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INSTALLATION

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EMC-RVD SERVICE DEPT.

If the electric generating plant is to operate properly, it must be correctly installed. This manual gives some of the more important aspects of installation. For more details, a Technical Bulletin (T-012) is available from Onan.

Ventilation is the most important factor to consider. The unit must have enough cooling air to operate safely and efficiently. The heated air must be disposed of to keep the engine from overheating and losing power. For the

NH power plant running at 1800 rpm, the amount of air discharged is 750 cfm. The minimum free air inlet with no filter or restriction is 140 sq. in.

Onan Vacu-Flo cooled units are specifically designed for mounting in small compartments (where proper cooling is difficult) and are equipped to provide sufficient cooling air and adequate disposition of heated air. With this type of cooling, a centrifugal fan in a scroll housing pulls cooling air into the compartment

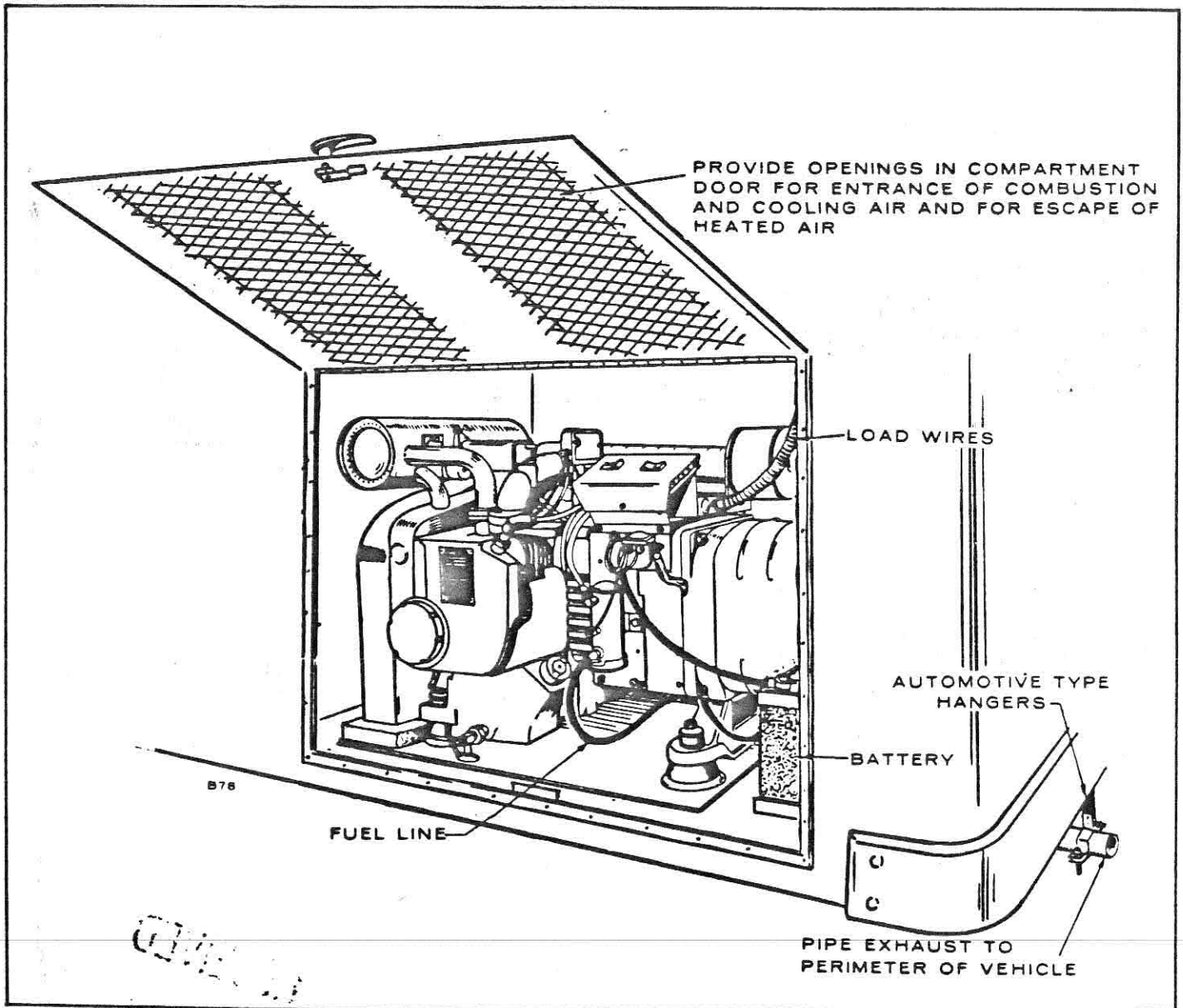


FIGURE 1. TYPICAL MOBILE INSTALLATION

and over the cooling fins and surfaces of the engine. Heated air is expelled through a single discharge and away from the unit and installation area.

LOCATION

The compartment itself should be of vapor tight design and completely independent of living quarters. The interior lining should be fireproof. A sheet metal covered compartment may be readily sealed and lends itself easily to treatment. The set may have to be removed for service, so make the door large enough to facilitate removal of the unit.

The compartment location is determined by physical size, access opening and most important, best mounting support. Allow 2" clearance on all sides of the unit for rocking on mounts.

POSITIONING

The following should be considered for accessibility when mounting the unit in a compartment. (Position so operating instructions and nameplate are visible and/or install an accessible nameplate, data decal or sticker.)

1. Make air discharge duct as short as possible. Position so exhaust heated air is not drawn into cool air inlet.
2. Air cleaner should be easy to remove and service.
3. Battery or batteries must be accessible for service.
4. Oil fill tube cap should be easy to reach.
5. The control box switch should be visible.
6. Provide space for muffler.
7. Oil drain should be readily accessible.
8. Cylinder head should be readily accessible for service.
9. Rope start sheave should be accessible.

MOUNTING

The best method of mounting is to attach the plant to a mounting platform using Onan vibration isolators. See Figure 2. The vibration isolators must be properly installed to minimize vibration. The Onan mounts are a "fail-safe" type with mounting bolts that prevent the unit from breaking loose if the mounts are damaged.

The mounting base should be fastened directly to the supporting frame. Channel, box or angle iron can be used for a mounting base frame. This will provide the greatest support, plus a base sealed against air, dirt and sound. Do not use sheet metal or thin plate without a supporting frame.

CAUTION Plywood is vulnerable to climatic elements, will tend to become oil soaked, and is not fireproof.

The supporting base or platform must be strong enough to withstand the shock from sharp turns, bumps, holes, etc. which accompany mobile applications. Brace the mounting platform to eliminate any chance of the platform bowing or bending.

