

OPERATION MANUAL



SmartStickTM
MODEL DLW500ESA4
WELDER/GENERATOR
(ISUZU 4LE2T DIESEL ENGINE)
INSTRUCTION MANUAL NO. D6844301434

Revision #1 (01/19/24)

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



THIS MANUAL MUST ACCOMPANY THE EQUIPMENT AT ALL TIMES.

PROPOSITION 65 WARNING



REPORTING SAFETY DEFECTS

If you believe that your vehicle has a defect that could cause a crash or could cause injury or death, you should immediately inform the National Highway Traffic Safety Administration (NHTSA) in addition to notifying Multiquip Inc. at 1-800-421-1244.

If NHTSA receives similar complaints, it may open an investigation, and if it finds that a safety defect exists in a group of vehicles, it may order a recall and remedy campaign. However, NHTSA cannot become involved in individual problems between you, your dealer, or Multiquip Inc.

To contact NHTSA, you may either call the Vehicle Safety Hotline toll-free at 1-888-327-4236 (TTY: 1-800-424-9153), go to <http://www.safercar.gov>, or write to:

Administrator
NHTSA
1200 New Jersey Avenue, SE
Washington, DC 20590

You can also obtain information about motor vehicle safety from <http://www.safercar.gov>.

DLW500ESA4 Welder-Generator

Proposition 65 Warning	2
Reporting Safety Defects.....	3
Safety Information	5-12
Specifications (Welder-Generator)	13
Specifications (Fuel Consumption).....	14
Dimensions.....	15
Installation	16-17
General Information.....	18
Welding Polarity And Duty Cycle	19
Welding Terms.....	20
Components Welder/Generator.....	21-22
Engine Components	23
Power Receptacles.....	24
Control Panel.....	25-27
Inspection	28-30
Setup	31-33
Local Operation	34-45
Remote Operation	46-48
Maintenance.....	49-63
Welder-Generator Fault Codes	64-65
Engine Diagnostic Fault Codes	66-67
Welder-Generator Troubleshooting	68-69
Generator Wiring Diagram.....	70
Generator Reference Designators/Connectors	71
Engine Wiring Diagram.....	72
Controller Wiring Diagram	73
Battery Charger Wiring Diagram	74
Engine Block Heater Wiring Diagram	75

NOTICE

Specifications are subject to change without notice.

SAFETY INFORMATION

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










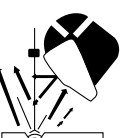


SAFETY MESSAGES

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 equipment 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
	Welding Hazards
	EMF Hazards
	Pacemaker Hazards
	Implant Hazards
	Flying Sparks Hazards
	Fire Hazards
	Electric Shock Hazards

SAFETY INFORMATION

GENERAL SAFETY

⚠ CAUTION

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

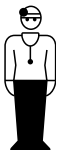


- **NEVER** operate this equipment under the influence of drugs or alcohol.



NOTICE


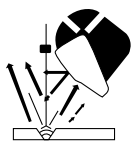

- This equipment should only be operated by trained and qualified personnel 18 years of age and older.
- Whenever necessary, replace nameplate, operation and safety decals when they become difficult read.
- Manufacturer does not assume responsibility for any accident due to equipment modifications. Unauthorized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



SAFETY INFORMATION


WELDER SAFETY

DANGER

- **NEVER** install or operate the welder-generator in an explosive atmosphere or near combustible materials. An explosion or fire could result causing severe **bodily harm or even death.** 
- Flying sparks can cause injury. Wear a face shield to protect eyes and face. 
- Remove all flammables within 35 ft (10.7 m) of welding arc. If this is not possible, tightly cover them with approved covers.
- Do not weld where flying sparks can strike flammable material.
- Hot metal from air arc cutting and gouging can cause fire or explosion. **DO NOT** cut or gouge near flammables. 
- Welding on closed containers, like tanks, drums or pipes, can cause them to blow up. **DO NOT** weld on closed containers unless they are properly prepared according to AWS F4.1 (see *Recommended Safe Practices for the Preparation for Welding and Cutting of Containers and Piping* from American Welding Society Standards). Check and be sure area is safe before doing any welding.
- Protect yourself and others from flying sparks and hot metal. Wear oil-free protective garments like leather gloves, heavy shirt, cuffless trousers, high shoes and a cap.
- Be alert that welding sparks and hot materials from welding can go through small cracks and openings to adjacent areas.
- Be aware that welding on a ceiling, floor, bulkhead or partition can cause fire on hidden side.
- Connect welding cable to the work as close to welding area as practical to prevent welding current from traveling long, possibly unknown paths and causing electric shock, sparks and fire hazards.
- **DO NOT** use welder-generator to thaw frozen pipes.
- Remove stick electrode from holder or cut off welding wire at contact tip when not in use.


- **DO NOT** touch output terminals during operation. Contact with output terminals during operation can cause **electrocution, electrical shock or burn.**
- Remove any combustibles, such as a butane lighter or matches, from your person before doing any welding.
- After completion of work, inspect area to ensure it is free of sparks, glowing embers and flames.
- Follow requirements in OSHA 1910.252 (a) (2) (iv) and NFPA 51B for hot work and have a fire watcher and extinguisher nearby.

WARNING

- Keep your head out of the fumes. Use enough ventilation or exhaust at the arc, or both, to keep the fumes and gases from your breathing zone and the general area. In a large room or outdoors, natural ventilation may be adequate if you keep your head out of the fumes.
- **DO NOT** get too close to the arc. Use corrective lenses if necessary to stay a reasonable distance away from the arc.
- Use natural drafts or fans to keep the fumes away from your face.
- Welding wire can cause injury. Do not press gun trigger until instructed to do so. Do not point gun toward any part of the body, other people or any metal when threading welding wire. 
- Have only qualified people remove doors, panels, covers or guards for maintenance and troubleshooting if necessary.
- Reinstall doors, panels, covers or guards when servicing is finished and before starting engine.
- **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.

SAFETY INFORMATION

CAUTION

- Electric current flowing through any conductor causes localized Electro Magnetic Fields (EMF). Welding current creates EMF fields around welding cables and welding machines. 
- Wearers of **pacemakers** and other implanted medical devices should keep away from welding equipment when in use. 
- Implanted medical device wearers should consult their doctor and the device manufacturer before going near arc welding, spot welding, gouging, plasma arc cutting or induction heating operations. 
- Exposure to EMF fields in welding may have other health effects which are now not known.
- All welders should use the following procedures in order to minimize exposure to EMF fields from the welding circuit:
 - Route the electrode and work cables together. Secure them with tape when possible.
 - **NEVER** coil the electrode lead around your body.
 - **DO NOT** place your body between the electrode and work cables. If the electrode cable is on your right side, the work cable should also be on your right side.
 - Connect the work cable to the workpiece as close as possible to the area being welded.
 - **DO NOT** work next to the welder-generator.

NOTICE

- Electromagnetic energy can interfere with sensitive electronic equipment such as microprocessors, computers and computer-driven equipment such as robots. Be sure all equipment in the welding area is electromagnetically compatible. 
- To reduce possible interference, keep weld cables as short as possible, close together and down low, such as on the floor. Locate welding operation 100 meters from any sensitive electronic equipment. Be sure welder-generator is installed and grounded according to this manual.
- If interference still occurs, the operator must take extra measures, like moving the welder-generator, using shielded cables, using line filters or shielding the work area.
- **NEVER** lubricate components or attempt service on a running machine.
- Overheating can damage equipment. Turn off or unplug equipment before starting or stopping engine. Low voltage and frequency caused by low engine speed can damage electric devices. Ensure engine speed is correct during operation.
- Overloading shortens the life of the welder-generator. Use the machine with appropriate AC and DC current and appropriate duty cycle.
- **ALWAYS** ensure welder-generator is on level ground before use.
- **ALWAYS** keep the welder-generator in proper running condition.
- Fix damage to welder-generator and replace any broken parts immediately.
- **ALWAYS** store welder-generator properly when it is not being used. Equipment should be stored in a clean, dry location out of the reach of children and unauthorized personnel.

SAFETY INFORMATION

ENGINE SAFETY

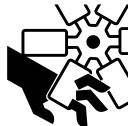
DANGER

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



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 or coolant drain plug while the engine is hot. High pressure boiling water or coolant will gush out and severely scald any persons in the general area of the welder-generator.
- **DO NOT** remove the engine oil drain plug while the engine is hot. Hot oil will gush out of the engine crankcase and severely scald any persons in the general area of the welder-generator.



CAUTION

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



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 equipment can result if operating in speed ranges above the maximum allowable.
- 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.
- 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.

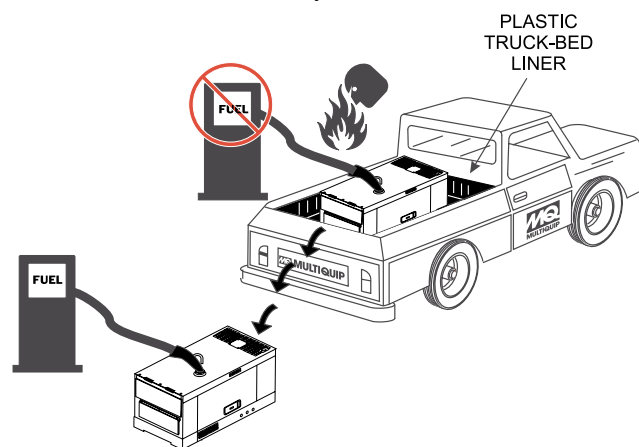
Wet stacking does not usually cause any permanent damage and can be alleviated if additional load is applied to relieve the condition. It can reduce the system performance and increase maintenance. Applying an increasing load over a period of time until the excess fuel is burned off and the system capacity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

SAFETY INFORMATION

FUEL SAFETY

DANGER

- **DO NOT** add fuel to equipment if it is placed inside truck bed with plastic liner. Possibility exists of explosion or fire due to static electricity.



- **DO NOT** start the engine near spilled fuel or combustible fluids. Gasoline 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 equipment. Fire or explosion could result from fuel vapors or if fuel is spilled on a hot engine



ELECTRICAL SAFETY

DANGER

- Turn welder-generator and all circuit breakers **OFF** before performing maintenance on the generator or making contact with output receptacles.
- **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 welder-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 or DC power from the generator is being transferred to a load.
- **NEVER** use **damaged** or **worn** cables or cords when connecting equipment 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

- These welder-generators are equipped with a grounding terminal at the base of the pipe frame. Electrical grounding requirements can differ by State, Province, District, Municipality, and unique application settings.
- For portable and vehicle-mounted welder-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
- **NEVER** use gas piping as an electrical ground.

BATTERY SAFETY

DANGER

- **DO NOT** drop the battery. There is a possibility that the battery will explode.
- **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.
- **DO NOT** charge battery if frozen. Battery can explode. When frozen, warm the battery to at least 61°F (16°C)



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.

TRANSPORTING SAFETY

CAUTION

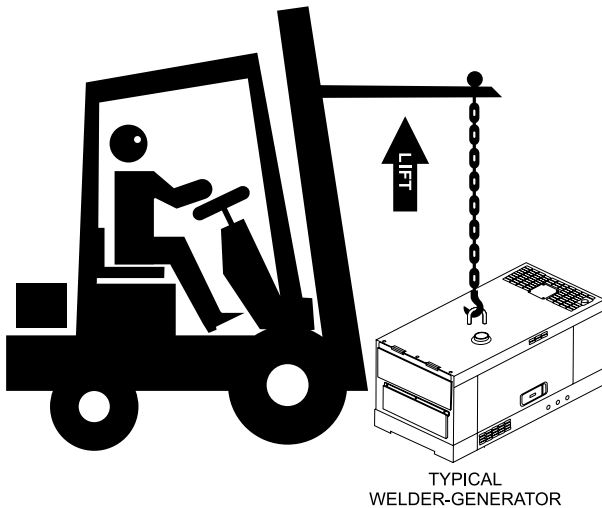
- **NEVER** allow any person or animal to stand underneath the equipment while lifting.

NOTICE

- Before lifting, make sure that the equipment parts (lifting bail) is not damaged and screws are not loose or missing.
- **ALWAYS** make sure crane or lifting device has been properly secured to the lifting bail (hook) of the equipment.
- **ALWAYS** shutdown engine before transporting.
- **NEVER** lift the equipment while the engine is running.
- Tighten fuel tank cap securely and close fuel cock to prevent fuel from spilling.
- Use adequate lifting cable (wire or rope) of sufficient strength.

SAFETY INFORMATION

- Use one point suspension hook and lift straight upwards.



- **DO NOT** lift machine to unnecessary heights.
- **ALWAYS** tie down equipment during transport by securing the equipment with rope.

ENVIRONMENTAL SAFETY/DECOMMISSIONING

NOTICE

Decommissioning is a controlled process used to safely retire a piece of equipment that is no longer serviceable. If the equipment poses an unacceptable and unrepairable safety risk due to wear or damage or is no longer cost effective to maintain (beyond life-cycle reliability) and is to be decommissioned (demolition and dismantlement), be sure to follow 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 equipment.
- When the life cycle of this equipment is over, remove battery (if equipped) and bring to appropriate facility for lead reclamation. Use safety precautions when handling batteries that contain sulfuric acid.



- When the life cycle of this equipment is over, it is recommended that the unit frame and all other metal parts be sent to a recycling center.

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

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

EMISSIONS INFORMATION

NOTICE

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

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

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

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

Emission Control Label

The emission control label is an integral part of the emission system and is strictly controlled by regulation(s).

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 (WELDER-GENERATOR)

Table 1. Welding Generator Specifications

	CC Mode				CV Mode			
	High Speed		Low Speed		High Speed		Low Speed	
	Single	Dual	Single	Dual	Single	Dual	Single	Dual
Rated Output	17.1 kW	7.5 kW	7.5 kW	4.9 kW	16.4 kW	6.6 kW	6.6 kW	4.1 kW
Rated Current	450 A	250 A	250 A	180 A	450 A	250 A	250 A	180 A
Rated Voltage	38.0 V	30.0 V	30.0 V	27.2 V	36.5 V	26.5 V	26.5 V	23.0 V
Duty Cycle	100%		100%		100%		100%	
Rated Speed	1800 rpm		1200 rpm		1800 rpm		1800 rpm	
Current Range	30~500 A	30~280 A	30~280 A	30~180 A	—	—	—	—
Voltage Range	—	—	—	—	14~40 V	14~29 V	14~29 V	14~24 V

Table 2. AC Generator Specifications

No. of Phases	1
Wires	3-Wires (Neutral Grounded)
Rated Output	14 kW (14 kVA)
Rated Voltage	120/240 VAC
Amperage	116/58
Frequency	60 Hz
Power Factor	1
Rating	Continuous
Receptacles (4)	GFCI, 30 Amp Twist Lock (2) 50 Amp Twist Lock

Table 3. DC/AC Simultaneous Use

Electrode Size (Dia. in.)	DC Welding Amps	AC Output (kW)	AC Output (Amps) 120/240V
—	—	14	116.6/58.3
3/32	80	14	116.6/58.3
1/8	130	14	116.6/58.3
5/32	170	14	116.6/58.3
3/16	220	11	91.6/45.8
7/32	270	9	75.0/37.5
1/4	320	7	58.3/29.1
5/16	370	5	41.6/20.83

Table 4. Engine Specifications

Model	ISUZU 4LE2T
Type	Vertical, 4-Cycle Water Cooled, EGR
Rated Output	40.2 HP/1800 rpm
Displacement	133 cu. in. (2.179 L)
Cooling System	Water-Cooled-Radiator
Starting System	Electric Starting
Fuel Tank Capacity	17.7 gal. (67 L)
Fuel Type	No. 2 Diesel Fuel Low Sulfur/Ultra Low Sulfur Diesel fuel
Cooling Water Capacity	2.35 gal. (8.9 L)
Lube Oil Capacity	2.75 gal. (10.4 L)
Lubricating Type Oil	API Service Class See Table 26 and Table 27
Battery	12 V 64Ah x 1
Dry Weight	1962 lbs. (890 kg)
Exhaust Gas-After Treatment	DOC

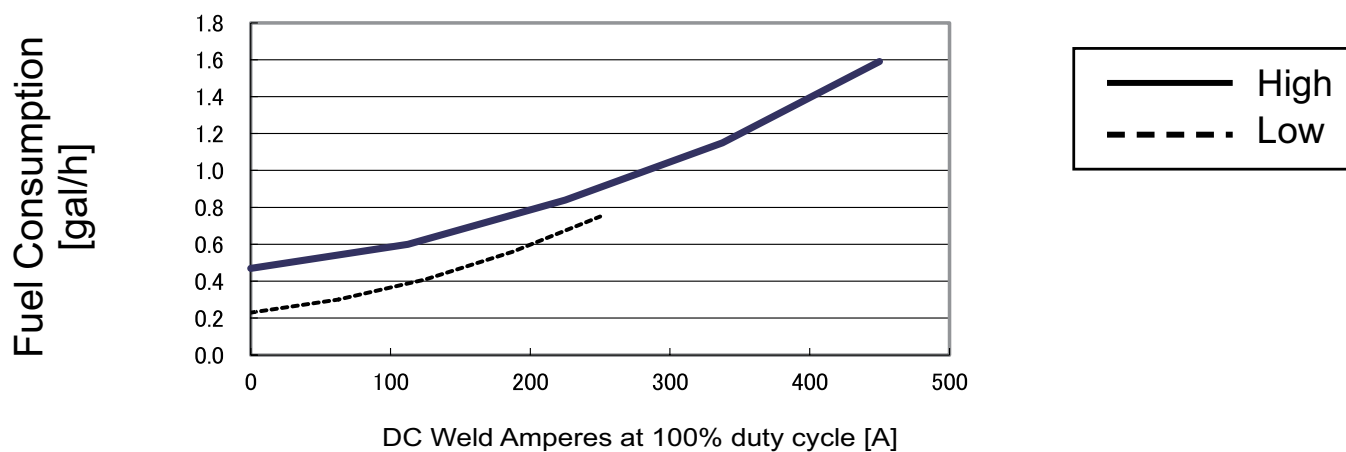
NOTICE

This unit is a two function device, welder and AC generator. The single-phase AC power source (14 kW) can be used in conjunction with DC welding operations. Refer to Table 3 for simultaneous use of AC power and DC welding. **DO NOT** overload unit when AC and DC voltages are used simultaneous. Main circuit breaker will trip when overload condition exist.

SPECIFICATIONS (FUEL CONSUMPTION)

Table 5. Fuel Consumption				
No Load	High (1800 rpm)		Low (1200 rpm)	
Fuel Consumption gal/hr. (liters/hr.)	0.47 (1.77)		0.23 (0.87)	
High (1800 rpm)				
Amperes ¹	113	225	338	450
Fuel Consumption gal/hr. (liters/hr.)	0.60 (2.27)	0.84 (3.17)	1.15 (4.35)	1.59 (6.00)
Low (1200 rpm)				
Amperes	63	125	188	250
Fuel Consumption gal/hr. (liters/hr.)	0.30 (1.13)	0.41 (1.55)	0.56 (2.11)	0.75 (2.83)
¹ DC welding current at 100%				

Fuel Consumption



DIMENSIONS

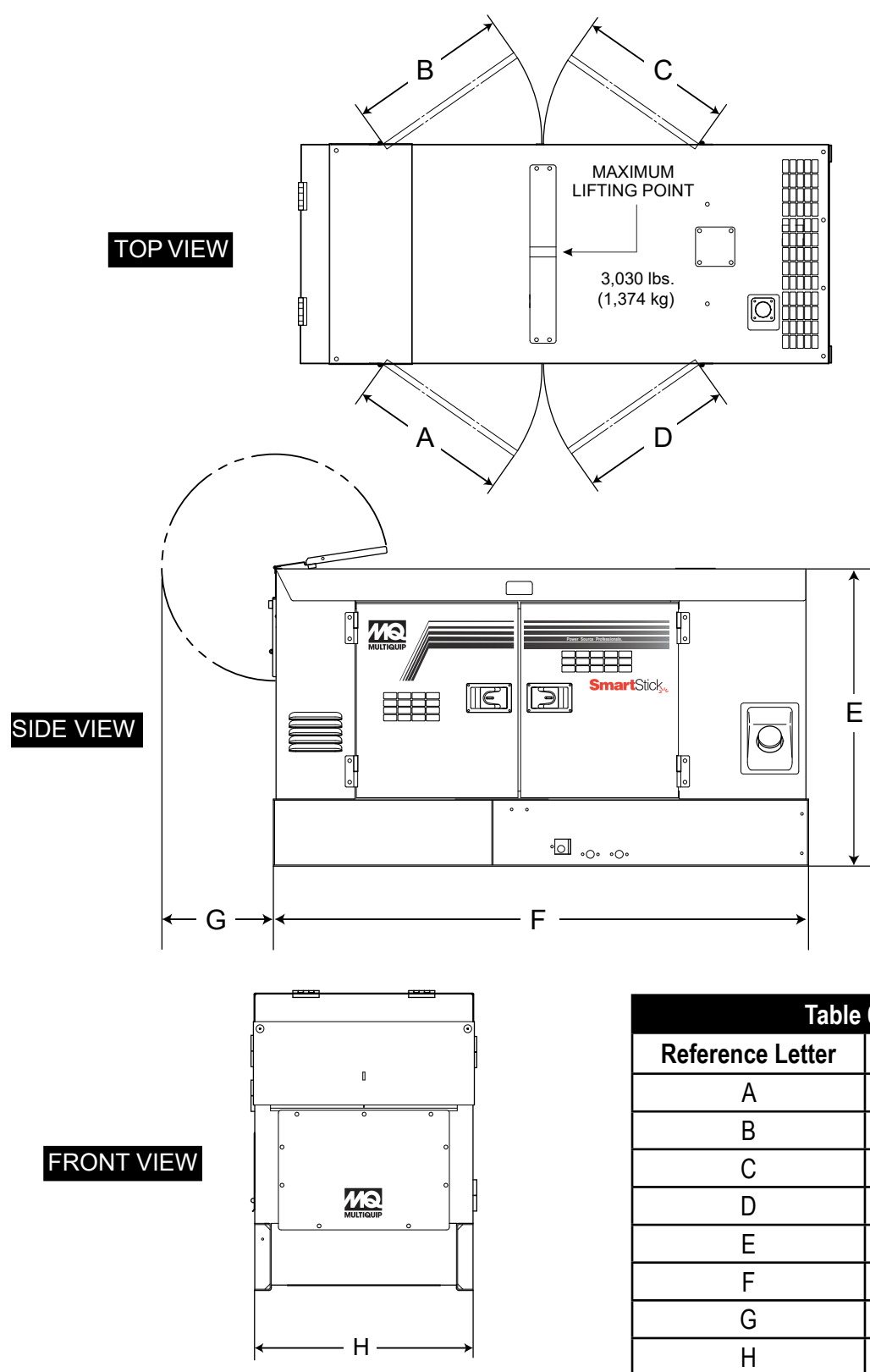


Table 6. Dimensions	
Reference Letter	Dimension in. (mm)
A	24.21 (615)
B	24.21 (615)
C	23.62 (600)
D	23.62 (600)
E	44.48 (1130)
F	80.11 (2035)
G	16.92 (430)
H	32.67 (830)

Figure 2. Dimensions

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 welder-generator ground point (Figure 3). Connect the other end of the ground cable to a suitable earth ground (ground rod).

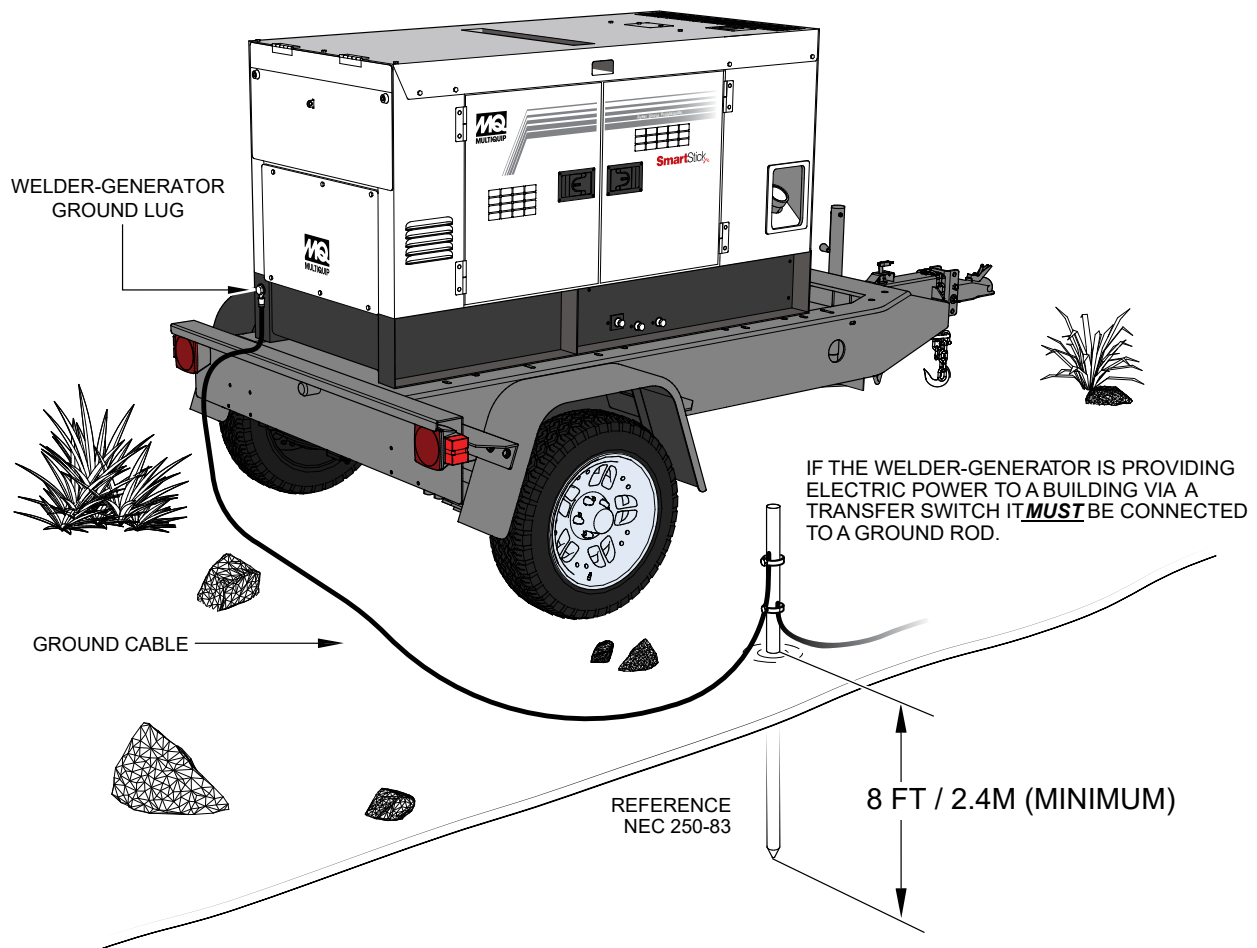


Figure 3. Welder-Generator Grounding Application

NOTICE

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

OUTDOOR INSTALLATION

If possible install the welder-generator in a area that is free of debris, bystanders, and overhead obstructions. Make sure the welder-generator is on secure level ground so that it cannot slide or shift around.

