



Installation Manual

DV
GenSets

Safety Precautions

Before operating the generator set, read the Operator's Manual and become familiar with it and your equipment. Safe and efficient operation can be achieved only if the equipment is properly operated and maintained. Many accidents are caused by failure to follow fundamental rules and precautions.

The following symbols, found throughout this manual, alert you to potentially dangerous conditions to the operator, service personnel, or the equipment.

⚠ DANGER *This symbol warns of immediate hazards which will result in severe personal injury or death.*

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

⚠ CAUTION *This symbol refers to a hazard or unsafe practice which can result in personal injury or product or property damage.*

FUEL AND FUMES ARE FLAMMABLE. Fire and explosion can result from improper practices.

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

- 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.

MOVING PARTS CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- 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.

- Keep your hands away from moving parts.
- Before starting work on the generator set, disconnect batteries. This will prevent accidental starting.
- Make sure that fasteners on the generator set are secure. Tighten supports and clamps, keep guards in position over fans, drive belts, etc.
- Do not wear loose clothing 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 and cause shock or burning.
- If adjustment *must* be made while the unit is running, use extreme caution around hot manifolds, moving parts, etc.

ELECTRICAL SHOCK CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- Remove electric power before removing protective shields or touching electrical equipment. Use rubber insulative mats placed on dry wood platforms over floors that are metal or concrete when around electrical equipment. Do not wear damp clothing (particularly wet shoes) or allow skin surfaces to be damp when handling electrical equipment.
- Use extreme caution when working on electrical components. High voltages cause injury or death. DO NOT tamper with interlocks.
- Follow all state and local electrical codes. Have all electrical installations performed by a qualified licensed electrician. Tag open switches to avoid accidental closure.
- DO NOT CONNECT GENERATOR SET DIRECTLY TO ANY BUILDING ELECTRICAL SYSTEM. Hazardous voltages can flow from the generator set into the utility line. This creates a potential for electrocution or property damage. Connect only through an approved isolation switch or an approved paralleling device.

GENERAL SAFETY PRECAUTIONS

- 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 rags are not left on or near the engine.
- Remove all unnecessary grease and oil from the unit. Accumulated grease and oil can cause overheating and engine damage which present a potential fire hazard.
- Keep your generator set and the surrounding area clean and free from obstructions. Remove any debris from set and keep the floor clean and dry.
- Do not work on this equipment when mentally or physically fatigued, or after consuming any alcohol or drug that makes the operation of equipment unsafe.



Supplement 982-1000

Date: 8-85

Insert with -

Title: DV Installation Manual

Number: 982-0600, 982-0601

Use the following instructions in addition to those found in the installation manual. On Page 2 of the installation manual where mounting the generator set is described, note the following correction.

The Onan DVF and DVG series generator sets do not include vibration isolators as an integral part of the unit. However, for mounting these generators sets, vibration isolators are required between the skid base and mounting surface. Onan has vibration isolators available for these generator sets. Contact your Onan distributor for details.

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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.

Generator sets are mounted on a steel skid which provides proper support. The engine-generator assembly is isolated from the skid frame by rubber mounts which provide adequate vibration isolation for normal installations.

Use anchored mounting bolts to secure the generator set skid to the floor to prevent movement. Refer to set outline drawing for proper spacing of mounting bolts and set mounting dimensions.

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 air flow 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.

