SERVICE AND TROUBLESHOOTING MANUAL

MULTIQUIP®

DCA6 – DCA600
MQ POWER GENERATORS

Revision #2 (10/27/25)

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WARNING
CANCER &
REPRODUCTIVE HARM
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P/N 38707

DCA6 – DCA600 60 Hz Generators Service and Troubleshooting Manual

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

SAFETY MESSAGES

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

SAFETY SYMBOLS

DANGER

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

WARNING

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

CAUTION

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

NOTICE

Addresses practices not related to personal injury.

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

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

GENERAL SAFETY

CAUTION

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

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

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

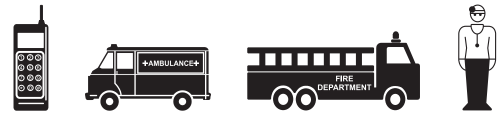
- **ALWAYS** check the generator for loosened threads or bolts before starting.
- **NEVER** use the generator for any purpose other than its intended purposes or applications.

NOTICE

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

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

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



GENERATOR SAFETY

DANGER

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

WARNING

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

CAUTION

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

NOTICE

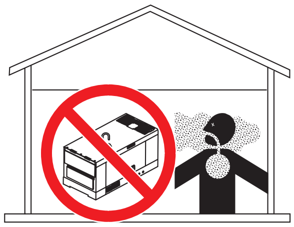
- **ALWAYS** ensure the generator is on level ground before use.
- **ALWAYS** keep the generator in proper running condition.
- Fix damage to the generator and replace any broken parts immediately.
- **ALWAYS** store the generator properly when it is not being used. The generator should be stored in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

ENGINE SAFETY

DANGER

- The engine fuel exhaust gases contain poisonous carbon monoxide. This gas is colorless and odorless, and can cause **death** if inhaled.

- The engine of this generator requires an adequate, free flow of cooling air. **NEVER** operate this equipment in any enclosed or narrow area where free flow of the air is restricted. If the air flow is restricted it will cause injury to people and property and serious damage to the equipment or engine.



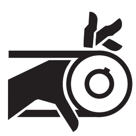
- When operating the generator outdoors, **DO NOT** place the generator near doors, windows or vents that could allow carbon monoxide to enter and build up in occupied spaces.

WARNING

- **NEVER** place hands or fingers inside the engine compartment when the engine is running.

- **NEVER** operate the engine with heat shields or guards removed.

- Keep fingers, hands, hair and clothing away from all moving parts to prevent injury.



- **NEVER** operate the generator with the doors open. Stop the engine before servicing.

- **DO NOT** remove the radiator cap while the engine is hot. High pressure boiling water will gush out of the radiator and severely scald any persons in the general area of the generator.

- **DO NOT** remove the coolant drain plug while the engine is hot. Hot coolant will gush out of the coolant tank and severely scald any persons in the general area of the generator.

- **DO NOT** drain the engine oil while the engine is hot. Hot oil will gush out and severely scald any persons near the generator.

- Operation of the generator may create sparks that can start fires around dry vegetation. A spark arrestor may be required. The operator should contact local fire agencies for laws or regulations relating to fire prevention requirements.

CAUTION

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

NOTICE

- **NEVER** run the engine without an air filter or with a dirty air filter. Severe engine damage may occur. Service the air filter frequently to prevent engine malfunction.

- **NEVER** tamper with the factory settings of the engine or engine governor. Damage to the engine or generator can result if operating in speed ranges above the maximum allowable.

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

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

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

FUEL SAFETY

DANGER

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

TOWING SAFETY

CAUTION

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

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

ELECTRICAL SAFETY

DANGER

- **NEVER** touch the output terminals during operation. Contact with the output terminals during operation can cause **electrocution, electrical shock, or burn**.

- The electrical voltage required to operate the generator can cause **severe injury or even death** through physical contact with live circuits. Turn the generator and all circuit breakers **OFF** before performing maintenance on the generator or making contact with the output terminals.

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

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

Power Cord/Cable Safety

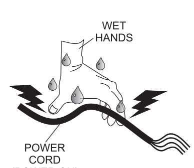
DANGER

- **NEVER** let power cords or cables **lay in water**.

- **NEVER stand in water** while AC power from the generator is being transferred to a load.

- **NEVER** use **damaged** or **worn** cables or cords when connecting equipment to the generator. Inspect the insulation for cuts.

- **NEVER** grab or touch a live power cord or cable with wet hands. The possibility exists of **electrical shock, electrocution or death**.



- Make sure power cables are securely connected to the generator's output receptacles. Incorrect connections may cause electrical shock and damage to the generator.

NOTICE

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

Grounding Safety

DANGER

- **ALWAYS** make sure that electrical circuits are properly grounded to a suitable earth ground (ground rod) per the National Electrical Code (NEC) and local codes before operating the generator. **Severe injury or death by electrocution** can result from operating an ungrounded generator.

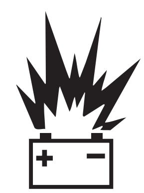
- **NEVER** use gas piping as an electrical ground.

BATTERY SAFETY

DANGER

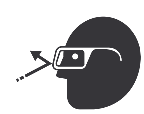
- **DO NOT** drop the battery. There is a possibility that the battery will explode.

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



WARNING

- **ALWAYS** wear safety glasses when handling the battery to avoid eye irritation. The battery contains acids that can cause injury to the eyes and skin.



- Use well-insulated gloves when picking up the battery.

- **ALWAYS** keep the battery charged. If the battery is not charged, combustible gas will build up.

- **ALWAYS** recharge the battery in a well-ventilated environment to avoid the risk of a dangerous concentration of combustible gases.

- If the battery liquid (dilute sulfuric acid) comes into contact with **clothing or skin**, rinse skin or clothing immediately with plenty of water.

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

⚠ CAUTION

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

ENVIRONMENTAL SAFETY/DECOMMISSIONING

NOTICE

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

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

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

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

EMISSIONS INFORMATION

NOTICE

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

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

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

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

Emission Control Label

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

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

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

ALTERNATOR

The generator (Figure 1) creates electricity by a series of fine wire windings inside a ***magnetic field***, called an ***armature***. As the rotor rotates inside the magnetic field by the diesel engine, ***current*** and ***voltage*** is generated in those windings of wire and electricity is transferred.

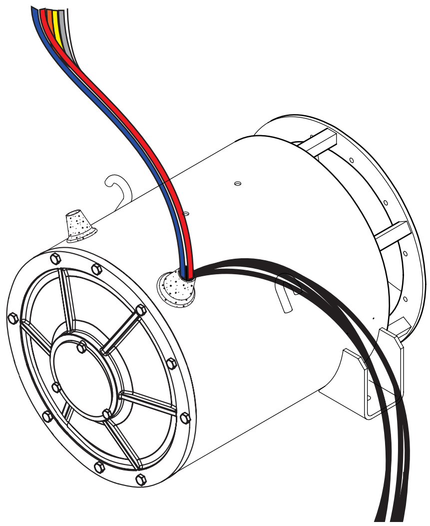


Figure 1. Typical Alternator

The current and voltage will be directly proportional to the speed that the rotor rotates and to the strength of the magnetic field. Each complete revolution, one complete cycle of alternating current (AC) is developed. This is called a ***rotating rotor***.

Most current generator designs, including Multiquip's, utilize a ***rotating field type alternator***. The magnetic field rotates inside the main stator.

The frequency of the generated voltage is dependent on the number of field poles that make up the rotor and the speed at which the generator is operated. Frequency, measured in ***hertz*** (Hz), is the number of complete cycles per second in alternating current.

As current flows through the armature, there is some amount of resistance and inductive reactance. The combination of these make up what is known as the ***internal resistance***.

When a ***direct current*** (DC) voltage is applied to the stationary exciter field windings, current flows through the windings and sets up a steady magnetic field. This is called ***field excitation***.

An exciter is part of the generator package supplying direct current to the alternator field windings to magnetize the rotating poles. The exciter output may be controlled by a voltage regulator. A regulator is an important option to consider if there is frequency or voltage sensitive equipment such as computers.

ALTERNATOR COMPONENTS

The alternator is broken down into two major components, ***Stator Assembly*** and ***Rotor Assembly***.

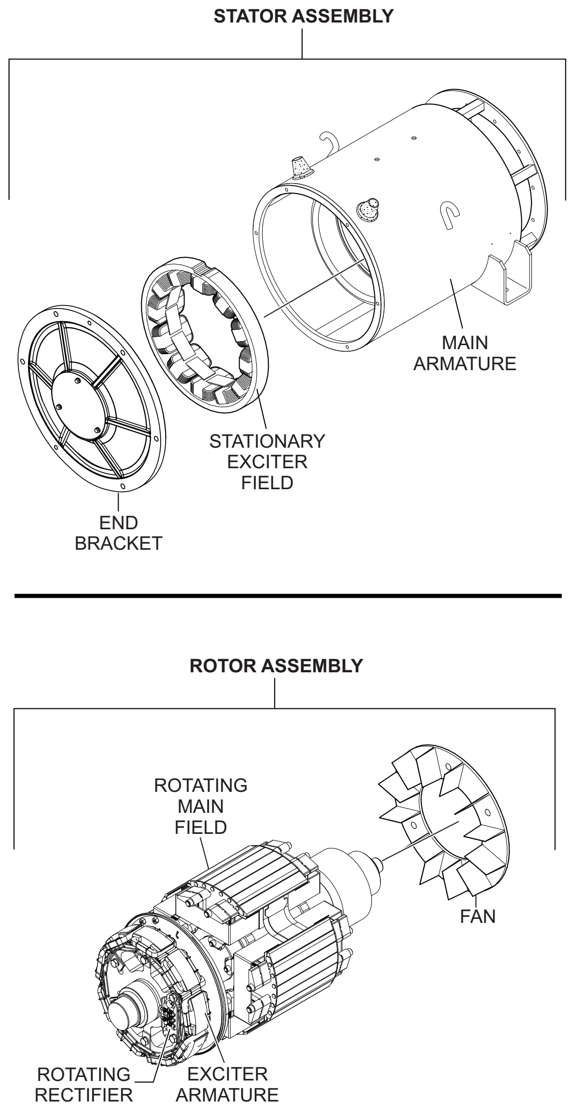


Figure 2. Stator and Rotor Assemblies

Stationary Exciter Field

The ***stationary exciter field*** (Ex Fg) Figure 3 receives DC current from the ***automatic voltage regulator*** (AVR) to create an electromagnetic field that produces the magnetic flux required to induce an AC voltage into the rotating exciter armature. The strength of the magnetic field is controlled by the amount of DC current received from the AVR.

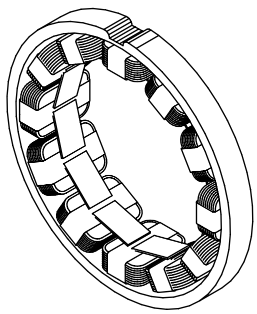


Figure 3. Stationary Exciter Field

Exciter Armature

The ***exciter armature*** (Ex Ar) Figure 4 is a three-phase armature and it rotates inside the exciter field and cuts through the magnetic lines of flux created by the exciter field, which through magnetic induction induces an AC voltage into the exciter armature windings.

The magnitude of the induced voltage is controlled by the strength of the exciter's magnetic field and how fast the exciter armature cuts through the lines of flux (engine speed).

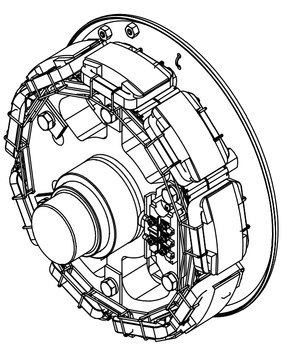


Figure 4. Exciter Armature

Rectifiers (Re)

Rectifiers (Figure 5) are mounted on the end of the rotor plate. The rectifiers vary between models, for example the DCA45–70 utilize three single-phase ***half wave*** rectifiers. DCA125–150 utilize two ***full wave*** three-phase rectifiers connected in parallel.

The rectifiers receive three-phase AC voltage from the exciter armature and convert the AC to DC voltage which is sent to the main field to create a rotating electromagnetic field.

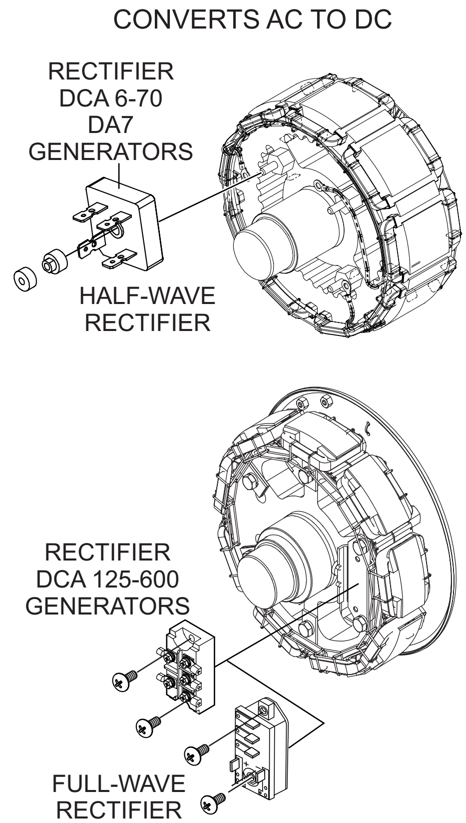


Figure 5. Rectifiers

Rotating Main Field

The ***rotating main field*** (Fg) Figure 6, is a 4-pole rotating field, it rotates inside of the armature windings located inside of the armature housing. The main field receives DC voltage from the rectifiers to create a magnetic field.

The stationary armature windings cut through the rotating magnetic lines of flux which induces an AC voltage into the armature and open-delta windings.

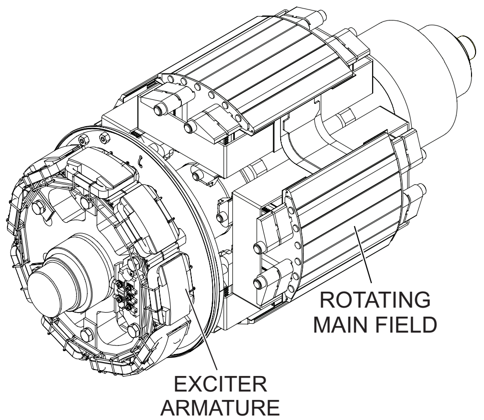


Figure 6. Rotating Main Field

Surge Absorber

The ***surge absorber*** (Figure 7) is a metal oxide varistor connected in parallel with the main field and its purpose is to dissipate transient voltage spikes caused from sudden load changes to prevent damage to field windings, rectifiers and exciter armature windings.

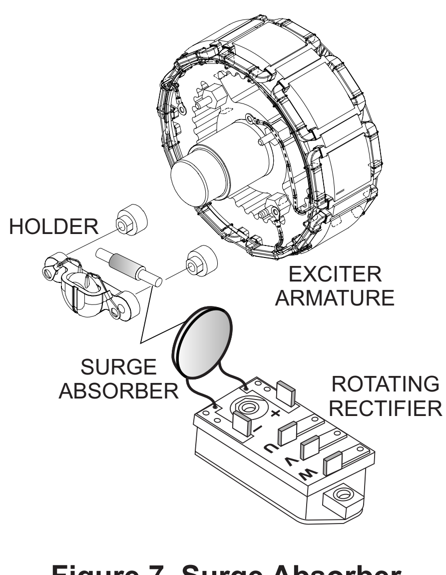


Figure 7. Surge Absorber

Armature

The ***armature*** (Ar) houses the ***main armature windings*** (Figure 8) and ***auxiliary open delta windings***. Utilizing magnetic induction, the stationary armature windings cut through magnetic lines of flux created by the rotating main field and induce alternating current (AC) into the armature and open-delta windings.

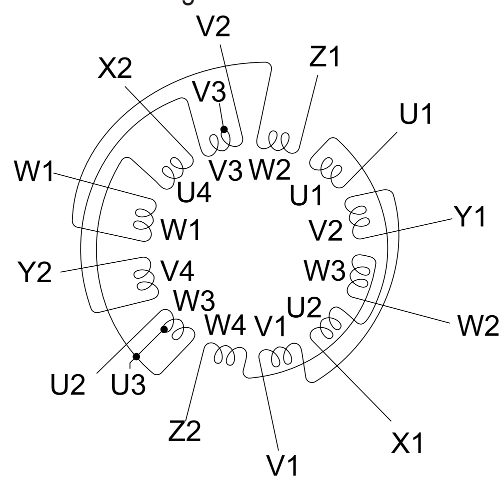


Figure 8. Main Armature Windings

The armature for DCA25–150 generators is a ***12-lead*** armature, DCA180–600 generators use a 10-lead armature which means there are ***six*** individual windings which allow the unit to be connected in different voltage configurations.

DCA25–150 generators have a voltage selector switch which allows the generator to be connected in three different configurations, three-phase 240/139V Wye (Figure 9**A**), 480/277V Wye (Figure 9**B**), and single-phase 240/120V Zig-Zag (Figure 9**C**).

DCA180–600 generators utilize ***bus bars*** to connect the armature windings in two different voltage configurations which are three-phase 480/277V ***high*** wye or 240/139V ***low*** wye.

Figure 9 represents 3Ø high/low Wye wiring applications and 1Ø applications. Reference Figure 35 for armature windings and voltage selector switch (VSS) terminal callouts.

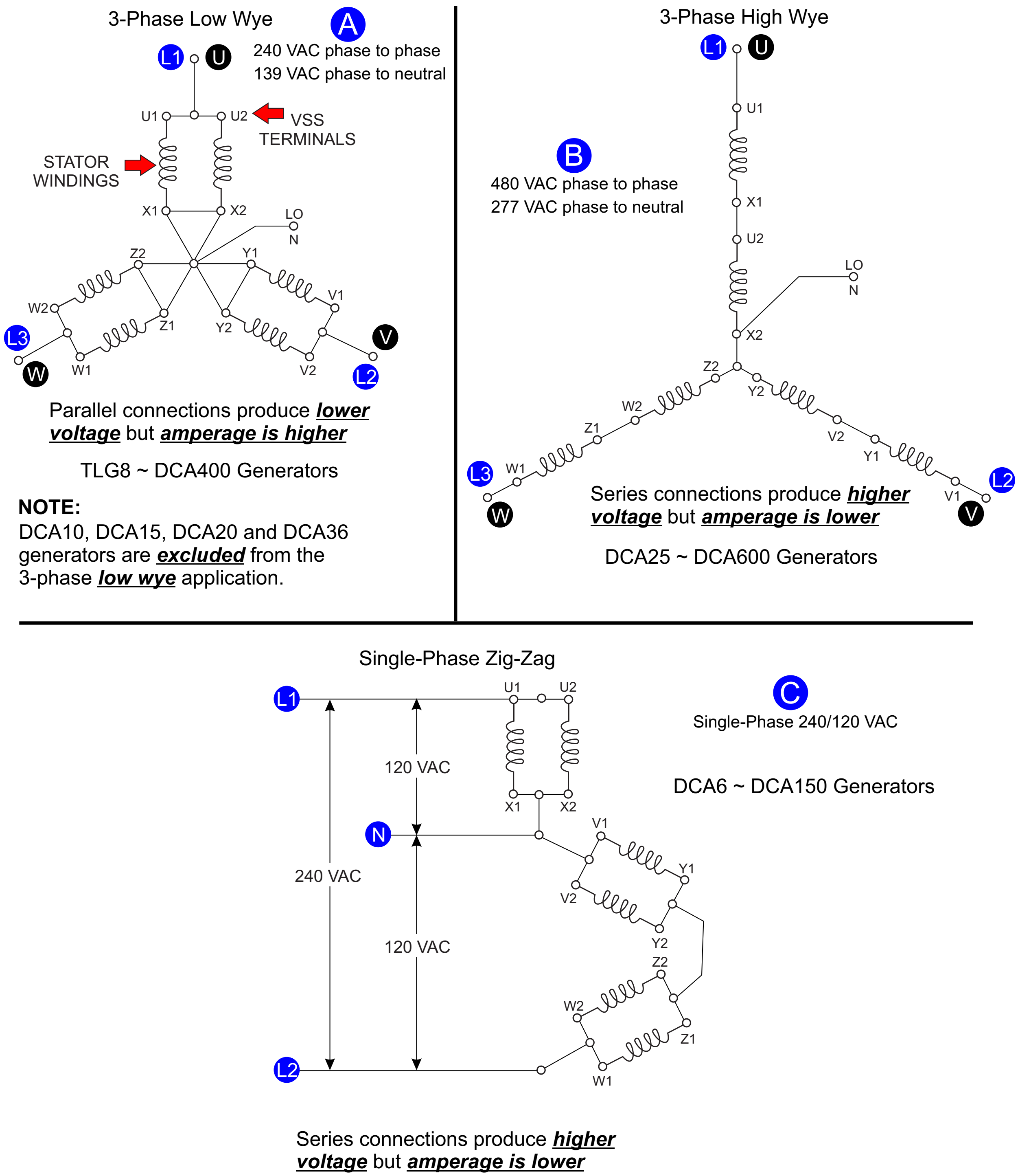


Figure 9. 3Ø Wye and 1Ø Zig Zag Diagrams

Automatic Voltage Regulator

NOTICE

Important! There is no procedure for directly testing the AVR. Best method of testing the AVR is to use a process of elimination.

The ***automatic voltage regulator*** (AVR) Figure 10 monitors voltage/frequency of the alternator then reacts to frequency dips or lags in the load by aiding frequency recovery through limiting or even reducing excitation as a function of frequency.

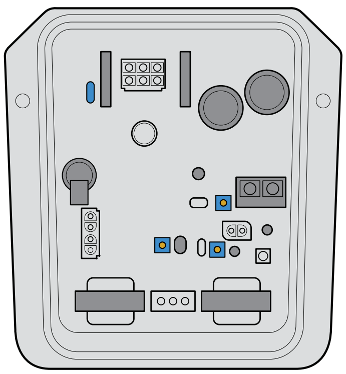


Figure 10. Automatic Voltage Regulator (AVR)

When the frequency dips below a predetermined threshold as a result of a heavy instantaneous load change on the engine, the regulator reduces generator voltage and in turn the kW load by the square of the voltage which allows the frequency to recover more rapidly, and at the same time regulates voltage recovery to minimize voltage overshoot.

The AVR also aids the generator to sustain fault current for a longer time period allowing downstream protective devices to operate.

The heavy-duty construction designed AVR utilizes three-phase voltage sensing for generator output monitoring. The sensing leads are center tapped at the ***voltage change-over board*** (Figure 11**A**) for 180kVA generators and above and at the ***voltage selector switch*** for 150kVA generators and below so there is no operator interaction with the AVR required when switching from 240 to 480 VAC.

The AVR receives its power from the three-phase, open-delta configured auxiliary windings (Figure 11**B**) and regulates the output to the field excitation winding (Figure 11**C**) to maintain constant and stable voltage to the load.

The auxiliary windings are coupled to one another in a three-phase series connection or open-delta with two open ends.

The four terminal points (Figure 11**D**) of the windings connected to the AVR allow for automatic switching between the output points of the open-delta winding to provide current support to the field windings as load demand on the generator changes.

This multiple-output open-delta configuration allows the AVR to utilize the first field harmonic to generate power for normal operation and responds to transient loads and motor-starting inrush current by utilizing the zero-phase component having the third harmonic obtained through the open ends of the series-connected windings.

The employment of the zero-phase component for field control makes it possible for the AVR to have excellent response to motor-starting inrush current and short-circuit faults.

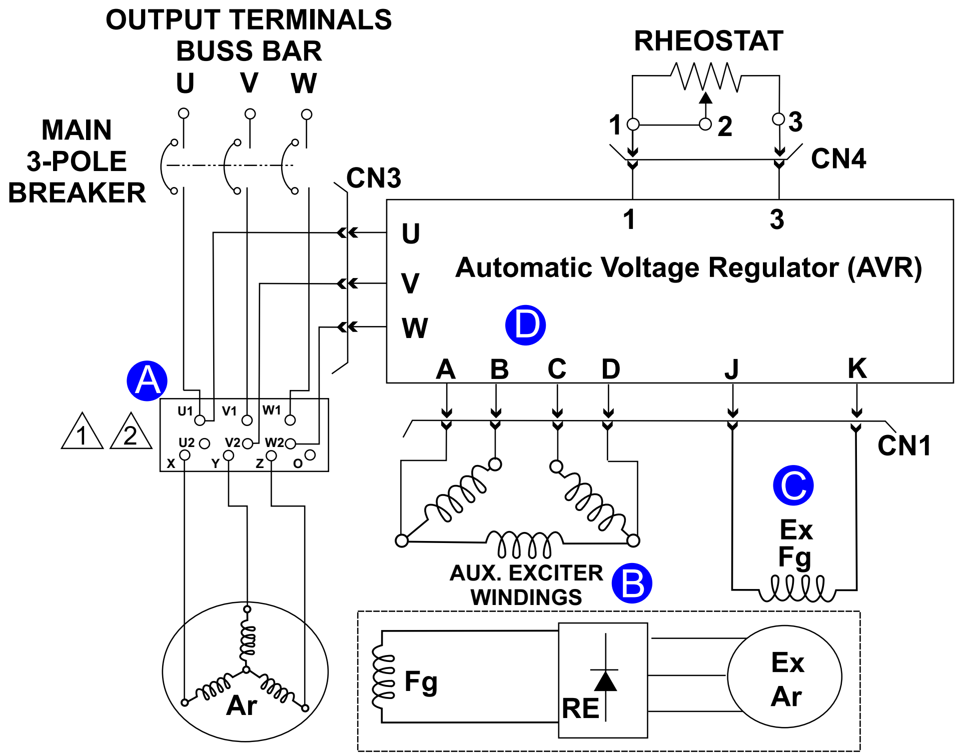
MQ Power Generator Advantage

MQ Power manufactured generators (alternators) have excellent heat rise ratings and utilize multiple output auxiliary windings wound in the stator core that are independent of the load winding to provide clean input power to the AVR.

The MQ Power ***"Separately Derived Excitation"*** system provides a high degree of immunity from the effects of non-linear loads. The patented AVR creates a robust system of transient load control for quicker recovery. This type of system allows MQ Power manufactured generators to endure the harsh rental and construction industry environment.

The advantage of the use of the three-phase multiple output open-delta auxiliary windings compared to the use of a ***permanent magnetic generator*** (PMG) system, simply, it's a more efficient and durable system and has an extremely low incidence rate whereas the PMG is an add-on system available at an additional cost.

The add-on PMG system increases the weight and length of the alternator and is less efficient. In addition, the MQ Power alternators have internal winding taps to provide true 120 VAC at the convenience receptacles without the use of an additional transformer when the generator is operating at either 240 or 480 VAC.



NOTE:

△1 DCA150 GENERATOR MODELS AND BELOW USE A VOLTAGE SELECTOR SWITCH.

△2 DCA180 GENERATOR MODELS AND ABOVE USE A VOLTAGE CHANGE-OVER BOARD.

Figure 11. AVR Wiring Diagram

WHAT IS HEAT RISE?

The insulation classification of the alternator's insulation system is based on its thermal endurance when operating at a specific rating.

The alternator windings and rotor components along with the structural parts and the insulating material all make up the generator's insulation system. The insulation classification is a specific rating of the system's ability to ***dissipate heat*** generated as current is passed through the copper wires (windings) and the ability of the insulating material to withstand the overall temperatures reached without damage.

The insulating material temperature tolerance has been categorized into ***four classes*** and each class of insulation has been assigned a maximum allowable total temperature by various standard writing associations.

The standard adhered to by most manufacturers in the United States is the ***National Electrical Manufacturers Association (NEMA)***. NEMA standard MG-1, Part 32, Table 32-3 lists four insulation classifications and they are A, B, F and H for continuous duty and standby rated alternators.

Reference Table 1 below for the four insulation classification system temperatures.

Table 1. NEMA Insulation Class/Heat Rise

Temperature Tolerance Class	Maximum Operation Temperature Allowed		Allowable Temperature Rise at Full Load 1.0 Service Factor Motor[1]		Allowable Temperature Rise 1.0 Service Factor Motor[1]	
	ºC	ºF	ºC	ºF	ºC	ºF
A	105	221	60	140	70	158
B	130	266	80	176	90	194
F	155	311	105	221	115	239
H	180	356	125	257	-	-

[1]Allowable temperature rises are based upon a reference ambient temperature of 40°C (104°F).
Operation temperature is reference temperature ***plus*** allowable temperature rise ***plus*** allowance for hot spot winding.

[2] Celsius to Fahrenheit conversion formula: Temp °F = Temp °C (9/5) +32

The temperature rise is the increase in winding temperature above ambient due to the flow of current in the windings and any internal losses that may occur in the machine during operation.

Alternators are designed to a specific maximum value of temperature rise under operating conditions that do not exceed the nameplate rated temperature value.

Total temperature of an alternator in operation is the sum of two temperatures, ***ambient*** plus the temperature ***rise***. Ambient temperature is the temperature of the air entering the alternator.

Continuous duty is defined at constant full load during 24/7 operation, whereas standby ratings are higher than prime and continuous because they are designed to be used as backup emergency power and their operation is generally no more than 4–12 hours.

Generally, standby ratings are 25°C above those for continuous operation. Operation at these standby temperature values cause the alternator insulation to age thermally at about four to eight times the rate that occurs at the continuous duty temperature rise values. Operating 1 hour at standby temperature rise value is approximately equivalent to operating 4 to 8 hours at continuous-duty values.

Note, temperature rise values are based on the rated voltage of the alternator. Example, if the rated voltage is 240 VAC and the unit is operated at 208V the alternator would have to be slightly derated because of the max current flow at 208 VAC.

Please note, when operating a unit at the standby temperature rise values an overload could exceed the thermal damage value of the alternator in a shorter time span.

Altitude has a direct impact on temperature rise. The temperature rise value is based on operating at an altitude up to 3,300 feet (1,000 meters). Operating a unit above the base altitude requires a temperature reduction of 1°C for every 330 feet (100 meters) above the base value.

Environmental concerns must also be taken into consideration such as humidity, condensation due to long term storage, or fungus growth which normally occur in tropical areas.

Material used in class F and H alternators are non-nutrient for most known fungi. Another consideration is corrosive atmospheres such as salt which will attach the outer coating of winding insulation and may cause premature failure. Abrasive dust can also impact the insulation.

In dusty and sandy areas, the particles can be drawn through the alternator by the cooling fan. The high-velocity particles can basically cause a sand-blast effect to the windings and wear away the outer layers of the insulation.

Epoxy type of coating on the insulation is more susceptible. Care must be given when operating in these areas by putting filters on the air intake vents.

LOAD BANKING

The purpose of load banking is to simulate the actual load that a generator (power source) will encounter during an application. Load banking is a technique used to determine maximum standby power and system performance. A load bank provides a load to the generator for simulation and testing.

The load bank is basically a ***maintenance tool***. This method of providing a load to the generator is extremely beneficial because a real load is often unpredictable and random in value. The load applied from a load bank provides a ***controllable load*** with controls that allow an operator to incrementally step and vary the simulated load.

Load banking is a critical requirement to ensure the generator will perform as expected when placed into service.

To confirm generator reliability, load bank testing should ***always*** be performed after the following service or maintenance procedures:

- Scheduled maintenance
- After any major repair or component replacements have occurred.
- Yearly to confirm the unit is in full operational condition.

WET STACKING

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, 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.

Wet stacking can reduce the system performance. MQ Power provides a load management system (PowerBalance®) as an option that works with the applied customer load to help protect the engine generator from problems resulting from sustained low-load operations.

The PowerBalance® system continuously monitors engine load. The load management controller senses and increases engine load automatically using ***resistive coils*** (Figure 12) when the controller determines that the load is ***too low***.

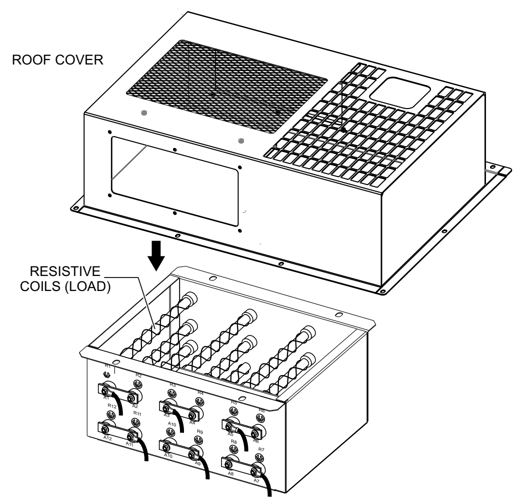


Figure 12. PowerBalance® (Resistive Load)

The following is a compiled list of duties performed by service technicians. Most of the tasks should be done during normal scheduled maintenance.

ENGINE CHECK/INSPECT

- Air cleaner for restrictions and contaminants. Replace if necessary.
- Cooling system hoses for cracks and distortions — tighten clamps or repair as needed.
- Radiator for restrictions and corrosion.
- Engine block heater for leaks and verify unit functioning properly. Engine block heater is an option on some units.
- Coolant, fuel and oil leaks. Tighten connections or repair as needed.
- Belts and pulleys for cracks and wear — adjust or repair as needed.
- Governor and injection pump for leaks and proper operation.
- Turbocharger for proper clearance and free movement as required. Reference engine service manual.
- Fuel tank for contaminants and condensation.
- Fuel hoses, piping and connections for chafing and restrictions.
- Line trap, drain as required.
- Hangers, anchors and supports for exhaust system.
- Exhaust system for cracks and leaks.
- Battery charging system including alternator and external charger (option).
- Battery terminals, clean and apply anti-corrosion protectant as needed.

NOTICE

For complete engine inspection and service specifications, consult the engine manufacturer's "Owners" and/or "Service" Manuals.

GENERATOR CHECK/INSPECT

- Cable ends, wire connectors and terminals, tighten and repair as needed.
- Generator end for signs of heat discoloration.
- Panel controls and breakers for signs of heat discoloration and that they are securely mounted.
- All gauges for proper operation during test run.
- Frequency and voltage, adjust as necessary.

When servicing generators, having an accurate AC/DC ***multimeter*** is a must (Figure 13).

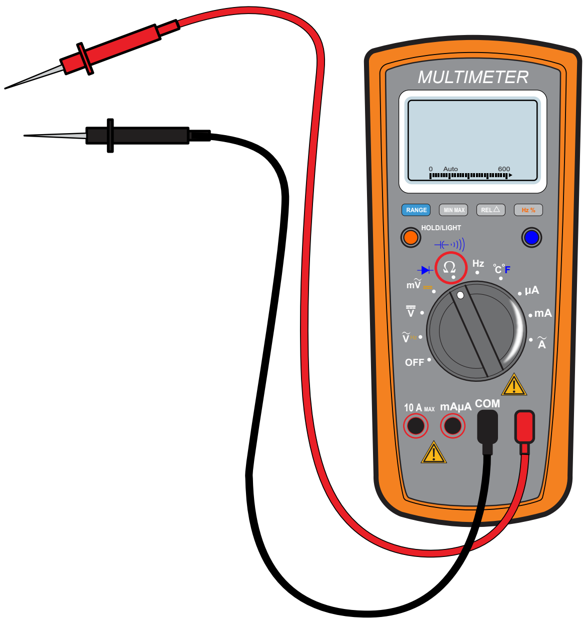


Figure 13. AC/DC Multimeter

ELECTRICAL INSPECTION

The first step in generator troubleshooting is to conduct a visual inspection before doing any electrical tests. Looking over the generator carefully should expose any environmental factors that might contribute to the problem. As you remove the generator control box cover and begin your inspection, look for the following:

Electrical Connections — Rusted, corroded and oxidized connections will prevent the circuit from being completed. This applies not only to the major cables externally, but also to the electronic control devices internally.

Carbon Flash — If the AC receptacles on the generator have ever been shorted, carbon flash deposits around the 120/240V AC receptacles may appear. This will indicate whether the device that was plugged into the generator shorted out the receptacle. The device may have shorted the generator to ground and caused a carbon flash when the plug prongs touched the receptacle.

Wire Overheating — Signs of wire overheating (discoloration and a burnt smell) should be noticeable inside the generator. Look to see if the windings turned black. The winding insulative coating may vary in color from shades of reddish brown to light brown to dark brown, so try to compare the color to that of a new unit.

Infestation — Insects and rodents may have created a nest inside the generator. These nests and associated debris can cause electrical shorts. Generators left out in remote areas provide a home for spiders, wasps, other insects, and mice. Always inspect the generator daily.

Hardware — Loose hardware will shorten the life cycle of the generator and decrease the overall performance of the generator.

Terminal Lugs/Bus Bars — Always make sure all nuts, bolts, screws, and fasteners are securely tightened. **DO NOT** overtighten. Reference Torque Specifications (Table 9). Look for any elongation on the bolt hole opening on the bus bar.

Electrical Connectors — Sometimes electrical connectors do not always make a good connection. Always make sure the electrical connectors are seated correctly. Some electrical connectors may have more than a dozen male-female connections.

These are often inside some plastic or rubber cover that prevents you from seeing any possible corrosion. In electrical troubleshooting, always unplug and plug all connectors three times to produce a freshly scraped metallic surface for good electrical contact.

Using an ***ohmmeter***, check for ***zero*** ohms on all connections. Spray the contacts with an electrical insulative spray before reassembling them.

