

INSTRUCTION MANUAL AND PARTS LIST



(Price 75 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 replacing 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.

IMPORTANT—RETURN WARRANTY CARD ATTACHED TO PLANT

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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 41 miles.

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

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

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

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

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

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

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

GENERATING PLANT RUNNING HOURS		AUTOMOBILE RUNNING MILES	GENERATING PLANT RUNNING HOURS		AUTOMOBILE RUNNING MILES
DAILY AVERAGE	1 Hr.	41 Miles	MONTHLY AVERAGE	30 Hrs.	1,050 Miles
	4 Hrs.	164 "		120 "	4,200 "
	6 "	246 "		180 "	6,300 "
	8 "	328 "		240 "	8,400 "
WEEKLY AVERAGE	7 "	245 "	YEARLY AVERAGE	365 "	14,965 "
	28 "	980 "		1,460 "	59,860 "
	42 "	1,470 "		2,190 "	76,650 "
	56 "	1,960 "		2,920 "	102,200 "

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

RUNNING TIME METER

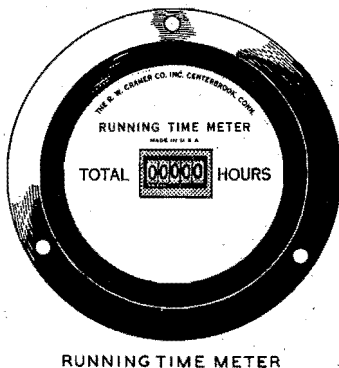
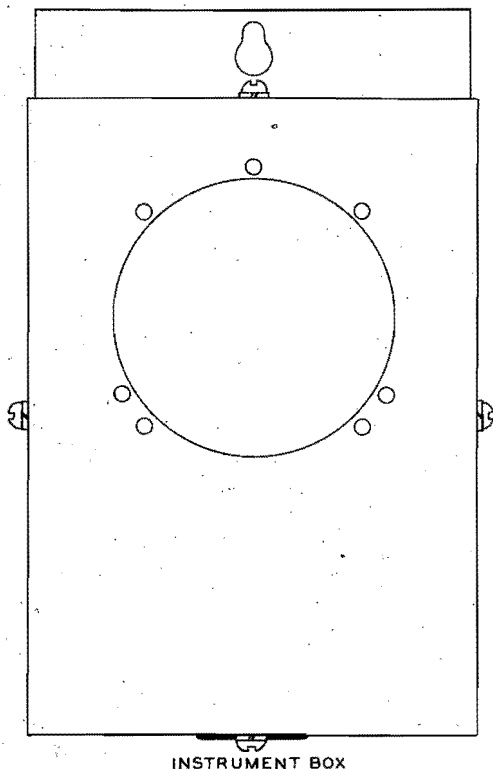
Don't Guess - Know how many hours your plant runs, so that you can change oil and service the plant at proper intervals.

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

PART NO.	USED WITH PLANT	PRICE
302-68	60 Cycle, 115 V. A.C.	\$12.50
302-102	50 Cycle, 115 V. A.C.	12.50
304-99	Resistor - adding to either meter above makes it suitable for 230 V. use.	.75

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

301-500	Instrument Box	2.50
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DESCRIPTION

GENERAL.— The alternating current plants to which this manual applies are complete electric generating plants. Each plant includes an internal combustion engine, a self excited generator directly coupled to the engine, and such accessories as are necessary for a normal installation. Each plant is carefully inspected and given a test run before shipment to assure that all parts are in good condition and that the plant will produce its rated output. Carefully inspect the plant before installing it, making sure that no damage occurred in shipment. Any damaged part must be repaired or replaced before the plant is put into operation.

This manual is supplied to assist the operator in installing and operating the plant and in maintaining it so that it will provide maximum service at minimum cost. One copy of this manual is supplied with each plant of the basic models listed in the following table and with other models which differ slightly from these basic models.

GENERAL DATA

TYPE PLANT	STARTING METHOD	WATTS	VOLTS	FREQUENCY	CAPACITY IN QUARTS (U.S. MEASURE)		† PARTS REFERENCE SYMBOL
					CRANKCASE	FUEL TANK	
MANUAL	MANUAL ONLY	500	115	60 CYCLE	2	4	A
REMOTE CONTROL	ELECTRIC OR MANUAL	500	115	60 CYCLE	2	20	B
MANUAL	MANUAL ONLY	750	115	60 CYCLE	2	4	C
REMOTE CONTROL	ELECTRIC OR MANUAL	750	115	60 CYCLE	2	20	D

† THE PARTS REFERENCE SYMBOL A, B, C OR D INDICATES WHICH COLUMN TO USE UNDER THE HEADING "QUANTITY USED" IN THE PARTS LIST AT THE BACK OF THIS BOOK. TO DETERMINE WHICH COLUMN TO USE, COMPARE THE CHARACTERISTICS OF YOUR PLANT AND THE DATA GIVEN ON THE PLANT NAMEPLATE WITH THE DATA IN THE ABOVE TABLE. FOR EXAMPLE: IF YOUR PLANT IS A REMOTE CONTROL TYPE, 500 WATT, 115 VOLT, 60 CYCLE PLANT, USE COLUMN "B" IN THE PARTS LIST. ORDER ONLY THOSE PARTS WHICH HAVE A QUANTITY SHOWN IN THAT COLUMN. IF YOUR PLANT IS OF A DIFFERENT VOLTAGE OR FREQUENCY THAN ANY SHOWN IN THE ABOVE TABLE, ORDER GENERATOR PARTS BY DESCRIPTION ONLY. ALWAYS BE SURE TO GIVE THE PLANT MODEL, SPEC. NUMBER, AND SERIAL NUMBER OF THE PLANT. REFER TO PAGE 33 FOR ADDITIONAL PARTS ORDERING INFORMATION.

MANUAL TYPE PLANT.— The manual type plant is equipped for manual starting only. This type of plant has a fuel tank mounted on the plant, and is especially designed for applications where portability is important. A convenient output receptacle provides for quick load connection.

REMOTE CONTROL TYPE PLANT.— The remote control type plant may be started and stopped electrically, by means of a switch located on the plant. Additional start-stop switches may be installed at convenient locations for remote starting and stopping of the plant. In an emergency, the plant may be started manually. A 12 volt battery (or two 6 volt batteries in series) must be properly connected to the plant to furnish power for starting the plant electrically. Leads extending from the control box are provided for connecting to the load wires.

ENGINE

The engine is a vertical single cylinder, four stroke cycle, air cooled, L head, internal combustion type. The cylinder bore is 2-1/2", the piston stroke is 2-1/4", piston displacement 11 cubic inches, compression ratio is 6.2 to 1, and the rated horsepower at 1800 r.p.m. is 1.78. The cast iron cylinder and crankcase are a single casting.

DESCRIPTION

The speed is controlled by a flyball type governor built into the camshaft gear. Engine speed is 1800 r.p.m. for 60 cycle plants. Ignition current is supplied by a high tension, flywheel type magneto. Blower fins on the flywheel draw cooling air in through the front of the engine and force the air around the cylinder walls and head.

The engine has an aluminum alloy 3 ring piston, aluminum alloy connecting rod, and full floating type piston pin. The counter balanced crankshaft turns in two unusually large sleeve type main bearings. The oil base and cylinder head are removable for servicing the engine. Positive splash type lubrication is employed.

GENERATOR

The air cooled generator is a four pole, revolving armature, alternating current (AC) saturated field, inherently regulated, self excited type. The machined steel ring frame mounts the pole shoes and field coils. Both the manual and remote type plants have saturated shunt wound field windings, and the remote type plant has an additional series field winding which permits use of the generator as a motor for cranking the engine. The armature contains both AC and DC windings. The DC output is used to excite the field, and on the remote control plants is also used for charging the starting battery. The armature is directly connected to the crankshaft, and is supported at the engine end by the engine rear main bearing and at the outer end by a ball bearing. Due to the inherent design of the generator, voltage regulation between no load and full load is approximately 128 volts to 110 volts for the 115 volt plant. Frequency of the current depends upon engine speed.

CONTROLS

MANUAL TYPE PLANT.— The manual type plant has a manual carburetor choke control, a stop button on the blower housing, and an AC output receptacle.

REMOTE TYPE PLANT.— The remote control type plant is equipped with a control box containing a reverse current relay, a start solenoid, a start-stop toggle switch, a hi-low charge rate switch, a charge rate ammeter, and a resistor. Terminals for battery connections are provided. The carburetor is automatically choked. Remote start-stop switches may be connected, if desired.

ACCESSORIES

Standard accessories supplied include rubber mounting bushings, muffler, starting rope, oil drain extension, breaker point wrench, and instruction manual. In addition, the remote control type plant is supplied with a starting battery, battery cables, battery hydrometer, flexible exhaust tube, and a remote start-stop switch. The manual type plant has a convenient carrying handle.

INSTALLATION

IMPORTANCE OF PROPER INSTALLATION.— The plant must be properly installed and prepared for operation if it is to give satisfactory service. The plant may be easily moved, and may be operated outdoors, but rain, snow, dust, and dirt are unfavorable factors to satisfactory operation. Install the plant inside a building or closed vehicle, if practicable.

CAUTION

EXHAUST GASES ARE POISONOUS. EXCESSIVE INHALATION WILL CAUSE SEVERE ILLNESS OR DEATH. DO NOT OPERATE THE PLANT INSIDE A BUILDING OR OTHER CONFINED SPACE WITHOUT PIPING ALL EXHAUST GASES OUTDOORS.

MOBILE OR INDOOR INSTALLATION.— Select a location which will be as near the electrical center of the load as is practicable. The space for the plant should be clean, dry, and well ventilated, and preferably heated in extremely cold weather. A damp or dusty location will necessitate more frequent servicing. Mount the plant on a substantial level concrete or timber base, preferably at least 12 inches in height. Mounting hole centers are 8-1/4" x 9-1/4". Use the rubber mounting bushings to minimize vibration. Do not compress the bushings tight enough to distort them, or their shock absorbing effect will be lost. The base should be located so as to provide at least 24 inches space on all sides of the plant for convenience in servicing. Provide separate air inlet and outlet openings for proper circulation of cooling air. Pipe the engine exhaust gases outside the enclosure, using pipe at least as large as the exhaust outlet of the engine, which is threaded for 3/4" pipe. Connect the flexible exhaust tube to the plant exhaust outlet, a sufficient length of pipe to conduct the gases outside the enclosure, and the muffler to the pipe outside the enclosure. If the exhaust line passes through a wall, or close to any inflammable material, it must be properly insulated or shielded. If the exhaust line must be inclined upward from the plant, construct a condensation trap of pipe fittings and install it at the point where the upward pitch begins.

UNDERGROUND MUFFLER.— If exhaust noise will be objectionable, an underground exhaust chamber may be constructed. Do not use an underground exhaust chamber if there is danger of its filling with water at any time. A heavy 15 gallon drum may be used, with suitable pipe fittings welded in place. Do not use a drum which contained any inflammable liquid. Remove the bottom of the drum, or drill holes in the bottom to allow condensation to drain away. The outlet pipe should extend at least 24" above ground, with a gooseneck fitting on the end.

PORTABLE INSTALLATION.— The manual type plant is particularly adaptable to portable applications. Install the muffler directly to the engine exhaust outlet. The plant may be mounted on a dolly, trailer or suitable platform. Make sure the plant will set level when it is in operation. Protect it as much as possible from the elements.

FUEL TANK, REMOTE TYPE PLANT.— The remote control type plant is supplied with a separate 5 gallon (U. S. Measure) fuel tank which may be placed at any convenient location which is not lower than 4 feet

INSTALLATION

below the fuel pump on the plant. Install the shut-off valve in the bottom opening of the tank. Connect the fuel line between the fuel tank shut-off valve and the fuel pump inlet, being sure to start threads straight. Tighten all connections well to avoid any air leak which would prevent the fuel pump from drawing gasoline from the tank.