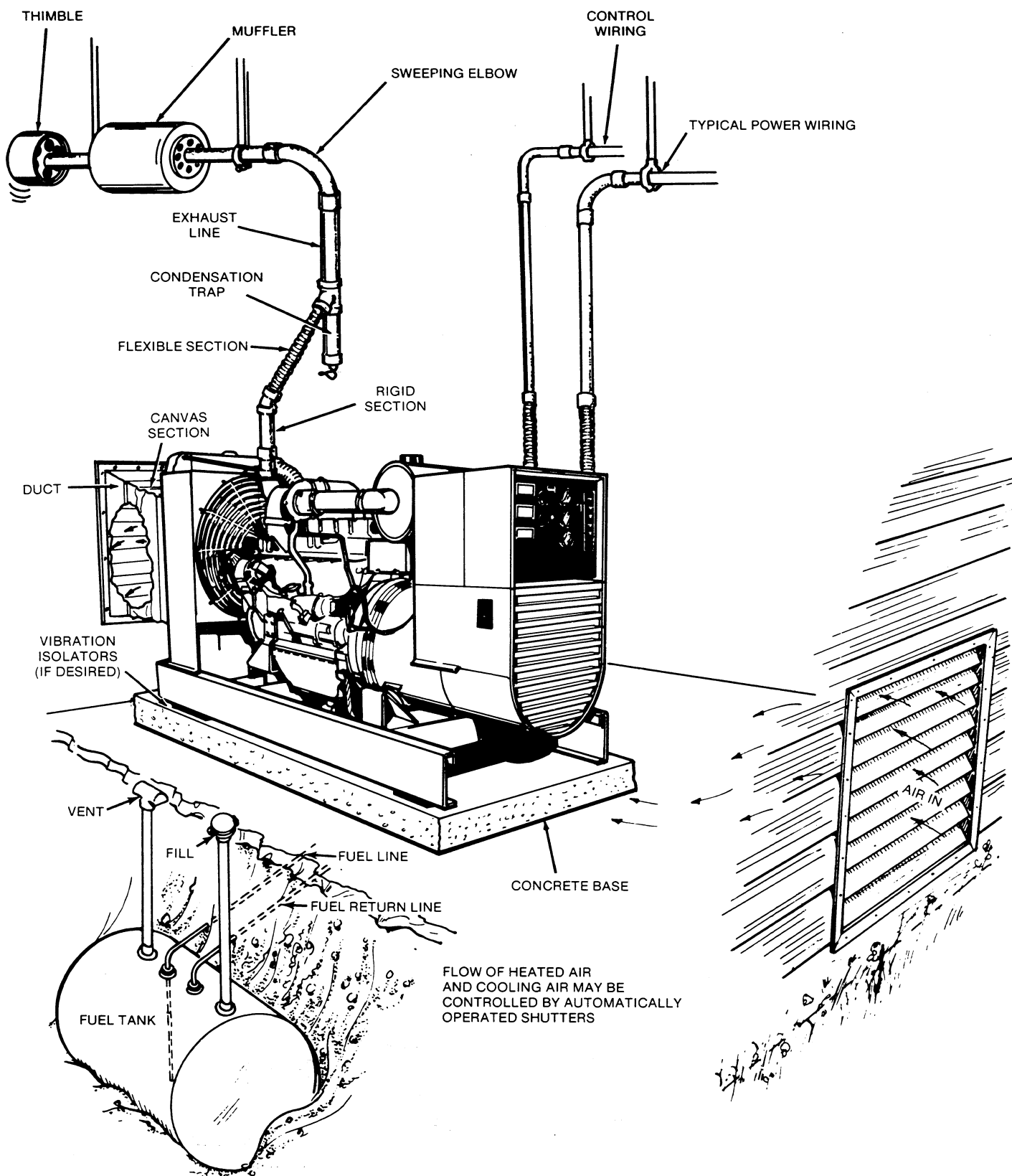


FIGURE 1. TYPICAL DV GENERATOR SET INSTALLATION

COOLING SYSTEMS

A set mounted radiator with engine driven fan is standard on the generator set. Optional cooling systems include remote radiator and heat exchanger cooling. The following sections briefly cover the installation requirements for each system. Refer to Technical Bulletin T-030 for more detailed information.

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.

