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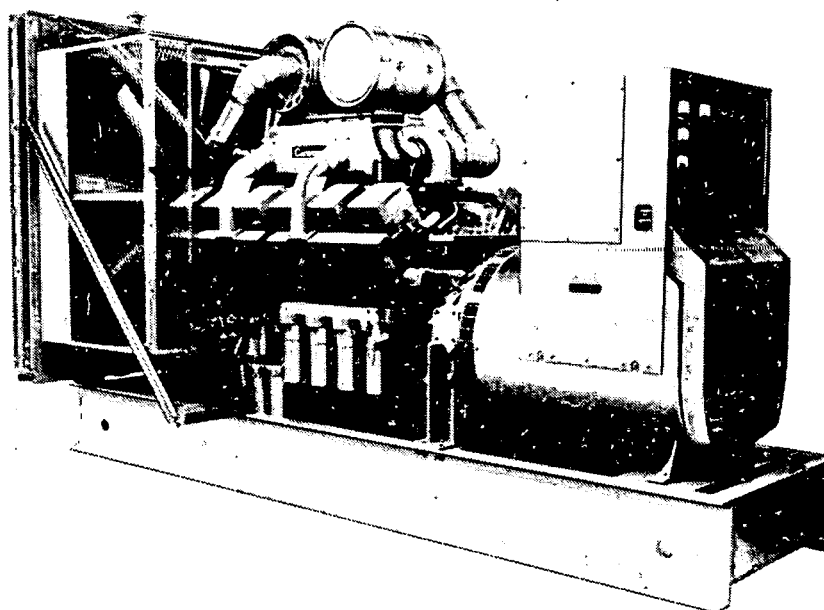
**OPERATOR'S MANUAL
AND
PARTS CATALOG**

FOR

DFX

SERIES

ELECTRIC GENERATING SETS



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The need for an international standard of measurement has been increased by today's improved communication and transportation between countries.

This has prompted formation of modernized metrics known as the International System of Units, officially abbreviated SI.

ONAN products appear on the world market, therefore both metric and the present American system of units (CU) will be found in this manual.

To assist in familiarization, refer to the following terms.

TERM	METRIC	ENGLISH
Length	millimetre (mm)	Inch (in)
Pressure	kilopascals (kPa)	pounds per square inch (PSI)
Mass (Weight)	kilogram (kg)	pound (lb)
Volume (Liquid)	litre	gallon (gal)
Power	kilowatt	horsepower (HP)
Frequency	hertz (Hz)	cycles per second (CPS)
Energy	Joules (J)	BTU
Battery Capacity	Coulomb (C)	Ampere Hour (AH)
Revolutions per Minute	r/min	rpm
Temperature	Celsius (°C)	Fahrenheit (°F)

The customary unit of Brake Horsepower (BHP) becomes kilowatts (kW) when converted to SI metric units. This kW rating should not be confused with the kW rating of the generator which will always be lower due to losses inherent with any electrical induction device.

WARNING

TO AVOID POSSIBLE PERSONAL INJURY OR EQUIPMENT DAMAGE, A QUALIFIED ELECTRICIAN OR AN AUTHORIZED SERVICE REPRESENTATIVE MUST PERFORM INSTALLATION AND ALL SERVICE.

INTRODUCTION

FOREWORD

This manual is applicable to the DFX Series electric generating set, consisting of an ONAN UV 600 kW generator, driven by a Cummins KT2300-G Diesel Engine.

This manual is divided into two sections.

Section 1 provides information on installation, operation and troubleshooting.

Section 2 is a Parts Catalog for ONAN optional and standard equipment.

The manual should be used in conjunction with the Cummins engine manual, for specific engine information.

WARNING Onan uses this symbol throughout this manual to warn of possible serious personal injury.

CAUTION This symbol refers to possible equipment damage.

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.

600	DFX	4XR/	1	A
1	2	3	4	5

1. Indicates Kilowatt rating (600 kW).
2. Factory code for SERIES identification.
3. Refer to Table 1.
R—Indicates remote starting feature.
4. Factory code for designating optional equipment.
5. Specification letter. (Advances when factory makes production modifications.)

When contacting 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 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 right hand side of the block.

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

SAFETY PRECAUTIONS

Throughout this manual you will find eye-catching flags containing Warnings and Cautions. These will alert you to conditions that could result in danger to you or the equipment, if the notice is ignored.

ONAN recommends that you read your manual and become thoroughly acquainted with it and your equipment before you start your unit. The accumulated experience of ONAN engineers is available to you, enabling you to operate your set in the most efficient and safest manner possible. These recommendations and the following safety precautions are for your protection. Study and know them!

REMEMBER. Most accidents are caused by failure to follow simple and fundamental safety rules or precautions.

Most accidents can be prevented!

KNOW YOUR MANUAL—KNOW YOUR EQUIPMENT

WARNING

Set forth below are a number of potential hazards which could result in some degree of personal injury. The suggested procedures should be adhered to.

General

- Keep your electric generating set and the surrounding area clean and free from obstructions. Remove all oil deposits; keep the floor clean and dry.
- Provide appropriate fire extinguishers and install them in convenient locations. Consult your local fire department for the correct type of extinguisher to use. Do not use foam on electrical fires. Use extinguisher rated ABC by NFPA.
- Make sure that all fasteners on the generating set are secure. Tighten supports and clamps, keep guards in position over fans, driving belts, etc.
- Do not wear loose clothing in the vicinity of moving parts, or jewelry while working on electrical equipment. Loose clothing and jewelry can become caught in moving parts. Jewelry can short out electrical contacts; cause shock or burning.
- If necessary to make adjustments while the unit is running, use extreme caution when close to hot exhausts, moving parts, etc.

- Do not stand on a wet floor while working on electrical equipment. Use rubber insulative mats placed on dry wood platforms.

Fuel System

- DO NOT fill fuel tanks while engine is running, unless tanks are outside engine compartment. Fuel contact with hot engine or exhaust is a potential fire hazard.
- DO NOT SMOKE OR USE AN OPEN FLAME in the vicinity of the generator set or fuel tank. Internal combustion engine fuels are highly flammable.

REMEMBER—IF YOU CAN SMELL FUMES—A POSSIBLE EXPLOSION AND FIRE CONDITION EXISTS!

- Make sure that oily rags are not left on or near the engine. Oil-soaked rags are combustible and present hazardous walking conditions.
- Fuel lines must be of steel piping, adequately secured, and free from leaks. Piping at the engine should be approved flexible line. Do not use copper piping on flexible lines as copper will work harden and become brittle.
- Your engine installation should be equipped with a means of positive fuel shutoff in applications when fuel is conducted from a remote source. Fuels under pressure (e.g. natural gas or liquefied petroleum gas) should be controlled by a positive shutoff valve, preferably automatic, in addition to any valve integral with the carburetor or gas regulator equipment.

Exhaust System

- Exhaust products of any internal combustion engine are toxic and can cause serious personal injury, if inhaled. All engine installations, especially those within a confine, should be equipped with an exhaust system to discharge gases to the atmosphere. Do not use exhaust gases to heat a compartment.
- Inspect exhaust system regularly to assure that system is free of leaks.

Coolant System

- Coolants under pressure have a higher boiling point than that of water. DO NOT open a radiator or heat exchanger pressure cap or break a system while the engine is running, and in no case until the system pressure has been bled off.
- Radiator fan belts are guarded for your protection. DO NOT remove covers or guards.
- Keep your hands away from moving parts.

Ventilation System

- Check remote radiators frequently. Remove any dirt, debris, bird nests, etc.
- Check ventilation louvres frequently. Make sure that free-fall louvres and motor operated louvres open and close properly and that there is no restriction in the free-air flow.

Electrical System

- The electrical installation exterior to your generator should have been performed by qualified licensed electricians. All local and state

codes should have been consulted and complied with. It is essential that all load circuit breakers adequately protect electrical functions, all circuits are properly grounded and wiring is correct capacity.

- Tag open switches.
- DON'T tamper with interlocks.
- Before starting work on the generating set, disconnect batteries. This will prevent inadvertent starting of the set.
- Use extreme caution when making adjustments on the electrical components in the control cabinet while the engine is running. High voltages are present and could cause serious personal injury.
- DO NOT SMOKE while servicing batteries. Verify correct polarity of battery cables before connecting. Lead acid batteries give off a highly explosive hydrogen gas which can be ignited by electrical arcing or by smoking. When connecting batteries, connect the ground lead last.

WARNING

ENGINE EXHAUST GAS (CARBON MONOXIDE) IS DEADLY!

Carbon monoxide is an odorless, colorless gas formed by incomplete combustion of hydrocarbon fuels. Carbon monoxide is a dangerous gas that can cause unconsciousness and is potentially lethal. Some of the symptoms or signs of carbon monoxide inhalation are:

- | | |
|---------------------------|------------------------|
| • Dizziness | • Vomiting |
| • Intense Headache | • Muscular Twitching |
| • Weakness and Sleepiness | • Throbbing in Temples |

If you experience any of the above symptoms, get out into fresh air immediately.

The best protection against carbon monoxide inhalation is a regular inspection of the complete exhaust system. If you notice a change in the sound or appearance of exhaust system, shut the unit down immediately and have it inspected and repaired at once by a competent mechanic.

SPECIFICATIONS

600.0 kW

ENGINE DETAILS

Engine Manufacturer	Cummins
Engine Series	KT2300-G
Number of Cylinders	V12
Displacement	2300-in ³ (37.7 litres)
BHP @ 1800 r/min. (standby power)	910 (679 kW)
Compression Ratio	15.5:1
Bore	6.25-inch (158.75 mm)
Stroke	6.25-inch (158.75 mm)
Fuel	ASTM No. 2 Diesel
Battery Voltage	24
Battery Group (Four 12 Volt, 225 A/hr [1620 kC])	8D
Starting Method	Solenoid Shift
Governor Regulation	Adjustable Isoch. to 5%
Battery Charging Current	35-Amperes

GENERATOR DETAILS

Type	60 Hz
	50 Hz
Rating (Watts)	
60 Hertz Continuous Standby	600,000 (750 kVA)
50 Hertz Continuous Standby	500,000 (625 kVA)
AC Voltage Regulation	± 2%
60 Hertz r/min	1800
50 Hertz r/min	1500
Output Rating	0.8 PF
AC Frequency Regulation	0-3 Hz Max.

CAPACITIES AND REQUIREMENTS

Cooling System (Engine and Radiator)	55.0 gallons (207.9 litres)
Engine Oil Capacity (Filter, Lines, Crankcase)	40 gallons (151.4 litres)
Exhaust Connections (inches pipe thread)	Two 5-inch (male)

AIR REQUIREMENTS (1800 r/min)

Engine Combustion	1950-ft ³ /min (0.92 m ³ /s)
Radiator Cooled Engine	56,200-ft ³ /min (26.5 m ³ /s)
Total for Radiator Cooled Model	58,150-ft ³ /min (27.5 m ³ /s)
Alternator Cooling Air (1800 r/min)	3120-ft ³ /min (1.5 m ³ /s)
Alternator Cooling Air (1500 r/min)	2600-ft ³ /min (1.2 m ³ /s)
Fuel Consumption at Rated Load	
60 Hertz	46 gallon/hr (48.4 cm ³ /s)
50 Hertz	38 gallon/hr (40.0 cm ³ /s)

GENERAL

Height	93.06-inches (2.36 m)
Width	68.56-inches (1.74 m)
Length	1540-inches (3.9 m)
Approximate Weight (Mass)	15,500-lb (7030 kg)

TABLE 1
UV GENERATOR VOLTAGE/CURRENT OPTIONS

600.0 kW @ 60 Hz (750 kVA)

500.0 kW @ 50 Hz (625 kVA)

VOLTAGE	CODE	HZ	AMPERES	DELTA	SERIES WYE	PARALLEL WYE
120/208	4	60	2082			X
120/240	5D	60	1804	X		
139/240	4X	60	1804			X
240/416	7X	60	1041		X	
240/480	6D	60	902	X		
277/480	4X	60	902		X	
347/600	9X	60	722			X
220/380	57	50	950			X
230/400	57	50	902			X

NOTE: Single phase 0.8 pf. current available is 2/3 that of value given.

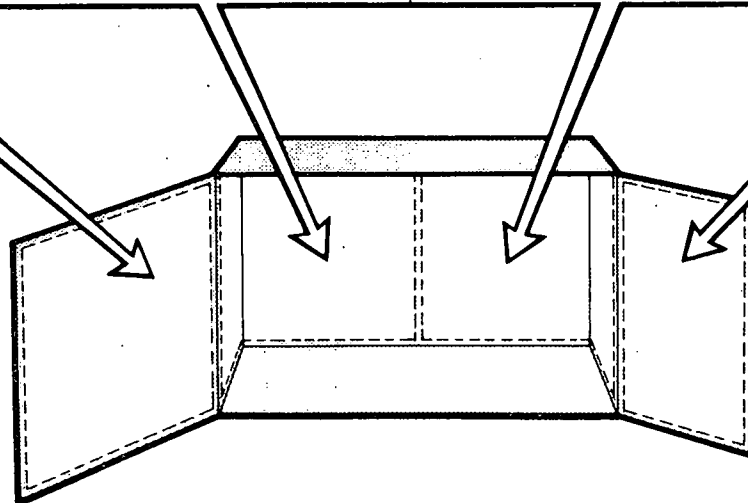
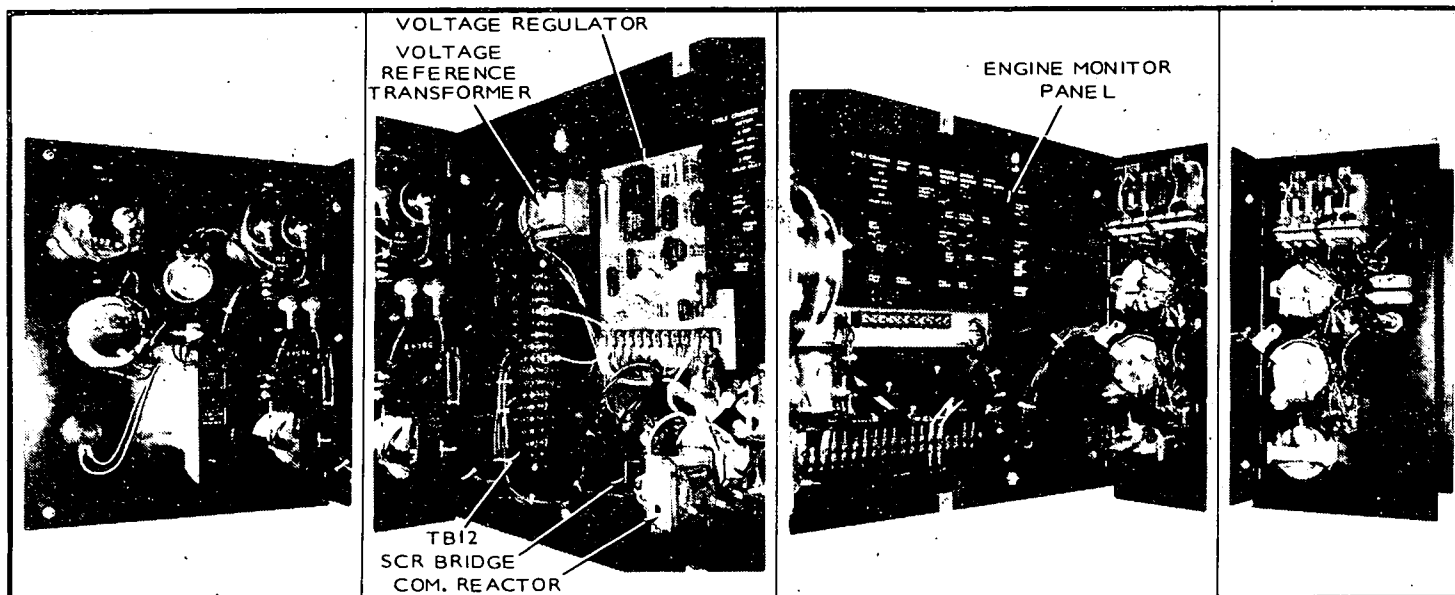
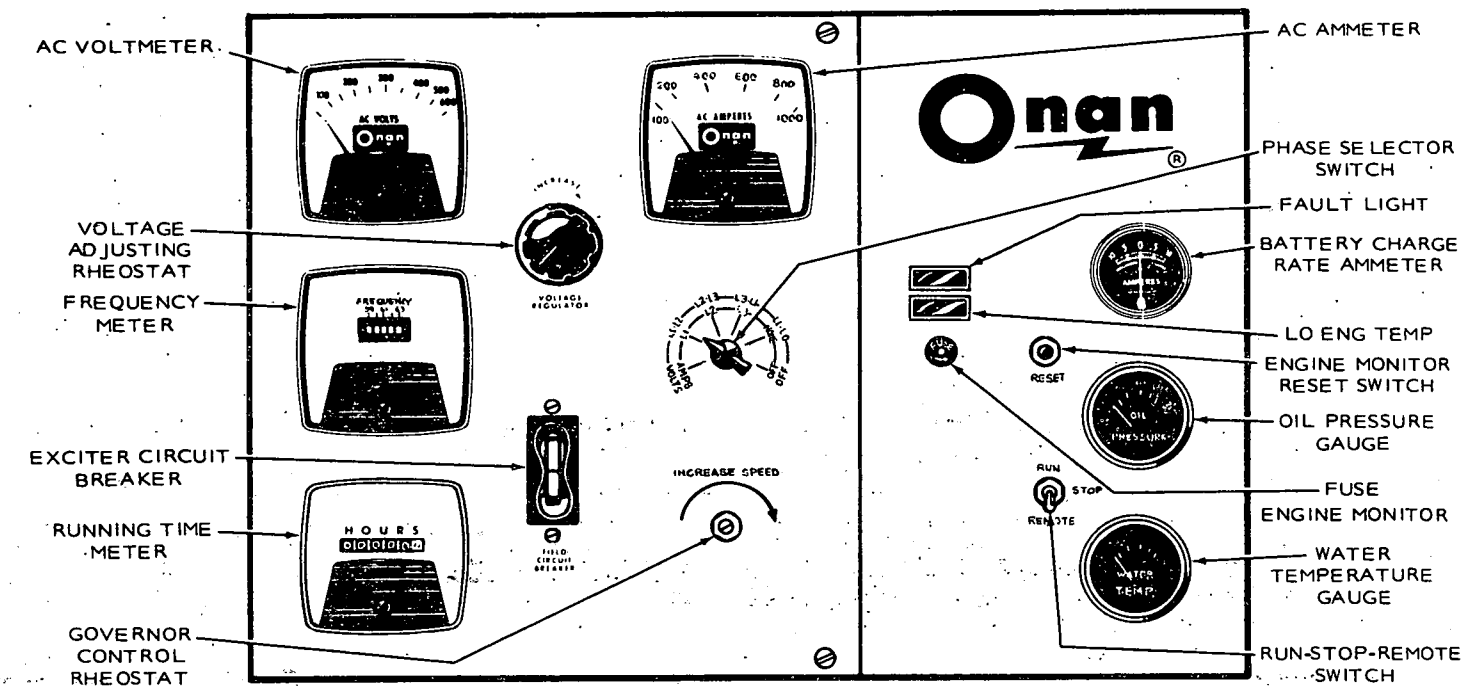


FIGURE 1. CONTROL PANEL

DESCRIPTION

GENERAL

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

ENGINE

The engine on the DFX is a Cummins KT2300G, as described in the engine manual. Basic measurements and requirements will be found under **SPECIFICATIONS**. For operation, maintenance and service information, consult the Cummins manual.

AC GENERATOR

The generator is an ONAN Type UV, 4 lead, 4-pole revolving field, brushless unit. The main rotor is attached directly to the engine flywheel, therefore engine speed determines generator output frequency. The 60 Hz set operates at 1800 r/min, the 50 Hz at 1500 r/min. Excitation is achieved as follows—

Residual alternating current from the stator winding is applied to the voltage regulator, where it is compared with a reference voltage, rectified and returned to the field winding of the exciter. Current then induced in the exciter rotor is rectified and fed into the generator rotor. This induces a current in generator stator which is applied to the load.

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 battery charging current.

Run-Stop/Reset-Remote Switch: Starts and stops the unit locally or from a remote location. Resets engine monitor relay in Stop/Reset position.

Warning Lights: (1) Low Engine Temperature. Wired into a switch on engine block which operates at a nominal temperature of 75° F (24° C). (2) Fault, gives indication of engine malfunction shutdown due to:

- a. Overcrank
- b. Overspeed
- c. Low Oil Pressure
- d. High Engine Temperature
- e. Generator Overvoltage

Reset Switch: Manual reset for engine monitor after shutdown.

AC Panel

AC Voltmeter: Indicates AC generator output voltage.

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.

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

OPTIONAL EQUIPMENT

AC Panel

AC Ammeter: Indicates AC generator output current.

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

CONTROL PANEL INTERIOR

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 12.5-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). See Figure 2.
 - c. Low oil pressure 14 psi (96.53 kPa).
 - d. High engine temperature 205°F (96°C).
 - e. Generator overvoltage.
 - f. Battery condition indicator.

Upper light green	Alternator 22-28 VDC
Lower light green	Battery 22-28 VDC
Upper light red	Alternator over 28 VDC
Lower light green	Battery 22-28 VDC
Upper light green	Alternator 22-28 VDC
Lower light red	Battery below 22 VDC
Upper light red	Alternator above 28 VDC
Lower light red	Battery below 22 VDC

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 3.

CAUTION

High Engine Temperature Cutoff will shut down engine in an overheat condition only if coolant level is sufficiently high to physically contact shutdown switch. Loss of coolant will allow engine to overheat without protection of shutdown device, thereby causing severe damage to the engine. It is therefore imperative that adequate engine coolant levels be maintained, to ensure operational integrity of cooling system and engine coolant overheat shutdown protection.

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.

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.

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

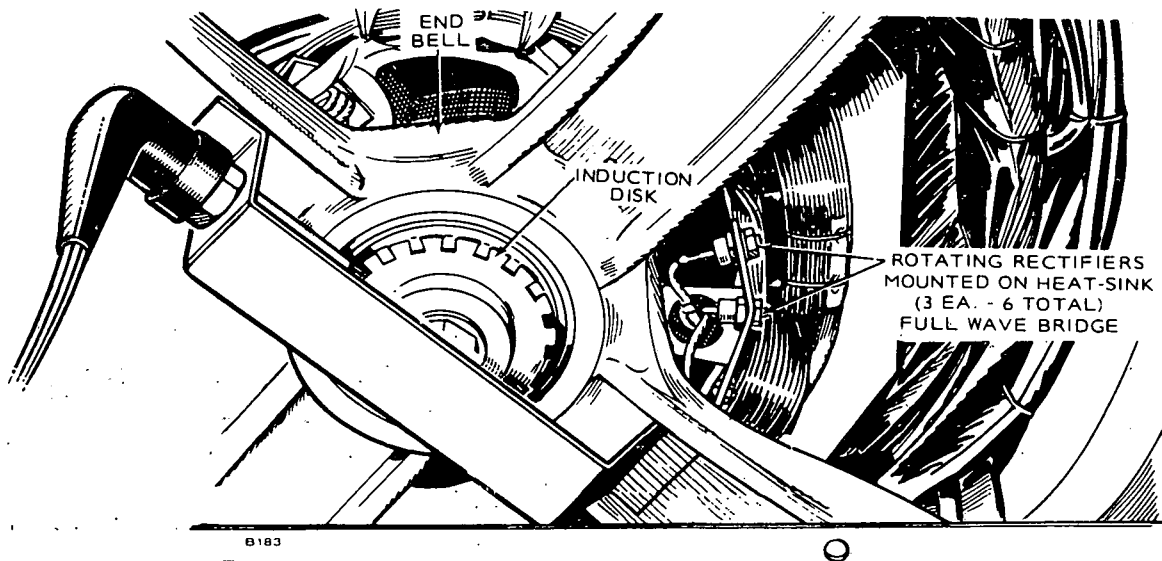


FIGURE 2: OVERSPEED SWITCH

ENGINE SENSORS

Resistance units and switches in the engine temperature and oil pressure monitoring and shut-down systems are sealed units and are not repairable.

For location, refer to Figures 3 and 4. When changing a sensor, do not substitute, use recommended replacement parts. Resistance units are matched to the gauge they supply, and cut-off switches are close-tolerance actuation parts, made for a specific application.

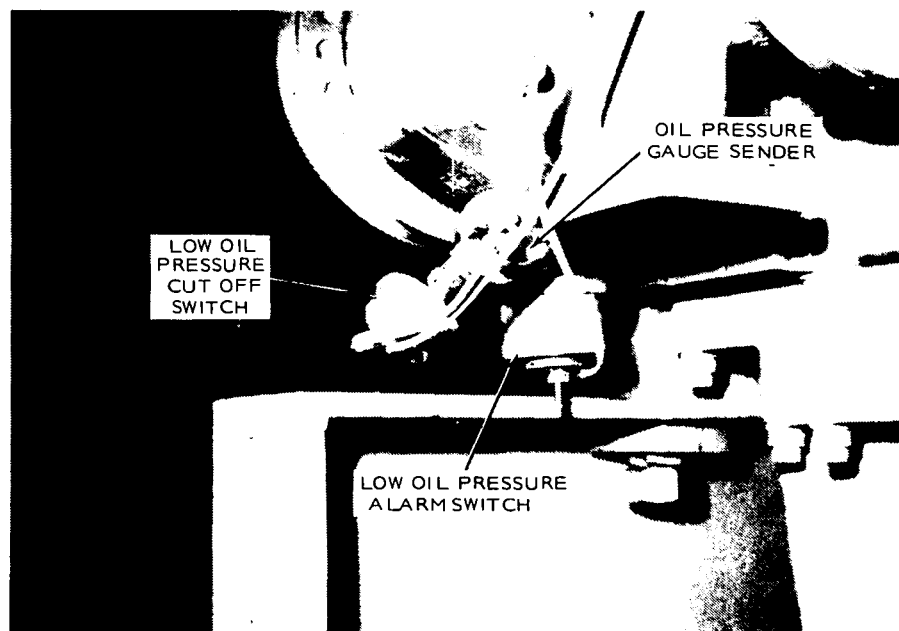


FIGURE 3. OIL PRESSURE MONITORS

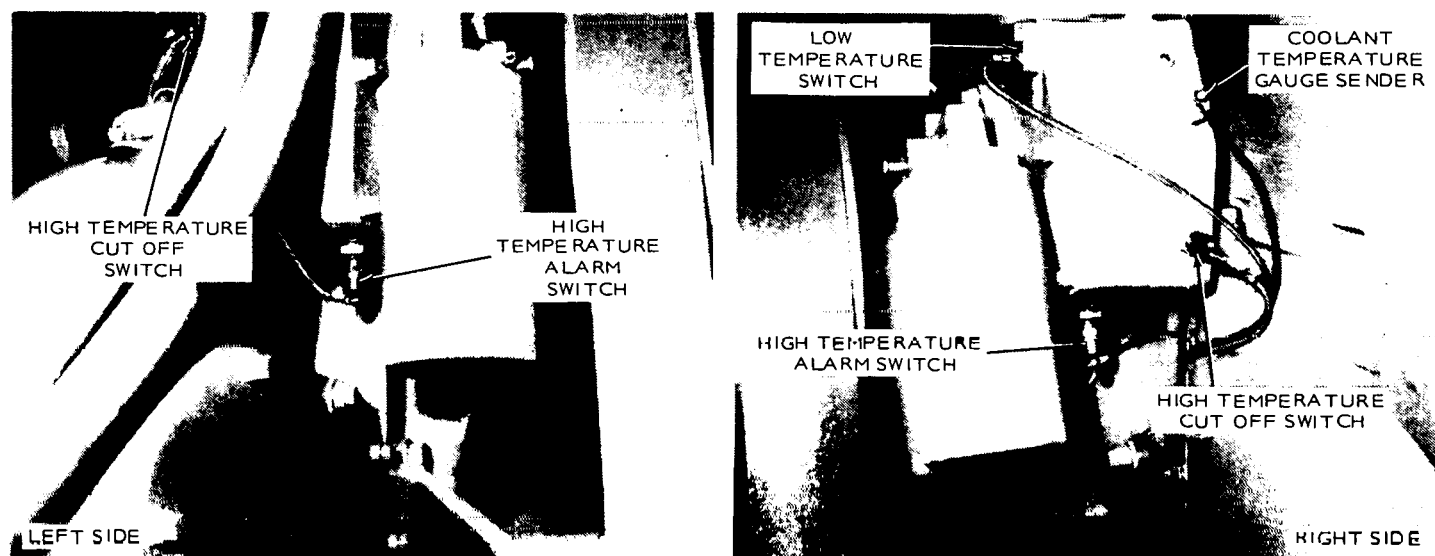


FIGURE 4. WATER TEMPERATURE MONITORS

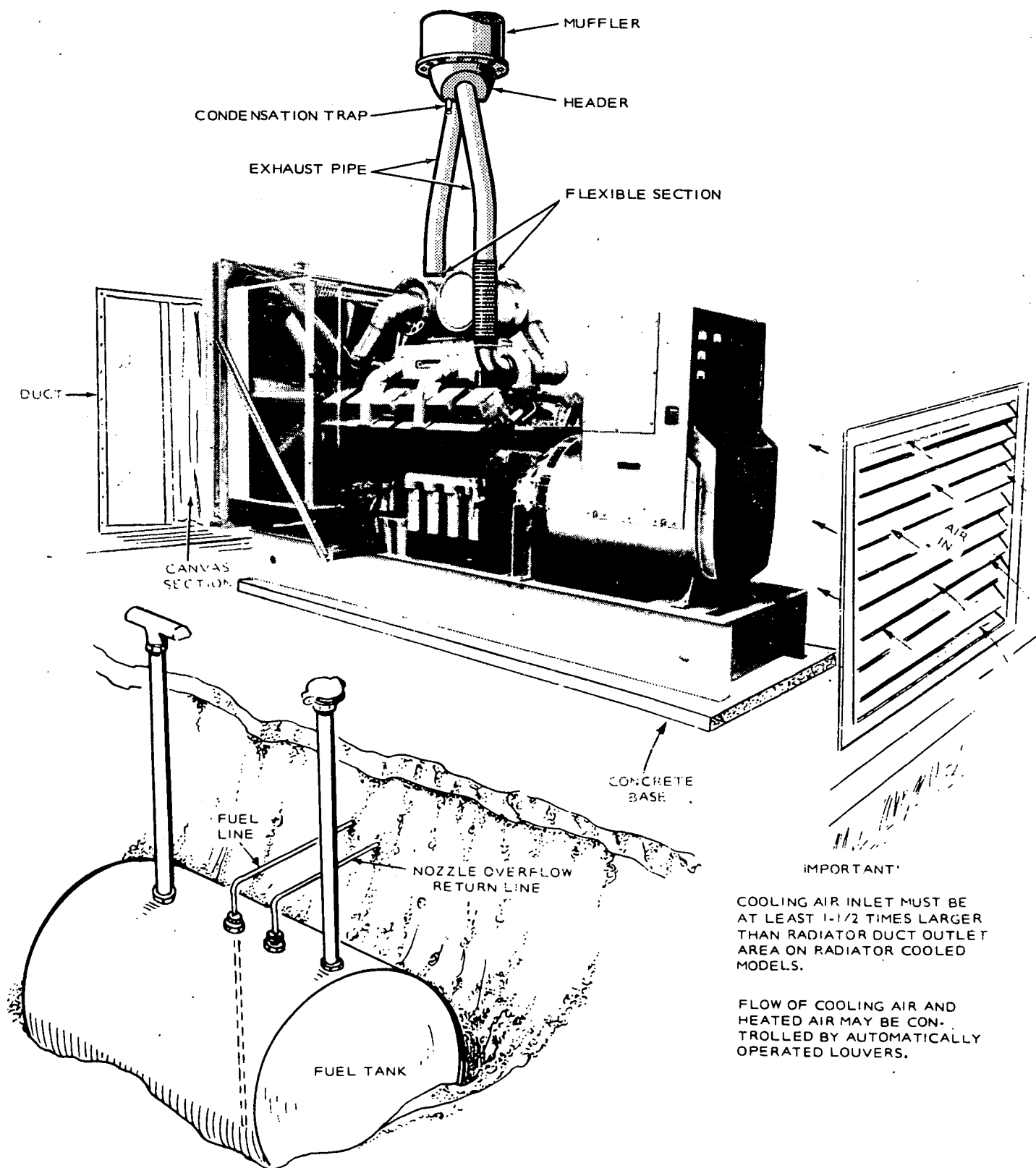


FIGURE 5. TYPICAL DFX INSTALLATION

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 5.

