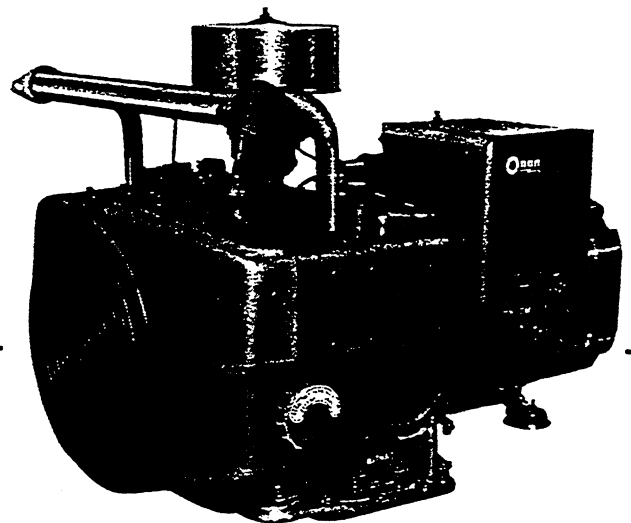




Operators Manual

NH
GenSet

- Standard Model
- Contractor's Model
- Mobile Refrigeration



940-0120
BEGIN SPEC P
10-83
Replaces 940-0120
Dated 2-79
Printed in U.S.A.

Safety Precautions

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

WARNING *This symbol is used throughout this manual to warn of possible serious personal injury or death.*

CAUTION *This symbol refers to possible equipment damage.*

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

Do not work on this equipment when mentally or physically fatigued.

- **Use Extreme Caution Near Gasoline, Gaseous Fuel and Diesel Fuel. A constant potential explosive or fire hazard exists.**

Do not fill fuel tank with engine running. Do not smoke or use open flame near the unit or the fuel tank.

Be sure all fuel supplies have a positive shutoff valve between the fuel tank and generator set.

Fuel lines must be of steel piping, adequately secured and free of leaks. Use a flexible section of fuel line between generator set fuel pump and incoming stationary fuel supply line. This flexible section must be 100% NON-METALLIC to prevent electrical current from using it as a conductor. Do NOT use copper tubing for flexible fuel lines as copper will work harden and become brittle enough to break. Use black pipe on natural gas or gaseous fuel models, but NOT on gasoline or diesel fuel models. Piping at the engine connection must be approved flexible line. The fuel line must be routed separately and never tied together with any electrical wiring.

Have a fire extinguisher nearby. Be sure extinguisher is properly maintained and be familiar with its proper use. Extinguishers rated ABC by the NFPA are appropriate for all applications. Consult the local fire department for the correct type of extinguisher for various applications.

- **Guard Against Electric Shock**

Disconnect 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.

Jewelry is a good electrical conductor and should be removed before working on any electrical equipment.

Use extreme caution when working on electrical components. High voltages can cause severe personal injury or death.

Follow all state and local electrical codes. Have all electrical installations performed by a qualified licensed electrician.

Always use an appropriately sized, approved double-throw transfer switch with any generator set. DO NOT PLUG OR CONNECT ANY PORTABLE, MOBILE OR STANDBY SET DIRECTLY INTO A HOUSE RECEPTACLE OR DISTRIBUTION BOX TO PROVIDE EMERGENCY POWER. It is possible for current to flow from generator into the utility line. This creates extreme hazards to anyone working on lines to restore power.

- **Do Not Smoke While Servicing Batteries**

Lead acid batteries emit a highly explosive hydrogen gas that can be ignited by flame, electrical arcing or by smoking.

- **Exhaust Gases Are Toxic**

Provide an adequate exhaust system to properly expel discharged gases. Inspect exhaust system visually and audibly for leaks daily. Ensure that exhaust manifold is secure and not warped. Be sure the unit is well ventilated. Don't use discharged cooling air for compartment heating since it could contain poisonous exhaust gases.

Engine exhaust contains CARBON MONOXIDE, a dangerous gas that is potentially lethal. Avoid carbon monoxide inhalation by NOT operating the generator set in any type of enclosure that could allow exhaust gases to accumulate. On portable models, locate the generator set so that exhaust is directed away from any building windows or entrances.

- **Keep the Unit and Surrounding Area Clean**

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.

Do NOT store anything in the generator compartment or on the unit itself such as oil or gas cans, oily rags, chains, wooden blocks, etc. A fire could result or the generator set operation may be adversely affected. Keep the set and/or compartment and floor clean and dry.

Do not steam clean the generator set while the engine is running. When cleaning, do not spray directly into the generator, control box, or air cleaner.

- **Protect Against Moving Parts**

Avoid moving parts of the unit. Loose jackets, shirts or sleeves should not be worn because of the danger of becoming caught in moving parts.

Make sure all nuts and bolts are secure. Keep power shields and guards in position.

If adjustments *must* be made while the unit is running, use extreme caution around hot manifolds, moving parts, etc.

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Introduction

ABOUT THIS MANUAL

This manual provides general information for operating and maintaining your Onan generator set. Study this manual carefully and observe all warnings and cautions. Using the generator set properly and following a regular maintenance schedule will result in longer unit life, better performance, and safer operation.

HOW TO OBTAIN SERVICE

When the generator set requires servicing, contact an Onan Distributor for assistance. Onan factory-trained Parts and Service representatives are ready to handle all your service needs.

When contacting an Onan Distributor, always supply the complete Model number and Serial number as shown on the Onan nameplate. The Onan nameplate is located on the side of the generator control box.

McGraw-Edison		
Onan GenSet		
Model and Spec No.		
Serial No.		
Important Always give above no.'s when ordering parts		
AC Volts	Ph	
KVA	kW	
PF	Amps	Hz
DCV	Amps	Watts
RPM	Bat.	
Time Rating		
For Elec Eqpt Only		
Insulation - NEMA Class F Amb 40°C		
Mfd by Onan Corp Minneapolis Mn 55432 USA Made in USA		
99-0444		

Onan Nameplate

WARNING

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

Specifications

GENERATOR DETAILS

Type	Onan UN Revolving Armature, 4-Pole
Phase	1 and 3
1 and 3 Phase Ratings	
60 Hertz General Utility Rating	
6.5 NH	6.5 kW (6.5 kVA at 1.0 PF)
50 Hertz General Utility Rating	
5.5 NH	5.5 kW (5.5 kVA at 1.0 PF)
Frequency Regulation (No load to rated load)	3 Hertz (5 percent)
Voltage Regulation	+ or - 7 percent

ENGINE DETAILS

Engine	Onan NH
Engine Speed	
60 Hertz	1800 r/min
50 Hertz	1500 r/min
Fuel (Gasoline fueled sets)	Unleaded or Regular grade gasoline
Fuel Pump Inlet Size	
Mechanical	7/16-24 Thd-Invt Flare
Electric	1/4 In Barbed
Fuel Pump Maximum Lift (Mechanical)	4 ft (1.22 m)
Exhaust Outlet	1-1/2 In flanged pipe
Starting System Voltage	12
Battery Requirements	
Standard Model and Mobile Generators	
Amp/Hour Capacity	74
SAE Number	60
Battery Voltage	12
Quantity Required	1
Contractor's Model	
Amp/Hour Capacity	70
SAE Number	22 F
Battery Voltage	12
Quantity Required	1
Cooling System Requirements (Standard Model-Enclosed)	
Pressure Cooled Sets	
Inlet Vent	3.5 Sq Ft (0.326 m ²)
Outlet Vent	7.0 Sq Ft (0.651 m ²)
Vacu-Flo Cooled Sets	
Inlet Vent	1.0 Sq Ft (929 cm ²)
Outlet Vent	0.25 Sq Ft (232 cm ²)
Engine Oil Capacity (With Filter)	3-1/2 Qt (3.3 L)
Spark Plug Gap	
Gasoline	0.025 In (0.64 mm)
Gaseous or Gas/Gaso Combination	0.020 In (0.51 mm)
Breaker Point Gap	0.020 In (0.51 mm)

Installation - Standard Model

GENERAL

Consider each installation individually. Use these instructions as a guide in obtaining a safe and efficient installation. Consult your local building inspector for information on local building codes, fire ordinances, etc. before installing your generator set. 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:

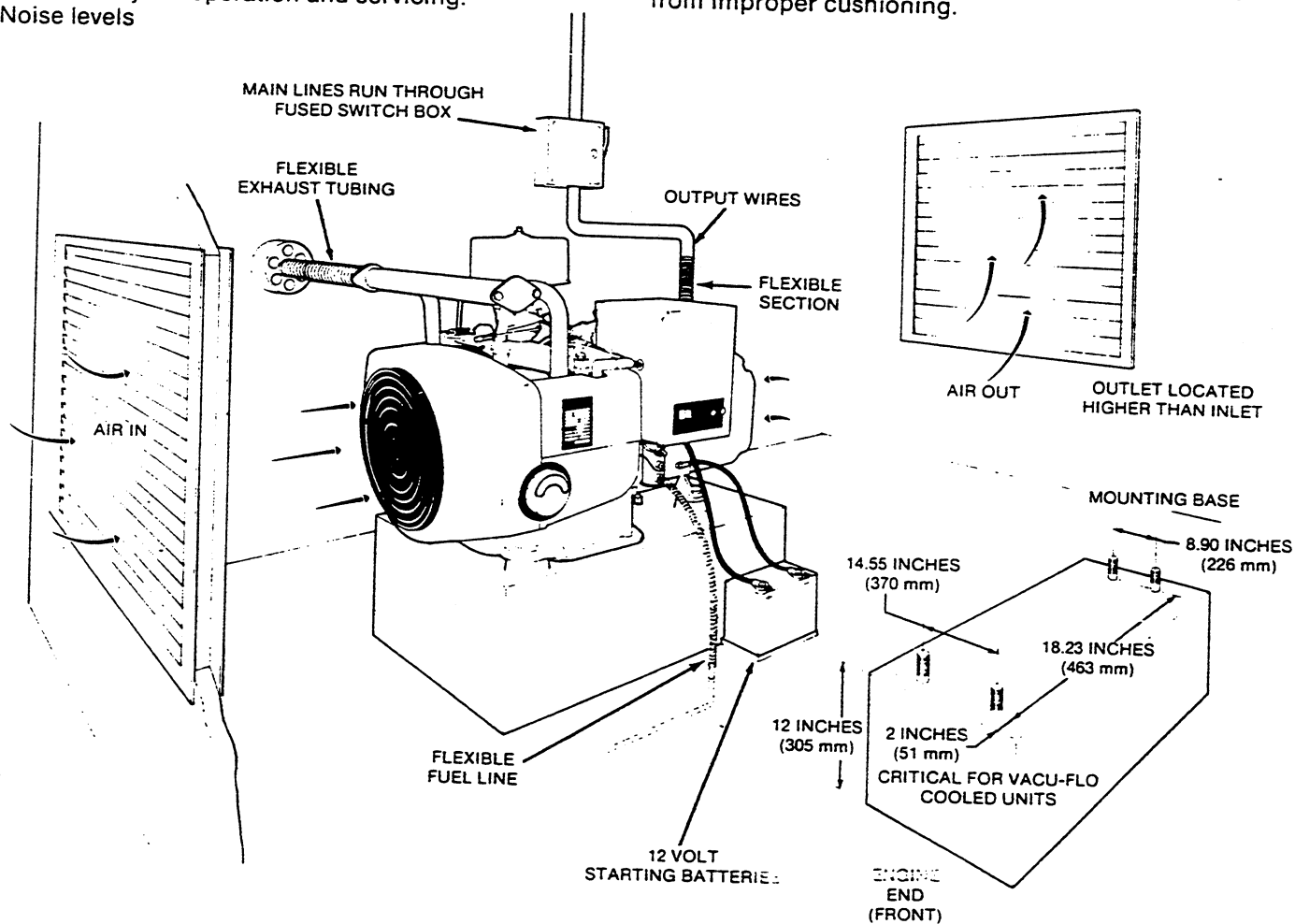
- Level mounting surface
- Adequate cooling air
- Adequate fresh induction air
- Discharge of circulated air
- Discharge of exhaust gases
- Electrical connections
- Fuel installation
- Accessibility for operation and servicing.
- Noise levels

LOCATION AND MOUNTING

Provide a protected location that is dry, dust-free and, preferably, well-ventilated. Allow at least 24 inches (610 mm) around the installation for service and maintenance of the unit. Figure 1 illustrates a typical installation for a pressure-cooled generator set.

Permanent installations need a sturdy, level mounting base of concrete, heavy wood, structural steel or other sturdy support at least 12 inches (305 mm) high to aid routine maintenance, operation and service.

Assemble the vibration isolators as shown in Figure 2. The spacer bushing prevents compression of the snubber or upper rubber cushion. Two vibration isolators are for the engine-end only and two are for the generator-end only. Use them in their respective positions to avoid undesirable vibration resulting from improper cushioning.



XM 1539

FIGURE 1. TYPICAL NH GENERATING SET INSTALLATION

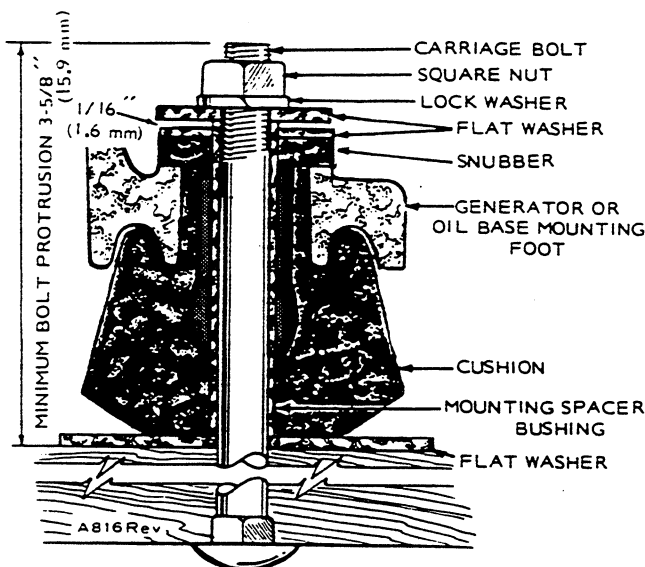


FIGURE 2. VIBRATION ISOLATOR

VENTILATION AND COOLING

Air circulation is needed to dissipate heat produced by the engine and generator in normal operation. Outdoor installations can rely on natural circulation, but indoor or housed installations need properly sized and positioned vents for required airflow.

Vents and Ducts

The *Specifications* section of this manual lists minimum inlet and outlet vent sizes for proper ventilation of units installed in enclosed structures. If free air flow is in any way restricted by louvers or screens, increase the vent areas 1/4 to 1/2 times. Prevailing winds may also affect airflow if they consistently blow directly into the outlet vent.

Pressure Cooled Sets

With pressure cooling, air is drawn in from the front (engine end) of the generator set. The cool air passes over the cooling fins on the engine and absorbs the heat. The heated air is then discharged to the rear of the generator set.

The inlet and outlet vent must be installed properly to provide the required flow of cooling air. Locate the inlet vent directly in front of the generator set and as close as possible as shown in Figure 1. Locate the outlet vent to the rear of the generator set.

Arrange the vents so air cannot escape without first passing through the immediate area of the installation. Locate the outlet slightly higher than the inlet to allow for convection airflow. Take steps to prevent recirculation of cooling air. If inlet air is more than 10°F (5.9°C) above ambient, recirculation is probably occurring. Inlet air should not exceed 120°F (49°C) when the engine is running at full load.

Vacu-Flo Cooled Sets

With Vacu-Flo cooling, a flywheel fan draws cool air in from the rear (generator end) of the generator set. The cool air passes over the cooling fins on the engine and absorbs the heat. The heated air is then discharged through the opening in the vacu-flo scroll (see Figure 3).

