BALDOR®

GLC Generator

(Gaseous Liquid Cooled)

GLC30, 35, 45, 50, 60, 80, 100 and 125

Installation & Operating Manual

5/04 MN2408

WARNING:
CALIFORNIA PROPOSITION 65 WARNING:

Engine exhaust from this product contains chemicals known to the state of California to cause cancer, birth defects and other reproductive harm.

WARNING:
CALIFORNIA PROPOSITION 65 WARNING:

Battery posts, terminals and related accessories are known to the state of California to cause cancer, birth defects and other reproductive harm.

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Section 1
Product Safety Information

Safety Notice

Be sure that you are completely familiar with the safe operation of this equipment. This equipment may be connected to other machines that have rotating parts or parts that are controlled by this equipment. Improper use can cause serious or fatal injury. Always disconnect all electrical loads before starting the generator.

Installation and repair procedures require specialized skills with electrical generating equipment and liquid cooled engine systems. Any person that installs or repairs this generator must have these specialized skills to ensure that this generating unit is safe to operate. Contact Baldor service department for repairs or any questions you may have about the safe installation and operation of this system.

The precaution statements are general guidelines for the safe use and operation of this generator. It is not practical to list all unsafe conditions. Therefore, if you use a procedure that is not recommended in this manual you must determine if it is safe for the operator and all personnel in the proximity to the generator and connected loads. If there is any question of the safety of a procedure please contact Baldor before starting the generator.

This equipment contains high voltages. Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt the start–up procedure or troubleshoot this equipment.

This equipment may be connected to other machines that have rotating parts or parts that are driven by this equipment. Improper use can cause serious or fatal injury. Only qualified personnel should attempt the start–up procedure or troubleshoot this equipment.

- System documentation must be available to anyone that operates this equipment at all times.
- Keep non-qualified personnel at a safe distance from this equipment.
- Only qualified personnel familiar with the safe installation, operation and maintenance of this device should attempt start-up or operating procedures.
- Always stop engine before making or removing any connections.
- Always stop engine and allow it to cool before refueling.

Responsibility

When your generator is delivered, it becomes the responsibility of the owner/operator of the generator set to prevent unsafe conditions and operation of the equipment. Some responsibilities include (but are not limited to) the following:

1. It is the responsibility of the owner/operator of this generator to ensure that this equipment is correctly and safely installed.
2. It is the responsibility of the owner/operator of this generator to ensure that this equipment, when installed fully complies with all federal, state and local codes.
3. It is the responsibility of the owner/operator of this generator to ensure that any person operating this equipment has been properly trained.
4. It is the responsibility of the owner/operator of this generator to ensure that any person operating this equipment has access to all manuals and information required for the safe use and operation of this equipment.
5. It is the responsibility of the owner/operator of this generator to ensure that it is properly maintained and safety inspected at regular scheduled intervals.
6. It is the responsibility of the owner/operator of this generator to ensure that any person who has not been trained on the safe use of this equipment does not have access to this equipment.

Read This Manual Thoroughly

If you do not understand any concept, any procedure, any safety warning statement, any safety caution statement or any portion of this manual, contact Baldor or your nearest authorized Baldor representative. We are happy to make sure you understand the information in this manual so that you can safely enjoy the full use of this generator.

Baldor Generators
3815 Oregon Street
Oshkosh, WI 54902
(920) 236–4200 (voice); or (920) 236–4219 (fax); or www.baldor.com

Symbols

This symbol is shown throughout the manual to indicate a connection to ground reference point.

Indicates a potentially hazardous situation which, if not avoided, could result in injury or death.

Indicates a potentially hazardous situation which, if not avoided, could result in injury or death.

Precaution Statements Used In This Manual

There are three classifications of precautionary statements used in this manual. The most critical is a **WARNING** statement, then the **Caution** statement and the least critical is the Note statement. The usage of each statement is as follows:

WARNING: Indicates a potentially hazardous situation which, if not avoided, could result in injury or death.

Caution: Indicates a potentially hazardous situation which, if not avoided, could result in damage to property.

Note: Additional information that is not critical to the installation or operation.

IMPORTANT SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS – This manual contains important instructions for the generator that should be followed during installation, operation and maintenance of the generator and battery (batteries). For ease of reading, the Warning statements are divided into four categories: Operation, Burn, Installation, and Maintenance.

Operation

WARNING: Never operate this generator in a manner other than as described in this manual. Operation in any manner not described in this manual should be considered unsafe and should not be attempted. Never start the engine unless you have first verified that the installation and operation of the generator are as described in this manual.

WARNING: Be sure that you are completely familiar with the safe operation of this equipment. This equipment may be connected to other machines that have rotating parts or parts that are controlled by this equipment. Improper use can cause serious or fatal injury.

WARNING: Exhaust fumes/gases are extremely dangerous and can cause severe illness or death. Never breath exhaust fumes produced by a running engine. Only run the engine outdoors where ventilation is plentiful. Exhaust gases contain carbon monoxide, a colorless, odorless and extremely dangerous gas that can cause unconsciousness or death. Symptoms of carbon monoxide poisoning include: dizziness, nausea, headaches, sleepiness, vomiting or incoherence. If you or anyone else experiences these symptoms, get out into fresh air immediately. Stop the engine and do not restart the engine until it has been inspected and if necessary repaired or reinstalled in a well ventilated area.

WARNING: Hot exhaust gasses must never be directed toward anything that may catch fire or explode.

WARNING: This generator must not be used on or near any forest covered, brush covered, or grass covered land unless the engine's exhaust system is equipped with a spark arrestor. The spark arrestor must be maintained in effective working order by the operator.

WARNING: Some parts of this generator rotate during operation. Rotating parts can present extreme danger if clothing or body extremities are caught by the rotating part and can cause serious or fatal injury. Never touch a part of the generator until the engine has been stopped and all rotating parts are completely stopped. Also, disconnect the spark plug wires and battery connection to prevent accidental engine rotation during servicing.

WARNING: Never move a generator set that is running. Loads should be connected and position secure before starting the engine. Hazards are caused by moving a generator set that is running.

Continued on next page.

Operation Warning Statements Continued

WARNING: Never connect or disconnect loads during operation. Always connect load circuits before starting the engine and use external branch disconnects etc. to switch loads On/Off.

WARNING: Be sure that you understand how to stop the engine quickly in case of an emergency situation. Become familiar with the controls and safety systems provided with this generator set.

WARNING: Always wear safety glasses with side shields and hearing protection when working near the generator.

WARNING: Improper operation may cause violent motion of connected equipment. Be certain that unexpected movement will not cause injury to personnel or damage to equipment.

WARNING: Never operate the generator set indoors or in a poorly ventilated area such as a tunnel or cave. Exhaust fumes are extremely dangerous to all personnel that are in or in contact with that area.

WARNING: Never permit anyone to operate the generator without proper instructions. Be sure to keep a copy of this manual with the generator so that all users can be properly informed of its safe operation.

WARNING: Never allow children or pets to be in the area where the generator is running. The generator and the equipment being powered by the generator may cause injury or death.

WARNING: Never operate the generator unless all guards, covers, shields and other safety items are properly installed.

WARNING: Do not put hands, feet, tools clothing or other objects near rotating parts such as drive shaft, pulley, belt etc. Rotating parts cause extremely dangerous situations because they can catch loose clothing or extremities and cause serious or fatal injury.

WARNING: When operating this generator remain alert at all times. Never operate machinery when physically or mentally fatigued, or while under the influence of alcohol, drugs or medication.

WARNING: Never operate the engine when the air cleaner is removed. An engine backfire can cause serious burns.

WARNING: Never "jump start" a generator to start the engine. If the battery charge is insufficient to start the engine, charge or replace the battery and try to restart. Jump starting a battery can cause the battery to explode and cause severe injury or death to anyone in the area.

WARNING: High voltage is present whenever engine is running. Electrical shock can cause serious or fatal injury. Never operate electrical equipment while standing in water, on wet ground or with wet hands, feet or shoes or while barefoot.

WARNING: High voltage is present whenever the engine is running. Electrical shock can cause serious or fatal injury. Always stop engine before connecting or disconnecting power cords or external devices.

WARNING: Do not smoke near generator during operation or when close to fuel source. LPG and natural gas fuels are flammable and can cause fire, explosions, injury or death.

WARNING: Keep generator at least three feet away from buildings and other structures.

WARNING: Keep generator away from flammable or hazardous materials (trash, rags, lubricants, explosives, paints etc.) and grass or leaf build up.

WARNING: Keep a fire extinguisher near the generator while generator is in use. An extinguisher rated "ABC" by the National Fire Protection Association is appropriate.

Burn

WARNING: Parts of this generator are extremely hot during and after operation. To prevent severe burns, do not touch any part of the generator until you have first determined if the part is hot. Wear protective clothing and after use allow sufficient time for parts to cool before touching any part of the generator.

WARNING: Do not touch the hot exhaust parts or the high voltage spark plug or coil terminals of the engine. Although spark plug voltages are not normally lethal, a sudden involuntary jerk of the hand or body part caused by contact with high voltage or a hot surface can result in injury to yourself or others.

WARNING: Engine coolant is under pressure and is near the boiling point of water when engine is hot. Do not open the coolant system until the engine has completely cooled. Hot coolant can cause severe burns and other injuries. When engine is cool, coolant level can be checked.

Continued on next page.

Warning Statements Continued

Installation

WARNING: Installation and servicing of batteries is to be performed or supervised by personnel knowledgeable of batteries and the required precautions. Keep unauthorized personnel away from batteries.

WARNING: Disconnect the battery's ground terminal before working in the vicinity of the battery or battery wires. Contact with the battery can result in electrical shock when a tool accidently touches the positive battery terminal or wire. The risk of such shock is reduced when the ground lead is removed during installation and maintenance.

WARNING: An open bottom stationary engine generator set must be installed over noncombustible materials and shall be located such that it prevents combustible materials from accumulating under the generator set.

WARNING: Installation and repair procedures requires specialized skills with electrical generating equipment and small engine systems. Any person that installs or performs repairs must have these specialized skills to ensure that the generator set is safe to operate. Contact Baldor for installation or repairs.

WARNING: Be sure all wiring complies with the National Electrical Code (NEC) and all regional and local codes or CE Compliance. Improper wiring may cause a hazardous condition and exposure to electrical hazards can cause serious injury or death.

WARNING: Be sure the system is properly grounded before applying power. Do not apply AC power before you ensure that grounds are connected. Electrical shock can cause serious or fatal injury. NEC requires that the frame and exposed conductive surfaces (metal parts) be connected to an approved earth ground. Local codes may also require proper grounding of generator systems.

WARNING: Place protective covers over all rotating parts such as drive shaft, pulley, belt etc. Rotating parts cause extremely dangerous situations because they can catch loose clothing or extremities and cause serious or fatal injury.

WARNING: Unauthorized modification of a generator set may make the unit unsafe for operation or may impair the operation of the unit. Never start a generator set that has been modified or tampered with. Be sure that all covers and guards are properly installed and that the unit is safe before starting the engine. If you are unsure, contact Baldor before starting the engine.

WARNING: When moving the generator, use reasonable caution. Be careful where you place fingers and toes to prevent injury "Pinch Points". Never try to lift a generator without a hoist or lift means because they are heavy and bodily injury may result.

Warning: Never connect this generator to the electrical system of any building unless a licensed electrician has installed an approved transfer switch. The national electrical code (NEC) requires that connection of a generator to any electrical circuit normally powered by means of an electric utility must be connected by means of approved transfer switch equipment to isolate the electrical circuit from the utility distribution system when the generator is operating. Failure to isolate the electrical circuits by such means may result in injury or death to utility power workers due to backfeed of electrical energy onto the utility lines.

WARNING: Circuit overload protection must be provided in accordance with the National Electrical Code and local regulations.

WARNING: Check Ground Fault Circuit Interrupt (GFCI) receptacles monthly by using the "Test" and "Reset" buttons.

WARNING: Only a professional experienced technician should install a fuel supply system. LPG and natural gas fuels are flammable and can cause fire, explosions, injury or death. Fuel supply lines should be kept away from sharp objects to prevent rupture. Comply with all NFPA regulations and local codes for shut–off valves, regulators, fuel line type, connectors etc.

WARNING: Have electrical circuits and wiring installed and checked by licensed electrician or qualified technician. Electrical shock can cause serious or fatal injury.

WARNING: Incorrect installation of this generator set could result in property damage, injury or death. Connection of the generator to its fuel source must be done by a qualified professional technician or contractor.

WARNING: An open bottom stationary engine generator set must be installed over noncombustible materials and shall be located such that it prevents combustible materials from accumulating under the generator set.

Continued on next page.

Warning Statements Continued

Maintenance

WARNING: Disconnect the battery's ground terminal before working in the vicinity of the battery or battery wires. Contact with the battery can result in electrical shock when a tool accidently touches the positive battery terminal or wire. The risk of such shock is reduced when the ground lead is removed during installation and maintenance.

WARNING: Installation and servicing of batteries is to be performed or supervised by personnel knowledgeable of batteries and the required precautions. Keep unauthorized personnel away from batteries.

WARNING: A battery presents a risk of fire and explosion because they generate hydrogen gas. Hydrogen gas is extremely explosive. Never jump start a battery, smoke in the area around the battery or cause any spark to occur in the area around the battery.

WARNING: Do not mutilate the battery or dispose of a battery in a fire. The battery is capable of exploding. If the battery explodes, electrolyte solution will be released in all directions. Battery electrolyte solution is caustic and can cause severe burns and blindness. If electrolyte contacts skin or eyes, immediately flush the area with water and seek medical attention quickly.

WARNING: A battery presents a risk of electrical shock hazard and high short circuit current. Electrical shock can cause serious or fatal injury. Never wear jewelry, watch or any metal objects when in the area around the battery.

WARNING: The battery electrolyte is a dilute sulfuric acid that is harmful to the skin and eyes. It is electrically conductive and corrosive. If electrolyte contacts the skin, flush the area immediately with water and wash it off using soap and water. If electrolyte contacts the eyes, immediately flush the eye thoroughly with water and seek medical attention quickly.

WARNING: Before cleaning, inspecting, repairing or performing any maintenance to the generator set, always be sure the engine has stopped and that all rotating parts have also stopped. After stopping, certain components are still extremely hot so be careful not to get burned. Before servicing the generator set, be sure to disconnect the spark plug wires and the battery terminals to prevent accidental engine rotation or starting.

WARNING: Engine coolant is under pressure and is near the boiling point of water when engine is hot. Do not open the coolant system until the engine has completely cooled. Hot coolant can cause severe burns and other injuries. When engine is cool, coolant level can be checked.

WARNING: Before servicing the generator set, be sure to disconnect the spark plug wires and the battery terminals to prevent accidental engine rotation or starting.

WARNING: Inspect all wiring frequently and replace any damaged, broken or frayed wiring or wires with damaged insulation immediately. Electrical shock can cause serious or fatal injury.

WARNING: Disconnect all electrical wires and load devices from generator power outlets before servicing the generator. Electrical shock can cause serious or fatal injury. Always treat electrical circuits as if they are energized.

WARNING: Check all fuel supply piping, and their connections monthly for fuel leaks. LPG and natural gas fuels are flammable and can cause fire, explosions, injury or death. If a leak is found, replace only with approved pipe or components.

Continued on next page.

Caution Statements

Caution: **Avoid installing the generator set beside heat generating equipment, or directly below water or steam pipes or in the vicinity of corrosive substances or vapors, metal particles and dust. Heat can cause engine problems to develop and unwanted substances can cause rust or generator failure over time.**

Caution: **Do not apply high voltage to windings (do not start the generator) in a moisture–saturated condition. Moisture can cause insulation breakdown, making it necessary to return the generator to the factory for repair, and consequent expense and loss of time.**

Caution: **Use only original equipment or authorized replacement parts. Using the correct parts will assure continued safe operation as designed.**

Caution: **Do not support the generator from the top of the frame or enclosure.**

Caution: **Do not tamper with or change the engine speed. Engine speed is factory set to produce the correct voltage and output frequency.**

Caution: **Never operate the engine without a muffler. The engine is designed to have the correct exhaust components installed and operating without these components can present a fire hazard, cause excessive exhaust gases and cause damage to engine. Inspect muffler periodically and replace if necessary.**

Caution: **The Programmable Output Contacts selection must agree with the external control wiring prior to energizing the controller. Failure to do so may cause severe equipment damage.**

Section 2
General Information

Thank you for purchasing your Baldor Generator Set. This manual contains information you need to safely and efficiently install and operate your generator set. During the preparation of this manual every effort was made to ensure the accuracy of its contents. This manual describes only very basic engine information. A separate owner's manual for the engine is supplied with this unit for your use. Please refer to the engine manual for information relative to engine operation, maintenance, recommendations and additional safety warnings.

Baldor Generators have earned the reputation of being high quality and dependable. We take pride in this fact and continue to keep our quality standards high on our list of priorities. We are also constantly researching new technological ideas to determine if they could be used to make our generator sets even better.

Baldor makes no representations or warranties with respect to the contents hereof and specifically disclaims any implied warranties of fitness for any particular purpose. The information in this document is subject to change without notice. Baldor assumes no responsibility for any errors that may appear in this document.

Limited Warranty

Baldor Generators will replace or repair free of charge any part or parts of the generator of their manufacture that are defective in workmanship and materials for a period of time as set forth in the Warranty Period chart below. All Baldor products requiring warranty service shall be transported or shipped freight pre–paid, at the risk of the party requiring warranty service, to a Baldor Generator repair facility, or to Baldor Generators Department in Oshkosh, Wisconsin. Written notification of the alleged defect in addition to a description of the manner in which the Baldor generator is used, and the name, address and telephone number of the party requiring warranty service must be included. Baldor is not responsible for removal and shipment of the Baldor product to the service center or for the reinstallation of the Baldor product upon its return to the party requiring warranty service. Problems with Baldor products can be due to improper maintenance, faulty installation, non–Baldor additions or modifications, or other problems not due to defects in Baldor workmanship or materials. If a Baldor Generator repair facility determines that the problem with a Baldor product is not due to defects in Baldor workmanship or materials, then the party requesting warranty service will be responsible for the cost of any necessary repairs. EXCEPT FOR THE EXPRESSED WARRANTY SET FORTH ABOVE, BALDOR GENERATORS DISCLAIMS ALL OTHER EXPRESSED AND IMPLIED WARRANTIES INCLUDING THE IMPLIED WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE AND MERCHANTABILITY. NO OTHER WARRANTY, EXPRESSED OR IMPLIED, WHETHER OR NOT SIMILAR IN NATURE TO ANY OTHER WARRANTY PROVIDED HEREIN, SHALL EXIST WITH RESPECT TO THE GOODS SOLD UNDER THE PROVISIONS OF THESE TERMS AND CONDITIONS. ALL OTHER SUCH WARRANTIES ARE HEREBY EXPRESSLY WAIVED BY THE BUYER. UNDER NO CIRCUMSTANCES SHALL BALDOR GENERATORS BE LIABLE OR RESPONSIBLE IN ANY MANNER WHATSOEVER FOR ANY INCIDENTAL, CONSEQUENTIAL OR PUNITIVE DAMAGES, OR ANTICIPATED PROFITS RESULTING FROM THE DEFECT, REMOVAL, REINSTALLATION, SHIPMENT OR OTHERWISE. This is the sole warranty of Baldor Generators and no other affirmations or promises made by Baldor Generators shall be deemed to create an expressed or implied warranty. Baldor Generators has not authorized anyone to make any representations or warranties other than the warranty contained herein.

Warranty Period

Generator Series	Labor*	Parts
Portable Products (Premier, Powerchief, DG Series, K Series)	1 Year	3 Years
Towable Products (TS)	1 Year or 3,000 Hours Whichever comes first	3 Years or 3,000 Hours Whichever comes first
3600 RPM Standby Systems (Some AE Models)	1 Year or 1,000 Hours Whichever comes first	3 Years or 1,000 Hours Whichever comes first
1800 RPM Standby Systems (Some AE Models, DLC, GLC)	1 Year or 3,000 Hours Whichever comes first	3 Years or 3,000 Hours Whichever comes first
Industrial Standby Systems	1 Year or 1,000 Hours Whichever comes first	2 Years or 1,000 Hours Whichever comes first
Industrial Prime Power Systems	1 Year or 1,000 Hours Whichever comes first	1 Year or 1,000 Hours Whichever comes first
International	1 Year or 1,000 Hours Whichever comes first	1 Year or 1,000 Hours Whichever comes first

*For products covered under labor coverage, travel expenses will be allowed up to 7 hours straight labor or 300 miles, whichever occurs first and only applies to permanently wired and mounted products (AE, DLC, GLC, IDLC).
No warranty registration card is necessary to obtain warranty on Baldor Generators.
You must save the purchase receipt. Proof of purchase, date, serial number and model number will be required for all portable and Towable products to qualify for any warranty consideration.
For all other products, a start–up inspection form/warranty registration must be completed in its entirety and submitted to Baldor Generators within 30 days of start–up to qualify for any warranty consideration.

Important Be sure you are completely familiar with all Safety Instructions detailed in Section 1 of this manual. Do not proceed if you are unsure of any detail. Contact your Baldor Distributor, they are experienced and are happy to assist you and to answer your questions.

Installation Guidelines

The procedures presented in this manual are suggestions and it is the responsibility of the Owner/Operator to arrange for these procedures to be performed by licensed contractors according to all applicable codes including local codes for your Municipality/City/County and State. In addition to these suggestions, before installing your generator you should obtain the most up to date copies of the following documents from the National Electrical Code and other authorities:

- National Electric Code, Articles 230, 250, 445, 517, 700.
- National Fire Protection Association
  No. 30 – Storage, Handling and Use of Flammable Liquids.
  No. 37 – Stationary Combustion Engines and Gas Turbines.
  No. 99 – Essential Electrical Systems for Health Care Facilities.
  No. 101 – Life Safety Code No. Systems.
  No. 110 – 1985 Emergency and Standby Power Systems.
- NEMA MG1
- Local Codes applicable to Genset Installation. See your local building inspector.

NFPA (National Fire Protection Association (617) 770–3000 (includes NEC)
1 Batterymarch Park, Quincy, MA 02169–7471 USA

NEMA (National Electrical Manufacturers Association) (703) 841–3200
1300 N. 17th Street, Suite 1847, Rosslyn, VA, 22209 USA

Site Planning

Room Size

Open frame generators must be protected from the environment while having good ventilation and cooling. Here are some considerations for planning a generator room or enclosure:

- Never use the Genset room for storage as well.
- The room must be large enough to contain the genset and all the accessories, such as batteries and their charging system, transfer switch and other controls, and elements of the cooling and fuel systems.
- A minimum of 2 feet (preferably 4 feet), must be allowed on the two sides of the engine for service access.
- On the generator end of the engine, allow a space equal to the length of the generator (generator length only, not the entire genset).
- At the front of the engine, 4 feet of clearance is preferable. Allow clearance between hot parts of the system (exhaust) and structural members of the building.
- Certain safety and building codes may require the genset room not to be used to house any other mechanical or electrical equipment.

Room Location Often a separate building located on the site away from the main building is the most simple and cost effective. Major considerations when housing the genset in a separate building are:

- Maintain the building at a satisfactory temperature year round (to meet applicable codes).
- Assure the genset is not located so far from the emergency loads that reliability is compromised.
- The floor's load carrying capacity must be checked and must exceed the weight of the genset and its associated equipment.
- **Engine Cooling System**
  A genset with an engine mounted radiator is the least costly to install; however, the room must be located in a place where sufficient radiator cooling air can be brought into and exhausted from the room.
- **Exhaust System**
  The exhaust system must minimize exhaust restriction. Exhaust restriction must be limited to 3 in. Hg (76 mm Hg) maximum, to ensure proper engine operation. The exhaust system should be as short and have as few bends as possible.
- **Room Air**
  If the genset is cooled with an engine mounted radiator, and sufficient air is brought into and exhausted from the room to satisfy the radiator cooling requirements and the combustion air requirements, the room will not overheat when the genset is running. If a remote mounted radiator or a heat exchanger is used, and adequate air is circulated through the room to keep it at a reasonable temperature, there will be adequate air for combustion.
- **Fuel Tanks (Diesel Only)**
  Locate the fuel storage tank as near the genset as possible. This will minimize the cost of fuel system installation and will maximize fuel system reliability.
- **Controls and Transfer Switch**
  Locate the control switch gear as close to the emergency loads and the genset as practical. This will minimize the chances that a failure of the power line to the emergency load will go undetected. In locating the switchgear, accessibility for service and maintenance must be considered.
- **Genset Noise**
  Internal combustion engines produce noise, so the room should be located away from occupied buildings. In addition the genset room can be treated to reduce noise transmission. In locating the genset room, both engine, fan and exhaust noise must be considered.

  If noise within the genset room, or noise transmitted to the surrounding parts of the building are a concern, then the room must be made large enough to allow for installation of noise attenuating walls and noise absorbing walls.
  Light weight concrete blocks filled with sand or special "sound block" concrete blocks are commonly used. Noise attenuating, tight fitting windows and doors also help reduce noise transmission to the rest of the building.
  A double–walled room should be considered. Vibration isolators under the genset rails will also reduce the transmission of noise through the floor.
- **Code Requirements**
  Building and safety codes deal with engine location. These requirements are concerned with fire rated walls, a location that minimizes the possibility of damage to the genset and interruption of the emergency system due to storms, foods, fire, vandalism, etc.

  Codes often deal with the need to maintain certain temperatures in the genset room and with fuel system location. The most important codes in the USA are the National Fire Protection Association Code Numbers 99 and 110, but local codes must also be observed.

Foundation Design

WARNING: An open bottom stationary engine generator set must be installed over noncombustible materials and shall be located such that it prevents combustible materials from accumulating under the generator set.

Foundation Checklist

A. Evaluate if a separate, isolated foundation is required for the application.
B. Observe local codes on soil bearing capacity freezing and thawing.
C. Design the separate foundation for the genset and specify the appropriate concrete mix.
D. Determine if the application requires vibration isolators and if so, order as a factory option.

The foundation must be strong enough to support the weight of the genset and its associated equipment, must prevent any deflection of the genset base and absorb vibration produced by the rotating and reciprocating masses.

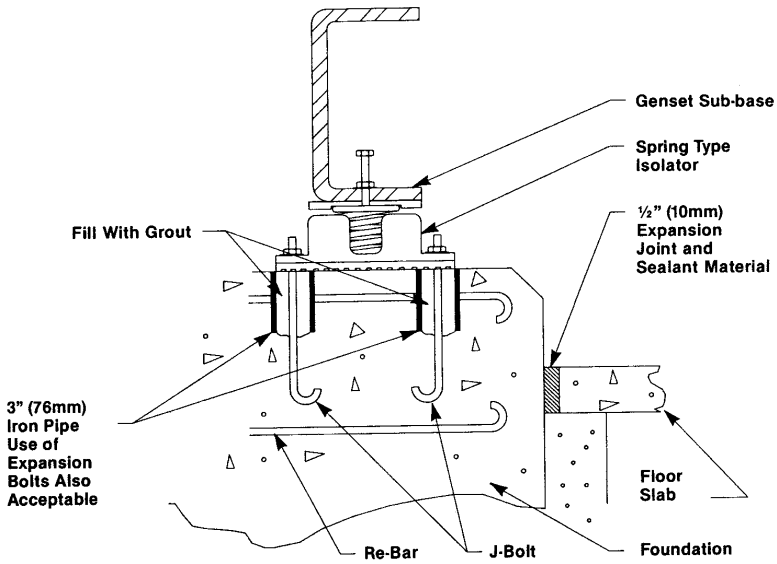
Setting The Genset On An Existing Concrete Floor Slab

- If an existing floor is used, the floor slab must be strong enough to carry 1.50 times the genset wet weight (including coolant and oil) to accommodate dynamic loads.
- The actual mounting arrangement (ie., surface area in contact with the floor) will determine the compressive strength required.
- The genset should be securely fastened to the floor slab with expansion anchors that fit the mounting holes shown on the genset installation diagram.
- For installations not expected to be permanent, elastomer pad with non–slip surface placed between the base and the floor will also prevent movement.
- Any floor/slab surface should be as flat as possible to prevent sub–base deflection.

Vibration Isolators

- Mounting to the pad, will result in overall reduced motion on other parts of the genset. The trade–off is that slightly more vibration is transmitted to the structure.
- A more common practice when mounting to a concrete pad is to use vibration isolators. The two most common types of vibration isolators are steel spring and elastomer pad. The primary purpose of vibration isolators is to reduce the noise and vibration which would be transmitted from the genset to the foundation or supporting structure.
- A simple and effective method of mounting and applying pad type isolators is to place non–skidding type isolation pads directly between the sub–base and floor. The number of pads required will be determined by the load bearing capability of the pads and the genset's weight.

Figure 2-1 Typical Installation of Spring Type Isolator



- Steel spring isolators are a very effective and commonly used. Steel spring isolators are typically 95–98% efficient (reduces the transmitted vibration 95–98%) while a pad type can be 75–88% efficient. Spring isolators also level the genset sub–base in the event the foundation pad is not perfectly level.

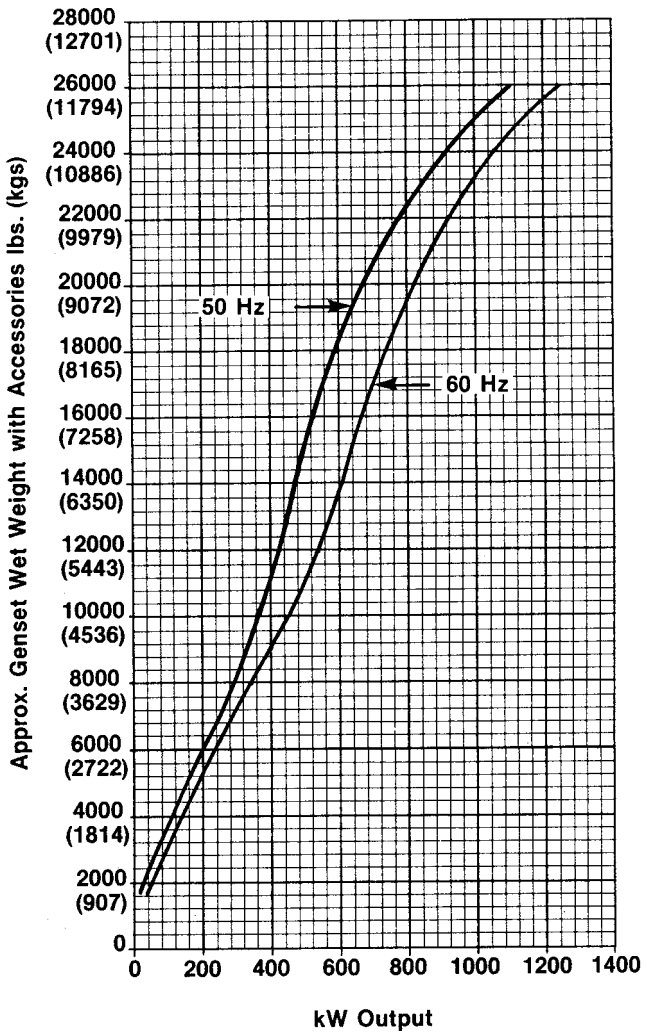
  Spring steel isolators offer the highest level of vibration isolation, however higher levels of vibration (although not detrimental) may be seen on some areas of the genset when mounted on steel springs, due to the (almost) total isolation from the foundation. The base of most steel spring isolators contains a non–skid pad. The base should be mounted to the foundation pad as shown in Figure 2-1 or as recommended by the isolator manufacturer.

  A common practice is to pour a concrete pad directly on top of the floor slab and to mount the genset on this pad. The purpose of the pad is to facilitate cleaning around the genset and to provide a more level base. When using this method, floor strength must support the pad and the genset. The pad should be at least 6in (150mm) thick and extend beyond the genset in all directions 12in (300mm).

Weight Of The Genset

The dry weight of the entire genset is shown on the Generator Set Specification Sheet. The wet weight includes the fluids (coolant and oil). Figure 2-2 can be used to design the foundation except in critical situations.

Figure 2-2 Approximate Weight vs. kW Output



Designing An Isolated Foundation

If the genset cannot be mounted directly on a floor slab, or if it is desirable to isolate it from the floor slab, then a separate foundation slab must be designed.

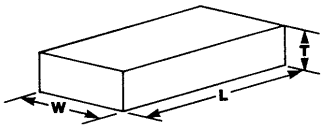
A massive concrete foundation is not required. Outside dimensions of the foundation should exceed the outside genset dimensions by 12in (300mm).

For single genset installation, the foundation weight should be a minimum of 1.50 times the genset wet weight.

For multiple genset installation, the foundation weight should be a minimum of 2.0 times the genset wet weight.

Figure 2-3 shows a method to calculate foundation thickness and the soil bearing load of the foundation and generator set. The soil load bearing capacity under the foundation must equal or exceed the load from the foundation and genset. If it does not, then a footing, as shown in Figure 2-4 must be added to spread the load over a larger area.

Figure 2-3 Calculate Soil Bearing Load (SBL) Capacity



$$T = \frac{W_T}{145 \times L \times W}$$

Where:
- T = foundation depth in feet (m)
- W_T = wet weight of genset in pounds (kg)
- 145 = density of concrete in pounds per cubic foot (2322 kg/m³)
- L = foundation length in feet (m)
- W = foundation width in feet (m)

$$SBL = \frac{TW}{W \times L}$$

Where:
- SBL = soil bearing load in lbs. per square foot (kPa)
- TW = total weight of the engine – generator, the foundation, and any other equipment that is supported on the foundation in pounds (kg)
- W = foundation width in feet (m)
- L = foundation length in feet (m)

Figure 2-4 Typical Footing on Foundation in Soil With Low Soil Load Bearing Capacity

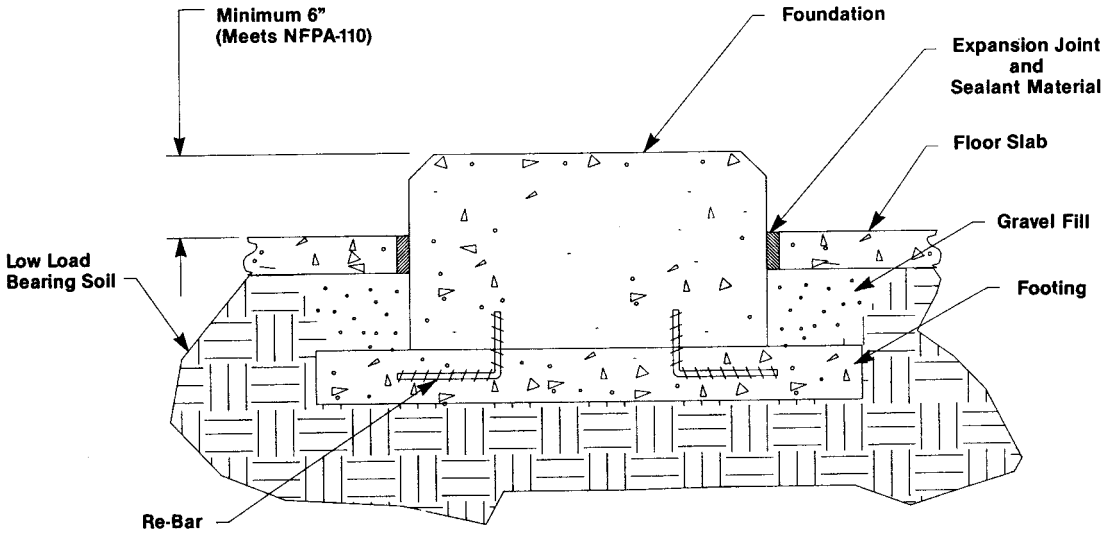


Table 2-1 Approximate Load Bearing Capacities of Various Soil Types

Soil Type	Safe Bearing Capacity	
	lb per ft^2	kilo Pascals
Hard Rock – Granite etc.	50,000 – 200,000	2,395 – 9,576
Medium Rock – Shale etc.	20,000 – 30,000	958 – 1,436
Hardpan	16,000 – 20,000	766 – 958
Soft Rock	10,000 – 20,000	479 – 958
Compacted Sand and Gravel	10,000 – 12,000	479 – 575
Hard Clay	8,000 – 10,000	383 – 479
Gravel and Coarse Sand	8,000 – 10,000	383 – 479
Loose, Medium and Coarse Sand	8,000 – 10,000	383 – 479
Compacted Fine Sand	6,000 – 8,000	287 – 383
Medium Clay	4,000 – 8,000	192 – 383
Loose Fine Sand	2,000 – 4,000	96 – 192
Soft Clay	2,000	96

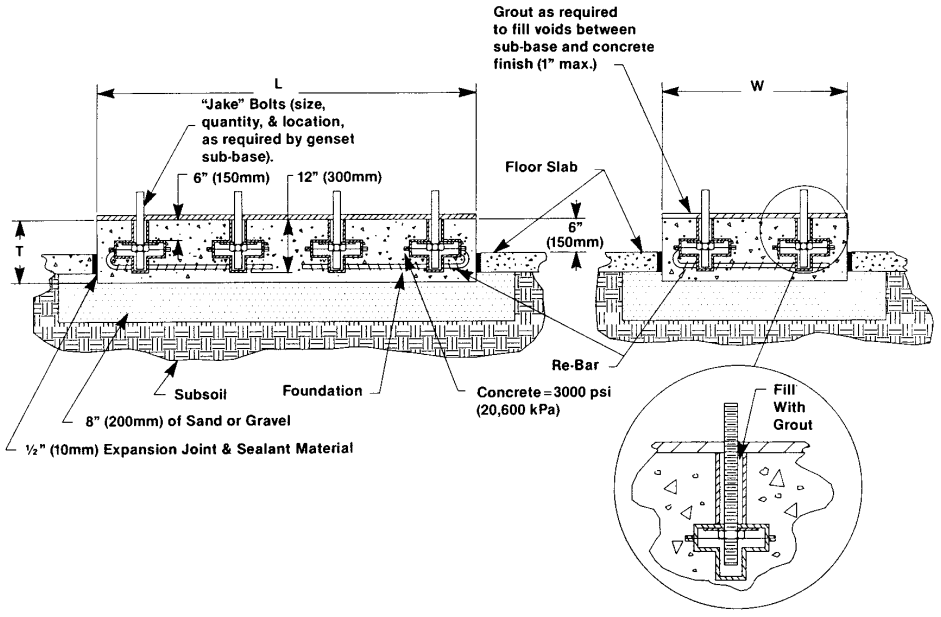
Table 2-1 shows approximate load bearing capacities for various types of soil if the actual load bearing capacity of the soil under the foundation is not known.

Caution: Check the local building codes for load bearing capacity requirements.

Caution: If the soil is subject to freezing and thawing, the foundation must be extended below the frost line. Check the local building codes.

- Reinforce the foundation with No. 8 gauge steel wire mesh placed horizontally on 6in (150mm) centers. As an alternative, use No. 6 re–bars on 12in (300mm) centers horizontally. Minimum cover over the bars should be 3in (76mm).
- Suggested concrete mixture by volume is 1 part cement, 2 parts sand, and 3 parts aggregate. Maximum slump of 4in (100mm) and a 28–day compressive strength of 3000 psi (20,600 kPa).
- The size of the bolts holding the sub–base to the foundation should be sized to fit the mounting holes shown on the Installation Diagram.
- Three–inch (76mm) iron pipe sleeves should be placed around the bolts in the foundation to allow for any mislocation of the bolts after the foundation hardens. “J” or “L” type bolts are recommended for the foundation bolts.
- After the foundation is cured and the genset is located, the sleeves are filled with grout. Figure 2-5 shows a typical foundation installation.

Figure 2-5 Typical Foundation Installation



Exhaust System

Exhaust Checklist

A. Exhaust outlets are not located upwind or near any building air intakes.
B. Flexible piping section is used at engine exhaust outlet.
C. Exhaust piping material is adequate for expected service.
D. Exhaust piping sizing is adequate to prevent back pressure.
E. Exhaust piping components are insulated as necessary to prevent operator burns and reduce pipe radiant heat losses.
F. Pipe sleeves or fire proof materials are used where exhaust pipe passes through building materials as per local and state codes.
G. Exhaust pipe includes rain cap or is horizontal.

The purpose of the exhaust system is to safely discharge the engine combustion products into the atmosphere outside the building. A silencer should be installed in the exhaust system to reduce noise levels. Compliance with local noise codes is always required.

Level Of Attenuation

In general, manufacturers offer three grades of silencers: industrial, residential, and critical. In most cases, these grades are comparable from make to make. However, attenuation curves for the silencer should be checked to assure the desired level of silencing is met.

System Placement

By this time, the general genset placement within the room or building has been decided. The routing of the exhaust system should be as direct as possible to the building exterior.

WARNING: Never allow the exhaust outlet to be positioned so that the exhaust gases are directed towards any openings or air entry routes (doors, windows, vents, etc...) of an occupied building. When discharging the hot exhaust gases out of the building do not direct them towards anything that could catch fire or explode.

For aesthetic reasons, consider exhaust placement in relation to the building. Over a period of time, exhaust gas carbon deposits will tend to accumulate on any nearby wall or structure. Attention must also be given to exhaust noise in selecting placement of the exhaust system.

Multi–Engine Installations

Caution: Do not connect multi–engine exhaust systems together. Each engine must have its own exhaust system for proper operation.

Exhaust gases from an operating engine will migrate back through a non–operating engine and cause a hydraulic lock. This may interfere with starting of the second engine. The migrating gases will also tend to turn the turbos which are not being provided lubrication if the engine is not running. The use of check valves in the exhaust system are discouraged due to their tendency to “stick”.

Exhaust Manifold

There are two exhaust manifold types. Dry type which is standard and the optional water cooled. The dry type is simply exposed to the surrounding air and becomes very hot. Shields, insulating wraps, or other types of guards can be used to limit operator contact with the hot surfaces. This practice is common where engine room size is small, creating cramped conditions.

Water cooled exhaust manifolds are not available on all engine models. This type manifold has passages through which engine coolant is circulated to remove heat from the manifold surface. It also will help protect the operator from contact with the hot manifold surface. This will reduce the amount of heat that is radiated by the engine to the surrounding air by approximately 20%. In addition, this type manifold significantly increases the amount of heat the cooling system must dissipate. Marine and Mining Safety Administration (MSA) codes may require water cooled manifolds in all genset installations. If you are in doubt on your particular application, consult your Baldor Distributor.

Exhaust Gas Restriction

The maximum allowable back pressure, or system restriction, is 3 inches of mercury. If this back pressure is exceeded, the air–fuel ratio is reduced due to incomplete scavenging of the cylinders, fuel economy and power output is reduced, engine life is reduced and exhaust temperatures and smoke levels increase. Any restriction of the exhaust gas reduces horsepower. Take every precaution to reduce restriction. Proper design and installation will provide safe genset operation.

It is essential that all engine exhaust systems by designed with the least possible restriction to exhaust gas flow. This can be calculated through the use of Figure 2-6, or in the case of simple exhaust systems, the nomograph in Figure 2-6 may be used.

Figure 2-6 Exhaust System Calculations

$$P\ (psi) = \frac{L \times S \times Q^2}{5{,}184 \times D^5}$$

$$P\ (kPa) = \frac{L \times S \times Q^2 \times 10{,}000}{0.0027787 \times D^5}$$

P = Backpressure (psi) (kPa)
psi = 0.4912 x inches Hg
kPa = 0.1333 x mm Hg
L = Length of pipe (ft) (m)
Q = Exhaust gas flow (cfm) (m³/min.)
D = Inside diameter of pipe (in) (mm)
S = Specific weight of gas (lb-ft³) (kg/m³)

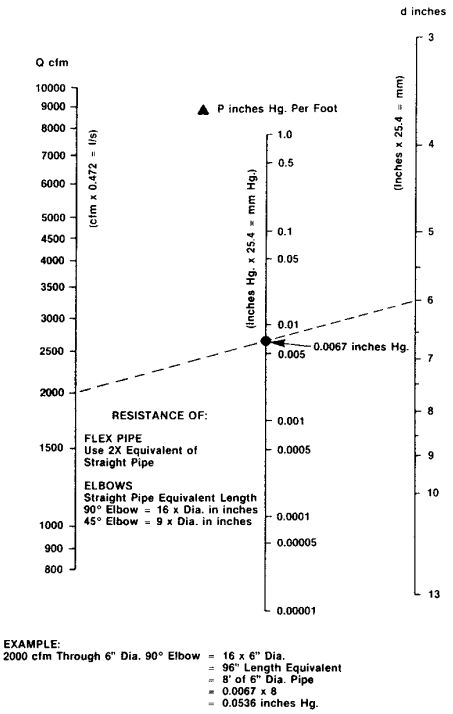
$$S\ (lb\text{-}ft^3) = \frac{39.6}{\text{Exhaust Temperature} + 460°F}$$

$$S\ (kg/m^3) = \frac{352.05}{\text{Exhaust Temperature} + 273.16°C}$$

To obtain equivalent length of straight pipe for each long radius 90° bend:

$$L\ (ft) = 15 \times D \qquad L\ (m) = 15 \times D$$
$$L\ (in) = \frac{15 \times D}{12} \qquad L\ (mm) = \frac{15 \times D}{1000}$$

The radius of 90° bends with radii 1½ times the pipe diameter help to lower resistance.



