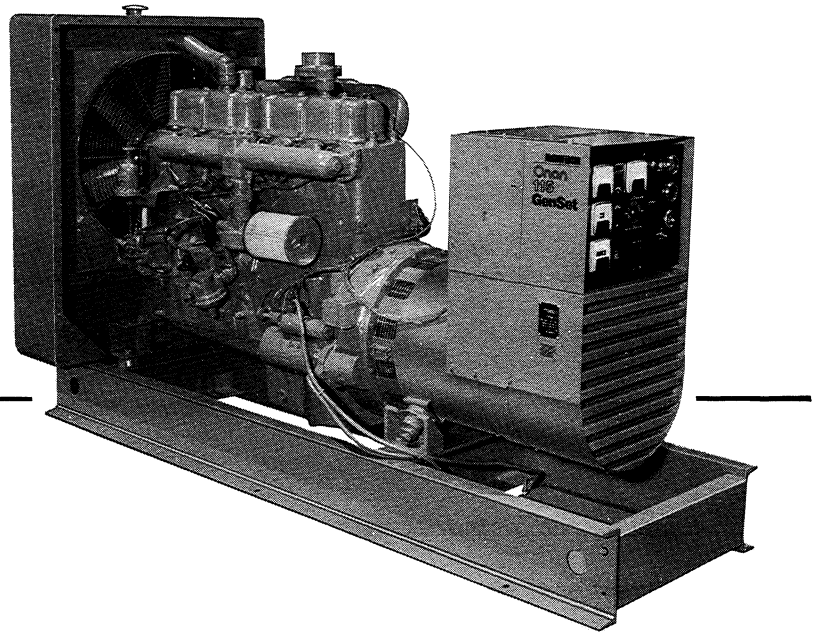
Onan

Operator's Manual

WA

GenSet



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Safety Precautions

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

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

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

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

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

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

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

EXHAUST GASES ARE DEADLY

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

MOVING PARTS CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- Coolants under pressure have a higher boiling point than water. DO NOT open a radiator or heat exchanger pressure cap while the engine is running. Bleed the system pressure first.
- Keep your hands away from moving parts.
- Before starting work on the generator set, disconnect batteries. This will prevent accidental starting.
- Make sure that fasteners on the generator set are secure. Tighten supports and clamps, keep guards in position over fans, drive belts, etc.
- Do not wear loose clothing in the vicinity of moving parts, or jewelry while working on electrical equipment. Loose clothing and jewelry can become caught in moving parts. Jewelry can short out electrical contacts and cause shock or burning.
- If adjustment *must* be made while the unit is running, use extreme caution around hot manifolds, moving parts, etc.

ELECTRICAL SHOCK CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

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

GENERAL SAFETY PRECAUTIONS

- Provide appropriate fire extinguishers and install them in convenient locations. Consult your local fire department for the correct type of extinguisher to use. Do not use foam on electrical fires. Use extinguisher rated ABC by NFPA.
- Make sure that rags are not left on or near the engine.
- Remove all unnecessary grease and oil from the unit. Accumulated grease and oil can cause overheating and engine damage which present a potential fire hazard.
- Keep your generator set and the surrounding area clean and free from obstructions. Remove any debris from set and keep the floor clean and dry.
- Do not work on this equipment when mentally or physically fatigued, or after consuming any alcohol or drug that makes the operation of equipment safe.

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ONAN RECOMMENDS THAT ALL SERVICE, INCLUDING INSTALLATION OF REPLACEMENT PARTS, BE PERFORMED BY QUALIFIED PERSONNEL.

INTRODUCTION

FOREWORD

This manual is applicable to the WA Series electric generating set, consisting of an Onan UR 115.0KW AC generator, driven by a Waukesha F-817-G engine. Information is provided on installation, operation, troubleshooting and parts ordering for the WA set. The manual should be used in conjunction with the Waukesha engine manual, as your specific engine may have variations due to optional equipment available.

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

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

If it is necessary to contact a dealer or the factory regarding the set, always mention the complete Model, Spec No. and Serial No. as given on the ONAN nameplate. This nameplate information is necessary to properly identify your unit among the many types manufactured. Refer to the engine nameplate when requesting information from its manufacturer. The ONAN nameplate is located on the right side of the generator; the Waukesha nameplate is on the right side above the crankcase.

Left side and right side are considered when viewed from the engine or front end of the generating set.

SPECIFICATIONS

ENGINE DETAILS

Engine Manufacturer	Waukesha
Engine Series	F-817-G
Number of Cylinders	6
Displacement	817-cubic inches
BHP @ 1800 RPM (Maximum)	234
Compression Ratio	7.2:1
Bore	5.375-inches
Stroke	6.0-inches
Fuel	Gas/Gasoline
Battery Voltage	12 Volts
Battery Group (Two 6-volt, 190 A.H.)	5D
Starting Method	Solenoid Shift
Governor Regulation	5%

GENERATOR DETAILS

Type	UR
Rating (Watts)	
60 Hertz Continuous Standby	115,000
50 Hertz Continuous Standby	95,000
AC Voltage Regulation	±2%
60 Hertz RPM	1800
50 Hertz RPM	1500
Output Rating	0.8 PF
AC Frequency Regulation	3 Hz Max. No load to Full load
Battery Charging Current	35 Amperes Max.

CAPACITIES AND REQUIREMENTS

Cooling System (Includes Radiator)	15 Gallons
Engine Oil Capacity (Filter, Lines, Crankcase)	20 Quarts
Exhaust Connection (inches pipe thread)	3

AIR REQUIREMENTS (1800 RPM)

Engine Combustion	340 CFM
Radiator Cooled Engine	11,850 CFM
Total for Radiator Cooled Model	13,440 CFM
Alternator Cooling Air	
(1800 RPM)	1250 CFM
(1500 RPM)	1040 CFM
Fuel Consumption at Rated Load	
Gasoline	15.3 GPH
Natural Gas (1000 BTU/cu. ft.)	1800 Cu. Ft./Hr.
Gaseous Fuel (2500 BTU/cu. ft.)	730 Cu. Ft./Hr.

GENERAL

Height	56.875 inches
Width	40.0 inches
Length	103.5 inches
Weight (approx.)	4,310 pounds

TABLE 1. UR GENERATOR VOLTAGE OPTIONS

VOLTS	FREQ.	PHASE	AMPERES	DOUBLE DELTA	SERIES DELTA	PARALLEL WYE	SERIES WYE	REF. VOLTAGE WIRE (W12) TAP
120/240	60 Hz	1	399	x				H5
115/230	50 Hz	1	416	x				H6
120/240	60 Hz	3	346		x			H5
115/230	50 Hz	3	298		x			H6
120/208	60 Hz	3	399			x		H3
127/220	60 Hz	3	377			x		H4
139/240	60 Hz	3	346			x		H5
110/190	50 Hz	3	361			x		H3
115/200	50 Hz	3	344			x		H4
240/416	60 Hz	3	200				x	H3
254/440	60 Hz	3	188				x	H4
277/480	60 Hz	3	173				x	H5
220/380	50 Hz	3	181				x	H3
230/400	50 Hz	3	172				x	H4
9 X R 347/600	60 Hz	3	139					Not Reconnectible

50 Hz.	95KW	118.75KVA	CODE 515
60 Hz.	115KW	143.75KVA	CODE 15

SAFETY PRECAUTIONS

Throughout this manual you will find eye-catching flags containing Warnings and Cautions, alerting you to conditions that could result in danger to you or the equipment, if the notice is ignored.

ONAN recommends that you read your manual and become thoroughly acquainted with it and your equipment before you start your unit. The accumulated experience of ONAN engineers is available to you, enabling you to operate your set in the most efficient and safest manner possible. These recommendations and the following safety precautions are for your protection. Study and know them!

REMEMBER. Most accidents are caused by failure to follow simple and fundamental safety rules or precautions.

Most accidents can be prevented!

KNOW YOUR MANUAL — KNOW YOUR EQUIPMENT

General

- Keep your generating set and the surrounding area clean and free from obstructions. Remove all oil deposits; keep the floor clean and dry.
- Provide appropriate fire extinguishers and install them in convenient locations. Consult your local fire department for the correct type of extinguisher to use. Do not use foam or carbon tetrachloride on electrical fires. Use extinguisher rated ABC by NFPA.
- Make sure that all fasteners on the generating set are secure. Tighten supports and clamps, keep guards in position over fans, driving belts, etc.
- Do not wear loose clothing in the vicinity of moving parts, or jewelry while working on electrical equipment.
- If it is necessary to make adjustments while the unit is running, use extreme caution when close to hot exhausts, moving parts, etc.
- Do not stand on a wet floor while working on electrical equipment. Use rubber insulative mats placed on dry wood platforms.

Fuel System

- DO NOT fill fuel tanks while engine is running, unless tanks are outside engine compartment.
- DO NOT SMOKE OR USE AN OPEN FLAME in the vicinity of the generator set or fuel tank. Internal combustion engine fuels are highly flammable.

  REMEMBER — IF YOU CAN SMELL FUMES — YOU'RE COURTING A POSSIBLE EXPLOSION AND FIRE!
- Make sure that oily rags are not left on or near the engine.
- Fuel lines must be of steel piping, adequately secured, and free from leaks. Piping at the engine should be approved flexible line. Do not use copper piping on flexible lines as copper will work harden and become brittle. Use black pipe on natural gas or gaseous fuels, but not on gasoline or diesel fuel.
- Your engine installation should be equipped with a means of positive fuel shutoff in applications when fuel is conducted from a remote source. Fuels under pressure (e.g. natural gas or liquified petroleum gas) should be controlled by a positive shutoff valve, preferably automatic, in addition to any valve integral with the carburetor or gas regulator equipment.

Exhaust System

- Exhaust products of any internal combustion engine are toxic and can cause injury, or death if inhaled. All engine installations, especially those within a confine, should be equipped with an exhaust system to discharge gases to the atmosphere. Do not use exhaust gases to heat a compartment.

- Make sure that your exhaust system is free of leaks. Ensure that exhaust manifolds are secure and have not warped by bolts unevenly torqued.

Coolant System

- Coolants under pressure have a higher boiling point than that of water. DO NOT open a radiator or heat exchanger pressure cap or break a system while the engine is running, and in no case until the system has been bled off.

- Radiator fan belts are guarded for your protection. DO NOT remove covers or guards.

- Keep your hands away from moving parts.

Ventilation System

- Check remote radiators frequently. Remove any dirt, debris, bird nests, etc.

- Check ventilation louvres frequently. Make sure that free-fall louvres and motor operated louvres open and close properly and that there is no restriction in the free air flow.

Electrical System

The electrical installation exterior to your generator should have been performed by qualified licensed electricians. All local and state codes should have been consulted and complied with. It is essential that all load circuit breakers adequately protect electrical functions, all circuits are properly grounded and wiring is correct capacity.

- Tag open switches.

- DON'T tamper with interlocks.

- Before starting work on the generating set, disconnect batteries. This will prevent inadvertent starting of the set.

- Use extreme caution when making adjustments on the electrical components in the control panel while the engine is running. High voltages are present and could cause serious injury or death.

- DO NOT SMOKE while servicing batteries. Verify correct polarity of battery cables before connecting. Lead acid batteries give off a highly explosive hydrogen gas which can be ignited by electrical arcing or by smoking. When connecting batteries, connect the ground lead last.

⚠WARNING

EXHAUST GAS IS DEADLY!

Exhaust gases contain carbon monoxide, an odorless and colorless gas. Carbon monoxide is poisonous and can cause unconsciousness and death. Symptoms of carbon monoxide poisoning can include:

- ***Dizziness***
- ***Nausea***
- ***Headache***
- ***Weakness and Sleepiness***
- ***Throbbing in Temples***
- ***Muscular Twitching***
- ***Vomiting***
- ***Inability to Think Coherently***

IF YOU OR ANYONE ELSE EXPERIENCE ANY OF THESE SYMPTOMS, GET OUT INTO THE FRESH AIR IMMEDIATELY. If symptoms persist, seek medical attention. Shut down the unit and do not operate until it has been inspected and repaired.

