OPERATORS MANUAL AND PARTS CATALOG

FOR

Onan®

ELECTRIC GENERATING PLANTS

DEB
SERIES

ONAN ENGINE/GENERATOR DIVISION Studebaker CORPORATION

2515 UNIVERSITY AVE. S.E. MINNEAPOLIS, MINN. 55414
IN CANADA: ONAN GENERATORS CANADA LTD., P.O. BOX 652, GUELPH, ONTARIO

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GENERAL INFORMATION

This instruction book contains information for the proper installation, operation, and maintenance of your equipment. We suggest that this book be kept handy so that it can be referred to when necessary.

This equipment is the result of proven engineering design, highest quality materials, and expert workmanship. Thorough inspection and testing assures you that this equipment will perform as expected.

If you wish to contact your dealer or the factory regarding this equipment, be sure to supply the complete MODEL and SPEC. NO., and the full serial number of the equipment as shown on the nameplate. This information is necessary to identify the equipment among the many basic and special optional types manufactured.

MANUFACTURER'S WARRANTY

The Manufacturer warrants, to the original user, that each product of its manufacture is free from defects in material and factory workmanship if properly installed, serviced and operated under normal conditions according to the Manufacturer's instructions.

Manufacturer's obligation under this warranty is limited to correcting without charge at its factory any part or parts thereof which shall be returned to its factory or one of its Authorized Service Stations, transportation charges prepaid, within one year after being put into service by the original user, and which upon examination shall disclose to the Manufacturer's satisfaction to have been originally defective. Correction of such defects by repair to, or supplying of replacements for defective parts, shall constitute fulfillment of all obligations to original user.

This warranty shall not apply to any of the Manufacturer's products which must be replaced because of normal wear, which have been subject to misuse, negligence or accident or which shall have been repaired or altered outside of the Manufacturer's factory unless authorized by the Manufacturer.

Manufacturer shall not be liable for loss, damage or expense directly or indirectly from the use of its product or from any other cause.

The above warranty supersedes and is in lieu of all other warranties, expressed or implied, and of all other liabilities or obligations on part of Manufacturer. No person, agent or dealer is authorized to give any warranties on behalf of the Manufacturer nor to assume for the Manufacturer any other liability in connection with any of its products unless made in writing and signed by an officer of the Manufacturer.

DATED August 1, 1963

IMPORTANT

RETURN WARRANTY CARD ATTACHED TO UNIT

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DESCRIPTION

Onan generating plants of the DEB series are complete units consisting of a diesel engine, self excited alternating current generator, and such controls and accessories as are specified by the purchaser.

Electrical characteristics of plants vary according to the particular model, and are noted on the Onan nameplate attached to the unit. The rated power is based on an .8 power factor load. For standby service, optional controls for automatic starting, load transfer, and stopping may be connected.

If it ever becomes necessary to contact a dealer or the factory regarding the plant, be sure to mention the complete Model and Spec. No., and the Serial No. as given on the Onan nameplate. This nameplate information is necessary to properly identify the plant among the many types manufactured. Refer to the engine nameplate when requesting information from its manufacturer.

Generating plants are given a complete running test under various load conditions and thoroughly checked before leaving the factory. Inspect the plant closely for damage that might have occurred in shipment. Any such damage must be repaired before putting the plant in operation.

ENGINE

The engine is a Ford Model ..DD-172.. and is fully described in the Ford manual. It basically is a four-cylinder, water cooled, diesel (compression ignition) engine. Cylinder bore is 3.90 inches, piston stroke is 3.60 inches, and displacement is 172-cubic inches. Engines are rated 53: horsepower (standby) at 1800-rpm. Compression ratio is 16.8 to 1. Standard oil capacity is 4 U.S. quarts. 12-volt battery current is used for starting and control circuits. Specific engines used may have variations due to optional features of the generating plant (type cooling etc.) specified by the plant purchaser.

GENERATOR

The generator consists of a 4-pole revolving field alternator and "static" exciter with magnetic amplifier regulation. Alternating current output is generated in the alternator stator winding attached directly to the rear end of the engine. The rotating field of the alternator is attached to the engine flywheel, and so turns at engine speed. Rotor speed determines the current frequency - thus the 60-cycle plant must operate at approximately 1800-rpm, and the 50-cycle plant at approximately 1500-rpm. The outer end of the rotor turns in a large sealed ball bearing fitted into the end bell.

The stationary exciter is mounted on a metal frame attached to the alternator end bell, and protected by a sheet metal enclosure. The exciter and regulator provides voltage regulation of plus or minus 2%, from no-load to continuous-load. Stable generator output is established within 5 seconds after a change in load. The exciter has no moving parts, and needs no external voltage regulator.

DESCRIPTION

CONTROLS

Engine controls for standard plants include 12-volt automotive starting and battery charging circuits with necessary relays, and a charge rate ammeter. Water temperature and oil pressure gauges provide for checking engine performance. A water temperature safety shut-off switch protects against engine damage if engine coolant temperature should rise dangerously high. Terminals may be provided for connection of optional warning devices, etc.

Generating plants are adaptable to the use of automatic load transfer control equipment (for emergency standby installations) if the ambient temperature will be above 50^0F.

Electrical instrument panel equipment varies according to model and purchaser options. Instruments may include voltmeter, ammeter, circuit breaker, running time meter, etc. Output terminals are provided for load wire connections.

The control section is mounted at the rear of the unit and is accessible through the rear door. The control panel swings down for access to the rear of the panel and internal wiring. The control panel contains all connections, meters, and controls to monitor and adjust generator output.

The engine control panel contains signal light, latching relay, gages, and switches to monitor and control engine operation. The oil pressure gage and water temperature gage are wired into resistance element type sending units mounted on the engine. The charge ammeter indicates battery current of the engine electrical system. It is wired in parallel with the battery. The RUN-STOP-REMOTE switch controls plant starting and stopping from the engine control panel. When set at RUN, battery voltage is applied to the normally closed contacts of the cranking limiter, latching relay, starter pilot relay, starter solenoid (the starter engages and begins to crank the engine). As the engine starts to crank, a heating element in the Cranking Limiter is energized and continues to heat until cranking stops or its thermal device operates to de-energize (open) the limiter. The limiter allows approximately one minute of engine cranking before opening. A button protrudes from the limiter when open. Limiter contacts open to remove battery voltage from the ignition system and open the circuit to the Starter Solenoid to stop engine cranking. The limiter must be manually re-set before engine cranking can again be attempted. As the engine starts and builds up speed the battery-charging generator begins to produce voltage. A connection to the armature or generator terminal on the regulator to the coil of the Start-Disconnect relay allows generator voltage to energize the Start-Disconnect relay and open the circuit to the starter solenoid to stop engine cranking. The Time Delay relay in the low oil pressure circuit energizes, contacts open, for approximately 15-seconds to allow oil pressure build-up while starting. After the 15-second delay, the contacts close to complete the low-oil pressure circuit to the pressure switch. If the oil pressure drops below 14-psi, the pressure switch actuates allowing the Latching Relay to open, stopping the plant. The latching relay must be manually re-set before

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resuming operation. The low oil pressure condition must be repaired before the plant will operate. The High Water Temperature switch actuates when the coolant temperature exceeds 215^{O}F. The latching relay energizes, shutting down the plant. The latching relay must be manually re-set before resuming operation and the high temperature condition must be repaired before the plant will operate. The over-speed switch is a centrifugal type mounted on the end of the generator shaft behind the static exciter. If plant speed exceeds approximately 2100 rpm, the switch actuates, energizing the latching relay and shutting down the plant.

THEORY OF OPERATION

GENERATOR: The generator is a synchronous four-pole, revolving field, externally-excited (generator mounted static exciter) type. The revolving field is coupled to the engine and rotates at engine speed. Field excitation voltage (DC) is supplied and regulated by the static exciter through slip rings and brushes to the field coils (Fig. 4-1). The alternating current output is tapped from the stator windings with the output leads terminated at a terminal board on the output box.

The static exciter (Magneciter) functions as both a voltage regulator and a power supply for the revolving field. By regulating the amount of current to the field, it controls the ac output voltage of the generator. The circuit shown in Fig. 4-2 is the power supply. It's a full wave rectifier and supplies direct current to the field. Two saturable reactors control the generator output voltage by controlling the current flowing in the field (Fig. 4-3).

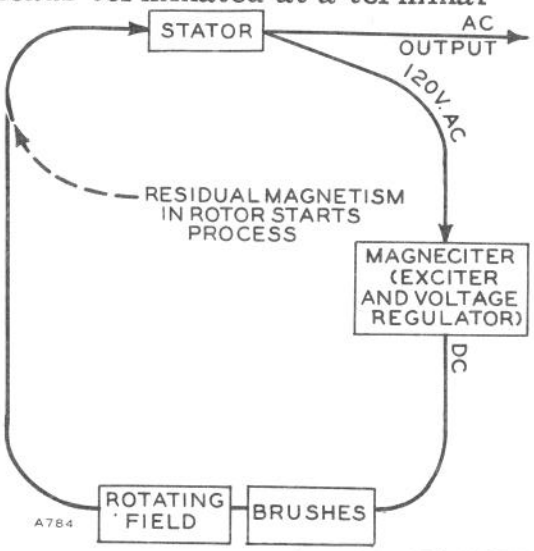


FIG. 4-1. SCHEMATIC ALTERNATOR AND EXCITER

Each saturable reactor is a doughnut shaped metal core with 3 windings, an output or gate winding and two control windings. The amount of current the reactor allows to flow in the gate winding is dependent on the degree of saturation of the reactor core. As core saturation increases, the gate opens, until finally, when the core is fully saturated, the gate is all the way open and the reactor does not oppose current flow. Since the rectifiers allow current in the gate winding to flow in only one direction, it can act only to saturate the core. If the saturation of the core were decreased, this would reduce the current flow through the gate winding.

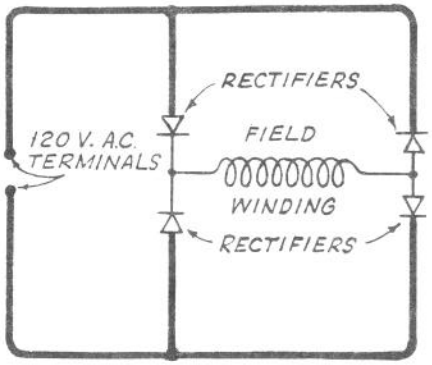


FIG. 4-2. POWER SUPPLY

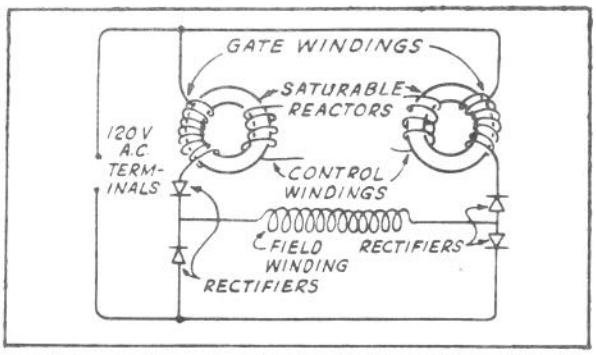


FIG. 4-3. POWER SUPPLY WITH GATE REACTORS

Current flow in the control windings decreases saturation of the reactor core, and therefore reduces the current flow in the gate winding. More de-magnetizing current in the control winding allows less current in the gate winding and generator field and a lower output voltage.

The regulator circuit uses rectifiers to allow the current to flow in only one direction, a control reactor and one set of control windings (Fig. 4-4). The circuit allows little or no current flow up to a certain output voltage and a large flow above that voltage so the current in the control windings will depend on the voltage output of the generator (Fig. 4-4). The control reactor is the voltage sensitive control of the regulator. Its characteristics are shown in Fig. 4-5. Below the proper voltage, little current flows through the reactor, so little current flows in the control windings allowing full current to the field windings. When the reactor saturates magnetically during a voltage change, current flows through the control windings, reducing the current to the field windings. This reduces the generators' output voltage, which, in turn reduces the current through the control reactor and control windings back to the set requirements. The regulator holds voltage at the pre-set level determined by the control reactor.