The inlet and outlet vents must be installed properly to provide the required flow of cooling air. Locate the inlet vent to the rear of the generator set. Locate the outlet vent directly in front of the scroll opening and as close to the set as possible.

When a duct is used between the scroll discharge and the outlet vent, it must be flexible enough to allow unit movement and have a free area at least as large as the scroll opening. A canvas section in the duct will prevent transfer of vibration. Use large radius elbows and increase duct size for runs over 5 feet (1.52 m). Pitch the duct slightly upward to allow heat to escape when the set is shut down.

WARNING

Discharged cooling air might contain poisonous exhaust gases which might cause serious personal injury or death if inhaled. Never use discharged cooling air for heating a room, compartment, or storage area.

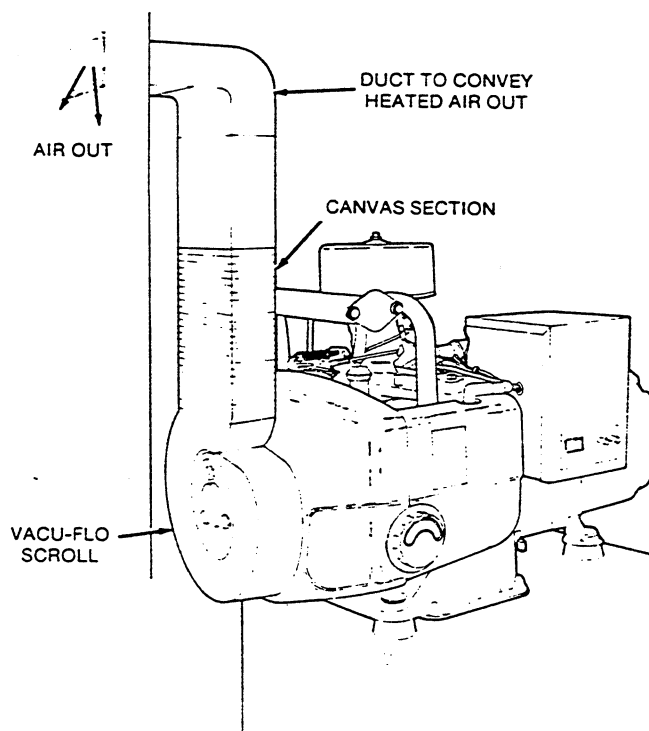


FIGURE 3. VACU-FLO COOLING

XCS 1246

EXHAUST SYSTEM

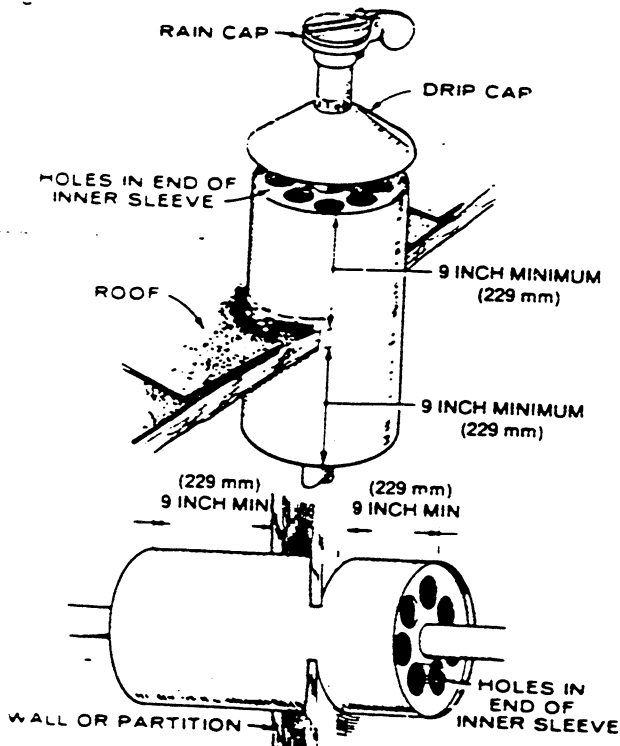
Pipe exhaust gases to the outside of any enclosure. Locate the exhaust outlet away from any air inlets to avoid exhaust gases re-entering the enclosure. Exhaust installations are subject to various detrimental conditions such as extreme heat, infrequent operation, light loads, etc. Therefore, make regular and frequent inspections of the exhaust system to make sure that the entire system remains fume tight and safe for operation.

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"). Exhaust heat should not raise the temperature of any combustible material more than 117°F (65°C).

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).

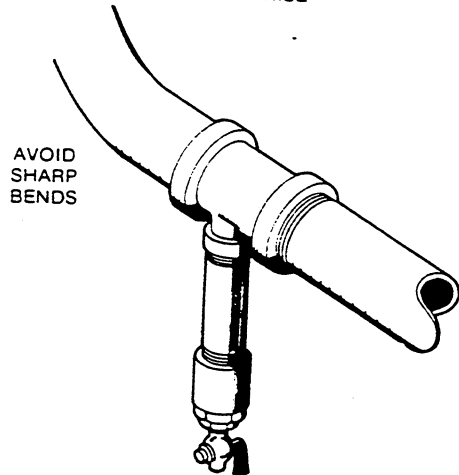


Diameter of Thimble Must Be 12 Inches (305 mm) Larger Than Diameter of Exhaust Pipe

FIGURE 4. EXHAUST THIMBLE

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

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



DRAIN CONDENSATION TRAP PERIODICALLY

EXS1046

FIGURE 5. EXHAUST CONDENSATION TRAP

FUEL SYSTEM

Before starting any type of fuel installation, refer to NFPA (National Fire Prevention Association), Pamphlet 58 for recommendations concerning gasoline or gaseous fuel systems. The fuel system must comply with all local and state building codes, fire ordinances, and other regulations that may apply. Have the installation inspected by the appropriate code enforcement officials before the set is put into service.

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.

WARNING

Because of the potential hazard of fire and explosion with any fuel, carefully design and install the fuel system observing all applicable codes.

1. Use only compatible metal components when installing fuel lines underground. Electrolytic corrosion might cause hazardous fuel leaks.
2. Do not install tank or fuel lines near exhaust system components.
3. Always use a flexible section of fuel line between the generator set and the stationary fuel supply line to withstand vibration.

Gasoline Fueled Sets

Use a flexible section of tubing between the fuel pump and the stationary fuel supply line to withstand vibration. The recommended supply line size is 5/16 inch. Use only compatible metal fuel lines when installing stationary fuel lines underground to avoid electrolysis.

An electric solenoid 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.

Always check local codes for fuel tank location restrictions. Locate the fuel tank as close as possible to the generator set and within the lift capacity of the fuel pump. The bottom of the tank must not be more

than 4 feet (1.22 m) below the fuel pump inlet. The tank top must also be below the fuel pump level to prevent siphoning. If the fuel tank is shared with another engine, use a separate fuel line. Choose a tank that has sufficient capacity to keep the generator set running continuously at full load for a minimum of 36 hours.

Refer to Technical Bulletin T-029 for additional information if the tank cannot be installed within the lift capability of the fuel pump or if an overhead tank is required.

Gaseous Fueled Sets

Check with the local gas supplier for gas regulations and gas supply pressures before starting the installation. Figure 6 shows the components in a typical fuel supply system. A manual shutoff valve and a dry fuel filter are required for all installations. An electric solenoid shutoff valve is usually required for indoor automatic or remote starting installations. A demand type regulator is also required and should be located close to the generator set to aid starting.

Regulator supply line pressure must be between 6 to 8 ounces (2.6 to 3.4 kPa).

Use flexible tubing between the engine and gas demand regulator to absorb vibration. Use the shortest possible hose for best starting. Seal all gas line connections with shellac or other compound approved for use in gaseous fuel systems. Thread sealing compounds with a lead base are not satisfactory.

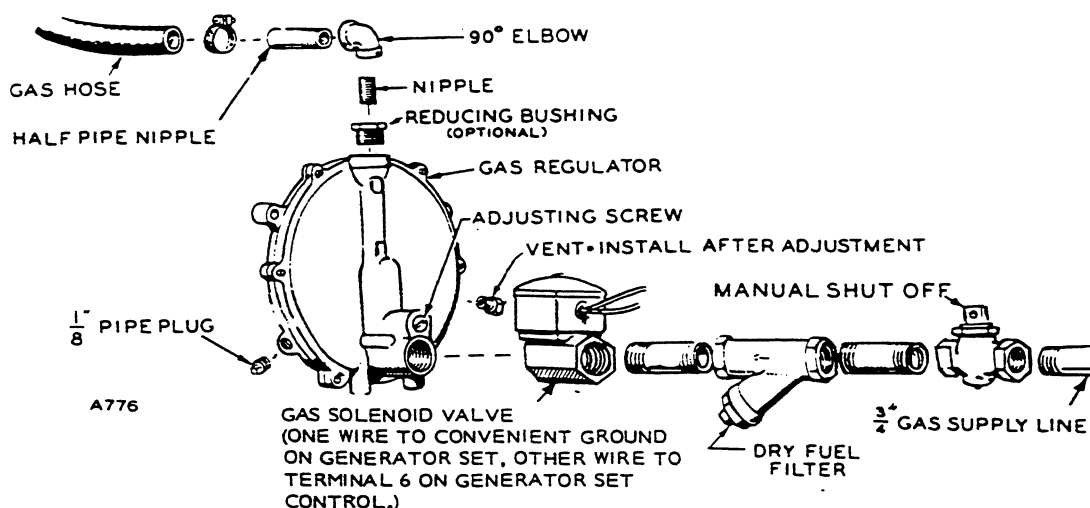


FIGURE 6. CONNECTIONS FOR GAS LINE

Gas Solenoid Valve: When a gas solenoid valve is installed, connect one wire lead to terminal 6 on the control terminal block using #18 wire (see Figure 7). Connect the other wire lead to a convenient ground connection on the generator set.

Gas Vacuum Switch: A vacuum switch is sometimes used in conjunction with a gas solenoid valve. The vacuum switch installs on the intake manifold on the engine. Use #18 wire to make the connections shown in Figure 7. Connect one wire of the gas solenoid valve to a convenient ground connection on the generator set. Connect the other solenoid lead wire to the VALVE terminal on the vacuum switch. Connect the START terminal on the vacuum switch to the B terminal on the voltage regulator. Connect the IGN terminal on the vacuum switch to terminal 6 on the control terminal block.

Combination Gas-Gasoline

Combination gas-gasoline sets are designed for normal operation on gas fuel, with provision for emergency operation on gasoline. Both gas and gasoline procedures must be followed.

The choke is not required when the set is operated on gaseous fuel. Use the spring wire provided with the combination gas/gasoline carburetor to lock the choke in the fully **open** position.

ELECTRICAL SYSTEM

Installing the generator set electrical system includes connecting the load and switchgear and installing the remote start control (if used). The batteries should not be connected until all other systems are completely installed.

WARNING *Accidental starting of the set might cause severe personal injury or death. Connect the batteries last to avoid accidental starting of the set during installation.*

Most location 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.

WARNING *Improper wiring might 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 double throw transfer switch must always be used. Connect this switch (either automatic or manual) so that it is impossible for commercial power and generator current to be connected to the load at the same time. Instructions for connecting an automatic load transfer control are included with such equipment.

Load Connections

AC output wires are located in the compartment at the rear of the set control box (Figure 8). Remove the control box cover to gain access. Installation should be made by a qualified electrician and inspected by the local building inspector to be sure it meets all applicable code requirements.

Use flexible conduit and stranded load wires near the set to absorb vibration. Use sufficiently large insulated wires. Strip the insulation from the wire ends as necessary for clean connections. Connect each load wire to the proper generator output lead inside the AC output box. Insulate the bare ends of ungrounded wires. Install a fused main switch (or circuit breaker) between the generator set and the load.

Single Phase Reconnectable Generator: Voltage selection on reconnectable single-phase generators is for use as 120/240 volts, 3 wire; 120 volts, 2 wire; or 240 volts, 2 wire (Figure 9). Use the connection for two-wire service when one load exceeds one-half the rated capacity. Balance the load when connecting for three-wire service. Current for any one output lead must not exceed nameplate rating. Serious overloading can damage the generator windings. When two or more single-phase circuits are available, divide the load equally between them.

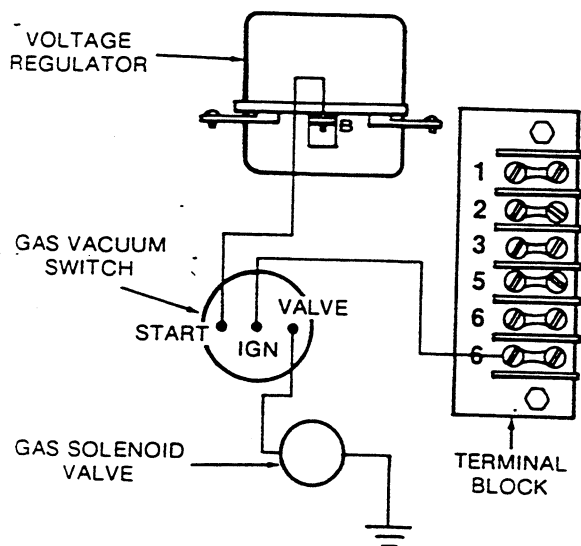


FIGURE 7. VACUUM SWITCH CONNECTIONS

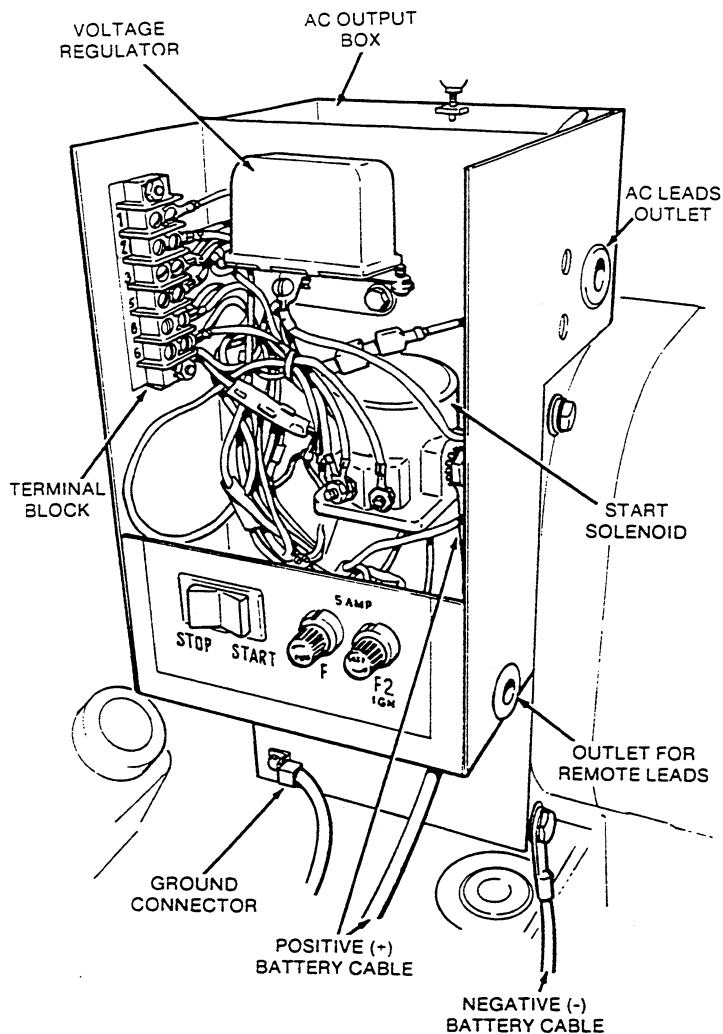


FIGURE 8. CONTROL BOX CONNECTIONS

Three Phase Wye Connected Generators: A three-phase, four-wire generator set produces a single-phase current of one voltage and three-phase current of a different voltage. The single-phase voltage is the lower voltage as noted on the nameplate, and the three-phase voltage is the higher nameplate voltage. See Figure 10.