Crimp Connections — Even though they are widely used, they can become loose as the machine vibrates and lose consistent quality contact. Because dissimilar metals are in contact, a galvanic cell is set up that may result in corrosion when moisture is present.

Solder Joints — Solder joints that have cracked or broken loose. This condition occurs much less frequently than crimped connections and basically results from poor-quality workmanship.

Wire Identification — Verify all unmarked wiring and correct, particularly if the unit comes from another shop with unresolved issues or you receive it partially disassembled.

Circuit Safety Devices — Check for physical damage to housing, buttons and levers on all fuses, circuit breakers, and ground fault interrupters.

WIRE INSULATION

All generator windings, motors, and extension cords have electric wire that is covered with some form of insulation. Electrical wire is normally ***copper*** and is a good conductor of electrical current that powers various electric devices. The insulation material (fiber) must be the opposite of the conductor material; it should resist the current and keep it in its path along the conductor.

The purpose of the insulation around a conductor is similar to that of a pipe carrying water. Pressure on water from a pump causes water to flow along the pipe. If the pipe were to spring a leak you'd waste water and lose some water pressure. With electricity, voltage is like the pump pressure causing current to move along the copper wire. As with the flow of water in a pipe, there is resistance to the flow of current but it is much less along the conductor than through its insulation.

Wire insulation is hardened over time due to heat exposure and overheating. Long-term heating should be more uniform. A short, excessive heat cycle may have less hardening and burning on the outer perimeter and excessive heat signs toward the center or heat source.

Worn wire insulation allows wires to short. Wire insulation deteriorates from physical contact when wires rub together due to vibrations. Eventually, the internal wires can short to each other or to ground.

It should be noted that no insulation is perfect, meaning no insulation has infinite resistance, so some electricity does flow along the insulation or even through it to ground. The current passing through the insulation may only be a millionth of an ampere (one microampere) but it is the basis of insulation testing. A higher voltage tends to cause more current leakage through the insulation. This current leakage can become a problem if the insulation has deteriorated.

All of this leads us to determine "what is good insulation." Under normal conditions, "good" means a relatively high resistance to current. Or it can also be stated that a good insulation has the ability to keep a high resistance. A suitable way of measuring resistance can tell us how good the insulation is. Also if regular insulation measurements are made you can track trends toward its deterioration.

Megohmmeters (Figure 14) provide a quick and easy way to determine the condition of the insulation on wires, generators, and motor windings. A megohmmeter is an electric meter that measures very high resistance values by ***sending a high-voltage signal*** into the object being tested.

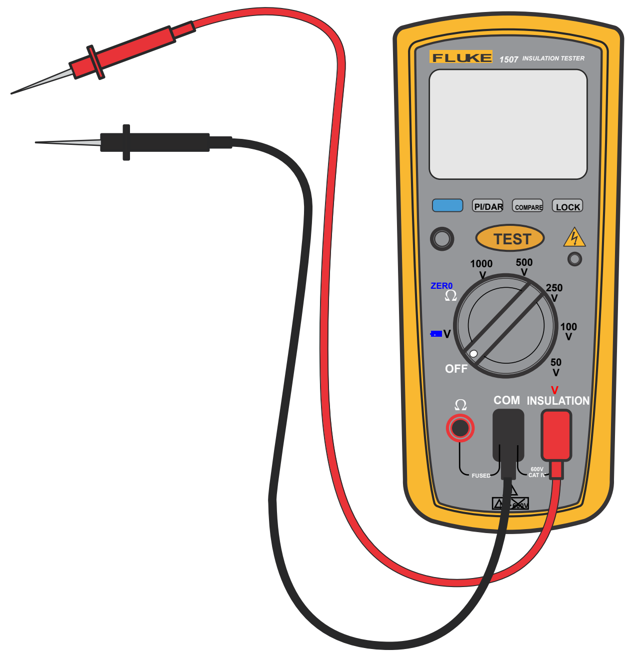


Figure 14. Megohmmeter

When generators, welders and electric motors are new, the insulation should be at its highest level of resistance. During equipment use, insulation is subject to many effects which can cause it to fail.

These causes can be mechanical damage, vibrations, excessive heat or cold, dirt, oil, corrosive vapors, and even moisture from humidity. During the life of a conductor's insulation all of these causes are at work in combination with electrical stresses. If a pinhole or a crack develops in the insulation (Figure 15), moisture and foreign matter can penetrate the surfaces of the insulation.

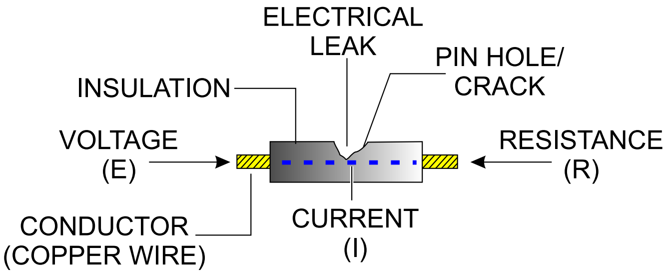


Figure 15. Insulation Leak

This provides for a low-resistance path for leakage current. Once the insulation has begun to deteriorate all elements of causes tend to combine until excessive current leakage is allowed through the insulation.

At times the drop in insulation resistance can be sudden, such as occurs if the equipment is flooded. Normally insulation resistance drops gradually and gives plenty of warning if checked as preventative maintenance.

RHEOSTAT (VR)

The rheostat (Figure 16) is a variable resistor (VR) connected directly to the AVR and is used for fine tuning output voltage.

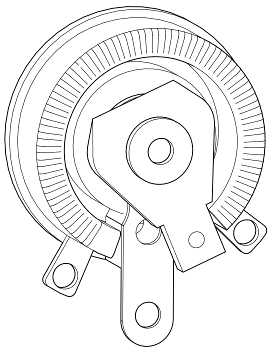


Figure 16. Rheostat (VR)

VOLTAGE SELECTOR SWITCH

> **NOTICE**
>
> The ***voltage selector switch*** is only used on DCA 150 model generators and below. DCA 180 model generators and above use a ***voltage change-over board***. Reference Figure 18.

The voltage selector switch (Figure 17) is used to configure the generator coils for the selected voltage output by reconfiguring the internal contacts of the switch each time a voltage selection is made.

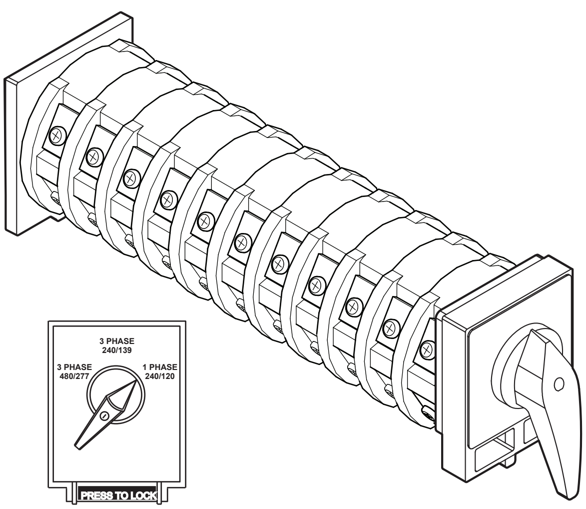


Figure 17. Voltage Selector Switch

VOLTAGE CHANGE-OVER BOARD

> **NOTICE**
>
> The ***voltage change-over board*** (Figure 18) is only used on DCA 180 model generators and above. DCA 150 model generators and below use a ***voltage selector switch***. Reference Figure 17.

The ***voltage change-over board*** (Figure 18) is used to configure the generator coils for the selected voltage output by arranging jumper plates onto the change-over board to obtain various voltage output configurations.

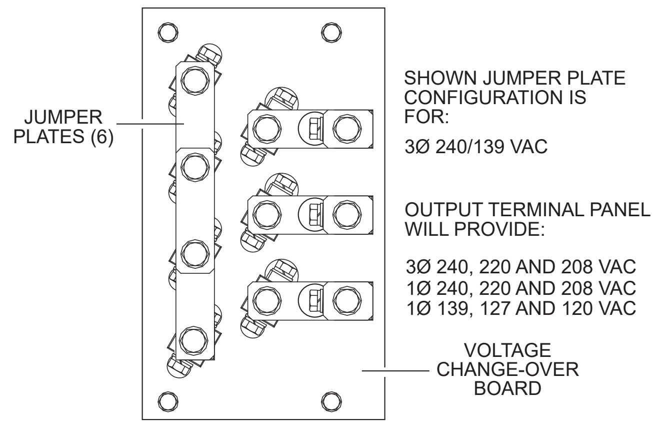


Figure 18. Voltage Change-Over Board

OVERCURRENT RELAY (THERMAL OVERLOAD)

The ***overcurrent relay*** (OCR) is connected to the main circuit breaker and monitors current to the output terminals via the current transformers. In the event of an overload or short circuit it will electronically trip the main circuit breaker.

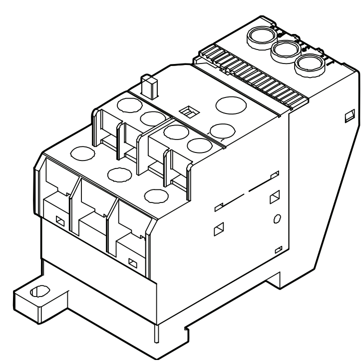


Figure 19. Overcurrent Relay

MAIN CIRCUIT BREAKER (CB1)

The ***main circuit breaker*** (Figure 20) commonly referenced as CB1, protects the generator output terminals U V W from overload.

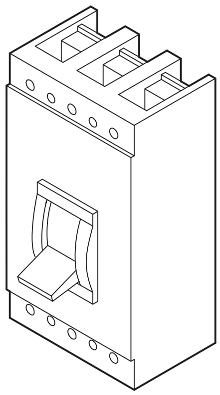


Figure 20. Main Circuit Breaker (CB1)

CURRENT TRANSFORMER (CT)

Figure 21 shows some of the different types of ***current transformers*** installed in the generators.These current transformers (CT1, 2, 3) sense the output current supplied by the generator and are connected to the ammeter and the OCR.

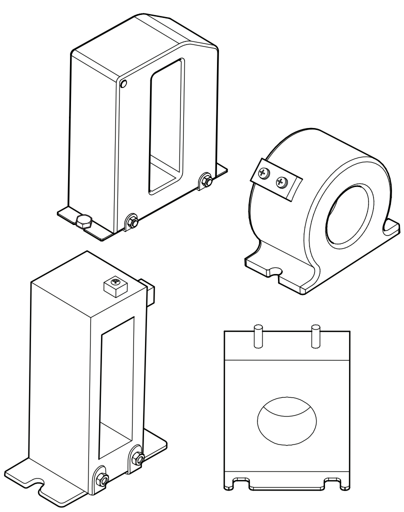


Figure 21. Current Transformers

RELAY UNIT (RY1)

The ***relay unit*** (Figure 22) disconnects the V-leg at the AVR and AC voltmeter when the voltage selector switch has been placed in the 120/240 single-phase position.

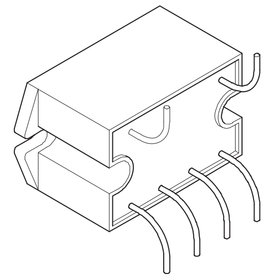


Figure 22. Relay Unit

TWIST-LOCK RECEPTACLE (CS6369)

For DCA 150 model generators and below, the voltage selector switch (Figure 17) must be placed in the single-phase, 120/240V position, and the main circuit breaker closed in order to use the 120/240V, 50-amp ***twist-lock receptacle*** (Figure 23).

> ***NOTICE***
>
> For DCA 180 model generators and above, the ***voltage change-over board*** (Figure 18) must be configured for the single-phase, 120/240V application in order to use the 120/240V, 50-amp ***twist-lock receptacle*** (Figure 23).

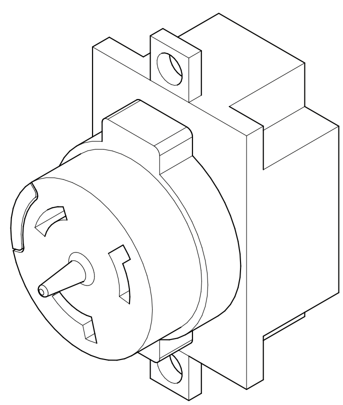
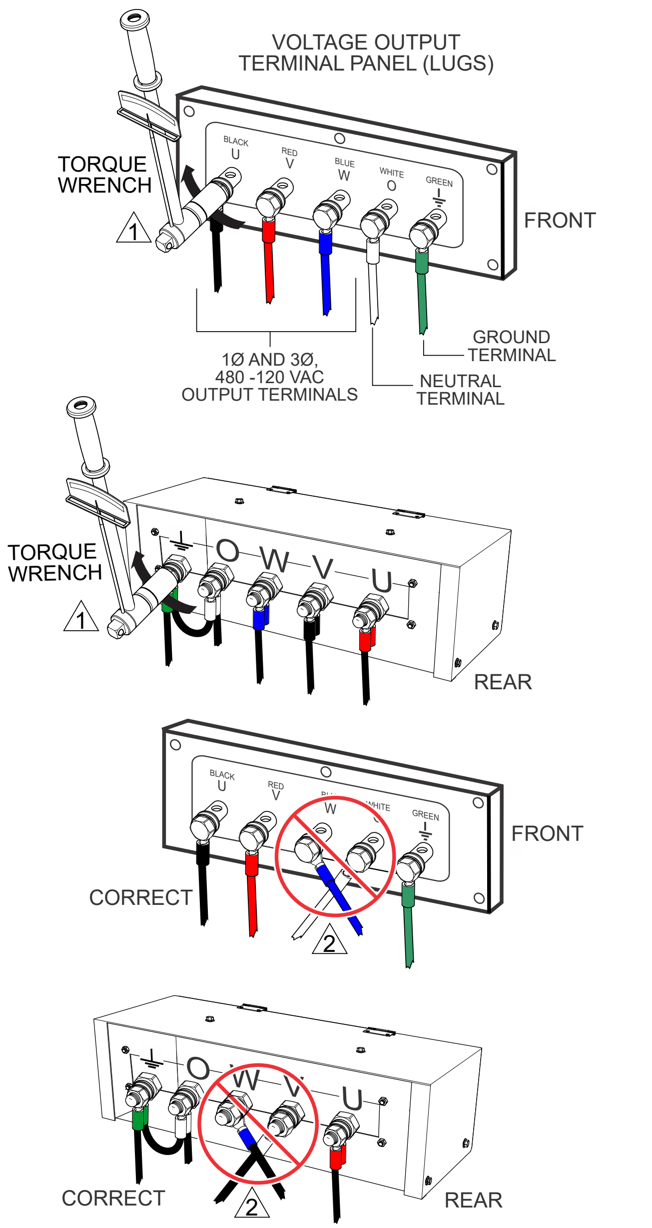


Figure 23. Twist-Lock Receptacle

VOLTAGE OUTPUTS

External loads are connected to the generator via the UVWO voltage outputs. Various output voltages can be accessed either by ***terminal lugs***, ***bus bars***, or ***camloks***. Voltages are dependent on the position of either the voltage selector switch or voltage change-over board depending on type of generator.



NOTE:

1. TORQUE NUTS/BOLTS AS REFERENCED IN TABLE 9.
2. TERMINAL RING WITH WIRE SHOULD BE FULLY VERTICAL ON FRONT AND REAR ON OUTPUT TERMINAL PANEL.

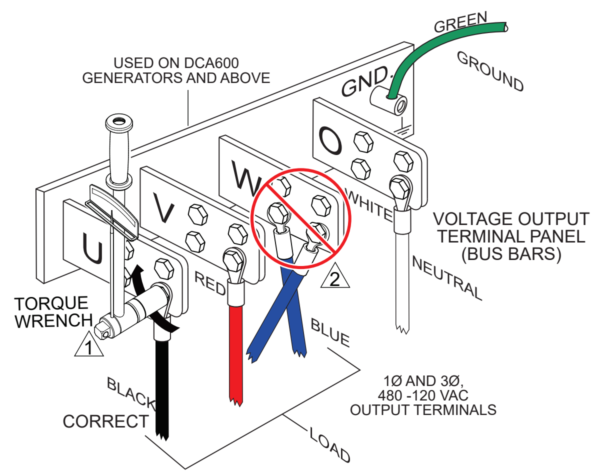
Figure 24. Output Terminal Panel Voltage Outputs

NOTICE

DCA 400 model generators and ***<u>below</u>*** use ***terminal lugs*** for the UVWO voltage output as referenced in Figure 24.

DCA 600 model generators and ***<u>above</u>*** utilize ***bus bars*** (for the UVWO voltage output as referenced in Figure 25.

Camloks are available as an option on most MQ Power generators.



NOTE:

1. TORQUE NUTS/BOLTS AS REFERENCED IN TABLE 9.
2. TERMINAL RING WITH WIRE SHOULD BE FULLY VERTICAL ON BUS BAR.

Figure 25. Bus Bar Voltage Outputs

When attaching terminal rings with wires to the output terminal panel, always make sure the wires are in a fully vertical position. **NEVER** attached the wires at an ***angle***. The possibility exists that the wires could touch each other, thus causing a short. This condition could cause severe damage to the equipment and bodily harm.

DO NOT overtighten the nuts and bolts that secure the wire terminals to the output terminal panel. Reference Table 9 for the correct torque specification.

CAMLOKS

Some generators are equipped with a camlok panel ***(option)***. Use the camlok panel to connect external loads to the generator.

Shown in Figure 26 are just some of the camlok panels used on MQ Power generators.

> **NOTICE**
>
> Contact the Multiquip Sales Department to order the camlok panel required for your generator.

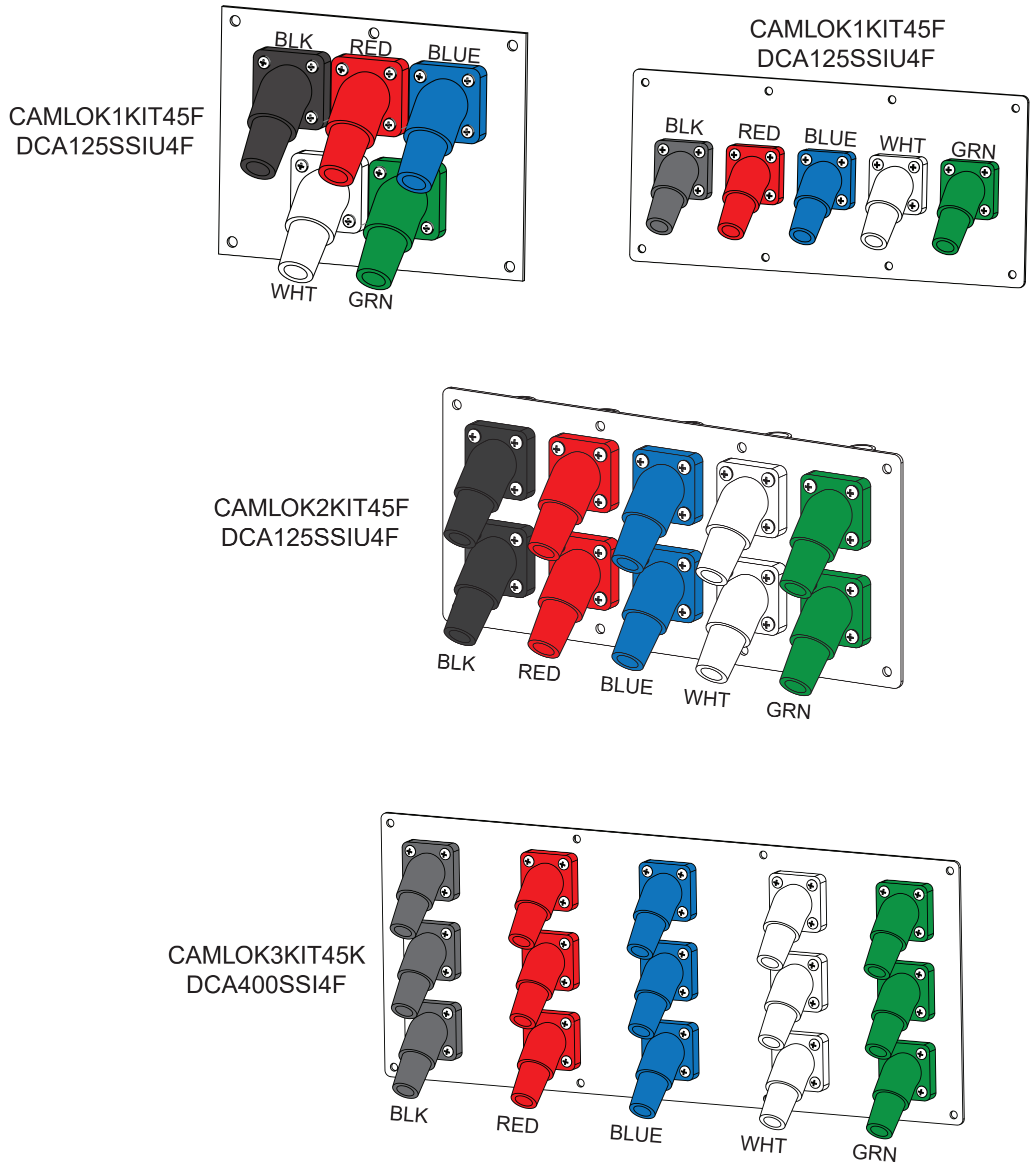


Figure 26. Camlok Panel Voltage Output

CONTROL PANELS

There are many different types of ***control panels*** used on the DCA series generators. Figure 27 shows just a few. For a complete understanding of each control panel, please reference the associated operation manual.

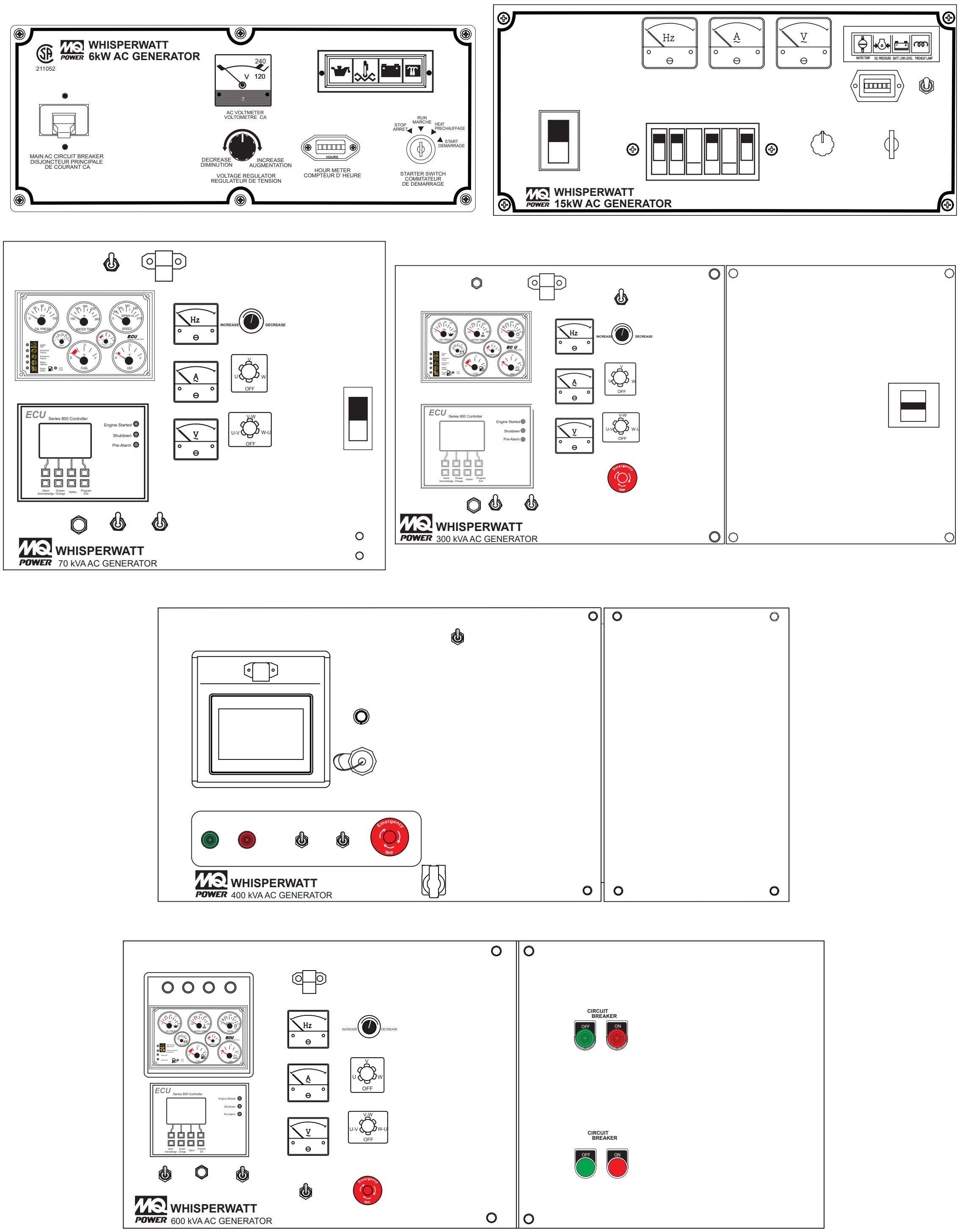
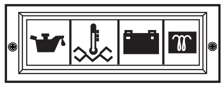


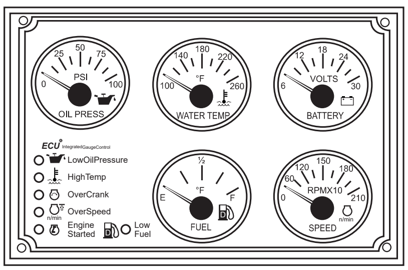
Figure 27. Control Panels

CONTROLLERS, GAUGE UNITS AND DISPLAYS

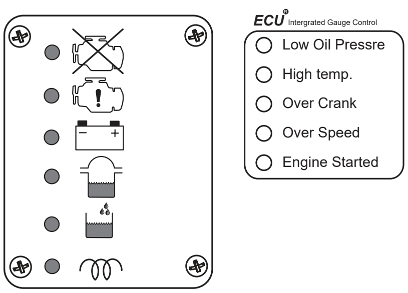
There are many different types of ***controllers***, ***gauge units***, ***and displays*** used on the DCA series generators. Figure 28 and Figure 29 show just a few. For a complete understanding of each assembly, please reference the associated operation manual.



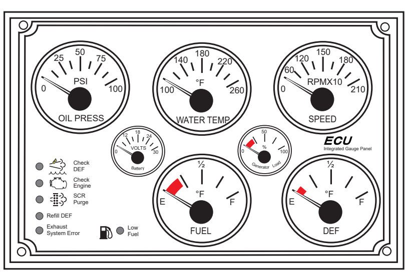
WARNING LAMP UNIT
DCA6SPX4F
DA7000SSA3
DCA10SPX4
DCA15SPX4F
TLG8SSK4F2



ECU-755 AUTO START/STOP CONTROLLER
WITH GAUGE UNIT ASSEMBLY
DCA20SPXU4F
DCA25SSIU4F
DCA25SSIU4FC8
DCA36SPXU4F
DCA45SSIU4F
DCA45SSIU4FC8



CAN-78 AUTO START/STOP CONTROLLER
WITH WARNING LAMP UNIT
DCA40SSKU4F2



ECU-845 ENGINE-GENERATOR CONTROLLER
WITH ECU-670 GAUGE UNIT ASSEMBLY
DCA70SSIU4F
DCA70SSJU4F
DCA125SSIU4F
DCA150SSJU4F3
DCA180SSJU4F3
DCA220SSJU4F3
DCA300SSJU4F3

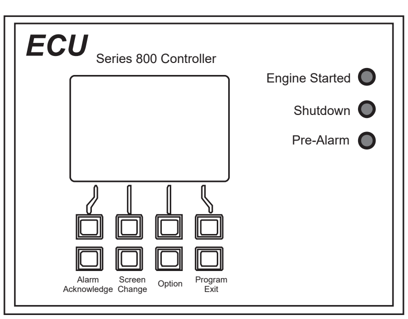
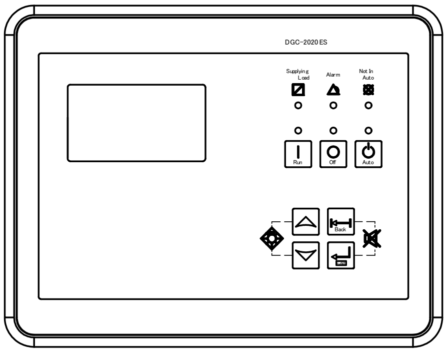
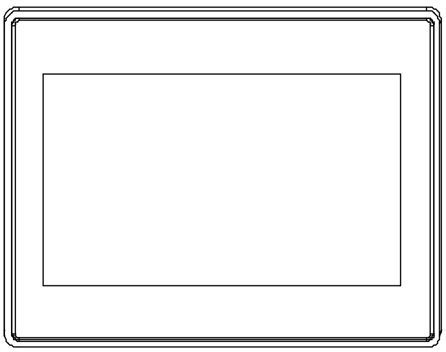


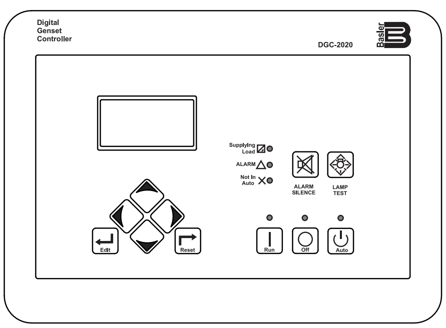
Figure 28. Controllers, Gauge Units, and Displays



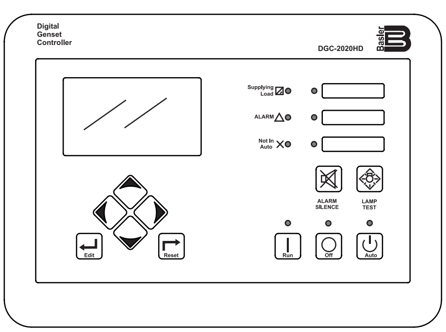
BASLER DGC-2020 ES DIGITAL GENSET CONTROLLER
NGA100SSPUL



DEIF AGC-4 Mk II AUTOMATIC GENSET CONTROLLER
DCA180SSJU4F3PD
DCA220SSJU4F3PD
DCA300SSJU4F3PD
DCA400SSIU4F3PD
DCA600SSV4F3PD



BASLER DGC-2020 DIGITAL GENSET CONTROLLER
DCA70SSIU4FC8B
DCA150SSJU4F3B
DCA180SSJU4F3B
DCA220SSJU4F3B
DCA300SSJU4F3B
DCA400SSI4F3B
DCA600SSV4F3B



BASLER DGC-2020HD DIGITAL GENSET CONTROLLER
DCA150SSJU4F3PB
DCA180SSJU4F3PB
DCA220SSJU4F3PB
DCA300SSJU4F3PB
DCA400SSI4F3PB
DCA600SSV4F3PB

Figure 29. Controllers, Gauge Units, and Displays (Continued)

NOTICE

The current flow diagram (Figure 30) is representative of a DCA45SSIU4F type generator.

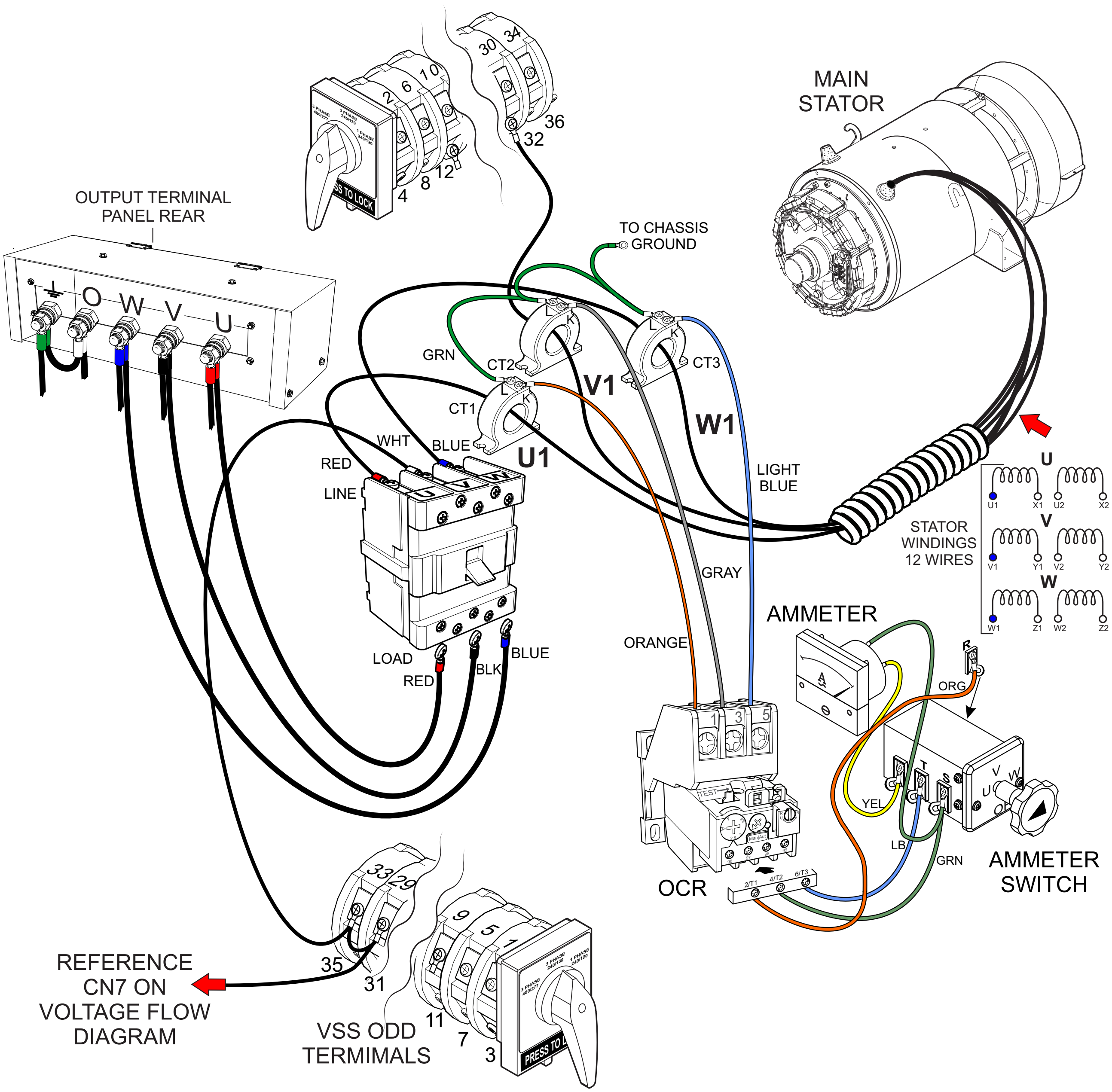


Figure 30. Current Flow Diagram

NOTICE

The voltage flow diagram (Figure 31) is representative of a DCA45SSIU4F type generator.

