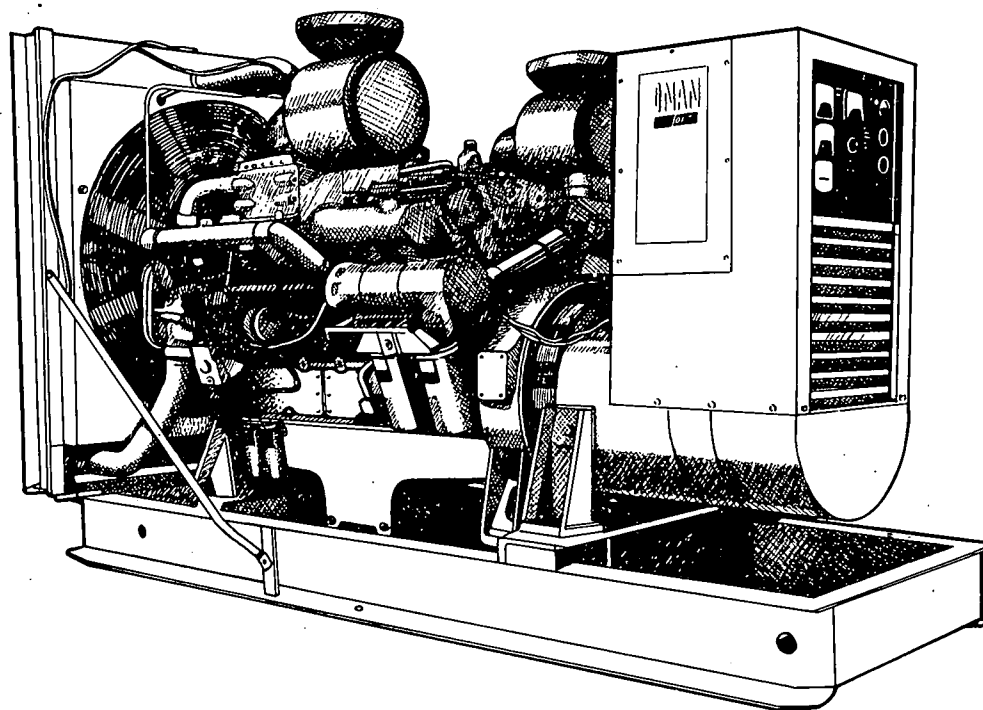


OPERATORS MANUAL AND PARTS CATALOG

FOR
DFT
SERIES
ELECTRIC GENERATING SETS



BEGIN SPEC. E

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INTRODUCTION

FOREWORD

This manual is applicable to the DFT Series electric generating set, consisting of an Onan YB17/1 300.0KW AC generator, driven by a Cummins V17/10-P500 Diesel engine. Information is provided on installation, operation, troubleshooting and parts ordering for the set. The manual should be used in conjunction with The Cummins engine manual, as your specific engine may have variations due to optional equipment available.

CAUTION

Onan uses this symbol throughout the text to warn of possible equipment damage.

WARNING

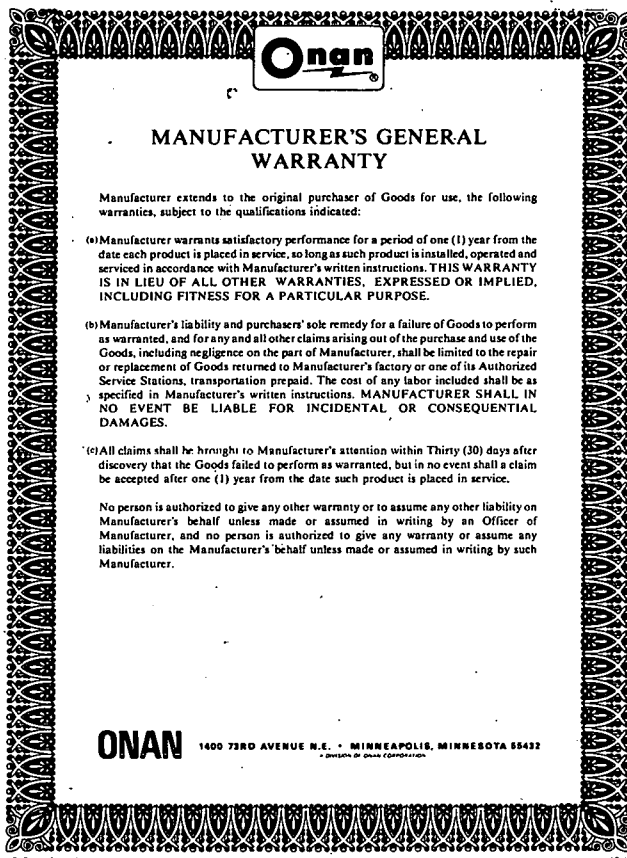
This symbol is used to warn of any possible personal injury.

MODEL IDENTIFICATION

Identify your 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.

300.0	DFT	17	/	1	E
1	2	3		4	5

1. Indicates Kilowatt rating.
2. Factory code for SERIES identification.
3. Indicates voltage code.
4. Factory code for designating optional equipment.
5. Specification letter. (Advances when factory makes production modifications.)



If it is necessary to contact a dealer or the factory regarding the set, always mention the complete Model, Spec No. and Serial No. as given on the Onan nameplate. This nameplate information is necessary to properly identify your unit among the many types manufactured. Refer to the engine nameplate when requesting information from its manufacturer. The Onan nameplate is located on the right side of the generator; the Cummins nameplate is on the left rear side, on engine block.

Left side and right side are considered when viewed from the engine or front end of the generating set.

IMPORTANT! RETURN WARRANTY CARD ATTACHED TO UNIT.

SPECIFICATIONS

ENGINE DETAILS

Engine Manufacturer	Cummins
Engine Series	V1710-P500
Number of Cylinders	12
Displacement	1710 cu. inches
BHP @ 1800 RPM	463
Compression Ratio	15.0:1
Bore	5.5 inches
Stroke	6.0 inches
Fuel	No. 2 Diesel
Battery Voltage	24
Battery Group (Two 12-Volt, 225 A.H.)	8D - over 25°F Operating Temp.
Starting Method	Solenoid Shift
Governor Regulation	5% Maximum

GENERATOR DETAILS

Type	YB 17 /1, 60 Hz. YB517 50 Hz.
Rating (Watts)	
60 Hertz Continuous Standby	300,000
50 Hertz Continuous Standby	250,000
AC Voltage Regulation	2%
60 Hertz RPM	1800
50 Hertz RPM	1500
Output Rating	0.8 PF
AC Frequency Regulation	3.0 Hz No Load-Full Load
Battery Charging Current	35 Amps

CAPACITIES AND REQUIREMENTS

Cooling System (Includes Radiator)	42 Gallons
Engine	21 Gallons
Engine Oil Capacity (Filter, Lines, Crankcase)	21 Gallons
Exhaust Connection (inches pipe thread)	4

AIR REQUIREMENTS (1800 RPM)

Engine Combustion	830 CFM
Radiator Cooled Engine	30,400 CFM
Total for Radiator Cooled Model	32,430 CFM
Alternator Cooling Air	
(1800 RPM)	1200 CFM
(1500 RPM)	1000 CFM
Fuel Consumption at Rated Load	25.4 GPH

GENERAL

Height	81.375 inches
Width	55.0 inches
Length	125.0 inches
Weight (Approx.)	9,900 lbs.

TABLE 1. GENERATOR VOLTAGE OPTIONS

VOLTAGE	PHASE	FREQUENCY	MAXIMUM CURRENT	PARALLEL WYE	SERIES WYE	CONNECT WIRE W12
(YB17) 120/208	3	60 Hz	1042 AMPS	x		H3
127/220	3	60 Hz	984 AMPS	x		H4
139/240	3	60 Hz	900 AMPS	x		H5
240/416	3	60 Hz	520 AMPS		x	H3
254/440	3	60 Hz	492 AMPS		x	H4
277/480	3	60 Hz	451 AMPS		x	H5
(YB517) 110/190	3	50 Hz	946 AMPS	x		H3
115/200	3	50 Hz	906 AMPS	x		H4
120/208	3	50 Hz	868 AMPS	x		H4
127/220	3	50 Hz	822 AMPS	x		H5
220/380	3	50 Hz	475 AMPS		x	H3
230/400	3	50 Hz	453 AMPS		x	H4
240/416	3	50 Hz	434 AMPS		x	H4
254/440	3	50 Hz	412 AMPS		x	H5

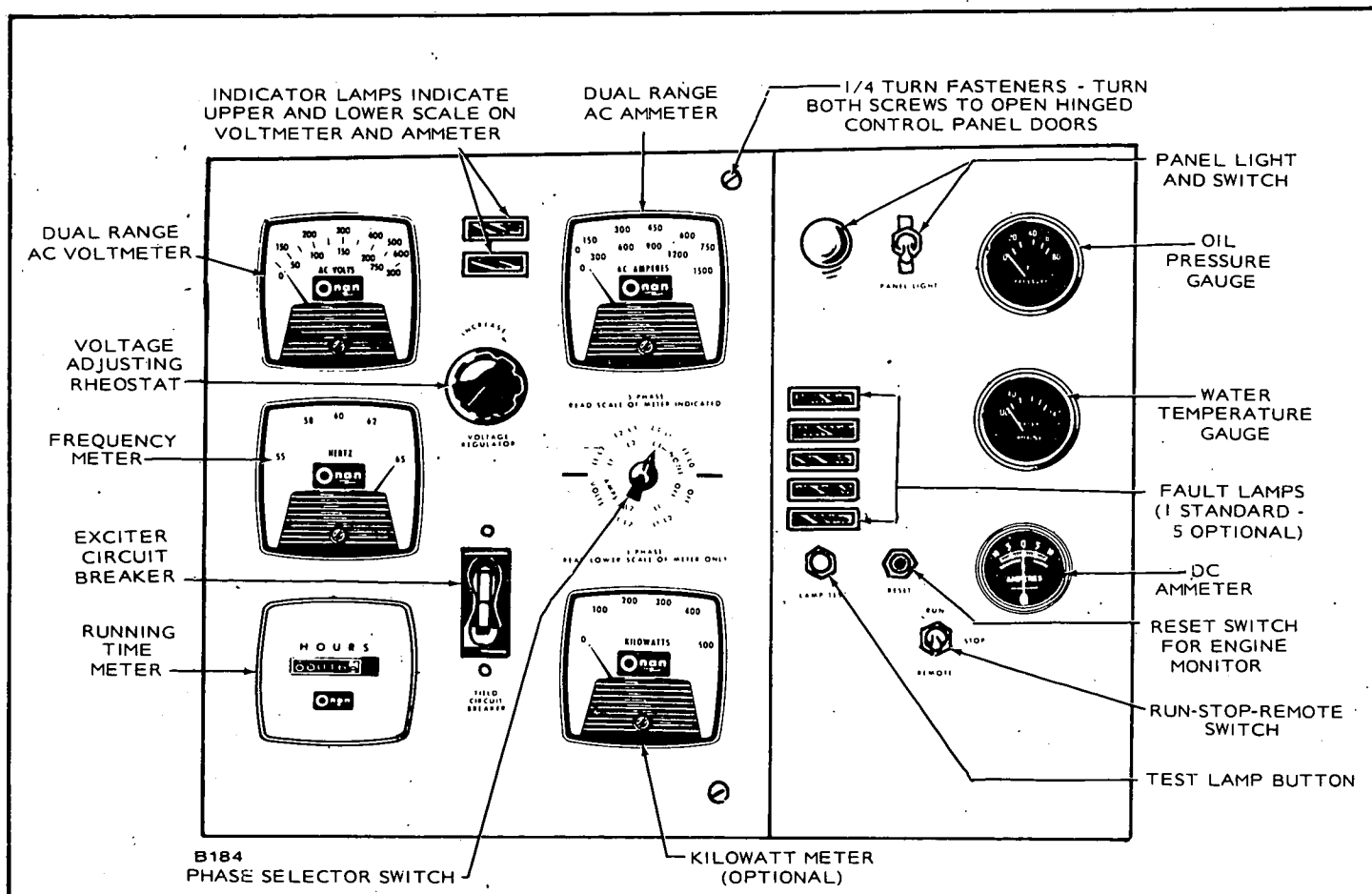


FIGURE 1. CONTROL PANEL

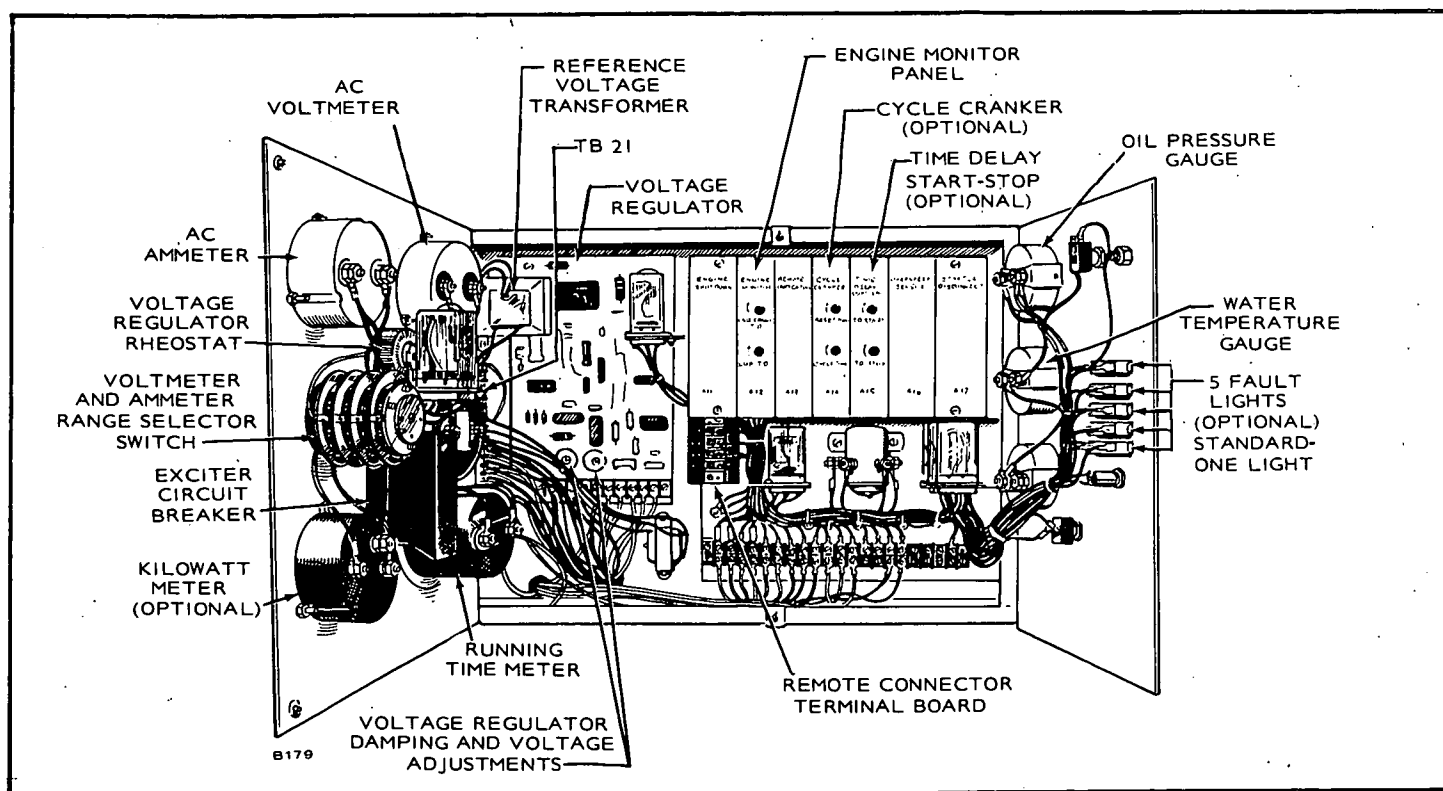


FIGURE 2. CONTROL PANEL INTERIOR

DESCRIPTION

GENERAL

An Onan DFT series electric generating set is a complete unit consisting of an engine driven AC generator, with controls and accessories as ordered.

ENGINE

The engine on the DFT is a Cummins V1710-P500 as described in engine manual. Basic measurements and requirements will be found under *Specifications*. However, the engine used for your unit may have variations due to optional equipment available, therefore the Cummins manual should be consulted.

AC GENERATOR

The generator is an Onan Type YB 12 lead, 4 pole revolving field, reconnectable bus-bar brushless unit. The alternating current is generated in the stator winding. The alternator rotor, attached directly to the engine flywheel turns at engine speed. Therefore, the speed at which the rotor turns, determines generator output frequency. The 60 hertz set operates at 1800 rpm and the 50 hertz at 1500 rpm. Excitation is achieved by feeding AC output to a voltage regulator, where it is compared with a reference voltage in the regulator, rectified and returned to the field of the exciter, then to the exciter armature, rectified and fed to the generator field.

CONTROL PANEL

The following is a brief description of each of the standard controls and instruments located on the face of the panel. See Figure 1.

DC PANEL

Panel Light and Switch: Illuminates control panel.

Oil Pressure Gauge: Indicates pressure of lubricating oil in engine (wired to a sensor unit located on the engine).

Water Temperature Gauge: Indicates temperature of circulating coolant in engine. (Wired to a sensor unit located on the engine.)

Battery Charge Rate DC Ammeter: Indicates the battery charging current.

Run-Stop-Remote Switch: Starts and stops the unit locally or from a remote location.

Reset Switch: Manual reset for engine monitor after shut-down.

Lamp Test: Press to test warning lamp bulbs (when engine is running only).

Warning Lights: Indicates "Fault" in engine operation.

AC PANEL

AC Voltmeter: Indicates AC generator output voltage.

Dual range instrument: measurement range in use shown on indicator light.

AC Ammeter: Indicates AC generator output current. Dual range instrument: measurement range in use shown on indicator lights.

Voltmeter-Ammeter Phase Selector Switch: Selects the phases of the generator output to be measured by the AC voltmeter and AC ammeter.

Voltage Regulator: Rheostat, provides approximately plus or minus 5% adjustment of the rated output voltage.

Exciter Circuit Breaker: Provides generator exciter and regulator protection from overheating in the event of certain failure modes of the generator, exciter and voltage regulator.

Running Time Meter: Registers the total number of hours, to 1/10th that the unit has run. Use it to keep a record for periodic servicing. Time is accumulative, meter cannot be reset.

Frequency Meter: Indicates the frequency of the generator output in hertz. It can be used to check engine speed. (Each hertz equals 30 rpm).

OPTIONAL EQUIPMENT

DC Panel

Warning Lights: Eliminates the one "Fault" light and substitutes five indicator lights to give warning of -

- a. Overcrank
- b. Overspeed
- c. Low oil pressure
- d. High engine temperature
- e. Low engine temperature

Operation of these lights will be discussed in conjunction with engine monitor panel.

