacle (Figure 65) has been provided on the output terminal panel to allow commercial power to be applied.

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

When using the generator in **hot** climates there is no need to apply power to jacket water heater. However, if the generator will be used in **cold** climates, it is best to apply power to the jacket water 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.

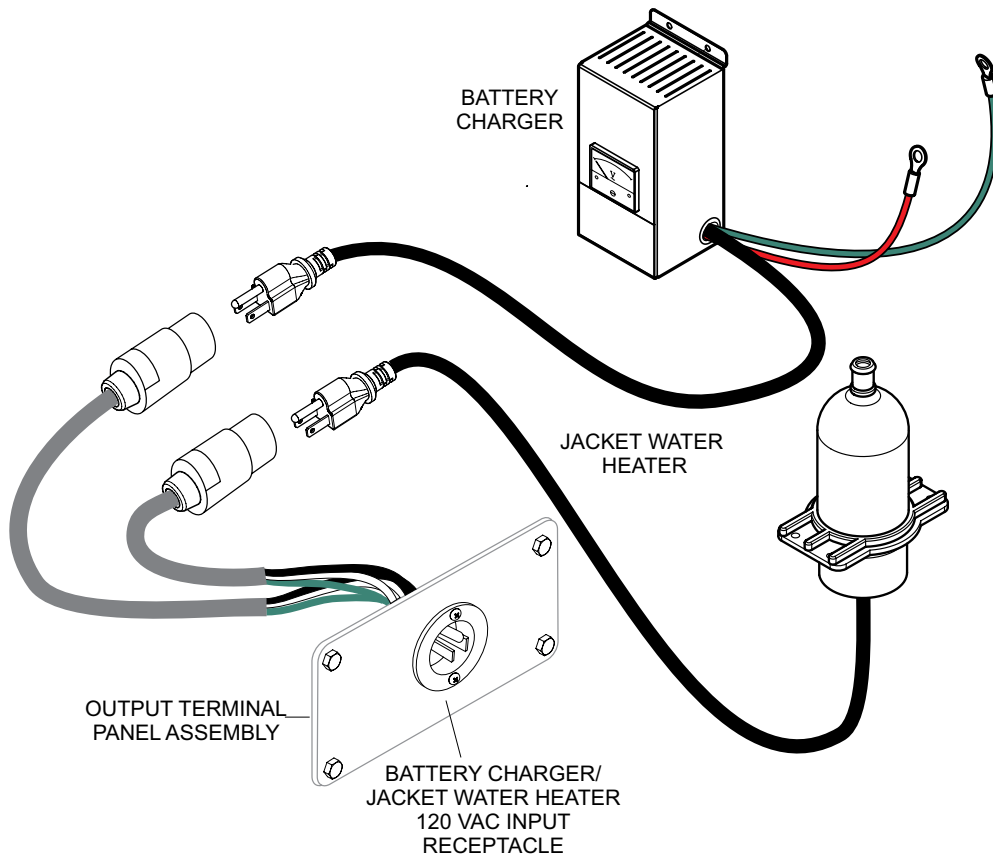


Figure 65. Jacket Water Heater and Battery Charger (Option)

EMISSION CONTROL

The emission control system employed with this **ISUZU** diesel engine consist of a **Diesel Oxidation Catalyst (DOC)** and a **Selective Catalytic Reduction (SCR)** catalyst as an exhaust gas after-treatment system that helps reducing harmful gases and destroying 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 66) 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 a catalysts to oxidize hydrocarbons and carbon monoxide.

EMISSION CARBON CHECK

Deposition of carbon (soot, unburned fuel) in the exhaust pipe line and muffler could cause not only system derates but also could lead to fires.

To reduce soot and unburned fuel, run the unit at rated power until the exhaust gas become mostly colorless every 250 hours operation time. More carbon will be generated when the unit operates at less then 30% of rated power. In this case, perform the above procedures more frequently.

NOTICE

Applying a large load suddenly to the unit when the carbon deposition is generated in the exhaust system could produce sparks and will lead to abnormal combustion. Therefore, apply load gradually and observe the exhaust gas color during the process.

