

Installation Manual

□ W
GenSets

DVH DVJ Electric Generator Sets

Safety Precautions

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.

A DANGER This symbol if used warns of immediate hazards which will result in severe personal injury or death.

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

ACAUTION 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.

Important Safety Precautions

Read and observe these safety precautions when using or working on electric generators, engines and related equipment. Also read and follow the literature provided with the equipment.

Proper operation and maintenance are critical to performance and safety. Electricity, fuel, exhaust, moving parts and batteries present hazards that can cause severe personal injury or death.

FUEL, ENGINE OIL, AND FUMES ARE FLAMMABLE AND TOXIC

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

- Used engine oil, and benzene and lead, found in some gasoline, have been identified by government agencies as causing cancer or reproductive toxicity. When checking, draining or adding fuel or oil, do not ingest, breathe the fumes, or contact gasoline or used oil.
- Do not fill tanks with engine running. Do not smoke around the area. Wipe up oil or fuel spills. Do not leave rags in engine compartment or on equipment. Keep this and surrounding area clean.
- Inspect fuel system before each operation and periodically while running.
- Equip fuel supply with a positive fuel shutoff.
- Do not store or transport equipment with fuel in tank.
- Keep an ABC-rated fire extinguisher available near equipment and adjacent areas for use on all types of fires except alcohol.
- Unless provided with equipment or noted otherwise in installation manual, fuel lines must be copper or steel, secured, free of leaks and separated or shielded from electrical wiring.
- Use approved, non-conductive flexible fuel hose for fuel connections. Do not use copper tubing as a flexible connection. It will work-harden and break.

EXHAUST GAS IS DEADLY

- Engine exhaust contains carbon monoxide (CO), an odorless, invisible, poisonous gas. Learn the symptoms of CO poisoning.
- Never sleep in a vessel, vehicle, or room with a genset or engine running unless the area is equipped with an operating CO detector with an audible alarm.
- Each time the engine or genset is started, or at least every day, thoroughly inspect the exhaust system.
 Shut down the unit and repair leaks immediately.

 Warning: Engine exhaust is known to the State of California to cause cancer, birth defects and other reproductive harm.

Make sure exhaust is properly ventilated.

- Vessel bilge must have an operating power exhaust.
- Vehicle exhaust system must extend beyond vehicle perimeter and not near windows, doors or vents.
- Do not use engine or genset cooling air to heat an area.
- Do not operate engine/genset in enclosed area without ample fresh air ventilation.
- Expel exhaust away from enclosed, sheltered, or occupied areas.
- Make sure exhaust system components are securely fastened and not warped.

MOVING PARTS CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- Do not remove any guards or covers with the equipment running.
- Keep hands, clothing, hair, and jewelry away from moving parts.
- Before performing any maintenance, disconnect battery (negative [–] cable first) to prevent accidental starting.
- Make sure fasteners and joints are secure. Tighten supports and clamps, keep guards in position over fans, drive belts, etc.
- If adjustments must be made while equipment is running, use extreme caution around hot manifolds and moving parts, etc. Wear safety glasses and protective clothing.

BATTERY GAS IS EXPLOSIVE

- Wear safety glasses and do not smoke while servicing batteries.
- Always disconnect battery negative (-) lead first and reconnect it last. Make sure you connect battery correctly. A direct short across battery terminals can cause an explosion. Do not smoke while servicing batteries. Hydrogen gas given off during charging is explosive.
- Do not disconnect or connect battery cables if fuel vapors are present. Ventilate the area thoroughly.

DO NOT OPERATE IN FLAMMABLE AND EXPLOSIVE ENVIRONMENTS

Flammable vapor can be ignited by equipment operation or cause a diesel engine to overspeed and become difficult to stop, resulting in possible fire, explosion, severe personal injury and death. Do not operate diesel equipment where a flammable vapor environment can be created by fuel spill, leak, etc., unless equipped with an automatic safety device to block the air intake and stop the engine.

HOT COOLANT CAN CAUSE SEVERE PERSONAL INJURY

 Hot coolant is under pressure. Do not loosen the coolant pressure cap while the engine is hot. Let the engine cool before opening the pressure cap.