AC Panel

Kilowatt Meter: Indicates output of the AC generator in kilowatts. Connected into a transducer mounted in the control box housing.

CONTROL PANEL INTERIOR

The only equipments discussed in this section will be those which the operator may have reason to adjust or inspect for service. Refer to Figure 2 for location of units mentioned.

Terminal Board (TB) 21: Connection of wandering lead (W12) to terminals H3, H4, H5 is made at this point, to change voltage regulator tap when reconnecting generator for different voltages. Refer to Figure 12.

Voltage Regulator: Solid state unit controls AC output from generator at predetermined level regardless of load. Regulation plus or minus 2% from no load to full load, 0.8 P.F.

Engine Monitor: Printed circuit plug-in modules provide the following functions:

1. A 75 second cranking period.
2. Approximately a 12-1/2 second time delay for oil pressure buildup.
3. An external alarm contact to light a fault lamp and shut down the set for alarm conditions such as:
 - a. Overcrank (failed to start after cranking 75 seconds).
 - b. Overspeed (engine speed reaches 2100 rpm).
 - c. Low oil pressure (14 psi).
 - d. High engine temperature (215° F).

On standard control panels, all four alarms are wired into one common fault lamp; on units with five fault lamps, four have shutdown alarms, the fifth (low engine temperature) lights a fault lamp only. Refer to Table 2.

TABLE 2. FAULT LAMP OPTIONS.

SYSTEM	FAULT	FAULT LAMP	STOP ENGINE	EXTERNAL ALARM	PRE-ALARM
PENN STATE SINGLE LIGHT	Overcrank	x	x	x	
	Overspeed	x	x	x	
	Low Oil Pressure	x		x	
	High Engine Temperature	x		x	
STANDARD SINGLE LIGHT	Overcrank	x	x	x	
	Overspeed	x	x	x	
	Low Oil Pressure	x	x	x	
	High Engine Temperature	x	x	x	
5 LIGHT	Overcrank	x	x	x	
	Overspeed	x	x	x	
	Low Oil Pressure	x	x	x	
	High Engine Temperature	x	x	x	
	Low Engine Temperature	x			
5 LIGHT PRE-ALARM	Overcrank	x	x	x	
	Overspeed	x	x	x	
	Low Oil Pressure	x	*	x	x
	High Engine Temperature	x	*	x	x
	Low Engine Temperature	x			

* - With additional optional sensors.

Standard Cranking Module: Limits engine cranking time to 75 seconds. If engine fails to start after 75 seconds the engine monitor lights a fault lamp and opens the cranking circuit.

Start-Disconnect and Overspeed: Plug-in module. Operates at approximately 100 rpm above maximum cranking speed to prevent the starter from being energized while engine is running. Overspeed operates at 2000-2200 rpm. See Figure 3.

OPTIONAL MODULES

Cycle Cranker: Plug-in module replaces standard cranking circuit. Automatically provides a 15-second crank time and a 10-second rest time for three ON and two OFF cycles in 65 seconds. If engine fails to start, after 75-seconds the engine monitor lights a fault lamp and opens the cranking circuit.

Time Delay Start/Stop: Operative from remote location only. Provides 1-10 seconds time delay on starting and 30-seconds to 5-minutes delay on stopping. Delay period adjustable on engine monitor panel.

Pre-Alarm: Gives advance warning for low oil pressure or high engine temperature. Requires two sensors, each for engine temperature and oil pressure.

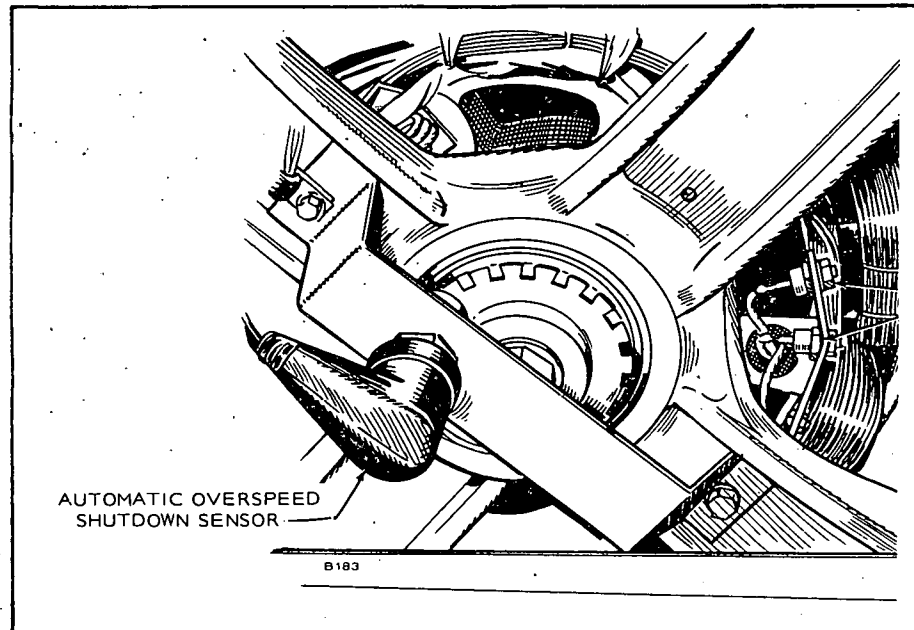
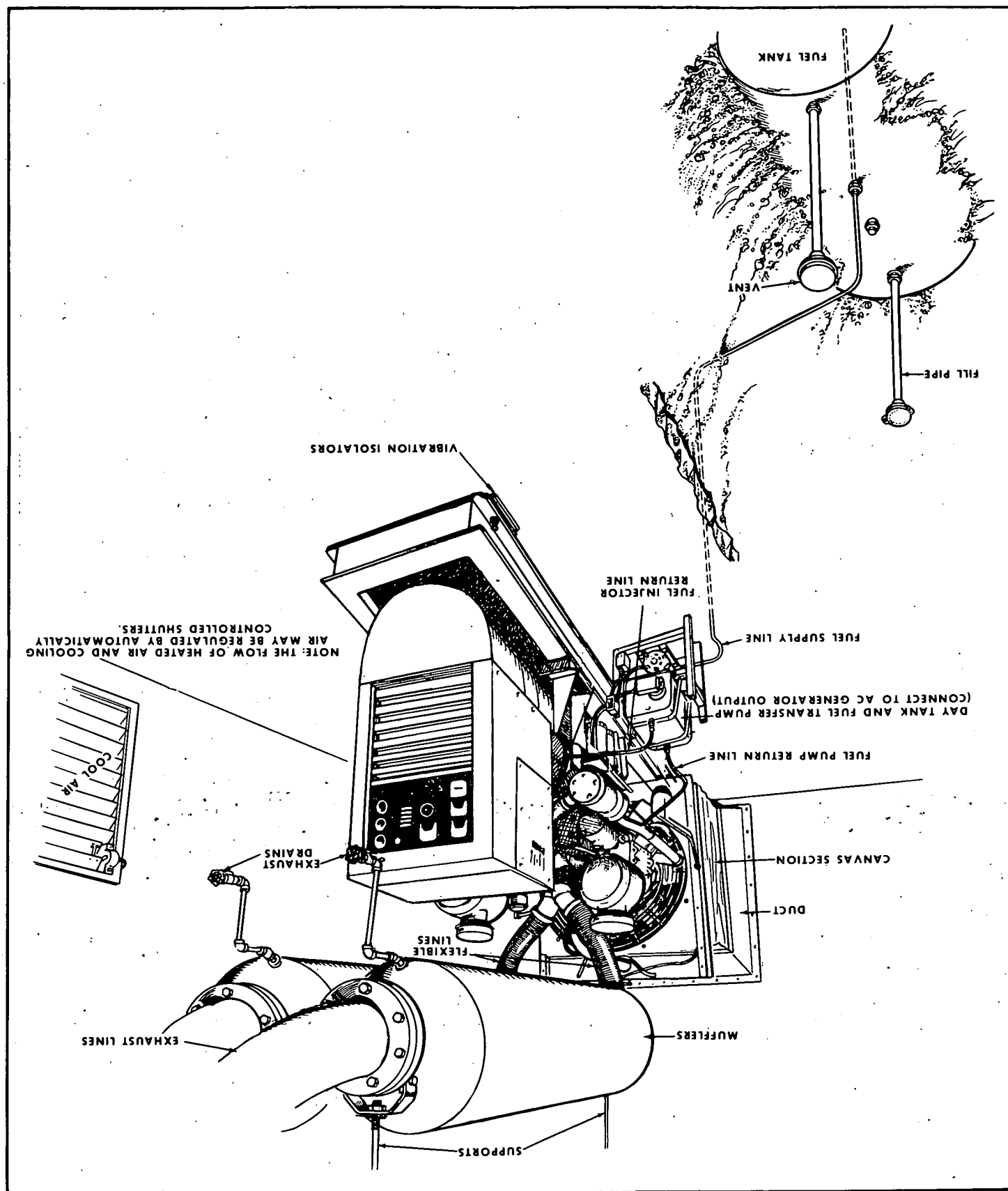


FIGURE 3. OVERSPEED SENSOR

FIGURE 4. TYPICAL INSTALLATION



INSTALLATION

GENERAL

Installations must be considered individually. Use these instructions as a general guide. Meet regulations of local building codes, fire ordinances, etc., which may affect installation details. See Figure 4.

Installation points to consider include:

1. Level mounting surface.
2. Adequate cooling air.
3. Adequate fresh induction air.
4. Discharge of circulated air.
5. Discharge of exhaust gases.
6. Electrical connections.
7. Fuel connections.
8. Water connections.
9. Accessibility for operation and servicing.
10. Vibration isolation.
11. Noise levels.

LOCATION

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

MOUNTING

Generating sets are mounted on a rigid skid base which provides proper support. Install vibration isolators between skid base and foundation. For convenience in draining crankcase oil and general servicing, mount set on raised pedestals (at least 6 inches high). 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 recommended for stationary installations.

VENTILATION

Generating sets create considerable 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.

Radiator set cooling air travels from the rear of the set to the front end. Locate the room or compartment air inlet where most convenient, preferably to the rear of the set. Make the inlet opening at least as large as the radiator area (preferably 1-1/2 times larger).

Engine heat is removed by a pusher fan which blows cooling air out through the front of the radiator. Locate the cooling air outlet directly in front of the radiator and as close as practical. The opening size should be at least as large as the radiator area. Length and shape of the air outlet duct should offer minimum restriction to air flow. Use a duct of canvas or sheet metal between the radiator and the air outlet opening. The duct prevents recirculation of heated air.

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

City water cooled sets do not use the conventional radiator. 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 than generator outlet 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.

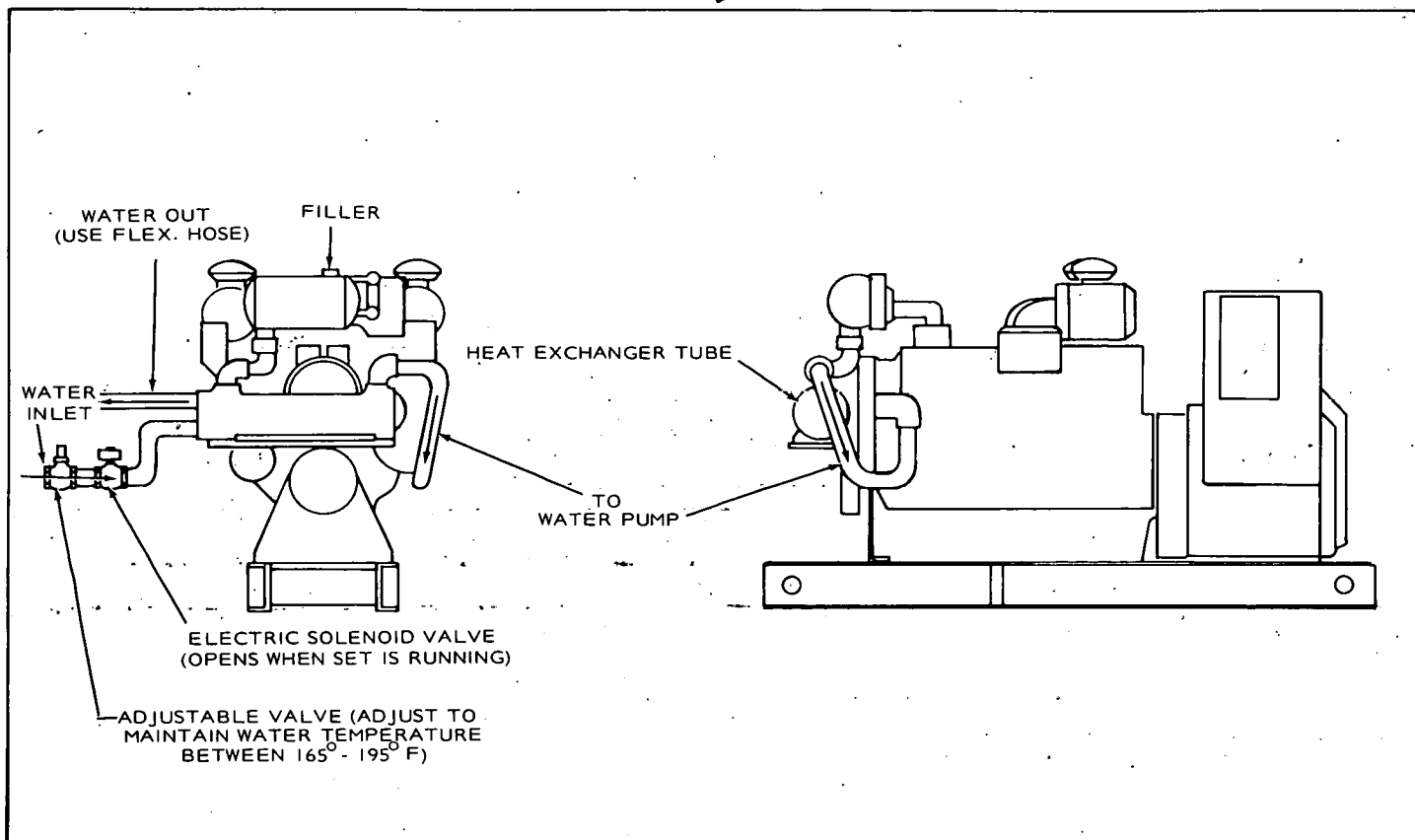


FIGURE 5. HEAT EXCHANGER COOLING.

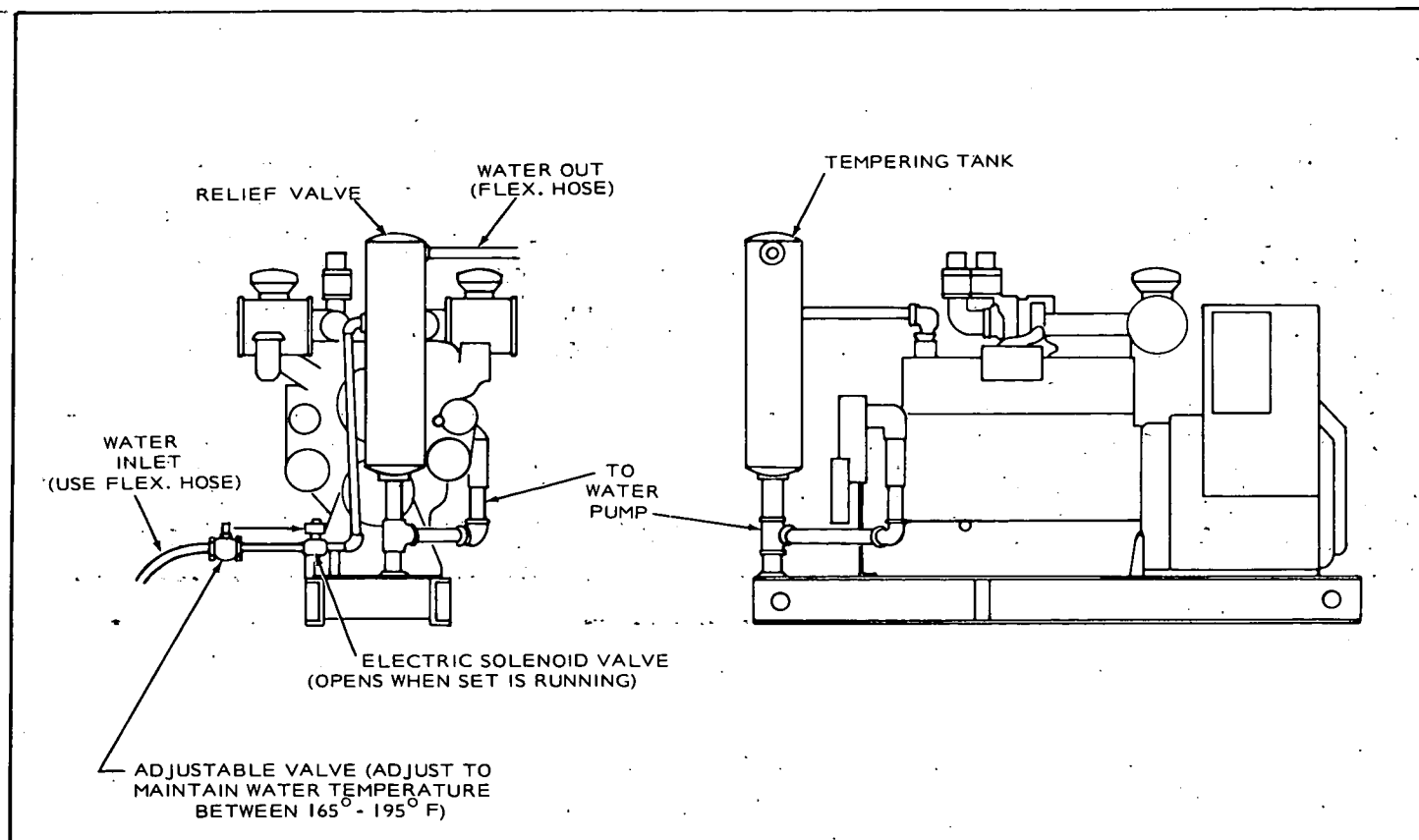


FIGURE 6. STANDPIPE COOLING

CITY WATER COOLING

An optional method of engine cooling, in place of the conventional radiator and fan, uses a constant pressure water supply. This is referred to as CITY WATER COOLING. There are two varieties of city water cooling: the HEAT EXCHANGER SYSTEM and STANDPIPE SYSTEM. See Figures 5 and 6.

The HEAT EXCHANGER provides for a closed engine cooling system. Engine coolant flows 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 set.

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 other impurities.

On both systems use flexible pipe for connecting water supply and outlet flow pipes to engine. Pipe the outlet flow to a convenient drain. Install an electric solenoid valve and a rate of flow valve in the water supply line. The electric solenoid valve opens and allows water flow through the system only when the plant operates. The rate of flow valve, either automatic or manual, provides for the proper flow rate to the engine. Adjust the flow to maintain water temperature between 165 degrees and 195 degrees while viewing the water temperature gauge.