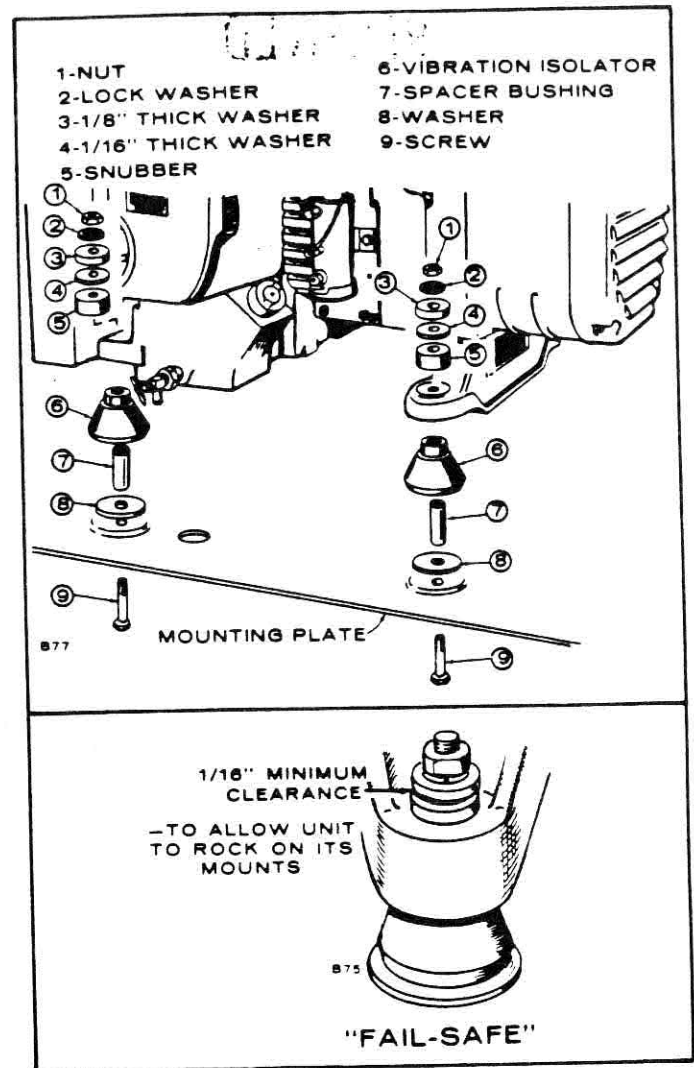


FIGURE 2. ONAN VIBRATION ISOLATORS

FUEL SUPPLY (GASOLINE)

Install a separate fuel tank for the unit. If the plant has to be connected to the vehicle supply tank, do not tee off the vehicle supply line. The generating plant must have a separate fuel line because the more powerful vehicle fuel pump will starve the generating unit for gasoline.

FUEL LINES

Use annealed copper or seamless steel tubing and flared connections. Run fuel lines, at the top level of the tank to a point as close to the engine as possible, to reduce the danger of fuel siphoning out of the tank if the line should break. Install lines so they are accessible at all times and protected from mechanical injury. Use nonferrous metal straps, without sharp edges, to secure the fuel lines.

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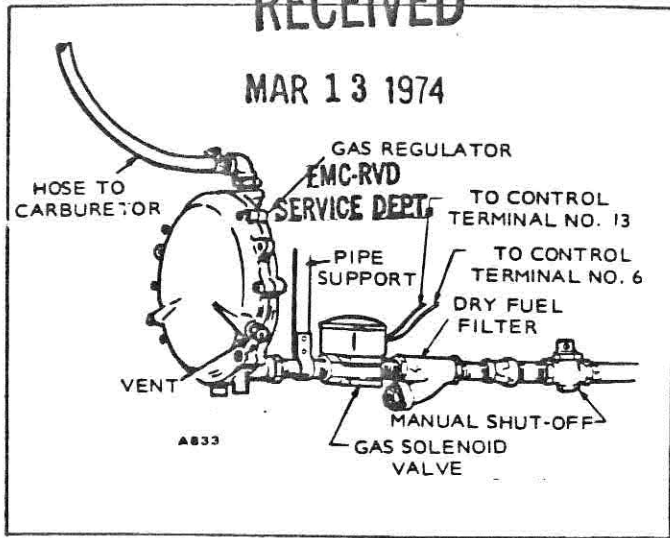


FIGURE 2A. GAS FUEL LINE INSTALLATION

FUEL CONNECTION (GASEOUS FUEL)

For gaseous sets (see Figure 2A), check with the local fuel supplier for gas regulations and line pressure. Provide a manual gas valve. A filter in the line may be necessary. Electric solenoid shut-off valves in the supply line are usually required for remote starting installations. Connect solenoid wires to battery ignition circuit (Figure 2A) to open valve during running. Install a demand type gas regulator according to instructions and position it near the set to aid starting.

IMPORTANT: Always use flexible tubing between engine and the gas demand regulator.

Gas-Gasoline sets provide a manual shutoff valve in both fuel supply lines.

EXHAUST SYSTEM

Observe the following when installing the plant's exhaust system:

1. Construct exhaust system to prevent damage from leakage and vibration. Use automotive type hangers and connections under the vehicle.
2. Use an insulating thimble where exhaust piping passes through a partition or floor of flammable material.
3. Terminate the exhaust outlet aft of the set compartment and extend to perimeter of vehicle so DEADLY exhaust fumes will not enter vehicle under ordinary conditions of driving or parking.

WARNING Do not install the exhaust outlet closer than three feet from the gasoline filler spout. Do not pipe exhaust into Vacuum scroll.

When installing mufflers, other than those supplied with the unit or if the exhaust system is excessively complicated, the exhaust back pressure should be checked. Exhaust back pressure at rated load, measured at the exhaust manifold, should not exceed 2 in. Hg. (Mercury column). Where a tapped hole is not provided, the manifold and/or a pipe coupling may be drilled and tapped. After measurement is made, plug the hole with an ordinary pipe plug.

BATTERY CONNECTION

Connect the positive (+) battery cable to the start solenoid. Connect the negative (-) cable to the generator through-bolt. Refer to Figure 3.

CAUTION Do not disconnect the starting batteries while the engine is running. The resulting overvoltage will damage the electric choke and other control components. Do not reverse battery connections; doing so may damage the electrical system.

In mobile applications where the generator is normally operated in ambient temperatures above 0°F and the battery is kept charged by frequent running of the unit, a single 12 volt battery of 74 amp/hr capacity minimum is sufficient.

GROUND (GENERATOR TO VEHICLE)

A solderless terminal is provided between AC output box and control on top side of unit. Connect a ground between this terminal and clean, bare metal on vehicle frame. See Figure 3.

LOAD WIRE CONNECTIONS

The set nameplate shows the electrical output rating of the set in watts, volts and cycles. The wiring diagram shows the electrical circuits and connections necessary for the available output voltage. Also see Figure 4.

Meet all applicable code requirements. A qualified serviceman or electrician should make the installation and the installation should be inspected and approved. The AC output box has provisions to accommodate load wires. 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 bare ends of ungrounded wires. Install a fused main switch (or circuit breaker) between the generating set and the load.

Output Lead Markings: Generator leads are marked, M1, M2, M3 and M4. These identifying marks also appear on the wiring diagram.

Voltage Selection on Reconnectable Single Phase Generators: These units are reconnectable for use as 120/240 volt, 3 wire; 120 volt, 2 wire, or a 240 volt.