BATTERY, REMOTE TYPE PLANT.- The battery supplied with a plant intended for ultimate use in the United States is ready for immediate use. Check the battery for charge condition, following the directions supplied with the hydrometer. A battery supplied with a plant which was boxed for export shipment must be prepared for service as directed on the tag attached to the battery. Connect one of the two battery cables between the positive (+) battery post and the BATTERY POSITIVE terminal on the control box of the plant. Connect the other battery cable between the negative (-) battery post and the BATTERY NEGATIVE terminal on the control box. A 12 volt battery is used. If two 6 volt batteries are used, connect a short cable between the positive post of one battery and the negative post of the other battery.

WIRING.- If necessary to install wiring between the plant and the load, check local and national electrical codes, or consult a competent electrician. Use sufficiently large, insulated wire between the plant and the load. The size of the wire will depend upon the distance and permissible voltage drop between the plant and the load. Install a fused main switch in the load line near the plant.

GROUNDING THE PLANT.- If grounding is called for in local codes, or if radio interference necessitates it, provide a separate ground. Drive a 1/2" diameter pipe or rod into the ground as near to the plant as possible. Make certain that the pipe or rod penetrates moist earth. Fasten an approved ground clamp to the pipe and run a number 14 or larger wire from the clamp to either the BATTERY NEGATIVE terminal on the plant control box or to the white (ground) load line wire. Radio interference may result if the plant is grounded to a water pipe or to a ground used by a radio.

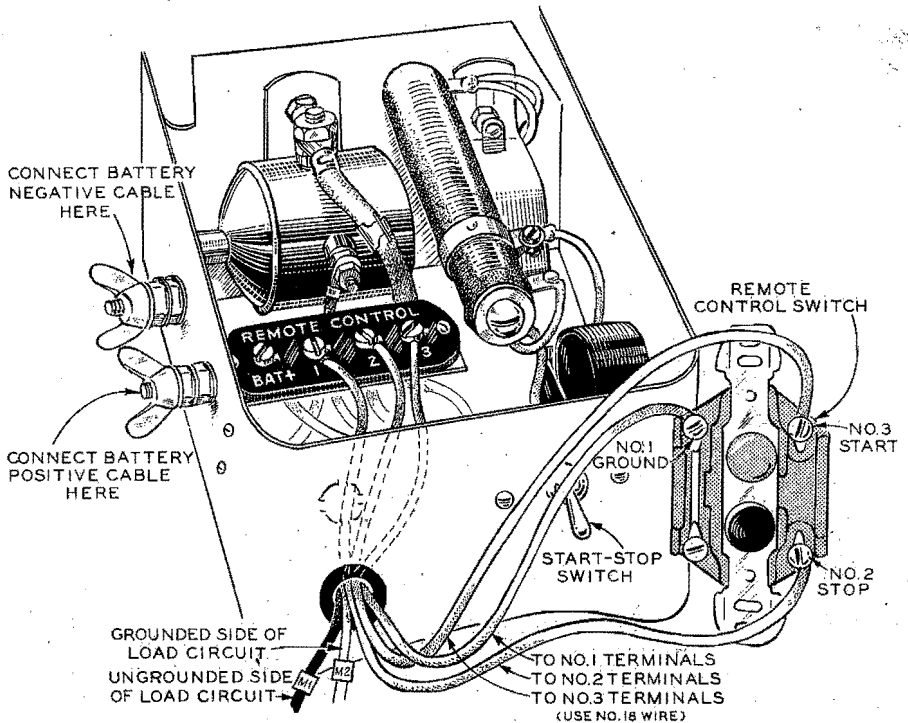
REMOTE CONTROL CONNECTIONS.- One or more remote control switches may be connected to provide remote starting and stopping, or automatic or line transfer equipment may be connected. Remote switches may be connected within 250 feet of the plant, using #18 three wire cable (see the parts list). Connect switch terminals #1, 2, and 3 to the corresponding small terminals marked 1, 2, and 3 inside the control box. Be sure switch terminal #1 is connected to box terminal #1, switch terminal #2 to box terminal #2, etc. The B+ terminal is used only with automatic or line transfer equipment, directions for which are included with the equipment.

CONNECTING THE LOAD WIRES.- Connect the load wires to the remote control plant by connecting the grounded (white) load wire to the lead marked M2 (or the white wire if unmarked) which extends from the control box. Connect the black (ungrounded) load wire to the control box lead marked M1, or the black wire. Be sure that connections are made tight and are separately taped with electrical rubber tape, and then secured with friction tape. Leave the load line switch open until the plant has been started and checked. No damage to the generator will result from running the plant with no load connected.

INSTALLATION

The manual control plant is provided with an output receptacle at the side of the generator. No preliminary connections are necessary when installing the plant.

OIL DRAIN EXTENSION.— An oil drain extension is provided for convenience and cleanliness in draining the oil from the oil base. Before filling the crankcase with oil, remove the oil drain plug from the oil and mounting base and install the pipe nipple and coupling in its place. Install the drain plug in the coupling. When draining the oil remove only the plug.



CONTROL BOX CONNECTIONS

PREPARATION

BEFORE THE PLANT IS PUT INTO OPERATION, IT MUST BE SUPPLIED WITH PROPER OIL AND FUEL. COMPLY WITH THE FOLLOWING DIRECTIONS.

LUBRICATION.— The use of a heavy duty (detergent) type oil in the crankcase will increase the life of piston and rings, and its use is strongly recommended. Use two quarts (U. S. Measure) of oil to fill the crankcase to the top of the threads in the oil fill hole. Use 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 it is standing idle.

TEMPERATURE	SAE NUMBER
Above 90° F. (32° C.)	50
30° F. to 90° F. (-1° C. to 32° C.)	30
0° F. to 30° F. (-18° C. to -1° C.)	10
Below 0° F. (-18° C.) See ABNORMAL OPERATING CONDITIONS.	10 or LOW diluted with 10% kerosene

CAUTION

If a change is made to the use of a detergent type oil after using non-detergent oil in the crankcase, allow only one third the normal operating hours before changing oil for the next two change periods. Change oil at the regular intervals thereafter, as recommended under PERIODIC SERVICE.

When using a detergent type oil, always use oil of the same brand when adding oil between oil changes. When mixed together, detergent oils of different manufacturers sometimes form chemical compounds that are harmful to internal engine parts.

Place a drop or two of oil on the governor arm ball joint and at the point where the governor linkage engages the carburetor throttle arm.

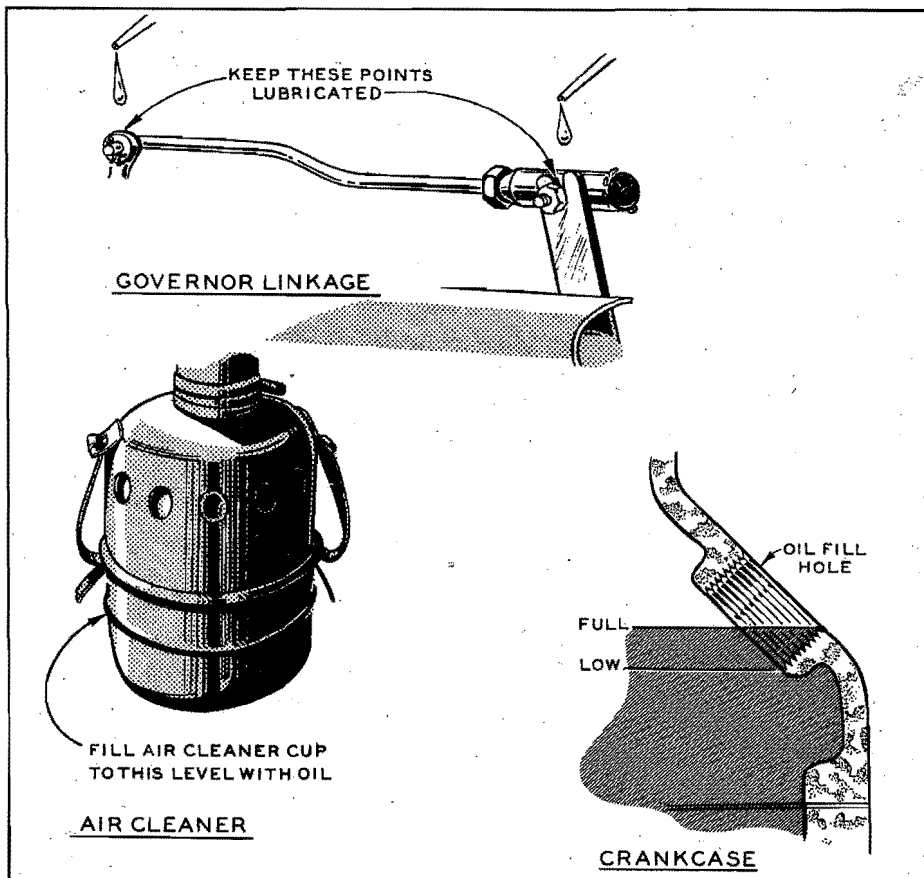
Remove the bottom cup of the air cleaner and fill to the indicated level with oil of the same SAE number as used in the crankcase. Replace the air cleaner cup, making sure the clamps snap properly into place.

FUEL.— The tank mounted on the manual type plant has a capacity of 1 gallon, U. S. Measure. The separate tank supplied with the remote control type plant has a capacity of 5 gallons, U. S. Measure. Fill the tank nearly full with clean, fresh, automotive type gasoline of 68 to 74 octane rating. Do not use a highly leaded premium type gasoline, as its use will necessitate more frequent carbon removal and spark plug and valve service. Do not fill the tank entirely full of cold gasoline, for expansion as the plant warms up may cause the gasoline to overflow and result in a fire. Observe the usual precautions when handling gasoline. NEVER FILL THE TANK WHEN THE PLANT IS RUNNING.

PREPARATION

Open the fuel shut-off valve and inspect the fuel system for leaks.

If the preceding instructions have been followed, the plant should be ready for operation. Before starting the plant, however, carefully study the sections OPERATION and ABNORMAL OPERATING CONDITIONS immediately following.



LUBRICATION

OPERATION

STARTING THE PLANT ELECTRICALLY - REMOTE CONTROL PLANT.- Before starting a new plant the first time, or one which has exhausted the gasoline in the carburetor, it will first be necessary to pump sufficient gasoline into the carburetor. If the fuel pump has no manual operating lever, pump the carburetor full of gasoline by cranking the engine either with the manual starting rope or by throwing the START-STOP switch to the START position. It usually takes approximately 30 revolutions of the crankshaft to properly fill the carburetor. Some plants are equipped with a fuel pump which has a manual operating lever. Use this lever to pump gasoline until the carburetor is properly filled, as evidenced by decreased lever action. Be sure to leave the manual lever pointing downward. If the lever is left pointing outward, it may hold the pump diaphragm down, causing failure of the pump to operate when the plant starts. If fuel does not reach the carburetor, inspect carefully for an air leak between the fuel pump inlet and the fuel tank. Be sure the fuel shut-off valve is open.

To start the plant, push the START-STOP toggle switch to the START position. The plant should start after a few revolutions. If it does not start after a few crankings of approximately 5 seconds each, check the fuel and ignition systems, correcting any trouble found. Release the switch as soon as the plant starts, making sure that the switch returns to the center position. If one or more remote control switches have been installed, check the installation by trying the START and STOP buttons in each remote control switch.

STARTING THE REMOTE CONTROL PLANT MANUALLY.- See that the carburetor is properly filled with gasoline as described above under **STARTING THE PLANT ELECTRICALLY**. Engage the knot of the starting rope in the notch of the flywheel rope sheave and wind the rope in a clockwise direction to within a few inches of the handle. Crank the engine with a strong, fast pull the full length of the rope. Avoid jerking the rope. Repeat as necessary. If the plant does not start readily, check the fuel and ignition systems, correcting any trouble found.

