



Installation Manual

Generator Set with PowerCommand® 2100 Controller

DQHAA (Spec A–F)
DQHAB (Spec A–H)

California

Proposition 65 Warning

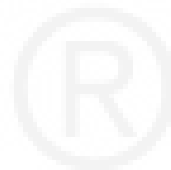
Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

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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. To prevent severe scalding, let engine cool down before removing coolant pressure cap. Turn cap slowly, and do not open it fully until the pressure has been relieved.
- 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 or combustible material are not left on or near the generator set.
- Make sure generator set is mounted in a manner to prevent combustible materials from accumulating under or near 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 breathe 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 near an operating generator set.
- To prevent serious burns, avoid contact with hot metal parts such as radiator system, turbo charger system 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 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.

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 modifica-

tions. 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 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 power system that usually includes power distribution equipment, transfer switches, ventilation equipment, mounting pads, 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 power system and for selecting the materials and products required.

Installation refers to the actual set-up and assembly of the 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 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 be heated as necessary to maintain the water jacket temperature determined by the manufacturer for cold start and load acceptance for the type of system.

Although Cummins Power Generation generator sets may start in temperatures below 40°F (4°C) when equipped with engine jacket water coolant

heaters, it might take more than 10 seconds to warm the engine before a load can be applied and may also require other supplemental starting aids. Refer to engine manual for specific engine requirements.

The **Low Coolant Temperature (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 and operating correctly. 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.

Product Modifications

Agency certified products purchased from Cummins Power Generation comply only with those specific requirements and as noted on company product specification sheets. Subsequent modifications must meet commonly accepted engineering practices and/or local and national codes and standards. Product modifications must be submitted to the local authority having jurisdiction for approval.

CAUTION

THIS GENERATOR SET REQUIRES LOW SULFUR HIGHWAY DIESEL FUEL (500 PPM MAXIMUM). REFER TO CUMMINS ENGINE OWNERS MANUAL FOR DETAILED FUEL REQUIREMENTS.



2. Specifications

MODEL	DQHAA, DQHAB
Engine Cummins Diesel Series	QSM11-G4
Generator kW Rating	See Genset Nameplate
Engine Fuel Connection Inlet/Outlet Thread Size	Refer to Generator Outline Drawing
Fuel Flow Max. Fuel Inlet Restriction Max. Fuel Return Restriction	8 in. Hg. (204 mmHg) 8 in. Hg. (204 mmHg)
Exhaust Outlet Size Max. Allowable Back Pressure Exhaust Flow at Rated Load Exhaust Temperature	4 in. NPT (Male) 40.8 in. H ₂ O (10.15 kPa) 2188 cfm (61.95 m ³ /min) 922.0° F (494.4° C)
Electrical System Starting Voltage Battery Group Number CCA (minimum) Cold Soak @ 0°F (-18° C)	24 Volts DC Two, 12 Volt 8D 1400
Cooling System Capacity with Standard Radiator	8.9 Gal (36.72 L)
Lubricating System Oil Capacity with Filters Oil Type*	38.8 Qts (26.5 L)
* Refer to Cummins engine <i>Owners Manual</i> for lubricating oil recommendations/specifications.	

FUEL CONSUMPTION (STANDBY/FULL LOAD/60HZ)

MODEL	DQHAA	DQHAB
US gph (L/hr)	21.81 (82.56)	23.15 (87.63)



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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. A typical generator set installation is shown in Figure 3-1.

Requirements to be considered prior to installation:

- Level mounting surface
- Adequate cooling air
- Adequate fresh induction air
- Discharge of generator set air
- Non-combustible mounting surface

- Discharge of exhaust gases
- 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 service entrance. Exhaust must not be able to enter or accumulate around inhabited areas.

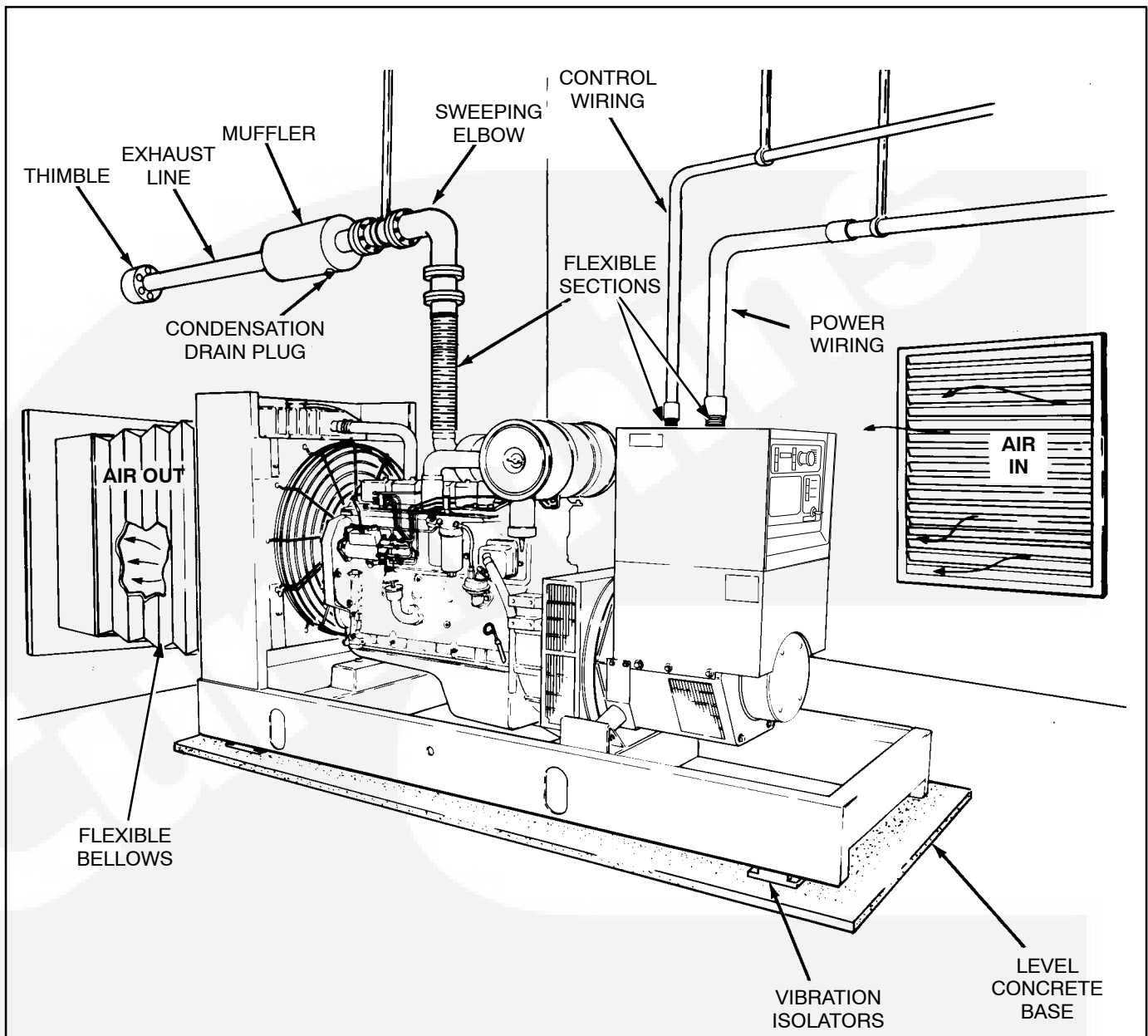
Provide a location away from extreme ambient temperatures and protect the generator set from adverse weather conditions. Optional housings are available for outdoor operation.

⚠ 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.



IMPORTANT!

COOLING AIR INLET MUST BE AT LEAST 1-1/2 TIMES LARGER THAN RADIATOR DUCT OUTLET AREA ON RADIATOR-COOLED MODELS.

FLOW OF COOLING AIR AND HEATED AIR MAY BE CONTROLLED BY AUTOMATICALLY OPERATED LOUVRES.

FIGURE 3-1. TYPICAL RADIATOR SET INSTALLATION

MOUNTING

Generator sets are mounted on a steel skid that provides 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.

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 to the skid using a flat washer and hexagonal nut for each bolt (see Figure 3-2). 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*.

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. (Increase clearance by width of door if optional housing is used.) 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.

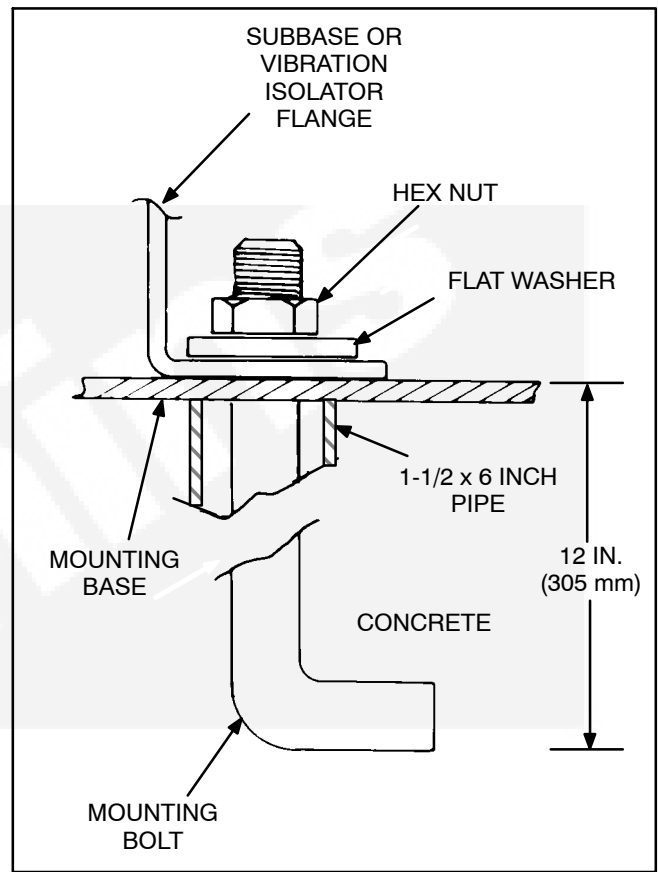


FIGURE 3-2. BOLT DIAGRAM

VIBRATION ISOLATORS

Installation and Adjustment Procedure

1. Place the vibration isolators (Figure 3-3) 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 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 may remain loose and therefore provide better isolation between the genset and support structure.

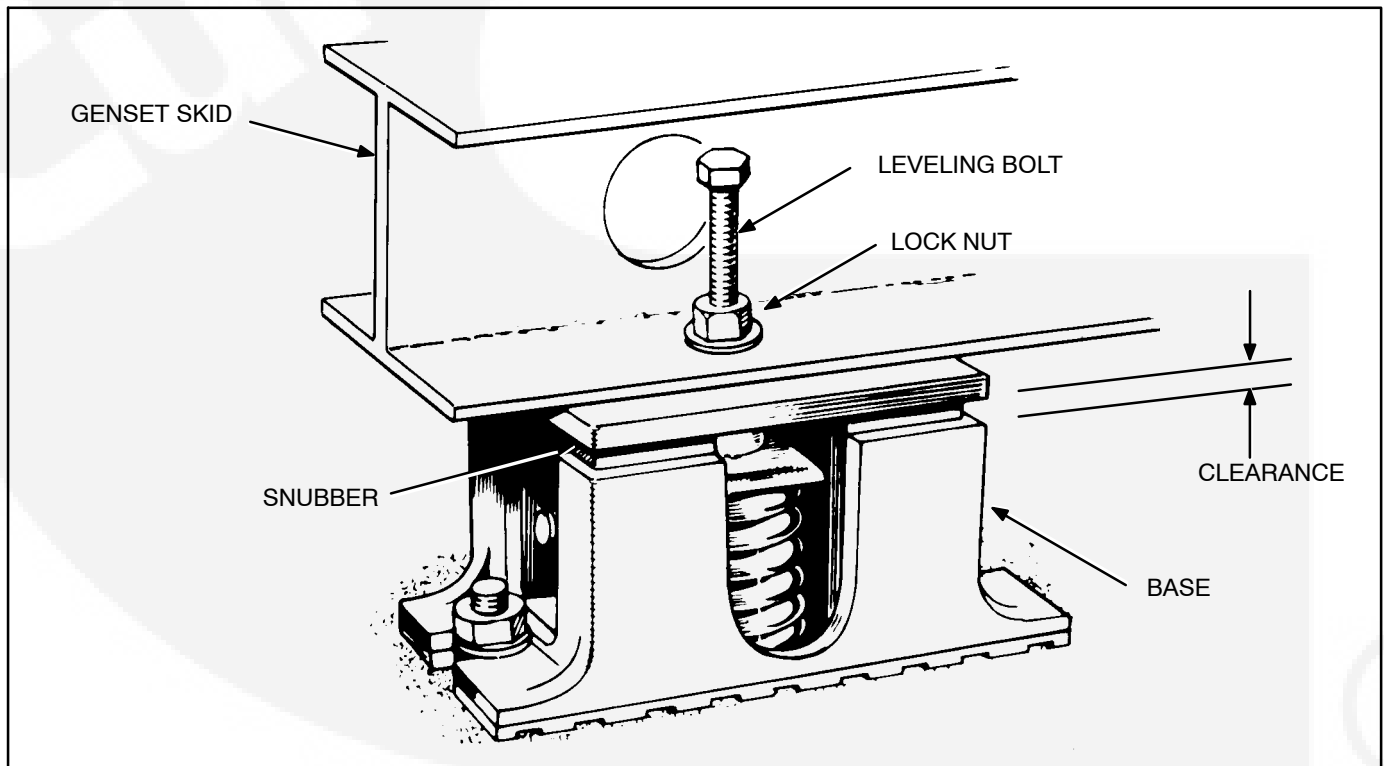


FIGURE 3-3. VIBRATION ISOLATORS

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

This generator set requires low sulfur highway diesel fuel (500 ppm maximum). Refer to Cummins engine *Owners Manual* for detailed fuel requirements.

