INSTALLATION AND OPERATING INSTRUCTIONS

GENERATOR AND ENGINE ACCESSORIES PARTS LIST

FOR

Onan®

ELECTRIC GENERATING PLANTS

KA

SERIES

ONAN 2515 UNIVERSITY AVE. S.E. • MINNEAPOLIS, MINN. 55414
A DIVISION OF STUDEBAKER CORPORATION
IN CANADA: ONAN GENERATORS CANADA LTD., P.O. BOX 652, GUELPH, ONTARIO

917-68 Price $4.00 Printed in U.S.A. A-L

This publication is supplied with all models of the KA series complete electric generating plants manufactured by D.W. ONAN & SONS INC. of Minneapolis, Minnesota, U.S.A.

This publication is to be used with other publications prepared by International Harvester Company. The International Harvester publications cover information on the International Harvester six cylinder gasoline engine, International Harvester Model U-450 with LQ-8_, LQ-24_, or LQ-25_, modification for Onan, which is used to power the generator. This Onan publication contains information on the revolving field AC output generator and the controls portion of the plants together with certain engine information not covered by the International Harvester book. The wiring diagram differs between certain plant models and is supplied separately with each plant rather than combined in this book. Keep these publications and the wiring diagram accessible for reference. The parts list for the AC generator and the engine parts added by D.W. ONAN & SONS INC. is at the rear of this manual.

These combined publications are supplied to assist the operator in the proper installation and operation of the generating plant. An understanding of the plant characteristics and operation will assist the operator in determining the cause of trouble if it occurs. Disregarding these instructions may lead to unnecessary trouble and expense.

Each electric generating plant is given an actual running test and is carefully checked under various electrical load conditions before leaving the factory, to assure that it is free of defects and will produce its rated output. Inspect the plant for any damage which may have occured in shipment. Any part damaged must be repaired or replaced before putting the plant in operation.

Instructions and parts listed herein apply specifically to the standard models. Some details may not apply to special models. Some special installation or operating conditions may require the operator of this plant to modify these instructions. However, by following as closely as possible the recommendations as given in this book and by referring to the plant wiring diagram, the operator should have no difficulty in making a good installation and in properly operating the generating plant.

If it ever becomes necessary to contact the factory or an Authorized Service Station in regard to this generating plant, be sure to supply the plant Model, Specification and Serial Number, which appears on the plant nameplate, along with all other available details. This information must be known in order to properly identify the plant and to enable proper advice to be given.

When referring to the plant, it is advisable to mention "radiator end", "carburetor side", or "opposite carburetor side" rather than "left side" or "right side". This will eliminate confusion because "left side" of the complete plant, as designed by D.W. ONAN & SONS INC., is determined by viewing the plant from the radiator end and results in the carburetor side, whereas, "left side" of the engine only, as designated by International Harvester Company, is the side opposite the carburetor. The radiator end is designated as "front end" by both, thus no conflict in concept results.

The generating plant consists, basically, of an internal combustion engine and an alternating current output generator having a DC exciter generator and a separate automatic voltage regulator. Accessories and controls suitable for a normal installation and according to the particular model are supplied.

ENGINE DETAILS

Most of the engine details are described in the International Harvester publication. A high water temperature cut-off switch and a low oil pressure cut-off switch are standard equipment. The ignition system is radio noise suppressed. Refer to the list of parts herein for those items added by ONAN and to which no reference will appear in the International Harvester publication.

Plants may have certain optional equipment such as, a heat exchanger for butane and propane fuels, or special carburetors for bottled gas, natural gas and gasoline fuels. Plants so equipped carry a special model specification. Reduced output may result, depending on the richness of gas used.

GENERATOR DETAILS

The air cooled generator has two main components: the alternator, and the exciter.

The alternator is a revolving field type alternating current generator. The generator rotor is connected directly to the engine flywheel and turns at engine speed. The rotor is a four pole type on all models, and consequently must operate at approximately 1800 rpm for the 60 cycle plants and 1500 rpm for the 50 cycle plants. The alternating current is generated in the stator winding of the alternator and is taken to the AC output terminals inside the sheet metal box on the generator. The outboard end of the rotor is carried in a double sealed permanently lubricated ball bearing. The stator end bell casting, which might be called an adapter bell to distinguish it from the exciter end bell, houses this stator bearing and its rubber ring type of anti-rotation device, as well as the slip ring brush rig which serves to feed exciter current through the rotor. Hand holes in the adapter bell provide access to the slip ring brushes and to the constant-pressure type brush springs for servicing.

The separate exciter is a stationary field direct current generator. The output of the exciter is used to create a magnetic field in the rotor. On plants using Generator Data Sheet No. 50KA4N3A the exciter construction is as shown in Figure 13. The exciter armature shaft is tapered, keyed and held by a through stud to the outboard end of the rotor shaft and the outboard end of the exciter is carred in a ball bearing. The exciter end bell houses the ball bearing and its spring clip type of anti-rotation device, as well as the commutator brush rig which serves to carry the DC excitation current generated in the exciter armature. The cover plate for the exciter bearing is easily removable for access to the bearing during lubrication. The commutator brush rig may be serviced after removing the end bell band.

On all plant models except those using Generator Data Sheet No. 50KA4N3A, the exciter is constructed as shown in Figure 14. The exciter shaft slips over the alternator rotor shaft and is keyed and held by a standard hexagonal head cap screw. There is no bearing on the outboard end of the exciter.

GENERATOR DETAILS (CONT.)

The generator is specifically designed for high efficiency and excellent motor starting ability. The external voltage regulator gives extremely close (2%) voltage regulation. The manually operated field rheostat may be used to control voltage for emergency operation if the automatic regulator should fail. The frequency of the current is determined by the engine speed, and is regulated by the engine governor. The output rating is at 0.8 (80%) power factor load. The rated capacity for 60 cycle plants is 50,000 watts (50KW). The rated capacity for 50 cycle plants is reduced to 40,000 watts (40KW) due to the slower engine speed. Capacitors are mounted on the exciter and slip ring brush rig to minimize radio interference.

CONTROL DETAILS - STANDARD EQUIPMENT

All plants are equipped with an engine control box mounting start-stop buttons, battery charge rate ammeter, oil pressure gauge, water temperature gauge, running time meter and a two-way switch for remote starting or for hand cranking. An alternating current ammeter, an alternating current voltmeter, a phase selector switch (2 ammeters and no switch on 1 phase models), and a manual reset circuit breaker, are standard equipment for Spec J and later plants.

CONTROL DETAILS - OPTIONAL EQUIPMENT

PANEL INSTRUMENTS. - Optional equipment on the control box may include electrical instruments such as a frequency meter. Models manufactured prior to Spec J may have AC output meters as optional equipment.

ALARM SYSTEM. - The high water temperature cut-off switch and the low oil pressure cut-off switch are standard equipment and on standard models are wired to shut down the plant. However, on special models these switches might be wired to operate an alarm bell or light rather than cause an automatic shutdown. The alarm system operates on battery charging generator current, and consequently it must be for 12 volts.

EXPLANATION OF MODELS

ELECTRICAL OUTPUT	BASIC MODEL	
	60 CYCLE (50 KW)	50 CYCLE (40KW)
120/240 VOLT, 1 PHASE, 3 WIRE	50KA-3R8	40KA-53R8
120/208 VOLT, 3 PHASE, 4 WIRE	50KA-4R8	40KA-54R8
230 VOLT, 3 PHASE, 3 WIRE. WYE-CONNECTED	50KA-5R8	40KA-55R8
120/240 VOLT, 3 PHASE, 4 WIRE, DELTA-CONNECTED	50KA-5DR8	40KA-55DR8
480 VOLT, 3 PHASE, 3 WIRE	50KA-6R8	40KA-56R8
220/380 VOLT, 3 PHASE, 4 WIRE	50KA-7R8	40KA-57R8

ORIENTATION

Production changes in the KA series basic models of generating plants, which coincided with a plant model spec letter advance, include the following:

Spec A. - Original design.

Spec B. - Change from Onan design to I. H. C. design radiator and related parts. Therefore Onan #100P158 displaces Onan #100P142 engine.

Spec C. - New location of parts on control panel. Example, Voltage Regulator Rheostat moved to front and terminal blocks added. Heat shield added near carburetor.

Spec D. - New design generator with no ball bearing on outboard end of exciter armature. Generator data advanced to B. Control panel with no voltmeter selector switch. Change in engine governor.

Spec E. - Added anti-dieseling device with carburetor dip tank. Larger hub on generator rotor. Generator data advanced to C.

Spec F. - Larger rotor shaft in generator. Generator data advanced to D. Starting November 1955, control box mounts with 4 vibration dampeners and 1 bonding strap.

Spec G. - Changes which apply only to "Pennsylvania Approved" standby plants, (Special Purpose).

Spec H. - Changed exciter and voltage regulator. Generator data advanced to E. Changed to 0-80 Lb. oil pressure gauge.

Spec J. - Changed to dual outlet exhaust manifold, new charging generator and charging rate regulator. Eliminated heat shield. Panel with output meters becomes standard equipment rather than optional equipment. Identification of the engine as used on basic models changes as follows: Onan #100P226 displaces Onan #100P158; I. H. C. Power Unit U450 with modification for Onan advances to LQ-8D displacing LQ-8C. Identification of the engine equipped with the water cooled exhaust manifold (remains single outlet) changes as follows: Onan #100P227 displaces #100P199; I. H. C. Power Unit U450 with modification for Onan advances to LQ-24A displacing LQ-24.

Spec K. - Changed starter, flywheel and ring gear and the charging regulator.

Spec L. - Control box redesigned, AC terminal box moved to a separate enclosure. Control mounting holes changed on generator. Generator data advances to F.

LOCATION. - Locate the generating plant so that it will be as close to the electrical center of the load as is practicable. Voltage drop will be less when the plant is located close to the load. Long load lines require larger size wire.

Install the plant inside a building or covered vehicle for protection against the weather. The site selected for the plant should be dry, clean and free of dust and well ventilated. A location which is either damp or dusty will require more frequent inspection and servicing of the plant.

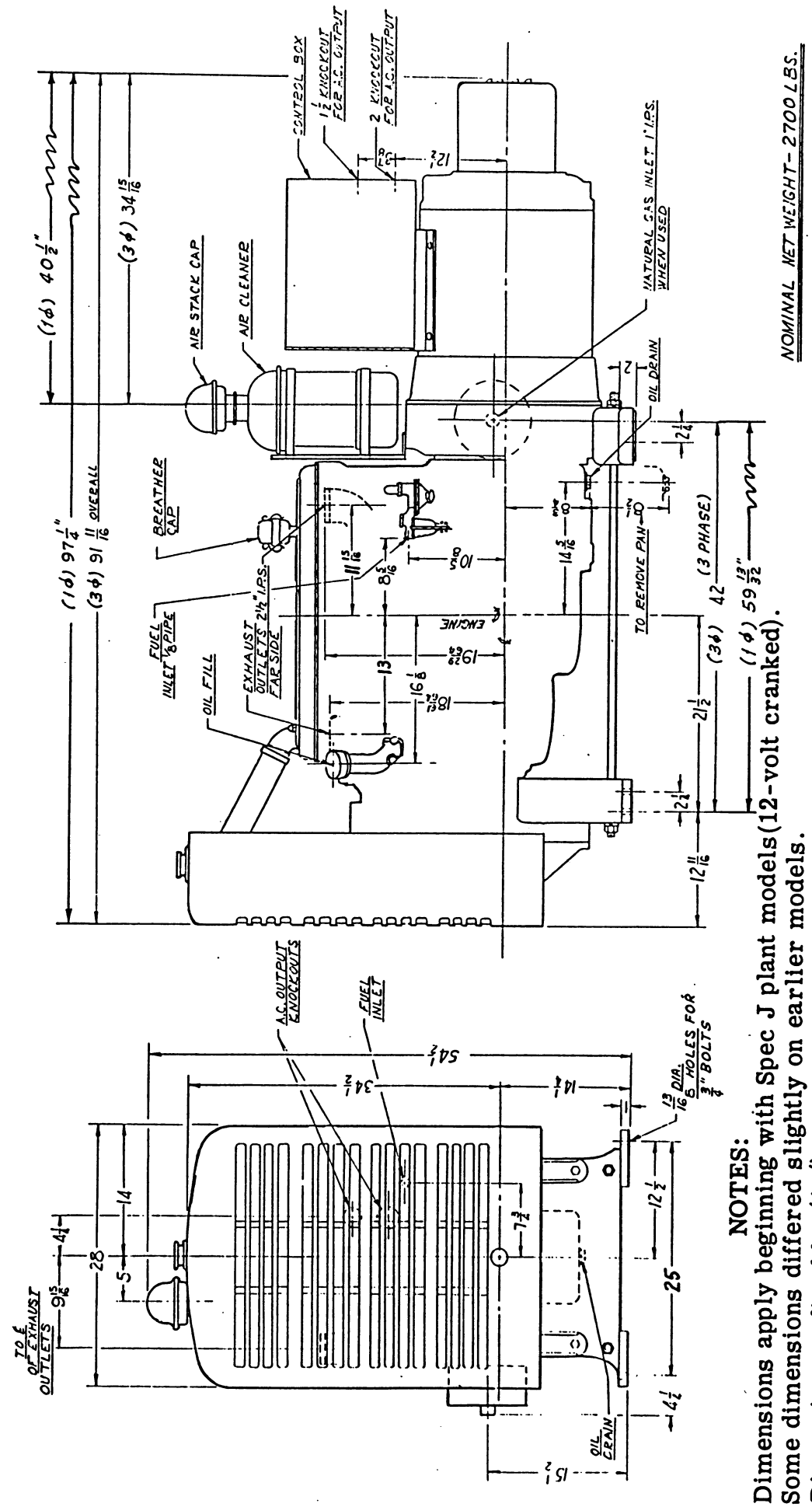
If the plant is installed in a permanent location, it may be bolted down to a substantial base of concrete or heavy timber. If the plant is mounted aboard a truck or trailer, see that it is fastened securely when in transit, and that it sets in a reasonably level position when in operation. Allow at least 24 inches clearance on all sides of the plant for convenience in servicing. Refer to the illustrations, Typical Installation and Dimensional Outline.

VENTILATION. - The engine and generator create a considerable amount of heat, which must be removed through proper ventilation. Provide separate air inlet and outlet openings for the room or compartment in which the plant is installed. The net area (area after subtracting any screen or louver restrictions) of the air outlet opening in the building must be at least as large as the radiator area. The air inlet opening should be at least as large as the outlet opening. The size of the ventilating openings will depend upon temperature conditions; the higher the air temperature, the larger the ventilation openings must be. In cold climates, provide some means of regulating the size of the air openings, so as to control the temperature of the compartment.

