

V45

INSTRUCTION MANUAL

GEN. POWER PLANT-5000Watt.
Model V-45-S14 #63.65653
110/220 Volts, 45/22 amp.
1800 RPM
Eng. Mod. # 4455

MY
Generator

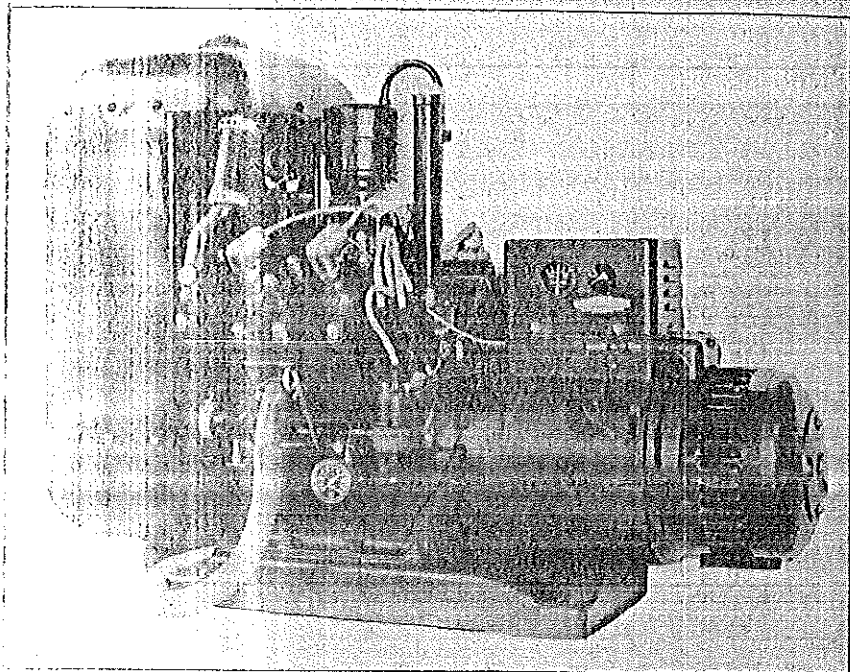
D.W. Onan & Sons Inc.
Minneapolis, Minnesota

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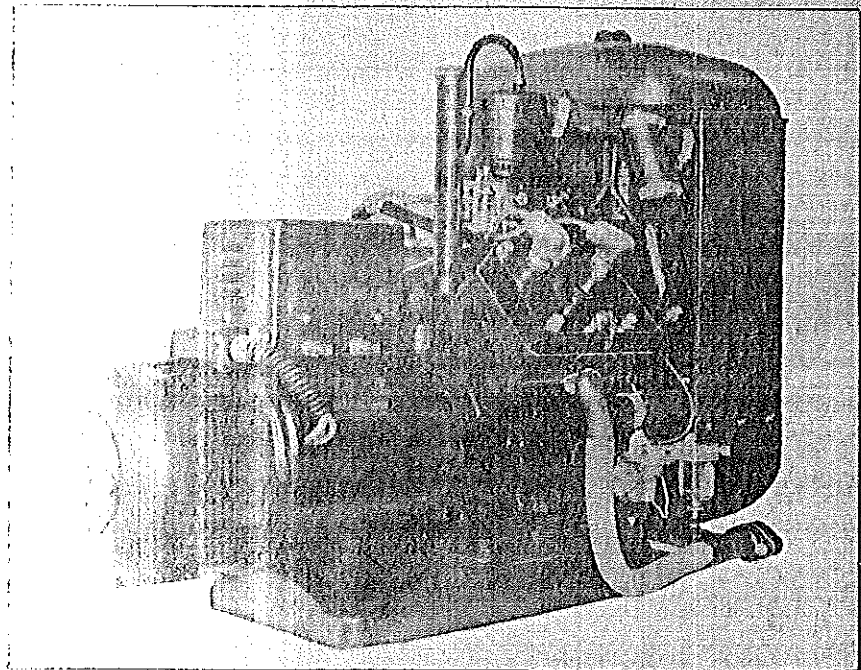
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READ THIS BOOK CAREFULLY AND
PRESERVE FOR FUTURE REFERENCE

PRINTED IN U. S. A.



Right Side View



Left Side View

PLANT RUNNING HOURS COMPARED TO AUTOMOBILE RUNNING MILES

The engine of your generating plant makes as many revolutions in one hour, as the average automobile engine does when the car travels a distance of 41 miles.

100 running hours time on a generating plant engine is equivalent in total RPM's to approximately 4100 running miles on an automobile.

However, do not conclude that the wear on the generating plant engine and the wear on the automobile engine would be the same. The generating plant engine is built much more ruggedly, (having larger main bearings, bigger oil capacity and has a heavier crankshaft proportionately per horsepower) than most automobile engines. Given the proper care and periodic servicing the generating plant engine will continue to give many more hours of efficient service than an automobile engine will after having been run the equivalent number of running miles.

Compare the running time of your generating plant engine with the number of miles traveled by an automobile. The oil in an auto is checked every one or two hundred miles (3 to 5 hrs. running time) and changed every 1000 to 1500 miles (28 to 42 hrs.) Whereas in a generating plant or stationary power engine, the oil should be checked every 6 to 8 running hours (250 to 350 miles) and changed every 50 to 100 operating hours (2000 to 4000 miles) depending on operating conditions.

About every 5,000 to 10,000 miles (120 to 250 hours), services have to be performed on an auto, such as checking ignition points, replacing spark plugs, condensers, etc. Similarly on your generating plant engine, these same services have to be performed periodically except the change period is reckoned in hours. 10,000 miles on an auto is equivalent to about 250 running hours on your plant engine.

To arrive at an approximate figure of comparative generating plant running hours as against automobile engine running miles, multiply the total number of running hours by 41 to find the equivalent of running miles on an automobile.

Your generating plant engine can "take it" and will give many hours of efficient performance provided it is serviced regularly.

Below is a chart showing the comparison between a generating plant engine running hours and an automobile running miles.

GENERATING PLANT RUNNING HOURS		AUTOMOBILE RUNNING MILES	GENERATING PLANT RUNNING HOURS		AUTOMOBILE RUNNING MILES
DAILY AVERAGE	1 Hr.	41 Miles	MONTHLY AVERAGE	30 Hrs.	1,230 Miles
	4 Hrs.	164 "		120 "	4,920 "
	6 "	246 "		180 "	7,380 "
	8 "	328 "		240 "	9,840 "
WEEKLY AVERAGE	7 "	287 "	YEARLY AVERAGE	365 "	14,965 "
	28 "	1,148 "		1,460 "	59,860 "
	42 "	1,722 "		2,190 "	89,790 "
	56 "	2,296 "		2,920 "	119,720 "

NOTE: Electric generating plants do not operate economically when used to power electric refrigerators and will add from 4 to 8 operating hours per day in addition to the regular lighting load.

RUNNING TIME METER

Don't Guess - Know how many hours your plant runs, so that you can change oil and service the plant at proper intervals.

This meter will be an investment rather than an expense. Simple to connect. This meter runs only when the plant is operating.

PART NO.

USED WITH PLANT

302-68

60 Cycle, 115 V. A.C.

302-102

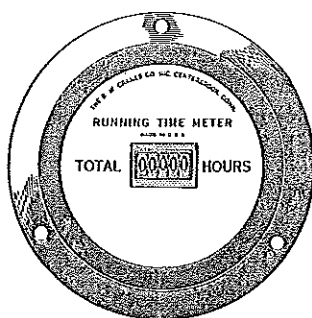
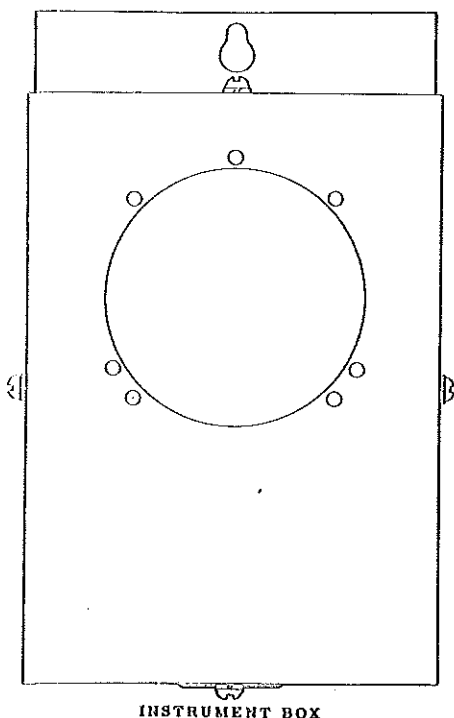
50 Cycle, 115 V. A.C.

304-99

Resistor - adding to either meter above makes it suitable for 230 V. use.

Meters listed above are 3-1/2 inch diameter, and are for flush mounting on panel; fit into 2-29/32 inch hole. For wall mounting, order separately.

301-500 Instrument Box



RUNNING TIME METER

Should installation instructions be necessary, follow the suggestions given in the illustrations on the pages immediately following these instructions on preparation. After the plant has been installed in the proper location and on a suitable mounting base, the plant should be prepared for operation as described in the following paragraphs.

LUBRICATION.— Crankcase oil capacity is 8 quarts, U. S. measure. Fill the crankcase to the full mark on the gauge with a good grade of the SAE number oil recommended in the following table for temperatures at the plant. Do not overfill as the connecting rods may strike the oil, causing it to foam, interfering with proper lubrication. Never operate your plant with the oil level below the low level on the gauge.

LOWEST TEMPERATURE AT THE PLANT	SAE NO. OIL
Above 90° F. (For Continuous Duty) Above 32° C.	No. 50
Between 30° F. and 90° F. Between -1° C. and 32° C.	No. 30
Between 0° F. and 30° F. Between -18° C. and -1° C.	No. 10
Below 0° F. Below -18° C.	No. 5

Place a few drops of oil on the joints of the linkage between the governor arm and the carburetor.

Remove the plug in the fan hub and fill the reservoir to the point of overflowing. Replace the plug.

Remove the cover and filter element from the air cleaner. Fill the body of the air cleaner to the level indicated with new oil of the same SAE number as that used in the crankcase. Replace the element and cover.

FUEL.— Fill the fuel tank nearly full with clean, fresh, regular gasoline of 68 to 74 octane. Do not use premium grade gasoline. Engine life will be greatest when fuel containing the smallest amount of lead is used. NEVER FILL THE FUEL TANK WITH THE ENGINE RUNNING.

