INSTALLATION AND OPERATING INSTRUCTIONS

FOR

ONAN ELECTRIC GENERATING PLANTS

DZC

Series

PARTS AVAILABILITY
NO LONGER GUARANTEED

Onan®

DIVISION OF STUDEBAKER CORPORATION
MINNEAPOLIS 14, MINNESOTA

945-2

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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 each product of its manufacture to be 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 ninety (90) days 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 Manufacturer makes no warranty whatsoever with respect to component parts which are warranted separately by their respective manufacturers.

The above warranty supersedes and is in lieu of all other warranties, expressed or implied, and 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.

IMPORTANT

RETURN WARRANTY CARD ATTACHED TO UNIT

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The Onan generating plant of the DZC series is a complete unit consisting of a diesel type engine, a self excited alternating current generator, and such controls and accessories as are specified by the purchaser.

The electrical characteristics of the plant 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 type 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.

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

ENGINE

The engine is Hercules model D2300, which replaces Hercules model DD226H effective with Onan specification F. The engine is fully described in the Hercules manual but basically it is a 4 cylinder, water cooled, diesel (compression ignition)type. The cylinder bore is 4 inches, piston stroke is 4-1/2 inches, and displacement is 226 cubic inches. The engine is rated 60 horsepower at 1800 rpm. Compression ratio is 15.5 to 1. The standard oil capacity is 6 U.S. quarts. 12 volt battery current is used for starting and control circuits. The specific engine 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 type alternator and "static" type exciter with magnetic amplifier regulation. The 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. The speed at which the rotor turns 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 ball bearing fitted into the end bell.

The stationary exciter components are mounted on a metal frame attached to the alternator end bell, and are protected by a sheet metal enclosure. The design of the exciter and regulator provides voltage regulation of plus or minus 3%, no load to full load. Stable generator output is established within 2 seconds after a change in load. The exciter has no moving parts, and needs no external voltage regulator.

CONTROLS

The engine controls for a standard plant include 12 volt automotive type 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.

A manually controlled intake manifold heater assists in cold weather starting.

The generating plant is adaptable to the use of automatic line transfer control equipment (for emergency standby installations) if the ambient temperature will be above 50° F.

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

A voltage regulator rheostat has been added to the control panel as standard equipment on plants beginning with spec. C.

Installation of the generating plant involves its location, connection to a fuel source, exhaust system, starting battery connections, 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 a proper installation can be made. Local regulations (building code, fire ordinance, etc.) may affect some installation details, and such regulations must be followed.

LOCATION. - Normally, the location has been pre-selected. For the average installation a warm indoor site is usually required. The location should be dry, well ventilated, and reasonably dust free. If practicable, locate near the main power line switch. Provide for sufficient clearance (at least 24 inches recommended) on all sides for convenience in servicing the plant.

MOUNTING. - Refer to the installation outline drawing supplied. The plant is mounted to a rigid skid base and frame that provides proper support and adequate vibration dampening. However, for convenience in draining crankcase oil, general servicing, etc., the plant can be mounted on raised pedestals or rails at least 6 inches high. If mounting in a trailer, or other mobile application, bolt securely in place. For stationary installations, bolting down is optional.

VENTILATION. - For a radiator cooled unit, proper ventilation is of vital importance. Under ambient temperatures of not over 120°F., approximately 7500 cubic feet of air per minute will provide sufficient cooling. In a small room installation this may require installation of an auxiliary fan connected to operate at any time the plant is running.

