File Copy
W/Print Orde

OPERATORS MANUAL AND PARTS CATALOG

FOR

Onan®

ELECTRIC GENERATING PLANTS

DFC

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

954-301

11AF68 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 name-plate.

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

TABLE OF CONTENTS

INTRODUCTION

When the instructions in this manual refer to a specific model of electric plant, identify the model by referring to the MODEL AND SPECIFICATION NO. as shown on the ONAN nameplate. Electrical characteristics are shown on the lower portion of the nameplate.

How to interpret MODEL and SPEC. NO.

1. Factory code for SERIES identification.
2. Combines with number 1 to identify model. Indicates model, output voltage, method of starting: E-ELECTRIC starting, R-REMOTE electric starting.
3. Factory code for designating optional equipment.
4. Specification letter. (Advances when factory makes production modifications.)

If it ever becomes necessary to contact a dealer or the factory regarding the plant, be sure to mention the complete Model, Spec. No, and 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.

Electric plants are given a complete running test under various load conditions and are thoroughly checked before leaving the factory. Inspect the plant closely for loose or missing parts and any damage which may have occurred in shipment. Tighten loose parts, replace missing parts, and repair any damage before putting plant in operation.

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.

IMPORTANT... RETURN WARRANTY CARD ATTACHED TO UNIT

SPECIFICATIONS

Dimension (nominal)	
Height (inches)	69 5/16
Width (inches)	38 1/8
Length (inches)	113
Weight (approximate in pounds)	5,050
Number of cylinders	6
Displacement (cu. in)	743
Bore (inches)	5 1/8
Stroke (inches)	6
BHP at 1,800 - rpm (nominal)	182
Compression Ratio (Diesel)	15.5: 1
Manufacturer (engine)	Cummins
Series	H-743
Governor Regulation %	3
Nominal Battery Voltage	24
Battery Size	
SAE Group 8D (12-volts)	Two
Amp/Hr. SAE 20-hr. Nominal	200
Solenoid Shift Starter	Yes
Engine Cooling Air (CFM at 1,800-rpm)	
City Water Cooling	5330
Radiator Cooling	14,200
Combustion Air (CFM at 1,800-rpm)	310
Alternator Cooling Air (CFM at 1,800-rpm)	800
Output Rated At Power Factor Load	0.8
Rating (Output in Watts)	
50-cycle AC intermittent service	100,000
50-cycle AC continuous service	99,000
60-cycle AC intermittent service	115,000
60-cycle AC continuous service	100,000
AC Voltage Regulation in %	2
AC Frequency Regulation in %	5
Revolving Field Alternator(4-pole)	Yes
Magneciter	Yes
Cooling System Capacity	
Radiator (gallons)	19.5
Heat Exchanger (gallons)	36
Engine Oil Capacity (gallons)	7
Exhaust Connections (inches pipe thread)	3 1/2
Air Cleaner (Oil bath)	Yes
Closed Crankcase Breather System	No
RPM (60-cycle)	1800
RPM (50-cycle)	1500
Battery Charging Alternator	Yes

DESCRIPTION

GENERAL

An Onan electric generating plant of the DFC series is a complete unit consisting of a diesel engine driving a self-excited AC generator and such controls and accessories as specified by the purchaser.

ENGINE

The engine is a Cummins basic model H-743-P190 as described in the Cummins manual. The specific engine used may have variations due to some of the optional equipment available as specified by the plant purchaser.

AC GENERATOR AND EXCITER

The complete generator consists of a, 4-pole revolving field alternator and a static exciter with a magnetic amplifier regulator. The alternating current output is generated in the stator winding of the alternator, attached to the rear portion of the engine. The alternator's rotating field, attached directly to the engine flywheel, 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.

The rotating rectifier exciter provides for almost constant AC output voltage over a wide range of load conditions. It is used for providing excitation current (DC) to the rotating field of the generator. The improved design of this brushless unit simplifies servicing and maintenance. It does this by eliminating parts which are subject to normal wear, such as brushes, slip rings and commutator.

A solid-state transistorized voltage regulator system works in conjunction with the exciter. A voltage control rheostat is used to maintain a desired output voltage.

STANDARD ENGINE CONTROLS AND EQUIPMENT

Engine controls and equipment, which are mounted on the control box, contain components for starting, controlling, and stopping the plant. Each of these controls is described below.

Run-Stop-Remote Switch: Starts and stops engine from either the plant or a remote location.

Cranking Limiter: Opens the starting circuit if engine does not start within approximately 45 seconds.

Oil Pressure Gauge: Indicates engine oil pressure.(Wired into a sending unit.)

Water Temperature Gauge: Indicates engine coolant temperature. (Wired into a sending unit.)

Emergency Latch Relay: Shuts engine off and protects from damage due to high water temperature, low oil pressure, and engine overspeed. Utilizes a safety indicator light and an alarm terminal. When cause of trouble has been corrected a button must be manually reset before engine can be started again

Automatic Overspeed Shutdown: If plant speed exceeds 2100 rpm this switch automatically actuates the latching relay and shuts down the plant.

High Water Temperature Cut-Out: If engine coolant temperature exceeds 205°F the latching relay is energized, shutting down the plant.

Low Oil Pressure Cut-Out: Allows oil pressure build-up while starting and shuts down the plant through the latching relay if oil pressure drops below 14 psi.

Battery Charging DC Alternator: A 24-volt DC, 20 amp output charges the two 12-volt batteries necessary for starting. Also utilizes a mounted voltage regulator.

Battery Charge Rate Ammeter: Indicates the battery charging current.

WARNING

Several protective switches are built into this plant. These switches protect the engine from high water temperature, low oil pressure and overspeed, all operating through an emergency latch relay. These devices automatically shut off the engine if one of these malfunctions occurs. Do not by-pass or disconnect these switches under any circumstances. Extensive damage to the plant could be the result.

AC GENERATOR CONTROLS AND EQUIPMENT

The electrical instrument panel and equipment will vary according to the model and purchaser options. The following is a brief description of each of the controls and components which are standard items.

AC Ammeter: Indicates load current connected to the generator circuit.

AC Voltmeter: Indicates the voltage of the AC output.

Voltage Adjusting Rheostat: Provides for approximately 5% plus or minus adjustment of the output voltage.

Phase Selector Switch: Selects the phase of the generator output which is indicated by the AC ammeter and voltmeter.

Frequency Meter: Indicates the frequency of the output current in cycles per second. It can be used to check engine speed. (Each cycle per second equals 30-rpm. engine speed.)

Running Time Meter: Registers the total number of hours to 1/10th, that the plant has run. Use it to keep a record of periodic servicing.

OTHER OPTIONS

Tne generating plant is adaptable to AUTOMATIC LOAD TRANSFER equipment, manual/automatic paralleling switchboards, and other devices. Terminals can be provided for connecting optional warning equipment, etc.

SIGNAL LIGHTS may be included to warn of improper operation. Terminals for connecting such lights, horn or other warning devices are available. Refer to the engine wiring diagram if such equipment is to be connected.

Optional WATER JACKET (tank type) HEATERS are available to keep the engine coolant warm during periods of plant shutdown in low ambient temperatures. Connect the heater to a normally energized electric power source, making sure that the line voltage is correct for the rated voltage of the heater.

INSTALLATION

GENERAL

Installation points to consider include: adequate engine and generator cooling air, discharge of circulated air, adequate fresh induction air, discharge of exhaust gases, electrical connections, fuel connections, water connections, accessibility for operation and servicing and a sturdy, level floor.

These instructions are intended as a general guide, however, each installation must be considered individually. Consult local regulations which may affect some installation details.

LOCATION

Provide a location that is protected from the weather and is dry, clean, dust free and well-ventilated. If practical, install inside a building for protection from extremes in weather conditions, and preferably heated in cold weather.

MOUNTING (Fig. 1 and 2)

Plants are mounted on a rigid skid base which provides proper support and adequate vibration isolation. For convenience in draining crankcase oil and general servicing, plants can be mounted on raised pedestals (at least 6" high). Extra vibration isolators are available and may be installed under the plant base. If mounting in a trailer, or for other mobile applications, bolt securely in place. Extra support for the vehicle flooring may be necessary. Bolting down is optional for stationary installations.

NOTE: *Alignment of the generator to the engine is very important. Refer to instructions (Fig.1).*

VENTILATION

Plants create considerable amounts of heat which must be removed by proper ventilation. Outdoor installations rely on natural air circulation but *mobile* and *indoor* installations need properly sized and positioned vents for the required air flow. See Specifications for the air required to operate with rated load under normal conditions at 1800-rpm.

Cooling air travels from the rear of the plant to the front end. Locate the room or compartment air inlet where most convenient, preferably to the rear of the plant. The inlet opening should be at least as large as the radiator area.

Engine heat is removed by a pusher fan which blows cooling air out through the front of the radiator. The cooling air outlet should be directly in front of the radiator and as close as is practical. The opening size should be at least as large as the radiator area. A duct of canvas or sheet metal should be used between the radiator and the air outlet opening. The duct will prevent recirculation of heated air.

A means of restricting the air flow in cold weather should be provided to keep the room or compartment temperature at a normal point.

On city water cooled plants the conventional radiator is not used and a constantly changing water flow cools the engine. Ventilation is seldom a problem, but sufficient air movement and fresh air must be available to properly cool the generator and support combustion in the engine. For small compartments, a duct of equal or larger area is recommended to remove the heated air from the generator air outlet to the outside atmosphere. Limit bends and use radius type elbows where needed. A larger well ventilated compartment or room does not require a hot air duct.

Installations made in a small room may require installation of an auxiliary fan (connected to operate only when the plant is running) of sufficient size to assure proper air circulation.