Installation points to consider include:

1. Level mounting surface.
2. Adequate cooling air.
3. Adequate fresh induction air.
4. Discharge of cooling and ventilation 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 [155 mm]).

CAUTION The generator support must be aligned to the skid base to prevent premature generator bearing failure, vibration and possible drive disc failure. Failure to do so could void the warranty. Align generator support to skid base according to the following instructions.

1. Set unit on its mounting foundation, using vibration isolators between skid base and foundation (Figure 6). Secure skid base to the isolators and the isolators to mounting foundation. Remove the two mounting bolts; use them as jack screws by moving them to adjacent threaded holes, then raise the generator and remove shims from between generator and support and skid base.

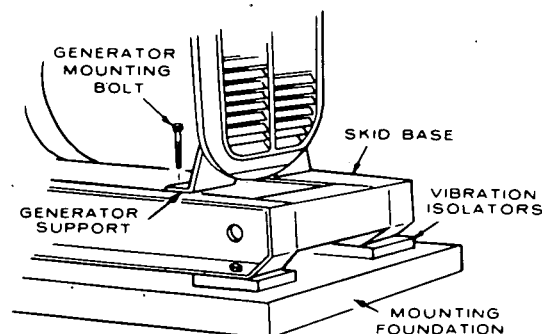
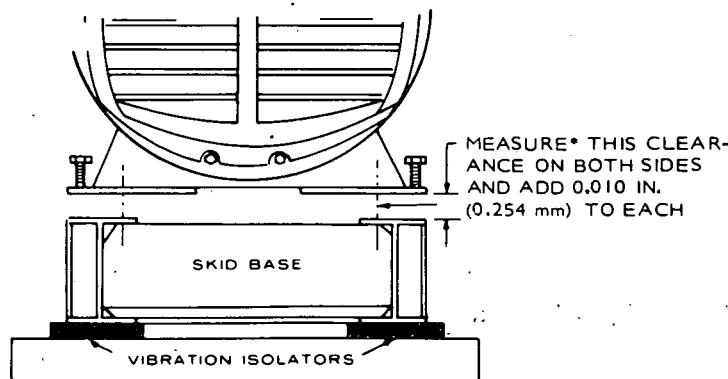


FIGURE 6

2. Adjust tension from the jackscrews and allow generator to hang free. Using a feeler gauge, measure clearance from the top surface of the skid base to each generator support mounting surface (Figure 7). To this measured clearance, add 0.010 inches (0.254 mm) to each side of the skid base—this total clearance will determine the amount of shims required.

The clearance may be different for each side of skid base. If there is a great difference, loosen generator support and realign.



*The measurement should be taken in line with bolt hole.

FIGURE 7

3. After determining the proper clearance for each side of the skid base, turn jackscrews in the threaded holes to allow a clearance for placing the shims between skid base and generator support (Figure 8). Lower generator (using jackscrews) and allow to rest on shims. Recheck the total generator clearance, base to support; it must equal the base to support clearance plus the 0.010-inches (0.254 mm).

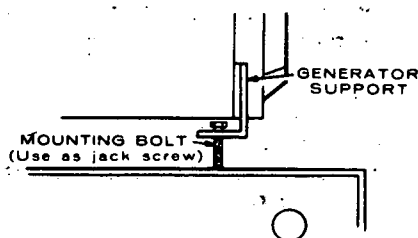


FIGURE 8

4. Remove the jackscrews and reinstall as mounting bolts through generator support, shims and skid base. Secure and lock the mounting bolts in place (Figure 9).

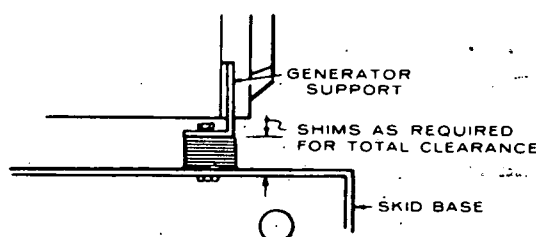


FIGURE 9

VENTILATION

Generator sets create considerable heat which must be removed by proper ventilation. Outdoor installations rely on natural air circulation but 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 r/min.

Radiator set cooling air travels from the rear of the set and is removed by a pusher fan which blows out through the radiator. Locate the air inlet to the rear of the set. Make the inlet opening at least 1½-times larger than the radiator.

Locate the cooling air outlet directly in front of the radiator and as close as possible. 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.

For operation outside a building, a shelter housing with electrically operated louvers is available as an option. Transformers connected across the generator output supply current to the motors.

When the generator is operating, current in the transformers actuate the motors and open the louvers. The louvers are held open for the duration of the set operation, then are closed by return springs when the set is shut down.

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, disperse heat convected off the engine 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 unit is running) of sufficient size to assure proper air circulation and evacuation of fumes.

COOLING SYSTEM

Standard Radiator Cooling, uses a set mounted radiator and engine driven pusher type fan to cool engine water jacket. Air travels from the generator end of the set, across the engine and out through the radiator. An integral discharge duct adapter flange surrounds the radiator grille.

Heat Exchanger Cooling (optional), uses a shell and tube type heat exchanger instead of the standard radiator and fan. Engine jacket coolant circulates through the shell side of the heat exchanger, while raw cooling water is pumped through the tubes. Engine coolant and raw water do not mix. This type of cooling separation is necessary when the raw water contains scale forming lime and other impurities.

This system reduces set enclosure airflow and noise levels. Proper operation depends upon a constant supply of raw water for heat removal. The engine coolant side of the system may be protected from freezing the raw water side cannot. See Figure 10 for typical installation.

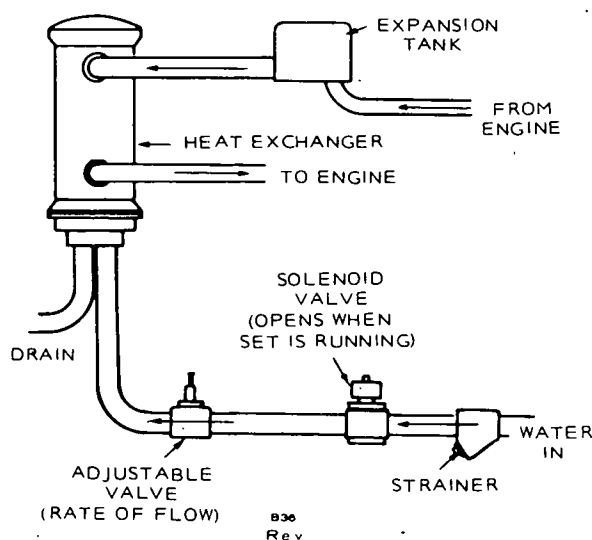


FIGURE 10. TYPICAL HEAT EXCHANGER SYSTEM

Standpipe Cooling (optional) substitutes a mixing (tempering) tank for the standard radiator and fan. Cooling water circulating through the engine jacket is mixed with raw water in the tank. Because raw water flows through the engine jacket, it must not contain scale forming impurities or fouling of the engine water will occur. Fouling results in engine overheating and costly repair bills.

This system reduces set enclosure airflow requirements and noise levels. Proper operation is dependent on a constant supply of cooling water. The system cannot be protected from freezing. See Figure 11.

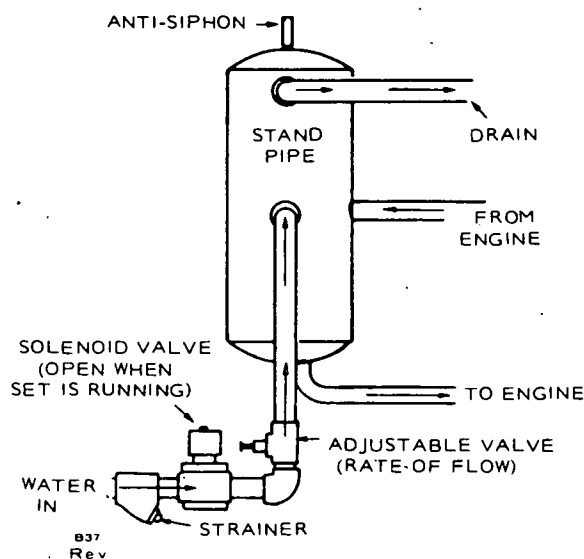


FIGURE 11. TYPICAL STANDPIPE SYSTEM

Remote Radiator Cooling (optional), substitutes a remote mounted radiator and an electrically driven fan, for the set mounted components. Removal of the radiator and fan from the set reduces set enclosure airflow requirements and noise levels without forcing dependence on a continuous cooling water supply. The remote radiator system can be completely protected against freezing.

This system must be designed to meet specific requirements of the application.

Water Jacket Heater. Installed to keep engine coolant warm while engine is shut down. It heats and circulates the coolant within the engine, which reduces start-up time and engine wear caused by cold starts. It is electrically operated and thermostatically controlled.

COOLING CONNECTIONS

The radiator cooled (standard) set does not require any external connections except as discussed under *Ventilation*. Allow clearance around the set for access to service the radiator and fan belts. See Figure 5.

Heat Exchanger and Standpipe cooled sets must be connected to a pressurized supply of cold water. Make connections to the set with flexible pipe to absorb vibration. On the cool water line install a solenoid valve to shut off the flow when the set is shut down and a rate of flow valve to control engine temperature. This valve can be either manual or automatic. Actual rate of flow will depend on inlet water temperature.

Adjust the flow to maintain water temperature between 165°F and 195°F (73.9°C and 90.6°C) 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.

Remote radiator plumbing will vary with installation. All systems must comply with the following conditions—

1. Make all connections to the set and to the radiator, with flexible pipe.
2. Install an auxiliary circulating pump if the horizontal distance between the engine and pump exceeds 15-feet (4.65 m).
3. Install a hot-well system to relieve excess engine water jacket pressure if the top of the radiator is more than 15-feet (4.65 m) above the center-line of the engine crankshaft.

COOLANT FILTER

Four spin-on type corrosion filters are standard equipment on a DFX set. These precharge filters are compatible with plain water or all permanent ethylene glycol base permanent antifreeze coolants. Refer to engine manufacturer's manual for instructions if a methoxy propanol base antifreeze is desired.

Do not use any type of antifreeze with a stop-leak additive. The filter will remove the additive (usually a particulate) and become clogged and ineffective. Replace filter periodically as recommended in *GENERAL MAINTENANCE* section. A shut-off valve is installed in each filter cap to facilitate filter changing (see Figure 12).

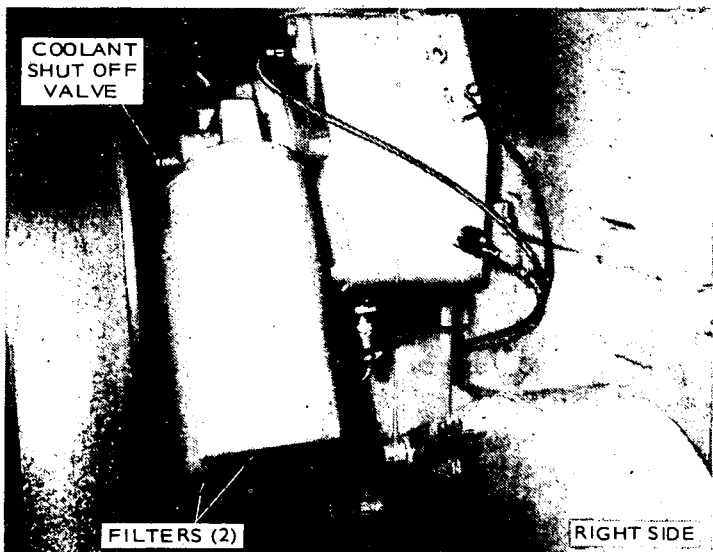


FIGURE 12. COOLANT FILTER INSTALLATION

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 13) must be used where exhaust pipes pass through walls or partitions. Pitch exhaust pipes downward or install a condensation trap (Figure 14) 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 5 for a typical exhaust installation. Shield or insulate exhaust lines if there is danger of personal contact. Allow at least 9 inches (230 mm) of clearance if the pipes run close to a combustible wall or partition.

Maximum permissible exhaust restriction (back pressure) is 3 inches (76 mm) Hg.

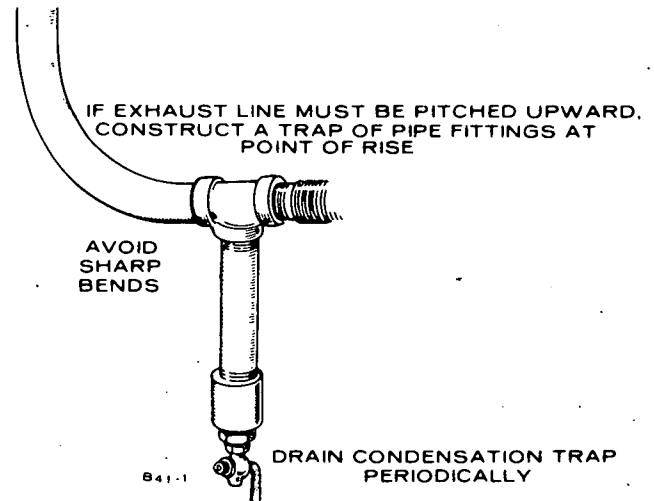


FIGURE 14. EXHAUST CONDENSATION TRAP

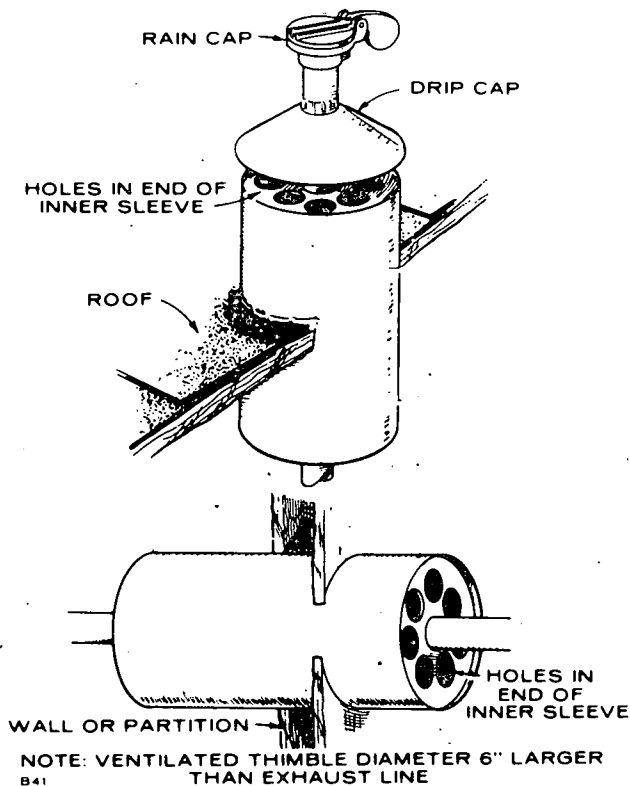


FIGURE 13. TYPICAL EXHAUST THIMBLE

Use two, five-inch (127 mm) pipes with a flexible portion between the engine and mufflers. Do not connect flexible line to the exhaust manifold.

A critical muffler recommended for this unit is sized for a 10-inch exhaust pipe. Maximum allowable length of exhaust pipe for this diameter is 400-feet (122 m).

FUEL SYSTEM

Cummins engines used on the DFX sets are designed for use with ASTM No. 2 Diesel fuel. They will, however, operate on diesel fuels within the specifications delineated in 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.

A fuel lift in excess of 12 feet (3.6 m) is not recommended without a day tank installation, because of fuel drainage.

Fuel inlet connection is to the filter and is threaded for 7/8 inch 14 UNF fitting. Injector's return to the tank is threaded for 3/4 inch 16 UNF fitting. See Figure 15 for fuel system installation.

Maximum return line restriction, 4 inches (100 mm) Hg.

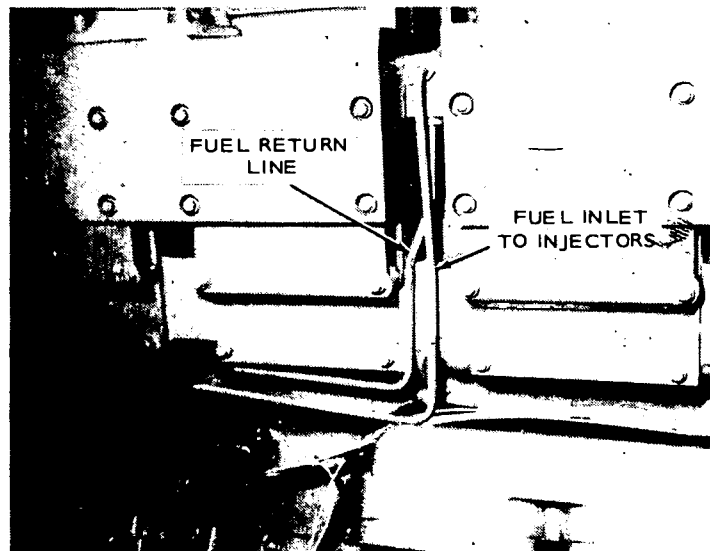
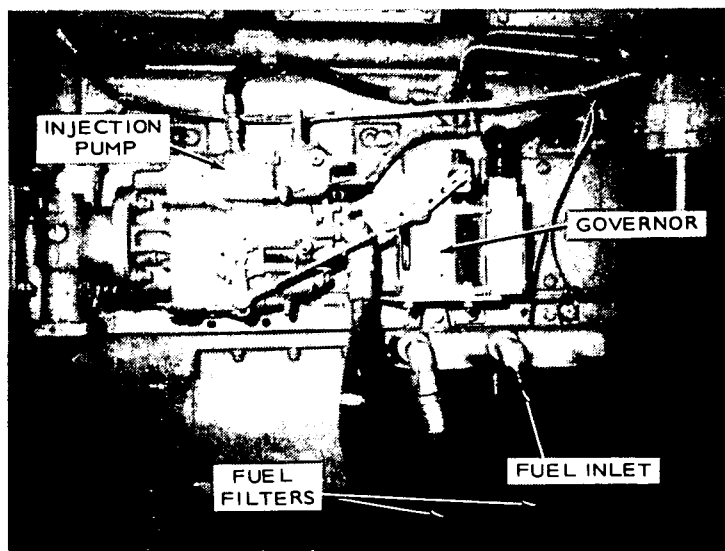


FIGURE 15. FUEL SYSTEM

DAY TANK

Generator set installations may be equipped with an optional separate fuel day tank. A float operated valve controls fuel flow into the fuel tank. The correct level is maintained to assure a constant source of fuel. It is necessary to install an overflow line between the day tank and main fuel tank. Refer to the installations included with the tank. See Figure 16 for an example of a day tank installation. Tank and lines must be below level of injector pump return outlet.

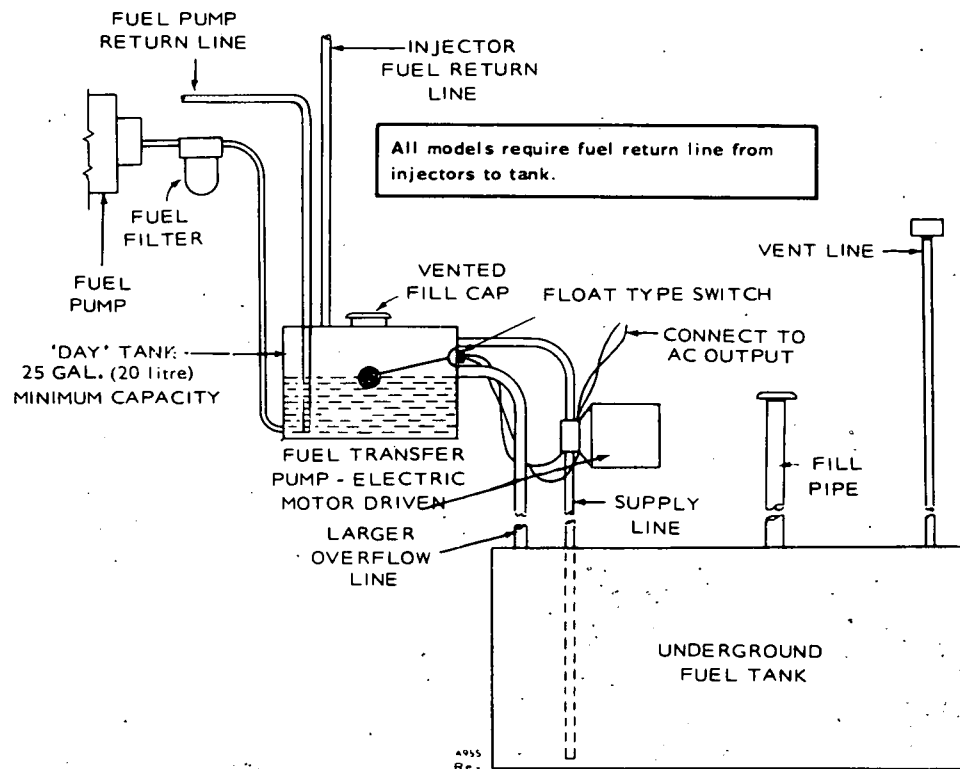
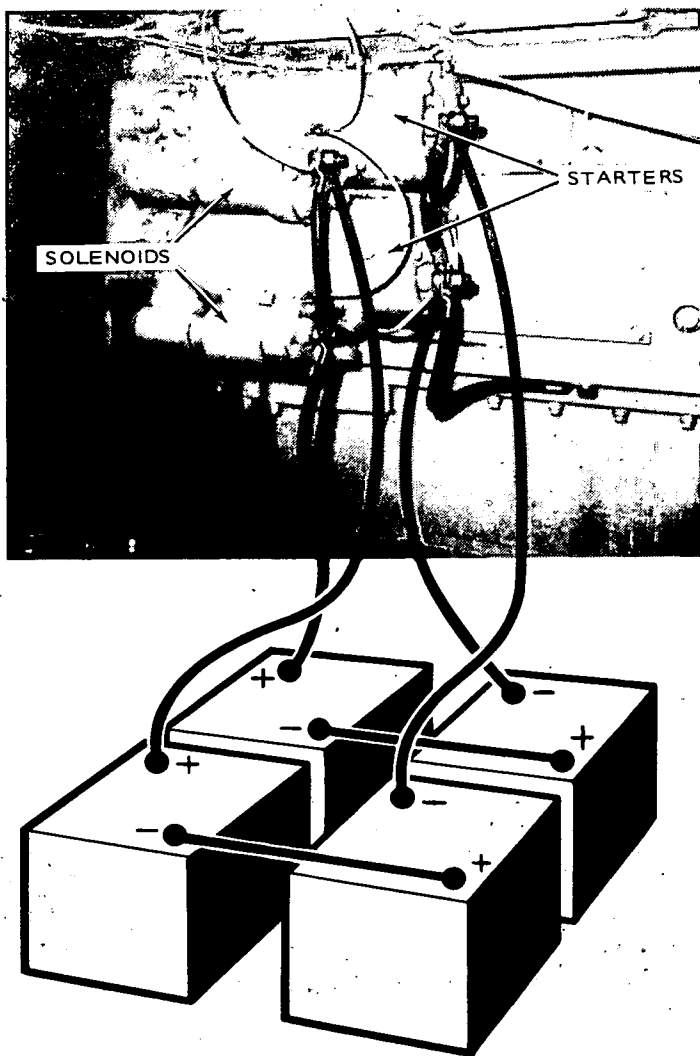


FIGURE 16. DAY TANK (TYPICAL)

BATTERY

Starting the unit requires 24-volt battery current. Use two 12-volt (see *SPECIFICATIONS*) batteries for a normal installation. Connect the batteries in series (negative post of first battery to positive post of second) as in Figure 17. Necessary battery cables are on unit. Service the batteries as necessary. Infrequent unit use (as in emergency standby service) may allow the batteries to self-discharge to the point where they cannot start the unit. 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.



4 - 12V 225 A/hr (1620 kC)
BATTERIES

FIGURE 17. BATTERY CONNECTION

BATTERY, HOT LOCATION

Batteries will self discharge very quickly when installed where the ambient temperature is consistently above 90°F (32.3°C) 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 (32.2°C), 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 a 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, and 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 14. If the distance between the set and remote station is less than 1000-feet (305 m), use No. 18 AWG wire; between 100- and 2000-feet (305 and 610 m), use No. 16 AWG wire.

