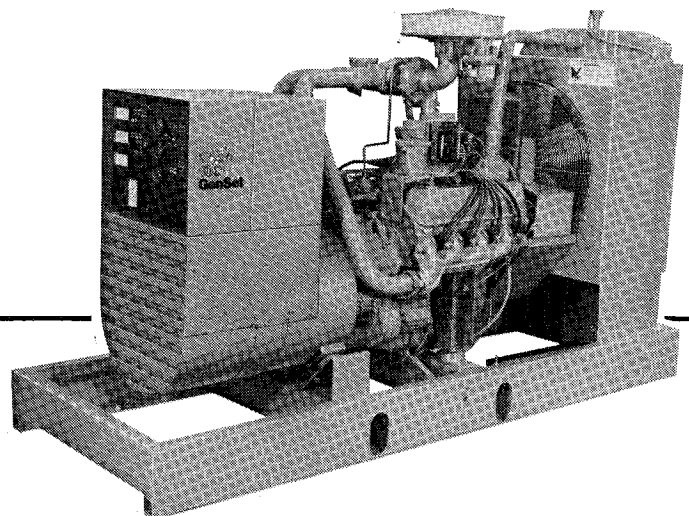


Onan

Installation Manual

ENTX GenSets

Natural Gas Fuel



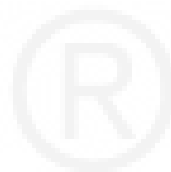
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Introduction

ABOUT THIS MANUAL

This manual provides specific installation instructions for the ENTX 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 generator set, refer to the ENTX specification and product data sheets. For general application information about generator set installation, refer to the following Onan Technical Bulletins.

T-009/T-017	— Selecting Onan Generator Sets
T-015	— Application Information for Gaseous Fuels
T-030	— Installation Information for Liquid-Cooled GenSets

Bulletins T-015 and T-030 are particularly useful installation references and are shipped with this manual. Bulletin T-009/T017 is included in the Onan Power Systems Manual 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.

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

INSTALLATION INFORMATION

Gaseous Fuel System

Regulator Inlet Size	1.00 In. NPT
Regulator Inlet Maximum Pressure	20 In. H ₂ O (508 mm)
Regulator Outlet Pressure	
Natural Gas	4.5 to 5.0 In. H ₂ O (114 to 127 mm)

Exhaust System

Exhaust Outlet Size	3.00 In. NPT
Exhaust Back Pressure (Max)	40 In. H ₂ O (1016 mm)

Electrical System

Starting System Voltage	12
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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.

