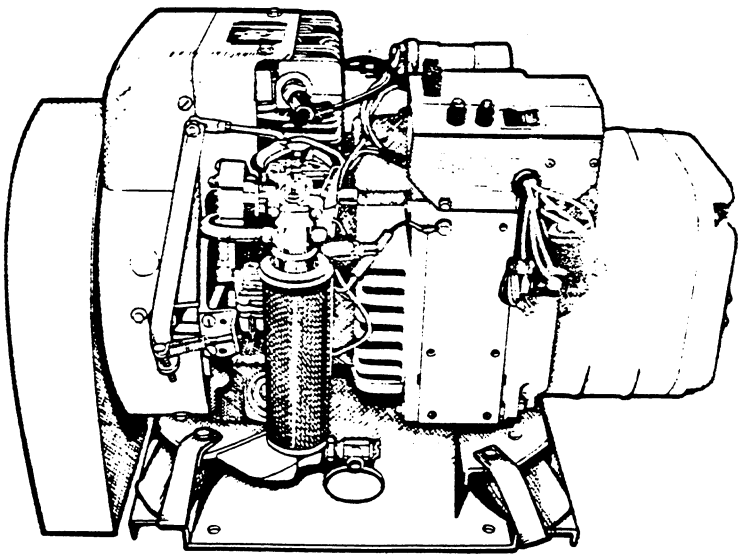
operator's manual

Onan

For series

LK

R.V. ELECTRIC GENERATING SETS



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SAFETY PRECAUTIONS

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

WARNING **Onan uses this symbol throughout this manual to warn of possible serious personal injury.**

CAUTION **This symbol refers to possible equipment damage.**

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

- **Use Extreme Caution Near Gasoline. A constant potential explosive or fire hazard exists.**

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

  Be sure all fuel supplies have a positive shutoff valve.

  Fuel lines must be of steel piping, adequately secured and free of leaks. Use a flexible section of fuel line between generator set and stationary fuel line in the vehicle. This flexible section must be 100% NON-METALLIC to prevent electrical current from using it as a conductor.

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

- **Guard Against Electric Shock**

  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.

  Jewelry is a good conductor of electricity and should be removed when working on electrical equipment.

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

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

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

- **Do Not Smoke While Servicing Batteries**

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

- **Exhaust Gases Are Toxic**

  Provide an adequate exhaust system to properly expel discharged gases. Check exhaust system regularly for leaks. Ensure that exhaust manifolds are secure and not warped.

  Be sure the unit is well ventilated.

- **Keep The Unit And Surrounding Area Clean**

  Remove all oil deposits. Remove all unnecessary grease and oil from the unit. Accumulated grease and oil can cause overheating and subsequent engine damage and may present a potential fire hazard.

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

- **Protect Against Moving Parts**

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

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

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

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

TO THE OWNER

Welcome to the growing family of *Onan Power users* . . . We are proud to have you as a customer.

Read this manual carefully and observe all safety rules within. Operating instructions, adjustments and periodic maintenance procedures are given so that you . . . the owner, can keep your unit running like new and expect many years of dependable service from it. Remember . . . any machine, regardless of design or type, will perform only in relation to the services it receives.

If your generator set needs special attention, ask your Onan dealer for assistance; the Onan Parts and Service Organization has been factory-trained to provide up-to-date know-how for keeping your RV electric generating set "on the road". A complete Parts Catalog is available at nominal cost and may be ordered under #930-0220.

TABLE OF CONTENTS

WARNING

TO PREVENT FIRE OR ACCIDENT HAZARD . . . THIS UNIT MUST BE INSTALLED ACCORDING TO THE MANUFACTURER'S DETAILED INSTALLATION PROCEDURES OBSERVING ALL MINIMUM CLEARANCES.

TO AVOID POSSIBLE PERSONAL INJURY OR EQUIPMENT DAMAGE, ANY INSTALLATION AND ALL SERVICE MUST BE PERFORMED BY QUALIFIED PERSONNEL.

GENERAL INFORMATION

YOUR MANUAL

This manual contains operation and other information to properly maintain, service, and make adjustments on your LK generator set. Study and follow the instructions carefully. A well-planned service and maintenance program will result in longer unit life and better performance. Because the most important part of repair is diagnosis, a troubleshooting chart is included.

Throughout the manual, engine end of the generator set is the front. Left and right sides are determined when facing the engine (front) end.

When contacting your Onan dealer, distributor, or the factory about the generator set, always supply the complete model number and serial number as shown on the nameplate (see *Model Designation* following). This information is necessary to identify your generator set among the many types manufactured by Onan.

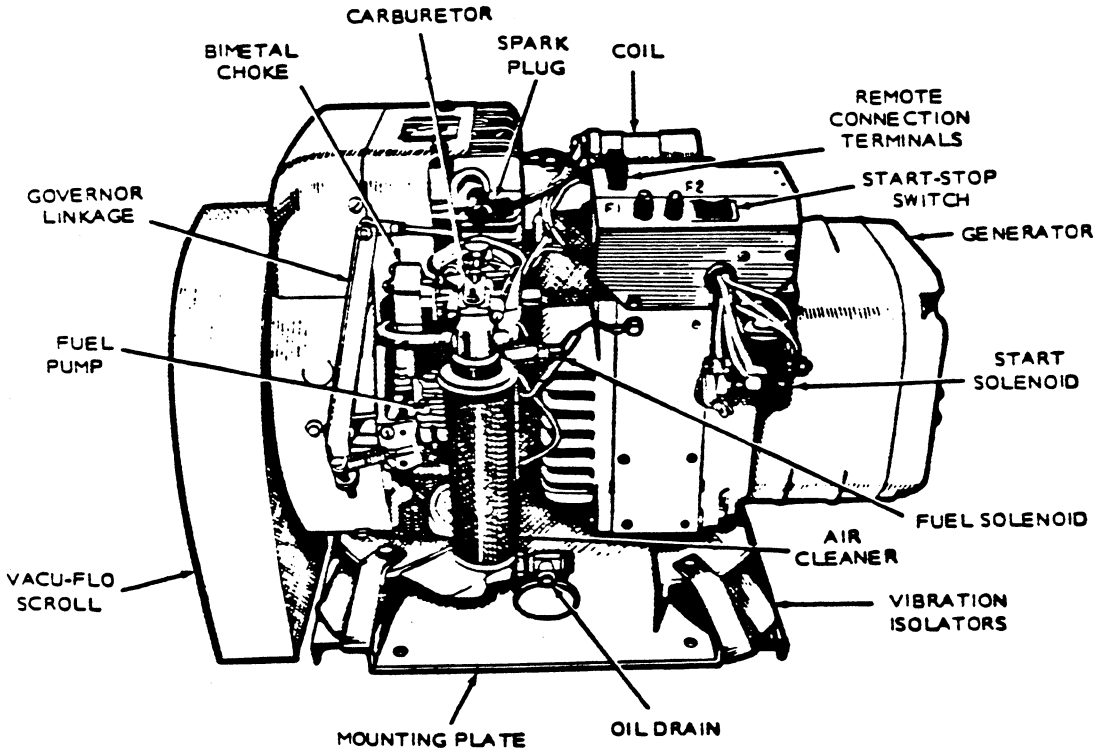
MODEL DESIGNATION

The following typical model number is broken down into code segments used by Onan.

2.5	LK	-	3C	R	12006	M
1	2		3	4	5	6

1. Indicates kilowatt rating.
2. Series identification.
3. Number 3 is the voltage code for 120/240 volts single phase. "C" is the code for reconnectible (120 volts, 2 wire; and 120/240 volts, 3 wire).
4. Method of starting: R—remote electric starting.
5. Factory code for designating optional equipment, if any.
6. Specification letter which advances when the factory makes production modification.

Onan electric sets are given a complete running test under various load conditions and are thoroughly checked before leaving the factory. Upon receiving your unit, check it thoroughly for any damage that may have occurred during shipping. Tighten loose parts, replace missing parts and repair any damage before operating the unit.



SPECIFICATIONS

This manual contains SI metric equivalents that follow immediately in parentheses after the U.S. customary units of measure.

GENERAL

Nominal Dimensions of Set	
Height	19 in. (483 mm)
Width	17.88 in. (454 mm)
Length	27.25 in. (692 mm)
Weight	225 lbs. (102 kg)

ENGINE DETAILS

Manufacturer	ONAN
Number of Cylinders	1
Displacement (cubic inches)	24.9 (408.11 cc)
Cylinder Bore	3.25 in. (82.55 mm)
Piston Stroke	3.00 in. (76.20 mm)
Compression Ratio	5.5:1
Engine Speed	1800 RPM
Engine Design	Four Cycle, Single Cylinder, L-Head, Vertical Design
Fuel Recommended (Gasoline)	Lead Free or Low Lead
Starting System	Exciter Cranking (Generator)
Break-away Current	400 Amps

GENERATOR DETAILS

Manufacturer	ONAN
Design	Revolving Armature, Four Pole, 1800 RPM, Self Exciter
Rating (in watts)	2500 (2.5 kW)
Voltage	120 or 120/240
Current Rating	
120 Volt	20.8 Amperes
240 Volt	10.4 Amperes
Phase	Single
Wire	4-Wire Reconnectible
Output Rating	Unity Power Factor
Cranking Current	120 Amps

CAPACITIES AND REQUIREMENTS

Oil Capacity	2 quarts (1.89 litres)
Recommended Battery	
Electric Start	12 Volt 92 Amp/Hr (331.20 kC)
Battery Charge Rate	
Fixed	1-1/2 Amps
Air Inlet Size Required (Minimum)	100 in^2 (645 cm^2)

TUNE-UP SPECIFICATIONS

Spark Plug Gap	0.025 in. (.635 mm)
Breaker Point Gap	0.020 in. (.508 mm)
Ignition Timing	19° BTC
Tappet Adjustment (Engine Cold)	
Intake	.008 (0.20 mm)
Exhaust	.016 (0.41 mm)

INSTALLATION CHECKS

INSTALLATION

Nearly all Onan electric generating sets are installed by the motor home manufacturer. Although the manufacturer must follow safety codes when installing, certain installation problems could arise after the unit is installed and subjected to vibration. There are a few areas that you, as the operator, should be concerned with. If in doubt about any aspect of your generator set's operation or safety, contact your nearest authorized Onan Service Center. A daily inspection of your installation should include the following:

- Exhaust
- Fuel System
- Electrical
- Ventilation

EXHAUST

Check for leaks around manifolds, gaskets, and welds. Make sure exhaust lines are not heating surrounding areas excessively. If so, have corrected immediately. Remember EXHAUST GASES CONTAIN DEADLY CARBON MONOXIDE. Be sure all holes to the inside of RV from set compartment are sealed to prevent poisonous exhaust gases from entering vehicles.