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

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



WARNING



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 gas 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.

PLACEMENT

This welder-generator should always be placed on a flat level surface when it is running. **DO NOT** place the welder-generator on slopes, the possibility exists that the unit could slide.



DANGER



Electric shock can occur when vibrators are used. Pay close attention to handling when operating vibrators and always use rubber boots and gloves to insulate the body from a short circuit.

WELDER-GENERATOR GROUNDING

NOTICE

The Occupational Safety and Health Administration (OSHA) and the National Electrical Code (NEC) recommend that if the welder-generator is providing electrical power to a structure (home, office shop, trailer or similar) it **must** be connected to a grounding electrode system, such as driven ground rod (Figure 3).

If applicable, to guard against electrical shock and possible damage to the generator, it is important to provide a good **EARTH** ground, (Figure 3).

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. It 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 3) is required, connect one end of 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

When used in **single** mode applications, Multiquip's Model DLW500ESA4 Whisper Weld™ is a 500 amp DC welder. **Dual** mode applications provide 280 amps at each of the A and B welding terminals.

This unit incorporates a brushless revolving field simultaneous power generator, featuring stable arc characteristics, excellent vibration resistance and durability.

The unit also incorporates an AC power source (14 kW) which provides power for tools, submersible water pumps and other industrial and construction machinery.

In addition, this unit features incredibly quiet operation and can be operated at night or in restricted noise level locations.

This instruction manual provides information necessary for proper handling and operation of the welder/generator.

Please read the manual to ensure maximum operation and long service life.

CONTROL PANEL

The control panel is provided with the following components:

- DC Weld Meter
- Hour Meter
- Display Change Button
- Idle Stop Monitor
- Fuel Gauge
- Warning Lamp/Hour Display Button
- Welding Regulation Control A/B
- Current Voltage Regulator Control A/B
- Single-Dual Selector Switch
- Welding Mode Selector Switch CC/CV
- E-Mode Selector Switch
- Operation Lamp
- Engine Start Button
- Starter Switch
- 60 Amp Main Circuit Breaker
- AC Voltmeter
- Idle Stop Time Regulator Control
- Idle Stop Select Switch
- GFCI Sensing Module

OUTPUT TERMINAL PANEL

- 120 VAC GFCI Receptacle (5-20R)
- 120V Twist-Lock Output Receptacle (L5-30R)
- 240V Twist-Lock Output Receptacle (L6-30R)
- 120/240V Output Twist-Lock Receptacle (CS6369)
- 20 Amp 2P Circuit Breaker
- 30 Amp 1P Circuit Breaker
- 30 Amp 2P Circuit Breaker
- Ground Terminal

OPTIONS

The welder-generator has the following options:

- TRLRMP/TRLRMPXF Trailers
- Trailer Tool Box
- Cable Carrier
- Wired Remote Control
- Block Heater
- Fuel Heater
- Battery Tender

This welder-generator is powered by a 4 cylinder, 4-cycle liquid-cooled Isuzu 4LE2T diesel engine. This engine is designed to meet every performance requirement for the generator. Reference Table 4 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 11) as a guide for selecting proper extension cable size.

WELDING POLARITY AND DUTY CYCLE

WELDING POLARITY

Polarity indicates the direction of the current flow in that circuit. Since DC current moves in only one direction, polarity is important because the flow of current must be changed depending on the application.

By changing the **polarity**, the greatest amount of heat can be concentrated where it is most needed. With straight polarity (electrode negative), more heat is directed to the **workplace**. When using reverse polarity (electrode positive), more of the heat generated is directed to the **electrode**. Reference Figure 19.

NOTICE

When high quality welding is required **DO NOT** use AC power side of unit.

DUTY CYCLE

NOTICE

The **American Welding Society** sets all regulations and procedures for the welding industry. All welders are subject to the same regulations.

Duty cycle is based on a 10-minute welding period. Exceeding the duty cycle will have an affect on the welding process. The amperage will start dropping off and the welding process will not have the proper amperage required to proceed. If the duty cycle is exceeded, damage can occur to the welding machine.

The 10-minute duty cycle period means 100% welding. If the duty cycle is 70%, then you can only **weld for seven minutes** and the machine must **cool down for three minutes** (Reference Table 7).

Table 7. 10-Minute Duty Cycle

Duty Cycle %	Welding ON Time (Min.)	Cool Down Time (Min.)	Welding Current (Amps)
Single Mode (High Speed)			
100 ¹	Continuous	N/A	30 ~ 450
90	9	1	470
80	8	2	480
70	7	3	500
Dual Mode (High Speed)			
100 ¹	Continuous	N/A	30 ~ 250
90	9	1	260
80	8	2	270
70	7	3	280

¹The DLW500ESA4 welder has a 100% duty cycle @ 450 amps (single mode) or 250 amps (dual mode).

Table 8. 10-Minute Duty Cycle

Duty Cycle %	Welding ON Time (Min.)	Cool Down Time (Min.)	Welding Current (Amps)
Single Mode (Low Speed)			
100	Continuous	N/A	30 ~ 250
90	9	1	260
80	8	2	270
70	7	3	280

Table 9. 10-Minute Duty Cycle

Duty Cycle %	Welding ON Time (Min.)	Cool Down Time (Min.)	Welding Current (Amps)
Dual Mode (Low Speed)			
100 ¹	Continuous	N/A	30 ~ 180

¹Unit can only be operated at 100% duty cycle.

DEFINITIONS OF WELDING TERMS

1. **Weld** – The unification of metallic parts by heating and allowing the metals to flow together or by hammering or compressing with or without previous heating.
2. **Straight Polarity** – A term for direct current electrode negative.
3. **Reverse Polarity** – A term for direct current electrode positive.
4. **Manual Welding** – A welding operation performed and controlled completely by hand.
5. **AC or Alternating Current** – AC is the kind of electricity, which reverses its direction periodically. For 60 cycle current, the current goes in one direction and then in the other direction 60 times in the same second, so that the current changes its direction 120 times in one second.
6. **DC or Direct Current** – DC is the kind of electricity, which only flows in one direction. The flow of electricity is from the power source to the application. In welding, an arc welding process wherein the power supply is at the arc is direct current.
7. **ARC Force** – An adjustment that allows the operator to fine tune the arc characteristics according to job requirements.
8. **ARC Length** – The distance from the end of the electrode to the point where the arc makes contact with the work surface.
9. **ARC Voltage** – The voltage across the welding arc.
10. **ARC Blow** – The deflection of an electric arc from its normal path because of magnetic forces.
11. **Base Metal (Material)** – The metal (material) to be welded, brazed, soldered, or cut.
12. **E-Mode** – Improves fuel efficiency by allowing the operator to weld with engine at idle speed at up to 280 amps (single mode). Reduces operating costs and noise levels.
13. **Covered Electrode** – A composite fill metal electrode consisting of a core of a bare electrode or metal-cored electrode to which a covering sufficient to provide a slag layer on the weld metal has been applied.

The covering may contain materials providing such functions as shielding from the atmosphere, deoxidization, and arc stabilization and can serve as a source of metallic additions to the weld.

14. **Fillet Weld** – A weld of triangular cross section joining two surfaces approximately at right angles to each other in a lap joint, T-joint or corner joint.
15. **Tack Weld** – A weld made to hold parts of a weldment for proper alignment until the final welds are made.
16. **Shade Number** – This number pertains to the lightness or darkness of the lens in the welding helmet. Lens number range from 2 to 14 where 2 would be the lightest lens and 14 would be the darkest lens.
17. **CC or Constant Current** – In this mode the amperage or current stays constant, but the direct current voltage will change depending on the arc length. This mode is applied to SMAW and FCAW processes.
18. **CV or Constant Voltage** – In this mode the direct current voltage stays constant, but direct current amperage will change slightly. This mode is applied to GMAW and FCAW.
19. **Parallel Connection** – Simply connect the positive terminals together, then connect the negative terminals together. Make sure that the machines are located as close together as possible.

Welding cables should be sized appropriately to handle the additional amperage. Rheostats must be set at the same amperage or as close as possible. (Note: Unlike competitive models, no parallel box is needed with Multiquip's welder-generators.)

WELDING PROCESSES

- SMAW – Shielded-Metal Arc Welding
- FCAW – Flux-Cored Arc Welding
- GMAW – Gas-Metal Arc Welding
- GTAW – Gas-Tungsten Arc Welding
- ACAC – Air Carbon Arc Cutting

COMPONENTS WELDER/GENERATOR

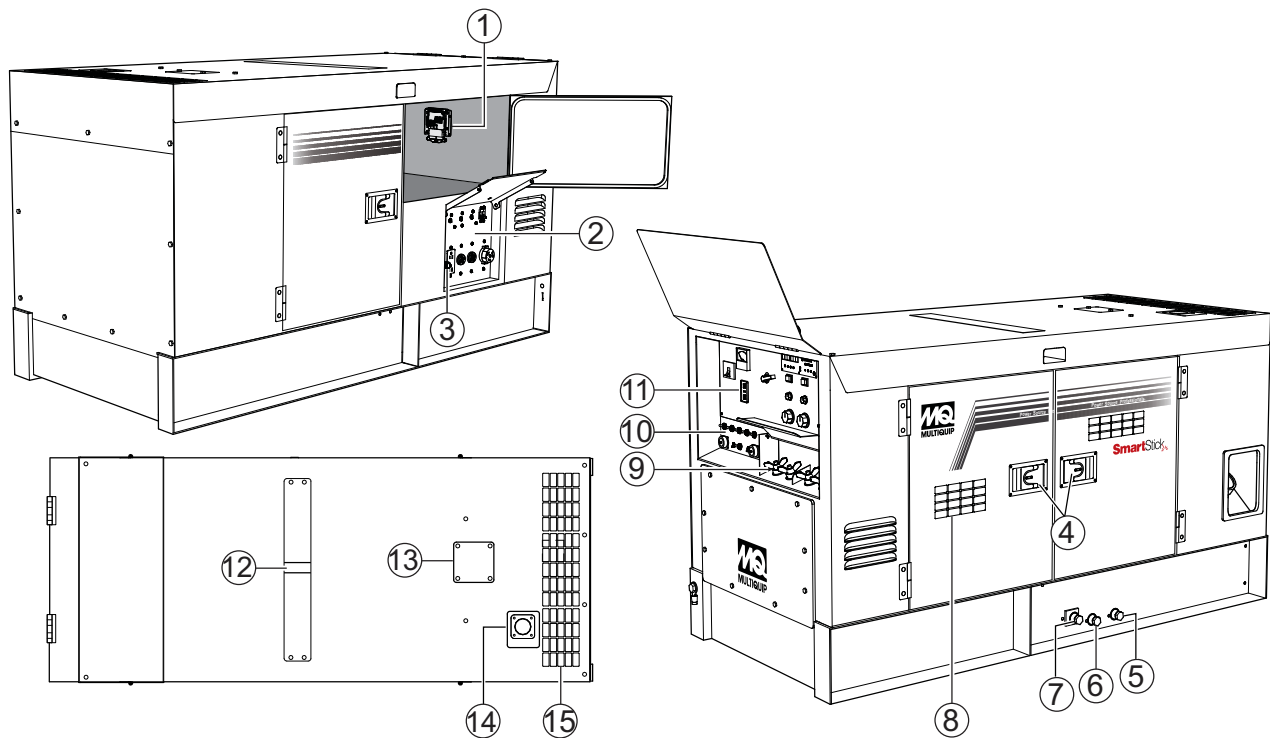


Figure 4. Welder-Generator Components

1. **Engine Control Module (ECM)** – An embedded electronic control system that controls various engine operating functions.
2. **Output Terminal Panel** – Provides convenience receptacles for AC power. All receptacles are circuit breaker protected.
3. **GFCI Ground Terminal** — Used to connect external equipment ground so that the GFCI receptacle will have a ground path.
4. **Door Release Latch** – Pull outward to release cabinet door.
5. **Coolant Drain Plug** – Remove this plug to drain coolant from the radiator. Reference Table 4 for coolant capacity.
6. **Fuel Drain Plug** – Remove this plug to drain fuel from fuel tank Reference Table 4 for fuel tank capacity.
7. **Oil Drain Plug** – Remove this plug to drain engine oil. Reference Table 4 for engine oil capacity and oil type.
8. **Air Inlet Vent** — Allows outside air to enter the generator. **NEVER** block this opening.
9. **A/B DC Welding Output Terminals** – Connect the DC welding cables to these terminals. Note the polarity marked on the welder-generator terminals. Select the appropriate polarities according to the application as specified in Table 17.
10. **Remote Welding Panel** – Provides local/remote control switches and receptacles for remote welding capability.
11. **Control Panel** – Contains controls and indicators necessary to operate the welder-generator.
12. **Lifting Hook** – Attach a strap or chain of adequate lifting capacity to this lifting point when the welder-generator must be lifted. Lifting device capacity must be able to lift a maximum of 3,030 lbs. (1,374 kg).
13. **Radiator Inlet** – Remove this cover to gain access to the radiator cap. Always allow engine to cool before removing radiator cap.
14. **Engine Exhaust Outlet** — Allows engine exhaust to exit the generator into the open air. **NEVER** block this opening.
15. **Air Outlet Vent** — Allows inside air to escape the generator. **NEVER** block this opening.

COMPONENTS WELDER/GENERATOR (CONT'D.)

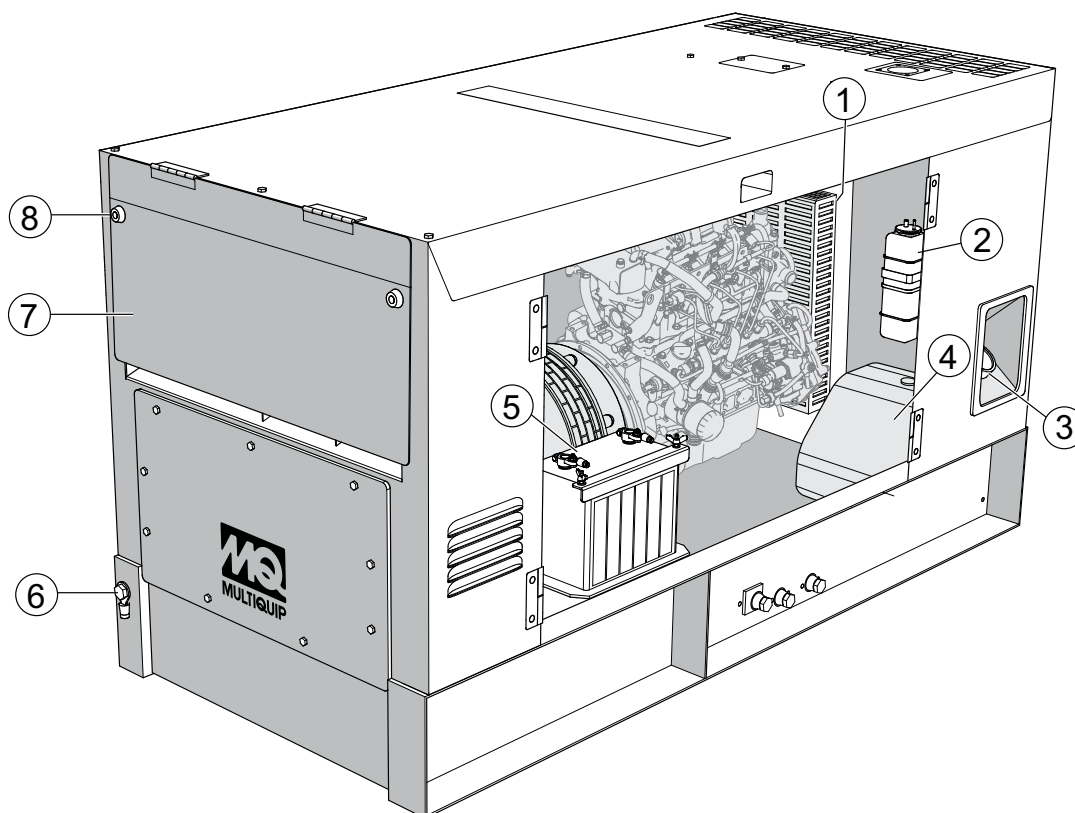


Figure 5. Welder-Generator Components (Continued)

1. **Radiator** — Holds coolant/water necessary to keep the engine at a safe operating temperature. Remove this cap to add water/antifreeze when cool.
2. **Expansion Bottle** — Supplies coolant to the radiator when radiator coolant level is low. Fill to indicated level as shown on expansion bottle.
3. **Fuel Cap** — Remove this cap to add diesel fuel to the fuel tank. Reference Table 4 for engine fuel tank capacity and type fuel. Make sure cap is tightened securely. **DO NOT** over fill.
4. **Fuel Tank** — Holds 17.7 gallons (67 liters). Fill with diesel fuel as specified in Table 4.
5. **Battery** — Provides +12 VDC power for the welder-generator. When replacing battery (12V 64Ah) use only recommended type battery.
6. **Frame Ground Lug** — Connect a ground strap between this lug and a ground rod. Make sure that the ground rod is inserted deep into the ground to provide a good earth ground. Consult with local Electrical and Safety Codes for proper connection based on condition of use.
7. **Front Panel Cover** — Lift upwards to gain access to the welder-generator control panel.
8. **Rubber Stopper** — Prevents scratching of front cover when front cover is folded back.

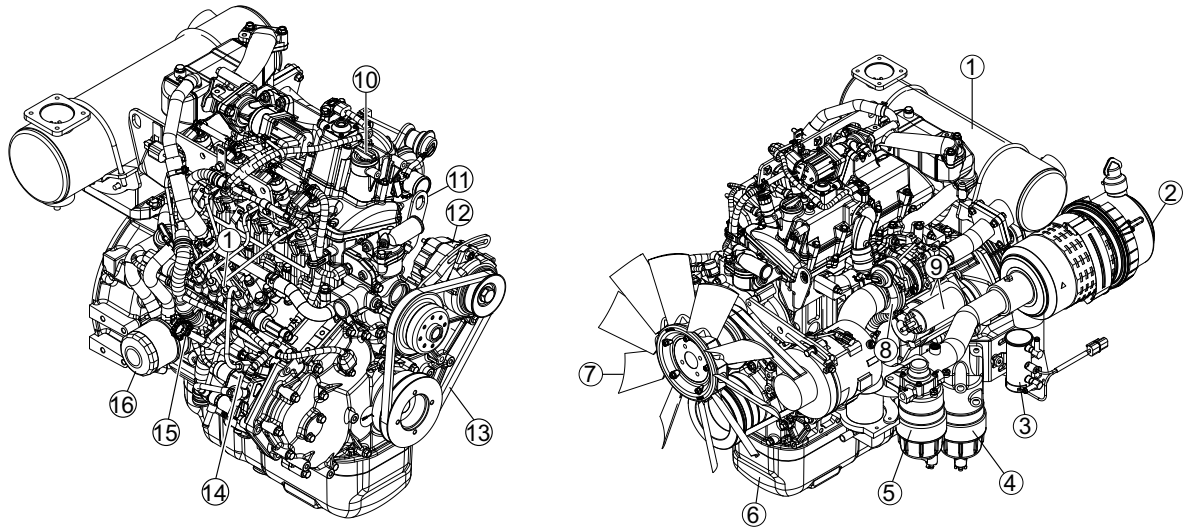


Figure 6. Isuzu 4LE2T Basic Engine Components

INITIAL SERVICING

The engine (Figure 6) must be checked for proper lubrication and filled with fuel prior to operation. Refer to the manufacturer's engine manual for instructions and details of operation and servicing.

1. **Diesel Oxidation Catalyst (DOC)** — Filters out large amounts of harmful **Nitrogen Oxides (NOx)** and **Particulate Matter (PM)** which are emitted by diesel engines.
2. **Air Filter** — Prevents dirt and other debris from entering the air intake system. Loosen clips on side of air filter canister to gain access to filter element. Replace with manufacturer's recommended type air cleaner only.
3. **+12 VDC Electric Fuel Pump** — Pumps fuel to the injectors.
4. **Secondary Fuel Filter** — Prevents dirt and other debris from entering the fuel system. Service the fuel filter as recommended in the maintenance section of this manual.
5. **Primary Fuel Filter** — Prevents dirt and other debris from entering the fuel system. Service the fuel filter as recommended in the maintenance section of this manual.
6. **Oil Pan** — Reservoir for engine oil. Capacity is 2.75 gallons (10.4 liters).
7. **Cooling Fan Blades** — Make sure cooling fan blades are not bent or broken. A damaged fan blade can cause the engine to run hot and overheat.
8. **Turbocharger** — Provides pressurized intake air to the cylinder by means of a turbine energized by exhaust gas that rotates the blower.
9. **Starter Solenoid** — This engine uses a 12VDC starter motor with solenoid.
10. **Oil Filler Port/Cap** — Remove this cap to add engine oil to the crankcase. Fill with recommended type of oil as specified in the maintenance section of this manual.
11. **Lifting Eye** — When lifting of the engine is required attach a strap or chain of adequate lifting capacity to this lifting point.
12. **Alternator** — Provides power to the +12VDC electrical system. Replace with only manufacturer's recommended type alternator.
13. **V-Belt** — **ALWAYS** make sure V-belt is properly tensioned. A loose or defective V-belt can adversely affect the performance of the generator.
14. **Injector Pump** — Provides fuel under pressure to the injector nozzles.
15. **Oil Dip Stick/Gauge** — Remove to check amount and condition of oil in crankcase. Refill or replace with recommended type oil as listed in Table 26 and Table 27.
16. **Oil Filter** — Spin-on type, filters oil for contaminants. Replace with manufacturer's recommended type oil filter only.

POWER RECEPTACLES

POWER RECEPTACLES

Located on the side of the welder/generator are the auxilliary power receptacles. These power receptacles are described below.

120 VAC GFCI RECEPTACLE

NOTICE

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

The 120 VAC, 20 amp GFCI (Duplex Nema 5-20R) receptacle (Figure 7) is protected by a 20 amp circuit breaker (CB5). The breaker is located above the GFCI receptacle. The **green** LED should be **ON**, indicating that the receptacle is working properly. If the **red** LED is **flashing**, **DO NOT** use the receptacle. Replace it immediately.

Pressing the **reset** button resets the GFCI receptacle after being tripped. Reference the maintance section of this manual for proper testing of the GFCI receptacle.

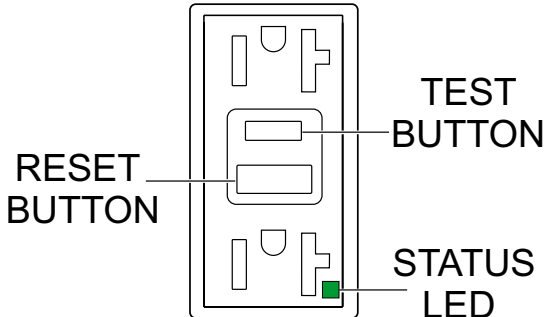


Figure 7. G.F.C.I. Receptacle

Twist Lock Receptacles

There are three auxiliary twist-lock receptacles. These power receptacles (Figure 8) are described below.

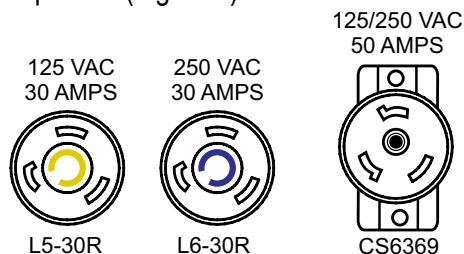


Figure 8. Auxiliary Twist-Lock Receptacles

SINGLE PHASE LOAD

Always be sure to check the nameplate on the welder-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 welder-generator is 1.0. See Table 10 below when connecting loads.

Table 10. 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 11. 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

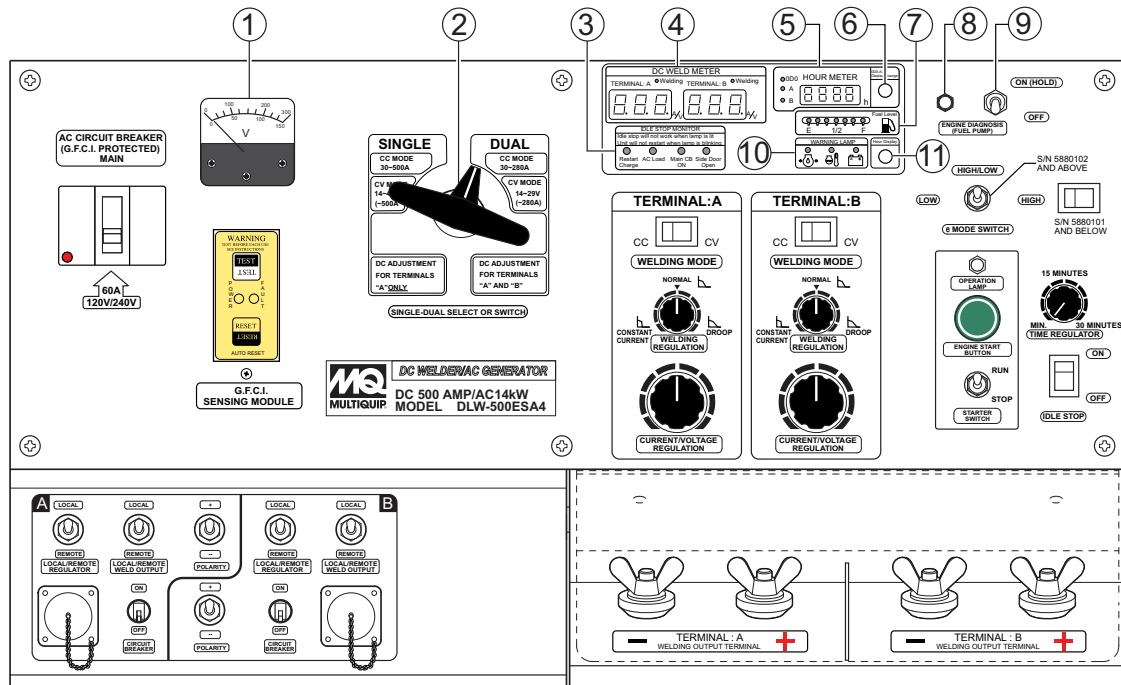


Figure 9. Control Panel (Items 1 ~ 11)

- AC-Voltmeter** – This voltmeter indicates the rated 60 Hz (single-phase) output voltage. In addition, the voltmeter can also be used as a diagnostic tool.