STARTING THE MANUAL TYPE PLANT.- The manual type plant has a gravity feed fuel system and a manual carburetor choke. The extent to which the carburetor will have to be choked for starting will depend upon temperature conditions. If the plant has been standing idle in cold weather, the choke control may have to be pulled all the way out. In hot weather, or if the plant has been stopped temporarily and is still warm when it is to be restarted, little or no choking should be required. Avoid overchoking. To start the plant, pull the choke control out as required, engage the knot of the starting rope in the notch of the flywheel rope sheave and wind the rope in a clockwise direction to within a few inches of the handle. Crank the engine with a strong, fast pull the full length of the rope. If the engine does not start after a few attempts, change the choke setting and repeat the cranking. As soon as the plant starts, push the choke control in to the point where the plant runs smoothly. As the plant warms up, gradually push the choke control in until the plant runs smoothly with the choke control at its innermost position.

OPERATION

CONNECTING THE LOAD.— Best results are obtained if the plant is allowed to thoroughly warm up before connecting a heavy load. Connect the load to the remote control type plant by throwing the main line switch to the ON position. If no main line switch was installed, throw the switch for the individual load to the ON position.

Connect the load to the manual type plant by inserting the load plug directly into the receptacle at the side of the generator. Turn the plug slightly to the right to lock the plug, thus preventing accidental disconnection. Some tools or appliances have a third wire for grounding purposes which should be connected to the grounding stud on the outlet box. Throw the switch for the individual load to the ON position.

CAUTION

Continuous overloading of the generator will cause the generator temperature to rise to a dangerous point and may lead to serious damage to the windings. The generator will safely handle an overload temporarily, but for continuous operation keep the load within the rating of the plant as shown on the name-plate.

BATTERY CHARGE RATE.— A toggle switch on the control box of the remote control type plant provides for control of the battery charging rate. The LO position of the switch provides a charge rate of approximately 2 amperes, which will keep the battery in a satisfactory state of charge under normal operating conditions. If frequent starts and short operating periods lead to the battery becoming discharged, throw the toggle switch to the HI position temporarily, returning to the LO position as the battery nears the fully charged condition. Check the charge condition of the battery frequently with a hydrometer.

STOPPING THE PLANT.— To stop the manual type engine, press the STOP button on the blower housing until the engine has come to a complete stop. To stop the remote control type plant, press the remote STOP button or throw the control box switch to the STOP position. The high tension magneto provides a firing spark even when the engine is turning at very few r.p.m. Release of the STOP button too soon will cause the plant to again pick up speed and continue to run. In an emergency, if the STOP button fails to work, the plant may be stopped by closing the fuel shut-off valve.

ABNORMAL OPERATING CONDITIONS

LOW TEMPERATURES

Lubrication and fuel require special consideration at temperatures below 0° F. or -18° C.

CRANKCASE LUBRICATION.— If the plant will be exposed to temperatures below 0° F. (-18° C.) when standing idle, use diluted oil in the crankcase as follows. Thoroughly mix 1/2 pint of kerosene with 2 quarts (U. S. Measure) of SAE number 10W oil. Drain the old oil from the oil base while the plant is warm. Replace the drain plug and refill the crankcase to the proper level with the diluted oil. Start the engine at once and run for at least 10 minutes to thoroughly circulate the mixture through the engine. Do not add kerosene to oil already in the crankcase in order to dilute the oil, and do not dilute a heavier oil than SAE number 10.

CAUTION

If an unexpected temperature drop causes oil in the crankcase to become too stiff to run freely from the oil drain, do not start the plant. Starting the plant when the oil is congealed may cause extensive damage due to lack of proper lubrication. Remove the plant to a warm location or apply heat externally until the oil in the crankcase will flow freely from the oil base drain. Then prepare and use diluted oil as explained above.

When using diluted oil in the crankcase, check the oil level frequently, adding oil and kerosene mixture to bring the level to the proper point. Change the crankcase oil at least every 50 operating hours when using diluted oil.

FUEL.— Fresh, winter grade, regular automotive type gasoline is an aid to starting in cold weather. Premium gasoline containing a high percentage of lead should not be used. Keep gasoline supplies free of moisture condensation. Do not fill the fuel tank completely full of cold gasoline, as expansion may cause it to overflow.

AIR CLEANER.— If congealed number 10W oil or frost formation within the air cleaner cup restricts the flow of air to the carburetor, remove and clean the air cleaner cup. Replace the cup and use without oil until conditions permit the use of oil in the normal manner.

COOLING.— The flow of air to the engine may be partially obstructed to keep the engine at operating temperature, if desired. However, use extreme care to avoid overheating.

IGNITION.— Cold weather starting is aided by a properly serviced ignition system. Keep the breaker points and spark plug clean and properly adjusted.

ABNORMAL OPERATING CONDITIONS

HIGH TEMPERATURES

LUBRICATION.- In temperatures above 90° F. (32° C.) use SAE number 50 oil. Keep the oil level close to the top threads of the oil fill hole, and change the oil at least every 100 operating hours.

COOLING.- It is extremely important to provide ample ventilation to assure proper cooling of the engine and generator. See that nothing obstructs the flow of air to and around the plant. The blower housing and cylinder air housing parts must be in place and undamaged.

DUST AND DIRT

Keep the plant as clean as practicable. Keep the oil and fuel supplies in airtight containers. Change the crankcase oil, clean the carburetor, and clean the air cleaner more frequently as conditions require. Keep the commutator, slip rings, and brushes clean and see that the brushes ride freely in their holders. Cooling fins must be kept free of dirt deposits to assure proper cooling. Change the crankcase oil more frequently if it becomes discolored before the normal time has elapsed between changes.

PERIODIC SERVICE

Follow a definite schedule of inspection and servicing to assure the best performance and long life of the plant. Service periods outlined below are for average service and normal operating conditions. Under unusual service or abnormal operating conditions, service the plant more frequently. Keep a record of the hours the plant is operated each day to assure servicing at the proper time.

DAILY SERVICE

If the engine is operated more than 8 hours daily, perform the following services each 8 hours of operation.

FUEL.- Check the fuel supply often enough to avoid running out of fuel. NEVER FILL THE FUEL TANK WHILE THE PLANT IS RUNNING. Use clean, fresh, regular automotive type gasoline of 68 to 74 octane rating. Use of a highly leaded premium grade of gasoline is not recommended.

CRANKCASE.- Remove the oil fill plug and check the crankcase oil level. If the oil level is below the bottom threads of the fill hole, add oil as necessary to bring the level to the top of the threads. Replace the plug securely.

AIR CLEANER.- Remove the air cleaner bottom cup and inspect the oil level inside the cup. Add sufficient oil to bring the oil level to the proper point.

CLEANING.- A clean plant will give more satisfactory service. Wipe off dirt and any spilled oil.

WEEKLY SERVICE

If the plant is operated more than 50 hours weekly, perform the following services each 50 hours of operation.

CRANKCASE.- If using diluted oil, or highly leaded gasoline, change the crankcase oil each 50 hours of operation. Under normal conditions and when using oil which is not diluted, change the crankcase oil each 100 hours of operation. Do not drain the oil when the plant has been standing idle. Run the plant until the oil is thoroughly warmed up, then stop the plant and drain the oil.

AIR CLEANER.- Remove the air cleaner bottom cup and clean out the old oil and sediment. Refill the cup to the proper level with fresh oil and replace. Use oil of the same SAE number as used in the crankcase, except as noted under ABNORMAL OPERATING CONDITIONS. Under dusty conditions, service the air cleaner more frequently.

GOVERNOR LINKAGE.- Put a drop or two of lubricating oil on the governor arm ball joint and at the point where the link engages the carburetor throttle arm.

PERIODIC SERVICE

SPARK PLUG.— Clean the spark plug and reset the gap to between .024" and .026". Test the plug on a plug testing machine, if available.

BATTERY.— If the plant uses a starting battery, keep the connections tight and clean. Keep the electrolyte level at approximately 3/8" above the separators by adding clean water. Distilled water is recommended for use in batteries. If distilled water is not obtainable, use clean soft water such as filtered rain water. Do not use water which contains alkali or minerals. Use the hydrometer to check the charge condition before adding water. In freezing weather, add water only before running the plant, to assure mixing the water with the electrolyte.

MONTHLY SERVICE

If the plant is operated more than 200 hours monthly, perform the following services each 200 hours of operation.

FUEL SYSTEM.— Drain the fuel tank and remove the shut-off valve and filter assembly. Carefully clean the filter screen. Tighten connections well when reassembling. Remove the plug from the bottom of the carburetor and drain the carburetor of any sediment which may have accumulated. Replace the plug securely.

MAGNETO BREAKER POINTS.— Remove the blower housing and the blower-flywheel. Inspect the magneto breaker points. Contact points which are not badly burned or pitted may be dressed smooth, using a fine abrasive stone or hone. If the points are pitted or burned deeply, replace them with new points. Excessive burning of the contact points is usually an indication of a defective condenser, which should be replaced with a new one. Adjust the gap between the points to between .018" and .022". Place a light coating of grease on the crankshaft cam which operates the magneto breaker arm.

ANTI-FLICKER BREAKER POINTS.— Keep the gap between the anti-flicker breaker points adjusted to between .023" and .025". Follow the same principles of care as given above for the magneto points.

EXHAUST SYSTEM.— Inspect all exhaust line connections carefully. Make any necessary repairs or replacements.

CARBON REMOVAL.— Regular removal of carbon deposits from the combustion chamber helps to keep engine efficiency high. The frequency with which it is advisable to remove carbon will vary considerably with the type of fuel used, the type of oil used and operating conditions. Use of highly leaded gasoline necessitates frequent removal of carbon from the cylinder head, top of piston and valves and top surface of the cylinder block.

GENERATOR.— Check the condition of the commutator, collector rings, and brushes. Replace brushes worn to 5/8" or less in length. Clean the commutator and collector rings with a lint free cloth moistened with cleaning solvent. The commutator and collector rings may be lightly sanded with #00 sandpaper if necessary. Do not use emery or carborundum cloth or paper. See that all connections are tight. Remove carbon dust from the brush rig and end bell.

PERIODIC SERVICE

CONTROL BOX.— Keep the control box of the remote control plant free of dust and dirt. Clean the relay contacts with a piece of hard finish paper drawn through the points. See that connections are tight and clean. Replace with a new one any part which fails to function properly.

GENERAL.— Thoroughly inspect the entire plant for loose connections, loose screws or nuts, oil leaks, etc. Make any necessary repairs.

SIX-MONTHLY SERVICE

Each six months or 1200 operating hours, whichever occurs first, renew the generator bearing grease as follows.

GENERATOR BEARING.— Clean all dirt from around the large expansion plug at the rear of the generator and pry out the plug. With a clean finger remove all the old lubricant and work approximately one tablespoonful of new bearing lubricant into the bearing. Again clean out the bearing, then refill about 1/2 full, packing the lubricant well into the lower half of the bearing. Use only a good ball bearing lubricant, such as that supplied with the plant. Take care to avoid getting any dirt into the bearing. Replace the large plug, using a new plug if necessary.

ADJUSTMENTS

ANTI-FLICKER MECHANISM.— Breaker points and a field resistor are used to compensate for a surge in the voltage during the power stroke of the engine. The breaker points are located on the left side of the crankcase just behind the gear cover and are protected by a sheet metal cover. Loosen the governor arm ball joint and swing the link to one side. If the plant has a fuel pump, remove the fuel pump inlet elbow. The anti-flicker mechanism cover can then be removed. The resistor is mounted in a recess at the bottom left hand side of the adapter casting joining the generator to the engine.