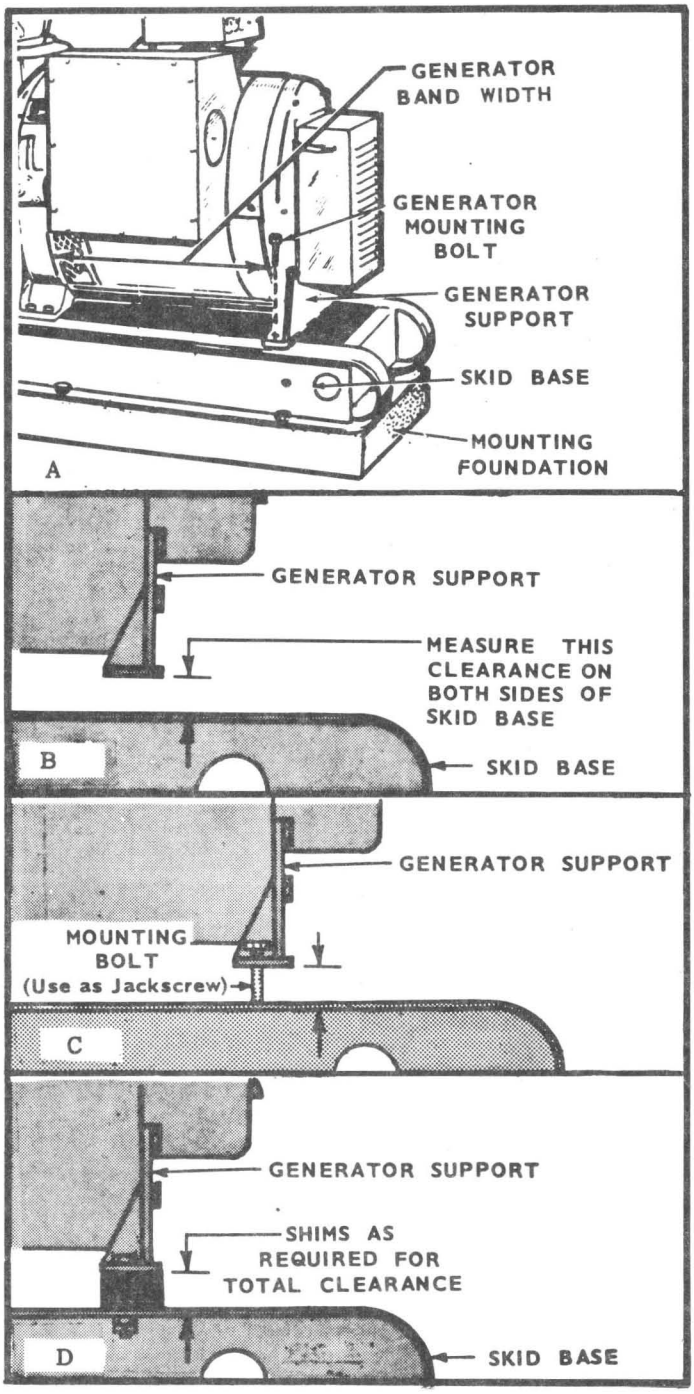
CITY WATER COOLING

An optional method of engine cooling, in place of the conventional radiator and fan, uses a constant pressurized water supply. For piping connections, etc., refer to the separate outline drawing furnished. Variations of "city" water cooling are optional: the water may circulate directly through the engine cooling system or may be cooled through a heat exchanger. The cooling water may also be used to cool the exhaust manifolds. (Water cooled exhaust manifolds are recommended.) An electric solenoid valve is installed in the water supply line, connected to open the water flow only when the plant is operating. A rate-of-flow valve (either automatic or hand adjusted) is recommended for installation in the supply line to control the water flow. Use flexible hose to connect water supply and outlet flow pipes to the engine connection points. Pipe the outlet flow to a convenient drain. (continued page 10).

INSTALLATION ALIGNMENT FOR DFC GENERATING PLANT

When installing ONAN electric generating plants, through 250 KW, the generator must be aligned to the engine to prevent premature generator bearing failure. Align the generator according to the following instructions:

1. Set the plant on its mounting foundation. Remove the two mounting bolts which secure the generator support to the skid base (FIG.A). Remove shims between skid base and generator support: (Use mounting bolts as jackscrews to raise generator to remove shims. Remove tension from jackscrews and allow generator to hang free.)
2. Secure the skid base to the mounting foundations.
3. Measure the clearance from the top surfaces of the skid base to both mounting surfaces of the generator support (FIG.B). Measure the width of the generator bands (wide and narrow bands) to determine the weight correction figure (FIG. A and Table 1).
4. Add clearance of skid base-to-support (FIG.A) and weight correction figure (Table 1) to determine the total amount of generator alignment shims required. The clearances may be different for both sides of the skid base. Select shims (Table 2) required according to alignment figures.
5. Using mounting bolts as jackscrews, increase clearance between base and support to allow placing the shims between base and support (FIG.C). Lower generator and allow to rest on shims. Total generator clearance, base to support, must equal the base-to-support clearance plus the weight correction figure.
6. Remove jackscr ew bolts and install as mounting bolts through generator support, shims, and skid base. Secure and lock the mounting bolts in place (FIG.D).



Note: The laminated shim has .002" increment. Use these shims as thick as possible to eliminate having to separate the increments.

TABLE 1

GENERATOR BAND LENGTH	WEIGHT CORRECTION FIGURE - INCH
19-1/4 to 21-1/4"	.012
23-5/8"	.014
25-5/8"	.018
28"	.026

TABLE 2

SHIM PART NUMBER	THICKNESS INCH	METAL GAUGE	SIZE
232A1490	.0359	#20	3 x 3
232A1489	.0598	#16	3 x 3
232A1817	.002 to .062 (Laminated Shim) (.002 Increments)		2 x 2-1/2

FIG. 1

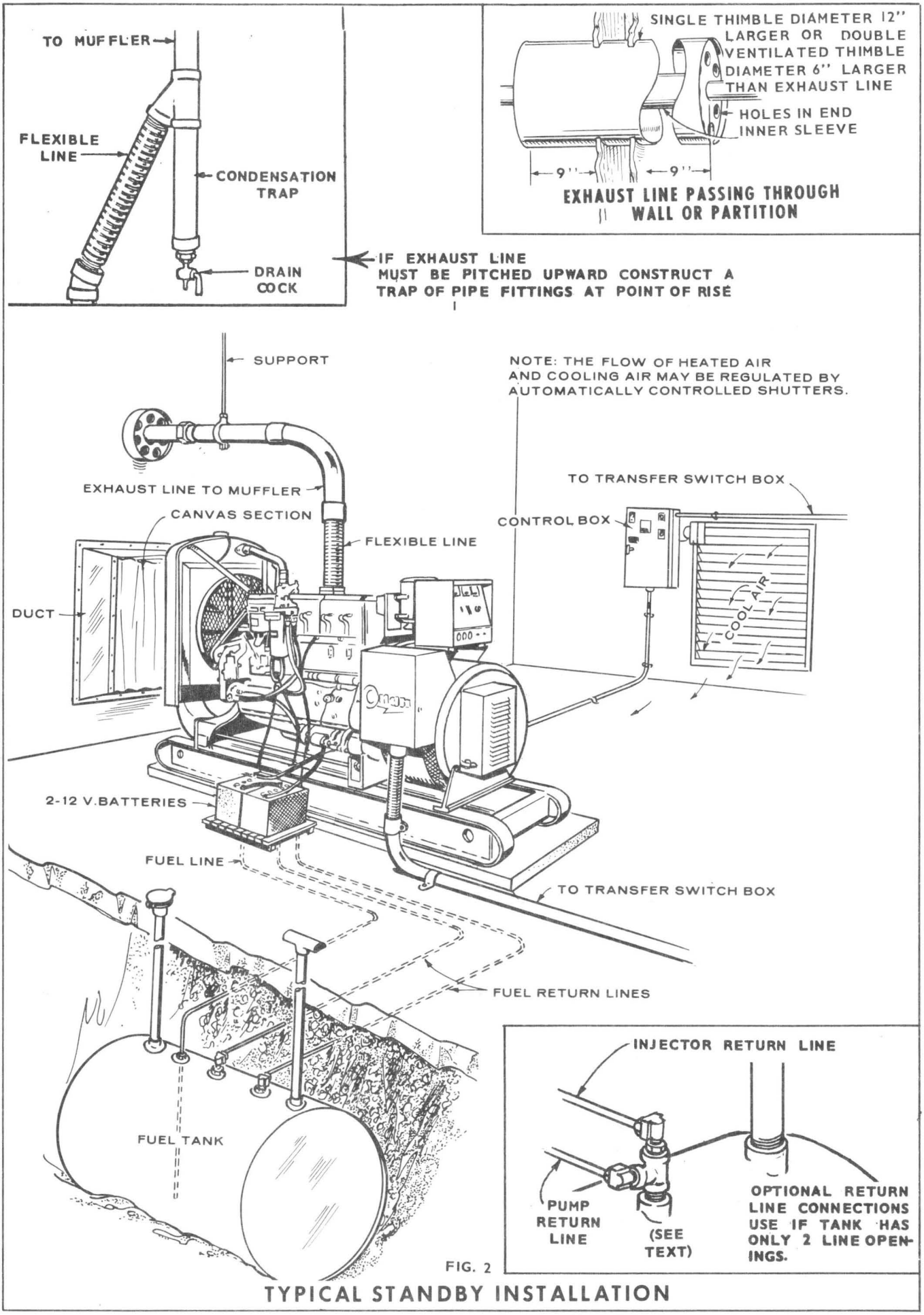
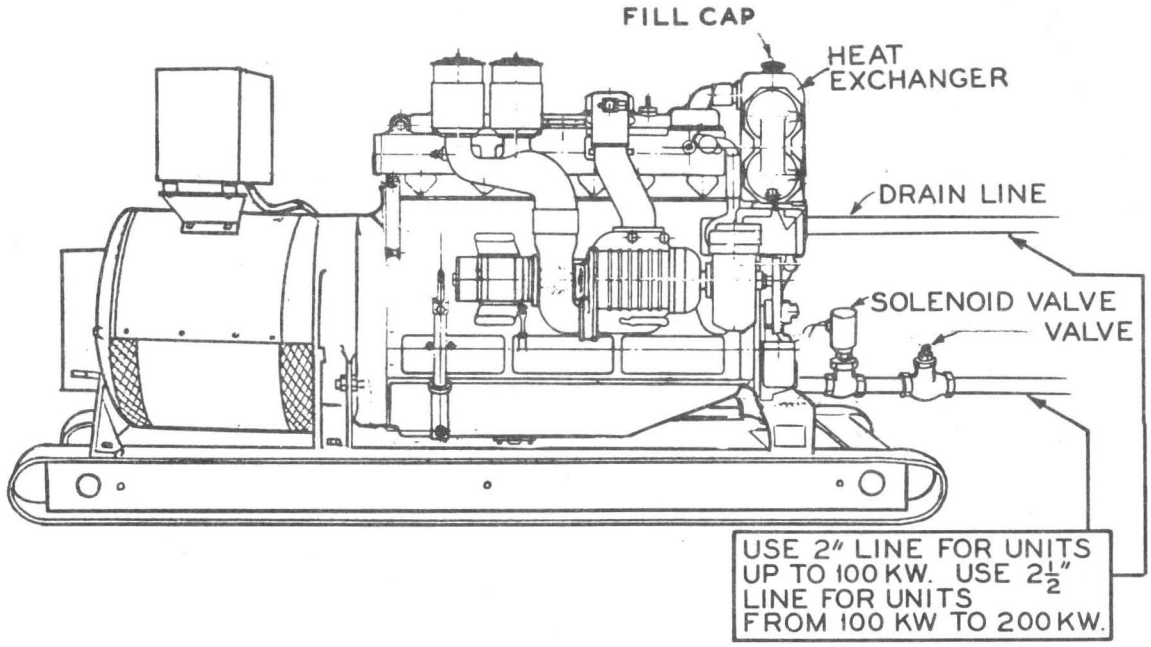