Exhaust Piping

Caution: The weight of the exhaust system must never be imposed on the turbo–charger outlet. Damage to the turbo–charger and other components may result.

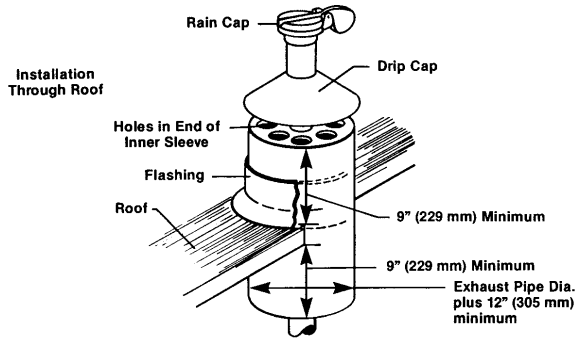
An exhaust system must withstand the vibration and thermal expansion that they are subjected to, yet supported well enough to remain independent of the engine.

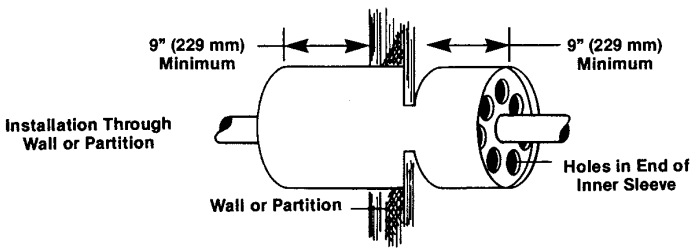
The most common method of providing flexibility is with the use of bellows type flexible piping. This piping component allows lateral and linear movement of the piping system without subjecting fixed components to excessive stress. A minimum of 12 inches of flexible connection must be provided at the engine exhaust manifold to allow for thermal expansion and vibration. If the engine is to be mounted on spring type vibration isolators, increase the length to 24 inches. This component can be specified to be provided by your Baldor distributor. Flexible pipe should never be used for pipe bends or to cure misalignment problems.

Exhaust piping systems may be supported by a wide variety of methods to long as the system remains flexible, and capable of withstanding thermal expansion.

The material most commonly used for straight runs and elbows in exhaust systems is Schedule 40 black iron. If hanging weight is a problem, other materials may be used. Galvanized piping should never be used in exhaust system. Where exhaust piping passes through combustible material, exhaust thimbles must be used. See Figure 2-7.

Figure 2-7 Exhaust Pipe Thimble Installation





Rain Protection

Moisture entering the engine through an exhaust system can cause extensive damage. Exhaust outlets must have a rain cap or be horizontal to prevent such damage. See Figure 2-7.

Cooling System

Cooling System Checklist

A. Have noise considerations been taken into account?
B. Has system piping been properly sized?
C. Has system been properly protected from freeze up and corrosion?
D. Have standby equipment heaters been specified?
E. Have all electrically driven devices been connected to load side of EPS connection points?
F. Have system drain valves and air eliminators been installed?

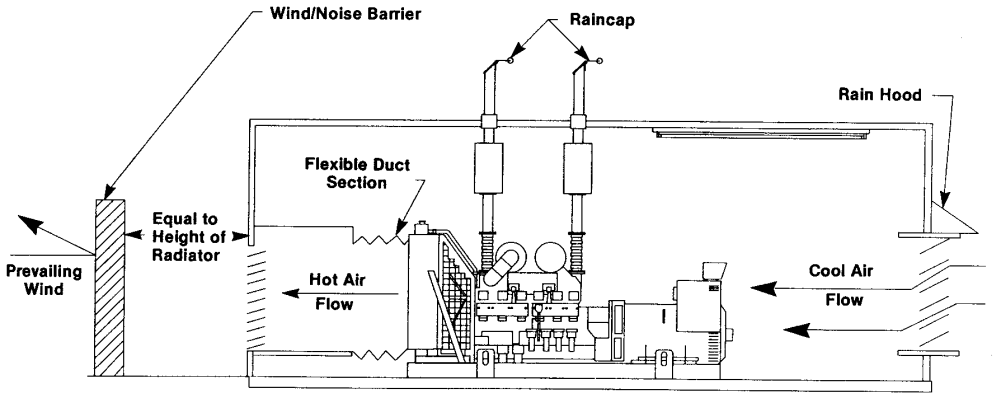
The system consists of the cooling medium which is generally a solution of water and ethylene glycol, a method of rejecting engine produced heat, and a means to transport cooling medium between the engine and heat rejection system. The first determination is the type of cooling system to use – radiator cooling or heat exchanger cooling.

Radiator Cooling

The first and simplest is the engine mounted radiator shown in Figure 2-8. The radiator, water circulating pump, fan and fan drive are mounted to the generator set base rails by the factory. This method of engine cooling is the most economical, but may require large ventilation vents and ducts. An added advantage of this arrangement is that the cooling air removes radiated heat from the engine, generator, and other equipment located in the emergency power system room.

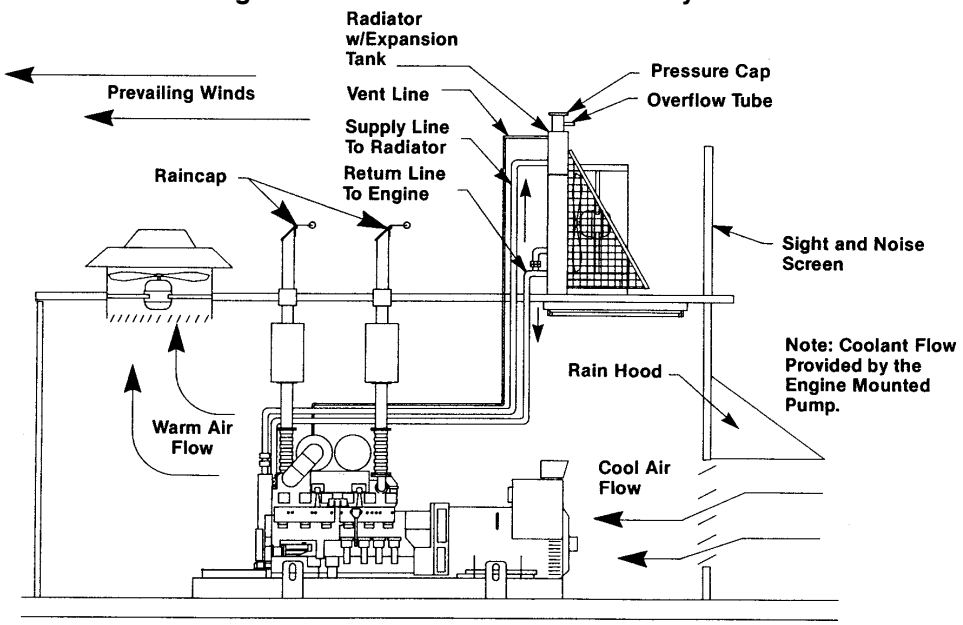
The only remaining design work with the engine mounted radiator is arranging a method of providing air to the room, and exhausting it from the radiator. See “Air Systems”.

Figure 2-8 Engine Mounted Radiator Cooled System With Wind/Noise Barrier



The radiator can be mounted remotely (not mounted directly at the engine). The remote/close system uses the same radiator type except it is mounted in another room or outside the building, but within close proximity to the genset. See Figure 2-9.

Figure 2-9 Remote Radiator Cooled System



The remote radiator may be mounted either vertically or horizontally. In general, the radiator will have an electric fan to provide cooling air and may be able to utilize the engine mounted coolant pump to provide coolant flow.

The piping system friction and head loss between engine and radiator must be calculated and not exceed the capacity of the engine pump. If the maximum coolant friction head loss external to the engine is exceeded, a hot well system must be used. Before designing the piping system using an auxiliary pump and hot well, the consultant should look very closely at increasing the system's pipe size.

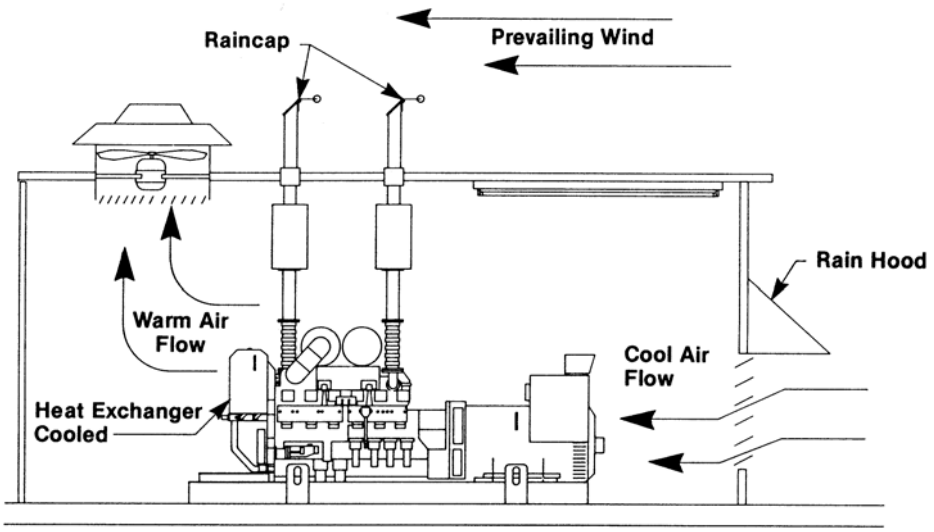
The electric fan and auxiliary pump, if used, must be connected to the emergency power system. Radiator and cooling fan must be sized to provide the cooling capacity required at an acceptable sound level.

Caution: In cold climates, the high volume of outside air drawn into the genset room can quickly reduce temperatures in the room to freezing. Any water piping or other equipment susceptible to freeze damage should be properly insulated or located elsewhere.

Heat Exchanger

In the heat exchanger system, engine coolant is circulated through the shell side of a heat exchanger, while city water, well water, or some other cooling medium, is circulated through the tube side. The primary consideration in this type cooling system is to remember that during certain types of disasters, these cooling mediums may not be available, especially city water. The system is relatively inexpensive to install and maintenance is low. See Figure 2-10.

Figure 2-10 Heat Exchanger Cooled System



The heat exchanger cooling system can be used with a cooling tower. These systems are complex, and consists of circulating pumps, heat exchanger for engine coolant, and cooling tower for heat rejection. The system design requires that several pieces of equipment be sized and installed. Overall, this system is more expensive than other methods of engine cooling.

Cooling System Determination

After cooling system selection, gather the required basic information before proceeding through this section. Information required includes engine heat rejection load, pumping capacity of the engine mounted pump, engine coolant flow requirements and pressure drop through the engine, and allowable operating temperature. This information is found on the engine data sheet.

Cooling System Design

Engine Mounted Radiator Cooling

If the engine mounted radiator is selected, the only remaining design work is arranging a method of providing air to the room, and exhausting that air from the radiator. See "Air Systems".

Remote Radiator Cooling

Remote Radiator Airflow generally assumed there will be no external restrictions to airflow. If this is not true, restriction must be considered in sizing and selection of a cooling fan and drive motor. Typical examples of restrictions include landscaping, nearby buildings, air turbulence created by buildings or other structures, and sight or noise "screens". See Figure 2-9.

Remote Radiator Fan Motor. Remote radiator cooling systems require the use of an electrically driven fan. This fan must be connected to the emergency power source. Size of the motor is determined by the fan size and fan speed.

1. To specify a radiator to cool the coolant you will need to determine the amount of heat rejected to the coolant. This is listed on the Engine Data Sheet as Heat Rejected to Coolant in BTU/min. for engines using dry or water cooled type exhaust manifolds, as applicable.
2. Determine the minimum water flow required at the engine, and the maximum top tank temperature. Using this information, determine the heat rejection capacity required of the radiator. Radiator systems should be sized with approximately 15% greater capacity than the engine's maximum full load heat rejection to allow for overload and cooling system deterioration. Whether water flow is produced by an engine mounted or auxiliary pump, total piping system friction loss must be calculated. To do this, genset location, remote radiator location and friction loss within the radiator, and piping system must be estimated.
3. Pressure drop through the radiator must be obtained from radiator manufacturer.
4. If total piping system pressure exceeds the allowable Maximum Coolant Friction Head External to the engine as listed on the Engine Data Sheet, the coolant piping size should be increased and/or a radiator with less restriction must be used.
5. Pressure drop in pipelines may be determined by the use of information in Table 2-2 Figure 2-11, and friction of water tables which may be found in most mechanical handbooks such as "Cameron Hydraulic Data" handbook.

Table 2-2

Fitting Size	Flow Restriction of Fittings Expressed as Equivalent of Straight Pipe (in inches)											
	1.5	**2**	**2.5**	**3**	**4**	**5**	**6**	**8**	**10**	**12**	**14**	**16**
90 Elbow	4.4	5.5	6.5	8	11	14	16	21	26	32	37	42
45 Elbow		2.5	3	3.8	5	6.3	7.5	10	13	15	17	19
Long Sweep Elbow	2.8	3.5	4.2	5.2	7	9	11	14	17	20	24	27
Close Return Bend		13	15	18	24	31	37	51	61	74	85	100
Tee–Straight Run		3.5	4.2	5.2	7	9	11	14	17	20	24	27
Tee–Side Inlet or Outlet	9.3	12	14	17	22	27	33	43	53	68	78	88
Globe Valve Open		55	67	82	110	140						
Angle Valve Open		27	33	41	53	70						
Gate Valve Fully Open		1.2	1.4	1.7	2.3	2.9	3.5	4.5	5.8	6.8	8	9
Gate Valve Half Open		27	33	41	53	70	100	130	160	200	230	260
Check Valve		19	23	32	43	53						

Hot Well Installations

One final consideration on the water side is the Maximum Static Head. This is the maximum height allowable from the engine crank center line to the highest point in the coolant system. The maximum static head is specified on generator specification sheets. If this number must be exceeded, a hot well tank system must be used. A typical example is shown in Figure 2-12.

The design of hot well tanks and piping systems is somewhat complex. Your authorized Baldor Distributor has experience in the design and installation of hot well systems. Consult your Baldor Distributor if the static head of the coolant system in your genset application exceeds this criteria and requires a hot well system.

Figure 2-11 Valves & Fittings and Fluid Flow in Pipe

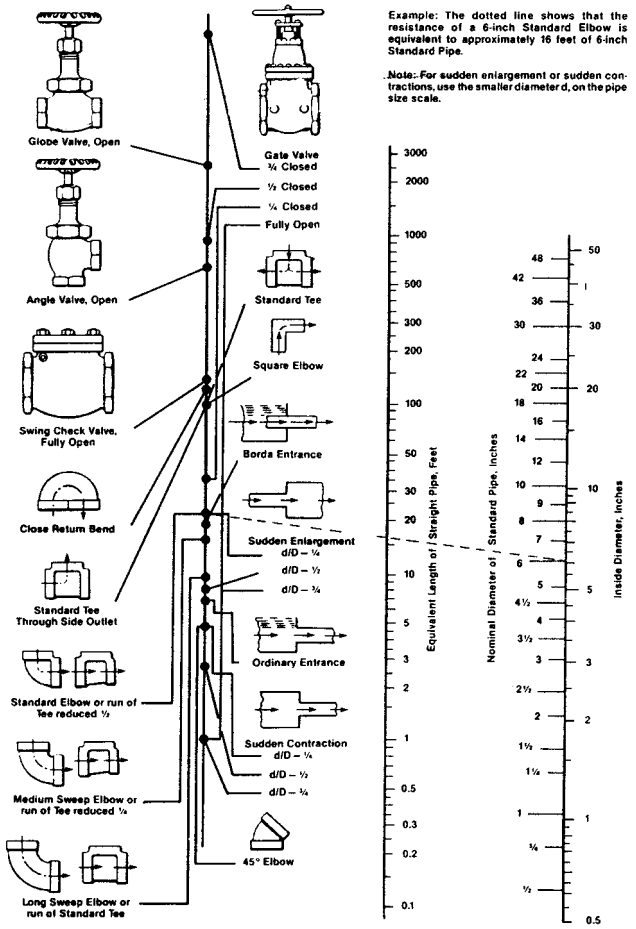
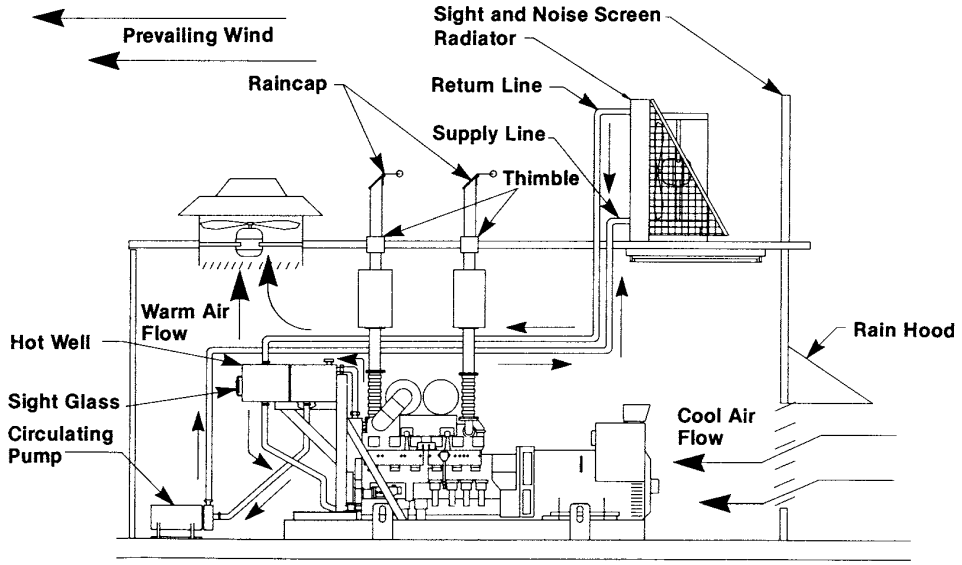


Figure 2-12 Hot Well Installation



Other Considerations

General:

1. Deaeration of the coolant. This can be accomplished through the use of the system deaerators in very large systems, or simply ensuring the radiator top tank or surge tank is at the highest point in the piping system. Unvented piping systems can create air pockets which reduce coolant flow and can lead to engine overheating. Baldor furnished radiators are equipped with deaerating top tanks.
2. Flexible hoses must be installed at all engine connections and to the radiator to isolate vibration and allow for thermal expansion.
3. Drain valves must be installed at the lowest point of the cooling system to facilitate system cleaning and flushing.
4. Water treatment and antifreeze must be added to system coolant. Baldor recommends 50/50 ethylene glycol and coolant treatment for all engines.
5. Thermostatically controlled engine coolant heaters are required to be installed on all standby gensets. These will increase starting reliability under cold conditions, and improve the start–up load handling ability.
6. According the NFPA 110, priority level 1 equipment jacket water heaters shall maintain coolant at a minimum of 90 °F (32 °C). In outdoor installations where temperatures will be expected to drop below 32 °F (0 °C), a battery heater should be employed to keep the batteries at a minimum of 50 °F (10 °C), and will shut off at 90 °F (32 °C).
   All heaters will shut off when the engine is operating. Adequate antifreeze protection will be provided and ether starting aids will not be permitted.
7. The consultant should also consider oil sump heaters if conditions warrant.

Heat Exchanger Cooling:

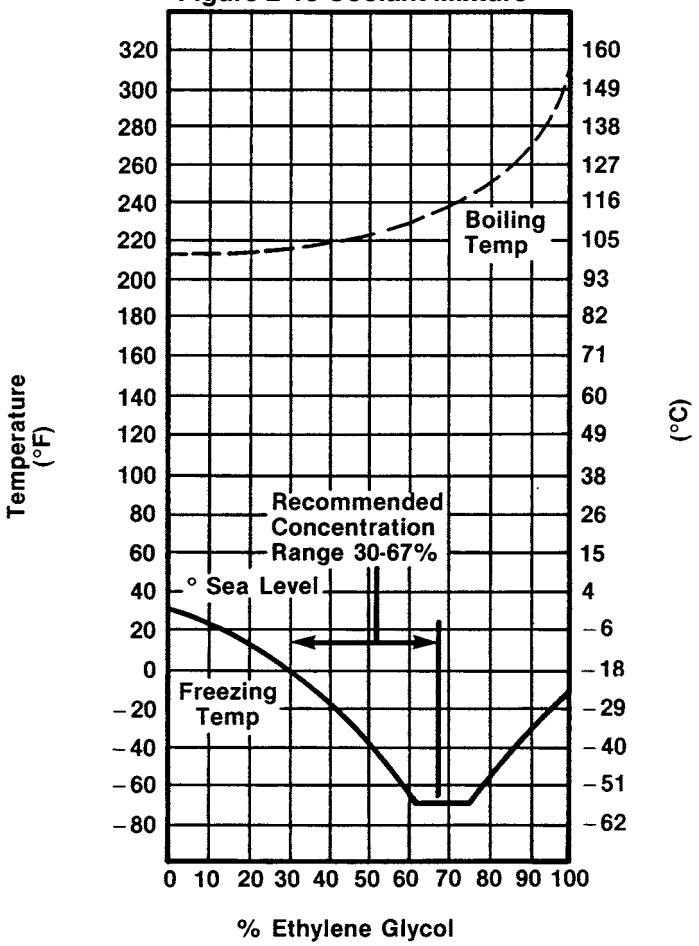
1. If the engine is to be heat exchanger cooled, the system will require a reliable raw cooling water source and controls to regulate water flow during genset operation.
2. The system will also need a reliable method of starting and stopping water flow automatically. The heat exchanger cooled system may be used with a cooling tower.
3. Baldor Gensets are available with heat exchangers sized and mounted on the engine by the factory. If a heat exchanger cooled system is required, specify with order.
4. Shell and tube type heat exchangers are connected such that raw cooling water flows through the tube side of the heat exchanger, and engine coolant through the shell side. Tubes are more easily cleaned and the potential for fouling is much greater on the raw water side.
5. For economic reasons, the raw water flow can be regulated by varying the flow of raw cooling water through the heat exchanger. This control can be accomplished with a temperature actuated control valve. The thermostatic bulb for this control must be in the engine jacket water discharge line. The control valve should be a fully modulated type with a minimum flow setting. **NEVER attempt to regulate engine water flow.**
6. Water flow regulators are used only if raw water is from a city or well water source. Do not attempt to regulate flow if a cooling tower is used. Maintain at least 2 ft/second of water flow through the tube side of the heat exchanger.
7. Heat exchanger cooled systems using city or well water, and cooling, tower heat rejection, however, will not be protected on the tube side of the heat exchanger, nor interconnecting piping and cooling tower as engine coolant is not circulated through these components. These systems must be heat traced, and have sump heaters installed to protect the various components when the genset is on standby.

   It must also be noted that if an antifreeze solution is used in the shell side of the engine cooling system heat exchanger, local codes may restrict the discharge of the tube side cooling water after flowing through the heat exchanger.

Coolant Treatment: See Figure 2-13.

1. Engine coolant should be treated with a Diesel Coolant Additive (DCA) to minimize corrosion of the engine and cooling system components. A 50/50 ethylene glycol antifreeze solution is recommended for all genset engines. This will provide freeze protection and increase the boiling point of the engine coolant. A solution can be increased to 65%. Do not exceed 65% as freeze protection begins to diminish at 65%.
2. It is recommended that the consultant specify Baldor supplied DCA and water filters, and Baldor antifreeze.
3. When the proper solution concentration of antifreeze is used with radiators (engine mounted as well as remote mounted), and hot well systems, the system will be adequately protected from freeze–up.

Figure 2-13 Coolant Mixture



Air System

Air System Checklist

A. Air inlet faces the direction of prevailing winds.
B. Air outlet does not face noise sensitive areas without noise attenuating devices.
C. All heat loads have been taken into consideration in sizing air flow.
D. Gravity louvers face inward for air intake and outward for discharge.
E. Where electrically operated ventilation devices are used, power must be present under all operating situations. Be certain these devices are on the emergency circuit.

The room in which the generator set is to be installed must have adequate air flow through it to provide combustion air, and remove heat radiated from the engine, exhaust system and generator. See Figure 2-14 for air flow calculations.

Figure 2-14 Air Flow Calculations

	Btu/min	Btu/hr
$V_{(cfm)} =$	$\frac{Q_M}{0.0181 \times \Delta T_{F°}}$	$\frac{Q_H}{1.085 \times \Delta T_{F°}}$

Where:

- V = Ventilating air flow in Cubic Feet per Minute (cfm) or Cubic Meters per Minute (m³/min)
- Q_M = Heat radiated or rejected from the engine, generator and other equipment in Btu/hr. (See note #4).
- Q_H = Heat radiated or rejected from the engine, generator and other equipment in Btu/hr.
- kW-h = Heat radiated or rejected from the engine, generator and other equipment in Kilowatt-Hours.
- ΔT = The permissible temperature rise in the room in F° or C°.

Kilowatt-Hours

$$V_{(m^3/min)} = \frac{kW\text{-}h}{0.02015 \times \Delta T_{C°}}$$

Notes:

1) The above calculations assume 100°F (38°C) as ambient air in the room.
2) Increase the air flow by 10% for every 2,500 ft. (762 m) above sea level.
3) Increase air flow by 10% if uninsulated mufflers are located within the room.
4) The Engine Data Sheet gives this as "Radiated Heat to Ambient" in Btu/min. Values are given for Dry Type and Water Cooled Exhaust Manifolds.
5) Generator efficiency is 88 to 95% on gensets from 50 to 1 200 kW. 1 kW loss = 56.88 Btu/min.

Radiator Cooling

The engine mounted radiator shown in Figure 2-8. With an engine mounted radiator cooling system, air movement is provided by the engine driven radiator fan. The consultant must design the inlet and outlet duct work and louvers to accommodate the air flow required. The radiator fan is limited in the amount of external static pressure it will tolerate. The maximum air restriction on the discharge side of the radiator is shown under the heading of Cooling System on the Engine Data Sheets. Cooling fan air flow is listed under Engine Data by dry type and water cooled exhaust manifold for 100 °F and 125 °F cooling systems.

The ideal setup for cooling air would be to arrange the inlet or inlets such that relatively clean, cool, dry air is drawn across the electrical switchgear, generator, and engine. The air is then drawn into the radiator fan, and is blown through the radiator and exhausted by duct work outside the building. Air inlets must be sized to minimize air restriction and provide the quantity of air required by the radiator fan, engine combustion air, and any other air exhausts which might be used in the room. On engine mounted radiator cooled systems, the engine mounted fan will handle 0.25" of water column. This is combined intake and exhaust restriction.

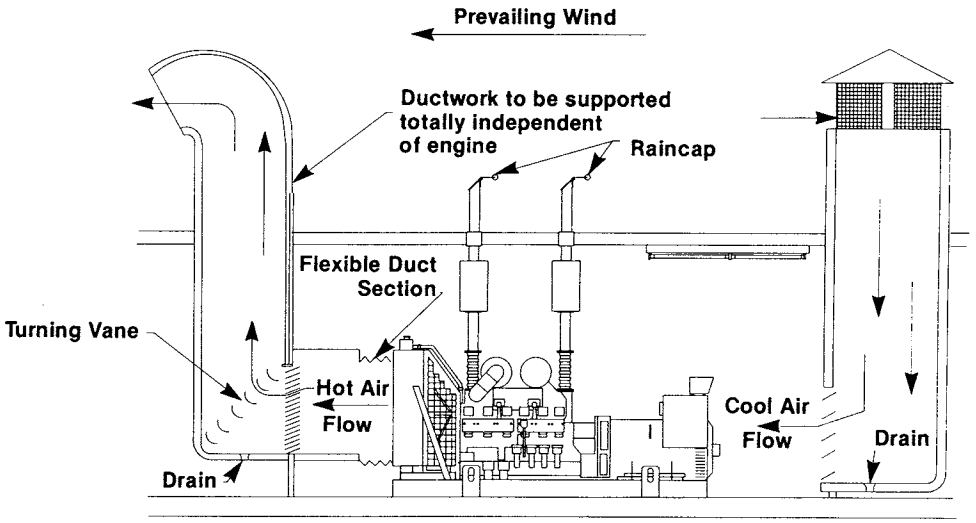
The room air intakes must be located so as to minimize drawing exhaust fumes and other outside contaminants into the room. Be very cautious about the location of the engine exhausts in relation to room air intakes. Also, when locating the inlet and outlet, the consultant should consider prevailing winds and noise. Motor operated louvers or properly designed and sized gravity louvers should be used on the air intake and exhaust to minimize static pressure drop.

Electric motorized louvers used with engine mounted radiators should be connected to the standby genset and controlled to open whenever the genset is running. Operable outlet louvers should be temperature actuated on remote radiator or heat exchanger cooled units. Louvers have resistance to air flow. Openings with louvers should be twice the area of an unobstructed opening to provide proper air flow. At times duct work is necessary to provide cooling air for the room, see Figure 2-15. Duct work must be sized and installed according to SMACNA Standards.

Wind Barrier

Wind blowing against air exhaust or intake openings of the genset room must be considered, especially where the radiator and fan are located on the engine. Wind blowing against an exhaust opening creates restriction to the fan. Wind blowing against intake openings can blow open gravity louvers causing low temperature and moisture problems in bad weather.

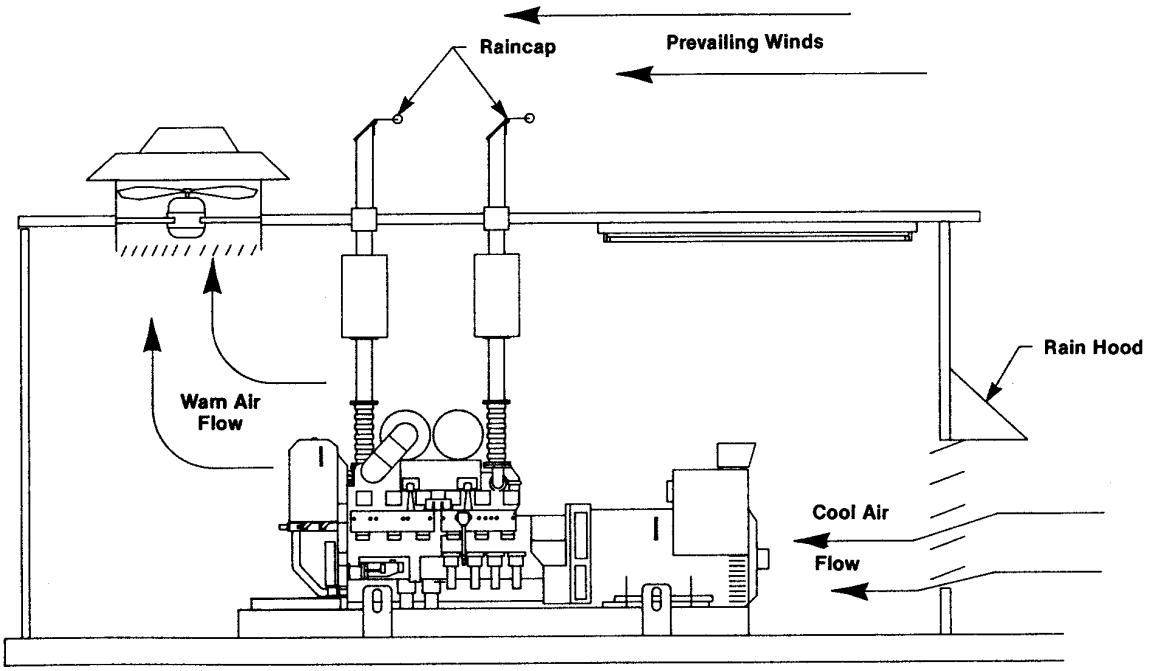
Figure 2-15 Radiator Cooling with Ducted Air Handling



Other Engine Cooling Systems

Remote radiator and heat exchanger cooled engine cooling systems will not have an engine driven fan. As a result, the consultant must provide a means of supplying air to the room, and exhausting it. The air movement must be provided by an electrically driven fan. This fan may be located in the air inlet or exhaust opening. If the fan is located on the exhaust side, care must be taken to not create a high negative pressure in the room and starve the engine of combustion air. If the fan is located in the air inlet, it must be noted that odors may be forced into other parts of the building if the room is not properly sealed. This electrically driven fan must be connected so as to run whenever the generator is operating. Any fans for the engine room should be on the emergency circuit. An example may be seen in Figure 2-16.

Figure 2-16



Engine Crankcase Ventilation

For gensets operating more than 1000 hours per year, the engine crankcase breather should be vented upward and outside of the engine room. This prevents the buildup of oil vapors inside the building.

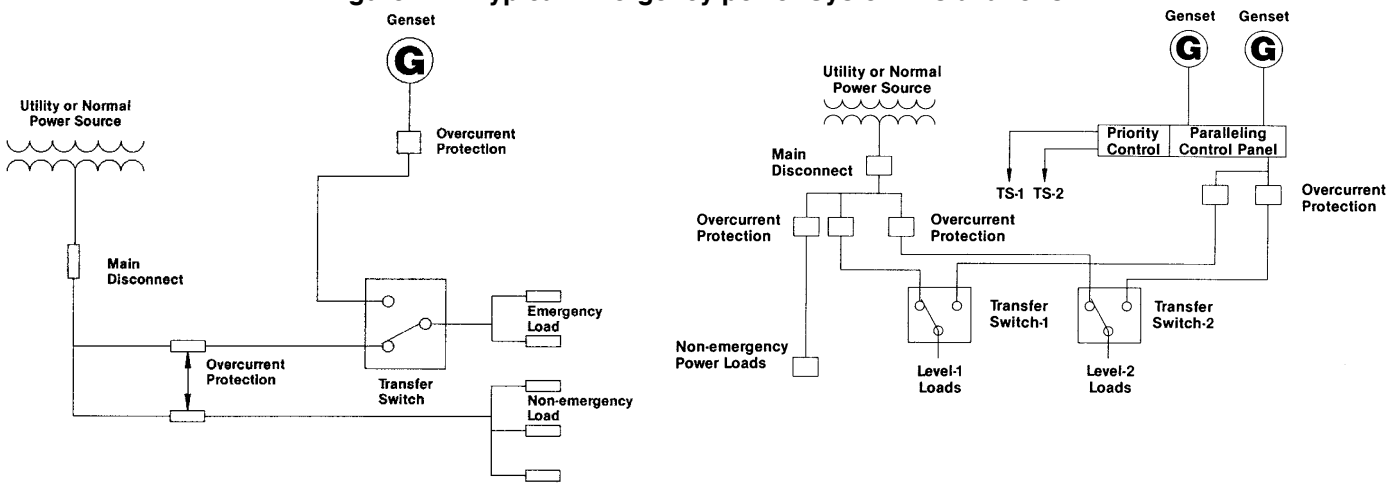
Transfer Switch

Transfer Switch Checklist

A. Locate transfer switch in a clean, dry place, near the emergency load.
B. Provide a circuit breaker between the genset and the transfer switch.
C. Put a flexible connection between the conduit and genset.
D. Observe applicable codes in wiring–in the transfer switch and genset.

The transfer switch connects the genset to the emergency power system. The emergency power system may include several gensets and several transfer switches. Typically, the genset is wired to the emergency power system through a transfer switch as shown in Figure 2-17.

Figure 2-17 Typical Emergency power System Installations



Multiple Gensets can be arranged either in parallel or separately connected to dedicated emergency loads. Figure 2-17 also shows a typical arrangement of two gensets in parallel with transfer switches for loads that have different levels of priority. A typical multiple genset installation is shown for NFPA 110 Level 1 and Level 2 emergency power circuits and a priority control to select the appropriate transfer switch.

Wattmeters should be installed on each genset so load sharing can be checked. The control system should include an automatic paralleling control. Paralleling identical gensets is not difficult, but paralleling dissimilar sets can cause load sharing problems. When designing an installation that includes the paralleling of dissimilar generators, contract your nearby Baldor Distributor.

Transfer Switch Location

The transfer switch location is important and key considerations are:

1. Locate the transfer switch as close to the emergency load as practical to avoid interruptions of the emergency power system due to natural or man–made disasters, or to equipment failures. Consider several small transfer switches instead of one large one to increase reliability.
2. Locate the transfer switch in a clean, dry, well ventilated location, away from excessive heat. When the ambient air is above 104 °F (40 °C), fuses and circuit breakers must be derated. Allow adequate working space around the transfer switch.
3. A circuit breaker (or fuses) should be installed in the line between the generator and the transfer switch. Baldor Gensets are available with properly sized circuit breaker built into the generator control through 1200 amp breakers. The circuit breaker can be separately mounted. In the case of very large circuit breakers, a separate floor mounted circuit breaker is easier to wire up than a wall mounted breaker.
4. Install power and control wires in separate solid conduit with flexible sections at the genset. The flexible sections prevent vibration from damaging the conduit. All power conduits from the genset must contain all three phases.
5. Never install control wires in the same conduit as power conductors.

6. Conduit, wire, circuit protective device sizes, insulation etc. must conform to applicable local and national codes and regulations.
7. Be certain to seal around conduits that penetrate the walls of the genset room to reduce the amount of noise that is transmitted to the surrounding areas of the building and maintain site fire code rating.

Battery Starting System

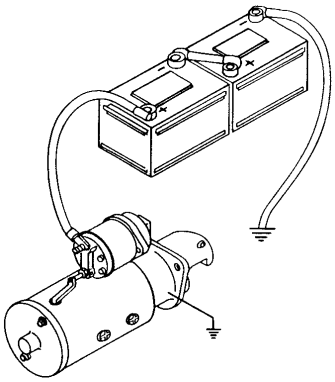
This section describes the battery starting system (nominal 12 volt rating of the battery supply) for the engine, battery charger, and precautions to take if the ambient temperature is expected to be below 70 °F (20°C).

WARNING: If batteries are not mounted in the battery rack supplied with the genset, protect batteries from vibration and do not locate them near a source of flame or spark. A battery presents a risk of fire and explosion because they generate hydrogen gas. Hydrogen gas is extremely explosive. Never jump start a battery, smoke in the area around the battery or cause any spark to occur in the area around the battery.

Battery Location

Locate batteries as close as possible to the genset to minimize starting circuit resistance, see Figure 2-18. High starting circuit resistance substantially reduces starting cranking ability. The genset data sheet lists the maximum allowable cranking system resistance. Mount batteries on a level rack away from dirt and liquids. Allow space for servicing (checking water level and level of charge). Baldor gensets can be ordered with battery racks already installed. Cold ambient temperature at the battery location substantially reduces the battery output.

Figure 2-18 Battery Starting System



Battery Size

The ability to start the engine depends upon battery capacity, ambient temperature and coolant and oil temperatures. The Engine/Generator Set Data Sheet lists minimum recommended battery capacity at various ambient temperatures. The recommended battery capacities are listed in the Electric Systems section of the Engine Data Sheet, cold cranking amps (CCA) at 0 °F (–18 °C).

Battery capacities decrease as ambient temperatures decrease so it is important to specify batteries with the appropriate CCA rating at a temperature no higher than the minimum ambient temperature for the application. Baldor requires thermostatically controlled coolant heaters on all after cooled standby gensets. After cooling is called out on the Engine Data Sheet under General Engine Data section as “aspiration“.

Oil pan immersion heaters are recommended for standby gensets housed outside where ambient temperatures may drop below 0 °F (–18 °C). Coolant heaters and oil pan immersion heaters are available from Baldor as factory installed options.

Battery Charger

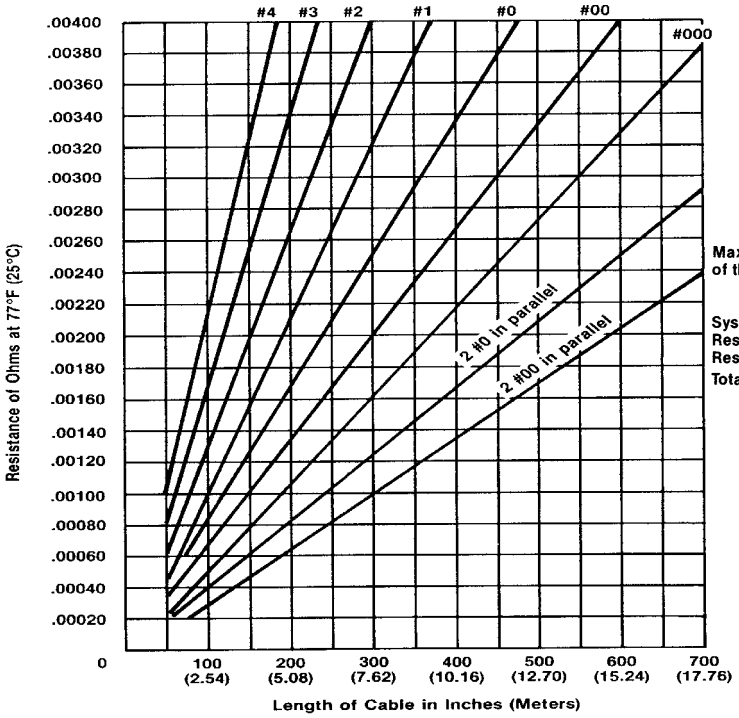
An engine mounted alternator to charge the batteries during operation is an available option. Standby gensets require a solid state battery charger that is connected to utility power so the battery is charged continuously while the genset is not running. The battery charger should be connected to the emergency circuit. The batteries on prime power gensets are charged by the engine mounted alternator, if equipped.

Harmonic wave forms from solid state battery charges and belt driven alternators can cause the electronic governor on the engine to act erratically. To avoid this, the output of the battery charger or the belt driven alternator must be connected directly to the battery or to the battery terminals on the starter. Make control connections to the genset control using a conduit with a flexible section at the genset to avoid damage due to genset vibrations.

Battery Cables

The wire size (wire gauge) of the cables connecting the starter to the batteries must be large enough to ensure the resistance of the cranking circuit is less than the “Maximum Allowable Resistance of the Cranking Circuit” as shown on the Engine–Generator Set Data Sheet. The total cranking circuit resistance includes the resistance of the cables from the starting motor to the battery and the resistance of all relays, solenoids, switches, and connections. The resistance of various sizes of cables is shown in Figure 2-19. For purposes of calculating cranking circuit resistance to select cable size, the resistance of each connection can be taken as .00001 ohms and the resistance of each relay, solenoid, and switch can be taken as .0002 ohms. Figure 2-19 illustrates an example of a typical cranking circuit resistance calculation.

Figure 2-19 Typical Battery Cable Calculations



Maximum Allowable Resistance of the Cranking Circuit ..... 0.002 Ohms for 24 Volt System
0.0012 Ohms for 12 Volt System

System voltage	24 Volt
Resistance of 6 Connections	0.00006 Ohms
Resistance of 100" of #1 Cable	0.00100 Ohms
Total Resistance of Cranking Circuit =	0.00106 Ohms

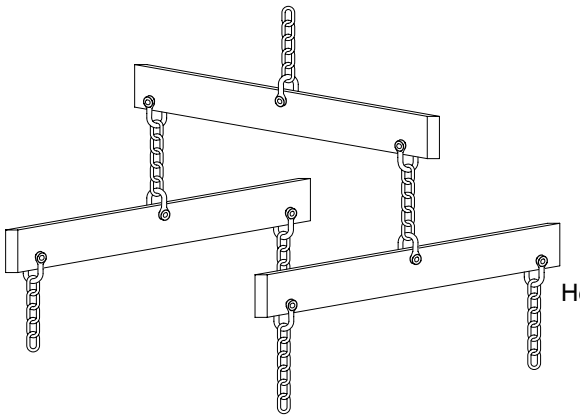
Section 3
Receiving & Installation

Receiving & Inspection When you receive your generator, there are several things you should do immediately.

