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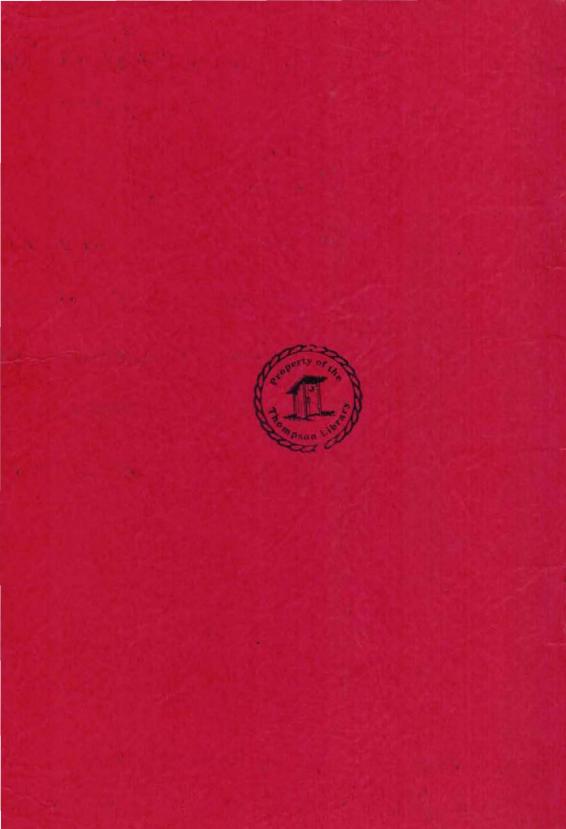
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INSTRUCTION MANUAL AND PARTS LIST

D. W. ONAN & SONS, INC.

(Price 78 cents)

READ THIS BOOK CAREFULLY AND PRESERVE FOR FUTURE REFERENCE



GENERAL INFORMATION

THE PURPOSE OF THIS BOOK. This instruction book is furnished so that the operator may learn of the characteristics of the plant. A thorough study of the book will help the operator to keep the plant in good operating condition so that it will give efficient service. An understanding of the plant will also assist the operator in determining the cause of trouble if it occurs.

KEEP THIS BOOK HANDY. Such simple mistakes as the use of improper oil, improper fuel, or the neglect of routine servicing may result in failure of the plant at a time when it is urgently needed. It is suggested that this book be kept near the plant so that it may be referred to when necessary.

SERVICE. If trouble occurs and the operator is unable to determine the cause after a thorough study of this book, or if he is unable to determine what repair parts are required, needed information will be furnished upon request. When asking for information, be sure to state the Model, Serial, and Generator numbers of the plant. This information is absolutely necessary and may be obtained from name plates on the plant. Give all other available details.

MANUFACTURER'S WARRANTY

The manufacturer warrants each new engine or electric plant to be free from defects in material and workmanship. Under normal use and service our obligation under this warranty is limited to the furnishing of any part without charge which, within ninety (90) days after delivery to the original user shall be returned to us or our authorized service station with transportation charges prepaid, and which our examination shall disclose to have been defective.

Our liability in case of defective workmanship, material or any costs incurred in remedying any claimed defective condition in any unit or such unit having been repaired, altered, or which installation and service recommendations have not been complied with, is limited strictly to the proper adjustment authorized by the factory.

This warranty does not include or cover standard accessories used, such as carburetors, magnetos, fuel pumps, etc., made by other manufacturers. Such accessories have separate warranties made by the respective manufacturers. Repair or exchange of such accessories will be made by us on the basis of such warranties.

This warranty is in lieu of all other warranties expressed or implied.

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

This manual applies to the 5000 watt, alternating current, electric generating plants. This manual also applies to the 6000 watt, direct current, electric generating plants, when it is used in conjunction with the supplement beginning on page 67.

One copy of this manual is supplied with each plant of the basic models listed in the General Data below, and with special models which differ slightly from these basic models.

Each plant is test run and carefully checked under various electrical loads before leaving the factory to assure that it is in good condition and will produce its rated output. Before putting the plant into operation, carefully inspect for any damage which may have occurred during shipment. Damaged parts must be repaired or replaced. Read this manual thoroughly to become familiar with the details of installation and operation of this plant.

GENERAL DATA

OUTPUT WATTS	OUTPUT VOLTS	CYCLES	PHASE	WIRES	CAPACITY COOLING SYSTEM		CRANK-	† PARTS REF. SYMBOL
5000	115	60	1	2	11	24	*3	A.
5000	115/230	60	1	3	11	24	*3	В
5000	120-208	- 60	3	4	11	24	*3	. С
5000	230	60	3	3	. 11	24	*3	D
6000	115	DIRE	CT CURR	ENT	11	24	*3	E
6000	230	DIRE	CT CURR	ENT	11	24	*3	F

^{*} Plus 1 quart for the oil filter.

When ordering Generator Group parts for a 50 cycle plant, order by description as given in the parts list, giving the plant model, spec., serial, and generator data numbers. See page 39 for further Instructions for Ordering Repair Parts.

[†] The Parts Ref. Symbols A, B, C, D, E & F indicate which column to use in the Parts List where more than 1 column is used. Compare the data on the plant nameplate with the data in the above table. Select the corresponding Ref. Symbol and use that column in the Generator and Control Panel Groups of the Parts List. Unless otherwise specified in the description of the part, engine parts are the same for all plants to which this manual applies.

ENGINE

A Continental Red Seal engine, spec. No. Y91-273 or Y91-264 powers the plant. The engine is a 4 cylinder, L head, 4 stroke cycle, water cooled internal combustion type. The cylinder bore is 2-7/8", the piston stroke 3-1/2", compression ratio 6.1 to 1, and the maximum horsepower at 1800 r.p.m. is 23. The engine speed is controlled by a centrifugal flyweight type, gear driven governor. 12 volt starting and ignition current is furnished by two 6 volt batteries connected in series. Charging current for the batteries is furnished by the generator. Full length water jackets surround the cylinders and valve seats. Circulation of the engine coolant is maintained by a belt driven, ball bearing pump, and the coolant temperature is thermostat controlled. The cooling system capacity is 11 quarts, U. S. Measure. A pusher type fan forces cooling air out through the front of the radiator. A high water temperature cut-off switch stops the engine if the coolant temperature reaches a dangerously high point. A gear type oil pump supplies pressure lubrication to main, camshaft and connecting rod bearings. The crankcase oil capacity, including the oil filter, is 4 quarts, U. S. Measure. A fuel pump provides for connection to any appropriate gasoline fuel supply tank. Some model plants are equipped with a 6 gallon fuel tank mounted inside the plant housing. Other special model plants are equipped to burn gaseous fuel.

GENERATOR

The generator is air cooled, has four stationary poles, and a revolving armature. The generator is directly coupled to the engine, with the armature turning at crankshaft speed. A series winding is used for electrically cranking the engine. The generator is self excited, generating both AC and DC. The direct current is used for exciting the field and charging the batteries.

An extremely large commutator and slip rings are mounted at the ball bearing end of the armature. The inner end of the armature is supported by the rear main engine bearing. All generator windings are thoroughly impregnated with insulating varnish and baked, to minimize the possibility of internal short circuits.

Voltage and frequency are proportional to engine speed, which is regulated by the engine governor. Speed is approximately 1800 r.p.m. for 60 cycle plants, and approximately 1500 r.p.m. for 50 cycle plants. The generator design assures close voltage regulation between full load and no load conditions.

CONTROLS

The plant controls include an electric choke, a start-stop switch, an ignition switch, and other relays and regulators necessary to the proper operation of the plant. Remote control switches, automatic controls, or line transfers may be connected to the plant. Some plants are equipped with an electrical meter panel.

ACCESSORIES

Accessories supplied with a standard housed plant include a hand crank, batteries, battery hydrometer, breaker point wrench, a remote start-stop switch, a jar of ball bearing grease, and instruction manuals.

IMPORTANCE OF PROPER INSTALLATION. Proper installation is essential to satisfactory and dependable performance. Location and ventilation are important factors to consider in installation.

LOCATION. The plant should be centrally located in relation to the electrical load. If practicable, install the plant in a building or covered vehicle for protection from extremes in weather conditions.

CAUTION

Exhaust gases are deadly poisonous and must be piped outdeers if the plant is installed indoors. Excessive inhalation of exhaust gases may cause serious illness or death. Some engines have a small hole in the bottom of the exhaust manifold, under the exhaust outlet, for moisture to escape. This hole may be plugged if exhaust gas escape is objectionable.

The muffler outlet is threaded for $1-1/4^n$ standard pipe. If necessary to run an exhaust line upward from the plant, install a suitable condensation trap at the lowest point in the line and drain it regularly. Proper shielding must be provided if the exhaust line passes through an inflammable wall.

If desired, an underground muffler may be constructed. Use a heavy 10 gallon or larger tank or drum, welding suitable pipe fittings to the drum. Use 1-1/4" pipe between the plant muffler and the underground muffler. Bury the underground muffler in loose gravel, and see that the bottom of the drum is perforated to allow condensation to drain out. Extend the muffler outlet at least 24" above ground and fit it with a pipe gooseneck.

The site should be dry, clean, and well ventilated. Either a damp or a dusty condition will require more frequent inspection and servicing of the plant. Allow at least 24" space on all sides for ease in servicing.

If the plant is mounted aboard a truck or trailer, see that it is fastened securely when in transit, and that it sets in a level position when operating. Mounting holes are 18^n apart lengthwise of the plant and $20-3/4^n$ crosswise of the plant.

VENTILATION. - Proper cooling depends upon correct ventilation to dissipate the heat generated by the engine and generator. Separate air inlet and outlet openings must be provided if the plant is mounted in a small room or compartment.

FUEL SUPPLY, GASOLINE.— The fuel pump inlet has $1/8^n$ pipe threads, into which a fitting for $1/4^n$ flared tubing is installed. Be sure any fitting substituted has $1/8^n$ male pipe threads, to fit the fuel pump inlet. Any tank used must be not more than 8 ft. below the fuel pump. Connections must be air tight to permit the fuel to reach the fuel pump. Observe local fire code specifications in making the installation.

NATURAL GAS OR VAPOR FUEL. Some special model plants are equipped to burn LPG or natural gas fuel. Any applicable gas codes must be complied with when connecting the plant to a source of gas fuel. In some localities, presence of foreign matter in the gas supply may require installation of a fuel filter in the fuel supply line. The fuel inlet is threaded for $3/4^{\circ}$ pipe.

NOTE

On natural gas installations the atmospheric regulator on the plant is designed to operate on a line pressure not to exceed 4.6 ounces. If the line pressure exceeds 4.6 ounces pressure, it will be necessary to install a primary regulator in the line to reduce the pressure before it enters the atmospheric regulator.

BATTERIES. Two 6-volt batteries are connected in series by a short jumper cable. Connect the cable which is attached to the start solenoid switch to the remaining positive (+) post of the two batteries. Connect the cable which is grounded on the cylinder head to the remaining negative post. If the plant was boxed for export shipment, service the batteries as directed on the tags attached to the batteries.

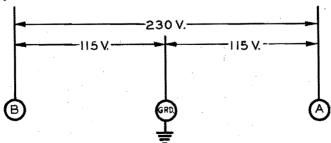
CONNECTING THE LOAD WIRES. The AC output terminals are located behind the control panel, on the fuel tank support. Run the load wires through the hole in the rear panel, connecting them to the solderless connectors on the output terminals. Be sure to use the proper size insulated wire, taking into consideration the distance between the plant and the load, and the type of load. Consult a competent electrician, and observe applicable electrical codes in making the installation. See that the main line is protected by a fused main switch or a circuit breaker between the load and the generator. Refer to the plant wiring diagram, and follow the applicable directions given below for connecting the load wires.

115 VOLT, SINGLE PHASE, 2 WIRE PLANT

Connect the white or grounded load wire to the grounded plant terminal. Connect the other (black) load wire to the insulated plant terminal. If the control panel has a receptacle, a load not to exceed 15 amps may be connected to each outlet.

115/230 VOLT, SINGLE PHASE, 3 WIRE PLANT

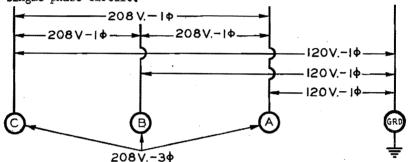
The center terminal is grounded. For 115 volt current, connect the white or grounded load wire to the center terminal and the other load wire to either of the two outside terminals, A or B. 2500 watts are available on each 115 volt circuit, ground to A, and ground to B. For 230 volt current, connect the load wires to the two outside insulated terminals, A and B, leaving the center terminal unused. If the control panel has a receptacle, a load not to exceed 15 amps, 115 volts may be connected to each outlet.



120 VOLT, SINGLE PHASE/208 VOLT, THREE PHASE - 4 WIRE PLANT

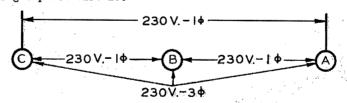
The terminal farthest from the generator is grounded. For 120 volt, single phase current connect the grounded load wire to the grounded terminal and the other load wire to any one of the other three insulated terminals, A, B, or C. For 208 volt, 3 phase current, connect a load wire to each of the three insulated terminals A, B, and C, leaving the grounded terminal unused. Reversing the connections between any two insulated terminals will reverse the direction of rotation of three phase motors. Use a phase sequence indicator to assure in-phase connection.

For 208 volt, single phase current, connect one of the two load wires to each of any two insulated terminals. 1666 watts are available on each single phase circuit.



230 VOLT, THREE PHASE, 3 WIRE PLANT

No terminal is grounded. Reversing the connections between any two of terminals A, B, or C will reverse the direction of rotation of three phase motors. Use a phase sequence indicator to assure in-phase connection. 230 volt single phase current may be obtained by connecting one load wire to each of any two terminals. 1666 watts are available on each single phase circuit.



ALL MODELS

One or more remote control switches may be connected for remote starting and stopping. Connect the switch terminals Nos. 1, 2, and 3 to the corresponding terminals, marked REMOTE, behind the control panel, on the fuel tank support. Use No. 18 wire to connect switches up to 250 ft. in distance, No. 16 wire up to 500 ft. and No. 14 wire up to 1000 ft. If automatic or line transfer equipment is to be connected, follow the directions supplied with the equipment.

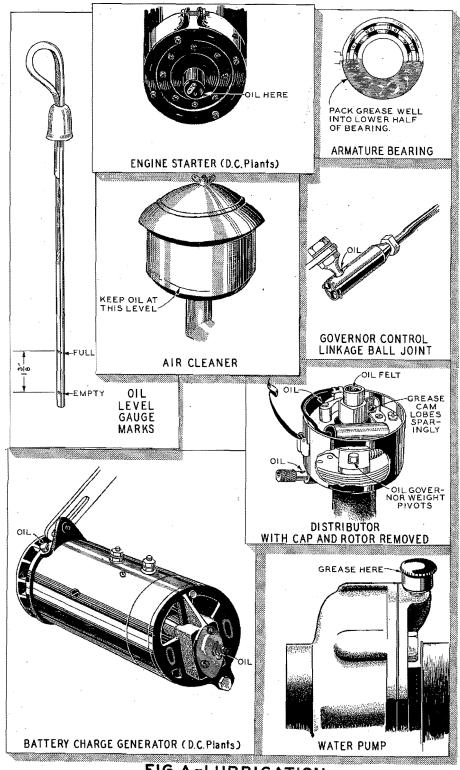


FIG. A - LUBRICATION

PREPARATION FOR OPERATION. - Before putting the plant in operation, it must be supplied with fuel, oil, and water (or antifreeze liquid). Comply with the following instructions.