Before filling cooling system check all hardware for security. This includes hose clamps, capscrews, fittings and connections. Use flexible coolant lines with heat exchanger, standpipe or remote mounting radiator.

WATER JACKET HEATER (OPTIONAL)

This heater is installed to maintain an elevated engine temperature in lower ambient temperature applications. It heats and circulates engine coolant, and is thermostatically controlled (Figure 17).

EXHAUST

WARNING

Inhalation of exhaust gases can result in death.

Engine exhaust gas must be piped outside building or enclosure. Do not terminate exhaust pipe near inlet vents or combustible materials. An approved thimble (Figure 7) must be used where exhaust pipes pass through walls or partitions. Pitch exhaust pipes downward or install a condensation trap (Figure 8) at the point where a rise in the exhaust system begins. Avoid sharp bends, use sweeping long radius elbows. Provide adequate support for mufflers and exhaust pipes. Refer to Figure 4 for a typical exhaust installation. Shield or insulate exhaust lines if there is danger of personal contact. Allow at least 9-inches of clearance if the pipes run close to a combustible wall or partition. Use a pipe at least as large as the 4-inch pipe size outlet of the engine with a flexible portion

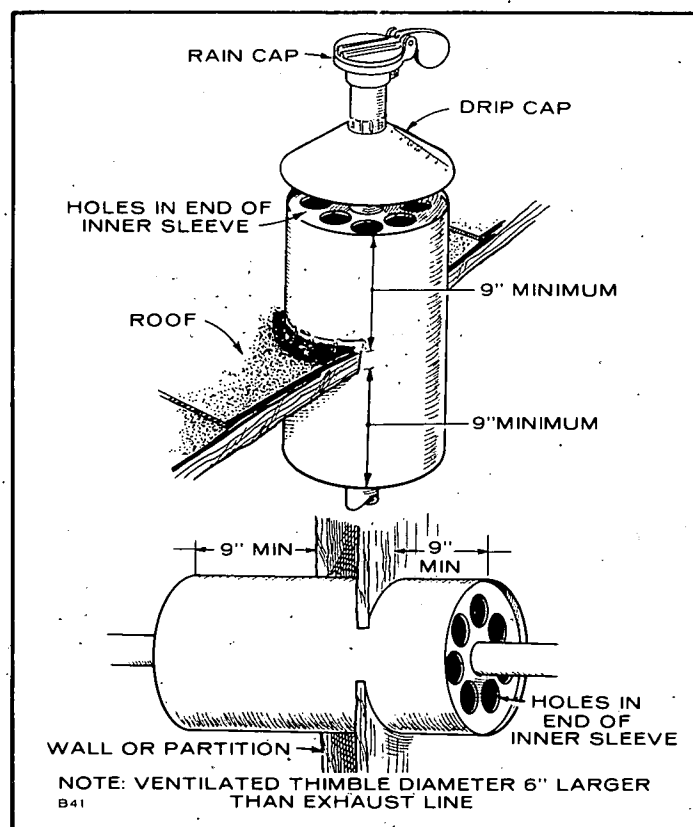


FIGURE 7. EXHAUST THIMBLE

between the engine and the muffler. Do not connect a flexible line to the exhaust manifold. Minimum diameters and maximum lengths of pipe are as follows:

Single Exhaust system

6-inch pipe	90-feet
8-inch pipe	300-feet

Dual Exhaust system (length per pipe)

5-inch pipe	104-feet
6-inch pipe	282-feet

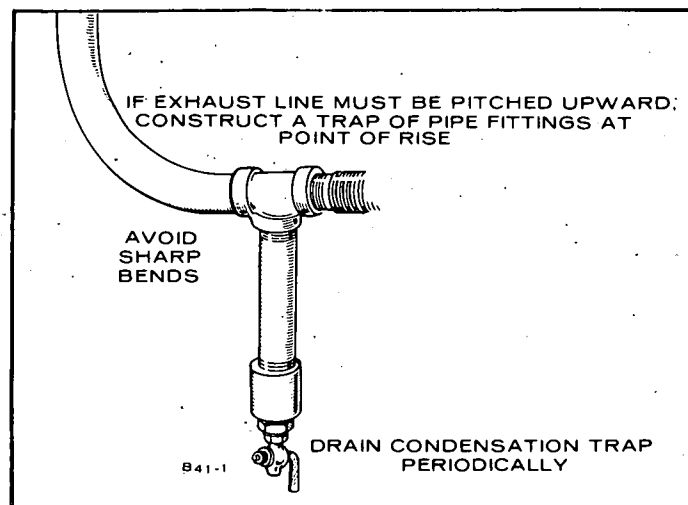


FIGURE 8. EXHAUST CONDENSATION TRAP

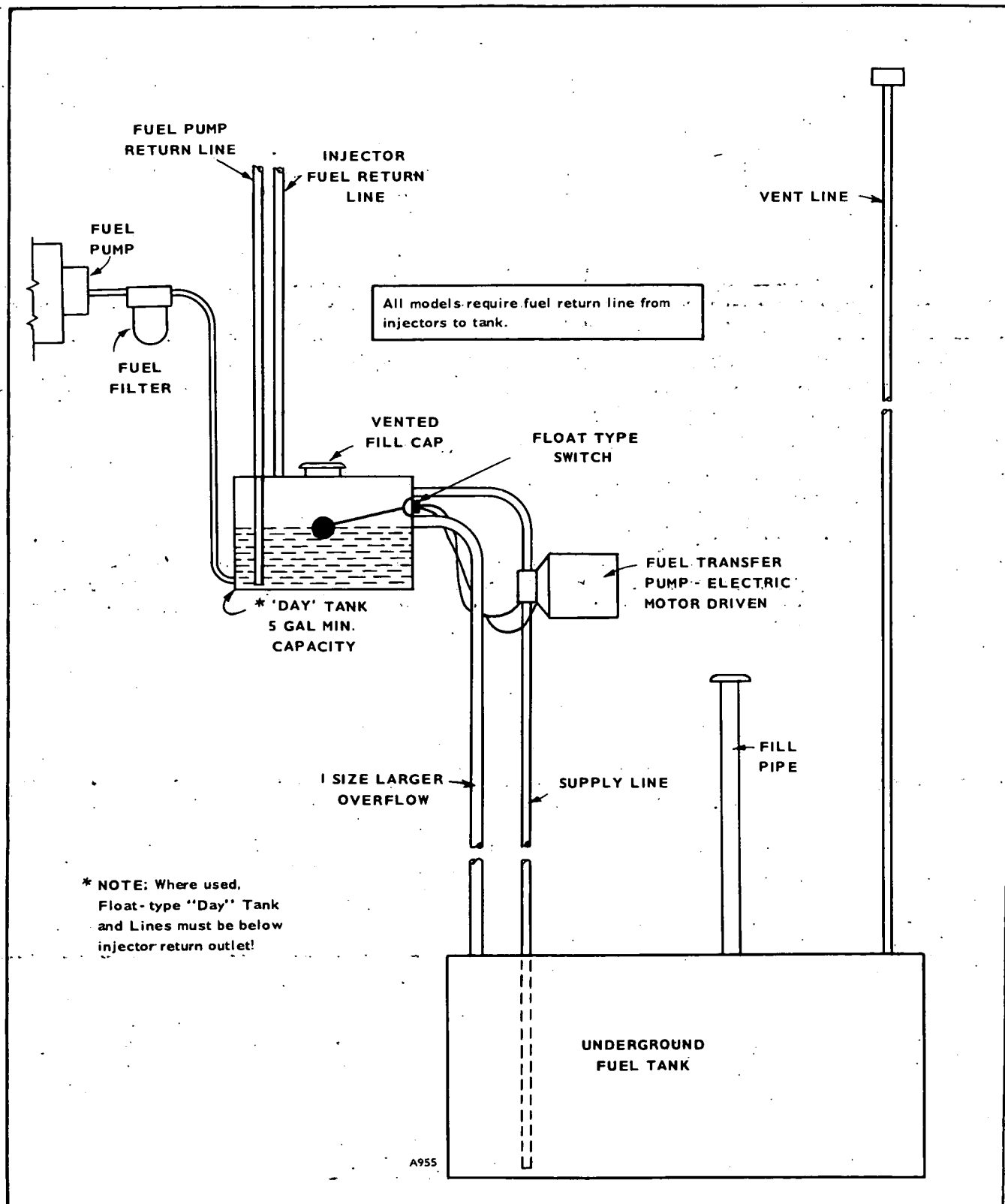


FIGURE 9. DAY TANK

FUEL SYSTEM

The Cummins engines used on the DFT sets are naturally-aspirated, designed for use with No. 2 Diesel fuel. They will however operate on other fuels within the specifications delineated in section 3-4 of the Cummins engine manual.

FUEL CONNECTIONS

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

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

The maximum fuel lift without any horizontal run should not exceed 8 feet. The horizontal run, if the supply tank is level with the fuel pump, should not exceed 12-1/2 feet. Use 5/8 inch tubing for the fuel supply line. The inlet fitting on the fuel filter is threaded for a 7/8 inch SAE flared fitting. Use 1/2 inch tubing for the fuel return line from the injector manifold; the fitting in the injector manifold is threaded for a 3/4 inch SAE flared-fitting. The fuel pump return line is threaded for a 5/8 inch SAE flared fitting. Use 3/8 inch tubing for the fuel pump return line.

DAY TANK

Generator set installations 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 the supply tank is optional, consult local regulations. Refer to the installation instructions included with the tank. See Figure 9.

BATTERY

Starting the plant requires 24-volt battery current. Use two 12-volt (see specification) batteries for a normal installation. Connect the batteries in series (negative post of first battery to positive post of second) as in Figure 10. Necessary battery cables are on unit. 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 an automatic transfer switch that has no built-in charge circuit, connect a separate trickle charger. Onan automatic transfer switches include such a battery charging circuit.

WARNING

Do not smoke while servicing batteries. Lead acid batteries give off explosive gases while being charged.

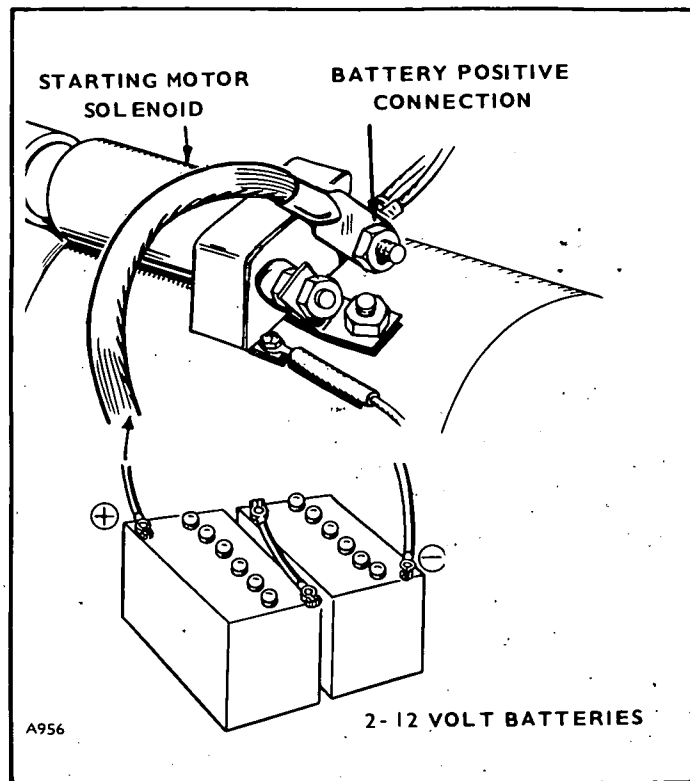


FIGURE 10. BATTERY CONNECTION

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 the electrolyte above the plates in each cell. DO NOT ATTEMPT TO POUR OFF, use an hydrometer or filler bulb and dispose of it in a safe manner. Avoid skin or clothing contact with the electrolyte.
3. Refill each cell with distilled water, to normal level.
4. Continue charging for 1 hour at a 4 to 6 hour rate.
5. Test each cell. If the specific gravity is still above 1.255, repeat steps 2, 3, 4 until the reading is reduced to 1.225. Usually, repeating steps twice is sufficient.

REMOTE CONTROL CONNECTIONS

Provision is made for addition of remote starting. This is accomplished on a 4 place terminal block situated within the control box. Connect one or more remote switches across remote terminal and B+ terminal as shown in Figure 11. If the distance between the set and remote station is less than 1000-feet, use No. 18 AWG wire, between 1000- and 2000-feet, use No. 16AWG wire.

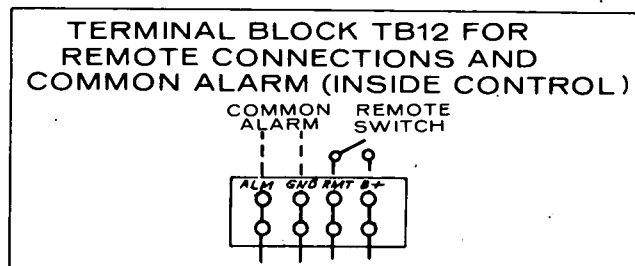


FIGURE 11. REMOTE STARTING

WIRING CONNECTIONS

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 sizes, 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 (Figure 12) must always be used. Connect this switch (either automatic or manual) so that it is impossible for commercial power and generator power to be connected to the load at the same time. Instructions for connecting an automatic transfer switch are included with such equipment.

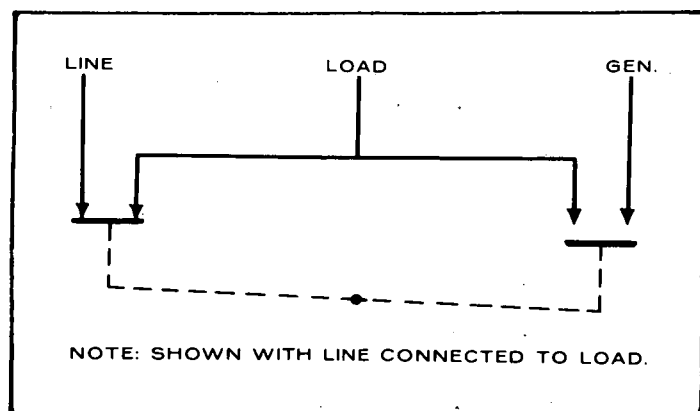


FIGURE 12. LOAD TRANSFER SWITCH

CONTROL BOX CONNECTION

Reconnection lead W12 on TB21 is a jumper which connects a single phase output from the generator to the appropriate tap on the voltage reference transformer. This lead is connected at one end to terminal 63 on the terminal board. The other end will be connected to a terminal marked H3, H4 or H5 depending upon the voltage option required. Refer to Table 1 and Figure 16 for voltages available and correct hookup.

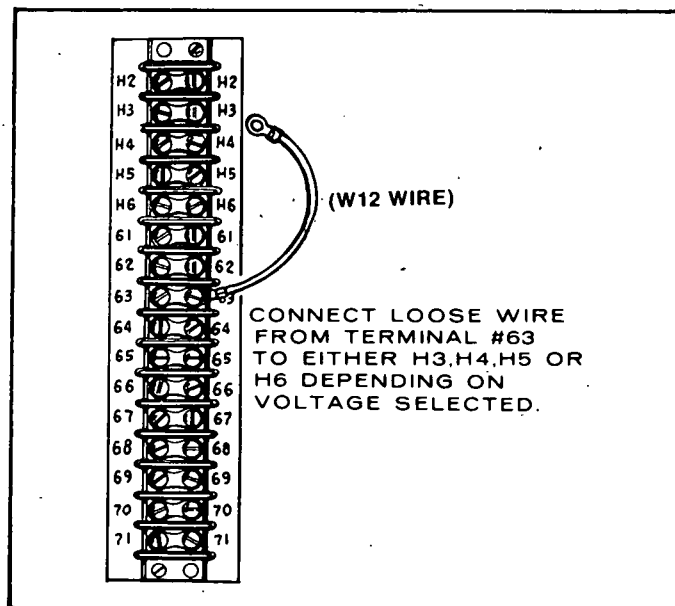


FIGURE 13. CONTROL BOX CONNECTION

GENERATOR CONNECTIONS

The model YB generator is a 3-phase 60-Hertz (or 50-Hertz) set which can be connected in either series wye or parallel wye configuration to give the line to neutral and line to line voltage options referred to in Table 1 and Figure 16. The line to neutral voltage is the lower voltage noted on the unit nameplate, while the line to line voltage is the higher nameplate rating. Refer to Figure 14 for an example of 120/208 voltage.

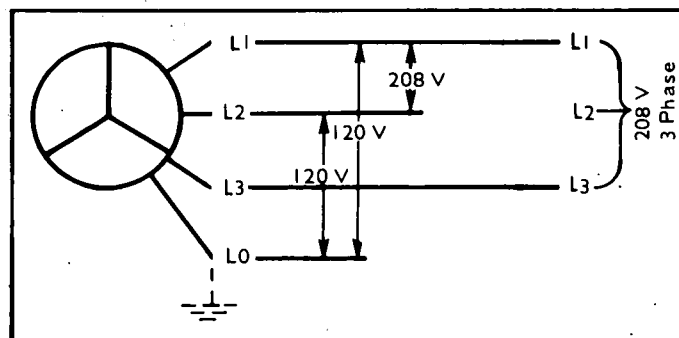


FIGURE 14. 3 PHASE WYE CONNECTION

For 3-phase loads connect separate load wires to each of the set terminals L1, L2 and L3 (Figure 15). For a large single phase load only, connect between terminals L1 and L2. Available capacity is 2/3 maximum output.

The terminal L0 can be grounded. For 1-phase loads connect the neutral load wire to the L0 terminal. Connect the load wire to either terminal — L1, L2. Two separate single phase circuits are available with a total capacity of up to 2/3 of the generator rated 3-phase output.

If using 1-phase and 3-phase current at the same time, ensure the 1-phase load is properly balanced. Do not exceed rated line current.

Bus bars and reconnection bars are aluminum, plated to retard electrolytic corrosion. Select connecting cables and terminal lugs with care to keep dissimilar materials apart. Do not overtorque bolts.

ONAN recommends that all connections from the generator to the bus-bars and from the bus-bars to the load be made by a qualified electrician. All applicable local and state laws should be complied with.