In all fuel system installations, cleanliness is of the utmost 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 the genset "Switched B+" circuit to open the valve during generator set operation.

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 model-specific genset *Specification Sheet*.

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.

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 all applicable codes.*

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.

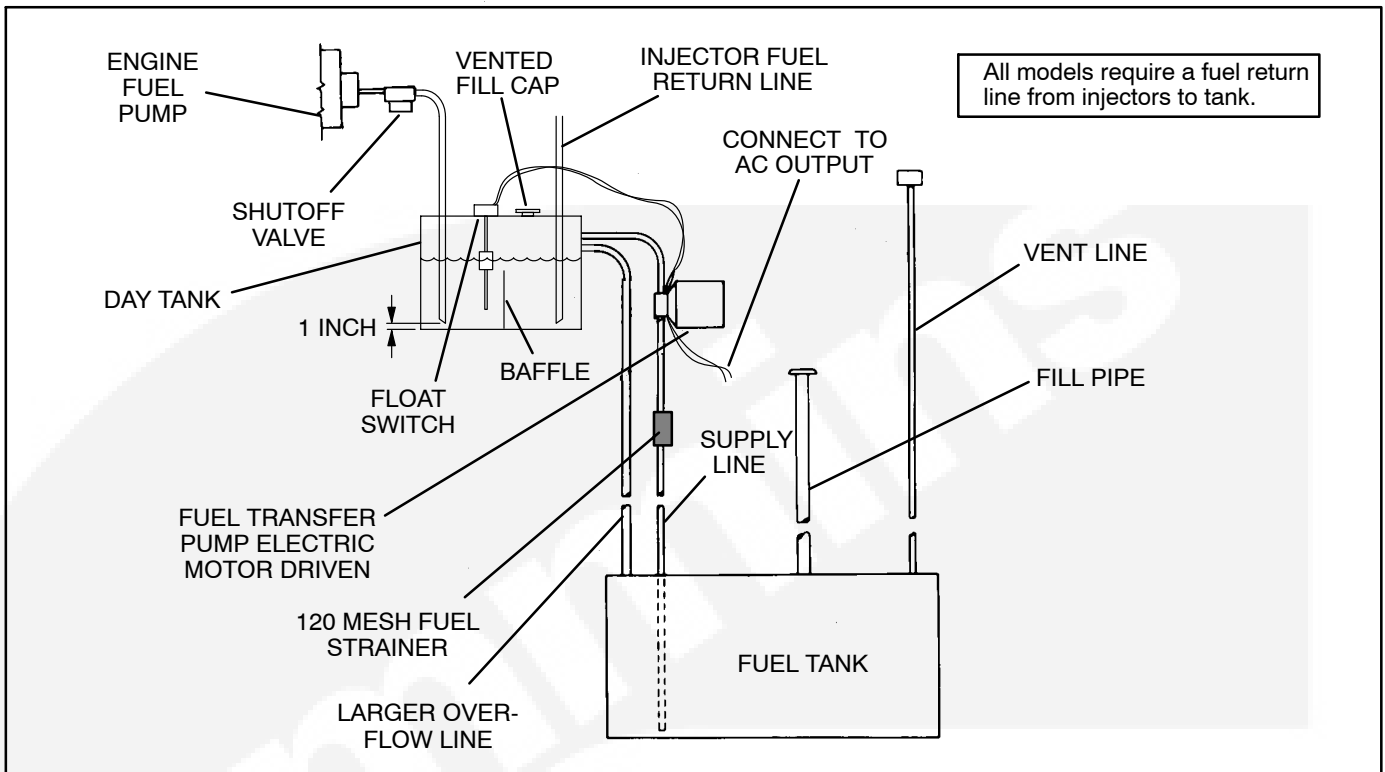


FIGURE 4-1. TYPICAL FUEL SUPPLY INSTALLATION

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 *Specification Sheet* for fuel consumption data.

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 (sometimes 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 genset 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 model-specific genset *Specification Sheet*.

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 a fuel transfer pump, to pump fuel from the supply tank to the day tank. A float switch in the day tank controls operation of the fuel transfer 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 Fig-

ure 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.

⚠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: With this installation, the day tank is installed near the generator set, below the fuel injection system and within the fuel inlet restriction limit. Include a automatic fuel 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.

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.

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



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 fume 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 fume tight exhaust system. Improper installation of slip type fittings (secured with a muffler clamp) may allow excessive 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 fume tight exhaust system.*

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. When a unit is provided with a partially installed or incomplete exhaust system, exhaust piping and chimneys shall be designed, constructed, and installed in accordance with the Standardary Combustion Engines and Gas Tur-

bines, NFPA 37 or applicable local standards. 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 to the exhaust system 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.*

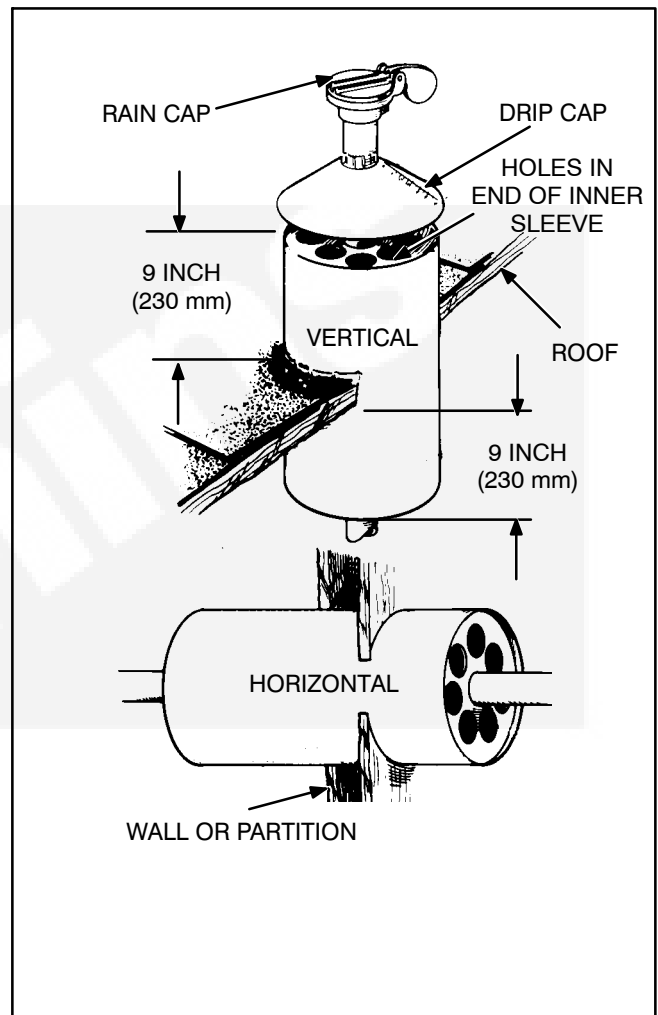


FIGURE 4-2. MOUNTING EXHAUST THIMBLE

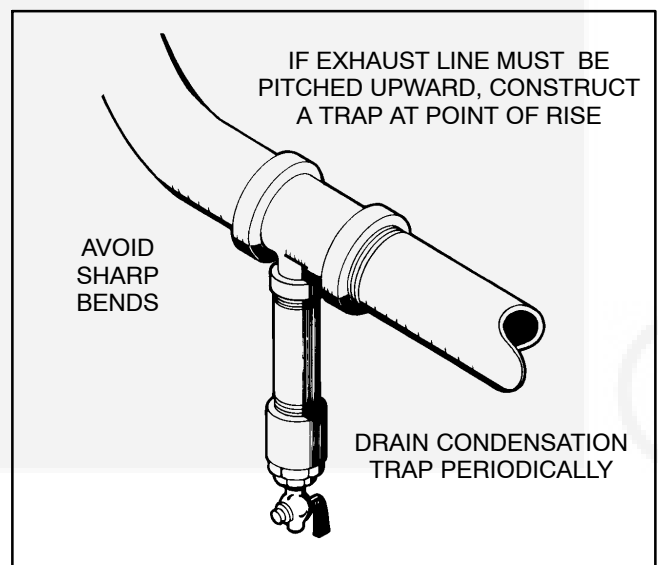


FIGURE 4-3. CONDENSATION TRAP

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 *Specification 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, or if outlet vent cannot be located as mentioned, install wind barrier. See Figure 4-4.

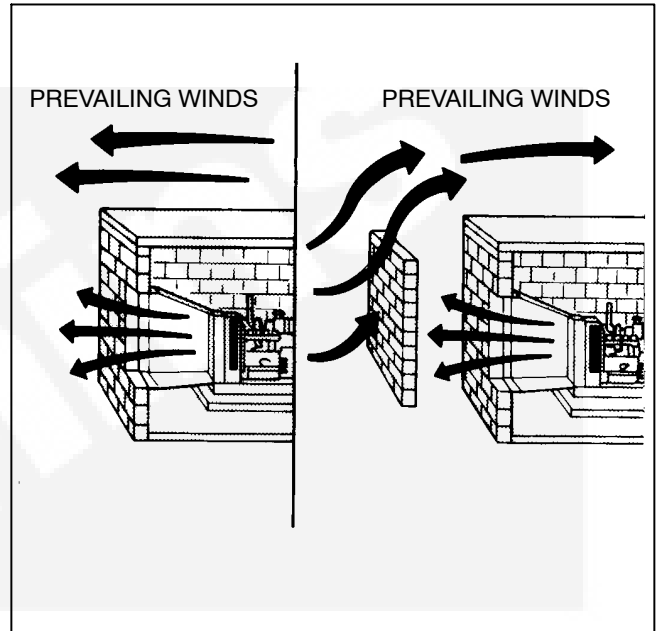


FIGURE 4-4. WIND BARRIER



Dampers

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

In cold climates, the radiator exhaust air can be recirculated to modulate the ambient air temperature in the generator set room. This will help the generator set warm up faster, and help to keep fuel temperatures higher than the cloud point of the fuel. If recirculation dampers are used, they should be designed to “fail closed”, with the main exhaust dampers open, so that the generator set can continue to operate when required. Designers should be aware that the generator set room operating temperature will be very close to the outdoor temperature, and either not route water piping through the generator set room, or protect it from freezing.

Radiator Set Requirements

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.

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

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 air outlet opening using screws and nuts so duct can be removed for maintenance purposes. The duct prevents recirculation of heated air. Before installing the duct, remove the radiator core guard.

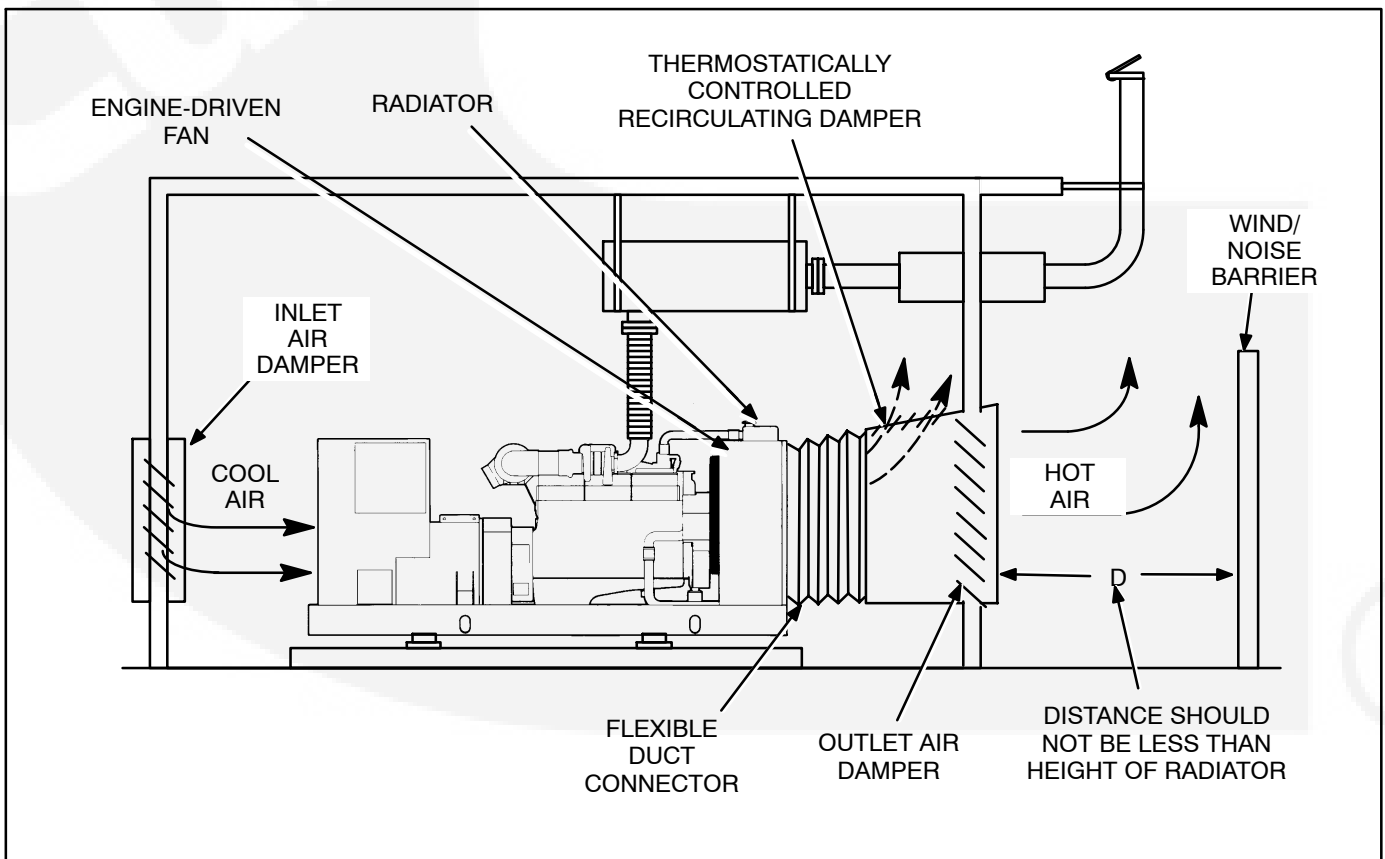
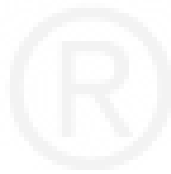


FIGURE 4-5. TYPICAL RADIATOR SET INSTALLATION



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5. DC Control Wiring

CONTROL WIRING

The generator set control panel box contains connection points for remote control and monitor options.

