

INSTRUCTION MANUAL

AND PARTS CATALOG

FOR



ELECTRIC GENERATING PLANTS

DWF

SERIES

ONAN

2515 UNIVERSITY AVE. S. E. • MINNEAPOLIS, MINNESOTA 55414

A DIVISION OF STUDEBAKER CORPORATION

IN CANADA: ONAN GENERATORS CANADA LTD., 233 CAMPBELL ROAD, GUELPH, ONTARIO
INTERNATIONAL DISTRICT OFFICE: EMPIRE STATE BLDG., 350-5TH AVE., RM. 2204, NEW YORK 10001

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.

PERFORMANCE CERTIFIED

We certify that when properly installed and operated this Onan electric plant will deliver the full power and the voltage and frequency regulation promised by its nameplate and published specifications. This plant has undergone several hours of running-in and testing under realistic load conditions, in accordance with procedures certified by an independent testing laboratory.

ONAN Division of Studebaker Corporation
Minneapolis 14, Minnesota

GENERAL INFORMATION

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

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

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

MANUFACTURER'S WARRANTY

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

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

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

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

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

DATED August 1, 1963

IMPORTANT

RETURN WARRANTY CARD ATTACHED TO UNIT

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DESCRIPTION

The Onan generating plant of the DWF series is a complete unit consisting of a diesel type engine driving a self excited 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. When the plant is used for standby service, optional controls for starting, load transfer, and stopping may be connected during installation. 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 a Waukesha basic model 6-WAKDSU (WAKDBSU early models) described in the Waukesha manual. The specific engine used may have variations due to optional features of the generating plant, type of cooling, etc. Specified by the plant purchaser. Basically the engine is a 6-cylinder water cooled, supercharged diesel (compression ignition) type. The cylinder bore is 6-1/4 inches, piston stroke 6-1/2 inches, and displacement is 1197 cubic inches. The engine is rated 400 horsepower at 1800 rpm. The standard oil capacity is 8 U.S. gallons, plus 4-1/2 gallons for the oil filters. A 24 volt battery system energizes the starting and control circuits. Accessories, safety devices, etc. vary according to the model and purchaser options.

The standard engine cooling system uses a radiator and pusher type fan. Optional cooling systems use "city" water, or similar separate pressure source of water supply. When the water supply is very alkaline or otherwise unsuitable for circulating through the engine, a "heat exchanger" system is recommended. If the water supply can safely be used directly, a "mixing" standpipe or tempering tank can be used.

GENERATOR

The generator consists of a 4 pole revolving field type alternator, and a static exciter with magnetic amplifier regulator. The alternating current output is generated in the alternator stator winding, attached directly to the rear end of the engine. Some models are designed to permit reconnection for different output voltages, if proper procedure is followed. The alternator's rotating field 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 frame.

DESCRIPTION

The exciter components are mounted inside a sheet metal enclosure attached to the alternator end frame. The design of the exciter provides for almost constant ac output voltage over a wide range of load conditions. This is particularly advantageous when the generator is called upon to start large electric motors. The static exciter is considerably smaller and lighter than a conventional dc generator type and eliminates the necessity of an external voltage regulator, through the use of a magnetic amplifier. Some models are provided with a panel mounted rheostat control for voltage adjustment.

CONTROLS

The plant control box is mounted on the generator. It contains components for starting, controlling, and stopping the plant. Instruments to indicate engine and generator performance are flush mounted on the operator's panel of the control.

The engine is started through a run-stop switch, a fuel solenoid relay, 2 cycle cranking relays, a pilot relay, a series-parallel solenoid, and a starter motor. Cranking alternates in 10 second cranking cycle and 5 second rest cycle until the engine starts or the cranking limiter opens. A start disconnect relay stops the cranking when the engine starts.

Engine performance is indicated by a water temperature gauge, a low oil pressure gauge, and a battery charge ammeter. The engine is protected from high water temperature, low oil pressure, and overspeed, all operating through an emergency latch relay. A latched relay is indicated by a red light on the control panel and by a protruding button which has to be manually reset. There is a terminal block in the control for connecting wires to a remote control switch. Other controls are used in conjunction with accessories specified by the purchaser.

WARNING

AN OVERSPEED PROTECTIVE SWITCH IS BUILT INTO THE OUTER END OF THE GENERATOR SHAFT. THIS OVERSPEED DEVICE AUTOMATICALLY SHUTS OFF THE ENGINE IF THE SPEED REACHES 2100 RPM. UNDER NO CIRCUMSTANCES SHOULD THE OVERSPEED SWITCH BE BY PASSED OR DISCONNECTED. EXTENSIVE GENERATOR DAMAGE WILL RESULT FROM OVERSPEED.

PARALLEL OPERATION. - If the plant is to be operated in parallel with another plant, special procedures are necessary. Parallel operation demands that the operator clearly understand the many requirements and proper procedures.

Plants designed for parallel operation usually have a special control panel with synchronizing lights, governor speed control, cross current compensating circuit, etc. Plants not so equipped can usually be altered as necessary. Consult the factory for specific information.

INSTALLATION

Installation of the generating plant involves its 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 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 should be consulted.

LOCATION. - In the average installation, the location has been pre-selected. However, there are certain basic requirements for a satisfactory location. The ambient temperature should be warm enough to assure easy starting. A plant used for emergency standby service should be installed where the ambient temperature will not fall below 60°F. unless special heating accessories are used. Many specifications or local regulations require a minimum of 65°F. Special starting aids are required for temperatures below 40°F.

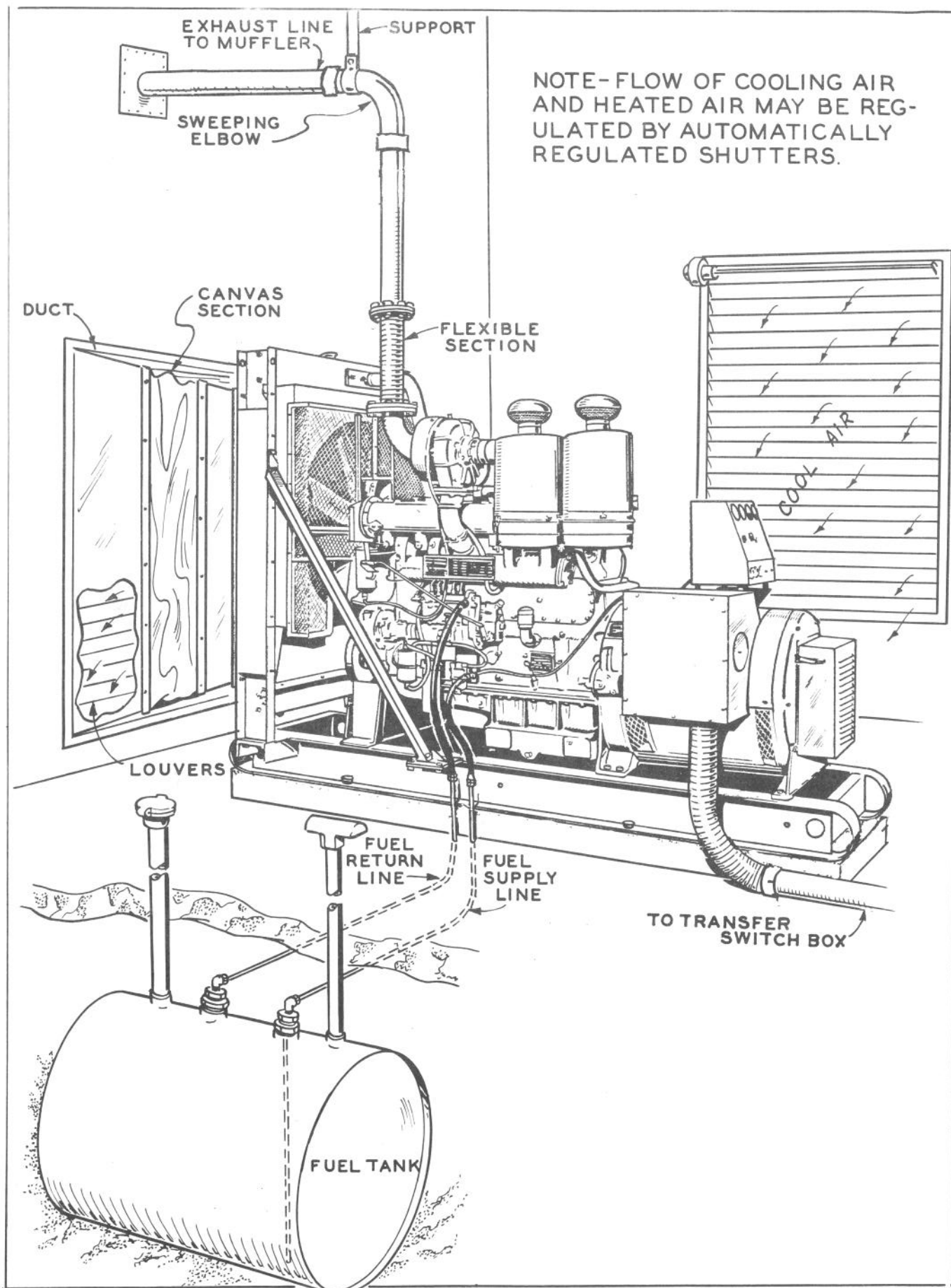
Extremely high ambient temperatures can create cooling problems. A radiator cooled plant is usually limited to an ambient temperature below 120°F. See **COOLING AND VENTILATION.**

The plant location should be dry, and reasonably dust free. Provide for at least 24 inches space on all sides, for convenience in servicing the plant.

MOUNTING. - The plant is mounted on a rigid skid base that provides proper support. If additional vibration dampers, raised pedestals, etc. are employed, it may be necessary to provide special footings or other support as necessary to carry the more concentrated weight. Refer to the separate outline drawing for mounting dimensions, etc. Note that a clearance of 25 inches is required for removal of the engine oil pan. It is suggested that sufficient ceiling clearance be made available to provide for jacking up, or that a pit be provided for necessary clearance. Bolting in place is optional.

COOLING AND VENTILATION. - Proper ventilation is of vital importance, particularly for a radiator cooled unit. Under normal operating conditions, approximately 28,500 cubic feet of air per minute will provide for proper cooling. For a "city water" cooled unit, approximately 7,125 cu. ft. per minute will provide sufficient air for cooling the generator and support combustion in the engine. In a small room installation this may require the installation of an auxiliary air intake fan, connected to operate only during plant operation.

If air temperature outside the enclosure is expected to fall below the recommended minimum starting temperature, provision must be made to prevent any inward flow of cold outside air during shut down periods. Some form of shuttered openings for the air inlet and outlet openings should be provided. If the installation provides for automatic control of starting and stopping, air shutters should also be automatic in operation. Motor operated furnace type controls can be adapted for use with air shutters.



INSTALLATION

The pusher type fan used on a radiator cooled plant forces the heated air out through the front of the radiator. The usual method of exhausting the heated air from a room or compartment is to construct a sheet metal duct from the front of the radiator to an outside wall. Use a short canvas section next to the plant to reduce transmission of noise and vibration. The air inlet opening should be located to prevent recirculation of heated air or exhaust fumes, and at least as large in area as the air outlet. If the engine is cooled by the "city water" method, ventilation is seldom a problem, but sufficient air movement and fresh air must be available to properly cool the generator, and to support combustion in the engine.