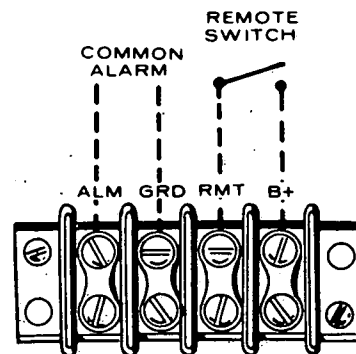
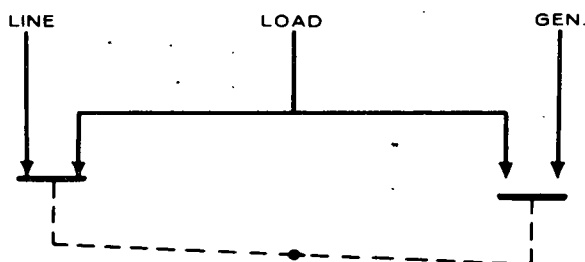


FIGURE 18. REMOTE START CONNECTION (TB12)

WIRING CONNECTIONS

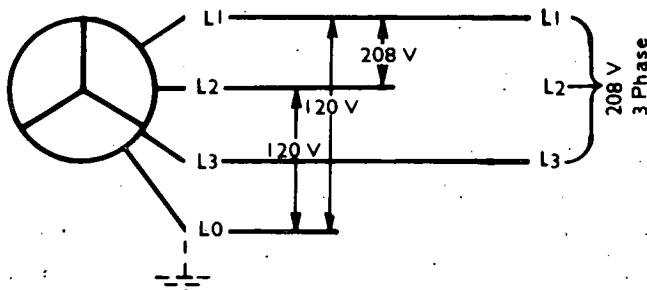
Most local regulations require that wiring connections be made by a licensed electrician and that the installation be inspected and approved before operation. All connections, wire sizes, etc. must conform to requirements of electrical codes in effect at the installation site.

If the installation is for standby service, a double throw transfer switch (Figure 19) 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.



NOTE: SHOWN WITH LINE CONNECTED TO LOAD.

FIGURE 19. LOAD TRANSFER SWITCH (TYPICAL)



3-PHASE WYE CONNECTION

GENERATOR CONNECTIONS

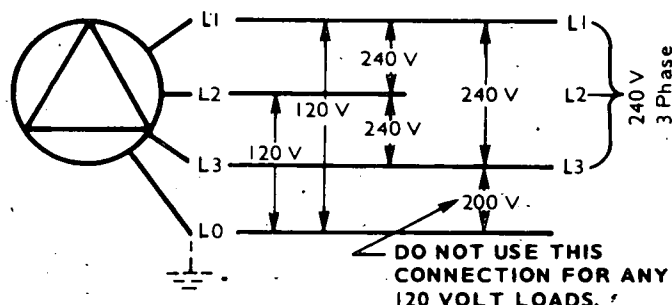
Voltage output of the model UV generator is predetermined at the factory by the internal connections to the bus-bars. It is not recommended that these be changed. The generator is rated in two voltages, the lower being line to neutral and the higher is the line-to-line voltage. Refer to the rating plate on the generator. For maximum current available at these voltages, see Table 1.

For 3-phase loads connect separate load wires to each of the set terminals L1, L2 and L3 (Figure 19). For a single phase load of higher nameplate voltage only, connect between terminals L1 and L2. Available capacity is 2/3 maximum output.

The terminal L0 can be grounded. For 1-phase loads of lower nameplate voltage, connect the neutral load wire to the L0 terminal. Connect the "hot" (black) 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.

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.



3-PHASE DELTA CONNECTION

FIGURE 20.

OPERATION

GENERAL

Onan DFX Series electric generating sets are given a complete running test under various load conditions and are 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 crankcase to capacities shown below. After engine has been run, check dipstick, add oil to bring level to full mark. Record capacity for future oil changes.

Lubricating oil recommended for turbo-charged diesel engines is API Class CC/CD with a maximum sulphated ash content of 1.85%. Oils in this class should be satisfactory for most operating conditions. Do not mix brands nor grades of oil.

Oil viscosity should be as follows:

AMBIENT TEMPERATURES	VISCOSITY
-10°F (-23°C) and below	See engine manual. 10W 20-20W 30
-10 to 30°F (-23 to -1°C)	
20 to 60°F (-7 to 16°C)	
40°F (4°C) and above	

Nominal lubricating oil capacity (including oil pan, and filter) is 40 gallons (151.0 litres).

Cooling System: Cooling system was drained prior to shipment. Fill cooling system before starting. Nominal capacity is 55-gallons (208 litres). 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

1. Verify that the electric solenoid valve used with city water cooled sets is open before initial starting of unit to allow coolant chambers to fill. Overheating and damage to the engine could result from noncompliance.

CAUTION

If engine is equipped with a cooling system filter, do not use antifreeze with an anti-leak formula. The stop leak element can prevent or retard the coolant flow through the filter, thereby eliminating the filtering process completely.

WARNING

Be careful when checking coolant under pressure. It is advisable to shut engine down and bleed off pressure before removing pressure cap. Severe burns could result from contact with hot coolant.

Fuel System: Refer to 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.

Priming Oil System: To prime oil system, proceed as follows:

1. Remove oil inlet line from turbo-charger housing (Figure 21), fill bearing housing with clean engine lubricating oil; replace line, secure.
Repeat for second turbo-charger.
2. Fill crankcase to "L" (low) mark on dipstick (Figure 22).
3. Remove plug from head of oil filter housing (Figure 21A) and connect a hand or motor-driven priming pump from a source of clean lubricating oil to the plug boss in filter housing.
4. Prime until a 30 psi (207 kPa) pressure is obtained.
5. Disconnect wire from fuel solenoid valve (Figure 23), close throttle and crank engine while maintaining an external prime pressure of 15 psi (103 kPa), for 15 seconds.
6. Remove external priming equipment, replace plug in filter housing, torque 15 to 20 lb-ft (20 to 27 N•m).
7. Reconnect wire to fuel shut-off valve.
8. Complete oil fill to "H" (high) mark on dipstick.

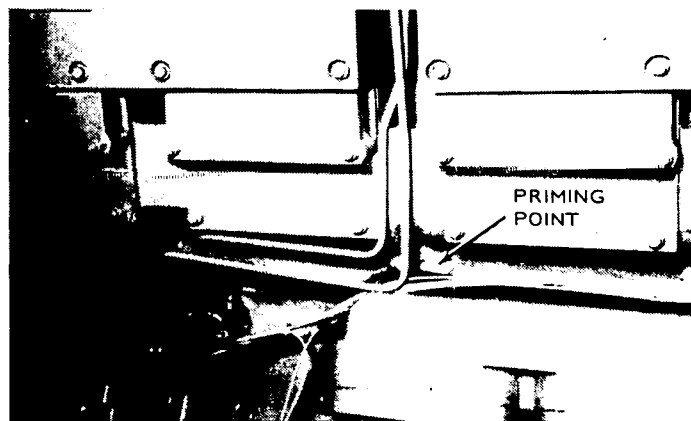


FIGURE 21A. LUBRICATION SYSTEM PRIMING POINT



FIGURE 22. OIL FILL AND DIPSTICK LOCATIONS

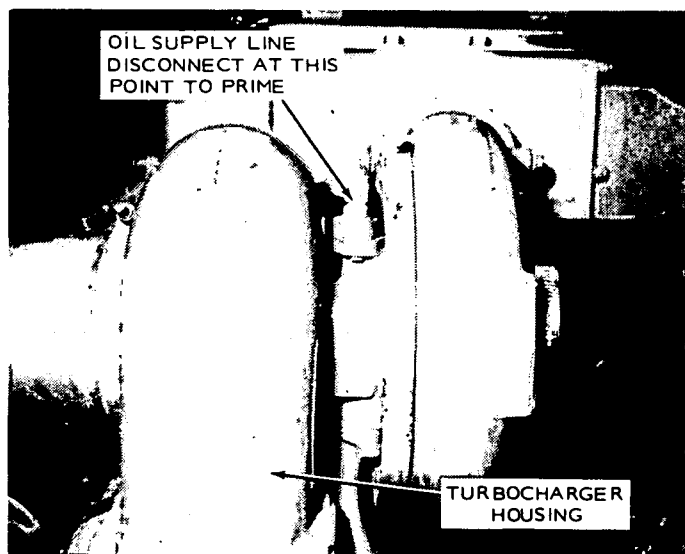


FIGURE 21. PRIMING TURBOCHARGER

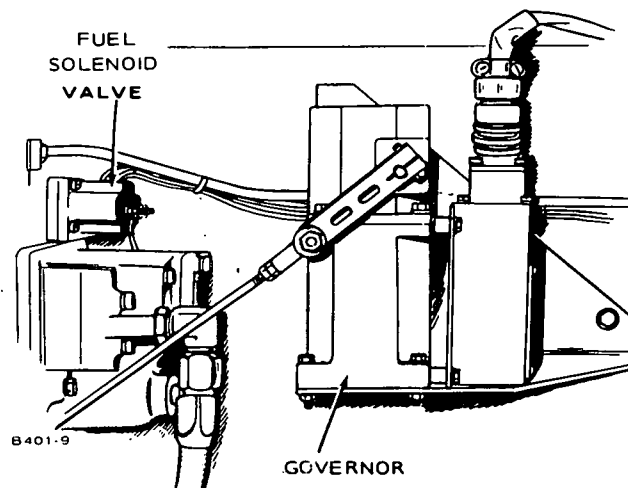


FIGURE 23. FUEL SOLENOID VALVE LOCATION

Priming Fuel System: Priming should not be necessary as the set was checked out before shipping. If however it is desired to verify and reprime system, remove each fuel filter and fill with clean fuel oil. Replace filters and make sure that all connections are secure (see Figure 27).

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 (26.7°C). 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. Governor sump filled.
3. Cooling system filled—input solenoid valve open.
4. Batteries charged and connected.
5. Fuel solenoid valve open.

To start, move the "run-stop/reset-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 between 50- and 70 psi (345.0—483 kPa). Check the following gauges:

1. DC Ammeter—10 to 30 amperes.
2. AC Voltmeter—AC generator output voltage.
3. Frequency Meter—AC generator output frequency.

After running 10 minutes under load the water temperature gauge should have stabilized at 165°F to 195°F (74°C to 90.6°C). 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°F to 195°F (74°C to 90.6°C).

STOPPING

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

Move the run-stop/reset-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 troubleshooting chart.

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.

EXERCISE PERIOD

Generator sets on continuous standby service are required to be operative at essential loads from a cold start in a short period of time 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 off fuel tank, check engine for leaks and unit for general condition. Locate cause of leaks (if any) and correct.

TABLE 2.
TROUBLESHOOTING ENGINE SHUTDOWN SYSTEM

An engine malfunction shutdown will be indicated by the 'FAULT' light on the DC control panel. To locate the problem source, open control panel and check lights on engine monitor panel situated at top right hand side of cabinet. A red light will indicate in one of the following areas.

1. Overcrank
2. Low Oil Pressure
3. High Engine Temperature
4. Overspeed
5. Generator Overvoltage.

Proceed with troubleshooting as follows:

SYMPTOM	CORRECTIVE ACTION
1. Fault lamp lights and engine stops cranking after approximately 75-seconds.	1. See engine service manual for troubleshooting fuel system. After correcting fault, reset engine monitor relay by placing Run-Stop/Reset-Remote switch to Stop/Reset position, depressing Reset button, then to the required running position..
2. Engine runs, shuts down, cranks for 75-seconds, cranking cycle stops, light ON.	2. Check fuel supply.
3. *Low oil pressure shutdown.	3. Check— a. Oil level. Replenish if necessary. b. Sensor. Faulty sensor will shut down engine. c. Refer to engine service manual for troubleshooting guide for oil system.
4. *High engine temperature shutdown.	4. Check— a. Coolant level. Replenish is necessary. b. City water cooled sets. Check water flow, valves, etc. c. Check sensor; check thermostat. d. Radiator model, check fan belts, radiator for obstructions, etc.
5. Overspeed shutdown.	5. Check governor and throttle linkages for freedom of movement.
6. Overspeed light on, no shutdown.	6. Disconnect wire at TB11-29. Light ON after reset; replace engine monitor board.
7. *Low oil pressure light ON. No shutdown.	7. Disconnect wire at TB11-30. Light ON after relay reset. Replace engine monitor board.
8. *High engine temperature light ON. No shutdown.	8. Disconnect wire at TB11-31. Light ON after relay reset. Replace engine monitor board.
9. Generator overvoltage.	9. Indication of malfunction in generator regulator system. a. Replace SCR block. b. Replace voltage regulator.

* - Not applicable on Pennsylvania State models.

NOTE: The above troubleshooting procedure is designed to locate the more obvious causes of malfunction shutdown. If after performing the appropriate remedy the fault persists, contact the nearest ONAN distributor or Service Department.

OUT-OF-SERVICE PROTECTION

If an engine remains out of service for three or four weeks (maximum six months), special precautions should be taken to prevent rust. The operations listed below are required to minimize or prevent damage to temporarily stored engines.

1. Engine must be started and operated until thoroughly warm. Disconnect fuel lines to engine fuel filter and injector drain line. Fill two containers, one with diesel fuel and a second with preservative oil.
2. Start engine with fuel line to filter using diesel fuel. The injector drain line can flow into the container with diesel fuel. After engine is running smoothly, switch fuel line to container with preservative oil. Operate five to ten minutes on preservative oil. Stop engine and reconnect the fuel lines.
3. Drain oil sump, fuel filters and fuel tank and reinstall drain plugs. Sump may remain empty until engine is ready for use; tag engine with warning tag.
4. Disconnect electrical wiring and turn fuel pump manual shut-off valve fully counterclockwise. Spray lubricating oil into intake manifold and air compressor while cranking engine slowly.
5. Cover all openings with tape to prevent entrance of dirt and moisture.
6. Drain coolant from cooling system unless it is permanent type antifreeze with rust inhibitor added.
7. Store engine in dry and uniform temperature area.
8. Bar engine crankshaft two or three revolutions each three to four weeks.

Above storage procedure is valid for a six month maximum period. For storage in excess of six months, refer to Cummins Service manual.

PREPARING A STORED ENGINE FOR SERVICE

When an engine is removed from storage and put into service, the following operations should be performed.

Clean Engine

1. Clean accumulated dirt from exterior of engine. Remove covers, tape and wrappings.

2. Use suitable cleaner to remove rust preventive compound from unpainted surfaces.
3. Refill crankcase with clean lubricating oil. Flush and fill cooling system.

Inspection

1. When an engine has been stored for six months or less, it is necessary to adjust injectors, valves and belts, tighten cylinder head capscrews and connections; replace filters and check air filter and screens.
2. When an engine has been stored for six months or more, the following procedure should be followed:
 - a. Flush fuel system with clean fuel oil until all preservative oil is removed.
 - b. Remove plug from oil gallery and force hot, light mineral oil through the oil passages to flush away all preservative oil. Bar over engine crankshaft three or four revolutions during flushing operation.
 - c. Replace all filters and clean all screens before engine is started.
 - d. After inspecting engine and parts, make sure all preservative oil and gummed oil has been flushed away.
3. Clean and check battery. Measure specific gravity (1.250 at 77° F [25° C]) and verify level to be at split ring. If specific gravity is low, charge until correct value is obtained. If level is low, add distilled water and charge until specific gravity is correct. DO NOT OVERCHARGE.

WARNING

Do not smoke while servicing batteries. Explosive gases are emitted from batteries in operation. Ignition of these gases can cause severe personal injury.

4. Check coolant level, adjust or refill as necessary.
5. Connect batteries.
6. Verify that no loads are connected to generator.
7. Perform 'PRESTART SERVICING.' Start engine.
8. After start, apply load to at least 50 percent of rated capacity.
9. Check all gauges to be reading correctly. Unit is ready for service.

HIGH ALTITUDE

Engine ratings apply to altitudes up to 5000-feet (1500 m), standard cooling, normal ambients and with No. 2 Diesel fuel. Consult factory or nearest authorized Onan distributor for operating characteristics under other conditions.

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 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.

GENERAL MAINTENANCE

GENERAL

Establish and adhere to a definite schedule of maintenance inspection and servicing, application and environment being the governing factors in determining such a schedule. If your set is a prime power application, base your schedule on operating hours. Use the running time meter to log hours run; maintain an accurate record of hours and service for warranty support.

A set on stand-by duty will need servicing at times other than those recommended by Onan and the engine manufacturer. Refer to Cummins manual for engine services and maintenance procedures. Adjust your schedule to satisfy the following conditions—

- Continuous duty (prime power)
- Standby power
- Extremes in ambient temperature
- Exposure to elements
- Exposure to salt water or sea water
- Exposure to dust, sand, etc.

Consult with your ONAN distributor or dealer for a schedule of maintenance and service more suitable to the unique environment and application of your set.

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.

TABLE 5. OPERATOR MAINTENANCE SCHEDULE

MAINTENANCE ITEMS	OPERATIONAL HOURS			
	8	50	100	200-250
Inspect Set	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		x5		
Replace Fuel Filter				x
Check all hardware, fittings, clamps, fasteners, exhaust system for security.	x*		x6	

x1 - Or every 3 months, perform more often in extremely dusty conditions.

x2 - Or every 3 months, adjust to 1/2 inch depression between pulleys.

x3 - Or every 3 months, check for rust or scale formation. Flush if necessary.

x4 - For accurate readings, check oil level approximately 15 minutes after shutdown. Keep oil level as near "FULL" mark on dipstick as possible. See engine manual.

x5 - Or every two weeks.

x6 - Or every 3 months.

x* - With set running, visually and audibly check exhaust system for leaks.

NOTE: The above schedule is a minimum requirement. For the recommended service periods for your engine, refer to engine manual.

GOVERNOR ADJUSTMENTS - ENGINE SPEED

A Barber-Colman governor is standard equipment on DFX generator sets. Governor is set at the Onan testing facility and does not require further adjustment for normal standby service.

If however unit is used frequently or if the governor is removed for service, adjustment may be required. This is accomplished as follows:

1. Remove four screws and cover from governor controller (Figure 24).
2. Disconnect wire from TB11-22. This disconnects the starter solenoid.
3. Place Run-Stop-Remote switch to RUN position. Governor should stay at the minimum fuel position. If this position is not obtained, consult with Onan service representative.
4. Return Run-Stop-Remote switch to STOP. Reconnect wire at TB11-22.
5. Position speed control rheostat on generator control panel to midrange of travel (out 5-turns from low r/min).
6. Adjust speed reference potentiometer in governor controller counterclockwise four complete turns.
7. Start engine. Be prepared at this point, to assume manual control of engine in the event that adjustments are incorrect. If engine does not attain correct r/min it may be necessary to adjust the speed reference potentiometer. Clockwise to increase speed, counterclockwise to decrease.
8. Adjust Gain potentiometer slightly clockwise then counterclockwise as necessary until engine is stable and responsive to governor control.

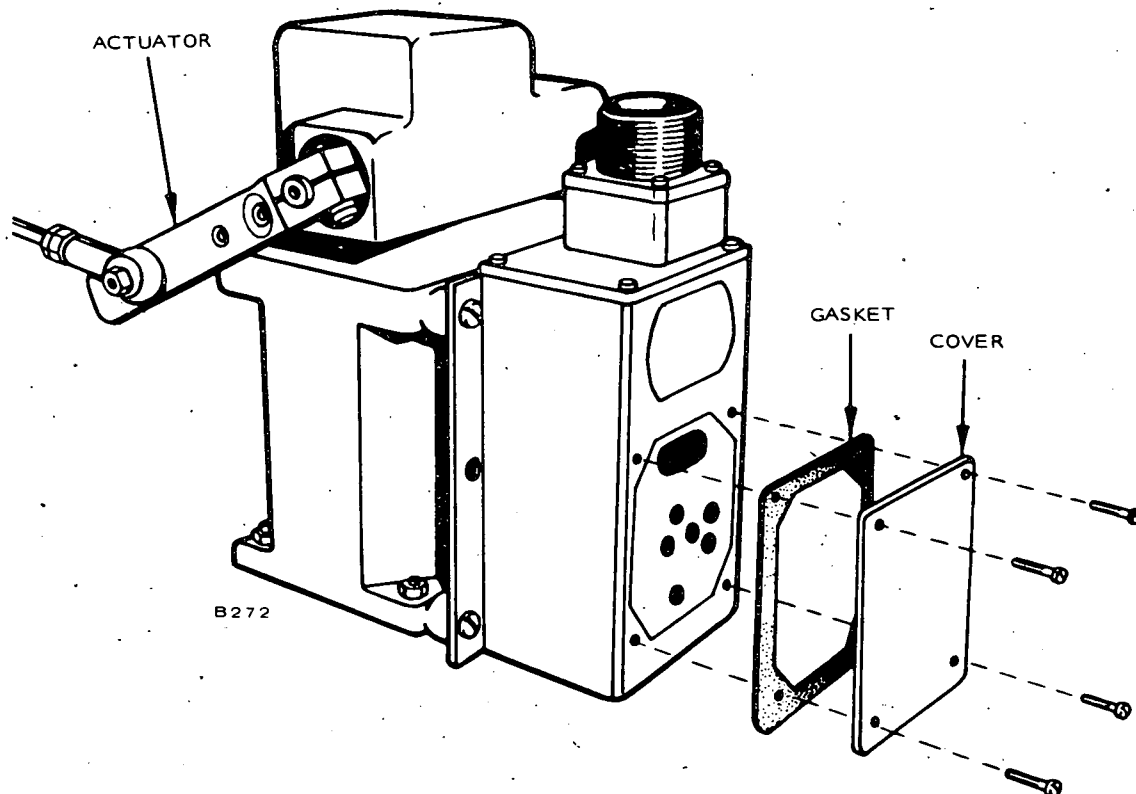


FIGURE 24. BARBER COLMAN GOVERNOR

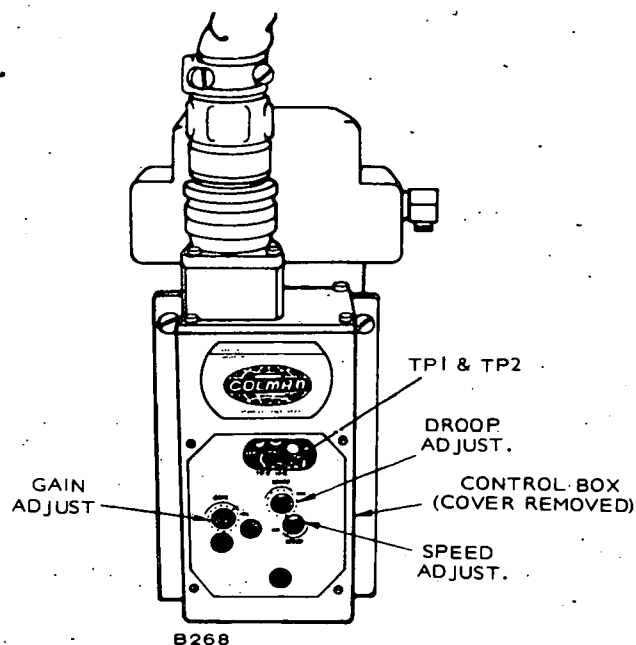


FIGURE 24A. GOVERNOR CONTROL BOX

9. Load and unload engine several times to ensure correct gain adjustment.
10. Shut down engine. Restart engine to make sure that unit does not overspeed.
11. Shut down engine. Replace governor control box cover. Engine is now ready for service.

Any subsequent speed adjustment can be made at the control panel potentiometer.

When using 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 Hertz and 1500 rpm for 50 Hertz sets.

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.

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.

FILTERS

A planned program of filter cleaning or replacement will pay dividends in engine life, operation and reliability.

Air Filter: Replace or clean when plugged, or in accordance with service maintenance instructions. To remove filter element, unsnap four latches holding head, lift off head and remove filter element (see Figure 25).

Recommended cleaning method for element:

FRAM

FA 250-PL SERIES

SERVICE CARTRIDGES:
COMPLETE PRECLEANER & PLEATED PAPER... CA-250PL

PLEATED PAPER CARTRIDGE CA-250PL

SERVICE INSTRUCTIONS

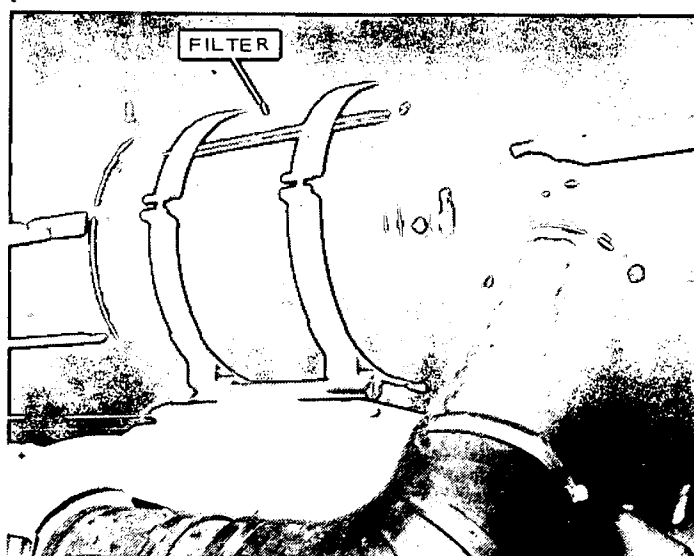
EVERY 100 HOURS — REMOVE CARTRIDGE ASSEMBLY FROM HOUSING. REMOVE AND DISCARD PRECLEANER CARTRIDGE. BLOW (FROM INSIDE) OR SHAKE OUT ACCUMULATED DIRT FROM PLEATED PAPER CARTRIDGE.
CAUTION — DO NOT EXCEED 30 PSI AIR PRESSURE AT NOZZLE AS HIGH PRESSURES CAN RUPTURE PAPER. INSTALL NEW PRECLEANER CARTRIDGE. CLEAN HOUSING AND REINSTALL CARTRIDGE ASSEMBLY.

EVERY 400 HOURS — REPLACE BOTH PRECLEANER AND PAPER CARTRIDGES.
IMPORTANT — UNDER EXTREME DUST CONDITIONS SERVICE CARTRIDGES MORE OFTEN AS REQUIRED.

MANUFACTURED BY FRAM CORPORATION PROVIDENCE, R. I. 02916

230806

CAUTION Filters should be handled with care to prevent damage. If the filter does become damaged, install recommended replacement part.



Lubrication Oil Filter: Spin-off throw away elements, replace at every oil change.

To change filter, proceed as follows—

1. Unscrew and discard filters (Figure 26).
2. Fill new filters with lubricating oil.
3. Position filter on adapter and hand tighten until seal contacts filter head. Advance one-half to three quarters turn. Do not overtighten.
4. Fill crankcase to "H" mark on dipstick, run engine to verify no oil leaks, shut down engine and add oil as necessary.

Always allow 15 minutes after engine shutdown before checking oil level. This will give oil time to drain back into the crankcase.

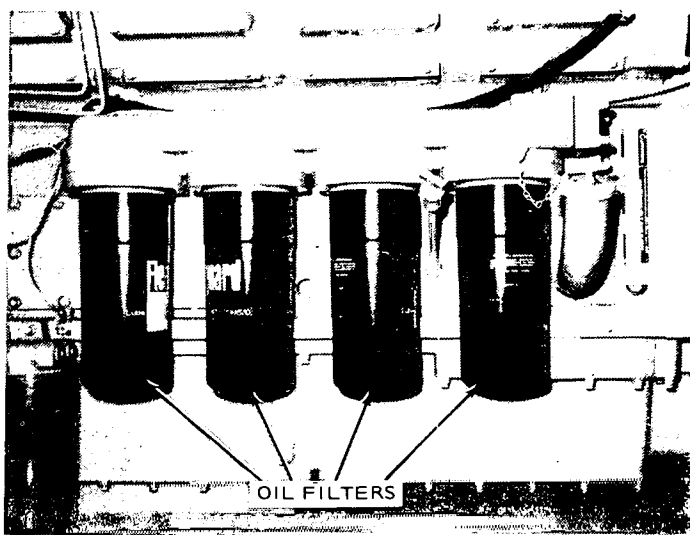


FIGURE 26. LUBRICATION OIL FILTER

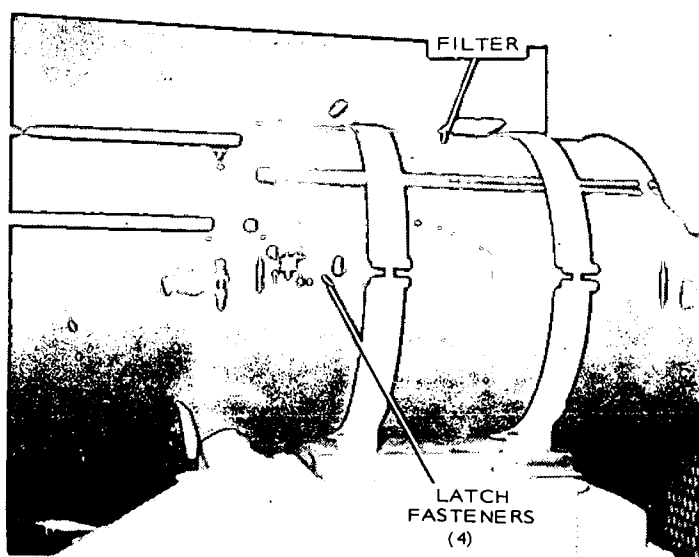


FIGURE 25. AIR FILTERS

Fuel Filter: Spin-off, throw-away unit. A water drain is situated at the bottom of the filter case. This should be used to drain off moisture either daily or at the end of every exercise period, depending on unit application. When replacing filter, fill with clean fuel before installation (see Figure 27).

