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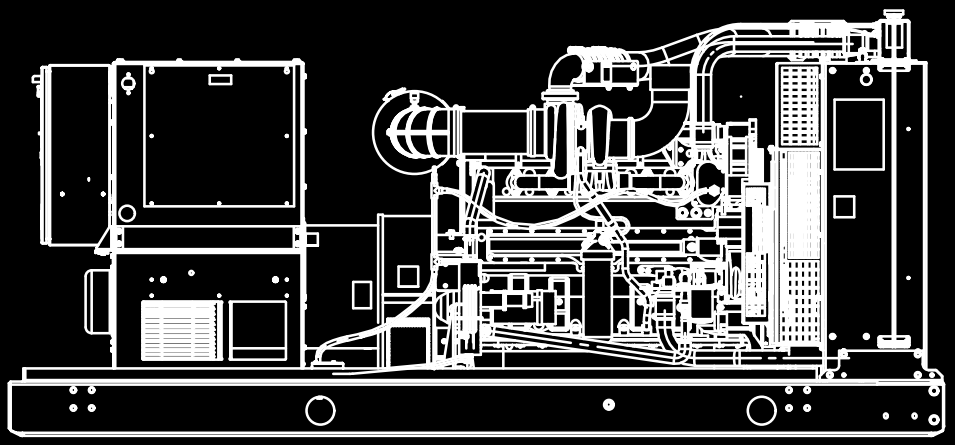
Power Generation

Installation Manual

PowerCommand® Control
3200 Series
Generator Sets



Models
DFEG, DFEH, DFEJ, DFEK

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960-0633B 02-2004

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California

Proposition 65 Warning

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

IMPORTANT SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS – This manual contains important instructions that should be followed during installation and maintenance of the generator and batteries.

Before operating the generator set (genset), read the Operator's Manual and become familiar with it and the equipment. **Safe and efficient operation can be achieved only if the equipment is properly operated and maintained.** Many accidents are caused by failure to follow fundamental rules and precautions.

The following symbols, found throughout this manual, alert you to potentially dangerous conditions to the operator, service personnel, or the equipment.

⚠ DANGER ***This symbol warns of immediate hazards which will result in severe personal injury or death.***

⚠ WARNING ***This symbol refers to a hazard or unsafe practice which can result in severe personal injury or death.***

⚠ CAUTION ***This symbol refers to a hazard or unsafe practice which can result in personal injury or product or property damage.***

FUEL AND FUMES ARE FLAMMABLE

Fire, explosion, and personal injury or death can result from improper practices.

- DO NOT fill fuel tanks while engine is running, unless tanks are outside the engine compartment. Fuel contact with hot engine or exhaust is a potential fire hazard.
- DO NOT permit any flame, cigarette, pilot light, spark, arcing equipment, or other ignition source near the generator set or fuel tank.
- Fuel lines must be adequately secured and free of leaks. Fuel connection at the engine should be made with an approved flexible line. Do not use zinc coated or copper fuel lines with diesel fuel.
- Be sure all fuel supplies have a positive shutoff valve.
- Be sure battery area has been well-ventilated prior to servicing near it. Lead-acid batteries emit a highly explosive hydrogen gas that can be ignited by arcing, sparking, smoking, etc.

EXHAUST GASES ARE DEADLY

- Provide an adequate exhaust system to properly expel discharged gases away from enclosed or sheltered areas and areas where individuals are likely to congregate. Visually and audibly inspect the exhaust daily for leaks per the maintenance schedule. Make sure that exhaust manifolds are secured and not warped. Do not use exhaust gases to heat a compartment.
- Be sure the unit is well ventilated.
- Engine exhaust and some of its constituents are known to the state of California to cause cancer, birth defects, and other reproductive harm.

MOVING PARTS CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- Keep your hands, clothing, and jewelry away from moving parts.
- Before starting work on the generator set, disconnect battery charger from its AC source, then disconnect starting batteries, negative (**–**) cable first. This will prevent accidental starting.
- Make sure that fasteners on the generator set are secure. Tighten supports and clamps, keep guards in position over fans, drive belts, etc.
- Do not wear loose clothing or jewelry in the vicinity of moving parts, or while working on electrical equipment. Loose clothing and jewelry can become caught in moving parts.
- If adjustment must be made while the unit is running, use extreme caution around hot manifolds, moving parts, etc.

DO NOT OPERATE IN FLAMMABLE AND EXPLOSIVE ENVIRONMENTS

Flammable vapor can cause an engine to overspeed and become difficult to stop, resulting in possible fire, explosion, severe personal injury and death. Do not operate a genset where a flammable vapor environment can be created by fuel spill, leak, etc., unless the genset is equipped with an automatic safety device to block the air intake and stop the engine. The owners and operators of the genset are solely responsible for operating the genset safely. Contact your authorized Cummins Power Generation distributor for more information.

ELECTRICAL SHOCK CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- Remove electric power before removing protective shields or touching electrical equipment. Use rubber insulative mats placed on dry wood platforms over floors that are metal or concrete when around electrical equipment. Do not wear damp clothing (particularly wet shoes) or allow skin surface to be damp when handling electrical equipment. Do not wear jewelry. Jewelry can short out electrical contacts and cause shock or burning.
- Use extreme caution when working on electrical components. High voltages can cause injury or death. DO NOT tamper with interlocks.
- Follow all applicable state and local electrical codes. Have all electrical installations performed by a qualified licensed electrician. Tag and lock open switches to avoid accidental closure.
- DO NOT CONNECT GENERATOR SET DIRECTLY TO ANY BUILDING ELECTRICAL SYSTEM. Hazardous voltages can flow from the generator set into the utility line. This creates a potential for electrocution or property damage. Connect only through an approved isolation switch or an approved paralleling device.

GENERAL SAFETY PRECAUTIONS

- Coolants under pressure have a higher boiling point than water. DO NOT open a radiator or heat exchanger pressure cap while the engine is running. Allow the generator set to cool and bleed the system pressure first.
- Used engine oils have been identified by some state or federal agencies as causing cancer or reproductive toxicity. When checking or changing engine oil, take care not to ingest, breathe the fumes, or contact used oil.
- Keep multi-class ABC fire extinguishers handy. Class A fires involve ordinary combustible materials such as wood and cloth; Class B fires, combustible and flammable liquid fuels and gaseous fuels; Class C fires, live electrical equipment. (ref. NFPA No. 10).
- Make sure that rags are not left on or near the engine.
- Make sure generator set is mounted in a manner to prevent combustible materials from accumulating under the unit.
- Remove all unnecessary grease and oil from the unit. Accumulated grease and oil can cause overheating and engine damage which present a potential fire hazard.
- Keep the generator set and the surrounding area clean and free from obstructions. Remove any debris from the set and keep the floor clean and dry.
- Do not work on this equipment when mentally or physically fatigued, or after consuming any alcohol or drug that makes the operation of equipment unsafe.
- Substances in exhaust gases have been identified by some state or federal agencies as causing cancer or reproductive toxicity. Take care not to breath or ingest or come into contact with exhaust gases.
- Do not store any flammable liquids, such as fuel, cleaners, oil, etc., near the generator set. A fire or explosion could result.
- Wear hearing protection when going near an operating generator set.
- To prevent serious burns, avoid contact with hot metal parts such as radiator, turbo charger and exhaust system.

KEEP THIS MANUAL NEAR THE GENSET FOR EASY REFERENCE

1. Introduction

ABOUT THIS MANUAL

This manual provides installation instructions for the generator set models listed on the front cover. This manual includes the following information:

Mounting Recommendations - for fastening generator set to base and space requirements for normal operation and service.

Mechanical and Electrical Connections - covers most aspects of the generator set installation.

Optional Enclosure Electrical Connections - covers installation of enclosure optional features.

Prestart − checklist of items or procedures needed to prepare generator set for operation.

Initial Startup − test complete system to ensure proper installation, satisfactory performance, and safe operation. Refer to Operators Manual for troubleshooting information.

Installation Checklist − reference checks upon completion of installation.

This manual DOES NOT provide application information for selecting a generator set or designing the complete installation. If it is necessary to design the various integrated systems (fuel, exhaust, cooling, etc.), additional information is required. Review standard installation practices. For engineering data specific to the generator set, refer to the *Specification* and *Data Sheets*. For application information, refer to Application Manual T-030, “Liquid Cooled Generator Sets”.

INSTALLATION OVERVIEW

These installation recommendations apply to typical installations with standard model generator sets. Whenever possible, these recommendations also cover factory designed options or modifications. However, because of the many variables in any installation, it is not possible to provide specific recommendations for every situation. If there are any questions not answered by this manual, contact your nearest Cummins Power Generation distributor for assistance.

Application and Installation

A standby power system must be carefully planned and correctly installed for proper operation. This involves two essential elements: application and installation.

Application (as it applies to generator set installations) refers to the design of the complete standby power system that usually includes power distribution equipment, transfer switches, ventilation equipment, mounting pads, and cooling, exhaust, and fuel systems. Each component must be correctly designed so the complete system will function as intended. Application and design is an engineering function generally done by specifying engineers or other trained specialists. Specifying engineers or other trained specialists are responsible for the design of the complete standby system and for selecting the materials and products required.

Installation refers to the actual set-up and assembly of the standby power system. The installers set up and connect the various components of the system as specified in the system design plan. The complexity of the standby system normally requires the special skills of qualified electricians, plumbers, sheetmetal workers, etc. to complete the various segments of the installation. This is necessary so all components are assembled using standard methods and practices.

Safety Considerations

The generator set has been carefully designed to provide safe and efficient service when properly installed, maintained, and operated. However, the overall safety and reliability of the complete system is dependent on many factors outside the control of the generator set manufacturer. To avoid possible safety hazards, make all mechanical and electrical connections to the generator set exactly as specified in this manual. All systems external to the generator (fuel, exhaust, electrical, etc.) must comply with all applicable codes. Make certain all required inspections and tests have been completed and all code requirements have been satisfied before certifying the installation is complete and ready for service.

Standby Heating Devices

In accordance with NFPA 110, Cummins Power Generation recommends installing diesel standby generator sets (life safety systems) equipped with engine jacket water coolant heaters in locations where the minimum ambient temperature is above 40°F (4°C). NFPA also requires that the engine jacket water coolant be maintained at a minimum of 90°F (32°C) and, for most applications, accept the emergency load in 10 seconds or less. Although most Cummins Power Generation generator sets will start in temperatures down to −25°F (−32°C) when equipped with engine jacket water coolant heaters, it might take more than 10 seconds to warm the engine up before a load can be applied when ambient temperatures are below 40°F (4°C).

The **Engine Cold (Code 1435)** message, in conjunction with illumination of the Warning LED, is provided to meet the requirements of NFPA 110. The engine cold sensing logic initiates a warning when the engine jacket water coolant temperature falls below 70°F (21°C). In applications where the ambient temperature falls below 40°F (4°C), a cold engine may be indicated even though the coolant heaters are connected. Under these conditions, although the generator set may start, it may not be able to accept load within 10 seconds. When this condition occurs, check the coolant heaters for proper operation. If the coolant heaters are operating properly, other precautions may be necessary to warm the engine before applying a load.

2. Specifications

MODEL	DFEG, DFEH, DFEJ, DFEK
Cummins Diesel Series	QSX15 (50/60 Hz)
Generator Kw Rating	See Genset Nameplate for rating information.
Cooling System (Capacity Std. Raidiator) − Gal (L)	15.3 (58)
Lubricating System Oil Cap. w/Filters Oil Type*	 26 Gallons (58 L)
Engine Fuel Connection Inlet/Outlet Thread Size	 Refer to Generator Outline Drawing
Fuel Flow Max. Fuel Inlet Pressure Max. Fuel Inlet Restriction Max. Fuel Return Restriction	 10 PSI (69 kPa) 5 in. Hg. (16.9 kPa) 3.05 in. Hg. (10.3 kPa)
Exhaust Outlet Size Maximum Allowable Back Pres. H_20 kPa Hg	 6” NPT Male STD. (A299)/ASA Flange (A355) or Slip-on (A298) Optional 27 in (686 mm) 6.8 2.0 in (51 mm)
Electrical System Starting Voltage Battery Group number CCA (minimum) Cold Soak @ 0° F (-18° C)	 24 Volts DC Two, 12 Volt 8D 1400
* Refer to Cummins QSX15 Series Engine Operation and Maintenance Manual for lubricating oil recommendations/specifications.	

FUEL CONSUMPTION (STANDBY/FULL LOAD/60HZ)

MODEL	DFEG	DFEH	DFEJ	DFEK
US gph (L/hr)	24.6 (93.2)	27.1 (102.7)	30 (113.7)	34.8 (131.9)

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3. Mounting the Generator Set

GENERAL

Generator set installations must be engineered so the generator set will function properly under the expected load conditions. Use these instructions as a general guide only. Follow the instructions of the consulting engineer when locating or installing any components. The complete installation must comply with all local and state building codes, fire ordinances, and other applicable regulations.

Requirements to be considered prior to installation:

- Level mounting surface
- Adequate cooling air
- Adequate fresh induction air
- Discharge of generator set air
- Discharge of exhaust gases
- Non-combustible mounting surface.
- Electrical connections
- Accessibility for operation and servicing
- Noise levels
- Vibration isolation

LOCATION

Generator set location is decided mainly by related systems such as ventilation, wiring, fuel, and exhaust. The set should be located as near as possible to the main power breaker box. Exhaust must not be able to enter or accumulate around inhabited areas.

Provide a location away from extreme ambient temperatures and protect the generator set from adverse weather conditions.

⚠WARNING

INCORRECT INSTALLATION, SERVICE OR PARTS REPLACEMENT CAN RESULT IN SEVERE PERSONAL INJURY, DEATH, AND/OR EQUIPMENT DAMAGE. SERVICE PERSONNEL MUST BE TRAINED AND EXPERIENCED TO PERFORM ELECTRICAL AND MECHANICAL COMPONENT INSTALLATION.

IMPORTANT

DEPENDING ON YOUR LOCATION AND INTENDED USE, FEDERAL, STATE OR LOCAL LAWS AND REGULATIONS MAY REQUIRE YOU TO OBTAIN AN AIR QUALITY EMISSIONS PERMIT BEFORE BEGINNING INSTALLATION OF YOUR GENSET. BE SURE TO CONSULT LOCAL POLLUTION CONTROL OR AIR QUALITY AUTHORITIES BEFORE COMPLETING YOUR CONSTRUCTION PLANS.

MOVING

⚠WARNING ***Generator set weight can cause severe personal injury or death. Use extreme caution when lifting, hoisting, or moving the generator set. Make certain to use a hoist or other lifting device whose capacity is rated well above the weight of the generator set. The generator sets models listed on the front cover of this manual can weigh 9800 pounds (4445 kgs) (refer to Specification Sheet for Model weight). Make certain that the maximum lifting capacity of the hoist exceeds the weight of the generator set by a large margin. Follow the manufacturer's instructions carefully regarding the weight capacity of the hoist and the recommended hoisting procedure.***

When lifting, hoisting, or moving the generator set, use only the lifting eyes (optional) or skid lifting holes as shown in Figure 3-1. **Do not attach lifting device to brackets on engine or generator.** These brackets are only used and designed for the removal of the engine or the generator from the generator set.

⚠WARNING ***Improper genset lifting can cause severe personal injury or death. Do not use engine or generator lift brackets to move or hoist the generator set. Brackets are designed for weight of engine or generator only. When moving or lifting genset, use skid eye brackets/ holes.***

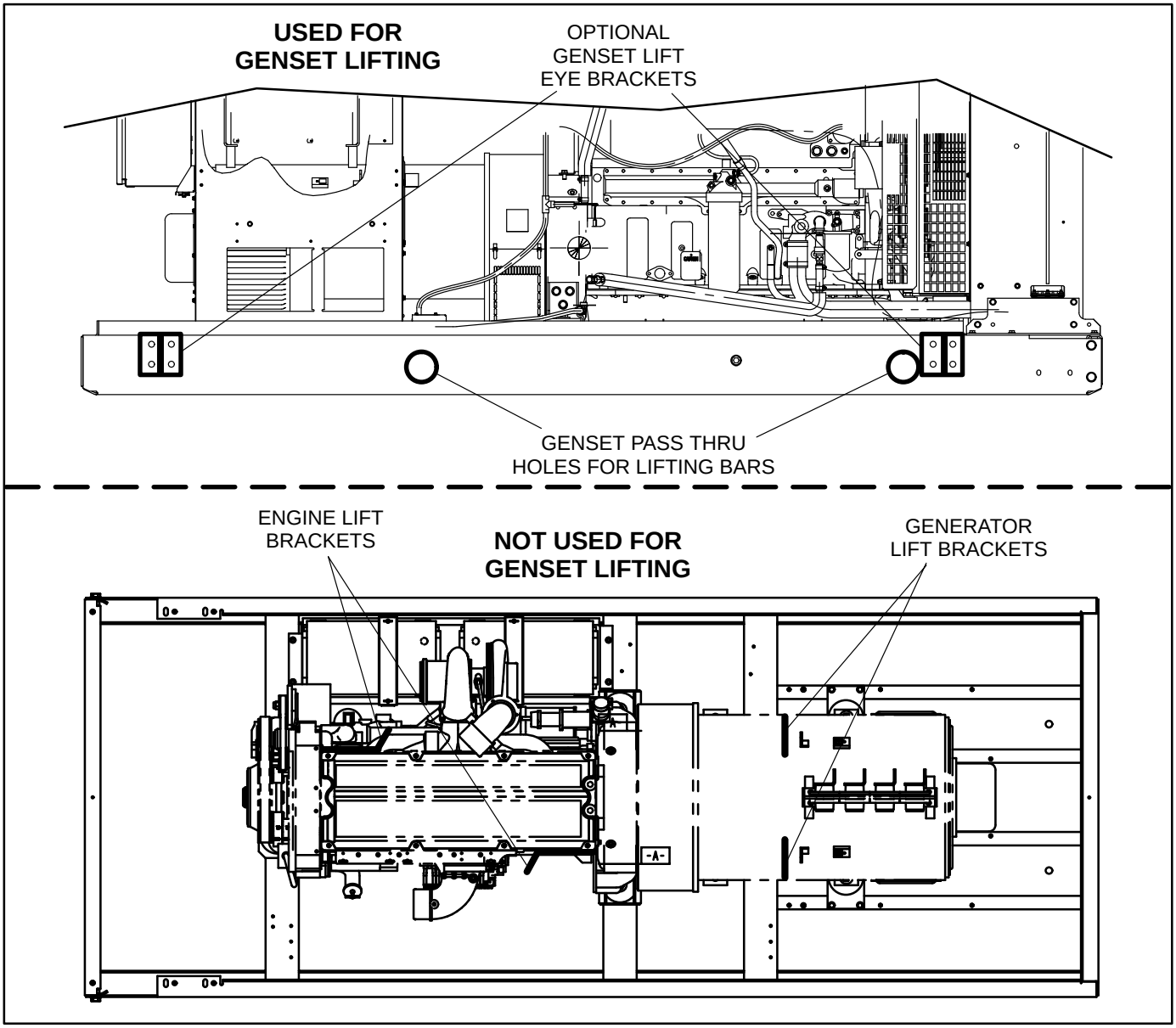

FIGURE 3-1. GENERATOR SET LIFTING/HOISTING/MOVING LOCATIONS

MOUNTING

Generator sets are mounted on a steel skid or fuel tank that provide proper support. The engine-generator assembly is isolated from the skid frame by rubber mounts that provide adequate vibration isolation for normal installations. Where required by building codes or special isolation needs, generator sets may be mounted on rubber pads or mechanical spring isolators. The use of unapproved isolators may result in harmful resonances and may void the genset warranty.

For fuel tank mounted generator sets, it is required that the tank be mounted such that an air space is provided between the bottom of the tank and the floor underneath to reduce corrosion and permit visual inspections for leaks.

Mount the generator set on a substantial and level base such as a concrete pad. A non-combustible material must be used for the pad.

Use 5/8 inch or 16 mm anchored mounting bolts to secure the vibration isolators to the base. Secure the vibration isolators using flat or bevel washer and hexagonal nut for each bolt (see Figure 3-1). The 1-1/2 x 6 inch pipe inserted over the mounting bolts allows minor adjustment of the bolts to align them to the holes in the subbase or vibration isolator.

Locate the isolators as shown on the generator set *Outline Drawing* referenced in the *Data Sheet*.

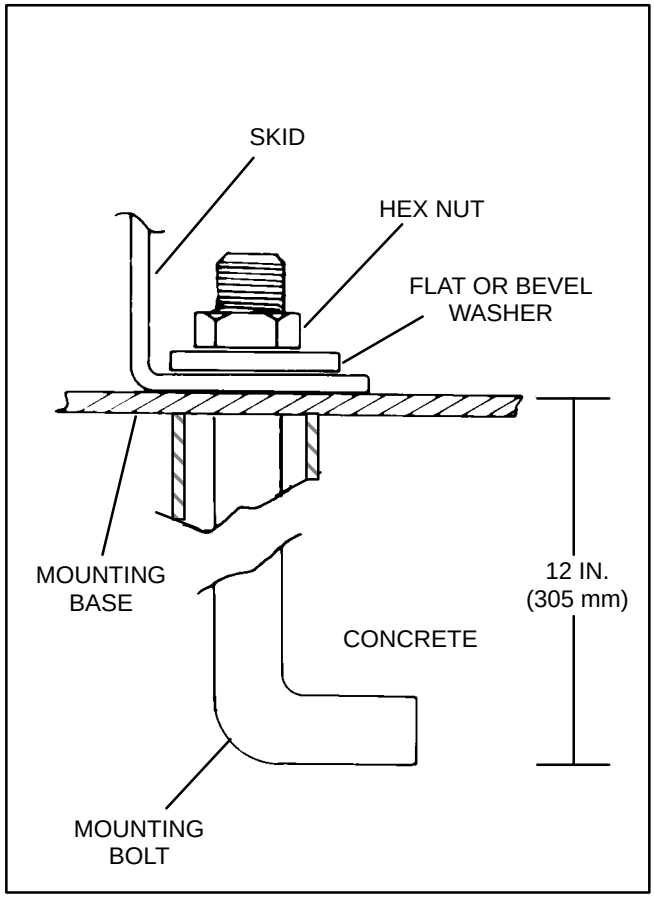

FIGURE 3-2. BOLT DIAGRAM

ACCESS TO SET

Generally, at least 1 meter (3 feet) of clearance should be provided on all sides of the generator set for maintenance and service access. A raised foundation or slab of 150 mm (6 inches) or more above floor level will make servicing easier.

Lighting should be adequate for operation, maintenance and service operations and should be connected on the load side of the transfer switch so that it is available at all times.

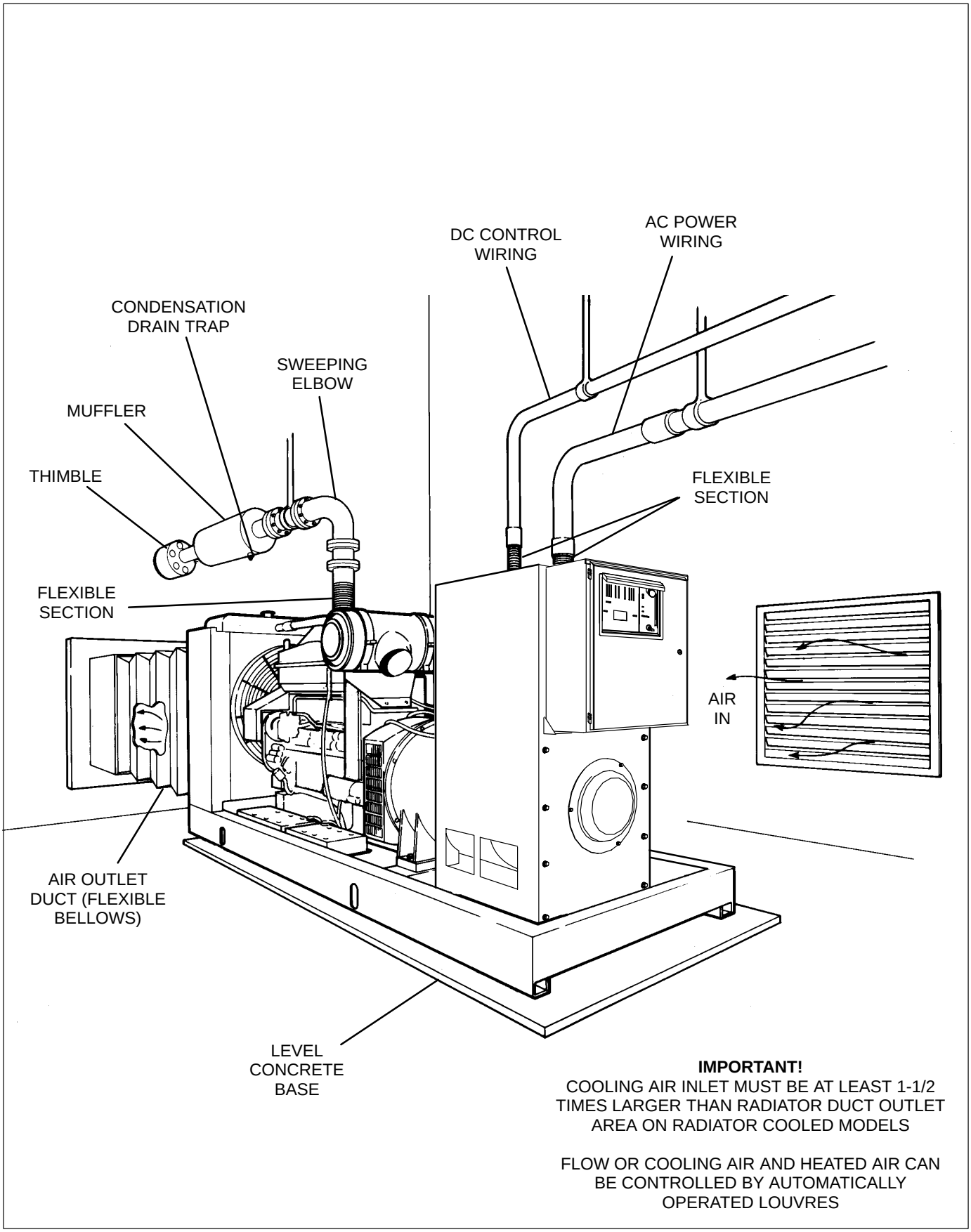

FIGURE 3-3. TYPICAL INSTALLATION

VIBRATION ISOLATORS

Installation and Adjustment Procedure

1. Place the vibration isolators (Figure 3-4) on the genset support structure. The isolators should be shimmed or grouted to ensure that all of the isolator bases are within 0.25 inch (6 mm) elevation of each other. The surface that the isolator bases rest on must also be flat and level.
2. Loosen the side snubber lock nuts so that the top plate of the isolator is free to move vertically and horizontally. Be sure that the top plate is correctly aligned with the base and springs.
3. Place the genset onto the isolators while aligning the skid's mounting with the threaded isolator hole. The top plates will move down and approach the base of the isolator as load is applied.
4. Once the genset is in position, the isolators may require adjusting so that the set is level. The isolators are adjusted by inserting the leveling bolt through the skid and into the isolator (the leveling bolt's locking nut should be threaded up towards the bolt head).