ELECTRICAL SHOCK CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- Do not service control panel or engine with unit running. High voltages are present. Work that must be done while unit is running should be done only by qualified service personnel.
- Do not connect the generator set to the public utility or to any other electrical power system. Electrocution can occur at a remote site where line or equipment repairs are being made. An approved transfer switch must be used if more than one power source is connected.
- Disconnect starting battery (negative [-] cable first) before removing protective shields or touching electrical equipment. Use insulative mats placed on dry wood platforms. Do not wear jewelry, damp clothing or allow skin surface to be damp when handling electrical equipment.
- Use insulated tools. 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.
- With transfer switches, keep cabinet closed and locked. Only authorized personnel should have cabinet or operational keys. Due to serious shock hazard from high voltages within cabinet, all service and adjustments must be performed by an electrician or authorized service representative.

If the cabinet must be opened for any reason:

- Move genset operation switch or Stop/Auto/ Handcrank switch (whichever applies) to Stop.
- Disconnect genset batteries (negative [–] lead first).
- Remove AC power to automatic transfer switch. If instructions require otherwise, use extreme caution due to shock hazard.

MEDIUM VOLTAGE GENERATOR SETS (601V TO 15kV)

- Medium voltage acts differently than low voltage. Special equipment and training are required to work on or around medium voltage equipment. Operation and maintenance must be done only by persons trained and qualified to work on such devices. Improper use or procedures will result in severe personal injury or death.
- Do not work on energized equipment. Unauthorized personnel must not be permitted near energized equipment. Induced voltage remains even after equipment is disconnected from the power source. Plan maintenance with authorized personnel so equipment can be de-energized and safely grounded.

GENERAL SAFETY PRECAUTIONS

- Do not work on equipment when mentally or physically fatigued or after consuming alcohol or drugs.
- Carefully follow all applicable local, state and federal codes.
- Never step on equipment (as when entering or leaving the engine compartment). It can stress and break unit components, possibly resulting in dangerous operating conditions from leaking fuel, leaking exhaust fumes, etc.
- Keep equipment and area clean. Oil, grease, dirt, or stowed gear can cause fire or damage equipment by restricting airflow.
- Equipment owners and operators are solely responsible for operating equipment safely. Contact your authorized Onan/Cummins dealer or distributor for more information.

KEEP THIS DOCUMENT NEAR EQUIPMENT FOR EASY REFERENCE.

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▲WARNING

ONAN RECOMMENDS THAT ALL SERVICE INCLUDING INSTALLATION OF REPLACEMENT PARTS BE DONE ONLY BY PERSONS QUALIFIED TO PERFORM ELECTRICAL AND/OR MECHANICAL SERVICE. FROM THE STANDPOINT OF POSSIBLE INJURY AND/OR EQUIPMENT DAMAGE IT IS IMPERATIVE THAT THE SERVICE PERSON BE QUALIFIED.

Installation

GENERAL

Most generator set installations must be engineered to insure that 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 regulations that may apply.

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.
- Fuel installation.
- · Accessibility for operation and servicing.
- Noise levels.

LOCATION AND MOUNTING

Generator set location is decided mainly by related systems such as ventilation, wiring, fuel, and exhaust. Provide a location away from extreme ambient temperatures and protect the generator set from adverse weather conditions. Locate as near as possible to the main power fuse box. See Figure 1.

Plan for access to the generator set for servicing and provide adequate lighting around the unit. Wood floors should be covered with sheet metal extending 12 inches (305 mm) beyond the extremities of the set.

Mount the generator set on a substantial and level base such as a concrete pad. For convenience in general servicing such as changing the crankcase oil, the surface of the mounting base should be at least 6 inches (152 mm) above the floor.

Vibration isolators must be installed between the skid and floor. Four are required per installation and are available through Onan. The spring type shown in Figure 1 provides the greatest attenuation for critical installations. Use anchored mounting bolts to secure the isolators to the floor.

VENTILATION

Generator sets create considerable heat which 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 1.

Size the vents and ducts so they are large enough to allow the required flow rate of air. "Free area" of louvers, screens and ducts must be as large as the radiator area (when radiator is used). The inlet air vent should be 1-1/2 times the size of the radiator outlet vent.

Cooling air travels from the generator end to the engine end on Onan generator sets.

Wind will restrict free airflow if it blows directly into the air outlet vent. Consider prevailing wind directions when planning vent locations.

Dampers

Dampers can be 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 more detailed information.

Radiator Set Ventilation Requirements

Radiator set cooling air is drawn past the rear of the set by a fan which blows air through the radiator. Locate the air inlet to the rear of set and near the floor. Make the inlet vent opening 1-1/2 times larger than the radiator.