Coolant Filter: A shut off valve (see Figure 28) is installed in the coolant filter housing to be closed, for minimum coolant loss when the filter is removed. Refer to engine manufacturer's manual for coolant filter replacement information.

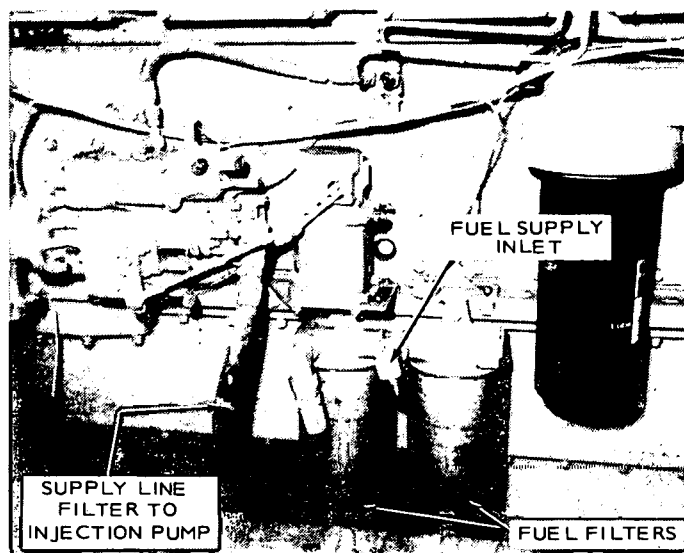


FIGURE 27. FUEL FILTERS

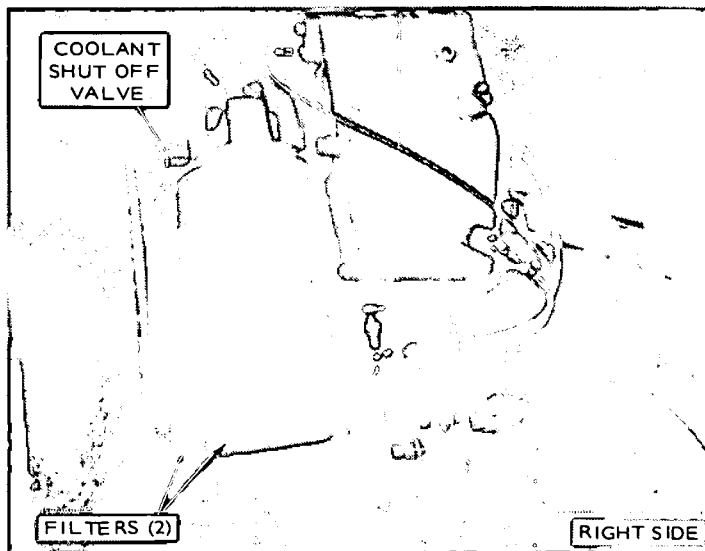
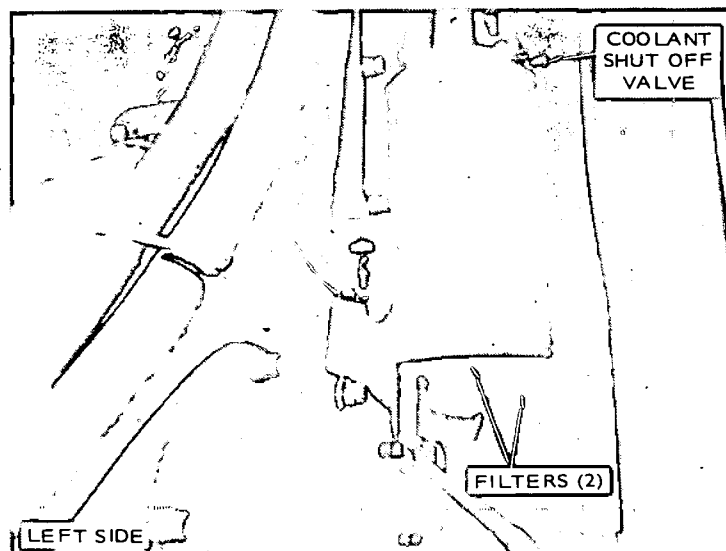


FIGURE 28. COOLANT FILTER

PARTS CATALOG

This catalog applies to the standard Generator Sets as listed below. Parts are arranged in groups of related items. Each illustrated part is identified by a reference number corresponding to the same reference number in the parts list for that group. Parts illustrations are typical. Using the *Model* and *Spec No.* from the nameplate, select the parts from this catalog that apply to your set. Unless otherwise mentioned in the description, parts are interchangeable between models. Right and left sides are determined by facing the engine end (front) of the set.

SET DATA TABLE

MODEL AND SPEC NO.	ELECTRICAL DATA				
	WATTS	VOLTS	HERTZ	WIRE	PHASE
600.0 DFX - 4R/£	600,000	120/208	60	4	3
600.0 DFX - 4XR/£	600,000	277/480	60	4	3
600.0 DFX - 5DR/£	600,000	120/240	60	4	3
600.0 DFX - 6DR/£	600,000	240/480	60	4	3
600.0 DFX - 7XR/£	600,000	240/416	60	4	3
600.0 DFX - 9XR/£	600,000	347/600	60	4	3
500.0 DFX - 57R/£	500,000	220/380	50	4	3
500.0 DFX - 57R/£	500,000	230/400	50	4	3

£ - The Specification Letter advances (A to B, B to C, . . . Z to AA, etc.) with manufacturing changes.

A Specification Number, other than 1, designates customer option(s).

NOTE: Hertz is a unit of frequency equal to one cycle per second.

REPLACEMENT ENGINE

100-1383

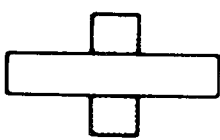
1

Engine, Replacement (Cummins Model KT2300G)

General Description:

Includes: Complete Cylinder Block, Fuel Pump, Fuel Filter, Oil Filter, Governor, Starter, Fan Blades (pusher type), Fan Belt, Flywheel, Water Pump, and Turbocharger.

Excludes: Alternator, Water Temperature Sender, Oil Pressure Sender, Radiator, Ammeter, Voltage Regulator, and Air Cleaner.

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

Engine parts modified or added by Onan will be in this parts list and have Onan part numbers. These supersede similar parts listed in the Cummins engine manual.

All Cummins engine parts must be ordered from your nearest authorized Cummins distributor. When ordering parts, refer to the engine nameplate giving the complete engine, model and serial numbers.

NOTICE!

ITEMS REFERENCED AS **OPTIONAL** INDICATE PART IS FACTORY INSTALLED AND MAY NOT BE APPLICABLE TO ALL MODELS. FOR FIELD CONVERSIONS ADDITIONAL PARTS ARE USUALLY REQUIRED.

INSTRUCTIONS FOR ORDERING **Onan** REPAIR PARTS

For parts or service, contact the dealer from whom you purchased this equipment or refer to your Nearest Authorized Onan Parts and Service Center.

To avoid errors or delay in filling your parts order, please furnish all information requested.

Always refer to the nameplate on your unit:

1. Always give the MODEL and SPEC NO. and SERIAL NO.

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 120/208 127/220 139/240 120/240/416	
AMPS	
VOLTS 254/440 277/460 347/600 120/240	
AMPS 10	
BAT VOLTS	
MANUFACTURED BY ONAN DIVISION OF ONAN CORPORATION MINNEAPOLIS, MINN. 55432, U.S.A. FOR ELECT. EQUIPMENT ONLY 	

For handy reference, insert "YOUR" nameplate information in the spaces above.

2. Do not order by reference number or group number; always use part number and description.
3. Give the part number, description and quantity needed of each item. If an older part cannot be identified, return the part prepaid to your dealer or nearest AUTHORIZED SERVICE STATION. Print your name and address plainly on the package. Write a letter to the same address stating the reason for returning the part.
4. State definite shipping instructions. Any claim for loss or damage to your unit in transit should be filed promptly against the transportation company making the delivery. Shipments are complete unless the packing list indicates items are back ordered.

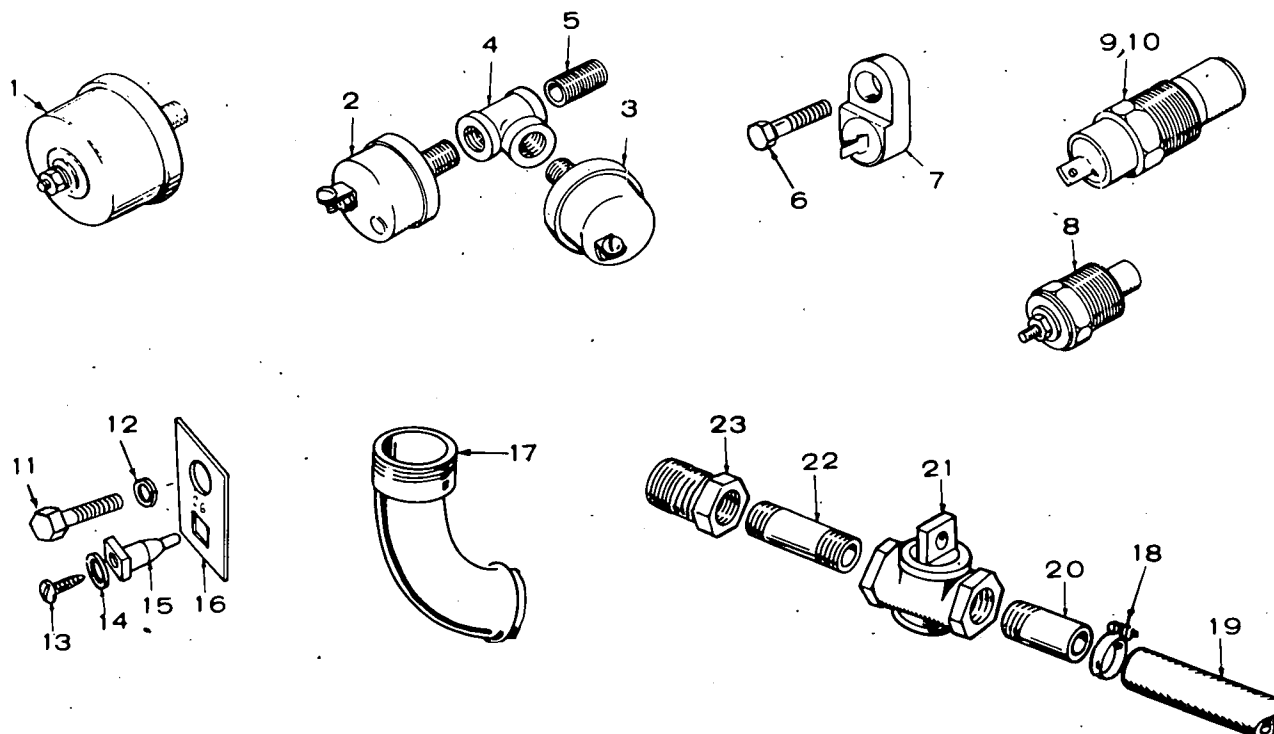
Prices are purposely omitted from this Parts Catalog due to the confusion resulting from fluctuating costs, import duties, sales taxes, exchange rates, etc.

For current parts prices, consult your Onan Dealer, Distributor or Parts and Service Center.

"En esta lista de partes los precios se omiten de proposito, ya que bastante confusion resulto de fluctuaciones de los precios, derechos aduanales, impuestos de venta, cambios extranjeros, etc."

Consiga los precios vigentes de su distribuidor de productos "ONAN".

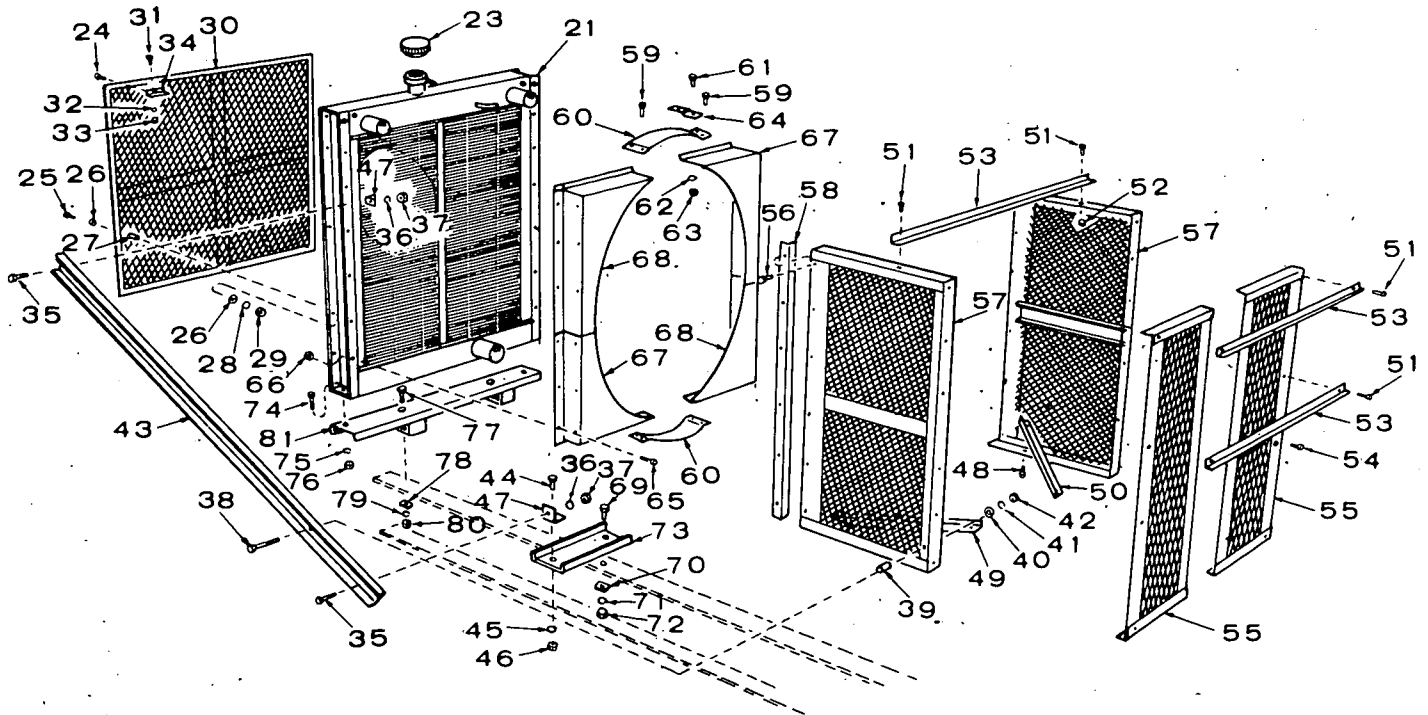
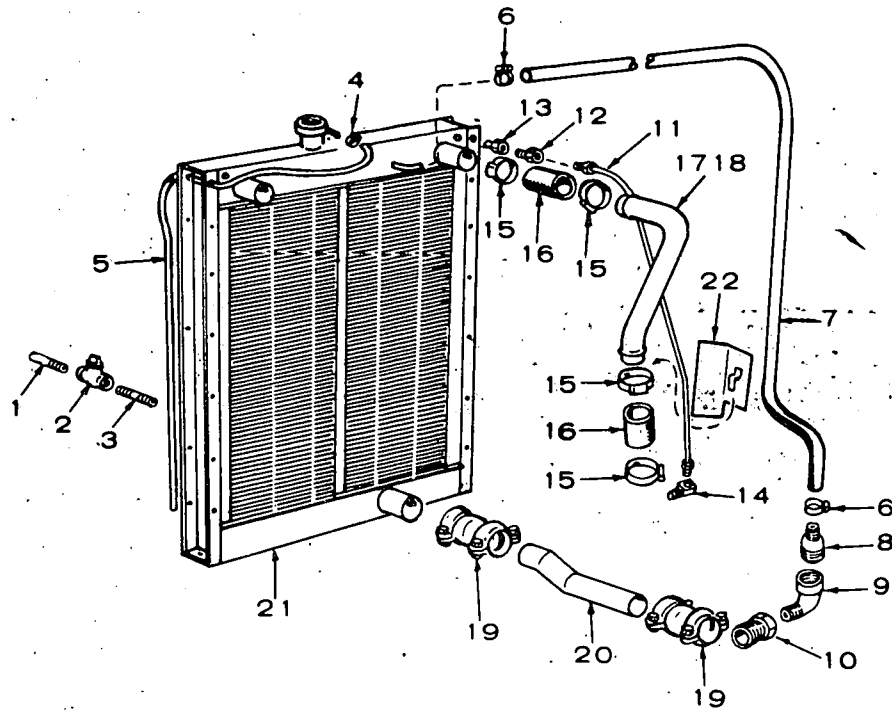
MISCELLANEOUS ENGINE PARTS GROUP



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	193-0108	1	Sender, Oil Pressure
2	309-0169	1	Switch, Pressure - Low Oil Pressure Shutdown
3	309-0272	1	Switch, Pressure - Low Oil Pressure Alarm
4	505-0059	1	Tee, Pipe (1/8" NPT)
5	505-0098	1	Nipple, Pipe - Close (1/8" NPT x 3/4")
6	800-0061	1	Screw, Cap - Hex Head (3/8-16 x 3-3/4")
7	309-0269	1	Switch, Thermostatic - Low Engine Temperature
8	193-0109	1	Sender, Temperature - Engine Coolant
9	309-0179	2	Switch, Thermostatic - High Coolant Temperature Shutdown
10	309-0178	2	Switch, Thermostatic - High Coolant Temperature Alarm

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
11	800-0069	1	Screw, Cap - Hex Head (7/16-14 x 3/4")
12	850-0055	1	Washer, Lock - Spring (7/16")
13	809-0035	1	Screw, Tapping - Round Head (#8 x 3/4")
14	508-0015	1	Washer, Flat - Fiber (#8)
15	870-0196	1	Nut, Insert - Insulator
16	332-1281	1	Bracket, Mounting
17	155-1407	2	Elbow, Pipe - Exhaust (90°)
18	503-0197	1	Clamp, Hose
19	503-0789	As Req'd	Hose, Rubber - Oil Drain (20" used)
20	505-0185	1	Nipple, Pipe - Half (1/2" NPT x 1-1/2")
21	504-0011	1	Valve, Shutoff - Oil Drain
22	505-0100	1	Nipple, Pipe (1/2" NPT x 1-1/8")
23	505-0022	1	Bushing, Reducer - Pipe (1" NPT x 1/2" NPT)

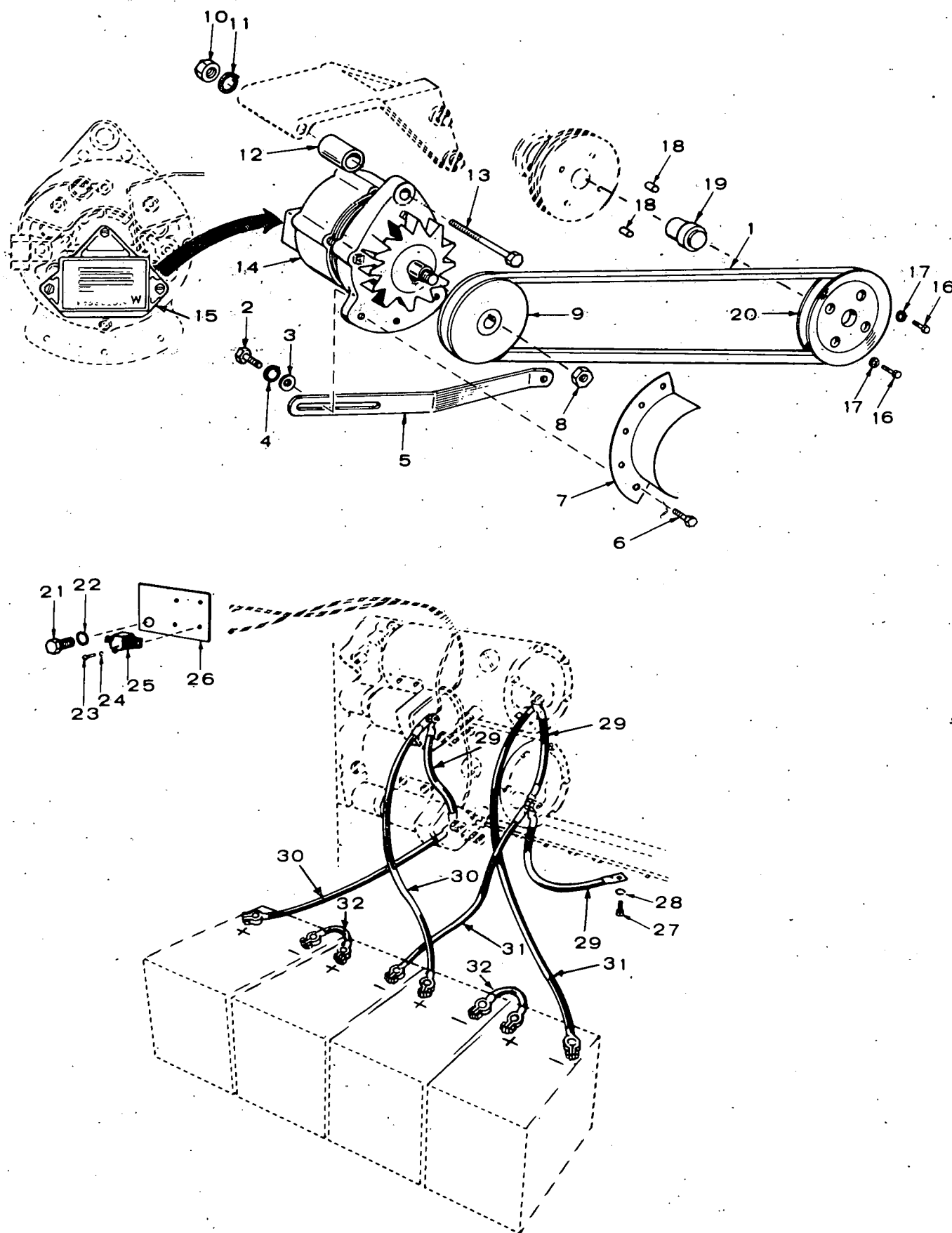
COOLING SYSTEM GROUP (RADIATOR COOLED SETS)



COOLING SYSTEM GROUP (RADIATOR COOLED SETS)

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION	REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	505-0185	1	Nipple, Pipe - Half (1/2" NPT x 1-1/2")	43	130-1045	2	Brace, Support - Radiator
2	504-0011	1	Valve, Shut-off	44	800-0092	4	Screw, Cap - Hex Head (1/2-13 x 1-1/2")
3	505-0100	1	Nipple, Pipe (1/2" NPT x 1-1/8")	45	850-0060	4	Washer, Lock - Spring (1/2")
4	503-0547	1	Clamp, Hose	46	862-0016	4	Nut, Hex (1/2-13)
5	503-0794	As Req'd	Hose, Rubber (1/2" Dia) - 12 ft. Required	47	130-0944	4	Bracket, Angle - Support Brace
6	503-0398	2	Clamp, Hose	48	821-0009	4	Screw, Self-locking - Hex Head (1/4-20 x 3/8")
7	503-0790	As Req'd	Hose, Rubber (1" ID x 1-3/8" OD - 8 ft Required)	49	130-1105	1	Gusset - Fan Guard (Right Side)
8	505-0759	1	Adapter, Pipe	50	130-1108	1	Gusset - Fan Guard (Left Side)
9	505-0003	1	Elbow, Pipe - Street, 90° (1" NPT)	51	821-0011	10	Screw, Self-locking - Hex Head (1/4-20 x 7/8")
10	505-0023	1	Bushing, Reducer - Pipe (1-1/4" NPT x 1" NPT)	52	870-0243	2	Nut, Self-locking - Hex (1/4-20)
11	501-0213	2	Line, Flexible	53	370-1020	3	Bracket, Angle - Fan Guard
12	502-0193	2	Connector, Pipe - Male	54	821-0011	8	Screw, Self-locking - Hex Head (1/4-20 x 7/8")
13	505-0007	2	Bushing, Reducer - Pipe (1/4" NPT x 1/8" NPT)	55	130-1104	2	Panel, Rear - Fan Guard
14	502-0287	2	Elbow, Pipe - 90°, Brass (1/4" NPT x 1/2-20 SAE)	56	821-0010	12	Screw, Self-locking - Hex Head (1/4-20 x 1/2")
15	503-0621	8	Clamp, Hose	57	130-1101	2	Panel, Side - Fan Guard
16	503-0788	4	Hose, Rubber (3" ID)	58	130-1098	2	Stiffener - Side Panel
17	130-1032	1	Tube, Coolant - Right Side	59	821-0009	12	Screw, Self-locking - Hex Head (1/4-20 x 3/8")
18	130-1033	1	Tube, Coolant - Left Side	60	130-1068	2	Bridge, Support - Fan Shroud
19	130-0966	2	Coupling, Flexible - Pipe	61	800-0027	4	Screw, Cap - Hex Head (5/16-18 x 7/8")
20	130-1044	1	Tube, Coolant - Lower	62	850-0045	4	Washer, Lock - Spring (5/16")
21	130-1043	1	Radiator, Engine Coolant	63	862-0015	4	Nut, Hex (5/16-18)
22	130-1073	1	Shield, Heat	64	130-1093	4	Bracket, Double Angle - Shroud Support
23		1	Cap, Radiator (Part of Radiator)	65	821-0016	10	Screw, Self-locking - Hex Head (5/16-18 x 3/4")
24	821-0016	8	Screw, Self-locking - Hex Head (5/16-18 x 3/4")	66	870-0257	10	Nut, Self-locking, Hex (5/16-18)
25	800-0032	4	Screw, Cap - Hex Head (5/16-18 x 1-3/4")	67	130-1069	2	Shroud, Fan (Lower Right, Upper Left)
26	526-0115	8	Washer, Flat (11/32" ID x 11/16" OD x 1/16" Thk)	68	130-1070	2	Shroud, Fan (Lower Left, Upper Right)
27	402-0017	4	Spacer, Sleeve	69	800-0158	4	Screw, Cap - Hex Head (3/4-10 x 2-3/4")
28	850-0045	4	Washer, Lock - Spring (5/16")	70	403-1141	4	Washer, Bevel - Square
29	862-0015	4	Nut, Hex (5/16-18)	71	850-0079	4	Washer, Lock - Spring (3/4")
30	130-1080	1	Guard, Radiator - Front	72	862-0020	4	Nut, Hex (3/4-10)
31	800-0027	12	Screw, Cap - Hex Head (5/16-18 x 7/8")	73	130-1037	2	Channel - Radiator Support Brace
32	850-0045	12	Washer, Lock - Spring (5/16")	74	800-0156	2	Screw, Cap - Hex Head (3/4-10 x 2-1/4")
33	862-0015	12	Nut, Hex (5/16-18)	75	850-0079	2	Washer, Lock - Spring (3/4")
34	130-1078	8	Bracket, Angle - Radiator Guard	76	862-0020	2	Nut, Hex (3/4-10)
35	800-0092	4	Screw, Cap - Hex Head (1/2-13 x 1-1/2")	77	800-0158	2	Screw, Cap - Hex Head (3/4-10 x 2-3/4")
36	850-0060	4	Washer, Lock - Spring (1/2")	78	403-1141	2	Washer, Bevel - Square
37	862-0016	4	Nut, Hex (1/2-13)	79	850-0079	2	Washer, Lock - Spring (3/4")
38	800-0014	2	Screw, Cap - Hex Head (1/4-20 x 2-3/4")	80	862-0020	2	Nut, Hex (3/4-10)
39	130-1107	2	Spacer	81	130-1036	1	Support, Radiator
40	526-0018	2	Washer, Flat (17/64" ID x 5/8" OD x 1/16" Thk)				
41	850-0040	2	Washer, Lock - Spring (1/4")				
42	862-0001	2	Nut, Hex (1/4-20)				