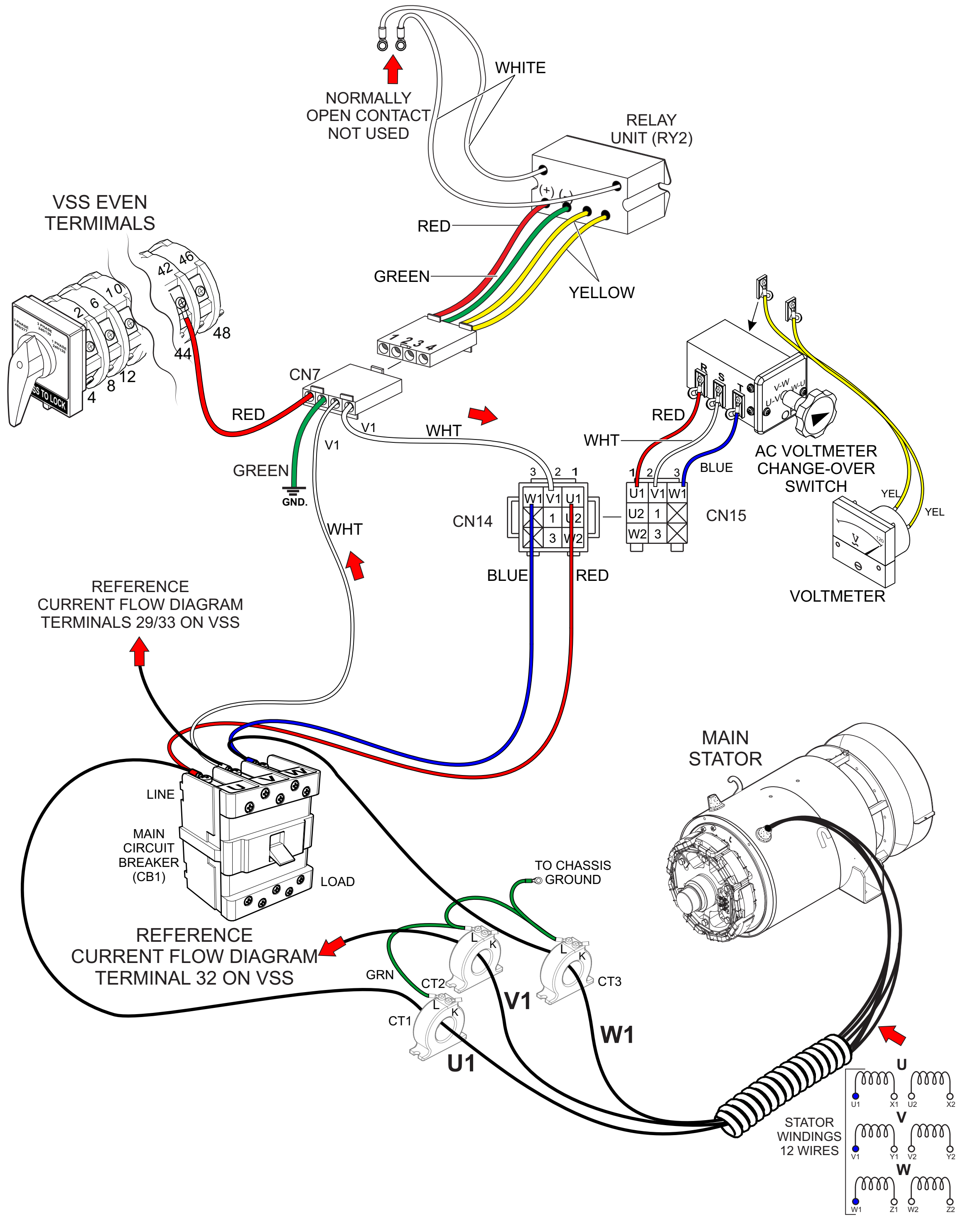


Figure 31. Voltage Flow Diagram

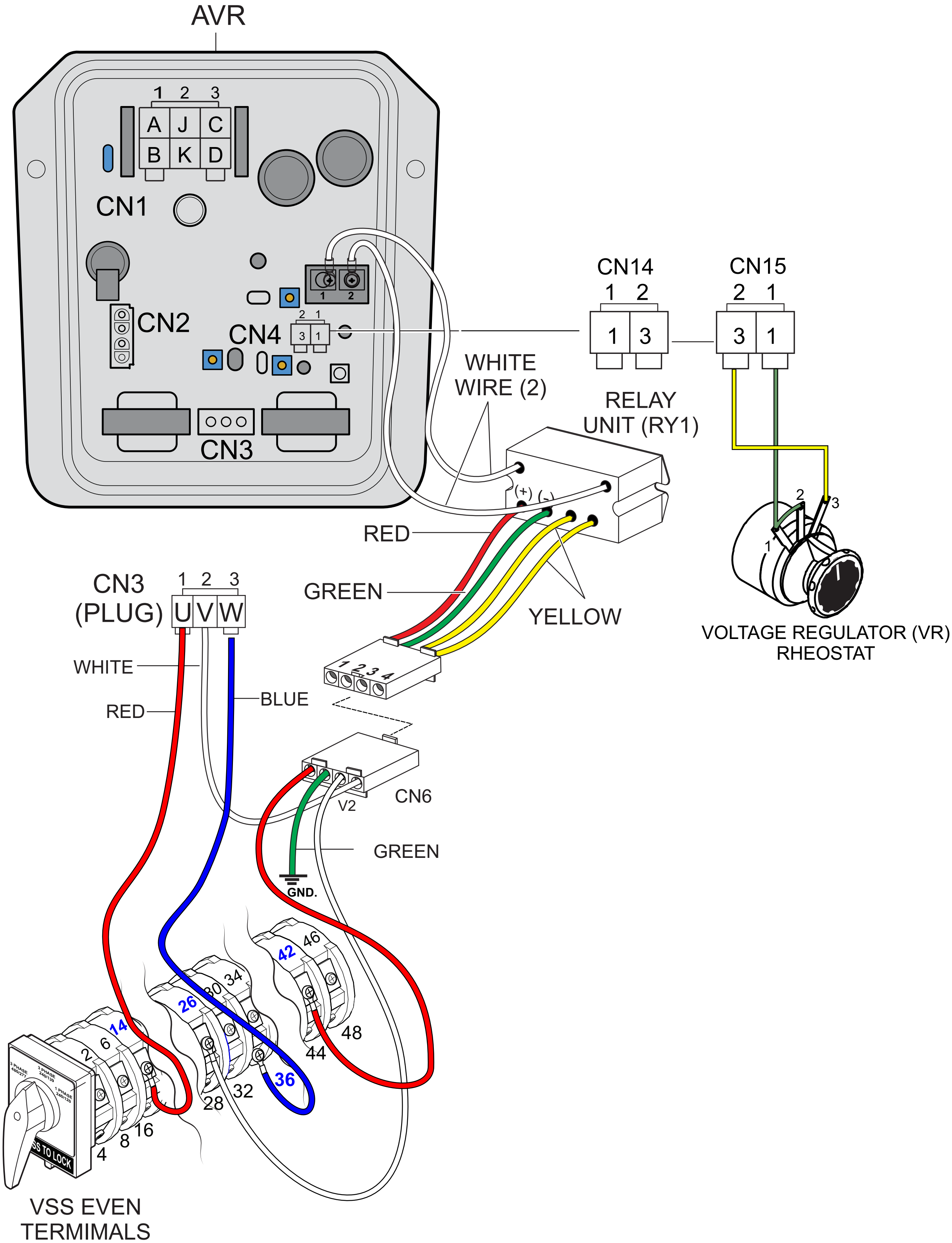


Figure 32. Voltage Regulator (VR) Diagram

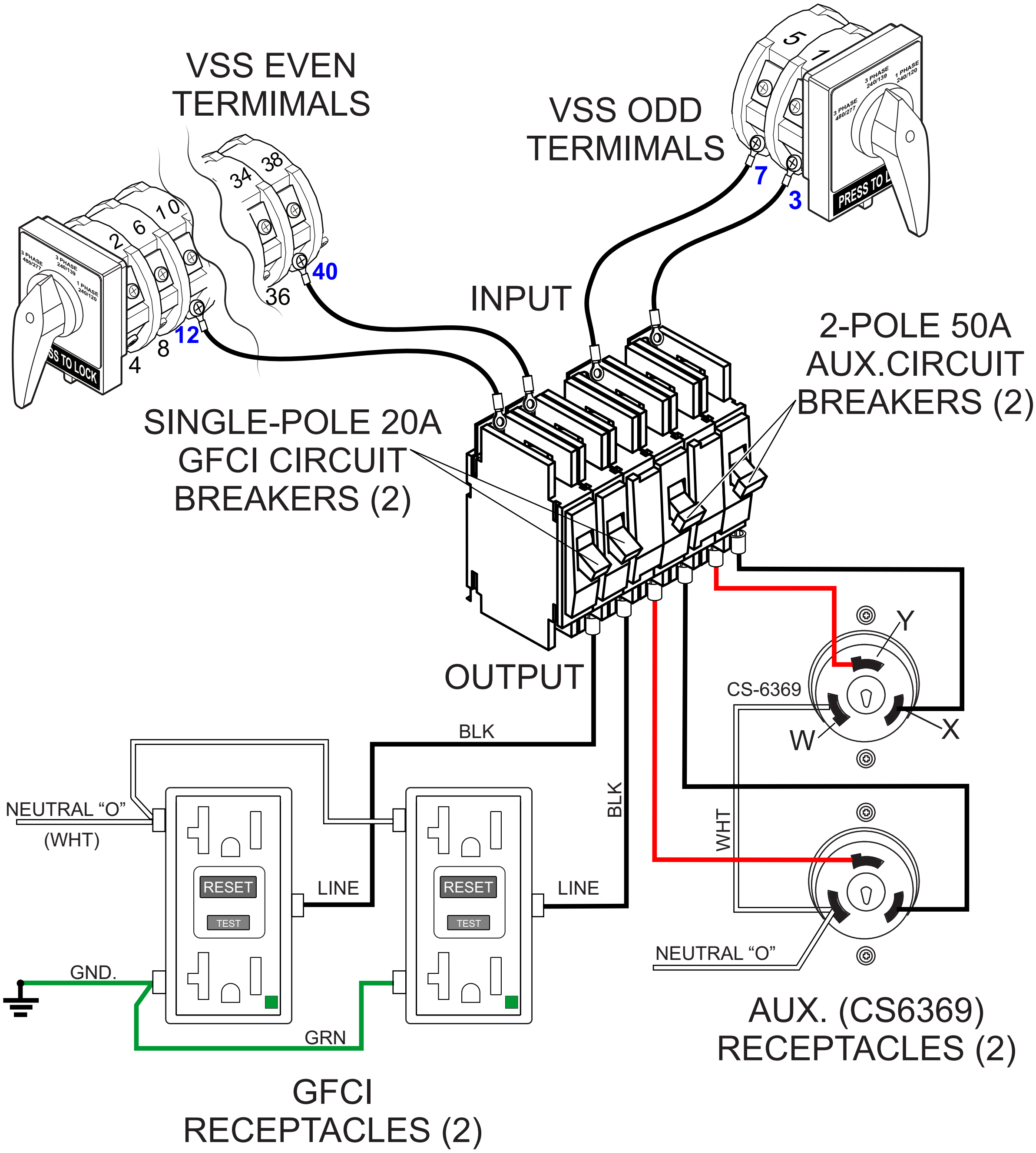


Figure 33. Auxiliary Receptacles Diagram

OPEN-DELTA LEAD WIRES

The main armature has ***four open-delta lead wires***. All wires are ***black***. These wires are designated as **A**, **B**, **C**, and **D** (Figure 34**A**). The purpose of these wires is to supply the supplementary voltage needed to maintain a steady-state excitation output during the different levels of load. These four wires are connected to the AVR via the 6-pin plug to the CN1 receptacle.

EXCITATION LEAD WIRES

The stationary exciter field (Figure 34**B**) has ***two black excitation lead wires*** which are designated as **J** and **K**. These two excitation lead wires are connected to the AVR via the 6-pin plug to the CN1 receptacle (Figure 34**A**).

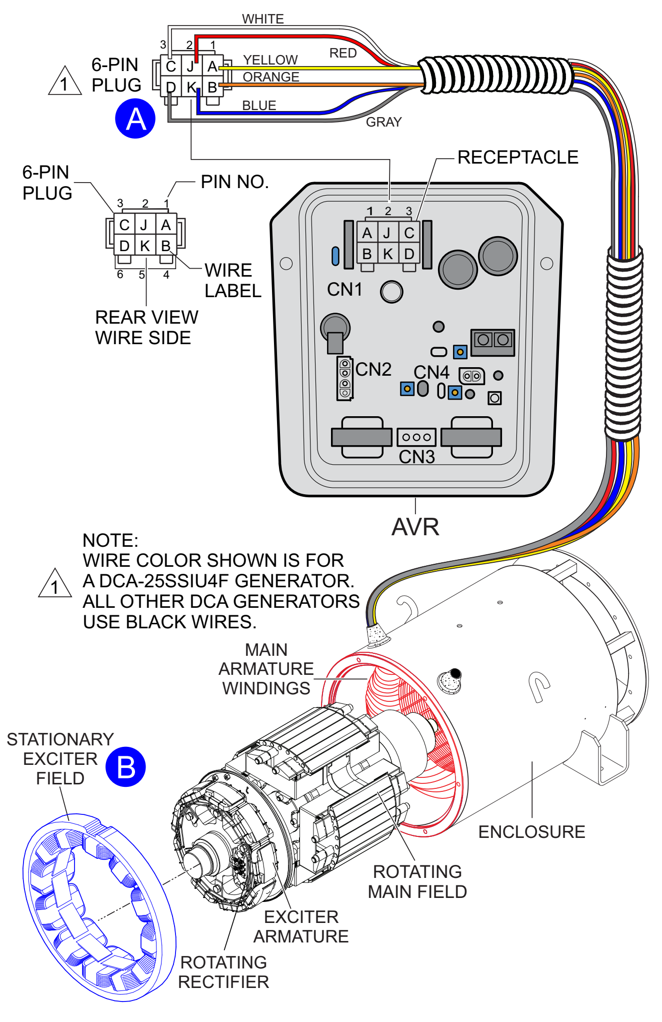


Figure 34. Open Delta/Excitation Lead Wires

MAIN ARMATURE RESISTANCE TEST

> ***NOTICE***
>
> Before performing the main armature windings resistance test, the ***load lead wires*** (Figure 35) ***must be disconnected*** from either the voltage selector switch or the voltage change-over board. If the reading indicates an *open circuit* the component may have to be replaced or repaired.

The main armature has ***12 load lead wires*** (Figure 35**A**) for DCA150 model generators and below. DCA180 model generators and above have ***10 load lead wires*** (Figure 35**B**). All wires are black.

The 12 load lead wires for DCA150 model generators and below are designated as U1, X1, U2, X2, V1, Y1, V2, Y2, W1, Z1, W2 and Z2. These wires are AC outputs and are connected to the ***voltage selector switch*** and main circuit breaker via the current transformers.

The 10 load lead wires for DCA180 model generators and above are designated as U1, X, V1, Y, W1, Z, U2, V2, W2 and 0. These wires are AC outputs and are connected to the ***voltage change-over board*** and main circuit breaker via the current transformers.

Using a multimeter (Figure 35), check the resistance across ***each pair of wires*** as referenced in Table 6, column **A**. Be sure to place the selection dial on the multimeter in the Ω position.

MAIN ARMATURE WINDINGS RESISTANCE TEST

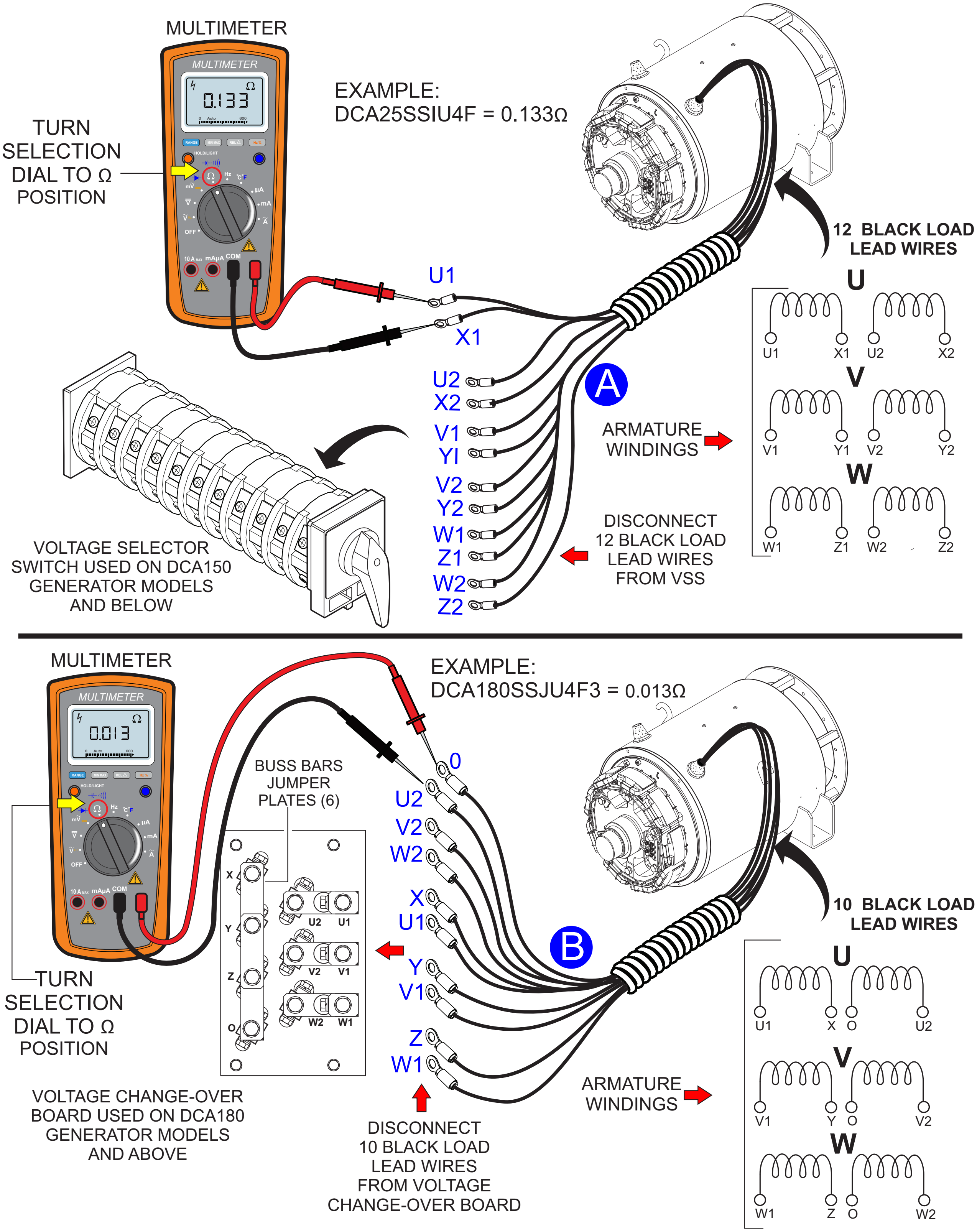


Figure 35. Main Armature Resistance Check

MAIN FIELD RESISTANCE TEST

NOTICE

Before performing the resistance test, the ***two black lead wires*** (Figure 36) ***must be disconnected*** from the rotating rectifier.

The main field (Figure 36) consists of ***two black lead wires*** with no wire designation. These two wire leads are connected to the **DC positive** and **DC negative** terminals on the rotating rectifier in conjunction with the ***surge protector***.

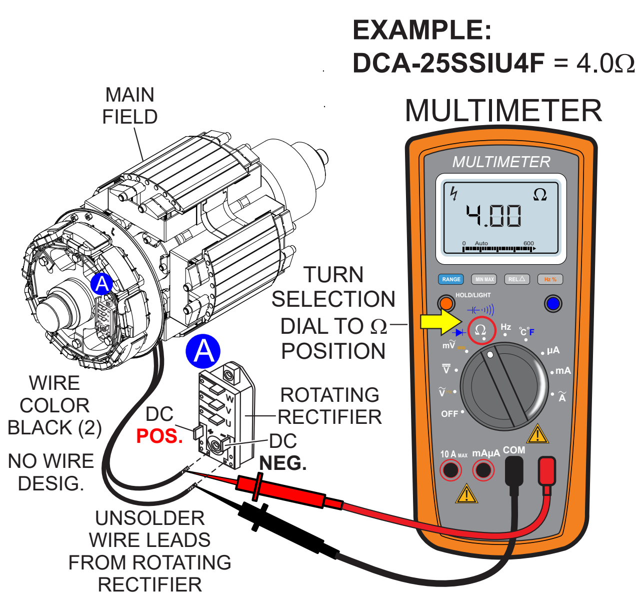


Figure 36. Main Field Resistance Test

Using a multimeter (Figure 36), check the resistance across each black wire as referenced in Table 6, column **B**. Be sure to place the selection dial on the multimeter to the Ω position. If the reading indicates an ***open circuit*** the component may have to be replaced or repaired.

EXCITER ARMATURE RESISTANCE TEST

NOTICE

Before performing the resistance test, the ***three yellow lead wires*** (Figure 37) ***must be disconnected*** from the rotating rectifier. If the reading indicates an ***open circuit*** the component may have to be replaced or repaired.

The exciter armature (Figure 37) consists of three yellow lead wires with no wire designation. These three wire leads are connected to the U, V and W terminals on the ***rotating rectifier***.

Using a multimeter (Figure 37), check the resistance across each pair of wires as referenced in Table 6, column **C**. Be sure to place the selection dial on the multimeter to the Ω position.

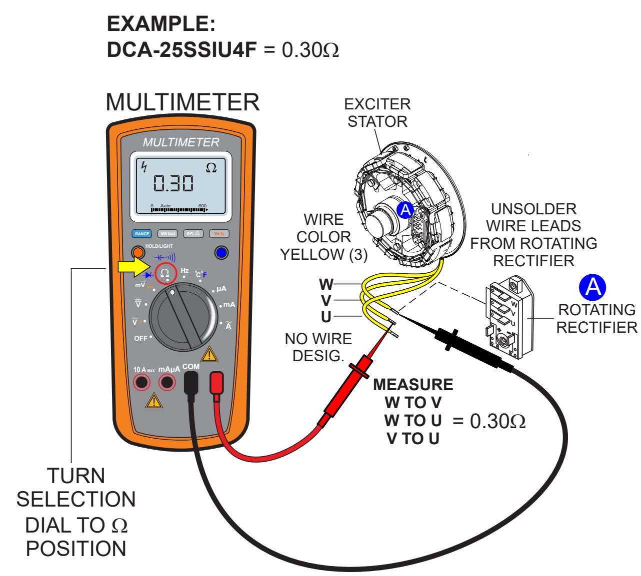


Figure 37. Exciter Armature Resistance Check

EXCITER FIELD RESISTANCE TEST

NOTICE

Before performing the exciter field resistance test, the ***6-pin plug*** (Figure 38) ***must be disconnected*** from the CN1 receptacle on the AVR. If the reading indicates an ***open circuit*** the component may have to be replaced or repaired.

Using a multimeter (Figure 38), check the resistance across the **J** and **K** wire leads on the ***6-pin plug*** as referenced in Table 6, column **D**. The reading shoud be within 2–5 ohms of nominal. Be sure to place the selection dial on the multimeter in the Ω position. Also be sure to ***unplug*** the 6-pin plug from the CN1 receptacle on the AVR.

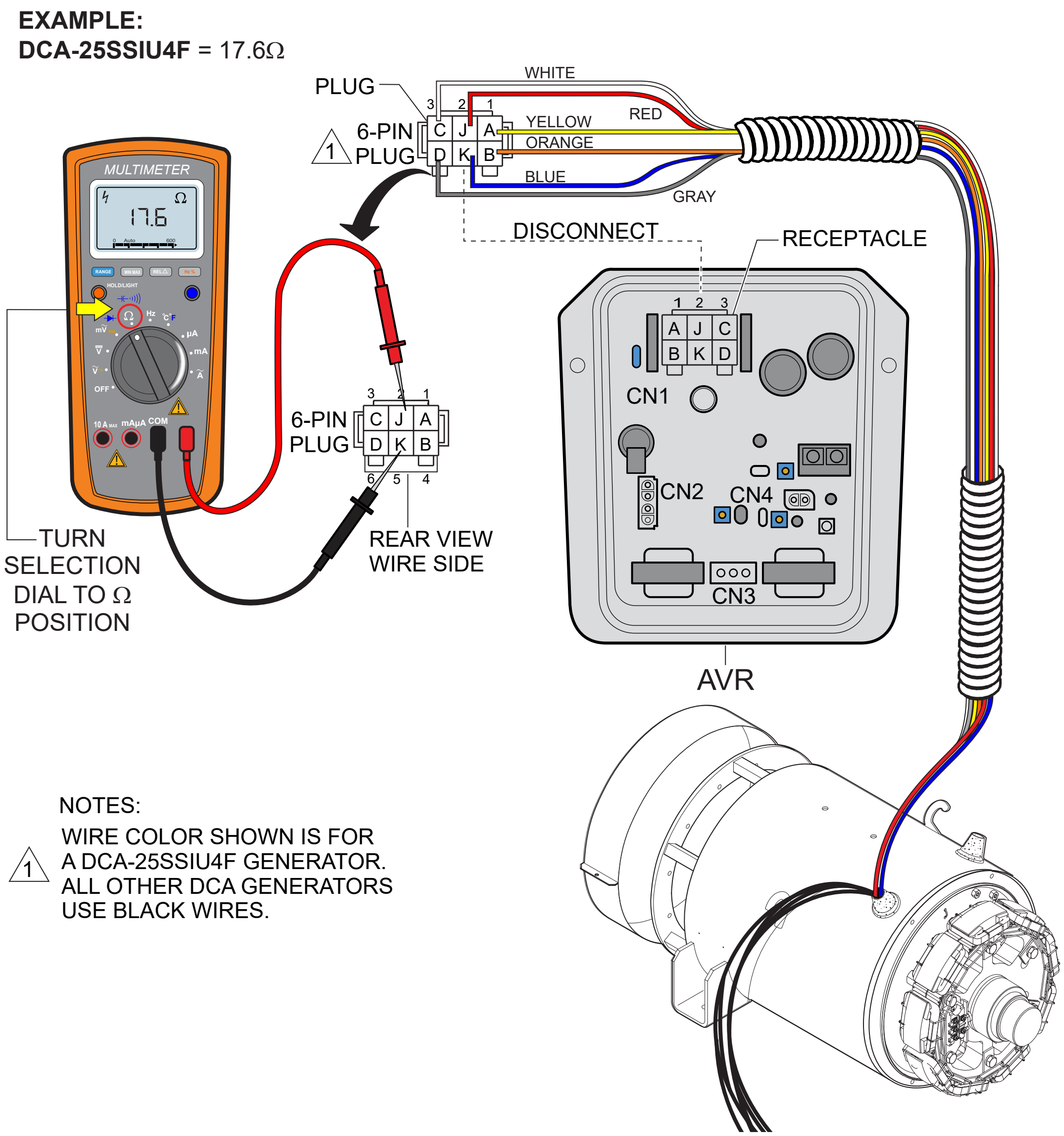


Figure 38. Exciter Field Resistance Check

MANUAL EXCITATION TEST (3-PHASE VOLTAGE)

1. With the engine **OFF**, place the ***voltage selector switch*** (Figure 39**A**) in the 3-Phase, 240/139V position.
2. Unplug the 6-pin plug from the CN1 receptacle on the AVR (Figure 39**B**).
3. Connect an SPST toggle switch (Figure 39**C**) between the positive battery terminal and pin **J** on the 6-pin plug.
4. Connect a wire from the negative battery terminal to pin **K** on the 6-pin plug (Figure 39**D**).
5. Place toggle switch in the **OFF** (open) position. If equipped, set engine speed switch to the ***low*** position (idle). Start the engine, then place toggle switch in **ON** position (closed).
6. Next, place engine speed switch in the ***high*** position and run the engine at ***full*** rpm.
7. Place the selection dial on the multimeter to the AC volts position (Figure 39**E**).
8. Using a multimeter, measure voltage at the **U**, **V** and **W** terminals (Figure 39**F**) located on top of the main circuit breaker (line side).
9. Take both phase-to-phase and phase-to-neutral readings. Compare readings as referenced in Table 7, column **E**. Verify voltage reading is balanced phase to phase and phase to neutral.

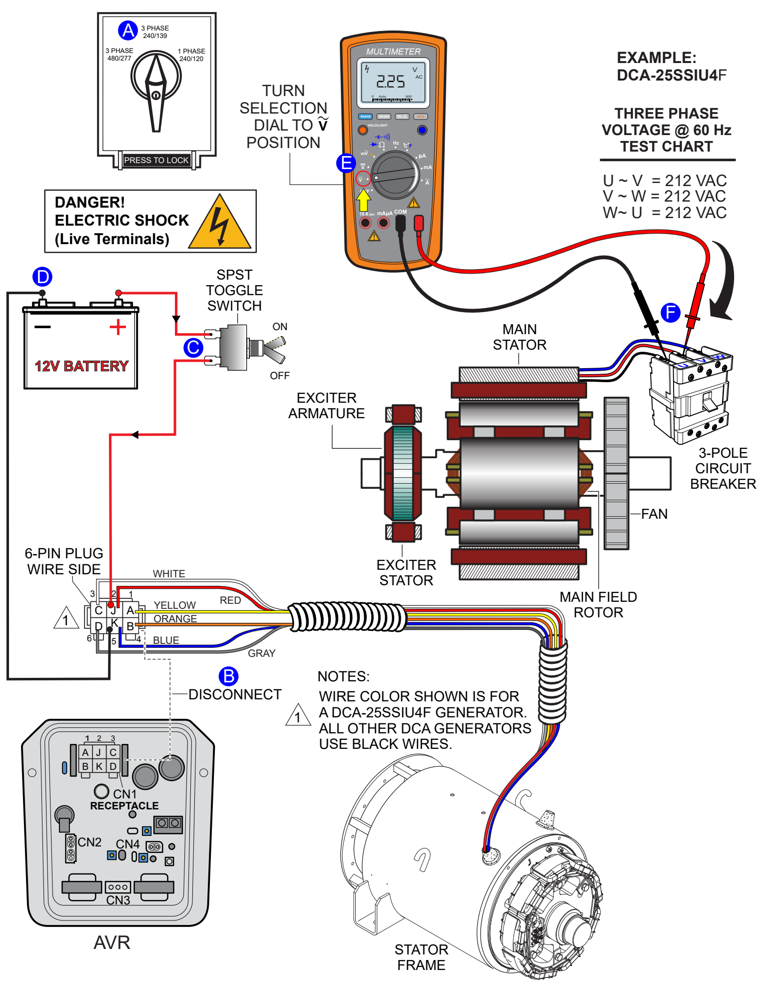


Figure 39. Manual Excitation Test Three-Phase Voltage

MANUAL EXCITATION TEST (WINDING VOLTAGE)

1. With the engine **OFF**, place the ***voltage selector switch*** (Figure 40**A**) in the 3-Phase, 240/139V position.
2. Unplug the 6-pin plug from the CN1 receptacle on the AVR (Figure 40**B**).
3. Connect an SPST toggle switch (Figure 40**C**) between the positive battery terminal and pin **J** on the CN5 plug.
4. Connect a wire from the negative battery terminal to pin **K** on the 6-pin plug (Figure 40**D**).
5. Place toggle switch in the **OFF** (open) position, then set engine speed switch to ***low*** position (idle). Start the engine, then place toggle switch in **ON** position (closed).
6. Next, place engine speed switch in the ***high*** position and run the engine at ***full*** rpm.
7. Place the selection dial on the multimeter to the AC volts position (Figure 40**E**).
8. Connect the test leads of the multimeter across pins **A–B**, **C–D** and **D–A** on the 6-pin plug as shown in Figure 40**F**.
9. Verify that the voltage readings are within range as referenced in Table 7, column **F**.

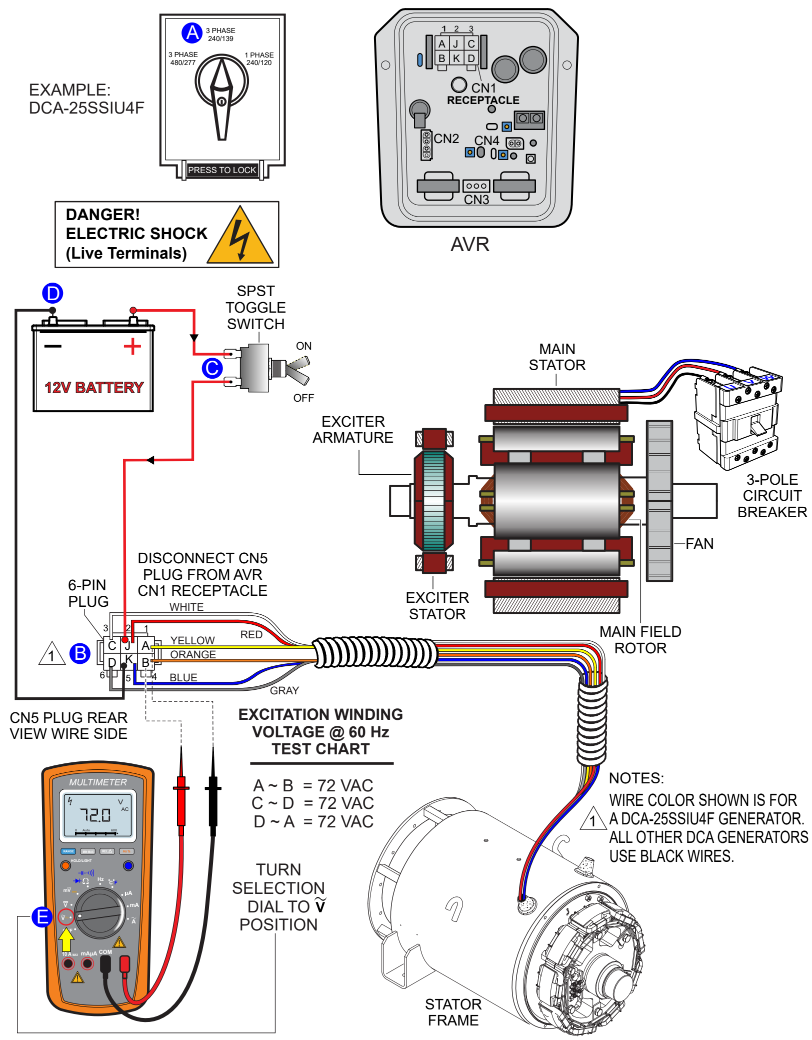


Figure 40. Manual Excitation Winding Voltage Test

EXCITER FIELD CURRENT MEASUREMENT (NO LOAD)

1. With the engine **OFF**, place the ***voltage selector switch*** (Figure 41**A**) in the 1-Phase, 240/120V position.
2. If equipped, set engine speed switch to the ***low*** position (idle).
3. Start the engine.
4. If equipped, place engine speed switch in the ***high*** position and run the engine at ***full*** rpm.
5. Place ammeter clamp around pin **K** on the 6-pin plug as shown in Figure 41**B**.
6. Verify that the exciter field amperage (no load) reading is within range as referenced in Table 7, column **A.**

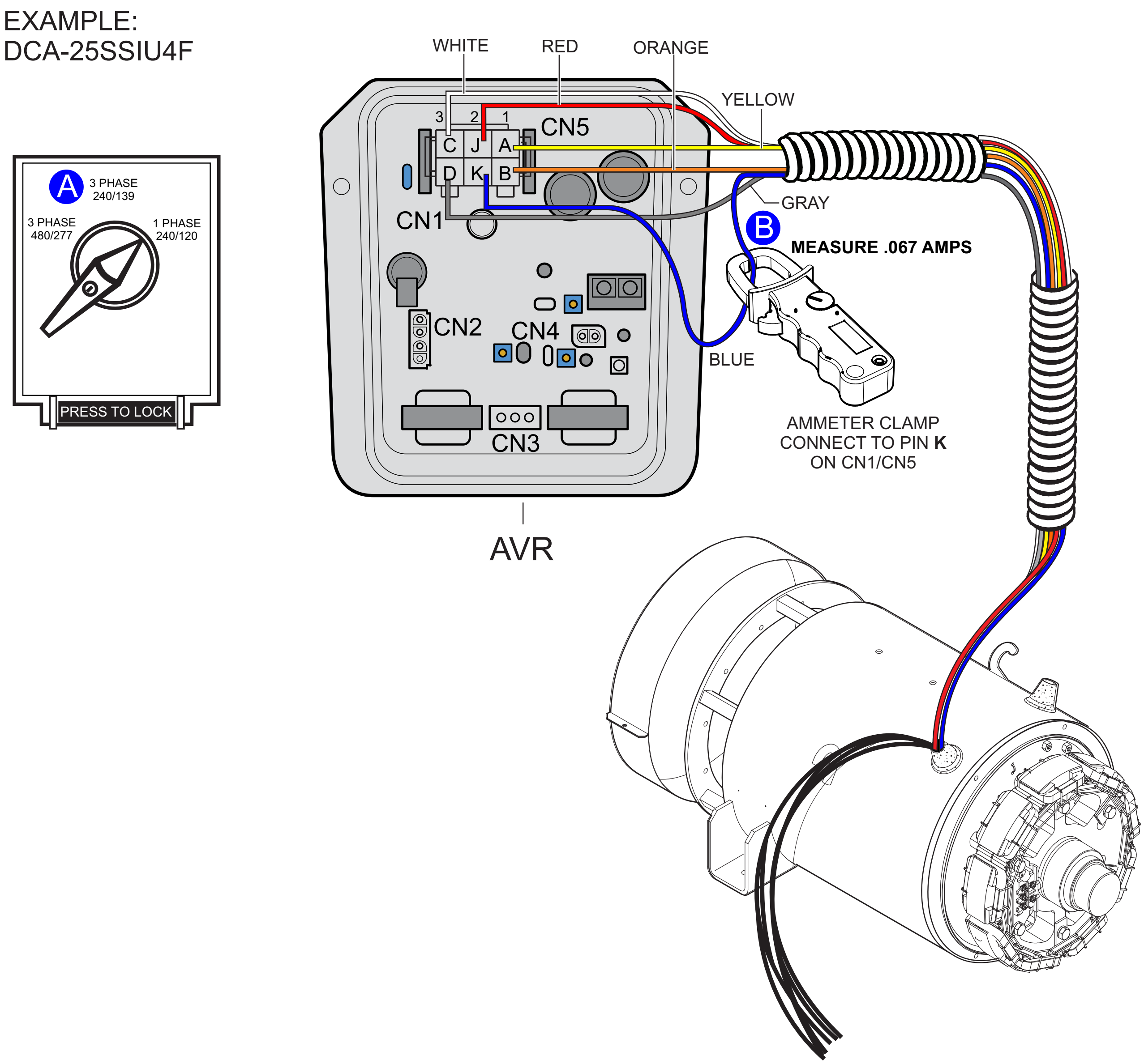


Figure 41. Exciter Field Current Measurement (No Load)

EXCITER FIELD CURRENT MEASUREMENT (WITH LOAD)

1. With the engine **OFF**, place the ***voltage selector switch*** (Figure 42**A**) in the 1-Phase, 240/120V position.
2. If equipped, set engine speed switch to the ***low*** position (idle).
3. Connect an external load bank to the output terminal panel or bus bars on the generator as shown in Figure 42**B**.
4. Configure load bank for the specified rated load as referenced in the data sheet. This example will use a load rating of 20 kW / 25 kVA for a DCA25SSIU4F generator.
5. Start the engine.
6. If equipped, place engine speed switch in the ***high*** position and run the engine at ***full*** rpm.
7. Place ammeter clamp around pin **K** on the ***6-pin plug*** as shown in Figure 42**C**.
8. Verify that the exciter field amperage (with load) reading is within range as referenced in Table 7, column **B**.

