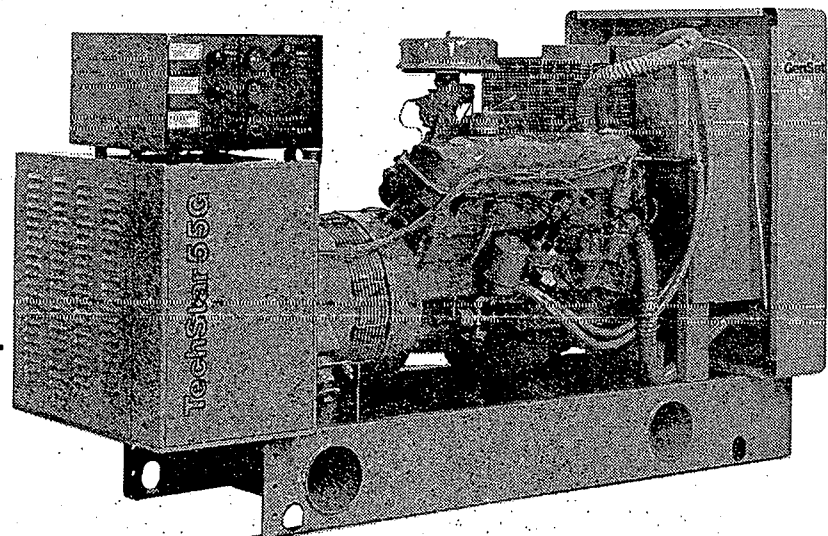


**Onan**

# **Installation Manual**

## **SKB GenSets**



**946-0622**

12/85

Printed in U.S.A.

# Safety Precautions

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The following symbols in this manual signal potentially dangerous conditions to the operator or equipment. Read this manual carefully. Know when these conditions can exist. Then, take necessary steps to protect personnel as well as equipment.

Read your manual and become thoroughly acquainted with it and your equipment before you start your unit. These recommendations and the following safety precautions are for your protection.

Fuels, electrical equipment, batteries, exhaust gases and moving parts present potential hazards that could result in serious, personal injury. Take care in following these recommended procedures.

**⚠ DANGER** *This symbol if used 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.*

## General

- Keep your electric generating set and the surrounding area clean and free from obstructions. Remove any debris from set and keep the floor clean and dry.
- Provide appropriate fire extinguishers and install them in convenient locations. Consult your local fire department for the correct type of extinguisher to use. Do not use foam on electrical fires. Use extinguisher rated ABC by NFPA.
- Make sure that all fasteners on the generating set are secure. Tighten supports and clamps, keep guards in position over fans, driving belts, etc.
- Do not wear loose clothing in the vicinity of moving parts, or jewelry while working on electrical equipment. Loose clothing and jewelry can become caught in moving parts. Jewelry can short out electrical contacts; cause shock or burning.
- If adjustment *must* be made while the unit is running, use extreme caution around hot manifolds, moving parts, etc.
- Do not work on this equipment when mentally or physically fatigued.
- 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. Bleed the system pressure first.

## Protect Against Moving Parts

- Keep your hands away from moving parts.
- Before starting work on the generating set, disconnect batteries. This will prevent starting the set accidentally.

## Fuel System

- DO NOT fill fuel tanks while engine is running, unless tanks are outside engine compartment. Fuel contact with hot engine or exhaust is a potential fire hazard.
- DO NOT SMOKE OR USE AN OPEN FLAME in the vicinity of the generator set or fuel tank. Internal combustion engine fuels are highly flammable.
- Fuel lines must be adequately secured and free from leaks. Piping at the engine should be approved flexible line. Do not use copper piping on flexible lines as copper will work harden and become brittle.
- Be sure all fuel supplies have a positive shutoff valve.

## Guard Against Electric Shock

- 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 surfaces to be damp when handling electrical equipment.
- Use extreme caution when working on electrical components. High voltages cause injury or death. DON'T tamper with interlocks.
- Follow all state and local electrical codes. Have all electrical installations performed by a qualified licensed electrician. Tag open switches.
- DO NOT SMOKE while servicing batteries. Lead acid batteries emit a highly explosive hydrogen gas that can be ignited by electrical arcing or by smoking.

## Exhaust Gases Are Toxic

- Provide an adequate exhaust system to properly expel discharged gases. Inspect exhaust system daily for leaks per the maintenance schedule. Ensure that exhaust manifolds are secure and not warped. Do not use exhaust gases to heat a compartment.
- Be sure the unit is well ventilated.

## Keep the Unit and Surrounding Area Clean

- Make sure that oily rags are not left on or near the engine.
- Remove all oil deposits. Remove all unnecessary grease and oil from the unit. Accumulated grease and oil can cause overheating and subsequent engine damage and may present a potential fire hazard.

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# Introduction

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## ABOUT THIS MANUAL

This manual provides specific installation instructions for the SKB generator set. This 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 to ensure proper installation, satisfactory performance, and safe operation.

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 SKB generator set, refer to the SKB

Specification Sheet and SKB Product Data Sheet. For general application information about generator set installation, refer to the following Onan Technical Bulletins:

T-009 — Selecting GenSets for Electric Motor Loads

T-015 — Application Information for Gaseous Fuels

T-017 — Rating Factors for GenSets

T030 — Installation Information for Liquid-Cooled GenSets

These bulletins are included with Volume 1 of the Onan Engineers Catalog or may be obtained separately on request from an authorized Onan Distributor.

## INSTALLATION OVERVIEW

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

### WARNING

**INCORRECT SERVICE OR REPLACEMENT OF PARTS CAN RESULT IN SEVERE PERSONAL INJURY AND/OR EQUIPMENT DAMAGE. SERVICE PERSONNEL MUST BE QUALIFIED TO PERFORM ELECTRICAL AND/OR MECHANICAL SERVICE.**

## **Installation Options**

Several fuel system options have a significant effect on the installation requirements for the generator set. The standard model generator set has a gasoline carburetor and fuel system. Optional fuel systems include LP gas (vapor), natural gas, or combination natural gas/gasoline. The installer must be aware of the different installation requirements for each of these options. Refer to the appropriate section of this manual for the specific requirements for each system.

## **Application and Installation**

A standby power system must be carefully planned and correctly installed to ensure 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. The generator set is a single component in an integrated power system that usually includes power distribution equipment, transfer switches, ventilation equipment, mounting pads, and cooling, exhaust, and fuel systems. Each component must be correctly designed so the complete system will function as intended. Application and design is an engineering function generally done by specifying engineers or other trained specialists. Specifying engineers are responsible for the design of the complete standby system and for selecting the materials and products required.

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

## **Safety Considerations**

The generator set has been carefully designed to provide safe and efficient service. 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.