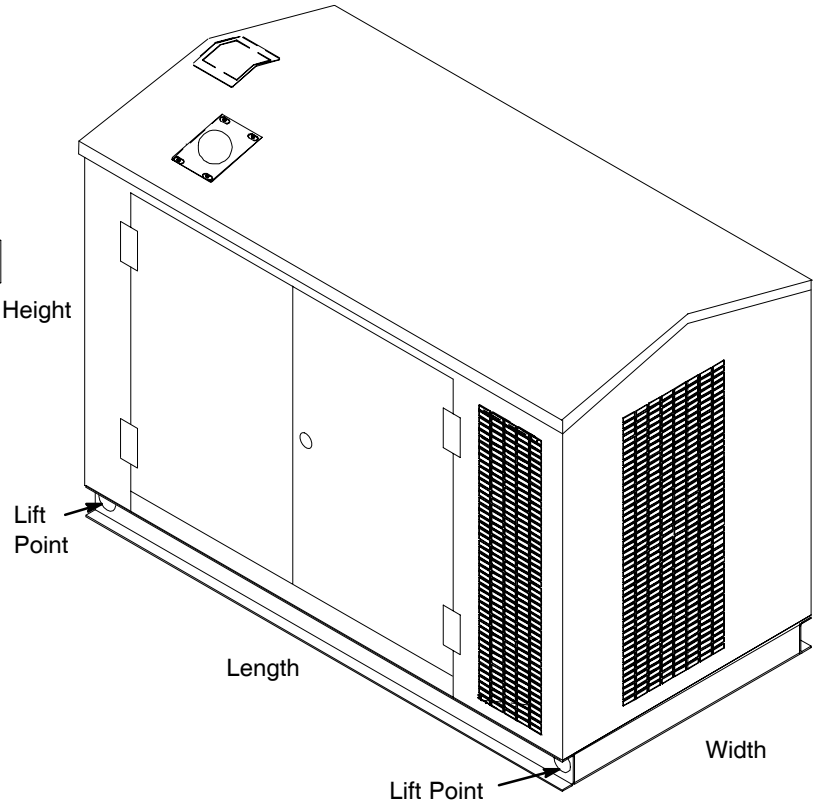
1. Observe the condition of the shipping container and report any damage immediately to the commercial carrier that delivered your system.
2. Verify that the part number of the system you received is the same as the part number listed on your purchase order.
3. If the system is to be stored for several weeks before use, be sure that it is stored in a location that conforms to published storage temperature and humidity specifications.

Lifting the Generator When lift or hoist equipment is used to lift the generator and move it to position, be careful not to contact overhead wires or other obstacles. The generator can weigh as much as 3,000 lbs. Be sure lift or hoist equipment has appropriate tires for the terrain to avoid becoming stuck or tipping over. If the shipping pallet is intact, use a fork lift to move the generator. If the shipping pallet has been removed, use two steel pipes through the "Lift Point" holes to lift the generator. See Figure 3-1.

Figure 3-1 Generator Lifting



To lift the generator, always use spreader bars, chains eyehooks and other hardware that is of sufficient strength to lift at least three times the weight of the generator.



Physical Location The mounting location of the system is important. It should be installed in an area that is protected from direct harmful gases or liquids, dust, metallic particles, shock and vibration. It should be installed in an outdoor location so the exhaust fumes are vented to the atmosphere.

When the Generator is installed outdoors

If the generator is installed outdoors there should not be a cooling problem. The factory installed enclosure is designed to keep out undesirable weather elements while providing cooling and ventilation.

When the Generator is installed in a building it is essential to provide:

1. Adequate control and exhausting of the heated air.
2. An adequate and constant supply of incoming cooling air.
3. Adequate control and discharge of the engine's hot exhaust gases.
4. Adequate ventilation of the building when the engine shuts down.

WARNING: An open bottom stationary engine generator set must be installed over noncombustible materials and shall be located such that it prevents combustible materials from accumulating under the generator set.

Several other factors should be carefully evaluated when selecting a location for installation:

1. For effective cooling and maintenance, the system should be mounted on a flat, smooth, noncombustible level surface. A concrete pad is ideal and provides a secure installation.
2. Installation should prevent water levels from reaching the generator. Drainage must be adequate to keep concrete pad free from standing water.
3. Installation should prevent obstructions by buildup of leaves, grass, sand, snow, etc. If these items pose a problem, consider building a small fence or other break to protect the unit from accumulation of debris.
4. Installation should place the generator as close as possible to the fuel supply and transfer switch.
5. At least forty–eight (48) inches clearance must be provided on all sides for air flow.
6. Access must be provided to allow the enclosure covers to be opened or removed for service and maintenance.
7. Maximum Ambient temperature is 122°F (50°C).

Figure 3-2 Generator Mounting

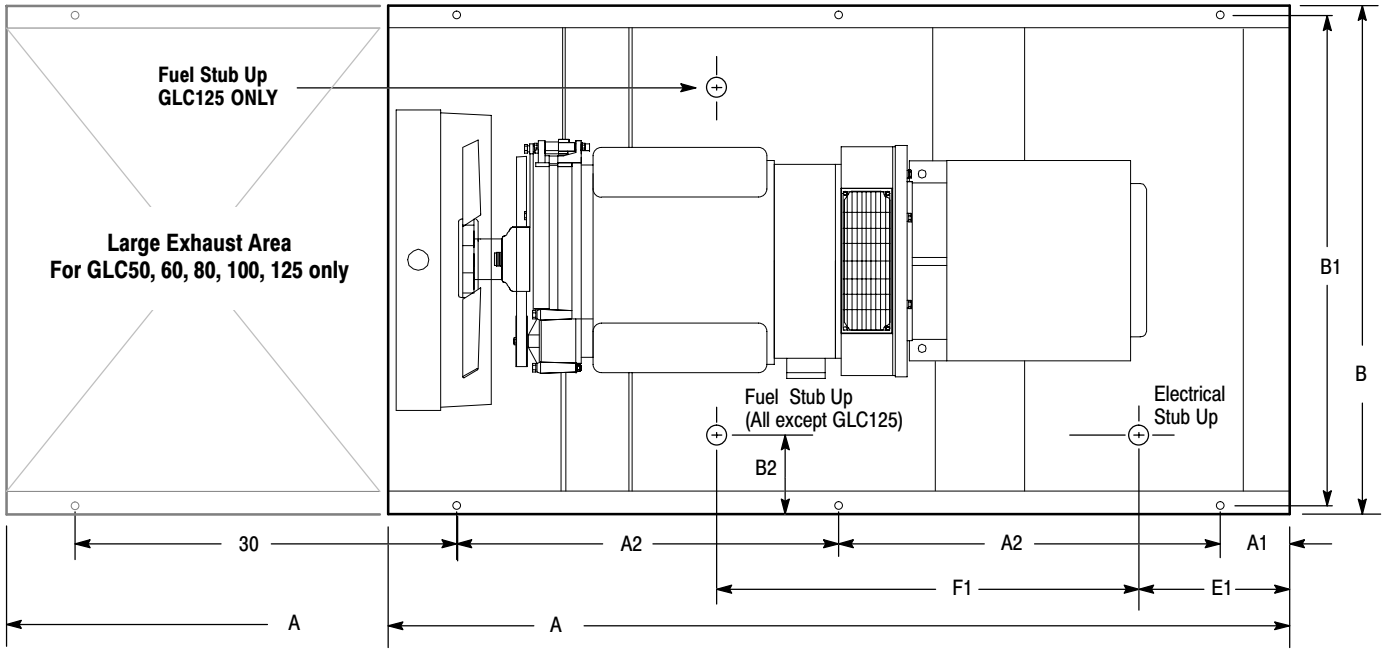


Table 3-3 Mounting Dimensions

Generator	A	A1	A2	B	B1	B2	E1	F1
GLC30	78.0	6.0	33.0	44.0	42.5	6.25	17.0	32.0
GLC35	78.0	6.0	33.0	44.0	42.5	6.25	17.0	32.0
GLC45	78.0	6.0	33.0	44.0	42.5	6.25	17.0	32.0
GLC50	118.0	6.0	38.0	44.0	42.5	6.25	17.0	32.0
GLC60	118.0	6.0	38.0	44.0	42.5	6.25	17.0	32.0
GLC80	118.0	6.0	38.0	44.0	42.5	6.25	17.0	32.0
GLC100	118.0	6.0	38.0	44.0	42.5	6.25	17.0	32.0
GLC125	118.0	6.0	38.0	44.0	42.5	6.25	17.0	32.0

Secure the Generator

Six (eight for the GLC125) mounting bolts in the base frame secure the generator to the shipping pallet. Remove these bolts, lift the generator and remove the shipping pallet. Secure the generator to the concrete pad using $^{3}/_{8}''$ anchor hardware (not provided) in the base frame mounting holes. See Figure 3-2. Anchor bolts must be long enough to extend through the generator mounting frame.

Engine Cooling A sufficient flow of clean, cool air is required for combustion and to dissipate the heat produced by the engine. Approximately 60% of the heat value of the fuel used is given off as heat (cooling air and exhaust).

The air that will cool the engine must be brought in from outside the building. A sufficient air–flow of rate "Cubic Feet per Minute" (CFM) will allow the incoming fresh air to cool the engine. This requires a power ventilation system of sufficient CFM to be located at the highest possible point of the building to exhaust hot air and draw in cool fresh air.

Note: The exhaust fan must not be located where it could easily become blocked by leaves, snow, water, debris, etc.

It is recommended that the cool air intake have at least three (3) times the cross–sectional area of the power ventilation system. It is also recommended that the cool air intake be located as close as possible to the top of the generator set.

The exhaust fan must be connected to the AC power terminals of the generator set so that when the generator set starts it will provide immediate cooling air flow. The fan will operate until the generator set stops. To test the ventilation system, do the following:

Ventilation Test

1. Place a thermometer as close to the cool air intake of the engine's blower housing as you can without allowing the thermometer to touch any material surface.
2. Place another thermometer outside of the building or compartment in the open air (Keep the thermometer out of direct sunlight or any other heat sources).
3. Run the engine under maximum load for an extended period of time (at least one hour).
4. The temperature difference between the two should not exceed 15 degrees F.

Note that opening any door, window or other opening can upset the air–flow pattern and result in a significant reduction in the cooling air–flow across the generator set. This may result in overheating, fire, or explosion. To find out if this is true with your specific application run the Ventilation Test with all doors and windows closed. Then repeat this test with different doors and windows open, and eventually with all the windows and doors open. If any of these tests result in a temperature difference in excess of 15° F, you must not run the generator set under those specific conditions.

Hot Exhaust Gasses

WARNING: Exhaust fumes/gases are extremely dangerous and can cause severe illness or death. Never breath exhaust fumes produced by a running engine. Only run the engine outdoors where ventilation is plentiful. Exhaust gases contain carbon monoxide, a colorless, odorless and extremely dangerous gas that can cause unconsciousness or death. Symptoms of carbon monoxide poisoning include: dizziness, nausea, headaches, sleepiness, vomiting or incoherence. If you or anyone else experiences these symptoms, get out into fresh air immediately. Stop the engine and do not restart the engine until it has been inspected and if necessary repaired or reinstalled in a well ventilated area.

WARNING: Hot exhaust gasses must never be directed toward anything that may catch fire or explode.

It is extremely important to discharge engine exhaust gasses away from the engine and out of the building. If these gasses remain in the cylinder, poor performance or eventual engine damage may result. This condition results from excessive back–pressure, which could be caused by any one or a combination of the following conditions:

1. Exhaust pipe too long or the diameter is too small.
2. Excessive number of sharp bends in the exhaust system.
3. Obstruction in the exhaust system.
   Backpressure must not exceed 20" of water column.

The direction of the discharged hot air and hot exhaust gases is important as they have the potential to create brown spots on the lawn. In extreme cases this extremely hot air could cause dried grass or other debris to ignite.

Exhaust lines should be as short and straight as possible. Long pipe lengths and elbows tend to resist the flow of gases and accumulate carbon deposits. Each pipe fitting and elbow will further restrict the exhaust flow.

Guidelines for Exhaust System

1. If you are using a remote muffler it should be mounted as close to the engine as possible, since it will clog with carbon if it's operating temperature is too low.
2. If you are using a remote muffler a flexible coupling of 12" or more must be installed between the exhaust line and the manifold to absorb the engine's vibration. However, a short, solid section of pipe between 6" and 8" long should be placed between the connection of the manifold and the flexible coupling. This nipple will reduce the possibility of the hot gases burning up the flexible coupling.
3. It is extremely important that you do not allow the hot exhaust gases to re–circulate into the engine's cooling air intake.
4. Water is one by–product of combustion and is present in the exhaust pipes or muffler. This water must be kept from draining back into the engine. This can be done by slanting the horizontal section of the exhaust system piping downward slightly, away from the engine. A water trap consisting of a tee extension with a drain cock should also be provided. This water trap should be located between the flex coupling and the muffler, but as close to the engine as possible on a horizontal section of the exhaust piping.
5. It is also recommended that an exhaust rain cap be used whenever it is possible that rain could get into the system. This will help to prevent corrosion and damage to the exhaust system and engine.
6. The exhaust system is subject to the engine's vibration and it must therefore be solidly secured to reduce mechanical stress and the potential for breakage.
7. The engine's exhaust system is the hottest component of the installation and extreme care and considerations must be given to it.

8. As much of the exhaust piping as possible should be located near the power ventilation exhaust. This will reduce the radiant exhaust heat inside the building.
9. Keep all fuel and its associated piping away from all components of the engine exhaust system.
10. After the exhaust system is installed it should be inspected on a regular basis to assure there are no toxic exhaust gas leaks. In some areas this inspection may be provided by your local public service.
11. A carbon monoxide tester may be installed to detect the presence of the deadly gas during times when you are in the building with the engine running (during testing or maintenance).

WARNING: Never allow the exhaust outlet to be positioned so that the exhaust gases are directed towards any openings or air entry routes (doors, windows, vents, etc...) of an occupied building. When discharging the hot exhaust gases out of the building do not direct them towards anything that could catch fire or explode.

WARNING: Exhaust fumes/gases are extremely dangerous and can cause severe illness or death. Never breath exhaust fumes produced by a running engine. Only run the engine outdoors where ventilation is plentiful. Exhaust gases contain carbon monoxide, a colorless, odorless and extremely dangerous gas that can cause unconsciousness or death. Symptoms of carbon monoxide poisoning include: dizziness, nausea, headaches, sleepiness, vomiting or incoherence. If you or anyone else experiences these symptoms, get out into fresh air immediately. Stop the engine and do not restart the engine until it has been inspected and if necessary repaired or reinstalled in a well ventilated area.

Installation

The generator is completely assembled, tested and adjusted at the factory before it is shipped to you. The procedures presented in this manual are suggestions and it is the responsibility of the Owner/Operator to arrange for these procedures to be performed by licensed contractors according to all applicable codes including local codes for your Municipality/City/County and State. External connections required at the time of installation are:

1. Fuel System.
2. Electrical Connections – power wiring (optional transfer switch) and control wiring.
3. Battery (not included).
4. Ground Connection.

After installation, the post installation checks must be performed prior to starting the engine. After these checks have been performed and the system operation is verified to be good, refer to Section 5 Maintenance for periodic checks that must be performed at scheduled intervals to ensure continued operation with minimal problems.

Fuel Connections

Fuel selection is Natural Gas or LPG (Liquid Propane Gas). If natural gas supply is used, follow the "Natural Gas Connections" procedure. If LPG supply is used, follow the "LP Gas Connections" procedure. Table 3-4 defines the flow rate required for each fuel type.

Table 3-4 Fuel Consumption Natural and LPG

Generator Model	Fuel Consumption at 100% load (cubic feet per hour)	
	Natural Gas	LP Gas
GLC30	14.9	5.6
GLC35	16.3	6.0
GLC45	16.5	6.9
GLC50	20.7	8.2
GLC60	22.1	9.1
GLC80	28.7	12
GLC100	32.1	13.8
GLC125	46.8	16.5

General Considerations

1. A generator set needs the engine to deliver 2 hp of energy to the alternator for every 1000 watts of electric output power (example: an 8000 watt generator needs the engine to deliver 16 hp of energy to the generator end).
2. An engine needs 10,000 BTU's of fuel energy per horsepower of engine power to provide a sufficient supply of fuel (example: a 16 Hp engine needs 160,000 BTU's of fuel energy for it to work properly). This fuel must be supplied to the regulator on the generator set at a pressure of 6 oz (11 inches of water column). To achieve this 6 oz. pressure in a L.P. System, you will normally have to reduce the tank pressure by means of a primary regulator or a regulator system of 2 or more regulators.
3. There are 2,516 BTU's in one cubic foot of Propane (LP Fuel).
   There are 1,096 BTU's in one cubic foot of Natural Gas.
4. There are 36.39 cubic feet in one gallon of Propane.
   There are 57.75 cubic feet in one gallon of Natural Gas.
5. There are 8.58 cubic feet per pound of Propane.
   There are 23.56 cubic feet per pound of Natural Gas.
6. When installing the piping for the gaseous fuel supply please refer to the pipe chart in Tables 3-5 and 3-6 to be sure you are using piping of significantly large size to deliver the necessary amount of fuel.
7. If copper tubing is used, it should be "K" or "L" having a minimum wall thickness of 0.032 inches. Black Iron Pipe is recommended but follow building codes for your area.

The following pamphlets are available from:

National Fire Protection Association (NFPA) P.O. Box 9101 Quincy, MA 02269

No. 37 – Combustion Engines
No. 54 – Gaseous Appliances and piping
No. 58 – Storage and handling LPG

Example: Determining Pipe Size for Natural Gas

A generator has a 16Hp engine 60 feet from the supply.
Determine the supply pipe size for Natural Gas fuel.
16 x 10,000 = 160,000 BTU's / per hour for proper operation.

$$\frac{160,000}{1,096} = 146 \text{ cubic feet per hour.}$$

From Table 3-6, a 60 foot run requires a minimum 1" pipe at full engine load.

Natural Gas Connections

The incoming pressure must be 11 inches water column (6 oz. pressure).

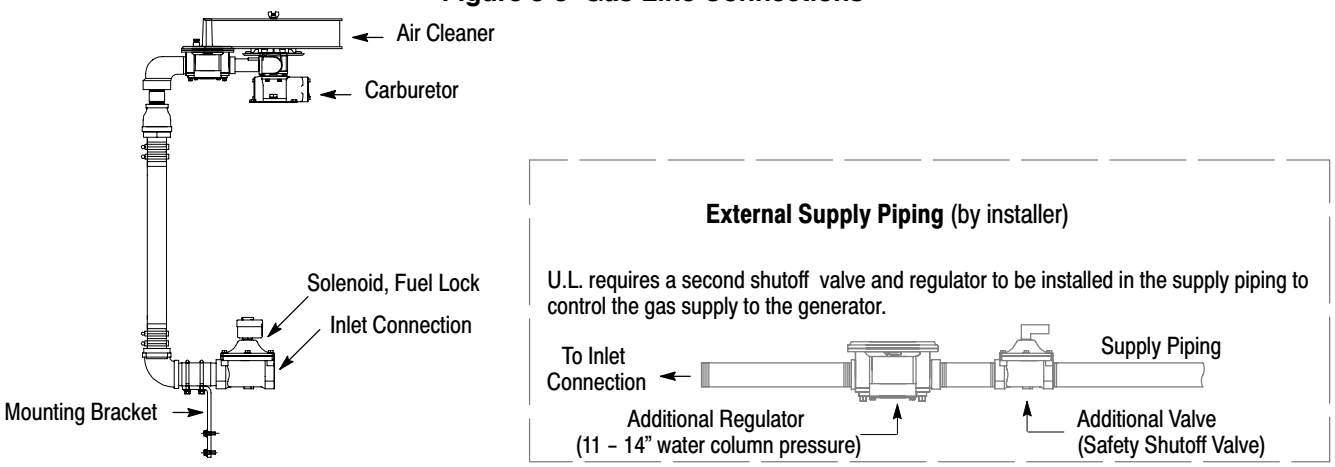
Table 3-5 Natural Gas Flow Rate (Cubic Feet per Hour) per Pipe Length

Pipe Length (Feet)	Iron Pipe Size										
	1/2″	3/4″	1″	1–1/4″	1–1/2″	2″	2–1/2″	3″	4″	6″	8″
15	73	165	332	722	1174	2386	3704	6253	13352	37229	
30	50	115	232	515	818	1712	2646	4521	9331	26330	53728
45	41	95	191	418	673	1419	2213	3752	7600	22462	43867
60	37	83	166	366	587	1241	1924	3319	6542	18595	37999
75		74	149	332	524	1077	1684	2886	5772	16652	33959
90		67	137	298	433	962	1501	2597	5291	15200	31025
105		63	126	274		885	1376	2357	4906	14064	28715
120			115	260	404	827	1289	2213	4618	13160	26859
150			105	233	366	750	1174	2011	4185	11775	24050
180			96	216	337	693	1077	1876	3848	10736	21934
210			89	197	308	635	991	1712	3559	9937	20298
240				183	289	596	933	1616	3357	9235	18990
270				171	274	558	875	1520	3127	8658	17903
300				164	260	524	827	1433	2886	8177	16998

Note: Almost all operation problems are related to the installation techniques used. Do Not guess, be sure pipe size is adequate for required flow rate.

1. Connect the proper size gas pipe at the Inlet Connection to the Fuel Lock Solenoid. Connect the Natural Gas pipe line shown in Figure 3-3 using the correct size pipe for the required flow rate and length of pipe. Refer to Table 3-5 for pipe size. Be certain that all connections are sealed and no leaks are present. The installer must ensure that all gas connections comply with all building codes.
2. Verify Fuel Supply Pressure
   Prior to initial operation of generator, verify that fuel system pressure is 11″ Water Column (6 oz. pressure) and fuel pipe sizes comply with Table 3-5.
3. Proceed to Electrical Connections.

Figure 3-3 Gas Line Connections



Example: Determining Pipe Size for LPG

A generator has a 16Hp engine 60 feet from the supply.
Determine the supply pipe size for Natural Gas fuel.
16 x 10,000 = 160,000 BTU's / per hour for proper operation.

$$\frac{160,000}{2,516} = 63.5 \text{ cubic feet per hour.}$$

From Table 3-6, a 60 foot run requires a minimum 1" pipe at full engine load.

LP Gas Connections (vapor withdrawal only)

The LPG connections should only be made if your generator is setup to run on LPG. If it is setup to run on Natural Gas, contact your Baldor representative and do not continue with installation.

The incoming pressure must be 11 inches water column (6 oz. pressure).

Table 3-6 LP Gas Flow Rate (Cubic Feet per Hour) per Pipe Length

Pipe Length (Feet)	Iron Pipe Size										
	1/2″	3/4″	1″	1–1/4″	1–1/2″	2″	2–1/2″	3″	4″	6″	8″
15	48	109	218	475	772	1570	2437	4115	8786	24497	50007
30	33	76	153	339	538	1127	1741	2975	6140	17325	35353
45	27	63	126	275	443	934	1456	2469	5001	14781	28865
60	24	54	110	241	386	817	1266	2184	4304	12236	25004
75		49	98	218	345	709	1108	1899	3798	10957	22345
90		44	89	196	310	633	987	1709	3482	10001	20414
105		41	83	180	285	582	905	1551	3228	9254	18895
120			76	171	266	544	848	1456	3038	8659	17673
150			69	153	241	494	772	1323	2754	7748	15825
180			63	142	222	456	709	1234	2532	7064	14432
210			58	130	202	418	652	1127	2342	6439	13356
240				120	190	393	614	1063	2209	6077	12405
270				113	180	367	576	1000	2057	5697	11780
300				108	171	345	544	943	1899	5381	11179

Note: Almost all operation problems are related to the installation techniques used. Do Not guess, be sure pipe size is adequate for required flow rate.

1. Connect the proper size gas pipe at the input to the LP Gas regulator. Connect the LPG pipe line shown in Figure 3-3 using the correct size pipe for the required flow rate and length of pipe. Refer to Table 3-6 for pipe size. Be certain that all connections are sealed and no leaks are present. The installer must ensure that all gas connections comply with all building codes.
2. Verify Fuel Supply Pressure
   Prior to initial operation of generator, verify that fuel system pressure is 11″ Water Column (6 oz. pressure) and fuel pipe sizes comply with Table 3-6.
3. Proceed to Electrical Connections.

Electrical Connections Class 1 wiring methods must be used for field wiring connections to terminals of a class 2 circuit. It is the responsibility of the owner/operator to arrange for these procedures to be performed by a licensed electrical contractor and ensure conformance to all applicable codes including local codes peculiar to your municipality/city/county and state. Wire size and insulation type should be as required by NEC (National Electrical Code) and local codes.

Warning: Never connect this generator to the electrical system of any building unless a licensed electrician has installed an approved transfer switch. The national electrical code (NEC) requires that connection of a generator to any electrical circuit normally powered by means of an electric utility must be connected by means of approved transfer switch equipment to isolate the electrical circuit from the utility distribution system when the generator is operating. Failure to isolate the electrical circuits by such means may result in injury or death to utility power workers due to backfeed of electrical energy onto the utility lines.

Warning: Incorrect installation of this generator set could result in property damage, injury or death. Connection of the generator to its fuel source must be done by a qualified professional technician or contractor.

WARNING: Be sure the system is properly grounded before applying power. Do not apply AC power before you ensure that grounds are connected. Electrical shock can cause serious or fatal injury. NEC requires that the frame and exposed conductive surfaces (metal parts) be connected to an approved earth ground. Local codes may also require proper grounding of generator systems.

Intended Use The intended purpose of this generator set is to provide emergency power when the main utility power supply is interrupted. Therefore, it is important that all the wiring that connects the generator set with your house, transfer switch, distribution box, battery charger, etc. be properly installed.

Circuit Protection Circuit protection is not provided within the generator. Circuit Breaker protection is an option. If purchased with your generator, the breaker box is mounted to the generator prior to shipment. If the optional circuit breaker protection was not ordered, see "GLC Circuit Breaker & Wire Size Data" in Appendix A for recommendations.

Wire Size Proper lead wire from the circuit breaker to the automatic transfer switch (or load switching device) is mandatory. See transfer switch information for connection information. When connecting the generator output to an electrical load, a UL listed circuit breaker with the appropriate ratings must be provided within 25 feet of the generator set. Use only copper wires.

Generator Rating		Input Breaker Rating (at 115% FLA)			
Catalog No.	Kilowatt (kW) Rating	3 Phase Amps (240VAC) *		3 Phase Amps (480VAC) *	
		Nat. Gas Delta (Wye)	LPG Delta (Wye)	Nat. Gas Delta (Wye)	LPG Delta (Wye)
GLC30	30	110	110	60	60
GLC35	35	125	125	60	60
GLC45	45	150	175	70	80
GLC50	50	175	175	90	90
GLC60	60	200	200(225)	100	110
GLC80	80	300	300	150	150
GLC100	100	300	350	150	175
GLC125	125	450	400	225	200

Transfer Switch Considerations

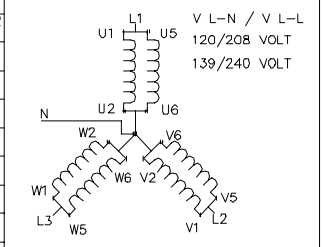
The following are general considerations for the safe use of a transfer switch:

1. The transfer switch should be located inside the building near the main breaker box or the disconnect box.
2. The transfer switch must be kept away from any location that might allow water to get on it.
3. If the transfer switch is mounted outside, it must be protected from the environment and it's elements.
4. Do not mount the transfer switch on the generator set.
5. Do not mount the transfer switch where flammable liquids or vapors are present.

Figure 3-4 Three Phase WYE and DELTA Connections

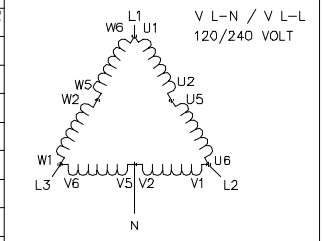
Parallel WYE

Term Block	Gen Lead	REGULATOR Lead
A	NO LEAD	
B	NO LEAD	
C	NO LEAD	
D	W2, W6, V2	
E	V6, U6, U2	
F	W1, W5	(7030)
G	V1, V5	3
H	U1, U5	2



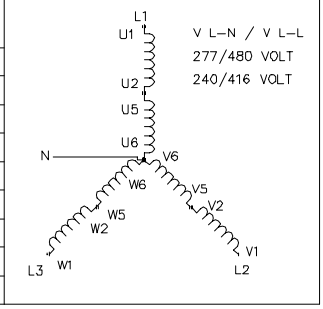
Series Delta

Term Block	Gen Lead	REGULATOR Lead
A	W6, U1	
B	U6, V1	2
C	W1, V6	3 (7030)
D	W2, W5	
E	U2, U5	
F	V5, V2	
G	NO LEAD	
H	NO LEAD	



Series WYE

Term Block	Gen Lead	F2 PINOUT Lead
A	U1	
B	V1	
C	W1	
D	U6, V6, W6	
E	U2, U5	2
F	V2, V5	3
G	W2, W5	(7030)
H		



Battery Charger Considerations

1. Mount the battery charger on the generator or as close to the generator as possible.
2. If you mount the battery charger inside the building, mount it near the main breaker box or disconnect box.
3. If you mount the battery charger outside, you must protect it from the environment and the elements.
4. Do not mount the battery charger where flammable liquids or vapors are present.

General Wiring Considerations

1. When routing the interface wiring, do not route it up against anything that could cut or chafe the wiring. do not route the wire up against any hot or potentially hot object.
2. Make sure that all the electrical components (generator set, transfer switch, battery charger, etc.) share a common hard wired ground.
3. Check with your local building inspector to determine what you must do to comply with the local regulations for grounding of this type of permanent installation.

Frame Ground Connection

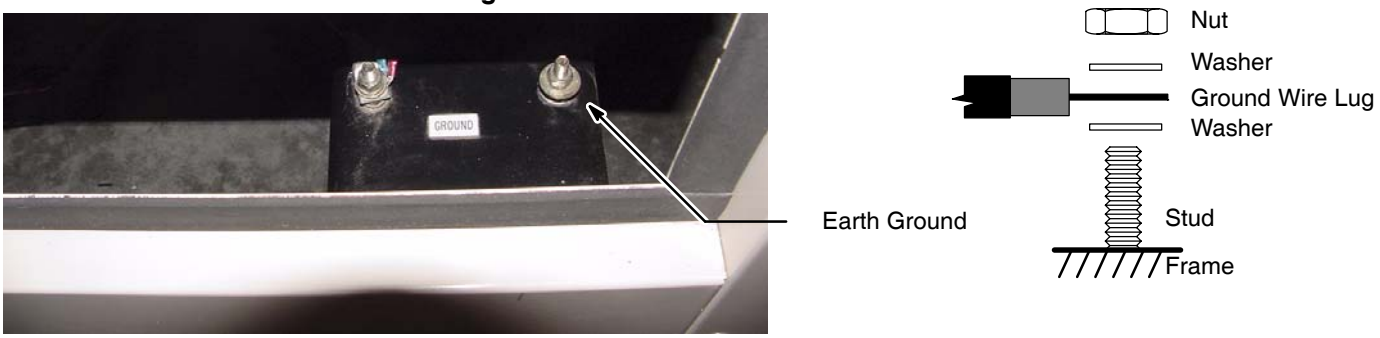
WARNING: Be sure the system is properly grounded before applying power. Do not apply AC power before you ensure that grounds are connected. Electrical shock can cause serious or fatal injury. NEC requires that the frame and exposed conductive surfaces (metal parts) be connected to an approved earth ground. Local codes may also require proper grounding of generator systems.

It is important for safety reasons that the Generator set, transfer switch and battery charger share a common Ground and neutral.

The NEC requires that the frame and exposed metal surfaces be at local ground reference potential to avoid electrical shock hazard. A local ground reference may require a driven earth ground conductor at the generator installation site. Make the ground connection as shown in Figure 3-5. Use the appropriate size wire as required by NEC and local codes.

Warning: Do not connect the generator output neutral to the frame or local ground. The generator output is isolated from ground. NEC and local codes require that the generator output remain isolated from local ground reference.

Figure 3-5 Frame Ground Connection



1. Open the enclosure access panel door 2 (Figure 3-2).
2. Connect the ground wire to the “earth ground” terminal shown in Figure 3-5. This ground is the local reference ground to ground the generator frame only.

Battery Connections The generator is shipped with no battery installed.

WARNING: Installation and servicing of batteries is to be performed or supervised by personnel knowledgeable of batteries and the required precautions. Keep unauthorized personnel away from batteries.

WARNING: Do not dispose of battery or batteries in a fire. The battery is capable of exploding. If the battery explodes, electrolyte solution will be released in all directions. Battery electrolyte solution is caustic and can cause severe burns and blindness. If electrolyte contacts skin or eyes, immediately flush the area with water and seek medical attention quickly.

WARNING: Do not mutilate the battery . The battery contains electrolyte solution which is caustic and can cause severe burns and blindness. If electrolyte contacts skin or eyes, immediately flush the area with water and seek medical attention quickly.

WARNING: A battery presents a risk of electrical shock hazard and high short circuit current. The following precautions are to be followed when working on batteries:

1. Remove watches, rings, necklaces and all other metal objects.
2. Use tools with insulated handles.
3. Wear rubber gloves and boots.

WARNING: The battery electrolyte is a dilute sulfuric acid that is harmful to the skin and eyes. It is electrically conductive and corrosive. The following precautions are to be followed when working on batteries:

1. Wear full eye protection (safety glasses or goggles) and protective clothing.
2. Where electrolyte contacts the skin, flush the area immediately with water and wash it off using soap and water.
3. Where electrolyte contacts the eyes, immediately flush the eye thoroughly with water and seek medical attention quickly.
4. Spilled electrolyte is to be washed down with an acid neutralizing agent. A common practice is to use a solution of one pound (500 grams) bicarbonate of soda to one gallon (four liters) of water. The bicarbonate solution is to be added until evidence of reaction (foaming) has ceased. The resulting liquid is to be flushed with water and the area dried.

WARNING: A battery presents a risk of fire because they generate hydrogen gas. Hydrogen gas is extremely explosive. Never jump start a battery, smoke in the area around the battery or cause any spark to occur in the area around the battery. The following precautions are to be followed when working on batteries:

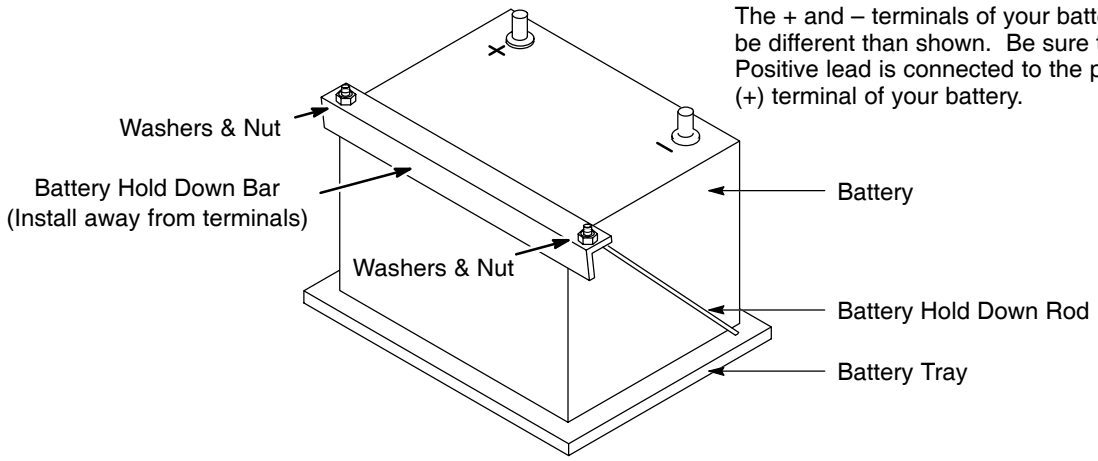
1. Do not smoke when near batteries.
2. Do not cause flame or spark in battery area.
3. Discharge static electricity from body before touching batteries by first touching a grounded metal surface.

WARNING: Disconnect the battery's ground terminal before working in the vicinity of the battery or battery wires. Contact with the battery can result in electrical shock when a tool accidently touches the positive battery terminal or wire. The risk of such shock is reduced when the ground lead is removed during installation and maintenance.

Procedure: The correct type battery must be installed in the battery compartment provided, see Table 3-7. Installation and servicing of batteries is to be performed or supervised by personnel knowledgeable of batteries and the required precautions.
Keep unauthorized personnel away from batteries.

1. Open access doors and locate battery tray.
2. Place the correct battery (see Table 3-7) on the tray.
3. Install the Battery Hold Down Bar and Rods as shown in Figure 3-6.
   a. Place the bent end of the Battery Hold Down Rod through the hole in the Battery Tray.
   b. Place the threaded end of the Battery Hold Down Rod through the hole in the Battery Hold Down Bar and secure with flat washer, lock washer and nut.
   c. Repeat steps a and b for the other Battery Hold Down Rod.

Figure 3-6 Battery Installation



4. Connect the positive lead to the positive (+) battery terminal.
5. Connect the negative lead to the negative (–) battery terminal.
6. Do not lay tools or metal parts on top of batteries.
7. Connect charging source to the battery terminals.
8. Disconnect the battery's ground terminal before working in the vicinity of the battery or battery wires. Contact with the battery can result in electrical shock when a tool accidently touches the positive battery terminal or wire. The risk of such shock is reduced when the ground lead is removed during installation and maintenance.

Recommended Engine Oil and Battery Type

When replacing batteries, use only the recommended battery for your generator, see Table 3-7.

Table 3-7

MODEL	SUMMER OIL	WINTER OIL	OIL CAPACITY	RECOMMENDED BATTERY	(AMPS) COLD CRANKING
GLC30	SAE. 30	5W/30	6.0 QTS	BCI Group 31	925
GLC35	SAE. 30	5W/30	6.0 QTS	BCI Group 31	925
GLC45	SAE. 30	5W/30	6.0 QTS	BCI Group 31	925
GLC50	SAE. 30	5W/30	6.2 QTS	BCI Group 31	925
GLC60	SAE. 30	5W/30	6.2 QTS	BCI Group 31	925
GLC80	SAE. 30	5W/30	6.5 QTS	BCI Group 31	925
GLC100	SAE. 30	5W/30	6.5 QTS	BCI Group 31	925
GLC125	SAE. 30	5W/30	6.5 QTS	BCI Group 31	925

Post Installation Checks

When the initial installation is complete, these checks must be performed before starting the engine. These checks are not required before each start, only after the initial installation.

1. Generators that have been in transit or storage for long periods may be subjected to extreme temperature and moisture changes. This can cause excessive condensation, and the generator windings should be thoroughly dried before bringing the generator up to full nameplate voltage. If this precaution is not taken, serious damage to the generator can result.

Caution: Do not apply high voltage to windings (do not start the generator) in a moisture–saturated condition. Moisture can cause insulation breakdown, making it necessary to return the generator to the factory for repair, and consequent expense and loss of time.

Note: These precautions are especially necessary in locations such as seaboard installations and other high humidity areas. Some installations will be in atmospheres that are much more corrosive than others. Prevention of a failure is better than being forced to make a repair.

2. Verify that the transfer switch is in Utility Power mode. No power must be present at the generator or transfer switch connections. Verify with a voltmeter.
3. Verify that the engine starting battery is disconnected so accidental starting is not possible.
4. Verify that the generator is securely mounted and anchored to its cement pad.
5. Verify that proper clearance exists on all sides and top of enclosure.
6. Verify that generator power is properly connected to the transfer switch.
7. Verify that generator and transfer switch are properly grounded.
8. Assure that generator is a safe distance from any flammable or combustible material.
9. Verify that the generator and transfer switch load are voltage compatible.
10. Verify that no load is connected to the circuit breaker and/or transfer switch.
11. Inspect the engine and generator and verify that there are no loose wires or components. Tighten if necessary.
12. Verify that the ground conductor is of correct wire size and properly connected.
13. Verify engine oil level is full. Refer to engine manual if necessary.
14. Verify engine coolant level is full. Refer to engine manual if necessary.
15. Verify exhaust system to assure it is in properly connected and pointing away from combustible materials.
16. Verify that the Master Control Switch is still in the “Stop” position.
Connect the engine starting battery to the starter. Verify it is installed correctly.
17. Verify the fuel source is ON and the pressure and flow rate are correct.
18. Remove all tools, rags, etc. from inside the generator enclosure. Close all enclosure doors and be sure no hands are inside the generator enclosure when it starts.

Post Installation Checks Continued

19. Verify all loads are disconnected.
20. Start the generator. (Refer to Section 4 Operation for details).
21. The engine should begin to crank and start when the fuel moves through the pipe to the carburetor. If the engine fails to start, refer to Section 5 Troubleshooting.
22. With the engine running, several checks must be made:
    a. Verify there are no fuel leaks. If a fuel leak is detected, stop the engine (move the Master Control Switch to the “Stop” position) immediately and repair the leak before proceeding.
    b. Verify there are no coolant or oil leaks. If a leak is detected, stop the engine (move the Master Control Switch to the “Stop” position) immediately and repair the leak before proceeding.
    c. Verify that operation is smooth. If belt squeals, vibrations or other sources of noise exist, stop the engine (move the Master Control Switch to the “Stop” position) immediately and repair before proceeding.
    d. Verify that the correct voltage exists (line–to–line and line–to–neutral) at the generator and at the transfer switch.
    e. Minor adjustment of the output voltage is made using the “Voltage Adjust” potentiometer on the control panel.

WARNING: Engine coolant is under pressure and is near the boiling point of water when engine is hot. Do not open the coolant system until the engine has completely cooled. Hot coolant can cause severe burns and other injuries. When engine is cool, coolant level can be checked.

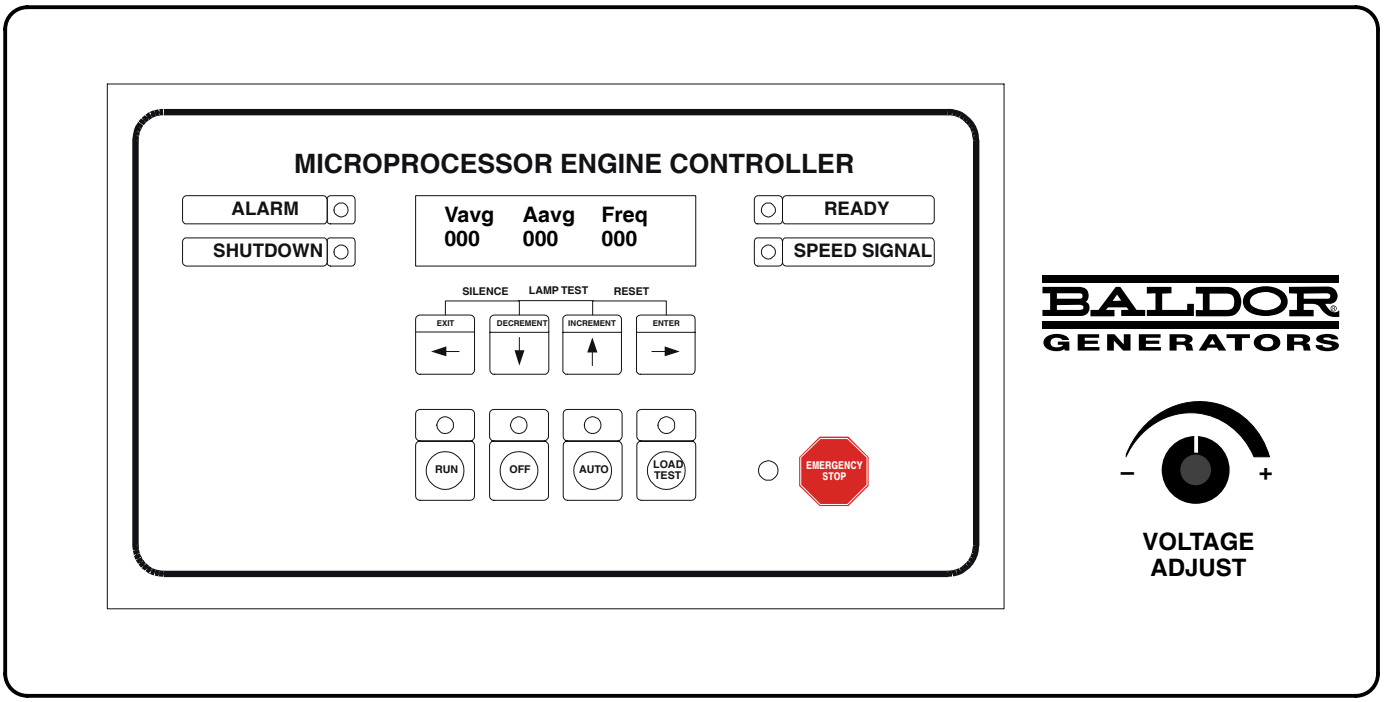
23. After the operation checks are made, stop the engine (move the Master Control Switch to the “Stop” position) and wait at least 2 hours for the engine to cool. When the engine is cool, check engine oil and coolant levels as instructed in the engine operation manual.
24. Close all enclosure covers. The post installation checks are now complete.

Operator Control Panel (Digital Engine Controller Only)

The Operator Control Panel is shown in Figure 4-1.

WARNING: Never connect this generator to any buildings electrical system unless a licensed electrician has installed an approved transfer switch. The National Electrical Code (NEC) requires that connection of a generator to any electrical circuit normally powered by means of an electric utility must be connected by means of approved transfer switch equipment so as to isolate the electrical circuit from the utility distribution system when the generator is operating. Failure to isolate the electrical circuits by such means may result in injury or death to utility power workers due to backfeed of electrical energy onto the utility lines.