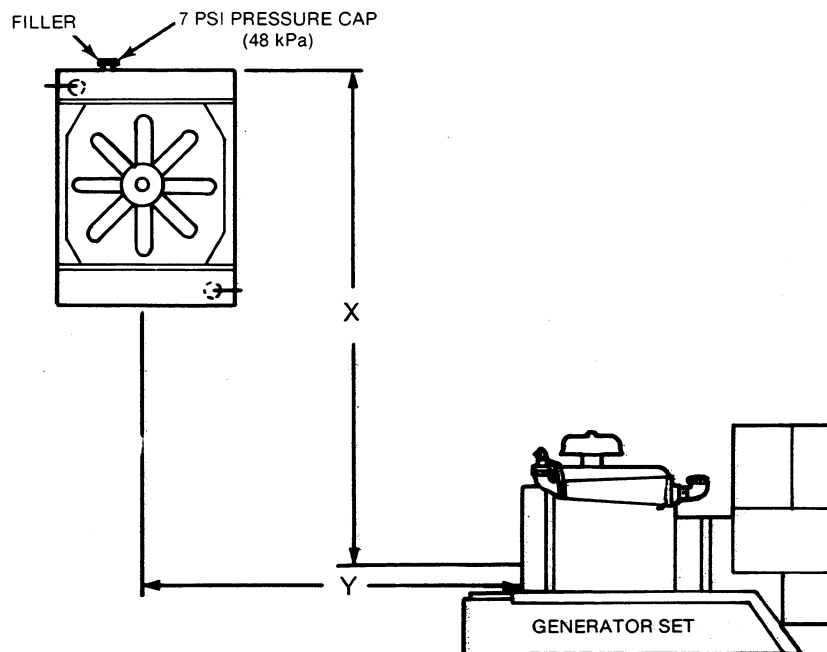
Remote Radiator (Optional)

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.

The two key design considerations in a remote radiator installation are the vertical distance (X) from the engine centerline to the radiator top and the horizontal distance (Y) from the engine front to the radiator centerline (see Figure 2). 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 when installing a remote radiator system.

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 horizontal distance between the engine and pump exceeds 15 feet (4.65 m).
- Install a hot-well system to relieve excess engine water jacket pressure if the top of the radiator is more than 15 feet (4.65 m) above the centerline of the engine crankshaft.



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FIGURE 2. REMOTE RADIATOR INSTALLATION

City Water Cooling

The city water cooling option uses a heat exchanger for cooling the generator set. This system depends on an uninterrupted supply of cool water.

This system uses a shell and tube type heat exchanger instead of the standard radiator and fan. Engine coolant circulates through the shell side of the heat exchanger while raw cooling water is pumped through the tubes. Engine coolant and raw water do not mix.

A heat exchanger system reduces set noise levels. Proper operation depends upon a constant supply of raw water for heat removal. The engine coolant side of the system can be protected from freezing, but not the raw water side. See Figure 3 for a schematic of a heat exchanger system.

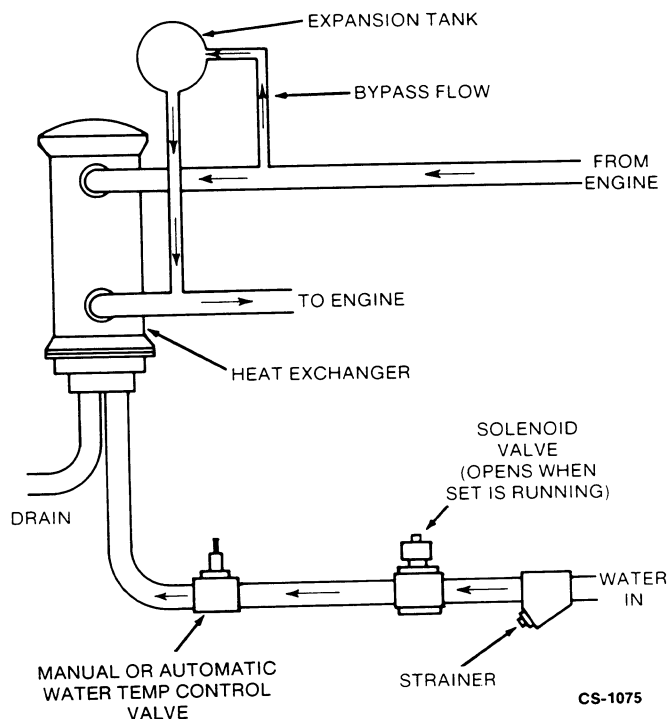


FIGURE 3. HEAT EXCHANGER COOLING

Cooling Connections: All heat exchanger cooled sets must be connected to a pressurized supply of cold water. Make connections to the set with cold water flexible pipe to absorb vibration. On the cool water line, install a solenoid valve to shut off the flow when the set is shut down and a rate of flow valve to control engine temperature. This valve can be either manual or automatic. Actual rate of flow depends on inlet water temperature.