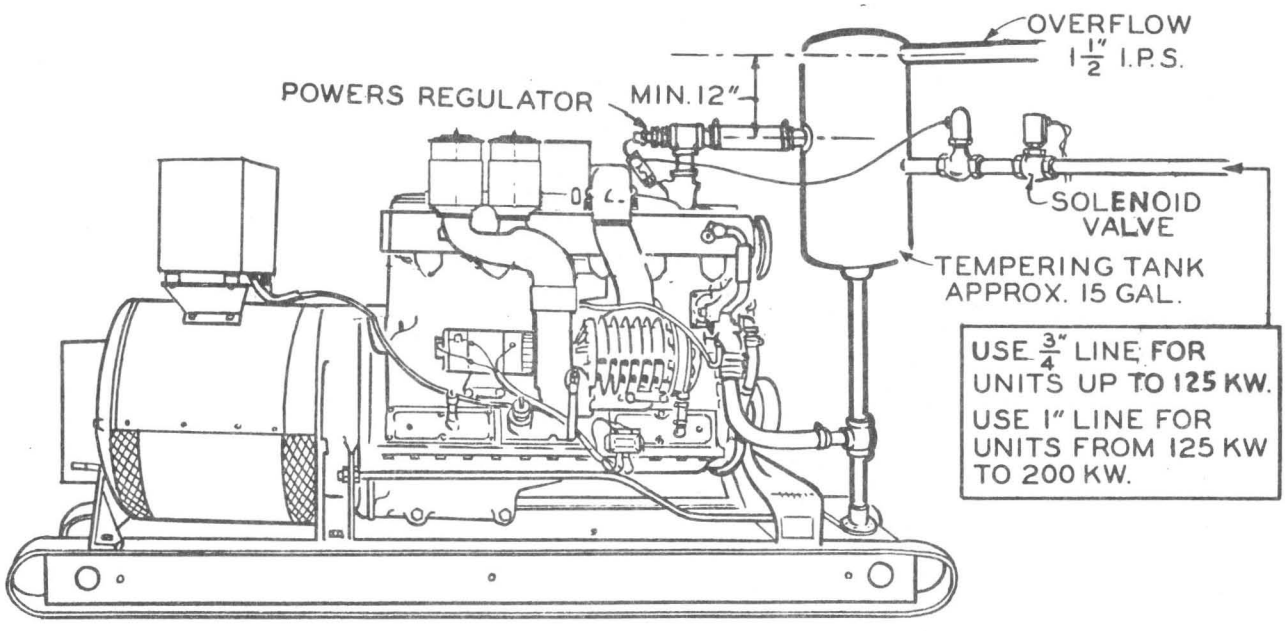
FIG. 2

TYPICAL STANDBY INSTALLATION



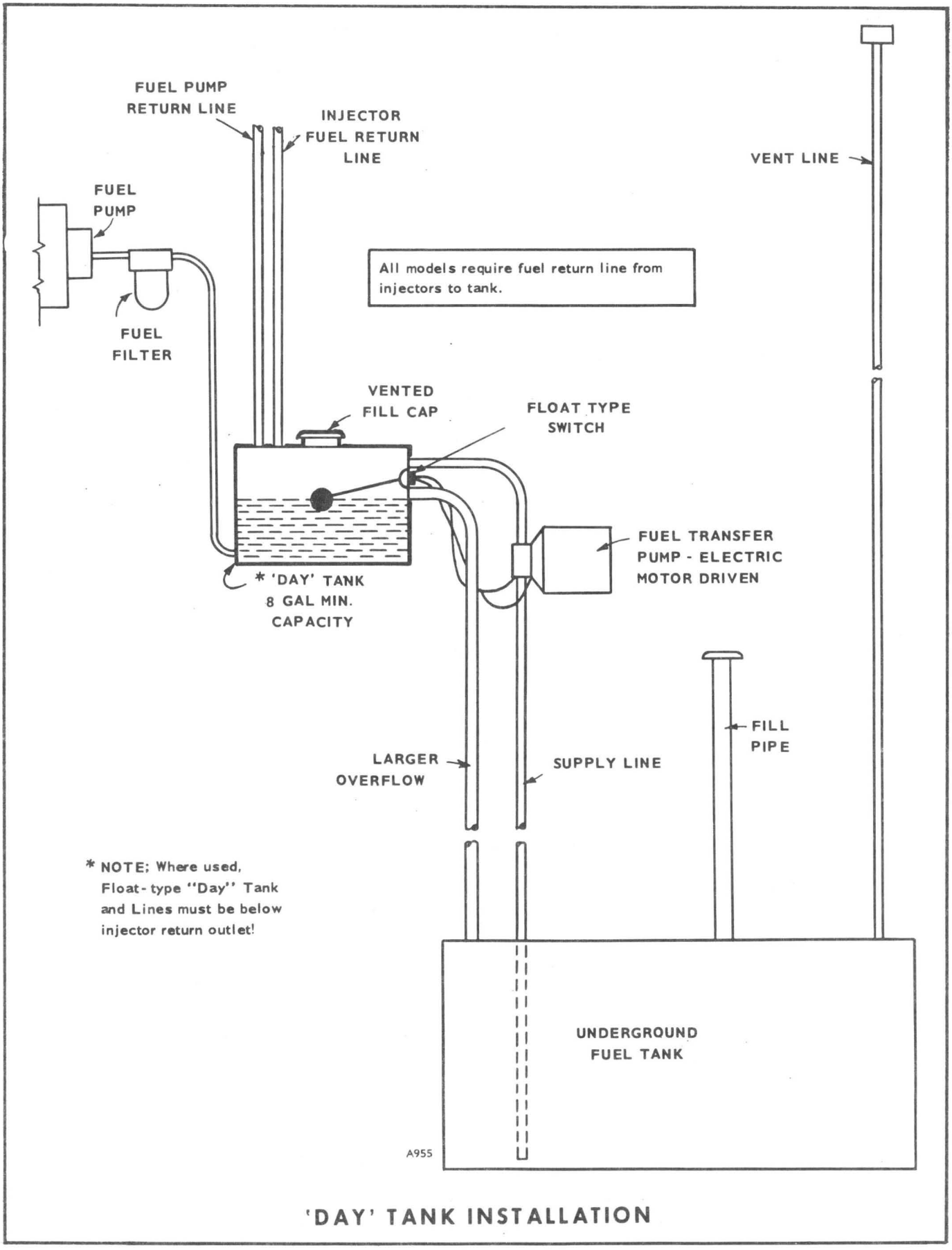
CITY WATER HEAT EXCHANGER COOLING

FIG. 3



CITY WATER STANDPIPE WITH POWERS REGULATOR

FIG. 4



'DAY' TANK INSTALLATION

FIG. 5

Standpipe System (Fig.4): The standpipe system uses a mixing or tempering tank. Cooling water that circulates through the engine mixes with a source of cool "raw" water. The "raw" water supply must be free of scale-forming lime or similar impurities.

Heat Exchanger System (Fig.3): The heat exchanger installation provides for a "closed" engine cooling system. Engine coolant circulates through a tubed chamber, keeping the coolant separate from the cool "raw" water supply. The coolant chamber must be filled for operation. as for a radiator cooled plant. An electric solenoid valve is installed in the water supply line, and is connected to open and allow water to flow only when the plant is operating. A rate of flow valve (either automatic or hand adjusted) is recommended for installation in the supply line to control the water flow. Use a flexible hose to connect water supply and outlet flow pipes to the engine connection points.

If the plant is equipped for "city" water cooling, see that the water supply to the engine is turned on. If the system is the "closed" (heat exchanger) type, see that the chamber portion is properly filled, similar to a radiator equipped unit. Make a preliminary adjustment of the water flow as indicated in Fig. 6 or 7. Make final adjustment after the plant warms up.

MINIMUM WATER FLOW, HEAT EXCHANGER COOLING

ELECTRICAL LOAD	WATER TEMP.	MIN. FLOW GAL./MIN.
115 KW	40°F	14
	60°F	21
	80°F	29

FIG. 6

MINIMUM WATER FLOW, TEMPERING TANK COOLING

ELECTRICAL LOAD	WATER TEMP.	MIN. FLOW GAL./MIN.
115 KW	40°F	11.6
	60°F	13.9
	80°F	17.4

FIG.7

COOLING SYSTEM FILTER (Corrosion Resistor)

The engine is equipped with a cooling system filter. This is a unit which bypasses a small amount of coolant from the system through a filtering and treating device. It softens water, neutralizes acidity and protects against corrosion by the use of a replaceable chemically-activated filtering element. In addition, the unit contains a sacrificial metal plate which arrests pitting of metals in the system by electro-chemical action.

Service the filter at each 300 to 500 hour interval of operation.

NOTE: The initial element should be changed after 150 hours of operation.

Refer to the Cummins Operator's Manual for servicing information.

Two different types of chemically activated replacement elements are available from any Cummins dealer:

1. Regular formula
2. PAF formula

The regular formula can be used with plain water, non permanent antifreezes, and selected permanent type antifreezes, and selected permanent type antifreezes (Consult your nearest Cummins dealer for a listing of compatible antifreezes). The best protection results will be gained by using the regular formula element with one of the compatible antifreezes.

The PAF formula elements can be used with all permanent antifreezes, but is not recommended for use with plain water. It is necessary to drain and flush the system thoroughly when changing from one element formula to the other if a non-compatible antifreeze is in use.

CAUTION: *Do not use soluble oil or other conditioners in the cooling system.*

EXHAUST

Pipe exhaust gases outside any enclosure (Fig.2). Use pipe at least as large as the size of the outlet of the engine. Increase the pipe diameter one pipe size for each additional 10' in length. Use a flexible connection at the engine exhaust manifold. Provide adequate support for the piping. Pipe fittings cause a resistance to the flow of exhaust gases and can result in a loss of engine power. Use sweeping elbows in preference to standard pipe elbows, and keep the number of necessary turns to a minimum. If the exhaust line runs upward at any point, install a vapor or condensation trap at the low point, with a provision for periodic draining. Fig.2. Shield or insulate the line if there is any danger of personnel contact. If the line passes close to a combustible wall or partition, allow at least 4" clearance. If it passes thru a combustible wall or partition, install a thimble as shown in Fig.2. Install a suitable muffler.

FUEL CONNECTIONS

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

NOTE: *In any Diesel engine installation fuel system cleanliness is of utmost importance. Make every effort to prevent entrance of any moisture or contamination matter of any kind. Do not use lines or fittings of galvanized material.*

The maximum fuel lift without any horizontal run should not exceed 8'. The horizontal run, if the supply tank is level with the fuel pump, should not exceed 12-1/2'. Use 5/8" tubing for the fuel supply line. The inlet fitting on the fuel filter is threaded for a 5/8" SAE flared fitting. Use 1/2" tubing for the fuel return line from the injector manifold; the fitting in the injector manifold is threaded for a 1/2" SAE flared fitting.

DAY TANK (Fig.5)

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

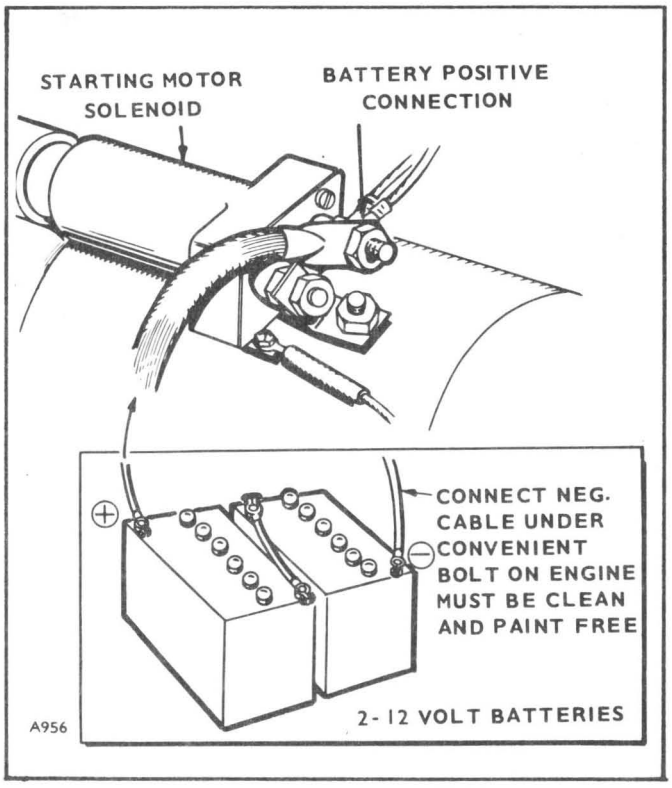


FIG. 8

BATTERY (Fig. 8)

24-volt battery current is required for starting purposes. Use two 12-volt type 8 D batteries for a normal installation. Connect the batteries in series (negative post of first battery to positive post of second). Note a small wire connected to one of the two larger terminals on the starter magnetic switch. Connect the battery positive cable to this switch terminal. Connect the battery negative cable to a good (paint free) ground on the engine frame. Service the batteries as necessary.