ALTERNATOR AND STARTER GROUP



ALTERNATOR AND STARTER GROUP

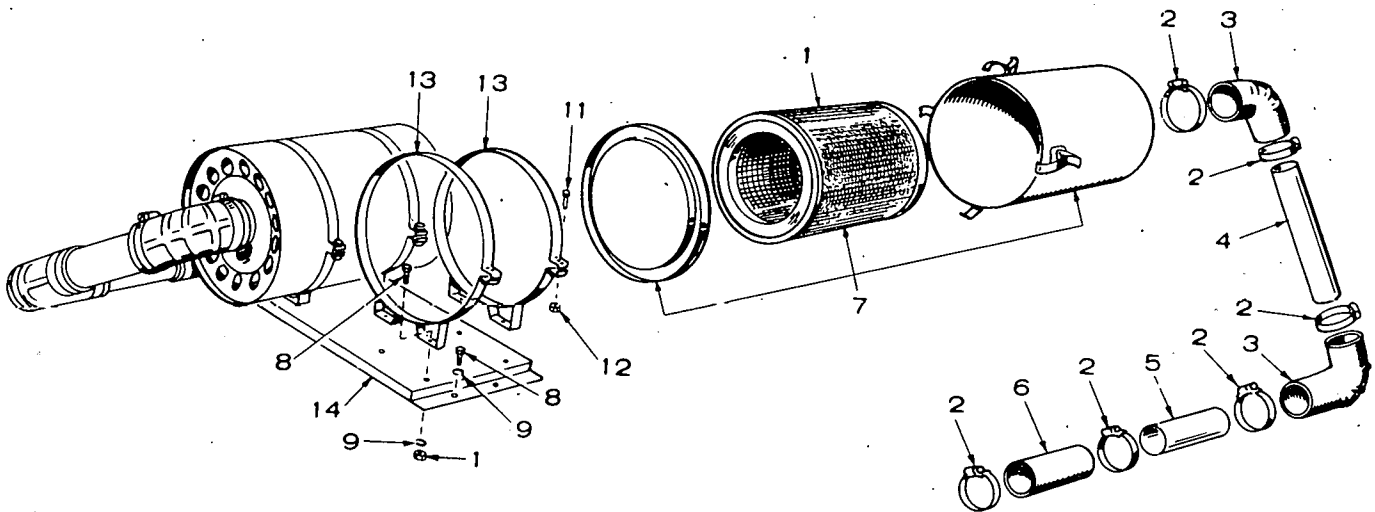
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	511-0059	1	Belt, Drive
2	800-0028	1	Screw, Cap - Hex Head (5/16-18 x 1")
3	526-0022	1	Washer, Flat (21/64" ID x 9/16" OD x 1/16" Thk)
4	850-0045	1	Washer, Lock - Spring (5/16")
5	191-1152	1	Bracket, Adjusting - Alternator
6	821-0014	2	Screw, Self-locking - Hex Head (5/16-18 x 1/2")
7	191-0725	1	Guard, Belt
8		1	Nut, Hex (5/8-18 NP-2A) Part of Alternator
9	191-0781	1	Pulley - Alternator Drive
10	862-0016	1	Nut, Hex (1/2-13)
11	850-0060	1	Washer, Lock - Spring (1/2")
12	191-1153	1	Spacer, Sleeve
13	800-0110	1	Screw, Cap - Hex Head (1/2-13 x 7-1/2")
14	191-0688	1	† Alternator - Includes Regulator (Motorola #70D44039B04)
15	191-0733	1	† Regulator, Voltage - Part of Alternator
16	800-0069	2	Screw, Cap - Hex Head (7/16-14 x 3/4")
17	850-0055	2	Washer, Lock - Spring (7/16")
18	191-1165	2	Spacer, Sleeve

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
19	191-1164	1	Adapter, Pulley
20	512-0063	1	Pulley
21	800-0151	1	Screw, Cap - Hex Head (3/4-10 x 1")
22	850-0079	1	Washer, Lock - Spring (3/4")
23	811-0103	4	Screw, Machine - Round Head, Brass (#10-32 x 3/4")
24	850-0030	4	Washer, Lock - Spring (#10)
25	320-0240	2	Breaker, Circuit
26	301-4206	1	Bracket, Mounting
27	800-0090	1	Screw, Cap - Hex Head (1/2-13 x 1")
28	850-0060	1	Washer, Lock - Spring (1/2")
29	416-0680	3	Cable, Electrical
30	416-0682	2	Cable, Battery (Positive) (#2/0 x 44")
31	416-0681	2	Cable, Battery (Negative) (#2/0 x 44")
32	416-0473	2	Cable, Battery - Jumper

* - Use the 12 point Cap Screw, part of Engine Block to mount Alternator Adjusting Bracket.

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

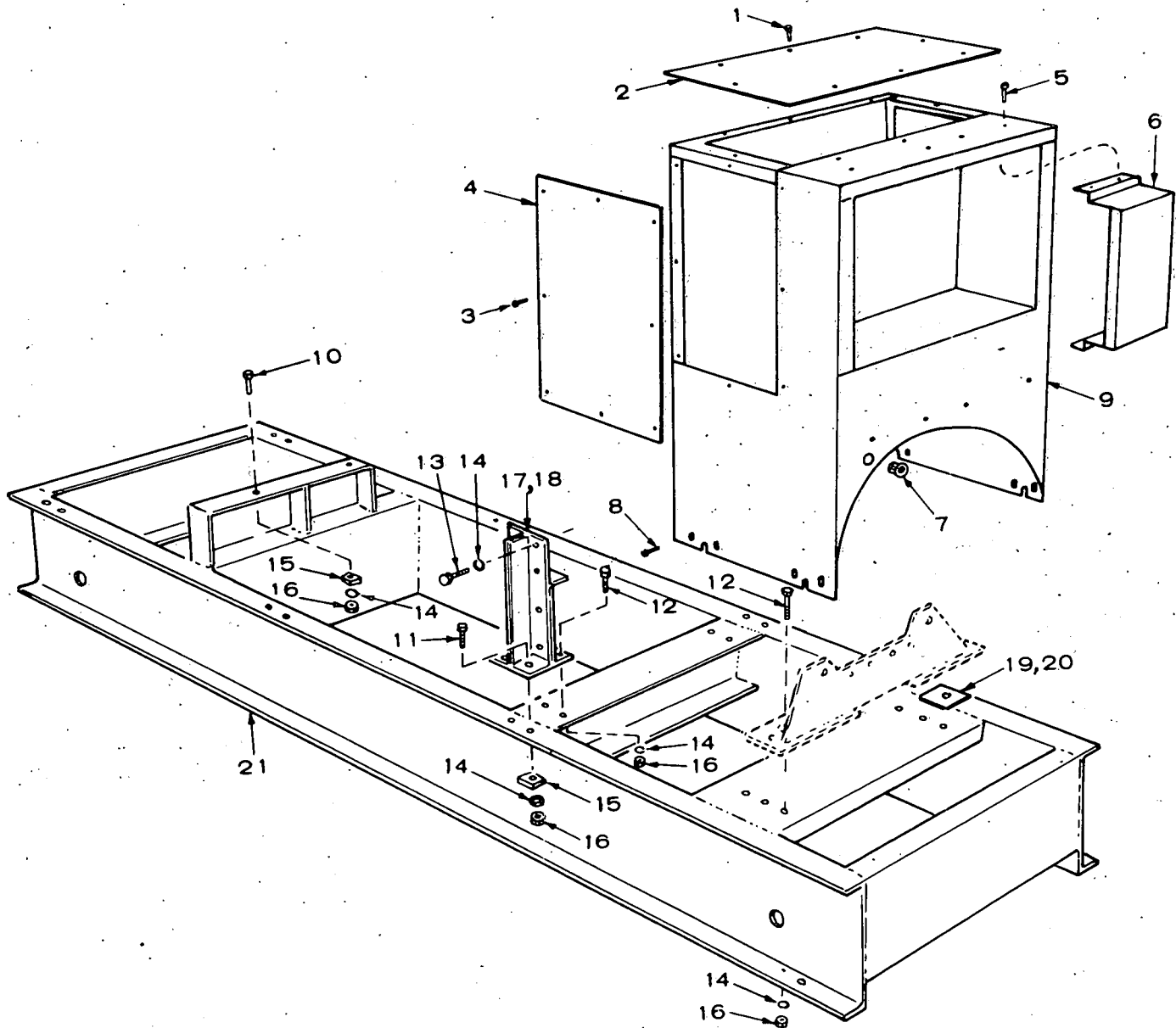
AIR CLEANER GROUP



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	140-1371	2	Filter, Air - Paper (Replacement)
2	503-0784	12	Clamp, Hose
3	140-1415	4	Elbow, Hose - 90°, Preformed
4	140-1397	2	Tube, Air (5-1/2" OD x 13" Lg)
5	140-1396	2	Tube, Air (5-1/2" OD x 7-1/2" Lg)
6	503-0787	2	Hose, Rubber (5-1/2" ID)
7	140-1370	2	Air Cleaner (Includes Replacement Filter)

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
8	800-0069	12	Screw, Cap - Hex Head (7/16-14 x 3/4")
9	850-0055	12	Washer, Lock - Spring (7/16")
10	862-0004	8	Nut, Hex (7/16-14)
11	800-0032	4	Screw, Cap - Hex Head (5/16-18 x 1-3/4")
12	870-0257	4	Nut, Self-locking, Hex (5/16-18)
13	140-1410	4	Band, Mounting - Air Cleaner
14	140-1398	1	Base Plate - Air Cleaner

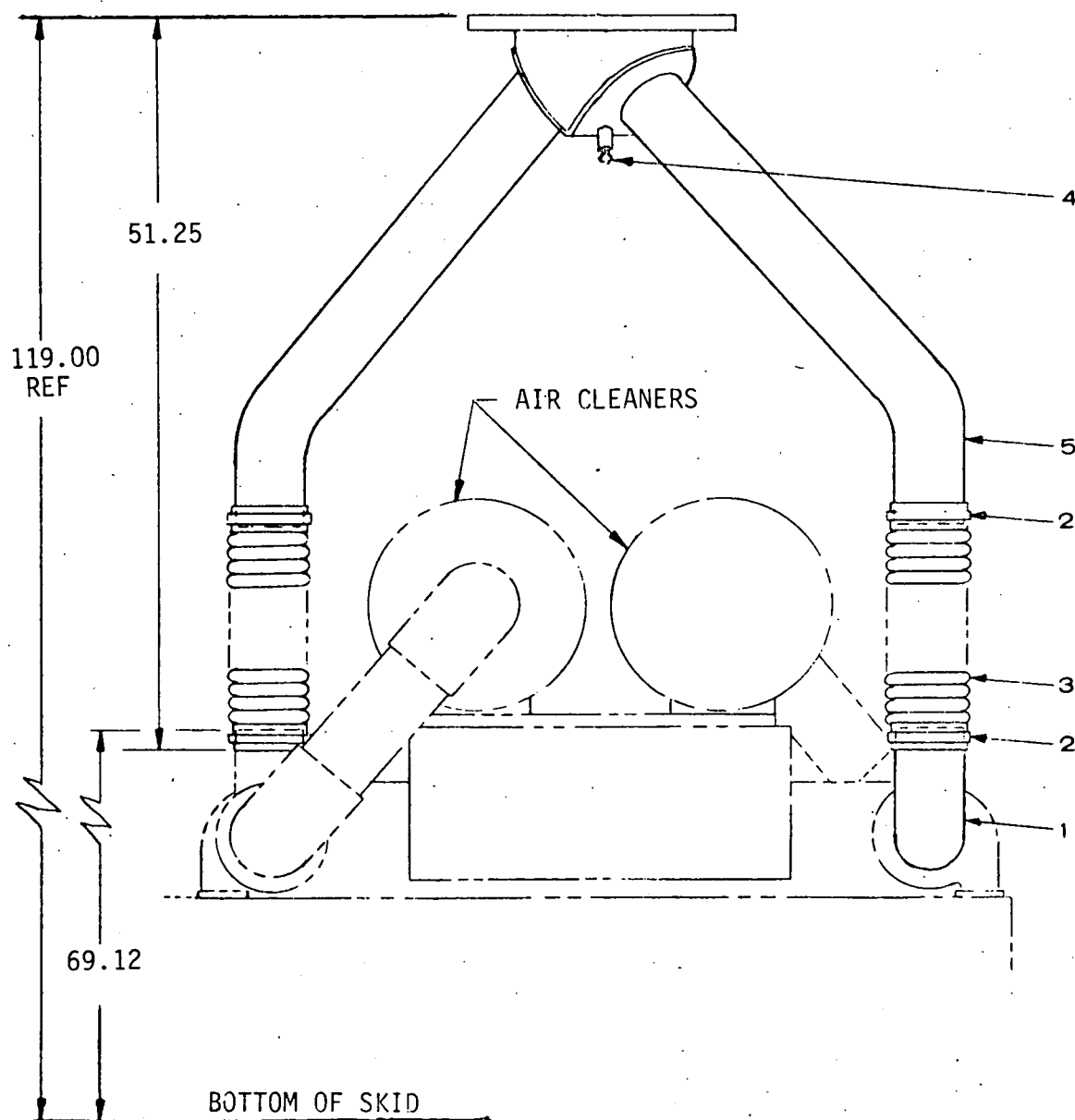
CHASSIS AND CONTROL HOUSING GROUP



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	821-0010	8	Screw, Self-locking - Hex Head (1/4-20 x 1/2")
2	301-2904	1	Panel, Top
3	821-0010	16	Screw, Self-locking - Hex Head (1/4-20 x 1/2")
4	301-2905	2	Panel, Side
5	821-0010	4	Screw, Self-locking - Hex Head (1/4-20 x 1/2")
6	301-4110	1	Panel, Blank
7	331-0088	2	Bushing, Insulator
8	821-0014	10	Screw, Self-locking - Hex Head (5/16-18 x 1/2")
9	301-4118	1	Housing, Control
10	800-0164	2	Screw, Cap - Hex Head (3/4-10 x 4-1/2")

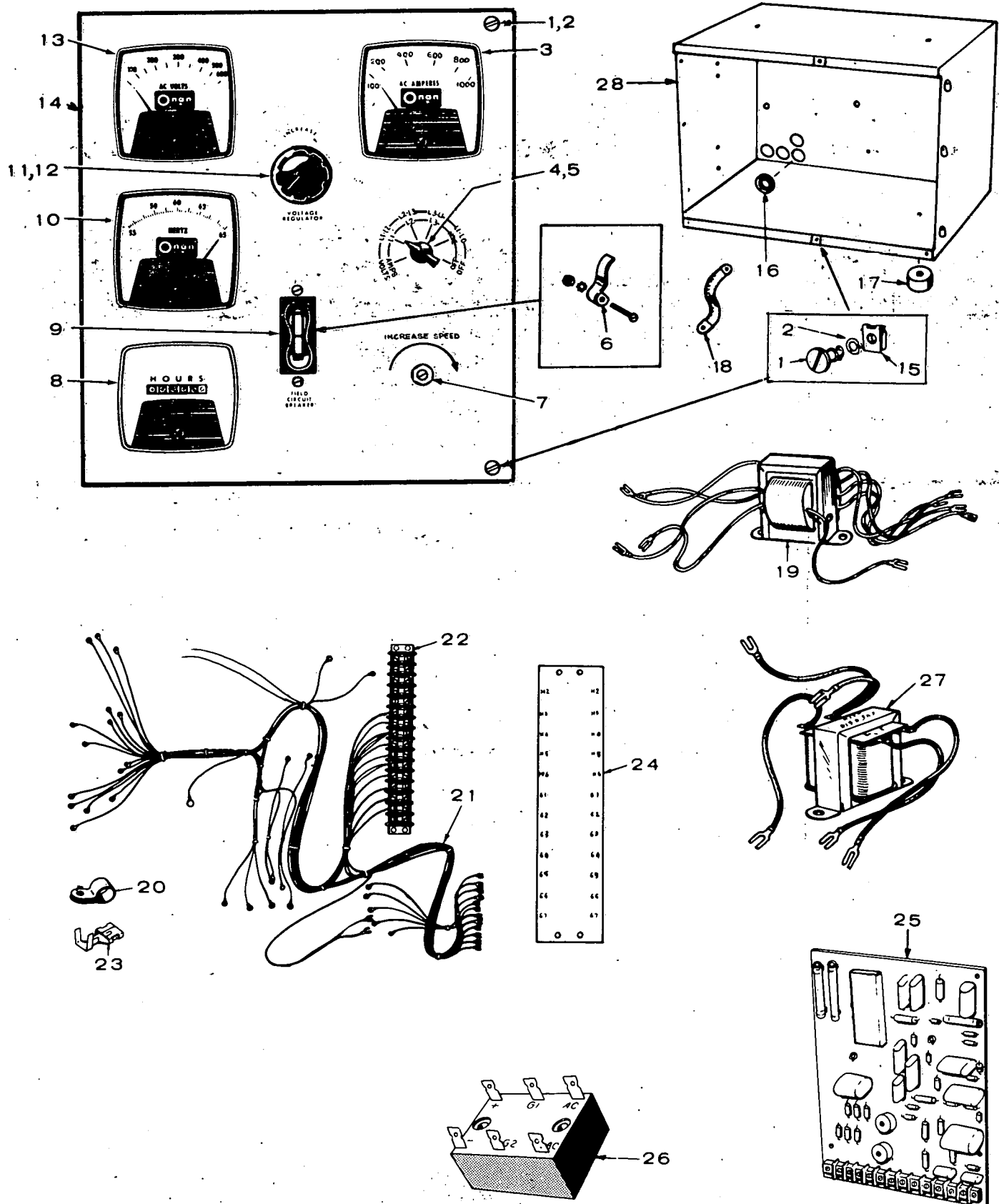
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
11	800-0158	4	Screw, Cap - Hex Head (3/4-10 x 2-3/4")
12	800-0157	8	Screw, Cap - Hex Head (3/4-10 x 2-1/2")
13	800-0153	8	Screw, Cap - Hex Head (3/4-10 x 1-1/2")
14	850-0079	21	Washer, Lock - Spring (3/4")
15	403-1141	6	Washer, Bevel - Square
16	862-0020	12	Nut, Hex (3/4-10)
17	403-1250	1	Support, Engine - Left Side
18	403-1251	1	Support, Engine - Right Side
19	232-1489	6	Shim - Generator Mounting
20	232-1490	6	Shim - Generator Mounting
21	403-1244	1	Base, Skid - Generator Set

179-1537 INSTALLATION EXHAUST HEADER—OPTIONAL EQUIPMENT



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	155-1406	2	Elbow, Pipe - Exhaust, 90° - Optional (Use with Header System)
2	503-0605	4	Clamp, Hose
3	155-1456	2	Tube, Exhaust - Flexible
4	505-0110	1	Plug, Pipe (3/8" NPT) - Trap Drain
5	155-1457	1	Header Assembly, Exhaust

CONTROL GROUP (AC OUTPUT PORTION)



CONTROL GROUP (AC OUTPUT PORTION)

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	406-0333	2	Stud, Turnbutton Fastener
2	406-0334	2	Washer, Lock - Turnbutton Fastener
3	AMMETER (Check Meter Scale - Select According to Rating)		
	302-0414	1	Scale reads 0-500 Amperes
	302-0415	1	Scale reads 0-750 Amperes
	302-0416	1	Scale reads 0-1000 Amperes
	302-0640	1	Scale reads 0-1200 Amperes
	302-0641	1	Scale reads 0-1500 Amperes
	302-0642	1	Scale reads 0-2000 Amperes
	302-1044	1	Scale reads 0-2500 Amperes
	302-1045	1	Scale reads 0-3000 Amperes
4	303-0076	1	Knob, Pointer
5	308-0284	1	Switch, Rotary
6	320-0307	1	Lock, Handle - Circuit Breaker (Standard on Penn State Sets, Optional on other sets)
7	151-0402	1	Potentiometer - Speed Control
8	METER, TIME TOTALIZING (Select According to Rating)		
	302-0466	1	60 Hertz Sets
	302-0469	1	50 Hertz Sets
9	320-0455	1	Circuit Breaker - 3 Amp, 240 Volt
10	METER, ELECTRICAL FREQUENCY (Select According to Rating)		
	302-0810	1	60 Hertz, 208 Volt
	302-0811	1	60 Hertz, 240 Volt
	302-0894	1	50 Hertz, 208 Volt
	302-0895	1	50 Hertz, 240 Volt

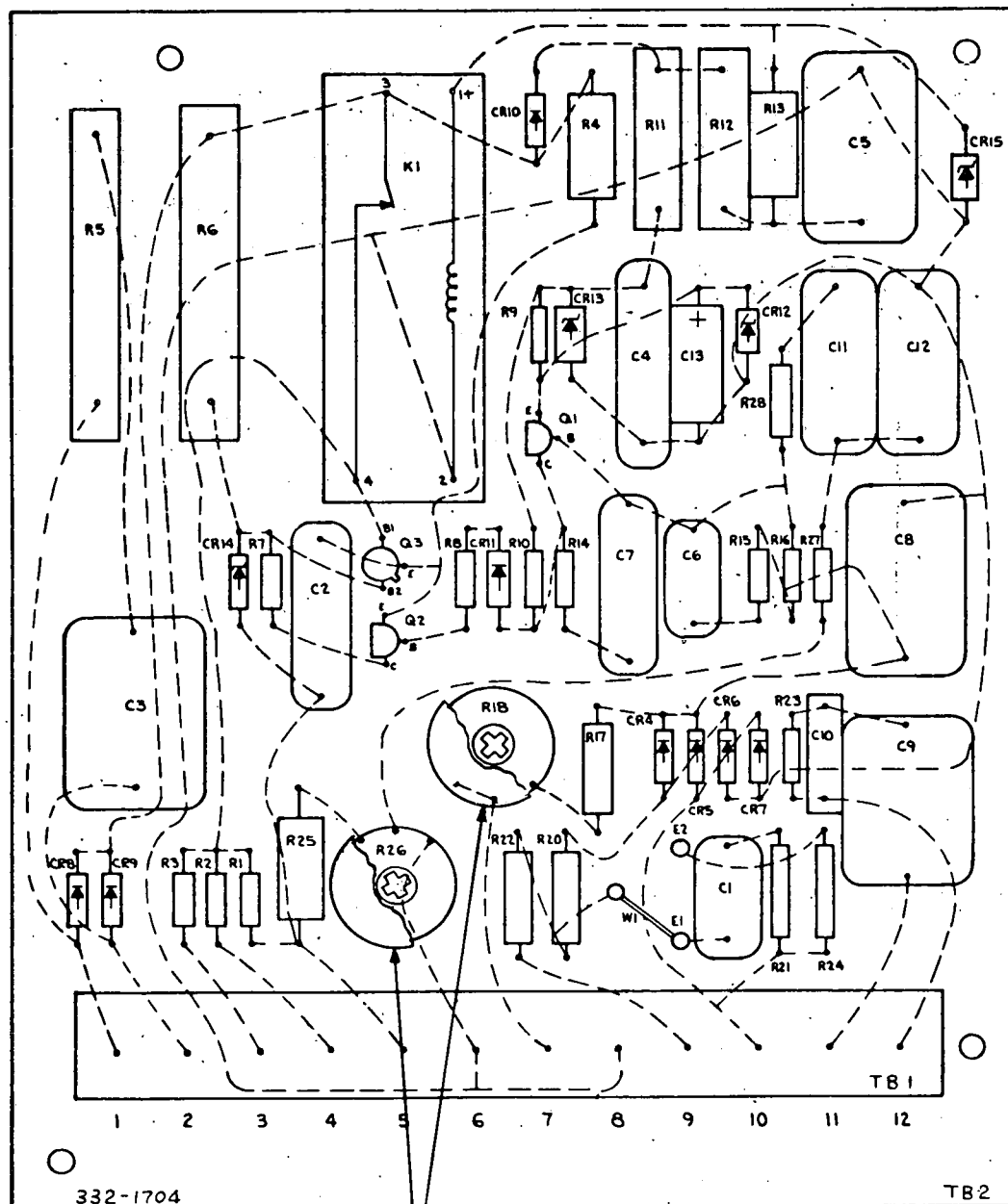
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
11	303-0032	1	Knob
12	303-0170	1	Rheostat - 3500-Ohm, 25 Watt
13	VOLTMETER (Select According to Rating)		
	302-0421	1	Scale Reads 0-300 Volts
	302-0779	1	Scale Reads 0-750 Volts
	302-1072	1	Scale Reads 0-600 Volts
14	£	1	Panel, Control (Generator Section)
15	406-0332	2	Receptacle, Turnbutton Fastener
16	508-0001	4	Grommet, Rubber (1-1/16" OD)
17	402-0070	4	Mount, Vibration
18	337-0049	1	Lead, Electrical - Ground
19	315-0342	1	Transformer, Voltage
20	332-0051	1	Clamp, Loop
21	£	1	Harness, Wiring (Includes Parts Marked †)
22	332-0795	1	† Terminal Board (16 Place)
23	332-0529	As Req'd	† Terminal, Lug
24	332-1242	1	Strip, Marker (16 Place)
25	332-1704	1	* Regulator, Voltage
26	305-0524	1	Rectifier Assembly, Bridge
27	315-0384	1	Reactor
28	301-4135	1	Box, Control

† - Included in Wiring Harness.

* - See Separate Group for Components.

£ - Furnish Model, Specification and Serial Numbers from the Onan nameplate when ordering these parts.