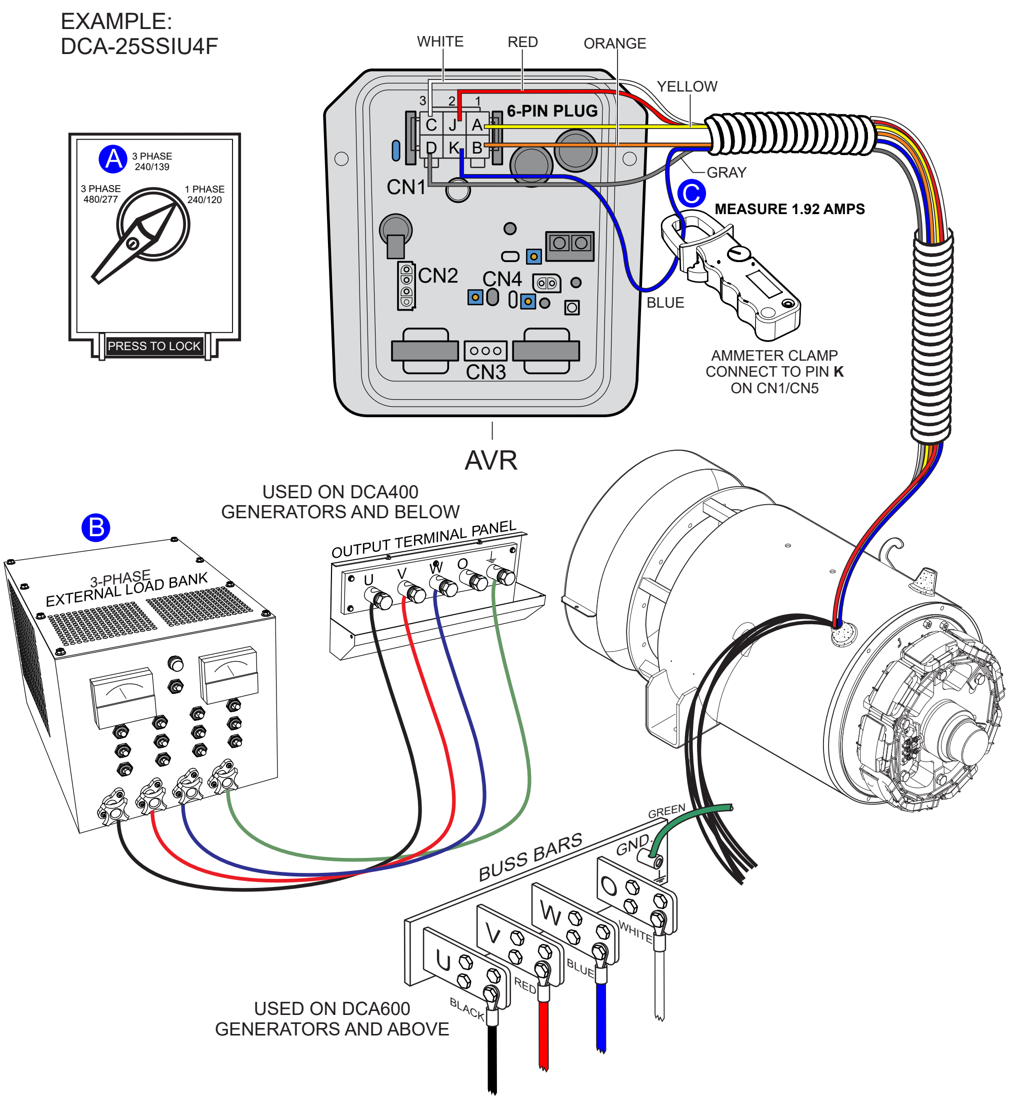


Figure 42. Exciter Field Current Measurement (With Load)

EXCITER FIELD VOLTAGE MEASUREMENT (NO LOAD)

NOTICE

Use extreme caution when performing this test. The possibility exists of ***electrical shock*** which could cause severe bodily harm.

1. With ***no load*** applied, start the engine as referenced in the operation manual.
2. The voltage selector switch or voltage change-over board can be configured in any position or setting.
3. Next, open the control panel door on the generator and locate the 6-pin plug (Figure 43**A**) on the AVR.
4. Set the selection dial on the multimeter to AC volts (Figure 43**B**).
5. Place the multimeter test leads across pins J and K on the 6-pin plug as shown in Figure 43**C**. Multimeter probe extenders are recommended for easy access to the connector pins.
6. Verify that the exciter field voltage (no load) reading is within range as referenced in Table 7, column **C**.

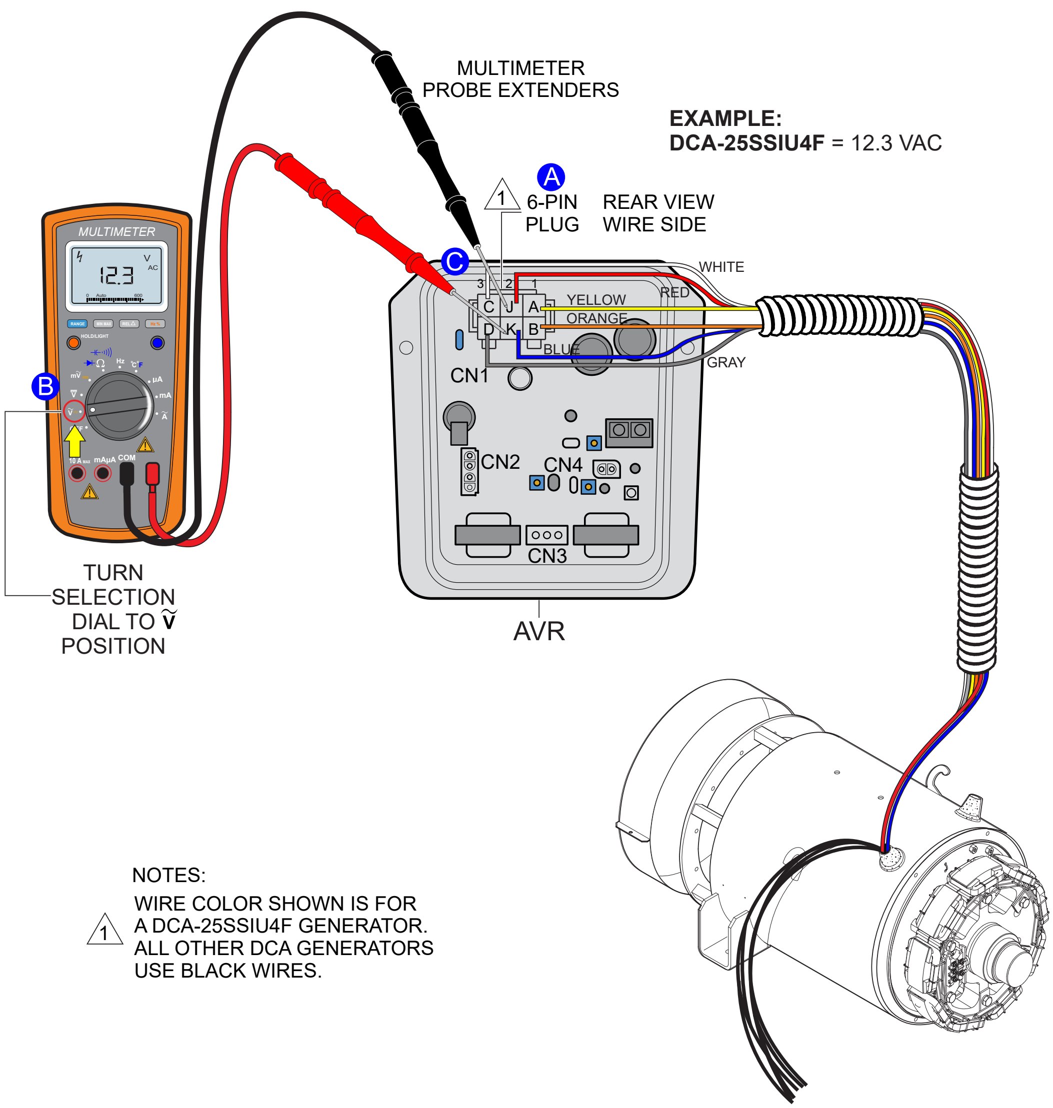


Figure 43. Exciter Field Voltage Measurement (No Load)

EXCITER FIELD VOLTAGE MEASUREMENT (WITH LOAD)

> **NOTICE**
>
> Use extreme caution when performing this test. The possibility exists of ***electrical shock*** which could cause severe bodily harm.

1. Connect an external load bank to the output terminal panel or bus bars on the generator as shown in Figure 44**A**.
2. If equipped, set engine speed switch to the ***low*** position (idle).
3. Start the engine as referenced in the operation manual.
4. If equipped, place engine speed switch in the ***high*** position and run the engine at ***full*** rpm
5. Configure load bank for the specified rated load as referenced in the data sheet. This example will use a load rating of 20 kW / 25 kVA for a DCA25SSIU4F generator.
6. Next, open the control panel door on the generator and locate the 6-pin plug (Figure 44**B**) on the AVR.
7. Set the selection dial on the multimeter to AC volts (Figure 44**C**).
8. Place the multimeter test leads across pins J and K on the 6-pin plug as shown in Figure 44**D**. Multimeter probe extenders are recommended for easy access to the connector pins.
9. Verify that the exciter field voltage (no load) reading is within range as referenced in Table 7, column **D**.

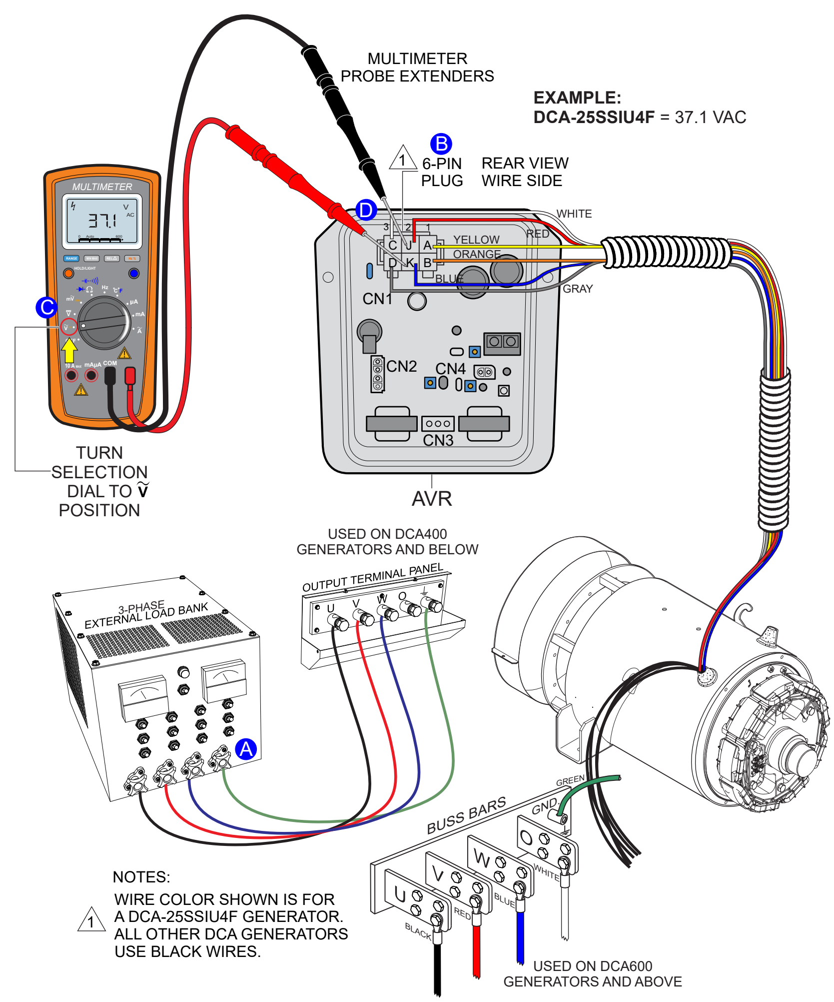


Figure 44. Exciter Field Voltage Measurement (With Load)

3-PHASE RECTIFICATION

3-phase rectification is the process of converting a balanced 3-phase power supply into a fixed DC supply using solid-state diodes. The rotating rectifier is a full-wave bridge rectifier and utilizes ***six diodes*** (Figure 45) to convert one ***full wave*** of alternating current into one ***full pulse*** of direct current.

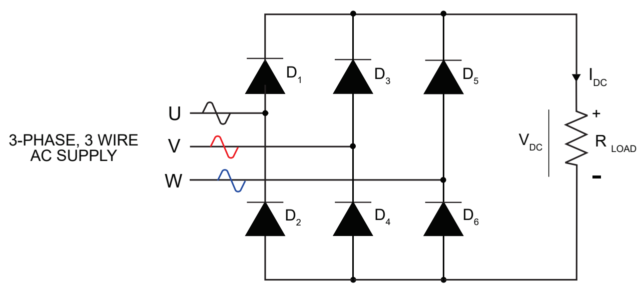


Figure 45. 3Ø Rectification

A diode is a semiconductor device that essentially acts as a ***one-way switch*** for current. It allows current to flow ***easily*** in one direction (Figure 46**A**), but ***restricts*** current from flowing in the opposite direction (Figure 46**B**).

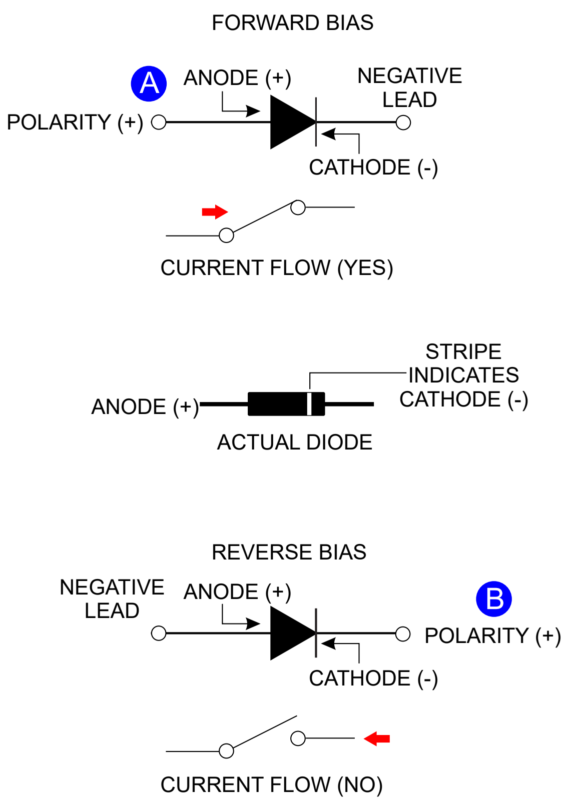


Figure 46. Forward/Reverse Bias Diode

Single-phase generators are generally 120_{VRMS} (root mean square voltage) or 240_{VRMS} phase-to-neutral, also called line-to-neutral (L–N), and nominally of a fixed voltage and frequency producing an alternating voltage or current in the form of a sinusoidal waveform being given the abbreviation of "AC".

Three-phase rectification, also known as poly-phase rectification, is similar to single-phase rectification. The main difference is that ***<u>three single-phase circuits are connected together</u>*** to produced a three-phase output.

The advantage is that 3-phase rectification circuits can be used to power many data centers, commercial and industrial applications such as motor control, or battery charging systems which have higher power requirements than a single-phase rectifier circuit is able to supply.

3-phase generators combine together ***three AC voltages*** of identical frequency and amplitude, with each AC voltage being called a "phase". These three phases are 120 electrical degrees out of phase from each other producing a phase sequence, or phase rotation of: 360 ÷ 3 = 120 as shown in Figure 47.

Three-phase alternating current (AC) can be used to provide electrical power directly to balanced loads and rectifiers. Since a 3-phase AC supply has a fixed voltage and frequency, it can be used by a rectification circuit to produce a fixed DC voltage.

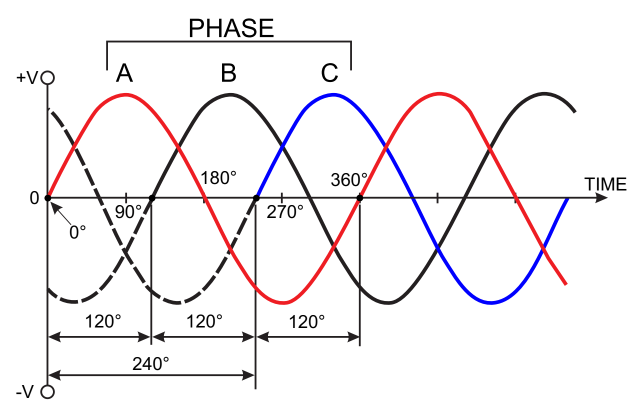


Figure 47. 3-Phase Waveform

ROTATING RECTIFIER TEST

> **NOTICE**
>
> Before performing the continuity test, ***all lead wires*** (Figure 48) ***must be disconnected*** from the rectifier.

The rotating rectifier is connected to both the ***main field*** and ***exciter armature*** and is mounted on the exciter stator armature.

Be sure to place the selection dial on the multimeter in the ***diode*** position. Sometimes referenced as the diode feature test.

Place the positive lead from the multimeter on the **DC POSTIVE** (+) terminal of the rectifier (Figure 48). Now touch the U, V and W terminals one at a time with the **NEGATIVE** (–) lead. Each terminal should give a ***continuity*** reading.

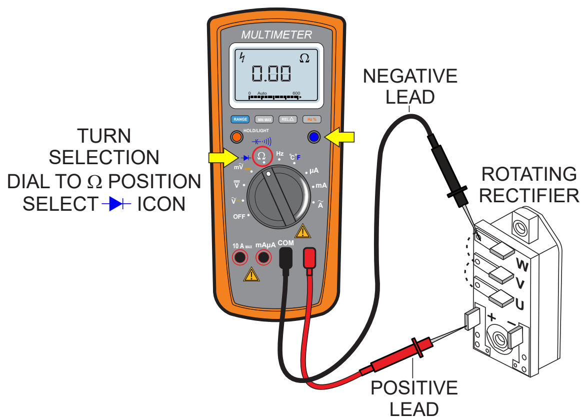


Figure 48. Rotating Rectifier Check (Positive)

Reverse the multimeter leads. Place the **NEGATIVE** lead of the multimeter on the DC Positive (+) terminal of the rectifier (Figure 49) and touch U, V and W terminals with the positive lead. This should cause the multimeter to read ***open*** circuit.

> **NOTICEa**
>
> If the rotating rectifier fails any of the tests as referenced in Figure 48 or Figure 49, replace the rectifier.

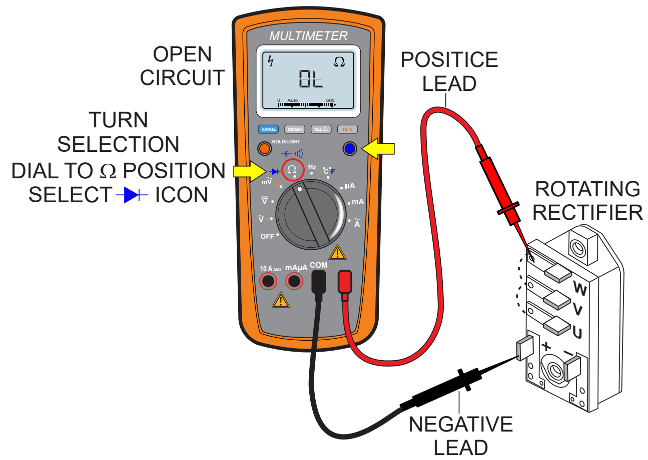


Figure 49. Rotating Rectifier Check (Negative)

SURGE PROTECTOR CHECK (DCA125–150)

> **NOTICE**
>
> Before performing the continuity check, both surge protector lead wires (Figure 50) ***must be disconnected*** from the rotating rectifier.

Place the selection dial on the multimeter in the Ω position.

Next, place the multimeter leads across the surge protector as shown in Figure 50 and verify that the meter displays an ***open circuit***. If the meter indicates ***continuity*** or another reading, replace the surge protector.

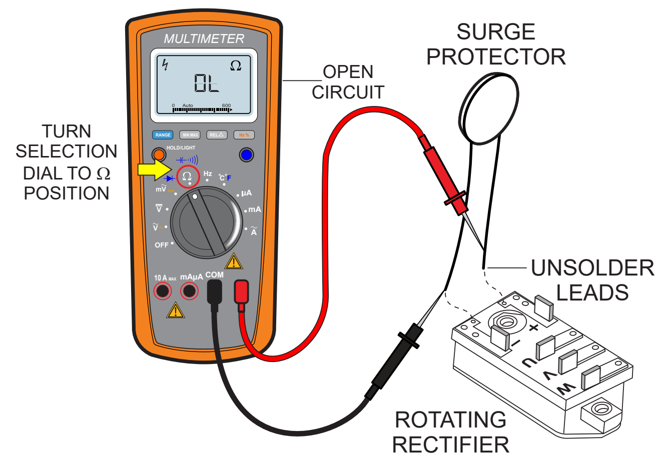


Figure 50. Surge Protector Check

MAIN ARMATURE AVR INPUTS RESISTANCE CHECK (CN1)

NOTICE

Before performing the resistance check, the 6-pin plug (Figure 51**B**) ***must be disconnected*** from the CN1 receptacle on the AVR. If the reading indicates an ***open circuit*** the component may have to be replaced or repaired.

Set the multimeter selection dial to the Ω position as shown in Figure 51**A**.

Next, check the resistance across the A–B, C–D, D–A ***open delta*** wire leads as referenced in Figure 51**B.** Compare measured reading to values listed in Table 6, column **E**.

Finally, check the resistance across the B–C ***open delta*** wire leads as referenced in Figure 51**B.** Compare measured reading to values listed in Table 6, column **F**.

Again, be sure to ***unplug*** the 6-pin plug from the CN1 receptacle on the AVR.

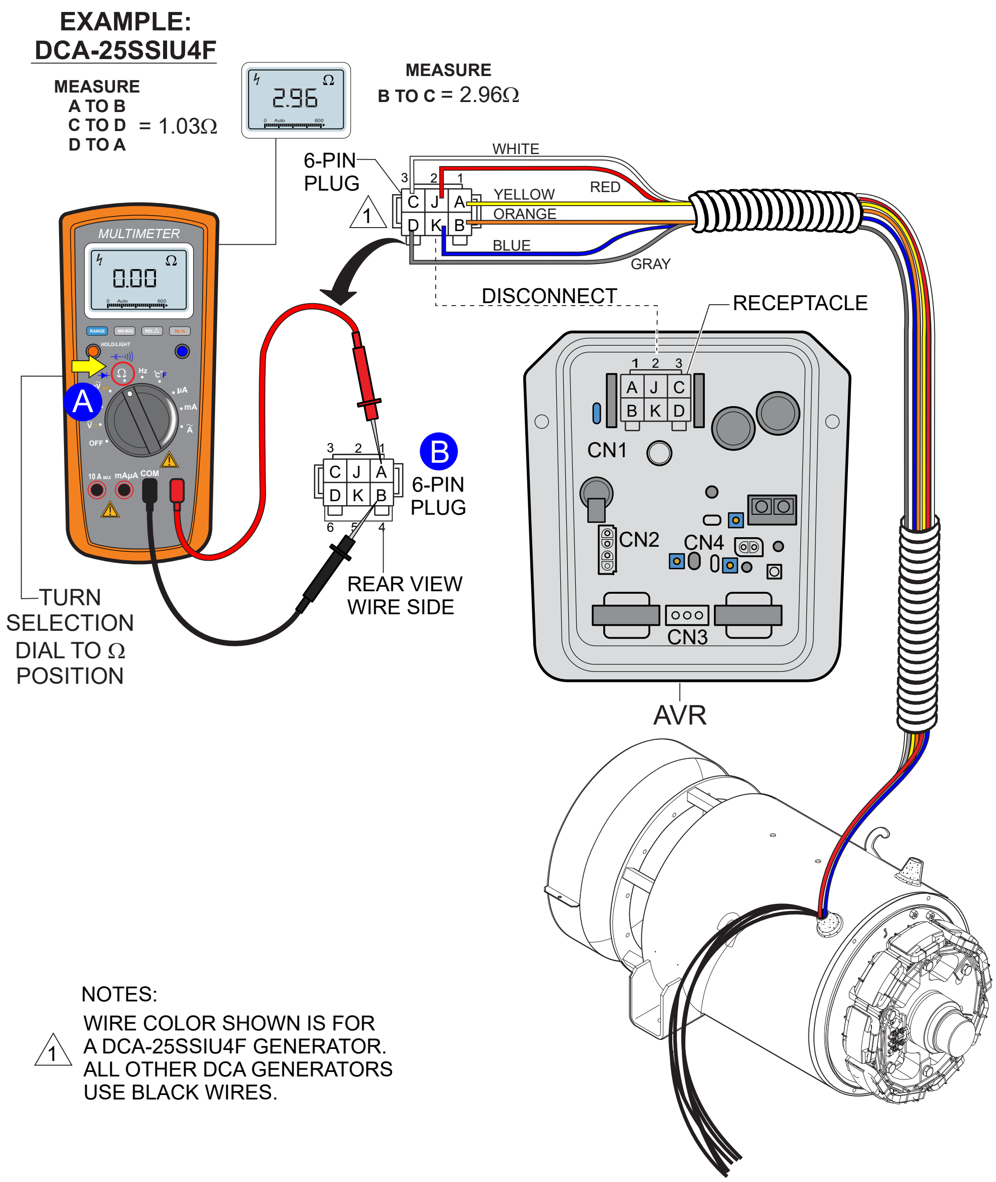


Figure 51. Main Armature AVR Inputs Resistance Check

As shown in Figure 52, there are three outside connectors that plug into the CN1, CN3 and CN4 receptacles on the AVR.

The CN2 receptacle has no outside plug connected to it. Pins 1 and 2 are internally jumpered together and pins 3 and 4 are also jumpered together.

As shown in Figure 52, there are two **WHITE** wires that connect to the AVR 2-pin terminal block via relay unit RY1. The AVR also has ***three potentiometers*** only one is used for coarse adjustment of the voltage, the other two are factory set and should **NOT** be adjusted. In addition, there is an 8-amp circuit protection fuse.

AVR INTERNAL SENSING (CN3)

The CN3 connector (Figure 52) is used for the ***internal sensing*** of the AVR.

- **U**-phase wire is **RED** and is connected to terminal #14 on the voltage selector switch.
- **V**-phase wire is **WHITE** and is connected to V-Leg on Relay Unit (RY1).
- **W**-phase wire is **BLUE** and is connected to terminal #36 on the voltage selector switch.

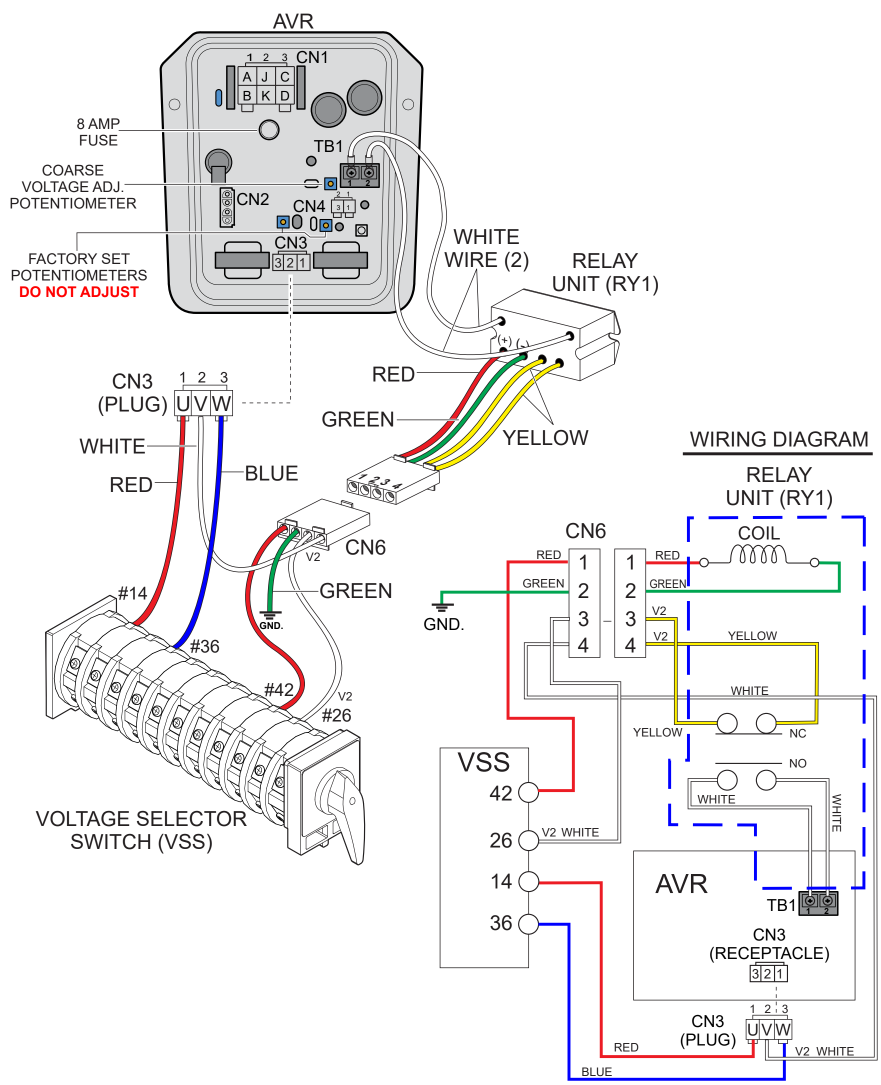


Figure 52. AVR Internal Sensing

RHEOSTAT CHECK (CN4)

> ***NOTICE***
>
> Before performing the resistance check, the CN14 connector plug (Figure 53) ***must be disconnected*** from the CN4 receptacle on the AVR. If the reading indicates an ***open circuit*** or incorrect reading, replace the rheostat.

Symptom: AC voltage output is half the normal value and there is no response when adjusting rheostat.

Disconnect the CN14 plug from the CN4 receptacle on the AVR and measure the resistance of the rheostat at the connector plug.

Set the multimeter selection dial to the Ω position as shown in Figure 53**A**.

Place the multimeter leads between pins 1 and 3 on the CN14 connector plug (Figure 53**B**). Turn the voltage control knob (Figure 53**C**) fully counterclockwise. The multimeter should read 1,000 ohms (Figure 53**D**).

Next, turn the knob slowly until the knob is fully clockwise and the multimeter should read about zero ohms (Figure 53**E**).

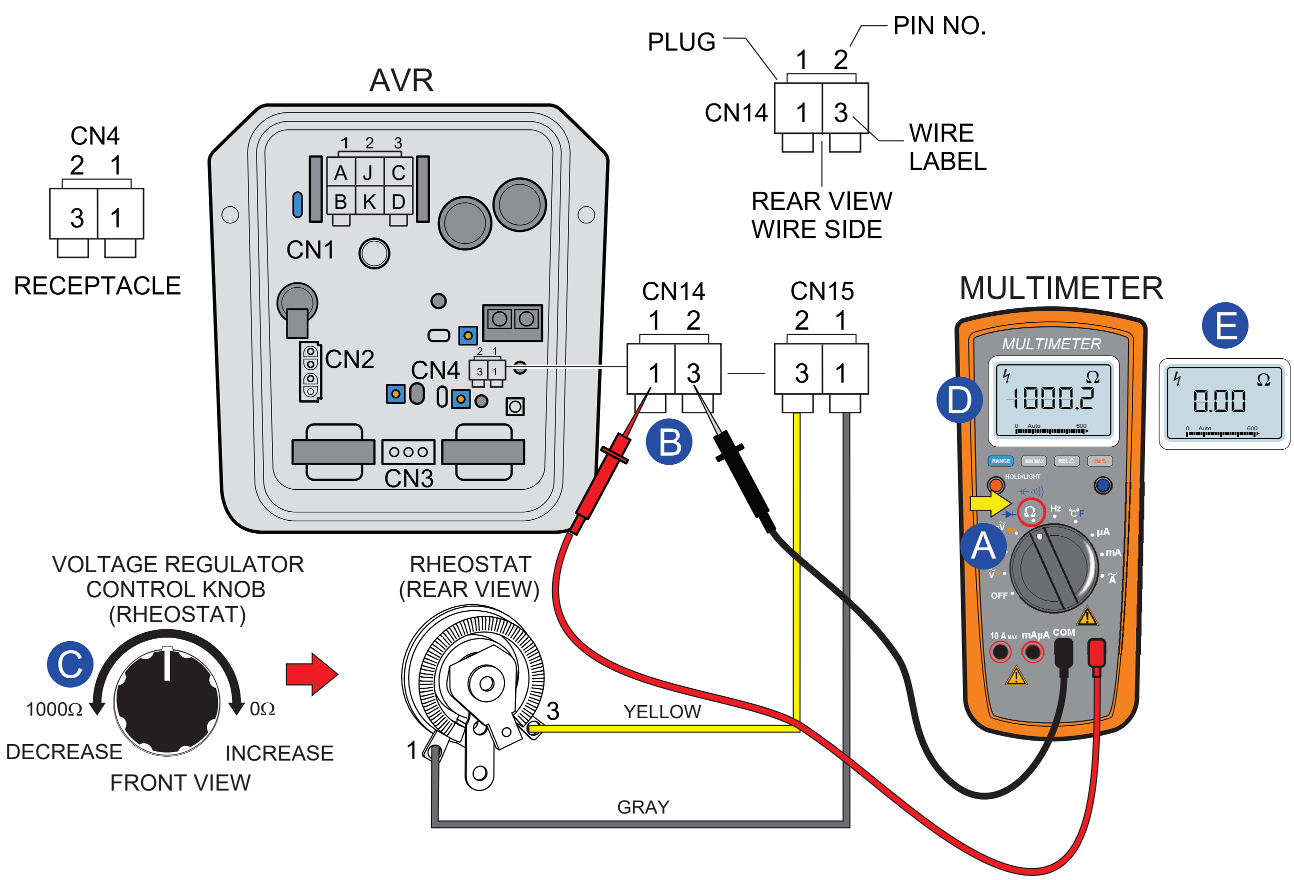


Figure 53. Rheostat Resistance Check

MAIN CIRCUIT BREAKER

The ***main circuit breaker*** (Figure 54) connects and disconnects the generator output voltage from the U, V, and W output terminal lugs.

Most of the circuit breaker (CB) trip faults are due to insufficient sizing of the generator to the load. It is essential that the unit being used for the application be sized properly to the load in order to prevent these types of nuisances. Reference Table 2.

With the generator **OFF**, place the circuit breaker (Figure 54) in the **OFF** position. Set the multimeter selection dial to the Ω position, then select the sound icon.

Next, verify that there is no continuity ***(no beep!)*** between the L1, L2 and L3 inputs and output contacts of the breaker (top and bottom). This implies an **OPEN** circuit, no continuity (good).

Repeat the above test with the circuit breaker in the **ON** position. Verify that there is continuity ***(beep! beep!)*** between the input and output contacts of the breaker. This implies a **CLOSED** circuit, continuity. Reference Table 2 for the amperage characteristics of the breaker installed on the specified generator.