The output lead marked M0 is grounded. For single-phase current, connect the neutral (white) load wire to the M0 lead. Connect the "hot" (black) load wire to any one of the other three output leads . . . M1, M2 or M3.

Three separate single-phase circuits are available, with not more than one-third the rated capacity of the generator set from any one circuit.

For three-phase current, connect separate load wires to each of the generator leads M1, M2 and M3. Single-phase current of the higher nameplate voltage is obtained between any two three-phase leads. If single-phase and three-phase currents are used at the same time, use care to properly balance the single-phase load.

CAUTION Any combination of single-phase and three-phase loads may be used as long as the current in each line of the generator does not exceed rated current.

Three Phase Delta Connected Generator: Three-phase delta connected generator sets are designed to supply 120-volt, single-phase current; 240-volt, single-phase current; or 240-volt, three-phase current. See Figure 10.

For three-phase operation, connect the three load wires to the three output leads M1, M2 and M3 . . . one wire to each terminal. M0 is the neutral wire and is not used for three-phase operation.

For single phase, 120 volt operation, connect the load circuit to either the M1 or M2 (two circuits available) terminals. Connect the neutral wire to the M0 terminal. The M3 terminal is not used. Single phase 120 volt loads up to two-thirds of the three-phase rating can be used if there are no other loads on the generator.

CAUTION Do not use M0 and M3 as a 120-volt circuit on delta models. This connection provides approximately 190 volts and it could damage 120-volt loads.

For single-phase, 240-volt service, connect the load circuit between M1 and M2, or between M2 and M3, or between M1 and M3 (three circuits available). The M0 lead is not used. Any combination of single-phase and three-phase loading can be used at the same time as long as no lead current exceeds the nameplate rating of the generator.

Balancing the Load

Current for any one output lead must not exceed nameplate rating. Serious overloading can damage the generator windings. When two or more single-phase circuits are available, divide the load equally between them.

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 local electrical inspector when installing the grounding system.

WARNING Contact with electrical 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.

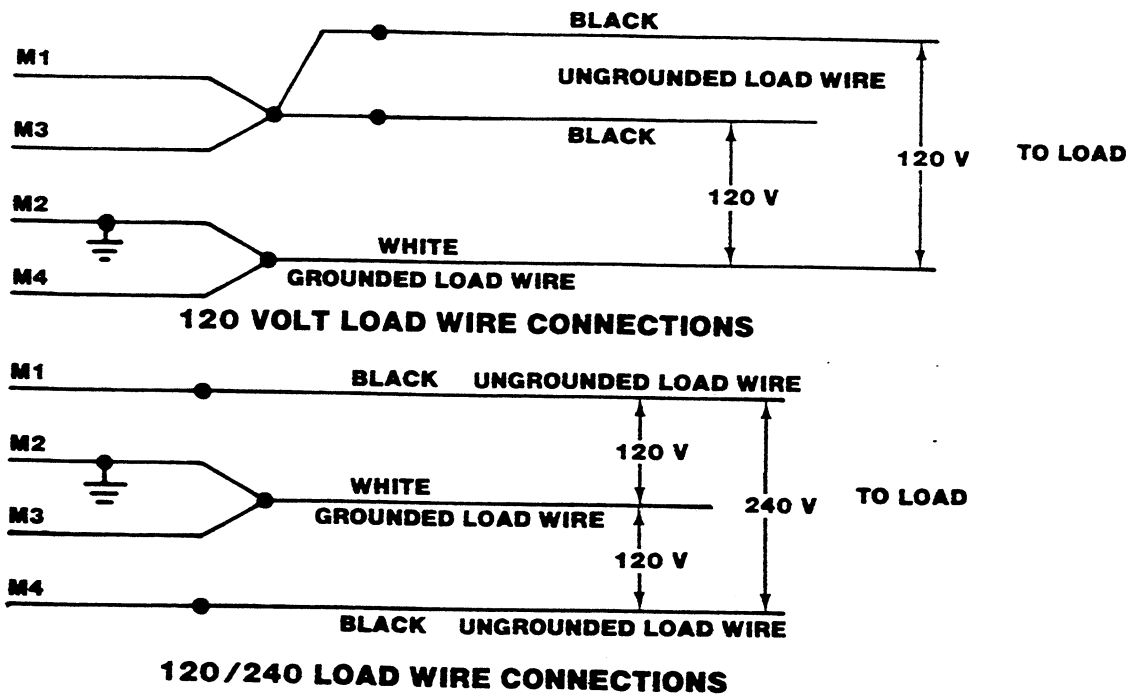


FIGURE 9. SINGLE-PHASE, VOLTAGE CODE -3C GENERATOR CONNECTIONS

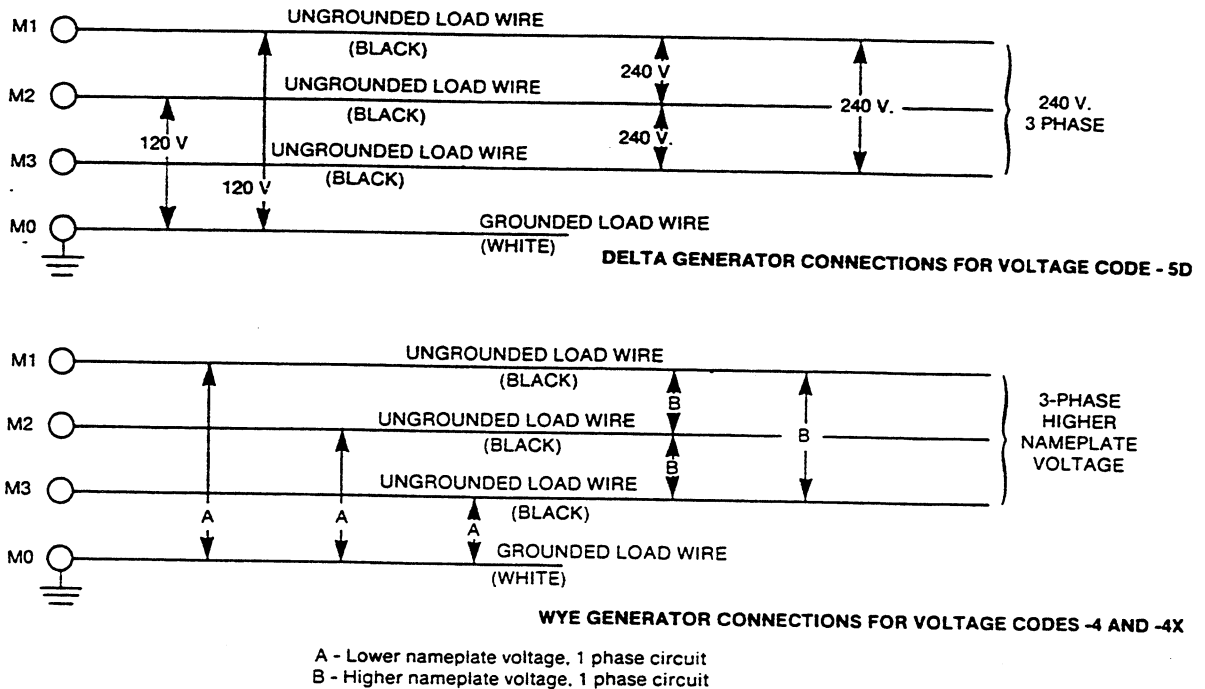


FIGURE 10. THREE-PHASE, FOUR-WIRE GENERATOR CONNECTIONS

Typical requirements for bonding and grounding are given in the National Electrical Code, 1981, Article 250. All connections, wire sizes, etc. must conform to the requirements of the electrical codes in effect at the installation site.

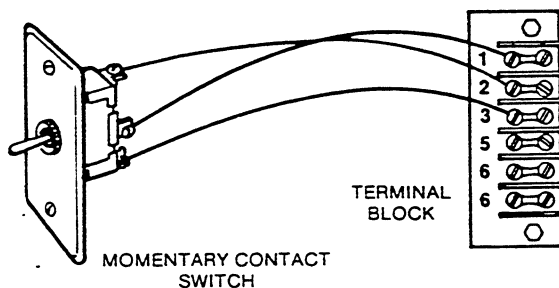
Switchboard

When an optional wall mounted switchboard containing ammeters, voltmeters and circuit breakers is used, these load wire connections apply. Connect one ungrounded (hot) generator lead to the unused terminal of each ammeter. Connect any generator leads and lead wires which are to be grounded to the ground stud in the switchboard. On sets that generate more than one voltage, the voltmeter reads the higher voltage shown on the nameplate. The lower voltage is correct when the higher voltage is correct.

Remote Control Connections

Provision is made inside the control for addition of optional remote accessories. Connections are made on a six plate terminal board.

Remote Stop/Start Switch: A remote switch (SPDT, momentary contact, center off type) can be used for remote control starting and stopping. Use three wires to connect the switch to the control terminal block as shown in Figure 11.



WIRE SIZE	DISTANCE
#18	to 125 ft. (38 m)
#16	to 200 ft (61 m)
#14	to 300 ft (91 m)
#12	to 500 ft (152 m)

FIGURE 11. REMOTE START/STOP SWITCH CONNECTIONS

DC Voltmeter: A DC voltmeter may be used to monitor battery condition. Connect the voltmeter leads to terminals 1 and 5 on the control terminal block as shown in Figure 12. Use number 18 or larger size wire.

Running Time Meter: A running time meter may be used to determine maintenance intervals. Connect the time meter leads to terminals 1 and 6 on the control terminal block as shown in Figure 12. Use number 18 or larger size wire.

12-Volt Generator Lamp: A 12-volt lamp may be used to indicate when the generator set is operating. Connect the lamp leads to terminals 1 and 6 on the control terminal block as shown in Figure 12. Use 18 or larger size wire.

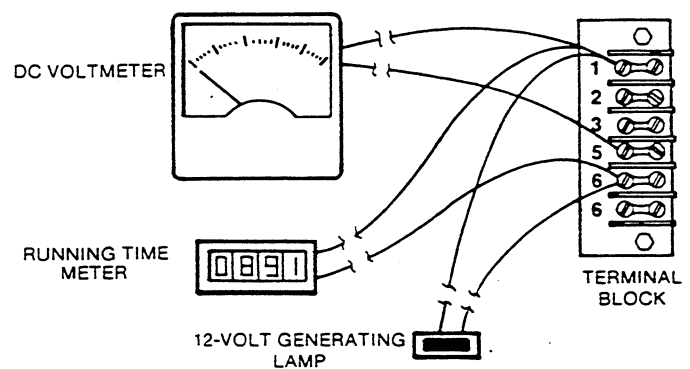


FIGURE 12. DC VOLTMETER, RUNNING TIME METER, AND 12-VOLT LAMP CONNECTIONS

PREPARING GENERATOR SET FOR OPERATION

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 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.

Fuel

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

Ventilation

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

Exhaust System

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

Electrical System

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

Mechanical

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

Battery Connections

Remove the cover from the control box and connect the positive (+) battery cable to the terminal marked "BAT" on the start solenoid (Figure 8). Connect the negative (—) cable to the generator through-bolt as shown. Connect battery positive before connecting battery negative to prevent arcing.

If the battery connections are accidentally reversed the engine will start and run, but have no battery charging capability.

Service the battery as necessary. Infrequent set use (as in emergency standby service) may allow the battery to self-discharge to the point where it cannot start the set.

WARNING

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

Installation — Mobile Models

GENERAL

Consider each installation individually. Use these instructions as a guide in obtaining a safe and efficient installation. Consult the appropriate code enforcement officials for information on any codes that may apply before installing the generator set. The complete installation must comply with all local, state, or federal codes and regulations that may apply.

Requirements to be considered prior to installation:

- Compartment size and location
- Adequate ventilation
- Discharge of exhaust gases
- Fuel supply system
- Electrical connections
- Accessibility for operation and servicing
- Noise levels

COMPARTMENT SIZE AND LOCATION

Compartment location is determined largely by:

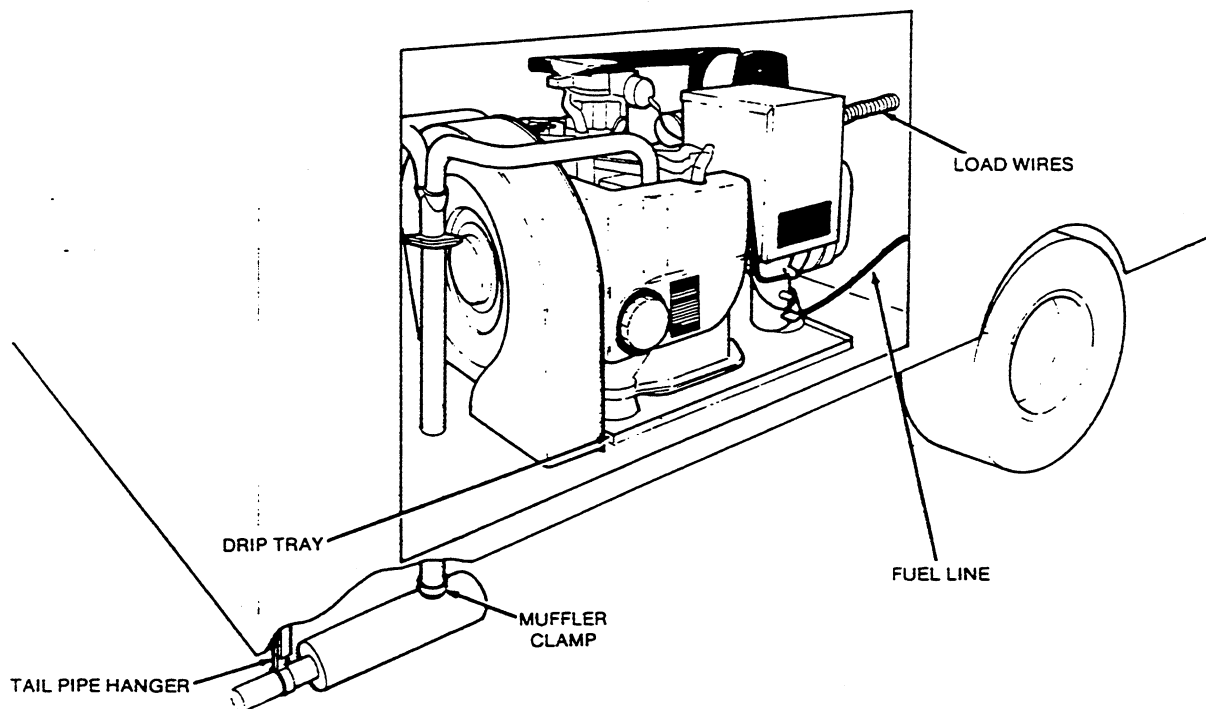
1. Physical size.
2. Access opening.
3. Mounting support—most important of all.

Physical Size

The area in the vehicle for the electric generating set must be large enough for the compartment, with specified minimum clearance between the electric generating set and compartment walls or ceiling (and acoustical material, if used). See Figure 14.

Access Opening

Plan the location for an access opening large enough to permit set removal. Compartment door should be designed for easy removal or for easy access for operator or service personal.



