



Installation Manual

10 GEAA
20 GEAB
GENERATOR SETS

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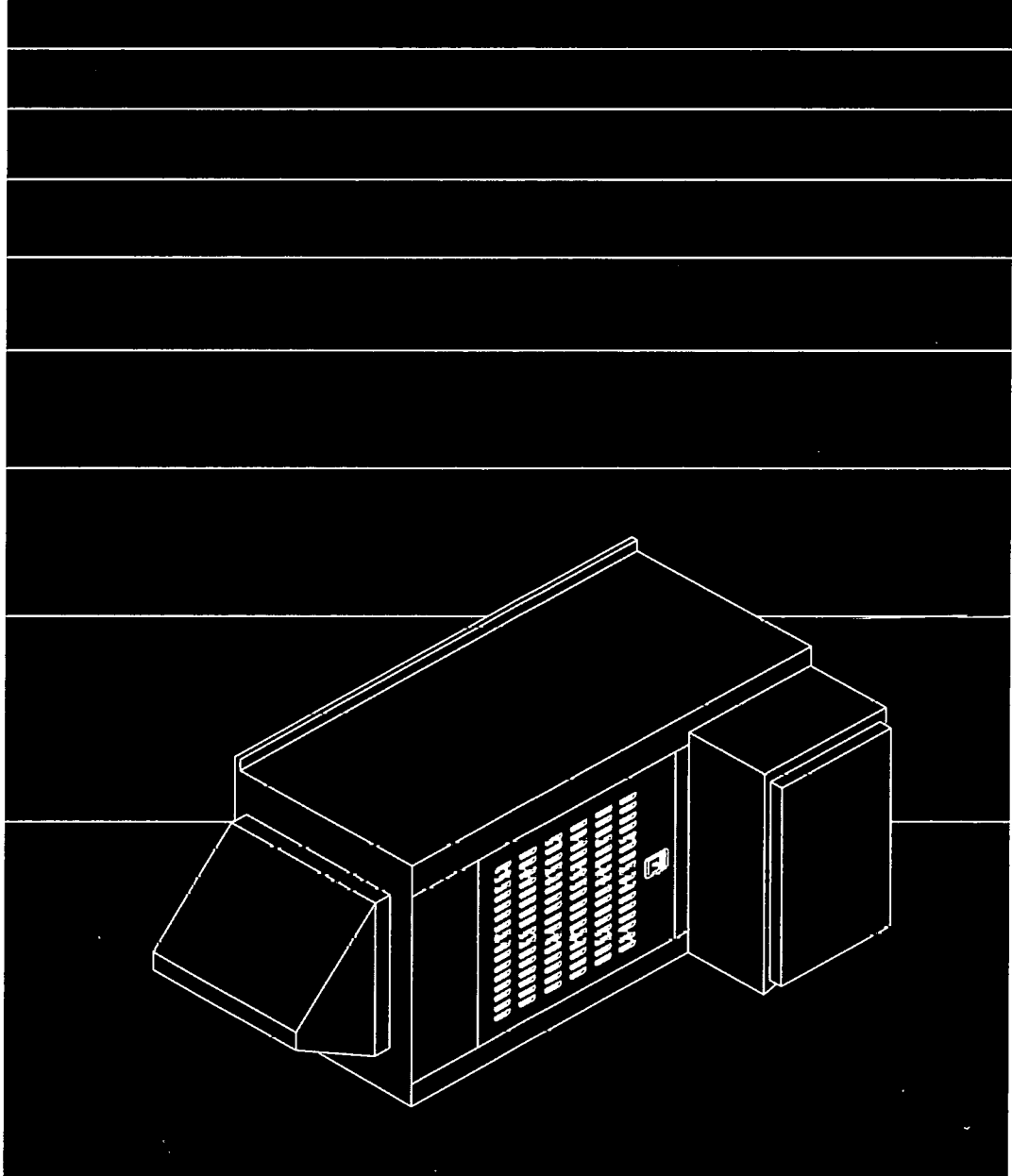


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Safety Precautions

Before operating the generator set, 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. Do not use copper piping on flexible lines as copper will become brittle if continuously vibrated or repeatedly bent.
- Be sure all fuel supplies have a positive shutoff valve.

- Do not smoke while servicing lead acid batteries. Lead acid batteries emit a highly explosive hydrogen gas that can be ignited by electrical arcing or by smoking.

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. Ensure 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 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. Jewelry can short out electrical contacts and cause shock or burning.
- If adjustment must be made while the unit is running, use extreme caution around hot manifolds, moving parts, etc.

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.
- 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 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.
- Provide appropriate fire extinguishers and install them in convenient locations. Consult the local fire department for the correct type of extinguisher to use. Do not use foam on electrical fires. Use extinguishers rated ABC by NFPA.
- Make sure that rags are not left on or near the engine.
- 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.