COOLING SYSTEM.— The capacity of the cooling system is 17 quarts U. S. measure. Use only clean water or antifreeze in the cooling system. Do not use salt water or alkali water in the cooling system. Fill the radiator to a point somewhat below the top of the overflow pipe to allow for expansion of the liquid. If antifreeze is used it should be of the permanent type. The cooling system operates on the thermal syphon principle and operating temperatures of the water are high. NOTE: Whenever draining the cooling system, be sure to open the petcocks at the bottom of the radiator support casting, also at the water inlet elbows on the cylinder blocks.

PREPARATION

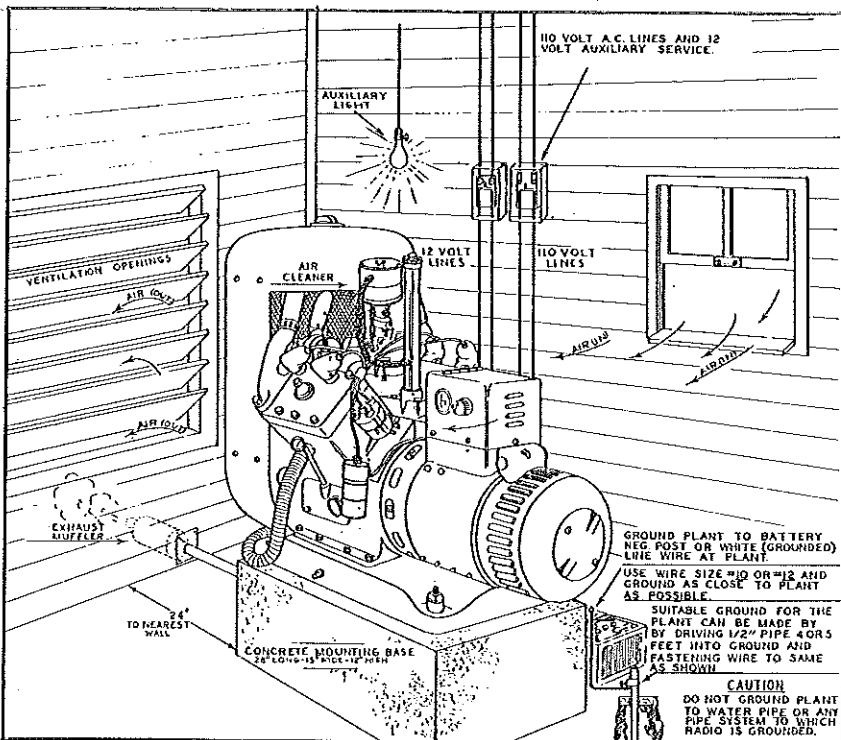
BATTERIES.-- When making cable connections at the battery it may be necessary to spread the cable lug open slightly before it will fit easily onto the terminal post. Don't use a hammer to drive the cable lugs onto the battery terminal posts or the battery may be damaged. Be sure the cable lugs make full contact on the battery terminal posts to prevent loss of current at this point. Be sure the contact surfaces of the cable lugs and battery terminal posts are clean before making connections. Coat the lugs and battery terminal posts with a thin coating of vaseline to retard corrosion. Make battery connections as follows:

If a single 12-volt battery is used, connect one cable from the positive (+) post on the battery to the POSITIVE terminal on the plant control box. Connect the other cable from the negative (-) post on the battery to the NEGATIVE terminal on the plant control box. Be sure connections are tight at all points.

If two 6-volt batteries are to be connected in series to form a 12-volt battery, connect a short jumper cable from the negative (-) post of one battery to the positive (+) of the second battery. Make the longer cable connections to the control box as described in the foregoing paragraph.

Batteries for battery charging plants should be prepared for operation according to instructions supplied by the battery manufacturer.

FUSED MAIN LINE SWITCH OR CIRCUIT BREAKER.-- It is recommended that a fused main line switch or circuit breaker be installed between the plant and the connected load to protect the plant against an overload or short circuit. Any local electrical supply house should be able to supply you with a disconnect switch of the proper type. Be sure you have information as to the capacity of your plant, the phase and the number of wires when making the purchase. This information is given on the plant nameplate.



PROPER INSTALLATION

A PROPERLY INSTALLED ELECTRIC PLANT FOR PERMANENT INSTALLATION SHOULD BE SET UP IN A WELL VENTILATED ROOM OF AMPLE SIZE (AT LEAST 10' X 10'). INSTALL PLANT AT LEAST 2' 4" AWAY FROM WALLS TO ALLOW EASY ACCESS TO PLANT FOR STARTING OR SERVICING.

RUBBER SHOCK ABSORBING BUSHINGS FURNISHED WITH THE UNIT SHOULD BE SET UNDER THE PLANT TO PREVENT THE SLIGHTEST VIBRATION. SHOCK ABSORBING VALUE OF BUSHINGS WILL BE GREATER IF NOT BOLTED DOWN TOO TIGHT.

EXHAUST PIPE, BATTERY AND LINE CONNECTIONS ARE ON OPPOSITE SIDE OF THE UNIT AS SHOWN ABOVE. EXHAUST TUBING CAN BE RUN EITHER DIRECTLY TO THE OUTSIDE OF THE BUILDING OR INTO AN UNDERGROUND EXHAUST CHAMBER IF EXTREME SILENCE IS DESIRED.

CAUTION—ALL EXHAUST CONNECTIONS MUST BE TIGHT AS LEAKAGE OF EXHAUST FUMES WHICH CONTAIN POISONOUS MONOXIDE GAS IS EXTREMELY DANGEROUS.

IF PLANT MUST BE INSTALLED IN BASEMENT, INSTALL A WATER TRAP TO TAKE CARE OF CONDENSATION IN THE EXHAUST PIPE. DO NOT RUN EXHAUST PIPE OVER TWENTY FEET

PROPER VENTILATION

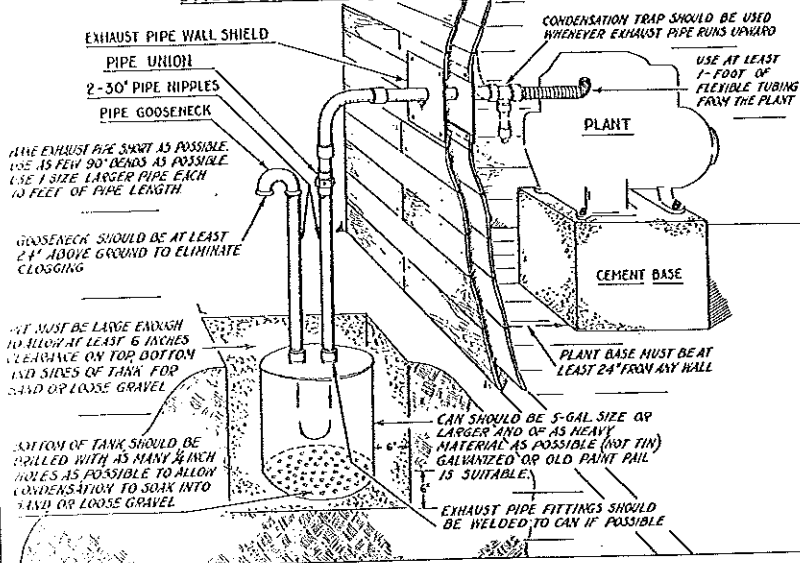
A FREE FLOW OF CLEAN FRESH AIR MUST BE AVAILABLE FROM SUITABLE WINDOWS OR OPENINGS IN THE WALLS THROUGH AND AROUND RADIATOR AND PLANT. SKETCH SHOWS A VERY SATISFACTORY METHOD OF AIR CIRCULATION, WITH AMPLE PROTECTION FROM OUTSIDE ELEMENTS. **DO NOT OPERATE YOUR PLANT IN A CLOSED ROOM AT ANY TIME.**

OPENINGS OR VENTILATORS SHOULD BE AT LEAST 16" X 16" WITH LOUVERS, COVER VENTILATORS OR OPENINGS WITH LARGE MESH SCREEN.

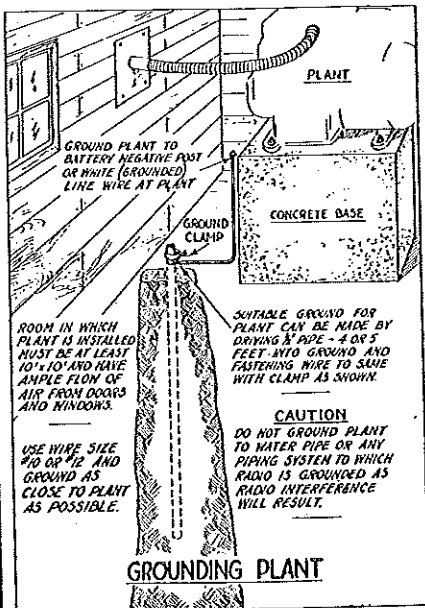
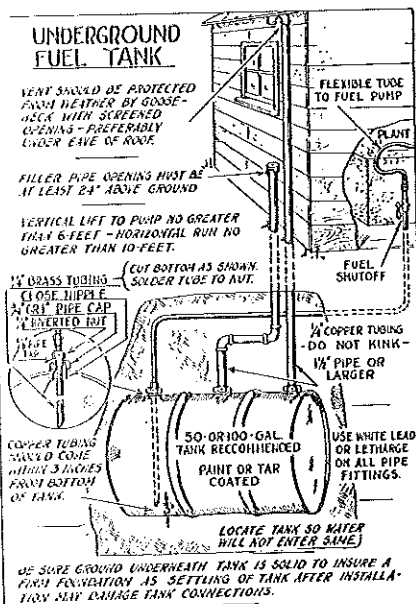
IF PLANT MUST BE INSTALLED IN BASEMENT BE SURE TO PROVIDE EXTRA CELLAR OPENINGS FOR THE AIR CIRCULATION NEEDED BY PLANT. BASEMENT LOCATIONS ARE NOT RECOMMENDED BECAUSE OF DAMPNESS AND POOR AIR CIRCULATION—ALSO EVEN A SLIGHT AMOUNT OF MECHANICAL NOISE IS USUALLY OBJECTIONABLE.

DO NOT INSTALL YOUR PLANT IN A HEN HOUSE OR BARN. (FEATHERS, HAY OR STRAW WILL CREATE A FIRE HAZARD AND ALSO DAMAGE YOUR ENGINE).

UNDERGROUND EXHAUST MUFFLER



UNDERGROUND FUEL TANK



PRELIMINARY.-- Before starting your plant make a final check to see that the plant has been properly serviced with oil, gasoline and water or antifreeze. If the plant is to be operated under adverse conditions, refer to the section on ABNORMAL OPERATING CONDITIONS to see that all necessary precautions have been taken. Then open the main line disconnect switch and proceed as follows.