The engine cooling fan pushes the heated air out through the FRONT of the radiator. If the plant is installed so that the front of the radiator is reasonably close to an outside wall, a duct may be constructed to conduct the heated air from the front of the radiator to the outlet opening. The duct prevents recirculation of the heated air.

FUEL CONNECTION. - The fuel pump on the engine has a 1/8" iron pipe size thread for making the fuel line connection. Provide for vibration damage protection in the line used. Certain special plants are equipped with a Day Tank which serves as a gravity feed to the carburetor to replace fuel lost through evaporation while idle and thereby insures a faster start. Refer to the illustration, Typical Installation.

BATTERY CONNECTIONS. - Refer to the wiring diagram. A 12 volt battery, or two 6 volt batteries in series, must be used on the 12 volt system. If two 6 volt batteries are used, use the short cable to connect the positive post of one battery to the negative post of the second battery. Connect the remaining positive battery post to the start solenoid switch cable. Connect the remaining battery negative post to the ground cable. DO NOT REVERSE THESE CONNECTIONS. The starting system is designed for NEGATIVE GROUND.



NOMINAL NET WEIGHT- 2700 LBS.

FIG. 1 - PLANT DIMENSIONAL OUTLINE

NOTES:
Dimensions apply beginning with Spec J plant models(12-volt cranked).
Some dimensions differed slightly on earlier models.
Dimension prefixed by (1 ϕ) is for Single Phase Plants.
Dimension prefixed by (3 ϕ) is for Three Phase Plants.

Typical Onan Standby Installation

UNIT CAN BE ADAPTED FOR GAS OPERATION.

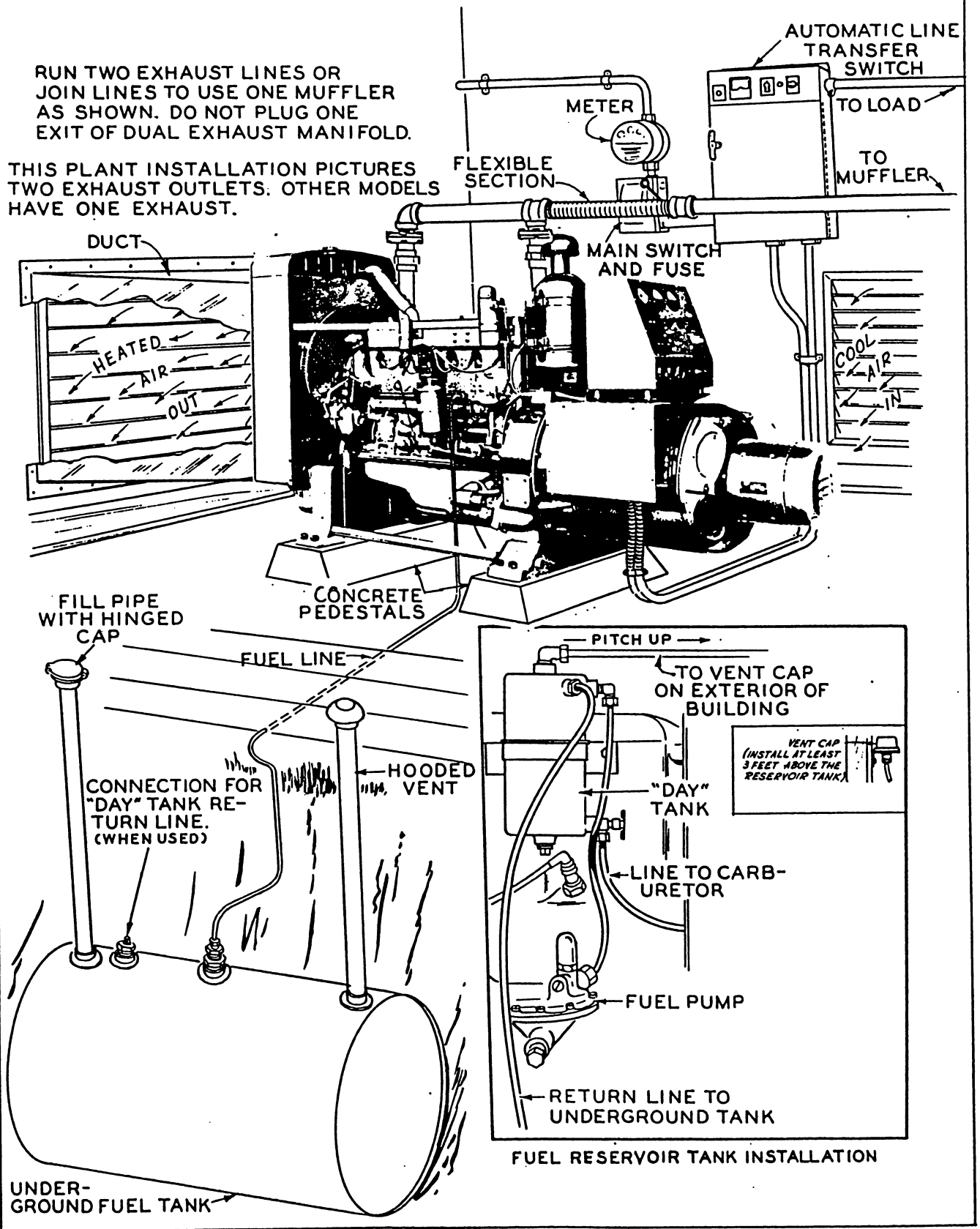
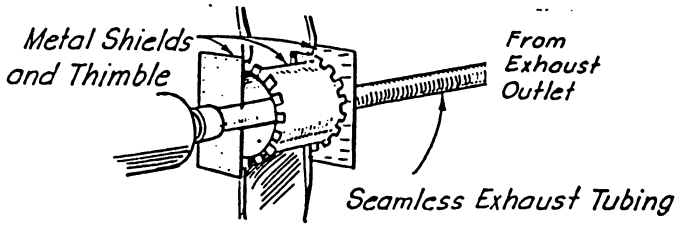


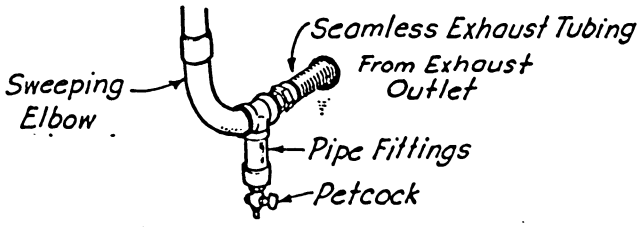
FIG. 2 - TYPICAL INSTALLATION
(CHECK REGULATIONS BEFORE INSTALLING)

EXHAUST. - Pipe the exhaust gases outside the enclosure. Use pipe at least as large as the exhaust connection on the engine. Increase the diameter of the exhaust line pipe, one pipe size for each 10 feet in additional length. Keep the exhaust line as short and as free of sharp turns as the installation permits. A sweeping elbow made by bending the pipe should be used instead of short 90° elbows whenever possible. Insulate or shield the exhaust line where it may be a fire hazard, or where it may inflict a painful burn. Install the muffler to the end of the exhaust line, outside the enclosure. Exhaust snubbers, for quiet operation, may be used in place of standard mufflers. Do not plug one exit of the dual exhaust manifold used on later standard models. Run two exhaust lines or join lines to use one muffler.

If the exhaust line is pitched upward, install a condensation trap to prevent moisture damage to the engine.



WALL PLATE & THIMBLE DETAIL



SWEEPING ELBOW DETAIL

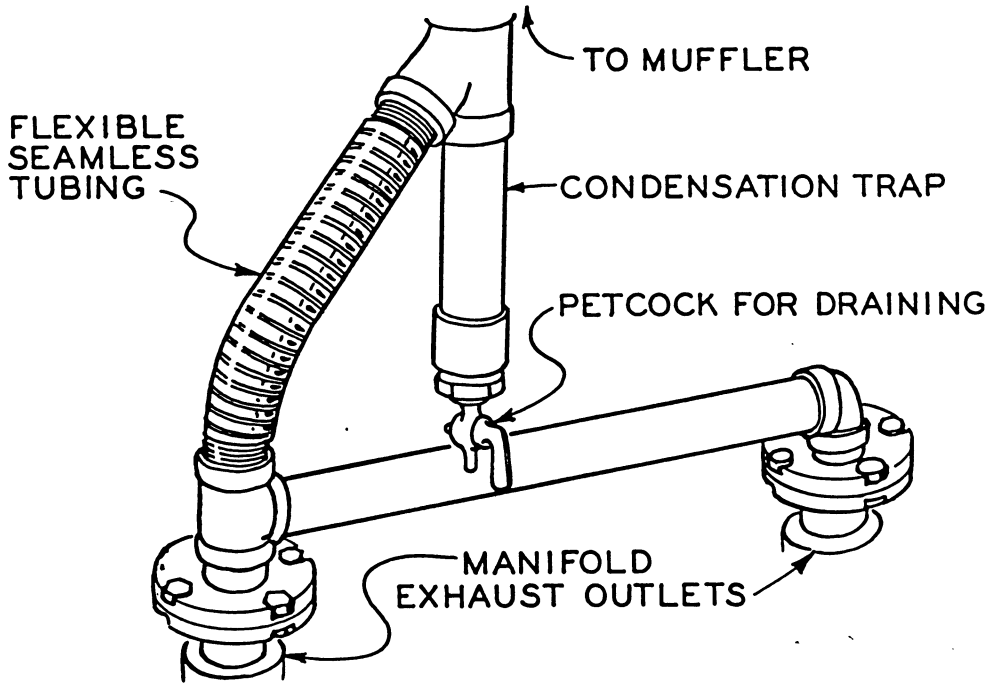


FIG. 3 - TYPICAL EXHAUST INSTALLATION

ENGINE SERVICING. - Service the engine as instructed in the engine manual. The radiator must be properly filled. INSPECT THE CRANKCASE OIL LEVEL. If the plant were shipped with "Break In" oil in the crankcase, this oil, as explained on a tag attached, is intended for use during the first 120 hours of running. If the crankcase is empty or low, then refill it with oil as directed in the engine manual, according to temperature conditions.

CONNECTING THE LOAD WIRES. - Connect the A.C. load wires to the terminal posts inside the sheet metal box on the generator. Knock-out openings are provided for bringing in the load wires. For access to the output terminals, remove the screws from the side panel and swing the panel downward on its hinges. Observe electrical code specifications. Be sure to provide a switch for disconnecting all electrical load from the plant. Connect the load line wires to the terminal posts according to the following directions, depending upon the type of plant. Properly fuse each circuit. See the plant wiring diagram.

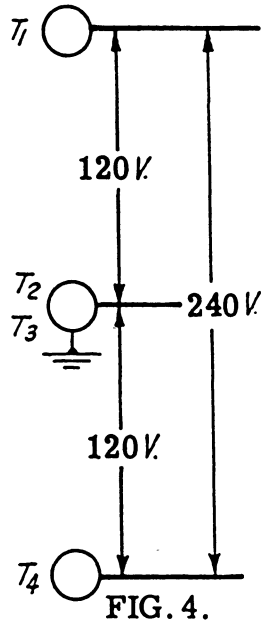


FIG. 4.

120/240 VOLT, SINGLE PHASE, 3 WIRE PLANT.-

The terminal post marked "T2 , T3" is grounded. For 120 volt current, connect the "NEUTRAL" (white) load wire to the "T2, T3" terminal. Connect the "hot" (black) load wire to either the "T1" or "T4" terminal. Two 120 volt circuits are thus available, with not more than one half the rated capacity of the plant available on each circuit. Balance the load as closely as possible between the two circuits.

For 240 volt current, connect one load wire to terminal "T1" and the other load wire to terminal "T4", leaving terminal "T2, T3" unused.

If both 120 and 240 volt current are used at the same time, use care not to overload either side of the circuit.

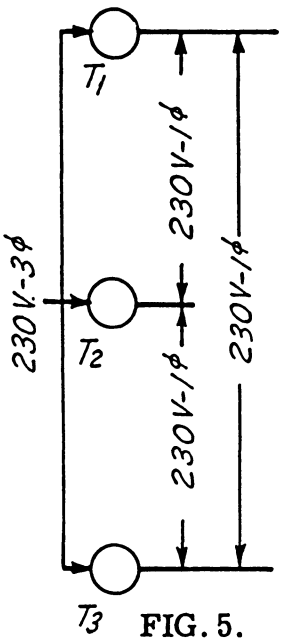


FIG. 5.

230 VOLT, 3 PHASE, 3 WIRE PLANT.-

No terminal is grounded. For three phase current, connect separate load wires to each plant terminal "T1", "T2", and "T3", one wire to each terminal. Reversing the connections between any two terminals will reverse the direction of rotation of 3 phase motors. If phase sequence is important, as when paralleling plants, be sure to check the phase sequence before connections are completed.

To obtain 230 volt, single phase current, connect separate load wires to each of any two plant terminals. Three 230 volt single phase circuits are thus available, with not more than 1/3 of the plant rated capacity for each circuit. Balance the load as closely as possible among the circuits.

If both single phase and three phase current is to be used at the same time, use care not to overload any one circuit. Subtract

the amount of the 3 phase load from the rated capacity of the plant. Divide the remainder by 3, and this is the maximum load that can be taken from any one circuit for single phase current use. For example, a 50,000 watt plant is used, with a 20,000 watt 3 phase load connected. This leaves 30,000 watts available for single phase use. Divide the 30,000 watts by 3, giving 10,000 watts available on each single phase circuit. Do not attempt to take all 30,000 watts in this example off one circuit, as overloading of the generator will result.

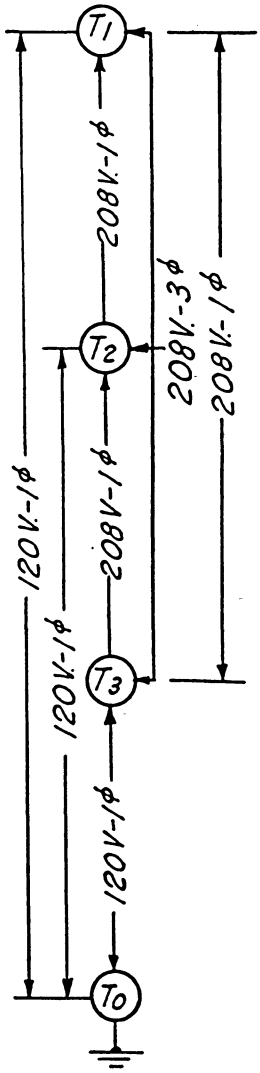


FIG. 6.