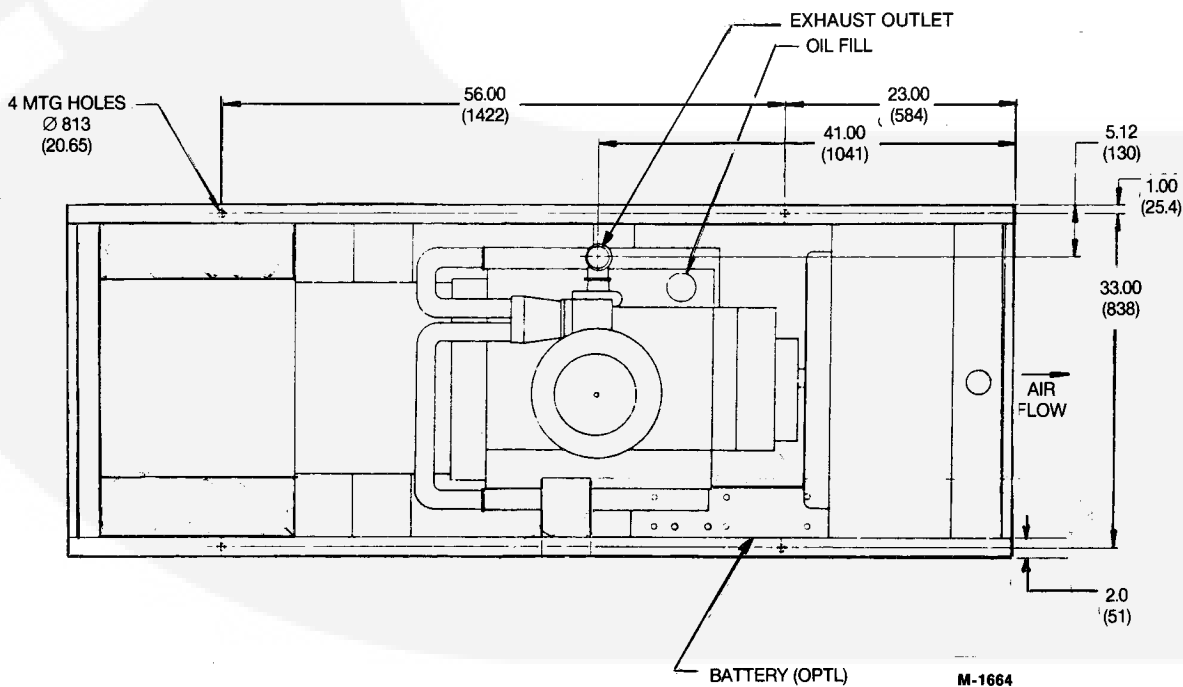
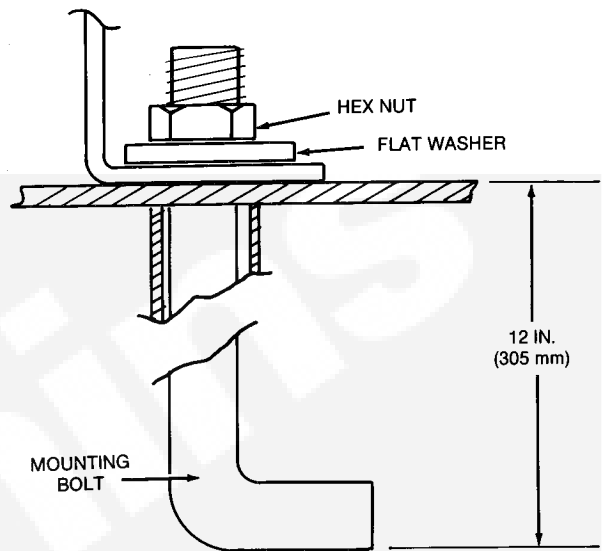


FIGURE 1. SKID OUTLINE DRAWING

Use 3/4-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).

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.



M-1627

FIGURE 2. BOLT DIAGRAM

Mechanical Connections

The generator set mechanical system installation includes connecting the fuel, exhaust, 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

The engine used on the ENTX generator set is designed to operate on natural gas fuel with a thermal rating of 1000 BTU/ft³ (37 MJ/m³). No other fuels are approved for use with this generator set.

Fuels under pressure (such as natural gas) 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

Natural 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 1800 r/min at no load. It should also be 3 inches H₂O or more at rated load. If this is not checked the supply line could be sized too small. If the pressure is excessive, install a suitable pressure reducing regulator. Use a short length of approved flexible connection between the supply pipe and the set regulator inlet.

Be sure to comply with all local regulations such as:

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

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 (Figure 3) where exhaust pipes pass through wall 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.*

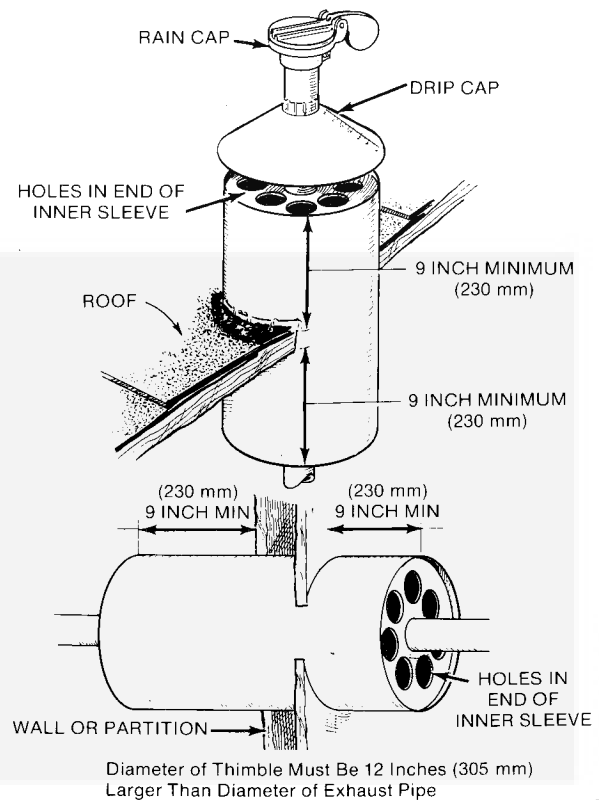


FIGURE 3. EXHAUST THIMBLE

EXS-1036

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.