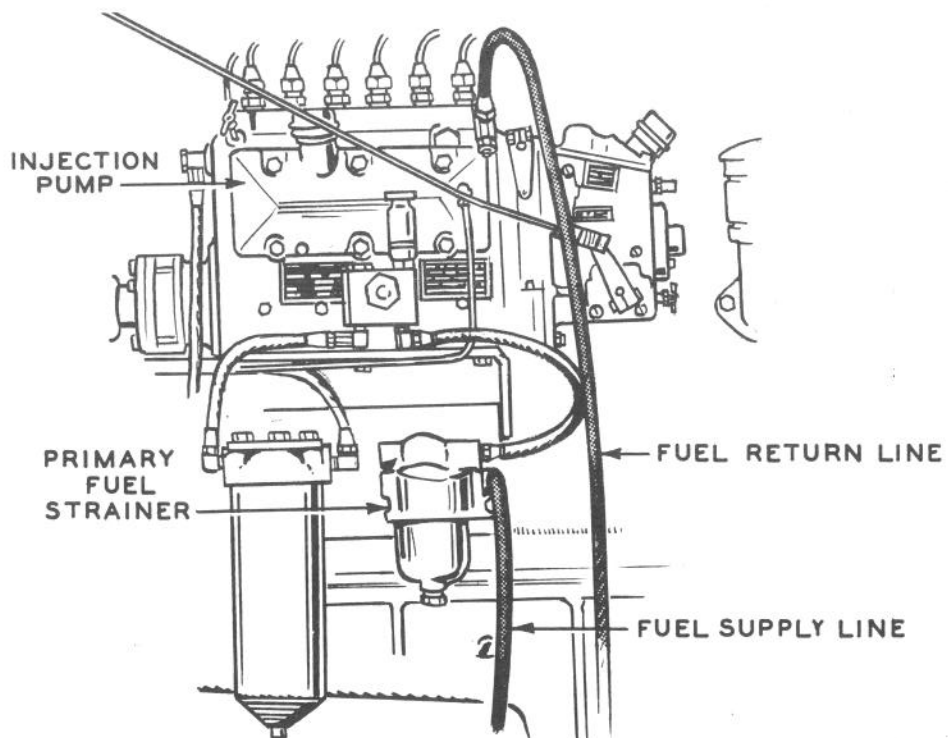
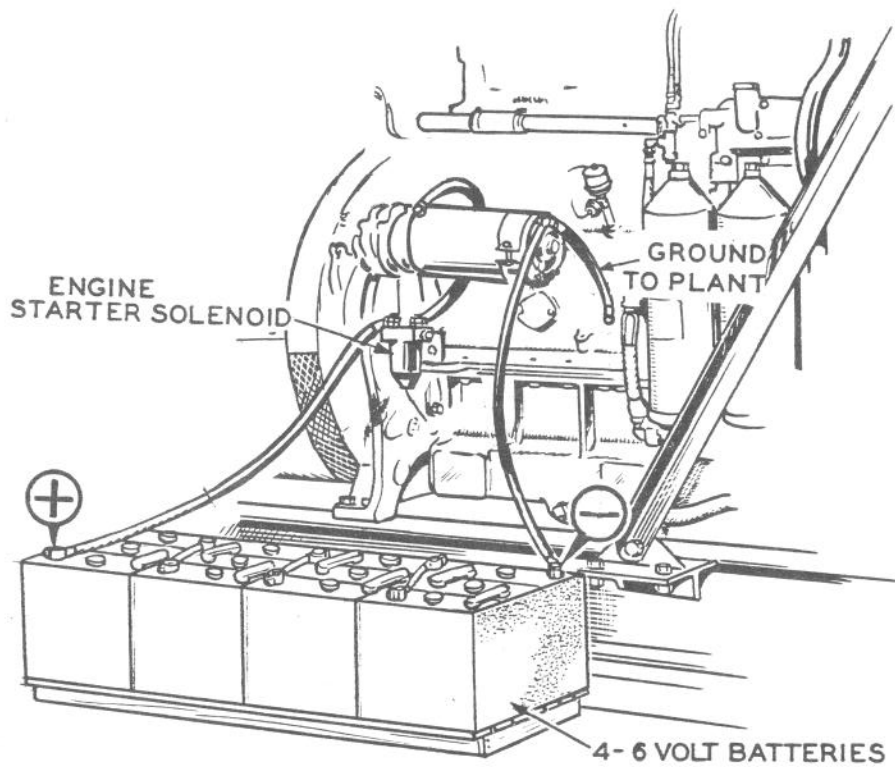
Two types of "city water" cooling modifications are optional. The conventional radiator is not used, and a constantly changing water flow cools the engine.

1. Heat Exchanger. - The heat exchanger cooling system provides a "closed" engine water system. The engine coolant circulates through a tubed chamber. A constant flow of fresh cool water surrounds the cooling tubes and is piped out to a convenient drain. An electrically operated valve (solenoid type) opens the water flow when the plant starts, and shuts off the water flow as the plant stops. The solenoid valve is connected as shown on the engine control wiring diagram. Rate of water flow is controlled by either a hand valve or an optional automatic regulator. If rate of flow is hand adjusted, refer to the water flow table, showing the approximate minimum water required at the loads listed. Use pipe size, for connections, as indicated on the installation outline drawing supplied. Do not use pipe smaller than indicated.

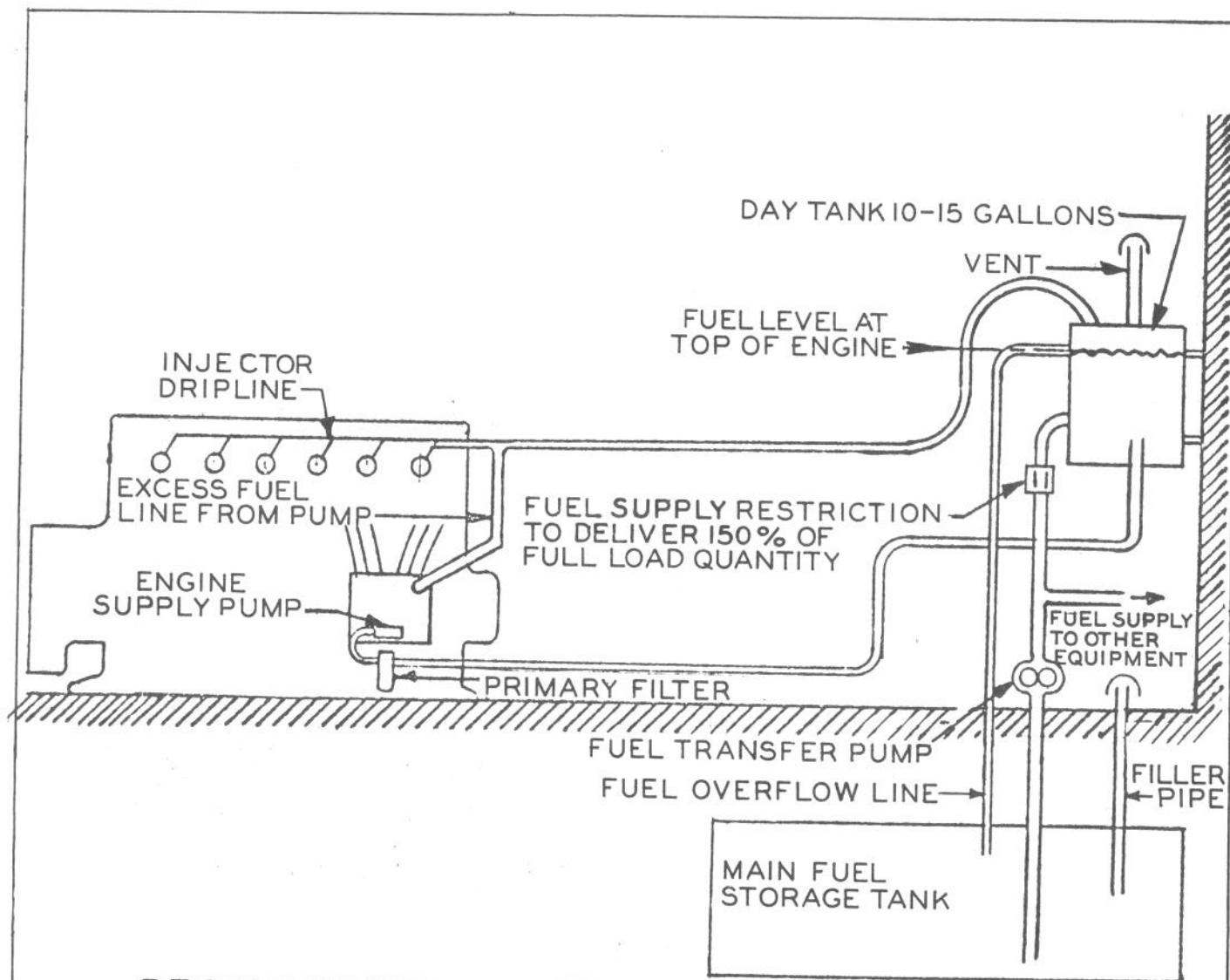
MINIMUM WATER FLOW, HEAT EXCHANGER COOLING

ELECTRICAL LOAD	WATER TEMP.	MIN.FLOW-GAL./MIN.
175 KW	40°F.	57.5
	60°F.	85.
	80°F.	115.
200 KW	40°F.	65.
	60°F.	97.5
	80°F.	130.
230 KW	40°F.	77.
	60°F.	109.
	80°F.	144.

2. Tempering Tank. - The tempering tank (standpipe) system uses a mixing tank - the engine cooling water mixes with the incoming fresh water, and is then piped to a convenient drain. An electrically operated valve (solenoid type) opens the water flow when the plant starts, and shuts off the flow as the plant stops. The solenoid valve is connected as shown on the engine control wiring diagram. Rate of water flow is controlled by either a hand valve or an optional automatic regulator. If the hand valve is used, refer to the water flow table, showing the approximate minimum water required at the loads listed.



INSTALLATION



RECOMMENDED DIESEL FUEL SUPPLY SYSTEM FOR REMOTE MAIN STORAGE TANK AND USING A DAY TANK IN ENGINE ROOM

The Day tank is necessary to prevent loss of prime (dry fuel system) which would result in starting failure..

An alternate method of keeping the pump primed is installation of a solenoid valve near the inlet of the engine supply pump. Wire it to open only for starting and running.

INSTALLATION

MINIMUM WATER FLOW, TEMPERING TANK COOLING

ELECTRICAL LOAD	WATER TEMP.	MIN.FLOW-GAL./MIN.
175 KW	40°F.	13.
	60°F.	22.
	80°F.	28.
200 KW	40°F.	15.
	60°F.	25.
	80°F.	32.5
230 KW	40°F.	17.5
	60°F.	28.5
	80°F.	37.5

EXHAUST. - Pipe the exhaust gases outside any enclosure. A section of flexible pipe is installed between the exhaust outlet and such additional piping as is necessary. Use a 5 inch pipe flange and fittings, increasing the pipe diameter one size for each additional 10 feet in length. Avoid sharp elbow turns - use sweeping type elbows to keep back pressure to a minimum. Be sure to provide adequate support for the exhaust piping, to avoid strain on the supercharger assembly. If the line runs upward for a considerable distance after leaving the plant, install a condensation trap at the low point, with provision for periodic draining. Shield or insulate the line if there is any danger of personnel contact. If the line passes through a combustible wall or partition, the opening should provide for at least 4 inches space between the pipe and nearest point of the opening. Install a suitable muffler.

FUEL CONNECTIONS. - Two fuel line connections are required: a fuel supply line, and a fuel return line. Use flexible sections between the plant connection point and any rigid wall copper tubing. Connect the fuel supply line to the inlet of the primary fuel filter. Use at least 3/8 inch (inside diameter) size tubing for distance of 25 feet or less, 5/8 inch size tubing for greater distance of fuel travel. Vertical lift of fuel can not exceed 12 feet. Connect the fuel return line to the injection pump. Use 5/16 inch tubing.

An underground tank usually has connections at the top, requiring a drop or suction tube extending to within an inch or two of the tank bottom. All supply line connections must be air tight. The return line does not require a drop tube inside the tank.

NOTE

In any diesel installation, fuel system cleanliness is of utmost importance, and can not be over emphasized. Make every effort to prevent entrance of any foreign matter, moisture, etc. Do not use fittings of galvanized material.

BATTERY. - 24 volt battery current is required for starting purposes. Four 6 volt, type 3D batteries are recommended for normal installations. Batteries should be installed on an open wooden platform, to provide air circulation

INSTALLATION

around them. Connect the batteries in series - the negative post of one battery to the positive post of the next battery. Connect the start solenoid cable of the engine starter to the remaining positive battery post. Connect the grounded battery cable to the remaining battery negative post. "Dry" charged batteries require servicing with electrolyte before use. "Wet" batteries may require a freshening charge.

Infrequent use of the plant (as in emergency standby service) may allow the batteries to self discharge to the point where they cannot start the plant in an emergency. If the AC load transfer switch assembly does not include a trickle charge circuit, a separate trickle charger should be connected.

CONTROL CONNECTIONS. - Load transfer and automatic demand controls operate through the plant control to start, control, and stop the plant as demanded by the application. Wiring instructions are in the manuals supplied with these automatic controls. Connections at the remote control terminal block are shown on the plant control wiring diagram. The GND terminal is for a customer-supplied alarm at a remote location to warn of high water temperature, low oil pressure, and overspeed. For plants prior to Spec D, connections are to a 5 place terminal block designated CL1, CL2, B+, GND, and START; CL1 and CL2 are for alarm circuit, B+ is for voltage to the control, GND is for alarm grounding, START is for starting and stopping.