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

REMOTE CONTROL CONNECTIONS

Starting and stopping is accomplished through a 2-wire electrical system. To extend this control to one or several remote locations, a 3-place terminal block is provided in the plant control box. The terminal block is marked REMOTE, B+, and GND. If a load transfer or an automatic control is used, follow the instructions supplied with the control. If a SPST manual switch is used, connect the wires and mount the switch so the engine will run when the switch handle is up the same as an ordinary light switch. The size wire to use is determined by the plant-to-control distance. Use #18 wire up to 900-ft. (Fig.9). The GND terminal is for a customer-supplied alarm at a remote location to warn of low oil pressure, high water temperature and overspeed.

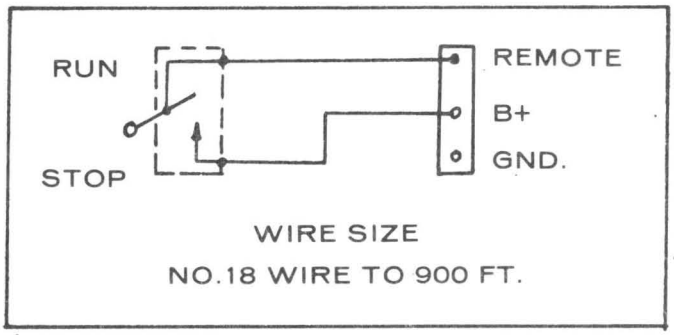


FIG. 9

CONNECTING LOAD WIRES

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

If the installation is for standby service, a double throw transfer switch (Fig. 10) must always be used. This switch (either manual or automatic) must be connected so that it is impossible for the normal source and generator current to be connected to the load at the same time. Instructions for connecting an automatic load transfer control are included with such equipment. It is assumed that personnel connecting the generator, and any such auxiliary equipment, are fully qualified and understand the problem of balancing the circuits, grounding the plant, etc. Refer to the output control wiring diagram furnished. Each generator lead is marked according to the wiring diagram.

Make load wire connections to the generator according to the type of facilities provided. If large terminal posts are provided, make load wire connection directly to the posts. Some plants are reconnectible for different voltages and have extra leads. These are pre-connected according to the nameplate ratings.

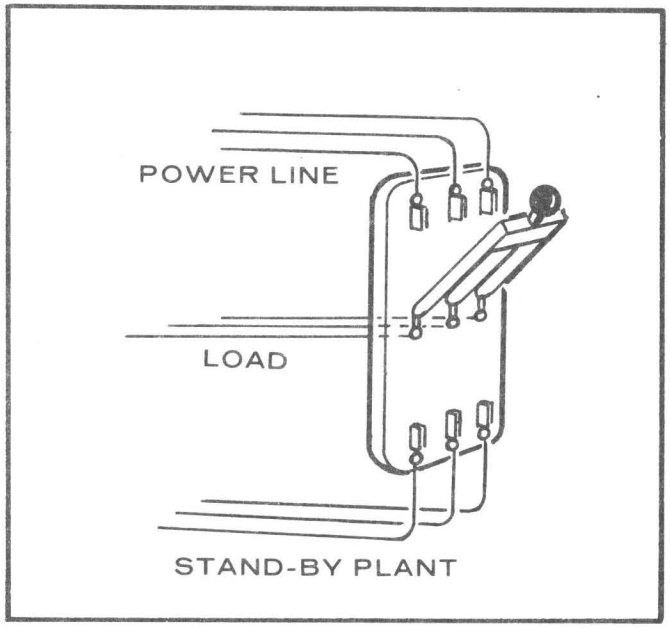


FIG. 10

3-Phase, 3-Wire Plant (Fig.11): No terminal is grounded. For three-phase current, connect separate load wires to each plant terminal T1, T2, and T3.

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

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

If both single-phase and three-phase current is to be used at the same time, use care not to over-load any one circuit. Subtract the amount of the 3-phase load from the rated capacity of the plant. Divide the remainder by 3, and this is the maximum load that can be connected to any one single-phase circuit. For example, a 10,000 -watt 3-phase load is connected to a 25,000 watt plant. This leaves 15,000 watts available for single phase use -- 5,000 watts on each circuit. Do not attempt to take all 15,000 watts in this example off one circuit, as over loading of the generator will result.

3-Phase, 4-Wire, Wye Connected Plant (Fig.12): The 3-phase 4-wire plant produces single-phase current of one voltage and three-phase current of a different voltage. The single-phase voltage is the lower voltage as noted on the plant nameplate, and the three-phase voltage is the higher nameplate voltage.

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

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

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

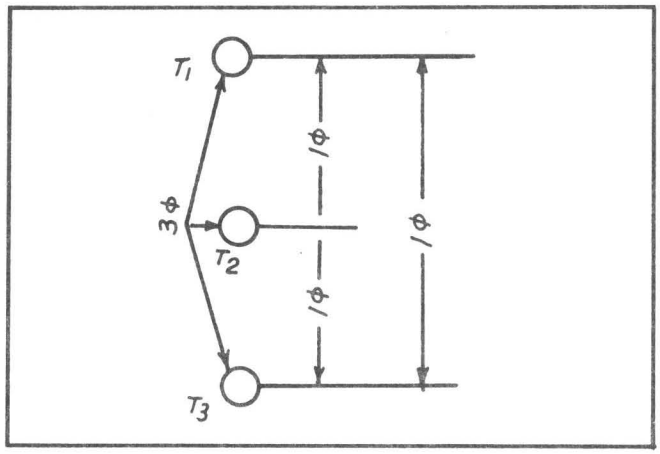


FIG. 11

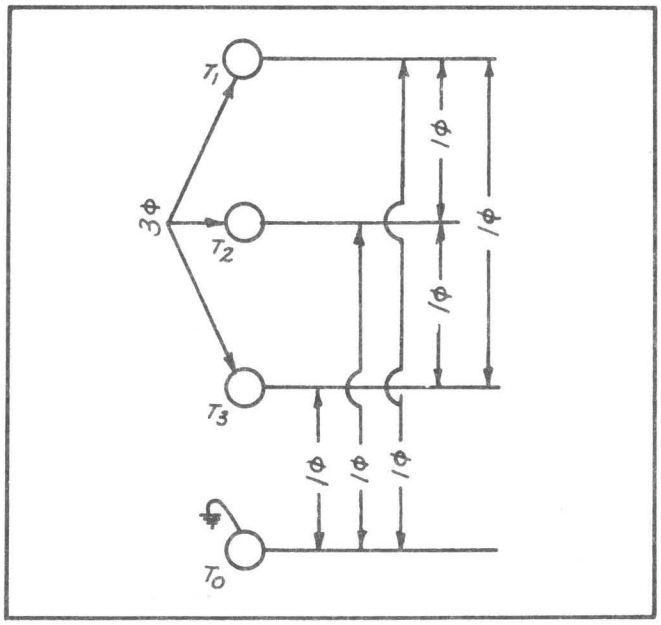


FIG. 12

120/240 - Volt, 3-Phase, 4-Wire Delta Connected Plant (Fig. 13): The 3-phase Delta Connected plant is designed to supply 120-volt single-phase current and 240-volt 3-phase current. For single-phase operation, connect the three load wires to the three plant terminals T1, T2, and T3 - one wire to each terminal. For 3-phase operation the T0 terminal is not used.

For 120/240-volt, 1-phase, 3-wire operation, terminals T1 and T2 are the "hot" terminals. The T0 terminal is the neutral, which can be grounded if required. For 120-volt service, connect the "hot" (black) load wire to either the T1 or T2 terminal. Connect the neutral (white) wire to the T0 terminal. Two 120-volt circuits are available. Any combination of single-phase and three-phase loading can be used at the same time as long as no terminal current exceeds the NAMEPLATE rating of the generator. If no 3-phase output is used, usable 1-phase output is 2/3 of 3-phase KVA.

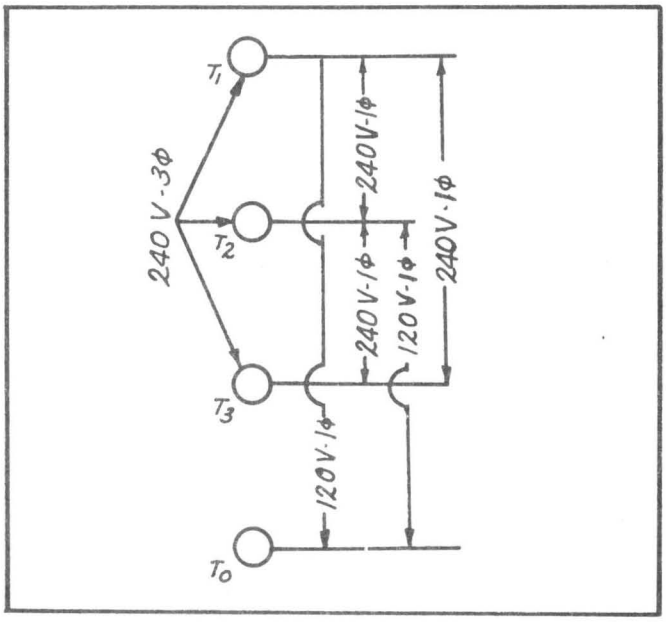


FIG. 13

OPERATION

CRANKCASE OIL

Refer to Section 3 of the Cummins manual. Note that for average operating conditions, MIL-L-2104A military Specification oil is recommended. Many oils designated for MS or DG service meet these requirements. Check with the oil supplier.

The capacity of the oil pan is approximately 7 U.S. gallons. However, an extra amount may be required for the oil filter or other accessories. Check the level after 10 to 15 minutes of the initial run.

Use oil of the recommended viscosity according to the ambient temperature. Do not use a multi-viscosity oil such as 10W - 30, or other oil designated for ordinary automotive uses. Do not mix brands nor grades of lubricating oils.

GOVERNOR OIL

The standard engine is equipped with a hydraulic governor The governor does not have an independent oil sump, but uses engine oil as a control medium.

AIR CLEANER

If the engine is equipped with an oil bath type air cleaner, fill to the level indicated with oil of the same viscosity as used in the crankcase. However, a non-detergent (straight mineral) oil is recommended.

CRANKCASE BREATHER AIR CLEANER

Service the crankcase breather air cleaner in the same manner as the main combustion intake air cleaner.

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 19.5 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 with ethylene glycol base as instructed in the Cummins manual. 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 Cummins manual for fuel oil specifications. Check with the fuel supplier for assurance that the fuel supplied meets the specifications. Make every effort to keep the fuel supply clean. Ordinarily no preliminary priming or "bleeding" of the fuel system is necessary.

BEFORE INITIAL START

Refer to Pre-Start instructions (section 2) in the Cummins manual.

WARNING

ENGINE OIL and COOLANT DRAINED

Rust inhibiting oil is applied to cylinders for shipping

Before Operating: FILL cooling system.. FILL with lubricating oil.

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 5 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.

OPERATORS NOTE: Always use all instruments provided with the unit to obtain the most satisfactory service from it.

BREAK-IN NOTE: Run plant at 50% rated load for the first 1/2 hour after reachin operating temperature.