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.*

Avoid sharp bends by using sweeping, long radius elbows and provide adequate support for mufflers and tailpipe. 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 4).

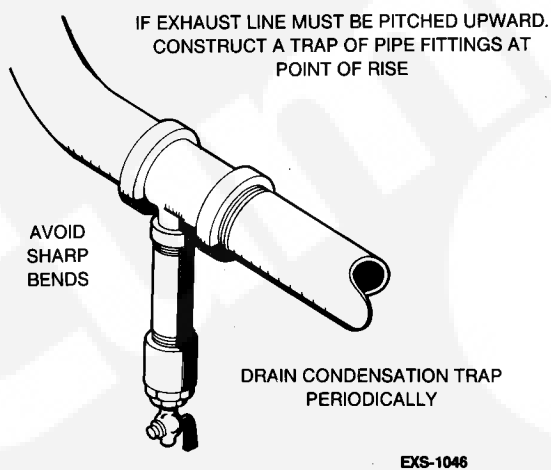


FIGURE 4. EXHAUST CONDENSATION TRAP

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.

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.

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 (see Figure 5 for a typical installation).

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 ENTX Product Data Sheets for the airflow requirements.

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.

For operation outside a building, a shelter housing with electrically operated louvres is available as an option. Transformers connected across the generator output supply current to the motors.

When the generator is operating, current in the transformers actuate the motors and open the louvres. The louvres are held open for the duration of the set operation, then are closed by return springs when the set is shut down.

Dampers

Dampers are used in any system to block the airflow through the vents when the generator set is not running. This is sometimes necessary in cold climates to keep the generator enclosure at a normal temperature. Refer to Onan Technical Bulletin, T-030, for additional application information.

Radiator Set Requirements

Radiator set cooling air is drawn past the rear of the set by a 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.

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

Standard Radiator Cooling uses a set mounted radiator and engine drive pusher type fan to cool engine water jacket. Air travels from the generator end of the set, across the engine and out through the radiator. An integral discharge duct adapter flange surrounds the radiator grille.