If the voltmeter indicator (needle) is below the rated voltage, engine problems may exist (low/high RPM's). To prevent damage to the generator or power tools, turn the generator **OFF** and consult your authorized Multiquip service dealer.
- Single/Dual Selector Switch** – Place this switch in the desired welding mode. **DO NOT** switch under load.
- Idle Stop Monitor** – Consists of four status LEDs, if any of the LEDs are lit or blinking, idle stop function will not work.
- DC Weld Meter** – A digital display that indicates the amperage and voltage at the A and B welding terminals. In addition, this display is also used to display engine error codes and other welder-generator diagnostic information. Reference Table 29 for engine error code definitions.
- Hour Meter** – Displays the accumulated engine operation time (ODO) and welding hours on terminals A and B.
- ODO-A-B Display Change Button** – When pressed, allows hour meter display to cycle between ODO (run time) and welding output terminals A and B. Press and hold this button to reset the trip time.
- Fuel Tank LED Indicators** – Consists of seven status LEDs indicating the amount of fuel in the fuel tank.
- Engine Diagnostic Lamp** – When lit (**ON**) indicates that an engine fault has occurred. Reference Figure 101 and Figure 102.
- Engine Diagnostic Switch** – Place this switch in the up position and hold to display engine fault code pattern via diagnostic lamp. Reference Figure 101.
- Engine Warning Lamps** – Consists of three status LEDs, oil pressure, high coolant temperature and battery charge. If any of the LEDs are lit, the engine will shutdown automatically.
- Hour Display Button** – Only used when engine is off. When pressed and held, ODO, loaded and unloaded hours of operation will be displayed on hour meter display.

Press display change button while holding down hour display button to toggle between ODO and A and B welding output terminals.

CONTROL PANEL (CONT'D.)

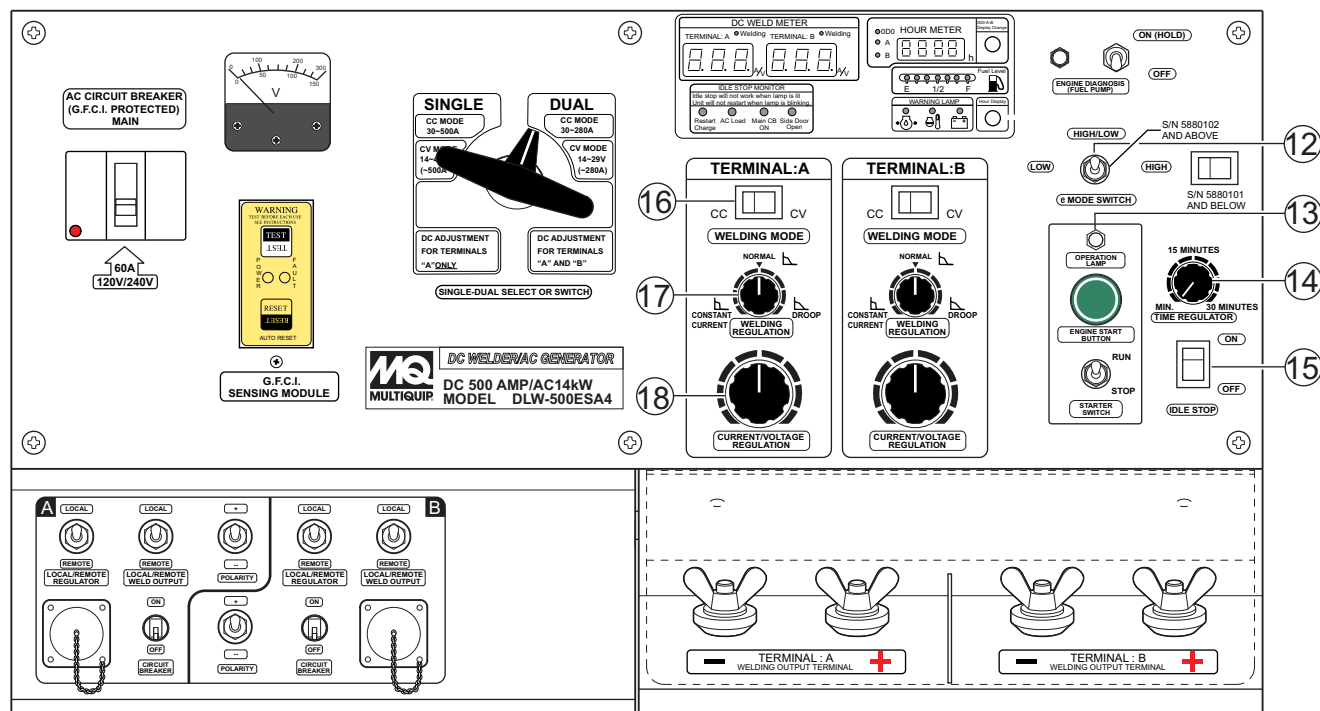


Figure 10. Control Panel (Items 12 ~ 18)

12. **E-Mode Selector Switch** – This 3-position rocker switch allows the engine to operate at low speed with no load or low welding load. The three switch positions are defined as follows:

- **Low** – When the welding power and AC power are not in use, engine will run at lowest speed (1200 rpm). During welding operations engine speed is automatically controlled depending on welding output. However if an AC load of 100 watts or more is detected, the engine will be operated at high speed.
- **High/Low** – With an AC load of 100 watts or more or while welding, the engine will be operated at high speed (1800 rpm) to respond to the preset AC frequency regardless of the welding work.
- **High Position** – Engine is always operated at high speed (1800 rpm) with or without load.

13. **Operation Lamp** – When lit, indicates unit is **ON** and in use.

14. **Time Regulator Control** – Indicates the amount of time (1~30 min.) the unit will run before automatic shutdown will occur. This control is only active in the **idle stop** mode.

15. **Idle Stop Switch** – Place this switch in the **ON** position to enable the idle stop function.

16. **Welding Mode** – Place this rocker switch in the desired welding mode, **up** for constant voltage (CV), **down** for constant current (CC).

17. **Terminals A/B ARC Force Regulator Control** – An adjustment that allows the operator to fine tune the arc characteristics according to job requirements. This control allows the user to adjust the arc from a soft smooth arc to a more aggressive digging arc.

Placing the voltage selector switch in the **single** mode position will access terminal **A**. Placing the voltage selector switch in the **dual** mode will access both terminals **A** and **B**.

18. **Terminals A/B Current/Voltage Reg. Control** – Place this knob in the desired setting when welding is required. Current range is from 30 to 500 amps (CC single mode), 30 to 280 amps (CC dual mode).

Placing the voltage selector switch in the **single** mode position will access terminal **A**. Placing the voltage selector switch in the **dual** mode will access both terminals **A** and **B**.

CONTROL PANEL (CONT'D.)

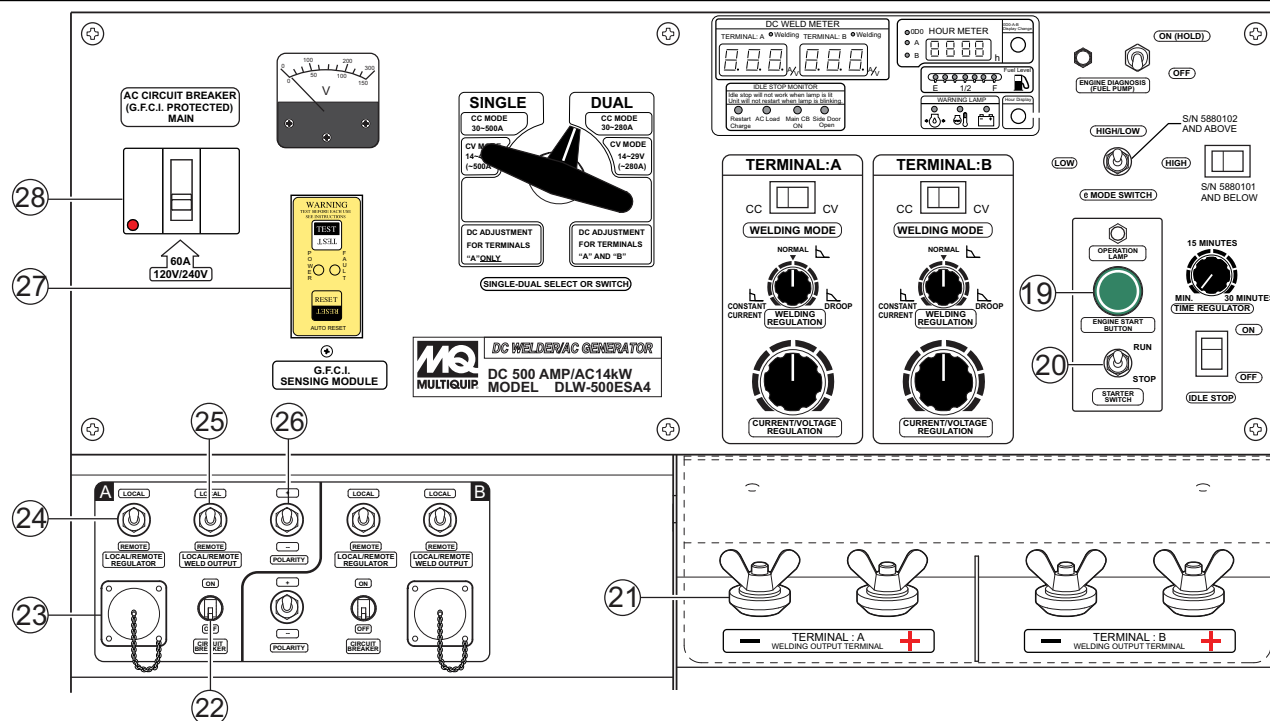


Figure 11. Control Panel (Items 19 ~ 28)

19. **Engine Start Button** – After the ignition key has been placed in the **RUN** position, press this button **once** to start the engine. Continuous pushing of the button is not required to start the engine.
20. **Starter Switch** — When starting of the engine is required, place switch in the **UP** position. Then press the engine start button to start engine. To **STOP** the engine, place the switch in the down position.
21. **A/B-Side Welding Terminals** — Connect welding cables to these terminals.
22. **A/B-Side Remote Welding Circuit Breakers** — When remote welding is required place these breakers CB6A/B in the **ON** position.
23. **14P Remote Welding Receptacle** — Connect an external wire feeder via a control cable to this receptacle. Reference Figure 65.
24. **A/B-Side Local/Remote Reg. Switch** — When placed in the **local** position, the current/voltage regulator knob on the control panel is active. If switch is placed in the **remote** position, the current/voltage regulation is controlled by an external wire feeder. Reference Figure 69 for various remote welding configurations.
25. **A/B-Side Local/Remote Weld Output Switch** — When placed in the **local** position, the welding regulation knob on the control panel is active. If switch is placed in the **remote** position, the welding regulation is controlled by an external wire feeder. Reference Figure 69 for various remote welding configurations.
26. **A/B-Side Polarity Switches** — These switches are intended to allow the user to match the voltmeter polarity on the welder/generator with the voltmeter polarity on the wire feeder.
27. **GFCI Sensing Module** – Interrupts power when a ground fault exists.
28. **Main Breaker** – Place this 60 amp breaker (CB1) in the **ON** position (up) to provide AC voltage to auxiliary circuit breakers CB2, CB3 and CB4. This breaker is not required when welding.

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 12) on the dipstick. See Table 12 for proper selection of engine oil.

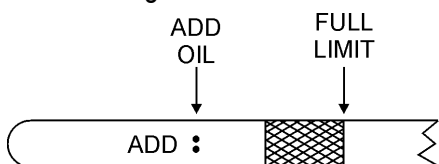


Figure 12. Engine Oil Dipstick

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 Engine Owner's Manual**. Oil should be warm before draining.

When low sulfur or ultra low diesel fuel is used, it is recommended that CF-4 or CG-4 (classification) engine oil be used. Reference Table 12 when replacing engine oil.

Table 12. Recommended Motor Oil		
OIL: SAE		
°F	°C	
122	50	10W/40
104	40	30
86	30	10W/40
68	20	15W/30
50	10	10W/30
32	0	5W/30
-14	-10	ARCTIC OIL
-4	-20	10W
-22	-30	20W/40
-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.

REFILLING THE FUEL SYSTEM



CAUTION

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

1. Lift the control panel lid and lay backwards.
2. Next, place the starter switch in the **RUN** position.
3. Read the fuel gauge status LEDs (Figure 13) on the control panel and determine if the fuel level is low. Reference Table 13 for LED fuel gauge level indication.
4. Place the starter switch in the **STOP** position.

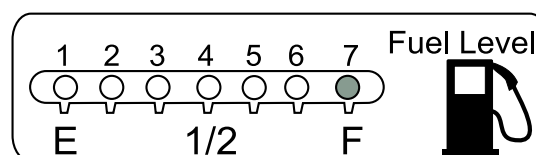


Figure 13. Fuel Gauge

Table 13. Fuel Gauge LEDs		
LED #	LED Color	Fuel Tank Level gal. (liters)
1	Red (Empty)	0~ 3.7 (0 ~ 14.0)
	Green	3.7~ 5.7 (14.0 ~ 21.5)
2	Green	5.7~8.0 (21.5 ~ 30.2)
3	Green	8.0 ~9.8 (30.2 ~ 37.0)
4	Green	9.8~12.0 (37.0 ~ 45.4)
5	Green	12.0~14.0 (45.4 ~ 53.0)
6	Green	14.0~16.0 (53.0 ~ 60.5)
7	Green (Full)	16.0 (60.5)


If fuel level is low, **ALWAYS** fill the fuel tank with clean fresh **low sulfur** or **ultra low sulfur** diesel fuel. No. 2 diesel fuel can be used as an alternative. **DO NOT** fill the fuel tank beyond its capacity.

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

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 14 for engine, radiator, and reserve tank coolant capacities. Make sure the coolant level in the reserve tank is always between the "H" and the "L" markings.

NOTICE

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

Verify that the coolant level in the coolant reserve tank is between the **FULL** and **LOW** markings as shown in Figure 14.

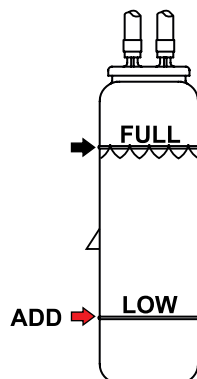


Figure 14. Coolant Reserve Tank

Table 14. Coolant Capacity	
Engine and Radiator	2.35 gal (8.9 liters)
Reserve Tank	.22 gal (.832 liters)

Operation in Freezing Weather

When operating in freezing weather, be certain the proper amount of antifreeze (Table 15) has been added.

Table 15. Anti-Freeze Operating Temperatures		
Vol % Anti-Freeze	Freezing Point	
	°C	°F
50	-37	-34

NOTICE

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

CLEANING THE RADIATOR

The engine may overheat if the radiator 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 as referenced in the maintenance section of this manual.

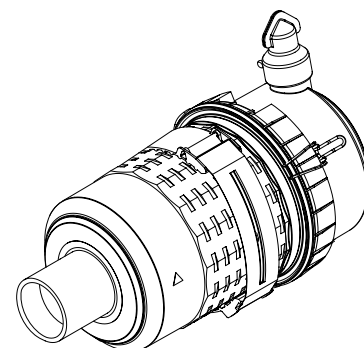


Figure 15. Air Cleaner

FAN BELT TENSION

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

The fan belt tension (Figure 16) is proper if the fan belt bends 0.4~0.6 inches (10~15 mm) when depressed with the thumb as shown below.

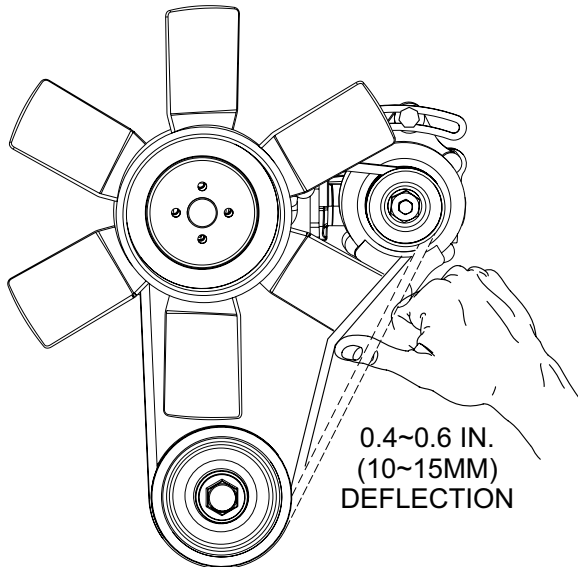


Figure 16. Fan Belt Tension

CAUTION



NEVER place hands near the belts or fan while the welder-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 levels 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. Coat the terminals with an approved battery terminal treatment compound. Replace battery with only recommended type battery.

The battery is sufficiently charged if the specific gravity of the battery fluid is 1.28 (at 68° F). If the specific gravity should fall to 1.245 or lower, 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 17) are properly connected to the battery terminals as shown below. **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**.

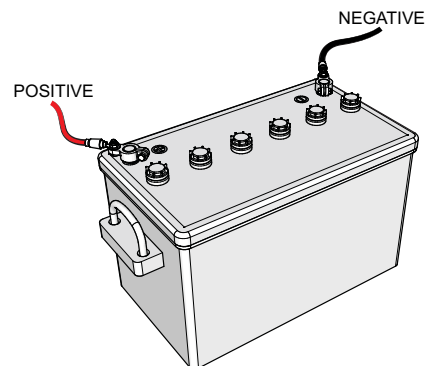


Figure 17. Battery

SELECTING THE WELDING CABLE

The welding cable should be larger in size as it becomes longer or its current becomes higher. Prepare a cable with suitable size by referring to Table 16.

Table 16. Selecting the Welding Cable							
Length (ft) / Current (A)	50	100	125	150	200	250	300
100	#4	#4	#4	#4	#3	#2	#1
150	#3	#3	#3	#2	#1	#1 ₀	#2 ₀
200	#2	#2	#2	#1	#1 ₀	#2 ₀	#3 ₀
250	#1	#1	#1	#1 ₀	#2 ₀	#3 ₀	#4 ₀
300	#1 ₀	#1 ₀	#1 ₀	#2 ₀	#3 ₀	#4 ₀	#2-2 ₀
400	#2 ₀	#2 ₀	#2 ₀	#3 ₀	#4 ₀	#2-2 ₀	#2-3 ₀

Cable size values are based on a voltage drop of maximum 4 volts.

WELDING CABLES AND POLARITIES

- ALWAYS** attach terminal ring connectors (Figure 18) to the end of the welding cable that will be connected to the welder output terminals.
- NEVER** connect exposed wires (Figure 18) directly to the welder output terminals. Exposed wiring may cause shocks or di-electric breakdown from poor contact.

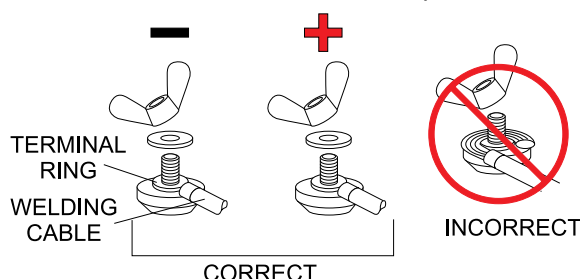


Figure 18. Welder Output Terminals

- Connect the welding cables to the welder output terminals located just below the control panel. The output terminals are marked (+) and (-) polarities. Select the appropriate polarities according to the application. Reference Table 17.

! DANGER

NEVER allow the welding cable terminal to come in contact with the adjacent welding terminal or the welder-generator frame when the machine is in use. The possibility exists of electrical shock or short circuit which could cause a fire resulting in severe bodily harm and damage to the equipment.

Table 17. Polarities and Applications

Polarity	Welding Method	Typical Applications
Straight Polarity	(+)...Grounding (base metal) (-)...Welding holder	Arc welding for steel material of general structures, and for thick plates Arc welding for copper alloy
Reverse Polarity	(+)...Welding holder (-)...Grounding (base metal)	Build-up welding Air gouging Arc welding of thin plates Arc welding of stainless steel

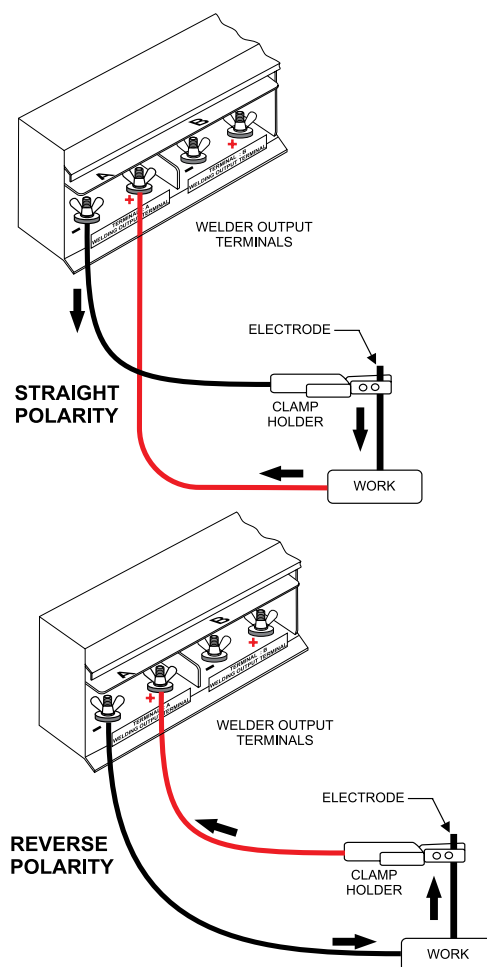


Figure 19. Welding Cable Connections (Electrode Type Correct)

WARNING

When operating the welder in dual mode, **NEVER** connect the positive and negative terminals (Figure 20) from the **A** and **B** sides together.

This condition may cause the voltage between the welding terminals to double under no load, causing damage to the equipment and **electrical shock** to personnel.

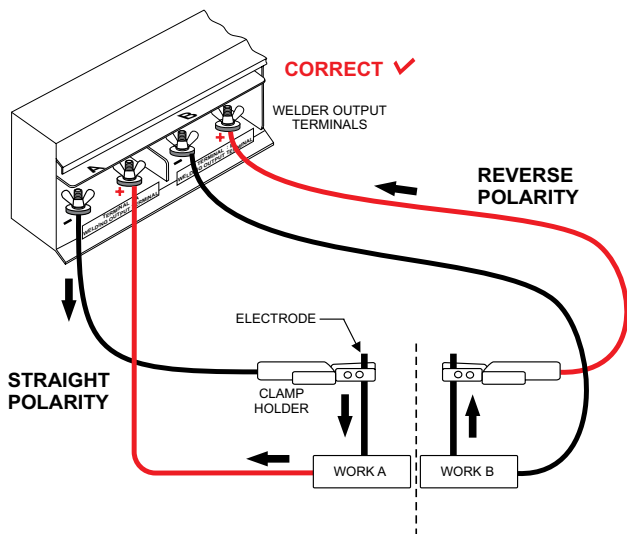
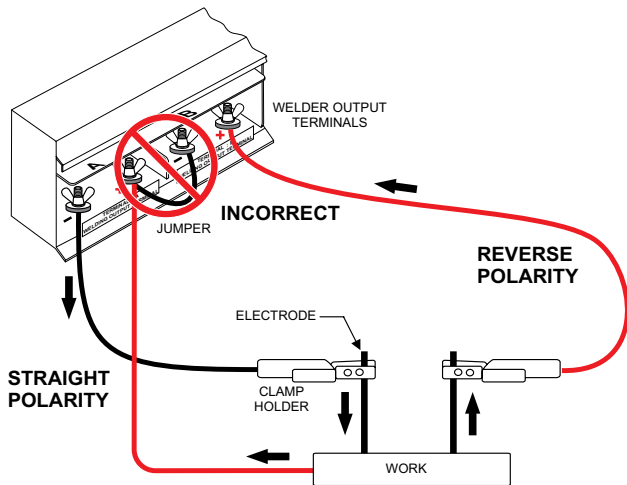


Figure 20. Welding Cable Connections (Electrode Type Incorrect)

- For CC mode welding, select the appropriate electrode size in accordance with Table 18 (Single Mode Operation) or Table 19 (Dual Mode Operation).
- Attach the clamp holder to the electrode as shown in Figure 19 and Figure 20.

Table 18. Current Range/Electrode Size (Single Mode Operation)

	Low 1200 rpm	High 1800 rpm
Current/ Range Amps	30~280A	30~500A
Electrode Size Diameter	3/32" ~ 3/16"	3/32" ~ 5/16"

Table 19. Current Range/Electrode Size (Dual Mode Operation)

	Low 1200 rpm	High 1800 rpm
Current/ Range Amps	30~180A	30~280A
Electrode Size Diameter	3/32" ~ 3/16"	3/32" ~ 3/16"

CV Mode Welding

NOTICE

A wire feeder (Figure 21) can be used when in the CV mode. The wire feeder utilizes the power output from the DC welding terminals. Consult the manufacturer's instructions when connecting the wire feeder to the welder-generator.

- Connect the welding cables from the welder-generator to the wire feeder as shown in Figure 21.