Protection against carbon monoxide inhalation includes proper installation and regular, frequent visual and audible inspections of the complete exhaust system.

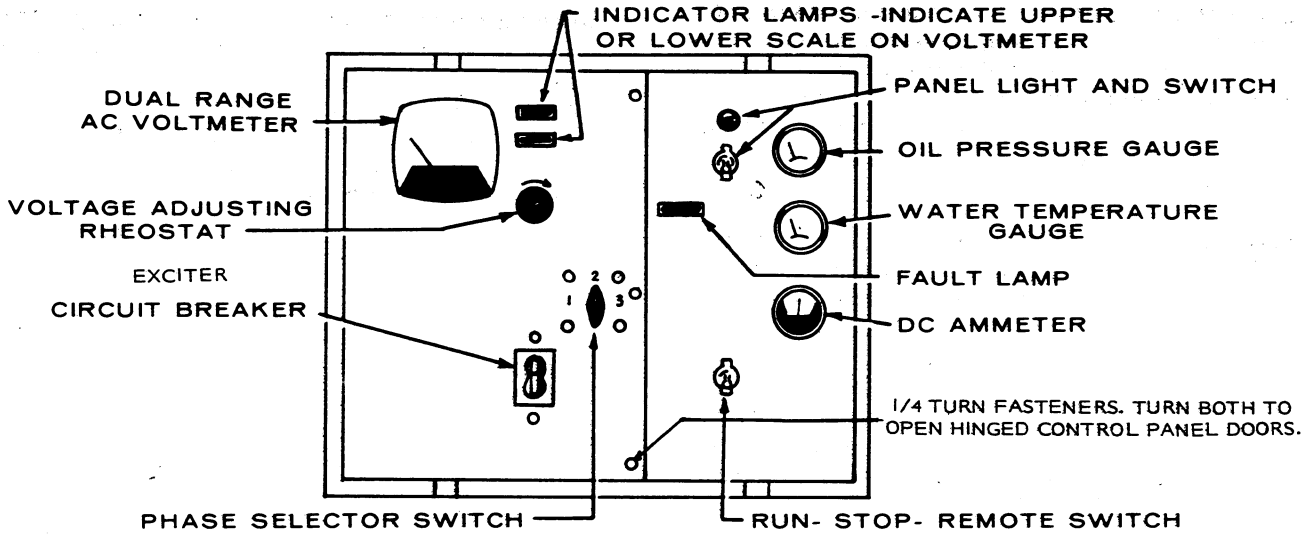


FIGURE 1. TYPICAL CONTROL PANEL (ONE FAULT LAMP)

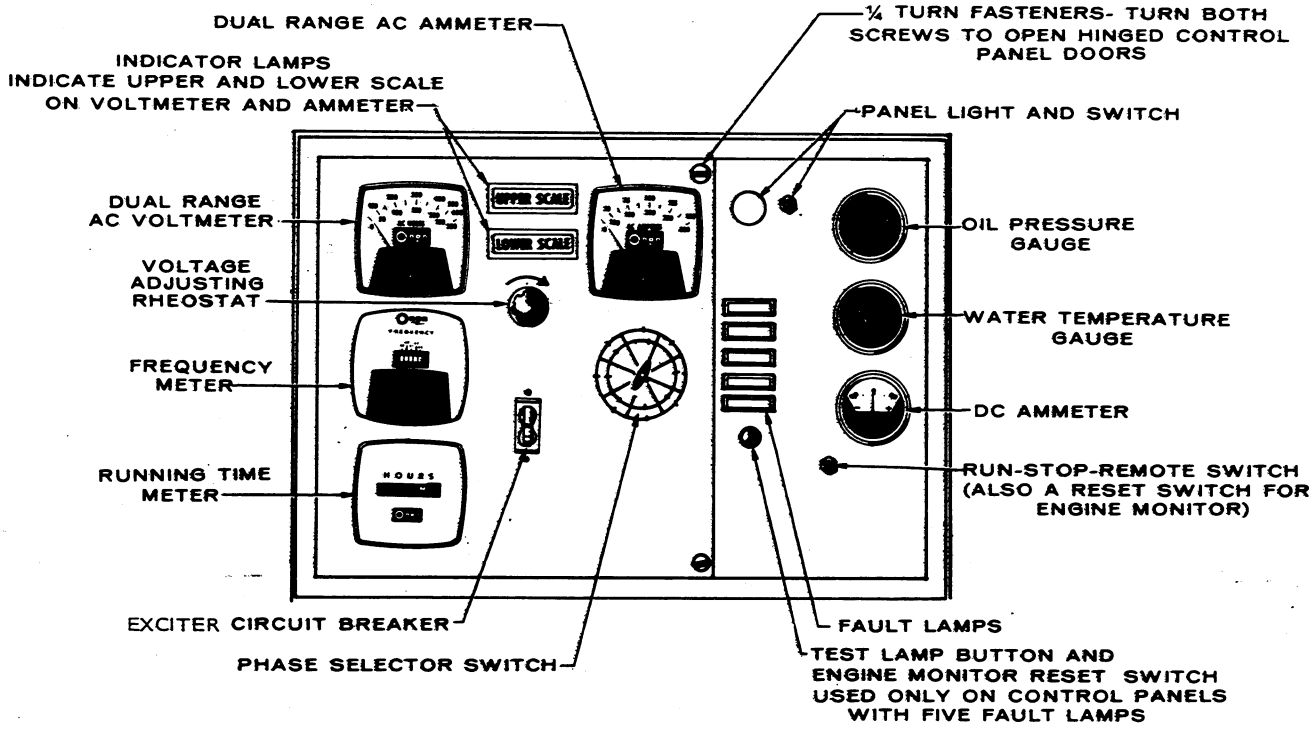


FIGURE 2. OPTIONAL CONTROL PANEL (FIVE FAULT LAMPS)

DESCRIPTION

GENERAL

An ONAN WA Series electric generating set is a complete unit consisting of an engine driven AC generator, with controls and accessories as ordered.

ENGINE

The engine on the WA is a Waukesha F817-G as described in engine manual. Basic measurements and requirements will be found under *Specifications*. However, the engine used for your unit may have variations due to optional equipment available, therefore the Waukesha manual should be consulted.

AC GENERATOR

The generator is an ONAN Type UR 15, 12 lead, 4 pole revolving field, reconnectible, brushless unit. The alternating current is generated in the stator winding. The alternator rotor, attached directly to the engine flywheel turns at engine speed. Therefore, the speed at which the rotor turns, determines generator output frequency. The 60 hertz set operates at 1800 rpm and the 50 hertz at 1500 rpm. Excitation is achieved by feeding AC output to a voltage regulator, where it is compared with a reference voltage in the regulator, rectified and returned to the field of the exciter, then to the exciter armature, rectified and fed to the generator field.

CONTROL PANEL

The following is a brief description of each of the standard controls and instruments located on the face of the panel. See Figure 1.

DC PANEL

Panel Light and Switch: Illuminates control panel.

Oil Pressure Gauge: Indicates pressure of lubricating oil in engine (wired to a sensor unit located on the engine).

Water Temperature Gauge: Indicates temperature of circulating coolant in engine. (Wired to a sensor unit located on the engine.)

Battery Charge Rate DC Ammeter: Indicates the battery charging current.

Run-Stop/Reset-Remote Switch: Starts and stops the unit locally or from a remote location.

Reset Switch: Manual reset for engine monitor after shut-down.

Warning Light: Indicates "Fault" in engine operation.

AC PANEL

AC Voltmeter: Indicates AC generator output voltage. Dual range instrument: measurement range in use shown on indicator light.

AC Ammeter: Indicates AC generator output current. Dual range instrument: measurement range in use shown on indicator lights.

Voltmeter-Ammeter Phase Selector Switch: Selects the phases of the generator output to be measured by the AC voltmeter and AC ammeter.

Voltage Adjusting Rheostat: Provides approximately plus or minus 5% adjustment of the rated output voltage.

Exciter Circuit Breaker: Provides generator exciter and regulator protection from overheating in the event of certain failure modes of the generator, exciter and voltage regulator.

Running Time Meter: Registers the total number of hours, to 1/10th that the unit has run. Use it to keep a record for periodic servicing. Time is accumulative, meter cannot be reset.

Frequency Meter: Indicates the frequency of the generator output in hertz. It can be used to check engine speed. (Each hertz equals 30 rpm.)

OPTIONAL EQUIPMENT

For location of optional panel equipment, refer to Figure 2.

Warning Lights: Eliminates the one "Fault" light and substitutes five indicator lights to give warning of —

a. Overcrank (failed to start)
b. Overspeed
c. Low oil pressure
d. High engine temperature
e. Low engine temperature

Operation of these lights will be discussed in conjunction with engine monitor panel.

Lamp Test: Press to test warning lamp bulbs (when engine is running only).

CONTROL PANEL INTERIOR

The only equipments discussed in this section will be those which the operator may have reason to adjust or inspect for service.

Terminal Board (TB) 21: Connection of wandering lead (W12) to terminals H3, H4, H5 and H6 is made at this point, to change voltage regulator tap when reconnecting generator for different voltages. Refer to Figure 12.

Voltage Regulator: Solid state unit controls AC output from generator at predetermined level regardless of load. Regulation plus or minus 2% from no load to full load, 0.8 PF.

Engine Monitor: Printed circuit plug-in module provides the following functions:

1. A 75 second cranking period.
2. Approximately a 12-1/2 second time delay for oil pressure buildup.
3. An external alarm contact to light a fault lamp and shut down the set for alarm conditions such as:
   a. Overcrank (failed to start after cranking 75 seconds).
   b. Overspeed (engine speed reaches approximately 2100 rpm).
   c. Low oil pressure (approximately 14 psi).
   d. High engine temperature (approximately 215°F).

On standard control panels, all four alarms are wired into one common fault lamp; on units with five fault lamps, four have shutdown alarms, the fifth (low engine temperature) lights a fault lamp only. Refer to Table 2.

TABLE 2. FAULT LAMP OPTIONS

SYSTEM	FAULT	FAULT LAMP	STOP ENGINE	EXTERNAL ALARM	PRE-ALARM
PENN STATE SINGLE LIGHT	Overcrank	x	x	x	
	Overspeed	x	x	x	
	Low Oil Pressure	x		x	
	High Engine Temperature	x		x	
STANDARD SINGLE LIGHT	Overcrank	x	x	x	
	Overspeed	x	x	x	
	Low Oil Pressure	x	x	x	
	High Engine Temperature	x	x	x	
5 LIGHT	Overcrank	x	x	x	
	Overspeed	x	x	x	
	Low Oil Pressure	x	x	x	
	High Engine Temperature	x	x	x	
	Low Engine Temperature	x			
5 LIGHT PRE-ALARM	Overcrank	x	x	x	
	Overspeed	x	x	x	
	Low Oil Pressure	x	*	x	x
	High Engine Temperature	x	*	x	x
	Low Engine Temperature	x			

* - *With additional optional sensors.*

Standard Cranking Module: Limits engine cranking time to 75 seconds. If engine fails to start after 75 seconds the engine monitor lights a fault lamp and opens the cranking circuit.

Start-Disconnect and Overspeed: Plug-in module. Operates at approximately 100 rpm above maximum cranking speed to prevent the starter from being energized while engine is running. Overspeed operates at 2000-2200 rpm. See Figure 3.

OPTIONAL MODULES

Cycle Cranker: Plug-in module replaces standard cranking circuit. Automatically provides a 15-second cranktime and a 10-second rest time for three ON and two OFF cycles in 65 seconds. If engine fails to start, after 75-seconds the engine monitor lights a fault lamp and opens the cranking circuit.

Pre-Alarm: Gives advance warning for low oil pressure or high engine temperature. Requires two sensors, each for engine temperature and oil pressure.