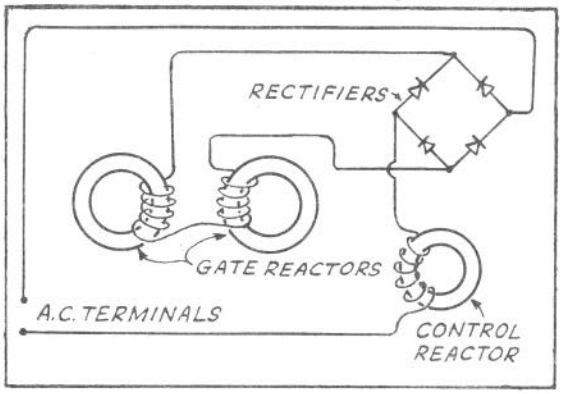


FIG. 4-4. REGULATOR CIRCUIT

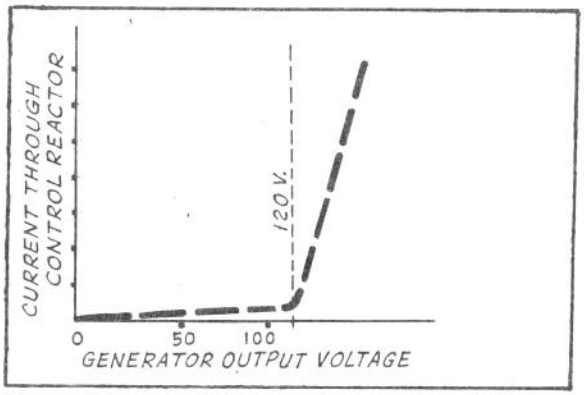
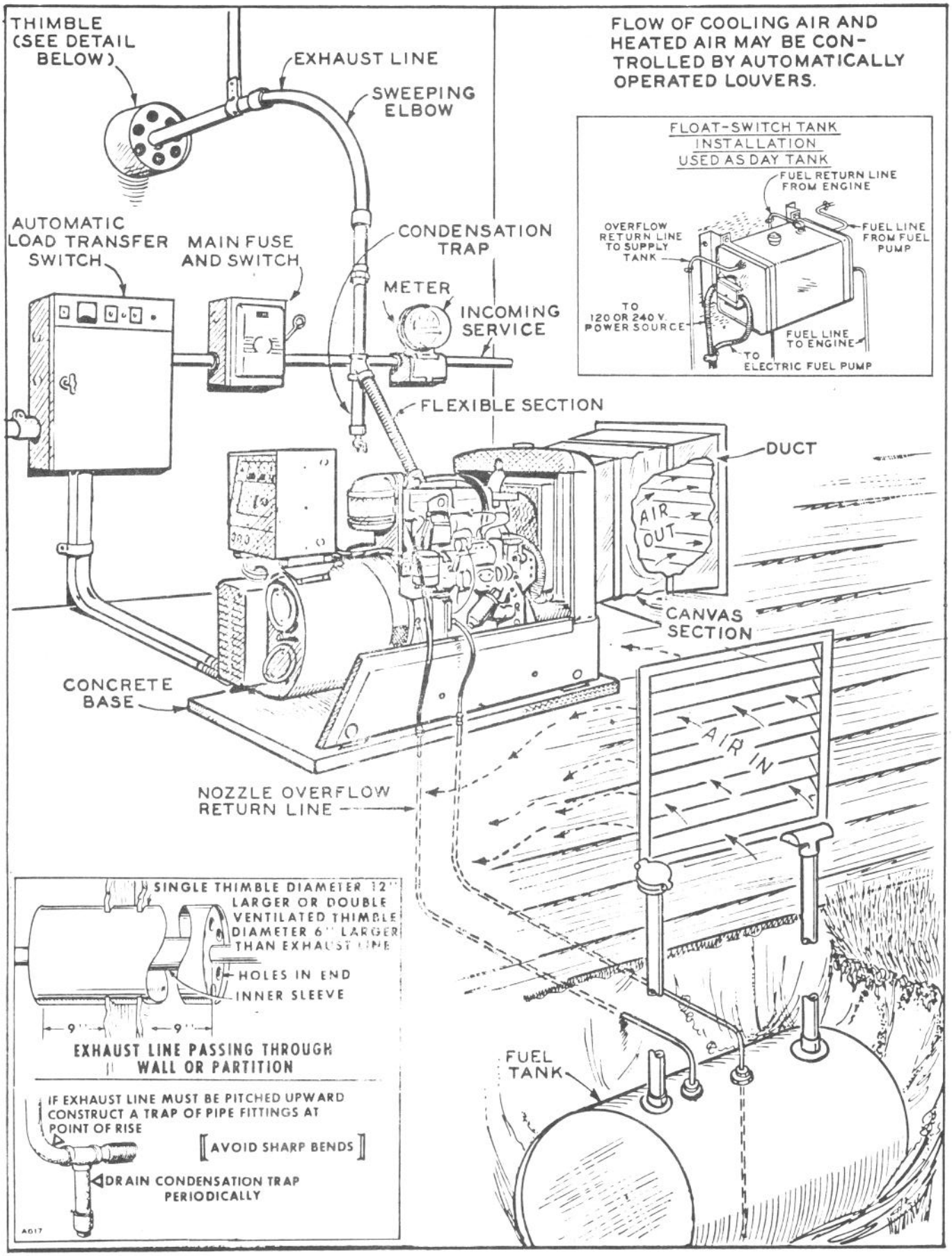


FIG. 4-5. CONTROL REACTOR CHARACTERISTICS

Compounding windings on each large reactor, help to retain voltage control through changes in load and an output voltage control resistor allows adjustment of the output voltage by changing the voltage across the control reactor.

TYPICAL INSTALLATION



INSTALLATION

Generating plant installation involves location, connection to a fuel source, exhaust system, starting battery installation, etc. Each installation must be considered individually - use these instructions as a general guide. A typical installation is shown, and by following the principles outlined and referring to the installation outline drawing supplied a proper installation can be made. Local regulations (building code, fire ordinance, etc.) may affect some details, and any such regulations should be fully observed.

LOCATION. - Usually, the location has been pre-selected. For the average installation, a warm indoor site is recommended. Local regulations sometimes require that for emergency standby service the ambient temperature must not fall below a specified minimum. The selected site should be dry, well ventilated, and reasonably dust free. Provide for sufficient clearance (at least 24" recommended) on all sides for convenience in plant servicing.

MOUNTING. - Plants are mounted to a rigid base that provides proper support and adequate vibration damping. However, for convenience in draining crankcase oil, general servicing, etc., plants can be mounted on raised pedestals or rails at least 6" high. Extra vibration dampers are available and may be installed under the plant base. If mounting in a trailer, or for other mobile applications, bolt securely in place. Bolting down is optional for stationary installations.

VENTILATION. - The engine generates a considerable amount of heat that must be dissipated. For a radiator cooled unit, proper ventilation is of vital importance. Under average operating conditions, a cooling air volume of approximately 4000-cubic feet of air per minute will provide sufficient cooling. If the installation is made in a small room, this may require installation of an auxiliary fan of sufficient size to assure proper volume of air. The fan can be connected to operate only when the plant is running.

Pusher fans used on radiator cooled units force cooling air out through the front of the radiator. For room or compartment installations the usual method of exhausting the heated air is to construct a duct from the front of the radiator to an opening in an outside wall. The duct and wall opening area should be at least as large as the plant radiator outlet area. An air inlet opening of at least equal area must also be provided.

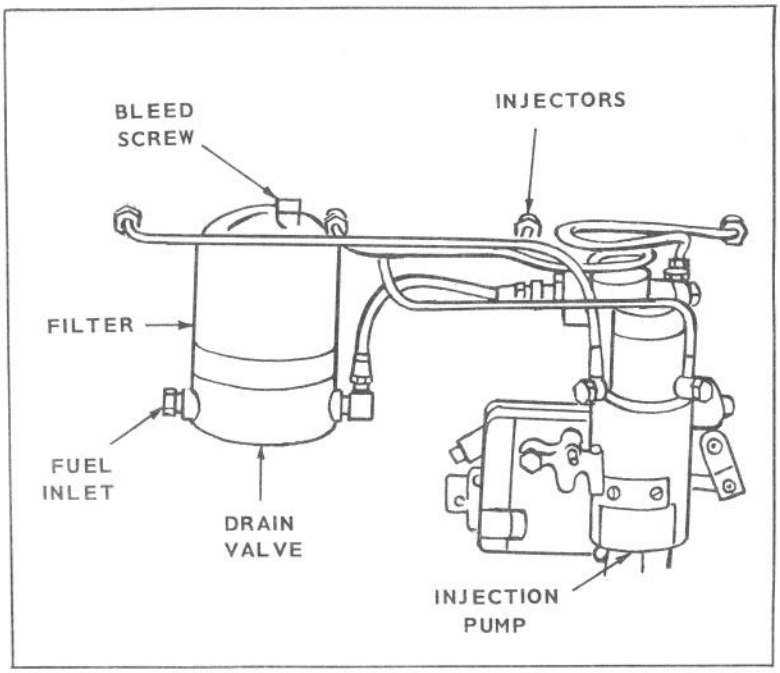
Air inlet and outlet openings should be provided with suitable shutters to prevent back flow of cold outside air during shut down periods. Proper consideration must be given to any other draft creating equipment installed in the same room. If unattended, automatic starting (as for emergency standby with automatic load transfer switch) is planned, the shutters should be automatically controlled.

EXHAUST. - Pipe exhaust gases outside any enclosure. Use pipe at least as large as the 1 1/2" pipe size outlet of the engine. Increase the pipe diameter one pipe size for each additional 12-feet in length. Use a flexible connection at the engine exhaust manifold. Provide adequate support for the piping. Pipe fittings cause a resistance to the flow of exhaust gases and can result in a loss of engine power. Use sweeping elbows in preference to standard pipe elbows, and keep the number of necessary turns to the minimum. If the exhaust line runs upward at any point, install a vapor trap at the low point, with provision for periodic draining. Shield or insulate the line if there is danger of personnel contact. If the line passes close to a combustible wall or partition, allow at least 4" clearance. Install a suitable muffler.

FUEL CONNECTIONS. - Check local regulations governing the installation of a fuel supply tank.

NOTE

In any diesel engine installation, fuel system cleanliness is of utmost importance. Make every effort to prevent entrance of any moisture or contaminating matter of any kind. Do not use lines or fittings of galvanized material.



The maximum fuel lift without any horizontal run should not exceed 6-feet. The horizontal run, if the supply tank is level with the fuel pump, should not exceed 12-1/2 feet. Use 1/2-inch tubing for the supply line from the fuel tank and 3/8-inch tubing for the nozzle overflow return line. Use a flexible section to connect the lines to the plant.

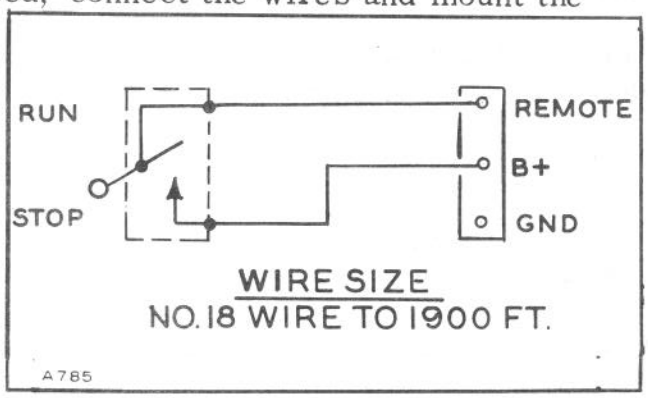
DAY TANK. - Engines may be equipped with an optional day tank. A float operated switch controls an electric fuel pump (not included with day tank) to maintain the correct fuel level to assure a constant source of fuel. Do not mount the tank on the plant. Mount the tank on a vibration free support below the engine fuel return line. The tank overflow line to supply tank is optional, consult local regulations. Refer to the installation instructions included with the tank.

Use proper adapter fittings for line connections to the engine: the fuel inlet on the fuel pump, and the injector nozzle fuel return connection are threaded for a 1/8" pipe fitting, Be sure there is no possibility of an air leak in the supply line connections, which would prevent pumping of fuel.

BATTERY. - Two 6-volt batteries are recommended. Note that each battery cable terminal clamp is stamped "P" (positive) or "N" (negative) for connection to the proper battery terminal post. Connect positive to the large terminal of the start solenoid on the starter. Connect negative to a convenient ground point on the engine. Service the batteries as necessary.

Infrequent plant use (as in emergency standby service) may allow the batteries to self discharge to the point where they can not start the plant. A separate trickle charger should be connected if installing a load transfer switch that has no built-in charge circuit. Onan load transfer controls include such a battery charging circuit.

REMOTE CONTROL CONNECTIONS. - Starting and stopping is through a 2-wire electrical system. To extend this control to one or several remote locations, a 3-place terminal block is provided in the plant control box. The terminal block is marked REMOTE, B+, and GND. If a load transfer or an automatic control is used, follow the instructions supplied with the control. If a SPST manual switch is used, connect the wires and mount the switch so the engine will run when the switch handle is up, the same as an ordinary light switch. The size wire to use is determined by the plant-to-control distance. Use #18 wire up to 900-ft. The GND terminal is for a customer-supplied alarm at a remote location to warn of low oil pressure, high water temperature and overspeed.

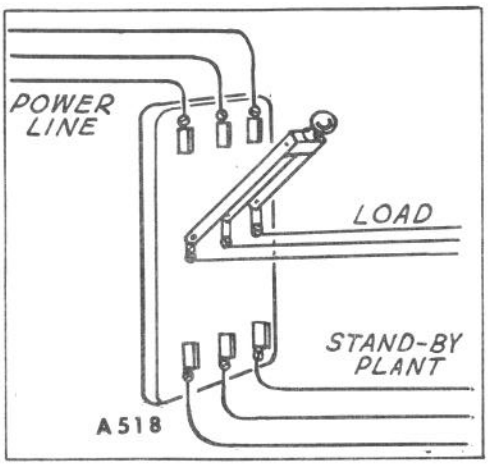


CONNECTING LOAD WIRES. - The plant AC output terminals are large studs located inside the control box, at the generator end of the plant. Knock out openings are provided for convenience in bringing the load wires into the control box.

Most local regulations require that wiring connections be made by a licensed electrician, and that the installation be inspected and approved before operation. All connections, wire size, etc., must conform to requirements of electrical codes in effect at the installation site.

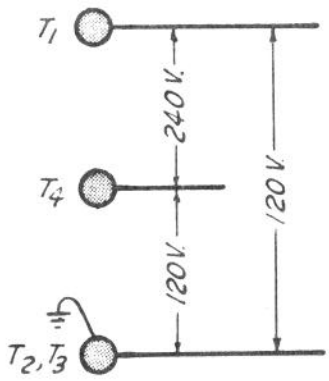
INSTALLATION

If the installation is for standby service, a double throw transfer switch must always be used. This switch (either manual or automatic) must be connected so that it is impossible for the generator current to be fed into the normal power source lines, nor for the normal source and generator current to be connected at the same time. Instructions for connecting an automatic load transfer control are included with such equipment. It is assumed that personnel connecting the generator, and any such auxiliary equipment, are fully qualified and understand the problems of balancing the circuits, grounding the plant, etc. Refer to the output control wiring diagram furnished. Each generator lead is marked according to the wiring diagram.



120/240-VOLT, 1-PHASE, 3-WIRE PLANT

Terminal post T2, T3 is the grounded (neutral) terminal. For 120-volt current, connect the "hot" load wire to either the T1 or T4 terminal. Connect the neutral load wire to the T2, T3 terminal. Two 120-volt circuits are thus available, with not more than 1/2 the rated capacity of the plant available on each circuit. Balance the load as closely as possible.



For 240-volt current, connect one load wire to terminal T1 and the second load wire to terminal T4. Terminal T2, T3 is not used for 240-volt service.

If both 120 and 240-volt current is to be used at the same time, use care not to overload either circuit.

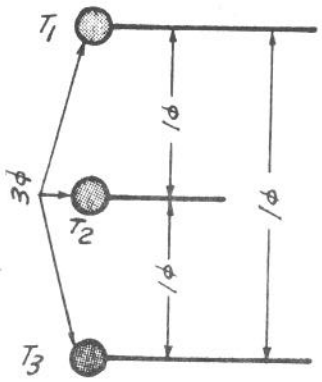
3-PHASE, 3-WIRE PLANT

No terminal is grounded. For three-phase current, connect separate load wires to each plant terminal T1, T2, and T3.

If phase sequence is important, as with 3-phase motors, final connections may be postponed until a trial run is made. When the plant is installed for standby service, phase sequence of the normal line service and the generator output must be the same, for proper load operation.

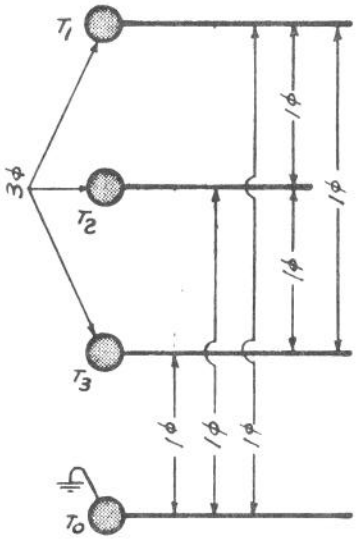
Single-phase current is obtained from any two plant terminals. Three single-phase circuits are thus available: T1-T2, T1-T3, and T2-T3. The load connected to any one single-phase circuit must not be greater than 1/3 the rated capacity of the plant.

