Onan®

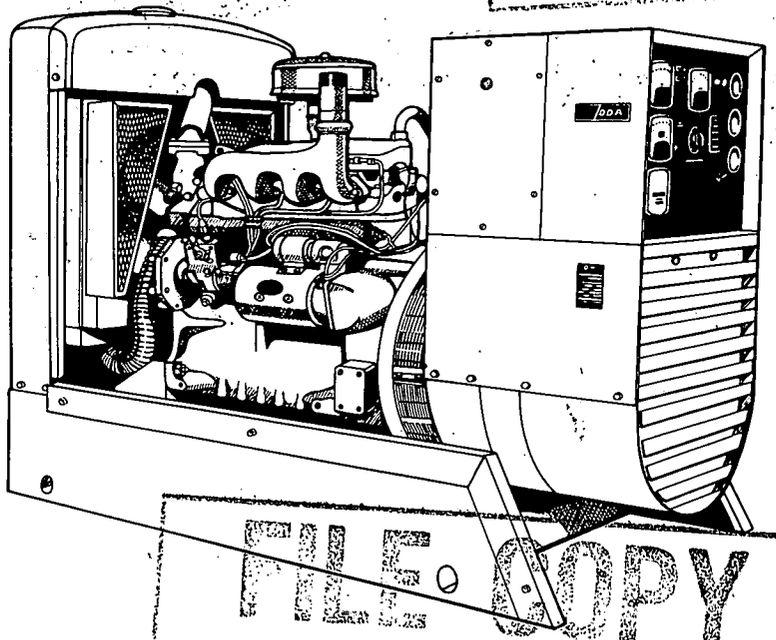
OPERATORS MANUAL AND PARTS CATALOG

FOR

ELECTRIC GENERATING SETS

DDA

SERIES



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(Replaces 4A74)

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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/m	rpm
Temperature	Celsius (°C)	Fahrenheit (°F)

The customary unit of Brake Horsepower (BHP) becomes kilowatts (kW) when converted to S I 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.

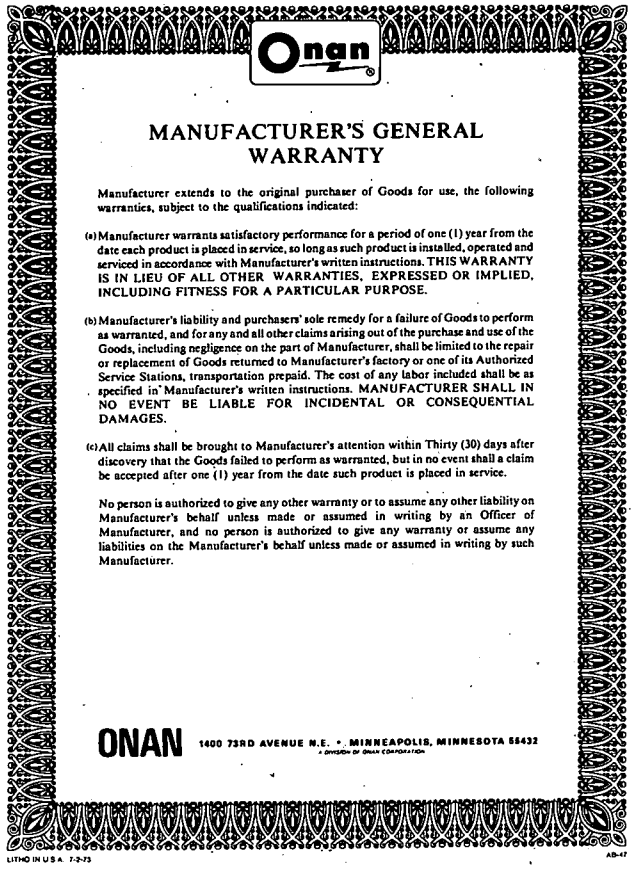
INTRODUCTION

FOREWORD

This manual is applicable to the DDA Series electric generating set, consisting of an Onan UR 30.0KW AC generator, driven by a John Deere 4219D diesel engine. Information is provided on installation, operation, troubleshooting and parts ordering for the set. The manual should be used in conjunction with the John Deere engine manual, as your specific engine may have variations due to optional equipment available.

WARNING **Onan uses this symbol throughout the text to warn of possible injury or death.**

CAUTION **This symbol is used to warn of possible equipment damage.**



Onan

MANUFACTURER'S GENERAL WARRANTY

Manufacturer extends to the original purchaser of Goods for use, the following warranties, subject to the qualifications indicated:

(a) Manufacturer warrants satisfactory performance for a period of one (1) year from the date each product is placed in service, so long as such product is installed, operated and serviced in accordance with Manufacturer's written instructions. THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING FITNESS FOR A PARTICULAR PURPOSE.

(b) Manufacturer's liability and purchasers' sole remedy for a failure of Goods to perform as warranted, and for any and all other claims arising out of the purchase and use of the Goods, including negligence on the part of Manufacturer, shall be limited to the repair or replacement of Goods returned to Manufacturer's factory or one of its Authorized Service Stations, transportation prepaid. The cost of any labor included shall be as specified in Manufacturer's written instructions. MANUFACTURER SHALL IN NO EVENT BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

(c) All claims shall be brought to Manufacturer's attention within Thirty (30) days after discovery that the Goods failed to perform as warranted, but in no event shall a claim be accepted after one (1) year from the date such product is placed in service.

No person is authorized to give any other warranty or to assume any other liability on Manufacturer's behalf unless made or assumed in writing by an Officer of Manufacturer, and no person is authorized to give any warranty or assume any liabilities on the Manufacturer's behalf unless made or assumed in writing by such Manufacturer.

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• DIVISION OF ONAN CORPORATION

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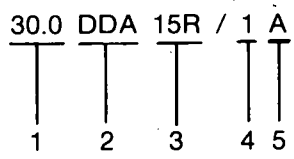
MODEL IDENTIFICATION

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.



1. Indicates Kilowatt rating.
2. Factory code for SERIES identification.
3. 15 indicates reconnectible
   R indicates remote electric start
4. Factory code for designating optional equipment.
5. Specification letter. (Advances when factory makes production modifications.)

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

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

IMPORTANT! RETURN WARRANTY CARD ATTACHED TO UNIT.

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.

SPECIFICATIONS

ENGINE DETAILS

Engine Manufacturer	John Deere
Engine Series	300-4219D
Number of Cylinders	4
Displacement	219 cu. inch (3.59 litres)
BHP @ 1800 r/m	58 (43.27 kW)
Compression Ratio	16.3:1
Bore	4.02-inches (102.11 mm)
Stroke	4.33-inches (109.98 mm)
Fuel	ASTM No. 2 Diesel
Battery Voltage	12
Battery Group (Two 6-Volt, 135-A.H. [486 kC])	2H
Starting Method	Solenoid Shift
Governor Regulation	5% No Load—Full load
Battery Charging Current	35

GENERATOR DETAILS

Type	UR 15, 60 Hz UR 515, 50 Hz UR 3, 60 Hz
Rating (Watts)	
60 Hertz Continuous Standby	30,000 (37.5 kVA)
50 Hertz Continuous Standby	25,000 (31.25 kVA)
AC Voltage Regulation	± 2%
60 Hertz r/m	1800
50 Hertz r/m	1500
Output Rating	0.8 PF
AC Frequency Regulation	3 Hz

CAPACITIES AND REQUIREMENTS

Cooling System (Includes Radiator)	4.25 gal. (16.1 litre)
Engine Oil Capacity (Filter, Lines, Crankcase)	6 qt. (5.7 litre)
Exhaust Connection (inches pipe thread)	2

AIR REQUIREMENTS (1800 r/m)

Engine Combustion	135 CFM (0.06 m^3/s)
Radiator Cooled Engine	3875 CFM (1.83 m^3/s)
Total for Radiator Cooled Model	4010 CFM (1.9 m^3/s)
Alternator Cooling Air	
(1800 r/m)	1000 CFM (0.47 m^3/s)
(1500 r/m)	834 CFM (0.4 m^3/s)
Fuel Consumption at Rated Load	2.50 Gallon/Hr. (9.5 lit/hr)

GENERAL

Height	45.5-inches (1.16 m)
Width	33.0-inches (0.838 m)
Length	66.0-inches (1.8 m)
Approx. Weight (Mass)	1780 lbs. (799 kg)

TABLE 1. UR GENERATOR VOLTAGE/CURRENT OPTIONS

VOLTS	FREQ.	PHASE	AMPERES	DOUBLE DELTA	SERIES DELTA	PARALLEL WYE	SERIES WYE	REF. VOLTAGE WIRE (W12) TAP
110/220	50 Hz	1	142 *	x				H6
115/230	50 Hz	1	136 *	x				H6
120/240	60 Hz	1	156 *	x				H5
110/190	50 Hz	3	94			x		H3
115/200	50 Hz	3	90			x		H4
120/208	60 Hz	3	104			x		H4
110/220	50 Hz	3	82		x			H6
127/220	60 Hz	3	98			x		H4
115/230	50 Hz	3	78		x			H6
120/240	60 Hz	3	90		x			H5
139/240	60 Hz	3	90			x		H5
220/380	50 Hz	3	47				x	H3
230/400	50 Hz	3	45				x	H4
240/416	60 Hz	3	52				x	H4
254/440	60 Hz	3	49				x	H5
277/480	60 Hz	3	45				x	H5
9X 347/600	60 Hz	3	36					H5 — Not Reconnectible
3 120/240	60 Hz	1	156					Not Reconnectible
53 115/230	50 Hz	1	136					Not Reconnectible

30.0 kW 37.5 kVA 60 Hz
25.0 kW 31.25 kVA 50 Hz

* - These current valves are available only from special long stack units. When standard 3-phase unit is reconnected into Double Delta configuration, maximum current is 2/3 that of valve given

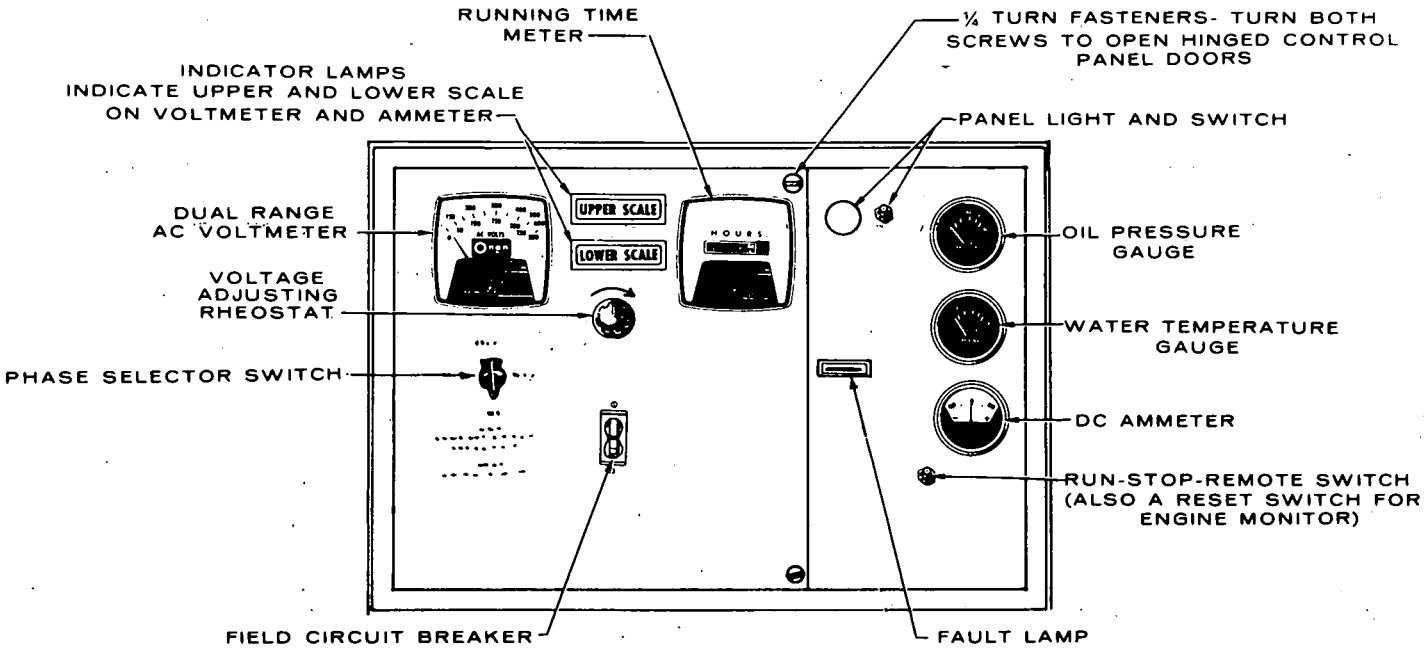


FIGURE 1. TYPICAL CONTROL PANEL (ONE FAULT LAMP)

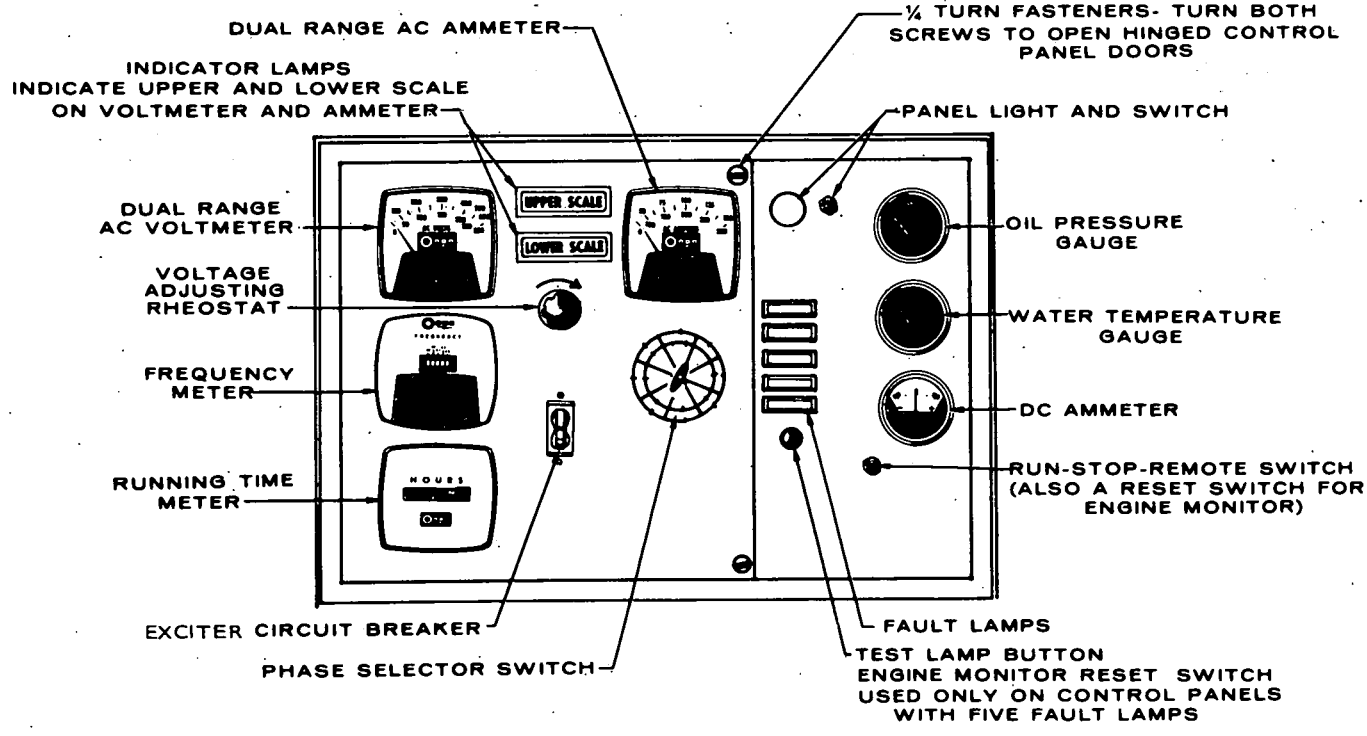


FIGURE 2. OPTIONAL CONTROL PANEL (FIVE FAULT LAMPS)

DESCRIPTION

GENERAL

An Onan DDA 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 DDA is a John Deere 4219 D as described in the engine manual. Basic measurements and requirements will be found under *Specifications.* For operation, maintenance and service information, consult the John Deere manual.

AC GENERATOR

The generator is an ONAN Type UR, 12 lead 4-pole revolving field, reconnectible, 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 rpm, the 50 Hz at 1500 rpm. 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 the battery charging current.

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

Warning Light: Indicates "Fault" in engine operation.

AC Panel

AC Voltmeter: Indicates AC generator output voltage. Dual range instrument: measurement range in use shown on indicator light.

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

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.

OPTIONAL EQUIPMENT

DC Panel

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

a. Overcrank (failed to start)
b. Overspeed
c. Low oil pressure
d. High engine temperature
e. Low engine temperature

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

AC Panel

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

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

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

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

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

CONTROL PANEL INTERIOR

The only equipments discussed in this section will be those which the operator may have reason to adjust or inspect for service.

Terminal Board (TB) 21: Connection of wire W12 to terminals H3, H4, H5, and H6 is made at this point, to change reference voltage when reconnecting generator for different voltages. Refer to Figure 14.

Voltage Regulator: Solid state unit, consisting of VR21, CR21 and L21. 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 r/m).
   c. Low oil pressure (14 psi: 96.6 kPa).
   d. High engine temperature (215° F: 102° C).

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

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.

TABLE 2. FAULT LAMP OPTIONS

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

* - With additional optional sensors.

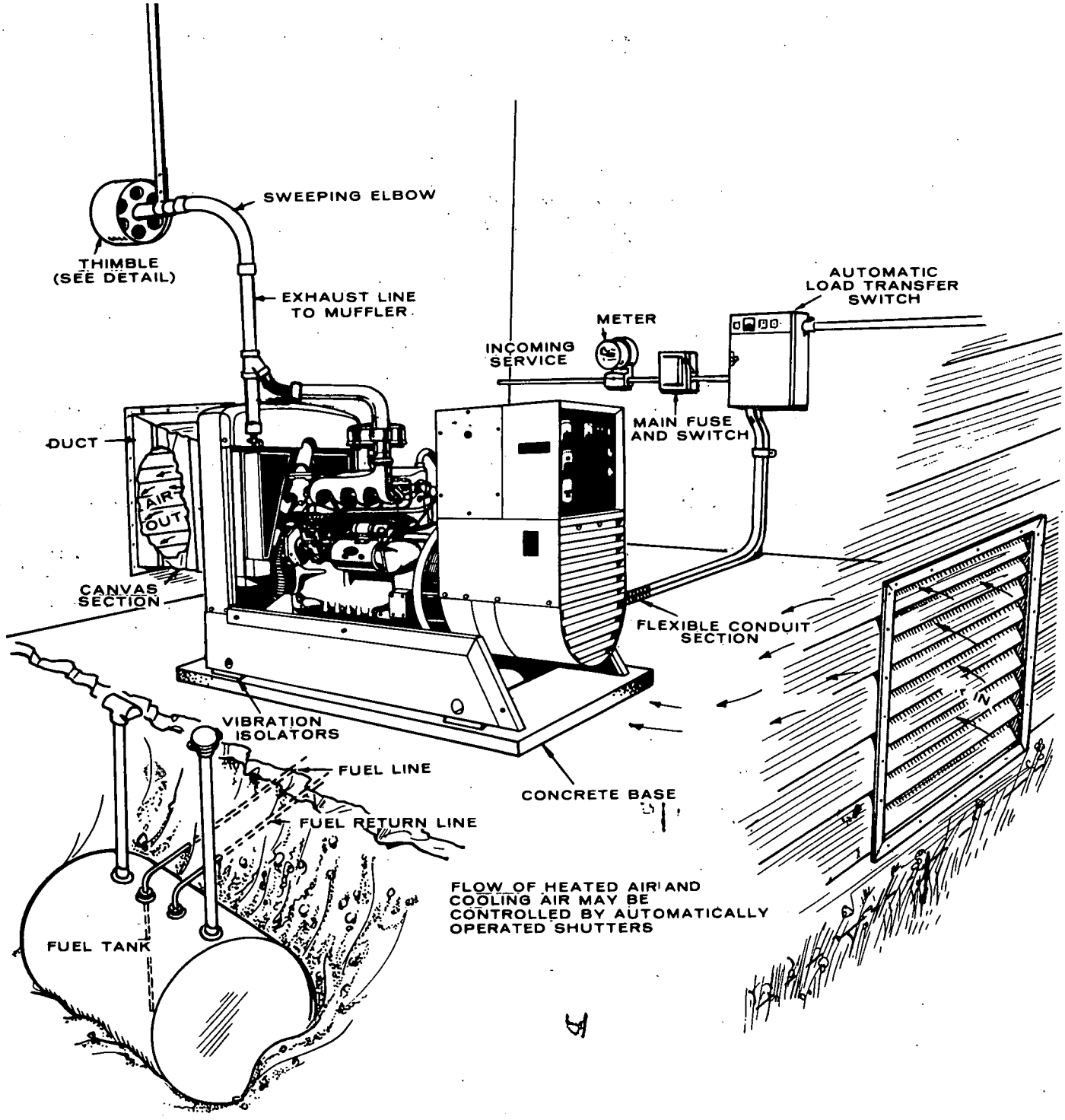


FIGURE 3. TYPICAL INSTALLATION

INSTALLATION

GENERAL

Installations must be considered individually. Use these instructions as a general guide. Meet regulations of local building codes, fire ordinances, etc., which may affect installation details. See Figure 3.

Installation points to consider include:

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

LOCATION

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

MOUNTING

Generating sets are mounted on a rigid skid base which provides proper support. Install vibration isolators between skid base and foundation. For convenience in draining crankcase oil and general servicing, mount set on raised pedestals (at least 6 inches high). If mounting in a trailer, or for other mobile applications, bolt securely in place. Extra support for the vehicle flooring may be necessary. Bolting down is recommended for stationary installations.

VENTILATION

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

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

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

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

A shelter housing with electrically operated louvres 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 louvres. The louvres 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 plant is running) of sufficient size to assure proper air circulation.

CITY WATER COOLING

An optional method of engine cooling, in place of the conventional radiator and fan, uses a constant pressure water supply. This is referred to as CITY WATER COOLING. There are two varieties of city water cooling: the HEAT EXCHANGER SYSTEM and STANDPIPE SYSTEM. See Figures 4 and 5.

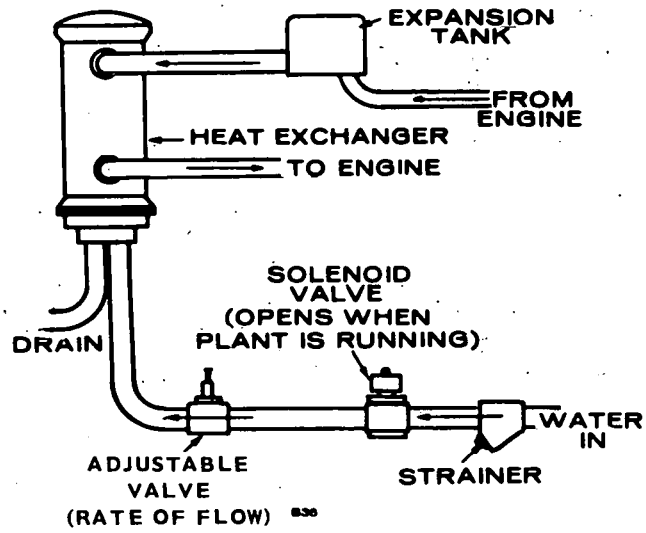


FIGURE 4. TYPICAL HEAT EXCHANGER SYSTEM

The HEAT EXCHANGER provides for a closed engine cooling system. Engine coolant flows through a tubed chamber, keeping the coolant separate from the cool "raw" water supply. The coolant chamber must be filled for operation, as for a radiator cooled set.

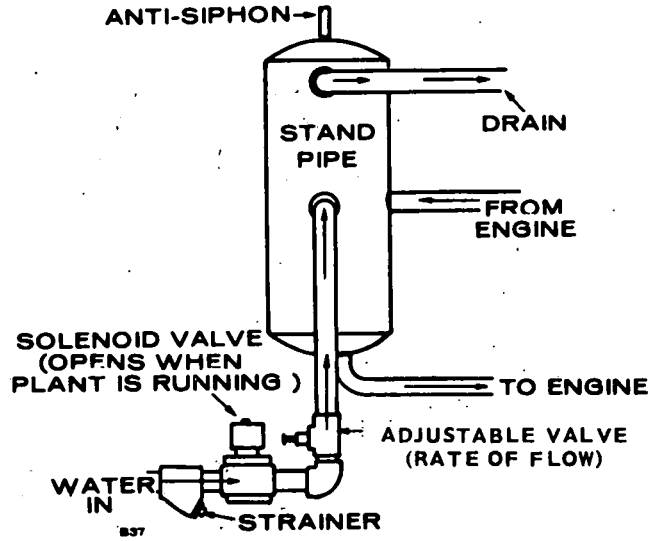


FIGURE 5. TYPICAL STANDPIPE SYSTEM

The STANDPIPE SYSTEM uses a mixing or tempering tank. Cooling water that circulates through the engine mixes with a source of cool "raw" water. The "raw" water supply must be free of scale forming lime or other impurities.

On both systems use flexible pipe for connecting water supply and outlet flow pipes to engine. Pipe the outlet flow to a convenient drain. Install an electric solenoid valve and a rate of flow valve in the water supply line. The electric solenoid valve opens and allows water flow through the system only when the plant operates. The rate of flow valve, either automatic or manual, provides for the proper flow rate to the engine. Adjust the flow to maintain water temperature between 165°F and 195°F (74°C to 91°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.

WATER JACKET HEATER (Optional)

This heater is installed to maintain an elevated engine temperature in lower ambient temperature applications. It heats and circulates engine coolant, and is thermostatically controlled (Figure 19).

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 6) must be used where exhaust pipes pass through walls or partitions. Pitch exhaust pipes downward or install a condensation trap (Figure 7) 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 3 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. Use a pipe at least as large as the 2-inch pipe size outlet of the engine with a flexible portion between the engine and the muffler. Do not connect a flexible line to the exhaust manifold. Minimum diameters and maximum lengths of pipe (with critical muffler) are as follows:

Single Exhaust system:

2½-inch pipe	58-feet (17.68 m)
3-inch pipe	191-feet (58.2 m)
3½-inch pipe	419-feet (128 m)

Maximum permissible exhaust restriction (back pressure) is 25-inches H_2O (1.84-inches Hg: [6.23 kPa]).

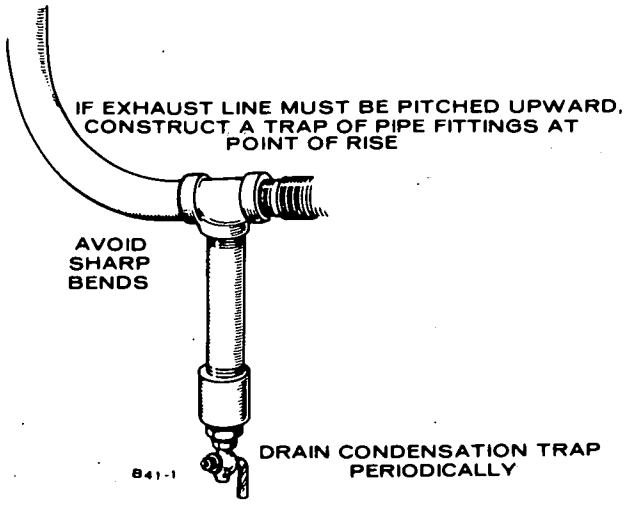


FIGURE 7. EXHAUST CONDENSATION TRAP

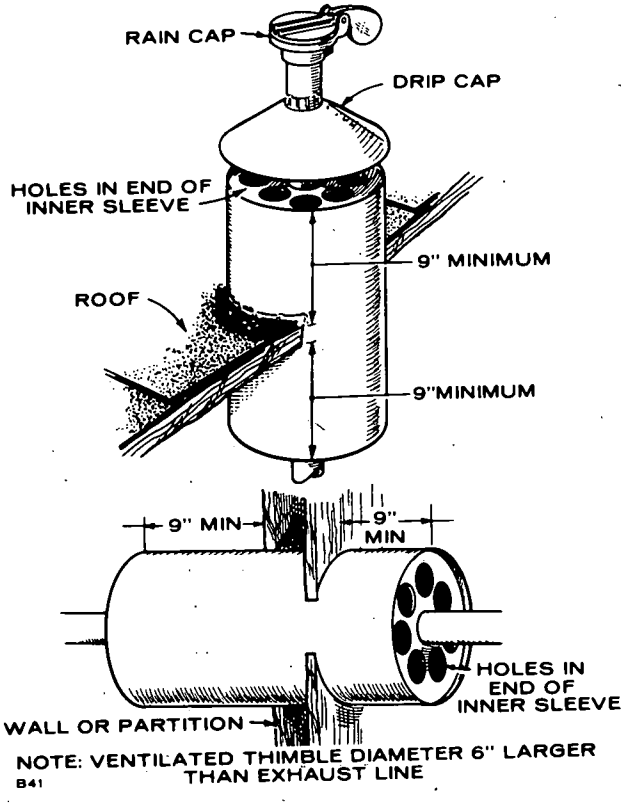


FIGURE 6. EXHAUST THIMBLE

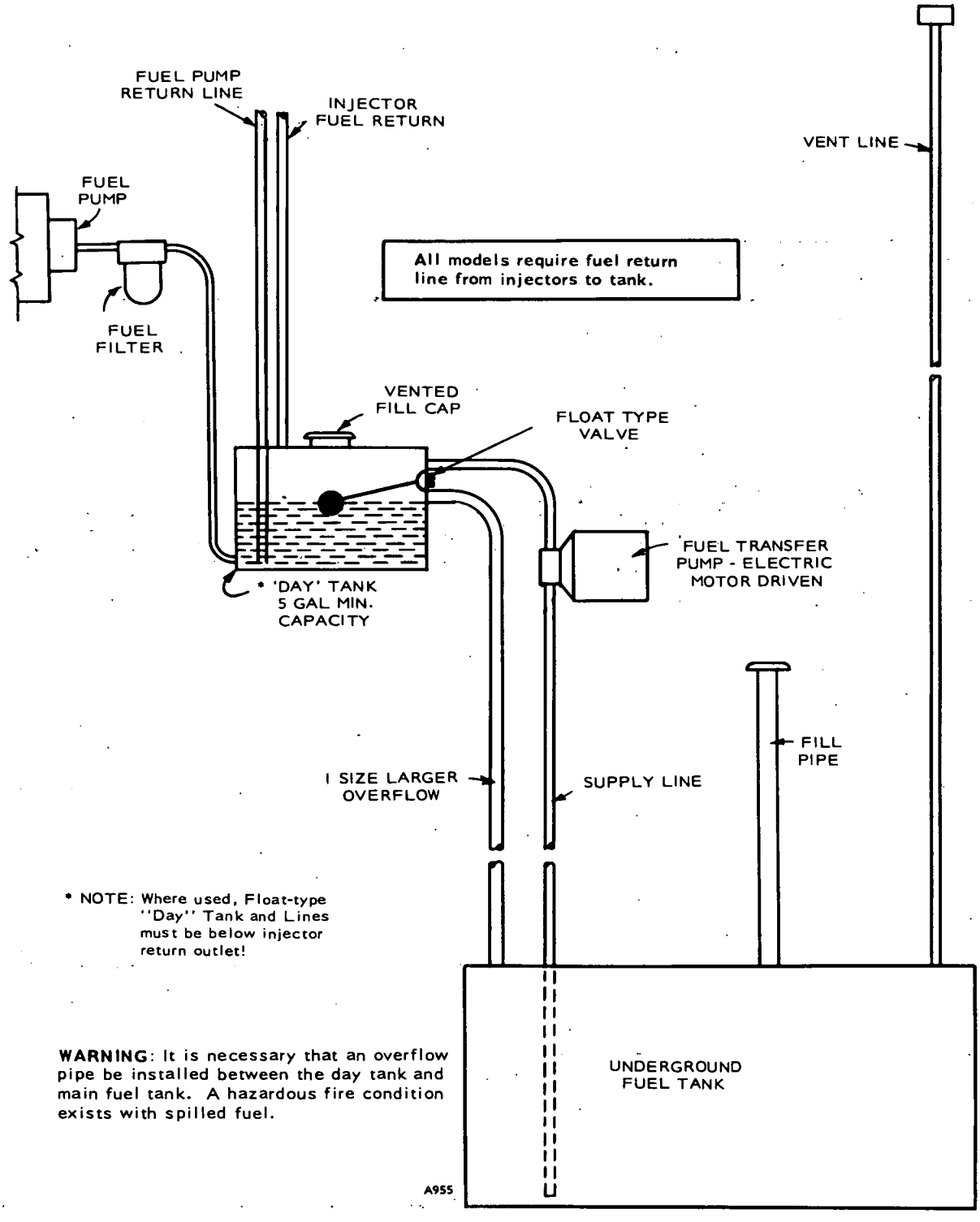


FIGURE 8. DAY TANK INSTALLATION

FUEL SYSTEM

The John Deere engines used on the DDA sets are designed for use with ASTM No.2 Diesel fuel. They will however, operate on diesel fuels within the specifications delineated in the John Deere 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 10-feet (3 m) is not recommended without a day tank installation, because of fuel drainage. Horizontal run, if the supply tank is level with the fuel pump should not exceed 25-feet (7.62 m). However, a day tank is again recommended.

The fuel inlet is to the transfer pump and is threaded for 1/8-inch pipe. Injector pump return line is common with the injectors' return line, and requires a 1/8-inch low pressure hose connection.

DAY TANK

Generator set installations may be equipped with an optional integral 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 the main fuel tank. Refer to the installations included with the tank. See Figure 8 for an example of a Day tank installation.

BATTERY

Starting the plant requires 12-volt battery current. Use two 6-volt (see specification) batteries for a normal installation. Connect the batteries in series (negative post of first battery to positive post of second) as in Figure 9. Necessary battery cables are on unit. Service the batteries as necessary. Infrequent plant use (as in emergency standby service) may allow the batteries to self-discharge to the point where they cannot start the plant. If installing an automatic transfer switch that has no built-in charge circuit, connect a separate trickle charger. Onan automatic transfer switches include such a battery charging circuit.

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

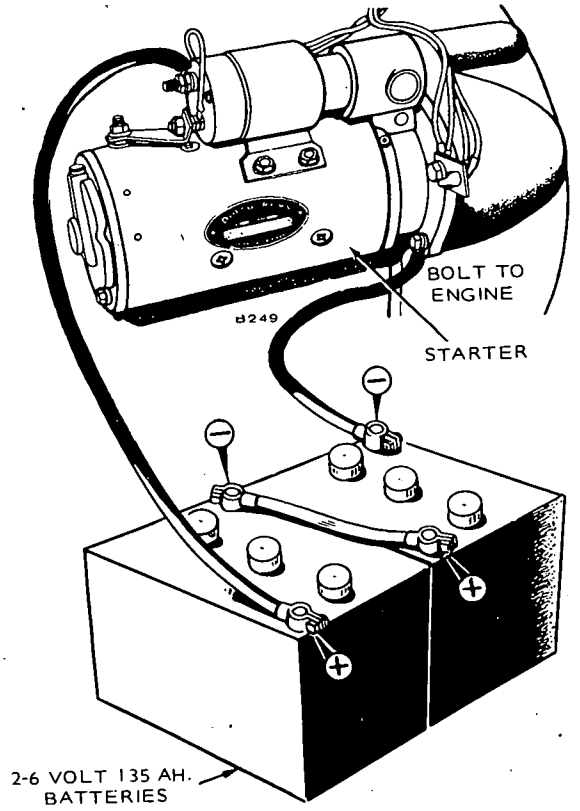


FIGURE 9. BATTERY CONNECTION

BATTERY, HOT LOCATION

Batteries will self discharge very quickly when installed where the ambient temperature is consistently above 90° F (32.2° C), such as in a boiler room. To lenghten 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 an hydrometer or filler bulb and dispose of it in a safe manner. Avoid skin or clothing contact with the electrolyte.
3. Refill each cell with distilled water, to normal level.
4. Continue charging for 1 hour at a 4 to 6 hour rate.
5. Test each cell. If the specific gravity is still above 1.255, repeat steps 2, 3, 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 10. If the distance between the set and remote station is less than 1000-feet (300 m), use No. 18 AWG wire; between 1000- and 2000-feet (600 m), use No. 16 AWG wire.

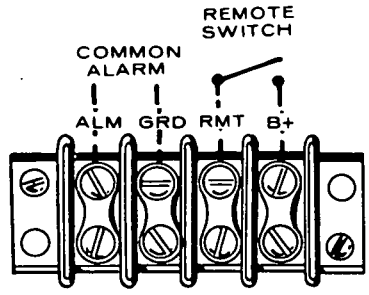
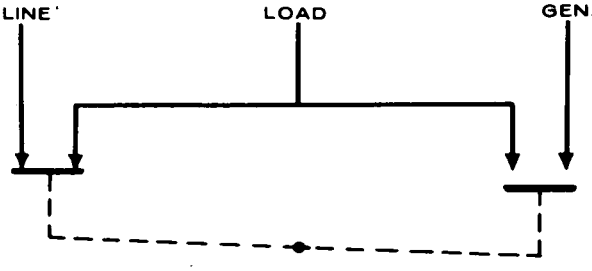


FIGURE 10. REMOTE STARTING

WIRING CONNECTIONS

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

If the installation is for standby service, a double throw transfer switch must always be used. Connect this switch (either automatic or manual) so that it is impossible for commercial power and generator current to be connected to the load at the same time. Instructions for connecting an automatic load transfer control are included with such equipment.



NOTE: SHOWN WITH LINE CONNECTED TO LOAD.

FIGURE 11. LOAD TRANSFER SWITCH

Control Box Connections: The factory ships these 12 lead generators with load connection wires NOT connected together in the control box. These 12 wires are labeled T1 through T12 and must be brought together before making load connections. Proceed as follows:

1. Remove either right, left or top panel from control box. See Figure 12.
2. Connect wires together as shown on panel and in Figure 13 according to voltage desired.
3. Open hinged control panel doors. Connect lead from terminal 63 to correct terminal for voltage desired. These terminals are labeled H2, H3, H4, H5 and H6. See Figure 14.

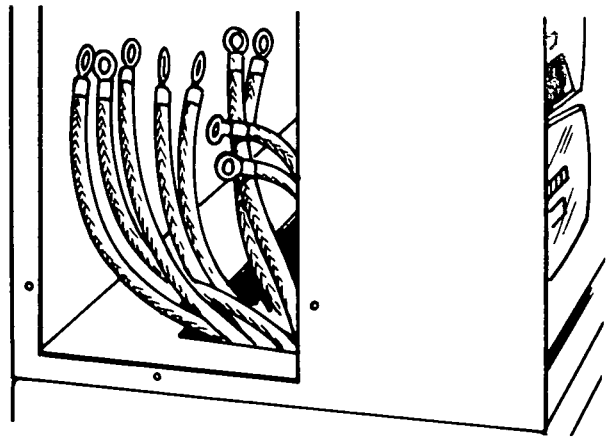


FIGURE 12. CONTROL BOX (SIDE PANEL REMOVED)

4. Close front panel and secure with 1/4 turn fasteners.
5. Connect load wires to generator leads.

Preceding instructions do not apply to models with a 347/600 voltage (designated 9X) or a 120/240 voltage (designated 3R); these connections are made at the factory. The installer must only connect load wires.

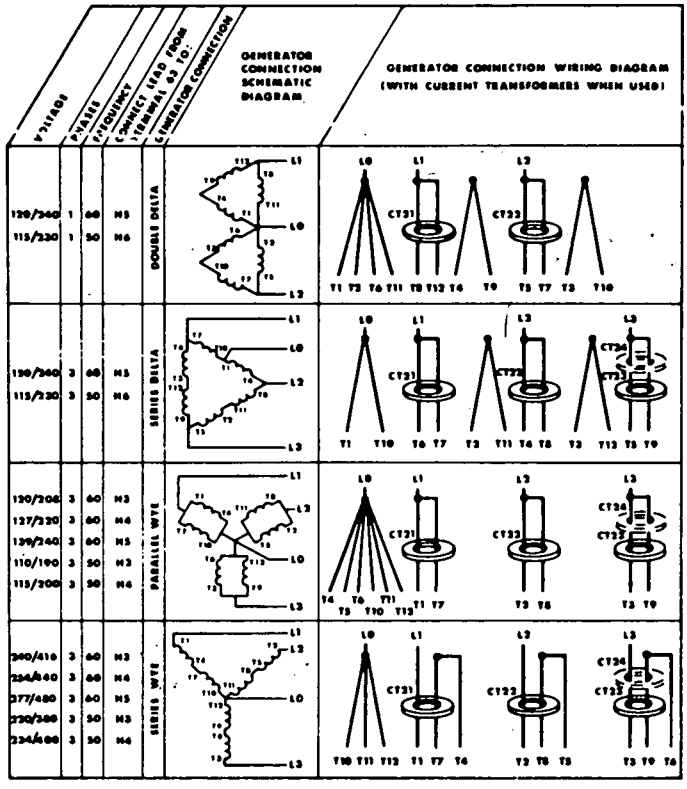


FIGURE 13. VOLTAGE CONNECTIONS

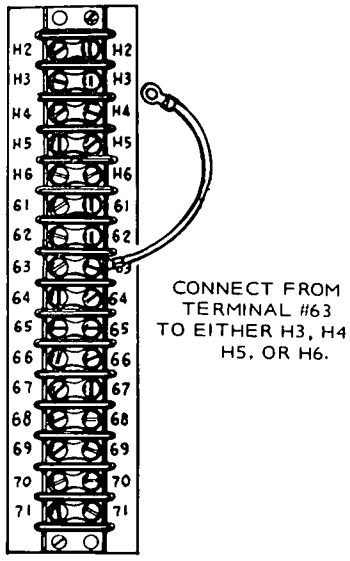


FIGURE 14. CONNECTING LEAD FROM TERMINAL 63

120/240 Volt, Single Phase, 12 Lead: Terminal connection L0 can be the ground (neutral). For 120 volts, connect the hot load wires to either the L1 or L2 connection, Figure 15. Connect the neutral load wire to the L0 connection. Two 120 volt circuits are thus available, with not more than 1/3 the rated capacity of the set available on either circuit. If using both circuits, be sure to balance the load between them.

For 240 volts, connect one load wire to the L1 connection and the second load wire to the L2 connection. Terminal connection L0 is not used for 240 volt service.

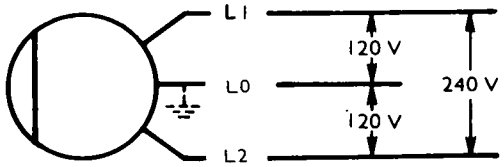


FIGURE 15. 120/240 VOLT, SINGLE PHASE, 12 LEAD

120/240 Volt, 3 Phase, 4 Wire Delta Connected Set; 12 Lead: The 3 phase Delta connected set is designed to supply 120- and 240 volt, 1 phase current and 240 volt, 3 phase current, Figure 16. For 3 phase operation, connect the three load wires to generator terminals L1, L2 and L3 — one wire to each terminal. For 3 phase operation the L0 terminal is not used.

For 120/240 volt, 1 phase, 3 wire operation, terminals L1 and L2 are the "hot" terminals. The L0 terminal is the neutral, which can be grounded if required. For 120 volt service, connect the black load wire to either the L1 or L2 terminal. Connect the neutral (white) wire to the L0 terminal. Two 120 volt circuits are available.

Any combination of 1 phase and 3 phase loading can be used at the same time as long as no terminal current exceeds the NAMEPLATE rating of the generator. If no 3 phase output is used, usable 1 phase output is 2/3 of 3 phase KVA.

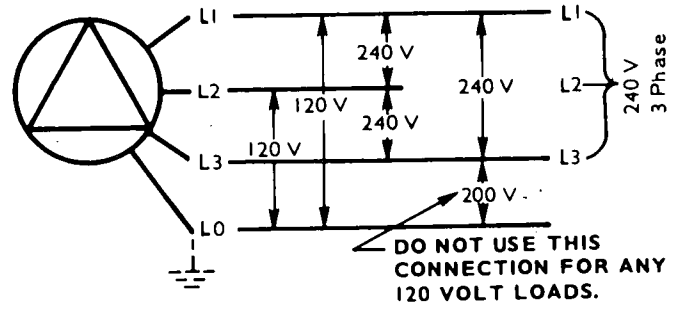


FIGURE 16. 3 PHASE, DELTA CONNECTION, 12 LEAD

3 Phase, 4 Wire, Wye Connected Set; 12 Lead: The 3 phase, 4 wire set produces line to neutral voltage and line to line voltage. The line to neutral voltage is the lower voltage as noted on the unit nameplate, and the line to line voltage is the higher nameplate voltage.

For 3 phase loads, connect separate load wires to each of the set terminals L1, L2 and L3. Single phase output is obtained between any two 3 phase terminals.