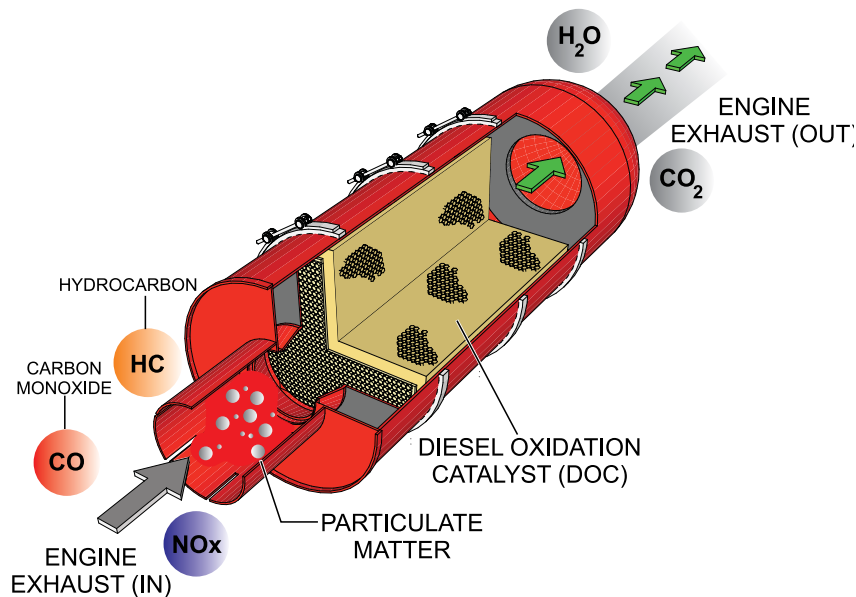


Figure 66. Diesel Oxidation Catalyst (DOC)

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; and 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 67) 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

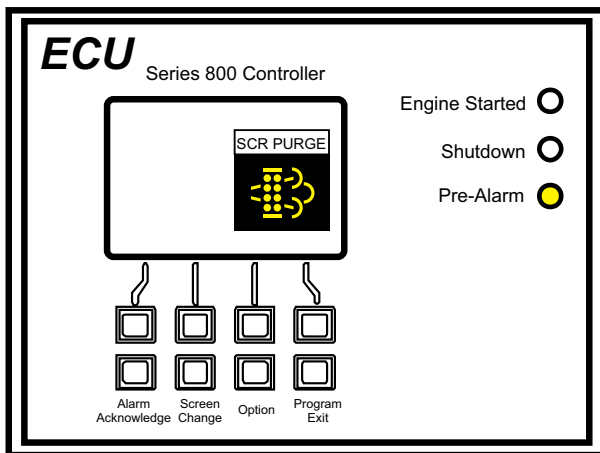


Figure 67. SCR Purge Symbol

NOTICE

During urea SCR system purging, **white smoke** may be emitted from the exhaust tailpipe temporarily this should not be considered a failure. In addition the smell of **amonia** during the purging process should not be considered a failure.

If the purging process is underway while running a light load (0-30%) the unit may produce unusual sounds. This should not be considered a failure or malfunction.

SYSTEM PURGING GUIDELINES

NOTICE

DO NOT perform purging in conditions where it may be unsafe due to high exhasust temperatures.

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

NOTICE

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

- **DO NOT** operate the unit in 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.
- Exhaust emissions from the tailpipe have a smell different from those emitted from engines without urea SCR systems due to the exhaust emission reduction functions of the exhaust system.

If the **diesel exhaust fluid (DEF)** symbol (Figure 68) is displayed during ECU controller operation, it indicates the following:

- DEF tank level is below 10%. Reference Table 17, DEF Level System Action System.
- DEF quality is poor. Check DEF tank level and check active **diagnostics trouble codes (DTC)**.

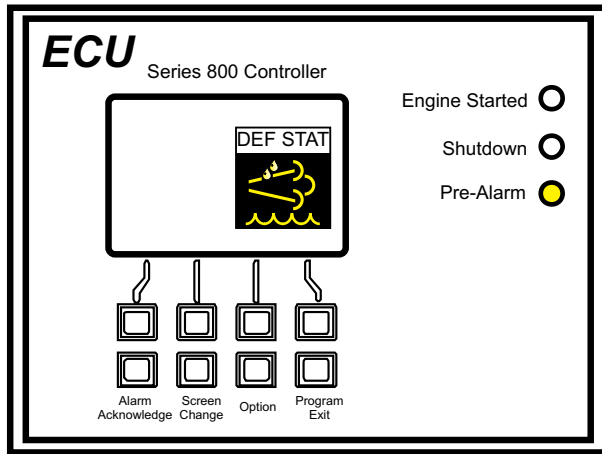


Figure 68. ECU DEF State Pre-Alarm

DIESEL EXHAUST FLUID (DEF)

The amount of fluid in the DEF tank will be shown on the ECU Controller main screen during operation. The symbol shown in Figure 69 will be shown on the ECU monitor indicating the level of fluid in the DEF tank.