   The leveling bolt will adjust the clearance between the top plate and the isolator base. A nominal clearance of 0.25 inch (6 mm) or greater is desired. This will provide sufficient clearance for the rocking that occurs during startup and shutdown. If the 0.25 inch (6 mm) clearance is not present, turn the leveling bolt until the desired clearance is achieved.
5. The genset may not be level yet; therefore, adjust the leveling bolts until the set is level and sufficient clearance still remains. (Clearance on all isolators should be roughly equal). Once all isolators have been set, lock the leveling bolt in place with the lock nut.
6. The snubber nuts must remain loose and therefore provide better isolation between the genset and support structure.

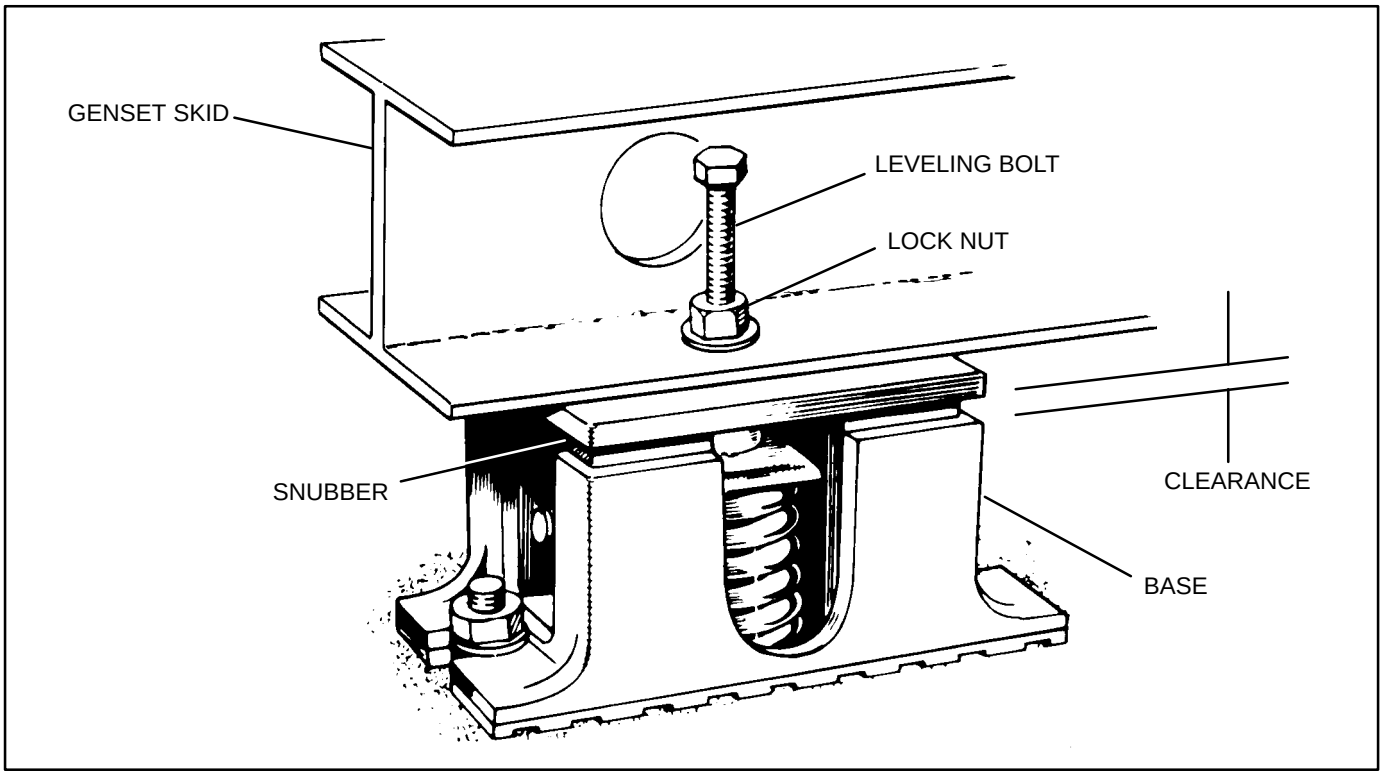

FIGURE 3-4. VIBRATION ISOLATORS

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4. Mechanical Connections

GENERAL

The generator set mechanical system installation includes connecting the fuel, exhaust, ventilation and cooling systems. Before starting any type of fuel installation, all pertinent state and local codes must be complied with and the installation must be inspected before the unit is put in service.

FUEL SYSTEM

Cummins engines normally use ASTM No. 2 diesel fuel. They will, however, operate on alternate diesel fuels within the specifications shown in the Cummins engine *Operation and Maintenance Manual.*

In all fuel system installations, cleanliness is of the upmost importance. Make every effort to prevent entrance of moisture, dirt or contaminants of any kind into the fuel system. Clean all fuel system components before installing.

A fuel filter/strainer/water separator of 100-120 mesh or equivalent (approximately 150 microns nominal) must be fitted between either the main tank and day tank or between the main tank and the engine.

Use only compatible metal fuel lines to avoid electrolysis when fuel lines must be buried. Buried fuel lines must be protected from corrosion.

⚠ **CAUTION** ***Never use galvanized or copper fuel lines, fittings or fuel tanks. Condensation in the tank and lines combines with the sulfur in diesel fuel to produce sulfuric acid. The molecular structure of the copper or galvanized lines or tanks reacts with the acid and contaminates the fuel.***

An electric solenoid valve in the supply line is recommended for all installations and required for indoor automatic or remote starting installations. Connect the solenoid wires to TB3-5 and TB3-6 (see Customer Connections, Section 9) which provide switched B+ that opens the valve during genset operation and closes the valve 10 seconds after a stop signal is received. This 10 second delay keeps the fuel line open during genset shutdown (normal or warning) sequence. If the valve is allowed to close before the engine stops, hard starts and possible damage to the engine can occur.

⚠ **CAUTION** ***Hard starts or engine damage will occur if fuel supply solenoid is not connected to the Delayed Switched B+ circuit. Fuel supply line must remain open until engine has completely stopped.***

Separate fuel return lines to the day tank or supply tank must be provided for each generator set in a multiple-set installation to prevent the return lines of idle sets from being pressurized. Fuel return lines must not contain a shutoff device. Engine damage will occur if the engine is run with the return fuel lines blocked or restricted.

⚠ **CAUTION** ***Never install shutoff device in fuel return line(s). If fuel return line(s) is blocked or exceeds fuel restriction limit, engine damage will occur.***

Fuel Return Restriction (or Pressure) Limit: Fuel return drain restriction (consisting of friction head and static head) between the engine injector return line connection and the fuel tank must not exceed the limit stated in the *Specification* section.

Fuel Lines − Routing

A flexible fuel hose(s) or section of flexible fuel hose(s) must be used between the engine's fuel system and fuel supply and return line(s) to protect the fuel system from damage caused by vibration, expansion and contraction. Flexible lines for connecting between the engine and the stationary fuel lines are supplied as standard equipment.

Installation of the fuel hose must be done according to all applicable codes and standards, and installation recommendations provided by the manufacturer. The supplied flexible hose is approved by the hose manufacture for use with the genset fuel type and product application.

Support fuel lines to restrain movement and prevent chaffing or contact with sharp edges, electrical wiring and hot exhaust parts.

⚠WARNING ***Sparks and hot surfaces can ignite fuel, leading to severe personal injury or death. Do not route fuel lines near electrical wiring or hot exhaust parts.***

Fuel lines must be routed and secured to maintain a 1/2 inch (12.7 mm) minimum clearance from electrical wiring and a 2 inch (51 mm) minimum clearance from hot exhaust parts.

Engine Fuel Connections

Identification tags are attached to the fuel supply line and fuel return line connections.

Supply Tank

Locate the fuel tank as close as possible to the generator set and within the restriction limitations of the fuel pump.

Install a fuel tank that has sufficient capacity to supply the genset operating continuously at full rated load for the planned period of operation or power outage. Refer to the *Specification* section for fuel consumption data.

⚠WARNING ***Fuel leaks create fire and explosion hazards which can result in severe personal injury or death. Always use flexible tubing between engine and fuel supply to avoid line failure and leaks due to vibration. The fuel system must meet applicable codes.***

If the fuel inlet restriction exceeds the defined limit due to the distance/customer-supplied plumbing between the genset and the main fuel tank, a transfer tank (referred to as a day tank) and auxiliary pump will also be required. If an overhead main fuel tank is installed, a transfer tank and float valve will be required to prevent fuel head pressures from being placed on the fuel system components.

For critical start applications, where generator sets are paralleled or must satisfy emergency start-time requirements, it is recommended that a fuel tank or reservoir be located such that the lowest possible fuel level is not less than 6 inches (150 mm) above the fuel pump inlet. This will prevent air from accumulating in the fuel line while the set is in standby, eliminating the period during startup when it has to be purged.

Fuel Inlet Pressure/Restriction Limit: Engine performance and fuel system durability will be compromised if the fuel inlet pressure or restriction limits are not adhered to. Fuel inlet pressure or restriction must not exceed the limits stated in the *Specification* section.

Day Tank (If Used)

Fuel day tanks are used when fuel inlet restriction limits can not be met, or the supply tank is overhead and presents problems of high fuel head pressure for the fuel inlet and return lines.

Supply Tank Lower Than Engine: With this installation, the day tank is installed near the generator set, below the fuel injection system and within the fuel inlet restriction limit. Install an auxiliary fuel pump, to pump fuel from the supply tank to the day tank. A float switch in the day tank controls operation of the auxiliary fuel pump.

The supply tank top must be below the day tank top to prevent siphoning from the fuel supply to the day tank.

Provide a return line from the engine injection system return connection to the day tank. Plumb the return line to the bottom of day tank as shown in Figure 4-1. Provide a day tank overflow line to the supply tank in case the float switch fails to shut off the fuel transfer pump. Also, the overflow line should be one pipe diameter larger than the supply line.

⚠WARNING Spilled fuel presents the hazard of fire or explosion which can result in severe personal injury or death. Provide an overflow line to the supply tank from the day tank.

Supply Tank Higher Than Engine: Install the day tank near the generator set, but below the fuel injection system. Use fuel line at least as large as the fuel pump inlet. The engine fuel return line must enter the day tank.

Include a shutoff valve in the fuel line between the fuel supply tank and the day tank to stop fuel flow when the generator set is off.

⚠WARNING Spilled fuel can create environmental hazards. Check local requirements for containment and prevention of draining to sewer and ground water.

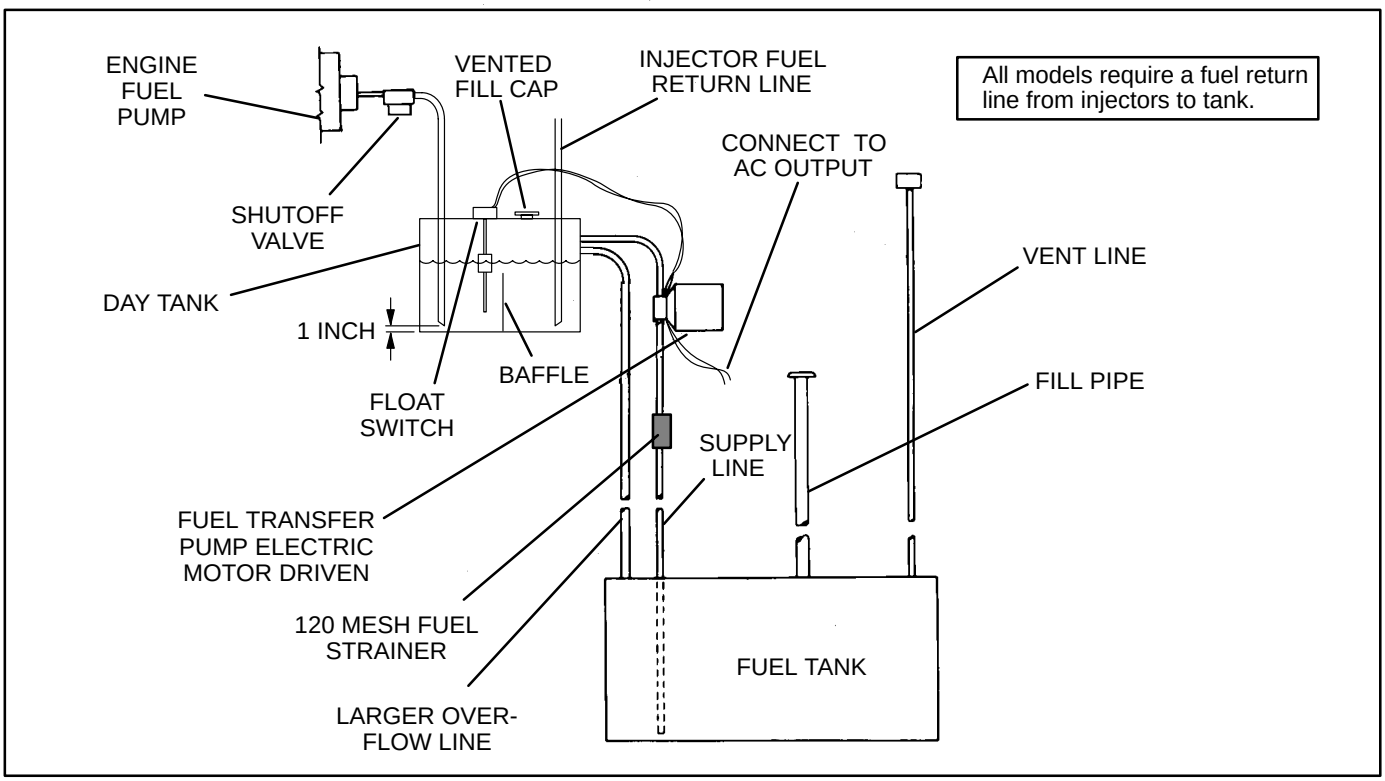

FIGURE 4-1. TYPICAL FUEL SUPPLY INSTALLATION

EXHAUST SYSTEM

Pipe exhaust gases to the outside of any enclosure. Locate the exhaust outlets away from any air inlets to avoid gases re-entering the enclosure. Exhaust installations are subject to various detrimental conditions such as extreme heat, infrequent operation and light loads. Regularly inspect the exhaust system both visually and audibly to see that the entire system remains fume tight and safe for operation.

⚠WARNING ***Inhalation of exhaust gases can result in severe personal injury or death. Use extreme care during installation to provide a tight exhaust system. Terminate exhaust pipe away from enclosed or sheltered areas, windows, doors and vents.***

For indoor installation, the exhaust system must use sealed joint type fittings, (for example NPT fittings) to provide a tighter exhaust system. Use of slip type fittings (secured with a muffler clamp) may allow leakage of exhaust gases into the building.

⚠WARNING ***Inhalation of exhaust gases can result in severe personal injury or death. Use extreme care during installation to provide a tight exhaust system. Use NPT or equivalent type fittings for all indoor installations.***

Use an approved thimble (Figure 4-2) where exhaust pipes pass through wall or partitions. Insulated wall/roof thimbles are used where exhaust pipes pass through a combustible roof or wall. This includes structures, such as wood framing or insulated steel decking, etc. Uninsulated wall/roof thimbles are used where exhaust pipes pass through a non-combustible wall or roof, such as concrete. Refer to NFPA 37, Section 6-3. “Stationary Combustion Engines and Gas Turbines” for accepted design practices. Build according to the code requirements in effect at the installation site.

⚠WARNING ***Hot exhaust pipes can start a fire and cause severe injury or death if improperly routed through walls. Use an approved thimble where exhaust pipes pass through walls or partitions.***

⚠WARNING ***Inhalation of exhaust gases can result in severe personal injury or death. Do not use exhaust heat to warm a room, compartment or storage area.***

Rain caps are available for the discharge end of vertical exhaust pipes. The rain cap clamps onto the end of the pipe and opens due to exhaust discharge force from the generator set. When the generator set is stopped, the rain cap automatically closes, protecting the exhaust system from rain, snow, etc.

Use a section of flexible exhaust pipe between the engine and remainder of exhaust system. Support exhaust system to prevent weight from being applied to engine exhaust outlet elbow/turbocharger connection.

⚠CAUTION ***Weight applied to the engine manifold can result in turbocharger damage. Support the muffler and exhaust piping so no weight or stress is applied to engine exhaust elbow.***

The exhaust system design should meet local code requirements.

Liability for injury, death, damage, and warranty expense due to use of unapproved mufflers or modifications becomes the responsibility of the person installing the unapproved muffler or performing the modification. Contact a Cummins Power Generation distributor for approved exhaust system parts.

Avoid sharp bends by using sweeping, long radius elbows and provide adequate support for muffler and tailpipe. Pitch a horizontal run of exhaust pipe DOWNWARD (away from engine) to allow any moisture condensation to drain away from the engine. If an exhaust pipe must be turned upward, install a condensation trap at the point where the rise begins (Figure 4-3).

Shield or insulate exhaust lines if there is danger of personal contact. Allow at least 12 inches (305 mm) of clearance if the pipes pass close to a combustible wall or partition. Before installing insulation on exhaust system components, check the exhaust system for leaks while operating the genset under full load and correct all leaks.

⚠WARNING ***Exhaust pipes are very hot and they can cause severe personal injury or death from direct contact or from fire hazard. Shield or insulate exhaust pipes if there is danger of personal contact or when routed through walls or near other combustible materials.***

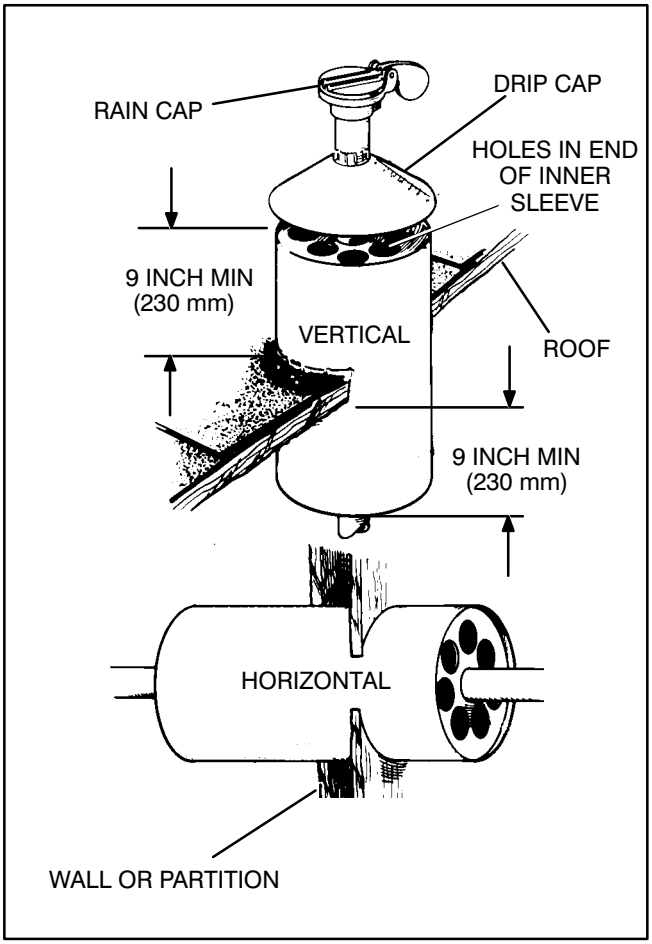

FIGURE 4-2. MOUNTING EXHAUST THIMBLE

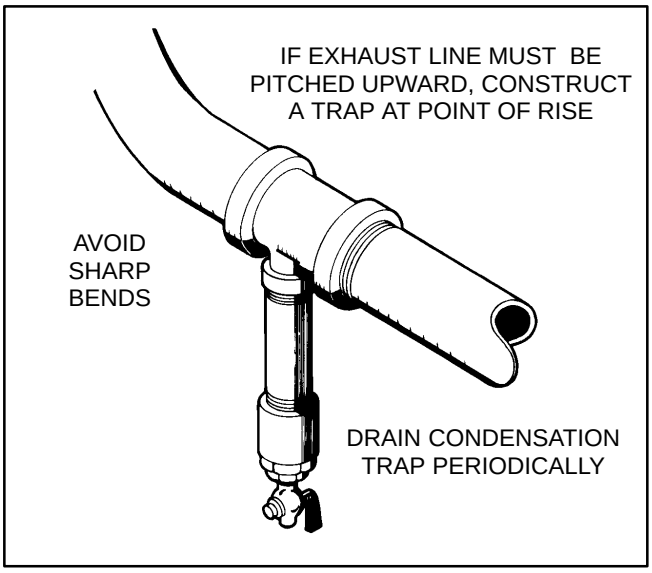

FIGURE 4-3. CONDENSATION TRAP

VENTILATION AND COOLING

Generator sets create considerable heat that must be removed by proper ventilation. Outdoor installations normally rely on natural air circulation but indoor installations need properly sized and positioned vents for required airflow.

Vents and Ducts

For indoor installations, locate vents so incoming air passes through the immediate area of the installation before exhausting. Install the air outlet higher than the air inlet to allow for convection air movement.

Size the vents and ducts so they are large enough to allow the required flow rate of air. The ”free area” of ducts must be as large as the exposed area of the radiator. Refer to the genset *Data Sheet* for the airflow requirements and allowed airflow restriction.

Wind will restrict free airflow if it blows directly into the air outlet vent. Locate the outlet vent so the effects of wind are eliminated. See Figure 4-4.

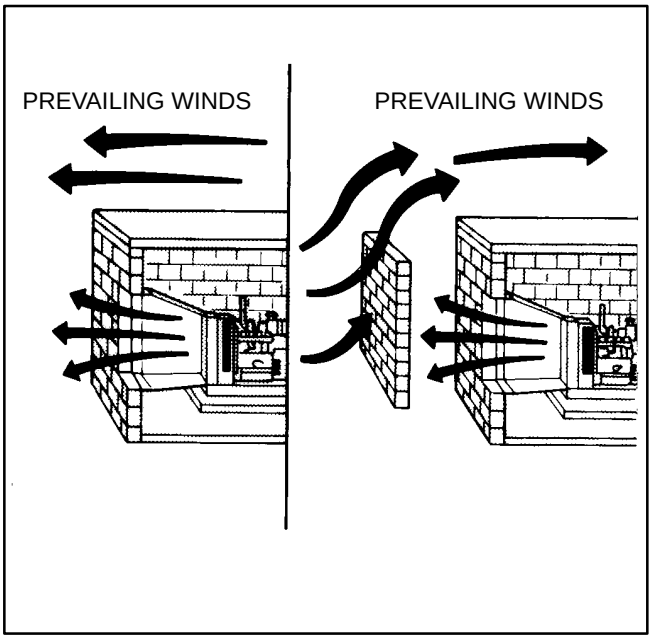

FIGURE 4-4. WIND BARRIER

Dampers

Dampers or louvres protect the genset and equipment room from the outside environment. Their operation of opening and closing should be controlled by operation of the genset.

In cooler climates movable or discharge dampers are used. These dampers allow the air to be recirculated back to the equipment room. This enables the equipment room to be heated while the genset engine is still cold, increasing the engine efficiency.

Radiator Set Requirements

Radiator set cooling air is drawn past the control end of the set by a pusher fan that blows air through the radiator (Figure 4-5). Locate the air inlet to the to the rear of the set. Make the inlet vent opening 1-1/2 to 2 times larger than the radiator area.

Louvers and screens over air inlet and outlet openings restrict air flow and vary widely in performance. A louver assembly with narrow vanes, for example, tends to be more restrictive than one with wide vanes. The effective open area specified by the louver or screen manufacturer should be used.

Locate the cooling air outlet directly in front of the radiator and as close as possible. The outlet opening must be at least as large as the radiator area. Length and shape of the air outlet duct should offer minimum restriction to airflow.

Attach a canvas or sheet metal duct to the flange and the air outlet opening using screws and nuts so duct can be removed for maintenance purposes. The duct prevents circulation of heated air. Before installing the duct, remove the radiator core guard.

Coolant Heater (Optional)

An optional coolant heater can be installed to keep the engine warm for starting under adverse weather conditions. Connect the heater to a power source that will be on when the engine is NOT running.

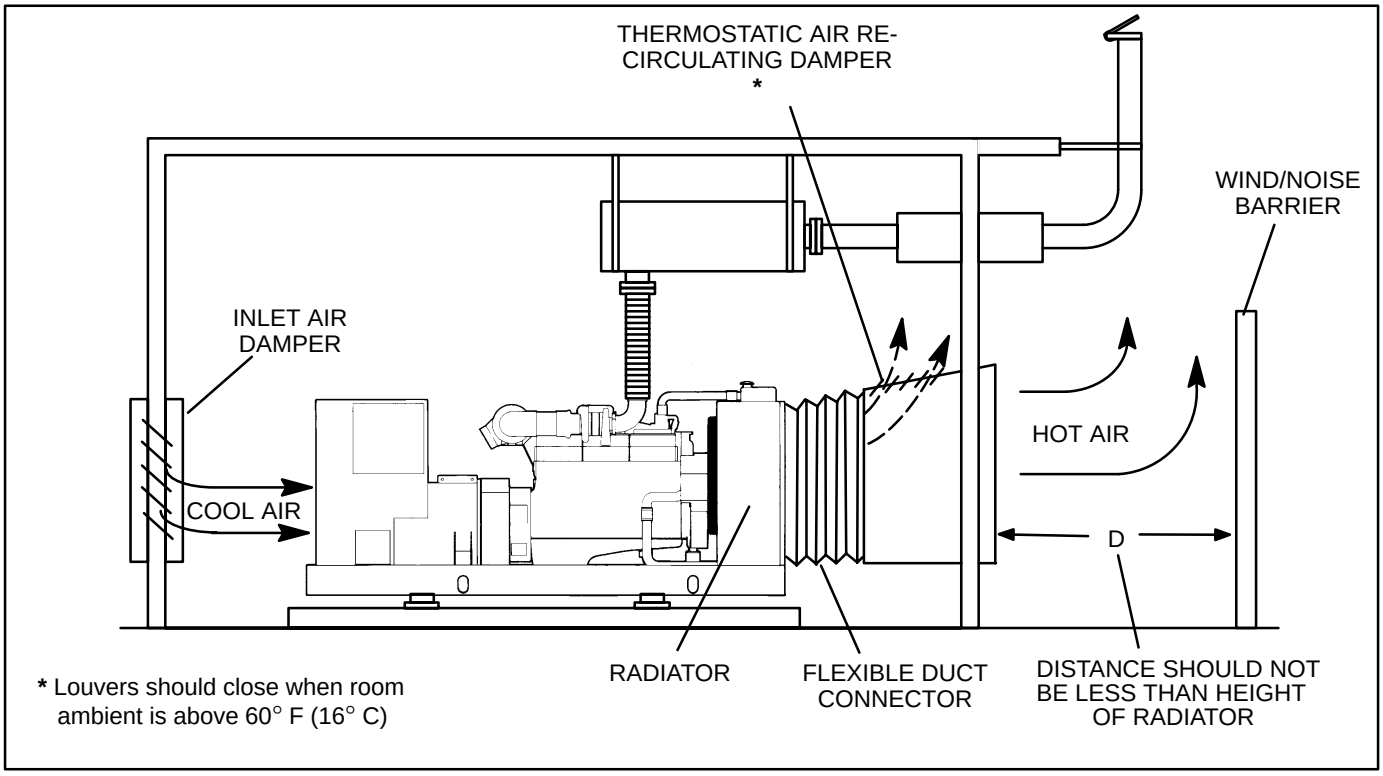

FIGURE 4-5. TYPICAL RADIATOR SET INSTALLATION

LUBRICATION

Before starting, check the engine oil level. Gensets are shipped with oil. Fill if needed using the recommended oil. Refer to the Cummins *QSX15 Series Engines Operation and Maintenance Manual* for the recommended oil.