# Specifications

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## INSTALLATION INFORMATION

Gasoline Fuel System	
Fuel Pump Inlet Size .....	7/16 In. Hose Fitting
Fuel Pump Maximum Lift .....	6 Ft. (1.8 m)
Gaseous Fuel System	
Regulator Inlet Size .....	3/4 In. NPT
Regulator Inlet Maximum Pressure .....	20 In. H <sub>2</sub> O (508 mm)
Regulator Outlet Pressure	
Natural Gas .....	4.5 to 5.0 In. H <sub>2</sub> O (114 to 127 mm)
LPG Vapor .....	Negative (-) 1 In. H <sub>2</sub> O (-25.4 mm)
Exhaust System	
Exhaust Outlet Size .....	2 In. NPT External
Exhaust Back Pressure (Max) .....	40 In. H <sub>2</sub> O (1016 mm)
Electrical System	
Starting System Voltage .....	12

# Mounting the Generator Set

## GENERAL

Most generator set installations must be engineered to ensure 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. Refer to Onan Technical Bulletin, T-030, for further installation information.

Requirements to be considered prior to installation:

- Level mounting surface
- Adequate cooling air
- Adequate fresh induction air
- Discharge of circulated air
- 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 fuse box.

Provide a location away from extreme ambient temperatures and protect the generator set from adverse weather conditions. An optional housing is available for outside operation.

## 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. For critical installations, install vibration isolators between the skid base and foundations.

Mount the generator set on a substantial and level base such as a concrete pad. See set outline drawing, Figure 1, for proper spacing of mounting bolts and set mounting dimensions.

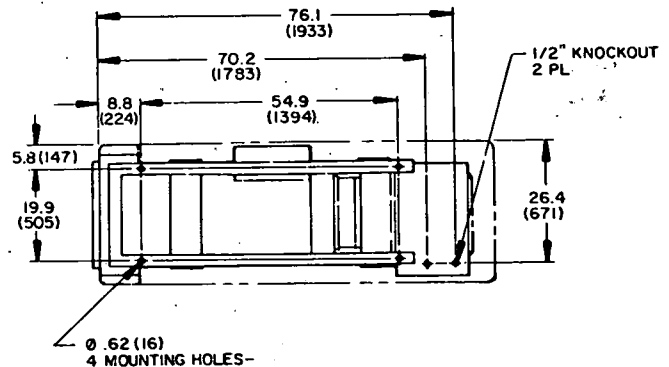


FIGURE 1. SKID OUTLINE DRAWING

Use 5/8-inch diameter, anchored mounting bolts to secure the generator set skid to the floor to prevent movement. Secure the skid using a flat washer and hexagon nut for each bolt (see Figure 2).

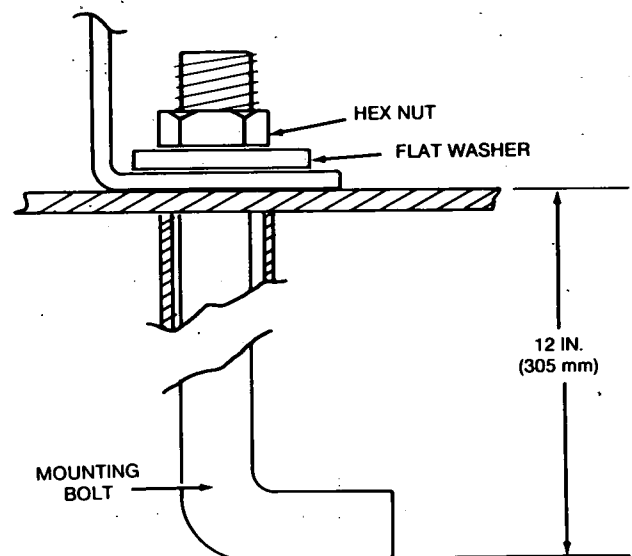


FIGURE 2. BOLT DIAGRAM

## ACCESS TO SET

Plan for access to the generator set for servicing and provide adequate lighting around the unit. For convenience in general servicing such as the radiator, fan belt, and changing the crankcase oil; the surface of the mounting base should be at least 6 inches (152 mm) above the floor.

# Mechanical Connections

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

## FUEL SYSTEM

Chrysler engines used on SKB sets are designed to operate on gasoline (automotive regular leaded or unleaded), natural gas with a thermal rating of 1000 BTU/ft<sup>3</sup> (37.25 MJ/m<sup>3</sup>), or liquefied petroleum gas (LPG) propane at 2500 BTU/ft<sup>3</sup> (93.13 MJ/m<sup>3</sup>).

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

### Fuel Connections

Sets may be equipped to operate on gasoline only, natural gas only, or both. Special heat exchanger equipment is provided on LPG burning models.

Identification tags are attached to the fuel supply line and fuel return line connections by the factory. Flexible lines for connecting between the engine and the stationary fuel line are supplied as standard equipment. Refer to the SPECIFICATIONS section for the fitting sizes.

**Gasoline Fuel:** Use 1/2-inch tubing to connect the engine fuel pump inlet (see Figure 3) to an approved fuel tank installation.

The fuel lift from the supply tank to the fuel pump should not exceed 6 feet (1.8 m) and the horizontal distance not more than 50 feet (15.2 m). Use 1/2-inch tubing for up to 25 feet (7.6 m) and 5/8-inch tubing for up to 50 feet (15.2 m). Use a suitable adapter fitting to fit the 1/4-inch pipe thread on the fuel pump inlet opening.

Comply with local regulations when installing any gasoline supply tank. Underground tanks usually have the fuel outlet at the top, requiring a drop or suction tube extending to within an inch or two of the bottom. All supply connections must be airtight to ensure the pump will lift the fuel from the tank.

