OPERATORS MANUAL AND PARTS CATALOG

FOR

Onan®

ELECTRIC GENERATING PLANTS

DWJ

SERIES

ONAN ENGINE/GENERATOR DIVISION Studebaker CORPORATION

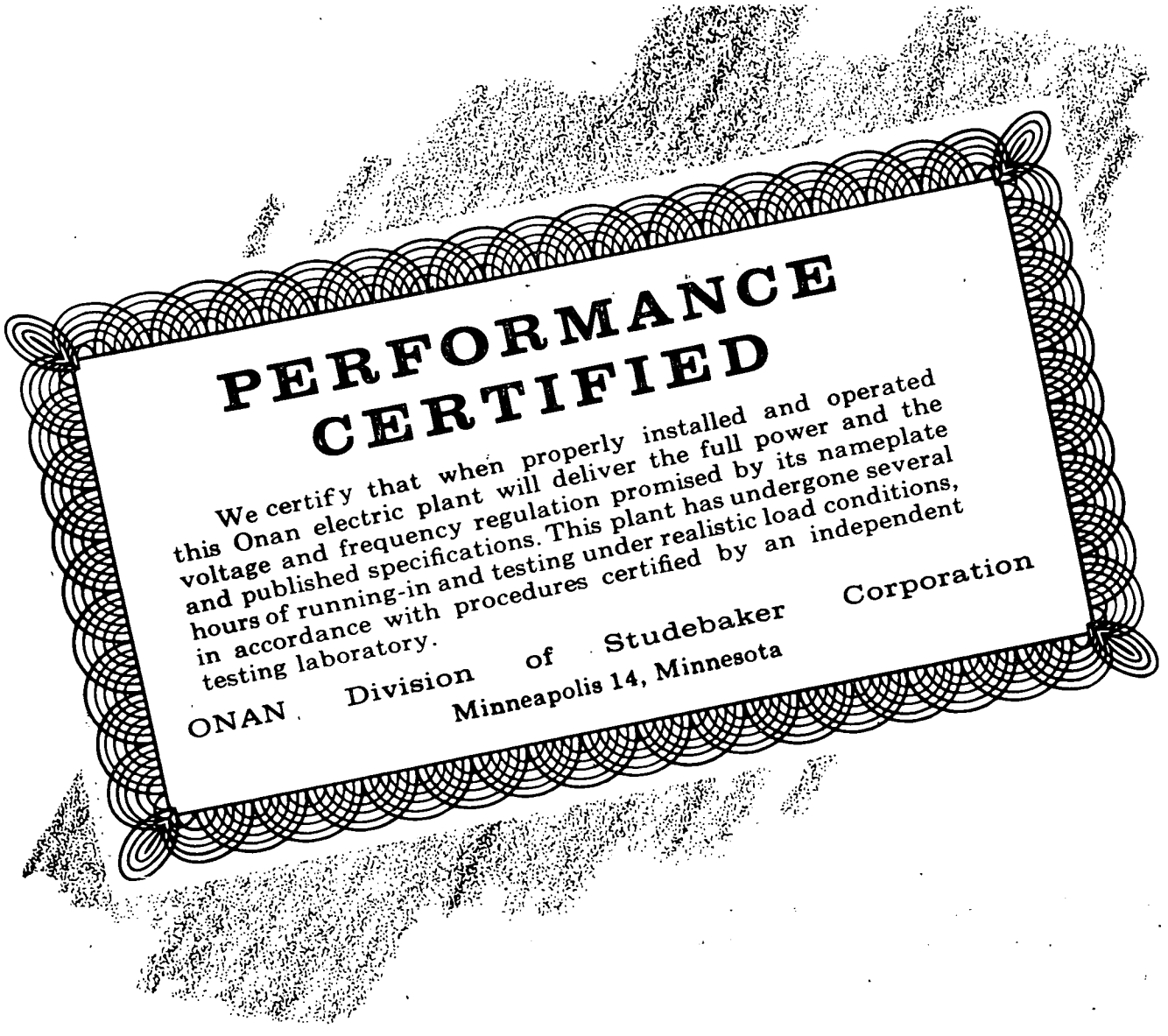
2515 UNIVERSITY AVE. S.E. MINNEAPOLIS, MINN. 55414
IN CANADA: ONAN GENERATORS CANADA LTD., P.O. BOX 652, GUELPH, ONTARIO

973-301 Price $1.00 1AB67 Printed in U.S.A.

We mean it.....

.....and this certificate with the Onan electric plant you purchased proves we mean it! When this plant left our factory in Minneapolis it took with it our sincere assurance that it will produce exactly as stated on its nameplate.

The name of ONAN is synonymous with satisfactory performance, certified performance.



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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

TABLE OF CONTENTS

Onan series DWJ generating plants consist of a diesel engine, revolving field generator connected directly to the engine flywheel, static exciter-voltage regulator and controls.

Electrical characteristics of the plants vary according to the particular model. They are noted on the Onan nameplate attached to the unit. When the plant is used for standby service, optional controls for starting, load transfer and stopping, must be connected during installation. If it ever becomes necessary to contact a dealer or the factory about the plant, be sure to mention the complete Model, Spec. and Serial Numbers, as given on the Onan nameplate. This nameplate information is necessary to properly identify your plant among the many types manufactured by Onan. Refer to the engine nameplate when requesting information from the Waukesha Motor Company.

Your generating plant has been tested under various load conditions and 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.

Plants are rated as indicated on the Onan nameplate. Ratings are based on an .8 power factor electrical load. When rated for standby service, the plant is intended to serve as an emergency source of electric power with operation confined to a few hundred hours per hour. When plants are used for standby service, optional controls can be installed for automatic starting, transfer of load, and stopping. If the plant is expected to operate in ambient temperatures below 50°F, an engine heater is required for dependable starting. Local regulations may require that a higher ambient be maintained.

ENGINE

The Waukesha engine, Model 135DK, is fully described in the Waukesha manual. Basically, it is a 6-cylinder, water-cooled, naturally asperated, diesel engine. It has a 4-1/2" bore, 5" stroke, 426 cu. in. displacement and 106-horsepower at 1800 rpm. Standard oil capacity is 3-gallons. The block and radiator hold 12-gallons of water. A 12-volt battery supplies power for the control and starting circuits. Standard options and extra-cost equipment vary according to the purchaser's specifications.

Standard engine cooling is from a radiator and pusher fan, but optional systems that use a separate source of water are also available. They include the heat exchanger, used when the water supply is not suitable for circulating through the engine, and the standpipe or tempering tank, in which water circulated through the engine is tempered with cold water in the standpipe.

GENERATOR

The generator has a 4-pole revolving field connected directly to the engine flywheel. A static exciter mounted at the rear of the generator supplies direct cur-

rent through slip rings on the rotor shaft for exciting the field coils. A magnetic amplifier, integral with the exciter, provides voltage regulation of plus or minus 2% from no load to continuous rating, recovery to a stable condition within 2 seconds, and maximum voltage dip of 13% when instantaneously applying a full load. A rheostat on the control panel provides a means of adjusting output voltage over a ±5% range. Frequency regulation, proportional to engine speed and determined by the engine governor, is 3% or about 54 rpm at continuous rating of plant. Engine speed for a frequency of 60 cps is 1800 rpm and for 50 cps is, 1500 rpm. The outer end of the rotor is ball bearing loaded and housed in the generator end frame.

CONTROLS

Electrical controls for plant operation are contained in a control box mounted on the generator. A 12-volt, 2-wire system is used for starting and controlling engine operation.

Electrical meters, controls and engine indicating gauges, vary according to model and optional equipment. Refer to the wiring diagrams supplied. Relays, etc., provide for proper sequence of events during starting, operation, and stopping. Engine indicating gauges provide for checking engine performance. Electrical meters provide for checking the generator output. Provision is made for operation with automatic load transfer equipment for unattended standby service. Various safety devices protect the plant and provide automatic stopping under unusual or dangerous operating conditions.

The ac output voltage is adjustable, plus or minus 5%, by means of a rheostat on the control panel.

Optional controls include automatic load transfer controls, a water solenoid valve and water solenoid relay for city water cooling.

There is a terminal block in the control for connecting wires to a remote control switch.

Installation of the generating plant involves the selection of a suitable location, connection of fuel source, connection of exhaust system, starting battery installation, connection to the load wiring and for some special models connection to a source of cooling water. Each installation must be considered on an individual basis, so use the following instructions only as a general guide. Consult local regulations (building code, fire ordinance, etc.) for details which may affect the installation.

LOCATION. - The installation area for generating plants of this size is usually selected in advance because there are some basic requirements that should be considered. The location should be dry, well ventilated, and reasonably dust free. If automatic controls are included for unattended starting, load transfer and stopping, the ambient temperature must be high enough to assure positive starting. The minimum intake air temperature for dependable starting is 50°F, but local regulations may require a higher ambient for greater assurance. If the ambient temperature is expected to fall below the minimum, engine heaters are available. Extremely high ambient temperatures can also be a problem and they frequently are more troublesome than starting in low ambients. See COOLING AND VENTILATION.

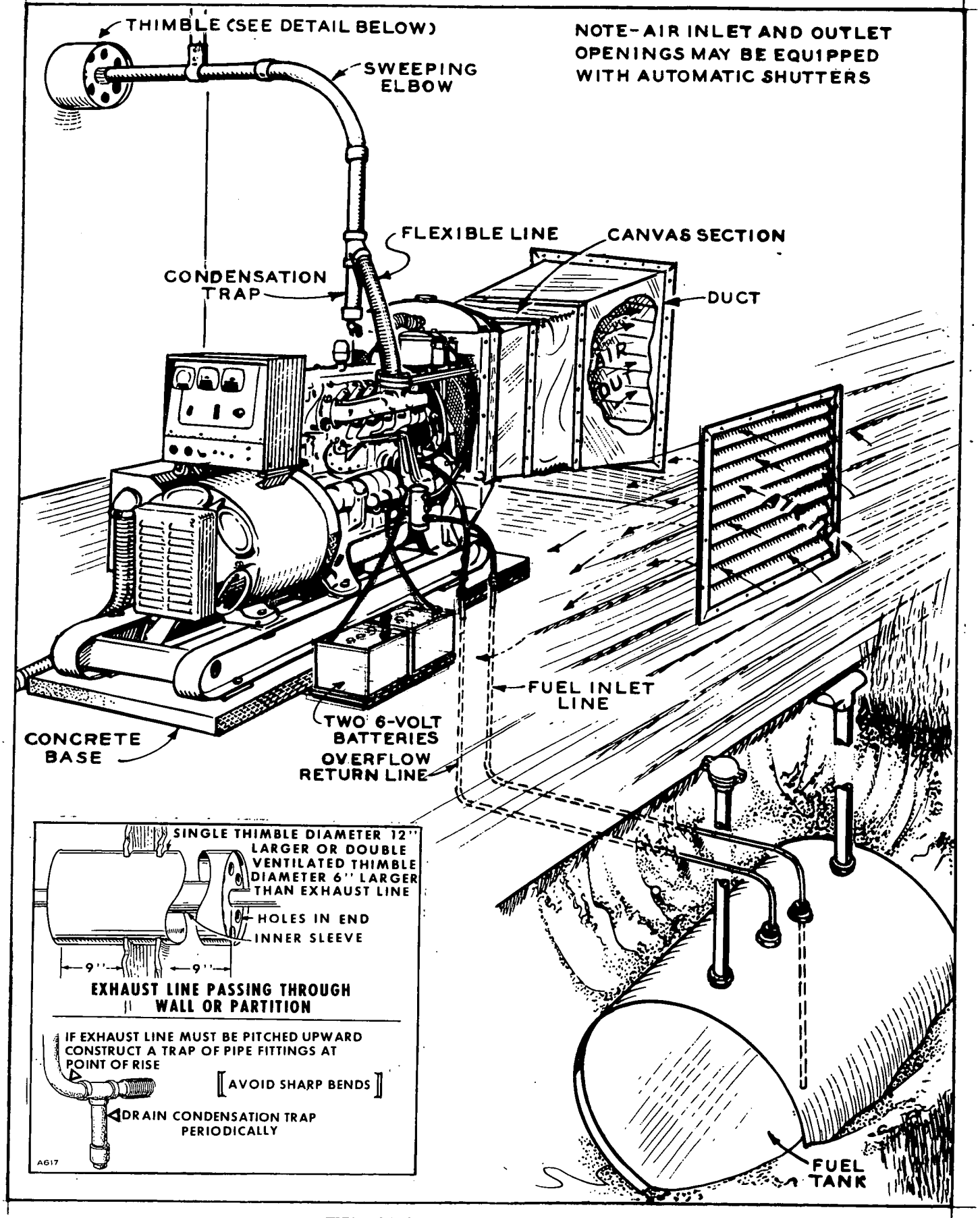
Normally the plant should be located near the main power line switch. Provide sufficient clearance (at least 24 inches) on all sides for convenient plant service.

MOUNTING. - Refer to the installation drawing. The plant is mounted on a rigid skid base which does not need to be secured to the floor. If additional vibration dampers, raised pedestals, etc., are used, it may be necessary to provide special footings to carry the more concentrated weight.