If both single-phase and three-phase current is to be used at the same time, use care not to over-load 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 connected to any one single-phase circuit. For example a 10, 000-watt 3-phase load is connected to a 20, 000-watt plant. This leaves 10, 000 watts available for single phase use - 3, 300 watts on each circuit. Do not attempt to take all 10, 000 watts in this example off one circuit, as over loading of the generator will result.



3-PHASE, 4-WIRE, WYE CONNECTED PLANT

The 3-phase 4-wire plant produces single-phase current of one voltage and three-phase current of a different voltage. The single-phase voltage is the lower voltage as noted on the plant nameplate, and the three-phase voltage is the higher nameplate voltage.



The terminal marked T0 is grounded. For 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, or T3. Three separate single-phase circuits are available, with not more than 1/3 the rated capacity of the plant from any one circuit.

For 3-phase current, connect separate load wires to each of the plant terminals T1, T2, and T3. If phase sequence is important, refer to the principles of connection as given for the 3-phase 3-wire plant. Single-phase current is obtained between any two 3-phase terminals.

If single-phase and 3-phase current is to be used at the same time, use care to properly balance the single-phase load.

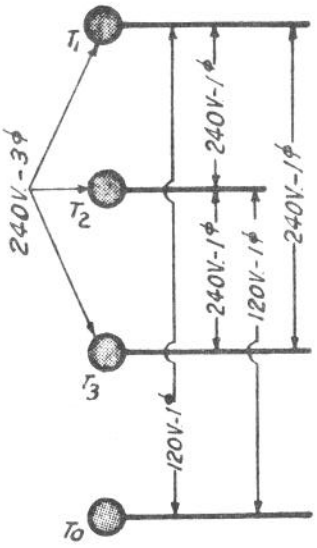
120/240-VOLT, 3-PHASE, 4-WIRE DELTA CONNECTED PLANT

The 3-phase Delta connected plant is designed to supply 120-volt single-phase current and 240-volt 3-phase current. The T0 terminal is the generator center tap between T1 and T2, and is normally not grounded.

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

INSTALLATION

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 required. For 120-volt service, connect the "hot" (black) load wire to either the T1 or T2 terminal. Connect the neutral (white) wire to the T0 terminal. Two 120-volt circuits are available. Any combination of single-phase and three-phase loading can be used at the same time as long as no terminal current exceeds the NAMEPLATE rating of the generator.



SIGNAL LIGHTS, ETC. - Optional equipment may include signal lights to warn of improper operation, or terminals for connecting such lights, horn, or other warning devices. Refer to the engine wiring diagram if such equipment is to be connected.

WATER JACKET HEATER. - The optional water jacket heater serves to keep the engine coolant warm during periods of plant shut-down in low ambient temperatures, thus promoting easier starting. Connect the heater to a normally energized electric power source, making sure that the line voltage is correct for the rated voltage of the heater.

WARNING
THIS ENGINE CONTAINS BREAK-IN OIL

Before Operating: FILL cooling system. CHECK lubricating oil level. CHANGE break-in oil after 15-hours operation. CHANGE oil filter after 15-hours.

Rust Inhibiting Oil is applied to cylinders for shipping. Run Diesel plant at 50% rated load for first 1/2-hour.

PREPARATION

CRANKCASE OIL. - Refer to the LUBRICATION section of the Ford engine manual for recommendations as to the SAE number of oil to use. Fill the crankcase with 4 quarts (U.S. measure) of a good quality, heavy duty oil designated for "type DS" service.

Approximately 1-pint of oil drains from the oil filter into the crankcase during shut down, so a level reading is most accurate if taken immediately upon stopping.

AIR CLEANER. - Service the air cleaner with oil, filling to the level marked on the cleaner. Use the same SAE number oil as used in the crankcase. However, it is not necessary to use expensive heavy duty oil in the air cleaner. A straight non-detergent mineral oil is satisfactory.

RADIATOR. - Fill the radiator with clean soft water. Use a good rust and scale inhibitor. If there is any danger of exposure to freezing temperatures, use a standard antifreeze in the recommended proportion. The approximate capacity of the cooling system is 15 U.S. quarts. On the initial run, check the level several times and add liquid as necessary to compensate for any air pockets which may have formed when filling.

FUEL. - Refer to the Ford manual for fuel oil specifications. Check with the fuel supplier for assurance that the fuel meets the specifications.

Before the initial start, the fuel system must be properly primed and all air bled from the fuel system.

1. Loosen the drain plug on bottom of fuel filter until fuel flows from drain and then close the drain.
2. Open the filter bleed screw on top of filter. When fuel flows from the bleeder screw, tighten the screw. Failure to bleed the fuel system of air may result in an air lock condition and cause engine stoppage or erratic running.
3. Check the entire fuel system for leaks after starting the engine.

OPERATION

STARTING. - Always be sure the fuel system is air free, as directed under PREPARATION. If fuel lines have been disconnected, or if fuel has been exhausted bleed the entire fuel system. For normal starts, no further priming is necessary.

To start, press the START-STOP switch to its START position, holding in contact to crank the engine. The engine should start with a few seconds of cranking. Investigate any failure to start - do not crank for more than 30 seconds at one time. If engine fails to crank, check that the cranking limiter switch is closed.

For starting in temperatures below +10°F., be sure the fuel has a pour point well below the prevailing temperature. The fuel supplier is responsible for providing a fuel suitable for the temperature conditions - free of wax, etc. Drain, preheat, and refill the engine coolant and crankcase oil. If practical, keep the battery in a warm location during shut down and reconnect just before starting.

CHECKING OPERATION. - As soon as the engine starts, always check the oil pressure. Normal oil pressure is 30 to 45 lbs. at operating temperature, but will be considerable higher until the engine warms up.

The water temperature gauge indicates the coolant temperature during operation. Normal operating temperature is approximately 190°F.

The small DC ammeter indicates the battery charging current. An automatic regulator controls the charging rate, which will vary according to the charge condition of the battery. Normal charge rate is 5 to 10 amperes when the plant first starts. The rate should fall to almost zero as the battery becomes fully charged.

STOPPING. - If conditions permit, disconnect electrical load and allow the plant to run a few minutes at no load. This will allow the plant to cool off slightly and may prevent an excessive temperature rise when the plant stops and ventilation ceases. Press the START-STOP switch to its STOP position to stop the plant.

LOW OIL PRESSURE SWITCH. - In case of low engine oil pressure, the oil pressure switch acts through the emergency stop relay to stop the plant. After correcting the cause of the low oil pressure, press the reset button before attempting to restart the engine.

HIGH WATER TEMPERATURE. - If the engine coolant temperature rises to a dangerously high point, a thermostatic switch actuates the stop circuit and stops the plant. Correct the condition that caused the high temperature. The coolant temperature must drop approximately 10°F. before the plant can be started again. The high water temperature switch acts through the EMERGENCY STOP RELAY, and the PUSH TO RESET button must be pressed to restore normal operation.

VOLTAGE REGULATOR RHEOSTAT. - On plants equipped with the voltage regulator rheostat, the rheostat provides for approximately 5% plus or minus adjustment of the output voltage. Turn clockwise to increase the voltage, counterclockwise to decrease the voltage.

BATTERY, HOT LOCATION. - Batteries will self discharge very quickly when the ambient temperature is consistently above 90°F., such as in a boiler room. To lengthen battery life, dilute the electrolyte from its normal 1.275 specific gravity reading a full charge to a 1.225 reading. The cranking power of the battery will be reduced slightly when the electrolyte is so reduced, but if the temperature is above 90°F. this should not be noticed, and the lengthened battery life will be a distinct advantage.

CRANKING LIMITER. - The cranking limiter is a safety device which prevents excessive engine cranking. The electrically operated thermal relay will automatically open the engine cranking circuit after approximately one-minute cranking time. The limiter must be manually reset after opening. Allow at least one minute before attempting to reset the limiter. Investigate any failure in starting.

EXERCISE PERIOD. - If the plant is used infrequently, such as in standby service, start and operate for 15 to 30 minutes at least once a week. This exercise period keeps oil distributed on engine parts, fuel system full, etc., and promotes easier starting.

NO LOAD OPERATION. - Period of no load operation should be held to a minimum. After about 4 hours of continuous no load operation, the injection nozzles may become fouled enough to require servicing. If it is necessary to keep the engine running for long periods of time when no electrical output is required, best engine performance will be obtained by connecting a "dummy" electrical load. Such a load could consist of heater elements, etc.

OPERATION

SPECIAL EQUIPMENT

Some plant models are equipped with electrical indicating meters, running time meter, circuit breakers, etc. Such equipment varies according to purchaser options or plant model.

AC AMMETER. - The ac ammeter indicates the amount of load connected to the generator circuit. On three-phase models, the current shown will be for one phase only, according to the position of the selector switch.

AC VOLTMETER. - The ac voltmeter indicates the voltage of the ac output. On three-phase models, the voltage shown will be for the same phase as the amperage shown, according to the position of the selector switch. On a single-phase (no selector switch) or four-wire, three-phase model, the voltage shown will be the higher nameplate voltage.

METER SELECTOR SWITCH. - The meter selector switch is provided on three-phase models. The position of its handle indicates the phase of the generator output that is indicated on the ac ammeter and voltmeter.

RUNNING TIME METER. - The running time meter registers the total number of hours, to 1/10th, that the plant has run. Use it to keep a record of periodic servicing.

CIRCUIT BREAKER. - The circuit breaker is a safety device to protect the generator against damage from an over-load. If an over-load should occur, the circuit breaker will automatically trip, disconnecting the generator output from the load terminals. After correcting the over-load condition, it is necessary to manually reset the breaker to the ON position.

WATER JACKET HEATER. - Intended for use in cold weather applications. The electrically operated heater keeps the engine coolant at a moderate temperature to prevent condensation, oil thickening, hard starting.

FREQUENCY METER. - The frequency meter indicates the frequency of the output current in cycles per second. It can be used to check engine speed (each cycle per second equals 30-rpm engine speed).

TACHOMETER. - The tachometer indicates the engine operating speed in revolutions per minute. It can be used to check current frequency.

EMERGENCY STOP RELAY. - If a plant safety device operates to stop the plant, the emergency stop relay PUSH TO RESET button must be pressed in before the plant can be started again. Always be sure to correct the condition that caused the emergency stop.

PARALLEL PLANT OPERATION

Synchronizing Lamps (2) are provided on the generator control panel for parallel plant operation. The lamps indicate when voltage wave forms of both operating plants coincide and paralleling can be accomplished. The CROSS CURRENT switch is set at OFF during single plant operation and set at ON when operating in parallel. When attempting to parallel plants, both must be operating at the same frequency. Adjust plant speed (frequency) by adjusting the governors and switch on panel. Set CROSS CURRENT switch at ON. Observe the synchronizing lamps which will alternately glow and darken more and more slowly. When the lamps are dark for approximately 5 seconds, adjust the voltage of one plant to match the other plant with the VOLTAGE ADJUST rheostat. At the instant the lamps are darkest, set the SYNCHRONIZE switch at ON. Both plants are now operating in parallel. Adjust frequency (engine speed) until the AMMETERS on both plants indicate approximately the same current.

Set ammeter selector switch in the same position on both plants. Adjust the voltage control on one plant to the point where the sum of the output ammeter readings of both plants is reduced to a value as low as possible. Several trial adjustments may be necessary.

EXAMPLE

Trial No.	Amps, Plant A		Amps, Plant B		Sum
1	60	–	65	–	125
2	65.4	–	55.6	–	121
*3	70.6	–	48.8	–	119.4
4	77.2	–	43.8	–	121

* Trial No. 3 indicates the correct voltage control adjustment since the sum of the two output ammeter (current) readings is the lowest obtained. The low sum indicates minimum cross currents between the two generators.

The output ammeters now indicate how the two plants are sharing the load. Plant B is not carrying its proper share of the load since it is supplying only 48.8 amperes as compared to 70.6 amperes supplied by plant A. Adjust the governor speed (frequency) control of plant B carefully to the point where the ammeter readings of both plants are equal.

The two plants should now be furnishing nearly equal power to the load, and reactive power should be equally divided. In some cases it may be desirable to repeat the voltage control adjusting step to reduce cross currents. If the output voltage or frequency is outside the desired limits, it may be necessary to make slight adjustments on plant A and then repeat plant B adjustments.

PERIODIC SERVICE

GENERAL. - Follow a definite schedule of inspection and servicing, based on operating hours. Keep an accurate record of operating time. Use the running time meter (optional equipment) to keep a record of operation and servicing. Service periods outlined below are for normal service and operating conditions. For continuous duty, extreme temperature, etc., service more frequently. For infrequent use, light duty, etc., service periods can be lengthened accordingly. Refer to the Ford engine manual for details of engine service operations.

DAILY SERVICE, NORMAL 8-HOURS OF OPERATION.

1. FUEL OIL. - Check, replenish as necessary.
2. CRANKCASE OIL. - Check level, add as necessary.

NOTE

Check the oil level immediately after stopping, before oil in the filter drains back into the crankcase. Drain sediment off.

3. RADIATOR. - Check level, add as necessary.
4. CLEAN AND INSPECT. - Wipe clean of dust, spilled oil, etc. Inspect for loose parts, leaks, etc.

WEEKLY SERVICE, NORMAL 50-HOURS OF OPERATION.

1. AIR CLEANER. - Check, clean, replenish oil as frequently as necessary.

SEMI-MONTHLY SERVICE, NORMAL 100-HOURS OF OPERATION.

1. CRANKCASE BREATHER. - Clean and inspect.
2. FAN BELT. - Inspect and adjust to 1/2-inch depression between pulleys.
3. FUEL FILTER. - Drain sediment. Reprime.
4. COOLING SYSTEM. - Check for rust or scale formation.

MONTHLY SERVICE, NORMAL 200-250 HOURS OF OPERATION.

1. CHARGE ALTERNATOR. - Clean and inspect.
2. STARTER. - Oil front bearing sparingly, check brushes.
3. INJECTION NOZZLE. - Check for proper spray pattern, etc. Refer to the Ford manual.
4. AC GENERATOR. - Check brushes, replace if worn to 1/2-inch or if damaged. DO NOT LUBRICATE.
5. FUEL FILTER - Replace elements, clean, and reprime.
6. CRANKCASE OIL. - Drain and refill unless experience indicates otherwise. Refer to LUBRICATION in the Ford manual.
7. OIL FILTER. - Replace the element at time of oil change.

MAINTENANCE

ENGINE

GENERAL. - Basic engine maintenance procedures are covered in the Ford engine manual. Proper attention to correct operating and periodic service procedures will lessen the necessity for future maintenance repairs.

ENGINE SPEED. - The frequency of the generator output current is in direct ratio to the engine speed. The engine speed is controlled by the built-in governor of the fuel injection pump. The original factory setting of the governor should not be disturbed. However, in case of pump repair, the governor is easily reset.

1. See that the injection pump is properly timed to the engine. Refer to the Ford engine manual.

2. Adjust the throttle to give an engine speed of approximately 1800-rpm for a 60-cycle plant (1500-rpm for a 50-cycle plant). Use an accurate tachometer to determine engine speed, or a frequency meter connected to the AC generator output. Multiply frequency by 30 to obtain engine speed.