FUEL

Fill the fuel tanks with the recommended fuel. Open all manual shutoff valves. Engine fuel may not be primed at the fuel filters after shipment. To check and reprime the fuel system, refer to the Cummins *QSX15 Series Engines Operation and Maintenance Manual* for the recommended procedure.

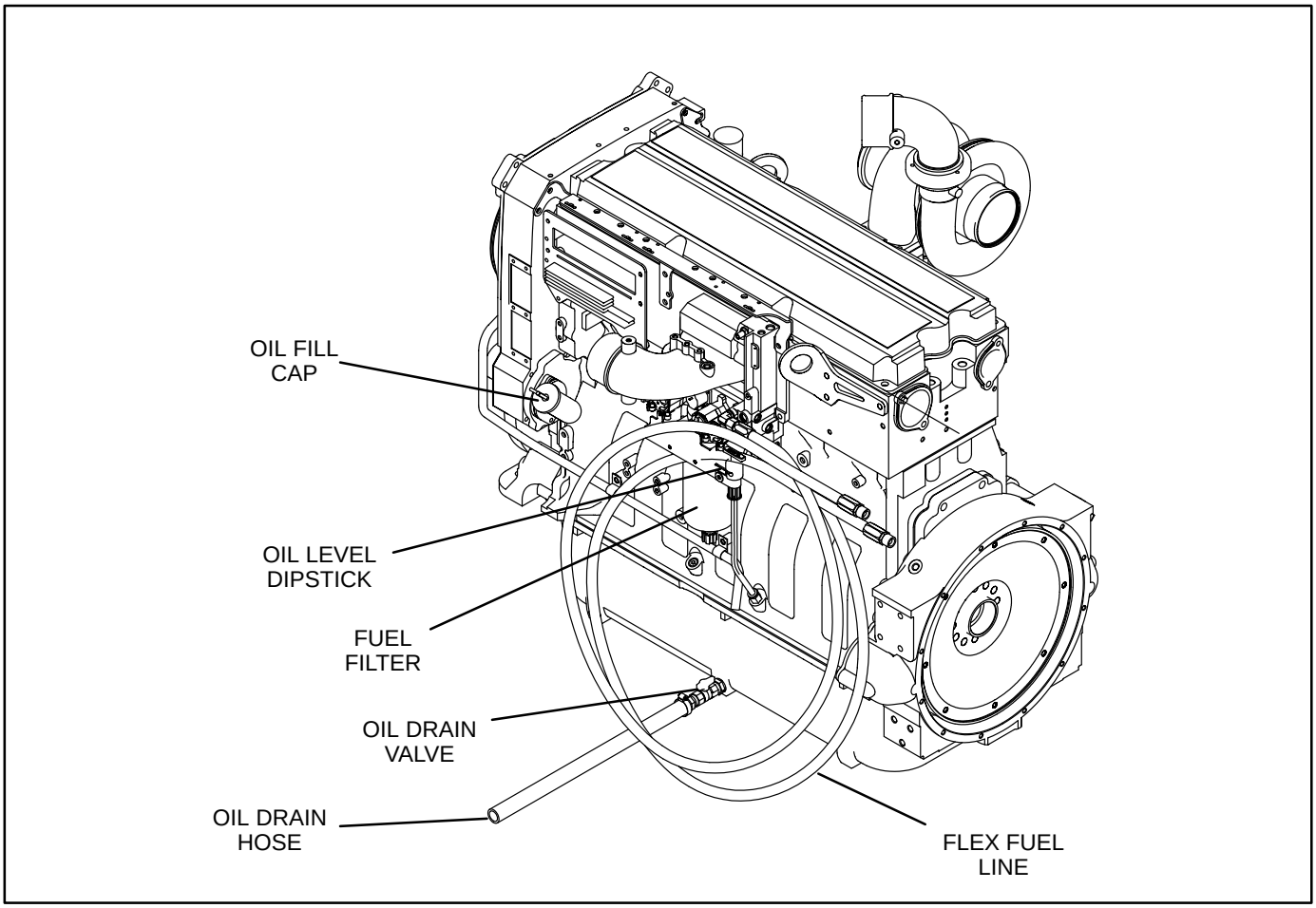

FIGURE 4-6. LUBRICATION AND FUEL COMPONENTS

COOLANT

Before starting, check the engine coolant level. Gensets are shipped with coolant. Fill the cooling system with the recommended coolant. Refer to the Cummins *QSX15 Series Engines Operation and Maintenance Manual* for the recommended coolant.

Coolant Filters

A spin-on type corrosion filter (Figure 4-7) is standard equipment. An on/off valve is provided to prevent coolant leakage while changing the coolant filter. With the valve in the **ON** position, the coolant flows through the filter. In the **OFF** position, the coolant does not flow through the filter.

Make sure coolant shut off valve is in the **ON** position before operating the generator set.

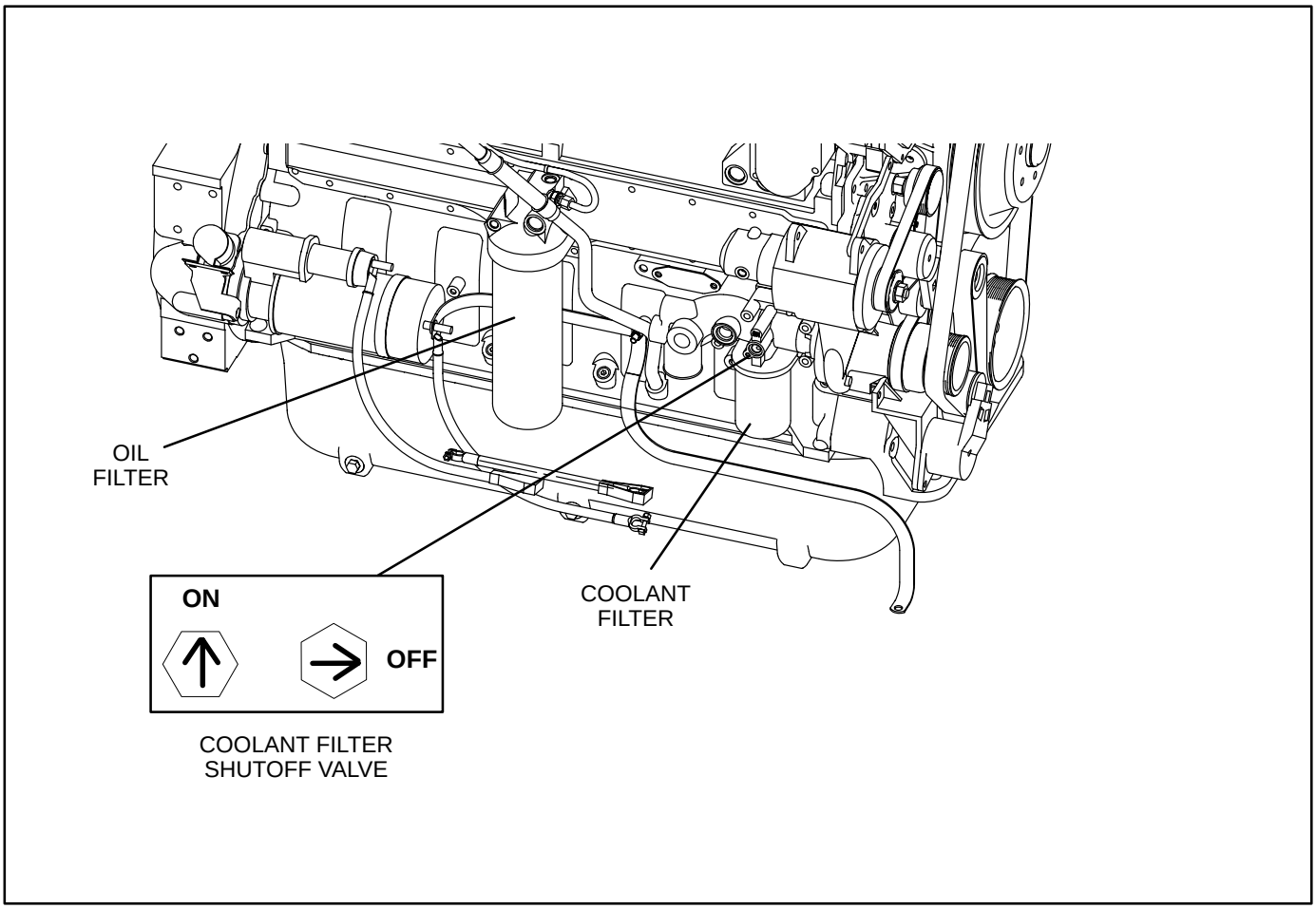

FIGURE 4-7. COOLANT AND LUBRICATION COMPONENTS

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5. DC Control Wiring

CONTROL WIRING

The generator set control box assembly (Figure 5-1), which is located on the rear or optionally on either side of the control housing, contains connection points for remote control and monitor options.

⚠ CAUTION ***Do not attach conduit to the control box assembly for any reason. All conduit must be attached to the control housing. Attaching conduit to the control box assembly will compress the control box vibration isolators, causing the box to vibrate and damage the electronic circuitry.***

Use flexible conduit for all wiring connections to the generator set. All conduit used for control wiring must be attached to the control housing, not to the control box assembly. Route the control wiring through the control housing and into the access hole on the back panel of the control box assembly (Figure 5-2). Use cable ties to keep control wiring away from sharp edges and AC power cables within control housing.

After completing all customer connections (wires routed and secured), heat shrink the boot that is located on backside of access hole, until sealed.

⚠ CAUTION ***Stranded copper wire must be used for all customer connections to the electronics box. Solid copper wire may break due to genset vibration.***

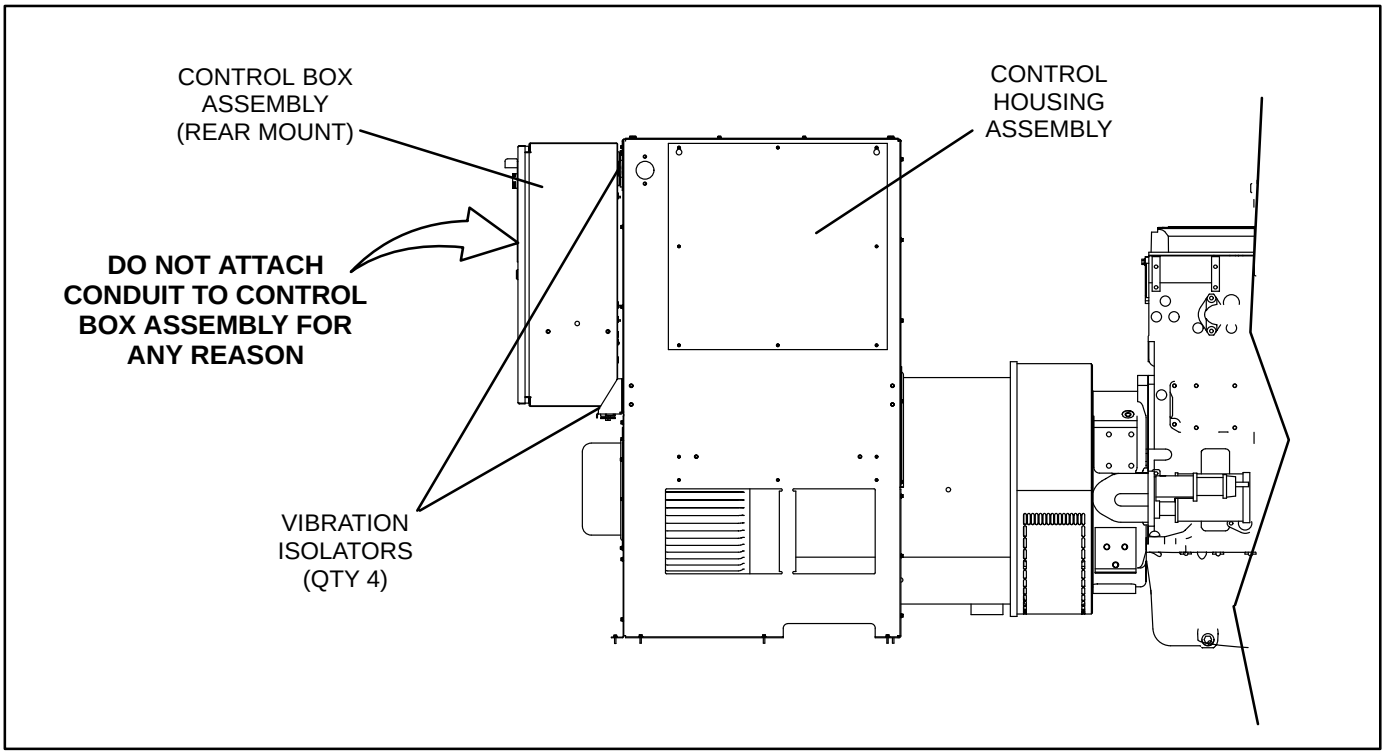

FIGURE 5-1. CONTROL BOX − REAR MOUNT

REMOTE MONITOR/CONTROL CONNECTIONS

Customer monitor/control connections are attached to terminal blocks TB3 and TB8 (see Figure 5-2). Optional equipment such as a remote annunciator panel, sensing devices used to monitor genset operation, remote start/stop switches, control box heater, and etc. are also attached to these terminal blocks. Driver signals for customer supplied relays are also provided for several alarm and shut down conditions. Refer to Customer Connections diagram in Section 10.

⚠ CAUTION ***When removing terminal block connector TB8 from Base card, note orientation of connector. This terminal block connector is not keyed and can be installed incorrectly, which will cause control failures.***

Terminal Block Wiring

⚠ CAUTION ***Always run control circuit wiring in a separate metal conduit from AC power cables to avoid inducing currents that could cause problems within the control.***

Digital Connections: Connection points, other then relayed outputs, network, switched B+ and B+ are considered digital connections to the terminal blocks. The type/gauge wire to use for these connections are:

- Less than 1000 feet (305m), use 20 gauge stranded copper wire.
- 1000 to 2000 feet (305 to 610m), use 18 gauge stranded copper wire.

Relay Connections: Due to the wide variety of devices that can be attached to the relay outputs of terminal blocks, the electrical contractor must determine the gauge of the **stranded copper** wire that is used at this installation site. Refer to Customer Connections diagram in Section 10 for the relay specifications.

Switched B+: (Fused at 10 amps.) Same as Relay Connection description.

Delayed Switched B+: (Fused at 10 amps. with a 10 second dropout) Use for external fuel shut-off solenoid. Same as Relay Connection description.

B+: (Fused at 10 amps.) Same as Relay Connection description.

Network Connections: Refer to Onan 900-0366 *PowerCommand Network Installation and Operation* manual for the type/gauge wire to use for these connections.

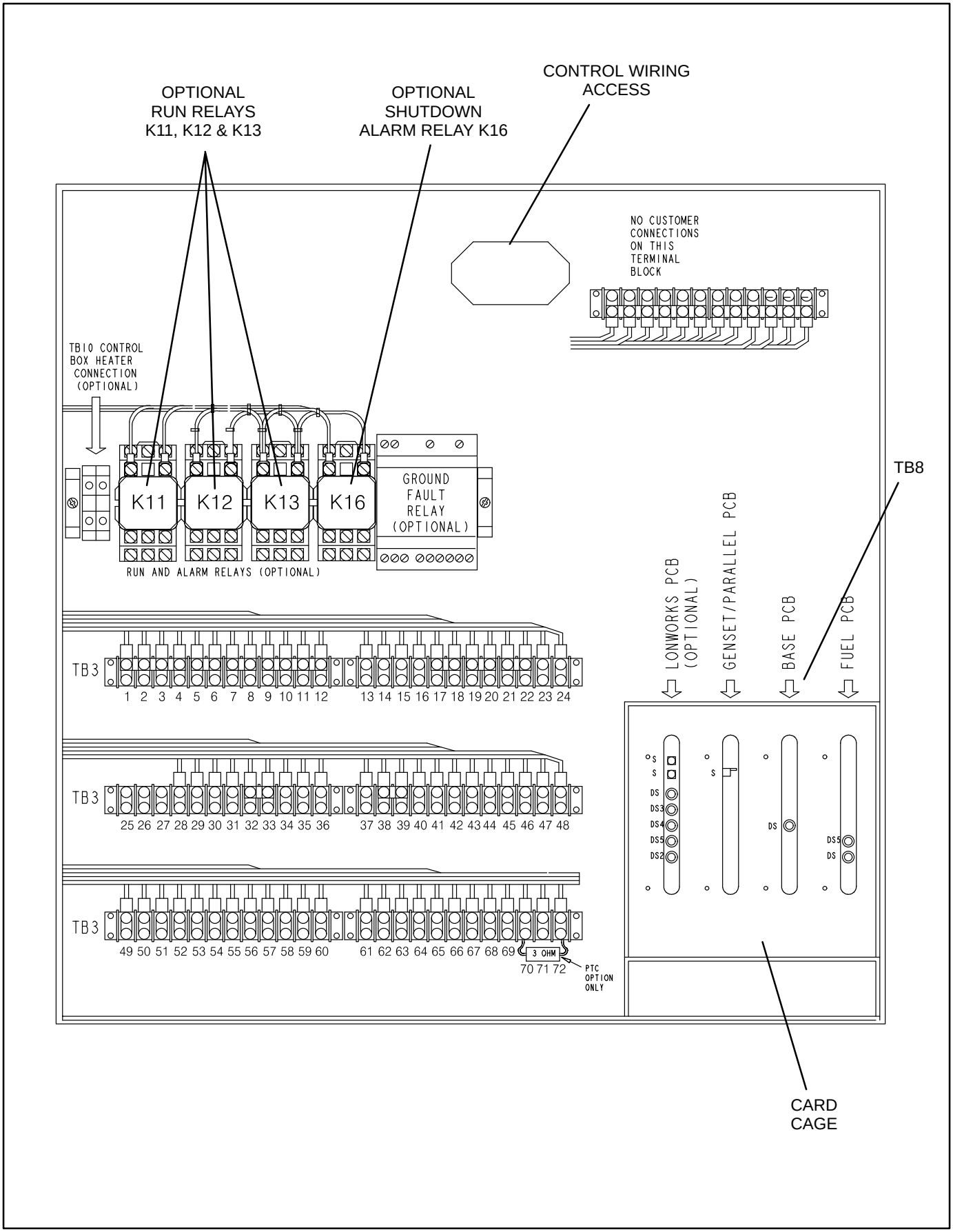

FIGURE 5-2. CONTROL BOX ASSEMBLY INTERIOR

RUN RELAYS (K11, K12, K13)

The optional run relays are rail mounted inside the control box (Figure 5-2). The rail mount allows you to easily remove and replace the snap-on relays. The generator set can be equipped with one, two or three run relays.

The three-pole, double-throw run relays (Figure 5-3) are used to control auxiliary equipment such as fans, pumps and motorized air dampers. The run relays are energized when the generator set reaches operating speed.

The contacts are rated:

- 10 amps at 28 VDC or 120 VAC, 80%PF
- 6 amps at 240 VAC, 80%PF
- 3 amps at 480/600 VAC, 80%PF

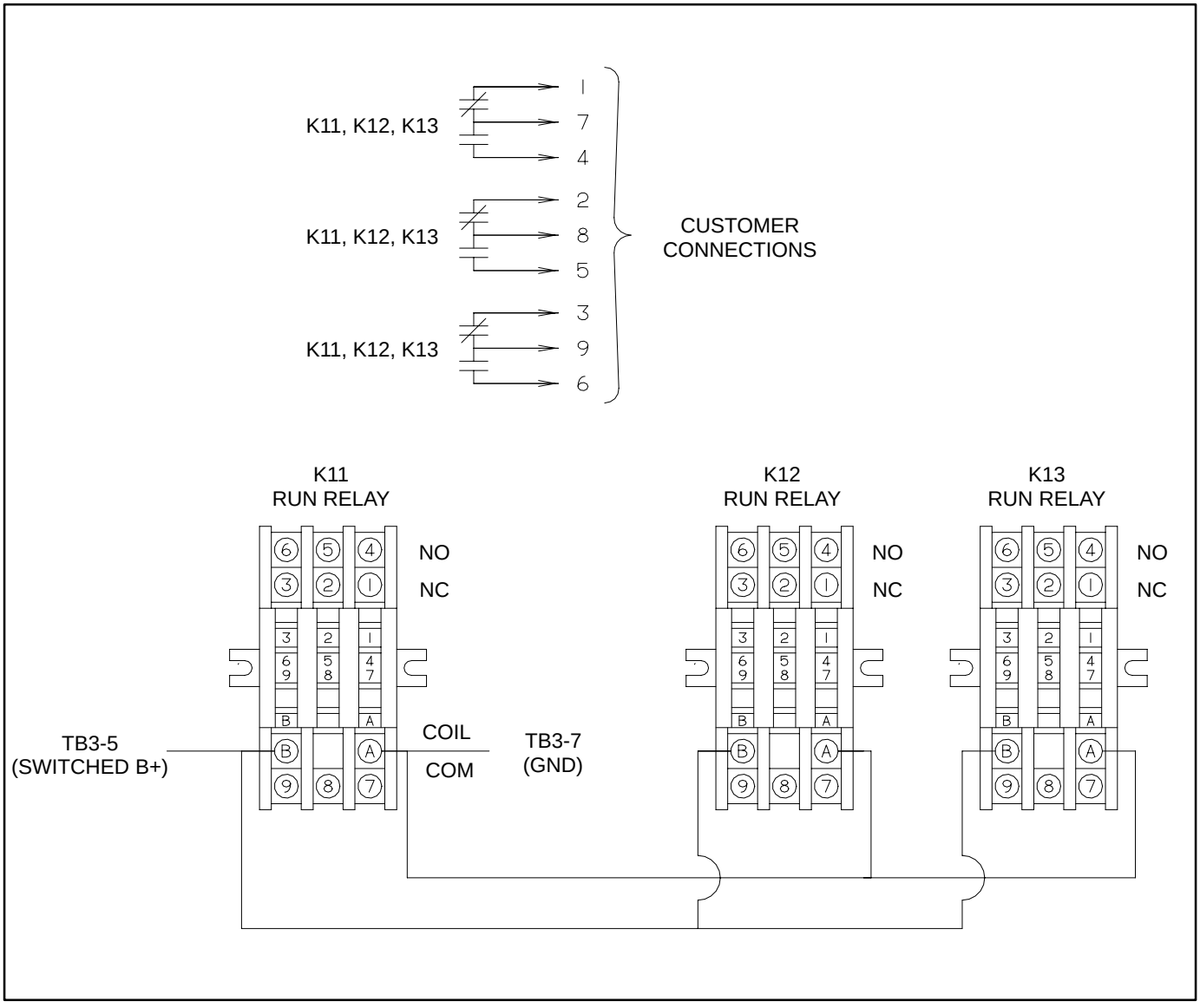

FIGURE 5-3. OPTIONAL RUN RELAYS (K11, K12, K13)

ALARM RELAY (K16)

The optional alarm relay is rail mounted inside the control box (Figure 5-2). The rail mount allows you to easily remove and replace the snap-on relay.

The three-pole, double-throw alarm relay (Figure 5-4) is often used to energize warning devices such as audible alarms. Any generator set shutdown will energize the alarm relay.

The contacts are rated:

- 10 amps at 28 VDC or 120 VAC, 80%PF
- 6 amps at 240 VAC, 80%PF
- 3 amps at 480/600 VAC, 80%PF

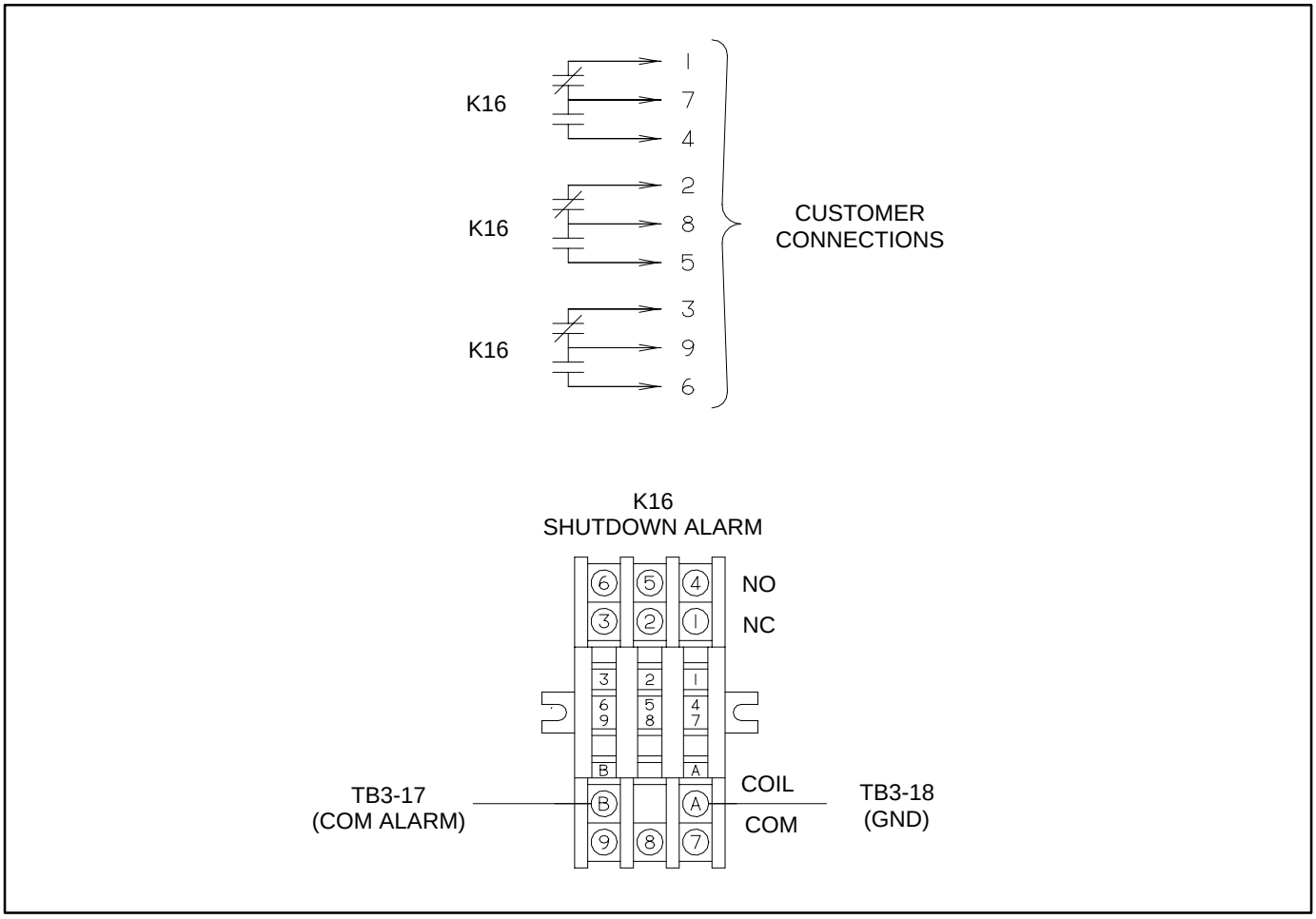

FIGURE 5-4. OPTIONAL ALARM RELAY (K16)

POWER TRANSFER CONTROL (OPTIONAL)

The optional Power Transfer Control (PTC) feature requires connecting the control relays of the PTC circuit to the generator set and utility circuit breakers. These relays are used to control the opening and closing of these circuit breakers via the PCC, for transfer and retransfer of the load to the generator set or the utility. A typical PTC installation is shown in Figure 5-5.