Locate the cooling air outlet directly in front of the radiator and as close as possible. The effective opening area should be 1.3 times as large as the radiator area. Length and shape of the air outlet duct should offer minimum restriction to airflow. Use a duct of canvas or sheet metal between the radiator and the air outlet opening to prevent recirculation of heated air. The radiator has an air discharge duct adapter flange. Remove the radiator core guard prior to installing the duct.

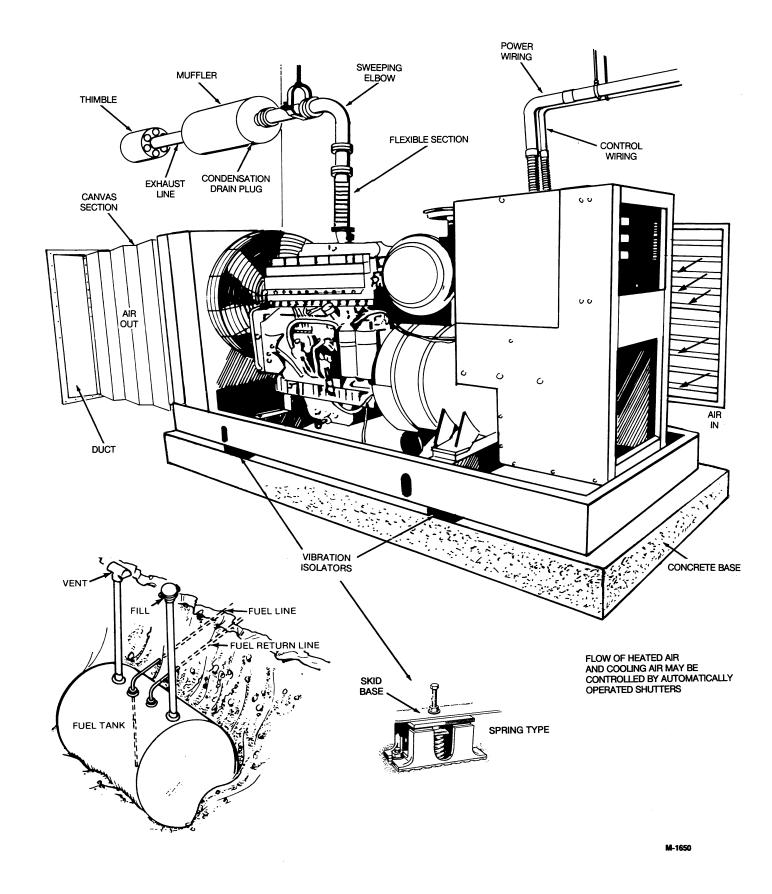


FIGURE 1. TYPICAL DV GENERATOR SET INSTALLATIONS

COOLING SYSTEMS

A set mounted radiator with engine driven fan is standard on the generator set. Optional cooling systems include remote radiator cooling. The following sections briefly cover the installation requirements for each system. Refer to Technical Bulletin T030 and the Product Data Sheet for more detailed information (available from the Onan distributor).

Radiator Cooling (Standard)

The standard radiator cooling system (see Figure 1) uses a set mounted radiator with an engine driven pusher type fan to cool the generator set. Air is pulled from the generator end of the set across the engine and then forced through the radiator. An air duct adapter flange surrounds the radiator grill to allow mounting of the air discharge duct. Refer to the section on Ventilation for location and sizing of ducts and vents.

Remote Radiator (Optional)

Remote radiator cooling systems use a remote mounted radiator with electrically driven fans for generator set cooling. Removal of the radiator and fan from the set reduces the set enclosure ventilation requirements to the level of city water cooled sets without making the unit dependent on a continuous water supply. The remote radiator system can also be completely protected against freezing.

Figure 2 shows a pictorial view of a typical short remote radiator installation. Two key design considerations are the vertical and horizontal distance between the engine and the radiator. These distances determine if any additional equipment is required such as a surge tank, auxiliary pump, or hot well. Because of the many design

considerations, all remote radiator installations must be engineered to insure that the system will function properly. Follow the instructions of the consulting engineer with experience in remote radiator systems.