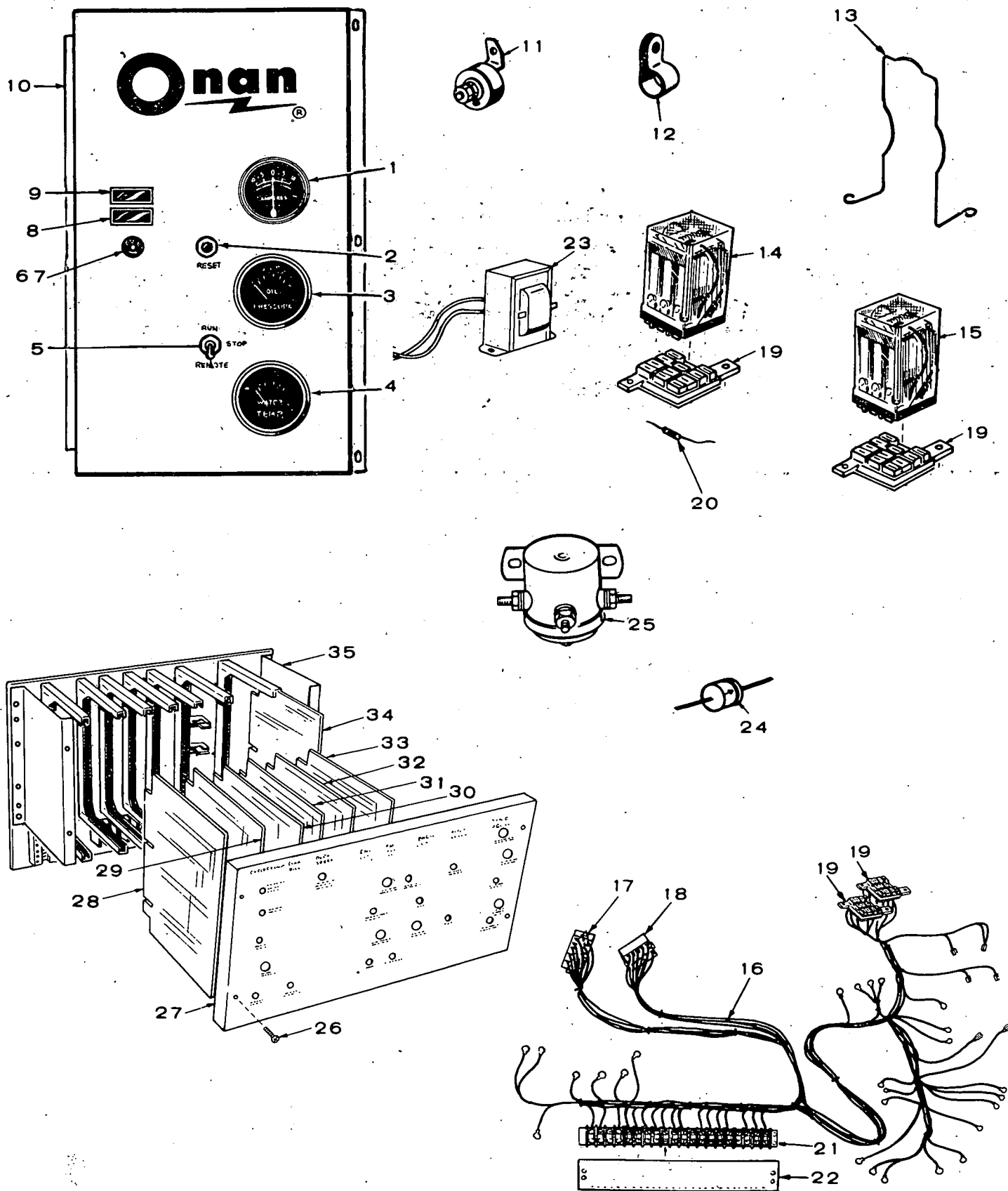
VOLTAGE REGULATOR GROUP



VOLTAGE REGULATOR GROUP

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION	REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
C1	332-1704		Regulator, Voltage	R2	350-0351	1	Resistor, Composition
	355-0018	1	Capacitor, Plastic Dielectric				(33-Ohm, 1/2 Watt, 5 percent)
C2	355-0005	1	Capacitor, Plastic Dielectric	R3	350-0351	1	Resistor, Composition
			(0.22 Microfarad, 100 Volt)				(33-Ohm, 1/2 Watt, 5 percent)
C3	355-0017	1	Capacitor, Plastic Dielectric	R4	350-1075	1	Resistor, Composition
			(0.47 Microfarad, 400 Volt)				(4.7-Megohm, 2 Watt, 5 percent)
C4	355-0006	1	Capacitor, Plastic Dielectric	R5	353-0040	1	Resistor, Wirewound
			(0.47 Microfarad, 200 Volt)				(270-Ohm, 10 Watt, 5 percent)
C5	355-0016	1	Capacitor, Plastic Dielectric	R6	353-0039	1	Resistor, Wirewound
			(1 Microfarad, 100 Volt)				(5000-Ohm, 15 Watt, 5 percent)
C6	355-0034	1	Capacitor, Plastic Dielectric	R7	350-0398	1	Resistor, Composition
			(0.33 Microfarad, 100 Volt)				(3000-Ohm, 1/2 Watt, 5 percent)
C7	355-0005	1	Capacitor, Plastic Dielectric	R8	350-0447	1	Resistor, Composition
			(0.22 Microfarad, 200 Volt)				(33000-Ohm, 1/2 Watt, 5 percent)
C8	355-0016	1	Capacitor, Plastic Dielectric	R9	350-0423	1	Resistor, Composition
			(1 Microfarad, 100 Volt)				(33000-Ohm, 1/2 Watt, 5 percent)
C9	355-0017	1	Capacitor, Plastic Dielectric	R10	350-0423	1	Resistor, Composition
			(0.41 Microfarad, 400 Volt)				(33000-Ohm, 1/2 Watt, 5 percent)
C10	355-0014	1	Capacitor, Plastic Dielectric	R11	352-0151	1	Resistor, Wirewound
			(0.047 Microfarad, 200 Volt)				(15000-Ohm, 5 Watt, 5 percent)
C11	355-0017	1	Capacitor, Plastic Dielectric	R12	352-0151	1	Resistor, Wirewound
			(0.47 Microfarad, 400 Volt)				(15000-Ohm, 5 Watt, 5 percent)
C12	355-0033	1	Capacitor, Plastic Dielectric	R13	350-1007	1	Resistor, Composition
			(1 Microfarad, 200 Volt)				(6800-Ohm, 2 Watt, 5 percent)
C13	356-0039	1	Capacitor, Electrolytic	R14	350-0443	1	Resistor, Composition
			(100 Microfarad, 10 Volt)				(220000-Ohm, 1/2 Watt, 5 percent)
CR1			Not used	R15	350-0435	1	Resistor, Composition
CR2			Not used				(100000-Ohm, 1/2 Watt, 5 percent)
CR3			Not used	R16	350-0447	1	Resistor, Composition
CR4	357-0004	1	Diode, Rectifier				(330000-Ohm, 1/2 Watt, 5 percent)
			(400 Milliampere, 400 Volt)	R17	351-0521	1	Resistor, Film
CR5	357-0004	1	Diode, Rectifier				(12100-Ohm, 1/4 Watt, 1 percent)
			(400 Milliampere, 400 Volt)	R18	303-0168	1	Potentiometer
CR6	357-0004	1	Diode, Rectifier				(5000-Ohm, 3 Watt, 5 percent)
			(400 Milliampere, 400 Volt)	R19			Not used
CR7	357-0004	1	Diode, Rectifier	R20	351-0520	1	Resistor, Film
			(400 Milliampere, 400 Volt)				(28000-Ohm, 1/4 Watt, 1 percent)
CR8	357-0004	1	Diode, Rectifier	R21	351-0522	1	Resistor, Film
			(400 Milliampere, 400 Volt)				(5110-Ohm, 1/4 Watt, 1 percent)
CR9	357-0004	1	Diode, Rectifier	R22	351-0520	1	Resistor, Film
			(400 Milliampere, 400 Volt)				(28000-Ohm, 1/4 Watt, 1 percent)
CR10	357-0004	1	Diode, Rectifier	R23	350-0355	1	Resistor, Composition
			(400 Milliampere, 400 Volt)				(47000-Ohm, 1/2 Watt, 5 percent)
CR11	357-0004	1	Diode, Rectifier	R24	351-0523	1	Resistor, Film
			(400 Milliampere, 400 Volt)				(8870-Ohm, 1/4 Watt, 1 percent)
CR12	359-0016	1	Diode, Zener (250 Milliwatt,	R25	350-1011	1	Resistor, Composition
			6.8 Volt, 5 percent)				(10000-Ohm, 2 Watt, 5 percent)
CR13	359-0025	1	Diode, Zener (1 Watt,	R26	303-0164	1	Potentiometer
			20 Volt, 5 percent)				(8000-Ohm, 3 Watt, 20 percent)
CR14	359-0026	1	Diode, Zener (1 Watt,	R27	350-0435	1	Resistor, Composition
			18 Volt, 5 percent)				(100000-Ohm, 1/2 Watt, 5 percent)
CR15	359-0015	1	Diode, Zener (400 Milliwatt,	R28	350-0459	1	Resistor, Composition
			24 Volt, 5 percent)				(1-Megohm, 1/2 Watt, 5 percent)
K1	307-1063	1	Relay, Armature - Miniature	TB1	332-1252	1	Terminal Strip
Q1	362-0017	1	Transistor	TB2	332-1258	1	Board, Printed Wiring
Q2	362-0017	1	Transistor	MP1	517-0217	1	Cover, Dust - Potentiometer
R1	350-0355	1	Resistor, Composition	MP2	517-0217	1	Cover, Dust - Potentiometer
			(47-Ohm, 1/2 Watt, 5 percent)				

CONTROL GROUP (ENGINE SECTION)



CONTROL GROUP (ENGINE SECTION)

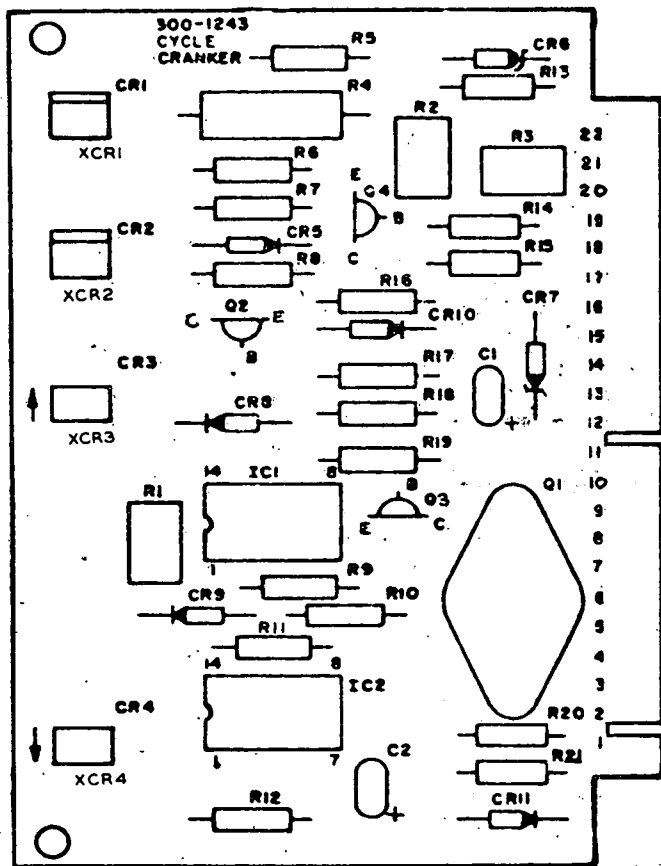
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	302-0061	1	Ammeter (30-0-30)
2	308-0091	1	Switch, Push
3	193-0107	1	Gauge, Oil Pressure (0-80)
4	193-0106	1	Gauge, Water Temperature
5	SWITCH, TOGGLE	1	
	308-0220	1	Standard Sets
	308-0347	1	Penn State Sets
6	321-0147	1	Fuse - 5 Amp
7	321-0217	1	Fuseholder
8	322-0122	1	Light, Indicator (Low Engine Temperature)
9	322-0129	1	Light, Indicator (Fault)
10	301-4086	1	Panel, Control
11	193-0189	2	Resistor, Gauge
12	332-0051	1	Clamp, Loop
13	307-1157	2	Spring, Hold-down - Relay
14	307-1061	1	Relay, Armature - Starter Protection
15	307-1056	1	Relay, Armature - Start-Disconnect
16	338-1016	1	Harness, Wiring (Includes Parts Marked †)
17	332-0984	1	†Connector, Plug, Electrical (12 Pin)
18	332-0986	1	†Connector, Plug, Electrical (10 Pin)

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
19	323-0765	2	†Socket, Relay
20	357-0004	1	†Diode
21	332-1005	1	†Board, Terminal (20 Place)
22	332-1559	1	Strip, Marker
23	315-0361	1	Transformer, Step-down
24	357-0004	1	Diode
25	307-0061	1	Relay, Armature - Starting
26	815-0387	4	Screw, Machine - Pan Head, Cross-Recessed Drive (#6-32 x 1/4")
27	301-4015	1	Cover, Access - Control Modules
28	300-1243	1	*Module, Cycle Cranker
29	300-1244	1	*Module, Start-Disconnect
30	300-1245	1	*Module, Overspeed Control
31	300-1246	1	*Module, Monitor No. 1
32	300-1247	1	*Module, Monitor No. 2
33	300-1248	1	*Module, Engine Shutdown
34	300-1249	1	*Module, Time Delay Start-Stop
35	300-1242	1	*Chassis, Control

* - See Separate Group for Components.

† - Included in Wiring Harness.

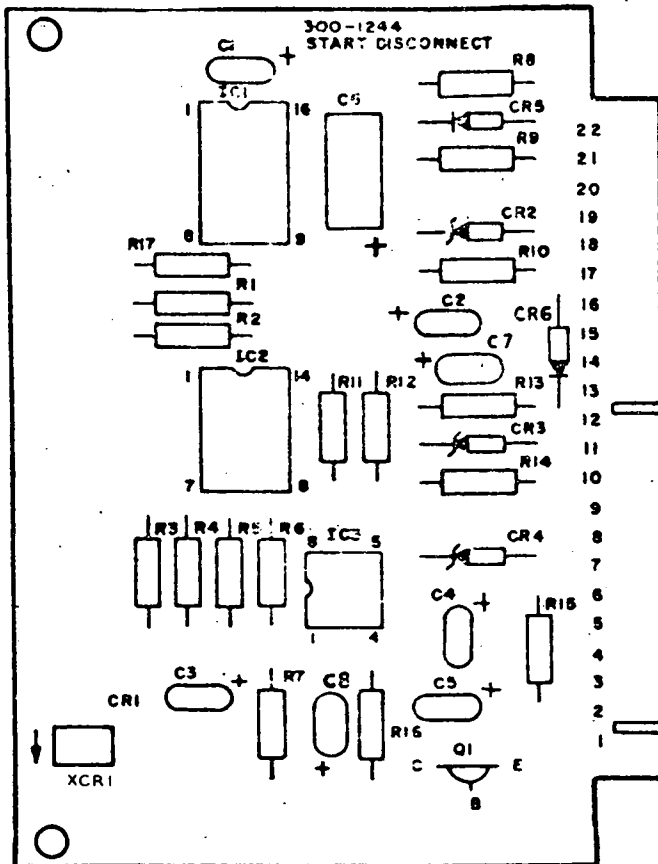
CRANKER CYCLE MODULE GROUP



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	300-1243		Module, Cycle Cranker
C1	356-0051	1	Capacitor, Electrolytic (6.8 Microfarad, 3.5 Volt)
C2	356-0053	1	Capacitor, Electrolytic (1 Microfarad, 35 Volt)
CR1	322-0171	1	Diode, Light Emitting (Red/Green)
CR2	322-0171	1	Diode, Light Emitting (Red, Green)
CR3	322-0157	1	Diode, Light Emitting (Red)
CR4	322-0172	1	Diode, Light Emitting (Green)
CR5	359-0032	1	Diode, Zener (400 Milliwatt, 8.2 Volt, 5 percent)
CR6	359-0016	1	Diode, Zener (250 Milliwatt, 6.8 Volt, 5 percent)
CR7	359-0002	1	Diode, Zener (400 Milliwatt, 13 Volt, 5 percent)
CR8	357-0004	1	Diode, Rectifier (400 Milliampere, 400 Volt)
CR9	357-0004	1	Diode, Rectifier (400 Milliampere, 400 Volt)
CR10	357-0004	1	Diode, Rectifier (400 Milliampere, 400 Volt)
CR11	357-0004	1	Diode, Rectifier (400 Milliampere, 400 Volt)
IC1	367-0017	1	Integrated Circuit (Counter)
IC2	367-0016	1	Integrated Circuit (Timing)
Q1	362-0036	1	Transistor
Q2	362-0011	1	Transistor
Q3	362-0011	1	Transistor
Q4	362-0011	1	Transistor

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
R1	303-0171	1	Potentiometer (100000-Ohm, 1/4 Watt)
R2	303-0191	1	Potentiometer (5000-Ohm, 1/4 Watt)
R3	303-0191	1	Potentiometer (5000-Ohm, 1/4 Watt)
R4	350-1132	1	Resistor, Composition (470-Ohm, 2 Watt, 10 percent)
R5	350-0532	1	Resistor, Composition (470000-Ohm, 1/2 Watt, 10 percent)
R6	350-0537	1	Resistor, Composition (1200-Ohm, 1/2 Watt, 10 percent)
R7	350-0382	1	Resistor, Composition (620000-Ohm, 1/2 Watt, 5 percent)
R8	350-0537	1	Resistor, Composition (1200-Ohm, 1/2 Watt, 10 percent)
R9	350-0394	1	Resistor, Composition (2000-Ohm, 1/2 Watt, 5 percent)
R10	350-0418	1	Resistor, Composition (20000-Ohm, 1/2 Watt, 5 percent)
R11	350-0548	1	Resistor, Composition (10000-Ohm, 1/2 Watt, 10 percent)
R12	350-0428	1	Resistor, Composition (51000-Ohm, 1/2 Watt, 5 percent)
R13	350-0548	1	Resistor, Composition (10000-Ohm, 1/2 Watt, 10 percent)
R14	350-0536	1	Resistor, Composition (1000-Ohm, 1/2 Watt, 10 percent)
R15	350-0536	1	Resistor, Composition (1000-Ohm, 1/2 Watt, 10 percent)
R16	350-0548	1	Resistor, Composition (10000-Ohm, 1/2 Watt, 10 percent)
R17	350-0548	1	Resistor, Composition (10000-Ohm, 1/2 Watt, 10 percent)
R18	350-0532	1	Resistor, Composition (470-Ohm, 1/2 Watt, 10 percent)
R19	350-0380	1	Resistor, Composition (510-Ohm, 1/2 Watt, 10 percent)
R20	350-0374	1	Resistor, Composition (300-Ohm, 1/2 Watt, 5 percent)
R21	350-0548	1	Resistor, Composition (10000-Ohm, 1/2 Watt, 10 percent)
TB1	332-1846	1	Board, Printed Wiring
XCR1	322-0175	1	Socket, Diode
XCR2	322-0175	1	Socket, Diode
XCR3	322-0175	1	Socket, Diode
XCR4	322-0175	1	Socket, Diode

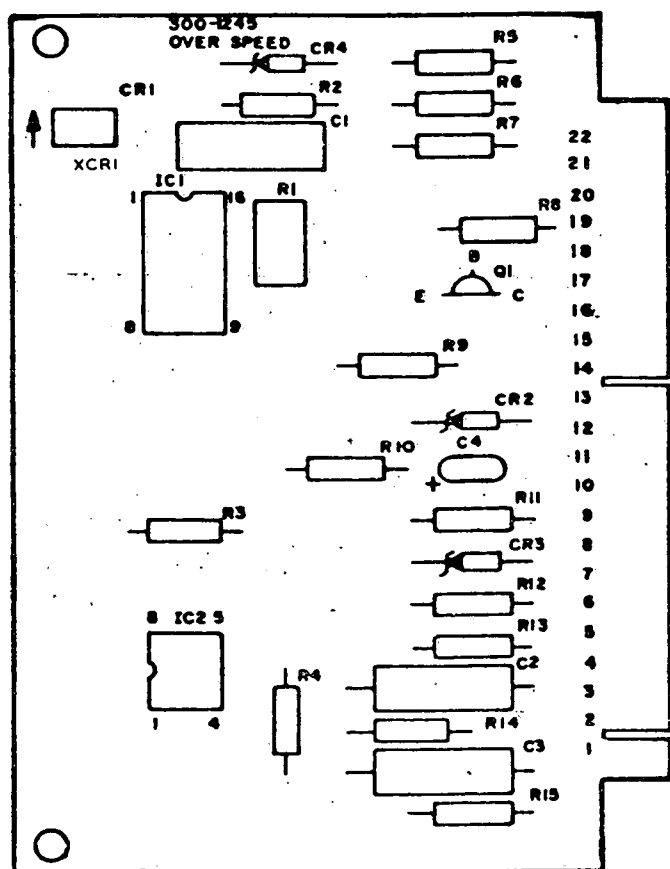
START DISCONNECT MODULE GROUP



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	300-1244		Module, Start Disconnect
C1	356-0051	1	Capacitor, Electrolytic (6.8 Microfarad, 35 Volt)
C2	356-0066	1	Capacitor, Electrolytic (47 Microfarad, 20 Volt)
C3	356-0051	1	Capacitor, Electrolytic (6.8 Microfarad, 35 Volt)
C4	356-0066	1	Capacitor, Electrolytic (47 Microfarad, 20 Volt)
C5	356-0059	1	Capacitor, Electrolytic (2.2 Microfarad, 35 Volt)
C6	355-0015	1	Capacitor, Plastic Dielectric (0.1 Microfarad, 200 Volt, 10 percent)
C7	356-0066	1	Capacitor, Electrolytic (47 Microfarad, 20 Volt)
C8	356-0066	1	Capacitor, Electrolytic (47 Microfarad, 20 Volt)
CR1	322-0172	1	Diode, Light Emitting (Green)
CR2	359-0002	1	Diode, Zener (400 Milliwatt, 13 Volt, 5 percent)
CR3	359-0002	1	Diode, Zener (400 Milliwatt, 13 Volt, 5 percent)
CR4	359-0032	1	Diode, Zener (400 Milliwatt, 8.2 Volt, 5 percent)
CR5	357-0004	1	Diode, Rectifier (400 Milliampere, 400 Volt)
CR6	357-0004	1	Diode, Rectifier (400 Milliampere, 400 Volt)
IC1	367-0014	1	Integrated Circuit (Multivibrator)
IC2	367-0013	1	Integrated Circuit (Dual 2 Input, Nand Gate)
IC3	367-0001	1	Integrated Circuit (OPRL Amplifier)

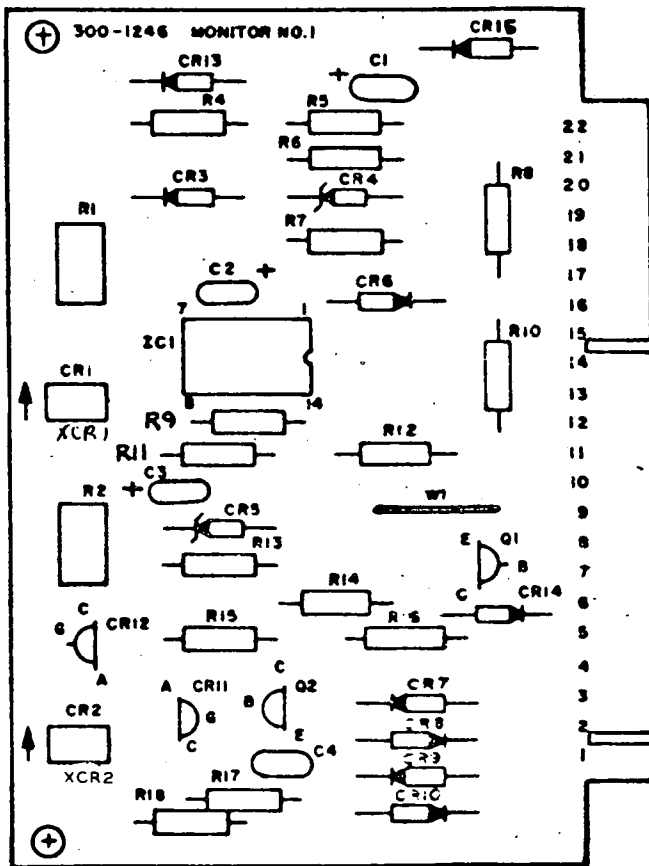
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
Q1	362-0011	1	Transistor
R1	350-0418	1	Resistor, Composition (20000-Ohm, 1/2 Watt, 5 percent)
R2	350-0418	1	Resistor, Composition (20000-Ohm, 1/2 Watt, 5 percent)
R3	350-0548	1	Resistor, Composition (10000-Ohm, 1/2 Watt, 5 percent)
R4	350-0422	1	Resistor, Composition (30000-Ohm, 1/2 Watt, 5 percent)
R5	350-0418	1	Resistor, Composition (20000-Ohm, 1/2 Watt, 5 percent)
R6	350-0418	1	Resistor, Composition (20000-Ohm, 1/2 Watt, 5 percent)
R7	350-0524	1	Resistor, Composition (100-Ohm, 1/2 Watt, 10 percent)
R8	350-0422	1	Resistor, Composition (30000-Ohm, 1/2 Watt, 5 percent)
R9	350-0428	1	Resistor, Composition (51000-Ohm, 1/2 Watt, 5 percent)
R10	350-0380	1	Resistor, Composition (510-Ohm, 1/2 Watt, 5 percent)
R11	350-0548	1	Resistor, Composition (10000-Ohm, 1/2 Watt, 10 percent)
R12	350-0548	1	Resistor, Composition (10000-Ohm, 1/2 Watt, 10 percent)
R13	350-0380	1	Resistor, Composition (510-Ohm, 1/2 Watt, 5 percent)
R14	350-0404	1	Resistor, Composition (5100-Ohm, 1/2 Watt, 5 percent)
R15	350-0548	1	Resistor, Composition (10000-Ohm, 1/2 Watt, 10 percent)
R16	350-0548	1	Resistor, Composition (10000-Ohm, 1/2 Watt, 10 percent)
R17	350-0418	1	Resistor, Composition (20000-Ohm, 1/2 Watt, 5 percent)
TB1	332-1848	1	Board, Printed Wiring
XCR1	322-0175	1	Socket, Diode

OVERSPEED CONTROL MODULE GROUP



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION	REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	300-1245		Module, Overspeed Control	R5	350-0370	1	Resistor, Composition (200-Ohm, 1/2 Watt, 5 percent)
C1	355-0015	1	Capacitor, Plastic Dielectric (0.1 Microfarad, 200 Volt, 10 percent)	R6	350-0548	1	Resistor, Composition (10000-Ohm, 1/2 Watt, 10 percent)
C2	355-0010	1	Capacitor, Plastic Dielectric (0.0022 Microfarad, 100 Volt, 10 percent)	R7	350-0548	1	Resistor, Composition (10000-Ohm, 1/2 Watt, 10 percent)
C3	355-0010	1	Capacitor, Plastic Dielectric (0.0022 Microfarad, 100 Volt, 10 percent)	R8	350-0548	1	Resistor, Composition (10000-Ohm, 1/2 Watt, 10 percent)
C4	356-0066	1	Capacitor, Electrolytic (47 Microfarad, 20 Volt)	R9	350-0548	1	Resistor, Composition (10000-Ohm, 1/2 Watt, 10 percent)
CR1	322-0172	1	Diode, Light Emitting	R10	350-0540	1	Resistor, Composition (2200-Ohm, 1/2 Watt, 10 percent)
CR2	359-0032	1	Diode, Zener (400 Milliwatt, 8.2 Volt, 5 percent)	R11	350-0376	1	Resistor, Composition (360-Ohm, 1/2 Watt, 5 percent)
CR3	359-0002	1	Diode, Zener (400 Milliwatt, 13 Volt, 5 percent)	R12	350-0548	1	Resistor, Composition (10000-Ohm, 1/2 Watt, 10 percent)
CR4	359-0028	1	Diode, Zener (500 Milliwatt, 3.9 Volt, 5 percent)	R13	350-0548	1	Resistor, Composition (10000-Ohm, 1/2 Watt, 10 percent)
IC1	367-0014	1	Integrated Circuit (Multivibration)	R14	350-0548	1	Resistor, Composition (10000-Ohm, 1/2 Watt, 10 percent)
IC2	367-0001	1	Integrated Circuit (OPRL Amplifier)	R15	350-0548	1	Resistor, Composition (10000-Ohm, 1/2 Watt, 10 percent)
Q1	362-0011	1	Transistor	TB1	332-1850	1	Board, Printed Wiring
R1	303-0191	1	Potentiometer (5000-Ohm, 1/4 Watt)	XCR1	322-0175	1	Socket, Diode
R2	350-0418	1	Resistor, Composition (20000-Ohm, 1/2 Watt, 5 percent)				
R3	350-0568	1	Resistor, Composition (470000-Ohm, 1/2 Watt, 10 percent)				
R4	350-0568	1	Resistor, Composition (470000-Ohm, 1/2 Watt, 10 percent)				

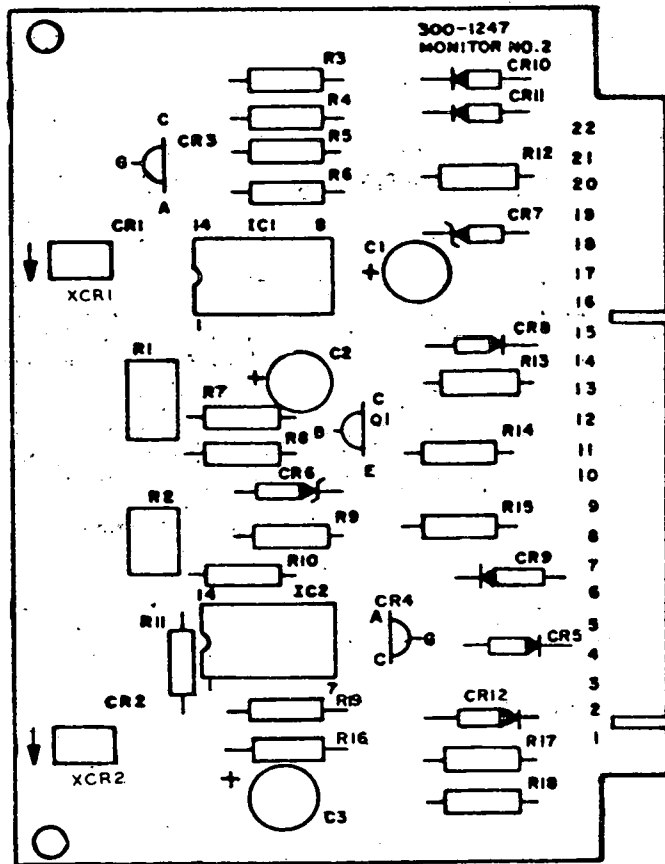
ENGINE MONITOR NO. 1 MODULE GROUP



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	300-1246		Module, Engine Monitor No. 1
C1	356-0051	1	Capacitor, Electrolytic (6.8 Microfarad, 35 Volt)
C2	356-0051	1	Capacitor, Electrolytic (6.8 Microfarad, 35 Volt)
C3	356-0051	1	Capacitor, Electrolytic (6.8 Microfarad, 35 Volt)
C4	355-0028	1	Capacitor, Plastic Dielectric (0.5 Microfarad, 100 Volt, 5 percent)
CR1	322-0157	1	Diode, Light Emitting (Red)
CR2	322-0157	1	Diode, Light Emitting (Red)
CR3	357-0004	1	Diode, Rectifier (400 Milliampere, 400 Volt)
CR4	359-0002	1	Diode, Zener (400 Milliwatt, 13 Volt, 5 percent)
CR5	359-0002	1	Diode, Zener (400 Milliwatt, 13 Volt, 5 percent)
CR6	357-0004	1	Diode, Rectifier (400 Milliampere, 400 Volt)
CR7	357-0004	1	Diode, Rectifier (400 Milliampere, 400 Volt)
CR8	357-0004	1	Diode, Rectifier (400 Milliampere, 400 Volt)
CR9	357-0004	1	Diode, Rectifier (400 Milliampere, 400 Volt)
CR10	357-0004	1	Diode, Rectifier (400 Milliampere, 400 Volt)
CR11	364-0011	1	Diode, Rectifier (0.8 Ampere, 30 Volt)
CR12	364-0011	1	Diode, Rectifier (0.8 Ampere, 30 Volt)
CR13	357-0004	1	Diode, Rectifier (400 Milliampere, 400 Volt)