KEEP THIS MANUAL NEAR THE GENSET FOR EASY REFERENCE

1. Introduction

ABOUT THIS MANUAL

This manual provides installation instructions for the GEAA and GEAB generator sets. These generator sets shall be installed in outdoor applications only. This manual includes the following information:

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

Mechanical Connections - Location of connection points for fuel, exhaust, ventilation, and cooling.

Electrical Connections - Location of electrical connection points for the control, generator, and starting system.

Prestart - Checklist of items or procedures needed to prepare generator set for operation.

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

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.), review standard installation practices, or specify system materials, additional information is required. For engineering data specific to the generator set, refer to the specification and product data sheets. For application information, refer to Application Manual T-030, "Liquid Cooled Generator Sets".

INSTALLATION OVERVIEW

These installation recommendations apply to typical CEV (Controlled Environmental Vault) installations for GEAA and GEAB 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 an Onan 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 are an engineering function, generally done by specifying engineers or other trained specialists. Specifying engineers 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, sheet metal 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 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, 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.

2. Specifications

FUEL

Fuel	Natural Gas or Propane (LPG)
Natural Gas Consumption at Full Load	317 cfh (9m ³ /h)
Propane (Vapor) Consumption at Full Load	128 cfh (3.6 m ³ /h)
Maximum Natural Gas or Propane Supply Pressure	12 inches (305 mm)
Natural Gas Supply Connection	3/4 inch NPT
Propane Vapor Supply Connection	3/4 inch NPT

BATTERY

Required Battery Voltage	12 VDC
Recommended Battery Rating - Cold Cranking Amps	325

OIL AND COOLANT CAPACITY

Engine Oil Capacity	4.5 U.S. quarts (4.0 L)
Engine Coolant Capacity	11.5 U.S. quarts (11.0 L)

TUNE-UP SPECS

Spark Plug Gap	0.032 to 0.036 inches (0.8 to 0.9 mm)
Valve Clearance	Zero (Hydraulic Tappets)

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 GENERATOR SET. BE SURE TO CONSULT LOCAL POLLUTION CONTROL OR AIR QUALITY AUTHORITIES BEFORE COMPLETING YOUR CONSTRUCTION PLANS.

3. Mounting the Genset

GENERAL

Most 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. The complete installation must comply with all local and state building codes, fire ordinances, and other applicable regulations. Refer to Onan Application Manual, T-030, for further installation information.

Requirements to be considered prior to installation:

- Level mounting surface
- Adequate cooling air
- Discharge of cooling air
- Fuel system installation
- Discharge of exhaust gases
- Electrical connections
- Accessibility for operation and servicing
- Noise levels
- Vibration isolation

LOCATION AND ACCESS TO SET

This generator set is designed for outdoor applications only.

The generator set includes a standard weather protective housing. Allow adequate clearance around inlets and outlets. Also allow adequate clearance for door openings, cover removal and normal preventive maintenance. Provide adequate lighting around the unit.

MOUNTING

Generator sets are mounted on a steel frame that is designed to mount on most CEV collars. The engine-generator assembly is isolated from the frame by rubber mounts that provide adequate vibration isolation for this application.

Use 5/16-inch diameter, anchored expansion bolts to secure the generator set frame to the collar (four places) to prevent movement. Secure the frame using a flat washer and hex nut for each bolt (Figure 3-1).