Figure 4-1 Digital Operator Control Panel



LCD Display – **Vavg** (average voltage) display 0–999 volts.
Aavg (average amperage) display 0–999 amperes.
Freq (frequency) display 0–999 hertz.

Alarm LED– Flashes when a fault is detected.

Shutdown LED– Flashes when a fault is detected.

Ready LED– On when the generator set is ready for automatic operation and no Shutdown or Alarm faults are detected.

Speed Signal LED– On when the engine speed signal is detected (i.e. the engine is cranking).

Emergency Stop LED– On when the Emergency Stop Switch is used to stop the engine.

Emergency Stop Switch– When pushed, the engine is stopped immediately. The engine cannot be restarted until the controller is reset.

Programming Keys

← Exit pushbutton used to scroll backward through the status menus or programming prompts to the previous item.
Note: The longer the push–button is held down, the faster the menu prompts appear.

↓ Decrement pushbutton used to reduce a programming value while in the programming mode.
Note: The longer the push–button is held down, the faster the value will be decremented.

↑ Increase pushbutton used to increase a programming value while in the programming mode.
Note: The longer the push–button is held down, the faster the value will be incremented.

→ Enter pushbutton used to scroll forward through the status menus or programming prompts to the next item.
Note: The longer the push–button is held down, the faster the menu prompts appear.

Run Switch– When pushed, initiates a manual start signal to start the engine. The engine will start and operate continuously providing no shutdown faults are active. All protective circuits are operative in this mode. There will be no cool down cycle at the end of a manual run sequence.

Run LED– On when the Run switch is used to start the engine (generator set).

OFF Switch– When pushed, sends a stop signal to the engine to stop the engine.

OFF LED– On when the OFF Switch is used to stop the engine.

Operator Control Panel Continued

Auto Switch – When pushed, initiates automatic operation of the engine (generator set). Starting and stopping of the engine is controlled by a remote contact (transfer switch). When the remote start signal is removed the engine will continue to run for the cool down period (if selected) then stop. Pushing the Off switch will stop the engine immediately, even if the cool down period is not complete.

Auto LED– On when the Auto Switch is used to start automatic operation.

Load Test Switch – When pushed, initiates a load test of the generator set with the associated transfer switch. Only operative for AMF connections or if one of the programmable output contacts is configured for "ATS Test" and the remote transfer switch has remote testing circuitry. When pushed, a signal is issued to the remote transfer switch to permit an automatic engine start and load transfer. Once initiated, the engine will receive a start signal from the transfer switch and upon the generator reaching nominal voltage and frequency levels, a load transfer will be initiated. The generator set will remain running at load until a different operating mode is selected or the generator set develops an alarm or shutdown fault condition.

Load Test LED – On when the load test of the generator set is active.

Special Function Switches

Silence Horn Silence. Press both "Exit and Decrement" at the same time.
This will silence the audible alarm horn without resetting the fail condition.

Lamp Test Press both "Decrement and Increment" at the same time.
Causes the LED's and LCD display to illuminate for approximately 2 seconds then return to their original status.

Note: The emergency stop LED is not affected by this test.

Reset Fault Reset. Press both "Increment and Enter" at the same time.
Resets the controller when in a shutdown mode.

Note: To reset after a fault, the engine must come to a complete stop and the controller's "OFF" switch must be pressed.

Voltage Adjust – Increase or Decrease the Generator output voltage (displayed on VOLTAGE meter)

Operating Procedures The engine–generator controller is designed to start and stop an engine from either a local ("Manual") or remote ("Automatic") modes. When a start command is issued, the controller issues a run and crank output signal. The controller then monitors engine speed and when crank disconnect speed is reached, the crank signal is terminated. While the engine accelerates to normal speed, the controller continuously monitors the engines speed signal. Should the engine speed exceed the maximum predetermined setpoint, the overspeed shutdown fault circuit will activate, terminating the run signal.

In addition to overspeed shutdown, the engine controller also monitors many other engine protection circuits and should they be activated, the engine will be stopped and/or alarm initiated. The engine will automatically stop for any shutdown condition, or when the remote and/or local start signal is removed. The engine controller operation includes time delay circuits for normal operating conditions such as start delays, cool down and cranking periods.

Manual Start/Stop

To manually Start the Gen–Set, push the "RUN" push–button. The following happens:

1. When the "RUN" push–button is pressed, an ENGINE START DELAY timer is initiated. (The start sequence will not be initiated if any shutdown fault condition is present.)
2. When the engine start delay time expires, an engine RUN and CRANK output signal will be initiated. (The RUN output may be programmed to only energize when a start signal is initiated and an engine speed signal is detected.)
3. When the engine starts and begins to accelerate to nominal speed, the controllers speed sensor will terminate the CRANK output when engine speed reaches approximately 20% speed (i.e. CRANK DISCONNECT speed setpoint). Immediately upon reaching crank disconnect speed, the controller will initiate the BYPASS DELAY time delay function. After the BYPASS DELAY time period (typically 10 seconds) all fault circuits programmed as BYPASS DELAY=YES are active. (All fault circuits programmed as BYPASS DELAY=NO are continuously armed irrespective of any operation sequence.)

To manually Stop the Gen–Set, push the "OFF" push–button. The controllers RUN output will be immediately terminated which will initiate the engine stop sequence.

Automatic Start/Stop

To setup the generator for automatic operation, pressing the "AUTO" push–button.
The following happens:

1. The engine will automatically start upon activation of the remote start contact input. The remote device initiates a start sequence upon contact closure.
2. When the remote start signal is activated, the engine will start as per the sequence of operation described for the manual start sequence.
3. The automatic stop sequence will be initiated by removal of the remote start signal.
4. When the start signal is removed, a cool down delay function will be initiated.

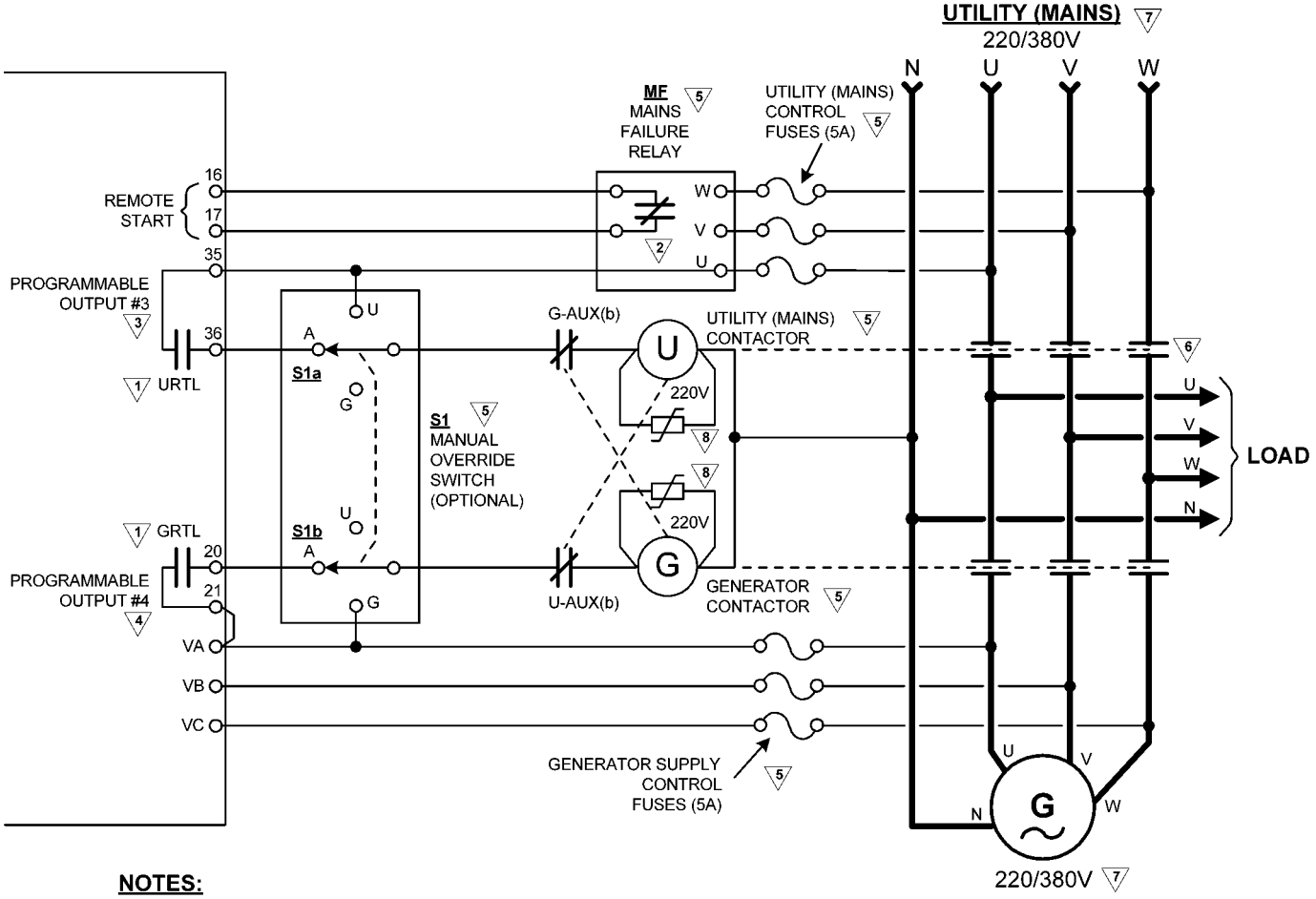
5. When the cool down time delay period expires (typically 5 minutes), the controllers RUN output will be immediately terminated which will initiate the engine to stop.

Automatic Fault Shutdown

When a fault circuit is programmed as a SHUTDOWN, the engine will immediately stop when the fault is activated. A specific shutdown fault can be programmed with a definite time transient delay period that must expire before the shutdown is activated. The stop sequence will cause the controllers RUN output to be immediately terminated which will cause the engine to stop. This will prevent subsequent operation of the generator set. The Run/Stop/Auto selector switch on the operator control panel must be momentarily placed in the “Stop” position to reset the fault.

Automatic Mains Failure (AMF)

Figure 4-2 Auto Mains Failure (AMF) Connections



NOTES:

1. CONTACTS RATED 10A, 240VAC RESISTIVE
2. MAINS FAILURE CONTACT CLOSES WHEN VOLTAGE DROPS BELOW SETPOINT
3. PROGRAMMABLE OUTPUT #3 MUST BE PROGRAMMED FOR "UTILITY READY TO LOAD"
4. PROGRAMMABLE OUTPUT #4 MUST BE PROGRAMMED FOR "GENERATOR READY TO LOAD"
5. ALL COMPONENTS SHOWN EXTERNAL TO THE MEC 2 / MEC 20 ARE OPTIONAL ITEMS
6. 3 POLE CHANGEOVER SWITCH SHOWN
7. FOR OTHER SYSTEM VOLTAGE APPLICATIONS, CONSULT TTI FACTORY
8. AC COIL SPIKE SUPPRESSION DEVICES ARE REQUIRED

When the controller is applied in an Auto Mains Failure (AMF) application with a transfer switch, it must be wired as shown in Figure 4-2. Programmable output #3 must be selected for Utility Ready To Load and programmable output #4 must be selected for Gen Ready To Load. After the controller is programmed, the AMF sequence of operation will be as follows:

Utility Normal Condition:

1. Remote Start input signal (terminals 16 & 17) is not activated (i.e. normal).
2. Utility Ready To Load output is energized (i.e. signal to transfer switch to transfer to utility power).
3. Generator Ready To Load output is de–energized.

Utility Power Failure Conditions:

1. Remote Start input signal is activated (i.e. remote start contact closes when utility power fails, as sensed by utility voltage sensor).
2. Engine starts after the Engine Start Delay timer (Utility Ready To Load output stays energized).
3. After the engine has started and the generator output rises above the programmed voltage and frequency limits, a Warm–Up timer is initiated.
4. After the Warm–Up timer expires the Utility Ready to Load output de–energizes and the NEUTRAL Delay timer is initiated.
5. After the NEUTRAL DELAY timer expires the Gen Ready to Load output energizes to signal the transfer switch to transfer to the generator supply. Note: The neutral delay function is only operative with an electrically–held type transfer switch mechanism (ie. electrical contactor type).

Utility Power Restored:

1. Remote Start input signal is removed and the Return Delay timer is initiated (i.e. Utility Voltage returns to normal and the Utility voltage sensor contact opens).
2. After the Return Delay timer expires, the Generator Ready to Load output de–energizes and the Neutral Delay timer is initiated.
3. After the Neutral Delay timer expires the Utility Ready to Load output energizes to signal the transfer switch to transfer to the utility supply. Note: If the generator has a shutdown during the Return or Neutral Delay periods, the timers are bypassed, and the Utility Ready to Load output immediately energizes.
4. The generator Cool down Timer starts after the Return Delay timer.
5. The generator stops after the Cool down Timer.

Load Test Push–button Operation

1. When the Load Test pushbutton is pressed, the logic will internally simulate receiving a remote start input.
2. Engine starts after the Engine Start delay timer.
3. After the engine has started and the generator output rises above the programmed voltage and frequency limits, a Warm–Up timer is initiated.
4. After the Warm–Up timer expires the Utility Ready to Load output de–energizes and the Neutral Delay timer is initiated.
5. After the Neutral Timer expires the Gen Ready To Load output energizes to signal the transfer switch to transfer to the generator supply.

Note: If a generator shutdown occurs during a Load Test Operation, the Load Test mode will be de–activated.

When Auto Mode is restored (after Load Test Operation) the following occurs:

1. Simulated Remote Start input signal is removed.
2. Gen Ready To Load output de–energizes, and Neutral Delay timer is initiated.
3. After the Neutral Delay timer expires The Utility Ready To Load output energizes to signal the transfer switch to transfer to the utility supply.
4. The generator Cool down timer starts timing following the transfer to the utility supply.
5. The generator stops after the Cool down timer.

No Load Test

To allow a timed No Load Test of the engine/generator set while using the AMF control application, a digital input contact from an external timer must be programmed for NO LOAD Test The sequence of operation for a No Load Test condition is as follows:

1. With the utility supply normal and the generator stopped, a no load test sequence may be initiated by closing an external exercise timer contact to the programmed digital input for No Load Test.
2. After the external exercise timer contact closes, the engine will start and come–up to normal operating speed and voltage. The controller will issue an alarm of a No Load Test condition. The connected transfer switch will remain on the utility and the generator will not transfer on load. Note: should the utility supply fail, the generator will automatically transfer on load.
3. The engine will continue to run as long as the external exercise timer contact remains closed.
4. After the external exercise timer contact opens, the engine will continue to run for its cool down time as programmed, then it will automatically stop.

Standard Faults

When a fault occurs, information about the fault is displayed. The engine controller has many analog and digital inputs for monitoring and control operations. Three types of faults are used:

1. Internal Faults are derived from a combination of digital and analog inputs.
2. Digital Input Faults are initiated from external contact inputs.
3. Analog Input Faults are initiated from external analog signal inputs.

Figure 4-3 shows how the controller inputs and outputs are organized.
A description of each is provided.

Internal Faults

Overspeed Shutdown

Overspeed Shutdown is initiated when the engine's speed has increased above the overspeed setpoint. The overspeed fault circuit is internally programmed as a latching shutdown fault. The overspeed shutdown fault circuit is programmable for the percentage of nominal engine speed (i.e. overspeed setpoint) and for the transient time delay period. The programming prompts for overspeed are located in the main menu programming loop.

Loss of Speed Alarm/Shutdown

Loss Of Speed is initiated when the engine's speed sensing circuit does not detect a speed signal for a period more than 2 seconds following a run signal. The loss of speed fault may be user programmed as a latching shutdown fault or alarm only. The programming prompts for loss of speed are located in the main menu programming loop.

Overcrank Shutdown

Overcrank Shutdown is initiated when the engine fails to start after the selected crank time or number of crank cycles. The overcrank fault circuit is internally programmed as a latching shutdown fault and is not user programmable.

Switch not in AUTO

Switch not in AUTO is initiated when the controller's operating mode switch is changed from the auto position to any other position (ON the keypad). This fault is internally programmed as a non latching alarm. In the main programming loop, this alarm may be user programmed to initiate the common fail output relay.

Digital Input Faults

Digital Inputs (N/O or N/C)

Four digital faults are provided and these are user programmable. Each digital fault input circuit is activated by a remote sensing contact that is external to the controller. Each digital fault input circuit may be programmed with a unique fault label description as stored in the controller's non–volatile memory.
Factory settings have four standard digital faults as follows:

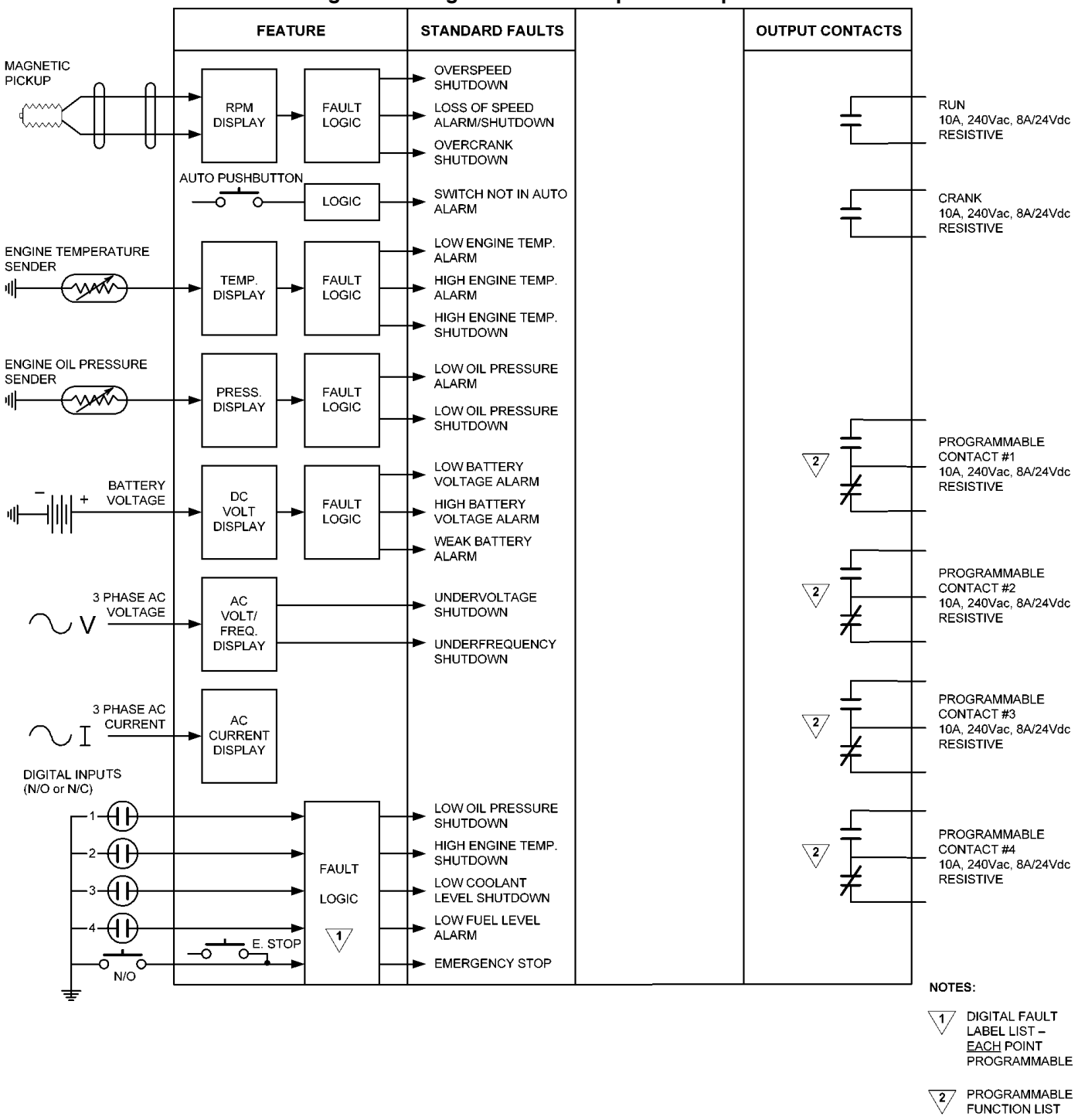
Fault Name	Fault Action	Digital Inputs Terminal #
Low Oil Pressure	Shutdown	1
High Engine Temperature	Shutdown	2
Battery Charger Input Fail	Alarm	3
Low Fuel Level	Alarm	4

The following is a list of all digital faults:

High Bearing Temp	Failed To Sync	Reverse Power	Bat Charger Input Fail
High Cooler Vibration	Low Fuel Press	Fail To Sync	Bat Chrg Trouble
High Engine Temp	Low Engine Temp	Vent Damper Fail	Bat Charger Fail
High Engine Vibration	Low Oil Pressure	Gen Breaker Open	DC Fail
High Fuel Level	Low Fuel Level	Ground Fault	Breaker Tripped
High Oil Level	Low Oil Level	No Load Test	Basin Rupture
High Oil Temp	Fuel Leak	ATS In Bypass	
High Winding Temp	Low Fuel Press	Remote Emerg. Stop	
*Highintkmanftemp	Low Coolant Level	Air Damper Tripped	

"Blank" (i.e. no text for unused inputs)

Figure 4-3 Engine Controller Inputs & Outputs



Analog Faults

Eight analog fault inputs are user programmable for 12 fault conditions. Each analog fault input requires a specific analog signal type.

Fault Name	Fault Action	Inputs Signal
Low Engine Temperature	Alarm	Engine Temperature
High Engine Temperature #1	Alarm	Engine Temperature
High Engine Temperature # 2	Shutdown	Engine Temperature
Low Oil Pressure #1	Alarm	Oil Pressure
Low Oil Pressure #2	Shutdown	Oil Pressure
Low Battery Voltage	Alarm	Battery Voltage
High Battery Voltage	Alarm	Battery Voltage
Weak Battery	Alarm	Battery Voltage
Undervoltage	Shutdown	Voltage
Under frequency	Shutdown	AC Frequency

Low Engine Temperature An analog DC signal is provided from an engine mounted sender. The low engine temperature fault is activated when engine temperature is below a pre-determined setpoint for a specified time delay. This fault is programmable for temperature setpoint level, transient time delay settings and other functions.

High Engine Temperature #1 An analog DC signal is provided from an engine mounted sender. The high engine temperature fault is activated when engine temperature is above a pre-determined setpoint for a specified time delay. This fault is programmable for the level of temperature setpoint, transient time delay settings and other functions.

High Engine Temperature # 2 An analog DC signal is provided from an engine mounted sender. The high engine temperature fault is activated when the engine temperature rises above a pre-determined setpoint for a specified time delay. This fault is programmable for the level of temperature setpoint, transient time delay settings and other functions.

Low Oil Pressure #1 An analog DC signal is provided from an engine mounted sender. The low oil pressure alarm fault is activated when the oil pressure is below a pre-determined setpoint for a specified time delay. This fault is programmable for pressure setpoint level, transient time delay settings and other functions.

Low Oil Pressure #2 An analog DC signal is provided from an engine mounted sender. The low oil pressure shutdown fault is activated when the oil pressure is below a pre-determined setpoint for a specified time delay. This fault is programmable for pressure setpoint level, transient time delay settings and other functions.

Low Battery Voltage The low battery voltage alarm fault is activated when the battery voltage drops below a pre-determined setpoint for a specified time delay. This fault is programmable for the voltage setpoint level, transient time delay settings and other functions.

High Battery Voltage The high battery voltage alarm fault is activated when the battery voltage rises above a pre-determined setpoint for a specified time delay. This fault is programmable for voltage setpoint level, transient time delay settings and other functions.

Weak Battery The weak battery alarm fault is activated when the battery voltage drops below a pre-determined setpoint for a specified time delay. The weak battery alarm detects a low capacity (i.e. "weak") battery condition during the cranking cycle. The weak battery alarm is programmed for a lower battery voltage setpoint and shorter time delay than the low battery alarm function. This fault is programmable for voltage setpoint level, transient time delay settings and other functions.

Undervoltage All 3-phases of the generator output are monitored for an undervoltage condition. The undervoltage sensor is programmable for type of fault action (alarm or shutdown), pickup and dropout voltage setpoints (i.e. adjustable hysteresis) and transient time delay settings.

Under frequency The generator output is monitored for an under frequency condition. The under frequency sensor is programmable for type of fault action (alarm or shutdown), frequency setpoint, and transient time delay settings.

Engine Speed Analog Input A magnetic pickup (engine speed sensor) measures engine speed. The engine speed sensor allows the controller to perform the following control functions:

- Overspeed shutdown
- Crank Disconnect control
- Loss of speed signal detection
- Starter Re-engage control
- RPM display

Output Contacts All output contacts are non–powered (i.e. dry contacts) and are rated 10A/240VAC, 8A/28VDC resistive (3A inductive, 0.4pf). Output contacts are not fused therefore external overcurrent protection (maximum 10A) is required for all control circuits using these contacts. Contacts are shown in a de–energized state and will change state upon activation.

Run The Run contact is a Form "A" dry contact to control the engines "Run" circuit. This typically includes external control devices such as "Fuel Rack Solenoids" or electronic governors.

Note: An additional pilot relay will be required to energize high current devices that exceed the 10A resistive rating. The run output control logic provides an "Energize To Run Signal" (i.e. the run contact closes when a run condition is activated). For energize to stop control logic, refer to the programmable output control function.

Crank The Crank output contact is a Form "A" dry contact and is used to control an external crank pilot relay that directly controls the engine starter motor.

Note: An external crank pilot relay is required to energize the high current starter motor pinion solenoid that exceeds the 10A resistive crank output contact rating. The crank output contact closes when a crank condition is activated and the contact will automatically open when crank disconnect speed is obtained and/or the generators output AC voltage exceeds 10% of nominal level. The generators output AC voltage is utilized for back–up crank disconnect protection should the speed sensor fail.

Programmable Contacts Four (4) standard programmable output contacts are provided, #1, #2, #3 and #4. Each programmable output is a Form "C" dry contact that is programmable for any of the following conditions:

- **Energize To Stop** The output relay will energize when a stop signal has been activated. The output will remain energized for 10 seconds after the engine has come to a complete stop, then de–energizes.
- **Switch Not In Auto** The output relay will energize when the controller's operation mode switch is not in the auto position.
- **Engine Ready** The output relay will energize when the controller's mode switch is in the auto mode and no shutdown or alarm conditions are present.
- **Preheat** The output relay will energize during the start delay timer period and cranking period until the engine starts and reaches crank disconnect speed. The preheat output is typically used for an engine starting aid such as glow plugs.
  Note: An external pilot relay is required to switch the high current glow plug load.
- **GEN Ready To Load** The output relay will energize when the generators output voltage and frequency exceeds predetermined setpoints (e.g. voltage 90% nominal, frequency 95% nominal as user programmed) and a warm–up time delay period expires. After the output has energized, it will remain on (regardless of voltage/frequency levels) until the controller either has a stop/shutdown signal, or the engine's speed drops below crank disconnect level. The voltage, frequency and time delay levels are programmable. This output is typically used in an Auto Mains Failure (AMF) application.
- **Utility Ready To Load** The output relay will energize when the remote start input has not been activated (i.e. contact on terminals 16 & 17 not closed) and the Return Delay & Neutral Delays have expired (if programmed). The output will de–energize when the remote start input has been activated and the Engine Start Delay & Warm–Up Delays have expired (if programmed). This output is typically used for Auto Mains Failure (AMF) applications.
- **Engine Running** The output relay will energize when the engine has started and has reached crank disconnect speed.
- **Engine Run (Fuel)** The output relay will energize when the engine "RUN" (i.e. FUEL) energizes prior to the engine starting. The output will remain on until the engine has reached a "stop" or "shutdown" command.
- **Airflap** The output relay will energize when the engine's speed exceeds the overspeed setpoint level. The output will remain energized until the engine's speed drops below the low speed setpoint (typically 5% of rated speed).
  Note: An external pilot relay is required if the main air flap solenoid current rating exceeds the contact rating.
- **ATS Test** This feature is only operative if the remote transfer switch is interconnected with remote testing capability.
  The output relay will energize when a load test operating mode is selected by the "Load Test" keypad push–button. After initiated, the engine will receive a start signal from the transfer switch and when the generator reaches nominal voltage and frequency levels, a load transfer will be initiated. The generator set will remain running on load until a different operating mode is selected or the generator set develops an alarm or shutdown condition.

  Note 1: When the "Utility Ready to Load" and "Generator Ready to Load" outputs are programmed, the "Load Test" programmable output is not required as the engine starting logic is internally initiated.

  Note 2: When both "Utility Ready to Load" and "Generator Ready to Load" outputs are programmed for an AMF control configuration, the ATS Output is not used (i.e. engine start signal is internally generated).
- **Oil Bypass Timer Complete** The output relay will energize when the controller's oil bypass delay timer expires, following a normal start sequence.
- **Common Alarm** The output relay will energize when any alarm fault has been activated.
- **Common Fail** The output relay will energize when any alarm or shutdown fault has been activated.
- **Common Shutdown** The output relay will energize when any shutdown fault has been activated.
- **EPS Supplying Load** The output relay will energize when the engine is running and the generator is supplying current to the load more than or equal to 10% of nominal CT ratio.

Display Modes The controller is in the display mode at all times except when in the programming mode. The display screens and menus may be selected by pressing the Enter or Exit keys to access Operating Status Display, Fault Display, Timer Countdown, Generator AC Metering or Programming Menus. The LCD display shows the status of the generator output:

Operating Status The controller will power–up into an Emergency Stop failure mode, preventing possible engine operation. The controller must be manually reset before normal operation can be established. To reset the Emergency Stop condition, press the “OFF” push–button first, then press both “INCREMENT” and “ENTER” push–buttons simultaneously. The controller will then reset, if a remote emergency stop condition is not activated. The Utility Ready to Load programmable output will energize if the remote start contact is open. The Main LCD Display will be shown.

Action	Description	Display	Comments
Apply Power and Reset faults.	Main LCD Display.	Vavg 000 Aavg 000 Freq 000	
Press Enter key	Show Operating Status screens	UNIT READY	Controller is in “Auto” position and there are no active faults.
Press ↑ or ↓ key	Scroll to next.	SWITCH IN OFF	Controller is in “OFF” position from the front panel keypad push-button.
Press ↑ or ↓ key	Scroll to next.	UNIT RUNNING	Engine is running and all conditions are normal.
Press ↑ or ↓ key	Scroll to next.	UNIT SHUTDOWN	A shutdown fault is active. The specific fault will be automatically displayed.
Press ↑ or ↓ key	Scroll to next.	UNIT ALARM	One or more faults are active. The display will automatically scroll through all active faults at a two second rate.

Fault Display The fault display menu is automatically displayed when an alarm or shutdown fault is activated. The specific alarm or shutdown fault label will be displayed and if multiple alarm conditions are present, the display will automatically scroll through all active faults.

Timer Countdown Timer countdown menus are automatically displayed when a specific time delay function occurs during a control sequence. When a time delay begins, the LCD display will show the time delay function name (i.e. Engine Start Delay) and the current time remaining in the countdown sequence. When the timing function has expired, the LCD display will automatically change to either the next timing sequence countdown display or return to the original system status menu.

Action	Description	Display	Comments
Apply Power and Reset faults.	Main LCD Display.	Vavg 000 Aavg 000 Freq 000	
	Show Operating Status screens	ENGINE START DELAY 45 SEC	Displays specific time delay function name and remaining time.
	Other time delay functions are:		
		ENGINE START DELAY 45 SEC	
		CRANK PERIOD XX SEC	
		REST PERIOD XX SEC	
		STARTER RE–ENGAGE DELAY XX SEC	
		BYPASS DELAY XX SEC	
		COOLDOWN DELAY XXXX SEC	
		WARMUP DELAY XX SEC	
		RETURN DELAY XX SEC	
		NEUTRAL DELAY XX SEC	

Note: Countdown screens only appear if Utility/Gen Ready To Load outputs are programmed.

Generator AC Metering The controller is in the display mode at all times except when in the programming mode. The display screens and menus may be selected by pressing the Enter or Exit keys to access Operating Status Display, Fault Display, Timer Countdown, Generator AC Metering or Programming Menus. The LCD display shows the status of the generator output:

Generator Average Output Display

Vavg	Aavg	Freq
000	000	000

Average Voltage — Displays the average generator voltage as follows:
3-phase system: AVERAGE LINE TO LINE VOLTAGE--Phases
1-phase system: LINE TO LINE VOLTAGE--Phases A to B

Average Current — Displays the average generator current as follows:
3-phase system: AVERAGE LINE CURRENT--Phases A,B,C
1-phase system: AVERAGE LINE CURRENT--Phases A,B

Frequency — Displays generator frequency in hertz (HZ). The frequency is displayed with a resolution of 1/10 of a hertz.

Generator KVA Display

KVA
632.23

KVA — Displays the generator's total power output in kilo-voltamperes (KVA).

Generator Phase Voltage Display (Line to Line)

Vab	Vbc	Vca
600	600	600

Vab — Displays the generator's output voltage:
3-phase system: LINE TO LINE VOLTAGE--Phases A to B
1-phase system: LINE TO LINE VOLTAGE--Phases A to B

Vbc — Displays the generator's output voltage:
3-phase system: LINE TO LINE VOLTAGE--Phases B to C
1-phase system: LINE TO NEUTRAL VOLTAGE--Phases A-N

Vca — Displays the generator's output voltage:
3-phase system: LINE TO LINE VOLTAGE--Phases C to A
1-phase system: LINE TO NEUTRAL VOLTAGE--Phases B-N

Generator Phase/Neutral Voltage Display (Line to Neutral)

Van	Vbn	Vcn
347	347	347

Note: The generator's neutral must be connected to controller terminal TB1-VN and the "neutral connected" prompt in the main program menu must be selected as "Yes".

Van — Displays generator voltage Phase A to Neutral.

Vbn — Displays generator voltage Phase B to Neutral.

Vcn — Displays generator voltage Phase C to Neutral.

Generator Phase Current Display

Amps	a	b	c
	408	451	415

Amps a — Displays generator load current as follows:
3-phase system: PHASE A CURRENT
1-phase system: PHASE A CURRENT

Amps b — Displays generator load current as follows:
3-phase system: PHASE B CURRENT
1-phase system: PHASE B CURRENT

Amps c — Displays generator load current as follows:
3-phase system: PHASE C CURRENT
1-phase system: not applicable

Generator Frequency/Hourmeter Display

FREQ	60.1 Hz
HOURS	56788 Hrs

FREQ — Displays generator frequency in hertz (HZ). The frequency is displayed with a resolution of 1/10 of a hertz.

HOURS — Displays unit operating hours.

Engine Parameter Display Two engine operating parameter screens are provided.

Battery Voltage/Engine Speed (Tachometer)

BATTERY	27.0 Vdc
SPEED	1800 rpm

Battery	Displays battery voltage in DC volts. The voltage is displayed with a resolution of 1/10 of a volt.
Speed	Displays engine speed in revolutions per minute (RPM).

Engine Temperature/Oil Pressure

ENG TEMP	57 Deg C
OIL PRESS	200 KPA

ENG TEMP	Displays engine temperature in either degrees Celsius or Fahrenheit (as selected).
OIL PRESS	Displays engine oil pressure in either pounds per square inch (PSI) or in Kilopascals (KPA) (as selected).

Program Menus

The programming menu is used to change values such as time delays, analog fault settings, digital fault settings. Access to the programming sub–menus may only be obtained with a security password number. The sub menus are organized as follows:

Program Menu

PROGRAM MENU?
NO

Displays two messages that may be toggled between YES and NO by pressing the INCREMENT push–button.
NO Programming sub–menus are disabled when NO is displayed.
YES Programming sub–menus are enabled when YES is displayed and a valid password number is entered.

PASSWORD
0

Press INCREMENT or DECREMENT to change the password. Press ENTER when the correct number is displayed.

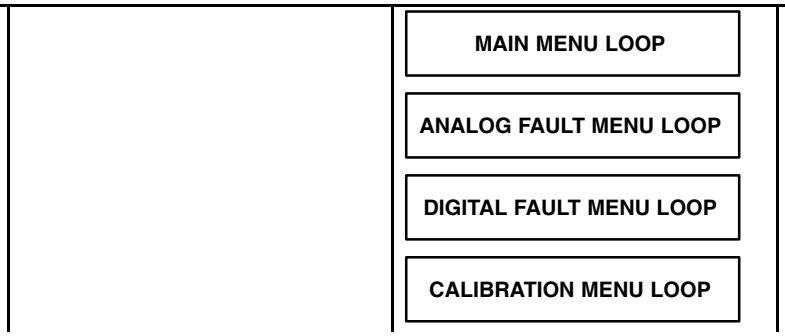
Read Only Mode
User can view the parameters but cannot change any values. The factory setting for this level is one (1).

Read / Write Mode
User can view and modify any parameter value. The factory setting for this level is two (2).

Master Read / Write Mode
User can view and modify any parameter value and view/modify the security password level numbers.
Contact Baldor for master password if required.

The values of the parameter settings for your generator–set can be recorded for future reference using the Configuration Data Sheet shown in Figure 4-4.

After the correct password number is entered, the you may choose one of four programming menus. Press INCREMENT or DECREMENT to find the desired menu then press ENTER.



Navigation Hints

Programming parameters are displayed in the same order as the Programming Sheets (see Figures 4-5 to 4-8). To skip over parameters that do not require changes, push and hold the ENTER push–button until the desired parameter is displayed. The EXIT push–button may be used to scroll backwards through the programming parameter loops.

To change a parameter value, use the INCREMENT or DECREMENT push–buttons to scroll through the available options or to adjust a value as desired and press the ENTER to accept the new value.

Note: If programming mode is terminated before the last change is accepted (pressing ENTER), that parameter value will remain unchanged.

Main Menu Loop The Main Menu Loop contains general system configuration programming such as system input voltages, currents, transformer ratios, as well as standard operating time delay functions.

System Voltage	Set to nominal system voltage as expressed in phase to phase voltage (i.e. a 347/600 volt system would be entered as 600). The programmable range of values is 120V–15,000V.
System Frequency	Set to nominal system frequency of either 50 HZ or 60 HZ.
System Phases	Set to match the power distribution system used on the generator set (i.e. either single phase or 3 phase system).
Neutral Connected	Set to Yes if generator's neutral conductor is connected to controller terminal TB1–VN and it is desired to display line–neutral AC voltages for a 3 phase, 4 wire system.
Voltage Sensing Ratio	For direct voltage sensing wiring connections from 208 to 600 volts, enter 1 (i.e. a ratio of 1:1). When potential transformers are utilized for voltage sensing, enter the calculated transformer ratio (e.g. when using 600:120 transformers, enter a number of 5).
Current Sensing Ratio	For current sensing wiring connections from current transformers (CT's), enter the calculated CT ratio (e.g. when using a 600:5 CT, enter a number of 120).
Temperature Scale	Select the desired units for engine temperature display and analog setpoints: Degrees Fahrenheit or Degrees Celsius. Note: Alarm setpoints do not automatically re–configure when changing between Fahrenheit or degrees Celsius.
Pressure Scale	Select the desired units for engine pressure display and analog setpoints: Pounds per square inch (PSI) or Kilopascals (KPA). Note: Alarm setpoints do not automatically re–configure when changing between PSI and KPA.
Start Delay	Select desired engine start delay time in seconds. If engine start delay is not required, set to zero. Note: If preheat and or prelube functions are used, the engine start delay time should be set as required for these functions.
Crank Time	Select desired cranking time in seconds. If cycle cranking is selected, this time will be the crank time per attempt.
Rest Time	Select desired rest time between cranking attempts. (Only valid if multiple crank attempts are selected). Note: This value will be ignored if only one attempt has been programmed.
Starter Re–Engage Duration	This feature checks for a speed signal during cranking. If no speed signal is sensed, the controller assumes that the engine starter is not turning the engine over and disengages it after the programmed time delay, and re–engages it again. This process will repeat until a speed signal is sensed or cranking time expires, whichever occurs first. If a speed signal is sensed, cranking continues until the engine starts or an overcrank condition occurs. Set time in seconds as desired (i.e. a setting of 5 seconds will attempt cranking for 5 seconds after which time if no speed signal is detected, the crank output will be removed for a preset 1 second delay before re–engaging.) Note: This action is more than a cycle cranking function and is independent of the number of attempts selected. Therefore, the "crank" time should be considered. To disable this feature, set to zero.
Number Of Crank Cycles	Set to the number of cranking cycles required. (Zero will default to one.)
Bypass Delay	This setting is the time period that Alarm or Shutdown faults will be ignored after crank disconnect, allowing the engine to settle into its normal operating mode (i.e. proper oil pressure, etc.). Typically 10 seconds.
Cool down Time	Set to desired cool down time in seconds. Up to 9999 seconds of cool down time may be programmed. Set to zero if not required. Note: If the controller is used in an AMF application it is recommended to set the cool down timer to a minimum of 10 seconds to allow the generator to transfer Off Load before enabling the cool down time. (Ensures the load is transferred off of generator prior to stopping the engine.)
Nominal Engine RPM	Set to the nominal engine speed in revolutions per minute (RPM).
Flywheel Teeth	Set to the number of ring gear teeth on the engine flywheel. The magnetic pick–up must be installed to sense the same teeth for speed sensing as programmed.
Crank Disconnect Speed	Set crank disconnect speed in percentage of nominal speed, i.e. 30% or 540 RPM on an 1800 RPM engine.
Overspeed	Set overspeed shutdown point in percentage of nominal speed (i.e. 110% or 1980 RPM on an 1800 RPM engine).
Overspeed Transient Delay	Select desired overspeed transient delay time in seconds. Time setting may be entered in tenths of seconds.
Run Output Fail–safe	When enabled (factory setting), this feature inhibits the run output until the controller receives a speed sensing signal. This prevents possible damage caused by starting the engine with no speed sensing for crank disconnect and overspeed. If selected, ensure that the speed signal is not less than 3.0VAC from the magnetic pick up while the engine is cranking. Note: If this feature is disabled, no overspeed protection or crank disconnect will be provided if the speed signal fails. If you disable this feature Baldor strongly recommends that backup crank disconnect protection and additional overspeed protection is provided.

Main Menu Loop Continued

Loss Of Speed Signal — Select the desired action (i.e. alarm or shutdown) when a loss of speed signal is detected during operation.
Note: A loss of speed signal must be detected for longer than 2 seconds to initiate the desired action.

Common Fail For "Not In Auto" Function — Selects if a common fail alarm condition is to be activated during manual operation.

Horn For Not In Auto — The Horn may be programmed to sound when the controllers operating mode is switched from the Auto position. If the Horn is not to sound, select program setting No.

Warm-up Delay — The WARM-UP Delay menu appears when the Gen Ready To Load programmable output is selected (typically for AMF application). Set to the desired time in seconds, which the generator requires to effectively "warm-up" before accepting load. This is typically set for 3 seconds. The Warm-Up Delay is initiated after the generator is above programmed voltage and frequency limits (per the analog programming menus).

Neutral Delay — The Neutral Delay menu appears when the Utility Ready To Load programmable output is selected (typically for AMF application). The Neutral Delay timer is used when transferring between the available power sources. When transferring from the utility supply to the generator supply, the Neutral Delay timer will start when the Utility Ready To Load output de-energizes. When the Neutral Delay time period expires, the Generator Ready To Load output is energized. The purpose of the Neutral Delay timer is to prevent out of phase transfers, which may be caused by a fast transfer and the two sources of supply are out of synchronism. The Neutral Delay timer ensures the load voltages decay before the transfer is initiated. Set to the desired time in seconds. The Neutral Delay timer is typically set for 3 seconds.

Note: The Neutral Delay feature is only effective when an electrically held "contactor-type" transfer switch is connected. Contact Baldor for further application information on use with other types of transfer switch mechanisms.

Return Delay — The Return Delay menu appears when the Utility Ready To Load output is selected (typically for AMF application). The Return Delay is initiated when the remote start signal is removed (signaling utility power is available). After the Return Delay timer expires, the Generator Ready To Load output is removed, and the Utility Ready To Load output energizes to signal transfer the load back to the utility supply. The purpose of the Return Delay timer is to ensure that the utility power has returned to a steady state for the selected time period before the load is transferred back to the utility supply. The Return Delay timer is typically set for 120 seconds.

Caution: The Programmable Output Contacts selection must agree with the external control wiring prior to energizing the controller. Failure to do so may cause severe equipment damage.