EXAMPLE: 30 x 61 (cycles) equals 1830-rpm.

Check the generator voltage. It may be necessary to make a slight re-adjustment of the speed setting to obtain the preferred voltage at average load. A range of 1830 to 1890-rpm (61 to 63 cycles) might give the desired voltage.

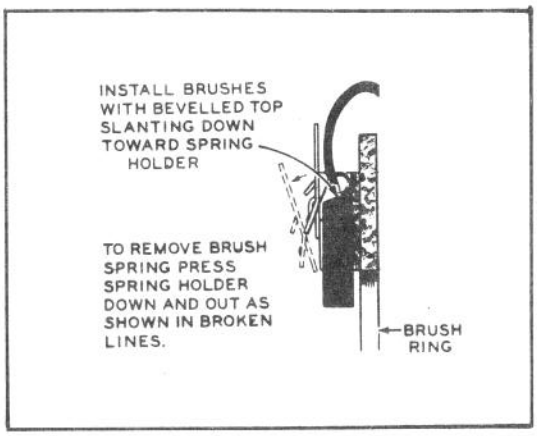
MAINTENANCE

GENERATOR

AC generators normally require very little servicing. Periodic inspection, to coincide with engine oil changes, will assure continued good performance.

BRUSHES. - To examine the brushes, brush springs, and slip rings, remove the inspection and ventilating covers from the end bell openings. Keep the end bell, brush rig, etc. free of dust and dirt.

Brushes should be replaced when worn to approximately 1/2-inch long, or so that the lead end of the brush is below a point midway between the outer and inner end of its guide. Do not attempt to remove the brush without first removing its spring and bracket as shown. Never bend a spring back over its bracket - doing so will put a kink in it and require its replacement. Do not use a substitute brush that may look identical but may have entirely different electrical characteristics. Be sure the brush is installed so that the short side of its taper is toward the spring and its bracket.



GENERATOR BEARING. - The generator bearing is prelubricated for its life and sealed. It requires no servicing.

EXCITER. - The exciter contains no moving parts. Occasionally blow out any dust, etc. Check thoroughly to assure that all components are mechanically secure, and that all electrical connections are tight.

Generator tests. - If the generator does not function properly, a few simple tests with the plant off may isolate the cause.

1. Temporarily disconnect the leads from exciter terminals E1, E2, AF1 and AF2. Check the exciter wiring diagram for input voltage to the exciter, and temporarily connect an alternate source (such as commercial line) of AC power with the same voltage rating to exciter terminals **E1 and E2**.

   Check the voltage across terminals AF1 (+) and AF2 (-). If there is no dc voltage, the exciter is not functioning.

2. If dc voltage at terminals 2 and 3 is 25-volts or higher, check the alternator for a grounded or open circuits as follows:

   Rotor Continuity Tests: Remove the brushes so none touches the collector rings.

a. Using an ohmmeter, test for grounding between each slip ring and the rotor shaft.

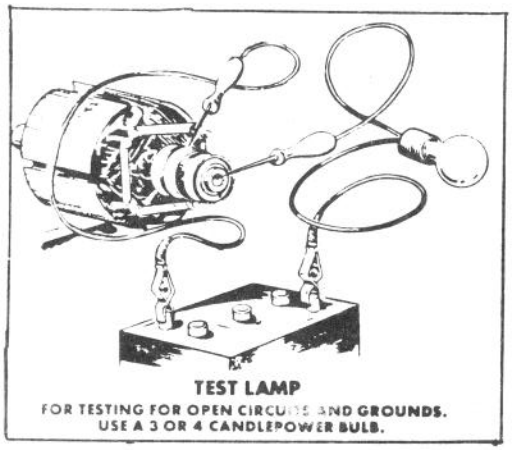
b. Test for short or open circuit in rotor winding, by measuring resistance of winding. It should measure approximately 2.61 ohms (at 70°F). If an accurate ohmmeter isn't available, check the rotor for open circuit or grounding with a dc test lamp.

Replace the rotor if it is grounded, or has an open circuit or short.

Stator Continuity Tests: Disconnect the generator output leads in the control box. Refer to wiring diagrams to determine the output lead coding.

a. Using either the test lamp or an ohmmeter, check each winding of the stator for grounding to the laminations or frame.

NOTE: Some generators have ground connections to the frame. Check wiring diagrams.



CONTINUITY TEST LAMP

b. Using an accurate ohmmeter, test the resistance of each stator winding. Compare the resistances obtained. All windings of equal output voltage should indicate about the same resistance. An usually low reading indicates a short; a high reading an open circuit.

If the ohmmeter required for this test isn't available, check for open circuits with the test lamp.

If any windings are shorted, open-circuited or grounded, replace the stator assembly. Before replacement, check the leads for broken wires or insulation and replace any defective lead. If this does not correct the fault, replace the assembly.

3. No terminal of the exciter should show a grounded circuit.

4. CHECKING STATIC EXCITER. - Troubles are listed in advancing order, from no output voltage to a rated but fluctuating output voltage. The relationship between trouble and cause is not always consistent from model to model, so the following information must be used as a guide, not an absolute rule. The column entitled "step" indicates the step for testing a standard component. When the word "None" appears in that column, all the information needed to complete the check is given in the column headed "Corrective Action". Use a multimeter to check continuity, voltage, and resistance as indicated in the tests.

Note: It is imperative that the testing procedures are completely understood by the serviceman before attempting to perform corrective maintenance. Use caution when working on an operating plant.

NATURE OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION	STEP
Generator will not build up voltage.	Circuit breaker in "off" or "tripped" position	Reset and close breaker	None
	Open in circuit breaker	Stop plant and check breaker continuity	None
	No AC power to Magneciter	Check AC voltage at E1-E2 with the plant operating. Voltage should be five per cent of the rated voltage. If not, check continuity from E1-E2 back to the generator	None
	Partial loss of residual in Rotor	With plant operating jumper from E2 to heat sink of field rectifier Z until voltage begins to build-up. Then remove.	None
	Pair of Field Rectifiers (either W & Z or X & Y) open	Test rectifiers and replace if defective	5
	Both Field Rectifiers X and Y shorted	Test rectifiers and replace if defective	5

NATURE OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION	STEP
Output voltage slow to build up. Circuit breaker opens in about five seconds	Either Field Rectifier X or Y shorted	Test rectifiers and replace if defective	5
Output voltage slow to build up and five per cent below rated voltage after build up. Voltage regulation poor.	Either Field Rectifier W or Z shorted	Test Rectifier and replace if defective	5
Output voltage slow to build up and higher than rated voltage after build up	Open circuit in one or more Control Rectifier	Test rectifier and replace if defective. Check soldered connections to rectifiers	5
Output voltage slow to build up and ten to twenty percent above rated voltage after build up	Open in one Field Rectifier	Test rectifiers and replace if defective	5
	Open circuit in Gate winding G1-G2 of Reactor A or B	If Field Rectifiers Y and Z check okay, check continuities of Gate windings G1-G2	6
Output voltage builds up normally but less than rated voltage after build up	Shorted winding in Control Reactor	Test Control Reactor and replace if defective	7
Output voltage builds up normally with slightly less than rated voltage at no load and low voltage at full load	Compound winding S1-S2 installed backward or has open circuit.	Check wiring diagram for polarity of Compound windings through Reactors A and B and test for continuity	None
Output voltage builds up normally but 20 percent above rated voltage after build up. Voltage regulation poor.	Compound winding S1-S2 installed backward through one Reactor (A or B)	Check wiring diagram for polarity of Compound winding through Reactor A or B	None
Output voltage builds up normally but is twenty five percent above rated voltage after build up	Open circuit in Control Rectifier bridge	Check continuity from the junction of Control Rectifiers 1 and 2 to the junction of Control Rectifiers 3 and 4	None

NATURE OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION	STEP
Output voltage builds up normally but 125 to 150-percent above rated voltage after build up	Shorted turn in gate winding G1-G2 of Reactor A or B	Test Reactors A and B for shorted turns and replace if defective	6
Output voltage builds up normally but 150 to 200-percent above rated voltage after build up. No regulation possible	Control winding C1-C2 of Reactor A or B polarized incorrectly	Check circuit connections of both Reactors A and B	None
	Shorted turn in Control winding C1-C2 of Reactor A or B	Test Reactors A and B for shorted turn and replace if defective	6
	Open in Control Circuit	Check continuity from E1 to E2 through Control Circuit	None
Generator Voltage fluctuating while engine running at constant speed	Incorrect setting on the Stabilizing Resistor	Check resistance and reset.	8

5. Checking Rectifiers. Disconnect one lead from, or remove, each rectifier for its individual test.

CAUTION

Note carefully the DIRECTION OF MOUNTING of any rectifier removed. It must be remounted in its original direction.

a. Connect the ohmmeter across the rectifier contacts and observe the meter reading.

b. Reverse the connections and compare the new reading with the first reading.

c. If one reading is considerably higher than the other reading, the rectifier can be considered satisfactory. However, if both readings are low, or if both indicate an "open" circuit, replace the rectifier with a new identical part.

6. Checking Reactors "A" and "B".

   CAUTION: The extent to which the resistance values obtained when trouble shooting with an ohmmeter are reliable and useful is governed by the accuracy of that ohmmeter. Resistance readings of the range of values found between G and G2 cannot be read with accuracy on the multimeter.

   a. Set the resistance range selector on the meter to the resistance range.

   b. Isolate one Gate winding by disconnecting either end of Gate winding G1-G2 from its point of connection; for example, disconnect G1 at E2. Measure the resistance in the Gate winding across G1-G2. Should be 0.66.

   c. Isolate one Control winding by disconnecting either lead C1 or C2 from the terminal block. Measure the resistance in the Control winding across C1-C2. Should be 5.5.

   d. Connect one meter lead to the disconnected Gate winding lead and the other meter lead to the disconnected Control winding lead and check for continuity.

   Results:

   1. REACTOR IS SERVICEABLE if resistance is within 20 percent either way of the value listed and there is no continuity between the Control and Gate windings.

   2. REACTOR IS DEFECTIVE if there is an open circuit in either the Gate or the Control windings. Continuity between the Gate and the Control windings is also an indication of a defective Reactor. In either case, the Reactor should be replaced.

7. Checking Control Reactor.

   a. Isolate the Control Reactor by disconnecting common lead "C" from its point of connection and carefully measure the resistance from this lead to the numbered lead on the Control Reactor. Should be 12.5.

   Results:

   1. CONTROL REACTOR IS SERVICEABLE if resistance is within 10 percent of the value specified.

   2. CONTROL REACTOR IS DEFECTIVE if no continuity is indicated between the common lead "C" and the numbered lead, indicating the presence of an open circuit.

8. Checking Resistors:

   The resistors must be checked with a multimeter adjusted to the appropriate range of resistances. See wiring diagram for correct values.

   a. Isolate the Resistor by disconnecting one end from its point of connection and carefully measure the resistance.

Results:

1. RESISTOR IS SERVICEABLE if the measured resistance falls within 20-percent of the value specified in the wiring diagram.

2. RESISTOR IS DEFECTIVE if there is no indication of continuity through the resistor. If the measured resistance exceeds the percent limits either way, the Stabilizing Resistor can be adjusted to bring the resistance within the required limits.

Static exciter service and repair does not require complete disassembly. Individual components are easily accessible for servicing. All components are easily removable after disconnecting the attached leadwires. Refer to the Parts List for the exploded view and part numbers. See its Wiring Diagrams for leadwire connections.

Generator Disassembly: If generator tests determine generator repair is required, remove and disassemble the generator according to Generator Assembly Illustration and the following instructions. Index numbers refer to Generator Assembly except where noted.

1. Disconnect generator and control leadwires from the terminal blocks in the control box. Check leadwire markings for legibility to ease assembly. Arrange leads so they can be withdrawn from the control box easily.

2. Remove the control box mounting screws (4) which secure the control mount to the generator frame. Remove the control box. In some cases it may be necessary to remove the control box from its shock mountings and base to facilitate leadwire removal.

3. Remove the cap nuts (4) which attach the exciter cover and remove the cover. Disconnect the leadwires which come from the generator to the exciter (check leadwire markings for legibility). Remove the capscrews (6) which secure the exciter to the generator end bell and remove the entire exciter assembly

4. Remove the centrifugal switch (item 8) from the end bell (13) and rotor shaft. Remove the end bell covers (items 9, 9A). Slip the brushes (item 7) and springs (item 6) from brush rig (item 5) - it is not necessary to disconnect the brush leads unless brush replacement is required.

5. Block the rear of the engine in place by supporting the flywheel housing. Remove the narrow generator band (item 14). Remove the large capscrews which secure the generator mounting pad (item 19) to the skid base. Remove the capscrews which secure the stator assembly (item 4) to the engine flywheel housing.

6. Using an overhead hoist and sling, slide the stator assembly (item 4) off the rotor assembly (item 1). CAUTION: Do not damage the brush rig (item 5) while removing the stator.

7. Remove the brush rig (item 5), large generator band (item 15), and the end bell (item 13) from the stator assembly (item 4) if required.

8. Attach the hoist and sling to the rotor assembly (item 1) and apply a slight lift to support the rotor. Remove the bolts which secure the flexible drive coupling to the engine flywheel and pull the rotor from the engine.

9. Pull the bearing (item 3) from the rotor shaft if required with a wheel or gear puller. If required, remove the blower (item 2) from the rotor and the air scroll (item 11). Refer to the Parts Catalog for replaceable parts and assemblies.

Generator assembly is the reverse of disassembly procedures.