Before changing the position of the sliding contact on the resistor, make sure that the engine r.p.m. is correct. This should be 1800 r.p.m. for 60 cycle plants, or 1500 r.p.m. for 50 cycle plants. Readjust the governor if necessary. If r.p.m. is correct, check the breaker contact points. They should be clean, not burned or pitted, and the gap at full separation should be .023" to .025". A defective condenser would cause excessive flicker.

If r.p.m. is correct and points and condenser are in good condition and flicker is still objectionable, adjust the resistor as follows. Apply the average electrical load to the plant. Loosen the sliding clip on the resistor and, while watching a light connected to the plant load, slide the clip along the resistor to the position where the least flicker is noticeable. Tighten the clip in this position.

GOVERNOR.— A voltmeter and frequency meter (or tachometer) will prove helpful in setting the governor correctly. The governor arm is fastened to a shaft extending from the gear cover and is connected by a ball joint and link to the carburetor throttle arm.

If the governor fails to function properly, check to see that there is no binding or looseness in the mechanism. A binding in the bearings of the shaft extending from the gear cover, in the ball joint, or in the carburetor throttle assembly would cause sluggish governor action or poor regulation. Looseness or excessive wear in the ball joint or carburetor throttle assembly may cause erratic governor action or alternate increase and decrease in speed (hunting).

To adjust the governor proceed as follows, with the plant stopped. See that there is tension on the governor arm spring. If necessary, adjust the length of the connecting linkage so that the carburetor throttle arm is pushed toward the generator end of the plant. The carburetor throttle shaft stop bracket should just touch the stop projection on the throttle shaft boss, or clear it by not more than 1/16". The linkage may be lengthened or shortened as necessary to obtain this setting by turning the ball joint on the threads of the link. Be sure to retighten the ball joint securely to the governor arm. The governor action is now synchronized with the carburetor throttle action.

Start the plant and run without load temporarily. Adjust the speed to slightly above normal by turning the spring tension adjusting nut clockwise to increase the speed or counterclockwise to decrease the speed. Apply the average electrical load to the generator and make any necessary correction for speed. Use the frequency meter or tachometer to determine speed.

ADJUSTMENTS

Test the speed and generator voltage at various electrical loads. If the governor permits the engine to run too fast at light or no load condition and too slow at full load condition, adjust the sensitivity adjusting stud to bring the governor arm end of the spring closer to the center of the governor arm shaft. If speed regulation is good but there is a tendency toward hunting (alternate increase and decrease in speed), turn the sensitivity adjusting stud to increase the distance between the spring end and the arm shaft. Any adjustment of the sensitivity stud will require correcting the speed. Keep the sensitivity stud adjusted to give the best sensitivity without hunting. At full load, the voltage should be approximately 110 volts, and at no load approximately 126 volts for a 115 volt plant. Voltages will be correspondingly higher for a 230 volt plant, or approximately 225 volts to 250 volts.

Springs of all kinds have a tendency to lose their calibrated tension through fatigue, after long service. If the governor action is still erratic after all adjustments are carefully made, installation of a new governor spring and correcting the adjustments will usually correct the trouble.

CARBURETOR CHOKE.— The remote control type plant is equipped with a thermal action automatic carburetor choke. A thermostatic coil engages the carburetor choke shaft and is set at the factory to give the correct choking action for average temperature conditions. When the plant starts, the thermal coil is slowly heated by a small electrical heating element in the choke assembly cover, which receives current from the generator. As the plant warms up, the thermal coil gradually turns the choke shaft, opening the choke until it is wide open. When the plant is stopped, no heat is applied to the thermal coil and it gradually cools off, causing the choke shaft to return to the correct position for the next start.

If extreme temperature conditions require readjusting the choke, loosen the screw which locks the choke assembly on the carburetor choke shaft boss. For a leaner choke mixture turn the choke assembly slightly in a counterclockwise direction, looking at the thermal unit end. For a richer choke mixture, turn slightly in a clockwise direction. At 70° F. (21° C.) the choke plate inside the carburetor should be almost closed, the edges of the plate approximately 1/16" from the sides of the carburetor barrel. Be sure to retighten the clamp screw securely.

A manual operating knob fastened to the opposite end of the choke shaft may be used in the event the electric element burns out or the choke becomes inoperative for any reason. When facing the manual knob, turn the knob clockwise to choke the carburetor. Turn the knob counterclockwise to lessen choking action. The choke is completely closed when the knob is turned clockwise as far as possible. The choke is completely open when the knob is turned counterclockwise as far as possible.

If the choke fails to operate properly, check to see that the heating element heats properly. There must be no binding of the choke shaft or thermal coil.

BATTERY CHARGE RATE.— The battery charge rate with the toggle switch in the HI position may be reduced, if desired. Loosen the sliding clip on the resistor inside the control box and move the clip toward the end of the resistor to which the lead from the ammeter is attached. Retighten the sliding clip at the point where the ammeter shows that the desired charging rate has been attained.

ADJUSTMENTS

CARBURETOR.— Some carburetors are of the fixed jet type. On other carburetors, the main jet is fitted with an adjusting needle assembly. To adjust the needle, proceed in the following manner. Turn the adjusting needle in (clockwise) until it seats gently. Do not force the needle to a tight seat, or it may be permanently damaged by doing so. Turn the needle out (counterclockwise) one full turn, then start the plant. Allow the plant to warm up thoroughly and apply the full electrical load to the plant. Turn the adjusting needle slowly in until the engine begins to lose speed from lack of fuel. Slowly turn the needle out until the plant will carry the full load smoothly. Check the operation at various loads. If there is a tendency to hunt (alternate increase and decrease in speed) at any load, turn the adjustment slowly out until the hunt is corrected, but do not turn the needle out more than one half turn beyond the point where maximum generator output is obtained. If a hunt continues after proper carburetor adjustment is made, refer to GOVERNOR in this section.

A small piece of foreign matter lodging in a jet may cause hard starting and poor operation. Dirty gasoline may cause the jets to wear larger, resulting in excessive gasoline consumption. Refer to MAINTENANCE AND REPAIR - CARBURETOR if it becomes necessary to remove the carburetor for repairs.

MAINTENANCE AND REPAIR

ENGINE

GENERAL.-- Refer to the Service Diagnosis section for assistance in locating and correcting troubles which may occur. If a major repair or overhaul becomes necessary, the engine should be carefully checked and necessary repairs made by a competent mechanic. Major generator repairs should be made by a competent electrician. Maintain factory limits and clearances as given in the Table of Clearances.

CARBURETOR.-- Carburetor maintenance should consist of regular cleaning. Some types of gasoline have a tendency toward formation of gum deposits inside the carburetor. This gum can usually be removed by the use of alcohol or acetone. Jets should be removed, soaked in alcohol or acetone and cleaned by a stream of compressed air. Some carburetors have an adjustable main jet. On other carburetors the main jet is not adjustable, the main jet adjustment being replaced by a hexagon head plug. The main jet can be removed after first removing either the main jet adjustment or the plug near the bottom of the carburetor, as the case may be. The compensator jet is accessible inside the carburetor bowl after first removing the bowl cover. When replacing jets, be sure the small fibre gasket is replaced under the head of each jet. When reinstalling the main jet adjustment use care not to force the adjusting needle tight into the jet, as the needle may be damaged by doing so. Check the float and its axle for wear. Replace the fuel inlet valve assembly with a new one if there is a noticeable ridge worn on the valve needle. See that the throttle assembly works freely. Replace a worn throttle shaft with a new shaft and lever assembly.

FUEL PUMP.-- The fuel pump is similar in principle to those used on most automobiles. A "pin hole" in the diaphragm, stuck valve, broken diaphragm spring, or wear in the linkage may cause failure of the pump. An air leak at any point between the pump inlet and the fuel supply will prevent the pump from pumping gasoline to the carburetor. To remove the diaphragm assembly, turn $1/4$ turn in either direction. Replacing the diaphragm assembly is made easier if a small flat tool or screw driver is used to pry the small link upward while engaging the diaphragm pull rod with the link. Some fuel pumps have a manual operating lever which is used to pump gasoline to the carburetor if the fuel system has been drained for any reason. This manual lever must be left in a vertical position when through using it. If the lever is left at an angle, the diaphragm is held down and the pump will not operate.

VALVE SERVICE.-- Properly seating valves are essential to good engine performance. Do not use a pry to loosen the aluminum cylinder head. Rap sharply on the edge with a soft faced hammer, taking care not to break any cooling fins. Clean all carbon deposits from the cylinder head, piston top, valves, guides, etc. If a valve face is badly burned or warped, or the stem worn, install a new valve.

Valve guides are replaceable from inside the valve chamber. When installing a new intake valve guide, be sure the shoulder gasket contacts tightly against the upper surface of the valve compartment. Tappets are removable from the valve compartment, after first removing the valve assemblies.

Reface valve seats and faces to a 45° angle. Grind only enough to assure a good seal. Be sure to reassemble each valve to its proper seat. Remove all traces of grinding compound. Before final reassembly of the valves, check the tappet clearances as directed below. Lightly oil the valves when reassembling.

MAINTENANCE AND REPAIR

TAPPET ADJUSTMENT.— The tappet clearances may be easily checked after removing the valve compartment cover and the blower housing. Crank the engine over by hand until the intake valve (the one nearest the carburetor) opens and closes. Continue cranking slowly until the TC mark on the flywheel is in alignment with the horizontal mark on the gear cover. Use a .014" feeler gauge for both the intake and exhaust valves. If a thicker feeler gauge will go between the end of the valve and the tappet, clearance should be reduced by grinding the face of the valve the correct amount. If clearance is not enough to permit an .008" feeler gauge to be inserted, grind off the valve stem and the correct amount. Grinding of either the valve face to reduce clearance, or the valve stem to increase clearance should be done only in an accurate valve grinding machine.

Some engines are equipped with adjustable tappets, which have a self locking adjusting screw. Turn the adjusting screw in or out to increase or decrease the tappet clearance as necessary.

MAGNETO.— The high tension magneto supplies ignition current to the spark plug. To test the spark, disconnect the cable from the spark plug and support it so that the end of the wire is 3/16" from a clean metal part, such as the spark plug base. Crank the engine with the hand rope, observing the spark, which should jump the 3/16" gap with ease. If the spark is weak or yellowish in color, repair as necessary.

Remove the blower housing and loosen the flywheel center bolt a few turns. While pulling outward on the flywheel, strike the flywheel bolt a sharp endwise blow to loosen the flywheel. Remove the flywheel and examine the magneto breaker points. Points which are not badly burned or pitted may sometimes be dressed smooth with a thin flexible abrasive stone or removed and dressed on any fine stone or hone. Badly pitted points should be replaced with new ones. Adjust the gap between points to .018" to .022" at full separation. A defective condenser must be replaced with a new one of proper capacity. Check all connections, making sure that all are tight and clean. A defective coil should be replaced with a new one. A flywheel magnet which has lost its magnetism through being dropped can be remagnetized. If the magneto backplate has been loosened or removed, see that the gap between the coil pole shoe and the flywheel is .004" to .008". Too wide an air gap would produce a weak thin spark.

TIMING THE IGNITION.— Proper timing of the spark is important, and is timed to occur 19° before top center (BTC) position of piston travel. If available, use a series type test lamp for accuracy.

See that the point gap is properly adjusted to .018" to .020". Install the flywheel loosely, with its key in place, and turn the flywheel in a clockwise direction to the position where the 19° degree mark on the edge of the flywheel is in alignment with the horizontal mark on the gear cover. The points should just separate at this point. If they do not, remove the flywheel and loosen the magneto backplate mounting screws slightly. If the points do not separate soon enough, shift the entire backplate assembly slightly in a counterclockwise direction. If the points separate too soon, shift the

MAINTENANCE AND REPAIR

backplate assembly clockwise. Retighten the backplate mounting screws and recheck the work for accuracy. When replacing the fly-wheel, always make sure the key is properly in place on the crankshaft.