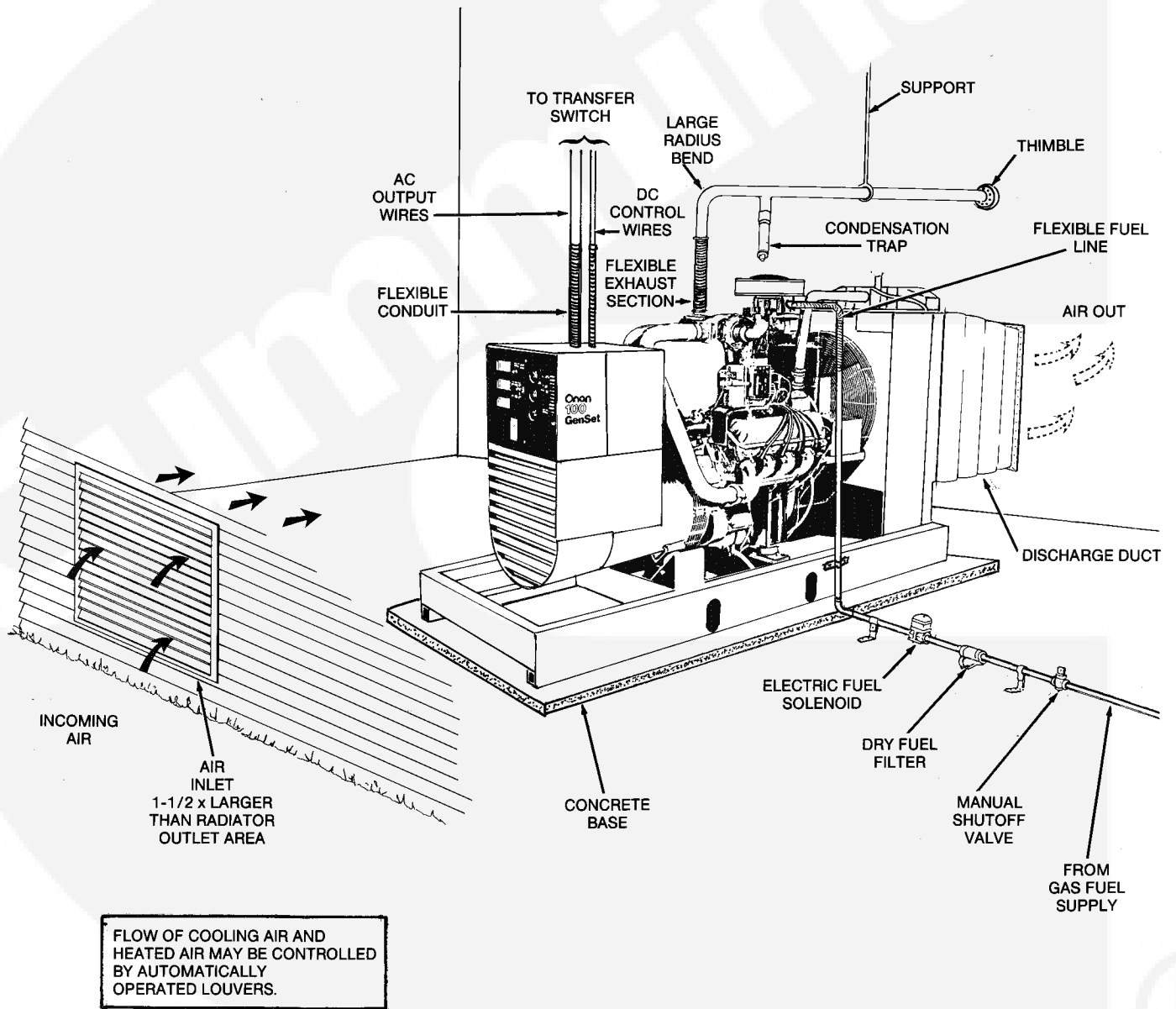


FIGURE 5. TYPICAL INSTALLATION

Remote Radiator Cooling (optional), substitutes a remote mounted radiator and an electrically driven fan for the set mounted components. Removal of the radiator and fan from the set reduces set enclosure airflow requirements and noise levels without forcing dependence on a continuous cooling water supply. The remote radiator system can be completely protected against freezing.

This system must be designed to meet specific requirements of the application.

Before filling cooling system check all hardware for security. This includes hose clamps, capscrews, fittings and connections. Use flexible coolant lines with heat exchanger, standpipe or remote mounting radiator.

Remote radiator plumbing will vary with installation. All systems must comply with the following conditions:

1. Make all connections to the set and to the radiator with flexible pipe.
2. Install an auxiliary circulating pump if the horizontal distance between the engine and pump exceeds 15 feet (4.57 m).
3. Install a hot-well system to relieve excess engine water jacket pressure if the top of the radiator is more than 10 feet (3.05 m) above the centerline of the engine crankshaft.

Water Jacket Heater (optional) can be installed to keep the engine warm to ensure starting under adverse weather conditions. Figure 6 shows the mechanical installation for the heater. Connect the heater to a power source that will be on when the engine is NOT running. Refer to the Electrical Connections section to ensure the voltage rating is correct for the heater element.