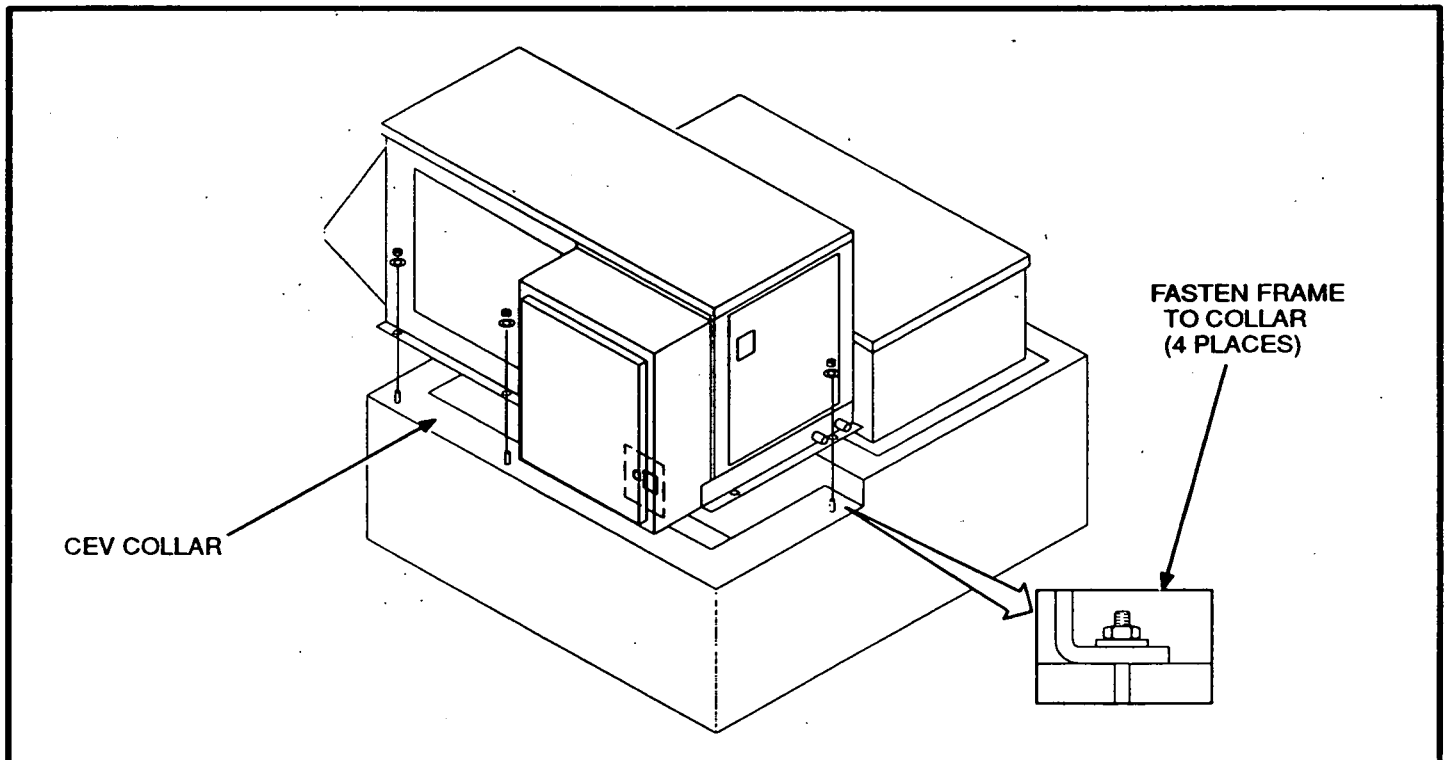


FIGURE 3-1. FASTENING THE GENERATOR SET

4. Mechanical Connections

FUEL SYSTEM

Mechanical connections include connecting the fuel system. Before starting any fuel installation, all pertinent state and local codes must be complied with and the installation must be inspected before putting the unit in service.

Fuels under pressure (such as natural gas or LPG) must be controlled by a positive shut-off valve, preferably automatic, in addition to any valve integral with the carburetor or gas regulator equipment.

⚠WARNING: *Natural gas and LPG vapor are heavier than air. Do not bleed lines so fumes can collect in low areas. Do not smoke or allow any flame, spark, arcing switch or equipment, pilot light, or other source of ignition around fuel lines.*

Natural Gas/LPG Vapor Fuel System

These sets are equipped to operate on natural gas (prime fuel) or LPG vapor (backup fuel). Both fuel inlets are located (and marked) on the bottom of the set under control panel. Inlets are sized 3/4 inch NPT. A gas regulator and shutoff valve must be added between fuel supply and genset to obtain the specified natural gas supply pressures. A manual changeover switch is located on the governor bracket next to the carburetor. When running on natural gas, be sure switch is moved to *Natural Gas* position; when using backup fuel (LPG vapor), move the switch to *LPG Vapor* position.

Plumb the natural gas to the connection on the frame. Route pipes away from sharp, abrasive and hot surfaces. Be sure the top of pipe does not extend higher than the bottom of air inlet grille. A regulator and hose are supplied loose for the propane backup system; these must remain stored with the generator set for emergency purposes.

EXHAUST SYSTEM

This genset has an internal exhaust system, with an underslung spark arrestor muffler. The exhaust

gases are vented through the air discharge hood. Precautions must be taken to ensure the exhaust outlet hood is located away from any air inlets so exhaust gases will not enter a building or enclosure. Regularly inspect the exhaust system both visually and audibly so 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.*

⚠WARNING: *The exhaust and air outlet hood must not be removed. The hood protects the exhaust system from rain, snow, etc and shields the exhaust pipes from the danger of personnel contact.*

VENTILATION AND COOLING

Generator sets create considerable heat that must be removed by proper ventilation. Outdoor installations rely on natural air circulation.

Vents and Ducts

The vents and ducts on these gensets are large enough to allow the required flow rate of air. Care must be taken during installation not to block the inlets and outlets and to ensure adequate clearance is provided around the generator set for proper operation and opening or removal of access panels.

Radiator Set Requirements

Radiator set cooling air is drawn past the rear of the set by a pusher fan that blows air through the radiator.

The radiator has an air discharge duct. Exhausted cooling air is also used to direct exhaust gases down and away from the set.

Before filling cooling system, check all hardware for security. This includes hose clamps, capscrews, fittings and connections.