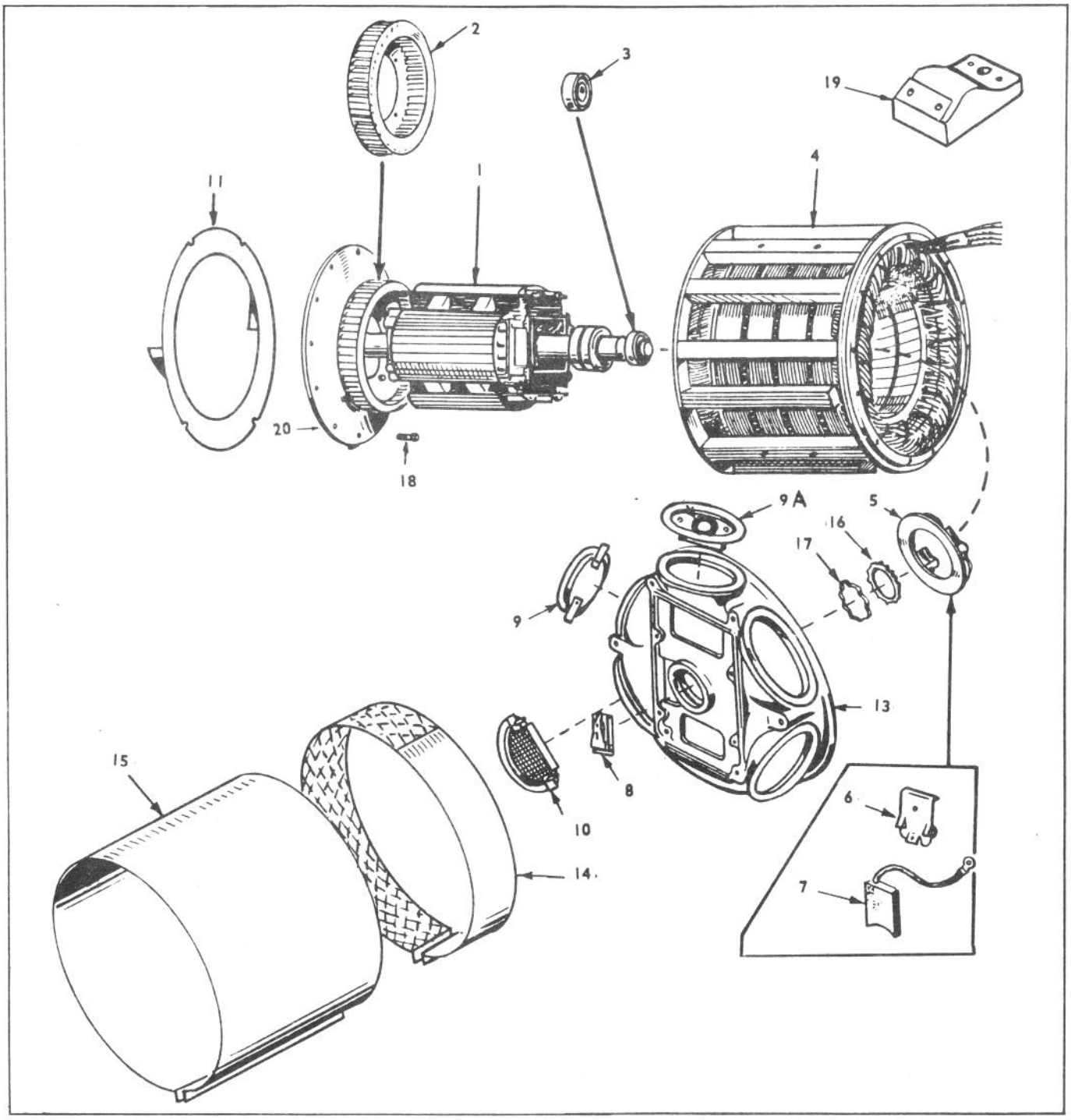
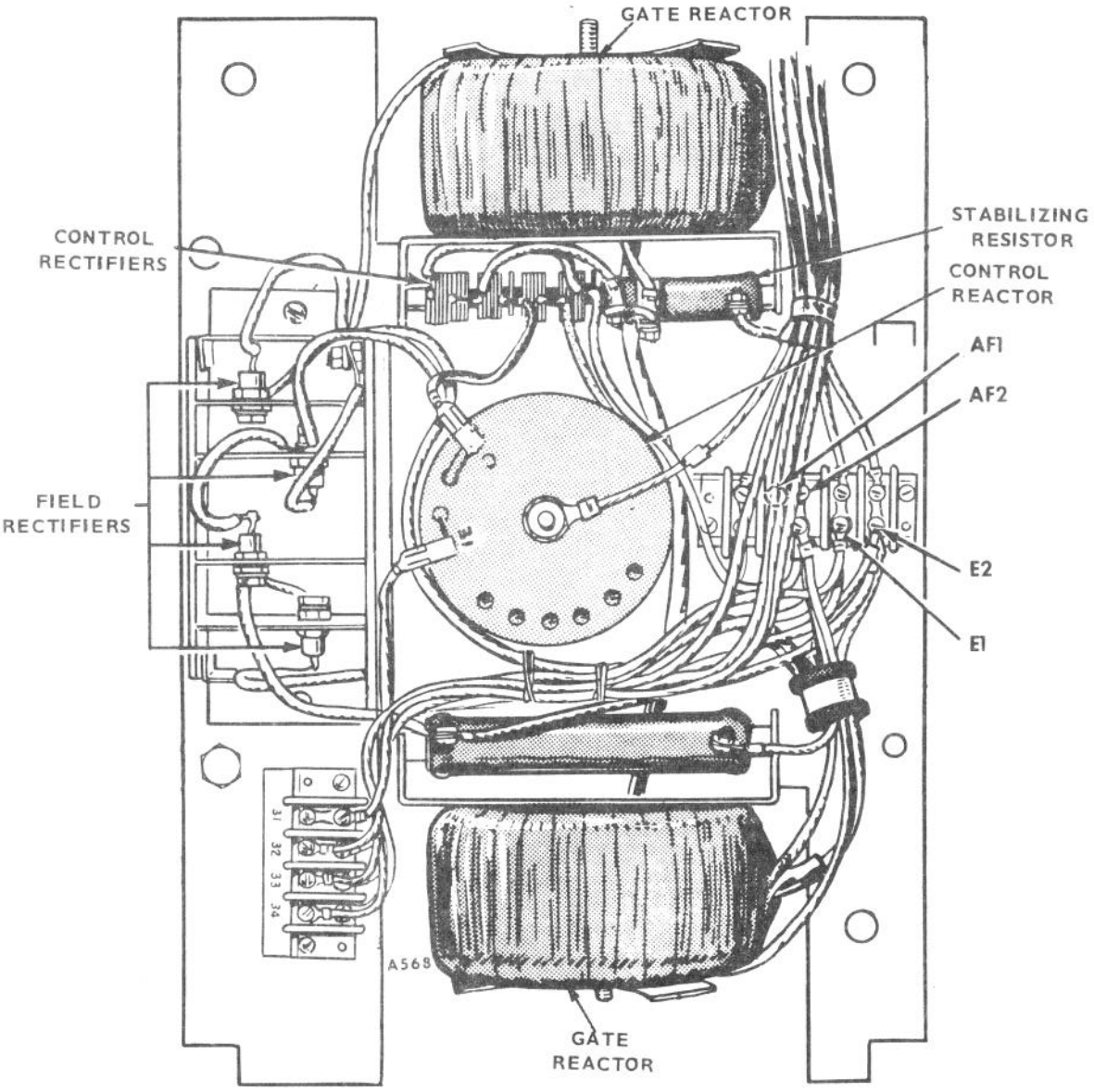


FIG. 6-13. GENERATOR ASSEMBLY

REF. NO.	QTY. USED	PART DESCRIPTIONS
1	1	Rotor Assy., Wound - Includes Brg., Blower & Drive Assy.
2	1	Blower
3	1	Bearing
4	1	Stator Assy., Wound
5	1	Rig Assy., Brush
6	4	Spring, Brush
7	4	Brush
8	1	Switch Assy., Overspeed
9	2	Cover, End Bell, Open. (Plain)
9A	1	COVER, END BELL OPENINGS (W/Lead Hole) - INCLUDES GROMMET
10	2	Cover, End Bell Openings (Screened)
11	1	Scroll, Air
13	1	Bell, End
14	1	Band, Gen. - Front (Narrow)
15	1	BAND, GENERATOR - REAR (Wide)
16	1	Holder, Brg. (Anti-Rotation)
17	1	Spring, Brg. Holder
18	6	Bolt, Shoulder (5/16-18")
19	2	Pad, Generator Mtg.
20	1	Disc. Drive



STATIC EXCITER ASSEMBLY (COVER REMOVED).

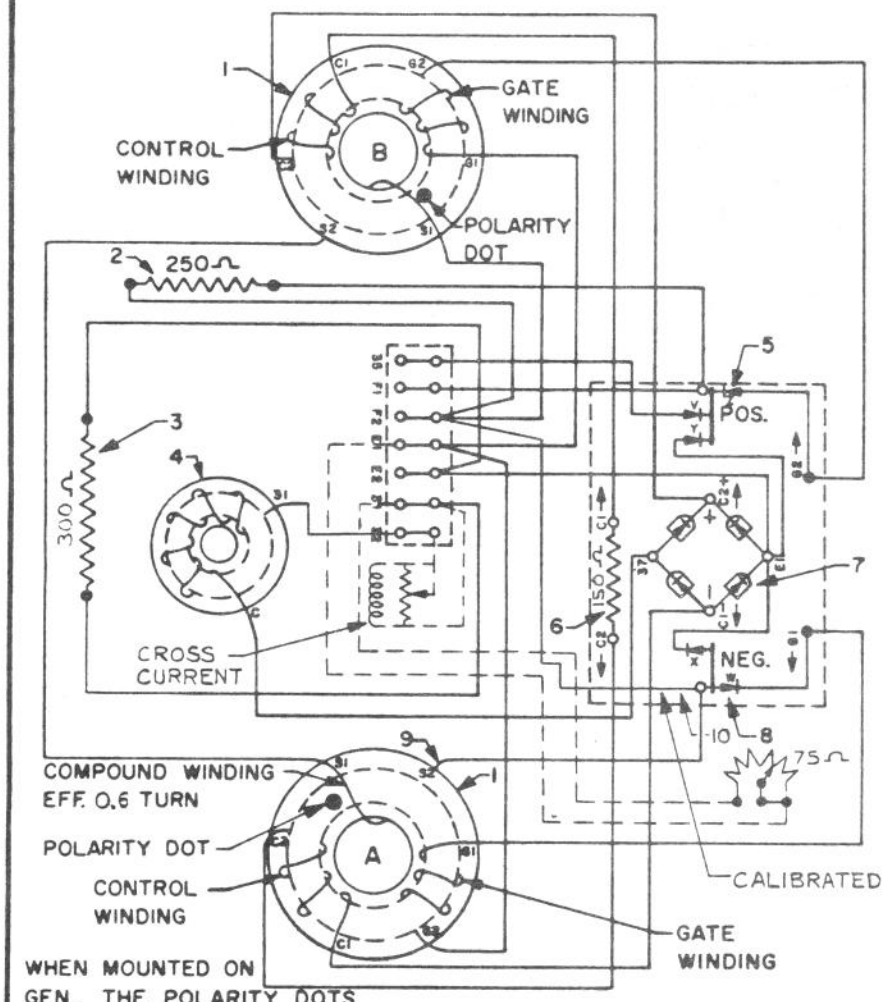
TROUBLE-SHOOTING CHART

POSSIBLE CAUSE	REMEDY
ENGINE RUNS BUT VOLTAGE DOES NOT BUILD UP	
Poor brush contact.	See that brushes seat well on slip rings, are free in holders, are not worn too short, and have good spring tension. Refer to the *Generator Maintenance and Repair* section.
Open circuit, short circuit, or ground in generator	
VOLTAGE UNSTEADY BUT ENGINE NOT MISFIRING	
Speed too low.	Adjust governor to correct speed.
Poor brush contact.	Refinish slip rings if necessary. See that brushes seat well on slip rings, are free in holders, are not worn too short, and have good spring tension.
Loose connections.	Tighten connections.
Fluctuating load.	Correct any abnormal load condition causing trouble.
GENERATOR OVERHEATING	
Short in load circuit.	Correct short circuit.
Generator overloaded.	Reduce the load.

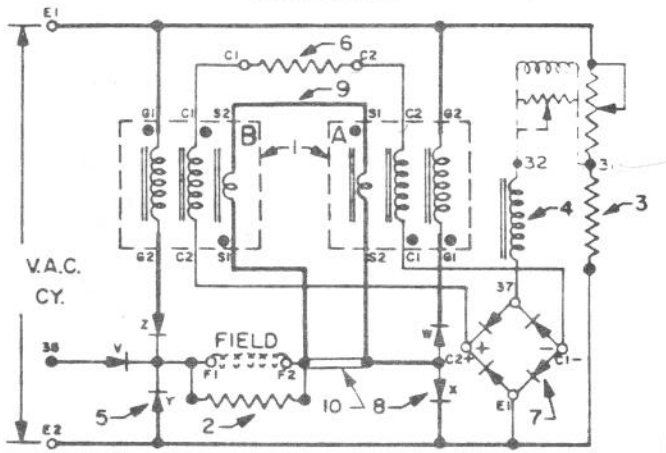
POSSIBLE CAUSE	REMEDY
VOLTAGE LOW AT FAR END OF LINE BUT NORMAL NEAR PLANT	
Too small line wire used for load and distance.	Install larger or extra wires or reduce load.
MOTORS RUN TOO SLOWLY AND OVERHEAT AT FAR END OF LINE BUT OK NEAR THE PLANT	
Too small line wire used for load and distance.	Install larger or extra wires or reduce load.
NOISY BRUSHES	
Rough slip rings.	Resurface. Undercut mica.
EXCESSIVE ARCING OF BRUSHES	
Rough slip rings.	Turn down.
Dirty slip rings.	Clean.
Brushes not seating properly.	Sand to a good seat or reduce load until worn in.

625A790

PICTORIAL



SCHEMATIC



ITEM	QTY		DESCRIPTION
10	1		NO. 16 WIRE, 27½" LG.
9	1		NO. 14 WIRE, 27½" LG.
8	2		RECTIFIER-FIELD NEG.
7	4		RECTIFIER-CONTROL
6	1		RESISTOR-STABILIZING
5	3		RECTIFIER-FIELD POS.
4	1		REACTOR-CONTROL
3	1		RESISTOR-VOLT. CONTROL
2	1		RESISTOR-DAMPING
1	2		REACTOR-GATE

PARTS LIST

Onan — DIVISION OF STUDEBAKER INDUSTRIES, INC. Minneapolis, Minnesota

DATE	DR.	ENGR	CKR	SC.
1-10-67	CDR	JO	WJB	

NAME: STATIC EXCITER WIRING DIAGRAM 120 V.A.C. 60 CY.