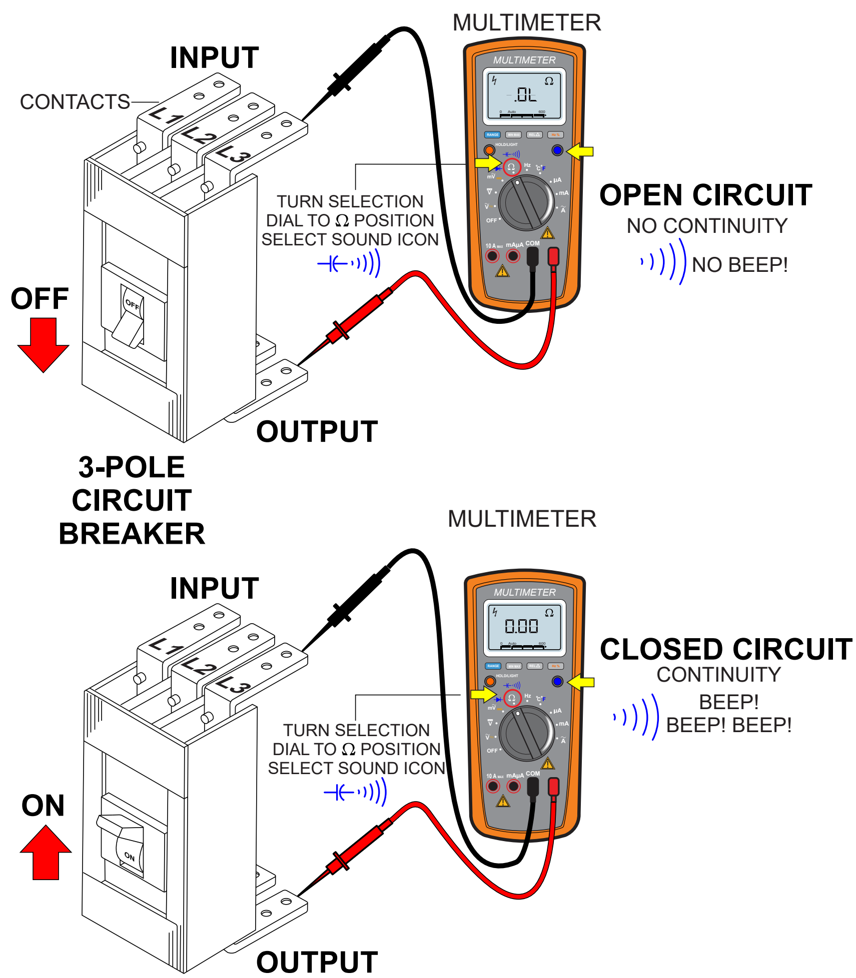


Figure 54. Circuit Breaker Continuity Test

Table 2. Generator Amperage Chart/CB-OC Trip Ratings

MODEL	PRIME OUTPUT		AMPS 240 VAC 3Ø	AMPS 480 VAC 3Ø	AMPS 120 VAC 1Ø	AMPS 240 VAC 1Ø	CIRCUIT BREAKER TRIP RATING (AMPS)	OVERCURRENT RELAY TRIP SET POINT (AMPS)
	kVA	kW						
DCA6	6	6	N/A	N/A	25.0 × 2	25	25	N/A
DCA10	10	10	N/A	N/A	30	41.6	45	N/A
DCA15	14	14	N/A	N/A	58.3 × 2	58.3	70	N/A
DCA25[1]	25	20	60	30	60.0 × 2	60	60	30
DCA36	36	36	N/A	N/A	150 × 2	150	150	N/A
DCA40[1]	36	28.8	86	43	108 × 2	108	110	43
DCA45[1]	45	36	108	54	108 × 2	108	125	54
DCA70[1]	70	56	168	84	168 × 2	168	200	84
DCA125[1]	125	100	300	150	300 × 2	300	300	152
DCA150[1]	150	120	361	180	361 × 2	361	400	180
DCA180[2]	180	144	433	216	400	200	500	216
DCA220[2]	220	176	529	264	488.9	244.4	600	256
DCA300[2]	300	240	722	360	666.7	333.3	800	361
DCA400[2]	400	320	962.3	481.1	888.9	444.4	1,000	480
DCA600[2]	600	480	1,443.4	721.7	1,333.3	666.7	1,600	1,443.4 (240 V) 720 (480 V)
DCA800[2]	800	640	1,924.6	962.3	1,778.8	888.9	2,500	960

[1]Zigzag wire configuration, [2]Four wire configuration.

SINGLE-PHASE LOAD

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

NOTICE

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

WATTS = VOLTAGE × AMPERAGE

THREE-PHASE LOAD

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

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

NOTICE

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

ENGINE CONTROL UNIT (ECU 9988N)

The ECU 9988N is an ***auto-start/stop*** engine controller. This controller should not be confused with the actual engine manufacturer's ***Engine Control Module*** (ECM). The ECM monitors engine operational inputs and directly controls outputs for fuel delivery actuators, electronic fuel injectors, etc. While the ECM does include safety shutdowns, its main purpose is regulating fuel to meet emission standards. The ECM is preprogrammed with proprietary information by the engine manufacturer.

The ECU controller has a vertical row of status LEDs (inset), that when lit, indicate that an engine malfunction (fault) has been detected. When a fault has been detected, the engine controller (ECM) will evaluate the fault and all major faults will shut down the generator.

During cranking cycle, the ECU will attempt to crank the engine for 10 seconds before disengaging.

If the engine does not engage (start) by the third attempt, the engine will be shut down by the engine controller's ***Over Crank Protection*** mode. If the engine engages at a speed (RPM) that is not safe, the controller will shut down the engine by initializing the ***Over Speed Protection*** mode.

Also, the ECM will shut down the engine in the event of low oil pressure, high coolant temperature, and loss of magnetic pickup. These conditions can be observed by monitoring the LED status indicators on the front of the ECU controller module.

Low Oil Pressure — Indicates the engine oil pressure has fallen ***below*** a predetermined level. The oil pressure is detected using variable resistive values from the oil pressure sending unit. This is considered a ***major*** fault.

High Coolant Temperature — Indicates the engine temperature has ***exceeded*** a predetermined level. The engine temperature is detected using variable resistive values from the temperature sending unit. This is considered a ***major*** fault.

Overspeed Shutdown — Indicates the engine is running at an ***unsafe speed***. This is considered a ***major*** fault.

Overcrank — Indicates no engine start after 3 attempts.

The ECU has a ***3-position switch*** located at the top of the unit. This switch controls the running of the unit. If this switch is set to the ***OFF/RESET*** position, the unit will not start. When this switch is set to the ***MANUAL*** position, the generator will start immediately.

If the generator is to be connected to a building's AC power source via a transfer (isolation) switch, place the switch in the ***AUTO*** position. In this position, the generator will monitor the AC line output from the building's power source. Once the building's power drops below a specified level, a signal will be sent to the generator via the auto-start contacts and the the generator will start.

NOTICE

While operating in **Auto mode**, should a power outage occur, the automatic transfer switch (ATS) will start the generator automatically via the generator's auto-start contacts connected to the ATS's start contacts. Please refer to your ATS installation manual for further instructions for the correct installation of the auto-start contacts of the generator to the ATS.

WARNING

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

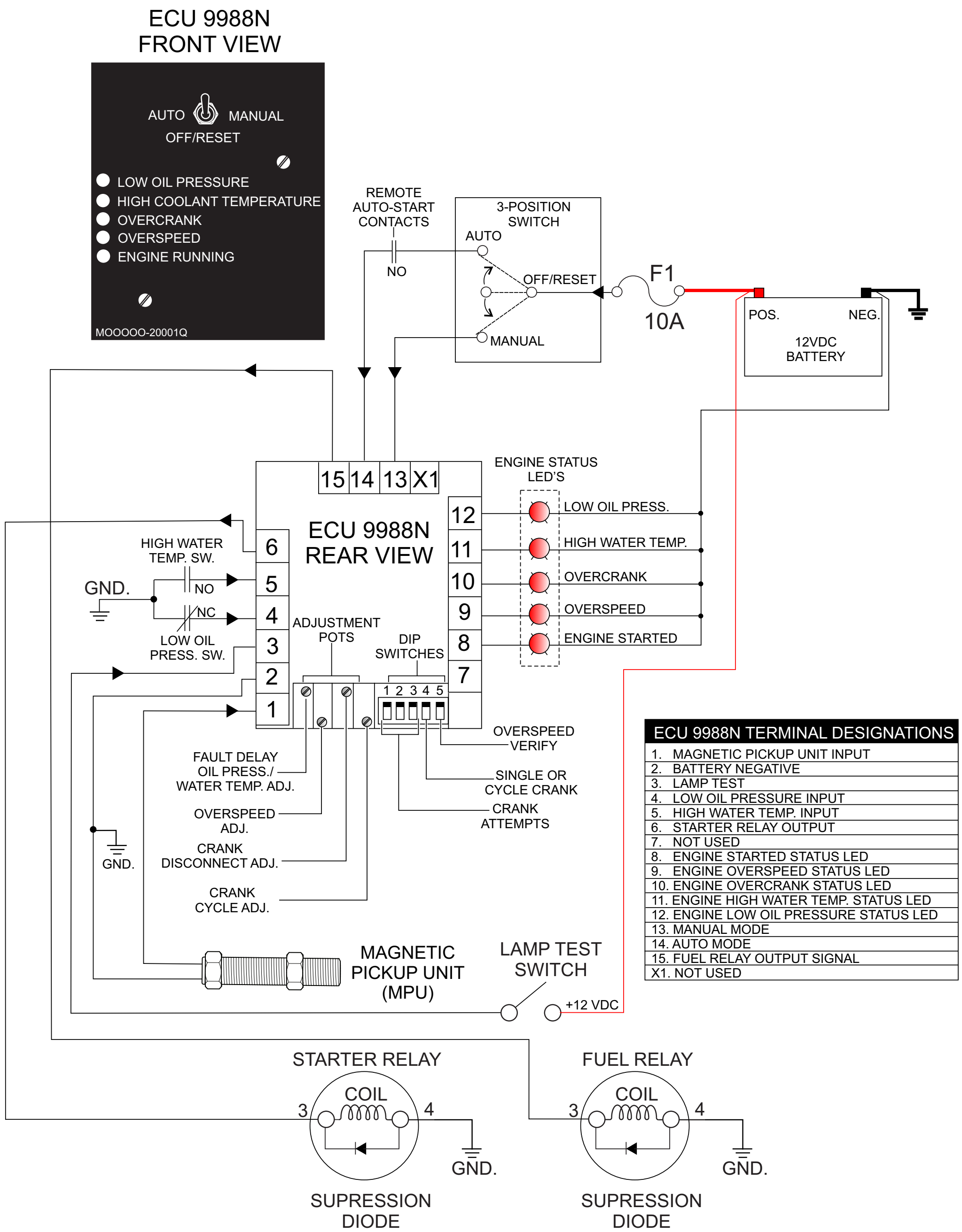
Figure 55 illustrates the ECU 9988N engine controller with an energized-to-run engine. Placing the control switch in ***manual*** position or closure of the ***remote-start contacts*** while in **AUTO** initiates the ***crank mode***. The fuel and starter relays are energized causing the engine to begin cranking. If the engine does not start in the allotted time, the overcrank fault occurs, and the ***fuel*** and ***starter*** relays are turned off.

If during engine cranking the internal speed switch detects a speed equal to or above the crank disconnect pre-set value, the starter relay will turn off.

If the engine ECM issues either a ***low oil pressure*** or ***high water temperature*** fault, the engine will shut down immediately. If the internal speed switch detects a speed equal to or above the overspeed setting, the engine will shut down immediately.

To stop the engine or to clear a fault condition, place the control switch in the **OFF** position.

If the CAN or speed signal from the engine ECM is lost during cranking or while the engine is running, the engine will shut down and the ***overcrank*** and ***overspeed*** LEDs will both turn on.



ECU 9988N TERMINAL DESIGNATIONS
1. MAGNETIC PICKUP UNIT INPUT
2. BATTERY NEGATIVE
3. LAMP TEST
4. LOW OIL PRESSURE INPUT
5. HIGH WATER TEMP. INPUT
6. STARTER RELAY OUTPUT
7. NOT USED
8. ENGINE STARTED STATUS LED
9. ENGINE OVERSPEED STATUS LED
10. ENGINE OVERCRANK STATUS LED
11. ENGINE HIGH WATER TEMP. STATUS LED
12. ENGINE LOW OIL PRESSURE STATUS LED
13. MANUAL MODE
14. AUTO MODE
15. FUEL RELAY OUTPUT SIGNAL
X1. NOT USED

Figure 55. ECU 9988N Basic Wiring Diagram

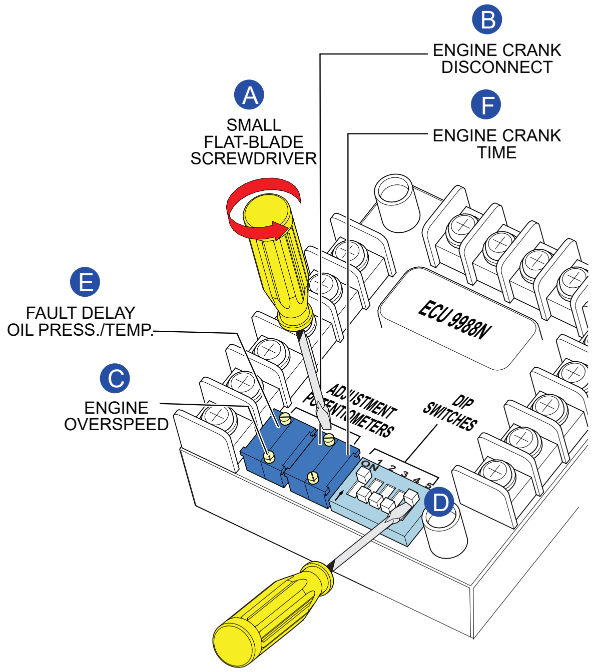


Figure 56. Potentiometer Adjustments

ADJUSTING ENGINE CRANK DISCONNECT

This is an adjustment for the engine starter (crank duration). Using a small, flat-blade screwdriver (Figure 56**A**), turn the engine crank disconnect adjustment potentiometer (Figure 56**B**) 30 turns counterclockwise. Then turn it about 3 turns clockwise.

Try to start the engine. The starter should crank but disengage quickly. If the engine starts, the ECU engine running lamp should be lit. Once verified, shut down the engine.

With the engine shut down, adjust the engine crank disconnect adjustment potentiometer 1 turn clockwise and try restarting the engine. Continue performing this adjustment of the potentiometer, in a clockwise direction, until the engine starts reliably. If the ***overcrank*** and ***overspeed*** LEDs light at the same time on your unit, reference ***Troubleshooting Flowcharts*** in this service manual for additional information.

ADJUSTING ENGINE OVERSPEED

This adjustment is for engine overspeed as a safety measure.

> ***NOTICE***
>
> Be sure you have adjusted the engine crank disconnect potentiometer first.

Turn the engine ***overspeed*** adjustment potentiometer (Figure 56**C)** 30 turns clockwise. Using a small, flat-blade screwdriver, set the DIP switch at ***position 5*** (Figure 56**D**) to the **ON** position (up).

Start the engine. It should crank and start. Verify that the engine running LED is lit. Now start turning the overspeed adjustment potentiometer counterclockwise until the engine control shuts down the engine (overspeed fault). Again using a small, flat-blade screwdriver, set the DIP switch at position 5 to the **OFF** position (down).

If the ***overcrank*** and ***overspeed*** LEDs light at the same time on the ECU, reference ***Troubleshooting Flowcharts*** in this service manual for additional information.

ADJUSTING FAULT DELAY

This adjustment is for how long the engine can run in fault mode.

Turn the engine fault delay adjustment potentiometer (Figure 56**E**) 30 turns counterclockwise. This will allow for about 1 second of fault delay. Fault delay is begun after the engine has started.

The purpose of the delay is to allow time for ***oil pressure*** to build adequately, before the oil pressure monitor starts checking the oil pressure sender. ***High water temperature*** is also ignored during the fault delay time to allow engine coolant to circulate in the engine.

ADJUSTING ENGINE CRANK CYCLE TIME

This adjustment is for the starter **ON** time.

Turn the engine crank cycle adjustment potentiometer (Figure 56**F**) 30 turns counterclockwise.Then turn it about 3 turns clockwise. This will allow about 1 second or so of actual engine cranking (starting motor on) time. Each turn adds about 1 second to the crank time. Adjusting the crank time automatically sets the rest time to the same value. Multiquip recommends a 3-second crank cycle on average. **DO NOT *exceed 10 seconds***.

ENGINE CRANK CYCLES (DIP SWITCHES 1, 2 AND 3)

Using a small, flat-blade screwdriver, set DIP switches 1, 2 and 3 as referenced in Table 3 and Figure 58 to achieve the desired number of attempted engine crank cycles. Engine crank cycles is defined as the amount of times the engine will turn on the starter to attempt engine cranking.

Table 3. Crank Cycle DIP Switch Settings

SW1	SW2	SW3	CYCLES
OFF	OFF	OFF	1
OFF	ON	OFF	2
ON	OFF	OFF	3[1]
ON	ON	OFF	4
OFF	OFF	ON	5
OFF	ON	ON	6
ON	OFF	ON	7
ON	ON	ON	8

[1]OEM set point from factory.

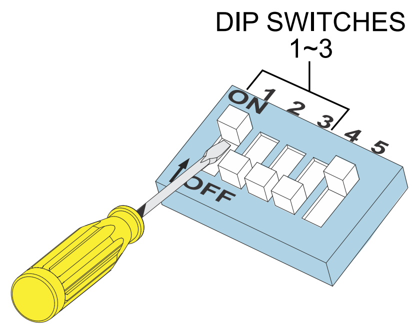


Figure 57. DIP Switches (Crank Cycles)

If the engine fails to start within the set intervals shown in Table 3, the Overcrank LED (Figure 58) should be **ON**. To reset the controller a ***power reset*** is required.

To initiate a power reset, simply toggle the Auto Start/Stop switch (Figure 58) from the manual position back to the Off/Reset position.

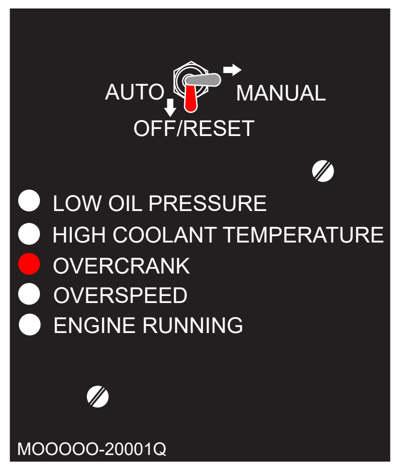


Figure 58. Controller Power Reset

SINGLE OR MULTIPLE ENGINE CRANKS (DIP SWITCH 4)

Using a small, flat-blade screwdriver, set DIP switch 4 (Figure 56**D**) for either ***single*** or ***multiple*** engine cranks as referenced in Table 4.

When DIP switch 4 is placed in the **ON** position (up) all the multiple engine cranks will add together to create one ***large*** engine crank. In effect it disables all other remaining cycles.

Placing DIP switch 4 in the **OFF** position will allow multiple engine cranks as referenced in Table 4.

Table 4. Single/Multiple Engine Crank DIP Switch Setting

SW4[1]	FUNCTION
ON	Single Engine Crank
OFF	Multiple Engine Cranks

[1]Factory built DCA units have Dip Switch 4 set to OFF.

TESTING ENGINE OVERSPEED (DIP SWITCH 5)

After the engine has started and is running at normal speed, using a small, flat-blade screwdriver, place DIP switch 5 as referenced in Figure 56**D** and Table 5 in the **ON** position (up). If the ***overspeed potentiometer*** has been adjusted correctly, the engine will shut down when an overspeed fault occurs. For normal operation, be sure DIP switch 5 is placed in the **OFF** (down) position.

Table 5. Overspeed DIP Switch Setting

SW5	FUNCTION
ON	Makes ECU think engine is going approximately 13% faster than it really is.
OFF	True engine speed (normal operation)

OVERCURRENT RELAY

The ***overcurrent relay*** (OCR) is a circuit/load protection device. In the event of an overload, both the circuit breaker and the OCR may trip. If the circuit breaker cannot be reset, the reset button on the OCR must be depressed.

> ***NOTICE***
>
> The reset button is spring operated, it will always appear tripped. If the OCR was indeed tripped, the operator will feel a detent when the button is depressed.

The OCR is a plug-in device that plugs into a relay base located inside the box. Figure 59 provides a brief explanation of the control dials and the various components that interface with the OCR.

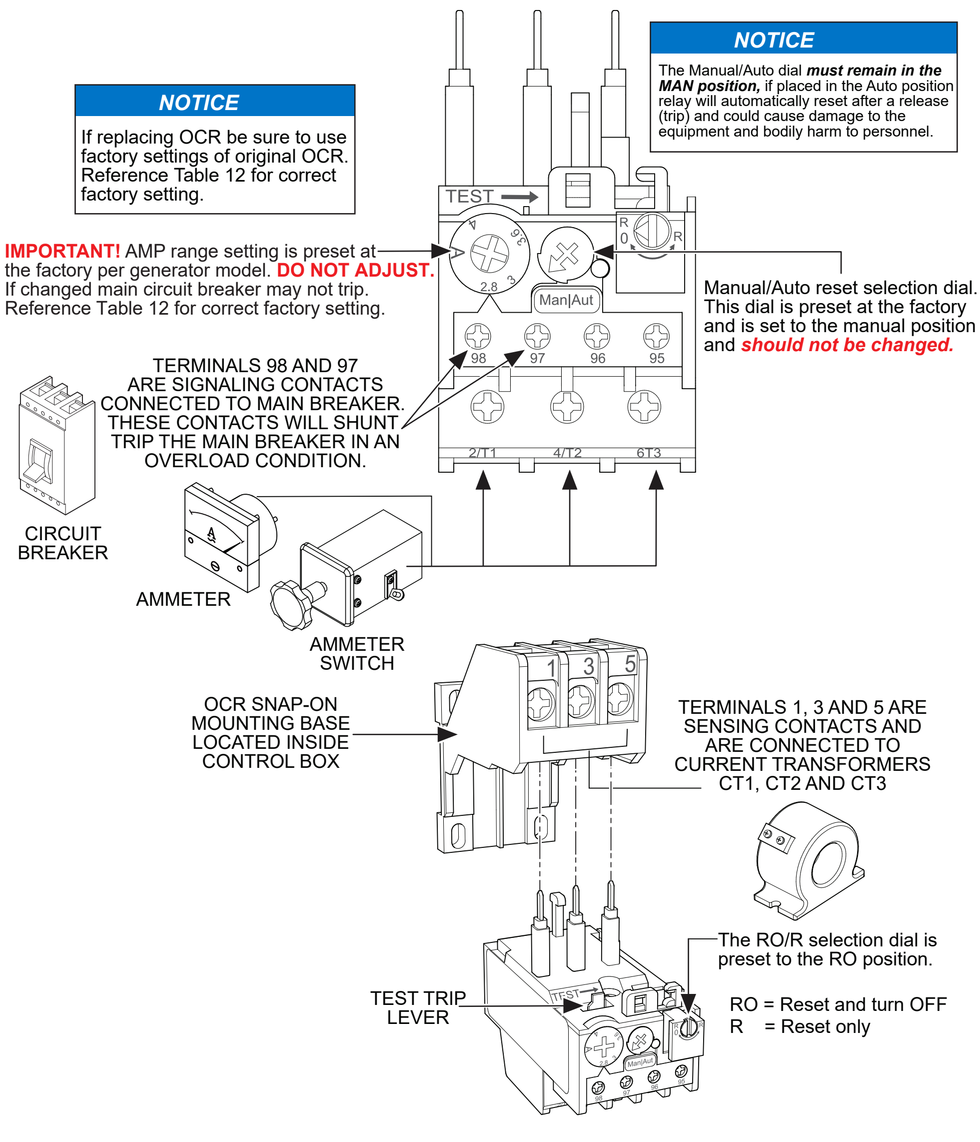


Figure 59. Overcurrent Relay

OCR TESTING

1. Place the selection dial (Figure 60**A**) on the multimeter to the Ω position, then select the sound icon.
2. Next, with the ***engine OFF and no power applied*** to the relay, place the multimeter leads (Figure 60**B**) across terminals 95 and 96 on the relay and verify that there is continuity ***(beep! beep!)***. This implies a **CLOSED** circuit, continuity.
3. **PRESS** the spring-loaded relay ***reset*** button (Figure 60**C**).
4. Move the multimeter leads to terminals 97 and 98 (Figure 60**D**) on the relay and verify that there is no continuity ***(no beep!)***. This implies an **OPEN** circuit, no continuity.
5. To trip the OCR, slide the manual trip lever on the relay as shown in Figure 60**E** and verify that the multimeter indicates an **OPEN** circuit ***(no beep!)*** across terminals 95 and 96. This implies an **OPEN** circuit, no continuity.
6. Move the multimeter leads to terminals 97 and 98 on the relay and verify that there is continuity ***(beep! beep!)***. This implies a **CLOSED** circuit, continuity.

NOTICE

Activating the test button while the unit is running will shunt trip the main circuit breaker. Only perform with no load on the generator.

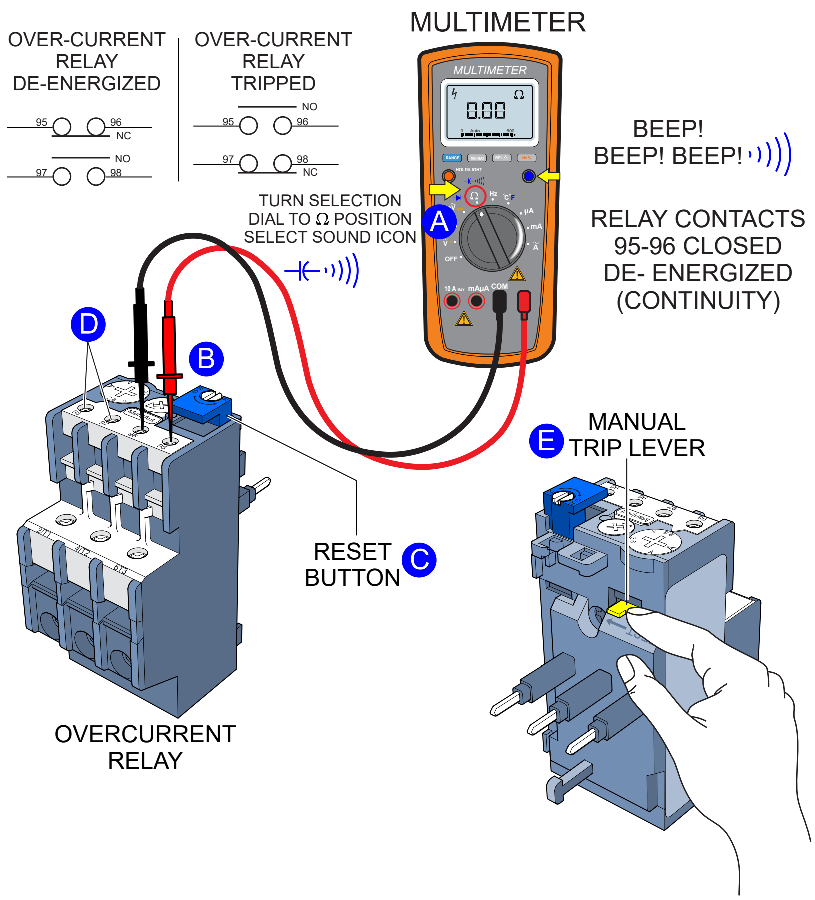


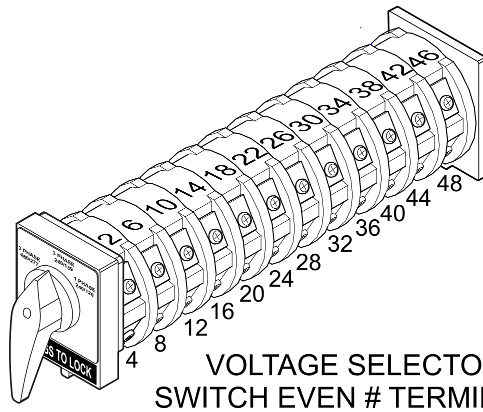
Figure 60. OCR Trip Test

VOLTAGE SELECTOR SWITCH INTERNAL CONNECTIONS BETWEEN TERMINALS

3-PHASE 480/277	3-PHASE 240/139	1-PHASE 240/120
-	-	1~2
-	-	3~4
-	-	5~6
-	9~10	
-	9~10	9~10
-	-	11~12
15~16		-
15~16	17~18	
~	19~20	
~	19~20	19~20
21~22	-	-
23~24	23~24	-
-	-	25~26
-	27~28	-
-	29-30	-
33~34		31~32
33-34	33~34	-
35~36	37~38	
-	37~38	37~38
-	-	39~40
43~44		41~42
43-44	43~44	-

DCA25SSI, DCA45SSI, DCA60SSI, DCA70SSI, DCA70SSJ, DCA100SSJ, DCA100SSV, DCA125SSI DCA125SSJ, DCA150SSI, DCA150SSJ AND DCA150SSV. USE 44 TERMINAL VSS.

TERMINAL NUMBERS



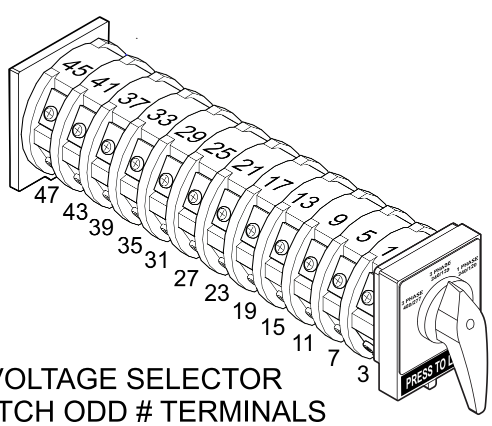
VOLTAGE SELECTOR SWITCH EVEN # TERMINALS

VOLTAGE SELECTOR SWITCH INTERNAL CONNECTIONS BETWEEN TERMINALS

3-PHASE 480/277	3-PHASE 240/139	1-PHASE 240/120
-	-	1~2
-	-	3~4
-	-	5~6
-	9~10	
-	9~10	9~10
-	-	11~12
15~16		-
15~16	17~18	
~	19~20	
~	19~20	19~20
21~22	-	-
23~24	23~24	-
-	-	25~26
-	27~28	-
-	29-30	-
33~34		31~32
33-34	33~34	-
35~36	37~38	
-	37~38	37~38
-	-	39~40
43~44		41~42
45~46		-
45~46	45~46	-
-	-	47~48

DCA25USI, DCA45USU, DCA70USU, DCA85USI, DCA125USJ AND DCA150USJ. USE 48 TERMINAL VSS.

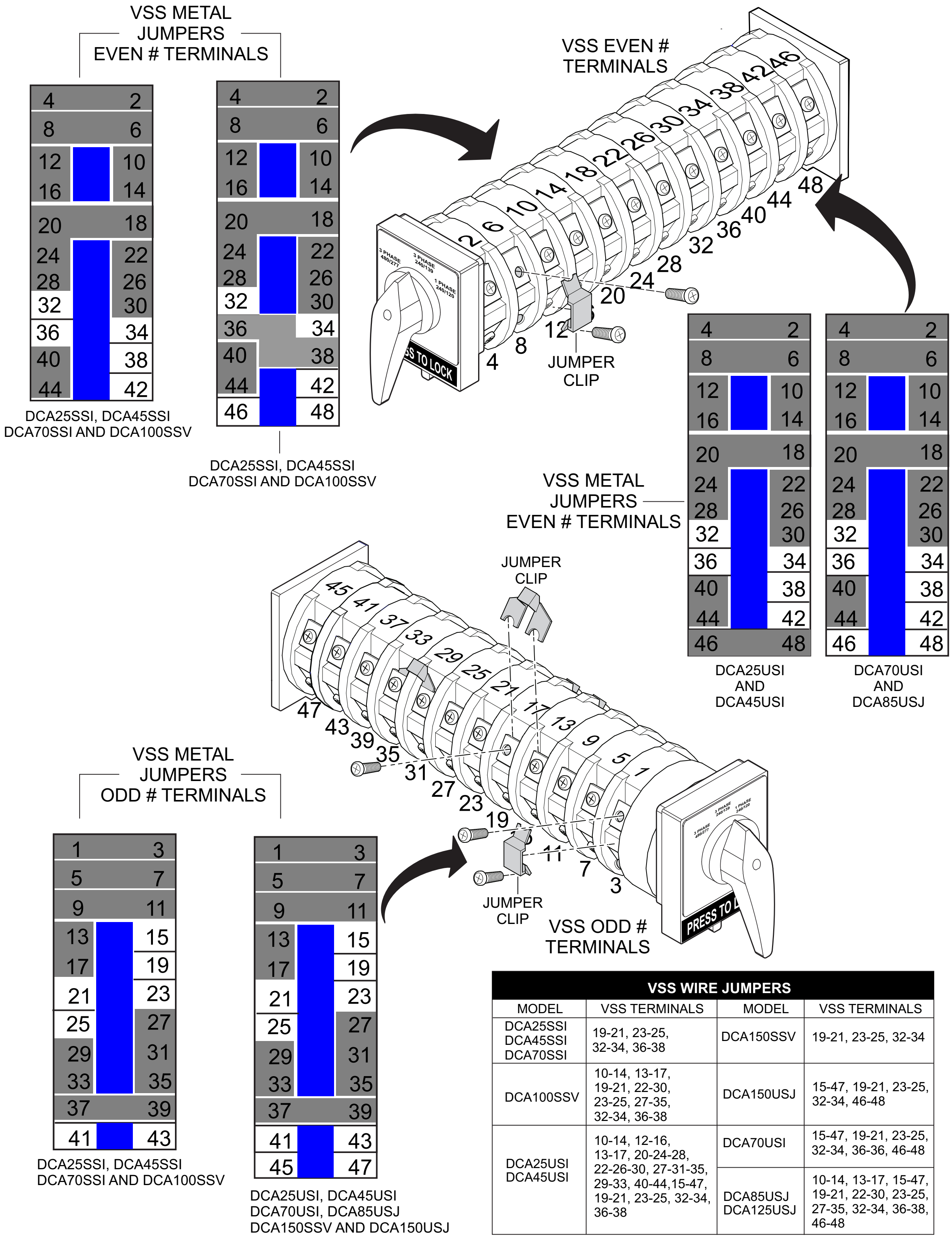
TERMINAL NUMBERS



VOLTAGE SELECTOR SWITCH ODD # TERMINALS

Figure 61. Voltage Selector Switch

Figure 62 shows the metal and wire jumper placement onto the voltage selector switch.



VSS WIRE JUMPERS

MODEL	VSS TERMINALS	MODEL	VSS TERMINALS
DCA25SSI DCA45SSI DCA70SSI	19-21, 23-25, 32-34, 36-38	DCA150SSV	19-21, 23-25, 32-34
DCA100SSV	10-14, 13-17, 19-21, 22-30, 23-25, 27-35, 32-34, 36-38	DCA150USJ	15-47, 19-21, 23-25, 32-34, 46-48
DCA25USI DCA45USI	10-14, 12-16, 13-17, 20-24-28, 22-26-30, 27-31-35, 29-33, 40-44,15-47, 19-21, 23-25, 32-34, 36-38	DCA70USI	15-47, 19-21, 23-25, 32-34, 36-36, 46-48
		DCA85USJ DCA125USJ	10-14, 13-17, 15-47, 19-21, 22-30, 23-25, 27-35, 32-34, 36-38, 46-48

Figure 62. VSS Metal Jumper Placement

GFCI

A ***ground fault circuit interrupter*** (GFCI) is a device that compares the amount of current flowing through a circuit. If there is a difference of more than 5 milliamps (0.005 amps), the GFCI will ***open*** the circuit as leakage is present within the circuit.

The GFCI is designed to protect people from ***severe or fatal electric shocks*** but because a GFCI detects ground faults, it can also prevent some electrical fires and reduce the severity of other fires by interrupting the flow of electric current.

What Are The Limitations Of A GFCI?

- The GFCI module should never be used as a circuit tester. The GFCI does not have the capability to do circuit testing or analysis. Multimeters or similar devices should be used for circuit analysis or troubleshooting, not a GFCI. The GFCI makes an excellent life protection device.
- GFCIs do not prevent shocks, they reduce the severity of the shock. The GFCI is only operated when a ground fault occurs. Someone using the equipment might receive a shock, but it will be of a very short duration (1/30 of a second) if the GFCI is working as designed. Severe electrocution will normally be prevented because of the short duration.
- GFCIs do not prevent all electrocutions. The GFCI reacts to electric current flowing from the power line to ground. It does not react to current flow between power lines. In other words, the GFCI will react to someone standing in water and coming in contact with one of the power lines. It will not protect someone who is holding the neutral power line in one hand and hot wire with the other.
- GFCIs are not intended to replace fuses or circuit breakers. Fuses and circuit breakers are designed to protect equipment by reacting to excessive current flow, normally on the order of 15 to 20 amps.
- GFCIs are designed to protect people by reacting to leakage currents to ground on the order of 5 mA (0.005 amps). Except in the case of GFCI/circuit breaker combinations sold to be installed in building installations, they are separate devices performing separate functions.

Is The Ground Wire Still Required?

The GFCI will work and perform its function with or without the tool being grounded. For applications, always consult the National Electrical Code for proper grounding conditions and requirements.

How Can We Be Sure The GFCI Is Working?

There are two methods of testing GFCIs. All GFCIs are provided with a test button and a reset button.

GFCI Method 1 Testing

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

1. Start the generator as outlined in the start-up procedure in the operation manual.
2. Place a GFCI circuit breaker (Figure 63) in the **ON** position.