Relay Connections: Due to a wide verity of circuit breakers that can be attached to the relay outputs of PCC terminal block TB3, the system designer must determine if the electrical requirements of the installation does not exceed the limits of the PTC control relays. Relays that can handle larger switching current/voltage will need to be connected to the PTC control relays if the electrical limits of the PTC relays are exceeded.

The four PTC control relays are each rated at 16 amps at 250 VAC or 24 VDC.

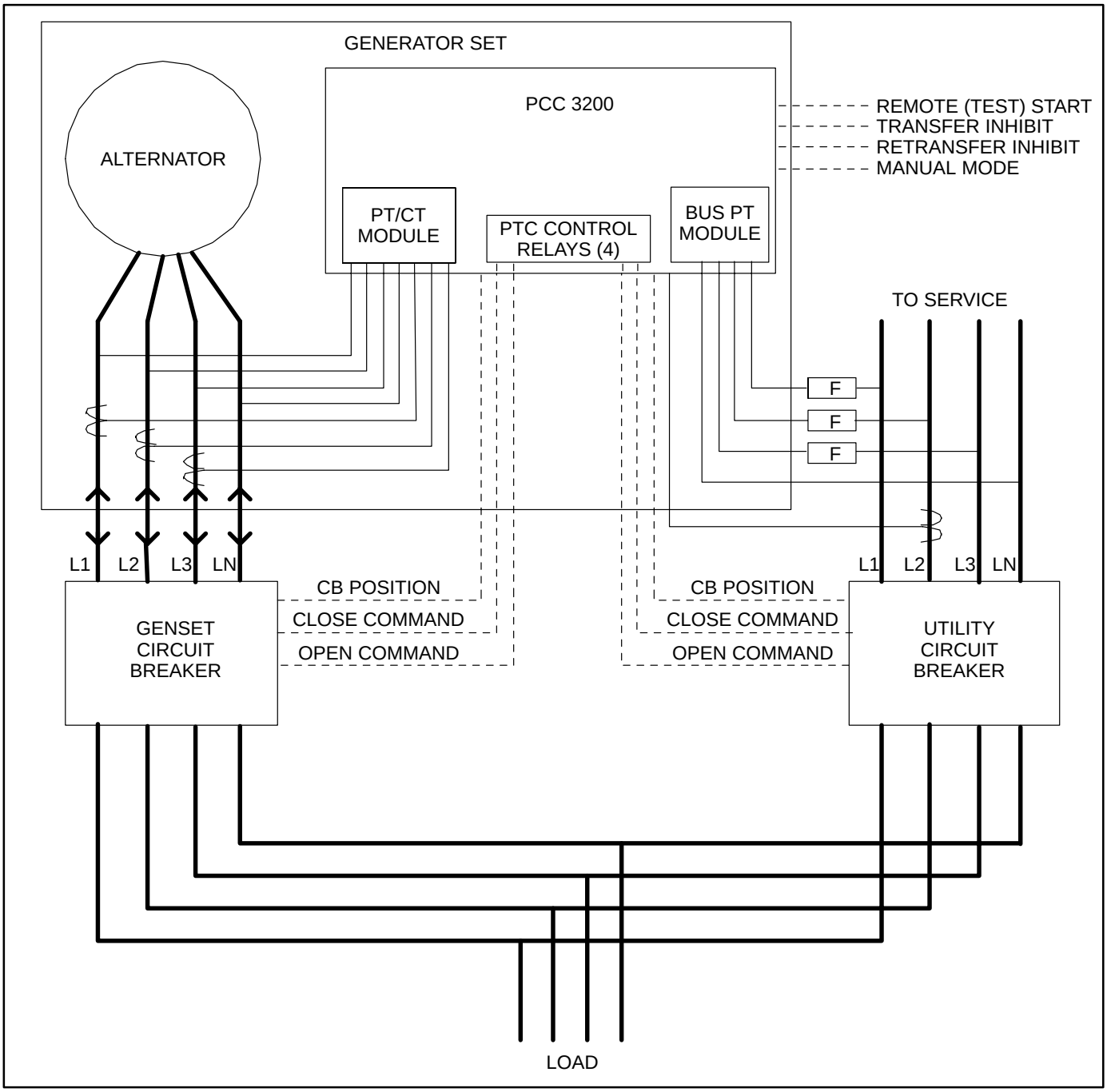

FIGURE 5-5. TYPICAL POWER TRANSFER CONTROL INSTALLATION

6. AC Electrical Connections

GENERAL

This section provides the procedure that is used to connect the AC electrical system of the genset.

Before making any AC electrical connections, make certain the generator set cannot be accidentally started. Move the O/Manual/Auto switch on the control panel to the O (off) position. Turn off or remove AC power from the battery charger and then remove the negative (**–**) battery cable from the set starting battery.

⚠WARNING ***Ignition of explosive battery gases can cause severe personal injury or death. Arcing at battery terminals, light switch or other equipment, flame, pilot lights and sparks can ignite battery gas. Do not smoke, or switch trouble light ON or OFF near battery. Discharge static electricity from body before touching batteries by first touching a grounded metal surface.***

Ventilate battery area before working on or near battery—Wear goggles—Stop genset and disconnect charger before disconnecting battery cables—Disconnect negative (−) cable first and reconnect last.

⚠CAUTION ***Disconnect battery charger from AC source before disconnecting battery cables. Otherwise, disconnecting cables can result in voltage spikes damaging to DC control circuits of the set.***

⚠WARNING ***Accidental starting of the generator set can cause severe personal injury or death. Prevent accidental starting by disconnecting the negative (−) cable from the battery terminal.***

⚠WARNING ***Each of the operations described in this section should be done only by persons trained and experienced in electrical maintenance. Improper procedures may result in property damage, bodily injury or death.***

Connecting the genset AC electrical system involves:

- Installation of transfer switch
- Generator output voltage selection
- Load cable connection
- Standard and optional AC equipment connections (e.g., control box heater, coolant heater, etc.
- Optional enclosure electrical connections (refer to *Section 7*).

Local regulations often require that wiring connections be made by a licensed electrician, and that the installation be inspected and approved before operation. All connections, wire sizes, materials used, etc. must conform to the requirements of electrical codes in effect at the installation site.

⚠WARNING ***Improper wiring can cause a fire or electrocution, resulting in severe personal injury or death and/or property and equipment damage.***

Before starting the genset, check to make sure that all electrical connections are secure, and that all wiring is complete. Replace and secure any access panels that have been removed during installation. Check that the load cables from the genset are properly connected.

⚠WARNING ***Backfeed to utility system can cause electrocution or property damage. Do not connect to any building electrical system except through an approved device and after building main switch is opened.***

TRANSFER SWITCH

If the installation is for standby service, a transfer switch must be used for switching the load from the normal power source to the genset (see Figure 6-1). Either a manual or automatic transfer switch may be used. Follow the installation instructions provided with the transfer switch when connecting the load and control wiring.

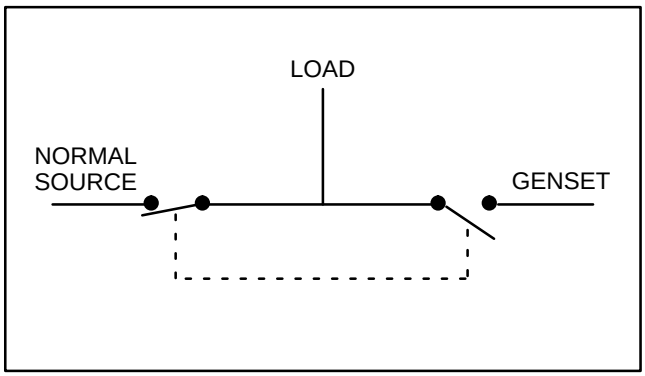

FIGURE 6-1. TYPICAL LOAD TRANSFER FUNCTION

AC WIRING

Generator Voltage Connections

The available generator output voltages and maximum current ratings are specified on the generator set nameplate. Line-to-neutral voltage is always the lower voltage shown and line-to-line voltage is the higher rating.

These generators can be configured to the nameplate voltages as shown on the Reconnection Diagram located on the side access cover of the control housing. Many of the voltages listed will require reconfiguration of the generator output leads on the connection terminal block. This reconfiguration must only be done by service personnel that are trained and experienced to perform electrical installation. The generator set was adjusted to produce a specified voltage during production verification testing prior to shipment. The installer must always check the stator lead terminal block connections and perform any necessary reconnect to obtain the voltage required.

Some generator sets are capable of producing a wide range of voltages and connection configurations, others have specific limited capabilities. Refer to wiring diagram and generator voltages (from the nameplate) when reviewing the voltage connection information and use the wiring diagram supplied with your generator set when actually performing load connections.

⚠ CAUTION ***Reconfiguring generator sets to higher voltages can exceed the voltage capability of the specific generator windings and damage the generator and also decrease line current, rendering line circuit breakers too large. Consult with your distributor before performing reconnection for a different voltage.***

⚠ CAUTION ***Reconfiguring generator sets to lower voltages can reduce generator set ratings, and also increase line current, rendering line circuit breakers too small. Consult with your distributor before performing reconnection for a different voltage.***

Load Connections

Flexible conduit and stranded conductors must be used for connections to take up movement of the generator set.

All loads are connected to the generator by bolting **stranded** load wires to the appropriate terminals on the generator reconnection terminal block or circuit breaker lugs. The terminals are stamped U, V, W and N to indicate the line and neutral connections. (Reference: U, V, and W correspond with L1, L2 and L3; and N with L0 respectively).

Load Balancing

When connecting loads to the generator set, balance the loads so the current flow from each line terminal (L1, L2 and L3) is about the same. This is especially important if both single phase and three phase loads are connected. Any combination of single phase and three phase loading can be used as long as each line current is about the same, within 10 percent of median value and no line current exceeds the nameplate rating of the generator. Check the current flow from each line after connections by observing the control panel ammeter.

Current Transformers

Current transformers (CT's) are required on gensets that contain AC meters. The CT's must be installed as noted in the following CT Installation Requirements.

Refer to the Reconnection Diagram to identify the output leads/phase that must be routed through each CT, and also appropriate transformer post selection for meter sensing leads. The transformers are labeled CT21, CT22 and CT23 on the reconnection wiring diagram. (The Reconnection Diagram is located on the upper side cover of the control housing.)

CT Installation Requirements:

A. The CT has a dot on one side. This dot must be facing toward the generator (conventional current flowing into the dot). A dot is also used to indicate pin 1 of the CT.
B. CT21 − U load leads (A phase),
   CT22 − V load leads (B phase)
   CT23 − W load leads (C phase)
C. Route the appropriate load wires through each CT.
D. The CT's have dual secondaries (3 pins). The CT secondary wire marked 1 is connected to pin 1 of the CT. CT secondary wire marked 2/3 is connected to pin 2 for high voltage gensets or to pin 3 for low voltage gensets. (Refer to Reconnection Diagram.)

Grounding

The following is a brief description of system and equipment grounding of permanently installed AC generators within a facility wiring system. It is important to follow the requirements of the local electrical code.

Figure 6-2 illustrates typical system grounding for a 3-pole and a 4-pole automatic transfer switch (ATS). In the 3-pole ATS, note that the generator neutral is connected to the ATS and is NOT bonded to ground at the generator. In the 4-pole ATS system, a grounding electrode conductor and a bonding jumper are used to connect the generator neutral to ground.

Make sure the genset is grounded to earth in one location only. On generators without a circuit breaker, ground to the point indicated on the top of the generator. On gensets with circuit breakers, use the ground lug provided in the circuit breaker box.

⚠WARNING ***Electric current can cause severe personal injury or death. Bonding and grounding must be done properly. All metallic parts that could become energized under abnormal conditions must be properly grounded.***

Typical requirements for bonding and grounding are given in the National Electrical Code, Article 250. All connections, wire sizes, etc. must conform to the requirements of the electrical codes in effect at the installation site.

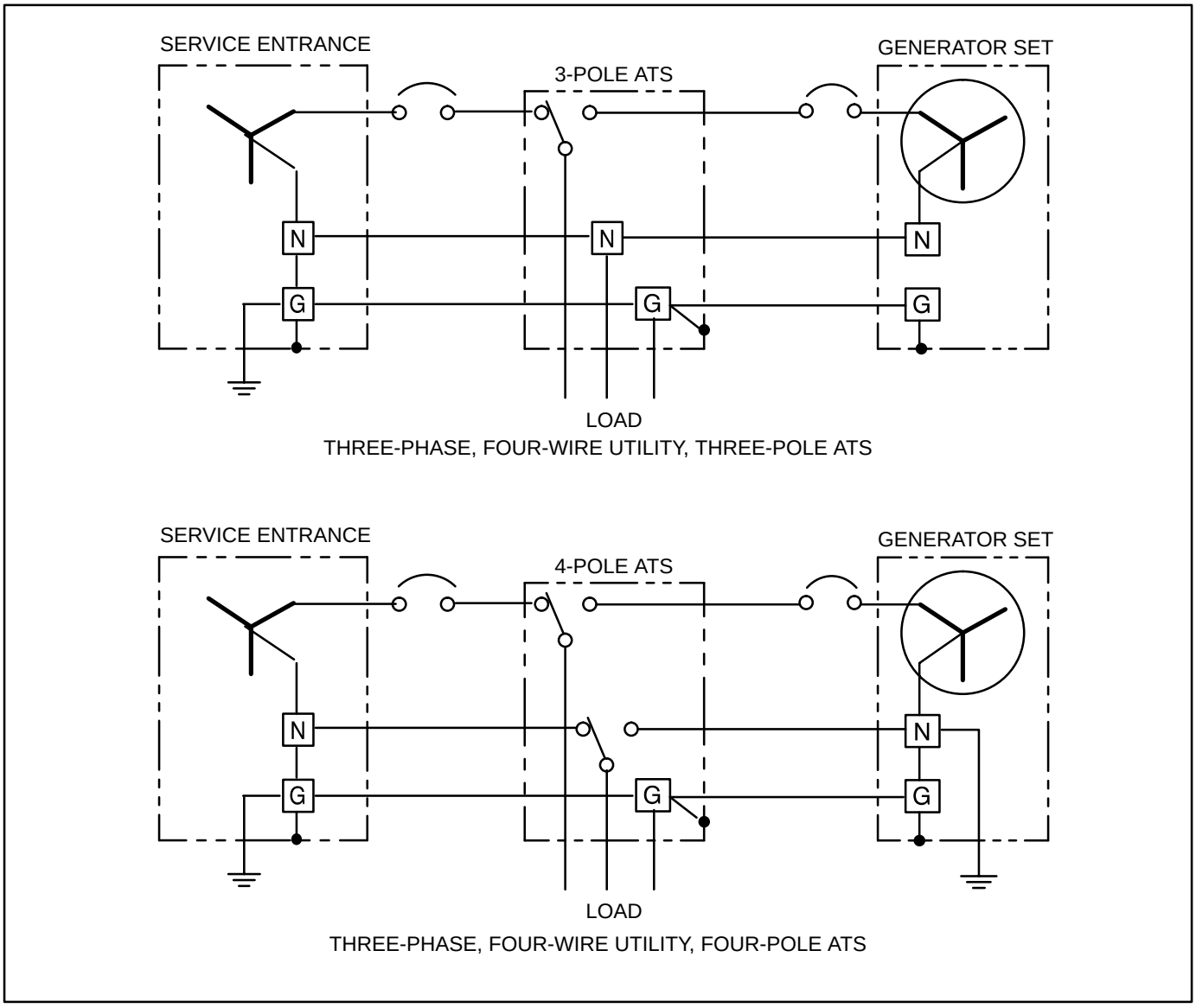

FIGURE 6-2. TYPICAL SYSTEM GROUNDING ONE-LINE DIAGRAMS

CONTROL HEATER (OPTIONAL)

A control heater (Figure 6-3) provides a means of humidity /temperature control of the control box interior. It protects the components when the generator set is subjected to varying ambient air conditions during extended periods of non-use. Thermostat control de−energizes the heater when the control box interior reaches 75° F (24° C).

Connect the heater to a source of power that will be on during the time the engine is not running. Be sure the supply voltage and circuit amperage is correct for the heater rating.

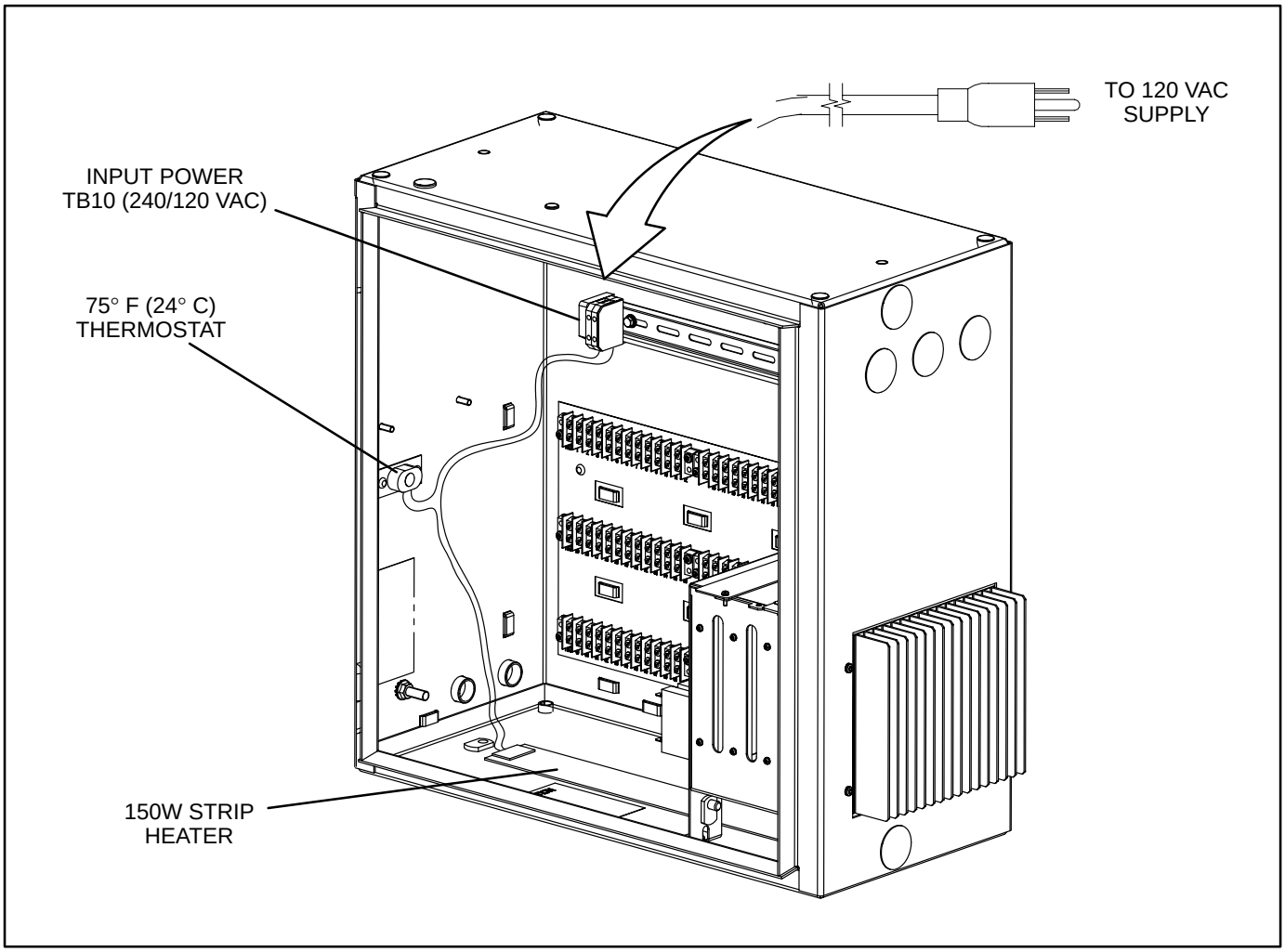

FIGURE 6-3. OPTIONAL CONTROL HEATER

COOLANT HEATER (OPTIONAL)

Coolant heaters keep the engine coolant warm when the engine is shut down. It heats and circulates the coolant within the engine. This reduces startup time and lessens engine wear caused by cold starts. It is electrically operated and thermostatically controlled.

⚠ CAUTION ***The coolant heater must not be operated while the cooling system is empty, when ball valves are closed or when the engine is running or damage to the heater will occur.***

Figure 6-4 shows a typical coolant heater. Connect the heater to a source of power that will be on during the time the engine is not running. Be sure the supply voltage and circuit amperage is correct for the heater element rating.

A battery charger is required to prevent battery discharge. The heater control relay draws 83 mA of current when the heater(s) is off. The heater is off when the engine has reached the proper temperature or the engine is running.

⚠ CAUTION ***Do not connect AC power to the heater before connecting battery cables. Heater will run continuously without DC power and can overheat and damage heater.***

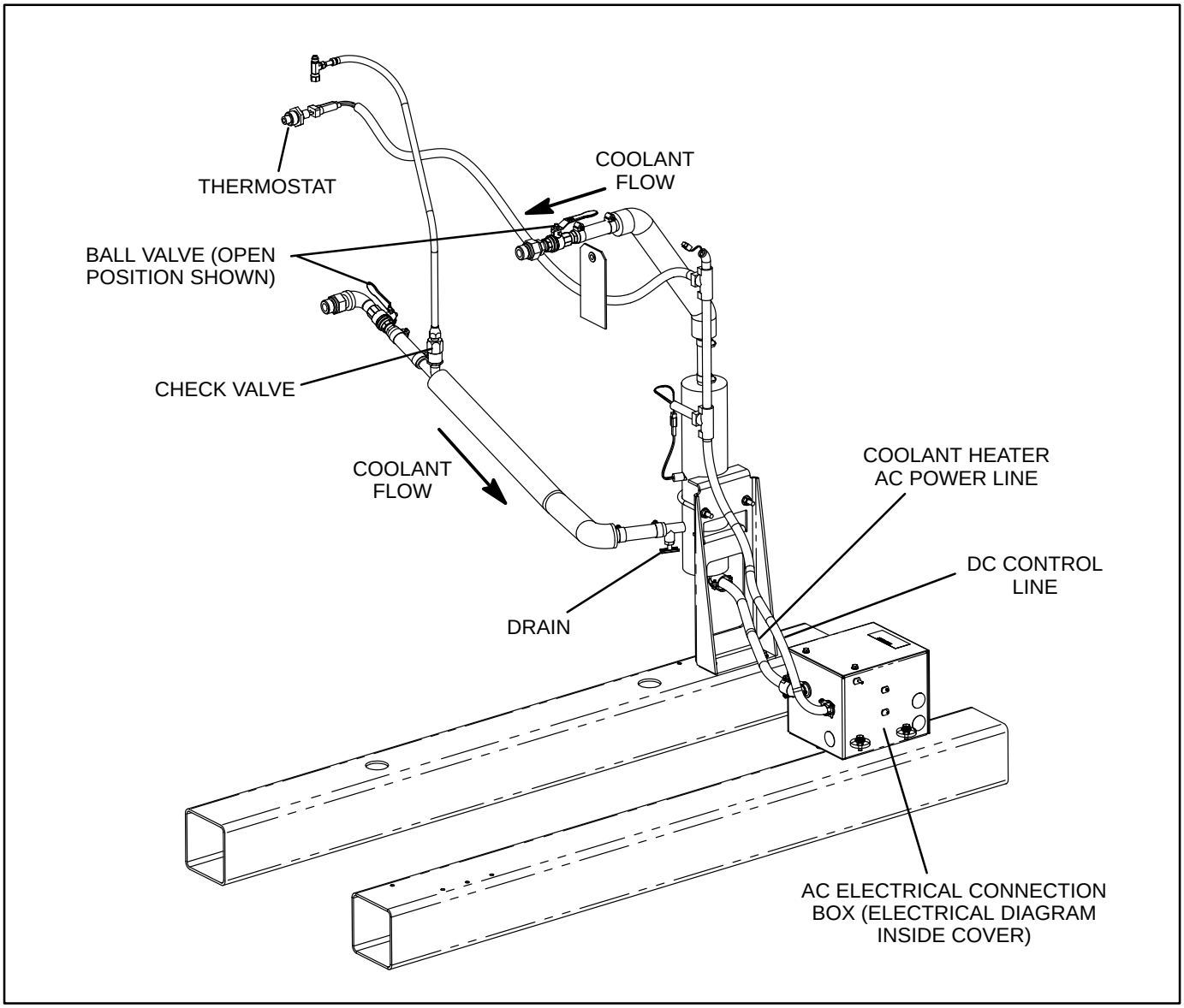

FIGURE 6-4. TYPICAL COOLANT HEATER

GENERATOR HEATER (OPTIONAL)

A generator heater(s) is used to help keep the generator free of condensation when the generator set is not running. During cool and humid conditions, condensation can form within a generator, creating flashing and a shock hazard.

⚠WARNING ***Water or moisture inside a generator increases the possibility of flashing and electrical shock, which can cause equipment damage and severe personal injury or death. Do not use a generator which is not dry inside and out.***

Figure 6-5 illustrates the installation of two heater elements. Connect the heater(s) to a source of power that will be on during the time the engine is not running. Be sure the supply voltage and circuit amperage is correct for the heater element rating.