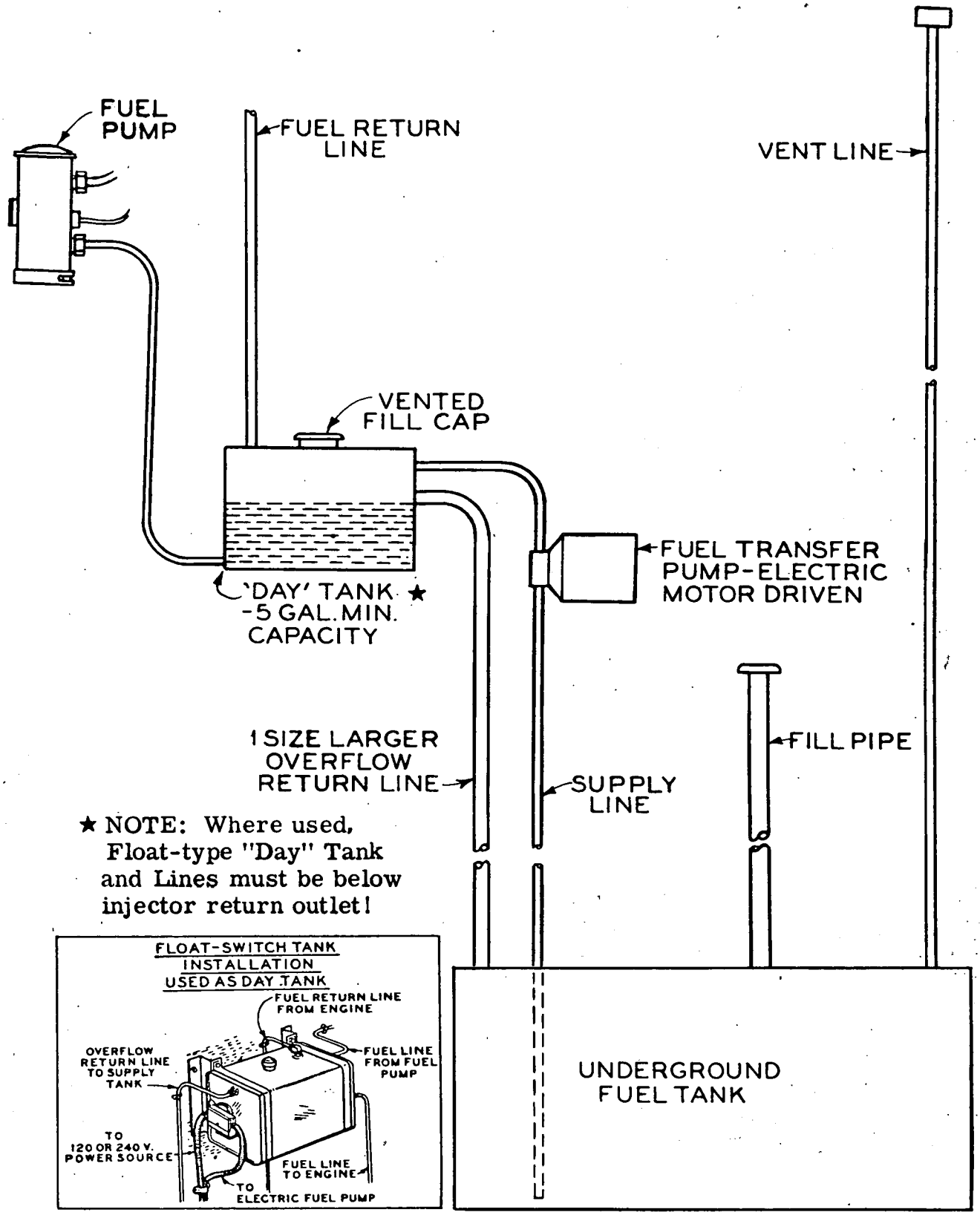
VENTILATION. - Proper ventilation is vital, particularly for radiator cooled models. Under normal operating conditions, 6600 cubic feet per minute of air flow at 1800 rpm is required to properly cool the engine and generator and to support combustion. The requirement at 1500 rpm is 5500 cubic feet per minute. For city water cooled units, the air requirements for 1800 and 1500 rpm operation are 1650 and 1375 cubic feet per minute, respectively. This air is for generator cooling and engine combustion. Air flow for units installed in relatively small rooms may have to be forced by an auxiliary fan, connected to operate only when the plant operates. Separate air inlet and outlet openings are necessary. Automatically controlled shutters are frequently used in the outlet vent to regulate air flow for maintaining a desirable engine temperature. At shut-down, the shutters close. Motor operated furnace type controls can be adapted for use with air shutters.

The pusher fan used on radiator-cooled plants forces the heated air out through the front of the radiator. A sheet metal duct is used between the radiator and the outlet vent to prevent recirculation. A canvas section between the radiator and rigid duct restricts vibration to the plant. If no duct is used, the outlet vent must be located in such a way that discharged air will not be permitted to recirculate over the engine.

If the engine is cooled by city water, then ventilation is required only for generator cooling and engine combustion.



TYPICAL INSTALLATION



"DAY" TANK INSTALLATION

OPTIONAL "CITY" WATER COOLING. - Two common types of city water cooling systems using a constantly changing water flow are optional in place of the conventional radiator cooling. They are the heat exchanger type and standpipe type. An adequate supply of water from an outside source is required.

The heat exchanger type is a closed system in which the city water does not mix with the engine coolant. Instead, the engine coolant circulates through tubes inside a chamber which contains a constantly changing flow of "raw" or city water. Heat carried by the engine coolant is inducted through the tubes and absorbed by the city water which is then drained off. Rate of water flow through the chamber determines the efficiency of the system. An electrically operated solenoid valve opens when the plant starts and closes when it stops. The wiring of this valve is shown on the plant wiring diagram. Rate of flow is controlled by a hand valve or an optional automatic regulator. If a hand valve is used, consult the water flow table which gives the approximate minimum water required at various loads. Use 2 inch pipe for discharging water to a convenient drain. Be sure to fill the heat exchanger "closed" chamber with water before operating equipment.

MINIMUM WATER FLOW - HEAT EXCHANGER COOLING SYSTEM

ELECTRICAL LOAD	WATER TEMPERATURE	MINIMUM FLOW IN GAL/MIN.
40KW	40°	15
	60°	18
	80°	27
50KW	40°	16
	60°	22
	80°	33
60KW	40°	18
	60°	27
	80°	40

The standpipe type has a large tempering tank into which city water and the engine coolant flow. Cold city water enters the tank midway between the engine water inlet and outlet and serves as a hot water barrier, which then rises and flows out the overflow to a convenient drain. A certain amount of hot water is mixed with the cold city water to maintain optimum engine temperature. An electrically operated solenoid valve opens when the engine is running and closes when the engine stops. Wiring of the valve is shown on the plant wiring diagram. Rate of flow is controlled by a hand valve or optional automatic regulator. If a hand valve is used, consult the flow table which gives the minimum water flow required at various loads. Use 3/4" pipe for supply line and 1-1/2" pipe for overflow.

MINIMUM WATER FLOW - STANDPIPE COOLING SYSTEM

ELECTRICAL LOAD	WATER TEMPERATURE	MINIMUM FLOW - GAL./MIN.
40KW	40°	3.8
	60°	4.5
	80°	5.4
50KW	40°	4.7
	60°	5.5
	80°	6.6
60KW	40°	5.2
	60°	6.1
	80°	7.4

FUEL CONNECTIONS. - Check local regulations regarding the installation of a fuel supply tank and components. The maximum lifting capacity of the fuel pump is 8 ft. If greater lift is required, install an auxiliary day tank of at least 5 gallons capacity fed by an electrically driven fuel transfer pump. If an underground tank is used, be sure all connections are air-tight. If the connections are at the top of the fuel tank, use a drop tube extending to within an inch or two of the bottom and a foot valve to keep the lines primed during shutdown. Use an approved vent cap. Note that the injector return line feeds directly into the tank. Use flexible lines between the engine and any rigid piping to absorb engine vibration.

NOTE

In diesel installation's, fuel cleanliness is of great importance. Make every effort to prevent the entrance of contaminants. Do not use galvanized fittings.

Connect the fuel supply line to the inverted male elbow (7/16-24 SAE) at the electric fuel pump. Use tubing with an inside diameter of at least 3/8" for runs up to 25 feet and 5/8" tubing for runs greater than 25 feet. Connect the fuel return line to the outlet of the injector manifold. Use tubing with an inside diameter of 5/16".

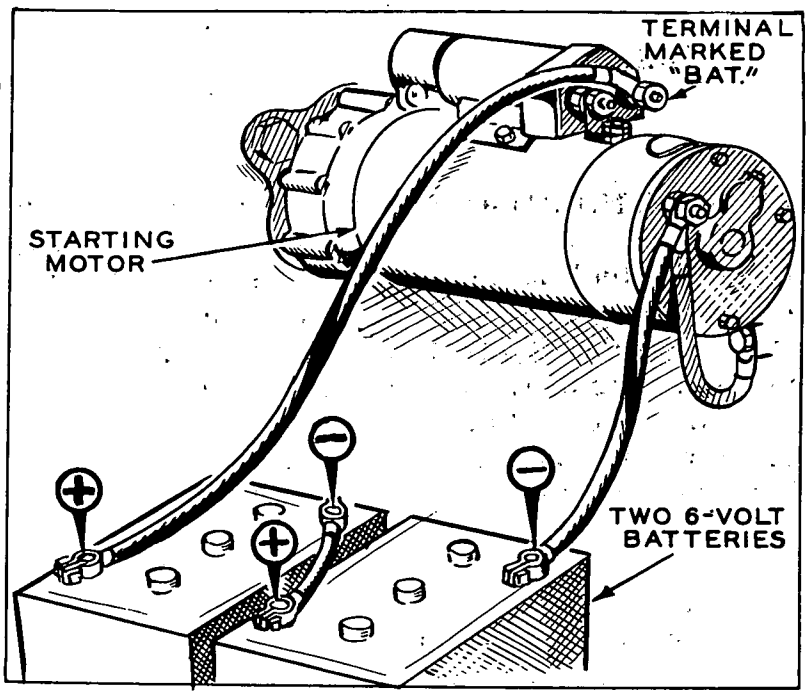
EXHAUST. - Pipe the exhaust gases outside any enclosure. Use pipe at least as large as the exhaust manifold (3"). If the exhaust pipe extends more than 10 feet, increase the diameter one size for each additional 10 feet. Use a flexible connection at the exhaust manifold and long radius elbows to keep back pressure to a minimum when making turns. If the exhaust line runs upward at any point, install a condensation trap at the low point with provision for periodic draining. Shield or insulate the line if there is danger of personnel contact. Protect walls and partitions through which the exhaust line passes with a thimble (see typical installation). Install a suitable muffler.

WATER JACKET HEATER (Optional). - Connect the heater to a normally energized power source of the voltage specified on the nameplate. Thermostatically controlled, the heater keep's the engine coolant at a

temperature to give dependable starting at low ambients. The heater is usually connected to the main line by-passing load transfer connections to limit heater operation to the periods when the plant is off.

BATTERY CONNECTIONS. - A 12-volt battery source is required for cranking power and for certain control functions. Use two 6-volt 3D batteries, rated at 315 amp/hr., connected in series. To connect two batteries in series, connect a jumper cable to the positive of one and to the negative of the other, leaving a positive and a negative terminal for the engine cables.

Mount the batteries on a wood or metal platform near the starter. Do not locate the batteries beneath the plant - battery fumes can cause corrosion and eventual deterioration of plant components. If the batteries are housed in a box or small compartment, provide holes for ventilation.



BATTERY CONNECTIONS

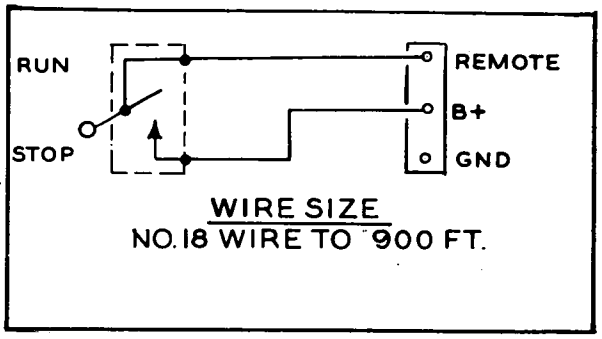
Connect the battery positive cable to the upper of the two large terminals on the starter solenoid marked BAT. Connect the battery negative cable to a good, paint-free ground on the engine. Be sure all battery connections are clean and tight.

A trickle charger should be used with units in standby service to keep the batteries fully charged. All idle batteries self discharge to the point where sufficient cranking power would not be available in an emergency. If the load transfer control does not have a trickle charge circuit, consider installing a separate trickle charging unit. Trickle chargers can not recharge a discharged battery. Their purpose is to prevent fully charged batteries from self-discharging during months of idleness.

REMOTE RUN-STOP SWITCH (Optional). - When the unit is operated from a remote control station or through a load transfer control, the normal run-stop circuit is extended from the plant control to the other control point. A terminal block for making such an extension is in the plant control. Refer to the engine control wiring diagram. If an automatic load transfer control is to be used, follow the instructions supplied with the control.