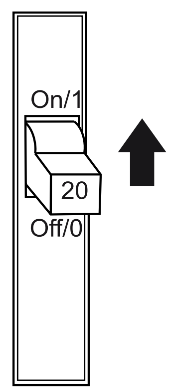


Figure 63. GFCI Circuit Breaker

3. Verify that the status LED (Figure 64) on the corresponding GFCI receptacle is **ON (GREEN)**.

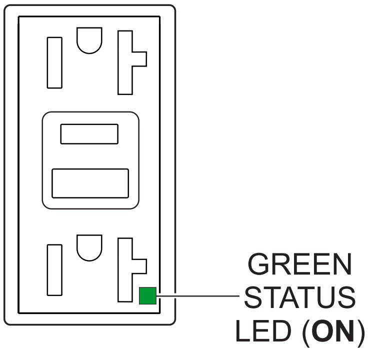


Figure 64. GFCI Receptacle (ON)

4. Press the **TEST** button (Figure 65) on the GFCI receptacle and verify that the status LED turns **OFF**.

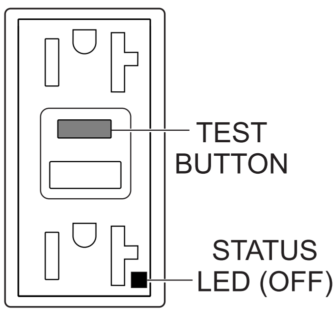


Figure 65. GFCI Receptacle (OFF)

5. Press the **RESET** button (Figure 66) to restore power to the GFCI receptacle and verify that the status LED is **ON (GREEN)**.

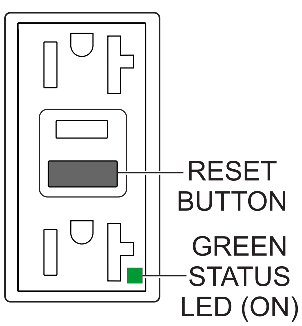


Figure 66. GFCI Receptacle (ON/Restore)

6. If the status LED (Figure 67) is **flashing (RED)**, **DO NOT** use the GFCI receptacle and replace it immediately.

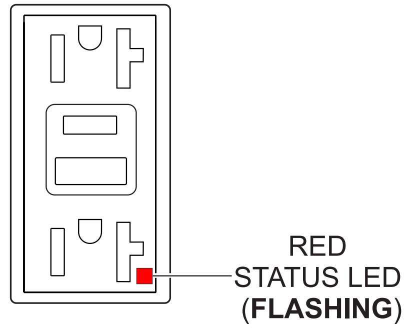


Figure 67. GFCI Receptacle (RED Flashing LED)

GFCI Method 2 Testing

To measure the ***trip current*** of a GFCI requires a *GFCI tester* (Figure 68). Insert the GFCI tester into the GFCI receptacle.

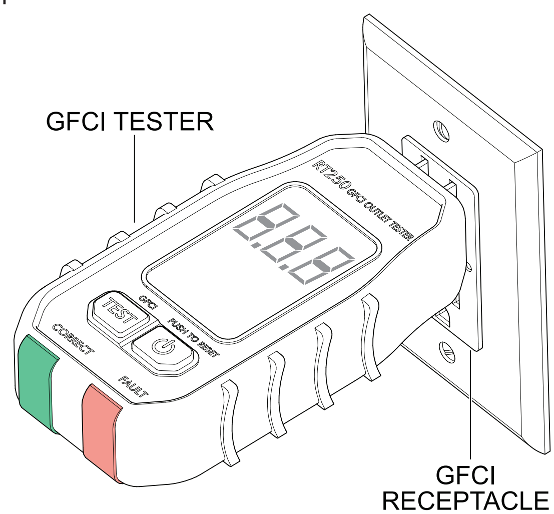


Figure 68. GFCI Tester

The tester will determine if the GFCI is working correctly. The GFCI will "sense" the difference in the amount of electricity flowing into the circuit to that flowing out. This trip value is typically ***four*** to ***six*** milliamps.

The GFCI reacts quickly (less than one-tenth of a second) to trip or shut off the circuit.

One test that should not be performed on a GFCI is a ***high-load test***. The GFCI contains small electronic parts that are damaged if high voltages are applied to them. **DO NOT** test any GFCI on a HI-POT, dialectic, or Doyle-type tester.

FUEL PUMP RELAY

The ***fuel pump relay***, sometimes called a ***run*** or ***ignition*** relay, provides the DC voltage to the fuel pump. The fuel pump relay in some generators is mounted onto a base with terminals to allow connections. Other types of fuel pump relays used in some generator models do not require a base and are direct wired.

Testing the fuel relay is simple and does not require any special tooling with the exception of a multimeter and proper battery voltage, 12 VDC or 24 VDC, depending on the system being used. The layout of contacts on the fuel pump relay is shown in Figure 69.

Some fuel pump relays have a suppression diode installed across the coil to prevent back feed. Other fuel pump relays used in some generator models may not have this suppression diode installed. Symptoms for a possible failed relay are engine cranking with no start.

Testing And Inspection

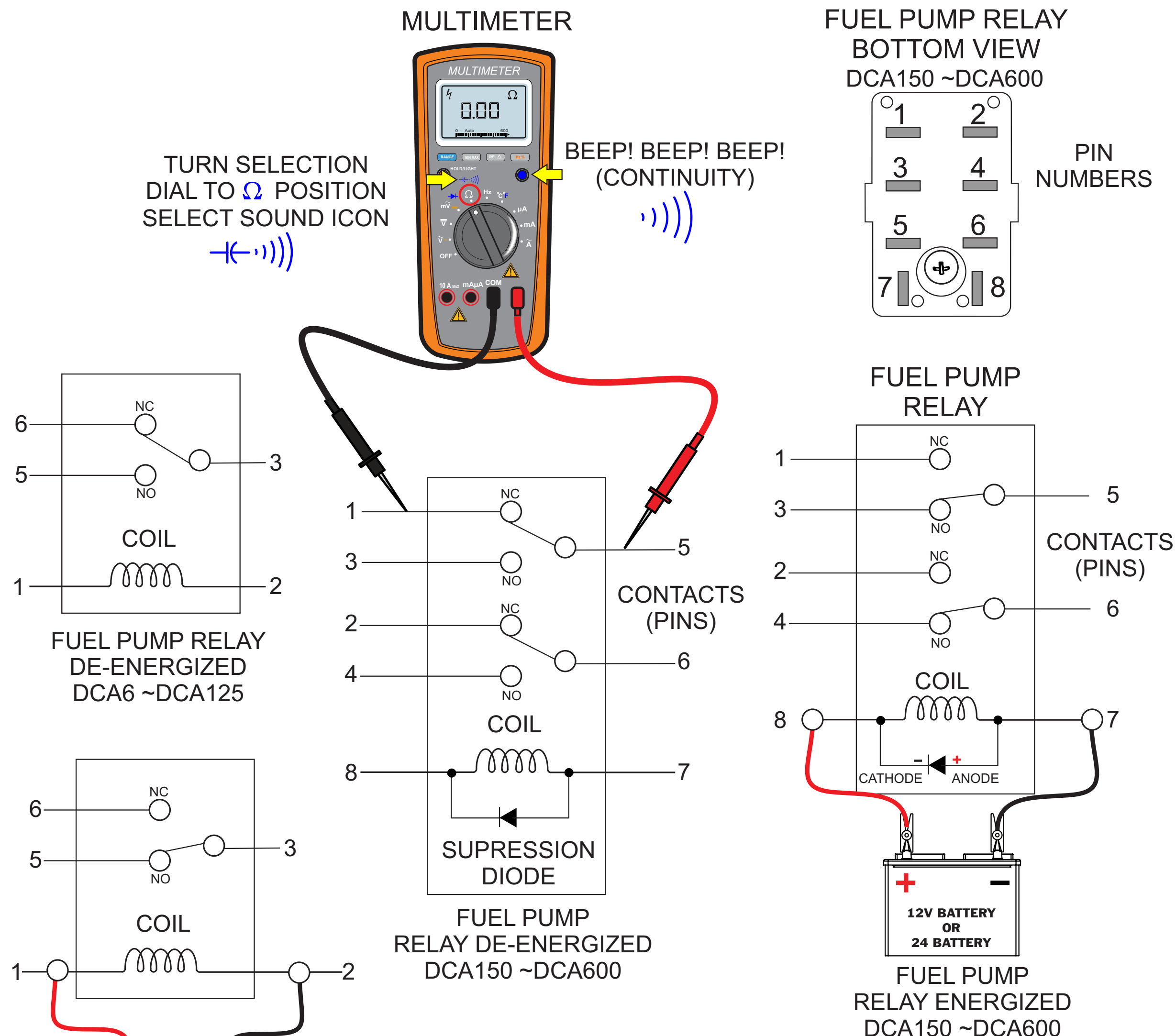
1. Remove the fuel pump relay from its base holder (DCA150 – DCA600 generators). For DCA6 – DCA125 generators, disconnect wiring from relay terminals. Be sure to mark and tag terminals for reconnections.
2. Using a multimeter, measure the continuity between the contact pins as referenced in “Fuel Pump Relay De-Energized Table” (Figure 69**A**).
3. Next, apply either 12 VDC or 24 VDC to the coil at pin 8 and apply a ground to pin 7 (DCA150 – DCA600 generators). Measure the continuity between the contact pins as referenced in “Fuel Pump Relay Energized Table” (Figure 69**B**).
4. For DCA6 – DCA125 generators, apply 12 VDC to the coil at pin 1 and apply a ground to pin 2. Measure the continuity between the contact pins as referenced in “Fuel Pump Relay Energized Table” (Figure 69**B**).
5. Reinstall the fuel pump relay back into its base holder (DCA150 – DCA600 generators) or reconnect the wires (DCA6 – DCA125 generators) and attempt to start the engine.
6. If the engine does not start, check DC voltage across the relay coil, and pins 7 and 8 on DCA150 – DCA600 generators or pins 1 and 2 on DCA6 – DCA125 generators.
7. If the DC voltage is not present at the relay coil along with a known good ground, refer to associated wiring diagram to trace relay DC signal path.

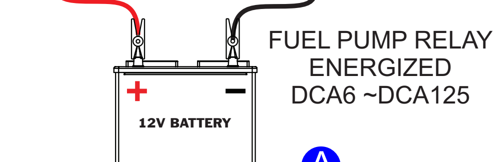
Relay Base Holder Testing And Inspection (DCA150 – DCA600 Generators Only)

If the fuel pump relay tested normal, the problem may be within the ***relay base holder***. DCA6 – DCA125 generators do have a fuel pump relay base holder. The fuel pump relay base holder is not a ‘sealed type’ and is susceptible to corrosion and dirt.

This condition can cause the continuity between the relay pins and the base holder to be compromised. To ensure good continuity between the relay and its base holder, cleaning the base holder is required. Perform the procedure below when cleaning of the relay base holder is required.

- Remove the fuel pump relay from its base holder and spray dielectric cleaner onto the contact pins on the relay base holder.
- With compressed air, not to exceed 110 psi (758 kPa), blow off any dirt and debris that may have accumulated within the relay base holder contact pins.
- Reinstall the fuel pump relay back into its base holder and attempt to start engine. If engine still does not start, relay base holder ***may*** need to be replaced.





B

FUEL PUMP RELAY ENERGIZED DCA6 ~ DCA125		
PIN NO.	CONTINUITY	MEASUREMENT
3 AND 6	NO	OPEN CONTACTS
3 AND 5	YES	CLOSED CONTACTS
1	N/A	APPLY +12 VDC
2	N/A	APPLY GND
FUEL PUMP RELAY ENERGIZED DCA150 ~ DCA600		
1 AND 5	NO	OPEN CONTACTS
3 AND 5	YES	CLOSED CONTACTS
2 AND 6	YES	OPEN CONTACTS
4 AND 6	NO	CLOSED CONTACTS
8	N/A	APPLY +12 VDC APPLY +24 VDC
7	N/A	APPLY GND

A

FUEL PUMP RELAY DE-ENERGIZED DCA6 ~ DCA125		
PIN NO.	CONTINUITY	MEASUREMENT
3 AND 6	YES	CLOSED CONTACTS
3 AND 5	NO	OPEN CONTACTS
1 AND 2	N/A	160 OHMS (12V)
FUEL PUMP RELAY DE-ENERGIZED DCA150 ~ DCA600		
1 AND 5	YES	CLOSED CONTACTS
3 AND 5	NO	OPEN CONTACTS
2 AND 6	YES	CLOSED CONTACTS
4 AND 6	NO	OPEN CONTACTS
8 AND 7	N/A	160 OHMS (12V) 60 OHMS (24V)

Figure 69. Fuel Pump Relay Pin Call-Outs

ENGINE START (CRANK) RELAY

For use on DCA20, 25, 36, 45, 70 (Isuzu), and 125 generators. See next page for other model generators.

As shown in Figure 70, a typical starter solenoid has one small terminal for the starter control wire and two large terminals for the positive battery cable and the thick wire that provides power to the starter motor. The B+ battery terminal connects the solenoid directly to the positive battery cable.

The B+ battery voltage is also connected to the normally open contact on the starter relay (pin 2). When the starter relay is energized at pin 3 ***(coil)*** by the ECU ***crank signal output*** (pin 6), this will cause the normally open contact to close and the voltage is sent via pin 1 of the starter relay to the starter solenoid (crank signal "S").

Pin 4 on the starter relay is provided a ground signal via the ***starter cut relay*** (pins 3 and 6). The starter cut relay is controlled by the engine control module (ECM). Pin 1 on the starter cut relay is connected to B+ via the ECM controller while pin 2 is provided a ground signal via the ECM controller.

Once the engine has started, the engine ECM will send a ground signal to pin 2 of the starter cut relay, which will cause the starter crank relay to be de-energized (the ground signal is removed from pin 4 on the starter crank relay), thus ending the cranking cycle.

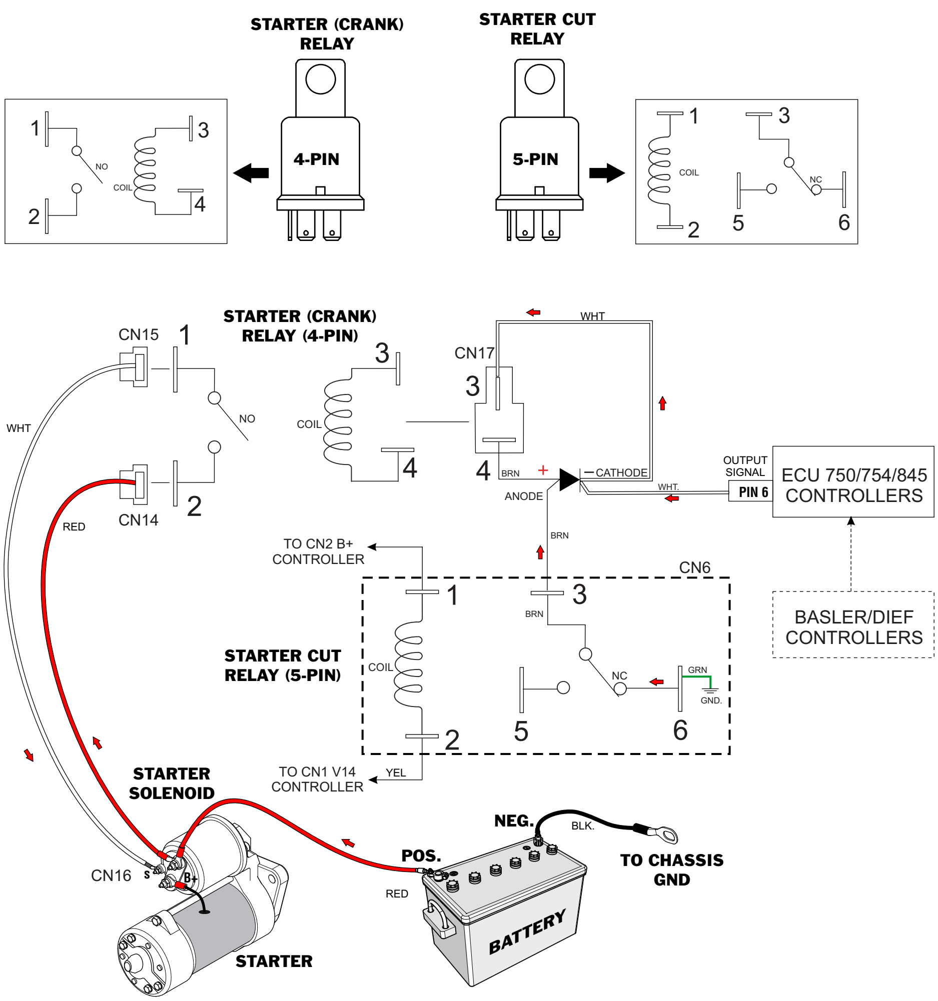


Figure 70. 4-Pin Starter (Crank) Relay

ENGINE START (CRANK) RELAY

For use on DCA70, 150, 180, 220 and 300 generators (John Deere engines). See previous page for other model generators.

As shown in Figure 71, a typical starter solenoid has one small terminal for the starter control wire and two large terminals for the positive battery cable and the thick wire that provides power to the starter motor. The B+ battery terminal connects the solenoid directly to the positive battery cable.

The B+ battery voltage is also connected to the normally open contact on the starter relay (terminal 4). When the starter relay is energized at terminal 2 ***(coil)*** by the ECU ***crank output signal*** (pin 5), this will cause the normally open contacts (terminals 1 and 4) to close and the voltage is sent via terminal 1 of the starter relay to the starter solenoid (crank signal "S"). Terminal 3 on the starter relay is always connected to chassis ground.

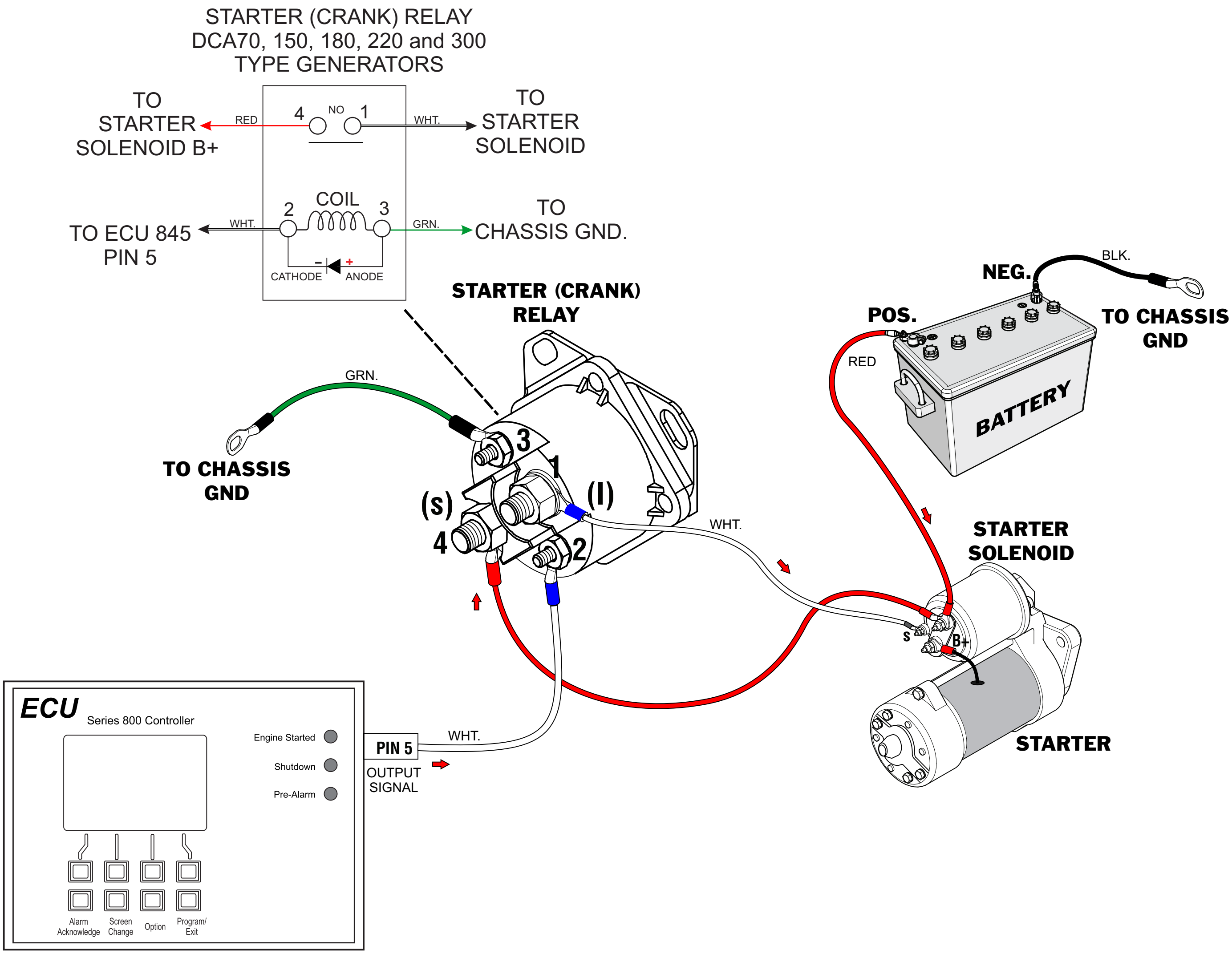


Figure 71. 4-Terminal Round Starter (Crank) Relay

ENGINE GLOW PLUG RELAY (ISUZU ENGINES ONLY)

The engine ***glow plug relay*** (Figure 72) is connected to the engine glow plugs and directly to the battery via a 65-amp fuse for pre-heating. This relay is controlled by the engine control module (ECM).

The coil of the glow plug relay (pins 3 and 4) is controlled by the ECM. Pin 3 is connected to B+ while pin 4 is waiting to received a ground signal from the ECM. Once the ground signal is received on pin 4, the normally open contact will be closed and +12 VDC will be sent to the glow plugs. When the warming of the glow plugs has been completed, the ground signal will be removed from pin 4.

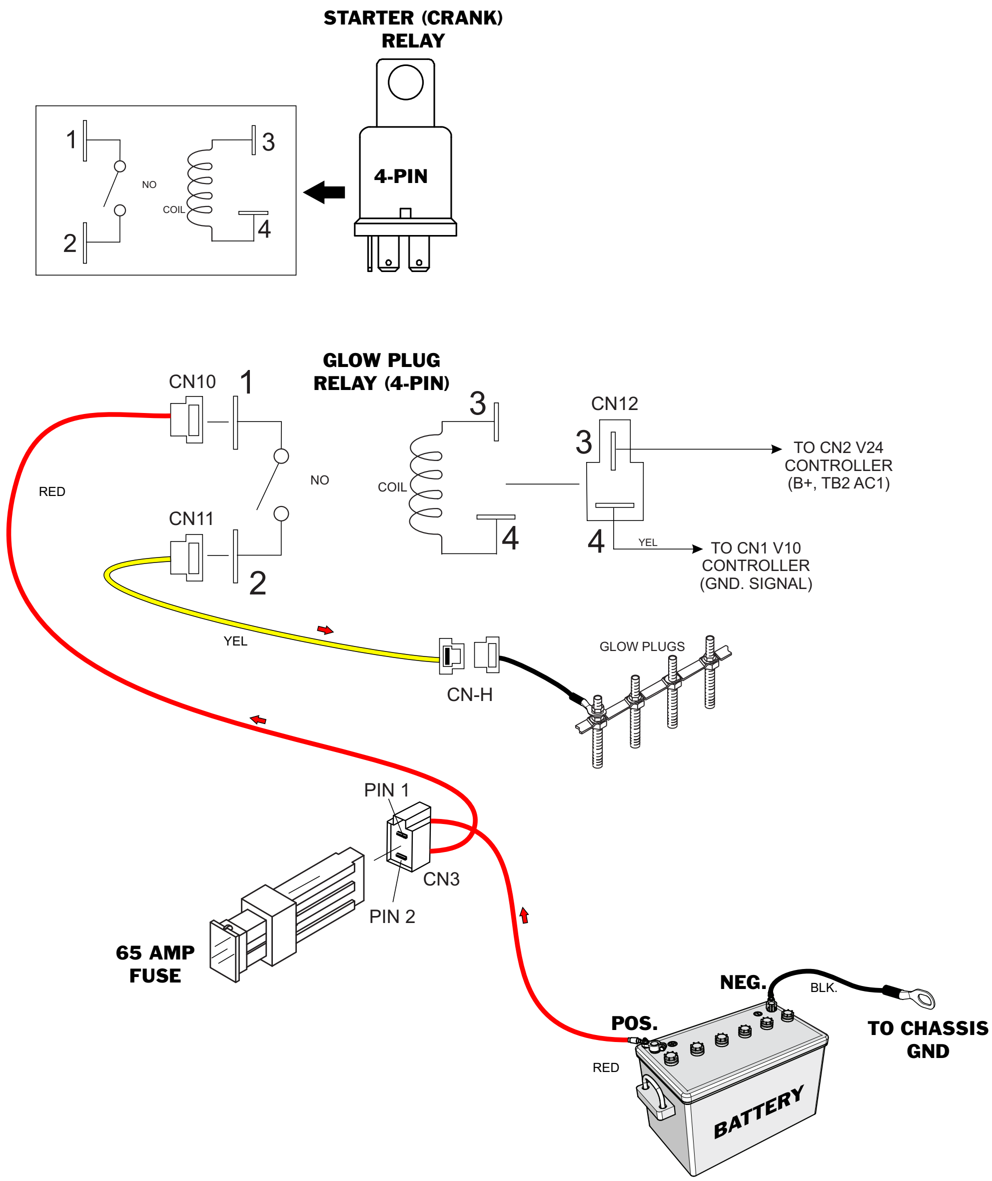


Figure 72. Glow Plug Relay

MAGNETIC PICK UP (MPU)

The magnetic pick-up (MPU) is an electromagnetic sensor and is mounted in the flywheel bell housing of the engine. When a tooth from the engine flywheel passes under the tip of the sensor, electrical impulses are induced within the coil of the MPU and transmitted to the ***electronic control module*** (ECM).

This electrical impulse signal is expressed in hertz (Hz) and is directly proportional to the engine speed. The ECU uses this signal to determine engine speed.

MPU Continuity Test

1. Place the multimeter test leads across pins 1 and 2 on the ECU ***auto-start module*** as shown in Figure 73.

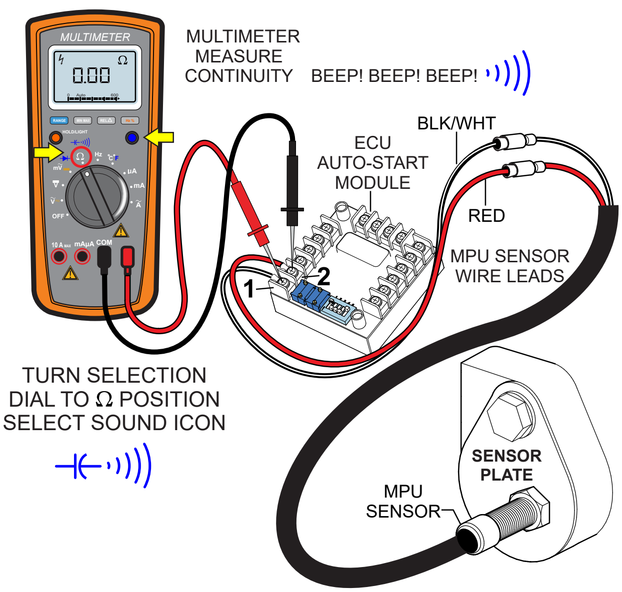


Figure 73. MPU Continuity Test

2. Set the multimeter selection dial to the ***sound*** position and verify that there is continuity ***(beep!)*** between the pin 1 **(BLACK/WHITE)** and pin 2 **(RED)** wire leads on the ECU ***auto-start module*** as referenced in Figure 73.

3. If the multimeter reads **OPEN** (no continuity or beep), replace the MPU sensor.

MPU AC Voltage Test

1. With the multimeter test leads still placed across pins 1 and 2 on the ECU ***auto-start module***, set the multimeter selection dial to the ***AC Volts*** position (Figure 74).

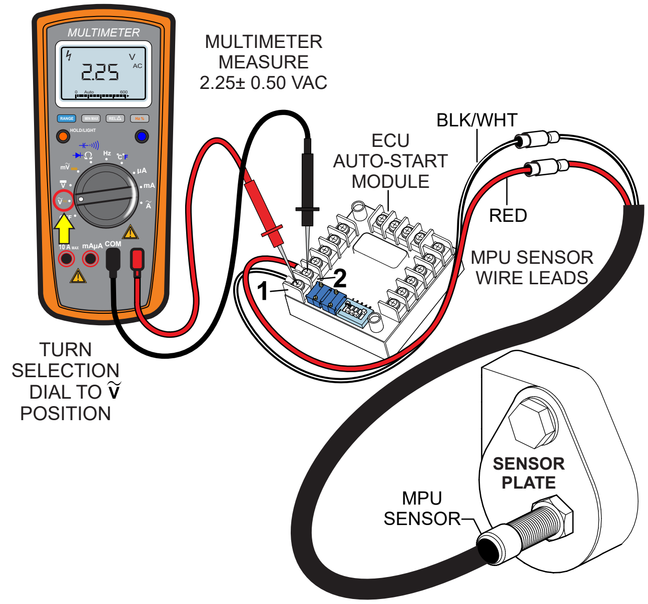


Figure 74. MPU Voltage Test

2. Now crank the engine (engine will not start) and verify that the multimeter reads between 2.25 ± 0.50 VAC.

3. If a low voltage reading is obtained, reference the "MPU Installation and Adjustment" section.

MPU Installation And Adjustment

1. Loosen the jam nut that secures the MPU to the sensor plate.

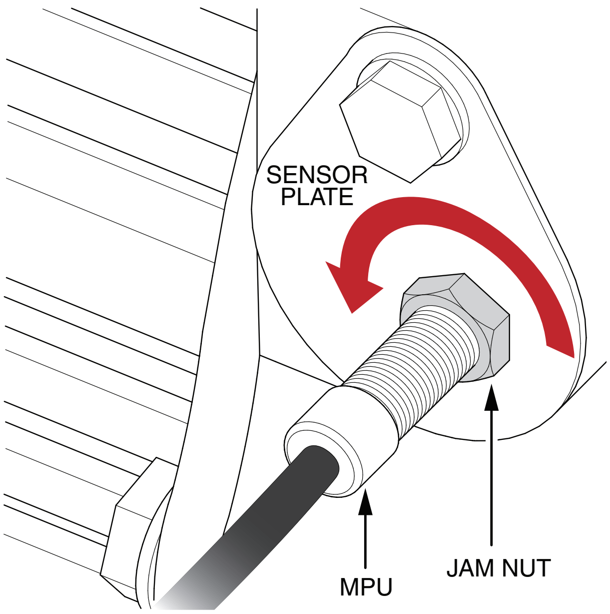


Figure 75. MPU Removal

2. Remove MPU.
3. Next, visually view the ***flywheel teeth*** through the hole opening on the sensor plate.

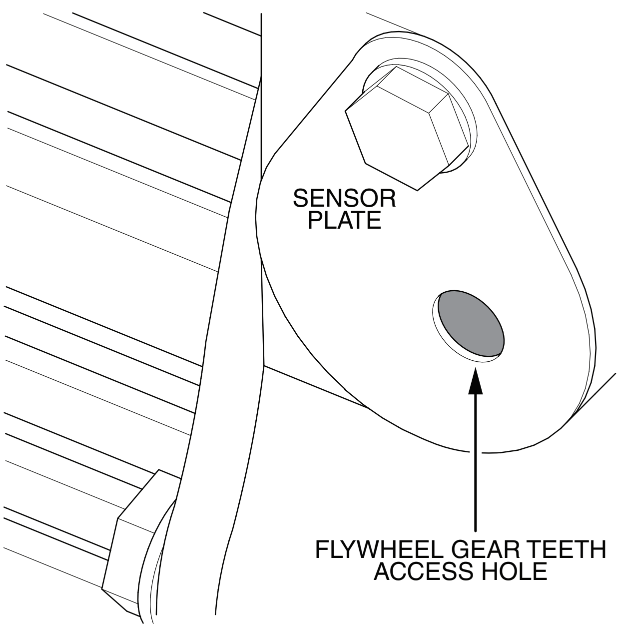


Figure 76. Gear Teeth Access Hole

4. Attach a ratchet to the crankshaft pulley and rotate the flywheel gear until the ***highest point*** of the flywheel gear tooth is visible as shown in Figure 77.

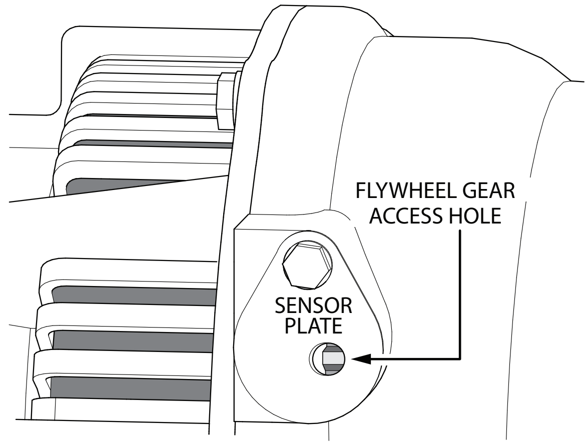


Figure 77. Flywheel Gear Teeth Alignment

5. Reinstall the MPU sensor back into the sensor plate. Continue screwing the MPU sensor clockwise until contact is made with the flywheel gear tooth (Figure 78).

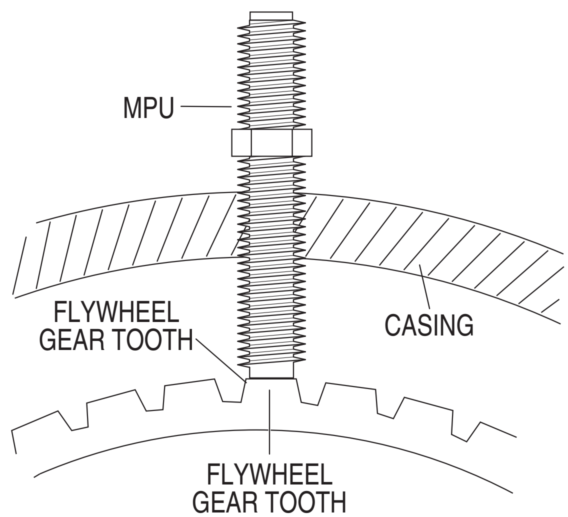


Figure 78. Gear Tooth MPU Contact

6. After making contact with the flywheel gear tooth, unscrew the MPU sensor counterclockwise ***1/2 turn***. Reference Figure 79.

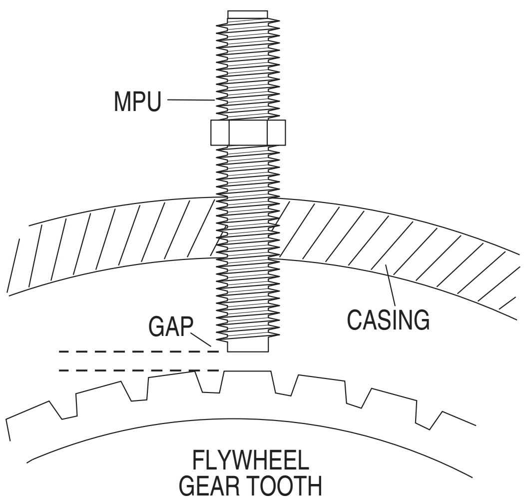


Figure 79. MPU Flywheel Gap

7. Verify that the MPU sensor does not make contact with the flywheel by rotating the flywheel gear completely around. Flywheel should rotate freely.

8. The MPU sensor-flywheel gear gap should be adjusted so that the minimum voltage required is attained while the engine is in crank status. The voltage setting we are looking to obtain is 2.25 ± 0.50 VAC.

9. Once the correct gap is obtained, tighten the MPU sensor jam nut to secure it to the sensor plate.

FUEL FEED PUMP STRAINER

The fuel pump strainer is used on all DCA generators equipped with Isuzu engines.

> ***NOTICE***
>
> When replacing fuel pump strainer always replace banjo bolt and gasket.

The fuel feed pump strainer is located inside the banjo bolt which is attached to the fuel-water separator as shown in Figure 80. Inspecting and cleaning the fuel strainer is considered part of regular maintenance. If the strainer becomes clogged, remove it from the banjo bolt and clean it with clean, fresh diesel fuel. If the fuel strainer cannot be cleaned, replace it.

Examples of a clogged strainer are:

- Hard starting
- Engine runs rough
- White smoke emitting from exhaust

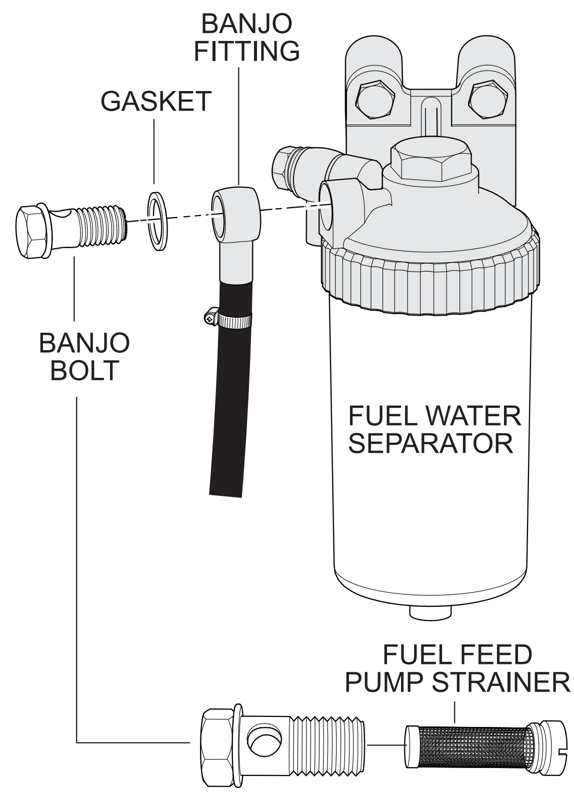


Figure 80. Fuel Feed Pump Strainer

Below is a list of typically asked questions received by the MQ Power Service Department.