Before filling cooling system, check all hardware for tightness. This includes hose clamps, capscrews, fittings and connections. Use flexible coolant lines with heat exchanger or remote mounted radiator. Adjust the valve to maintain water outlet temperature between 165° to 195° F (74° to 90° C) while operating the unit at full load.

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. Hookup is covered in the Electrical Connections section.

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.

WARNING *Inhalation of exhaust gases might result in serious personal injury or death. Use extreme care during installation to ensure a tight exhaust system.*

Use an approved thimble (see Figure 4) 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").

WARNING *Inhalation of exhaust gases might result in serious 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 5).

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.

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

The maximum exhaust back pressure is given in the Product Data Sheet. The Onan Distributor can provide assistance to calculate exhaust system parameters.

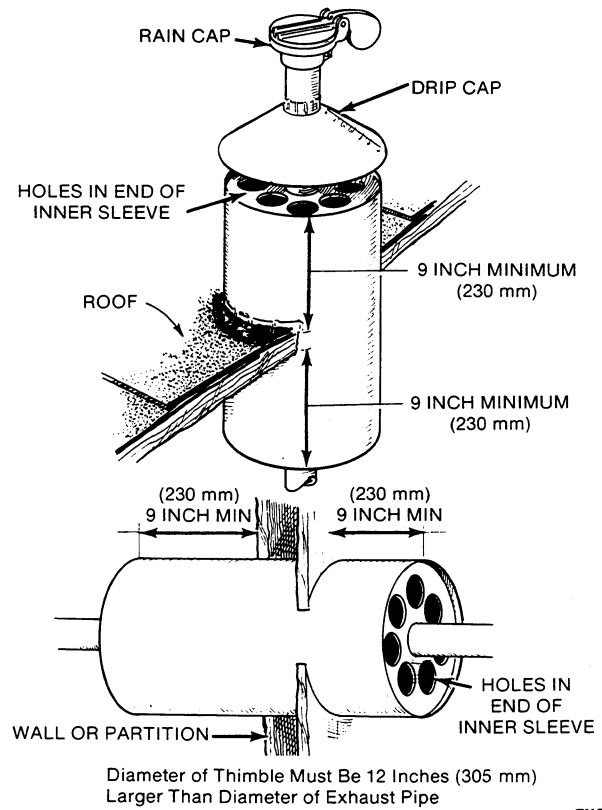


FIGURE 4. EXHAUST THIMBLE

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

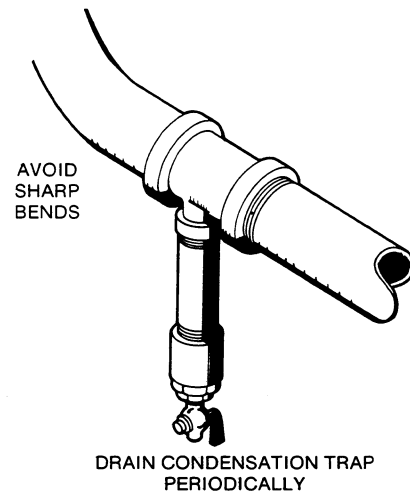


FIGURE 5. EXHAUST CONDENSATION TRAP

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.

CAUTION

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. Onan can supply underground fuel tanks from 55 to 560 gallons (208 to 2120 litres) in capacity.

WARNING

Fuel leaks create fire and explosion hazards which might 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.