For remote control of starting and stopping use two wires to connect a remote switch (SPST) to the terminal block in the plant control marked REMOTE, B+, GND. If two

control stations are needed, use a pair of SPDT switches (such as "3-way" house switches). For three or more control stations use "3-way" switches at two of the places and "4-way" at each of the other locations.



REMOTE SWITCH CONNECTIONS

To operate the plant from a remote station, the plant control switch must be in its REMOTE position.

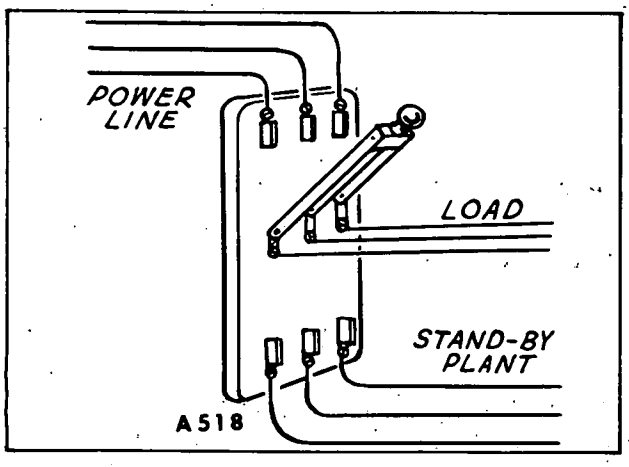
OPTIONAL ALARM. - The GND terminal on the remote control terminal block is for a customer-supplied alarm at a remote location to warn of emergency shut-down. This condition is indicated at the plant by a light on the control panel. Refer to wiring diagram for voltages.

CONNECTING LOAD WIRES - The generator output leads terminate inside the sheet metal box on the generator. Knock-out openings are provided for bringing in the load wires.

Observe requirements of electrical codes at the installation site. Most local regulations require that wiring connections be made by a licensed electrician and the installation inspected and approved before operation.

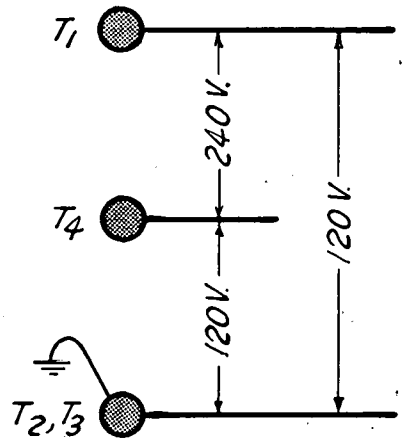
The plant nameplate shows the voltages available. The current for any one output lead must not exceed the nameplate ampere rating.

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 output to be fed into the normal power source lines, or for normal source and generator output to be connected to the load at the same time. Instructions for connecting an automatic load transfer switch are included with such equipment. It is assumed that personnel connecting the generator, and any 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. Note that each generator lead is marked as noted on the wiring diagram.



DOUBLE THROW TRANSFER SWITCH

120/240 VOLT, 1-PHASE

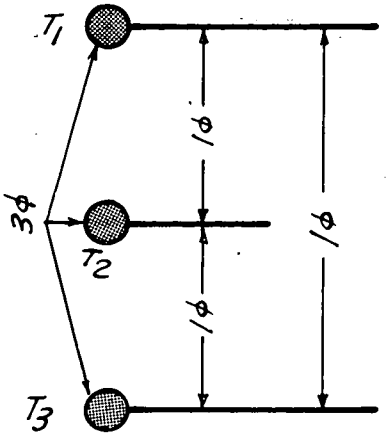


Note that the lead marked T2, T3 is grounded. This is the neutral lead for 120 volt service. Leads T1 and T4 are the "hot" leads, providing two 120-volt circuits with up to 1/2 the plant rated capacity available on each circuit.

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

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

3-PHASE, 3-WIRE



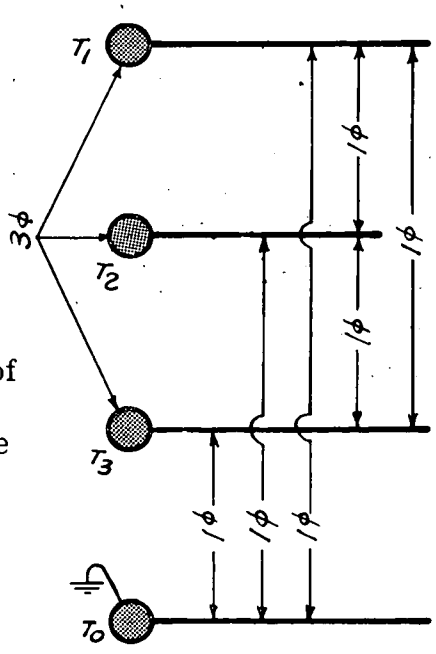
No lead is grounded; each pair of leads serving as one "leg" of the three phase circuit. Connect a separate load wire to each generator lead T1, T2, and T3.

If phase sequence is important, as with 3-phase motors, final connections may be postponed until a trial run is made. If 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 output leads, T1-T2, T1-T3, or T2-T3. However, 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 and three phase service is to be used at the same time, use care not to overload any one circuit. Subtract the amount of the 3-phase load from the rated capacity of the plant. Divide the remainder by three, this is the maximum load that can be connected to any one single-phase circuit.

3-PHASE, 4-WIRE, Y-CONNECTED



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 voltage.

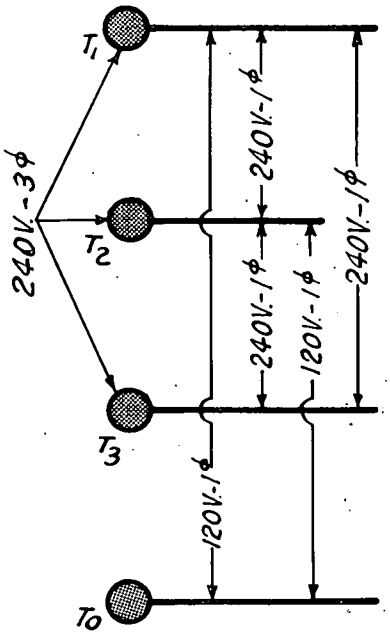
The lead marked T0 is the grounded lead for single-phase service. Connect the single-phase load neutral wire to the

T0 generator lead. Connect the "hot" load wire to any one of the other three leads T1, T2, or T3.

For three-phase service, connect the separate load wires to the three generator leads T1, T2, and T3. If phase sequence is important, refer to the principles of connection as given for the 3-phase 3-wire plant. If single-phase and three-phase current is to be used at the same time, use care to properly balance the load as explained for the 3-wire plant.

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

The 3-phase DELTA connected plant is designed to supply 120-volt single-phase service and 240-volt three-phase service. The lead marked T0 is the generator center tap between T1 and T2 and is normally not grounded.



For 240-volt 3-phase service, connect the three load wires to the three generator leads T1, T2, and T3. The T0 lead is not used for 3-phase service. If phase sequence is important, refer to the principles of connection as given for the 3-wire plant.

For single-phase service, leads T1 and T2 are the "hot" leads. The T0 lead is neutral and can be grounded if required. For 120-volt service, connect the "hot" load wire to either the T1 or T2 generator lead. Connect the neutral load wire to the T0 generator lead. Two 120-volt circuits are available and one 240-volt single-phase circuit is available between leads T1 and T2.

Any combination of single-phase and three-phase loading can be used at the same time as long as the current for any one output lead does not exceed the nameplate rating of the generator.

Before the plant can be operated, the engine must be serviced for operation. The initial service is continued on a regular and periodic basis, along with other procedures covered in the periodic service section.

CRANKCASE OIL. - Recommendations for lubricating oil are in the service section of the Waukesha operation and service handbook. Fill the crankcase (capacity 12 U.S. quarts) with a heavy duty oil of the S.A.E. number recommended for the expected temperature conditions. Most oils marketed for MS or DG service meet requirements MIL-L-2104A. Avoid mixing brands or grades.

AIR CLEANER. - The air cleaner is an oil bath type with a removable oil pan. Oil level is indicated on the pan and instructions for service are on the air cleaner. Use the same grade and weight of oil recommended for the crankcase. Change oil at the suggested intervals until a more realistic period is determined through experience.

ENGINE COOLANT. - For radiator-equipped units, fill the cooling system with clean soft water and add a good rust inhibitor. Capacity of the radiator and block is 12-gallons. On the initial run, check the coolant level and add as necessary to compensate for air pockets which may have formed during filling. If there is a possibility the unit will be operated in freezing temperatures, use a permanent anti-freeze in the proportion recommended by the manufacturer.

Heat-exchanger equipped plants require the same initial service on the closed side of the system as radiator equipped plants. A fill cap is on top of the chamber. Fill with clean soft water and add a good rust inhibitor.

All city water cooled plants need a continuous supply of water to carry away heat rejected by the engine. For plants with a manual flow valve, see that the valve is adjusted to give the correct flow rate for the intended load, as noted in the installation section of this manual.

FUEL. - The fuel oil specification for this engine is in the Waukesha operation and service handbook. Check with your fuel oil supplier for assurance that his fuel meets specifications. Make every effort to keep the fuel supply clean to obtain the highest degree of diesel performance.

Specific engine starting instructions are in the Waukesha handbook. Read that section before starting engine

STARTING. - Start the plant without a load by moving the circuit breaker to the OFF position.

Then move the run-stop switch to the RUN position and leave it there. When the engine starts, cranking will automatically stop when the dc generator develops enough power to energize the start disconnect relay. Immediately check oil pressure and battery charging current. As the engine warms up, watch the temperature gauge, especially on models with city water cooling. Carefully check the entire installation for irregularities.

NOTE: When starting the plant from a remote station or automatic load transfer control, the switch on the plant control must be in its REMOTE position.

CHECKING OPERATION. - With the engine at normal operating temperature and all systems functioning satisfactorily, move the control panel circuit breaker to its ON position and check the electrical output as indicated by the voltmeter. To connect the load move the double-throw switch from line to generator. If an automatic load transfer is connected, check its operation according to its instructions.

A rheostat voltage control knob on the control panel provides for adjusting the output voltage within limits of 5% plus or minus rated voltage. Since voltage and current frequency are dependent on the speed the generator rotor turns, engine speed is critical and should be checked on the initial run. An engine speed of 1800 rpm is correct for 60-cycle plants and 1500 rpm for 50-cycle plants.

WATER FLOW. - If the plant is city water cooled and has a manual flow valve, check the rate of water flow to insure proper cooling. A lock shield valve is used to prevent the accidental readjustment of the flow rate. With the key for the valve, adjust the flow rate so the coolant temperature is within the normal operating range of 165° to 185°F. Too high a flow rate results in poor economy and engine efficiency. Too low a flow rate may result in engine shutdown from high water temperature. Adjust water flow, remove and store the key.

STOPPING. - If conditions permit, run the plant a few minutes without load. This allows the engine to cool slightly and prevents excessive temperature rise when the engine is stopped and ventilation ceases. To stop engine, move the run-stop switch to STOP position.

NORMAL OPERATING FUNCTIONS

Performance of the generating system is indicated by meters and gauges and is controlled by switches, relays, and circuit breakers. The purpose and function of these standard or optional equipment devices is explained here.

The generator produces power at a given frequency within certain specified limits as stated in Description Section. Voltage is automatically controlled by the static exciter. Frequency varies with engine speed and is dependent on the engine governor.

SAFETY STOPPING DEVICES. - The plant is equipped with safety devices that automatically stop the plant under abnormal operating conditions that could cause severe damage.

NOTE

If one of the safety devices stops the plant, the Emergency Latch Relay PUSH TO SET button must be reset before the plant can be restarted.

1. Low Oil Pressure Cut-Off. - A pressure operated switch on the engine stops the plant if engine oil pressure drops too low.

2. High Water Temperature Cut-Off. - A thermostatic switch on the engine stops the plant if coolant temperature rises to 202 plus or minus 2°F. This switch is non-adjustable.

3. Overspeed Cut-Off. - A centrifugal weight switch is attached to the outer end of the generator shaft and is not adjustable. This switch stops the plant if engine speed rises to a dangerous point. Under no circumstances should the plant be operated if the switch is disconnected or otherwise made inoperative. Excessive speed could cause extensive generator damage.

If the switch stops the plant, check the governor system to make sure it is adjusted correctly and operating freely. If the governor is correctly adjusted and engine is otherwise functioning properly, and the plant still shuts down, the switch may not be operating properly. Do not attempt to adjust the switch, replace with a new one.

OPTIONAL ALARM. - The GND terminal on the remote control terminal block is for a customer supplied alarm at a remote location to warn of emergency shutdown. Refer to wiring diagram for proper voltages.

OIL PRESSURE GAUGE. - The oil pressure gauge indicates oil pressure with engine running. Pressure at normal operating temperature is 40 psi (hot). To check for low oil pressure adjust throttle to get 500 rpm (idle) with no load, oil pressure should be at least 15 psi.

WATER TEMPERATURE GAUGE. - The temperature gauge should indicate a normal operating temperature of 165°F to 185°F.