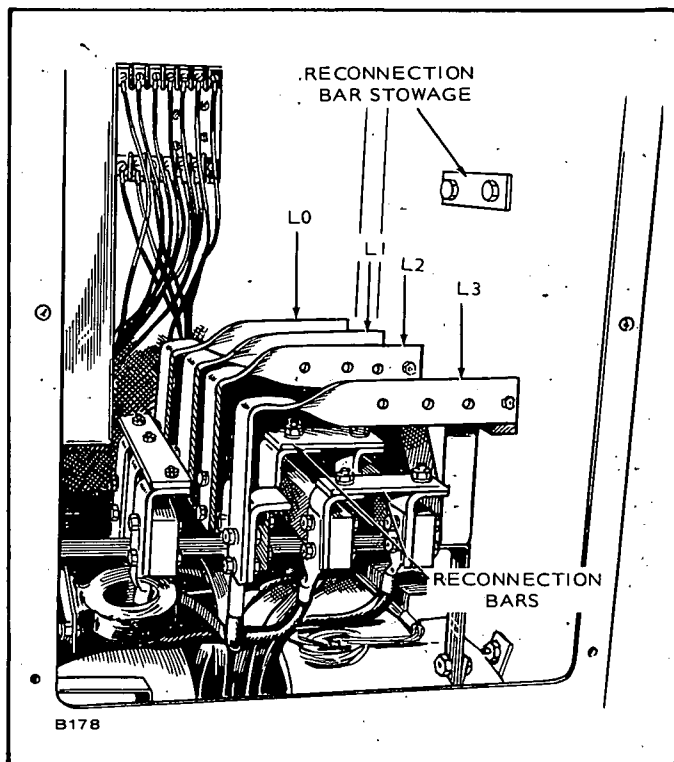
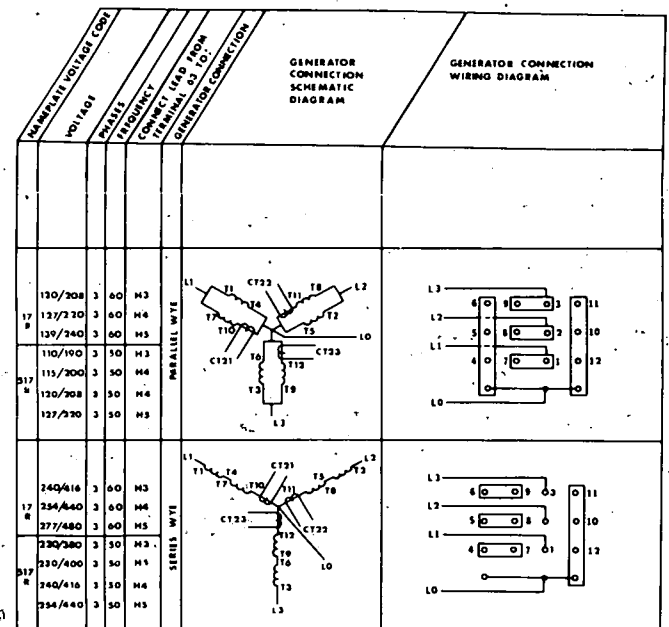


FIGURE 15. LOAD WIRE CONNECTION



OPERATION

GENERAL

ONAN DFT series electric generating sets are given a complete running test under various load conditions and thoroughly checked before leaving the factory. Inspect your unit closely for loose or missing parts and damage which may have occurred in transit. Tighten loose parts, replace missing parts and repair any damage before putting set into operation.

PRESTART SERVICING

Lubrication System: Engine oil was drained prior to shipment. Fill engine to capacities shown. After engine has been run, check dipstick, add oil to bring level to full mark. Record total capacity for future oil changes. Refer to Cummins engine manual section 3.2 for engine oil recommendations. For average operating conditions, oils conforming to Military Specifications MIL-L-2104B are recommended. Do not mix brands or grades of lubricating oils.

Oil viscosity should be as follows:

AMBIENT TEMPERATURE	USE SAE VISCOSITY
Between -10°F and 30°F	10W
Between 20°F and 60°F	20-20W
Above 40°F	30

Oil Capacities (nominal)

Oil Pan 18 Gallons
Filter 3 Gallons

Oil quantity dipsticks have dual markings with high and low-level marks: static oil level on one side and engine at low speed marks on opposite side. Be sure to use proper scale.

To prime lubrication oil system, disconnect plug in oil filter housing and using a hand operated or motor driven pump, prime with clean oil to a minimum pressure of 30 psi.

Cooling System: Cooling system was drained prior to shipment. Fill cooling system before starting. Nominal capacity is 42 gallons. For units using either a radiator or heat exchanger (city water cooled), fill the system with clean soft water. Use a good rust and scale inhibitor additive. If a possibility exists of a radiator cooled set being exposed to freezing temperatures use anti-freeze with an ethylene-glycol base. During initial engine run, check the coolant level several times and replenish if necessary to compensate for air pockets which may have formed during filling. Refer to Cummins engine manual for additional information.

CAUTION Verify that the electric solenoid valve used with city water cooled plants is open before initial starting of plant to allow coolant chambers to fill. Overheating and damage to the engine could result from non-compliance.

Ensure that water supply for city water cooling is turned ON.

Fuel System: Refer to section 3.4 of the Cummins engine manual for fuel oil specifications. Check with fuel supplier and ensure that fuel supplied meets the specifications. Filter or strain fuel when filling tank.

Fuel supply tanks should be kept as nearly full as possible by topping up each time engine is used. Warm fuel returning from the injector pump heats the fuel in the supply tank. If the fuel level is low in cold weather, the upper portion of the tank not heated by returning fuel tends to increase condensation. In warm weather both the supply tank and fuel are warm. Cool night air lowers the temperature of the tank more rapidly than the temperature of the fuel. Again this tends to increase condensation.

Condensate mixing with the sulphur in the fuel forms a sulphurous acid which will corrode and damage the engine. KEEP FUEL CLEAN.

WARNING DO NOT SMOKE while handling fuel. Diesel fuel is flammable.

Remove suction line from fuel pump and prime with clean fuel. Reconnect suction line. Check all connections in fuel system, for security, to ensure that pressure will not bleed off when engine is not in use. Pressure should be maintained for immediate starting if unit is on standby service.

BATTERIES

Ensure that the cable connections to the batteries are secure. Coat connections with petroleum based or non-conductive grease to retard formation of corrosive deposits.

Check level of electrolyte to be at split ring mark. Measure specific gravity of electrolyte: SG 1.280 at 80°F. If distilled water has been added or specific gravity is less than 1.280, place batteries on charge until desired reading is reached. Do not over charge.

STARTING

When the preceding service functions have been performed, recheck to verify unit is ready to start.

1. Crankcase filled
2. Cooling system filled - input solenoid valve open.
3. Batteries charged and connected.
4. Fuel solenoid valve open.

To start, move the "run-stop-remote" switch to the "run" position. The engine should start after a few seconds of cranking. Immediately after start, observe the oil pressure gauge. Normal oil pressure is approximately 50 psi. Check the following gauges:

1. D.C. Ammeter — 10 to 30 amperes.
2. A.C. Voltmeter — A.C. generator output voltage.
3. Frequency Meter — A.C. generator output frequency.

After running 10 minutes under load the water temperature gauge should have stabilized at 165 degrees to 195°F. On city water cooled units an adjustable valve is connected in the water supply line. Adjust the hand wheel valve to provide a water flow that will keep the water temperature gauge reading within the range of 165° to 195°F.

STOPPING

To reduce and stabilize engine temperatures, run the engine at no load for three to five minutes before shutting down.

Move the run-stop-remote switch to stop position to shut down the set.

Break-In Note: Run set at 50 percent rated load for the first half-hour of initial operation after reaching operating temperature.

Non-Start: If after a few seconds of cranking engine fails to start, or starts and runs then stops and fault lamp lights, refer to appropriate troubleshooting chart, Table 3 or Table 4.

EXERCISE PERIOD

Generating sets on continuous standby service are required to be operative at full load from a cold start in less than 10-seconds in the event of a power outage.

This imposes severe conditions on the engine. Friction of dry piston rings upon dry cylinder walls causes scuffing and rapid wearing. These can be relieved by exercising the set at least once a week for a minimum time of 30-minutes per exercise period. Preferably, run the set under at least 50 percent load to allow the engine to reach normal operating temperature. This will keep engine parts lubricated, maintain fuel prime, prevent electrical relay contacts from oxidizing and insure easy emergency starts. ONAN automatic transfer switches contain an optional exercise switch which, by pre-selection, will start, determine run period and shut down a set on a weekly frequency. For example, the switch can be set for time of start, length of run, A.M. or P.M. and day of week.

After each exercise period, top up fuel tank, check engine for leaks and unit for general condition. Locate cause of leaks (if any) and correct.

HIGH ALTITUDE

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.

Engine horsepower loss is approximately 3 percent for each 1000 feet of altitude above sea level for a naturally aspirated engine. Use lower power requirement at high altitudes to prevent smoke, over-fueling and high temperatures.

NO LOAD OPERATION

Periods of no load operation should be held to a minimum. If it is necessary to keep the engine running for long periods of time when no electric output is required, best engine performance will be obtained by connecting a "dummy" electrical load. Such a load could consist of heater elements, etc.

TABLE 3
TROUBLESHOOTING ENGINE SHUTDOWN SYSTEM
(Units with only one fault lamp)

SYMPTOM	CORRECTIVE ACTION
1. Fault lamp lights and engine stops cranking after approximately 75 seconds.	1. See engine service manual for troubleshooting fuel system, ignition system, etc. After correcting problem, reset the engine monitor by holding run-stop-remote switch in stop position, and depressing reset switch. Release and return to run position.
2. Fault lamp lights immediately after engine starts.	2. Check for: a. overspeed condition as engine starts. b. high temperature condition. c. faulty high engine temperature sensor or overspeed switch. d. faulty starter disconnect.
3. Fault lamp lights after engine is running.	3. Check the following: a. Oil level-engine will shut down after approximately 12-1/2 seconds if low oil pressure sensor does not open. b. Oil pressure sensor may be defective. c. High engine temperature - See engine service manual. d. Faulty high engine temperature sensor. e. Faulty starter disconnect.
4. Fault lamp lights - no fault condition exists.	4. Be certain that no fault condition exists. Disconnect lead 30 and 31 from TB11 inside control box (refer to wiring diagram). If fault lamp still lights with leads disconnected, remove and replace engine monitor plug-in printed circuit board.

TABLE 4
TROUBLESHOOTING ENGINE SHUTDOWN SYSTEM
(Units with five fault lamps)

SYMPTOM	CORRECTIVE ACTION
1. Overcrank fault lamp lights and engine stops cranking after approximately 75 seconds.	1. See engine service manual for troubleshooting fuel system, ignition system, etc. After correcting problem, reset the engine monitor by moving run-stop-remote switch to stop position, and depressing reset switch. PENN STATE. Move and hold run-stop-remote switch to OFF. Press reset, release and move switch to ON.
2. Overcrank fault lamp lights after engine has run for approximately 75 seconds.	2. Replace start-disconnect circuit board.
3. High engine temperature lamp lights as soon as engine starts.	3. Check for defective sensor or high temperature condition.
4. Low oil pressure lamp lights after engine is running.	4. Check: a. Oil level - engine will shut down after approximately 12-1/2 seconds if oil pressure is low.
5. High engine temperature lamp lights after engine is running.	5. Check for: a. High temperature condition. See Engine service manual. b. Defective high engine temperature sensor.
6. Overspeed lamp lights - no fault condition exists.	6. Replace overspeed circuit board.
7. Low oil pressure fault lamp lights - no fault condition exists.	7. Be certain that no fault condition exists. Disconnect lead 30 from TB11 inside control box (refer to wiring diagram). If low oil pressure lamp still lights, remove and replace engine monitor plug-in printed circuit board.
8. High engine temperature fault lamp lights - no fault condition exists.	8. Be certain that no fault condition exists. Remove lead 31 from TB11 inside control box (refer to wiring diagram). If high engine temperature lamp still lights, remove and replace engine monitor plug-in printed circuit board.
9. When pressing test lamp button - one or more fault lamps do not light.	9. Fault lamp/lamps burned out - replace. Engine not running.

DUST AND DIRT

1. Keep set clean. Keep cooling system free of dirt, etc.
2. Service air cleaners frequently.
3. Store oil and fuel in dust-tight containers.
4. See engine operation and maintenance manual.

OUT-OF-SERVICE PROTECTION

Protect a set that will be out-of-service for more than 30 days as follows:

1. Run set 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-ounce (two tablespoons) of rust inhibitor (or SAE #10 oil) into each cylinder. Crank engine over several times. Install injectors.
4. Service air cleaner as outlined in Cummins Manual.
5. Clean throttle 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. Disconnect battery and follow standard battery storage procedure.
9. Provide a suitable cover for the entire unit.
10. See engine operation and maintenance manual.

HIGH TEMPERATURES

1. See that nothing obstructs air flow to-and-from the set.
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. Connect water-jacket heater when set is not running.
6. Refer to Cummins manual for further information.

Water Jacket Heater: The function of this optional heater is to keep the engine warm enough to assure starting under adverse weather conditions. Connect the heater to a source of power that will be on during the time the engine is not running. Be sure the voltage rating is correct for the heater element rating (Figure 17).

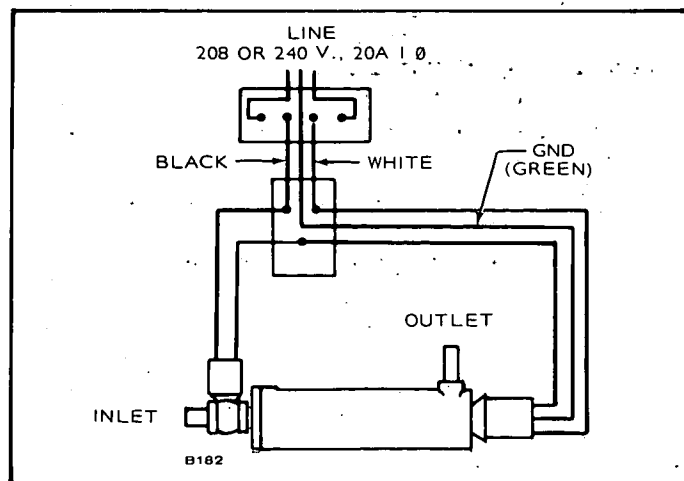


FIGURE 17. ENGINE HEATER

CAUTION

Do not energize heater until engine cooling system is filled with coolant.

GENERAL MAINTENANCE

GENERAL

Follow a definite schedule of inspection and servicing, based on operating hours (Table 5). Keep an accurate logbook of maintenance, servicing, and operating time. Use the running time meter (optional equipment) to keep a record of operation and servicing. Service periods outlined below are recommended for normal service and operating conditions. For continuous duty, extreme temperature, etc., service more frequently. For infrequent use, light duty, etc., service periods can be lengthened accordingly. Refer to Cummins engine manual for details of engine service and maintenance procedures.

WARNING

Before commencing any maintenance work on the engine, generator, control panel, automatic transfer switch or associated wiring, disconnect batteries. Failure to do so could result in damage to the unit or serious personal injury in the event of inadvertent starting.

ENGINE SPEED

Generator frequency is in direct ratio to engine speed, which is controlled by the Governor.

A Woodward SG governor is standard equipment on the DFT generator set. High speed and low speed limit stops are set at the ONAN testing facility and normally do not require further adjustment, therefore if your set is used on continuous standby service, the governor may never need to be touched. If however the unit is used frequently, adjustment may be required due to wear of internal components. This adjustment is achieved by backing off the high speed stop screw and rotating the speed adjusting shaft until the generator output frequency meter reads 60 Hz (generator on load). Screw in the high speed stop screw until it bottoms, then secure the lock nut. See Figure 18.

When using the generator frequency meter to determine engine speed, multiply frequency by 30 to calculate engine speed.

Example: $30 \times 61 \text{ (Hz)} = 1830 \text{ rpm}$.

Adjust engine speed to 1800 rpm for 60 Hz sets and 1500 rpm for 50 Hz sets.

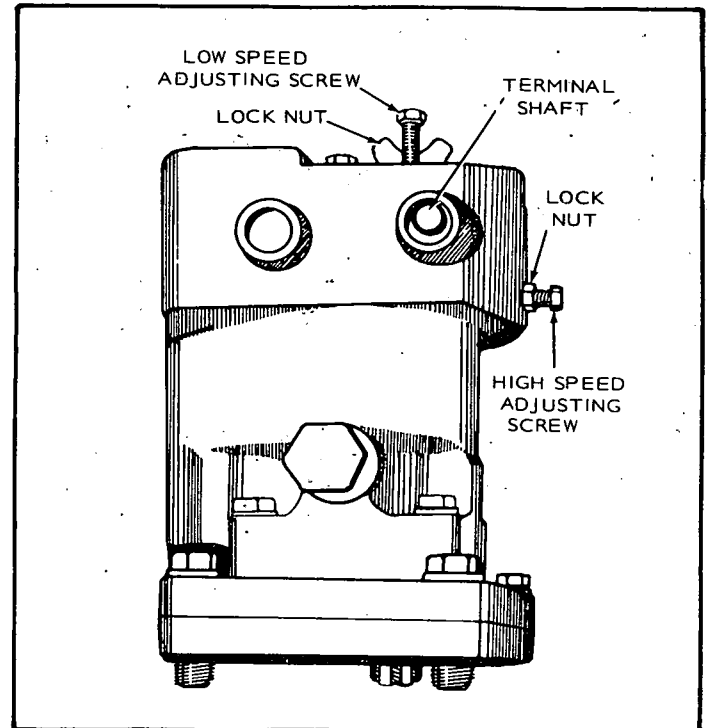


FIGURE 18. WOODWARD SG GOVERNOR

AC GENERATOR

There are no brushes, brush springs or collector rings on these generators, therefore they require very little servicing. Periodic inspections, to coincide with engine oil changes, will ensure good performance.

Generator Bearing: Inspect the bearing every 1000 hours with the unit running.

If using the unit for "prime power", replace the bearing every 10,000 hours or two years. If using the set for "standby", replace the bearing every five years.

Check generator voltage. It may be necessary to make a slight readjustment of the voltage rheostat to obtain the preferred voltage at average load.

INSPECTION AND CLEANING

When inspecting the rotating rectifier assembly, make sure diodes are free of dust, dirt and grease. Excessive foreign matter on these diodes and heat sinks will cause the diodes to overheat and will result in their failure. Blow out the assembly periodically, with filtered, low pressure air. Also check to see that diodes and leadwires are properly torqued. The diodes should be torqued to 30 in. lb. or finger tight plus a quarter turn. Clean and check control box interior.

BATTERIES

Check the condition of the starting batteries at least every two weeks. See that connections are clean and tight. A light coating of non-conductive grease will retard corrosion at terminals. Keep the electrolyte at the proper level above the plates by adding distilled water. Check specific gravity; recharge if below 1.280.

CONNECTIONS (Fuel, Exhaust, etc.)

Operator should periodically make a complete visual inspection of the set 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 or daily, drain moisture from condensation traps.
4. Inspect water lines and connections for leaks and security.
5. Inspect electrical wires and connections for security and fray damage.

If generator requires major repair or servicing, contact an authorized Onan dealer or distributor.