LUBRICATION. Refer to Fig. A. Use approximately 3 quarts (U. S. Measure) of a good quality heavy duty (detergent) type oil to fill the crankcase to the high level mark on the bayonet type gauge. Approximately 1 quart of oil remained in the oil filter when the crankcase was drained at the factory. Do not use an oil heavier than SAE number 20 in a plant being put into service the first time. After the first oil change, use an oil of the proper SAE number as indicated in the following table, according to the lowest temperature to which the plant will be exposed when not running. Temperatures indicated are for conditions where the plant will be standing idle long enough to cool to the surrounding temperature.

LOWEST TEMPERATURE	SAE NUMBER OF	OIL
100° F. (38° C.)	70	
32° F. (0° C.)	30	
0° F. (-18° C.) Below 0° F. (-18° C.)	20 5W	

See ABNORMAL OPERATING CONDITIONS

The crankcase oil capacity is 3 quarts (U. S. Measure), plus approximately 1 quart used in the operation of the oil filter. When a new oil filter element is installed, it will be found that the element will absorb approximately 1 quart of oil.

The use of a heavy duty (detergent) type oil will greatly increase the life of pistons and rings. If a change to a heavy duty type oil is made after using non-detergent oil in this plant, allow not more than one third the usual operating hours between the next two oil changes. Thereafter change the crankcase oil at the regular periods, as recommended under PERIODIC SERVICE.

Edition and CAUTION and Edition of

When using a detergent type oil, always use oil of the same brand when adding oil between changes.

When mixed together, detergent oils of different manufacturers sometimes form chemical compounds that are harmful to internal engine parts.

Keep the crankcase oil level at or near the upper level mark on the oil level gauge, but not above it. If the crankcase is overfilled, the connecting rods may strike the oil, causing improper lubrication and excessive oil consumption. Never allow the oil level to fall below the low level mark on the oil level gauge.

Remove the air cleaner top and fill the cup to the level indicated with oil of the same SAE number as that used in the crankcase, except as instructed under ABNORMAL OPERATING CONDITIONS - COLD TEMPERATURES.

Ada Garage

Fill the oil cup on the side of the distributor.

Place a drop of oil on each of the governor to carburetor link ball joints.

It is unnecessary to lubricate the generator bearing and water pump until time to do so as noted under PERIODIC SERVICE.

FUEL, GASOLINE.— Use only a good grade, clean, fresh, regular automotive type gasoline of 68 to 74 octane rating. Do not use any highly leaded premium type of gasoline. The use of any gasoline which has a high lead content will necessitate more frequent carbon removal, spark plug, and valve servicing. However, do not use a low octane gasoline, such as "stove" gas, as its use will cause excessive detonation or "spark knock", and damage to engine bearings, valves, rings, etc.

If the plant has the mounted fuel tank, do not fill the tank entirely full of cold gasoline, as the fuel may expand as the plant warms up, causing the gasoline to overflow. Observe the usual precautions when handling gasoline. Do not fill the tank when the plant is running.

On plants equipped with the mounted fuel tank, note that the electric fuel gauge on the control panel registers the amount of fuel in the tank only when the plant is running. If it is desired to check the fuel when the plant is stopped, throw the ignition switch to the HAND START position while making the observation. Be sure to return the switch to the ELECT. START position.

If an auxiliary fuel tank is used, connection may be made to the two way fuel shut-off valve at the bottom of the tank mounted on the plant.

FUEL, NATURAL GAS OR LPG. - Make sure that fuel supply lines (and tanks, if used) have been properly installed and connected.

RADIATOR. The capacity of the cooling system is approximately 11 quarts (U. S. Measure). See that the radiator and cylinder block drain cocks are closed. Fill the radiator with clean, alkali-free water such as clean rainwater. The use of a rust and scale inhibitor is recommended. If the plant will be exposed to freezing temperatures, use a standard anti-freeze in the proper proportion. To avoid loss of anti-freeze through the overflow pipe due to expansion, fill only to approximately 2 inches below the bottom of the filler neck. Check the cooling system to see that there are no leaks.

If the foregoing instructions have been carefully complied with, the plant should be ready for operation. However, before starting the plant, carefully study the paragraphs under the headings OPERATION and ABNORMAL OPERATING CONDITION immediately following.



PRELIMINARY.- Be sure that the plant has been properly installed and prepared for operation before starting it. Turn on the fuel supply and check for leaks, correcting any that may be found. See that the circuit breaker handle is in the OFF position, so that no load is connected.

CAUTION

If the preparation has been made for extremely cold weather, using diluted No. 10W oil, the initial filling of the crankcase with diluted oil should have been left to be done immediately before starting the plant. Be sure the crankcase is filled with the proper oil to the high level mark on the bayonet gauge.

Oil was sprayed into the cylinders before the plant was shipped, and it may be necessary to remove and clean the spark plugs in gasoline before the engine will start the first time. Dry the plugs before reinstalling them.

STARTING THE PLANT ELECTRICALLY. See that the ignition switch is set at the ELEC. START position. If the plant is to be operated on gascline fuel, press the START button firmly for several seconds to allow the fuel pump to become full and to pump gasoline into the carburetor. The carburetor is automatically choked, and the engine should start after a few seconds of cranking. Hold the start button in until the plant has reached running speed. If it does not start, do not press the START button continuously, but for periods of not more than five seconds at a time, with equivalent stops between. If the plant fails to start after a few attempts, check the fuel and ignition systems and repeat the procedure after correcting the trouble.

If the plant is equipped for natural or Liquid Petroleum Gas operation, see that the arm of the choke control mounted upon the exhaust manifold is locked down so as to make the choke inoperative. No choking is necessary when operating on gas, and the carburetor choke valve should be wide open. See that the gasoline supply is turned off, and that there is no gasoline in the carburetor bowl. Turn on the fuel supply and press the START button. The regulator primer button, at the center of the regulator, may have to be pushed to start the engine the first time. Do not overprime. Unless the fuel to be used is of approximately the same BTU rating as that used by the manufacturer (1000 BTU) it will be necessary to readjust the carburetor gas adjustment valve to insure smooth and economical operation. See the section headed ADJUSTMENTS.

STARTING THE PLANT MANUALLY.— If gasoline fuel is used, use the hand crank to turn the engine over enough times to fill the fuel pump and carburetor. Throw the ignition switch to the HAND START position. Crank the engine with a quick upward pull. Have some one pull up on the automatic choke arm while cranking. Do not spin the crank or press down on it. If gas fuel is being used, it may be necessary to press the regulator priming button, at the center of the regulator, to start the engine the first time. Do not overprime. For manually starting a plant equipped for gas fuel, the gas should have a BTU rating above 800 BTU per cu. ft. The temperature should be above 30° F. (-1° C.). See that the automatic choke arm is locked down. After the carburetor gas adjustment valve has been properly adjusted, it should be unnecessary to use the priming button. After the plant starts, be sure to return the igniswitch to the ELECT. START position.

CAUTION

KEEP THE IGNITION SWITCH AT THE ELECT. START POSITION AT ALL TIMES EXCEPT WHEN ACTUALLY STARTING THE PLANT MANUALLY. THROW THE SWITCH TO THE HAND START POSITION WHILE CRANKING THE PLANT MANUALLY, BUT RETURN IT TO THE ELECT. START POSITION AS SOON AS THE PLANT STARTS. WHILE THIS SWITCH IS AT THE HAND START POSITION THE HIGH WATER TEMPERATURE CUT-OFF SWITCH (AND LOW OIL PRESSURE SWITCH, IF THE PLANT IS SO EQUIPPED) IS CUT OUT OF THE CIRCUIT AND THE PLANT IS NOT PROTECTED AGAINST OVERHEATING. IF THE SWITCH IS LEFT AT THE HAND START POSITION WHEN THE PLANT IS NOT RUNNING, THE BATTERY MAY BECOME DISCHARGED AND THE IGNITION COIL DAMAGED.

If the plant will start but does not continue to run, when electrically cranked, possibly the start button is being released too soon. If not, try starting the plant manually. If the plant starts and continues to run with the ignition switch at the HAND START position, but stops when thrown to the ELECT. START position, trouble is indicated in one of the relays, the high water temperature switch, or a loose connection.

CHECKING THE OPERATION.— After the plant starts, allow the engine to reach operating temperature. Check the level of the coolant in the radiator, as the thermostat may have allowed an air pocket to form, thus preventing complete filling. Add coolant to bring the level to the proper point, if necessary. The oil pressure should be between 20 and 40 pounds, the coolant temperature approximately 150° to 180° F. (65° to 82° C.), and the battery charge rate between 2 and 7 amperes, depending upon the charge condition of the batteries.

When the plant is not in operation, the water temperature gauge will register 212° F. The fuel gauge, oil pressure gauge, and charge ammeter will register zero. If it is desired to check the water temperature or fuel supply when the plant is not running, throw the ignition switch to the HAND START position while making the observation. Be sure to return the switch to the ELECT. START position after making the observation. While the plant is running, the various gauges are automatically in operation when the ignition switch is at the ELECT. START position.

Connect a load to the plant by throwing the main line switch, or control panel circuit breaker if the plant is so equipped, to the ON position. The no load voltage is approximately 125 volts for the 115 volt plant, after the plant has reached operating temperature. The full load voltage is approximately 108 volts, for a 115 volt plant. Voltage will be correspondingly higher for plants of other voltages. If the plant tends to surge, or the voltage tends to fluctuate, it is usually an indication the engine needs additional warm-up before connecting a heavy load. Those plants which are equipped with the electrical meter panel have a circuit breaker which will automatically disconnect the load if the plant is severely overloaded. If the plant is not equipped with the circuit breaker, keep the correct size fuse in the load line switch. Those plants equipped with an output receptacle on the panel will not register on the meters any load which may be connected to the receptacle. This receptacle is provided for a trouble light or similar light load up to 15 amps., 115 volts for each outlet.

Continuous overloading of the generator will cause the generator temperature to rise to a dangerous point and lead to early failure of the windings. If the main line fuse should blow out or the plant circuit breaker open, remove the cause of overloading before again connecting the load to the plant. On the three phase plant, if part of the load is single phase, the total load on any one "leg" should not exceed one third the total capacity of the generator. On the 115/230 volt plant, divide the load as closely as possible between the two circuits when using 115 volt current. Confine the load on each 115 volt circuit to not more than 2500 watts.

STOPPING THE PLANT. Throw the main line switch or the plant circuit breaker to the OFF position, to disconnect the load. Press the STOP button firmly. The ignition switch must be at the ELECT. START position, as pressing the STOP button will have no effect if the switch is at the HAND START position. In an emergency, if the stop circuit fails to work, turn off the fuel supply. The plant will stop when the supply of fuel in the carburetor is exhausted.

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ABNORMAL OPERATING CONDITIONS

LOW TEMPERATURES

Lubrication, fuel, and the cooling system require special attention at temperatures below 32° F. $(0^{\circ}$ C.).

CRANKCASE OIL.- If the plant must be started after standing unused in temperatures between 32° F. (0° C.) and 0° F. (-18° C.) use a good quality oil of SAE number 20W in the crankcase. For temperatures below 0° F. (-18° C.) use SAE number 5W oil. The oil should be the detergent, or heavy duty type.

If number 5W oil is not obtainable, dilute number 10W oil with approximately 1 part of kerosene to 4 parts of oil. Thoroughly mix the oil and kerosene just before pouring into the engine. Immediately start the plant and run for at least 10 minutes to thoroughly circulate the mixture through the engine. Do not put diluted oil into the engine until ready to start the plant. Mix the oil well just before pouring it into the engine. Always use a mixture of the same proportions when adding oil between changes. When using diluted oil, change the oil every 25 operating hours and check the oil level frequently. Use undiluted oil again as soon as temperature conditions permit.

CAUTION

Always drain the oil only when the engine is warm. Drain the oil filter when changing to a lighter oil. Add sufficient oil to compensate for that used to fill the oil filter.

AIR CLEANER.- If congealed oil or frost formation within the air cleaner restricts the air flow, remove and clean the air cleaner. Reassemble and use the air cleaner without oil until conditions permit the use of eil in the normal manner.

COOLING SYSTEM. The coolant must be protected if there is any possibility of its freezing. Use any good antifreeze, in the proportion recommended by the manufacturer for the lowest temperature to which the plant will be exposed. The capacity of the cooling system is approximately ll quarts.

If the plant is to be stored in freezing temperatures, without adding anti-freeze solution, be sure to open the cylinder block drain cock to thoroughly drain all water from the block, after draining the radiator.

If the water temperature gauge shows the engine to be operating too cool, a portion of the radiator surface may be covered to raise the coolant temperature to normal. Avoid overheating. Set the high water temperature cut-off switch to operate at a temperature several degrees below the boiling point of the coolant, taking into consideration the altitude at which the plant is operating, and the type of anti-freeze solution used. Check the antifreeze solution frequently.

ABNORMAL OPERATING CONDITIONS

FUEL, GASOLINE .- Use fresh, clean, high test (not highly leaded, premium) gasoline for easy starting in cold weather. Keep the fuel tank nearly full in order to prevent moisture condensation within the tank, which can cause considerable trouble from ice formation in the fuel system. Do not fill the fuel tank entirely full of gasoline, for expansion as the plant warms up may cause it to overflow.

FUEL, GAS OR VAPOR .- Some types of Liquid Petroleum Gas will not vaporize readily at low temperatures. Heat exchanger equipment is available, at extra cost, and should be installed at the factory if temperature conditions require it.

BATTERIES .- Check the charge condition of the batteries frequently, to be sure that they are kept in a fully charged condition. A discharged battery will freeze at approximately 20°F. (-7°C.) and be permanently damaged. A fully charged battery will not freeze at -90°F. (-67°C.). Run the plant for at least 20 minutes after adding water, to assure mixing the water with the electrolyte.

HIGH TEMPERATURES

If the plant is to be operated in abnormally high temperatures (above 100°F., or 38°C.). provide sufficient air circulation for proper cooling. Keep the cooling system clean and free of rust and scale. See that the high water temperature cut-off switch is correctly set, and that the ignition switch is at the ELECT. START position. Keep the ignition timed correctly. Keep the radiator well filled, the fan belt tension properly adjusted, and the crankcase oil level at, but not above, the upper level mark on the oil level gauge.

CAUTION

For best cooling effects, keep the door panels in place on the plant when it is in operation.

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Use SAE number 30 oil for temperatures up to 100°F. (38°C.) and SAE number 40 for higher temperatures. Check the oil level frequently, and change the crankcase oil at least every 50 hours. Keep the electrolyte level in the batteries up to normal.

DUST AND DIRT Keep the plant as clean as practicable. Service the air cleaner as frequently as conditions require. Keep the radiator fins clean and free of obstructions. Keep the generator commutator and slip rings and brushes clean. See that all brushes ride freely in their holders. Keep oil and gasoline supplies in air tight containers. Install a new oil filter element as often as necessary to keep the oil clean. Change the crankcase oil more frequently if it becomes discolored before the normal time has elapsed between changes, were to assist assisting the last the last assistance of

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GENERAL. Follow a definite schedule of inspection and servicing to assure better performance and longer life of the plant at minimum expense. Service periods outlined below are for normal service and average operating conditions. For extreme load conditions, or abnormal operating conditions, service more frequently. Keep a record of the hours of operation each day to assure servicing at the proper periods.