CHARGE AMMETER. - The dc ammeter indicates the battery charging current. An automatic regulator controls the charge rate and varies it according to the condition of the batteries. The charge rate will be comparatively high when the plant first starts but should move back to zero as batteries become fully charged.

EMERGENCY LATCH RELAY. - The emergency latch relay is energized by battery voltage when a ground is provided by one of the safety devices. A red panel warning light indicates a latched relay. The relay is manually reset before the engine can be restarted. The reset button is below the warning light.

RUN-STOP-REMOTE SWITCH. - A SPDT (center off switch) functions as a manual control for starting and stopping and as a selector when plant is operated from a remote station or automatic load transfer controls.

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.

METER SELECTOR SWITCH. - Used on 3-phase plants only. The switch handle position indicates which generator output phase is shown on the ac ammeter and voltmeter. Turn handle to desired position.

VOLTAGE ADJUSTMENT RHEOSTAT. - Turn clockwise to increase ac voltage, counterclockwise to decrease the voltage.

RUNNING TIME METER. - This meter registers the total number of operating hours, (to 1/10th). Use it to establish maintenance schedules.

TIME DELAY RELAY. - This relay allows the plant to build up oil pressure to open the low oil pressure cut-off switch during starting.

HEATER SWITCH. - Used when ambient temperatures are low and pre-heating is required. Closing the switch energizes a heater relay providing a circuit to the engine glow plugs.

With a load transfer control, pre-heating is controlled by a time delay relay.

CRANKING LIMITER. - If the plant fails to start in 45 to 120 seconds the cranking limiter trips and cranking stops. Remedy the cause and reset cranking limiter before attempting to re-start.

AMMETER. - Indicates the amount of ac load connected to the phase indicated by the selector switch. Single phase models have two ammeters and no selector switch.

VOLTMETER. - Measures generator output voltage. On 3-wire generators, the voltmeter indicates only the higher nameplate voltage. On 4-wire generators, it's connected through a selector switch to measure voltage on each phase of the generator.

FREQUENCY METER (Optional). - Indicates exact frequency of output current in cycles per second. Frequency is adjusted by changing engine speed.

PERIODIC EXERCISE. - If the plant is used infrequently (as in standby service) it should be started at least once a week to permit engine to reach normal operating temperature (15 to 30 minutes). This procedure keeps oil distributed to internal parts, refills the fuel system, drives condensation from the crankcase, recharges the starting batteries and promotes longer engine life. An automatic exerciser is available.

BATTERIES, HOT LOCATION. - Batteries self-discharge rapidly if installed where the ambient temperature is consistently above 90°F. To lengthen battery life, dilute electrolyte from its normal 1.275 specific gravity at full charge to a 1.225 reading (see procedure below). Cranking power is reduced slightly but if the temperature is above 90°F., starting should be no problem. The extended battery life will be a distinct advantage.

1. Fully charge the battery.
2. Draw off all 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 recommended level.
4. Continue charging for 1-hour at a 4 to 6-ampere rate.
5. Test each cell. If specific gravity is still above 1.225, repeat steps 2, 3 and 4, until reading is reduced to 1.225.

PARALLEL OPERATION. - If two plants are operated in parallel, special procedures are necessary. Parallel operation demands that the operator clearly understand the many requirements and procedures. Consult the factory for specific information.

GENERAL. - Follow a definite preventive maintenance schedule. Use the running time meter as your guide. Service periods are based on hours of normal running time and operating conditions. For continuous heavy duty, extreme temperatures, or other unusual operating conditions, service more frequently. For light duty, periods of little use, etc., service periods can be lengthened accordingly.

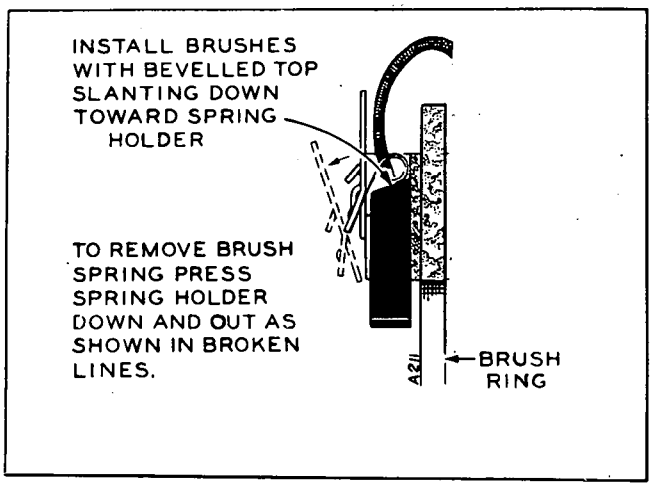
ENGINE - Refer to "Service Section" of Waukesha engine manual for schedule of inspections (daily, weekly, etc.).

BATTERIES. - Check batteries every two weeks. See that all connections are clean and tight. A light coating of grease or asphalt paint retards corrosion at terminals. Keep electrolyte at proper level (above plates) by adding clean and approved water. See that batteries are kept in a satisfactory charge condition.

AC GENERATOR. - Brushes and slip rings must be inspected periodically. In normal service, generator slip rings acquire a glossy brown surface. Do not attempt to maintain a newly machined appearance. Normal cleaning can be performed with a dry, lint-free cloth or light canvas. Slight roughness can be remedied by lightly sanding with #00 sandpaper (do not use emery or carborundum cloth or paper). Blow out all sanding and brush dust.

See that brushes ride freely in their guides and make proper contact. Replace brushes when worn to 1/2 inch in length or if damaged. Note: It is necessary to remove each brush spring and plate before removing brush. The spring will be damaged if the brush is pulled out past the mounted spring.

Brushes are tapered at the wire lead end. The short side of the taper must face toward the spring and its plate. New brushes are contoured to fit without sanding but may require a short run-in period before full load is applied to the generator.



BRUSH SPRING REMOVAL

GENERATOR BEARING. - The generator ball bearing is a double-sealed type, permanently lubricated. It never needs lubrication.

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.

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

GENERATOR. - Requires little maintenance other than periodic service. Openings in alternator end bell permit access to brushes and slip rings.

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.

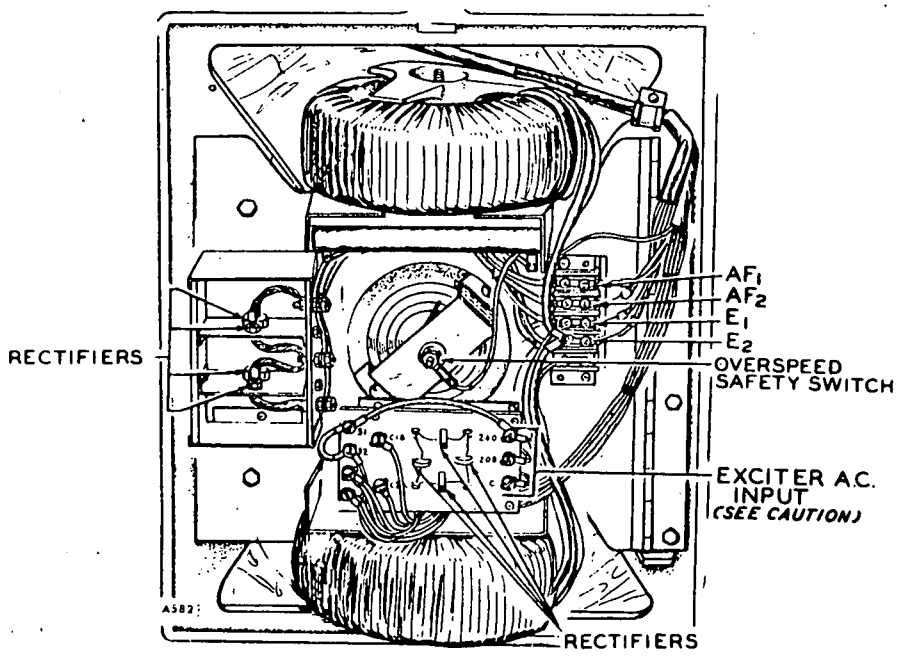
   Check the voltage across terminals AF1 (+) and AF2 (–). If there is no dc voltage, the exciter is not functioning.

2. If dc voltage at terminals AF1 and AF2 is 25-volts or higher, check the alternator for a grounded or open circuit, etc.

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

CAUTION

On some models, the exciter is operable on either 208 or 240-volt ac input, and is factory connected for the correct voltage. This exciter input voltage has no direct relationship to the generator ac OUTPUT voltage. DO NOT change the original factory exciter jumper connection unless the special instructions for reconnecting for different ac output are being followed. These special instructions are supplied on request.



1. 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	
	Both Field Rectifiers X and Y shorted	Test rectifiers and replace if defective	

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

2. 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.

3. 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_1 and G_2 cannot be read with accuracy on the multimeter.
   a. Turn the resistance range selector on the meter to the desired resistance range as given in steps b and c below.
   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 0.30.

   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 8.5.

   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.

4. 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 18.0.

   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.

5. Checking Resistors:

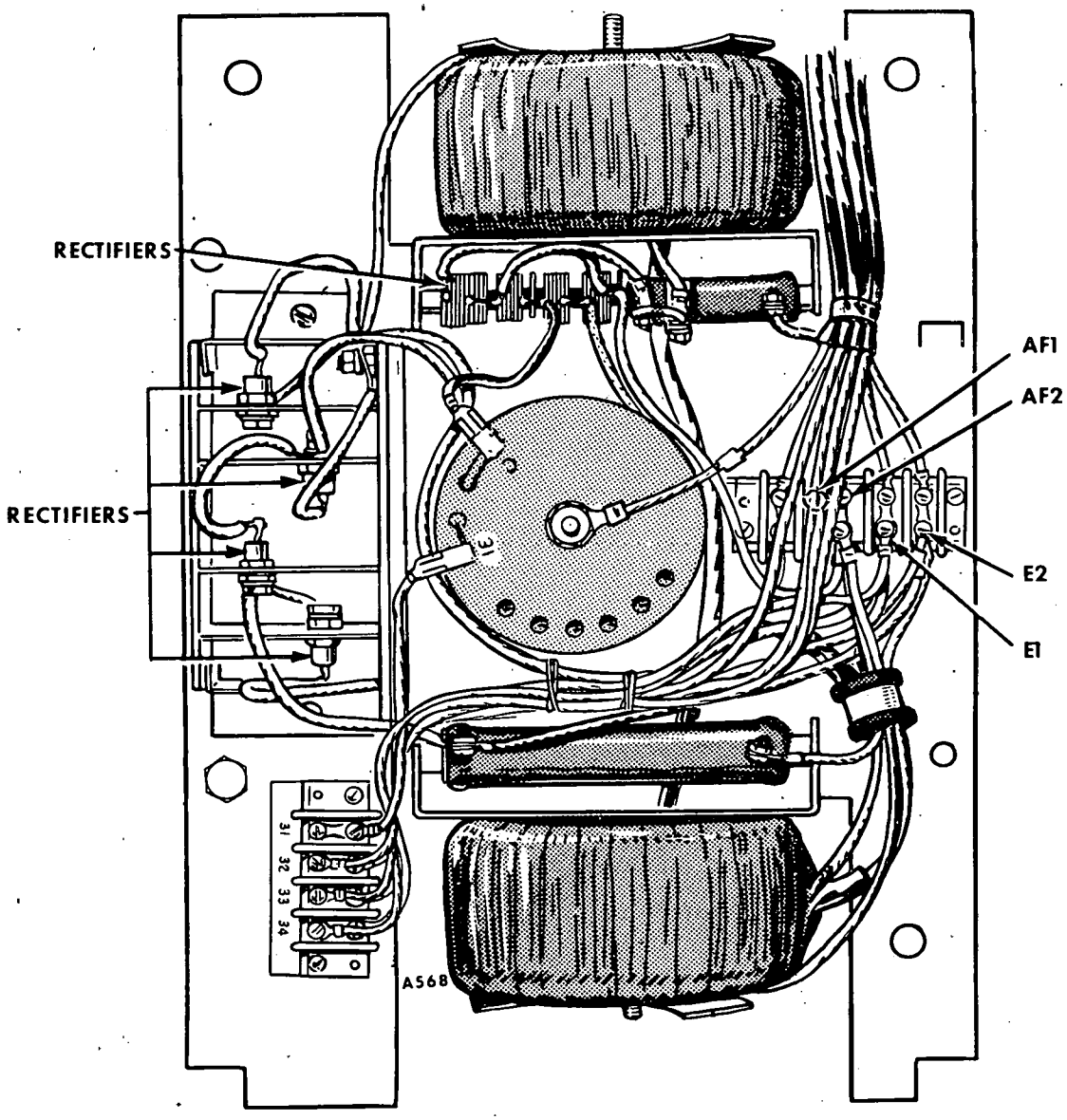
   The resistors must be checked with a multimeter adjusted to the appropriate range of resistances. See wiring diagram for correct values.

   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.