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

Use flexible conduit for all wiring connections to the generator set. All conduit used for control wiring is attached to the control housing.

Route the control wiring through the control housing and into the access holes on the bottom of the control panel box. Figure 5-1 also shows the access holes that should be used according to where the wires are terminated inside the control box.

A compression type strain-relief connector should be used to prevent dust, insects, etc. from entering control box.

Use cable ties to keep control wiring away from sharp edges and AC power cables within the control housing.

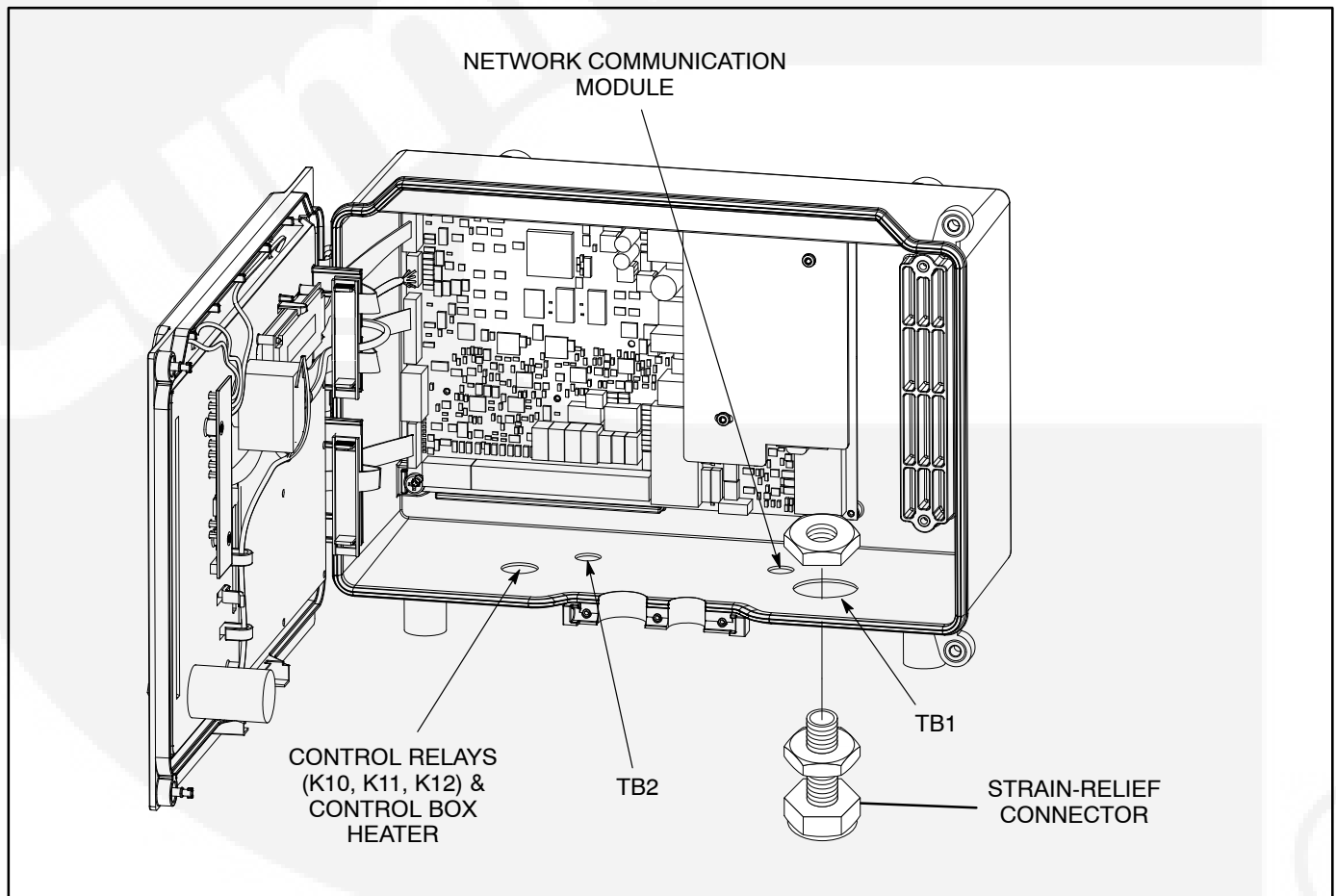


FIGURE 5-1. SUGGESTED CUSTOMER WIRE ROUTING

TB1 REMOTE MONITOR/CONTROL CONNECTIONS

Customer monitor/control connections are attached to terminal block TB1 (Figure 5-2). Optional equipment such as a remote annunciator panel, sensing devices used to monitor genset operation, remote start/stop switches, battery charger, etc. are attached to TB1. Refer to Customer Connections diagram in Section 10.

TB1 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 than relayed outputs, network, switched B+ and B+ are considered digital connections to terminal strip TB1. 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 TB1, the electrical contractor must determine the gauge of the **stranded copper** wire that is used at this installation site. Refer to PCC Customer Connections diagram in Section 10 for the relay specifications.

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

Switched B+: (Fused at 5 amps.) Same as Relay Connection description.

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

TB1 Customer Inputs

Refer to Page 10-2 for typical connections to TB1.

Remote Start: When the O/Manual/ Auto switch is in the Auto position, grounding this input initiates the engine cranking and start sequence. This circuit must be opened to permit resetting a shutdown condition with the Reset input. (The remote stop is actually the removal of the remote start signal to the control.)

Remote Emergency Stop: Grounding this input causes an immediate shutdown. Emergency stop must be reset at the front panel.

Remote Reset: When the O/Manual/ Auto switch is in the Auto position and the remote start switch is open, grounding this input resets any warning and shutdown fault (except Emergency Stop, which must be reset at the genset front panel.)

Customer Fault Inputs 1 through 4: Grounding any one of these inputs activates the corresponding warning or shutdown sequence.

External sensing equipment must be connected to the designated digital input.

The nature of the fault is an optional customer selection. Example inputs: Low Fuel Day Tank, Water In Fuel, Ground Fault, Low Starting Hydraulic Pressure, Low Starting Air Pressure, etc.

Each of the four fault functions can be programmed (using InPower), as follows:

- Enable/disable input. Default setting:
Enable 1 through 4
- Status, Warning or Shutdown. Default setting:
1 – None
2 thru 4 – Warning
- Active closed or open. Default setting:
Closed [ground] 1 through 4
- Change display name using up to 19 characters. Default setting:
1 – Customer Fault 1
2 – Ground Fault
3 – Low Fuel
4 – Rupture Basin Fault

TB1 Customer Outputs

Refer to Page 10-2 for typical connections to TB1.

Customer Outputs 1 through 4: One set of normally open (NO) contacts, rated for 2 amps at 30 VDC for each of the four output signals. The relays can be used to control small devices and indicator lamps.

The nature of the customer output signal (contacts closed) is an optional customer selection. Example outputs: Genset running, common warning, common fault, load shed, ready to load, etc.

Each relay can be independently programmed (using InPower) to energize as follows.

- Enable/disable output. Default setting:
Enable 1 through 4
- Status, Warning or Shutdown. Default setting:

- 1 – Common warning
- 2 – Common shutdown
- 3 – Not in Auto
- 4 – Ready to Load

The customer outputs can also be connected to three control relays (optional) to operate larger equipment, such as fans, pumps and motorized air dampers. Refer to *Control Relays* in this section for additional information.

B+: This is a fused 10 amp, 12/24 volt output. (Fuse F1 is located on Base board.) Two terminals (TB1-17 and -18) are connected to this 10 amp circuit.

Switched B+: This is a fused 5 amp, 12/24 volt switched output. This output is activated when the control receives a run command. (Fuse F2 is located on Base board.)

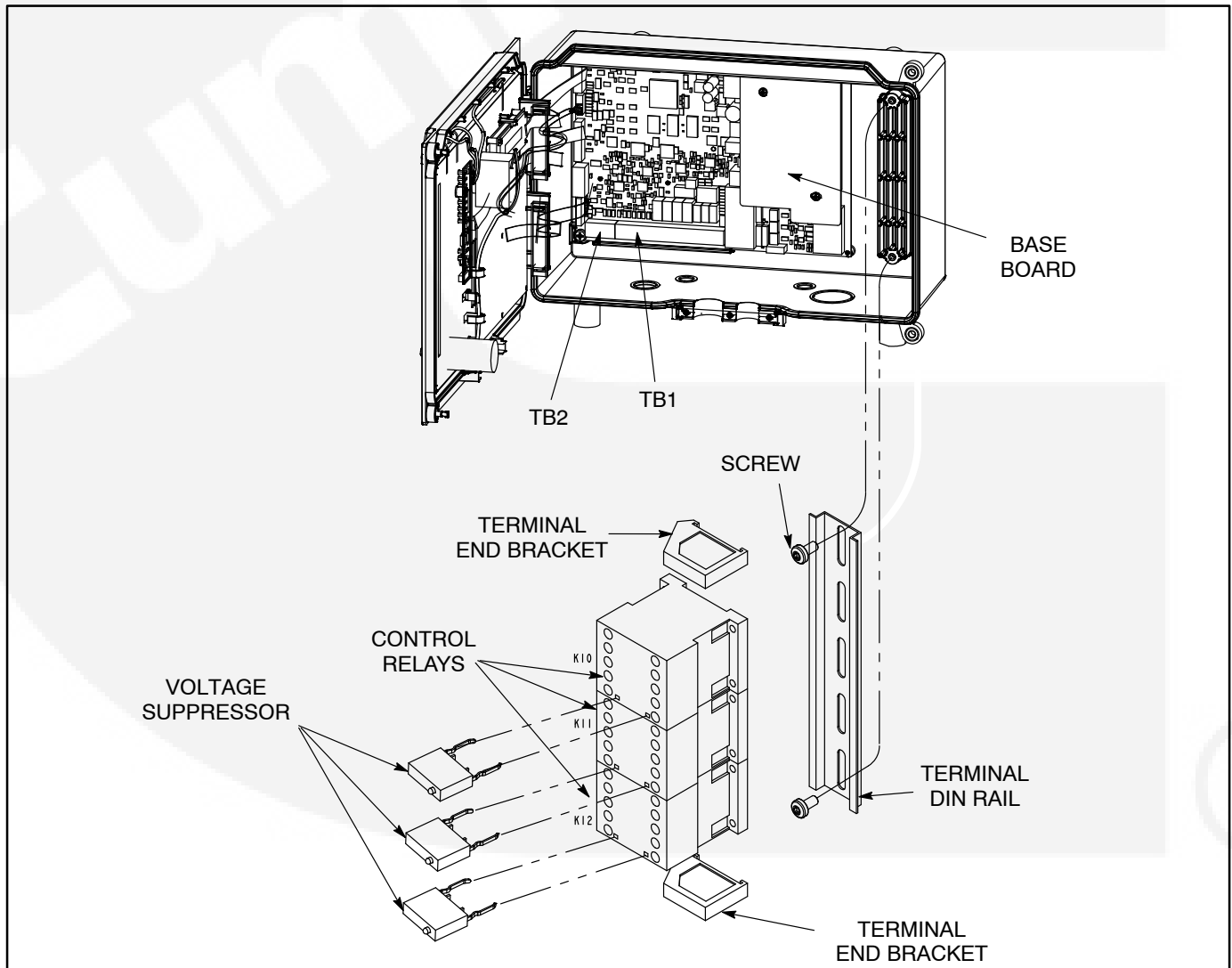


FIGURE 5-2. CONTROL PANEL BOX

CONTROL RELAYS (K10, K11, K12)

CAUTION *Damage to the Base board can occur if the voltage suppressors (Figures 5-2 and 5-3) are not installed across relay coils (A1/A2) of control relays K11, K12 and K13 before connecting genset battery cables.*

The three optional control relays are rail mounted inside the control panel housing. Each relay is a

4-pole relay with 2 poles normally open and two poles normally closed.