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

- Make all connections to the set and to the radiator with flexible pipe.
- Install an auxiliary circulating pump if the engine friction and static head pressures are exceeded (see Product Data Sheet).
- Install a hot well system and an auxiliary pump in a high remote radiator installation that exceeds the engine's maximum static head pressure.

Coolant Heater (Optional)

A coolant heater option will keep the engine coolant warm while the engine is shut down. It heats and circulates the coolant within the engine which reduces start-up time and engine wear caused by cold starts. It is electrically operated and thermostatically controlled. Hookup is covered in the Electrical Connections section.

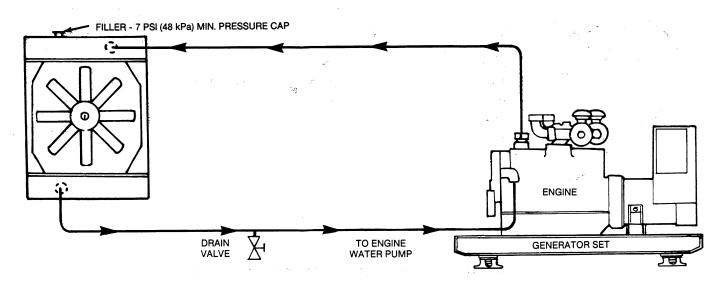


FIGURE 2. SHORT REMOTE RADIATOR INSTALLATION

EXHAUST SYSTEMS

Pipe exhaust gases to the outside of any enclosure. Locate the exhaust outlet away from any air inlets to avoid exhaust gases re-entering the enclosure. Exhaust installations are subject to various detrimental conditions such as extreme heat, infrequent operation, light loads, etc.

AWARNING Inhalation of exhaust gases can cause severe personal injury or death. Use extreme care during installation to ensure a tight exhaust system.

Use an approved thimble (see Figure 3) where exhaust pipes pass through walls or partitions. Build the thimble according to code requirements (see National Fire Protection Association bulletin, Volume 4, section 211, covering "Standards for Chimneys, Fireplaces, and Vents").

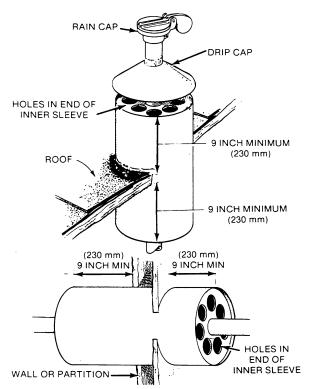
AWARNING Inhalation of exhaust gases can cause severe personal injury or death. Do not use exhaust heat to warm a room, compartment or storage area.

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 4).

Use large radius elbows and provide adequate support for mufflers and piping. Use a section of flexible stainless steel tubing between the engine exhaust connection and the exhaust piping system to permit movement and thermal expansion. Shield or insulate exhaust lines if there is danger of personal contact. Allow at least 12 inches (305 mm) of clearance if the pipes pass close to a combustible wall or partition.

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

The exhaust back pressure of the generator set when measured at full load and governed engine speed must not exceed the value indicated on the Product Data Sheet. See Onan Technical Bulletin T030 for detailed information or contact the Onan distributor for assistance to calculate exhaust system parameters.



Diameter of Thimble Must Be 12 Inches (305 mm) Larger Than Diameter of Exhaust Pipe

EXS-1036

EXS-1046

FIGURE 3. EXHAUST THIMBLE

IF EXHAUST LINE MUST BE PITCHED UPWARD.
CONSTRUCT A TRAP OF PIPE FITTINGS AT
POINT OF RISE

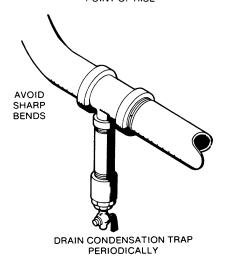


FIGURE 4. EXHAUST CONDENSATION TRAP

FUEL SUPPLY SYSTEMS

Check local regulations governing installation of fuel tanks before installing the fuel supply system.

General

In all fuel system installations, cleanliness is of the utmost importance. Make every effort to prevent entrance of moisture, dirt or contaminants of any kind. Clean all fuel system components before installing. If water in the fuel is a problem despite all precautions to prevent entrance of moisture, a water separator is recommended.

Use a flexible section of tubing between the engine and the stationary fuel supply line to withstand vibration. Use only compatible metal fuel lines when installing stationary fuel supply lines underground to avoid electrolysis. Onan can supply copper fuel lines with brass fittings if required.