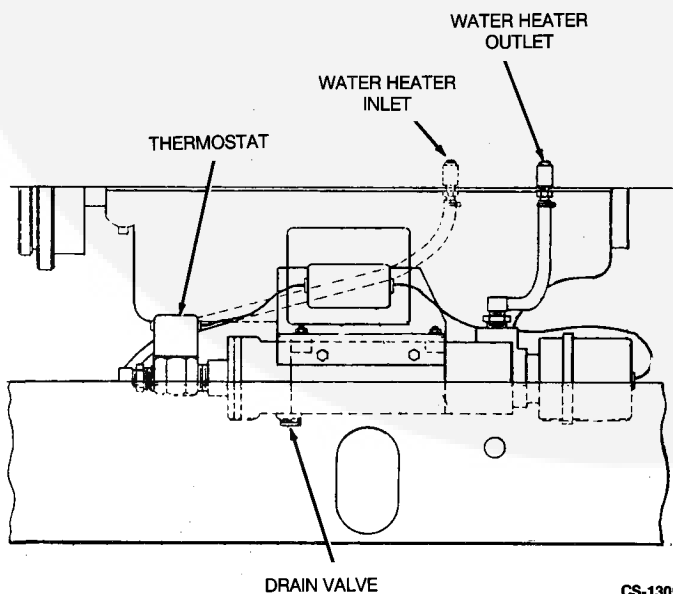


FIGURE 6. WATER JACKET HEATER

Heat Exchanger Cooling (optional) uses a shell and tube type heat exchanger instead of the standard radiator and fan (see Figure 7). Engine jacket coolant circulates through the shell side of the heat exchanger, while the cooling water is pumped through the tubes. Engine coolant and raw water do not mix. This type of cooling separation is necessary when the raw water contains scale forming lime, or other impurities.

This system can reduce set enclosure airflow requirements and noise levels. Proper operation depends on a constant supply of raw water for heat removal. Adjust the flow to maintain water temperature between 165° and 195°F (74° and 91°C) while viewing the water temperature gauge. The engine coolant side of the system can be protected from freezing; the raw water side cannot be protected.

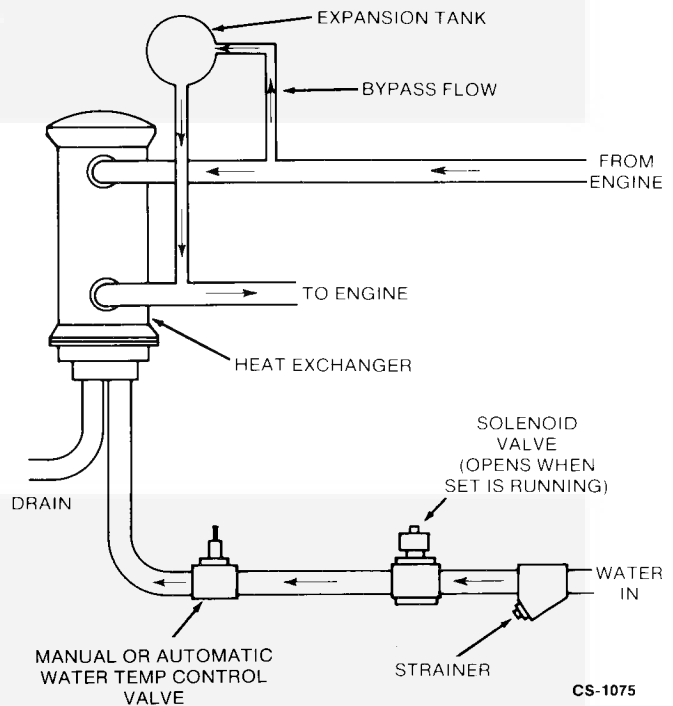


FIGURE 7. HEAT EXCHANGER COOLING SYSTEM

Electrical Connections

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 local 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 6D, 7R, 523 and 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, 32 and 515): Generators with codes 15 and 32 (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.