M 1541

FIGURE 13. TYPICAL NH MOBILE SET INSTALLATION

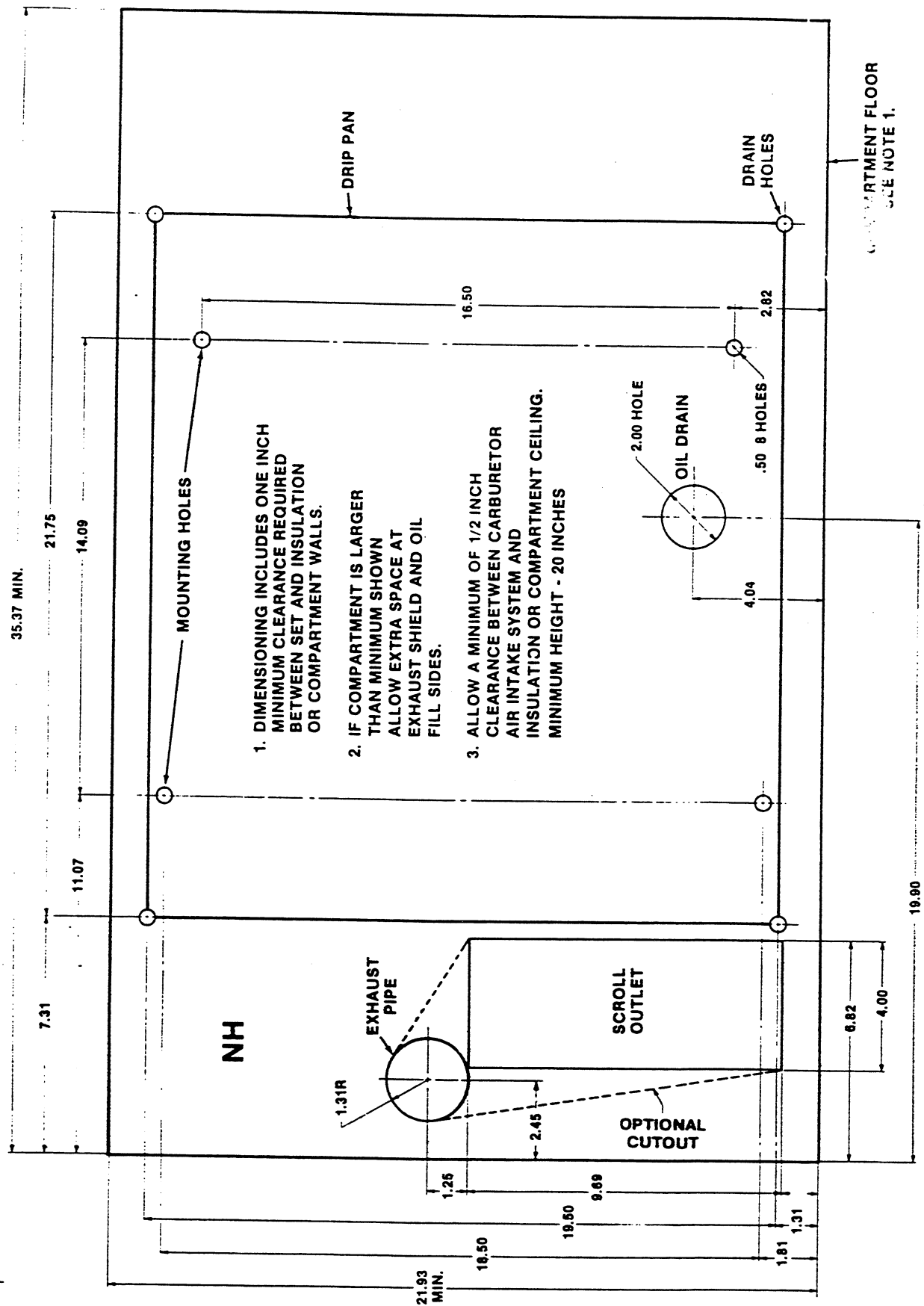


FIGURE 14. TYPICAL INSTALLATION COMPARTMENT SIZE AND MINIMUM DIMENSIONS

Mounting and Location

Because of compartment weight, the most desirable mounting location is between the main frame members of the vehicle. However, this is seldom possible. Most common installations are on the side of the vehicle and most difficult to reinforce. One side of the compartment is fastened to the frame and the opposite side secured to the body. Compartment floor must be metal.

Channel, box or angle iron can be used for a compartment frame with a sheet metal cover.

Before actual mounting of the electric generating set takes place, read this entire manual. Additional allowances should be made to allow easy access to the oil fill, drain and oil dip stick as well as the air cleaner element for service purposes.

Construction

1. Compartment or installation area must be separated from interior by a vapor-tight wall.
2. Line the compartment or separate from interior with a fire barrier of sheet metal or other non-combustible material. The compartment can also be readily sealed and lends itself easily to sound or acoustical treatment.

WARNING

Do not use flammable material directly above or around the electric generating set compartment. Heat transferred through the sheet metal compartment structure or other material can be HOT enough to discolor, char or ignite fiberboard, seat cushions, etc. Use of asbestos or other non-combustible temperature insulating material in high temperature areas may be necessary.

3. See Figure 14 for minimum clearances and compartment size.
4. DO NOT use absorbent sound proofing material on compartment floor. The floor should have minimum openings to reduce entrance of road dirt. Compartment floor must be so constructed as to prevent accumulation of oil, fuel or water in any corner. Drainage can be accomplished through the use of a 1/2" diameter hole near each corner or other suitable means.

WARNING

Be sure hole is not directly above muffler to prevent fire hazard.

Equip base with an oil drain hole to outside of compartment. It is recommended that the manufacturer provide a raised edge or collar around exhaust pipe outlet to prevent gasoline leakage onto exhaust system.

Vibration Isolators

Rubber vibration isolators are furnished with all Onan generator sets.

CAUTION

Use only the vibration isolators provided with the electric generating set, as they are designed to support units weight.

Onan mounts are a "through bolt" type which prevent the set from breaking loose if they are damaged.

Vibration isolators of the type shown (with snubbing washers) in Figure 15 must be installed properly to minimize vibration. Leave 1/16-inch minimum clearance between the snubbing washers as shown in Figure 15.

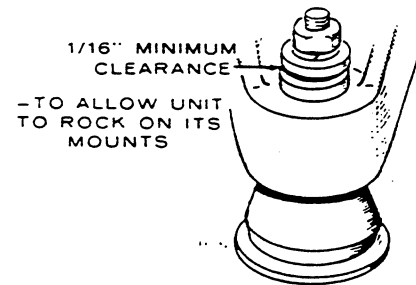


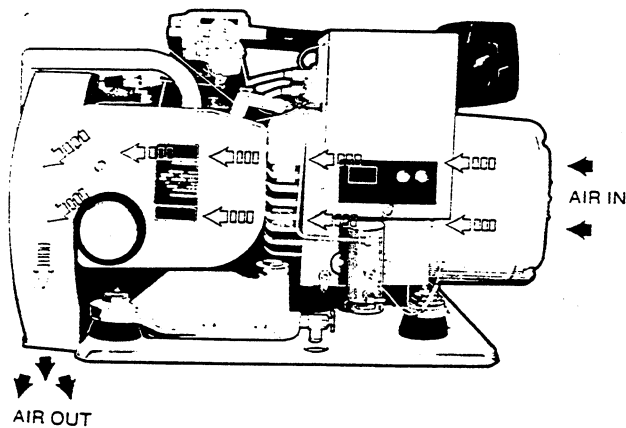
FIGURE 15. VIBRATION ISOLATORS

VENTILATION AND COOLING

The most important factors of ventilation for an air-cooled mobile electric generating set are sufficient incoming cooling air and exhausting heated air. Before considering the installation problems, knowledge of how an Onan unit cools itself is needed.

Vacu-Flo Cooling

All generator sets for mobile installations use Vacu-Flo cooling. A centrifugal fan located in the scroll housing (see Figure 16) draws air in from the generator end of the compartment. The cool air passes over the engine cooling fins and absorbs the excess heat. The heated air is then discharged out through the Vacu-Flo scroll opening. All sets have the scroll positioned downward. Nothing must obstruct or restrict the discharge airflow or overheating may occur.



CS 1247

FIGURE 16. VACU-FLO COOLING

WARNING Discharged cooling air might contain poisonous exhaust gases which might cause serious personal injury or death if inhaled. Never use discharged cooling air for heating a room, compartment, or storage area.

Allow for ducts or obstructions of airflow. Position of the air openings must permit airflow while the unit is running to purge the compartment of heated air. But on shutdown, the openings must allow for convection cooling of the compartment for heated air to escape.

Air Requirements

Since the discharge area can't be changed, air inlet opening is *critical*! The 6.5 kW NH running at 1800 rpm requires a minimum free air inlet of 120 square inches with no restrictions.

The Onan UL tested air cleaner element is specifically designed to meet the combustion air requirements of the 6.5 NH.

Restricted Air Openings

Sheet metal with louvers can be used over inlet areas. However, some provide only 60 percent free inlet area per square foot. Even the most efficient grille only provides about 90 percent free inlet area per square foot. The free inlet area of the material can be obtained from the manufacturer. Calculate the inlet area needed by dividing 120 square inches (minimum free inlet area) by the percent (%) of free air of the proposed louver. The result is the necessary surface area required for the proposed louver material. A typical louvered door is shown in Figure 17.

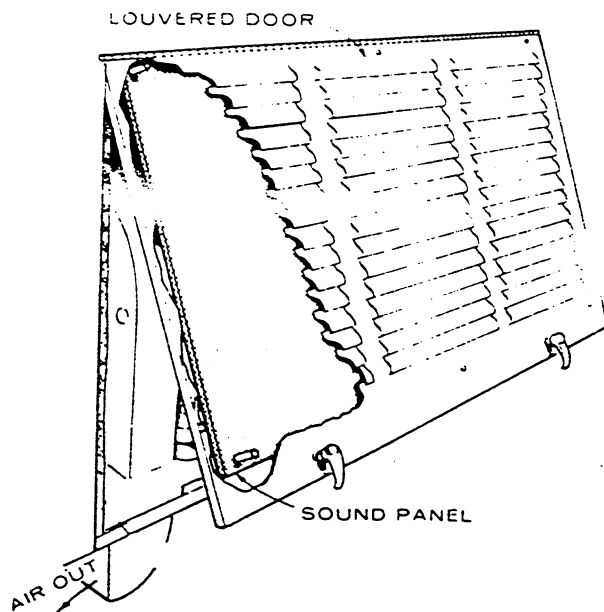


FIGURE 17. TYPICAL LOUVERED DOOR AIR INLET

EXHAUST SYSTEM

Plan each individual exhaust system carefully. A proper installation is not only gas tight, but usually quieter, too. Be sure to check all applicable vehicle standards, local codes and regulations.

WARNING Inhalation of exhaust gases might result in severe personal injury or death. Plan the exhaust system carefully to prevent exhaust gases from entering the vehicle interior. Follow the recommended installation procedures to ensure safe operation.

Observe the following recommendations when installing the exhaust system:

1. Where the exhaust system passes through the base or floor, leave adequate clearance as protection against exhaust pipe damage from vibration (Figure 18). The metal around the hole should be turned up or some type of collar used to prevent gas or oil from draining onto hot exhaust parts.

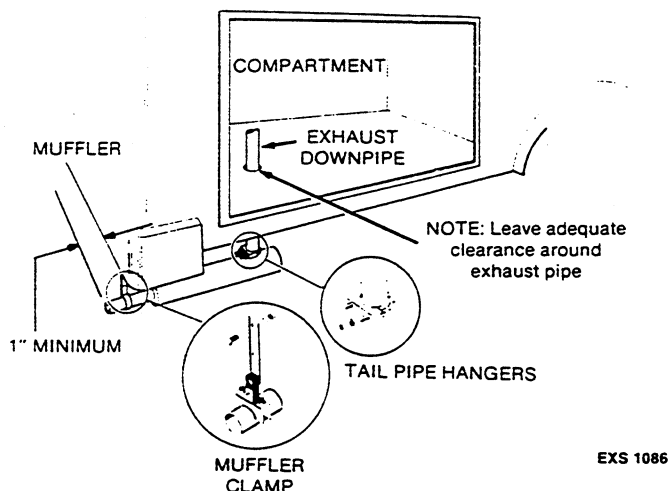


FIGURE 18. TYPICAL EXHAUST SYSTEM INSTALLATION

- The exhaust system must be no closer than 1-1/2 inches from any combustible material, or be so located, insulated or shielded so it does not raise temperature of any combustible material by more than 117°F (65°C) above the ambient air inlet temperature.

IMPORTANT: Certain states (particularly California) have state ordinances pertaining to the type and usage of exhaust muffler/spark arresters on internal combustion engines or engine driven equipment when used off highway. Be sure your installation meets all Federal, State and local codes pertaining to your unit. Failure to provide and maintain a spark arrester may be in violation of the law.

- Secure the exhaust downpipe to the exhaust manifold using 5/16-18 bolts, lock washers, and nuts. Use a new asbestos gasket between the exhaust-manifold flanges to prevent leaks and tighten securely. Do not use sealer on the gasket.
- Attach the inlet of the muffler to the downpipe using a 1-5/8 inch automotive type U-bolt clamp **ONLY** (Figure 18) and tighten securely. If downpipe must be shortened, cut two 1/2 inch slots in the end of the downpipe after shortening.
- When installing the tailpipe, refer to the following guidelines for selecting and locating the tailpipe.

WARNING *Inhalation of exhaust gases might result in severe personal injury or death. Exhaust gases might enter the interior if the tailpipe is improperly installed. Follow the recommended exhaust system installation procedures to ensure safe operation.*

- Use 1-3/8 inch ID, 18 gauge, rigid steel tubing for tailpipe. Do not use flexible exhaust tailpipe since it might break due to road shock and vibration.
- Use 1-1/2 inch U-bolt type automotive muffler clamps and shock mounted hangers for attaching and supporting the muffler and tailpipe. Only approved SAE automotive muffler clamps are acceptable for fastening the exhaust tailpipe to the muffler.
- Install exhaust tailpipe at least 1-1/2 inches away from the fuel tank and any combustible material. If 1-1/2 inches clearances cannot be maintained, install suitable heat shielding between tailpipe and combustible material or fuel tank to prevent excessive heating.
- Do **not** terminate the exhaust tailpipe:

- Under a window, door, or any opening that might allow exhaust gases to enter the vehicle interior.
- Ahead of or under the generator compartment air intake to prevent recirculation of exhaust gases. Terminate tailpipe to the **rear** of the compartment air intake.
- Under the fuel tank fill spout to prevent spilled fuel from being ignited by a hot tailpipe.
- Under the vehicle to prevent exhaust gases from entering the vehicle interior through small openings in the underside of the vehicle.

- Extend the tailpipe at least **one inch** (25 mm) beyond the perimeter of the vehicle. Direct exhaust gases **down** and **away** from the vehicle and **away** from windows, doors, or compartment openings.
 - Do not connect the generator set exhaust tailpipe to the vehicle exhaust system. Exhaust gases will be forced into the non-running engine and might be released through the carburetor air inlet. Water vapor from the exhaust might also damage the non-running engine.
- Attach the tailpipe to the outlet end of the muffler and provide support using a shock mounted support hanger with clamp (see Figure 18).

CAUTION *To prevent excessive vibration transfer to the vehicle, mount muffler and tailpipe hanger brackets directly above the component being supported and **NOT** at an angle.*

- Run the generator set for five minutes and check entire exhaust system (visually and audibly) for leaks or excessive noise.

FUEL SYSTEM

The fuel supply system must be properly designed to provide reliable and safe operation of the vehicle and the generator set. Consult the vehicle manufacturer before making connections to the vehicle fuel system. After installation, check the complete system to verify that all connections are secure and that there are no fuel leaks.

WARNING *Leakage of gasoline in or around the compartment is a serious fire hazard. The ventilation system should provide a constant flow of air to expel any accumulation of fuel vapor while the vehicle is in transit. Compartments must be vapor tight to the interior to keep fumes from within the vehicle.*

Fuel Lines

Observe the following recommendations when installing the fuel supply lines:

1. Most electric generating set installations are designed to share the vehicle fuel supply tank with the vehicle engine. All connections to vehicle fuel system must be in accordance with chassis (vehicle) manufacturers' installation instructions.
2. Install a separate fuel pickup in the vehicle fuel tank for the generator set. Do not extend the generator set fuel pickup to the bottom of the fuel tank. The generator set should run out of fuel before the vehicle engine.