DAILY SERVICE

If the plant is operated more than 8 hours daily, perform the DAILY SERVICE operations every 8 hours.

FUEL.- If the plant is operated on gasoline fuel, check the fuel gauge often enough to assure a continuous fuel supply. Do not fill the tank while the plant is running.

RADIATOR. - Check the level of the coolant and, if necessary, add sufficient liquid to bring the level up to within one or two inches of the bottom of the filler neck. In freezing weather, if a nonpermanent type antifreeze is used, check the protective strength of the coolant.

AIR CLEANER. - Check the oil level in the air cleaner cup and add sufficient oil to bring it to the indicated level. Clean out and refill the oil cup if dusty conditions prevail.

CRANKCASE OIL LEVEL. Check the oil level as indicated on the bayonet type oil level gauge. Do not allow the engine to operate with the oil level close to the low level mark on the gauge. Add sufficient oil of the proper SAE number to bring the level to the upper level mark, but do not overfill the crankcase.

CLEANING.- Keep the plant as clean as possible. A clean plant will give longer and more satisfactory service.

WEEKLY SERVICE

If the plant is operated more than 50 hours a week, perform the WEEKLY SERVICE operations every 50 hours.

CRANKCASE OIL.- Add crankcase oil as necessary, or change the oil after 50 operating hours. If the plant has been operating with diluted oil, change the oil after 25 hours operation.

GENERAL LUBRICATION. - Put a drop of light lubricating oil on each of the governor to carburetor link ball joints, and fill the distributor oil cup. Put several drops of oil in the oil holes at each end of the battery charging generator, and in the oil hole at the forward end of the starting motor of the direct current, battery ignition plant.

AIR CLEANER. - Clean the air cleaner filter element and cup thoroughly in gasoline or other suitable solvent. Allow to dry, or use compressed air to dry. Refill the cup to the indicated level with clean oil of the same SAE number as that used in the crankcase, except as noted under ABNORMAL OPERATING CONDITIONS.

FAN BELT.- Check the fan belt tension. Adjust to permit about 3/4" play when pressure is applied midway between the fan and crankshaft pulleys. See ADJUSTMENTS section. Install a new belt if the old one is badly worn.

BATTERIES. See that battery connections are clean and tight. Keep the electrolyte level at the proper level above the plates by adding only clean water which has been approved for use in batteries. In freezing weather, run the plant at least 20 minutes after adding water, to mix the water with the electrolyte.

SPARK PLUGS.— Clean the spark plugs and check the electrodes gap. Keep the gap adjusted to 0.025". More frequent spark plug service may be necessary if leaded gasoline is used.

WATER PUMP LUBRICATION. Use a good grade of water pump grease in the water pump grease cup. Turn the grease cup cap down 1 turn each 50 hours of operation. If grease appears in the coolant, the water pump is being overlubricated. To correct, turn the cap down less than 1 turn.

DISTRIBUTOR. - Check the distributor contact points. If they are only slightly burned or pitted, remove and resurface them on a fine stone. Install new contact points if the old ones are badly burned. Keep the gap adjusted to 0.020°. Excessive burning or pitting of the points indicates a faulty condenser, which should be replaced with a new one.

MONTHLY SERVICE

If the plant is operated more than 200 hours a month, perform the MONTHLY SERVICE operations every 200 hours.

FUEL SYSTEM. - Remove the pipe plug at the bottom of the carburetor and drain the carburetor of any sediment which may have accumulated.

Remove the cover and filter screen from the fuel pump. Clean the screen thoroughly. Reassemble the screen and cover. Be sure the cover gasket is in good condition. Be sure there are no leaks at any point in the fuel system.

DISTRIBUTOR. - Place one drop of light oil on the distributor breaker arm pivot pin, several drops on the felt pad under the rotor, and three or four drops on the flyweight machanism, distributed where it will reach friction points. Place a light coating of grease on each cam lobe, where the breaker arm block rubs.

EXHAUST SYSTEM. - Inspect all exhaust connections carefully. Make any necessary repairs.

COCLING SYSTEM. In some localities, presence of lime or mineral deposits in the water may necessitate frequent flushing of the plant cooling system. Remove the top and bottom radiator hoses. If available, connect a source of water under pressure to the bottom of the radiator and reverse flush until the water runs clear from the top radiator connection. Repeat the operation on the engine, reversing the usual flow by running the water in at the outlet elbow. Make sure hose connections are tight when refilling the cooling system.

PERIODIC SERVICE

OIL FILTER.- If the crankcase oil is becoming discolored, remove and discard the oil filter element. Clean out the oil filter and install a new element. The new filter element will absorb approximately one quart of oil when the plant is started up. After a short running period, stop the plant and check the crankcase oil level. Add oil as necessary to bring the oil up to the proper level

ENGINE COMPRESSION. - Check the compression of each cylinder, using a compression gauge. A difference of more than 10 pounds pressure between cylinders indicates a compression loss which should be corrected. High compression is an indication of excessive carbon or lead deposits in the combustion chambers.

CARBON REMOVAL. The frequency of necessary carbon and lead removal servicing will vary with the type of fuel used. When a highly leaded gasoline is used, it may be necessary to remove lead deposits more frequently than every 200 operating hours. Remove the cylinder head and clean all carbon and lead deposits from the tops of pistons, valves, and top surface of the cylinder block. Clean the deposits from the cylinder head. If necessary, grind the valves to a good seat.

GENERATOR. - Check the condition of the commutator, collector rings, and brushes. In service, the commutator and collector rings acquire a glossy brown color, which is a normal condition. Do not attempt to maintain a bright, metallic, newly machined finish. If the commutator or collector rings become heavily coated, clean with a lint free cloth. Slight roughness may be remedied by lightly sanding with #00 sandpaper. Clean out all carbon and sandpaper dust.

When brushes are worn so that the top of the brush is below a point midway between the top and bottom of the brush holder, replace the brushes with new ones. Brushes must ride freely in their holders, and spring tension should be uniform. Commutator brush spring tension is approximately 30 oz. and collector ring brush spring tension is approximately 16 oz. Tension should be measured with the free end of the spring level with the top edge of the brush holder.

Check the brush rig for proper alignment of the reference marks on the brush rig and its support. See Maintenance and Repair, Brush Rig.

GENERAL.- Thoroughly inspect the plant for oil or water leaks, loose electrical connections, and loose bolts or nuts. Make any necessary repairs.

SEMI-YEARLY SERVICE

Every 6 months or 1200 operating hours, whichever occurs first, service the generator ball bearing.

Remove the plate from the housing rear end. Thoroughly clean all dirt from around the generator bearing cover and remove the cover and gasket. Remove the old lubricant from the bearing with a clean finger. Work about one tablespoon of new ball bearing lubricant into the bearing and again remove the lubricant. Refill the bearing housing about one half full of bearing lubricant, packing it well into the lower half of the bearing. Be sure that no dirt gets into the bearing. Reinstall the bearing cover, using a new gasket if necessary.

CARBURETOR, GASOLINE. The carburetor should require no servicing other than keeping it clean and free of sediment. When cleaning jets and passages, use compressed air or a fine, soft copper wire. Be sure that all gaskets are in their proper place when reassembling.

Changes in the type of fuel used, or in operating conditions may necessitate a readjustment of the carburetor. The main jet is not adjustable and its size has been selected to give the best performance. The idle adjustment needle should be adjusted to give the smoothest operation at no load. Turn the idle adjustment needle out, counterclockwise, until the engine begins to misfire, then turn the needle in, clockwise, until the engine runs smoothly. Adjust the throttle lever stop screw so that there is 1/32" space between the screw end and the throttle stop when the plant is operating at no load.

CARBURETOR, GAS OR VAPOR.— A change in the BTU rating of the fuel used will probably necessitate readjusting the knurled head gas adjustment valve at the bottom of the carburetor. With a full load on the plant, turn the adjusting valve in (clockwise) until the voltage as shown on the AC voltmeter drops noticeably, or the engine begins to lose speed. Turn the screw slowly out (counterclockwise) until the voltage rises to normal and the engine runs smoothly. If it is necessary to open the adjustment much beyond the point where normal voltage is attained in order to obtain smooth operation, a readjustment of the governor may be necessary. Check the operation at various loads. There is no idle adjustment necessary for gas or Butane-Propane vapor operation except to see that the throttle lever stop screw is adjusted to 1/32" clearance between the screw end and the throttle stop with the plant operating at no load.

ELECTRIC CHOKE. The choke was adjusted at the factory to operate at a temperature of 70°F. or 21°C. In extremely cold temperatures, the choke may close so tightly that it will cause overchoking. In extremely high temperatures a reverse situation may occur. To readjust this type of choke to function properly in very cold temperatures, loosen the choke thermostat housing lockscrew and turn the thermostat housing slightly to the left (counterclockwise). To readjust the choke for very high temperatures turn the thermostat housing to the right (clockwise). Be sure to tighten the lockscrew after making the adjustment.

SISSON CHOKE. Some plants are equipped with the Sisson choke control mounted on the exhaust manifold. This type choke control should not require seasonal adjustments, but may be readjusted in the following manner. Turn the shaft of the control to the position where a 3/32" diameter rod or nail may be passed down through the hole in the end of the shaft opposite the lever. Engage the rod or nail in the notch in the mounting flange of the control. Loosen the lever clamp screw just enough to allow the lever to be turned slightly. To adjust the choke for a leaner mixture, push the lever downward. To adjust the choke for a richer mixture, pull the lever upward. Retighten the lever clamp screw, and remove the rod from the hole in the shaft. Check to see that there is no binding or sticking action.

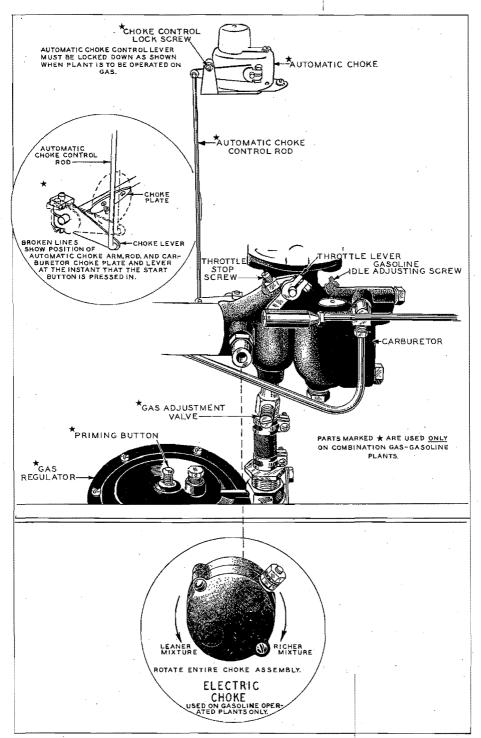


FIG.B-CARBURETOR AND CHOKE ADJUSTMENT

GOVERNOR.— The governor controls the speed of the engine, and therefore the voltage and frequency of the current. Proper governor adjustment may be made as follows, referring to Fig. C. Use a voltmeter while making the adjustments.

- 1. With the engine stopped, and tension on the governor spring, adjust the governor linkage length so that the carburetor throttle stop lever clears the stop pin by not less than 1/64" as shown.
- 2. Start the plant and allow it to reach operating temperature.
- 3. With no electrical load connected, adjust the speed screw to the point where the voltage is approximately 126 volts for a 115 volt AC plant, or 121 volts for a DC plant. Apply a full load to the plant and check the voltage. It should be approximately 108 volts for a 115 volt AC plant, or 110 volts for a DC plant. Voltages will be proportionally higher for 230 volt plants, or lower for 208 volt plants. Engine speed, as checked with a tachometer should be within the limits of 1890 r.p.m. at no load to 1745 r.p.m. at full load for an AC plant. The DC plant engine speed should be within 1800 r.p.m. and 2000 r.p.m., with a spread between no load and full load of not more than 100 r.p.m.
- 4. If the plant tends to hunt (alternately increase and decrease speed) under load conditions, increase very slightly the distance between the eye of the sensitivity screw and its support. For best regulation keep the screw in as close as possible without causing hunting. ANY CHANGE IN THE SETTING OF THE SENSITIVITY SCREW WILL REQUIRE CORRECTING THE SPEED SCREW ADJUSTMENT.
- 5. If hunting occurs at NO LOAD, screw the small bumper screw in until the hunt is stopped, but not far enough to increase the engine speed. CAUTION: Be sure all load is removed when adjusting the bumper screw.

Be sure that all lock nuts are tightened as adjustments are completed. The governor can not operate properly if there is any binding, sticking, or excessive looseness in the connecting linkage or carburetor throttle assembly. A lean fuel mixture, or a cold engine may cause hunting. If the voltage drop is excessive when a full load is applied, and adjustments are correctly made, it is probable that the engine is low on power and should be repaired as necessary.

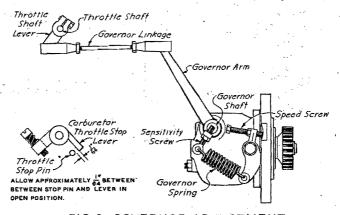


FIG.C-GOVERNOR ADJUSTMENT

HIGH WATER TEMPERATURE SWITCH. The high water temperature switch operates to stop the engine if the coolant temperature rises too high. This prevents overheating, which could cause serious damage to the engine parts. The engine may be started again when the coolant temperature drops approximately 10°F. The dial adjustment should be set to operate at a temperature several degrees below the boiling point of the coolant, taking into consideration the altitude at which the plant is operating. Lower the setting 3°F. for each 1000 feet above sea level. The dial was set at 205°F, at the factory. Do not set the switch to operate at too low a temperature, or the engine may be stopped before it reaches normal operating temperature. The switch will not operate if the ignition switch is at the HAND START POSITION.

FAN BELT TENSION.— The fan belt tension is regulated by the width of the fan pulley groove. The front half of the pulley turns on the hub. By loosening the two lock belts and turning the front half of the pulley clockwise, the pulley groove is narrowed and the belt tightened. Turn the pulley counterclockwise to widen the pulley groove and lessen the belt tension. Allow 3/4" play in the belt as shown in the illustration, Fig. D. Too tight a belt will have a short life and cause excessive strain and wear on the water pump bearings. A belt too loose will slip, wear out rapidly, and will result in inefficient cooling. Be sure that the adjustment lock screws are properly tightened. Check these screws frequently, even when no adjustment is necessary.

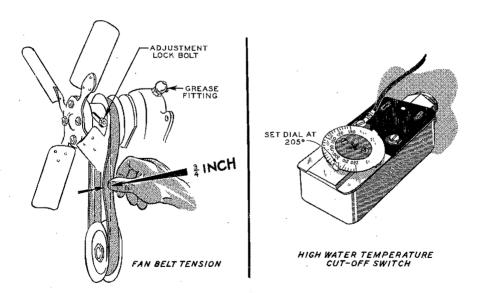


FIG.D

GENERAL.- Refer to the SERVICE DIAGNOSIS section for assistance in locating and correcting troubles which may occur. The information in this section is intended to assist in properly maintaining the equipment and in making repairs. Should a major overhaul become necessary, it is recommended that the plant be carefully checked and all necessary repairs made by a competent mechanic who is thoroughly familiar with modern internal combustion engines and revolving armature type generators.