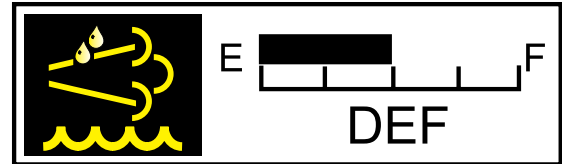


Figure 69. DEF Tank Level Gauge

NOTICE




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

Table 17. DEF Level System Action System

DEF Level	Over 10%	Below 10%	0%	Empty or After 4 hrs. From 0%
Controller Message	—	DEF<10% Tank Level	DEF<10% Tank Level	DEF Tank Empty Level
DEF Symbol	—	● ON	● Blinking	● Blinking
Pre-Alarm Lamp	—	—	● 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 jets, 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 18:

Table 18. DEF Inducement					
Stage	Controller Message	SCR System Pop-Up	DEF Symbol	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, unit will enter ESCAPE MODE and may require as much as 30 minutes to restart.					

HOW TO ACTIVE ESCAPE MODE

If the ECU displays any messages referenced in Table 18, it may be necessary to restart via ESCAPE MODE.

Starting

1. Start the Diagnostic Mode as referenced in the "Troubleshooting Diagnostics" section in this manual.
2. Exit the Status Check Screen by pressing the [EXIT] button (Figure 70).

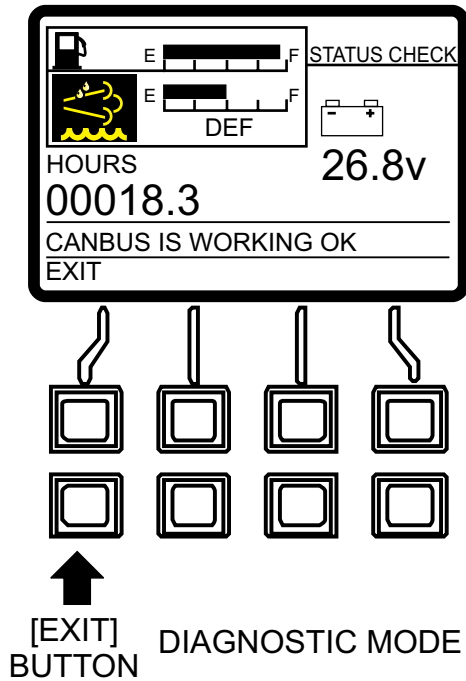


Figure 70. Status Check Screen (Diagnostic Mode)

3. Next, press the [Program/Exit] button (Figure 71) to enter the Main Menu.

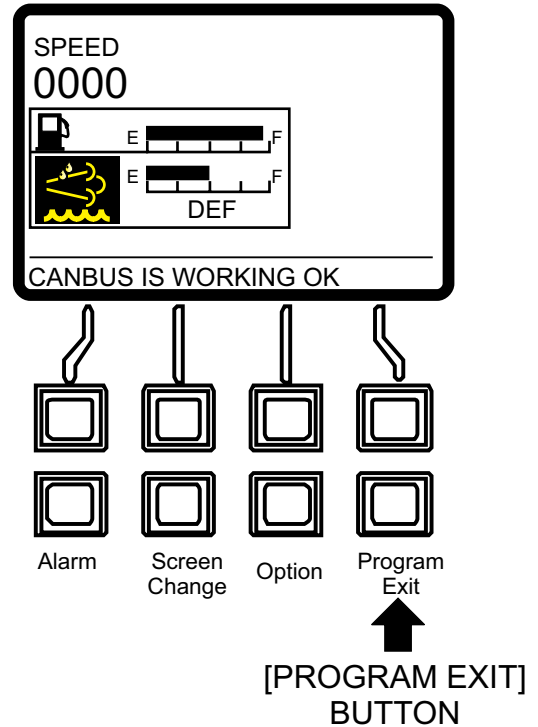


Figure 71. Main Screen

4. Press the [DOWN] button (Figure 72) to scroll to the Escape Mode item.

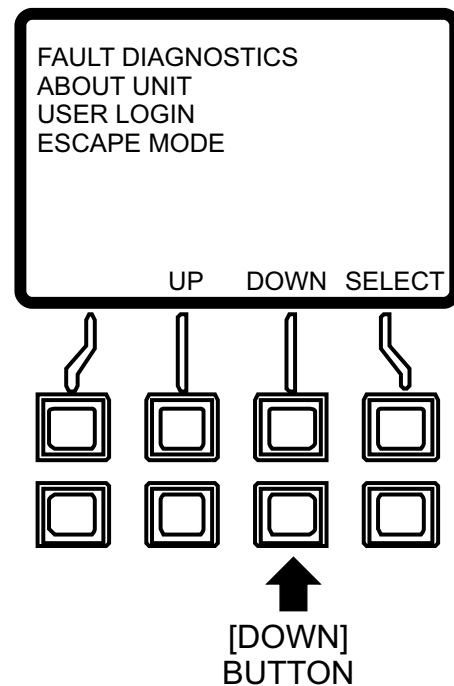


Figure 72. Main Menu (Down Button)

- Press the **[SELECT]** button (Figure 73) to enter the "Escape Mode" menu.