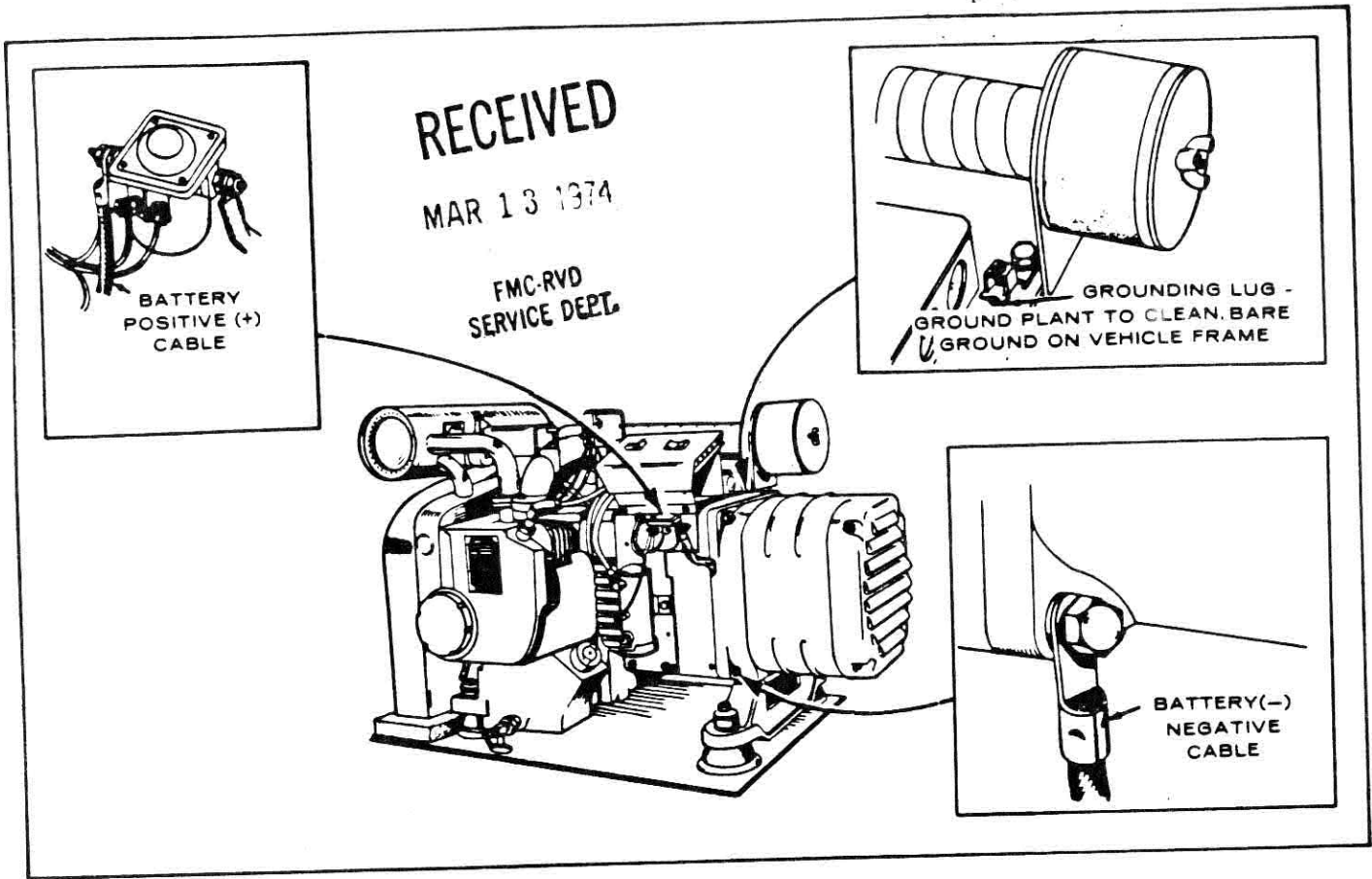


FIGURE 3. BATTERY AND GROUND CONNECTION

2 wire power source (see Figure 4). Use the connection for two wire service when one load exceeds 1/2 the rated capacity. Balance the load when connecting for three-wire service.

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.

Balancing the Load: Current for any one output lead

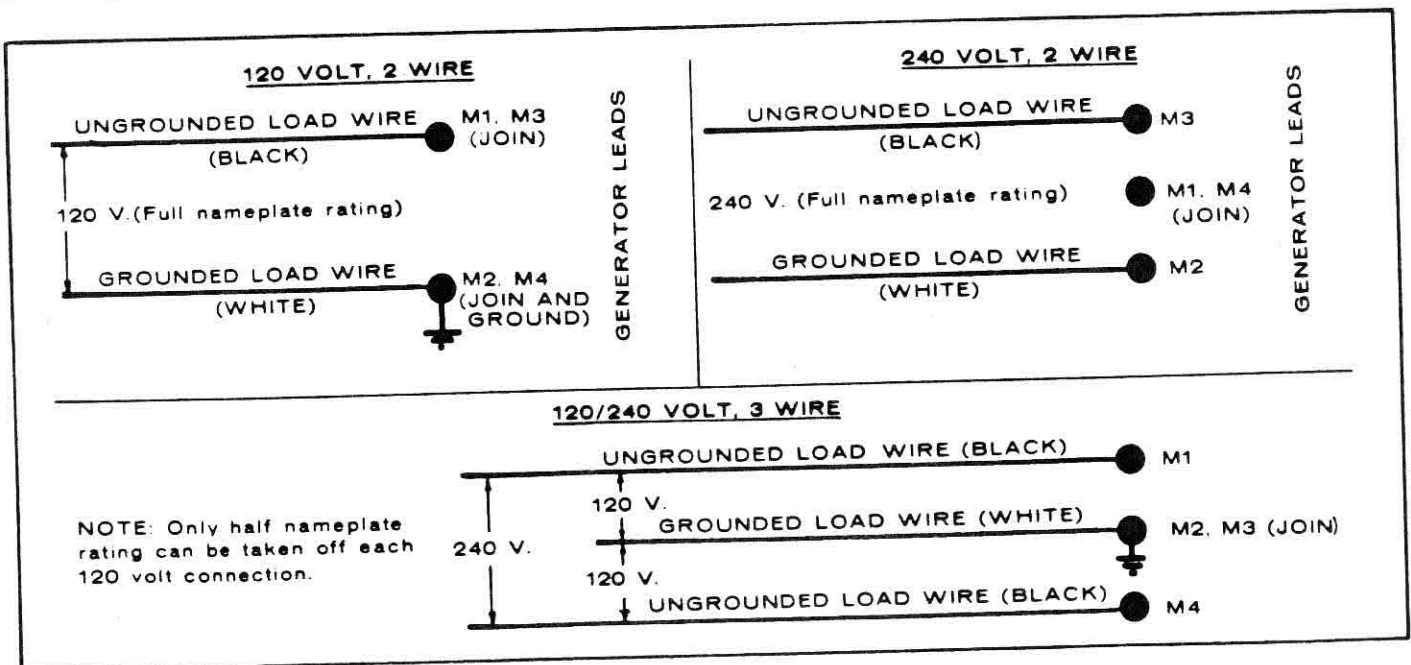


FIGURE 4. LOAD CONNECTIONS

CONTROL BOARD REMOTE WIRING (BEGIN SPEC D)

The printed circuit board (located under start-stop control) is the "heart" of the generating plant's control system. Terminals 1 through 9, on the left side of printed circuit board, (Figure 6) connect to engine components such as:

- Ignition Points
- Ignition Coil and Fuel Pump
- Start Solenoid
- LOP (Low Oil Pressure)
- HET (High Engine Temperature)
- Charging Resistors

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Terminals 10 through 18, located on right side of printed circuit board, are for connection to a Remote Control Station. These include the following options:

- Start-Stop Switch
- Charging Ammeter
- Running Time Meter
- Generator "On" Light
- LOP (Low Oil Pressure) Alarm
- HET (High Engine Temperature) Alarm

START-STOP SWITCH (BEGIN SPEC D)

Connect a remote start-stop, double-pole, double-throw, momentary switch to terminals 13, 14, 15 and 16 as shown in Figures 5 and 6. Use Onan switch 308-0329 or similar switch(es) and number 18 or larger wires for connections.