120/208-VOLT, 3 PHASE, 4 WIRE, WYE-CONNECTED PLANT. -

The terminal marked "T0" is grounded. For 120 volt, single phase current, connect the "neutral" (white) load wire to the "T0" terminal. Connect the "hot" (black) load wire to any one of the other three terminals, "T1", "T2", "T3". Three separate 120 volt, single phase circuits are thus available. Do not attempt to take more than 1/3 the rated capacity of the plant from any one circuit. Balance the load as closely as possible between the three circuits.

For 208 volt, three phase current, connect a separate load wire to each of the plant terminals "T1", "T2", and "T3", leaving the "T0" terminal unused. Reversing the connections between any two terminals will reverse the direction of rotation of 3 phase motors. If phase sequence is important, as when paralleling plants, check the phase sequence before making final connections.

For 208 volt, single phase current, connect a separate load wire to each of any two terminals "T1", "T2", or "T3". Do not use the "T0" terminal. Three separate single phase circuits are available: "T1", and "T2", "T1" and "T3", "T2", and "T3". Do not attempt to take more than 1/3 the rated capacity of the plant from any one circuit. Balance the load as closely as possible between the three circuits.

If both single and three phase current is used at the same time, follow the principles of load distribution as given for the 3 phase, 3 wire plant.

480 VOLT OR 575 VOLT, THREE PHASE, THREE WIRE PLANT.-

Follow the principles of connection as given for the 230 volt, 3 phase, 3 wire plant.

220 VOLT, SINGLE PHASE/380 VOLT, THREE PHASE, 4 WIRE PLANT.-

Follow the principles of connection as given for the 120 volt, single phase / 208 volt, 3 phase, 4 wire plant.

120/240 VOLT, 3 PHASE, 4 WIRE, DELTA-CONNECTED PLANT.-

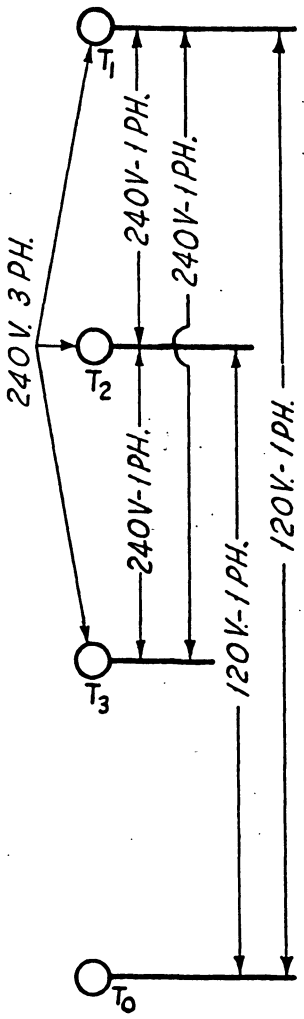


FIG. 7.

This type of generating plant is specially designed so that two types of loading can be applied to the generator; regular 240 volt, 3 phase, 3 wire operation; or, combination 240 volt, 3 phase, 3 wire and 120/240 volt, 1 phase, 3 wire operation.

The load terminals are marked T1, T2, T3 and T0 from top to bottom. The T0 terminal is the generator center tap between T1, and T2. The T0 terminal of the generator is not grounded.

For 240 volt 3 phase 3 wire operation connect the three load wires to the three terminals T1, T2, T3, one wire to each terminal post. For 3 phase 3 wire operation the T0 terminal is not used and is normally not grounded.

If it is desired to use combination single phase and three phase loads simultaneously connect such single phase loads as follows:

For 120/240 volt, 1 phase, 3 wire operation, terminals T1 and T2 are the "Hot" terminals; the T0 terminal is the neutral (which can be grounded if desired). For 120 volt service, connect the "Hot" (Black) load wires to the T1 and T2 terminals, and the neutral (White) wire to the T0 terminal. Two 120 volt circuits are thus obtained. The two black wires connected to T1 and T2 will give one 240 volt circuit.

Any combination of single phase and three phase loading can be applied to the generator simultaneously as specified above as long as no terminal current exceeds the rated NAMEPLATE current of the generator.

Combination single phase and three phase loads applied to a three phase generator are unbalanced loads which cause the phase voltages to be unequal. These unbalanced loads will not create voltage unbalance of the phase voltages of greater than 5 per cent so long as no terminal current exceeds the rated current of the generator.

This generating plant may be used with an ONAN automatic line transfer control, for standby plant operation. The T0 terminal of the ONAN automatic line transfer control is always grounded. Connecting the generating plant T0 to the line transfer T0 terminal grounds the generator. If used in conjunction with an ONAN automatic line transfer control on a 3 phase 3 wire circuit, the line transfer T0 terminal should be left open and not used.

REMOTE CONTROL CONNECTIONS. - A small 4-place terminal block marked "REMOTE D.C. OUTPUT" is located inside the control box. If automatic or line failure controls are to be connected, follow the directions for connections as supplied with the control equipment.

Connections for two styles of momentary contact toggle switches for use as Remote Start-Stop Stations are illustrated in Figure 8. Connect all number "2" or "OFF" switch terminals to the number "2" terminal on the plant terminal block. Likewise, connect together all number "3" or "ON" terminals and also, all number "1" or "Single" (not marked) terminals. If the switch is to be mounted vertically, "START" or "ON" position should be upward to conform with operation at the plant when a toggle switch is used.

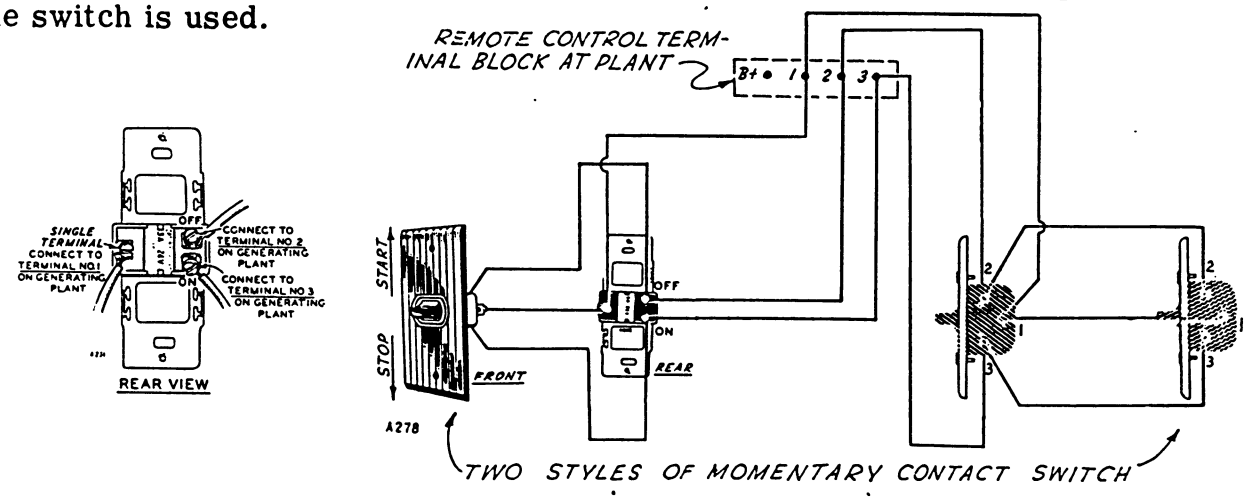


FIG. 8. REMOTE CONTROL CONNECTIONS

A remote control switch may be used with the remote starting type plant. This switch and additional switches may be installed at convenient points. The wire length from the plant to the switch determines the wire size necessary. Use #18 wire up to 85 feet, #16 wire up to 135 feet, #14 wire up to 215 feet, and #12 wire up to 350 feet.

AUTOMATIC LINE TRANSFER CONTROLS. - Separately mounted automatic line transfer controls can be connected to the generating plant. Before buying and installing such a control, the purpose should be analyzed in order to select the correct type desired. This type of control starts and stops the plant and transfers the load during an interruption of commercial power. Automatic line transfer controls should be used when even a short interruption of commercial power is serious or in locations where there is no attendant to throw a hand-operated switch. These controls serve various other functions and literature and advice covering the particular application should be requested.

FUEL RESERVOIR (DAY) TANK. - In standby service, the generating plant may stand unused for many days. In this period of shut down, sufficient gasoline may evaporate from the carburetor to lower its fuel level considerably. Prolonged cranking may then be necessary in order to pump enough gasoline into the carburetor for the engine to start. On installations where automatic, unattended starting after extended shut-down is necessary, an auxiliary, gravity feed fuel tank should be installed. Fuel from this tank flows by gravity to the carburetor, thus replacing any fuel lost through evaporation and promotes quick starting after an idle period.

PRELIMINARY. - Before putting the plant in operation, check carefully to see that the installation has been properly completed. Check the engine operators' manual to be sure that preliminary services have been completed. ALL OIL WAS DRAINED FROM THE CRANKCASE BEFORE SHIPMENT. REFILL WITH OIL AS RECOMMENDED IN THE ENGINE MANUAL, ACCORDING TO TEMPERATURE CONDITIONS.

STARTING THE PLANT. - Before starting the plant, whenever practicable disconnect the electrical load. An electric choke provides choking for the gasoline fuel carburetor. The engine starts at wide open throttle. See that the toggle switch is at REMOTE position as necessary for electrical cranking. See that the rheostat switch is at REGULATOR ON position.

If necessary to crank the engine manually, snap the switch to HAND CRANK position but return it to REMOTE position as soon as the plant starts. NEVER LEAVE THE SWITCH AT HAND CRANK POSITION UNLESS ACTUALLY CRANKING MANUALLY OR READING GAUGES. While at HAND CRANK position, the plant cannot be stopped by pressing the stop button at the plant or at a remote station. Also while stopped, the battery will discharge.

Start the plant by holding the Start Button at the plant (or the momentary contact switch at a remote station) at START position until engine oil pressure builds up and charging generator voltage builds up. If a false start is attempted, do not crank continuously for more than 30 seconds. (NOTE: The anti-dieseling solenoid must be manually operated (held in the operated position by hand) when the Hand Crank-Remote switch is at the "Hand Crank" position in order to have it hold in when the battery is low.)

After the plant starts, allow it to reach operating temperature, check the panel instruments and operation in general, check the voltage, then connect the load. Normally no voltage adjustment is required when the switch is left at REGULATOR ON position. Refer to the paragraph on Regulating the AC Output Voltage.

STOPPING THE PLANT. - The plant stops when the Ignition Relay is shorted out. To stop the plant, hold the Stop Button at STOP position either at the plant or at a remote station until the plant stops. Likewise, low oil pressure or high water temperature will cause an emergency shut-down. When practicable, disconnect the load before stopping the plant.

OPTIONAL EQUIPMENT. - Optional equipment might be necessary for the particular installation or it might be installed for the convenience of the operator. If the plant is not equipped with certain electrical AC output meters, the efficiency of the plant is not affected, but it does impose upon the operator the responsibility of becoming sufficiently familiar with the performance of the plant to recognize any abnormal condition before damage may be done.

ALARM SYSTEM (Optional). - The engine optional equipment may include an alarm system to indicate high water temperature or low oil pressure. Should the alarm system operate, shut down the plant immediately and remedy the cause of the trouble before again starting it up.

METERS (Optional). - On 3 phase models having a voltmeter and ammeter, a meter selector switch is provided. Turn the switch to check the individual circuits. The voltmeter registers the output voltage. The AC ammeter reading is an indication of the amount of load connected. The meters register only for the particular "leg" or circuit to which they are connected through the selector switch. On single phase models, two ammeters are used, one for each circuit, with no switch necessary.

CIRCUIT BREAKER (Optional). - The circuit breaker protects the generator against overloading. If the generator is overloaded, the circuit breaker will automatically break the generator field circuit. Before resetting the circuit breaker to the "ON" position, correct the overload conditions which caused the circuit breaker to operate.

ENGINE CONTROL OPERATION. - A brief description of the function of the various engine control circuits will enable the operator to more easily understand their operation.

When the Start Button on the control panel is pushed to start position, battery current is fed to the Start Solenoid Relay, its contacts close and feed battery current to the Start Solenoid; its contacts close and feed battery current to the Starting Motor which cranks the engine. The Start-Disconnect Relay, which is in the cranking circuit, opens its contacts and disconnects the cranking circuit, when it becomes energized by the charging generator voltage as it comes up to speed.

When the Start Button is pushed, the Start-Ignition Relay is energized, connecting the battery across the ignition circuit. As soon as the battery charging generator comes up to speed, as the engine is cranking, enough voltage is generated to close the ignition relay. The ignition relay remains operated as long as the plant is operating. To stop the plant, operation of the Stop Push Button grounds the coil of the Ignition Relay; disconnects the ignition circuit and stops the plant.

The ignition circuit goes thru the normally closed contact of the Emergency Stop Relay. If either high water temperature or low oil pressure occurs, the Emergency Stop Relay coil connected to the charging generator becomes energized, disconnects the ignition circuit, and stops the plant. When the Emergency Stop Relay is energized, the normally open contacts close connecting the hold in coil circuit to the battery positive. When this occurs, the cause of the plant shutdown should be determined, first, before attempting to start the plant again. Whenever the Emergency Stop Relay has operated, the Emergency Reset Switch must be operated before the plant can be started. (NOTE: On plants built prior to Serial No. 491549, a mechanical latching relay is used instead of the Emergency Stop Relay. See the following paragraph).

MECHANICAL LATCHING RELAY. - On units built prior to Serial No. 491549, a mechanical latching relay was used with the low oil pressure cutoff switch and the high water temperature cutoff switch. On these units resetting of the latching relay is automatic whenever the start button is

pressed. When the start button is pressed, the coil of the latching relay is energized, which causes the latching relay to become mechanically latched. The relay will then remain latched until either safety cut-off switch has operated to unlatch it and thereby open the ignition circuit causing an emergency shut-down.

DRIP TANK OPERATION. - On all plants beginning with Spec E or later, the carburetor has a drip tank assembly added at the bottom of the carburetor. When the stop button is operated to stop the engine, the engine continues to rotate a few times which causes a decrease in the vacuum which exists in the intake manifold and carburetor while the plant is running. The carburetor has an accelerating pump which automatically shoots extra gasoline into the carburetor when the vacuum decreases. The raw gasoline drips down into the drip tank where it remains until the engine is started again. This gasoline is drawn into the intake manifold and the engine cylinders thru the fuel line connected to the intake manifold as soon as sufficient vacuum is created in the intake manifold when the engine is started. The drip tank prevents flooding the carburetor and prevents fuel waste when the engine is stopped.