FUEL SYSTEM

With set running, check for leaks. Raw fuel will cause fumes which could EXPLODE. Check around carburetor and fuel pump inlets. Make sure fuel lines are not rubbing against anything which could cause breakage.

ELECTRICAL

AC Output

All AC leads (M1, M2, M3 and M4) terminate in generator set's junction box. These wires should be connected to distribution box with multistrand wire enclosed in a flexible conduit. Check all wires (to and from the generator set) for fraying and loose connections. For information on load connections refer to *OPERATION* section following.

Battery Connections

Battery positive (+) connection connects to start solenoid. Battery negative connects to location on rear of generator. Check terminals on set and battery for clean and tight connections.

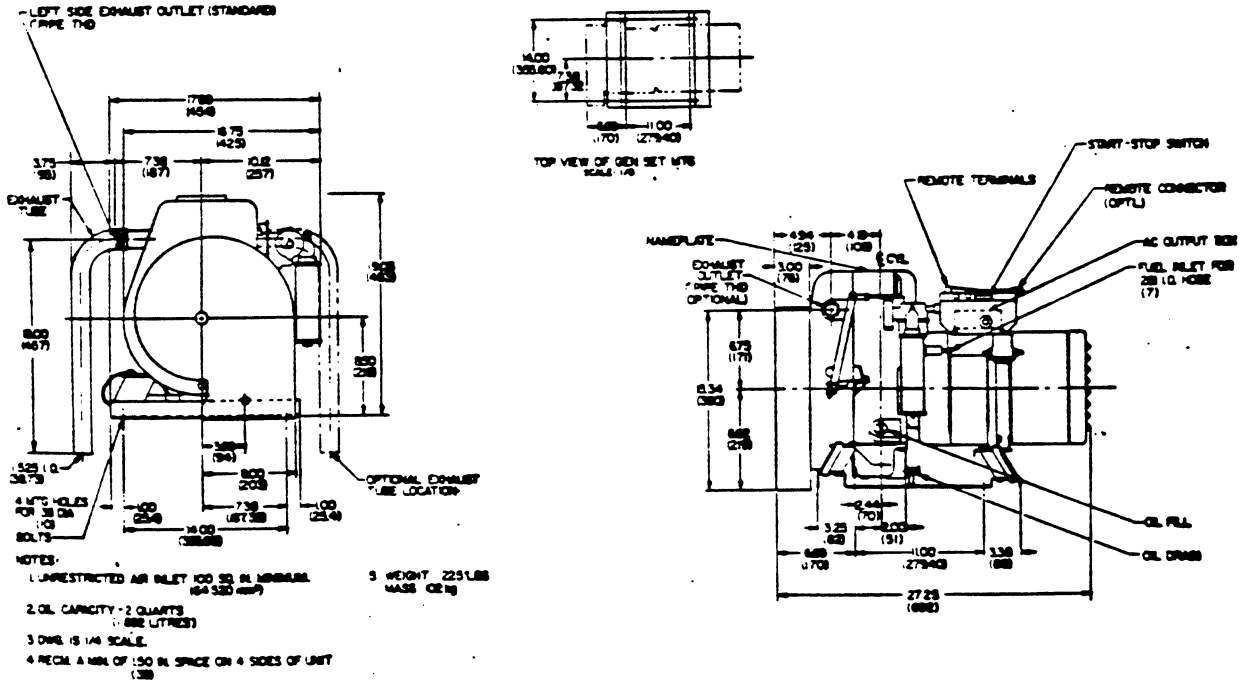


FIGURE 1. INSTALLATION OUTLINE

WARNING **Do NOT use unvented batteries with this generator set. Malfunction of the starting-charging system can produce high charging currents, causing excessive gassing. An unvented battery can build up sufficient pressure to explode.**

Grounding

Generator must be effectively bonded to recreational vehicle chassis.

For additional information on installation, contact your Onan Service Representative or request *Technical Bulletin (T-012)* from Onan.

VENTILATION

The biggest enemy of electric generating sets installed in motor homes is excessive heat. Make sure the set's air inlet and outlet are not plugged with dust, dirt, bugs, leaves or anything that could restrict cooling air.

WARNING **DO NOT DISCONNECT BATTERY CABLES FROM BATTERY WHILE GENERATOR SET IS CRANKING OR RUNNING; SPARKS MAY CAUSE AN EXPLOSION.**

WARNING **Don't use discharged cooling air for compartment heating since it could contain poisonous exhaust gases.**

OPERATION

OIL

Check oil level daily. (See Figure 2.) Be sure unit is level when checking oil. Add oil to top of fill hole if required. See *MAINTENANCE* section of this manual for type of oil, oil viscosity and crankcase capacity.

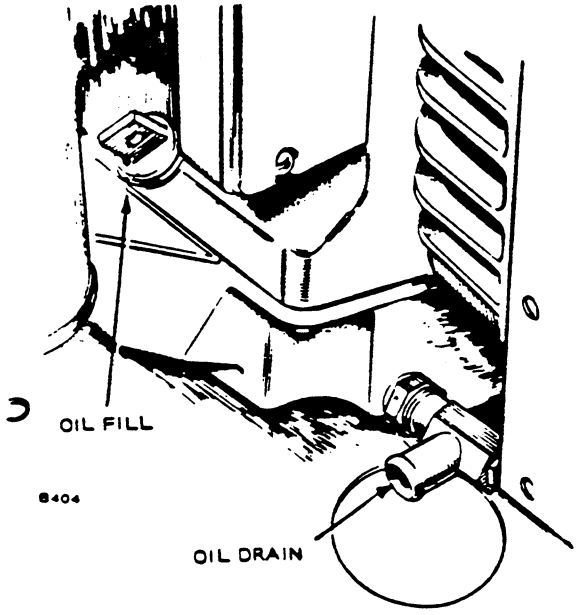


FIGURE 2. CHECKING OIL LEVEL

Use a good quality, heavy duty oil with the API (American Petroleum Institute) designation SE or SE/CC (gasoline operation only). If this oil is not available, SD or SE/CC designated oil can be used.

Check oil level daily and change oil every 100 normal operating hours. If operating in extremely dusty or dirty conditions, the oil might have to be changed sooner. When adding oil between changes, use the same brand as in the crankcase. Various brands of oil might not be compatible when mixed.

WARNING **DO NOT check oil while the generator set is operating. Hot oil could cause burns by blowing out of oil fill due to crankcase pressure.**

TEMPERATURE	GRADES
Above 90° F (32° C)	SAE 50
32° F to 90° F (0° C to 32° C)	SAE 30
0° F to 32° F (-17.8° C to 0° C)	SAE 10W-40, 5W-30
Below 0° F (-17.8° C)	SAE 5W-30

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

Use of the same grade and quality oil as that used in your recreational vehicle engine is acceptable as long as unit is serviced regularly and oil meets API designation SE or SE/CC. Other factors (primarily temperature) should also be considered when selecting appropriate engine oil.

RECOMMENDED FUEL

All Onan AC electric generating sets for recreational vehicles use gasoline fuel. Because any AC electric generating set runs at a constant speed, lead deposits tend to build up in the combustion chambers. For this reason, use clean, fresh, lead free or low-lead gasoline. Regular grade gasoline may also be used, but DO NOT use highly leaded premium types of fuel.

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

CAUTION **Lead deposits must be removed from an engine before switching from leaded to nonleaded gasoline. If not, preignition can occur causing engine damage.**

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

STARTING AND STOPPING

Push the toggle start switch to the right to crank the engine. When the engine starts, release the switch. Allow the generator set to warm up before applying a load.

To stop the engine, push the toggle switch to the left. If the set has been running with a full load connected, disconnect the load and allow the set to run for a few minutes before pushing the stop switch.

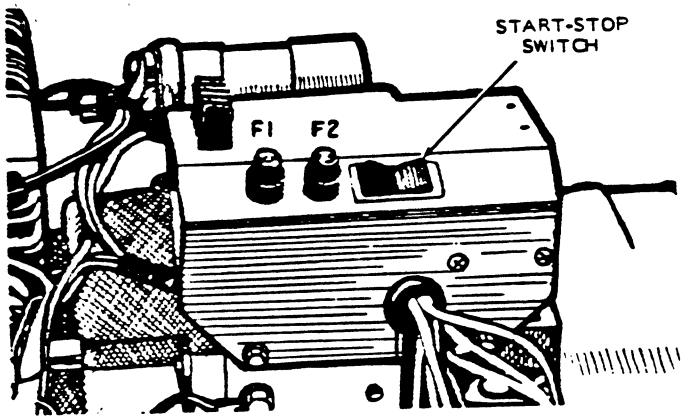


FIGURE 3. START-STOP SWITCH

CONTROL FUSES

A 10 amp, 32 volt fuse (F2) is connected in the ignition circuit of the control. If unit cranks but fails to start when switch S1 is pushed, check fuse F2. If remote battery condition meter does not operate, check fuse F1.

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 set. Break-in as follows:

1. One half hour at 1/2 load (1000-1200 watts).
2. One half hour at 3/4 load (with one air conditioner) only.
3. Change crankcase oil after the first 50 hours of operation.

APPLYING LOAD

If practical, allow set 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 nameplate rating.

RECONNECTIBLE, SINGLE-PHASE GENERATOR

Voltage selection on reconnectible, single-phase generators is for use as 120/240 volts, 3 wire; or 120 volts, 2 wire. Use the connection for two-wire service when one load exceeds one half the rated capacity. Balance the load when connecting for three wire service. Current for any one output lead must not exceed nameplate rating. When two or more single-phase circuits are available, divide the load equally between them. See Figure 4.

LOAD CONNECTIONS

1. Generator set load wires M1, M2, M3 and M4 terminate within the junction box. Connect and join wires within junction box in an approved manner for desired voltage code. See Figure 4.
2. Wires must be adequate size, properly insulated and supported.
3. Mount switches and controls securely to prevent damage from vibration and road shocks. All switches must be vibration proof to prevent accidental opening or closing while the vehicle is in motion.
4. All wiring must meet applicable local electrical codes. Have a qualified electrician install and inspect the wiring.

EXERCISE

Infrequent use results in hard starting. Operate the generator set one 30-minute period each week. Run longer if battery needs charging. Exercising for one long period each week is better than several short periods.

BATTERY CHARGING

The battery charge rate is controlled by a fixed value resistor that allows a trickle charge rate of 1 to 1-1/2 amps under all conditions.