TABLE 5. OPERATOR MAINTENANCE SCHEDULE

MAINTENANCE ITEMS	OPERATIONAL HOURS			
	8	50	100	200-250
Inspect Plant	x			
Check Radiator Coolant	x			
Check Oil Level	x4			
Check Air Cleaner (Clean if Required)		x1		
Clean and Inspect Crankcase Breather			x	
Inspect Fan Belt			x2	
Check Cooling System			x3	
Clean and Inspect Battery Charging Alternator				x
Change Crankcase Oil				x1
Replace Oil Filter Element				x1
Check Batteries		x		

x1 - Perform more often in extremely dusty conditions.

x2 - Adjust to 1/2 inch depression between pulleys.

x3 - Check for rust or scale formation. Flush if necessary.

x4 - For accurate readings, check oil level approximately 30 minutes after shut down. Keep oil level as near "H" mark on dipstick as possible. See engine manual.

PARTS CATALOG

This catalog applies to the DFT generator sets listed below. Engine parts modified or added by Onan will be in this list and have Onan part numbers. These supersede similar parts listed in the Cummins manual. Onan parts are arranged in groups of related items and are identified by a reference. All part illustrations are typical. Using the Model and Specification from the Onan nameplate, select the parts from this catalog that apply to your set.

ONAN PARTS

All parts in this list are Onan parts. For Onan parts or service, contact the dealer from whom you purchased this equipment or your nearest authorized service station. To avoid errors or delay in filling your order, please refer to the Onan nameplate and give the complete MODEL, SPECIFICATION and SERIAL NUMBER.

MODEL AND SPECIFICATION**

250.0 DFT - 517R/*
300.0 DFT - 17R/*

WATTS

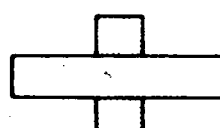
250,000
300,000

Onan®			
ELECTRIC GEN SET			
MODEL		SERIAL NO.	
IMPORTANT - ALWAYS GIVE ABOVE NOS. WHEN ORDERING PARTS			
CONTINUOUS		RATING	
HERTZ-60 RPM - 1800			
3 PHASE		1 PHASE	
KW	KVA	KW	KVA
VOLTS 120/208 127/220 139/240 12C/240 240/416			
AMPS			
VOLTS 254/440 277/480 347/600 20/240			
AMPS			
BAT. VOLTS			
MANUFACTURED BY ONAN DIV. OF STUDEBAKER CORPORATION MINNEAPOLIS, MINN. 55432, U.S.A. FOR ELECT. EQUIPMENT ONLY 			
99A1C34			

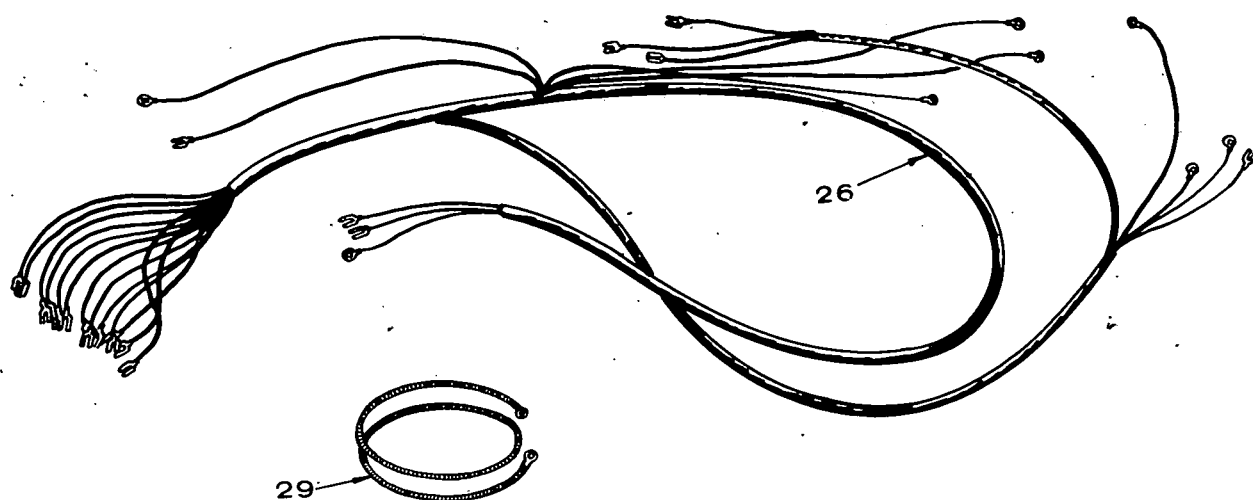
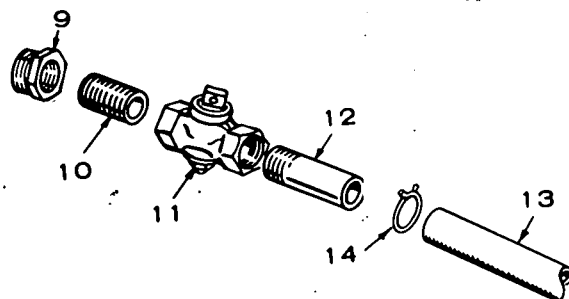
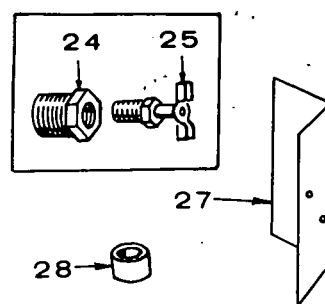
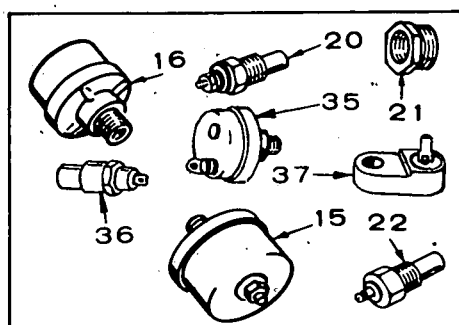
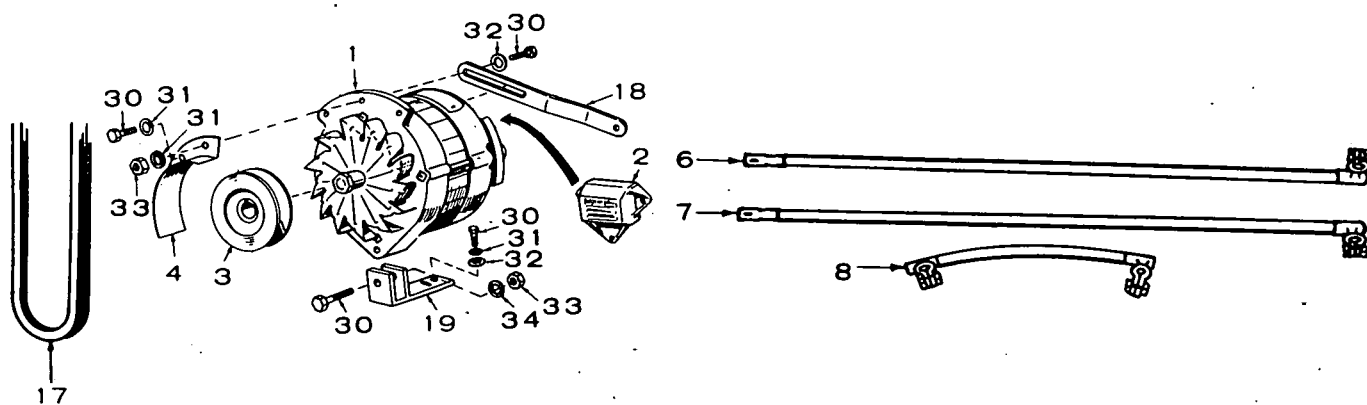
- * The Specification Letter advances (A to B, B to C, etc.) with manufacturing changes.
- ** Refer to Specifications Section (Generator Details) in Operators Manual for Electrical Data.

CUMMINS PARTS

All Cummins parts must be ordered from the Cummins Engine Company, Inc., Columbus, Indiana or their nearest authorized Cummins distributor or dealer. When ordering parts, refer to the Cummins nameplate and supply all information stated.

CUMMINS		CUMMINS ENGINE COMPANY, INC. COLUMBUS, INDIANA, U.S.A.		
SBM NO.	MODEL	ENG NO.	OTHER REF. NO.	

MISCELLANEOUS ENGINE PARTS GROUP

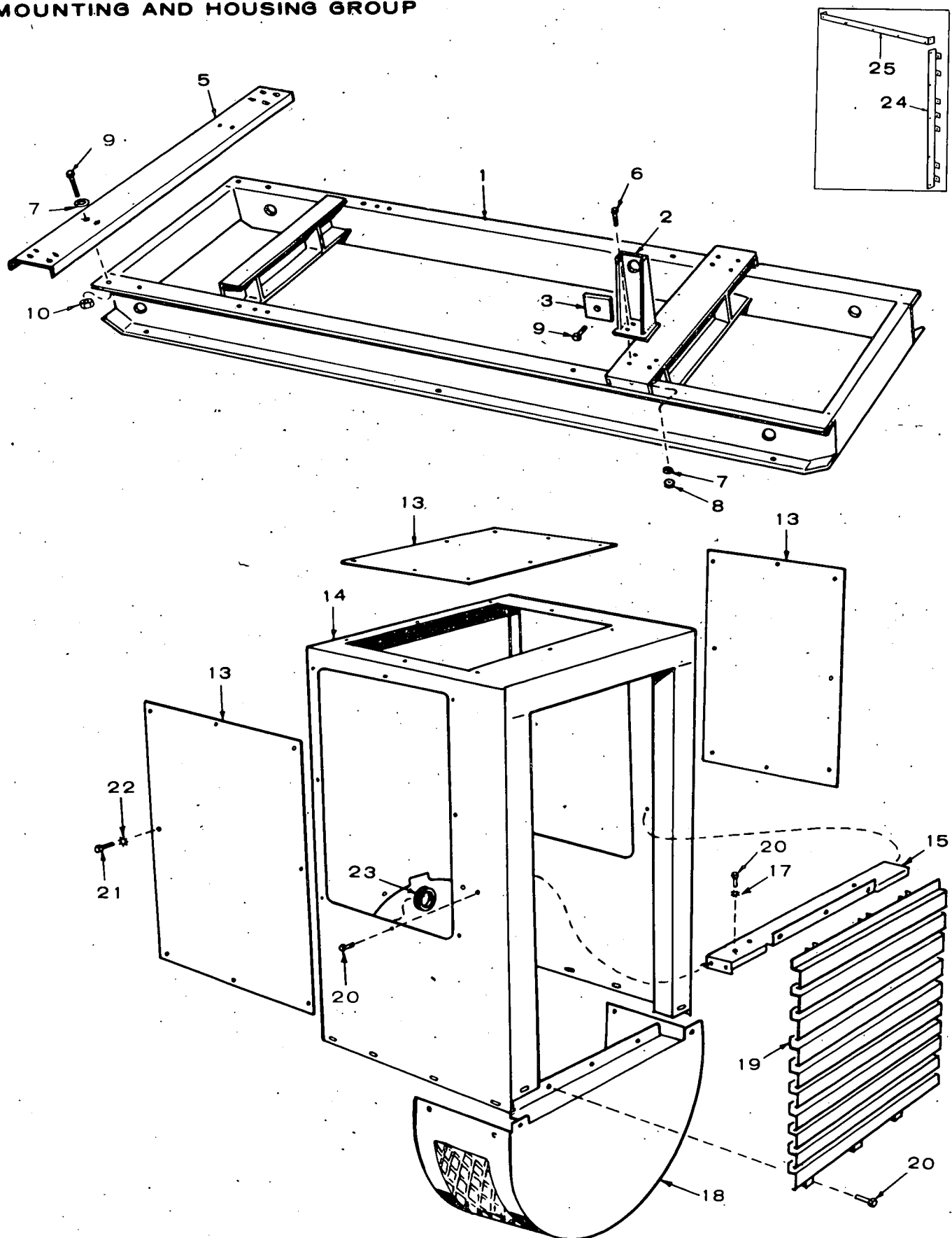


REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	191-0871	1	*Alternator, Charge - Includes Regulator & Fan (Motorola #70D44039B04) - EXCEPT: Specify #49A41756A01 Counterclockwise Fan)
2	191-0733	1	Regulator, Alternator
3	191-0624	1	Pulley, Alternator
4	191-0725	1	Guard, Alternator Belt
6	416-0444	1	Cable, Battery - Positive
7	416-0445	1	Cable, Battery - Negative
8	416-0446	1	Cable, Jumper
9	505-0021	1	Bushing, Reducer (3/4 x 1/2")
10	505-0100	1	Nipple, Close (1/2 x 1-1/8")
11	504-0011	1	Valve, Shutoff - Oil Drain
12	505-0185	1	Nipple, Half (1/2 x 1-1/2")
13			Hose, Drain (3/4 x 1") - Order 12" of Bulk Hose #503-0098
14	503-0197	1	Clamp, Hose
15	193-0195	1	Sender, Oil Pressure
16	309-0272	1	Switch, Oil Pressure Cutoff
17	511-0037	1	Belt, Alternator
18	191-0101	1	Strap, Alternator Adjusting
19	191-0697	1	Bracket, Alternator
20	193-0109	1	Sender, Water Temperature
21	505-0021	1	Bushing (3/4 x 1/2"), Reducer - Water Temperature Sender
22	309-0178	1	Switch, High Water Temperature
24	505-0131	1	Bushing (3/4 x 3/8"), Reducer - Radiator Drain
25	504-0028	1	Valve, Drain - Radiator Drain
26	338-0694	1	Harness Engine
27	309-0246	1	Shield, Heat
28	403-0851	2	Spacer
29	416-0632	1	Lead, Starter Ground

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
30	SCREW, HEX HEAD 800-0048	2	Alternator Mounting Bracket (3/8-16 x 3/4")
	800-0025	1	Alternator Belt Guard (5/16-18 x 5/8")
	800-0030	1	Alternator to Adjusting Bracket (5/16-18 x 1-1/4")
	800-0094	1	Alternator to Mounting Bracket (1/2-13 x 2")
31	WASHER, LOCK 850-0050	2	Alternator Mounting Bracket (3/8")
	850-0045	2	Alternator Belt Guard (5/16")
32	WASHER, FLAT 526-0183	2	Alternator Mounting Bracket (3/8")
	526-0022	1	Alternator to Adjusting Bracket (5/16")
33	NUT, HEX 862-0015	1	Alternator to Adjusting Bracket (5/16-18)
	862-0005	1	Alternator to Mounting Bracket (1/2 x 13)
34	856-0013	1	Washer, Shakeproof EIT - Alternator to Mounting Bracket (1/2")
35	309-0169	1	Switch, Oil Pressure (Pre-Alarm) - Optional
36	309-0179	1	Switch, High Engine Temperature (Pre-Alarm) - Optional
37	309-0269	1	Switch, Low Engine Temperature (Pre-Alarm) - Optional
38	320-0240	1	Circuit Breaker, Starter - 12.5 Amp.

* For components, contact your nearest Motorola Dealer or
Motorola Automotive Products, Inc., 9401 W. Grand Ave.,
Franklin Park, Illinois 60131.

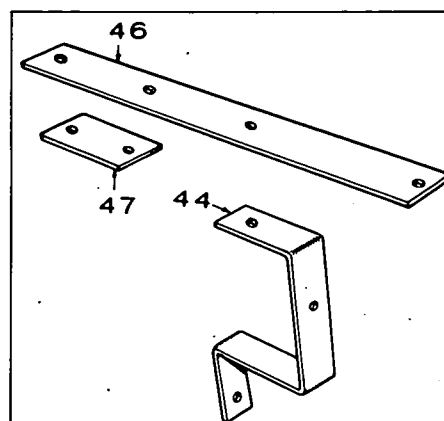
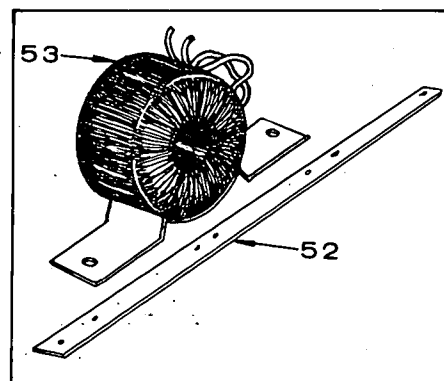
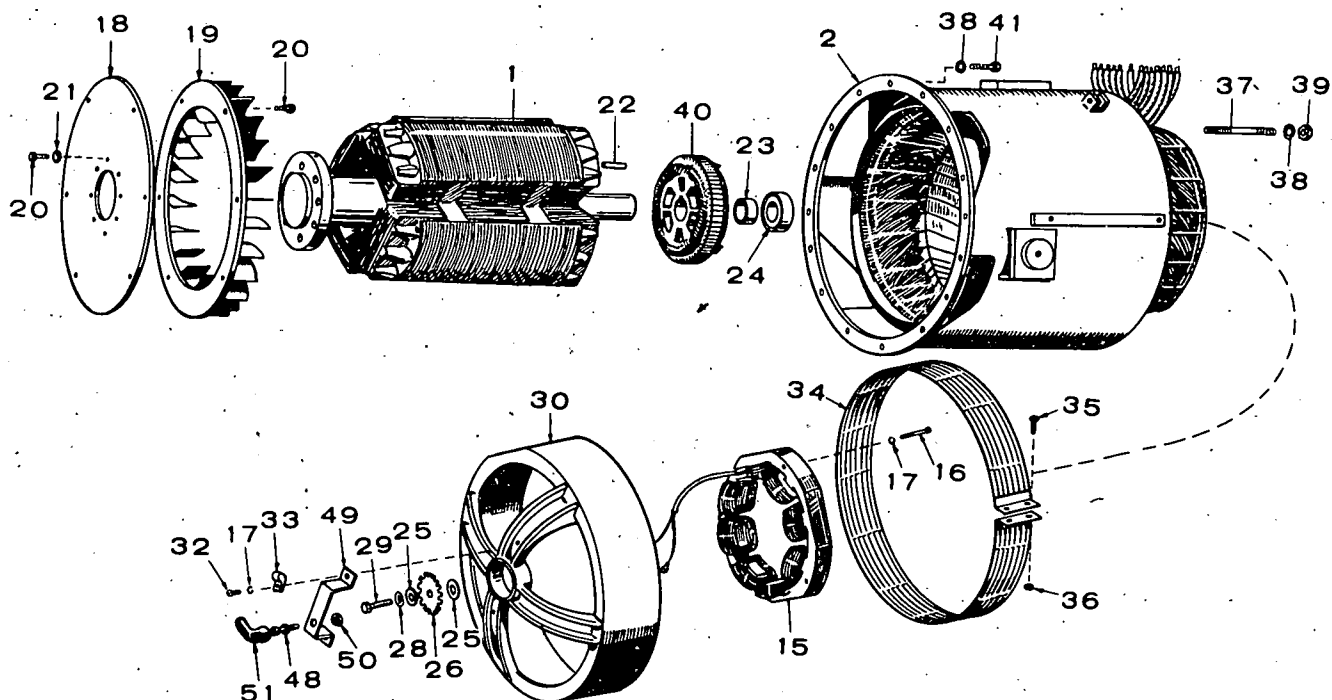
MOUNTING AND HOUSING GROUP