WATER FLOW **(See typical installation on page 8)** If the If the plant is city water (pressure) cooled, but without the optional flow (Powers) 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 conditions permit, disconnect electrical load and allow the plant to run a few minutes at no load. This will allow the plant to cool off slightly, and may prevent an excessive temperature rise when the plant stops and ventilation ceases. Press the RUN-STOP switch to its STOP position to stop the plant.

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.

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 below about 9 lbs. 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. A thermostatic switch is mounted on the engine. If the water temperature rises to about 205°F., the switch acts to stop the plant. The coolant temperature must drop about 10° before the engine can be restarted.

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 worth the effort.

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 distilled water, to normal 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.

NO LOAD OPERATION

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

EXERCISE PERIOD

If the plant is used infrequently, such as in standby service, start and operate for at least 30 minutes once a week. This exercise period keeps engine parts lubricated and insures easy emergency starts.

OUT - OF - SERVICE PROTECTION

Protect a plant that is to be out-of-service for more than 30 days as follows:

1. Run plant until thoroughly warm.
2. Drain oil from oil base while still warm. Refill and attach a warning tag stating oil viscosity used.
3. Remove each injector. Pour 1 oz. (two tablespoons) of rust inhibitor (or SAE #50 oil) into each cylinder. Install injector.

4. Service air cleaner as outlined in Cummins manual.
5. Clean governor linkage and protect by wrapping with a clean cloth.
6. Plug exhaust outlets to prevent entrance of moisture, bugs, dirt, etc.
7. Wipe entire unit. Coat parts susceptible to rust with a light film of grease or oil.
8. If battery is used, disconnect and follow standard battery storage procedure.
9. Provide a suitable cover for the entire unit.

HIGH TEMPERATURES

1. See that nothing obstructs air flow to-and-from the plant.
2. Keep cooling system clean.
3. Use correct SAE No. oil for temperature conditions.

LOW TEMPERATURES

1. Use correct SAE No. oil for temperature conditions. Change oil only when engine is warm.
2. Use fresh fuel. Protect against moisture condensation.
3. Keep fuel system clean, and batteries in a well charged condition.
4. Partially restrict cool air flow but use care to avoid overheating.
5. Refer to Cummins manual for additional information.

DUST AND DIRT

1. Keep plant clean.Keep cooling system free of dirt,etc.
2. Service air cleaner as frequently as necessary.
3. Change crankcase oil every 100 operating hours.
4. Keep oil and fuel in dust-tight containers.
5. Keep injector pump linkage clean.

RATINGS

Ratings apply to altitudes up to 1000 feet, standard cooling, normal ambients and with No. 2 Diesel fuel. Consult factory or nearest authorized Onan distributor for operating characteristics under other conditions.

GENERAL MAINTENANCE

GENERAL

Follow a definite schedule of inspection and servicing, based on operating hours. Use the running time meter to keep a record of operation and servicing. Service periods outlined below are for normal service and operating conditions. For continuous duty, extreme temperature, etc., service more frequently. For infrequent use, light duty, etc., service periods can be lengthened accordingly.

ENGINE

Refer to the Cummins engine manual for details and periodic maintenance.

AC GENERATOR

In addition to the engine service operations scheduled under the "C" column in the Cummins manual, check the condition of the AC generator. Service and maintenance are outlined in the next chapter.

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 distilled water.

CONNECTIONS (Fuel, exhaust, etc.)

Operator should periodically make a complete visual inspection of the plant while running at rated load. Some of the things to check for are as follows:

1. Check all fuel and oil lines for possible leakage.
2. Inspect exhaust lines and mufflers for possible leakage and cracks.
3. Periodically drain moisture from condensation traps.
4. Inspect water lines and connections for leaks and security.
5. Inspect electrical wires for security.

ENGINE SPEED

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

1. See that the injection pump is properly timed to the engine. Refer to the Cummins engine manual.
2. Refer to instructions in Cummins manual for governor adjustment. Adjust engine speed to 1800 rpm for 60-cycle operation and 1500-rpm for 50-cycle operation. Use an accurate tachometer for determining engine speed settings, or a frequency meter connected to AC generator output terminals. Multiply frequency by 30 to obtain engine speed.

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

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

GENERATOR MAINTENANCE

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

BRUSHES

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

Brushes should be replaced when worn to approximately 5/8 inch long. Do not attempt to remove the brush without first removing its spring and bracket as shown. Never bend a spring back over its bracket - doing so will put a kink in it and require its replacement. Do not use a substitute brush that may look identical but may have entirely different electrical characteristics. Be sure the brush is installed so that the short side of its taper is toward the spring and its bracket.

GENERATOR BEARING

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

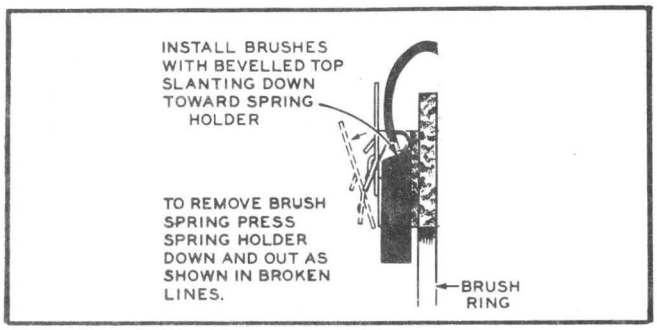


FIG. 14

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.

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 reconnection for different AC output are being followed. These special instructions are supplied on request.

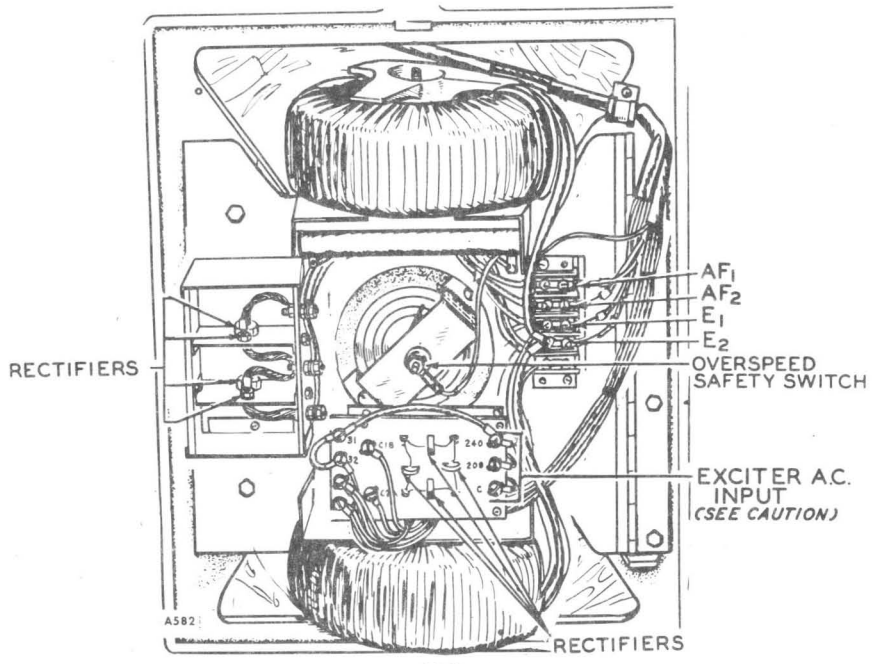


FIG. 15

TROUBLE SHOOTING

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 No. 1 until voltage begins to build-up. Then remove.	None
	Pair of Field Rectifiers (either 1&4 or 2&3) open	Test rectifiers and replace if defective	
	Both Field Rectifiers 2 and 3 shorted	Test rectifiers and replace if defective.	
Output voltage slow to build up. Circuit breaker opens in about five seconds.	Either Field Rectifier 2 or 3 shorted	Test rectifiers and replace if defective	2
Output voltage slow to build up and five per cent below rated voltage after build up. Voltage regulation poor.	Either Field Rectifier 1 or 4 shorted	Test Rectifier and replace if defective	2
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	2

NATURE OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION	STEP
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	2
	Open circuit in Gate winding G1-G2 of Reactor A or B	If Field Rectifiers 1 and 2 check okay, check continuities of Gate windings G1-G2	3
Output voltage builds up normally but less than rated voltage after build up	Shorted winding in Control Reactor	Test Control Reactor and and replace if defective	4
Output voltage builds up normally with slightly less than rated voltage at no load and low voltage	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
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	3
Output voltage builds up normally but 150 to 200 percent above rated voltage after build up No regulation possible	Control winding C1-C2 of 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	3
	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	5

Step 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.

Step 3. Checking Reactors "A" and "B".

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

b. Isolate one Gate winding by disconnecting either end of Gate winding G1–G2 from its point of connection; for example, disconnect G1 at E2. Measure the resistance in the Control winding across C1-C2. Should be 17.5.

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.

Step 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 150.0.

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 presence of an open circuit.

Step 5. Checking Resistors.

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

b. 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 or if the measured resistance exceeds the percent limits either way.

RECONNECTIBLE POSSIBILITIES

The "reconnectible generator" is designed to provide multiple output leads for conversions to different voltage outputs than the original nameplate rating.

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

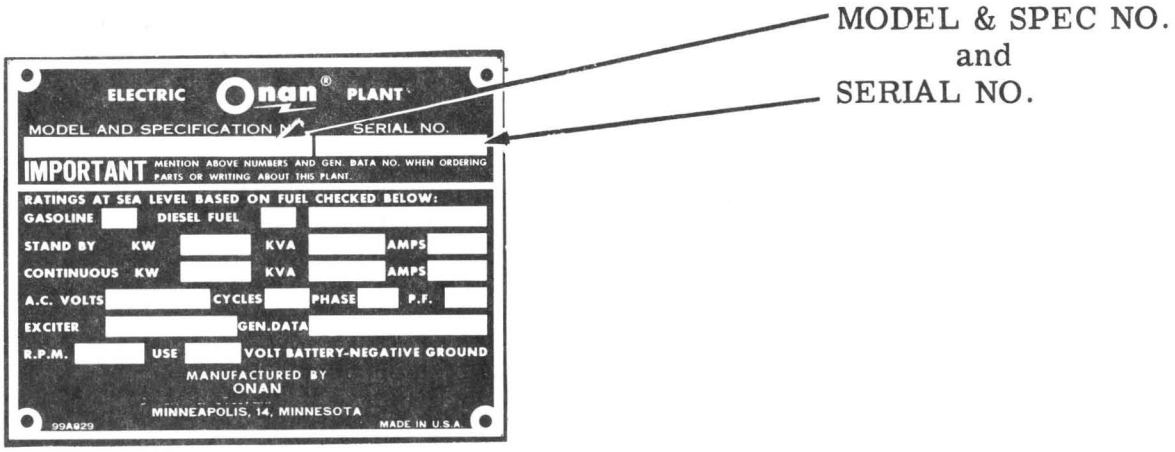
PARALLEL OPERATION

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 equipped as such can usually be altered as necessary. Consult the factory for specific information.