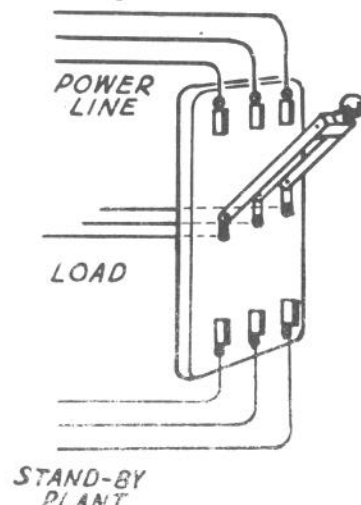
OPTIONAL SIGNALS. - Refer to the engine control wiring diagram furnished. Terminals are provided for connection of a signal light or audible alarm to indicate an emergency stop, or for failure to start automatically. Any such signals, etc. must be rated for 24 volt dc service.

AUXILIARY HEATER. - If the plant is equipped with an optional auxiliary water or oil heater, connect the device to a normally energized power source. Be sure the voltage is correct for the heater rated voltage.

LOAD CONNECTIONS. - Be sure the wiring meets requirements of electrical codes in effect at the installation site. Many local regulations require that the installation be inspected and approved before operation.

If the plant is installed for standby service, a double throw load switch of the proper capacity rating must always be used. This switch (either manual or automatic type) must be connected so that there is no possibility for the generator current to be fed into the normal power source lines, nor for the normal source and generator current to be connected to the load at the same time.

Instructions for connecting an automatic switch (load transfer control) are supplied with such equipment. It is assumed that per-



INSTALLATION

sonnel connecting the generator, and any auxiliary equipment, are fully qualified.

Knock out sections are provided for entrance of load wires to the connection box at the side of the generator. Make connections according to the type of facilities provided. If large terminal posts are provided, make load wire connections directly to the posts. Some plants are "reconnectible" for different voltage (see CAUTION) and have extra leads that are pre-connected for the nameplate rated voltage.

CAUTION

Reconnection, for different output voltage than shown on the plant nameplate, involves also control panel changes - sometimes of a very extensive nature. For specific information, contact the factory. Give the COMPLETE information shown on the Onan nameplate, and indicate the desired NEW voltage.

1. Preliminary Connections. - Each individual lead is labeled, T1 through T12.
Leads are combined into groups of 2 or more as indicated on the output control wiring diagram provided. Some lead groups are further identified for load wire connections. Thus on a 4 wire, 3 phase plant, there may be a group of 12 leads identified as T0 for the load neutral wire connection. Other groups will be identified in a similar manner.
 - a. Use commercially available cable connectors to connect the leads of each group.
 - b. See that the small leads (transformer, etc.) are connected to the ground post inside the connection box.
 - c. Select each generator lead group that is to be connected to a load wire. Connect the load wires to the proper generator wire group, as shown on the output wiring diagram. Typical connection diagrams are shown below.
 - d. If a "T0" (neutral) wire group is used, note that one wire of the group connects to the ground post in the connection box.
 - e. Tape or otherwise insulate each connection. Such insulation must be at least equal to the original wire insulation.

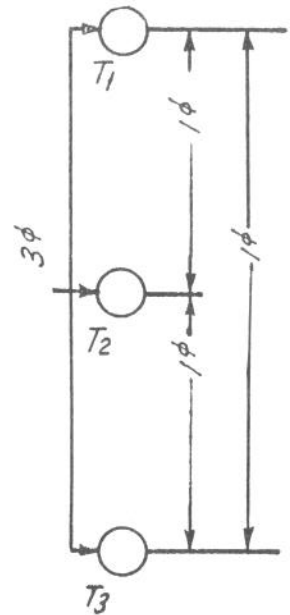
INSTALLATION

3 PHASE, 3 WIRE PLANT

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

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

If both single phase and three phase current are to be used at the same time, use care not to overload any one circuit. Subtract the amount of the 3 phase load from the rated capacity of the plant. Divide the remainder by 3, and this is the maximum load that can be taken from any one circuit for single phase current use.

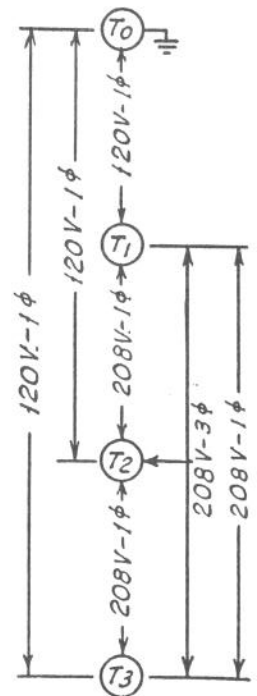


3 PHASE, 4 WIRE WYE -CONNECTED PLANT (120/208 volt example shown)

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", "T3". Three separate single phase circuits are thus available. Do not attempt to take more than 1/3 the rated capacity of the plant from any one circuit. Balance the load as closely as possible between the three circuits.

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

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



INSTALLATION

3 PHASE, 4 WIRE, DELTA-CONNECTED PLANT (120/240 volt example shown)

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

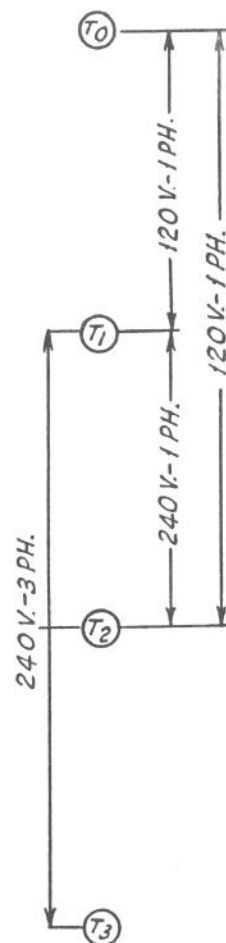
The load terminals are marked T1, T2, T3 and T0. The T0 terminal is the generator center tap between T1, and T2. The T0 terminal of the generator is not grounded.

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

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

For 1 phase, 3 wire operation, terminals T1 and T2 are the "hot" terminals; the T0 terminal is the neutral (which can be grounded if desired).

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



PREPARATION

CRANKCASE OIL. - Refer to the SERVICE section of the Waukesha operators' manual. The engine manufacturer recommends the use of oil designated as "Series 3". Most oil suppliers market such an oil, designated as "DS", for heavy truck service. Fill the crankcase before starting the engine.

The capacity of the oil pan is 8 U.S. gallons. However, an extra 4-1/2 gallons may be required for the oil filters. Check the level after a few minutes of the initial run.

Follow the engine manufacturer's recommendations for selecting the oil viscosity. A special thermometer is installed on the engine for guidance in selecting the oil viscosity. Do not mix brands, nor grades of the same brand, of lubricating oil.

INJECTION PUMP AND GOVERNOR OIL. - See that the injection pump case is properly filled with 1/2 pint of lubricating oil. See that the governor case is filled with 1/4 pint of oil. Use the same type of oil as used in the engine crankcase.

AIR CLEANER. - Fill the air cleaners to the level indicated with oil of the same viscosity as that used in the crankcase. However, a non-detergent (straight mineral) oil can be used.

COOLANT. - For units which use either a radiator or heat exchanger (city water cooled), fill the cooling system with clean soft water. The standard radiator and block capacity is 28 U.S. gallons. Use a good rust and scale inhibitor. If there is any possibility of a radiator cooled plant being exposed to freezing temperatures, use antifreeze solution in the proper proportion. On the initial run, check the coolant level several times and add liquid if necessary to compensate for any air pockets which may have formed during filling.

If the plant is equipped for "city" water cooling, see that the water supply is turned on.

FUEL. - Refer to the Service section of the Waukesha engine manual. Check with the fuel supplier for assurance that the fuel supplied meets the specifications. Make every effort to keep the fuel clean.

FUEL OIL SPECIFICATIONS

Viscosity, Saybolt at 100°F.	30-50 seconds
Residue after open cup combustion	2% maximum
Sulphur	0.7% maximum
Water and sediment	0.5% maximum
Cetane number	45 minimum
Cold test - 0°F. or at least 10°F. below the lowest ambient temperature.	

OPERATION

PRELIMINARY. - On the initial run, or if the fuel system has been opened for servicing, it is necessary to "bleed" the fuel system. Bleeder vents are provided on the secondary and final fuel filters, and on the injection pump. Use the hand primer to purge the fuel system of all air. Be sure all bleeder vents are closed when through bleeding.

STARTING. - During the initial run have the field circuit breaker OFF so the unit can run at no load. To start the unit, move the run-stop switch to the RUN position and leave it there. The unit will run as long as the switch is at that position. The cranking motor will be disconnected by the start disconnect relay when the engine comes up to speed. If the unit fails to start within about 10 seconds, the cycle cranking relay will interrupt cranking for about 10 seconds, and then the unit will automatically crank again.

The standard engine is designed for normal starting in temperatures of 50°F. or higher. Optional equipment is available if operation in lower temperatures is required.

CHECKING OPERATION. - As soon as the engine starts, check the oil pressure gauge and the battery charge ammeter. As the engine warms up, check the water temperature gauge. When the engine reaches operating temperature, as indicated by the oil pressure and water temperature gauges, energize the generator by moving the field circuit breaker to ON. Then check the voltmeter for the correct output voltage. A voltage adjustment of 5% can be made with the rheostat on the control panel. If a voltage adjustment is necessary, wait until the voltage remains at a stable level. Should the voltage tend to wander from the stable point, a governor sensitivity adjustment may be required. Operating instructions for a line transfer or an automatic demand control are in separate manuals.

WATER FLOW. - If the plant is city water (pressure) cooled, but without the optional flow regulator, check the rate of water flow. At installation, an adjustable valve was connected in the water supply line. With the key provided, adjust the valve to provide a flow of water sufficient to keep the water temperature gauge reading within the range of 165°F. to 185°F. Excessive water flow is wasteful and expensive - too little flow will cause a rise in coolant temperature and automatic shut down by the high temperature safety switch. To avoid unauthorized tampering after proper adjustment, remove and store the adjusting key.

STOPPING. - If operating conditions permit, disconnect the electrical load and allow the plant to run at no load to prevent an excessive temperature rise. To stop the plant, move the run-stop switch to the STOP position.

NORMAL OPERATING FUNCTIONS

SAFETY STOPPING DEVICES. - In addition to the ac circuit breaker (which does not stop the plant) the plant is equipped with several safety devices that stop the engine under conditions that could cause severe damage.

OPERATION

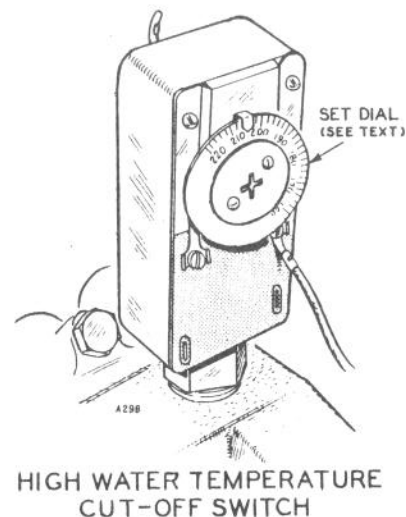
NOTE

If one of the safety stopping devices operates to stop the plant the Emergency Latch Relay PUSH TO RESET button must be reset before the plant can be restarted.

1. Low Oil Pressure Cut-Off. - A pressure operated switch mounted on the engine stops the plant if the engine oil pressure drops dangerously low. The switch is not adjustable.
2. Over Speed Cut-Off. - A centrifugal weight type switch is attached to the outer end of the generator shaft and is not adjustable. The switch operates to stop the plant if the engine speed should accidentally rise 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, the plant still shuts down, the switch may not be operating properly. Do not attempt to adjust the switch, replace with a new one.

3. High Water Temperature Cut-Off. - Early models have an adjustable thermostatic cut-off switch. Late models have a non-adjustable thermostatic cut-off switch. Both types of switches cause the engine to stop in a high water temperature condition. Water temperature must drop 10°F. before the engine can be restarted.



The dial setting should be set several degrees below the boiling point of the coolant used.

Lower the setting 3 degrees F. for each 1000 feet above sea level. Do not set the switch to operate at a temperature so low as to shut off the plant before it reaches operating temperature.

OIL PRESSURE. - The oil pressure gauge indicates the engine oil pressure while the engine is running. Normal oil pressure at operating temperature is within a range of 30 - 75 psi. Pressure will be high until the engine warms up.

ENGINE OIL TEMPERATURE. - The engine is equipped with a special thermometer for checking the oil temperature during operation, for guidance in the choice of oil viscosity. Refer to the Waukesha manual.

OPERATION

WATER TEMPERATURE. - The panel water temperature gauge indicates the coolant temperature during operation. Normal operating temperature is 165°F. to 185°F.

CHARGE AMMETER. - The small dc ammeter indicates the battery charging current. An automatic regulator controls the charge rate, and it will vary according to the charge condition of the battery. The charge rate will be comparatively high when the plant first starts, but should fall to almost zero as the battery becomes fully charged.