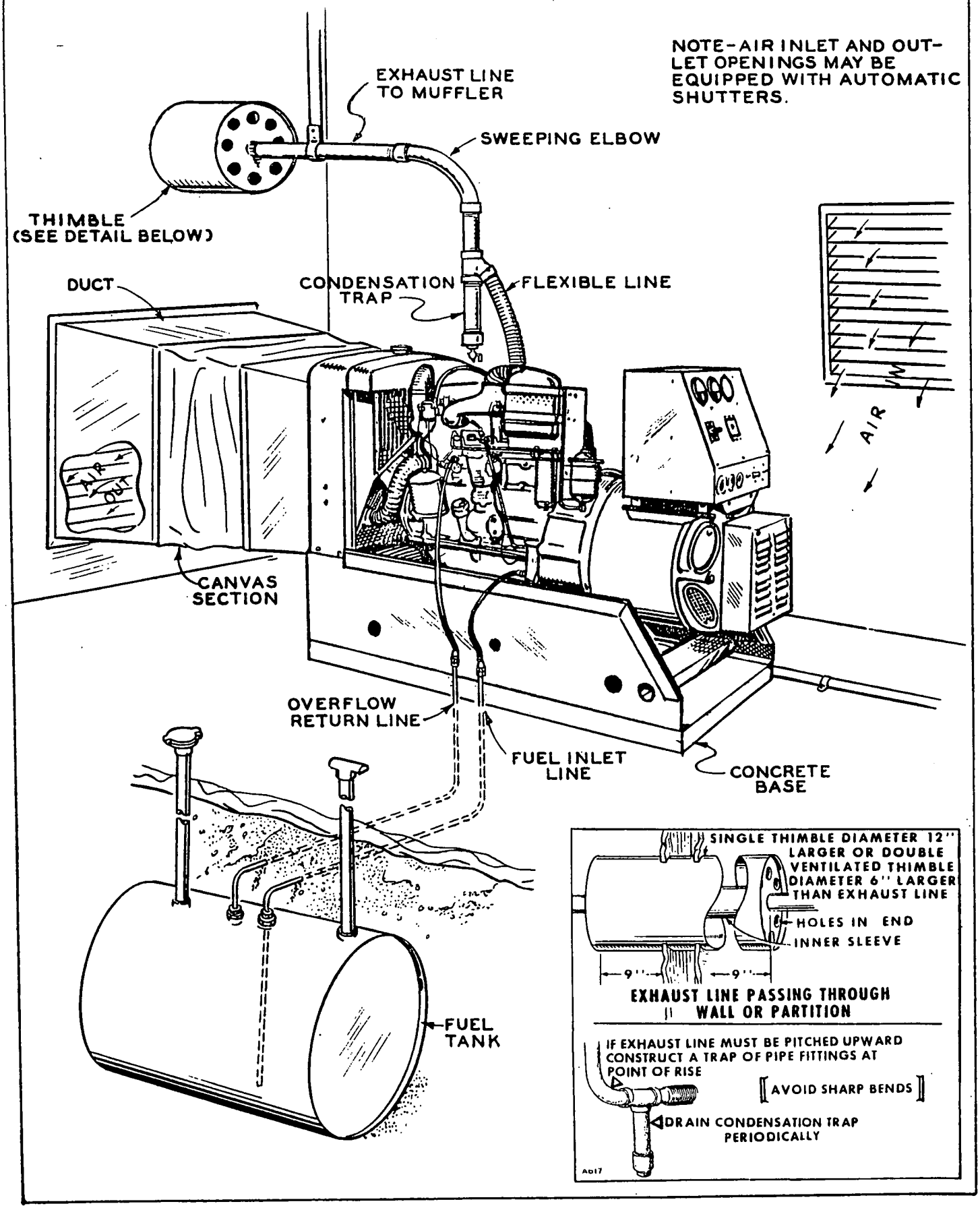
The pusher type fan forces the cooling air out through the front of the radiator. The usual method of exhausting the heated air is to construct a duct from the front of the radiator to an opening in an outside wall. The wall opening should be at least as large as the plant air outlet area. An air inlet opening of at least equal area must be provided.

For room or compartment installations, air inlet and outlet openings should be provided with shutters to prevent back flow of cold outside air during shut down periods. If unattended, automatic starting is planned the shutters should be automatically controlled.

CITY WATER COOLING. - An optional method of engine cooling uses a constant pressurized water supply in place of the conventional radiator and fan. A rate of flow valve must be installed in the water supply line, and an electric solenoid shut off valve connected to open the flow only when the plant is operating. Refer to the separate outline drawing furnished for piping connections, etc.