These relays (Figure 5-3) are used to control auxiliary equipment, such as fans, pumps and motorized air dampers. Energizing of the relays is user definable.

The contacts are rated at 10 amps at 600 VAC.

Refer to Customer Connections diagram in Section 10.

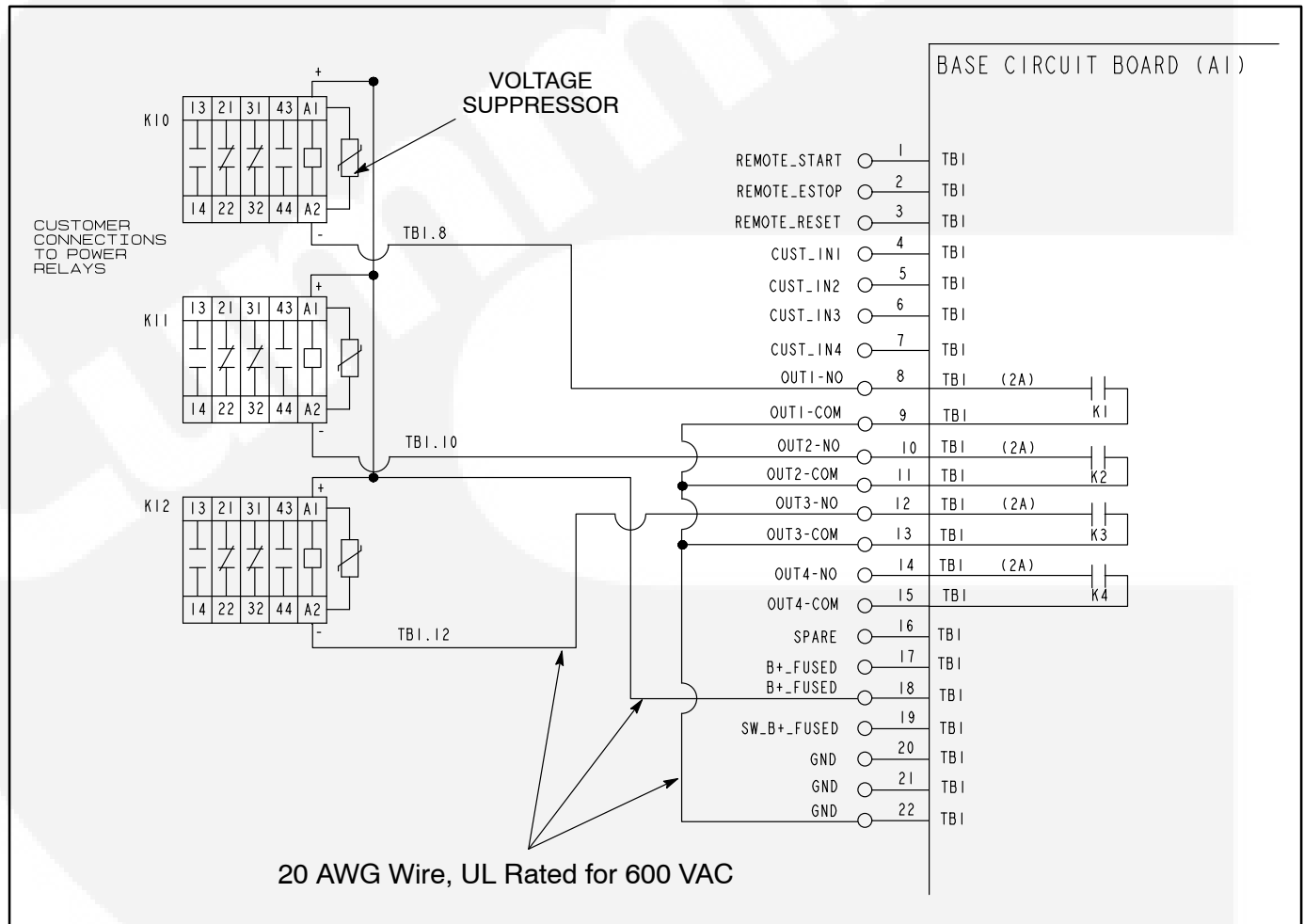


FIGURE 5-3. OPTIONAL CONTROL RELAYS (K10, K11, K12)

6. AC Electrical Connections

GENERAL

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

CAUTION Before disconnecting battery cable(s), press the Emergency Stop button and wait at least 30 seconds. Engine performance may be affected (e.g., engine dying or hard starting) if battery cable(s) is removed during the 30 second waiting period. Service personnel may be required to correct fault.

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.

Before making any AC electrical connections, make certain the generator set cannot be accidentally started as follows:

1. Move the O/Manual/Auto switch on the control panel to the O (OFF) position.

2. Press the Emergency Stop button and wait at least 30 seconds before completing Step 3.
3. Turn off or remove AC power from the battery charger.
4. Remove the negative (-) battery cable from the generator set starting battery.

Connecting the genset AC electrical system involves:

- Installation of transfer switch (refer to transfer switch Installation manual)
- 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 electrical hazard, 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). Follow the installation instructions provided with the transfer switch when connecting the load and control wiring.

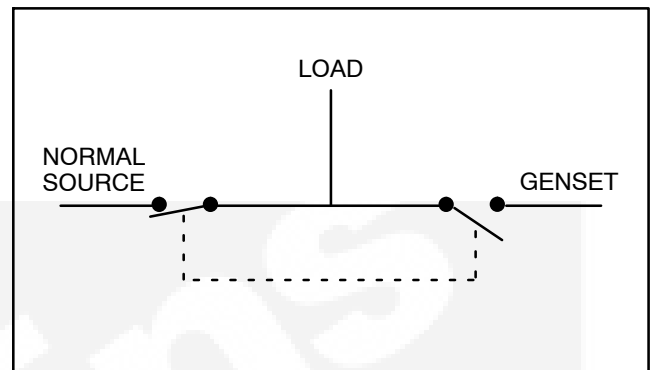


FIGURE 6-1. TYPICAL LOAD TRANSFER FUNCTION

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 generator sets 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 CT1, CT2 and CT3 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 reconnection terminal block. A dot is also used to indicate pin 1 of the CT.
- B. CT1 – U load leads (A phase),
CT2 – V load leads (B phase)
CT3 – W load leads (C phase)
- C. Route the load lead (U, V or W) through the appropriate CT (refer to Reconnection Diagram).
- D. The CT's have dual secondaries (3 pins marked X1, X2 & X3). (Refer to Reconnection Diagram.)
 - X1 & X2 for above 300 volts L–L
 - X1 & X3 for below 300 volts L–L

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.

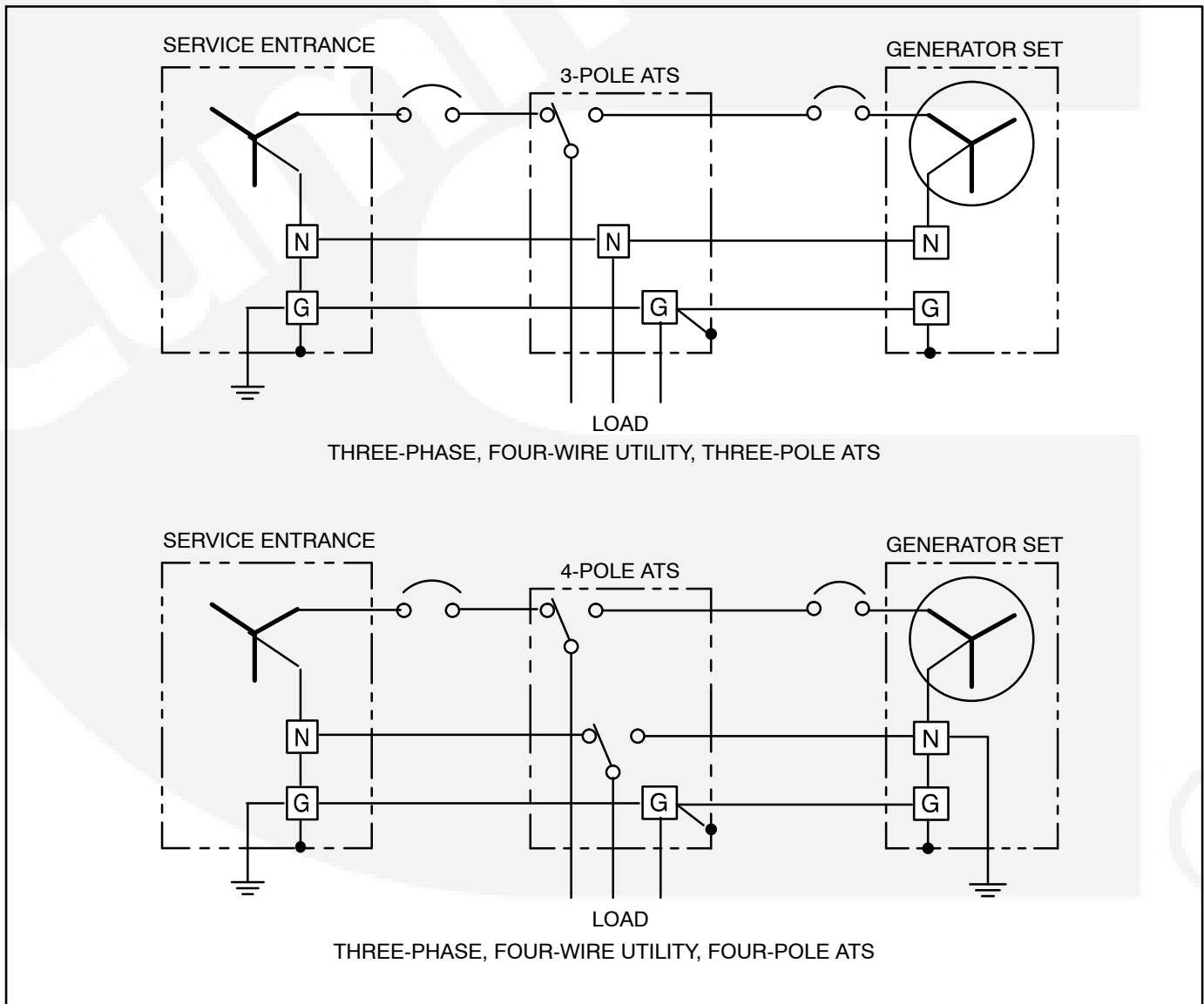


FIGURE 6-2. TYPICAL SYSTEM GROUNDING ONE-LINE DIAGRAMS

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.

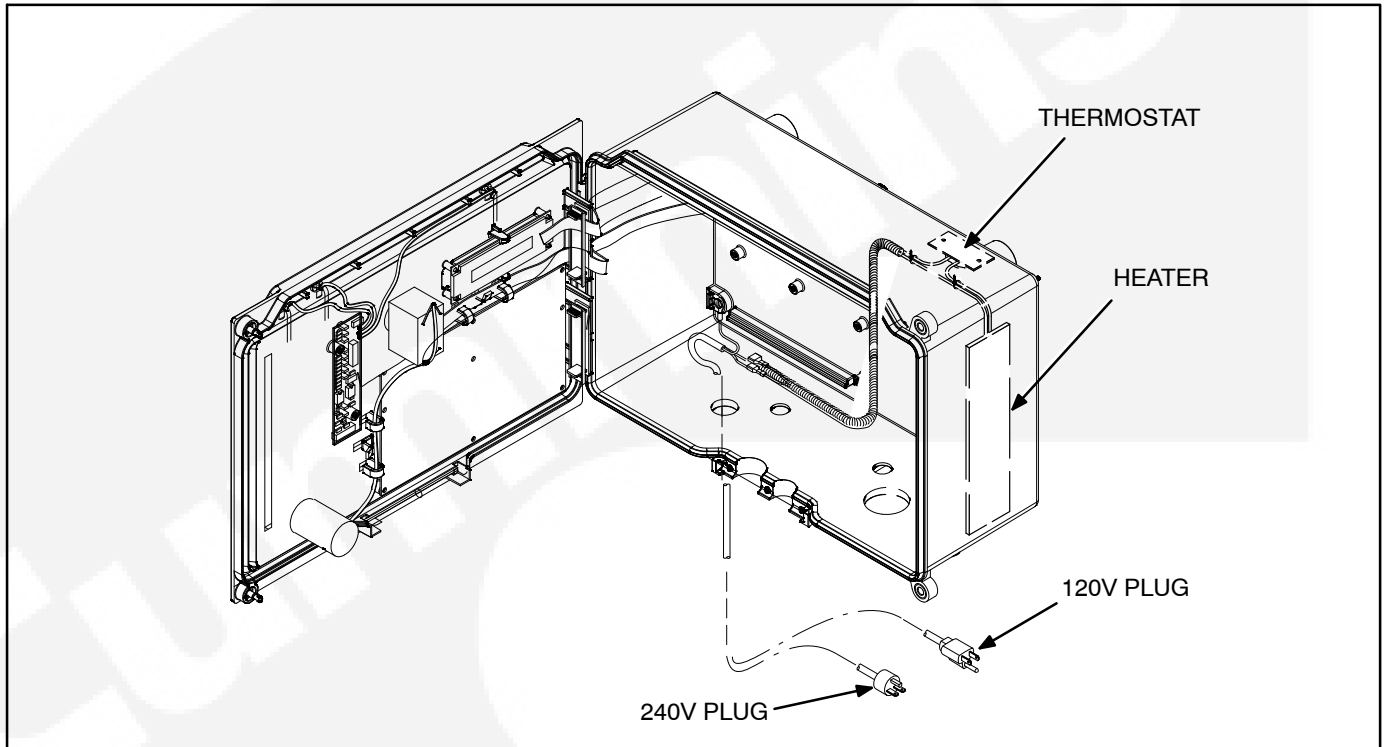


FIGURE 6-3. OPTIONAL CONTROL HEATER

COOLANT HEATER (OPTIONAL)

A coolant heater keeps 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 or when ball valves are closed or damage to the heater will occur.*

Figure 6-4 shows a typical coolant heater installation. 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.