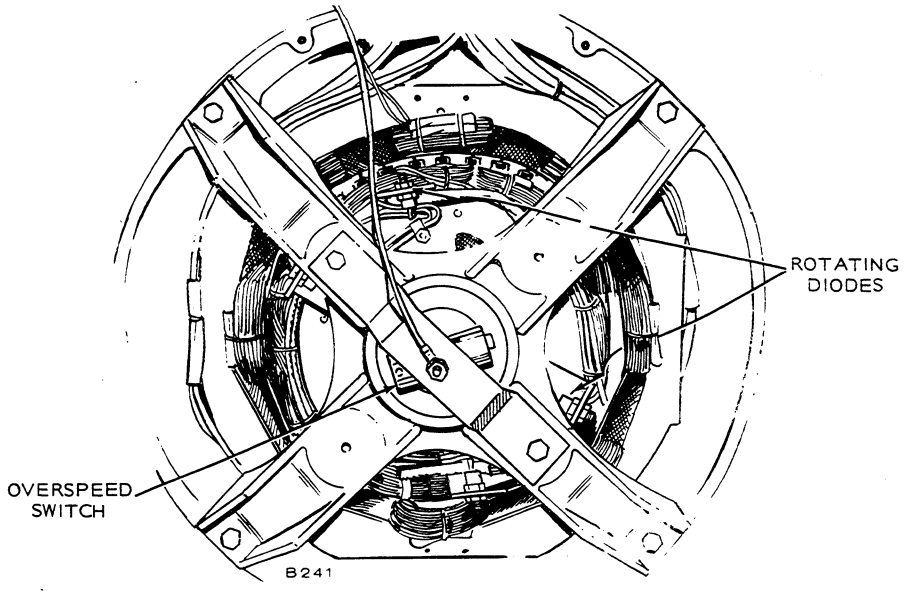


FIGURE 3. OVERSPEED SWITCH

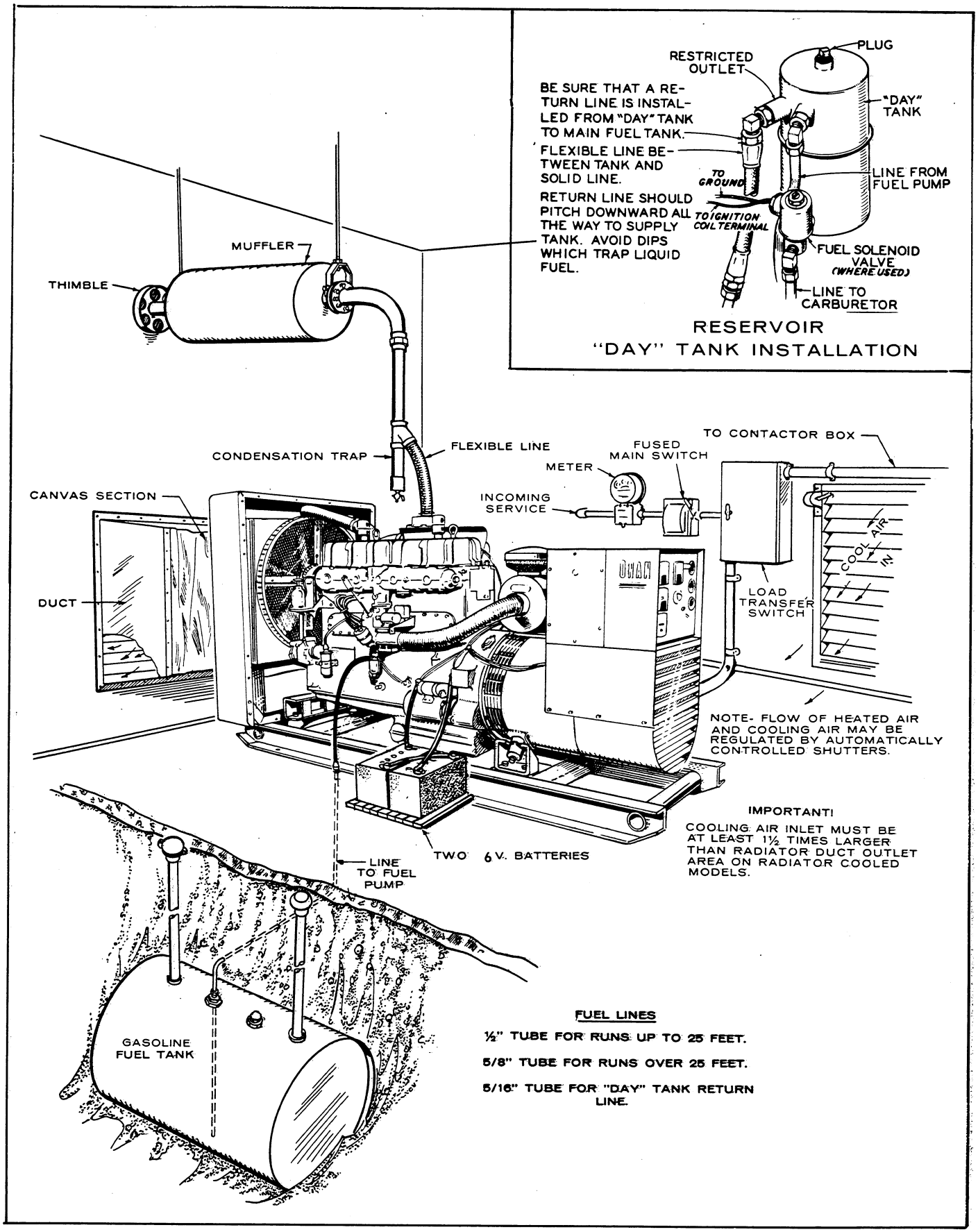


FIGURE 4. TYPICAL INSTALLATION — GASOLINE FUEL, RADIATOR COOLED

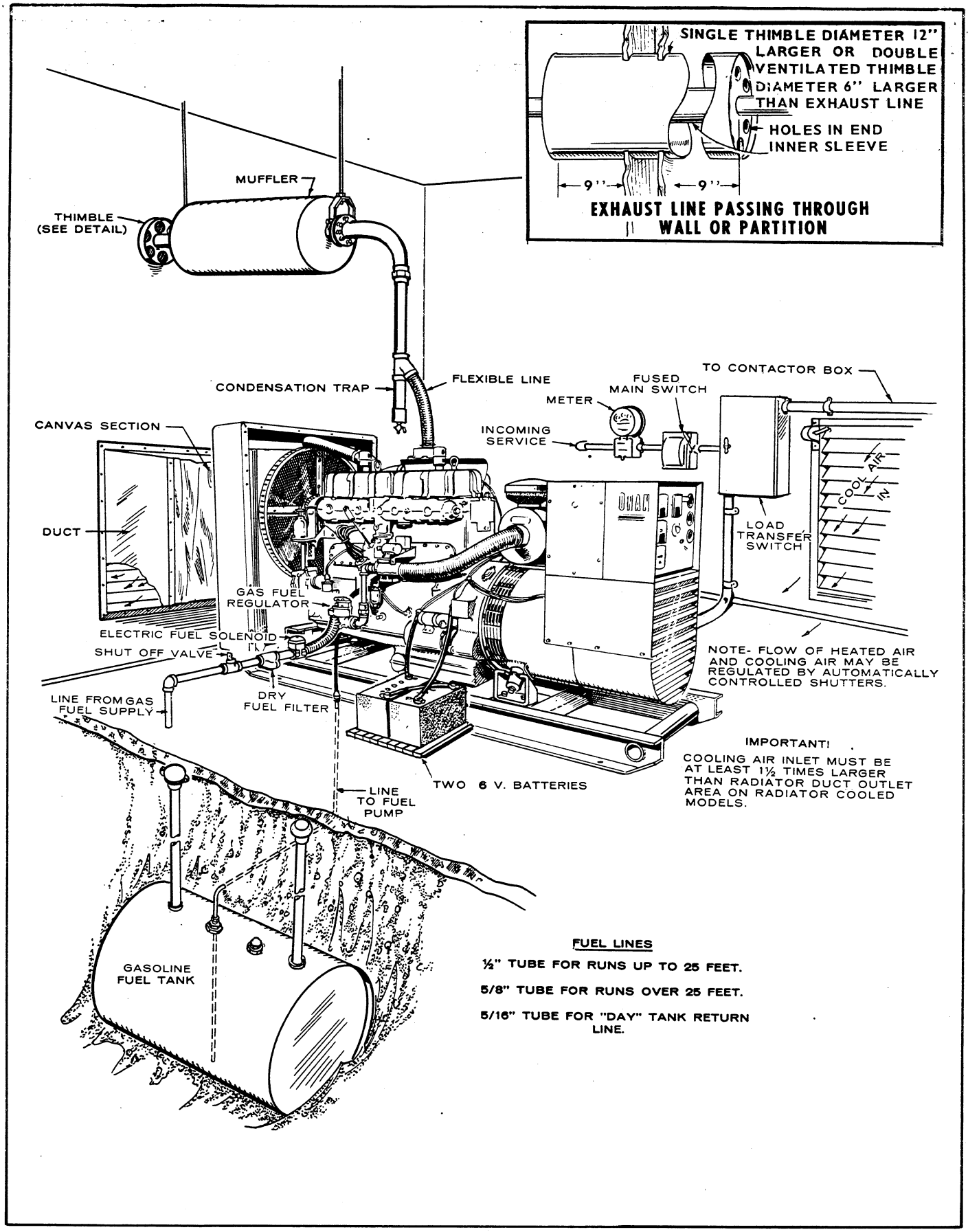


FIGURE 5. TYPICAL INSTALLATION — GAS/GASOLINE FUEL

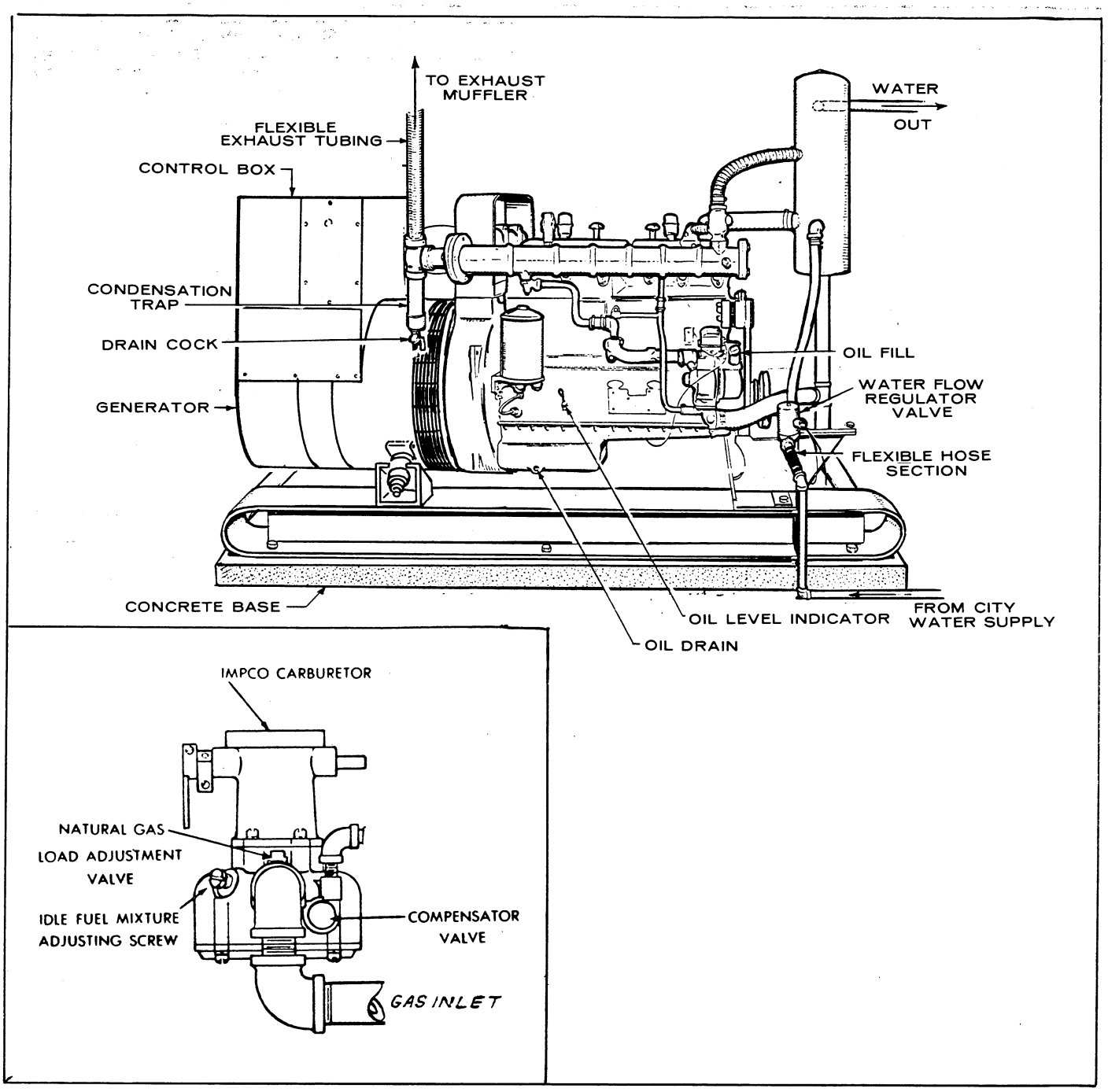


FIGURE 6. TYPICAL INSTALLATION — STANDPIPE-COOLED, NATURAL GAS FUEL

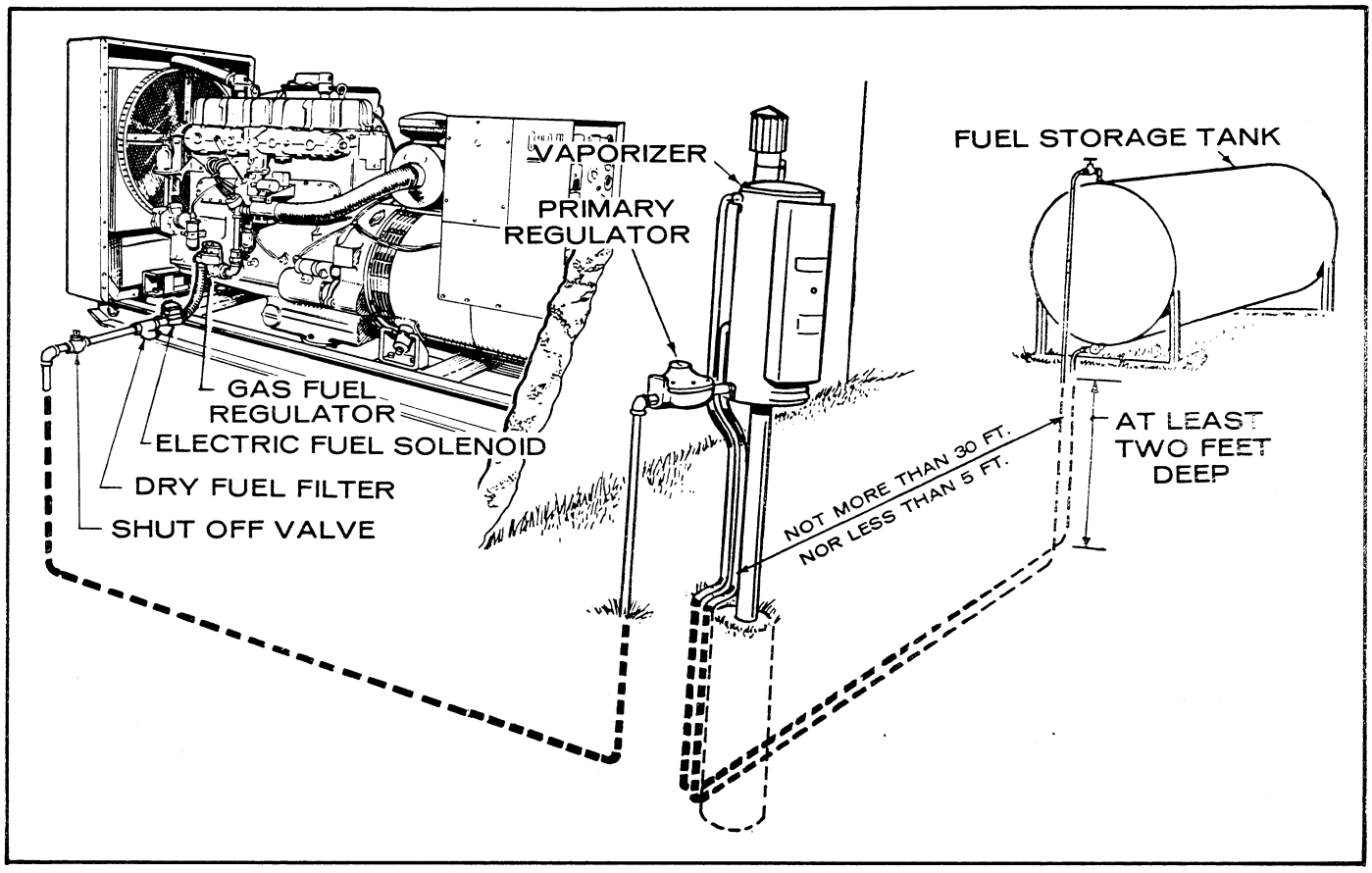


FIGURE 7. TYPICAL INSTALLATION OF LPG WITHDRAWAL SYSTEM

INSTALLATION

GENERAL

Installations must be considered individually. Use these instructions as a general guide. Meet regulations of local building codes, fire ordinances, etc., which may affect installation details. See Figures 4 through 7 for typical installations.

Installation points to consider include:

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

LOCATION

Provide a location that is protected from the weather and is dry, clean, dust free and well ventilated. If practical, install inside a heated building for protection from extremes in weather conditions.

MOUNTING

Generating sets are mounted on a rigid skid base which provides proper support. Install vibration isolators between skid base and foundation. For convenience in draining crankcase oil and general servicing, mount set on raised pedestals (at least 6 inches high). If mounting in a trailer, or for other mobile applications, bolt securely in place. Extra support for the vehicle flooring may be necessary. Bolting down is recommended for stationary installations.

VENTILATION

Generating sets create considerable heat which must be removed by proper ventilation. Outdoor installations rely on natural air circulation but mobile and indoor installations need properly sized and positioned vents for the required air flow. See *Specifications* for the air required to operate with rated load under normal conditions at 1800 rpm.

Radiator set cooling air travels from the rear of the set to the front end. Locate the room or compartment air inlet where most convenient, preferably to the rear of the set. Make the inlet opening at least 1-1/2 times larger than the radiator outlet area.

Engine heat is removed by a pusher fan which blows cooling air out through the front of the radiator. Locate the cooling air outlet directly in front of the radiator and as close as practical. The opening size should be at least as large as the radiator area. Length and shape of the air outlet duct should offer minimum restriction to air flow. Use a duct of canvas or sheet metal between the radiator and the air outlet opening. The duct prevents recirculation of heated air.