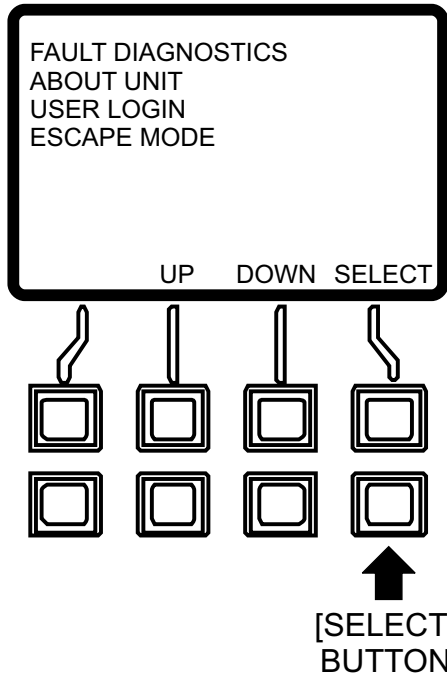


Figure 73. Main Menu (Select Button)

- Press the **[REQUEST]** button (Figure 74) to send "Escape Mode Request" signal to ECM.

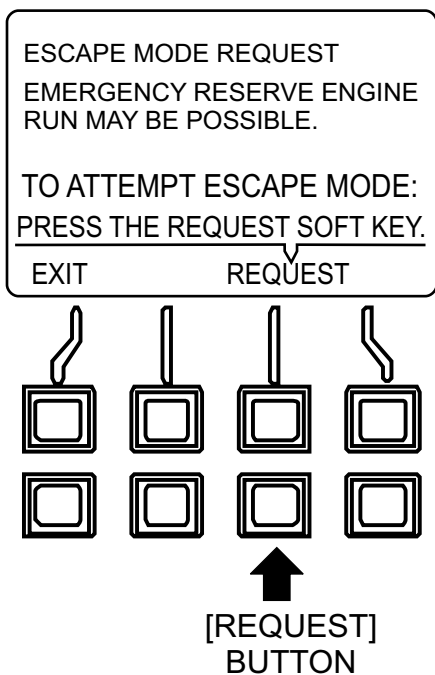


Figure 74. Escape Mode Menu Screen

- Place the Auto Start/Stop Switch (Figure 75), to the "Off /Reset" position.

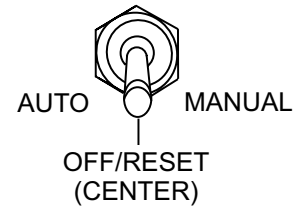


Figure 75. Auto Off/Reset Manual Switch (Off/Reset Position)

- Next, place the Auto Start/Stop Switch (Figure 76) to the "Manual" position to start the engine.

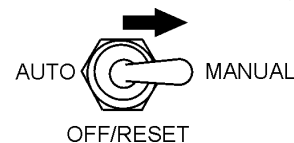


Figure 76. Auto-Off/Reset Manual Switch (Manual Position)

- The **Escape Mode Timer** (Figure 77) will appear on the **main** screen. This timer displays remaining driving possibility time.