CAUTION Be sure the start-stop switch is momentary contact only. If not, the start solenoid will be damaged.

DC Ammeter: Connect a direct reading 0 to 10 ampere ammeter (Onan number 302-0561) to terminals 17 (+) and 18 (-). For distances up to 10 feet make connections with no smaller than number 18 (Figure 5). When installed, Jumper W1 must be removed from the printed circuit board. See Figures 5 and 6. Jumper W1 is located near the 1-1/4 x 2 inch copper heat sink.

CAUTION Terminal 13 is the ground connection for the printed circuit board and must always be connected.

Running Time Meter: Connect running time meter (Onan number 302-0885) to terminals 10 and 13 (Grd.) using number 18 or larger wire. Terminal 10 operates at approximately 30 volts during normal operation. See Figure 5A.

DC Voltmeter: Connect DC voltmeter (Onan number 302-0562) between terminals 15 and 13 (Grd.) using number 18 wire. See Figure 5A.

24 Volt Generating Lamp: Connect a 24 volt generating lamp between terminals 10 and 15 (Figure 5B). Use a diode (IN4004) in series as shown.

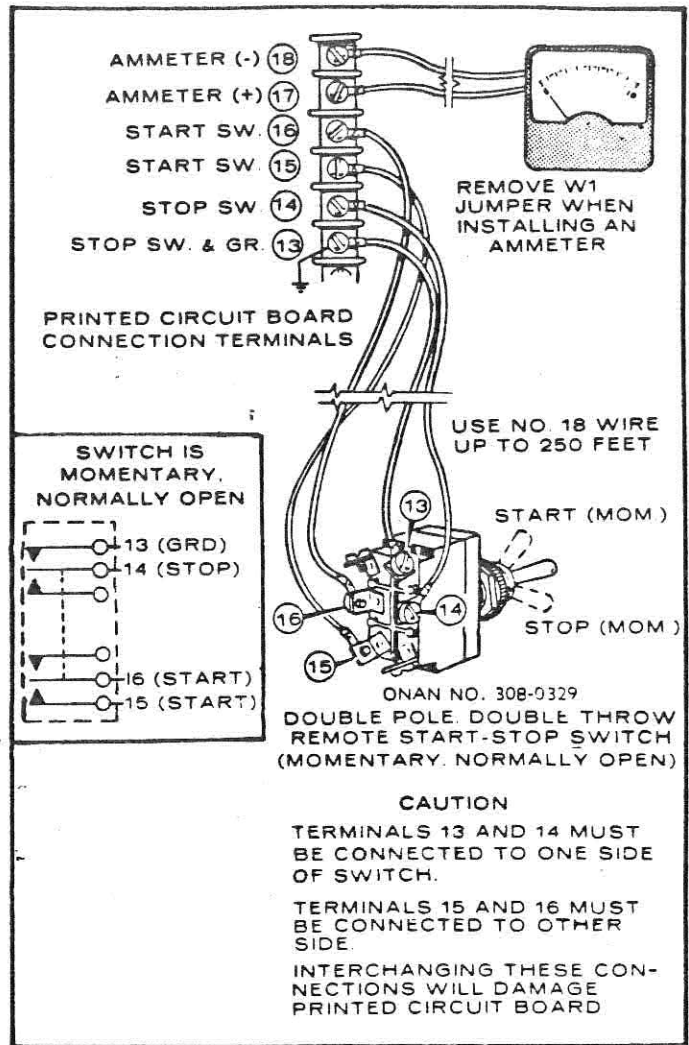


FIGURE 5. START-STOP SWITCH AND AMMETER

12 Volt Generating Lamp: Connect a 12 volt generating lamp between terminals 10 and 15 (Figure 5C). Connect a diode (IN4004) on one end of lamp and a 5 watt, 6 volt zener diode (IN5340) on the other end.

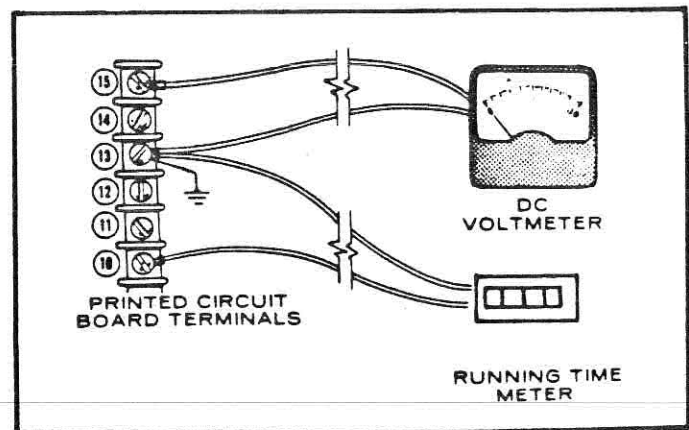


FIGURE 5A. RUNNING TIME METER AND DC VOLTMETER

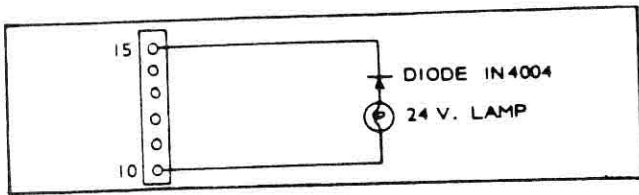


FIGURE 5B. 24 VOLT GENERATING LAMP

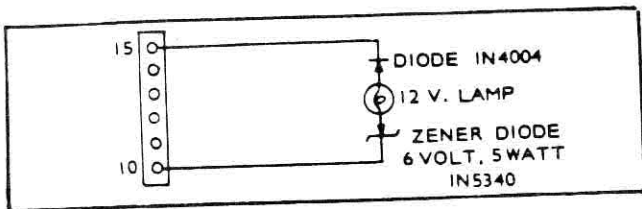


FIGURE 5C. 12 VOLT GENERATING LAMP

Fused Connections: On early models a small fuse (F1) used to protect the circuit against reversed battery connections, is located under the "STOP" side of Start-Stop Switch next to CR4. If fuse is damaged, replace by carefully clearing out solder holes and replacing the fuse with a bare, number 36 wire and resoldering the holes.

Later models use a 9 amp fuse (F1) which is located in the wiring harness between terminal 5 (on printed circuit board) and battery. If fuse is damaged (caused by connecting battery backwards), replace with an SFE 9 automotive type fuse.

Terminal 5 has a PC fuse connection (F2) in the battery lead to protect the printed circuit board from any shorts on the board or from external remote connections. Terminal 10 has a PC fuse connection (F3) in the generator lead to protect the printed circuit board from any external shorts when using the remote connections. If F2 or F3 printed circuit board path is "blown", replace either with number 22 wire, one inch long and solder into circuit.

CAUTION Do not attempt to check for current flow on the printed circuit board by jumpering across components with a screwdriver, wire, etc. Always have these boards checked by an authorized Onan service center or a qualified electrician using the proper instruments (e.g. voltmeter, ohmmeter, or multimeter).