HIGH OPERATING TEMPERATURE CONDITIONS

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

LOW OPERATING TEMPERATURE CONDITIONS

1. Use correct SAE oil for temperature conditions. Change oil only when engine is warm. If an unexpected temperature drop causes an emergency, move vehicle to a warm location.
2. Use fresh gasoline. Protect against moisture condensation. Below 0°F (-18°C), 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 airflow, but use care to avoid overheating.

EXTREMELY DUSTY AND DIRTY CONDITIONS

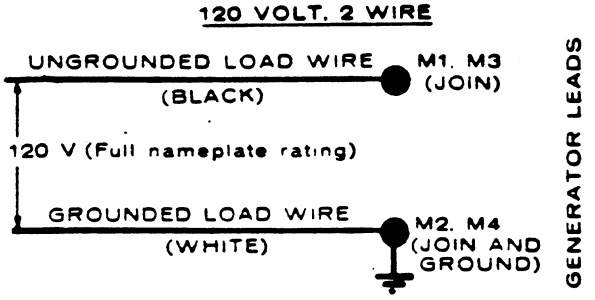
1. Keep unit clean. Keep cooling surfaces clean.
2. Service air cleaner as frequently as necessary.
3. Change crankcase oil every 50 operating hours.
4. Keep oil and gasoline in dust-tight containers.
5. Keep governor linkage clean.
6. Clean generator brushes, slip rings, and commutator; do *not* remove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

HIGH ALTITUDE OPERATION

For operation at altitudes of 2500 feet (775 m) above sea level, close carburetor main jet adjustment slightly to maintain proper air-to-fuel ratio (refer to the *ADJUSTMENTS* section). Maximum power will be reduced approximately four percent for each 1000 feet (310 m) above sea level after the first 1000 feet.

POWER REQUIREMENTS FOR APPLIANCES

Appliance or Tool	Approximate Running Wattage
Refrigerator	600-1000
Electric broom	200-500
Coffee percolator	550-700
Electric frying pan	1000-1350
Hair dryer	350-500
Electric stove (per element)	350-1000
Electric iron	500-1200
Radio	50-200
Electric water heater	1000-1500
Space heater	1000-1500
Electric blanket	50-200
Television	200-600
Electric drill	250-750
Battery charger	Up to 800
Electric water pump	500-600
Air Conditioner	1400-2000
Converter	300-350
Microwave Oven	700-1500



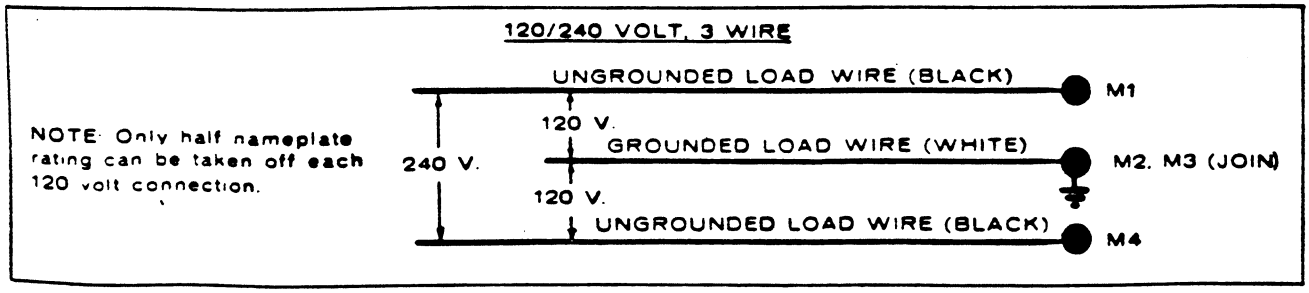
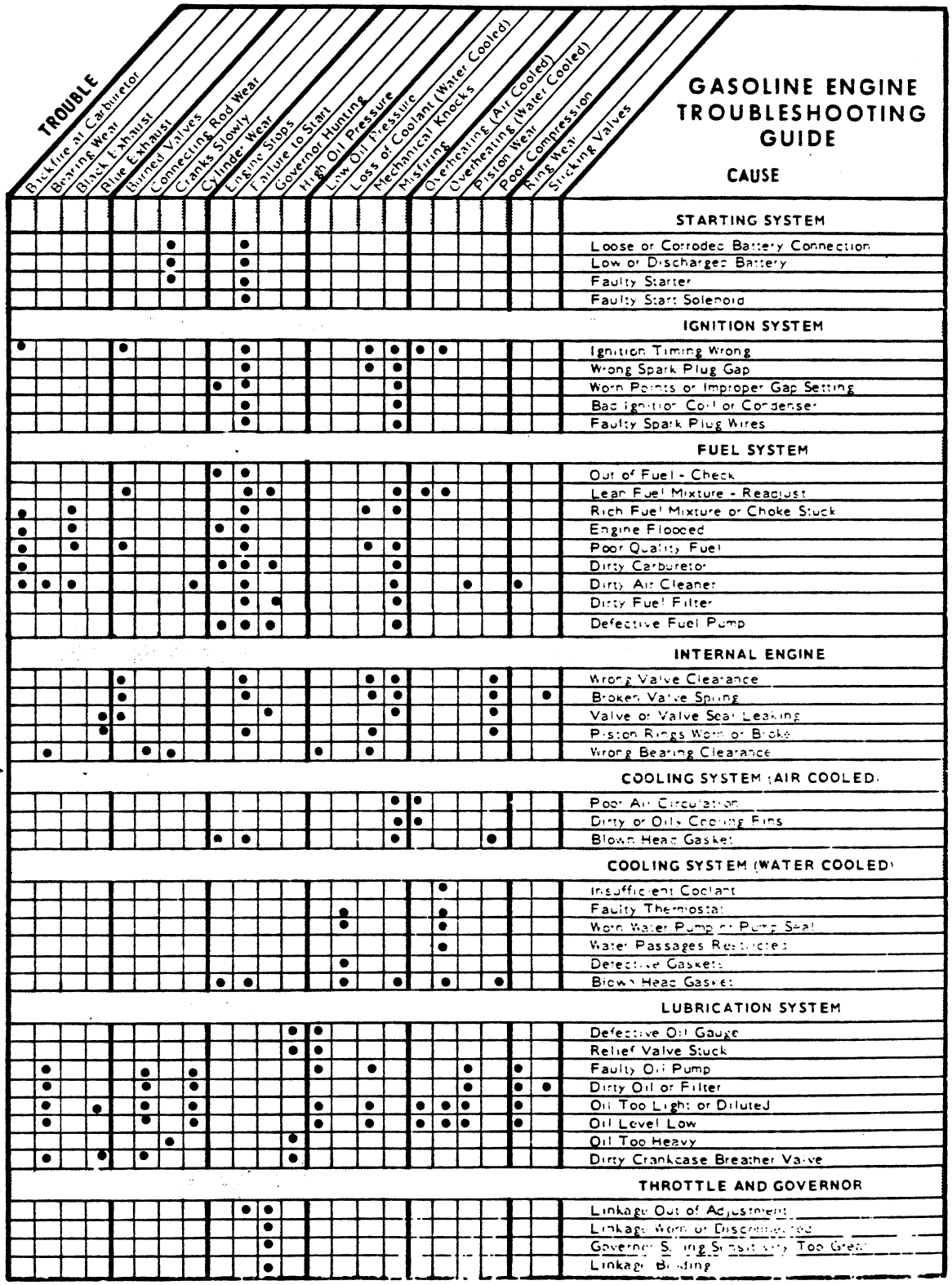


FIGURE 4. SINGLE-PHASE, "-3C" VOLTAGE CODE GENERATOR CONNECTIONS

ENGINE TROUBLESHOOTING GUIDE



MAINTENANCE

WARNING **Before beginning any maintenance work on the engine, generator, control panel or associated wiring, disconnect the battery. Failure to do so could result in damage to the unit or serious personal injury in the event of accidental starting.**

Periodically, make a complete visual inspection of the unit when running it at rated load. Some things to check:

1. Check all fuel and oil lines for possible leakage.
2. Inspect exhaust lines and mufflers for possible cracks and leakage.
3. Periodically, inspect air shrouds for leaks and security. Be sure cooling fins are clean.
4. Inspect electrical wires and connections for security and fray damage.

   If the generator set requires major repair or servicing, contact an authorized Onan Dealer or Distributor.

5. Maintain the electrolyte level by adding water (drinking quality or better) as needed for filling to split level marker. (The water ingredient of the electrolyte evaporates, but the sulphuric acid ingredient remains; therefore, add water, not electrolyte.)
6. Avoid overcharging when recharging. Stop the boost charge when the specific gravity is 1.260 and the electrolyte is 80°F (26.7°C).

FUEL SOLENOID

Evaporative control systems on late model motor homes require a positive fuel shutoff valve to prevent the generator set from flooding when not is use. An electric fuel solenoid mounts between fuel pump outlet and carburetor inlet. The solenoid opens during cranking and running. A defective solenoid will not allow set to start.

COOLING SYSTEM

The generator set is cooled by a flywheel blower fan which pulls air over the cylinders and cooling fins. The air path is directed by sheet metal shrouds and plates. These shrouds and plates must always be installed properly so unit does not overheat.

Check and clean (if necessary) the cooling fins at least every 200 hours of operation. Remove any dust, dirt or oil which may have accumulated. Check compartment air inlet and power plant air outlet for buildup of dirt, chaff, etc.

AIR CLEANER ELEMENT

Check and clean element at least every 100 hours. Loosen wing nut to remove. Clean by tapping base lightly on a flat surface. Replace element at least every 200 operating hours; clean or replace more often in dusty conditions.

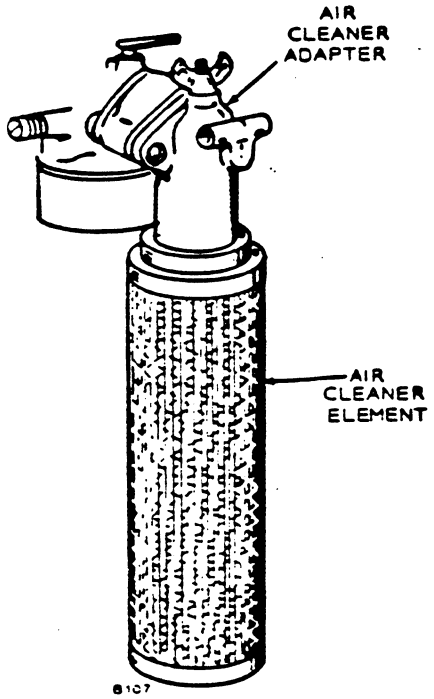


FIGURE 5. AIR CLEANER ELEMENT

SPARK PLUG

Replace spark plug every 100 hours or at least once a year. A badly leaded plug will cause misfiring, poor operation or stopping when a load is applied.