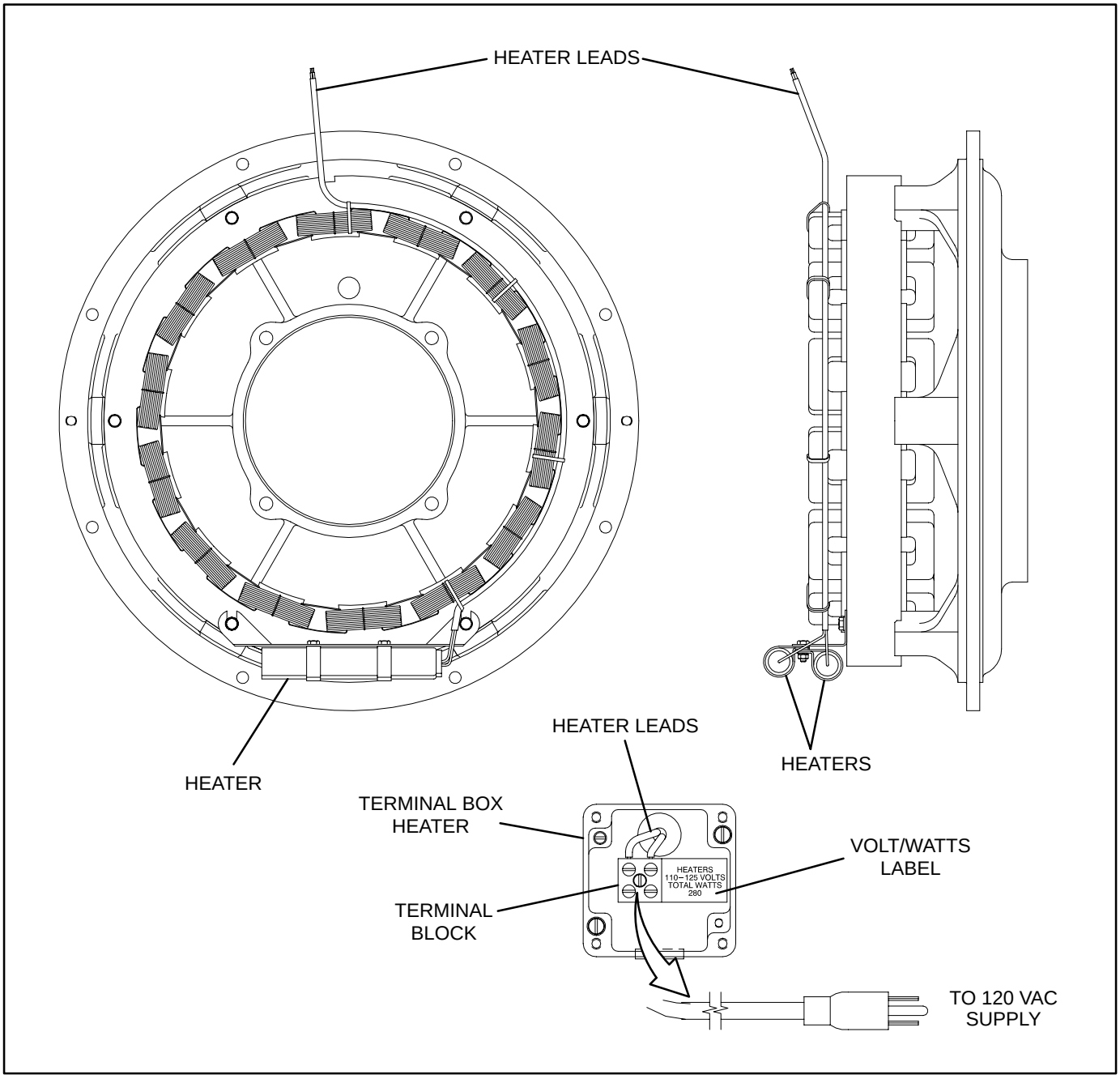

FIGURE 6-5. TYPICAL GENERATOR HEATER INSTALLATION

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7. Enclosure Electrical Connections

GENERAL

Generator sets configured with an enclosure can contain one or more optional features. The optional features that require electrical connections when installing the generator set are described in this section. For wiring diagrams of enclosure options, refer to Section 10, *Enclosure/Options Wiring*.

⚠ CAUTION ***Flexible conduit and stranded conductors must be used for connections to take up movement of the genset. Solid copper wire may break due to genset vibration.***

Figure 7-1 shows the location of the optional features within the enclosure.

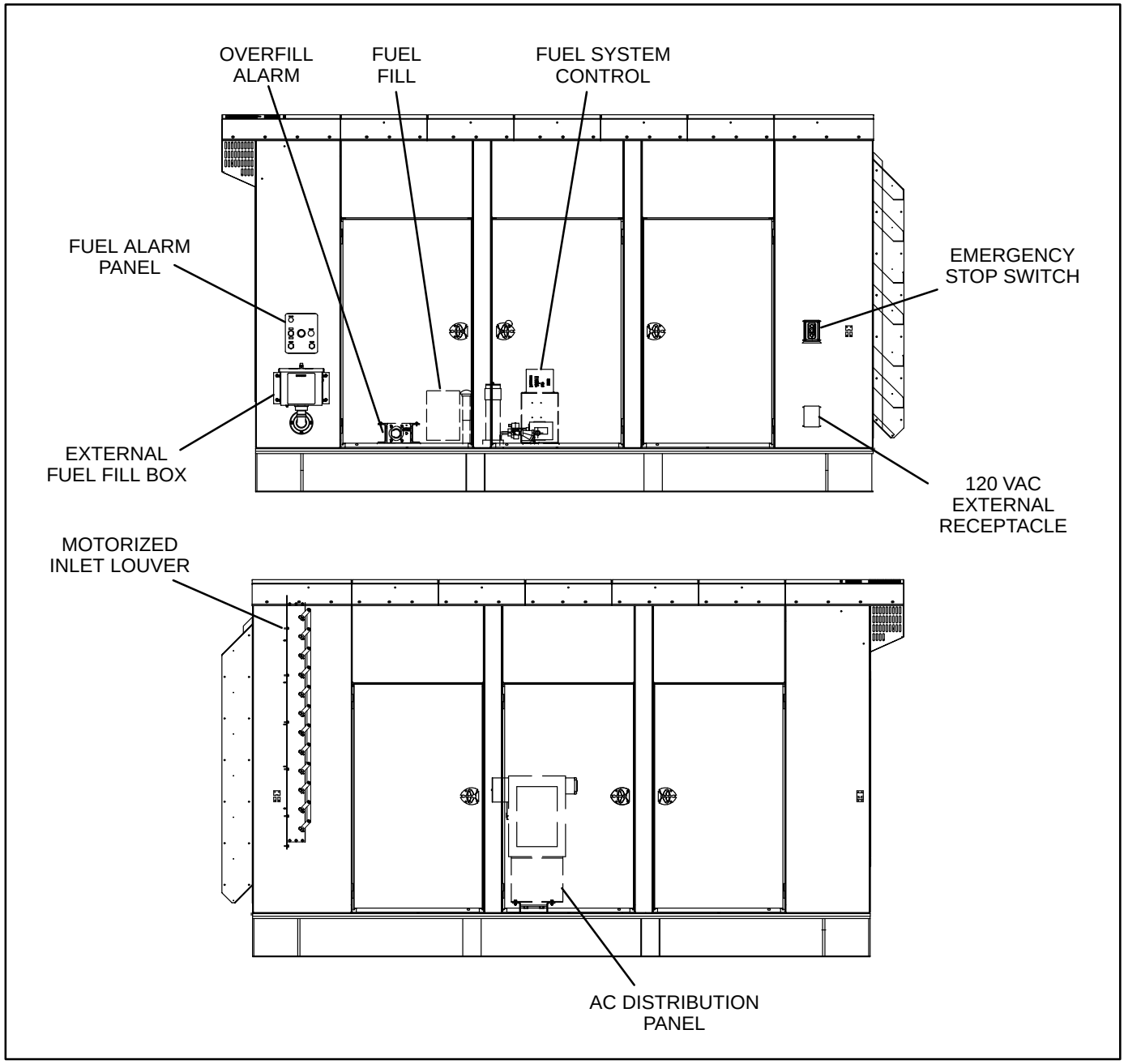


FIGURE 7-1. OPTIONAL ENCLOSURE FEATURES (WEATHER ENCLOSURE SHOWN)

OPTIONAL AC DISTRIBUTION PANEL

The AC distribution panel (Figure 7-2) provides a centralized power source (120/220VAC) for all optional enclosure features.

⚠ CAUTION ***Make sure all circuit breakers are in the OFF position before applying power to the AC distribution panel. Other options may require additional installation before connecting to power.***

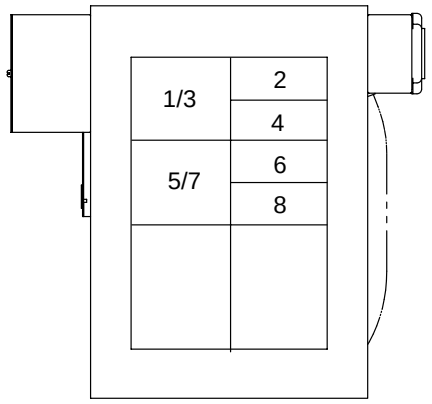
⚠ CAUTION ***When the generator set contains the fuel transfer pump option, power to the AC distribution panel must be fed from a transfer switch and step-down transformer to maintain 120V power to the pump when utility power is interrupted. If the transfer pump option is not installed, power to the AC distribution panel can be fed from a non-emergency source. (Other optional features connected to the AC distribution panel are not needed for generator set operation.)***

All connections to the AC distribution panel are to be done in compliance with the National Electric Code and all applicable local codes and standards using 60 or 75 degree conductors.

The AC distribution panel is designed to be fed with a 100AMP, 120/240VAC, single phase feeder. The two line conductors connect into the 100AMP main breaker that is listed for #4 to 2/0 conductors, AL or CU when torqued to 50 in-lbs.

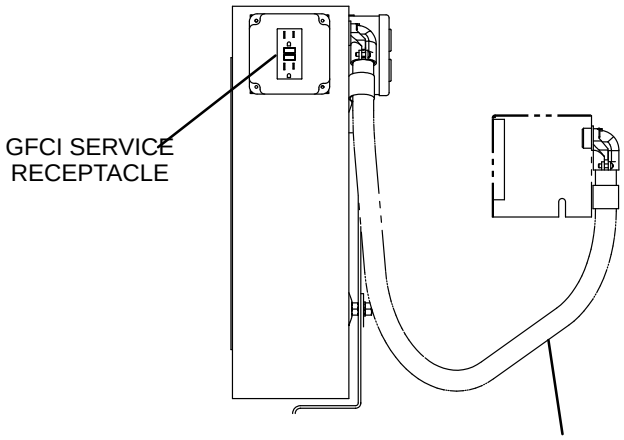
The neutral conductor connects into the neutral bus which is listed for #5 to 300KCMIL conductors, AL or CU when torqued to 21 ft-lbs.

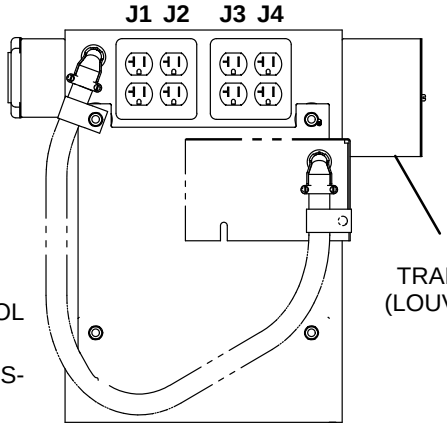
The grounding conductor, if used, connects into the ground bar which is listed for #1 to 2/0 conductors, AL or CU when torqued to 17 ft-lbs.



CIRCUIT BREAKERS

1/3: 100A MAIN
2: 20A J1/J2 RECEPTACLES
4: 20A J3/J4 RECEPTACLES
5/7: 40A COOLANT HEATERS
6: 20A INLET/OUTLET LOUVERS
8: 20A INTERNAL/EXTERNAL SERVICE RECEPTACLES





120VAC RECEPTACLES FOR OPTIONAL FEATURES

J1: ENGINE OIL HEATER
J2: BATTERY HEATER
J3: ALTERNATOR /CONTROL CABINET HEATERS
J4: BATTERY CHARGER/TRANSFER PUMP CONTROLLER

FIGURE 7-2. AC DISTRIBUTION PANEL FEATURES

OPTIONAL MOTORIZED INLET/OUTLET LOUVERS

Louvers (inlet and/or outlet) are powered by either 24VDC supplied by genset control switched B+ or 24VAC transformer connected to shore power.

With switched B+ or gensets having the AC distribution panel, the motorized louvers are prewired and require no further installation (Figure 7-3).

Without the AC distribution panel, the 24VAC louvers are not prewired. Louvers operating on 24VAC require 30VAC, 24 volt class 2 transformer(s). (Transformers are not supplied with genset that does not contain an AC distribution panel.) Mount and connect the transformer(s) to the 18 gauge wires terminated at the AC distribution panel location. Connect the transformer(s) to a source of power that will be on during the time the engine is not running.

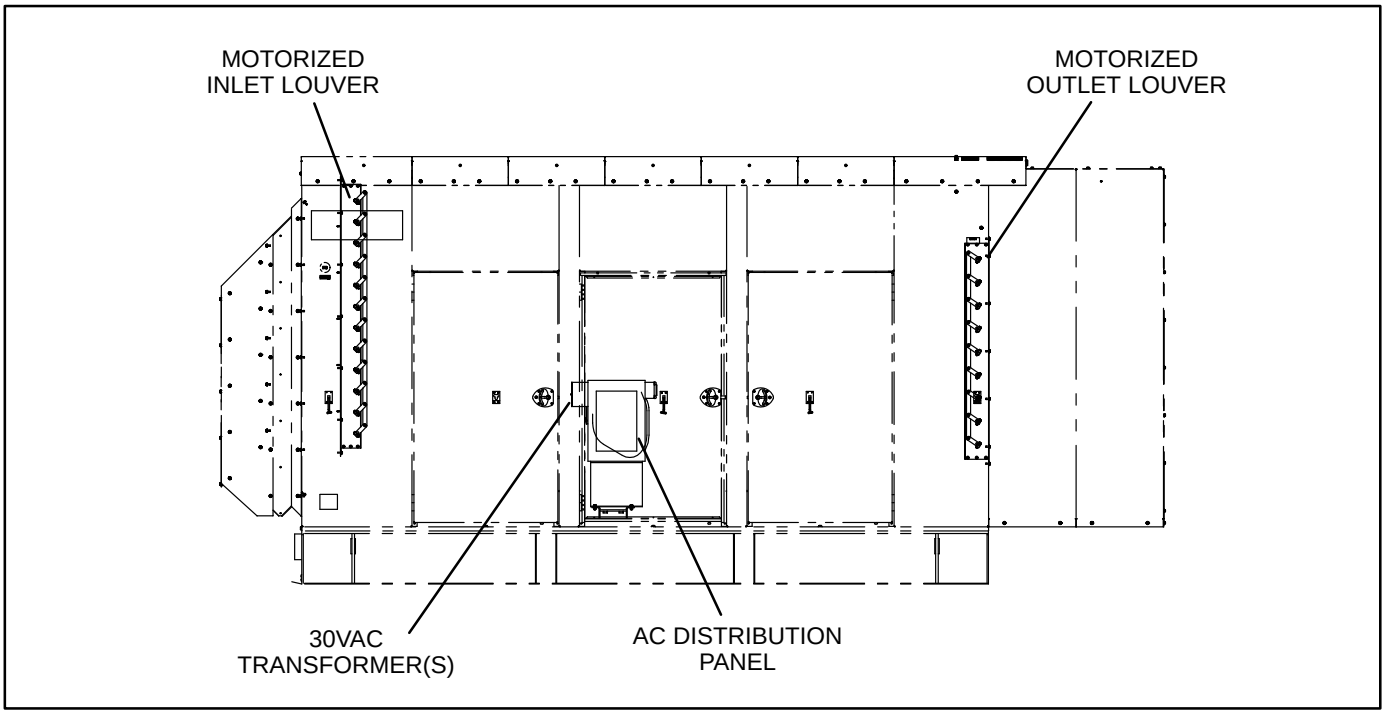


FIGURE 7-3. MOTORIZED LOUVER

OPTIONAL FUEL TRANSFER PUMP

A fuel transfer pump and control are available when a sub-base fuel tank is provided. The automatic control operates the fuel pump to maintain a reservoir of fuel in the sub-base tank.

⚠ CAUTION ***Power to the fuel transfer pump must be fed from a transfer switch and step-down transformer to maintain 120V power to the pump when utility power is interrupted. Power must be supplied to the transfer pump during the time the genset is running or not running.***

The fuel transfer pump/controller is prewired and ready to connect to a 120VAC source.

NOTE: When power is applied to the control or is restored after a power interruption, the control will automatically go to the power on mode (functions the same as pressing the ON switch). The pump will start if the control detects low fuel in sub-base tank.

⚠ CAUTION ***Do not connect AC power to the fuel transfer pump control without having fuel in the supply tank. Damage to the pump can occur if pump operates with no fuel in supply tank.***

Supply Tank

Refer to *Section 4* for information regarding the installation/plumping of the supply tank to the sub-base fuel tank.

The fuel transfer pump has a maximum inlet restriction capability of 16 inch Hg (which is approximately equivalent to 20 feet of diesel).

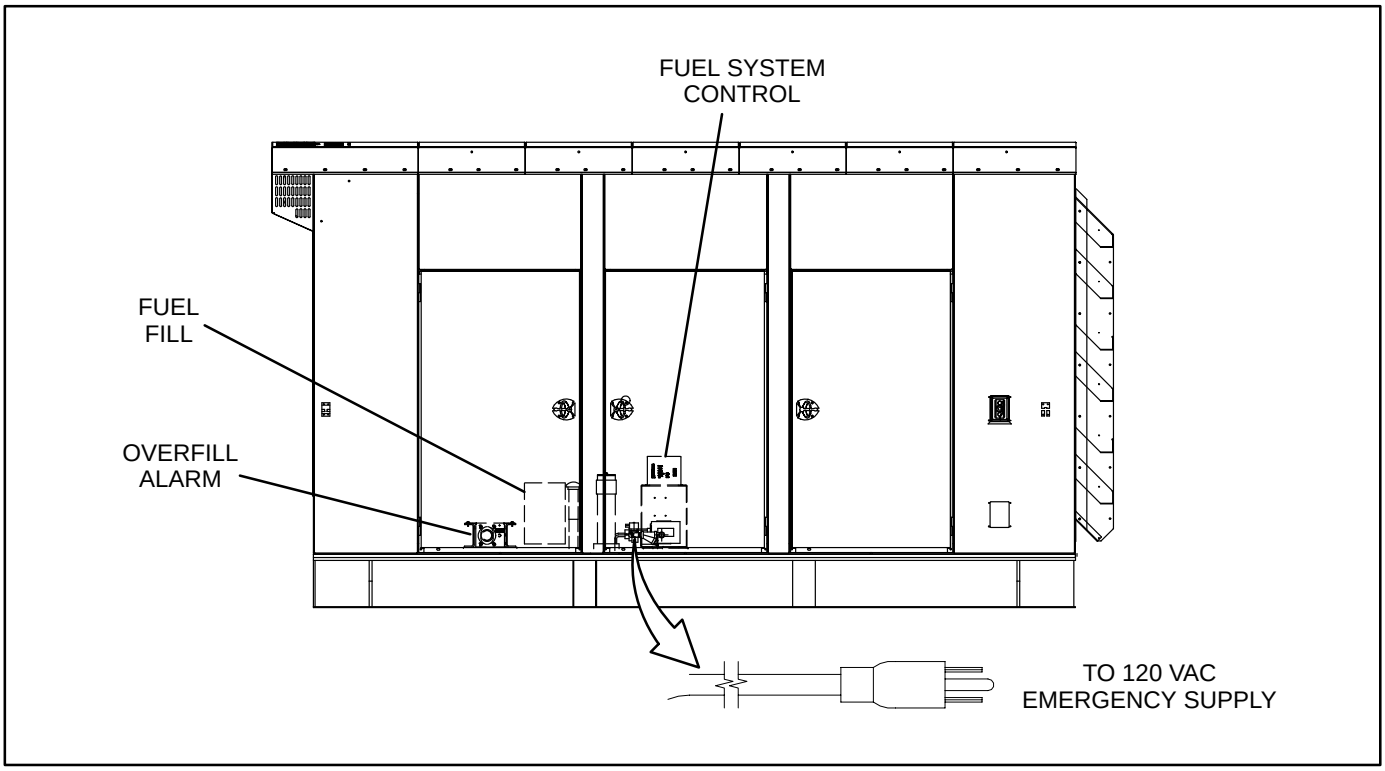


FIGURE 7-4. FUEL TRANSFER PUMP/CONTROL LOCATION

8. Prestart Preparation

GENERAL

Before attempting the initial start of the generator set, be sure to complete the *Installation Checklist* in *Section 9*.

INPOWER SERVICE TOOL GENERAL INFORMATION

InPower is a PC based service tool for the PowerCommand® 3200 Control (PCC). Use InPower to:

- Make adjustments to the controls trims and settings.
- Perform diagnostics and monitoring.
- Review event history.
- Create a capture file of the controls trims and settings.
- Update control calibrations (InPower PRO version).

Refer to INPOWER User's Guide for specifics.

InPower Adjust Mode

The adjustment feature allows you to make adjustments to genset parameters, calibrations and settings. There are several groups of adjustment parameters; note that not all gensets will have the same adjustments available.

InPower Capture File Description

InPower provides a method of extracting (capturing) a device's parameter values. Capturing saves device information in a file that is identified with a .CAP extension.

Capture files are used to store a copy of the genset's parameter values. During genset installation, it is suggested that a capture file be made before and after changes are made to the genset operating parameters. This information can be a very useful when troubleshooting the genset (determine if parameters/settings have been modified after installation) and when replacement of the Base board is necessary. The capture file can be used as a template to write the previous settings to the new Base board software.

ELECTRICAL SYSTEM

Make sure all electrical connections are secure and all wiring is complete and inspected. Replace and secure any access panels that may have been removed during installation.

Battery Connections

⚠WARNING ***Accidental starting of the generator set can cause severe personal injury or death. Make sure that the O/Manual/Auto switch on the control panel is set to the O (Off) position before connecting the battery cables.***

Starting the unit requires 24 volt battery current, using two, 12 volt batteries (see *Specification* section). Connect the batteries in series (negative post of first battery to the positive post of the second battery) as shown in Figure 8-1.

Necessary battery cables are on the unit. Service batteries as necessary. Infrequent use (as in emergency standby service), may allow battery to self-discharge to the point where it cannot start the unit. If installing an automatic transfer switch that has no built-in charge circuit, connect a separate trickle charger. Onan automatic transfer switches include such a battery charging circuit.

⚠WARNING ***Ignition of explosive battery gases can cause severe personal injury or death. Always connect negative (−) battery cable last to prevent arcing.***

⚠WARNING ***Ventilate battery area before working on or near battery. Arcing at battery terminals, light switch or other equipment, flame, pilot lights and sparks can ignite battery gas. Do not smoke, or switch trouble light ON or OFF near battery. Discharge static electricity from body before touching batteries by first touching a grounded metal surface.***

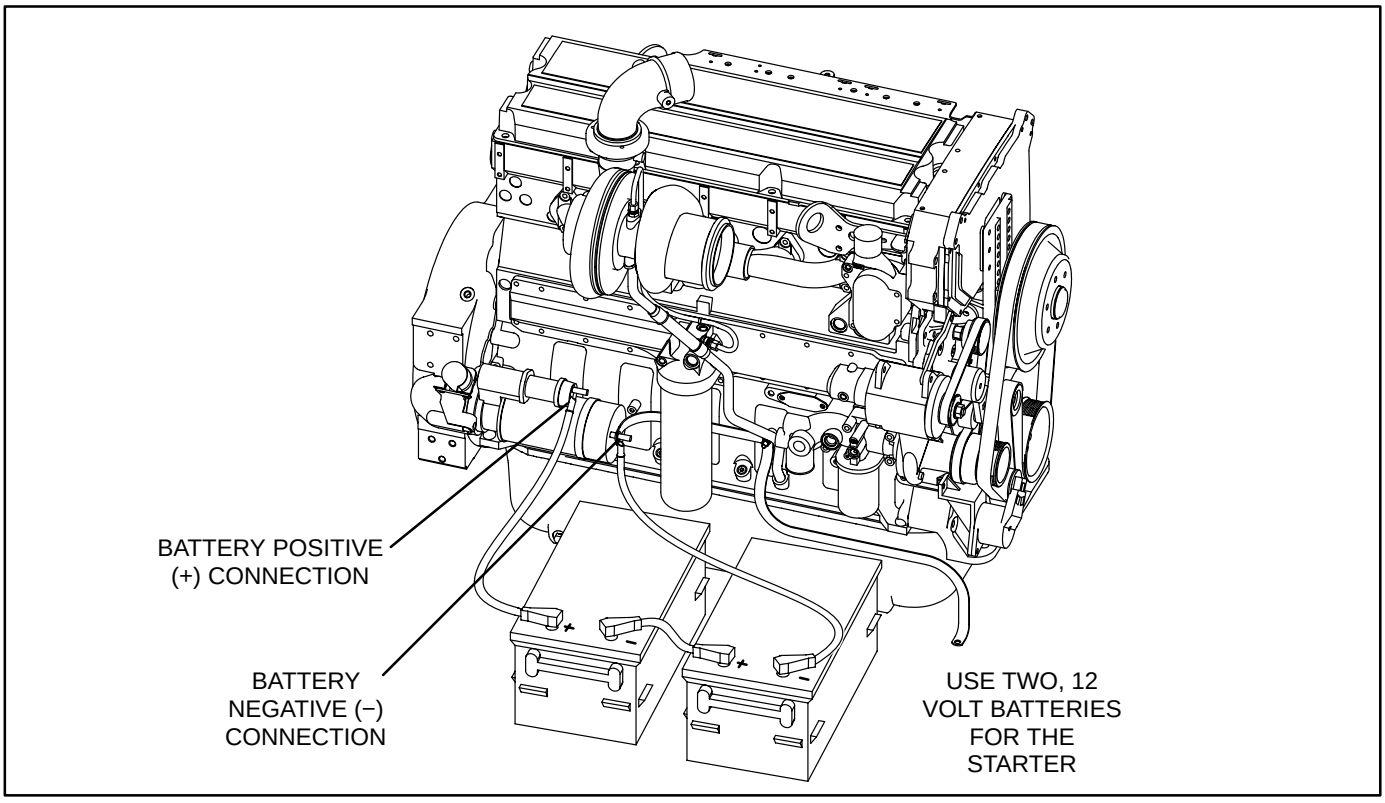


FIGURE 8-1. GENSET BATTERY CONNECTIONS

CONTROL PRESTART CHECKS

All generator set configuration options are set at the factory except for site related options, (e.g., Start/Stop Delays, Cycle Crank, Customer Fault names, etc.) and the optional Power Transfer Control (PTC) feature.

Adjustments of these options are divided into two categories within the menu driven system. These two categories are Setup and Adjust.

The Setup submenus are intended for qualified service personnel only. The Adjust submenu is intended for qualified service and site personnel only. For this reason, a separate password is required to modify the Setup submenus. The Adjust submenu may or may not require a password (site dependent).

⚠ CAUTION ***Improper calibration or adjustment of the control can cause equipment malfunction or damage. Calibration and adjustment must be performed by technically qualified personnel only.***

The following procedures describe how to modify the Adjust submenu options and if installed, the PTC Setup submenus, which are required to complete the genset installation.

The Adjust submenu allows you to calibrate the generator set voltage/frequency and start/stop time delays. For the prestart checks, adjustment of only the start/stop delays is required.

The PTC Setup submenus contain parameters with adjustable default values that should be checked and modified if necessary for this site. The descriptions in this section include ranges for the parameters and default values for this feature.

Saving Menu Changes

Changes are automatically saved when the menu is exited.

Password Menu

To allow the site personnel to modify only the Adjust submenu and not the Setup submenus, two passwords are assigned within the system software. An **Application** password is used for the Setup submenus and a **User** password is used for the Adjust submenu.

The two passwords are assigned during the initial installation of the generator set (via InPower) and will vary between sites. The installer must make sure that the passwords are available to the appropriate personnel.

When the generator set is first installed, the *Application* and *User* password are both set to GENSET to allow initial modification of the Setup and Adjust submenus. Assign new passwords when site installation is complete.

When viewing the Adjust menu, pressing the **+** or **−** button will display the User Password menu.

When viewing a Setup menu, pressing the **+** or **−** button will always display the Application Password menu.

After entering the correct password, the system will allow you to modify the submenus. To help prevent unauthorized adjustment, the entered password is valid for 10 minutes after the last button is pressed (i.e., the password will need to be reentered after the ten minute time−out.

Entering Password

To enter the password:

1. Display submenu to modify.
2. Press either the **+** or **−** button within the displayed submenu. The Password menu appears.
3. Press the **+** and **−** button to select the first character of the password (A−Z or 0−9). (Enter **Application** password for Setup submenus; Enter **User** password for Adjust submenu.)
4. Press the → button to select the next character field. Selected character field is highlighted.
5. Repeat steps 3 and 4 to enter remaining password characters.
6. Press the **Enter** button after entering the password. The submenu selected in step 1 will reappear.
7. After making desired changes to submenu, exit submenu to save changes.