ENGINE

TIMING GEARS.— The crankshaft and camshaft timing gears are keyed to their respective shafts. The camshaft gear is fastened with a large hexagon nut and locking washer. The gears may be removed with a gear puller. Always install both gears new when either needs replacing, never one only. The crankshaft gear has one tooth punch-marked, which must mesh with the two teeth punch-marked on the camshaft gear. See the illustration, TIMING GEARS, Fig. E.

TAPPET ADJUSTMENT.- The tappet adjustments may be reached by removing the valve chamber cover. The tappets are the adjustable screw type, requiring three wrenches to adjust. See the illustration, TAPPET ADJUSTMENT, Fig. F.

Adjust the valves for each cylinder as follows. Crank the engine by hand until the intake valve opens and closes. Both valves for that cylinder will then be closed. Intake valves are numbers 2, 3, 6 and 7. The adjusting screw clearance should be set to 0.012" for both the intake and exhaust valves. On engines which have the "Roto" type exhaust valves, set the exhaust valve tappet clearance to 0.010". Make sure the lock nut on each adjusting screw is securely tightened after the adjustment is made. Tappets set too close may cause burned or warped valves, seats, and scored tappets or camshaft lobes. Make a final check with the engine running at idle speed.

VALVE SERVICE.— The proper seating of the valves is essential to good engine performance. If any one valve is leaking, service all valves. Each valve, its guide, piston top, the cylinder head, and the top surface of the cylinder block should be thoroughly cleaned of all carbon deposits. Replace with a new one any valve of which the stem is worn or the head is warped or badly burned. The intake valve face angle is 300 and the exhaust valve face angle is 450.

All old valves to be reused should be ground and assembled to their original seats. Grind only enough to assure a perfect seal. Be sure to remove all traces of grinding compound from valves and seats. Lightly oil the valves and guides before reassembly.

On some engines the exhaust valves are of the "Roto" type, each valve having a cap under the end of the valve stem which pushes up against the valve spring retaining washer, permitting the valve to rotate slightly as it opens and closes. When reassembling, install the cap on the end of the valve stem before installing the spring retainer locks. Note that the exhaust valve retainer locks have a slight taper. The thinner edge of the lock must face upward. Be sure two locks are installed on each valve stem. The intake valve locks are the single pin type. If the "Roto" exhaust valves are properly installed, it will be possible to turn them in their guides when fully open which is not possible with the conventional type valves.

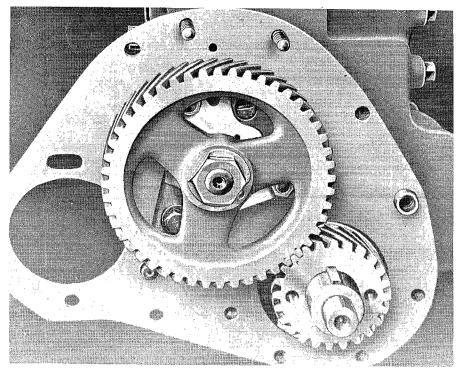
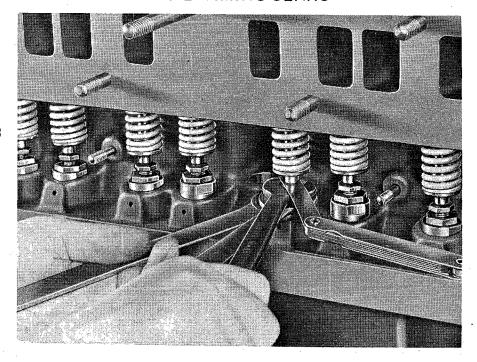


FIG.E-TIMING GEARS



Set the tappet clearances after the valves have been reassembled in the engine. When tightening the cylinder head nuts, start at the center of the head and work outward and towards the ends. After approximately 10 hours of operation, again check the tappet clearnaces, making any necessary adjustments.

IGNITION TIMING .- See Fig. G. Set the distributor contact points to 0.020" gap at full separation. There are stamped markings on the flywheel which can be seen by removing the small flywheel inspection hole cover on the right side of the engine. Turn the engine over with the hand crank until the No. 1 piston is coming up on the compression stroke. Slowly crank the engine until the flywheel mark IGN centers in the inspection hole. At this point, the distributor rotor should point to the distributor cap tower for the No. 1 spark plug wire, and the distributor points should just separate. If the rotor points to the tower for the No. 4 spark plug wire, it will be necessary to remove the distributor, lift the drive shaft in the cylinder head and turn it one half turn. Start the plant and allow it to reach operating temperature. Test the spark advance by applying a full electrical load. Slow the engine by pulling on the governor arm, then release and allow the engine to suddenly accelerate. There should be one or two "pings" or detonation knocks. If no ping is heard, advance the timing. If a continuous ping is present, retard the timing. Advance or retard the spark timing as necessary by loosening the distributor clamp and turning the distributor body slightly clockwise to advance, or countercleckwise to retard. Retighten the clamp screw. Keep the spark advanced as far as possible without causing a "ping", or detonation under normal running conditions.

PISTON RING REPLACEMENT. The piston and connecting rod assemblies are removed from the tops of the cylinders. Check the cylinders for out of round, tapered or scored condition. Rebore for oversize pistons if necessary. Any ridge worn at the top of the cylinder should be removed if not reboring.

Two compression rings and one oil control ring are used on each piston. Fit each ring to its individual cylinder, checking the gap between the ring ends by placing the ring squarely in the cylinder in a position corresponding to the bottom of its travel. See Fig. H. The correct gap is from 0.008 to 0.013". Do not use rings which require too much filling to obtain the correct gap. If using the old pistons, clean all ring grooves of carbon deposits and see that oil return holes are open. See that each ring fits its groove properly, with 0.0015" to 0.002" clearance. Rings of the tapered type will be marked "TOP" or may be otherwise easily identified, and this taper must be installed with the smaller diameter toward the closed end of the piston. Fit the proper ring in each ring groove on the piston, spacing the gaps equally around the circumference of the piston, and no gap directly in line with the piston pin.

PISTON REPLACEMENT. If cylinders become badly worn, tapered or scored, rebore and hone to fit one of the available oversizes in pistons. Pistons are available in .010", .020", .030", .040", .050" and .060" oversizes. The pistons should be fitted to the cylinders to a clearance of .0015" measured with a 1/2" wide feeler gauge inserted between the piston and cylinder at a point half way between piston pin holes. A pull of 5 to 10 pounds should be required to pull the feeler gauge past the piston. See Fig. I. Piston and connecting rod assemblies must be properly aligned before installation in the engine.

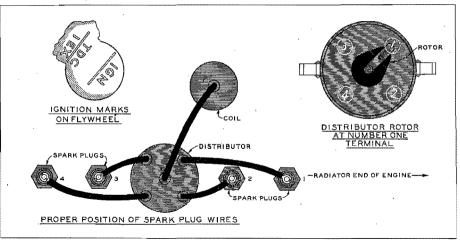


FIG.G-IGNITION TIMING

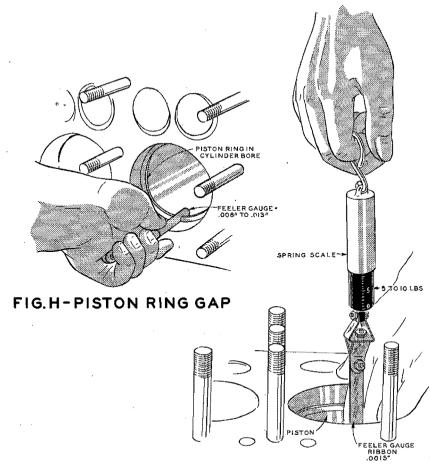


FIG. I-PISTON FITTING

CONNECTING RODS. The connecting rod lower and bearings are steel backed and readily replaceable. When removing the connecting rods, be sure to note the numbers on the rods and bearing caps, and reassemble with the numbers toward the camshaft. Connecting rods 1 and 3 are not interchangeable with rods 2 and 4, nor are the bearings. Notches machined in the connecting rod halves act as retainers for matching ears stamped into the steel back of the bearing shells, or inserts. This design locks the shells and prevents their turning in the rod. If a shell becomes worn, both shells for that rod should be discarded, and new ones installed. The shells are designed to give a clearance of .0015" to .002" without any scraping or other fitting. Under no condition should fitting ever be attempted by scraping or filing of the cap or upper half of the rod, as this would permanently ruin the rod. Be sure that rods and caps, as well as bearing shells are perfectly clean and free of oil when inserting the shells. Qil on the back of the shell will prevent proper seating of the shell in the rod or cap. Oil the crankshaft journal after the bearing shell has been firmly seated.

The sides of the connecting rod crank ends are not babbitt lined in this engine. The faces are steel and, being exposed to the steel crankshaft, it is of vital importance that the side play clearance of .006" to .010" be maintained. When installing new pistons, pins, or connecting rods, be sure pistons and connecting rod assemblies are first properly aligned on an accurate aligning gauge.

MAIN BEARINGS.— The crankshaft main bearings are of the same type as the connecting rod bearings. The upper and lower shells are made in pairs for each individual bearing, but front, center and rear bearings are not interchangeable as pairs. The same general directions given for fitting the connecting rod bearings should be observed in fitting the main bearings. The clearance, when installed, should be .0015" to .002". The rear face of the front main bearing takes the end thrust of the crankshaft. The crankshaft end play should be .004" to .006" and is regulated by a removable thrust collar just to the rear of the crankshaft gear, together with a shim pack to the rear of this collar. When servicing the crankshaft or any parts in connection with the shaft, especially connecting rod and main bearings, always be sure that all oil holes in the shaft are open and clean. Note that one center main bearing cap screw is shorter than the other bearing cap screws. This shorter screw must be installed on the camshaft side of the bearing cap. Use of one of the longer screws at this point will block the oil passage.

PISTON PINS.— The hardened piston pins are selected in production to obtain a 0.0003" loose fit in connecting rod pin bushing, and light push fit in piston boss. By heating the piston in hot water, the piston pin can be pushed in by hand. Maintain these clearances if necessary to fit eversize piston pins. Pins are available in .003", .005", and .010" oversizes. When reinstalling old pistons, be sure that they are installed in their original cylinder, and in the same position relative to the numbered side of the connecting rod. When reassembling, make sure that the snap ring at either end of the pin is tightly in place.

CAMSHAFT. The camshaft is an alloy steel forging. Provided that proper lubrication is supplied, the camshaft and its bearings should never require servicing. The cams, if cut by too close adjustment of the tappet clearance, can be reconditioned by careful honing if not too badly damaged.

MAINTENANCE AND REPAIR

The camshaft bearings are bronze bushings which are line reamed after installation in the crankcase, to a clearance of .0015" to .002". The installation of new camshaft bearings is not practicable without the proper line reaming equipment.

WATER PUMP. The water pump on this engine is a centrifugal, ball bearing, self sealing type. To dismantle the pump proceed as follows:

- Remove the nut and lockwasher from the front of the water pump shaft and, using a suitable puller, pull the pulley off the shaft.
- Remove the three nuts mounting the shaft support to the body and remove the support assembly.
- 3. To remove the impeller, remove the set screw and pull or press the impeller from the shaft. Note that if the set screw is loosened only a few turns it will not be free from the hole in the shaft.
- 4. To remove the shaft and bearings from the support, remove the set screw from the top of the support and press the assembly out through the front.
- 5. The seal will be found assembled in the impeller hub. Care must be taken in removing this assembly, as the carbon seal is fragile and easily broken. To reassemble, reverse the procedure used in disassembly. When reassembling the pump make sure that the set screw projects far enough to line up the impeller on the shaft. Press the impeller on flush with the end of the shaft. Pack the space between bearings with a good grade of waterpump grease.

CRANKCASE VENTILATION. The crankcase oil fill cap permits entry of air to the crankcase which is drawn out through the valve chamber cover tube to the intake manifold. If the oil fill cap becomes clogged with dust and dirt, excessive crankcase vacuum may build up, causing oil to be drawn from the valve chamber into the intake manifold. The baffle plate on the inner side of the valve cover must be in place and undamaged for proper ventilation.

LUBRICATION SYSTEM. A gear type oil pump supplies oil under pressure through drilled passageways to the crankshaft main bearings, lower connecting rod bearings, camshaft bearings and valve tappets. Whenever the engine is disassembled for servicing, make sure that all oil passages are unobstructed. Thoroughly clean the engine oil pan and the oil pump strainer screen. An oil pressure relief adjustment is adjusted at the factory to give a pressure of 20-40 pounds at the governed speed, with the engine oil hot. The oil pressure relief adjustment is reached by removing a large hexagon shaped plug in the side of the crankcase just below the oil filter, and adjusted by adding or removing spacer washers.

MAINTENANCE AND REPAIR

TABLE OF CLEARANCES

NOTE

The clearances given below are for settings at 72° F. (22.2° C.).

	MINIMUM	MAXIMUM
Valve Tappets - Roto Exhaust	.010"	
Valve Tappets - Intake and Exhaust (Conventional	.012"	
Valve Seat Width - Intake and Exhaust	1/16"	3/32"
Crankshaft Main Bearings	.0015"	.002 ⁿ
Crankshaft End Play	.004 ⁿ	•006¤
Connecting Rod Bearing	.0015"	.002"
Connecting Rod End Play	•006#	.010"
Piston in Cylinder	•0015	n
Camshaft Bearings	.0015"	.002"
Distributor Breaker Points Gap	.020"	
Spark Plug Electrode Gap	.025#	
Piston Ring Gap	*008u	•013"

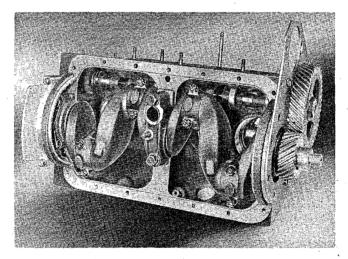


FIG.J-BOTTOM VIEW OF ENGINE

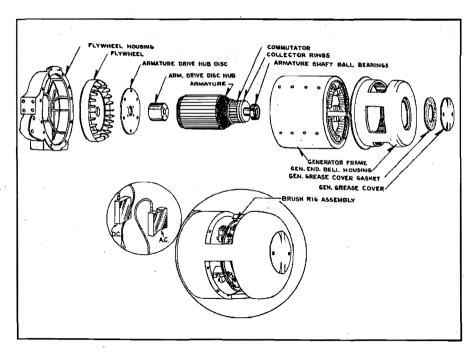


FIG. K-ALTERNATING CURRENT GENERATOR ASSEMBLY

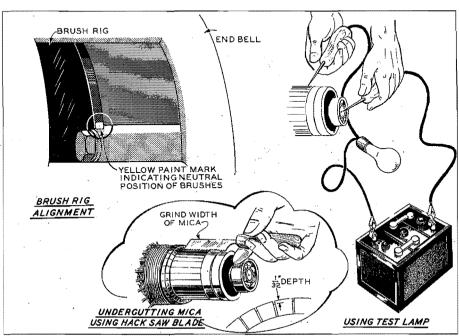


FIG.L-CARE OF COMMUTATOR AND BRUSHES

GENERATOR

GENERAL. The generator normally requires little maintenance other than the PERIODIC SERVICE.