ACAUTION

Never use galvanized fuel lines, fittings or fuel tanks with diesel fuel systems. Condensation in the tank and lines combines with the sulfur in diesel fuel to produce sulfuric acid. The zinc coating on galvanized lines or tanks reacts with the acid and flakes off to contaminate the fuel.

An electric solenoid shutoff valve in the supply line is recommended for all installations and required for indoor automatic or remote starting installations. Connect the solenoid wires to open the valve during generator set operation.

Supply Tank

Locate the fuel tank as close as possible to the generator set and within the 3.5 feet (1.07 m) lift capacity of the fuel pump if possible. Choose a tank that has sufficient capacity to keep the generator running continuously at full load for at least 36 hours.

AWARNING

Fuel presents the hazard of fire or explosion 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.

A typical underground fuel system consists of a main fuel tank, vent and fill pipes, fuel supply line, and fuel return line (see Figure 1). If the tank is installed below the lift capabilities of the standard fuel transfer pump, a day tank and auxiliary pump will also be required. If an overhead tank is installed, a day tank and float valve will be required to prevent fuel head pressures from being placed on the fuel system components. Refer to Technical Bulletin T-030 for examples of fuel supply systems that require a day tank.

Day Tank (If Used)

Day tanks are fuel transfer tanks which are used when the standard engine fuel pump does not have the capacity to draw the fuel from the supply tank; or the supply tank is overhead and presents problems of high fuel head pressure for the fuel return. See Figure 5.

AWARNING
Fuel presents the hazard of explosion or fire which can result in severe personal injury or death. An overflow pipe must be installed between the day tank and main fuel tank to prevent fuel spills in the installation area.

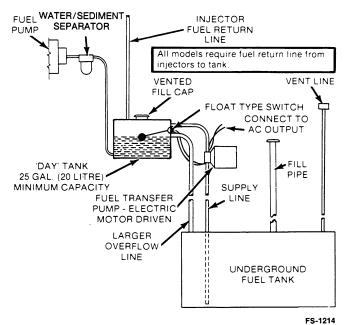


FIGURE 5. DAY TANK (TYPICAL)

Supply Tank Lower Than Engine: With this installation, the day tank is installed near the generator set and within the engine fuel pump lift capability, but below the fuel injection system. Install an auxiliary fuel pump as close as possible to the supply tank to pump fuel from the supply tank to the day tank. A float switch in the day tank controls operation of the auxiliary fuel pump.

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

Provide a day tank overflow line to the supply tank in case the float switch fails to shut off the fuel transfer pump.

Supply Tank Above Engine: Install the day tank near the generator set and within the engine fuel pump lift capability, but below the fuel injection system. Use fuel line at least as large as the fuel pump inlet.

Include a shutoff solenoid in the fuel line between the fuel supply tank and the day tank. It stops fuel flow when the generator set is shut down.

Engine Fuel Connections

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 of the Operator's Manual for the fitting sizes. A fuel water/sediment separator is recommended between the engine and the fuel tank. See Figure 5.

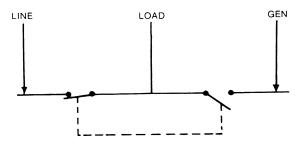
ELECTRICAL CONNECTIONS

General

Installing the generator set electrical system includes connecting the load and switchgear, and installing the remote start control (if used). The batteries should always be connected last to avoid accidental starting of the unit during installation. Battery connections are covered under "Preparing Generator Set for Operation."

Most local regulations require that wiring connections be made by a licensed electrician and that 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. Flexible conduit connections at the generator set for load and control wiring can be made at locations shown in Figure 6.

If the installation is for standby service, a double throw transfer switch must always be used (see Figure 7). Instructions for connecting an automatic load transfer control are included with such equipment.



NOTE: SHOWN WITH LINE CONNECTED TO LOAD

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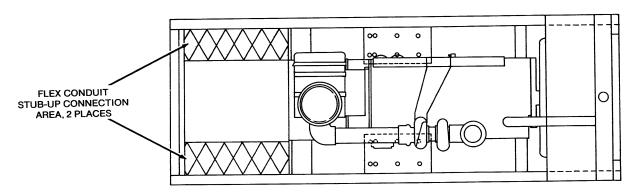
FIGURE 7. LOAD TRANSFER SWITCH (TYPICAL FUNCTION)

Generator Voltage Connections

The generator output voltage 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.