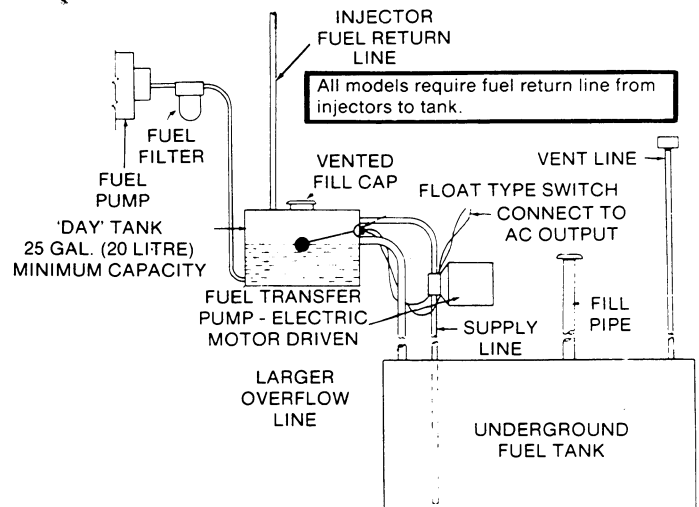
A typical underground fuel system consists of a main fuel tank, vent and fill pipes, fuel supply line, and fuel return line (see Figure 1). If the tank is installed below the lift capabilities of the standard fuel transfer pump, a day tank and auxiliary pump will also be required. If an overhead tank 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 6.

WARNING

Spilled fuel creates a hazardous fire condition which might result in severe personal injury or death. An overflow pipe must be installed between the day tank and main fuel tank.



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FIGURE 6. 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 for the fitting sizes.

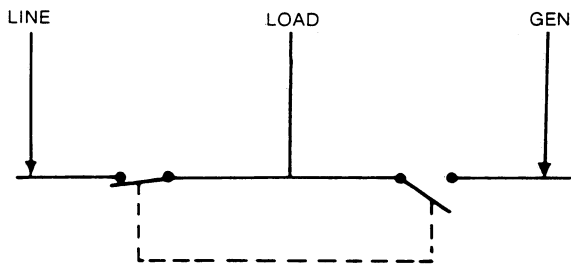
ELECTRICAL CONNECTIONS

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.

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

Generator Voltage Connections

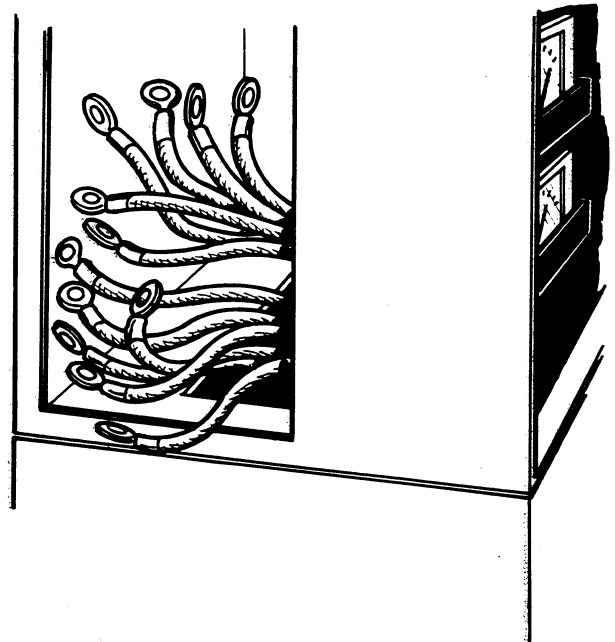
The generator output voltage and maximum current rating is specified on the generator nameplate. Line-to-neutral voltage is always the lower voltage shown on the nameplate and line-to-line voltage is the higher rating.

The generators can be wired to give one of several possible voltages. The generators are shipped with their twelve leads not connected together in the output box. Remove the right or left panel from the output box. Then connect the wires together according to Figure 9 for the voltage selected. Proceed to LOAD CONNECTIONS.

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 generator leads in the output box as indicated in Figure 8. Insulate the connections. Use a section of flexible conduit at the output box to permit movement.



ES-1545

FIGURE 8. OUTPUT BOX (SIDE PANEL REMOVED)

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	515	115/230	1	50	DOUBLE DELTA		
					110/220	1	50			
15	120/240	3	60	515	115/230	3	50	SERIES DELTA		
					110/220	3	50			
15	120/208	3	60	515	127/220	3	60	PARALLEL WYE		
					139/240	3	60			
					110/190	3	50			
					115/200	3	50			
					120/208	3	50			
					127/220	3	50			
15	240/416	3	60	515	254/440	3	60	SERIES WYE		
					277/480	3	60			
					220/380	3	50			
					230/400	3	50			
					240/416	3	50			
					254/440	3	50			

FIGURE 9. VOLTAGE CONNECTIONS

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.