ANTI-DIESELING CONTROL OPERATION. - All plants beginning with Spec E or later, have an Anti-Dieseling Control. When the engine is operating hot and the ignition is turned off to stop it, any gasoline reaching the cylinders will ignite and keep it running; creating what is called a "dieseling" condition. To prevent this "dieseling" condition from occuring, a butterfly valve is located in the carburetor and connected to a spring and to the anti-dieseling solenoid. As soon as the plant stops, the spring pulls the carburetor butterfly valve shut, stopping any further fuel and air flow to the engine. The carburetor butterfly valve is automatically opened by the anti-dieseling solenoid as soon as the engine starts cranking. (NOTE: On some wiring diagrams, the anti-dieseling solenoid is called the governor solenoid and the anti-dieseling solenoid start relay is called the governor solenoid start relay). The anti-dieseling solenoid must be manually operated (Held in the operated position by hand) when the Hand Crank-Remote switch is at the "Hand Crank" position in order to have it hold in when the battery is low.

GASEOUS FUEL OPERATION (Natural or LPG). - Be sure the choke is locked in its wide open position and the lock screw in bottom of carburetor bowl is screwed in tight. Limit the gas pressure to 5 lbs. entering the secondary regulator. Be sure the choke works freely in the adapter. If the engine will not start because the gate valve (located between the regulator and carburetor) setting was changed, close the valve tight. Then open the valve 1/2 turn. Start cranking the engine and slowly open the valve until the engine starts running. Apply load and open the valve until the engine gallops. Then close the valve until the engine runs smoothly.

VOLTAGE REGULATOR OPERATION

GENERAL. - The REGOHM regulator operates as an automatically adjusting field rheostat which adjusts the field current of the exciter of the generator to provide the proper excitation required to maintain the AC voltage within plus or minus 2% of its rated value for all normal load conditions. If the generator speed varies by greater than 75 rpm from the nameplate speed, the regulator range will exceed plus or minus 2%. Changes in temperature or changes in the load power factor will not affect the voltage regulation. It regulates by connecting in or out of the circuit a group of resistors in series with the shunt field circuit. The allowable range of operation of the regulator is approximately plus or minus 5% of the rated voltage of the generator. This means, for example, that for a 230 volt rated generator, it can be operated from 218.5 volts to 241.5 volts. The regulator is adjusted at the factory and no further adjustments should be attempted except the dashpot adjustment which may be necessary if a hunting voltage condition occurs.

There are two types of control circuits which have been used on the voltage regulator:

TYPE (1):

The first type was used until June 1954 and is readily identified by the presence of a "REGULATOR ON-RHEOSTAT ON" toggle switch located on the control panel.

TYPE (2):

The second type, used after June 1954, uses the same circuit but the "REGULATOR ON-RHEOSTAT ON" toggle switch is no longer mounted on the control box, but is combined with the manual field rheostat and is operated automatically when the rheostat knob is turned all the way counterclockwise (Maximum resistance giving lowest AC output voltage). This design insures proper operation.

There are three controls for the generator which affect the regulator operation, as follows:

(1) The "REGULATOR ON-RHEOSTAT ON" toggle switch. (On type 1 controls, this switch is located on the control box. On type 2 controls, it is mounted on the rear of the manual field rheostat).

When the switch is at the "REGULATOR ON" position, the voltage regulator is in operation. When the switch is at the "RHEOSTAT ON" position, the voltage MUST BE CONTROLLED BY HAND OPERATION OF THE RHEOSTAT. This switch is provided for emergency operation only, and should be left at "REGULATOR ON" position at all times, except in case of accidental failure of the regulator.

(2). The manual field rheostat knob located on the control box. The manual field rheostat knob is to be used for manual control of the generator output voltage ONLY when the toggle switch is at the "RHEOSTAT ON" position.

(3). The voltage adjusting knob for the voltage regulator. This knob is used for raising or lowering the output voltage when the regulator is in operation. The adjusting knob is on the control panel. (On models built prior to July 1954, this rheostat was not mounted on the control panel; it was mounted on the side of the voltage regulator box.) Turn the knob clockwise to increase voltage, or counterclockwise to lower the voltage.

TYPE (1) VOLTAGE REGULATOR CONTROL OPERATION. - To operate the generator plant equipped with the separate Rheostat-Regulator toggle switch by automatic voltage reglator, proceed as follows:

1. Be sure the toggle switch is at the "Regulator On" position.

2. Start the plant in the normal manner.

3. Adjust the voltage regulator rheostat (not the field rheostat) to obtain the proper output voltage.

WARNING

Always keep the manual field rheostat at its counterclockwise position (maximum resistance) when not actually using it for manual voltage control. Thus if the setting of the Rheostat-Regulator switch is accidentally changed, no regulator damage will occur. NEVER switch to "Regulator" position, when the plant is in operation, without first turning the field rheostat fully counterclockwise.

4. Adjust the voltage regulator rheostat to obtain rated AC voltage. When the regulator is operating properly the output voltage can be varied as desired by adjusting the voltage regulator rheostat. After this procedure has been followed, the generator may be started and stopped as often as desired without any further adjustment. If the regulator ever requires adjustment, see the paragraph under "Voltage Regulator Adjustment" located in the "ADJUSTMENTS" section of this manual.

TYPE (2) VOLTAGE REGULATOR CONTROL OPERATION. - The "REGULATOR ON-RHEOSTAT ON" toggle switch is automatically snapped to "REGULATOR ON" position when the field rheostat knob is turned all-the-way-counterclockwise. Then by turning the knob slightly clockwise,the switch is automatically snapped to "RHEOSTAT ON" position. The control leaves the factory with the field rheostat turned for "REGULATOR ON" operation. No further change should be made during future operation unless the regulator fails. If failure occurs, first check the rear of the field rheostat to see that

the DPDT toggle switch is in time with the rheostat.

When the regulator is operating properly the output voltage can be varied as desired by adjusting the voltage regulator rheostat. If the regulator ever requires adjustment, see the paragraph under "Voltage Regulator Adjustment" located in the "ADJUSTMENTS" section of this manual.

RHEOSTAT OPERATION(For Emergency Only!). - On the type 2 control, when the manual field rheostat knob is turned slightly in the clockwise direction, it is at the "RHEOSTAT ON" position, and the output voltage must be manually controlled by adjusting the manual rheostat knob. On the type 1 control, the toggle switch is mounted on the control box and it must be snapped to the "RHEOSTAT ON" position manually. CAUTION: Before starting the plant, turn the knob counterclockwise to lower the voltage. (Do not turn the knob to the extreme counterclockwise direction on the type 2 control unless it is desired to switch over to voltage regulated operation.) This is necessary to compensate for naturally higher voltage produced by a cold generator, and not under load. The voltage will drop somewhat as it warms up.

The setting of the rheostat must be changed with changes in the electrical load. At a light load, the rheostat must be toward a counterclockwise position. As electrical load is increased, the generator voltage will drop, and it is necessary to turn the rheostat clockwise to bring the voltage up to the proper value.

Do not fail to adjust the voltage with the panel rheostat when ever a substantial change is made in the electrical load on the generator. If a substantial electrical load is reduced, turn the rheostat counterclockwise to lower the voltage. If this is not done, the voltage may be so high as to damage a light load. If a light electrical load is increased substantially, turn the rheostat clockwise to raise the voltage to the proper value. If this is not done, the voltage may be so low as to cause motors to overheat, etc.

The rheostat is provided solely for emergency operation in case of failure of the voltage regulator. Care must be used in the use of the rheostat and repairs or replacement of the regulator should be made as promptly as possible.

HIGH ALTITUDE OPERATION. - If the unit is to be operated at an altitude of 2500 feet or more above sea level, the carburetor main jet adjustment should be "leaned" slightly to obtain maximum possible power. The carburetor was adjusted for best performance at the factory altitude: approximately 860 feet. Because the air becomes less dense as the altitude increases, less fuel is required to maintain the proper air-to-fuel ratio. Consequently, any engine will develop less power at higher altitudes. The usual altitude de-rating amount is approximately 4% for each 1000 feet above sea level.

RUNNING TIME METER. - A running time meter is mounted on the box on the generator. This meter indicates the TOTAL number of hours the plant has been in operation. Refer to the meter to assure servicing the plant at the proper intervals. A chart on which each servicing is recorded can be easily maintained.

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

Perform the periodic service as instructed in the International Harvester Operators Manual under preventive maintenance. Generator maintenance instructions include assembly procedures which might be helpful during periodic servicing.

COMMUTATOR AND SLIP RINGS. - Every 200 hours of operation, check the condition of the exciter commutator, and the alternator slip rings. In service, the commutator and slip 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 slip 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. NEVER use emery or carborundum cloth or paper to clean the commutator or slip rings. Such abrasive particles will embed and cause damage.

BRUSHES. - Every 200 hours of operation, check the condition of the brushes and springs. 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. Do not use a substitute brush which looks the same but may have different electrical characteristics. See that brushes ride freely in their holders and make good contact. Spring tension must be uniform. To service the exciter brush rig, remove the end bell band, or the end bell cover on later model generators. To service the alternator brush rig, remove the covers over the hand holes of the adapter end bell casting of the alternator.

Check the exciter brush rig for proper alignment of the reference marks on the brush rig and its support.

GENERATOR BEARING. - The alternator ball bearing does not require lubrication service because it is a double sealed pre-lubricated type. Only the Generator Data Sheet No. 50KA4N3A model generator uses an exciter bearing. Lubricate the exciter ball bearing at intervals determined by the type of grease used. Service intervals are for normal operating conditions. Grease must have the proper characteristics to adequately dissipate heat, prevent rust and corrosion, and to exclude dirt and foreign particles. Avoid mixing greases whenever practicable.

Follow the paragraph of instructions below, according to the type of grease used.

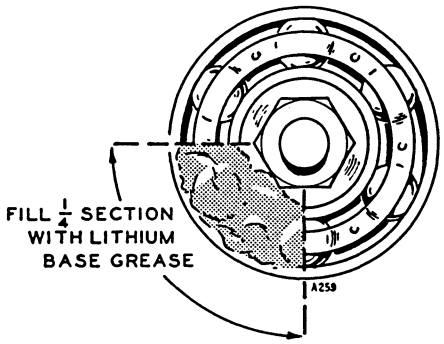


FIG. 9.

Lithium base type bearing grease is used by and recommended by the factory. This bearing grease is superior because it does not run, and will not become hard or caked when used at temperatures ranging from minus 90°F. to 125°F. With lithium base grease, service the generator ball bearing each 5000 operating hours or each 2 years. Only a small quantity of this grease need be used. With a clean finger, remove as much as possible of the old grease. Force fresh grease into a 1/4 section of the bearing. DO NOT fill the entire bearing. Do not put a reserve of grease in the bearing recess nor in the bearing cover. If dirt has gotten into the bearing, remove the bearing and clean it in a good solvent. Dry the bearing thoroughly and reinstall it.

If ordinary good ball bearing grease is used, service the generator ball bearing each 2000 operating hours or each 6 months. 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.

Reinstall the bearing gasket and cover, using care that no dirt gets into the bearing.

GOVERNOR. - The governor controls the speed of the engine, and therefore the frequency of the AC voltage. Plant speed affects AC output voltage. Either a tachometer or frequency meter may be used to check engine speed for proper governor adjustment.

The governor should control the engine speed to within the range and spread as shown in the speed chart. The governor is adjusted at the factory and normally should require no further adjustment.

The engine speed control lever is held stationary by an adjustable link to the engine. It is located opposite the carburetor side of the engine. Normally no adjustment to the link nor to the governor itself should be necessary. However, speed can be increased by shortening the link slightly, or speed can be decreased by lengthening the link slightly.

A short lever is clamped to the carburetor throttle shaft and connects with the governor rod. This lever is set on the throttle shaft to give the best sensitivity control. That is, the best control of the drop in speed from no load operation to full load operation. This setting results in a 3/16" to 1/4" clearance at wide open position of the carburetor lever to its stop pin.

SPEED CHART FOR CHECKING GOVERNOR REGULATION

		SPEED RANGE LIMITS		SPEED SPREAD (WITHIN RANGE) PREFERRED	LIMITS	
		MAX.	MIN.	F. L. * to N. L.	MAX.	MIN.
FOR ALL 60 CYCLE PLANTS	CYCLE→	63	59	59 - 61	3	1.5
	RPM→	1890	1770	1770-1830	90	45
FOR ALL 50 CYCLE PLANTS	CYCLE→	53	49	49-51	3	1.5
	RPM→	1590	1470	1470-1530	90	45

* Speed Regulation for Full Rated Load is at 0.8 Power Factor.

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.

Recheck the AC output voltage.

AC VOLTAGE REGULATOR ADJUSTMENT PROCEDURE. - See also the instructions REGULATING THE VOLTAGE under Operation section of this manual.

This procedure will be necessary only after installation of new parts or after disturbing the setting of original parts. Reference to the plant wiring diagram will be helpful.

Be sure the engine speed is correct before attempting to correct output voltage by adjusting the AC voltage regulator.

1. Snap the toggle switch to RHEOSTAT ON position. This must be done by turning the manual field rheostat knob in a clockwise direction on the type 2 control as previously described under "OPERATION".

2. Adjust the manual rheostat to obtain an exciter voltage of 70 volts. Use a DC voltmeter across two adjacent DC brushes (A1 and A2).

3. Set the DC brushes. With the brush rig loosened, shift it to the position which gives the highest voltage. The peak DC exciter voltage gives the peak AC output voltage. This brush rig position will be the same as neutral position resulting in the least arcing at the brushes.

4. Adjust the manual field rheostat to the extreme counterclockwise position.

5. Snap the toggle switch to REGULATOR ON position. (This is done automatically when turning the manual field rheostat to the extreme counterclockwise position on type 2 controls.)

6. Set the regulator rheostat at approximately the middle of its rotation.

7. Refer to the VOLTAGE CHART and regulate the AC output voltage as instructed under REGULATING THE VOLTAGE under the OPERATION section.

8. The adjustable range of the regulator rheostat should be not less than ten per cent above and below the rated voltage.