Make sure that both ball valve are opened before connecting power to the heater. With ball valves closed, heated coolant will not circulate through the engine. Extended operation with ball valves closed can damage coolant heater.

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

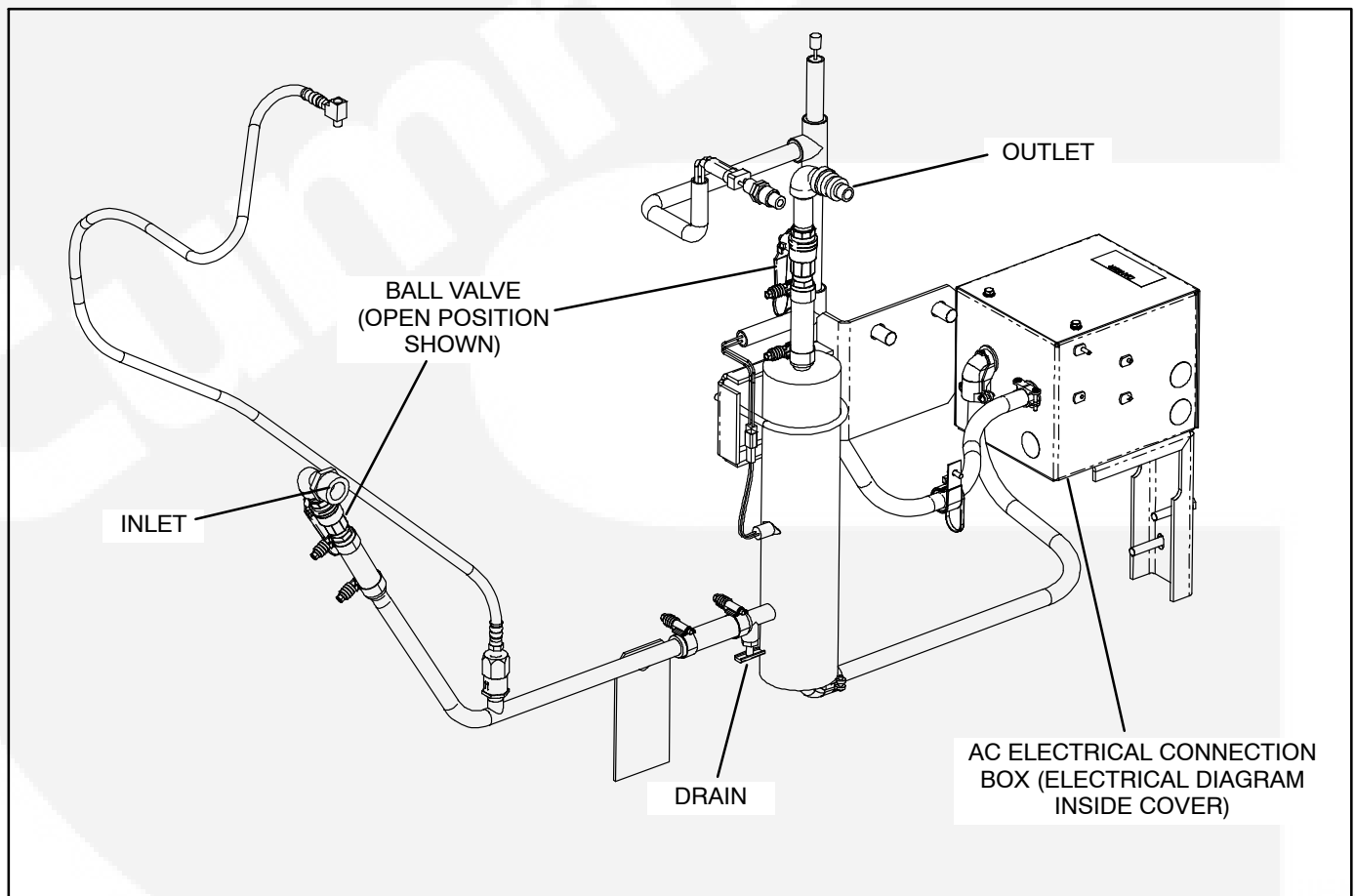


FIGURE 6-4. TYPICAL COOLANT HEATER

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 shock hazards.

⚠ 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) terminals 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.

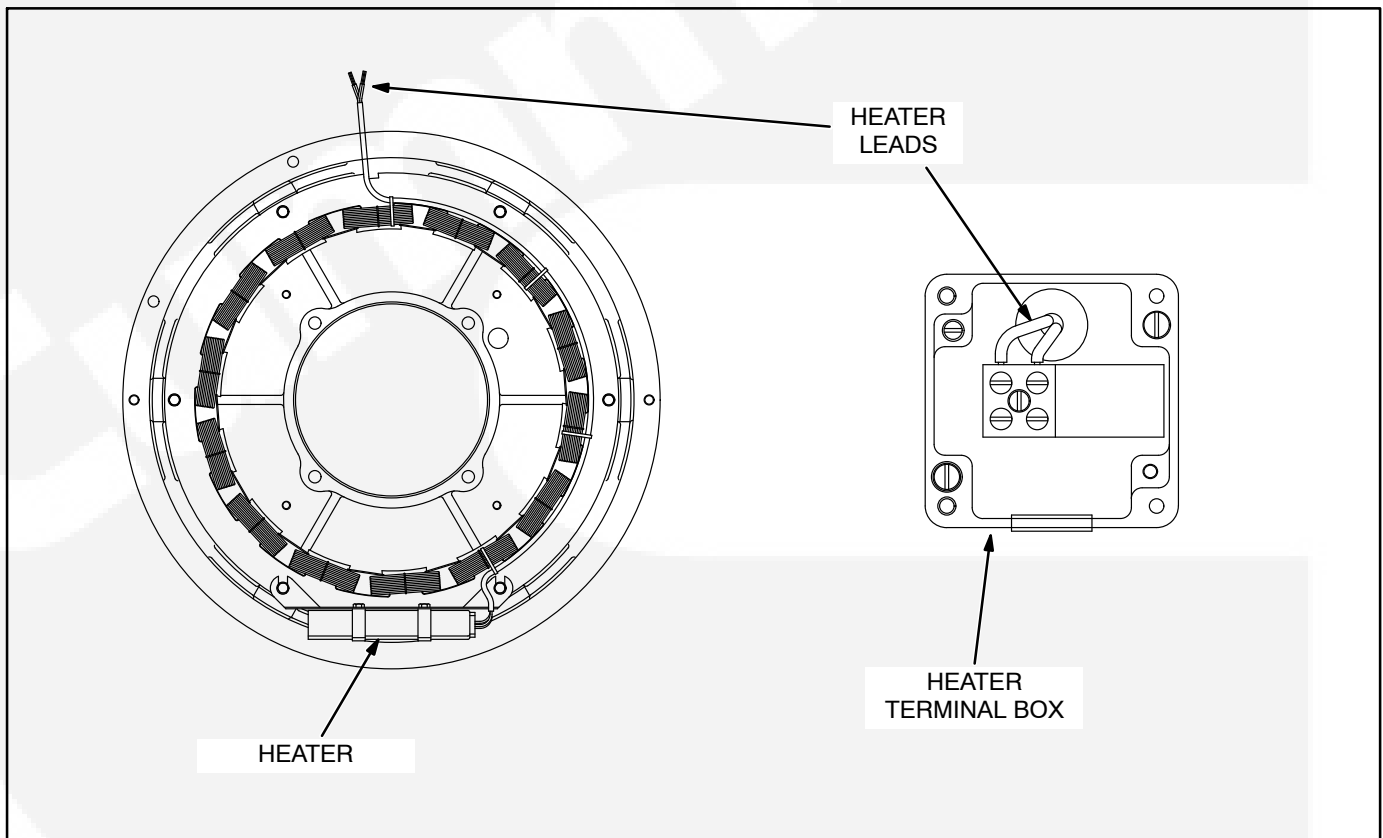


FIGURE 6-5. TYPICAL GENERATOR HEATER INSTALLATION



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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.

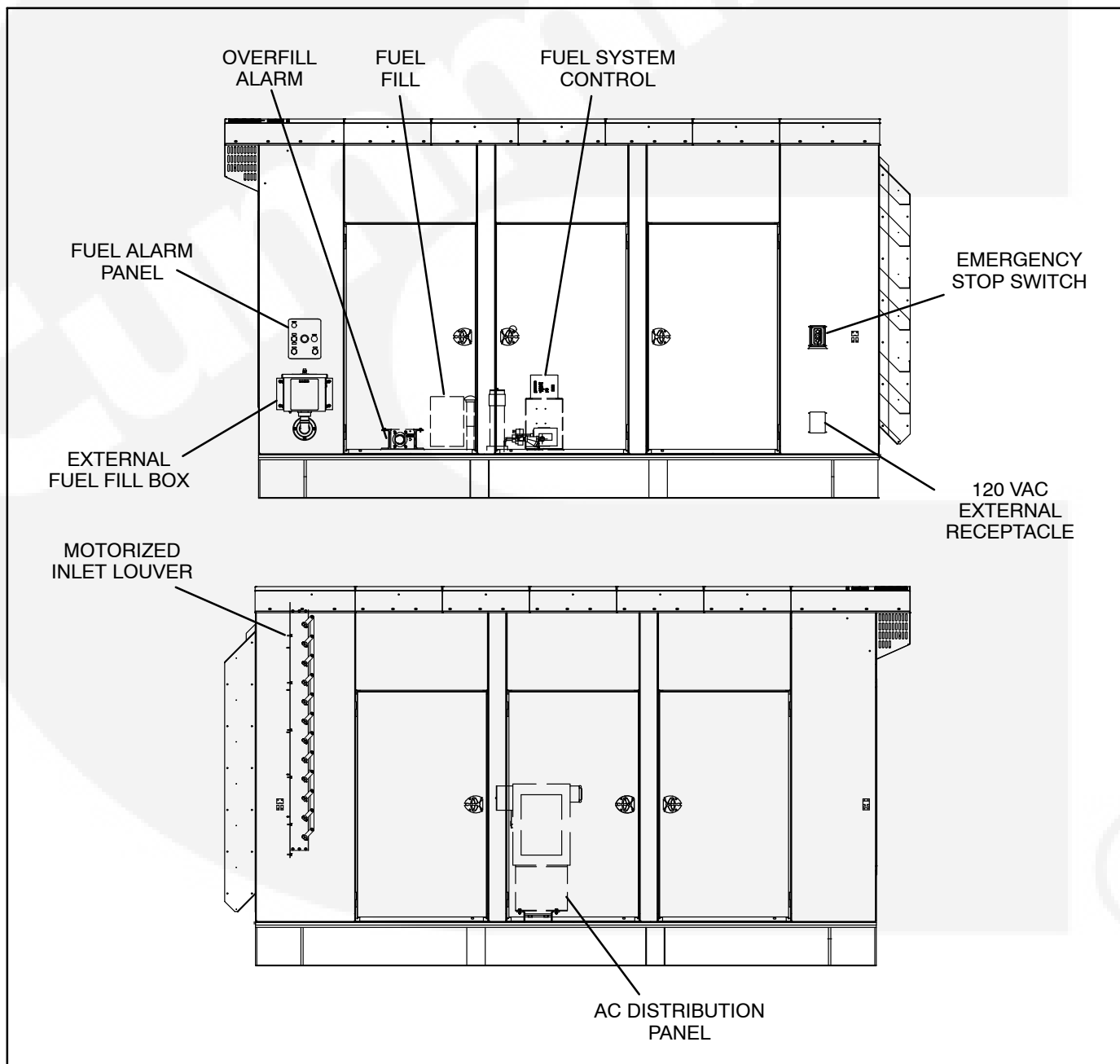


FIGURE 7-1. OPTIONAL ENCLOSURE FEATURES (WEATHER ENCLOSURE SHOWN)

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.