WARNING Contact with electrically "hot" equipment might 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 as shown in Figure 10. 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.

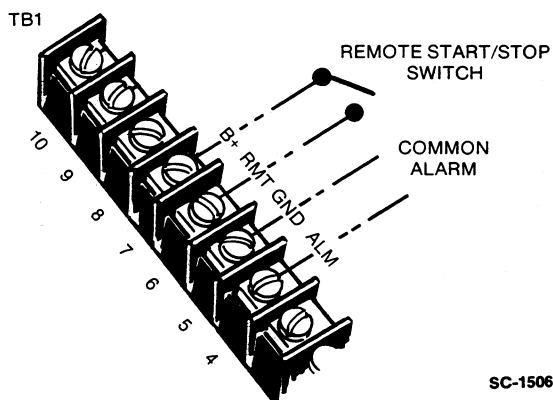


FIGURE 10. REMOTE CONTROL CONNECTIONS

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.

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.

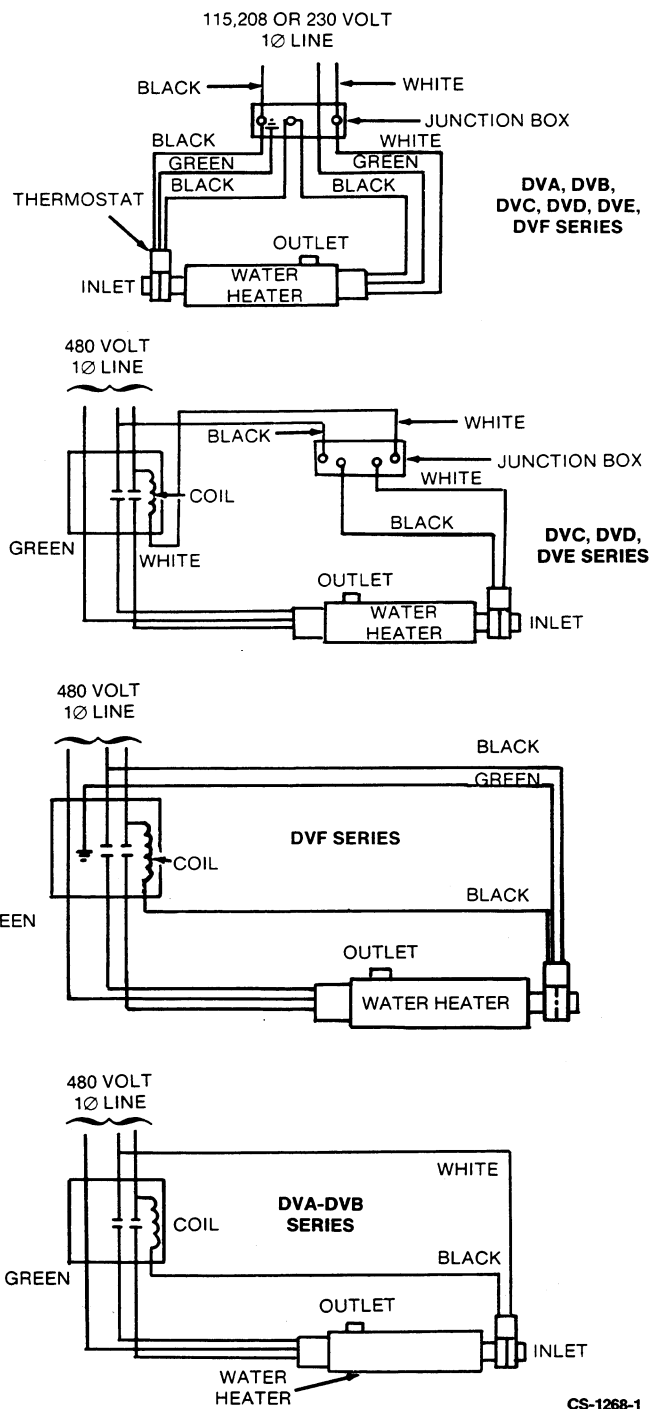