The terminal marked L0 can be grounded. For 1 phase loads, connect the neutral (white) load wire to the L0 terminal. Connect the black load wire to any one of the other three terminals — L1, L2 or L3. Three separate 1 phase circuits are available, with not more than 1/6 the rated capacity of the set from any one circuit.

If using 1 phase and 3 phase current at the same time, use care to properly balance the 1 phase load, and not to exceed rated line current.

Figure 17 shows load connections for 120/208 voltage. Other voltages are available from either parallel wye or series wye illustration in Figure 13.

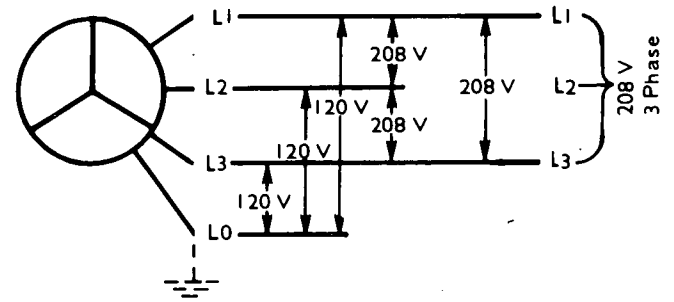


FIGURE 17. 3 PHASE, WYE CONNECTION, 12 LEAD

OPERATION

GENERAL

ONAN DDA 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 engine to capacities shown. After engine has been run, check dipstick, add oil to bring level to full mark. Record total capacity for future oil changes. Do not mix brands or grades of lubricating oils.

AMBIENT TEMPERATURE	SINGLE VISCOSITY	MULTI-VISCOSITY
Below -10°F (-23°C)	SAE 5W	SAE 5W20
Between -10°F and 32°F (-23°C and 0°C)	SAE 10W	SAE 10W30
Above 32°F (0°C)	SAE 30	Not Recommended
Use oil conforming to these specifications	API CD/SD MIL-L-2104C* Series 3* *API CC or CD	API CC/SE, CC/SD or SD MIL-L-46152

Oil capacities (nominal)

Oil Pan and Filter—6 quarts (5.7 litres)

Cooling System: Cooling system was drained prior to shipment. Fill cooling system before starting. Nominal capacity is 4.25 gallons (16.1 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 John Deere engine manual for additional information.

CAUTION **1. Verify that the electric solenoid valve used with city water cooled plants is open before initial starting of plant to allow coolant chambers to fill. Overheating and damage to the engine could result from non-compliance.**

2. 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.

3. 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 John Deere 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 Fuel System: Verify that all connections in the fuel system are secure and no leaks exist. Proceed with priming as follows:

1. Loosen bleed plug on top of fuel filter. Pump primer lever (Figure 18) until a solid stream of fuel, free of air bubbles, flows from bleed plug.
2. Secure bleed plug.
3. Loosen inlet fuel line on injector pump. Operate primer lever on fuel transfer pump until a solid stream of fuel, free of air bubbles, flows from inlet line opening.
4. Secure injector pump fuel inlet line.
5. Leave fuel transfer pump priming lever at lowest point of stroke.

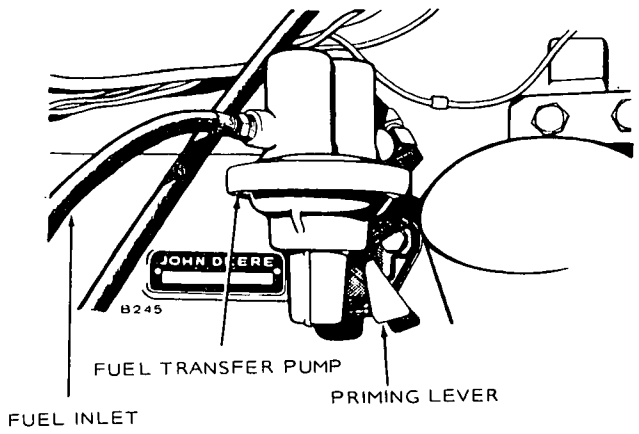


FIGURE 18. PRIMING FUEL SYSTEM

If the primer lever will not pump and no resistance is felt at upper end of stroke, turn engine over with starter to change position of fuel pump drive lobe on camshaft.

Check all connections in fuel system for security, to ensure that pressure will not bleed off when engine is not in use. Pressure should be maintained for immediate starting if unit is on standby service.

BATTERIES

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

Check level of electrolyte to be at split ring mark. Measure specific gravity of electrolyte: SG 1.280 at 80°F (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. Cooling system filled — input solenoid valve open.
3. Batteries charged and connected.
4. 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 45 and 65 psi (310.5 and 448.5 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 180° to 195°F (82.2°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 180°F to 220°F (82.2°C to 104.4°C).

STOPPING

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

Move the run-stop/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 appropriate troubleshooting chart, Table 3 or Table 4.

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

Generating 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 up fuel tank, check engine for leaks and unit for general condition. Locate cause of leaks (if any) and correct.

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

SYMPTOM	CORRECTIVE ACTION
1. Engine stops cranking and fault lamp lights, after cranking approximately 75 seconds.	1. See engine service manual for troubleshooting fuel system. After correcting problem, reset engine monitor relay by placing Run-Stop/ Reset-Remote switch to Stop/Reset, then back to the required running position.
2. Fault lamp lights immediately after engine starts.	2. Check for: Overspeed condition as engine starts.
3. Fault lamp lights and engine shuts down after running for a period.	3. Check the following: a. Oil level. Engine will shut down if sensor is closed. b. Check engine manual for troubleshooting oil system. c. High engine temperature. Check coolant level; check water flow (city water cooled systems); check radiator for free air flow, and fan belts for tightness. See engine manual for troubleshooting cooling system. d. Check for faulty oil pressure sensor or faulty high engine temperature sensor.
4. Engine runs, shuts down and cranks for 75-seconds. Cranking cycle stops; fault lamp lights.	4. Check fuel supply.
5. Fault lamp lights, no fault exists.	5. To check a no-fault condition, disconnect leads from TB11 terminals 29, 30 and 31. If fault lamp lights with leads disconnected, replace engine monitor board. Reconnect leads.

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

SYMPTOM	CORRECTIVE ACTION
1. Overcrank fault lamp lights and engine stops cranking after approximately 75-seconds.	1. See engine service manual for troubleshooting fuel system. 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, overcrank 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 if 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. Check overspeed switch.
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.

*NOTE: Not applicable on Pennsylvania State models.

HIGH ALTITUDE

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

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

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 John Deere manual for further information.

Water Jacket Heater: The function of this optional heater is to keep the engine warm enough to assure starting under adverse weather conditions. Connect the heater to a source of power that will be on during the time the engine is not running. Be sure the voltage rating is correct for the heater element rating (Figure 19).

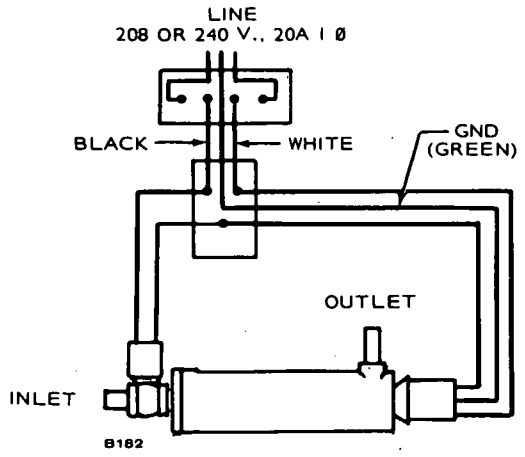


FIGURE 19. ENGINE HEATER

OUT-OF-SERVICE PROTECTION

Generator sets removed from service for extended periods of time should be protected from rust and corrosion. The natural lubrication qualities of ASTM No. 2 Diesel fuel should protect a diesel engine for at least 30-days when unit is not in service. To protect a unit that will be out of service over 30 days, Onan recommends the following procedure:

1. Check coolant, top up if necessary using recommended anti-freeze.
2. Run set until thoroughly warm; generator under at least 50% load.
3. Shut down engine and drain oil base while still warm. Refill and attach a warning tag indicating viscosity of oil used.
4. Service air cleaner.
5. Clean throttle and governor linkage and protect by wrapping with a clean cloth.
6. Plug exhaust outlets to prevent entrance of moisture, bugs, dirt, etc.
7. Clean off dirt and dry entire unit. Coat parts likely to rust with a light coat of grease or oil.
8. Disconnect battery and follow standard battery storage procedure. Apply a film of non-conductive grease (e.g., vaseline) to battery cable lugs.
9. Fill fuel tank to prevent condensation contamination.
10. Provide a suitable cover for the entire unit.

RETURNING A UNIT TO SERVICE

1. Remove cover and all protective wrapping. Remove plug from exhaust outlet.
2. Check warning tag on oil base and verify that oil viscosity is still correct for existing ambient temperature.
3. Clean and check battery. Measure specific gravity (1.260 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 if necessary.
5. Connect batteries.
6. Verify that no loads are connected to generator.
7. 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.

GENERAL MAINTENANCE

GENERAL

Follow a definite schedule of inspection and servicing, based on operating hours. Keep an accurate logbook of maintenance, servicing, and operating time. Use the running time meter to keep a record of operation and servicing. Service periods outlined in Table 5 are recommended for normal service and operating conditions. For continuous duty, extreme temperature, etc., service more frequently.

A set on stand-by duty will need servicing at times other than those recommended by Onan and the engine manufacturer. These maintenance service periods will vary according to set site or location and application. 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.

CAUTION **When changing oil filters, it is important that the replacement filter is a bypass type. Failure to use a bypass filter could cause the filter material to rupture during heavy pressures on cold starts, resulting in non-filtered oil and subsequent engine damage.**

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	MAINTENANCE PERIOD						
	10 hrs.	50 hrs.	100 hrs.	200 hrs.	500 hrs.	1000 hrs.	6 mths.
Inspect plant	x						
Check coolant level	x						
Check oil level	x						
Air cleaner	x1						
Fuel filter	x						
Batteries		x					
Alternator and fan belt			x2				
Engine crankcase - drain - refill			x1				
Crankcase oil filter			x1				
Crankcase vent tube					x		
Valve tappets					x		
Hoses					x		
Injection pump - check timing						x	
Injection nozzles						x	
Fuel filter - change						x	
Starter						x	
Cooling system - drain, flush, refill							x3
Clean and inspect battery charging alternator				x			
Air cleaner - replace			x				

x1 - or every 3 months, perform more often in extremely dusty conditions.
x2 - or every 3 months. Adjust to 3/4 depression with 20 pounds force.
x3 - More often in extremely dusty conditions.

NOTE: The above schedule is a minimum requirement for your engine. Refer to the John Deere service manual for recommended service periods.

ENGINE SPEED

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

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

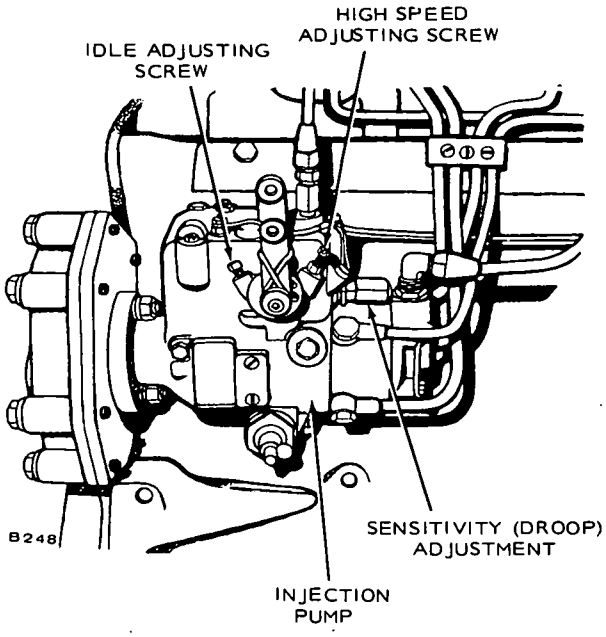


FIGURE 20. ROOSA-MASTER GOVERNOR

Governor sensitivity is adjusted by rotating an external knurled knob at the rear of the injector pump housing. Turning inward (clockwise) shortens governor control spring making it less sensitive, thereby increasing speed droop. Turning outward (counterclockwise) has opposite effect. Adjustment can be made with engine running. The speed droop is set at the ONAN plant to give a regulation of 3 percent to 5 percent from no-load to full-load.

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

Example: 30 x 61 (Hz) = 1830 rpm.

Adjust engine speed to 1800 rpm for 60 Hertz sets 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. Blow dust out of control panel.

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 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.

PARTS CATALOG

This catalog applies to the standard DDA 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
25.0 DDA-515R/*	25,000	£	50	12	1 or 3
30.0 DDA-3R/*	30,000	120/240	60	3	1
30.0 DDA-15R/*	30,000	£	60	12	1 or 3
30.0 DDA-9XR/*	30,000	347/600	60	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).

£ - These sets are reconnectible, refer to Specifications (Generator Details) in Operator's Manual for Electrical Data.

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

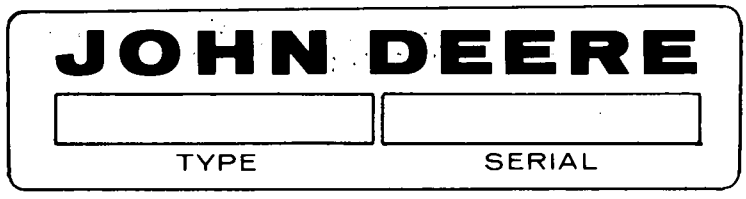
REPLACEMENT ENGINE

100-1265	1	Engine, Replacement (John Deere Model 4219D)
General Description:		Includes: Complete Cylinder Block, Fuel Pump, Fuel Filter, Oil Filter, Governor, Fan Blades (Pusher Type), Water Pump, Oil Pan, Oil Fill, Exhaust Manifold, Flywheel Housing, Starter Adapter, Fan Belt, and Alternator Drive Belt.
		Excludes: Alternator, Temperature Sender, Oil Pressure Sender, Starter, Flywheel, Air Cleaner and Radiator.

ENGINE PARTS

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 John Deere manual.

All John Deere parts must be ordered from your nearest authorized John Deere distributor. When ordering parts, refer to the John Deere nameplate giving the complete engine TYPE and SERIAL NUMBER.



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.

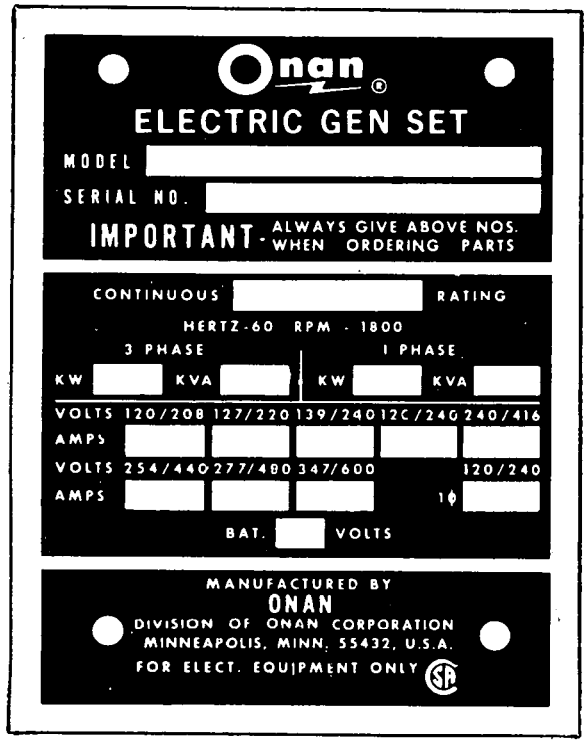
INSTRUCTIONS FOR ORDERING Onan REPAIR PARTS

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.



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.

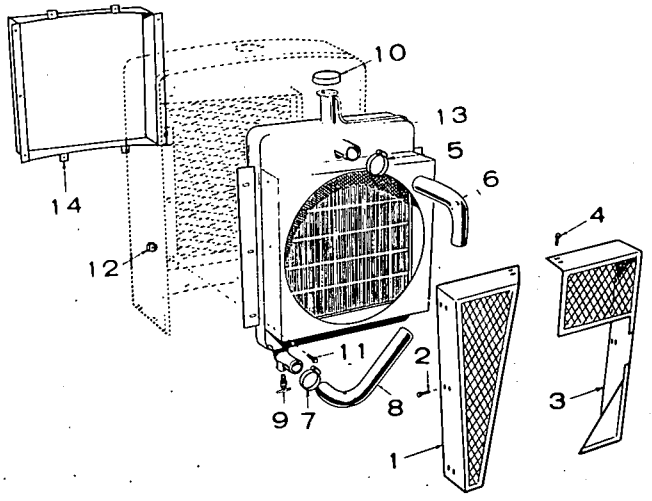
Prices are purposely omitted from this Parts Catalog due to the confusion resulting from fluctuating costs, import duties, sales taxes, exchange rates, etc.

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".

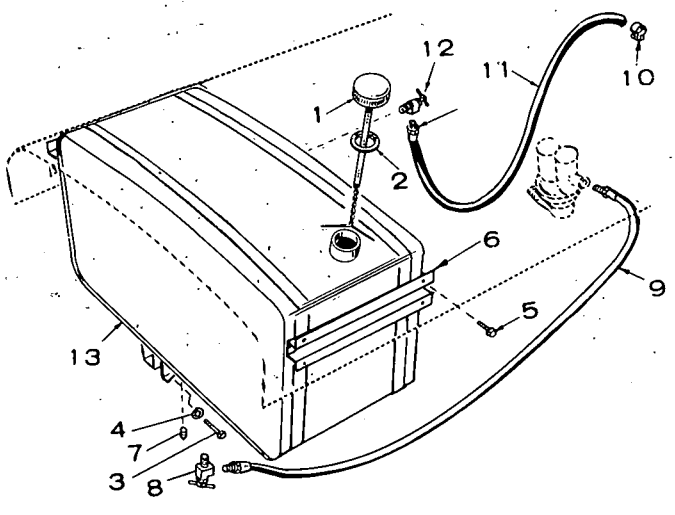
COOLING SYSTEM GROUP (Radiator Cooled Generator Sets)



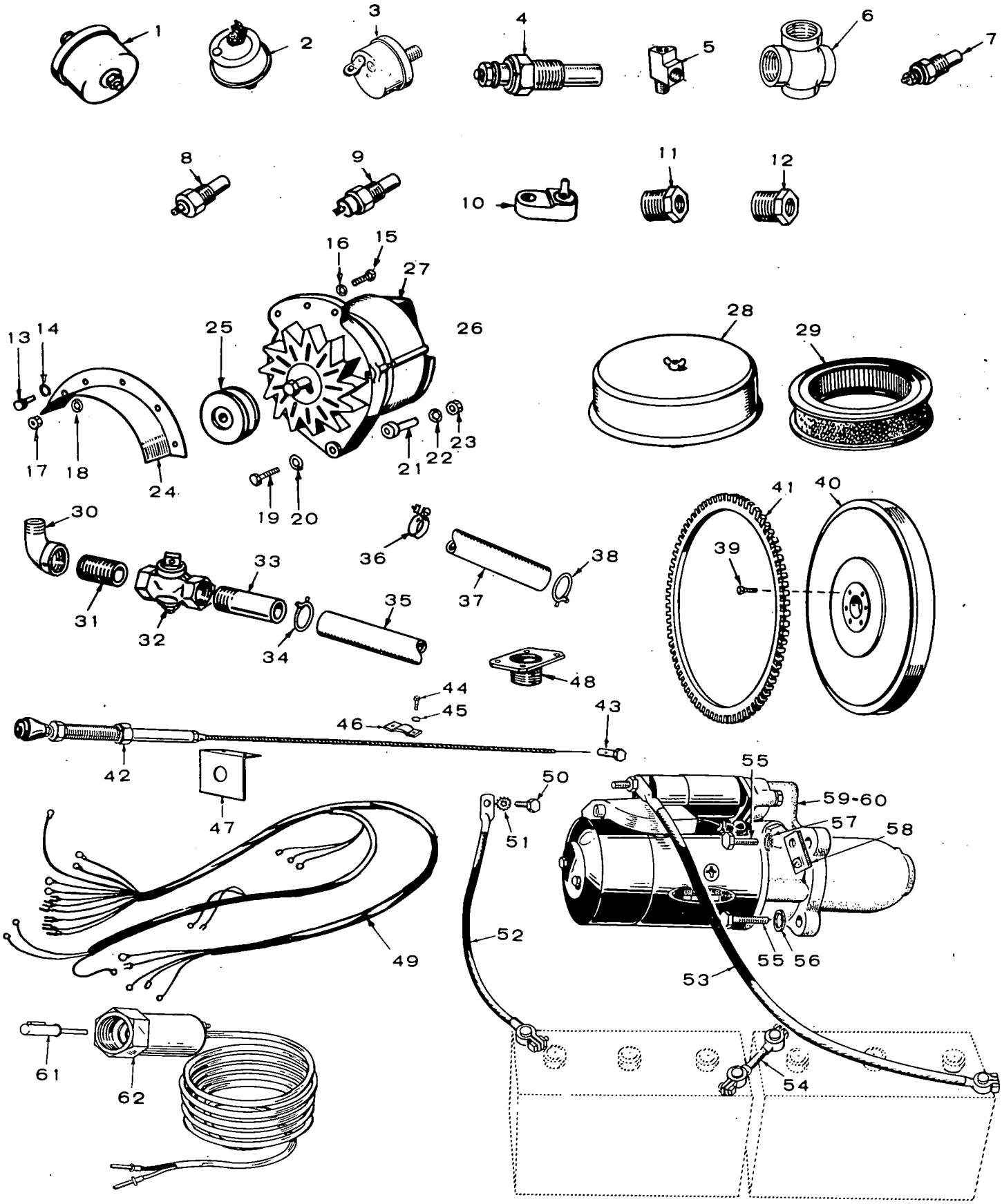
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	130-0934	1	Guard, Fan - Right Side
2	815-0181	4	Screw, Tapping, Thread Cutting - Hex Head with External Tooth Washer (#10-32 x 1/2")
3	130-0935	1	Guard, Fan - Left Side
4	815-0181	4	Screw, Tapping, Thread Cutting - Hex Head with External Tooth Washer (#10-32 x 1/2")
5	503-0365	2	Clamp, Hose
6	503-0727	1	Hose, Rubber - Upper
7	503-0365	2	Clamp, Hose
8	503-0635	1	Hose, Rubber - Lower
9	504-0028	1	Valve - Drain
10	130-0449	1	Cap - Radiator
11	821-0014	8	Screw, Self-Locking - Hex Head (5/16-18 x 1/2")
12	870-0113	8	Nut, Clinch (5/16-18)
13	130-0815	1	Radiator
14	405-1054	1	Flange, Duct - Optional

MOUNTED FUEL TANK GROUP - OPTIONAL (Housed Sets Only)

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	159-0512	1	Cap and Indicator
2	159-0751	1	Gasket, Gas Cap
3	812-0158	2	Screw, Machine - Round Head (1/4-20 x 2")
4	850-0040	2	Washer, Lock - Spring (1/4)
5	821-0010	8	Screw, Self-Locking - Hex Head (1/4-20 x 1/2")
6	159-0489	1	Strap Assembly, Mounting
7	505-0057	1	Plug, Pipe - Square Head
8	504-0013	1	Valve, Globe
9	501-0027	1	Hose, Rubber
10	503-0685	1	Clamp, Hose
11	501-0205	1	Hose, Rubber
12	504-0007	1	Valve, Globe
13	159-1025	1	Tank, Fuel (20 gallon)



MISCELLANEOUS ENGINE PARTS GROUP (Includes Optionals)



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	193-0108	1	Sender, Oil Pressure
2	309-0169	1	Switch, Low Oil Pressure
3	309-0064	1	Switch, Low Oil Pressure Shutdown - Optional
4	193-0202	1	Sender, Oil Temperature - Optional
5	502-0058	1	Tee, Pipe (1/8")
6	505-0763	1	Cross, Pipe (1/8")
7	193-0104	1	Sender, Water Temperature
8	309-0179	1	Switch, High Water Temperature
9	309-0178	1	Switch, High Water Temperature Alarm - Optional
10	309-0269	1	Switch, Low Engine Temperature - Optional
11	505-0131	1	Reducer, Pipe (3/4 x 3/8)
12	505-0117	1	Reducer, Pipe (1/2 x 3/8)
13	800-0024	1	Screw, Cap - Hex Head (5/16-18 x 1/2")
14	850-0045	1	Washer, Lock - Spring (5/16)
15	800-0030	1	Screw, Cap - Hex Head (5/16-18 x 1-1/4")
16	526-0115	1	Washer, Flat (11/32" ID x 11/16" OD x 1/16" THK)
17	862-0015	1	Nut, Hex (5/16-18)
18	850-0045	1	Washer, Lock - Spring (5/16)
19	800-0058	1	Screw, Cap - Hex Head (3/8-16 x 3")
20	526-0035	2	Washer, Flat (17/32" ID x 7/8" OD x 1/8" THK)
21	232-2183	1	Spacer, Stepped
22	850-0050	1	Washer, Lock - Spring (3/8)
23	862-0003	1	Nut, Hex (3/8-16)
24	191-0725	1	Guard, Belt
25	191-1099	1	Pulley
26	191-0665	1	†Alternator - Includes Regulator (Motorola #70D44039B01)
27	191-0732	1	†Regulator, Voltage - Part of Alternator
28	140-1083	1	Cleaner, Air - Includes Element
29	140-1089	1	Element, Air Cleaner
30	505-0050	1	Elbow, Pipe - Street (1/2" x 90°)
31	505-0100	1	Nipple, Pipe - Close (1/2")
32	504-0011	1	Valve, Plug - BRS
33	505-0185	1	Nipple, Pipe - Half (1/2" x 1-1/2")
34	503-0197	1	Clamp, Hose
35	503-0098	As Req.	Hose, Rubber - Oil Drain (Order 17")
36	148-0274	1	Clamp, Loop
37	503-0098	24"	Hose, Rubber - Breather Extension
38	503-0197	1	Clamp, Hose
39	800-0094	4	Screw, Cap - Hex Head (1/2-13 x 2")
40	104-0871	1	Flywheel - Includes Ring Gear
41	104-0858	1	Gear, Ring - Part of Flywheel
	VERNIER THROTTLE ASSEMBLY - OPTIONAL (Includes Parts Marked *)		
42	152-0120	1	*Cable, Throttle
43	152-0158	1	*Swivel
44	815-0104	2	*Screw, Machine - Fillister Head (#8-32 x 5/16")
45	526-0052	2	*Washer, Flat - Brass (17/64" ID x 9/16" OD x 1/32" THK)
46	152-0036	1	*Clamp, Cable
47	151-0230	1	*Bracket, Angle - Throttle Mounting
48	154-1674	1	Adapter, Exhaust Manifold - Spec A Only
49	338-0771	1	Harness, Wiring - Engine
50	800-0090	1	Screw, Cap - Hex Head (1/2-13 x 1")
51	856-0008	2	Washer, Lock - External/ Internal Tooth (1/2)
52	416-0530	1	Cable, Electrical - Battery, Ground (16")
53	416-0531	1	Cable, Electrical - Battery, Positive (24")
54	416-0446	1	Cable, Electrical - Battery, Jumper
55	800-0051	3	Screw, Cap - Hex Head (3/8-16 x 1-1/4")
56	850-0050	3	Washer, Lock - Spring (3/8)
57	856-0010	1	Washer, Lock - External/ Internal Tooth (3/8)
58	332-1292	1	Terminal Board
59	191-1097	1	+Starter - Spec A; Alternate Source Beginning Spec B (Delco Remy #1113402)
60	191-1117	1	§Starter - Begin Spec B (Nippondenso #028000-3930)
61	302-0967	1	Tang, Drive - Optional (Tach Sender)
62	302-0750	1	Sender, Tach - Optional

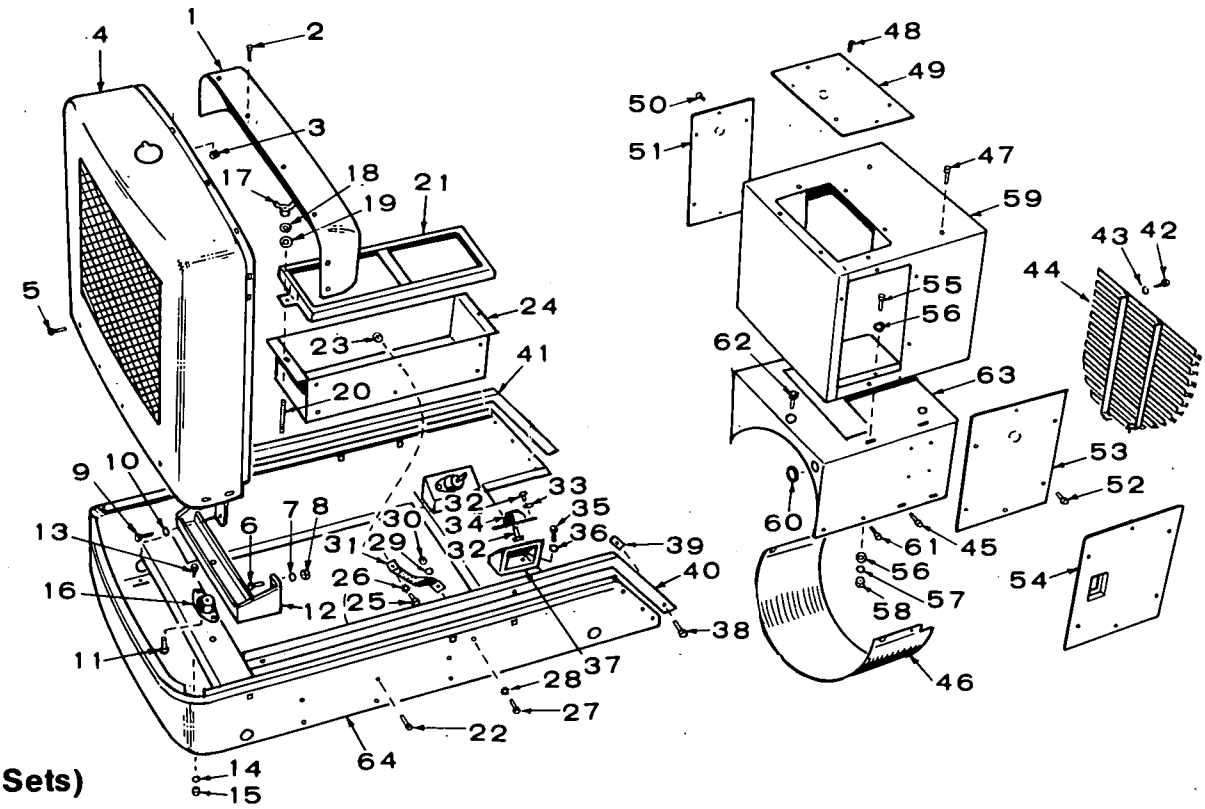
† - For components, contact your nearest Motorola Dealer or Motorola Automotive Products, Inc., 9401 W. Grand Ave., Franklin Park, Illinois 60131.

* - Included in Optional Vernier Throttle Assembly.

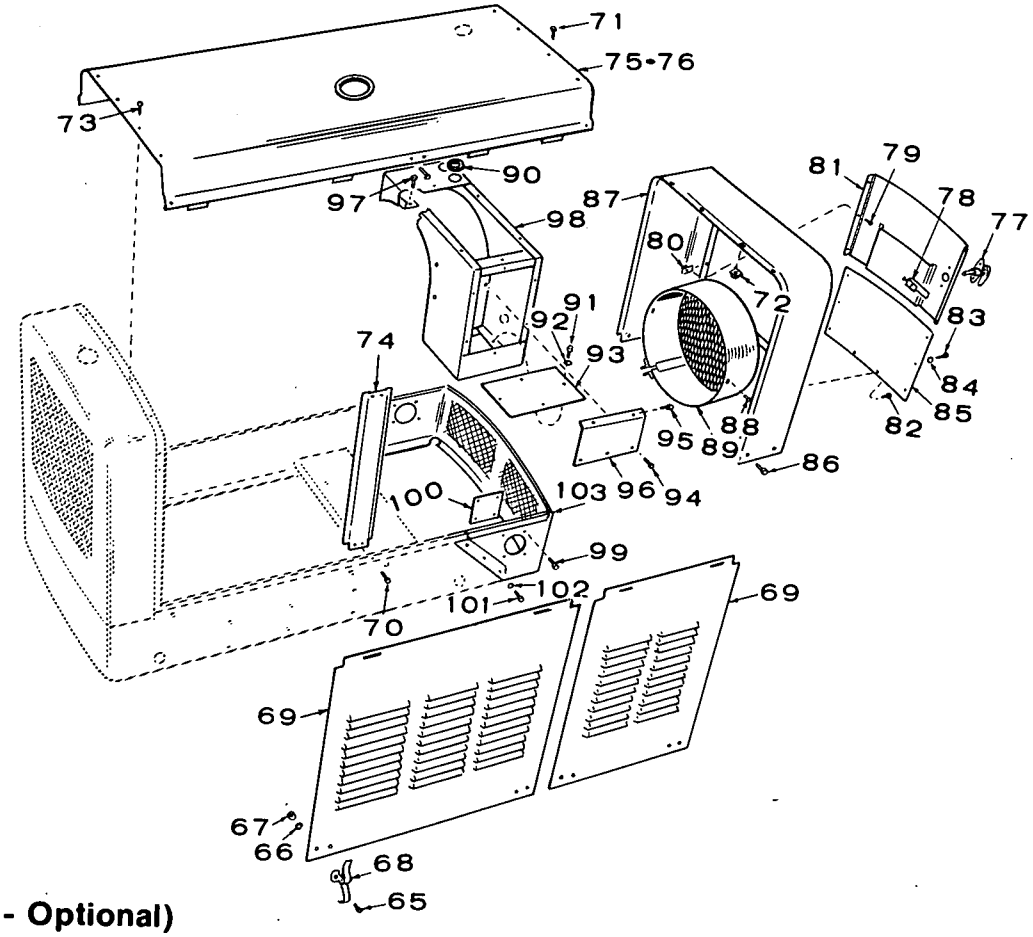
+ - For components; contact your nearest Delco Remy Dealer or Delco Remy Division of General Motors Corporation, Anderson, Indiana 46011.

§ - For components, contact your nearest Nippondenso Dealer or Detroit Branch, Nippondenso Sales, Inc. 21840 West Nine Mile Road, Southfield, Michigan 48075, U.S.A.

CHASSIS AND HOUSING GROUP

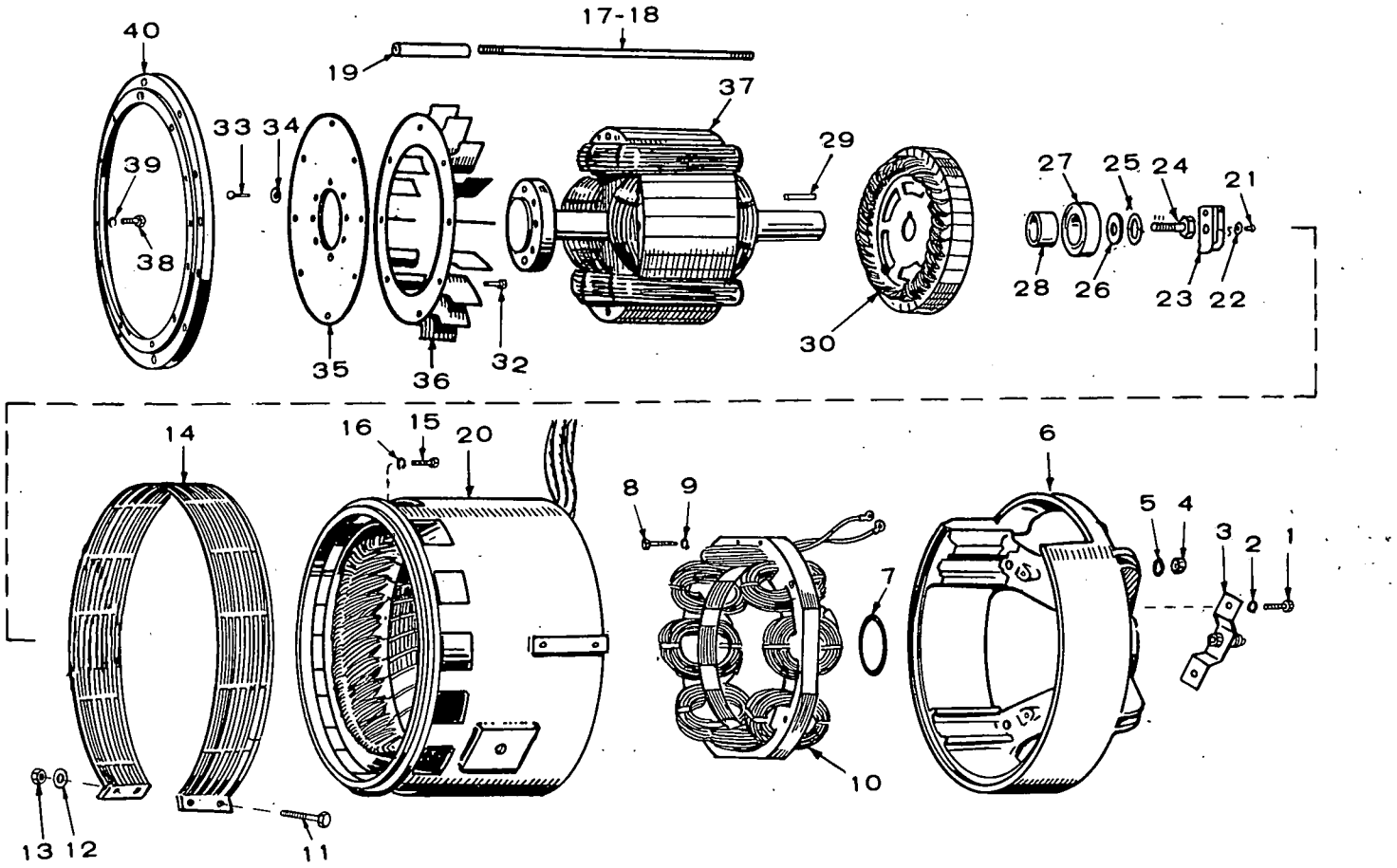


(Unhoused Sets)



(Housed Sets - Optional)

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	405-1409	1	Extension, Hood - Radiator
2	821-0014	8	Screw, Self-locking - Hex Head (5/16-18 x 1/2")
3	870-0113	8	Nut, Clinch (5/16-18) (Also used with Housed Sets)
4	405-1811	1	Panel, Radiator (Also used with Housed Sets)
5	821-0014	8	Screw, Self-locking - Hex Head (5/16-18 x 1/2")
6	800-0095	2	Screw, Cap - Hex Head (1/2-13 x 2-1/4")
7	850-0060	2	Washer, Lock - Spring (1/2)
8	862-0016	2	Nut, Hex (1/2-13)
9	800-0132	2	Screw, Cap - Hex Head (5/8-11 x 1-1/2")
10	850-0070	2	Washer, Lock - Spring (5/8)
11	800-0520	1	Screw, Cap - Special Hex Head, Unplated (3/4-10 x 1")
12	403-1110	1	Support, Engine
13	800-0090	2	Screw, Cap - Hex Head (1/2-13 x 1")
14	850-0060	2	Washer, Lock - Spring (1/2)
15	862-0016	2	Nut, Hex (1/2-13)
16	402-0371	1	Mount, Vibration
17	865-0007	2	Nut, Wing (5/16-18)
18	850-0045	2	Washer, Lock - Spring (5/16)
19	526-0115	2	Washer, Flat (11/32" ID x 11/16" OD x 1/16" THK)
20	520-0663	2	Stud (5/16-18 x 3-1/4")
21	416-0480	1	Frame, Hold-down - Battery
22	821-0029	6	Screw, Self-Locking - Hex Head (3/8-16 x 3/4")
23	870-0281	6	Nut, Self-locking (3/8-16)
24	416-0666	1	Tray - Battery
25	800-0090	1	Screw, Cap - Hex Head (1/2-13 x 1")
26	856-0013	1	Washer, Lock - External/Internal Tooth (1/2)
27	800-0091	1	Screw, Cap - Hex Head (1/2-13 x 1-1/4")
28	856-0013	1	Washer, Lock - External/Internal Tooth (1/2)
29	850-0050	1	Washer, Lock - Spring (1/2)
30	862-0016	1	Nut, Hex (1/2-13)
31	337-0090	1	Lead, Electrical - Ground (Flexible)
32	SCREW, CAP		
	800-0520	2	Screw, Cap - Special Hex Head, Unplated (3/4-10 x 1")
	800-0071	4	Screw, Cap - Hex Head (7/16-14 x 1")
33	850-0055	4	Washer, Lock - Spring (7/16)
34	402-0030	2	Mount, Vibration
35	800-0091	4	Screw, Cap - Hex Head (1/2-13 x 1-1/4")
36	850-0055	4	Washer, Lock - Spring (1/2)
37	232-2106	2	Bracket, Support - Generator
38	821-0014	6	Screw, Self-locking - Hex Head (5/16-18 x 1/2")
39	870-0020	6	Nut, Plate (5/16-18)
40	403-0913	1	Trim, Chassis - Right Side
41	403-0914	1	Trim, Chassis - Left Side
42	812-0146	4	Screw, Machine - Round Head (1/4-20 x 3/8")
43	850-0040	4	Washer, Lock - Spring (1/4)
44	234-0370	1	Grille, Inlet, Air
45	821-0010	7	Screw, Self-locking - Hex Head (1/4-20 x 1/2")
46	234-0361	1	Wrapper, End Bell - Generator
47	821-0014	4	Screw, Self-locking - Hex Head (5/16-18 x 1/2") - Control Box Mounting
48	815-0350	6	Screw, Tapping - Hex Head, Slotted (#10-32 x 3/8")
49	301-3156	1	Panel, Blank - Top (Also used on Housed Sets)
50	815-0350	6	Screw, Tapping - Hex Head, Slotted (#10-32 x 3/8")
51	301-3156	1	Panel, Blank - Left Side
52	815-0350	6	Screw, Tapping - Hex Head, Slotted (#10-32 x 3/8")
53	301-3156	1	Panel, Blank - Right Side (Also used on Housed Sets)
54	301-3192	1	Panel, Circuit Breaker - Right Side - Optional (Used with Line Load Circuit Breaker)
55	800-0003	4	Screw, Cap - Hex Head (1/4-20 x 1/2)
56	526-0018	8	Washer, Flat (17/64" ID x 5/8" OD x 1/16" THK)
57	850-0040	4	Washer, Lock - Spring (1/4)
58	862-0001	4	Nut, Hex (1/4-20)
59	301-3155	1	Housing, Control Box
60	508-0001	1	Grommet, Rubber (3/4" ID x 1-9/32" OD)
61	821-0014	4	Screw, Self-locking - Hex Head (5/16-18 x 1/2")
62	821-0010	1	Screw, Self-locking - Hex Head (1/4-20 x 1/2")
63	301-3154	1	Saddle - Control Box Housing
64	403-1111	1	Chassis - Engine/Generator (Also used with Housed Sets)
	HOUSED SETS - OPTIONAL (Includes following parts and unhoused set items indicated above)		
65	813-0098	16	Screw, Machine - Round Head (#10-32 x 3/8")
66	850-0030	16	Washer, Lock - Spring (#10)
67	870-0053	16	Nut, Hex (#10-32)
68	406-0105	8	Clamp, Door
69	DOOR, LOUVERED		
	405-1808	2	Door, Louvered - Engine section
	405-1832	2	Door, Louvered - Generator section
70	821-0014	4	Screw, Self-locking - Hex Head (5/16-18 x 1/2")
71	821-0016	6	Screw, Self-locking - Hex Head (5/16-18 x 3/4")
72	870-0113	6	Nut, Clinch (5/16-18)
73	821-0014	6	Screw, Self-locking - Hex Head (5/16-18 x 1/2")
74	405-1814	2	Support, Housing - Center
75	405-2151	1	Panel, Housing - Top (Used with standard exhaust manifold)
76	405-2207	1	Panel, Housing - Top (Used with water cooled exhaust manifold)
77	406-0157	1	Handle, Latch (with Keys)
78	406-0089	1	Catch, Latch
79	809-0059	3	Screw, Tapping - Pan Head (#14 x 1/2")
80	870-0106	3	Nut, Spring Sheet (#14)
81	405-1777	1	Door, Access - Rear
82	821-0014	2	Screw, Self-locking - Hex Head (5/16-18 x 1/2")
83	813-0098	6	Screw, Machine - Round Head (#10-32 x 3/8")
84	850-0030	6	Washer, Lock - Spring (#10)
85	405-1780	1	Panel, Access - Rear
86	821-0014	4	Screw, Self-locking - Hex Head (5/16-18 x 1/2")
87	405-1812	1	Panel, Housing - Rear
88	821-0010	4	Screw, Self-locking - Hex Head (1/4-20 x 1/2")
89	234-0369	1	Cover, End Bell - Generator
90	508-0001	2	Grommet, Rubber (3/4" ID x 1-9/32" OD)
91	813-0098	4	Screw, Machine - Round Head (#10-32 x 3/8")
92	850-0030	4	Washer, Lock - Spring (#10)
93	301-3195	1	Plate, Blank - Bottom, Junction Box
94	821-0010	3	Screw, Self-locking - Hex Head (1/4-20 x 1/2")
95	821-0014	2	Screw, Self-locking - Hex Head (5/16-18 x 1/2")
96	301-3196	1	Bracket, Support - Current Transformer Assembly
97	821-0010	1	Screw, Self-locking - Hex Head (1/4-20 x 1/2")
98	301-3191	1	Box, Junction
99	821-0010	8	Screw, Self-locking - Hex Head (1/4-20 x 1/2")
100	403-0895	2	Plate, Cover
101	800-0048	6	Screw, Cap - Hex Head (3/8-16 x 3/4")
102	850-0050	6	Washer, Lock - Spring (3/8)
103	403-0894	1	Adapter, Chassis - Rear

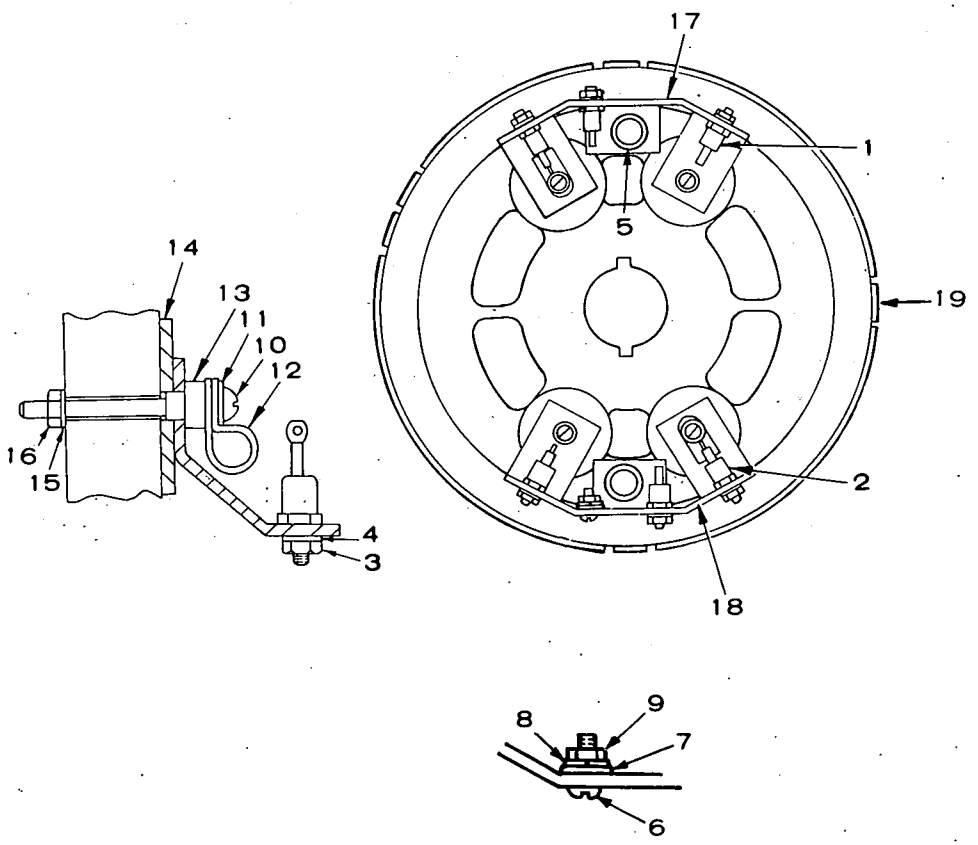


GENERATOR GROUP

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	800-0003	2	Screw, Cap - Hex Head (1/4-20 x 1/2")
2	850-0040	2	Washer, Lock - Spring (1/4)
3	150-1456	1	Contact Assembly - Overspeed Switch
4	862-0011	4	Nut, Hex - Special, Grade 8 (3/8-16)
5	850-0050	4	Washer, Lock - Spring (3/8)
6	211-0185	1	End Bell - Generator
7	509-0125	1	Seal, Oil - O-Ring
8	800-0009	4	Screw, Cap - Hex Head (1/4-20 x 1-1/2")
9	850-0040	4	Washer, Lock - Spring (1/4)
10	220-2353	1	Stator, Exciter
11	800-0008	2	Screw, Cap - Hex Head (1/4-20 x 1-1/4")
12	850-0040	2	Washer, Lock - Spring (1/4)
13	862-0001	2	Nut, Hex (1/4-20)
14	234-0368	1	Screen, Air Outlet - Generator
15	800-0051	8	Screw, Cap - Hex Head (3/8-16 x 1-1/4")
16	850-0050	8	Washer, Lock - Spring (3/8)
17	520-0718	4	Stud (3/8-16 x 3/8-16 x 14-11/16") Used on Single Phase Sets
18	520-0721	4	Stud (3/8-16 x 3/8-16 x 16-11/32") Used on Three Phase Sets
19	503-0611	4	Hose, Rubber
20	£	1	Stator, Generator
21	812-0189	1	Screw, Machine - Round Head (3/8-16 x 3/4")
22	856-0010	1	Washer, Lock - External/ Internal Tooth (3/8)
23	150-0717	1	Switch, Overspeed
			ROTOR ASSEMBLY, GENERATOR (Includes items marked *)
24	800-0513	1	*Screw, Cap - Hex Head, Special Heat Treat, Unplated (3/4-10 x 1-1/2")
25	850-0079	1	*Washer, Lock - Spring (3/4)
26	526-0238	1	*Washer, Flat - Steel Alloy (13/16" ID x 2" OD x 3/16" THK)
27	510-0101	1	*Bearing, Ball
28	232-2102	1	*Spacer, Sleeve
29	515-0145	1	*Key, Machine (1/4" x 1/4" x 7/8")
30	201-1739	1	*Rotor Assembly, Exciter (See Separate Group for Components)
32	805-0018	8	Bolt, Hex Head - Grade 8 (3/8-16 x 1")
33	805-0033	8	*Bolt, Hex Head - Grade 8 (5/8-11 x 1")
34	526-0259	8	*Washer, Flat - Special Hardened Steel (5/8)
35	232-2078	1	*Disk, Drive - Generator
36	205-0089	1	*Fan, Centrifugal - Generator
37	£	1	*Rotor, Generator
38	802-0072	12	Screw, Cap - Socket Head (3/8-16 x 1")
39	850-0050	12	Washer, Lock - Spring (3/8)
40	231-0188	1	Adapter, Generator

£ - Refer to Factory giving Complete Model, Spec and Serial Number from nameplate.