COMMUTATOR AND COLLECTOR RINGS.— After a long period of service, the surface of the commutator may become worn to such an extent as to cause the mica insulation between the commutator bars to extend above the level of the bars. This condition would cause noisy brushes and would soon lead to excessive brush sparking and pitting of the commutator bars. High mica should be undercut to a depth equal to the distance between bars, or approximately 1/32". Lift each brush high in its guide so that its spring will press against its side, and remove the end bell. Tag leads to insure correct replacement. With a tool fashioned from a hack saw blade, carefully undercut the mica. Be sure to remove any burrs which may have been formed when undercutting, and see that spaces between bars are completely free of any metallic particles.

Should dusty operating conditions cause the surface of the commutator or collector rings to become grooved, out of round, pitted or rough, it will be necessary to remove the armature and turn the commutator or collector rings down in a lathe. It will be necessary to remove the generator field frame before the armature can be removed. Remove the ball bearing from the armature shaft before turning down to prevent any foreign material getting into it. After the commutator is turned down, the mica between bars must be undercut as described above. When the armature is reinstalled, align it as carefully as possible before installing the frame and end bell.

BRUSH RIG.- It is unnecessary to remove the brush rig from the end bell when servicing the generator. If it has been removed mistakenly, line up the paint mark on the outer edge of the brush rig with the mark on the brush rig support in the end bell. A deviation from the proper positioning of the brush rig will lead to excessive arcing of the brushes, burning of the commutator, low generator output, and possible irreparable damage to the generator windings due to overheating. Any defective condenser should be replaced with a new one of the same capacity.

BRUSHES.- Install new brushes when the old ones are worn so that the top of the brush is below a point midway between the top and bottom of the brush guide. Do not continue to use brushes that are worn too short, because the spring tension lessens as the brush becomes shorter, and weak spring tension leads to excessive brush sparking and pitting of the commutator or collector rings. It is recommended that only a moderate load be applied to the generator until the new brushes have been "run in", to eliminate excessive sparking. See that brushes ride freely in their guides and that spring tension is uniform. The correct tension is 30 oz. for the commutator brush springs and 16 oz. for the collector ring brush springs, measured with the contact point of the spring level with the top of the guide.

GENERATOR WINDINGS. Use a continuity type test lamp set to test for grounded or open circuits in the generator windings. Be sure that all brushes are lifted away from contact with the commutator and collector rings and that generator leads to the control panel are disconnected. When disconnecting leads, tag them to facilitate correct replacement. Disconnect condenser leads from brush terminals to avoid mistaking a defective condenser for a grounded lead.

Use an armature growler to test the armature for an internal short circuit. Field coil windings may be tested for an internal short circuit by comparative ohmeter readings.

If one or more field coils test defective, install a new set of field coils. If an armature winding tests defective, install a new armature assembly. Leads may be repaired as necessary.

CONTROLS

CONTROL PANEL EQUIPMENT. If any of the control panel equipment fails to function properly, the defective part should be replaced with a corresponding new unit rather than to attempt repairs on the old part. Disconnect the battery whenever servicing any control panel equipment. Keep all connections tight and clean.

If the plant will start but does not continue to run, start the plant manually. If it continues to run with the ignition switch at the HAND START position, trouble is indicated in one of the relays, the high water temperature switch, or a loose connection. An open circuit between the generator and the stop relay will also prevent the plant from running with the ignition switch at the ELECT. START position.

DO NOT LEAVE THE IGNITION SWITCH AT THE HAND START POSTTION LONGER THAN NECESSARY TO MAKE TESTS.

The plant is equipped with a start disconnect relay which serves to open the start circuit when the plant is started with automatic or line transfer equipment. Failure of the start disconnect relay to operate will cause the start circuit to remain closed after the plant starts and will allow an excessively high voltage to reach the batteries.

Failure of the reverse current relay (charge relay) may cause the charge ammeter to show a discharge of approximately 7 amps when the plant is stopped. Replace the relay with a new one if cleaning the contact points with a hard finish paper does not remedy the situation. The correct adjustment is obtained by setting the spring tension to allow the relay points to open at 12.6 volts and close at 15.4 volts when tested on a test bench.

The voltage regulator relay should allow a charge rate of approximately 6 amps when the batteries are less than 3/4 fully charged. As the batteries approach a fully charged condition the charge rate should drop to approximately 2 amps or less. The spring tension may be increased to advance the high charge rate cut in point, or decreased to retard the point at which the high charge rate becomes effective.

REMEDY

GENERATOR OVERHEATING

Overloaded.

Reduce load.

Brush rig out of position.

Be sure to line up marks. See Brush

Rig.

VOLTAGE DROPS UNDER HEAVY LOAD

Engine lacks power.

See remedies for engine missing under

heavy load.

Poor compression.

Tighten cylinder head and spark plugs. If still not corrected, grind the valves. Replace piston rings, if necessary. Refer to MAINTENANCE AND

REPAIR.

Faulty carburetion.

Check the fuel system. Clean, ad-

just or replace parts necessary.

Restricted air cleaner.

Clean and refill.

Excessive choking.

See that choke opens properly.

Carbon in cylinder.

Remove carbon.

Restricted exhaust line.

Clean or increase the size.

ENGINE MISFIRES AT LIGHT LOAD

Carburetor idle adjustment set wrong or clogged.

Adjust, clean if needed.

Spark plug gaps too narrow.

Adjust to correct gap, 0.025".

Intake air leak.

Tighten or replace gaskets.

Faulty ignition.

Clean, adjust, or replace breaker points, plugs, condenser, coil, etc.,

or retime ignition.

Uneven compression.

Tighten cylinder head and spark plugs. If still not corrected, grind valves. Replace piston rings, if necessary.

Worn intake valve stems or guides.

Replace valves or guides.

SERVICE DIAGNOSIS

POSSIBLE CAUSE

REMEDY

ENGINE MISFIRES AT HEAVY LOAD

Spark plugs defective.

Replace.

Faulty ignition.

Clean, adjust, or replace breaker points, plugs, condenser, coil, etc.,

or retime ignition.

Clogged carburetor.

Clean jets.

Clogged fuel screen.

Clean.

Defective spark plug cables.

Replace.

ENGINE MISFIRES AT ALL LOADS

Fouled spark plug.

Clean and adjust.

Defective or wrong spark plug.

Replace.

Sticking valves.

Clean stems and guides.

Broken valve spring.

Replace.

Defective ignition wires.

Replace.

Defective or improperly adjusted points.

Adjust or replace breaker points.

See Periodic Service - Weekly.

LOW OIL PRESSURE

Too long screw on center main bearing.

See MAIN BEARINGS.

Oil too light.

Drair refill with proper oil. See PREPARATION.

Oil badly diluted.

Drain, refill with proper oil.

Oil too low.

Add oil.

Oil relief valve not seating.

Remove and clean, or replace.

See LUBRICATION SYSTEM.

Badly worn bearings.

Replace. See MAINTENANCE AND

REPAIR.

Sludge on oil pump screen.

Remove and clean.

Badly worn oil pump.

Replace.

Defective oil pressure gauge.

Replace.

REMEDY

HIGH OIL PRESSURE

Oil too heavy.

Drain, refill with proper oil. See

PREPARATION.

Clogged oil passage.

Clean all lines and passages.

Oil relief valve stuck.

Remove and clean. See LUBRICATION

SYSTEM.

Defective oil pressure gauge.

Replace.

PLANT STARTS BUT DOES NOT CONTINUE TO RUN

START button released too soon.

Hold in contact longer.

Defective panel equipment.

See Controls.

ENGINE BACKFIRES AT CARBURETOR

Lean fuel mixture.

Clean carburetor.

Clogged fuel screen.

Clean screen.

Intake air leak.

Replace flange gaskets, tighten

carburetor.

Poor fuel.

Refill with good, fresh fuel.

Spark too late.

Retime ignition. See IGNITION TIMING.

Spark plug wires crossed.

Install wires correctly. See IGNITION

TIMING.

Intake valves leaking.

Grind or replace. See VALVE SERVICE.

EXCESSIVE OIL CONSUMPTION, LIGHT BLUE SMOKY EXHAUST

and the many of the section of

Worm piston rings.

Install new piston rings. See PISTON

RING REPLACEMENT.

Oil leaks from engine or connections. This does not cause smoky exhaust.

Replace gaskets or leaking tubing. Tighten screws and connections.

Oil too light or diluted.

Drain, refill with correct oil. See

PREPARATION.

Too large bearing clearance.

Replace bearings. See MAINTENANCE AND REPAIR.

Oil pressure too high. Refer to symptoms of high oil pressure for a Stage and a for remedies.

REMEDY

EXCESSIVE OIL CONSUMPTION, LIGHT BLUE SMOKY EXHAUST (CONT.)

Breather Cap Clogged.

Clean - See CRANKCASE VENTILATION.

Engine misfires.

Refer to symptoms of engine mis-

fires.

Faulty ignition.

Clean, adjust, or replace breaker points, plugs, condenser, coil, etc.,

or retime ignition.

Unit operated at light or no load for long periods.

No remedy needed.

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.

Adjust choke. Install needed carburetor parts, adjust float level.

Choke not open.

See that choke opens properly. See

ADJUSTMENTS.

Dirty air cleaner.

Clean, refill to proper level.

LIGHT POUNDING KNOCK

Loose connecting rod bearing.

Replace. See MAINTENANCE AND

REPAIR.

Low oil supply.

Add oil.

Low oil pressure.

Refer to symptom of low oil pressure

for remedies.

Oil badly diluted.

Change oil.

ENGINE STOPS UNEXPECTEDLY

Fuel tank empty.

Refill.

High water temperature.

See symptoms for engine overheating.

Defective ignition.

Check the ignition system. Repair or replace parts necessary.

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

Loose crankshaft.

Replace bearings, unless one of the next three remedies permanently corrects the trouble.

REMEDY

SHARP METALLIC THUD, ESPECIALLY WHEN COLD ENGINE FIRST STARTED

Low oil supply.

Add oil.

Low oil pressure.

Refer to symptom of low pressure for

remedies.

Oil badly diluted.

Change oil.

PINGING SOUND WHEN ENGINE IS RAPIDLY ACCELERATED OR HEAVILY LOADED

Carbon in cylinders.

Remove carbon.

Spark too early.

Retime ignition. See IGNITION TIMING.

Wrong spark plugs.

Install Champion J8 plugs.

Spark plugs burned or carboned.

Install new plugs.

Valves hot.

Adjust tappet clearance. See TAPPET

ADJUSTMENT.

Fuel stale or low octane.

Use good fresh fuel.

Lean fuel mixture.

Clean carburetor.

ENGINE CRANKS TOO STIFFLY

Too heavy oil in crankcase.

Drain, refill with lighter oil.

Engine stuck.

Disassemble and repair.

ENGINE WILL NOT START WHEN CRANKED

Faulty ignition.

Clean, adjust, or replace breaker points, plugs, condenser, coil, 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 screen.

Cylinders flooded.

Clean.

Crank few times with spark plugs removed.

Drain, refill with good fuel.

Poor compression.

Tighten cylinder head and spark plugs. If still not corrected, grind the valves. Replace piston rings, if

necessary. See MAINTENANCE AND REPAIR.

Wrong timing.

Poor fuel.

Retime ignition. See IGNITION TIMING.

REMEDY

ENGINE RUNS BUT CURRENT DOES NOT BUILD UP

Poor brush contact or dirty commutator or slip rings.

See that brushes seat well, are free in holders, are not worn too short, and have good spring tension.

Open circuit, short circuit, or ground in generator.

See GENERATOR, replace part necessary.

CURRENT UNSTEADY BUT ENGINE NOT MISFIRING

Speed too low.

Adjust governor to correct speed.

Poor commutation or brush contact.

See that brushes seat well on commutator and slip rings, are free in holders, are not worn too short, and

have good spring tension.

Loose connections.

Tighten connections.

Fluctuating load.

Correct any abnormal load condition causing trouble.

TAPPING SOUND

Tappet clearance too great.

Adjust or replace tappets.

Broken valve spring.

Install new spring.

HOLLOW CLICKING SOUND WITH COOL ENGINE UNDER LOAD

Loose pistons.

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

VOLTAGE LOW AT FAR END OF LINE BUT NORMAL NEAR POWER UNIT

Too small line wire for load and distance.

Install larger or extra wires or reduce load.

MOTORS RUN TO SLOWLY AND OVERHEAT AT FAR END OF LINE BUT OK NEAR POWER UNIT

Too small line wire for load and distance.

Install larger or extra wires, or reduce load.

NOISY BRUSHES

High mica between bars of commutator.

Undercut mica. See GENERATOR.

SERVICE DIAGNOSIS

POSSIBLE CAUSE

REMEDY

EXCESSIVE ARCING OF BRUSHES

Rough commutator or rings.

Turn down.

Dirty commutator or rings.

Clean. See GENERATOR.

High mica.

Undercut mica.

Brush rig out of position.

Line up marks on brush rig

and support.

ENGINE OVERHEATING

Low water in radiator.

Refill radiator.

Overloaded.

Remove part of load.

Improper lubrication.

See Low Oil Pressure.

Radiator obstructed.

Clean radiator.

Ignition timing late.

Adjust. See IGNITION TIMING.

NOTICE!!

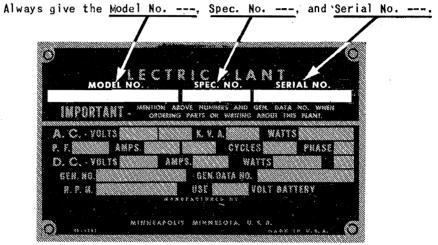
Refer to page 67 for details on servicing or ordering parts for 6000 watt direct current generating plants.

INSTRUCTIONS FOR ORDERING REPAIR PARTS

FOR PARTS OR SERVICE, CONTACT THE DEALER FROM WHOM YOU PURCHASED THIS EQUIPMENT OR REFER TO YOUR NEAR-EST AUTHORIZED SERVICE STATION. NAMES AND ADDRESSES OF SERVICE STATIONS ARE LISTED ON THE BACK COVER OF THIS MANUAL.

TO AVOID ERRORS OR DELAY IN FILLING YOUR PARTS ORDER, PLEASE FURNISH ALL INFORMATION REQUESTED.

REFER TO THE NAMEPLATE ON YOUR UNIT.



- 2. Order only parts that have a quantity shown under the "Parts Reference Symbol" that applies to your plant. These symbols are listed under "Quantity Used" in the parts list. "Parts Reference Symbols" are given in the Data Table on page |.
- Do not order by reference number or group number, use part number and description.
- 4. Give the part number, description and quantity needed of each item. If an old part cannot be identified, return the part prepaid to your dealer or nearest 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.
- 5. 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 indicates items are back ordered.

PRICES QUOTED IN THE PARTS LIST ARE F.O.B. MINNEAPOLIS, MINN. AND ARE SUBJECT TO CHANGE WITHOUT NOTICE.