Provide a means of restricting the air flow in cold weather to keep the room or compartment temperature at a normal point.

City water cooled sets do not use the conventional radiator. A constantly changing water flow cools the engine. Ventilation is seldom a problem, but sufficient air movement and fresh air must be available to properly cool the generator and support combustion in the engine.

For small compartments, a duct of equal or larger area is recommended to remove the heated air from the generator air outlet to the outside atmosphere. Limit bends and use radius type elbows where needed. A larger, well ventilated compartment or room does not require a hot air duct.

Installations made in a small room may require installation of an auxiliary fan (connected to operate only when the plant is running) of sufficient size to assure proper air circulation.

CITY WATER COOLING

An optional method of engine cooling, in place of the conventional radiator and fan, uses a constant pressure water supply. This is referred to as CITY WATER COOLING. There are two varieties of city water cooling: the HEAT EXCHANGER SYSTEM and STANDPIPE SYSTEM. See Figures 8 and 9.

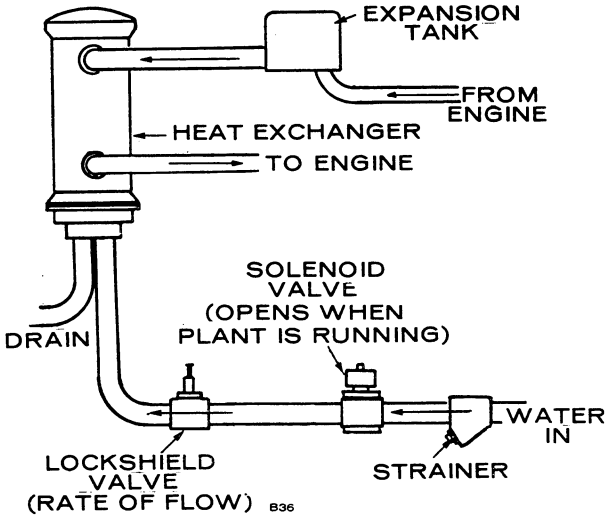


FIGURE 8. TYPICAL HEAT EXCHANGER SYSTEM

The HEAT EXCHANGER provides for a closed engine cooling system. Engine coolant flows through a tubed chamber, keeping the coolant separate from the cool "raw" water supply. The coolant chamber must be filled for operation, as for a radiator cooled set.

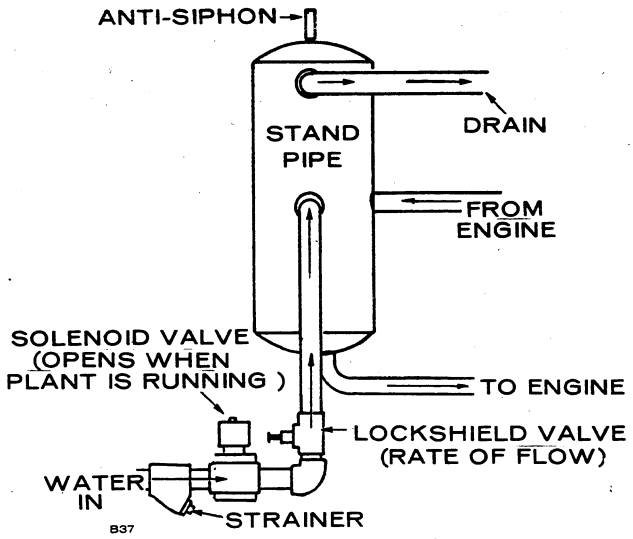


FIGURE 9. TYPICAL STANDPIPE SYSTEM

The STANDPIPE SYSTEM uses a mixing or tempering tank. Cooling water that circulates through the engine mixes with a source of cool "raw" water. The "raw" water supply must be free of scale forming lime or other impurities.

On both systems use flexible pipe for connecting water supply and outlet flow pipes to engine. Pipe the outlet flow to a convenient drain. Install an electric solenoid valve and a rate of flow valve in the water supply line. The electric solenoid valve opens and allows water flow through the system only when the plant operates. The rate of flow valve, either automatic or manual, provides for the proper flow rate to the engine. Adjust the flow to maintain water temperature between 165 degrees and 195 degrees while viewing the water temperature gauge.

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

WATER JACKET HEATER (Optional)

This heater is installed to maintain an elevated engine temperature in lower ambient temperature applications. It heats and circulates engine coolant, and is thermostatically controlled (Figure 16).