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 ON YOUR PLANT. ONAN NAMEPLATE IS LOCATED ON THE UPPER RIGHT SIDE OF THE FLYWHEEL HOUSING. ALWAYS GIVE THE COMPLETE:

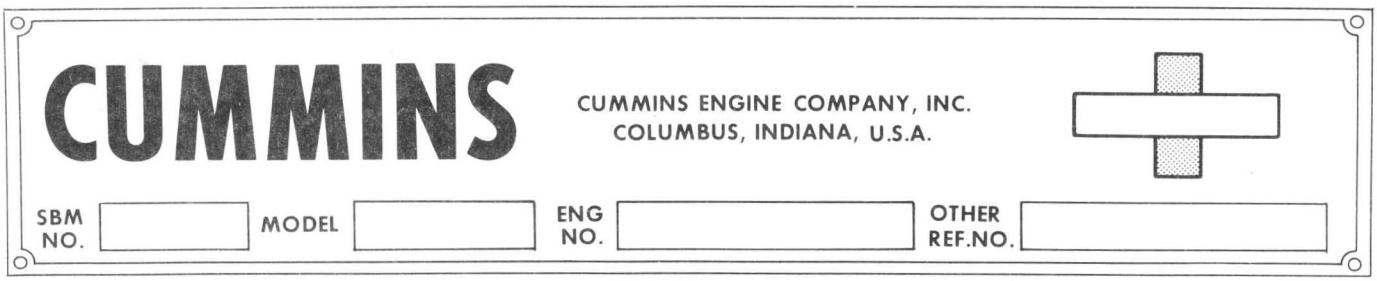


CUMMINS PARTS

ALL CUMMINS PARTS MUST BE ORDERED FROM THE CUMMINS ENGINE COMPANY, INC., COLUMBUS, INDIANA OR THEIR NEAREST AUTHORIZED CUMMINS DISTRIBUTOR OR DEALER.

REFER TO THE CUMMINS ENGINE NAMEPLATE LOCATED ON THE GEAR COVER ON THE RIGHT SIDE OF THE ENGINE AS VIEWED FACING THE RADIATOR END.

WHEN ORDERING PARTS OR REQUESTING SERVICE INFORMATION, SUPPLY CUMMINS WITH ALL INFORMATION STATED ON THE ENGINE NAMEPLATE.



PARTS CATALOG

DFC SERIES

This parts catalog applies to the standard ONAN DFC Series electric generating plants. They are powered by a Cummins Model HRF-6 engine which is more completely described in the Cummins manual. Basically, the engine is a 6 cylinder, water cooled, diesel (compression ignition) type. The cylinder bore is 5-1/8 inches, piston stroke is 6 inches, and displacement is 743 cubic inches.

Cummins Engine parts must be selected from the appropriate Cummins parts list and parts must be secured from the Cummins Engine Company or their 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: 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 PLANT DATA TABLE.

PLANT DATA TABLE

MODEL & SPEC NO. †	ELECTRICAL DATA				
	WATTS	VOLTS	PHASE	WIRE	CPS
100DFC-53R8	100, 000	120/240	1	3	50
100DFC-54R8	100, 000	120/208	3	4	50
100DFC-55DR8	100, 000	120/240	3	4	50
100DFC-57R8	100, 000	220/380	3	4	50
100DFC-54XR8	100, 000	277/480	3	4	50
100DFC-59XR8	100, 000	347/600	3	4	50
115DFC-3R8/	115, 000	120/240	1	3	60
115DFC-4R8/	115, 000	120/208	3	4	60
115DFC-5DR8/▲	115, 000	120/240	3	4	60
115DFC-6R8/	115, 000	480	3	3	60
115DFC-7R8/	115, 000	220/380	3	4	60
115DFC-9R8/	115, 000	600	3	3	60
115DFC-4XR8	115, 000	277/480	3	4	60
115DFC-9XR8	115, 000	347/600	3	4	60

† - The NUMBER after the diagnonal 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.

* - Maximum rating is shown. Continuous rating also appears on nameplate.