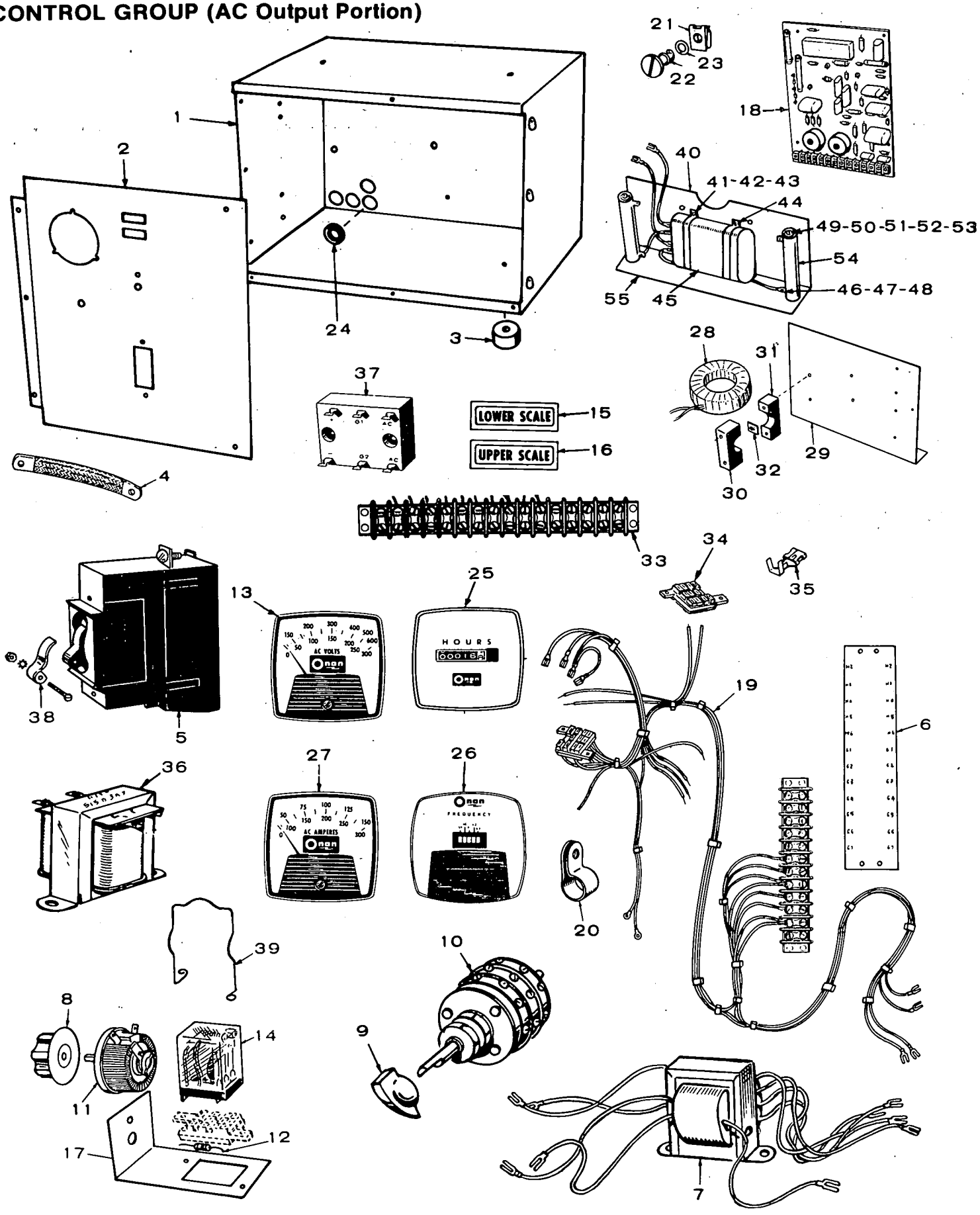
* - Included in Generator Rotor Assembly.



EXCITER ROTOR GROUP

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	358-0016	3	Rectifier, Diode - Positive
2	358-0015	3	Rectifier, Diode - Negative
3	870-0053	6	Nut, Hex (#10-32)
4	850-0030	6	Washer, Lock - Spring (#10)
5	508-0093	2	Grommet, Rubber
6	813-0100	2	Screw, Machine - Round Head (#10-32 x 1/2")
7	526-0008	2	Washer, Flat (13/64" ID x 7/16" OD x 1/32" THK)
8	850-0030	2	Washer, Lock - Spring (#10)
9	870-0053	2	Nut, Hex (#10-32)
10	813-0110	4	Screw, Machine - Round Head (#10-32 x 2")
11	526-0009	4	Washer, Flat (7/32" ID x 1/2" OD x 1/16" THK)
12	332-0050	2	Clamp, Loop
13	508-0124	4	Spacer, Stepped
14	508-0156	4	Washer, Flat - Fiber (19/64" ID x 1-7/8" OD x 1/8" THK)
15	850-0030	5	Washer, Lock - Spring (#10)
16	870-0053	4	Nut, Hex (#10-32)
17	363-0054	1	Heat Sink, Rectifier - Positive
18	363-0055	1	Heat Sink, Rectifier - Negative
19	201-1737	1	Rotor, Exciter

CONTROL GROUP (AC Output Portion)



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	301-3158	1	Box, Control
2	£	1	Panel, Control (Generator Section)
3	402-0078	4	Mount, Vibration
4	337-0049	1	Lead, Electrical - Ground
5	320-0431	1	Breaker, Circuit
6	MARKER STRIP		
	332-1248	1	Strip, Marker (12 Place)
	332-1242	1	Strip, Marker - Optional (16 Place)
7	315-0342	1	Transformer, Voltage
8	303-0032	1	Knob
9	303-0076	1	Knob, Pointer
10	ROTARY SWITCH		
	308-0012	1	Switch, Rotary - 2 Pole, 4 Position
	308-0284	1	Switch, Rotary - 4 Pole, 4 Position - Optional
11	303-0170	1	Rheostat
12	350-0556	1	†Resistor, Composition (47,000-Ohm, 1/2 Watt, 5%)
13	VOLTMETER		
	302-0421	1	Voltmeter - Optional (0-300 Volt)
	302-0718	1	Voltmeter - Optional (0-300 Volt, 0-600 Volt)
	302-0779	1	Voltmeter - Optional (0-750 Volt)
14	307-1061	1	Relay, Armature
15	322-0130	1	Light, Indicator - Optional (Lower Scale)
16	322-0131	1	Light, Indicator - Optional (Upper Scale)
17	301-3244	1	Bracket, Angle - Relay Socket
18	332-1268	1	*Regulator, Voltage
19	£	1	Harness, Wiring (Includes parts marked †)
20	332-0050	1	Clamp, Loop
21	406-0332	2	Receptacle, Turnbutton Fastener
22	406-0333	2	Stud, Turnbutton Fastener
23	406-0334	2	Washer, Lock - Turnbutton Stud
24	508-0001	4	Grommet, Rubber (1-1/16" OD)
25	TIME TOTALIZING METER		
	302-0466	1	Meter, Time Totalizing - 60 Hertz
	302-0469	1	Meter, Time Totalizing - 50 Hertz
26	ELECTRICAL FREQUENCY METER		
	302-0221	1	Meter, Electrical Frequency - 60 Hertz
	302-0256	1	Meter, Electrical Frequency - 50 Hertz
27	AMMETER		
	302-0412	2	Ammeter (0-250) - Optional
	302-0719	1	Ammeter (0-75, 0-150)
28	CURRENT TRANSFORMER		
	302-0743	3	Transformer, Current
	302-0739	2	Transformer, Current - Optional
	302-0496	1	Transformer, Current - Optional
29	302-0729	1	Bracket, Angle - Current Transformer Mounting
30	302-0235	3	Clamp, Retaining, Transformer - Upper
31	302-0236	3	Clamp, Retaining, Transformer - Lower
32	302-0253	As Req.	Shim - Transformer Mounting
33	TERMINAL BOARD		
	332-0607	1	†Board, Terminal (12 Place)
	332-0795	1	†Board, Terminal (16 Place) - Optional
34	323-0764	1	†Socket, Relay
35	332-1280	As Req.	†Terminal, Lug
36	315-0384	1	Reactor
37	305-0524	1	Rectifier Assembly
38	320-0307	1	Lock, Handle - Circuit Breaker - Optional (Penn State Sets)
39	307-1157	1	Clip, Retaining - Relay
40	232-2219	1	Filter, Voltage Regulator - Optional (Includes parts marked +)
41	812-0061	4	+Screw, Machine - Round Head (#6-32 x 3/8")
42	850-0020	5	+Washer, Lock - Spring (#6)
43	860-0006	4	+Nut, Hex (#6-32)
44	312-0189	2	+Bracket, Hold-down - Capacitor
45	312-0188	1	+Capacitor, Plastic Dielectric, Metal Case (15 MFD, 440 VAC)
46	815-0001	4	+Screw, Machine - Binding Head, Brass (#6-32 x 1/4")
47	853-0003	4	+Washer, Lock - External Tooth (#6)
48	860-0006	4	+Nut, Hex (#6-32)
49	812-0165	2	+Screw, Machine - Round Head (1/4-20 x 4-1/2")
50	304-0427	4	+Washer, Shoulder - Centering
51	304-0292	2	+Insulator, Disk
52	850-0040	2	+Washer, Lock - Spring (1/4)
53	862-0001	2	+Nut, Hex (1/4-20)
54	354-0025	2	+Resistor, Wirewound (10-Ohm, 100 Watts, 5%)
55	232-2218	1	+Bracket, Angle - Mounting
	ATTACHING HARDWARE - NOT ILLUSTRATED (Select as Applicable)		
	812-0059	As Req.	Screw, Machine - Round Head (#6-32 x 1/4")
	812-0061	As Req.	Screw, Machine - Round Head (#6-32 x 3/8")
	812-0066	As Req.	Screw, Machine - Round Head (#6-32 x 3/4")
	812-0077	As Req.	Screw, Machine - Round Head (#8-32 x 3/8")
	815-0026	As Req.	Screw, Machine - Truss Head (#10-32 x 3/8")
	815-0203	As Req.	Screw, Machine - Round Head, Brass with External Tooth Lockwasher (#10-32 x 7/8")
	800-0024	As Req.	Screw, Cap - Hex Head (5/16-18 x 3/8")
	800-0045	As Req.	Screw, Cap - Hex Head (5/16-18 x 1/2")
	526-0049	As Req.	Washer, Flat, Brass (.200" ID x 7/16" OD x 1/32" THK)
	850-0020	As Req.	Washer, Lock - Spring (#6)
	853-0003	As Req.	Washer, Lock - External Tooth (#6)
	853-0008	As Req.	Washer, Lock - External Tooth (#10)
	850-0045	As Req.	Washer, Lock - Spring (5/16)
	856-0008	As Req.	Washer, Lock - External/ Internal Tooth (5/16)
	871-0010	As Req.	Nut, Hex - Brass (#6-32)
	870-0053	As Req.	Nut, Hex (#10-32)
	862-0015	As Req.	Nut, Hex (5/16-18)

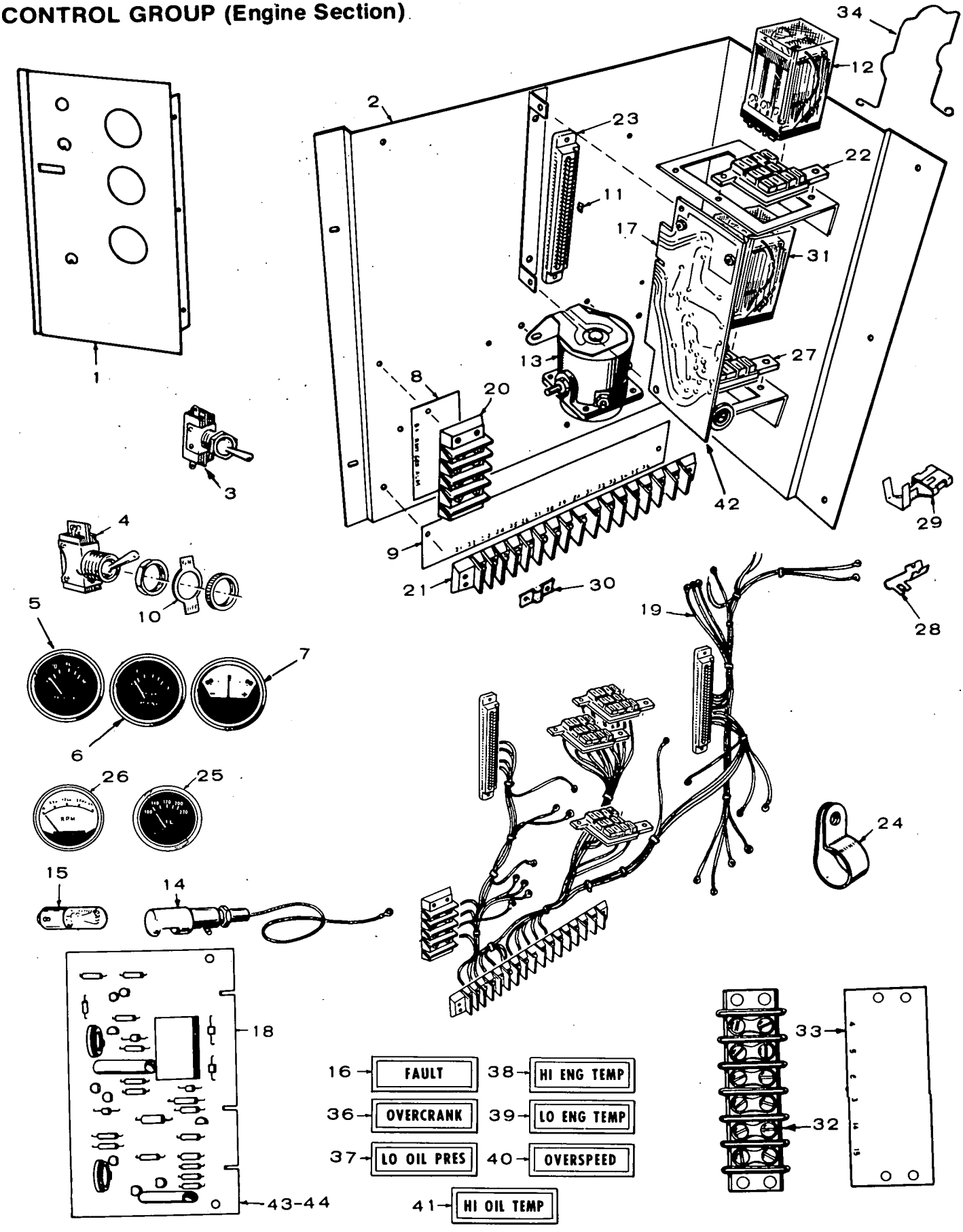
+ - Included in Filter.

† - Included in Wiring Harness.

* - See Separate Group for Components.

£ - To order refer to Factory, giving Model, Spec and Serial number from nameplate; additional data as to Quantity of meters, etc. will assist identification

CONTROL GROUP (Engine Section)



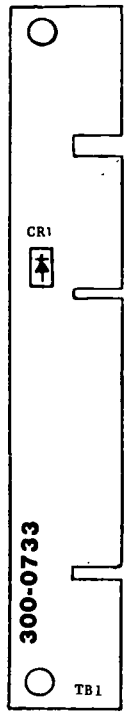
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	£	1	Panel, Control (Engine Section)
2	301-3253	1	Bracket, Angle - Control Mounting
3	308-0138	1	Switch, Toggle (SPDT)
4	308-0002	1	Switch, Toggle (SPST)
5	193-0107	1	Gauge, Oil Pressure
6	193-0106	1	Gauge, Water Temperature
7	302-0061	1	Ammeter (30-0-30)
8	332-1239	1	Strip, Marker
9	332-1241	1	Strip, Marker
10	308-0003	1	Plate, Switch (On-Off)
11	332-1276	4	Plug, Key
12	307-1058	2	Relay, Armature
13	307-1031	1	Relay, Armature
14	322-0149	1	Light, Panel
15	322-0004	1	Lamp, Incandescent (12 Volt)
16	322-0128	1	Light, Indicator (Fault)
17	300-0733	1	*Control, Cycle Cranker
18	300-0679	1	*Control, Engine Monitor
19	£	1	Harness, Wiring (Includes parts marked †)
20	332-0537	1	†Board, Terminal (4 Place)
21	332-0795	1	†Board, Terminal (16 Place)
22	332-0765	2	†Socket, Relay
23	332-1271	2	†Housing, Connector (PC Boards)
24	332-0051	1	Clamp, Loop
25	193-0187	1	Gauge, Oil Temperature - Optional
26	302-0749	1	Tachometer, Electrical - Optional
27	323-0764	1	†Socket, Relay
28	332-1269	As Req.	†Contact, Electrical - PC Board Connector
29	332-1280	As Req.	†Terminal, Lug
30	332-1043	1	†Jumper
31	307-1061	1	Relay, Armature
32	332-0699	1	†Board, Terminal (6 Place)
33	332-1240	1	Strip, Marker
34	307-1157	3	Clip, Retaining - Relay
35	308-0327	1	Switch, Toggle - Optional (SPDT) Penn State
36	322-0107	1	Light, Indicator (Overcrank)
37	322-0108	1	Light, Indicator (Low Oil Pressure)
38	322-0109	1	Light, Indicator (Hi Engine Temp)
39	322-0110	1	Light, Indicator (Low Engine Temp)
40	322-0111	1	Light, Indicator (Overspeed)
41	322-0112	1	Light, Indicator (Hi Oil Temp)
42	300-0714	1	*Control, Cycle Cranker - Optional
43	300-0730	1	*Control, Engine Monitor - Optional
44	300-0681	1	*Control, Engine Monitor - Optional
	ATTACHING HARDWARE—NOT ILLUSTRATED (Select as Applicable)		
	812-0066	As Req.	Screw, Machine - Round Head (#6-32 x 3/4")
	812-0077	As Req.	Screw, Machine - Round Head (#8-32 x 3/8")
	815-0026	As Req.	Screw, Machine - Truss Head (#10-32 x 3/8")
	813-0098	As Req.	Screw, Machine - Round Head (#10-32 x 3/8")
	815-0203	As Req.	Screw, Machine - Round Head, Brass with External Tooth Lockwasher (#10-32 x 7/8")
	853-0003	As Req.	Washer, Lock - External Tooth (#6)
	850-0025	As Req.	Washer, Lock - Spring (#8)
	526-0049	As Req.	Washer, Flat - Brass (.200" ID x 7/16" OD x 1/32" THK)
	850-0030	As Req.	Washer, Lock - Spring (#10)
	856-0003	As Req.	Washer, Lock - External/ Internal Tooth (#10)
	853-0008	As Req.	Washer, Lock - External Tooth (#10)
	860-0006	As Req.	Nut, Hex (#6-32)
	860-0008	As Req.	Nut, Hex (#8-32)
	870-0053	As Req.	Nut, Hex (#10-32)
	871-0010	As Req.	Nut, Hex - Brass (#6-32)
	518-0295	As Req.	Pin, Round Head, Non-Metallic (PC Board Fastener)

* - See Separate Group for Components.

† - Included in Wiring Harness.

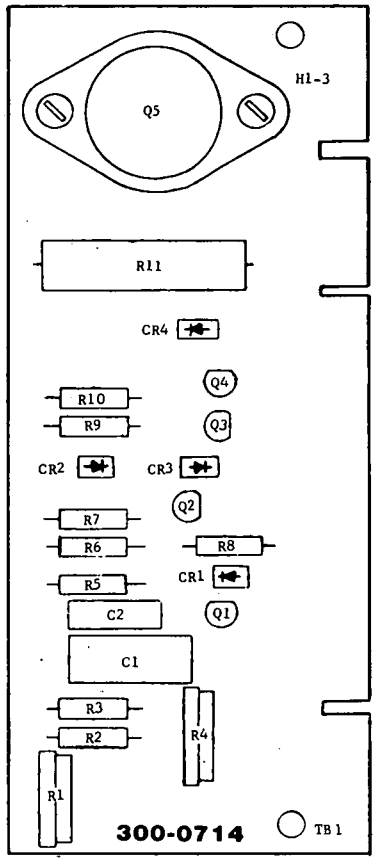
£ - To Order refer to Factory, giving Model, Spec and Serial Number. Additional data as to quantity of meters, etc. will assist identification.

CRANKER CONTROL GROUP - 12 VOLT STANDARD



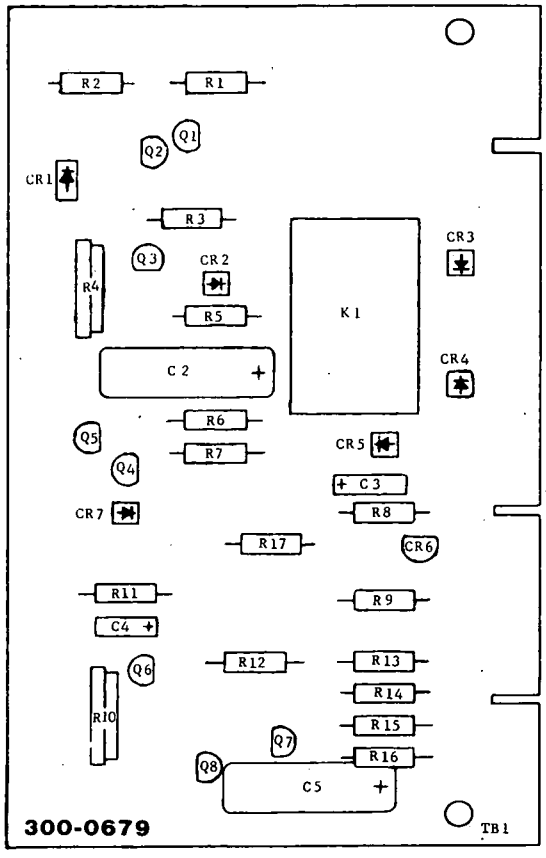
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	300-0733		Control, Cranker - 12 Volt
CR1	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
TB1	332-1285	1	Printed Wiring Board

CRANKER CYCLE CONTROL GROUP - 12 VOLT OPTIONAL



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	300-0714		Control, Cranker Cycle - 12 Volt
C1	356-0039	1	Capacitor, Electrolytic (100 Mfd, 10 Volt)
C2	355-0010	1	Capacitor, Plastic Dielectric (.0022 Mfd, 100 VDC, 10%)
CR1	359-0027	1	Diode, Zener
CR2	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
CR3	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
CR4	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
H1	812-0061	2	Screw, Machine, Round Head (#6-32 x 3/8")
H2	853-0003	2	Washer, Lock - External Tooth (#6)
H3	860-0006	2	Nut, Hex (#6-32)
Q1	362-0008	1	Transistor
Q2	362-0008	1	Transistor
Q3	362-0017	1	Transistor
Q4	362-0026	1	Transistor
Q5	362-0019	1	Transistor
R1	303-0171	1	Potentiometer (100,000-Ohm, 1/4 Watt)
R2	350-0560	1	Resistor, Composition (0.1 Megohm, 1/2 Watt, 10%)
R3	350-0548	1	Resistor, Composition (10,000-Ohm, 1/2 Watt, 10%)
R4	303-0171	1	Potentiometer (100,000-Ohm, 1/4 Watt)
R5	350-0558	1	Resistor, Composition (68,000-Ohm, 1/2 Watt, 10%)
R6	350-0420	1	Resistor, Composition (24,000-Ohm, 1/2 Watt, 5%)
R7	350-0546	1	Resistor, Composition (6800-Ohm, 1/2 Watt, 10%)
R8	350-0520	1	Resistor, Composition (47-Ohm, 1/2 Watt, 5%)
R9	350-0548	1	Resistor, Composition (10,000-Ohm, 1/2 Watt, 10%)
R10	350-0500	1	Resistor, Composition (1-Ohm, 1/2 Watt, 10%)
R11	352-0152	1	Resistor, Wirewound (25-Ohm, 5 Watt, 5%)
TB1	332-1275	1	Printed Wiring Board

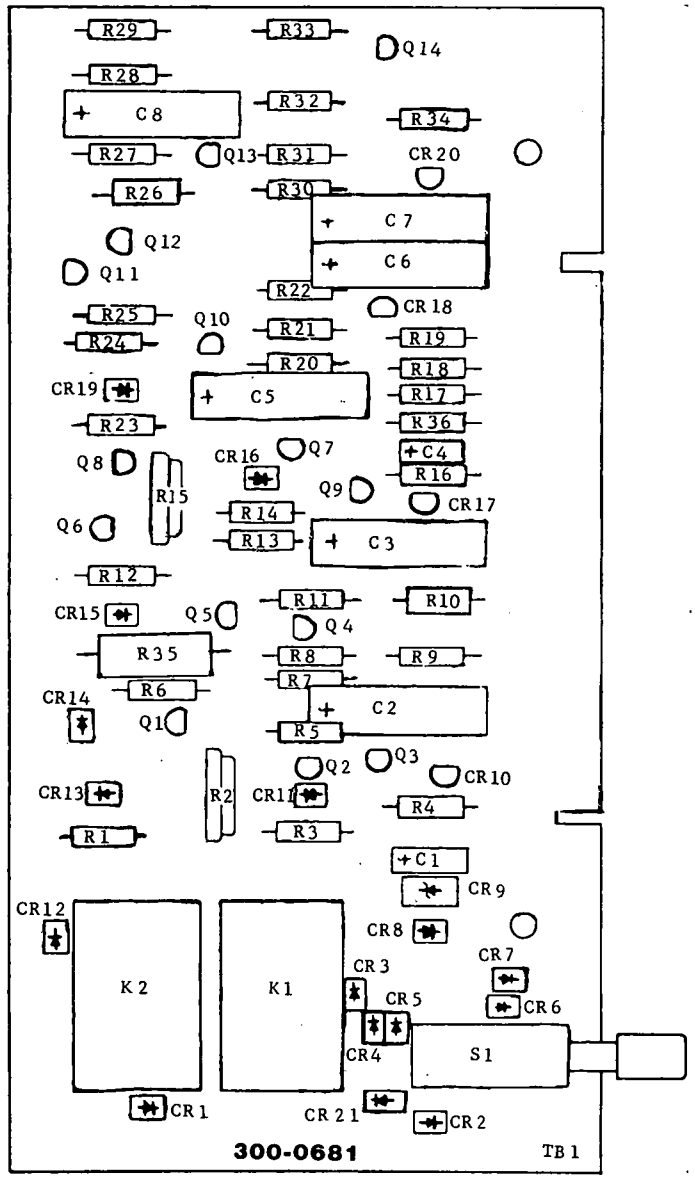
ENGINE CONTROL MONITOR GROUP - 12 VOLT



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	300-0679		Monitor, Engine Control - 12 Volt
C1			Not used
C2	355-0005	1	Capacitor, Plastic Dielectric (.22 Mfd, 200 VDC, 10%)
C3	356-0040	1	Capacitor, Electrolytic (10 Mfd, 20 Volt)
C4	356-0030	1	Capacitor, Electrolytic (1 Mfd, 35 Volt)
C5	355-0005	1	Capacitor, Plastic Dielectric (.22 Mfd, 200 VDC, 10%)
CR1	359-0027	1	Diode, Zener (1 Watt, 7.5 Volt, 5%)
CR2	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
CR3	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
CR4	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
CR5	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
CR6	364-0017	1	Diode, Rectifier (8 Amp, 30 Volt)
CR7	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
K1	307-1039	1	Relay, Armature (12 Volt)
Q1	361-0003	1	Transistor
Q2	362-0025	1	Transistor
Q3	362-0025	1	Transistor
Q4	361-0003	1	Transistor
Q5	362-0025	1	Transistor
Q6	362-0025	1	Transistor
Q7	362-0008	1	Transistor
Q8	362-0008	1	Transistor

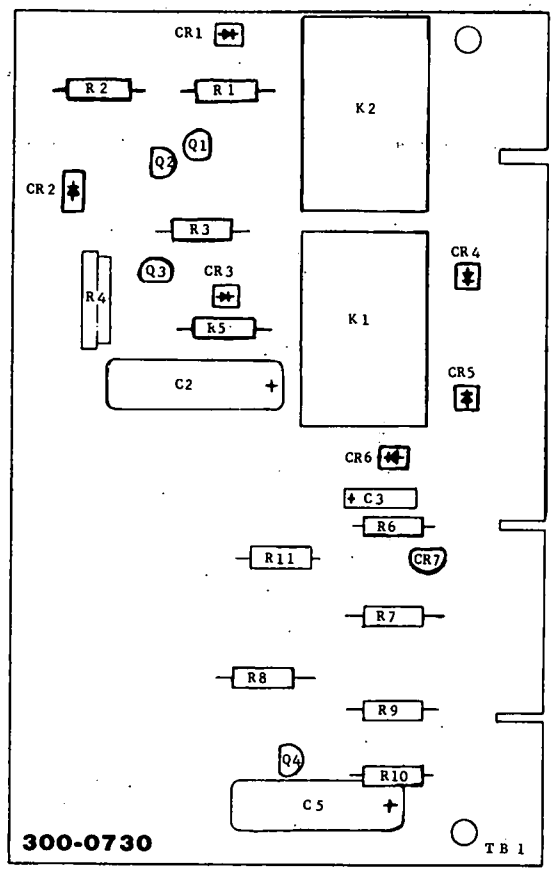
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
R1	350-0536	1	Resistor, Composition (1000-Ohm, 1/2 Watt, 10%)
R2	350-0526	1	Resistor, Composition (100-Ohm, 1/2 Watt, 10%)
R3	350-0548	1	Resistor, Composition (10,000-Ohm, 1/2 Watt, 10%)
R4	303-0169	1	Potentiometer (3.5 Meg Ohm, 1/4 Watt, 30%)
R5	350-0572	1	Resistor, Composition (1-Meg Ohm, 1/2 Watt, 10%)
R6	350-0552	1	Resistor, Composition (22,000-Ohm, 1/2 Watt, 10%)
R7	350-0536	1	Resistor, Composition (1000-Ohm, 1/2 Watt, 10%)
R8	350-0505	1	Resistor, Composition (2.7-Ohm, 1/2 Watt, 10%)
R9	350-0517	1	Resistor, Composition (27-Ohm, 1/2 Watt, 10%)
R10	303-0169	1	Potentiometer (3.5-Meg Ohm, 1/4 Watt, 30%)
R11	350-0584	1	Resistor, Composition (10-Meg Ohm, 1/2 Watt, 10%)
R12	350-0529	1	Resistor, Composition (270-Ohm, 1/2 Watt, 10%)
R13	350-0529	1	Resistor, Composition (270-Ohm, 1/2 Watt, 10%)
R14	350-0529	1	Resistor, Composition (270-Ohm, 1/2 Watt, 10%)
R15	350-0540	1	Resistor, Composition (2200-Ohm, 1/2 Watt, 10%)
R16	350-0540	1	Resistor, Composition (2200-Ohm, 1/2 Watt, 10%)
R17	350-1128	1	Resistor, Composition (220-Ohm, 2 Watt, 10%)
TB1	332-1246	1	Printed Wiring Board

ENGINE CONTROL MONITOR GROUP - 12 VOLT
OPTIONAL (5 Fault Lights)



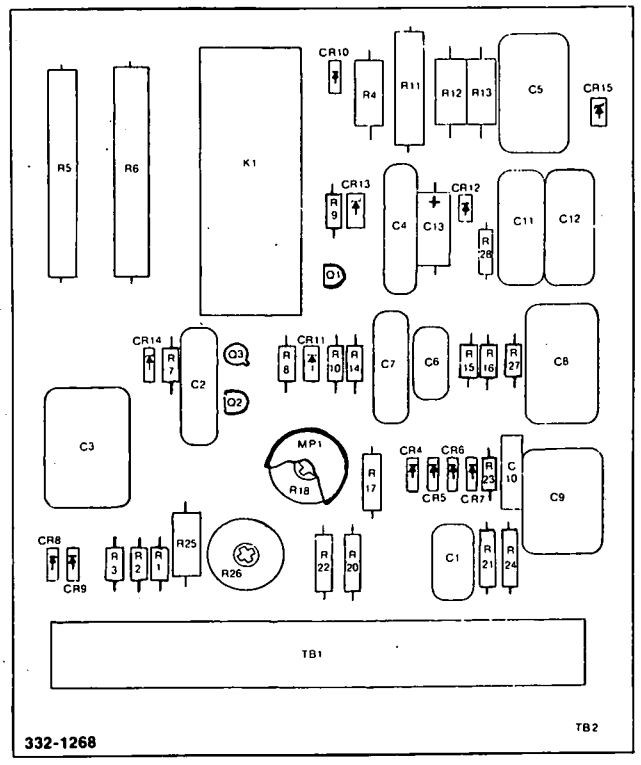
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	300-0681		Monitor, Engine Control - 12 Volt - Optional
C1	356-0040	1	Capacitor, Electrolytic (10 Mfd, 20 Volt)
C2	355-0005	1	Capacitor, Plastic Dielectric (.22 Mfd, 200 VDC, 10%)
C3	355-0005	1	Capacitor, Plastic Dielectric (.22 Mfd, 200 VDC, 10%)
C4	356-0030	1	Capacitor, Electrolytic (1 Mfd, 35 Volt)
C5	355-0005	1	Capacitor, Plastic Dielectric (.22 Mfd, 200 VDC, 10%)
C6	355-0005	1	Capacitor, Plastic Dielectric (.22 Mfd, 200 VDC, 10%)
C7	355-0005	1	Capacitor, Plastic Dielectric (.22 Mfd, 200 VDC, 10%)
C8	355-0005	1	Capacitor, Plastic Dielectric (.22 Mfd, 200 VDC, 10%)
CR1	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
CR2	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
CR3	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
CR4	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
CR5	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
CR6	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
CR7	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
CR8	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
CR9	359-0027	1	Diode, Zener (1 Watt, 7.5 Volt, 5%)
CR10	364-0017	1	Diode, Rectifier (8 Amp, 30 Volt)
CR11	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
CR12	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
CR13	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
CR14	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
CR15	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
CR16	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
CR17	364-0017	1	Diode, Rectifier (8 Amp, 30 Volt)
CR18	364-0017	1	Diode, Rectifier (8 Amp, 30 Volt)
CR19	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
CR20	364-0017	1	Diode, Rectifier (8 Amp, 30 Volt)
CR21	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
K1	307-1039	1	Relay, Armature (12 Volt)
K2	307-1039	1	Relay, Armature (12 Volt)
Q1	362-0025	1	Transistor
Q2	362-0025	1	Transistor
Q3	361-0003	1	Transistor
Q4	362-0008	1	Transistor
Q5	362-0008	1	Transistor
Q6	362-0008	1	Transistor
Q7	362-0031	1	Transistor
Q8	362-0031	1	Transistor
Q9	361-0003	1	Transistor
Q10	362-0008	1	Transistor
Q11	362-0008	1	Transistor
Q12	362-0008	1	Transistor
Q13	362-0008	1	Transistor
Q14	362-0008	1	Transistor
R1	350-0526	1	Resistor, Composition (100-Ohm, 1/2 Watt, 10%)
R2	303-0169	1	Potentiometer (3.5 Megohm, 1/4 Watt, 30%)
R3	350-0572	1	Resistor, Composition (1 Megohm, 1/2 Watt, 10%)
R4	350-0517	1	Resistor, Composition (27-Ohm, 1/2 Watt, 10%)
R5	350-0536	1	Resistor, Composition (1000-Ohm, 1/2 Watt, 10%)
R6	350-0548	1	Resistor, Composition (10,000-Ohm, 1/2 Watt, 10%)
R7	350-0505	1	Resistor, Composition (2.7-Ohm, 1/2 Watt, 10%)
R8	350-0529	1	Resistor, Composition (270-Ohm, 1/2 Watt, 10%)
R9	350-0540	1	Resistor, Composition (2200-Ohm, 1/2 Watt, 10%)
R10	350-0380	1	Resistor, Composition (510-Ohm, 1/2 Watt, 5%)
R11	350-0529	1	Resistor, Composition (270-Ohm, 1/2 Watt, 10%)
R12	350-0552	1	Resistor, Composition (22,000-Ohm, 1/2 Watt, 10%)
R13	350-0505	1	Resistor, Composition (2.7-Ohm, 1/2 Watt, 10%)
R14	350-0536	1	Resistor, Composition (1000-Ohm, 1/2 Watt, 10%)
R15	303-0169	1	Potentiometer (3.5 Megohm, 1/4 Watt, 30%)
R16	350-0517	1	Resistor, Composition (27-Ohm, 1/2 Watt, 10%)
R17	350-0540	1	Resistor, Composition (2200-Ohm, 1/2 Watt, 10%)
R18	350-0540	1	Resistor, Composition (2200-Ohm, 1/2 Watt, 10%)
R19	350-0517	1	Resistor, Composition (27-Ohm, 1/2 Watt, 10%)
R20	350-0529	1	Resistor, Composition (270-Ohm, 1/2 Watt, 10%)
R21	350-0529	1	Resistor, Composition (270-Ohm, 1/2 Watt, 10%)
R22	350-0505	1	Resistor, Composition (2.7-Ohm, 1/2 Watt, 10%)
R23	350-0529	1	Resistor, Composition (270-Ohm, 1/2 Watt, 10%)
R24	350-0529	1	Resistor, Composition (270-Ohm, 1/2 Watt, 10%)
R25	350-0540	1	Resistor, Composition (2200-Ohm, 1/2 Watt, 10%)
R21	350-0380	1	Resistor, Composition (510-Ohm, 1/2 Watt, 5%)
R27	350-0529	1	Resistor, Composition (270-Ohm, 1/2 Watt, 10%)
R28	350-0529	1	Resistor, Composition (270-Ohm, 1/2 Watt, 10%)
R29	350-0540	1	Resistor, Composition (2200-Ohm, 1/2 Watt, 10%)
R30	350-0505	1	Resistor, Composition (2.7-Ohm, 1/2 Watt, 10%)
R31	350-0529	1	Resistor, Composition (270-Ohm, 1/2 Watt, 10%)
R32	350-0540	1	Resistor, Composition (2200-Ohm, 1/2 Watt, 10%)
R33	350-0529	1	Resistor, Composition (270-Ohm, 1/2 Watt, 10%)
R34	350-0517	1	Resistor, Composition (27-Ohm, 1/2 Watt, 10%)
R35	350-1128	1	Resistor, Composition (220-Ohm, 2 Watt, 10%)
R36	350-0584	1	Resistor, Composition (10 Megohm, 1/2 Watt, 10%)
S1	308-0280	1	Switch, Push - DPDT (1A, 28 VDC/.45A, 115 VAC)
TB1	332-1231	1	Printed Wiring Board