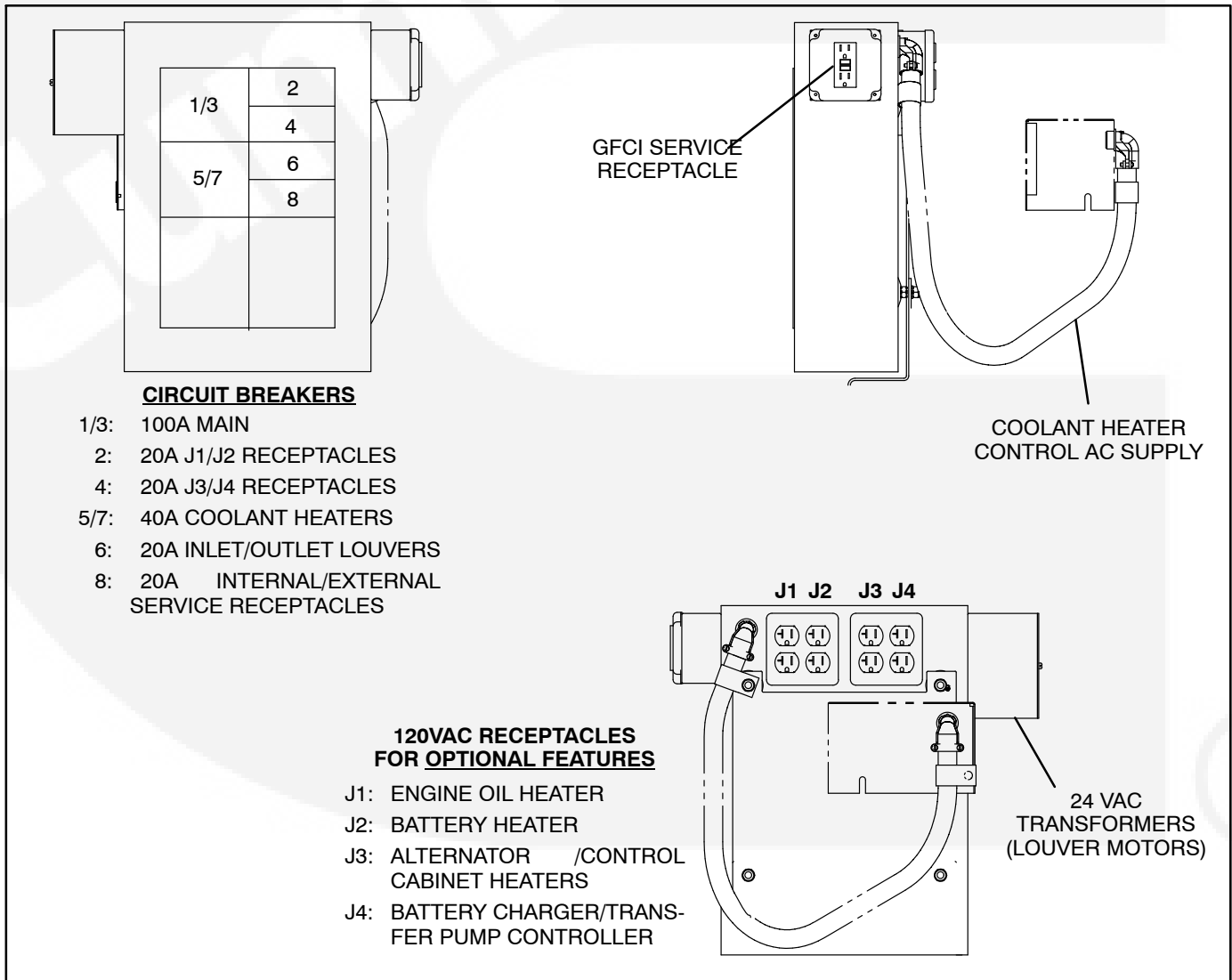


FIGURE 7-2. AC DISTRIBUTION PANEL FEATURES

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.

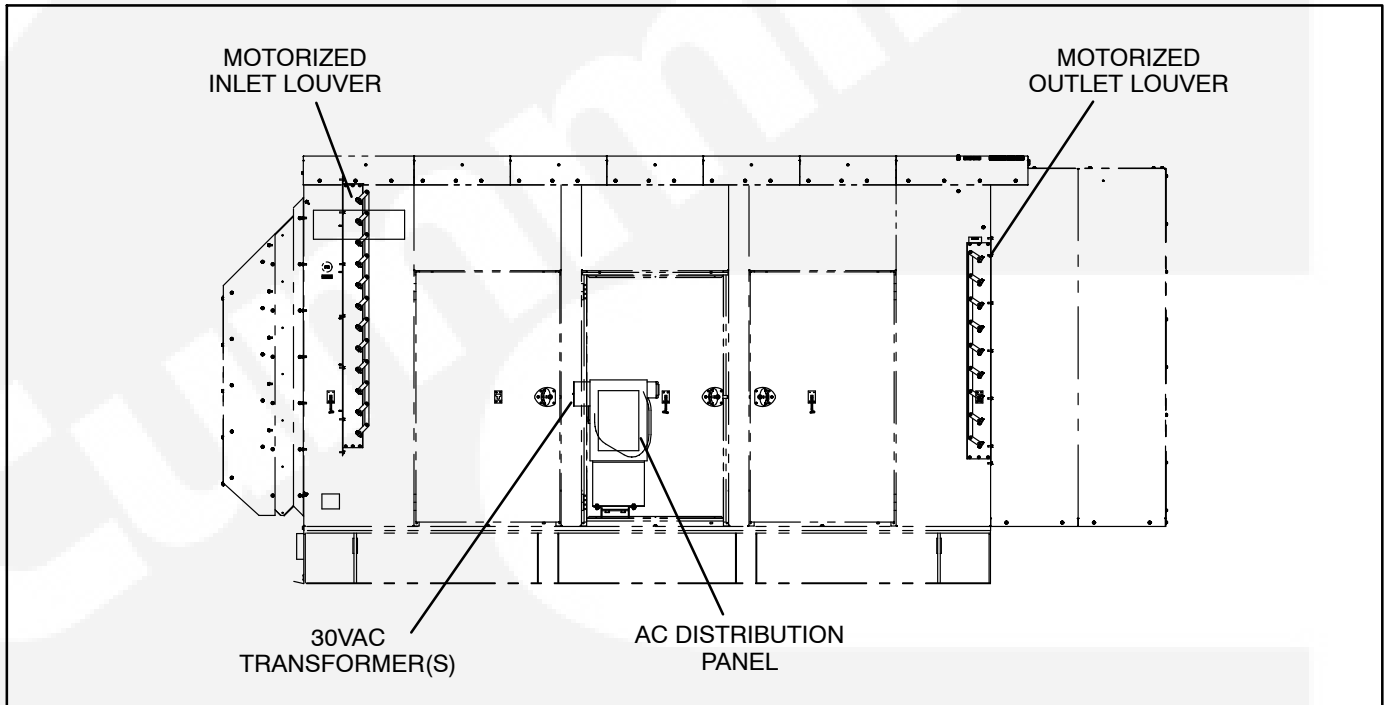


FIGURE 7-3. MOTORIZED LOUVER

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 au-

tomatically 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/plumbing 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).

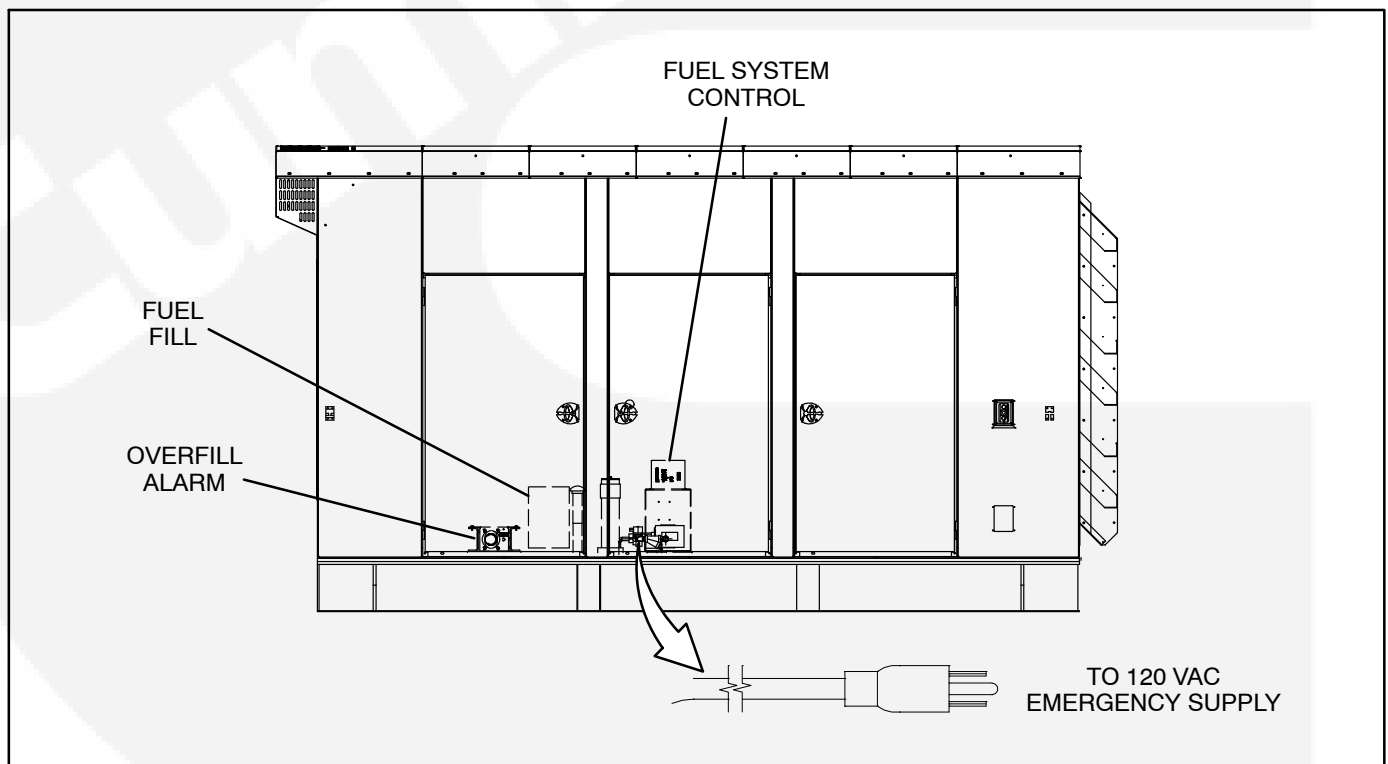


FIGURE 7-4. FUEL TRANSFER PUMP/CONTROL LOCATION

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 Power-Command® 2100 Control (PCC). Use InPower to:

- Make adjustments to the controls trims and settings.
- Perform diagnostics and monitoring.
- 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

Verify 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 Run/Off/Auto switch on the control panel is set to the Off position before connecting the battery cables.*

Starting the unit requires a 24 volt battery. Connect positive battery cable before connecting negative battery cable to prevent arcing.

Service the batteries as necessary. If an automatic transfer switch is installed without a built-in charge circuit, connect a separate battery charger. Proper selection and maintenance of batteries and battery chargers is essential for system reliability.

⚠ 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.*

PCC OPTIONS PRESTART CHECKS

All generator set configuration options are set at the factory except for site related options, (e.g., Language, Start/Stop Time Delays, Idle Start, Cycle Crank, Customer Fault 1 and 2, etc..)

Adjustment of these options are divided into two categories within the menu driven system. These two categories are *Setup* and *Controller Configuration/Adjust*.

The *Setup* submenus are intended for qualified service personnel only and require a password to modify these submenus. The *Controller Configuration* and *Adjust* submenus are intended for service personnel and site personnel.

The *Controller Configuration* submenus are used to change the default language, temperature units, and pressure units to be displayed in menus.

The *Adjust* submenus allow site personnel to calibrate the generator set voltage/frequency, idle speed and start/stop time delays. For the prestart checks, adjustment of only the start/stop delays is required.

Controller Configuration

Figure 8-1 shows a block representation of the Controller Configuration menus.

To view the first Controller Configuration menu, make sure Main Menu 1 is displayed and simultaneously press the Home Menu and Previous Main Menu buttons.

As shown in the diagram, the Controller Configuration menu has three submenus.

Press the buttons next to the ↓ and ↑ symbols in the digital display to navigate between the menus.

Press the button next to the ► symbol in the display until the + and – symbols are displayed.

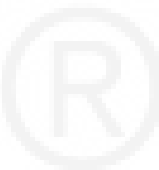
Press the button next to the + or – symbol to select the desired option.

After selecting option, pressing the ► symbol results in the changes being saved. If the Home button or Previous Main Menu button is pressed before pressing the ► symbol, the changes are not saved.

Language Selected submenu: Used to select desired language (default = English).

Temperature Units submenu: Used to select Fahrenheit or Centigrade for temperature readings.

Fluid Pressure Units submenu: Used to select PSI or kPA for pressure readings.