MODEL: 06SX/60

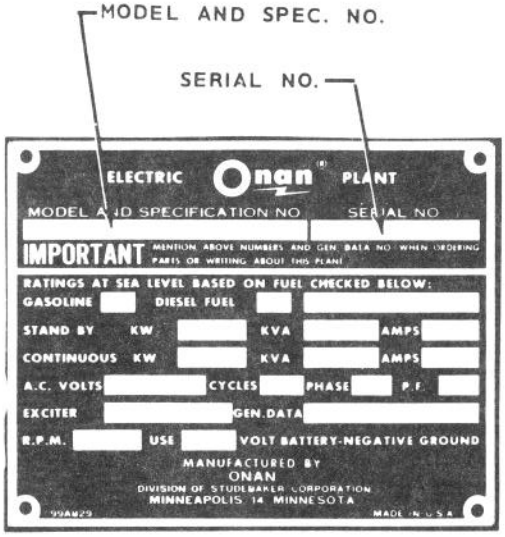
DWG. NO.: 625A790

3 BE	PARTS	TEST	SHIP	BD	TP	PO	LET	REVISIONS	ENG	CKR	DATE
	✓	✓	✓	✓	✓	✓					

INSTRUCTIONS FOR ORDERING REPAIR PARTS

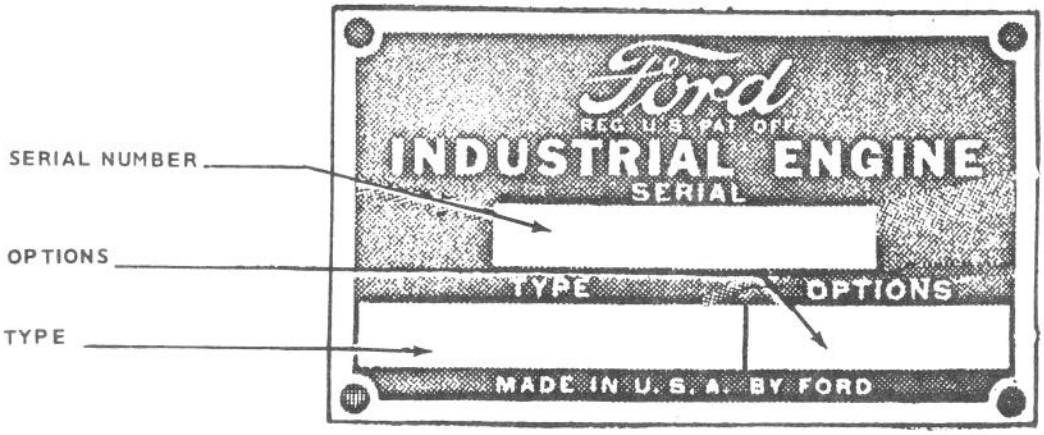
ONAN PARTS

All parts in this list are *Onan* parts. For *Onan* parts or service, contact the dealer from whom you purchased this equipment or your nearest authorized service station. To avoid errors or delay in filling your order, please refer to the *Onan nameplate* located on the upper right side of the flywheel housing and give the complete:



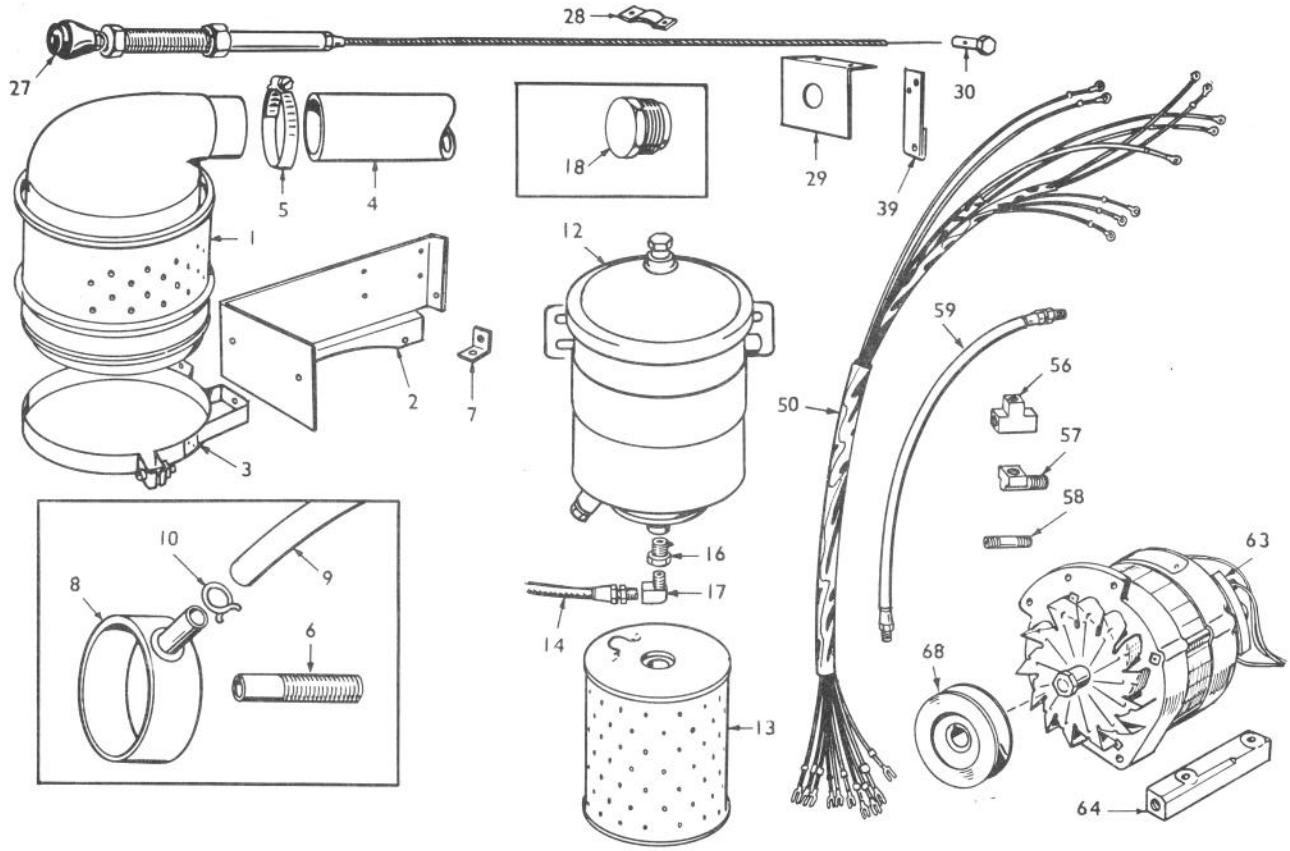
FORD PARTS

All Ford parts must be ordered from the Ford Motor Company of Dearborn, Michigan, or their nearest authorized distributor. Refer to the Engine nameplate located on side of the crankcase. When ordering parts, always supply Ford with the following nameplate information:



PARTS CATALOG

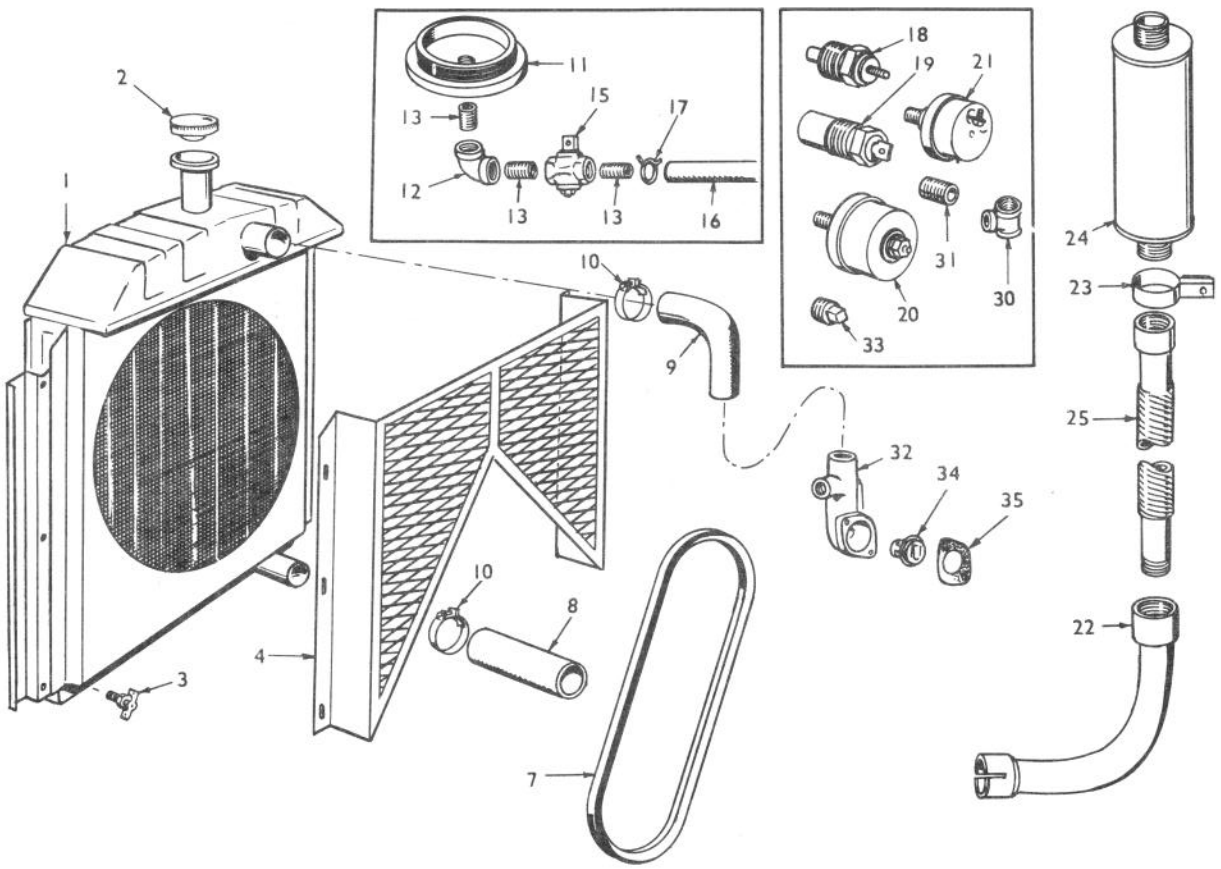
This catalog applies to the standard 20DEB-4R/5751. Powered by a Ford COPB-6005-A engine (see Ford Manual). Engine parts modified by or added by *Onan* will be in this list and have *Onan* part numbers. These supersede similar parts listed in the Ford Manual. Onan parts are arranged in groups of related items and are identified by a reference. All parts illustrations are typical. Unless otherwise mentioned, parts are interchangeable. Right and left plant sides are determined by facing the front end of the engine.



FUEL SYSTEM AND MISCELLANEOUS PARTS GROUP

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTIONS
1	140B500	1	Cleaner, Air
2	140C967	1	Bracket, Air Clnr. Mtg.
3	140B519	1	Band, Air Clnr. Mtg.
4	503-540	1	Hose, Air Clnr. to Air Inlet
5	503-465	2	Clamp, Air Clnr. Hose
6	123A1007	1	Adapter, Breather Hose to Manifold
7	140A966	1	Bracket, Air Clnr. Brkt to Eng.
8	123A1006	1	Adapter, Breather Hose
9	503-539	1	Hose, Breather
10	503-171	2	Clamp, Breather Hose
12	149C1078	1	Filter, Fuel - Primary
13	149P846	1	Cartridge, Fuel Filter
14	501-4	1	Line, Fuel - Primary to Sec. Filter
16	502-29	2	Bushing, Primary Fuel Filter
17	502-20	2	Elbow, Inv. Male

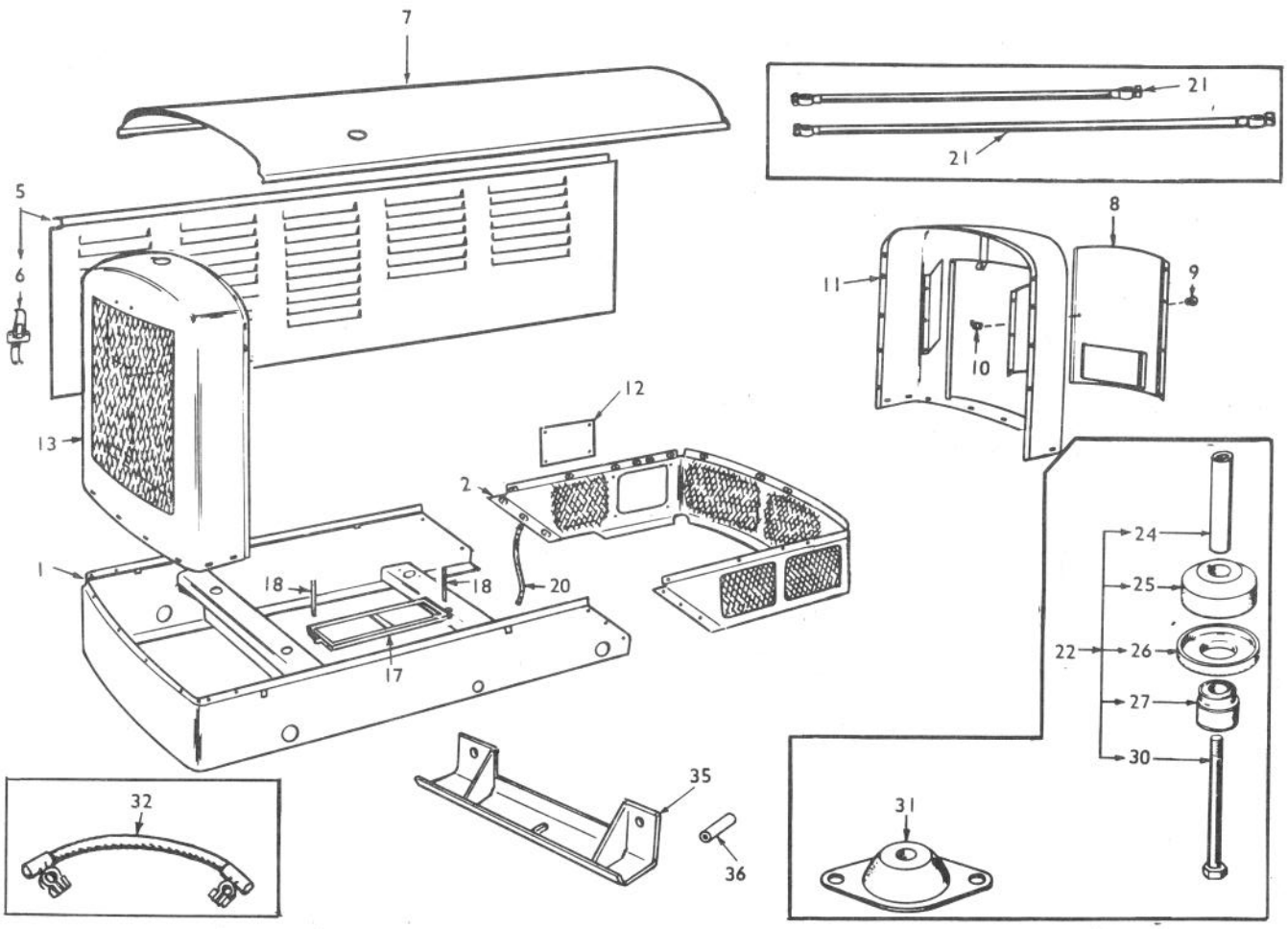
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTIONS
18	154A1143	1	Plug, Intake Manifold
27	152P157	1	Cable, Throttle Control
28	152A36	2	Clamp, Cable
29	151A230	1	Bracket, Throttle Control
30	152A158	1	Swivel
39	151A356	1	Lever, Governor
50	338C418	1	Harness, Engine Cont.
56	502-79	1	Tee, Fuel Ret.
57	502-2	1	Elbow, Fuel Ret.
58	502-32	1	Nipple, Fuel Ret. -
59	501-4	1	Line, Fuel Ret.
63	191B665	1	Alternator, Charge - Incl. Reg.
64	191A677	1	Support Alternator Mtg.
68	191-649	1	Pulley, Charge Alt.