- Black deposits indicate a rich mixture.
- Wet plug indicates misfiring.
- Badly or frequently fouled plug indicates the need for a major tune-up.

Each time the spark plug is removed, inspect, clean and regap (Figure 6). If the plug looks discolored or has fouled, replace it.

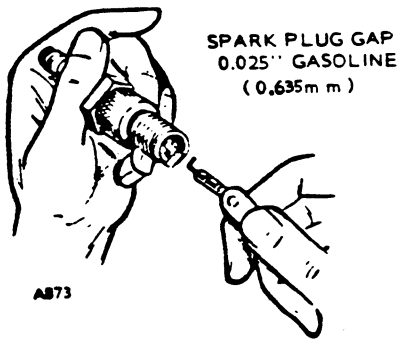


FIGURE 6. CHECKING SPARK PLUG GAP

GOVERNOR LINKAGE

The linkage must be able to move freely through its entire travel. Every 50 hours of operation, clean the joints and lubricate as shown in Figure 7. Also inspect the linkage for binding, excessive slack and wear.

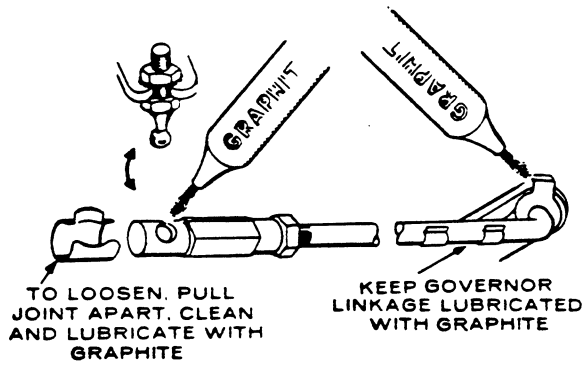


FIGURE 7. GOVERNOR LINKAGE

OUT-OF-SERVICE PROTECTION

Protect a generator set that will be out of service for more than 30 days from damage caused by rust or corrosion. Use the following procedure to properly protect the set.

1. Run the generator set with at least a 50-percent load until thoroughly warm (usually about 1 hour).
2. Turn off fuel supply and allow the engine to run out of fuel. Also operate the choke manually as the engine stops to help drain the carburetor completely.
3. Drain the oil from oil base while engine is still warm. Replace the oil filter if so equipped. Replace drain plug and refill. Attach a warning tag stating type and viscosity of oil used.
4. Remove spark plug. Pour 1 ounce of rust inhibitor oil (or SAE #10) into the cylinder. (Spray cans work well for this application.) Turn engine over by hand at least two complete revolutions. Replace the spark plug.
5. Replace the air cleaner at least on an annual basis.
6. Plug the exhaust outlet to prevent entrance of moisture, dirt, bugs, etc.
7. Clean and oil all exposed engine parts including carburetor and governor linkage.
8. Wipe generator brushes, slip rings, housing, etc. Do not apply any lubricant or preservative.
9. Remove the battery and store in a cool dry place. Coat the battery terminals and cable connections with vasoline or grease to prevent any corrosion. Recharge the battery at least monthly or maintain with a trickle type battery charger.
10. Provide a suitable cover if the unit is exposed to the elements.

RETURNING THE UNIT TO SERVICE

1. Remove the cover and all protective wrapping. Wipe the oil film off all exposed engine parts. Remove the plug from the exhaust outlet.
2. Visually inspect the unit for any damage. Check to be sure the carburetor and governor linkage are free. Remove the generator end bell band and check to be sure the brushes work freely in their holders.
3. Check the tag to ensure oil of the proper brand and grade has been installed. Check the oil level.
4. Install the battery (be sure battery is fully charged), observing proper polarity. Ground is negative.
5. Remove spark plug. Clean and gap. Turn the engine over by hand several times. Reinstall spark plug.
6. Turn on fuel, disconnect electric fuel pump lead and electric fuel solenoid shut-off lead if unit is so equipped. Jumper the fuel pump and electric fuel solenoid shut-off leads to the battery to prime the unit. Use the hand primer lever on units with mechanical pumps. Reconnect the leads.
7. Remove all load and start the generator set at the unit. Initial start may be slow due to oil or rust inhibitor in the cylinder. Excessive smoke and rough operation will occur until the oil or rust inhibitor is burned off.
8. Apply a 50-percent load after the set runs smooth. Allow the generator set to warm up (1 hour) with the load connected. Check speed and voltage.
9. Unit is now ready for service.

BREATHER VALVE

The crankcase breather prevents pressure from building up on the crankcase but maintains a vacuum in the crankcase to reduce oil leaks. A sticky breather valve can cause oil leaks, high oil consumption, rough idling, reduced engine power and a rapid formation of sludge and varnish within the engine.

Every 100 hours of operation, remove the hose that carries air from the breather valve at the valve compartment cover to the carburetor adapter (Figure 8). Loosen the valve with pliers. Occasionally, the valve will lift out and remain inside the hose. Wash the valve in kerosene or other suitable solvent. Dry and replace. The valve must work free and the hose must not be restricted to prevent expelled air from reentering the crankcase.

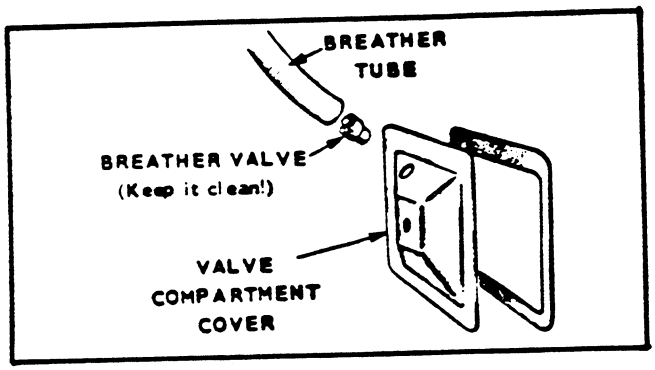


FIGURE 8. BREATHER VALVE

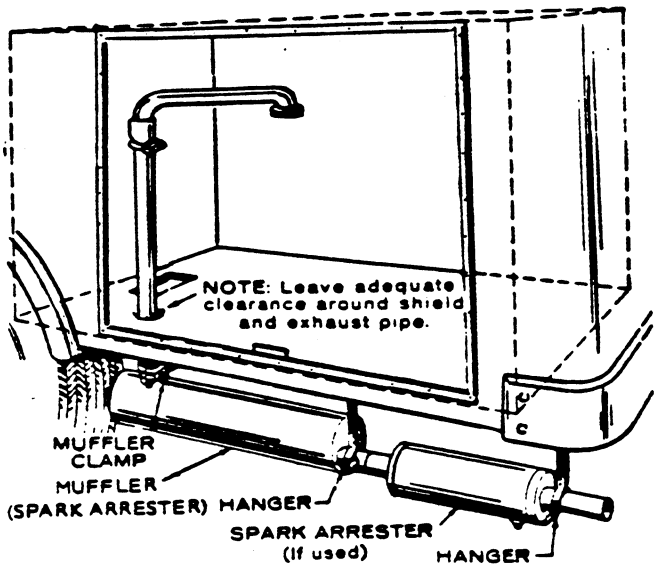


FIGURE 9. SPARK ARRESTER (OPTIONAL)

GENERATOR MAINTENANCE

The generator normally needs little care other than a periodic check of the brushes, commutator and collector rings. If a major repair job on the generator should become necessary, have the equipment checked by a competent electrician who is thoroughly familiar with the operation of electric generator equipment.

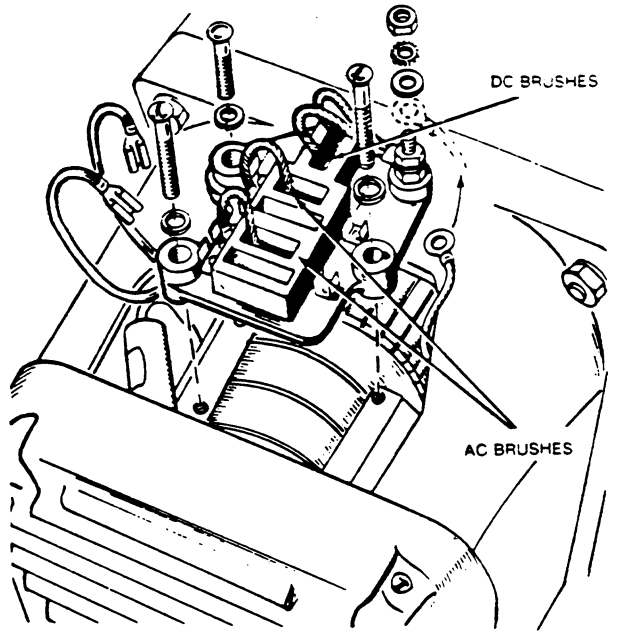
SPIN-OUT SPARK ARRESTER (Optional)

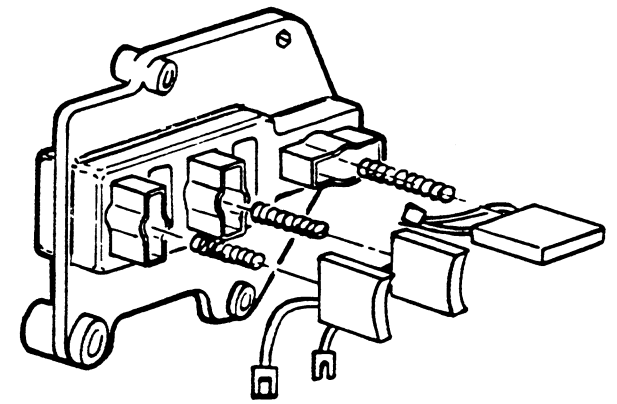
The spin-out spark arrester attaches to the muffler (Figure 9). It removes carbon particles from the generator set exhaust by centrifugal force, catching the particles in a holding chamber. Removing a pipe plug from the arrester and operating the electric plant (at a convenient time and place) cleans out the deposits. It is important to note that this arrester does not plug up when the holding chamber is full and does not cause harmful, high exhaust pressure. When full, particles pass through the arrester. Arrester must be cleaned every 50 to 100 hours.