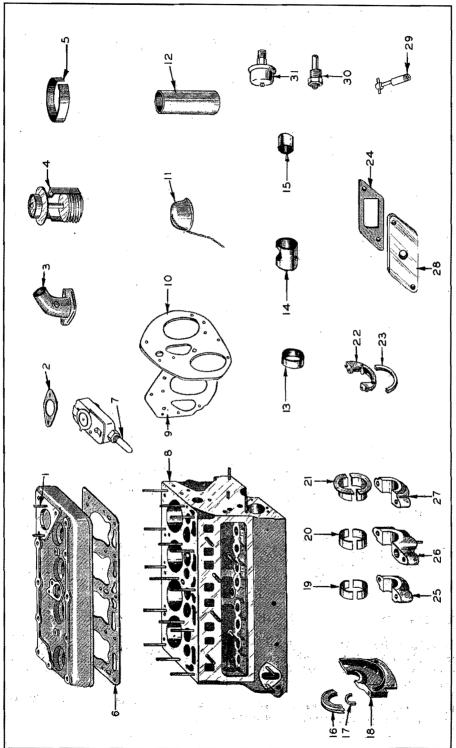


Fig. 1 CYLINDER BLOCK AND HEAD GROUP

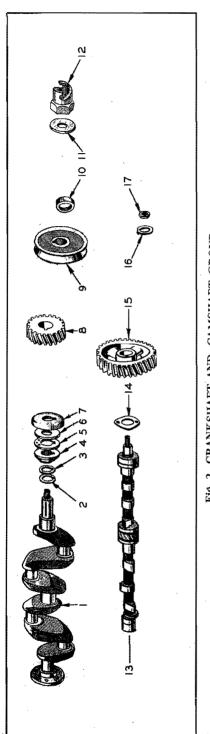
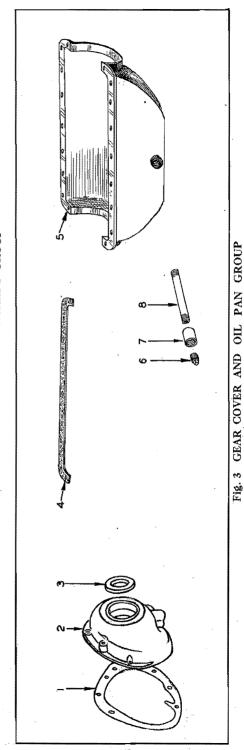


Fig. 2 CRANKSHAFT AND CAMSHAFT GROUP



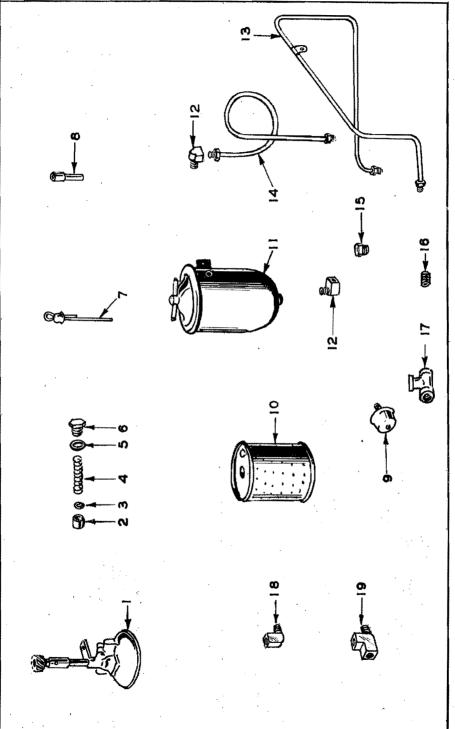


Fig. 4 OIL PUMP AND OIL FILTER GROUP

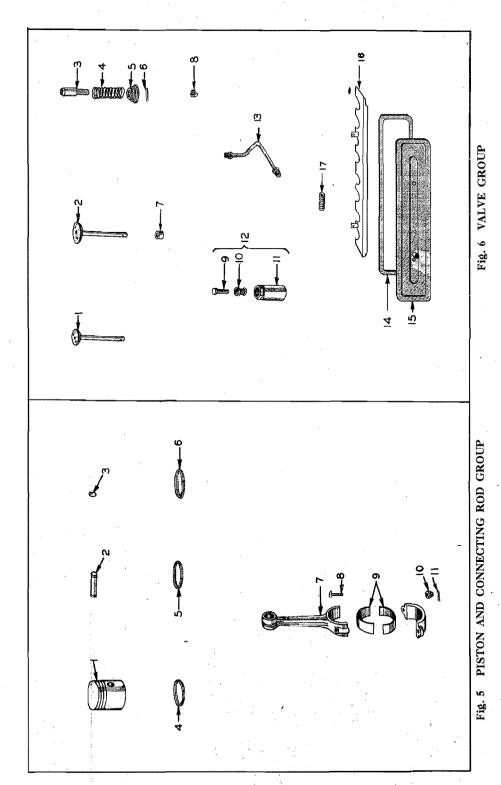


Fig. 7 WATER PUMP AND FAN GROUP

Fig. 9 MUFFLER GROUP

Fig. 8 FLYWHEEL GROUP

Fig. 11 FUEL SYSTEM GROUP

Fig. 10 RADIATOR GROUP

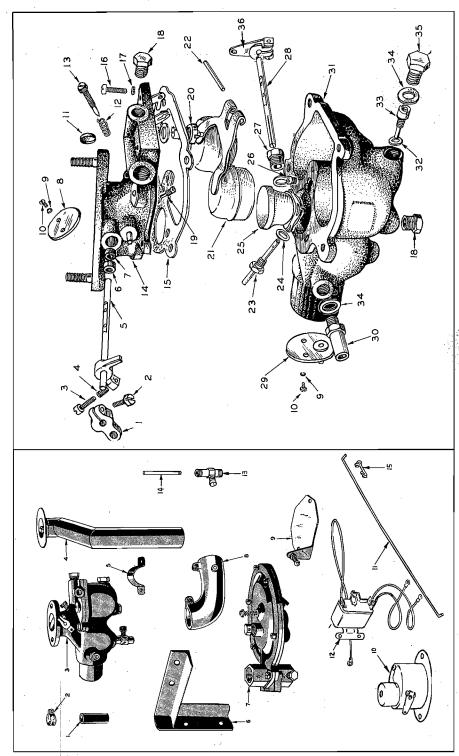


Fig. 15 GOVERNOR GROUP

Fig. 14 IGNITION GROUP

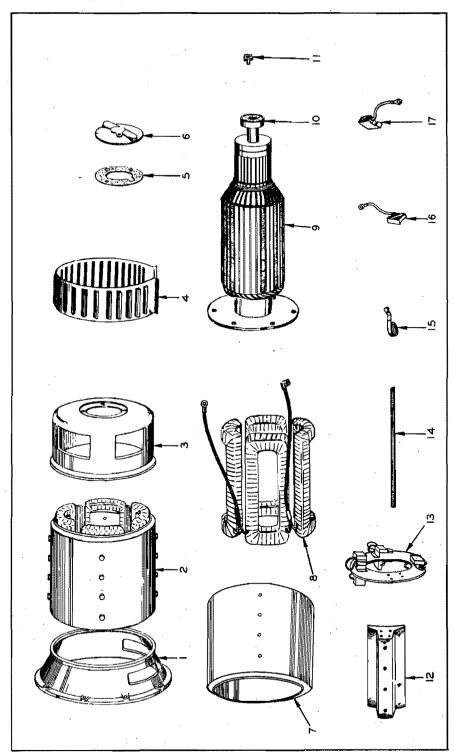


Fig. 17 CONTROL PANEL GROUP

REF.	PART NO.	DESCRIPTION	OUAN. USED	PRICE
		CYLINDER BLOCK AND HEAD GROUP		
~ 1	Y91A-401	Head, Cvlinder	Н	19.70
N)	C400K-215	Elbow	ı –ı	9.
m.	F600K-335	Elbow, Water Outlet	н.	2.50
4 11	F218K-304	Thermostat, Cylinder Mater Temperature	-1	 8.6
۰,0	X400A-412	Gasket, Cylinder Head		1,35
2	3099	Switch, Cut-Off - High Water Temperature	Н	13.00
ಯ	Y91A-2162A	Block Cylinder - Includes Valve Stem Guides, Bushings, Bearing Caps,	_	
o	X69B-305	Gasket, Front End Plate	1	,15
, S	X69B-4060	Plate, Front End	ı –ı	14.80
Ħ	X400L-2620	Cover Assembly, Oil Filler Tube	Н.	1.65
75	X400L-3170	Tube Assembly, Oil Filler	Н	
ย	T400G-229	Bushing, Camshaft Rear	H	ୡ
7	Y400G-228	Bushing, Camshaft Center	Н	04.
15	F600G-296	Bushing, Camshaft Front	, -i	8
16	D600B-305	Guard, 011 - Rear Bearing	Н,	2
17	D600B-217	Seal, Crankshaft Rear Bearing Filler Block	∾.	9
3 5	D600B-406	Block, Crankshaft Rear Bearing Filler	r	2.75
3,5	1400G-2061 77,00G-3061	Bearing Shell, Crankshait Mear - Upper and Lower, Fair	r-	L.95
ಚ	17600-3321		1 7) •
22	D600B-322	Block, Crankshaft Front Bearing Filler	Н	1.45
£	D600B-214	Gasket, Filler Block to Oil Pan - Front and Rear	N	10
77	X400K-212	Gasket, Cylinder Block Drain Cover	М	9.
52	T400B-317	Cap, Bearing - Crankshaft Rear	~	1.25
% 5	1400B-316	Cap, Bearing - Crankshaft Center	٠,	2.35
7 6	1400B-318	Cap, Bearing - Urankshait Front	 -	1.55
3 8	504-3	Cock. Cylinder Drain	-1	9
·8	193-23	Element, Water Temperature Gauge	Н	2,52
<u>ج</u>	193-25	Element, Oil Pressure Gauge	Н	2.5
			_	

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Plug, Expansion - Camshaft Rear Bearing Plug, Expansion - Cylinder Core Hole - 1-1/8" Diameter Plug, Pipe - Cylinder Block - 1" Pipe Thread Screw, Hex. Hd. Cap - 1/2" - 13 x 2-1/2" - Crankshaft Bearing Screw, Fillister Hd 5/16" - 18 x 2-5/8" - Rear Filler Block Screw, Fillister Hd 5/16" - 18 x 7/8" - Front Filler Block Screw, Fillister Hd 5/16" - 18 x 7/8" - Front Filler Block Screw, Fillister Hd 5/16" - 18 x 3/4" - Front Filler Block Screw, Aex. Hd. Cap - 5/16" - 18 x 3/4" - Front End Plate Screw, Spacing - Cylinder Head Stud Stud, Cylinder Head - 3/8" x 4" Stud, Cylinder Head - 3/8" x 4" Stud, Water Outlet Elbow - 5/16" x 1-5/8"	CRANKSHAFT AND CAMSHAFT GROUP Grankshaft Shim, Grankshaft Thrust002" Shim, Grankshaft Thrust008" Flate, Orankshaft Thrust Spacer, Crankshaft Thrust Spacer, Crankshaft Thrust Spacer, Crankshaft Thrust Thrower, Oil Thrower, Oil Fulley, Fan Drive Seal, Fan Drive Pulley Dust Washer, Crankshaft Starting Jaw Jaw, Crankshaft Starting Gamshaft Flate, Camshaft Gear Nut Lock - Camshaft Gear Nut Key, Grankshaft Gear and Pulley - 1/\mathfrace{\text{L}}\text{L}} Key, Grankshaft Gear and Pulley - 1/\mathfrace{\text{L}}\text{L}\text{L}} Key, Grankshaft Gear and Pulley - 1/\mathfrace{\text{L}}\text{L}\text{L}} Key, Grankshaft Gear - 3/\mathfrace{\text{L}}\text{L}
X2236 X2207 X-113 X-3555 X-3544A 6fB-105 X-3924 X3164 X3184 X3182 F162A-214 X1925 X1975	1400C-213 9LC-208 9LC-208 1400C-213 1400C-219 1400C-219 1400C-219 1400C-219 1400C-219 1400C-219 1400C-219 1400C-219 1400C-203 1400C-204 1400C-204 1400C-204 1400C-204 1400C-205 1400C-204 1400C-204 1400C-204 1400C-204 1400C-204 1400C-204 1400C-204 1400C-204 1400C-204
	100400000100100C

REF.	PART NO.	DESCRIPTION	OUAN. USED	PRICE
-	Y69R_309	GEAR COVER AND OIL PAN GROUP (Fig. 3)	_	. 8
10000	Y918-4102 21RM-201	Gover, dear Cover Seal, Oil - Gear Cover	4440	1,05
4000	169B-3191 169B-3191 505-13 505-14	Pan, 011 Fan. Plug, Pipe - 1/2" - 011 Drain Coupling, Pipe - 1/2" - 011 Drain	у л пп	i ii
χ	715-215 715-215 X4240 X4266 X3181	Nipple, Fipe - 011 Drain Dowal, Ring - Gear Cover Stud, Ring Dowel - 3/8"-16 x 2-7/8" Stud, Ring Dowel - 3/8"-16 x 2-1/8" Stud, Ring Dowel - 5/7/6"-18 x 2-1/8"	нанне	អូ ខ ម៉ង់
•	X3232 X3159 X3182	Hex. Head -	ኪ _{ካግ} ፣	9799
		OIL PUMP AND OIL FILTER GROUP (Fig. 4)		
H 864	1,400L-4036 1,58L-211 W5L-213 10EL-230	Oil Pump Assembly - Includes Body, Gears, Strainer Frame, Screen, Cover, Shaft, Idler Stud, Suction Tube, Screws and Nuts. Plunger, Oil Pressure Relief Valve . Washer, Oil Pressure Relief Valve Spring . Soring, Oil Pressure Relief Valve Alve .	1 1 48.88eq.	24.15
N0 10 0	X-365 41AL-200 Y400L-2540 Y400L-254 7276	Oil. Pressure Relief Valve 1 Pressure Relief Valve kayonet - Oil Level - Inclu Bayonet Gauge	।ਜਜਜਜ	5.85.85
*#####	Y91L-315 122-25 502-2 122833 122834	Klement, Oil Filter Filter, Oil - Includes Cover Elbow, Oil Filter Outlet and Inlet Line, Oil - Filter Inlet Line, Oil - Filter Outlet	пнопн	22.14

iii.		iżżii	### ##################################
инннин.	44 0 44 44 N	N to -4 -4 to to	4448884
502-3 Connector, Gil Filter Inlet Line 505-98 Nipple, Gil Filter Inlet Tee - 1/8" Pipe - Gasoline Plant 505-59 Tee, Oil Filter Inlet Line - Gasoline Plant 502-20 Elbow, Gil Filter Inlet Tee - Gas-Gasoline Plant 702-1 Tee, Oil Filter Inlet Line - Gas-Gasoline Plant 7-4125 Stud - Gil Filter Mounting 7-4125 Fig. Oil Level Gauge Fig.L. 210 Filter Mounting PISTON AND CONNECTING ROD CROUP	(Fig. 5) (Fig. 5) (Kig. 5) (Kig. 5) (Kig. 5) (Kig. 5) (Kig. 5) (Kid. 207 (King. Retaining (Kid. 202 (King. Piston - Top Groove - Compression (You 2014-30) (King. Piston - Middle Groove - Compression (You 301 Ring. Piston - Middle Groove - Compression (You 3014-30) (King. Piston - Middle Groove - Compression (You 3014-30) (King. Piston - Piston - Compression (You 3014-30) (King. Piston - Middle Groove - Cil Control (You 3014-30) (Mood-3023 Rod, Connecting - Cylinders 2 and 4 - Includes Rod, Gap, Bearings, Pin Bushing, Bolts and Nuts Mood-200 Bolt, Connecting Rod Mood-314 Bearing Shell, Connecting Rod - Cylinders 2 and 4 - Upper and Lower Mut, Connecting Rod - Cylinders 1 and 3 - Upper and Lower Nut, Connecting Rod - Cylinders 1 and 3 - Upper and Lower Nut, Connecting Rod Bolt - 5/16"-24 - Hardened Nat, Connecting Rod Nut Fin, Cotter - Connecting Rod Nut (Fig. 6) 	ILOOI-301 Valve, Intake ILLOOI-308 Valve, Exhaust - Roto (Not Used on 191 Spec. 246) ILLOOI-309 Valve, Exhaust - Conventional (Used on Spec. 246) ILLOOI-200 Guide, Valve Stem ILLOOI-205 Spring, Valve ILLOOI-205 Spring, Valve Spring - Intake (And Conventional Exhaust) Valve ILLOOI-207 Retainer, Valve Spring - Exhaust Valve (Roto Type Only) ILLOOI-205 Pin, Valve Spring Retainer Lock - Intake (and Conventional Exhaust) ILLOOI-209 Cap, Valve Stem - Exhaust (Roto Type Only)
242222 242222	4 654 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	2	1444444444444444444444444444444444444