FIGURE 11. COOLANT HEATER WIRING DIAGRAMS

PREPARING GENERATOR SET FOR OPERATION

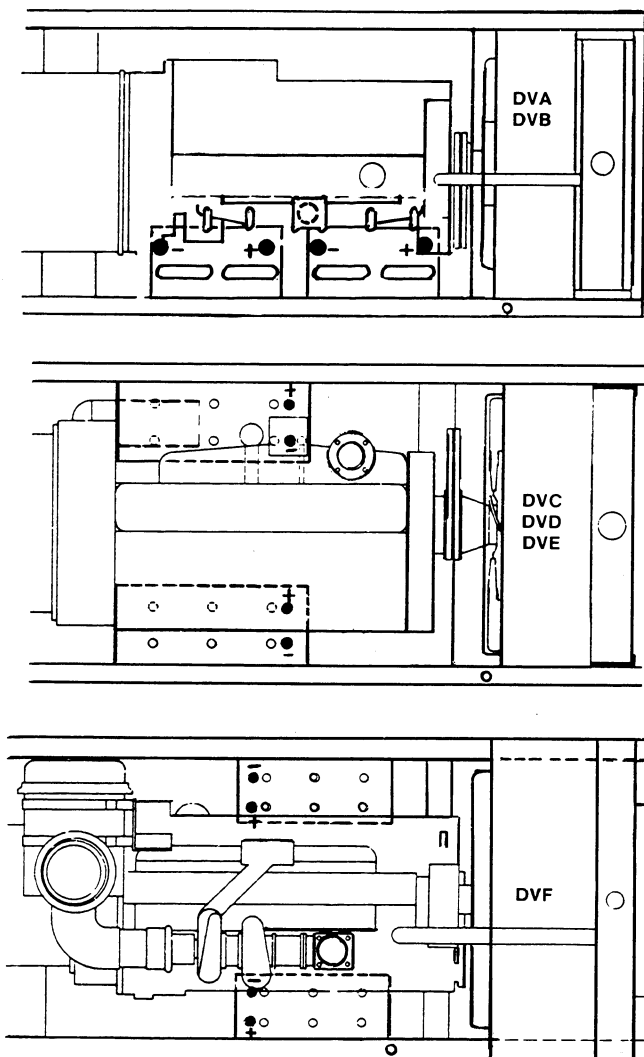
Before attempting the initial start of the generator set, be sure it is serviced for operation. Refer to the MAINTENANCE section of the operator's manual for the proper procedures and recommendations. Service the following.

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.