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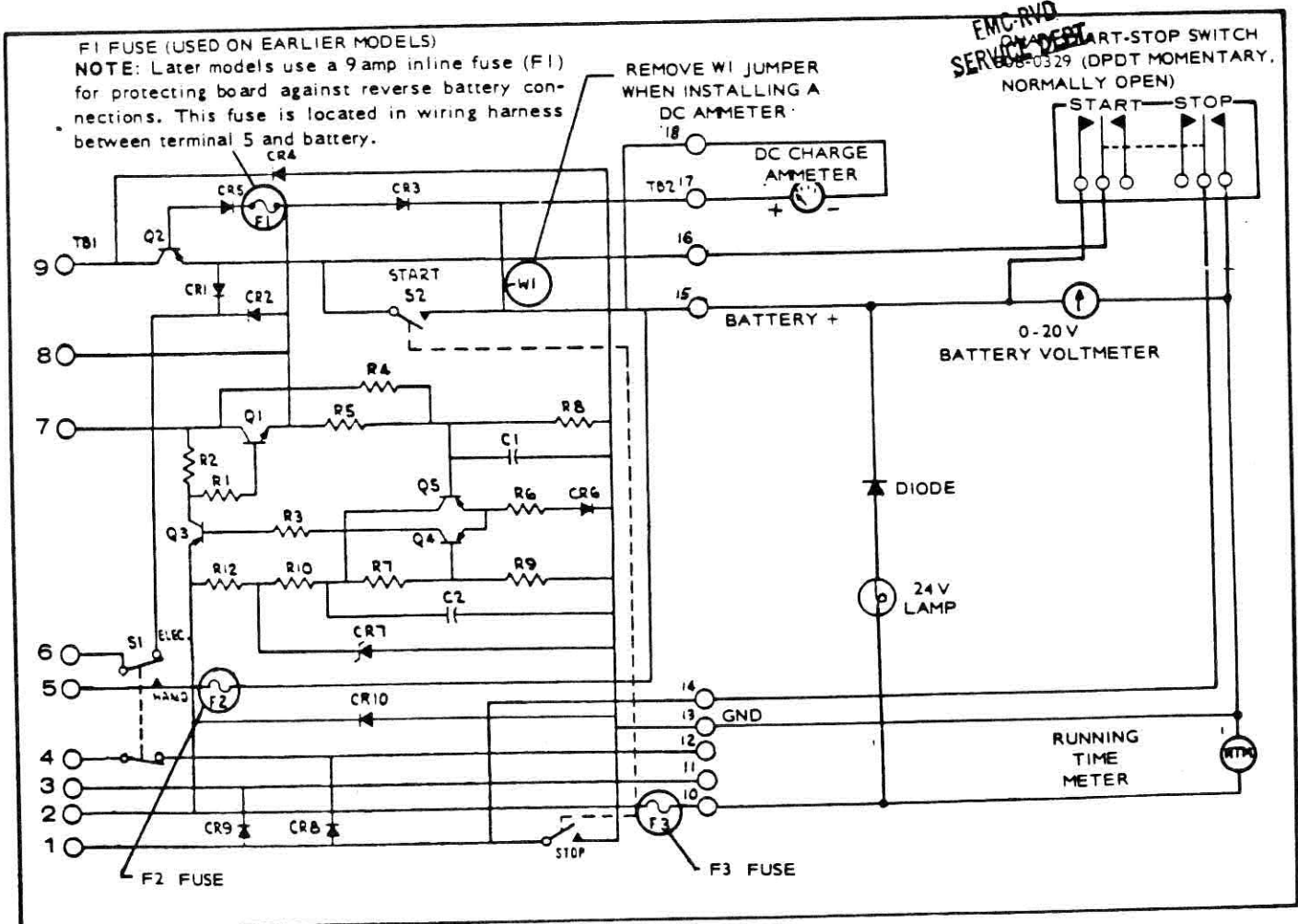


FIGURE 6. REMOTE WIRING SCHEMATIC

REMOTE START-STOP CONTROLS (SPEC A THROUGH C)

Standard remote start-stop controls for Onan remote starting electric plants consist of a single pole, double throw momentary contact switch, connected by three wires to the plant remote control terminal block. Pushing the switch up engages the starter, the center position is for running and pushing it down stops the plant.

To control the plant from several locations, install separate switches and wire them in parallel (Figure 6A). Any number of switches may be used.

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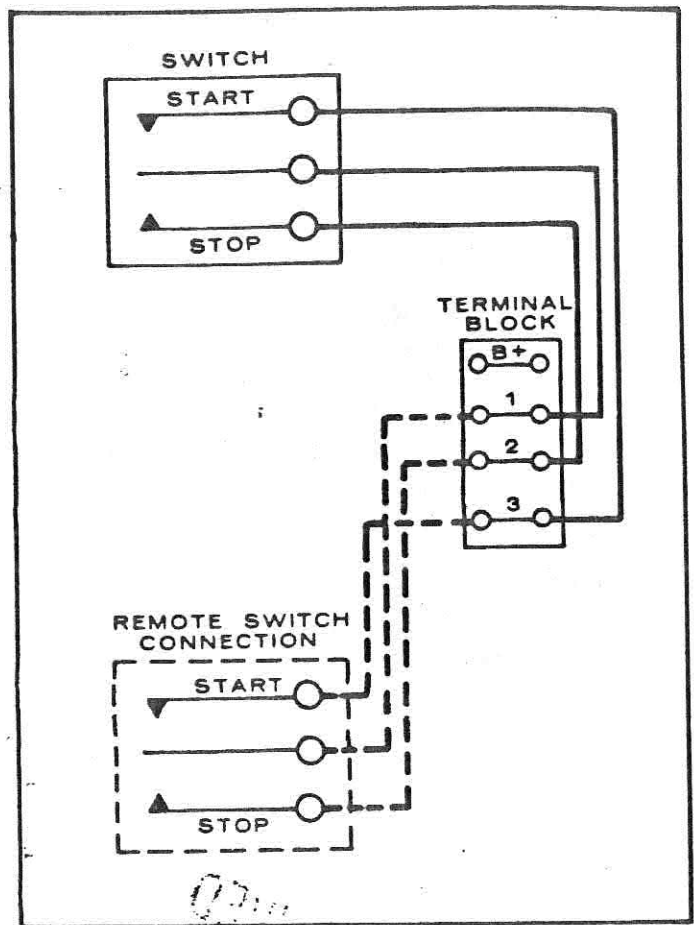
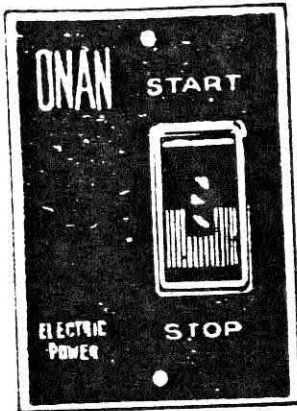