EXHAUST. - Pipe the exhaust gases outside any enclosure. Use pipe at least as large as the 2 inch pipe size outlet of the engine. Increase the pipe diameter 1 pipe size for each additional 10 feet in length. Use a flexible connection

TYPICAL INSTALLATION

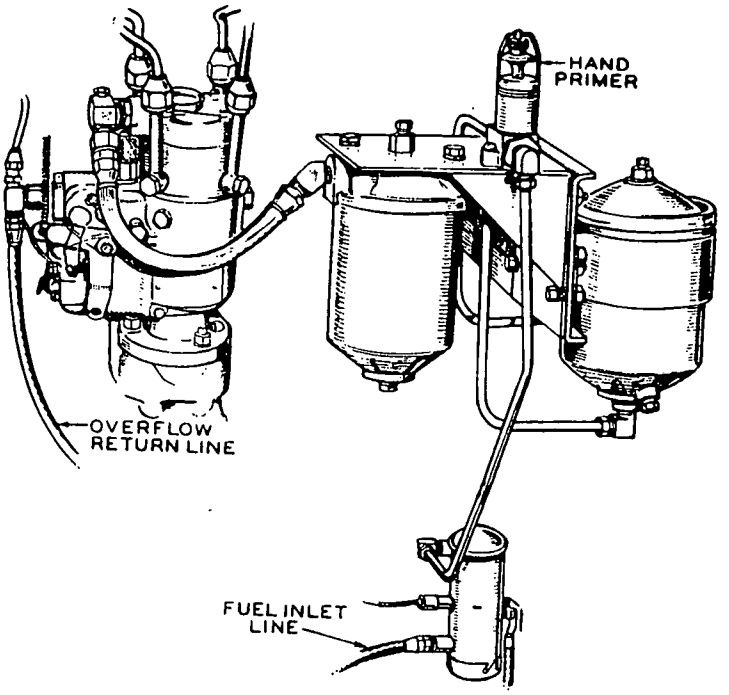


to the engine exhaust manifold. Exhaust pipe fittings cause a resistance to the flow and result in loss of engine power. Use sweeping type elbows in preference to standard elbows. A standard elbow's resistance is approximately twice that of a long radius elbow. If the exhaust line runs upward at any point, install a vapor trap at the low point, with provision for periodic draining. Shield or insulate the exhaust line if there is danger of personnel contact. A thimble, similar to the one illustrated, is necessary to protect walls etc. through which exhaust lines pass.

FUEL CONNECTIONS. - Check local regulations governing the installation of a fuel supply tank. The tank must have a supply line for fuel flow to the plant, and a second line for return of excess fuel to the 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.



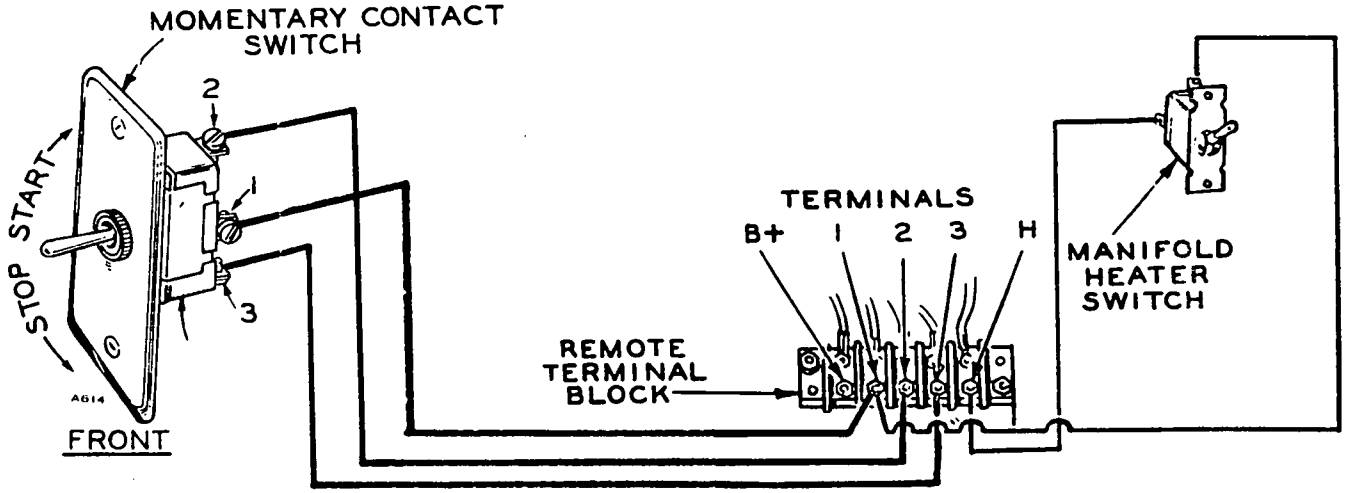
The maximum fuel lift without any horizontal run should not exceed 12 feet; for example, 7 feet from the supply tank to the auxiliary electric fuel pump and another 5 feet from the auxiliary electric fuel pump to the injection pump would total 12 feet, the maximum lift. The horizontal run, if the fuel supply tank is level with the engine pump, should not exceed 25 feet. Use 1/2 inch tubing for the supply line, 3/8 inch tubing for the return line from the injection pump. Use a flexible section to connect the lines at the plant connection points.