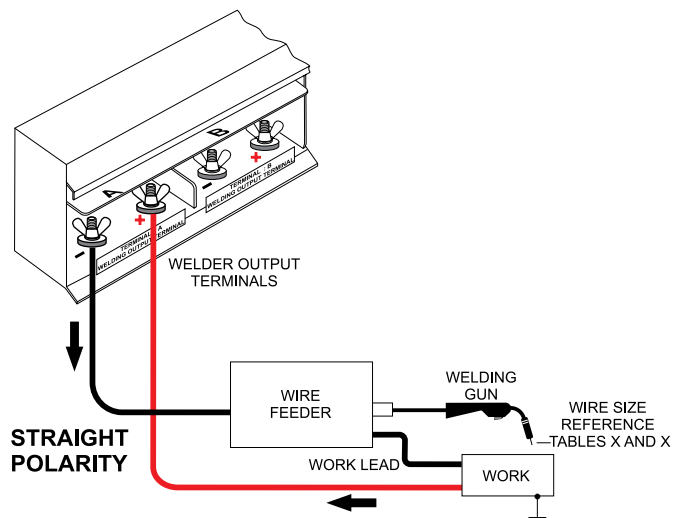


Figure 21. CV Setup (Wire Feeder)

2. Select the appropriate welding wire size depending on the application as referenced in the wire feeder instruction manual.
3. After the correct wire size has been determined, install wire spool onto wire feeder.
4. Adjust the CV voltage regulator for the desired DC voltage to the wire feeder.
5. Reference Table 20 when using flux-cored wires commonly known as Flux Cored Arc Welding (FCAW) process. This process has two types of flux-cored wires. One is self-shielded (FCAW-S), the other is gas-shielded (FCAW-G).

Table 20. Flux-Cored Wires (Self/Gas Shielded)	
Weld Process/ WireType	Welder Output Terminal
Gas-Shielded	Connect to positive (+) terminal
Self-Shielded	Connect polarity as defined by the wire manufacturer instructions
NR-211MP Wire	Connect to negative (–) terminal
NR-311MP Wire	Connect to negative (–) terminal
NR-232MP Wire	Connect to negative (–) terminal

LOCAL OPERATION

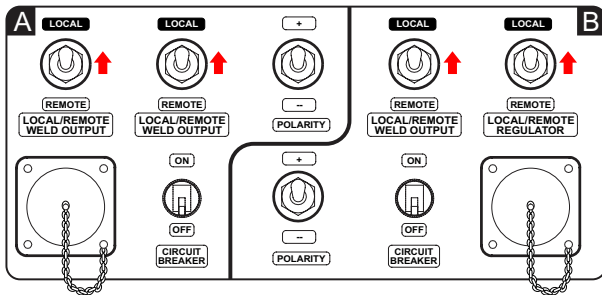
Before starting the welder-generator, the pre-inspection safety checks must be completed. In addition, do a general survey of the area surrounding the machine making sure the area is safe, air vents of the machine are not blocked and the exhaust can be freely discharged.

The machine can be started, once the people surrounding the machine have been notified that the machine is going to be used.

STARTING THE ENGINE

NOTICE

This welder/generator has the capability of remote welding (wire feeder) or local welder. If the unit is intended to be operated locally, place the **local/remote regulator** and **local/remote weld output** switches in the **LOCAL** position for both **A** and **B** welding sides as shown in Figure 22. For remote operation of the welder/generator reference the "Remote Operation" section in this manual.



**Figure 22. Local/Remote Switches
Local Position**

1. To protect the welder-generator from an overload, a 3-pole, 60 amp, **main** circuit breaker (CB1) is provided. Place this breaker (Figure 23) in the **OFF** position prior to starting the engine.

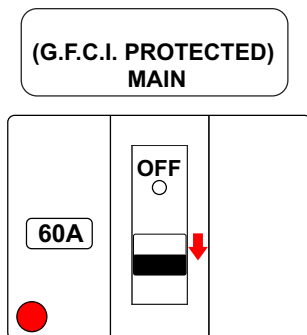


Figure 23. Main Circuit Breaker (CB1)

2. In addition, there are **four** circuit breakers (Figure 24) provided to protect the GFCI and auxiliary receptacles from overload. Make sure to switch **all** circuit breakers to the **OFF** position prior to starting the welder-generator.

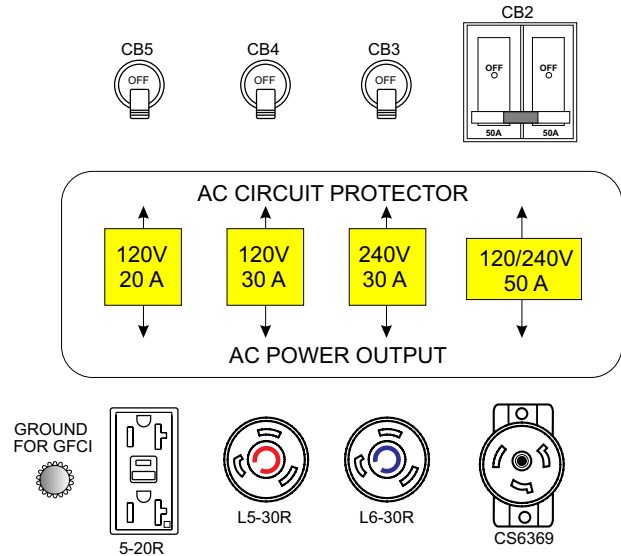


Figure 24. Auxiliary Circuit Breakers

3. Place the fuel valve lever (Figure 25) in the **ON** position.

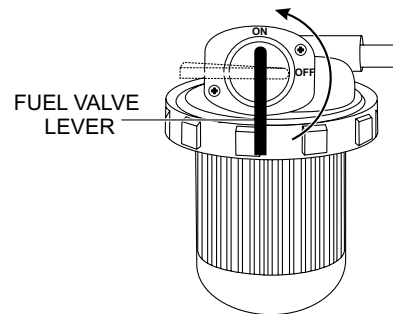


Figure 25. Fuel Valve Lever (ON)

4. Close all enclosure doors (Figure 26).

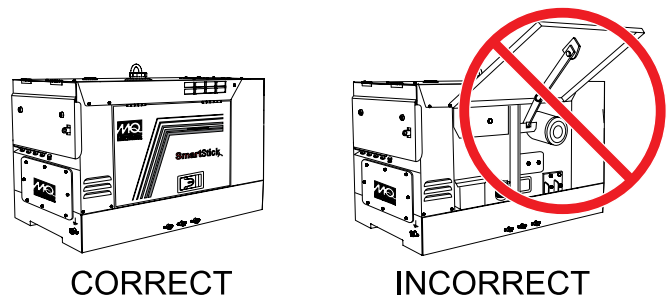


Figure 26. Enclosure Doors (Closed)

LOCAL OPERATION

NOTICE

DO NOT operate this equipment with the enclosure doors open. Operating the unit with the doors open during operation will effect the internal cooling air-flow of the machine and will allow foreign substances (e.g. dust and dirt) to be drawn into the unit.

- Place the idle stop switch (Figure 27) in the **OFF** position.

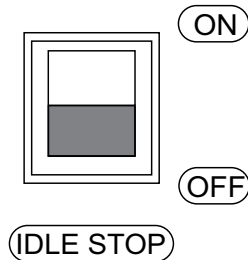


Figure 27. Idle Stop Rocker Switch (OFF)

- Place the “Starter Switch” (Figure 28) in the **RUN** position.

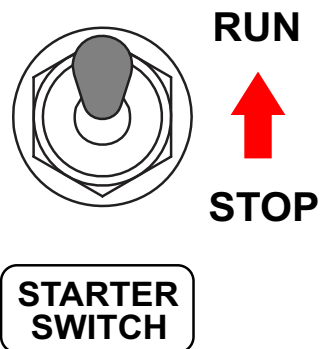


Figure 28. Starter Switch (RUN Position)

- Verify operation lamp is lit (**ON**). Reference Figure 29.

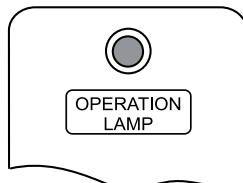


Figure 29. Operation Lamp

- Next, verify that the ODO LED indicator is lit (**ON**) and the hour meter display (Figure 30) shows total machine hour used.

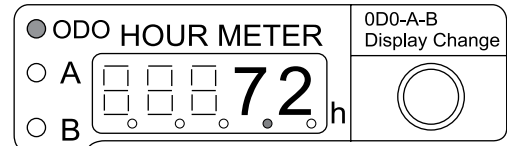


Figure 30. Hour Meter (Run Position)

- Next, press the **GREEN** engine start button (Figure 31) only once. Continuous pressing of the button is not necessary. The engine will automatically start once the count down sequence has been completed.

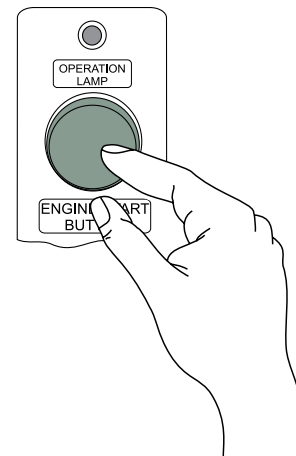


Figure 31. Engine Start Button

- Verify that right-most decimal (Figure 32) on the hour meter display is **flashing**.

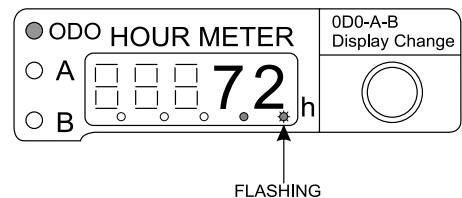


Figure 32. Hour Meter (Engine Start)

- The DC welding meter will display the pre-heating countdown time value. The example shown in Figure 33 indicates 10 seconds before engine cranking can begin.

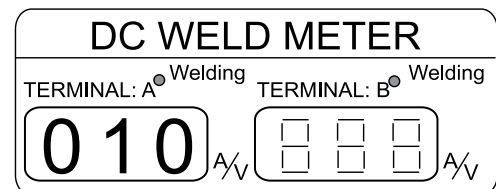


Figure 33. DC Weld Meter (Countdown)

LOCAL OPERATION

- When the pre-heating time has been completed, engine cranking will begin and the engine will be started.

NOTICE

All pre-heating and cranking are automatic. The pre-heating time and cranking times are automatically controlled by the temperature sensor located on the unit. The lower the temperature, the longer the pre-heating and cranking time.

Three sets of pre-heating and cranking times are repeated until the engine is started. If the engine is not started with 3 sets of repetition, the DC Weld Meter will indicate E06 (starting failure), E01 (low oil pressure) and E03 (insufficient system charging).

- After the engine starts, let the machine idle for 5~10 minutes to warm-up.
- Carefully check the engine for abnormal vibration (noise), oil leakage, fuel leakage, cooling water leakage and air leakage. Also, verify if any alarm lights are lit. If any abnormal conditions exists, turn the engine **OFF** and correct the problem.

SINGLE MODE WELDING (CC)

- Place the welding mode selector switch (Figure 34) in the **single** mode position. Select CC mode 30-500A.

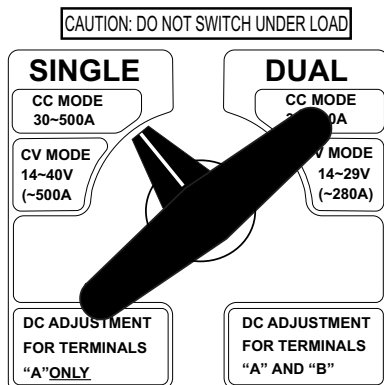


Figure 34. Single-Dual Selector Switch (Single Position)

- For **CC welding**, place the terminal **A** welding mode rocker switch in the CC position (down).

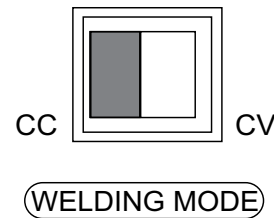


Figure 35. Welding Mode Switch (CC Mode)

- Place e-Mode selector switch (Figure 36) in the desired position as defined by Table 21. This switch is a 3-position **toggle** switch (S/N 5880102 and above) or 3-position **rocker** switch (S/N 5880101 and below).

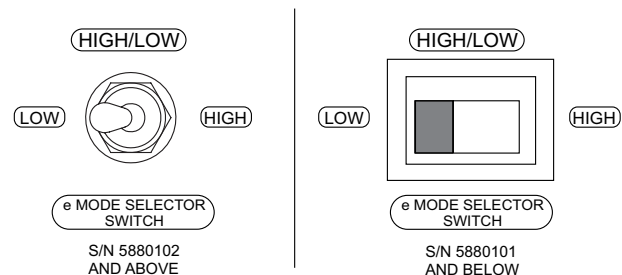


Figure 36. E-Mode Selector Switch (CC Mode)

Table 21. Current Range/Engine Speed (Single Mode Operation)

e Mode Selector Switch	Low 1200 rpm	High 1800 rpm
Low	30~280A See Notes	—
High/Low	See Notes	30~500A
High	—	30~500A See Notes

Note 1: If using two welders connected with different polarities to weld the same work, the voltage between the holders may cause electric shock to the operator.

Note 2: If using two welders connected with different polarities to weld the same work, use separate grounds for each welder.

Note 3: **NEVER** switch the Single-Dual Selector Switch during welding operations. Switch contacting failure may occur.

NOTICE

If the welding work requires a current of 280 amps or less for single mode applications, place the e-mode selector switch in the high/low or high position if bead appearance or welding faults are a concern.

In addition, place the e-mode selector switch in the high position if an AC load of 100 watts or an AC load with a magnet switch is used.

4. Next, set the current/voltage regulator control knob (Figure 37) in accordance with the selected electrode size as referenced in Table 18.

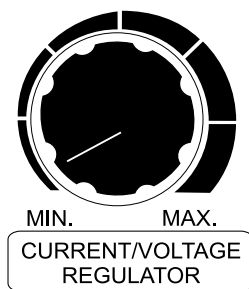


Figure 37. Current/Voltage Regulator Control Knob (Current Adjust)

5. The selected current (amps) will be displayed on the DC weld meter. The example shown in Figure 38 is for a constant current value of 135 amps.

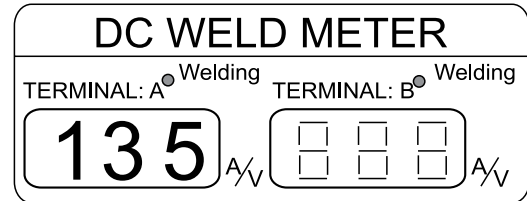


Figure 38. DC Weld Meter (135 Amps)

6. Set the welding regulation control knob (Figure 39) to the desired setting.

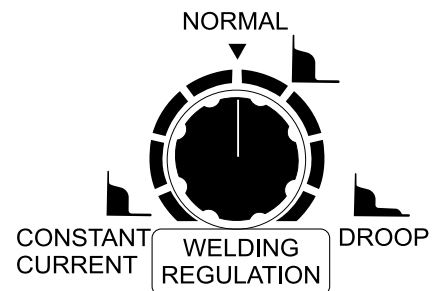


Figure 39. Welding Regulation Control Knob

NOTICE

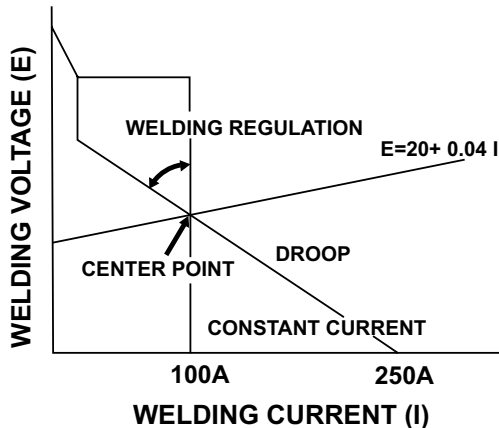
The welding regulation control knob is an adjustment used to control the **length** and **strength** of the welding arc. In addition this control can be used to **fine tune** the arc based on the specific application being used.

ADJUSTMENT OF WELDING REGULATION

The welding voltage/current curves (Figure 40) are obtained when the **welding regulation** control knob is turned fully counterclockwise (constant current) as shown in Figure 41.

Welding Regulation (Constant Current)

EXAMPLE: WELDING CURRENT 100A



EXAMPLE: WELDING CURRENT 400A

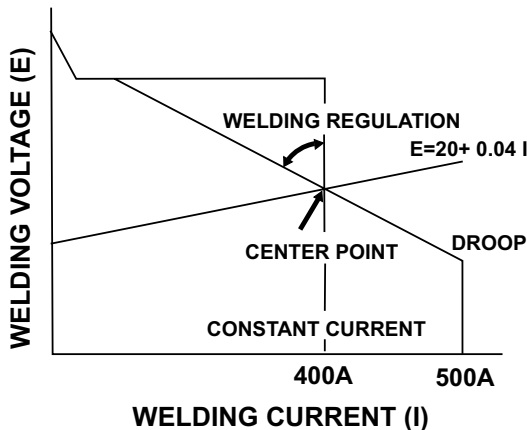


Figure 40. Constant Current Curves

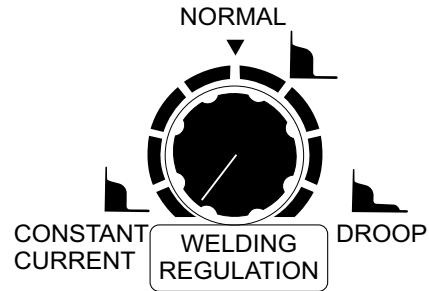


Figure 41. Welding Regulation Knob (CC)

By turning the welding regulation control knob (Figure 41) clockwise, the welding output **current increases** as the welding output **voltage decreases**, and the regulator is adjusted to the drooping characteristic in which the current decreases as the voltage increases.

The drooping curve gradient varies with the adjustment grade. The center point of the gradient variation can be adjusted relative to the preset value of welding current on the welding load curve ($E = 20 + 0.04I$).

By varying the welding regulation, the welding characteristics can be adjusted to any setting parameters.

NOTICE

The welding voltage/current curves (Figure 40) are an example for the single side. The limiter will work at a welding output current of 280A or more on the dual side and at 500A or more on the single side to limit the overcurrent.

Also when the welding regulation knob is placed in the constant current position (fully counterclockwise), the welding output current is always adjusted to a preset current value without being affected by the length and diameter of the welding cable and whether the arc length is long or short.

The short-circuit current is kept at a preset value. As the arc is stable and has little spatter, this setting is suited for general welding work.

Welding Regulation (Normal)

When the **welding regulation** control knob is placed in the **normal** position (Figure 42). The short-circuit current is about 1.7 times the preset welding current.

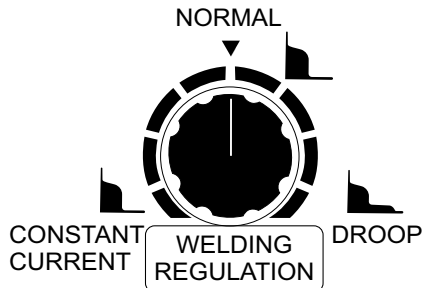


Figure 42. Welding Regulation Knob (Normal)

The balance between arc start and arc stability is good and the setting is suited for most of the welding electrodes. As the welding current is adjusted by varying the arc length in controlling the welding electrode, heat input and delicate bead adjustment is available.

If the welding current is higher, it is affected more by the welding cable voltage drop and if the cable is long and has a small diameter, the welding output current will decrease.

NOTICE

To protect the engine against over loads in the case of cable voltage drop when welding, this unit has a built-in function of automatically limiting the output current, to not exceed the value at the output terminals (total of A-side and B-side currents for dual mode).

NOTICE

Figure 43 below shows the relationship between the welding output current versus cable distance. An increase in welding cable length will cause a decrease in welding output current.

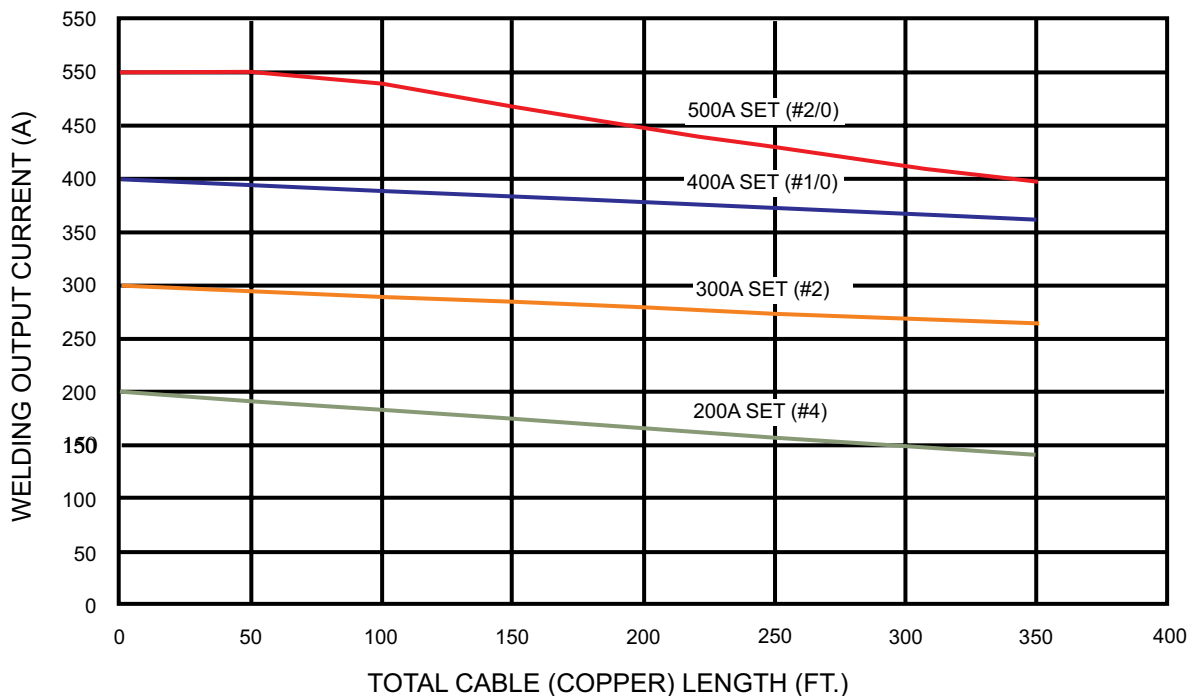


Figure 43. Welding Output Current VS Cable Length (Normal Position)

Welding Regulation (Droop)

Drooping is defined as when the terminal voltage of the welding unit decreases the welding current increases

When the **welding regulation** control knob is placed in the **droop** position fully clockwise (Figure 44), the short-circuit current is about 2.5 times the preset welding current.

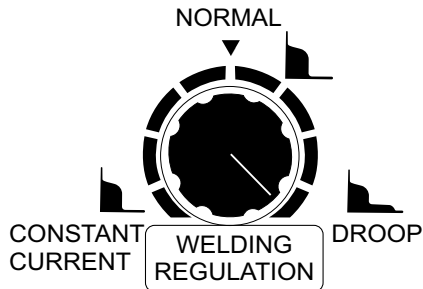


Figure 44. Welding Regulation Knob (Droop)

The arc start becomes better and the arc directivity is also higher because the arc appears stronger owing to the high short-circuit current.

The current variation is higher than when in the **normal** position by varying the arc length. This setting is also suited for the high-cellulose type welding electrodes to make touch-welding at a short arc length.

This setting is more affected by voltage drop caused by improperly sized welding cables due to its incorrect length and diameter than when in the **normal** position.

DUAL MODE WELDING (CC)

NOTICE

NEVER switch the **single/dual selector switch** when welding. The possibility exists of contact failure which could cause arcing thus causing a fire and damage to the equipment.

1. Place the welding mode selector switch (Figure 45) in the **dual** mode position. Select CC mode 30-280A.

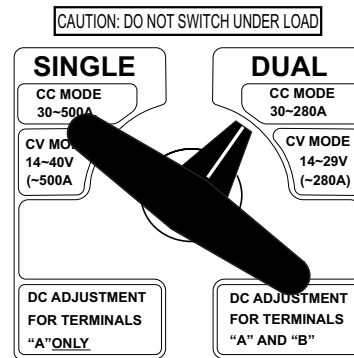


Figure 45. Single-Dual Selector Switch (Dual Position)

2. Follow steps 2 through 6 as outlined in the Single Mode Welding (CC) section and reference Table 22 instead of Table 21.

Table 22. Current Range/Engine Speed (Dual Mode Operation)

e Mode Selector Switch	Low 1200 rpm	High 1800 rpm
Low	A+B Total 30~180A See Note	—
High/Low	See Note	A+B Total 30~280A
High	—	A+B Total 30~280A See Note

Note: Reference notes 1, 2 and 3 as specified in Table 21.

CV Welding

- For **CV welding**, place the welding mode rocker switch (Figure 46) in the CV position.

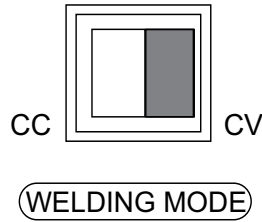


Figure 46. Welding Mode Switch (CV Mode)

- Place the welding mode selector switch (Figure 47) in either the **single** or **dual** mode position. Select CV mode either 14~40V/single or 14~29V/dual.

NOTICE

If the single-dual selector switch has been placed in the **single position**, B-side welding terminals cannot be used.

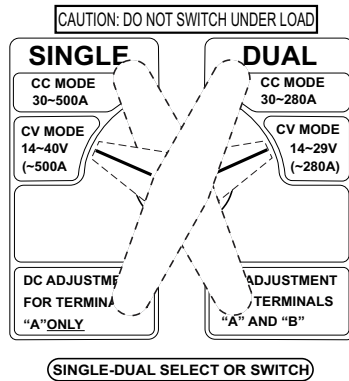


Figure 47. Single-Dual Selector Switch

Table 23. Voltage Range/Engine Speed (Single Mode Operation)

e Mode Selector Switch	Low 1200 rpm	High 1800 rpm
Low	14~29 VDC See Notes	—
High/Low	See Notes	14~40 VDC
High	—	14~40 VDC See Notes

Note 1: If using two welders connected with different polarities to weld the same work, the voltage between the holders may cause electric shock to the operator.

Note 2: If using two welders connected with different polarities to weld the same work, use separate grounds for each welder.

Note 3: **NEVER** switch the Single-Dual Selector Switch during welding operations. Switch contacting failure may occur.