PART NO.		DESCRIPTION
7,6001-310 Lock Valve Sorri	Lock Valve Sor	VALVE GROUP—CONT'D. Gook Walve Spring Retainer - Exhaust (Roto Twne Only)
, v.,	Screw, Tappet Adjust Nut, Tappet Adjust	Screw, Tappet Adjusting
		<pre>lappet, Valve</pre>
PYA-305 Gasket, Valve Chambe Y400A-3030 Cover, Valve Chamber 1108349 Baffle, Oil - Valve		Valve Chamber Cover
Spring, Klbow, Stud, V. Gasket,	Spring, Oil Baffle . Elbow, Valve Cover - Stud, Valve Cover - Gasket, Washer - Val	Spring, Oil Baffle Ribow, Valve Cover - Ventilating Tube Stud, Valve Cover - 1/4" - 20 x 2-1/4" Basket, Washer - Valve Cover Nut
WATER PU	WATER PU	WATER PUMP AND FAN GROUP $(Fig. 7)$
I400K-4072 Pump Assembly, Water - Impeller, Seal, Fan		Pump Assembly, Water - Includes Body, Bearings, Support, Shaft, Bushing, Impeller, Seal, Fan Hub Serew, Studs and Nuts
	Body, Water Pump Gasket, Drive Shaft S	
Y400K-332 Impeller, Water Fump, Y400K-3330 Seal Assembly Water F		Impeller, Water Pump
1.	1.	Bushing, Drive Shaft
 		Support Assembly - Drive Shaft
യെ	Ring, Retainer - Ball Retainer, Snap Ring	Ring, Retainer - Ball Bearing Retaining
Spacer, Bearing	Ball Bearin	bearing, Ball - Drive Shaft
Y400K-251 Hub, Fan	Hub, FanBelt, Fan - Used With Belt, Fan - Used With	Hub, Fan Belt, Fan - Used With Charging Generator Belt, Fan - Used Without Charging Generator

25.25	45.90 4.10 1.25 .10	0.1 21.7 23.5 20.6 0.0 0.0
нановенно пере	наннана	HHHHHNH444
Flange, Fan Belt Adjusting Fan, Cooling Gasket, Mater Pump Mounting Lock - Fan Belt Adj. Flange Screw Gup, Grease - Water Pump Key, Water Pump Drive Shaft - Woodruff #5 Key, Fan Drive Pulley Flug, Fan Drive Pulley Stud, Water Pump Body - 3/8"-16 x 1-3/4" Stud, Mater Pump Body - 3/8"-16 x 1" Stud, Drive Shaft Support - 3/8"-16 x 1" Strew, Set - 1/4"-20 - Water Pump Impeller	FLYWHEEL GROUP (Fig. 8) Flywheel Assembly - Includes Blower and Ring Gear Gear, Ring - Flywheel Housing, Flywheel - Includes Timing Hole Cover, Felt Cover, Starter Hole Cover, Timing Hole Cover, Timing Hole Screw, Flywheel	MUFFLER GROUP (Fig. 9) Flange, Exhaust Tube to Manifold Gasket, Exhaust Flange Tube Assembly, Exhaust - Includes 15444 Flange Gasket, Manifold Assembly, Intake and Exhaust Bracket, Muffler, Exhaust Stud, Manifold Washer, Heavy - Manifold Washer, Heavy - Manifold Washer, Heavy - Manifold Wut, Manifold (Brass)
ILLOOK-320 130-57 ILOOK-340 8UK-205 518-41 X-504 CLOOK-217 X-19006 X-19006 X-19098 X-19098	1916-4010 1586-309 1018130 2328223 F4000-208 64006-206	15444 155410 155810 157865 74608-302 7915-207 155861 15586 15580 WB-110 6EE-100
112 112 114	H 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	10m4m0r

	REF.	PART NO.	DESCRIPTION	OUAN. USED	PRICE
	l à		RADIATOR GROUP (Fig. 10)		
	Н	130-6	Radiator, Standard	н	
	H.	130074	Radiator, Corrosion Resistant	Д,	42.50
	71. rr	130654	Guard, Fan - beit Hand	٦,٦	2.8 %%
) M	130053	Guard, Fan - Right Hand - Use When No Charging Generator is Used	1 ~	2 2 3
	~ † 4	503-26	Hose, Upper Radiator	Н с	9.5
	V 1V	50 73 73 73 73 73 73 73 73	Clamp, Hose - Upper	4 (2	99
	9 8	130B177	Support, Hadiator	Нг	
	~ &	503-25	Hose, Lower Radiator - Gurved		8
		504-3	Cock, Drain - Radiator	rl r	8.8
		505-27	Coupling, Pipe - 1/4" x 1" - Radiator Drain		15
			FUEL SYSTEM GROUP		
	•		(Fig. 11)		
	Н	140412	Bolt, Wing - Air Cleaner Cover	-1	
	CV C	140-9			9.09 8.08
	n <u>~</u>	159065	cap, fuel fank (for much tank)		3,71
	'n	193-15	Gauge, Fuel - Tank Element (Used W/Mtd. Tank)	-	1.25
	9.	140469	Gasket, Air Cleaner	H	•
	<u>~</u> α	140A10	Bracket, Air Cleaner Adapter		5
	0	141-221	Carburetor Assembly - Electric Choke	17	12.50
	유:	Y91F-3280	Line, Fuel - Fuel Pump to Carburetor	٦,	07.
	12	14007	Adapter, Air Cleaner		
,	គ	149-12	•	ı	1.35
	# #	501–3 501–15	Line, Fuel - Tank to Filter (Used W/Mtd. Tank)		1.00
	15	149-50	•	· Н	9.00
				-	

	55.	8.5	.8	.15	9.5	19	8.	શ	٠. بۇ:	78	52.	ន្	ନ୍:	3.5	3.5	.75		8.	2	16.50	3 %		12.75	2.50	٠, تخ	3,5	2.5	2.25	ક	
_	ผน	Нг	ı	Н,		1 7	Н	н,			-	α .	~ (N 6	ų	н		٦	cz,	-1.	-1 r-	1 71	Н	Н.	r-1 ,	-1 -		1 -1	~	ev
	Clamp, Air Cleaner Adapter Hose				Rod Assembly, Choke - Manual - Special Models Only					Bracket, Fuel Filter Mtg. (Used W/Mtd. Tank)		Kibow, Inverted Male - 1/8" x 1/4" - Shut Off Valve	Connector, Inverted Male - 1/8" x 5/16" - Fuel Pump Outlet	Stud, Fuel Fump mounting - 2/10"-18 X 1-1/4"	Connector Fig. Line to Filter Bowl (Red W.Mtd. Tent)	Kit, Fuel Pump Repair	GAS-GASOLINE FUEL SYSTEM GROUP (Fig. 12)	_		_	Adapter, All treamer	Bracket, Regulator Mounting	Regulator, Gas - Atmospheric	Choke Assembly - Elbow	Lock - Disson Choke Lever	THE PARTY CONTROL TO TAKE TO THE TOTAL TO TH	Relay Assembly - Auto. Choke	Valve, Carburetor Gas Adjust.	Nozzle, Carburetor Gas	Clip. Choke Rod End
	28 27 17 17 17 17 17	153452	153458	153486	153841	141428	193-10	1098	1098A	1494105	502-4	505-2	502-18	770077	50213	1409		503-30	503-32	141-22	75865	148B55	148-9	148B47	153420	1671	207874 307878	148464	148-71	7482
	126	820	ន់	d 8	2 22	13	25	56	8	8 8	8	ੜ:	32		33	`		đ,	o o	m -	4 v	0ء	~	60 (٥,	3 ;	12	13	#	15

REF. NO.	PART NO.	DESCRIPTION	OUAN. USED	PRICE
		CARBURETOR GROUP (Fig. 13)		
нς	141÷189.	Lever, Throttle	٦,	1,35
≀ w -=	14-201			19.5
· w.o	141-188	Shaft Assembly, Throttle - Includes Stop Bracket Washer, Shaft, Packing	i	1.3
; c ~ ¢	203-541	Washer, Packing Retainer	1	01.8
	69-171	Washer, Lock - Throttle Valve (2), Choke Valve (2)	1,44	19.5
17	141-202	Plug - Shaff Hole		19
25	141-9 141-8	Spring, Idle Adjusting Screw Screw. Idle Adjusting	Н	3.
17.	781-171	Body, Throttle	(mi	**85
15	141-207 141-75	Gasket, Body to Bowl. Screw: Body to Bowl.	H -4	
71	141-76	Washer, Lock - Body to Bowl		9.5
9 57	141-195	Jug - I tut I assage (1), born blank (1)	V H	18
ର ଟ	141-197	Valve Assembly, Fuel Inlet - Needle Valve, Seat and Gasket		88
188	902-TT1	Axle, Float - Zenith No. Cl20-4	4 ~ .	15
গ র	141-196	Jet, Discharge		ž,
25.	141-198	Venturi	П	1.35
8 %	141-337	Jet, Well Vent Bushing - Choke Shaft	-1	
% 8	141-190	Shaft - Choke	H	85
383	141A209	Bushing - Choke Shaft		9.9
7 K	141-193	Bowl. Washer, Fibre - Main Jet		99
	,		_	

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наччч				Н.	17	, ,	1.01	н,		† ~	H	→ †	1 50	Н,	٦,		н		-1			,	
Washer, Fibre - Main Jet Flug, Choke Shaft Bushing Plug, Main Jet Passage Lever, Choke Shaft Lever, Choke - Used With Automatic Choke	IGNITION GROUP (Fig. 14)	Distributor Assembly - Ignition	Shaft Assembly - Distributor Brive - Includes Shaft and Coupling	Adapter - Distributor	Clamp, Coil	Insert - Coll Clamp	Cable, Battery - 15"	Cable, Battery - Jumper - 5"	Crank - Manual Starting	Condenser - Distributor - AI IGB-1025	Condenser, Coll	Suppressor - Spark Plug Summessor - Distributor	Cable, High Tension - Does Not Include Suppressor	Contact Point Set - Distributor	Rotor, Distributor	Magneto Assembly - Used on Manual Start Models Only	Switch, Momentary Contact - Used With Low Oil Pressure Switch	GOVERNOR GROUP	Governor Assembly - Complete	Gasket, Governor Mounting	Spring - Governor - Pierce Governor No. SN-1270	Stud - Governor Link - AC Plant	
141-194 141-11 141-11 141-186 141A162		166-4	Y91M-2110	1914-321	166B101	166B102	₹-9 1	416-1	192828 167_13	312-10	312471	24-35 24-35	167A1070	18906	5924	162-195	308-37		151-24	F4005-200	C1438-204	520A201 520A95	JEVA70
8448		40	u w	41	V-0	c- a	0.0	2:	12	12	13	71.	12	17	87.5	8	ส		н	ct o	ر 4	n	`

REF.	. PART	NOTEGIAL	_	AU U	QUANTITY USED	X	PRICE
NO.	•		[m	0		EACH
		GOVERNOR GROUP-CONT'D.					
978	150-69 1918-215 1918-214 X-318	Joint, Ball - Governor Link Gasket - Governor Plate Plate - Governor Mounting Gasket, Washer - Governor Mtg. Screw	8444	8444	пння	8444	.65 .15 .15
нα	231D4 210A1271	GENERATOR GROUP (Fig. 16) Adapter - Generator to Engine	<u> </u>	, 러 -	н	rd r	8.00
WW41	211029 211010 232B56 232A57	Pole Shoes Bell, End Bell, End Bell Gover Basket - Basting Cover		1 444			17.50
101-86	232855 2100115 222A1171 201A232	Bearing. Generator - Without Windings or Pole Shoes ssembly, Field - Set of 4 Coils e Assembly - Includes Drive Disc and Ball Bearing	H # HH	ААА	144	ннн	1.25
6 6	201A237	Rebuilt Trade-in Allowance Armature Assembly - Includes Drive Disc and Ball Bearing New Rebuilt Trade-in Allowance Armature Assembly - Includes Drive Disc and Ball Bearing New	 	дда	. н		27.50 105.00 115.00
6 9135	201.4236 510.432 232.4333 221.452 21.2040	Rebuilt Armature Assembly - Includes Drive Disc and Ball Bearing New Bearing, Ball - Armature Clip - Bearing Retainer Pole Shoe Right Assembly, Brush - Includes Brushes and Springs	ннчн	нн 4	-	данана	105.00 105.00 27.10 20.50

18.50 20.00 18.50 18.50 1.00 1.75 1.75	44 1.9.9.2.2.2.2.9.9.9.9.9.9.9.9.9.9.9.9.9.	4.4 00.6 00.6
ユ 4の4の411	н нача а мачан наче	\H H H
л 44444нн	н нача <mark>и «ч</mark> ана наче	<u>ਮੁਜੰਜ</u>
H 40404HH	л л плп п «нпппп п пп«	<u> </u>
14444A	an adaa a daadaa da $^\circ$	<u> </u>
Rig Assembly, Brush - Includes Brushes and Springs Rig Assembly, Brush - Includes Brushes and Springs Rig Assembly, Brush - Includes Brushes and Springs Stud - Generator Mounting Spring, AC Brush Brush, AC Brush, AC Brush, DC Brush Spring, DC Brush Brush Condenser - AC Brush Condenser - AC Brush	CONTROL PANEL GROUP (Rig. 17) Panel, Control Mounting - Right Hand Panel, Control Mounting - Left Hand Light, Pilot - Assembly Gauge, Engine Oil Pressure - Panel Element Gauge, Engine Oil Pressure - Panel Element Voltmeter, AC - 0-300 Volt Voltmeter, AC - 0-50 Amps Ammeter, Charet and Stop Receptacle - Daplex Twistite Breaker, Circuit - 2 Role - 50 Amps Switch, Toegle - Panel Light Bresistor, Toegle - Panel Light Bresistor, Fixed - Charet Circuit - 5 Charet - 5 Char	Switch - Voltmeter Selector
212041 212080 2120112 520443 21241004 214410 214423 312-27	3010327 3010327 3010327 3010332 3022-5 302-40 302-40 302-5 302-5 302-69 308-5 308-5	38-12 38-12 304-32
12554333	14444444444444444444444444444444444444	17 17 17 17 17 17 17 17 17 17 17 17 17 1

Refer to page 1 regarding the use of PARTS REK. STABOLS A, B, C, and D.