EXHAUST

WARNING **Inhalation of exhaust gases can result in death.**

Engine exhaust gas must be piped outside building or enclosure. Do not terminate exhaust pipe near inlet vents or combustible materials. An approved thimble (Figure 10) must be used where exhaust pipes pass through walls or partitions. Pitch exhaust pipes downward or install a condensation trap (Figure 11) at the point where a rise in the exhaust system begins. Avoid sharp bends; use sweeping long radius elbows. Provide adequate support for mufflers and exhaust pipes. Shield or insulate exhaust lines if there is danger of personal contact. Allow at least 9-inches of clearance if the pipes run close to a combustible wall or partition. Use a pipe at least as large as the 3-inch pipe size outlet of the engine with a flexible portion

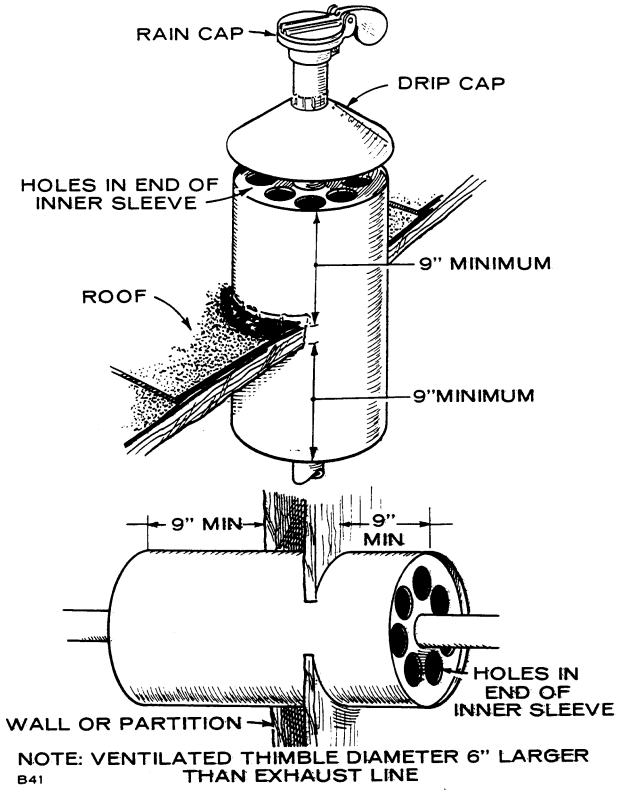


FIGURE 10. EXHAUST THIMBLE

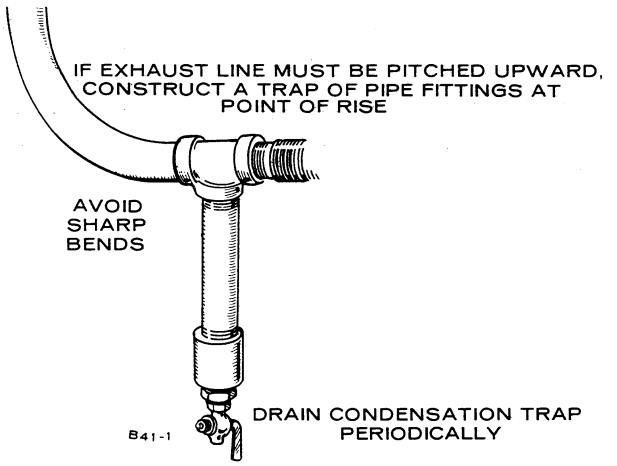


FIGURE 11. EXHAUST CONDENSATION TRAP

between the engine and the muffler. Do not connect a flexible line to the exhaust manifold. Minimum diameters and maximum lengths of pipe are as follows:

Single Exhaust system:

4-inch pipe	76-feet
5-inch pipe	260-feet
6-inch pipe	530-feet

FUEL CONNECTIONS

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

1. **Gasoline Fuel (Figure 4):** Use 1/2 inch tubing to connect the engine fuel pump inlet to an approved fuel tank installation. If the set is equipped with the one-quart "DAY" reservoir tank above the carburetor, install a fuel return line (5/16 inch tube size) to return excess fuel to the supply tank. Be sure this line has a continuous drop to the supply tank, avoiding traps.

   Comply with local regulations when installing any gasoline supply tank. Underground tanks usually have the fuel outlet at the top, requiring a drop or suction tube extending down to within an inch or two of the bottom. All supply connections must be air tight to ensure that the pump will lift the fuel from the tank. The fuel lift from the supply tank to the fuel pump should not exceed 6 feet, and the horizontal distance not more than 50 feet. Use 1/2-inch tubing for up to 25 feet, 5/8-inch tubing up to 50 feet. Use a suitable adapter fitting to fit the 1/4-inch pipe thread on the fuel pump inlet opening.

2. **Combination Gas-Gasoline (Figure 5):** These sets are designed for normal operation on gas fuel, with provisions for emergency operation on gasoline. Follow procedures given for gas fuel connections. A reservoir tank is sometimes provided, so a fuel return line may be necessary as described for gasoline fuel.

3. **Natural or Manufactured Gas:** On sets equipped with the Impco carburetor, the gas pressure at the carburetor must be set at 3 ounces (5-inches water column) with the engine running at 1800 rpm at no load. If the pressure is excessive, adjust the Thermac regulator. Be sure to comply with all local regulations such as:
   - Recommended electric shutoff valve.
   - Hand shutoff valve at the fuel source.
   - Supply line filter.

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

4. **LPG Fuel (Figure 6):** Liquified petroleum gas-fueled sets are equipped with a vaporizer system combined with a pressure reducing regulator. Use only approved materials and methods to connect to the supply source. Install a liquid fuel filter in the supply line and an electric solenoid valve. Refer to the engine control wiring diagram for solenoid valve connections. An emergency hand shutoff valve should be provided.

For operation in below freezing weather, a gas-fired vaporizer should be installed as shown in Figure 7. The carburetion system must then be changed to LPG vapor withdrawal.

Models shipped after June 15, 1967 had the Thermac pressure reduction valve inverted as shown in Figure 12. When changing from natural gas to LPG vapor withdrawal, remove the spring (Figure 12, Item 3) and replace Items 1 and 2. This valve now becomes a zero pressure valve.

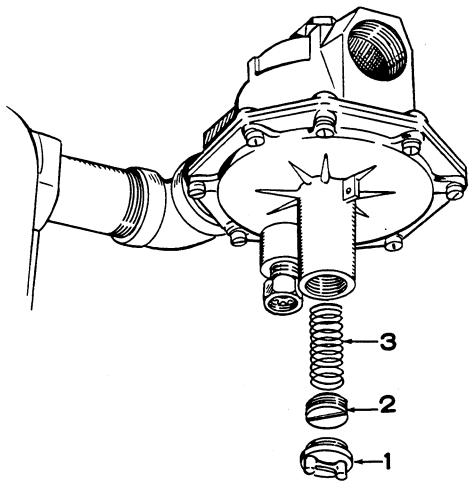


FIGURE 12. SPRING REMOVAL FOR LPG

BATTERY

Starting the plant requires 12-volt battery current. Use two 6-volt (see specification) batteries for a normal installation. Connect the batteries in series (negative post of first battery to positive post of second) as in Figure 13. Necessary battery cables are on unit. Service the batteries as necessary. Infrequent plant use (as in emergency standby service) may allow the batteries to self-discharge to the point where they cannot start the plant. If installing an automatic transfer switch that has no built-in charge circuit, connect a separate trickle charger. Onan automatic transfer switches include such a battery charging circuit.

WARNING **Do not smoke while servicing batteries. Lead acid batteries give off explosive gases while being charged.**

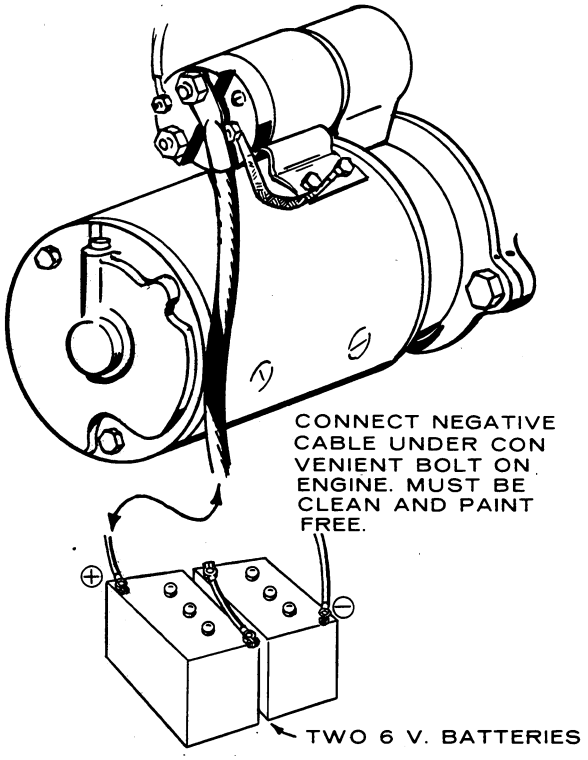


FIGURE 13. BATTERY CONNECTION

BATTERY, HOT LOCATION

Batteries will self discharge very quickly when installed where the ambient temperature is consistently above 90° F, such as in a boiler room. To lengthen battery life, dilute the electrolyte from its normal 1.275 specific gravity reading at full charge to a 1.225 reading. The cranking power is reduced slightly when the electrolyte is so diluted, but if the temperature is above 90° F, this should not be noticed. The lengthened battery life will be worth the effort.

1. Fully charge the battery.
2. With the battery still on charge, draw off the electrolyte above the plates in each cell. DO NOT ATTEMPT TO POUR OFF; use an hydrometer or filler bulb and dispose of it in a safe manner. Avoid skin or clothing contact with the electrolyte.
3. Refill each cell with distilled water, to normal level.
4. Continue charging for 1 hour at a 4 to 6 hour rate.
5. Test each cell. If the specific gravity is still above 1.255, repeat steps 2, 3, 4 until the reading is reduced to 1.225. Usually, repeating steps twice is sufficient.

REMOTE CONTROL CONNECTIONS

Provision is made for addition of remote starting. This is accomplished on a 4 place terminal block situated within the control box. Connect one or more remote switches across remote terminal and B+ terminal as shown in Figure 14. If the distance between the set and remote station is less than 1000-feet, use No. 18 AWG wire, between 1000- and 2000-feet, use No. 16 AWG wire.

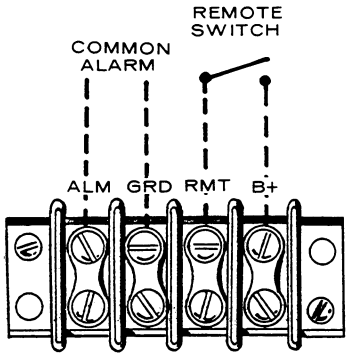
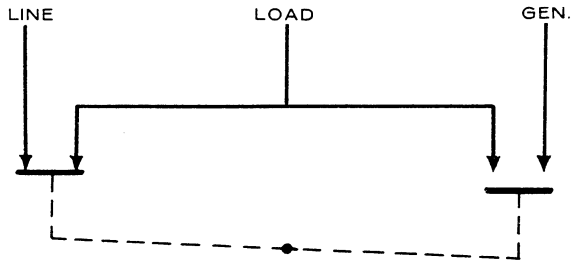


FIGURE 14. REMOTE CONTROL

WIRING CONNECTIONS

Most local regulations require that wiring connections be made by a licensed electrician and that the installation be inspected and approved before operation. All connections, wire sizes, etc. must conform to requirements of electrical codes in effect at the installation site.

If the installation is for standby service, a double throw transfer switch (Figure 15) must always be used. Connect this switch (either automatic or manual) so that it is impossible for commercial power and generator power to be connected to the load at the same time. Instructions for connecting an automatic transfer switch are included with such equipment.



NOTE: SHOWN WITH LINE CONNECTED TO LOAD.

FIGURE 15. LOAD TRANSFER SWITCH

CONTROL BOX CONNECTION

Reconnection lead W12 on TB21 is a jumper which connects a single phase output from the generator to the appropriate tap on the voltage reference transformer. This lead is connected at one end to terminal 63 on the terminal board (see Figure 16). The other end will be connected to a terminal marked H3, H4 or H5 depending upon the voltage option required. Refer to Table 1 and Figure 18 for voltages available and correct hookup.