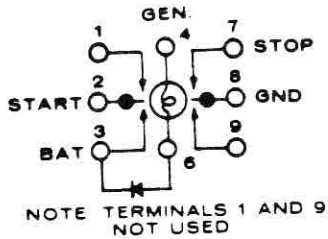
FIGURE 6A. REMOTE SWITCH CONNECTIONS

FRONT SIDE OF
REMOTE CONTROL
SWITCH



REMOTE CONTROL ASSEMBLY
#300-0942

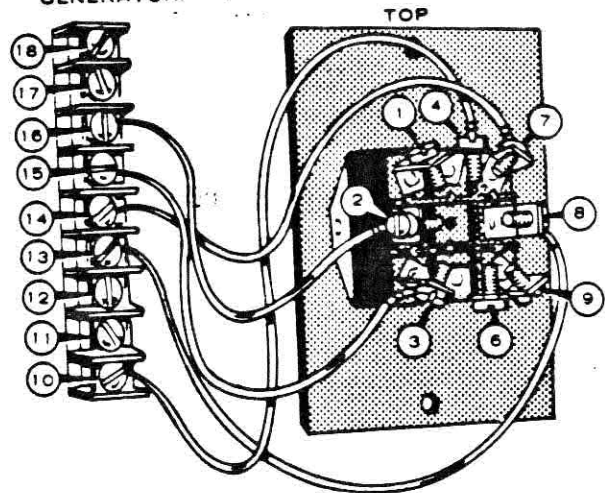
CONTROL SWITCH
SCHEMATIC (REAR VIEW)



REMOTE CONTROL SWITCH TERMINAL	FUNCTION
2	START
3	BATTERY
7	STOP
8	GROUND
4	GENERATING LAMP

PRINTED CIRCUIT
BOARD CONNECTION
TERMINALS ON
GENERATOR

BACK SIDE OF
REMOTE CONTROL
SWITCH



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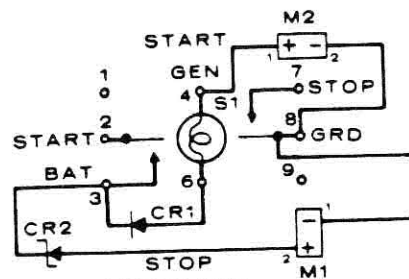
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STOP-START SWITCH (DPDT)
(Amber light glows when
generator set is running)



RUNNING TIME METER (M2) BATTERY CONDITION METER (M1)

DELUXE REMOTE CONTROL ASSEMBLY
#300-0943



SCHEMATIC
(REAR VIEW OF CONTROL)
NOTE TERMINALS 1 AND 9 ON REMOTE
CONTROL NOT USED

FIGURE 6B. CONNECTING REMOTE CONTROL TO ELECTRIC GENERATING PLANT

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OPERATION

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Crankcase Oil: Be sure the crankcase has been filled with oil to the "FULL" mark on the oil level indicator. Refer to the MAINTENANCE SECTION for the recommended oil changes and complete lubricating oil recommendations.

Recommended Fuel: Use clean, fresh, regular grade, automotive gasoline. Do not use highly leaded premium types.

For new engines, the most satisfactory results are obtained by using nonleaded gasoline. For older engines that have previously used leaded gasoline, heads must be taken off and all lead deposits removed from engine before switching to nonleaded gasoline.

CAUTION If lead deposits are not removed from engine before switching from leaded to nonleaded gasoline, preignition could occur causing severe damage to the engine.

ELECTRIC STARTING

Push the Start-Stop switch to its "START" position. Release the switch as soon as the engine starts.

If the engine fails to start at first try, inhibitor oil used at the factory may have fouled the spark plugs. Remove the plugs, clean in a suitable solvent, dry thoroughly and install. Heavy exhaust smoke when the engine is first started is normal and is caused by the inhibitor oil.

APPLYING LOAD

If practical, allow unit to warm up before connecting a heavy load. Continuous generator overloading may cause high operating temperatures that can damage the windings. Keep the load within the nameplate rating.

STOPPING

1. Push Start-Stop switch to "STOP" position.
2. Release switch when unit stops.

BREAK-IN PROCEDURE

Controlled break-in with the proper oil and a conscientiously applied maintenance program will help to assure satisfactory service from your Onan electric generating plant.

When operating engine for the first time, use the following sequence using SE or SE/CC oil (former designation was MS or MS/DG):

1. One half hour at 1/2 load.
2. One half hour at 3/4 load.
3. Full load.
4. Change crankcase oil after the first 50 hours of operation.

BATTERY CHARGING (Begin Spec D)

The battery charge rate is automatically controlled by a solid-state voltage regulator. The high charge rate was set at the factory for average operating conditions.

INFREQUENT SERVICE

If the unit is used infrequently, extended shutdown periods can result in difficult starting. Run unit at least 30 minutes every week to eliminate hard starting.

HIGH TEMPERATURES

1. See that nothing obstructs air flow to and from the plant.
2. Keep cooling fins clean. Air housing should be properly installed and undamaged.
3. Keep ignition timing properly adjusted.

LOW TEMPERATURES

1. Use correct SAE No. oil for temperature conditions. Change oil only when engine is warm. If an unexpected temperature drop causes an emergency, move the vehicle to a warm location.
2. Use fresh gasoline. Protect against moisture condensation. Below 0°F adjust carburetor main jet for a slightly richer fuel mixture.
3. Keep ignition system clean, properly adjusted and batteries in a well charged condition.
4. Partially restrict cool air flow, but use care to avoid overheating.

OUT-OF-SERVICE PROTECTION

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

1. Run the plant until thoroughly warm.
2. Turn off fuel supply and run until engine stops.
3. Drain oil from oil base while still warm. Refill and attach a warning tag stating oil viscosity used.
4. Remove each spark plug. Pour 1 oz. (two table-spoons) of rust inhibitor (or SAE #50 oil) into each cylinder. Crank engine slowly (by hand) several times. Install spark plugs.
5. Service air cleaner.
6. Clean governor linkage and protect by wrapping with a clean cloth.
7. Plug exhaust outlet to prevent entrance of moisture, dirt, bugs, etc.
8. Wipe generator brushes, slip rings, etc. Do not apply lubricant or preservative.

9. Wipe entire unit. Coat rustable parts with a light film of grease or oil.
10. If battery is used, disconnect and follow standard battery storage procedure.

DUST AND DIRT

1. Keep plant clean. Keep cooling surfaces clean.
2. Service air cleaner as frequently as necessary.
3. Change crankcase oil every 50 operating hours or sooner.
4. Keep oil and gasoline in dust-tight containers.
5. Keep governor linkage clean.
6. Clean generator brushes, slip rings and commutator. Do not remove normal (dark brown) film. Do not polish.

HIGH ALTITUDE

For operation at altitudes of 2500 feet above sea level, close carburetor main jet adjustment slightly to maintain proper air-to-fuel ratio (refer to the ADJUSTMENT SECTION). Maximum power will be reduced approximately 4% for each 1000 feet above sea level, after the first 1000 feet.