COOLING, OIL DRAIN AND EXHAUST GROUP

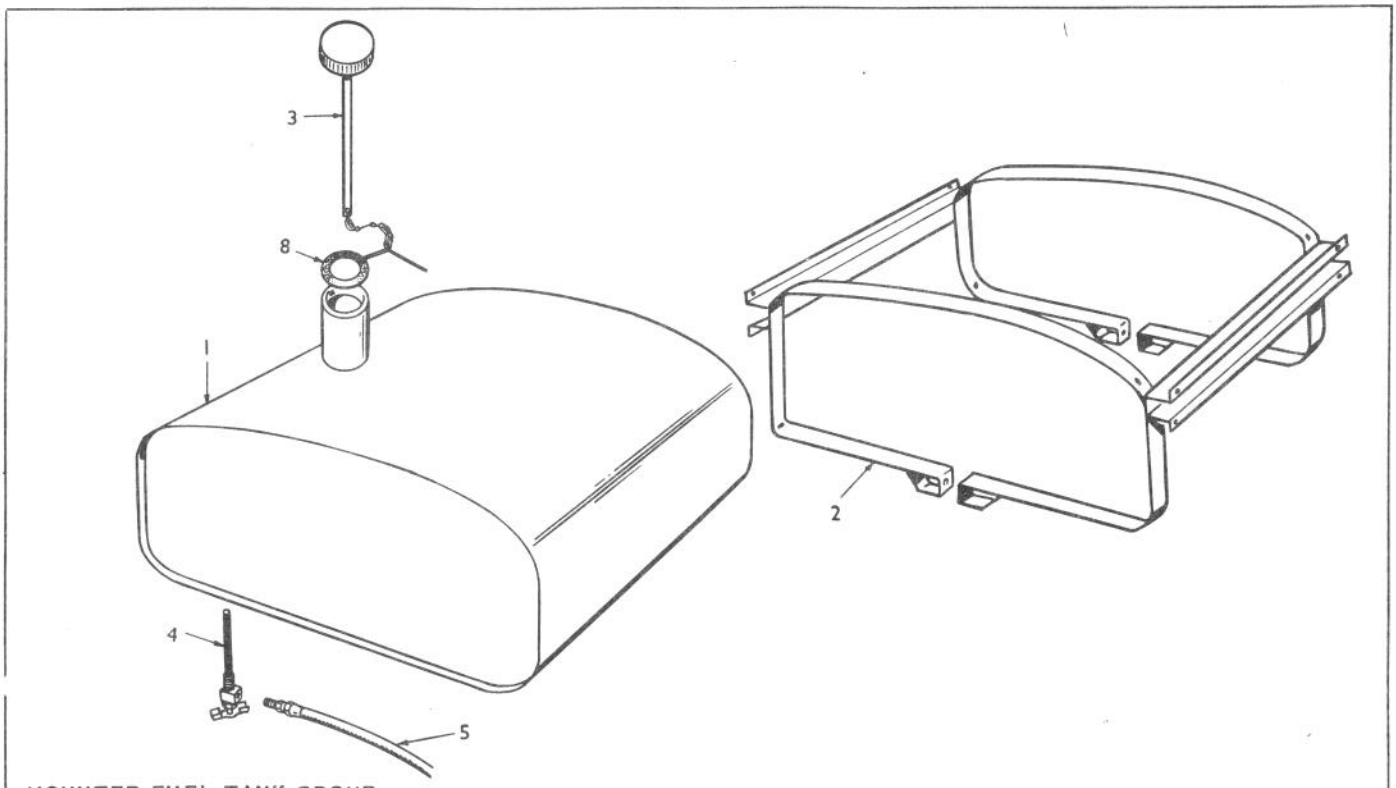
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTIONS
1	130D694	1	Radiator
2	130B449	1	Cap, Radiator
3	504-3	1	Valve, Rad. Drain
4	130C613	1	Guard, Fan
7	511P75	1	Belt, Chg. Alt. - Begin Spec B
8	503P536	1	Hose, Lower - Rad.
9	503B535	1	Hose, Upper - Rad.
10	503P4	4	Clamp, Hose
11	102A609	1	Adapter, Oil Drain
12	505-39	1	Elbow, Oil Drain
13	505-101	3	Nipple, Pipe - Oil Drain
15	504-30	1	Valve, Oil Drain
16	503-537	1	Hose, Oil Drain
17	503-131	1	Clamp, Hose - Oil Drain

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTIONS
18	193A104	1	Element, Water Temp.
19	309A179	1	Switch, Water Hi-Temp.
20	193A108	1	Element, Oil Pressure
21	309B10	1	Switch, Low Oil Pressure
22	155A880	1	Tube, Exhaust
23	155A881	1	Clamp, Exhaust Tube
24	155B456	1	Muffler
25	155B467	1	Tube, Exh. Flexible
30	505-58	1	Tee, Oil Pressure
31	505-98	1	Nipple, Oil Pressure
32	130C611	1	Elbow, Water Outlet
33	505-56	1	Plug, Water Outlet
34	309P225	1	Thermostat
35	130A696	1	Gasket, Thermostat



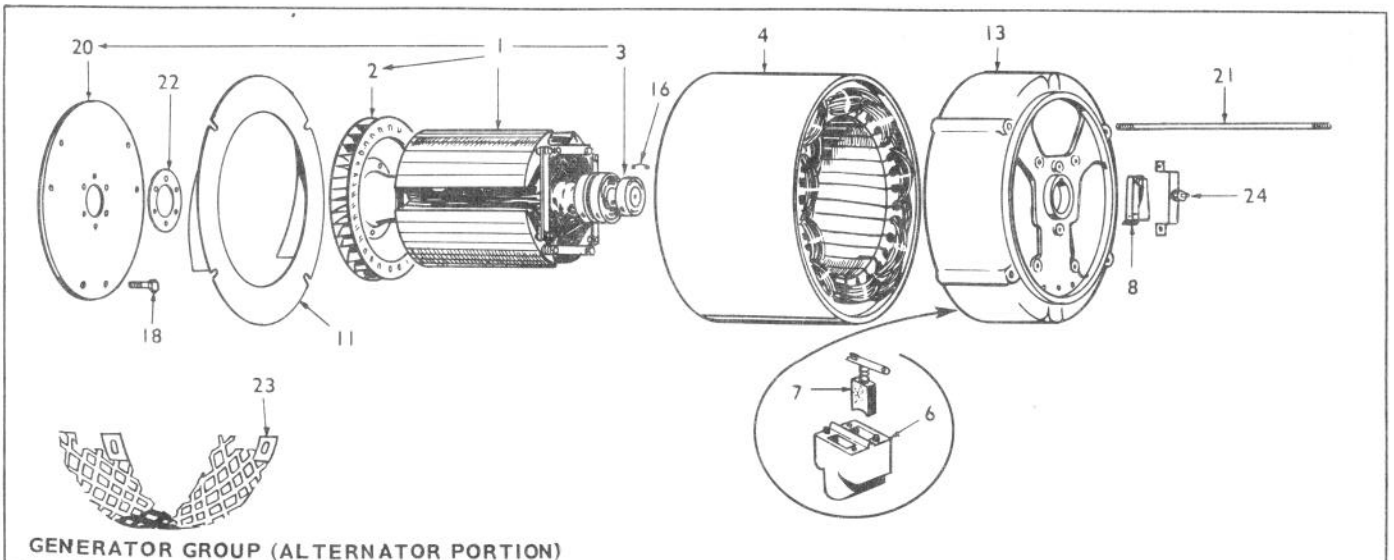
MOUNTING AND HOUSING GROUP

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTIONS
1	403D709	1	Chassis, Front
2	403D477	1	Chassis, Rear
5	405C1395	2	Panel, Door Side
6	406A105	4	Clamp, Door
7	405D1404	1	Panel, Top
8	405B1080	1	Panel, Rear Door
9	406-2	1	Knob, Door
10	405A1181	1	Stop, Door
11	405D1392	1	Panel, Rear
12	403A373	1	Panel, Chassis
13	405D1393	1	Panel, Front
17	416B495	1	Frame, Battery Hold-down
18	520A636	1	Stud, Battery Hold-down
20	336A476	1	Cable, Ground
21	CABLE, BATTERY		
	416A530	1	16" Long
	416A531	1	24" Long
22	402A253	2	Mounting Assembly, Engine End Incl. Parts Marked*
24	402A633	2	*Spacer, Engine Mount
25	402A10	2	*Mount, Rubber (Upper)
26	402A12	2	*Cup, Metal
27	402A11	2	*Mount, Rubber (Lower)
30	801-81	2	*Screw, Cap. Hex
31	402P190	2	Mount, Vibration, Gen. End
32	416A446	1	Cable, Batt. (9")
35	403C708	1	Bracket, Support - Eng. Front
36	403-630	2	Spacer, Mount to Eng. Support



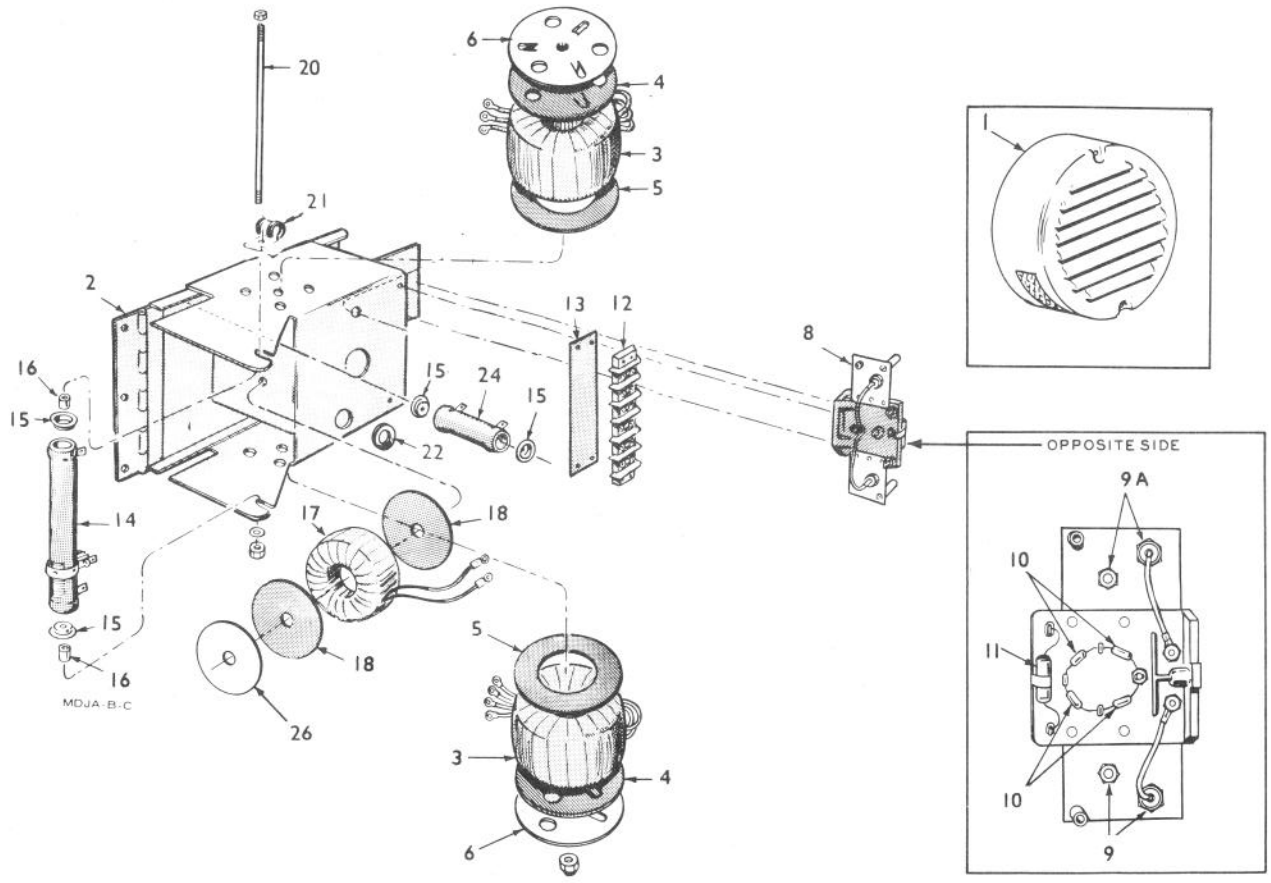
MOUNTED FUEL TANK GROUP

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTIONS
1	159D639	1	Tank, Fuel
2	159D640	1	Strap, Assy., Fuel Tank Mtg.
3	159D642	1	Cap & Ind., Fuel Tank
4	VALVE, SHUT-OFF		
	504-13	1	Fuel Supply - With Screen
	504-7	1	Fuel Return
5	LINE, FUEL		
	501-4	1	Fuel Supply (12")
	501-7	1	Fuel Return (24")
8	159P751	1	Gasket, Gas Tank Filler Neck



GENERATOR GROUP (ALTERNATOR PORTION)

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTIONS
1	201-1459	1	Rotor Assy. Wound - Incl. Brg. Blower & Drive Assy.
2	205C62	1	Blower
3	510A47	1	Bearing
4	220-1024	1	Stator Assy. Wound
6	212A1064	2	Block, Brush
7	214A59	4	Brush
8	150A717	1	Switch Assy., Overspeed
11	234C268	1	Scroll, Air
13	211E146	1	Bell, End
16	232A596	1	Clip, Brg. (Anti-Rotation)
18	815A292	6	Bolt, Shoulder (5/16-18")
20	232B1867	1	Disc. Drive
21	520A640	4	Stud, Generator Through
22	232A1824	As Req.	Shim, Drive Disc.
23	234B271	1	Screen, Adapter Opening
24	150A958	1	Bracket, Overspeed Switch Incl. Contact Points