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	403-1024	1	Base, Skid
2	232-2386	2	Bracket, Generator Mounting
3	232-2385	2	Plate, Generator Mounting Retainer
5	130-0889	1	Support, Radiator
6	800-0156	12	Screw (3/4-10 x 2-1/4") - Generator to Skid
7	850-0079	22	Washer (3/4"), Lock
8	862-0020	12	Nut (3/4-10)
9	800-0153	14	Screw (3/4-10 x 1-1/2") - (2) Retainer Plate (4) Radiator Support to Skid (8) Radiator to Support
10	862-0008	8	Nut (3/4-10)

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
13	301-2905	3	Plate, Control Box
14	301-3605	1	Housing, Control Box
15	301-3604	1	Shelf, Control Box Housing
17	856-0006	2	Washer (1/4") - Shakeproof EIT
18	234-0489	1	Cover, End Bell
19	234-0490	1	Grille, Generator Air Inlet
20	821-0010	9	Screw (1/4-20 x 1/2")
21	815-0241	24	Screw (1/4-20 x 1/2") Truss Head
22	853-0013	24	Washer (1/4"), Shakeproof ET
23	508-0001	1	Grommet, Rubber
24	405-1677	2	Flange, Radiator - Optional
25	405-1676	2	Flange, Radiator - Optional

GENERATOR GROUP

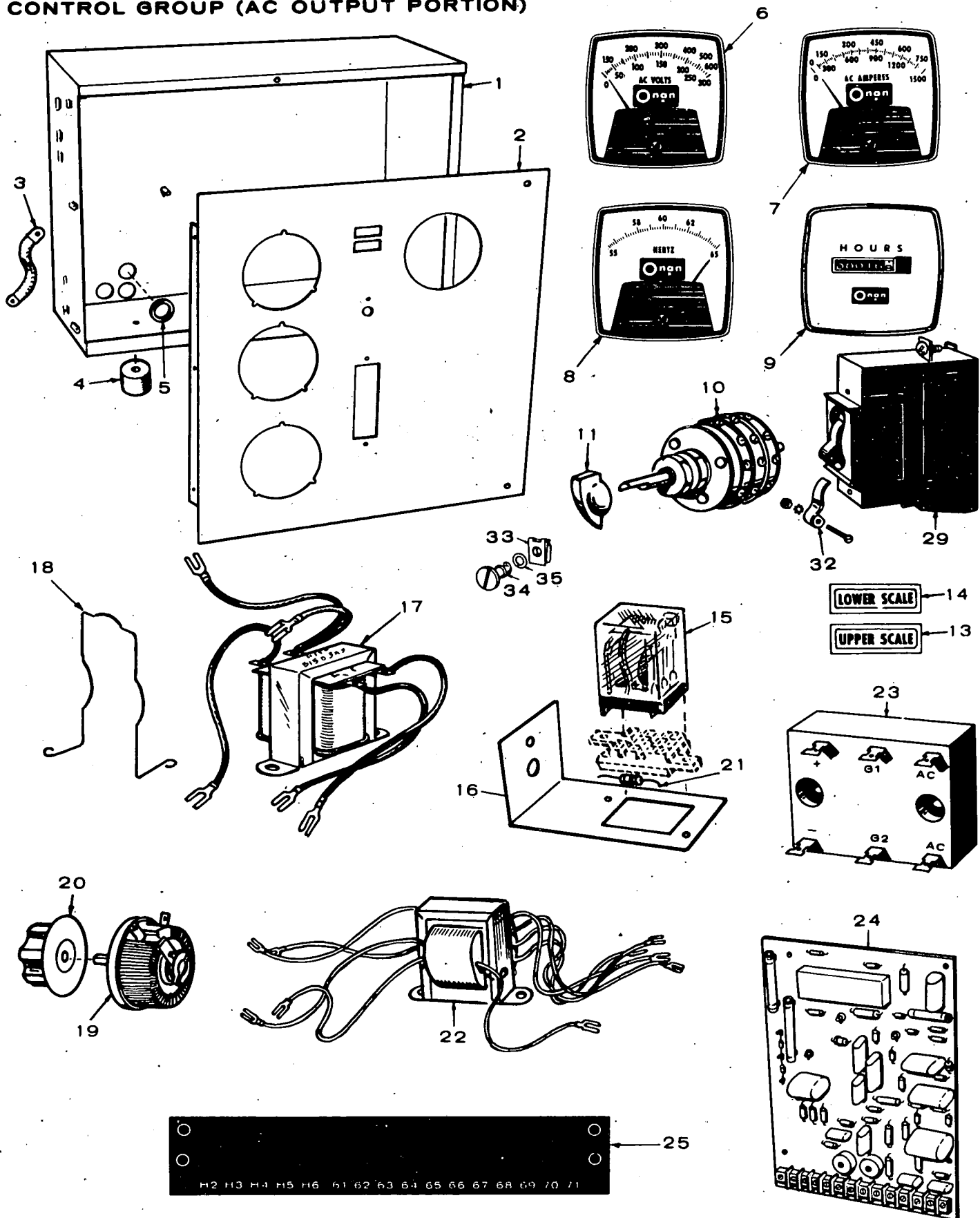


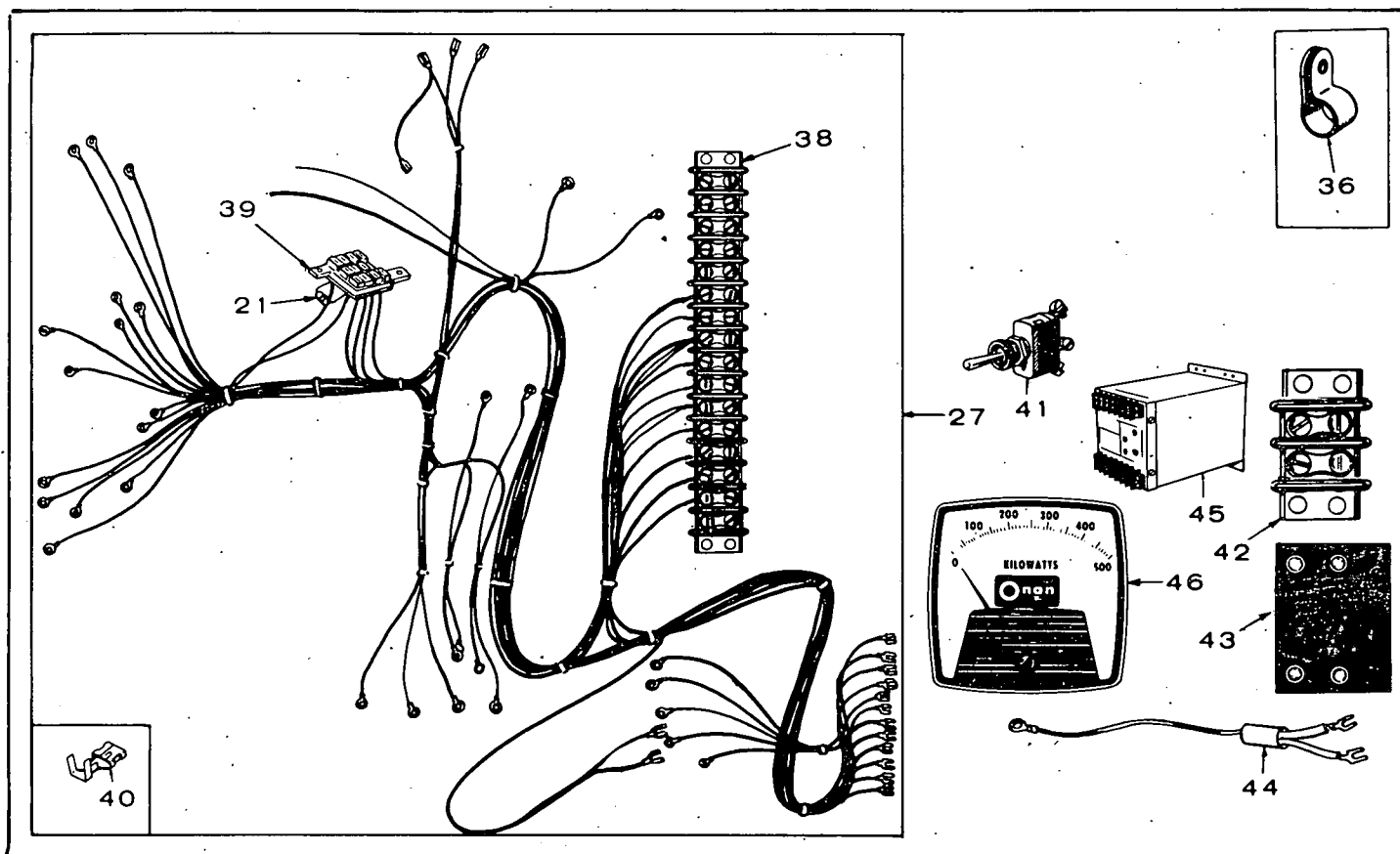
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	★	1	Rotor Assembly, Wound
2	★	1	Stator Assembly, Wound
3	232-2249	2	Bracket, Terminal Board Mounting
4	232-2237	1	Bracket, Bus Bar Support
5	232-2245	1	Board, Insulating - Bus Bar Support
6	232-2387	4	Bracket, Bus Bar
7	232-2243	2	Board, Insulating
8	232-2242	2	Board, Insulating
9	232-2343	3	Bar, Bus
10	232-2241	11	Bar, Bus
11	232-2240	4	Bar, Bus
12	232-2238	1	Bracket, Bus Bar
13	232-2344	32	Spacer, Terminal Connection
14	520-0142	14	Stud (5/16-18 x 1-1/4")
15	220-1920	1	Stator Assembly, Wound-Exitor
16	800-0009	4	Screw (1/4-20 x 1-1/2") - Stator Assembly
17	850-0040	12	Washer (1/4"), Lock
18	232-2309	1	Disc, Generator Drive
19	205-0103	1	Fan, Generator
20	805-0035	14	Bolt (5/8-11 x 1-1/2"), Drive - (8) Drive Disc to Hub (6) Fan to Drive Disc
21	526-0259	8	Washer - Drive Disc to Hub
22	515-0145	1	Key, Exitor Rotor
23	232-2317	1	Spacer, Bearing
24	510-0106	1	Bearing

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
25	526-0252	2	Washer (3/4")
26	150-1405	1	Wheel, Speed Sensor
28	850-0060	1	Washer (1/2"), Lock
29	800-0092	1	Screw (1/2-13 x 1-1/2")
30	211-0214	1	End Bell, Generator
32	800-0005	2	Screw (1/4-20 x 3/4") - Speed Sensor Mounting
33	332-1554	1	Clamp, Loop
34	234-0455	1	Screen Assembly, Fan
35	800-0008	2	Screw (1/4-20 x 1-1/4") - Screen Mounting
36	862-0001	2	Nut (1/4-20)
37	520-0780	4	Stud (1/2" x 6-1/2") - End Bell Mounting
38	850-0060	20	Washer (1/2"), Lock
39	862-0016	4	Nut (1/2-13)
40	201-1902	1	Rotor Assy. - Wound-Exitor
41	800-0092	16	Screw (1/2-13 x 1-1/2") - Stator to Engine Adapter
44	232-2342	2	Bracket, Terminal Board Mtg.
45	332-1402	1	Clamp
46	232-2246	2	Bar, Reconnection
47	232-2248	3	Bar, Reconnection
48	150-1406	1	Sensor, Speed
49	150-1407	1	Bracket, Speed Sensor
50	870-0289	1	Nut (3/4-16)
51	150-1410	1	Cap, Insulator
52	315-0389	1	Plate, Transformer Mounting
53	TRANSFORMER, CURRENT		
	302-0547	3	250 KW
	302-0876	3	300 KW

★ - Refer to factory giving complete Model, Spec and
Serial Number from the Onan nameplate.

CONTROL GROUP (AC OUTPUT PORTION)



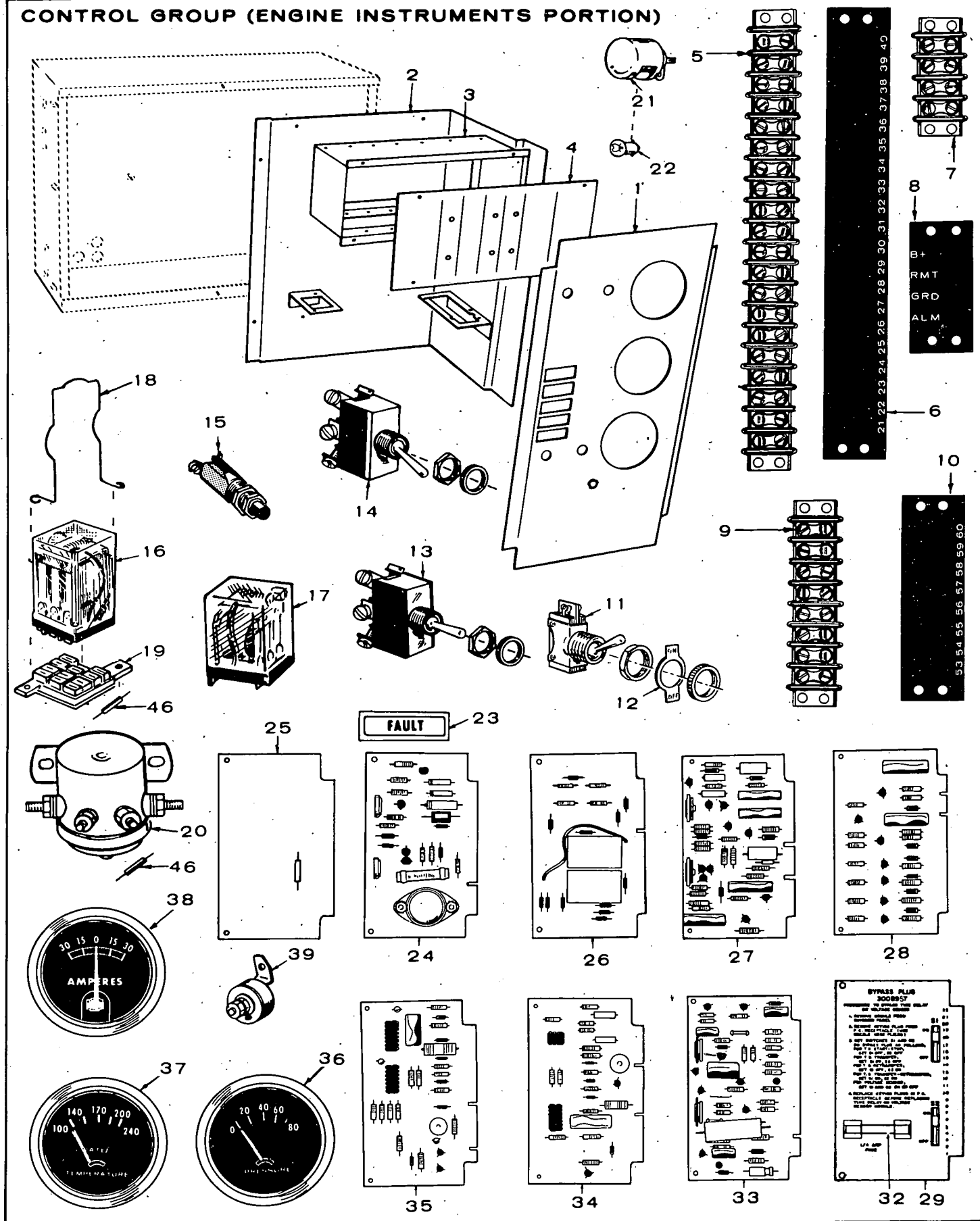


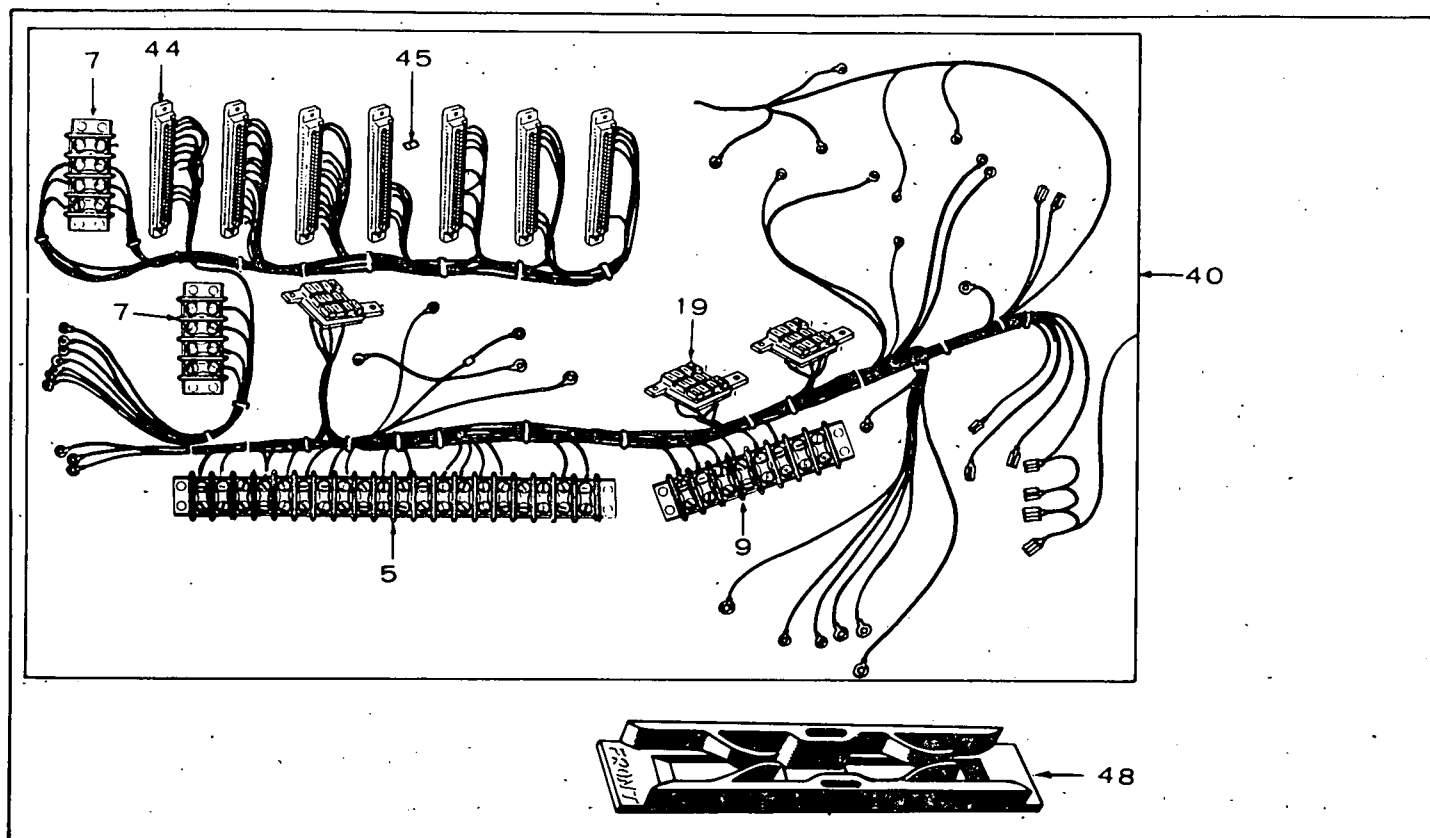
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	301-3158	1	Box, Control
2	PANEL, CONTROL BOX		
	301-3170	1	Standard Units
	301-3312	1	Units With Wattmeter
3	337-0049	1	Strap, Bond
4	402-0070	4	Dampener, Vibration
5	508-0001	4	Grommet (1-1/16"), Rubber
6	302-0718	1	Voltmeter, AC - Dual Scale 0-300, 0-600
7	AMMETER, AC		
	302-0878	1	250 KW - Dual Scale 0-500, 0-1000
	302-0879	1	300 KW - Dual Scale 0-600, 0-1200
8	METER, FREQUENCY		
	302-0810	1	60 Hertz
	302-0894	1	50 Hertz
9	METER, RUNNING TIME		
	302-0466	1	60 Hertz
	302-0469	1	50 Hertz
10	308-0284	1	Switch, Voltage & Ammeter
11	303-0076	1	Knob
13	322-0131	1	Light, Upper Scale
14	322-0130	1	Light, Lower Scale
15	307-1061	1	Relay, Voltage Selector
16	301-3244	1	Bracket, Relay Mounting
17	315-0384	1	Reactor Assembly, Comm
18	307-1157	1	Spring, Relay Holddown
19	303-0170	1	Rheostat, Voltage Adj.
20	303-0032	1	Knob, Rheostat
21	350-0556	1	*Resistor
22	315-0342	1	Transformer, Voltage