EMERGENCY LATCH RELAY. - The emergency latch relay is energized by battery voltage when a ground is provided by one of the engine safety devices. A red light comes on and a button protrudes from the control panel to indicate a latched relay.

RUN-STOP SWITCH. - A SPDT, center off switch, it functions as a manual control for starting and stopping and as a selector when a switch is installed for remote control.

If the plant is to be controlled by an automatic line transfer control, or from a remote manual switch point, leave the panel switch at its STOP-AUTO. position.

METER SELECTOR SWITCH. - The selector switch handle position indicates which phase of the generator output is indicated on the ac voltmeter and ammeter. Turn the handle to the desired position.

VOLTAGE ADJUSTMENT RHEOSTAT. - The voltage adjustment rheostat provides for adjusting the ac output voltage under normal operation conditions. Turn clockwise to increase the voltage - counterclockwise to decrease the voltage. The rheostat provides for approximately plus or minus 5% adjustment.

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.

FREQUENCY METER. - The frequency meter indicates the frequency of the output current in cycles per second. A vibrating reed indicator shows the exact frequency.

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 service, etc.

AC AMMETER. - The ac ammeter indicates the amount of load connected to the phase indicated by the selector switch position.

OPERATION

AC VOLTMETER. - The ac voltmeter indicates the voltage of the same phase as the amperage shown. On a four wire, three phase model, the voltage shown will always be the three phase (higher) nameplate voltage.

TACHOMETER (Optional). - The tachometer indicates the engine operating speed in revolutions per minute.

EXERCISE PERIOD. - If the plant is used infrequently, as in standby service, start and operate at least once a week. Operate long enough (15 to 30 minutes) to thoroughly warm up the engine. This will help to keep oil distributed on engine parts, fuel system full, etc., and promotes easier starting and longer engine life.

BATTERY, HOT LOCATION. - Batteries will self discharge very quickly when installed where 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 is reduced slightly when the electrolyte is so diluted, but if the temperature is above 90°F. this should not be noticed. 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 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 twice is sufficient.

PERIODIC SERVICE

GENERAL. - Follow a definite schedule of inspection and servicing. Use the running time meter to keep a written record of service operations performed. Service periods are based on normal service and operating conditions. For continuous heavy duty, extreme temperatures, etc., service more frequently. For light duty, infrequent use, etc., service periods can be lengthened accordingly.

ENGINE. - Refer to the Waukesha engine manual "Service" section for details of service operations. Note particularly that a separate oil filter is used in connection with the supercharger. A schedule of inspections is given in the "Operation" section of the Waukesha manual. Do not neglect any of the lubricating points.

- Crankcase oil
- Injection pump oil
- Governor oil
- Battery charging generator (sparingly)
- Starter (sparingly)
- Air cleaners
- Water pump
- Fan hub

Note that the Waukesha engine is a turbosupercharged model. A special section toward the back of the Waukesha manual is devoted to the turbocharger. However, the turbocharger supplied is not the same as described, although the general principles apply. If specific information for the turbocharger is required, consult the engine manufacturer.

BATTERIES. - Check the condition of the starting batteries at least every two weeks. See that connections are clean and tight. A light coating of grease or asphalt paint will retard corrosion at terminals. Keep the electrolyte at the proper level above the plates by adding only clean water that is satisfactory for battery use. See that the batteries are kept in a satisfactory charge condition.

AC GENERATOR. - The ac generator normally requires very little servicing. However, periodic inspection, to coincide with engine oil changes, will assure continued good performance.

It is normal for the slip rings to acquire a dark brown glossy surface. Do not attempt to maintain a bright metallic appearance. Clean only with a dry, lint free, hard finish cloth. Any slight roughness can be remedied by lightly sanding with #00 sandpaper.

Never lubricate brushes. Refer to Generator Maintenance.

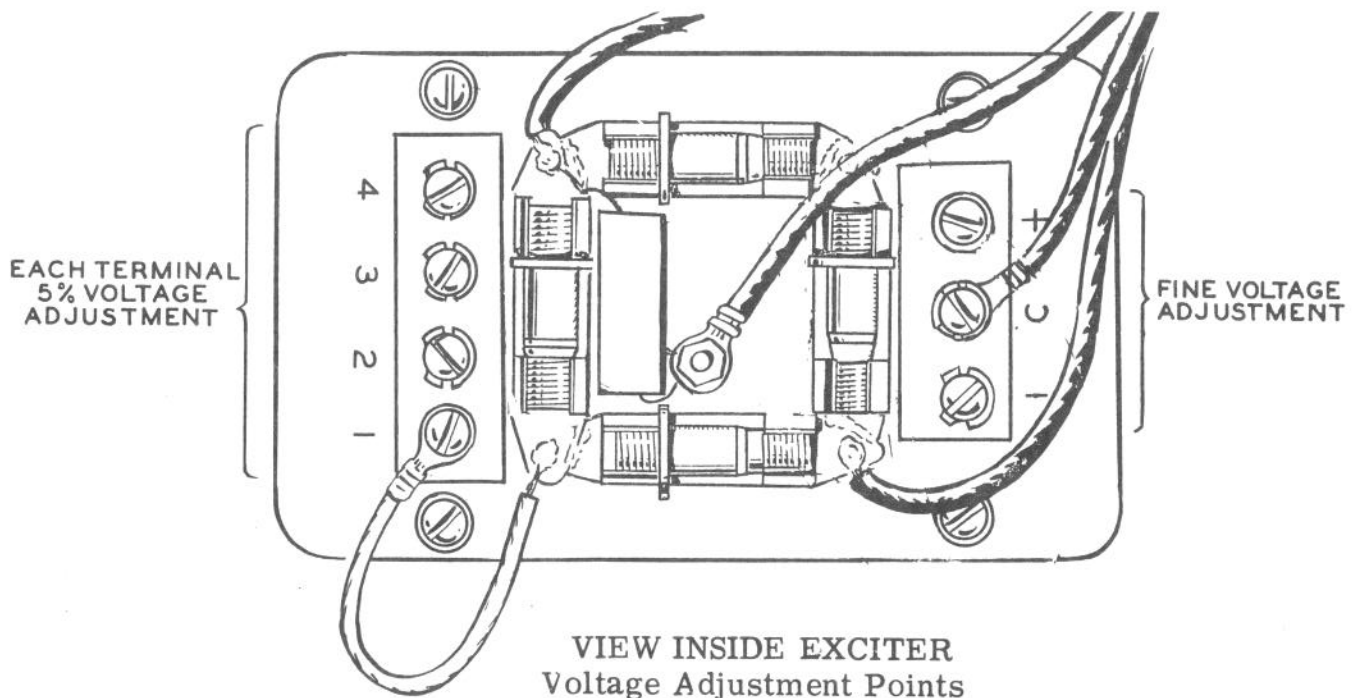
The generator bearing is pre-lubricated and sealed. It requires no additional lubrication during its service life.

ADJUSTMENTS

GOVERNOR. - Basic principles of governor adjustment are given in the engine manual. The purpose of the governor is to control the engine speed, under various load conditions, to keep the generator output current stable.

The governor should control the engine speed so that the frequency at full load is within 2 to 3 cycles of the no load frequency. A momentary surge beyond the 3 cycle limit is normal when the load is changed, but the frequency should stabilize within a few seconds. Normal frequency at no load is approximately 61 cycles for a 60 cycle plant, but may be as high as 63 cycles if necessary to obtain the correct voltage. The frequency at full load should not drop below 59 cycles.

OUTPUT VOLTAGE, PLANTS PRIOR TO SPEC. LETTER C. - Ordinarily, if the governor is properly adjusted, the output voltage will be correct. The exciter was connected for rated output during the factory test run. However, minor voltage adjustments are possible by changing exciter connections. Refer to the illustration.



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.

ADJUSTMENTS

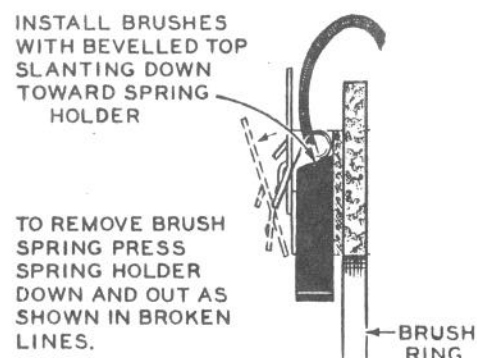
3. Note that one lead is connected to a 3 place terminal block marked +, C, and -. By moving the lead connection from the C terminal to the + terminal, output voltage will be raised approximately 3%. Moving to the - terminal will lower the voltage by a like amount.
4. If a greater adjustment is necessary, note a second lead connected to a terminal block marked 1, 2, 3 and 4. By moving the lead to an adjacent terminal (2 to 3), etc.) voltage will be changed approximately 5%. After making such a change, start the plant and check the voltage. It may be necessary to readjust the "fine" voltage adjustment as described in step 3.

MAINTENANCE

GENERATOR MAINTENANCE. - The generator normally requires little maintenance other than the periodic servicing. Inspection during periodic servicing should indicate when the slip ring brushes must be replaced.

To examine the brushes, brush springs, and slip rings, remove the exciter cover. Note that the exciter assembly mounts on a hinged plate. Remove the screws from the left side of the exciter plate and swing the assembly outward. Openings in the alternator end bell permit access to the brush rig.

Brushes should be replaced when worn to approximately 1/2 inch long, or so that the top of the brush is below a point midway between the outer and inner end of its guide. 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. 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 replacement.



BRUSH SPRING REMOVAL

The generator bearing is pre-lubricated and sealed. It requires no servicing.

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.

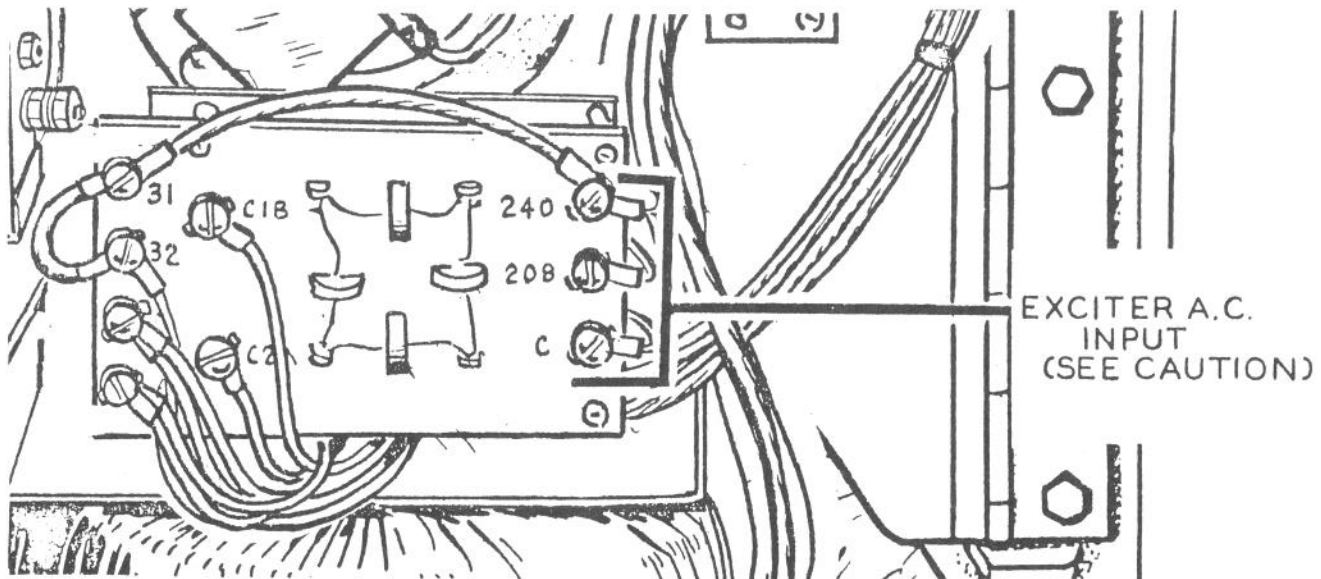
1. Temporarily disconnect leads E1, E2, AF1, and AF2 from the terminal block. Connect a substitute ac power source, such as the normal line voltage. Be sure the substitute power source is the correct voltage, as indicated on the exciter wiring diagram. For example, do not connect 480 volt current directly to the E1 and E2 exciter terminals. **CAUTION - Limit test voltage application to one minute or less.**

If there is no dc voltage at terminals AF1 and AF2 with an independent power source connected to exciter terminals E1 and E2, the exciter is not functioning.

MAINTENANCE

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.



2. No component or terminal of the exciter should show a grounded circuit.
3. If dc voltage is present at terminals AF1 and AF2 in step 1 above, check the alternator for grounds, opens, etc.
4. Connect exciter leads. 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 the test.