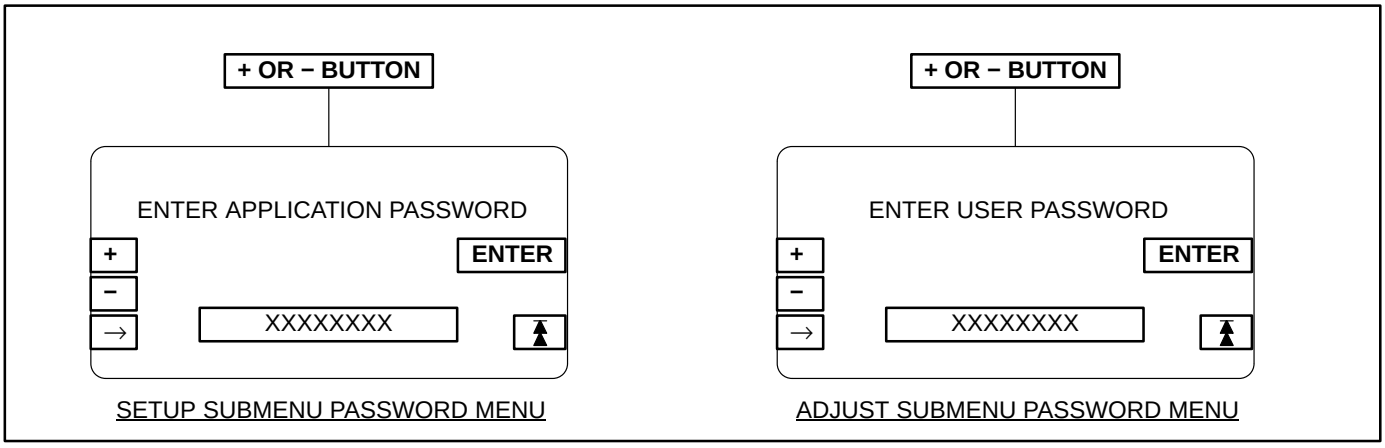


FIGURE 8-2. PASSWORD MENUS

ADJUST SUBMENU

Figure 8-2 shows the main menus (Menu A and Menu B) of the system control and the Adjust submenu.

To display the Adjust submenu, press the **MORE>>** button in Menu A and then the **ADJUST** button in Menu B.

The Adjust procedure is intended for qualified service personnel and site personnel only and may require a **USER** password. If a password is required, the **USER** password menu will appear when you try to modify the Adjust submenu. (Refer to *PASSWORD Menu* in this section to enter password.

Changes are automatically saved when you exit this menu.

Use the + and − buttons to increase or decrease the values in the following fields. Use the arrow (→) button to move the cursor within a field or to the next field.

START DELAY: This delay applies only to remote starting in the Auto mode. The Start Delay adjustment range is 0 to 300 seconds.

STOP DELAY: This delay applies only to remote stopping in the Auto mode. The Stop Delay adjustment range is 0 to 600 seconds.

VOLTAGE: Used to adjust the output voltage ±5%.

FREQUENCY: Used to adjust the frequency ±3 Hz.

VOLTAGE/SPEED DROOP: These two submenus apply to a genset that has the paralleling option and is configured to operate in droop mode. These adjustments must be performed by technically qualified personnel only.

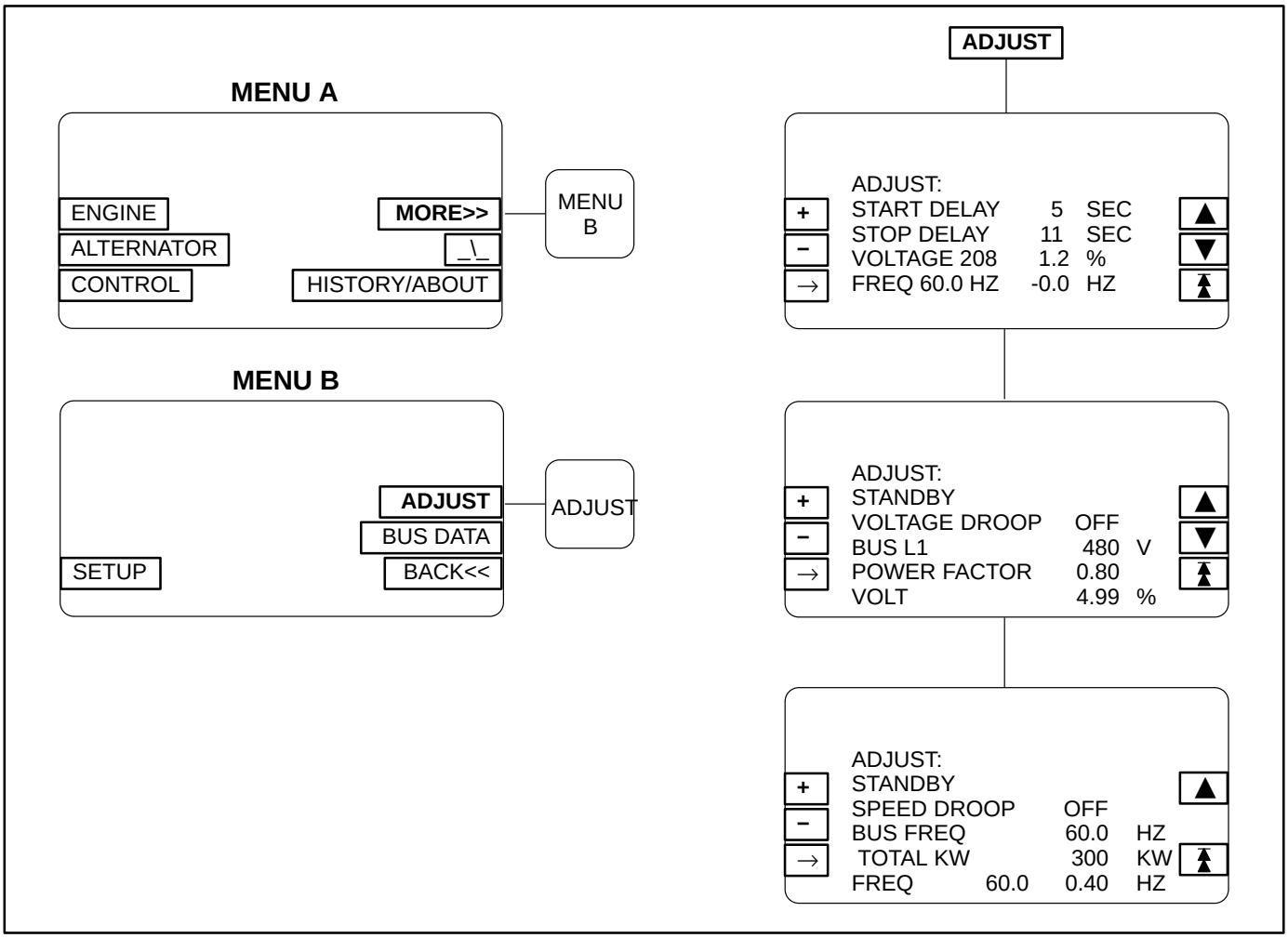


FIGURE 8-3. ADJUST SUBMENU

POWER TRANSFER CONTROL MAIN MENUS

Figure 8-4 shows the main menus (Menu A and Menu B) of the system control, the two setup menus and the two main menus of the optional Power Transfer Control (PTC) feature.

To adjust PTC system parameters, press the appropriate PTC main menu button and refer to the page number shown in Figure 8-4 for detailed information related to the submenu selected.

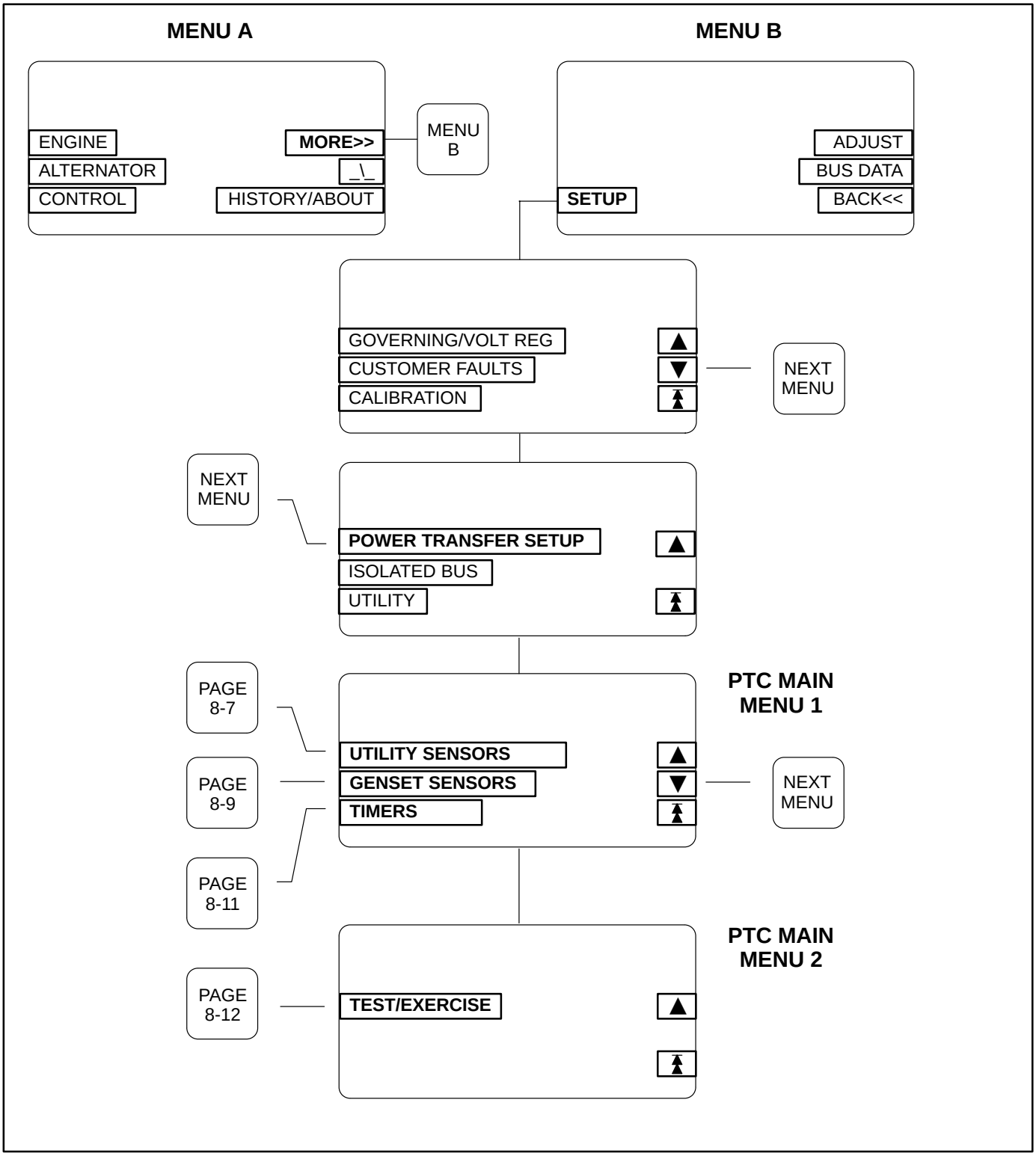


FIGURE 8-4. PTC SETUP MAIN MENUS

UTILITY SENSORS SUBMENUS

If you press the “UTILITY SENSORS” button in the PTC Main Menu 1, the Utility Sensors submenus will appear (Figure 8-5).

The following field descriptions show the valid field entries and default value (shown in parenthesis) for each field. For a complete explanation of these fields, refer to heading “*PTC Detailed Field Descriptions*“ in this section.

Use the + and − buttons to increase or decrease the values in the following fields. Use the arrow (→) button to move the cursor within a field or to the next field. Exit menu to save changes.

U PT VOLT LL: Enter the value of the utility line-to-line voltage which yields 100% voltage at the terminals of the utility (bus) PT module.

Range: 1−15000V, adjustable by standard nominal voltage values, 100V, 10V and 1V increments (1V).

The 100% voltages for each of the four possible utility (bus) PT modules are as follows, based on module dash number:
−01 = 208 volts LL
−02 = 416 volts LL
−03 = 600 volts LL
−04 = 120 volts LL

Example 1: Nominal Utility voltage is 480V. This means that utility (bus) PT module number −02 should be used. The voltage which will yield 100% volts at this PT module is 416 per the above table. Thus enter 416V.

Example 2: Nominal Utility voltage is 4160V. A primary stage transformer with a ratio of 4200/240 is used. This means that utility (bus) PT module number −01 should be used. The voltage which will yield the 100% volts (208V from above table) is calculated as follows:

208 x (4200/240) = 3640. Thus enter 3640V.

U NOM VOLT LL: Enter the nominal utility line-to-line voltage. For example, 480, 4160, etc.. Range: 1−15000 V, adjustable by standard nominal voltage values, 100V, 10V and 1V increments (1V).

U CT RATIO: Enter the CT Ratio of the Utility L2 CT. This is the Ratio to 1 Amp. Range: 1−18000 (1A).

⚠ CAUTION ***This CT must be rated for 1 Amp output (e.g. NOT 5 Amp). Be sure CT secondary circuit has burden resistor or a shorting jumper in place before putting power through the CT. Example: CT Ratio = 2650:1. Thus enter 2650.***

U SENSOR TYPE: Enter the line-to-line (L-N) for 3 phase line-neutral voltage sensing or line-to-line (L-L) for 3 phase line-line voltage sensing. This applies to both the utility undervoltage and overvoltage sensors. Range: L−L, L−N (L−N).

U <wye> <delta>: Enter utility connection type. Range: Delta, Wye (Wye).

U UNLOADED KW: Enter the kW on utility Line 2 at which the utility is considered as unloaded. This is the L2 kW level at which a closed transition soft transfer will disconnect from the utility.

UTILITY UNDERVOLTAGE: Non-adjustable field, always enabled.

UTILITY OVERVOLTAGE, FREQUENCY: Used to enable or disable menu function. Choose Enabled or Disabled (Enabled).

UV PICKUP: Enter a number between 85 and 100% of the nominal voltage (90%).

UV DROP OUT: Enter a number between 75 and 98% of the under-voltage pick-up percentage (90%).

UV DELAY: Enter a time between 0.1 and 5.0 seconds (0.5 seconds).

UV MIN PHASE: Displays the lowest line voltage of the three utility phases.

OV PICKUP: This adjusts the over-voltage pickup as a percentage of the over-voltage drop-out. Enter a number between 95 and 99% (95%).

OV DROP OUT: Enter a percentage between 105 and 135% of the nominal voltage (110%).

OV DELAY: Enter a range between 0 and 120 seconds (3 seconds).

OV MAX PHASE: Displays the highest line voltage of the three utility phases.

CENTER (FREQ): Enter a frequency between 45 and 65 Hz (60 Hz).

PICK UP (FREQ): Enter a percentage between 5 and 20% of the nominal frequency (10%).

DROP OUT (FREQ): Enter a percentage between 1 and 5% of the nominal frequency (1%).

DELAY (FREQ): Enter a time between 0.1 and 15.0 seconds (5.0 seconds).

FREQUENCY: This field displays the sensed utility line frequency.

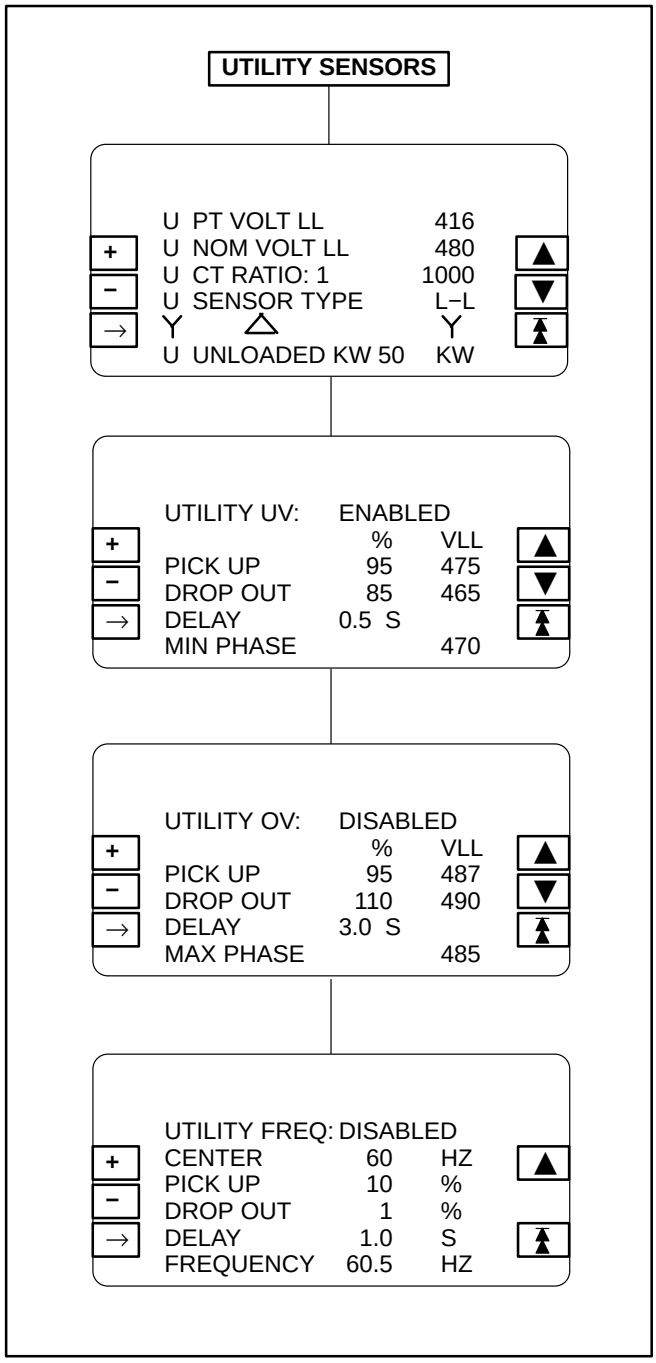


FIGURE 8-5. UTILITY SENSORS SUBMENUS

GENSET SENSORS SUBMENUS

If you press the “GENSET SENSORS” button in the PTC Main Menu 1, the Genset Sensors submenus will appear (Figure 8-6).

The following field descriptions show the valid field entries and default value (shown in parenthesis) for each field. For additional information regarding these fields, refer to heading “*PTC Detailed Field Descriptions*“ in this section.

Use the + and − buttons to increase or decrease the values in the following fields. Use the arrow (→) button to move the cursor within a field or to the next field. Exit menu to save changes.

G NOM VOLT LL: Non-adjustable field, displays current setting of genset nominal voltage. (See Adjust submenu to adjust the output voltage ±5%.)

G SENSOR TYPE: Enter the line-to-line (L-N) for 3 phase line-neutral voltage sensing or line-to-line (L-L) for 3 phase line-line voltage sensing. This applies to both the genset undervoltage and overvoltage sensors. Range: L−L, L−N (L−N).

G BASE LOAD: Enter the maximum load the genset will carry during a closed transition. Range: 0−100% (80%).

G RAMP LOAD: Enter the ramp time for the genset ramp load rate during a closed transition soft load transfer. Ramp rate is +100%kW divided by this time setting. Range: 0−900 seconds (20 sec).

G RAMP UNLOAD: Enter the ramp time for the genset ramp unload rate during a closed transtion soft load retransfer. Ramp rate is −100%kW divided by this time setting. Range: 0−900 seconds (20 sec).

G UNLOADED KW: Enter the %kW (based on standby rating) that the genset is considered unloaded. This is the %kW level at which a closed transition soft retransfer will disconnect from the genset. Range: 0−100% (5%).

GEN UNDERVOLTAGE: Non-adjustable field, always enabled.

GEN OVERVOLTAGE, FREQUENCY: Used to enable or disable menu function. Choose Enabled or Disabled (Enabled).

UV PICKUP: Enter a number between 85 and 100% of the nominal voltage (90%).

UV DROP OUT: Enter a number between 75 and 98% of the under-voltage pick-up percentage (90%).

UV DELAY: Enter a time between 0.1 and 5.0 seconds (4 seconds).

UV MIN PHASE: Displays the lowest line voltage of the three genset phases.

OV PICKUP: This adjusts the over-voltage pickup as a percentage of the over-voltage drop-out. Enter a number between 95 and 99% (95%).

OV DROP OUT: Enter a percentage between 105 and 135% of the nominal voltage (110%).

OV DELAY: Enter a range between 0 and 120 seconds (3 seconds).

OV MAX PHASE: Displays the highest line voltage of the three genset phases.

CENTER (FREQ): Enter a frequency between 45 and 65 Hz (60 Hz).

PICK UP (FREQ): Enter a percentage between 5 and 20% of the nominal frequency (10%).

DROP OUT (FREQ): Enter a percentage between 1 and 5% of the nominal frequency (1%).

DELAY (FREQ): Enter a time between 0.1 and 15.0 seconds (5.0 seconds).

FREQUENCY: Displays the sensed genset line frequency.

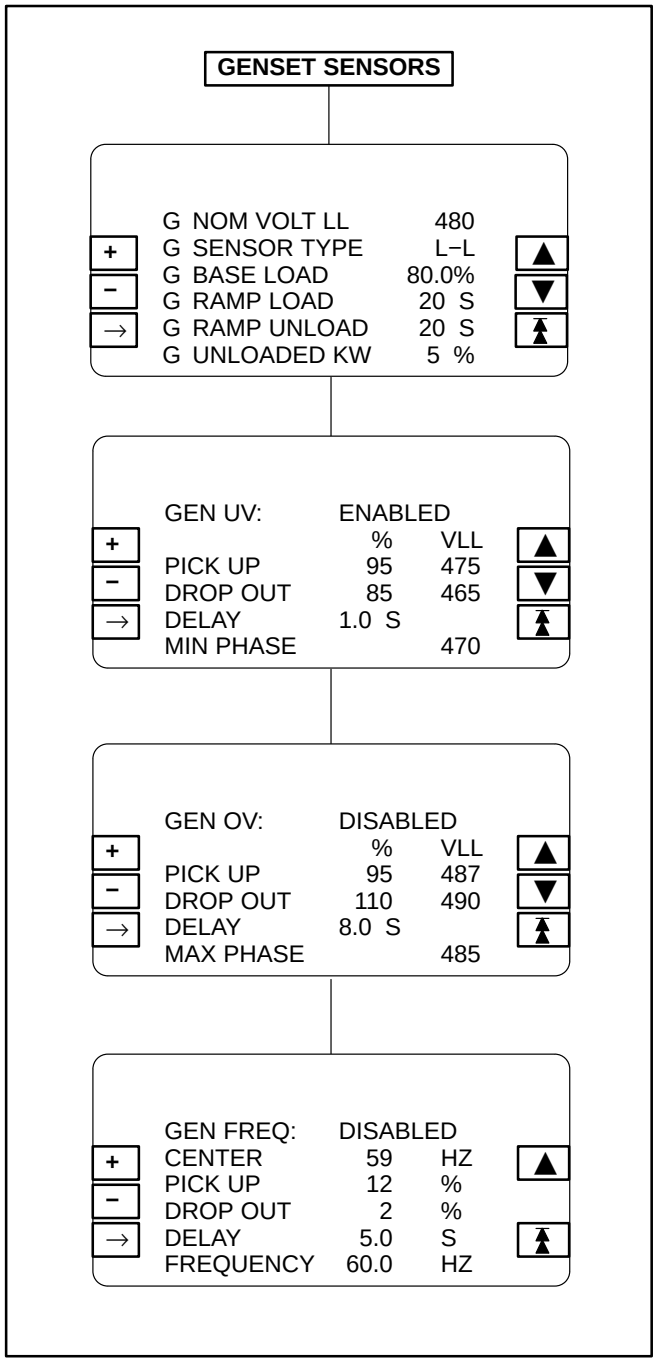


FIGURE 8-6. GENSET SENSORS SUBMENUS

TIMERS SUBMENU

If you press the “TIMERS” button in the PTC Main Menu 1, the Timers submenu will appear (Figure 8-7).

The following field descriptions show the valid field entries and default value (shown in parenthesis) for each field. For a complete explanation of these fields, refer to heading “*PTC Detailed Field Descriptions*“ in this section.

Use the + and − buttons to increase or decrease the values in the following fields. Use the arrow (→) button to move the cursor within a field or to the next field. Exit menu to save changes.

START DELAY: Sets time delay for genset engine start. Prevents nuisance genset starting during brief power interruptions.

Enter a range from 0 to 300 seconds (0 seconds).

STOP DELAY: Sets the time delay for engine cooldown following a re-transfer. This stop delay works in conjunction with and is activated at the same time as the normal cooldown timer. (Will extend normal cooldown timer if entered time is greater.)

Enter a time from 0 to 600 seconds (0 seconds).

TRANSFER: In a Normal to Emergency transfer this function allows the genset to stabilize before the load is applied. Enter a time from 0 to 120 seconds (10 seconds).

RETRANSFER: In a Emergency to Normal transfer this function allows the utility to stabilize before the load is applied.

Enter a time from 0 to 1800 seconds (600 seconds).

PGM TRANSIT: Sets the time delay for Programmed Transition. A setting of 0.0 disables the program.

Enter a time from 0 to 60 seconds (0 seconds).

MAX PARALLEL: Sets the maximum time during closed transition that utility and genset can be paralleled.

Enter a time from 0 to 1800 seconds (20 seconds).

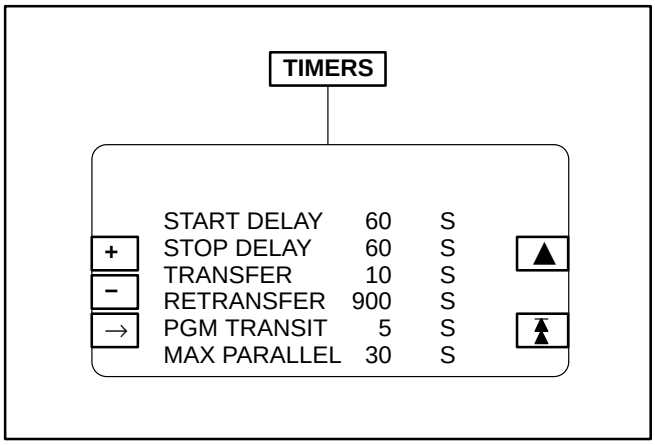


FIGURE 8-7. TIMERS SUBMENU

TEST/EXERCISE SUBMENU

If you press the “TEST/EXERCISE” button in the PTC Main Menu 2, the Test/Exercise submenu will appear (Figure 8-8).

The following field descriptions show the valid field entries and default value (shown in parenthesis) for each field.

Use the + and − buttons to increase or decrease the values in the following fields. Use the arrow (→) button to move the cursor within a field or to the next field. Exit menu to save changes.

MODE: Indicates the generator set application type for PTC option.

OT-PGM TRAN − Open transition load transfer.

CT-MOMENT − Closed transition load transfer with momentary (<100ms) overlap.

CT-SOFT − Closed transition load transfer with load ramping.