GEAR COVER.- When removing the gear cover, it is not necessary to remove the magneto assembly from the cover. Just disconnect the spark plug lead at the spark plug, and the stop wire at either the blower housing stop button or the control box connection, as the case may be.

When installing the gear cover, make sure that the pin on the governor cup engages the slot of the governor arm yoke. Turn the governor cup so that the pin is in a position where it corresponds to the 6 o'clock position on the face of a clock. Turn the governor arm and shaft clockwise as far as possible and hold in this position until the gear cover is installed flush against the crankcase. Check to see if the pin and yoke are properly engaged by pulling outward on the arm and shaft. If the shaft can be pulled outward more than 1/2 inch the pin is not in the yoke slot and the installation procedure must be repeated. Be careful not to damage the gear cover oil seal.

GOVERNOR CUP.- The governor cup may be removed from the cam gear and shaft after first removing the small lock ring from the camshaft center pin. Catch the governor flyballs in the hand as the cup assembly is removed.

If a new governor cup is being installed, the distance from the small lock ring on the center pin to the face of the governor cup sleeve must be exactly 7/32" when the cup is pressed back against the flyballs as far as possible. If the distance is too small, carefully dress the face of the sleeve as required, being sure to remove any burr from the inside of the sleeve. If the distance is more than 7/32", carefully press the pin in the required amount. Be very careful not to damage the pin, as it is not practicable to replace it in the field. Replacement of governor flyballs is easier if the plant is tipped backward with the timing gears upward. Be sure that all 10 flyballs are replaced.

TIMING GEARS.- If replacement of either the crankshaft gear or the camshaft gear becomes necessary, install both gears new, never one only. To remove the crankshaft gear, insert two long #10-32 steel screws into the tapped gear holes and tighten the screws alternately. As the screws are tightened, the screw ends will seat against the crankshaft shoulder and force the gear off the end of the crankshaft.

The camshaft gear is pressed on and keyed to the camshaft. The camshaft and gear must be removed as an assembly, after first removing the crankshaft gear lock ring and washer. Before removing the camshaft and gear assembly, remove the anti-flicker breaker arm plunger from the side of the crankcase and remove the cylinder head. The valves and tappets must be lifted high enough for the tappets to clear the rear camshaft bearing journal. After removing the governor cup assembly from the gear, the camshaft may be pressed out of the gear by use of a hollow tool or pipe which will fit over the

MAINTENANCE AND REPAIR

camshaft center pin. Do not press on the center pin, or damage it in any way. The governor ball spacer is a press fit to the camshaft gear.

If either the crankshaft gear or camshaft gear becomes damaged or worn, replace both gears with new ones, never one only. When pressing a camshaft gear onto the camshaft, be sure the gear is started straight and that the key is properly in place. Install the governor cup assembly before installing the camshaft and gear in the engine.

Note that timing gears are each stamped with an "O" mark. These marks must coincide when the gears are installed. Be sure the thrust washer is in place behind the camshaft gear. Replace the crankshaft washer and lock ring.

CYLINDER.— If the cylinder wall becomes worn or scored, the cylinder may be refinished to accommodate a new piston and rings of one of the available oversizes listed in the parts list. If the cylinder is not being refinished, but new piston rings are being installed, remove any ridge which may have become formed at the top of the cylinder bore.

PISTON AND RINGS.— The piston and connecting rod assembly are removed through the top of the cylinder. The piston is fitted with two compression rings and one oil control ring. The piston ring grooves should be cleaned of any carbon deposits, and the oil return holes in the lower groove must be open. Before installing new rings on the piston, check the ring gap by placing each ring squarely in the cylinder at a position corresponding to the bottom of its travel. The gap between the ends of the ring should be from .008" to .013". Rings which are slightly oversize may be filed as necessary to obtain the correct gap, but do not use rings which require too much filing. Standard size rings may be used on a .005" oversize piston. .010" and .025" oversize rings are to be used on .010" and .025" oversize pistons, respectively. Rings of the tapered type are usually marked "TOP" on one side, or identified in some other manner, and the ring must be installed with this mark toward the closed end of the piston. Space each ring gap one third of the way around the piston from the preceding one, with no gap directly in line with the piston pin. The bottom piston ring groove should be fitted with an oil control ring and the two upper grooves fitted with compression rings.

The piston is fitted with a full floating type piston pin. The pin is kept in place by two lock rings in the piston, one at each side. Be sure these lock rings are properly in place before installing the piston and connecting rod in the engine. Correct piston to cylinder clearance is .003" to .0045".

CONNECTING ROD.— Mark the connecting rod before removing it to assure reassembling with the same side facing the camshaft. Note that the oil dipper is installed so as to splash oil towards the camshaft side of the engine.

The connecting rod bearing clearance to the crankshaft journal may be reduced as necessary by carefully dressing the cap on a sheet of abrasive cloth placed flat on a surface plate or piece of plate glass.

MAINTENANCE AND REPAIR

The connecting rod and piston assembly must be properly aligned before reassembly to the engine. The aligning should be done on an accurate aligning gauge by a competent operator. Misalignment may cause rapid wear of piston, pin, cylinder and connecting rod.

Be sure the connecting rod oil dipper is properly installed, as it is vital to proper lubrication.

MAIN BEARINGS.— The sleeve type aluminum alloy main bearings are flanged to take the crankshaft and thrust. Because of their extra large size they seldom need replacing. If replacement does become necessary, the bearings must be pressed in, the generator adapter assembled to the crankcase, and the bearings line bored or reamed to correct size. Replacement of the bearings should not be attempted if the proper equipment is not available. Proper crankshaft end play is .006" to .008" and is obtained by using the correct thickness of gaskets between the generator adapter and the crankcase.

CAMSHAFT BEARINGS.— The steel backed, babbitt lined camshaft bearings are not flanged. These bearings, as with the crankshaft bearings, must be line bored after being pressed into the crankcase. Replacement of the camshaft bearings is not practicable without the proper equipment.

VALVE COMPARTMENT OIL DRAIN.— A drain tube extends from the valve compartment to the bottom of the crankcase. This tube must be unobstructed to provide for proper drainage of oil from the valve compartment.

OIL SEALS.— When replacing either crankshaft oil seal, be sure the open side faces toward the inside of the engine. Use care not to turn back the leather edge of the oil seal or damage it in any way. The adapter between the engine and generator must be removed to replace the rear oil seal. Remove the gear cover to replace the front oil seal.

TABLE OF CLEARANCES

	<u>MINIMUM</u>	<u>MAXIMUM</u>
Tappets - Intake and Exhaust - Cold		.014"
Valve Seat Width	.047"	.078"
Valve Stem in Guide - Intake	.0015"	.003"
Valve Stem in Guide - Exhaust	.003"	.0045"
Crankshaft Bearing	.002"	.003"
Camshaft Bearing	.001"	.003"
Crankshaft End Play	.006"	.008"
Connecting Rod Bearing	.0015"	.0025"
Piston Pin in Piston - 72° F.	Hand Push Fit	
Piston Pin in Rod - 72° F	Thumb Push Fit	
Piston to Cylinder	.003"	.0045"
Piston Ring Gap	.008"	.013"
Magneto Breaker Point Gap	.018"	.022"
Anti-Flicker Point Gap	.023"	.025"
Spark Plug Gap	.024"	.026"
Magneto Pole Shoe Air Gap	.004"	.008"
Ignition Timing	19° B.T.C.	
Cylinder Head Nut, Torque	23-25 lb.ft.	
Connecting Rod Bolt, Torque	18-20 lb.ft.	

MAINTENANCE AND REPAIR

GENERATOR

BRUSH REPLACEMENT.— Install new brushes when the old ones are worn to 5/8" or less in length. It is not necessary to remove the end bell or brush rig to install new brushes. Unsnap one end of the end bell cover band and remove the band. The brushes and leads are then easily accessible. New brushes are shaped to fit the commutator or collector rings and seldom require sanding to seat properly. Be sure to retighten the brush lead terminal nuts securely. Each commutator brush should be installed in its guide with the lead toward the open side of the guide. If brush sparking occurs after replacing brushes, run the plant at a light load until the brushes have worn to a good seat.

BRUSH RIG POSITION.— The position of the brush rig inside the end bell is important. This position was carefully set at the factory and is identified by a reference mark on the armature bearing hub in alignment with a similar mark on the end bell. If either the brush rig or bearing hub is removed for any reason, these marks must be properly realigned. Improper brush rig position may cause the generator temperature to rise to a dangerous point, leading to extensive damage to generator windings. Excessive sparking will cause rapid burning or pitting of the commutator. If a new brush rig is installed, it may be necessary to adjust the position to the point where the least sparking occurs at the average load. Loosen the four hub retaining screws a few turns and turn the hub, to which the brush rig is mounted, to the proper neutral position. Be sure to retighten all four hub screws securely.

GENERATOR DISASSEMBLY.— The generator is simple in construction and offers no unusual problems if it becomes necessary to remove it. Remove the end bell cover band and lift all brushes high in their guides so that each brush is held away from contact with the commutator or collector rings by spring pressure against its side.

Leads which are disconnected should be tagged to insure correct replacement. After removing the two acorn nuts, the end bell and frame may be removed as a unit, or the two may be separated to gain access to the brush rig. The armature has an external taper which fits into an internal taper of the engine crankshaft. To remove the armature, loosen the through stud nut even with the end of the stud and while pulling outward on the armature, strike the stud and nut a sharp end-wise blow with a heavy soft faced hammer. After removing the blower shroud retaining screws and the stud nut, slide the armature carefully off the through stud.

When reassembling the generator, be sure to line up the notch and pin on the edges of the adapter, generator frame and the end bell. Note that a small spring clip on the edge of the armature ball bearing must fit into a slot in the bearing hub.

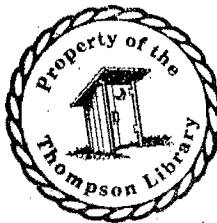
COMMUTATOR AND COLLECTOR RINGS.— The commutator and collector rings acquire a glossy brown finish in normal operation. Do not attempt to maintain a bright, newly machined appearance. Slight roughness may be removed by light sanding with very fine sandpaper, #00.

MAINTENANCE AND REPAIR

After a long period of service the surface of the commutator may become worn to such an extent as to permit the mica insulation between the bars to contact the brushes, causing rapid brush wear, sparking, and noisy brush operation. When this condition exists the mica between the bars should be cut down to $1/32$ " below the surface of the bars. This may be done with a tool fashioned from a hack saw blade, grinding the blade to a thickness equal to the width of the mica between the commutator bars. Be very careful not to scratch the surface of the bars. Remove any burrs left along the edges of the bars.

CONTROL BOX EQUIPMENT.— Disconnect the battery before touching any control box equipment. An adjustable resistor inside the control box regulates the charging rate to the battery when the toggle switch is in the HI position. If desired, the high charge rate may be adjusted by moving the sliding clip toward the end to which two leads are attached to raise the charge rate or by moving the clip toward the end to which the ammeter lead is attached to lower the charge rate.

Do not attempt to repair such units as meters, relays, resistors, switches, etc. Keep the control box free of dust. Do not use a file or abrasive on relay contact points. Keep all connections clean and tight.



SERVICE DIAGNOSIS

POSSIBLE CAUSE

REMEDY

GENERATOR WILL NOT CRANK ENGINE (REMOTE CONTROL TYPE PLANT)

Battery discharged.	Recharge.
Loose connections.	Tighten connections.
Defective starting circuit.	Repair or replace as necessary.
Defective switch.	Replace.