ENGINE CONTROL MONITOR GROUP - 12 VOLT
PENN STATE (1 Fault Light)

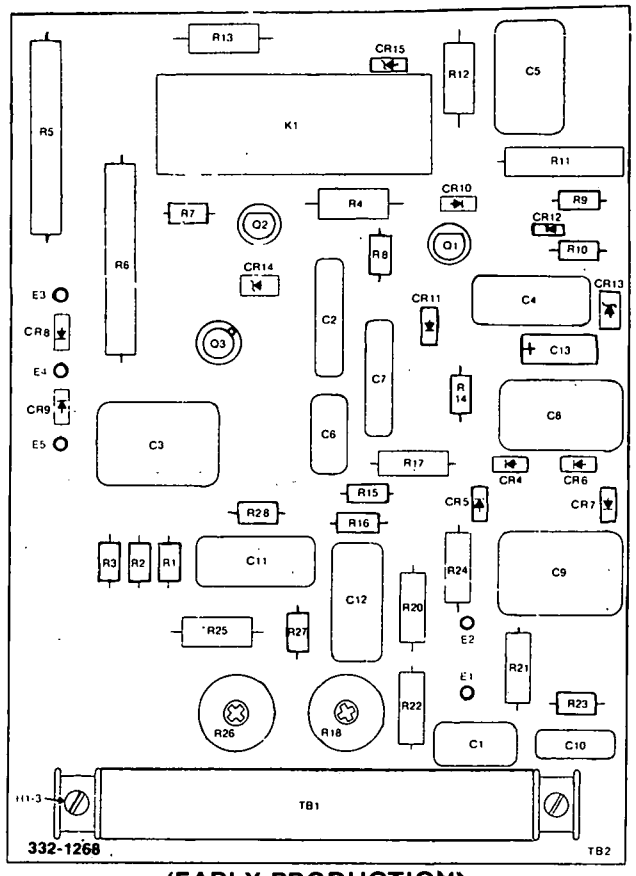


REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	300-0730		Monitor, Engine Control - 12 Volt (Penn State)
C1			Not used
C2	355-0005	1	Capacitor, Plastic Dielectric (.22 Mfd, 200 VDC, 10%)
C3	356-0040	1	Capacitor, Electrolytic (10 Mfd, 20 Volt)
C4			Not used
C5	355-0005	1	Capacitor, Plastic Dielectric (.22 Mfd, 200 VDC, 10%)
CR1	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
CR2	359-0027	1	Diode, Zener (1 Watt, 7.5 Volt, 5%)
CR3	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
CR4	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
CR5	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
CR6	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
CR7	364-0017	1	Diode, Rectifier (8 Amp, 30 Volt)
K1	307-1039	1	Relay, Armature (12 Volt)
K2	307-1039	1	Relay, Armature (12 Volt)
Q1	361-0003	1	Transistor
Q2	362-0025	1	Transistor
Q3	362-0025	1	Transistor
Q4	362-0008	1	Transistor
R1	350-0536	1	Resistor, Composition (1000-Ohm, 1/2 Watt, 10%)
R2	350-0526	1	Resistor, Composition (100-Ohm, 1/2 Watt, 10%)
R3	350-0552	1	Resistor, Composition (22,000-Ohm, 1/2 Watt, 10%)
R4	303-0169	1	Potentiometer (3.5 Megohm, 1/4 Watt, 30%)
R5	350-0572	1	Resistor, Composition (1 Megohm, 1/2 Watt, 10%)
R6	350-0505	1	Resistor, Composition (2.7-Ohm, 1/2 Watt, 10%)
R7	350-0517	1	Resistor, Composition (27-Ohm, 1/2 Watt, 10%)
R8	350-0529	1	Resistor, Composition (270-Ohm, 1/2 Watt, 10%)
R9	350-0529	1	Resistor, Composition (270-Ohm, 1/2 Watt, 10%)
R10	350-0540	1	Resistor, Composition (2200-Ohm, 1/2 Watt, 10%)
R11	350-0971	1	Resistor, Composition (220-Ohm, 2 Watt, 5%)
TB1	332-1246	1	Printed Wiring Board

VOLTAGE REGULATOR



(LATEST PRODUCTION)



(EARLY PRODUCTION)

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
C1	355-0018	1	Capacitor, Plastic Die (.47 MFD, 100 VDC, 2%)
C2	355-0005	1	Capacitor, Plastic Die (.22 MFD, 200 VDC,10%)
C3	355-0017	1	Capacitor, Plastic Die (.47 MFD, 400 VDC,10%)
C4	355-0006	1	Capacitor, Plastic Die (.47 MFD, 200 VDC,10%)
C5	355-0016	1	Capacitor, Plastic Die(1 MFD, 100 VDC, 10%)
C6	355-0015	1	Capacitor, Plastic Die(.1 MFD, 200 VDC, 10%)
C7	355-0005	1	Capacitor, Plastic Die (.22 MFD, 200 VDC,10%)
C8	355-0016	1	Capacitor, Plastic Die(1 MFD, 100 VDC, 10%)
C9	355-0017	1	Capacitor, Plastic Die(.47 MFD,400 VDC,10 %)
C10	355-0014	1	Capacitor, Plastic Die(.047 MFD,200 VDC 10%)
C11	355-0020	1	Capacitor, Plastic Die(.1 MFD,400VDC,10%)
C12	355-0006	1	Capacitor, Plastic Die (.47 MFD,200 VDC,10%)
C13	356-0039	1	Capacitor, Electrolytic (100 MFD, 10 Volts)
CR4	357-0014	1	Diode, Rectifier
CR5	357-0014	1	Diode, Rectifier
CR6	357-0014	1	Diode, Rectifier
CR7	357-0014	1	Diode, Rectifier
CR8	357-0014	1	Diode, Rectifier
CR9	357-0014	1	Diode, Rectifier
CR10	357-0014	1	Diode, Rectifier
CR11	357-0014	1	Diode, Rectifier
CR12	359-0016	1	Diode, Zener
CR13	359-0025	1	Diode, Zener
CR14	359-0026	1	Diode, Zener
CR15	359-0015	1	Diode, Zener
E1-5	332-0833	5	*Terminal, Stud
H1	812-0081	2	*Screw, Round Head (#8-32 x 5/8")
H2	853-0005	2	*Washer, Lock - External Tooth (#8)
H3	860-0008	2	*Nut, Hex (#8-32)
K1	307-1063	1	Relay, Armature
MP1	517-0127	1	Cover, Potentiometer
Q1	362-0017	1	Transistor
Q2	362-0017	1	Transistor
Q3	361-0004	1	Transistor

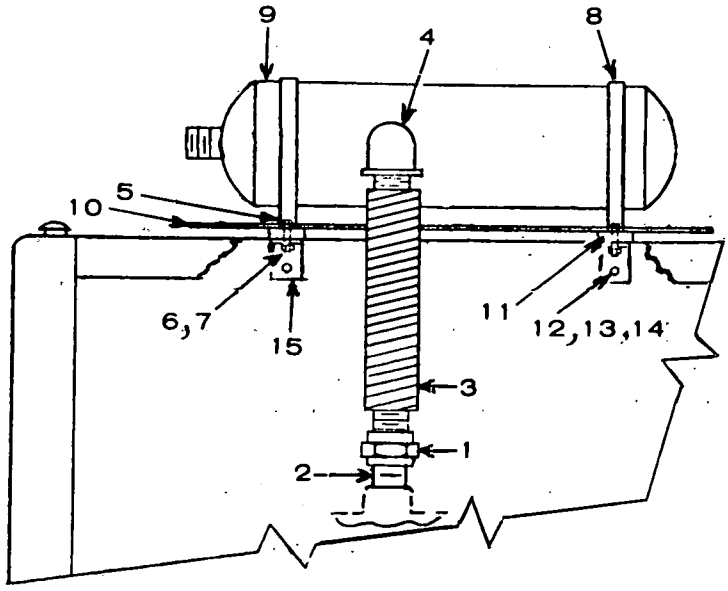
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
R1	350-0355	1	Resistor, Composition (47-Ohm, 1/2 Watt, 5%)
R2	350-0351	1	Resistor, Composition (33-Ohm, 1/2 Watt, 5%)
R3	350-0351	1	Resistor, Composition (33-Ohm, 1/2 Watt, 5%)
R4	350-1075	1	Resistor, Composition (4.7 Megohm, 2 Watt, 5%)
R5	353-0040	1	Resistor, Wire Wound (270-Ohm, 10 Watt, 5%)
R6	353-0039	1	Resistor, Wire Wound (5000-Ohm, 15 Watt, 5%)
R7	350-0398	1	Resistor, Composition (3000-Ohm, 1/2 Watt, 5%)
R8	350-0447	1	Resistor, Composition (330,000-Ohm, 1/2 Watt, 5%)
R9	350-0423	1	Resistor, Composition (33,000-Ohm, 1/2 Watt, 5%)
R10	350-0423	1	Resistor, Composition (33,000-Ohm, 1/2 Watt, 5%)
R11	352-0151	1	Resistor, Wire Wound (15,000-Ohm, 5 Watt, 5%)
R12	350-1014	1	Resistor, Composition (13,000-Ohm, 2 Watt, 5%)
R13	350-1007	1	Resistor, Composition (6800-Ohm, 2 Watt, 5%)
R14	350-0443	1	Resistor, Composition (220,000-Ohm, 1/2 Watt, 5%)
R15	350-0435	1	Resistor, Composition (100,000-Ohm, 1/2 Watt, 5%)
R16	350-0447	1	Resistor, Composition (330,000-Ohm, 1/2 Watt, 5%)
R17	351-0521	1	Resistor, Film (12,100-Ohm, 1/4 Watt, 1%)
R18	303-0168	1	Potentiometer (5000-Ohm, 3 Watt, 5%)
R19			Not used
R20	351-0520	1	Resistor, Film (28,000-Ohm, 1/4 Watt, 1%)
R21	351-0522	1	Resistor, Film (5110-Ohm, 1/4 Watt, 1%)
R22	351-0520	1	Resistor, Film (28,000-Ohm, 1/4 Watt, 1%)
R23	350-0355	1	Resistor, Composition (47-Ohm, 1/2 Watt, 5%)
R24	351-0523	1	Resistor, Film (8870-Ohm, 1/4 Watt, 1%)
R25	350-1011	1	Resistor, Composition (10,000-Ohm, 2 Watt, 5%)
R26	303-0164	1	Potentiometer (8000-Ohm, 3 Watt, 20%)
R27	350-0447	1	Resistor, Composition (100,000-Ohm, 1/2 Watt, 5%)
R28	350-0459	1	Resistor, Composition (1 Megohm, 1/2 Watt, 5%)
TB1	332-1252	1	Terminal Board
TB2	332-1258	1	Printed Wiring Board

* - Used only on Early Production Units.

179-1520

EXHAUST MUFFLER - OPTIONAL

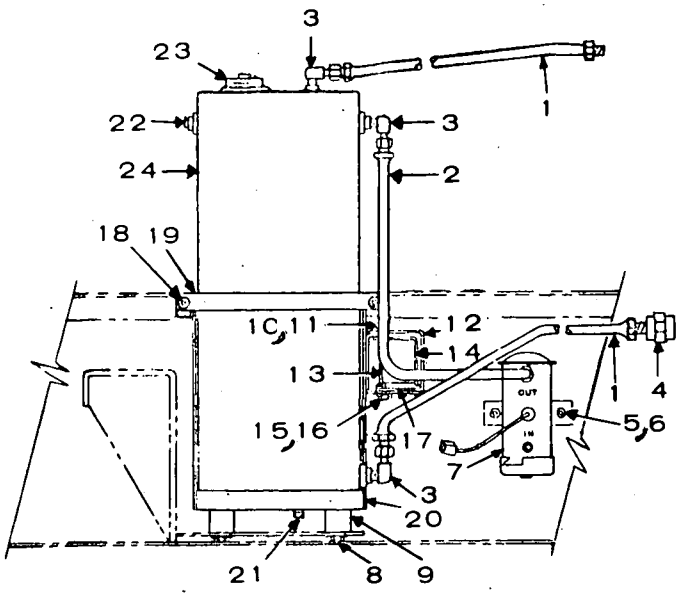
INSTALLATION (Housed Sets)



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	179-1520		Installation of Exhaust Muffler
1	505-0454	1	Union, Pipe
2	505-0172	1	Nipple, Pipe - Close
3	155-1115	1	Pipe, Exhaust - Flexible
4	505-0175	1	Elbow, Pipe - 90 Degree
5	800-0028	4	Screw, Cap - Hex Head (5/16-18 x 1")
6	850-0045	4	Washer, Lock - Spring (5/16)
7	862-0015	4	Nut, Hex (5/16-18)
8	140-0649	2	Strap, Retaining
9	155-0988	1	Muffler, Exhaust
10	155-0978	1	Heat, Shield
11	526-0172	4	Washer, Flat (1/2" ID x 2-1/4" OD x 1/4" THK)
12	800-0026	6	Screw, Cap - Hex Head (5/16-18 x 3/4")
13	850-0045	6	Washer, Lock - Spring (5/16-18)
14	862-0015	6	Nut, Hex (5/16-18)
15	155-0789	2	Bracket, Angle - Support

179-0441

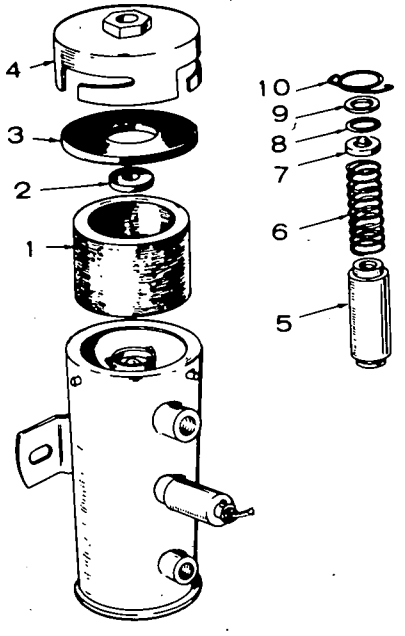
DAY FUEL TANK - OPTIONAL INSTALLATION



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	179-0441		Installation of Day Fuel Tank
1	501-0008	2	Line, Fuel - Flexible
2	501-0015	1	Line, Fuel - Flexible
3	502-0041	3	Elbow, Pipe - Street, Brass (1/4" x 1/4")
4	502-0051	1	Coupling, Pipe - Brass (1/4" x 1/4")
5	821-0018	2	Screw, Self-locking - Hex Head (1/4-20 x 5/8")
6	870-0212	2	Nut, Hex - Self-locking
7	149-0554	1	Pump, Fuel - Electric (See Separate Group for Components)
8	821-0014	8	Screw, Self-locking - Hex Head (5/16-18 x 1/2")
9	402-0070	4	Mount, Vibration
10	813-0098	1	Screw, Machine - Round Head (#10-32 x 3/8")
11	850-0030	1	Washer, Lock - Spring (#10)
12	415-0326	1	Cover, Relay
13	307-1157	1	Spring, Retaining - Relay
14	307-1058	1	Relay, Armature - 12 VDC
15	812-0001	2	Screw, Machine - Round Head (#6-32 x 3/8")
16	870-1183	2	Nut, Hex - With External Tooth Lockwasher (#6-32)
17	323-0897	1	Socket, Relay (Includes leads)
18	821-0013	2	Screw, Self-locking - Hex Head (1/4-20 x 1")
19	415-0323	1	Strap, Retaining
20	415-0324	1	Bracket, Angle - Tank Support
21	505-0110	1	Plug, Pipe - Square Head (3/8")
22	505-0054	1	Plug, Pipe - Square Head (1/4")
23	415-0321	1	Switch, Float - Liquid Level
24	415-0325	1	Tank, Fuel

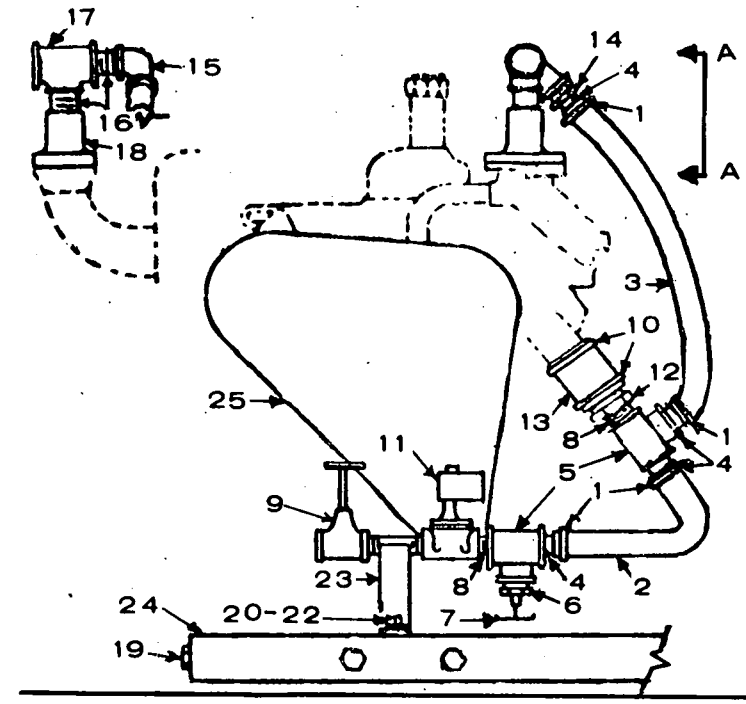
ELECTRIC FUEL PUMP GROUP OPTIONAL

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	149-0554	1	Pump, Fuel
1	149-1445	1	Filter
2	149-1447	1	Magnet
3	149-1446	1	Gasket, Cover
4	149-1453	1	Cover
5	149-1452	1	Plunger
6	149-0705	1	Spring, Plunger Return
7	149-1451	1	Spring Cup & Valve
8	149-1450	1	Gasket, Spring Cup
9	149-1449	1	Washer, Cup Gasket
10	149-1448	1	Retainer, Cup & Plunger



179-1023

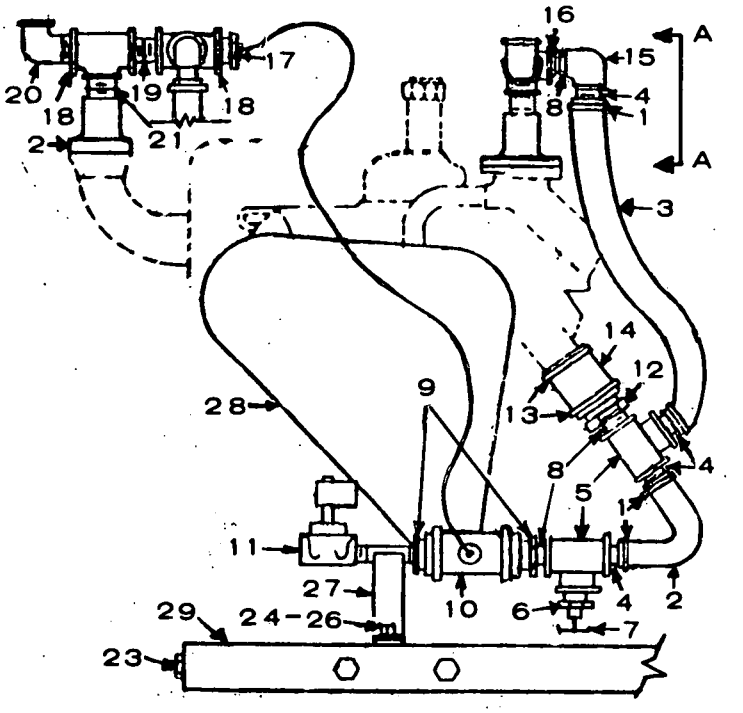
CITY WATER COOLING - OPTIONAL INSTALLATION



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	179-1023		Installation of City Water Cooling
1	503-0189	4	Clamp, Hose
2	503-0191	14"	Hose, Rubber
3	503-0191	20"	Hose, Rubber
4	505-0185	4	Nipple, Pipe - Half (1/2" x 1-1/2")
5	505-0108	2	Tee, Pipe (1/2")
6	505-0018	1	Reducer, Pipe (1/2" x 1/4")
7	504-0063	1	Cock, Drain
8	505-0100	2	Nipple, Pipe - Close (1/2" x 1-1/8")
9	504-0019	1	Valve, Globe
10	503-0365	2	Clamp, Hose
11	307-0833	1	Valve, Solenoid (12 VDC)
12	110-0576	1	Adapter, Pipe to Hose
13	503-0356	3"	Hose, Rubber
14	505-0022	1	Reducer, Pipe (1/2" x 1")
15	505-0041	1	Elbow, Pipe - Street, 90° (1")
16	505-0004	2	Nipple, Pipe - Close (1" x 1-1/2")
17	505-0304	1	Tee, Pipe (1")
18	130-0954	1	Adapter, Water Outlet
19	821-0014	6	Screw, Self-locking - Hex Head (5/16-18 x 1/2")
20	800-0007	2	Screw, Cap - Hex Head (1/4-20 x 1")
21	850-0040	2	Washer, Lock - Spring (1/4)
22	862-0001	2	Nut, Hex (1/4-20)
23	110-0526	1	Bracket & Nipple Assembly
24	130-0499	1	Plate, Mounting
25	130-0957	1	Guard, Belt

179-1024

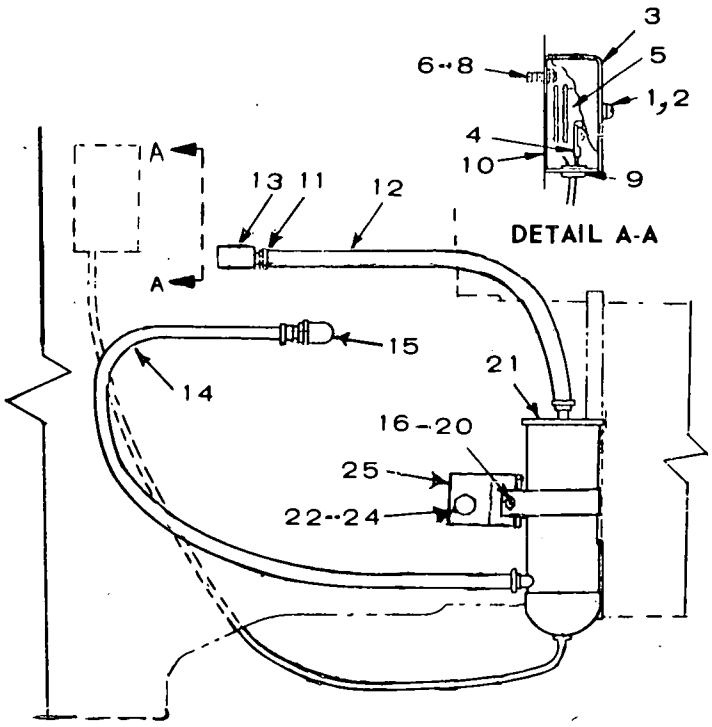
CITY WATER COOLING WITH REGULATOR - OPTIONAL INSTALLATION



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	179-1024		Installation of City Water Cooling with Regulator
1	503-0189	4	Clamp, Hose
2	503-0191	13"	Hose, Rubber
3	503-0191	20"	Hose, Rubber
4	505-0185	4	Nipple, Pipe - Half (1/2" x 1-1/2")
5	505-0108	2	Tee, Pipe (1/2")
6	505-0018	1	Reducer, Pipe (1/2" x 1/4")
7	504-0063	1	Cock, Drain
8	505-0100	3	Nipple, Pipe - Close (1/2" x 1-1/8")
9	505-0021	2	Reducer, Pipe (3/4" x 1/2")
10	309-0241	1	Valve, Temperature Regulating (Includes Sensor)
11	307-0833	1	Valve, Solenoid (12 VDC)
12	110-0576	1	Adapter, Pipe to Hose
13	503-0365	2	Clamp, Hose
14	503-0356	3"	Hose, Rubber
15	505-0040	1	Elbow, Pipe - 90°
16	505-0022	1	Reducer, Pipe (1/2" x 1")
17	505-0129	1	Reducer, Pipe (1" x 3/4")
18	505-0304	2	Tee, Pipe (1")
19	505-0086	1	Nipple, Pipe - Half (1" x 2-1/2")
20	505-0003	1	Elbow, Pipe - Street, 90° (1")
21	505-0004	1	Nipple, Pipe - Close (1" x 1-1/2")
22	130-0954	1	Adapter, Water Outlet
23	821-0014	6	Screw, Self-locking - Hex Head (5/16-18 x 1/2")
24	800-0007	2	Screw, Cap - Hex Head (1/4-20 x 1"
25	850-0040	2	Washer, Lock - Spring (1/4)
26	862-0001	2	Nut, Hex (1/4-20)
27	110-0526	1	Bracket & Nipple Assembly
28	130-0957	1	Guard, Belt
29	130-0499	1	Plate, Mounting

179-2021

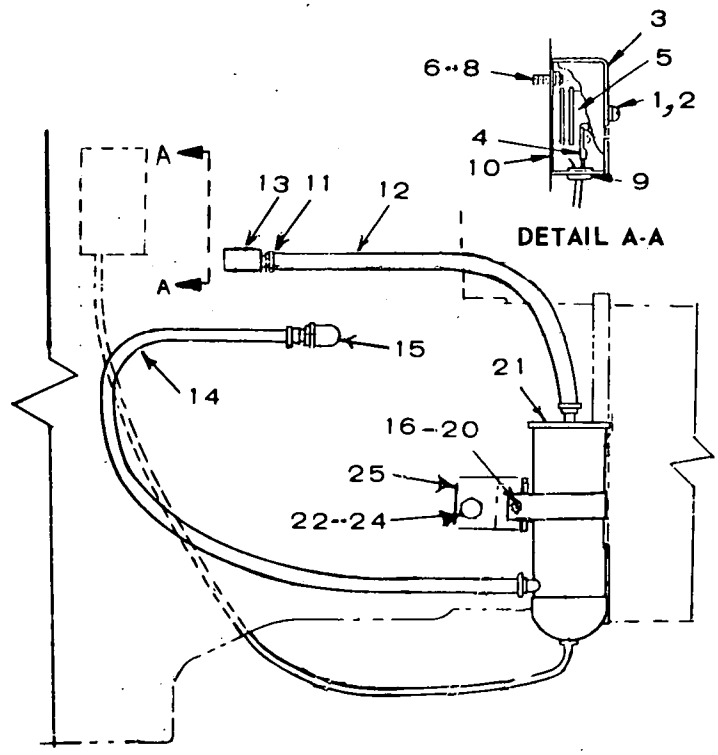
WATER JACKET HEATER - OPTIONAL INSTALLATION - 120 VOLT



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	179-2021		Installation of Water Jacket Heater
1	812-0076	2	Screw, Machine - Round Head (#8-32 x 5/16")
2	850-0025	2	Washer, Lock - Spring (#8)
3	333-0013	1	Cover, Box - Thermostat
4	332-0149	1	Terminal, Lug
5	309-0285	1	Thermostat
6	520-0446	2	Stud (#10-32 x 3/4")
7	850-0050	2	Washer, Lock - Spring (#10)
8	870-0053	2	Nut, Hex (#10-32)
9	509-0008	1	Grommet, Rubber
10	333-0012	1	Box, Thermostat
11	503-0183	4	Clamp, Hose
12	503-0386	24"	Hose, Rubber (5/8" ID)
13	502-0054	1	Elbow, Pipe - Street
14	503-0386	29"	Hose, Rubber (5/8" ID)
15	505-0011	1	Elbow, Pipe - Street
16	800-0031	1	Screw, Cap - Hex Head (5/16-18 x 1-1/2")
17	526-0115	2	Washer, Flat (11/32" ID x 11/16" OD x 1/16" THK)
18	856-0008	2	Washer, Lock - External/ Internal Tooth (5/16)
19	850-0045	1	Washer, Lock - Spring (5/16)
20	862-0015	1	Nut, Hex (5/16-18)
21	333-0052	1	Heater, Water (1500 Watt, 120 VAC)
22	800-0088	1	Screw, Cap - Hex Head (1/2-13 x 3/4")
23	850-0060	1	Washer, Lock - Spring (1/2)
24	856-0013	1	Washer, Lock - External/ Internal Tooth (1/2)
25	130-0755	1	Bracket, Angle

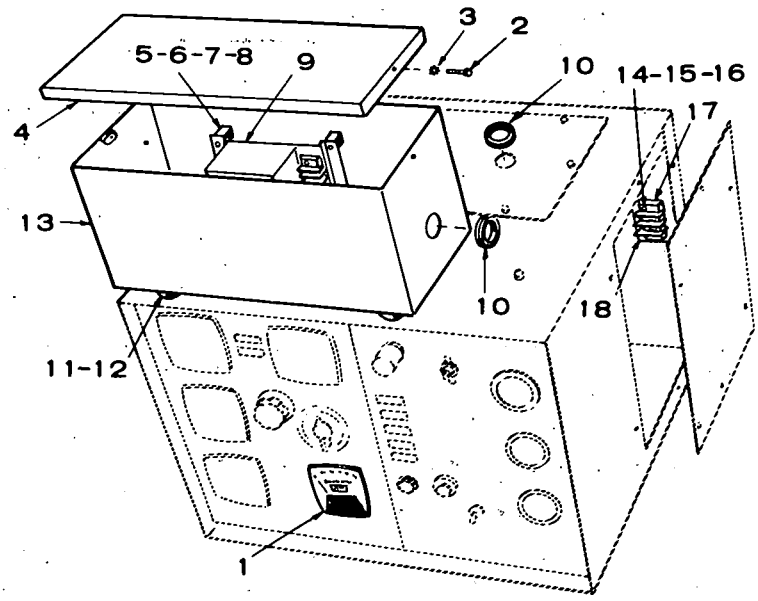
179-2024

WATER JACKET HEATER - OPTIONAL INSTALLATION - 240 VOLT



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	179-2024		Installation of Water Jacket Heater
1	812-0076	2	Screw, Machine - Round Head (#8-32 x 5/16")
2	850-0025	2	Washer, Lock - Spring (#8)
3	333-0013	1	Cover, Box - Thermostat
4	332-0149	1	Terminal, Lug
5	309-0285	1	Thermostat
6	520-0446	2	Stud (#10-32 x 3/4")
7	850-0050	2	Washer, Lock - Spring (#10)
8	870-0053	2	Nut, Hex (#10-32)
9	509-0008	1	Grommet, Rubber
10	333-0012	1	Box, Thermostat
11	503-0183	4	Clamp, Hose
12	503-0386	24"	Hose, Rubber (5/8" ID)
13	502-0054	1	Elbow, Pipe - Street
14	503-0386	29"	Hose, Rubber (5/8" ID)
15	505-0011	1	Elbow, Pipe - Street
16	800-0031	1	Screw, Cap - Hex Head (5/16-18 x 1-1/2")
17	526-0115	2	Washer, Flat (11/32" ID x 11/16" OD x 1/16" THK)
18	856-0008	2	Washer, Lock - External/ Internal Tooth (5/16)
19	850-0045	1	Washer, Lock - Spring (5/16)
20	862-0015	1	Nut, Hex (5/16-18)
21	333-0073	1	Heater, Water (2000 Watt, 240 VAC)
22	800-0088	1	Screw, Cap - Hex Head (1/2-13 x 3/4")
23	850-0060	1	Washer, Lock - Spring (1/2)
24	856-0013	1	Washer, Lock - External/ Internal Tooth (1/2)
25	130-0755	1	Bracket, Angle

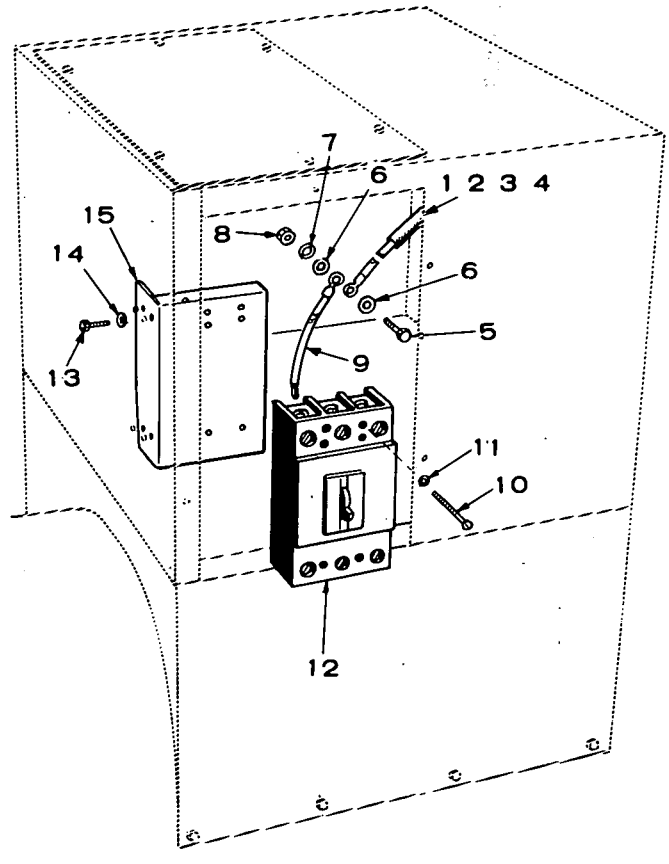
WATTMETER GROUP - OPTIONAL



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	302-0766	1	Wattmeter (0-35KW)
2	815-0026	2	Screw, Machine - Truss Head (#10-32 x 3/8")
3	853-0008	2	Washer, Lock - External Tooth (#10)
4	301-3476	1	Cover, Box - Transducer
5	860-0008	8	Nut, Hex (#8-32)
6	853-0005	8	Washer, Lock - External Tooth (#8)
7	526-0003	8	Washer, Flat (11/64" ID x 3/8" OD x 1/32" THK)
8	402-0354	4	Mount, Vibration
9	302-0902	1	Transducer, Watt
10	508-0001	2	Grommet, Rubber (1-1/6" OD)
11	821-0014	4	Screw, Self-locking - Hex Head (5/16-18 x 1/2")
12	402-0070	4	Mount, Vibration
13	301-3477	1	Box, Transducer
14	812-0063	4	Screw, Machine - Round Head (#6-32 x 1/2")
15	853-0003	4	Washer, Lock - External Tooth (#6)
16	860-0006	4	Nut, Hex (#6-32)
17	332-0609	1	Board; Terminal (2 Place)
18	332-0610	1	Strip, Marker

CIRCUIT BREAKER GROUP - OPTIONAL

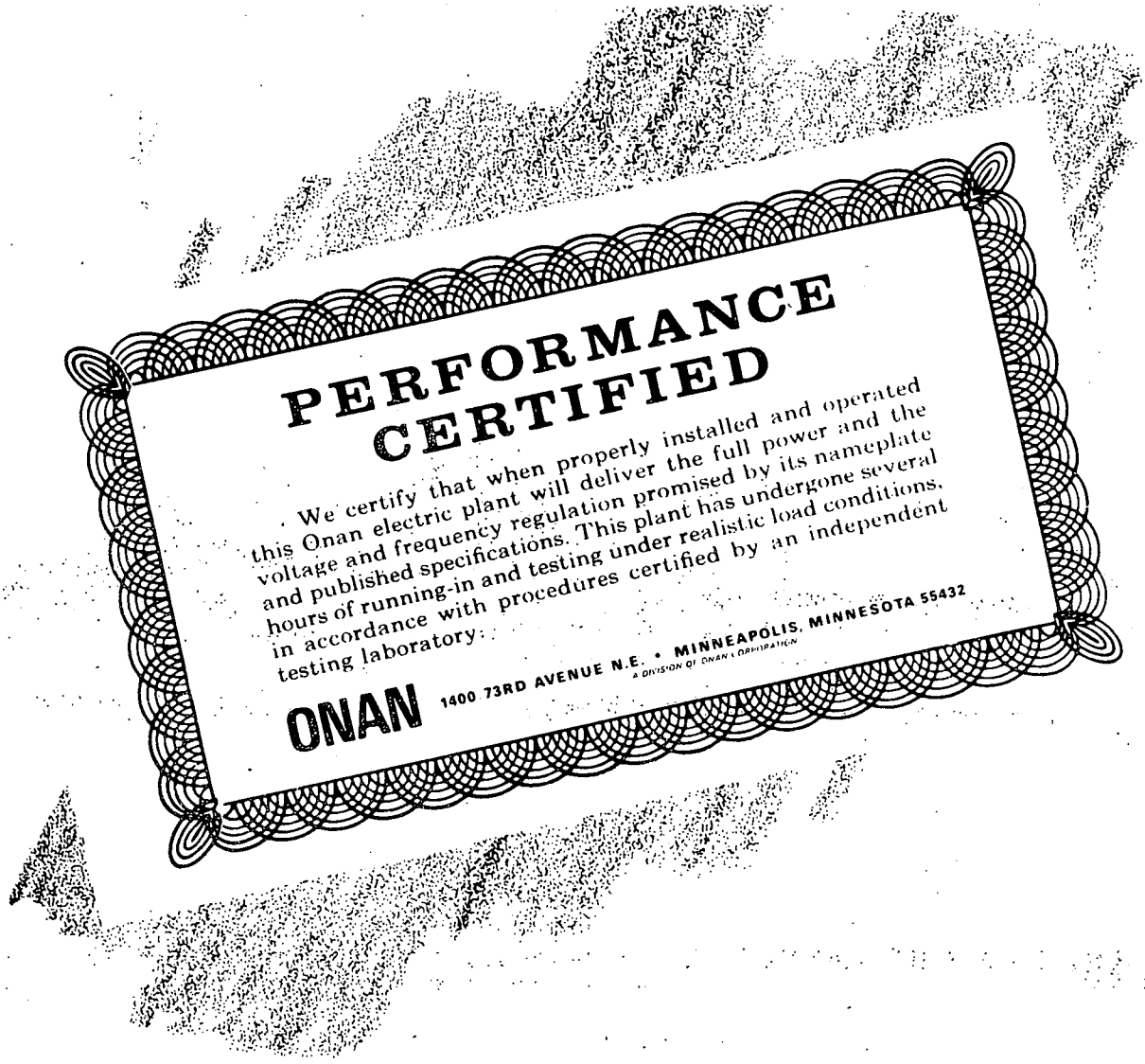
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	898-0863	4"	Sleeving, Insulation
2	898-0865	4"	Sleeving, Insulation
3	898-0867	4"	Sleeving, Insulation
4	898-0869	4"	Sleeving, Insulation
5	800-0028	5	Screw, Cap - Hex Head (5/16-18 x 1")
6	526-0022	10	Washer, Flat (21/64" ID x 9/16" OD x 1/16" THK)
7	850-0045	5	Washer, Lock - Spring (5/16)
8	862-0015	5	Nut, Hex (5/16-18)
9	226-0891	3	Lead, Electrical
10	812-0094	4	Screw, Machine - Round Head (#8-32 x 3-5/8")
11	850-0025	4	Washer, Lock - Spring (#8)
12	320-0412	1	Circuit Breaker (3 Pole, 100 Amp, 240 VAC)
13	800-0003	2	Screw, Cap - Hex Head (1/4-20 x 1/2")
14	850-0040	2	Washer, Lock - Spring (1/4)
15	301-3197	1	Bracket, Angle - Circuit Breaker Mounting
16	301-3192	1	Panel, Circuit Breaker (Illustrated in Housing Group, Item 54)

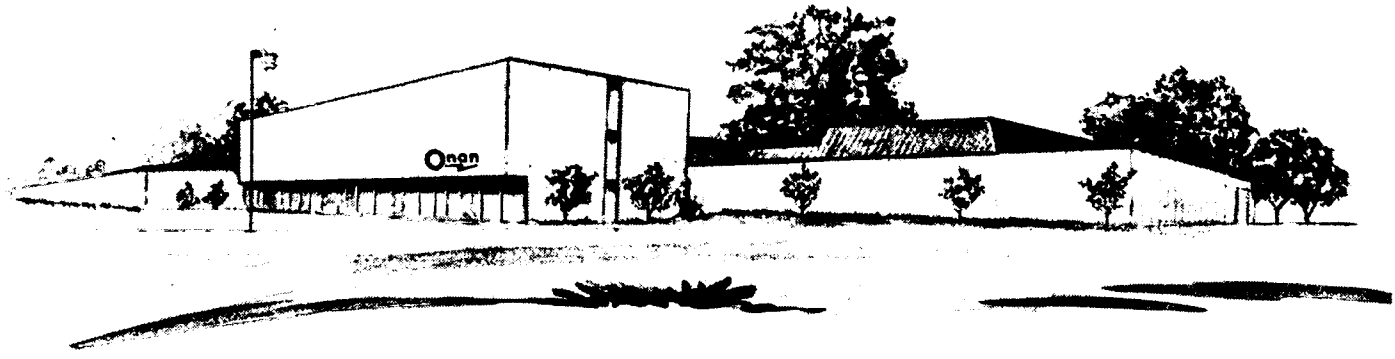


We mean it.....

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

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





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ONAN PRESS PUBLICATION

Onan®

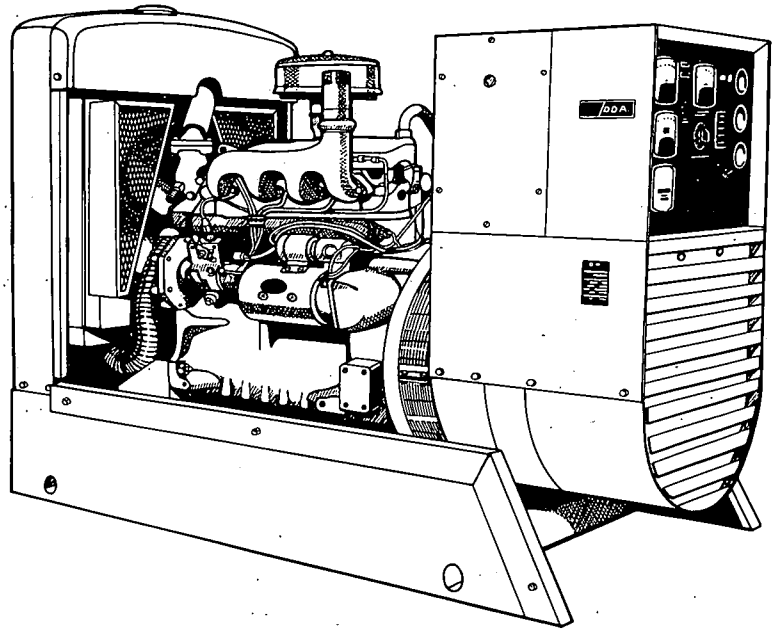
OPERATORS MANUAL AND PARTS CATALOG

FOR

ELECTRIC GENERATING SETS

DDA

SERIES



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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/m	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.

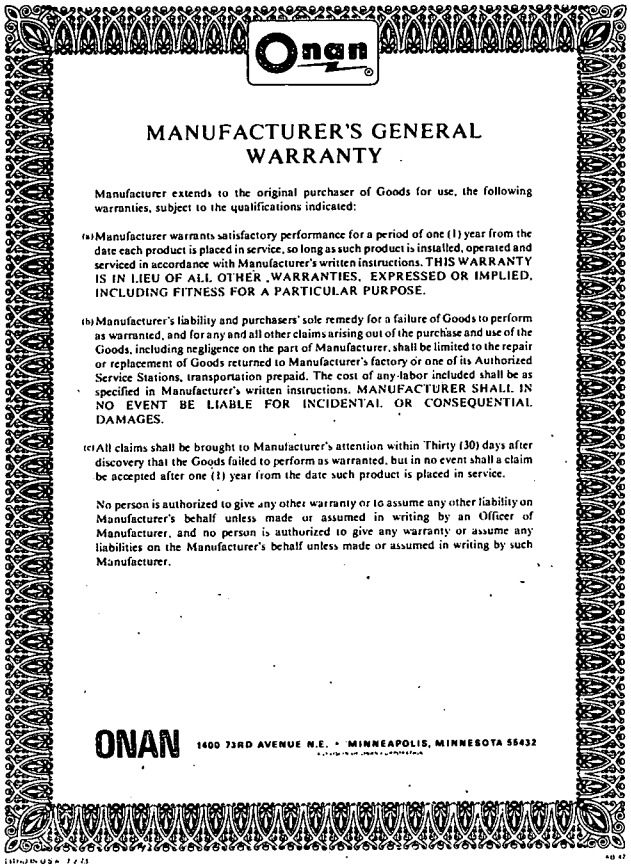
INTRODUCTION

FOREWORD

This manual is applicable to the DDA Series electric generating set, consisting of an Onan UR 30.0KW AC generator, driven by a John Deere 4219D diesel engine. Information is provided on installation, operation, troubleshooting and parts ordering for the set. The manual should be used in conjunction with the John Deere engine manual, as your specific engine may have variations due to optional equipment available.