Operating the generator set from a tee in the main fuel line can cause erratic operation when vehicle is operated at highway speeds. The set's fuel pump has neither the capacity nor the power to overcome the draw of vehicle engine fuel pump.

3. Install an approved flexible non-metallic and non-organic fuel line between the vehicle fuel system and the engine to absorb vibration.
4. Use of seamless steel tubing and flared connections are recommended for long runs between the fuel tank and the flexible connector to the generator set.
5. Run fuel lines at the top level of tank to a point as close to the engine as possible to reduce danger of fuel siphoning out of tank if the line should break.
6. Keep fuel lines away from hot engine or exhaust areas. This reduces chance of vapor lock.
7. Flexible line must be long enough to allow for 4" of set movement to prevent binding, stretching or breaking because of set movement.
8. Install lines so they are accessible and protected from damage.
9. Use metal straps without sharp edges to secure the fuel lines.
10. Do not run fuel line in conjunction with electrical wiring.

Fuel Pump

Onan electric generating sets with electric fuel pumps have filters within the fuel pump itself. Additional filters in the fuel lines are unnecessary unless unusual operating conditions exist.

A fuel shutoff valve is also an integral part of the fuel pump. The fuel shutoff valve automatically closes whenever the generator set is not operating. This prevents the generator set from flooding should the vehicle fuel tank become pressurized.

ELECTRICAL SYSTEM

Installing the generator set electrical system includes connecting the load and installing the remote control (if used). The batteries should not be connected until all other systems are completely installed.

WARNING *Accidental starting of the set might cause severe personal injury or death. Connect the batteries last to avoid accidental starting of the set during installation.*

Observe the following general recommendations when installing the electrical system:

1. All wiring must meet applicable local electrical codes. Have a qualified electrician install and inspect the wiring.
2. Wires must be adequate size, properly insulated and supported in an approved manner.
3. Mount switches and controls securely to prevent damage from vibration and road shocks. All switches must be vibration-proof to prevent accidental opening or closing while the vehicle is in motion.

WARNING *To prevent noxious gases from entering vehicle interior, seal any openings made in the set's compartment for conduit, wiring, etc.*

Wire Types

Use multistrand wire which meets all applicable codes as feeder conductors, from electric generating set to compartment junction box. Many installers use multistrand wire throughout the vehicle to reduce the danger of breakage from vibration.

The conductors of the electric generating set shall have an ampacity not less than 115 percent of the nameplate current rating of the generator. Neutral conductors shall be the same size as the conductors of the outside legs.

Supply conductors from the electric generating set to the junction box on the compartment wall must be installed in flexible conduit.

CAUTION Do not use solid metal conductors in compartment. They may develop metal fatigue from set movement and eventually break.

WARNING Improper wiring might result in fire and severe personal injury or death. Do not connect electrical wiring to the fuel line.

Load Connections

AC output wires are located in the compartment at the rear of the set control box (Figure 19). Remove the control box cover to gain access. Installation should be made by a qualified electrician and inspected to be sure it meets all applicable code requirements.

Use flexible conduit and stranded load wires near the set to absorb vibration. Use sufficiently large insulated wires. Strip the insulation from the wire ends as necessary for clean connections. Connect each load wire to the proper generator output lead inside the AC output box. Insulate the bare ends of ungrounded wires. Install a fused main switch (or circuit breaker) between the generator set and the load.

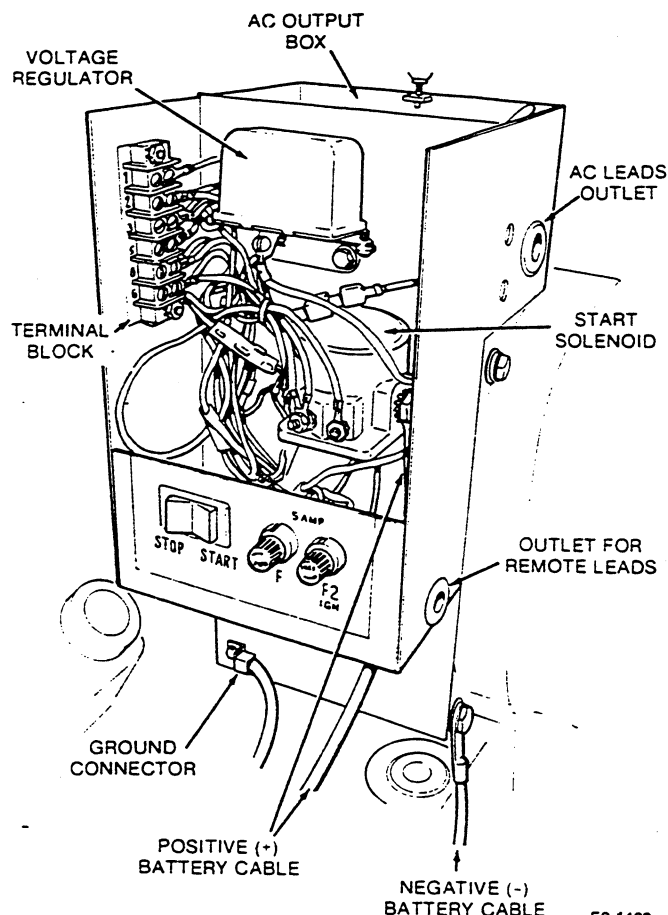


FIGURE 19. CONTROL BOX CONNECTIONS

Single Phase Reconnectable Generator: Voltage selection on reconnectable single-phase generators is for use as 120/240 volts, 3 wire; 120 volts, 2 wire; or 240 volts, 2 wire (Figure 20). Use the connection for two-wire service when one load exceeds one-half the rated capacity. Balance the load when connecting for three-wire service. Current for any one output lead must not exceed nameplate rating. Serious overloading can damage the generator windings. When two or more single-phase circuits are available, divide the load equally between them.

Three Phase Delta Connected Generator: Three-phase delta connected generator sets are designed to supply 120-volt, single-phase current; 240-volt, single-phase current; or 240 volt, three-phase current. See Figure 21.

For three-phase operation, connect the three load wires to the three output leads M1, M2 and M3. . . one wire to each terminal. MO is the neutral wire and is not used for three-phase operation.

For single phase, 120 volt operation, connect the load circuit to either the M1 or M2 (two circuits available) terminals. Connect the neutral wire to the MO terminal. The M3 terminal is not used. Single phase 120 volt loads up to two-thirds of the three-phase rating can be used if there are no other loads on the generator.

CAUTION Do not use M0 and M3 as a 120-volt circuit on delta models. This connection provides approximately 190 volts and it could damage 120-volt loads.

For single-phase 240 volt service, connect the load circuit between M1 and M2, or between M2 and M3, or between M1 and M3 (three circuits available). The M0 lead is not used. Any combination of single-phase and three-phase loading can be used at the same time as long as no lead current exceeds the nameplate rating of the generator.

Balancing the Load

Current for any one output lead must not exceed nameplate rating. Serious overloading can damage the generator windings. When two or more single-phase circuits are available, divide the load equally between them.

Remote Control Connections

Provision is made inside the control for addition of optional remote accessories. Connections are made on a six place terminal board.

CAUTION Do not route DC wires for remote control through conduit containing AC load wiring. Induced voltages may cause erratic operation.

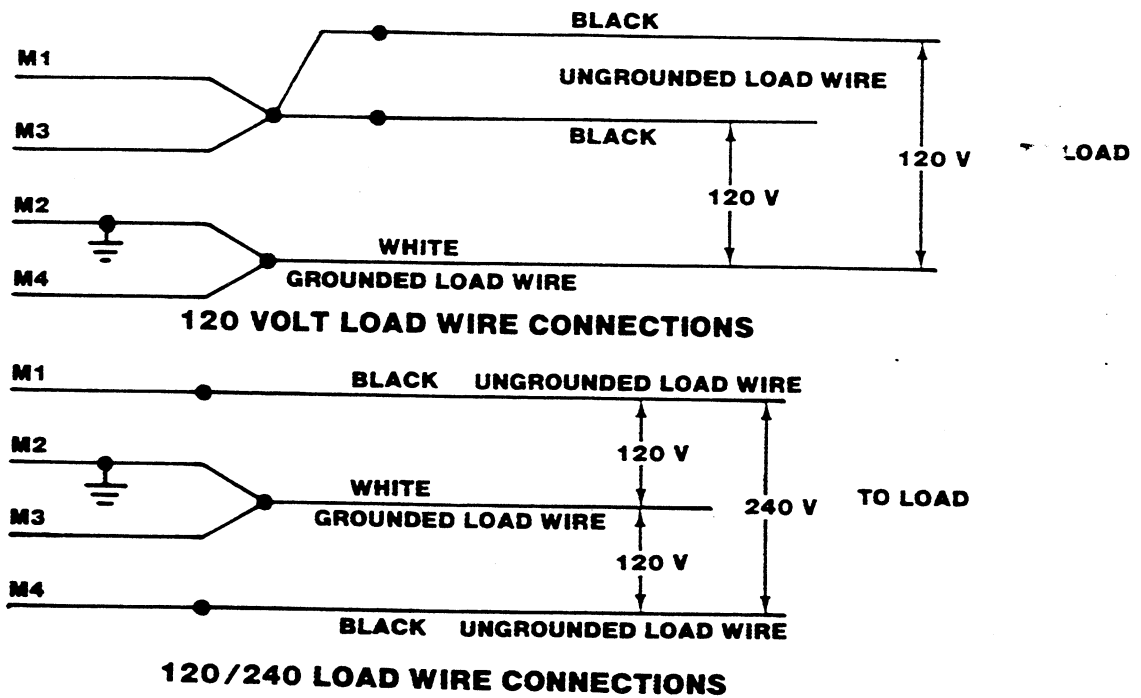


FIGURE 20. SINGLE PHASE, VOLTAGE CODE 3C GENERATOR CONNECTIONS

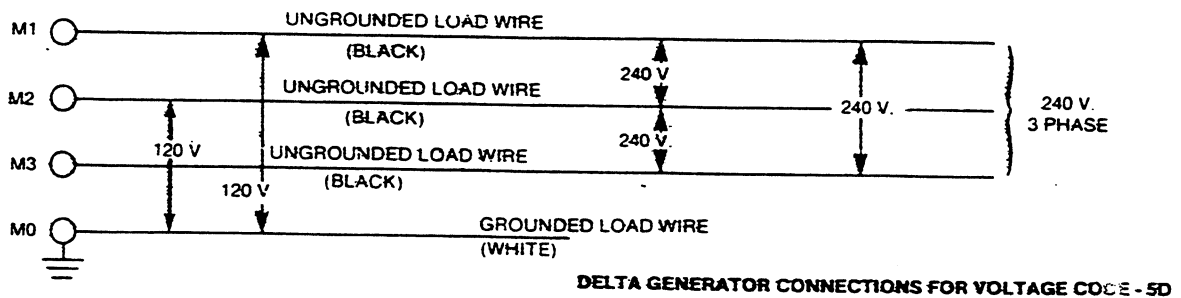
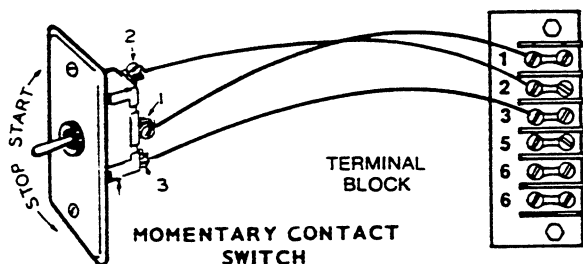


FIGURE 21. THREE PHASE, VOLTAGE CODE 5D GENERATOR CONNECTIONS

WARNING

Seal all holes that might allow noxious gases to enter vehicle.

Remote Stop/Start Switch: A remote switch (SPDT, momentary contact, center off type) can be used for remote control starting and stopping. Use three wires to connect the switch to the control terminal block as shown in Figure 22.



WIRE SIZE	DISTANCE
#18	to 125 ft. (38 m)
#16	to 200 ft. (61 m)
#14	to 300 ft. (91 m)
#12	to 500 ft. (152 m)

FIGURE 22. REMOTE START/STOP SWITCH CONNECTIONS

DC Voltmeter: A DC voltmeter may be used to monitor battery condition. Connect the voltmeter leads to terminals 1 and 5 on the control terminal block as shown in Figure 23. Use number 18 or larger size wire.

Running Time Meter: A running time meter may be used to determine maintenance intervals. Connect the time meter leads to terminals 1 and 6 on the control terminal block as shown in Figure 23. Use number 18 or larger size wire.

12-Volt Generator Lamp: A 12-volt lamp may be used to indicate when the generator set is operating. Connect the lamp leads to terminals 1 and 6 on the control terminal block as shown in Figure 23. Use 18 or larger size wire.

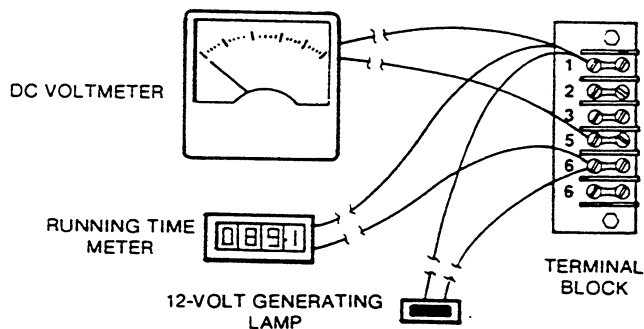


FIGURE 23. DC VOLTmeter, RUNNING TIME METER, AND 12-VOLT LAMP CONNECTIONS

PREPARING GENERATOR SET FOR OPERATION

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 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.

Fuel

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

Ventilation

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

Exhaust System

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

Electrical System

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

Mechanical

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

Battery Connections

In order for the electric generating set to crank efficiently under various operating conditions, the battery and battery cables must be correctly chosen and installed. Before selecting a battery, be sure the installation area is compatible and properly designed. The compartment for the battery must provide:

1. Rigid mounting support.
2. A location where accidental acid spills or leaks won't damage set, battery cables, etc.
3. Provide a minimum of 2 square inches at top and 2 square inches at bottom of battery for ventilation purposes.
4. Battery cable entry points should be sealed (vapor tight) if they enter or pass through living area.

WARNING Mount the battery in a separate compartment from the set or any spark producing device to prevent fire or explosion.

CAUTION Never disconnect the battery with either engine running and never crank both engines simultaneously.

Battery Cables: For reliable starting, voltage drop from the battery terminals to the exciter cranking windings of the generator should not exceed 0.12 volts per 100 amperes of break-away current *while cranking*. Measure voltage at battery terminals and at start solenoid terminals *while cranking*. Disconnect spark plug wire during test. The battery cables in Table 1 will meet this condition if the grounding system is adequate. Connect the battery negative to ground with the same size cable as used for battery positive.

Be sure the frame connection (major frame member if possible) is sufficient to minimize resistance. Try to avoid a connection at a weld or mechanical joint. For short distances, one negative battery cable can be used between set and battery rather than separate cables to chassis ground.

The 6.5 NH draws 75-100 amperes of cranking current. The charging current varies from 1-4 amperes depending on battery condition (state of charge).

For additional installation information, contact your Onan Service Representative or refer to *Technical Bulletin T-012*.

TABLE 1.
RECOMMENDED BATTERY CABLES FOR
RELIABLE COLD WEATHER STARTING

*CABLE LENGTH IN FEET (Metres)	CABLE SIZE
0-10 (0-3)	2
11-15 (3-4.5)	0
16-20 (4.5-6)	000

* Distance from battery to set.

TABLE 2.
MINIMUM 12 VOLT BATTERY SIZE*

Above 32° F (0° C)	Below 32° F (0° C)
360 Cold Cranking Amps (Approximately 70 Amp/Hr)	500 Cold Cranking Amps (Approximately 95 Amp/Hr)

Larger capacity batteries may be required if battery is also used to power other coach accessories.