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, plug, condenser, etc., or retime magneto.
Lack of fuel or faulty carburetion.	Refill the tank. Check the fuel system. Clean, adjust, or replace parts necessary.
Clogged fuel screen.	Clean.
Cylinder flooded.	Crank few times with spark plug removed.
Poor fuel.	Drain, refill with good fuel.
Poor compression.	Tighten cylinder head and spark plug. If still not corrected, grind the valves. Replace piston rings, if necessary.
Wrong timing.	Reset breaker points or retime magneto.

ENGINE RUNS BUT VOLTAGE DOES NOT BUILD UP

Poor commutation.	See that brushes seat well on commutator, are free in holders, are not worn shorter than 5/8 inch, and have good spring tension.
Open circuit, short circuit, or ground in generator.	See GENERATOR. Replace part necessary.

SERVICE DIAGNOSIS

POSSIBLE CAUSE

REMEDY

EXCESSIVE OIL CONSUMPTION, LIGHT BLUE SMOKY EXHAUST

Poor compression, usually due to worn piston, rings, or cylinder.	Refinish cylinder. Replace piston and rings.
Oil leaks from oil base or connections. This does not cause smoky exhaust.	Replace gaskets. Tighten screws and connections.
Oil too light or diluted.	Drain, refill with correct oil.
Worn engine.	Repair as necessary.
Worn intake valve guide or valve stem.	Replace.
Engine misfiring.	Refer to symptoms of engine misfiring.
Faulty ignition.	Clean, adjust, or replace breaker points, plug, condenser, etc., or retune magneto.
Too much oil.	Drain excess oil.

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

Fuel mixture too rich.	Adjust carburetor or choke. Install needed carburetor parts.
Choke not open.	See that choke opens properly.
Dirty air cleaner.	Clean.

LIGHT POUNDING KNOCK

Loose connecting rod bearing.	Adjust or replace.
Low oil supply.	Add oil.
Oil badly diluted.	Change oil.

ENGINE STOPS UNEXPECTEDLY

Fuel tank empty.	Refill.
Defective ignition.	Check the ignition system. Repair or replace parts necessary.

SERVICE DIAGNOSIS

POSSIBLE CAUSE

REMEDY

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

Loose crankshaft bearing.

Replace unless one of the next two remedies permanently corrects the trouble.

SHARP METALLIC THUD, ESPECIALLY WHEN COLD ENGINE FIRST STARTED

Low oil supply.

Add oil.

Oil badly diluted.

Change oil.

PINGING SOUND WHEN ENGINE IS SUDDENLY OR HEAVILY LOADED

Carbon in cylinder.

Remove carbon.

Spark too early.

Adjust breaker points or retime magneto.

Wrong spark plug.

Install correct spark plug.

Spark plug burned or carboned.

Install new plug.

Valves hot.

Adjust tappet clearance.

Fuel stale or low octane.

Use good fresh fuel.

Lean fuel mixture.

Clean and adjust carburetor.

Engine hot.

Check air circulation.

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 piston.

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 PLANT

Too small line wire for load and distance.

Install larger or extra wires or reduce load.

SERVICE DIAGNOSIS

POSSIBLE CAUSE

REMEDY

VOLTAGE 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, are free in their holders, are not worn shorter than $5/8$ inch, and have good spring tension.
Loose connections.	Tighten connections.
Fluctuating load.	Correct any abnormal load condition causing trouble.
Defective anti-flicker mechanism.	Adjust or replace as necessary.

ENGINE BACKFIRES AT CARBURETOR

Lean fuel mixture.	Clean or adjust carburetor.
Clogged fuel screen.	Clean screen.
Poor fuel.	Refill with good, fresh fuel.
Spark too late.	Adjust breaker points or retime magneto.
Intake valve leaking.	Grind or replace.

NOISY BRUSHES

High mica between bars of commutator.	Undercut mica.
---------------------------------------	----------------

EXCESSIVE ARCING OF BRUSHES

Rough commutator or rings.	Turn down.
Dirty commutator or rings.	Clean.
Brushes not seating properly.	Sand to a good seat.
Open circuit in armature.	Replace.
Brush rig out of position.	Line up properly.

SERVICE DIAGNOSIS

POSSIBLE CAUSE

REMEDY

GENERATOR OVERHEATING

Brush rig out of position.	Adjust.
Overloaded.	Reduce load.

VOLTAGE DROPS UNDER HEAVY LOAD

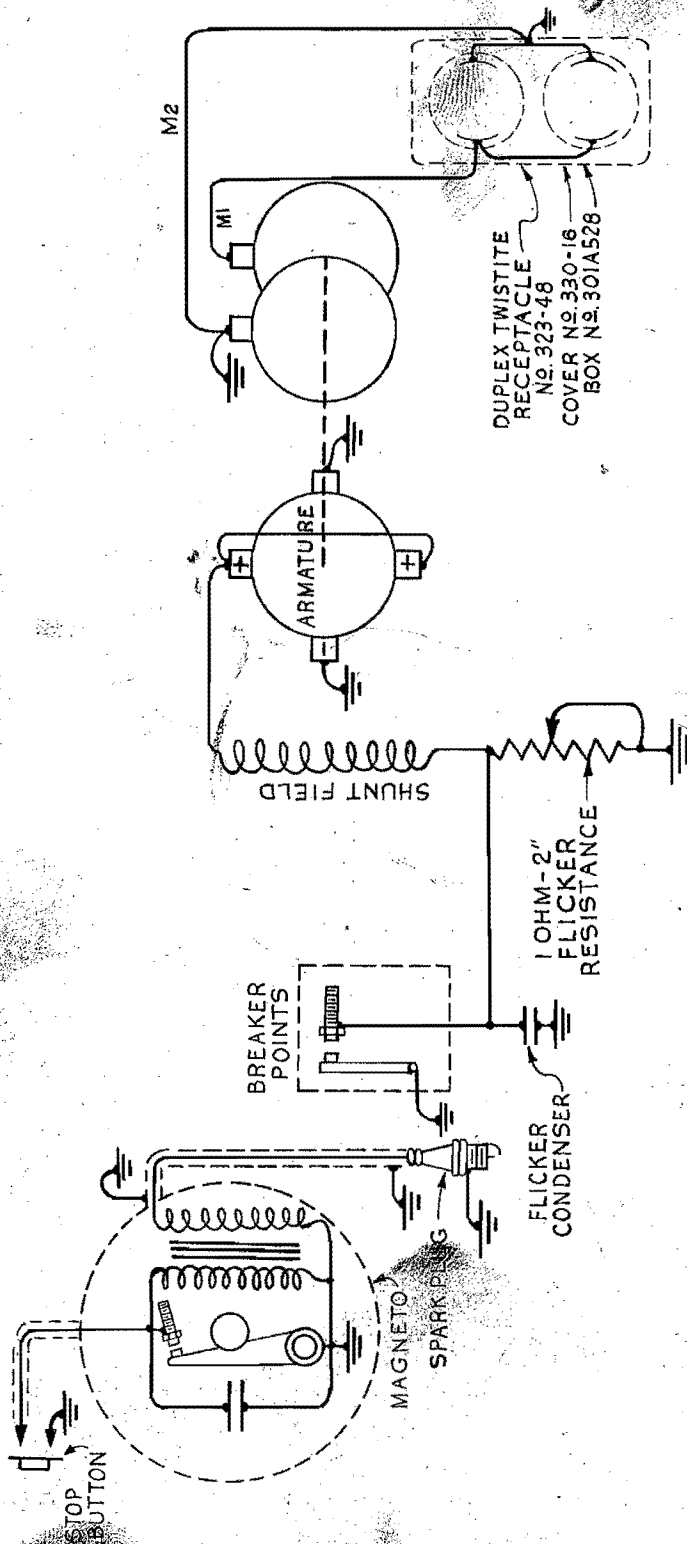
Engine lacks power.	See remedies for engine misfires under heavy load.
Poor Compression.	Tighten cylinder head and spark plug. If still not corrected, grind the valves. Replace piston rings, if necessary.
Faulty carburetion	Check the fuel system. Clean adjust or replace parts necessary.
Carburetor air cleaner.	Clean.
Choke partially closed.	See that it opens wide.
Carbon in cylinders.	Remove carbon.
Restricted exhaust line.	Clean or increase the size.

ENGINE MISFIRES AT LIGHT LOAD

Spark plug gap too narrow.	Adjust to correct gap.
Intake air leak.	Tighten or replace gaskets.
Faulty ignition.	Clean, adjust or replace breaker points, plug, condenser, etc., or retune ignition.
Low compression.	Tighten cylinder head and spark plug. If still not corrected, grind valves. Replace piston rings, if necessary.

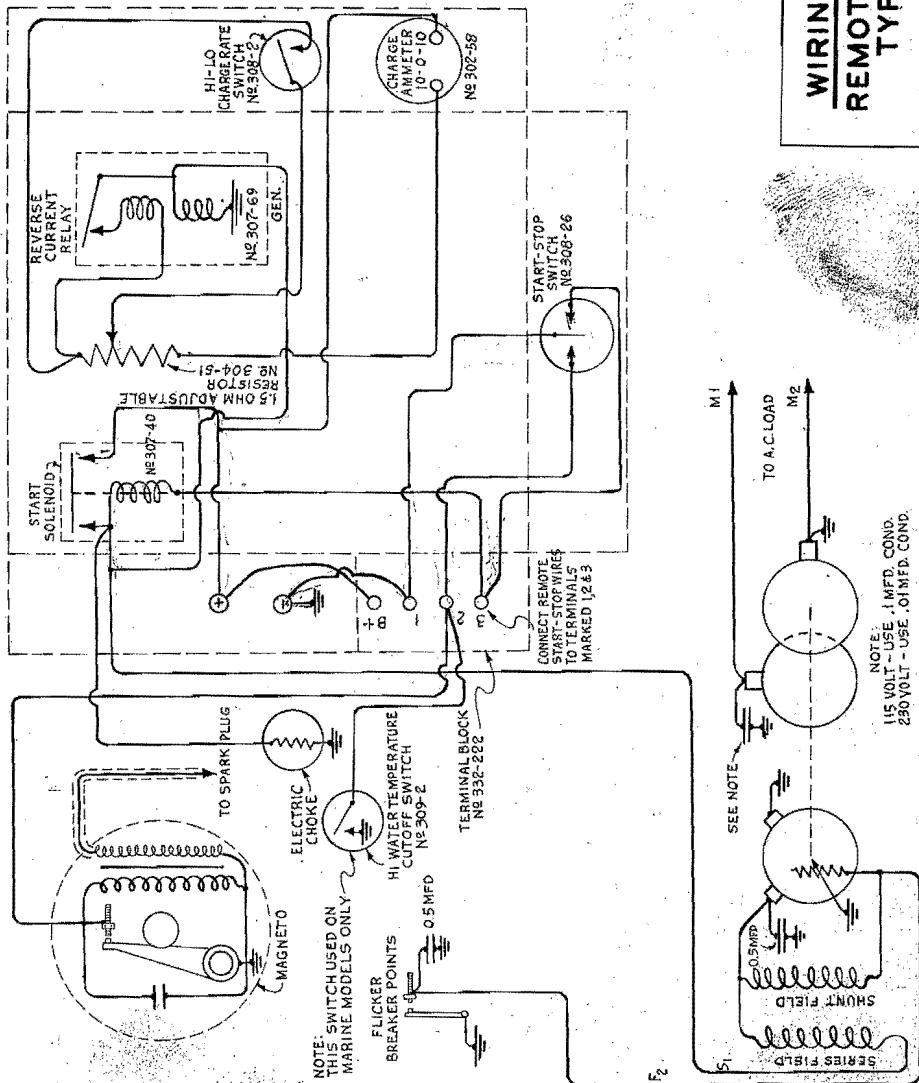
ENGINE MISFIRES AT HEAVY LOAD

Spark plug gap too wide.	Adjust gap.
Faulty ignition.	Clean, adjust, or replace breaker points, plug, condenser, etc., or retune magneto.
Clogged carburetor.	Clean jet.
Clogged fuel screen.	Clean.
Defective spark plug cable.	Replace.