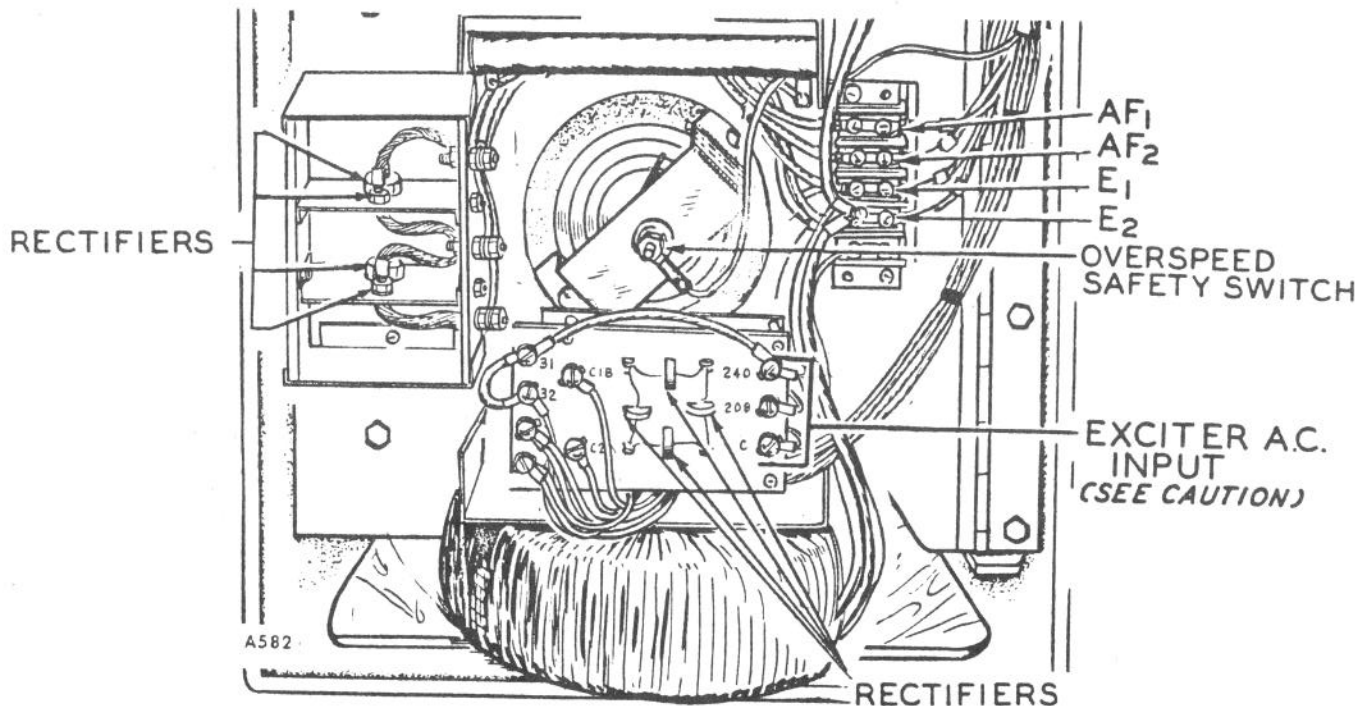
NOTE

Note carefully the DIRECTION OF MOUNTING of any rectifier removed. It must be remounted in its original direction. Use extreme care not to over-heat a rectifier if working on a soldered connection.

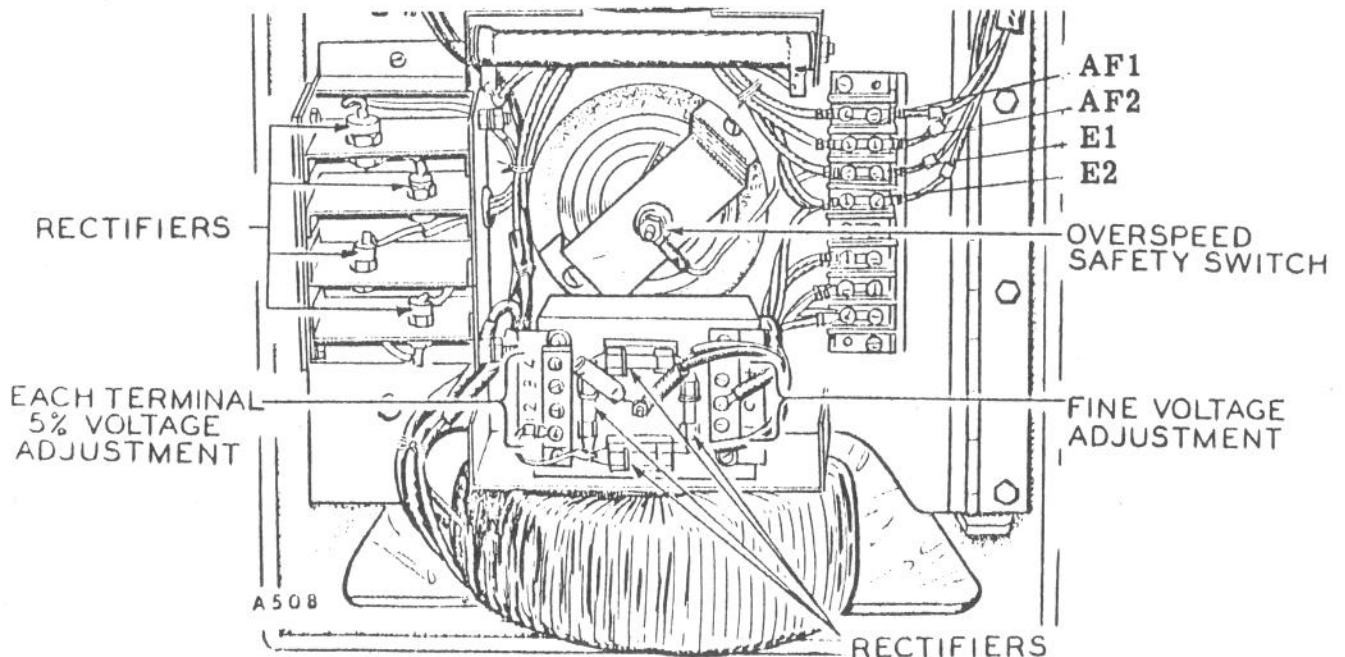
- a. Connect the ohmmeter across the rectifier contacts and obtain the meter reading.

MAINTENANCE

- b. Reverse the ohmmeter-rectifier 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. If both readings are low, or if both indicate an "open" circuit, replace the rectifier with a new part.



BEGINNING SPEC. LETTER B



PLANT SPEC. LETTER "A" ONLY

MAINTENANCE

RECONNECTIBLE POSSIBILITIES. -

The "reconnectible generator" is designed to provide for conversion to a different type of output than the original nameplate rated output voltage.

The generator may be one of three basic types "2X", "5X", or "6X", referring to a portion of the "generator data no." stamped on the plant nameplate. For example: 200UK2XN1A, 200UK5XN1A, or 200UK6XN1A. Each basic type can be reconnected to deliver the alternate voltages shown in the following table.

CAUTION

Reconnection, for different output voltage than shown on the plant nameplate, involves also control panel changes, sometimes of an extensive nature. For a basic "2X" type generator, a change in the exciter circuit may also be necessary. For specific information, contact the factory. Give the COMPLETE information shown on the Onan nameplate, and indicate the desired NEW voltage.

GENERATORS RECONNECTIBLE ONLY AS SHOWN

TYPE "2X"	TYPE "5X"	TYPE "6X"
120/208 - 3 ph, 4 wire	240/416 - 3 ph, 4 wire	277/480 - 3 ph, 4 wire
240/416 - 3 ph, 4 wire	240 - 3 ph, 3 wire*	138/240 - 3 ph, 4 wire
120/240 - 3 ph, 4 wire*	240/480 - 3 ph, 4 wire*	240/416 - 3 ph, 4 wire
240/480 - 1 ph, 3 wire		
220/380 - 3 ph, 4 wire		

* - Delta connection

INSTRUCTIONS FOR ORDERING REPAIR PARTS

ONAN PARTS

All parts in this list are ONAN parts. For ONAN parts or service, contact the dealer from whom you purchased this equipment or 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 upper right side of the Fly-wheel Housing. Always give the complete:

ELECTRIC Onan PLANT

MODEL AND SPECIFICATION _____ SERIAL NO. _____

IMPORTANT MENTION ABOVE NUMBERS AND GEN. DATA NO. WHEN ORDERING PARTS OR WRITING ABOUT THIS PLANT.

RATINGS AT SEA LEVEL BASED ON FUEL CHECKED BELOW:

GASOLINE ☐ DIESEL FUEL ☐

STAND BY KW KVA AMPS

CONTINUOUS KW KVA AMPS

A.C. VOLTS CYCLES PHASE P.F.

EXCITER GEN. DATA

R.P.M. USE VOLT BATTERY-NEGATIVE GROUND

MANUFACTURED BY
ONAN

MINNEAPOLIS, 14, MINNESOTA MADE IN U.S.A.

MODEL & SPEC. NO.
and
SERIAL NO.

WAUKESHA PARTS

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:

DIESEL ENGINE

Waukesha MOTOR

MODEL _____ SIZE _____

SERIAL _____ LOT _____ SPEC. _____

GOV'N'D SPEED _____ SET VALVES COLD INT ☐ EXH ☐

OIL SPEC SAE NO. WINTER ☐ SUMMER ☐ SPARK ADV ☐ DEG. AT R.P.M.

WAUKESHA MOTOR COMPANY WAUKESHA, WISCONSIN

MADE IN U.S.A.

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

PARTS CATALOG

DWF SERIES

This parts catalog applies to the standard ONAN DWF Series electric generating plants. They are powered by a Waukesha Model F1197DSU engine which is more completely described in the Waukesha Operator's Manual. Basically, the engine is a 6 cylinder, water cooled, supercharged diesel (compression ignition) type. The cylinder bore is 6-1/4 inches, piston stroke is 6-1/2 inches, and displacement is 1197 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.

"Right" and "Left" sides of the Generator and Control 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 numbers 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 the list, such as voltage, phase, etc. 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 DATA TABLE.

PLANT DATA TABLE

MODEL & SPEC. NO.†	ELECTRICAL DATA				
	WATTS	VOLTS	CYCLES	PHASE	WIRE
200DWF-4R/	200, 000	120/208	60	3	4
200DWF-5DR/▲	200, 000	120/240	60	3	4
200DWF-6R/	200, 000	480	60	3	3
230DWF-4R/	230, 000	120/208	60	3	4
230DWF-4XR/	230, 000	277/480	60	3	4
230DWF-5DR/▲	230, 000	120/240	60	3	4
230DWF-6R/	230, 000	480	60	3	3
230DWF-7R/	230, 000	220/380	60	3	4
230DWF-9R/	230, 000	600	60	3	3

† - 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.