Service the battery as necessary. Infrequent set use (as in emergency standby service) may allow the battery to self-discharge to the point where it cannot start the set.

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

Operation

GENERAL

This section covers starting and operating the generator set. It is recommended that the operator read through this entire section before attempting to start the set. It is essential that the operator be completely familiar with the set to insure safe operation.

PRE-START CHECKS

Before starting, be sure the following checks have been made and the unit is ready for operation. Refer to the *Maintenance* section for the proper procedures.

Lubrication

Check the engine oil level. Keep the oil as near as possible to the full mark.

Fuel

Make sure the fuel tanks are full and the fuel system primed for operation.

WARNING

Do not permit any flame, cigarette, or other igniter near the fuel system.

Fuel is highly flammable and potentially explosive and could result in severe personal injury or death.

Battery

Check the battery electrolyte level and make sure all terminal connections are secure and free of corrosion.

WARNING

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

CONTROL DESCRIPTION

The following sections describe the function and operation of the generator set control. Several controls are used with the NH generator set depending on the model type. Refer to the section that corresponds to the set control.

Standard

Refer to Figure 24 for the location of each component.

Start/Stop Switch: Three-position switch used for starting and stopping the generator set. Center position in the RUN position.

F1 Fuse: Five Ampere DC fuse. Provides overcurrent protection for optional accessories.

F2 Fuse: Five Ampere DC fuse. Provides overcurrent protection for control circuitry.

Control system provides automatic generator set shutdown for low oil pressure (standard) or high air temperature (optional). Two-step regulated battery charging is standard.

WARNING

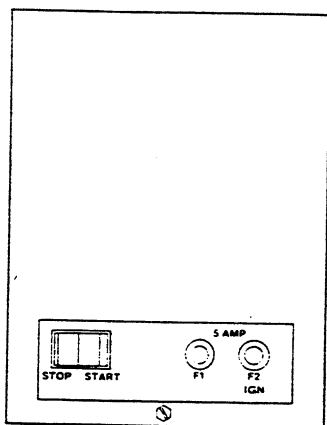
EXHAUST GAS IS DEADLY!

Exhaust gases contain carbon monoxide, a poisonous gas that might cause unconsciousness and death. It is an odorless and colorless gas formed during combustion of hydrocarbon fuels. Symptoms of carbon monoxide poisoning are:

- Dizziness
- Headache
- Weakness and Sleepiness
- Vomiting
- Muscular Twitching
- Throbbing in Temples

If you experience any of these symptoms, get out into fresh air immediately, shut down the unit and do not use until it has been inspected.

The best protection against carbon monoxide inhalation is proper installation and regular, frequent visual and audible inspections of the complete exhaust system. If you notice a change in the sound or appearance of exhaust system, shut the unit down immediately and have it inspected and repaired at once by a competent mechanic.



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FIGURE 24. STANDARD MODEL CONTROL

Mobile Refrigeration Model

Refer to Figure 25 for the location of each component.

Start/Stop Switch: Three-position switch used for starting and stopping the generator set. Center position is the RUN position.

F1 Fuse: Five Ampere DC fuse. Provides overcurrent protection for optional accessories.

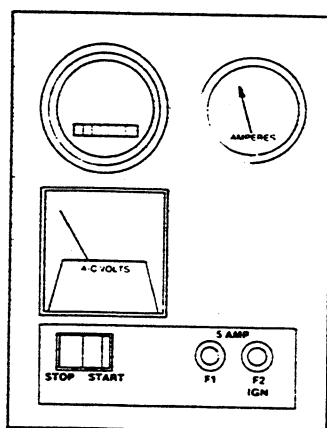
F2 Fuse: Five Ampere DC fuse. Provides overcurrent protection for control circuitry.

Battery Charge Rate DC Ammeter: Indicates battery charging current. Meter range is ± 30 amperes.

Running Time Meter: Registers the total number of hours that the unit has run. Use it to keep a record for periodic servicing. Time is cumulative; meter cannot be reset.

AC Ammeter: Indicates AC generator output voltage.

Oil Pressure Gauge: Indicates engine lubricating oil pressure.



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FIGURE 25. MOBILE REFRIGERATION CONTROL

Control system provides automatic generator set shutdown for low oil pressure (standard) or high air temperature (optional). Two step regulated battery charging is standard.

Contractor's Model

Refer to Figure 26 for the location of each component.

Start/Stop Switch: Three-position switch used for starting and stopping the generator set. Center position is the RUN position.

Voltage Selector Switch: Provides full power generator operation at 120 volts AC when placed in the 120 ONLY position. This avoids placing an unbalanced load on the generator when only 120 volt loads are connected. Power may be drawn simultaneously from the 120 volt duplex receptacle and 240 volt twist lock receptacle when the selector is placed in the 120/240 V position.

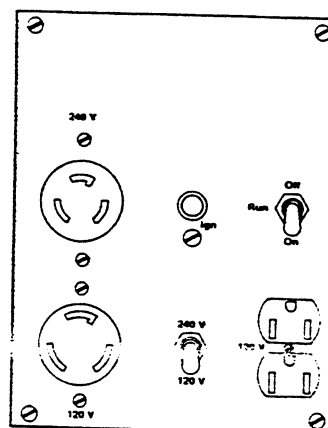
120 Volt Duplex Receptacle: Fifteen Ampere, 120 volt, duplex receptacle. Accepts standard 3-prong plug with ground wire.

120 Volt Twist Lock Receptacle: Thirty Ampere, 120 volt, twist lock receptacle. Accepts 3-prong twist lock plug with ground wire.

240 Volt Twist Lock Receptacle: Twenty Ampere, 240 volt, twist lock receptacle. Accepts 3 prong twist lock plug with ground wire.

F1 Fuse: Five Ampere DC fuse. Provides overcurrent protection for control circuitry.

Control system provides automatic generator set shutdown for low oil pressure (standard). Battery charging is continuous.



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FIGURE 26. CONTRACTOR'S MODEL CONTROL

STARTING/STOPPING

The following sections cover starting and stopping the generator set. New engines sometimes fail to start because the rust inhibitor oil used at the factory during assembly may have fouled the plugs. If necessary, remove the spark plugs and clean in kerosene. Dry the plugs thoroughly and reinstall. Heavy exhaust smoke when the engine is first started is normal and is caused by the rust inhibitor oil.

Electric Start

Push the Start/Stop switch on the control panel to the START position. Release Start/Stop switch as soon as the engine starts. Use short starting cycles (2 to 3 seconds) to provide the longest battery life. The battery is recharged during operation by a battery charger.

Manual Start (Optional on Contractor's Models)

Place the Start/Stop switch on the control panel in the center (RUN) position. Pull the starting rope with a fast steady pull to crank the engine. Do not jerk the rope or let it snap back into the rewind mechanism.

Stopping

Push the Start/Stop switch on the control panel to the STOP position.

GROUNDING REQUIREMENTS

(Contractor's Model)

The generator has all non-current carrying metal parts electrically bonded and solidly connected to the generator neutral to meet National Electric Code requirements for portable AC generator sets. Local code enforcement officials may require that the generator frame be electrically connected to a grounding electrode (water pipe, earth-driven grounding rod, etc.) during operation. A grounding lug (see Figure 26) has been provided for connecting the generator frame to a grounding electrode conductor if required.

WARNING

If faulty electrical equipment is connected to the generator, an electric shock hazard exists which could result in serious personal injury or death. Check all electrical equipment for frayed cords or breaks in the insulation before using.

Properly maintain all electrical equipment used with the generator set. As a minimum measure of protection, use only 3-wire or double insulated equipment. All 3-wire equipment must be used only with properly maintained 3-wire extension cords. Additional backup protection (in case of a faulty equipment grounding wire or flawed insulation) can be provided by Ground Fault Circuit Interrupters (GFCI's). It is recommended that where moisture or faulty cord-and-plug equipment may represent a hazard, GFCI's be used in addition to (but not instead of) the protection provided by 3-wire equipment or double insulation.

LOCATION

(Contractor's Model)

Operate the generator set outdoors where the exhaust gases and engine waste heat can be discharged directly into the open air. Do not operate the generator set indoors or in any type of enclosure that may allow exhaust fumes to accumulate. Do not operate the generator set near an open window, door, air intake, or any other place where exhaust gases may enter the interior of a building.

BREAK-IN PROCEDURE

Controlled break-in with the proper oil and a conscientiously applied maintenance program will help to assure satisfactory service from your generator set. Break-in as follows:

1. One-half hour at 1/2 load (approximately 3,250 watts).
2. One-half hour at 3/4 load (approximately 4,875 watts).
3. Change crankcase oil after the first 25 hours of operation.
4. Use regular grade leaded gasoline for the first 25 hours of operation.

The generator set is designed to operate with a load applied. When possible, avoid running the generator set for extended periods of time without a load, especially during the first 50 hours of operation. Failure to follow the recommended break-in procedure may result in poor piston ring seating.

HIGH/LOW OPERATING TEMPERATURES

The generator set will operate satisfactorily in both high (above 100° F/38° C) and low (below 0° F/-18° C) temperatures. Use the oil recommended in the MAINTENANCE section for the expected temperature conditions.

High Operating Temperatures

1. See that nothing obstructs airflow to and from the generator set.
2. Keep cooling fins clean. Cylinder air housings should be properly installed and undamaged.
3. Keep ignition timing properly adjusted.

Low Operating Temperatures

1. Use fresh gasoline and keep the tank filled to avoid condensation.
2. Keep the spark plug clean and correctly gapped.
3. Maintain the battery in a well charged condition.

EXTREMELY DUSTY OR DIRTY CONDITIONS

Observe the following when operating the generator set in extremely dusty or dirty conditions:

1. Keep the generator set clean and do not allow dust and dirt to accumulate on the set.
2. Check the air cleaner element at least every 25 hours and replace if necessary.
3. Change the crankcase oil every 25 operating hours.
4. Keep oil and gasoline in dust-tight containers suitable for the storage of fuels.

CONNECTING A LOAD

If practical, allow the generator set to warm up before connecting a load. Use the following sections to determine the maximum load that can be connected to the set.

Power Output Rating

The generator set maximum power output is stamped on the nameplate. Do not exceed the maximum power output rating by connecting too many loads.

CAUTION

Continuous overloading will cause high operating temperatures that can damage the generator set. Keep load within the generator's rating.

To determine if the load is within the maximum power output rating of the generator set, add up the wattage requirements of all the electrical loads that will be operated simultaneously. Most appliances or tools have the wattage requirements imprinted on the nameplate. Table 3 can be used as a guide if the wattage requirements are not listed on the equipment. The total should be LESS than the maximum power output rating of the generator set. See Derating section for factors that affect the maximum power output.

TABLE 3. POWER REQUIREMENTS FOR APPLIANCES

Appliance or Tool	Approximate Running Wattage
Air Conditioner	800-4000
Attic Fan	375
Battery Charger.....	Up to 800
Broiler	1325
Clothes Dryer.....	4500
Clothes Washer	250-1000
Coffee Percolator	550-700
Dishwasher (conventional)	300
Dishwasher (heating element).....	1150
Electric Blanket	50-200
Electric Broom.....	200-500
Electric Drill	250-750
Electric Frying Pan.....	1000-1350
Electric Iron	500-2000
Electric Saw	400-1500
Electric Stove (per element)	350-1000
Electric Water Heater.....	1000-1500
Electric Water Pump	500-600
Freezer	300-1000
Furnace Fan	225
Garbage Disposal Unit	325
Hair Dryer	350-500
Space Heater	1000-1500
Microwave Oven	700-1500
Oil Burner	250
Radio	50-200
Refrigerator	600-1000
Sump Pump	250-500
Television	200-600
Vacuum Cleaner	500-1500
Well Water Pump	250-1000

Voltage Selector Switch (Contractor's Models)

The voltage selector switch is standard equipment on contractor's models. When the switch is in the 120 V ONLY position, power may be drawn from the single 120 volt **twist lock** receptacle and from the 120 volt **duplex** receptacle. When the switch is in the 120/240 V position, power may be drawn from the 240 volt **twist lock** receptacle and from the 120 volt **duplex** receptacle. The 120 volt **twist lock** receptacle should only be used when the selector switch is in the 120 V ONLY position. Drawing power simultaneously from the 120 and 240 volt **twist lock** receptacles will place an unbalanced load on the generator set.

Derating

The generator maximum power output is based on operation at sea level at 85°F ambient temperature. When the generator is operated at altitudes above sea level or at temperatures above 85°F, the power rating must be derated. The reduction in the power rating is necessary to compensate for the reduction in engine horsepower that occurs at higher altitudes or higher temperatures.

GAS-GASOLINE CONVERSION

Engines having a combination gas-gasoline carburetor can be switched to gasoline operation by the following procedure:

1. Close the gaseous fuel shutoff valve in supply line, wherever located.
2. Open the gasoline fuel shutoff valve, wherever located.
3. Set the spark plug gap as given in the *Specifications* section.
4. See that the choke is free and works easily (be sure to release choke lock).
5. Start the engine. If the engine runs unevenly under half or full load, the carburetor main jet probably needs adjusting. (Refer to the Adjustments Section).

To change back to gaseous fuel operation, reverse the above procedure.

OUT-OF-SERVICE PROTECTION

Protect a unit that will be out of service for more than 6 months as follows:

1. Run the engine until it reaches normal operating temperature.
2. Turn off the fuel supply and run the engine until it stops.

3. Disconnect battery and store in a cool dry place.
4. Drain oil from oil base while the engine is still warm. Refill with fresh crankcase oil and attach a tag stating viscosity used.

WARNING

Hot crankcase oil can cause burns if spilled or splashed on skin. Keep fingers and hands clear when removing the oil drain plug and wear protective clothing.

5. Remove spark plugs. Pour 1 ounce (2 tablespoons or 28 grams) of rust inhibitor or SAE #50 oil into the cylinders. Crank the engine over a few times. Reinstall spark plugs.
6. Service air cleaner as outlined in *Maintenance* section.
7. Clean governor linkage and protect by wrapping with a clean cloth.
8. Tie a plastic bag over the exhaust outlet to prevent entrance of moisture, dirt, bugs, etc.
9. Wipe entire generator set. Coat rustable parts with a light film of grease or oil.
10. Provide a suitable cover for the entire unit.

To Return to Service

1. Remove cover and all protective wrapping. Remove plug from exhaust outlet.
2. Check tag on oil base and verify that oil viscosity is still correct for existing ambient temperatures.
3. Clean and check battery. If the electrolyte level is low, add distilled water and charge. DO NOT OVERCHARGE.
4. Check that fuel filter and fuel lines are secure, with no leaks.

Maintenance

Regularly scheduled maintenance is the key to lower operating costs and longer service life for the alternator. Use the time intervals shown in the Periodic Maintenance Schedule as a guide for regular maintenance. However, actual operating conditions should be the determining factor in establishing a maintenance schedule. The maintenance time intervals

must be reduced when operating in very dusty or dirty conditions or hot and cold temperature extremes.

WARNING Accidental starting of the set might cause severe personal injury or death. Disconnect the negative battery cable before performing maintenance.

PERIODIC MAINTENANCE SCHEDULE

AFTER EACH CYCLE OF INDICATED HOURS

SERVICE THESE ITEMS	8	25	100	200	400
General Inspection	x ¹				
Check Oil Level	x				
Service Polyband Air Filter (Contractor)		x ²			
Change Crankcase Oil		See Note 3	x ²		
Check Air Cleaner Element			x ²		
Clean Engine Cooling Fins			x ²		
Clean Spark Plugs			x		
Change Oil Filter				x ²	
Replace Spark Plugs				x	
Replace Breaker Points				x	
Clean Crankcase Breather				x	
Clean Governor Linkage				x	
Replace Air Cleaner Element				x ⁴	
Clean Fuel Filter					x
Check Generator Brushes					x
Remove Carbon from Heads					x ⁵
Adjust Valve Lash					x ⁵
Check Battery	MONTHLY				

- 1 - With engine running, visually and audibly check exhaust system for leaks. Refer to Safe Operation Inspection section for inspection procedures.
- 2 - Perform more often under extremely dusty or dirty conditions.
- 3 - Perform after first 25 hours of operation on new sets.
- 4 - Air cleaner element replacement interval for standard model generator sets is 400 hours.
- 5 - Contact an Onan Dealer or Distributor for service.