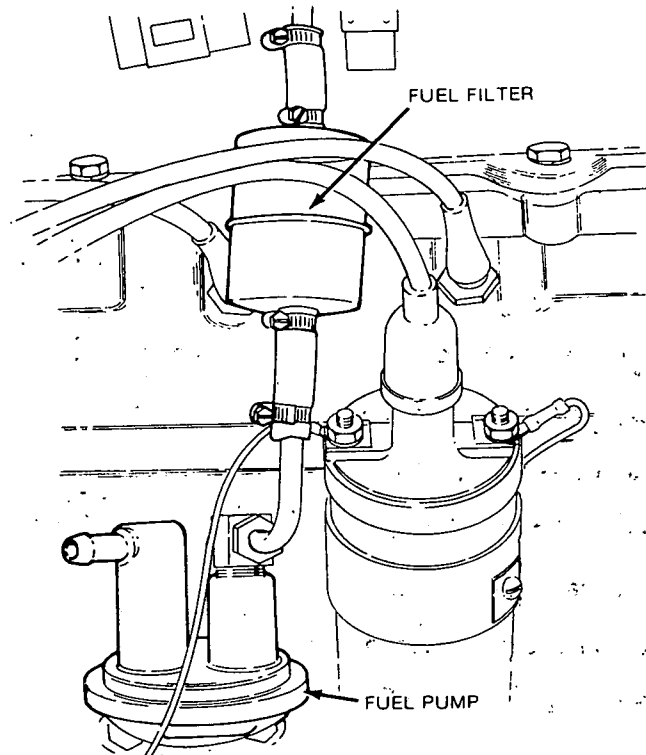


FIGURE 3. FUEL PUMP AND FITTINGS

**Natural or Manufactured Gas:** On sets equipped with an Impco carburetor, the gas pressure at the carburetor must be set at 3 ounces (1.2 kPa) gauge or 5-inches (127 mm) water column manometer with the engine running at 3600 r/min at no load. If the pressure is excessive, install a suitable pressure reducing regulator.

Be sure to comply with all local regulations such as:

- Recommended electric shutoff valve
- Manual shutoff valve at the fuel source
- Supply line filter

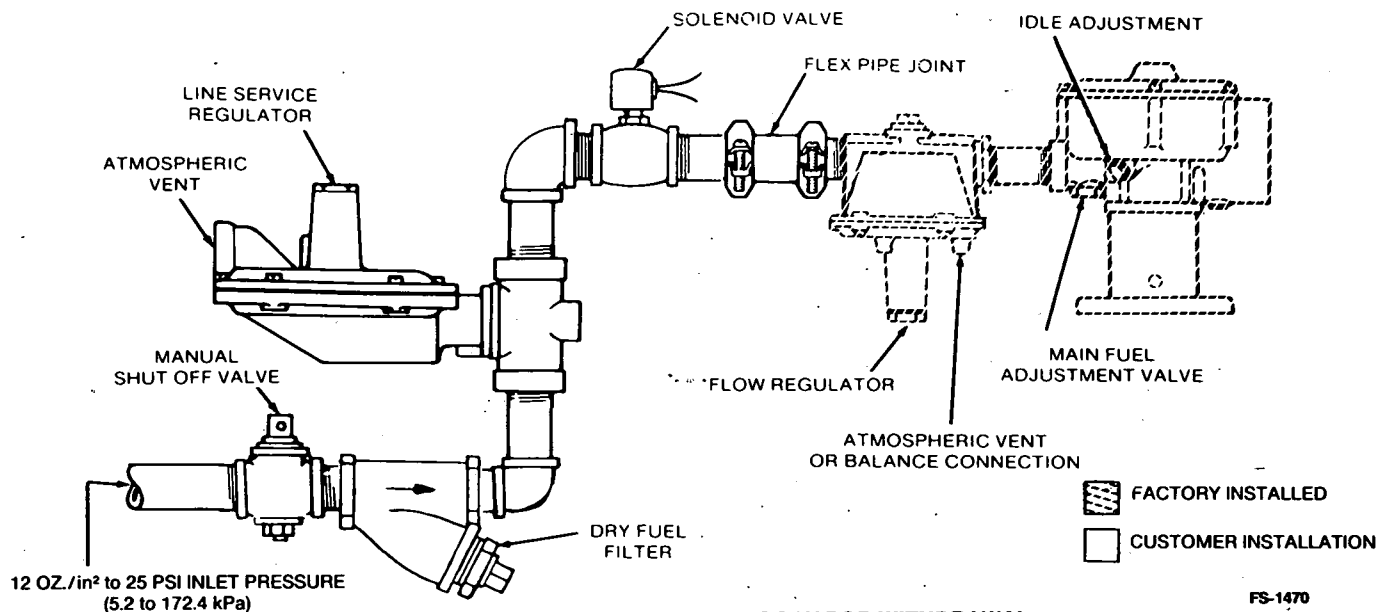
A typical fuel system schematic, Figure 4, shows what must be installed at the customer site.

Use a short length of approved flexible connection between the supply pipe and the plant regulator inlet. For emergency operation on gasoline fuel, follow the appropriate fuel connection instructions.