<u>**Question:**</u>

Why are the 50-amp twist-lock receptacles not working. No output voltage?

<u>**Answer (DCA6 – DCA150 Models):**</u>

The 50-amp twist-lock receptacles only work (voltage output) when the ***voltage selector switch*** is placed in the 1Ø 240/120V position. When the voltage selector switch is placed in any of the 3Ø positions, the receptacles have no voltage output.

NOTICE

Main and auxilliary breakers must be in the **CLOSED** position in order to obtain voltage at the 50-amp CS6369 twist-lock receptacles.

<u>**Answer (DCA180 – DCA600 Models):**</u>

The 50-amp CS6369 twist-lock receptacles can be used anytime during operation. Voltage can be adjusted using the voltage control regulator located on the control panel.

CAUTION

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

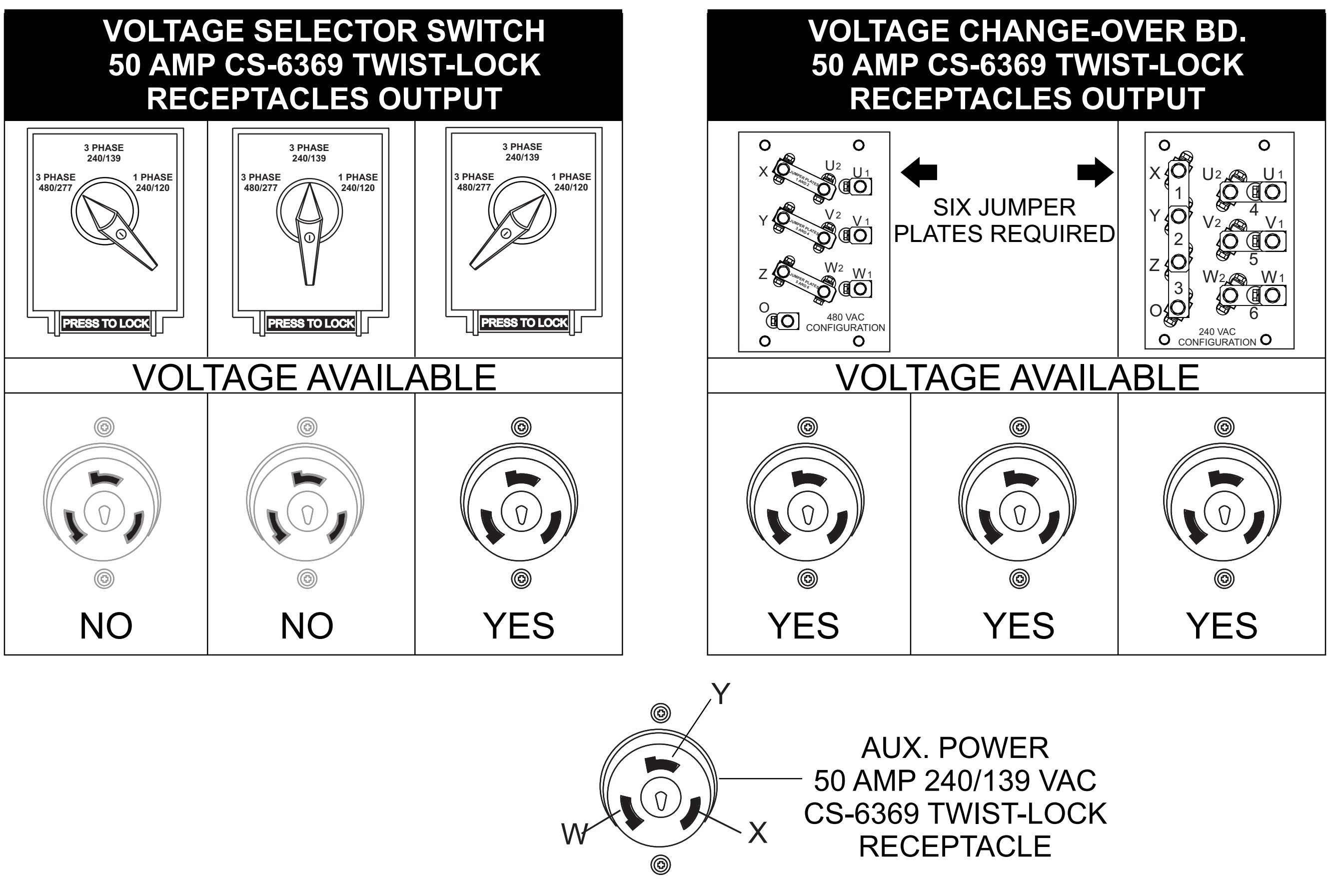


Figure 81. 50-Amp CS6369 Twist-Lock Receptacle

Question:

The main circuit breaker will not reset?

Answer:

The ***overcurrent relay*** (OCR) has been tripped and needs to be reset before the main breaker can be reset. The OCR trips when maximum amperage capacity has been exceeded.

To reset the OCR, simply press down on the reset button as shown in Figure 82. Reset button is spring loaded. If the OCR is tripped, a slight click will be felt when pushing down the reset button.

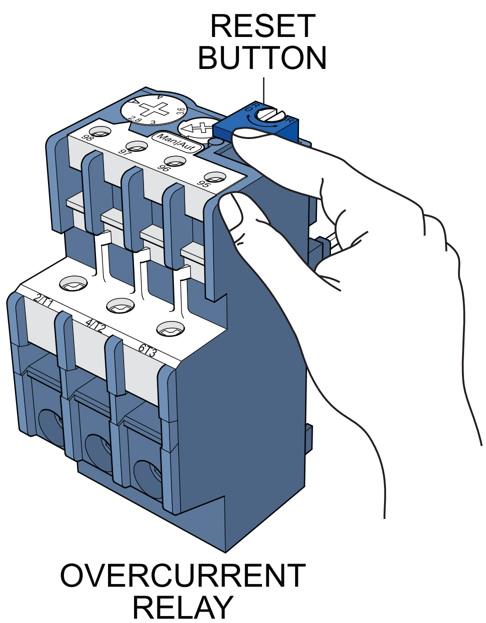


Figure 82. Reset Button

Question:

I replaced the engine temperature sensor but the engine still shuts down with the high temperature indicator on. Why?

Answer:

The engines have two types of triggers — one is for gauges (sensor) and one is for engine shutdown (switch). When replacing, ensure you are replacing the correct part.

Sensors — Provide a resistance reading depending on temperature.

Switches — Either open or close to ground depending on temperature.

This rule also applies to the oil pressure sensor and switch.

Question:

Does the generator end bearing require servicing?

Answer:

No. All current model generators **DO NOT** require any bearing maintenance.

Ammeter — An instrument for measuring the magnitude of an electrical current.

Amperage (Amps) —The strength of an electrical current measured in amperes.

Armature — That part of a generator or of an electric motor in which a current is induced by a magnetic field. The armature usually consists of a series of coils or groups of insulated conductors surrounding a core of iron. See ***Armature*** in the ***Generator Theory*** section for more information.

Automatic Voltage Regulator (AVR) — Increases or decreases exciter current for a more linear voltage and frequency.

Brushless Design —The purpose of the generator brush is to absorb power from the rotating armature of a generator and supply it to the stationary part of the generator. These brushes have a short life due to erosion. Multiquip's unique brushless design calls for less maintenance and a longer generator life.

Circuit Breaker (CB) — A mechanical switching device capable of making, carrying, and breaking currents under normal circuit conditions and also making, carrying for a specific time, and automatically breaking currents under specified abnormal circuit conditions such as a short circuit.

Controller — Starts and stops the generator. In addition, it monitors the following engine operating parameters:

- **Low Oil Pressure**
- **High Coolant Temperature**
- **Overcrank Shutdown**
- **Overspeed Shutdown**
- **Engine Running**

Diode — A device which allows current to pass in one direction only. It may be used as a rectifying element.

ECM — Commonly referred to as the ***Engine Control Module***. This module is provided by the engine manufacturer. Its main purpose is regulating fuel to meet emission standards.

Exciter — A device for supplying excitation to the generator field. It may be a rotating DC, AC with rectifiers, or a static device converting AC to DC.

Frequency (Hz) — Frequency is the number of complete cycles per second in alternating current direction. The standard unit of frequency is the hertz, abbreviated Hz. If a current completes one cycle per second, then the frequency is 1 Hz; 60 cycles per second equals 60 Hz.

Ground Fault Circuit Interrupter (GFCI) — GFCIs are a protective device specifically designed to break the circuit every time there is an imbalance between incoming and outgoing current.

The GFCI receptacle protects electrical wiring from overheating and possible fire, greatly minimizing the risk of shock injuries and fatal burns. It also detects ground faults and disrupts the flow of current, but should not be used to replace a fuse, as it does not offer protection against short circuits and overloading.

Heat Rise — Directly related to the longevity of the generator. Reference the Heat Rise section in this manual to understand why MQ Power-designed generators are the leader in the industry.

Kilovolt-Ampere (kVA) — Equal to 1,000 volt-amperes. Electrical power is measured in watts (W): The voltage multiplied by the current measured each instant. In a direct-current system or for resistive loads, the wattage and VA measurements will be identical.

Kilowatt (kW) — A kilowatt is a unit of power. One kilowatt is equal to one thousand watts.

Megohmmeter — An electric meter that measures very high resistance values by sending a high-voltage signal into the object being tested. This type of meter provides a quick and easy way to determine the condition (resistance) of the insulation on wires, generators, and motor windings.

NEMA — National Electrical Manufacturers Association, a nonprofit trade association supported by the manufacturers of electrical apparatus and supplies. NEMA is engaged in standardization to facilitate understanding between the manufacturers and users of electrical products.

For more information about NEMA and their standards, visit their website at http://www.nema.org/.

Ohm (Ω) — Unit of electrical resistance. One volt will cause a current of one ampere to flow through a resistance of one ohm.

Ohmmeter — A device for measuring electrical resistance.

Permanent Magnetic Generator (PMG) — The PMG eliminates the excitation losses in the rotor, which otherwise typically represent 20–30% of the total generator losses. It also gives a lower temperature rise in the generator.

Rheostat (VR) — Electrical resistor used to control a current by varying the resistance.

Short Circuit — An electrical circuit that allows current to travel along a ***different path*** from the one originally intended. The electrical opposite of a short circuit is an ***open circuit***, which is an infinite resistance between two nodes.

It is common to misuse the term 'short circuit' to describe any electrical malfunction, regardless of the actual problem. Damage from short circuits can be reduced or prevented by employing fuses, circuit breakers, or other overload protection, which disconnect the power in reaction to excessive current.

Single-Phase (1Ø) Power — Is typically 120 or 240 VAC that is carried between two wires, ***line*** and ***neutral*** and a third ***ground*** wire for safety. The frequency of the AC voltage is typically 60 Hz. 1Ø power is used in many applications. For example, 1Ø power is used to power all typical home electrical appliances.

Sound Level — Generator sound level is measured in decibels (dB). Ratings are typically published at 23 feet (7 meters).

Surge Protection Components — Surge protection devices attempt to regulate the voltage supplied to an electric device by either blocking or by shorting to ground voltages above a safe threshold.

- **Varistor** —An electronic component with a "diode-like" voltage characteristic. Varistors are used to protect circuits against excessive transient voltages by incorporating them into the circuit in such a way that, when triggered, they shunt the current created by the high voltage away from the sensitive components.

  A varistor is also known as a ***voltage dependent resistor*** (VDR). A varistor's function is to conduct significantly increased current when voltage is excessive.

- **Metal Oxide Varistor** — The metal oxide varistor (MOV) contains a material, typically granular zinc oxide, that conducts current (shorts) when presented with a voltage above its rated voltage. MOVs typically limit voltages to about 3 to 4 times the normal circuit voltage by diverting surge current elsewhere.

  MOVs have finite life expectancy and 'degrade' when exposed to a few large transients, or many more smaller transients. ***Degrading*** is the normal failure mode. MOVs that fail shorted are so small as to violate the MOV's ***absolute maximum ratings***. MOVs usually are thermal fused or otherwise protected to avoid short circuits and other fire hazards.

- **Zener Diode** — A silicon semiconductor device that permits current to flow in either a ***forward*** or ***reverse*** direction. The diode consists of a special, heavily doped P-N junction, designed to conduct in the reverse direction when a certain specified voltage is reached.

- **Diode** — An electrical component that allows the current to flow in only ***one direction***. It may be used as a rectifying element.

Three-Phase (3Ø) AC Power — Three-phase AC power is a type of polyphase system employing ***three wires*** (or four including an optional neutral return wire). Voltage is carried through three conductors, each 120 degrees out of phase with the other two. Three-phase AC power provides a more efficient means of supplying power to large electrical loads like motors.

Volt-Ampere (VA) — An International System (SI) unit for the apparent power in an electrical circuit. The apparent power equals the product of root mean square voltage (in volts) and root mean square current (in amperes).

Voltage (V) — The difference of electrical potential between any two conductors.

Voltmeter — Measures voltage, current, and resistance in electronic circuits. Also used to perform continuity tests.

Watt (W) — An International System (SI) unit of power equal to one joule per second, the power dissipated by a current of 1 ampere flowing across a resistance of 1 ohm.

Table 6. Alternator Resistance Values								
Generator ID		Resistance Measured In Ohms (Ω)						
Generator Model	Gen-Set Model #	Main		Exciter		Main Armature (AVR Inputs)	
		Column A (Armature)	Column B (Field)	Column C (Armature)	Column D (Field)	Column E (Coil)	Column F (Coil)
		AC Outputs	DC+ DC–	U V W	J+ K–	A–B / C–D / D–A	B–C
DA7000SSA3	–	0.165	6.30	0.69	2.0	–	–
DAC7000SSA3	–	0.165	6.30	0.69	2.0	–	–
TLG8SSK4F2	–	0.155	6.54	0.90	11.5	0.37	1.05
DCA6SPX4F	DFS-0100K	0.297	2.61	0.30	17.6	1.27	3.81
DCA10SPX4/SPXU4	DFS-0140XK (E2)	0.159	2.84	0.30	17.9	1.40	4.12
DCA15SPX4F/SPXU4F	DFS-0220XK (E2)	0.066	3.66	0.30	17.4	1.04	3.12
DCA20SPXU4F	DF-0277I	0.055	4.00	0.30	17.8	0.99	2.80
DCA36SPXU4F	DH-0647I	0.021	1.66	0.12	18.9	0.65	1.76
DCA25SSI4F/SSIU4F/C8	DF-0270I	0.133	4.00	0.30	17.6	1.03	2.96
DCA40SSKU4F2	DH-0480KU2	0.098	1.38	0.12	19.0	0.79	2.12
DCA45SSIU4F/C8	DH-0480I	0.099	1.38	0.12	19.0	0.78	2.13
DCA70SSIU4F/C8B	DH-0750I	0.047	1.85	0.12	19.4	0.72	1.90
DCA70SSJU4F	DH-0750J	0.047	1.85	0.12	19.0	0.69	1.82
DCA125SSIU4F	DB-1381I	0.018	1.52	0.08	17.6	0.43	1.05
DCA150SSJU4F3/B	DB-1651C	0.013	1.75	0.08	17.7	0.44	1.01
DCA180SSJU4F3/B/PD	DF-1951J	0.013	1.62	0.11	17.1	0.44	1.12
DCA220SSJU4F3/PB/PD	DF-2401J	0.017	1.90	0.11	17.0	0.47	1.14
DCA300SSJU4F3/PB/PD	DF-3301J	0.012	2.63	0.12	18.9	0.44	1.02
DCA400SSI4F3/B/PB/PD	DF-4401I	0.009	2.97	0.12	18.9	0.48	1.15
DCA600SSV4F3/B/PB/PD	DF-6601V	0.008	2.05	0.09	26.8	0.37	0.88
NGA100SSPUL	DB-1101PSI	0.027	1.40	0.08	17.4	0.43	1.14
NGA150SSPUPL	DB-1651PSI	0.013	1.75	0.08	17.5	0.36	0.98

All above values are reference values and not guaranteed values.

Table 7. Exciter Field Current And Voltage Values							
Generator ID		Exciter (Ex) Field Current (A)		Exciter (Ex) Field Voltage (A)		Induction Voltage (V) By Separate Excitation (12V)	
Generator Model	Gen-Set Model #	Column A No Load	Column B Rated Load	Column C No Load	Column D Rated Load	Column E 3-Phase Voltage U–V/V–W/ W–U	Column F Exciting Winding Voltage A–B / C–D / D–A
DA7000SSA3	–						
DAC7000SSA3	–						
TLG8SSK4F2	–						
DCA6SPX4F	DFS-0100K						
DCA10SPX4	DFS-0140XK (E2)	0.57	1.29	11.0	24.5	–	–
DCA15SPX4F	DFS-0220XK (E2)	0.74	1.27	13.0	24.0	–	–
DCA20SPXU4F	DF-0277I	0.73	1.37	12.8	27.9	203	69
DCA36SPXU4F	DH-0647I						
DCA25SSIU4F/C8	DF-0270I	0.67	1.92	12.3	37.1	212	72
DCA40SSKU4F2	DH-0480KU2						
DCA45SSIU4F/C8	DH-0480I						
DCA70SSIU4F/C8B	DH-0750I						
DCA70SSJU4F	DH-0750J						
DCA125SSIU4F	DB-1381I	0.96	2.59	16.6	51.8	165	59
DCA150SSJU4F3/B	DB-1651C	0.96	2.54	16.6	50.8	169	63
DCA180SSJU4F3/B/PD	DF-1951J	0.80	2.65	13.8	52.7	200	79
DCA220SSJU4F3/PB/PD	DF-2401J	0.88	2.59	15.1	51.3	188	75
DCA250SSIU	DF-2401I	0.88	2.59	15.1	51.3	188	75
DCA300SSJU4F3/PB/PD	DF-3301J	0.72	2.40	13.9	47.8	196	82
DCA400SSI4F3/B/PB/PD	DF-4401I	0.78	2.75	15.1	54.7	198	94
DCA600SSV4F3/B/PB/PD	DF-6601V	0.52	1.83	13.8	56.3	203	91
DCA25USI4CAN	DF-0270I2						
DCA45USI4CAN	DH-0480I						
DCA70USI3CAN	DH-0750I						
DCA1100SPC	HCI634J						
NGA100SSPUL	DB-1101PSI						
NGA150SSPUPL	DB-1651PSI						
All above values are reference values and not guaranteed values.							

GENERATOR WEIGHTS AND LIFTING POINTS TABLE

Table 8. Generator Weights And Lifting Points

Generator Model	Trailer Model	Dry Weight lb. (kg)			Wet Weight lb. (kg)			Maximum Lifting Point Capacity lb. (kg)
		Generator	Trailer	Total	Generator	Trailer	Total	
DA7000SSA3	TRLRMPXF*	533 (242)	508 (230)	1,041 (472)	597 (271)	508 (230)	1,105 (501)	2,910 (1,320)
DAC7000SSA3	TRLRMPXF*	535 (243)	508 (230)	1,043 (473)	599 (272)	508 (230)	1,107 (502)	2,910 (1,320)
TLG8SSK4F2	TRLRMPXF	579 (263)	347 (157)	926 (420)	645 (293)	347 (157)	992 (450)	1,190 (540)
DCA6SPX4F	TRLRMPXF	831 (377)	545 (247)	1,376 (624)	860 (390)	545 (247)	1,405 (637)	1,650 (748)
DCA10SPX4 (SPXU4C)	TRLRMPXF*	1,112 (504)	508 (230)	1,620 (735)	1,300 (590)	508 (230)	1,808 (820)	2,000 (907)
DCA15SPX4F (SPXU4F)	TRLRMPXF*	1,179 (535)	508 (230)	1,687 (765)	1,367 (620)	508 (230)	1,875 (850)	2,200 (997)
DCA20SPXU4F	TRLR25US2*	1,795 (814)	444 (201)	2,239 (1,016)	2,137 (969)	444 (201)	2,581 (1,171)	3,240 (1,470)
DCA36SPXU4F	TRLR45*	2,445 (1,109)	1,020 (463)	3,465 (1,572)	3,084 (1,399)	1,020 (463)	4,104 (1,862)	5,150 (2,336)
DCA25SSIU4F	TRLR25US2*	1,795 (814)	444 (201)	2,239 (1,016)	2,137 (969)	444 (201)	2,581 (1,171)	5,150 (2,336)
DCA25SSIU4FC8	TRLR25US2*	1,742 (790)	444 (201)	2,184 (991)	2,183 (990)	444 (201)	2,625 (1,191)	6,620 (3,003)
DCA40SSKU4F2	TRLR45*	2,205 (1,000)	1,020 (463)	3,225 (1,463)	2,735 (1,240)	1,020 (463)	3,755 (1,703)	5,150 (2,336)
DCA45SSIU4F	TRLR45*	2,335 (1,059)	1,056 (479)	3,391 (1,538)	2,974 (1,349)	1,056 (479)	4,030 (1,828)	5,150 (2,336)
DCA45SSIU4FC8	TRLR45*	2,425 (1,100)	1,018 (462)	3,443 (1,562)	3,152 (1,430)	1,018 (462)	4,170 (1,892)	6,960 (3,157)
DCA70SSIU4F/C8B	TRLR70US*	3,326 (1,509)	1,089 (494)	4,415 (2,003)	4,207 (1,908)	1,089 (494)	5,296 (2,402)	6,960 (3,157)
DCA70SSJU4F	TRLR75XF2	3,539 (1,605)	1,298 (589)	4,837 (2,194)	3,858 (1,750)	1,298 (589)	5,156 (2,339)	6,960 (3,157)
DCA125SSIU4F	TRLR125US*	5,291 (2,400)	1,722 (781)	7,013 (3,181)	6,702 (3,040)	1,722 (781)	8,424 (3,821)	14,050 (6,373)
DCA150SSJU4F3/B	TRLR180EV*	8,201 (3,720)	2,560 (1,161)	10,761 (4,881)	10,869 (4,930)	2,560 (1,161)	13,429 (6,091)	16,500 (7,483)
DCA180SSJU4F3/B/PD	TRLR180EV*	8,532 (3,870)	2,205 (1,000)	10,737 (4,870)	11,266 (5,110)	2,205 (1,000)	13,471 (6,110)	16,500 (7,483)
DCA220SSJU4F3/PB/PD	TRLR220EV	8,399 (3,810)	2,381 (1,080)	10,780 (4,890)	11,111 (5,040)	2,381 (1,080)	13,492 (6,120)	16,500 (7,483)
DCA250SSIU (SSI)	–	8,203 (3720)	–	–	9,305 (4,220)	–	–	14,050 (6,373)
DCA300SSJU4F3/PB/PD	TRLR300EV	11,220 (5,090)	2,920 (1,324)	14,140 (6,414)	15,010 (6,810)	2,920 (1,324)	17,930 (8,133)	19,000 (8,618)
DCA400SSI4F3/B/PB/PD	TRLR400XF3DAE	12,280 (5,570)	4,010 (1,819)	16,290 (7,389)	13,184 (5,980)	4,010 (1,819)	17,194 (7,799)	21,000 (9,525)
DCA600SSV4F3/B/PB/PD	TRLR600XF3BPE	17,574 (7,971)	10,146 (4,602)	27,720 (12,573)	19,117 (8,671)	12,869 (5,836)	31,986 (14,507)	25,000 (11,339)
DCA25USI4CAN	TRLR25US	1,918 (870)	406 (184)	2,324 (1,054)	2,227 (1,010)	406 (184)	2,633 (1,194)	6,620 (3,003)
DCA45USI4CAN	TRLR45	3,086 (1,400)	1,056 (479)	4,142 (1,879)	3,704 (1,680)	1,056 (479)	4,760 (2,159)	6,960 (3,157)
DCA70USI3CAN	TRLR70US	3,990 (1,810)	1,089 (494)	5,079 (2,304)	4,784 (2,170)	1,089 (494)	5,873 (2,664)	14,050 (6,373)
DCA1100SPC (SSC)	–	28,881 (13,100)	–	–	31,306 (14,200)	–	–	35,000 (15,873)
NGA100SSPUL	TRLR100H	4,652 (2,110)	1,071 (486)	5,723 (2,596)	–	–	–	6,960 (3,157)
NGA150SSPUPL	TRLR150H*	6,872 (3,117)		8,575 (3,890)	7,203 (3,267)		8,906 (4,040)	14,050 (6,373)

Weights are approximate and do not include options.

Table 9. Bolt Torque Specs

OUTPUT TERMINAL BOLTS AND TIE BOLTS

MODEL	PART NUMBER		TIE BOLT TORQUE SPEC		REMARKS
	OUTPUT TERMINAL BOLT	TIE BOLT	N·m	lbf·in	
DCA10SPXU4	N/A	N/A	N/A	N/A	No output terminal bolt
DCA15SPXU4	M0235100014	M9220000104A	7.4	65.0	M8
DCA20SPXU2	M9220000204	M9220000104A	7.4	65.0	M8
DCA36SPXU2	M2233000004	M2233100004	25.0	221.3	M12
DCA25SSIU4F	M9220000004B	M9220000104A	7.4	65.0	M8
DCA40SSKU4F2	M9220100204B	M9220100104B	14.7	130.1	M10
DCA45SSIU4F	M9220100204B	M9220100104B	14.7	130.1	M10
DCA70SSIU4F	M9220100304A	M9220100404	62.7	554.9	M16
DCA70SSJU4F	M9220100304A	M9220100404	62.7	554.9	M16
DCA125SSIU4F	M9220100304A	M9220100404	62.7	554.9	M16
DCA150SSJU4F3	M9220100304A	M9220100404	62.7	554.9	M16
DCA180SSJU4F3	M9220100914	M9220101004	123.0	1088.6	M20
DCA220SSJU4F3	M9220100304A	M9220100404	62.7	554.9	M16 × 2
DCA300SSJU4F3	M9220100914	M9220101004	123.0	1088.6	M20 × 2
DCA400SSI4F3	C0277500004	M9220101004	123.0	1088.6	M20 × 2
DCA-600SSV4F3	Y0010112040	Y0041212000 (Nut)	25.0	221.3	M12 × 4 (U, V, W, O) Bolt + Nut
	W0801830404B	M9220101004	123.0	1088.6	M20 (Earth)

CHANGE-OVER BOARD BOLTS

MODEL	PART NUMBER	TIE BOLT TORQUE SPEC		REMARKS
	CHANGE-OVER BOARD BOLT	N·m	lbf·in	
DCA180SSJU4F3	M9220100104	14.7	65.0	M10
DCA220SSJU4F3	M9220100104	14.7	65.0	M10
DCA300SSJU4F3	M9220101104	25.0	221.3	M12
DCA400SSI4F3	W0801830804	62.7	554.9	M16
DCA600SSV4F3	W0801832504	123.0	1088.6	M20

Table 10. ECU-845 AC Defaults (John Deere)

	Setpoint Defaults				
	J4FSA : DCA70SSJU4F	J4FSB : DCA180SSJU4F	J4FSC : DCA300SSJU4F2	J4FSD : DCA150SSJU4F2	J4FSE : DCA220SSJU4F2
Menu Structure	**J4FSA 0-11-0-17**	**J4FSB 0-11-0-17**	**J4FSC 0-11-0-17**	**J4FSD 0-11-0-17**	**J4FSE 0-11-0-17**
|-> AC MISC SETTINGS					
|-> AC HIGH HZ %	110	110	110	110	110
|-> AC HIGH HZ SECONDS	3	3	3	3	3
|-> AC LOW HZ %	90	90	90	90	90
|-> AC LOW HZ SECONDS	5	5	5	5	5
|-> AC GLOBAL ENABLE	1	1	1	1	1
|-> AC IDLE REENABLE SECS	5	5	5	5	5
|-> AC SIGNIFICANT KVA %	25	25	25	25	25
|-> AC AMPS THRESHOLD	10	10	15	10	10
|-> PHASE CFG DWELL SEC	5	5	5	5	5
|-> PHASE CFG TIMEOUT SEC	10	10	10	10	10
|-> VOLT AND AMP SETPOINTS					
|-> AC HIGH VOLTS %	110	110	110	110	110
|-> AC HIGH VOLTS SECONDS	5	5	5	5	5
|-> AC LOW VOLTS%	75	75	75	75	75
|-> AC LOW VOLTS SECONDS	5	5	5	5	5
|-> AC HIGH AMPS %	115	115	115	115	115
|-> AC HIGH AMPS SECONDS	<DISABLED> 000030	<DISABLED> 000030	<DISABLED> 000030	<DISABLED> 000030	<DISABLED> 000030
|-> KW AND KVAR SETPOINTS					
|-> AC HIGH KW %	115	115	115	115	115
|-> AC HIGH KW SECONDS	14	14	14	14	14
|-> AC LOW KW %	-15	-15	-15	-15	-15
|-> AC LOW KW SECONDS	<DISABLED> 000010	<DISABLED> 000010	<DISABLED> 000010	<DISABLED> 000010	<DISABLED> 000010
|-> AC LOW PF VALUE	35	35	35	35	35
|-> AC LOW PF SECONDS	<DISABLED> 000014	<DISABLED> 000014	<DISABLED> 000014	<DISABLED> 000014	<DISABLED> 000014
|-> AC HIGH KVA %	110	110	110	110	110
|-> AC HIGH KVA SECONDS	<DISABLED> 000014	<DISABLED> 000014	<DISABLED> 000014	<DISABLED> 000014	<DISABLED> 000014
|-> AC HIGH KVAR %	140	140	140	140	140
|-> AC HIGH KVAR SECONDS	<DISABLED> 000014	<DISABLED> 000014	<DISABLED> 000014	<DISABLED> 000014	<DISABLED> 000014
|-> AC LOW KVAR %	-55	-55	-55	-55	-55
|-> AC LOW KVAR SECONDS	<DISABLED> 000014	<DISABLED> 000014	<DISABLED> 000014	<DISABLED> 000014	<DISABLED> 000014
|-> RATINGS 60HZ					
|-> KW RATING OF SET	56	144	240	120	176
|-> SINGLE PHASE SETTINGS					
|-> SNGL PH RATED VOLTS LL	240	240	240	240	240
|-> SNGL PH RATED VOLTS LN	120	120	120	120	120
|-> SNGL RATED PHASE AMPS	168	433	722	361	529
|-> SNGL RATED PHASE KVA	20	52	87	43	63
|-> SNGL RATED PHASE KW	20	52	87	43	63
|-> SNGL RATED PHASE KVAR	20	52	87	43	63
|-> LOW WYE SETTINGS					
|-> LO WYE RATED VOLTS LL	240	240	240	240	240
|-> LO WYE RATED VOLTS LN	139	139	139	139	139
|-> LO WYE RATED PHASE AMP	168	433	722	361	529
|-> LO WYE RATED PHASE KVA	23	60	100	50	73
|-> LO WYE RATED PHASE KW	19	48	80	40	59
|-> LO WYE RATED PHASE KVAR	14	36	60	30	44

Table 10. ECU-845 AC Defaults (John Deere)

	Setpoint Defaults				
	J4FSA : DCA70SSJU4F	J4FSB : DCA180SSJU4F	J4FSC : DCA300SSJU4F2	J4FSD : DCA150SSJU4F2	J4FSE : DCA220SSJU4F2
Menu Structure	**J4FSA 0-11-0-17**	**J4FSB 0-11-0-17**	**J4FSC 0-11-0-17**	**J4FSD 0-11-0-17**	**J4FSE 0-11-0-17**
|-> HIGH WYE SETTINGS					
|-> HI WYE RATED VOLTS LL	480	480	480	480	480
|-> HI WYE RATED VOLTS LN	277	277	277	277	277
|-> HI WYE RATED PHASE AMPS	84	217	361	180	265
|-> HI WYE RATED PHASE KVA	23	60	100	50	73
|-> HI WYE RATED PHASE KW	19	48	80	40	59
|-> HI WYE RATED PHASE KVAR	14	36	60	30	44
|-> RATINGS 50HZ					
|-> KW RATING OF SET	44	120	216	100	160
|-> SINGLE PHASE SETTINGS					
|-> SNGL PH RATED VOLTS LL	200	200	200	200	200
|-> SNGL PH RATED VOLTS LN	100	100	100	100	100
|-> SNGL RATED PHASE AMPS	159	433	779	361	577
|-> SNGL RATED PHASE KVA	16	43	78	36	58
|-> SNGL RATED PHASE KW	16	43	78	36	58
|-> SNGL RATED PHASE KVAR	16	43	78	36	58
|-> LOW WYE SETTINGS					
|-> LO WYE RATED VOLTS LL	200	200	200	200	200
|-> LO WYE RATED VOLTS LN	115	115	115	115	115
|-> LO WYE RATED PHASE AMP	159	433	779	361	577
|-> LO WYE RATED PHASE KVA	18	50	90	42	67
|-> LO WYE RATED PHASE KW	14	40	72	34	53
|-> LO WYE RATED PHASE KVAR	11	30	54	25	40
|-> HIGH WYE SETTINGS					
|-> HI WYE RATED VOLTS LL	400	400	400	400	400
|-> HI WYE RATED VOLTS LN	231	231	231	231	231
|-> HI WYE RATED PHASE AMPS	79	217	390	180	289
|-> HI WYE RATED PHASE KVA	18	50	90	42	67
|-> HI WYE RATED PHASE KW	14	40	72	34	53
|-> HI WYE RATED PHASE KVAR	11	30	54	25	40

<table>
<tr><th colspan="5">Table 11. ECU-845 AC Defaults (Isuzu/Volvo)</th></tr>
<tr><th></th><th colspan="4">Setpoint Defaults</th></tr>
<tr><th></th><th>I4JHA : DCA70</th><th>I4JHB : DCA125</th><th>IZ4F : DCA400</th><th>V4F : DCA600</th></tr>
<tr><th>Menu Structure</th><th>I4JHA0-9-0-45</th><th>I4JHB0-9-0-45</th><th>IZ4F0-7-0-45</th><th>V4F0-12-0-9</th></tr>
<tr><td>|-> AC MISC SETTINGS</td><td></td><td></td><td></td><td></td></tr>
<tr><td>|-> AC HIGH HZ %</td><td>110</td><td>110</td><td>110</td><td>110</td></tr>
<tr><td>|-> AC HIGH HZ SECONDS</td><td>3</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>|-> AC LOW HZ %</td><td>90</td><td>90</td><td>90</td><td>90</td></tr>
<tr><td>|-> AC LOW HZ SECONDS</td><td>5</td><td>5</td><td>5</td><td>5</td></tr>
<tr><td>|-> AC GLOBAL ENABLE</td><td>1</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>|-> AC IDLE REENABLE SECS</td><td>5</td><td>5</td><td>5</td><td>5</td></tr>
<tr><td>|-> AC SIGNIFICANT KVA %</td><td>25</td><td>25</td><td>25</td><td>25</td></tr>
<tr><td>|-> AC AMPS THRESHOLD</td><td>10</td><td>10</td><td>30</td><td>15</td></tr>
<tr><td>|-> PHASE CFG DWELL SEC</td><td>5</td><td>5</td><td>5</td><td>5</td></tr>
<tr><td>|-> PHASE CFG TIMEOUT SEC</td><td>10</td><td>10</td><td>10</td><td>10</td></tr>
<tr><td>|-> VOLT AND AMP SETPOINTS</td><td></td><td></td><td></td><td></td></tr>
<tr><td>|-> AC HIGH VOLTS %</td><td>110</td><td>110</td><td>110</td><td>110</td></tr>
<tr><td>|-> AC HIGH VOLTS SECONDS</td><td>5</td><td>5</td><td>5</td><td>5</td></tr>
<tr><td>|-> AC LOW VOLTS%</td><td>75</td><td>75</td><td>75</td><td>75</td></tr>
<tr><td>|-> AC LOW VOLTS SECONDS</td><td>5</td><td>5</td><td>5</td><td>5</td></tr>
<tr><td>|-> AC HIGH AMPS %</td><td>115</td><td>115</td><td>115</td><td>115</td></tr>
<tr><td>|-> AC HIGH AMPS SECONDS</td><td><DISABLED> 000030</td><td><DISABLED> 000030</td><td><DISABLED> 000030</td><td><DISABLED> 000030</td></tr>
<tr><td>|-> KW AND KVAR SETPOINTS</td><td></td><td></td><td></td><td></td></tr>
<tr><td>|-> AC HIGH KW %</td><td>115</td><td>115</td><td>115</td><td>115</td></tr>
<tr><td>|-> AC HIGH KW SECONDS</td><td>14</td><td>14</td><td>14</td><td>14</td></tr>
<tr><td>|-> AC LOW KW %</td><td>-15</td><td>-15</td><td>-15</td><td>-15</td></tr>
<tr><td>|-> AC LOW KW SECONDS</td><td><DISABLED> 000010</td><td><DISABLED> 000010</td><td><DISABLED> 000010</td><td><DISABLED> 000010</td></tr>
<tr><td>|-> AC LOW PF VALUE</td><td>35</td><td>35</td><td>35</td><td>35</td></tr>
<tr><td>|-> AC LOW PF SECONDS</td><td><DISABLED> 000014</td><td><DISABLED> 000014</td><td><DISABLED> 000014</td><td><DISABLED> 000014</td></tr>
<tr><td>|-> AC HIGH KVA %</td><td>110</td><td>110</td><td>110</td><td>110</td></tr>
<tr><td>|-> AC HIGH KVA SECONDS</td><td><DISABLED> 000014</td><td><DISABLED> 000014</td><td><DISABLED> 000014</td><td><DISABLED> 000014</td></tr>
<tr><td>|-> AC HIGH KVAR %</td><td>140</td><td>140</td><td>140</td><td>140</td></tr>
<tr><td>|-> AC HIGH KVAR SECONDS</td><td><DISABLED> 000014</td><td><DISABLED> 000014</td><td><DISABLED> 000014</td><td><DISABLED> 000014</td></tr>
<tr><td>|-> AC LOW KVAR %</td><td>-55</td><td>-55</td><td>-55</td><td>-55</td></tr>
<tr><td>|-> AC LOW KVAR SECONDS</td><td><DISABLED> 000014</td><td><DISABLED> 000014</td><td><DISABLED> 000014</td><td><DISABLED> 000014</td></tr>
<tr><td>|-> RATINGS 60HZ</td><td></td><td></td><td></td><td></td></tr>
<tr><td>|-> KW RATING OF SET</td><td>56</td><td>100</td><td>320</td><td>480</td></tr>
<tr><td>|-> SINGLE PHASE SETTINGS</td><td></td><td></td><td></td><td></td></tr>
<tr><td>|-> SNGL PH RATED VOLTS LL</td><td>240</td><td>240</td><td>240</td><td>240</td></tr>
<tr><td>|-> SNGL PH RATED VOLTS LN</td><td>120</td><td>120</td><td>120</td><td>120</td></tr>
<tr><td>|-> SNGL RATED PHASE AMPS</td><td>168</td><td>301</td><td>962</td><td>1443</td></tr>
<tr><td>|-> SNGL RATED PHASE KVA</td><td>20</td><td>36</td><td>115</td><td>173</td></tr>
<tr><td>|-> SNGL RATED PHASE KW</td><td>20</td><td>36</td><td>115</td><td>173</td></tr>
<tr><td>|-> SNGL RATED PHASE KVAR</td><td>20</td><td>36</td><td>115</td><td>173</td></tr>
<tr><td>|-> LOW WYE SETTINGS</td><td></td><td></td><td></td><td></td></tr>
<tr><td>|-> LO WYE RATED VOLTS LL</td><td>240</td><td>240</td><td>240</td><td>240</td></tr>
<tr><td>|-> LO WYE RATED VOLTS LN</td><td>139</td><td>139</td><td>139</td><td>139</td></tr>
<tr><td>|-> LO WYE RATED PHASE AMP</td><td>168</td><td>301</td><td>962</td><td>1443</td></tr>
<tr><td>|-> LO WYE RATED PHASE KVA</td><td>23</td><td>42</td><td>133</td><td>200</td></tr>
<tr><td>|-> LO WYE RATED PHASE KW</td><td>19</td><td>33</td><td>107</td><td>160</td></tr>
<tr><td>|-> LO WYE RATED PHASE KVAR</td><td>14</td><td>25</td><td>80</td><td>120</td></tr>
<tr><td>|-> HIGH WYE SETTINGS</td><td></td><td></td><td></td><td></td></tr>
</table>