ES-1583

BATTERY ORIENTATION, GENSET TOP VIEW

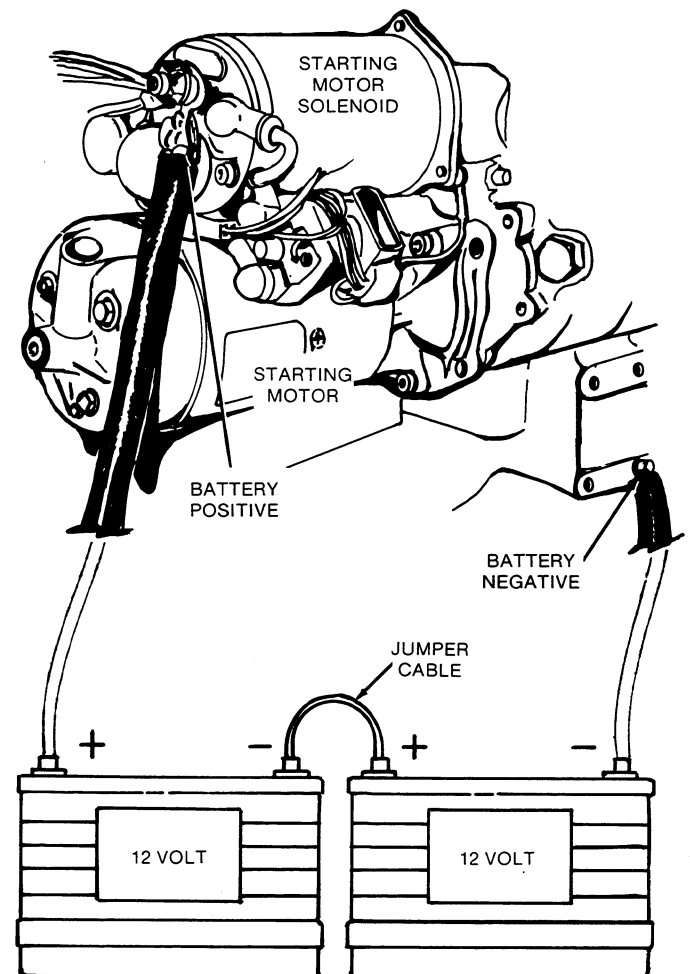
Fuel

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 12. 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.

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



ES-1584

BATTERY CONNECTIONS

FIGURE 12. STARTING BATTERY ORIENTATION/CONNECTIONS

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.
2. 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 Run-Stop-Remote switch to STOP.

WARNING

Exhaust gas is deadly. 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 Adjust control on the front panel, connect an accurate external voltmeter. If necessary, adjust R32 on VRAS-2 Voltage Regulator board for nameplate voltage (Figure 13).

WARNING

High voltages are present within the control cabinet which might cause serious personal injury or death. Proceed with care!

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

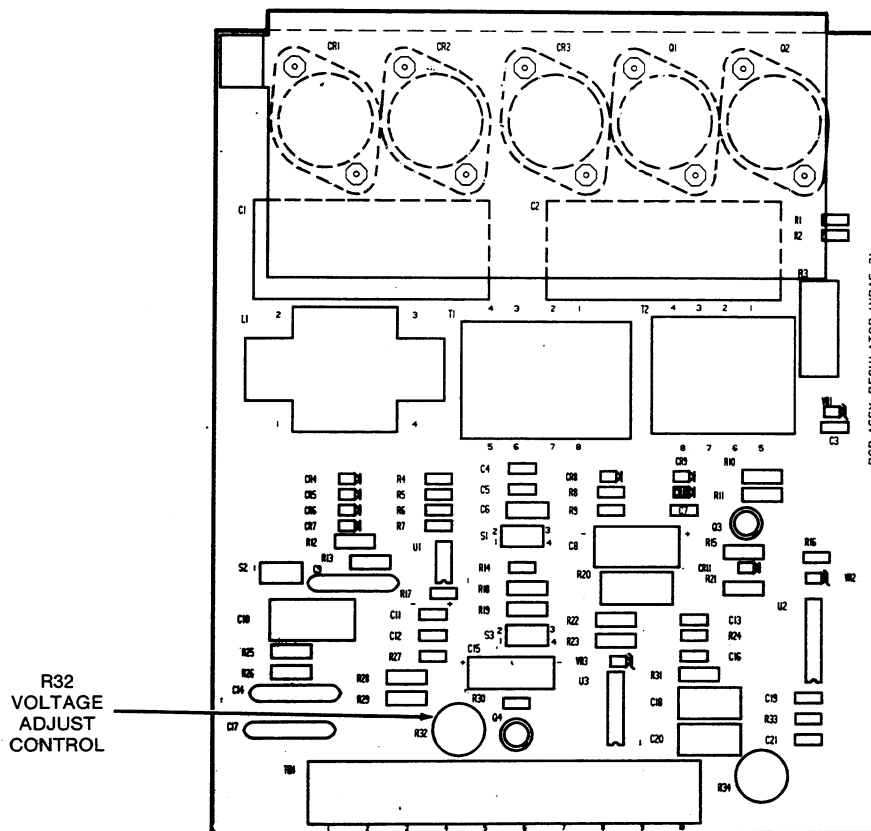


FIGURE 13. VRAS-2 VOLTAGE REGULATOR ASSEMBLY



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