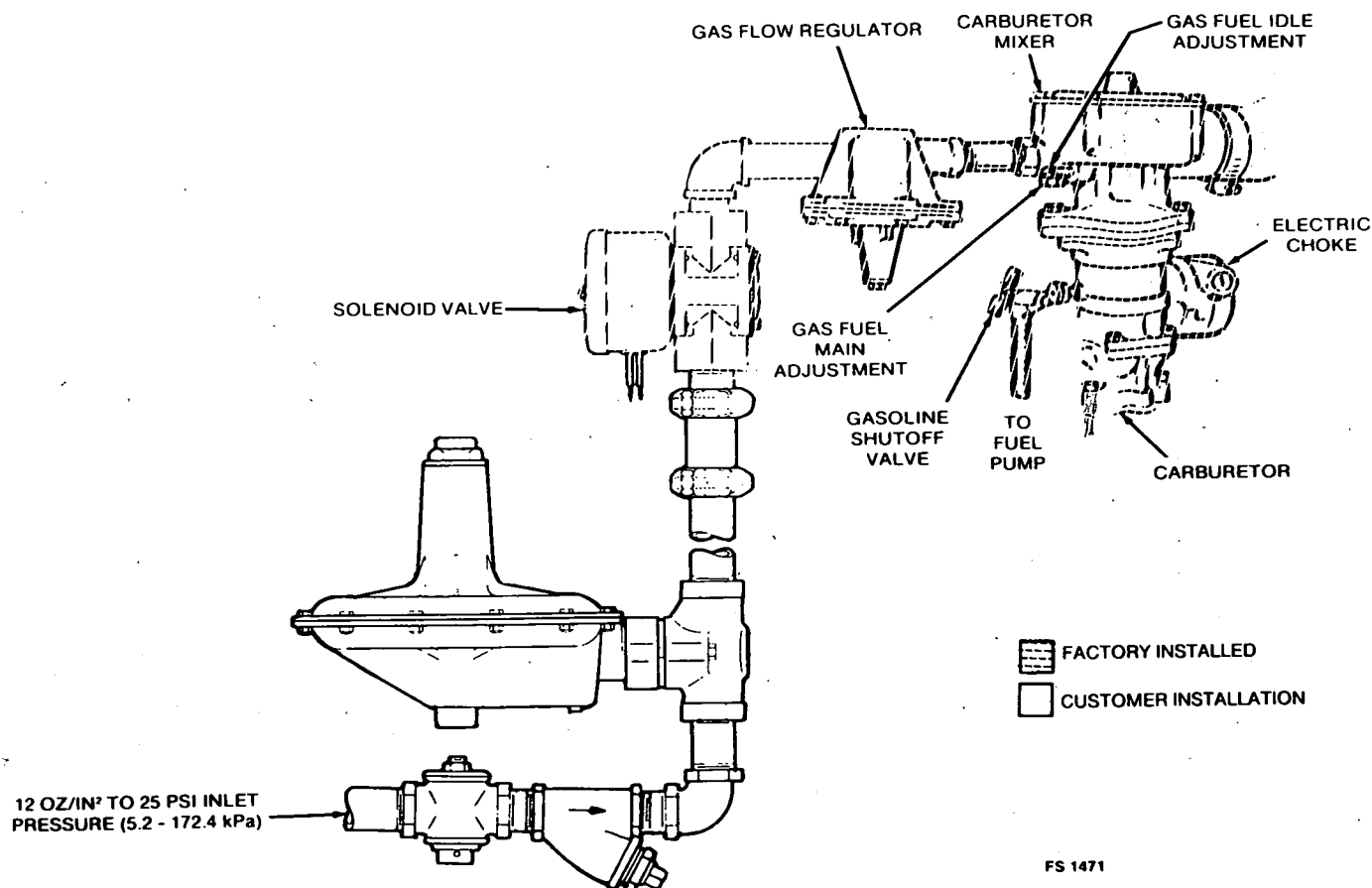


**LPG Fuel:** Liquefied petroleum gas-fueled sets are equipped with a vaporizer system combined with a pressure reducing regulator (refer to Figure 4). Use only approved materials and methods to connect to the supply source. Install a liquid fuel filter in the supply line and an electric solenoid valve. Refer to the engine control wiring diagram for solenoid valve connections. An emergency manual shutoff valve should be provided.

**Combination Gas-Gasoline:** These sets are designed for normal operation on gas fuel, with provisions for emergency operation on gasoline. Figure 5 shows a typical combination system schematic and installation needed at the customer site. Follow the procedures for gas and gasoline fuel connections. A reservoir tank is sometimes provided, so a fuel return line may be necessary as described for gasoline fuel.



**FIGURE 4. NATURAL GAS OR LPG VAPOR WITHDRAWAL  
TYPICAL FUEL SYSTEM SCHEMATIC**



**FIGURE 5. TYPICAL COMBINATION GAS/GASOLINE  
FUEL SYSTEM SCHEMATIC**

## EXHAUST SYSTEM

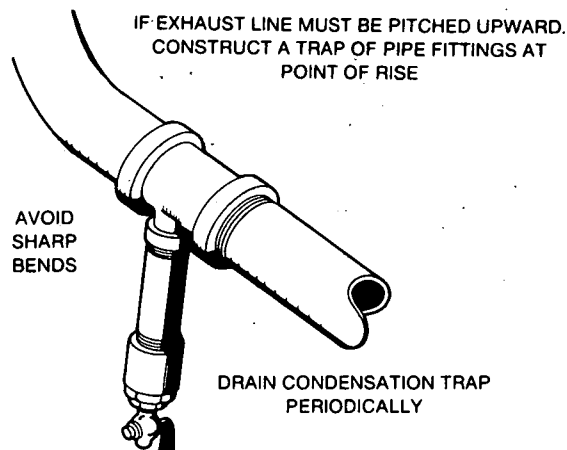
Pipe exhaust gases to the outside of any enclosure. Locate the exhaust outlet away from any air inlets to avoid exhaust gases from re-entering the enclosure. Exhaust installations are subject to various detrimental conditions such as extreme heat, infrequent operation, and light loads. Regularly inspect the exhaust system both visually and audibly to ensure 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 ensure a tight exhaust system.*

Use an approved thimble where exhaust pipes pass through walls or partitions. Refer to the National Fire Protection Association bulletin, Volume 4, section 211, covering Standards for Chimneys, Fireplaces, and Vents for suggested code requirements. Build according to the code requirements in effect at the installation site.

**⚠ 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.*

Pitch a horizontal run of exhaust pipe **DOWNWARD** 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 (see Figure 6).



EXS-1046

FIGURE 6. EXHAUST CONDENSATION TRAP

Avoid sharp bends by using sweeping, long radius elbows and provide adequate support for mufflers and tailpipe. Attach a section of flexible, 2-inch (50.8 mm), stainless steel tubing between the engine exhaust connection and the exhaust pipe system to permit movement and thermal expansion (refer to Figure 7).

Shield or insulate exhaust lines if there is a danger of personal contact. Allow at least 12 inches (305 mm) of clearance if the pipes pass close to a combustible wall or partition.

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

Onan has rain caps 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.