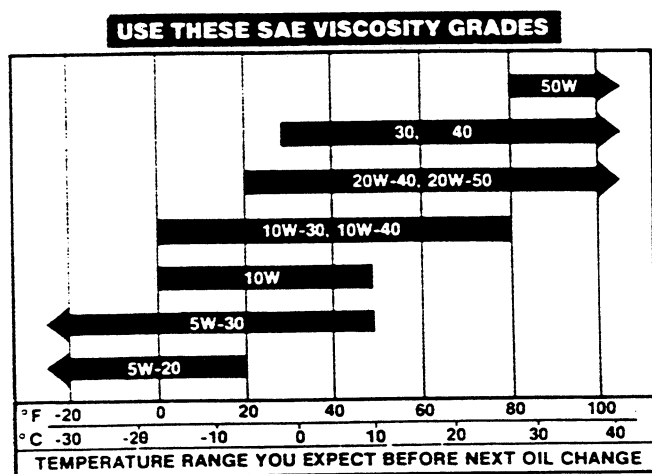
SAFE OPERATION INSPECTION

Make a daily inspection of the generator set. Check for loose or missing parts or for damages that may have occurred during use. Inspect the following items making certain that all connections are secure and all fasteners are tight:

- Battery cable connections
- Fuel line and fittings
- Muffler and exhaust system
- Intake manifold capscrews
- Grounding strap
- Air cleaner wing nut
- Carburetor hold down screws
- Spark plug lead
- Inspect visually and audibly for exhaust leaks

LUBRICATION SYSTEM

Use oil with the API (American Petroleum Institute) designation SF or SF/CC. Oil should be labeled as having passed MS Sequence Tests (also known as having passed ASTM-G-1V Sequence Tests). Refer to oil chart for recommended viscosity.



Oil consumption may be higher with a multigrade oil than with a single grade oil if both oils have comparable viscosities at 210°F (99°C). Therefore, single grade oils are generally more desirable, unless anticipating a wide range of temperatures.

Before adding oil, place the generator set on a level surface and clean the area around the oil plug or dipstick. Refer to the *Specifications* section for the engine oil capacity.

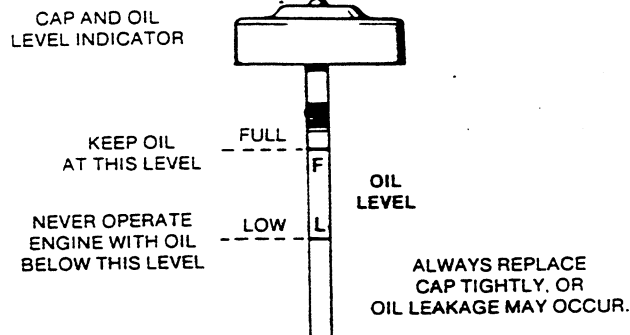


FIGURE 27. OIL LEVEL INDICATOR

Oil Fill

Fill the crankcase until the oil reaches the FULL mark on the oil level indicator (see Figure 27). DO NOT OVERFILL. Overfilling may cause foaming and result in engine damage.

Oil Level Check

Check the oil level daily or after every 8 operating hours and add as required. Check more frequently on a new or reconditioned engine as oil consumption is higher until the piston rings seat. Use the same brand of oil as in the crankcase when adding oil between changes. BE SURE OIL LEVEL IS MAINTAINED.

WARNING Crankcase pressure could force hot oil out of the oil fill opening. Do not check the oil level while the generator set is operating.

Oil and Filter Change

Change the oil after the first 25 hours of operation. Thereafter, change oil at recommended intervals. Remove the oil drain plug and drain oil while the engine is warm. Replace drain plug. Remove oil level indicator and refill with new oil of the proper grade and viscosity. Replace oil level indicator. See Figure 28.

WARNING Hot crankcase oil can cause burns if spilled or splashed on skin. Keep fingers and hands clear when removing the oil drain plug and wear protective clothing.

Change the oil filter after every 200 hours of operation and more often in extremely dusty conditions. Place a pan under the filter and remove by turning counterclockwise. Coat new oil filter gasket lightly with oil and install filter. Turn clockwise until gasket touches mounting base and then tighten an additional 1/2 turn.

WARNING Wipe up oil spills immediately to avoid an accident due to slipping.

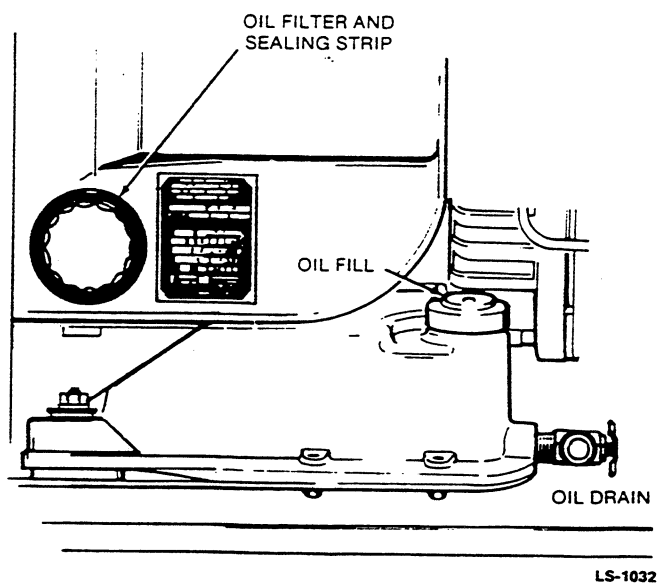


FIGURE 28. OIL AND FILTER CHANGE

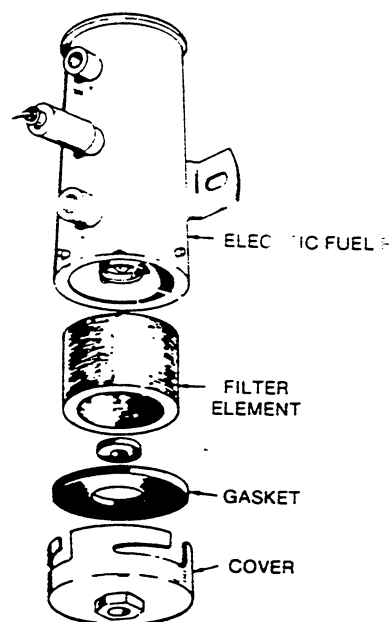


FIGURE 29. ELECTRIC FUEL PUMP

FUEL SYSTEM

Use clean, fresh, unleaded or regular grade gasoline for fuel. Using unleaded gasoline will result in longer spark plug life and better overall performance. If regular grade gasoline is used, carbon and lead deposits must be periodically removed from the cylinder heads to avoid power loss. Do not use highly leaded premium fuels.

WARNING

If an engine is switched to unleaded gasoline after an extended period of operation with regular gasoline, all carbon and lead deposits must be removed from the cylinder heads. Failure to remove deposits could lead to pre-ignition and result in damage to the engine if operated with unleaded gasoline.

Electric Fuel Pump (Contractor's Models)

Service of the fuel pump is limited to cleaning the filter. Drain the fuel pump and check the filter element. Turn the hex nut on the base of the pump to gain access to the filter element. If the element appears dirty, clean it. Be sure to replace gaskets when reassembling (Figure 29).

AIR CLEANER

Check the air cleaner at the recommended interval and more often if operating in dirty or dusty conditions. Refer to the appropriate section for the recommended maintenance procedures.

Standard Model

Check the air cleaner element every 100 hours. Clean by blowing low pressure air through the inside surface of the element. Replace the element every 400 operating hours. Clean or replace more frequently in dusty conditions. See Figure 30.

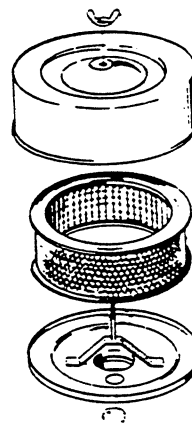


FIGURE 30. STANDARD AIR CLEANER

Mobile Generator

Check the air cleaner element every 100 hours. To remove, loosen the wing nut and take off the end cover (see Figure 31). Remove the element and clean by blowing low pressure air through the inside surface of the element. Replace this element every 200 operating hours. Clean or replace more frequently in dusty conditions.

CAUTION *Air cleaner element has been UL tested for fire control and should never be cleaned by immersing in a liquid.*

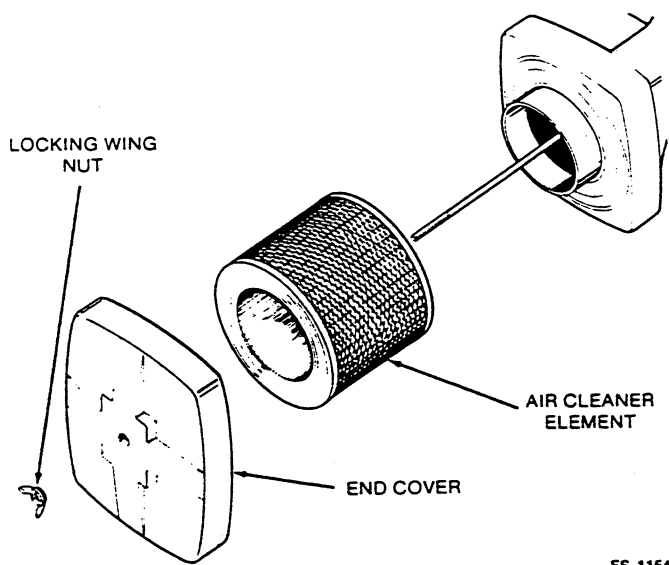


FIGURE 31. MOBILE SET AIR CLEANER

Contractor's Model

A two-stage air cleaner system (see Figure 32) is used with contractor's model generators. Service the polyband filter every 25 operating hours. Check and clean the paper element every 100 hours and replace every 200 hours. Use the following procedures to service.

Air Cleaner Polyband Filter: Wash in water and detergent and squeeze dry like a sponge. Allow to dry, then coat evenly with three tablespoons (44 ml) of SAE 30 engine oil. Knead into and wring excess oil from pre-cleaner. Reinstall over cartridge.

Air Cleaner Element: Clean the element by blowing low pressure air through the inside surface of the element. Clean or replace more frequently in dusty conditions.

COOLING SYSTEM

A flywheel fan cools the generator by blowing or drawing air over the cylinder and cooling fins. The air path is directed by sheet metal shrouds and plates. These shrouds and plates must always be kept in place.

CAUTION *Do not operate generator without shrouds and plates in place or engine will overheat.*

Check and clean (if necessary) the cooling fins at least every 100 hours of operation. Remove any dust, dirt or oil which may have accumulated.

CAUTION *Plugged or clogged cooling fins can cause overheating which might result in damage to the engine.*

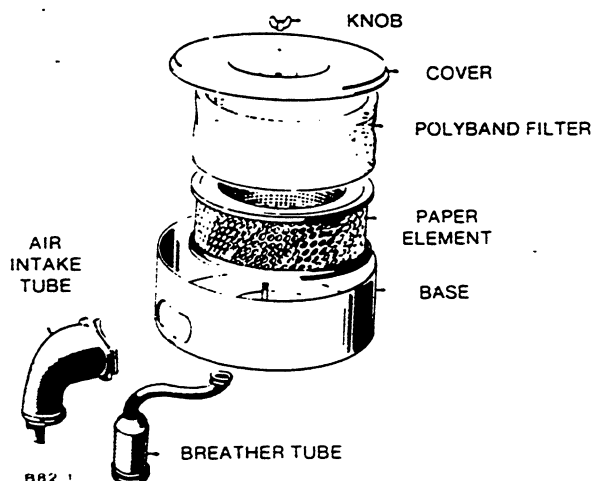


FIGURE 32. CONTRACTOR'S MODEL AIR CLEANER



CRANKCASE BREATHER

This engine uses a crankcase breather valve for maintaining crankcase vacuum. No maintenance is generally required. If the crankcase becomes pressurized as evidenced by oil leaks at the seals, clean baffle and valve in a suitable solvent (Figure 33). Check for cracks or breaks in the breather hose and replace if necessary.

WARNING Most parts cleaning solvents are flammable and could cause serious personal injury if used improperly. Follow the manufacturers recommendations when cleaning parts.

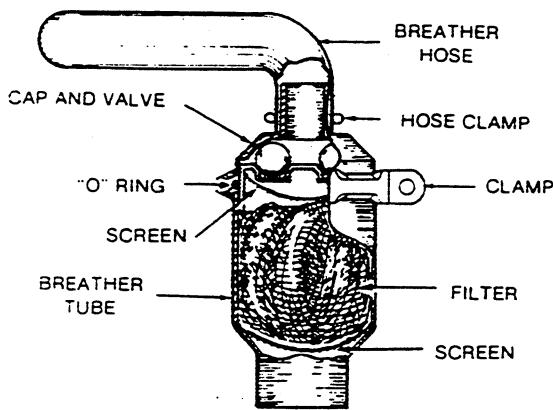


FIGURE 33. CRANKCASE BREATHER

GOVERNOR LINKAGE

The linkage must be able to move freely through its entire travel. Every 200 hours of operation, clean the joints and lubricate as shown in Figure 34. Also inspect the linkage for binding, excessive slack and wear.

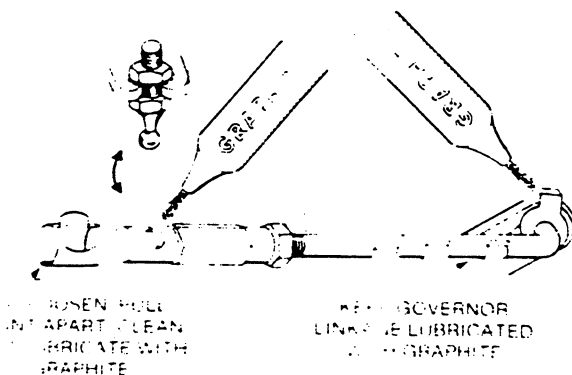
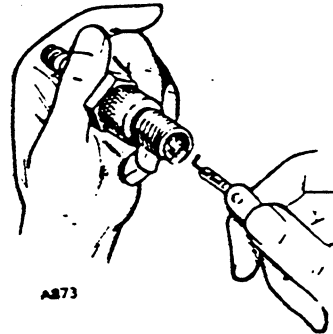


FIGURE 34. GOVERNOR LINKAGE

SPARK PLUGS

Check, clean and reset spark plugs every 100 hours of operation. Replace spark plugs that show signs of fouling or electrode erosion. Spark plug gap for gasoline-fueled units is 0.025 inch (0.64 mm), for gaseous-fueled units, gap is 0.020 inch (0.51 mm). Replace plug at least every 200 hours of operation. See Figure 35.



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FIGURE 35. SETTING SPARK PLUG GAP

BATTERY CARE

To increase battery life, the operator can perform a number of routine checks and some preventive maintenance.

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

1. Keep the battery case clean and dry.
2. Make sure the battery cable connections are clean and tight.
3. Coat the battery terminals with a mineral grease or petroleum jelly to reduce corrosion and oxidation.
4. Identify each battery cable to be positive or negative before making any connection. Always connect the ground (negative) cable last.
5. Maintain the electrolyte level by adding water (drinking quality or better) as needed for filling to split level market.