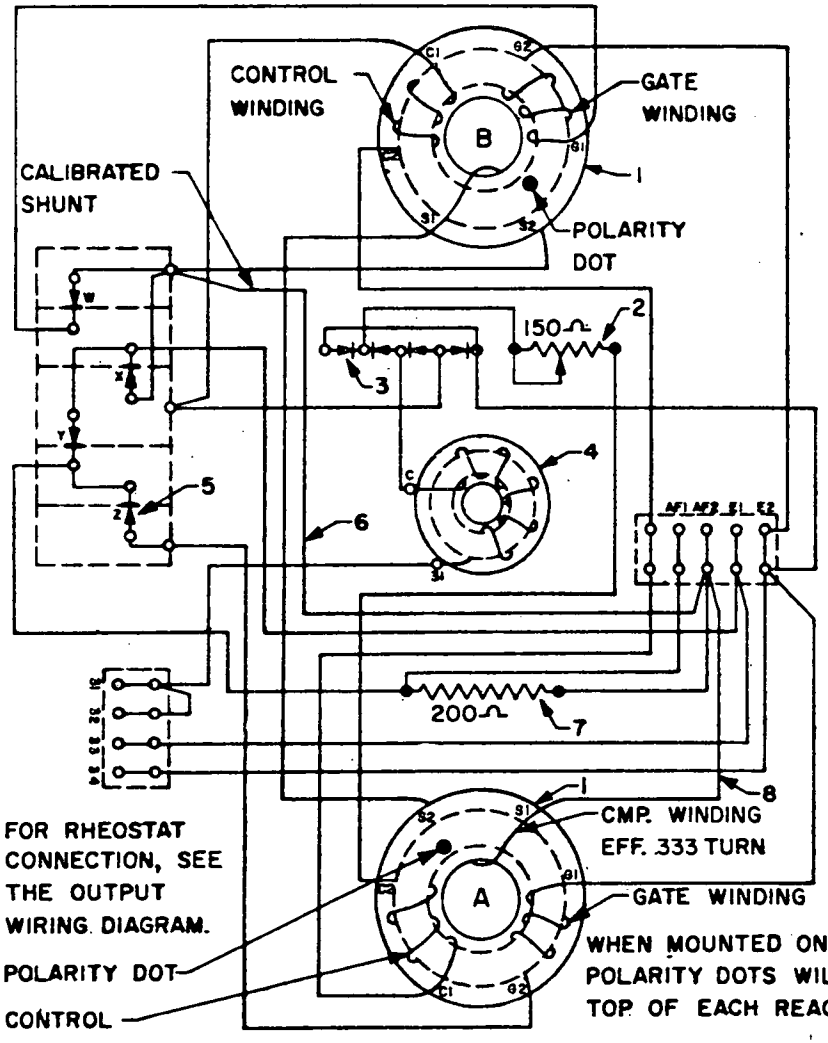
2. RESISTOR IS DEFECTIVE if there is no indication of continuity through the resistor. If the measured resistance exceeds the percent limits either way, the Stabilizing Resistor can be adjusted to bring the resistance within the required limits.



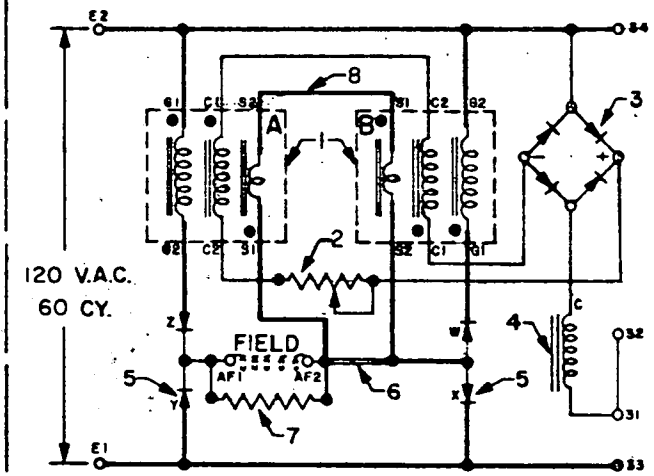
STATIC EXCITER

625A257

PICTORIAL



SCHEMATIC



ITEM	QTY	DESCRIPTION
8	1	NO. 14 WIRE, 27" LG.
7	1	RESISTOR-DAMPING
6	1	NO. 14 WIRE, 13½" LG.
5	4	RECTIFIER-FIELD
4	1	REACTOR-CONTROL
3	4	RECTIFIER-CONTROL
2	1	RESISTOR-STABILIZING
1	2	REACTOR-GATE

PARTS LIST

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

DATE	DR.	ENGR.	CKR.	SC.
12-15-65	CDR	GO	W. J. B.	

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

MODEL	DWG. NO.
102SXINIB	625A257

FIELD RECONNECTING ONAN 12-LEAD GENERATORS

IMPORTANT

BEFORE ATTEMPTING TO RE-CONNECT A GENERATOR-CONTACT THE ONAN FACTORY FOR REQUIRED INSTRUMENT CHANGES, NEW WIRING DIAGRAMS, NEW PLANT NAMEPLATE WITH PROPER SPECIFICATION NUMBER AND VOLTAGE.

When shipped - the generators are connected to deliver the voltage specified on the order. The plant nameplate will show *only* the single specified voltage for which the generator is connected. The output instruments on the plant (such as voltmeters, ammeters, transformers, frequency meters, and running time meters) are intended for use with the specific nameplate voltage.

Some plants may include an optional re-connection terminal block which allows safe and simple voltage changes. The generator leadwires terminate at the optional re-connection block or in the junction box on the generator side. The junction box also contains the ammeter current transformers (some plants have the current transformers in the control box) which may require replacement when changing to different output voltages. Instruments, which may require changes per new output voltages, are accessible by tipping out the control box front panel.

The generator is a basic coded type (either 2X, 5X, 6X) as identified by the generator data number on the plant nameplate. Example - 150UK2XN1A, 150UK5XN1A, 150UK6XN1A. Each type can be connected for output voltages shown in Tables 1 and 2. Use Table 1 for 10 to 85 KW and Table 2 for 100 to 230 KW generators.

All generator wires have wire tags for identification. The output leads to load are T0, T1, T2, T3. The generator winding leads, which are joined to form the output leads, are marked 1 through 12. See Figure 1 wiring diagrams for 10 to 85 KW and Figure 2 for 10 to 85 KW generators. All numbered leads are joined in various combinations to the output leads for the different voltages.

Instruments and their related parts may require changes because of different voltages and current. New instruments are selected by the new voltage and current ratings of the plant. Refer to Table 3 for voltage rated instruments and select according to the new voltage output. Always size the instrument so the plant output will not exceed instrument rating.

To determine if current rated instruments (ammeters and current transformers) must be changed, refer to Table 5 and find the correct ampere rating of the plant after re-connection. After determining current rating, refer to Table 4 for the proper size ammeter and current transformers.

Instrument wiring is essentially the same for all plants. Connect new instruments in the same manner as the old ones were connected. Wiring diagrams, supplied by ONAN after the re-connection registration, provide additional instructions and part numbers required to complete the plant wiring.

WARNING

SEVERE DAMAGE WILL RESULT IF LEADS ARE INCORRECTLY CONNECTED OR IMPROPERLY INSULATED. USE EXTREME CARE IN CHECKING LEADS TO ASSURE PROPER CONNECTIONS.

TABLE 1 (10-85 KW ONLY)

CODE	VOLTAGE	OUTPUT
	"2X" GENERATOR	
4R	120/208	3ph Wye
7XR	240/416	3ph Wye
5DR	120/240	3ph Delta (Note 2)
	240/480	1ph "Zig-Zag" (Note 1)
7R	220/380	3ph Wye "Dog-Leg"
	"5X" GENERATOR	
7XR	240/416	3ph Wye
5R	240	3ph Delta
6DR	240/480	3ph Delta (Note 2)
	240	1ph Delta (Note 1)
	"6X" GENERATOR	
4XR	277/480	3ph Wye
	138/240	3ph Wye
7XR	240/416	3ph Wye "Dog-Leg"

NOTE 1: Usable output is 2/3 of normal 3ph. rating.

NOTE 2: Delta-one phase center tapped. If no 3ph output is being used, usable 1ph output is up to 2/3 of normal 3ph rating but, 1ph output must be balanced between the two output legs.

TABLE 2. VOLTAGE RATED INSTRUMENTS

AC VOLTMETER VOLTAGE	RESISTOR	METER PART NO.
150	None	302P420
300	None	302P421
600	None	302P422
750	None	302P423
RUNNING-TIME METER		
120-240 (1ph)	None	302P465
120-208 (3ph)	None	302P465
220-380 (3ph)	None	302P466
277-480 (3ph)	None	302P467
FREQUENCY METER		
120	None	302P213
208	None	302P221
240	None	302P221
240 (5R connection	304A125	302P213
220-380 (3ph)	304A125	302P213
277-480 (3ph)	304A305	302P213
480	304A305	302P213

TABLE 3. CURRENT RATED INSTRUMENTS

AC AMMETER CURRENT (AMPS)	CURRENT TRANS.	METER PART NO.
30	None	302P418
50	None	302P419
80	None	302P458
100	302P78	302P408
150	302B79	302P410
200	302B106	302P411
300	302B107	302P413
500	302B372	302P414
750	302B385	302P415

TABLE 4 NOMINAL AMPERE RATINGS OF DIFFERENT SIZE ALTERNATORS

ALWAYS USE KVA RATINGS WHEN SHOWN OR KNOWN		ONAN CODE	SINGLE PHASE		THREE PHASE				
			-1	-3	-4	-5 -5D	-7	-4X -6	-9
POWER FACTOR									
80%		UNITY	120-V AMP	120/240-V AMP	120/208-V AMP	240-V 120/240-V AMP	220/380-V AMP	480-V 277/480-V AMP	600-V AMP
KW	KVA	KW/KVA							
50.0	62.5	62.5	521	260	174	151	95	75	60
55.0	68.75	68.75	574	286	191	166	105	83	66
60.0	75.0	75.0	625	313	209	181	114	90	72
65.0	81.25	81.25	677	339	226	196	124	98	78
70.0	87.5	87.5	730	365	244	210	133	105	84
75.0	93.75	93.75	782	390	261	226	143	113	90
80.0	100.0	100.0	834	417	278	240	152	120	96

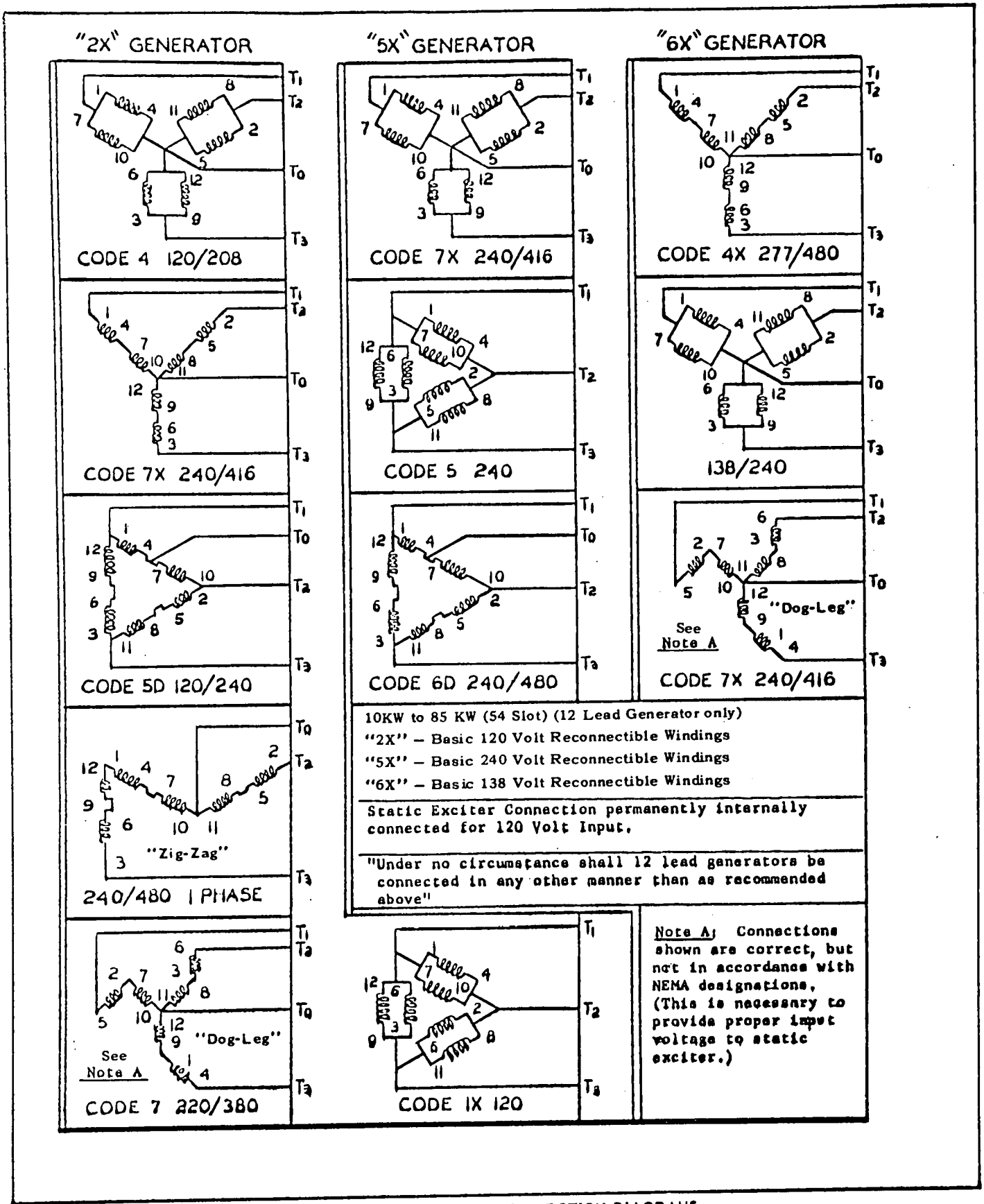
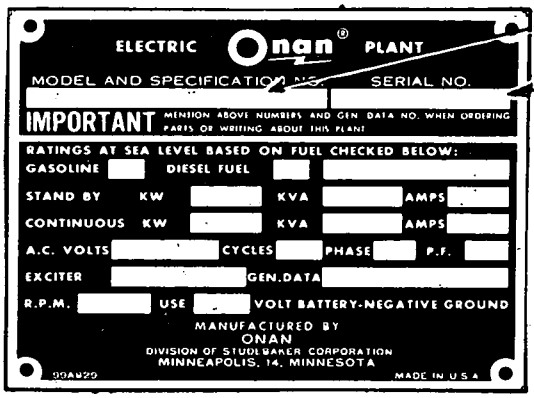