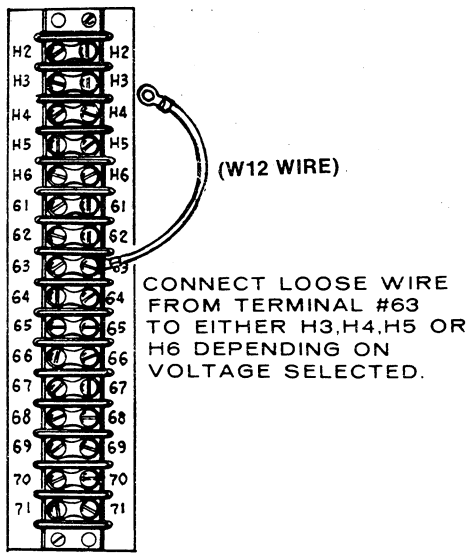


FIGURE 16. TERMINAL 63 CONNECTIONS

GENERATOR CONNECTIONS

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

1. Remove either right, left or top panel from control box. See Figure 17.

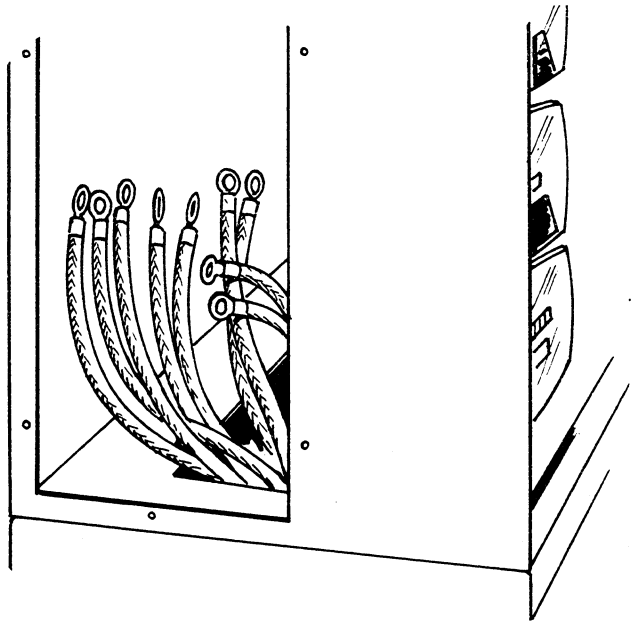


FIGURE 17. CONTROL BOX (SIDE PANEL REMOVED)

2. Connect wires together as shown in Figure 18 according to voltage desired.

Preceding instructions do not apply to models with a 347/600 voltage (designated 9X); these connections are made at the factory. The installer must only connect load wires.

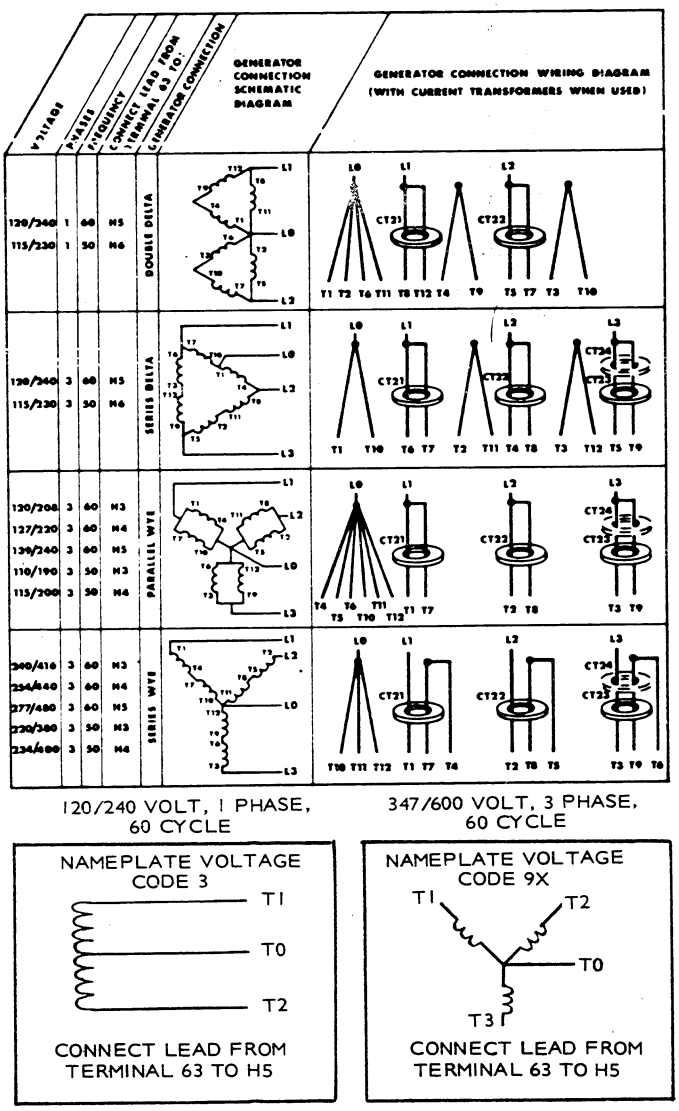


FIGURE 18. VOLTAGE CONNECTIONS

120/240 Volt, Single Phase; 12 Lead (Figure 19): Terminal connection L0 can be the grounded (neutral). For 120 volts, connect the hot load wire to either L1 or L2. Connect the neutral load wire to L0. Two 120-volt circuits are thus available, with not more than 1/3 the rated capacity of the plant available on either circuit. If using both circuits, be sure to balance the load between them.

For 240 volts, connect one load wire to L1 and the second load wire to L2. Terminal connection L0 is not used for 240-volt service.

For this connection only 2/3 of nameplate rating can be taken.

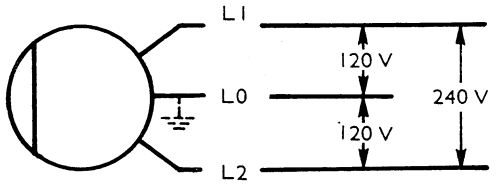


FIGURE 19. 120/240 VOLT, SINGLE PHASE, 12 LEAD

120/240 Volt, 3 Phase, 4 Wire Delta Connected Plant; 12 Lead (Figure 20): The 3 phase Delta connected plant is designed to supply 120 volt and 240 volt, 1 phase current and 240 volt, 3 phase current.

For 3 phase operation, connect the three load wires to the three plant terminal connections L1, L2 and L3 — one wire to each. For 3 phase operation, L0 is not used.

For 120 volt, 1 phase, 3 wire operation, L1 and L2 are "hot." L0 is the neutral, which can be grounded if required. For 120 volt service, connect the load wire to either L1 or L2. Connect the neutral wire to L0. Two 120 volt circuits are available. Any combination of 1 phase and 3 phase loading can be used at the same time as no terminal current exceeds the NAMEPLATE rating of the generator. If no 3 phase output is used, usable 1 phase output is 2/3 of 3 phase KVA.

When using 240-volt single phase, connect loads between L1 and L2 for best voltage regulation.

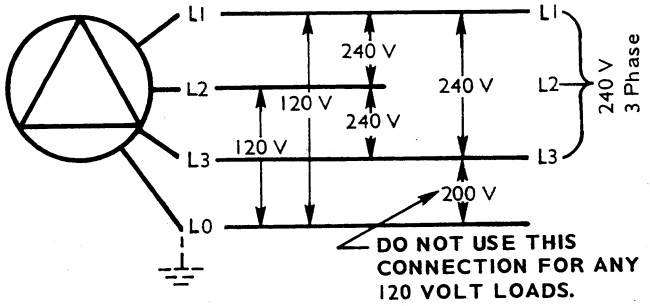


FIGURE 20. 3 PHASE, DELTA CONNECTION, 12 LEAD

3 Phase, 4 Wire, Wye Connected Plant; 12 Lead (Figure 21): The 3 phase, 4 wire plant produces line to neutral voltage and line to line voltage. The line to neutral voltage is the lower voltage as noted on the plant nameplate, and the line to line voltage is the higher nameplate voltage.

For 3 phase loads, connect separate load wires to each of the plant terminal connections L1, L2 and L3. Single phase output is obtained between any two 3 phase terminal connections.

The terminal marked L0 can be grounded. For 1 phase loads, connect the neutral load wire to L0. Connect the load wire to any one of the other three terminal connections — L1, L2 or L3. Three separate 1 phase circuits are available, with not more than 1/3 the rated capacity of the plant from any one circuit.

If using 1 phase and 3 phase current at the same time, use care to properly balance the 1 phase load, and not to exceed rated line current.

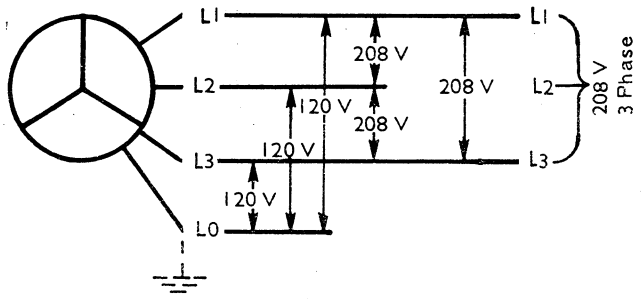


FIGURE 21. 3 PHASE, WYE CONNECTION, 12 LEAD

Figure 21 shows load connections for 120/208 voltage. Other voltages are available from either parallel wye or series wye illustration in Figure 18.

OPERATION

GENERAL

ONAN WA Series electric generating sets are given a complete running test under various load conditions and thoroughly checked before leaving the factory. Inspect your unit closely for loose or missing parts and damage which may have occurred in transit. Tighten loose parts, replace missing parts and repair any damage before putting set into operation.

PRESTART SERVICING

Lubrication System: Engine oil was drained and rust inhibiting oil applied to cylinders prior to shipment. Fill engine to capacities shown. After engine has been run, check dipstick, add oil to bring level to full mark. Record total capacity for future oil changes. Refer to Waukesha engine manual for engine oil recommendations. Note that for average operating conditions oils conforming to Military Specifications MIL-L-2104B and MIL-L-45199A (Series 3) are recommended. Do not mix brands or grades of lubricating oils.

Oil viscosity is determined by the oil operating (not ambient) temperature:

OIL OPERATING TEMPERATURE	USE SAE VISCOSITY
210° - 250°F	40
160° - 200°F	30
130° - 160°F	20

See engine service manual for more details.

Oil Capacities (nominal)

Oil Pan	18 quarts
Filter and Oil Lines	2 quarts
Total	20 quarts

Cooling System: Cooling system was drained prior to shipment. Fill cooling system before starting. Total capacity is 15 gallons. For units using either a radiator or heat exchanger (city water cooled), fill the system with clean, soft water. Use a good rust and scale inhibitor additive. If a possibility exists of a radiator cooled set being exposed to freezing temperatures, use anti-freeze with an ethylene-glycol base. During initial engine run, check the coolant level several times and replenish if necessary to compensate for air pockets which may have formed during filling. Refer to Waukesha manual for additional information.

CAUTION **Verify that the electric solenoid valve used with city water cooled plants is open before initial starting of plant to allow coolant chambers to fill. Overheating and damage to the engine could result from non-compliance.**

Ensure that water supply for city water cooling is turned ON.

Batteries: Ensure that the cable connections to the batteries are secure. Coat connections with petroleum based or non-conductive grease to retard formation of corrosive deposits.

Check level of electrolyte to be at split ring mark. Measure specific gravity of electrolyte: SG 1.275 at 70°F. If distilled water has been added or specific gravity is less than 1.275, place batteries on charge until desired reading is reached. Do not over charge.

Fuel System: For reasons of safety all gas installations in closed areas or buildings should have a positive shut-off valve to prevent gas leakage when engine is not operating.