SEQUENCE OF OPERATION

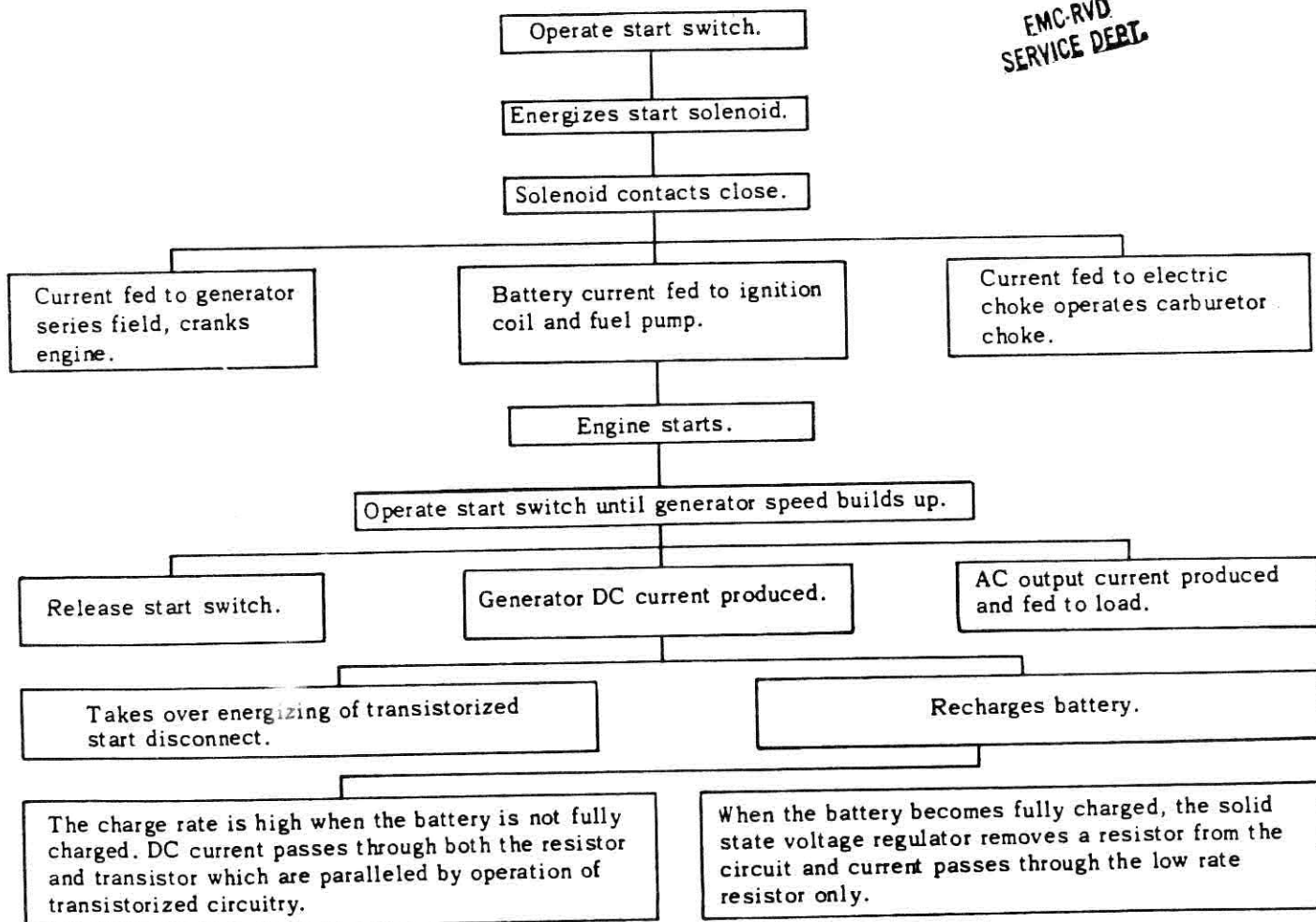
See Table 1 for a typical sequence of operation for your Onan electric generating plant.

TABLE 1. SEQUENCE OF OPERATION

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GAS-GASOLINE OPERATION

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

1. Close the manual fuel shutoff valve in supply line (the main fuel adjustment valve is not designed to use as a shutoff valve) for gaseous fuel. Set will not operate smoothly with both fuel supply lines turned on at the same time.
2. Open the gasoline fuel shutoff valve.
3. Set the spark plug gap as given in the Table of Dimensions and Clearances.
4. See that the choke is free and works easily.
5. Start the engine in the manner described. If the engine runs unevenly under half or full load, due to faulty carburetor adjustment, the main jet needs adjusting.

To change back to gaseous fuel, reverse the above procedure and reset the spark plug gap as given in the Table of Dimensions and Clearances. Use all gasoline from the carburetor to avoid stale fuel. If engine is run with one of the fuel supply lines disconnected, plug other outlet to prevent drawing air and dirt.

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SERVICE AND MAINTENANCE

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OPERATOR MAINTENANCE SCHEDULE
(Performed by Owner)

MAINTENANCE ITEMS	OPERATIONAL HOURS					
	8	50	100	200	250	500
Check Plant Generally	x					
Check Fuel Supply	x					
Check Oil Level	x					
Check Governor Linkage		x				
Change Air Cleaner			x			
Change Crankcase Oil			x*			
Check Battery			x			
Check or Replace Fuel Filter			x			
Change Spark Plugs					x	
Change Oil Filter				x		
Change Air Cleaner Element						x

Change every 50 hours when operating at high ambient temperatures (100°F and above).
Service more often under extreme dust conditions.

PERIODIC MAINTENANCE SCHEDULE

Regularly scheduled maintenance is the key to lower operating costs and longer service life for the unit. The above schedule can be used as a guide. However, actual operating conditions under which a unit is run should be the determining factor in establishing a maintenance schedule. When operating in very dusty or dirty conditions, some of the service periods may need to be reduced. Check the condition of the crankcase oil, the filters, etc. frequently until the proper service time periods can be established.

If any abnormalities occur in operation - unusual noises from engine or accessories, loss of power, overheating, etc. - contact your Onan dealer.

CRANKCASE OIL

The oil capacity is four U.S. quarts (4-1/2 with a filter change). Fill to the "FULL" mark on the oil level indicator. Use a good quality heavy duty oil with the API designation MS, MS/DG, SE or SE/CC. Oil should be labeled as having passed the MS Sequence Tests so known as the ASTM G-IV Sequence Tests) and the L-L-2104B Tests. When adding oil between changes, always use the same brand that is in the crankcase. Various brands of oil may not be compatible when mixed together.

Oil consumption may be higher with a multi-grade oil than with a single grade oil if both oils have comparable viscosities at 210°F. Therefore, single grade oils are generally more desirable, unless anticipating a wide

CRITICAL MAINTENANCE SCHEDULE (Performed by Onan Dealer)

MAINTENANCE ITEMS	OPERATIONAL HOURS		
	100	500	1000
Check Breaker Points	x		
Clean Commutator and Collector Rings			x
Check Brushes		x	
Remove Deposits From Combustion Chamber		x	
Check Valve Clearance †		x	
Clean Generator			x
Inspect Valves, Grind If Necessary			x

† - Tighten head bolts and adjust valve clearance after first 50 hours on a new or overhauled engine.

range of temperatures. Use the proper grade oil for the expected conditions.

TEMPERATURE

Above 90°F

32°F to 90°F

0°F to 32°F

Below 0°F

GRADE

SAE 50

SAE 30

SAE 10W-40, 5W-30

SAE 5W-30

Check oil level daily. Change oil every 100 hours under normal operating conditions. When operating in extremely dusty or dirty conditions, change oil every 50 hours or sooner (see Figure 14).

For gaseous fueled engines, LPG (butane, propane) or natural gas an ashless or low ash detergent oil is recommended (Chevron HDAZ natural gas oil or equal).