FIG. 1. 10 TO 85 KW RE-CONNECTION DIAGRAMS

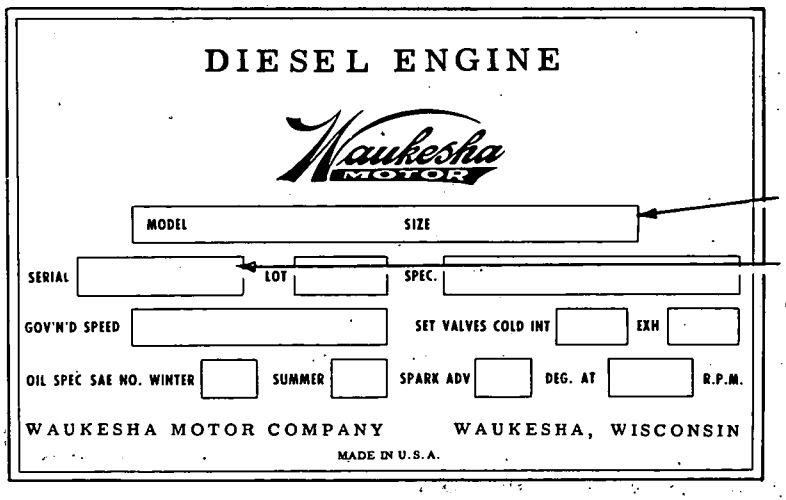
ONAN PARTS

All parts in this list are ONAN parts. For ONAN parts or service, contact the dealer from whom you purchased this equipment or refer to your nearest authorized service station. To avoid errors or delay in filling your parts order, please furnish all information requested. Refer to the ONAN Nameplate located on the Output Terminal Box Cover. Always give the complete:



MODEL & SPEC. NO.
and
SERIAL NO.

All Waukesha parts must be ordered from the Waukesha Motor Company of Waukesha, Wisconsin or their nearest authorized distributor. Refer to the Waukesha Engine Nameplate located on the side of the crankcase. When ordering parts, supply Waukesha with the complete nameplate information. Be sure to include:



SIZE, MODEL,
and
SERIAL NUMBER as shown on the engine nameplate.

PARTS CATALOG

DWJ SERIES

This parts catalog applies to the standard ONAN DWJ Series electric generating plants. They are powered by a Waukesha Model 135DKU engine which is more completely described in the Waukesha manual. Basically, the engine is a 6 cylinder, water cooled, diesel (compression ignition) type. The cylinder bore is 4-1/4 inches, piston stroke is 5 inches, and displacement is 426 cubic inches.

Waukesha Engine parts must be selected from the appropriate Waukesha parts list and parts must be secured from the Waukesha Motor Company or their nearest authorized distributor or dealer.

"Right" and "Left" sides of the Generator and Controls are determined by FACING the Radiator (Front) End.

Parts in this catalog are illustrated in groups and have reference numbers which correspond to the like number in the list for that group. Parts illustrations are typical and should not be construed to represent a particular part number.

Compare your ONAN plant nameplate MODEL and SPEC with the Plant Data Table. The Plant Data Table contains all descriptive information pertinent to this list, such as: ELECTRICAL DATA and PARTS KEY NO. which appears in the description of some parts that differ between basic models.

UNLESS OTHERWISE MENTIONED IN THE PARTS DESCRIPTION, PARTS ARE INTERCHANGEABLE BETWEEN ALL MODELS LISTED IN THE PLANT DATA TABLE.

Plant Data Table

MODEL & SPEC NO. †	ELECTRICAL DATA					PARTS
	WATTS (Max.)	VOLTS	CYCLE	PHASE	WIRE	KEY NO.
60DWJ-3R8/	60, 000	120/240	60	1	3	1
★ 60DWJ-3UR8/	60, 000	120/240	60	1	3	2
60DWJ-4R8/	60, 000	120/208	60	3	4	3
60DWJ-4XR8/	60, 000	277/480	60	3	4	4
▲ 60DWJ-5DR8/	60, 000	120/240	60	3	4	5
60DWJ-7R8/	60, 000	220/380	60	3	4	6
60DWJ-9R8/	60, 000	600	60	3	3	7

† - The NUMBER after the diagonal line (/) signifies standard or optional features (1 is Standard). The LETTER ending the Model and Spec No. is the Spec Letter and will advance with manufacturing changes (A to B, B to C, etc.)

▲ - This is a delta-wound 240 volt model with one phase center-tapped. A limited amount of 1 phase, 120/240 volt power can be utilized together with 3 phase power as long as no terminal current exceeds the rated nameplate current.

★ - U designates unity power factor.