If the generator is not operated often enough to keep the battery charged, connect battery to a separate charger at least once a month to maintain a full charge.

GENERATOR MAINTENANCE

The generator normally requires little care other than a periodic check of the brushes, commutator and the collector rings. Check the brushes every 400 hours of operation to be sure they can easily move in their holders. Remove any dust or dirt that could prevent movement.

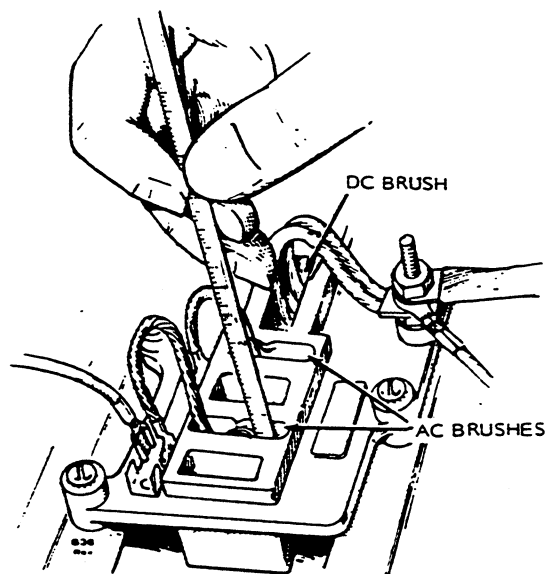
Check the brushes for wear as illustrated in Figure 36. It is not necessary to remove the brush holder unless the brushes and/or brush springs must be replaced.

Collector rings acquire a glossy brown finish in normal operation. Do not attempt to maintain a bright, newly machined appearing surface. Ordinary cleaning with a dry, lint free cloth is usually sufficient. Do not use emery or carborundum paper or cloth. Clean out all carbon dust from the generator.

BRUSH WEAR LIMITS

Condition	DC	AC
New	5/8 IN. (15.8 mm)	11/16 IN. (17.5 mm)
1/2 Wear	13/16 IN. (20.6 mm)	7/8 IN. (22.2 mm)
Replace	1 IN. (25.4 mm)	1-1/16 IN. (26.9 mm)

MEASURE FROM TOP FACE OF
BRUSH BLOCK TO TOP OF BRUSH



G 1148

FIGURE 36. MEASURING BRUSH WEAR

Adjustments

GASOLINE CARBURETORS

The most common cause of poor carburetion is unsatisfactory adjustment of the idle or main mixture adjustment screws. Significant variation from the correct settings may result in serious engine trouble. An overly rich mixture not only wastes fuel, but can increase engine wear by washing the lubricant from the cylinder walls and diluting the crankcase oil. An overly lean mixture results in a loss of power, flat spots in acceleration and a greater tendency to burn valves and spark plugs.

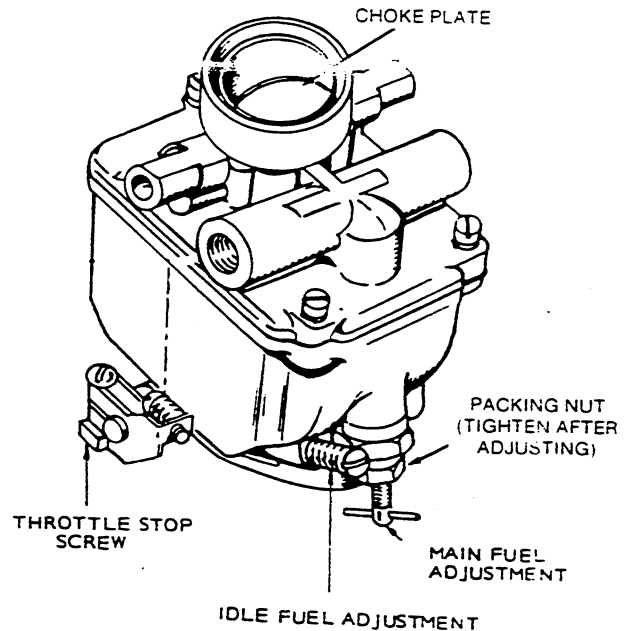
Mixture Screw Adjustments

Mixture screw adjustment should be checked with every engine tune-up and whenever a carburetion problem is suspected. Before adjusting, be sure the ignition system is working properly and the governor is correctly set. If the carburetor is totally out of adjustment, use the mixture settings given in the table as preliminary adjustments. Turn the mixture screws in until lightly seated, then turn out the specified number of turns.

CAUTION Forcing the mixture adjustment screws tight will damage the needle and seat. Turn in only until light tension can be felt.

WARNING T-handled main adjustment screws are locked in position with a packing nut. This nut must be loosened before adjustments are made and retightened afterward. Failure to tighten the packing nut might result in leaking fuel, creating a serious fuel hazard.

Start the engine and allow it to warm up until the choke is completely open, then set the adjustment screws. Refer to Figures 37 and 38 for the location of the idle and main adjustment screws.



STANDARD AND CONTRACTOR'S MODELS

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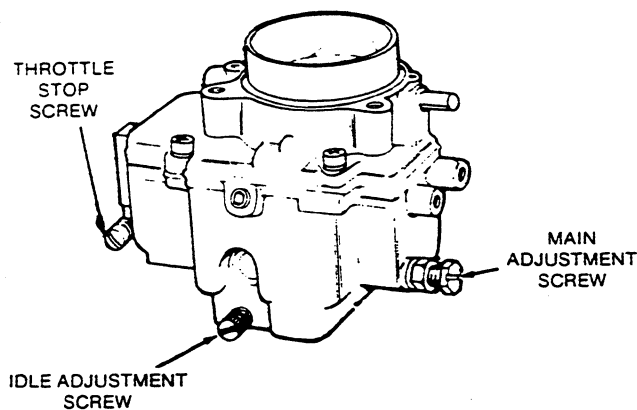
FIGURE 37. MIXTURE SCREWS

Use the following procedure to adjust the idle and main adjustment screws.

1. Remove all electrical loads and connect a voltmeter and frequency meter to the generator set.
2. Pull the governor linkage toward the front of the set so that the throttle lever on the carburetor is resting against the throttle stop screw. Adjust the stop screw to obtain a setting of 90 to 100 volts on the voltmeter.

PRELIMINARY CARBURETOR ADJUSTMENTS

MODEL	MIXTURE SETTINGS	
	IDLE	MAIN
Standard and Contractor	1-1/4	1-1/4
Mobile	7/8-1-1/8	1-1/4 - 1-1/2



MOBILE MODEL

FS 1480

FIGURE 38. MIXTURE SCREWS

3. Continue to hold the governor linkage. Determine the best idle mixture setting by first turning the idle adjustment screw inward until set voltage (or frequency) drops (indicating a lean mixture) and then outward until set voltage (or frequency) drops again (rich mixture). Over a narrow range between these two settings the generator set voltage (or frequency) will remain at its highest. Set the idle adjustment screw slightly outward (rich) from the midpoint of this highest voltage range. Readjust the throttle stop screw as needed to retain the 90 to 100 volt setting.
4. Release the governor and apply a full load to the set. Set the main adjustment screw using the same procedure as given above for idle adjustment. Once again, final adjustment should be to a point slightly outward (rich) from the midpoint of
5. Remove the load from the generator, then observe the stability of the generator set. Adjust the sensitivity of the governor as necessary (see Governor Adjustments section). Add and remove a full load several times to make certain the generator set does not bog down or hunt.

GASEOUS CARBURETORS

The same adjustment procedures are used whether the engine is operating on gaseous fuel or gasoline. However, when the engine is operating on gaseous fuel, neither the float nor the choke is used and the choke must be locked open (refer to *Gas-Gasoline Conversion* section). Figure 39 shows the location of both the gaseous and gasoline mixture screw.

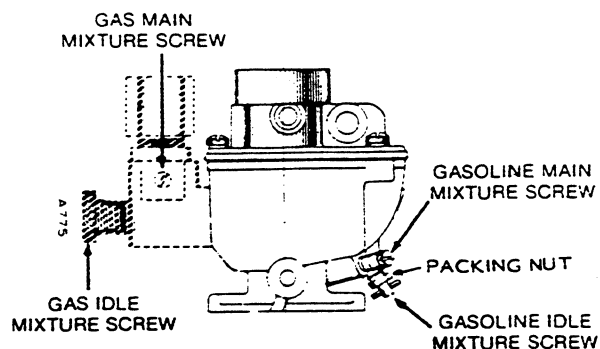


FIGURE 39. GASEOUS CARBURETOR ADJUSTMENTS

CHOKE ADJUSTMENTS

The choke consists of a bi-metal coil and an electric heating element. The bi-metal coil connects to the choke shaft and holds the choke plate nearly closed when the engine is cold.

As the engine starts, current is supplied to the electric heating element in the choke cover. Heat from the element causes the bi-metal coil to twist. The twisting action of the coil turns the choke valve shaft and gradually opens the valve. Heat from the element keeps the choke open while the engine is running.

WARNING *The choke cover gets very hot during normal operation and can cause serious burns if touched. Do not touch the choke cover while the set is operating.*

If the engine starts but runs roughly and blows out black smoke after a minute or two of operation, the choke is set too rich. If the engine starts but sputters or stops before it warms up, the choke is set too lean.

The choke specifications table lists average choke settings. Loosen the two mounting screws and rotate the choke cover until the correct setting is attained. Check the setting by starting the engine and observing its operation. Be sure to retighten the mounting screws after adjustment (see Figure 40).

CHOKE SPECIFICATIONS

AVERAGE CHOKE SETTING	
Ambient Temp.	Choke Opening
58° F (14° C)	closed
66° F (19° C)	1/4 open
72° F (22° C)	1/2 open
76° F (24° C)	3/4 open
82° F (28° C)	open

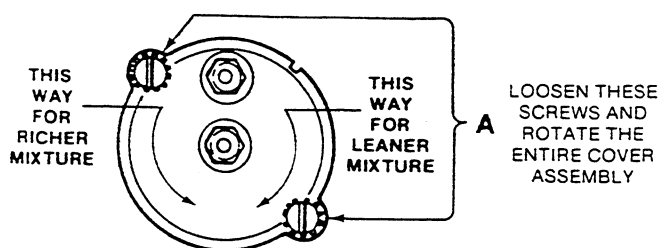


FIGURE 40. CHOKE ADJUSTMENTS

GOVERNOR ADJUSTMENTS

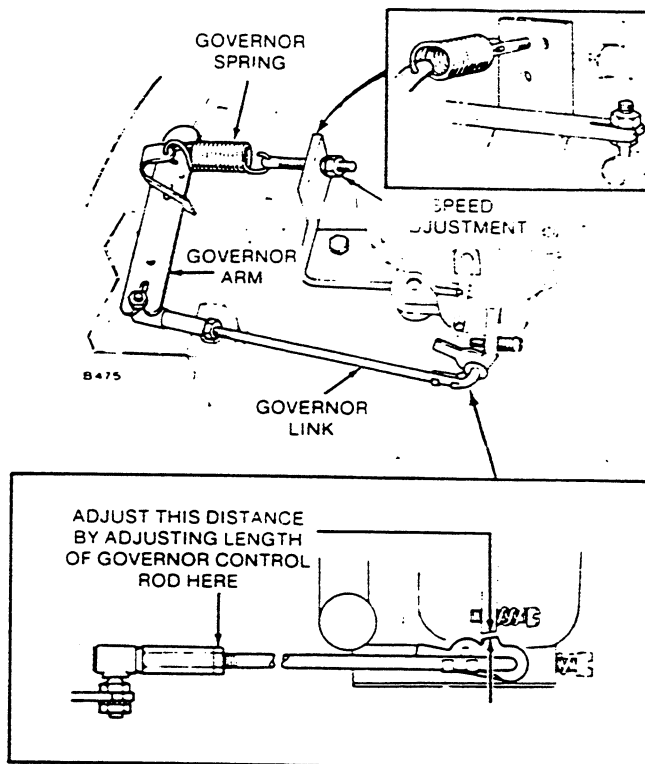
Before making governor adjustments, run the unit about 10 minutes under light load to reach normal operating temperature. If governor is completely out of adjustment, make a preliminary adjustment at no load to first attain a safe voltage and speed operating range.

Adjustments to the governor should be made in the following sequence.

1. Adjust the carburetor idle adjustment screw and main adjustment screw as specified in the Mixture Screw Adjustments section before making any adjustments to the governor.

WARNING Touching hot exhaust pipes or moving parts might result in serious personal injury. Use extreme caution when making adjustments while the engine is running.

2. Adjust the length of the governor linkage and check for binding or excessive looseness. The length of the linkage connecting the governor arm to the throttle shaft assembly is adjusted by loosening the lock nut and rotating the ball joint (see Figure 41). Adjust this length so that with the engine stopped and tension on the governor spring, the stop on the throttle shaft assembly almost touches the stop on the side of the carburetor. (One more turn of the governor ball joint would allow the throttle shaft stop to touch the carburetor). Tighten lock nut.
3. With the warmed up unit operating at **no load**, adjust the tension of the governor spring to obtain 127 volts and 61 hertz for voltage and speed.
4. Check the voltage and speed first with a load applied and then with no load applied. The voltage and speed should stay within the limits shown in the Voltage And Speed Charts table. Adjust the sensitivity to give the closest regulation (least speed and voltage difference between no load and full load) without causing a hunting condition. To increase insensitivity, (closer regulation) shift the spring toward the governor shaft.



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FIGURE 41. GOVERNOR ADJUSTMENTS

VOLTAGE AND SPEED CHARTS

VOLTAGE CHART FOR CHECKING GOVERNOR REGULATION		120 VOLT 60 HERTZ
Maximum No-Load Voltage		132
Minimum Full-Load Voltage		108
SPEED CHART FOR CHECKING GOVERNOR REGULATION		
Maximum No-Load Speed (r/min)		1890
Hertz (Frequency)		63
Minimum Full-Load Speed (r/min)		1770
Hertz		57

5. Recheck the speed adjustment made in step #4.
6. Set the carburetor throttle stop screw as described in the Mixture Screw Adjustments section.

BREAKER POINTS AND IGNITION TIMING

The ignition adjustments should be made with the engine stopped and cold. Make sure feeler gauge is clean and free of any grease, oil or dirt.

The correct point gap setting is 0.020 inch (0.51 mm) and should be adjusted as follows:

1. Remove cover by loosening screw and lift off.
2. To set the point gap, turn the engine crankshaft (with rotation) until the maximum breaker point gap is obtained.
3. Using an allen head wrench, adjust set screw (A) for 0.020 Inch (0.51 mm). Measure point gap with a flat thickness gauge. See Figure 42.

The timing is adjusted during initial engine assembly and is fixed by the point gap adjustment.

4. Replace point box cover.

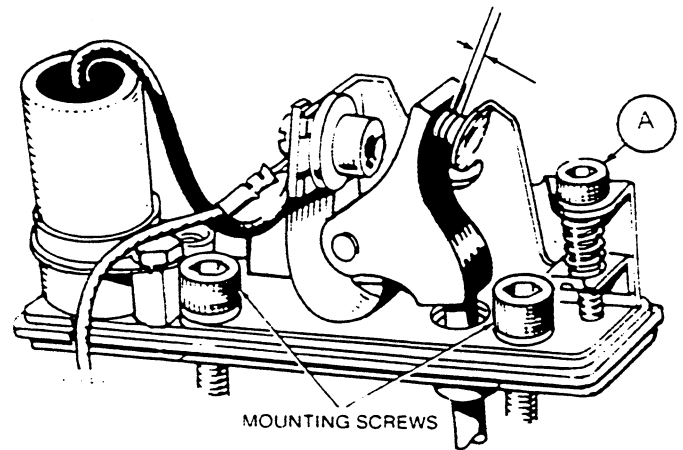


FIGURE 42. BREAKER POINT ADJUSTMENT