Use proper adapter fittings for line connections to the engine: the fuel inlet on the auxiliary electric fuel pump, and the fuel return opening of the injector pump are threaded for a 1/8 inch 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, type 2H, are recommended. Use the short jumper cable to connect the batteries in series for the necessary 12 volt starting current. Note that each battery cable terminal clamp is stamped "P" (positive) or "N" (negative) for connection to the proper battery terminal post. Connect the battery positive to the large terminal of the start solenoid on the starter. Connect the battery negative to a convenient ground point on the engine. Service the battery as necessary.

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

REMOTE CONTROL CONNECTIONS. - Mounted inside the control box is a small 5 place terminal block marked B+, 1, 2, 3, and H. The B+ terminal is used only with a line transfer control. Follow instructions furnished with such equipment. Terminals 1, 2, and 3 serve as extensions of the start and stop circuits. If a remote start-stop switch is to be used, connect terminal #1 to the unmarked switch terminal. Connect terminal #2 to the "OFF" switch terminal, and terminal #3 to the "ON" switch terminal. The distance between the plant and the remote control switch (or line transfer control) determines the size wire that is necessary. Use #18 wire up to 75 feet, #16 wire up to 135 feet,

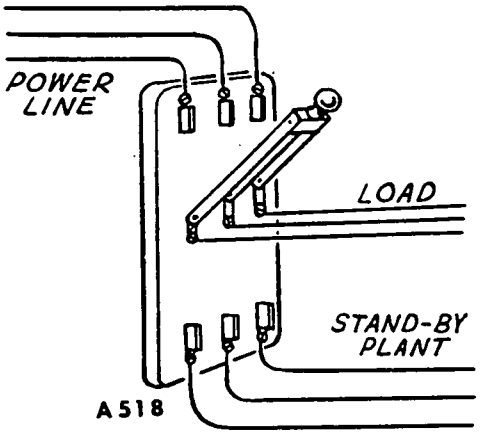


or #14 wire up to 215 feet. Plant terminal "H" serves as an extension of the manifold heater circuit. Use a momentary contact type switch, connecting one switch terminal to the "H" terminal, and the other switch terminal to the plant #1 terminal.

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.

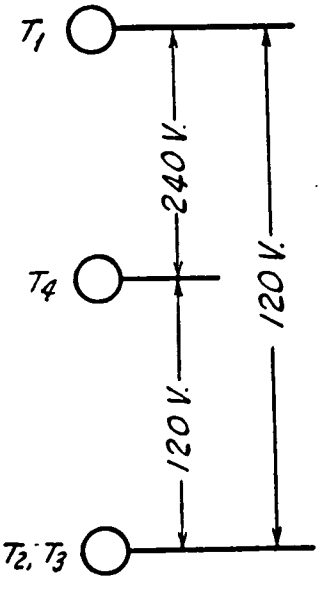
Most local regulations require that wiring connections be made by a licensed electrician, and that the installation be inspected and approved before operation. All connections, wire size, etc. must conform to requirements of electrical codes in effect at the installation site.

If the installation is for standby service, a double throw transfer switch must always be used. This switch (either manual or automatic type) 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 line 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.



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.

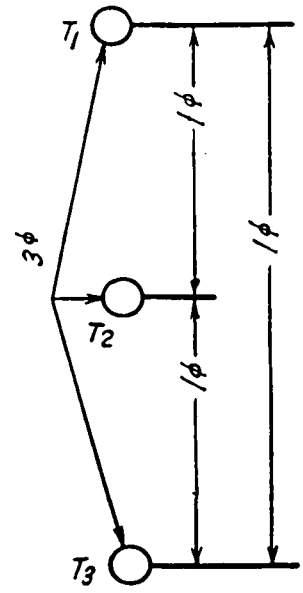


For 240 volt current, connect one load wire to terminal T1 and the second load wire to terminal T4. Terminal T2, T3 is not used for 240 volt service.