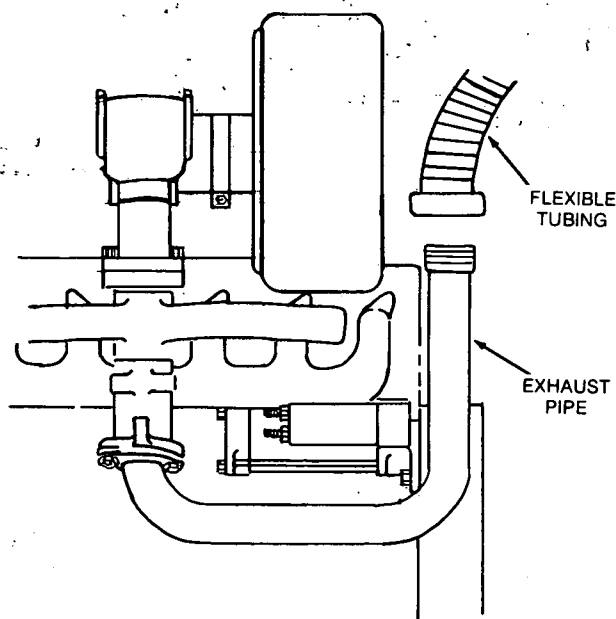


FIGURE 7. EXHAUST CONNECTION

## VENTILATION AND COOLING SYSTEM

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

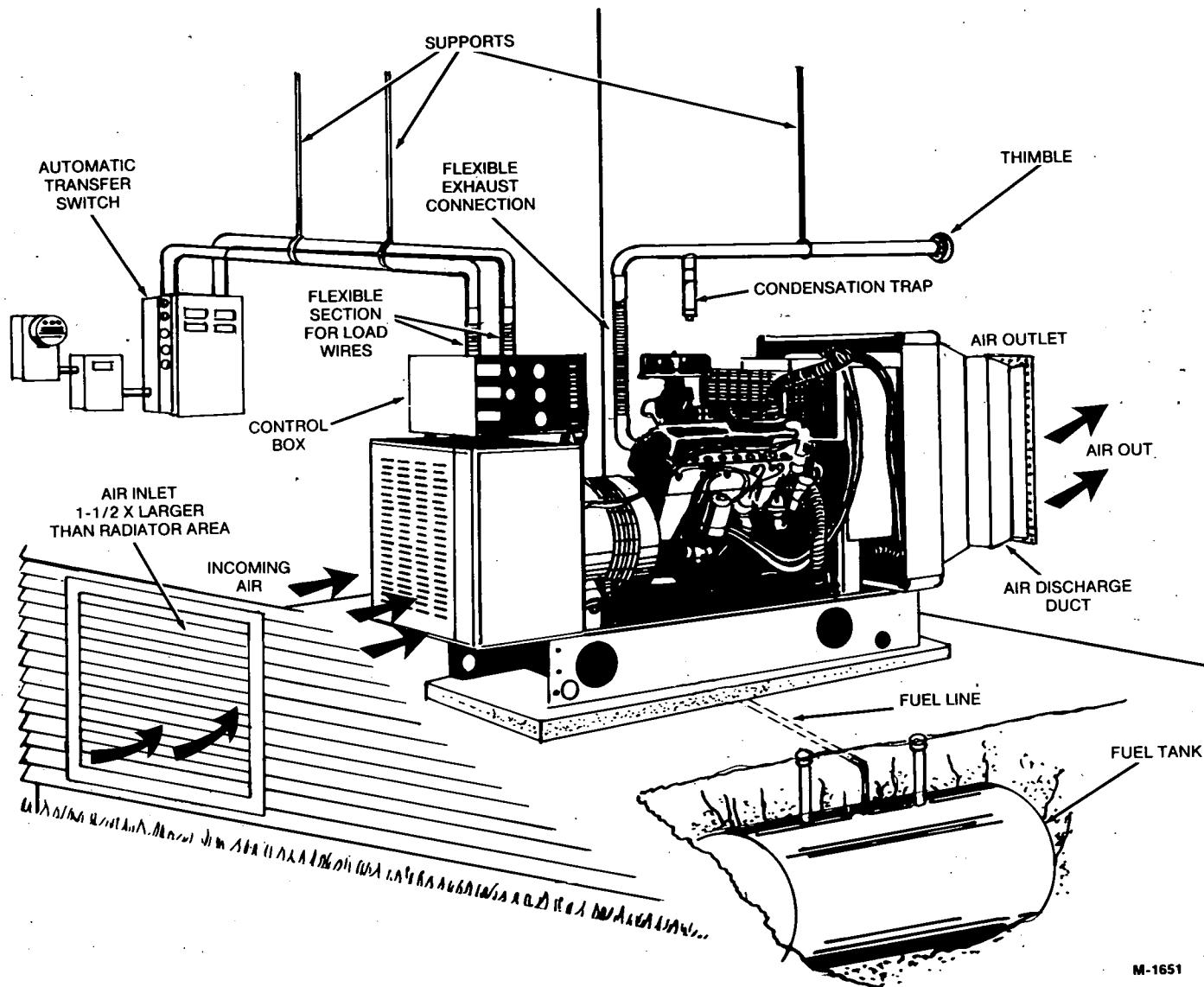


FIGURE 8. TYPICAL INSTALLATION

# Electrical Connections

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The generator set electrical system installation includes connecting the load, installing the control wiring, and connecting the batteries. The batteries should be connected last to avoid accidental starting of the unit during installation.

Most location regulations require wiring connections be made by a licensed electrician and the installation must 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 fire and severe personal injury or death. Do not connect electrical wiring to the fuel line.*

If the installation is for standby service, a transfer switch is required for switching the load from the normal power source to the generator set. Either a manual or automatic transfer switch may be used. Follow the installation instructions provided with the transfer switch when connecting the load and control wiring. Onan can supply transfer switches to match the generator rating if required.

## AC WIRING

### Generator Voltage Connections

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

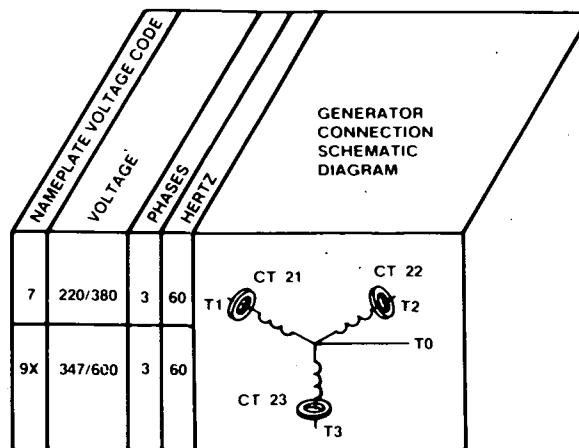
**Non-Reconnectible Generators (Voltage Codes 7 or 9X):** These generators are wired at the factory for a specific voltage and are not intended for reconnection. The voltage and corresponding current rating (amperes) are shown on the nameplate.

**Reconnectible Generators (Voltage Codes 15 and 515):** Generators with codes 15 (for 60 Hertz) and 515 (for 50 Hertz) are three phase generators that can be reconnected for any of the voltages shown in Figure 9. Refer to the set nameplate for the corresponding current rating (amperes).