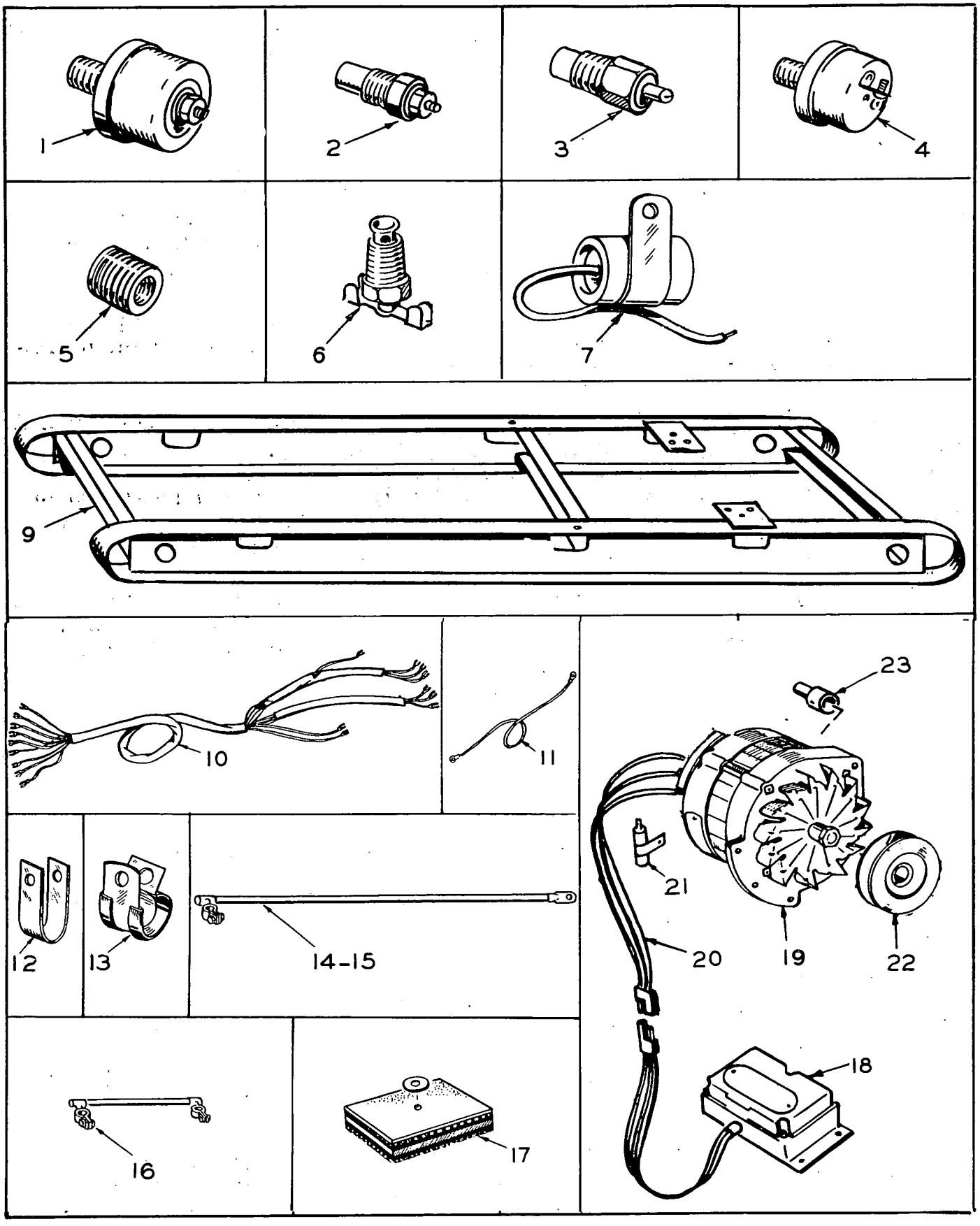


FIG. 1 - ENGINE GROUP

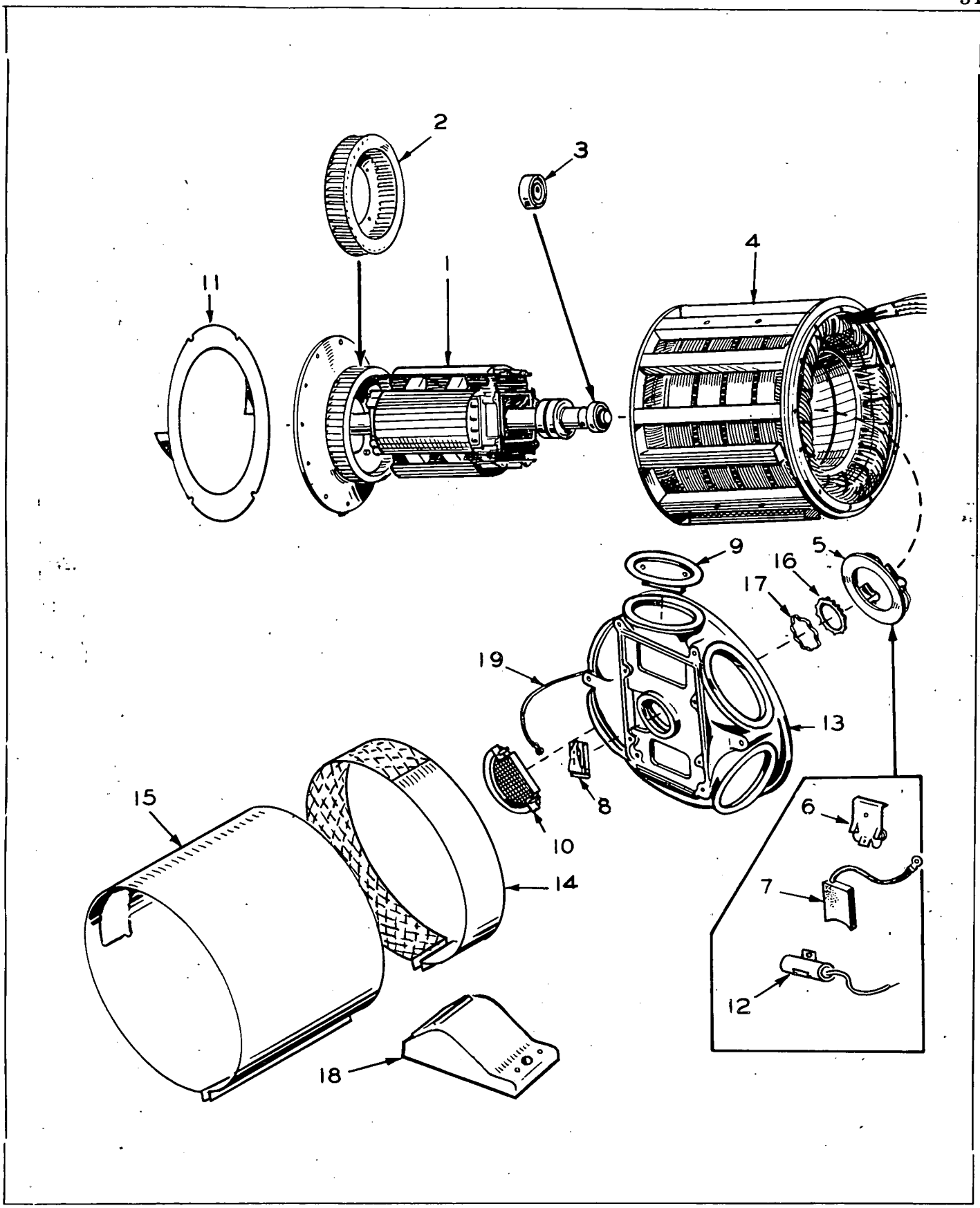


FIG. 2 - GENERATOR GROUP

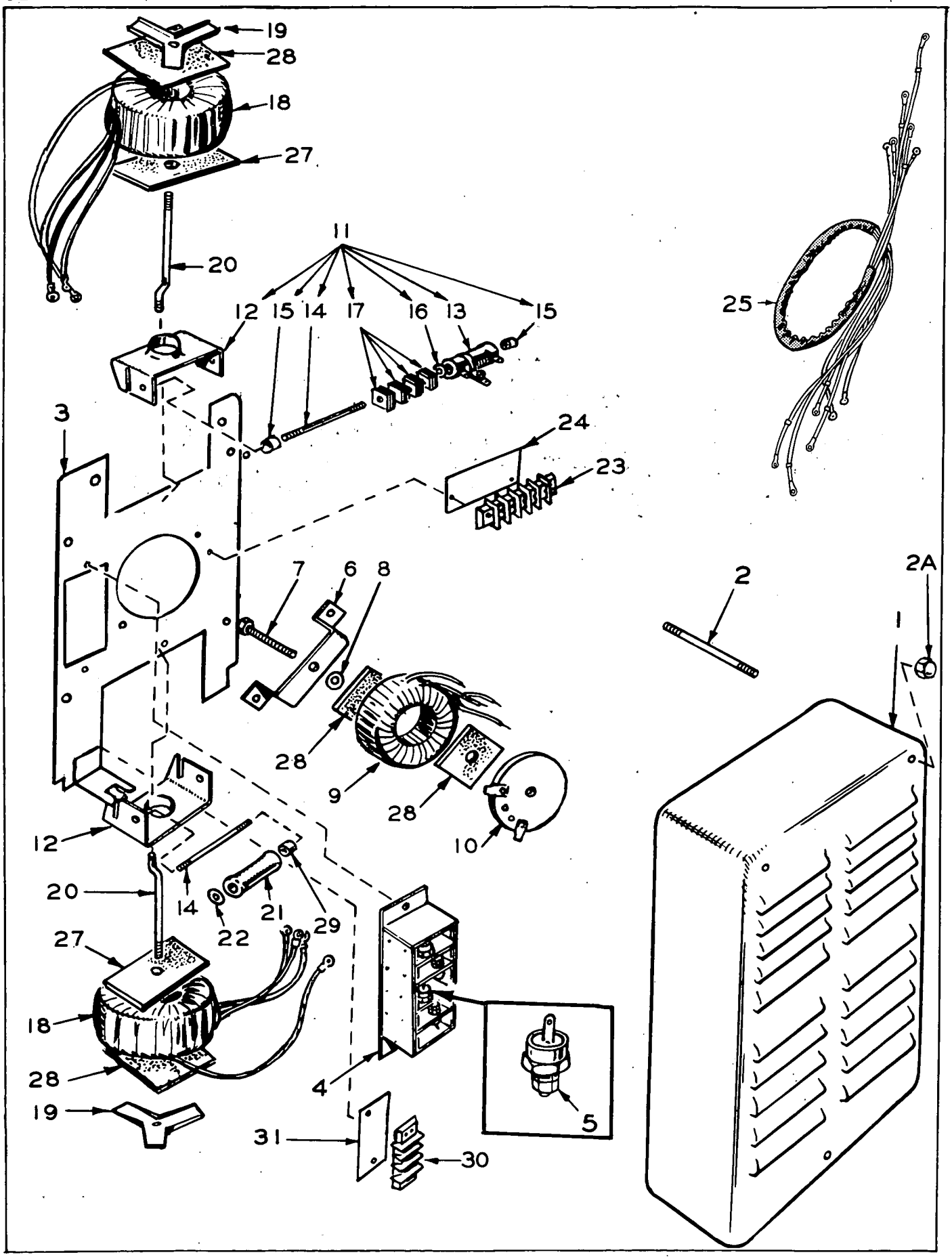
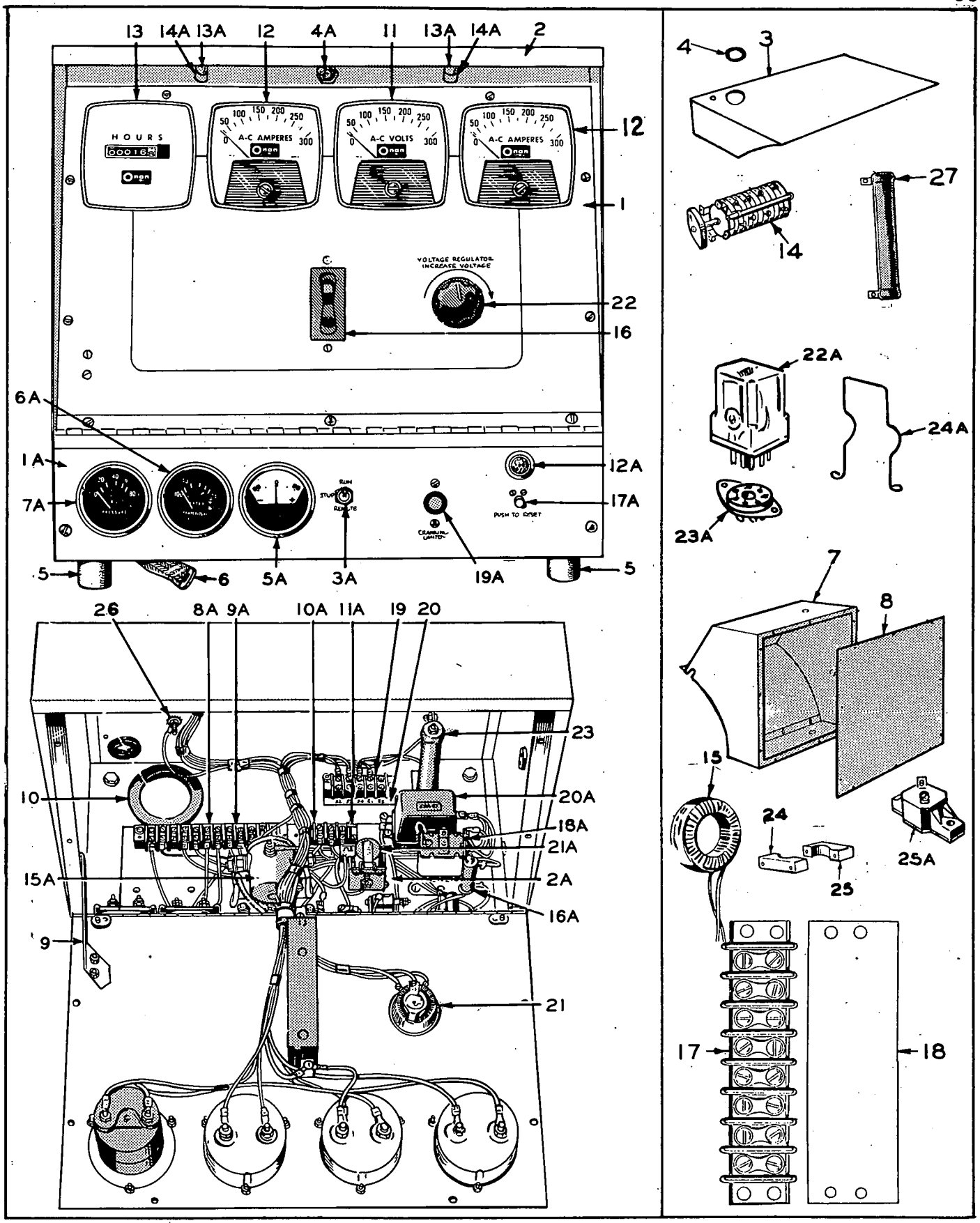


FIG. 3 - STATIC EXCITER GROUP



NOTE: Parts appear in two separate groups in the Parts List.

FIG. 4 - CONTROL GROUP (AC Output Portion)

FIG. 4A - CONTROL GROUP (Engine Instruments Portion)

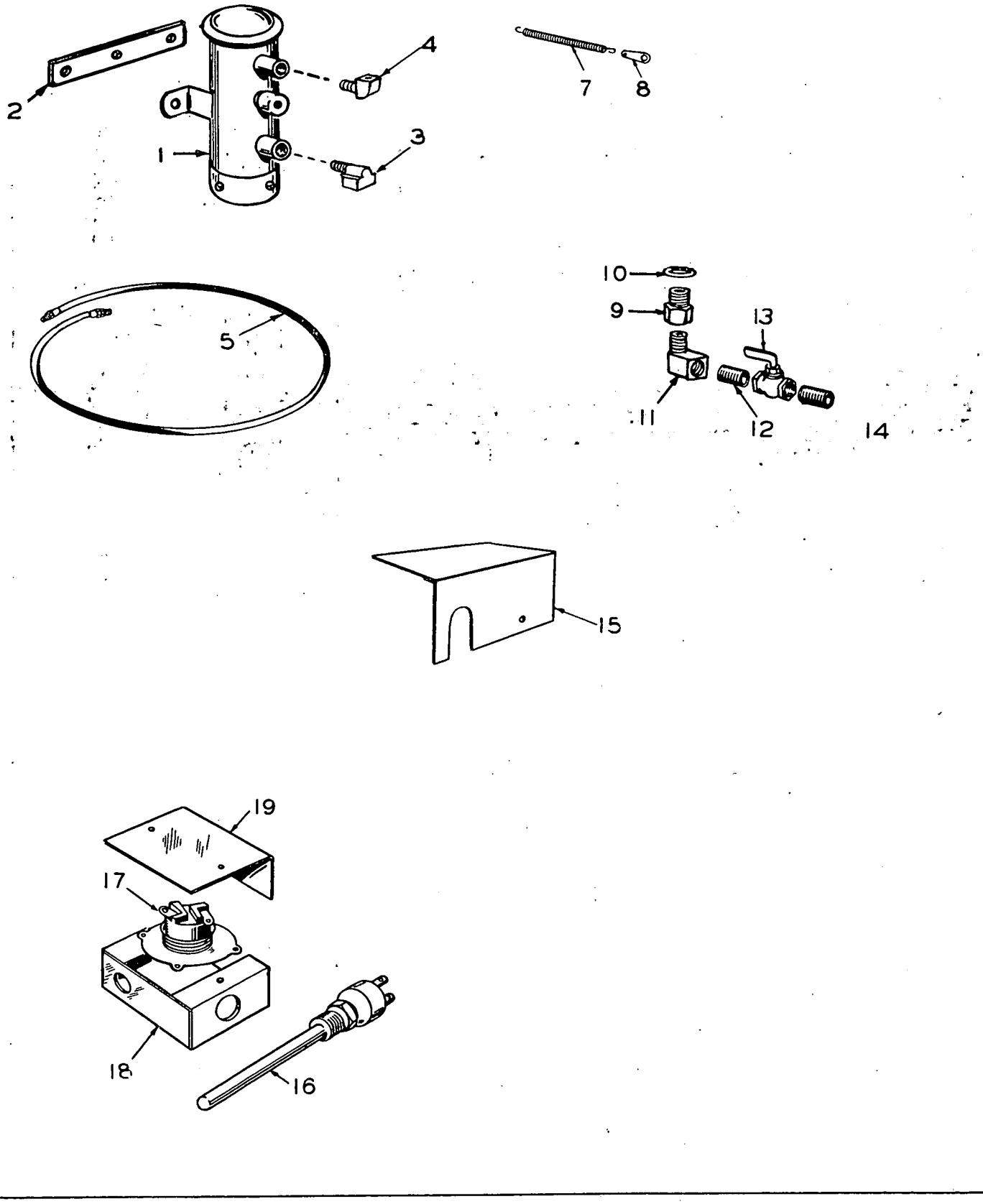


FIG. 5 - MISCELLANEOUS GROUP

REF. NO.	PART NO.	QUANT. USED	DESCRIPTION
			REPLACEMENT ENGINE
			Engine Replacement (Waukesha Engine Company 135DKU)
	100P595	1	For Standard Models - Replaces 100P444 General Description: Includes - Complete Cylinder Block; Fuel Pump; Air Cleaner; Fuel Filter; Oil Filter; Starter; Charge Generator and Voltage Regulator; Governor; Radiator; Water Pump; Fan Blades & Belt; Fan Guard; Exhaust Manifold; Flywheel; Flywheel Housing; Fuel Injection System and Oil Cooler Excludes - Mounting Base; Vibration Dampeners; Oil Pressure and Water Temperature Senders; Oil Pressure and High Temperature Cut-Off Switches; Radiator and Block Drain Valves
	100P596	1	Similar to 100P595 except with Water Cooled Exhaust Manifold - Replaces 100P456
			FIG. 1 - ENGINE GROUP
1	193A108	1	Sender, Oil Pressure Gage - Engine Unit Only
2	193A109	1	Sender, Water Temperature Gage - Eng. Unit Only
3	309A178	1	Switch, High Water Temp. Cut-off (Non-Adjust.)
4	309A10	1	Switch, Low Oil Pressure Cut-off
5	505-117	1	Bushing, 1/2 x 3/8" Red. - High Water Temp. Switch
6	504-28	2	Valve, Drain - Radiator and Block
7	312A58	2	Condenser, .1 Mfd. - Charging Generator
9	403C677	1	Base, Mounting
10	338C299	1	Harness Assembly, Engine (9-wires)
11	336A1415	1	Lead Assembly - Regulator to Generator
12	416A96	2	Clip, Harness - U Shaped, Steel
13	332-51	1	Clip, Harness - 1/2" Diameter, Tinnerman
14	416A444	1	Cable Assembly, Battery Positive
15	416A445	1	Cable Assembly, Battery Negative
16	416A446	1	Cable Assembly, Battery Jumper
17	402P203	4	Damper, Vibration
18	191-542	1	Regulator, Alternator - Charge
19	191-558	1	Alternator, Charge - Includes Pulley and Fan
20	191-544	1	Cable, Alternator to Regulator
21	191-545	1	Resistor, Alternator
22	191-624	1	Pulley, Alternator
23	232A1813	1	Spacer, Alternator Mounting