VOLTAGE CHART

TYPE OF PLANT			VOLTAGE LIMITS	
VOLT	PHASE	WIRE	MAXIMUM NO. LOAD VOLTAGE	MINIMUM FULL LOAD * VOLTAGE
120/208	3	4	212	204
230	3	3	234	226
460	3	3	468	452
220/380	3	4	388	372
127/220	3	4	224	215
575	3	3	586	564
115	3	3	117	113
120/240	3	4 (Delta-Connected)	244	236

* Voltage Regulation for Full Rated Load is specified at 0.8 Power Factor.

VOLTAGE REGULATOR RESISTOR ADJUSTMENT. - If the generator voltage can not be set at the desired point by adjusting the voltage regulator rheostat knob, it will be necessary to adjust the voltage adjusting resistor on the regulator. This resistor is identified on the regulator illustration in Figure 10. Set the regulator adjusting knob at its center position. Loosen the sliding clip on the adjusting resistor and move the clip backward and forward as necessary to obtain the desired voltage. Very little movement of the sliding clip will be necessary. Be sure to retighten the clip after the adjustment is completed.

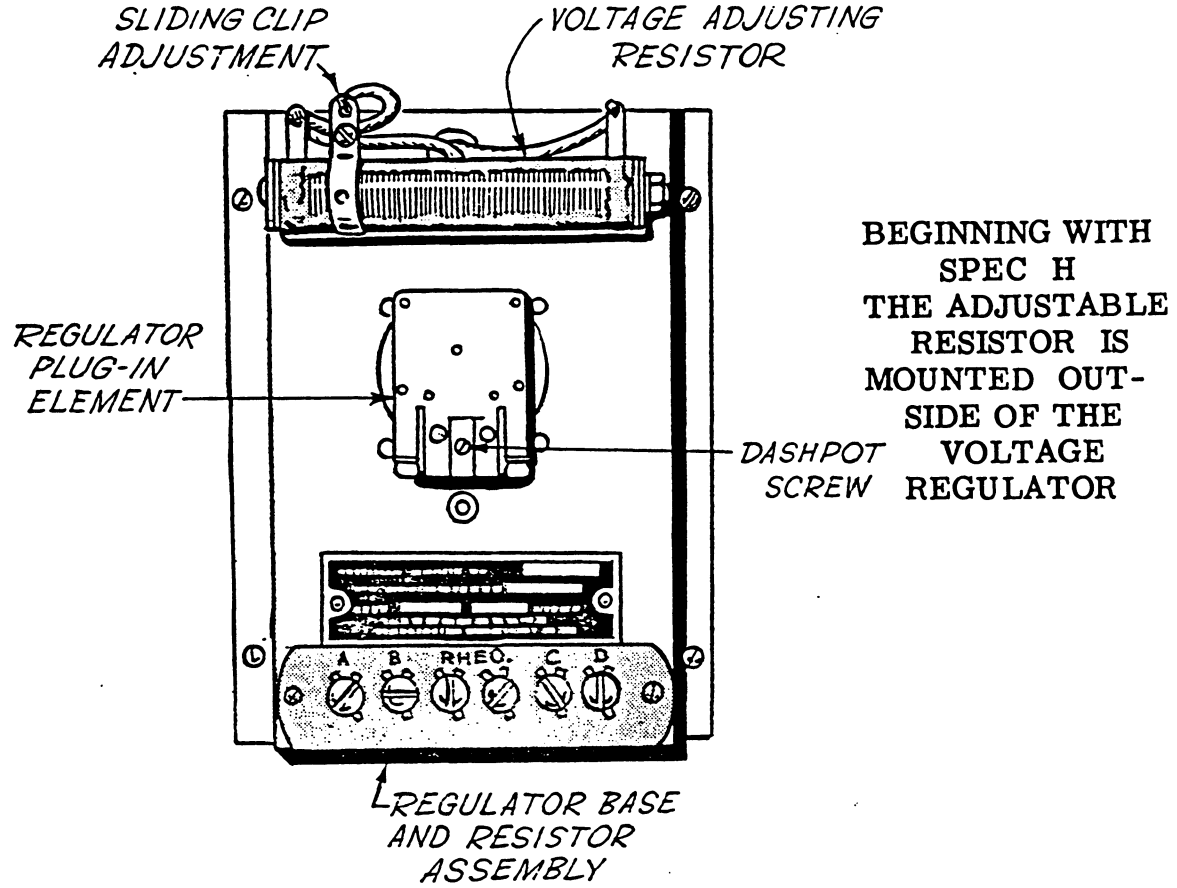


FIG. 10. REGOHM VOLTAGE REGULATOR

VOLTAGE REGULATOR DASHPOT ADJUSTMENT. - If a hunting voltage condition exists, the governor operation of the engine should be checked first. Otherwise the voltage regulator dashpot adjustment must be used. See the regulator illustration in Figure 10.

Remove the regulator cover. Remove the clamping bar from the metal can of the regulator. Remove the can, held in place by two screws at the top. Turn the slotted screw at the center, until the hunting (rising and falling of voltage) just stops.

IMPORTANT!

THIS IS THE ONLY ADJUSTMENT THAT WILL BE NECESSARY AND NO ADJUSTMENT TO ANY OTHER PART OF THE REGULATOR PLUG-IN UNIT SHOULD EVER BE ATTEMPTED. NEVER CHANGE THE FACTORY SETTINGS OF THE REGULATOR SPRINGS OR CONTACT FINGERS.

GAS CARBURETOR ADJUSTMENT. - Because the output generator uses an external voltage regulator, carburetor adjustments should be made while watching the governor reaction instead of watching the output voltage reaction to changes in the richness of the fuel mixture.

With the engine running at full rated load, watch the governor rod, screw the carburetor valve closed for leaner mixture until the governor starts to open the throttle, then screw the valve open until the governor starts to close the throttle, then screw the valve to a position midway between the two above points. Normally the final setting will be approximately 1/2 turn open from the (too lean) point where the governor starts to open the throttle. If no governor reaction is noticed, a too-small supply of fuel is evident. If normal voltage can not be attained, a governor readjustment may be required.

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

COMMUTATOR AND SLIP 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". Unclip the brush spring and support from the brush guide and lift each brush from its guide. Remove the end bell or the end bell cover on later model generators. 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 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 slip rings to become grooved, out of round, pitted, or rough, it will be necessary to machine it true by carefully turning it in a lathe, removing only enough to provide a perfectly true surface.

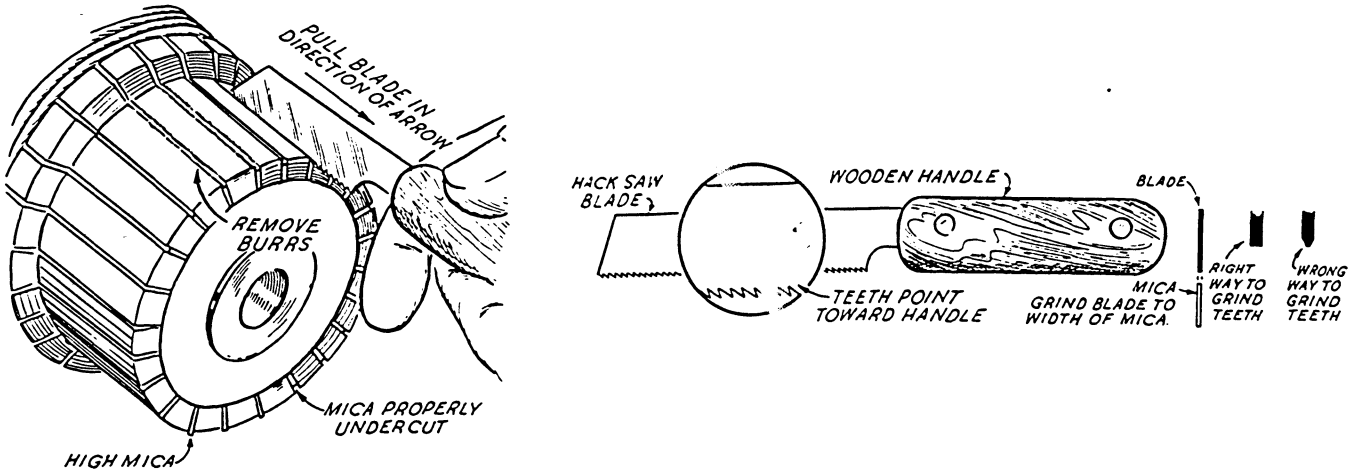


FIG. 11. COMMUTATOR REPAIR

The exciter and the rotor must be removed. The exciter bearing on the Generator Data Sheet No. 50KA4N3A model generator must be removed from its shaft to prevent any foreign material from getting into it during the turning operation. After the commutator is turned down, the mica between the bars must be undercut as described above. Refer to Generator Disassembly and Assembly for reinstallation.

BRUSH RIG. - It is unnecessary to remove the brush rig from the exciter 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. Poor brush contact leads to excessive brush sparking and pitting of the commutator or slip rings. See that brushes ride freely in their guides.

Each brush spring is attached permanently to a brass support which is detachable from the brush guide. These springs are designed to provide constant pressure as brushes wear shorter. To unclip the spring and support from the brush guide, push it toward the commutator or slip-ring and away from the brush guide. See Figure 12.

Use care not to damage the spring by bending it against the spring support.

Correct spring tension is 9 to 13 ounces. It is difficult to accurately measure the spring tension in the field, or to determine if a spring has become fatigued. Under normal conditions the springs may never require replacement, but after long usage or if they appear damaged, replacement is good preventive insurance. When replacing a brush in its guide, be sure that the low side of the beveled top edge is toward the spring support side of the brush guide. Refer to the brush spring removal illustration in Figure 12.

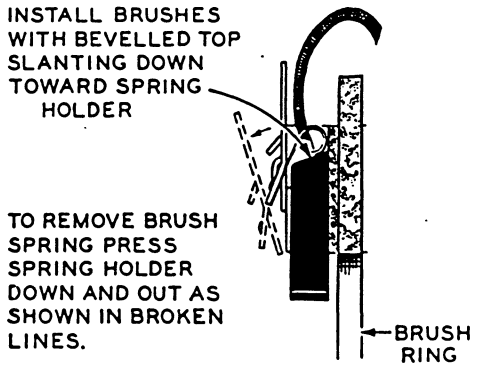


FIG. 12.-BRUSH SPRING REMOVAL

GENERATOR FAILURE. - If the generator should fail to produce electrically, it may be a fault in one of the several windings and should be located by a competent electrician who is familiar with generating plants. Replace the faulty part with a new one.

GENERATOR DISASSEMBLY AND ASSEMBLY. - The procedure for the Generator Data Sheet No. 50KA4N3A model generator is slightly different because it has an exciter bearing, a tapered shaft pilot; and an exciter end bell and cover band. All later model generators do not have an exciter bearing; use a straight concentric shaft pilot; and a sheet metal exciter end cover. The disassembly and assembly procedures for each type of generator will be treated separately. On all single phase plants it is necessary to support the engine rear end during generator disassembly due to the location of the rear mounting support on the longer plant.

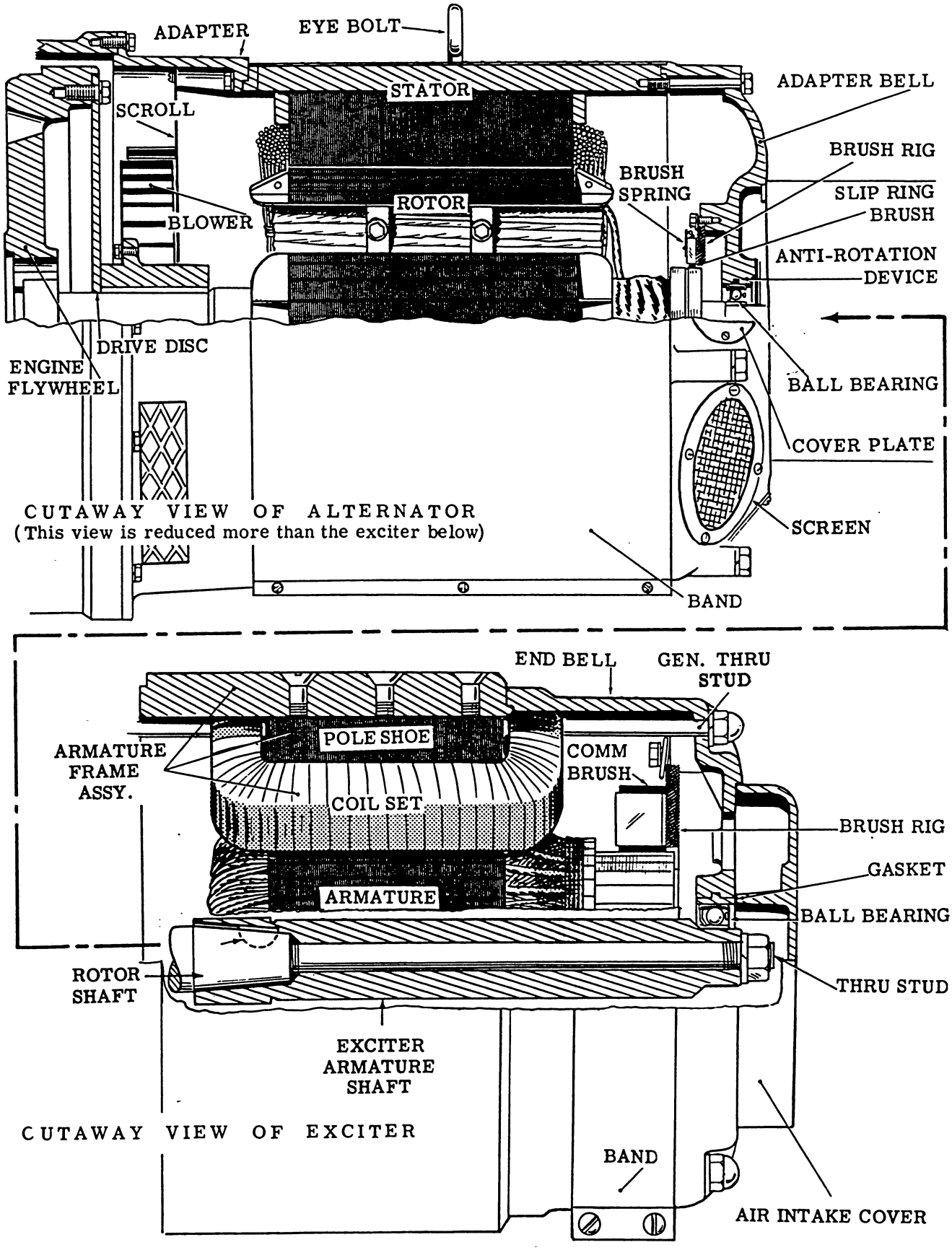


FIG. 13. GENERATOR ASSEMBLY WITH EXCITER BALL BEARING.