ALLOW ADEQUATE CLEARANCE AROUND UNIT FOR PROPER VENTILATION, OPENING OF ACCESS DOORS, REMOVAL OF ROOF PANEL, AND FOR SERVICING.

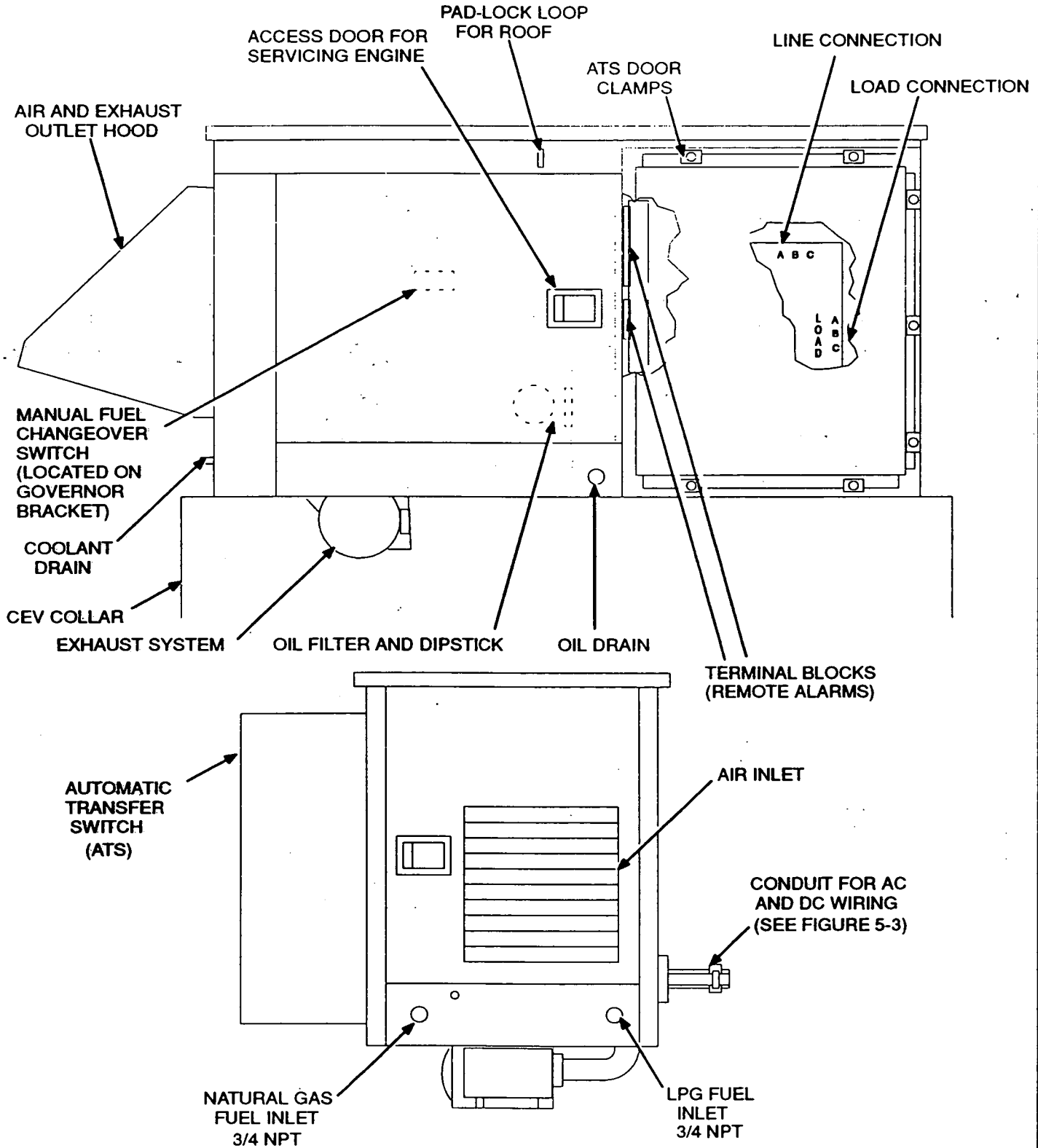


FIGURE 4-2. TYPICAL INSTALLATION

5. Electrical Connections

GENERAL

The genset electrical system includes connecting the load, installing the control wiring and connecting the batteries. Connect the batteries last to avoid accidental starting of the unit during installation.

⚠WARNING: *Accidental starting of the generator set while working on it can cause severe injury or death. Prevent accidental starting by disconnecting the starting battery cables (negative [-] first).*

Always remove the negative (-) cable first, and reconnect it last, to prevent arcing if a tool accidentally touches the frame or other grounded metal part while removing the positive (+) battery cable. Arcing can ignite the explosive hydrogen gas given off by the batteries, causing severe injury.

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

⚠WARNING: *Improper wiring can result in a fire or electrocution and severe injury or death.*

TRANSFER SWITCH

A transfer switch is mounted on the side of the genset for switching the load from the normal power source (utility) to the generator set (Figure 5-1). Follow the instructions provided with the transfer switch when connecting the load and control wiring.