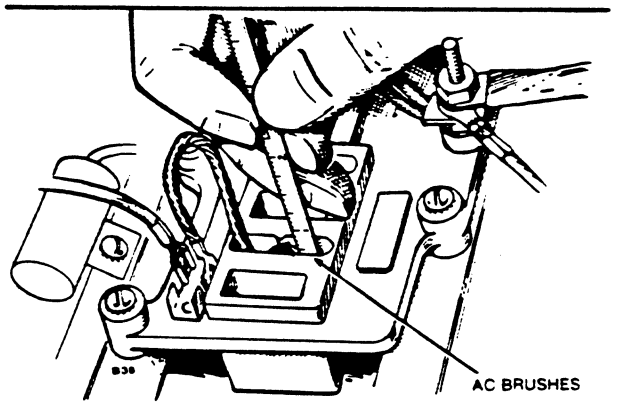
Brush Replacement

Install new brushes when the old ones are worn to the dimensions shown in Figure 10. Remove the end bell band to expose the brush holders. Remove the three screws holding each brush holder in place (Figure 10). Remove the old brushes and clean the holders so the new brushes can move easily in their holders. Install the new brushes in the same manner as the old ones. Always use the correct brush as listed in the *PARTS CATALOG* (930-0220). Never substitute a brush which may appear to be the same for it may have different characteristics. New brushes are shaped to fit and seldom need sanding to seat properly. If some brush sparking occurs after replacing brushes, run the set under a light load until the brushes wear to a good seat.

Collector rings acquire a glossy brown finish in normal operation. Do not attempt to maintain a bright newly machined appearing surface. Ordinary cleaning with a dry, lint-free cloth is usually sufficient. Very fine sandpaper (#00) may be used to remove slight roughness. Use only light pressure on the sandpaper, while the unit is operating. Do not use emery, carborundum paper or cloth. Clean out all carbon dust from the generator.







MEASURE FROM TOP FACE OF BRUSH BLOCK TO TOP OF BRUSH

	DC	AC
NEW	5/8"	11/16"
½ WEAR	13/16"	7/8"
REPLACE	1"	1 1/16"

FIGURE 10. BRUSH LENGTH

PERIODIC MAINTENANCE SCHEDULE

Regularly scheduled maintenance is the key to lower operating costs and longer service life for the unit. The following 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 have to be reduced. Check the condition of the crankcase oil, the filters, etc. frequently until the proper service time periods can be established.

For any abnormalities in operation, unusual noises from engine or accessories, loss of power, overheating, etc., contact your nearest authorized Onan Service Center.

SERVICE THESE ITEMS	AFTER EACH CYCLE OF INDICATED HOURS				
	8	50	100	200	400
General Inspection	x1				
Check Oil Level	x				
Check Battery Electrolyte Level		x			
Change Crankcase Oil			x2		
Check Spark Plugs			x4		
Check Breaker Points			x3		
Clean Breather Valve			x		
Clean Governor Linkage			x		
Service Air Cleaner (Oil Bath)			x2		
Replace Air Cleaner Element (Dry)				x2	
Clean Cooling Fins				x2	
Change Oil Filter (If Used)				x2	
Replace Breaker Points				x4	
Clean Crankcase Breather				x	
Remove Carbon Deposits From Heads				x	
Adjust Tappets					x
Replace Fuel Filter (If Used)					x4
Clean Carburetor					x
Check Generator Brushes (Replace if Necessary)	As Required				

x1 - With set running, visually and audibly check exhaust system for leaks.
x2 - Perform more often in extremely dusty conditions.
x3 - Replace if necessary.
x4 - Replace annually or prior to storage.

ADJUSTMENTS

Satisfactory generator set performance depends on correct adjustments. However, adjustments cannot fully compensate for low engine power due to wear, etc. If trouble develops, follow an orderly procedure to determine the cause before making any adjustment. Refer to the *Troubleshooting Chart* for help in checking the cause of any trouble that occurs. Consult your nearest Onan Service Representative.

BREAKER POINTS

Check the breaker points every 100 hours:

1. Remove the 2 screws and the cover on the breaker box.
2. Remove spark plug so engine can be rotated easily by hand.
3. Turn flywheel in a clockwise direction approximately 1/4 turn after top center (TC).
4. To adjust the gap, refer to Figure 11. Loosen screws (A) and turn cam (B) until point gap measures .020 inch (.508 mm) with a flat thickness gauge. Retighten screws (A) and recheck gap.
5. If points are slightly burned, dress smooth with a file or fine stone. If points appear to be burned and pitted, replace with a new set.
6. Replace spark plug and breaker box cover.

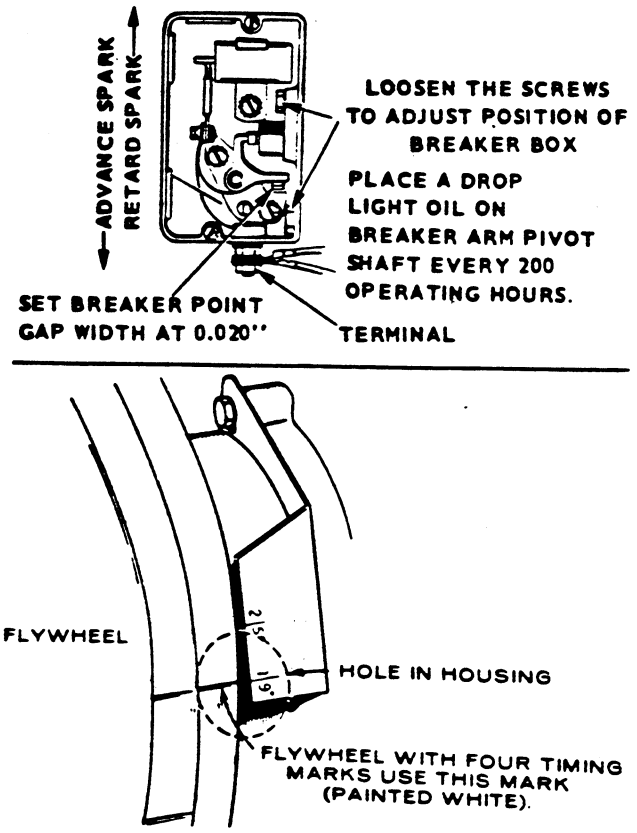


FIGURE 11. BREAKER POINTS AND TIMING MARKS

CARBURETOR—GASOLINE

Adjust the carburetor to obtain the correct fuel-to-air mixture for smooth, efficient operation.

The carburetor has a high speed fuel main adjustment and a fuel idle adjustment (Figure 12). The main adjustment affects operation under heavy load conditions; the idle adjustment affects operation at light or no load.

If the carburetor is completely out of adjustment so the engine will not run, open both needle valves 1 to 1-1/2 turns off their seats to permit starting.

CAUTION **When determining fuel mixture settings, never force the needle valve against its seat. This damages both the needle and the seat. The needle does not completely shut off when turned fully in.**

Adjust the carburetor in two steps—first the load adjustment, then the idle adjustment. Be sure the governor is properly adjusted. Then, allow the engine to warm up.

1. Remove all AC load. Connect a voltmeter to the AC leads or plug the meter into one of the generator set receptacles (if available).
2. Connect appliances to achieve a full load condition on the generator set.
3. With a rated load applied, adjust the main fuel adjustment to obtain the highest voltage.
4. Remove the connected load and hold the governor arm to minimum speed.
5. Release the governor arm and observe acceleration.

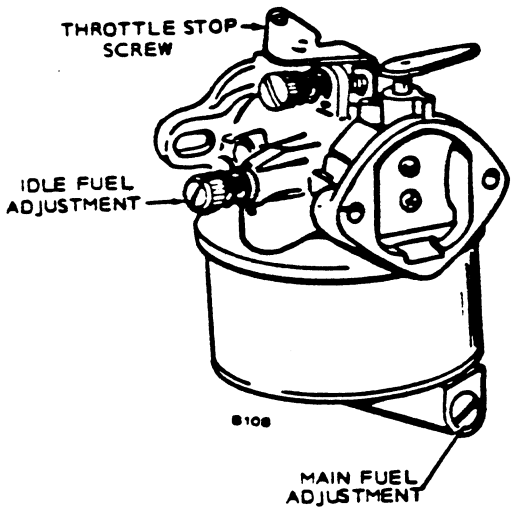


FIGURE 12. CARBURETOR ADJUSTMENTS

CAUTION **Do not open main fuel jet more than 1/2 turn beyond the maximum power point as this could cause spark plug fouling, etc.**

6. If surging occurs at governed speed, open the main jet slightly.

Do not exceed one-half turn beyond the full load point. If surging continues, adjust the governor sensitivity.

7. Leave the voltmeter connected. Hold the governor arm against the throttle. Turn the idle fuel adjustment in until the voltage drops.
8. Then, turn it out until the highest voltage is obtained.
9. Release the governor arm. The engine should accelerate to governed speed and become stable.

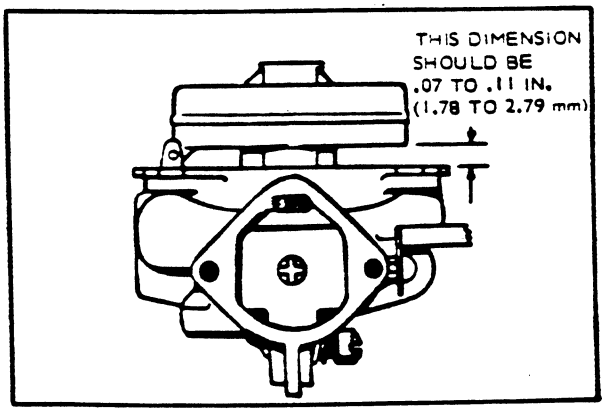


FIGURE 13. CARBURETOR FLOAT ADJUSTMENT

CARBURETOR FLOAT ADJUSTMENT

1. Invert float and casting. See Figure 13.
2. With the float resting lightly against the needle and seat, there should be .07 to .11 inch clearance between base of float and carburetor casting.

A drill bit can be used for this measurement as shown in Figure 13. Use a 3/32 inch drill bit or any bit between .07 inch (No. 50) and .11 inch (No. 35).

3. If it is necessary to reset float level, remove the float from carburetor and bend the float tang, near the pin, to obtain correct float level.

CAUTION **Do not bend the float when installed; doing so may cause deformation of needle or seat.**

4. Check the float closely for signs of leakage. Repair or replace float if damaged or filled with gasoline.
5. Before assembling carburetor, remove filter screen from float bowl and clean both screen and base of float bowl.
6. Install new gaskets when reassembling.

BIMETAL CHOKE

Onan equips the LK generator set with the bimetal choke. The choke controls the amount of air intake to the carburetor venturi. When the engine is first started, the choke is closed but gradually opens as the engine warms up. Rough operation of a cold engine indicates the need of choke adjustment.