Programmable Output Contacts — Select the desired function that will activate the programmable relay output contact.
One of the following functions may be selected:

Energize To Stop	Gen Ready To Load	Air Flap Eps Supplying Load	Utility Ready To Load
Oil Bypass Timer Complete	Common Fail	Digital Faults #1 to4	Switch Not In Auto
Overspeed	Engine Ready	Loss Of Speed Signal	Engine Run (Fuel)
Low Bat Voltage	Preheat High Bat Voltage	Engine Running	Weak Bat Voltage
ATS Test	Low Oil Press #1 Alarm	Common Alarm	Common Shutdown
Low Oil Press #2 Shutdown	High Eng Temp #1 Alarm	High Eng Temp #1 Shutdown	

Reset Run Hours — The hourmeter may be reset to zero hours when yes is programmed.
Note: This programming prompt is only accessible while using the "Master" programming security password.

Analog Fault Menu Loop The controller's analog fault settings are described as follows:

Level — Sets the actual analog signal setpoint at which the selected fault type will be activated.
Note: For AC voltage fault circuits, two levels (i.e. pick-up & drop-out) must be programmed.

Action — Allows a fault to be either an Alarm fault or a Shutdown fault.

Alarm Latch — If an fault was set as an Alarm, it may be selected as a "Latching" alarm or "Non-latching" alarm. A Latching alarm is not cleared until a reset command clears it.
Note: This value only appears if alarm faults are programmed. Shutdown faults are automatically set as latching.

Bypass On Start Delay — Allows the alarm or shutdown fault to be disabled until after the bypass timer has expired. Faults that are not delayed are enabled at all times (i.e. engine running or stopped).

Transient Delay Times — Allows the selected fault to be disabled until the delay period has expired. Delay times are 0.0 to 999.9 seconds.

Digital Fault Menu Loop The controller's digital fault settings are described as follows:

Caution: The Digital Fault Label selection must agree with the external control wiring prior to energizing the controller. Failure to do so may cause severe equipment damage.

Digital Fault Label — Select the desired fault label, these are stored in non-volatile memory.

Air Damper Tripped	High Oil Temp	Bat Charger Input Fail	High Winding Temp
Bat Chrg Trouble	Low Coolant Level	Breaker Tripped	Low Engine Temp
DC Fail	Low Fuel Level	Failed To Sync	Low Fuel Press
Gen Breaker Open	Low Oil Level	Ground Fault	Low Oil Pressure
High Bearing Temp	Remote Emerg.stop	High Cooler Vibration	Reverse Power
High Engine Temp	Basin Rupture	High Engine Vibration	ATS In Bypass
High Fuel Level	Fuel Leak	High Oil Level	Low Fuel Press
No Load Test	Bat Charger Fail	*Highintkmanftemp	Vent Damper Fail
High Fuel Level	Fail To Sync	"Blank" (i.e. no text for unused inputs)	

Action — Allows a fault to be either an Alarm fault or a Shutdown fault.
Note: Any activated alarm or shutdown fault will energize the "Common fail" fault and sound the alarm horn.

Alarm Latch — If an fault was set as an Alarm, it may be selected as a "Latching" alarm or "Non-latching" alarm. A Latching alarm is not cleared until a reset command clears it.
Note: This value only appears if alarm faults are programmed. Shutdown faults are automatically set as latching.

Polarity — Allows the digital fault circuit to be set for Open to Fail or Close to Fail sensing contacts.

Bypass On Start Delay — Allows the alarm or shutdown fault to be disabled until after the bypass timer has expired. Faults that are not delayed are enabled at all times (i.e. engine running or stopped).

Transient Delay Times — Allows the selected fault to be disabled until the delay period has expired. Delay times are 0.0 to 999.9 seconds.

Idle Control Digital Input Programming — When a digital input is set to Idle function, these settings must be programmed to ensure correct operation:

Action	Alarm
Alarm Latch	No
Polarity	Close
Bypass On Start	No
Transient Time	0.1

Note: The corresponding digital output must also be programmed for IDLE to enable correct operation.

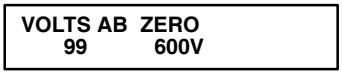
No Load Test Control Digital Input Programming

The No Load Test digital input feature is typically used in an AMF application where it is required to do an automatic timed No Load Test of the engine/generator set. A contact from an external exercise clock timer is required to be connected to the digital input circuit which is programmed for "No Load Test". When a digital input is programmed as No Load Test, these settings must be programmed to ensure correct operation:

Action	Alarm
Alarm Latch	No
Polarity	Close Or Open (dependent on external circuit used)
Bypass On Start	No
Transient Time	0.1

Calibration Menu Loop AC Voltage, AC current and battery voltage analog circuits are factory calibrated and should not require field calibration. If field calibration is required, refer to the calibration procedure.

Voltage Sensing Calibration (Phase To Phase or Phase To Neutral)



Displays the generator phase voltages to be calibrated.
Displays the type of calibration function, either ZERO or SPAN.
Displays the calibration correction factor number (0-255) used to obtain the correct voltage reading.
Note: To correctly calibrate any of the voltage sensors, the ZERO function must be calibrated before the SPAN function.
Displays the actual voltage measurement that will be the same value as shown on the MEC 2 display menus for generator supply. This voltage reading may be calibrated higher or lower by changing the correction factor number.

Voltage Calibration Procedure

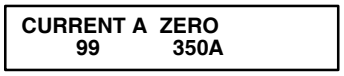
Note: Zero Calibration must be completed before Span Calibration.

Zero Calibration — Connect an external AC voltmeter of adequate voltage range and accuracy to the MEC 2 controller terminals associated with the voltage phases to be calibrated. With the generator stopped, confirm there is Zero volts on the phases to be calibrated. In the programming mode, scroll to each of the desired generator supply voltage phases (i.e. phase to phase or phase to neutral) with the ZERO function selected. Use the INCREMENT or DECREMENT push-buttons to adjust the correction factor number to obtain zero volts on the right hand side of the display as confirmed with the external voltmeter. The factory default correction factor is 127. Increasing this will raise the displayed value, conversely decreasing this value will decrease the displayed value. Note: Adjusting the ZERO function with voltage applied will result in non-linear voltage readings.
With the correct voltage displayed, press the ENTER push-button to accept the correction factor number. Record the correction factor number on the programming sheet for future reference. Repeat this procedure for all remaining phases.

Span Calibration Energize the generator supply voltage to the controller at nominal level. Note: It may be necessary to program the optional under and over voltage shutdowns as alarms to ensure the generator will continue to operate during calibration. Caution must be taken to ensure the generator output voltage is set within nominal limits. In the programming mode, scroll to the desired generator supply voltage phases with the SPAN function selected. Connect an external AC voltmeter of adequate voltage range and accuracy to the controller terminals associated with the voltage phases to be calibrated. Use the INCREMENT or DECREMENT push-buttons to adjust the correction factor number while observing the displayed voltage level. Adjust the correction factor number to obtain an identical voltage reading as measured with the external AC voltmeter. With the correct voltage displayed, press the ENTER push-button to accept the correction factor number. Record the correction factor number on the programming sheet for future reference.

Note: When the span calibration setting is complete, re-confirm the zero calibration points. If the zero calibration setpoint needs further adjustment, the span calibration point must also be re-calibrated.

Current Sensing Calibration To accurately calibrate the current sensors, an external test AC ammeter and current clamp is required, with an accuracy of 0.5% or better.



Displays the generator load current (phase A, B or C) to be calibrated.
Displays the type of calibration function, either ZERO or SPAN.
Displays the calibration correction factor number (0-255) used to obtain the correct current reading.
Note: To correctly calibrate any of the current sensors, the ZERO function must be calibrated before the SPAN function.
Displays the actual current measurement that will be the same value as shown on the MEC 2 display menus for generator supply. This current reading may be calibrated higher or lower by changing the correction factor number.

Zero Calibration Connect an external AC ammeter with current clamp of adequate current range to the controller terminals associated with the current phases to be calibrated. With the generator stopped, confirm there is "0" current on the phases to be calibrated. In the programming mode, scroll to each of the desired generator supply current phases with the ZERO function selected. Use the INCREMENT or DECREMENT push-buttons to adjust the correction factor number while observing the displayed current level. Adjust the correction factor until "0" amps is displayed.
With the correct current displayed, press the ENTER push-button to accept the correction factor number. Record the correction factor number on the programming sheet for future reference. Repeat for each phase.

Span Calibration Apply 50%-100% load to the generator set. It is recommended to load the generator set to 100% rated load for calibration purposes to obtain good accuracy throughout the full span of operation. Do not exceed the current rating of the CT. Non-linear output of the CT will result when the secondary current exceeds 5 amps and will similarly effect the displayed values.
In the programming mode, scroll to the desired generator supply current phases with the SPAN function selected. Connect an external AC ammeter and current clamp of adequate current range to the controller terminals associated with the current phases to be calibrated. Use the INCREMENT or DECREMENT push-buttons to adjust the correction factor number while observing the displayed current value. Adjust the correction factor number to obtain an identical current reading as measured with the external AC ammeter. With the correct current displayed, press the ENTER push-button to accept the correction factor number. Record the correction factor number on the programming sheet for future reference. Repeat for each phase.

Note: When the span calibration setting is complete, re-confirm the zero calibration points. If the zero calibration setpoint needs further adjustment, the span calibration point must also be re-calibrated.

Battery Voltage Calibration To accurately calibrate the MEC 2 battery voltage sensor, an external test DC voltmeter is required, with an accuracy of 0.5% or better.

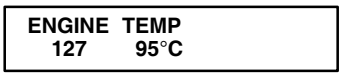
Displays the type of calibration function (SPAN).
Displays the calibration correction factor number (0-255) used to obtain the correct voltage reading.
Displays the actual battery voltage measurement that will be the same value as shown on the MEC 2 display menu. This voltage reading may be calibrated higher or lower by changing the correction factor.

SPAN Calibration Energize the battery supply voltage to the controller and connect the external test DC voltmeter to the battery terminals, B+ and B-. In the programming mode, scroll to the battery span calibration point. Use the INCREMENT or DECREMENT push-buttons to adjust the correction factor number while observing the displayed battery voltage level on the MEC 2. Adjust the correction factor number to obtain an identical voltage reading as measured with the external DC voltmeter. With the correct voltage displayed, press the ENTER push-button to accept the correction factor number. Record the correction factor number on the programming sheet for future reference.

Engine Temperature & Oil Pressure Calibration

To accurately calibrate the controller's temperature sensor, an external temporary engine mounted temperature gauge is required. The external temperature gauge should be connected as close as possible to the temperature sender.

To accurately calibrate the controller's pressure sensor, an external temporary engine mounted pressure gauge is required. The external pressure gauge should be connected as close as possible to the pressure sender.



Displays the type of calibration function.
Displays the calibration correction factor number (0-255) used to obtain the correct Temperature or Pressure reading.
Displays the actual temperature or pressure measurement shown on the display menus.
This reading may be calibrated higher or lower by changing the correction factor number.

Engine Temperature The engine temperature analog circuit must be calibrated with the engine temperature sender mounted on the engine. Connect a temporary engine mounted temperature gauge of suitable accuracy and start the engine. After the engine reaches normal operating temperature, enter the programming mode and scroll to the "Engine Temperature Offset" calibration point. Use the INCREMENT or DECREMENT push-buttons to adjust the correction factor number while observing the displayed temperature. Adjust the correction factor number to obtain the identical temperature reading as measured with the external temperature gauge. With the correct temperature displayed, press the "Enter" push-button to accept the correction factor number. Record the correction factor on the programming sheet for future reference.

Oil Pressure Connect a temporary engine mounted pressure gauge of suitable accuracy and start the engine. After the engine reaches normal operating pressure and temperature, enter the programming mode and scroll to the "Engine Pressure Offset" calibration point. Use the INCREMENT or DECREMENT push-buttons to adjust the correction factor number while observing the displayed pressure. Adjust the correction factor number to obtain the identical pressure reading as measured with the external pressure gauge. With the correct pressure displayed, press the "Enter" push-button to accept the correction factor. Record the correction factor on the programming sheet for future reference.

Engine Temperature		Sender Resistance	Oil Pressure		Sender Resistance
°F	°C	Ohms	KPA	PSI	Ohms
392	200	20	1034	150	38
374	190	24	965	140	42
356	180	28	896	130	48
338	170	33	827	120	54
320	160	39	758	110	62
302	150	46	689	100	70
284	140	55	621	90	79
266	130	65	552	80	89
248	120	76	483	70	101
230	110	90	414	60	114
212	100	106	345	50	127
194	90	147	276	40	142
176	80	197	207	30	160
150	70	290	138	20	183
140	60	426	69	10	206
122	50	622			
104	40	952			
86	30	1486			
68	20	2322			
50	10	3644			
32	0	6284			

Note: Sender resistance data shown are for Oil Pressure Sender p/n-003654 (Thompson p/n), Manufacturer- Datcon, p/n 102227. Datcon Sender must be used with MEC software version 1.81 or greater (previous software versions cannot be used).

Figure 4-4 Configuration Data Sheet

WORK ORDER #:	REV:	REV DATE:
INITIATED BY:	CUSTOMER:	DEFAULT PROGRAM:
DATE:	PROJECT NAME:	TPS VER:
NOTES:		

ENGINE/GEN SYSTEM INPUTS

SYSTEM AC VOLTS:	PHASES:	FREQUENCY:	DC VOLTAGE:

DIGITAL DISPLAY FEATURES

☐ AC VOLTAGE	☐ AC CURRENT	☐ BATTERY VOLTAGE
☐ ENGINE TEMPERATURE	☐ KVA	☐ TACHOMETER
☐ OIL PRESSURE	☐ FREQUENCY	☐ HOURMETER

DIGITAL FAULT CIRCUITS (15)		ANALOG FAULT CIRCUITS	
FAULT NAME	**INPUT NAME**	**FAULT NAME**	**INPUT NAME**
Overcrank Shutdown	Internal	Overspeed Shutdown	Mag-Pickup
Switch Not in Auto Alarm	Internal	Loss of Speed Sig. Shtdn	Mag-Pickup
Emergency Stop	Internal/ext	Undervoltage Shutdown	AC Voltage
	Ext Dig Input #1	Under Frequency Alarm	AC Freq
	Ext Dig Input #2	Weak Battery Alarm	DC Volts
	Ext Dig Input #3	Low Battery Voltage Alarm	DC Volts
	Ext Dig Input #4	High Battery Voltage Alarm	DC Volts
		Low Engine Temp. Alarm	Temp. Sender
		High Engine Temp #1 Alm	Temp. Sender
		High Engine Temp #2 Shdn	Temp. Sender
		Low Oil Pressure #1 Alarm	Press. Sender
		Low Oil Pressure #2 Shutdown	Press. Sender

	STANDARD OUTPUT CONTACTS	
	OUTPUT NAME	**OUTPUT TYPE**
	Run (Fuel)	Form A
	Crank	Form A

PROGRAMMABLE CONTACTS

OUTPUT NAME	OUTPUT TYPE
ATS Test (Std Default) or Custom _____	Programmable #1 – Form C
Common Alarm (Std Default) or Custom _____	Programmable #2 – Form C
Common Shutdown (Std Default) or Custom _____	Programmable #3 – Form C
Engine Running (Std Default) or Custom _____	Programmable #4 – Form C
EPS Supplying Load/Engine Running (Std Default) or Custom _____	Programmable #5 – Form A/B (EAP 110/MEC 2 Exp –Group 1 Only)
Disabled (Std Default) or Custom _____	Programmable #6 – Form A/B] (EAP 110/MEC 2 Exp –Group 2 Only)

Figure 4-5 Main Menu Loop Parameters

Parameter	Setting	Range
System Voltage (Line To Line)	XXXXX VAC	120–15000VAC
System Frequency	50Hz/60Hz	Toggle Between 50/60 Hz
System Phases	1 Phase/3 Phase	Toggle Between 1 & 3 Phase
	Neutral Connected	Toggle Between Yes/No
	Voltage Sensing	Voltage Sensing Pt Ratio
	Ratio XXX	Enter Number 1–208 (1=Direct)
	Current Sensing	Current Sensing Ct Ratio
	Ratio XXX	Enter Number 1–999 (1=Direct)
Temperature Scale	Deg C/Deg F	Toggle Between Deg C/Deg F
Pressure Scale	PSI/KPA	Toggle Between Psi/Kpa
Start Delay	XXX Seconds	0–999 Seconds
Crank Time	XX Seconds	0–99 Seconds
Rest Time	XX Seconds	0–99 Seconds
Starter Re–engage Delay	XX Seconds	0–99 Seconds 0=Disabled
Number Of Cranks	XX Cranks	0–99 Times 0=Continuous
Bypass Delay	XX Seconds	0–99 Seconds
Cool down Delay	XX Seconds	0–9999 Seconds
Nominal RPM	XXXX RPM	0–4000RPM
Flywheel Teeth (Engine Speed Sensing, Magnetic Pick Up	XXX Teeth	0–999 Teeth
Crank Disconnect	XX %	0–100%
Overspeed	XX %	100–150%
Overspeed Transient	X.X Seconds	0.0–9.9 Seconds
Run Output	Fail Safe Yes/No	Toggle Between Yes/No
Loss Of Speed Signal	Shutdown Alarm/Shutdown	Toggle Between Alarm/Shutdown
Common Fail For	Not In Auto Yes/No	Toggle Between Yes/No
Horn For Not In Auto		Toggle Between Yes/No
Prog Output #1		Common Fail (Factory setting)
Prog Output #2		Common Fail (Factory setting)
Prog Output #3		Common Fail (Factory setting)
Prog Output #4		Common Fail (Factory setting)
Prog Output #5		Common Fail (Factory setting)
Prog Output #6		Common Fail (Factory setting)
Warm–up Delay		0–99 Seconds
Neutral Delay		0–99 Seconds
Return Delay		0–999 Seconds
Reset Run Hours		Access by Master Password Only
Yes/No		Toggle Between Yes/No

Figure 4-6 Analog Fault Menu Loop Parameters

Fault Name	Input Analog Type	Fault E=Enable D=Disable	Setpoint Level (Pick-up)	Setpoint Level (Drop-out)	Action S=Shutdown A=Alarm	Alarm Latch Y=Yes N=No	Bypass On Start Y=Yes N=No	Transient Delay (Sec)
Under Voltage	AC Voltage	E*			S	Y	Y*	5.0
Under Frequency	AC Frequency	E*			S	Y	Y*	5.0
Weak Battery	DC Voltage	E*	18.0	N/A	A*	Y	N*	3.0
Low Battery Voltage	DC Voltage	E*	25.6	N/A	A*	N	N*	120.0
High Battery Voltage	DC Voltage	E*	30.4	N/A	A*	N	N*	10.0
Low Engine Temp	Temp Sender	E*	95 °F	N/A	A*	Y	N*	5.0
High ENG Temp #1 Alarm	Temp Sender	E*	198 °F	N/A	A	Y	Y	2.0
High ENG Temp #2 Shutdown	Temp Sender	E*	206 °F	N/A	S	Y	Y	2.0
Low Oil Press #1 Alarm	Press Sender	E*	30PSI	N/A	A	Y	Y*	2.0
Low Oil Press #2 Shutdown	Press Sender	E*	20PSI	N/A	S	Y	Y*	2.0

* Indicates parameter is non-programmable.

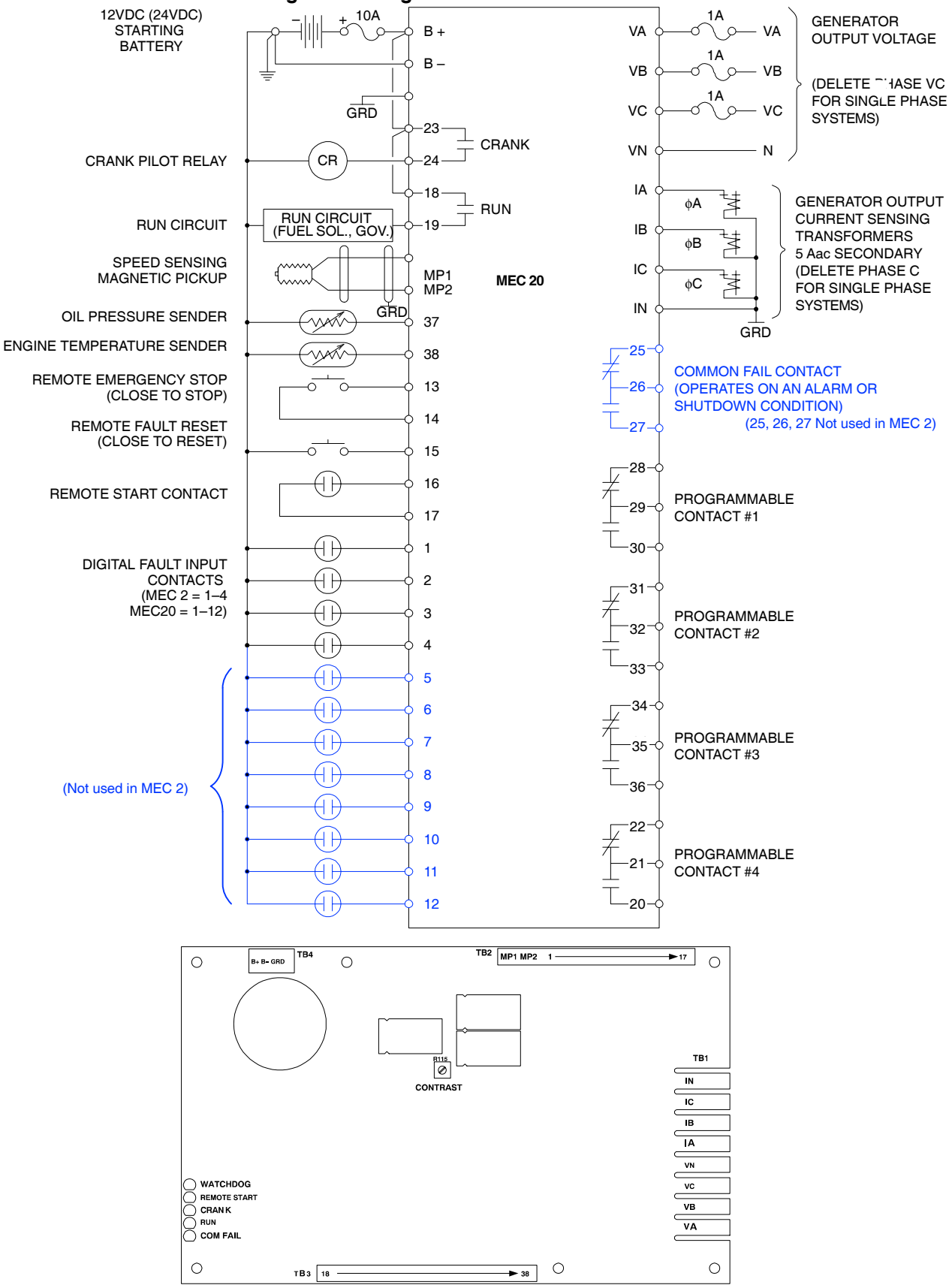
Figure 4-7 Digital Fault Menu Loop Parameters

Fault Name	Input #	Action S=Shutdown A=Alarm	Alarm Latch Y=Yes N=No	Polarity O=Open C=Close	Bypass On Start Y=Yes N=No	Transient Delay (Sec)
Low Oil Pressure	1	S	-	O	Y	0.5
High ENG TEMP	2	S	-	O	Y	1.0
Batt Chgr Input Fail	3	A	Y	C	N	30.0
Low Fuel Level	4	A	N	C	N	0.1

Figure 4-8 Calibration Menu Loop Parameters

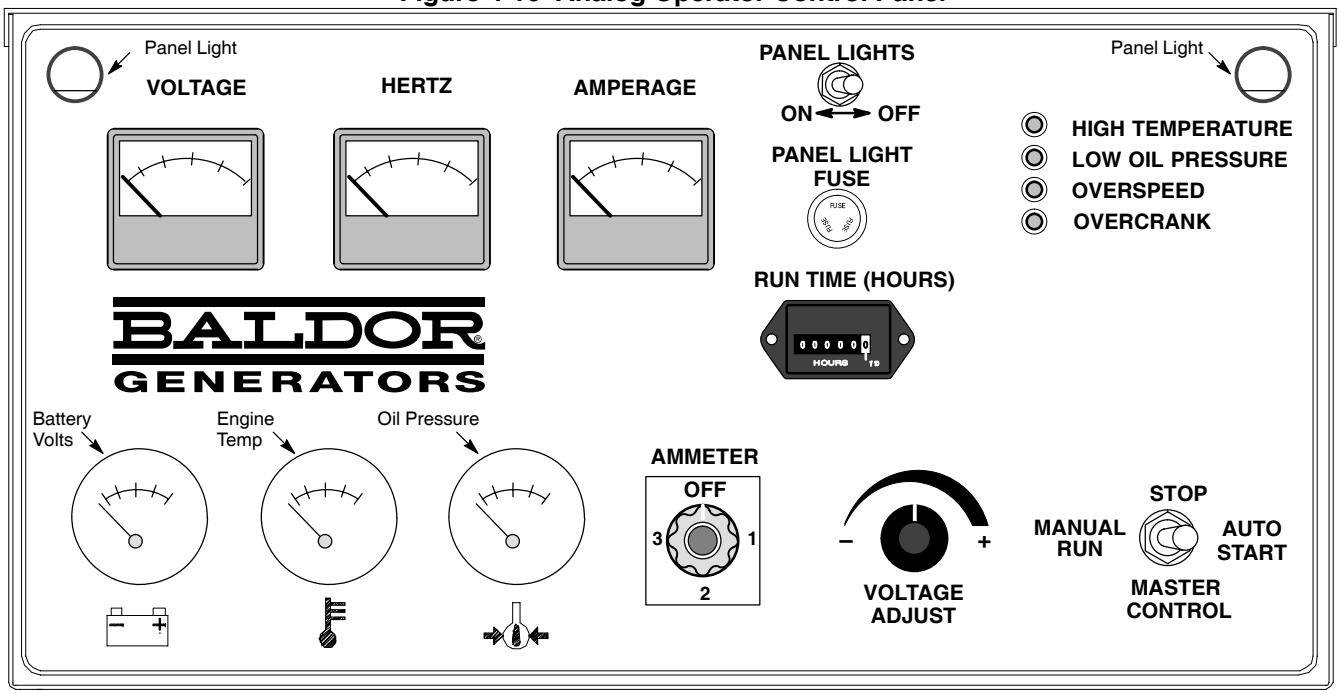
Parameter	**Setting**	
Volts A-B	Zero XXX	XXXVAC
Volts A-B	Span XXX	XXXVAC
Volts B-C	Zero XXX	XXXVAC
Volts B-C	Span XXX	XXXVAC
Volts C-A	Zero XXX	XXXVAC
Volts C-A	Span XXX	XXXVAC
Volts A-N	Zero XXX	XXXVAC
Volts A-N	Zero XXX	XXXVAC
Volts B-N	Zero XXX	XXXVAC
Volts B-N	Zero XXX	XXXVAC
Volts C-N	Zero XXX	XXXVAC
Volts C-N	Zero XXX	XXXVAC
Current A	Zero XXX	XXXAAC
Current A	Span XXX	XXXAAC
Current B	Zero XXX	XXXAAC
Current B	Span XXX	XXXAAC
Current C	Zero XXX	XXXAAC
Current C	Span XXX	XXXAAC
Battery Voltage	Span XXX	XX.X VDC
Engine Temperature	XXX	XXX C/F
Oil Pressure	XXX	XXXX PSI/KPA

Figure 4-9 Engine Control Connections



Operator Control Panel (Analog Engine Controller Only)

Figure 4-10 Analog Operator Control Panel



Panel Lights switch (On–Off)
Turns on two lamps to illuminate the operator panel.

Panel Light Fuse
Fuse for panel lights.

Master Control switch (Manual Run–Stop – Auto Start)
Manual Run – Starts the engine manually.
Stop – Stops the engine and generator.
Auto Start – Starts the engine when the "Remote start" terminals are closed.

Display Lamps
High Temperature – Indicates excessive engine coolant temperature.
Low Oil Pressure – Indicates low engine oil pressure.
Overspeed – Indicates engine speed is greater than preset limit.
Overcrank – Failure of the engine to start by the end of the crank period results in an "overcrank" shutdown and alarm indication.

Voltage Adjust
Increase or Decrease the Generator output voltage (displayed on VOLTAGE meter)

AC Voltage meter
Analog display of generator output voltage in RMS volts.

AMMETER switch (3 position)
Off – No current is measured by the Amperage meter.
1 – Phase 1 current is measured by the Amperage meter.
2 – Phase 2 current is measured by the Amperage meter.
3 – Phase 3 current is measured by the Amperage meter.

Amperage meter
Analog display of generator output current in RMS amps.

Hertz meter
Analog display of generator output frequency in Hertz.

Battery Voltage meter
Displays the voltage of the engine starting battery.

Engine Temperature meter
Displays the temperature of the engine coolant.

Oil Pressure meter
Displays engine oil pressure.

Run Time (Hours) meter
Total elapsed time indicator of generator set operation.

Operating Procedures The engine–generator controller is designed to start and stop an engine from either a local ("Manual") or remote ("Automatic") mode. When a start command is issued, the controller issues a run and crank output signal. The controller then monitors engine speed and when crank disconnect speed is reached, the crank signal is terminated. While the engine accelerates to normal speed, the controller continuously monitors the engines speed signal. Should the engine speed exceed the maximum predetermined setpoint, the overspeed shutdown fault circuit will activate, terminating the run signal.

In addition to overspeed shutdown, the engine controller also monitors many other engine protection circuits and should they be activated, the engine will be stopped and/or alarm initiated. The engine will automatically stop for any shutdown condition, or when the remote and/or local start signal is removed. The engine controller operation includes time delay circuits for normal operating conditions such as start delays, cool down and cranking periods.

Manual Start/Stop

To manually Start the Gen–Set, set the Master Control switch to the “Manual Run” position. The following happens:

1. When the “Manual Run” push–button is pressed, an Engine Start Delay timer is initiated. (The start sequence will not be initiated if any shutdown fault condition is present.)
2. When the engine start delay time expires, an engine RUN and CRANK output signal will be initiated. (The RUN output may be programmed to only energize when a start signal is initiated and an engine speed signal is detected.)
3. When the engine starts and begins to accelerate to nominal speed, the controllers speed sensor will terminate the CRANK output when engine speed reaches approximately 20% speed (i.e. CRANK DISCONNECT speed setpoint).

To manually Stop the Gen–Set, set the Master Control switch to the “Stop” position. The controllers RUN output will be immediately terminated which will initiate the engine stop sequence. The engine is locked out and will not run with the Master Control switch in “Stop”.

Automatic Start/Stop

To setup the generator for automatic operation, set the Master Control switch to the “Auto Start” position. The following happens:

1. The engine will automatically start upon activation of the remote start contact input. The remote device initiates a start sequence upon contact closure.
2. When the remote start signal is activated, the engine will start as per the sequence of operation described for the manual start sequence.
3. The automatic stop sequence will be initiated by removal of the remote start signal.
4. When the start signal is removed, a cool down delay function will be initiated.
5. When the cool down time delay period expires (typically 5 minutes), the controllers RUN output will be immediately terminated which will initiate the engine to stop.

Automatic Fault Shutdown

When a fault circuit is programmed as a SHUTDOWN, the engine will immediately stop when the fault is activated. A specific shutdown fault can be programmed with a definite time transient delay period that must expire before the shutdown is activated. The stop sequence will cause the controllers RUN output to be immediately terminated which will cause the engine to stop.

Figure 4-11 9957N Analog Engine Controller Connections

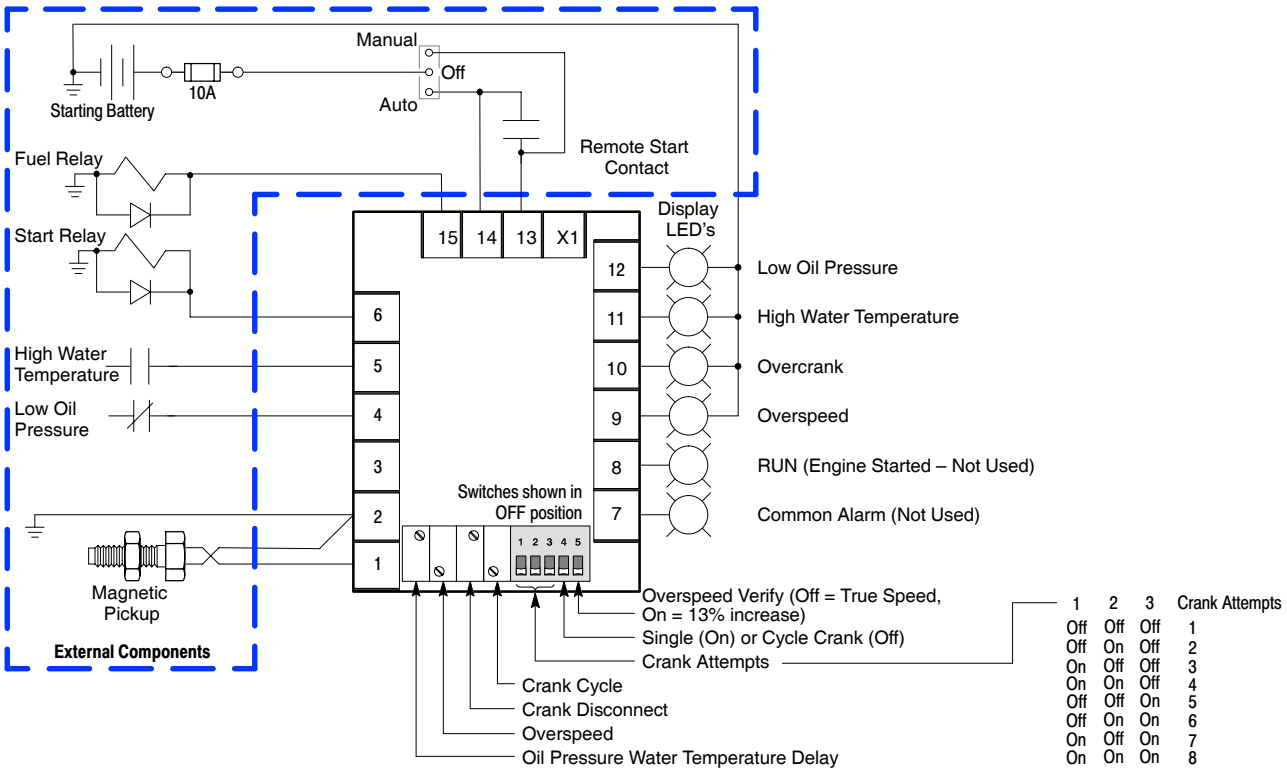


Figure 4-12 A121H Analog Engine Controller Connections

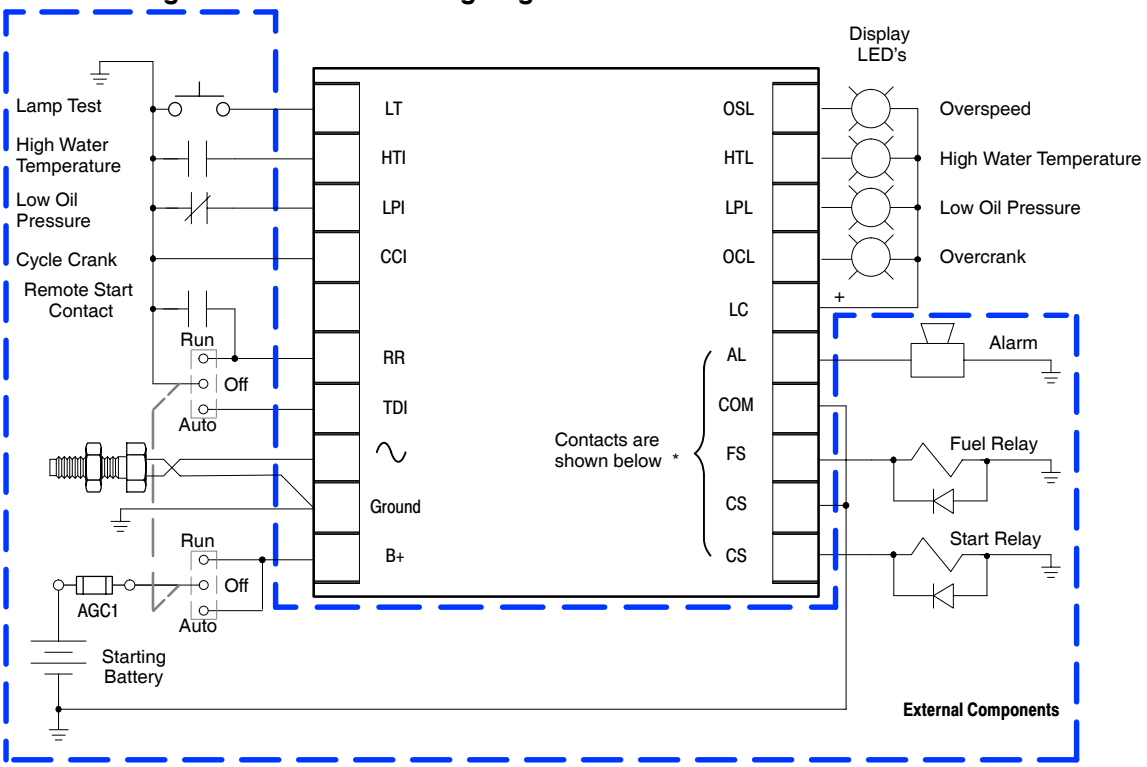
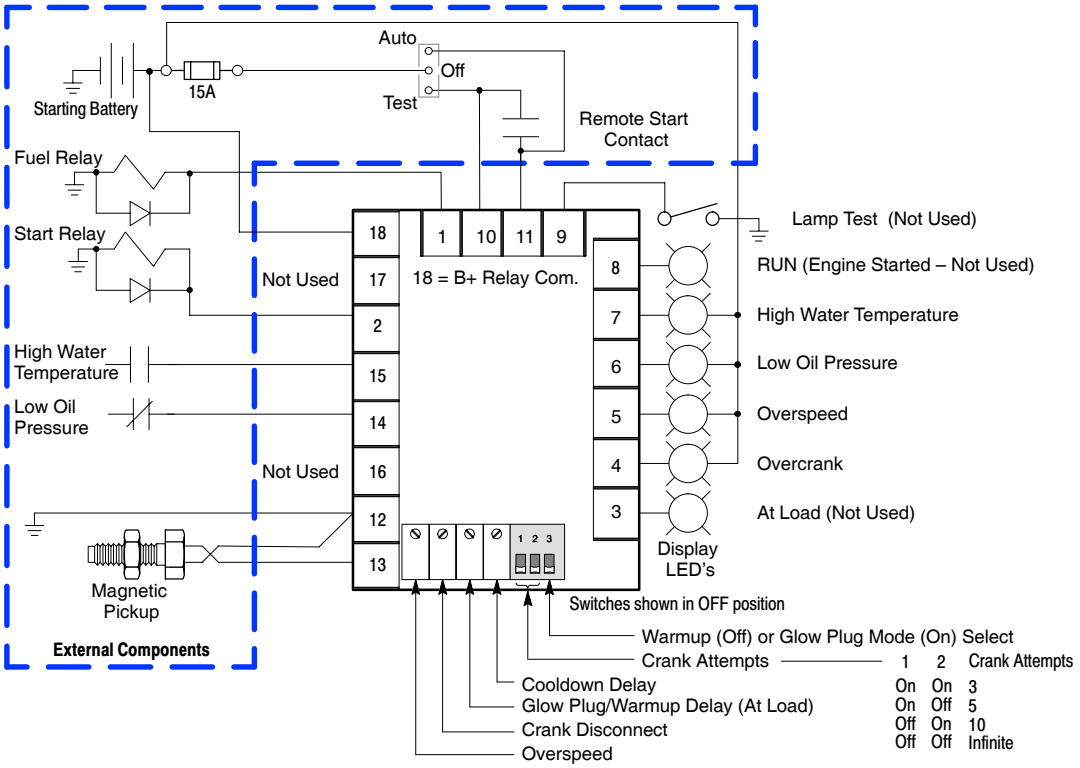


Figure 4-13 ASM160 Analog Engine Controller Connections



Garretson Model KN Fuel Valve Considerations

General

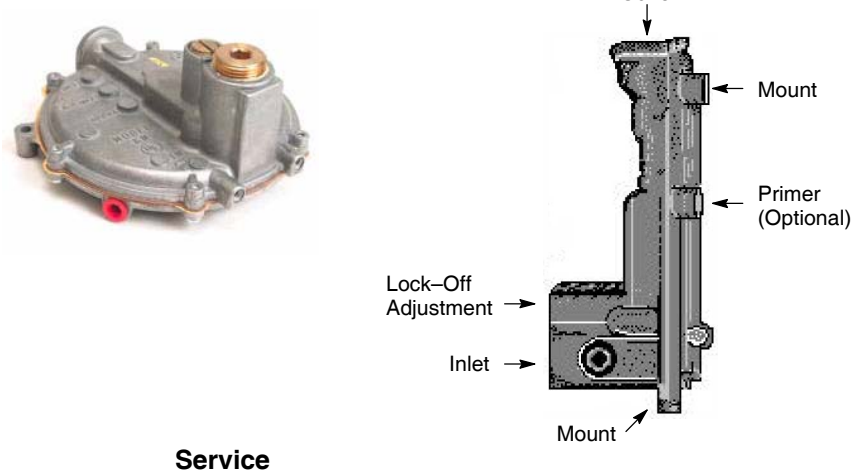
The KN is designed for sensitivity and simple operation. It is used with low–pressure vaporized gaseous fuels, where dependable starting is a requirement. Because of its extreme sensitivity, the KN offers excellent results in most remote starting applications (Standby power generators, etc.). With proper installation and maintenance, the KN will provide years of trouble–free service.

Operation

The KN is an atmospheric zero governor which acts like the float and needle valve in a gasoline carburetor. Air–flow through a venturi in the carburetor creates a vacuum, which acts through the outlet of the KN on the diaphragm. Atmospheric pressure then forces the diaphragm toward the vacuum, depressing the lever and pulling the valve seat away from the orifice, which allows fuel to flow as long as the demand persists. When the vacuum ceases, a spring force pushes on the lever and forces the valve seat against the orifice shutting off the fuel flow. It is important to remember that fuel should not flow through the KN when the engine is not running.

A properly adjusted KN requires a vacuum of only 0.25” to 0.35” of water column to start the opening sequence. Due to this sensitivity, most installations do not need priming to start unless low cranking speeds or restricted and lengthy piping are required. If priming is necessary and a manual primer is installed, use only 1 or 2 second bursts of fuel and immediately try to start the engine. If there is a choke on the carburetor, do not use it as this will probably cause flooding and hard starting. As you can see, the operation of this unit is simple and basic. If you are having trouble operating the engine, in most cases the fuel controller is not malfunctioning. There is generally a problem with the engine or fuel supply. so do not make adjustments or attempt to service the KN until you are sure it is needed.

Figure 4-14 Garretson KN Fuel Valve



Service

The KN should be periodically checked for leakage past the valve seat and the vents on the cover kept clean and free of obstructions. If the KN needs service we suggest you take it to a qualified serviceman. If that help is not available Garretson will furnish you a list of repair shops with the proper service information.

Installation

The KN should be mounted as close to the carburetor as possible with the arrow on the cover pointing up and the diaphragm in a vertical position. This helps to minimize the effects of gravity on diaphragm travel. This unit should also be placed for easy access to the primer if provided. There are two sets of mounting holes provided. either set of mounts will adequately support the KN. The bottom set of holes has a 1 3/4" bolt spacing for use with all Garretson universal mounting brackets. The mounting bosses on the cover are spaced (5 3/4") apart for use with 5/16 bolts.

Before installing the fuel supply line, be sure that the gas pressure is no more than the maximum inlet pressure shown on the front of the KN. If the pressure is greater, leakage could result in a fire hazard and or hard starting. The piping to the inlet should be of sufficient size to allow full flow to the KN. This is very important in natural gas installations as any restrictions can affect engine performance. If a solenoid is used ahead of the KN in the low– pressure line, it should have an orifice at least as big as the orifice in the KN. Flexible piping to the inlet should be used to prevent cracking from vibration if the KN is mounted on the engine or other vibrating surface.

Note: Thread sealing compound should be used on all pipe thread fittings between the KN and the fuel supply tank, being careful not to get any inside the inlet or fittings. Excess compound could collect on the seat and orifice and cause hazardous leakage, resulting in poor performance. After piping is complete, turn on the gas and use a soap solution to check all fittings for leaks.

If an electric solenoid primer is used, follow the wiring and adjusting instructions furnished separately. kit by connecting into a pressure line at a reduced pressure, call us. The KN outlet is 3/8 NPT and if an outlet fitting has not been provided, select and insert a suitable vapor fitting taking care not to allow any chips or dirt to enter the outlet. Use of street ells or conventional pipe fittings in the fuel line between the KN and the carburetor is not recommended as they may restrict the flow of fuel.

When installation of a properly sized fuel hose between the KN and carburetor is completed, if you are installing a complete conversion return to the instructions. For field replacement applications the unit is ready for service.