All generator load wires terminate in the transfer switch. Customer must provide load and control wires by routing through special conduit (provided) into the transfer switch (Figure 5-3). Wires from utility must also be routed through conduit and connected to *Normal* on the transfer switch. Wires from utility can also be brought through bottom of transfer switch. A load circuit breaker and a heater circuit breaker (Figure 5-2) are also provided on bottom right side of switch enclosure.

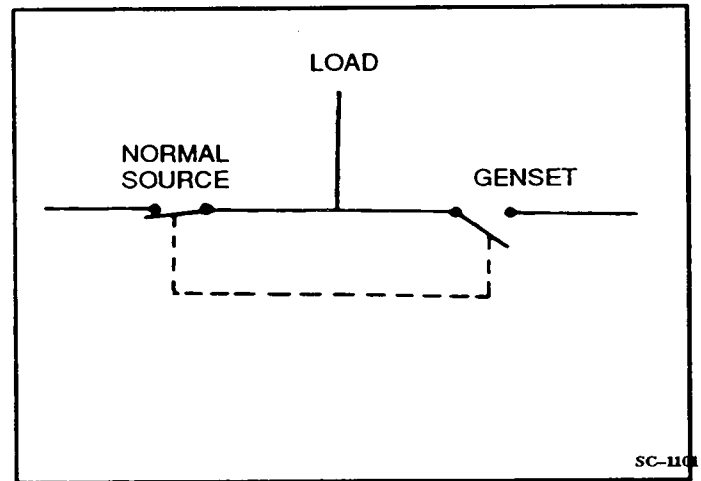


FIGURE 5-1. TYPICAL LOAD TRANSFER FUNCTION

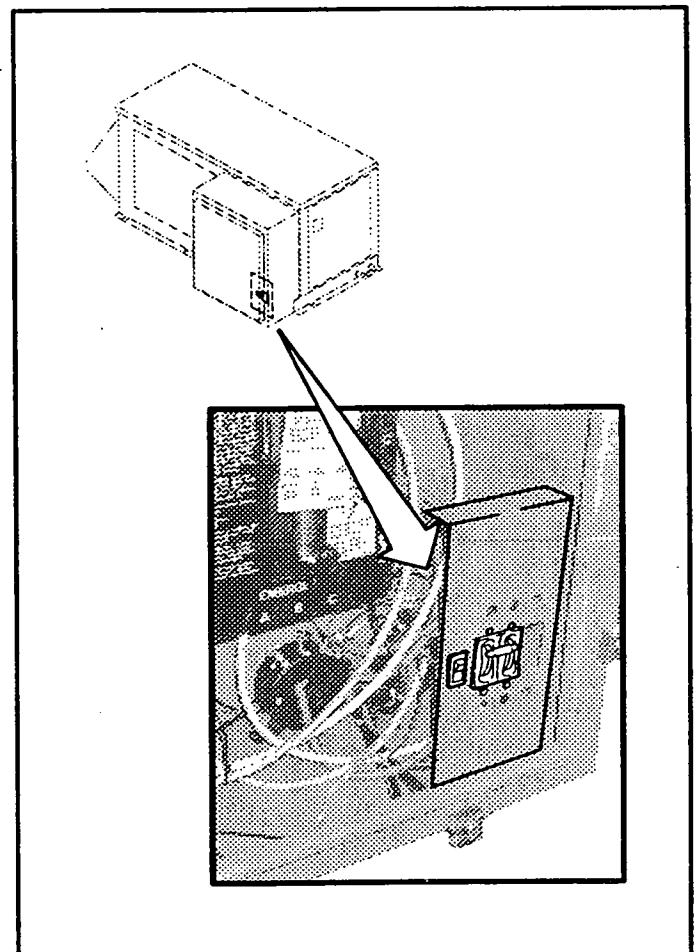


FIGURE 5-2. CIRCUIT BREAKERS

AC WIRING

Generator Voltage Connections

The generator output voltage and maximum current rating are specified on the generator set nameplate. A single phase generator is standard; a three phase generator is optional. Line-to-neutral voltage is always the lower voltage shown and line-to-line voltage is the higher rating.

Load Connections

Connecting the Load: All loads are connected by routing the load wires through supplied liquidtight conduit and fastening to Load side of transfer switch. Refer to Figure 5-3 and transfer switch manual.

Load Balancing

When connecting loads, balance the loads so the current flow from each line terminal 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 load-

ing 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.

Grounding

Grounding involves making a conducting connection between the metal parts of the generator set or one of its electrical circuits and the earth. The design and installation of a grounding system is affected by many factors such as the use of multiple transformers, ground fault protection requirements and physical location of the generator. Follow the recommendations of the consulting engineer when installing the grounding system.