STARTING MANUAL PLANTS.-- Before starting your plant, open the shut-off valve on the fuel tank. Then pull the choke control knob out about $\frac{3}{4}$ of the way. Insert the crank into the opening in the radiator grille and securely engage it with the crankdog. Crank the plant with a quick upward pull, using the right hand. Keep the thumb on the same side of the crank as the fingers. Do not spin the crank when starting the engine. NOTE: Several cycles of cranking may be necessary to fill the carburetor bowl with gasoline when starting a new plant or a plant that has run out of fuel. If it is necessary to repeat the cranking procedure, push the choke control knob part way in to avoid overchoking. As soon as the plant starts, push the choke control knob inward until the plant runs smoothly. As the plant warms up, slowly push the choke control knob inward until it is at its fully closed position. If the plant does not start, check the fuel and ignition systems and repeat the cranking procedure after correcting any trouble found. After the plant is thoroughly warmed up, close the main line disconnect switch to connect the load.

STARTING REMOTE CONTROL AND ELECTRIC START PLANTS.-- Before starting your plant, open the shut-off valve on the fuel tank. If the plant is being restarted after running out of fuel or other similar causes, work the manual lever on the fuel pump until the carburetor bowl is full of gasoline. If your plant has an ignition switch on the plant control panel, see that the switch is in ELECT. START or OFF position. Then simply press the START button in firmly. Choking is automatic and the plant should start at the first attempt. If it does not start, do not continue to press the START button in. Instead, press in for a period of five seconds at a time with a five second wait between each attempt. If the plant does not start after a few attempts, check the fuel and ignition systems and repeat the cranking procedure after correcting any trouble found. After the plant is thoroughly warmed up, close the main line disconnect switch to connect the load.

CAUTION.-- If your plant has an ignition switch on the plant control panel, keep this switch at ELEC. START or OFF position at all times except while actually starting the plant by hand cranking. If this switch is left at the HAND CRANK or ON position, the battery may be discharged.

CHARGE RATE ADJUSTMENT (Remote Control Plants).-- The charge rate to the starting battery is controlled by a rheostat. If the unit is to be operated for long periods of time, a charge rate of 2 to 3 amperes is usually enough to keep the battery in a well charged condition. If the unit is started frequently or only runs for short periods of time, use a charge rate of 6 to 8 amperes.

The charge rate of the battery charging plants is controlled by engine speed which in turn controls the output of the generator. Turning the governor speed adjusting screw in increases engine speed and generator output. Turning the governor speed adjusting screw out decreases engine speed and generator voltage. Follow the recommendations of the battery manufacturer as to the correct charging rate.

STOPPING THE PLANT.- To stop the plant, simply push the STOP button in until the engine has completely stopped running.

Under certain weather conditions extra precautions may be necessary to protect the plant from damage which may result from these conditions. Read these instructions carefully and take whatever steps you think are necessary to assure trouble free operation. When operating conditions return to normal, the plant should again be serviced for normal operating conditions as necessary.

LOW TEMPERATURES

LUBRICATION.-- If the plant is to be operated at temperatures of 0° F. (-18° C.) or below and the crankcase oil has not already been prepared for engine operation at these temperatures, proceed as follows:

Drain the oil from the crankcase while the engine is warm. Run the engine until warm if necessary. Refill the crankcase with SAE number 5 oil. Start the plant and allow it to run for at least 10 minutes to thoroughly circulate the oil to all points. Check oil level often when using No. 5 oil.

If SAE number 10 or number 5 oil is being used and it thickens or if frost forms inside the air cleaner and holds back the flow of air, remove the air cleaner and clean it. Reassemble the air cleaner and use it without oil until the weather warms up enough to allow using oil in the air cleaner again.

FUEL.-- Give special attention to fuel. Fresh fuel and high test fuel aid starting. Never fill the fuel tank entirely full with gasoline as it may expand and overflow, creating a fire hazard.

COOLING SYSTEM.-- Check all hoses and hose clamps. Tighten, repair or replace as needed. Check the cylinder head gaskets for leaks. Replace if necessary. Tighten all cylinder head nuts. Inspect the fan belt. Tighten or replace as necessary.

Protect the plant from freezing damage by adding a permanent type anti-freeze to the cooling system in the proportions recommended by the manufacturer of the antifreeze.

ELECTRICAL SYSTEM.-- Keep the ignition system correctly timed. Keep spark plugs and breaker points clean and space gaps properly. Keep batteries in a well charged condition. Discharged batteries may freeze and become damaged beyond repair at 20° F. Never add warm water to a cold battery. The battery should be on charge whenever water is added during freezing temperatures. Store discharged batteries in a warm place until they can be recharged.

AUTOMATIC CHOKE.-- Ordinarily the automatic choke should never require adjusting after being set at the factory. However, should an adjustment become necessary, turn to the ACCESSORY SERVICE section for instructions.

ABNORMAL OPERATING CONDITIONS

HIGH TEMPERATURES

LUBRICATION.-- Keep the oil level at the full mark on the gauge. Maintaining a lower level is dangerous as the engine will tend to run hotter. Maintaining a higher level can be equally dangerous as the oil may foam and parts which are normally spray lubricated would receive no oil.

FUEL.-- Never fill the fuel tank entirely full of gasoline. The gasoline may expand and overflow creating a fire hazard.

COOLING SYSTEM.-- Provide ample ventilation. Keep the liquid in the radiator at the recommended level. See that the fan belt has the right tension. Keep the cooling system clean and unobstructed.

DUST AND DIRT

Keep the plant as clean as practicable. Check the operation often and service as needed. Clean the air cleaner often. Clean the commutator, collector rings (a-c plants) and brushes often and see that the brushes ride freely in their holders. Keep supplies of fuel and oil in airtight containers.

GENERAL.— Follow a set schedule of inspection and service. Keep your plant in good running order at all times. You will find that operation will be better and running expenses less if the unit is serviced regularly. Service periods given are for normal operation. For extreme conditions of load, temperature, frequent starts, dust and dirt, service your plant more often.

DAILY SERVICE

If your plant is to be operated more than 8 hours daily, perform the following services at the end of each 8 hours of operation.

FUEL.— The amount of fuel used will vary between plants. Refill the fuel tank often enough to assure having fuel in the tank at all times. Use clean, regular gasoline of 68 to 74 octane. Do not use premium grade gasoline. NEVER FILL THE FUEL TANK WHILE THE ENGINE IS RUNNING.

CRANKCASE OIL LEVEL.— Check the crankcase oil level at least once each 8 hours of running time. Add oil as necessary to bring the oil level to the full mark on the gauge. Do not overfill. Never operate your plant with the crankcase oil level below the low mark on the gauge.

COOLING SYSTEM.— Check the level of the liquid in the radiator. Add liquid as necessary to keep the level of the liquid above the plates in the top of the radiator.

CLEANLINESS.— Keep your plant as clean as possible at all times. Keep oily rags in metal containers as they are a fire hazard.

AIR CLEANER.— Check the level of the oil in the air cleaner cup. If necessary, refill the cup to the indicated level with oil of the same SAE number as used in the engine crankcase, except as noted under ABNORMAL OPERATING CONDITIONS.

WEEKLY SERVICE

If your plant is to be operated more than 50 hours weekly, perform the following services at the end of each 50 hours of operation.

LUBRICATION.— Change the oil every 100 hours of running time unless it has been necessary to use highly leaded fuel, then change oil every 50 hours of running time.

Fill the oil reservoir in the fan hub with oil of the same SAE number used in the engine crankcase.

Place a drop of light oil on each joint of the governor to carburetor linkage.

Remove the cup and element from the air cleaner and clean them thoroughly in gasoline or other suitable solvent. Allow the element to dry or dry out by using compressed air before replacing it. Refill the oil cup to the level shown on the cup with oil of the same grade used in the engine crankcase, except as noted under ABNORMAL OPERATING CONDITIONS.

IGNITION.-- Remove the spark plugs, clean them, and reset the electrode gap at least once each week. If highly leaded fuels are used, clean the plugs more often. Use Champion No. 5 COM or a comparable type made by another manufacturer when replacing spark plugs.

Where used, keep the level of the fluid in the batteries to $3/8$ " above the separators by adding clean distilled water. If the battery manufacturer specifies a different level, follow his recommendations. Do not overfill the battery.

FUEL SYSTEM.-- Check the fuel strainer screen. Remove the filter bowl and screen and clean both. Replace carefully and check for leaks after starting the plant.

COOLING SYSTEM.-- Check the level of the liquid in the cooling system. Add liquid as necessary to keep the level of the liquid above the baffle plates in the top of the radiator. If antifreeze is used, add in the proportions recommended by the manufacturer of the antifreeze. Only permanent type antifreezes are recommended for use in these plants.

Check fan belt tension. There should be a $3/4$ " movement "in or out" from the normal stopped position. Adjust as described under **ACCESSORY SERVICE** if necessary.

GENERAL.-- Check your plant carefully for loose bolts, nuts, screws, electrical connections, etc. Tighten, repair or replace as needed.

MONTHLY SERVICE

If your plant is to be operated more than 200 hours monthly, perform the following services at the end of each 200 hours of operation.

IGNITION SYSTEM.-- Inspect the ignition breaker points. Clean points with a fine stone if necessary. Replace badly burned or pitted points. Points continually burning over usually indicate a defective condenser and the condenser should be replaced. Adjust the ignition point gap with the No. 1 piston at top center on the compression stroke. Correct gap is .015" for magneto ignition and .020" for battery ignition.

Check ignition system wires for cracks or breaks in the insulation and for loose connections. Repair or replace as needed.

EXHAUST SYSTEM.-- Check the exhaust line from the plant at all connecting points. Tighten or replace all parts that need it.

ENGINE COMPRESSION.-- Loss of compression is usually indicated when the plant is low on power, resulting in lowered generator output. The best way to check compression is with a compression gauge. If you do not have a compression gauge, a fairly good idea of compression of each cylinder can be obtained by inserting the crank and

turning the engine over slowly by hand. If compression is good, quite a little effort will be needed to crank the flywheel past the compression stroke of each cylinder. If compression is poor, little effort will be needed to crank the cylinder past the compression stroke of the cylinder low on compression. Compressed gases leaking past an exhaust valve can be heard at the exhaust outlet on the plant. Compressed gases leaking past an intake valve can be heard at the carburetor air inlet. A compression leak past the piston rings may be heard at the oil filler opening. Loss of compression may also be due to leaking spark plugs, spark plug gaskets, or cylinder head gaskets. Repair or replace as needed.