Generators can be divided into two groups, reconnectible and non-reconnectible. The reconnectible type generator can be wired to give one of several possible voltages. Non-reconnectible type generators produce only one specific voltage and cannot be wired to give a different voltage without extensive modifications. The following sections explain the connection procedure for each type of generator.

Non-reconnectible Generators (Voltage Code 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. For these generators, proceed to LOAD CONNECTIONS.



SC-1537

FIGURE 6. TOP VIEW SHOWING LOCATION OF LOAD/CONTROL CONNECTIONS

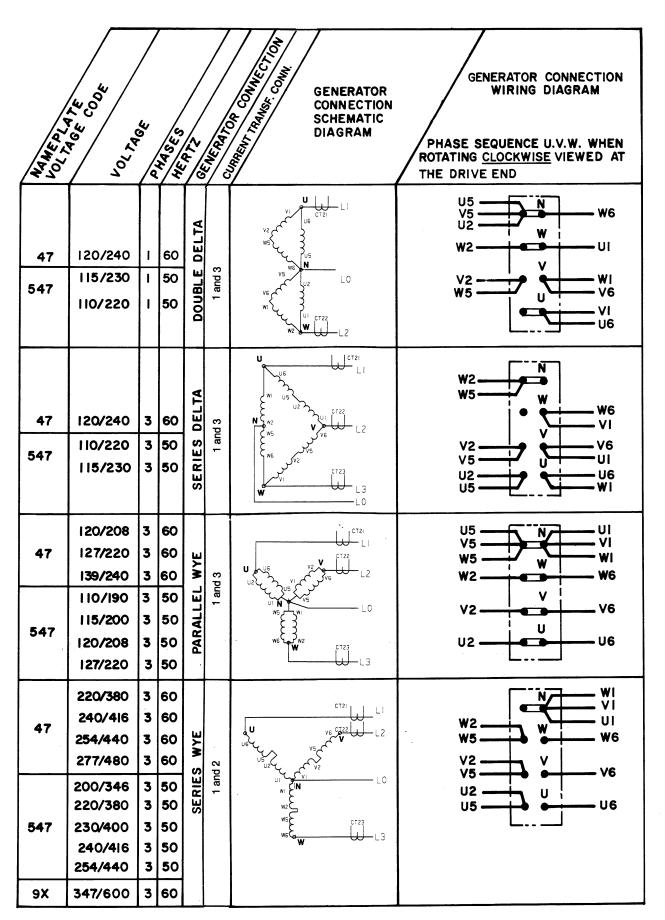


FIGURE 8. VOLTAGE CONNECTIONS

Reconnectible Generators (Voltage Code 47 or 547): Generators with voltage codes 47 (for 60 hertz) and 547 (for 50 hertz) are three phase and can be reconnected for the voltages shown in Figure 8. (If voltage and code are other than 47 or 547, see "Non-reconnectible Generators".) Most of these generators must be reconnected by the installer to give the voltage required for the installation. Before shipping, the factory tests the generator set output by connecting the generator to produce a particular test voltage. The installer must always check the terminal connections and reconnect to obtain the voltage desired.

Load Connections

Load Balancing: When connecting loads to the generator set, balance the loads so that 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 (procedure following) by observing the control panel ammeter.

Connecting the Load: All loads are connected to the generator by bolting the load wires to the appropriate terminals on the generator terminal block. The terminals are stamped N, W, V and U to indicate the neutral and line connections. See Figure 9. Generator sets with the AC meter option have the load leads routed through current transformers as shown in Figures 8, 9, and 10. The L0 lead is connected to the load neutral N terminal (when used).

Generator sets having the circuit breaker option have the incoming load leads connected to the breaker inside the breaker housing (Figure 10). An optional shunt trip feature of the breaker provides load disconnect should the generator set shut down. It is available for connection to numerous DC and AC shunt trip voltages depending on selected options.

ACAUTION If the generator is reconnected for a different voltage, a different circuit breaker must be installed for proper protection.