⚠WARNING: *Contact with electrical equipment can result in severe personal injury or death. It is extremely important that bonding and equipment grounding be properly done. All metallic parts that could become energized under abnormal conditions must be properly grounded.*

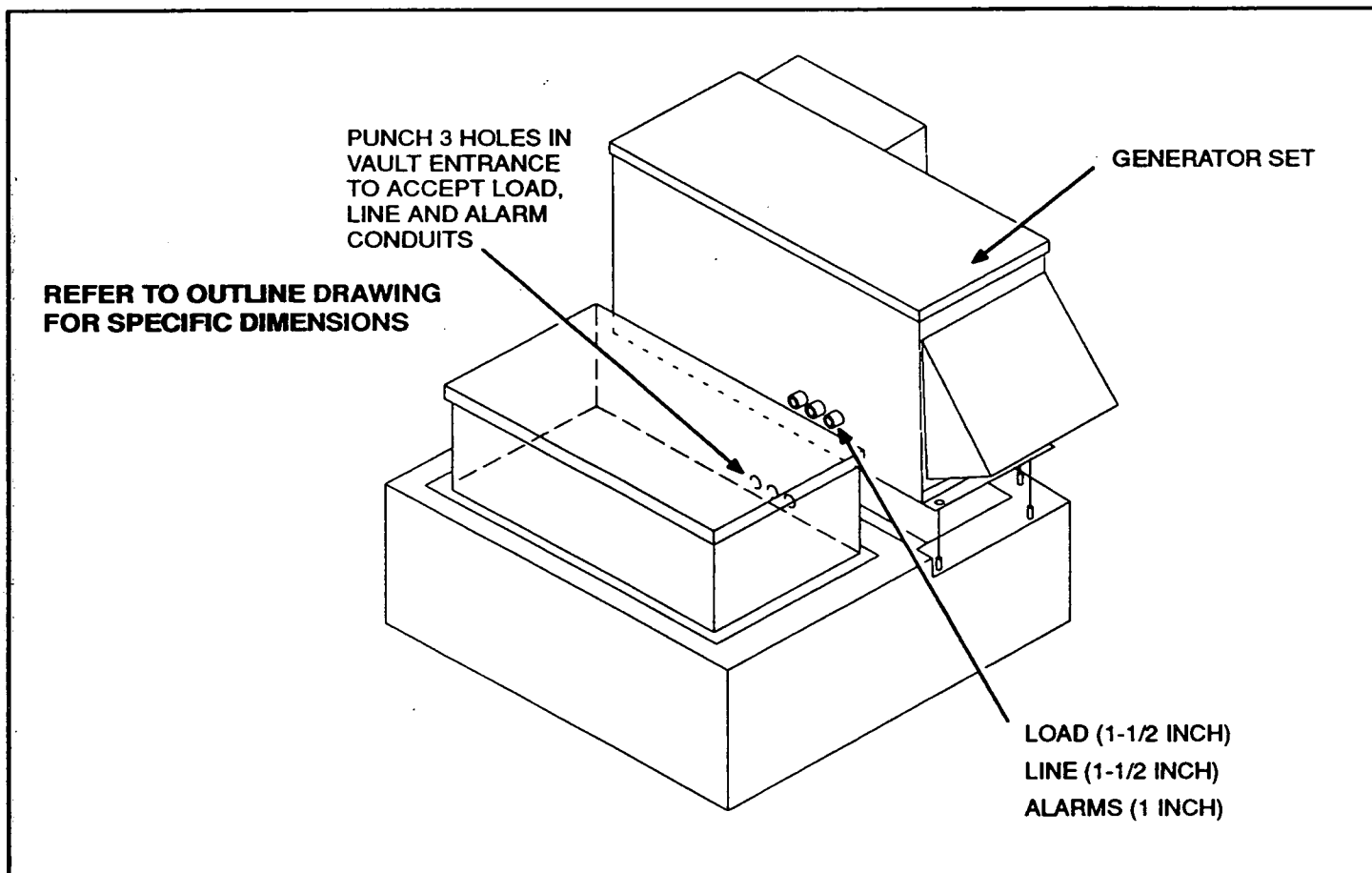


FIGURE 5-3. STANDARD FLEXIBLE CONDUIT FOR LOAD, LINE AND ALARM SIGNAL WIRING

DC WIRING

Remote Connections

Provisions are made inside the transfer switch cabinet for remote monitoring of these gensets. Refer to Figure 5-4. Customer connections are made on the terminal blocks (TB2 and TB3). The alarm terminals represent normally open contacts which close upon activation of the indicated conditions. Table 5-1 shows ratings for these contacts. A liquidtight conduit (Figure 5-3) is provided for routing these DC connections.