CARBON.— Remove carbon every 250 to 500 operating hours unless you find from experience that your plant needs it more often. Drain the cooling system, remove the cylinder heads and scrape the heads, pistons and valves clean of any carbon formation. Use a putty knife or similar tool. Tools are available in most automotive supply houses for cleaning valve guides. Inspect the cylinder head gaskets before reassembling the plant. Replace the gaskets if they are not in good condition.

VALVE GRINDING.— Valve grinding is a service that should be done periodically if your plant is to continue running efficiently. There is no set period for making this service. However, it is suggested that the plant be checked for a valve condition whenever the plant begins to lose power or to use more fuel or oil than it normally does.

GENERATOR.— Examine the collector rings (a-c plants), commutator and brushes. The brush surfaces of the collector rings (a-c plants) and commutator must be smooth and cylindrical to assure good brush contact. Brushes worn to $5/8$ " in length should be replaced. Rapid brush wear may be due to excessive arcing, resulting from the brush rig being out of the neutral position. Instructions for servicing are given under Generator in the MAINTENANCE AND REPAIR section.

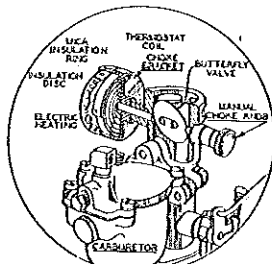
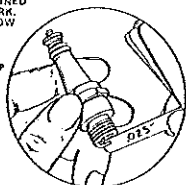
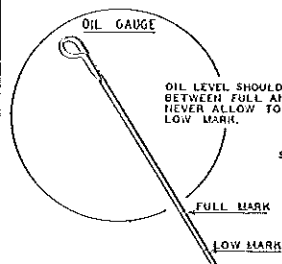
SEMI-YEARLY SERVICE

ARMATURE BEARING LUBRICATION.— Remove the bearing cover and gasket from the end bell. With a clean finger, remove all of the old bearing grease and then work about one tablespoonful of new bearing grease well into the bearing. Again clean the bearing and refill the bearing housing about $1/2$ full, packing the grease well into the lower half of the bearing.

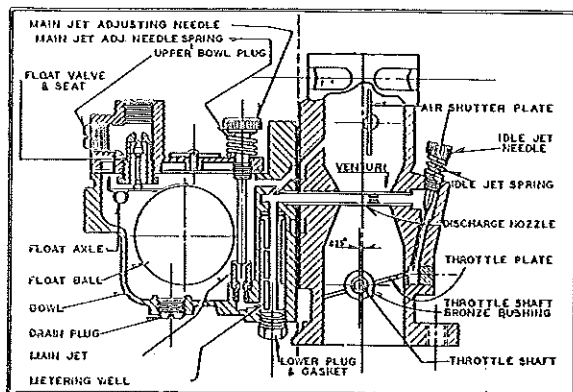
Use only a good bearing grease. Avoid getting dirt into the bearing. Replace the cover and gasket.

Check the plant thoroughly for loose bolts, nuts, screws, electrical connections, hose clamps, hoses, etc. Repair or replace as needed.

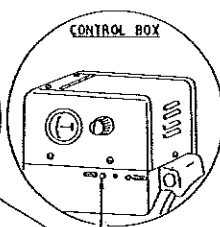
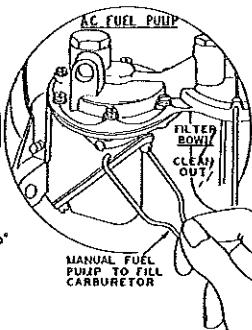
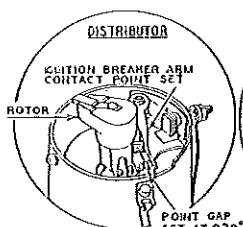
ACCESSORY SERVICE



AUTOMATIC CHOKE ASSY.
USED ON FULL AUTOMATIC & SELF STARTING MODELS



CUTAWAY VIEW OF CARBURETOR



DO NOT PRESS STARTER
BUTTON CONTINUOUSLY
WHILE STARTING.
PRESS INTERMITTENTLY FOR
PERIODS OF ABOUT FIVE
SECONDS.

GENERAL.— This section also includes instructions for making adjustments to other parts which are not really of an accessory nature but which you should be able to make if necessary. If trouble occurs, try to locate the cause of the trouble before making any adjustments. Many possible causes of troubles and their remedies are listed under the heading TROUBLES AND REMEDIES. Turn to this section and read it carefully. It may save you time and trouble in correcting troubles which may occur.

CARBURETOR ADJUSTMENTS.— The carburetor has adjustable main and idling jets. It is simple in construction and normally needs very little attention other than a good cleaning once in a while. If the engine runs unevenly at half or full load due to faulty carburetion, the main jet adjustment needs correcting. Adjust while the plant is running at normal operating temperature and carrying almost a full load. Turn the main adjusting needle out about two full turns. Then slowly turn the needle in until the engine begins to lose power and speed. Then turn it out very slowly until the engine runs at maximum power and speed.

The engine should be running at normal operating temperature and carrying no load when adjusting the idle jet needle. Turn the needle in until the engine loses considerable speed. Then turn the needle out until the engine runs smoothly. Normal setting is about 1/2 turn open.

If the carburetor is entirely out of adjustment, open both needles 1 to 1-1/2 turns to permit starting. Make final adjustments as described in the preceding paragraphs after the engine reaches normal operating temperature

If the engine develops a hunting condition (continuous increase and decrease of engine speed), try correcting by opening the main jet adjusting needle a little more. Do not open more than 1/2 turn beyond the maximum point of power. If this does not correct the condition, follow the instructions given for regulating the sensitivity of the governor under Governor Adjustment.

AUTOMATIC CHOKE ADJUSTMENT.— Normally the choke should never require an adjustment after it has once been properly adjusted at the factory. However, should an adjustment become necessary for any reason, proceed as follows:

Improper operation of the choke assembly will be indicated by hard starting or irregular running during the warm up period. The setting can be changed by loosening the screw clamping the thermostat housing to the carburetor choke shaft and rotating the entire choke assembly in a clockwise direction (when looking at the choke shaft knob) for a richer mixture or in a counterclockwise direction for a leaner mixture. At 72° F. the choke plate should be about 1/8 of an inch from its fully closed position but not under tension. Turn the choke assembly only about 1/8" at a time when making the adjustment. Then check by starting the plant and noting the actions of the choke plate. Repeat the adjustment until choking action is satisfactory, allowing the plant to cool thoroughly between each adjustment and check. Tighten the clamp screw securely after making an adjustment.

SPARK PLUG SERVICE.-- The spark plugs used in this plant are Champion No. 5 COM (Replaces 6M). They should be removed, cleaned and the electrode gap reset to .025". A close inspection should be made to determine by the condition of the porcelain and electrodes if the plugs need replacing. As a rule replacements should be made after 1500 to 2000 hours of operation. Replace oftener if necessary. New plugs should be Champion No. 5 COM or a comparable type made by another manufacturer.

Visual test of spark plug condition.

1. If the insulator is a light brown, condition is O.K.
2. If the insulator is a dead white color, the plug is too hot or fuel mixture is too lean.
3. If the insulator has a dull sticky deposit, the plug is too cold or the fuel mixture is too rich.
4. If the insulator has a shiny black deposit, the plug is too cold or the engine is pumping oil.
5. If the electrodes are burned, the plug is too hot or poor fuel has been used.

A "hot" plug has a large area of the insulator exposed to the burning gases.

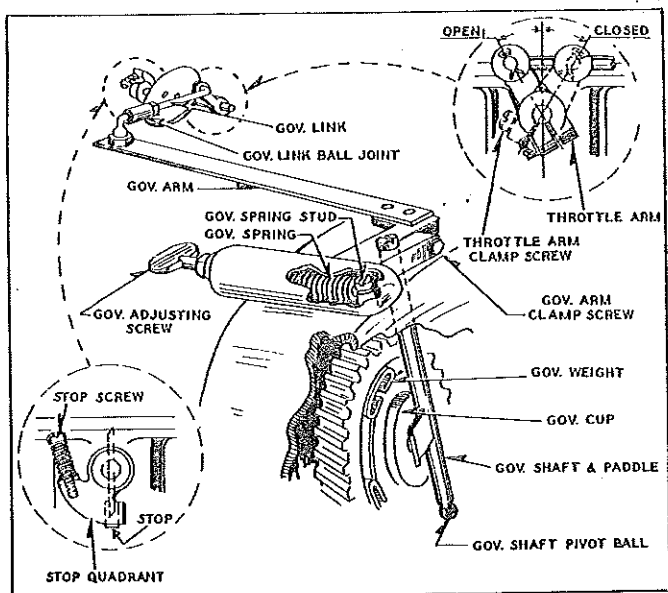
A "cold" plug has a small area of the insulator exposed to the burning gases.

GOVERNOR ADJUSTMENT.-- The purpose of the governor is to keep the generator voltage within proper limits by holding the engine speed at a constant rate. Failure of the governor to control the speed properly would cause varying brilliancy of lights, or constantly changing performance of accessories and appliances whenever the load was increased or decreased.

Two types of governors are used on these plants. With one, the operating mechanism is built as an integral part of the camshaft timing gear and gearcase cover. The other is a commercial type mounted to the top of the gearcase and driven by the camshaft timing gear. Both types are as simple and trouble free as any mechanical unit can be and neither type should need adjusting or servicing unless the plant has been overhauled or the adjustment tampered with.

The governor arm is linked to the carburetor throttle arm. Thus, whenever the load changes and the speed tends to gain or drop, the governor mechanism immediately moves to offset the change in load and either opens or closes the throttle valve to compensate for the change.

An oval headed thumb screw permits adjusting the tension of the governor spring. Turning the screw in towards the body of the governor arm bracket increases the tension on the spring, the engine speed, and the generator voltage. Turning the screw out decreases tension, speed and voltage. Whenever adjustment has been made and the voltage brought to the proper figure (not to exceed 126 volts at no load, for 115 volt circuits - 252 volts for 230 volt circuits), tighten the locknut against the bracket.



INTERNAL TYPE GOVERNOR

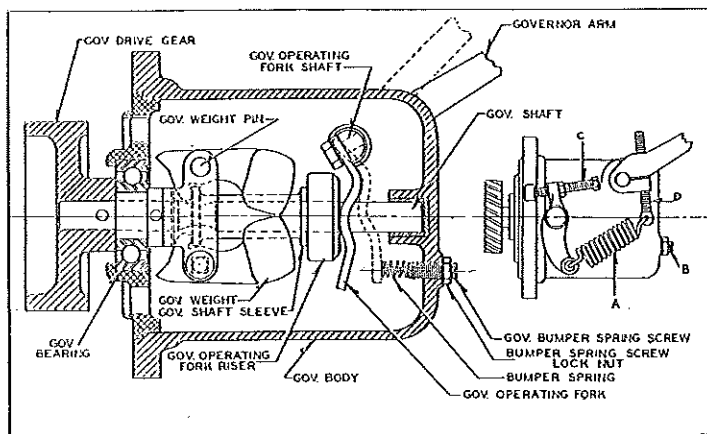
If, for any reason, the governor arm has become loosened from the governor shaft, it will be necessary to reset the arm. To do this, loosen the governor arm clamp screw, insert a screwdriver in the slot in the governor shaft, and turn it to the right as far as possible. Allow the governor spring to hold the throttle arm against the stop and retighten the clamp screw securely. This will correctly set the governor arm and it will then be necessary to reset the adjustment on the spring tension to correct the speed and voltage.