- Place e-Mode selector switch (Figure 48) in the desired position as defined by Table 23 or Table 24. This switch is a 3-position **toggle** switch (S/N 5880102 and above) or 3-position **rocker** switch (S/N 5880101 and below)

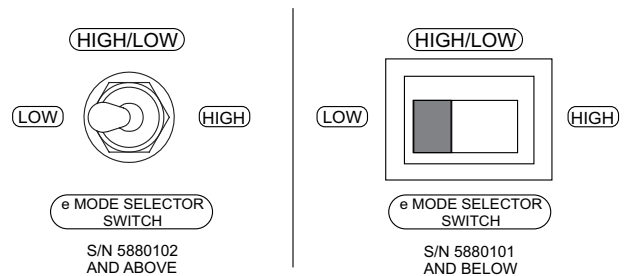


Figure 48. E-Mode Selector Switch (CV Mode)

Table 24. Voltage Range/Engine Speed (Dual Mode Operation)

e Mode Selector Switch	Low 1200 rpm	High 1800 rpm
Low	A+B Total 14~24V See Note	—
High/Low	See Note	A+B Total 14~29V
High	—	A+B Total 14~29V See Note

Note: Reference notes 1, 2 and 3 as specified in Table 23.

- Using the welding voltage control knob (Figure 49) adjust the voltage to the desired setting as referenced in Table 23 (Single Mode) or Table 24 (Dual Mode).

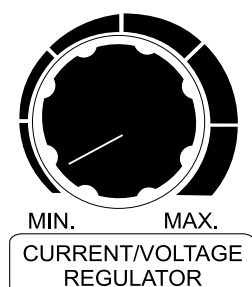


Figure 49. Current/Voltage Regulator Control Knob (Voltage Adjust)

- The selected voltage will be displayed on the DC weld meter (Figure 50).

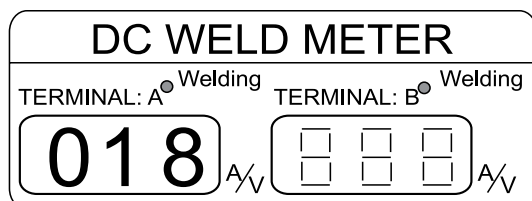


Figure 50. DC Weld Meter (18 VDC)

- Adjust welding current with the current regulator control on the wire feeder.

Idle Stop Function

NOTICE

The **idle stop** function when selected allows the welder-generator to be started or stopped remotely. Warning signs should be posted around the equipment indicating that the equipment can start without warning. All children and unauthorized personnel should be kept away when the equipment is operating in this mode.

- Place **main** circuit breaker in the **OFF** position.
- The idle stop function **will not work** if any of the lamps referenced in Figure 51 are **ON** or **BLINKING**.

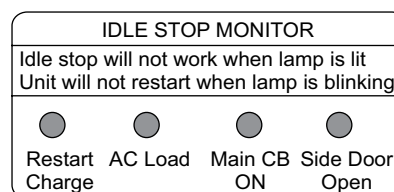


Figure 51. Idle Stop Monitor

- **Restart Charge Lamp** – If this lamp is **flashing** the engine cannot be started.

NOTICE

Whenever the unit is started either via pushbutton control or the Smart Stick™ function, battery voltage will be consumed. The restart charge lamp will turn on during engine cranking.

The lamp will remain on until the battery has received sufficient charge. Once a sufficient charge has been achieved, the lamp will turn off. This concept is in place to prevent the operator from shutting down and restarting the unit multiple times in a shorten time frame.

Multiple starts in a shorten time frame will deplete the battery charge, and cause battery replacement.

- **AC Load Lamp** – If lamp is **flashing**, indicates that the ON/OFF power switch of a power tool connected to the GFCI receptacle has been left in the **ON** position.
- **Main Circuit Breaker On Lamp** – If this lamp is **flashing** or **ON**, indicates that the main circuit breaker is in the **ON** position. Set this breaker to the **OFF** position when using the idle stop function.
- **Side Door Open** – If lamp is **flashing**, indicates side door is open.

LOCAL OPERATION

- If any of the status lamps as referenced in Figure 51 are **ON**, correct the problem before using the idle stop function.

WARNING

When using the idle stop function, be careful not to come in contact (**bare hands**) with the welding holder, welding terminals and the load connected to the GFCI receptacle. The possibility of electrical shock exist.

- Place the idle stop selector switch (Figure 52) in the **ON** position.

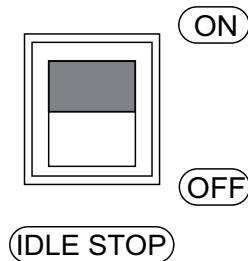


Figure 52. Idle Stop Selector Switch (ON)

- Next, set the time regulator to the desired setting. The example shown in (Figure 53) indicates 15 minutes.

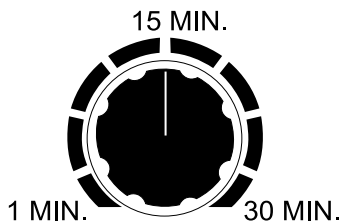


Figure 53. Time Regulator

- The welding process will be stopped once the preset time (1-30 minutes) has been reached. The engine will shutdown and the "1d5" message will be displayed on the DC Weld Meter (Figure 54).

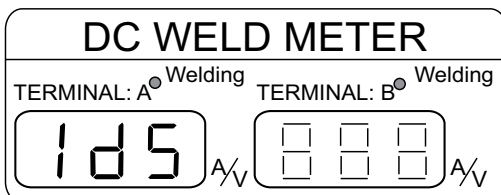


Figure 54. DC Weld Meter (Idle Stop)

RESTARTING FROM IDLE STOP (WELDING SIDE)

This section will describe how the welder detects the restart signal when idle stop selector switch has been placed in the **ON** position (welder side).

- The stopping of the engine creates a restart signal, a voltage of about 15 VDC at the welding terminals.
- To decrease the voltage at the welding terminals, tap the welding electrode tip to the welding material.
- If the detecting circuit detects the varying signal twice or more (tap, tap, tap), the engine will be restarted automatically.

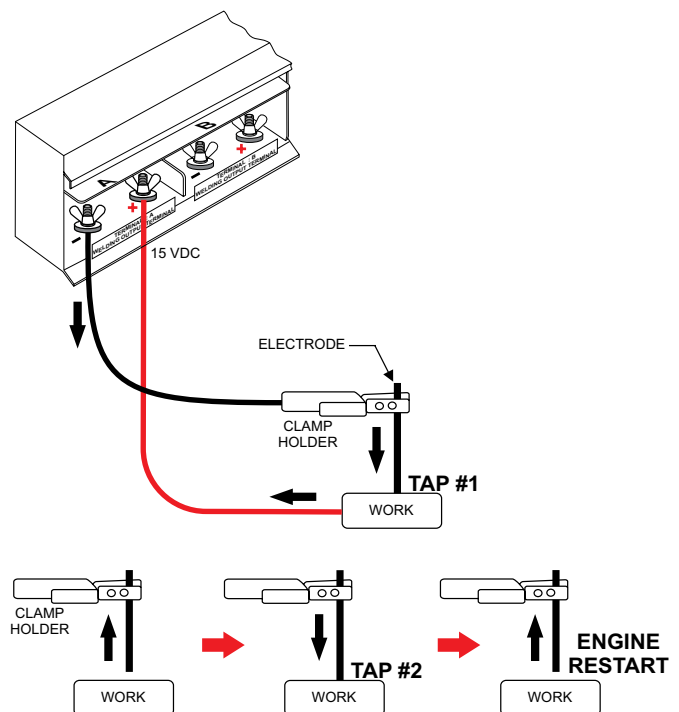


Figure 55. Restart Signal (Welder Side)

NOTICE

Make sure that the welding electrode tip (Figure 55) is free of any residue from the welding work and also make sure that the welding surface is not corroded. Both of these conditions could affect the restart signal.

Excessive residue on the electrode tip and corrosion on the welding surface may cause the engine not to start even after repeated tapping of the electrode on the work surface.

RESTARTING FROM IDLE STOP (GENERATOR SIDE)

This section will describe how the welder detects the restart signal when idle stop selector switch has been placed in the **ON** position (generator side).

1. To detect the restart signal, a voltage of about 15 VDC will be generated at the GFCI receptacle during the stopping of the engine.
2. Insert the plug from a power tool such as a electric drill or saw into the GFCI receptacle on the welder/ generator.
3. Make sure the GFCI circuit breaker (CB5) is in the **ON** position and the main circuit breaker (CB1) is **OFF**.

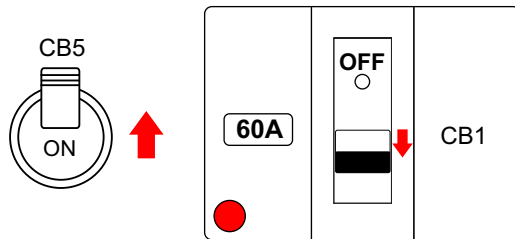


Figure 56. GFCI/Main Circuit Breakers

4. Make sure the ON/OFF switch on the power tool is in the **OFF** position.
5. Next, toggle the ON/OFF switch twice with the switch ending up in the **OFF** position.

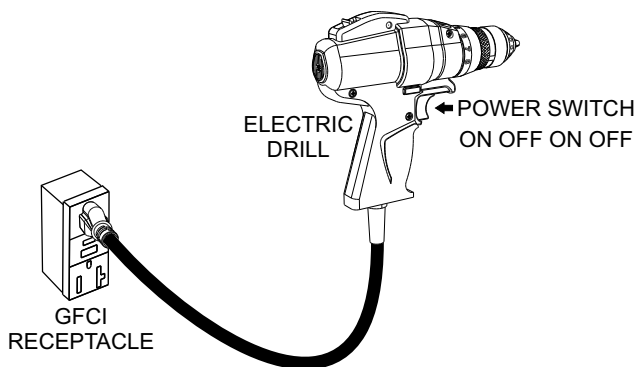


Figure 57. Restart Signal (Generator Side)

6. If the detecting circuit detects the varying signal twice or more (on, off, on and off) the engine will be restarted automatically.

NOTICE

Make sure the ON/OFF switch on the power tool is always placed in the OFF position after it has been toggled.

RESTART CHARGE LAMP

When the restart charge lamp is lit after starting the engine, the engine will not stop even after the preset time indicated by the idle stop time regulator.

The engine will only stop after the lamp goes out. This is a function to secure the forced charging time to compensate the discharged battery power used to start the engine and the discharged control power consumed during idling stop.

The charging time varies with the idling stop time as shown in Figure 58 below. If the operating time before idling stop is long, the function works to shorten the restart charge time, ensuring the improvement of fuel consumption.

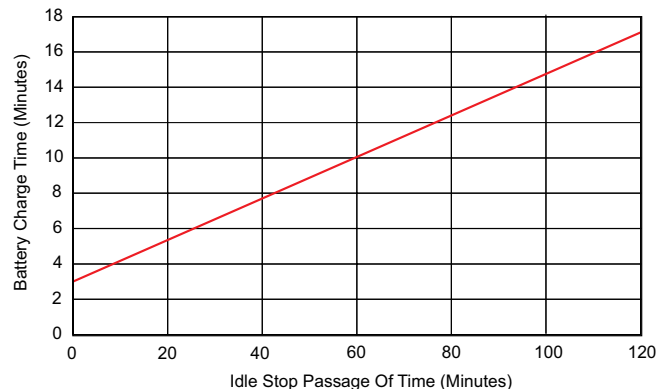


Figure 58. Idle Stop Passage Of Time Versus Battery Charge Time

NORMAL SHUTDOWN PROCEDURE

To shutdown the generator, use the following procedure:

1. Place the **main** circuit breaker (CB1) and auxiliary circuit breakers CB2 thru CB5 in the **OFF** position. Reference Figure 23 and Figure 24.
2. Place the e-Mode selector switch (Figure 59) in the low position.

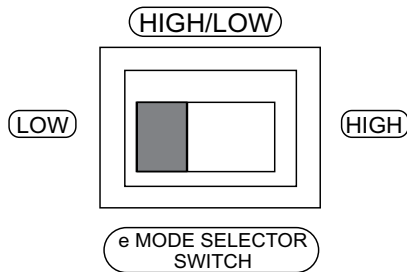


Figure 59. E-Mode Selector Switch (Low Position)

3. Let the engine run at idle speed for 5 minutes.
4. Place the starter switch (Figure 60) in the **STOP** position.

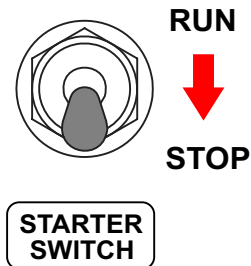


Figure 60. Starter Switch (STOP Position)

5. Remove all loads from the generator receptacles.
6. Remove any welding cables attached to the welding terminals.
7. Place the fuel valve lever (Figure 61) in the **OFF** position.

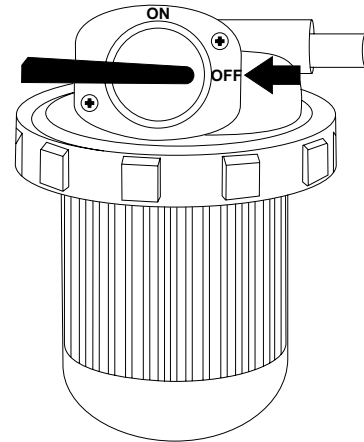


Figure 61. Fuel Valve Lever (OFF)

EMERGENCY SHUTDOWN PROCEDURE

Place the starter switch (Figure 60) in the **STOP** position.

REMOTE OPERATION

REMOTE OPERATION

NOTICE

The **remote** function when selected allows the welder-generator to be started or stopped remotely. Warning signs should be posted around the equipment indicating that the equipment can start without warning. All children and unauthorized personnel should be kept away when the equipment is operating in this mode.

Local/Remote Regulator Switch

When the local/remote regulator switch (Figure 62A) is placed in the **LOCAL** position, the output voltage setting can be adjusted with the current/voltage regulator knob (Figure 62B) on the control panel of the welder/generator.

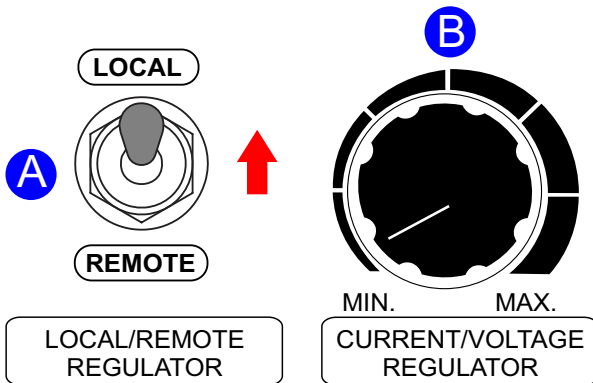


Figure 62. Local/Remote Regulator Switch

When the local/remote regulator switch is placed in the **REMOTE** position (Figure 63A), the output voltage can **only** be adjusted with the remote voltage control knob (Figure 63B) on the **remote side** (wire feeder). The output **cannot** be adjusted by operating the current/voltage regulator control on the welder/generator.

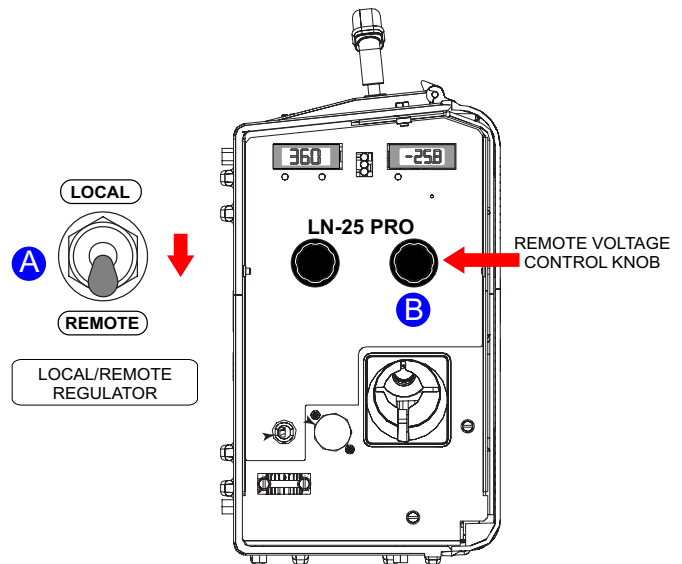


Figure 63. Remote Voltage Control Knob (Wire Feeder)

Local/Remote Weld Output Switch

When the welding mode selector switch (Figure 64A) is placed in the CV position and the local/remote weld output switch is placed in the **LOCAL** position (Figure 64B), the welding voltage is always output.

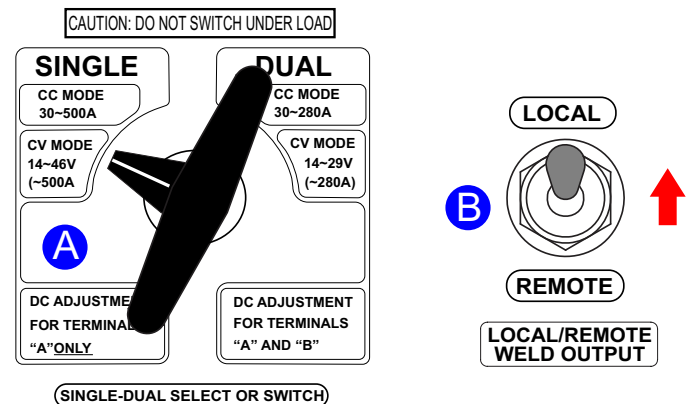


Figure 64. Weld Output Switch (Local)

REMOTE OPERATION

When a wire feeder (Figure 65) is connected to the 14P receptacle on the generator/welder via a control cable and the local/remote weld output switch is placed in the **REMOTE** position, the welding voltage output is in synchronization with the ON/OFF operation of the of the wire feeder.

NOTICE

Reference the wire feeder owner's manual when remote welding is required. Control cable is supplied with wire feeder. Follow instructions as referenced in wire feeder owner's manual for safe operation and setup.

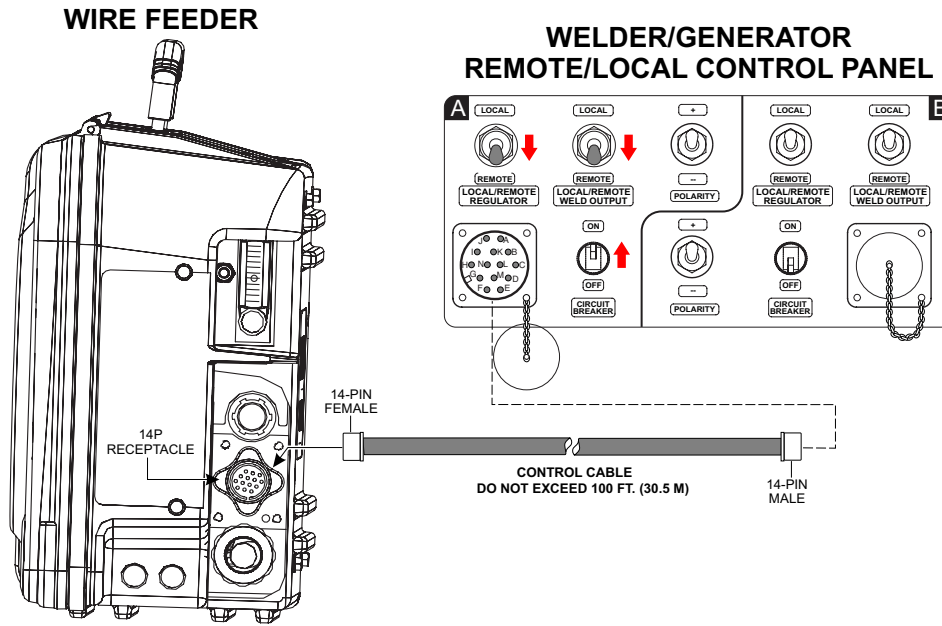


Figure 65. Wire Feeder To 14P Receptacle

When the welding mode selector switch is placed in the CC position (Figure 66A) the welding voltage is always output regardless of the position of the local/remote weld output switch (Figure 66B).

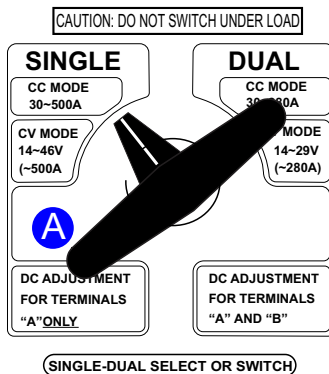


Figure 66. Weld Output Switch (Local/Remote)

When in the remote mode, make sure to place the side **A** circuit breaker (CB6A) in the **ON** position. If using side **B**, place CB6B in the **ON** position as shown in Figure 67.

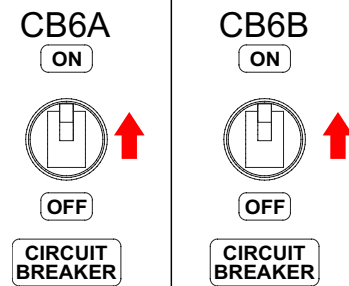


Figure 67. CB6A/CB6B ON/OFF Breakers

Place the polarity switch (Figure 68) in the position that matches the polarity of the wire feeder.

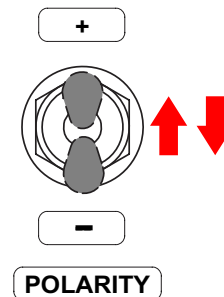


Figure 68. Polarity Switch

REMOTE OPERATION

Switch Settings (Local/Remote)

Reference Figure 69 for the various switch and dial settings when using the generator/welder and external wire feeder,

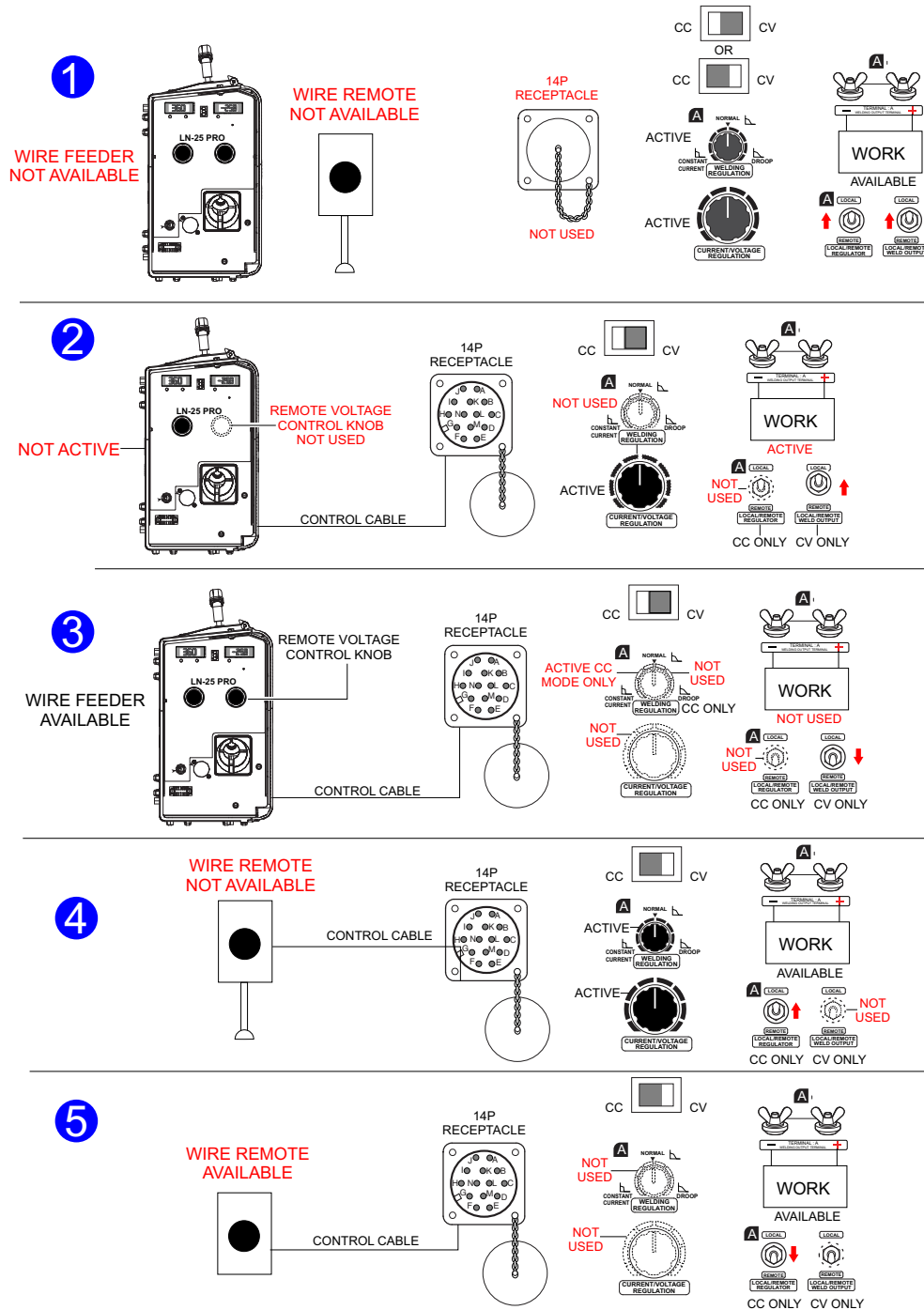


Figure 69. Switch/Dial Settings (Local/Remote)

MAINTENANCE

Table 25. 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 ^{*4}		X			As Required
	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	
	Flush and Refill Cooling System ^{*3}					1 yr. or 2000 hrs.
	Clean Inside of Fuel Tank					1000 hrs.
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 hours and a maximum of 250 hours. Service interval depends on type of oil.

*2 Add "Supplemental Coolant Additives" (SCAs) to recharge the engine coolant.

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

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

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

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

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

GENERAL INSPECTION

Prior to each use, the generator should be cleaned and inspected for deficiencies. Check for loose, missing or damaged nuts, bolts or other fasteners. Also check for fuel, oil, and coolant leaks. Use Table 25 as a general maintenance guideline **Engine Side** (Reference Engine Instruction Manual).

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 70) 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 become 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 Air Cleaner Elements

1. Release the latches (Figure 70) that secures the cover to the air cleaner body.
2. Remove the air cleaner cover and set aside.
3. Remove both the primary air cleaner element.
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 70), tap the filter element several times on a hard surface to remove dirt, or blow compressed air (not to exceed 30 psi (207 kPa, 2.1 kgf/cm²) through the filter element from the inside out.