TABLE 5-1. CONTACT RATINGS

CONTACT	RATINGS
ENG MAJOR ENG MINOR	10A, 240VAC or 3A, 600VAC
LOW FUEL BASIN	10A, 30VDC or 10A, 600VAC
COMRCL POWER FAILURE OVER/UNDER VOLTAGE PROPER OPERATION	 4A, 30VDC or 4A, 120VAC

If the distance between the generator set and remote stations is less than 1000 feet (305 m), use 18 gauge stranded copper wire. If the distance is 1000 to 2000 feet (305 to 610 m), use 16 gauge stranded copper wire. Always run control circuit wiring in a separate conduit from the AC power cables to avoid inducing currents that could cause problems within the control.

CAUTION Do not install DC alarm wiring in the same conduit as the AC power. AC voltage induced currents can create operational problems with electronic solid-state devices. A 1.00 inch conduit is provided for DC alarm wiring; Two 1.50 inch conduits are provided for line and load AC wiring.

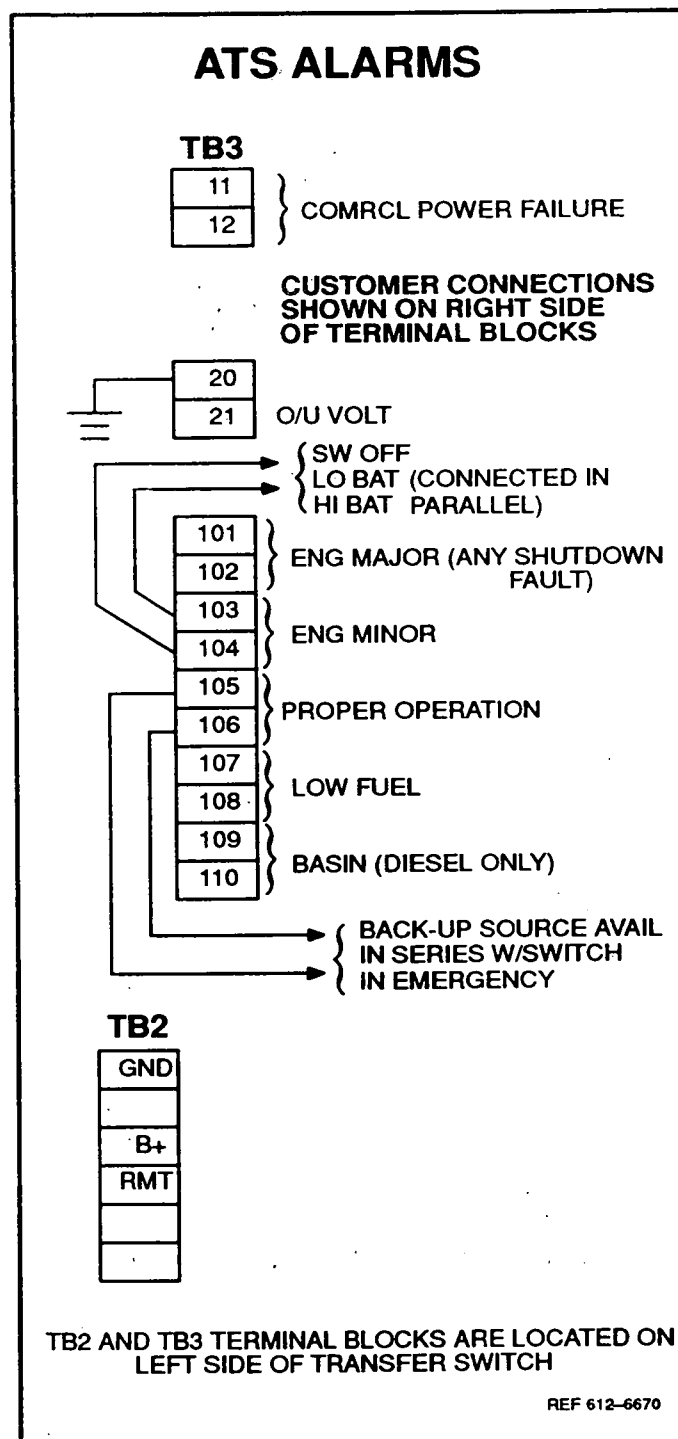


FIGURE 5-4. REMOTE DC CONNECTIONS

Battery Connections

Starting the unit requires 12 volt battery current. Use one 12 volt battery for a normal installation.

▲WARNING: Ignition of explosive battery gases can cause severe personal injury. Always connect battery negative last to prevent arcing.

Necessary battery cables and rack are on the unit. Service batteries as necessary. This unit comes standard with a battery charging circuit within the automatic transfer switch.

▲WARNING: Do not smoke while servicing the battery. Explosive gases are emitted from batteries in operation. Ignition of these gases can cause severe personal injury.

6. Prestart Preparations

GENERAL

Before attempting the initial start of the generator set, be sure it is serviced and ready for operation. Refer to the Maintenance section of the Operator's Manual for the recommended procedures for adding oil, coolant or fuel.

Gensets are shipped with oil and coolant added. Be sure to check these systems to make sure they are at proper operating levels before starting.