Four flyweights are so pivoted to the face of the camshaft gear that as the engine speed increases, the weights tend to fly outwards, forcing the governor cup away from the gear. The cup bears against a paddle welded to the governor shaft, rotating the shaft and the governor arm attached to its end. Tension of the governor spring against the governor arm resists this motion, and it is the balance of force between the spring and the flyweights that maintains an even speed.

A Pierce industrial type governor is bolted to the top of the gearcase cover where it is driven by the camshaft timing gear. There is no routine servicing required for this governor. In fact, it should never need attention unless the engine has been overhauled.

To adjust the governor, proceed as follows:

1. With the spring tension on the main governor spring "A" adjust the length of the throttle control rod so the carburetor lever clears the wide open stop by at least $1/64"$.
2. Loosen the lock nut and screw bumper "B" out far enough so it does not function. Then adjust the governor for the desired speed by turning the adjusting screw "C".
3. If the governor surges under load or part load conditions, screw the auxiliary adjusting screw "D" out a few turns at a time until the surging stops. Keep the screw "D" in as close as possible without surging to give close regulation.
4. If the governor surges at a no load speed, screw the bumper "B" in far enough to eliminate the surge, and then lock it. Do not screw "B" in far enough to increase the engine speed.



EXTERNAL TYPE GOVERNOR

TAPPET ADJUSTMENT.— Remove the valve box cover and loosen the cap screws locking the tappet lever to the bearing. Then push the lever into the crankcase as far as possible. Crank the engine over slowly until the Piston of the cylinder for which the tappet adjustment is being made is at top dead center on its compression stroke. Use .008" and .010" feeler gauges for the intake valve tappet and .010" and .012" feeler gauges for the exhaust valve tappet. Insert the smaller gauge between the camshaft and the face of the tappet lever. Pull the lever upward until the gauge is squeezed lightly between the camshaft and the tappet lever face. Then tighten the cap screw securely. Check the setting with the larger gauge. The smaller gauge should pass easily between the camshaft and the valve tappet face but the larger gauge should not.

After long periods of time, usually one to five years or longer, a complete overhauling of the engine and generator is usually necessary. However, the plant should be thoroughly inspected to determine whether or not a complete overhauling is needed. If you are not thoroughly familiar with internal combustion engines, it is recommended that you obtain the advice or service of a competent local mechanic to help you to determine the extent of repairs necessary.

When disassembling the plant, examine each part as it is removed. Decide which parts must be replaced, which need adjusting and which only need cleaning. Replace parts if their condition is doubtful. It is poor economy to use a part worn to such an extent that replacement would be needed before another general overhauling is necessary.

A complete set of gaskets for your plant should be on hand before overhauling the plant. Use a new gasket in place of the old one whenever the old one has been disturbed. Thoroughly clean the surfaces the gasket contacts before installing a gasket.

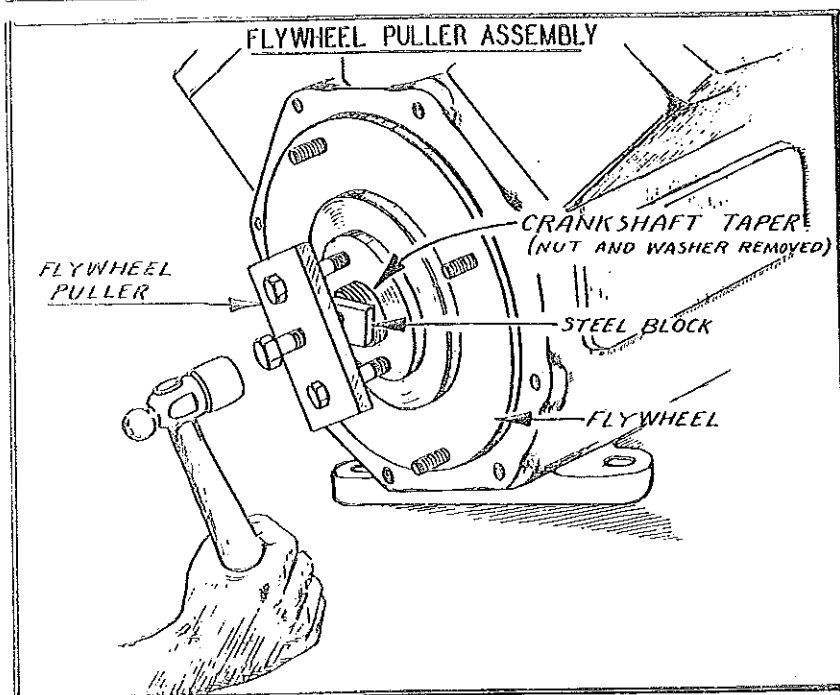
Worn cylinder blocks can be honed or bored to an oversize and oversize pistons installed to continue the old blocks in service or cylinder blocks using standard size parts are available from your dealer or Authorized Service Station. Replace worn or scored pistons, pins and rings. New connecting rod bearing inserts will restore proper bearing clearance unless the bearing journals are scored or rough. Then a new crankshaft will be necessary.

Main bearings are replaceable but are not adjustable. They must also be line reamed after being installed in the crankcase. When installing new main bearings, be sure the oil groove in the bearings heads in the direction opposite to crankshaft rotation.

The oil seals used in the bearing plate and the gear cover are of leather and sheet metal construction, the bearing plate oil seal being the larger of the two. New oil seals should be installed at these points whenever overhauling the engine or whenever oil leakage occurs at the seals. Place a piece of shim stock over the keyway on the crankshaft to avoid damaging the seal, tap the seal into place and spread Permatex or shellac around the seal at the point where it contacts the boss.

Should either of the timing gears need replacing, it is recommended that both gears be replaced. Be sure to align the timing marks on the two gears when making the installation.

The governor must be reset after a major overhauling of the unit. See "Governor Adjustments" in the ACCESSORY SERVICE section for details.



THE REAR ENGINE VIEW SKETCH ABOVE ILLUSTRATES THE OPERATION OF THE FLYWHEEL PULLER IN REMOVING THE FLYWHEEL FROM THE CRANKSHAFT TAPER.

THE OUTER BOLTS OF THE PULLER ARE TURNED INTO THE FLYWHEEL HUB. A STEEL BLOCK IS THEN PLACED OVER THE CRANKSHAFT END TO PROTECT IT FROM BEING DAMAGED BY THE CENTER BOLT OF THE PULLER. THE CENTER BOLT OF THE PULLER IS THEN DRAWN DEAD TIGHT AGAINST THE STEEL BLOCK AND RAPPED SHARPLY WITH A HAMMER AS SHOWN IN SKETCH. THIS WILL LOOSEN THE FLYWHEEL FOR REMOVAL.

TABLE OF CLEARANCES

	<u>MINIMUM</u>	<u>MAXIMUM</u>
Intake Valve Tappet Clearance .....	.008"	.010"
Exhaust Valve Tappet Clearance .....	.010"	.012"
Valve Seat Width	3/64"	1/16"
Intake Valve Stem Clearance in Guide .	.002"	.003"
Exhaust Valve Stem Clearance in Guide.	.0025"	.003"
Crankshaft Main Bearing .....	.0015"	.0025"
Crankshaft End Play .....	.015"	.020"
Connecting Rod Bearing .....	.0015"	.0025"
Connecting Rod End Play .....	.004"	.006"
Timing Gear Backlash .....	.004"	.005"
Piston Clearance in Cylinder .....	.003"	.005"
Piston Pin in Piston	Hand Push Fit	
Piston Pin in Rod .....	.0002"	.0003"
Camshaft Main Bearings .....	.002"	.0025"
Piston Ring Gap in Cylinder .....	.008"	.015"
Spark Plug Gap .....	.025"	
Distributor Point Gap .....	.020"	
Magneto Point Gap .....	.015"	

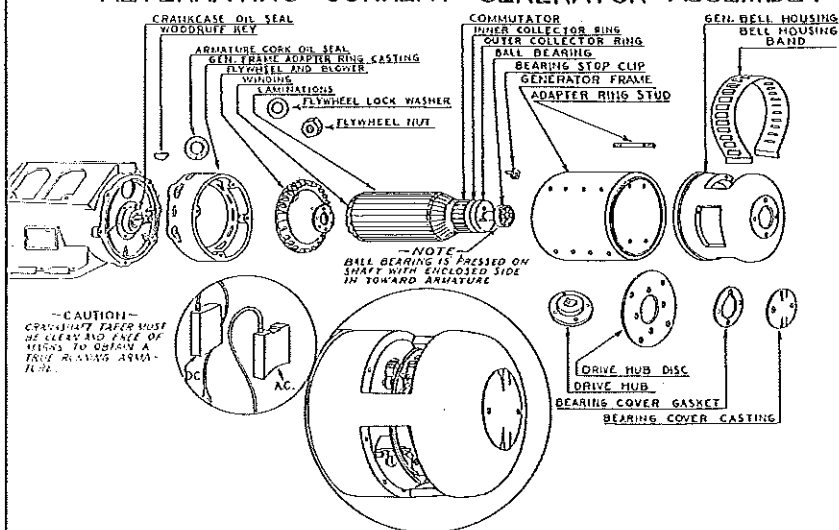
GENERATOR

GENERAL.-- The generator consists of two assemblies; the armature, which is the rotating part of the generator, and the frame assembly, which is the stationary part of the generator. The frame is a steel ring with two or four field coils and pole shoes bolted to the inside. The brush rig assembly, located in the generator end bell, is also a part of the frame assembly, and it is not necessary to separate these when removing the generator from the engine.