CONTROLLER CONFIGURATION MENU

Main Menu 1

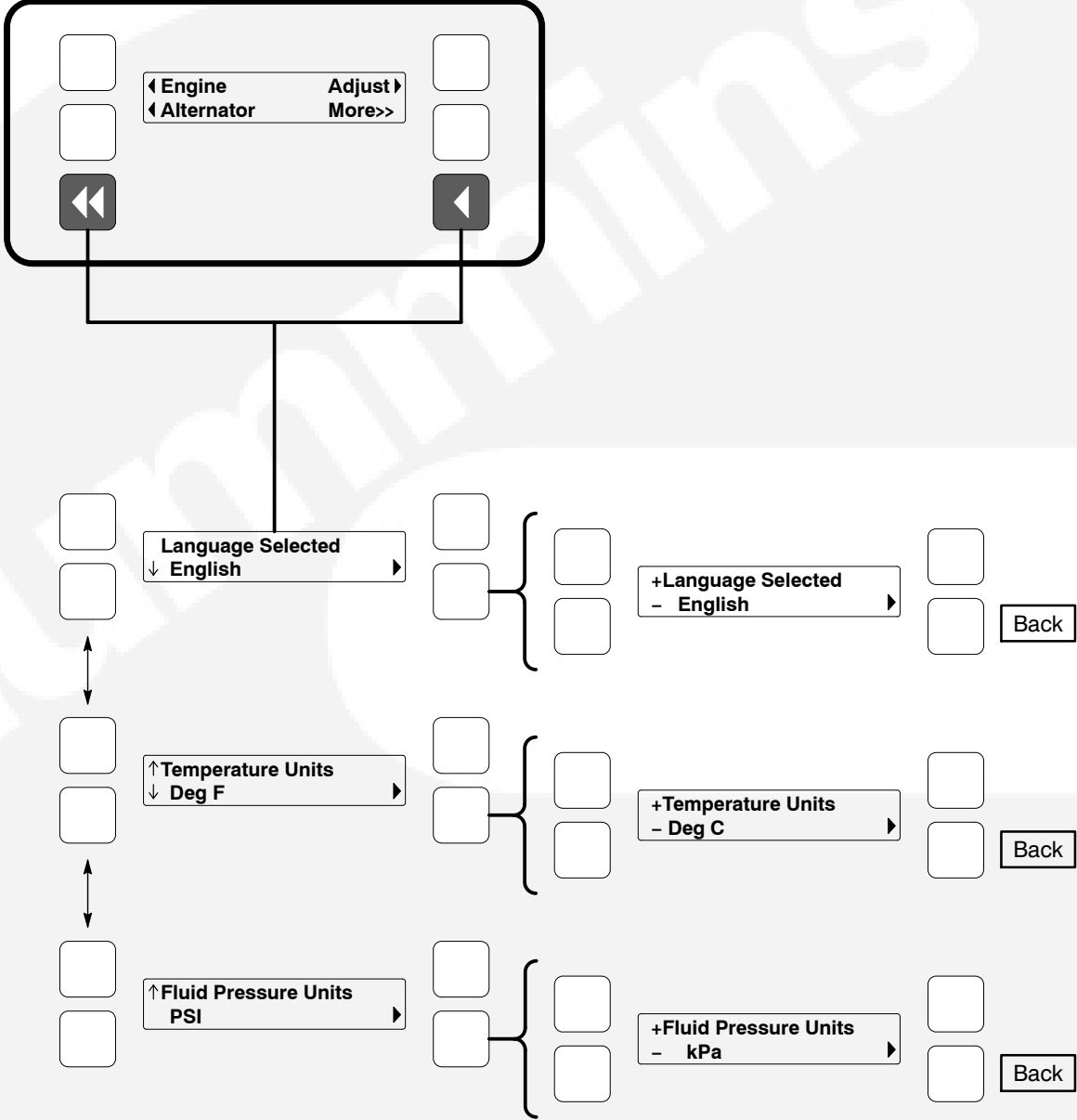


FIGURE 8-1. CONTROLLER CONFIGURATION MENU

Adjust Menu

Figure 8-2 shows a block representation of the Adjust menu. If you press the button next to the word “Adjust” in the display, the first Adjust submenu is displayed.

As shown in the diagram, the Adjust menu has five submenus. Each submenu includes a parameter or value that can be changed.

Press the buttons next to the ↓ and ↑ symbols in the digital display to navigate between the menus. Press the Home button or the Previous Main Menu button to return to Main Menu 1.

Adjusting Values/Parameters:

- 1.. Press the button next to the ► symbol in the display until the + and – symbols are displayed.
- 2.. If necessary, press the button next to the < or > symbols to move to the numeric character you wish to change.
- 3.. Press the button next to the + symbol to increase the value or select parameter; press the button next to the – symbol to decrease the value or select parameter.
- 4.. After adjusting values/selecting parameters, pressing the ► symbol results in the changes being saved. (When adjusting values, make sure the cursor is on the last numeric character before pressing the ► symbol).

If the Home button or Previous Main Menu button is pressed before pressing the ► symbol, the changes are not saved.

Voltage Adjust submenu: Voltage can be adjusted to ± 5 percent of the nominal voltage. For example, if genset output voltage is 208 volts, the voltage can be adjusted from 197 to 218 volts.

If the revised value is greater or less than the allowed (5%) range, the control will round off the displayed value (up or down). For example, if changing the value by –5% (maximum) equals 197.6, the display will show 197, but will display and change the output to 198 when saved.

Frequency Adjust submenu: Frequency can be adjusted to ± 5 percent of the nominal frequency. For example, if the genset frequency is 60.0 Hz, the frequency can be adjusted from 57.0 to 63.0 Hz.

Start Delay submenu: Start Delay can be set from 0 to 300 seconds (default = 0). This function is bypassed during a manual start/stop sequence.

Stop Delay submenu: Stop Delay can be set from 0 to 600 seconds (default = 0). This function is bypassed during a manual start/stop sequence and engine shutdown faults.

Rated To Idle: Rated To Idle delay can be set from 0 to 10 seconds (default = 0). (Enter 1 or more to enable.) Entering a non-zero delay will cause the genset to delay the transition to Cooldown At Idle.

Idle Start submenu (Only available on some models): Idle Start can be enabled or disabled (default = Disable). This function is only enabled when the genset is started in manual mode. Idle Start can also be enabled while the set is running in manual mode.

Enabling Idle Start will cause the genset to run in idle mode until Idle Start is disabled. A warning is displayed if genset is left in idle more than 10 minutes. Long periods of engine idling can eventually affect engine performance and may void engine warranty.

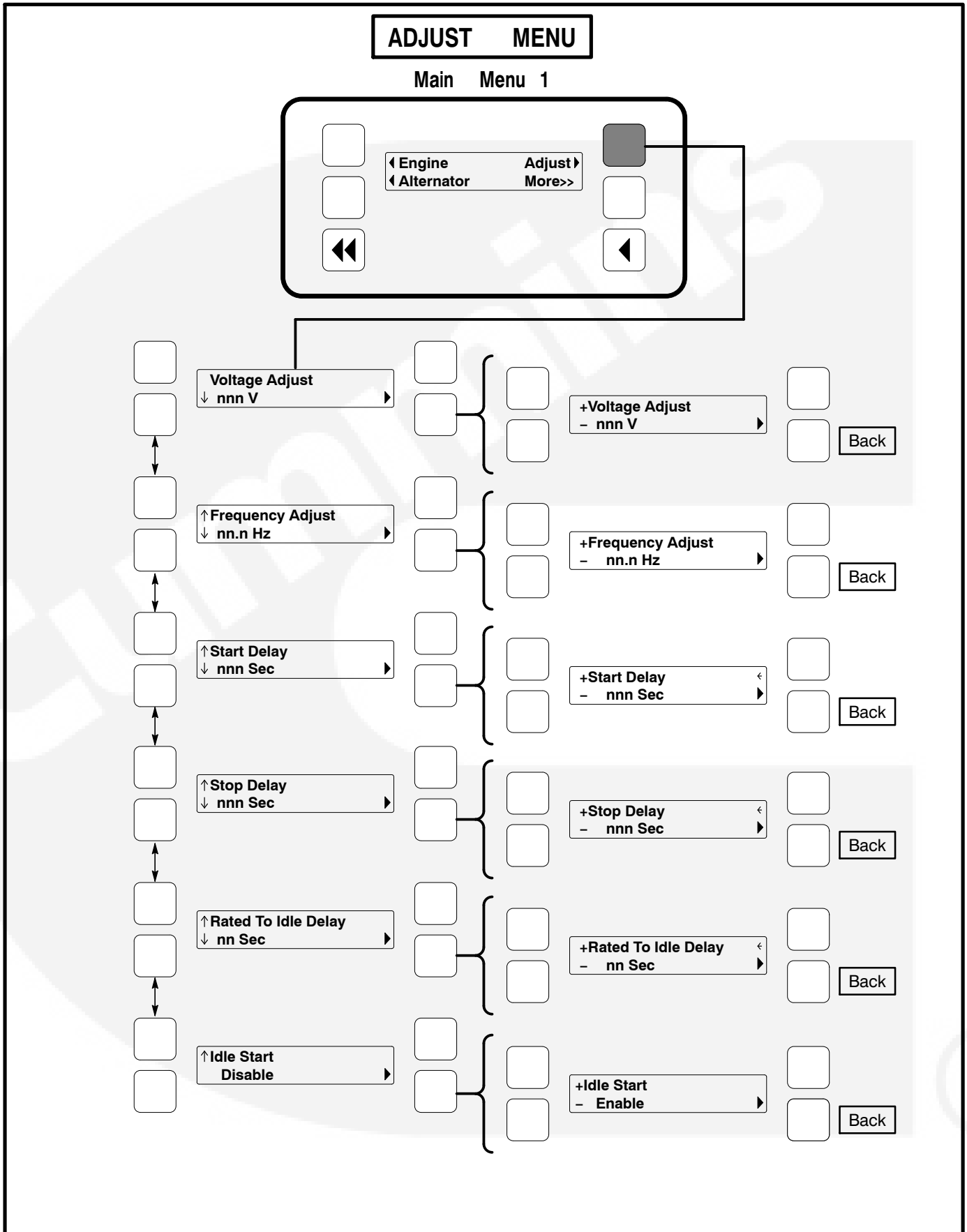
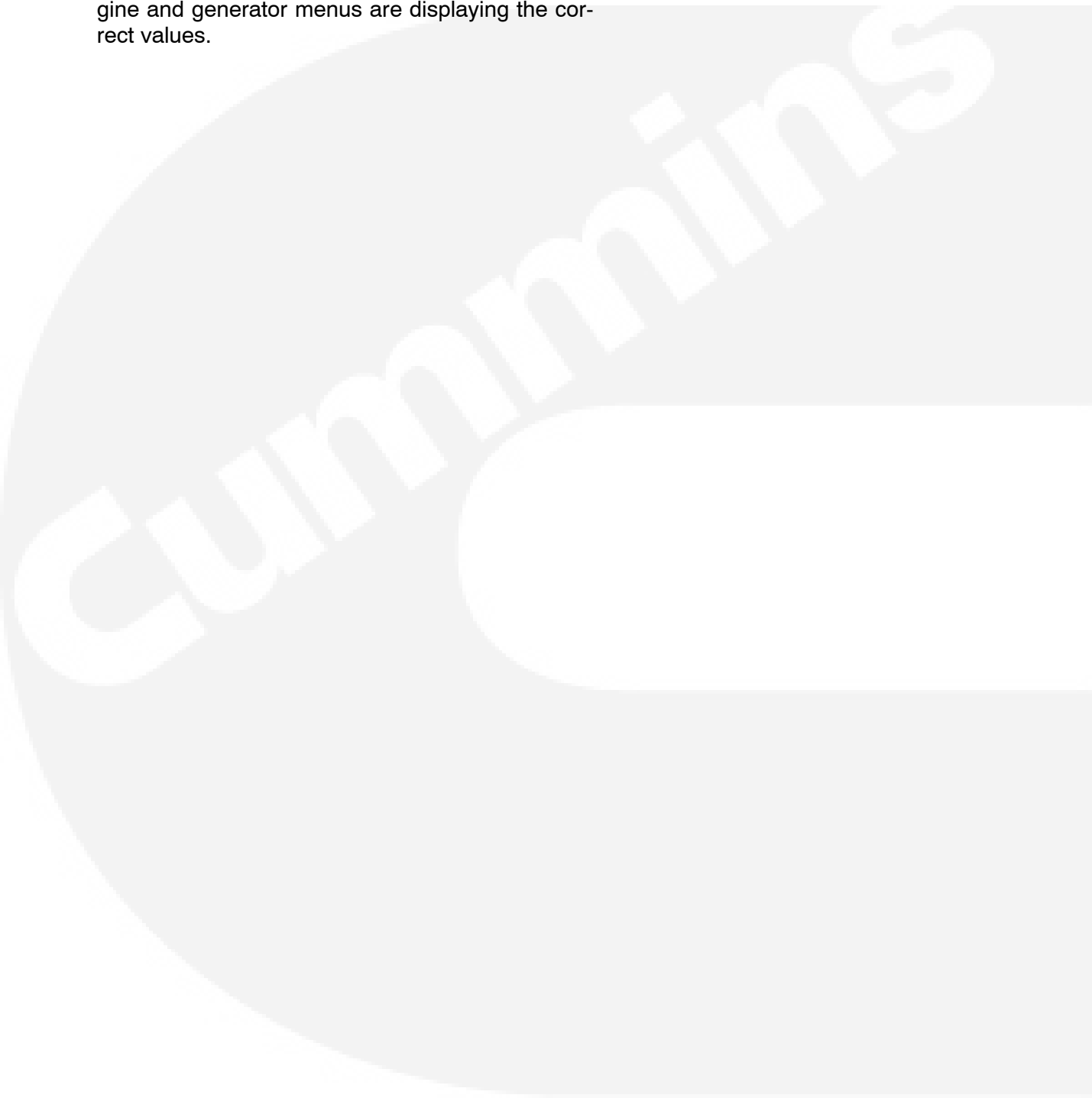


FIGURE 8-2. ADJUST MENU

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 menus are displaying the correct values.



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 out-of-doors 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.
- Created control capture file of the genset's parameter values before and after modifications.



10. Wiring Diagrams

GENERAL

This section consists of the schematic and connection wiring diagrams referenced in the text. The following drawings are included.