TEST WITH LOAD: Feature allows genset Test sequence, which is initiated through the Remote Start (TEST) switch, to operate with or without load. Default: **OFF**

EXER WITH LOAD: Feature allows genset Exercise sequence, which is initiated through control panel Exercise button to operate with or without load. Default: **OFF**

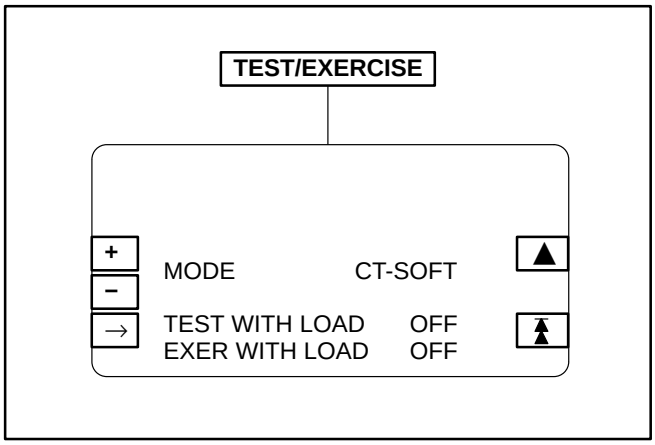


FIGURE 8-8. TIMERS SUBMENU

PTC DETAILED FIELD DESCRIPTIONS

⚠WARNING ***Improper calibration or adjustment of electronic control modules can cause death, severe personal injury, and equipment or property damage. Calibration and adjustment of these components must be performed by technically qualified personnel only.***

Start Delay: This start time delay is adjustable from 0 to 300 seconds. This brief time delay prevents the generator set from starting during short power interruptions. Timing starts at the utility power interruption. If the duration of interruption exceeds the delay time, the control system starts the generator.

Stop Delay: This stop time delay is adjustable from 0 to 600 seconds. The Stop Delay begins timing when the load is retransferred to the utility. At the end of the delay, the stop signal is sent to the generator set. This stop delay works in conjunction with and is activated at the same time as the normal cooldown timer. (Will extend normal cooldown timer if entered time for Stop Delay is greater.)

Transfer: This transfer time delay begins when genset voltage and frequency reach the settings of the control. After the delay, the PTC transfers the load to the utility. This brief time delay allows the generator set to stabilize before the load is applied. It has an adjustable range of 0 to 120 seconds. The default value is 10 seconds.

Retransfer: This retransfer time delay begins the moment utility line voltage and frequency return to specified values. After the delay, the PTC can retransfer the load to the utility. The delay allows the utility to stabilize before retransfer. It has an adjustable range of 0 to 1800 seconds. The default value is 600 seconds.

Under-Voltage Sensing

The PTC feature includes under-voltage sensors for the utility and the genset. When a sensor detects a low voltage condition over a specified time period, it initiates a transfer. When the source voltage returns to an acceptable value again, the sensor initiates a retransfer.

These parameters are adjustable. The under-voltage sensing range for a falling voltage (drop-out) is 75 to 98% of the pick-up voltage setting. The default value is 90%. The pick-up range for a rising voltage is 85 to 100% of the nominal voltage setpoint. The default value is 90%. The adjustable range for the time delay period is 0.1 to 5.0 seconds. The default delay time is 4 seconds. See Figure 8-9 for an example using the default values.

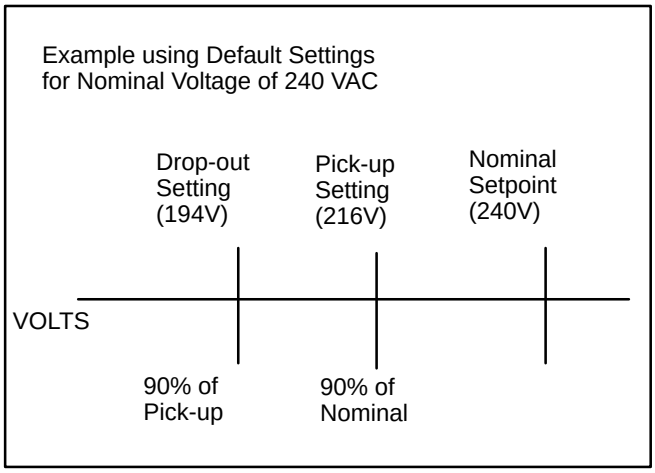


FIGURE 8-9. UNDER-VOLTAGE SENSING

Over-Voltage Sensing

The PTC feature includes over-voltage sensors for the utility and the genset that can be disabled and not used. When a sensor detects a high voltage condition over a specified time period (delay), it initiates a transfer. When the source voltage falls to an acceptable value again, the sensor initiates a retransfer.

These parameters are adjustable. The over-voltage sensing range (drop-out) for a rising voltage is 105 to 135% of the nominal voltage setpoint. The default value is 110%. The pick-up range for a falling voltage is 95 to 99% of the drop-out setting. The default value is 95%. The adjustable range for the delay time period is 0.0 to 120.0 seconds. The default delay time is 3.0 seconds. See Figure 8-10 for an example using the default values.

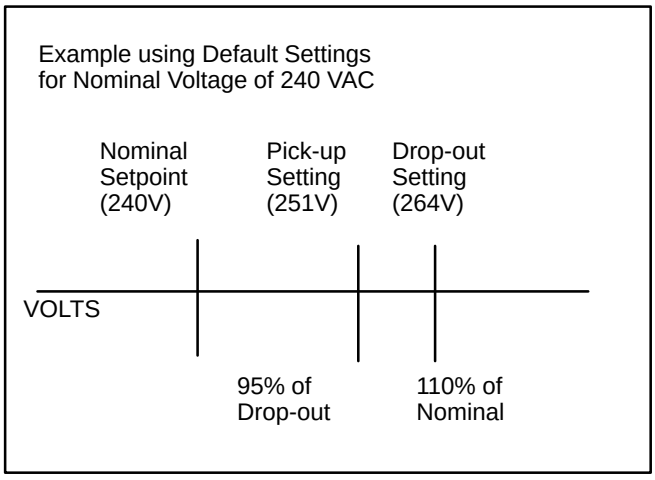


FIGURE 8-10. OVER-VOLTAGE SENSING

Frequency Sensing

The PTC feature includes frequency sensors for the utility and the genset that can be disabled and not used. When a sensor detects a high or low frequency condition over a specified delay time period, it initiates a transfer. When the frequency returns to an acceptable value again, the sensor initiates a retransfer.

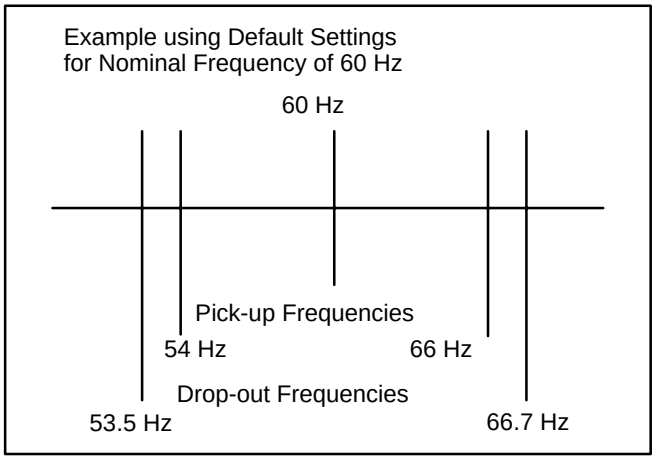


FIGURE 8-11. FREQUENCY SETTING

These parameters are adjustable. The nominal frequency can be set between 45.0 and 65.0 Hz. The default frequency is 60 Hz. The acceptable frequency bandwidth (pick-up) is ±5 to ±20% of the nominal frequency setpoint. The default value is 10%. The drop-out frequency is 1 to 5% beyond the pick-up. The default value is 1%. The range for the delay time period is 0.1 to 15 seconds. The default delay time is 5 seconds. The frequency sensing feature is enabled by default. This feature can also be disabled.

Programmed Transition

Programmed Transition introduces a delay (TDPT) during an “open transition” transfer or retransfer. Programmed transition causes a pause in the neutral position for an adjustable interval of time. In this position, the load is not connected to either the utility or the genset. This delay allows residual current from inductive loads to decay to an acceptable level before transfer is completed.

The length of time that the utility or genset breaker/contactors are both in the neutral (open) position can be adjusted from 0 to 60 seconds. The default value is 0 seconds. The proper adjustment is a function of the load. This feature is enabled by default.

This feature is not used in closed transition paralleling applications.

STARTING

Refer to the generator set *Operator’s* manual for important safety precautions and recommended procedures for starting the genset and verifying proper operation. Start the generator set and verify all engine and generator gauges are displaying the correct values.

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9. Installation Checklist

GENERAL

- ☐ Generator set wattage capacity is sufficient to handle maximum anticipated load.
- ☐ At least 3 feet of clearance (or greater for housing door) is provided around entire generator set for servicing and ventilation.
- ☐ Generator set is located in an area not subject to flooding.
- ☐ All operating personnel have read and are familiar with Operator's Manual.
- ☐ All operators have been thoroughly briefed on preventive maintenance procedures.
- ☐ All operators have read and understand all Important Safety Instructions in Operator's Manual.

GENERATOR SET SUPPORT

- ☐ Floor, roof or earth on which the generator set rests is strong enough and will not allow shifting or movement. Observe local codes on soil bearing capacity due to freezing and thawing.
- ☐ Generator set is properly supported and retained to approved base.
- ☐ Supporting base is large enough and is of non-combustible material − extends 6-inches all around set.

COOLING AIR FLOW

- ☐ Generator set air inlet is faced into direction of strongest, prevailing winds.
- ☐ Air inlet openings are unrestricted and at least 1−1/2 times larger than air outlet area.
- ☐ Cooling air outlet is on downwind side of building (if not, wind barrier is constructed).
- ☐ Proper ducting material (sheet metal, canvas) is used between radiator and air outlet.

DIESEL FUEL SYSTEM

- ☐ Fuel tanks meet or exceed all Local, State or National codes.
- ☐ Fuel lines are properly installed, supported and protected against damage.
- ☐ Approved flexible fuel line is installed between main fuel supply line and generator set's fuel system, near the generator set, to protect the fuel system from damage caused by vibration, expansion and contraction.
- ☐ Strainer or fuel screen (100 to 120 mesh) is installed in the fuel supply line to protect the fuel lift pump, day tank transfer pump or float valve seat from fuel supply tank debris.
- ☐ Fuel supply line shutoff valves are installed to prevent fuel flow in case of leaks.
- ☐ No shutoff valves are installed on engine fuel return line.
- ☐ External fuel pumps are connected and operational at all times (generator set started or shut down).
- ☐ Fuel system is properly primed.
- ☐ No fuel leaks are found in supply line or engine fuel system.

EXHAUST SYSTEM

- ☐ Operators are thoroughly briefed on the dangers of carbon monoxide gas.
- ☐ Areas around set are well ventilated. No possibility of exhaust fumes entering building doors, windows, or intake fans.
- ☐ Exhaust gases are piped safely outside and away from building.
- ☐ The correct length of approved rigid pipe is connected to the generator set flexible pipe using approved securing methods with no weight resting on engine exhaust components. There are no bends in flex section.
- ☐ Condensation drain is provided in lowest section of exhaust piping.
- ☐ Exhaust piping is insulated to guard against burns to personnel.
- ☐ Exhaust piping passing through walls or ceilings have approved fire-proof materials and are in compliance with all codes.
- ☐ Exhaust piping is large enough in diameter to prevent excessive back pressure on engine.

AC AND DC WIRING

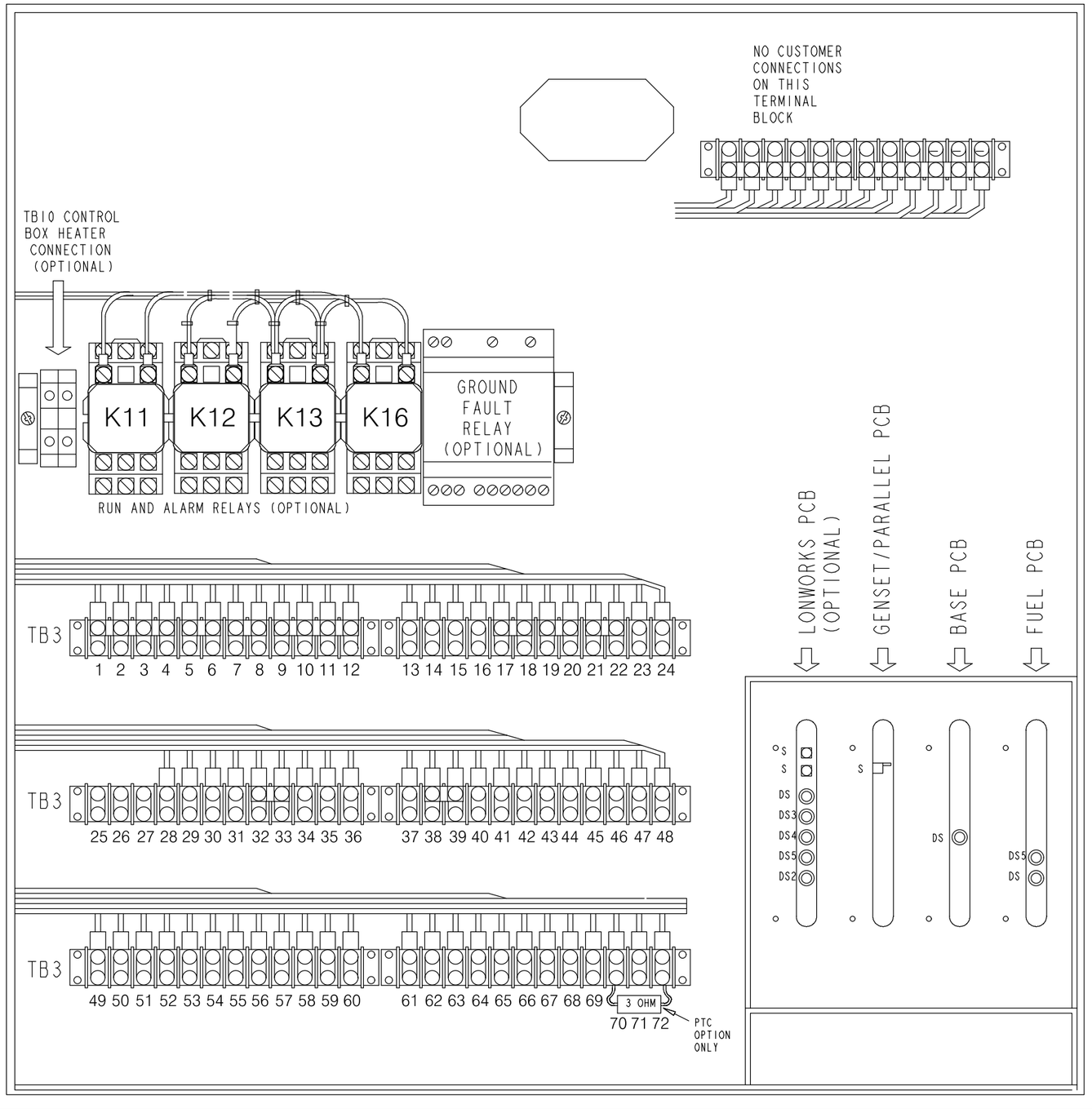
- ☐ Wire sizes, insulation, conduits and connection methods all meet applicable codes.
- ☐ AC and DC wires are separated in their own conduit to prevent electrical induction.
- ☐ All load, line and generator connections are proper and correct.
- ☐ Flexible conduit between generator set and building or surrounding structure.

GENERATOR SET PRESTART

- ☐ Generator set engine is properly serviced with oil and coolant.
- ☐ Batteries are properly installed, serviced and charged.
- ☐ Battery charger and engine coolant heater are connected and operational.
- ☐ All generator set covers and safety shields are installed properly.
- ☐ All fuel and coolant shutoff valves are operational.

DOOR INTERIOR

(SEE PAGE 10-2 FOR TERMINAL DESCRIPTIONS)



CUSTOMER CONNECTIONS (PAGE 1 OF 4)

TERMINAL BLOCK TB3

(SEE PAGE 10-1 FOR TB3 LOCATION)

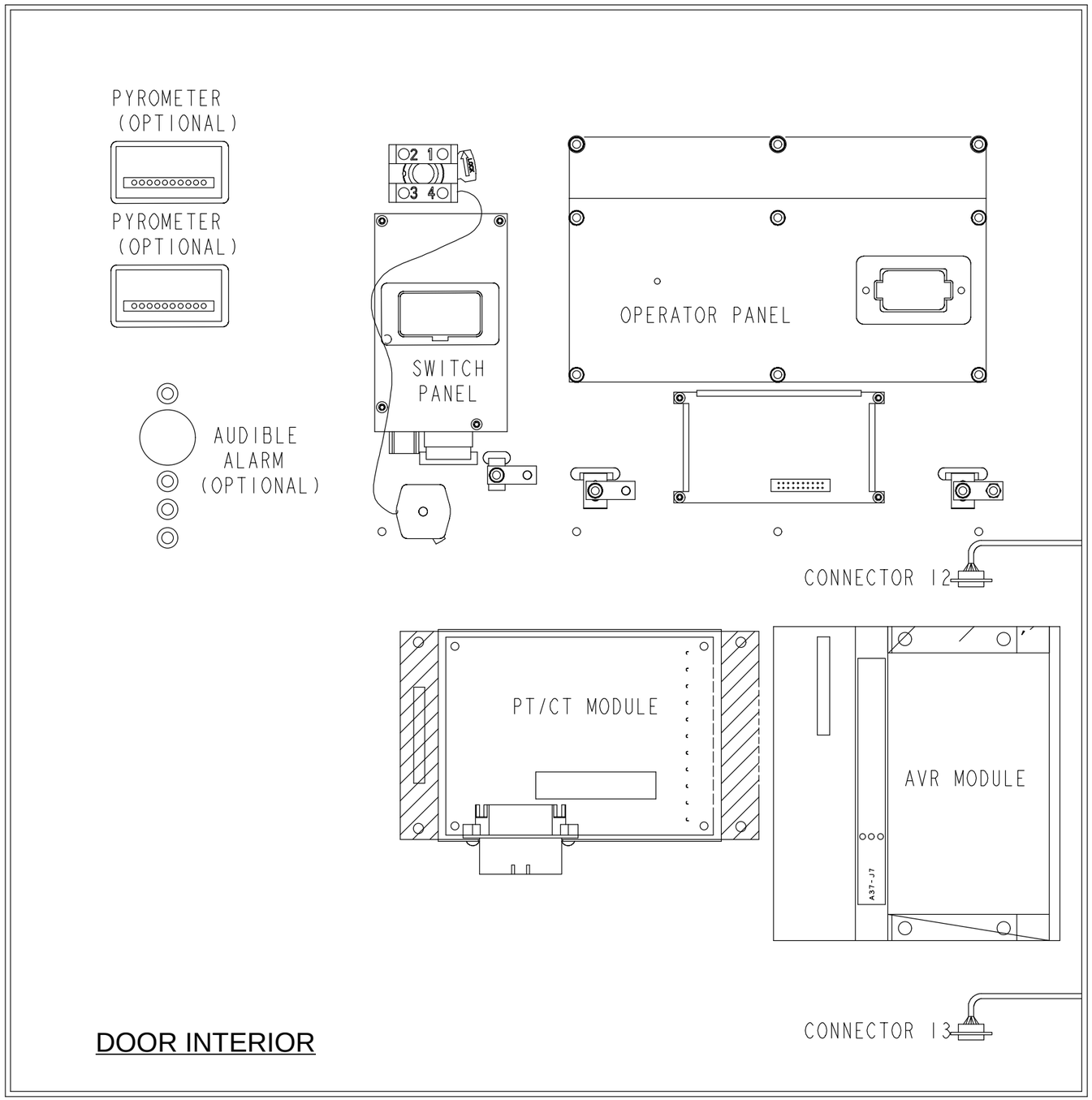
TB3-	NAME	DESCRIPTION
1	B+	24VDC/10 AMPS BATTERY VOLTAGE SUPPLY
2		
3		
4		
5	SWITCHED B+	24VDC/10 AMPS BATTERY VOLTAGE SUPPLY, AVAILABLE WHEN GENSET IS RUNNING
6		
7	DELAYED OFF SWITCHED B+	24VDC/10 AMPS BATTERY VOLTAGE SUPPL.Y, AVAILABLE WHEN GENSET IS RUNNING. CONFIGURABLE DELAYED OFF IS TYPICALLY USED FOR FUEL SHUTOFF.
8		
9	GND	BATTERY NEGATIVE
10		
11		
12		
13	CONFIGURABLE INPUT #1	CONFIGURABLE INPUT USED TO INITIATE A WARNING OR SHUTDOWN CONDITION. APPLY WITH (TB3-17/18) TO ACTIVATE
14	CONFIGURABLE INPUT #2	CONFIGURABLE INPUT USED TO INITIATE A WARNING OR SHUTDOWN CONDITION. APPLY WITH (TB3-17/18) TO ACTIVATE
15	CONFIGURABLE INPUT #3	CONFIGURABLE INPUT USED TO INITIATE A WARNING OR SHUTDOWN CONDITION. APPLY WITH (TB3-17/18) TO ACTIVATE
16	CONFIGURABLE INPUT #4	CONFIGURABLE INPUT USED TO INITIATE A WARNING OR SHUTDOWN CONDITION. APPLY WITH (TB3-17/18) TO ACTIVATE
17	CONFIGURABLE INPUT RETURN	RETURN PATH FOR CONFIGURABLE INPUTS. (TB3-13, 14, 15, 16)
18		
19	RELAY COIL SOURCE	SWITCHED 24VDC POWER SUPPLY. USE ON THE HIGH SIDE OF THE CUSTOMER SUPPLIED RELAY COIL IN CONJUNCTION WITH A RELAY DRIVER. PROVIDES A MINIMUM 800ma OF CURRENT
20		
21	READY TO LOAD RELAY DRIVER	ACTIVATES WHEN GENSET HAS REACHED 90% OF FREQUENCY & VOLTAGE. USE ON THE LOW SIDE OF THE CUSTOMER SUPPLIED RELAY COIL IN CONJUNCTION WITH RELAY COIL SOURCE (TB3-19/20).
22		
23	LOAD DUMP RELAY DRIVER	ACTIVATES AT A CONFIGURABLE LOAD LEVEL OR UNDER FREQUENCY CONDITION. USE ON THE LOW SIDE OF THE CUSTOMER SUPPLIED RELAY COIL IN CONJUNCTION WITH RELAY COIL SOURCE (TB3-19/20)
24	COMMON SHUTDOWN RELAY DRIVER	ACTIVATES ON ANY GENSET SHUTDOWN CONDITION. USE ON THE LOW SIDE OF THE CUSTOMER SUPPLIED RELAY COIL IN CONJUNCTION WITH RELAY COIL SOURCE (TB3-19/20) USE NC CONTACT TO POWER MODEM.
25	SPARE	
26	SPARE	
27	SPARE	
28	MODEM RELAY DRIVER	PROVIDES A CONFIGURABLE METHOD OF CONTROLLING AND CYCLING POWER TO AN EXTERNAL MODEM. USE ON THE LOW SIDE OF THE CUSTOMER SUPPLIED RELAY COIL IN CONJUNCTION WITH RELAY COIL SOURCE (TB3-19/20)
29	COMMON WARNING RELAY DRIVER	ACTIVATES ON ANY WARNING CONDITION. USE ON THE LOW SIDE OF THE CUSTOMER SUPPLIED RELAY COIL IN CONJUNCTION WITH RELAY COIL SOURCE (TB3-19/20)
30	LOCAL LOW FUEL INPUT	PROVIDES A LOW FUEL INDICATION FOR GENSETS APPLIED WITH A DAY TANK OR AN INTEGRATED FUEL TANK. SWITCH RETURN WITH TB3-31
31	LOCAL LOW FUEL RETURN	SWITCH RETURN FOR LOCAL LOW FUEL INPUT (TB3-30)
32	FIRST START INPUT	FOR PARALLELING APPLICATIONS, CONNECTS TO REMOTE MASTER START SENSOR OR BUS PT MODULE WITH FIRST START SENSOR.
33		

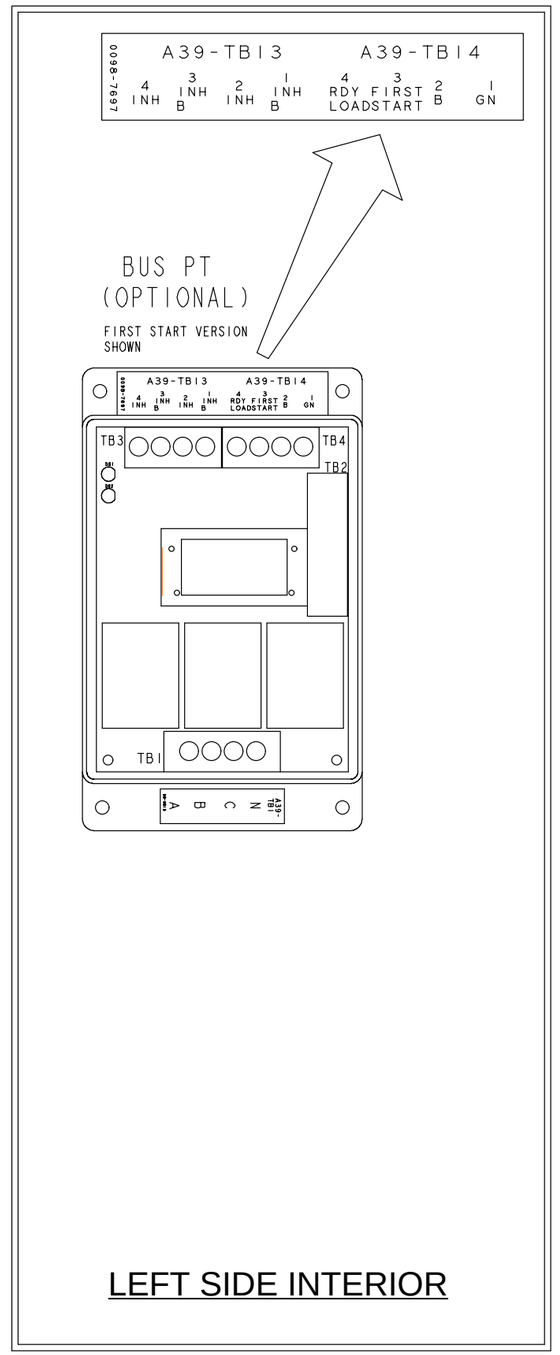
TB3-	NAME	DESCRIPTION
34	LOAD DEMAND INPUT	FOR ISOLATED BUS PARALLEL APPLICATIONS, INPUT ALLOWS GENSET TO RAMP TO NO LOAD, OPEN BREAKER AND SHUT DOWN. REMOVING INPUT CAUSES GENSET TO START, SYNCHRONIZE, CLOSE BREAKER, AND RAMP TO LOAD. FOR POWER TRANSFER CONTROL APPLICATIONS, INPUT WILL PUT CONTROL INTO MANUAL MODE. APPLY WITH SWITCH RETURN (TB3-38/39)
35	SINGLE MODE ENABLE INPUT	FOR SINGLE GENSET PARALLEL POWER TRANSFER (PLT) APPLICATIONS ONLY. APPLY WITH SWITCH RETURN (TB3-38/39) TO ENABLE MODE.
36	RAMP LOAD/UNLOAD SWITCH	USED WITH MULTIPLE GENSETS IN PARALLEL IN CONJUNCTION WITH A MASTER CONTROL OR OTHER PLC DEVICE. APPLY SWITCH RETURN (TB3-38/39) TO LOAD/UNLOAD GENSET AS LOAD PROFILE DICTATES
37	REMOTE LOW FUEL INPUT	PROVIDES A LOW FUEL INDICATION FOR GENSETS THAT ARE NOT FITTED WITH AN INTEGRATED FUEL TANK. APPLY SWITCH RETURN (TB-38/39) TO ACTIVATE
38	SWITCH RETURN	SWITCH RETURN FOR TB3-34, 35, 36, AND 37
39		
40	SYNC ENABLE INPUT	FOR USE IN SINGLE MODE PLT APPLICATIONS ONLY. +24VDC INPUT SIGNALS GENSET TO SYNCHRONIZE WITH UTILITY. (TB3-5 OR 6 CAN BE USED FOR 24VDC SUPPLY)
41	LOAD GOVERN KW + INPUT	ALLOWS A REMOTE DEVICE TO CONTROL KW LOAD ON GENSET WHILE UTILITY PARALLELED. ANALOG INPUT 0-5VDC
42	LOAD GOVERN KW -	RETURN LINE LOAD GOVERN KW
43	LOAD GOVERN KVAR + INPUT	ALLOWS A REMOTE DEVICE TO CONTROL KVAR LOAD ON GENSET WHILE UTILITY PARALLELED. ANALOG INPUT 0-5VDC THIS INPUT IS DEFAULTED TO "DISABLED" AND IS ENABLED WITH INPOWER.
44	LOAD GOVERN KVAR -	RETURN LINE FOR LOAD GOVERN KVAR.
45	EXTERNAL KW/KVAR SHIELD	SHIELD TERMINATION POINT FOR LOAD GOVERN INPUTS.
46	AUTO MODE OUTPUT	SWITCHED BATTERY 24VDC, FUSED AT 5A. AVAILABLE WHEN GENSET IS RUNNING IN AUTO MODE
47	GROUND FAULT INPUT	ACTIVATES A GROUND FAULT WARNING WHEN SWITCHED TO THE GROUND FAULT RETURN (TB3-48). USE IN CONJUNCTION WITH AN EXTERNAL GROUND FAULT RELAY.
48	GROUND FAULT RETURN	RETURN LINE FOR GROUND FAULT INPUT
49	GROUND FAULT ANALOG INPUT	FUTURE FEATURE.
50	GROUND FAULT METER RETURN	RETURN LINE FOR GROUND FAULT ANALOG INPUT.
51	LOAD SHARE KW +	FOR ISOLATED BUS PARALLELING ONLY. KW LOAD SHARING LINES FOR POWERCOMMAND GENSETS.
52	LOAD SHARE KW -	RETURN FOR LOAD SHARE KW.
53	LOAD SHARE KVAR +	FOR ISOLATED BUS PARALLELING ONLY. KVAR LOAD SHARING LINES FOR POWERCOMMAND GENSETS.
54	LOAD SHARE KVAR -	RETURN FOR LOAD SHARE KVAR .
55	LOAD SHARE SHIELD	SHIELD TERMINATION POINT FOR LOAD SHARE KW AND LOAD SHARE KVAR LINES.
56	GENSET BREAKER POSTION SWITCH INPUT	FOR PARALLELING AND POWER TRANSFER CONTROL APPLICATIONS. WHEN CLOSED INDICATES TO CONTROL THAT GENSET BREAKER IS CLOSED. USE WITH GENSET BREAKER SWITCH RETURN (TB3-58).
57	GENSET BREAKER INHIBIT SWITCH INPUT	FOR PARALLELING APPLICATIONS, WHEN CLOSED TO GENSET BREAKER SWITCH RETURN (TB3-50), GENSET BREAKER WILL OPEN, OR BE PREVENTED FROM CLOSING. FOR POWER TRANSFER CONTROL APPLICATIONS, WHEN CLOSED TO GENSET BREAKER SWITCH RETURN (TB3-50), RESULTS IN TRANSFER INHIBIT.