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
CR14	357-0004	1	Diode, Rectifier (400 Milliampere, 400 Volt)
CR15	357-0004	1	Diode, Rectifier (400 Milliampere, 400 Volt)
IC1	367-0016	1	Integrated Circuit (Timing)
Q1	362-0026	1	Transistor
Q2	362-0026	1	Transistor
R1	303-0191	1	Potentiometer (5000-Ohm, 1/4 Watt)
R2	303-0169	1	Potentiometer (3.5 Megohm, 1/4 Watt)
R3			Not used
R4	350-0536	1	Resistor, Composition (1000-Ohm, 1/2 Watt, 10 percent)
R5	350-0548	1	Resistor, Composition (10000-Ohm, 1/2 Watt, 10 percent)
R6	350-0536	1	Resistor, Composition (1000-Ohm, 1/2 Watt, 10 percent)
R7	350-0524	1	Resistor, Composition (100-Ohm, 1/2 Watt, 10 percent)
R8	350-0544	1	Resistor, Composition (4700-Ohm, 1/2 Watt, 10 percent)
R9	350-0548	1	Resistor, Composition (10000-Ohm, 1/2 Watt, 10 percent)
R10	350-0529	1	Resistor, Composition (270-Ohm, 1/2 Watt, 10 percent)
R11	350-0370	1	Resistor, Composition (200-Ohm, 1/2 Watt, 5 percent)
R12	350-0533	1	Resistor, Composition (560-Ohm, 1/2 Watt, 10 percent)
R13	350-0536	1	Resistor, Composition (1000-Ohm, 1/2 Watt, 10 percent)
R14	350-0534	1	Resistor, Composition (680-Ohm, 1/2 Watt, 10 percent)
R15	350-0380	1	Resistor, Composition (510-Ohm, 1/2 Watt, 5 percent)
R16	350-0540	1	Resistor, Composition (2200-Ohm, 1/2 Watt, 10 percent)
R17	350-0529	1	Resistor, Composition (270-Ohm, 1/2 Watt, 10 percent)
R18	350-0524	1	Resistor, Composition (100-Ohm, 1/2 Watt, 10 percent)
TB1	332-1856	1	Board, Printed Wiring
SCR1	322-0175	1	Socket, Diode
XCR2	322-0175	1	Socket, Diode

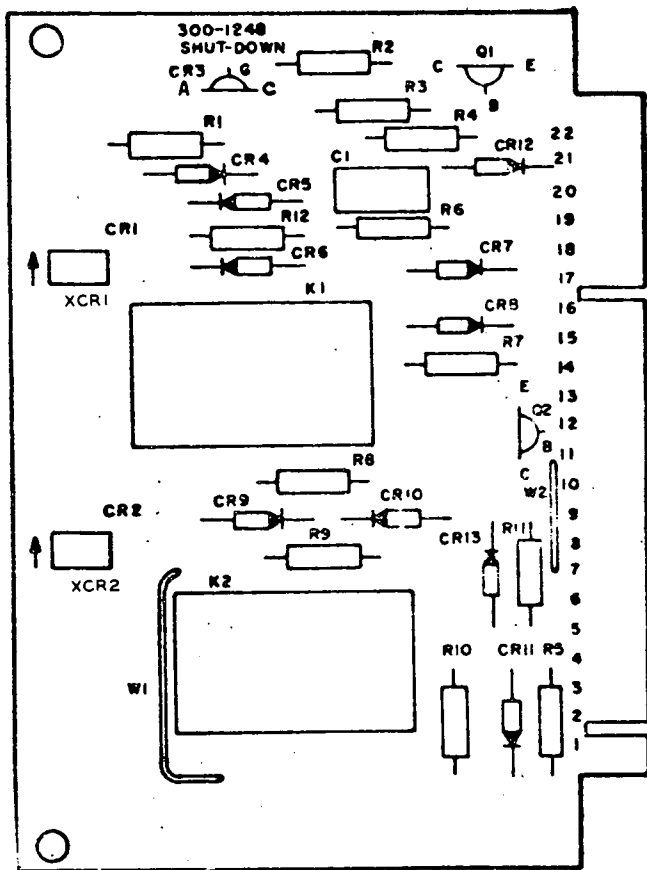
ENGINE MONITOR NO. 2 MODULE GROUP



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
R1	303-0169	1	Potentiometer (3.5 Megohm, 1/4 Watt)
R2	303-0169	1	Potentiometer (3.5 Megohm, 1/4 Watt)
R3	350-0555	1	Resistor, Composition (39000-Ohm, 1/2 Watt, 10 percent)
R4	350-0548	1	Resistor, Composition (10000-Ohm, 1/2 Watt, 10 percent)
R5	350-0534	1	Resistor, Composition (680-Ohm, 1/2 Watt, 10 percent)
R6	350-0370	1	Resistor, Composition (200-Ohm, 1/2 Watt, 5 percent)
R7	350-0548	1	Resistor, Composition (10000-Ohm, 1/2 Watt, 10 percent)
R8	350-0418	1	Resistor, Composition (20000-Ohm, 1/2 Watt, 10 percent)
R9	350-0370	1	Resistor, Composition (200-Ohm, 1/2 Watt, 5 percent)
R10	350-0548	1	Resistor, Composition (10000-Ohm, 1/2 Watt, 10 percent)
R11	350-0466	1	Resistor, Composition (2 Megohm, 1/2 Watt, 5 percent)
R12	350-0380	1	Resistor, Composition (510-Ohm, 1/2 Watt, 5 percent)
R13	350-0548	1	Resistor, Composition (10000-Ohm, 1/2 Watt, 10 percent)
R14	350-0548	1	Resistor, Composition (10000-Ohm, 1/2 Watt, 10 percent)
R15	350-0534	1	Resistor, Composition (680-Ohm, 1/2 Watt, 10 percent)
R16	350-0548	1	Resistor, Composition (10000-Ohm, 1/2 Watt, 10 percent)
R17	350-0370	1	Resistor, Composition (200-Ohm, 1/2 Watt, 5 percent)
R18	350-0370	1	Resistor, Composition (200-Ohm, 1/2 Watt, 5 percent)
R19	350-0394	1	Resistor, Composition (2000-Ohm, 1/2 Watt, 5 percent)
TB1	332-1852	1	Board, Printed Wiring
XCR1	322-0175	1	Socket, Diode
XCR2	322-0175	1	Socket, Diode

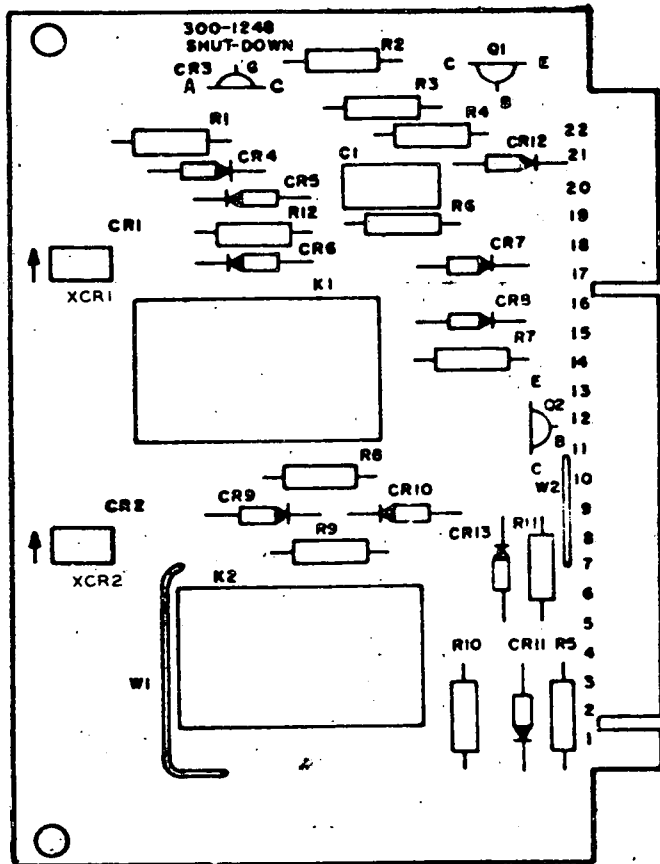
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	300-1247		Module, Engine Monitor No. 2
C1	350-0051	1	Capacitor, Electrolytic (6.8 Microfarad, 35 Volt)
C2	350-0051	1	Capacitor, Electrolytic (6.8 Microfarad, 35 Volt)
C3	350-0051	1	Capacitor, Electrolytic (6.8 Microfarad, 35 Volt)
CR1	322-0157	1	Diode, Light Emitting (Red)
CR2	322-0157	1	Diode, Light Emitting (Red)
CR3	364-0011	1	Diode, Rectifier (0.8 Ampere, 30 Volt)
CR4	364-0011	1	Diode, Rectifier (0.8 Ampere, 30 Volt)
CR5	357-0004	1	Diode, Rectifier (400-Milliampere, 400 Volt)
CR6	359-0028	1	Diode, Zener (500-Milliampere, 3.9 Volt, 5 percent)
CR7	359-0002	1	Diode, Zener (400-Milliampere, 13 Volt, 5 percent)
CR8	357-0004	1	Diode, Rectifier (400-Milliampere, 400 Volt)
CR9	357-0004	1	Diode, Rectifier (400-Milliampere, 400 Volt)
CR10	357-0004	1	Diode, Rectifier (400-Milliampere, 400 Volt)
CR11	357-0004	1	Diode, Rectifier (400-Milliampere, 400 Volt)
CR12	357-0004	1	Diode, Rectifier (400-Milliampere, 400 Volt)
IC1	367-0016	1	Integrated Circuit (Timing)
IC2	367-0016	1	Integrated Circuit (Timing)
Q1	326-0011	1	Transistor

ENGINE SHUTDOWN MODULE GROUP



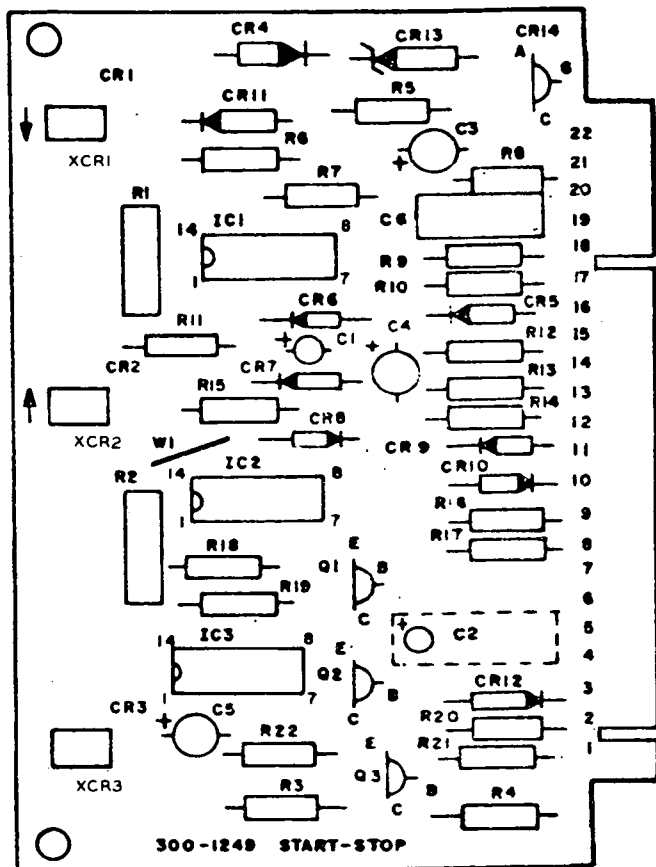
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION	REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	300-1248		Module, Engine Shutdown	R1	350-0524	1	Resistor, Composition (100-Ohm, 1/2 Watt, 10 percent)
C1	355-0015	1	Capacitor, Plastic Dielectric (0.1 Microfarad, 200 Volt)	R2	350-0533	1	Resistor, Composition (560-Ohm, 1/2 Watt, 10 percent)
CR1	322-0157	1	Diode, Light Emitting (Red)	R3	350-0529	1	Resistor, Composition (270-Ohm, 1/2 Watt, 10 percent)
CR2	322-0172	1	Diode, Light Emitting (Green)	R4	350-0540	1	Resistor, Composition (2200-Ohm, 1/2 Watt, 10 percent)
CR3	364-0011	1	Diode, Rectifier (0.8 Ampere, 30 Volt)	R5	350-0512	1	Resistor, Composition (10000-Ohm, 1/2 Watt, 10 percent)
CR4	357-0004	1	Diode, Rectifier (400 Milliampere, 400 Volt)	R6	350-0534	1	Resistor, Composition (680-Ohm, 1/2 Watt, 10 percent)
CR5	357-0004	1	Diode, Rectifier (400 Milliampere, 400 Volt)	R7	350-0533	1	Resistor, Composition (560-Ohm, 1/2 Watt, 10 percent)
CR6	357-0004	1	Diode, Rectifier (400 Milliampere, 400 Volt)	R8	350-0540	1	Resistor, Composition (2200-Ohm, 1/2 Watt, 10 percent)
CR7	357-0004	1	Diode, Rectifier (400 Milliampere, 400 Volt)	R9	350-0540	1	Resistor, Composition (2200-Ohm, 1/2 Watt, 10 percent)
CR8	357-0004	1	Diode, Rectifier (400 Milliampere, 400 Volt)	R10	350-0512	1	Resistor, Composition (10000-Ohm, 1/2 Watt, 10 percent)
CR9	357-0004	1	Diode, Rectifier (400 Milliampere, 400 Volt)	R11	350-0404	1	Resistor, Composition (5100-Ohm, 1/2 Watt, 5 percent)
CR10	357-0004	1	Diode, Rectifier (400 Milliampere, 400 Volt)	R12	350-0530	1	Resistor, Composition (330-Ohm, 1/2 Watt, 10 percent)
CR11	357-0004	1	Diode, Rectifier (400 Milliampere, 400 Volt)	TB1	332-1854	1	Board, Printed Wiring
CR12	357-0004	1	Diode, Rectifier (400 Milliampere, 400 Volt)	XCR1	322-0175	1	Socket, Relay
CR13	357-0004	1	Diode, Rectifier (400 Milliampere, 400 Volt)	XCR2	322-0175	1	Socket, Relay
K1	307-1076	1	Relay, Armature - Miniature (24 Volt)				
K2	307-1076	1	Relay, Armature - Miniature (24 Volt)				
Q1	362-0026	1	Transistor				
Q2	362-0011	1	Transistor				

ENGINE SHUTDOWN MODULE GROUP



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION	REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	300-1248		Module, Engine Shutdown	R1	350-0524	1	Resistor, Composition (100-Ohm, 1/2 Watt, 10 percent)
C1	355-0015	1	Capacitor, Plastic Dielectric (0.1 Microfarad, 200 Volt)	R2	350-0533	1	Resistor, Composition (560-Ohm, 1/2 Watt, 10 percent)
CR1	322-0157	1	Diode, Light Emitting (Red)	R3	350-0529	1	Resistor, Composition (270-Ohm, 1/2 Watt, 10 percent)
CR2	322-0172	1	Diode, Light Emitting (Green)	R4	350-0540	1	Resistor, Composition (2200-Ohm, 1/2 Watt, 10 percent)
CR3	364-0011	1	Diode, Rectifier (0.8 Ampere, 30 Volt)	R5	350-0512	1	Resistor, Composition (10000-Ohm, 1/2 Watt, 10 percent)
CR4	357-0004	1	Diode, Rectifier (400 Milliampere, 400 Volt)	R6	350-0534	1	Resistor, Composition (680-Ohm, 1/2 Watt, 10 percent)
CR5	357-0004	1	Diode, Rectifier (400 Milliampere, 400 Volt)	R7	350-0533	1	Resistor, Composition (560-Ohm, 1/2 Watt, 10 percent)
CR6	357-0004	1	Diode, Rectifier (400 Milliampere, 400 Volt)	R8	350-0540	1	Resistor, Composition (2200-Ohm, 1/2 Watt, 10 percent)
CR7	357-0004	1	Diode, Rectifier (400 Milliampere, 400 Volt)	R9	350-0540	1	Resistor, Composition (2200-Ohm, 1/2 Watt, 10 percent)
CR8	357-0004	1	Diode, Rectifier (400 Milliampere, 400 Volt)	R10	350-0512	1	Resistor, Composition (10000-Ohm, 1/2 Watt, 10 percent)
CR9	357-0004	1	Diode, Rectifier (400 Milliampere, 400 Volt)	R11	350-0404	1	Resistor, Composition (5100-Ohm, 1/2 Watt, 5 percent)
CR10	357-0004	1	Diode, Rectifier (400 Milliampere, 400 Volt)	R12	350-0530	1	Resistor, Composition (330-Ohm, 1/2 Watt, 10 percent)
CR11	357-0004	1	Diode, Rectifier (400 Milliampere, 400 Volt)	TB1	332-1854	1	Board, Printed Wiring
CR12	357-0004	1	Diode, Rectifier (400 Milliampere, 400 Volt)	XCR1	322-0175	1	Socket, Relay
CR13	357-0004	1	Diode, Rectifier (400 Milliampere, 400 Volt)	XCR2	322-0175	1	Socket, Relay
K1	307-1076	1	Relay, Armature - Miniature (24 Volt)				
K2	307-1076	1	Relay, Armature - Miniature (24 Volt)				
Q1	362-0026	1	Transistor				
Q2	362-0011	1	Transistor				

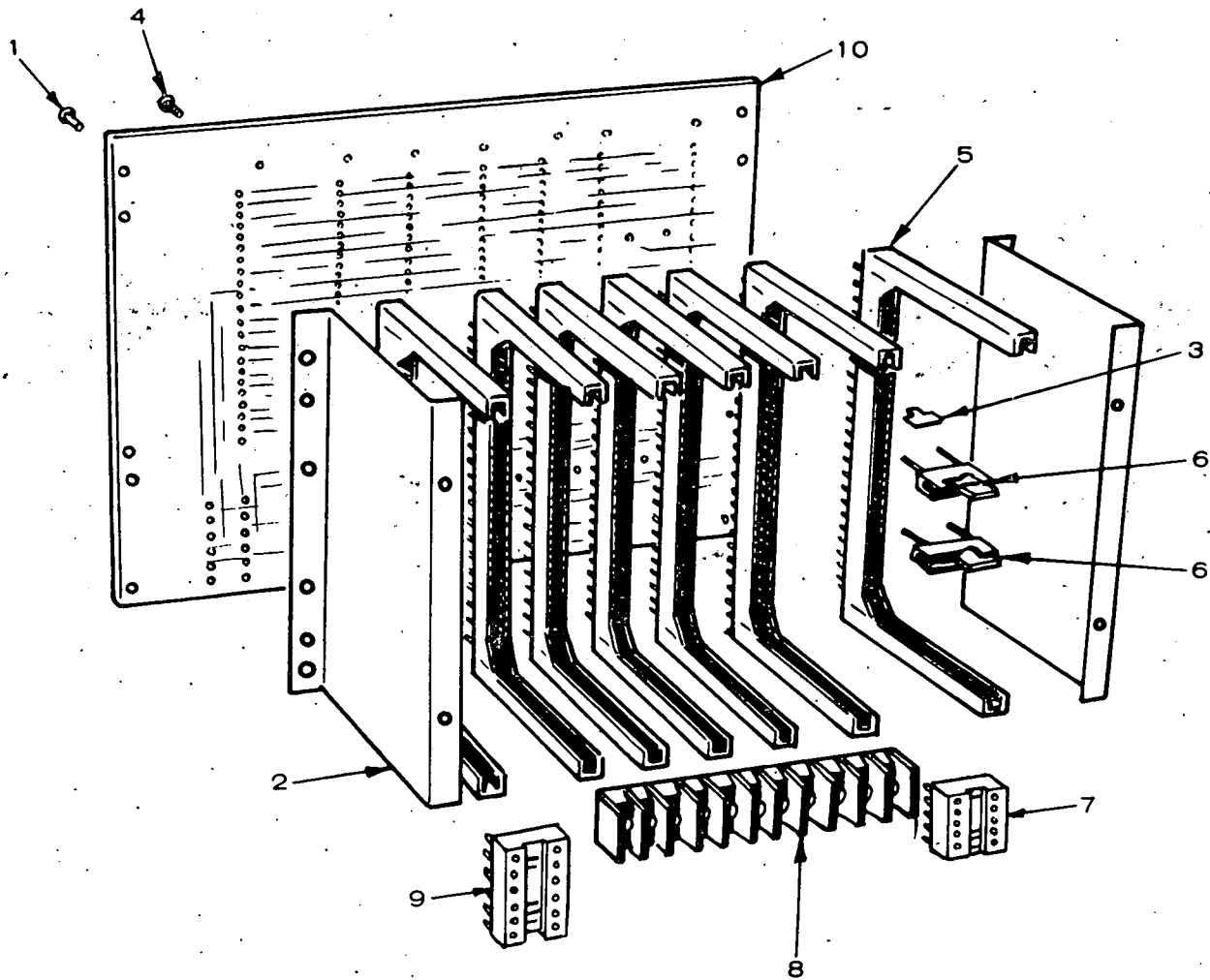
TIME DELAY START-STOP MODULE GROUP



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	300-1249		Module, Time Delay Start-Stop
C1	356-0059	1	Capacitor, Electrolytic (2.2 Microfarad, 35 Volt)
C2	356-0059	1	Capacitor, Electrolytic (2.2 Microfarad, 35 Volt)
C3	356-0051	1	Capacitor, Electrolytic (6.8 Microfarad, 35 Volt)
C4	356-0051	1	Capacitor, Electrolytic (6.8 Microfarad, 35 Volt)
C5	356-0051	1	Capacitor, Electrolytic (6.8 Microfarad, 35 Volt)
C6	355-0025	1	Capacitor, Plastic Dielectric (0.1 Microfarad, 100 Volt)
CR1	322-0172	1	Diode, Light Emitting (Green)
CR2	322-0157	1	Diode, Light Emitting (Red)
CR3	322-0171	1	Diode, Light Emitting (Red/Green)
CR4	357-0004	1	Diode, Rectifier (400 Milliampere, 400 Volt)
CR5	357-0004	1	Diode, Rectifier (400 Milliampere, 400 Volt)
CR6	357-0004	1	Diode, Rectifier (400 Milliampere, 400 Volt)
CR7	357-0004	1	Diode, Rectifier (400 Milliampere, 400 Volt)
CR8	357-0004	1	Diode, Rectifier (400 Milliampere, 400 Volt)
CR9	357-0004	1	Diode, Rectifier (400 Milliampere, 400 Volt)
CR10	357-0004	1	Diode, Rectifier (400 Milliampere, 400 Volt)
CR11	357-0004	1	Diode, Rectifier (400 Milliampere, 400 Volt)
CR12	357-0004	1	Diode, Rectifier (400 Milliampere, 400 Volt)

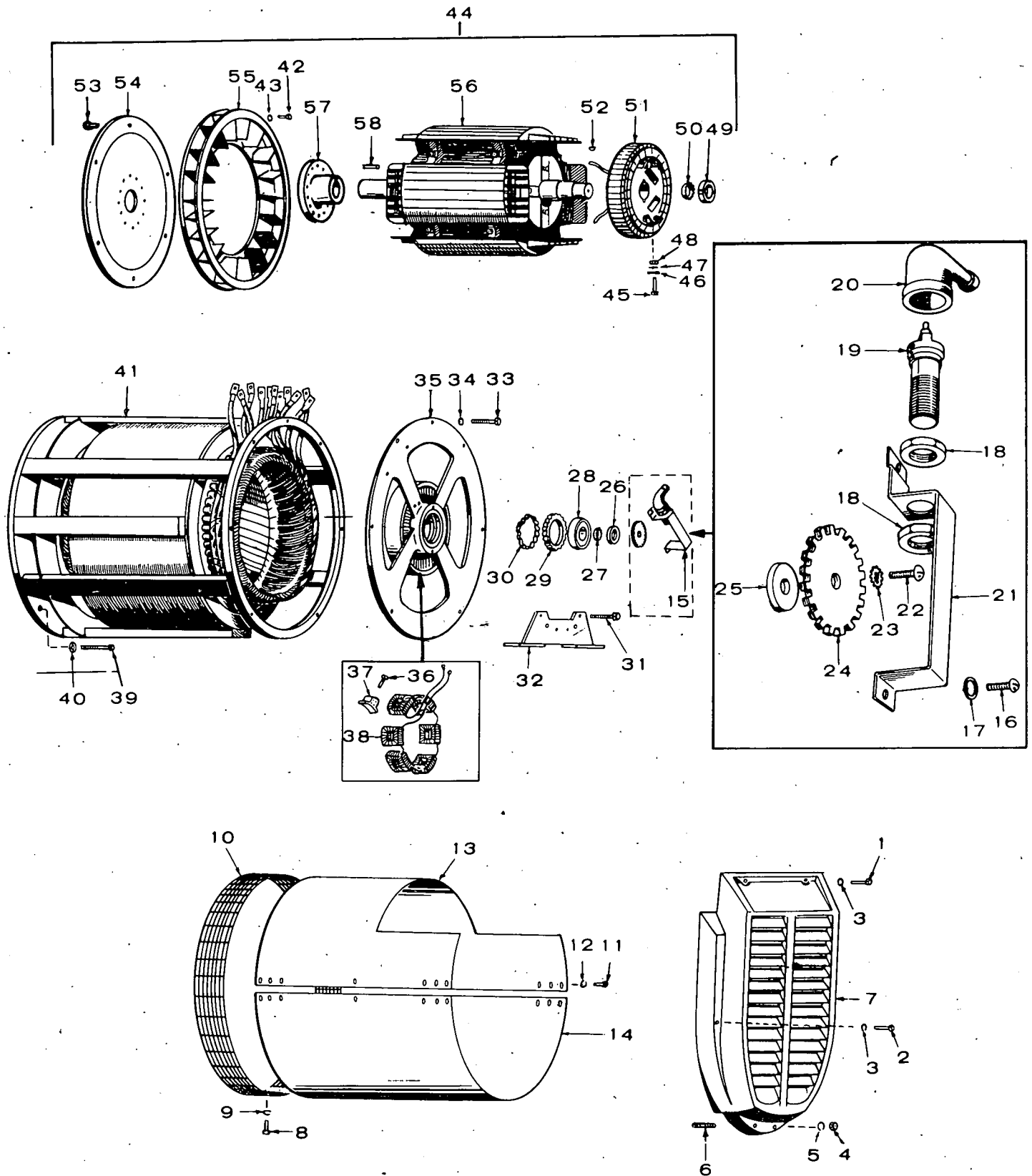
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
IC1	367-0016	1	Integrated Circuit (Timing)
IC2	367-0016	1	Integrated Circuit (Timing)
IC3	367-0017	1	Integrated Circuit (Counter 7 stage)
Q1	362-0011	1	Transistor
Q2	362-0011	1	Transistor
Q3	362-0011	1	Transistor
R1	303-0169	1	Potentiometer (3.5 Megohm, 1/4 Watt)
R2	303-0169	1	Potentiometer (3.5 Megohm, 1/4 Watt)
R3	350-0418	1	Resistor, Composition (20000-Ohm, 1/2 Watt, 5 percent)
R4	350-0376	1	Resistor, Composition (360-Ohm, 1/2 Watt, 5 percent)
R5	350-0548	1	Resistor, Composition (10000-Ohm, 1/2 Watt, 10 percent)
R6	350-0379	1	Resistor, Composition (470-Ohm, 1/2 Watt, 5 percent)
R7	350-0370	1	Resistor, Composition (200-Ohm, 1/2 Watt, 5 percent)
R8	350-0505	1	Resistor, Composition (2.7-Ohm, 1/2 Watt, 10 percent)
R9	350-0379	1	Resistor, Composition (470-Ohm, 1/2 Watt, 5 percent)
R10	350-0394	1	Resistor, Composition (2000-Ohm, 1/2 Watt, 5 percent)
R11	350-0548	1	Resistor, Composition (10000-Ohm, 1/2 Watt, 10 percent)
R12	350-0443	1	Resistor, Composition (220000-Ohm, 1/2 Watt, 5 percent)
R13	350-0537	1	Resistor, Composition (1200-Ohm, 1/2 Watt, 10 percent)
R14	350-0394	1	Resistor, Composition (2000-Ohm, 1/2 Watt, 5 percent)
R15	350-0548	1	Resistor, Composition (10000-Ohm, 1/2 Watt, 10 percent)
R16	350-0394	1	Resistor, Composition (2000-Ohm, 1/2 Watt, 5 percent)
R17	350-0537	1	Resistor, Composition (1200-Ohm, 1/2 Watt, 10 percent)
R18	350-0548	1	Resistor, Composition (10000-Ohm, 1/2 Watt, 10 percent)
R19	350-0418	1	Resistor, Composition (20000-Ohm, 1/2 Watt, 5 percent)
R20	350-0537	1	Resistor, Composition (1200-Ohm, 1/2 Watt, 10 percent)
R21	350-0537	1	Resistor, Composition (1200-Ohm, 1/2 Watt, 10 percent)
R22	350-0394	1	Resistor, Composition (2000-Ohm, 1/2 Watt, 5 percent)
TB1	332-1864	1	Board, Printed Wiring
XCR1	322-0175	1	Socket, Diode
XCR2	322-0175	1	Socket, Diode
XCR3	322-0175	1	Socket, Diode