- Page 10-2 – Customer Connections Diagram
- Page 10-3 and 4 – Enclosure/Options Wiring

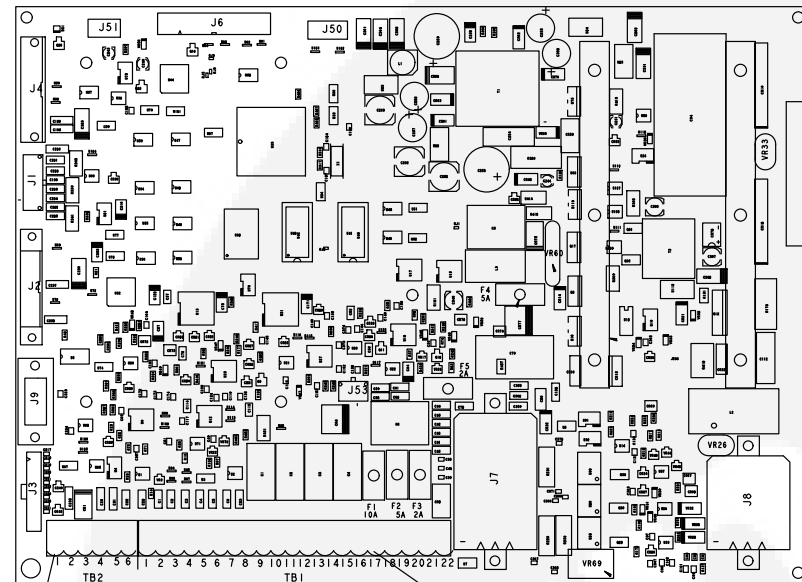




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TERMINAL/WIRE SPECIFICATION

- 1) TORQUE TERMINALS TO 4.4 IN/LBS (0.5 Nm)
- 2) WIRE SIZE, 30-12 AWG (0.14-2.5MM) (TB1)
- 3) WIRE TYPE, USE 60°C RATED MINIMUM, COPPER WIRE (TB1)
- 4) TERMINAL SCREWS ARE SLOTTED (0.6MM)
5. USE FLAT-BLADED SCREWDRIVER WITH 2.5MM BLADE
- 6) STRIP WIRE LENGTH TO 6.0MM

TB2 **NOT USED**

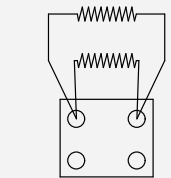
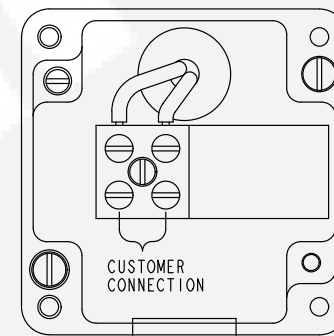
- DEFAULT SETTING**
- TB1-CUSTOMER FAULTS:**
- 1 CUSTOMER FAULT 1
 - 2 GROUND FAULT
 - 3 LOW FUEL
 - 4 RUPTURE BASIN FAULT
- TB1-CUSTOMER RELAYS:**
- 1 COMMON WARNING
 - 2 COMMON SHUTDOWN
 - 3 NOT IN AUTO
 - 4 READY TO LOAD

TERMINAL SPECIFICATION

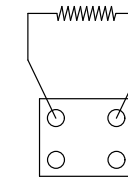
- 1) TORQUE TERMINALS TO 4.4 IN/LBS (0.5 Nm)
- 2) USE FLAT-BLADED SCREWDRIVER WITH 2.5MM BLADE

Terminal	Description	Notes
1	REMOTE START	
2	REMOTE E-STOP	
3	REMOTE RESET	
4	CUSTOMER FAULT 1	APPLY GROUND TO ACTIVATE
5	CUSTOMER FAULT 2	
6	CUSTOMER FAULT 3	
7	CUSTOMER FAULT 4	
8	CUSTOMER RELAY 1	
9	COM	
10	CUSTOMER RELAY 2	RATED 2A
11	COM	0
12	CUSTOMER RELAY 3	30VDC (MAX)
13	COM	
14	CUSTOMER RELAY 4	
15	COM	
16	(NOT USED)	
17	B+ FUSED OUT	10A FUSED
18	B+ FUSED OUT	
19	SWITCHED B+	5A FUSED
20	GND	
21	GND	
22	GND	

ALTERNATOR HEATER



DUAL HEATER



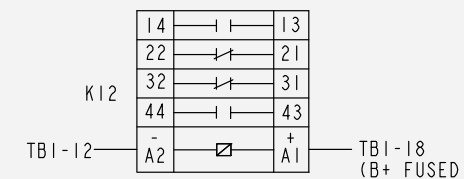
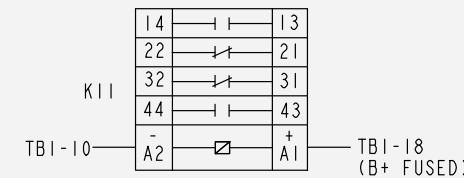
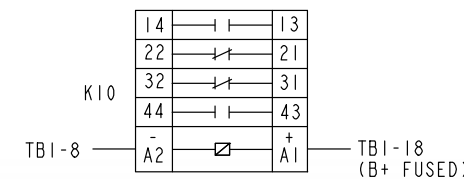
SINGLE HEATER

TERMINAL/WIRE SPECIFICATIONS

1. USE 60°C RATED MINIMUM COPPER WIRE.
2. WIRE SIZE: #12 - 18 AWG .
3. TORQUE TO 7.7 IN-Lb (0.9 Nm)
4. STRIP WIRE TO 0.32 INCHES (8.0 mm).
5. USE SLOTTED SCREWDRIVER WITH 3.0 mm BLADE
6. TERMINALS RATED AT 150V/20A AND 300V/10A.

HEATER RATING	
100 WATT	110 -125VAC 220 -260VAC
150 WATT	110 -125VAC 220 -260VAC
300 WATT	110 -125VAC 220 -260VAC

CUSTOMER RELAYS

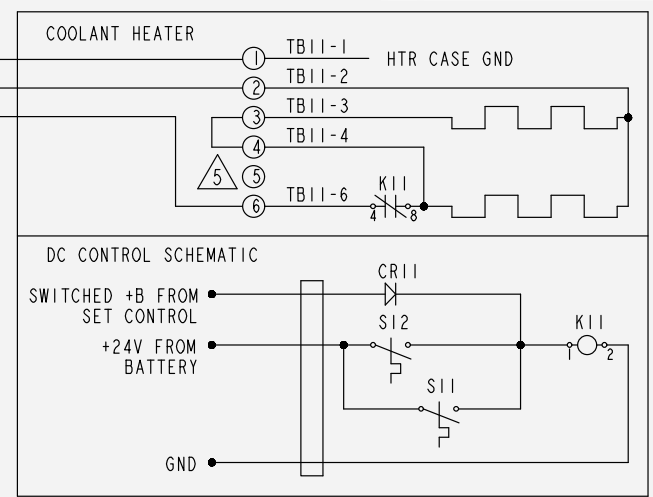
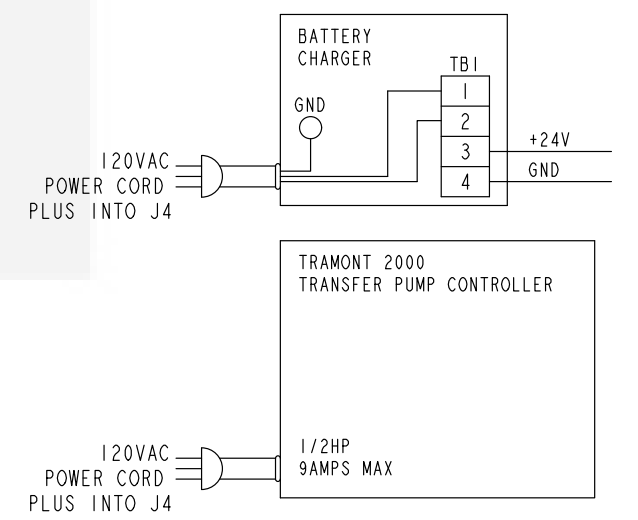
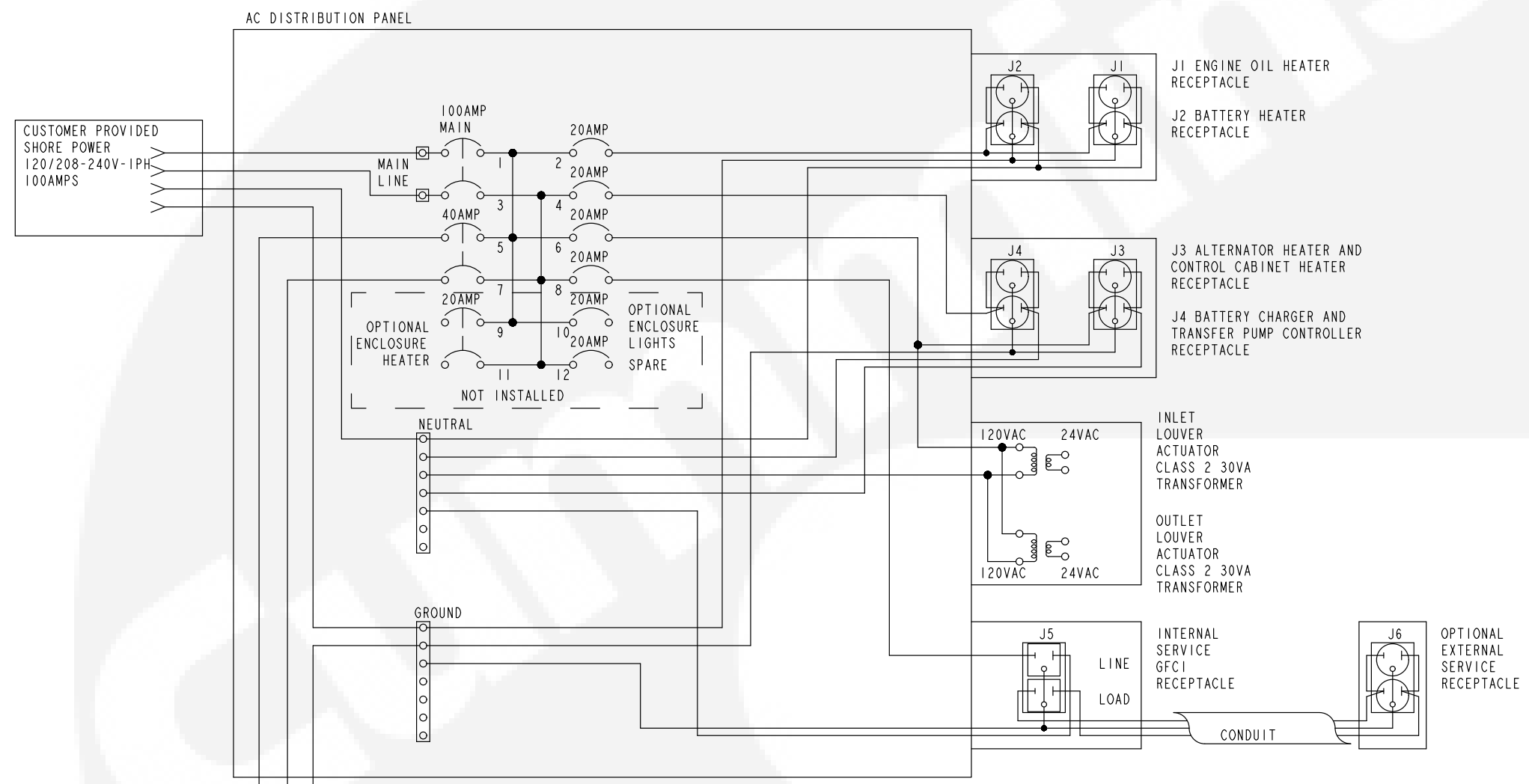


TERMINAL/WIRE SPECIFICATIONS

- 1) NORMALLY OPEN (NO) TERMINALS: 13,14 43,44
NORMALLY CLOSED (NC) TERMINALS: 21,22 31,32
- 2) TORQUE TERMINALS TO 7 INCH LBS (0.8Nm)
- 3) WIRE SIZE 1-18 AWG MIN (0.75MM²)
2-14 AWG MAX (2.5MM²)
1-12 AWG MAX (4.0MM²)
- 4) USE 60°C RATED MINIMUM, COPPER WIRE, 600VAC
- 5) TERMINAL SCREWS ARE PHIL SLOT
- 6) USE SLOTTED SCREWDRIVER WITH 5.0 MM BLADE OR NO. 2 PHILIPS
- 7) CONTACT RATINGS: 600VAC, 10 AMPS MAX
- 8) STRIP WIRE LENGTH TO 7.0 MM

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Modified 06-04

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COOLANT HEATER NOTES:

- S11 130F ENGINE THERMOSTAT
- S12 260F HEATER THERMOSTAT
- 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
- FOR COOLANT HEATER MOUNTING SEE OUTLINE DRAWING 500-3138

⚠️ 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

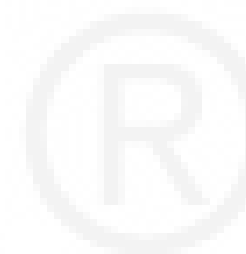
COOLANT HEATER AMPERAGE TABLE

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. 630-2672 sh 4 of 4
Rev. B
Modified 10-03

Cummins

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