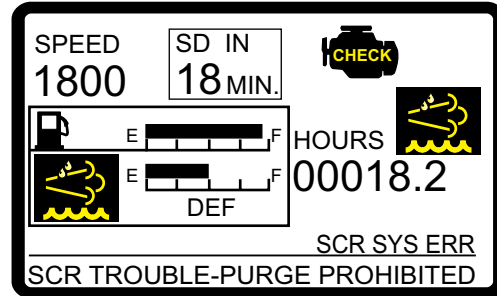
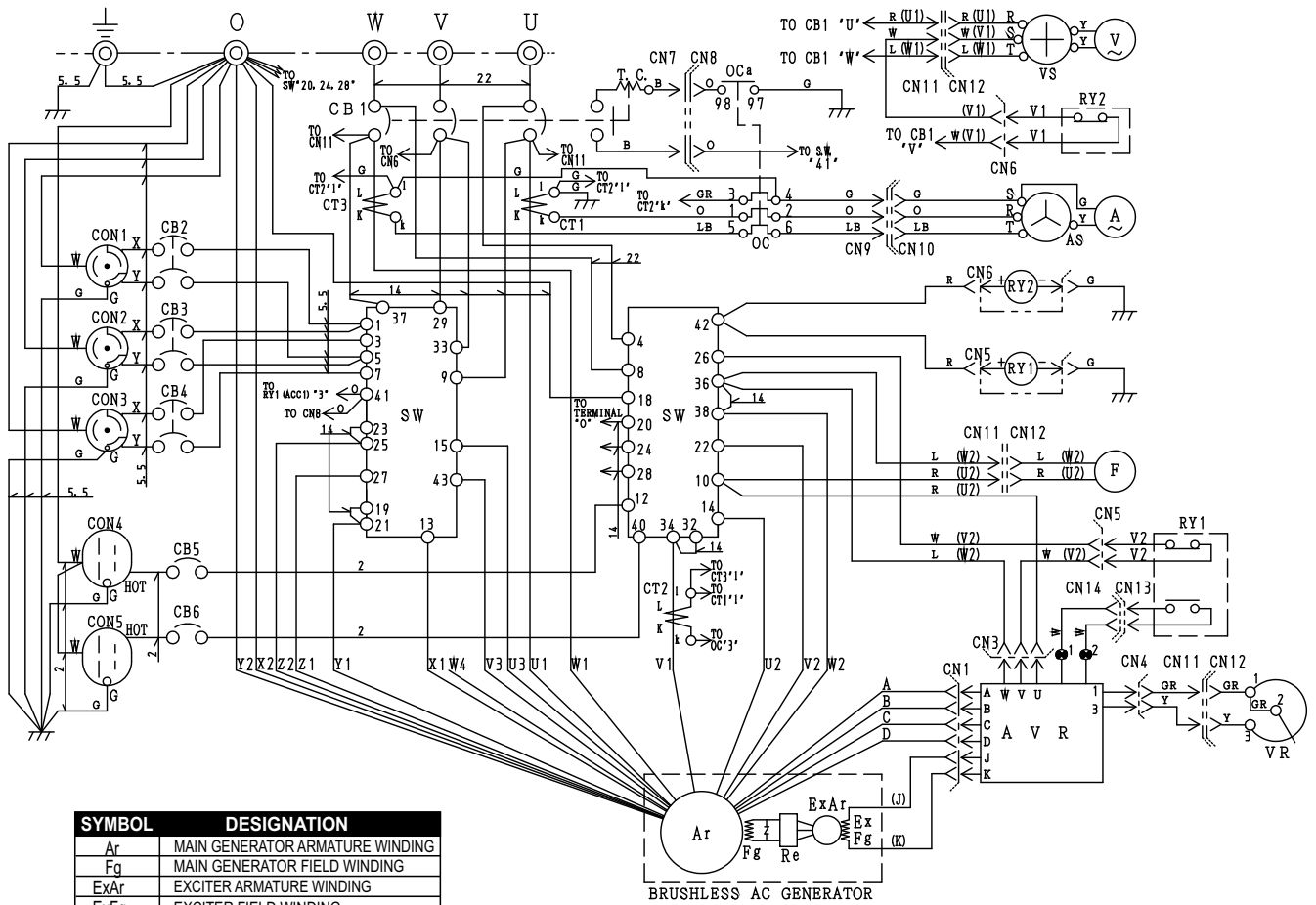


Figure 77. Escape Mode Timer

- If ESCAPE MODE is temporarily suspended, it is not necessary to return to the ESCAPE MODE screen and press the **[REQUEST]** button. ESCAPE MODE operation will be available until around 30 minutes after operation has been ended.
- Once the ESCAPE MODE timer reaches zero minutes, the engine will stop since the ESCAPE MODE time has expired. Please perform maintenance to return 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.

GENERATOR WIRING DIAGRAM

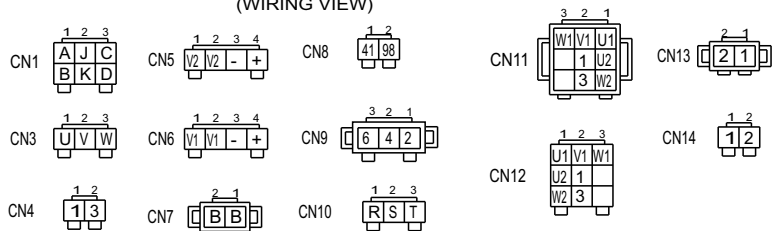


SYMBOL	DESIGNATION
Ar	MAIN GENERATOR ARMATURE WINDING
Fg	MAIN GENERATOR FIELD WINDING
ExAr	EXCITER ARMATURE WINDING
ExFg	EXCITER FIELD WINDING
Re	RECTIFIER
AVR	AUTOMATIC VOLTAGE REGULATOR
VR	VOLTAGE REGULATOR (RHEOSTAT)
CT 1,2,3	CURRENT TRANSFORMER
AS	CHANGE-OVER SWITCH, AMMETER
A	AC AMMETER
V	AC VOLTMETER
F	FREQUENCY METER
CB1	CIRCUIT BREAKER, 3P 200A
CB2, 3, 4	CIRCUIT BREAKER, 2P 50A
CB5, 6	CIRCUIT BREAKER, 1P 20A
CON1, 2, 3	RECEPTACLE, CS6369, 250 VAC @ 50 AMPS
CON4, 5	RECEPTACLE, GFCI, 125 VAC @ 20 AMPS X 2
OC	OVER CURRENT RELAY
SW	SELECTOR SWITCH
RY1	RELAY UNIT
RY2	RELAY UNIT