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
23	305-0524	1	Bridge, Rectifier
24	332-1268	1	Board Assembly, Printed Circuit Voltage Regulator
25	332-1242	1	Strip, Marker (H2-H6, 61-71)
27	338-0730	1	Harness, Wiring - AC Control (Includes Parts Marked *)
29	320-0455	1	Circuit Breaker (3 Amp)
32	320-0307	1	Lock, Circuit Breaker Handle (Penn State Models) - Optional
33	406-0332	2	Receptacle, Fastener
34	406-0333	2	Stud, Fastener
35	406-0334	2	Washer, Stud Fastener
36	332-0050	1	Clip, Tinnerman
38	332-0795	1	*Block, Terminal - 16 Place
39	323-0764	1	*Socket, Relay
40	332-1280	As Req.	*Terminal, Crimp
41	308-0154	1	Switch, Governor Control - Optional (Used With Motorized Governor)
42	332-0609	1	Block, Terminal (2 Place) - Optional (Motorized Governor)
43	332-0610	1	Strip, Marker (2 Place) - Optional
44	357-0019	1	Diode Assembly - Optional (Used With Motorized Governor)
45	302-0921	1	Transducer, Watt - Optional
46	WATTMETER, AC		
	302-0927	1	250 KW (Scale Reads 0-300)
	302-0928	1	300 KW (Scale Reads 0-500)

* - Included in Wiring Harness Assembly.

CONTROL GROUP (ENGINE INSTRUMENTS PORTION)





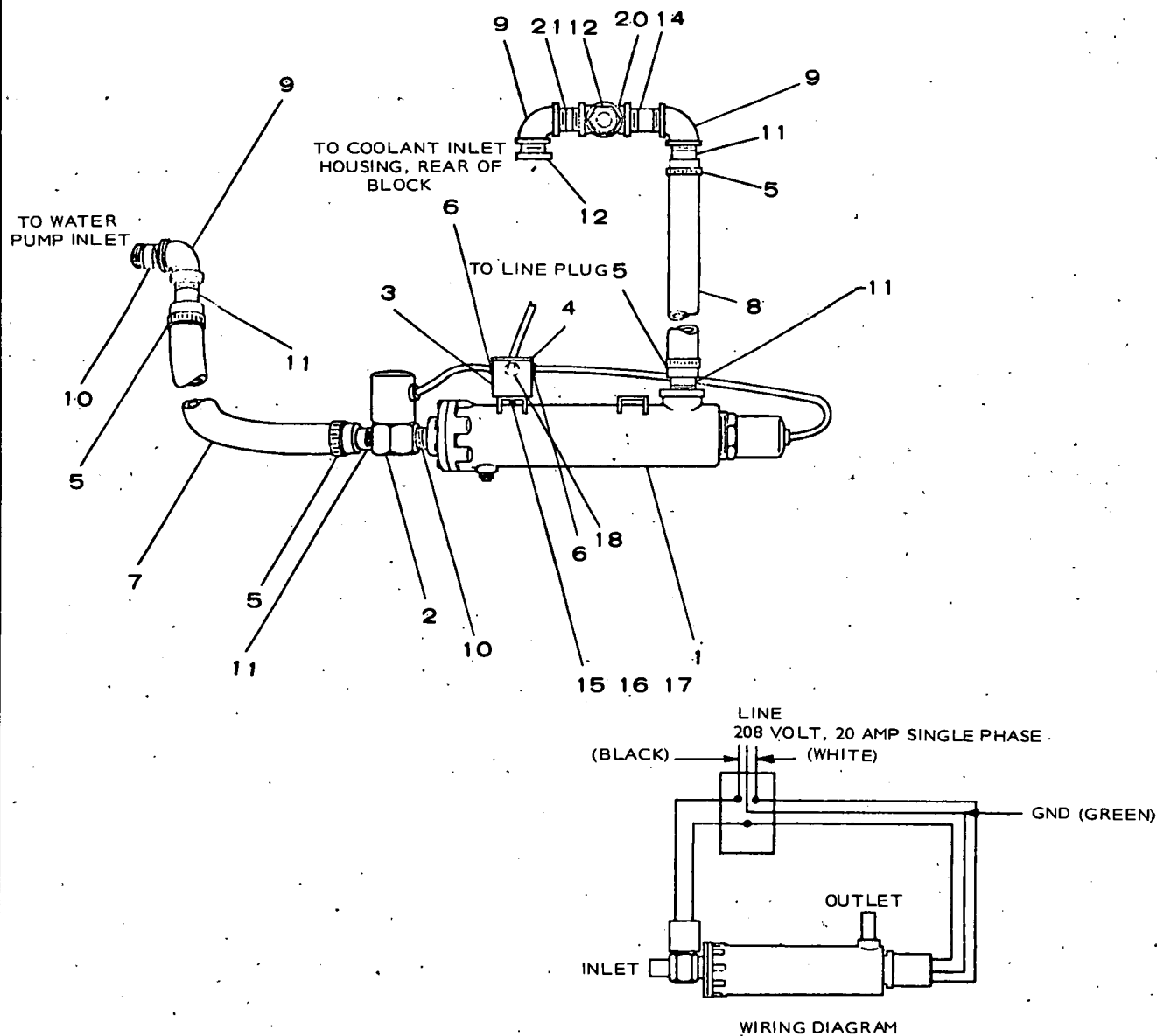
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	PANEL, ENGINE CONTROL		
	301-3661	1	Sets With One Fault Light
	301-3629	1	Sets With Five Fault Lights
2	301-3621	1	Bracket, Engine Control
3	301-3588	1	Rack, Module
4	301-3635	1	Cover Assembly, Rack
5	332-1005	1	*Block, Terminal - 20 Place
6	332-1559	1	Strip, Terminal Block Marker (21-40)
7	332-0537	2	*Block, Terminal - 4 Place
8	STRIP, TERMINAL BLOCK MARKER (4-Place)		
	332-1239	1	B+, Remote, Ground, Alarm
	332-1561	1	1-4
9	332-0699	1	*Block, Terminal - 8 Place - Set With Five Fault Lights
10	332-1560	1	Strip, Terminal Block Marker (53-60) - Sets With Five Fault Lights
11	308-0002	1	Switch, Panel Light
12	308-0003	1	Plate, On-Off Switch
13	SWITCH, SELECTOR		
	308-0220	1	Standard Control
	308-0347	1	Penn State Models (Optional)
14	308-0337	1	Switch, Lamp Test
15	308-0091	1	Switch, Reset
16	307-1056	2	Relay (1) Start Disconnect (1) Ignition
17	307-1061	1	Relay, Starter Protection
18	307-1157	3	Spring, Relay Holddown
19	323-0765	3	*Socket, Relay - 11 Place
20	307-0061	1	Relay, Start Solenoid
21	322-0149	1	Holder, Lamp
22	322-0017	1	Lamp, Panel
23	LAMP, FAULT		
	322-0129	1	Standard
	322-0119	1	Overcrank (Optional)
	322-0123	1	Overspeed (Optional)

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	322-0120	1	Low Oil Pressure (Opt.)
	322-0121	1	High Engine Temperature (Optional)
	322-0122	1	Low Engine Temperature (Optional)
24	300-0956	1	Control, Cycle Cranker (Optional)
25	300-0977	1	Control, Standard Cranker
26	300-0954	1	Control, Engine Shutdown -
27	300-0953	1	Control, Engine Monitor
28	300-0955	1	Control, Remote Indicator - Sets With Five Fault Lights
29	300-0987	1	Module, Bypass Plug
32	321-0168	1	Fuse, 1/4 Amp (Part of 300-0987 Module)
33	300-0973	1	Module, Time Delay Start-Stop (Optional)
34	300-0957	1	Control, Overspeed Sensor
35	300-0958	1	Control, Starter Disconnect -
36	193-0107	1	Gauge, Oil Pressure
37	193-0106	1	Gauge, Water Temperature
38	302-0061	1	Ammeter, Charge (30-0-30)
39	193-0189	2	Resistor, Gauge (1) Start Solenoid (1) Start Disconnect Relay
40	Harness, Wiring (Includes Parts Marked *)		
	338-0715	1	Sets With One Fault Light
	338-0705	1	Sets With Five Fault Lights
44	332-1271	6	*Housing, Printed Circuit Board Terminal (Seven on Sets With Five Fault Lights)
45	332-1276	As Req.	*Plug, Keying
46	357-0004	2	*Rectifier, Diode
48	323-0814	12	Guide, Printed Circuit Board (14 Used on Sets with Five Fault Lights)

* - Included in Wiring Harness Assembly.

179-0428

WATER JACKET HEATER INSTALLATION - 240 VOLT

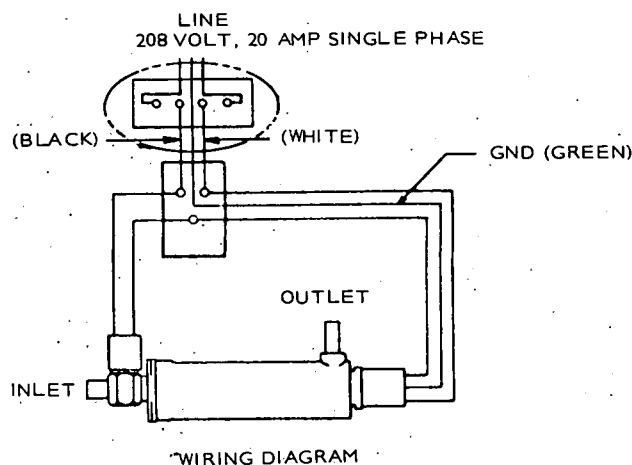
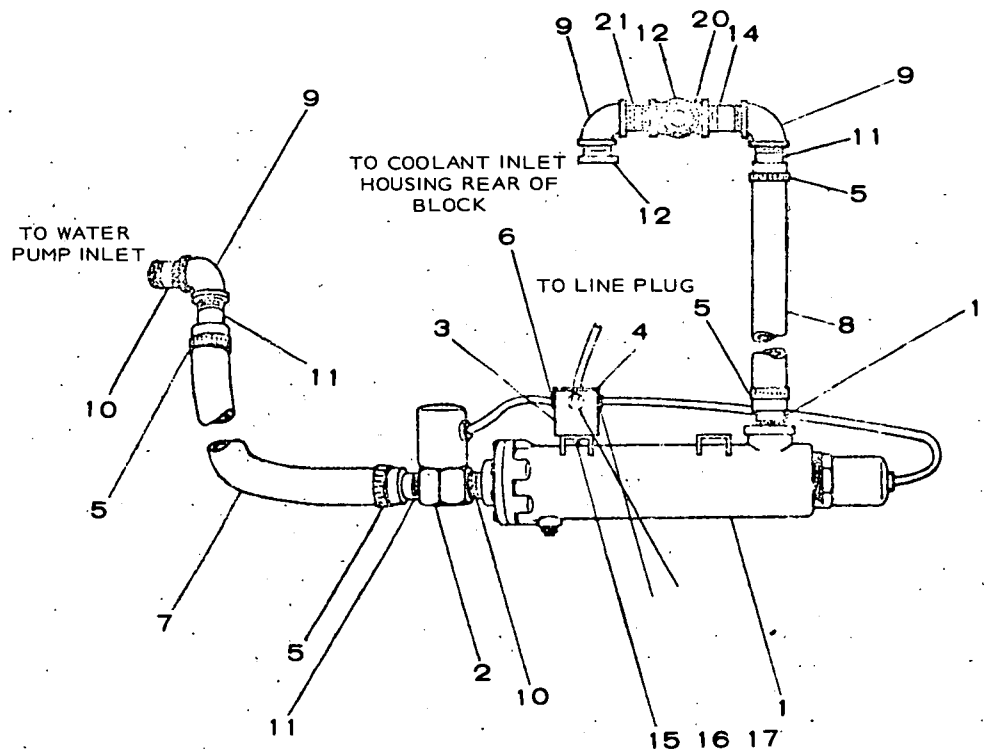


REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	333-0138	1	Heater, Engine (4000 Watts, 240 Volts)
2	309-0253	1	Thermostat
3	330-0005	1	Box, Outlet
4	330-0004	1	Cover, Box
5	503-0429	4	Clamp, Hose
6	503-0008	2	Grommet (1/2" I.D. x 1-1/16" O.D.)
7		1	Hose (Order 27" of Bulk Hose #503-0249)
8		1	Hose (Order 95" of Bulk Hose #503-0249)
9	505-0041	3	Elbow, Pipe (1" x 90°)
10	505-0107	2	Nipple, Pipe (1 x 2")
11	505-0759	4	Nipple, Half (1 x 4-3/4")
12	505-0129	3	Bushing, Reducer (1 x 3/4)

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
14	505-0086	1	Nipple, Pipe (1 x 2-1/2")
15	813-0103	2	Screw, RHM (10-32 x 3/4")
16	850-0030	2	Washer, Lock (#10)
17	870-0053	2	Nut, Hex (10-32)
18	331-0027	1	Connector, Romex (1/2")
20	505-0719	1	Cross, Pipe (1")
21	505-0004	1	Nipple, Pipe (1 x 1-1/2")
22	309-0271	1	*Switch, Oil Pressure
	333-0142	1	*Support, Pressure Switch
	502-0287	2	*Elbow
	501-0188	1	*Line, Flexible (24")
	505-0099	1	*Nipple (1/4 x Close)

* - These parts are not illustrated.

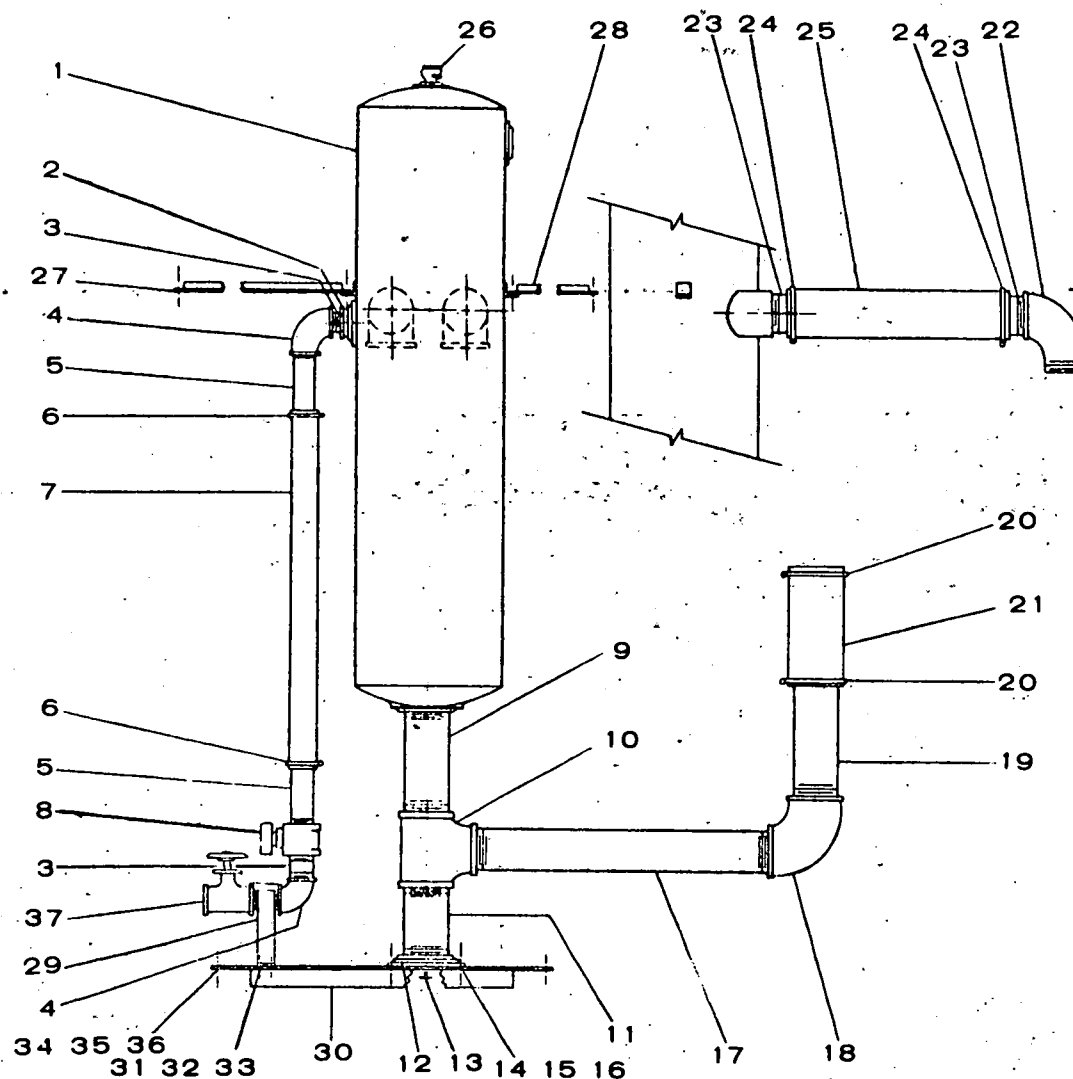
WATER JACKET HEATER INSTALLATION - 208 VOLT



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	333-0143	1	Heater (4000 Watt, 208 Volt)
2	309-0253	1	Thermostat
3	330-0005	1	Box, Outlet
4	330-0004	1	Cover, Box
5	503-0429	4	Clamp, Hose
6	508-0008	2	Grommet
7			Hose (Order 27" of Bulk Hose #503-0249)
8			Hose (Order 95" of Bulk Hose #503-0249)
9	505-0041	3	Elbow (1 x 90°)
10	505-0107	2	Nipple (1 x 2")
11	505-0759	4	Pipe, Adapter
12	505-0129	3	Bushing, Reducer (1 x 3/4")
14	505-0086	1	Nipple, Pipe (1 x 2-1/2")
15	813-0103	2	Screw, Round Head (10-32 x 3/4")
16	850-0030	2	Washer, Lock (#10)
17	870-0053	2	Nut (10-32)
18	331-0027	1	Connector (1/2")
20	505-0719	1	Cross, Pipe (1")
21	505-0004	1	Nipple, Pipe (1 x 1-1/2")
22	309-0271	1	Switch, Oil Pressure
23	333-0142	1	Support, Pressure Switch - Not Shown
24	502-0287	2	Elbow, Pipe - Not Shown
25	501-0188	1	Line - Not Shown
26	505-0099	1	Nipple, Close (1/4") - Not Shown