Normal fuel pressure to the carburetor is 5 inches water column at idle for 1000 B.T.U. natural gas. For natural gases of different thermal value it may be necessary to adjust carburetor intake pressure. Refer to Waukesha engine manual for further information on fuel system.

STARTING

When the preceding service functions have been performed, recheck to verify unit is ready to start.

1. Crankcase filled.
2. Cooling system filled — input solenoid valve open.
3. Batteries charged and connected.
4. Fuel solenoid valve open.

To start, move the "run-stop/reset-remote" switch to the "run" position. The engine should start after a few seconds of cranking. When the engine starts, excessive blue smoke will be exhausted and the engine will run rough for a few minutes. This is caused by the pre-shipping rust inhibitor being burned off. When this has been achieved the engine will run smoothly and the blue exhaust smoke will disappear.

Immediately after start, observe the oil pressure gauge. Normal oil pressure is between 40 and 50 psi. Check the following gauges:

1. DC Ammeter — 10 to 30 amperes.
2. AC Voltmeter — AC generator output voltage.
3. Frequency Meter — AC generator output frequency.

After running 10 minutes under load the water temperature gauge should have stabilized at 160° to 180° F. On city water cooled units an adjustable valve is connected in the water supply line. Adjust the hand wheel valve to provide a water flow that will keep the water temperature gauge reading within the range of 165° to 195° F.

STOPPING

To reduce and stabilize temperatures within the engine run the engine at no load for 3-5 minutes before shutting down.

Move the run-stop/reset-remote switch to stop position to shut down the set.

Break-in Note: Run set at 50% rated load for the first half-hour of initial operation after reaching operating temperature.

Non-Start: If after a few seconds of cranking engine fails to start, or starts and runs then stops and fault lamp lights, refer to appropriate troubleshooting chart, Table 3 or Table 4.

EXERCISE PERIOD

Generating sets on continuous standby service are required to be operative at full load from a cold start in less than 10-seconds in the event of a power outage.

This imposes severe conditions on the engine. Friction of dry piston rings upon dry cylinder walls causes scuffing and rapid wearing. These can be relieved by exercising the set at least once a week for a minimum time of 30-minutes per exercise period. Preferably, run the set under at least 50 percent load to allow the engine to reach normal operating temperature. This will keep engine parts lubricated, maintain fuel prime, prevent electrical relay contacts from oxidizing and insure easy emergency starts. ONAN automatic transfer switches contain an optional exercise switch which, by pre-selection, will start, determine run period and shut down a set on a weekly frequency. For example, the switch can be set for time of start, length of run, A.M. or P.M. and day of week.

After each exercise period, top up fuel tank, check engine for leaks and unit for general condition. Locate cause of leaks (if any) and correct.

NO LOAD OPERATION

Periods of no load operation should be held to a minimum. If it is necessary to keep the engine running for long periods of time when no electric output is required, best engine performance will be obtained by connecting a "dummy" electrical load. Such a load could consist of heater elements, etc.

TABLE 3
TROUBLESHOOTING ENGINE SHUTDOWN SYSTEM
(Units with only one fault lamp)

SYMPTOM	CORRECTIVE ACTION
1. Fault lamp lights and engine stops cranking after approximately 75 seconds.	1. See engine service manual for troubleshooting fuel system, ignition system, etc. After correcting problem, reset the engine monitor by moving run-stop/reset-remote switch to reset position. Release and return to run position.
2. Fault lamp lights immediately after engine starts.	2. Check for: a. overspeed condition as engine starts. b. high temperature condition. c. faulty high engine temperature sensor or overspeed switch. d. faulty starter disconnect.
3. Fault lamp lights after engine is running.	3. Check the following: a. Oil level-engine will shut down after approximately 12-1/2 seconds if low oil pressure sensor does not open. b. Oil pressure sensor may be defective. c. High engine temperature - caused by low coolant level, faulty thermostat, etc. d. Faulty high engine temperature sensor. e. Faulty starter disconnect.
4. Fault lamp lights - no fault condition exists.	4. Be certain that no fault condition exists. Disconnect lead 29, 30 and 31 from TB11 inside control box (refer to wiring diagram). If fault lamp still lights with leads disconnected, remove and replace engine monitor plug-in printed circuit board.

TABLE 4
TROUBLESHOOTING ENGINE SHUTDOWN SYSTEM
(Units with five fault lamps)

SYMPTOM	CORRECTIVE ACTION
1. Overcrank fault lamp lights and engine stops cranking after approximately 75 seconds.	1. See engine service manual for troubleshooting fuel system, ignition system, etc. After correcting fault, reset monitor by moving run-stop/reset-remote switch to reset position, then to either run or remote to restart engine.
2. Overcrank fault lamp lights after engine has run for approximately 75 seconds.	2. Replace start-disconnect circuit board.
3. High engine temperature lamp lights as soon as engine starts.	3. Check for defective sensor or actual high temperature condition.
4. Low oil pressure lamp lights after engine is running.	4. Check: a. Oil level - engine will shut down after approximately 12-1/2 seconds if oil pressure is low.
5. High engine temperature lamp lights after engine is running.	5. Check for: a. Defective thermostat/thermostats. b. Low coolant level. c. Defective high engine temperature sensor.
6. Overspeed lamp lights - no fault condition exists.	6. Replace overspeed circuit board.
7. Low oil pressure fault lamp lights - no fault condition exists.	7. Be certain that no fault condition exists. Disconnect lead 30 from TB11 inside control box (refer to wiring diagram). If low oil pressure lamp still lights, remove and replace engine monitor plug-in printed circuit board.
8. High engine temperature fault lamp lights - no fault condition exists.	8. Be certain that no fault condition exists. Remove lead 31 from TB11 inside control box (refer to wiring diagram). If high engine temperature lamp still lights, remove and replace engine monitor plug-in printed circuit board.
9. When pressing test lamp button - one or more fault lamps do not light.	9. Fault lamp/lamps burned out - replace. Engine not running.

OUT-OF-SERVICE PROTECTION

Protect a set that will be out-of-service for more than 30 days as follows:

1. Run set until thoroughly warm.
2. Drain oil from oil base while still warm. Refill and attach a warning tag stating oil viscosity used.
3. Remove each spark plug. Pour 1 ounce (two tablespoons) of rust inhibitor (or SAE #10 oil) into each cylinder. Crank engine over several times. Install spark plugs.
4. Service air cleaner as outlined in Waukesha Manual.
5. Clean throttle linkage and protect by wrapping with a clean cloth.
6. Plug exhaust outlets to prevent entrance of moisture, bugs, dirt, etc.
7. Wipe entire unit. Coat parts susceptible to rust with a light film of grease or oil.
8. Disconnect battery and follow standard battery storage procedure.
9. Provide a suitable cover for the entire unit.
10. See Waukesha engine manual.

HIGH ALTITUDE

Ratings apply to altitudes up to 1000 feet, standard cooling and normal ambients. Consult factory or nearest authorized Onan distributor for operating characteristics under other conditions.

Engine horsepower loss is approximately 3 percent for each 1000 feet of altitude above sea level for a naturally aspirated engine. Use lower power requirement at high altitudes to prevent smoke, overfueling and high temperatures.

HIGH TEMPERATURES

1. See that nothing obstructs air flow to-and-from the set.
2. Keep cooling system clean.
3. Use correct SAE No. oil for temperature conditions.

LOW TEMPERATURES

1. Use correct SAE No. oil for temperature conditions. Change oil only when engine is warm.
2. Use fresh fuel. Protect against moisture condensation.
3. Keep fuel system clean and batteries in a well charged condition.
4. Partially restrict cool air flow but use care to avoid overheating.
5. Connect water jacket heater when set is not running.
6. Refer to Waukesha manual for further information.

Water Jacket Heater: The function of this optional heater is to keep the engine warm enough to assure starting under adverse weather conditions. Connect the heater to a source of power that will be on during the time the engine is not running. Be sure the voltage rating is correct for the heater element rating (Figure 22).

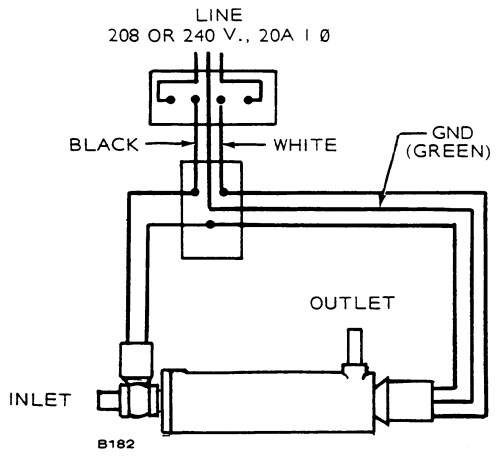


FIGURE 22. ENGINE HEATER

CAUTION **Do not energize heater until engine cooling system is filled with coolant.**

GENERAL MAINTENANCE

GENERAL

Follow a definite schedule of inspection and servicing, based on operating hours. Use the running time meter to keep a record of operation and servicing. Service periods outlined below are for normal service and operating conditions. For continuous duty, extreme temperature, etc., service more frequently. For infrequent use, light duty, etc., service periods can be lengthened accordingly.

RECOMMENDED MAINTENANCE SCHEDULE

MAINTENANCE ITEMS	8 HRS.	50 HRS.	200-250 HRS.
Check Gasoline Supply	x		
Check Oil Level	x		
Check Air Cleaner	x		
Check Radiator Level	x		
Clean Unit	x		
Inspect for Leaks, etc.	x		
Change Crankcase Oil		x	
Lubricate Governor Linkage		x	
Replace Oil Filter		x	
Clean & Check Spark Plugs			x
Reset or Replace Ignition Points			x
Check Ignition Timing			x
Check Valve Clearance			x
Clean Crankcase Breathers			x
Clean Fuel Sediment Bowl			x
Check DC Alternator Brushes			x

ENGINE

Refer to the Waukesha manual for details and periodic maintenance.

ENGINE SPEED

Generator frequency is a direct ratio to the engine speed. Engine speed is controlled by the governor. The original factory governor setting should not be disturbed. If necessary to readjust, refer to instructions in the Waukesha manual. Adjust the engine speed to 1800 rpm for 60 hertz operation and 1500 rpm for 50 hertz operation. Use an accurate tachometer for setting engine speed, or a frequency meter connected to the AC generator output terminals. Multiply frequency by 30 to obtain engine speed.

EXAMPLE: 30 times 60 (hertz) equals 1800 rpm

Check generator voltage. It may be necessary to make a slight readjustment of the speed setting to obtain the preferred voltage at average load. A range of 1830 to 1890 rpm (61 to 63 hertz) should give the desired voltage.

BATTERIES

Check the condition of the starting batteries at least every two weeks. See that connections are clean and tight. A light coating of grease or asphalt paint will retard corrosion at terminals. Keep the electrolyte at the proper level above the plates by adding distilled water.

CONNECTIONS (Fuel, Exhaust, etc.)

Operator should periodically make a complete visual inspection of the plant while running at rated load. Some of the things to check for are as follows:

1. Check all fuel and oil lines for possible leakage.
2. Inspect exhaust lines and mufflers for possible leakage and cracks.
3. Periodically or daily drain moisture from condensation traps.
4. Inspect water lines and connections for leaks and security.
5. Inspect electrical wires for security.

GASOLINE (Only) CARBURETOR CHOKE

The gasoline only carburetor may be equipped with an electrically heated choke. A heating element inside the choke cover acts upon a thermal coil to turn the choke shaft and valve. The choke cover outer edge is divided into small sections by raised marks, one of which is emphasized by an asterisk (*). See Figure 23. A long raised line on the side of the choke housing is used as a reference mark. The normal choke setting is made with the * mark aligned with the reference line. If adjustment is necessary, loosen the three cover retaining screws and turn the cover one or two marks. Turn counterclockwise for more choking action, or clockwise if less choking is desired. Retighten the retaining screws.