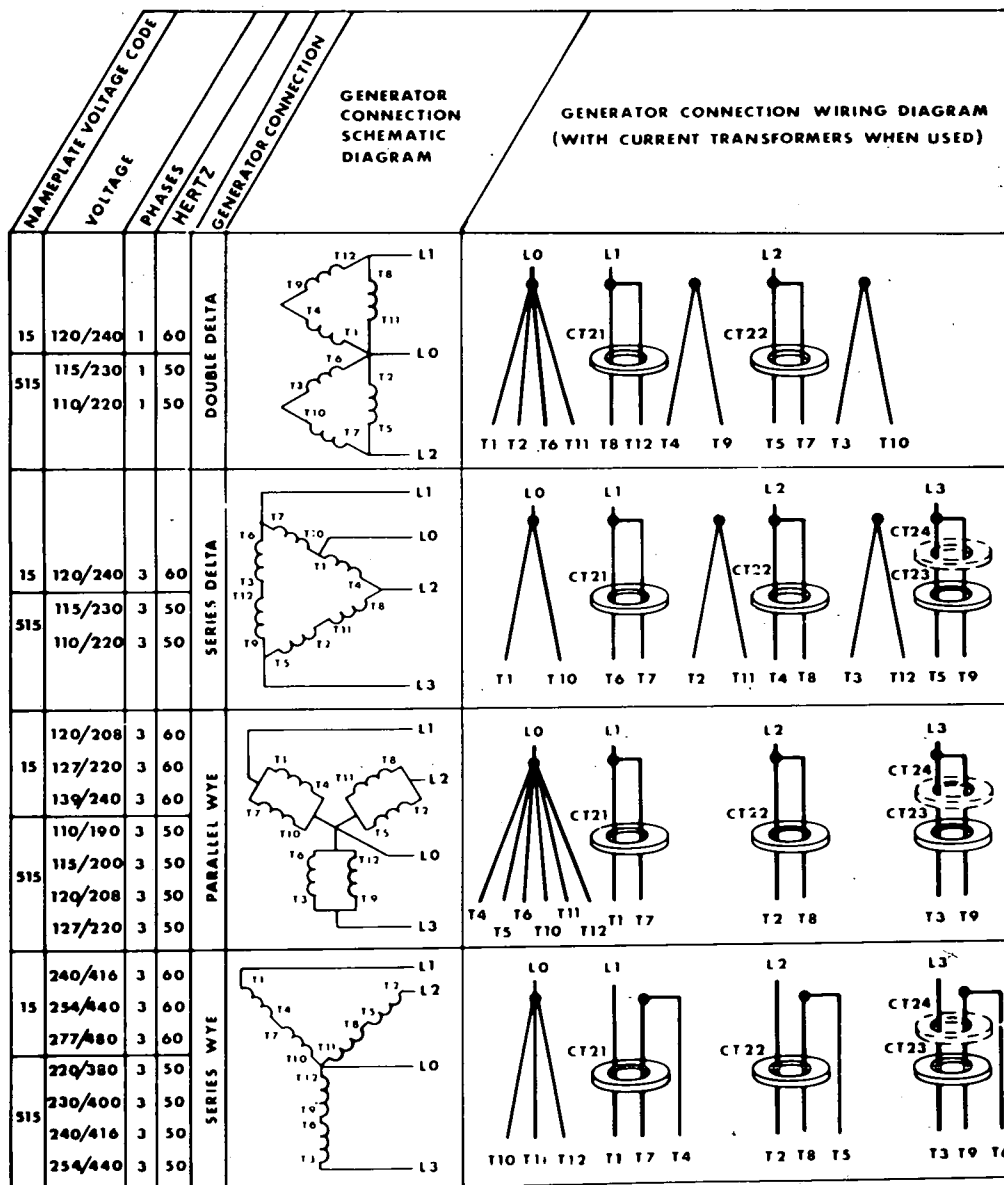
### Load Connections

The 12 lead generators with load connection wires ARE NOT connected together in the output box when shipped from the factory. These 12 wires are labeled T1 through T12 and must be brought together before making load connections. Proceed as follows:

1. Remove the right or left panel from output box.
2. Bolt the load wires to the appropriate generator lead wires in the output box according to Figure 9 for required voltage.
3. Insulate the connections.



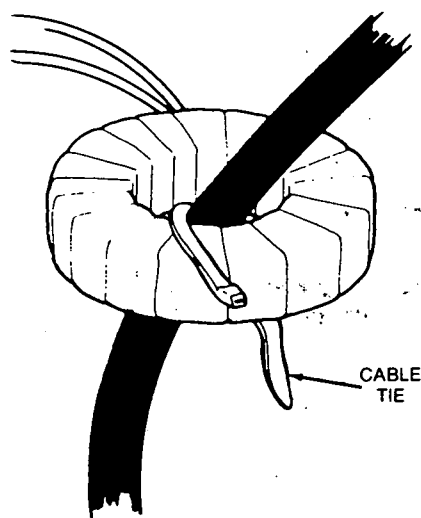
THIS DIAGRAM APPLIES TO 12 LEAD GENERATORS ONLY



ES-1630

FIGURE 9. GENERATOR VOLTAGE CONNECTIONS

When installing sets with the optional AC ammeter, the generator output leads must be routed through a current transformer for proper meter operation (see Figure 10). The transformers are identified CT21, CT22, and CT23 (three phase only) on the wiring diagram and electrical schematics. Refer to Figure 9 to identify the output leads that must be routed through each transformer. Use a cable tie to secure the loose transformer to the generator output leads.



ES-1624

FIGURE 10. CURRENT TRANSFORMERS

### 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.

### 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.*

### Voltage Regulator

The solid-state regulator (VRAS-2, see Figure 11) controls AC output voltage from the generator at a predetermined level regardless of load. Voltage is plus or minus 3 percent from no load to full load. Random voltage variation is plus or minus 1 percent for constant loads.

### Coolant Heater (Optional)

A coolant heater can be used to keep engine coolant warm when the engine is shut down. It heats and circulates the coolant within the engine. This reduces start-up time and lessens engine wear caused by cold starts. It is electrically operated and thermostatically controlled.

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

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

## DC WIRING

### Remote Control Connections

Provisions are made inside the control box for addition of optional remote starting and alarms. Connections are made on the 10- and 16-place terminal blocks (TB1 and TB2) located on the engine control circuit board (see Figures 11 and 12).

Use 18 gauge stranded copper wire if the distance between the set and remote station is less than 1000 feet (305 m); 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.