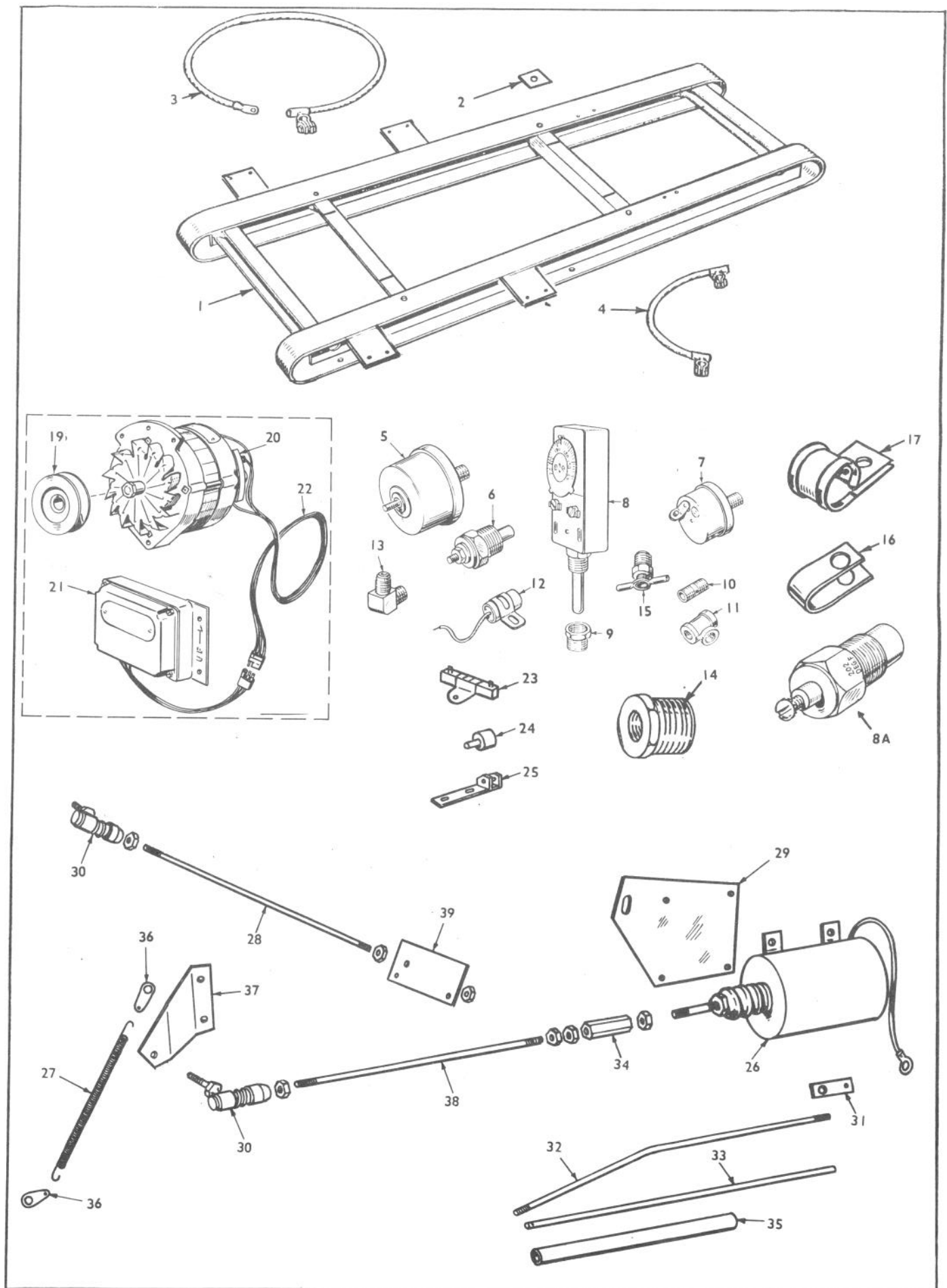


FIG. 1 - MISCELLANEOUS ENGINE PARTS GROUP

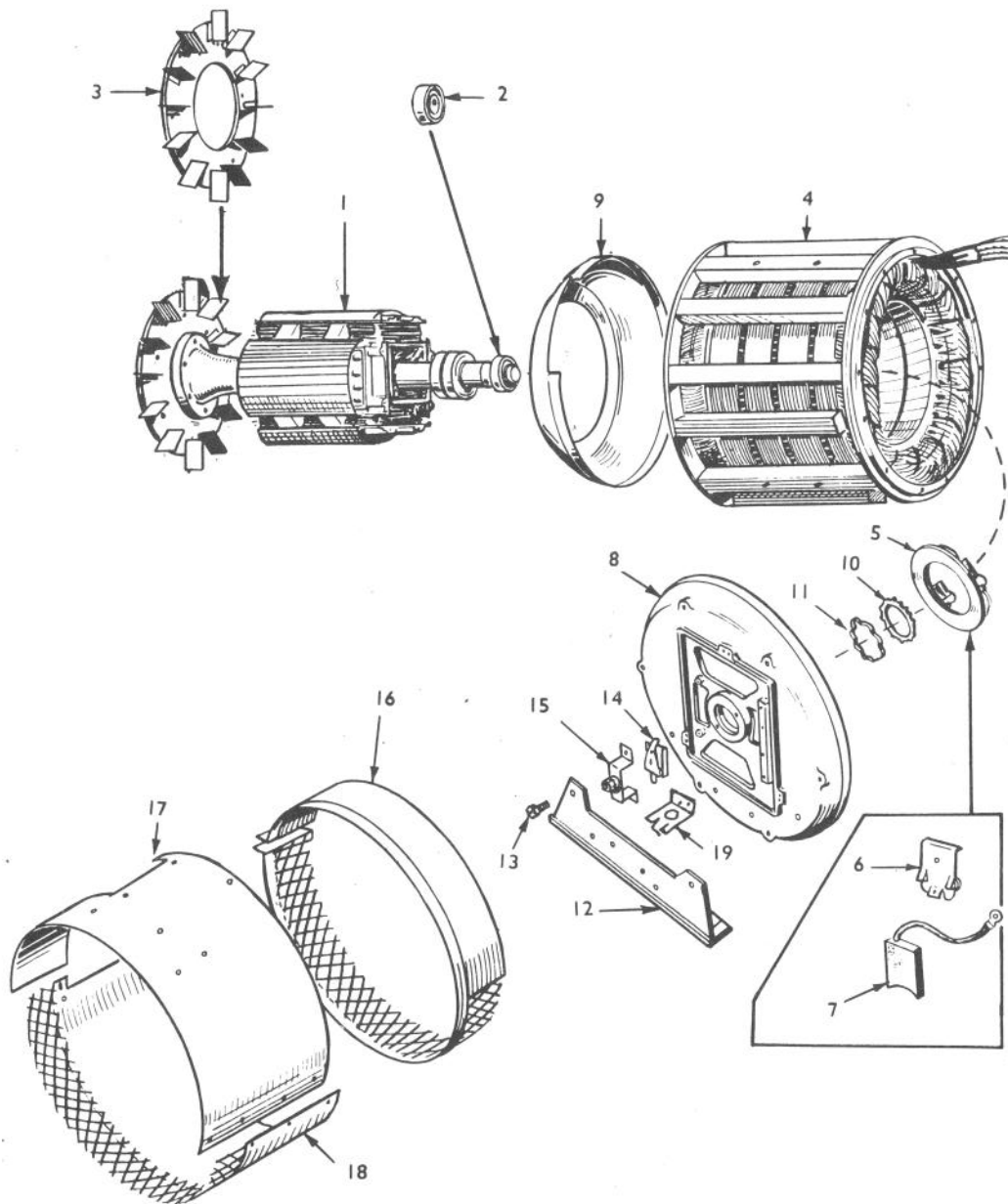


FIG. 2 - GENERATOR GROUP - Alternator Portion

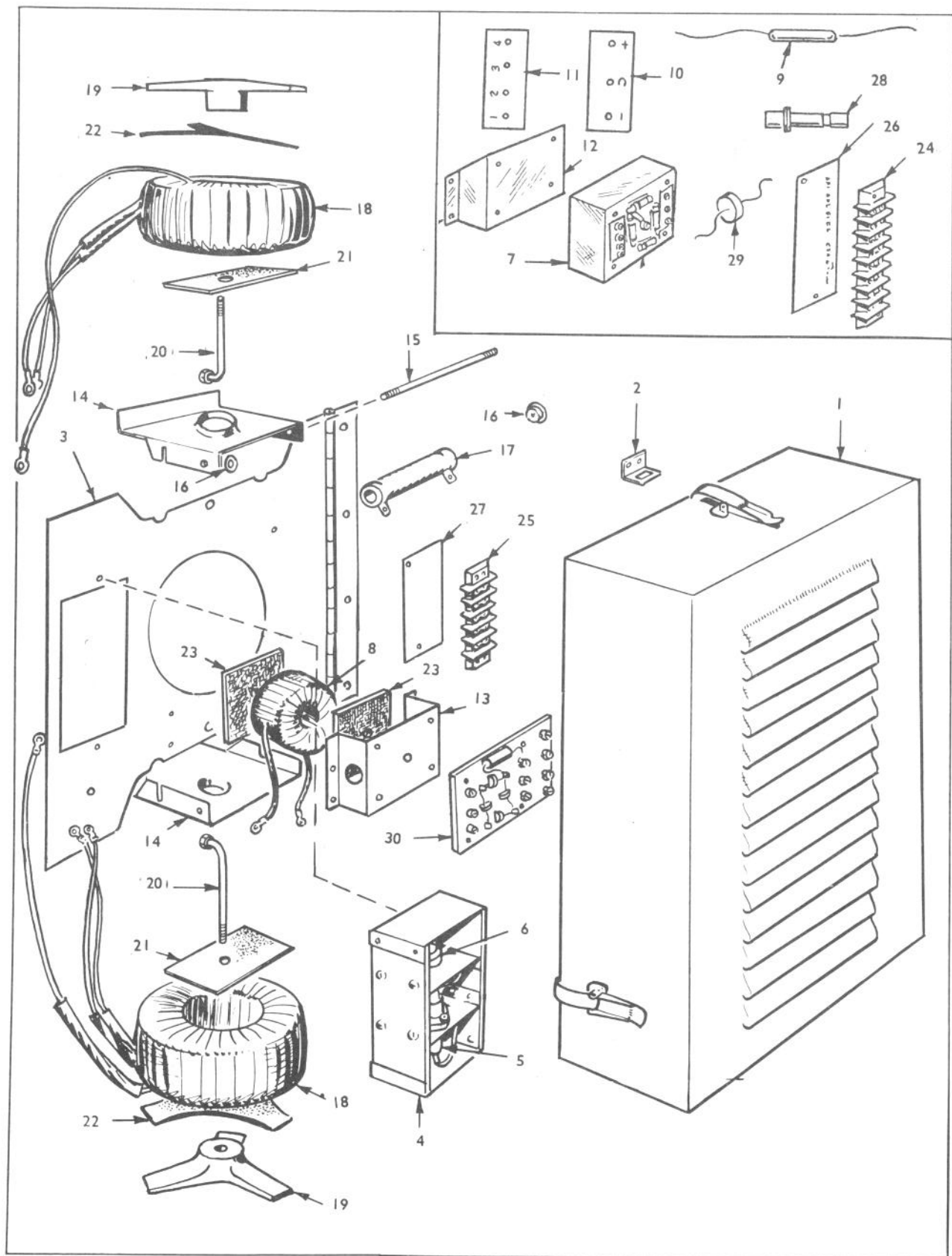


FIG. 3 - GENERATOR GROUP - Exciter Portion

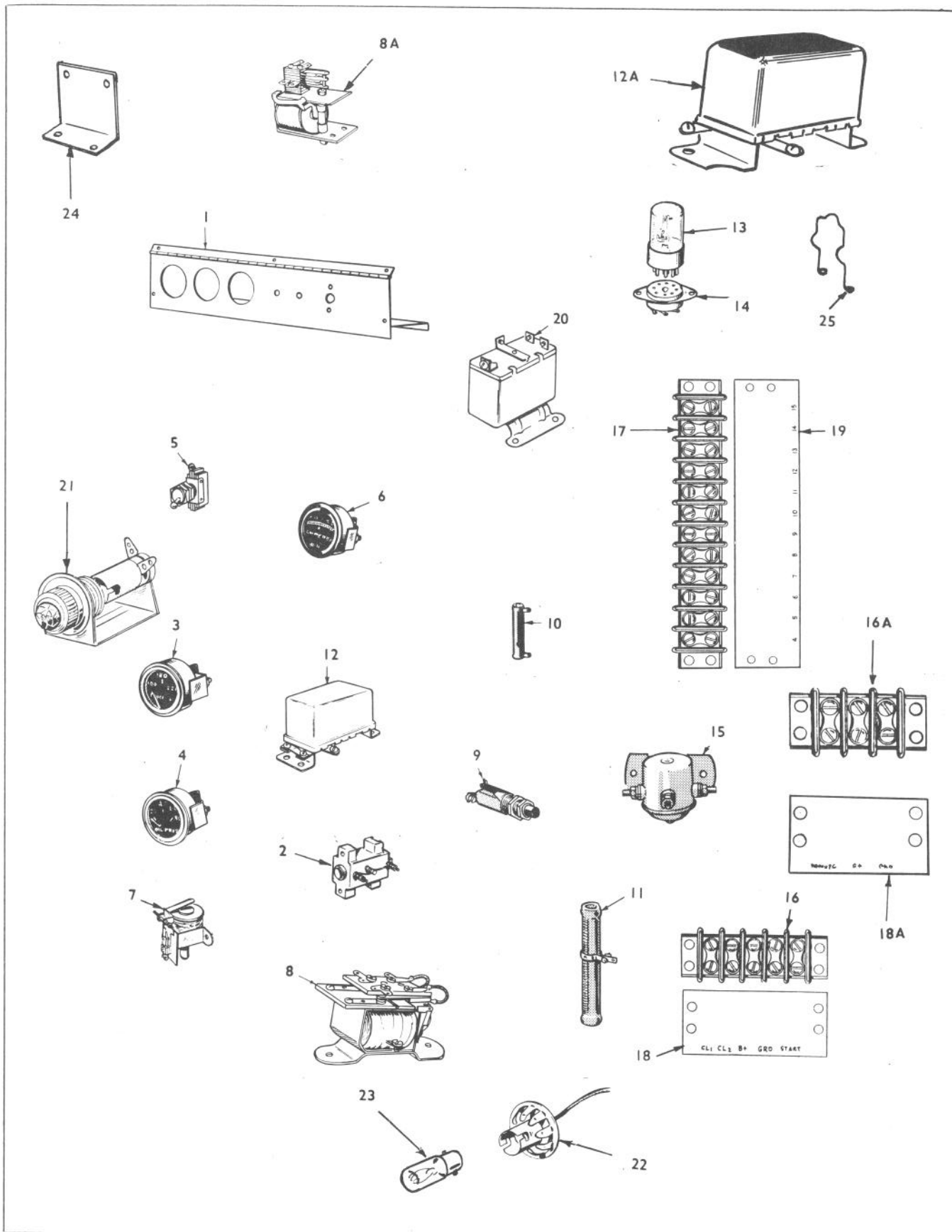


FIG. 4 - CONTROL GROUP - Engine Instruments Portion

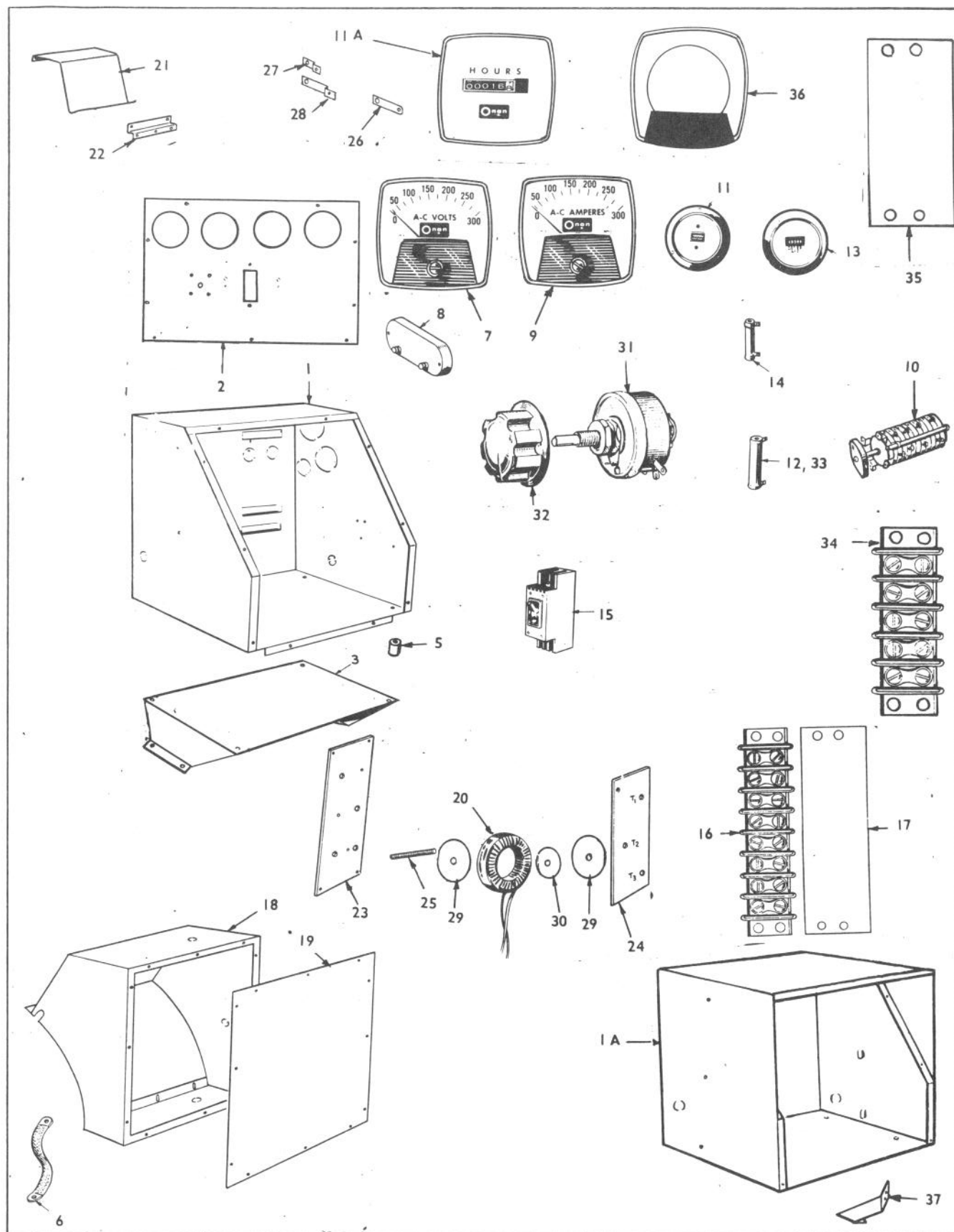


FIG. 5 - CONTROL GROUP - AC Output Portion

PARTS LIST

REF. NO.	PART NO.	QUANT. USED	DESCRIPTION
REPLACEMENT ENGINE			
100P624	1		Engine, Replacement (Waukesha Motor Company Model F1197DSU) General description: <u>Includes</u> - Complete Cylinder Block; Air Cleaner; Fuel Filter; Oil Filter; Starter; Charge Generator & Voltage Regulator; Governor; Radiator; Water Pump; Fan Blades & Belt; Fan Guard; Oil Cooler; Flywheel Housing; Engine Supports ; Alternator Mounting Brackets; and Water Cooled Exhaust Manifold <u>Excludes</u> - Starter Solenoid; Water Temperatur & Oil Pressure Gauge Senders; Fuel Shut off Solenoid; and Mounting Base.
FIG. 1 - MISCELLANEOUS ENGINE PARTS GROUP			
1	403C575	1	Base, Mounting.
2			Shim, Generator to Mounting Base.
	232A1489	2	No. 16 Gauge (.0598).
	232A1490	2	No. 20 Gauge (.0359).
3			Cable, Battery.
	416A444	1	Positive.
	416A445	1	Negative.
4	416A446	3	Cable, Battery Jumper.
5	193A98	1	Sender, Oil Pressure Gauge (Engine Sending unit only).
6	193A100	1	Sender, Water Temperature Gauge (Engine Sending Unit Only).
7	309B64	1	Switch, Oil Pressure.
8	309B1	1	Switch, High Water Temperature Cut-Off - Adjustable - Use 309A146
8A	309B178	1	Switch, High Water Temperature Cut-Off - Non - Adjustable - Replaces 309B1.
9	505-19	2	Bushing, Pipe Reducer (1/2 x 3/8") High Water Temperature Switch (1), Water Temperature Gauge Sender (1).
10	505-98	1	Nipple, Close (1/8 x 3/4") Oil Pressure Tee Mounting.
11	505-59	1	Tee, Pipe (1/8") Oil Pressure Switch and Oil Gauge Sender Mounting.
12	312A58	2	Condenser - .1Mfd. (1) Charge Generator, (1) Charge Regulator - Replaces 312A15.
13	502-218	1	Elbow, Male (5/8 x 1/2") Brass - Fuel Inlet to Injection Pump.
14	505-131	1	Bushing, Pipe Reducer (3/4 x 3/8") Radiator Outlet to Drain Valve.
15			Valve Drain.
	504-28	1	Radiator Drain.
	504-3	1	Cylinder Water Jacket Drain.

PARTS LIST

REF. NO.	PART NO.	QUANT. USED	DESCRIPTION
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FIG. 1 - MISCELLANEOUS ENGINE PARTS GROUP

16, 17			Clip, Harness - Engine Control Connections.
16	416A96	3	"U" Shaped - All Metal.
17	332-49	2	"O" Shaped - Metal with rubber insulator.
19	191B649	1	Pulley, Alternator - Begin Spec "F".
20	191D549	1	Alternator, Battery Charging (With Fan) - Begin Spec "F".
21	191C548	1	Regulator, Charging - Begin Spec "F".
22	191B544	1	Harness, Wiring - Alternator to Regulator - Begin Spec "F".
23	191C550	1	Resistor, Alternator (300 Ohm) - Begin Spec "F".
24	232A1813	1	Spacer, Alternator Mtg. - Begin Spec "F".
25	191B690	1	Bracket, Alternator Mtg. - Begin Spec "F".
26	307P478	1	Solenoid, Fuel Shut-Off.
27			Spring, Fuel Shut-Off.
	149A738		Prior to Spec "F".
	149A1126	1	Begin Spec "F".
28	520A590	1	Stud, Adjusting - Fuel Shut-Off
29			Bracket, Solenoid Mounting -
	145A190	1	Prior to Spec "F".
	306B219	1	Begin Spec "F".
30	150A638	2	Joint, Ball - Fuel Shut-Off
31	147A110	1	Clip, Fuel Shut-Off Spring - Prior to Spec "F".
32	147A109	1	Rod, Fuel Shut-Off - Prior to Spec "F".
33	147A111	1	Stud, Fuel Shut-Off - Prior to Spec "F".
34	147A112	1	Nut, Adjusting - Full Shut-Off
35	159A736	1	Spacer, Fuel Shut-Off Spring Stud -
			Prior to Spec "F".
36	149A118	2	Arm, Fuel Shut-Off Spring - Begin Spec "F".