CONTROL CHASSIS GROUP



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	818-0003	4	Rivet, Tubular (#6)
2	301-3881	2	Bracket, Mounting, Cover
3	332-1917	14	Plug, Key - Plug-in Module
4	812-0027	14	Screw, Machine - Round Head (#4-40 x 1/4")
5	332-1887	7	Socket, Plug-in Module
6	308-0324	2	Switch, Slide
7	323-0985	1	Connector, Receptacle, Electrical (10 Pin)
8	332-1909	1	Terminal Board (11 Place)
9	323-0983	1	Connector, Receptacle, Electrical (12 Pin)
10	332-1844	1	Board, Printed Wiring

GENERATOR GROUP



GENERATOR GROUP

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION	REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	800-0009	4	Screw, Cap - Hex Head (1/4-20 x 1-1/2")	34	850-0050	6	Washer, Lock - Spring (3/8")
2	800-0013	2	Screw, Cap - Hex Head (1/4-20 x 2-1/2")	35	211-0170	1	End Bell Assembly (Includes Replaceable Parts Marked *)
3	850-0040	6	Washer, Lock - Spring (1/4")	36	800-0031	12	*Screw, Cap - Hex Head (5/16-18 x 1-1/2")
4	862-0007	4	Nut, Hex (5/8-11)	37	221-0153	6	*Shoe, Pole - Exciter Stator
5	850-0070	4	Washer, Lock - Spring (5/8")	38	222-1693	1	*Coil Assembly, Field - Exciter Stator (Set of Six Coils)
6	520-0692	2	Stud (5/8-11 x 5/8-11 x 3-3/4")				
7	232-1923	1	Grill - Generator End Bell				
8	800-0003	1	Screw, Cap - Hex Head (1/4-20 x 1/2")	39	800-0092	16	Screw, Cap - Hex Head (1/2-13 x 1-1/2")
9	850-0040	1	Washer, Lock - Spring (1/4")	40	850-0060	16	Washer, Lock - Spring (1/2")
10	234-0272	1	Cover, Fan	41	£	1	Stator, Wound - Generator
11	800-0026	6	Screw, Cap - Hex Head (5/16-18 x 3/4")	42	800-0133	6	Screw, Cap - Hex Head (5/8-11 x 1-3/4")
12	850-0045	6	Washer, Lock - Spring (5/16")	43	850-0070	6	Washer, Lock - Spring (5/8")
13	234-0292	1	Band, Stator - Top	44	£	1	Rotor Assembly, Generator (Includes Parts Marked *)
14	234-0282	1	Band, Stator - Bottom				
15	150-1556	1	Sensor Assembly - Speed (Includes parts marked †)	45	820-1067	2	*Screw, Machine - Pan Head, Cross-Recessed (#10-32 x 1")
16	812-0148	2	Screw, Machine - Round Head (1/4-20 x 1/2")	46	526-1009	2	*Washer, Flat - Cadmium Plated (7/32" ID x 1/2" OD x 1/16" Thk)
17	850-0040	2	Washer, Lock - Spring (1/4")	47	850-1030	2	*Washer, Lock - Spring, Cadmium Plated (#10)
18	868-0011	2	†Nut, Hex - Jam (3/4-16)	48	870-1053	2	*Nut, Hex (#10-32)
19	150-1406	1	†Sensor, Magnetic - Speed	49	510-0092	1	*Nut, Lock - Bearing
20	150-1410	1	†Cap, Insulator	50	510-0094	1	*Washer, Lock - Bearing
21	150-1555	1	†Bracket, Mounting - Speed Sensor	51	201-1501	1	*Rotor Assembly, Exciter (See Separate Group for Component parts)
22	812-0192	1	Screw, Machine - Round Head (3/8-16 x 1")				
23	856-0010	1	Washer, Lock - External/Internal Tooth (3/8")	52	515-0162	1	*Key, Rectangular
24	150-1557	1	Wheel - Speed Sensor	53	805-0035	12	*Bolt (5/8-11 x 1-1/2")
25	526-0077	1	Washer, Flat (13/32" ID x 1-1/4" OD x 1/4" Thk)	54	232-1880	1	*Disc, Drive - Rotor
26	510-0091	1	*Nut, Lock - Bearing	55	205-0076	1	*Fan, Generator
27	510-0093	1	*Washer, Lock - Bearing	56	£	1	*Rotor, Wound - Generator (Includes Drive Hub and Key)
28	510-0090	1	*Bearing, Ball	57	232-1870	1	*Hub, Drive
29	232-1923	1	Ring, Holder - Bearing	58	515-0161	1	*Key, Rectangular
30	232-1924	1	Spring - Bearing Ring Holder				
31	805-0035	2	Bolt - Hex Head (5/8-11 x 1-1/2")				
32	232-1957	1	Support, Generator				
33	800-0051	6	Screw, Cap - Hex Head (3/8-16 x 1-1/4")				

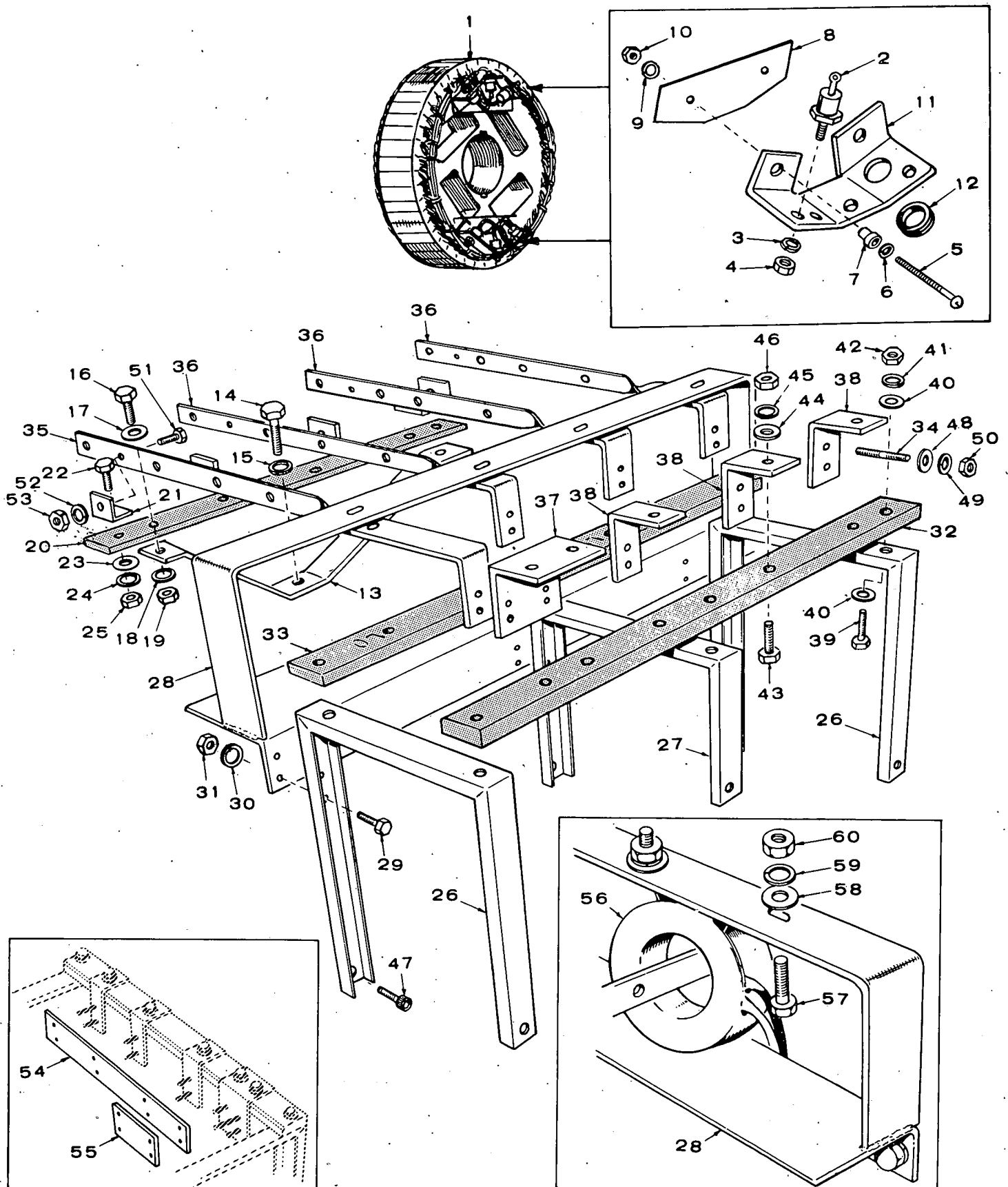
† - Included in Speed Sensor Assembly.

* - Included in End Bell Assembly.

★ - Included in Generator Rotor Assembly.

£ - Furnish Model, Specification and Serial Numbers from the Onan nameplate when ordering these parts.

EXCITER ROTOR AND BUS BAR GROUP

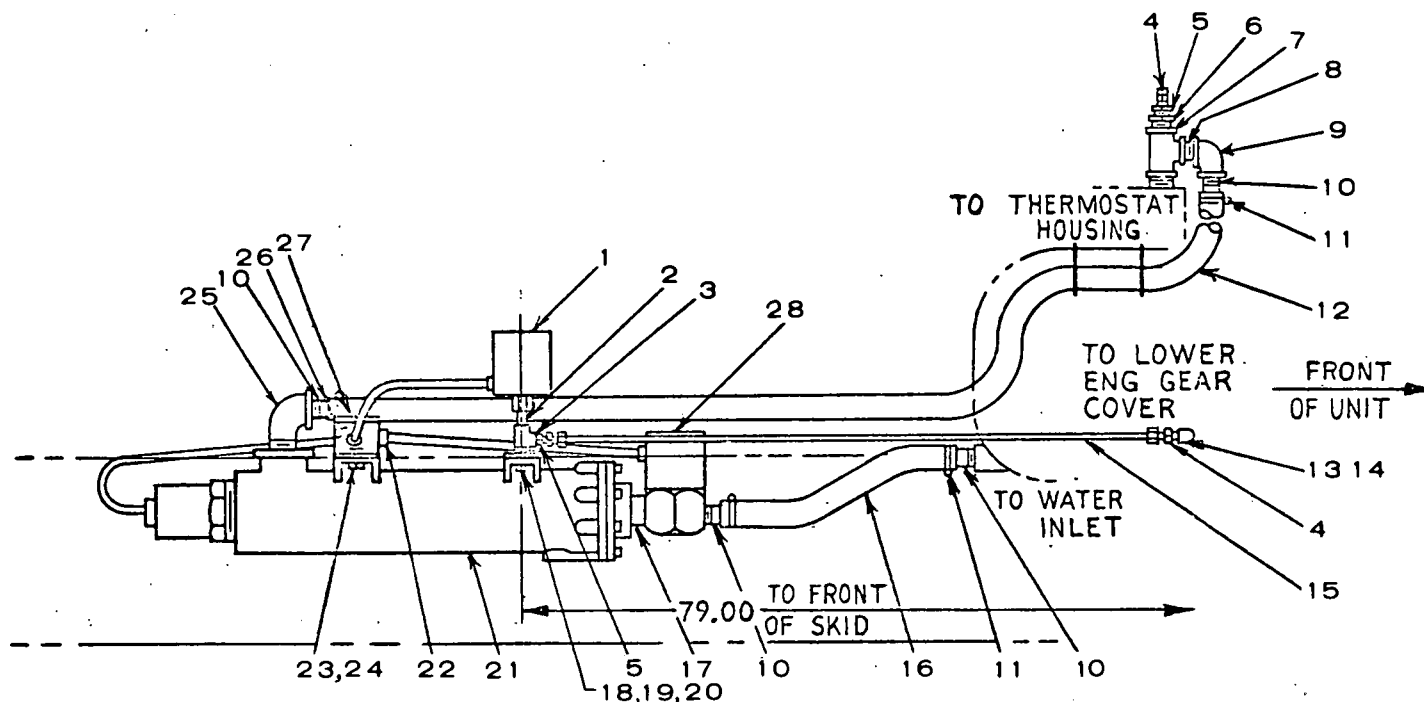


EXCITER ROTOR AND BUS BAR GROUP

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION	REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	201-1501	1	Rotor Assembly, Exciter - Wound (Includes Parts Marked †) - Also shown in Generator Group	33	232-1995	1	Board, Insulating
2	†RECTIFIER			34	520-0693	16	Stud (5/16-18 x 5/16-18 x 1-5/8")
	358-0011	3	Positive Stud	35	232-1996	1	Bar, Bus (17-3/8" Lg)
	358-0012	3	Negative Stud	36	232-2001	3	Bar, Bus (13-1/4" Lg)
3	850-0040	6	†Washer, Lock - Spring (1/4")	37	232-1991	1	Bar, Bus (Double)
4	868-0001	6	†Nut, Hex - Jam (1/4-28)	38	232-1990	3	Bar, Bus
5	813-0114	4	†Screw, Machine - Round Head (#10-32 x 3")	39	800-0052	9	Screw, Cap - Hex Head (3/8-16 x 1-1/2")
6	526-0008	4	†Washer, Flat (13/64" ID x 7/16" OD x 1/32" Thk)	40	526-0029	18	Washer, Flat (25/64" ID x 7/8" OD x 1/16" Thk)
7	508-0124	4	†Bushing, Shoulder - Insulating	41	850-0050	9	Washer, Lock - Spring (3/8")
8	232-1985	4	†Insulator, Heat Shield	42	862-0003	9	Nut, Hex (3/8-16)
9	850-0030	4	†Washer, Lock - Spring (#10)	43	800-0052	6	Screw, Cap - Hex Head (3/8-16 x 1-1/2")
10	870-0053	4	†Nut, Hex (#10-32)	44	526-0029	6	Washer, Flat (25/64" ID x 7/8" OD x 1/16" Thk)
11	†RECTIFIER HEATSINK			45	850-0050	6	Washer, Lock - Spring (3/8")
	363-0033	1	Negative	46	862-0003	6	Nut, Hex (3/8-16)
	363-0025	1	Positive	47	802-0069	6	Screw, Cap - Socket Head (3/8-16 x 5/8")
12	508-0093	2	†Grommet, Rubber	48	526-0115	32	Washer, Flat (11/32" ID x 11/16" OD x 1/16" Thk)
13	232-1994	1	Bracket, Bus Bar	49	850-0045	32	Washer, Lock - Spring (5/16")
14	800-0151	1	Screw, Cap - Hex Head (3/4-10 x 1")	50	862-0015	32	Nut, Hex (5/16-18)
15	850-0079	1	Washer, Lock - Spring (3/4")	51	800-0005	4	Screw, Cap - Hex Head (1/4-20 x 3/4")
16	800-0051	2	Screw, Cap - Hex Head (3/8-16 x 1-1/4")	52	850-0040	4	Washer, Lock - Spring (1/4")
17	526-0029	2	Washer, Flat (25/64" ID x 7/8" OD x 1/16" Thk)	53	862-0001	4	Nut, Hex (1/4-20)
18	850-0050	2	Washer, Lock - Spring (3/8")	54	232-1993	1	Jumper, Bus Bar (Used on Paralle Wye Wound Generator)
19	862-0003	2	Nut, Hex (3/8-16)	55	232-2005	1	Jumper, Bus Bar (Used on Delta Wound Generator)
20	232-1997	1	Board, Insulating	56	TRANSFORMER, CURRENT (Check Transformer Nameplate—Select According to Rating)		
21	232-1992	4	Bracket, Bus Bar	302-0547	3	Nameplate Reads 500/5	
22	800-0007	4	Screw, Cap - Hex Head (1/4-20 x 1")	302-0625	3	Nameplate Reads 750/5	
23	526-0018	4	Washer, Flat (17/64" ID x 5/8" OD x 1/16")	302-0589	3	Nameplate Reads 1000/5	
24	850-0040	4	Washer, Lock - Spring (1/4")	302-0643	3	Nameplate Reads 1200/5	
25	862-0001	4	Nut, Hex (1/4-20)	302-0644	3	Nameplate Reads 1500/5	
26	232-1999	2	Bracket, Terminal Board Mounting	302-0645	3	Nameplate Reads 2000/5	
27	232-2000	1	Bracket, Terminal Board Mounting	57	800-0052	6	Screw, Cap - Hex Head (3/8-16 x 1-1/2")
28	315-0302	1	Shelf, Current Transformer	58	526-0029	6	Washer, Flat (25/64" ID x 7/8" OD x 1/16" Thk)
29	800-0005	6	Screw, Cap - Hex Head (1/4-20 x 3/4")	59	850-0050	6	Washer, Lock - Spring (3/8")
30	850-0040	6	Washer, Lock - Spring (1/4")	60	862-0003	6	Nut, Hex (3/8-16)
31	862-0001	6	Nut, Hex (1/4-20)				
32	232-1998	1	Board, Insulating				

† - Included in 201-1501 Exciter Rotor Assembly.

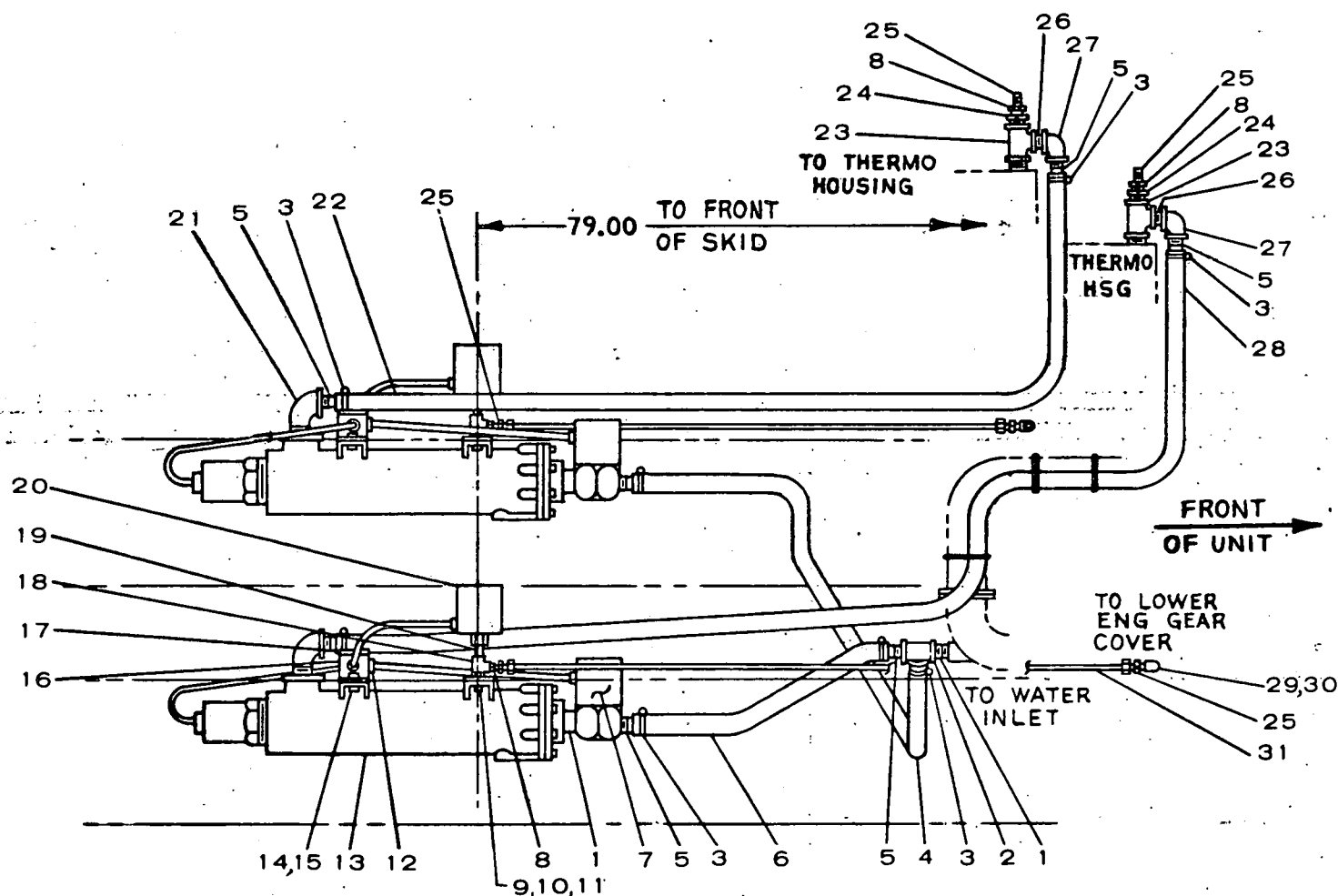
179-2051 INSTALLATION 240 VOLT WATER JACKET HEATER - STANDARD EQUIPMENT



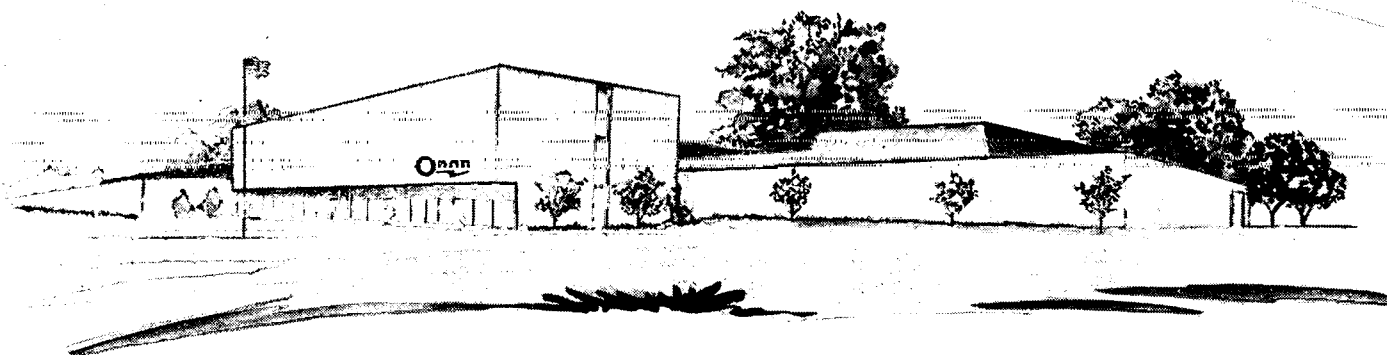
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION	REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	309-0271	1	Switch, Pressure - Oil	14	505-0037	1	Elbow, Pipe - 90° (1/8" NPT)
2	505-0099	1	Nipple, Pipe - Close (1/4" NPT x 7/8")	15	501-0199	1	Line, Fuel - Flexible (55" Lg)
3	333-0142	1	Support - Oil Pressure Switch	16	503-0792	1	Hose, Rubber (1" ID x 1-3/8" OD x 12-1/2" Lg)
4	502-0193	3	Connector, Pipe - Male (1/8" NPT x 1/2-20)	17	505-0107	1	Nipple, Pipe - Close (1" NPT x 2")
5	505-0007	2	Bushing, Reducer - Pipe (1/4" NPT x 1/8" NPT)	18	813-0103	2	Screw, Machine - Round Head (#10-32 x 3/4")
6	505-0020	1	Bushing, Reducer - Pipe (3/4" NPT x 1/4" NPT)	19	850-0030	2	Washer, Lock - Spring (#10)
7	505-0166	1	Tee, Pipe (3/4" NPT)	20	870-0053	2	Nut, Hex (#10-32)
8	505-0102	2	Nipple, Pipe (3/4" NPT x 1-3/8")	21	333-0138	1	Heater, Water (4000 Watt, 240 Volt)
9	505-0356	1	Elbow, Pipe - 90°, Reducing (3/4" NPT x 1" NPT)	22	331-0027	5	Connector, Conduit (1/2")
10	505-0759	4	Adapter, Pipe (1" NPT)	23	800-0008	2	Screw, Cap - Hex Head (1/4-20 x 1-1/8")
11	503-0398	4	Clamp, Hose	24	870-0212	2	Nut, Self-locking, Hex (1/4-20)
12	503-0793	1	Hose, Rubber (1" ID x 1-3/8" OD x 80" Lg)	25	505-0003	1	Elbow, Pipe - Street, 90° (1" NPT)
13	505-0104	1	Nipple, Pipe (1/8" NPT x 1-1/2")	26	330-0005	1	Box, Electrical - Outlet
				27	330-0004	1	Cover, Box - Electrical Outlet
				28	309-0253	1	Thermostat

**179-2052 INSTALLATION 240 VOLT DUAL WATER JACKET HEATERS—
OPTIONAL EQUIPMENT**

**179-2053 INSTALLATION 480 VOLT DUAL WATER JACKET HEATERS—
OPTIONAL EQUIPMENT**



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION	REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	505-0004	3	Nipple, Pipe (1" NPT x 1-1/2")	16	330-0005	2	Box, Electrical - Outlet
2	505-0304	1	Tee, Pipe (1" NPT)	17	330-0004	2	Cover, Box - Electrical Outlet
3	503-0398	8	Clamp, Hose	18	333-0142	2	Support - Oil Pressure Switch
4	503-0798	1	Hose, Rubber (1" ID x 1-3/8" OD x 40" Lg)	19	505-0099	2	Nipple, Pipe - Close (1/4" NPT x 7/8")
5	505-0759	8	Adapter, Pipe (1" NPT)	20	309-0271	2	Switch, Pressure - Oil
6	503-0282	1	Hose, Rubber (1" ID x 1-3/8" OD x 10" Lg)	21	505-0003	2	Elbow, Pipe - Street, 90° (1" NPT)
7	309-0253	2	Thermostat	22	503-0797	1	Hose, Rubber (1" ID x 1-3/8" OD x 100" Lg)
8	505-0007	4	Bushing, Reducer - Pipe (1/4" NPT x 1/8" NPT)	23	505-0166	2	Tee, Pipe (3/4" NPT)
9	813-0103	4	Screw, Machine - Round Head (#10-32 x 3/4")	24	505-0020	2	Bushing, Reducer - Pipe (3/4" NPT x 1/4" NPT)
10	850-0030	4	Washer, Lock - Spring (#10)	25	502-0193	6	Connector, Pipe - Male (1/8" NPT x 1/2-20)
11	870-0053	4	Nut, Hex (#10-32)	26	505-0102	4	Nipple, Pipe (3/4" NPT x 1-3/8")
12	331-0027	10	Connector, Conduit (1/2")	27	505-0356	2	Elbow, Pipe - Reducing, 90° (3/4" NPT x 1" NPT)
13	HEATER, WATER JACKET			28	503-0793	1	Hose, Rubber (1" ID x 1-3/8" OD x 80" Lg)
	333-0143	2	4000 Watt, 208/240 Volt)	29	505-0104	2	Nipple, Pipe (1/8" NPT x 1-1/2")
	333-0144	2	3750 Watt, 480 Volt)	30	505-0037	2	Elbow, Pipe - 90° (1/8" NPT)
14	800-0008	4	Screw, Cap - Hex Head (1/4-20 x 1-1/8")	31	501-0199	2	Line, Fuel - Flexible (55" Lg)
15	870-0212	4	Nut, Self-locking, Hex (1/4-20)				



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