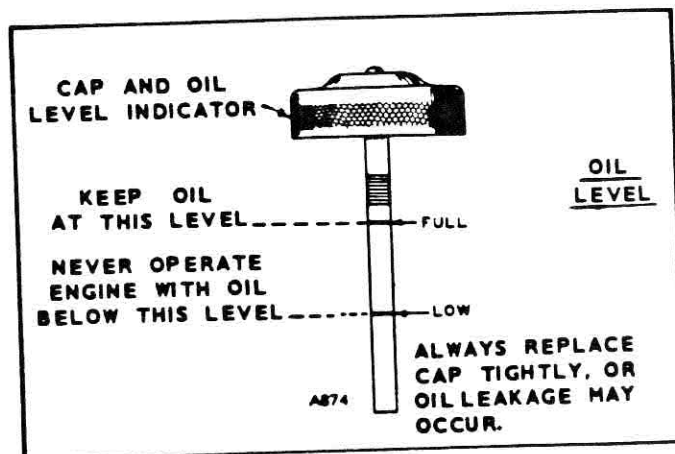


FIGURE 14. OIL LEVEL INDICATOR

OIL FILTER

Change the crankcase oil filter every 200 hours. Remove the filter by turning counterclockwise, using a filter wrench. Add the gasket provided with the filter to prevent air loss in the area indicated. It is advisable to wipe dry the drip pan located below the filter. Install the filter finger-tight plus 1/4 to 1/2 turn. If oil becomes so dirty that the markings on the oil level indicator cannot be seen, change the filter and shorten the filter service period (see Figure 15).

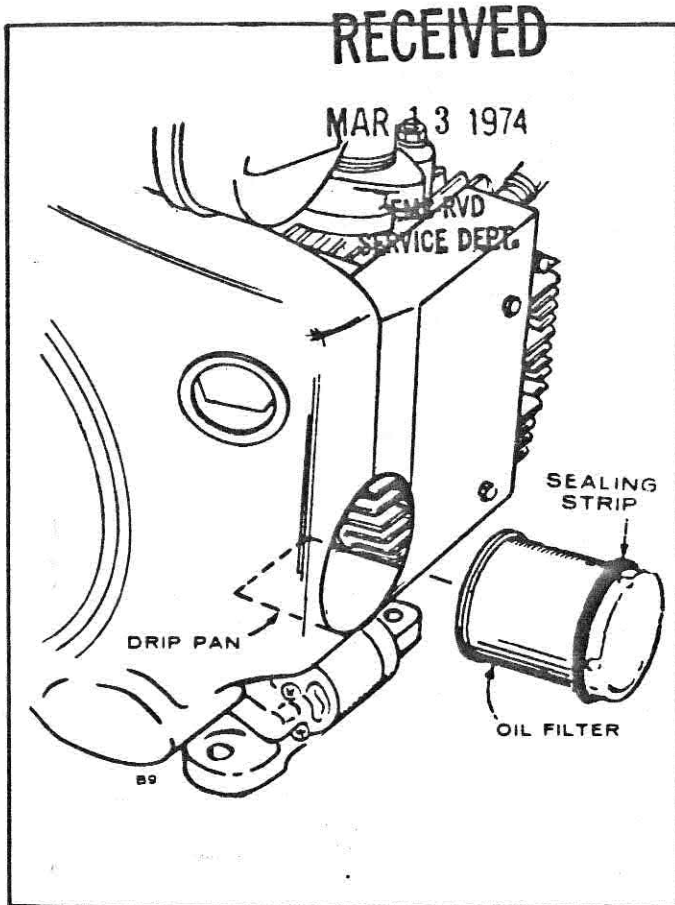


FIGURE 15. OIL FILTER

AIR CLEANER

Proper maintenance of the air cleaner is extremely important. Negligence of regular routine maintenance will result in reduced engine life.

Allowing the element to become plugged with dirt will restrict the intake of air into the engine. Inspect the element for tiny holes or tears which would permit particles of dust or dirt to enter the engine.

Remove the paper element every 100 operating hours (see Figure 16) and clean by removing foam wrapper and tapping element against a flat surface to loosen dust and dirt accumulation. The dirt can be blown out from the clean to the dirty side, but be sure to use less than 100 psi air pressure. The element and foam wrapper can be washed in a solution of warm water and mild detergent if additional cleaning seems necessary.

The element will normally require replacement every 500 operating hours and more often under severe operating conditions.

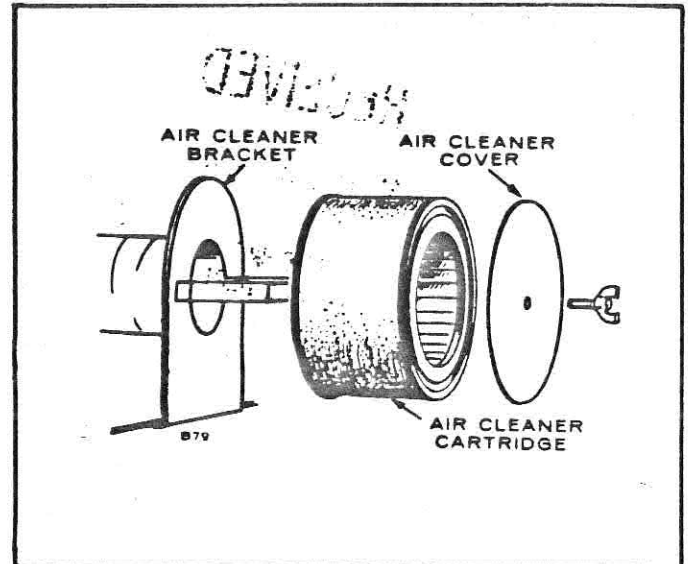


FIGURE 16. AIR CLEANER

CRANKCASE BREATHER

Lift off rubber breather cap. Carefully pry valve from cap. Otherwise press hard with both of your thumbs on top of cap and fingers below to release valve from rubber cap. Wash this fabric flapper type check valve in a suitable solvent. Dry and install. Position perforated disc toward engine.

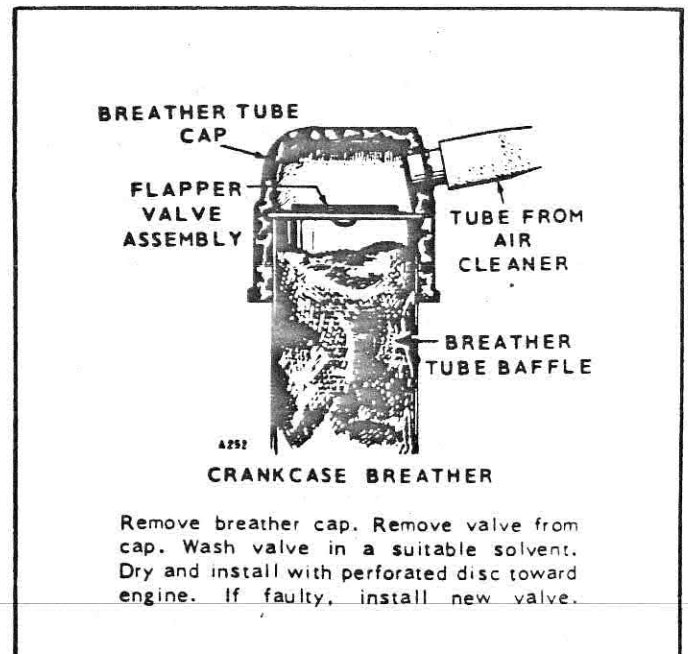


FIGURE 17. CRANKCASE BREATHER

Remove breather cap. Remove valve from cap. Wash valve in a suitable solvent. Dry and install with perforated disc toward engine. If faulty, install new valve.