Section 5
Troubleshooting and Maintenance

Maintenance

This manual contains only very minimal engine maintenance instructions. Refer to the engine manufacturer's owner's manual for specific engine maintenance instructions for your generator set. Any maintenance instructions or recommendations in the engine owner's manual take precedence over any of the following general recommendations.

General:

1. Inspect the fuel system for leaks. Replace all defective components immediately.
2. Inspect and replace any fuel line that shows signs of deterioration.
3. Inspect all the fuel clamps to ensure they are tight.
4. Inspect and clean the battery posts and the associated battery cable terminals.
5. Inspect the external wire cables and connectors used with the generator set for cuts, fraying, or loose connections. Repair or replace any problems prior to using the unit.

Engine:

1. Clean and/or replace any fuel, oil, and/or air filters per the engine manufacturers' guidelines.
2. Check oil level regularly; at least every 5 to 8 operating hours. Maintain the proper oil level.
3. Change the oil as is recommended in the engine manufacturer's owner's manual.
4. Replace the spark plug(s) as is recommended by the engine manufacturer.
5. Clean the cooling fins on the engine to keep the engine's heat dissipation potential at it's maximum.
6. Inspect and clean all governor and carburetor linkages so they operate properly.
7. Inspect the recoil starting rope for any damage and replace it if necessary (if applicable).
8. Clean the trash screen around the recoil starter or other cooling air intake.

Alternator: (also called Generator End)

This generator set must be run at its proper speed to obtain the correct electrical power at its output. All engines have a tendency to slow down when a load is applied to it. The engine governor is designed to hold the operating speed as nearly constant as possible. When the electrical load is increased, the engine is more heavily loaded and engine speed drops slightly. This slight decrease in engine speed results in a slight decrease in generator voltage and frequency output. This voltage and frequency variation has no appreciable effect in the operation of motors, lights, and most appliances and tools. However, timing devices and clocks will not keep perfect time when used on this generator.

1. Clean the generator set and remove any and all dust, dirt, or other foreign material.
2. Inspect and clean the cooling air intake and exhaust louvers of the generator end. Make sure they are clean. Remove dirt or any buildup that may restrict the cooling air flow.
3. Clean the generator set and its components with a damp cloth or sponge. Never use a water hose or pressure washer as this may damage electrical components.
4. Inspect and replace any control panel components that are broken or not working properly (receptacles, circuit breakers, switches, etc.)

Problems and Solutions

Some of the more common problems are listed in Table 5-1. This information is intended to be a check or verification that simple causes can be located and fixed. It is not an exhaustive "how to" for all types of problems. Procedures that require in depth knowledge or skills (like flashing the field) should be referred to the Baldor Generator Service Department by calling (920) 236–4200.

Table 5-1 General Troubleshooting Guide

Problem	Possible Cause	Remedy
Engine cranks but will not start	No fuel.	Check that fuel valves are ON. Check fuel level in fuel tank.
	Low Oil Level	Low Oil Pressure Sutdown activated. Replensih oil to full.
	Restricted air flow.	Check/replace air filter.
	No spark.	Check/replace spark plug(s).
		Check that engine switch is in Start position.
	No engine speed during crank	The magnetic pickup must be correctly adjusted and operating.
Engine will not crank (electric start)	Dead battery.	Remove battery and trickle charge or replace with new battery. Never Jump Start.
	Emergency Stop LED is ON	Reset controller after an Emergency Stop.
Engine starts but will not run smoothly	Fuel or ignition problem	Refer to engine manual.
Engine overheats	Excessive load	Remove one or more electrical loads.
	Debris or dirt buildup on engine	Remove debris. Clean engine surfaces to allow cooling.
No output voltage	Ciruit Breaker tripped or failed.	Reset circuit breaker or replace if required.
	Internal failure of Alternator	Return to factory for repair.
Output voltage varies	Irregular speed (fixed speed mode)	Check engine for malfunction or load for fluctuation
	Fluctuating speed (fixed speed mode)	Stabilize load. The addition of a lamp load (resistance load) may compensate partially for load changes caused by intermittent motor operation. Do not overload.
	Loose terminal or load connections	Verify all connections and terminal tighness.
Low output voltage	Low engine speed	Verify engine RPM.
	Excessive load	Check engine for malfunction or system for overload. Reduce load.
	High resistance connections – connections will be warm or hot	Verify all connections and terminal tighness.
	Internal failure of Alternator	Return to factory for repair.
	Low power factor	Reduce inductive (motor) load. Some AC motors use about the same current regardless of load. Do not use motors of greater horsepower rating than is necessary to move the mechanical load.
High output voltage	Excessive speed (fixed speed mode)	Check engine for malfunction. Verify engine RPM.
Electrical shock when frame is touched	Static charge.	Ground generator frame at local reference ground (see Section 3).
	Grounded armature or field coil.	Return to factory for repair
Mechanical noise	Internal failure of Alternator	Return to factory for repair
	Loose or misaligned coupling	Tighten; align coupling and alternator shaft to engine shaft.

Table 5-2 Troubleshooting Guide (Digital Controller Only)

Problem	Possible Cause	Remedy
Controller does not power up even with correct DC power applied	Wiring Mistake	Check that there are no wiring errors/short circuits connected to the controller.
	Overload Condition	The MEC 20 contains an electronic fuse that trips when an overload condition exists and does not reset until the supply voltage is removed and reapplied after the overload condition is corrected.
LCD Display cannot be viewed	Microprocessor failure	Check that the controller's microprocessor is running by observing a red flashing "watchdog" LED on the rear of the PCB. Replace controller if failed.
	Improper Supply Voltage	Check DC supply voltage at terminals B+ & B- (10-30VDC).
	Improper contrast adjustment	Adjust LCD contrast potentiometer (R115) on rear of PCB for best display.
Controller cannot be "Reset"	Engine not stopped	Verify the engine is at a complete stop before trying to reset.
	Controller not in OFF mode	Set the controller to the OFF mode before trying to reset.
No "RUN" output signal	"Shutdown Faults" not reset	All shutdown faults must be reset (red shutdown LED must be off).
	Engine speed not detected at cranking	Engine speed signal must be detected (speed signal green LED on) during cranking if the "run-output fail safe" feature is enabled. Verify correct magnetic pickup signal at cranking (2.0VAC min. during cranking).
	Run Contact not closing (terminals #18 & #19)	Check that the RUN output LED (on the rear of the PCB) is on. If yes, verify relay contact operation on terminals #18 & #19. Replace controller if failed.
Overspeed shutdown occurs at normal speed	Controller programmed values are wrong or controller has failed.	Verify the controller programmed values are correct for the number of flywheel teeth, nominal RPM, and overspeed setpoint percentage. Replace controller if failed.
Voltage or current metering is incorrect	Controller programmed values are wrong	Verify the controller programmed values are correct for the voltage sensing PT ratio and/or current sensing CT ratio.
	Ground is missing	Verify that the battery supply DC negative conductor is properly grounded to the engine block (i.e. to a common ground point).
	Analog input needs to be calibrated	Verify that the controller's analog input is properly calibrated.
	Voltage sensing wiring mistake	Verify the voltage sensing wiring connection to the MEC 20 matches power distribution type. Note: standard direct voltage connection requires that the generators neutral is solidly grounded.
Engine temperature or oil pressure display is incorrect	Analog input needs to be calibrated	Verify that the controller's analog input is properly calibrated.
	Failed engine sensor	Verify engine sensors. Note: engine sensors must be factory supplied units only.
	Ground is missing	Verify that the battery supply DC negative conductor is properly grounded to the engine block (i.e. to a common ground point).
Engine temperature or oil pressure displays 9999 **OR** Engine alarms are ON for high engine temperature or low oil pressure when engine is operating properly	Sending unit is disconnected (open circuit)	Verify the sending units wiring to controller terminals #37 & #38 (i.e. wiring is not open or shorted).
	Defective sending unit	Verify the engine mounted senders have correct resistance values for corresponding input temperature or pressure.
	Wrong Temp or pressure calibration	Verify calibration.
Keypad Buttons (switches) do not operate.	Keypad not connected to controller	Verify the interconnecting ribbon cable between the lexan faceplate and main printed circuit board is correctly connected. Replace controller if failed.

Note: See Engine Controller manual for additional information.

Table 5-3 Troubleshooting Guide (Analog Controller Only)

Problem	Possible Cause	Remedy
Controller cannot be “Reset”	Engine not stopped	Verify the engine is at a complete stop before trying to reset.
	Controller not in OFF mode	Set the controller to the OFF mode before trying to reset.
Engine alarms are ON for high engine temperature or low oil pressure when engine is operating properly	Sending unit is disconnected (open circuit)	Verify the sending units wiring to controller terminals is not open or shorted.
	Defective sending unit	Verify the engine mounted senders have correct resistance values for corresponding input temperature or pressure.
Overspeed shutdown occurs at normal speed	Controller has failed or input from Magnetic pickup is incorrect.	Verify the adjustments. Replace controller if failed.

Service

Service for your generator can be obtained from the service department at Baldor Generators by calling (920) 236–4200. Please have the following information available prior to contacting the factory:

The model number and serial number of the generator set.

A complete and accurate description of the problem.

Parts

Parts for your generator can be obtained from the service department at Baldor Generators by calling (920) 236–4200. Please have the following information available prior to contacting the factory:

The model number and serial number of the generator set.

A complete and accurate description of the part (part number if known).

Note: Engine parts can usually be obtained from a local distributor by using the information in the engine manufacturer’s owner’s manual.

Appendix A
Series GLC Parts & Wiring Diagrams

Replacement Parts Replacement parts information is provided in this section of the manual. Engine parts are identified in the engine manual that was provided with your generator set. 10.95030

IMPORTANT: **Fuses are installed in the control box to protect the engine controller and associated control circuits. When replacing fuses, use the exact replacement fuse (manufacturer and part number).**

Description	Part No. GLC30	Part No. GLC35	Part No. GLC45	Part No. GLC50	Part No. GLC60
WELDMENT, BASE	BA0236A07L2B	BA0236A07L2B	BA0236A07L2B	BA0236A04L2B	BA0236A04L2B
ISOLATOR, GEN END	RM1088A13	RM1088A13	RM1088A13	RM1088A18	RM1088A18
ISOLATOR		RM1088A27	RM1088A27	RM1088A27	RM1088A27
ISOLATOR, CONTROL BOX	RM1088A01	RM1088A01	RM1088A01	RM1088A01	RM1088A01
SOLENOID, ENGINE 12V	SE0057A01	SE0057A01	SE0057A01	SE0057A01	SE0057A01
BRKT, BATTERY TIE DOWN	HB6103A06	HB6103A06	HB6103A06	HB6103A06	HB6103A06
TANK, COOLANT RECOVERY	TA0000A07	TA0000A07	TA0000A07	TA0000A07	TA0000A07
CAP, COOLANT RECOVERY TANK	TA0002A07	TA0002A07	TA0002A07	TA0002A07	TA0002A07
VALVE, FUMOTO F-107-N	EA0044A07	EA0044A07	EA0044A07	EA0044A07	EA0044A07
VALVE, FUMOTO FG-2N	EA0044A05	EA0044A05	EA0044A05	EA0044A05	EA0044A05
MAG PICK-UP ASSY	EA0007A07	EA0007A07	EA0007A07		
RELAY	RE5031A01	RE5031A01	RE5031A01	RE5031A01	RE5031A01
DIODE, 1N5408	DI0176A00	DI0176A00	DI0176A00	DI0176A00	DI0176A00
FUSE, 1A	FU0071A00	FU0071A00	FU0071A00	FU0071A00	FU0071A00
FUSE, 10A	FU0070A00	FU0070A00	FU0070A00	FU0070A00	FU0070A00
FUSE, BUSS, AGC 15	FU0066A07	FU0066A07	FU0066A07	FU0066A07	FU0066A07
RHEOSTAT, 1K, 2W ENCLOSED	SP9134	SP9134	SP9134	SP9134	SP9134
KNOB, RHEOSTAT	HW2412A00	HW2412A00	HW2412A00	HW2412A00	HW2412A00
SOLENOID, FUEL,12VDC	SE0052A05	SE0052A05	SE0052A05	SE0052A04	SE0052A04
HEATER, BLOCK 120V	EA0049A01	EA0049A01	EA0049A01	EA0049A02	EA0049A02
CHARGER, BATTERY, 12V, 6 AMP	EA0010A02	EA0010A02	EA0010A02	EA0010A02	EA0010A02
SWITCH, E-STOP	SW00925A00	SW00925A00	SW00925A00	SW00925A00	SW00925A00
DECAL "BONDED NEUTRAL"	LB0300A00	LB0300A00	LB0300A00	LB0300A00	LB0300A00
DECAL "FUSE TYPE & WARNING"	LB0300A01	LB0300A01	LB0300A01	LB0300A01	LB0300A01
DECAL, CONTROL PANEL	LB0094B59	LB0094B59	LB0094B59	LB0094B59	LB0094B59
PLACARD, "REMOTE START"	LB0095A42	LB0095A42	LB0095A42	LB0095A42	LB0095A42
DECAL, BALDOR LOGO,26"	LB0100A20	LB0100A20	LB0100A20	LB0100A20	LB0100A20
DECAL, BALDOR LOGO	LB0100A25	LB0100A25	LB0100A25	LB0100A21	LB0100A21
DECAL, DANGER-HIGH VOLTAGE	LB0094A11	LB0094A11	LB0094A11	LB0094A11	LB0094A11
DECAL, WARNING, AUTO START	LB0094A30	LB0094A30	LB0094A30	LB0094A30	LB0094A30
PLACARD, "LINE"	LB0095A07	LB0095A07	LB0095A07	LB0095A07	LB0095A07
PLACARD, "LOAD"	LB0095A08	LB0095A08	LB0095A08	LB0095A08	LB0095A08
PLACARD, "NEUTRAL"	LB0095A15	LB0095A15	LB0095A15	LB0095A15	LB0095A15
PLACARD, "L1"	LB0095A16	LB0095A16	LB0095A16	LB0095A16	LB0095A16
PLACARD, "L2"	LB0095A17	LB0095A17	LB0095A17	LB0095A17	LB0095A17
PLACARD, "L3"			LB0095A18	LB0095A18	
PLACARD, "A.C. CONNECTION"	LB0095A51	LB0095A51	LB0095A51	LB0095A51	LB0095A51
PLACARD, "GROUND"	LB0095A37	LB0095A37	LB0095A37	LB0095A37	LB0095A37

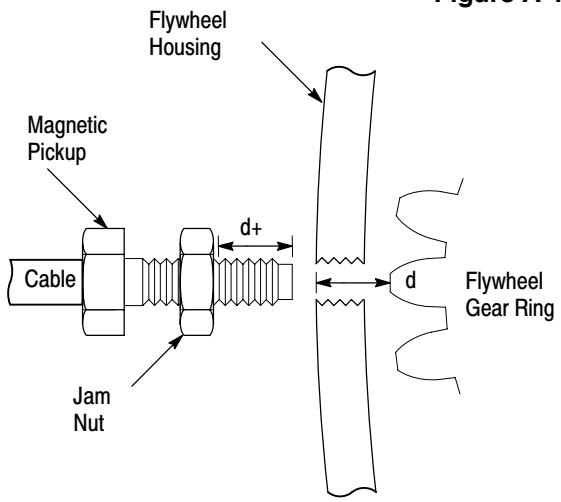
Replacement Parts Continued

Description	Part No.		
	GLC 80	GLC 100	GLC125
WELDMENT, BASE	BA0236A06L2B	BA0236A06L2B	BA0236A06L2B
ISOLATOR, GEN END	RM1088A18	RM1088A18	RM1088A18
ISOLATOR, CONTROL BOX	RM1088A01	RM1088A01	RM1088A01
SOLENOID, ENGINE 12V	SE0057A01	SE0057A01	SE0057A01
BRKT, BATTERY TIE DOWN	HB6103A06	HB6103A06	HB6103A06
TANK, COOLANT RECOVERY	TA0000A07	TA0000A07	TA0000A07
CAP, COOLANT RECOVERY TANK	TA0002A07	TA0002A07	TA0002A07
VALVE, FUMOTO F-107-N	EA0044A07	EA0044A07	EA0044A07
VALVE, FUMOTO FG-2N	EA0044A05	EA0044A05	EA0044A05
MAG PICK-UP ASSY GM ENGINES	EA0007A07	EA0007A07	EA0007A07
FUSE, 1A	FU0071A00		
FUSE, 10A	FU0070A00		
FUSE, AGC 2		FU0066A03	FU0066A03
FUSE, AGC 15	FU0066A07	FU0066A07	FU0066A07
SWITCH, TOGGLE			SP9079
SWITCH, DPDT			SP9094
SWITCH, E, 3PH			SP9095
RELAY	RE5031A01	RE5031A01	RE5031A01
DIODE, 1N5408	DI0176A00	DI0176A00	DI0176A00
LAMP FIXTURE, DASH			DI0179A00
LAMP, #67, 12 VOLT			DI0180A00
RHEOSTAT, 1K, 2W ENCLOSED	SP9134	SP9134	SP9134
KNOB, RHEOSTAT	HW2412A00	HW2412A00	HW2412A00
GASKET, EXHAUST RING	GS0089A07	GS0089A07	GS0089A04
DIODE, 1N5408	DI0176A00	DI0176A00	DI0176A00
AIR CLEANER, ELEMENT	EA0015A21	EA0015A21	EA0015A21
SOLENOID, FUEL,12VDC	SE0052A04	SE0052A04	SE0052A04
HEATER, BLOCK 120V	EA0049A02	EA0049A02	EA0049A02
CHARGER, BATTERY, 12V, 6 AMP	EA0010A02	EA0010A02	EA0010A02
BREAKER, W/SHUNT	CK0070A44	CK0070A62	CK0070A95
CURRENT TRANSFORMER	CT0050A06	CT0050A01	CT0050A03
SWITCH, E-STOP	SW00925A00	SW00925A00	SW00925A00

Replacement Parts Continued

Description	Part No.		
	GLC 80	GLC 100	GLC125
DECAL "BONDED NEUTRAL"	LB0300A00	LB0300A00	LB0300A00
DECAL "FUSE TYPE & WARNING"	LB0300A01	LB0300A01	LB0300A01
DECAL, CONTROL PANEL	LB0094B60	LB0094B60	LB0094B60
PLACARD, "REMOTE START"	LB0095A42	LB0095A42	LB0095A42
DECAL, BALDOR LOGO,26"	LB0100A27	LB0100A27	LB0100A27
DECAL, BALDOR LOGO	LB0100A29	LB0100A29	LB0100A29
DECAL, DANGER-HIGH VOLTAGE	LB0094A11	LB0094A11	LB0094A11
DECAL, WARNING, AUTO START	LB0094A30	LB0094A30	LB0094A30
PLACARD, "LINE"	LB0095A07	LB0095A07	LB0095A07
PLACARD, "LOAD"	LB0095A08	LB0095A08	LB0095A08
PLACARD, "NEUTRAL"	LB0095A15	LB0095A15	LB0095A15
PLACARD, "L1"	LB0095A16	LB0095A16	LB0095A16
PLACARD, "L2"	LB0095A17	LB0095A17	LB0095A17
PLACARD, "L3"		LB0095A18	LB0095A18
PLACARD, "A.C. CONNECTION"	LB0095A51	LB0095A51	LB0095A51
PLACARD, "GROUND"	LB0095A37	LB0095A37	LB0095A37

Figure A-1 Magnetic Pickup Replacement



This procedure is intended to help during the replacement of a Magnetic Pickup speed sensor.

1. Ensure that the battery is disconnected from the generator set prior to performing any service work on the unit. Remove the old Magnetic Pickup sensor.
2. Ensure that a tooth on the flywheel gear ring is centered directly in the hole for the Magnetic Pickup. If not, rotate the engine/generator to center a tooth by placing a socket on the engine main crank pulley.
   DO NOT insert a screwdriver into the hole for the magnetic pickup as the threads in the flywheel housing can be damaged. DO NOT use the generator cooling fan to rotate the engine/generator. The fan may crack and will have to be replaced.
3. With a tooth centered in the hole, measure the distance "d" from the top of the tooth to the outside top of the flywheel housing. Set the jam nut on the magnetic pickup slightly beyond that measurement "d+" to ensure that the magnetic pickup fully threads into the housing. (If the flywheel housing or magnetic pickup threads are damaged, the magnetic pickup may seem to have bottomed out when it stopped due to bad threads.)
4. Thread the magnetic pickup into the flywheel housing until it bottoms out on the flywheel tooth.
5. Back the magnetic pickup out 1/2 turn and tighten the jam nut to the flywheel housing.
   Note: The 1/2 turn out is very important. Too little can ruin the magnetic pickup and create extra cleanup work. Too much can result in poor operation.
6. Verify proper operation. (1.3 VAC while cranking)
7. Apply a drop of wicking fastener adhesive to the locking nut of the magnetic pickup. (Loctite, Permabond, etc.)

GLC Circuit Breaker & Electrical Data

GLC Model	Alternator		Engine		Output									
	Model	Leads/ Winding	Fuel Type	Size	KW Rated	Phase	Voltage Config	VAC (L – L)	VAC (L – N)	FLA	115% FLA	Circuit Breaker	C.T. Ratio	Wire Size (QTY) AWG
GLC125	UCI274E	4/06	Nat Gas	GM/8.1L	115	1	Series	240	120	479	551	600	600:5	(2) #2/0
GLC125	UCI274E	12/311	Nat Gas	GM/8.1L	125	3	// WYE	208	120	434	499	500	500:5	(2) #1/0
GLC125	UCI274E	12/311	Nat Gas	GM/8.1L	125	3	// WYE	220	127	410	472	500	500:5	(2) #1/0
GLC125	UCI274E	12/311	Nat Gas	GM/8.1L	125	3	Series/ Delta	240	120	376	432	450	500:5	(2) #1/0
GLC125	UCI274E	12/311	Nat Gas	GM/8.1L	130	3	// WYE	240	139	391	450	450	500:5	(2) #1/0
GLC125	UCI274E	12/311	Nat Gas	GM/8.1L	125	3	Series WYE	380	220	237	273	300	300:5	(1) #2/0
GLC125	UCI274E	12/311	Nat Gas			3		416						
GLC125	UCI274E	12/311	Nat Gas	GM/8.1L	130	3	Series WYE	480	277	195	225	225	250:5	(1) #1
GLC125	UCI274F	4/06	Nat Gas	GM/8.1L	125	1	Series	240	120	521	599	600	600:5	(2) #2/0
GLC125	UCI274F	12/311	Nat Gas	GM/8.1L	130	3	// WYE	208	120	451	519	600	600:5	(2) #2/0
GLC125	UCI274F	12/311	Nat Gas	GM/8.1L	130	3	// WYE	220	127	426	490	500	500:5	(2) #1/0
GLC125	UCI274F	12/311	Nat Gas	GM/8.1L	130	3	Series/ Delta	240	120	391	450	450	500:5	(2) #1/0
GLC125	UCI274F	12/311	Nat Gas	GM/8.1L	130	3	// WYE	240	139	391	450	450	500:5	(2) #1/0
GLC125	UCI274F	12/311	Nat Gas	GM/8.1L	125	3	Series WYE	380	220	237	273	300	300:5	(1) #2/0
GLC125	UCI274F	12/311	Nat Gas			3		416						
GLC125	UCI274F	12/311	Nat Gas	GM/8.1L	130	3	Series WYE	480	277	195	225	225	250:5	(1) #1
GLC125	UCI274E	4/06	LPG	GM/8.1L	105	1	Series	240	120	438	503	500	500:5	(2) #1/0
GLC125	UCI274E	12/311	LPG	GM/8.1L	110	3	// WYE	208	120	382	439	450	500:5	(2) #1/0
GLC125	UCI274E	12/311	LPG	GM/8.1L	110	3	// WYE	220	127	361	415	450	400:5	(2) #1/0
GLC125	UCI274E	12/311	LPG	GM/8.1L	110	3	Series/ Delta	240	120	331	380	400	400:5	(2) #4/0
GLC125	UCI274E	12/311	LPG	GM/8.1L	110	3	// WYE	240	139	331	380	400	400:5	(2) #4/0
GLC125	UCI274E	12/311	LPG	GM/8.1L	105	3	Series WYE	380	220	199	229	250	250:5	(2) #1/0
GLC125	UCI274E	12/311	LPG			3		416						
GLC125	UCI274E	12/311	LPG	GM/8.1L	110	3	Series WYE	480	277	165	190	200	200:5	(1) #1
GLC125	UCI274F	4/06	LPG	GM/8.1L	105	1	Series	240	120	438	503	500	500:5	(2) #1/0
GLC125	UCI274F	12/311	LPG	GM/8.1L	110	3	// WYE	208	120	382	439	450	500:5	(2) #1/0
GLC125	UCI274F	12/311	LPG	GM/8.1L	110	3	// WYE	220	127	361	415	450	400:5	(2) #1/0
GLC125	UCI274F	12/311	LPG	GM/8.1L	110	3	Series/ Delta	240	120	331	380	400	400:5	(2) #4/0
GLC125	UCI274F	12/311	LPG	GM/8.1L	110	3	// WYE	240	139	331	380	400	400:5	(2) #4/0
GLC125	UCI274F	12/311	LPG	GM/8.1L	105	3	Series WYE	380	220	199	229	250	250:5	(2) #1/0
GLC125	UCI274F	12/311	LPG			3		416						
GLC125	UCI274F	12/311	LPG	GM/8.1L	110	3	Series WYE	480	277	165	190	200	200:5	(1) #1

GLC DATA Continued

GLC Model	Alternator		Engine		Output									
	Model	Leads/ Winding	Fuel Type	Size	KW Rated	Phase	Voltage Config	VAC (L – L)	VAC (L – N)	FLA	115% FLA	Circuit Breaker	C.T. Ratio	Wire Size (QTY) AWG
GLC100	UCI274E	4/06	Nat Gas	GM/8.1L	84	1	Series	240	120	350	403	400	400:5	(2) #4/0
GLC100	UCI274E	12/311	Nat Gas	GM/8.1L	86	3	// WYE	208	120	298	343	350	400:5	(1) #3/0
GLC100	UCI274E	12/311	Nat Gas	GM/8.1L	86	3	// WYE	220	127	282	324	350	400:5	(1) #3/0
GLC100	UCI274E	12/311	Nat Gas	GM/8.1L	86	3	Series/ Delta	240	120	259	297	300	300:5	(1) #2/0
GLC100	UCI274E	12/311	Nat Gas	GM/8.1L	87	3	// WYE	240	139	262	301	300	300:5	(1) #2/0
GLC100	UCI274E	12/311	Nat Gas	GM/8.1L	86	3	Series Wye	380	220	163	188	200	200:5	(1) #1
GLC100	UCI274E	12/311	Nat Gas			3		416		0	0			
GLC100	UCI274E	12/311	Nat Gas	GM/8.1L	87	3	Series Wye	480	277	131	150	150	150:5	(1) #4
GLC100	UCI274E	4/06	LPG	GM/8.1L	97	1	Series	240	120	404	465	500	500:5	(2) #1/0
GLC100	UCI274E	12/311	LPG	GM/8.1L	99	3	// WYE	208	120	344	395	400	400:5	(2) #4/0
GLC100	UCI274E	12/311	LPG	GM/8.1L	99	3	// WYE	220	127	325	373	400	400:5	(2) #4/0
GLC100	UCI274E	12/311	LPG	GM/8.1L	99	3	Series/ Delta	240	120	298	342	350	400:5	(1) #3/0
GLC100	UCI274E	12/311	LPG	GM/8.1L	100	3	// WYE	240	139	301	346	350	400:5	(1) #3/0
GLC100	UCI274E	12/311	LPG	GM/8.1L	98	3	Series Wye	380	220	186	214	225	250:5	(1) #1
GLC100	UCI274E	12/311	LPG			3		416						
GLC100	UCI274E	12/311	LPG	GM/8.1L	100	3	Series Wye	480	277	150	173	175	200:5	(1) #1
GLC80	UCI224G	4/06	Nat Gas	GM/8.1L	75	1	Series	240	120	313	359	400	400:5	(2) #4/0
GLC80	UCI274C	12/311	Nat Gas	GM/8.1L	80	3	// WYE	208	120	278	319	350	400:5	(1) #3/0
GLC80	UCI274C	12/311	Nat Gas	GM/8.1L	80	3	// WYE	220	127	262	302	300	300:5	(1) #2/0
GLC80	UCI274C	12/311	Nat Gas	GM/8.1L	80	3	Series/ Delta	240	120	241	277	300	300:5	(1) #2/0
GLC80	UCI274C	12/311	Nat Gas	GM/8.1L	80	3	// WYE	240	139	241	277	300	300:5	(1) #2/0
GLC80	UCI274C	12/311	Nat Gas	GM/8.1L	80	3	Series Wye	380	220	152	175	175	200:5	(1) #1
GLC80	UCI274C	12/311	Nat Gas			3		416						
GLC80	UCI274C	12/311	Nat Gas	GM/8.1L	80	3	Series Wye	480	277	120	138	150	150:5	(1) #4
GLC80	UCI224G	4/06	LPG	GM/8.1L	75	1	Series	240	120	313	359	400	400:5	(2) #4/0
GLC80	UCI274C	12/311	LPG	GM/8.1L	80	3	// WYE	208	120	278	319	350	400:5	(1) #3/0
GLC80	UCI274C	12/311	LPG	GM/8.1L	80	3	// WYE	220	127	262	302	300	300:5	(1) #2/0
GLC80	UCI274C	12/311	LPG	GM/8.1L	80	3	Series/ Delta	240	120	241	277	300	300:5	(1) #2/0
GLC80	UCI274C	12/311	LPG	GM/8.1L	80	3	// WYE	240	139	241	277	300	300:5	(1) #2/0
GLC80	UCI274C	12/311	LPG	GM/8.1L	80	3	Series Wye	380	220	152	175	175	200:5	(1) #1
GLC80	UCI274C	12/311	LPG			3		416			0			
GLC80	UCI274C	12/311	LPG	GM/8.1L	80	3	Series Wye	480	277	120	138	150	150:5	(1) #4

GLC DATA Continued

GLC Model	Alternator		Engine		Output									
	Model	Leads/ Winding	Fuel Type	Size	KW Rated	Phase	Voltage Config	VAC (L – L)	VAC (L – N)	FLA	115% FLA	Circuit Breaker	C.T. Ratio	Wire Size (QTY) AWG
GLC60	UCI224F	4/06	Nat Gas	GM/5.7L	54	1	Series	240	120	225	259	300	300:5	(1) #2/0
GLC60	UCI224E	12/311	Nat Gas	GM/5.7L	53	3	// WYE	208	120	184	211	225	250:5	(1) #1
GLC60	UCI224E	12/311	Nat Gas	GM/5.7L	54	3	// WYE	220	127	177	204	225	200:5	(1) #1
GLC60	UCI224E	12/311	Nat Gas	GM/5.7L	54	3	Series/ Delta	240	120	162	187	200	200:5	(1) #1
GLC60	UCI224E	12/311	Nat Gas	GM/5.7L	55	3	// WYE	240	139	165	190	200	200:5	(1) #1
GLC60	UCI224E	12/311	Nat Gas	GM/5.7L	49	3	Series Wye	380	220	93	107	110	125:5	(1) #6
GLC60	UCI224E	12/311	Nat Gas			3		416			0			
GLC60	UCI224E	12/311	Nat Gas	GM/5.7L	55	3	Series Wye	480	277	83	95	100	100:5	(1) #6
GLC60	UCI224F	4/06	LPG	GM/5.7L	60	1	Series	240	120	250	288	300	300:5	(1) #2/0
GLC60	UCI224E	12/311	LPG	GM/5.7L	54	3	// WYE	208	120	187	215	225	250:5	(1) #1
GLC60	UCI224E	12/311	LPG	GM/5.7L	56	3	// WYE	220	127	184	211	225	250:5	(1) #1
GLC60	UCI224E	12/311	LPG	GM/5.7L	54	3	Series/ Delta	240	120	162	187	200	200:5	(1) #1
GLC60	UCI224E	12/311	LPG	GM/5.7L	60	3	// WYE	240	139	180	207	225	200:5	(1) #1
GLC60	UCI224E	12/311	LPG	GM/5.7L	49	3	Series Wye	380	220	93	107	110	125:5	(1) #6
GLC60	UCI224E	12/311	LPG			3		416			0			
GLC60	UCI224E	12/311	LPG	GM/5.7L	60	3	Series Wye	480	277	90	104	110	125:5	(1) #6
GLC50	UCI224D	4/06	Nat Gas	GM/5.7L	44	1	Series	240	120	183	211	225	250:5	(1) #1
GLC50	UCI224D	12/311	Nat Gas	GM/5.7L	48	3	// WYE	208	120	167	192	200	200:5	(1) #1
GLC50	UCI224D	12/311	Nat Gas	GM/5.7L	50	3	// WYE	220	127	164	189	200	200:5	(1) #1
GLC50	UCI224D	12/311	Nat Gas	GM/5.7L	48	3	Series/ Delta	240	120	144	166	175	200:5	(1) #1
GLC50	UCI224D	12/311	Nat Gas	GM/5.7L	50	3	// WYE	240	139	150	173	175	200:5	(1) #1
GLC50	UCI224D	12/311	Nat Gas	GM/5.7L	43	3	Series Wye	380	220	82	94	100	100:5	(1) #6
GLC50	UCI224D	12/311	Nat Gas			3		416			0			
GLC50	UCI224D	12/311	Nat Gas	GM/5.7L	50	3	Series Wye	480	277	75	86	90	100:5	(1) #6
GLC50	UCI224D	4/06	LPG	GM/5.7L	44	1	Series	240	120	183	211	225	250:5	(1) #1
GLC50	UCI224D	12/311	LPG	GM/5.7L	48	3	// WYE	208	120	167	192	200	200:5	(1) #1
GLC50	UCI224D	12/311	LPG	GM/5.7L	50	3	// WYE	220	127	164	189	200	200:5	(1) #1
GLC50	UCI224D	12/311	LPG	GM/5.7L	48	3	Series/ Delta	240	120	144	166	175	200:5	(1) #1
GLC50	UCI224D	12/311	LPG	GM/5.7L	50	3	// WYE	240	139	150	173	175	200:5	(1) #1
GLC50	UCI224D	12/311	LPG	GM/5.7L	43	3	Series Wye	380	220	82	94	100	100:5	(1) #6
GLC50	UCI224D	12/311	LPG			3		416			0			
GLC50	UCI224D	12/311	LPG	GM/5.7L	50	3	Series Wye	480	277	75	86	90	100:5	(1) #6

GLC DATA Continued

GLC Model	Alternator		Engine		Output									
	Model	Leads/ Winding	Fuel Type	Size	KW Rated	Phase	Voltage Config	VAC (L – L)	VAC (L – N)	FLA	115% FLA	Circuit Breaker	C.T. Ratio	Wire Size (QTY) AWG
GLC45	UCI224D	4/06	Nat Gas	GM/4.3L	37	1	Series	240	120	154	177	175	200:5	(1) #1
GLC45	UCI224D	12/311	Nat Gas	GM/4.3L	39	3	// WYE	208	120	135	156	175	150:5	(1) #1
GLC45	UCI224D	12/311	Nat Gas	GM/4.3L	39	3	// WYE	220	127	128	147	150	150:5	(1) #4
GLC45	UCI224D	12/311	Nat Gas	GM/4.3L	39	3	Series/ Delta	240	120	117	135	150	150:5	(1) #4
GLC45	UCI224D	12/311	Nat Gas	GM/4.3L	40	3	// WYE	240	139	120	138	150	150:5	(1) #4
GLC45	UCI224D	12/311	Nat Gas	GM/4.3L	40	3	Series Wye	380	220	76	87	90	100:5	(1) #6
GLC45	UCI224D	12/311	Nat Gas			3		416			0			
GLC45	UCI224D	12/311	Nat Gas	GM/4.3L	40	3	Series Wye	480	277	60	69	70	75:5	(1) #8
GLC45	UCI224D	4/06	LPG	GM/4.3L	41	1	Series	240	120	171	196	200	200:5	(1) #1
GLC45	UCI224D	12/311	LPG	GM/4.3L	44	3	// WYE	208	120	153	176	175	200:5	(1) #1
GLC45	UCI224D	12/311	LPG	GM/4.3L	44	3	// WYE	220	127	144	166	175	200:5	(1) #1
GLC45	UCI224D	12/311	LPG	GM/4.3L	44	3	Series/ Delta	240	120	132	152	175	150:5	(1) #1
GLC45	UCI224D	12/311	LPG	GM/4.3L	45	3	// WYE	240	139	135	156	175	150:5	(1) #1
GLC45	UCI224D	12/311	LPG	GM/4.3L	45	3	Series Wye	380	220	85	98	100	100:5	(1) #6
GLC45	UCI224D	12/311	LPG			3		416			0			
GLC45	UCI224D	12/311	LPG	GM/4.3L	45	3	Series Wye	480	277	68	78	80	75:5	(1) #8
GLC35	UCI224C	4/06	Nat Gas	GM/4.3L	35	1	Series	240	120	146	168	175	200:5	(1) #1
GLC35	UCI224C	12/311	Nat Gas	GM/4.3L	35	3	// WYE	208	120	121	140	150	150:5	(1) #4
GLC35	UCI224C	12/311	Nat Gas	GM/4.3L	35	3	// WYE	220	127	115	132	150	150:5	(1) #4
GLC35	UCI224C	12/311	Nat Gas	GM/4.3L	35	3	Series/ Delta	240	120	105	121	125	125:5	(1) #4
GLC35	UCI224C	12/311	Nat Gas	GM/4.3L	35	3	// WYE	240	139	105	121	125	125:5	(1) #4
GLC35	UCI224C	12/311	Nat Gas	GM/4.3L	35	3	Series Wye	380	220	66	76	80	75:5	(1) #8
GLC35	UCI224C	12/311	Nat Gas			3		416			0			
GLC35	UCI224C	12/311	Nat Gas	GM/4.3L	35	3	Series Wye	480	277	53	61	60	60:5	(1) #8
GLC35	UCI224C	4/06	LPG	GM/4.3L	35	1	Series	240	120	146	168	175	200:5	(1) #1
GLC35	UCI224C	12/311	LPG	GM/4.3L	35	3	// WYE	208	120	121	140	150	150:5	(1) #4
GLC35	UCI224C	12/311	LPG	GM/4.3L	35	3	// WYE	220	127	115	132	150	150:5	(1) #4
GLC35	UCI224C	12/311	LPG	GM/4.3L	35	3	Series/ Delta	240	120	105	121	125	125:5	(1) #4
GLC35	UCI224C	12/311	LPG	GM/4.3L	35	3	// WYE	240	139	105	121	125	125:5	(1) #4
GLC35	UCI224C	12/311	LPG	GM/4.3L	35	3	Series Wye	380	220	66	76	80	75:5	(1) #8
GLC35	UCI224C	12/311	LPG			3		416			0			
GLC35	UCI224C	12/311	LPG	GM/4.3L	35	3	Series Wye	480	277	53	61	60	60:5	(1) #8

GLC DATA Continued

GLC Model	Alternator		Engine		Output									
	Model	Leads/ Winding	Fuel Type	Size	KW Rated	Phase	Voltage Config	VAC (L – L)	VAC (L – N)	FLA	115% FLA	Circuit Breaker	C.T. Ratio	Wire Size (QTY) AWG
GLC30	BCI184G	4/06	Nat Gas	GM/4.3L	30	1	Series	240	120	125	144	150	150:5	(1) #4
GLC30	UCI224C	12/311	Nat Gas	GM/4.3L	30	3	// WYE	208	120	104	120	125	125:5	(1) #4
GLC30	UCI224C	12/311	Nat Gas	GM/4.3L	30	3	// WYE	220	127	98	113	125	125:5	(1) #4
GLC30	UCI224C	12/311	Nat Gas	GM/4.3L	30	3	Series/ Delta	240	120	90	104	110	125:5	(1) #6
GLC30	UCI224C	12/311	Nat Gas	GM/4.3L	30	3	// WYE	240	139	90	104	110	125:5	(1) #6
GLC30	UCI224C	12/311	Nat Gas	GM/4.3L	30	3	Series Wye	380	220	57	66	70	75:5	(1) #8
GLC30	UCI224C	12/311	Nat Gas			3		416			0			
GLC30	UCI224C	12/311	Nat Gas	GM/4.3L	30	3	Series Wye	480	277	45	52	60	60:5	(1) #8
GLC30	BCI184G	4/06	LPG	GM/4.3L	30	1	Series	240	120	125	144	150	150:5	(1) #4
GLC30	UCI224C	12/311	LPG	GM/4.3L	30	3	// WYE	208	120	104	120	125	125:5	(1) #4
GLC30	UCI224C	12/311	LPG	GM/4.3L	30	3	// WYE	220	127	98	113	125	125:5	(1) #4
GLC30	UCI224C	12/311	LPG	GM/4.3L	30	3	Series/ Delta	240	120	90	104	110	125:5	(1) #6
GLC30	UCI224C	12/311	LPG	GM/4.3L	30	3	// WYE	240	139	90	104	110	125:5	(1) #6
GLC30	UCI224C	12/311	LPG	GM/4.3L	30	3	Series Wye	380	220	57	66	70	75:5	(1) #8
GLC30	UCI224C	12/311	LPG			3		416			0			
GLC30	UCI224C	12/311	LPG	GM/4.3L	30	3	Series Wye	480	277	45	52	60	60:5	(1) #8

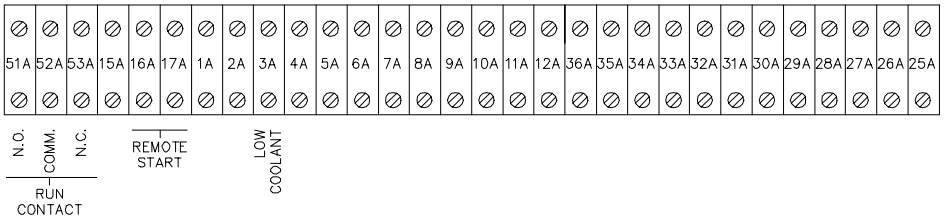
GLC Wire Size

Revision B 5–12–04				
Circuit Breaker Size	Quantity per Phase	Minimum Wire Gauge	EDI Plant	Ampacity @125C
15	1	#16	1 – #14 EPDM PER PHASE	40
20	1	#16	1 – #14 EPDM PER PHASE	40
30	1	#14	1 – #8 EPDM PER PHASE	90
40	1	#12	1 – #8 EPDM PER PHASE	90
50	1	#10	1 – #8 EPDM PER PHASE	90
60	1	#8	1 – #8 EPDM PER PHASE	90
70	1	#8	1 – #8 EPDM PER PHASE	90
80	1	#6	1 – #8 EPDM PER PHASE	90
90	1	#6	1 – #6 EPDM PER PHASE	125
100	1	#6	1 – #6 EPDM PER PHASE	125
110	1	#6	1 – #6 EPDM PER PHASE	125
125	1	#4	1 – #4 EPDM PER PHASE	170
150	1	#2	1 – #4 EPDM PER PHASE	170
175	1	#2	1 – #1 EPDM PER PHASE	265
200	1	#1	1 – #1 EPDM PER PHASE	265
225	1	1/0	1 – #1 EPDM PER PHASE	265
250	1	2/0	1 – #1/0 EPDM PER PHASE	305
300	1	4/0	1 – #2/0 EPDM PER PHASE	355
350	1	4/0	1 – #3/0 EPDM PER PHASE	410
400	2	#1	1 – #4/0 EPDM PER PHASE	475
450	2	1/0	2 – #1/0 EPDM PER PHASE	610
500	2	1/0	2 – #1/0 EPDM PER PHASE	610
600	2	3/0	2 – #2/0 EPDM PER PHASE	710
700	2	4/0	2 – #3/0 EPDM PER PHASE	820
800	3	2/0	2 – #4/0 EPDM PER PHASE	950
900	3	3/0	3 – #2/0 EPDM PER PHASE	1065
1000	3	3/0	3 – #3/0 EPDM PER PHASE	1230
1200	3	250	3 – #4/0 EPDM PER PHASE	1425
1400	4	4/0	4 – #4/0 EPDM PER PHASE	1900
1600	4	250	4 – #4/0 EPDM PER PHASE	1900
2000	5	250	5 – #4/0 EPDM PER PHASE	2375
2500	6	250	6 – #4/0 EPDM PER PHASE	2850
3000	7	250	6 – #250 EPDM PER PHASE	3180
4000	8	300	8 – #250 EPDM PER PHASE	4240

Wiring Diagrams Wiring diagrams for these generators are contained on the following pages of this appendix.