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.

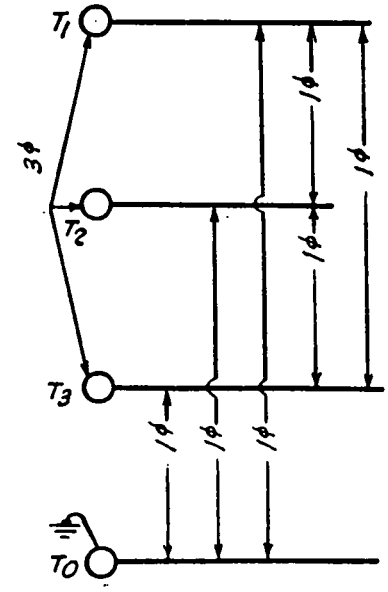


If phase sequence is important, as with 3 phase motors, final connections may be postponed until a trial run is made. When the plant is installed for standby service, phase sequence of the normal line service and the generator output must be the same, for proper load operation.

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 25,000 watt plant. This leaves 15,000 watts available for single phase use - 5,000 watts on each circuit. Do not attempt to take all 15,000 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.

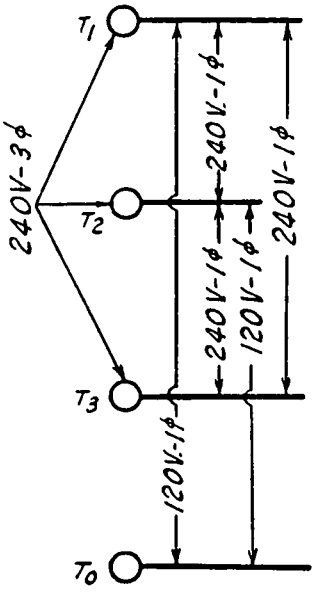
The terminal marked T0 is grounded. For single phase current, connect the neutral (white) load wire to the T0 terminal. Connect the "hot" (black) load wire to any one of the other three terminals - T1, T2, or T3. Three separate single phase circuits are available, with not more than 1/3 the rated capacity 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.

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 shutdown 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.

CRANKCASE OIL. - Refer to the LUBRICATION section of the Hercules engine manual for recommendations as to the SAE number of oil to use. Fill the crankcase with 6 quarts (U.S. measure) of a good quality, heavy duty oil designated by its marketer for "type DS" service.

Approximately 1 quart 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 17 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 Hercules 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 bleeder screw at the top of both fuel filters.

2. Operate the hand primer until the fuel flows from the first bleeder. Tighten the bleeder screw. Repeat for the second filter.

3. Temporarily disconnect the overflow (return) fuel line. Continue to operate the hand primer until at least one pint of fuel has been pumped from the overflow opening. Failure to hand prime long enough will result in an air lock condition and cause the engine to stop soon after starting.

4. Tighten the primer pump clamp securely.

5. Reconnect the fuel return line.

6. Check carefully against leaks after starting.

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. For normal starts, no further priming is necessary.

For starting in temperatures above 50°F., 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.

If the ambient temperature is between 50°F. and -10°F., hold the MANIFOLD HEATER switch in contact for from 30 to 60 seconds, depending upon the temperature. Continue to hold the heater switch in contact while cranking. Experience will soon indicate how much preheating is necessary.

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 practicable, 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 considerably 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.

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 at 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.

1. Fully charge the battery.
2. With the battery still on charge, draw off all the electrolyte above the plates in each cell. DO NOT ATTEMPT TO POUR OFF! Use a hydrometer or filler bulb. Avoid skin or clothing contact with the electrolyte, and dispose of it in a safe manner.
3. Refill each cell with approved water, to the recommended level.
4. Continue charging for 1 hour at a 4 to 6 ampere rate.
5. Test each cell. If the specific gravity is still above 1.225, repeat steps 2, 3 and 4 until the reading is reduced to 1.225, usually repeating steps 2, 3 and 4 two times is sufficient.