CURRENT TRANSFORMERS (CT1 - 3)	
REF. DES.	MARK AT CT
k	X1
l	NO MARK
K	H1
L	NO MARK

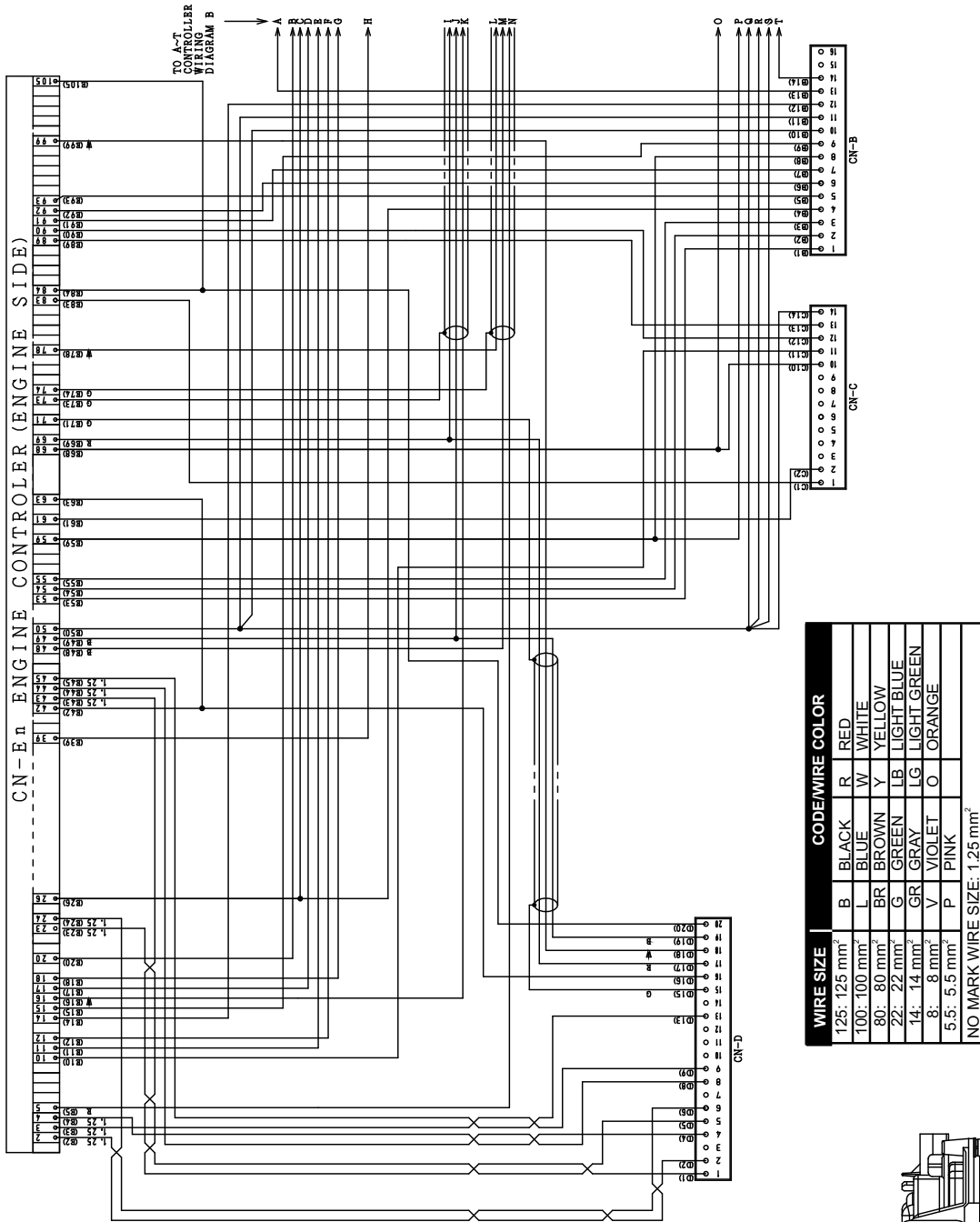
NOTE: EACH CABLE IS PASSED TWICE THROUGH CURRENT TRANSFORMERS CT1, CT2 AND CT3.