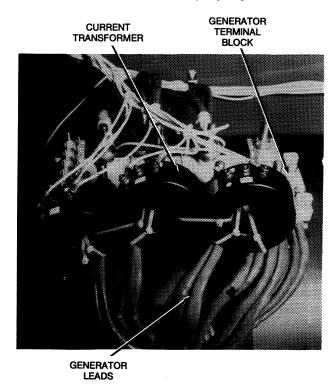


FIGURE 9. GENERATOR RECONNECTION TERMINAL BLOCK (MODEL DVH)

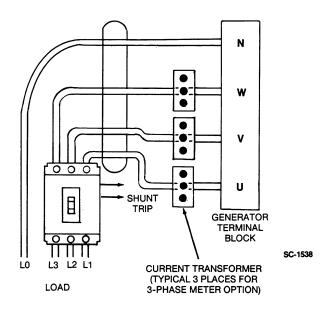


FIGURE 10. OPTIONAL CIRCUIT BREAKER CONNECTIONS (3-PHASE)

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 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.

AWARNING

Contact with electrically "hot" equipment can result in severe personal injury or death. It is extremely important that bonding and equipment grounding be properly done. All metallic parts which could become energized under abnormal conditions must be properly grounded.

Typical requirements for bonding and grounding are given in the National Electrical Code, NFPA NO. 70, Article 250. All connections, wire sizes, etc. must conform to the requirements of the electrical codes in effect at the installation site.

Remote Control Connections

Provision is made for connecting one or more remote starting switches and a common alarm to the DC control circuit. Connections are made to terminal block TB1 on the engine monitor circuit board (A11) as shown in Figure 11. The common alarm must be limited to 4 amperes maximum. If the distance between the set and remote station is less than 1000 feet (305 m), use No. 18 AWG wire; between 1000 and 2000 feet (305 and 610 m), use No. 16 AWG wire.

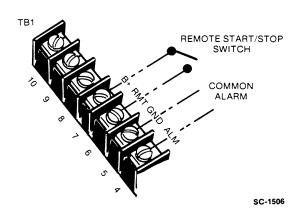


FIGURE 11. REMOTE CONTROL CONNECTIONS

Generator Heater (Optional)

The generator heater option is available in either 120-volt or 240-volt AC and must be plugged into the proper voltage power source. A non-adjustable thermostat closes the heater circuit at about 130°F (54°C) and opens the circuit at about 150°F (66°C).

The heater keeps the air temperature inside the generator (during shutdown) a few degrees higher than ambient and prevents condensation of moisture on components within the generator. This function is especially desirable in corrosive environments such as near salt water seacoasts.

Coolant Heater (Optional)

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

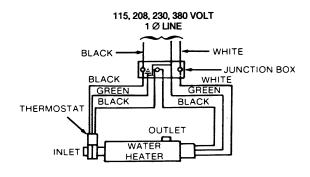
The heater must not be operated while the cooling system is empty or when the engine is running or damage to the heater will occur.

Figure 12 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.

Control Heater (Optional)

The thermostat controlled heater option maintains the control box temperature at $105^{\circ}\pm5^{\circ}$ F (41° $\pm3^{\circ}$ 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° ±5°F (41° ±3°C) and normally does not require adjustment. The wiring diagram in Figure 13 shows location of the thermostat adjustment screw. A schematic diagram is also shown for reference.



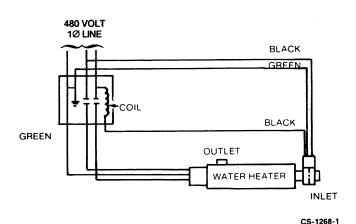
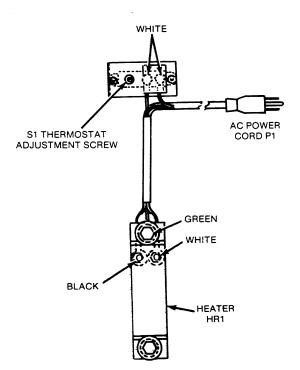
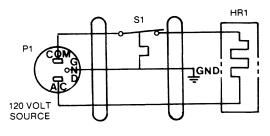


FIGURE 12. COOLANT HEATER WIRING DIAGRAMS





CS-1285

FIGURE 13. CONTROL HEATER WIRING AND SCHEMATIC DIAGRAM

PREPARING GENERATOR SET FOR OPERATION

Before attempting the initial start of the generator set, be sure it is serviced for operation. Refer to the MAINTENANCE section of the operator's manual for the proper procedures and recommendations. Service the following.