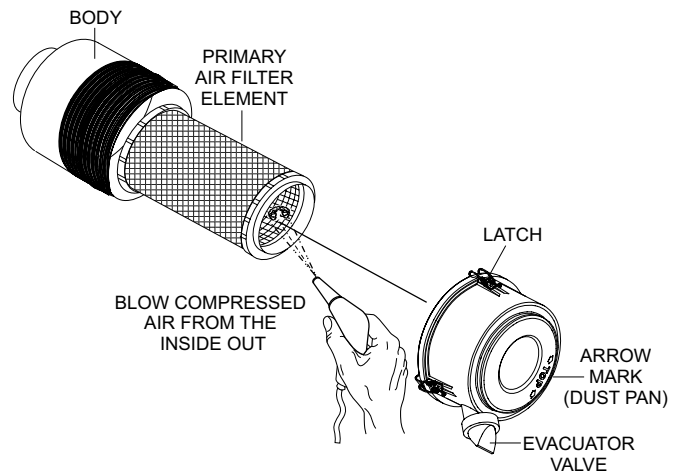


Figure 70. Air Cleaner

7. Clean the secondary element (paper air filter) as referenced in step 6.
8. Replace primary air filter elements if it is damaged or excessively dirty.
9. Clean the inside of the air cleaner body.
10. Reinstall the primary air filter element back into air cleaner body.
11. Reinstall the air cleaner cover, and secure with latches.

NOTICE

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

DRAINING THE FUEL FILTER ELEMENT

NOTICE

Inspect the fuel filter **daily**. If the fuel filter (Figure 57) 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 71) 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** (Figure 71A) approximately 3-1/2 turns until the valve drops down 1 inch (25.4 mm) and draining occurs (Figure 71B).

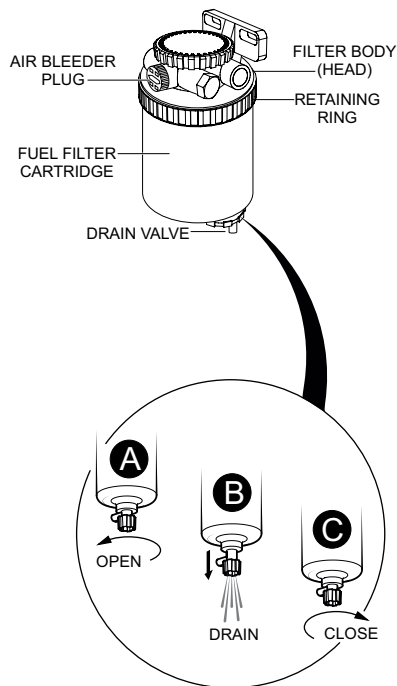


Figure 71. Draining Fuel Filter

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 72) from the fuel filter body.

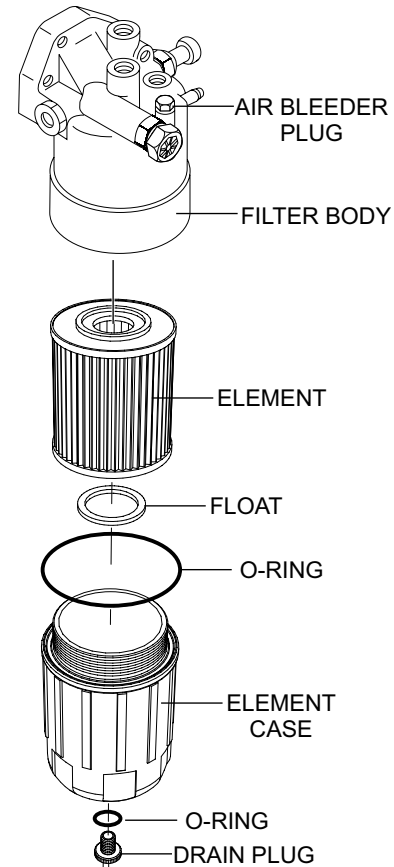


Figure 72. Fuel Filter Replacement

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

ELECTROMAGNETIC FUEL PUMP (500 HOURS)

The filter inside the fuel pump (Figure 73) is either a paper type or steel mesh type depending on the fuel pump type. Clean or replace the fuel pump filter as follows:

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

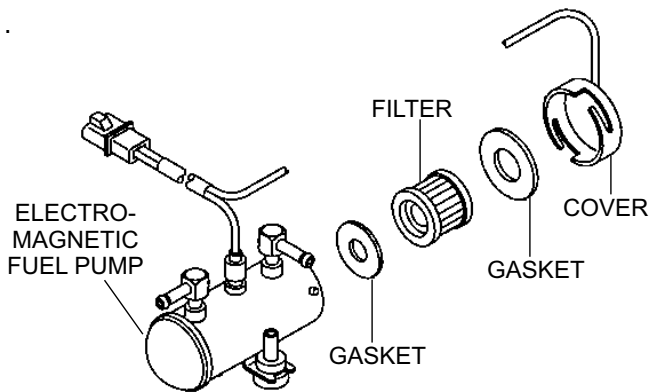


Figure 73. Electromagnetic Fuel Pump

NOTICE

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

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

CLEANING INSIDE THE FUEL TANK

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

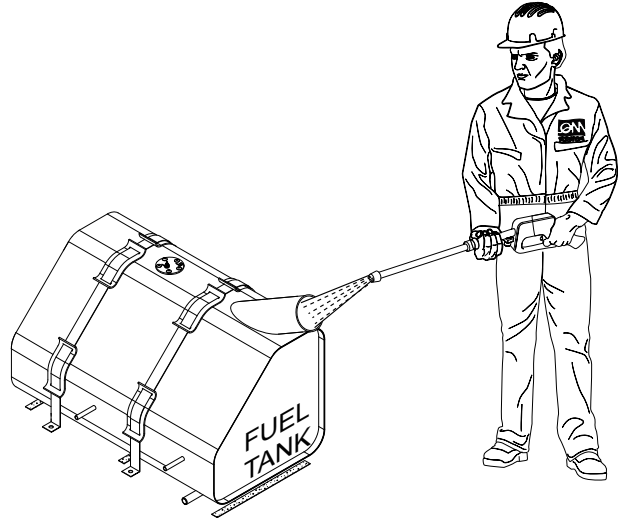


Figure 74. Fuel Tank Cleaning

FUEL TANK INSPECTION

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

- **Tank Bands/Pads** — Look for signs of wear or deformity. Replace tank bands or pads if necessary.
- **Fuel Hoses** — Inspect nylon and rubber hoses for signs of wear, deterioration or hardening.
- **Fuel Tank Lining** — Inspect the fuel tank lining for signs of excessive amounts of oil or other foreign matter.

DRIVE BELT (DAILY)

Drive Belt Tension

A slack drive belt (Figure 75) may contribute to overheating or insufficient charging of the battery. Adjust the drive belt in accordance with the Isuzu Operator's manual.

Drive Belt Inspection

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**" (a hard shiny appearance on the sides of the belt). Either of these two conditions can cause the belt to run hot, which can weaken it and increase the danger of it breaking.

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

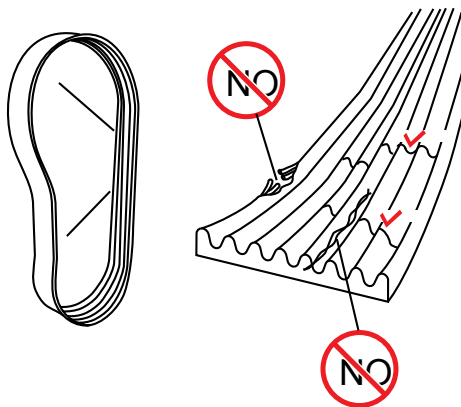


Figure 75. Drive Belt Inspection

ENGINE OIL (CHECK DAILY) LARRY

NOTICE

Contact your country's Department of Public Works or recycling agency in your area and arrange for proper disposal of any electrical components, fuel, oil or waste associated with this equipment.



1. When checking or adding oil, place the welder-generator on a level surface.
2. Pull the engine oil dipstick from its holder.
3. Reinsert the dipstick, then remove the dipstick from its holder. Check the oil level shown on the dipstick (Figure 76).

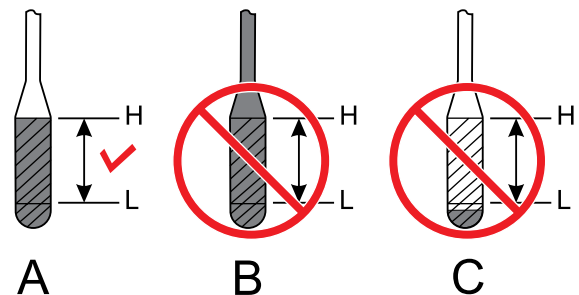


Figure 76. Dipstick Engine Oil Level

4. Verify that the engine oil level is maintained between the **H** and **L** markings on the dipstick as referenced in Figure 76A.
5. If the engine oil level is low (Figure 76C), remove the oil filler cap () and fill to a safe operating level (max) as indicated by the dipstick (Figure 76A).

NOTICE

When adding engine oil **DO NOT** overfill (Figure 76B).

6. If oil level is low, add correct amount of engine oil to bring oil level to a normal safe level (See Recommended Viscosity Grades, Table 26 and Table 27).

NOTICE

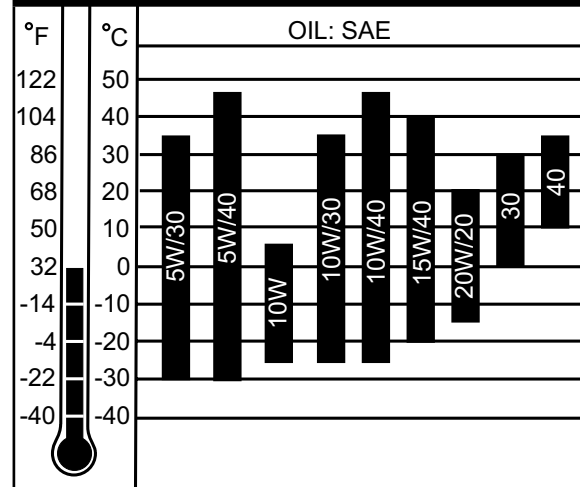
Refer to Table 27 for the suitable American Petroleum Institute (API) classification of engine oil according to the fuel type used (Low Sulfur, Ultra Low Sulfur or High Sulfur).

Table 26. Recommended Oil Classification

Fuel Type	API Classification (Engine Oil)
High Sulfur Fuel 0.05% (500 PPM) ≤ Sulfur Content < 0.50% (5000 PPM)	CF If the CF-4 , CG-4 , CH-4 or CI-4 engine oil is used with high sulfur fuel, change the engine oil at shorter intervals (approximately half).
Low Sulfur Fuel Sulfur Content < 0.05% (500 PPM) or Ultra Low Sulfur Fuel Sulfur Content < 0.0015% (15 PPM)	CF, CF-4, CG-4, CH-4 or CI-4

- Allow enough time for any added oil to make its way to the oil pan before rechecking.

Table 27. Oil Selection Chart



DRAINING ENGINE OIL

- Run the engine until the engine coolant reaches a temperature of 140° (60°C). Turn the engine off.
- Remove the oil dipstick from its holder.
- Open the cabinet doors and place the oil drain valve in the **OPEN** position (Figure 77A).
- Next, remove oil drain plug (Figure 77B), then allow the oil to drain into a suitable container.

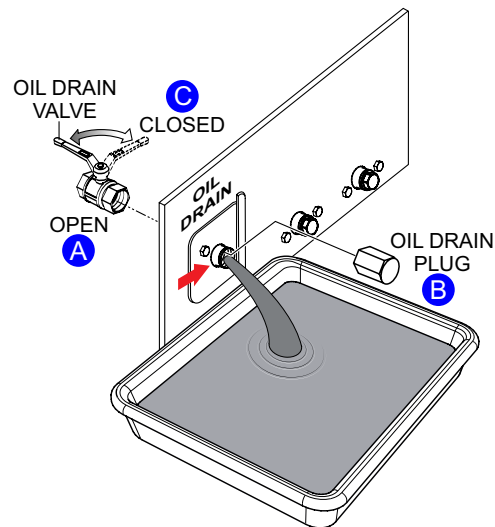


Figure 77. Draining Engine Oil

- After engine oil has been completely drained, reinstall oil drain plug and tighten securely.
- Place the oil drain valve in the **CLOSED** position (Figure 77C).

ENGINE OIL FILTER REPLACEMENT

1. Clean the area around the lubricating oil filter head.
2. Using an oil filter wrench (Figure 78), remove engine oil filter.

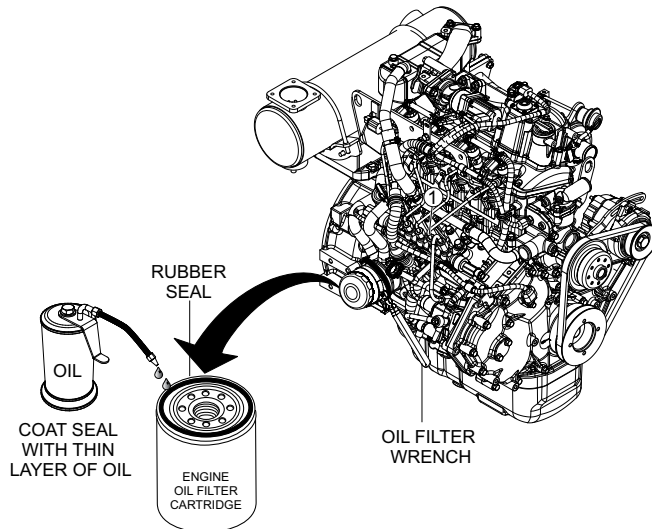


Figure 78. Engine Oil Filter Removal

3. Coat the rubber seal (gasket) surface of oil filter (Figure 78) with clean 15W-40 engine oil.
4. Install new oil filter first by hand until it makes contact with the filter head surface. Tighten it another 3/4 turn using the filter wrench.
5. Fill engine crankcase with high quality detergent oil as referenced in Table 27. Fill to the upper limit of dipstick. **DO NOT** overfill. Reference Table 4 for engine crankcase oil capacity.
6. Run the engine for several minutes. Watch for oil leakage. Shut the engine down and allow it to sit for several minutes. Top off the oil to the upper limit on the dipstick.

DRAINING ENGINE COOLANT

WARNING

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

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

1. Remove the radiator pressure cap (Figure 79) only if the coolant temperature is below 120°F (50°C).

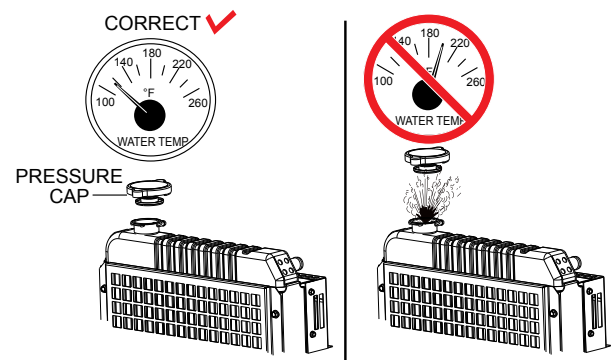


Figure 79. Radiator Pressure Cap Removal

2. Remove the coolant drain bolt and o-ring (Figure 80), then allow the coolant to drain into a suitable container.

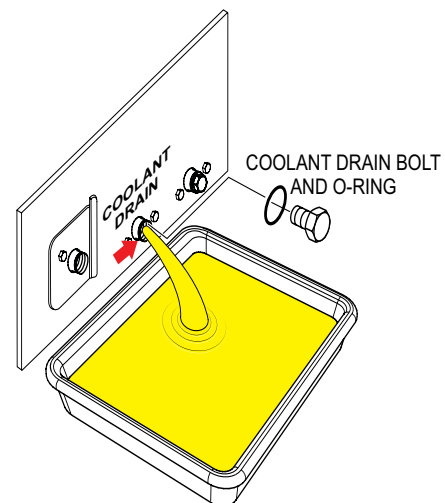


Figure 80. Draining Radiator Coolant

3. Check hoses for softening and kinks. Check clamps for signs of leakage.
4. Remove and inspect radiator cap.

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. Remove radiator cap.
2. Remove the coolant drain bolt and o-ring (Figure 80), then allow the coolant to drain into a suitable container
3. If equipped, remove the overflow tank. Drain and clean overflow tank.
4. Replace the overflow tank if necessary.
5. Check hoses for softening and kinks. Check clamps for signs of leakage.
6. 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.
7. Replace with coolant as recommended by the engine manufacturer. Reference Table 4 for coolant capacity.
8. Reinstall coolant drain bolt with o-ring and tighten securely.

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 Operation and Maintenance 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 via the radiator. When adding coolant to the radiator, **DO NOT** remove the radiator pressure cap until the unit has completely cooled. Reference Table 4 for coolant capacity.

OPERATION IN FREEZING WEATHER

When operating in freezing weather, be certain the proper amount of antifreeze has been added as referenced in Table 28.

Table 28. Anti-Freeze Operating Temperatures

Vol % Anti- Freeze	Freezing Point		Boiling Point	
	°C	°F	°C	°F
50	-37	-34	108	226

RADIATOR CLEANING

The radiator (Figure 81) 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.

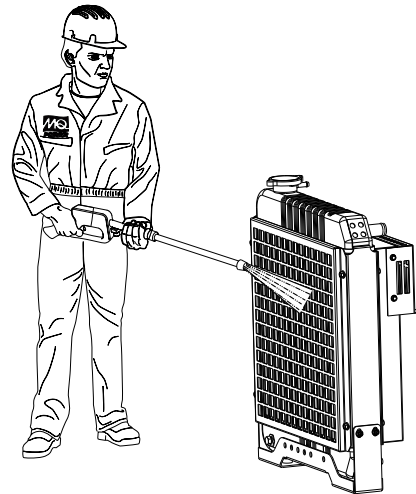


Figure 81. Radiator Cleaning

REMOVING WATER FROM THE FUEL TANK

1. After prolonged use, water and other impurities accumulate in the bottom of the tank. Occasionally inspect the fuel tank for water contamination.
2. If water contamination is present within the fuel tank, remove the fuel tank drain bolt and o-ring (Figure 82), then allow the fuel to drain into a suitable container.

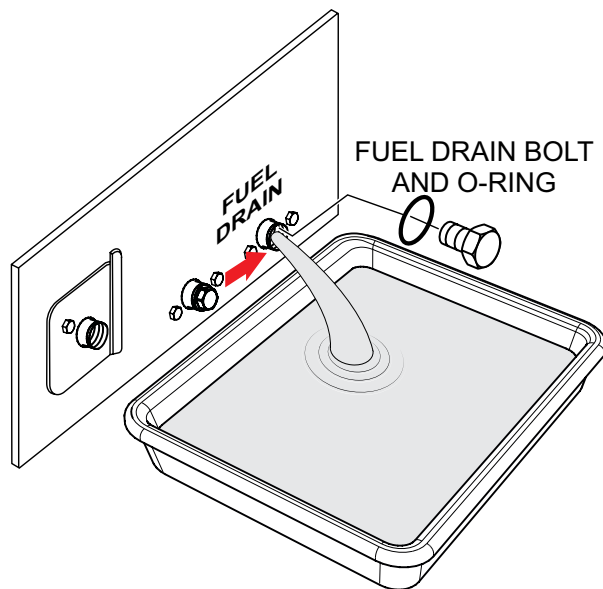


Figure 82. Draining Fuel Tank

3. 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.

NOTICE

If air enters the fuel injection system of a diesel engine, starting becomes impossible. After running out of fuel, or after disassembling the fuel system, bleed the system. Reference the **Isuzu Operation and Maintenance Manual** for details.

TESTING THE GFCI SENSING MODULE

If tripping of the **main** circuit breaker persists after a load is replaced with a known good one (no short circuit), perform this test with no load.

1. Start the welder-generator as outlined in the start up procedure in this manual.
2. Verify that the **RED** fault LED on the GFCI sensing module starts **flashing** (Figure 83).

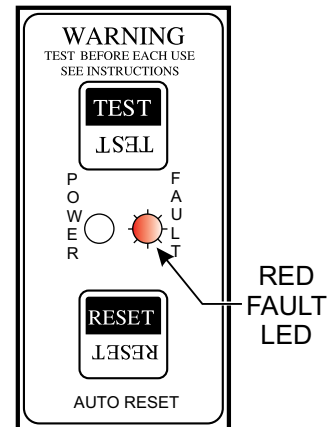


Figure 83. GFCI Sensing Module Red Fault LED Flashing

3. Press the **RESET** button on the GFCI module and verify that the **GREEN** power LED is **ON** (Figure 84).

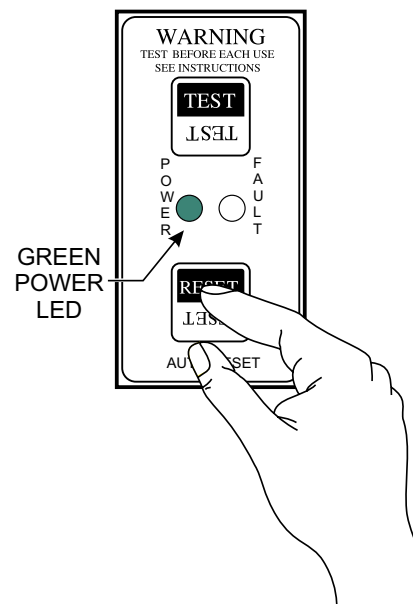


Figure 84. GFCI Sensing Module (Green LED ON)

- Place the main circuit breaker, CB1 (Figure 85) in the **ON** position within 5 seconds after pressing the **RESET** button on the GFCI sensing module.

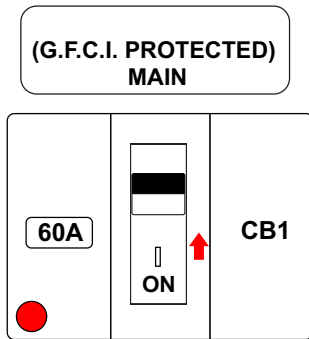


Figure 85. Main Circuit Breaker ON (GFCI Test)

- Also verify that the AC voltmeter is registering a voltage reading as indicated by Figure 90.
- Next, press the **TEST** button on the GFCI sensing module (Figure 86) and verify that the **GREEN** power LED turns **OFF** and the **RED** fault LED turns **ON**.

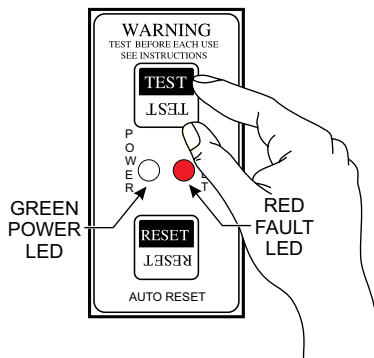


Figure 86. GFCI Sensing Module (Red/Fault LED ON)

- Also verify that the main circuit breaker (Figure 87) switch trips to the **OFF** position.

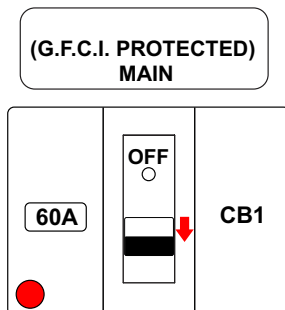


Figure 87. Circuit Breaker OFF (GFCI Test)

- Verify that the AC voltmeter (Figure 88) on the welder-generator reads zero volts.

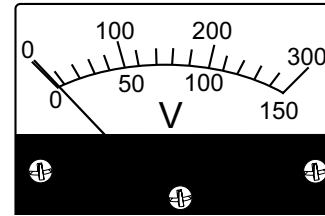


Figure 88. AC Voltmeter (Zero Volts)

- To restore power, press the **RESET** button (Figure 89) on the GFCI module and verify that the **RED** fault LED turns **OFF** and the **GREEN** power LED turns **ON**.

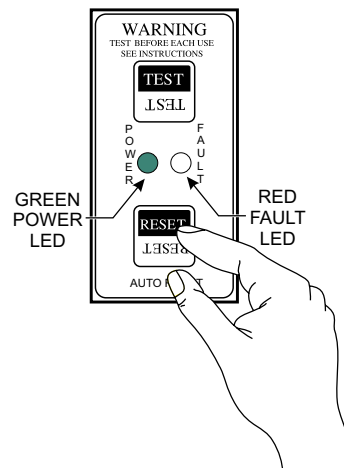


Figure 89. GFCI Sensing Module (Green LED ON Reset)

- Verify that the AC voltmeter is registering a voltage reading as indicated by Figure 90.

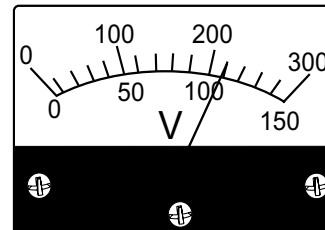


Figure 90. AC Voltmeter (120/240V)

11. If desired, a multimeter can be used to measure the AC voltage output at the auxiliary receptacles as shown in Figure 91. Make sure to place **all** auxiliary circuit breakers in the **ON** position before taking the voltage measurement.

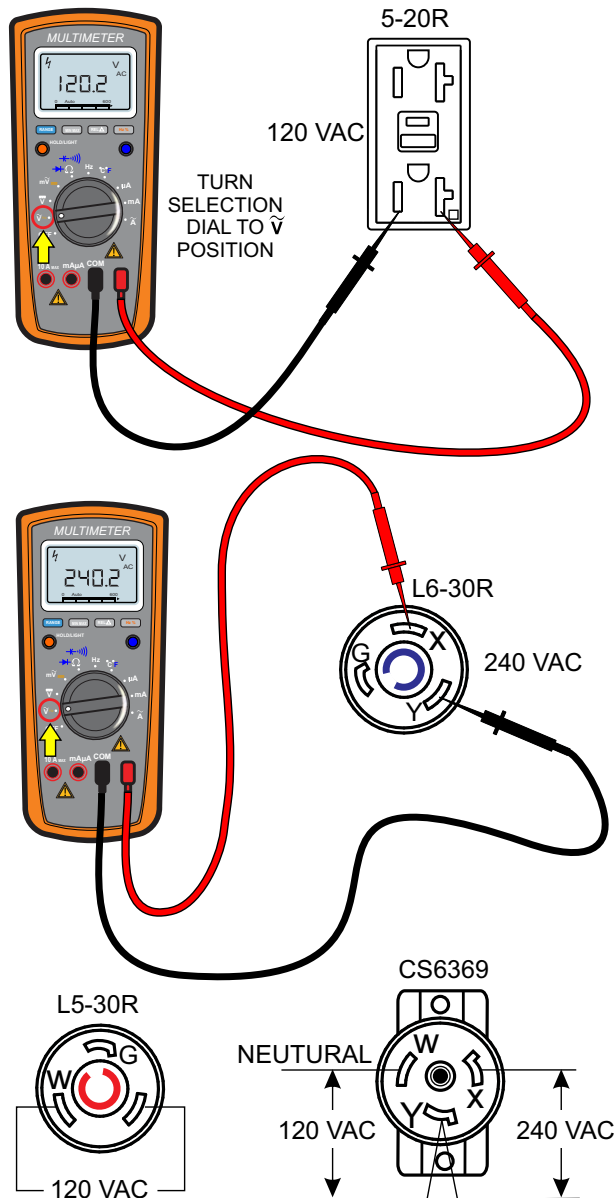


Figure 91. Auxiliary Receptacles Voltage Measurement

NOTICE

It is recommended that the GFCI sensing module be tested when the welder-generator is initially uncrated. Then, the module should be tested daily at startup.