To adjust the choke, the bimetal spring must be at ambient temperature. Allow the engine to cool for at least one hour before adjusting. Refer to Figure 14.

1. Remove the air cleaner and adapter to expose the carburetor throat.
2. Loosen the screw that secures the choke body.
3. Rotate the choke body clockwise to increase choke action and counterclockwise to decrease choke action (leaner mixture).

At 70° F (21.1° C) the choke valve should be almost wide open.

The direction marking "CHOKE" as appears cast on the body of some carburetors is correct for manually choked sets, but is wrong for electric choked sets due to the choke valve arrangement. Choking position of the weight lever is vertical, on the shaft of electrically choked sets. Choking position of the lever is horizontal on manually choked sets.

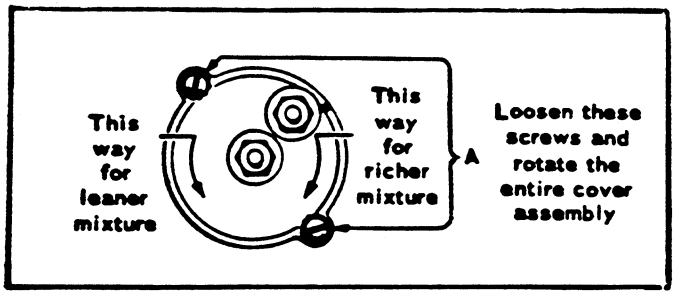


FIGURE 14. ELECTRIC CHOKE ADJUSTMENT

GOVERNOR ADJUSTMENTS

The governor controls the engine speed. On AC generating sets, the engine speed determines generator output voltage and current frequency. By increasing engine speed, the generator voltage and frequency is increased. Use an accurate voltmeter when adjusting the governor on AC units. A small speed drop not noticeable without instruments will result in an objectionable voltage drop.

The governor arm fastens to a shaft that extends from the gear cover (Figure 15). A ball joint and link connect the arm to the carburetor throttle arm. If the carburetor has been removed or the governor disassembled, a readjustment of the governor may be necessary.

Slow governor action or poor regulation results when binding develops

- In the bearings of the shaft that extends from the gear cover,
- In the ball joints, or
- In the carburetor throttle assembly.

Looseness or excessive wear in the governor mechanism causes erratic governor action or an alternate increase and decrease in speed (hunting). A lean carburetor adjustment may also cause hunting.

After long usage, the governor spring has a tendency to lose its calibrated tension due to fatigue. If governor action is still erratic after making all governor and carburetor adjustments properly, install a new spring and reset the adjustments.

With the carburetor and governor adjusted, set the throttle stop screw to allow 1/32 inch (7.95 mm) clearance to the stop pin with the engine operating at no load. This prevents excessive hunting when a large load is suddenly removed. See Figure 16.

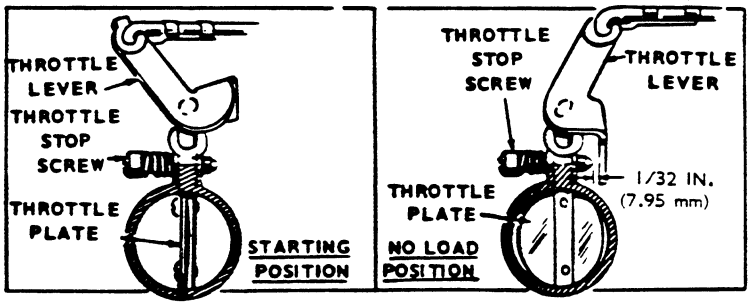


FIGURE 16. THROTTLE STOP SCREW

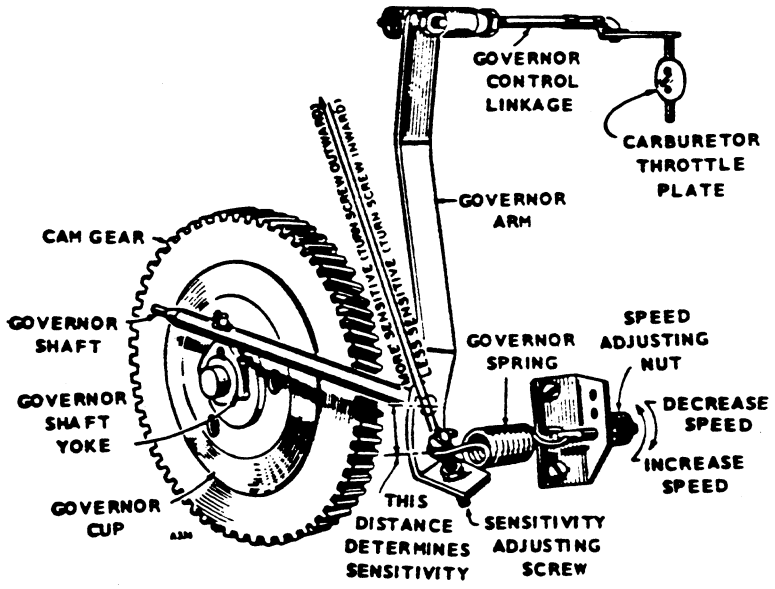


FIGURE 15. GOVERNOR ADJUSTMENTS

Linkage

The engine starts at wide open throttle. Rotate the ball joint housing to adjust the length of the linkage connecting the governor arm to the throttle arm. Adjust the length so that with the engine stopped and tension on the governor spring, the stop on the carburetor throttle lever is 1/32 inch (.795 mm) from the carburetor stop boss. This setting allows immediate control by the governor after starting and synchronizes travel of the governor arm and the throttle shaft.

Speed Adjustment

With the warmed up unit operating at no load, adjust the tension of the governor spring. Refer to the *Voltage* and *Speed Charts*. Turn the adjusting nut to obtain a voltage and speed reading within the limits shown.

SENSITIVITY ADJUSTMENT

The correct sensitivity gives the closest regulation without causing a hunting condition. The sensitivity of the LK governor depends on the position of the governor spring to the governor shaft—the closer the spring is to the shaft, the more sensitive is the regulation. Alter the position of the sensitivity spring by adjusting the sensitivity screw as Figure 15 shows.

If the setting is too sensitive, a hunting condition will result. If the setting is not sensitive enough, the speed variation between no load and full load conditions will be too great. Therefore, the correct sensitivity will result in the most stable speed regulation without causing a surge condition.

Always recheck the speed adjustment after a sensitivity adjustment. Increasing sensitivity causes a slight decrease in speed and requires a slight increase in the governor spring tension.

VOLTAGE CHART FOR CHECKING GOVERNOR REGULATION

AC GENERATOR SET	120-VOLT 1 PHASE 2 WIRE
Maximum No Load Volts	126
Minimum Full Load Volts	110

SPEED CHART FOR CHECKING GOVERNOR REGULATION

Maximum No Load Speed	
RPM	1870
Hertz (Current Frequency)	62
Minimum Full Load Speed	
RPM	1770
Hertz	59

CONTROL TROUBLESHOOTING

CRANKS SLOWLY	CRANKS - NO START	FAILS TO CRANK	RUNS A SHORT TIME	RUNS AND SURGES	STOPS	ELECTRO-MECHANICAL AND CONTROL TROUBLESHOOTING GUIDE PROBABLE CAUSE	STEP
•		•				Bad Battery Connection	1
•		•				Low Battery	2
	•	•				Faulty Relay K1 or K2	3
	•					Faulty Fuel Solenoid	4
	•				•	Faulty Ignition	5
	•					Faulty Low Oil Pressure Switch	6
			•	•	•	Faulty Choke	7
	•		•		•	Low Oil Level	8
				•		Governor Out of Adjustment	9

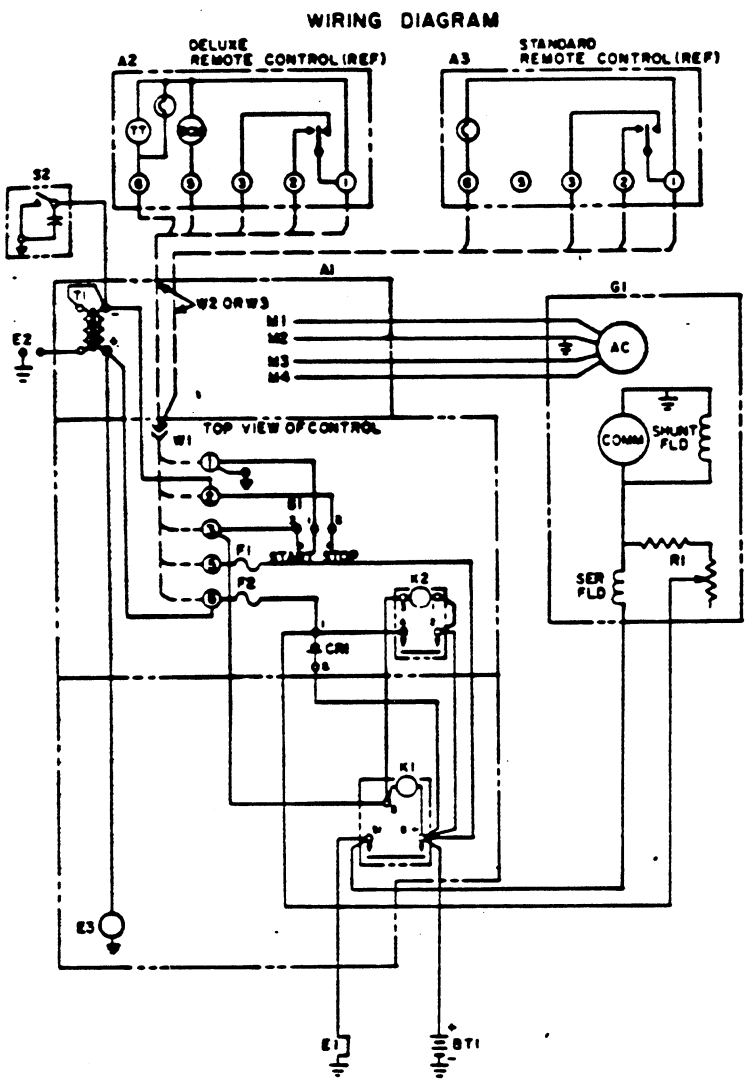
1. Clean and tighten all battery and cable connections.
2. Check specific gravity. Recharge or replace battery if necessary.
3. Push start switch. Check K1-S1 contacts to ground. Battery voltage should appear at this terminal; if not replace solenoid.