REF		WASTER TO SOLE IT.		QUANTITY	Ega	×	PRICE
NO.	NO.	PESCRIPTION	V	B	U	ρ	EACH
		CONTROL PANEL GROUP -CONTD.			,		
######################################	3078137 307-4 332-54 332-142 332-142 332-142 520A191 332A128 332A128 332A128 312A15 312A15 405G193 405G193 405G193 405G193 405G193 405G193 405G193 405G193 405G193 405G193 405G193 405G193 405G193 405G193 405G193 405G193 405G193 405G193 405G193	Relay Assembly, Reverse Current Relay Assembly, Stop Block, Terminal - 8 Flace Terminal Solderless - AC Output Connectors Block, Terminal - DC Output and Remote Control Relay, Start Disconnect - Mounted on Battery Support Stud Assembly - AC Insulated Terminal - Includes Washers and Nuts Stud Assembly - AC Grounded Terminal - Includes Washers and Nuts Condenser, Terminal Stud Condenser, Terminal Stud HOUSING GROUP (Fig. 18) Panel, Right Hand Door Plate, Top Panel, Rediator Knob - Panel Door Panel, Rediator Knob - Panel Batter Hand Door Panel, Rediator Panel, Rediator Fanel Sate - Right Hand Panel, Rediator Panel, Rediator Panel, Rediator Fanel Sate - Right Hand Panel, Rediator Panel, Rediator Panel, Rediator Fanel Assembly, Greak - Includes Spring, Wing Nut and Washers Support, Front Engine Support, Pront Engine		המה מה			8885.58335.8 8888 18885.8
15 16 17 18	405C198 405C389 403B146 405C191	Plate, Exhaust Compartment	чнчч				3.75

3388888		5.00 29.00 26.00 26.00		
444884	•			
4148884			·	
444884			 	
4448844				
Hook, Door	SERVICE KITS	Valve Grind Parts Kit Gasket Kit, Complete Plant Overhaul Kit - AC Plants Overhaul Kit - DC Plants Overhaul Kit - DC Plants Fuel Pump Repair Kit Carburetor Repair Kit Gas Conversion Kit, AC Plants Gas Conversion Kit, DC Bat. Ign. Plants		
406-3 403B147 402-55 402-11 402-12 416B87		110% 279 168K21 522K 59 522K 60 604,1 14,1X 336 14,8X 104		

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SUPPLEMENT TO INSTRUCTION MANUAL

NOTICE

The information in this supplement is to be substituted for, or added to the information on the corresponding pages in the instruction manual, to make the manual applicable to the 6000 watt, direct current plant.

READ THIS SUPPLEMENT CAREFULLY

Note that some pages are revised only as to paragraph or line. New illustrations are included where necessary.

Page 2 - Delete the information under the heading GENERATOR, and substitute the following information.

GENERATOR

The air cooled generator produces 6000 watts of direct current. The voltage is either 115 or 230 volts, as indicated on the plant nameplate. The generator is directly coupled to the engine, the armature turning at crankshaft speed. The generator field is compound wound and has two interpole coils for better commutation. The generator is self-excited. The armature is supported at the inner end by the engine rear main bearing, and at the outer end by a large ball bearing.

An extremely large commutator is mounted at the ball bearing end of the armature. All generator windings are thoroughly impregnated with insulating varnish and baked, to minimize the possibility of internal short circuits.

A centrifugal weight type, gear driven governor controls the speed of the engine, and so the output voltage of the generator. The normal speed is approximately 1800 r.p.m.

CONTROLS

Automatic or line transfer equipment is not available for the DC plants.

Pages 4 and 5 - Delete the information under the subject WIRING, and substitute the following information.

BATTERIES. Two 6-volt batteries are connected in series by a short jumper cable. Connect the cable which is attached to the start solenoid switch to the remaining positive (+) post of the two batteries. Connect the cable which is grounded on the cylinder head to the remaining negative (-) post. If the plant was boxed for export shipment, service the batteries as directed on the tags attached to the batteries.

GROUNDING.- If grounding is called for in local underwriters' codes, or radio interference requires it, drive a 1/2" diameter pipe or rod into the ground as close to the plant as is practicable. This pipe must penetrate moist ground. Fasten an approved ground clamp to this pipe, and run a number 8 or larger insulated wire from the clamp to the negative output terminal post on the plant.

WIRING. Observe any applicable underwriters' codes when connecting the load wires to the plant. Use sufficiently large, insulated wire. The size of the wire depends upon the distance and permissible voltage drop between the load and the plant, and the amount and kind of the load.

Connect the positive wire of the main line to the positive (+) DC OUTPUT terminal located behind the control panel. Connect the negative wire of the main line to the negative (-) DC OUTPUT terminal. Some model plants are equipped with a duplex receptacle mounted upon the control panel, which may be used to connect a load not to exceed 15 amps. at 115 volts, or 10 amps. at 230 volts for each outlet. If the plant is not equipped with a circuit breaker, install a switch in the main line as close to the plant as is practicable.

If it is desired to connect a remote start-stop control switch, connect the switch terminals Nos. 1, 2, and 3 to the corresponding terminals, marked REMOTE, behind and below the control panel.

Page 9 - Add the following information to that given under STARTING THE PLANT MANUALLY.

The magneto ignition plant has a momentary contact toggle switch which by-passes the low oil pressure cut-out switch. Hold this toggle switch in contact while cranking the engine and until the oil pressure has built up to normal running pressure. Manual carburetor choking is provided on the magneto ignition plant.

Page 21 - Add the following information to MAINTENANCE AND REPAIRS.

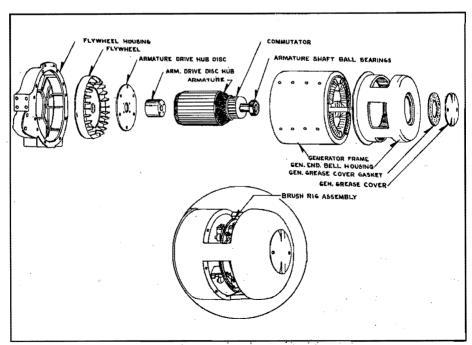
STARTER AND BATTERY CHARGING GENERATOR. When servicing the starting motor and small battery charging generator, follow the same general principles of maintenance and repairs as given for the main generator.

Page 29 - Paragraph headed COMMUTATOR AND COLLECTOR RINGS, line 1.

Delete reference to collector rings.

Paragraph headed BRUSHES, line 5. Delete reference to AC springs.

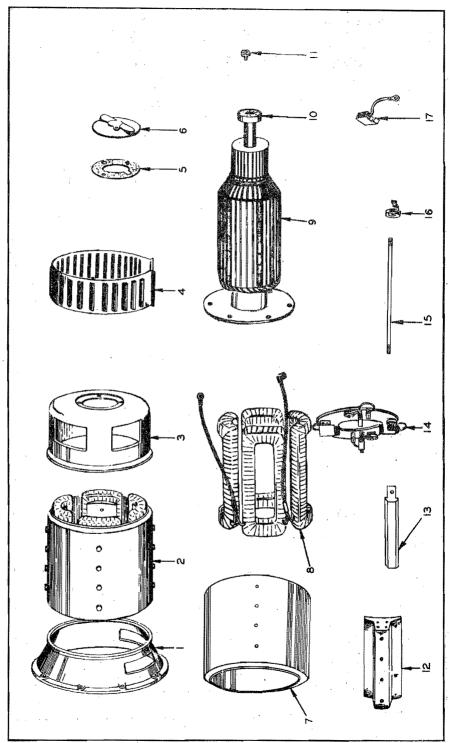
Page 28 - Substitute the illustration, DIRECT CURRENT GENERATOR ASSEMBLY for the ALTERNATING CURRENT GENERATOR ASSEMBLY illustration.



DIRECT CURRENT GENERATOR ASSEMBLY

- Page 49 Delete the generator Group illustration Fig. 16, and substitute the illustration Fig. 16A.
- Page 50 Delete the Control Panel Group illustration, Fig. 17 and substitute the illustration Fig. 17A. Add an illustration, Starter and Battery Charging generator Group, Fig. 19.
- Page 62 Delete the Generator Group, and substitute the DC Generator Group, page 74.
- Page 63 Delete the Control Panel Group, and substitute the DC Control Panel Group, page 75.

 Add the new group, Starter and Battery Charging Generator Group, page 76.



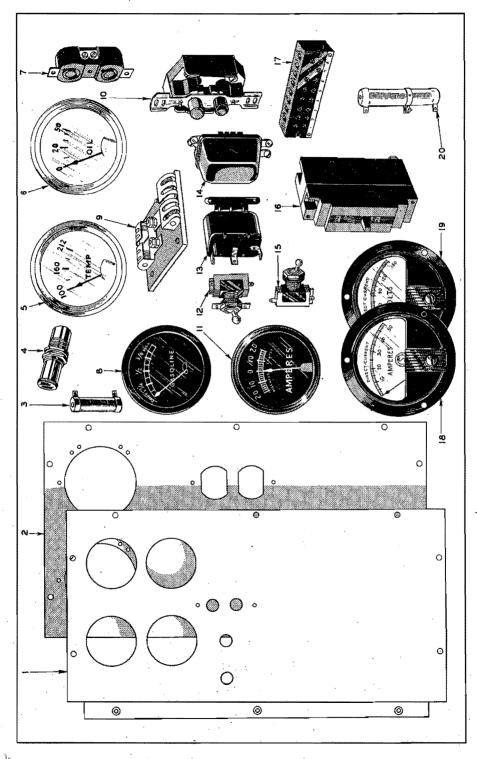


Fig. 19 STARTER AND BATTERY CHARGING GENERATOR GROUP

PARTS LIST

REF	PAKI	ZCIFALBUUEC	CSED	PRICE
Š.	.VO.		E F	- 1
		GENERATOR GROUP		
Н	23104	Adapter - Generator to Engine		00.6
N	210A1203	Frame Assembly, Generator - Includes Frame, Field Coils and Pole Shoes	' H	150.00
R	210A1211	Frame Assembly, Generator - Includes Frame, Field Coils and Pole Shoes		
Μ.	211010	Bell, End		ਹ ਲ
at ac	232850	band, and bell cover		
۰.0	232B55	Cover, Bearing		
<u>~</u> (210032	Frame, Generator - Without Windings or Pole Shoes		
XO 00	222A1127	Coll Assembly, Field - Set of A Main Colls and 2 Commutating Colls	 	
0	201A246	Armature Assembly - Includes Drive Disc and Ball Bearing	<u>-</u>	107.50
		Rebuilt	٠٠,	97.5
,		Trade-in Allowance	-	<u>چ</u>
6	201A256	Armature Assembly - Includes Drive Disc and Ball Bearing New		107.50
1.		Trade-in Al	-	
임	510A32	Bearing, Ball - Armature		
#	232A333	Clip, Bearing Retaining		۲ <u>.</u>
12	221B1	Shoe, Pole - Main	<u>. </u>	_
<u>.</u>	21 2m13	Bir lesemhly Rush Trelinde Rushes and Springs	_	2.
†	520A43	Stud - Generator Mounting	1 -4	
16	212AIO11	Spring, Brush		
14	214418	Brush F. 1694	≯	1.75
	508A3	Grommet, End Bell	17	``H
		CONTROL PANEL GROUP (Fig. 17A)		
н (3010326	Panel, Control Mounting - Right Hand		7.00
v cv	3010376 **	Fanel, Voluntal Mountains - Delt Hand		
'n	304-32	Resistor - Fixed - Relay - 15 Ohm - 10 Watt		3

PARTS LIST

	27.50 5.65 1.25 1.25 1.00 1.00 1.25 1.25
<u> </u>	<u> </u>
	<u> </u>
Light, Pilot - Assembly Gauge, Engine Water Temp Panel Element Gauge, Engine Water Temp Panel Element Gauge, Engine Oil Pressure - Panel Element Gauge, Rapine Oil Pressure - Panel Element Gauge, Fuel - Panel Element Only (Use W/Mtd. Tank) Divider, Voltage Divider, Voltage - 20-20 Amp Switch, Pusgle - Panel Light Switch, Toggle - Panel Light Switch, Toggle - Panel Light Switch, Toggle - Ignition Breaker, Circuit - Single Pole - 25 Amp Breaker, Circuit - Single Pole - 50 Amp Breaker, Circuit - Single Pole - 50 Amp Woltmeter - DC - 0-30 Amp Ammeter - DC - 0-100 Amp Woltmeter - DC - 0-30 Volts Woltmeter - DC - 0-30 Volts Block, Fuse Block, Fuse Block, Fuse Block, Fuse Block, Fuse Cartridge - 60 Amp, 115 Volt Fuse, Cartridge - 30 Amp, 230 Volt Gondenser - Output Terminals - 5 Mfd. STARTER AND BATTERY CHARGING GENERATOR GROUP	Starter - Motor
* * * * * * * * * * * * * * * * * * *	191-6 Y9JM-24 5 2328234 2328231 191-13 2328230 191-13 2328230 41649 1166435 191-21
382555555555555555555555555555555555555	1004500C800



Authorized Service Stations

The AUTHORIZED SERVICE STATIONS listed below are fully equipped to take care of most of your service needs and repair parts for ONAN electric generating plants and power units.

Considerable time can be saved by contacting your nearest AUTHORIZED SERVICE STATION.

BUDA ENGINE & EQUIPMENT CO., INC. 904 So. Bryny Street Dallas 1, Texas

SUDA ENGINE SALES & SERVICE Great Bend, Kansas

BUDA ENGINE SALES & SERVICE P.O. Box AA17 Okluboma C4ty, Okluboma

BUDA ENGINE SALES & SERVICE 517-521 West Archor Tulsa 1, Oktoboma

HE VIER SALES CO. 18 Mulberry St. Plymouth Ohio

ETS-HOKIN AND GALVAN 551 Mission Street San Francisco, Callfornia

ETS HOEIN AND GALVAN 218 N. Avalon Hivi. Wilmington, California FREMENT ELECTRIC CO. 744 N. 34th Street Seattle 2, Washington

GRAYLING AIR SERVICE Grayling, Michigan

HEMDRIE & BOLTHOFF 1635 17th Street Denver 17, Colorado

JOHN REINER & CO. 12-12 37th Avenue Long Island City, N. Y.

SERVICE & SUPPLY CO. 1301 W. 6th Avenue Amerillo, Texas

STARK ELECTRIC COMPANY Sharp & Ostend Street Baltimore 30, Maryland

VNCTON MARRIPACTURING CO. 5616 Laurabale Houston, Texas

MARINE (Only) SERVICE STATION

CEILS AND FOERST MARINE ELECTRIC CO 290 City Island Avenue City Island 64, New York

AUTHORIZED SERVICE STATIONS IN CANADA

DAVIES ELECTRIC CO. 617 Centre St. Calgary, Alberts, Canada

EDWARD LIPSETT LTD. 65 Water St. Venocuver, B. C. Canada DAVIES ELECTRIC CO. 347 Second ave. So. Saukatoon, Sank., Canada

Bownen Bron. Regina, Sankatchewan Canada

SC 9-1-49