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.

OPTIONAL EQUIPMENT

Some plant models are equipped with electrical indicating meters, running time meter, circuit breakers, low oil pressure stop switch, 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 overload. If an overload should occur, the circuit breaker will automatically trip, disconnecting the generator output from the load terminals. After correcting the overload condition, it is necessary to manually reset the breaker to the ON position.

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.

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.

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 Hercules 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. AIR CLEANER. - Check, clean, replenish oil as frequently as necessary.
4. RADIATOR. - Check level, add as necessary.
5. CLEAN AND INSPECT. - Wipe clean of dust, spilled oil, etc. Inspect for loose parts, leaks, etc.

WEEKLY SERVICE, NORMAL 50 HOURS OF OPERATION.

1. CRANKCASE OIL. - Drain and refill unless experience indicates otherwise. Refer to LUBRICATION in the Hercules manual.
2. OIL FILTER. - Replace the element at time of oil change. Use a Purolator #P-70FF replacement element.

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. Use ONLY a high capacity belt.
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 GENERATOR. - Oil bearings sparingly, check brushes.
2. STARTER. - Oil front bearing sparingly, check brushes.
3. INJECTION NOZZLE. - Check for proper spray pattern, etc. Refer to the Hercules manual.
4. AC GENERATOR. - Check brushes, replace if worn to 1/2 inch or if damaged. DO NOT LUBRICATE.

ENGINE

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

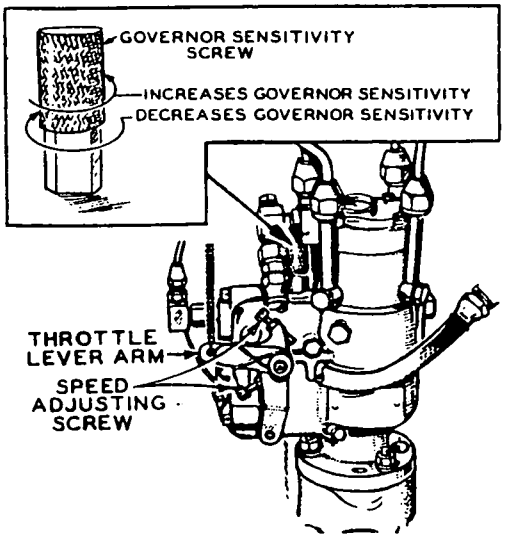
ENGINE SPEED. - The frequency of the generator output current is in direct ratio to the engine speed. The engine speed is controlled by the built-in governor of the fuel injection pump. The original factory setting of the governor should not be disturbed. However, in case of pump repair, the governor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

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

2. Use the throttle stop screws to lock the throttle in position 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) results in 1830 rpm.

3. The injector pump governor is equipped with the "variable speed droop device" described in the Roosamaster pump manual. Its function is to keep the speed differential between no load and full load conditions within desired limits. Turn the sensitivity (speed droop) adjustment screw to obtain about a 60 rpm speed (2 cycle) difference between no load and full load. For example, if engine speed under no load is 1830 rpm (61 cycles) the speed should drop to approximately 1770 rpm (59 cycles) under a full electrical load.

   Check the generator voltage. It may be necessary to make a slight readjustment of the speed setting to obtain the preferred voltage at average load. The figures given above are typical only, and a range of 1830 to 1890 rpm (61 to 63 cycles) might give the desired voltage.



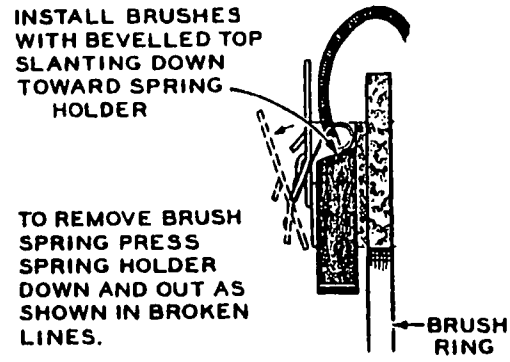
GOVERNOR ADJUSTMENT

GENERATOR

The ac generator normally requires very little servicing. However, 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.