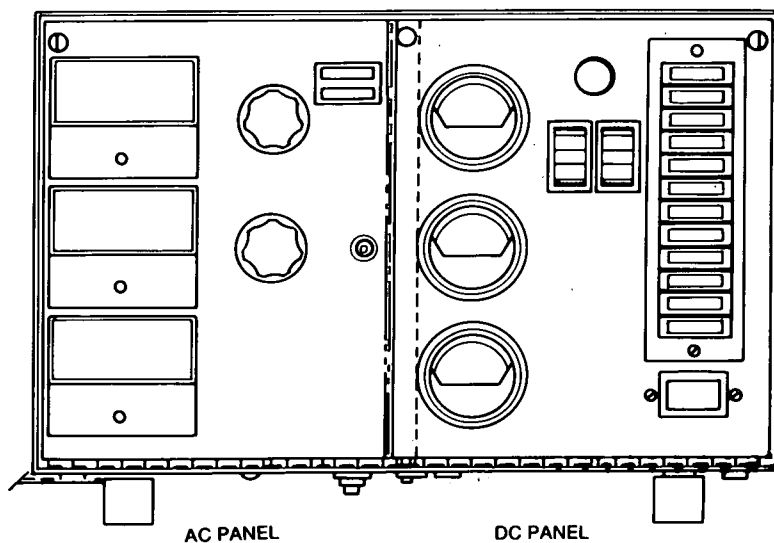
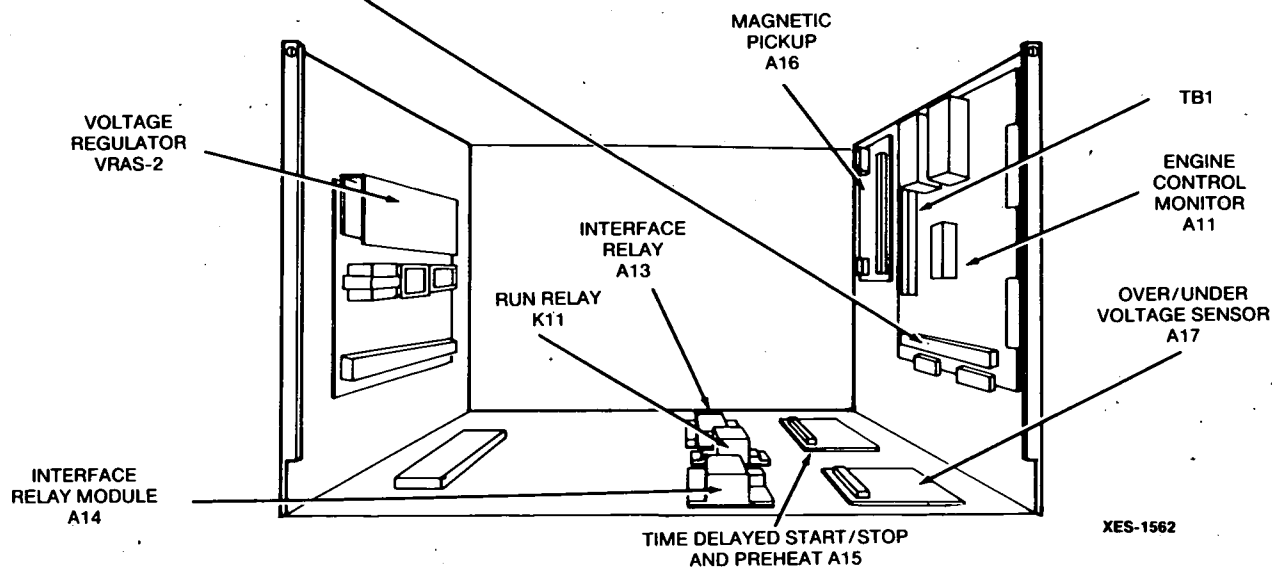
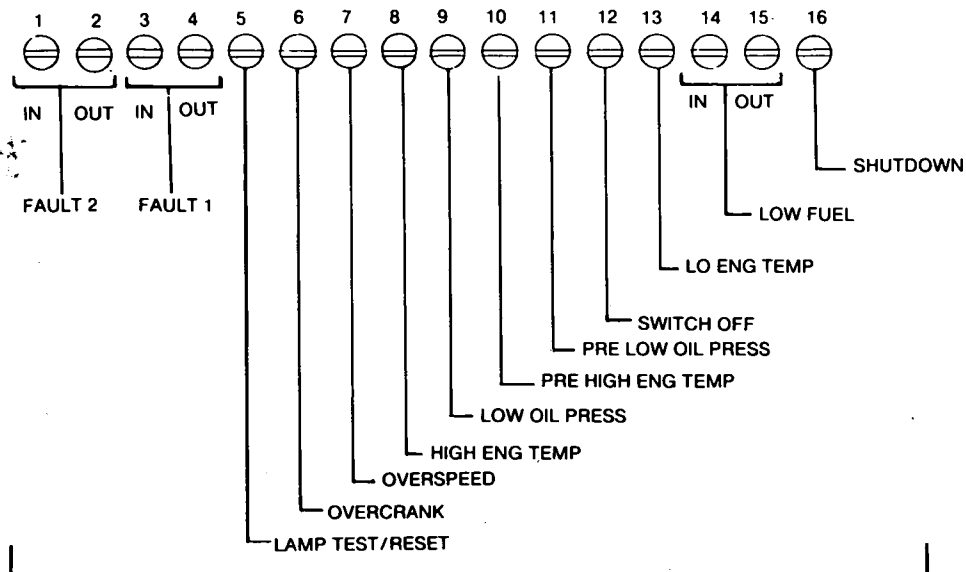


FIGURE 11. CONTROL BOX INTERIOR

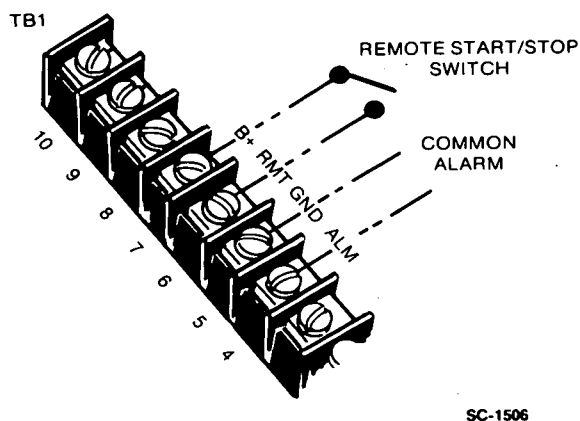


FIGURE 12. REMOTE CONTROL CONNECTIONS

### Battery Connections

The generator set requires one 12-volt battery, available from Onan as an option, see Figure 13 for a normal installation. The necessary battery cables and battery rack are included with the unit.

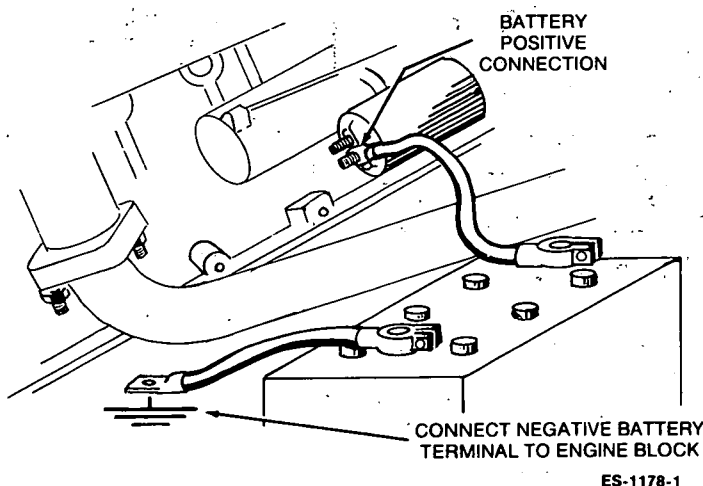


FIGURE 13. BATTERY CONNECTION

When shipped with a generator set, the battery must be serviced and charged. Follow the battery manufacturer's instructions.