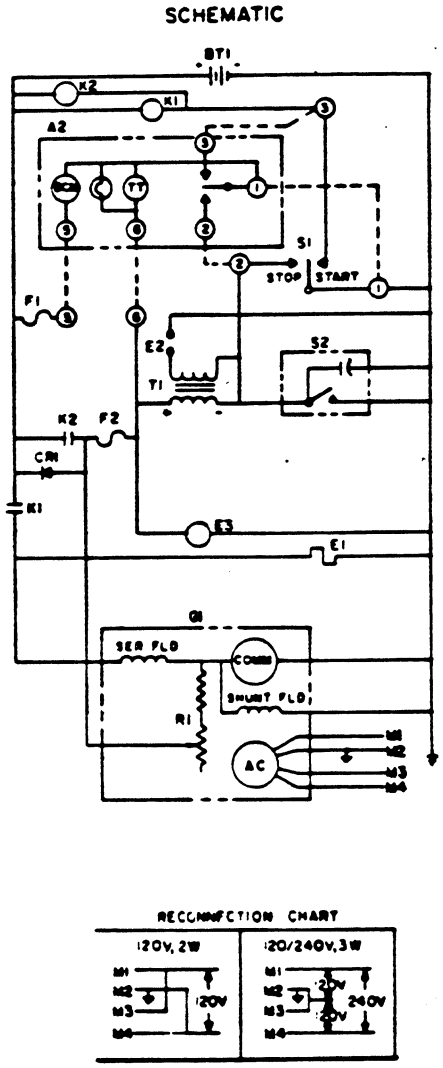
   Check K2-4 terminal voltage to ground. Battery voltage should appear at this terminal. If not, check for battery voltage at K2 terminals 1 and 2. If battery voltage is there replace K2. If not check the wiring between K1 and K2.
4. Fuel solenoid must open during cranking and running. Check by removing steel line from carburetor and crank engine. If fuel solenoid is open, fuel will pulsate out of this line. If it does not, the fuel solenoid and fuel pump must be checked separately to determine defective part.

WARNING **Use extreme care for this test. Direct fuel flow into a suitable container and make sure area is well ventilated to prevent accumulation of gasoline fumes.**

5. Check to see if points open and close during cranking. If they do not open and close, adjust and set points. Plug and plug wires must be in good condition. Voltage at ignition coil negative terminal (-) must alternate from +12 volts to zero volts as points open and close during engine cranking.
6. Remove wire lead from low oil pressure switch. With proper oil level in engine, crank and run engine. Replace wire lead to low oil pressure switch. Engine must continue to run when the wire lead is reconnected. If it does not, replace low oil pressure switch.
7. With engine not running, check choke vane movement by pushing choke lever arm. Choke must be in closed position with cold engine, and must be free to move against bimetal spring. As engine warms up, bi-metal spring relaxes and allows choke vane to open fully. The lever will pulsate as engine warms up. See *ADJUSTMENT* section.
8. Check oil level. If low or empty, refill to proper level.
9. Readjust governor.

610-0350C





A1 ..... Control Assembly
S1 ..... Start-Stop Switch
K1 ..... Start Solenoid
S2 ..... Breaker Points Assembly
E1 ..... Onan Choke
E3 ..... Fuel Solenoid
T1 ..... Ignition Coil

G1 ..... Generator
BT1 ..... 12 Volt Battery
E2 ..... Spark Plug
CR1 .... Reverse Current Diode
A2 ..... Deluxe Remote Control
A3 ..... Standard Remote Control
F1 & F2 . Fuse 10 Amp, 32 Volt

REMOTE ACCESSORIES

INSTALLING STANDARD REMOTE CONTROL

This control includes a start-stop switch with an indicator lamp. Install as follows:

1. Select switch location. Using Figure 17 as a guide, drill screw holes and cut holes in RV panel.
2. Following national and local electrical codes and using four insulated wires of predetermined length (#18 or larger), connect remote switch to terminals on generator. See Figure 18.

CAUTION **Ensure that leads from remote switch connect with corresponding terminals on generator terminal board.**

CAUTION **Don't route DC wires for remote control through conduit containing AC load wiring. Induced voltages may cause erratic operation.**

3. Insert remote switch in hole cutout and secure with two #5 woodscrews supplied with switch.

WARNING **Seal all holes that might allow noxious gases from generator set into motor home.**

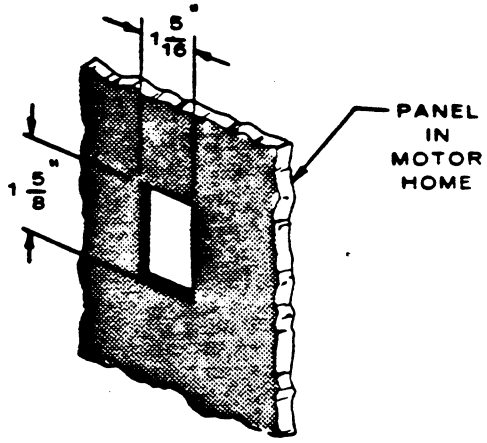
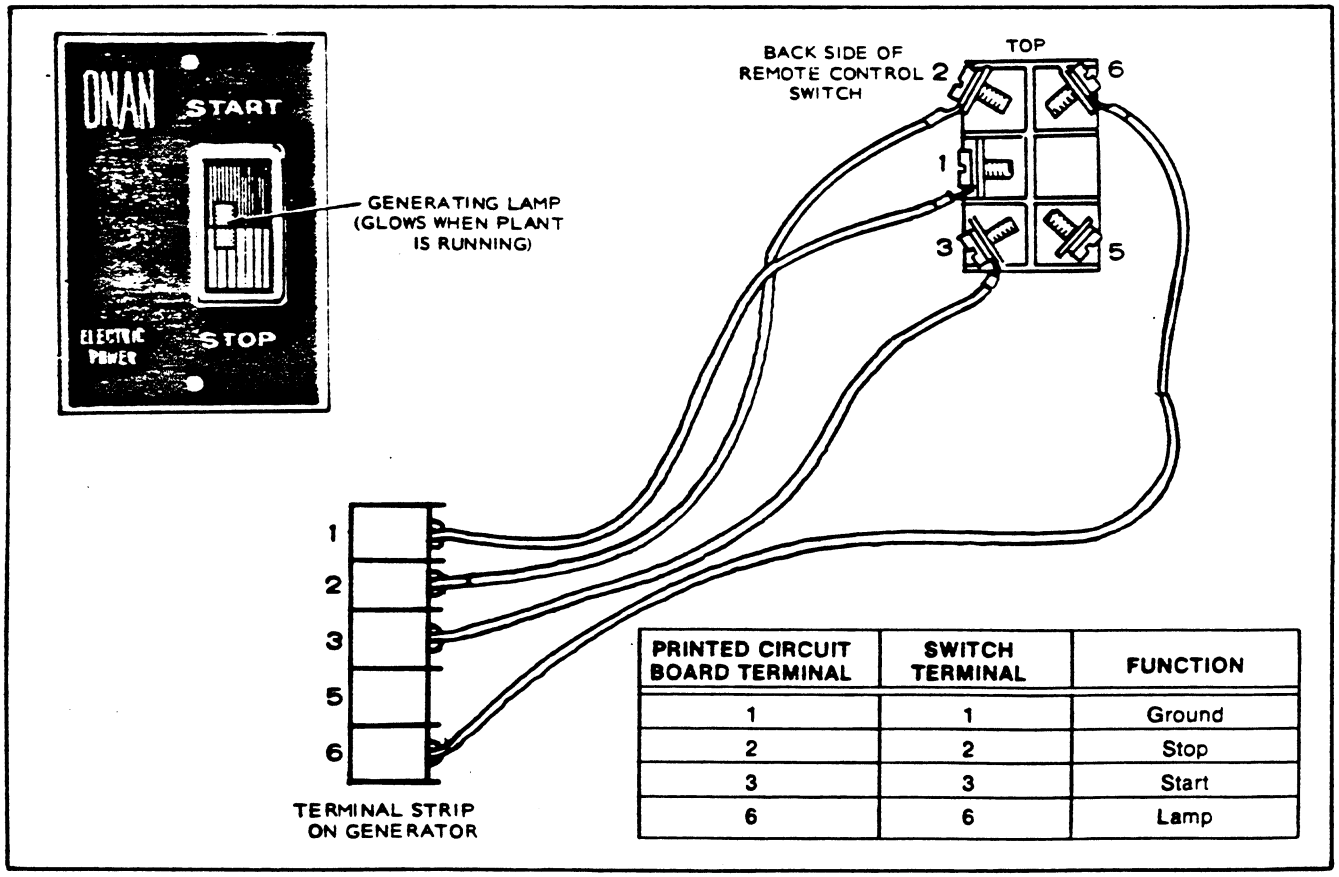


FIGURE 17. MOTOR HOME CUTOUT



PRINTED CIRCUIT BOARD TERMINAL	SWITCH TERMINAL	FUNCTION
1	1	Ground
2	2	Stop
3	3	Start
6	6	Lamp

FIGURE 18. CONNECTING REMOTE CONTROL (300-0985)

INSTALLING DELUXE REMOTE CONTROL

This control includes a start-stop switch with an indicator lamp, a running time meter and a battery condition meter. Install and connect as follows:

1. Select control location. Using Figure 19 as a guide, drill screw holes and cut hole to accommodate remote switch in panel.
2. Following national and local electrical codes and using five insulated wires of predetermined length (#18 or larger), connect remote control to terminals on generator. Ensure that leads from remote control connect to corresponding terminals on generator terminal board. See Figure 20.