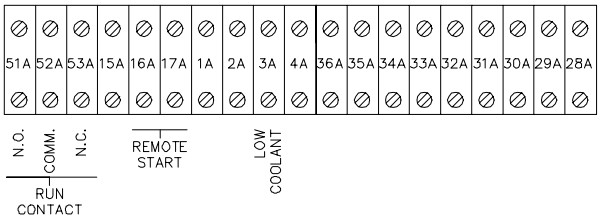
Figure A-2 Customer Interface Connection Diagram

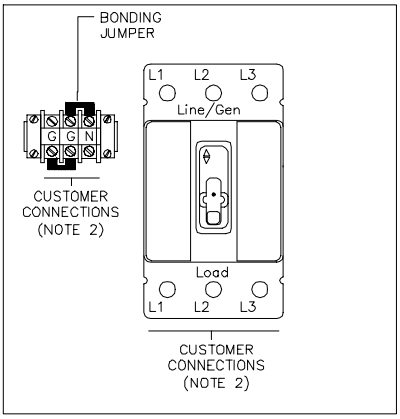
MEC20



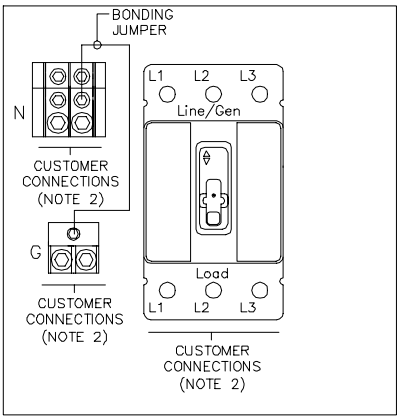
CUSTOMER CONNECTIONS–CONTROL PANEL ENCLOSURE	
	TERMINAL STRIP ALL TERMINALS
IDENTIFICATION	AS SHOWN/MEC MANUAL
AMPACITY/SIZE	LOCAL & NATIONAL ELECTRIC CODE
TEMP RISE	75C
CONDUCTORS	CU
CONNECTOR	SCREW
CONN RANGE	#22–#10
TORQUE	7–8 in–lb (ENTIRE WIRE RANGE)
NOTES:	
1. TERMINALS 1A–36A WIRED DIRECT SAME MEC TERMINAL	
2. TERMINAL SUFFIX "A" – WIRED OUT FOR ACCESS	
3. ONE WIRE/CONNECTOR	

MEC2





CUSTOMER CONNECTIONS–CIRCUIT BREAKER BOX				
	CIRCUIT BREAKER	TERMINAL STRIP		
	L1, L2, L3(NOTE1)	G NOTE 3	G	N
IDENTIFICATION	LOAD PHASE WIRES	NOTE 4	LOAD GND	LOAD N
AMPACITY/SIZE	LOCAL & NATIONAL ELECTRIC CODE			
TEMP RISE	75C	75C	75C	75C
CONDUCTORS	CU	CU	CU	CU
CONNECTOR	SCREW OR SOCKET	SCREW	SCREW	SCREW
CONN RANGE	SEE NAMEPLATE	#12 AWG–1/0 AWG	#12 AWG–1/0 AWG	#12 AWG–1/0 AWG
TORQUE	SEE NAMEPLATE	NOTE 5	NOTE 5	NOTE 5
NOTES:				
1. TERMINAL L3 NOT USED ON SINGLE PHASE UNITS				
2. ONE WIRE/CONNECTOR				
3. GROUNDING ELECTRODE TERMINAL				
4. GROUNDING ELECTRODE CONDUCTOR				
5. #10–#12 AWG 35 in–lb #8 AWG 40 in–lb #6–#4 AWG 45 in–lb #3–1/0 AWG 50 in–lb				



CUSTOMER CONNECTIONS–CIRCUIT BREAKER BOX					
	CIRCUIT BREAKER	GROUND PAD		NEUTRAL PAD	
	L1, L2, L3(NOTE1)	G NOTE 3	G	N	N
IDENTIFICATION	LOAD PHASE WIRES	NOTE 4	LOAD GND	LOAD N	LOAD N
AMPACITY/SIZE	LOCAL & NATIONAL ELECTRIC CODE				
TEMP RISE	75C	75C	75C	75C	75C
CONDUCTORS	CU	CU	CU	CU	CU
CONNECTOR	SOCKET HEAD				
CONN RANGE	SEE NAMEPLATE	#6 AWG–350 KCMIL	#6 AWG–350 KCMIL	#4 AWG–500 KCMIL	#4 AWG–500 KCMIL
TORQUE	SEE NAMEPLATE	275 in–lb	275 in–lb	375 in–lb	375 in–lb
NOTES:					
1. TERMINAL L3 NOT USED ON SINGLE PHASE UNITS					
2. ONE WIRE/CONNECTOR					
3. GROUNDING ELECTRODE TERMINAL					
4. GROUNDING ELECTRODE CONDUCTOR					

BW0440D

Figure A-3 Customer Interface (w/o Breaker) Power Connection Diagram

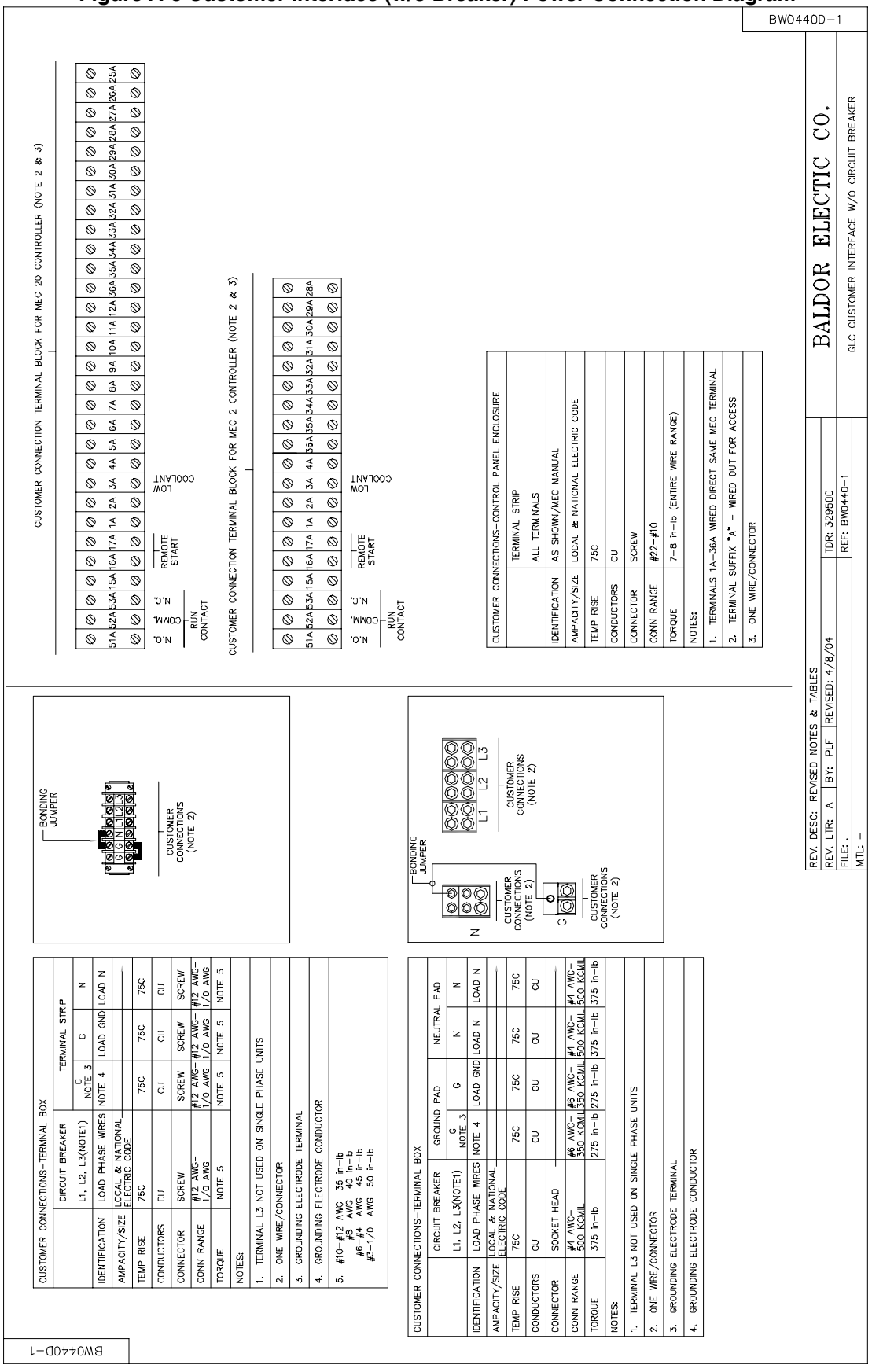


Figure A-4 Single Phase – (w/o Breaker) Connection Diagram

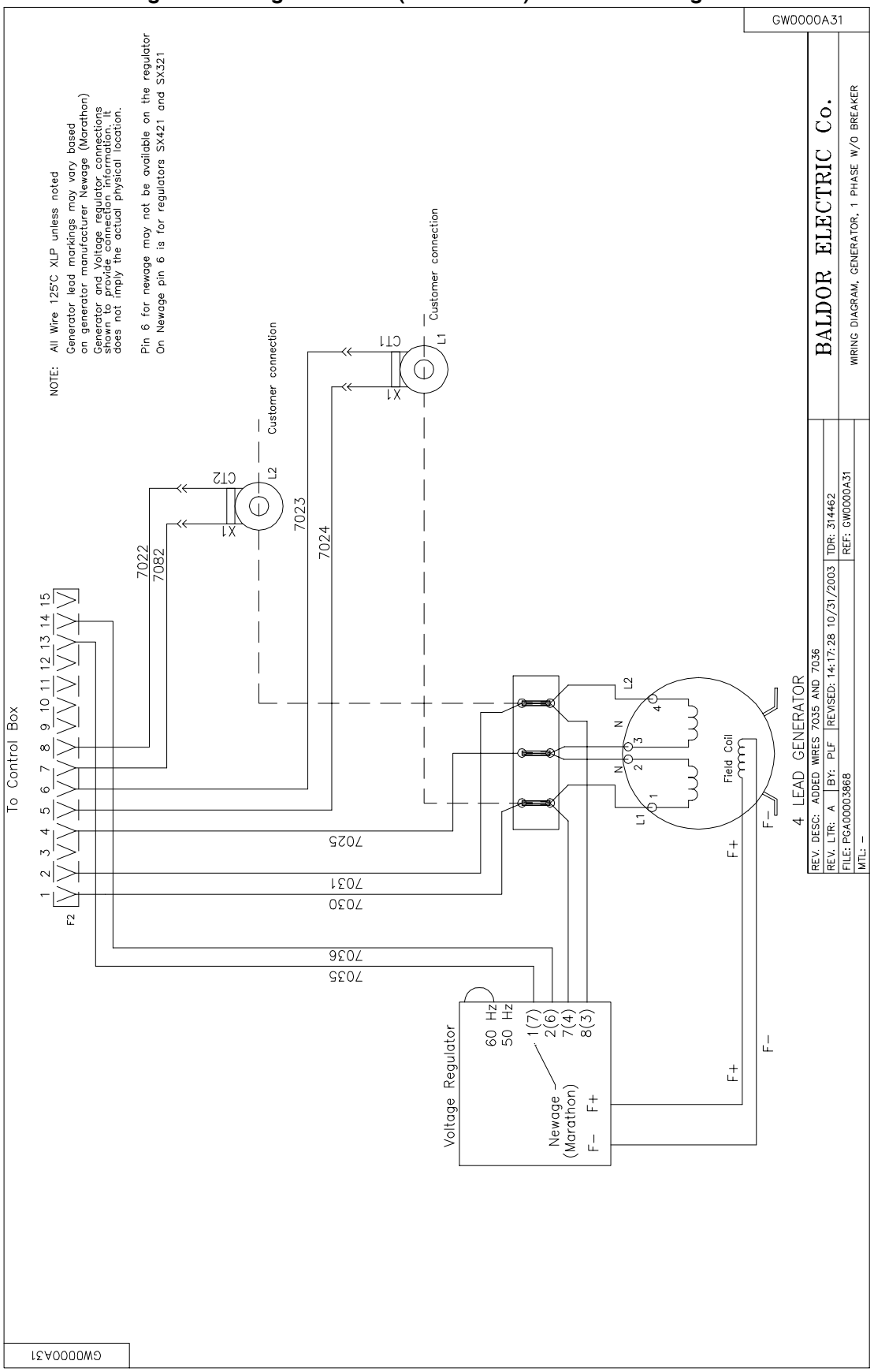


Figure A-5 Single Phase – One Breaker Connection Diagram

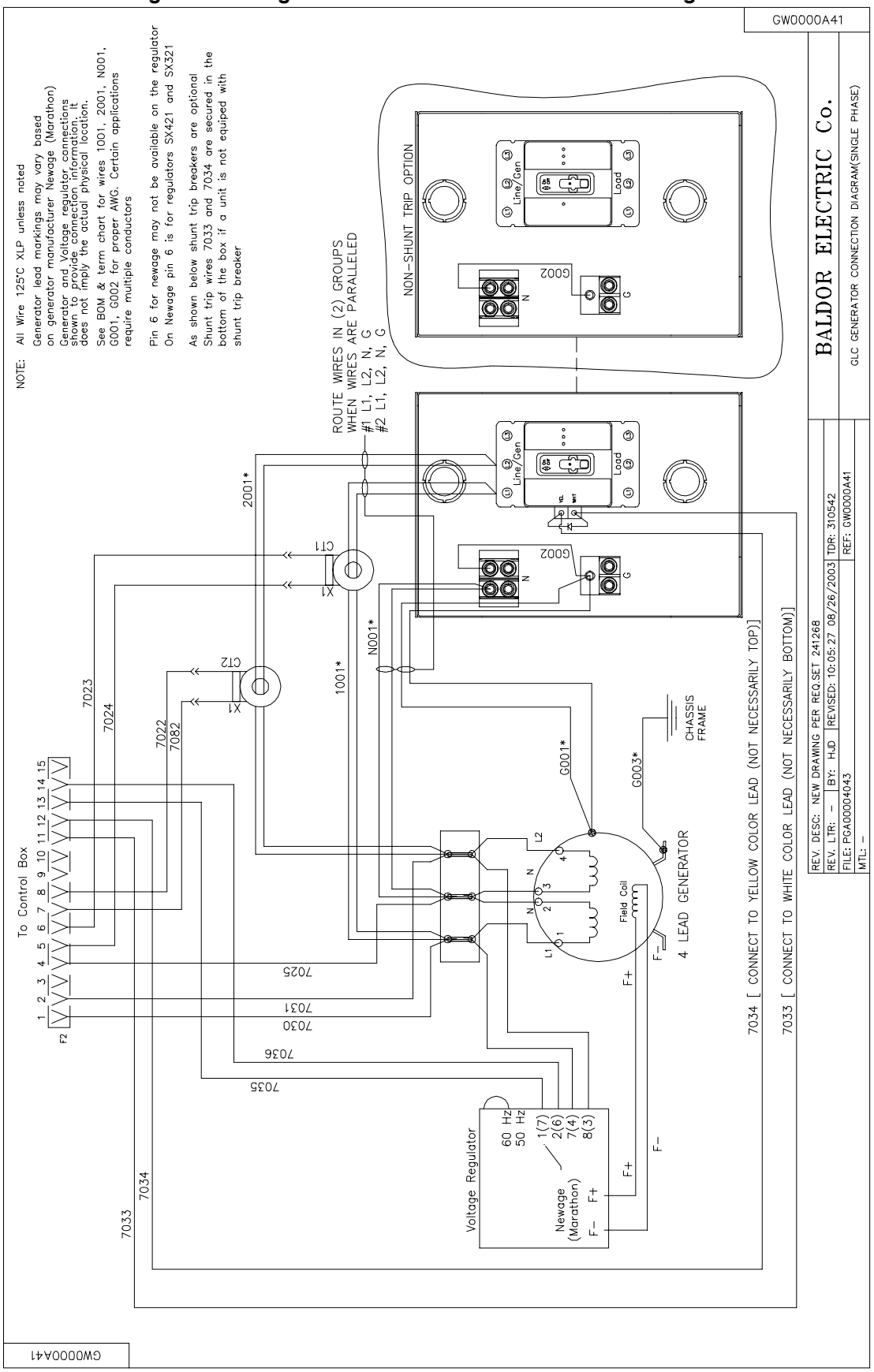


Figure A-6 Single Phase – Two Breaker Connection Diagram

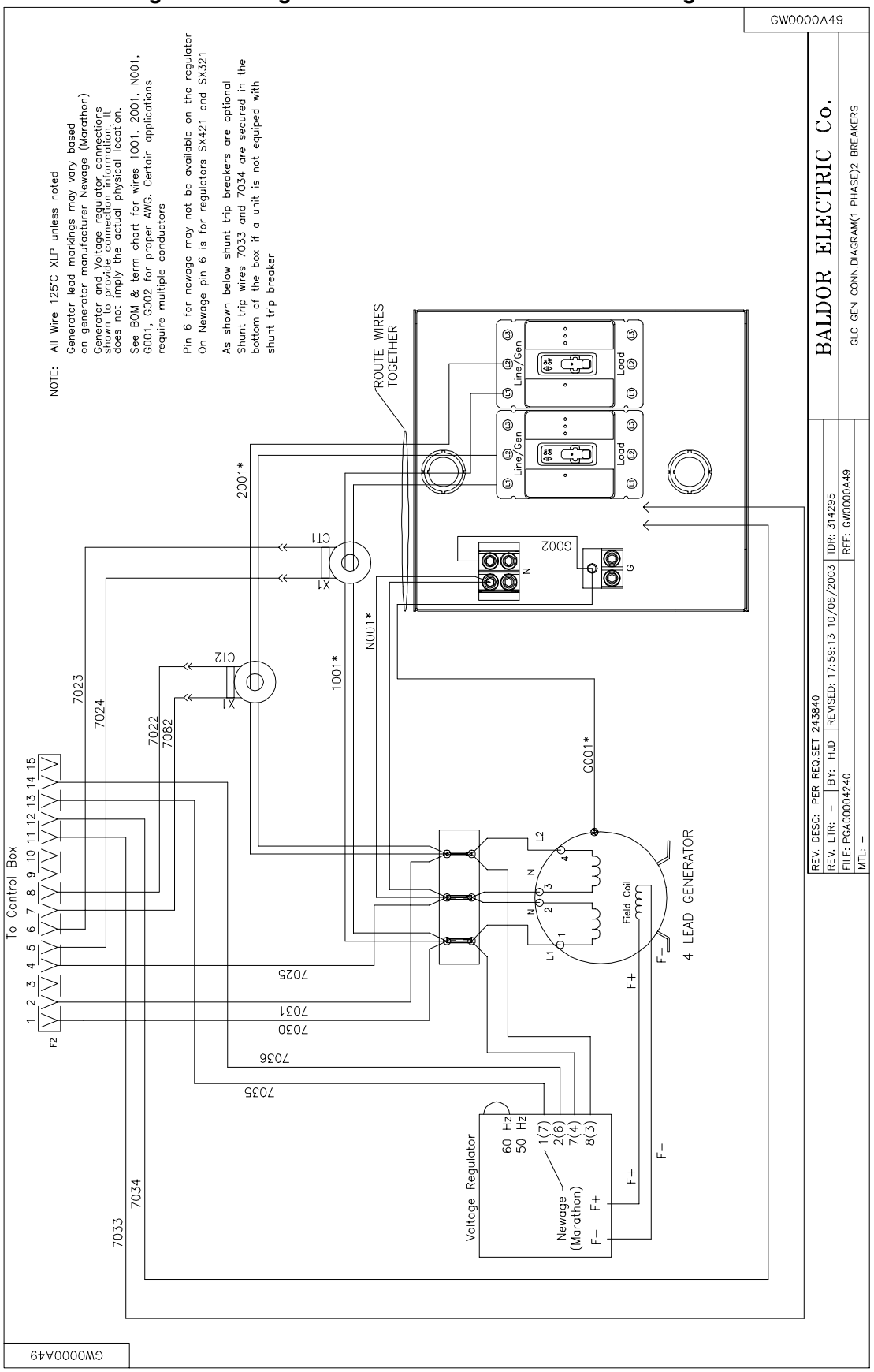


Figure A-7 Single Phase Connection Diagram (Wire 1/0 and Larger w/Breaker)

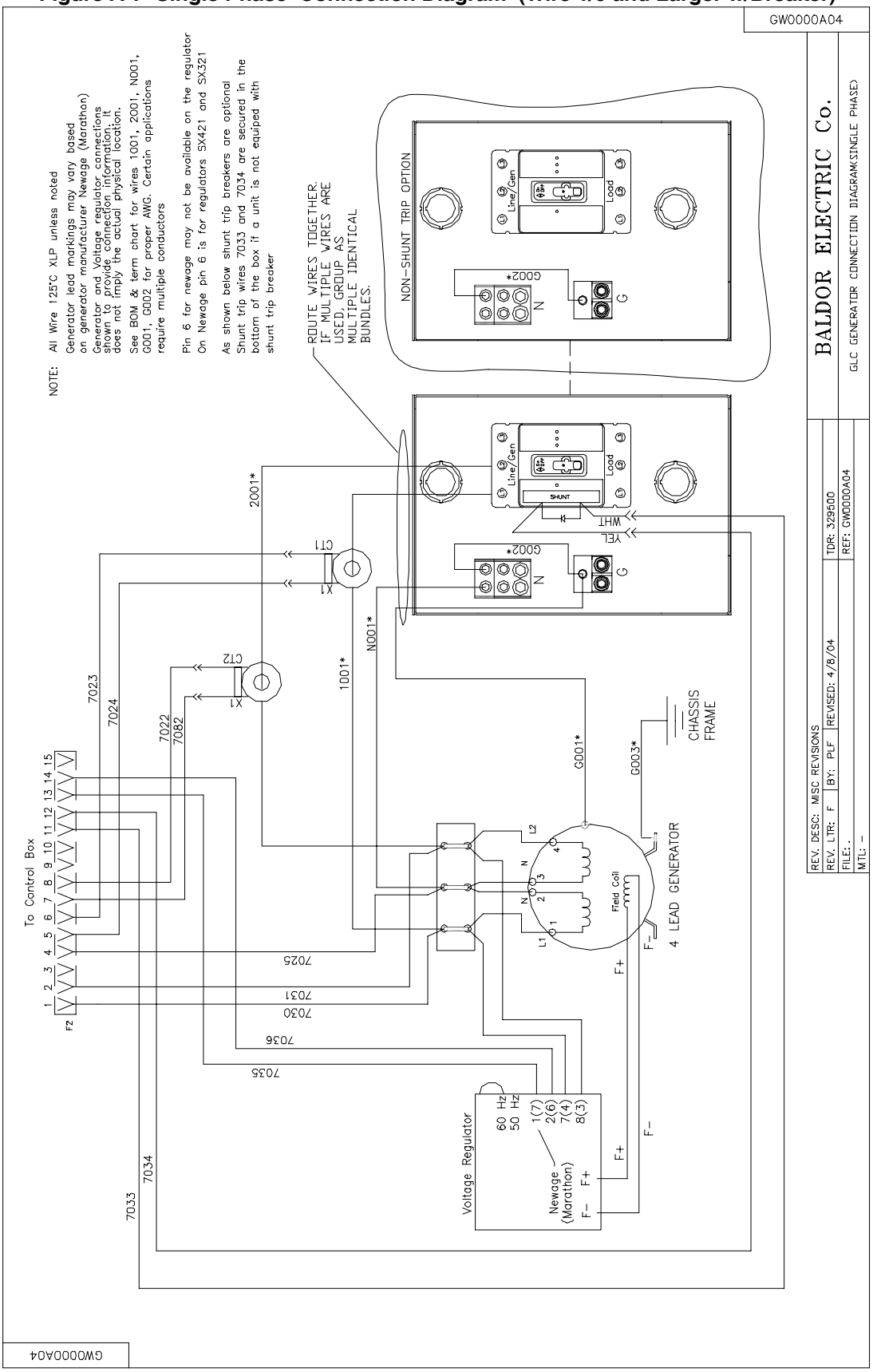


Figure A-8 Single Phase Connection Diagram (Wire 1/0 and Smaller w/Breaker)

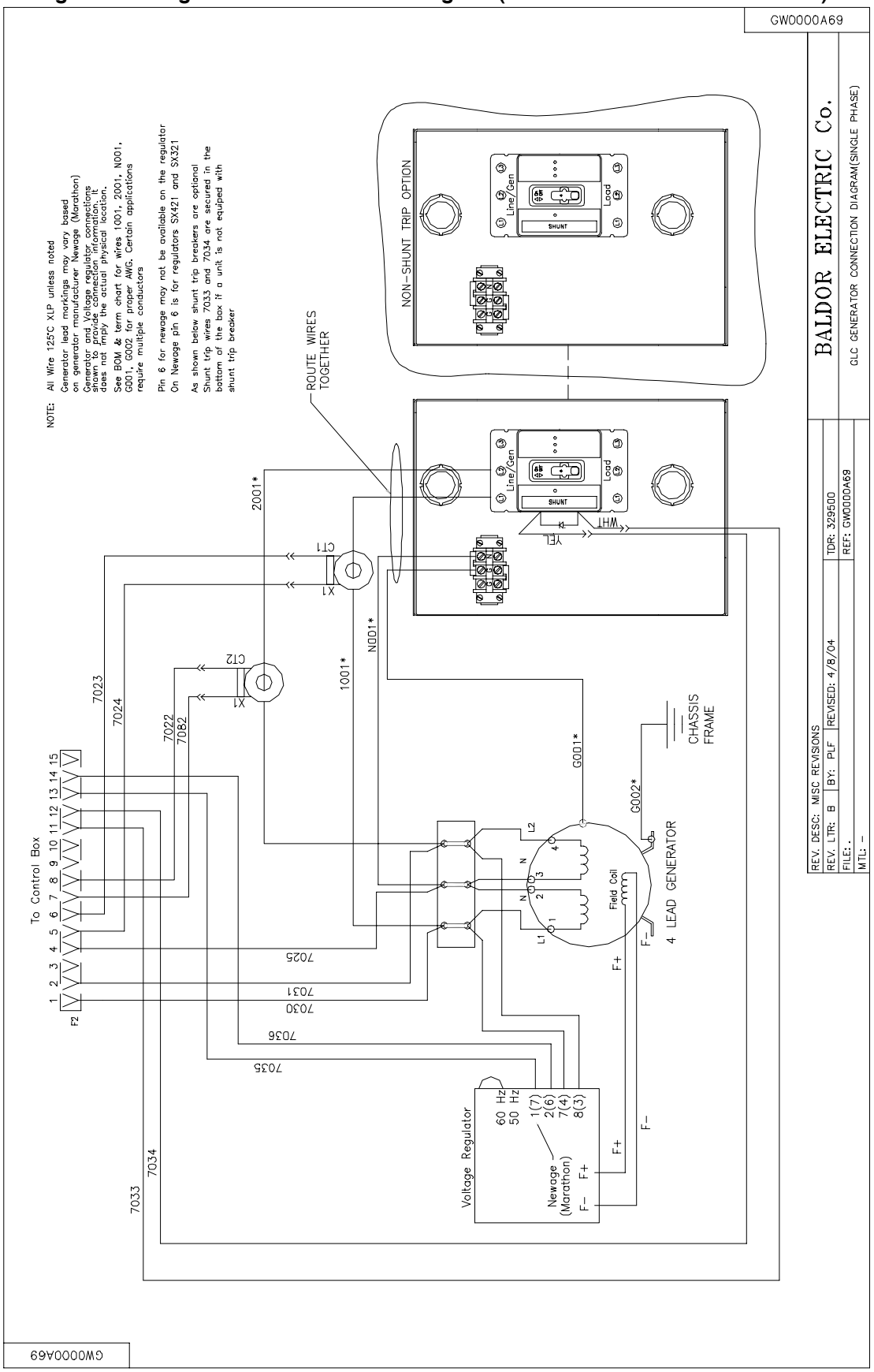


Figure A-9 Single Phase Connection Diagram (Wire 1/0 and Smaller w/o Breaker)

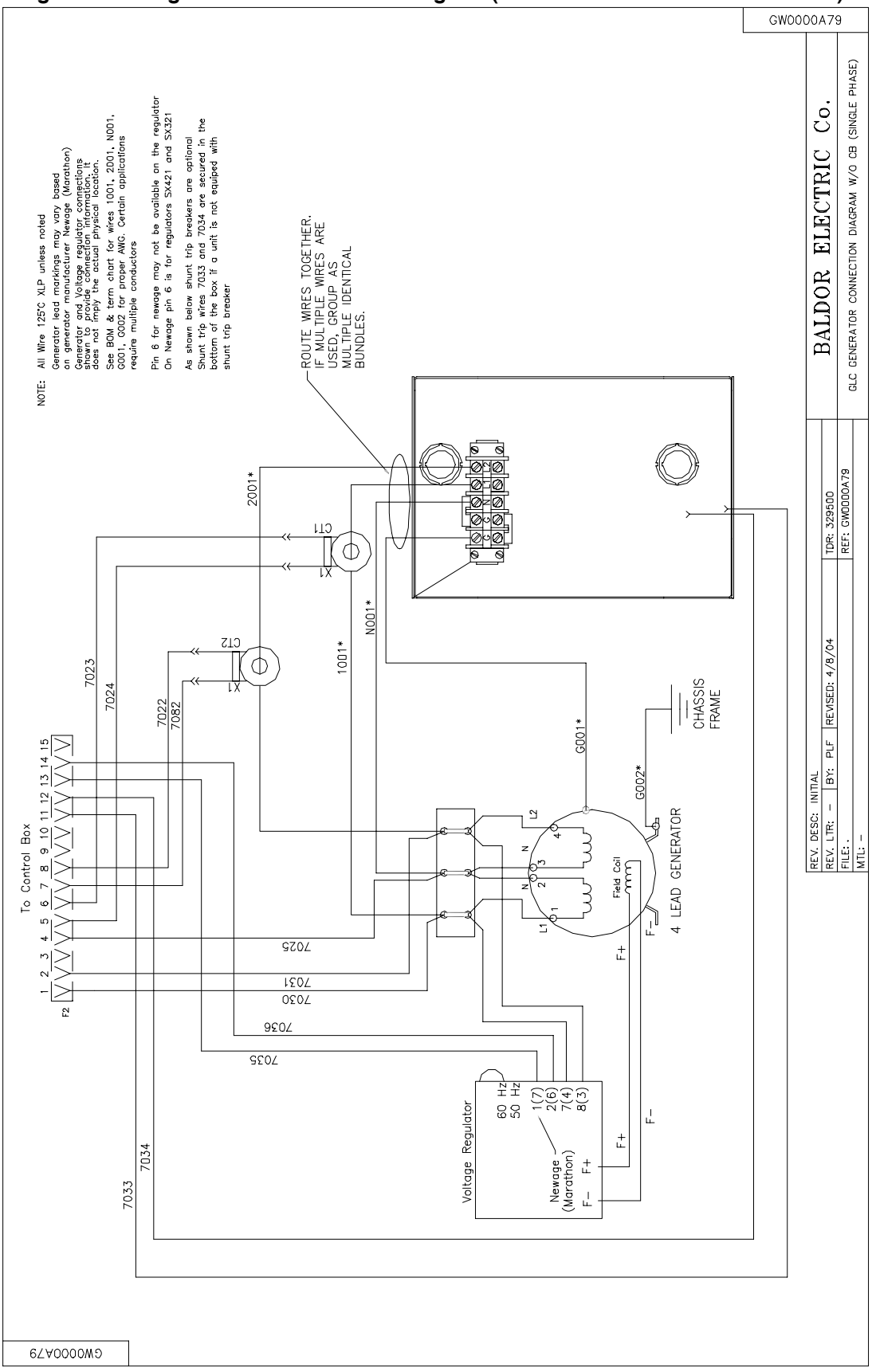


Figure A-10 Single Phase Connection Diagram (Wire Larger than 1/0 w/o Breaker)

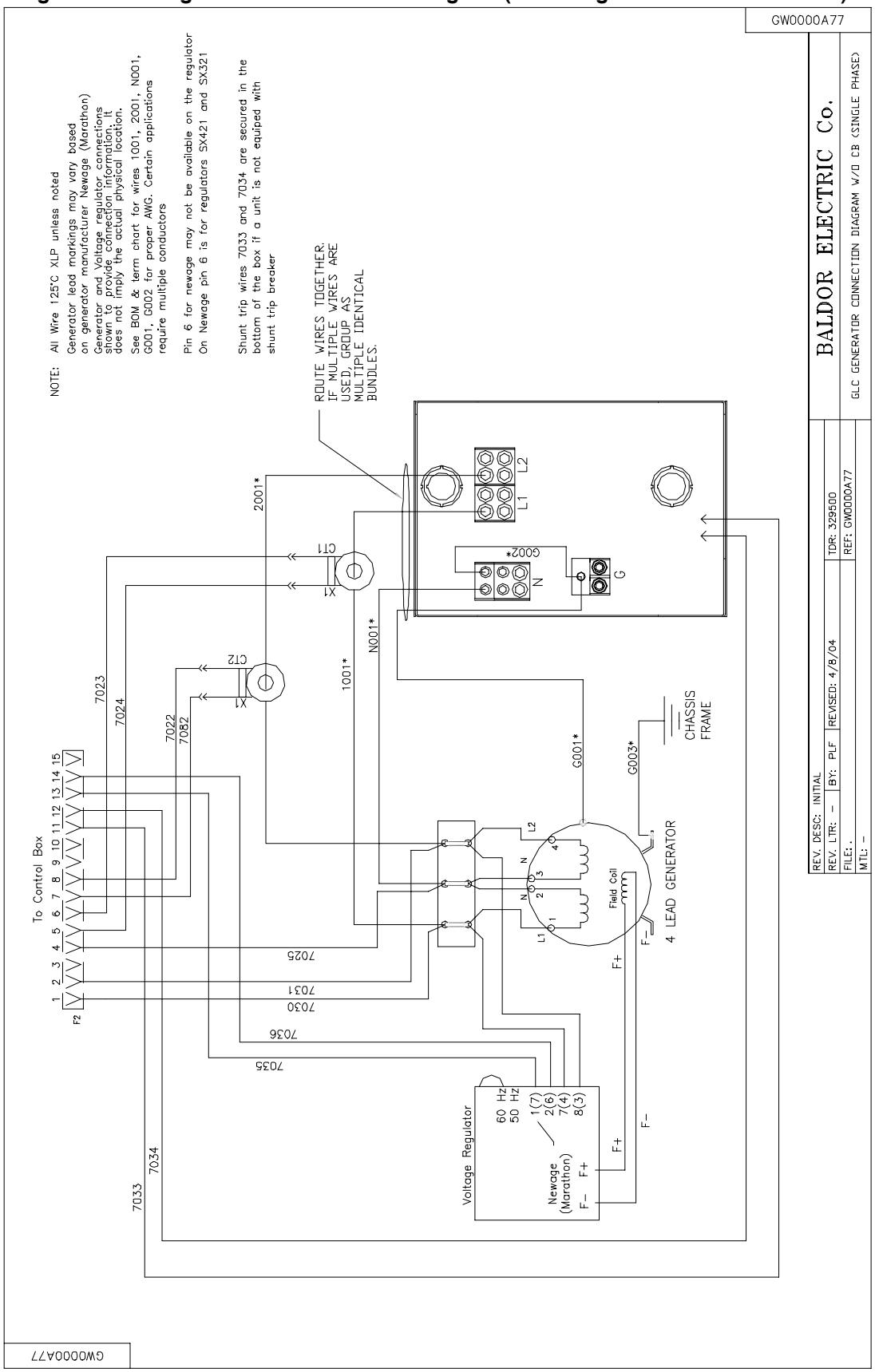


Figure A-11 Three Phase Connection Diagram

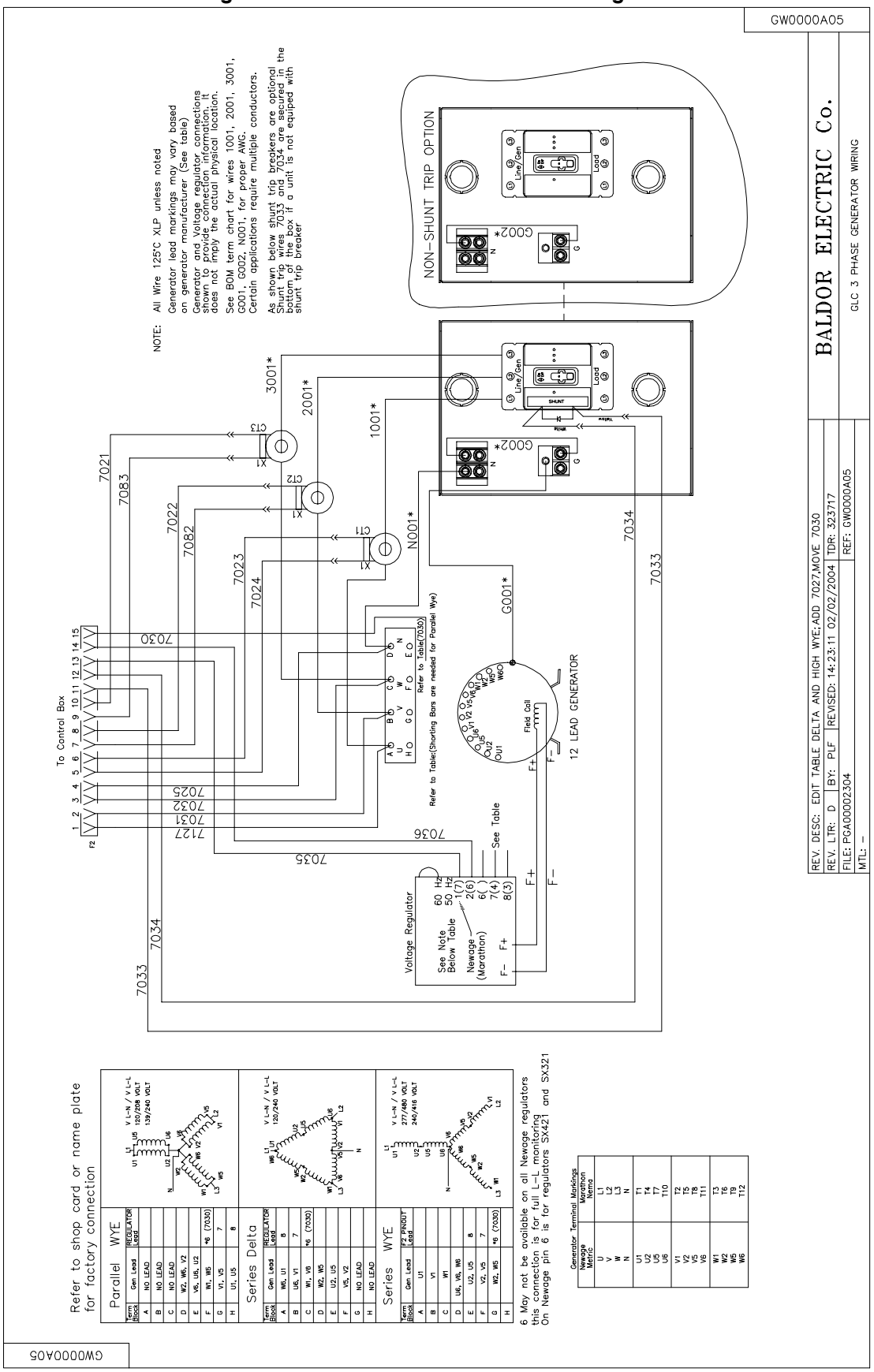


Figure A-12 Three Phase Connection Diagram with PMG

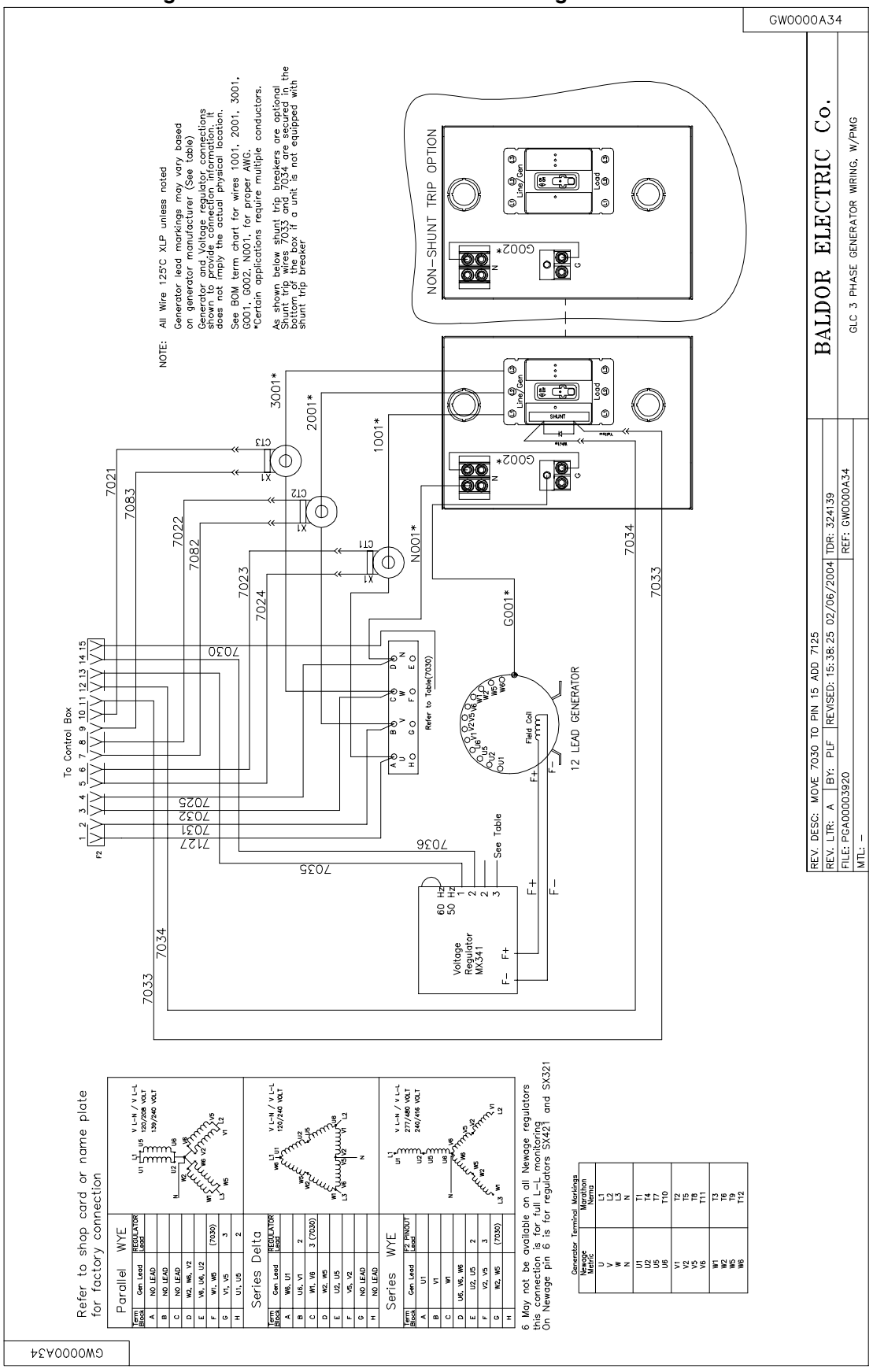


Figure A-13 Three Phase Connection Diagram (Wire 1/0 and larger)