Lubrication

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

Coolant

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

Fuel

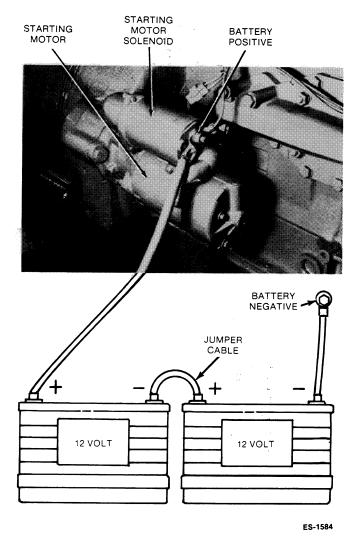
Fill the fuel tanks with the recommended fuel and prime the fuel system.

Connect Starting Batteries

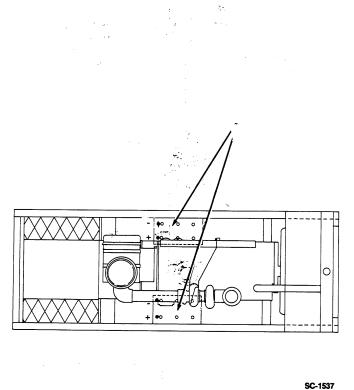
Starting the unit requires 24-volt battery current. Use two 12-volt batteries (see SPECIFICATIONS) for a normal installation. Connect the batteries in series (negative post of first battery to positive post of second) as in Figure 14. Necessary battery cables are included. Service the batteries as necessary. Infrequent unit use (as in emergency standby service) can allow the batteries to self-discharge to the point where they cannot start the unit. If installing an automatic transfer switch and it has no built-in charge circuit, connect a special float charger to keep the batteries charged at proper level.

AWARNING

Batteries present the hazard of explosion which can result in severe personal injury. Do not smoke or allow any arcproducing devices around the battery area. Do not disconnect battery cables while the generator set is cranking or running. Batteries give off explosive gases.



BATTERY CONNECTIONS



BATTERY ORIENTATION, GENSET TOP VIEW

INITIAL STARTING AND CHECKS

Before putting the generator set under load conditions, perform the following to verify the generator set will perform correctly.

- 1. Start the generator set. 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.
- Monitor the engine control panel and note the oil pressure, coolant temperature, and battery charge rate. With the engine at operating temperature, all readings should stay within the normal range.
- 3. Check the generator set for fuel, oil or coolant leaks. If you find any leaks, move the Run-Stop-Remote switch to STOP. Have the leak repaired before performing the rest of the checks.
- 4. Check the exhaust system for leaks, visually and audibly. Note the security of the exhaust system supports. If you find any leaks, shut down the generator set immediately by moving the RunStop-Remote switch to STOP.

AWARNING

Exhaust gas presents the hazard of severe personal injury or death. For this reason, shut down the generator set immediately if you discover an exhaust leak or component needing replacement. Do not use the generator set until you have the exhaust system repaired.

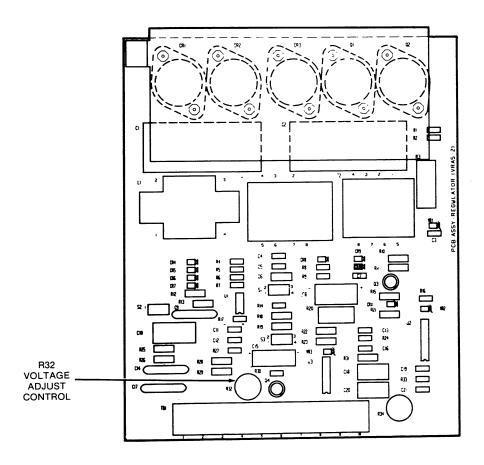
5. Note the AC instruments (if equipped) on the control panel. The frequency meter and voltmeter should indicate rated nameplate frequency and voltage. Turn the control panel Voltage Adjust control (if equipped) for nameplate voltage. Use the Phase Selector Switch to read each of the line-to-line voltages.

If unit does not have control instruments or a Voltage Adjustment control on the front panel, connect an accurate external voltmeter. If necessary, adjust R32 on VRAS-2 Voltage Regulator board for nameplate voltage (Figure 15).

AWARNING

High voltages within the control cabinet can cause severe personal injury or death. Proceed with care!

6. Stop the generator set by moving the Run-Stop-Remote switch to STOP.



SC-1507

FIGURE 15. VRAS-2 VOLTAGE REGULATOR ASSEMBLY



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