CAUTION **Don't route DC wires for remote control through conduit containing AC load wiring. Induced voltages may cause erratic operation.**

3. Insert remote control in hole cutout and secure with two #5 woodscrews supplied with switch.

WARNING **Seal all holes that might allow noxious gases to enter motor home.**

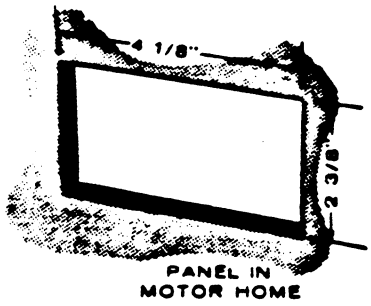
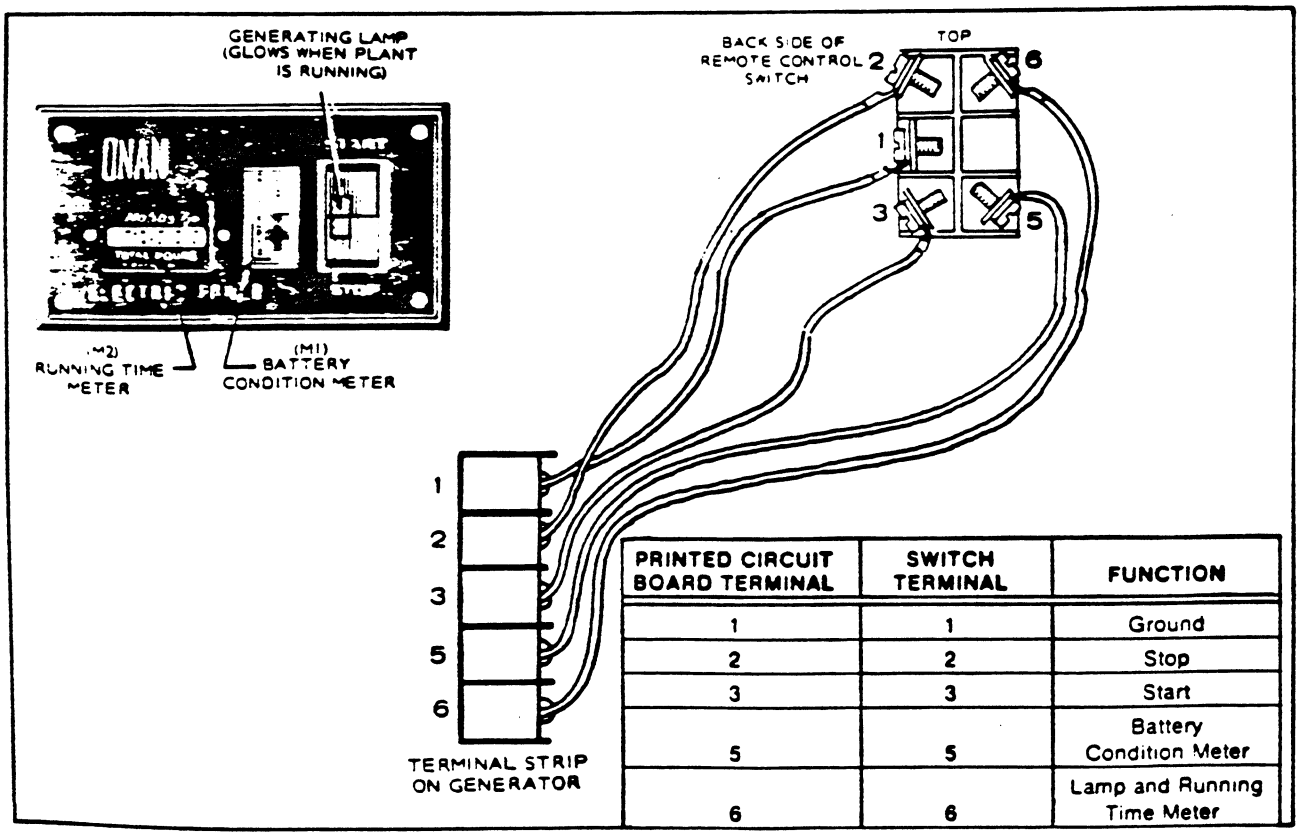


FIGURE 19. MOTOR HOME CUTOUT



PRINTED CIRCUIT BOARD TERMINAL	SWITCH TERMINAL	FUNCTION
1	1	Ground
2	2	Stop
3	3	Start
5	5	Battery Condition Meter
6	6	Lamp and Running Time Meter

FIGURE 20. CONNECTING DELUXE REMOTE CONTROL (300-0986)

LK "RV" PARTS INFORMATION

For additional information on parts or service contact your nearest authorized Onan dealer or Service Center. A complete parts manual is available and may be ordered under #930-0220.

The following Running Replacement Parts List consists of external items which may require replacement due to normal wear and service and can usually be installed by the operator.

RUNNING REPLACEMENT PARTS LIST

PART NO.	DESCRIPTION
140-1220	Air Cleaner Element
167-0241	Spark Plug
160-0002	Breaker Points
312-0069	Condenser (Breaker Points)
166-0278	Ignition Coil
146-0197	Carburetor
146-0124	Carburetor Gasket Kit
149-0690	Fuel Pump
214-0095 (DC)	Generator Brush
214-0096 (AC)	Generator Brush
307-0845	Start Solenoid
307-1279	Fuel Solenoid
402-0385	Focalized Mount
149-1353	In-Line Fuel Filter
321-0146	Fuse F1 & F2

MANUFACTURER'S LIMITED WARRANTY

Onan extends to the original purchaser of goods for use, the following warranty covering goods manufactured or supplied by Onan, subject to the qualifications indicated.

(1) Onan warrants to original purchaser for the periods set forth below that goods manufactured or supplied by it will be free from defects in workmanship and material, provided such goods are installed, operated, and maintained in accordance with Onan's written instructions, and further provided, that installation inspection and initial start-up on commercial-industrial generator set or power system installations are conducted by an Onan Authorized Distributor or its designated service representative.

PRODUCT APPLICATION	PERIOD OF WARRANTY
☐ Goods used in personal, family and household applications.	One (1) year from date of purchase.
☐ Goods used in commercial-industrial applications.	One (1) year from date of purchase.
☐ Commercial-industrial stationary generator sets.	One (1) year from date of initial start-up.
☐ Commercial-industrial, standby power systems with nominal operating speeds of 1800 rpms or less which are installed in the U.S. or Canada (must include Onan supplied generator sets, automatic transfer switch, exerciser and running time meter).	* Five (5) years or 1500 hours, whichever occurs first from the date of initial start-up. Labor allowance for the first two (2) years or 1500 hours, whichever occurs first from the date of initial start-up.
☐ Commercial-industrial, standby power systems with nominal operating speeds of 1800 rpms or less which are installed outside the U.S. or Canada (must include Onan supplied generator set, automatic transfer switch, exerciser and running time meter).	* Two (2) years or 1500 hours, whichever occurs first from the date of initial start-up
☐ Repair or replacement parts.	Ninety (90) days from date of purchase. excludes labor.

* Must be registered on Form No. 23C065, to be provided and completed by seller.

(2) Onan's sole liability and Purchaser's sole remedy for a failure of goods to perform as warranted shall be limited to the repair or replacement of goods returned to Onan's factory at 1400 73rd Avenue N.E., Minneapolis, Minnesota 55432, or to an Onan Authorized Distributor or its designated service representative, transportation prepaid.

Except as indicated below, this warranty does not include travel time and mileage labor for removal of Onan product from its application and reinstallation.

a) Removal and Reinstallation

i. *Garden Tractor Engines*—Onan will pay up to a maximum of two (2) hours labor for warranty work requiring removal and reinstallation of Onan industrial engines in garden tractor applications performed by an Onan Authorized Distributor or its designated service representative.

ii. *Vehicles*—Onan will pay one (1) hour labor for warranty work requiring removal and reinstallation performed by an Onan Authorized Distributor or its designated service representative on vehicle applications utilizing a POWER DRAWER® and Onan supplied sliding tray generator set installations.

b) Travel Time and Mileage

i. *Marine Generator Set Installations*—Onan will, for six (6) months after date of purchase, pay travel time up to four (4) hours and mileage costs up to one hundred fifty (150) miles related to warranty repairs, provided, such travel and repairs are performed by an Onan Authorized Distributor or its designated service representative.

ii. *Commercial-Industrial Standby Generator Set and System Installations*—Provided the generator set or system is permanently wired in a stationary installation, Onan will, for six (6) months after initial start-up, pay travel time up to four (4) hours and mileage costs up to one hundred fifty (150) miles for warranty repairs performed by an Onan Authorized Distributor or its designated service representative.

(3) THERE IS NO OTHER EXPRESS WARRANTY.

IMPLIED WARRANTIES INCLUDING MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. ARE LIMITED TO PERIODS OF WARRANTY SET FORTH ABOVE AND TO THE EXTENT PERMITTED BY LAW, ANY AND ALL IMPLIED WARRANTIES ARE EXCLUDED.

IN NO EVENT IS ONAN LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

(4) All claims must be brought to the attention of Onan or an Onan Authorized Distributor or its designated service representative within thirty (30) days after discovery that goods or parts fail to perform as warranted.

(5) THIS WARRANTY SHALL NOT APPLY TO:

a) Cost of maintenance, adjustments, installation and start-up.

b) Failures due to normal wear, accident, misuse, abuse, negligence or improper installation.

c) Products which are altered or modified in manner not authorized by manufacturer in writing.

d) Failure of goods caused by defects in the system or application in which the goods are installed.

e) Telephone, telegraph, teletype or other communication expenses.

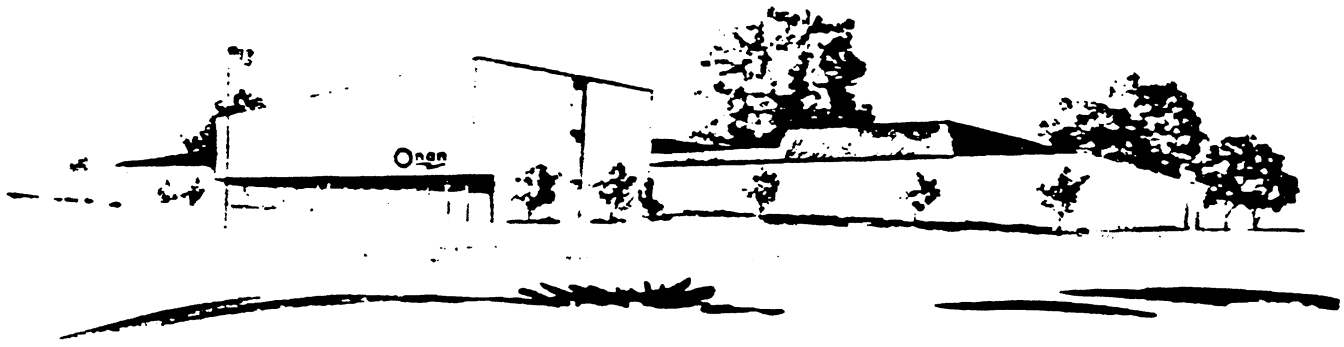
f) Living and travel expenses of persons performing service, except as specifically included in Section 2.

g) Rental equipment used while warranty repairs are being performed.

h) Overtime labor requested by purchaser.

i) Starting batteries.

(6) No person is authorized to give any other warranties or to assume any other liabilities on Onan's behalf, unless made or assumed in writing by an officer of Onan, and no person is authorized to give any warranties or assume any other liability on behalf of Seller unless made or assumed in writing by Seller.



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