BRUSH SPRING REMOVAL

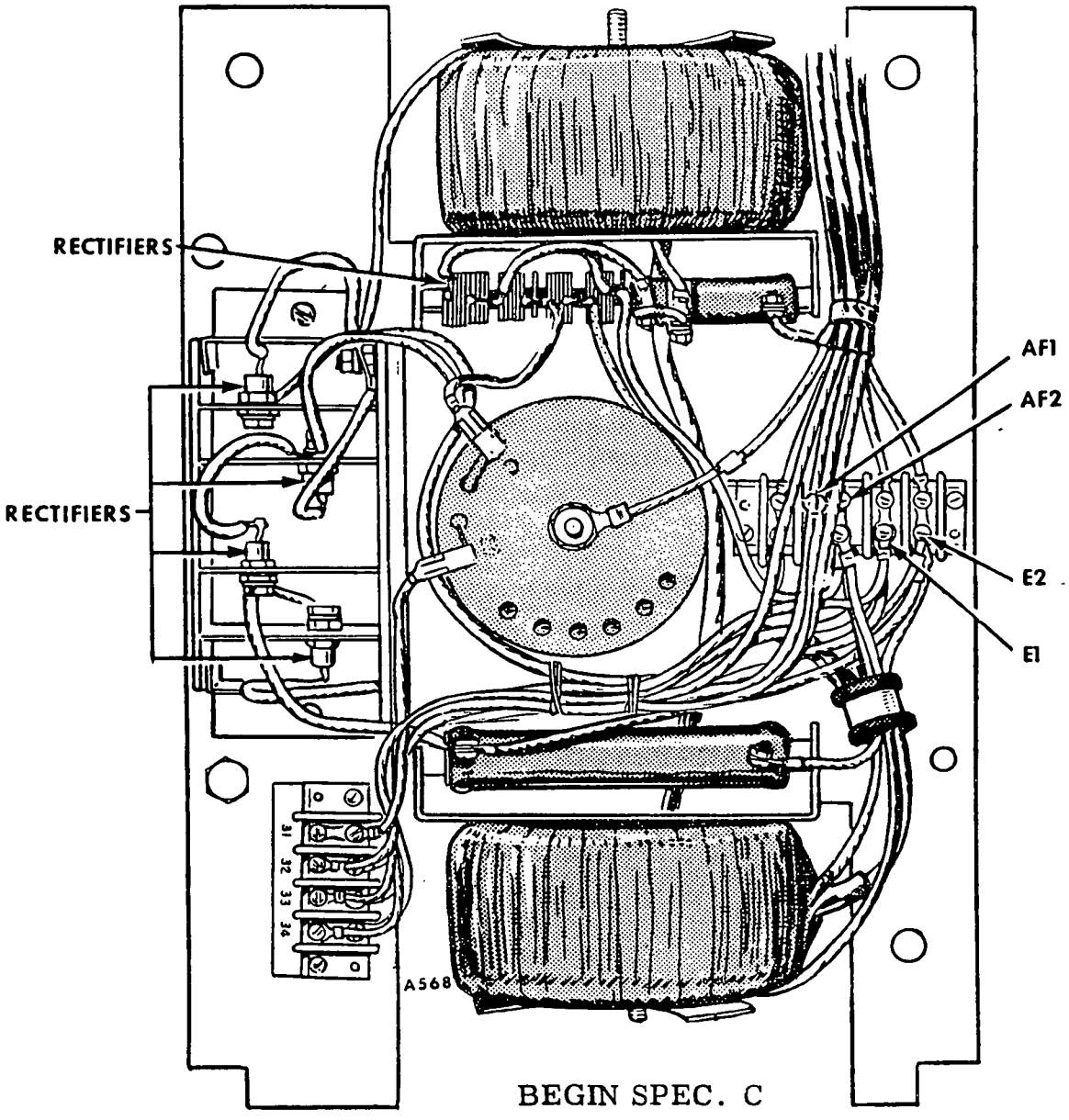
GENERATOR BEARING. - The generator bearing is prelubricated for its life and sealed. It requires no servicing.

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 may isolate the cause.

1. Temporarily disconnect the two leads from exciter terminals E_1 and E_2. 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 that voltage rating to the exciter terminals.

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



BEGIN SPEC. C

2. If dc voltage at terminals AF1 and AF2 is 25 volts or higher (no load condition) but there is no ac output at the generator main output terminals, check the alternator for a grounded or open circuit, etc.