(1) Generator Data Sheet No. 50KA4N3A Model Generator:

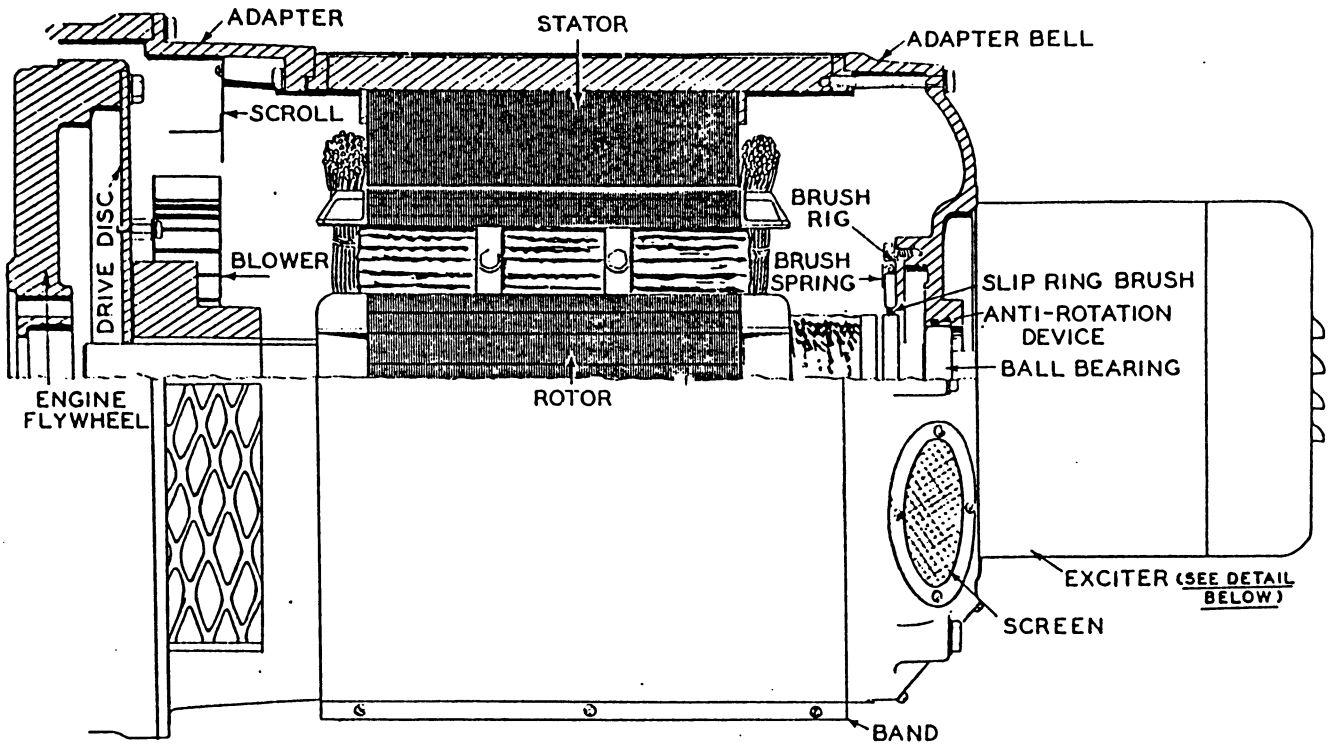
To remove the exciter, unclip the brush springs and lift all brushes as described previously under that subject. It is not necessary to remove the brush rig from the end bell. Disconnect the exciter leads in the control box and tag them to insure proper reassembly. Detach the conduit from the control box. The exciter is held to the adapter bell by two through studs. Remove those nuts and carefully work the frame assembly off to avoid damaging the armature. The bearing stop clip will usually cling to the tapered and keyed outboard end of alternator rotor shaft. Do not lose the key. Keep the bearing clean. If available, a sheet of aluminum foil can quickly be wrapped and crimped around the bearing until reassembly to keep it clean.

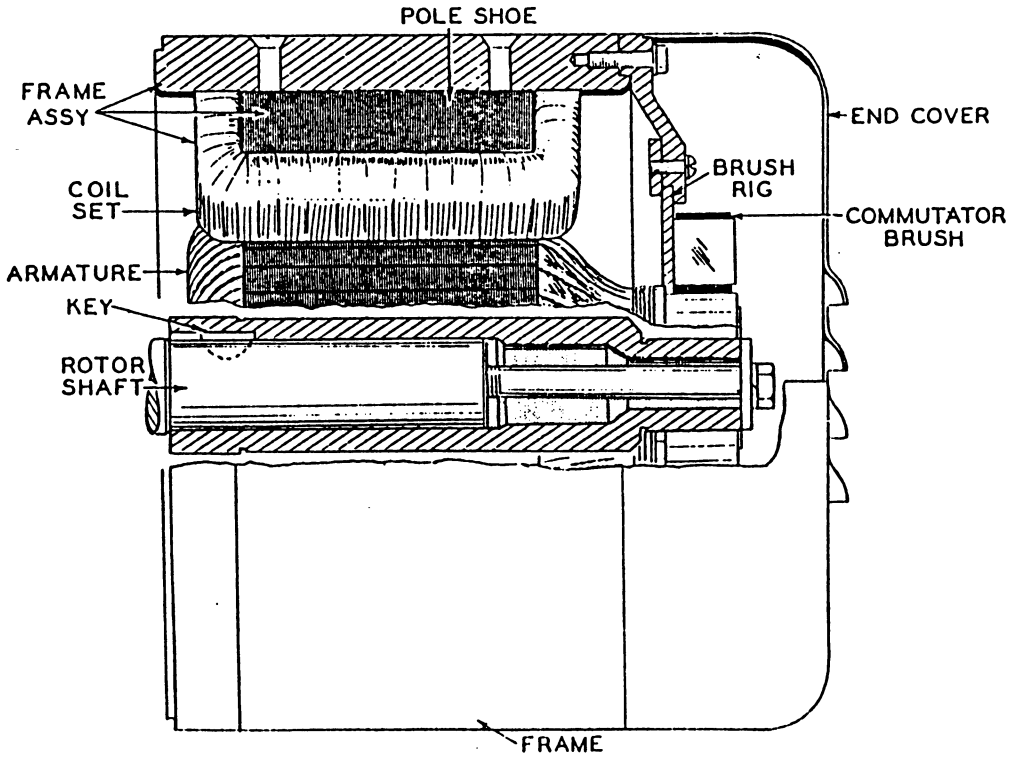
To remove the alternator, first remove the exciter. Disconnect leads that go from the Control box to the engine at the engine end and tag them to insure proper reassembly. Unclip the alternator brush springs and lift the brushes. It is not necessary to remove the brush rig from the adapter bell. Leave the control box attached to the alternator stator. Detach from the engine and remove as an assembly, the entire alternator stator, adapter to engine casting, brush rig and adapter bell casting. When removing the stator avoid damaging the rotor and watch for the rubber ring type of ball bearing anti-rotation device. The rotor is attached to the engine flywheel by means of a drive disc which pilots in the flywheel. Two 1/4-20 tapped holes are provided in the drive disc to facilitate the removal of the rotor by inserting screws to push the disc out. If it is necessary to remove the drive disc from the rotor, mark the position of the disc with relation to the rotor to assure correct balance after reassembly. Reinstall the shims behind the disc which are necessary to center the brushes on the slip rings.

To reinstall the alternator, reverse the procedure for removal and proceed as follows. The matching surfaces of the engine flywheel and the rotor drive disc must be free from nicks and dirt. Snug up the rotor mounting screws and check for excessive run-out at the bearing while rotating with the hand crank. Typical methods are illustrated. Excessive run-out, if not due to a nick or dirt on the disc or flywheel can usually be corrected by turning to the highest point, then applying sufficient pressure on the laminations, toward the "low" side. Recheck and repeat as necessary and perform a final check after screws are tightened. While positioning the stator over the rotor, see that the ball bearing anti-rotation device is in the groove of the adapter-bell bearing-bore and carefully expand it as necessary for the ball bearing to pass through it. A special expander tool may be helpful but not necessary.

To reinstall the exciter, first install the alternator. See that the key is in place on the rotor shaft, matching tapered surfaces are free from nicks or dirt, and that the spring type bearing stop clip is in place on the armature bearing. Install the armature. Install the exciter frame assembly and end bell, but without the bearing cover attached, seeing that the bearing stop clip enters the end bell keyway. Lubricate the exciter bearing as instructed under Periodic Service. See that the commutator brush rig is not shifted from neutral position. Reconnect all leads. Reinstall all brushes and springs. If certain generators use brush springs of different tension, the heavier springs will be for commutator brushes.

Maximum permissible total run-out at the rotor bearing is 0.012".





EXCITER DETAIL

FIG. 14. GENERATOR ASSEMBLY WITHOUT EXCITER BALL BEARING.

(2) Later Model Generators:

To remove the exciter, unclip the brush springs and lift all brushes as described previously under that subject. It is not necessary to remove the brush rig from the exciter. Disconnect the exciter leads in the control box and tag them to insure proper reassembly. Detach the conduit from the control box. The exciter is held to the adapter bell by two through studs. Remove those nuts and carefully work the frame assembly off to avoid damaging the armature. The armature through stud mounts the exciter armature to the keyed outboard end of the alternator rotor shaft. Do not lose the key.

To remove the alternator first remove the exciter. Disconnect leads that go from the Control box to the engine at the engine end and tag them to insure proper reassembly. Unclip the alternator brush springs and lift the brushes. It is not necessary to remove the brush rig from the adapter bell. Leave the control box attached to the alternator stator. Detach from the engine and remove as an assembly, the entire alternator stator, adapter to engine casting, brush rig and adapter bell casting. When removing the stator avoid damaging the rotor and watch for the rubber ring type of ball bearing anti-rotation device. The rotor is attached to the engine flywheel by means of a drive disc which pilots in the flywheel. Two 1/4-20 tapped holes are provided in the drive disc to facilitate the removal of the rotor by inserting screws to push the disc out. If it is necessary to remove the drive disc from the rotor mark the position of the disc with relation to the rotor to assure correct balance after reassembly. Reinstall the shims behind the disc which are necessary to center the brushes on the slip rings.

To reinstall the alternator reverse the procedure for removal and proceed as follows. The matching surfaces of the engine flywheel and the rotor drive disc must be free from nicks and dirt. Snug up the rotor mounting screws and check for excessive run-out at the bearing while rotating with the hand crank. Typical methods are illustrated. Excessive run-out, if not due to a nick or dirt on the disc or flywheel can usually be corrected by turning to the highest point, then applying sufficient pressure on the laminations, toward the "low" side. Recheck and repeat as necessary and perform a final check after screws are tightened. While positioning the stator over the rotor, see that the ball bearing anti-rotation device is in the groove of the adapter-bell bearing-bore and carefully expand it as necessary for the ball bearing to pass through it. A special expander tool may be helpful but not necessary.

To reinstall the exciter, first install the alternator. See that the key is in place on the rotor shaft, and the matching surfaces are free from nicks or dirt; Install the armature. Install the exciter frame assembly and end bell. See that the commutator brush rig is not shifted from neutral position. Reconnect all leads. Reinstall all brushes and springs. If certain generators use brush springs of different tension, the heavier springs will be for commutator brushes.

Maximum permissible total run-out at the rotor bearing is 0.012".

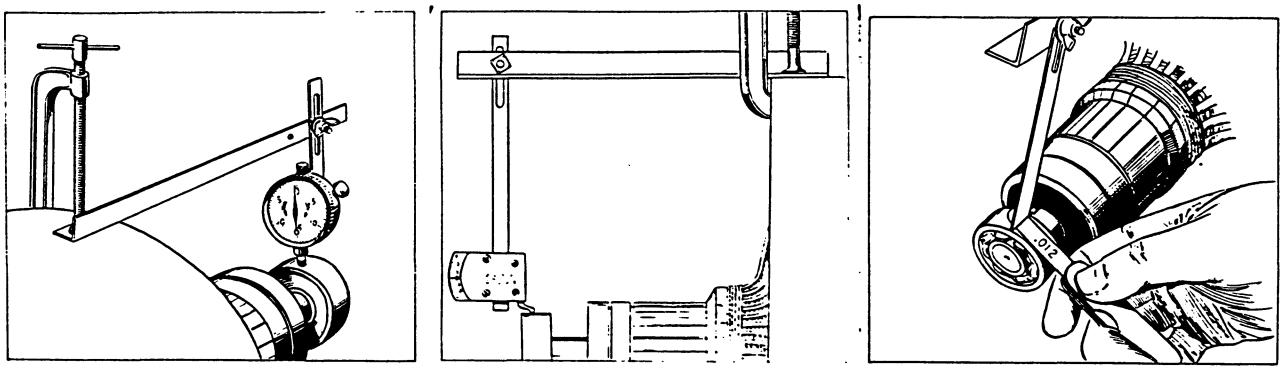


FIG. 15. TYPICAL METHODS OF CHECKING RUNOUT.

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 CRANK position, trouble is indicated, in one of the relays or a loose connection.

REGOHM REGULATOR MAINTENANCE. - No maintenance is required on the voltage regulator. The cover should always be kept on the regulator. The regulator should not be cleaned or lubricated nor should any adjustment be attempted on the mechanism inside the cover except the dashpot adjustment. The component parts of the regulator base assembly should be kept free of dust, dirt, grease and moisture. If faulty operation occurs, the circuit of the generator and load should be checked first. If the cause of the faulty operation can be definitely traced to the voltage regulator, return it to the factory for inspection and repair. When the voltage regulator is returned to the factory, remove the wires connected to the terminals marked A, B, RHEO, and D, C. Return the entire base assembly, consisting of the resistors, plus the regulator plug in unit to an ONAN Authorized Service Station or the factory.

PREPARING UNITS FOR STORAGE OR EXTENDED OUT-OF-SERVICE PERIODS. - Electrical generating sets are often taken out of service for extended periods of time. In many cases they are left to stand idle without being protected against possible damage from rust and corrosion or the elements. The factory recommends that any unit to be removed from service for 30 days or more be protected by this method:

Shut off the fuel supply at the tank and allow the unit to run until it stops from lack of fuel. The fuel system will then be free of gasoline except for the tank.

If the fuel tank will be subjected to temperature changes, fill the tank nearly full to lessen chances of condensation forming within the fuel tank.

Drain the oil from the oil base while the engine is warm. Replace the drain plug. See that the oil filler cap is in place. Attach a warning tag that oil has been drained.