179-1009

STANDPIPE INSTALLATION (With Marsh Regulator)

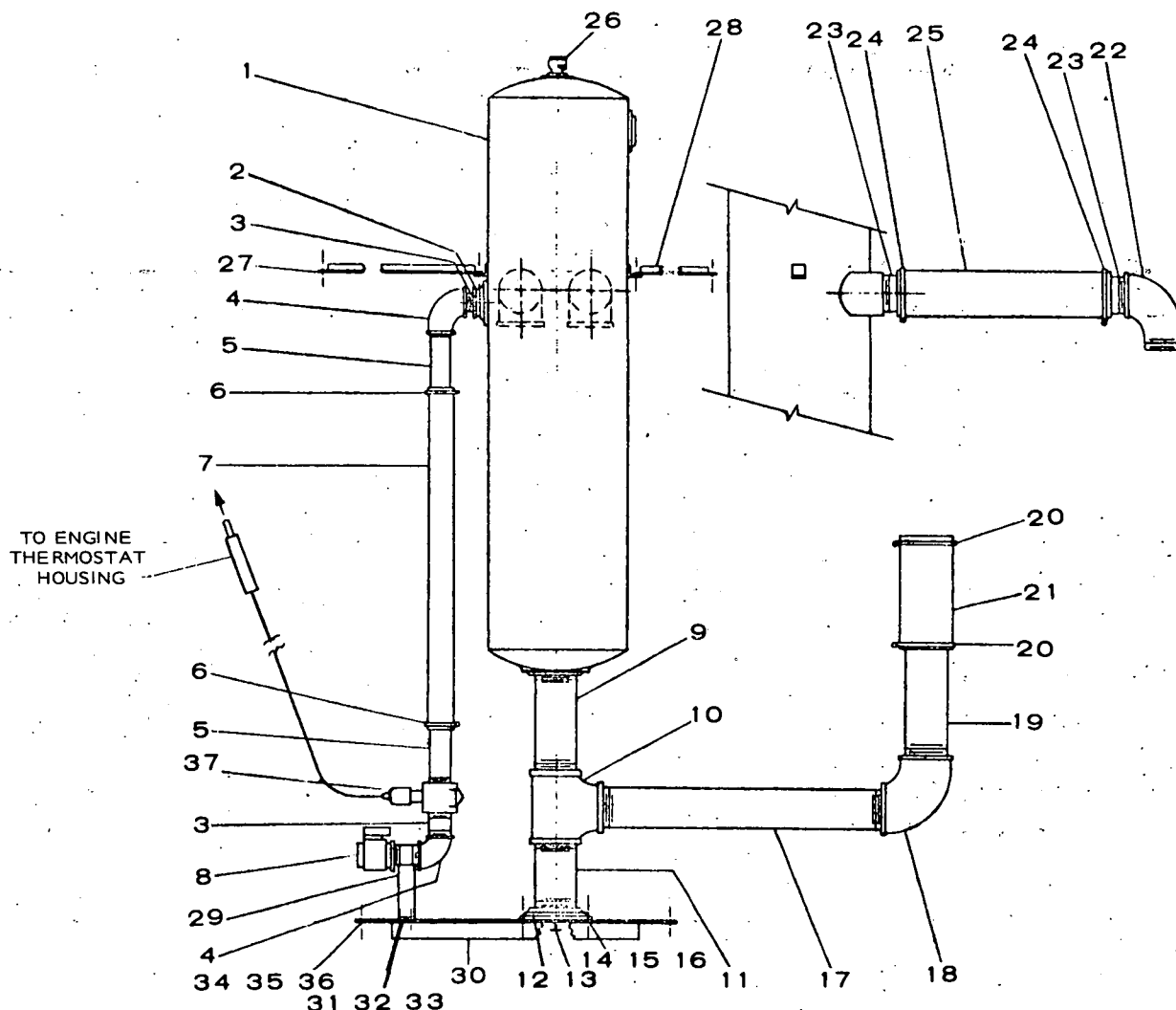


REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	130-0687	1	Standpipe
2	505-0270	1	Bushing, Reducer (2 x 1-1/4")
3	505-0258	2	Nipple (1-1/4 x 3")
4	505-0042	2	Elbow (90°)
5	505-0437	2	Nipple, Half (1-1/4 x 4")
6	503-0011	2	Clamp
7	503-0359	1	Hose (1-5/8" I.D. x 3')
8	307-0839	1	Valve, Solenoid
9	505-0679	1	Nipple (3 x 12")
10	505-0669	1	Tee
11	505-0328	1	Nipple (3 x 6")
12	130-0740	1	Flange Assembly
13	504-0006	1	Valve, Drain
14	800-0091	4	Screw (1/2-13 x 1-1/4") - Not Shown
15	862-0005	4	Nut (1/2-13) - Not Shown
16	850-0060	4	Washer, Lock (1/2") - Not Shown
17	505-0615	1	Nipple (3 x 24")
18	505-0453	1	Elbow (90°)
19	505-0604	1	Nipple (3 x 9-3/4")
20	503-0518	2	Clamp

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
21	503-0569	1	Hose (3-1/2" I.D. x 10")
22	505-0216	2	Elbow, Street (90°)
23	505-0178	4	Nipple, Half
24	503-0059	4	Clamp
25	503-0512	2	Hose (2-7/8" I.D. x 18")
26	504-0062	1	Valve, Relief
27	130-0465	1	Brace
28	130-0466	1	Brace
29	110-1168	1	Bracket & Nipple Assembly
30	130-0897	1	Support
31	800-0006	2	Screw (1/4-20 x 7/8") - Not Shown
32	862-0001	2	Nut (1/4-20) - Not Shown
33	850-0040	2	Washer, Lock (1/4") - Not Shown
34	800-0092	4	Screw (1/2-13 x 1-1/2") - Not Shown
35	862-0005	4	Nut (1/2-13) - Not Shown
36	850-0060	4	Washer, Lock (1/2") - Not Shown
37	504-0051	1	Valve (1-1/4")

179-1010

STANDPIPE INSTALLATION

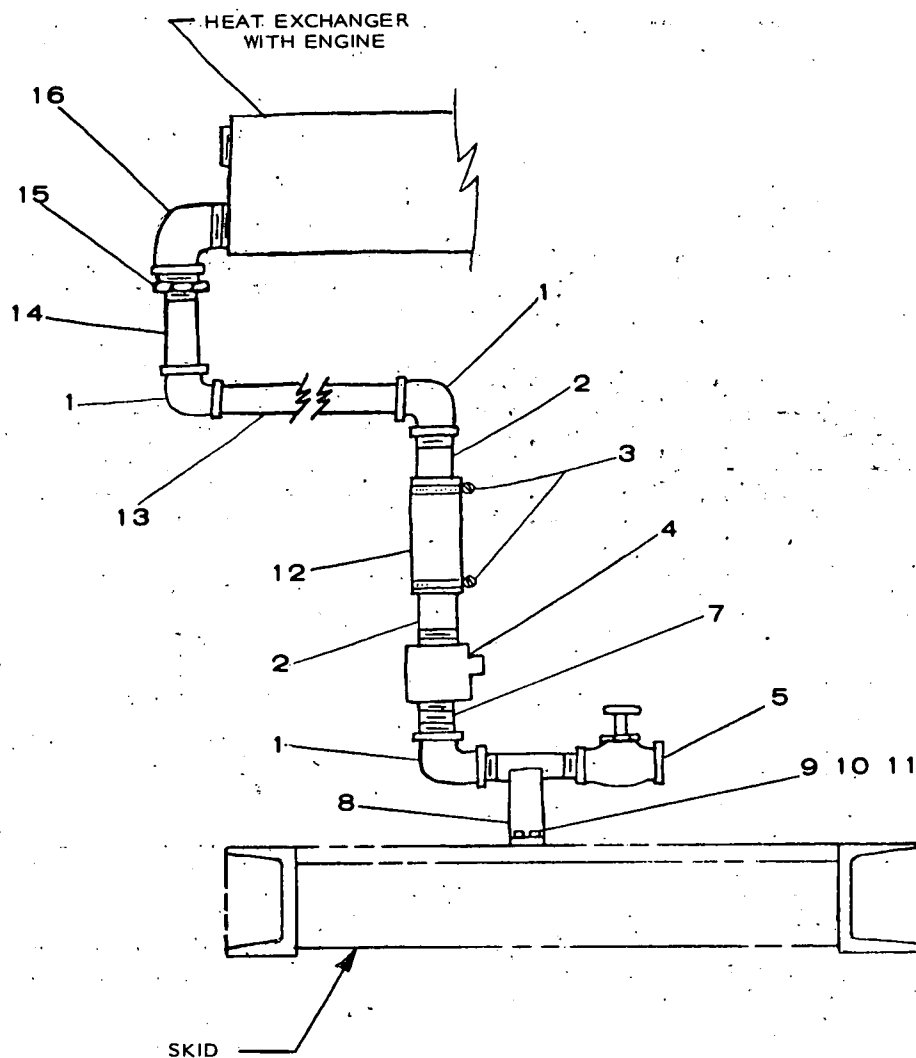


REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	130-0687	1	Standpipe
2	505-0270	1	Bushing, Reducer (2 x 1-1/4")
3	505-0258	2	Nipple (1-1/4 x 3")
4	505-0042	2	Elbow (90°)
5	505-0437	2	Nipple, Half (1-1/4 x 4")
6	503-0011	2	Clamp
7	503-0359	1	Hose (1-5/8" I.D. x 3')
8	307-0839	1	Valve, Solenoid
9	505-0679	1	Nipple (3 x 12")
10	505-0669	1	Tee
11	505-0328	1	Nipple (3 x 6")
12	130-0740	1	Flange Assembly
13	504-0006	1	Valve, Drain
14	800-0091	4	Screw (1/2-13 x 1-1/4") - Not Shown
15	862-0005	4	Nut (1/2-13) - Not Shown
16	850-0060	4	Washer, Lock (1/2") - Not Shown
17	505-0615	1	Nipple (3 x 24")
18	505-0453	1	Elbow (90°)
19	505-0604	1	Nipple (3 x 9-3/4")
20	503-0518	2	Clamp
21	503-0569	1	Hose (3-1/2" I.D. x 10")

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
22	505-0216	2	Elbow, Street (90°)
23	505-0178	4	Nipple, Half
24	503-0059	4	Clamp
25	503-0512	2	Hose (2-7/8" I.D. x 18")
26	504-0062	1	Valve, Relief
27	130-0465	1	Brace
28	130-0466	1	Brace
29	110-1168	1	Bracket & Nipple Assembly
30	130-0897	1	Support
31	800-0006	2	Screw (1/4-20 x 7/8") - Not Shown
32	862-0001	2	Nut (1/4-20) - Not Shown
33	850-0040	2	Washer, Lock (1/4") - Not Shown
34	800-0092	4	Screw (1/2-13 x 1-1/2") - Not Shown
35	862-0005	4	Nut (1/2-13) - Not Shown
36	850-0060	4	Washer, Lock (1/2") - Not Shown
37	309-0243	1	Valve, Marsh (1-1/4")

NOTE: Remove Thermostat From Engine.

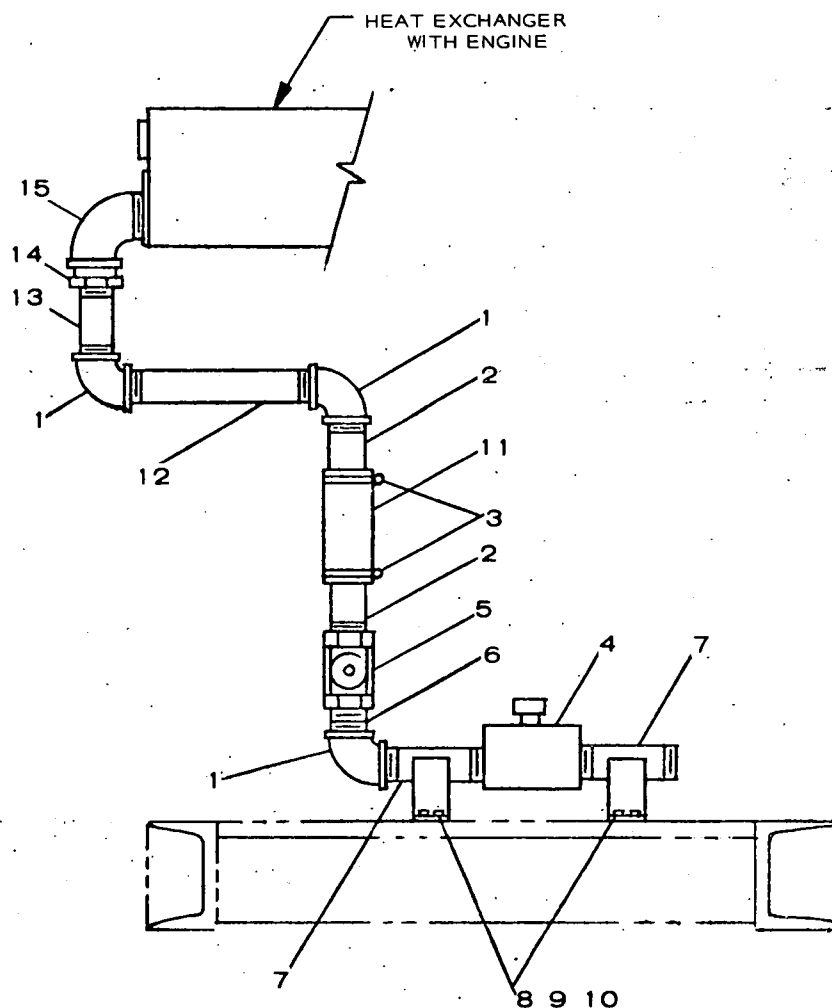
SOLENOID VALVE INSTALLATION



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	505-0175	3	Elbow, Pipe
2	505-0380	2	Nipple, Half (2 x 3")
3	503-0365	2	Clamp, Hose
4	307-0844	1	Valve, Solenoid
5	505-0057	1	Valve
7	505-0172	1	Nipple, Close (2 x 2")
8	130-0801	1	Nipple Assembly, Waterline
9	800-0007	2	Screw (1/4-20 x 1")
10	850-0040	2	Washer, Lock (1/4")
11	862-0001	2	Nut, Hex (1/4-20)
12			Hose, Radiator (Order 6" of Bulk Hose #503-0324)
13	505-0419	1	Nipple (2 x 12")
14	505-0173	1	Nipple (2 x 4")
15	505-0207	1	Bushing, Reducer (2-1/2 x 2")
16	505-0216	1	Elbow, Street (2-1/2")

NOTE: For Heat Exchanger Models.

REGULATOR & SOLENOID INSTALLATION



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	505-0175	3	Elbow, Pipe
2	505-0380	2	Nipple, Half (2 x 3")
3	503-0365	2	Clamp, Hose
4	307-0844	1	Valve, Solenoid
5	309-0245	1	Valve, Marsh
6	505-0172	1	Nipple, Close (2 x 2")
7	130-0801	2	Nipple Assembly, Waterline
8	800-0007	4	Screw (1/4-20 x 1")
9	850-0040	4	Washer, Lock (1/4")
10	862-0001	4	Nut (1/4-20)
11			Hose, Radiator (Order 6" of Bulk Hose #503-0324)
12	505-0419	1	Nipple (2 x 12")
13	505-0173	1	Nipple (2 x 4")
14	505-0207	1	Bushing, Reducer (2-1/2 x 2")
15	505-0216	1	Elbow, Street (2-1/2")

NOTES:

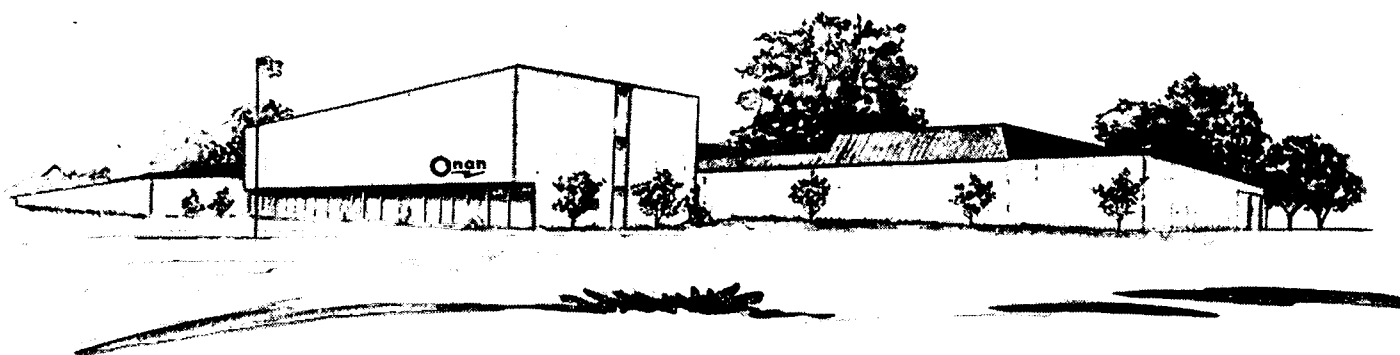
1. Remove Engine Thermostat.
2. For Heat Exchanger Models.

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