CAUTION

The GFCI sensing module is designed to interrupt power when a ground fault exists to prevent injuries and shock hazards. **DO NOT** operate the welder-generator if this test fails. Consult a qualified electrician for repair or replacement of the GFCI sensing module.

TESTING THE GFCI RECEPTACLE

NOTICE

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

If tripping of the **GFCI** receptacle persists after a load is replaced with a known good one (no short circuit), perform this test at least once a month.

1. Start the welder-generator as outlined in the start up procedure in this manual.
2. Place the GFCI circuit breaker (Figure 92) in the **ON** position.

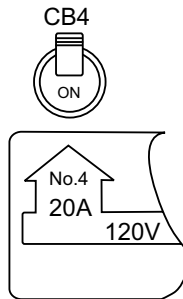


Figure 92. GFCI Circuit Breaker ON

3. Verify that the status LED on the GFCI receptacle (Figure 93) is **ON (GREEN)**.

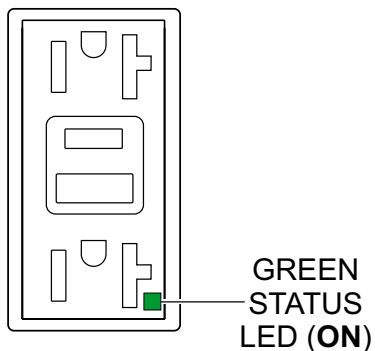


Figure 93. GFCI Receptacle (ON)

4. Press the **TEST** button (Figure 94) on the GFCI receptacle and verify that the status LED turns **OFF**.

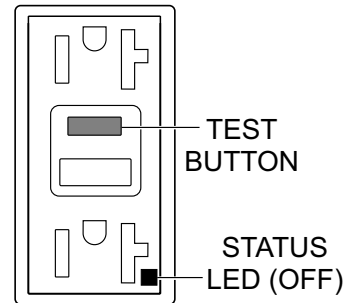


Figure 94. GFCI Receptacle (OFF)

5. Press the **RESET** button (Figure 95) to restore power to the GFCI receptacle and verify that the status LED is **ON (GREEN)**.

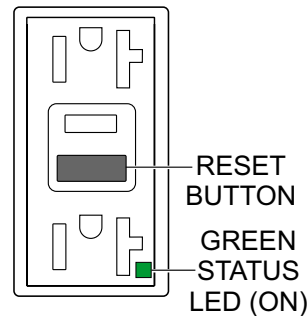


Figure 95. GFCI Receptacle (ON/Restore)

6. If the status LED (Figure 96) is **flashing (RED)**, **DO NOT** use the GFCI receptacle and replace it immediately.

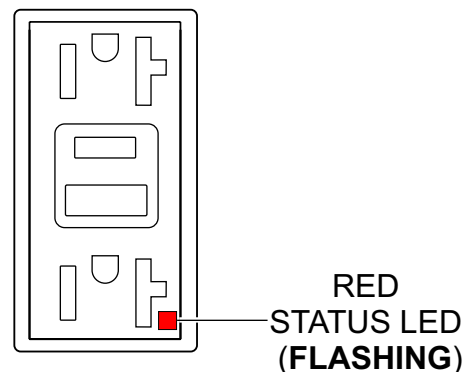


Figure 96. GFCI Receptacle (RED Flashing LED)

PROTECTION DEVICES

NOTICE

Low oil pressure, high coolant temperature, high engine speed and battery charge are considered major protection parameters and will cause the engine to shutdown.

1. This unit is equipped with **protection** devices. When any of the **major** protection devices are activated, the engine will **automatically stop** and the error code message will be displayed on the DC welding current meter (Figure 97).

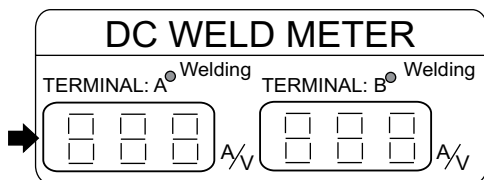


Figure 97. DC Weld Meter Error Codes

2. In addition, the battery charge, oil pressure and water temperature alarms will be displayed on the engine warning display (Figure 98).

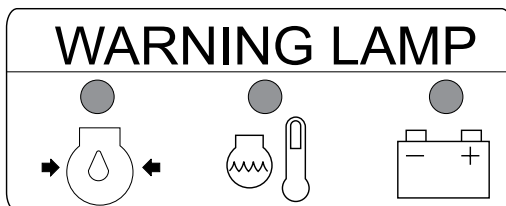


Figure 98. Engine Warning Lamps

3. Reference Table 29 and Table 30 for protection device error codes.

GENERATOR SIDE

If the power transistor (PTR), insulated-gate bipolar transistor (IGBT) on the welding side become abnormally hot, a protective error code will be displayed on the DC welding current meter. This condition will cause the welding to stop, but will not shutdown the engine.

An error code of E10 will be displayed on the terminal A side, while an error code of E20 will be displayed on the terminal B side.

The cause of these two error codes (E10/E20) is due to an overload condition on the welding side (duty cycle over the limit) or insufficient cooling due to an open cabinet door or blocked air intake. Take corrective action on these conditions and welding will resume when the PTR (IGBT) cools down.

FUSES

The engine wiring system has its own fuses (F1, F2 and F5). If either of these fuses are blown, check the wiring to determine if an electrical short circuit exists. Correct the problem before installing new fuses.

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

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

The engine block heater and internal battery charger both require 120 VAC in order to operate. A receptacle (Figure 99) has been provided on the output terminal panel to allow commercial power to be applied.

These receptacles will **ONLY** function when commercial power has been supplied to them (Figure 99). To apply commercial power to these receptacles, a power cord of adequate size will be required (See Table 11).

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

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

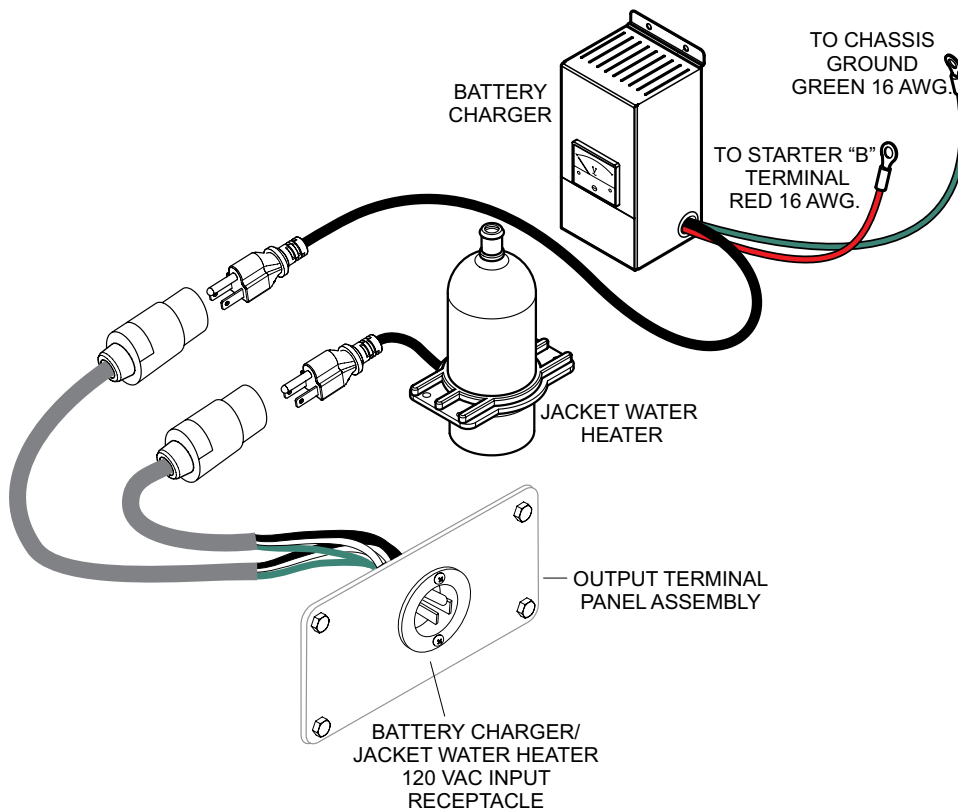


Figure 99. Battery Charger and Jacket Water Heater (Option)

EMISSION CONTROL

The emission control system employed with the Isuzu 4LE2T diesel engine consists of a Diesel Oxidation Catalyst (DOC).

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

Diesel Oxidation Catalyst (DOC)

The DOC (Figure 100) does not filter particles, it oxidizes them. This catalyst (honeycomb-like structure) uses a chemical process to break down pollutants in the exhaust stream into less harmful components. In general this catalyst collects/burns accumulated particulates. The DOC contains palladium and platinum which serve as catalysts to oxidize hydrocarbons and carbon monoxide.

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 becomes mostly colorless every 250 hours of operation time. More carbon will be generated when the unit operates at less than 30% of rated power. In this case, perform the above procedures more frequently.

NOTICE

Applying a large load suddenly to the unit when carbon deposition has been 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.

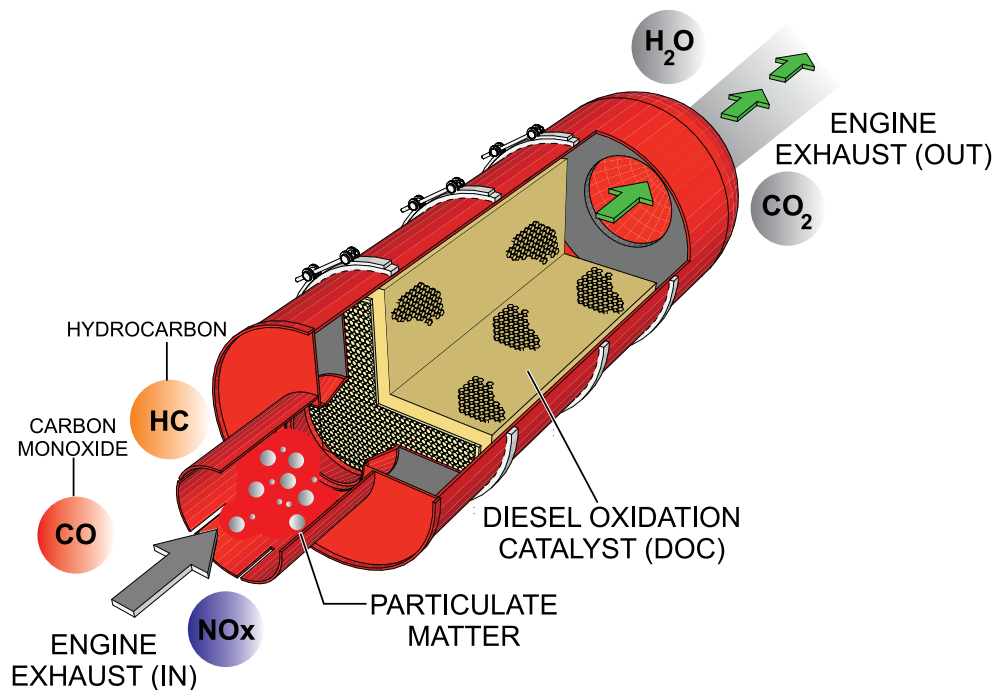


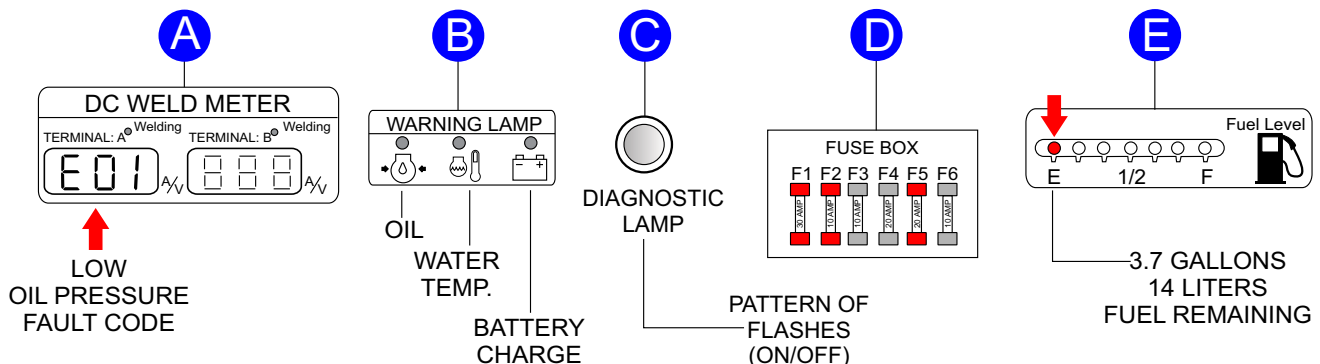
Figure 100. Diesel Oxidation Catalyst (DOC)

WELDER-GENERATOR FAULT CODES

Table 29. Engine/Welder Fault Codes

Fault Code (A)	Engine	Welding Output	Warning Lamp (B/E)	Diagnostic Lamp (C)	Possible Problem	Corrective Action
E01 ^[1]	STOP	STOP	● ON	● (294)	Low Lubricating Oil Pressure, below 0.48 MPa	<ul style="list-style-type: none"> • Check oil level. • Check oil pressure.
E02 ^[1]	STOP	STOP	● ON	● (542)	High Jacket Water Temp., > (212 °F) 100° C	<ul style="list-style-type: none"> • Check coolant level (after machine has cooled down). • Check air breathing and exhaust vents are not clogged. • Check for thermal effect of any other machines.
E03 ^[1]	STOP	STOP	● ON	—	The generated voltage of the charging generator is abnormally low	<ul style="list-style-type: none"> • Battery not charged, loose battery connections. • Fan belt loose or broken.
E04 ^[1]	STOP	STOP	—	—	Engine Over-Speed (Engine Shutdown)	<ul style="list-style-type: none"> • Engine speed too high, > 2070 rpm's. Reduce speed.
E06 ^[1]	STOP	STOP	—	—	Engine fails to start after 3 automatic attempts (pre-heat/ cranking)	<ul style="list-style-type: none"> • Add fuel to engine. Set fuel cock to ON • Inspect fuel tank and fuel filter for water or deposits. • Check battery liquid level and charging level. • Inspect fan belt for looseness. • Check fuses F1/F2/F5. (D)
E10 ^[1] E20 ^[1]	—	STOP Self Recovery	—	—	A-Side PTR (IGBT) Overheat (Welding) B-Side PTR (IGBT) Overheat (Welding)	<ul style="list-style-type: none"> • Check air breathing and exhaust vents are not clogged. • Check for thermal effect of any other machines. • Make sure side door is closed before operation.
Low fuel ^[1] (E)	—	—	● ON	—	Only 3.7 gal. (14 L) fuel remaining	<ul style="list-style-type: none"> • Add fuel to engine.

[1] : Major protection device



WELDER-GENERATOR FAULT CODES (CONT'D.)

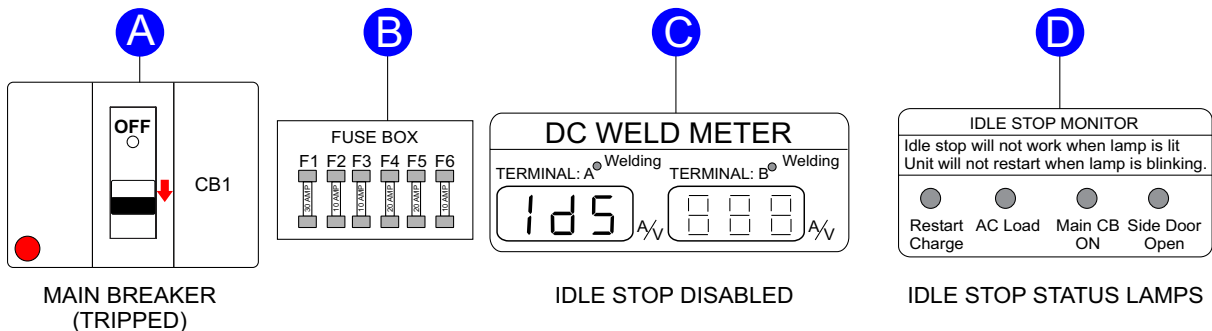
Table 30. Generator/Welder Fault Codes (Continued)

Parameter Fault Code	Circuit Breaker	Welding Output	Possible Problem	Corrective Action
AC ^[2] Overcurrent	Trip (A)	—	AC overload or short-circuit	<ul style="list-style-type: none"> • Reduce load. Reset main circuit breaker • Locate short
Electrical ^[2] Ground Fault	Trip (A)	—	Electrical Ground Fault	<ul style="list-style-type: none"> • Locate ground fault. Reset circuit breaker
Engine Fuses ^[2] (B)	—	—	AC overload or short-circuit	<ul style="list-style-type: none"> • Replace fuses F1/F2/F5. • Check engine wiring
E13	—	STOP	A-Side Welding Overcurrent	<ul style="list-style-type: none"> • Allow for proper duty cycle. Reference Table 7, 8 and 9.
E16	—	STOP	A-Side Current/Voltage Regulator Error	<ul style="list-style-type: none"> • Inspect regulator movement and connections.
E17	—	STOP	A-Side Welding Regulator Error	<ul style="list-style-type: none"> • Inspect, remove and test regulator for proper resistance.
E23	—	STOP	B-Side Welding Overcurrent	<ul style="list-style-type: none"> • Allow for proper duty cycle. Reference Table 7, 8 and 9.
E26	—	STOP	B-Side Current/Voltage Regulator	<ul style="list-style-type: none"> • Inspect regulator movement and connections.
E27	—	STOP	B-Side Welding Regulator Error	<ul style="list-style-type: none"> • Inspect, remove and test regulator for proper resistance.
E30	—	—	Idling Stop Regulator Error	<ul style="list-style-type: none"> • Inspect regulator movement and connections.
E33	—	—	Communication Error (Receiving Error At Display Board)	<ul style="list-style-type: none"> • Inspect intergrated circuit (IC) and digital meter (DM) board connections.
E34	—	—	Communication Error (Receiving Error At Control Board)	<ul style="list-style-type: none"> • Inspect intergrated circuit (IC) and control board (CB) connections.
IdS (blinking) (C)	—	—	Idling Stop Function Disabled	<ul style="list-style-type: none"> • Check idle stop monitor status LED's (D)

[1] : An error condition displayed with an asterisk (*) cannot always be corrected via simple inspection.
Please contact Multiquip Service Dept. or your MQ Service Dealer for assistance.

[2] : Major protection device

[3] : The codes listed above will not cause the engine to shut down.



ENGINE DIAGNOSTIC FAULT CODES

The engine controller of this generator diagnoses problems (faults/errors) that arise from the engine control system and the engine itself.

When any engine faults occur during operation of the generator the **engine diagnostic lamp** (diagnostic lamp) will turn on. If this condition occurs please perform immediately the engine fault code diagnostic procedure below.

ENGINE DIAGNOSTIC FAULT CODE PROCEDURE

1. Remove all loads from the generator and place all circuit breakers in the **OFF** position.
2. Stop the engine.
3. Verify that the **engine diagnostic lamp** is **ON**. This indicates that there is a fault/error in the engine or the engine control system.
4. To start the diagnostic process, place the momentary **engine diagnostic switch** (Figure 101A) in the **ON** position and hold.

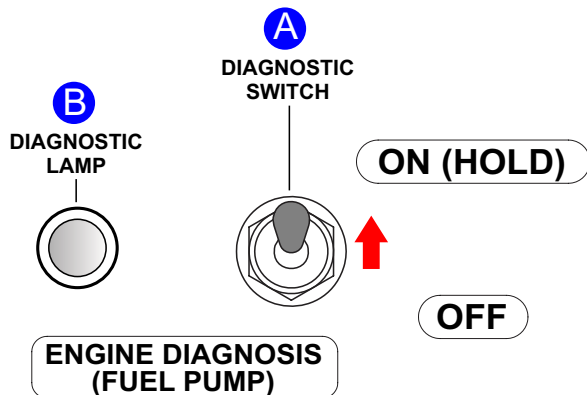


Figure 101. Engine Diagnostic Switch/Lamp

- The diagnostic lamp (Figure 101B) will start flashing with a pattern according to the detected fault code 3 times at an interval rate of 2.4 seconds. Reference Figure 102 on how to read the fault codes.
- If two or more fault codes are detected the diagnostic lamp will repeat the detected fault codes flashing patterns in ascending order. After all the detected fault codes are shown, the process will repeat starting with the first fault code.
- If no fault is detected the diagnostic lamp will flash repeatedly at an interval rate of 2.4 seconds.

NOTICE

For a complete understanding of diagnostic fault codes and troubleshooting procedures, refer to the enclosed engine instruction manual. Also refer to Table 31.

NOTICE

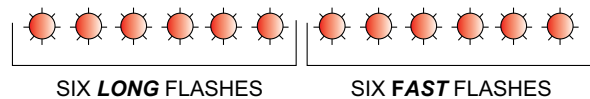
The diagnostic lamp will indicate the current fault code with the previous fault code in ascending order.

Also when a fault is detected the fault code will automatically be saved as the previous code in the ECM even after the fault has been repaired.

NOTICE

If a fault occurs while the engine is running the diagnostic lamp will turn on indicating only the current fault. Please note that the fault code (flashing pattern) cannot be shown while the engine is running.

FAULT CODE= 66 = GLOW RELAY FAULT



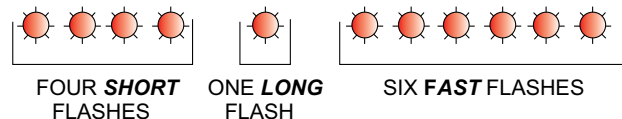
FLASH 3 TIMES AT AN INTERVAL RATE OF 2.4 SEC.

FAULT CODE= 211 = FUEL TEMP. SENSOR FAULT



FLASH 3 TIMES AT AN INTERVAL RATE OF 2.4 SEC.

FAULT CODE= 416 = MAIN RELAY CIRCUIT FAULT



FLASH 3 TIMES AT AN INTERVAL RATE OF 2.4 SEC.

Figure 102. Fault Code Examples

ENGINE DIAGNOSTICS FAULT CODES (CONT'D.)

Table 31. Engine Diagnostic Fault Codes	
Engine Diagnostic Fault Code	Component
14~16	Cam Sensor
15	Crank Sensor
19	Starter Cut Relay
22	Intake Air Temp. Sensor
23	Engine Coolant Temp. Sensor
32	Boost Pressure Sensor
34	ECM Charge Circuit
36	AID Conversion
44~45	EGR
51~54	Engine Controller
55	5 Volt Circuit
66 ^[1]	Glow Relay
71	Barometric Pressure Sensor
151	Common Rail Pressures
158~159	Injector Drive Circuit
211 ^[1]	Fuel Temp. Sensor
225	Rail Pressure Limiter Open
227	Fuel Rail Pressure is Low (Fuel Leak)
245	Fuel Rail Pressure Sensor
247	Fuel Pressure Regulator Control Circuit
271~277	Injector Circuit
416 ^[1]	Main Relay Circuit
[1] : Reference Figure 102 on how to read fault codes (Diagnostic Lamp)	

NOTICE

When an engine fault has been detected the diagnostic lamp will light (ON). To determine the fault description refer to the "Engine Diagnostic Fault Code Procedure" in this manual.

WELDER-GENERATOR — TROUBLESHOOTING

Table 32. Troubleshooting (Welder-Generator)

Symptom	Possible Problem	Solution
Starter switch is set to RUN but engine does not start.	Engine Start button has not been pushed?	Push Engine Start button.
" IdS " is indicated on welding current meter display.	Welding preset time (1–30 minutes) has been reached when using the idle stop function?	Restart engine from idle stop in any of the restarting methods, or set the starter switch to STOP once, then to RUN again and push the Engine Start button to start the engine.
No indication appears on welding current meter display though Starter switch is set to RUN . (Restart from idle stop is not possible.)	As engine has not been operated for 3 hours, automatic control power cut function is working?	If Engine Start button is not pushed while Starter switch remains at RUN position, or if idle stop state continues 2 hours or more, control power will automatically be cut off. (Operation lamp lights to remind operator to set to OFF .) When restarting engine, set the Starter switch to STOP once, then to RUN again and push the Engine Start button.
Idle stop function does not operate. (Main CB indicator lamp on idle stop monitor is ON .)	Idle Stop switch is set to OFF ?	Set Idle Stop switch to the ON position to enable the idle stop function.
	Idle stop preset time has not elapsed?	Idle stop is made after preset time elapses following a pause in work with welding power or output receptacle power (120V GFCI). Welding indicator lamp on welding current meter lights while welding work is performed. AC Load lamp on idle stop monitor lights when AC power is used.
	Charging time for battery is secured?	Just after engine start, idle stop is not made to charge battery. During charging time, Restart Charge lamp on idle stop monitor lights to indicate automatic stop is limited. Stop limit time varies with time idle stop is operated.
	Main AC circuit breaker (CB1) is set to the ON position?	Place Main AC circuit breaker (CB1) to the OFF position.

WELDER-GENERATOR — TROUBLESHOOTING (CONT'D.)