58	GENSET BREAKER SWITCH RETURN	RETURN LINE FOR TB3-56/57.
59	GENSET BREAKER OPEN COMMAND	FOR USE IN PARALLELING AND POWER TRANSFER CONTROL APPLICATIONS. NORMALLY OPEN CONTACT THAT CLOSES TO OPEN GENSET BREAKER. USE WITH TB3-60.
60	GENSET BREAKER OPEN COMMAND RETURN.	USE WITH TB3-59.
61	GENSET BREAKER CLOSE COMMAND.	FOR USE IN PARALLELING AND POWER TRANSFER CONTROL APPLICATIONS. NORMALLY OPEN CONTACT THAT CLOSES TO CLOSE GENSET BREAKER. USE WITH TB3-62.
62	GENSET BREAKER CLOSE COMMAND RETURN	USE WITH TB3-61.
63	UTILITY BREAKER POSTION INPUT	FOR POWER TRANSFER CONTROL APPLICATIONS. WHEN CLOSED INDICATES TO CONTROL THAT UTILITY BREAKER IS CLOSED. USE WITH UTILITY BREAKER RETURN (TB3-65).
64	UTILITY BREAKER INHIBIT INPUT	FOR POWER TRANSFER CONTROL APPLICATIONS. WHEN CLOSED TO UTILITY BREAKER RETURN (TB3-65), RESULTS IN RETRANSFER INHIBIT.
65	UTILITY BREAKER RETURN	USE WITH TB3-63/64
66	UTILITY BREAKER OPEN COMMAND	FOR USE IN POWER TRANSFER CONTROL APPLICATIONS. NORMALLY CLOSED CONTACT THAT OPENS TO OPEN UTILITY BREAKER.. USE WITH TB3-67.
67	UTILITY BREAKER OPEN COMMAND RETURN	USE WITH TB3-66.
68	UTILITY BREAKER CLOSE COMMAND	FOR USE IN POWER TRANSFER CONTROL APPLICATIONS. NORMALLY OPEN CONTACT THAT CLOSES TO CLOSE UTILITY BREAKER.. USE WITH TB3-69.
69	UTILITY BREAKER CLOSE COMMAND RETURN	USE WITH TB3-68.
70	SYSTEM LOAD INPUT	FOR POWER TRANSFER CONTROL APPLICATIONS. ACCEPTS CT INPUT FOR MONITORING B PHASE CURRENT ON THE UTILITY BUS. USE UTILITY CT RETURN (TB3-72). A 3 OHM BURDEN RESISTOR IS CONNECTED ACROSS TB3-70 AND TB3-72.
71	SPARE	
72	SYSTEM LOAD RETURN	USE WITH TB3-70.

NOTES

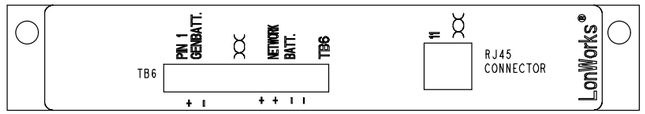
USE 18AWG SHIELDED CABLE FOR TERMINALS TB3-41, 42, 43, AND 44. TERMINATE DRAIN WIRE ON TB3-45
USE 18AWG SHIELDED CABLE FOR TERMINALS TB3-51, 52, 53, AND 54. TERMINATE DRAIN WIRE ON TB3-55



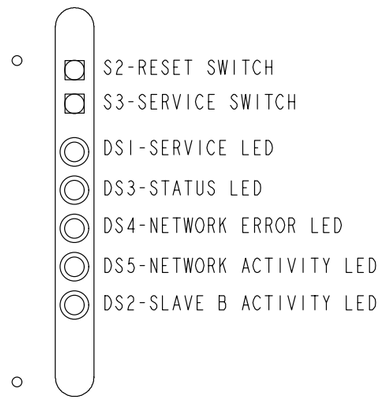


LONWORKS PCB (OPTIONAL)

LONWORKS PCB



FRONT OF CARD



TB6 CONNECTIONS

TB6-1	GENSET BATTERY +
TB6-2	GENSET BATTERY -
TB6-3	NOT USED
TB6-4	LONWORKS DATA CONNECTION 1
TB6-5	LONWORKS DATA CONNECTION 2
TB6-6	NETWORK POWER +
TB6-7	NETWORK POWER +
TB6-8	NETWORK POWER -
TB6-9	NETWORK POWER -

RJ45 CONNECTION

PROVIDES A TEMPORARY SERVICE CONNECTION TO THE NETWORK

S1-TERMINATION SWITCH

LOCATED ON TOP MIDDLE OF CIRCUIT CARD. CARD MUST BE REMOVED TO ACCESS. SWITCH TO ON IF SINGLE DEVICE NETWORK OR TERMINATED DEVICE IN A MULTIDROP TOPOLOGY.

S4-NODE CONFIGURATION SWITCH

LOCATED ON TOP FRONT OF CIRCUIT CARD. CARD MUST BE REMOVED TO ACCESS. USE TO SET NODE ADDRESS AND SWITCH BETWEEN 24VDC AND 12VDC SUPPLY.

S2-RESET SWITCH

MOMEMTARY PUSH BUTTON SWITCH USED TO RESET THE NETWORK COMMUNICATIONS MODULE (NCM).

S3-SERVICE SWITCH

MOMEMTARY PUSH BUTTON SWITCH USED TO PLACE THE NCM IN SERVICE MODE DURING LOGICAL INSTALLATION.

DS1-SERVICE LED (AMBER)

ILLUMINATED WHEN NCM IS IN SERVICE MODE.

DS3-STATUS LED (GREEN)

FLASHES AT A 1HZ RATE WHEN NCM IS PROPERLY EXECUTING ITS APPLICATION. WHEN THE LED IS NOT FLASHING THE NETWORK IS EITHER UNCONFIGURED, OFF-LINE, OR AN ERROR HAS OCCURRED.

DS4-NETWORK ERROR LED (RED)

ILLUMINATED WHEN NCM HAS DETECTED A NETWORK ERROR.

DS5-NETWORK ACTIVITY LED (GREEN)

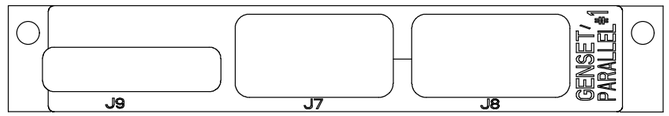
ILLUMINATED FOR 1/16TH OF A SECOND WHEN NCM SENDS OR RECEIVES AN EXPLICIT NETWORK MESSAGE.

DS2-SLAVE B ACTIVITY LED (GREEN)

ILLUMINATED WHEN NCM EXCHANGES DATA WITH THE BASE CARD.

STANDARD PCB
CUSTOMER CONNECTION INFORMATION

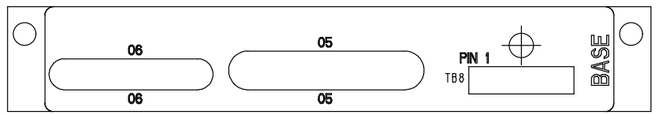
GENSET/PARALLEL PCB



S1-SLEEP IN AUTO SWITCH

SWITCH TO ON (UP POSITION) TO KEEP CONTROL AWAKE IN AUTO MODE.

BASE PCB

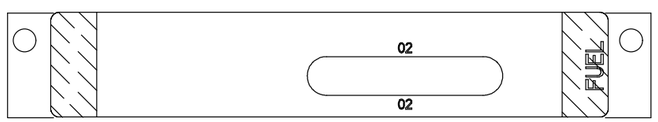


TB8-	NAME	DESCRIPTION
1	REMOTE EMERGENCY STOP	OPEN THE CONNECTION BETWEEN THESE TERMINAL POSITIONS TO INITIATE AN EMERGENCY STOP. TERMINAL POSITIONS MUST BE SHORTED TOGETHER IF REMOTE EMERGENCY STOP IS NOT USED.
2		
3	REMOTE START TYPE	DETERMINES START TYPE: OPEN = EMERGENCY START SEQUENCE. CLOSED = NORMAL START SEQUENCE. APPLY REMOTE START RETURN (TB8-5) TO CLOSE.
4	REMOTE START	APPLY REMOTE START RETURN (TB8-5) TO REMOTE START THE GENSET.
5	REMOTE START RETURN	RETURN LINE FOR REMOTE START TYPE AND REMOTE START.

DS1-READY STATUS LED (GREEN)

WHEN CONTINUOUSLY ILLUMINATED INDICATES THE CONTROL IS FUNCTIONING NORMALLY AND ALL CIRCUIT CARDS ARE IN THE CORRECT SLOT. LED WILL BLINK AT 1 SECOND INTERVALS WHEN THERE IS A CONFIGURATION PROBLEM. LED WILL BLINK AT 1/2 SECOND INTERVALS WHEN FAULT FLASHOUT IS ACTIVATED, WHEN FIRST BOOTING UP, OR WHEN A VALID OPERATING PROGRAM IS NOT LOADED.

FUEL PCB



DS5-WARNING LED (AMBER)

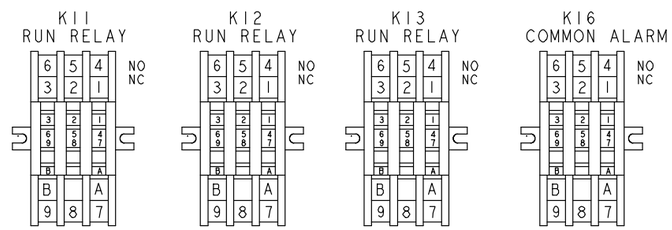
ILLUMINATED WHEN A WARNING CONDITION IS PRESENT.

DS1-SHUTDOWN LED (RED)

ILLUMINATED WHEN A SHUTDOWN HAS OCCURRED.

MISCELLANEOUS

CUSTOMER RELAYS



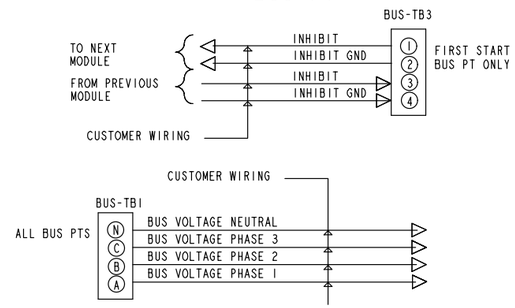
RUN RELAYS (K11, K12, & K13)

ACTIVATES WHEN GENERATOR SET IS RUNNING.

ALARM RELAY (K16)

ACTIVATES ON AN ALARM CONDITION.

BUS PT



BUS-TB3 (FIRST START VERSION ONLY)

PROVIDES A MEANS TO DAISY CHAIN CIRCUIT BREAKER INHIBIT SIGNALS AND SYSTEM GROUNDS WITH MULTIPLE GENSETS IN PARALLEL. BUS-TB3-4 AND BUS-TB3-2 ARE COMMON TO EACH OTHER. BUS-TB3-1 AND BUS-TB3-3 ARE COMMON TO EACH OTHER.

BUS-TB1

TERMINAL BLOCK FOR BUS VOLTAGE SENSING.

FRONT DOOR

CONNECTOR 12

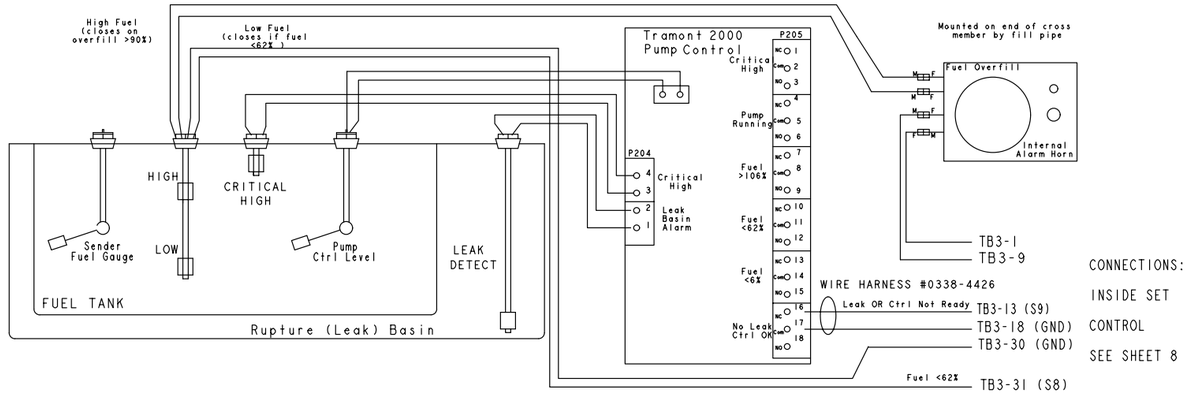
9 PIN RS232 CONNECTOR FOR DISPLAY PANEL PROGRAMMING.

CONNECTOR 13

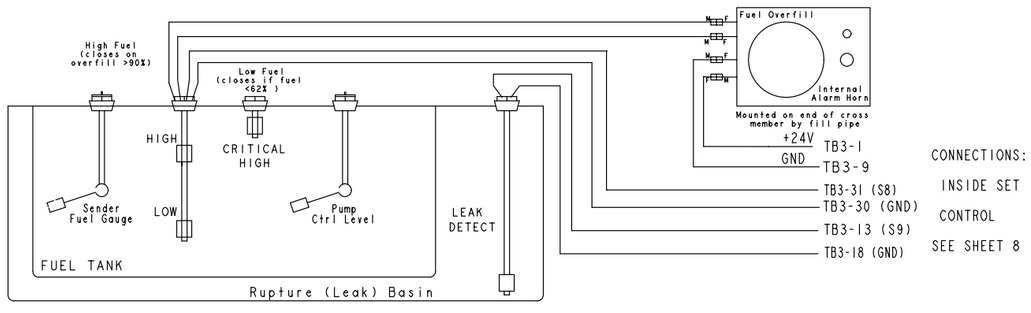
9 PIN RS232 CONNECTOR FOR PCC 3200 PROGRAMMING.

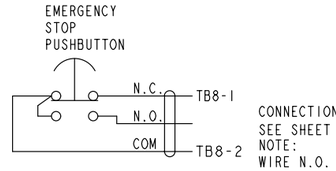
THIS IS A REPRESENTATIVE (GENERIC) SCHEMATIC/WIRING DIAGRAM. FOR TROUBLESHOOTING, REFER TO THE WIRING DIAGRAM PACKAGE THAT WAS INCLUDED WITH YOUR GENSET.

FUEL OVERFILL ALARM WITH TRANSFER PUMP CONTROLLER W/ CRITICAL ALARM AND LEAK BASIN ALARM



FUEL OVERFILL ALARM WITHOUT TRANSFER PUMP CONTROLLER

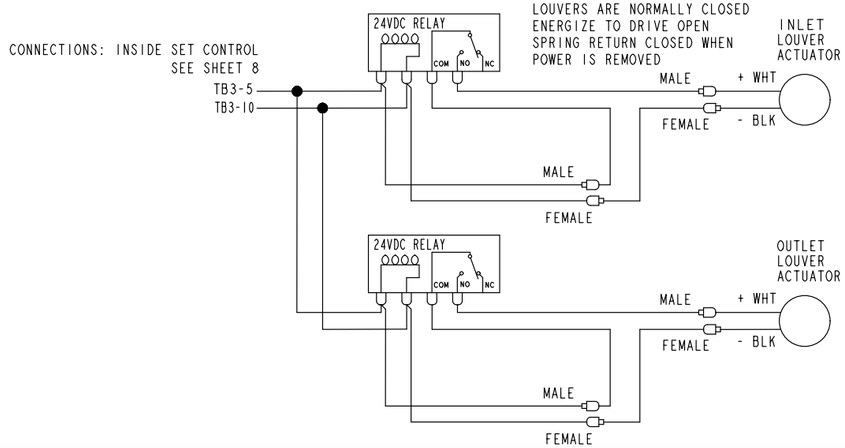




CONNECTIONS: INSIDE SET CONTROL SEE SHEET 8
NOTE: WIRE N.O. NOT CONNECTED

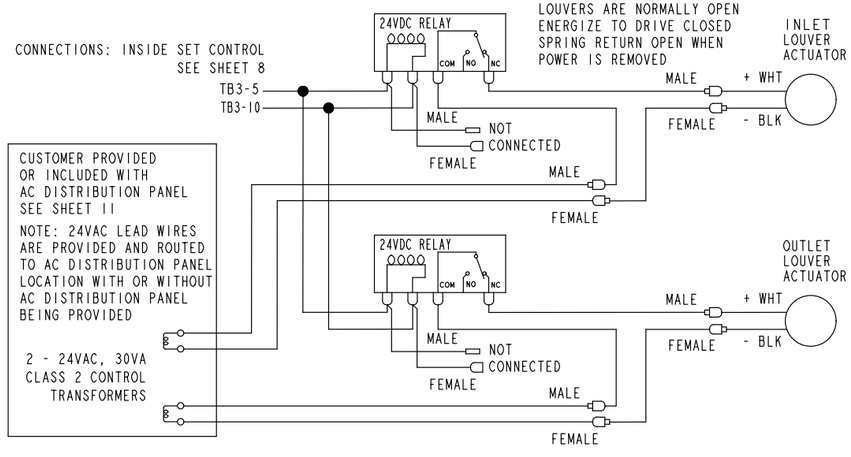
REMOVE JUMPER TB8-1 TO TB8-2 WHEN INSTALLING EMERGENCY STOP BUTTON

INLET AND OUTLET LOUVER CONNECTIONS (DC)



NOTE:
LOUVERS ARE NORMALLY CLOSED
ENERGIZE TO DRIVE OPEN
SPRING RETURN CLOSED WHEN POWER IS REMOVED

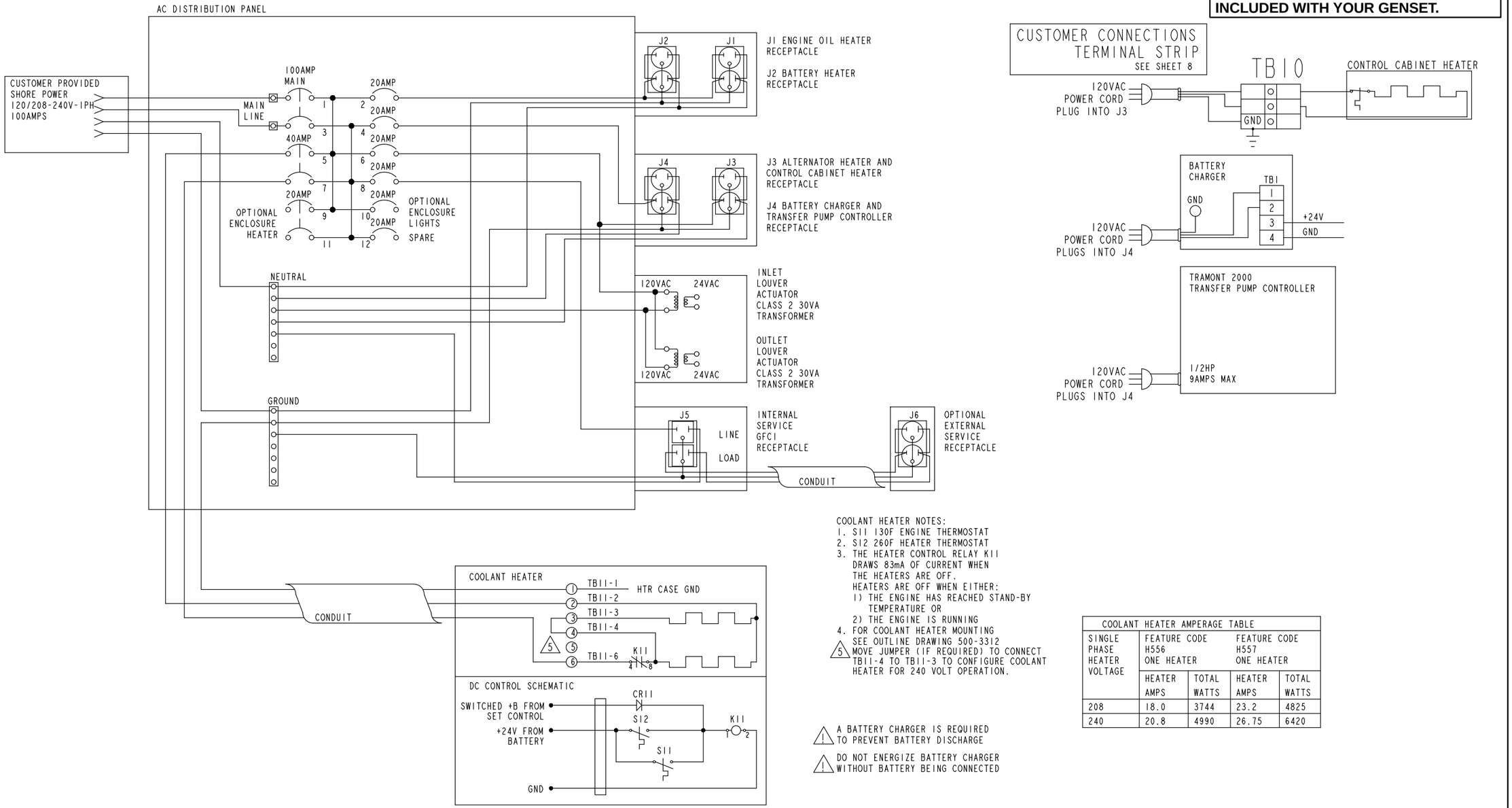
INLET AND OUTLET LOUVER CONNECTIONS (AC)



NOTE:
LOUVERS ARE NORMALLY OPEN
ENERGIZE TO DRIVE CLOSED
SPRING RETURN OPEN WHEN POWER IS REMOVED

No. 630-2592 sh 9 of 11
Rev. E
Modified 12-03

THIS IS A REPRESENTATIVE (GENERIC) SCHEMATIC/WIRING DIAGRAM. FOR TROUBLESHOOTING, REFER TO THE WIRING DIAGRAM PACKAGE THAT WAS INCLUDED WITH YOUR GENSET.



COOLANT HEATER NOTES:
1. S11 130F ENGINE THERMOSTAT
2. S12 260F HEATER THERMOSTAT
3. THE HEATER CONTROL RELAY K11 DRAWS 83mA OF CURRENT WHEN THE HEATERS ARE OFF. HEATERS ARE OFF WHEN EITHER:
   1) THE ENGINE HAS REACHED STAND-BY TEMPERATURE OR
   2) THE ENGINE IS RUNNING
4. FOR COOLANT HEATER MOUNTING SEE OUTLINE DRAWING 500-3312
5. MOVE JUMPER (IF REQUIRED) TO CONNECT TB11-4 TO TB11-3 TO CONFIGURE COOLANT HEATER FOR 240 VOLT OPERATION.

⚠ A BATTERY CHARGER IS REQUIRED TO PREVENT BATTERY DISCHARGE

⚠ DO NOT ENERGIZE BATTERY CHARGER WITHOUT BATTERY BEING CONNECTED

COOLANT HEATER AMPERAGE TABLE				
SINGLE PHASE HEATER VOLTAGE	FEATURE CODE H556 ONE HEATER		FEATURE CODE H557 ONE HEATER	
	HEATER AMPS	TOTAL WATTS	HEATER AMPS	TOTAL WATTS
208	18.0	3744	23.2	4825
240	20.8	4990	26.75	6420

No. 630-2592sh 11 of 11
Rev. E
Modified 12-03

ENCLOSURE/OPTIONS WIRING (SHEET 2 OF 2)

Cummins Power Generation
1400 73rd Avenue N.E.
Minneapolis, MN 55432
1-800-888-6626
763-574-5000 International Use
Fax: 763-528-7229

Power Generation