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

4. If ac voltage drops under load conditions, check the exciter rectifiers. Use a low voltage, battery powered "Multimeter" type ohmmeter. Disconnect one lead from, or remove, each rectifier for its test.

CAUTION

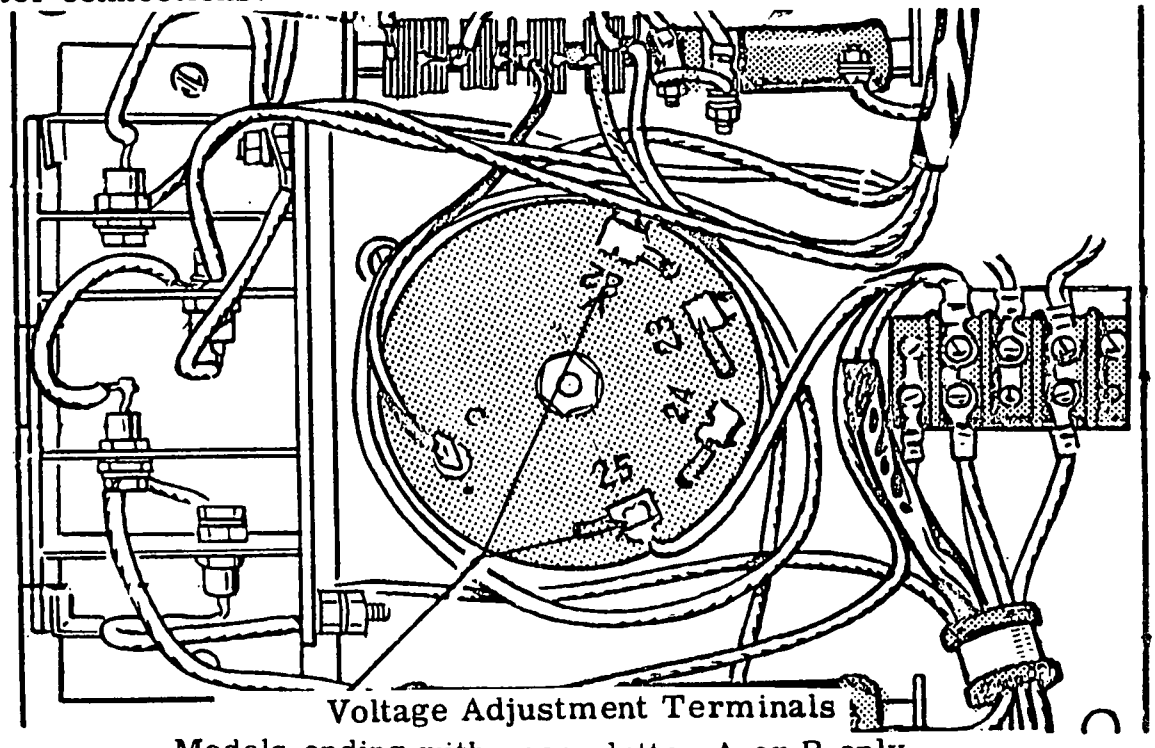
Note carefully the DIRECTION OF MOUNTING of any rectifier removed. It must be remounted in its original direction.

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.

OUTPUT VOLTAGE, Models ending with spec, letter A or B. - Ordinarily if the engine is operating properly and at opproximately the name plate indicated speed, the output voltage will be correct. The exciter was connected for rated output during the factory test run. However, if some local condition requires a change in the output voltage, change exciter connections.



Voltage Adjustment Terminals
Models ending with spec. letter A or B only.

1. Be sure the engine governor is properly adjusted, for correct current frequency (speed), sensitivity, stability, etc.

2. Stop the plant and remove the exciter cover.

3. Note a disc shaped terminal block at the center, with a lead connected to a terminal marked C, and a second lead connected to one of the terminals numbered 22, 23, 24, or 25. Moving the second lead to an adjacent terminal (from 23 to 22, etc.) will change the generator output approximately 5 per cent.

4. If a closer voltage adjustment is necessary, readjust the engine speed accordingly.

NOTE

Plant models ending with spec.letter C or later have a voltage regulator rheostat on the plant control panel.