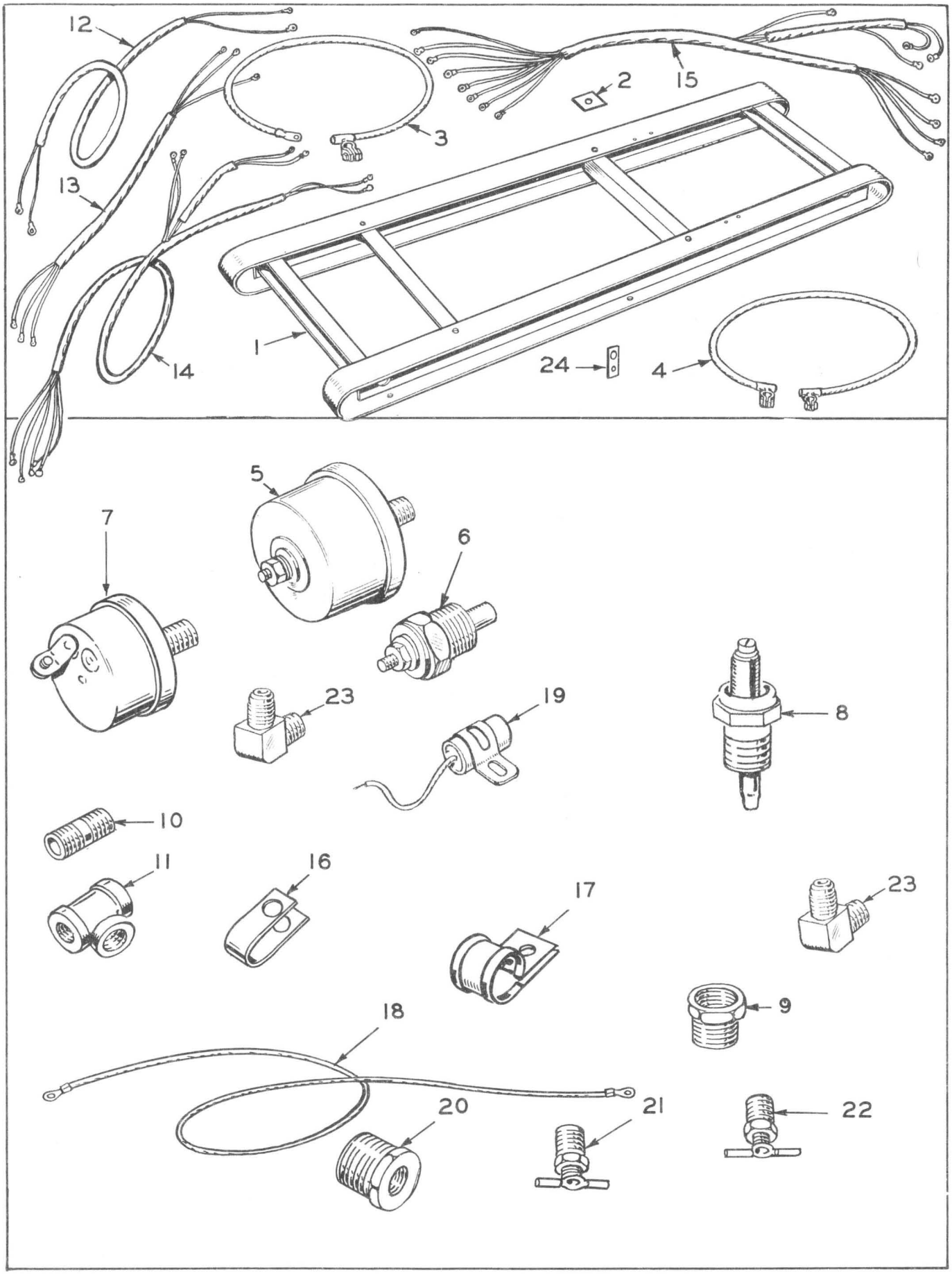


FIG. 1 - MOUNTING BASE, BATTERY CABLES & SENDER GROUP

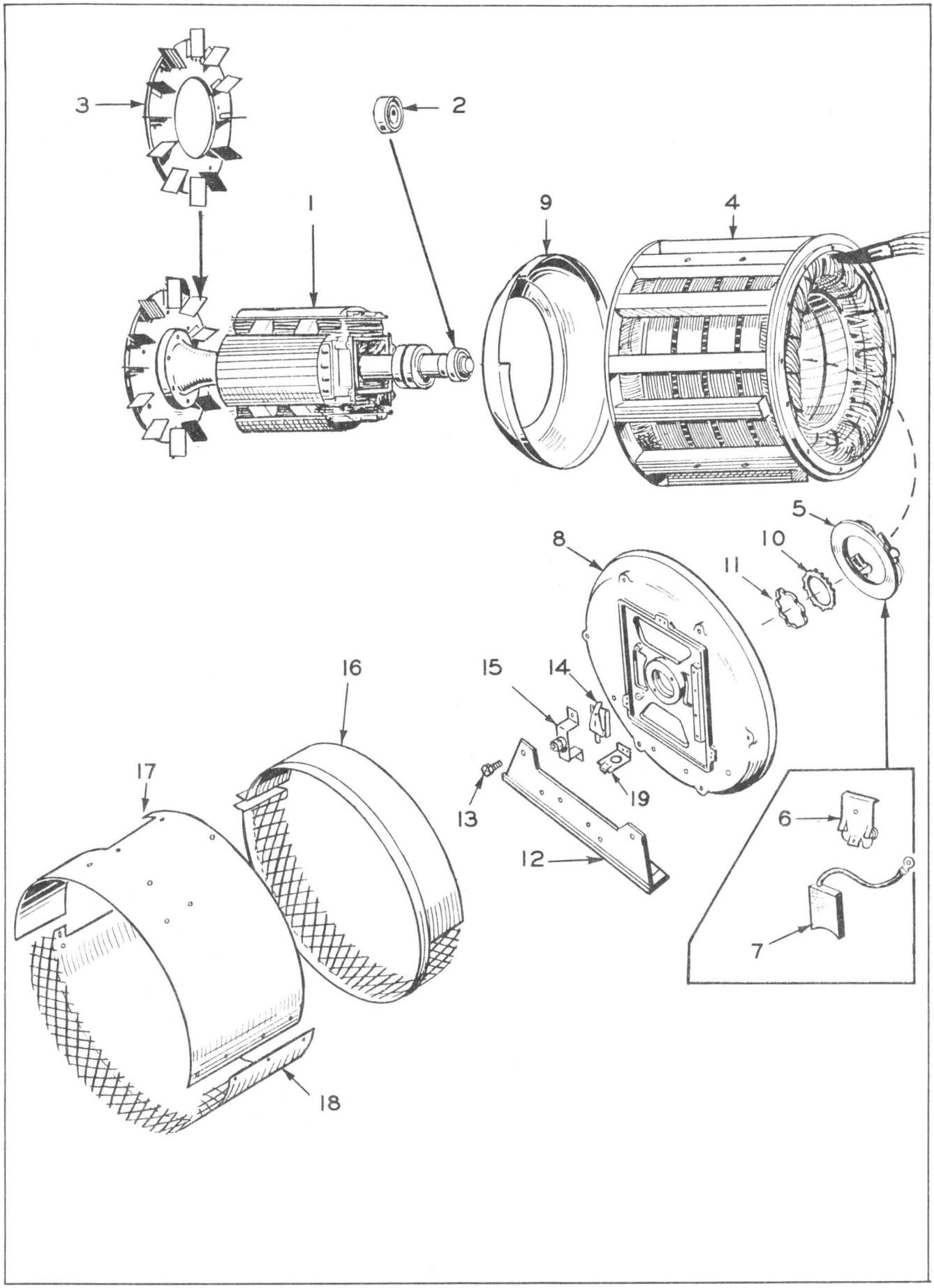


FIG. 2 - GENERATOR GROUP - Alternator Portion

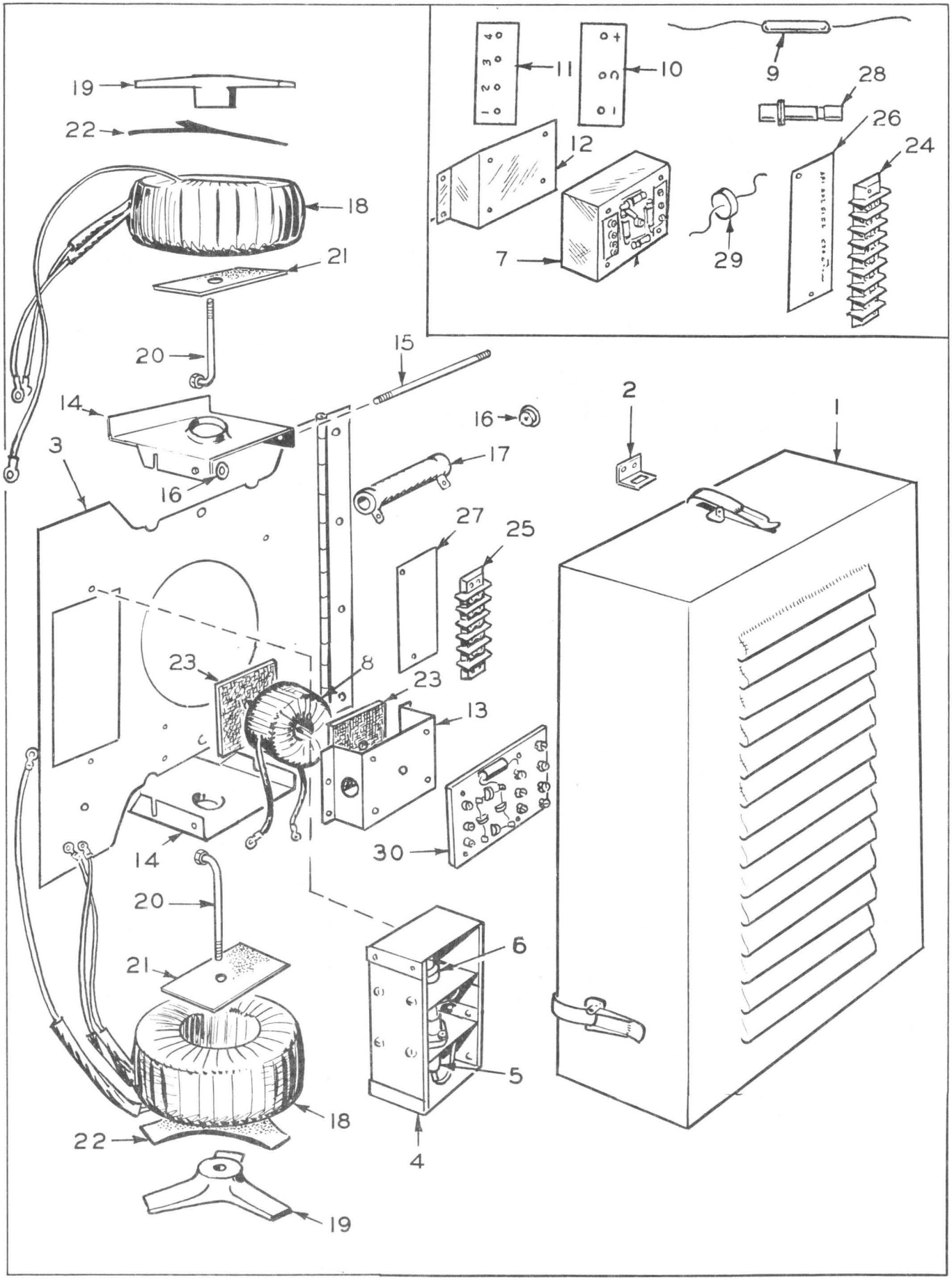


FIG. 3 - GENERATOR GROUP - Exciter Portion

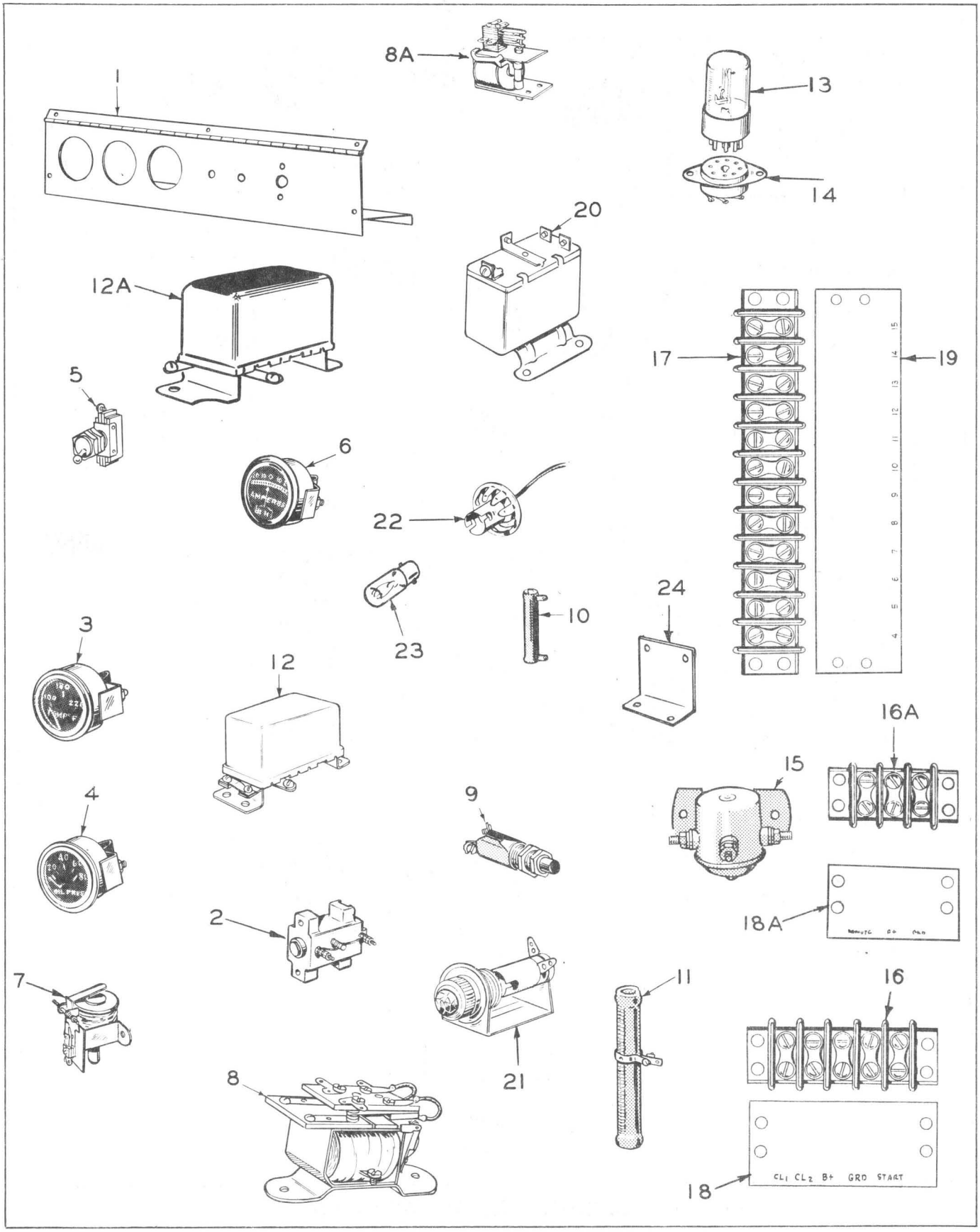


FIG. 4 - CONTROL GROUP - Engine Instruments

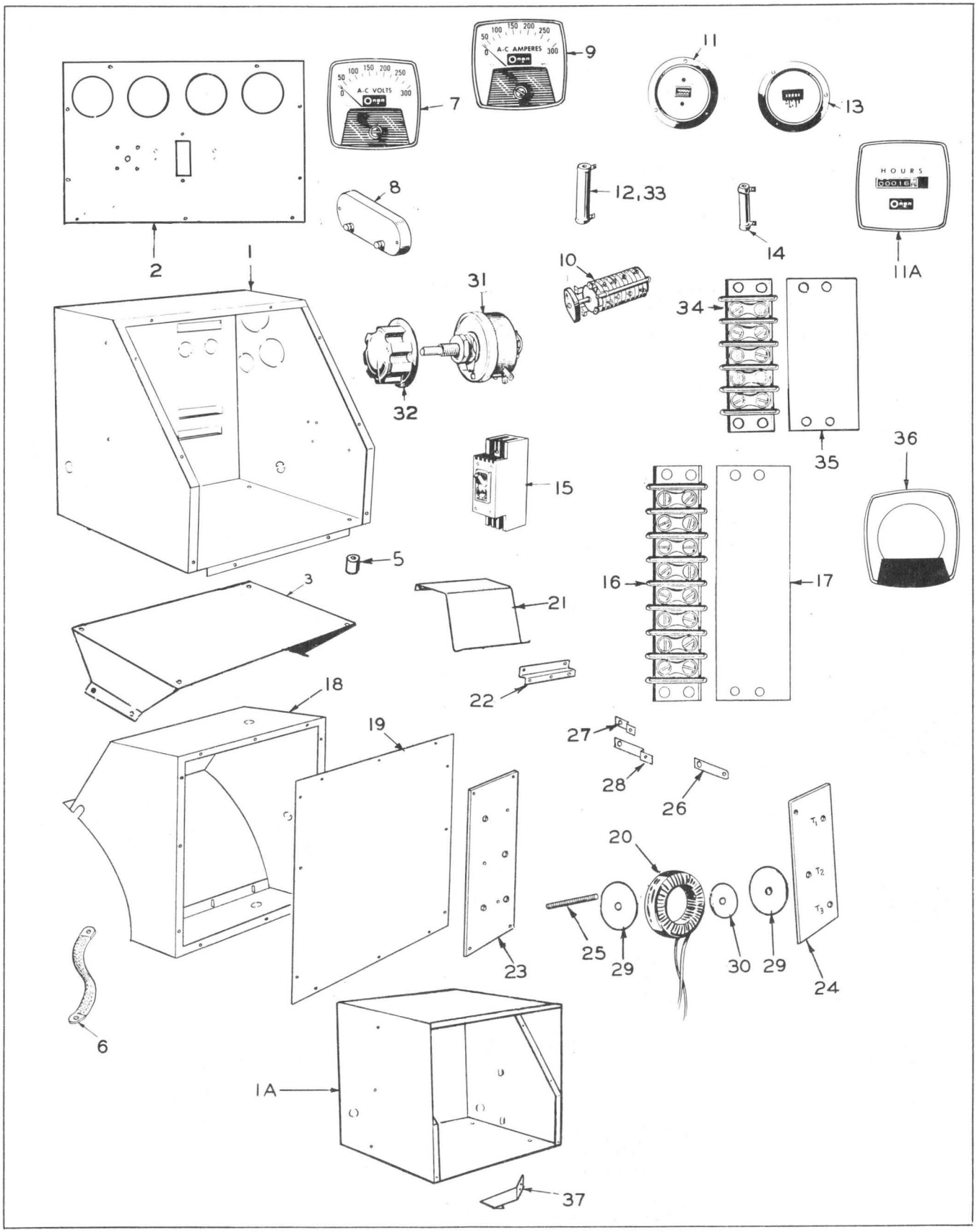


FIG. 5 - CONTROL GROUP - AC Output

PARTS LIST

REF. NO.	PART NO.	QUANT. USED	DESCRIPTION
			REPLACEMENT ENGINE
	100P258	1	Engine, Replacement (Cummins Engine Company Model HRF-6) General description: Includes - Complete Cylinder Block; Fuel Pump; Air Cleaner; Fuel Filter; Oil Filter; Starter; Charge Generator & Voltage Regulator; Governor; Radiator; Water Pump; Fan Blades & Belt; Fan Guard; Exhaust Manifold; Flywheel Housing; and Engine Supports. Excludes - Throttle Control; Engine Wiring; Oil Pressure & Water Temperature Gauge Senders; and Mounting Base.
			FIG. 1 - MOUNTING BASE, BATTERY CABLES & SENDER GROUP
1	403C559	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	1	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	309B146	1	Switch, High Water Temperature Cut-off (was 309A1)
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 to Block.
11	505-59	1	Tee, Pipe (1/8") Oil Pressure Switch and Oil Gauge Sender Mounting.
12-15			Harness Assembly - Complete with terminals.
12	338B213	1	Voltage Regulator Connections (2 Leads in sleeving).
13	338B214	1	Charge Generator Connections (3 Leads in sleeving).
14	338C215	1	Engine Control Connections (7 Leads in sleeving).
15	338C216	1	Static Exciter Connections (8 Leads in sleeving).
16,17			Clip, Harness - Engine Control Connections.
16	416A96	3	"U" Shaped - All Metal.
17	332-49	2	"O" Shaped - Metal with rubber insulator.