REF. NO.	PART NO.	QUANT. USED	DESCRIPTION

FIG. 2 - GENERATOR GROUP (Alternator Portion)

NOTE: Output Terminal Box Cover & Internal Parts are listed with the AC Output Control Group (Mounts on Side of Generator)

1	★	1	Rotor Assembly, Wound - Includes Bearing, Blower and Drive Assembly.
2	205C49	1	Blower
3	510P63	1	Bearing
4	★	1	Stator Assembly, Wound
5	212C248	1	Rig Assembly, Brush - Includes Brushes and Springs
6	212B1105	4	Spring, Brush
7	214A56	4	Brush
8	150A717	1	Switch Assembly, Overspeed
			Cover, End Bell Opening - Includes Latch & Bracket -
9	232B1254	2	Plain
10	232B1253	2	Screened
11	234C84	1	Scroll, Air
12	312A17	1	Condenser - .5 Mfd
13	211E131	1	Bell, End - Alternator to Exciter
14	234C83	1	Band, Generator - Front Portion Narrow
15			Band, Generator - Rear Portion - Wide
	234D81	1	Parts Key No. 1
	234D82	1	Parts Key Nos. 2, 3, 4, 5, 6, 7
16	232A1186	1	Holder, Bearing - Anti-Rotation
17	232A1187	1	Spring, Bearing Holder - Anti-Rotation
18	232C1556	2	Pad, Generator Mounting

★ - Order by description, giving Model, Spec, and Serial Number (ONAN Nameplate)

FIG. 3 GENERATOR GROUP (Exciter Portion) MODEL 102SX1N1B

1	234D106	1	Cover, Exciter
2	520A575	3	Stud, Exciter Cover Mounting
2A	866-1	3	Nut, Acorn - Exciter Cover Mounting
3	234D105	1	Panel Only, Exciter
4	305B212	1	Rectifier Assembly Power (Complete) Includes four #305P244 plus wire and hardware.
5	305P244	4	Rectifier Only, Power (Field) Included in #305B212 Assembly
6	150B733	1	Bracket Only, Overspeed Switch
7	150A772	1	Stud and Contact Point Assembly, Voltage Control Reactor Mounting

REF. NO.	PART NO.	QUANT. USED	DESCRIPTION
			FIG. 3 - GENERATOR GROUP (Exciter Portion) MODEL 102SX1N1B (Continued)
8			Washer, Fiber Insulating - Voltage Control Reactor Stud Mounting
	508-18	2	1/4" x 3/4" x 1/16"
	508-29	1	1/4" x 3/8" x 1/32"
9	315A74	1	Reactor, Voltage Control - Does not include Terminal Block
10	332A687	1	Block, Terminal - Voltage Control Reactor
11	305B202	1	Rectifier and Resistor Assembly (Includes parts marked * plus wire and hardware.)
12	234B60	2	*Bracket, Gate Reactor Mounting (Note: 1 only included with #305B202 Assembly.)
13	304A5	1	*Resistor, Control - Adjustable (150 Ohm, 25 Watt) 9/16" x 2"
14	520A579	2	*Stud, Resistor and Rectifier Mounting (Note: 1 only included with #305B202 Assembly.)
15	232A1473	2	*Spacer, Adjustable Resistor and Rectifier to Stud (3/8" O.D. x 3/16" I.D. x 7/32" long)
16	304A14	2	*Washer, Centering - Adjustable Resistor Mounting
17	305P208	4	*Rectifier, Control
18	315A57	2	Reactor, Gate
19	234B62	2	Retainer, Gate Reactor
20	232A1361	2	Stud, Gate Reactor Mounting
21	304A21	1	Resistor, Fixed - Alternator Field (Damping) 3/4" x 4" (200 Ohm, 50 Watt)
22	304A15	2	Washer, Centering - Fixed Resistor Mounting
23	332A604	1	Block, Terminal - 5 Place
24	332A678	1	Strip, Block Marker - For 5 Place Block
25	338B238	1	Harness, Wiring - Exciter to Control
27	232A1547	2	Gasket, Coil Retainer - Inner
28	232A1546	2	Gasket, Coil Retainer - Outer
29	232A1474	2	Spacer, Fixed Resistor to Stud (3/8" O.D. x 3/16" I.D. x 11/32" long)
30	332A537	1	Block, Terminal - 4 Place
31	332A686	1	Strip, Block Marker - For 4 Place Block

* - Included in #305B202 Rectifier Assembly.

PARTS LIST

REF. NO.	PART NO.	QUANT. USED	DESCRIPTION
			FIG. 4 - CONTROL GROUP (AC Output Portion)
1			Panel Only, Upper Control
	301C1810	1	Parts Key Nos. 1, 2 (Single Phase Models)
	301C1814	1	Parts Key Nos. 3, 4, 5, 6, 7 (Three Phase Models)
2	301D2115		Box Only, Control
3	301C2539	1	Bracket, Control Box Mtg. (Repl. 2 Piece Bracket)
4	508P63	1	Grommet, Control Box Bracket
5	402-78	4	Rubber, Mounting - Control Box to Mounting Bracket
6	337A44	1	Strap, Ground
7	301D1209	1	Box, Only, Output Terminal - Mounts on Side of Generator
8	301B1190	1	Cover, Output Terminal Box
9	301A1914	1	Bracket, Panel Stop
10	508-63	1	Grommet, Rubber - For 2-3/4" Hole
11			Voltmeter, AC (Check VOLTMETER Scale - Select According to Rating) -
	302P421	1	Voltmeter Scale Reads 0-300
	302P422	1	Voltmeter Scale Reads 0-600
	302P423	1	Voltmeter Scale Reads 0-750
12			Ammeter, AC (Check AMMETER Scale - Select According to Rating) -
	302P408	1	Ammeter Scale Reads 0-100
	302P410	1	Ammeter Scale Reads 0-150
	302P411	1	Ammeter Scale Reads 0-200
	302P412	1	Ammeter Scale Reads 0-250
	302P413	1	Ammeter Scale Reads 0-300 (Quantity is 2 for Single Phase Models)
	302P414	1	Ammeter Scale Reads 0-500 (Quantity is 2 for Single Phase Models
13			Meter, Running Time (Check Meter Face for Part No.)
	302P465	1	120 Volt, 60 Cycle
	302P466	1	220 Volt, 60 Cycle
	302P467	1	480 Volt, 60 Cycle
	302P468	1	120 Volt, 50 Cycle
	302P469	1	220 Volt, 50 Cycle
14	308B22	1	Switch, Voltage & Current Selector - 3 Phase Models Only
15			Transformer, Current (Mounts in Output Terminal Box) Check TRANSFORMER Nameplate - Select According to Rating
	302B78	3	Transformer Nameplate Reads "Ratio 100/5" (Use with 0-100 AC Ammeter)
	302B79	3	Transformer Nameplate Reads "Ratio 150/5" (Use with 0-150 AC Ammeter)
	302B106	3	Transformer Nameplate Reads "Ratio 200/5" (Use with 0-200 AC Ammeter)

REF. NO.	PART NO.	QUANT. USED	DESCRIPTION
			FIG. 4 - CONTROL GROUP (AC Output Portion) (Cont.)
	302B209	3	Transformer Nameplate Reads "Ratio 250/5" (Use with 0-250 AC Ammeter)
	302B107	2	Transformer Nameplate Reads "Ratio 300/5" (Use with 0-300 AC Ammeter)
	302B372	2	Transformer Nameplate Reads "Ratio 500/5" (Use with 0-500 AC Ammeter)
16	320B2	1	Breaker, Circuit - 15 Ampere
17	332A503	1	Block, Terminal - 8 Place
18	332A601	1	Strip, Block Marker (Marked 15 through 22)
19	332A604	1	Block, Terminal - 5 Place
20			Strip, Block Marker - For 5 Place Block
	332A689	1	Parts Key Nos. 1, 2, 3, 5 (Marked 32, 33, 34, E1, E2)
	332A690	1	Parts Key Nos. 4, 6, 7 (Marked 32, 33, 34, 35, 36)
21	303-97	1	Rheostat, Voltage Regulator - 75 Ohm, 50 Watt, Model H
22	303-32	1	Knob, Rheostat
23	304A479	1	Resistor, Rheostat (425 Ohm, 50 Watt 3/4 x 4"
			Clamp, Current Transformer Mounting (Note: Not used on 3R Models)
24	302A235	3	Inside Half - (Note: Quantity is 2 for 3UR Models)
25	302A236	3	Outside Half - (Note: Quantity is 2 for 3UR Models)
26	332A56	1	Stud, Ground
27	304A536	1	Resistor, Fixed (9000 Ohm, 50 Watt) Off Running Time Meter on 600 Volt Models

			FIG. 4 A-CONTROL GROUP (Engine Instrument Portion)
1A	301C2124	1	Panel, Control
2A	301A1685	1	Bracket, Time Delay Relay Mounting
3A	308P138	1	Switch, Run-Stop-Remote
4A	308-2	1	Switch, Panel Light
5A	302-61	1	Ammeter, Charge (30-0-30)
6A	193B106	1	Gauge, Water Temperature
7A	193B107	1	Gauge, Oil Pressure
8A	332A607	1	Block, Terminal - 12 Place
9A	332A608	1	Strip, Marker (Marked 4 through 15)
10A	332A611	1	Block, Terminal - 3 Place
11A	332A762	1	Strip, Marker (Marked - Remote, B+, GND).
12A	322P69	1	Light, Emergency Latch Relay
13A	322P72	2	Light, Panel

REF. NO.	PART NO.	QUANT. USED	DESCRIPTION
			FIG. 4A - CONTROL GROUP (Engine Instrument Panel) (Cont.)
14A	322-4	3	Lamp, Panel and Relay
15A	307B514	1	Relay, Starter Pilot
16A	304A192	1	Resistor, Cranking Limiter Circuit
17A	307A655	1	Relay, Emergency Latch
18A	307B52	1	Relay, Start-Disconnect - Spec. A Only
19A	320A104	1	Limiter, Cranking
20A	307B597	1	Relay, Fuel Solenoid
21A	307A388	1	Relay, Time Delay - Low Oil Pressure Switch Circuit
22A	307P819	1	Relay, Start-Disconnect - Begin Spec. B
23A	323-52	1	Socket, Start-Disconnect Relay - Begin Spec. B
24A	307P778	1	Hold-down, Start Disc Relay - Begin Spec. B
25A	320P165	1	Breaker, Circuit (17.5 Amp) Begin Spec. B
			FIG. 5 - MISCELLANEOUS GROUP
1	149P554	1	Pump, Fuel - Electric
2	149-784	1	Bracket, Fuel Pump Mounting
3	502-2	1	Elbow, Inverted Male - Fuel Pump Inlet
4	502-20	1	Elbow, Street - 90° - Fuel Pump Outlet
5	501A9	1	Line, Flexible Fuel - 36"
6	502-41	1	Elbow, Inverted Male - Filter Inlet
7	149A738	2	Spring, Throttle Return
8	145A118	2	Link, Return Spring Fastener
9	102A33	1	Fitting, Oil Drain
10	102A34	1	Gasket, Oil Drain Fitting
11	505-50	1	Elbow, Street - 1/2" x 90° - Oil Drain
12	505-100	1	Nipple, Pipe Close - 1/2" - Oil Drain
13	504-11	1	Valve, Oil Drain
14	505-472	1	Nipple, Half - 1/2" x 2" - Oil Drain
15	309B116	1	Shield, Heat
16			Heater, Water - Optional Equipment
	333P52	1	1, 300-Watt
	333P53	1	2, 000-Watt
17	309-29	1	Thermostat, Water Heater Control - Optional Equip.
18	333A12	1	Box, Thermostat - Optional Equipment
19	333A13	1	Cover, Thermostat Box - Optional Equipment

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