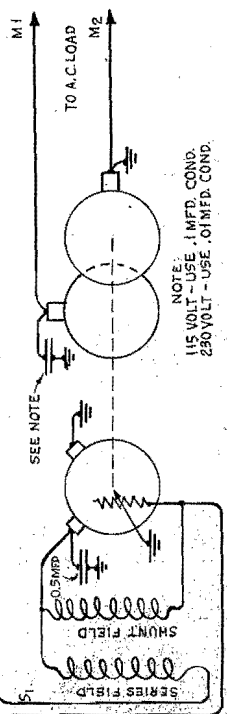


WIRING DIAGRAM
MANUAL TYPE
PLANT

60145



WIRING DIAGRAM
REMOTE CONTROL
TYPE PLANT
 61085



A PARTS ORDER BLANK IS PROVIDED AT THE BACK OF THIS BOOK FOR YOUR CONVENIENCE.

PLEASE USE IT WHEN ORDERING PARTS.

INSTRUCTIONS FOR ORDERING REPAIR PARTS

FOR SERVICE OR PARTS CONTACT THE DEALER FROM WHOM YOU PURCHASED THIS EQUIPMENT, OR REFER TO THE COMPANY LISTED ON THE NAME-PLATE.

The Parts Reference Symbols in the right hand column of the General Data table on page 1 correspond with the same symbols at the tops of the Quantity Used column in the Parts List. They indicate which Quantity Used column to use when ordering parts for one of the plants listed in the General Data table. Compare the characteristics of the plant with the data in the General Data table to determine which Parts Reference Symbol applies. Order only parts which have a quantity listed in the applicable Quantity Used column in the Parts List.

Be sure to state on your order the Model Number, Serial Number, and Generator Number of the plant for which the parts are required. Obtain these numbers directly from the nameplates on the plant.

Order parts by part numbers and complete descriptions as listed herein. State the quantity of each part desired. Do not order parts as "sets" unless they are listed as "sets" in the parts list. If unable to identify the part required, return the old part to the address shown on the nameplate. Be sure to print your name and address plainly on the package. Regardless of any previous correspondence, write a letter to the same address describing the part and stating the reason for returning it.

Please do not order parts in a letter in which some other subject is treated. State definite shipping instructions when ordering parts.

All shipments are complete unless the packing list indicates items are back ordered. Shipments are properly packed and in good order when delivered to the transportation company. Any claim for loss or damage in transit should be filed promptly against the transportation company making the delivery.

PARTS LIST

PART NO.	DESCRIPTION	† QUANTITY USED				PRICE EACH
		A	B	C	D	
CRANKCASE AND OIL BASE GROUP						
110A23	Block Assembly, Cylinder - Includes Generator Adapter, Bearings, Valve Guides	1	1	1	1	42.50
101-114	Gasket Kit, Adapter - Includes one each .006", .015"	1	1	1	1	.10
101D83	Adapter, Generator to Engine	1	1	1	1	7.50
101A44	Bearing, Crankshaft - Front or Rear	2	2	2	2	1.55
101A19	Bearing, Camshaft - Front	1	1	1	1	.75
517-18	Plug, Camshaft Bearing - Rear	1	1	1	1	.10
101A50	Bearing, Camshaft - Rear	1	1	1	1	.75
509-1	Seal, Oil - Generator Adapter, Crankshaft Rear	1	1	1	1	1.00
110A318	Cover, Valve Box	1	1	1	1	.25
110A152	Gasket, Valve Box Cover	1	1	1	1	.10
123A135	Tube Assy, Valve Box Drain	1	1	1	1	.35
102C26	Base, Oil	1	1	1	1	6.00
102B18	Gasket, Oil Base	1	1	1	1	.25
110C158	Head, Cylinder	1	1	1	1	3.25
110A159	Gasket, Cylinder Head	1	1	1	1	.65
110A254	Nut, Cylinder Head - Special	2	2	2	2	.10
516A11	Dowel, Gear Cover Locating	2	2	2	2	.10
520A106	Stud, Cylinder Head	3	3	3	3	.20
520A79	Stud, Cylinder Head	4	4	4	4	.20
520A114	Stud, Generator Adapter	5	5	5	5	.20
520A295	Stud, Oil Base	6	6	6	6	.20
520A115	Stud, Gear Cover	2	2	2	2	.20
520A124	Stud, Gear Cover	2	2	2	2	.20
520A123	Stud, Valve Box Cover	1	1	1	1	.20
520A24	Stud, Intake Manifold	2	2	2	2	.20
526-63	Washer, Copper - Valve Box Cover Nut	1	1	1	1	.10
402A44	Bushing, Rubber Mounting - Upper	4	4	4	4	.15
402A45	Bushing, Rubber Mounting - Lower	4	4	4	4	.15
402A48	Spacer, Bushing	4	4	4	4	

WHEN ORDERING PARTS BE SURE TO INCLUDE MODEL AND SERIAL NUMBER OF UNIT.

PARTS LIST

GEAR COVER GROUP

103C62	Cover Assembly, Gear - Includes Governor Arm Assembly	1	1	1	8.75
103C43	Cover, Gear	1	1	1	5.00
103B13	Gasket, Gear	1	1	1	.30
150A193	Shaft and Arm Assembly, Governor	1	1	1	1.65
510-13	Bearing, Governor Shaft - Upper	1	1	1	.65
510-8	Bearing, Governor Shaft - Lower	1	1	1	.80
510-14	Ball, Bearing - Governor Shaft Thrust	1	1	1	.10
509-8	Seal, Oil - Governor Shaft	1	1	1	.30
509-12	Seal, Oil - Front Crankshaft	1	1	1	1.00
150-29	Joint, Ball - Governor Arm	1	1	1	.65
150A58	Link, Governor Arm to Carburetor	1	1	1	.35
150A98	Spring, Governor	1	1	1	.15
150A177	Stud, Governor Sensitivity	1	1	1	.15
150A96	Stud, Governor Spring Tension	1	1	1	.20
150A89	Nut, Governor Spring Tension Stud	1	1	1	.15
150A80	Yoke, Governor Shaft	1	1	1	.50
150A76	Spring, Governor Yoke	1	1	1	.10
518-27	Nut, Yoke Spring	1	1	1	.10
150A156	Bracket, Governor Spring	1	1	1	.20
150A198	Cover, Spring Bracket	1	1	1	.30

CRANKSHAFT AND CAMSHAFT GROUP

104C56	Crankshaft	1	1	1	9.50
105-71	Gear Set, Timing - Crankshaft and Camshaft Gears	1	1	1	7.00
104A50	Washer, Crankshaft Gear	1	1	1	.35
518-12	Ring, Lock - Crankshaft Gear	1	1	1	.15
515-1	Key, Crankshaft Gear and Camshaft Gear	2	2	2	.10
105-78	Camshaft and Pin Assy.	1	1	1	5.00
150A77	Plate, Back - Governor Ball	1	1	1	.10
150B85	Spacer, Governor Ball	1	1	1	.25
150B105	Cup Assembly, Governor	1	1	1	2.00

+ Refer to page 33 regarding the use of PARTS REF. SYMBOLS A, B, C, and D.

PARTS LIST

PART NO.	DESCRIPTION	QUANTITY USED				PRICE EACH
		A	B	C	D	
CRANKSHAFT AND CAMSHAFT GROUP --CONT'D.						
516A16	Pin, Governor Cup	1	1	1	1	.10
150A78	Ring, Lock - Camshaft Center Pin	1	1	1	1	.10
510-15	Ball, Governor Fly	10	10	10	10	.10
105A4	Washer, Camshaft Thrust	1	1	1	1	.10
PISTON AND CONNECTING ROD GROUP						
112-15	Piston and Pin Assembly --Standard	1	1	1	1	3.25
112A20	Piston and Pin Assembly - .005", .010", .025" Oversize	1	1	1	1	3.75
112A13	Pin, Piston - Standard or .002" Oversize Available	1	1	1	1	.50
113-12	Ring, Lock - Piston Pin	2	2	2	2	.10
113A9	Ring Set, Piston - 2 Compr., 1 Oil - Standard, .010", .025" Over-size Available	1	1	1	1	1.00
113A10	Ring, Compression - Standard, .010", .025" Oversize Available	2	2	2	2	.35
114B17	Ring, Oil Control - Standard, .010", .025" Oversize Available	1	1	1	1	.45
114A24	Rod, Connecting	1	1	1	1	3.25
	Dipper, Oil - Connecting Rod	1	1	1	1	.25
STATE OVERSIZE DESIRED. - Use standard rings on .005" oversize piston.						
VALVE GROUP						
110A150	Valve, Intake	1	1	1	1	.75
110A287	Valve, Exhaust	1	1	1	1	.85
110A310	Spring, Valve	2	2	2	2	.20
110A6	Washer, Valve Spring Retainer	2	2	2	2	.20
110A8	Lock, Valve	4	4	4	4	.10

WHEN ORDERING PARTS BE SURE TO INCLUDE MODEL AND SERIAL NUMBER OF UNIT.

PARTS LIST

11546	Tapnet, Valve	2	2	1	.50
110434	Guide, Valve	2	2	1	.50
110468	Gasket, Valve Guide - Intake	1	1	1	.10
MAGNETO GROUP					
1600369	Flywheel, Magneto	1	1	1	1.50
526417	Washer, Flywheel	1	1	1	.10
1600172	Backplate Assembly, Magneto - Includes Points, Coil, Poleshoe and Condenser	1	1	1	8.75
160011	Backplate Assembly, Magneto - Includes Points, Coil, Poleshoe and Condenser	1	1	1	8.75
1600155	Coil, Magneto	1	1	1	3.00
31241	Condenser, Magneto	1	1	1	.75
160A170	Stud, Breaker Arm	1	1	1	.10
160A138	Bracket, Breaker Point	1	1	1	.15
160A137	Bushing, Breaker Point	2	2	2	.10
160A139	Spring, Breaker Arm	1	1	1	.15
160-174	Point Set, Breaker	1	1	1	1.00
160A144	Strip, Condenser Jumper	1	1	1	.10
336A403	Lead, Stop	1	1	1	.75
336A404	Lead, Stop	1	1	1	.75
167-28	Plug, Spark	1	1	1	.10
167-41	Shield Assembly, Spark Plug	1	1	1	1.00
167-41	Key, Flywheel	1	1	1	.50
160-143	Poleshoe, Magneto Coil	1	1	1	.75
192-23	Rope Assembly, Starting	1	1	1	.50
167A1087	Lead, High Tension	1	1	1	.75
FUEL SYSTEM GROUP					
1A15A10	Tank, Fuel	1	1	1	3.50
159C138	Tank, Fuel	1	1	1	7.00
504A13	Shut Off Assembly, Fuel Tank	1	1	1	1.50
159A56	Line, Fuel - Tank to Fuel Pump	1	1	1	1.50
149A100	Line, Fuel - Fuel Pump to Carburetor	1	1	1	.65
159A149	Line, Fuel - Tank to Carburetor	1	1	1	.75
141B339	Carburetor	1	1	1	7.50

+ Refer to page 33 regarding the use of PARTS REF. SYMBOLS A, B, C, and D.