CONNECTOR ARRANGEMENT (WIRING VIEW)



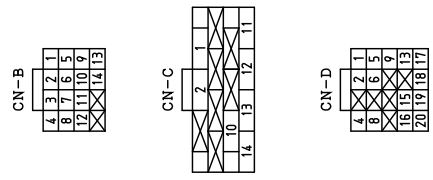
WIRE SIZE	CODE/WIRE COLOR			
125: 125 mm ²	B	BLACK	R	RED
100: 100 mm ²	L	BLUE	W	WHITE
80: 80 mm ²	BR	BROWN	Y	YELLOW
22: 22 mm ²	G	GREEN	LB	LIGHT BLUE
14: 14 mm ²	GR	GRAY	LG	LIGHT GREEN
8: 8 mm ²	V	VIOLET	O	ORANGE
5.5: 5.5 mm ²	P	PINK		
NO MARK WIRE SIZE: 1.25 mm ²				

CONTROLLER WIRING DIAGRAM

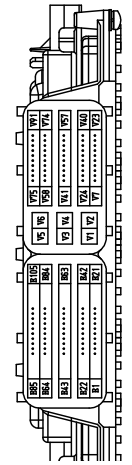


WIRE SIZE	CODE	WIRE COLOR
125: 125 mm ²	B	BLACK
100: 100 mm ²	L	BLUE
80: 80 mm ²	BR	BROWN
22: 22 mm ²	G	GREEN
14: 14 mm ²	GR	GRAY
8: 8 mm ²	V	VIOLET
5.5: 5.5 mm ²	P	PINK
	R	RED
	W	WHITE
	Y	YELLOW
	LB	LIGHT BLUE
	LG	LIGHT GREEN
	O	ORANGE