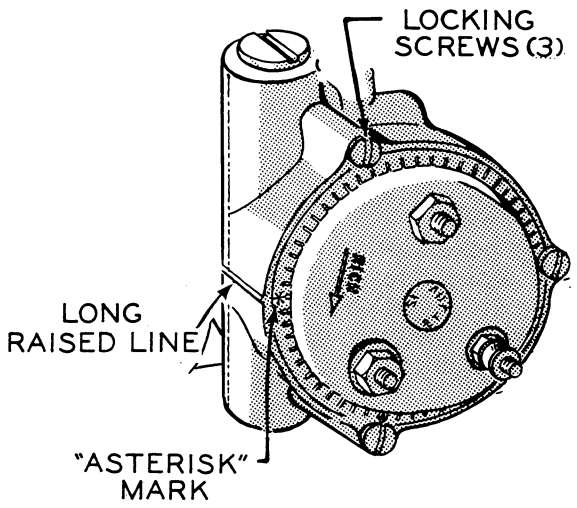


FIGURE 23. CHOKE ADJUSTMENT

SISSON CHOKE

The Sisson choke (Figure 24) may be found on some combination gas-gasoline fueled plants. For "cold" starts with gasoline fuel, the Sisson choke provides complete choke closing. Partial choking occurs during a "hot" start. When gas fuel is used, the electric choke arm must be locked to make it inoperative. An offset weight on the carburetor choke shaft provides the necessary choking for starting.

Gas Operation: The arm of the Sisson electric choke must be mechanically locked in the open position. Pull the arm down, engage the lock and tighten as shown. See that the offset weight is properly positioned for full (closed position) choking for starting. The choke must be free to blow open with the incoming air stream, its extent of opening is determined by the load conditions.

Gasoline Operation: The mechanical lock must be released to allow proper choke action. The choke linkage overrides the offset weight action, providing full choking action for cranking, and gradual opening during warmup by means of a heating element under the choke base. Be sure the heating element works properly.

Be sure the GAS-GASOLINE toggle switch is at its appropriate operating position.

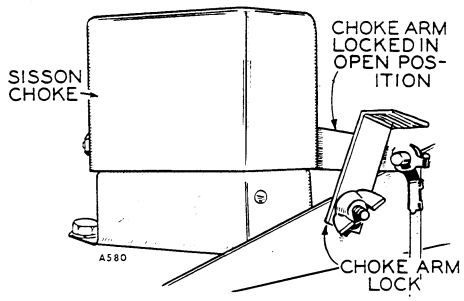


FIGURE 24. SISSON CHOKE

Adjustment: Extremes in ambient operating temperatures should not necessitate any readjustment of the choke. However, if the original factory settings have been disturbed, proper settings must be restored. Refer to Figure 25.

1. Remove the induction air hose at the carburetor air inlet, to observe the action of the choke valve plate.
2. Be sure the choke body is mounted to allow horizontal positioning of the choke valve plate shaft.
3. See that the override lever assembly is properly positioned, as shown, so that the valve plate is free to move from the fully closed to wide open position while the Sisson mechanism arm is held down.
4. Position the offset weight on the shaft so that, with the choke plate closed, the top of the weight is horizontally level.
5. Slip the Sisson choke assembly snap-on cover upward to remove it.
6. Insert an 8-penny nail, or similar 1/8-inch diameter rod, through the aligning holes of the solenoid armature and core as shown in Figure 21.
7. Tie the armature firmly against the core. This simulates the choke position while the engine is cranking.
8. Loosen the Sisson choke arm on its shaft.
9. Raise the Sisson choke arm to fully close the carburetor choke valve plate and tighten the Sisson arm on its shaft.

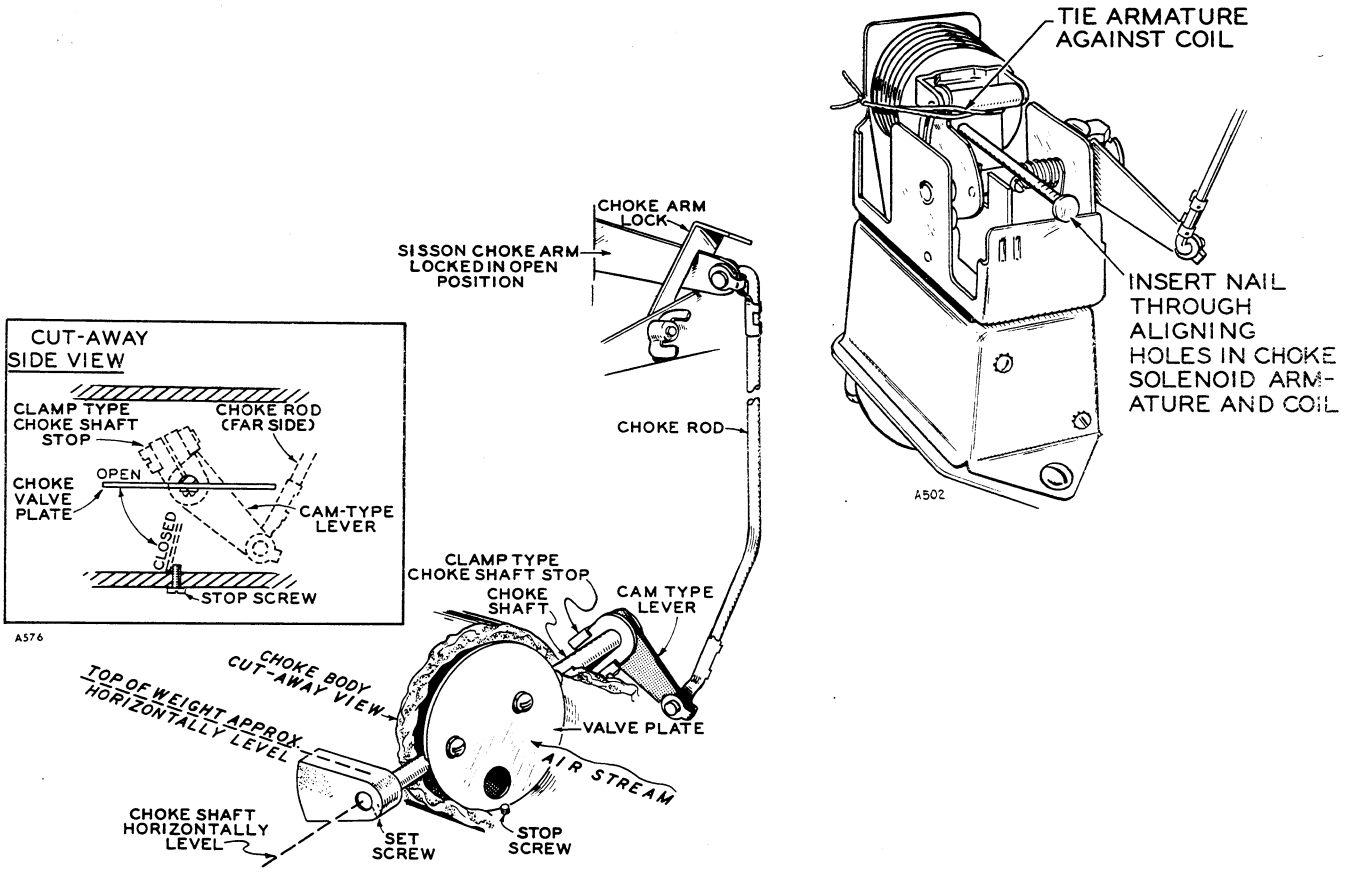


FIGURE 25. PROPER CHOKE ADJUSTMENT

10. Remove the alignment nail and untie the armature. Check to see that with the Sisson arm locked as for gas operation, the choke valve plate closes fully from the action of the counterweight but is free to blow open from air stream force. Reinstall the cover.

CARBURETOR FUEL ADJUSTMENT

Proper carburetor adjustment is essential to proper governor action. Too lean a carburetor adjustment is likely to cause erratic governor action, or surging. Too rich an adjustment will cause a power loss and excessive fuel consumption. Refer to the engine manual for Impco carburetor information.

AIR CLEANER

1. **Dust Removal:** Empty dust cap every 24 hours of operation; more in extremely dusty conditions. Service cup when space under disc becomes half filled. To service cup, loosen wing nuts. Remove wing bolt and disc from cup. After emptying cup, wipe disc and cup clean. When reassembling disc into dust cup, always align the side grooves. Replace any damaged gaskets immediately.

Wing bolt used to secure element in cleaner must be kept tight. Check wing bolt each time dust cup is serviced.

2. **Paper Element Removal:** Remove paper element and louver ring for cleaning when restriction reaches 15 inches of water. Service intervals will depend upon dust conditions. Remove wing bolt to remove paper element and louver ring. Clean louver ring. Wipe dust from inside of cleaner.
3. **Recommended Cleaning Method:** After rinsing excess dirt from element with water, soak for 15 minutes in a lukewarm solution using a non-foaming detergent. Do not use solvents, fuel oils or gasoline on element. Using clean water, flush all dirt from between pleats, first from inside, then from outside, always keeping open end of element downward. No more than six washings are recommended.
4. **Drying and Storing:** Shake excess water from element by hand. Allow it to dry thoroughly in a dust-free area with gasket end down. Never use compressed air on a wet paper element. Store element's gasket end down in a clean, dry location.
5. **Emergency or Moderate Cleaning:** First blow through element from inside to outside, then blow the dust from between the pleats on the outside of the element. Repeat the above action one or more times. To avoid tearing or damaging element, keep the compressed air nozzle moving up and down the pleats and no closer than one inch.

6. **Inspection:** Before using element, inspect for damage by inserting a bright light inside of the element. Any bright spots of light mean the element is not fit for service. Replace element if gasket is damaged or missing. Always keep an extra element on hand.

BRUSHLESS AC GENERATOR

There are no brushes, brush springs or collector rings on these generators, therefore they require very little servicing. Periodic inspections, to coincide with engine oil changes, will ensure good performance.

Generator Bearing: Inspect the bearing for rotation every 1000 hours with the unit running.

If using the unit for "prime power", replace the bearing every 10,000 hours or two years. If using the plant for "standby", replace the bearing every five years.

Inspection and Cleaning: When inspecting the voltage regulator and exciter assemblies, be sure the diodes and heat sinks are kept free of dust, dirt and grease (see Figure 26). Blow the assemblies out periodically with filtered, low pressure, compressed air. Also check these diodes for security.

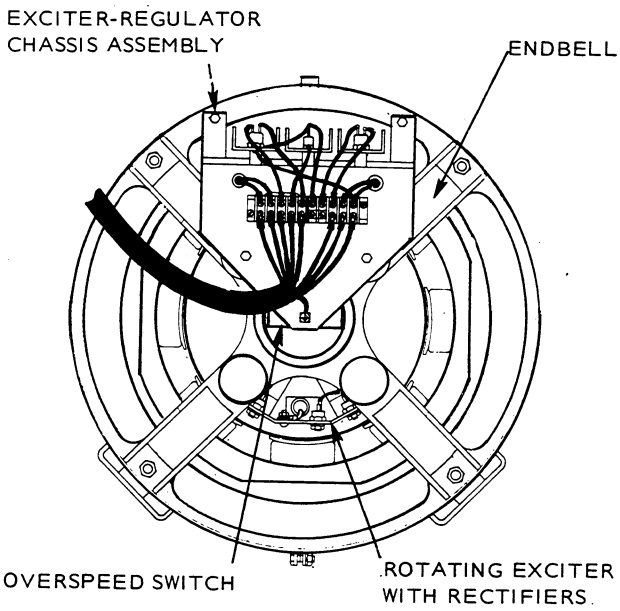


FIGURE 26. GENERATOR END VIEW (FRONT GRILLE REMOVED)

CAUTION **Excessive foreign matter on diodes and heat sinks will cause overheating and possible failure.**

1. If generator requires major repair or servicing, contact an authorized Onan dealer or distributor.

2. UR generators starting with specification "J" do not have the exciter-regulator chassis assembly mounted on the generator. This unit has been redesigned and is now located inside the control panel.

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