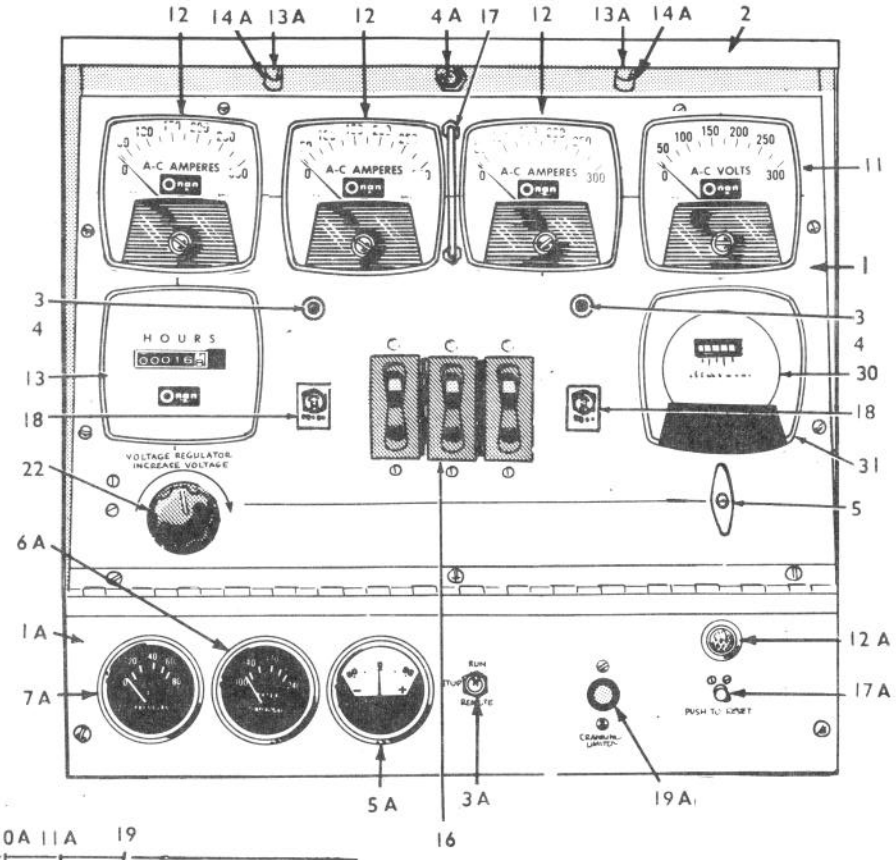


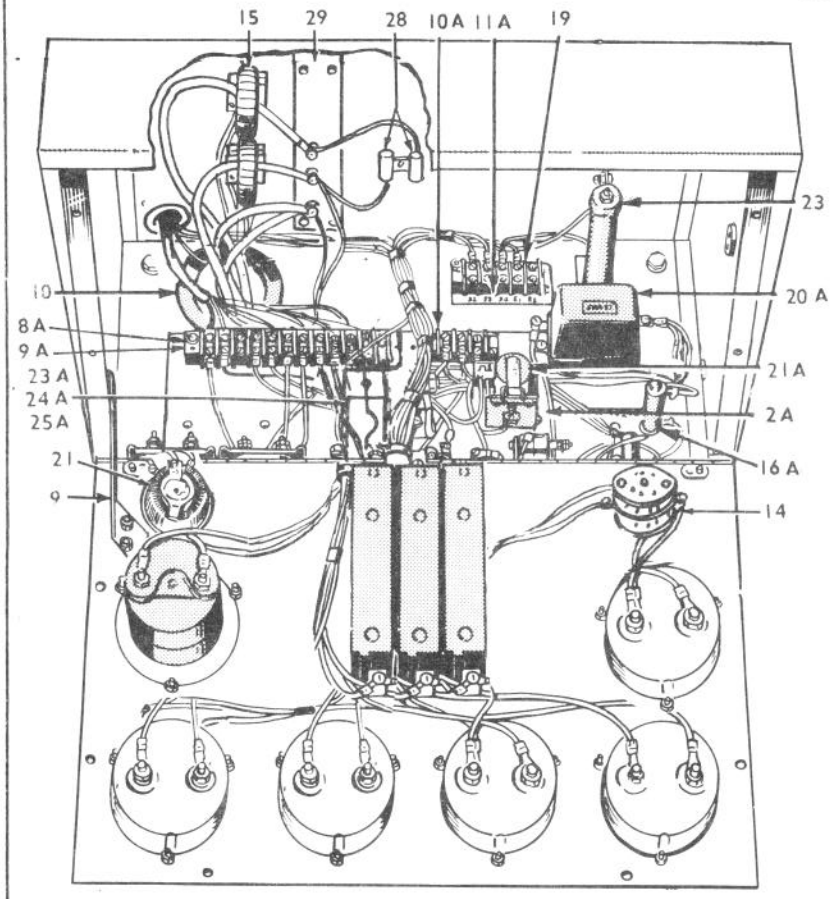
GENERATOR GROUP (EXCITER PORTION)

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTIONS
	209-80	1	Exciter Complete (Less Cover)
1	234B185	1	Cover, Exciter
2	234C186	1	Panel, Only Exciter
3	315B102	2	Reactor, Gate
4	232A1553	2	Gasket, Gate Reactor Mtg, Outer
5	232A1551	2	Gasket, Gate Reactor Mtg, Inner
6	232A1552	2	Retainer, Gate Reactor
8	305C388	1	Rectifier Assy., Resistor & Complete
9	305P238	2	Rectifier Only, Power Field, Neg.
9A	305P239	2	Rectifier Only, Power Field, Positive
10	305P240	4	Rectifier, Voltage Control
11	304A512	1	Resistor, Incl. in Rectifier Assy. (150-Ohm, 50-Watt)

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTIONS
12	332A745	1	Block, Terminal
13	332A925	1	Strip, Block Marker
14	304A527	1	Resistor, Tapped, 500-Ohm (425 Fixed, 75 Adj.)
15	304A15	4	Washer, Resistor Centering
16	232A1474	2	Spacer, Resistor Mounting
17	315A100	1	Reactor, Voltage Control
18	232A1548	2	Gasket, Voltage Control Reactor
20	520A641	1	Stud Tapped Resistor Mtg.
21	332-52	1	Clip, Tinnerman
22	508P8	1	Grommet, Rubber For 7/8" Hole
24	304A510	1	Resistor, Fixed (250-Ohm, 25-Watt)
26	526-173	1	Washer, Retainer, Voltage Control Reactor

CONTROL GROUP





REF. NO.	PART NO.	QTY. USED	PART DESCRIPTIONS
1	PANEL ONLY - UPPER CONTROL		
1	301C2791	1	Panel Only - Upper Control
2	301D2115	1	Box Only, Control
3	321-68	2	Socket, Synchronizing Light
4	322-86	2	Bulb, Synchronizing Light
5	303-76	1	Knob, Selector Switch
9	301A1914	1	Bracket, Panel Stop
10	508-63	1	Grommet (For 2-3/4" Hole)
11	302P421	1	Voltmeter, AC
12	302P458	3	Ammeter, AC
13	302P465	1	Meter, Running Time
14	308A12	1	Switch, Volt. & Current Sel.,
15	302B585	1	Transformer, Current
16	320P291	1	Breaker, Circuit & Relay
17	301A2727	1	Handle, Control Panel
18	308P69	2	Switch, Toggle
19	332A609	1	Block, Term. (2-Place)
21	303-97	1	Rheostat, Volt. Reg.
22	303-32	1	Knob, Rheostat
23	304A1	1	Resistor, Volt. Reg.
28	312A58	3	Condenser, Output Terminal Suppression
29	332A513	1	Block, Term., Output
30	302-213	1	Meter, Frequency
31	302B448	1	Plate, Meter Face - Opt.

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTIONS
1A	301C2124	1	Panel Only, Lower Cont.
2A	301A1685	1	Bracket, Time Delay Relay Mounting
3A	308P138	1	Switch (Run-Stop-Remote)
4A	308-2	1	Switch, Panel Light
5A	302A61	1	Ammeter, Charge (30-0-30)
6A	193B106	1	Gage, Water Temp.
7A	193B107	1	Gage, Oil Pressure
8A	332A607	1	Block, Term. (12-Place)
9A	332A608	1	Strip, Marker (4 through 15)
10A	332A611	1	Block, Term. (3-Place)
11A	332A762	1	Strip, Marker (Remote, B+, Ground)
12A	322P69	1	Receptacle Assy., Pilot Light
13A	322P72	2	Receptacle, Panel Light
14A	322-4	3	Bulb, (2) Panel (1) Pilot
16A	304A192	1	Resistor, Fixed (3-Ohm, 10-W)
17A	307A655	1	Relay, Emergency Latch
19A	320A104	1	Limiter, Cranking
20A	307B597	1	Relay, Fuel Solenoid
21A	307A388	1	Relay, Time Delay, Low Oil Pressure Switch
23A	307P819	1	Relay, Start, Disc. - Begin Spec B
24A	323P52	1	Socket, Relay
25A	307P778	1	Spring, Start-Disc. Relay Hold-down - Begin Spec B

975-1000

SUPPLEMENTARY INSTRUCTIONS AND PARTS CATALOG

These instructions supersede information in Operators Manual and Parts Catalog 975-301. This supplement modifys data in the manual to conform to Model 20DEB-2XR/5506A.

OPERATORS MANUAL

PAGE 17 - Delete paralleling information.

PAGE 31 - Add new wiring diagram 625A496

PARTS CATALOG

PAGE 33 - This catalog applies to 20DEB-2XR/5506A with supplementary instructions.

PAGE 34 - Delete items 27, 28, 29, 30.

PAGE 37 - Item 4 - Part No. 220-1184

Item 6 - Part No. 212A280

Item 13 - Part No. 211E152

PAGE 38 - First Item, Part No. 209-9

Item 14 - Part No. 304A479 Resistor 425-Ohms, 50-Watts.

Item 26 - Part No. 308A176 Switch (ADD. New Part)

PAGE 39 & 40 - Illustration and Parts List changes according to Wiring Diagram 612C3165 and 612C2897. Refer to wiring diagrams for part location within components.

Item 1 - Part No. 301C1814

Item 3 - Part No. Delete entire callout

Item 4 - Part No. Delete entire callout

Item 11 - Part No. 302P422

Item 12 - Part No. 302P408 (qty. 1)

Item 14 - Part No. 308B22

Item 15 - 302B78 (qty. 3)

Item 16 - 302B17

Item 18 - Part No. Delete entire callout

Item 19 - Part No. 332A613 (5-place)

Item 21 - Part No. 303P97

Item 23 - Part No. Delete entire callout

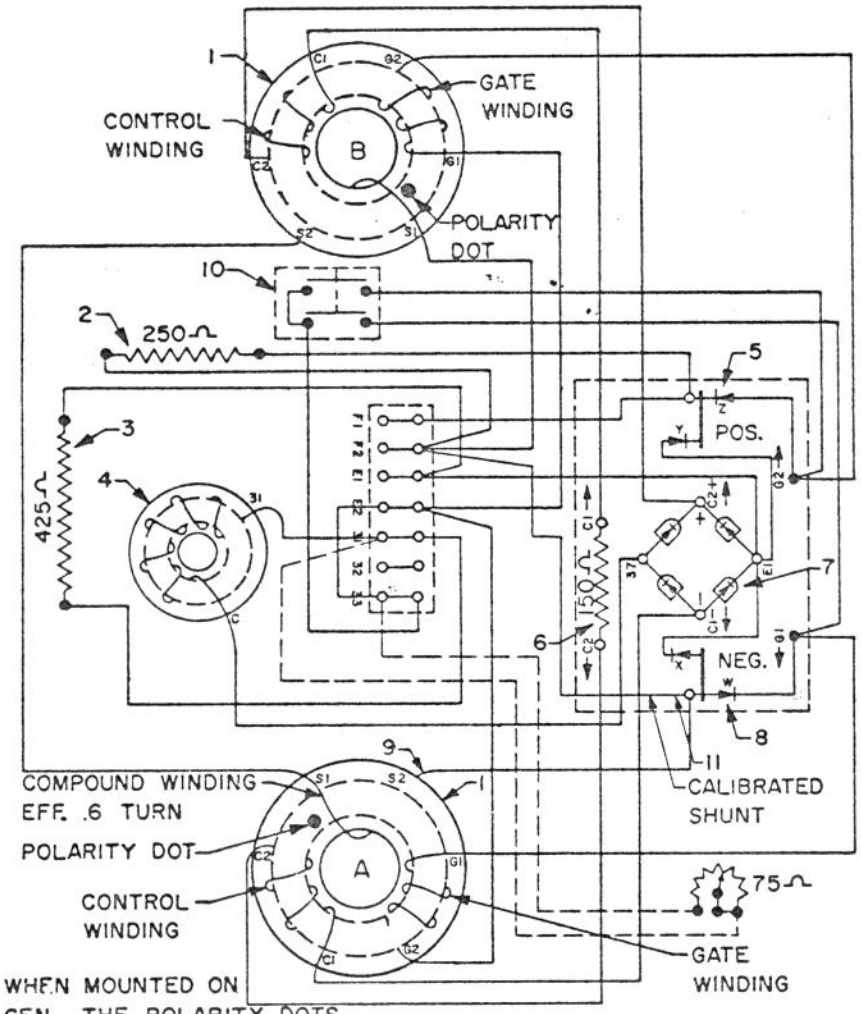
Item 28 - Part No. 312A145

Item 30 - Part No. Delete entire callout

Item 31 - Part No. Delete entire callout

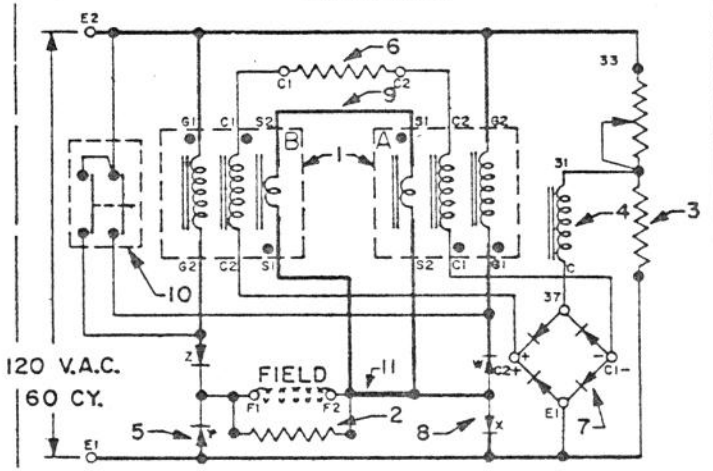
625A496

PICTORIAL



WHEN MOUNTED ON GEN., THE POLARITY DOTS WILL BE ON TOP OF EACH REACTOR.

SCHEMATIC



ITEM	QTY	PART NO.	DESCRIPTION
11	1		NO. 16 WIRE, 27½" LG.
10	1		SWITCH-RESIDUAL RESET
9	1		NO. 14 WIRE, 27½" LG.
8	2		RECTIFIER-FIELD NEG.
7	4		RECTIFIER-CONTROL
6	1		RESISTOR-STABILIZING
5	2		RECTIFIER-FIELD POS.
4	1		REACTOR-CONTROL
3	1		RESISTOR-VOLT. CONTROL
2	1		RESISTOR-DAMPING
1	2		REACTOR-GATE

PARTS LIST

Onan — DIVISION OF STUDEBAKER INDUSTRIES, INC. Minneapolis, Minnesota

DATE	DR	ENGR	CKR	SC
12-3-65	CDR	GO	W.J.B.	

NAME: STATIC EXCITER WIRING DIAGRAM 120 V.A.C. 60 CY.

MODEL: 06SXIN2B

DWG. NO. 625A496

3 GE	PARTS	TEST	SHIP	GO	TP	PO	LET	REVISIONS	ENG	CKR	DATE
	✓	✓	✓	✓	✓	✓	A	WAS "C" SIZE DWG.			