Table 11. ECU-845 AC Defaults (Isuzu/Volvo)				
	Setpoint Defaults			
	I4JHA : DCA70	I4JHB : DCA125	IZ4F : DCA400	V4F : DCA600
Menu Structure	I4JHA0-9-0-45	I4JHB0-9-0-45	IZ4F0-7-0-45	V4F0-12-0-9
|-> HI WYE RATED VOLTS LL	480	480	480	480
|-> HI WYE RATED VOLTS LN	277	277	277	277
|-> HI WYE RATED PHASE AMPS	84	150	481	722
|-> HI WYE RATED PHASE KVA	23	42	133	200
|-> HI WYE RATED PHASE KW	19	33	107	160
|-> HI WYE RATED PHASE KVAR	14	25	80	120
|-> RATINGS 50HZ	N/A	N/A	N/A	N/A

Table 12. Overcurrent Relay Trip Points		
Generator Model	**Factory OCR Setting**	**CT Ratios**
DCA-10SPXU4	No OCR	N/A
DCA-15SPXU4F	2.9	100:5A
DCA-20SPXU4F	No OCR	N/A
DCA-36SPXU4F	No OCR	N/A
DCA-25SSIU4F	3	100:5A
DCA-25SSIU4FC8	3	100:5A
DCA-25SSIU4FDS	3	100:5A
DCA-40SSKU4F2	2.9	150:5A
DCA-45SSIU4F	3.6	150:5A
DCA-45SSIU4FC8	3.6	150:5A
DCA-45SSIU4FDS	3.6	150:5A
DCA-70SSIU4F	2.8	150:5A
DCA-70SSIU4FC8B	2.8	150:5A
DCA-70SSJU4F	2.8	150:5A
DCA-125SSIU4F	3.8	200:5A
DCA-150SSJU4F3	3	300:5A
DCA-180SSJU4F3	3.6	300:5A
DCA-180SSJU4F3PD	1.8	600:5A
DCA-220SSJU4F3	3.3	400:5A
DCA-220SSJU4F3PD	1.8	400:5A
DCA-300SSJU4F3	3.6	500:5A
DCA-300SSJU4F3PD	1.8	1000:5A
NGA-100SSPUL	3	200:5A
NGA-150SSPUPL	No OCR	N/A
If your specific model is not listed, please contact MQ Power's Tech Support Department at 1-800-835-2551.		

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

Troubleshooting (Engine) - continued		
Symptom	**Possible Problem**	**Solution**
Low engine power output and low speed, black exhaust smoke.	Air filter blocked?	Clean or replace air filter.
	Incorrect valve clearances?	Adjust valves per engine specification.
	Malfunction at injector?	See engine manual.
Engine overheats.	Too much oil in engine crankcase?	Drain off engine oil down to upper mark on dipstick.
	Entire cooling air system contaminated or blocked?	Clean cooling air system and cooling fin areas.
	Fan belt broken or elongated?	Change belt or adjust belt tension.
	Coolant insufficient?	Replenish coolant.
	Radiator net or radiator fin clogged with dust?	Clean net or fin carefully.
	Fan, radiator, or radiator cap defective?	Replace defective part.
	Thermostat defective?	Check thermostat and replace if necessary.
	Head gasket defective or water leakage?	Replace parts.
Engine cranks but will not start	Defective fuel relay?	Check or replace relay.
	Loose wiring?	Inspect wiring.
	Defective ECU	Check or replace ECU.
	Defective MPU?	Check or replace MPU
Engine hunting	Defective AVR?	Check or replace AVR.
	Defective ECU	Check or replace ECU
Engine starts and shuts down after a few seconds	Defective ECU	Check or replace ECU
	Low oil pressure	Check and repair.
	High coolant temperature	Check and repair.
Excessive black smoke	Wet stacking?	Run engine at a high temperature.Reference load bank or Power Balance ™ applications.
Excessive white smoke	Air in fuel system?	Reference engine service manual.
Engine overheating	Defective thermostat	Replace thermostat. Reference engine service manual.
	Radiator clogged?	Clean/flush radiator. Reference engine service manual.
	Defective water pump?	Replace water pump. Reference engine service manual.
	Worn or cracked coolant hoses?	Replace hoses. Reference engine service manual.

The following ***flowcharts*** are intended to suggest a systematic approach to locating and correcting generator malfunctions. The flowcharts' steps have been arranged in such a manner as to perform the ***easy checks first*** and prevent further damage when troubleshooting of a disabled generator is required.

If serious problems can be identified before attempting to operate the generator, additional damage can be avoided, saving time and money.

The first step of troubleshooting is to gather as much information as possible from operating personnel and individuals present at the time the generator fault (shutdown) occurred.

Typical information includes the following:

- How long had the generator been operating?
- Hours on unit?
- Generator serial number?
- Engine serial number?
- Is the generator filled with diesel fuel and diesel exhaust fluid (DEF)?
- What voltage was the generator running at when the fault occurred?
- What loads were connected to the generator when the fault occurred?
- Gather all information about the application the generator was operating when the fault occurred. This information is crucial when determining the cause of the fault.
- Were there any prior issues with the generator?
- Obtain all generator maintenance history documentation.
- What were the weather conditions when the generator fault occurred?
- Is the generator placed on a level surface?
- Did the protective devices installed on the generator function correctly at the time of the fault?
- Was the engine operating at a constant speed at the time of the fault?
- Have there been extended periods of engine under-speed operation?
- Has the engine experienced an over-speed condition? If yes, what was the maximum speed, and how long did the unit operate at that elevated speed?

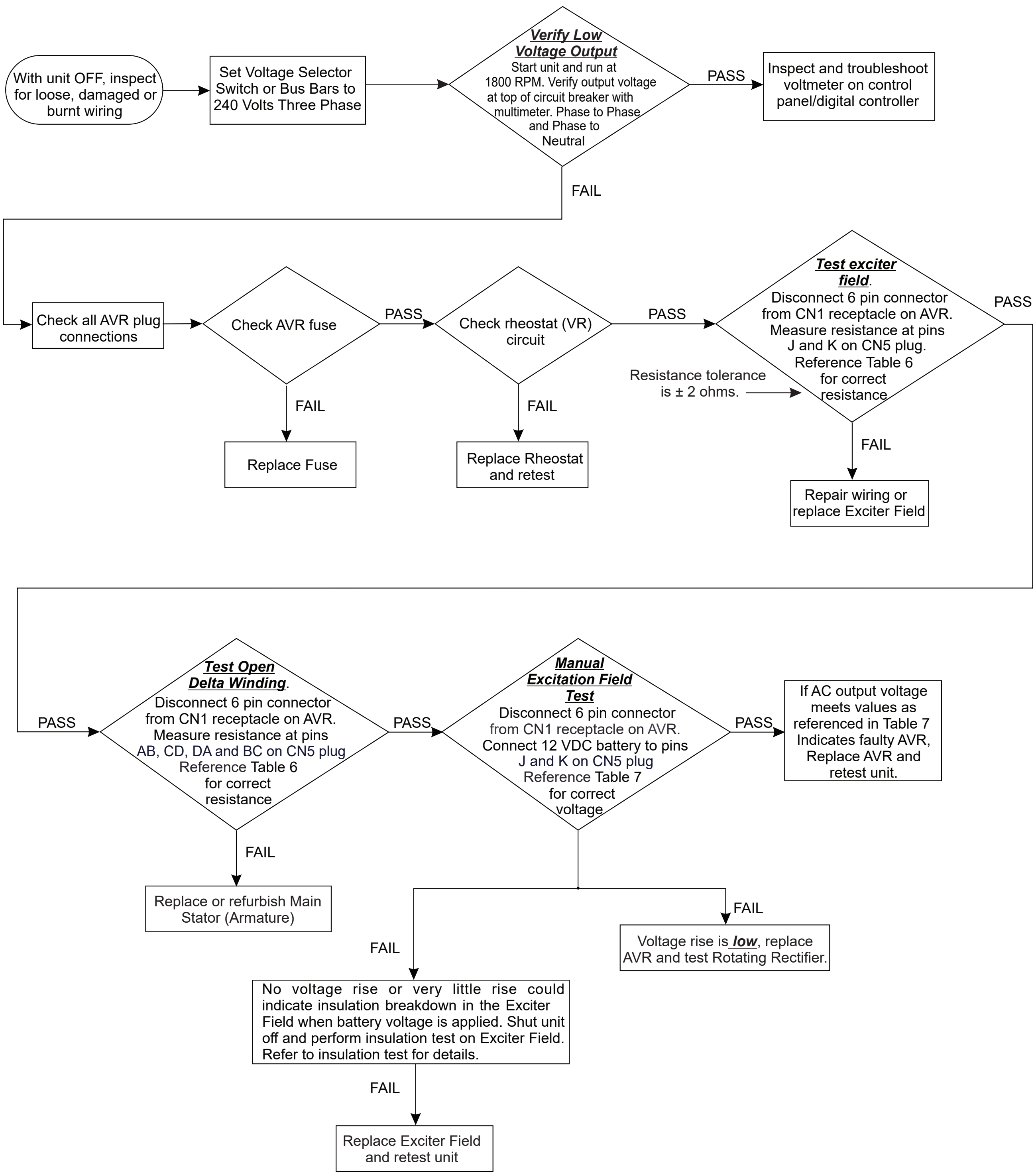
For normal operation, the engine speed should be maintained as indicated on the generator ***nameplate***. This speed is typically 1,800 rpm. The frequency of the generator depends upon a maintained rotational speed.

Always make a thorough ***visual inspection*** to check for obvious problems before attempting to run the generator. Remove covers and look for any obvious problems. Burnt windings, broken connectors, burnt wires, mounting brackets, etc., can usually be identified through inspection.

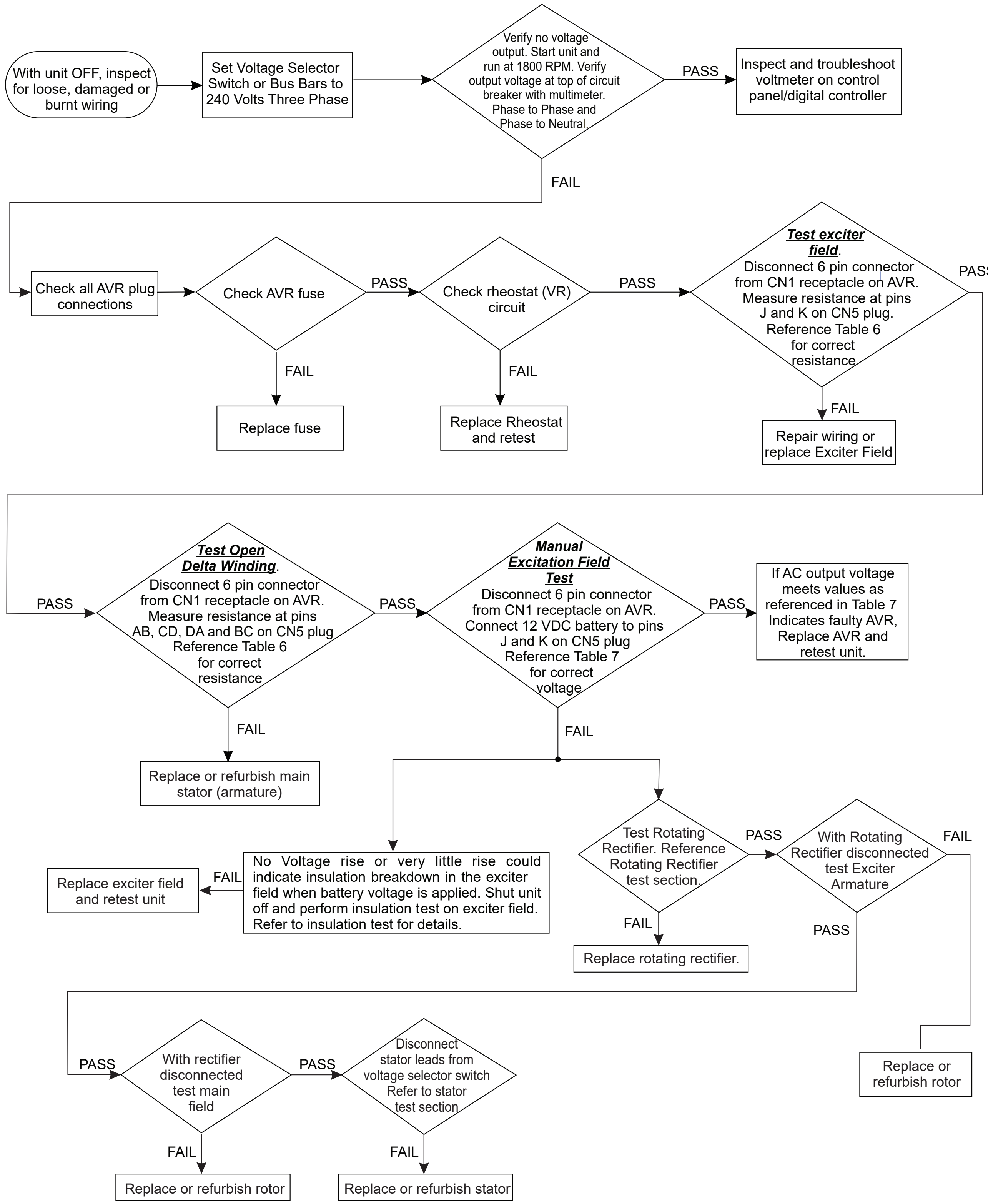
Look for any loose or frayed insulation, loose or dirty connections, or broken wires. Check for any foreign objects, or loose nuts, bolts and electrical connections.

If possible, rotate the generator rotor by hand to be sure it turns freely.

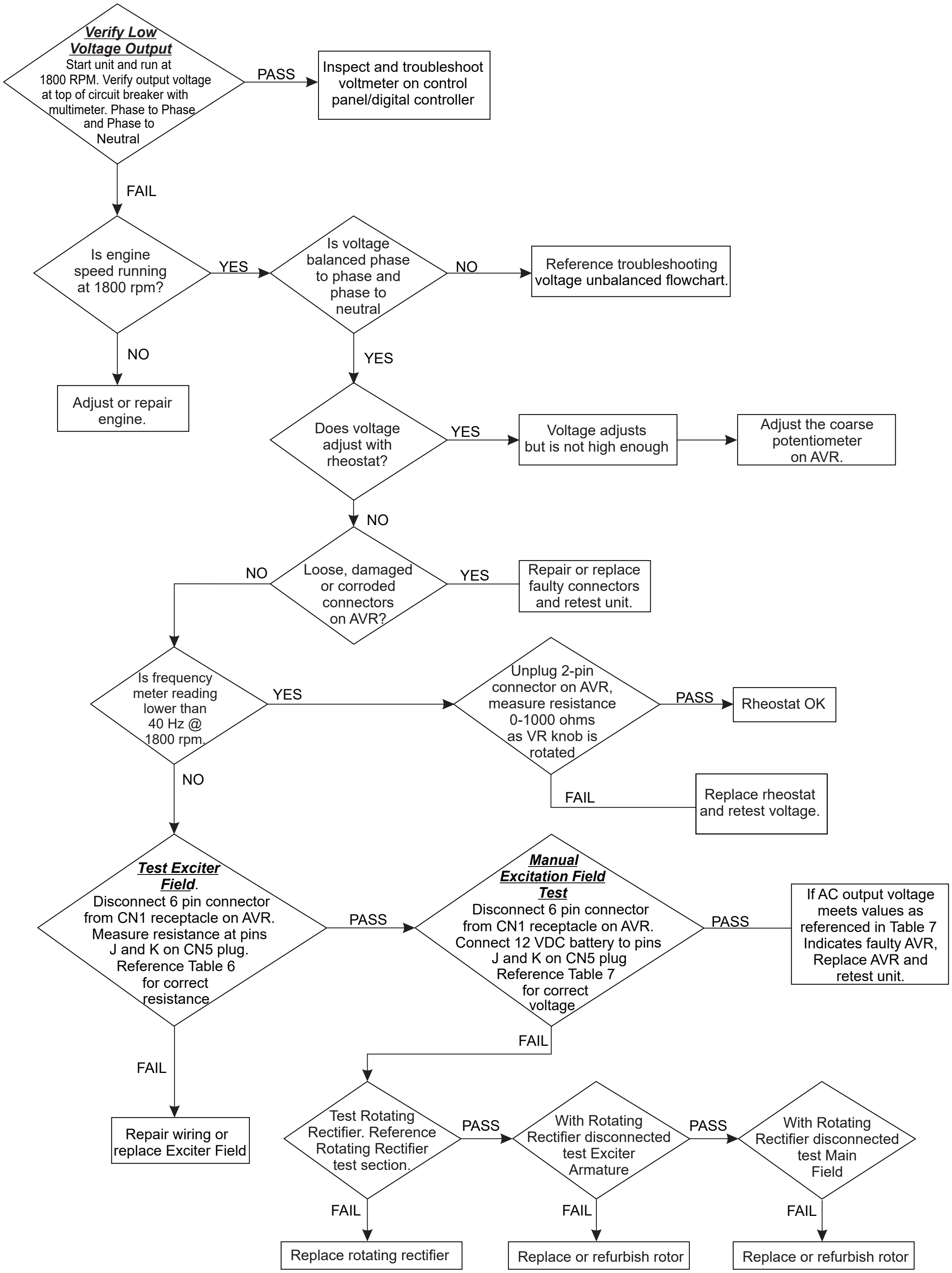
NO VOLTAGE - RESIDUAL VOLTAGE ONLY



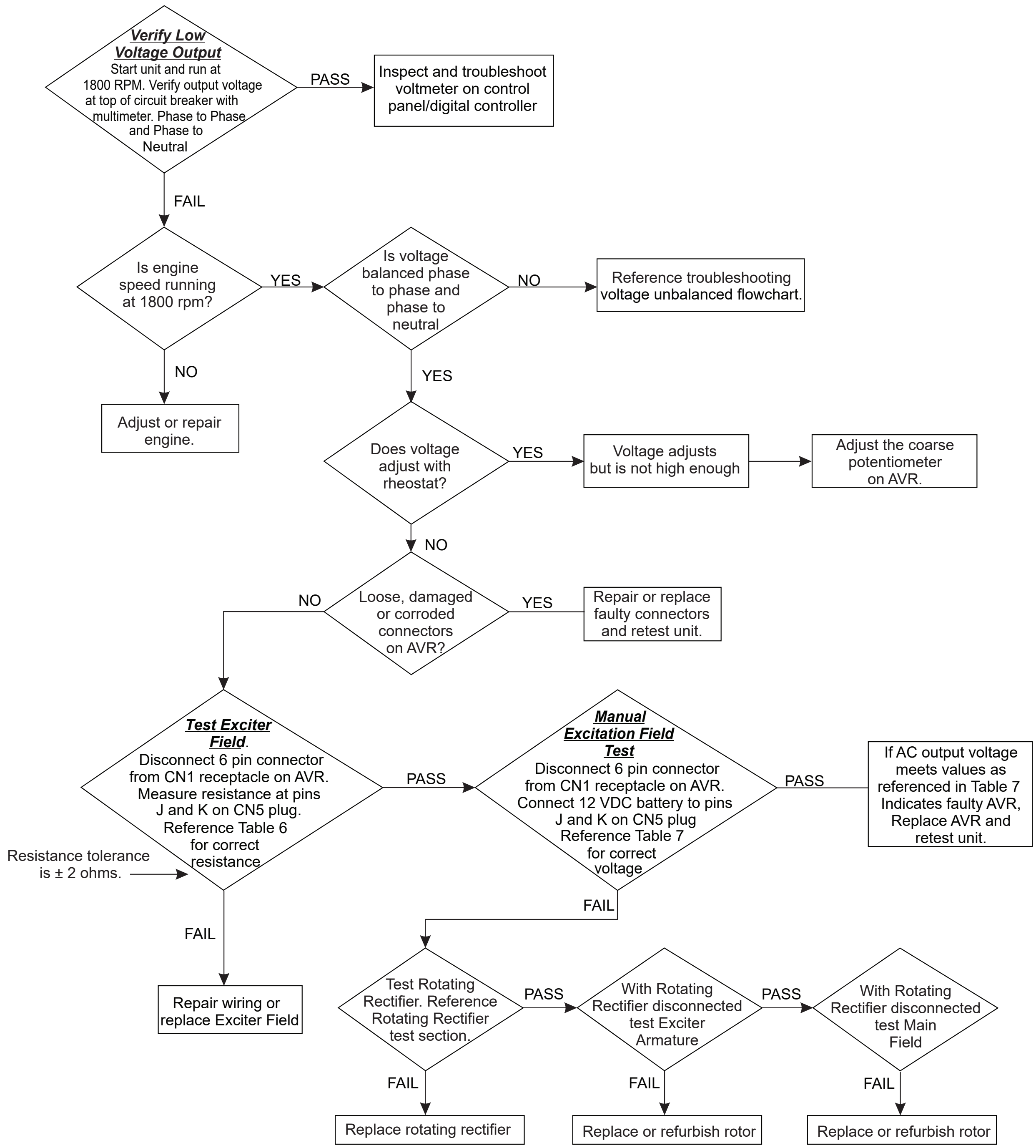
NO VOLTAGE


With unit OFF, inspect for loose, damaged or burnt wiring
Set Voltage Selector Switch or Bus Bars to 240 Volts Three Phase
Verify no voltage output. Start unit and run at 1800 RPM. Verify output voltage at top of circuit breaker with multimeter. Phase to Phase and Phase to Neutral.
PASS
Inspect and troubleshoot voltmeter on control panel/digital controller
FAIL
Check all AVR plug connections
Check AVR fuse
PASS
FAIL
Replace fuse
Check rheostat (VR) circuit
PASS
FAIL
Replace Rheostat and retest
Test exciter field. Disconnect 6 pin connector from CN1 receptacle on AVR. Measure resistance at pins J and K on CN5 plug. Reference Table 6 for correct resistance
PASS
FAIL
Repair wiring or replace Exciter Field
PASS
Test Open Delta Winding. Disconnect 6 pin connector from CN1 receptacle on AVR. Measure resistance at pins AB, CD, DA and BC on CN5 plug Reference Table 6 for correct resistance
FAIL
Replace or refurbish main stator (armature)
PASS
Manual Excitation Field Test Disconnect 6 pin connector from CN1 receptacle on AVR. Connect 12 VDC battery to pins J and K on CN5 plug Reference Table 7 for correct voltage
PASS
If AC output voltage meets values as referenced in Table 7 Indicates faulty AVR, Replace AVR and retest unit.
FAIL
No Voltage rise or very little rise could indicate insulation breakdown in the exciter field when battery voltage is applied. Shut unit off and perform insulation test on exciter field. Refer to insulation test for details.
FAIL
Replace exciter field and retest unit
Test Rotating Rectifier. Reference Rotating Rectifier test section.
FAIL
Replace rotating rectifier.
PASS
With Rotating Rectifier disconnected test Exciter Armature
FAIL
Replace or refurbish rotor
PASS
PASS
With rectifier disconnected test main field
FAIL
Replace or refurbish rotor
PASS
Disconnect stator leads from voltage selector switch Refer to stator test section
FAIL
Replace or refurbish stator

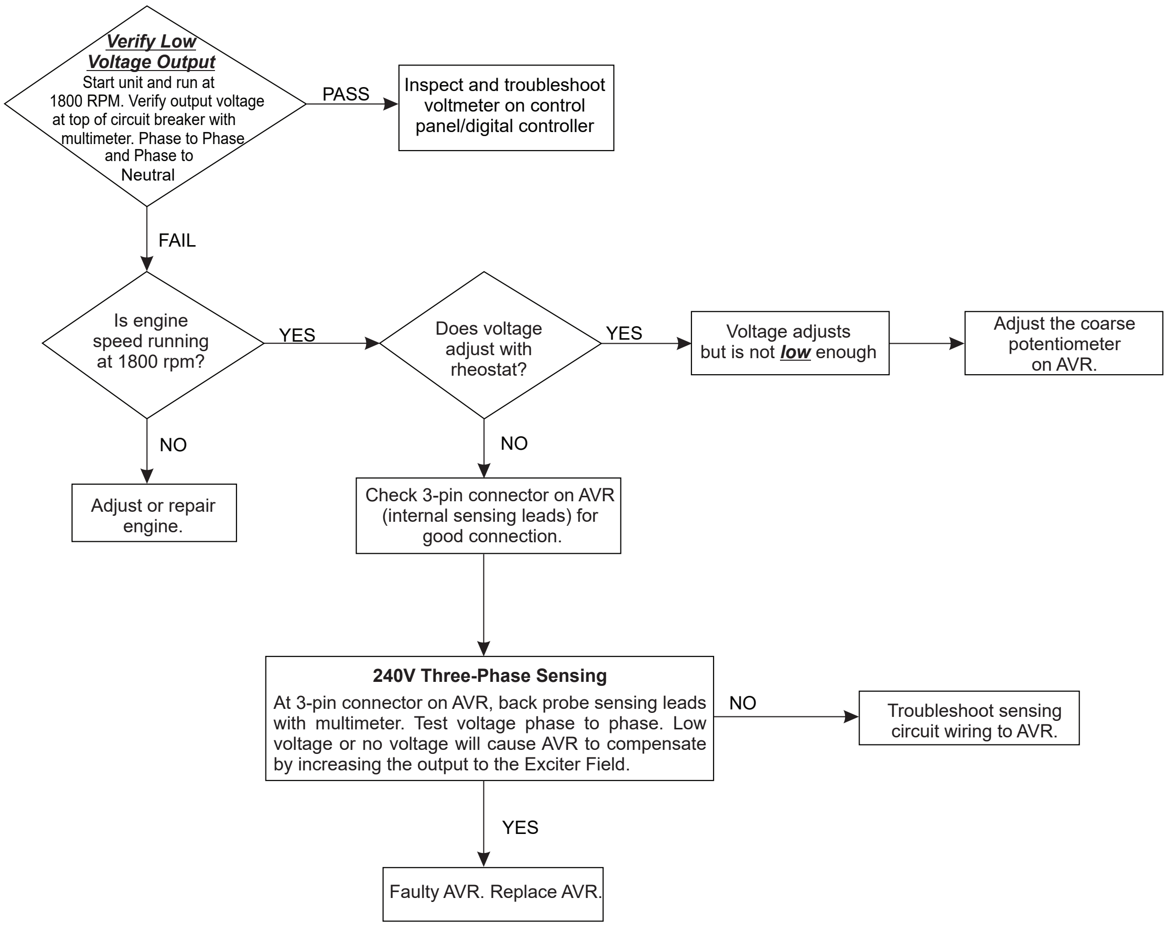
LOW VOLTAGE - NO LOAD



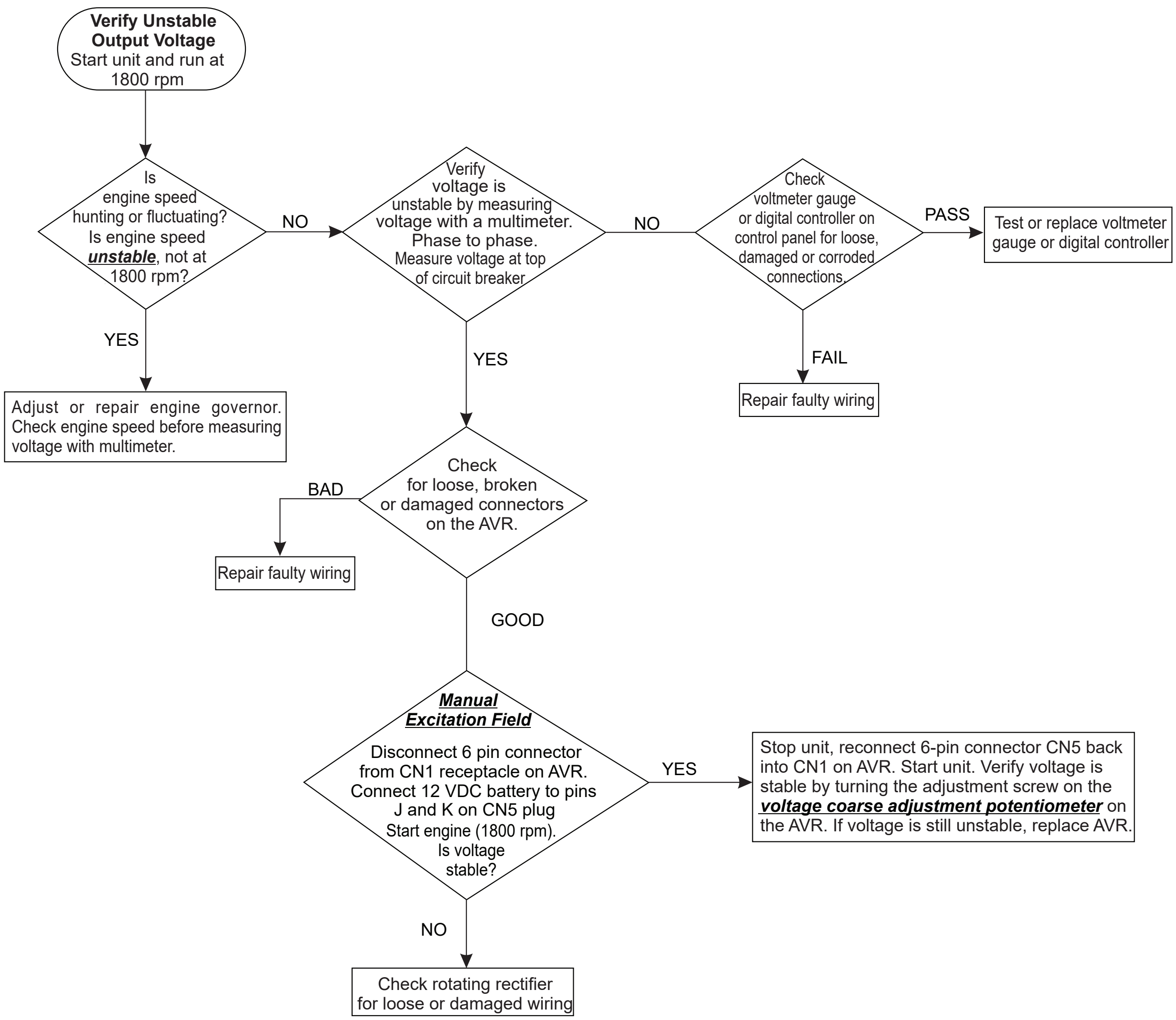
LOW VOLTAGE - WITH LOAD



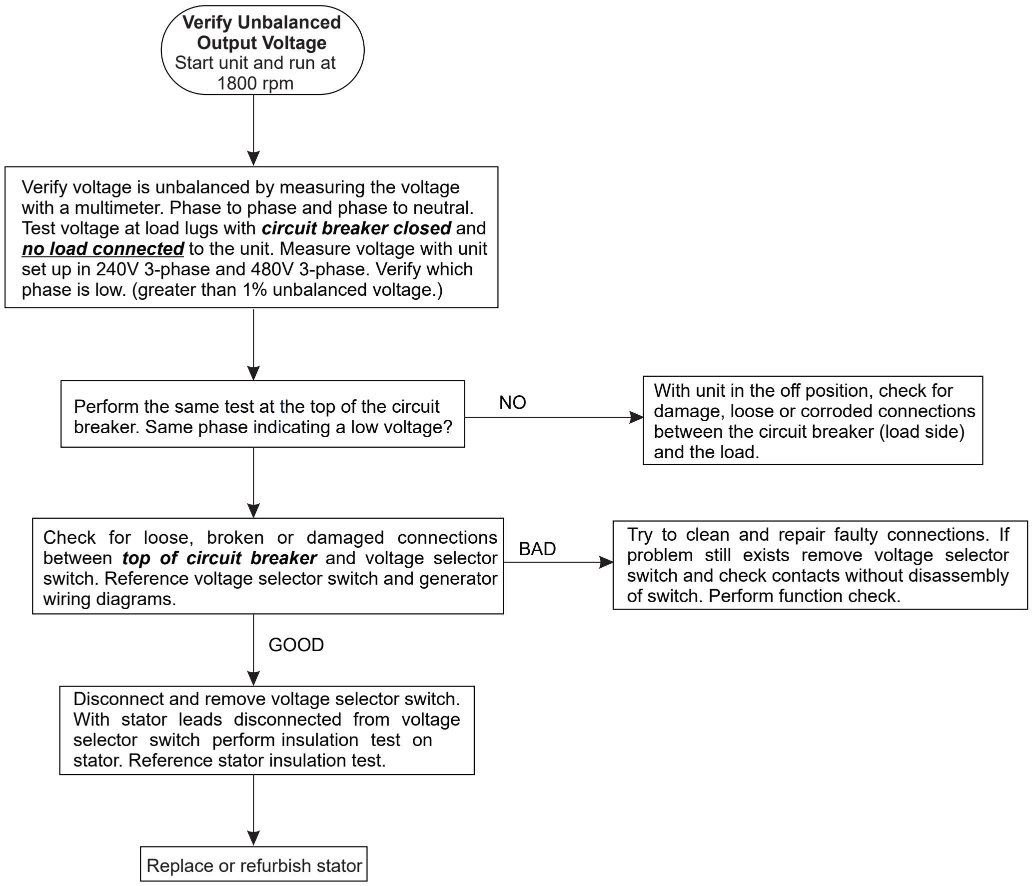
HIGH VOLTAGE



OUTPUT VOLTAGE UNSTABLE - NO LOAD



VOLTAGE UNBALANCED



SERVICE AND TROUBLESHOOTING MANUAL

HERE'S HOW TO GET HELP

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

UNITED STATES

Multiquip Inc.

(310) 537- 3700
6141 Katella Avenue Suite 200
Cypress, CA 90630
E-MAIL: mq@multiquip.com
WEBSITE: www.multiquip.com

CANADA

Multiquip

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

UNITED KINGDOM

Multiquip (UK) Limited Head Office

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

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