PARTS LIST

PART NO.	DESCRIPTION	QUANTITY USED				PRICE EACH
		A	B	C	D	
FUEL SYSTEM GROUP -CONT'D.						
141B335	Carburetor		1		1	7.50
141A78	Gasket, Carburetor and Intake Manifold		2	2	2	.10
154B35	Manifold, Intake	2	1		1	1.75
149C81	Pump, Fuel	1	1	1	1	6.00
149A3	Gasket, Fuel Pump or Hole Cover		1	1	1	.10
502-2	Elbow, Fuel Line Connection		1	3	1	.20
149A136	Cover, Fuel Pump Hole	1	1		1	.10
140B84	Cleaner, Air	1	1		1	4.25
153A49	Cover Assembly, Electric Choke - Includes Heating Element	1	1	1	1	1.90
153A48	Bracket Assembly, Choke - Includes Thermal Coil	1	1		1	2.00
153A17	Coil, Thermal - Choke		1		1	.75
153A86	Retainer, Thermal Coil		1		1	.15
155B1	Tube Assembly, Exhaust		1	1	1	2.00
155-143	Muffler		1		1	1.50
153A85	Rod Assembly, Manual Choke	1	1	1	1	.50
153A84	Clip, Manual Choke Rod	1	1	1	1	.10
159A80	Cap Assembly, Fuel Tank	1	1		1	.60
FUEL PUMP GROUP						
149A95 *	Body, Upper - Not Sold Separately		1		1	.10
149-96 *	Gasket, Valve		2	2	2	.20
149A84	Valve Assembly		2		2	.50
149A97 *	Retainer, Valve		1	1	1	.50
149A93	Diaphragm Assembly		1	1	1	.15
	Spring, Diaphragm		1	1	1	
149A87	Body, Lower - Not Sold Separately		1	1	1	.15
149A86	Link, Rocker Arm to Diaphragm		1	1	1	.75
149A94 *	Arm, Rocker		1	1	1	.10
516A25	Spring, Rocker Arm		1	1	1	.20
	Pin, Rocker Arm		1	1	1	

WHEN ORDERING PARTS BE SURE TO INCLUDE MODEL AND SERIAL NUMBER OF UNIT.

PARTS LIST

149A159	Gasket, Valve Retainer	2	1	.10
149A3	Gasket, Fuel Pump Mounting	1	1	.10
	Screw, Flat Head - #6-32 x 7/16" - Valve Retainer	2		
	* Parts contained in Fuel Pump Repair Kit #149-74.			
AIR HOUSING GROUP				
134D147	Housing, Blower	1	1	2.75
134A83	Bracket, Blower Housing	1	1	.15
134B144	Housing Assy., Cylinder Air	1	1	1.75
403A49	Handle, Carrying	1	1	.50
403-108	Grip, Carrying Handle	2	2	.20
313-18	Button Assy., Stop	1	1	.60
ANTI-FLICKER GROUP				
166A25	Cover, Flicker	1	1	.25
508-26	Grommet	1	1	.10
312A19	Condenser, Flicker Breaker	1	1	.75
160-175	Point Set, Breaker	1	1	1.00
160A33	Plunger, Breaker	1	1	.25
304-132	Resistor, Flicker	1	1	1.25
304-15	Washer, Centering - Resistor Mounting	1	1	.10
166A41	Insulator, Breaker Spring	2	2	.10
508-14	Pushing, Breaker Spring Screw	2	2	.10
520A347	Stud, Cover Mtg.	1	1	.20
GENERATOR GROUP				
210A1247	Frame Assembly, Generator - Includes Frame, Coil Set and Poleshoes	1		
210A1248	Frame Assembly, Generator - Includes Frame, Coil Set and Poleshoes	1	1	
210A1249	Frame Assembly, Generator - Includes Frame, Coil Set and Poleshoes			
210A1236	Frame Assembly, Generator - Includes Frame, Coil Set and Poleshoes			
222A1220	Coil Assembly, Field - Set of 4 Coils	1		18.00
222A1221	Coil Assembly, Field - Set of 4 Coils			
222A1222	Coil Assembly, Field - Set of 4 Coils	1	1	
222A1208	Coil Assembly, Field - Set of 4 Coils			
			1	20.00

† Refer to page 33 regarding the use of PARTS REF. SYMBOLS A, B, C, and D.

PARTS LIST

PART NO.	DESCRIPTION	† QUANTITY USED				PRICE EACH
		A	B	C	D	
GENERATOR GROUP—CONT'D.						
221A58	Poleshoe	4	4	4	4	45.00
221A59	Poleshoe	1	1	1	1	52.50
201A295	Armature Assembly	1	1	1	1	3.15
201A287	Armature Assembly	1	1	1	1	3.50
510A16	Bearing, Armature	1	1	1	1	3.00
211C30	End Bell, Generator	1	1	1	1	.10
232B249	Hub, Armature Bearing	1	1	1	1	.35
517-14	Plug, Bearing Hub	1	1	1	1	9.00
212A1061	Spider Ring, Brush Rig	1	1	1	1	.60
212C127	Rig Assembly, Brush - Includes Brushes and Springs	1	1	1	1	.60
21A24	Brush, Commutator	4	4	4	4	.25
21A19	Brush, Collector Ring	2	2	2	2	.75
212A1003	Spring, Commutator Brush	4	4	4	4	.75
212A1004	Spring, Collector Ring Brush	2	2	2	2	1.65
321A27	Condenser, 5 MFD - Commutator Brush	1	1	1	1	1.35
312A15	Condenser, 1 MFD - Collector Ring Brush	1	1	1	1	.25
232B210	Scroll, Air - Generator Ventilating	1	1	1	1	
205B16	Blower	1	1	1	1	
520A46	Stud, Generator End Bell	2	2	2	2	
520A47	Stud, Generator End Bell	1	1	1	1	.40
520A272	Stud, Armature Through	1	1	1	1	.40
520A164	Band, Cover - End Bell	1	1	1	1	.25
232B273	Band, Cover - End Bell	1	1	1	1	.10
232B5	Band, Cover - End Bell	4	4	4	4	.15
420-82	Grease, Bearing					
232A316	Clip, Bearing Stop					
212A1056	Support, Brush Rig					

WHEN ORDERING PARTS BE SURE TO INCLUDE MODEL AND SERIAL NUMBER OF UNIT.

PARTS LIST

CONTROL GROUP

301C387	Box, Control	1				.60
301B388	Cover, Control Box	1				2.50
302-58	Ammeter, Charge Rate 10-0-10	1				2.50
307-69	Relay Assembly, Reverse Current	1				.75
308-2	Switch, Hi-Lo Charge Rate	1				.50
332-222	Block, Terminal - 2 Post	1				.35
332A198	Bracket, Terminal Block	1				1.50
308-26	Switch, Start and Stop	1				3.25
307-6	Switch, Solenoid - Start	1				1.19
308-40	Switch, Assembly, Remote Start and Stop - Includes Cover Plate ..	1				.40
301A528	Box, Receptacle Mounting	1				.70
323-48	Receptacle, Duplex - Twistite	1				.30
330-16	Cover, Receptacle Box	1				1.50
416-77	Cable, Battery	2				.10
508-8	Grommet	1				1.75
304-51	Resistor, Adjustable	1				.03 $\frac{1}{2}$
1711	Cable, 3 Conductor - Remote Control Switch - Minimum Length 10 Ft.	As Req				.10
301A521	Bracket, Control Box	1				

SERVICE KITS

168-38	Gasket Kit, Complete Plant	1				2.65
522-73	Overhaul Kit, Complete Plant	1				12.50
149-74	Fuel Pump Repair Kit	1				1.50

† Refer to page 33 regarding the use of PARTS REF. SYMBOLS A, B, C, and D.



PARTS ORDER

DEALER _____		ORDER NO. _____		CUSTOMER _____		ORDER NO. _____	
ADDRESS _____				ADDRESS _____			
CITY _____		STATE _____		CITY _____		STATE _____	
AVOID DELAY FOR PROMPT DELIVERY COMPLETE ALL INFORMATION REQUESTED.							
MODEL NO. _____		ENGINE _____		GENERATOR _____			
		SERIAL NO. _____		SERIAL NO. _____			
PART NO. _____		DESCRIPTION _____		QUANTITY _____			

DESCRIPTION

QUANTITY	UNIT	PRICE	TOTAL
1	EA	10.00	10.00
2	EA	20.00	40.00
3	EA	30.00	90.00
4	EA	40.00	160.00
5	EA	50.00	250.00
6	EA	60.00	360.00
7	EA	70.00	490.00
8	EA	80.00	640.00
9	EA	90.00	810.00
10	EA	100.00	1000.00
11	EA	110.00	1210.00
12	EA	120.00	1440.00
13	EA	130.00	1690.00
14	EA	140.00	1960.00
15	EA	150.00	2250.00
16	EA	160.00	2560.00
17	EA	170.00	2890.00
18	EA	180.00	3240.00
19	EA	190.00	3610.00
20	EA	200.00	4000.00
21	EA	210.00	4410.00
22	EA	220.00	4840.00
23	EA	230.00	5290.00
24	EA	240.00	5760.00
25	EA	250.00	6250.00
26	EA	260.00	6760.00
27	EA	270.00	7290.00
28	EA	280.00	7840.00
29	EA	290.00	8410.00
30	EA	300.00	9000.00
31	EA	310.00	9610.00
32	EA	320.00	10240.00
33	EA	330.00	10890.00
34	EA	340.00	11560.00
35	EA	350.00	12250.00
36	EA	360.00	12960.00
37	EA	370.00	13690.00
38	EA	380.00	14440.00
39	EA	390.00	15210.00
40	EA	400.00	16000.00
41	EA	410.00	16810.00
42	EA	420.00	17640.00
43	EA	430.00	18490.00
44	EA	440.00	19360.00
45	EA	450.00	20250.00
46	EA	460.00	21160.00
47	EA	470.00	22090.00
48	EA	480.00	23040.00
49	EA	490.00	24010.00
50	EA	500.00	25000.00
51	EA	510.00	26010.00
52	EA	520.00	27040.00
53	EA	530.00	28090.00
54	EA	540.00	29160.00
55	EA	550.00	30250.00
56	EA	560.00	31360.00
57	EA	570.00	32490.00
58	EA	580.00	33640.00
59	EA	590.00	34810.00
60	EA	600.00	36000.00
61	EA	610.00	37210.00
62	EA	620.00	38440.00
63	EA	630.00	39690.00
64	EA	640.00	40960.00
65	EA	650.00	42250.00
66	EA	660.00	43560.00
67	EA	670.00	44890.00
68	EA	680.00	46240.00
69	EA	690.00	47610.00
70	EA	700.00	49000.00
71	EA	710.00	50410.00
72	EA	720.00	51840.00
73	EA	730.00	53290.00
74	EA	740.00	54760.00
75	EA	750.00	56250.00
76	EA	760.00	57760.00
77	EA	770.00	59290.00
78	EA	780.00	60840.00
79	EA	790.00	62410.00
80	EA	800.00	64000.00
81	EA	810.00	65610.00
82	EA	820.00	67240.00
83	EA	830.00	68890.00
84	EA	840.00	70560.00
85	EA	850.00	72250.00
86	EA	860.0	

CONTINUE LISTING ON OTHER SIDE

ALL PRICES ARE F.O.B. MINNEAPOLIS UNLESS INDICATED OTHERWISE.
NOTE:--DO NOT RETURN ANY PARTS TO THE FACTORY FOR CREDIT OR REPLACEMENT WITHOUT AUTHORIZATION.

SHIP TO

VIA DESIRED CARRIER

PARCEL POST	<input type="checkbox"/>	FREIGHT	<input type="checkbox"/>	TRUCK	<input type="checkbox"/>	EXPRESS	<input type="checkbox"/>	AIR EXPRESS	<input type="checkbox"/>
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SHIPPING CHARGES: PREPAID	COLLECT
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REMITTANCE: BY: CHECK ☐ SIGHT DRAFT ☐ C.O.D. ☐ RECEIPT OF INVOICE ☐

DATE _____ SIGNED _____

[illegible]





Temp. 1M 4-9-48
Temp. 2M 8-4-48

Printed in U. S. A.