WARNING **Onan uses this symbol throughout the text to warn of possible injury or death.**

CAUTION **This symbol is used to warn of possible equipment damage.**



Onan

MANUFACTURER'S GENERAL WARRANTY

Manufacturer extends to the original purchaser of Goods for use, the following warranties, subject to the qualifications indicated:

(a) Manufacturer warrants satisfactory performance for a period of one (1) year from the date each product is placed in service, so long as such product is installed, operated and serviced in accordance with Manufacturer's written instructions. THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING FITNESS FOR A PARTICULAR PURPOSE.

(b) Manufacturer's liability and purchasers' sole remedy for a failure of Goods to perform as warranted, and for any and all other claims arising out of the purchase and use of the Goods, including negligence on the part of Manufacturer, shall be limited to the repair or replacement of Goods returned to Manufacturer's factory or one of its Authorized Service Stations, transportation prepaid. The cost of any labor included shall be as specified in Manufacturer's written instructions. MANUFACTURER SHALL IN NO EVENT BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

(c) All claims shall be brought to Manufacturer's attention within Thirty (30) days after discovery that the Goods failed to perform as warranted, but in no event shall a claim be accepted after one (1) year from the date such product is placed in service.

No person is authorized to give any other warranty or to assume any other liability on Manufacturer's behalf unless made or assumed in writing by an Officer of Manufacturer, and no person is authorized to give any warranty or assume any liabilities on the Manufacturer's behalf unless made or assumed in writing by such Manufacturer.

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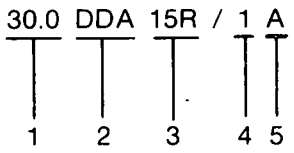
MODEL IDENTIFICATION

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.



1. Indicates Kilowatt rating.
2. Factory code for SERIES identification.
3. 15 indicates reconnectible
   R indicates remote electric start
4. Factory code for designating optional equipment.
5. Specification letter. (Advances when factory makes production modifications.)

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

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

IMPORTANT! RETURN WARRANTY CARD ATTACHED TO UNIT.

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.

SPECIFICATIONS

ENGINE DETAILS

Engine Manufacturer	John Deere
Engine Series	300-4219D
Number of Cylinders	4
Displacement	219 cu. inch (3.59 litres)
BHP @ 1800 r/m	58 (43.27 kW)
Compression Ratio	16.3:1
Bore	4.02-inches (102.11 mm)
Stroke	4.33-inches (109.98 mm)
Fuel	ASTM No. 2 Diesel
Battery Voltage	12
Battery Group (Two 6-Volt, 135-A.H. [486 kC])	2H
Starting Method	Solenoid Shift
Governor Regulation	5% No Load—Full load
Battery Charging Current	35

GENERATOR DETAILS

Type	UR 15, 60 Hz UR 515, 50 Hz UR 3, 60 Hz
Rating (Watts)	
60 Hertz Continuous Standby	30,000 (37.5 kVA)
50 Hertz Continuous Standby	25,000 (31.25 kVA)
AC Voltage Regulation	± 2%
60 Hertz r/m	1800
50 Hertz r/m	1500
Output Rating	0.8 PF
AC Frequency Regulation	3 Hz

CAPACITIES AND REQUIREMENTS

Cooling System (Includes Radiator)	4.25 gal. (16.1 litre)
Engine Oil Capacity (Filter, Lines, Crankcase)	6 qt. (5.7 litre)
Exhaust Connection (inches pipe thread)	2

AIR REQUIREMENTS (1800 r/m)

Engine Combustion	135 CFM (0.06 m^3/s)
Radiator Cooled Engine	3875 CFM (1.83 m^3/s)
Total for Radiator Cooled Model	4010 CFM (1.9 m^3/s)
Alternator Cooling Air	
(1800 r/m)	1000 CFM (0.47 m^3/s)
(1500 r/m)	834 CFM (0.4 m^3/s)
Fuel Consumption at Rated Load	2.50 Gallon/Hr. (9.5 lit/hr)

GENERAL

Height	45.5-inches (1.16 m)
Width	33.0-inches (0.838 m)
Length	66.0-inches (1.8 m)
Approx. Weight (Mass)	1780 lbs. (799 kg)

TABLE 1. UR GENERATOR VOLTAGE/CURRENT OPTIONS

VOLTS	FREQ.	PHASE	AMPERES	DOUBLE DELTA	SERIES DELTA	PARALLEL WYE	SERIES WYE	REF. VOLTAGE WIRE (W12) TAP
110/220	50 Hz	1	142 *	x				H6
115/230	50 Hz	1	136 *	x				H6
120/240	60 Hz	1	156 *	x				H5
110/190	50 Hz	3	94			x		H3
115/200	50 Hz	3	90			x		H4
120/208	60 Hz	3	104			x		H4
110/220	50 Hz	3	82		x			H6
127/220	60 Hz	3	98			x		H4
115/230	50 Hz	3	78		x			H6
120/240	60 Hz	3	90		x			H5
139/240	60 Hz	3	90			x		H5
220/380	50 Hz	3	47				x	H3
230/400	50 Hz	3	45				x	H4
240/416	60 Hz	3	52				x	H4
254/440	60 Hz	3	49				x	H5
277/480	60 Hz	3	45				x	H5
9X 347/600	60 Hz	3	36					H5 — Not Reconnectible
3 120/240	60 Hz	1	156					Not Reconnectible
53 115/230	50 Hz	1	136					Not Reconnectible

30.0 kW 37.5 kVA 60 Hz
25.0 kW 31.25 kVA 50 Hz

* - These current valves are available only from special long stack units. When standard 3-phase unit is reconnected into Double Delta configuration, maximum current is 2/3 that of valve given

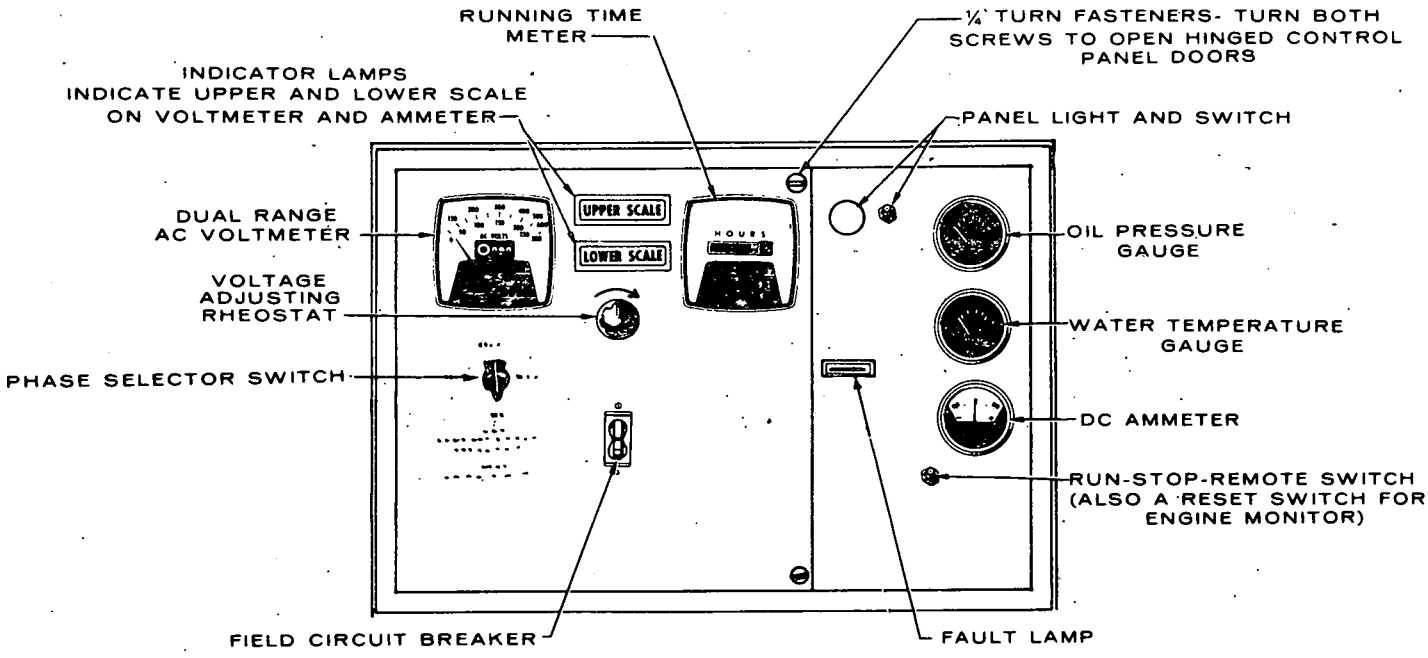


FIGURE 1. TYPICAL CONTROL PANEL (ONE FAULT LAMP)

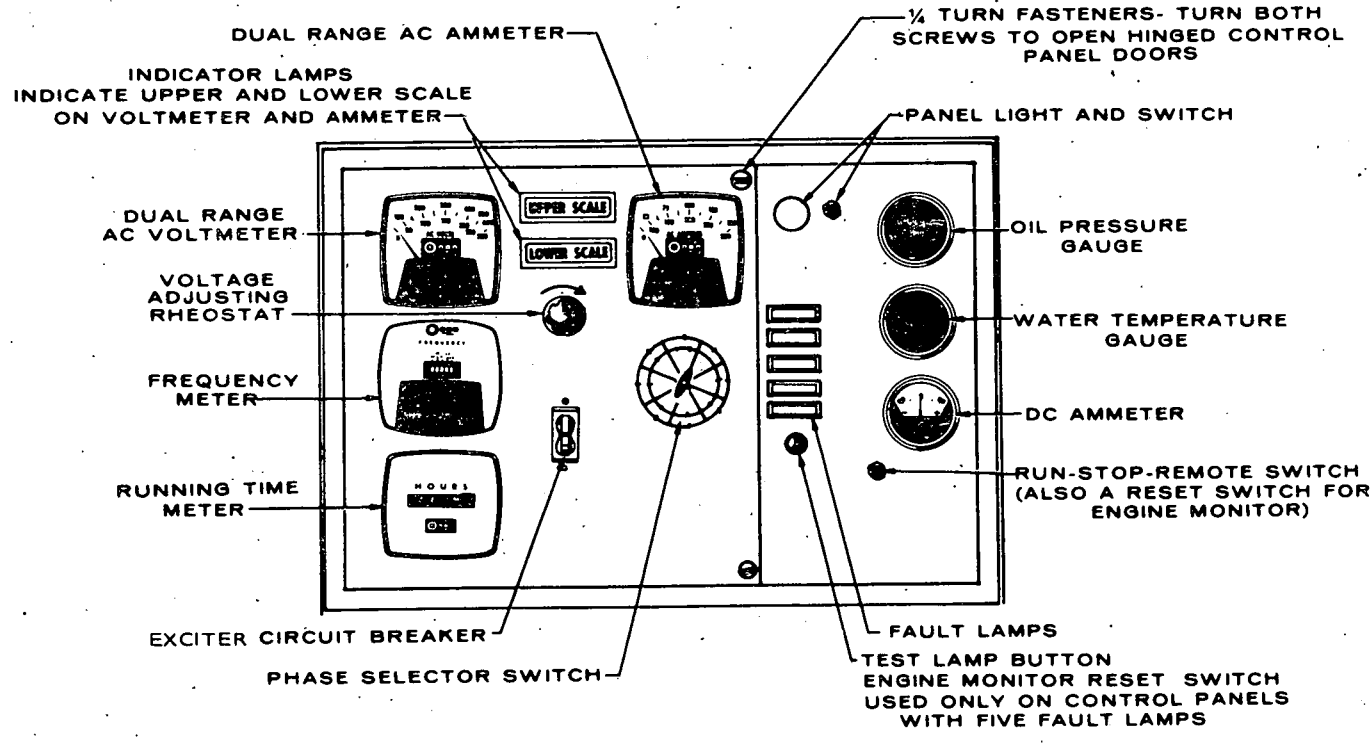


FIGURE 2. OPTIONAL CONTROL PANEL (FIVE FAULT LAMPS)

DESCRIPTION

GENERAL

An Onan DDA 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 DDA is a John Deere 4219 D as described in the engine manual. Basic measurements and requirements will be found under *Specifications.* For operation, maintenance and service information, consult the John Deere manual.

AC GENERATOR

The generator is an ONAN Type UR, 12 lead 4-pole revolving field, reconnectible, 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 rpm, the 50 Hz at 1500 rpm. 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 the battery charging current.

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

Warning Light: Indicates "Fault" in engine operation.

AC Panel

AC Voltmeter: Indicates AC generator output voltage. Dual range instrument: measurement range in use shown on indicator light.

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

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.

OPTIONAL EQUIPMENT

DC Panel

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

a. Overcrank (failed to start)
b. Overspeed
c. Low oil pressure
d. High engine temperature
e. Low engine temperature

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

AC Panel

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

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

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

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

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

CONTROL PANEL INTERIOR

The only equipments discussed in this section will be those which the operator may have reason to adjust or inspect for service.

Terminal Board (TB) 21: Connection of wire W12 to terminals H3, H4, H5, and H6 is made at this point, to change reference voltage when reconnecting generator for different voltages. Refer to Figure 14.

Voltage Regulator: Solid state unit, consisting of VR21, CR21 and L21. 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 r/m).
   c. Low oil pressure (14 psi: 96.6 kPa).
   d. High engine temperature (215° F: 102° C).

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

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.

TABLE 2. FAULT LAMP OPTIONS

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

* - With additional optional sensors.

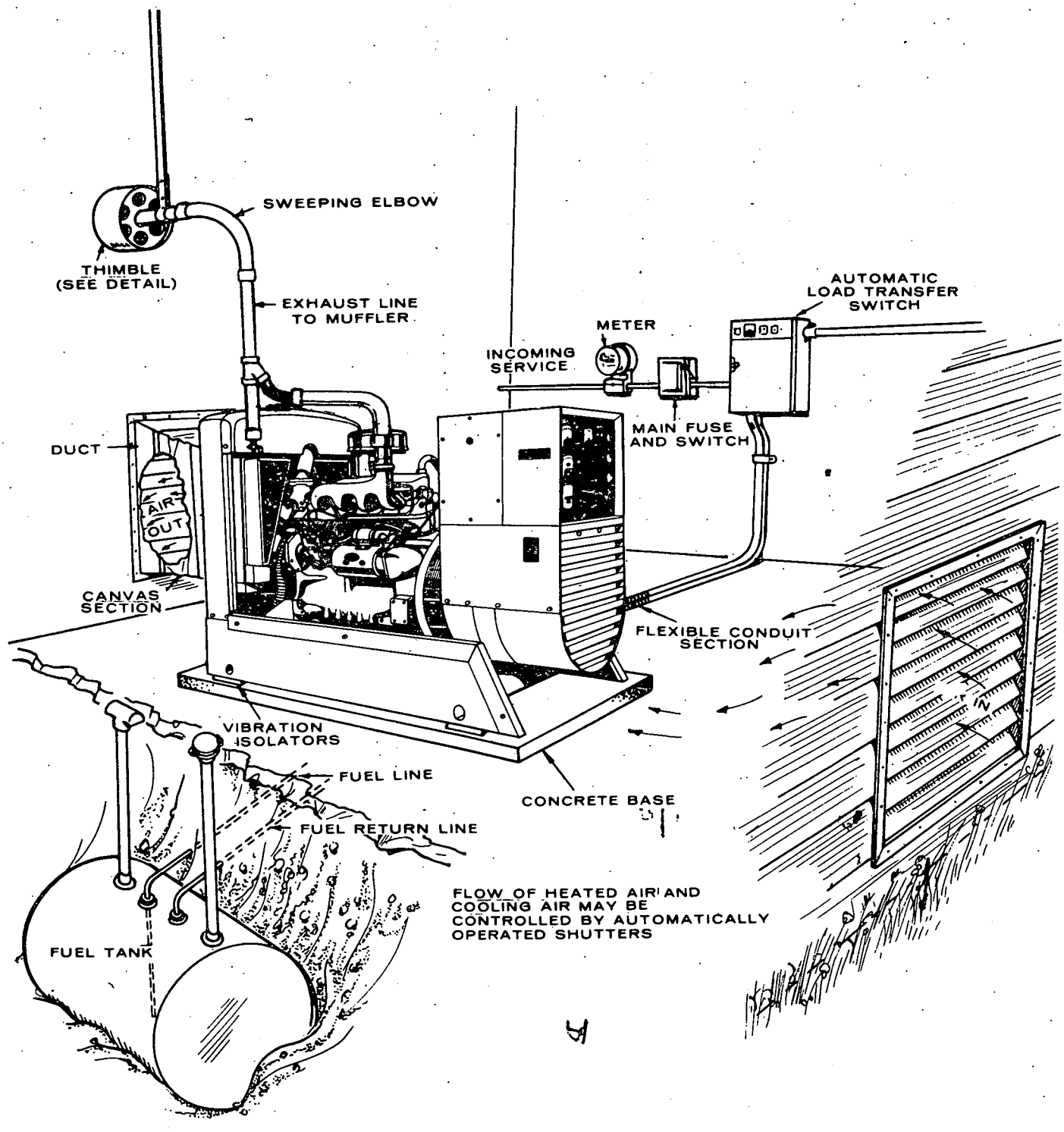


FIGURE 3. TYPICAL INSTALLATION

INSTALLATION

GENERAL

Installations must be considered individually. Use these instructions as a general guide. Meet regulations of local building codes, fire ordinances, etc., which may affect installation details. See Figure 3.

Installation points to consider include:

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

LOCATION

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

MOUNTING

Generating sets are mounted on a rigid skid base which provides proper support. Install vibration isolators between skid base and foundation. For convenience in draining crankcase oil and general servicing, mount set on raised pedestals (at least 6 inches high). If mounting in a trailer, or for other mobile applications, bolt securely in place. Extra support for the vehicle flooring may be necessary. Bolting down is recommended for stationary installations.

VENTILATION

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

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

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

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

A shelter housing with electrically operated louvres 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 louvres. The louvres 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 plant is running) of sufficient size to assure proper air circulation.

CITY WATER COOLING

An optional method of engine cooling, in place of the conventional radiator and fan, uses a constant pressure water supply. This is referred to as CITY WATER COOLING. There are two varieties of city water cooling: the HEAT EXCHANGER SYSTEM and STANDPIPE SYSTEM. See Figures 4 and 5.

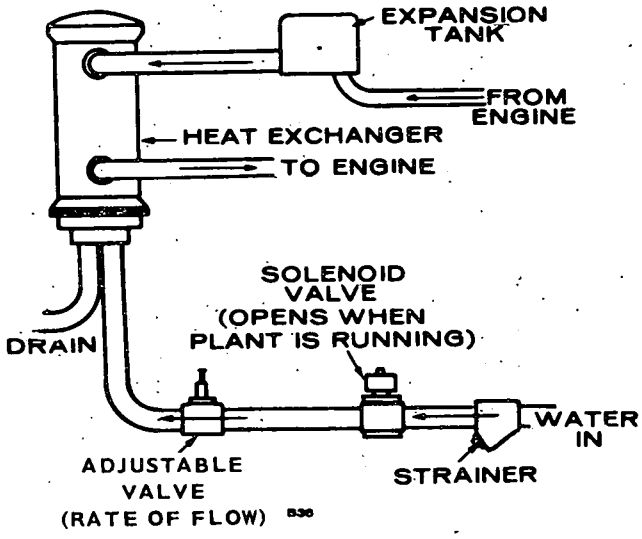


FIGURE 4. TYPICAL HEAT EXCHANGER SYSTEM

The HEAT EXCHANGER provides for a closed engine cooling system. Engine coolant flows through a tubed chamber, keeping the coolant separate from the cool "raw" water supply. The coolant chamber must be filled for operation, as for a radiator cooled set.

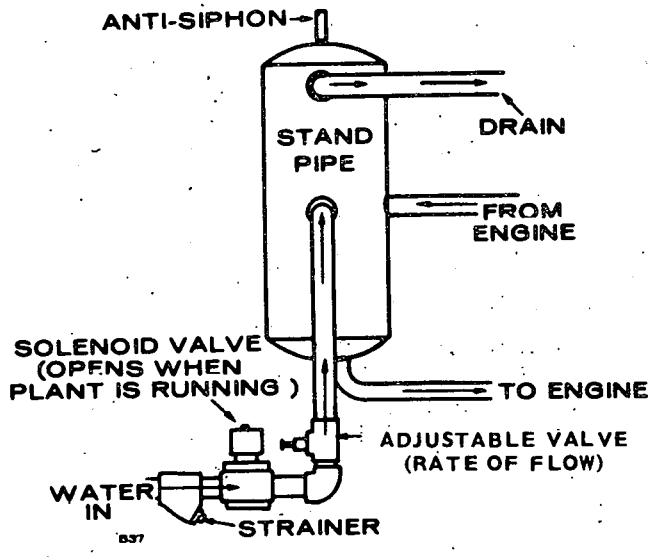


FIGURE 5. TYPICAL STANDPIPE SYSTEM

The STANDPIPE SYSTEM uses a mixing or tempering tank. Cooling water that circulates through the engine mixes with a source of cool "raw" water. The "raw" water supply must be free of scale forming lime or other impurities.

On both systems use flexible pipe for connecting water supply and outlet flow pipes to engine. Pipe the outlet flow to a convenient drain. Install an electric solenoid valve and a rate of flow valve in the water supply line. The electric solenoid valve opens and allows water flow through the system only when the plant operates. The rate of flow valve, either automatic or manual, provides for the proper flow rate to the engine. Adjust the flow to maintain water temperature between 165°F and 195°F (74°C to 91°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.

WATER JACKET HEATER (Optional)

This heater is installed to maintain an elevated engine temperature in lower ambient temperature applications. It heats and circulates engine coolant, and is thermostatically controlled (Figure 19).

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 6) must be used where exhaust pipes pass through walls or partitions. Pitch exhaust pipes downward or install a condensation trap (Figure 7) 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 3 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. Use a pipe at least as large as the 2-inch pipe size outlet of the engine with a flexible portion between the engine and the muffler. Do not connect a flexible line to the exhaust manifold. Minimum diameters and maximum lengths of pipe (with critical muffler) are as follows:

Single Exhaust system:

2½-inch pipe	58-feet (17.68 m)
3-inch pipe	191-feet (58.2 m)
3½-inch pipe	419-feet (128 m)

Maximum permissible exhaust restriction (back pressure) is 25-inches H_2O (1.84-inches Hg: [6.23 kPa]).

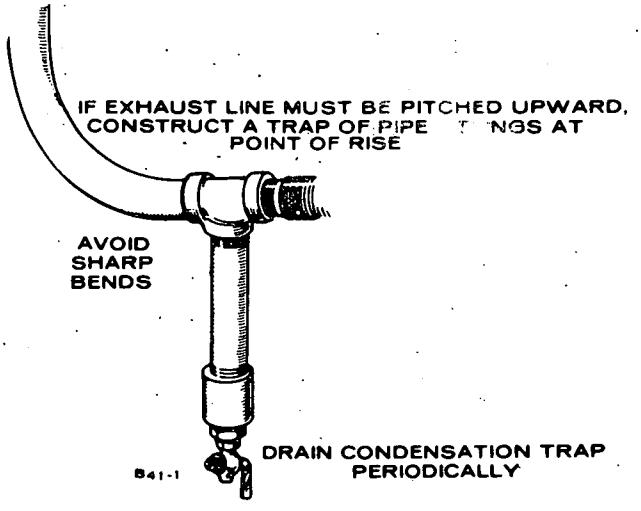


FIGURE 7. EXHAUST CONDENSATION TRAP

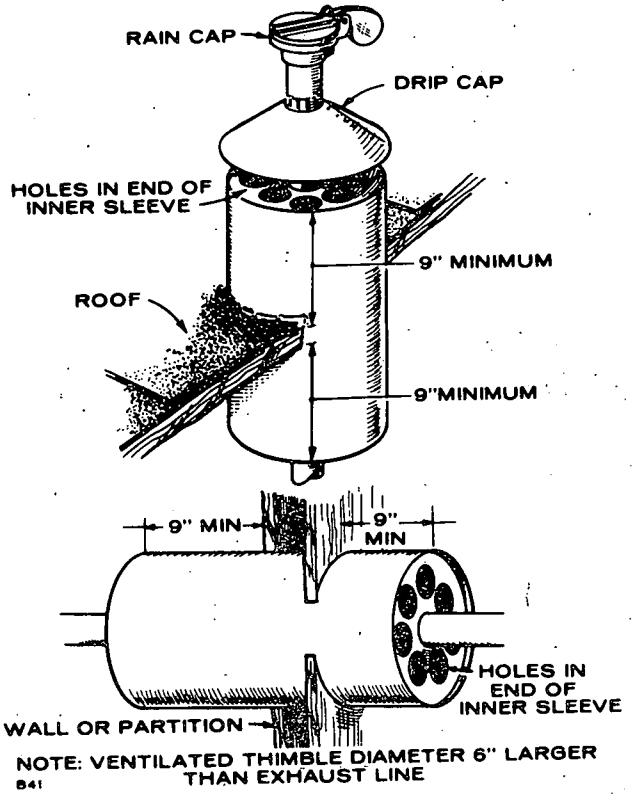


FIGURE 6. EXHAUST THIMBLE

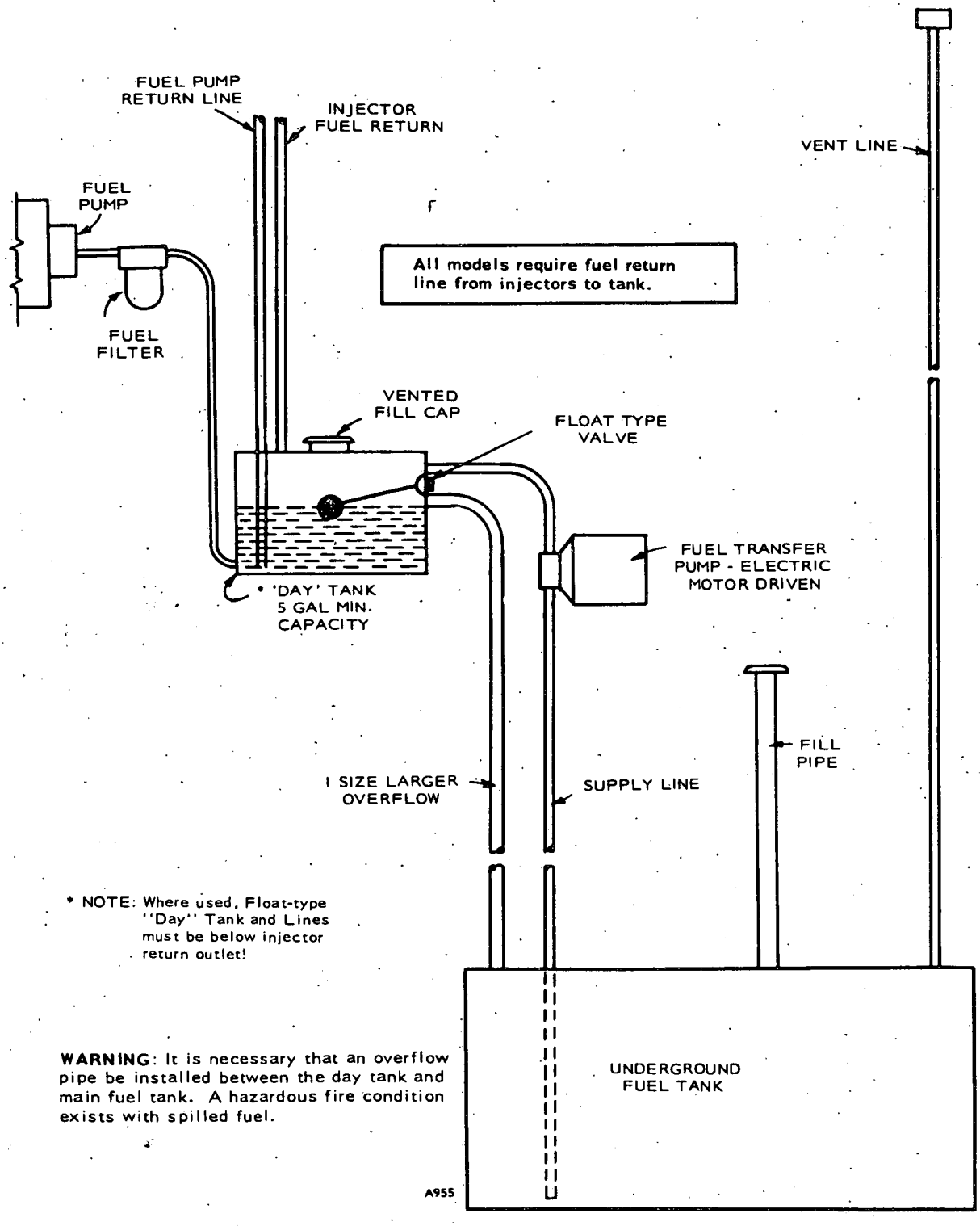


FIGURE 8. DAY TANK INSTALLATION

FUEL SYSTEM

The John Deere engines used on the DDA sets are designed for use with ASTM No.2 Diesel fuel. They will however, operate on diesel fuels within the specifications delineated in the John Deere 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 10-feet (3 m) is not recommended without a day tank installation, because of fuel drainage. Horizontal run, if the supply tank is level with the fuel pump should not exceed 25-feet (7.62 m). However, a day tank is again recommended.

The fuel inlet is to the transfer pump and is threaded for 1/8-inch pipe. Injector pump return line is common with the injectors' return line, and requires a 1/8-inch low pressure hose connection.

DAY TANK

Generator set installations may be equipped with an optional integral 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 the main fuel tank. Refer to the installations included with the tank. See Figure 8 for an example of a Day tank installation.

BATTERY

Starting the plant requires 12-volt battery current. Use two 6-volt (see specification) batteries for a normal installation. Connect the batteries in series (negative post of first battery to positive post of second) as in Figure 9. Necessary battery cables are on unit. Service the batteries as necessary. Infrequent plant use (as in emergency standby service) may allow the batteries to self-discharge to the point where they cannot start the plant. If installing an automatic transfer switch that has no built-in charge circuit, connect a separate trickle charger. Onan automatic transfer switches include such a battery charging circuit.

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

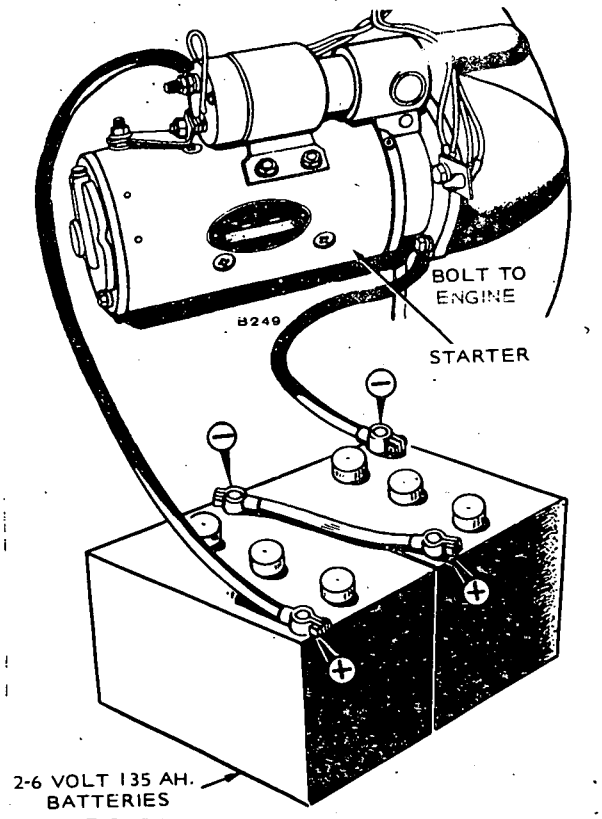


FIGURE 9. BATTERY CONNECTION

BATTERY, HOT LOCATION

Batteries will self discharge very quickly when installed where the ambient temperature is consistently above 90° F (32.2° C), such as in a boiler room. To lenghten 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 an hydrometer or filler bulb and dispose of it in a safe manner. Avoid skin or clothing contact with the electrolyte.
3. Refill each cell with distilled water, to normal level.
4. Continue charging for 1 hour at a 4 to 6 hour rate.
5. Test each cell. If the specific gravity is still above 1.255, repeat steps 2, 3, 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 10. If the distance between the set and remote station is less than 1000-feet (300 m), use No. 18 AWG wire; between 1000- and 2000-feet (600 m), use No. 16 AWG wire.

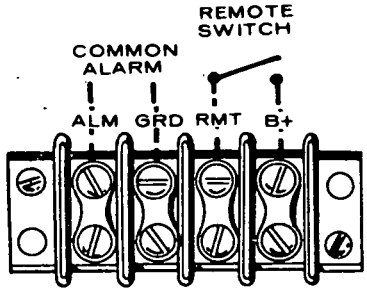
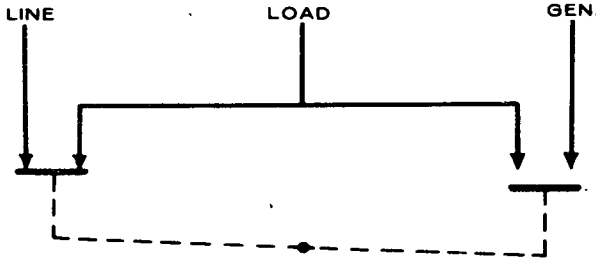


FIGURE 10. REMOTE STARTING

WIRING CONNECTIONS

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

If the installation is for standby service, a double throw transfer switch must always be used. Connect this switch (either automatic or manual) so that it is impossible for commercial power and generator current to be connected to the load at the same time. Instructions for connecting an automatic load transfer control are included with such equipment.



NOTE: SHOWN WITH LINE CONNECTED TO LOAD.

FIGURE 11. LOAD TRANSFER SWITCH

Control Box Connections: The factory ships these 12 lead generators with load connection wires NOT connected together in the control box. These 12 wires are labeled T1 through T12 and must be brought together before making load connections. Proceed as follows:

1. Remove either right, left or top panel from control box. See Figure 12.
2. Connect wires together as shown on panel and in Figure 13 according to voltage desired.
3. Open hinged control panel doors. Connect lead from terminal 63 to correct terminal for voltage desired. These terminals are labeled H2, H3, H4, H5 and H6. See Figure 14.

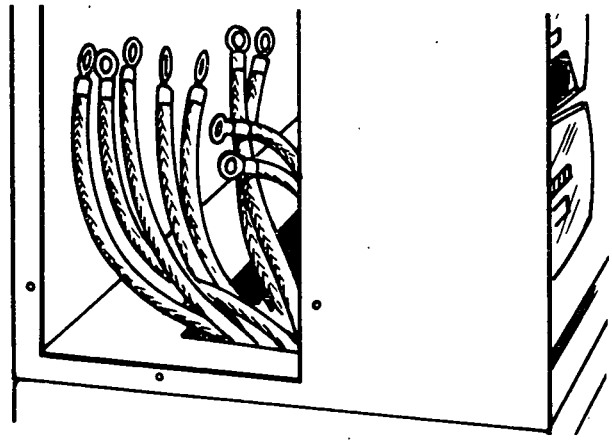
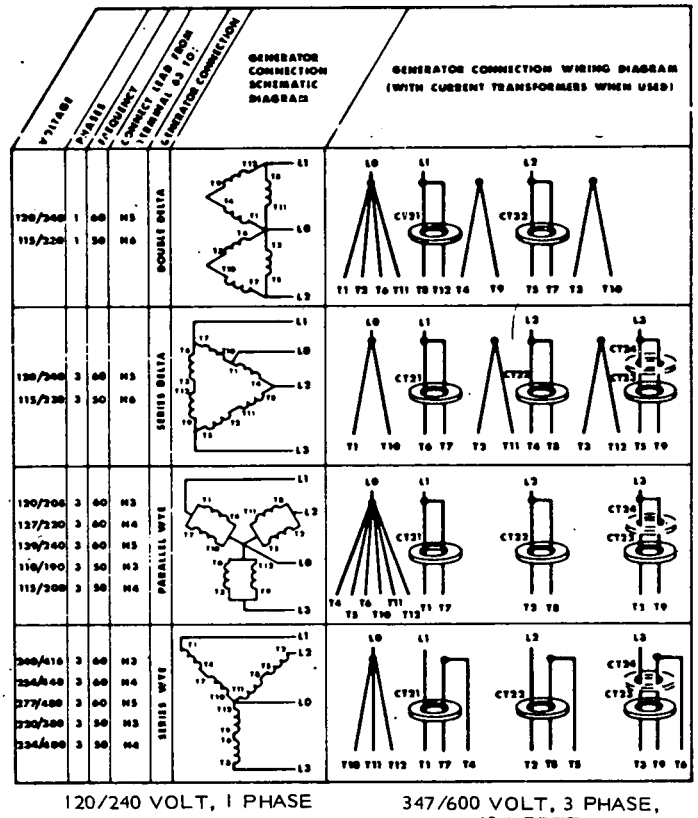


FIGURE 12. CONTROL BOX (SIDE PANEL REMOVED)

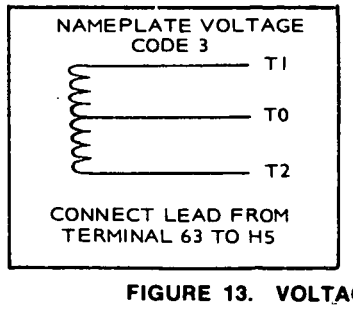
4. Close front panel and secure with 1/4 turn fasteners.
5. Connect load wires to generator leads.

Preceding instructions do not apply to models with a 347/600 voltage (designated 9X) or a 120/240 voltage (designated 3R); these connections are made at the factory. The installer must only connect load wires.



120/240 VOLT, 1 PHASE
60 HERTZ

347/600 VOLT, 3 PHASE,
60 HERTZ



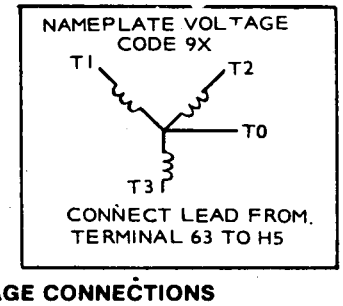


FIGURE 13. VOLTAGE CONNECTIONS

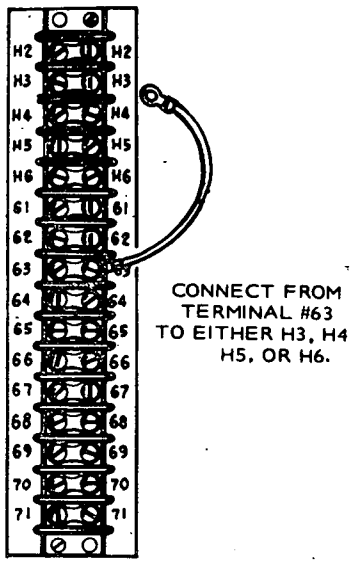


FIGURE 14. CONNECTING LEAD FROM TERMINAL 63

120/240 Volt, Single Phase, 12 Lead: Terminal connection L0 can be the ground (neutral). For 120 volts, connect the hot load wires to either the L1 or L2 connection, Figure 15. Connect the neutral load wire to the L0 connection. Two 120 volt circuits are thus available, with not more than 1/3 the rated capacity of the set available on either circuit. If using both circuits, be sure to balance the load between them.

For 240 volts, connect one load wire to the L1 connection and the second load wire to the L2 connection. Terminal connection L0 is not used for 240 volt service.

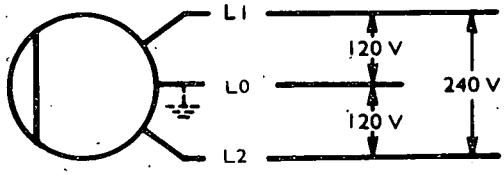


FIGURE 15. 120/240 VOLT, SINGLE PHASE, 12 LEAD

120/240 Volt, 3 Phase, 4 Wire Delta Connected Set; 12 Lead: The 3 phase Delta connected set is designed to supply 120- and 240 volt, 1 phase current and 240 volt, 3 phase current, Figure 16. For 3 phase operation, connect the three load wires to generator terminals L1, L2 and L3 — one wire to each terminal. For 3 phase operation the L0 terminal is not used.

For 120/240 volt, 1 phase, 3 wire operation, terminals L1 and L2 are the "hot" terminals. The L0 terminal is the neutral, which can be grounded if required. For 120 volt service, connect the black load wire to either the L1 or L2 terminal. Connect the neutral (white) wire to the L0 terminal. Two 120 volt circuits are available.

Any combination of 1 phase and 3 phase loading can be used at the same time as long as no terminal current exceeds the NAMEPLATE rating of the generator. If no 3 phase output is used, usable 1 phase output is 2/3 of 3 phase KVA.

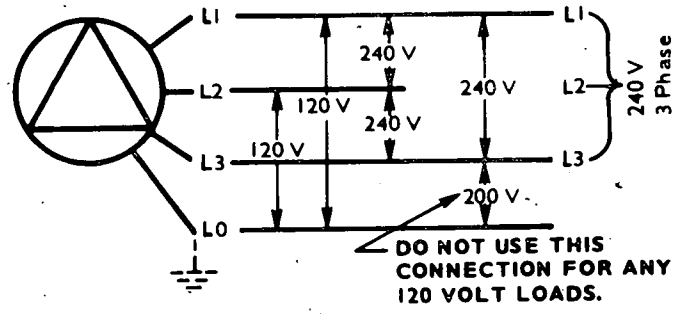


FIGURE 16. 3 PHASE, DELTA CONNECTION, 12 LEAD

3 Phase, 4 Wire, Wye Connected Set; 12 Lead: The 3 phase, 4 wire set produces line to neutral voltage and line to line voltage. The line to neutral voltage is the lower voltage as noted on the unit nameplate, and the line to line voltage is the higher nameplate voltage.

For 3 phase loads, connect separate load wires to each of the set terminals L1, L2 and L3. Single phase output is obtained between any two 3 phase terminals.

The terminal marked L0 can be grounded. For 1 phase loads, connect the neutral (white) load wire to the L0 terminal. Connect the black load wire to any one of the other three terminals — L1, L2 or L3. Three separate 1 phase circuits are available, with not more than 1/6 the rated capacity of the set from any one circuit.

If using 1 phase and 3 phase current at the same time, use care to properly balance the 1 phase load, and not to exceed rated line current.

Figure 17 shows load connections for 120/208 voltage. Other voltages are available from either parallel wye or series wye illustration in Figure 13.

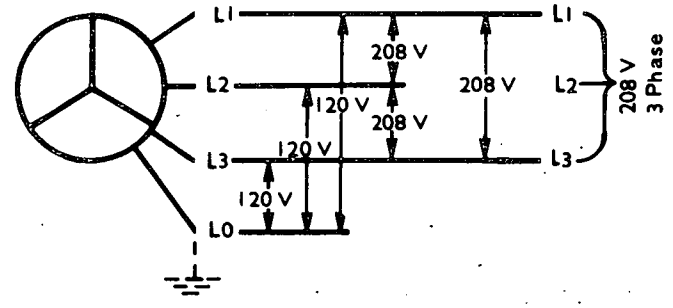


FIGURE 17. 3 PHASE, WYE CONNECTION, 12 LEAD

OPERATION

GENERAL

ONAN DDA 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 engine to capacities shown. After engine has been run, check dipstick, add oil to bring level to full mark. Record total capacity for future oil changes. Do not mix brands or grades of lubricating oils.

AMBIENT TEMPERATURE	SINGLE VISCOSITY	MULTI-VISCOSITY
Below -10°F (-23°C)	SAE 5W	SAE 5W20
Between -10°F and 32°F (-23°C and 0°C)	SAE 10W	SAE 10W30
Above 32°F (0°C)	SAE 30	Not Recommended
Use oil conforming to these specifications	API CD/SD MIL-L-2104C* Series 3* *API CC or CD	API CC/SE, CC/SD or SD MIL-L-46152

Oil capacities (nominal)

Oil Pan and Filter—6 quarts (5.7 litres)

Cooling System: Cooling system was drained prior to shipment. Fill cooling system before starting. Nominal capacity is 4.25 gallons (16.1 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 John Deere engine manual for additional information.

CAUTION **1. Verify that the electric solenoid valve used with city water cooled plants is open before initial starting of plant to allow coolant chambers to fill. Overheating and damage to the engine could result from non-compliance.**

2. 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.

3. 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 John Deere 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 Fuel System: Verify that all connections in the fuel system are secure and no leaks exist. Proceed with priming as follows:

1. Loosen bleed plug on top of fuel filter. Pump primer lever (Figure 18) until a solid stream of fuel, free of air bubbles, flows from bleed plug.
2. Secure bleed plug.
3. Loosen inlet fuel line on injector pump. Operate primer lever on fuel transfer pump until a solid stream of fuel, free of air bubbles, flows from inlet line opening.
4. Secure injector pump fuel inlet line.
5. Leave fuel transfer pump priming lever at lowest point of stroke.