PARTS LIST

REF. NO.	PART NO.	QUANT. USED	DESCRIPTION
			FIG. 1 - MOUNTING BASE, BATTERY CABLES & SENDER GROUP (Cont.)
18	336A1211	1	Lead, Starter - 14" Long.
19	312A58	2	Condenser - .1 Mfd. (1) Charge Gen. (1) Charge Regulator
20	505-131	1	Bushing, Pipe Reducer (3/4" x 3/8") Rad. Drain Valve.
21, 22			Valve, Drain.
21	504-28	1	Radiator Drain.
22	504-3	1	Cylinder Water Jacket Drain.
23	502-218	1	Elbow, Male (5/8" x 1/2) Brass - Fuel In. to Inj. Pump.
24	191A214	1	Connector, Starter Terminal (1" x 2" Copper Strip).
			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.
2	510P63	1	Bearing - To Spec "E".
2	510P88	1	Bearing - Begin Spec "E".
3	205C61	1	Blower.
4	★	1	Stator Assembly, Wound.
5	212C248	1	Rig Assy., Brush - Incl. Brushes, Sprgs & hardware.
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.
	232A1186	1	Prior to Spec "E".
	232A1807	1	Begin Spec "E".
11			Spring, Bearing Holder - Anti-Rotation.
	232A1187	1	Prior to Spec "E".
	232A1808	1	Begin Spec "E".
12	232D1396	1	Support, Generator Mounting.
13	805-35	4	Bolt, Place - Generator Mounting 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).
17			Band, Generator - Rear Portion - UPPER HALF (Wide).
			Single Phase Models.
	234D80	1	Prior to Spec "C".
	234C136	1	Begin Spec "C".
			3 Phase Models.
	234D71	1	Prior to Spec "C".
	234C130	1	Begin Spec "C".

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

PARTS LIST

REF. NO.	PART NO.	QUANT. USED	DESCRIPTION
			FIG. 2 - GENERATOR GROUP (Alternator Portion) Cont.
18			Band, Generator - Rear Portion - LOWER HALF (Wide).
			Single Phase Models.
	234D79	1	Prior to Spec "C".
	234C137	1	Begin Spec "C".
			3 Phase Models.
	234D72	1	Prior to Spec "C".
	234C131	1	Begin Spec "C".
19	234A107	1	Bracket, Conduit Connector - Begin Spec "C".
			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.
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 Recitifier & Resistor 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.

PARTS LIST

REF. NO.	PART NO.	QUANT. USED	DESCRIPTION
			FIG. 3 - GENERATOR GROUP (Exciter Portion) Model 2SX (Cont.)
			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.
			Block, Terminal.
24	332A503	1	Prior to Spec "C" (8 Place).
25	332A532	1	Begin Spec "C" (5 Place).
			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.
			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	Breaker, Circuit Cranking Limiter.
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			Relay, Time Delay.
	307A388	1	Prior to Spec "F".
	307A899	1	Begin Spec "F".

PARTS LIST

REF. NO.	PART NO.	QUANT. USED	DESCRIPTION
			FIG. 4 - CONTROL GROUP (Engine Instruments Portion) Cont.
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" - Prior to Spec "F".
	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" - Spec "D" through "E".
11			Resistor, Adjustable -
	304A66	1	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" - Prior to Spec "F".
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	Spec "D" through "E" - 10 Second Delay.
	307A753	1	Spec "D" through "E" - 5 Second Delay.
14	323-52	2	Socket, Cycle Cranking Relay (Prior to Spec "D" 1 Only Used).
15	307-61	1	Relay, Pilot - Prior to Spec "F".
16, 16A, 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, 18A			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)

PARTS LIST

REF. NO.	PART NO.	QUANT. USED	DESCRIPTION

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

20	307B52	1	Relay, Start-Disconnect.
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	320P240	1	Breaker, Circuit - Starter Motor - 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.
3	301C1830	1	Bracket, Control Box Mounting - Single Piece (Replaces Two Piece Brackets)
5	402-78	4	Rubber, Mounting - Control Box to Mounting Bracket
6	337A44	1	Strap, Ground
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) -
	302P412	1	Ammeter Scale Reads 0-250.
	302P411	1	Ammeter Scale Reads 0-200 - Replaces 302-13.
	302P414	1	Ammeter Scale Reads 0-500 - Replaces 302-371 (NOTE: Single Phase Plants Use Quantity of 2).
	302P415	1	Ammeter Scale Reads 0-750 - Replaces 302-384 (NOTE: Single Phase Plants Use Quantity of 2).
10	308-22	1	Switch, Voltage and Current Selector.
11,11A			Meter, Running Time -
11			Prior to Spec "D" -
	302-212	1	60 Cycle Plants (NOTE: When used to replace 302-387 meter on plants requiring a resistor, also order #304A125 Resistor for 480 volt

★ - 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.
11(cont.)			plants, #304A99 Resistor for 120/240 volt, 3 phase plants, and #304A134 Resistor for 600 volt plants).
	302-102	1	50 Cycle Plants.
11A			Begin Spec "D" -
	302P465	1	For 120/208 Volt, 120/240 Volt, 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 - For 302-212 Meter on 220/380 Volt, 3 Phase Plants.
	304A125	1	15, 000 Ohm, 25 Watt - For 302-212 Meter on 277/480 and 480 Volt, 3 Phase Plants.
	304A134	1	20, 000 Ohm, 25 Watt - For 302-212 Meter on 600 Volt, 3 Phase Plants.
	304A445	1	6, 500 Ohm, 25 Watt - For 302-387 Meter on 277/480 and 480 Volt 3 Phase Plants.
	304A444	1	2, 500 Ohm, 10 Watt - For 302-387 Meter on 220/380 Volt, 3 Phase Plants.
	304A458	1	10, 000 Ohm, 25 Watt - For 302-387 Meter on 600 Volt, 3 Phase Plants.
			Begin Spec "D" -
	304A536	1	9, 000 Ohm, 50 Watt - For 302P465 Meter on 600 Volt, 3 Phase 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 - For 480 Volt, 3 Phase, 3 Wire Plants, and 277/480 Volt, 3 Phase, 4 Wire Plants.
	304A125	1	15, 000 Ohm, 25 Watt - For 220/380 Volt, 3 Phase, 4 Wire Plants.
	304A402	1	60, 000 Ohm, 10 Watt - For 600 Volt, 3 Phase, 3 Wire Plants.
15			Breaker, Circuit -
	320B18	1	Single Phase Models.
	320B17	1	3 Phase Models - Prior to Spec "C".
	320B2	1	3 Phase Models - Begin Spec "C".
16	332A503	1	Block, Terminal (8 Place).
17	332A601	1	Strip, Block Marker (Marked 15 through 22).
18	301E1675	1	Box Only, Output Terminal - Mounts on Side of Generator.

PARTS LIST

REF. NO.	PART NO.	QUANT. USED	DESCRIPTION
			FIG. 5 - CONTROL GROUP (AC Output Portion) Cont.
19	301B1676	1	Cover, Output Terminal Box.
20			Transformer, Current (Mounts in Output Terminal Box) Check TRANSFORMER Nameplate - Select according to rating -
	302B106	3	Transformer Nameplate Reads "Ratio 200/5" (Use with 0-200 Scale AC Ammeter).
	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).
	302B209	3	Transformer Nameplate Reads "Ratio 250/5" (Use with 0-250 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			Panel Only, Current Transformer Mounting - Bottom Panel (Mounts Output Terminal Studs) - Prior to Spec "C" -
	232B1418	1	Single Phase Plants.
	232B1385	1	3 Phase Plants.
24			Panel Only, Current Transformer Retaining - Top Panel - Prior to Spec "C". -
	232B1419	1	Single Phase Plants.
	232B1386	1	3 Phase Plants.
25			Stud, Output Terminal - Copper - Prior to Spec "C" -
	232A1420	3	Single Phase Plants (7/8-14 x 6-1/2").
	232A1400	4	3 Phase Plants (5/8-18 x 6").
26			Strap, Output Terminal - Copper - Terminal Stud to Ground - Prior to Spec "C" -
	337A58	1	Single Phase Plants (3-3/8 x 1-1/2").
	337A57	1	3 Phase Plants (3-1/4" x 1").
27			Strap, Output Terminal - Copper - Grounded Stud to Machine Screw - Prior to Spec "C". -
	232A1416	1	Single Phase Plants (2-3/4 x 1-1/2").
	232A1397	1	3 Phase Plants (2-1/4" x 1").
28			Strap, Output Terminal - Copper - UNGROUNDED Studs to Machine Screw - Prior to Spec "C" -
	232A1415	2	Single Phase Plants (4-1/4" x 1-1/2").
	232A1398	3	3 Phase Plants (3-3/8" x 1").
29			Washer, Neoprene Insulating - Current Transformer Mounting - Prior to Spec "C" -
	508A81	4	Single Phase Plants (4-1/2" O.D.).
	508A79	6	3 Phase Plants (3" O.D.).

PARTS LIST

REF. NO.	PART NO.	QUANT. USED	DESCRIPTION
			FIG. 5 - CONTROL GROUP (AC Output Portion) Cont.
30			Washer, Fibre - Current Transformer Mounting - Prior to Spec "C" -
	508A83	2	Single Phase Plants (2-1/4" O.D.).
	508A82	3	3 Phase Plants (1-1/2" O.D.).
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".

ONAN

★ **Electric Plants**

★ **Two-Bearing Generators**

★ **Air Cooled Engines**

THESE OUTSTANDING PRODUCTS, designed and built by Onan, are known the world over for their ruggedness and dependability!

WHENEVER YOU NEED an independent source of electric power for any purpose, be sure to see the complete line of Onan Gasoline or Diesel Engine-Driven Electric Plants and Onan Generators. You'll find a type and size to fit every job...portable or mobile...heavy duty primary or emergency standby. AC - 500 to 400,000 Watts. DC to 15,000 Watts. Battery Chargers to 5,000 Watts.

IF YOU DESIGN AND BUILD commercial or military equipment requiring stamina-tested air cooled engines, consult the Onan factory for complete information about Onan deluxe engines.

Onan®