NO MARK WIRE SIZE: 1.25 mm²

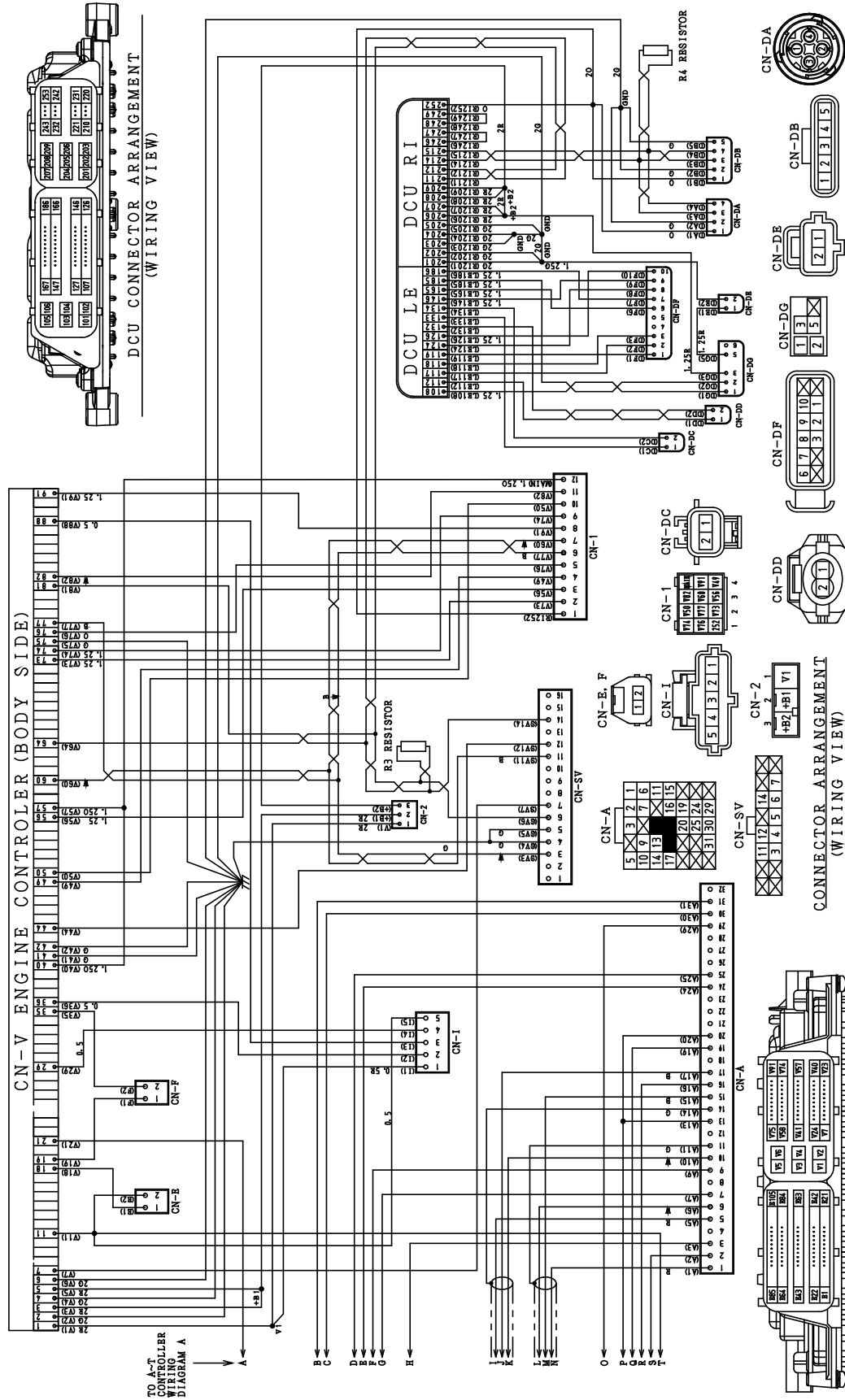


CONNECTOR ARRANGEMENT (WIRING VIEW)



CONNECTOR ARRANGEMENT (WIRING VIEW)

CONTROLLER WIRING DIAGRAM



CN-V ENGINE CONTROLLER (BODY SIDE)

DCU CONNECTOR ARRANGEMENT (WIRING VIEW)

WIRE SIZE	CODE	WIRE COLOR
125: 125 mm ²	B	BLACK
100: 100 mm ²	L	BLUE
80: 80 mm ²	BR	BROWN
22: 22 mm ²	G	GREEN
14: 14 mm ²	GR	GRAY
8: 8 mm ²	V	VIOLET
5.5: 5.5 mm ²	P	PINK
	R	RED
	W	WHITE
	Y	YELLOW
	LB	LIGHT BLUE
	LG	LIGHT GREEN
	O	ORANGE

ECM CONNECTOR ARRANGEMENT (WIRING VIEW)

TROUBLESHOOTING (GENERATOR)

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

Table 19. Generator Troubleshooting		
Symptom	Possible Problem	Solution
No Voltage Output	AC Voltmeter defective?	Check output voltage using a voltmeter.
	Is wiring connection loose?	Check wiring and repair.
	Is AVR defective?	Replace if necessary.
	Defective Rotating Rectifier?	Check and replace.
	Defective Exciter Field?	Check for approximately 19 ohms across J & K on CN1
Low Voltage Output	Is engine speed correct?	Place engine speed switch in "High" position.
	Is wiring connections loose?	Check wiring and repair.
	Defective AVR?	Replace if necessary.
High Voltage Output	Is wiring connections loose?	Check wiring and repair.
	Defective AVR?	Replace if necessary.
Circuit Breaker Tripped	Short Circuit in load?	Check load and repair.
	Over current?	Confirm load requirements and reduce.
	Defective circuit breaker?	Check and replace.
	Over current Relay actuated?	Confirm load requirement and replace.

TROUBLESHOOTING (DIAGNOSTICS)

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

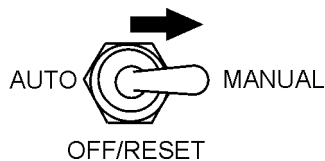
1. With the engine stopped (**OFF**), push and hold the **Hour Check Button** (Figure 78) located on the control panel.

HOUR CHECK
BUTTON



Figure 78. Hour Check Button

2. While keeping the **Hour Check Button** pressed, place the **Auto Off/Reset Manual Switch** (Figure 79) in the **MANUAL** position.



**Figure 79. Auto-Off/Reset Switch
(Manual Position)**

3. The **Hour Check Menu Screen** will be displayed on the ECU controller.
4. Releasing the **Hour Check Button** and pushing the **Program/Exit Button** on the ECU controller will return the controller to the main screen.

5. Push the **Program/Exit Button** on the ECU controller and select the **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 performing diagnostic tests, place the **Auto Off/Reset Manual Switch** in the **OFF** position

OPERATION MANUAL

HERE'S HOW TO GET HELP

PLEASE HAVE THE MODEL AND SERIAL
NUMBER ON-HAND WHEN CALLING

UNITED STATES

Multiquip Corporate Office

18910 Wilmington Ave.
Carson, CA 90746
Contact: mq@multiquip.com

Tel. (800) 421-1244
Fax (310) 537-3927

MQ Parts Department

800-427-1244
310-537-3700

Fax: 800-672-7877

Service Department

800-421-1244
310-537-3700

Warranty Department

800-421-1244
310-537-3700

Fax: 310-943-2249

Technical Assistance

800-478-1244

Fax: 310-943-2238

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Laval, Quebec, Canada H7L 6V3
Contact: infocanda@multiquip.com

Tel: (450) 625-2244
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Fax: (450) 625-8664

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