**⚠ WARNING** *Do not smoke while servicing batteries. Explosive gases are emitted from batteries in operation. Ignition of these gases can cause severe personal injury.*

Infrequent set use (as in emergency standby service) may allow battery to self-discharge to the point it cannot start the unit. If an automatic transfer switch is being installed with no built-in charge circuit, connect a separate trickle charger. Some Onan automatic transfer switches include a battery charging circuit.

During installation, connect the battery last to avoid accidental starting of the unit. Connect the positive cable first and the negative cable last to avoid arcing.

If the battery is installed outside the skid base, use battery cables that are of sufficient size to handle high current loads during cranking. Refer to Table 1 for recommended cable dimensions.

TABLE 1. CABLE SIZE

MM	6.5	7.3	8.3	9.3	10.5	11.6
INCH	0.258	0.289	0.325	0.365	0.410	0.460
WIRE SIZE	2	1	0	00	000	0000
LOOP	4 ft. 1.24m	5 ft. 1.55m	7 ft. 2.17m	9 ft. 2.79m	11 ft. 3.41m	14 ft. 4.34m

**⚠ WARNING** *Sparks can ignite battery gases and result in an explosion and severe personal injury. Do not disconnect battery cables from battery while generator set is cranking, running, or while the battery is being charged.*



# Prestart Preparations

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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 Operators Manual for the recommended procedures for adding oil, coolant, or fuel.

## LUBRICATION

Engine oil is drained prior to shipment. Before starting, fill the crankcase with the recommended oil.

## COOLANT

Engine coolant is drained prior to shipment. Before starting, fill the cooling system with the recommended coolant.

## FUEL

Fill the fuel tanks with the recommended fuel and prime the fuel system. All manual shutoff valves should be turned open.

## VENTILATION

Verify that all air vents and ducts are open and free of any obstructions. If dampers are used, verify they operate properly.

## EXHAUST SYSTEM

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

## ELECTRICAL SYSTEM

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

### Battery Connections

Use one 12-volt battery for a normal installation. Connect positive battery cable before connecting negative battery cable to prevent arcing.

Service the battery as necessary. If an automatic transfer switch is installed without a built-in charge circuit, connect a separate trickle charger.

## MECHANICAL CHECK

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

# Initial Start and Checks

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

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 and the fault lamp lights, refer to the Troubleshooting chart in the SKB Operators Manual.

## ENGINE GAUGES

Check the following while the generator set is operating.

### Oil Pressure Gauge

The oil pressure should be in the range of 30 to 70 psi (207 to 483 kPa) when the engine is at operating temperature.

### Water Temperature Gauge

The water temperature should be in the range of 165° to 195° F (74° to 91° C) depending on the load and ambient temperature.

### DC Ammeter

The maximum charge rate for the set mounted battery charging alternator is 37 amperes. Charge rate should taper to zero following start-up as battery becomes charged.

## AC METERS (IF EQUIPPED)

Note the AC instruments on the control panel. The frequency meter and voltmeter should indicate rated nameplate frequency and voltage. 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.

If unit does not have control instruments or a Voltage Adjust control on the front panel, connect an accurate external voltmeter. If necessary, adjust R32 on VRAS-2 Voltage Regulator board for nameplate voltage (see Figure 14).

**⚠ WARNING** *High voltages are present within the control cabinet which can cause severe personal injury or death. Proceed with care!*

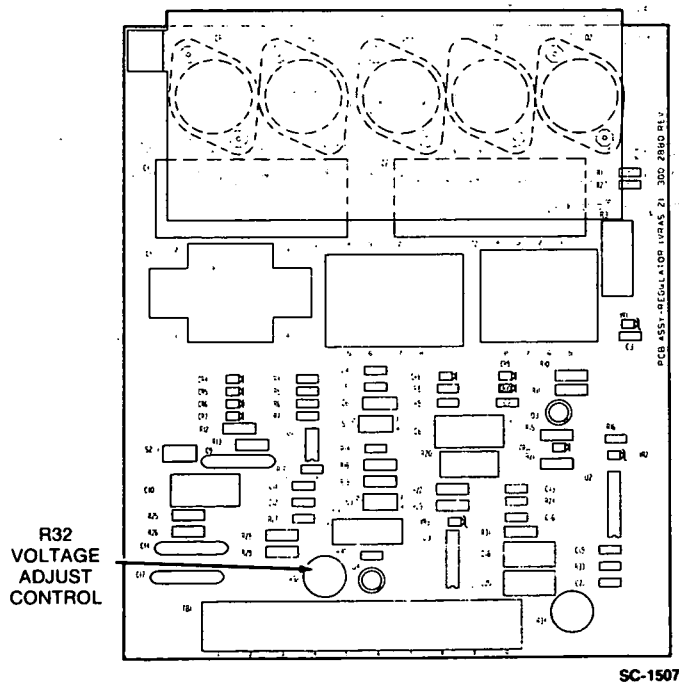


FIGURE 14. VRAS-2 VOLTAGE REGULATOR ASSEMBLY

Check the following while the generator set is operating.

### Frequency Meter

The generator frequency should be stable and the reading should be the same as the nameplate rating (50 or 60 Hz).

### 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 roughly the same and no line current should exceed the set nameplate rating.

### ENGINE MONITOR INDICATOR LIGHTS

Hold the Reset/Lamp Test switch in the Test position. All indicator lamps (except Run) should light. Verify all of the bulbs are on and then release the switch. Contact an Onan Distributor if any bulbs require replacement.

### EXHAUST SYSTEM

With the generator set 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 personal injury or death. Inspect exhaust system audibly and visually for leaks daily. Repair any leaks immediately.*

### FUEL SYSTEM

With the generator set operating, inspect the fuel supply lines, return lines, filters, and fittings for leaks. Check any flexible sections for cuts, cracks, and abrasions and make sure they are not rubbing against anything that could cause breakage.

**▲WARNING** *Leaking fuel will create a fire hazard which can result in severe personal injury or death if ignited by a spark. If any leaks are detected, have them corrected 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 to reduce the possibility of arcing.

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

### COOLING SYSTEM

When the engine is first started, remove the pressure cap and monitor the coolant level. As trapped air is expelled from the system, the coolant level will drop and additional coolant should be added. Replace the pressure cap when the coolant level is stable.

### MECHANICAL ADJUSTMENTS

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

With the set running, listen for any unusual noises that may indicate mechanical problems and check the oil pressure frequently. Investigate anything that indicates possible mechanical problems. Refer to the SKB Operators Manual for any necessary adjustments.



**ONAN**

1400 73rd Avenue N.E.  
Minneapolis, MN 55432 (612) 574-5000

Telex 29 0476 (U.S.)  
Telex 29 0856 (outside U.S.)  
TWX 910 576-2833  
Cable ONAN