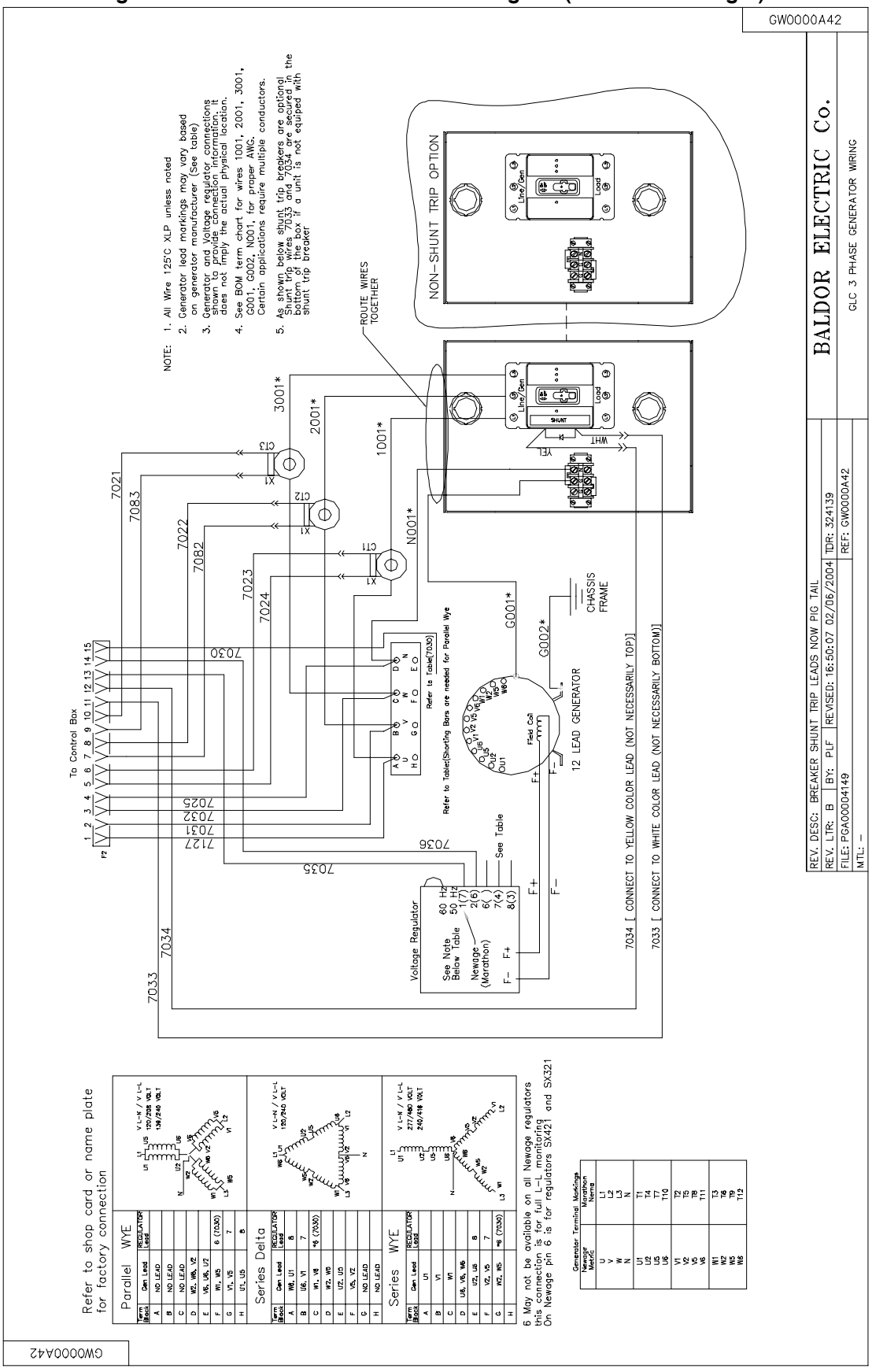


Figure A-14 Three Phase Connection Diagram (Wire Larger than 1/0 w/Breaker)

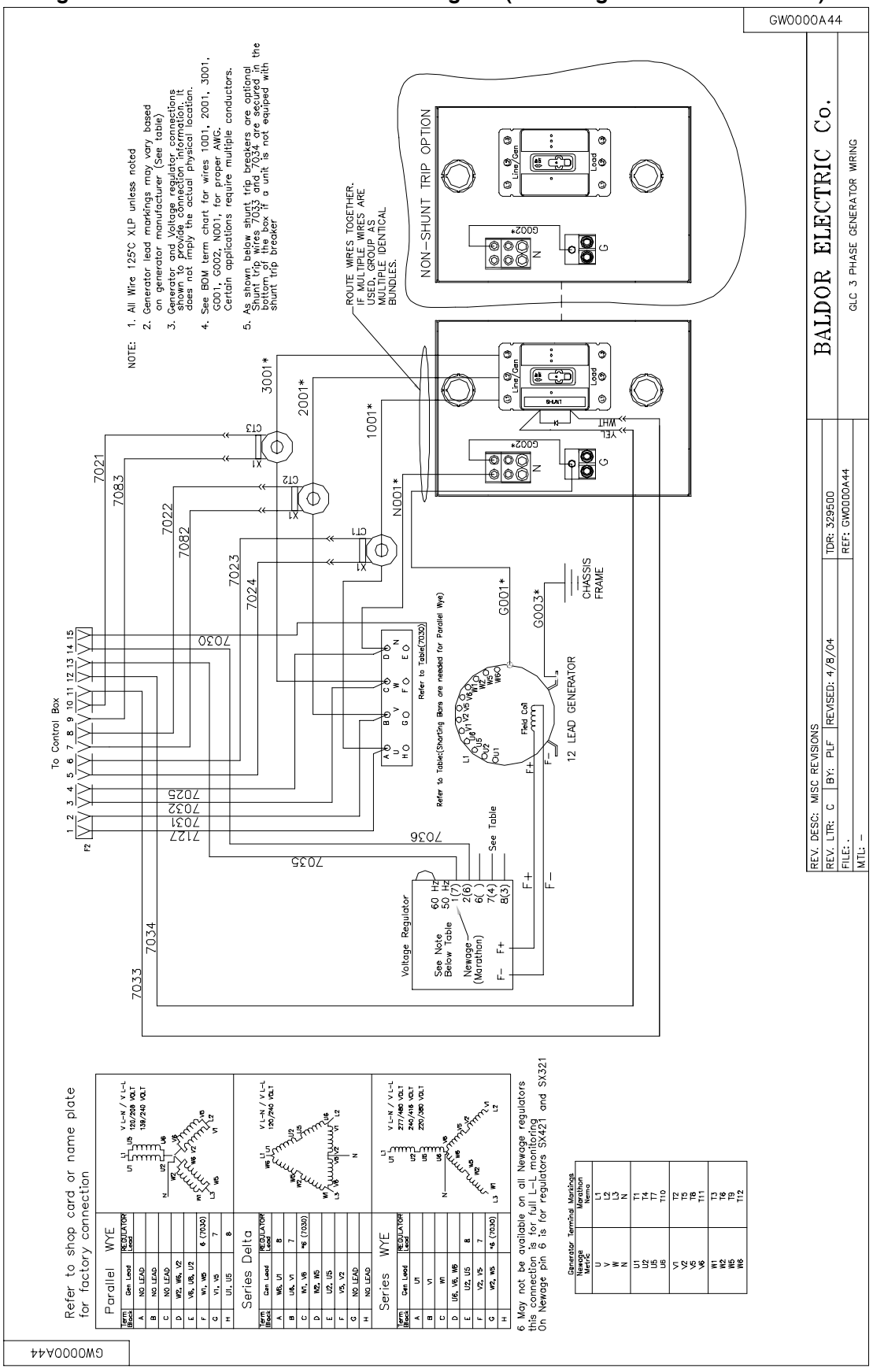


Figure A-15 Three Phase Connection Diagram (Wire 1/0 and Smaller w/Breaker)

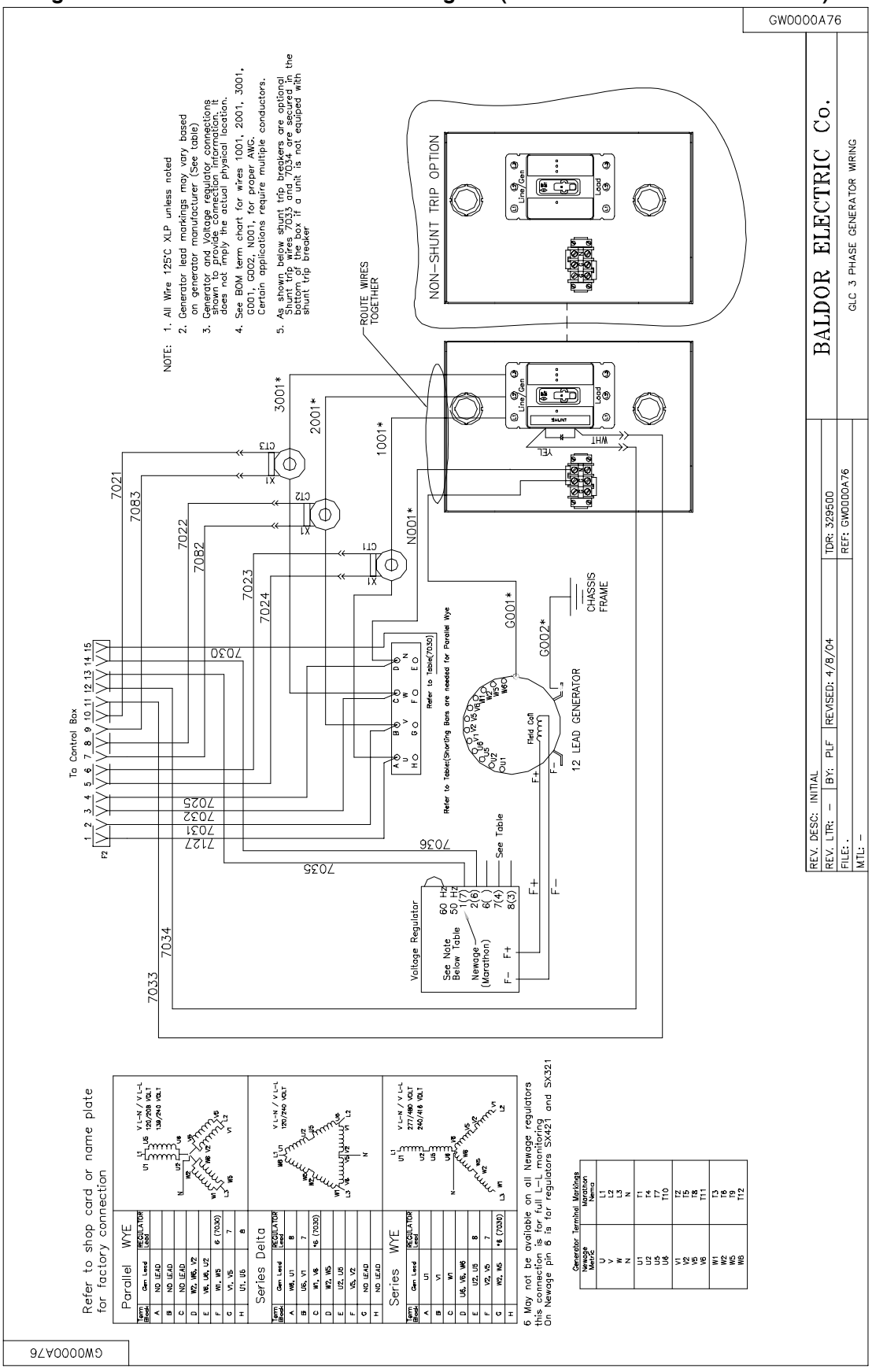


Figure A-16 Three Phase Connection Diagram (Wire Larger than 1/0 w/o Breaker)

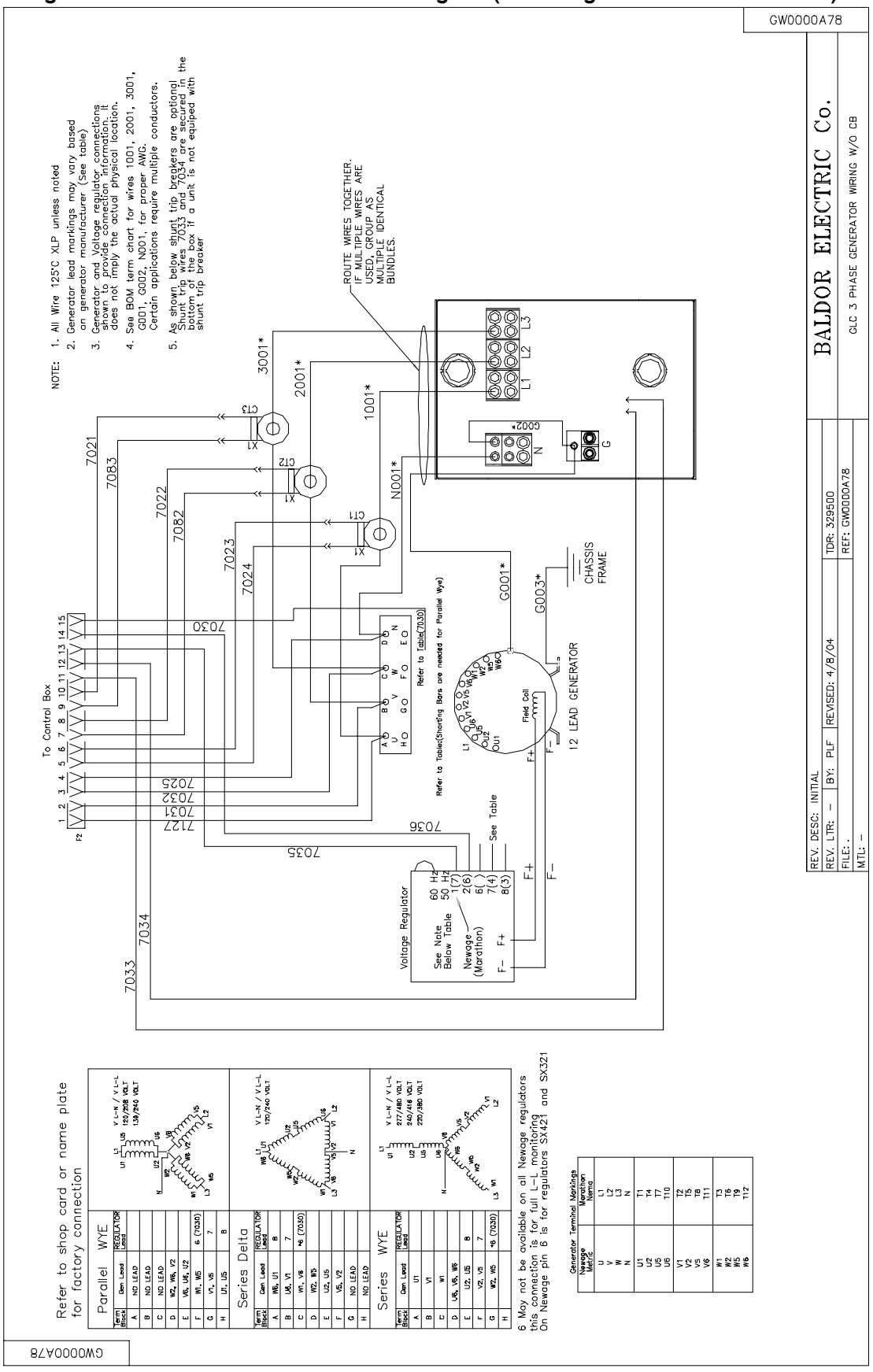


Figure A-17 Three Phase Connection Diagram (Wire 1/0 and Smaller w/o Breaker)

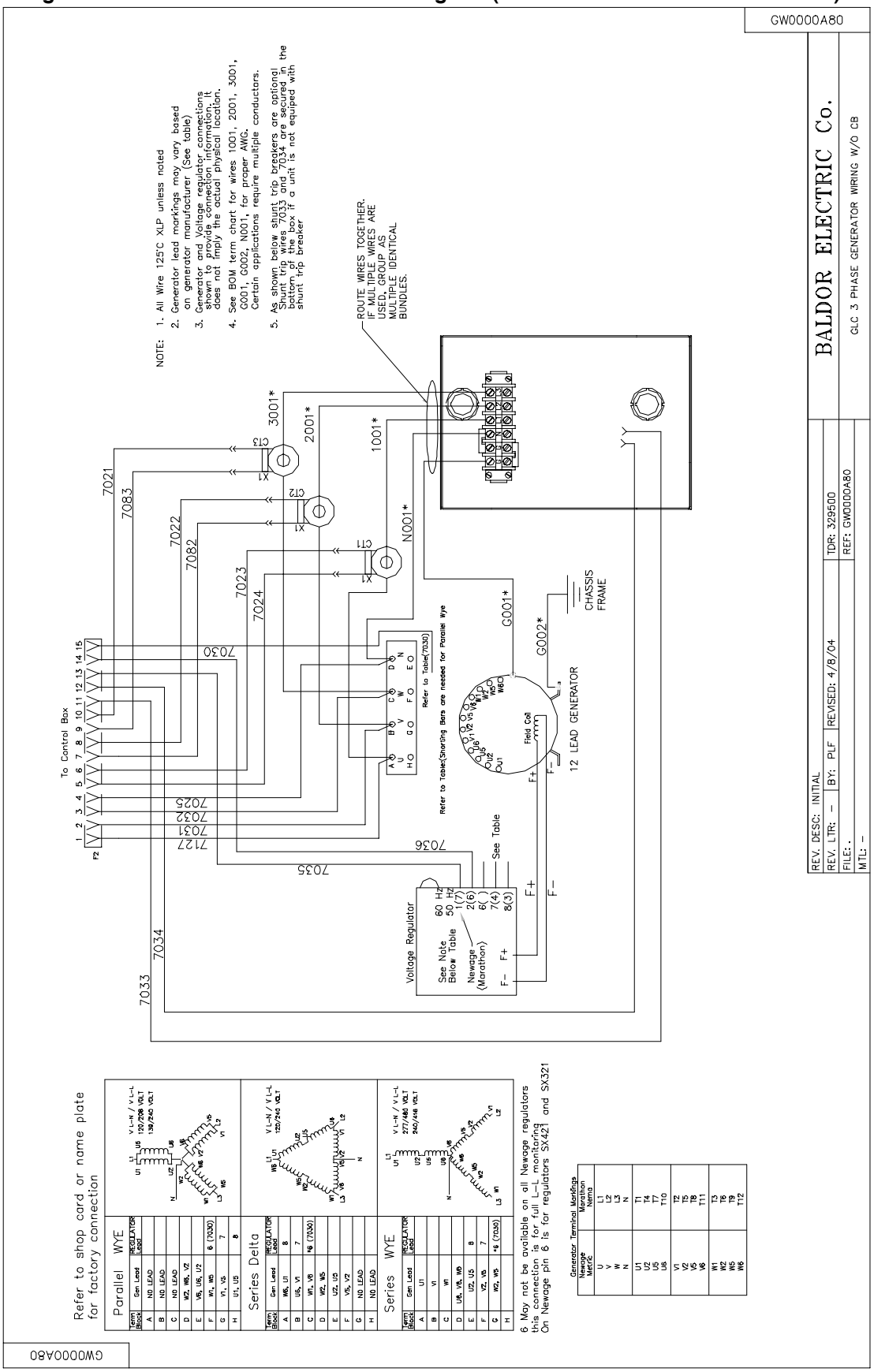


Figure A-18 Control Box Connections with MEC20 Controller

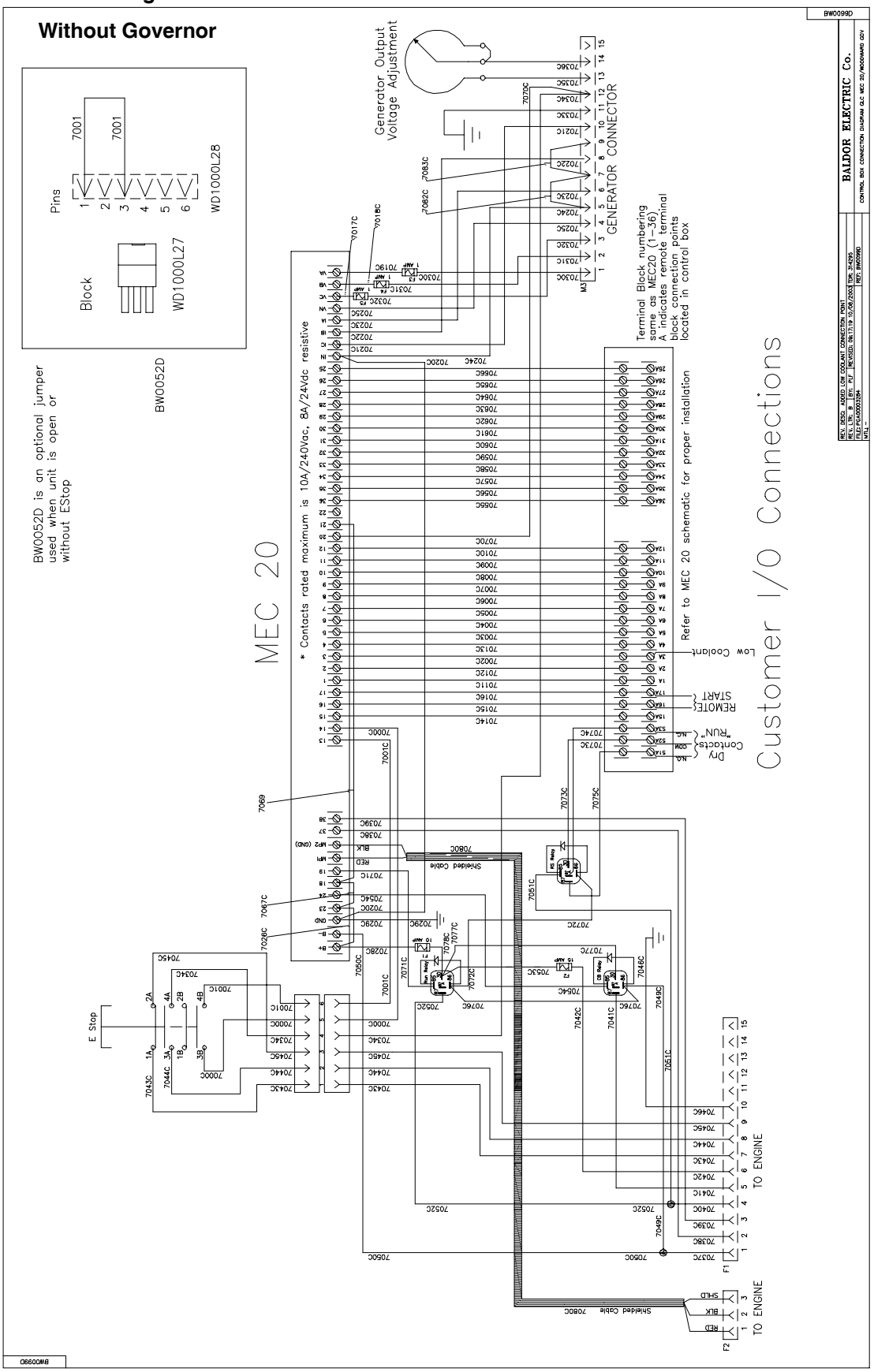


Figure A-19 Control Box Connections with MEC20 Controller & Governor

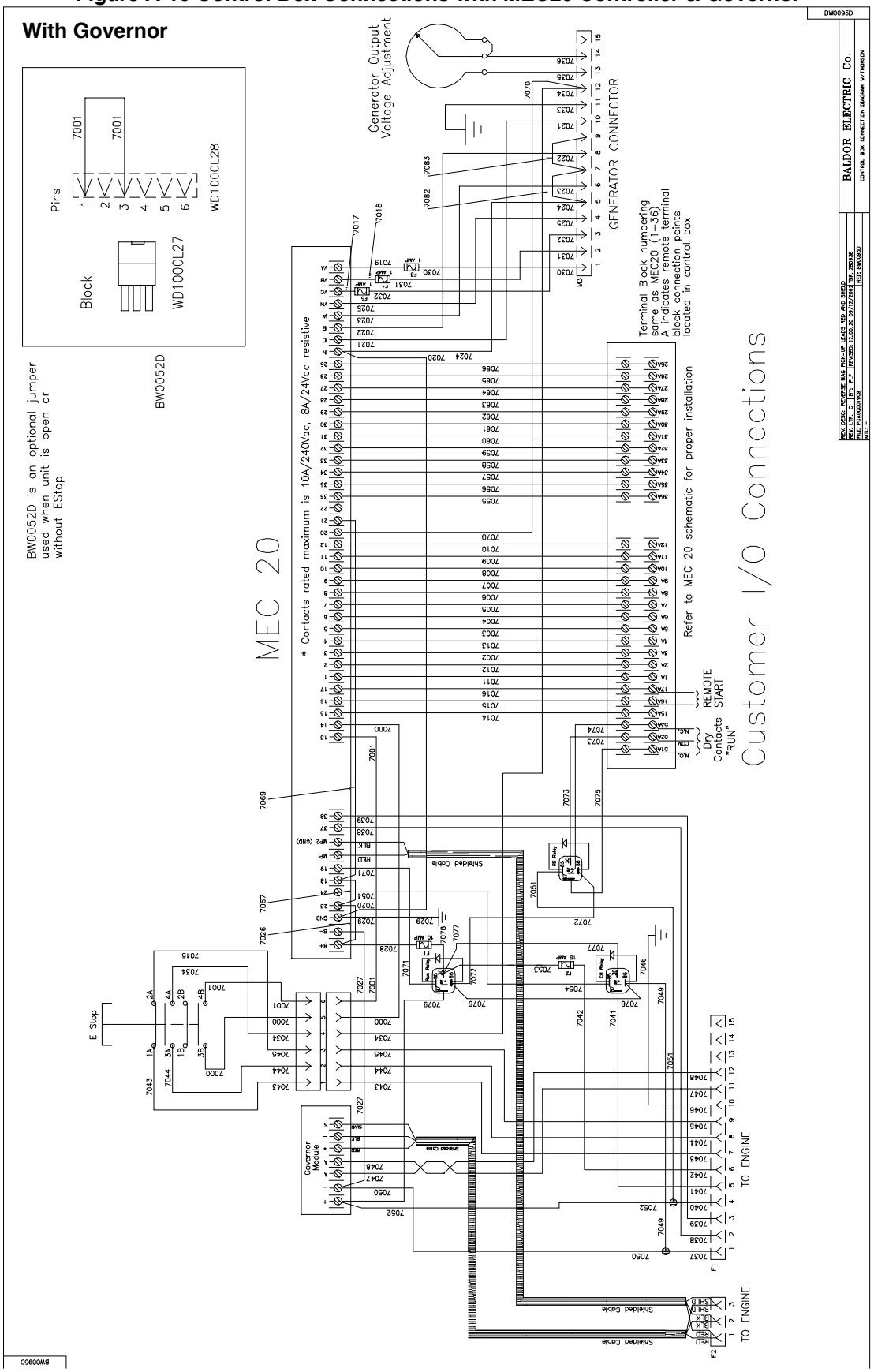


Figure A-20 Control Box Connections with MEC2 Controller

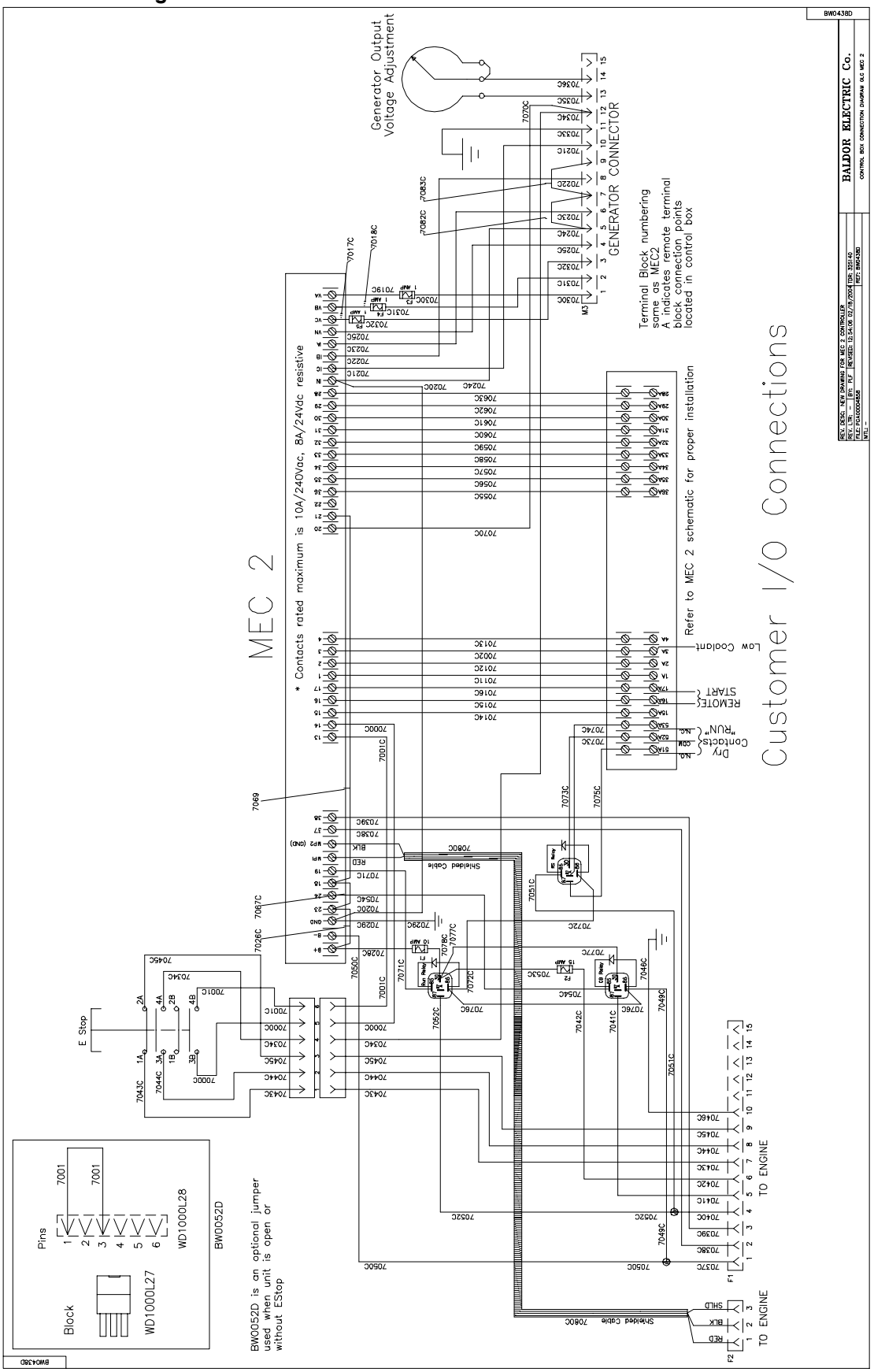


Figure A-21 Engine Wiring, Woodward 4.3L GM

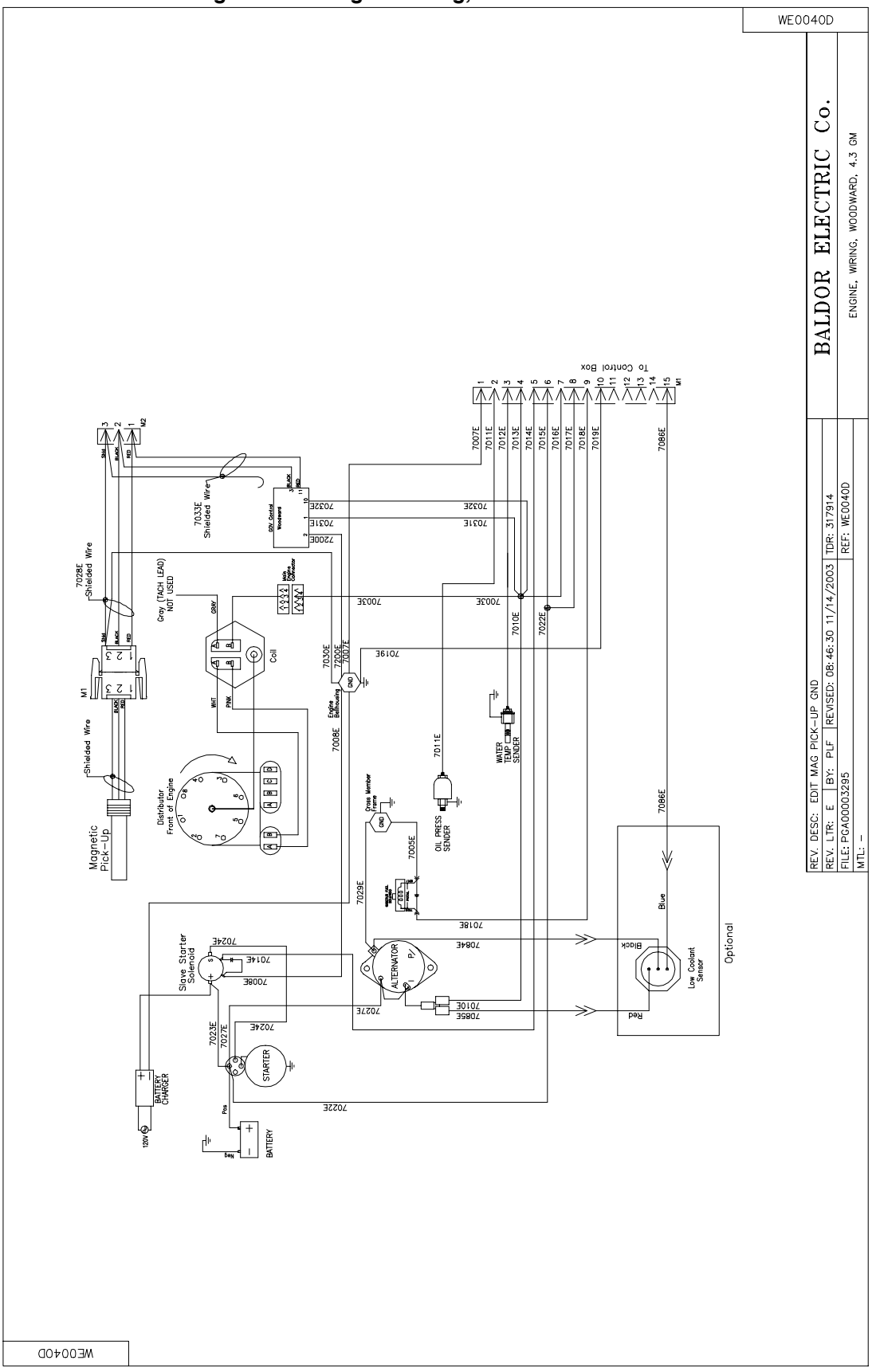


Figure A-22 Engine Wiring, Woodward 5.7L GM

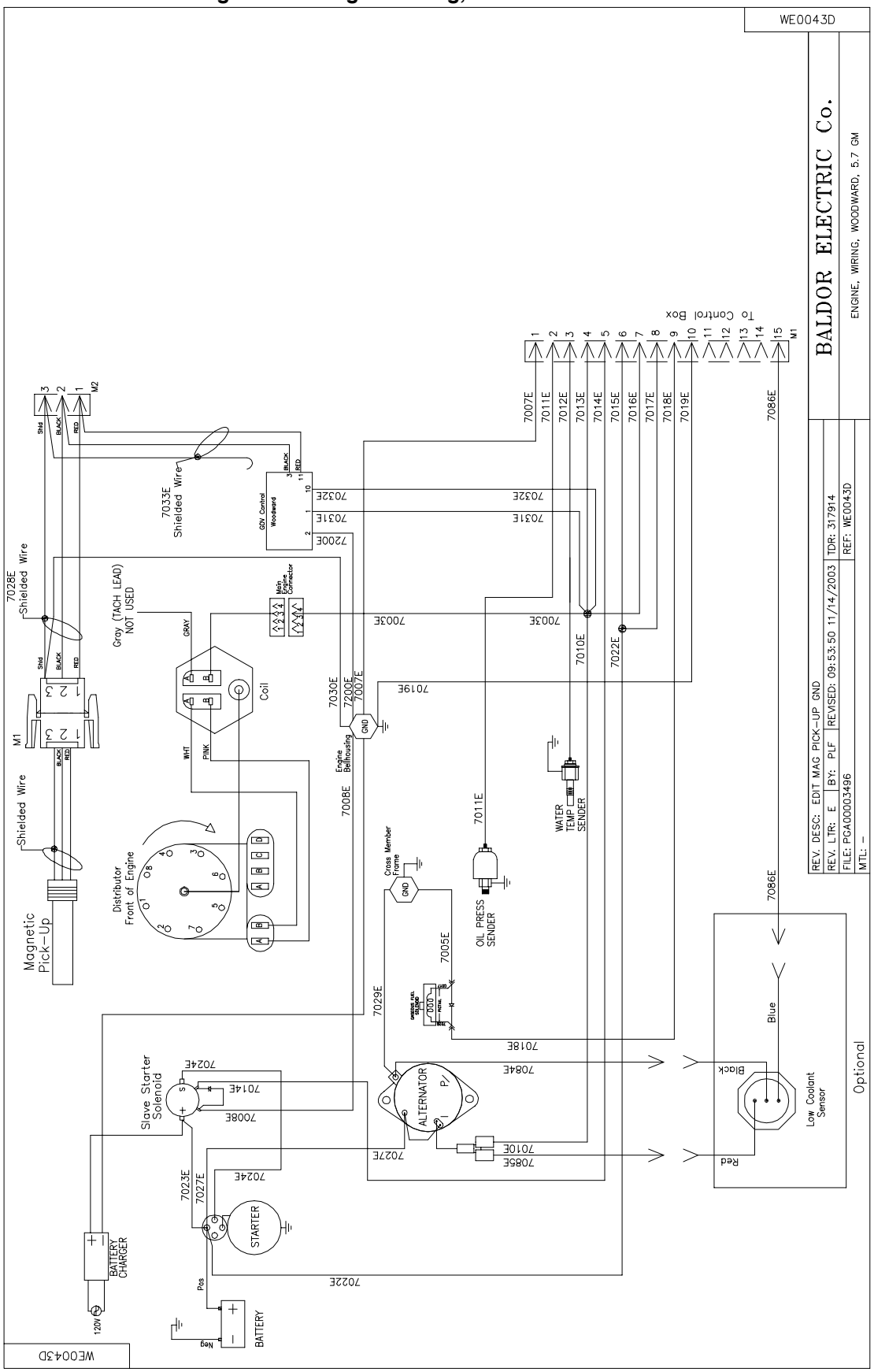
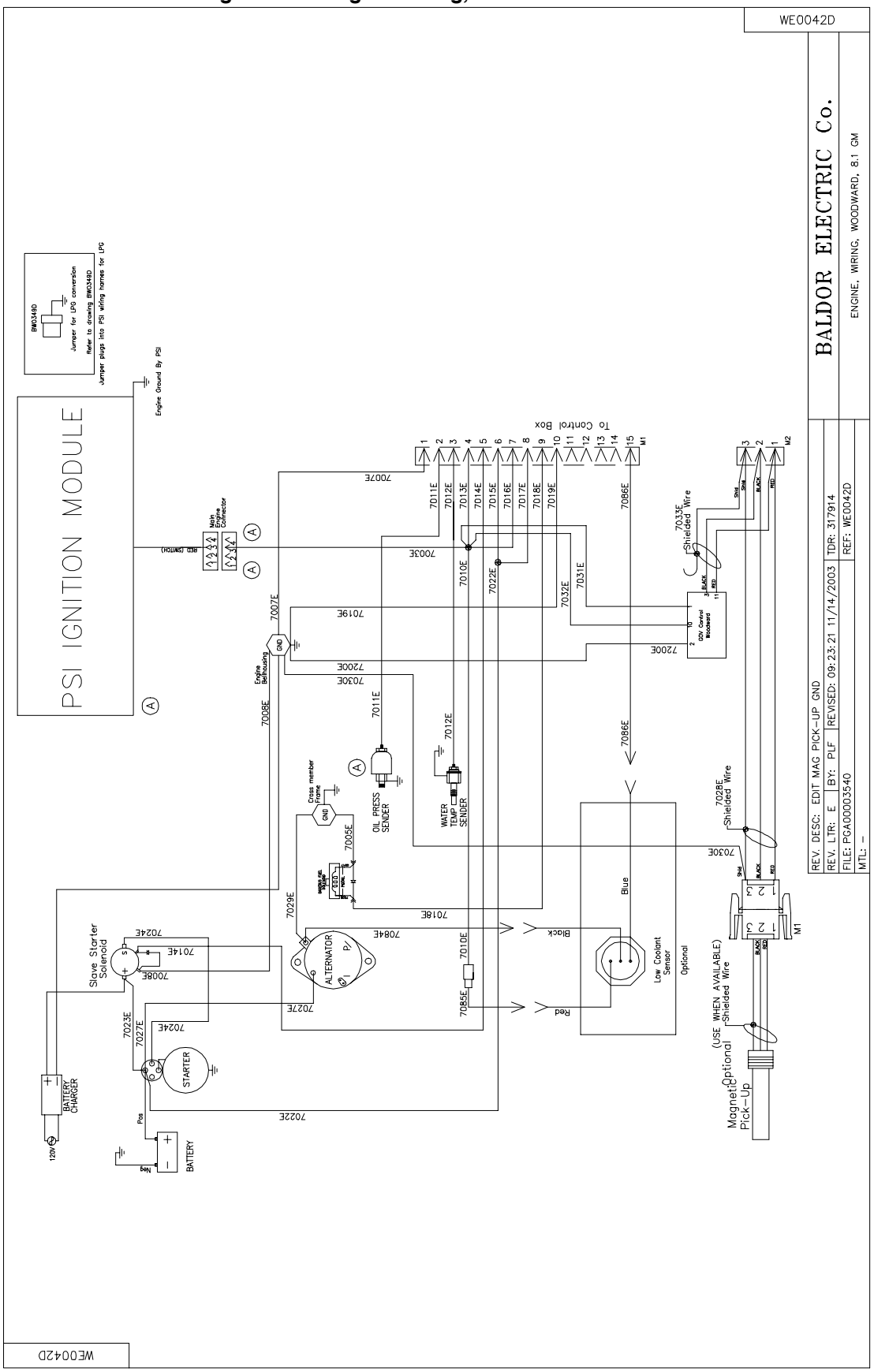


Figure A-23 Engine Wiring, Woodward 8.1L GM



Start–up Inspection Form It is required that both sides of this form be completed, signed where indicated and returned to Baldor Generators within 30 days of initial Start–up and test. It is your responsibility to deliver copies to:

☑ Baldor Generators Factory ☑ Baldor Distributor ☑ Customer

BALDOR® GENERATORS

START-UP INSPECTION FORM

For Standby, Automatic Emergency and Prime Power Generators

Distributor Information	End User / Owner Information
Name:	Name:
Address:	Address:
Phone:	Phone:

Model Number:	Job Number:
_____ RPM _____ Hz _____ P.F.	☐ Standby ☐ Continuous
_____ kW _____ Volts	_____ KVA _____ Amps.
Engine Model #:	Generator Model #:
Engine Serial #:	Generator Serial #:

List Items Installed by Distributor:	List Items Installed by Others:

Engine Hour Meter	Power Output kW No Load	Voltage (Phase–to–Phase)			Current				Oil Temp.	Oil Pressure	Water Temp.	Ambient Temp.
		1–2	2–3	3–1	1	2	3	Hz				

Start–up Performed by:	Date:
Address:	Technician:
Phone:	Customer Signature:

✓	Pre Start-up Check List	✓	Start-up Procedure
	No freight damage (Components tight, straight, etc.).		Check that all applicable warning decals are in their proper place and are legible.
	Proper belt alignment and tensions.		The ATS engine start wires and other DC wires, if any, must be properly connected.
	Flex fuel lines installed between engine and tank.		All wiring connections are tight.
	Fluid levels (Oil, Antifreeze, Battery, Governor, etc.) Check for leaks, tighten as necessary.		The equipment room is clean & all unrelated materials removed.
	Correct fuel and exhaust plumbing.		The equipment is protected from possible fire damage by fire extinguisher system.
	Adequate air flow.		Earthquake protection (when applicable) is adequate for the equipment.
	Correct AC wire sizes and connections.		Open generator mainline breaker or remove fuses.
	Correct DC wire sizes and connections (route separate from AC).		Turn down speed potentiometer (electronic governor) or speed screw (mechanical governor).
	Block heater is operational.		Move switch to "manual". Let the engine start & run.
	Bleed and prime the fuel system; check for leaks. Correct as necessary.		After a few minutes, check oil pressure & check for leaks.
	On natural gas fueled sets, gas pressure of 4-6 oz. of pressure with adequate volume is available.		Adjust the speed to 60/50Hz if equipped with electronic governor or 63/53 Hz with mechanical governor.
	Gas solenoid valve is properly functioning.		If speed is unstable, adjust per engine or governor manual.
	Exhaust line and flexible connections are properly installed without excessive bends and restrictions.		Adjust the AC voltage to match the normal source.
	Exhaust system termination properly located to prevent entry of exhaust gas into building.		Let the unit run until engine reaches proper water temp.
	Batteries properly filled with electrolyte & properly connected to the engine.		Close generator mainline breaker or replace fuses.
	Battery charger must be properly installed & connected to the battery. Battery must be fully charged prior to start-up.		Manually over-speed the unit until engine shutdown (68-70 Hz for 60 Hz generators ; 58-60 Hz for 50 Hz generator sets).
	Generator load connectors of proper ampacity are connected to either the circuit breaker or the emergency side of the transfer switch.		Test automatic shut-downs (low oil pressure, low coolant level, high coolant temperature, Overspeed set to _____Hz Other_____)
	The nameplate voltage & frequency of the Genset matches that of ATS & normal source.		***** Instruct End User On Functions Of Unit *****. Set Times to Customer's Request and Run a Simulated Power Outage.
			Instruct the customer in proper operation & maintenance of the system and make sure they have correct manuals.

Return this completed form to:

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