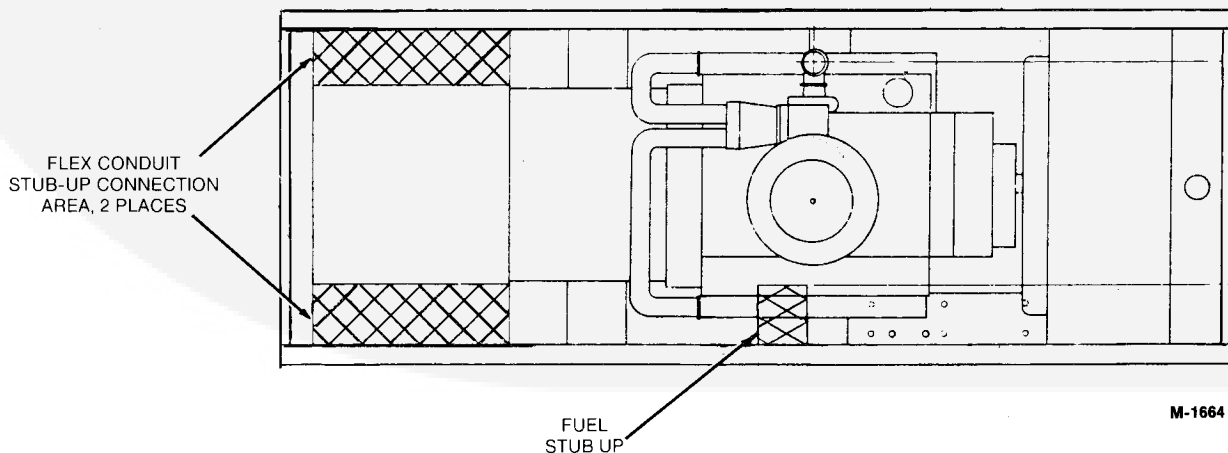
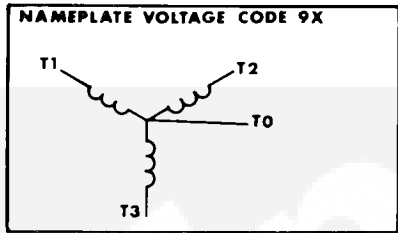


FIGURE 8. ELECTRICAL CONNECTION AREA

220/380 VOLT, 3 PHASE, 60 HERTZ
 347/600 VOLT, 3 PHASE, 60 HERTZ



NAMEPLATE VOLTAGE CODE	VOLTAGE	PHASES	HERTZ	GENERATOR CONNECTION	GENERATOR CONNECTION SCHEMATIC DIAGRAM	GENERATOR CONNECTION WIRING DIAGRAM (WITH CURRENT TRANSFORMERS WHEN USED)
15	120/240	1	60	DOUBLE DELTA		
515	115/230 110/220	1	50			
6D	240/480	3	60	SERIES DELTA		
15	120/240	3	60			
515	115/230 110/220	3	50			
15	120/208 127/220 139/240	3	60	PARALLEL WYE		
515	110/190 115/200 120/208 127/220	3	50			
15	240/416 254/440 277/480	3	60			
515	220/380 230/400 240/416 254/440	3	50			
				SERIES WYE		

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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.

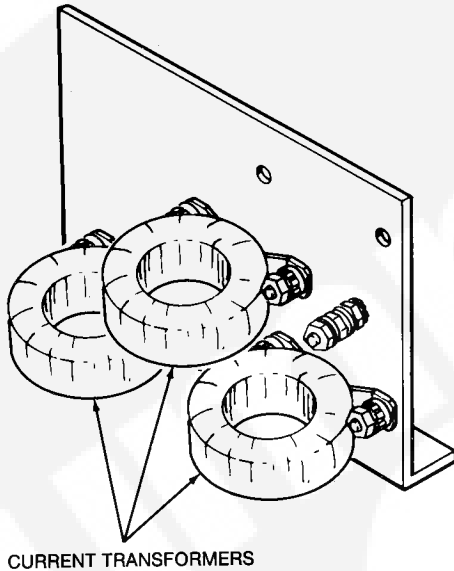


FIGURE 10. CURRENT TRANSFORMERS

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 14) controls AC output voltage from the generator at a predetermined level. Voltage is plus or minus 2 percent from no load to full load. Random voltage variation is plus or minus 1 percent for constant loads.

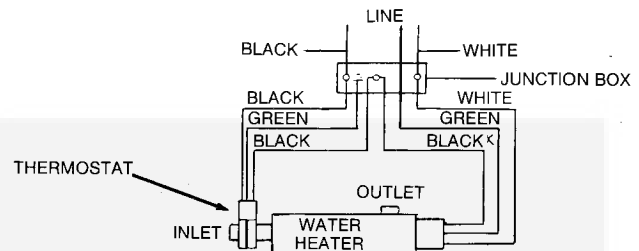
Water Jacket Heater (Optional)

A water jacket 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.