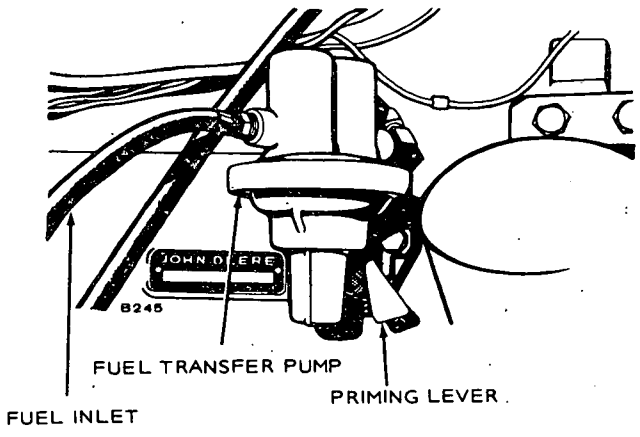


FIGURE 18. PRIMING FUEL SYSTEM

If the primer lever will not pump and no resistance is felt at upper end of stroke, turn engine over with starter to change position of fuel pump drive lobe on camshaft.

Check all connections in fuel system for security, to ensure that pressure will not bleed off when engine is not in use. Pressure should be maintained for immediate starting if unit is on standby service.

BATTERIES

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

Check level of electrolyte to be at split ring mark. Measure specific gravity of electrolyte: SG 1.280 at 80°F (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. Cooling system filled — input solenoid valve open.
3. Batteries charged and connected.
4. 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 45 and 65 psi (310.5 and 448.5 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 180° to 195°F (82.2°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 180°F to 220°F (82.2°C to 104.4°C).

STOPPING

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

Move the run-stop/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 appropriate troubleshooting chart, Table 3 or Table 4.

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

Generating 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 up fuel tank, check engine for leaks and unit for general condition. Locate cause of leaks (if any) and correct.

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

SYMPTOM	CORRECTIVE ACTION
1. Engine stops cranking and fault lamp lights, after cranking approximately 75 seconds.	1. See engine service manual for troubleshooting fuel system. After correcting problem, reset engine monitor relay by placing Run-Stop/ Reset-Remote switch to Stop/Reset, then back to the required running position.
2. Fault lamp lights immediately after engine starts.	2. Check for: Overspeed condition as engine starts.
3. Fault lamp lights and engine shuts down after running for a period.	3. Check the following: a. Oil level. Engine will shut down if sensor is closed. b. Check engine manual for troubleshooting oil system. c. High engine temperature. Check coolant level; check water flow (city water cooled systems); check radiator for free air flow, and fan belts for tightness. See engine manual for troubleshooting cooling system. d. Check for faulty oil pressure sensor or faulty high engine temperature sensor.
4. Engine runs, shuts down and cranks for 75-seconds. Cranking cycle stops; fault lamp lights.	4. Check fuel supply.
5. Fault lamp lights, no fault exists.	5. To check a no-fault condition, disconnect leads from TB11 terminals 29, 30 and 31. If fault lamp lights with leads disconnected, replace engine monitor board. Reconnect leads.

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

SYMPTOM	CORRECTIVE ACTION
1. Overcrank fault lamp lights and engine stops cranking after approximately 75-seconds.	1. See engine service manual for troubleshooting fuel system. 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, overcrank 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 if 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. Check overspeed switch.
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.

*NOTE: Not applicable on Pennsylvania State models.

HIGH ALTITUDE

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

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

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 John Deere manual for further information.

Water Jacket Heater: The function of this optional heater is to keep the engine warm enough to assure starting under adverse weather conditions. Connect the heater to a source of power that will be on during the time the engine is not running. Be sure the voltage rating is correct for the heater element rating (Figure 19).

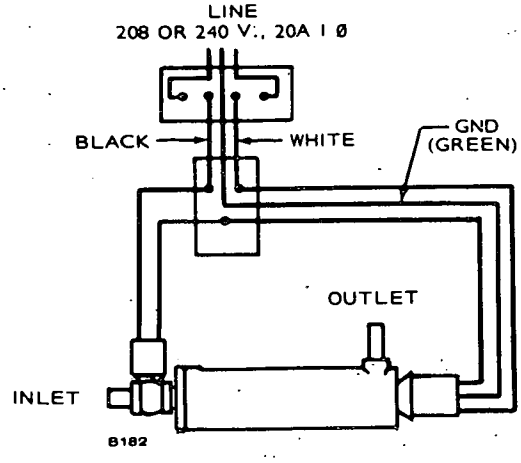


FIGURE 19. ENGINE HEATER

OUT-OF-SERVICE PROTECTION

Generator sets removed from service for extended periods of time should be protected from rust and corrosion. The natural lubrication qualities of ASTM No. 2 Diesel fuel should protect a diesel engine for at least 30-days when unit is not in service. To protect a unit that will be out of service over 30 days, Onan recommends the following procedure:

1. Check coolant, top up if necessary using recommended anti-freeze.
2. Run set until thoroughly warm; generator under at least 50% load.
3. Shut down engine and drain oil base while still warm. Refill and attach a warning tag indicating viscosity of oil used.
4. Service air cleaner.
5. Clean throttle and governor linkage and protect by wrapping with a clean cloth.
6. Plug exhaust outlets to prevent entrance of moisture, bugs, dirt, etc.
7. Clean off dirt and dry entire unit. Coat parts likely to rust with a light coat of grease or oil.
8. Disconnect battery and follow standard battery storage procedure. Apply a film of non-conductive grease (e.g., vaseline) to battery cable lugs.
9. Fill fuel tank to prevent condensation contamination.
10. Provide a suitable cover for the entire unit.

RETURNING A UNIT TO SERVICE

1. Remove cover and all protective wrapping. Remove plug from exhaust outlet.
2. Check warning tag on oil base and verify that oil viscosity is still correct for existing ambient temperature.
3. Clean and check battery. Measure specific gravity (1.260 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 if necessary.
5. Connect batteries.
6. Verify that no loads are connected to generator.
7. 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.

GENERAL MAINTENANCE

GENERAL

Follow a definite schedule of inspection and servicing, based on operating hours. Keep an accurate logbook of maintenance, servicing, and operating time. Use the running time meter to keep a record of operation and servicing. Service periods outlined in Table 5 are recommended for normal service and operating conditions. For continuous duty, extreme temperature, etc., service more frequently.

A set on stand-by duty will need servicing at times other than those recommended by Onan and the engine manufacturer. These maintenance service periods will vary according to set site or location and application. 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.

CAUTION **When changing oil filters, it is important that the replacement filter is a bypass type. Failure to use a bypass filter could cause the filter material to rupture during heavy pressures on cold starts, resulting in non-filtered oil and subsequent engine damage.**

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	MAINTENANCE PERIOD						
	10 hrs.	50 hrs.	100 hrs.	200 hrs.	500 hrs.	1000 hrs.	6 mths.
Inspect plant	x						
Check coolant level	x						
Check oil level	x						
Air cleaner	x1						
Fuel filter	x						
Batteries		x					
Alternator and fan belt			x2				
Engine crankcase - drain - refill			x1				
Crankcase oil filter			x1				
Crankcase vent tube					x		
Valve tappets					x		
Hoses					x		
Injection pump - check timing						x	
Injection nozzles						x	
Fuel filter - change						x	
Starter						x	
Cooling system - drain, flush, refill							x3
Clean and inspect battery charging alternator				x			
Air cleaner - replace			x				

x1 - or every 3 months, perform more often in extremely dusty conditions.
x2 - or every 3 months. Adjust to 3/4 depression with 20 pounds force.
x3 - More often in extremely dusty conditions.

NOTE: The above schedule is a minimum requirement for your engine. Refer to the John Deere service manual for recommended service periods.

ENGINE SPEED

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

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

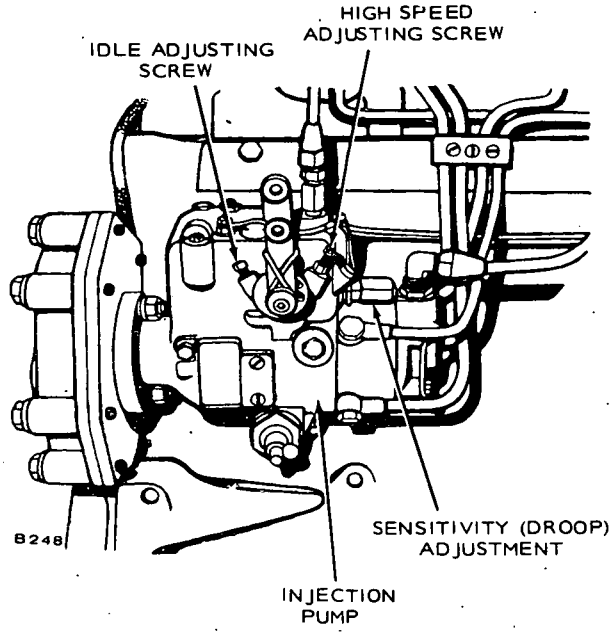


FIGURE 20. ROOSA-MASTER GOVERNOR

Governor sensitivity is adjusted by rotating an external knurled knob at the rear of the injector pump housing. Turning inward (clockwise) shortens governor control spring making it less sensitive, thereby increasing speed droop. Turning outward (counterclockwise) has opposite effect. Adjustment can be made with engine running. The speed droop is set at the ONAN plant to give a regulation of 3 percent to 5 percent from no-load to full-load.

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

Example: 30 x 61 (Hz) = 1830 rpm.

Adjust engine speed to 1800 rpm for 60 Hertz sets 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. Blow dust out of control panel.

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 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.

PARTS CATALOG

This catalog applies to the standard DDA 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
25.0 DDA-515R/*	25,000	£	50	12	1 or 3
30.0 DDA-3R/*	30,000	120/240	60	3	1
30.0 DDA-15R/*	30,000	£	60	12	1 or 3
30.0 DDA-9XR/*	30,000	347/600	60	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).

£ - These sets are reconnectible, refer to Specifications (Generator Details) in Operator's Manual for Electrical Data.

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

REPLACEMENT ENGINE

100-1265 1 Engine, Replacement (John Deere Model 4219D)

General Description: Includes: Complete Cylinder Block, Fuel Pump, Fuel Filter, Oil Filter, Governor, Fan Blades (Pusher Type), Water Pump, Oil Pan, Oil Fill, Exhaust Manifold, Flywheel Housing, Starter Adapter, Fan Belt, and Alternator Drive Belt.

Excludes: Alternator, Temperature Sender, Oil Pressure Sender, Starter, Flywheel, Air Cleaner and Radiator.

ENGINE PARTS

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 John Deere manual.

All John Deere parts must be ordered from your nearest authorized John Deere distributor. When ordering parts, refer to the John Deere nameplate giving the complete engine TYPE and SERIAL NUMBER.

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.

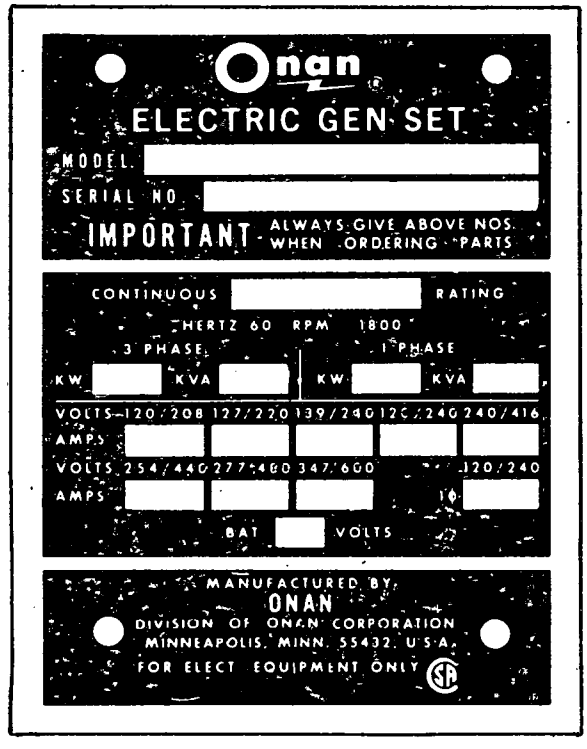
INSTRUCTIONS FOR ORDERING Onan REPAIR PARTS

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.



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.

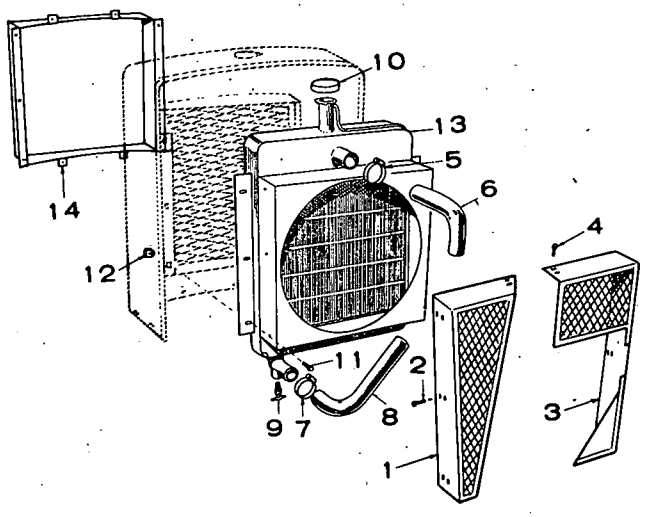
Prices are purposely omitted from this Parts Catalog due to the confusion resulting from fluctuating costs, import duties, sales taxes, exchange rates, etc.

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".

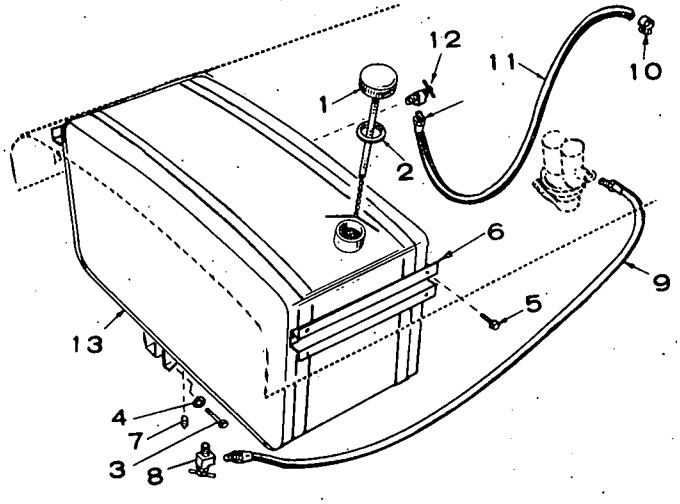
COOLING SYSTEM GROUP (Radiator Cooled Generator Sets)



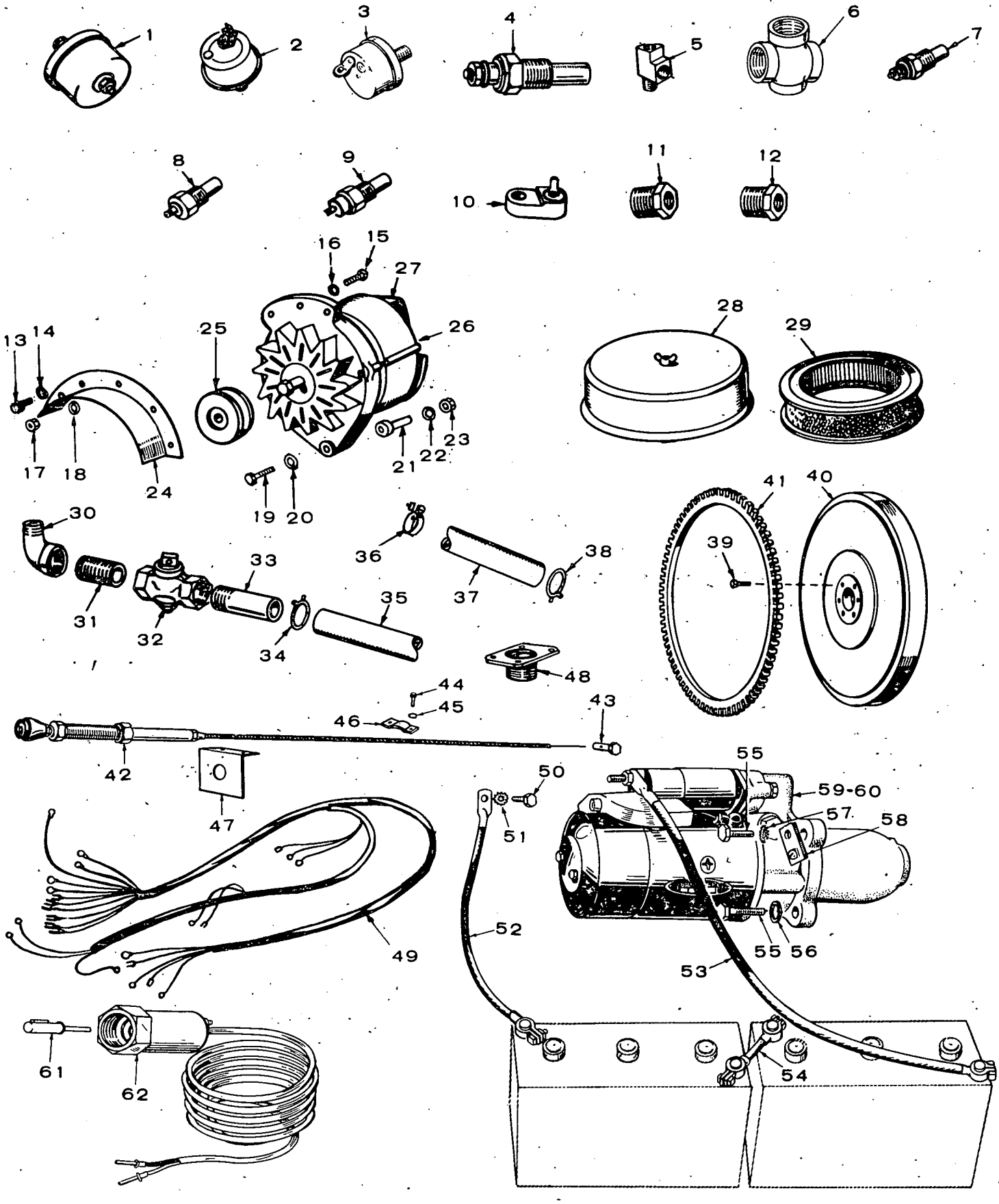
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	130-0934	1	Guard, Fan - Right Side
2	815-0181	4	Screw, Tapping, Thread Cutting - Hex Head with External Tooth Washer (#10-32 x 1/2")
3	130-0935	1	Guard, Fan - Left Side
4	815-0181	4	Screw, Tapping, Thread Cutting - Hex Head with External Tooth Washer (#10-32 x 1/2")
5	503-0365	2	Clamp, Hose
6	503-0727	1	Hose, Rubber - Upper
7	503-0365	2	Clamp, Hose
8	503-0635	1	Hose, Rubber - Lower
9	504-0028	1	Valve - Drain
10	130-0449	1	Cap - Radiator
11	821-0014	8	Screw, Self-Locking - Hex Head (5/16-18 x 1/2")
12	870-0113	8	Nut, Clinch (5/16-18)
13	130-0815	1	Radiator
14	405-1054	1	Flange, Duct - Optional

MOUNTED FUEL TANK GROUP - OPTIONAL (Housed Sets Only)

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	159-0512	1	Cap and Indicator
2	159-0751	1	Gasket, Gas Cap
3	812-0158	2	Screw, Machine - Round Head (1/4-20 x 2")
4	850-0040	2	Washer, Lock - Spring (1/4)
5	821-0010	8	Screw, Self-Locking - Hex Head (1/4-20 x 1/2")
6	159-0489	1	Strap Assembly, Mounting
7	505-0057	1	Plug, Pipe - Square Head
8	504-0013	1	Valve, Globe
9	501-0027	1	Hose, Rubber
10	503-0685	1	Clamp, Hose
11	501-0205	1	Hose, Rubber
12	504-0007	1	Valve, Globe
13	159-1025	1	Tank, Fuel (20 gallon)



MISCELLANEOUS ENGINE PARTS GROUP (Includes Optionals)



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	193-0108	1	Sender, Oil Pressure
2	309-0169	1	Switch, Low Oil Pressure
3	309-0064	1	Switch, Low Oil Pressure Shutdown - Optional
4	193-0202	1	Sender, Oil Temperature - Optional
5	502-0058	1	Tee, Pipe (1/8")
6	505-0763	1	Cross, Pipe (1/8")
7	193-0104	1	Sender, Water Temperature
8	309-0179	1	Switch, High Water Temperature
9	309-0178	1	Switch, High Water Temperature Alarm - Optional
10	309-0269	1	Switch, Low Engine Temperature - Optional
11	505-0131	1	Reducer, Pipe (3/4 x 3/8)
12	505-0117	1	Reducer, Pipe (1/2 x 3/8)
13	800-0024	1	Screw, Cap - Hex Head (5/16-18 x 1/2")
14	850-0045	1	Washer, Lock - Spring (5/16)
15	800-0030	1	Screw, Cap - Hex Head (5/16-18 x 1-1/4")
16	526-0115	1	Washer, Flat (11/32" ID x 11/16" OD x 1/16" THK)
17	862-0015	1	Nut, Hex (5/16-18)
18	850-0045	1	Washer, Lock - Spring (5/16)
19	800-0058	1	Screw, Cap - Hex Head (3/8-16 x 3")
20	526-0035	2	Washer, Flat (17/32" ID x 7/8" OD x 1/8" THK)
21	232-2183	1	Spacer, Stepped
22	850-0050	1	Washer, Lock - Spring (3/8)
23	862-0003	1	Nut, Hex (3/8-16)
24	191-0725	1	Guard, Belt
25	191-1099	1	Pulley
26	191-0665	1	†Alternator - Includes Regulator (Motorola #70D44039B01)
27	191-0732	1	†Regulator, Voltage - Part of Alternator
28	140-1083	1	Cleaner, Air - Includes Element
29	140-1089	1	Element, Air Cleaner
30	505-0050	1	Elbow, Pipe - Street (1/2" x 90°)
31	505-0100	1	Nipple, Pipe - Close (1/2")
32	504-0011	1	Valve, Plug - BRS
33	505-0185	1	Nipple, Pipe - Half (1/2" x 1-1/2")
34	503-0197	1	Clamp, Hose
35	503-0098	As Req.	Hose, Rubber - Oil Drain (Order 17")
36	148-0274	1	Clamp, Loop
37	503-0098	24"	Hose, Rubber - Breather Extension
38	503-0197	1	Clamp, Hose
39	800-0094	4	Screw, Cap - Hex Head (1/2-13 x 2")
40	104-0871	1	Flywheel - Includes Ring Gear
41	104-0859	1	Gear, Ring - Part of Flywheel
	VERNIER THROTTLE ASSEMBLY - OPTIONAL (Includes Parts Marked *)		
42	152-0120	1	*Cable, Throttle
43	152-0158	1	*Swivel
44	815-0104	2	*Screw, Machine - Fillister Head (#8-32 x 5/16")
45	526-0052	2	*Washer, Flat - Brass (17/64" ID x 9/16" OD x 1/32" THK)
46	152-0036	1	*Clamp, Cable
47	151-0230	1	*Bracket, Angle - Throttle Mounting
48	154-1674	1	Adapter, Exhaust Manifold - Spec A Only
49	338-0771	1	Harness, Wiring - Engine
50	800-0090	1	Screw, Cap - Hex Head (1/2-13 x 1")
51	856-0008	2	Washer, Lock - External/ Internal Tooth (1/2)
52	416-0530	1	Cable, Electrical - Battery, Ground (16")
53	416-0531	1	Cable, Electrical - Battery, Positive (24")
54	416-0446	1	Cable, Electrical - Battery, Jumper
55	800-0051	3	Screw, Cap - Hex Head (3/8-16 x 1-1/4")
56	850-0050	3	Washer, Lock - Spring (3/8)
57	856-0010	1	Washer, Lock - External/ Internal Tooth (3/8)
58	332-1292	1	Terminal Board
59	191-1097	1	+Starter - Spec A; Alternate Source Beginning Spec B (Delco Remy #1113402)
60	191-1117	1	§Starter - Begin Spec B (Nippondenso #028000-3930)
61	302-0967	1	Tang, Drive - Optional (Tach Sender)
62	302-0750	1	Sender, Tach - Optional

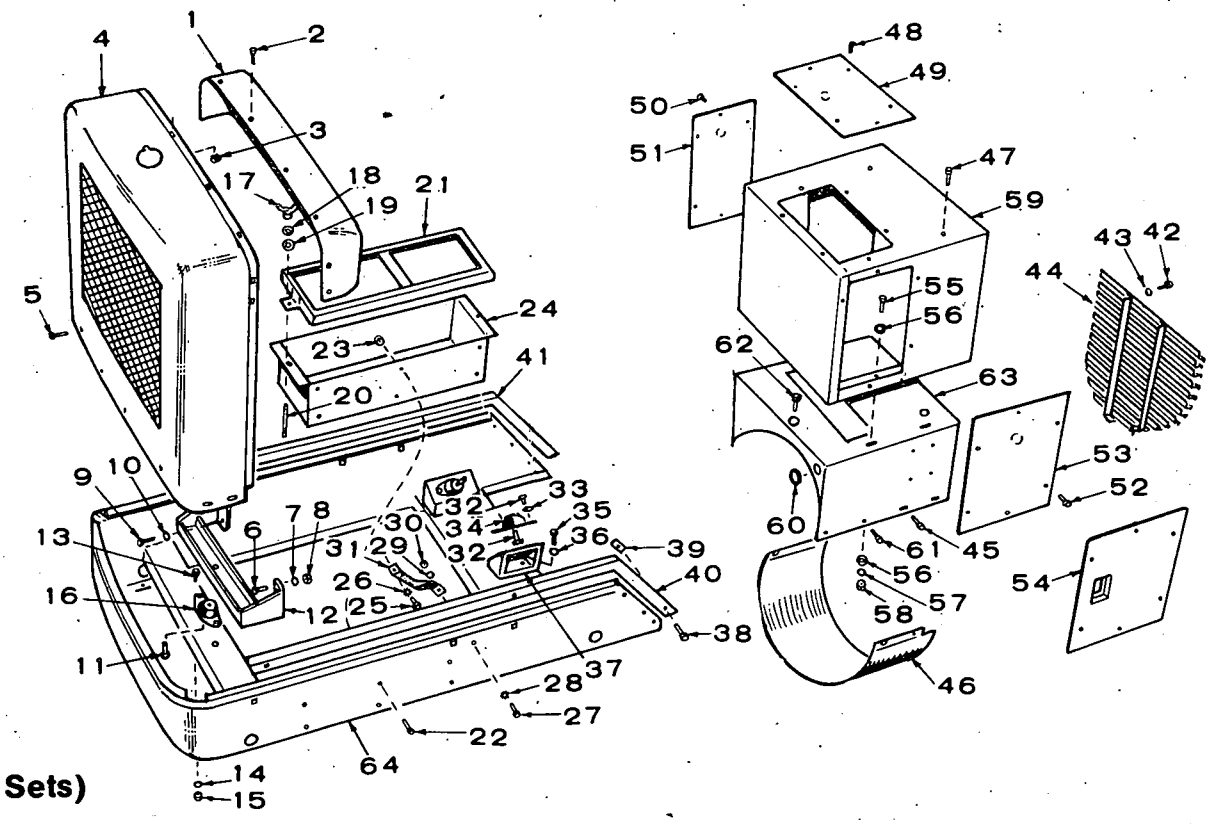
† - For components, contact your nearest Motorola Dealer or Motorola Automotive Products, Inc., 9401 W. Grand Ave., Franklin Park, Illinois 60131.

* - Included in Optional Vernier Throttle Assembly.

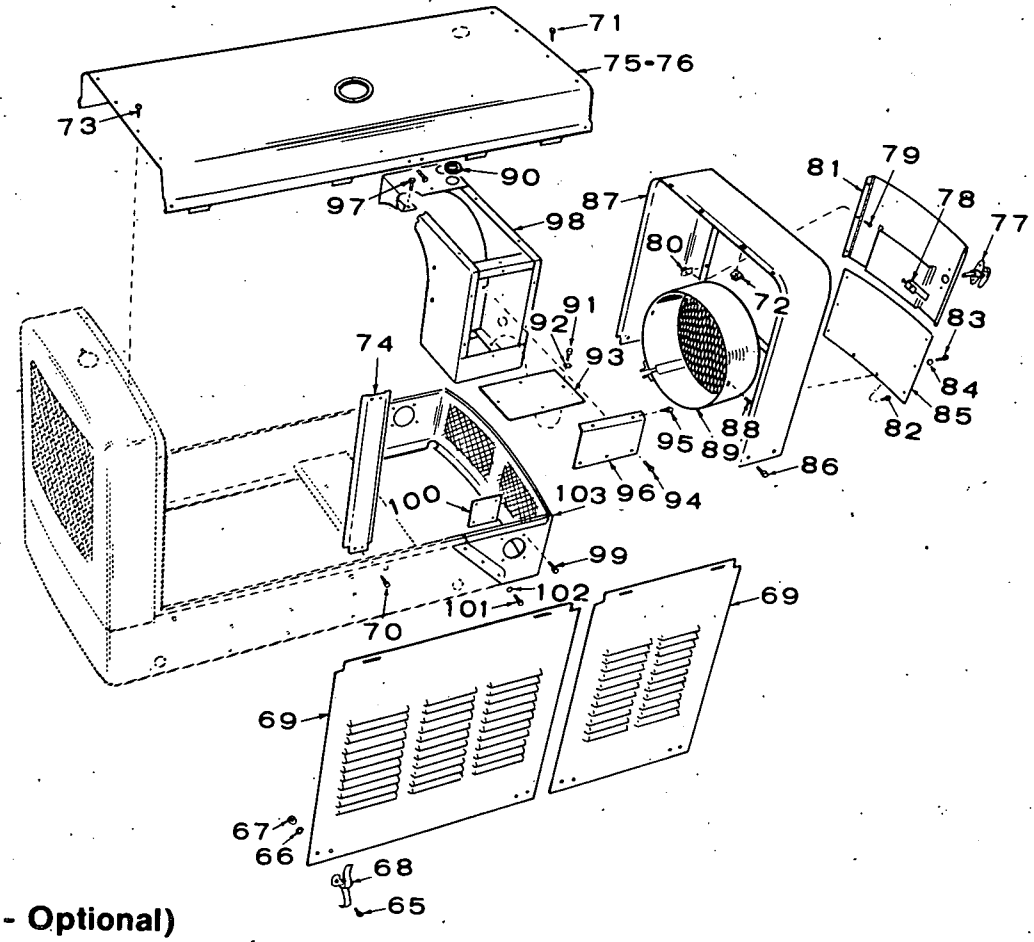
+ - For components, contact your nearest Delco Remy Dealer or Delco Remy Division of General Motors Corporation, Anderson, Indiana 46011.

§ - For components, contact your nearest Nippondenso Dealer or Detroit Branch, Nippondenso Sales, Inc. 21840 West Nine Mile Road, Southfield, Michigan 48075, U.S.A.

CHASSIS AND HOUSING GROUP

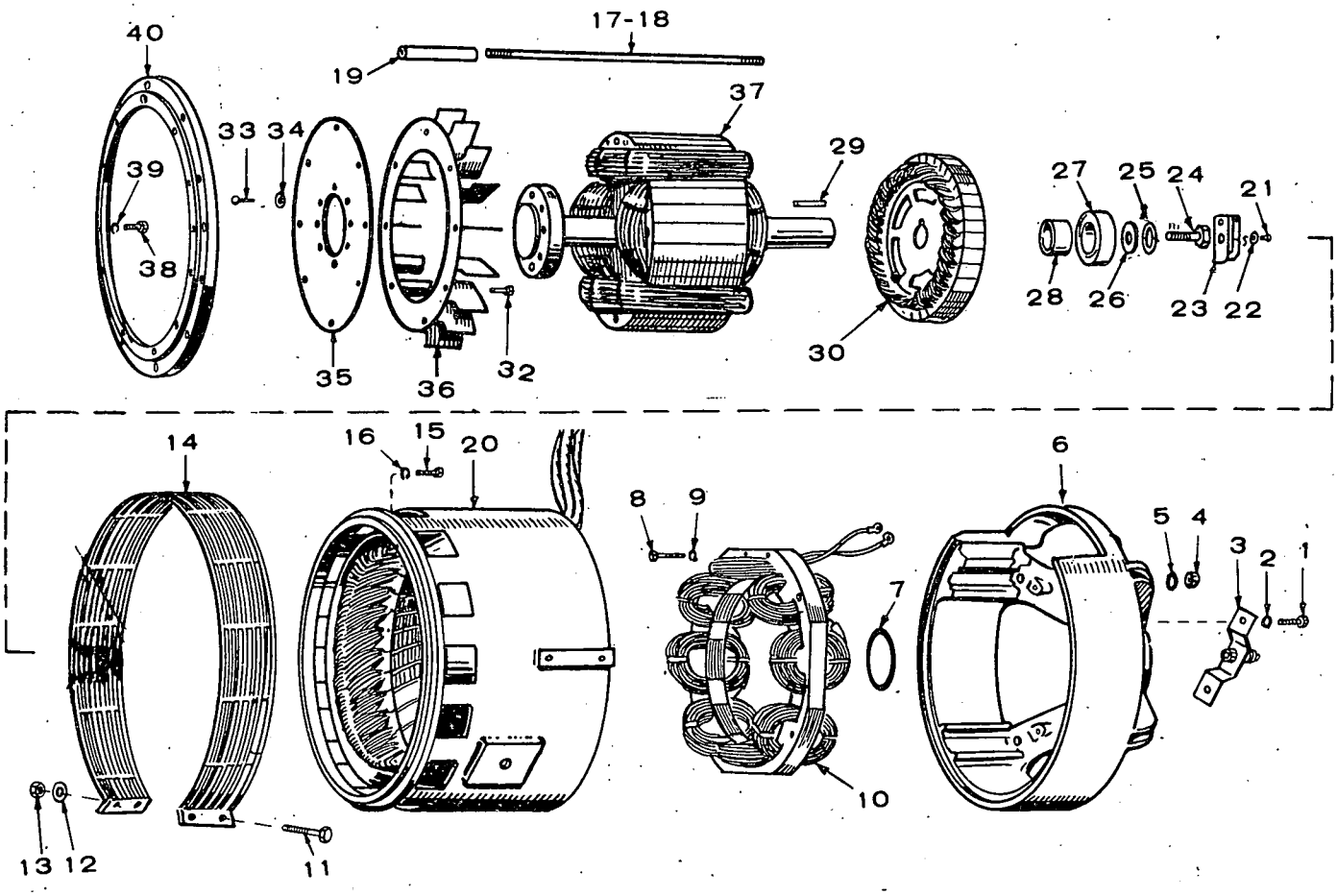


(Unhoused Sets)



(Housed Sets - Optional)

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	405-1409	1	Extension, Hood - Radiator
2	821-0014	8	Screw, Self-locking - Hex Head (5/16-18 x 1/2")
3	870-0113	8	Nut, Clinch (5/16-18) (Also used with Housed Sets)
4	405-1811	1	Panel, Radiator (Also used with Housed Sets)
5	821-0014	8	Screw, Self-locking - Hex Head (5/16-18 x 1/2")
6	800-0095	2	Screw, Cap - Hex Head (1/2-13 x 2-1/4")
7	850-0060	2	Washer, Lock - Spring (1/2)
8	862-0016	2	Nut, Hex (1/2-13)
9	800-0132	2	Screw, Cap - Hex Head (5/8-11 x 1-1/2")
10	850-0070	2	Washer, Lock - Spring (5/8)
11	800-0520	1	Screw, Cap - Special Hex Head, Unplated (3/4-10 x 1")
12	403-1110	1	Support, Engine
13	800-0090	2	Screw, Cap - Hex Head (1/2-13 x 1")
14	850-0060	2	Washer, Lock - Spring (1/2)
15	862-0016	2	Nut, Hex (1/2-13)
16	402-0371	1	Mount, Vibration
17	865-0007	2	Nut, Wing (5/16-18)
18	850-0045	2	Washer, Lock - Spring (5/16)
19	526-0115	2	Washer, Flat (11/32" ID x 11/16" OD x 1/16" THK)
20	520-0663	2	Stud (5/16-18 x 3-1/4")
21	416-0480	1	Frame, Hold-down - Battery
22	821-0029	6	Screw, Self-Locking - Hex Head (3/8-16 x 3/4")
23	870-0281	6	Nut, Self-locking (3/8-16)
24	416-0666	1	Tray - Battery
25	800-0090	1	Screw, Cap - Hex Head (1/2-13 x 1")
26	856-0013	1	Washer, Lock - External/Internal Tooth (1/2)
27	800-0091	1	Screw, Cap - Hex Head (1/2-13 x 1-1/4")
28	856-0013	1	Washer, Lock - External/Internal Tooth (1/2)
29	850-0050	1	Washer, Lock - Spring (1/2)
30	862-0016	1	Nut, Hex (1/2-13)
31	337-0090	1	Lead, Electrical - Ground (Flexible)
32	SCREW, CAP		
	800-0520	2	Screw, Cap - Special Hex Head, Unplated (3/4-10 x 1")
	800-0071	4	Screw, Cap - Hex Head (7/16-14 x 1")
33	850-0055	4	Washer, Lock - Spring (7/16)
34	402-0030	2	Mount, Vibration
35	800-0091	4	Screw, Cap - Hex Head (1/2-13 x 1-1/4")
36	850-0055	4	Washer, Lock - Spring (1/2)
37	232-2106	2	Bracket, Support - Generator
38	821-0014	6	Screw, Self-locking - Hex Head (5/16-18 x 1/2")
39	870-0020	6	Nut, Plate (5/16-18)
40	403-0913	1	Trim, Chassis - Right Side
41	403-0914	1	Trim, Chassis - Left Side
42	812-0146	4	Screw, Machine - Round Head (1/4-20 x 3/8")
43	850-0040	4	Washer, Lock - Spring (1/4)
44	234-0370	1	Grille, Inlet, Air
45	821-0010	7	Screw, Self-locking - Hex Head (1/4-20 x 1/2")
46	234-0361	1	Wrapper, End Bell - Generator
47	821-0014	4	Screw, Self-locking - Hex Head (5/16-18 x 1/2") - Control Box Mounting
48	815-0350	6	Screw, Tapping - Hex Head, Slotted (#10-32 x 3/8")
49	301-3156	1	Panel, Blank - Top (Also used on Housed Sets)
50	815-0350	6	Screw, Tapping - Hex Head, Slotted (#10-32 x 3/8")
51	301-3156	1	Panel, Blank - Left Side
52	815-0350	6	Screw, Tapping - Hex Head, Slotted (#10-32 x 3/8")
53	301-3156	1	Panel, Blank - Right Side (Also used on Housed Sets)
54	301-3192	1	Panel, Circuit Breaker - Right Side - Optional (Used with Line Load Circuit Breaker)
55	800-0003	4	Screw, Cap - Hex Head (1/4-20 x 1/2)
56	526-0018	8	Washer, Flat (17/64" ID x 5/8" OD x 1/16" THK)
57	850-0040	4	Washer, Lock - Spring (1/4)
58	862-0001	4	Nut, Hex (1/4-20)
59	301-3155	1	Housing, Control Box
60	508-0001	1	Grommet, Rubber (3/4" ID x 1-9/32" OD)
61	821-0014	4	Screw, Self-locking - Hex Head (5/16-18 x 1/2")
62	821-0010	1	Screw, Self-locking - Hex Head (1/4-20 x 1/2")
63	301-3154	1	Saddle - Control Box Housing
64	403-1111	1	Chassis - Engine/Generator (Also used with Housed Sets)
	HOUSED SETS - OPTIONAL (Includes following parts and unhoused set items indicated above)		
65	813-0098	16	Screw, Machine - Round Head (#10-32 x 3/8")
66	850-0030	16	Washer, Lock - Spring (#10)
67	870-0053	16	Nut, Hex (#10-32)
68	406-0105	8	Clamp, Door
69	DOOR, LOUVERED		
	405-1808	2	Door, Louvered - Engine section
	405-1832	2	Door, Louvered - Generator section
70	821-0014	4	Screw, Self-locking - Hex Head (5/16-18 x 1/2")
71	821-0016	6	Screw, Self-locking - Hex Head (5/16-18 x 3/4")
72	870-0113	6	Nut, Clinch (5/16-18)
73	821-0014	6	Screw, Self-locking - Hex Head (5/16-18 x 1/2")
74	405-1814	2	Support, Housing - Center
75	405-2151	1	Panel, Housing - Top (Used with standard exhaust manifold)
76	405-2207	1	Panel, Housing - Top (Used with water cooled exhaust manifold)
77	406-0157	1	Handle, Latch (with Keys)
78	406-0089	1	Catch, Latch
79	809-0059	3	Screw, Tapping - Pan Head (#14 x 1/2")
80	870-0106	3	Nut, Spring Sheet (#14)
81	405-1777	1	Door, Access - Rear
82	821-0014	2	Screw, Self-locking - Hex Head (5/16-18 x 1/2")
83	813-0098	6	Screw, Machine - Round Head (#10-32 x 3/8")
84	850-0030	6	Washer, Lock - Spring (#10)
85	405-1780	1	Panel, Access - Rear
86	821-0014	4	Screw, Self-locking - Hex Head (5/16-18 x 1/2")
87	405-1812	1	Panel, Housing - Rear
88	821-0010	4	Screw, Self-locking - Hex Head (1/4-20 x 1/2")
89	234-0369	1	Cover, End Bell - Generator
90	508-0001	2	Grommet, Rubber (3/4" ID x 1-9/32" OD)
91	813-0098	4	Screw, Machine - Round Head (#10-32 x 3/8")
92	850-0030	4	Washer, Lock - Spring (#10)
93	301-3195	1	Plate, Blank - Bottom, Junction Box
94	821-0010	3	Screw, Self-locking - Hex Head (1/4-20 x 1/2")
95	821-0014	2	Screw, Self-locking - Hex Head (5/16-18 x 1/2")
96	301-3196	1	Bracket, Support - Current Transformer Assembly
97	821-0010	1	Screw, Self-locking - Hex Head (1/4-20 x 1/2")
98	301-3191	1	Box, Junction
99	821-0010	8	Screw, Self-locking - Hex Head (1/4-20 x 1/2")
100	403-0895	2	Plate, Cover
101	800-0048	6	Screw, Cap - Hex Head (3/8-16 x 3/4")
102	850-0050	6	Washer, Lock - Spring (3/8)
103	403-0894	1	Adapter, Chassis - Rear

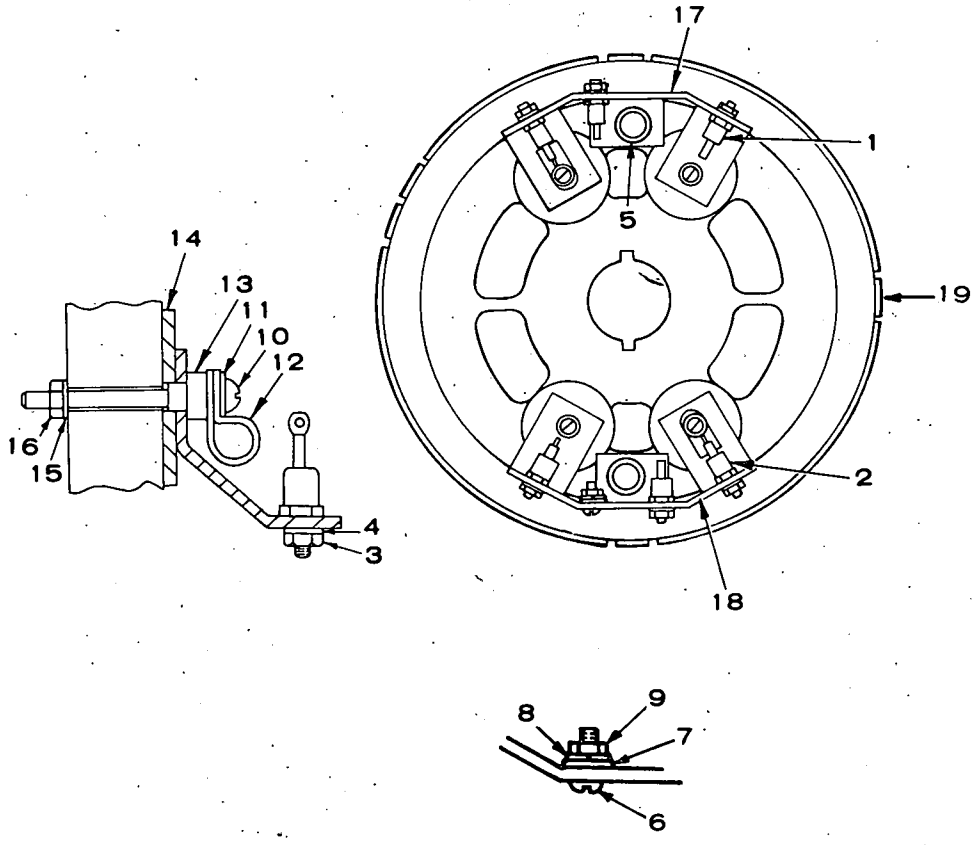


GENERATOR GROUP

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	800-0003	2	Screw, Cap - Hex Head (1/4-20 x 1/2")
2	850-0040	2	Washer, Lock - Spring (1/4)
3	150-1456	1	Contact Assembly - Overspeed Switch
4	862-0011	4	Nut, Hex - Special, Grade 8 (3/8-16)
5	850-0050	4	Washer, Lock - Spring (3/8)
6	211-0185	1	End Bell - Generator
7	509-0125	1	Seal, Oil - O-Ring
8	800-0009	4	Screw, Cap - Hex Head (1/4-20 x 1-1/2")
9	850-0040	4	Washer, Lock - Spring (1/4)
10	220-2353	1	Stator, Exciter
11	800-0008	2	Screw, Cap - Hex Head (1/4-20 x 1-1/4")
12	850-0040	2	Washer, Lock - Spring (1/4)
13	862-0001	2	Nut, Hex (1/4-20)
14	234-0368	1	Screen, Air Outlet - Generator
15	800-0051	8	Screw, Cap - Hex Head (3/8-16 x 1-1/4")
16	850-0050	8	Washer, Lock - Spring (3/8)
17	520-0718	4	Stud (3/8-16 x 3/8-16 x 14-11/16") Used on Single Phase Sets
18	520-0721	4	Stud (3/8-16 x 3/8-16 x 16-11/32") Used on Three Phase Sets
19	503-0611	4	Hose, Rubber
20	£	1	Stator, Generator
21	812-0189	1	Screw, Machine - Round Head (3/8-16 x 3/4")
22	856-0010	1	Washer, Lock - External/ Internal Tooth (3/8)
23	150-0717	1	Switch, Overspeed
	ROTOR ASSEMBLY, GENERATOR (Includes items marked *)		
24	800-0513	1	*Screw, Cap - Hex Head, Special Heat Treat, Unplated (3/4-10 x 1-1/2")
25	850-0079	1	*Washer, Lock - Spring (3/4)
26	526-0238	1	*Washer, Flat - Steel Alloy (13/16" ID x 2" OD x 3/16" THK)
27	510-0101	1	*Bearing, Ball
28	232-2102	1	*Spacer, Sleeve
29	515-0145	1	*Key, Machine (1/4" x 1/4" x 7/8")
30	201-1739	1	*Rotor Assembly, Exciter (See Separate Group for Components)
32	805-0018	8	Bolt, Hex Head - Grade 8 (3/8-16 x 1")
33	805-0033	8	*Bolt, Hex Head - Grade 8 (5/8-11 x 1")
34	526-0259	8	*Washer, Flat - Special Hardened Steel (5/8)
35	232-2078	1	*Disk, Drive - Generator
36	205-0089	1	*Fan, Centrifugal - Generator
37	£	1	*Rotor, Generator
38	802-0072	12	Screw, Cap - Socket Head (3/8-16 x 1")
39	850-0050	12	Washer, Lock - Spring (3/8)
40	231-0188	1	Adapter, Generator

£ - Refer to Factory giving Complete Model, Spec and Serial Number from nameplate.