If the cooling system does not have antifreeze and rust inhibitor, drain the entire cooling system. Be sure to drain both the radiator and the block.

Remove each spark plug and pour two tablespoonfuls of rust inhibitor oil (Use SAE 50 motor oil as a substitute) into each cylinder. Crank the engine over slowly by hand to lubricate the cylinders. Stop the engine with the TC (top center) mark on the flywheel indicating at least one piston is at top center position. Replace the spark plugs.

Clean the generator brushes, brush holders, commutator and collector rings by wiping with a clean cloth. Do not coat with lubricant or other preservative.

Remove, clean and replace the air cleaner.

Wipe all exposed parts clean and coat with a film of grease all such parts liable to rust.

Oil the governor to carburetor linkage with SAE 50 oil.

Plug the exhaust outlet with a wood plug to prevent entrance of moisture or foreign matter.

Where batteries are likely to be exposed to freezing temperatures, they must be removed and stored where there is no danger of freezing. A fully charged battery can withstand very low temperatures but an idle battery gradually loses its charge and may become discharged to the point where it will freeze. An idle battery should be given a freshening charge about every 40 days.

If the battery is not removed, disconnect the cables from the unit. Arrange the cables so that the lugs cannot come in contact with each other or with metal parts.

Provide a suitable cover for the entire unit, particularly if it will be exposed to the elements.

RETURNING THE UNIT TO SERVICE AFTER EXTENDED OUT-OF-SERVICE PERIODS. - Remove all protective coatings of grease from external parts. Wipe the entire unit clean of accumulated dust or other foreign matter.

Inspect the unit carefully for damage and for other conditions requiring attention. Service as needed.

Remove the plug from the exhaust outlet.

Remove, clean and adjust spark plugs. While the plugs are out, crank the engine over several times by hand to distribute oil over the cylinder walls. If the cylinders are dry, put a tablespoonful of oil into each cylinder and turn the engine over several times by hand to distribute the oil. Replace the spark plugs and gaskets.

Examine all fuel, oil and water lines and connections. Service as needed.

Refill the cooling system with clean, fresh water.

If antifreeze was left in the cooling system, check the level and add a 50 -50 solution of water and the type of antifreeze originally used to bring the cooling liquid up to proper level. If desired, the antifreeze solution can be drained and the cooling system refilled with clean, fresh water.

Refill the crankcase and air cleaner with the correct amount and grade of oil.

Check carefully for leaks of water, fuel or oil after servicing the unit. Correct any leaks before starting the unit.

Connect the battery cables to the unit. Carefully recheck to make sure the unit is ready for operation. Then start the unit in the regular manner as described under OPERATION in the instruction manual. Always connect the ground cable lastly.

FOR PARTS OR SERVICE CONTACT THE DEALER FROM WHOM YOU PURCHASED THIS EQUIPMENT OR REFER TO YOUR NEAREST AUTHORIZED SERVICE STATION.

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

REFER TO THE GENERATOR NAMEPLATE ON YOUR PLANT

1. Always give the complete Model and Spec. No. . . . . , and the Serial No. . . . . .

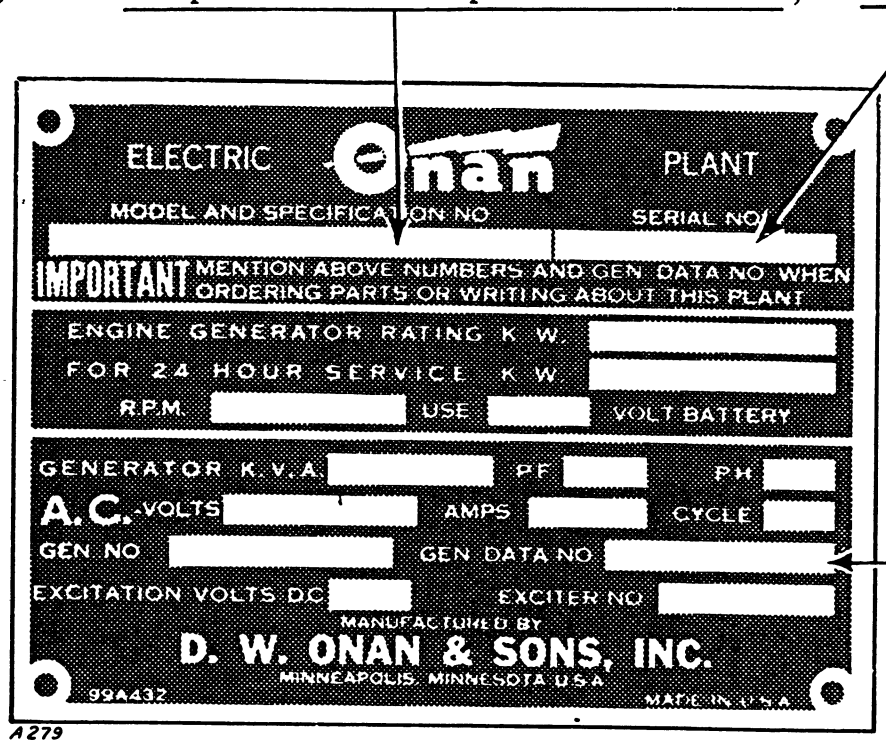


FIG. 16.

2. When ordering Engine Accessory parts, read each parts group heading and each part description carefully to insure ordering the correct desired part. Several groups of Optional Equipment are listed, as furnished on certain special models only.

3. Due to the existing variations in the design and electrical characteristics of the generators manufactured, part numbers are shown for brushes, brush springs and brush rig assemblies only. For all other parts, refer to the applicable generator illustration herein, and order the part by complete description and the quantity desired. Always furnish the requested nameplate information.

4. When ordering control parts, refer to the applicable plant wiring diagram which was furnished with the plant. Order by part number and description. Be sure to supply the complete plant model specification and serial number from the generating plant nameplate. In the case of separate automatic control parts, be sure to supply the nameplate information from the control nameplate. It will be helpful if the wiring diagram number, from which the numbers of the replacement parts are selected, is furnished with the order. If an improved or superseding part is available it will be supplied.

5. Give the part number, description and quantity, needed of each item. If a part cannot be identified, return the part prepaid to your ONAN dealer or nearest ONAN 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.

6. 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 are purposely omitted from the Parts List, due to the confusion resulting from fluctuating costs, import duties, sales taxes, exchange rates, etc.

For current parts prices, consult your ONAN Dealer, Distributor, or Parts and Service Center".

"En esta lista de partes los precios se omiten de proposito, ya que bastante confusion resulto de fluctaciones de los precios, derechos aduanales, impuestos de venta, cambios extranjeros etc.

Consiga los precios vigentes de su distribudor de productos "ONAN".

SELECTING PARTS FOR KA SERIES PLANTS

1. Refer first to the ONAN parts list (this section).

2. If the part is not shown in the Onan list, refer to the International Harvester Supplement (Engine Modifications for Onan, List).

3. If the part is not shown in either of the above lists, refer to the International Harvester Catalog for U-450 Power Units.

4. The orientation near the front of this publication helps clarify advances in models.

ORIENTATION

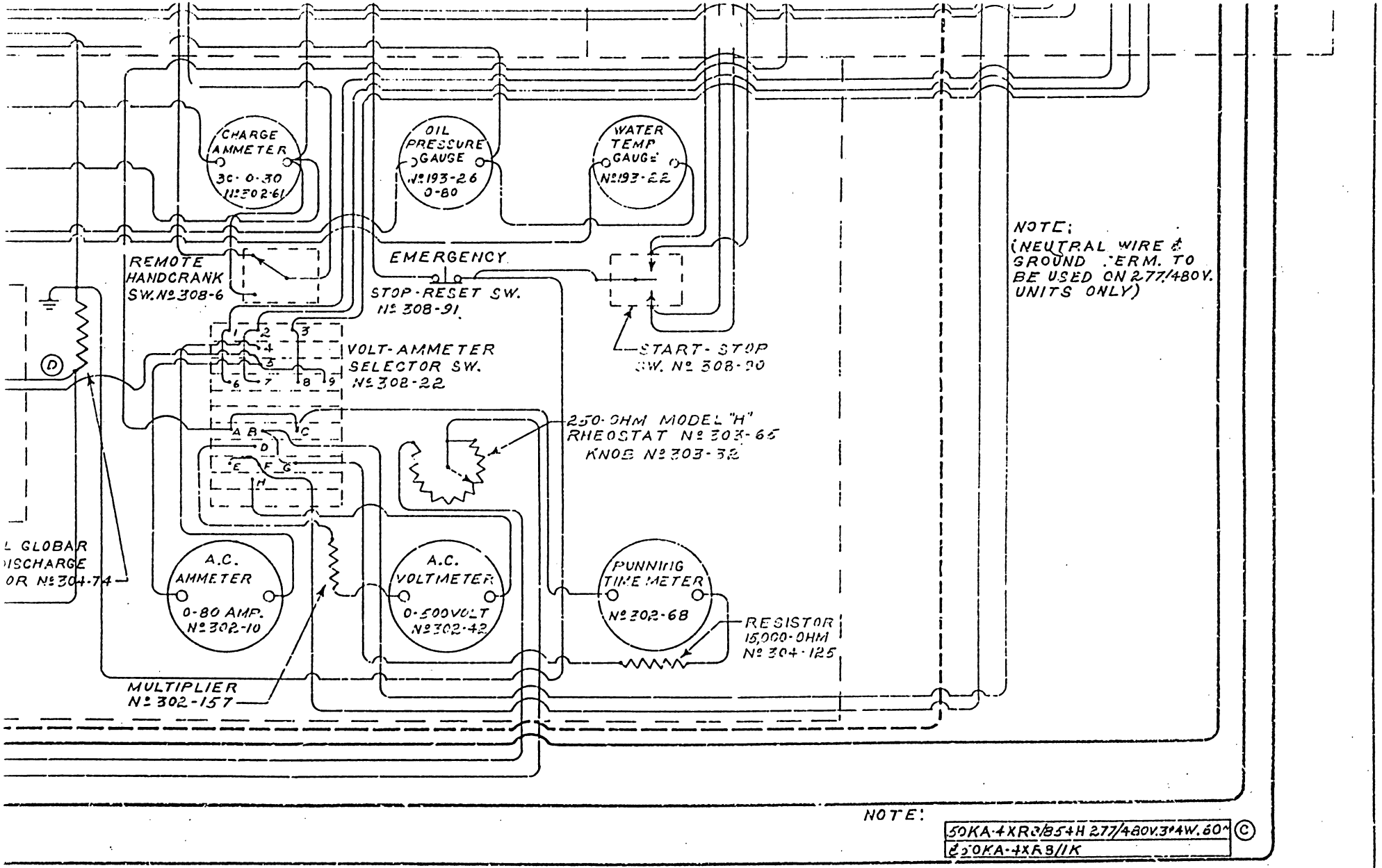
This parts list does not make reference to any particular complete plant model because the multitude of model designations in existance tends to confuse the user.

The electrical output characteristics of the basic models are listed near the front of this publication.

The plant specification follows the diagonal (/) in the plant model and serves primarily as factory identification of the plant's optional equipment.

All plants use a 12-volt starting motor except one group of "special purpose" plants. This one group, known as the "Pennsylvania Approved" standby plant, is equipped for 36-volt exciter cranking.

The part description identifies which part to select. The "Pennsylvania Approved" standby plant is quickly recognized by the number 30 appearing in the model of gasoline fuel plants or by the number 31 appearing in the model of gaseous fuel plants.



4-RUBBER MOUNTS №402-78
GROUND STRAP №337A44

IE893
2A198

№302A235
№302A236
3-446

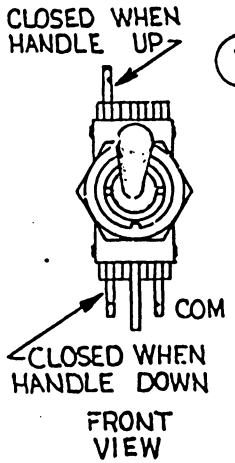
			B	ADDED 50KA-4XR8/854H	MB 11-2-56
			A	ADDED 304-72	MB 3-21-57
				REVISIONS	INIT. DATE
				MATL. WIRING DIAGRAM	
				D. W. ONAN & SONS INC. MINNEAPOLIS, MINN.	
				DR. C.I.P. CH. M.Q.B. SC. ~	
E	ADDED 50KA-4XR8/1K	MB 10-18-57		50KA-6R8/14N 460V. 3*3^. 60CY.	
D	REVISED CONN.	MB 4-16-57		DATE	DWG. №.
C	WAS 277/48V.	MB 1-28-57		6-19-56	612D542

B

308 P 6

OLD NO. 7238

1. Name of item: SWITCH - TOGGLE
2. Description: (SEE REMARKS)
3. Mfr. by ARROW-HART & HEGEMAN
   Address 130 HAWTHORNE ST., HARTFORD, CONN.
4. Manufacturer's number:
   - ☐ Mfr. standard No. _____ which describes it fully. It is a standard commercial item.
   - (A) ☒ Mfr. style No. 21350-BPA which is an incomplete description. Also necessary to specify (SEE REMARKS)
   - ☐ Mfr. Standard No. _____ which describes it fully, but the part is a modification of their standard No. _____ changed as follows:
     - ☐ To meet Govt. Spec. indicated below
     - ☐ Modified to suit our purpose (D)



5. Government Spec: The part described
   - ☒ Is not required to meet a Govt. Spec.
   - ☐ Must meet Govt. Specs as follows:
6. "OR EQUAL":
   - ☐ Only the brand detailed above is acceptable
   - ☒ An equal in another brand is acceptable.
7. Same as ONAN No. 308P5 except THAT IT HAS SOLDER LUGS
8. AFTER RECEIPT BY ONAN:
   - ☒ Used as is
   - ☐ Modified becomes ONAN No.
9. FIRST USED ON MODEL GENERAL USE
10. DATA THIS SHEET FURNISHED BY R. MILLER

REMARKS:

1. SINGLE POLE, DOUBLE THROW
2. SILVER TIPPED CONTACT POINTS
3. NON-LUBRICATED
4. BAKELITE SECTIONS
5. SOLDER LUGS
6. (C) RATED AT 125 VOLTS, 3 AMPERES
   250 VOLTS, 1 AMPERES
   UL LISTED
7. SINGLE HOLE MOUNTING WITH TWO (2) LOCKNUTS
8. SHANK: 15/32 DIA., 13/32 LONG
9. ROLLER BUTT CONTACT
10. (B) BAT. HANDLE OVER CENTER, LOCKING TYPE 11/16 Lg.
11. LESS INDICATING PLATE, BUT WITH GROOVE IN SLEEVE