LUBRICATION

Before starting, check engine dipstick and if required, fill the crankcase with the recommended oil.

COOLANT

Before starting, check the coolant recovery tank on radiator and fill (between *low* and *full* mark) with the recommended coolant.

FUEL

Open all manual shutoff valves. Be sure manual changeover switch is moved to *Natural Gas* or *LPG Vapor* position depending on fuel used.

VENTILATION

Verify all air vents and ducts are open and free from any obstructions.

EXHAUST SYSTEM

Check the exhaust system for proper installation. Verify there is at least 12 inches (305 mm) clearance between exhaust pipes and combustible materials.

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

Connect positive battery cable before connecting negative battery cable to prevent arcing. Verify that battery connections are secure

Service the battery as necessary.

MECHANICAL CHECKS

Check the generator set for loose or damaged components and repair or replace as required.

7. Initial Start and Checks

Before putting the generator set under load conditions, verify the set will perform correctly by checking the following areas.

STARTING

Move the Run/Stop/Remote switch on the engine control panel to the Run position. The starter should crank the engine and the engine should start within a few seconds. If after a few seconds of cranking the engine fails to start or starts, runs and then stops, refer to Troubleshooting charts in the Operator's Manual.

ENGINE GAUGES

Check the following while the genset is operating:

Oil Pressure Gauge

The oil pressure should be in the range of 40 to 65 psi (275 to 448 kPa) when the engine is at operating temperature.

Water Temperature Gauge

The water temperature should be in the range of 180° to 195°F (83° to 91°C) depending on the load and ambient temperature.

DC Ammeter/DC Voltmeter

The maximum charge rate for the set mounted battery charging alternator is 65 amperes. Charge rate should taper to zero following start-up as battery becomes charged. The DC voltmeter should read between 12 and 14 volts.

AC METERS (IF EQUIPPED)

Note the AC instruments on the control panel. The frequency meter and voltmeter should indicate rated nameplate frequency and voltage at no load. Turn the control panel Voltage Adjust control (if equipped) for nameplate voltage. Use the Phase Selector Switch to read each of the line-to-line voltages.

Frequency Meter

The generator frequency should be stable and the reading should be the same as the nameplate rating (60 hertz).

AC Voltmeter

Turn the phase selector switch to each line-to-line phase selection shown on the volts scale (L1-L2 on single phase sets; L1-L2, L2-L3 and L3-L1 on three phase sets). Read the AC voltmeter using the upper or lower scale as indicated by the scale indicator light. At no load, the line-to-line voltage should be the same as the set nameplate rating.

AC Ammeter

Turn the phase selector switch to each phase selection shown on the amperes scale (L1 and L2 on single phase sets; L1, L2 and L3 on three phase sets). Read the ammeter using the upper or lower scale as indicated by the scale indicator light. At no load, the current readings should be zero. With a load applied, each line current should be approximately the same and no line current should exceed the set nameplate reading.

ENGINE MONITOR INDICATOR LAMPS

Move the Run/Stop/Remote switch on the engine panel to the Stop position. Hold the Reset/Lamp Test switch in the Test position. All indicator lamps should light. Verify all the lamps are on and then release the switch. Contact your authorized service center if any lamps require replacement.

EXHAUST SYSTEM

With the genset operating, inspect the entire exhaust system including the exhaust manifold, muffler and exhaust pipe. Visually and audibly check for leaks at all connections, welds, gaskets and joints. Make sure exhaust pipes are not heating surrounding areas excessively. If any leaks are detected, have them corrected immediately.

⚠WARNING *Inhalation of exhaust gases can result in severe injury or death. Inspect exhaust system visually and audibly for leaks daily. Repair any leaks immediately.*

FUEL SYSTEM

With the genset operating, inspect the fuel supply lines, filters and fittings for leaks. Check any flexible sections for cuts, cracks and abrasions and make sure they are not rubbing against any sharp, abrasive or hot surface.

⚠WARNING *Leaking fuel creates a fire hazard that can result in severe personal injury or death. Shut off set and repair any leaks immediately.*

DC ELECTRICAL SYSTEM

With the generator set off, check the terminals on the battery for clean and tight connections. Loose or corroded connections create resistance that can hinder starting. Clean and reconnect the battery cables if loose. Always connect the negative battery cable last.

⚠WARNING *Ignition of explosive gases can cause severe personal injury. Do not smoke while servicing the batteries.*

COOLING SYSTEM

With the generator stopped, check for loose belts and fittings, leaking gaskets and hoses, or any signs of mechanical damage. If any problems or coolant leaks are found, have them corrected immediately.

With the set running, listen for any unusual noises that can indicate mechanical problems. Refer to Operator's or Service Manual for required adjustments.

LUBRICATION SYSTEM

Open access doors and inspect entire engine for oil leaks. When engine has been stopped for at least 10 minutes, check the oil level.



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