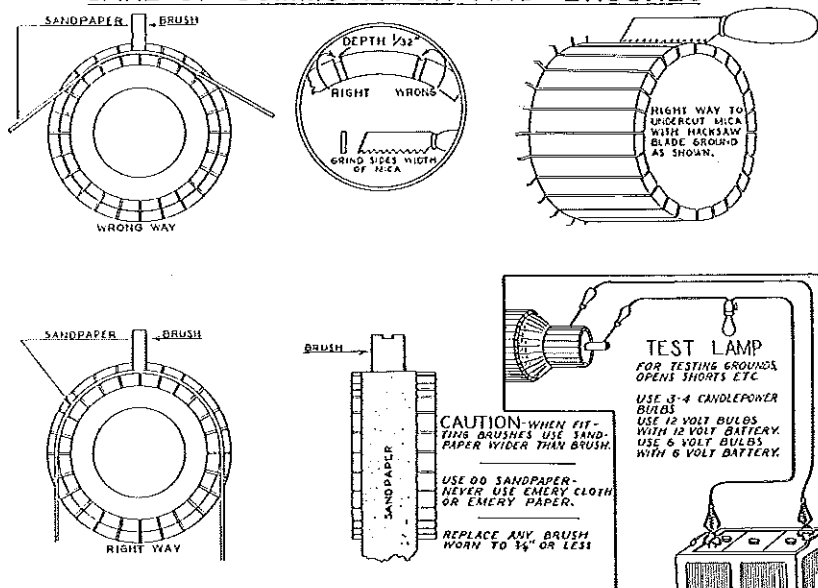
The most common reason for a generator failing to produce current is an external short on the main line, or in the control or outlet box. Disconnect all wires leading from the generator, and run a test lamp across the output of the generator while it is running. If the test lamp lights, the external circuit must be checked for a short circuit or a loose connection, but if it fails to light, the generator is at fault and steps must be taken to locate and correct the trouble.

Check the brushes to make sure that they ride freely in their holders and that there is sufficient spring tension on all the brushes. Check the wires leading from the brushes. If everything appears to be normal, disconnect all batteries or main line wires from the plant. Raise the brushes in their holders until the springs slip down the sides of the brushes and keep them from making contact with the armature. Disconnect the D.C. field wire, and proceed as outlined in the following paragraphs, using the tests which apply to the generator to be tested. All generators produce direct current, but only those rated as alternating current generators need be given the additional tests for that type of generator.

ALTERNATING CURRENT GENERATOR ASSEMBLY



CARE OF COMMUTATOR AND BRUSHES



TESTING FIELDS FOR OPEN CIRCUITS.-- Connect one end of a test lamp wire to one field wire and the other end to the other field wire. The test lamp should light if the field coil wiring has not been broken. If it fails to light, the winding or circuit is open and a new field coil set must be installed. However, if the break is in a wire connecting two coils, the connection can be resoldered, and the plant will again operate.

TESTING FIELDS FOR GROUNDS.-- Connect one end of the test lamp wire to one field wire and the other end to a clean surface on the generator frame. If the lamp lights, a field coil is grounded, and the field coils must either be replaced or repaired.

Temperature changes cause metal to expand or contract. Varying degrees of expansion between the iron in the frame and pole pieces and the copper in the wiring of the field coils can cause a chafing which may, over a long period of time, wear thru the insulation protecting the field coils and allow the wires to touch the frame. The electric current which should go to magnetize the pole pieces will be side-tracked, no magnetic field will be set up, and consequently no current will be produced.

The pole pieces can be unbolted from the frame allowing the removal of the field coils. If the wires are not damaged, a piece of tape can be placed over the worn spot, and the grounded field coils made serviceable again.

TESTING FOR A SHORTED FIELD COIL.-- A shorted or partially shorted field coil can be tested by a meter which will measure the amount of resistance in each coil. As the amount of resistance should be practically the same in each coil, if one coil shows less than the others, it is a good indication that that coil is shorted.

If there are no instruments handy for making this test, a fairly accurate check can be made when the symptoms are first noticed by feeling the temperature of the coils before stopping the plant. If one coil is shorted, it will run much cooler than the others, and by feeling the generator frame where the pole shoes are bolted to it, a shorted coil can be located. A shorted coil must be replaced.

TESTING THE D. C. WINDING OF THE ARMATURE FOR GROUNDS.-- If one end of a test lamp wire is placed on a clean surface of the armature shaft, the lamp should not light when the other end is touched to the commutator. If the lamp lights, the commutator or D.C. windings of the armature are grounded and the armature will have to be replaced.

TESTING THE D.C. WINDING OF THE ARMATURE FOR OPEN CIRCUITS.-- A test lamp should light when one end of the wire is connected to one commutator bar, and the other end touched to each of the other bars. If it fails to light when touched to any bar, the wire leading to that bar is open and the armature must be replaced.

TESTING A.C. WINDING OF THE ARMATURE FOR OPEN CIRCUITS OR GROUNDS.-- Place one end of a test lamp wire on the outer or insulated collector ring, and the other end on the inner collector ring. If the windings are in good condition, the lamp will light. If it fails to light, the circuit is open, and the armature must be replaced.

Place one end of the test lamp wire on the armature shaft. Touch the other end to each of the collector rings. If the lamp lights, the winding is grounded, and the armature must be replaced.

Note: Only a competent, well trained, armature repair service man is qualified to repair an armature that is either open or grounded. The armature must be completely rewound to correct either of these conditions, and no person without special training should ever attempt to do this work.

FILTER CONDENSERS.-- Filter condensers are mounted inside the generator frame. If one of these condensers should become shorted, no current would be generated. Disconnect the condenser leads and try the plant with the condensers disconnected. If the plant operates satisfactorily, check each condenser, and replace the one that is faulty. It is necessary to use condensers in the generator to suppress radio interference.

GENERATOR DISASSEMBLY.-- If the foregoing tests have shown that the field coils or armature need servicing or replacing, the generator must be removed from the engine and the armature disconnected from the engine crankshaft. If there is a fuel tank mounted on the generator, it must be removed. Likewise, any control box installation mounted on the generator should be taken off and set aside. On plants which have a starting sheave at the rear of the generator, loosen the set screw and pull it off the armature shaft, taking care not to lose the key which locks it to the shaft.

REMOVING THE FRAME FROM THE ENGINE.-- All generators are carried on a turned diameter at the rear of the crankcase. After any accessories which were mounted on the generator have been removed, the frame itself can be separated from the engine by loosening and removing the bolts which hold it in place and drawing it off over the armature. If it should stick when unbolted, a well directed blow with a hammer and punch at the inner rim will loosen the frame from the adapter ring.

Use great care when drawing the frame over the armature. Never allow the frame to touch or rest on the armature, as the weight of the frame can bend or distort the armature shaft enough to make it unserviceable.

BRUSH RIG.-- It is not necessary to remove the brush-rig assembly from the generator end bell when disassembling the generator. If it should have been removed accidentally, or for servicing, line up the mark on the rig with the indicator point on the frame when reinstalling it. Unless the brush rig is in the proper position, excessive arcing of the brushes, heating of the generator armature and field windings, and low voltage production will result.

POLE SHOES.— The pole shoes are made up of laminations of special electrical steel stacked and riveted together and bolted to the generator frame. They are to be removed only in order to remove the field coils. When replacing pole shoes, be very careful that all surfaces are clean. An accurate clearance must be maintained between the pole shoes (when assembled in the generator frame) and the revolving armature. Any dirt between the pole shoe and the generator frame would change this clearance and possibly cause damage to the armature. Use lock washers with the bolts, and be sure that they are tightened securely.

REMOVING ARMATURE FROM ENGINE.— The armature is bolted to the generator blower. The blower in turn is bolted to a separate flywheel. Remove the four nuts just inside the rim of the blower. Support the armature while these are being loosened, and when the last one is off, slide the armature over the studs and set it to one side where it cannot roll or become damaged. **NOTE.**— On certain units the flywheel and blower are one unit and a disc and hub are used between the flywheel and the armature. Follow the same general procedure in removing the armature as above.

If it is desired to remove the flywheel to check the rear main engine bearing oil seal, strike the flywheel a sharp blow at the edge to loosen it, and pull it off.

ARMATURE.— Always handle the armature carefully and do not allow it to roll around. It can be easily damaged by rough handling.

The commutator on the armature is probably the most frequent source of generator trouble. If it is dirty from brush wear, clean it with carbon tetrachloride. If it is rough or pitted, the armature must be mounted in a lathe and the commutator turned until smooth. It will then be necessary to shave or undercut the mica insulation about $1/32$ " below the level of the copper to allow the brushes to ride on the copper bars without interference. Polish the commutator carefully, and be sure that there are no metal particles in the cuts. If the plant should be started with metal particles between the bars, the armature windings would burn out.

The commutator should maintain a polished surface. Blackening of all the bars indicates an incorrect brush position. Blackening of groups of bars at regular intervals may be due to the same cause or to poor contact. Blackening at irregular intervals indicates a rough or eccentric commutator. A severely burned bar or number of bars, plus excessive flashing when the plant is under load, indicates an open circuit in the windings. Use a lint free cloth to keep the commutator clean.

Over a period of time, the copper bars will wear down to the level of the mica insulation. The mica is harder than the copper, and will form ridges which will cause the brushes to jump, make poor contact, and be very noisy (noisy brushes are always an indication of a rough commutator). It will be necessary to re-turn the commutator as described above, to correct this condition.

Never use a lubricant on the commutator or brushes. The use of any lubricant will increase commutation difficulties and spoil the brushes.

REASSEMBLING THE GENERATOR.— Reassembly is made by reversing the procedure used in disassembly. **BE SURE THAT ALL PARTS ARE CLEAN.** Before installing the armature, grease the end surface to keep it from rusting while in service, check the rear main bearing oil seal to be sure it is functioning properly.

Before installing the frame onto the crankcase, remove the bearing cap at the rear of the generator, and clean the bearing surface in the frame and the bearing on the armature shaft. Line up the notch in the bearing with the pin in the frame. Install the frame over the armature carefully, and tighten the bolts that hold it gradually and alternately. Never pull one down tight until the others are nearly tight. Repack the ball bearing with ball bearing grease only, and replace the gasket and cap.

BRUSHES.— The brushes must move freely in their holders and make firm even contact with the commutator or collector rings. Always keep an extra set on hand and replace any brush that wears to $5/8$ " in length or less. See the illustration on "Care of Commutator and Brushes" for proper method of seating brushes to the commutator.

Brush spring tension must be the same on all brushes. Measure tension with the brush spring raised to a point where the top of the brush is even with the top of the brush holder. Install new springs if the tension is unequal.

Replace all the accessories which were mounted on the generator, and the plant will be ready to be put into operation. However, before attempting to start the engine, turn it over slowly for several revolutions to be sure that the armature is not binding or striking against the pole pieces. The armature would be spoiled if such a condition should exist when the plant is started.

CONTROLS

Always disconnect the battery (where used) whenever servicing controls to avoid accidental starting of the plant. When disassembling controls, tag each lead that has to be removed and mark the connection point of the lead on the tag to assure correct connections when reassembling.