37	150A1152	1	Bracket, Fuel Shut-Off Arm Mounting - Begin Spec "F".
38	520A666	1	Stud, Fuel Shut-Off Solenoid to Injection pump - Begin Spec "F".
39	301A1772	1	Bracket, Fuel Shut - Off Adjusting Stud - Begin Spec "F".

FIG. 2 - GENERATOR GROUP (Alternator Portion)

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

1	★	1	Rotor Assembly, Wound - Includes Bearing, Blower and Drive Assembly
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PARTS LIST

REF. NO.	PART NO.	QUANT. USED	DESCRIPTION
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FIG. 2 - GENERATOR GROUP (Alternator Portion)

2	510P63	1	Bearing Spec A only
	510P88	1	Begin Spec B
3	205C61	1	Blower
4	★	1	Stator Assembly, Wound
5	212C248	1	Rig Assembly, Brush - Includes Brushes & Springs
6	212B1105	4	Spring Brush
7	214A56	4	Brush
8	211D153	1	*Bell, End - Alternator to Exciter
9	234D69	1	Baffle, Air
10			Holder, Bearing - Anti-Rotation
	232A1187	1	Spec A only
	232A1808	1	Begin Spec B
11			Spring, Bearing Holder - Anti-Rotation
	232A1186	1	Spec A only
	232A1807	1	Begin Spec B
12	232D1396	1	Support, Generator Mounting
13	805-35	4	Bolt, Place - Generator Mtg. Support to End Bell
14	150A717	1	Switch Assembly, Overspeed
15	150A713	1	Bracket, Overspeed Switch - Includes Contact Point
16	234D70	1	Band, Generator - Front Portion (Narrow)
			Band, Generator - Rear Portion (Wide)
17	★		Upper Half
18	★		Lower Half
19	234A107	1	Bracket, Conduit Connector

- ★ - Order by description, giving Model, Spec and Serial Number (ONAN Nameplate).
 * - To order end bell for Spec A plants also order 232A1807 Ring, 232A1808 Spring, 510P88 Bearing, 526A17 Spacer, and 812-192 Screw.

FIG. 3 - GENERATOR GROUP (Exciter Portion) Model 2SX

1			Cover, Exciter.
	234D73	1	Prior to Spec "C".
	234D116	1	Begin Spec "C"
2	232A1376	3	Bracket, Fastening - Exciter Cover to Alternator End Bell.
3	234D74	1	Panel Only, Exciter.

PARTS LIST

REF. NO.	PART NO.	QUANT. USED	DESCRIPTION
FIG. 3 - GENERATOR GROUP (Exciter Portion) Model 2SX (Cont.)			
4			Rectifier Assembly, Power - Complete.
	305B206	1	Prior to Spec "C" (Includes four #305-205 Rectifiers plus wire and hardware).
	305B228	1	Begin Spec "C" (Includes two #305P233 and two #305P234 Rectifiers plus wire and hardware).
5,6			Rectifier Only, Power (Field).
5	305-205	4	Prior to Spec "C" (Included in Rectifier Assembly #305B206).
			Begin Spec "C".
5	305P233	2	Lower two - Negative (Included in Rectifier Assembly #305B228).
6	305P234	2	Upper two - Positive (Included in Rectifier Assembly #305B228).
7,8			Reactor, Voltage Control.
7	315B53	1	Prior to Spec "C" (Includes #304-443 Resistor and four Rectifiers #305B203).
8	315A78	1	Begin Spec "C".
9			Resistor, Voltage Control Reactor.
	304-443	1	Prior to Spec "C" (Included in Reactor Assembly #315B53).
	304P476	1	Begin Spec "C" (Included in Rectifier & Reactor Assembly #305B227).
10,11			Strip, Marker - Voltage Control Reactor Connections - Prior to Spec "C".
10	332A644	1	Marked +, C, -.
11	332A645	1	Marked 1, 2, 3, 4.
12,13			Bracket Mounting - Voltage Control Reactor.
12	232B1404	1	Prior to Spec "C".
13	234B115	1	Begin Spec "C".
14	234B75	2	Bracket, Gate Reactor Mounting.
15	520A190	1	Stud, Fixed Resistor Mounting.
16	304A15	2	Washer, Fixed Resistor Centering.
17	304-442	1	Resistor, Fixed - Mounts to Gate Reactor Bracket.
18	315A51	2	Reactor, Gate.
19	232A1389	2	Retainer, Gate Reactor.
20	232A1403	2	Stud, Gate Reactor Mounting.
21	232B1388	2	Gasket, Gate Reactor Mounting.
22	232B1387	2	Gasket, Gate Reactor to Retainer.
23	232A1548	2	Gasket, Control Reactor Coil Mounting.
24,25			Block, Terminal.
24	332A503	1	Prior to Spec "C" (8 Place).
25	332A532	1	Begin Spec "C" (5 Place).