Table 33. Troubleshooting (Welder-Generator)

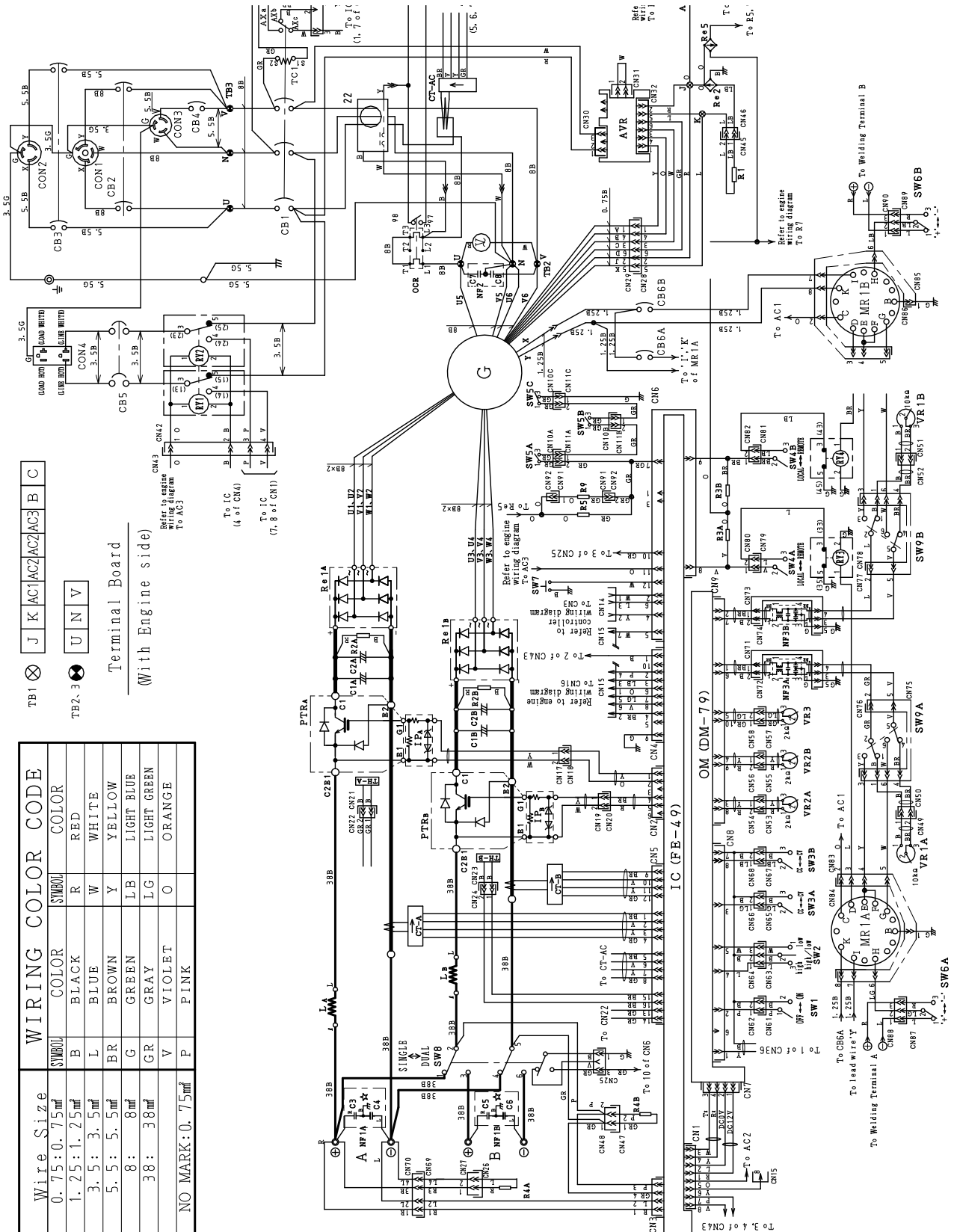
Symptom	Possible Problem	Solution
Engine cannot be restarted from idle stop.	Idle Stop switch is set to OFF ?	Make sure Idle Stop switch is in the ON position, then push the Engine Start button to start engine.
	Short-circuit and release between welding material and welding electrode cannot be detected twice or more?	If welding electrode and surface of welding material conduct current poorly due to rust or coating, or if welding electrode is continuously short-circuited by pressing it onto welding material, or if tapping intervals are too short or too long, voltage varying signal for restart may not be detected. “ IdS ” indication blinks on the welding current meter while welding electrode is being short-circuited.)
Engine cannot be restarted from idle stop. (“ IdS ” and preset current value are indicated alternately on welding current meter and indicator lamp on idle stop monitor is blinking.)	Main circuit breaker (CB1) and auxiliary AC circuit breakers (CB2, CB3 and CB4) are set to the ON position?	Place all circuit breakers to OFF position. AC Load lamp on idle stop monitor blinks if AC auxiliary circuit breakers are ON .
	Side door open?	Close side door. Side Door Open lamp on idle stop monitor blinks if side door is open.
	ON/OFF power switch from load (power tool) connected to 120V GFCI receptacle cannot be detected twice or more?	If power switch of the load connected to output receptacle remains ON , AC Load lamp on idle stop monitor blinks to prevent restart for safety. Set switch to ON then OFF twice or more and wait with switch in OFF position until engine restarts.
Engine RPM fluctuates higher or lower during welding.	Automatic control of engine revolutions responding to welding output and preset frequency of AC power in use is functioning?	If E-mode switch is set to Variable/Low position, engine revolutions are controlled based on preset value of welding current. Engine revolutions are adjusted up or down to meet total output for 2 operators. If AC power is used by 2 persons simultaneously, engine will operate at high speed because preset AC frequency is outputted.
	Semiconductor is overheated?	If the side-door is open or exhaust vents are clogged, causing insufficient cooling; if semiconductors are heated at an over-duty rate, output is limited to prevent such overheating.
AC power is not available.	AC circuit breakers are not set to ON ?	Place all circuit breakers CB1, CB2, CB3, and CB4 to the ON position.

GENERATOR WIRING DIAGRAM

Wire Size	SYMBOL	COLOR	SYMBOL	COLOR
0.75: 0.75	B	BLACK	R	RED
1.25: 1.25	L	BLUE	W	WHITE
3.5: 3.5	BR	BROWN	Y	YELLOW
5.5: 5.5	G	GREEN	LB	LIGHT BLUE
8: 8	GR	GRAY	LG	LIGHT GREEN
38: 38	V	VIOLET	O	ORANGE
NO MARK: 0.75	P	PINK		

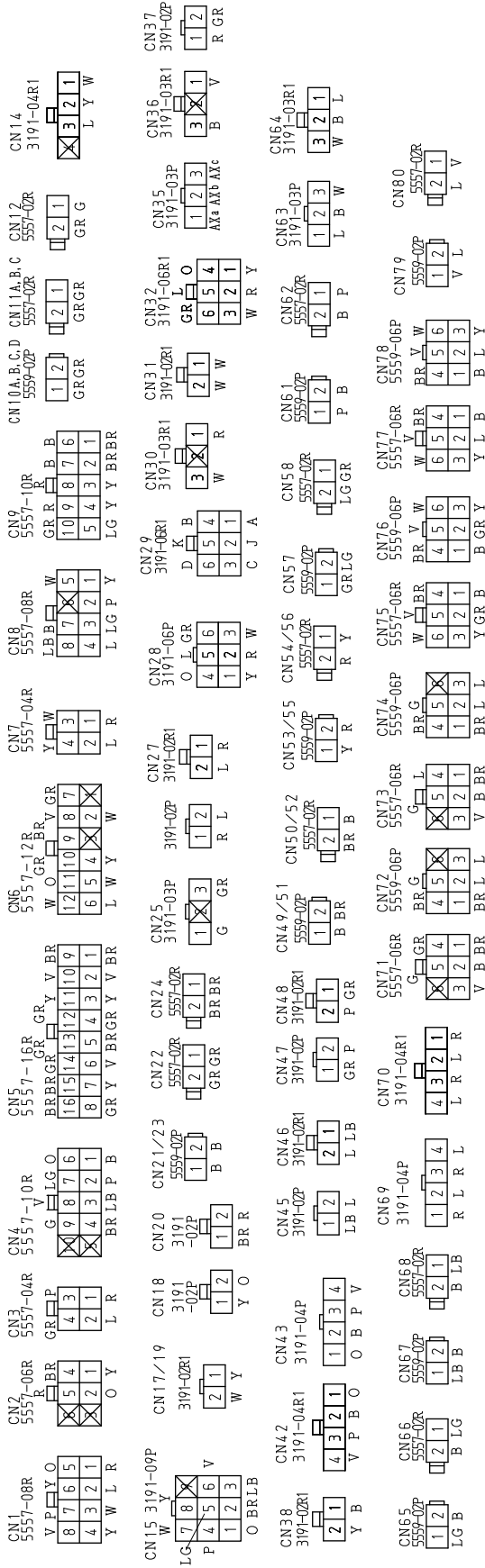
TB1 ⊗ J K AC1 AC2 AC3 B C
 TB2.3 ⊗ U N V

Terminal Board
(With Engine side)



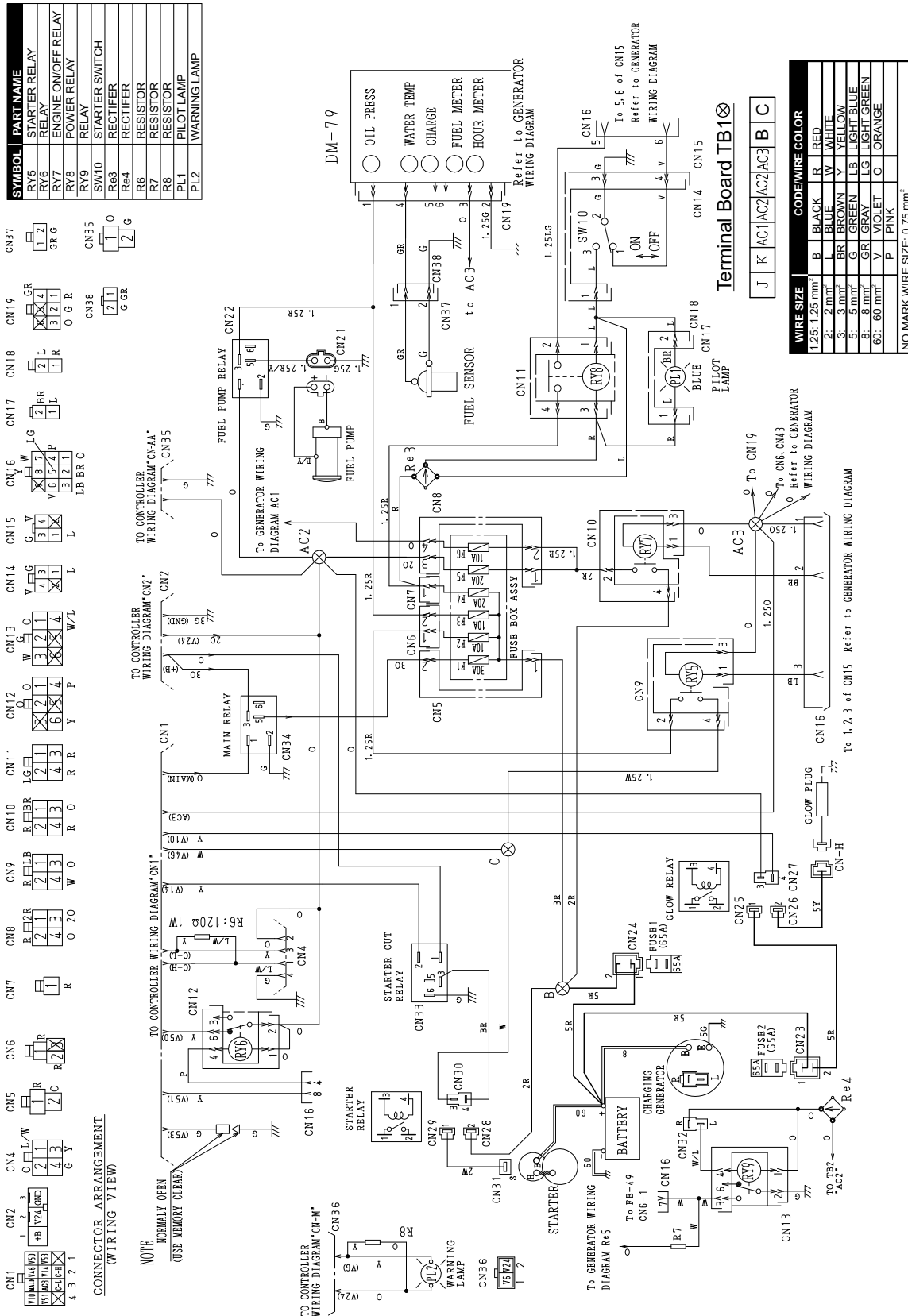
GENERATOR REFERENCE DESIGNATORS/CONNECTORS

SYMBOL	PARTS NAME	SYMBOL	PARTS NAME	SYMBOL	PARTS NAME
G	Brushless Generator	PTR A, B	IGBT	SW6A, B	Polarity Switch
CB1	AC Circuit Breaker	Re1 A, B	Rectifier	SW7	Engine Start Button
CB2	AC Circuit Protector	Re2, 5	Rectifier	SW8	Single-Dual Switch
CB3	AC Circuit Protector	C1, 2 (A, B)	Condenser	SW9A, B	Local/Remote Regulator Switch
CB4	AC Circuit Protector	THA, B	Thermostat	R1	Resistor
CB5	AC Circuit Protector	OM	Digital Panel	R2 A, B	Resistor
CB6 A, B	AC Circuit Protector	AVR	Automatic Voltage Regulator	R3 A, B	Resistor
CON1	Output Receptacle (120/240V)	NF1 A, B	Noise Filter	R4 A, B	Resistor
CON2	Output Receptacle (240V)	NF2	Noise Filter	R5	Resistor
CON3	Output Receptacle (120V)	NF3A, B	Noise Filter	R9	Resistor
CON4	Output Receptacle (120W, GFCI)	VR1 A, B	Current/Voltage Regulator	Ry1,2,3,4	Relay
V	AC Voltmeter	VR2 A, B	Welding Regulation	MR1A, B	Remote Connector
⊕ ⊖	DC Welding Output Terminal	VR3	Time Regulator	OCR	Over Current Relay
L A, B	DC Reactor	SW1	Idle Stop Switch	⊥	Ground Terminal (for GFCI)
IC	Control Unit , transistor (IGBT)	SW2	e Mode Switch	TB1	Terminal Board
IP A, B	Protector, transistor (IGBT)	SW3A, B	Welding Mode Selector Switch (CC/CV)	TB2, 3	Terminal Board
CT-A, B	Current Transformer	SW4A, B	Local/Remote Weld Output Switch		
CT-AC	Current Transformer	SW5A,B,C	Door Switch	22	GFCI Sensing Module

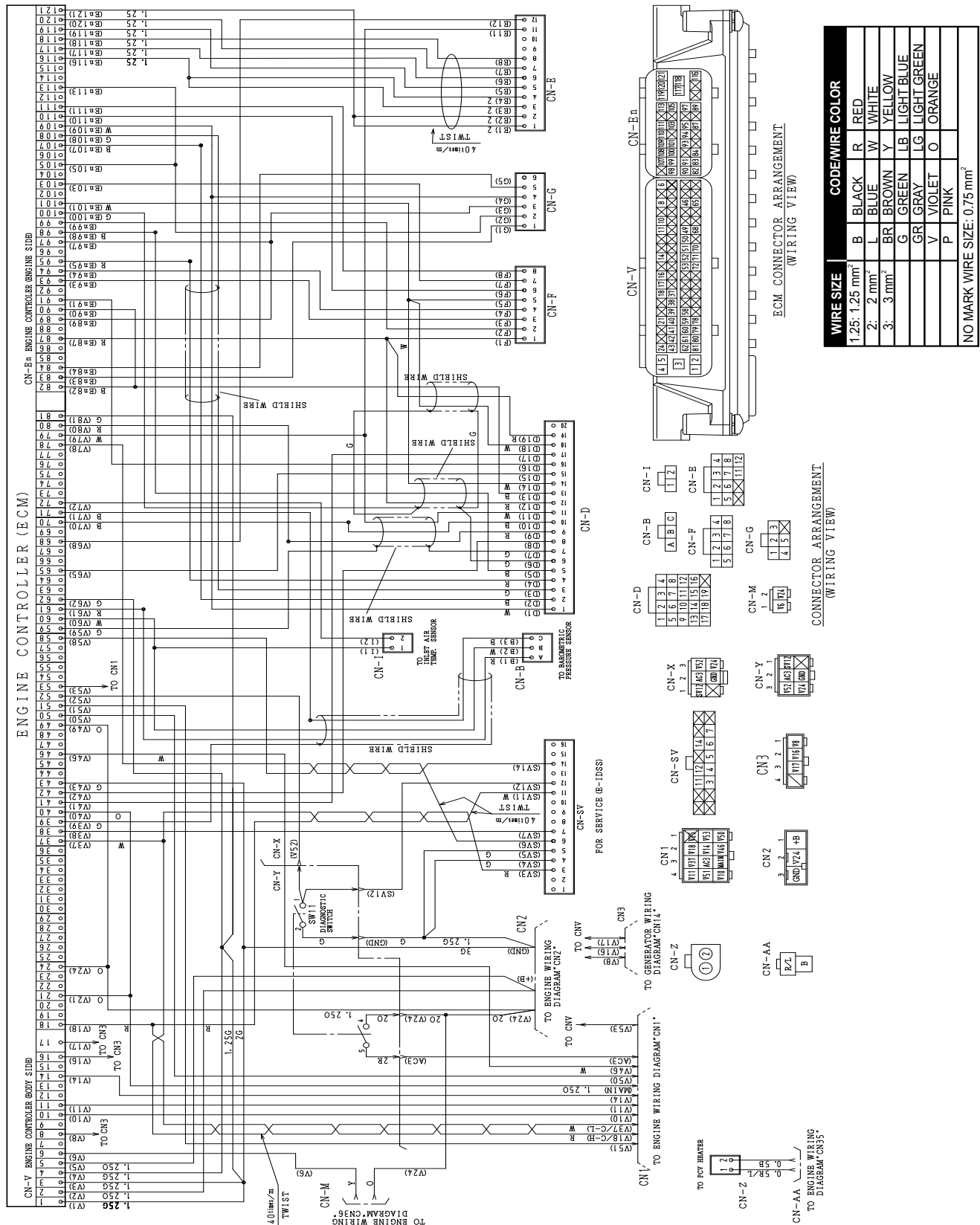


CONNECTOR
(View from Wiring side)

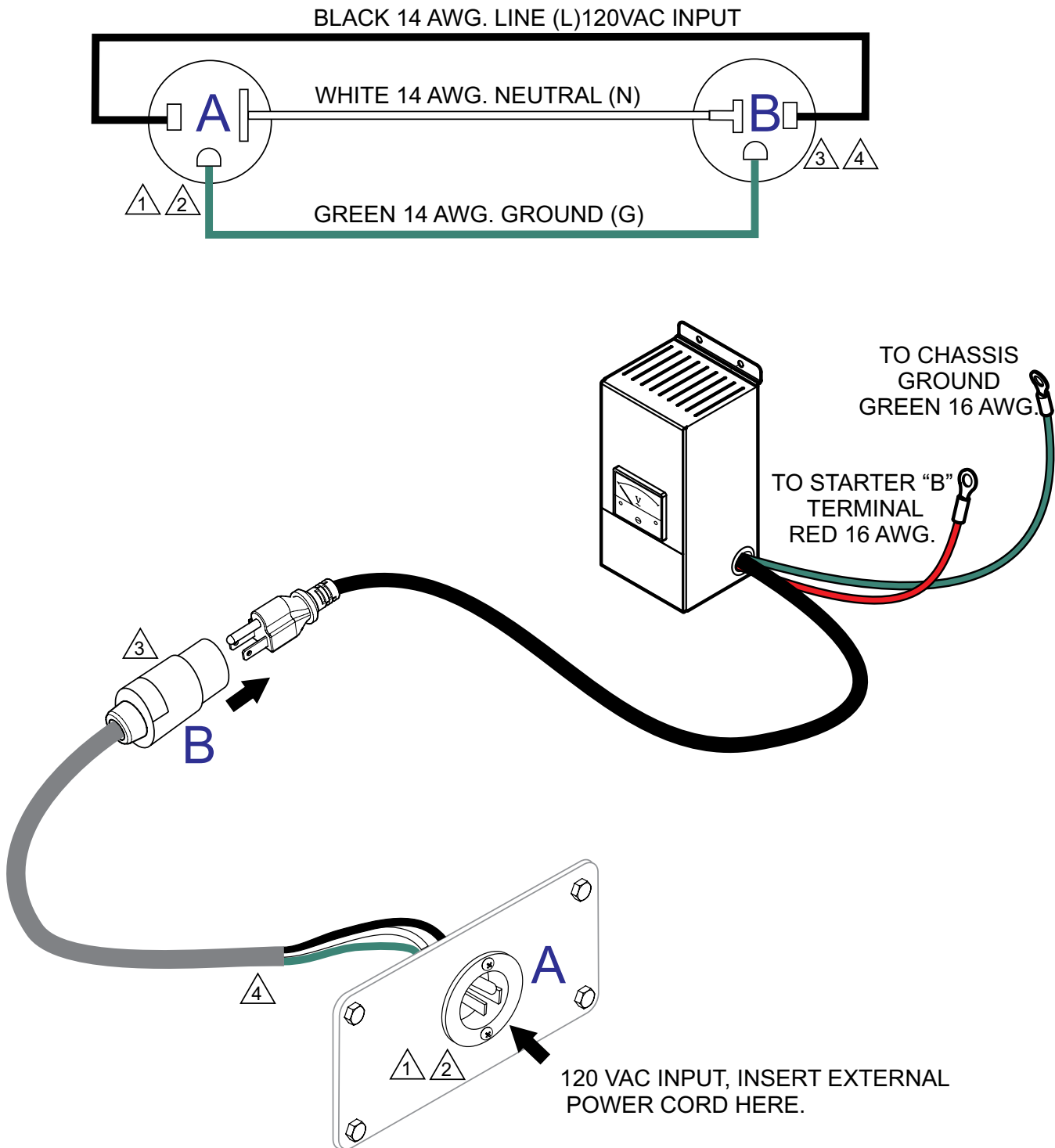
ENGINE WIRING DIAGRAM



CONTROLLER WIRING DIAGRAM



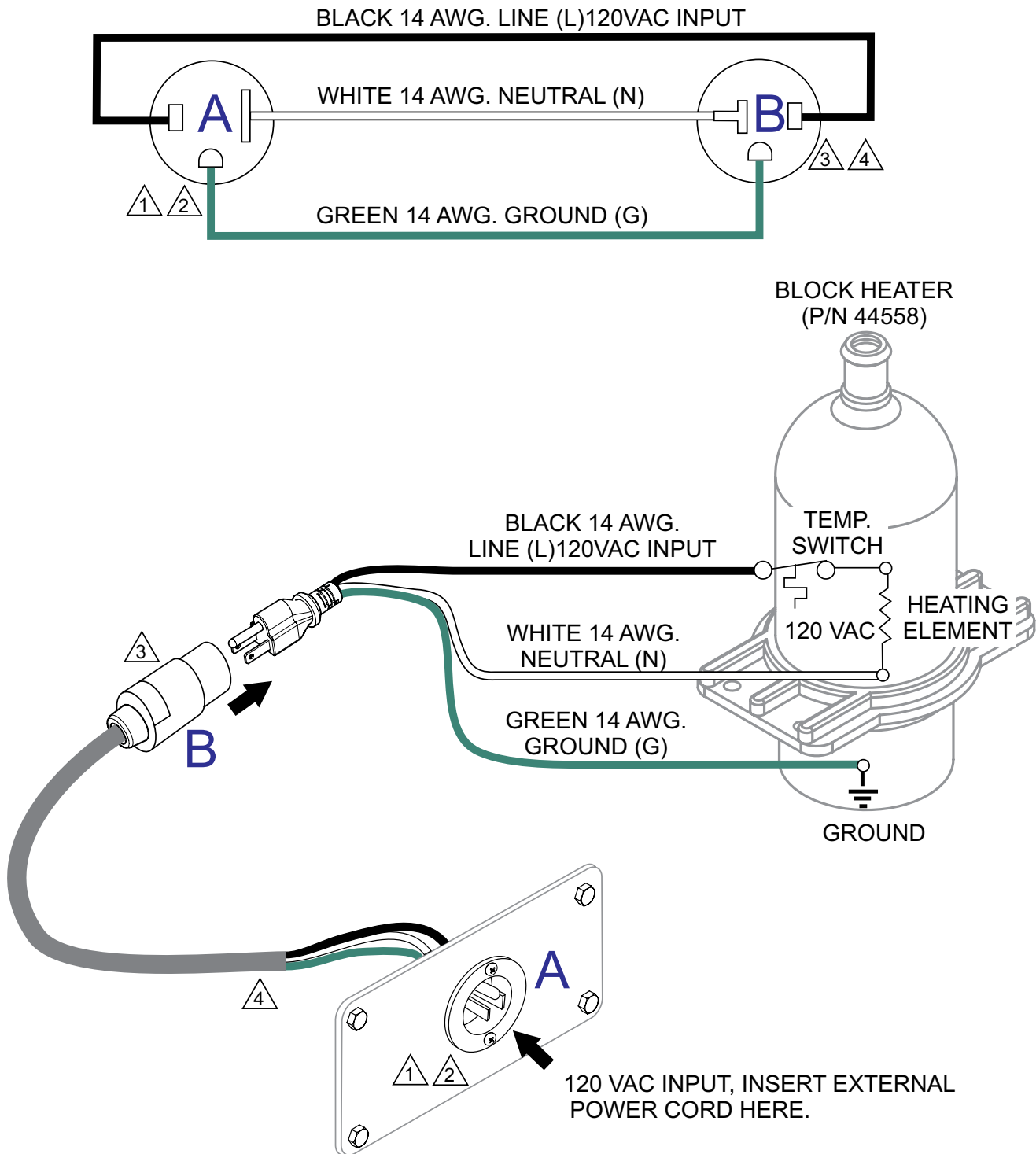
BATTERY CHARGER WIRING DIAGRAM



NOTES:

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

ENGINE BLOCK HEATER WIRING DIAGRAM



NOTES:

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

OPERATION MANUAL

HERE'S HOW TO GET HELP

PLEASE HAVE THE MODEL AND SERIAL
NUMBER ON HAND WHEN CALLING

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