B

D	ADDED FRONT VIEW OF SW	LL	WB	2-19-75
C	ADDED UL	LL	WB	2-19-75
A	ARROW NO. WAS 21350BP	GT	[illegible]	12-1-72
B	WAS BALL HANDLE	GT	RK	4-8-60
A	WAS #21350DE	GT	RK	4-8-60

D. W. ONAN AND SONS INC.
MINNEAPOLIS • MINNESOTA

DATE	DR	CH	SC
1-20-53		GT	

1	2	3	4	5			INST. MAN	SA	EA	COST	PUR.	RELAY	GD	INSP.	QC	PO	PRINTS TO
MACHINE SHOP DEPT. No.															X	X	

PATT. No. 8003 10-21-52

DWG. No. 308 P 6

PART NO.	QUANT. USED	DESCRIPTION 308-0006 Remote Hand
		ENGINE ACCESSORY GROUP
151B126	1	▲Arm, Governor - Prior to Spec D models.
145A104	1	▲Arm, Throttle - Prior to Spec D models.
140C306	1	Bracket, Air Cleaner Mounting.
140A218	1	Bracket, Air Cleaner Hose Mounting - 3/4" strap.
153A194	1	Bracket, Choke Resistor Mounting - Begin Spec D models.
151A122	1	Bracket, Governor Adjusting Screw.
416A77	2	Cable, Battery - 28 inch - For 12-volt motor cranked models.
416A37	2	Cable, Battery - 48 inch - For 36-volt exciter cranked models.
416A4	1	Cable, Jumper - 6-3/4 inch - For 12-volt motor cranked models.
416A133	5	Cable, Jumper - 7-1/2 inch - For 36-volt exciter cranked models.
503-44	2	Clamp, Hose - 2-3/8 inch diameter, wire type - Air Cleaner Hose.
503-49	As Req.	Clamp, Hose - 1 inch diameter, strap type - Gas Fuel Hose.
193-31	1	Clamp, Mechanical Oil Pressure Gauge - For 36-volt cranked plants only.
193-52	1	Clamp, Mechanical Water Temperature Gauge - For 36-volt cranked plants only.
140-319	1	Cleaner, Air.
166P184	1	Coil, Ignition - 24 volt - For 36-volt exciter cranked plants. (Coil for 12-volt cranked plants appears in I.H. Catalog).
312A15	1	Condenser, Ignition Coil Suppression - 0.1 Mfd.
192A244	1	Crank, Hand.
193-3	1	Gauge, Oil Pressure - 100# Mechanical - For 36-volt exciter cranked (Gauge for 12-volt cranked appears on Wiring Diagram).
193-8	1	Gauge, Water Temperature - Mechanical - For 36-volt exciter cranked (Gauge for 12-volt cranked appears on Wiring Diagram).
Describe	As Req.	Hose, Air Cleaner - 2-1/4" Wiremold - 503P151 x 36 inches.
Describe	As Req.	Hose, Gas Fuel Supply - 3/4"I.D. - 503P191 x 16-1/2 inches - For gaseous fuel models.
150A638	2	Joint, Ball - 1/4-28 thread.
155A393	1	Muffler - With dual outlet manifold beginning Spec J models use two if required by installation.

Crank switch (SPS to 308-0005)

NOTE ▲ - Corresponding parts for later models appear in the International Harvester catalog and supplement.

PART NO.	QUANT. USED	DESCRIPTION
155-0416	2-Exh Tube	ENGINE ACCESSORY GROUP (Cont.)
307B299	1	Relay, Latching - Prior to plant serial #491549 - Used with safety cut-off switches.
151A123	1	Screw, Governor Adjusting.
193-25	1	Sender, Oil Pressure Gauge (For 50 # Gauge) - Prior to Spec H Models.
193-27	1	Sender, Oil Pressure Gauge (For 80 # Gauge) - Begin Spec H Models.
193-23	1	Sender, Water Temperature Gauge.
145C106	1	Shield, Heat - Under Rear Exhaust Manifold - Begin Spec C thru Spec H models only.
307-234	1	Solenoid, Start - For 36-volt exciter cranked plants (Solenoid for 12-volt cranked plants appears in I.H. Catalog).
520A322	1	▲Stud, Governor - 1/4 x 18" - Prior to Spec D models.
520A429	1	Stud, Air Cleaner Mounting - 3/8 x 2-1/2".
314P6	1	Suppressor, Ignition Coil.
314P32	6	Suppressor, Spark Plug.
309-9	1	Switch, High Water Temperature Cut-off.
309B64	1	Switch, Low Oil Pressure Cut-off.
308A94	1	Switch, Remote Start-Stop (Optional Equipment).

NOTE ▲ - Corresponding parts for later models appear in the International Harvester parts catalog and supplement.

Spc Mfg.
(2) 402-0135
(2) 402-0136

MOUNTING GROUP

403C339	1	Base, Mounting - Begin Spec E models.
403A321	2	*Rod, Tie - Prior to Spec H models.
403A417	2	*Rod, Tie - Begin Spec H models.
403A322	2	*Spacer, Tie Rod - Prior to Spec H models.
403A416	2	*Spacer, Tie Rod - Begin Spec H Models.
232C1201	2	*Support, Mounting - Located under generator instead of under engine rear.

NOTE * - Used on 1 Phase plants only. For 3 Phase plants refer to International Harvester Parts Catalog Supplement.

PART NO.	QUANT. USED	DESCRIPTION
		ANTI-DIESELING CONTROL GROUP (Begin Spec E Models)
145A117	1	Bracket, Throttle Spring - Prior to Spec. L.
145B123	1	Bracket, Mounting - Prior to Spec. L.
145C137	1	Bracket, Mounting - Beginning with Spec. L.
150A638	1	Joint, Ball - 1/4-28 Thread.
145A124	1	Link, Solenoid - Prior to Spec. L.
145A133	1	Ling, Solenoid - Beginning with Spec. L.
145A118	1	Link, Throttle Spring.
307B4	1	Relay - Beginning with Spec. L. - Mounted in Control Box.
304A45	1	Resistor, Fixed, 4 Ohm, 50 Watt - For 12-volt cranked models. Beginning with Spec. L - Mounted in Control Box.
304A58	1	Resistor, 50 Ohm, 50 Watt (Must be set at 46 ohms) - For 36-volt exciter cranked models. Beginning with Spec. L - Mounted in Control Box
307B284	1	Solenoid and Lead Assembly - For 36-volt exciter cranked models.
307B277	1	Solenoid and Lead Assembly - For 12-volt cranked models.
145A119	1	Spring, Throttle.
304-15	2	Washer, Centering - Resistor Mounting.
150A146	1	Stud, Governor Adjusting - Beginning with Spec. L.
		CARBURETOR DRIP TANK GROUP (Begin Spec E Models)
502-19	2	Elbow, Inverted Male.
159A499	1	Line, Drip Tank to Manifold, 1/8" copper x 25-1/2".
149A587	1	Tank, Carburetor Drip.
148A107	1	Vent Assembly, Atmospheric.

PART NO.	QUANT. USED	DESCRIPTION

RADIATOR GROUP (Spec A Models only)

NOTE: For Spec B and later models, refer to International Harvester Parts Catalog and Supplement.

130-272	1	Blade, Fan.
130A288	1	Bracket, Radiator Support.
503-59	6	Clamp, Hose - 3 to 3-1/2 diameter, Wrap lock type - Radiator Hose.
405C480	1	Casting, Radiator Top.
405C491	1	Cover, Radiator Fill.
130C251	1	Grille, Radiator.
130C274	1	Guard, Fan - (On same side as carburetor).
130C273	1	Guard, Fan - (On side opposite carburetor).
503-221	1	Hose, Radiator - Lower.
503-222	1	Hose, Radiator - Upper.
130C252	1	Housing, Radiator - On same side as carburetor.
130C250	1	Housing, Radiator - On side opposite carburetor.
130D249	1	Mount, Radiator.
130B283	1	Radiator.
130A287	1	Rod, Radiator Support.
130B275	2	Support, Radiator.
130A293	1	Tube, Radiator Hose Adapter.

"DAY" TANK GROUP (Optional Equipment)

NOTES: This accessory group applies to the optional one quart-capacity reservoir fuel tank, along with the necessary vent cap and connecting lines, which serves to maintain carburetor fuel level by gravity feed. Reference Installation Instruction sheet A37 and drawing #159A507.

502-175	1	Adapter, Pipe - 1/8" - Brass Fitting.
159A121	1	Band, Day Tank.
159A419	1	Bracket, Day Tank.

PART NO.	QUANT. USED	DESCRIPTION
		"DAY" TANK GROUP (Optional Equipment) (Cont.)
415A55	1	Bracket, Vent Cap.
505-16	1	Bushing, 3/8" x 1/8 Pipe Reducer.
159-41	1	Cap, Vent.
502-116	1	Connector, Compression Male - For 5/16" Tubing - Includes Nut and Sleeve.
505-28	1	Coupling, Pipe - 3/8".
149A514	1	Line, Pump to Day Tank.
149A515	1	Line, Day Tank to Carburetor.
159A507	1	Tank Assembly, Day - Includes Basic Tank #159B294 plus Bracket, Fittings and Shut-off Valve.
159A345	1	Tubing, Copper (5/16"O.D. x 12 feet).
307B310	1	Valve, Solenoid - Gasoline Fuel Shut-off at Day Tank Outlet (Optional with Day Tank Accessory on 12-volt cranked plants).
		COMBINATION GAS-GASOLINE OR GAS ONLY CARBURETOR GROUP (Optional Equipment)
		NOTES: Carburetor for straight gasoline fuel appears in the International Harvester parts catalog and supplement. This group includes the converter as used on plants adapted for LPG fuel. Reference drawing #179C6 for converter with radiator cooled plants or drawing #179C11 for converter with city water cooled plants. Obtain locally the water and gas connecting hoses and clamps or order by inside diameter, length required and function served.
148B230	1	Bracket, Gas Regulator Mounting.
148B240	1	Bracket, Converter Mounting.
141C561	1	Carburetor, Combination Gas-Gasoline - With automatic choke located opposite from engine side - Prior to Spec D.
141C579	1	Carburetor, Combination Gas-Gasoline - With automatic choke located on engine side of carburetor - Begin Spec D models.
141C604	1	Carburetor, Gas only - Includes Choke Assembly.
148-100	1	Converter, Fuel - Liquid State to Gaseous State -(Also called heat exchanger).

PART NO.	QUANT. USED	DESCRIPTION
COMBINATION GAS-GASOLINE OR GAS ONLY CARBURETOR GROUP (Optional Equipment) (Cont.)		
148A231	1	Regulator Assembly - Includes regulator, valve bracket and fittings.
148-115	1	Regulator - Algas, 5# pressure.
504A50	1	Valve Assembly, Gate - 3/4" - Located at converter outlet.
148A107	1	Vent - Located at converter outlet.
148B212	1	Adapter, Choke
CITY WATER COOLING - WITH WATER COOLED MANIFOLD GROUP (Optional Equipment)		
NOTES: Reference drawing #179A7 (Prior to Spec H) or 179C12 (Begin Spec H). Reference drawing 179C11 (models adapted for LPG fuel). Reference Instruction Sheet M15a.		
110A812	1	Bracket, Solenoid Mounting.
110A825	1	Bracket, Water Inlet.
110A810	1	Bracket, Water Outlet - Includes Nipple.
508-38	1	Bushing, Wire Outlet - Used with Water Solenoid Valve.
504-20	1	Key, Lockshield Valve (Supersedes #504-47).
154P318	1	Manifold, Water Cooled.
405C874	1	Support, Crank and Pipe Mounting.
504-46	1	Valve, Lockshield - 3/4" - Water Inlet.
307P221	1	Valve, Solenoid - Water Inlet - 12 Volt DC.
307P268	1	Valve, Solenoid - LPG Fuel Shut-off - 12 Volt DC.
504-11	1	Valve, Water Shut-off.

PART NO.	QUANT. USED	DESCRIPTION
		ENGINE WATER JACKET HEATER & THERMOSTAT GROUP (Optional Equipment)
NOTE: Reference drawing #179B29		
332A12	1	Box.
333A13	1	Cover.
333P54	1	Heater, Engine Coolant.
309P29	1	Thermostat.
		ENGINE HOUSING GROUP (Optional Equipment)
405P920	2	Door Assembly, Side.
405P919	1	Hood & Dash Assembly.
322-4	1	Lamp, Panel Light - DC - Optional on models with Engine Housing.
322-5	1	Socket, Panel Light - Optional on models with Engine Housing.
		CARBURETOR AIR HEATER GROUP (Prior to Spec J Only) (Optional Equipment)
503-269	2	Clamp, Hose - Air Heater Hose.
140A367	1	Heater, Air Cleaner.
140P251	1	Horn, Air.
503-270	1	Hose, Carburetor Air Heater - Wiremold - 2-1/8" x 18".

PART NO.	QUANT. USED	DESCRIPTION

MISCELLANEOUS ELECTRICAL ACCESSORIES (Optional Equipment)

309-9	1	Switch, High Water Temperature Alarm.
309B64	1	Switch, Low Oil Pressure Alarm or Cut-off (Replaces 309B10)
309B16	1	Switch, Low Oil Pressure Cut-off (AC).

OUTPUT GENERATOR PARTS GROUP

NOTE: For parts not listed, refer to the factory. Furnish nameplate information.

214A46	4	Brush, Alternator Collector Ring.
214A44	4	†Brush, Exciter Commutator.
214A18	4	*Brush, Exciter Commutator.
212C194	1	Rig Assembly, Alternator Collector Ring Brush - Includes Brushes, and Springs.
212C197	1	▲Rig Assembly, Exciter Commutator Brush - Includes Brushes and Springs.
212C211	1	*Rig Assembly, Exciter Commutator Brush - Includes Brushes and Springs.
212B1105	4	Spring, Alternator Collector Ring Brush.
212B1105	4	†Spring, Exciter Commutator Brush.
212A1011	4	*Spring, Exciter Commutator Brush.

NOTE † - For 12-volt starter-motor cranked models (such as basic and variations of basic models).
NOTE * - For 36-volt exciter-cranked models (such as "special purpose", Pennsylvania-approved standby models).
NOTE ▲ - For 12-volt starting-motor-cranked models except for earlier manufactured generator which has an exciter outboard bearing (Gen. Data 50KA4N3A only) for which order 212C186 instead of 212C197.