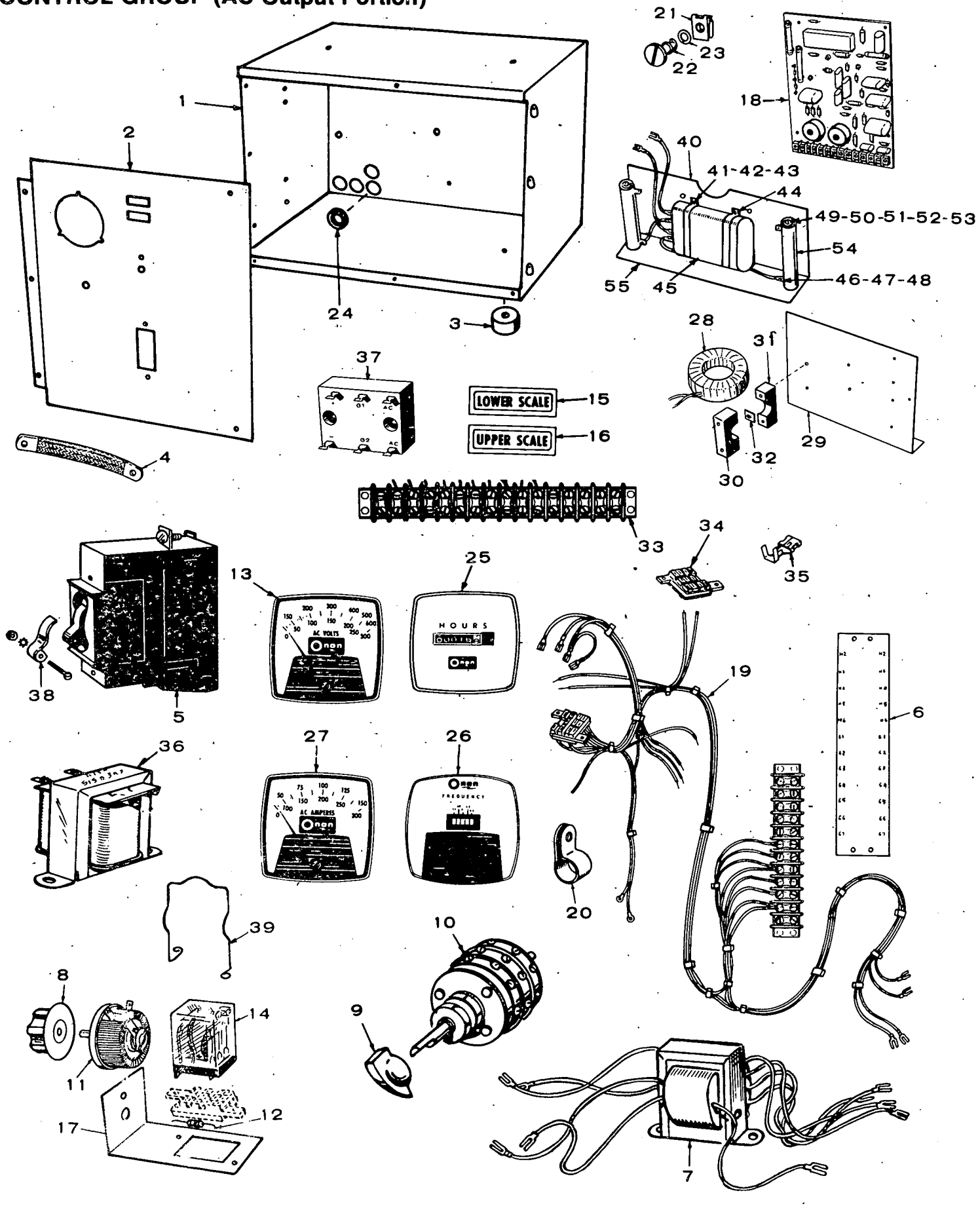
* - Included in Generator Rotor Assembly.



EXCITER ROTOR GROUP

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	358-0016	3	Rectifier, Diode - Positive
2	358-0015	3	Rectifier, Diode - Negative
3	870-0053	6	Nut, Hex (#10-32)
4	850-0030	6	Washer, Lock - Spring (#10)
5	508-0093	2	Grommet, Rubber
6	813-0100	2	Screw, Machine - Round Head (#10-32 x 1/2")
7	526-0008	2	Washer, Flat (13/64" ID x 7/16" OD x 1/32" THK)
8	850-0030	2	Washer, Lock - Spring (#10)
9	870-0053	2	Nut, Hex (#10-32)
10	813-0110	4	Screw, Machine - Round Head (#10-32 x 2")
11	526-0009	4	Washer, Flat (7/32" ID x 1/2" OD x 1/16" THK)
12	332-0050	2	Clamp, Loop
13	508-0124	4	Spacer, Stepped
14	508-0156	4	Washer, Flat - Fiber (19/64" ID x 1-7/8" OD x 1/8" THK)
15	850-0030	5	Washer, Lock - Spring (#10)
16	870-0053	4	Nut, Hex (#10-32)
17	363-0054	1	Heat Sink, Rectifier - Positive
18	363-0055	1	Heat Sink, Rectifier - Negative
19	201-1737	1	Rotor, Exciter

CONTROL GROUP (AC Output Portion)



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	301-3158	1	Box, Control
2	£	1	Panel, Control (Generator Section)
3	402-0078	4	Mount, Vibration
4	337-0049	1	Lead, Electrical - Ground
5	320-0431	1	Breaker, Circuit
6	MARKER STRIP		
	332-1248	1	Strip, Marker (12 Place)
	332-1242	1	Strip, Marker - Optional (16 Place)
7	315-0342	1	Transformer, Voltage
8	303-0032	1	Knob
9	303-0076	1	Knob, Pointer
10	ROTARY SWITCH		
	308-0012	1	Switch, Rotary - 2 Pole, 4 Position
	308-0284	1	Switch, Rotary - 4 Pole, 4 Position - Optional
11	303-0170	1	Rheostat
12	350-0556	1	†Resistor, Composition (47,000-Ohm, 1/2 Watt, 5%)
13	VOLTMETER		
	302-0421	1	Voltmeter - Optional (0-300 Volt)
	302-0718	1	Voltmeter - Optional (0-300 Volt, 0-600 Volt)
	302-0779	1	Voltmeter - Optional (0-750 Volt)
14	307-1061	1	Relay, Armature
15	322-0130	1	Light, Indicator - Optional (Lower Scale)
16	322-0131	1	Light, Indicator - Optional (Upper Scale)
17	301-3244	1	Bracket, Angle - Relay Socket
18	332-1268	1	*Regulator, Voltage
19	£	1	Harness, Wiring (Includes parts marked †)
20	332-0050	1	Clamp, Loop
21	406-0332	2	Receptacle, Turnbutton Fastener
22	406-0333	2	Stud, Turnbutton Fastener
23	406-0334	2	Washer, Lock - Turnbutton Stud
24	508-0001	4	Grommet, Rubber (1-1/16" OD)
25	TIME TOTALIZING METER		
	302-0466	1	Meter, Time Totalizing - 60 Hertz
	302-0469	1	Meter, Time Totalizing - 50 Hertz
26	ELECTRICAL FREQUENCY METER		
	302-0221	1	Meter, Electrical Frequency - 60 Hertz
	302-0256	1	Meter, Electrical Frequency - 50 Hertz
27	AMMETER		
	302-0412	2	Ammeter (0-250) - Optional
	302-0719	1	Ammeter (0-75, 0-150)
28	CURRENT TRANSFORMER		
	302-0743	3	Transformer, Current
	302-0739	2	Transformer, Current - Optional
	302-0496	1	Transformer, Current - Optional
29	302-0729	1	Bracket, Angle - Current Transformer Mounting
30	302-0235	3	Clamp, Retaining, Transformer - Upper
31	302-0236	3	Clamp, Retaining, Transformer - Lower
32	302-0253	As Req.	Shim - Transformer Mounting
33	TERMINAL BOARD		
	332-0607	1	†Board, Terminal (12 Place)
	332-0795	1	†Board, Terminal (16 Place) - Optional
34	323-0764	1	†Socket, Relay
35	332-1280	As Req.	†Terminal, Lug
36	315-0384	1	Reactor
37	305-0524	1	Rectifier Assembly
38	320-0307	1	Lock, Handle - Circuit Breaker - Optional (Penn State Sets)
39	307-1157	1	Clip, Retaining - Relay
40	232-2219	1	Filter, Voltage Regulator - Optional (Includes parts marked +)
41	812-0061	4	+Screw, Machine - Round Head (#6-32 x 3/8")
42	850-0020	5	+Washer, Lock - Spring (#6)
43	860-0006	4	+Nut, Hex (#6-32)
44	312-0189	2	+Bracket, Hold-down - Capacitor
45	312-0188	1	+Capacitor, Plastic Dielectric, Metal Case (15 MFD, 440 VAC)
46	815-0001	4	+Screw, Machine - Binding Head, Brass (#6-32 x 1/4")
47	853-0003	4	+Washer, Lock - External Tooth (#6)
48	860-0006	4	+Nut, Hex (#6-32)
49	812-0165	2	+Screw, Machine - Round Head (1/4-20 x 4-1/2")
50	304-0427	4	+Washer, Shoulder - Centering
51	304-0292	2	+Insulator, Disk
52	850-0040	2	+Washer, Lock - Spring (1/4)
53	862-0001	2	+Nut, Hex (1/4-20)
54	354-0025	2	+Resistor, Wirewound (10-Ohm, 100 Watts, 5%)
55	232-2218	1	+Bracket, Angle - Mounting
	ATTACHING HARDWARE - NOT ILLUSTRATED (Select as Applicable)		
	812-0059	As Req.	Screw, Machine - Round Head (#6-32 x 1/4")
	812-0061	As Req.	Screw, Machine - Round Head (#6-32 x 3/8")
	812-0066	As Req.	Screw, Machine - Round Head (#6-32 x 3/4")
	812-0077	As Req.	Screw, Machine - Round Head (#8-32 x 3/8")
	815-0026	As Req.	Screw, Machine - Truss Head (#10-32 x 3/8")
	815-0203	As Req.	Screw, Machine - Round Head, Brass with External Tooth Lockwasher (#10-32 x 7/8")
	800-0024	As Req.	Screw, Cap - Hex Head (5/16-18 x 3/8")
	800-0045	As Req.	Screw, Cap - Hex Head (5/16-18 x 1/2")
	526-0049	As Req.	Washer, Flat, Brass (.200" ID x 7/16" OD x 1/32" THK)
	850-0020	As Req.	Washer, Lock - Spring (#6)
	853-0003	As Req.	Washer, Lock - External Tooth (#6)
	853-0008	As Req.	Washer, Lock - External Tooth (#10)
	850-0045	As Req.	Washer, Lock - Spring (5/16)
	856-0008	As Req.	Washer, Lock - External/ Internal Tooth (5/16)
	871-0010	As Req.	Nut, Hex - Brass (#6-32)
	870-0053	As Req.	Nut, Hex (#10-32)
	862-0015	As Req.	Nut, Hex (5/16-18)

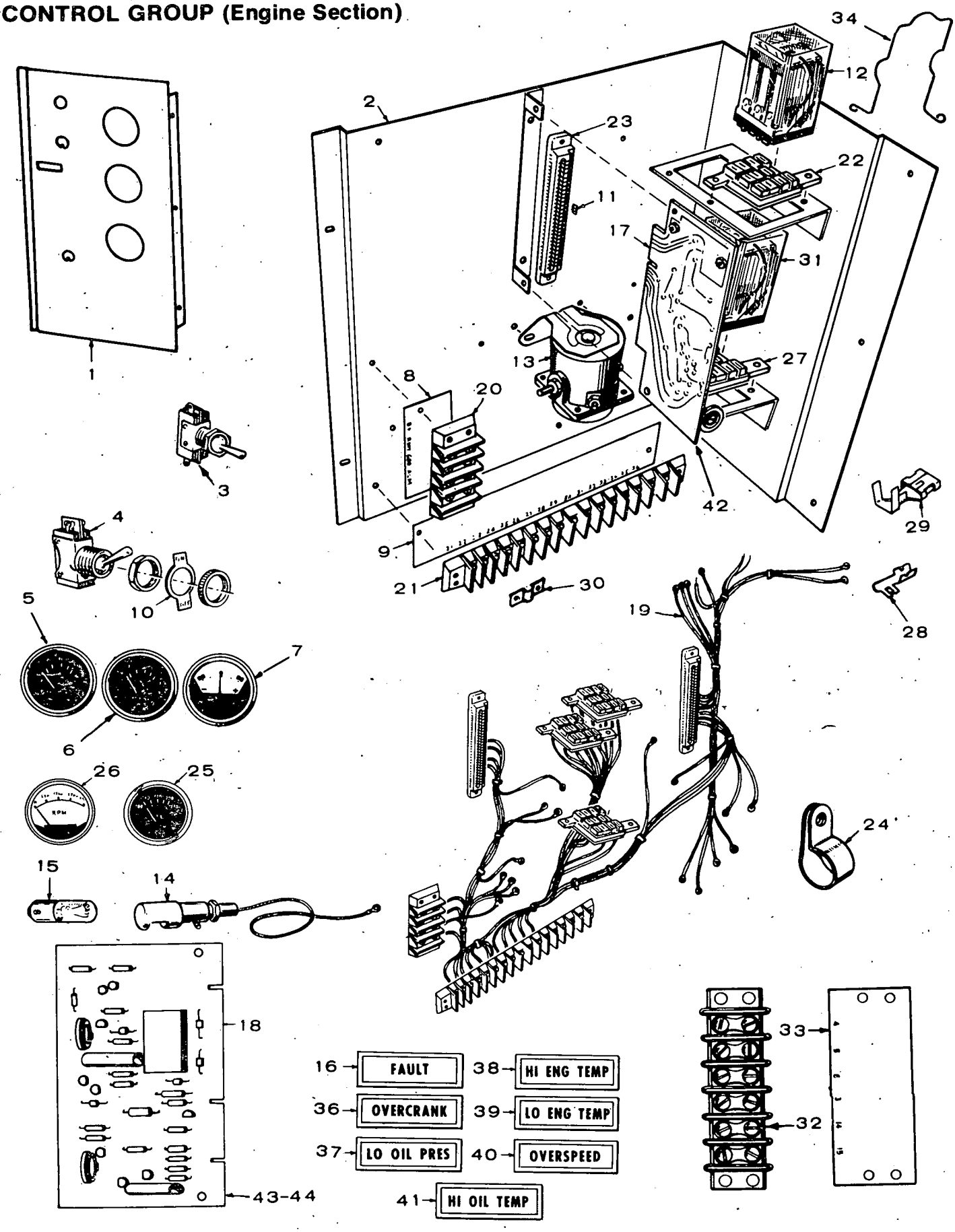
+ - Included in Filter.

† - Included in Wiring Harness.

* - See Separate Group for Components.

£ - To order refer to Factory, giving Model, Spec and Serial number from nameplate; additional data as to Quantity of meters, etc. will assist identification

CONTROL GROUP (Engine Section)



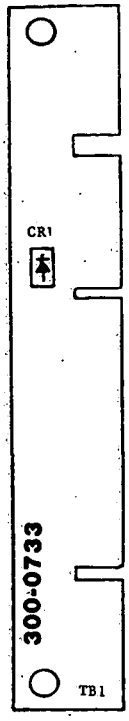
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	£	1	Panel, Control (Engine Section)
2	301-3253	1	Bracket, Angle - Control Mounting
3	308-0138	1	Switch, Toggle (SPDT)
4	308-0002	1	Switch, Toggle (SPST)
5	193-0107	1	Gauge, Oil Pressure
6	193-0106	1	Gauge, Water Temperature
7	302-0061	1	Ammeter (30-0-30)
8	332-1239	1	Strip, Marker
9	332-1241	1	Strip, Marker
10	308-0003	1	Plate, Switch (On-Off)
11	332-1276	4	Plug, Key
12	307-1058	2	Relay, Armature
13	307-1031	1	Relay, Armature
14	322-0149	1	Light, Panel
15	322-0004	1	Lamp, Incandescent (12 Volt)
16	322-0128	1	Light, Indicator (Fault)
17	300-0733	1	*Control, Cycle Cranker
18	300-0679	1	*Control, Engine Monitor
19	£	1	Harness, Wiring (Includes parts marked †)
20	332-0537	1	†Board, Terminal (4 Place)
21	332-0795	1	†Board, Terminal (16 Place)
22	332-0765	2	†Socket, Relay
23	332-1271	2	†Housing, Connector (PC Boards)
24	332-0051	1	Clamp, Loop
25	193-0187	1	Gauge, Oil Temperature - Optional
26	302-0749	1	Tachometer, Electrical - Optional
27	323-0764	1	†Socket, Relay
28	332-1269	As Req.	†Contact, Electrical - PC Board Connector
29	332-1280	As Req.	†Terminal, Lug
30	332-1043	1	†Jumper
31	307-1061	1	Relay, Armature
32	332-0699	1	†Board, Terminal (6 Place)
33	332-1240	1	Strip, Marker
34	307-1157	3	Clip, Retaining - Relay
35	308-0327	1	Switch, Toggle - Optional (SPDT) Penn State
36	322-0107	1	Light, Indicator (Overcrank)
37	322-0108	1	Light, Indicator (Low Oil Pressure)
38	322-0109	1	Light, Indicator (Hi Engine Temp)
39	322-0110	1	Light, Indicator (Low Engine Temp)
40	322-0111	1	Light, Indicator (Overspeed)
41	322-0112	1	Light, Indicator (Hi Oil Temp)
42	300-0714	1	*Control, Cycle Cranker - Optional
43	300-0730	1	*Control, Engine Monitor - Optional
44	300-0681	1	*Control, Engine Monitor - Optional
	ATTACHING HARDWARE—NOT ILLUSTRATED (Select as Applicable)		
	812-0066	As Req.	Screw, Machine - Round Head (#6-32 x 3/4")
	812-0077	As Req.	Screw, Machine - Round Head (#8-32 x 3/8")
	815-0026	As Req.	Screw, Machine - Truss Head (#10-32 x 3/8")
	813-0098	As Req.	Screw, Machine - Round Head (#10-32 x 3/8")
	815-0203	As Req.	Screw, Machine - Round Head, Brass with External Tooth Lockwasher (#10-32 x 7/8")
	853-0003	As Req.	Washer, Lock - External Tooth (#6)
	850-0025	As Req.	Washer, Lock - Spring (#8)
	526-0049	As Req.	Washer, Flat - Brass (.200" ID x 7/16" OD x 1/32" THK)
	850-0030	As Req.	Washer, Lock - Spring (#10)
	856-0003	As Req.	Washer, Lock - External/ Internal Tooth (#10)
	853-0008	As Req.	Washer, Lock - External Tooth (#10)
	860-0006	As Req.	Nut, Hex (#6-32)
	860-0008	As Req.	Nut, Hex (#8-32)
	870-0053	As Req.	Nut, Hex (#10-32)
	871-0010	As Req.	Nut, Hex - Brass (#6-32)
	518-0295	As Req.	Pin, Round Head, Non-Metallic (PC Board Fastener)

* - See Separate Group for Components.

† - Included in Wiring Harness.

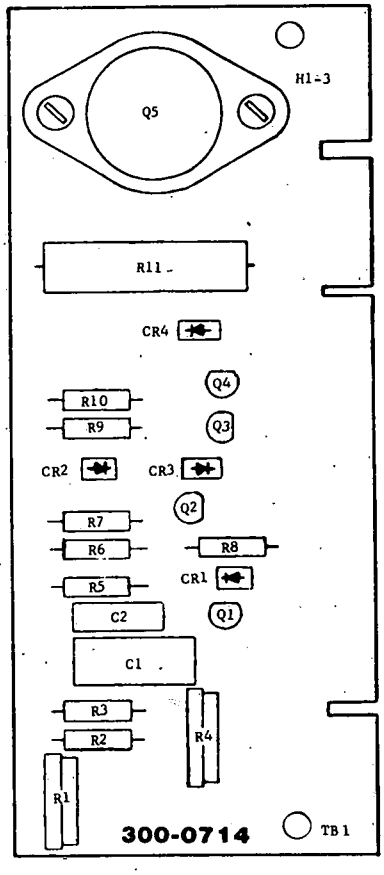
£ - To Order refer to Factory, giving Model, Spec and Serial Number. Additional data as to quantity of meters, etc. will assist identification.

CRANKER CONTROL GROUP - 12 VOLT STANDARD



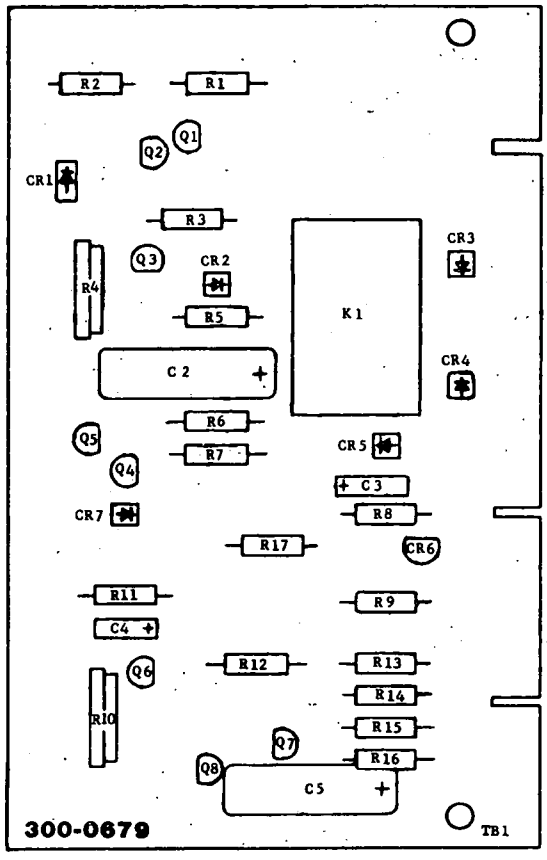
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	300-0733		Control, Cranker - 12 Volt
CR1	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
TB1	332-1285	1	Printed Wiring Board

CRANKER CYCLE CONTROL GROUP - 12 VOLT OPTIONAL



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	300-0714		Control, Cranker Cycle - 12 Volt
C1	356-0039	1	Capacitor, Electrolytic (100 Mfd, 10 Volt)
C2	355-0010	1	Capacitor, Plastic Dielectric (.0022 Mfd, 100 VDC, 10%)
CR1	359-0027	1	Diode, Zener
CR2	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
CR3	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
CR4	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
H1	812-0061	2	Screw, Machine, Round Head (#6-32 x 3/8")
H2	853-0003	2	Washer, Lock - External Tooth (#6)
H3	860-0006	2	Nut, Hex (#6-32)
Q1	362-0008	1	Transistor
Q2	362-0008	1	Transistor
Q3	362-0017	1	Transistor
Q4	362-0026	1	Transistor
Q5	362-0019	1	Transistor
R1	303-0171	1	Potentiometer (100,000-Ohm, 1/4 Watt)
R2	350-0560	1	Resistor, Composition (0.1 Megohm, 1/2 Watt, 10%)
R3	350-0548	1	Resistor, Composition (10,000-Ohm, 1/2 Watt, 10%)
R4	303-0171	1	Potentiometer (100,000-Ohm, 1/4 Watt)
R5	350-0558	1	Resistor, Composition (68,000-Ohm, 1/2 Watt, 10%)
R6	350-0420	1	Resistor, Composition (24,000-Ohm, 1/2 Watt, 5%)
R7	350-0546	1	Resistor, Composition (6800-Ohm, 1/2 Watt, 10%)
R8	350-0520	1	Resistor, Composition (47-Ohm, 1/2 Watt, 5%)
R9	350-0548	1	Resistor, Composition (10,000-Ohm, 1/2 Watt, 10%)
R10	350-0500	1	Resistor, Composition (1-Ohm, 1/2 Watt, 10%)
R11	352-0152	1	Resistor, Wirewound (25-Ohm, 5 Watt, 5%)
TB1	332-1275	1	Printed Wiring Board

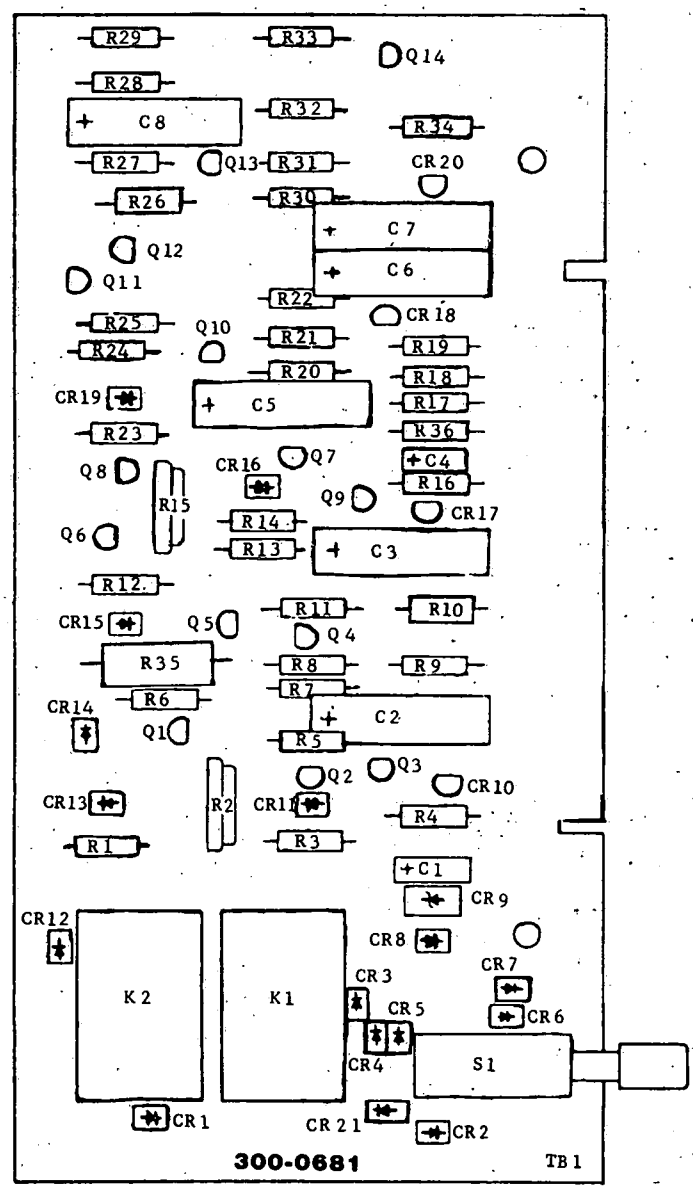
ENGINE CONTROL MONITOR GROUP - 12 VOLT



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	300-0679		Monitor, Engine Control - 12 Volt
C1			Not used
C2	355-0005	1	Capacitor, Plastic Dielectric (.22 Mfd, 200 VDC, 10%)
C3	356-0040	1	Capacitor, Electrolytic (10 Mfd, 20 Volt)
C4	356-0030	1	Capacitor, Electrolytic (1 Mfd, 35 Volt)
C5	355-0005	1	Capacitor, Plastic Dielectric (.22 Mfd, 200 VDC, 10%)
CR1	359-0027	1	Diode, Zener (1 Watt, 7.5 Volt, 5%)
CR2	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
CR3	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
CR4	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
CR5	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
CR6	364-0017	1	Diode, Rectifier (8 Amp, 30 Volt)
CR7	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
K1	307-1039	1	Relay, Armature (12 Volt)
Q1	361-0003	1	Transistor
Q2	362-0025	1	Transistor
Q3	362-0025	1	Transistor
Q4	361-0003	1	Transistor
Q5	362-0025	1	Transistor
Q6	362-0025	1	Transistor
Q7	362-0008	1	Transistor
Q8	362-0008	1	Transistor

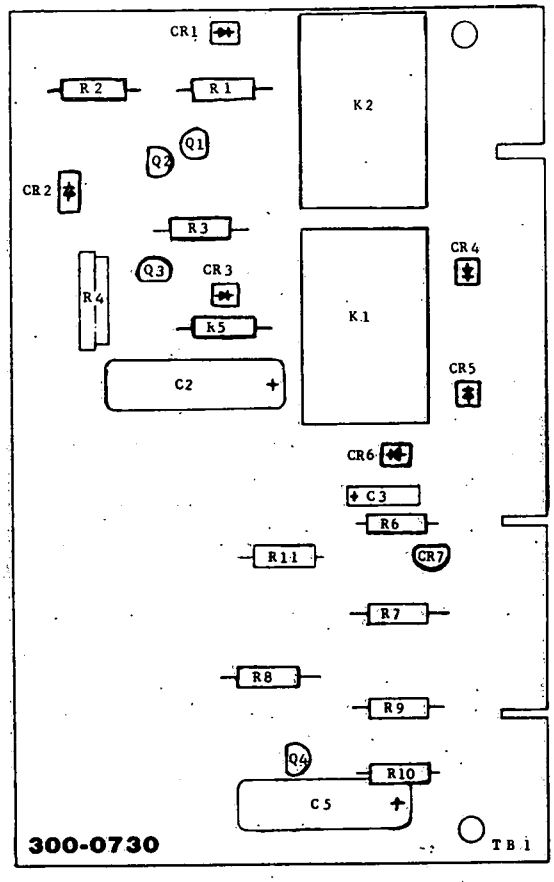
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
R1	350-0536	1	Resistor, Composition (1000-Ohm, 1/2 Watt, 10%)
R2	350-0526	1	Resistor, Composition (100-Ohm, 1/2 Watt, 10%)
R3	350-0548	1	Resistor, Composition (10,000-Ohm, 1/2 Watt, 10%)
R4	303-0169	1	Potentiometer (3.5 Meg Ohm, 1/4 Watt, 30%)
R5	350-0572	1	Resistor, Composition (1-Meg Ohm, 1/2 Watt, 10%)
R6	350-0552	1	Resistor, Composition (22,000-Ohm, 1/2 Watt, 10%)
R7	350-0536	1	Resistor, Composition (1000-Ohm, 1/2 Watt, 10%)
R8	350-0505	1	Resistor, Composition (2.7-Ohm, 1/2 Watt, 10%)
R9	350-0517	1	Resistor, Composition (27-Ohm, 1/2 Watt, 10%)
R10	303-0169	1	Potentiometer (3.5-Meg Ohm, 1/4 Watt, 30%)
R11	350-0584	1	Resistor, Composition (10-Meg Ohm, 1/2 Watt, 10%)
R12	350-0529	1	Resistor, Composition (270-Ohm, 1/2 Watt, 10%)
R13	350-0529	1	Resistor, Composition (270-Ohm, 1/2 Watt, 10%)
R14	350-0529	1	Resistor, Composition (270-Ohm, 1/2 Watt, 10%)
R15	350-0540	1	Resistor, Composition (2200-Ohm, 1/2 Watt, 10%)
R16	350-0540	1	Resistor, Composition (2200-Ohm, 1/2 Watt, 10%)
R17	350-1128	1	Resistor, Composition (220-Ohm, 2 Watt, 10%)
TB1	332-1246	1	Printed Wiring Board

ENGINE CONTROL MONITOR GROUP - 12 VOLT
OPTIONAL (5 Fault Lights)



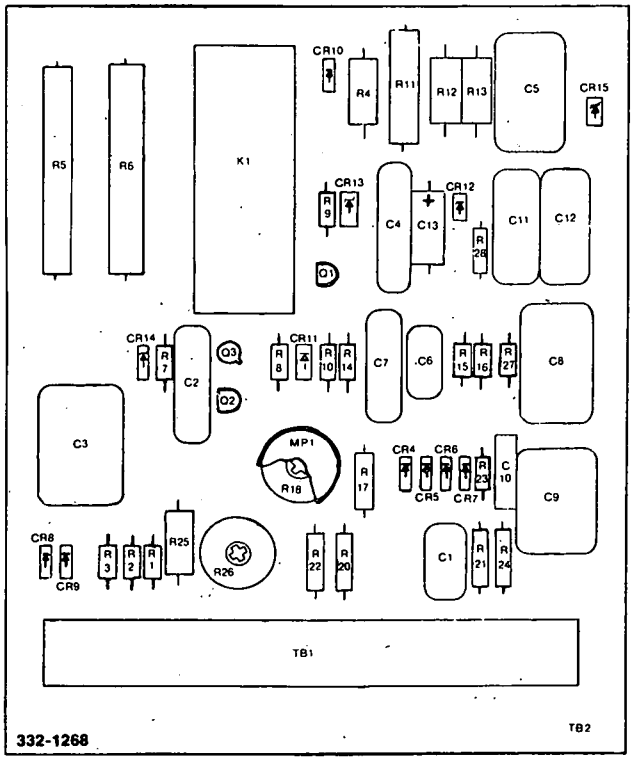
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	300-0681		Monitor, Engine Control - 12 Volt - Optional
C1	356-0040	1	Capacitor, Electrolytic (10 Mfd, 20 Volt)
C2	355-0005	1	Capacitor, Plastic Dielectric (.22 Mfd, 200 VDC, 10%)
C3	355-0005	1	Capacitor, Plastic Dielectric (.22 Mfd, 200 VDC, 10%)
C4	356-0030	1	Capacitor, Electrolytic (1 Mfd, 35 Volt)
C5	355-0005	1	Capacitor, Plastic Dielectric (.22 Mfd, 200 VDC, 10%)
C6	355-0005	1	Capacitor, Plastic Dielectric (.22 Mfd, 200 VDC, 10%)
C7	355-0005	1	Capacitor, Plastic Dielectric (.22 Mfd, 200 VDC, 10%)
C8	355-0005	1	Capacitor, Plastic Dielectric (.22 Mfd, 200 VDC, 10%)
CR1	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
CR2	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
CR3	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
CR4	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
CR5	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
CR6	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
CR7	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
CR8	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
CR9	359-0027	1	Diode, Zener (1 Watt, 7.5 Volt, 5%)
CR10	364-0017	1	Diode, Rectifier (8 Amp, 30 Volt)
CR11	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
CR12	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
CR13	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
CR14	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
CR15	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
CR16	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
CR17	364-0017	1	Diode, Rectifier (8 Amp, 30 Volt)
CR18	364-0017	1	Diode, Rectifier (8 Amp, 30 Volt)
CR19	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
CR20	364-0017	1	Diode, Rectifier (8 Amp, 30 Volt)
CR21	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
K1	307-1039	1	Relay, Armature (12 Volt)
K2	307-1039	1	Relay, Armature (12 Volt)
Q1	362-0025	1	Transistor
Q2	362-0025	1	Transistor
Q3	361-0003	1	Transistor
Q4	362-0008	1	Transistor
Q5	362-0008	1	Transistor
Q6	362-0008	1	Transistor
Q7	362-0031	1	Transistor
Q8	362-0031	1	Transistor
Q9	361-0003	1	Transistor
Q10	362-0008	1	Transistor
Q11	362-0008	1	Transistor
Q12	362-0008	1	Transistor
Q13	362-0008	1	Transistor
Q14	362-0008	1	Transistor
R1	350-0526	1	Resistor, Composition (100-Ohm, 1/2 Watt, 10%)
R2	303-0169	1	Potentiometer (3.5 Megohm, 1/4 Watt, 30%)
R3	350-0572	1	Resistor, Composition (1 Megohm, 1/2 Watt, 10%)
R4	350-0517	1	Resistor, Composition (27-Ohm, 1/2 Watt, 10%)
R5	350-0536	1	Resistor, Composition (1000-Ohm, 1/2 Watt, 10%)
R6	350-0548	1	Resistor, Composition (10,000-Ohm, 1/2 Watt, 10%)
R7	350-0505	1	Resistor, Composition (2.7-Ohm, 1/2 Watt, 10%)
R8	350-0529	1	Resistor, Composition (270-Ohm, 1/2 Watt, 10%)
R9	350-0540	1	Resistor, Composition (2200-Ohm, 1/2 Watt, 10%)
R10	350-0380	1	Resistor, Composition (510-Ohm, 1/2 Watt, 5%)
R11	350-0529	1	Resistor, Composition (270-Ohm, 1/2 Watt, 10%)
R12	350-0552	1	Resistor, Composition (22,000-Ohm, 1/2 Watt, 10%)
R13	350-0505	1	Resistor, Composition (2.7-Ohm, 1/2 Watt, 10%)
R14	350-0536	1	Resistor, Composition (1000-Ohm, 1/2 Watt, 10%)
R15	303-0169	1	Potentiometer (3.5 Megohm, 1/4 Watt, 30%)
R16	350-0517	1	Resistor, Composition (27-Ohm, 1/2 Watt, 10%)
R17	350-0540	1	Resistor, Composition (2200-Ohm, 1/2 Watt, 10%)
R18	350-0540	1	Resistor, Composition (2200-Ohm, 1/2 Watt, 10%)
R19	350-0517	1	Resistor, Composition (27-Ohm, 1/2 Watt, 10%)
R20	350-0529	1	Resistor, Composition (270-Ohm, 1/2 Watt, 10%)
R21	350-0529	1	Resistor, Composition (270-Ohm, 1/2 Watt, 10%)
R22	350-0505	1	Resistor, Composition (2.7-Ohm, 1/2 Watt, 10%)
R23	350-0529	1	Resistor, Composition (270-Ohm, 1/2 Watt, 10%)
R24	350-0529	1	Resistor, Composition (270-Ohm, 1/2 Watt, 10%)
R25	350-0540	1	Resistor, Composition (2200-Ohm, 1/2 Watt, 10%)
R21	350-0380	1	Resistor, Composition (510-Ohm, 1/2 Watt, 5%)
R27	350-0529	1	Resistor, Composition (270-Ohm, 1/2 Watt, 10%)
R28	350-0529	1	Resistor, Composition (270-Ohm, 1/2 Watt, 10%)
R29	350-0540	1	Resistor, Composition (2200-Ohm, 1/2 Watt, 10%)
R30	350-0505	1	Resistor, Composition (2.7-Ohm, 1/2 Watt, 10%)
R31	350-0529	1	Resistor, Composition (270-Ohm, 1/2 Watt, 10%)
R32	350-0540	1	Resistor, Composition (2200-Ohm, 1/2 Watt, 10%)
R33	350-0529	1	Resistor, Composition (270-Ohm, 1/2 Watt, 10%)
R34	350-0517	1	Resistor, Composition (27-Ohm, 1/2 Watt, 10%)
R35	350-1128	1	Resistor, Composition (220-Ohm, 2 Watt, 10%)
R36	350-0584	1	Resistor, Composition (10 Megohm, 1/2 Watt, 10%)
S1	308-0280	1	Switch, Push - DPDT (1A, 28 VDC/.45A, 115 VAC)
TB1	332-1231	1	Printed Wiring Board

ENGINE CONTROL MONITOR GROUP - 12 VOLT
PENN STATE (1 Fault Light)

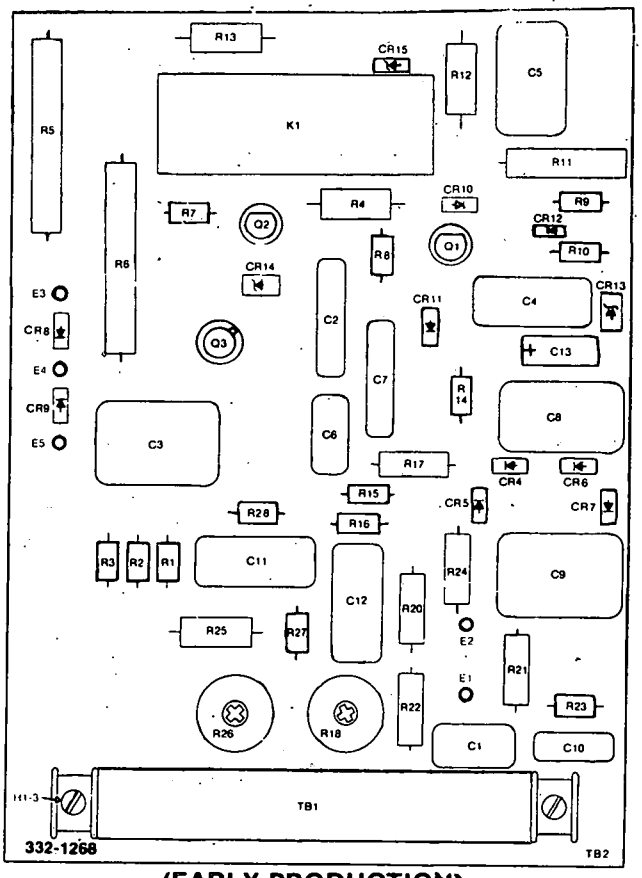


REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	300-0730		Monitor, Engine Control - 12 Volt (Penn State)
C1			Not used
C2	355-0005	1	Capacitor, Plastic Dielectric (.22 Mfd, 200 VDC, 10%)
C3	356-0040	1	Capacitor, Electrolytic (10 Mfd, 20 Volt)
C4			Not used
C5	355-0005	1	Capacitor, Plastic Dielectric (.22 Mfd, 200 VDC, 10%)
CR1	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
CR2	359-0027	1	Diode, Zener (1 Watt, 7.5 Volt, 5%)
CR3	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
CR4	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
CR5	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
CR6	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
CR7	364-0017	1	Diode, Rectifier (8 Amp, 30 Volt)
K1	307-1039	1	Relay, Armature (12 Volt)
K2	307-1039	1	Relay, Armature (12 Volt)
Q1	361-0003	1	Transistor
Q2	362-0025	1	Transistor
Q3	362-0025	1	Transistor
Q4	362-0008	1	Transistor
R1	350-0536	1	Resistor, Composition (1000-Ohm, 1/2 Watt, 10%)
R2	350-0526	1	Resistor, Composition (100-Ohm, 1/2 Watt, 10%)
R3	350-0552	1	Resistor, Composition (22,000-Ohm, 1/2 Watt, 10%)
R4	303-0169	1	Potentiometer (3.5 Megohm, 1/4 Watt, 30%)
R5	350-0572	1	Resistor, Composition (1 Megohm, 1/2 Watt, 10%)
R6	350-0505	1	Resistor, Composition (2.7-Ohm, 1/2 Watt, 10%)
R7	350-0517	1	Resistor, Composition (27-Ohm, 1/2 Watt, 10%)
R8	350-0529	1	Resistor, Composition (270-Ohm, 1/2 Watt, 10%)
R9	350-0529	1	Resistor, Composition (270-Ohm, 1/2 Watt, 10%)
R10	350-0540	1	Resistor, Composition (2200-Ohm, 1/2 Watt, 10%)
R11	350-0971	1	Resistor, Composition (220-Ohm, 2 Watt, 5%)
TB1	332-1246	1	Printed Wiring Board