If any of the control panel equipment fails to function properly, replace the defective part with a new part of the same kind rather than try to repair the old part. No attempt should be made to repair such parts as meters, fuses, switches, relays or receptacles. Check all electrical connections and contacts whenever servicing control equipment.

POSSIBLE CAUSEREMEDY

ENGINE CRANKS TOO STIFFLY

Too heavy oil in crankcase.	Drain. Refill with lighter oil. See PREPARATION.
Engine stuck.	Disassemble and repair.

ENGINE CRANKS TOO SLOWLY WHEN CRANKED ELECTRICALLY

Discharged or defective battery.	Recharge or replace.
Loose connections.	Tighten loose connections.
Corroded battery terminals.	Clean corroded terminals. Replace cable if necessary.
Brushes worn excessively or making poor contact.	Replace brushes or clean commutator.
Short circuit in generator or load circuit.	Repair or replace parts necessary. Disconnect load.
Dirty or corroded points in start solenoid switch.	Replace switch.

ENGINE WILL NOT START WHEN CRANKED

Faulty ignition.	Clean, adjust, or replace breaker points, spark plugs, condenser, etc., or retime ignition.
Lack of fuel or faulty carburetion.	Refill the tank. Check the fuel system. Clean, adjust, or replace parts necessary.
Clogged fuel filter.	Clean.
Cylinders flooded.	Ground spark plug cables. Crank engine with spark plugs removed.
Poor fuel.	Drain. Refill with good fuel.
Poor compression.	Tighten cylinder heads and spark plugs. If still not corrected, grind the valves. Replace piston rings if necessary.
Wrong ignition timing.	Reset breaker points or retime ignition. See IGNITION.

TROUBLES AND REMEDIES

POSSIBLE CAUSE

REMEDY

ENGINE RUNS BUT VOLTAGE DOES NOT BUILD UP

Poor brush contact.	See that brushes seat well on commutator and collector rings, are free in holders, are not worn shorter than 5/8 inch, and have good spring tension.
Open circuit, short circuit, or ground in generator.	Refer to the GENERATOR section of Maintenance and Repair.

VOLTAGE UNSTEADY BUT ENGINE NOT MISFIRING

Speed too low.	Adjust governor to correct speed.
Poor commutation or brush contact.	Refinish commutator or undercut mica if necessary. See that brushes seat well on commutator and collector rings, are free in holders, are not worn shorter than 5/8 inch, and have good spring tension.
Loose connections.	Tighten connections.
Fluctuating load.	Correct any abnormal load condition causing trouble.

GENERATOR OVERHEATING

Short in load circuit.	Correct short circuit.
Generator overloaded.	Reduce the load.
Improper brush rig position.	See BRUSHES, Maintenance and Repair.

ENGINE OVERHEATING

Improper lubrication.	See Low Oil Pressure.
Poor ventilation.	Provide ample ventilation at all times.
Dirty or oily cooling surfaces.	Keep the engine clean.
Retarded ignition timing.	Retime ignition.
Generator overloaded.	Reduce load.

VOLTAGE DROPS UNDER HEAVY LOAD

Engine lacks power.	See remedies under "Engine Misfires At Heavy Load"
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POSSIBLE CAUSEREMEDY

VOLTAGE DROPS UNDER HEAVY LOAD (CONT.)

Poor compression.	Tighten cylinder heads and spark plugs. If still not corrected, grind the valves. Replace piston rings if necessary.
Faulty carburation.	Check the fuel system. Clean, adjust or repair as needed.
Dirty carburetor air cleaner.	Clean. Refill with proper oil.
Choke.	Choke plate must be wide open at operating temperature.
Carbon in cylinders or in carburetor venturi.	Remove carbon.
Restricted exhaust line.	Clean or increase the size.

ENGINE MISFIRES AT LIGHT LOAD

Carburetor idle jet clogged or improperly adjusted.	Clean. See ACCESSORY SERVICE.
Spark plug gaps too marrow.	Adjust to correct gap - .025".
Intake air leak.	Tighten manifold and carburetor mounting screws. Replace gaskets if necessary.
Faulty ignition.	Clean, adjust, or replace breaker points, spark plugs, condenser, etc.
Poor compression.	Tighten cylinder heads and spark plugs. If still not corrected, grind the valves. Replace piston rings if necessary.

ENGINE MISFIRES AT HEAVY LOADS

Defective spark plug.	Replace.
Faulty ignition.	Clean, adjust, or replace breaker points, spark plugs, condenser, etc., or retime ignition.
Clogged carburetor.	Clean carburetor.

POSSIBLE CAUSEREMEDY

ENGINE MISFIRES AT HEAVY LOAD (CONT.)

Clogged fuel screen.	Clean.
Defective spark plug cable.	Replace.

ENGINE MISFIRES AT ALL LOADS

Fouled spark plug.	Clean and adjust.
Defective or wrong spark plug.	Replace.
Leaking valves.	See VALVE SERVICE.
Broken valve spring.	Replace.
Defective or improperly adjusted breaker points.	Adjust or replace breaker points.

LOW OIL PRESSURE

Oil too light.	Drain, refill with proper oil.
Oil badly diluted.	Drain, refill with proper oil.
Oil too low.	Add oil.
Oil relief valve not seating.	Remove and clean, or replace.
Badly worn bearings.	Replace.
Sludge on oil screen.	Remove and clean.
Badly worn oil pump.	Replace.
Defective oil pressure gauge.	Replace.

HIGH OIL PRESSURE

Oil too heavy.	Drain, refill with proper oil.
Clogged oil passage.	Clean all lines and passages.
Oil relief valve stuck.	Remove and clean.
Defective oil pressure gauge .	Replace.

POSSIBLE CAUSEREMEDY

ENGINE BACKFIRES AT CARBURETOR

Lean fuel mixture.	Clean carburetor. Adjust jets.
Clogged fuel filter.	Clean.
Air leak at intake manifold or carburetor flange.	Tighten mounting screws. Replace gaskets if necessary.
Poor fuel.	Refill with good, fresh fuel. See PREPARATION.
Spark advanced too far.	Reset breaker points or retime ignition.
Intake valve leaking.	Reseat or replace.

EXCESSIVE OIL CONSUMPTION, LIGHT BLUE SMOKY EXHAUST

Poor compression. Usually due to worn pistons, rings, or cylinders.	Refinish cylinders. Install over-size pistons and rings.
Oil too light or diluted.	Drain. Refill with proper oil.
Too large bearing clearance.	Replace bearings necessary.
Engine misfires.	Refer to "Engine Misfires At All Speeds".
Faulty ignition.	Clean, adjust, or replace breaker points, spark plugs, condenser, etc., or retime the ignition.
Too much oil.	Drain excess oil.

BLACK, SMOKY EXHAUST, EXCESSIVE FUEL CONSUMPTION, FOULING OF SPARK PLUGS WITH BLACK SOOT, POSSIBLE LACK OF POWER UNDER HEAVY LOAD.

Fuel mixture too rich.	See that choke opens properly. Adjust jets properly. Adjust the float level.
Choke not fully open.	See that choke opens properly.
Dirty air cleaner.	Clean. Refill with proper oil.

POSSIBLE CAUSEREMEDY

LIGHT POUNDING KNOCK

Loose connecting rod.	Adjust clearance or replace.
Low oil supply.	Add oil. Change if necessary.
Oil badly diluted.	Drain. Refill with proper oil.
Low oil pressure.	See Low Oil Pressure for remedies.

ENGINE STOPS UNEXPECTEDLY

Empty fuel tank.	Refill.
Defective ignition system.	Check the ignition system. Repair or replace as needed. See that the STOP button lead is not grounded.

DULL METALLIC THUD, IF NOT BAD, MAY DISAPPEAR
AFTER FEW MINUTES OPERATION, IF BAD, INCREASES
WITH LOAD.

Loose crankshaft bearing.	Replace, unless one of the next two remedies permanently corrects the trouble.
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SHARP METALLIC THUD, ESPECIALLY WHEN COLD ENGINE FIRST STARTED

Low oil supply.	Add oil. Change if necessary.
Oil badly diluted.	Drain. Refill with proper oil.

PINGING SOUND WHEN ENGINE IS SUDDENLY OR HEAVILY LOADED

Carbon in cylinders.	Remove the carbon.
Spark advanced too far.	Reset breaker points or retime ignition.
Wrong spark plugs.	Install correct spark plugs. Champion H9 Com.
Spark plugs burned or carboned.	Clean. Install new plugs if necessary.
Valves hot.	Adjust tappet clearance. See VALVE SERVICE.
Fuel stale or low octane.	Use good, fresh fuel. See PREPARATION.
Lean fuel mixture.	Clean fuel system. Adjust carburetor jets properly.

POSSIBLE CAUSEREMEDY

TAPPING SOUND

Valve clearance too great.

Adjust to proper clearance. See VALVE SERVICE.

Broken valve spring.

Install new spring.

HOLLOW CLICKING SOUND WITH COOL ENGINE UNDER LOAD

Loose piston.

If noise is only slight and disappears when engine warms up, no immediate attention needed. Otherwise replace parts necessary.

VOLTAGE LOW AT FAR END OF LINE BUT NORMAL NEAR PLANT

Too small line wire used for load and distance.

Install larger or extra wires or reduce load.

MOTORS RUN TOO SLOWLY AND OVERHEAT AT
FAR END OF LINE BUT OK NEAR PLANT.

Too small line wire used for load and distance.

Install larger or extra wires or reduce load.

NOISY BRUSHES

High mica between bars of commutator.

Undercut mica.

EXCESSIVE ARCING OF BRUSHES

Rough commutator or rings.

Turn down.

Dirty commutator or rings.

Clean.

Brushes not seating properly.