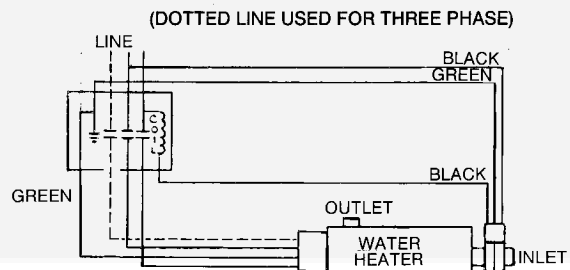
⚠CAUTION *The heater must not be operated while the cooling system is empty or when the engine is running or damage to the heater will occur.*

Figure 11 shows the heater connections. 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 is correct for the heater element rating.

115, 208, 230 VOLT (SINGLE PHASE)



480 VOLT (SINGLE PHASE) 380, 440, 480 VOLT (THREE PHASE)



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FIGURE 11. WATER JACKET HEATER WIRING DIAGRAMS

Control Heater (Optional)

The thermostat controlled heater option maintains the control box temperature at $105^{\circ} \pm 5^{\circ}\text{F}$ ($41^{\circ} \pm 3^{\circ}\text{C}$). This is desirable in environments with low ambient temperatures and/or high humidity. The heater power cord must be plugged into a 120-volt AC source.

The thermostat is factory set to open on rising temperature of $105^{\circ} \pm 5^{\circ}\text{F}$ ($41^{\circ} \pm 3^{\circ}\text{C}$) and normally does not require adjustment. The wiring diagram in Figure 12 shows location of the thermostat adjustment screw. A schematic diagram is also shown for reference.

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 terminal block (TB1) located on the engine monitor circuit board. Connect one or more remote switches across remote terminal and B+ terminal as shown in Figure 13.

If the distance between the set and remote station 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.

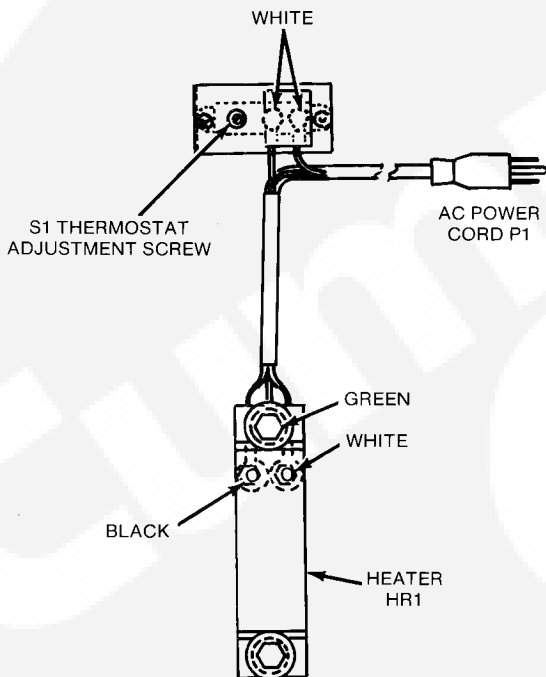
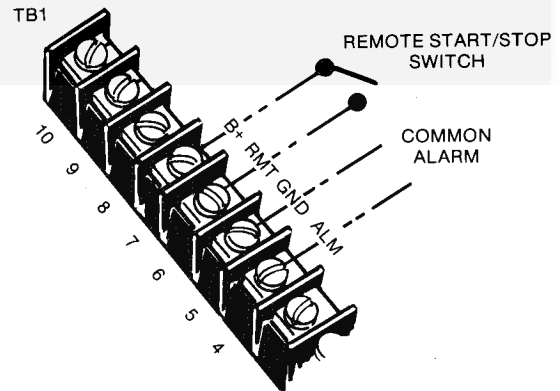


FIGURE 12. CONTROL HEATER WIRING AND SCHEMATIC DIAGRAM

CS-1285



SC-1506

FIGURE 13. REMOTE CONTROL CONNECTIONS

Battery Connections

The generator set requires one 12-volt battery, available from Onan as an option. See Figure 14 for a normal installation. The necessary battery cables and battery rack are included with the unit.