PARTS LIST

REF. NO.	PART NO.	QUANT. USED	DESCRIPTION
FIG. 3 - GENERATOR GROUP (Exciter Portion) Model 2SX (Cont.)			
26,27			Strip, Terminal Block Marker.
26	332A643	1	Prior to Spec "C" - For 8 Place Block.
27	332A693	1	Begin Spec "C" - For 5 Place Block.
28,29			Rectifier, Voltage Control Reactor.
28	305-203	4	Prior to Spec "C" (Included in Reactor Assembly #315B53).
29	305P218	4	Begin Spec "C" (Included in Rectifier & Resistor Assembly #305B227).
30	305B227	1	Resistor Assy., Rectifier & (Includes #304P476 Resistor and (4) Rectifiers #305P218) - Begin Spec "C".

FIG. 4 - CONTROL GROUP (Engine Instruments Portion)

1			Panel Only, Lower Control -
	301C1672	1	Prior to Spec "D".
	301C2124	1	Begin Spec "D".
2	320A104	1	Limiter, Cranking.
3	193B112	1	Gauge, Water Temperature (Panel Unit Only).
4	193B111	1	Gauge, Oil Pressure (Panel Unit Only).
5			Switch, Toggle -
	308P2	1	Panel Lights - Begin Spec "D".
	308P2	1	RUN, STOP, AUTOMATIC - Prior to Spec "D".
	308P138	1	RUN, STOP, REMOTE - Begin Spec "D".
6	302A61	1	Ammeter, Charge (30-0-30).
7	307A388.	1	Relay, Time Delay.
8,8A			Relay, Emergency Stop -
8	307B299	1	Prior to Spec "D".
8A	307A655	1	Begin Spec "D" - Latching.
9	308-91	1	Button, Emergency Stop Re-set - Prior to Spec "D".
10			Resistor, Fixed -
	304A446	2	(1) Water Temperature Gauge, (1) Oil Pressure Gauge (150 Ohm, 10 Watts) 5/16 x 1-3/4".
	304A262	3	(1) Start - Disconnect Relay (2) Emergency Stop Relay (50 Ohm, 10 Watt) 5/16 x 1-3/4" - Prior to Spec "D".
	304A262	1	Start-Disconnect Relay (50 Ohm, 10 Watt) 5/16 x 1-3/4" - Begin Spec "D".
	304A248	1	Time Delay Relay (100 Ohm, 10 Watt) 5/16 x 1-3/4".
	304A276	1	Between Fuel Solenoid Relay and Emergency Stop Relay (75 Ohm, 10 Watt) 5/16 x 1-3/4" - Begin Spec "D"
	304A62	1	Pilot Relay (25 Ohm, 25 Watt) 3/4 x 2" - Begin Spec "D".

PARTS LIST

REF. NO.	PART NO.	QUANT. USED	DESCRIPTION
FIG. 4 - CONTROL GROUP (Engine Instruments Portion) Cont.			
11	304A66	1	Resistor, Adjustable - Between Start-Disconnect Relay and Cranking Limiter - 3/4 x 4".
	304A194	1	Between Fuel Solenoid Relay and Start-Disconnect Relay - 9/16 x 2".
12,12A			Relay, Fuel Solenoid -
12	307B4	1	Prior to Spec "D".
12A	307B597	1	Begin Spec "D".
13			Relay, Cycle Cranking - Plug-in Type -
	307-509	1	Prior to Spec "D" - 15 Second Delay.
	307A697	1	Begin Spec "D" - 10 Second Delay.
	307A753	1	Begin Spec "D" - 5 Second Delay.
13	307P820	1	Relay, Start Disconnect
14	323-52	3	Socket, Cycle Cranking Relay (Spec "D" Through "E", 2 Used - Prior to Spec "D", 1 Only Used)..
15	307-61	1	Relay, Pilot.
16-17			Block, Terminal -
16	332A604	1	Remote Operation Connection (5 Place) - Prior to Spec "D".
16A	332A611	1	Remote Operation Connection (3 Place) - Begin Spec "D".
17	332A607	1	Engine Connection (12 Place).
18-19			Strip, Block Marker -
18	332A679	1	For Remote Operation Block (Marked CL1, CL2, B+, GND., START) - Prior to Spec "D",
18A	332A762	1	For Remote Operation Block (Marked REMOTE, B+, GND) - Begin Spec "D".
19	332A608	1	For Engine Connection Block (Marked 4 through 15).
20	307B52	1	Relay, Start-Disconnect - Prior to Spec "F".
21	322P69	1	Receptacle, Pilot Light - Begin Spec "D".
22	322P72	2	Receptacle, Panel Light - Begin Spec "D".
23	322P17	3	Bulb, (1) Pilot Light (2) Panel Lights - Begin Spec "D".
24	301A1685	1	Bracket, Time Delay Relay Mounting
25	307P778	1	Spring, Start Disconnect Relay Holddown - Begin Spec "F".

FIG. 5 - CONTROL GROUP (AC Output Portion)

1,1A			Box Only, Control -
1	301D1537	1	Prior to Spec "D".
1A	301D2115	1	Begin Spec "D".
2	★	1	Panel Only, Upper Control.
5	402-78	4	Rubber, Mounting - Control Box to Mounting Bracket.
6	337A44	1	Strap, Ground.

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

PARTS LIST

REF. NO.	PART NO.	QUANT. USED	DESCRIPTION
FIG. 5 - CONTROL GROUP (AC Output Portion) Cont.			
7			Voltmeter, AC (Check VOLTMETER Scale - Select according to rating) -
	302P421	1	Voltmeter Scale Reads 0-300 - Replaces 302-41.
	302P422	1	Voltmeter Scale Reads 0-600 - Replaces 302-42.
	302P423	1	Voltmeter Scale Reads 0-750.
8	302-157	1	Multiplier, Meter (Resistor) Voltmeter to Selector Switch (Use only with 0-500 Scale Voltmeter used Prior to Spec "D").
9			Ammeter, AC (Check AMMETER Scale - Select according to rating) -
	302P414	1	Ammeter Scale Reads 0-500 - Replaces 302-371.
	302P415	1	Ammeter Scale Reads 0-750 - Replaces 302-384.
	302P416	1	Ammeter Scale Reads 0-1000 - Replaces 302-395.
	302P413	1	Ammeter Scale Reads 0-300.
10	308-22	1	Switch, Voltage and Current Selector.
11,11A			Meter, Running Time -
11			Prior to Spec "D" -
	302-212		60 Cycle Plants (NOTE: When used to replace #302-387 Meter on early 480 volt plants, also order #304A125 Resistor).
	302-102		50 Cycle Plants
11A			Begin Spec "D" -
	302P465	1	For 120/208, 120/240, and 600 Volt, 3 Phase, 60 Cycle Plants.
	302P466	1	For 220/380 Volt, 3 Phase, 60 Cycle Plants.
	302P467	1	For 277/480 Volt, 3 Phase, 60 Cycle Plants.
	302P469	1	For 220/380 Volt, 3 Phase, 50 Cycle Plants.
12			Resistor, Running Time Meter -
			Prior to Spec "D" -
	304A99	1	5, 000 Ohm, 10 Watt (Used only with 302-212 meter on 120/240 volt plants.)
	304A125	1	15, 000 Ohm, 25 Watt (Used only with 302-212 meter on 480 volt plants.)
	304A444	1	2, 500 Ohm, 10 Watt (Used only with 302-387 meter on early 120/240 volt plants.)
	304A445	1	6, 500 Ohm, 25 Watt (Used only with 302-387 meter on early 480 volt plants.)
			Begin Spec "D" -
	304A536	1	9, 000 Ohm, 50 Watt (Used only with 302P465 meter on 600 volt plants.)
13			Meter, Frequency -
	302-213	1	60 Cycle Plants.
	302-234	1	50 Cycle Plants.
14			Resistor, Frequency Meter -
	304A305	1	45, 000 Ohm, 10 Watt (Used on 480 volt, 3 phase, 3 wire plants and 277/480 volt, 3 phase, 4 wire plants.)

PARTS LIST

REF. NO.	PART NO.	QUANT. USED	DESCRIPTION
FIG. 5 - CONTROL GROUP (AC Output Portion) Cont.			
(cont.)			
14	304A125	1	15, 000 Ohm, 25 Watt (Used on 120/240 volt, 3 phase, 4 wire plants - Prior to Spec "C").
	304A125	1	15, 000 Ohm, 25 Watt (Used on 220/380 volt, 3 phase, 4 wire plants Begin Spec "D".)
	304A402	1	60, 000 Ohm, 10 Watt (Used on 600 volt, 3 phase, 3 wire plants Begin Spec "D".
15			Breaker, Circuit -
	320B2	1	15 Amp - 200 KW Plants.
	320B170	1	18 Amp - 230 KW Plants.
16	332A503	1	Block, Terminal - 8 Place,
17	332A601	1	Strip, Block Marker (Marked 15 through 22).
18	301E1682	1	Box Only, Output Terminal (Mounts on Side of Generator).
19	301C1683	1	Cover, Output Terminal Box.
20			Transformer, Current (Mounts in Output Terminal Box) Check TRANSFORMER Nameplate - Select according to rating -
	302B372	3	Transformer Nameplate Reads "Ratio 500/5" (Use with 0-500 Scale AC Ammeter).
	302B385	3	Transformer Nameplate Reads "Ratio 750/5" (Use with 0-750 Scale AC Ammeter).
	302B394	3	Transformer Nameplate Reads "Ratio 1000/5" (Use with 0-1000 Scale AC Ammeter).
	302B107	3	Transformer Nameplate Reads "Ratio 300/5" (Use with 0-300 Scale AC Ammeter).
21,22			Bracket, Current Transformer Bottom Panel Mounting (Bolts to Generator Frame) - Prior to Spec "C".
21	232C1391	1	Upper (Large).
22	232C1390	1	Lower (Small).
23,24			Panel Only, Current Transformer - Prior to Spec "C".
23	232C1418	1	Bottom Panel - Current Transformer Mounting (Mounts Output Terminal Studs).
24	232B1419	1	Top Panel - Current Transformer Retaining.
25	232A1420	4	Stud, Output Terminal - Copper (7/8-14 x 6-1/2") - Prior to Spec "C".
26	337A58	1	Strap, Output Terminal - Copper - Terminal Stud to Ground (3-3/8" x 1-1/2") - Prior to Spec "C".
27	232A1416	1	Strap, Output Terminal - Copper - GROUNDED Stud to Machine Screw (2-3/4" x 1-1/2") - Prior to Spec "C".
28	232A1415	3	Strap, Output Terminal - Copper - UNGROUNDED Studs to Machine Screw (4-1/4" x 1-1/2") - Prior to Spec "C".
29	508A81	6	Washer, Neoprene Insulating - Current Transformer Mounting (4-1/2" O.D.) - Prior to Spec "C".

PARTS LIST

REF. NO.	PART NO.	QUANT. USED	DESCRIPTION
FIG. 5 - CONTROL GROUP (AC Output Portion) Cont.			
30	508A83	3	Washer, Fibre - Current Transformer Mounting (2-1/4" O.D.) - Prior to Spec "C".
31	303-111	1	Rheostat, Voltage Regulator - 175 Ohm, Model H - Begin Spec "C".
32	303-32	1	Knob, Rheostat - Begin Spec "C".
33	304A484	1	Resistor, Fixed - Rheostat (825 Ohm, 75 Watt) - Begin Spec "C".
34	332A604	1	Block, Terminal - Exciter Connections (5 Place) - Begin Spec "C".
35	332A690	1	Strip, Block Marker (5 Place) - Begin Spec "C".
36	302B448	As Req.	Plate, Meter Face - For Appearance Only - to give round meter a square appearance.
37	301A1914	1	Bracket, Panel Stop - Begin Spec "D".