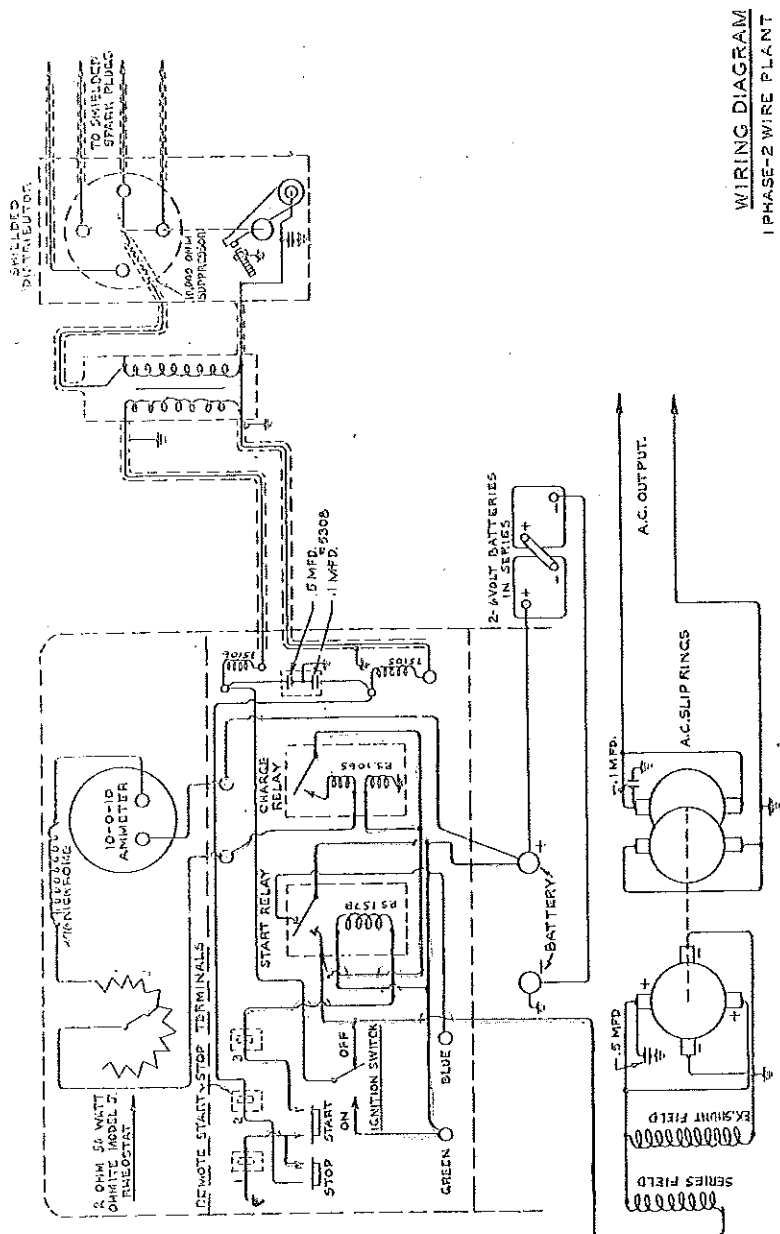
Sand to a good seat or reduce load until worn in.

Open circuit in armature.

Install a new armature.

Brush rig out of position.

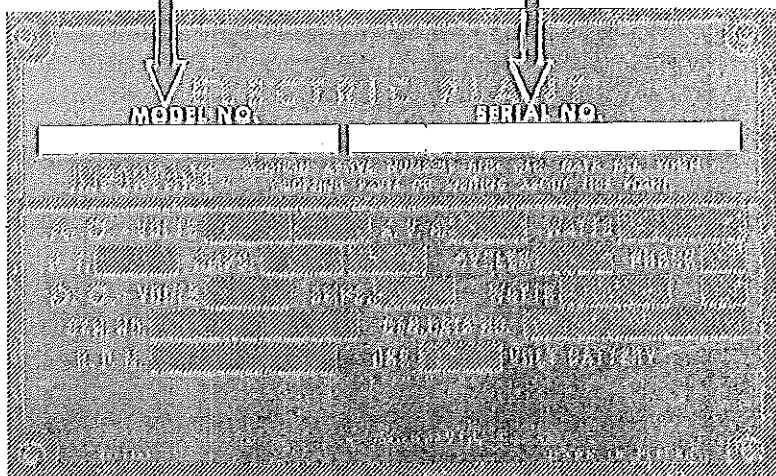
Line up properly.



WIRING DIAGRAM
1 PHASE-2 WIRE PLANT

Important!

Always GIVE THESE NUMBERS
WHEN ORDERING REPAIR PARTS OR
REQUESTING SERVICE INFORMATION
FOR YOUR UNIT !
WRITE IN NUMBERS SHOWN ON PLANT NAMEPLATE



(11 Jan.) Dec. 11 1950 (Los Angeles, Calif.)
0.14 lb. water
**INSTRUCTIONS
FOR ORDERING REPAIR PARTS**

FOR SERVICE OR PARTS, SEE THE DEALER FROM WHOM YOU PURCHASED THIS EQUIPMENT, OR REFER TO THE COMPANY REFERRED TO ON THE NAMEPLATE.

To insure prompt handling of your parts order, please give all information requested.

State on your order the Model No., Serial No. and Generator No. of the unit as it appears on the nameplate.

Order parts by Part Number and Full Description as given in the Parts List. When ordering parts use the part numbers listed in column headed, "New Part No." If there is no part number listed under "New Part No.," use number in column listed "Old Part No." The column headed, "Old Part No." is to be used for identifying parts in the illustrations. State the exact quantity wanted of each part.

If in doubt as to the identify of the part needed, return old part prepaid to your nearest dealer or Authorized Service Station. Print your name and address plainly on the package. Write a letter to the same address stating the reason for returning the part. State definite shipping instructions.

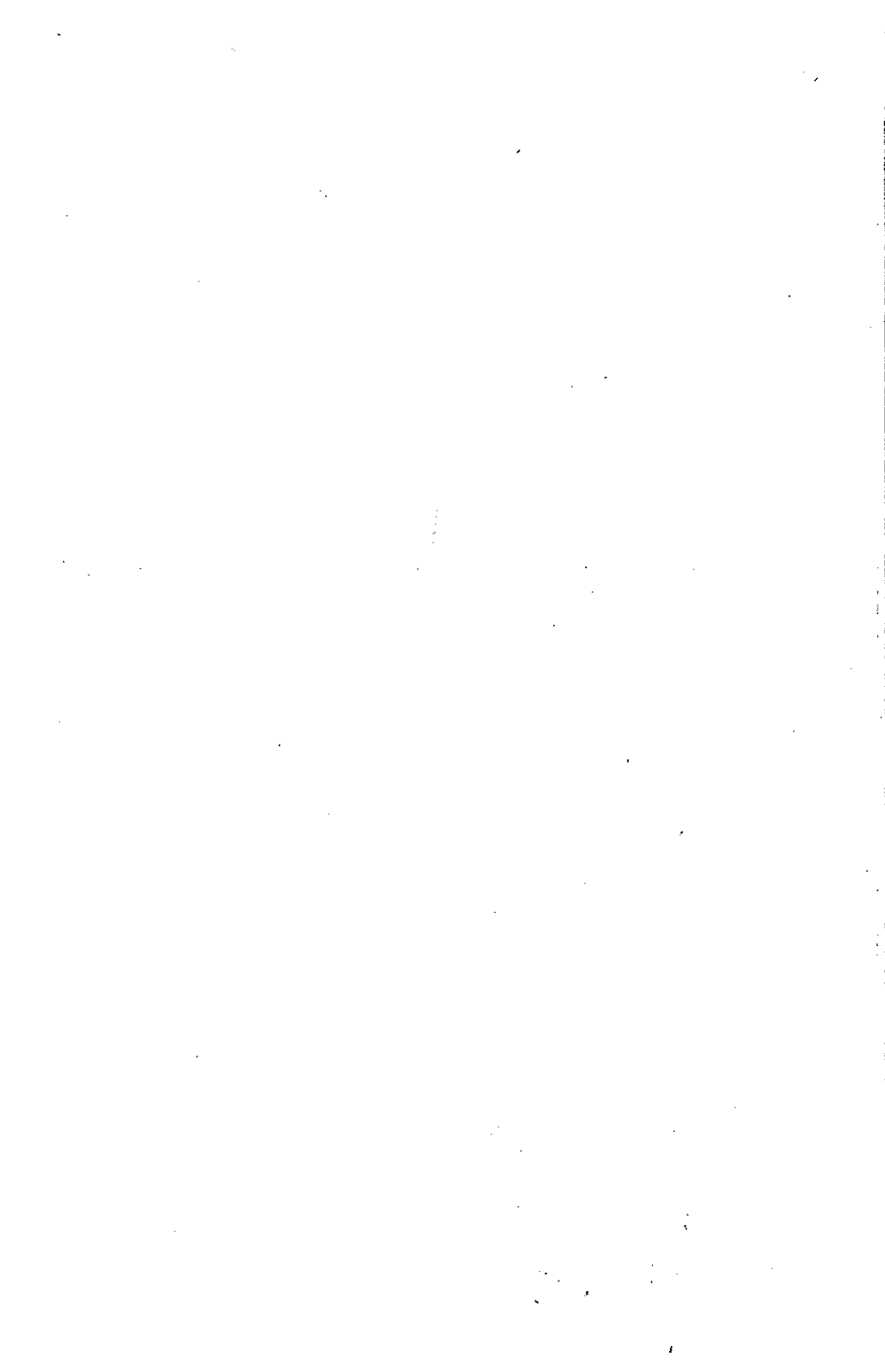
Any claim for loss or damage to your unit in transit should be filed promptly against the transportation company making the delivery. Shipments are complete unless the packing list indicate items are back ordered.

Prices shown in the Parts List were effective at the time the book was originally printed. Due to fluctuating costs some present day prices are considerably changed. All prices are F.O.B. and are subject to change without notice.

SPECIAL NOTES

The periodical checkups of engine and generator as recommended in this manual are vital to long life and uninterrupted service of your plant. Keep an accurate service log on this page! In this way you will avoid unduly long periods between service and overhauls by checking against previous dates, much like is done with passenger cars.

TO NEGLECT YOUR PLANT IS TO INVITE UNNECESSARY TROUBLE



Onan PARTS PETE says . . .



GENUINE ONAN PARTS will simplify your maintenance and service and will insure your Onan Plant operating at its peak efficiency.

* * *

See the dealer from whom you purchased your plant or go to an Onan Authorized Service Station or Parts Center. They will see that you receive the correct parts and will provide any service information you may need.

* * *

If you are operating your plant at a point where it is not convenient to secure very good delivery on parts, or your plant is receiving hard continuous service, your best insurance is to have a complete overhaul kit on hand.

* * *

Many times an added accessory will enable you to put your plant to greater or more complete service. Batteries, switches, controls, dollies or trailers are available for many Onan Plants.

* * *

Remember that the Onan Line is complete in the capacity range of 400 to 35,000 watts in gasoline; 3,000 to 65,000 watts in diesel; 1500 to 35,000 watts in separate generators, and 3,000 to 10,000 in tractor generators. These units are available in standard voltages of A.C., D.C. and battery charging current.

* * *

Onan Generating Equipment is designed for primary, portable, mobile or standby service. Where there is no other source of electricity it supplies primary power. It supplies portable or mobile power for fire and police departments, construction or radio use. For hospitals, hatcheries, industries or home there is no finer source of standby power. See your dealer for any of these needs.