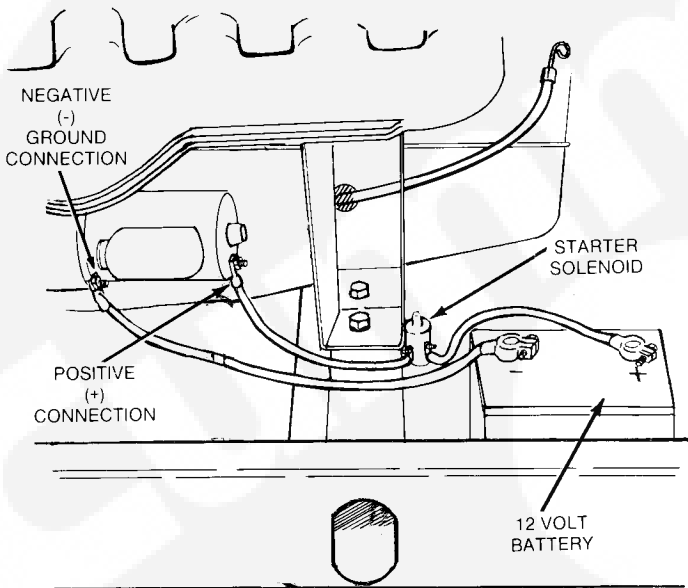
When shipped with a generator set, the battery must be serviced and charged. Follow the battery manufacturer's instructions.

⚠ 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.

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.



ES-1654

FIGURE 14. BATTERY CONNECTIONS

TABLE 1. CABLE SIZE

CABLE LENGTH	4 ft. 1.24 m	5 ft. 1.55 m	7 ft. 2.17 m	9 ft. 2.8 m	11 ft. 3.4 m	14 ft. 4.3 m
CABLE SIZE	2	1	0	00	000	0000

⚠ 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

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. Refer to the operators manual for oil specifications.

COOLANT

Engine coolant is drained prior to shipment. Before starting, fill the cooling system with the recommended coolant. Open petcock located on the thermostat housing and fill with coolant until it runs out of petcock. Close petcock and continue filling until radiator is full.

FUEL

All manual shutoff valves should be turned open.

VENTILATION

Verify all air vents and ducts are open and free of any obstructions. Verify dampers, if used, 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 ENTX 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 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

The maximum charge rate for the set mounted battery charging alternator is 35 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 15).

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

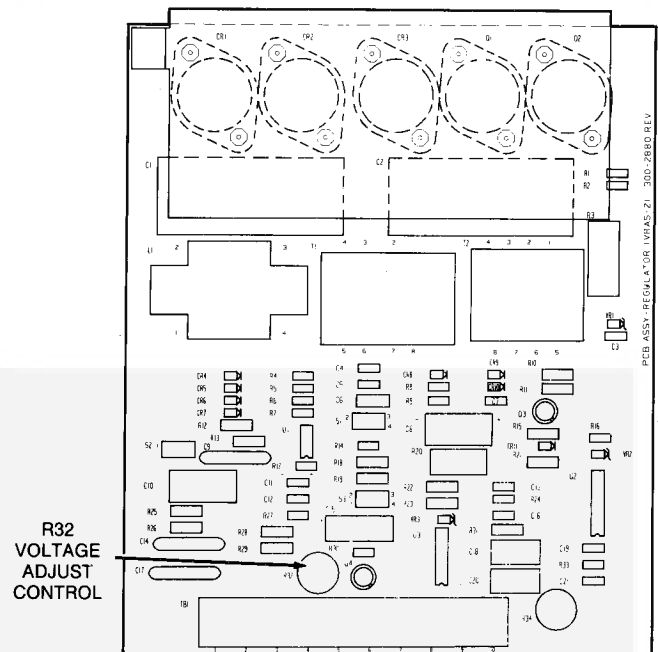


FIGURE 15. VRAS-2 VOLTAGE REGULATOR ASSEMBLY

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, turbocharger 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, 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 that 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.

▲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 ENTX Operator's Manual for any necessary adjustments.