VOLTAGE REGULATOR



(LATEST PRODUCTION)



(EARLY PRODUCTION)

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
C1	355-0018	1	Capacitor, Plastic Die (.47 MFD, 100 VDC, 2%)
C2	355-0005	1	Capacitor, Plastic Die (.22 MFD, 200 VDC,10%)
C3	355-0017	1	Capacitor, Plastic Die (.47 MFD, 400 VDC,10%)
C4	355-0006	1	Capacitor, Plastic Die (.47 MFD, 200 VDC,10%)
C5	355-0016	1	Capacitor, Plastic Die(1 MFD, 100 VDC, 10%)
C6	355-0015	1	Capacitor, Plastic Die(.1 MFD, 200 VDC, 10%)
C7	355-0005	1	Capacitor, Plastic Die (.22 MFD, 200 VDC,10%)
C8	355-0016	1	Capacitor, Plastic Die(1 MFD, 100 VDC, 10%)
C9	355-0017	1	Capacitor, Plastic Die(.47 MFD,400 VDC,10 %)
C10	355-0014	1	Capacitor, Plastic Die(.047 MFD,200 VDC 10%)
C11	355-0020	1	Capacitor, Plastic Die(.1 MFD,400VDC 10%)
C12	355-0006	1	Capacitor, Plastic Die (.47 MFD,200 VDC,10%)
C13	356-0039	1	Capacitor, Electrolytic (100 MFD, 10 Volts)
CR4	357-0014	1	Diode, Rectifier
CR5	357-0014	1	Diode, Rectifier
CR6	357-0014	1	Diode, Rectifier
CR7	357-0014	1	Diode, Rectifier
CR8	357-0014	1	Diode, Rectifier
CR9	357-0014	1	Diode, Rectifier
CR10	357-0014	1	Diode, Rectifier
CR11	357-0014	1	Diode, Rectifier
CR12	359-0016	1	Diode, Zener
CR13	359-0025	1	Diode, Zener
CR14	359-0026	1	Diode, Zener
CR15	359-0015	1	Diode, Zener
E1-5	332-0833	5	*Terminal, Stud
H1	812-0081	2	*Screw, Round Head (#8-32 x 5/8")
H2	853-0005	2	*Washer, Lock - External Tooth (#8)
H3	860-0008	2	*Nut, Hex (#8-32)
K1	307-1063	1	Relay, Armature
MP1	517-0127	1	Cover, Potentiometer
Q1	362-0017	1	Transistor
Q2	362-0017	1	Transistor
Q3	361-0004	1	Transistor

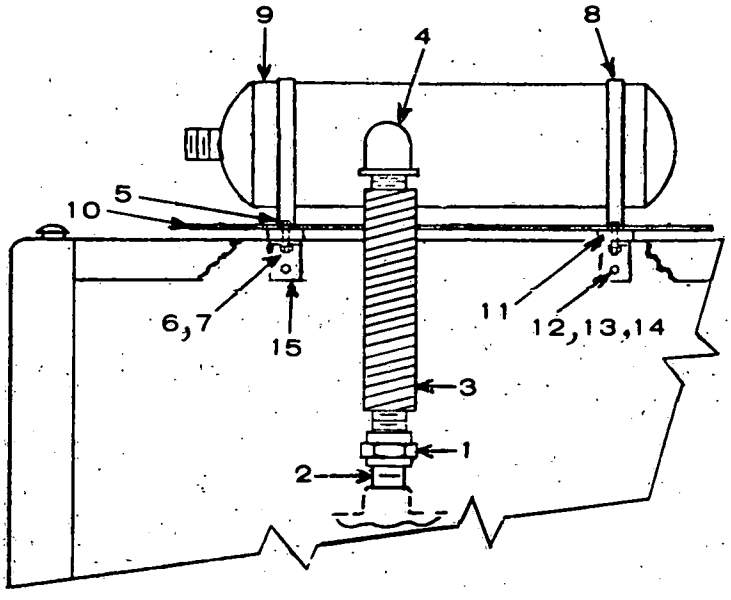
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
R1	350-0355	1	Resistor, Composition (47-Ohm, 1/2 Watt, 5%)
R2	350-0351	1	Resistor, Composition (33-Ohm, 1/2 Watt, 5%)
R3	350-0351	1	Resistor, Composition (33-Ohm, 1/2 Watt, 5%)
R4	350-1075	1	Resistor, Composition (4.7 Megohm, 2 Watt, 5%)
R5	353-0040	1	Resistor, Wire Wound (270-Ohm, 10 Watt, 5%)
R6	353-0039	1	Resistor, Wire Wound (5000-Ohm, 15 Watt, 5%)
R7	350-0398	1	Resistor, Composition (3000-Ohm, 1/2 Watt, 5%)
R8	350-0447	1	Resistor, Composition (330,000-Ohm, 1/2 Watt, 5%)
R9	350-0423	1	Resistor, Composition (33,000-Ohm, 1/2 Watt, 5%)
R10	350-0423	1	Resistor, Composition (33,000-Ohm, 1/2 Watt, 5%)
R11	352-0151	1	Resistor, Wire Wound (15,000-Ohm, 5 Watt, 5%)
R12	350-1014	1	Resistor, Composition (13,000-Ohm, 2 Watt, 5%)
R13	350-1007	1	Resistor, Composition (6800-Ohm, 2 Watt, 5%)
R14	350-0443	1	Resistor, Composition (220,000-Ohm, 1/2 Watt, 5%)
R15	350-0435	1	Resistor, Composition (100,000-Ohm, 1/2 Watt, 5%)
R16	350-0447	1	Resistor, Composition (330,000-Ohm, 1/2 Watt, 5%)
R17	351-0521	1	Resistor, Film (12,100-Ohm, 1/4 Watt, 1%)
R18	303-0168	1	Potentiometer (5000-Ohm, 3 Watt, 5%)
R19			Not used
R20	351-0520	1	Resistor, Film (28,000-Ohm, 1/4 Watt, 1%)
R21	351-0522	1	Resistor, Film (5110-Ohm, 1/4 Watt, 1%)
R22	351-0520	1	Resistor, Film (28,000-Ohm, 1/4 Watt, 1%)
R23	350-0355	1	Resistor, Composition (47-Ohm, 1/2 Watt, 5%)
R24	351-0523	1	Resistor, Film (8870-Ohm, 1/4 Watt, 1%)
R25	350-1011	1	Resistor, Composition (10,000-Ohm, 2 Watt, 5%)
R26	303-0164	1	Potentiometer (8000-Ohm, 3 Watt, 20%)
R27	350-0447	1	Resistor, Composition (100,000-Ohm, 1/2 Watt, 5%)
R28	350-0459	1	Resistor, Composition (1 Megohm, 1/2 Watt, 5%)
TB1	332-1252	1	Terminal Board
TB2	332-1258	1	Printed Wiring Board

* - Used only on Early Production Units.

179-1520

EXHAUST MUFFLER - OPTIONAL

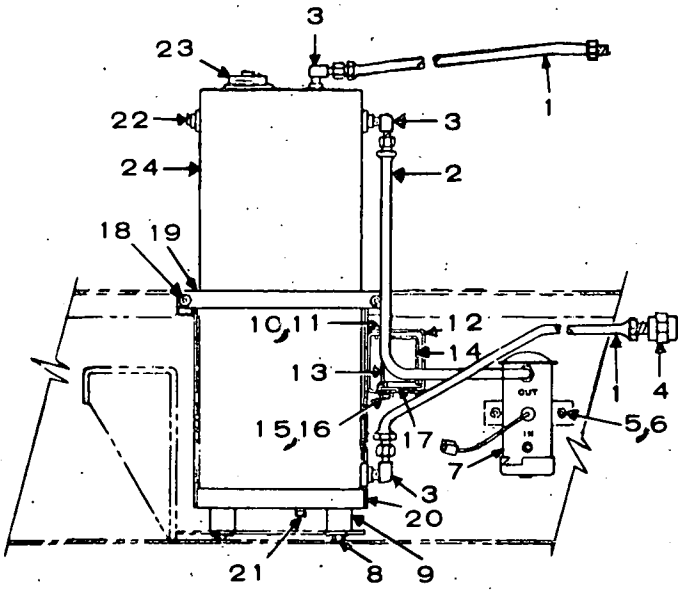
INSTALLATION (Housed Sets)



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	179-1520		Installation of Exhaust Muffler
1	505-0454	1	Union, Pipe
2	505-0172	1	Nipple, Pipe - Close
3	155-1115	1	Pipe, Exhaust - Flexible
4	505-0175	1	Elbow, Pipe - 90 Degree
5	800-0028	4	Screw, Cap - Hex Head (5/16-18 x 1")
6	850-0045	4	Washer, Lock - Spring (5/16)
7	862-0015	4	Nut, Hex (5/16-18)
8	140-0649	2	Strap, Retaining
9	155-0988	1	Muffler, Exhaust
10	155-0978	1	Heat, Shield
11	526-0172	4	Washer, Flat (1/2" ID x 2-1/4" OD x 1/4" THK)
12	800-0026	6	Screw, Cap - Hex Head (5/16-18 x 3/4")
13	850-0045	6	Washer, Lock - Spring (5/16-18)
14	862-0015	6	Nut, Hex (5/16-18)
15	155-0789	2	Bracket, Angle - Support

179-0441

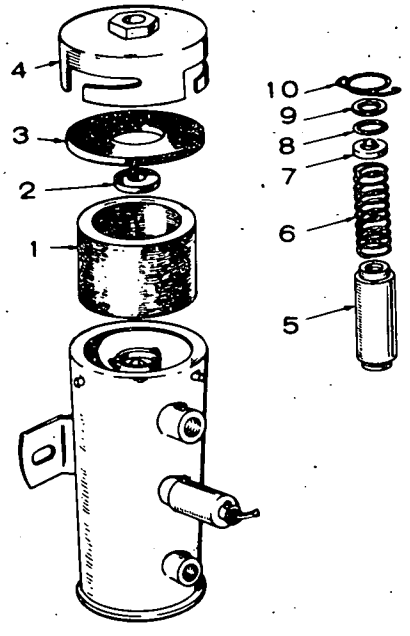
DAY FUEL TANK - OPTIONAL INSTALLATION



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	179-0441		Installation of Day Fuel Tank
1	501-0008	2	Line, Fuel - Flexible
2	501-0015	1	Line, Fuel - Flexible
3	502-0041	3	Elbow, Pipe - Street, Brass (1/4" x 1/4")
4	502-0051	1	Coupling, Pipe - Brass (1/4" x 1/4")
5	821-0018	2	Screw, Self-locking - Hex Head (1/4-20 x 5/8")
6	870-0212	2	Nut, Hex - Self-locking
7	149-0554	1	Pump, Fuel - Electric (See Separate Group for Components)
8	821-0014	8	Screw, Self-locking - Hex Head (5/16-18 x 1/2")
9	402-0070	4	Mount, Vibration
10	813-0098	1	Screw, Machine - Round Head (#10-32 x 3/8")
11	850-0030	1	Washer, Lock - Spring (#10)
12	415-0326	1	Cover, Relay
13	307-1157	1	Spring, Retaining - Relay
14	307-1058	1	Relay, Armature - 12 VDC
15	812-0001	2	Screw, Machine - Round Head (#6-32 x 3/8")
16	870-1183	2	Nut, Hex - With External Tooth Lockwasher (#6-32)
17	323-0897	1	Socket, Relay (Includes leads)
18	821-0013	2	Screw, Self-locking - Hex Head (1/4-20 x 1")
19	415-0323	1	Strap, Retaining
20	415-0324	1	Bracket, Angle - Tank Support
21	505-0110	1	Plug, Pipe - Square Head (3/8")
22	505-0054	1	Plug, Pipe - Square Head (1/4")
23	415-0321	1	Switch, Float - Liquid Level
24	415-0325	1	Tank, Fuel

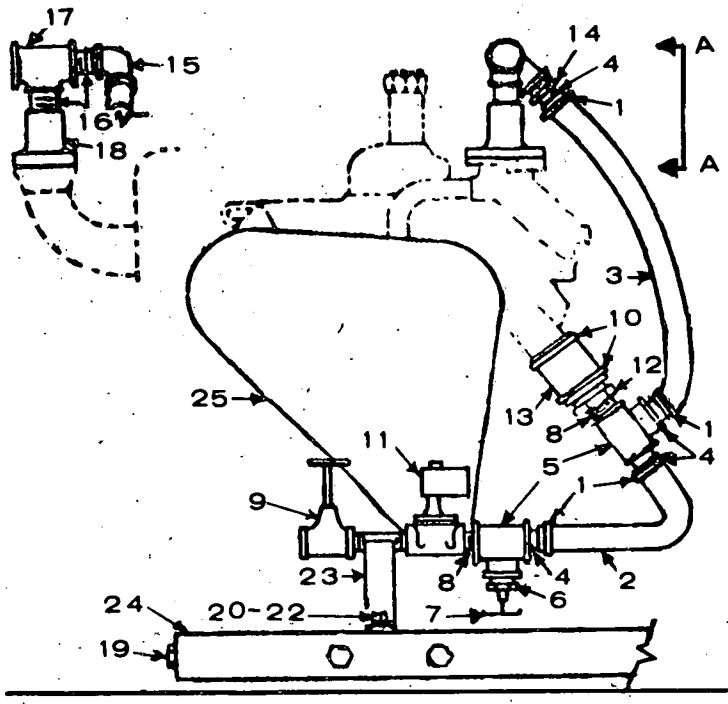
ELECTRIC FUEL PUMP GROUP OPTIONAL

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	149-0554	1	Pump, Fuel
1	149-1445	1	Filter
2	149-1447	1	Magnet,
3	149-1446	1	Gasket, Cover
4	149-1453	1	Cover
5	149-1452	1	Plunger
6	149-0705	1	Spring, Plunger Return
7	149-1451	1	Spring Cup & Valve
8	149-1450	1	Gasket, Spring Cup
9	149-1449	1	Washer, Cup Gasket
10	149-1448	1	Retainer, Cup & Plunger



179-1023

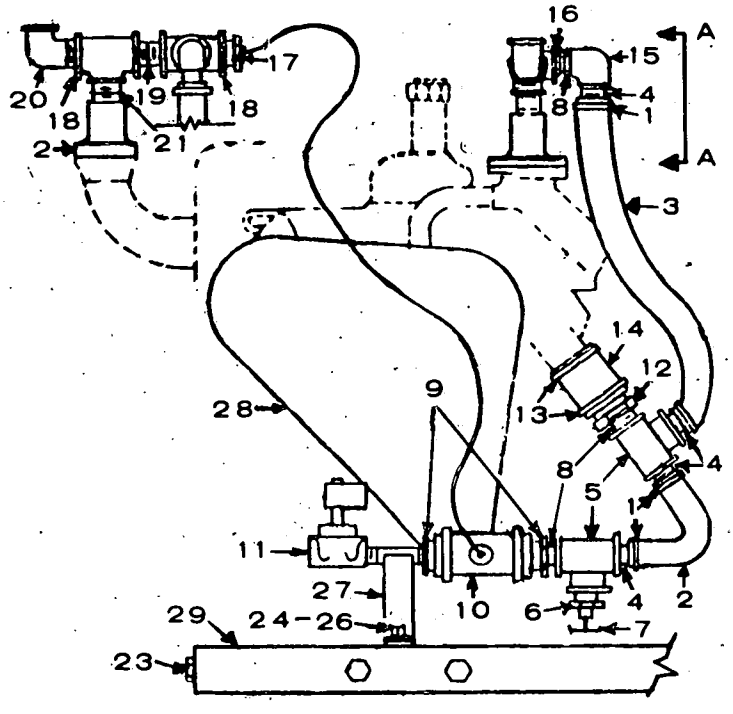
CITY WATER COOLING - OPTIONAL INSTALLATION



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	179-1023		Installation of City Water Cooling
1	503-0189	4	Clamp, Hose
2	503-0191	14"	Hose, Rubber
3	503-0191	20"	Hose, Rubber
4	505-0185	4	Nipple, Pipe - Half (1/2" x 1-1/2")
5	505-0108	2	Tee, Pipe (1/2")
6	505-0018	1	Reducer, Pipe (1/2" x 1/4")
7	504-0063	1	Cock, Drain
8	505-0100	2	Nipple, Pipe - Close (1/2" x 1-1/8")
9	504-0019	1	Valve, Globe
10	503-0365	2	Clamp, Hose
11	307-0833	1	Valve, Solenoid (12 VDC)
12	110-0576	1	Adapter, Pipe to Hose
13	503-0356	3"	Hose, Rubber
14	505-0022	1	Reducer, Pipe (1/2" x 1")
15	505-0041	1	Elbow, Pipe - Street, 90° (1")
16	505-0004	2	Nipple, Pipe - Close (1" x 1-1/2")
17	505-0304	1	Tee, Pipe (1")
18	130-0954	1	Adapter, Water Outlet
19	821-0014	6	Screw, Self-locking - Hex Head (5/16-18 x 1/2")
20	800-0007	2	Screw, Cap - Hex Head (1/4-20 x 1")
21	850-0040	2	Washer, Lock - Spring (1/4)
22	862-0001	2	Nut, Hex (1/4-20)
23	110-0526	1	Bracket & Nipple Assembly
24	130-0499	1	Plate, Mounting
25	130-0957	1	Guard, Belt

179-1024

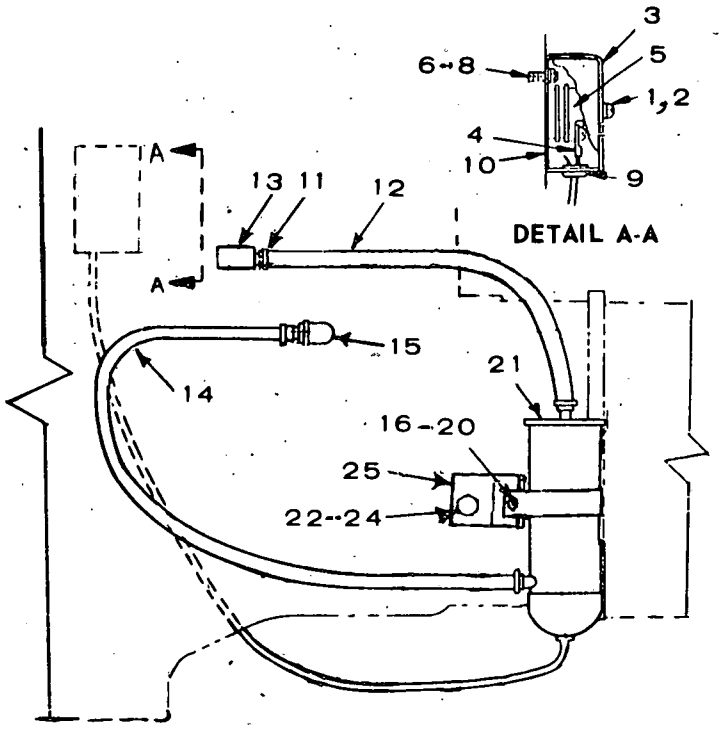
CITY WATER COOLING WITH REGULATOR - OPTIONAL INSTALLATION



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	179-1024		Installation of City Water Cooling with Regulator
1	503-0189	4	Clamp, Hose
2	503-0191	13"	Hose, Rubber
3	503-0191	20"	Hose, Rubber
4	505-0185	4	Nipple, Pipe - Half (1/2" x 1-1/2")
5	505-0108	2	Tee, Pipe (1/2")
6	505-0018	1	Reducer, Pipe (1/2" x 1/4")
7	504-0063	1	Cock, Drain
8	505-0100	3	Nipple, Pipe - Close (1/2" x 1-1/8")
9	505-0021	2	Reducer, Pipe (3/4" x 1/2")
10	309-0241	1	Valve, Temperature Regulating (Includes Sensor)
11	307-0833	1	Valve, Solenoid (12 VDC)
12	110-0576	1	Adapter, Pipe to Hose
13	503-0365	2	Clamp, Hose
14	503-0356	3"	Hose, Rubber
15	505-0040	1	Elbow, Pipe - 90°
16	505-0022	1	Reducer, Pipe (1/2" x 1")
17	505-0129	1	Reducer, Pipe (1" x 3/4")
18	505-0304	2	Tee, Pipe (1")
19	505-0086	1	Nipple, Pipe - Half (1" x 2-1/2")
20	505-0003	1	Elbow, Pipe - Street, 90° (1")
21	505-0004	1	Nipple, Pipe - Close (1" x 1-1/2")
22	130-0954	1	Adapter, Water Outlet
23	821-0014	6	Screw, Self-locking - Hex Head (5/16-18 x 1/2")
24	800-0007	2	Screw, Cap - Hex Head (1/4-20 x 1")
25	850-0040	2	Washer, Lock - Spring (1/4)
26	862-0001	2	Nut, Hex (1/4-20)
27	110-0526	1	Bracket & Nipple Assembly
28	130-0957	1	Guard, Belt
29	130-0499	1	Plate, Mounting

179-2021

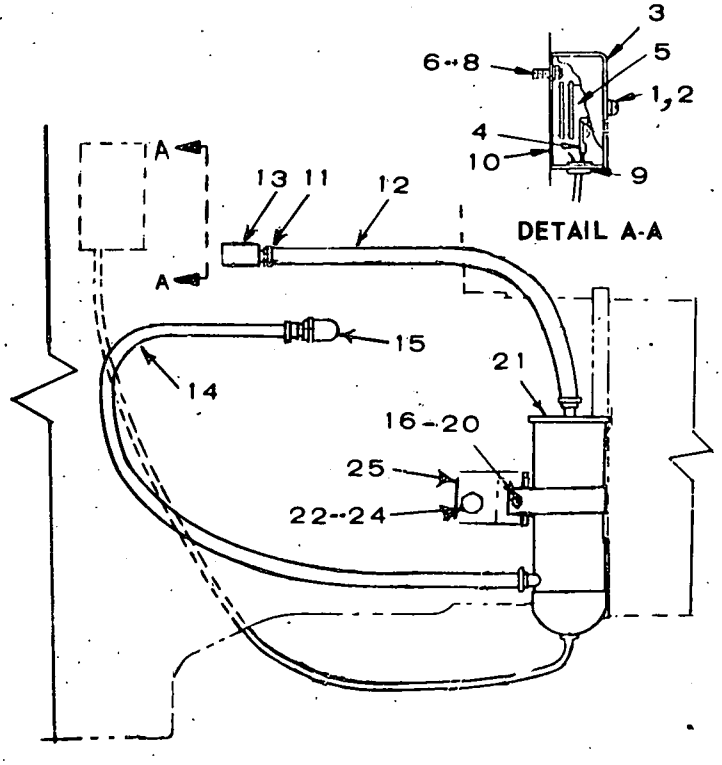
WATER JACKET HEATER - OPTIONAL INSTALLATION - 120 VOLT



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	179-2021		Installation of Water Jacket Heater
1	812-0076	2	Screw, Machine - Round Head (#8-32 x 5/16")
2	850-0025	2	Washer, Lock - Spring (#8)
3	333-0013	1	Cover, Box - Thermostat
4	332-0149	1	Terminal, Lug
5	309-0285	1	Thermostat
6	520-0446	2	Stud (#10-32 x 3/4")
7	850-0050	2	Washer, Lock - Spring (#10)
8	870-0053	2	Nut, Hex (#10-32)
9	509-0008	1	Grommet, Rubber
10	333-0012	1	Box, Thermostat
11	503-0183	4	Clamp, Hose
12	503-0386	24"	Hose, Rubber (5/8" ID)
13	502-0054	1	Elbow, Pipe - Street
14	503-0386	29"	Hose, Rubber (5/8" ID)
15	505-0011	1	Elbow, Pipe - Street
16	800-0031	1	Screw, Cap - Hex Head (5/16-18 x 1-1/2")
17	526-0115	2	Washer, Flat (11/32" ID x 11/16" OD x 1/16" THK)
18	856-0008	2	Washer, Lock - External/ Internal Tooth (5/16)
19	850-0045	1	Washer, Lock - Spring (5/16)
20	862-0015	1	Nut, Hex (5/16-18)
21	333-0052	1	Heater, Water (1500 Watt, 120 VAC)
22	800-0088	1	Screw, Cap - Hex Head (1/2-13 x 3/4")
23	850-0060	1	Washer, Lock - Spring (1/2)
24	856-0013	1	Washer, Lock - External/ Internal Tooth (1/2)
25	130-0755	1	Bracket, Angle

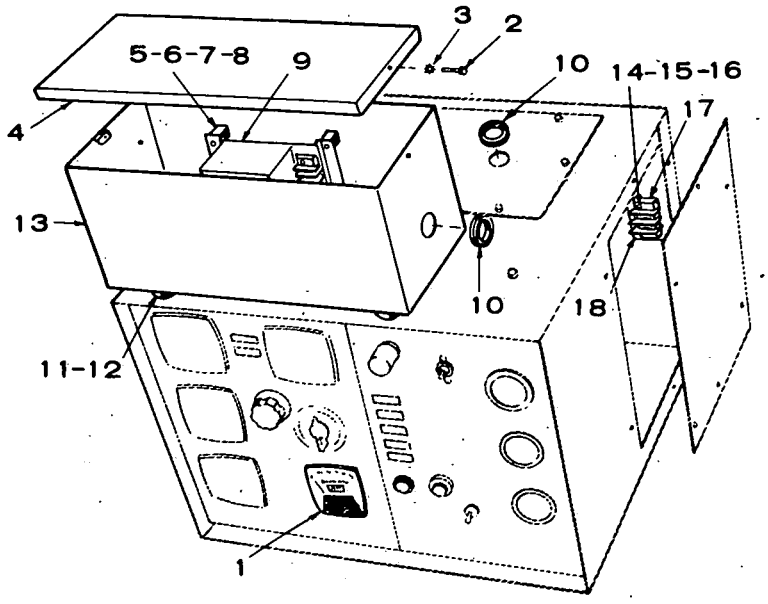
179-2024

WATER JACKET HEATER - OPTIONAL INSTALLATION - 240 VOLT



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	179-2024		Installation of Water Jacket Heater
1	812-0076	2	Screw, Machine - Round Head (#8-32 x 5/16")
2	850-0025	2	Washer, Lock - Spring (#8)
3	333-0013	1	Cover, Box - Thermostat
4	332-0149	1	Terminal, Lug
5	309-0285	1	Thermostat
6	520-0446	2	Stud (#10-32 x 3/4")
7	850-0050	2	Washer, Lock - Spring (#10)
8	870-0053	2	Nut, Hex (#10-32)
9	509-0008	1	Grommet, Rubber
10	333-0012	1	Box, Thermostat
11	503-0183	4	Clamp, Hose
12	503-0386	24"	Hose, Rubber (5/8" ID)
13	502-0054	1	Elbow, Pipe - Street
14	503-0386	29"	Hose, Rubber (5/8" ID)
15	505-0011	1	Elbow, Pipe - Street
16	800-0031	1	Screw, Cap - Hex Head (5/16-18 x 1-1/2")
17	526-0115	2	Washer, Flat (11/32" ID x 11/16" OD x 1/16" THK)
18	856-0008	2	Washer, Lock - External/ Internal Tooth (5/16)
19	850-0045	1	Washer, Lock - Spring (5/16)
20	862-0015	1	Nut, Hex (5/16-18)
21	333-0073	1	Heater, Water (2000 Watt, 240 VAC)
22	800-0088	1	Screw, Cap - Hex Head (1/2-13 x 3/4")
23	850-0060	1	Washer, Lock - Spring (1/2)
24	856-0013	1	Washer, Lock - External/ Internal Tooth (1/2)
25	130-0755	1	Bracket, Angle

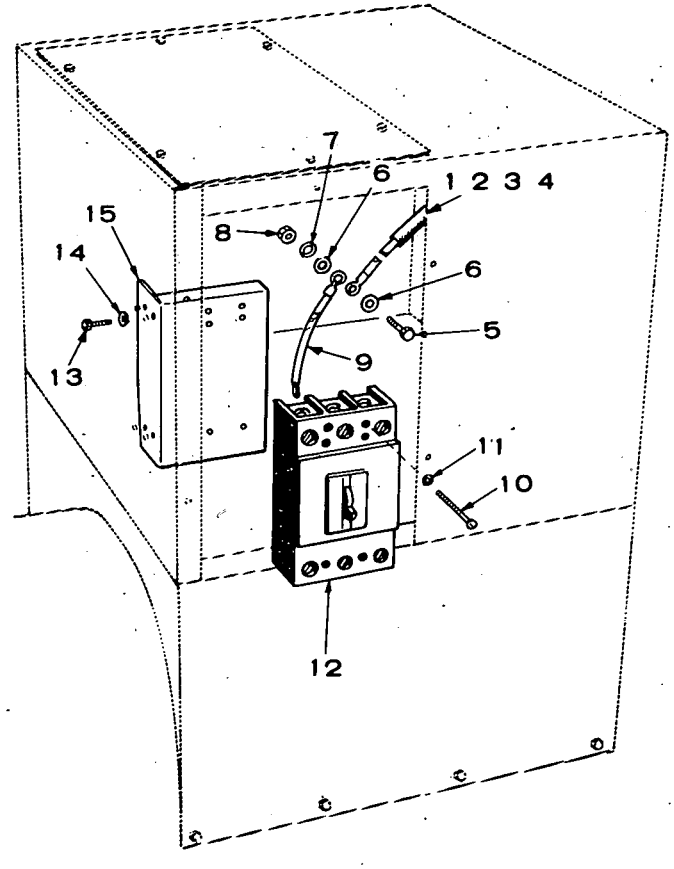
WATTMETER GROUP - OPTIONAL

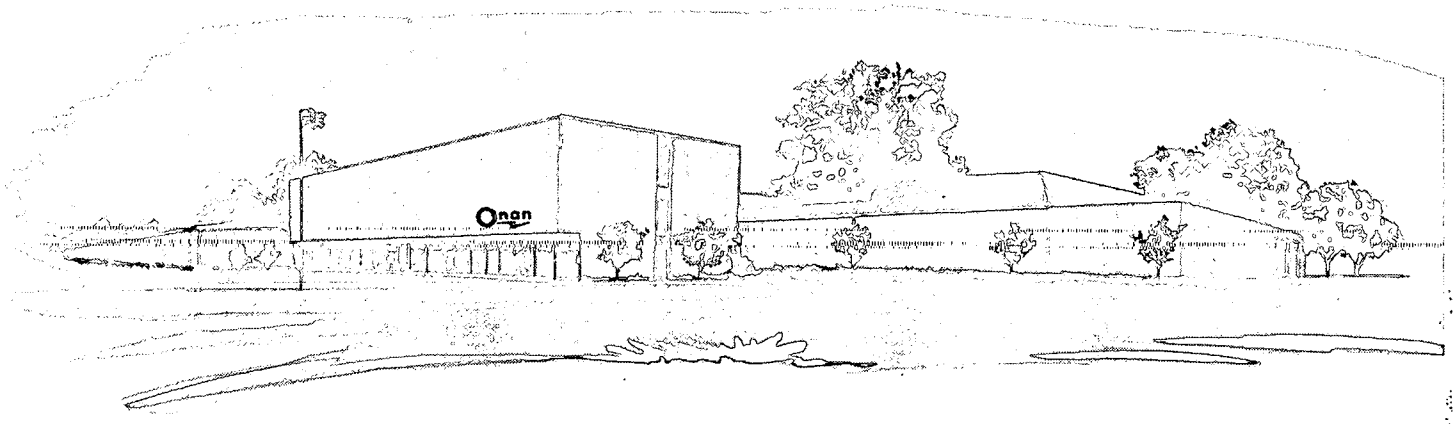


REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	302-0766	1	Wattmeter (0-35KW)
2	815-0026	2	Screw, Machine - Truss Head (#10-32 x 3/8")
3	853-0008	2	Washer, Lock - External Tooth (#10)
4	301-3476	1	Cover, Box - Transducer
5	860-0008	8	Nut, Hex (#8-32)
6	853-0005	8	Washer, Lock - External Tooth (#8)
7	526-0003	8	Washer, Flat (11/64" ID x 3/8" OD x 1/32" THK)
8	402-0354	4	Mount, Vibration
9	302-0902	1	Transducer, Watt
10	508-0001	2	Grommet, Rubber (1-1/6" OD)
11	821-0014	4	Screw, Self-locking - Hex Head (5/16-18 x 1/2")
12	402-0070	4	Mount, Vibration
13	301-3477	1	Box, Transducer
14	812-0063	4	Screw, Machine - Round Head (#6-32 x 1/2")
15	853-0003	4	Washer, Lock - External Tooth (#6)
16	860-0006	4	Nut, Hex (#6-32)
17	332-0609	1	Board, Terminal (2 Place)
18	332-0610	1	Strip, Marker

CIRCUIT BREAKER GROUP - OPTIONAL

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	898-0863	4"	Sleeving, Insulation
2	898-0865	4"	Sleeving, Insulation
3	898-0867	4"	Sleeving, Insulation
4	898-0869	4"	Sleeving, Insulation
5	800-0028	5	Screw, Cap - Hex Head (5/16-18 x 1")
6	526-0022	10	Washer, Flat (21/64" ID x 9/16" OD x 1/16" THK)
7	850-0045	5	Washer, Lock - Spring (5/16)
8	862-0015	5	Nut, Hex (5/16-18)
9	226-0891	3	Lead, Electrical
10	812-0094	4	Screw, Machine - Round Head (#8-32 x 3-5/8")
11	850-0025	4	Washer, Lock - Spring (#8)
12	320-0412	1	Circuit Breaker (3 Pole, 100 Amp, 240 VAC)
13	800-0003	2	Screw, Cap - Hex Head (1/4-20 x 1/2")
14	850-0040	2	Washer, Lock - Spring (1/4)
15	301-3197	1	Bracket, Angle - Circuit Breaker Mounting
16	301-3192	1	Panel, Circuit Breaker (Illustrated in Housing Group, Item 54)





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Onan®

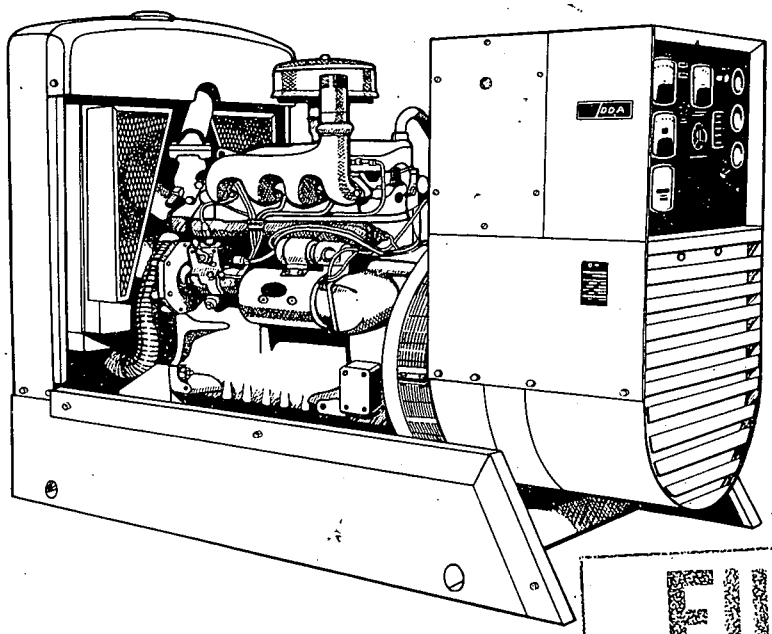
OPERATORS MANUAL AND PARTS CATALOG

FOR

ELECTRIC GENERATING SETS

DDA SERIES

Page 2



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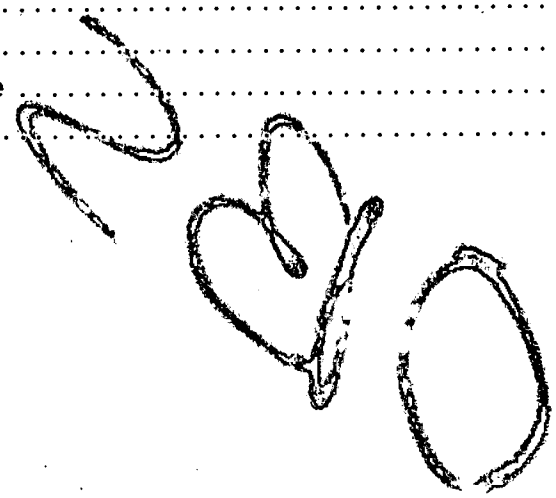


WARNING

MANUFACTURER RECOMMENDS THAT ALL SERVICE INCLUDING INSTALLATION OF REPLACEMENT PARTS BE DONE BY QUALIFIED ELECTRICAL AND/OR MECHANICAL SERVICEMEN. FROM THE STANDPOINT OF POSSIBLE INJURY AND/OR EQUIPMENT DAMAGE IT IS IMPERATIVE THAT THE SERVICEMAN IS QUALIFIED.

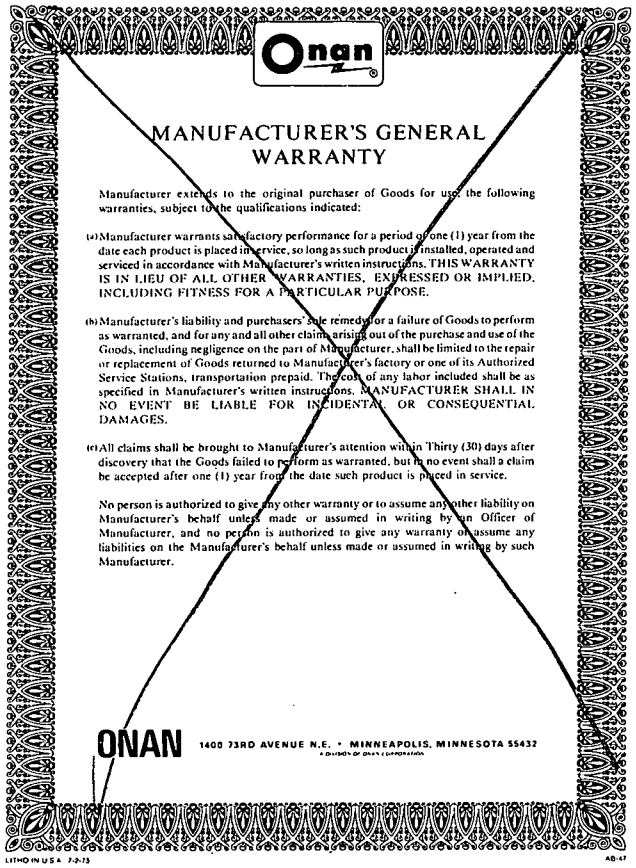
INTRODUCTION

FOREWORD

This manual is applicable to the DDA Series electric generating set, consisting of an Onan UR 30.0KW AC generator, driven by a John Deere 4219D diesel engine. Information is provided on installation, operation, troubleshooting and parts ordering for the set. The manual should be used in conjunction with the John Deere engine manual, as your specific engine may have variations due to optional equipment available.

WARNING **Onan uses this symbol throughout the text to warn of possible injury or death.**

CAUTION **This symbol is used to warn of possible equipment damage.**



Onan

MANUFACTURER'S GENERAL WARRANTY

Manufacturer extends to the original purchaser of Goods for use the following warranties, subject to the qualifications indicated:

(a) Manufacturer warrants satisfactory performance for a period of one (1) year from the date each product is placed in service, so long as such product is installed, operated and serviced in accordance with Manufacturer's written instructions. THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING FITNESS FOR A PARTICULAR PURPOSE.

(b) Manufacturer's liability and purchasers' sole remedy for a failure of Goods to perform as warranted, and for any and all other claims arising out of the purchase and use of the Goods, including negligence on the part of Manufacturer, shall be limited to the repair or replacement of Goods returned to Manufacturer's factory or one of its Authorized Service Stations, transportation prepaid. The cost of any labor included shall be as specified in Manufacturer's written instructions. MANUFACTURER SHALL IN NO EVENT BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

(c) All claims shall be brought to Manufacturer's attention within Thirty (30) days after discovery that the Goods failed to perform as warranted, but in no event shall a claim be accepted after one (1) year from the date such product is placed in service.

No person is authorized to give any other warranty or to assume any other liability on Manufacturer's behalf unless made or assumed in writing by an Officer of Manufacturer, and no person is authorized to give any warranty or assume any liabilities on the Manufacturer's behalf unless made or assumed in writing by such Manufacturer.

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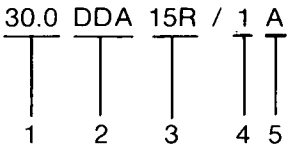
MODEL IDENTIFICATION

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.



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

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

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

IMPORTANT! RETURN WARRANTY CARD ATTACHED TO UNIT.

SPECIFICATIONS

ENGINE DETAILS

Engine Manufacturer	John Deere
Engine Series	300-4219D
Number of Cylinders	4
Displacement	219 cu. inch
BHP @ 1800 RPM	58
Compression Ratio	16.3:1
Bore	4.02-inches
Stroke	4.33-inches
Fuel	ASTM No.2 Diesel
Battery Voltage	12
Battery Group (Two 6-Volt, 135-A.H.)	2H
Starting Method	Solenoid Shift
Governor Regulation	5% No load—Full load

GENERATOR DETAILS

Type	UR 15R 60 Hz UR 515R 50 Hz UR 3R 60 Hz
Rating (Watts)	
60 Hertz Continuous Standby	30,000 (37.5KVA)
50 Hertz Continuous Standby	25,000 (31.25KVA)
AC Voltage Regulation	2%
60 Hertz RPM	1800
50 Hertz RPM	1500
Output Rating	0.8PF
AC Frequency Regulation	3 Hz
Battery Charging Current	35

CAPACITIES AND REQUIREMENTS

Cooling System (Includes Radiator)	4.25 qal.
Engine Oil Capacity (Filter, Lines, Crankcase)	6 qt.
Exhaust Connection (inches pipe thread)	2 qt. inch

AIR REQUIREMENTS (1800 RPM)

Engine Combustion	135 CFM
Radiator Cooled Engine	3875 CFM
Total for Radiator Cooled Model	4010 CFM
Alternator Cooling Air	
(1800 RPM)	1000 CFM
(1500 RPM)	834 CFM
Fuel Consumption at Rated Load	2.50 Gallon/Hr.

GENERAL

Height	45.5-inches
Width	33.0-inches
Length	66.0-inches
Weight (approx.)	1780 lbs.

TABLE 1. UR GENERATOR VOLTAGE OPTIONS

VOLTS	FREQ.	PHASE	AMPERES	DOUBLE DELTA	SERIES DELTA	PARALLEL WYE	SERIES WYE	REF. VOLTAGE WIRE (W12) TAP
120/240	60 Hz	1	156	x				H5
115/230	50 Hz	1	136	x				H6
120/240	60 Hz	3	90		x			H5
115/230	50 Hz	3	78		x			H6
120/208	60 Hz	3	104			x		H3
127/220	60 Hz	3	99			x		H4
139/240	60 Hz	3	90			x		H5
110/190	50 Hz	3	94			x		H3
115/200	50 Hz	3	90			x		H4
240/416	60 Hz	3	52				x	H3
254/440	60 Hz	3	49				x	H4
277/480	60 Hz	3	45				x	H5
220/380	50 Hz	3	48				x	H3
230/400	50 Hz	3	45				x	H4
9 X R 347/600	60 Hz	3	36					H3 — Not Reconnectible

30KW 37.5KVA 60 Hz
25KW 31.25KVA 50 Hz

SAFETY PRECAUTIONS

Throughout this manual you will find eye-catching flags containing Warnings and Cautions, alerting 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

General

- Keep your 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 or carbon tetrachloride 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.
- If it is 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.
- 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 — YOU'RE COURTING A POSSIBLE EXPLOSION AND FIRE!
- Make sure that oily rags are not left on or near the engine.
- 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. Use black pipe on natural gas or gaseous fuels, but not on gasoline or diesel fuel.
- 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 liquified 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 injury, or death 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.

- Make sure that your exhaust system is free of leaks. Ensure that exhaust manifolds are secure and have not warped by bolts unevenly torqued.

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 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 panel while the engine is running. High voltages are present and could cause serious injury or death.

- 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.

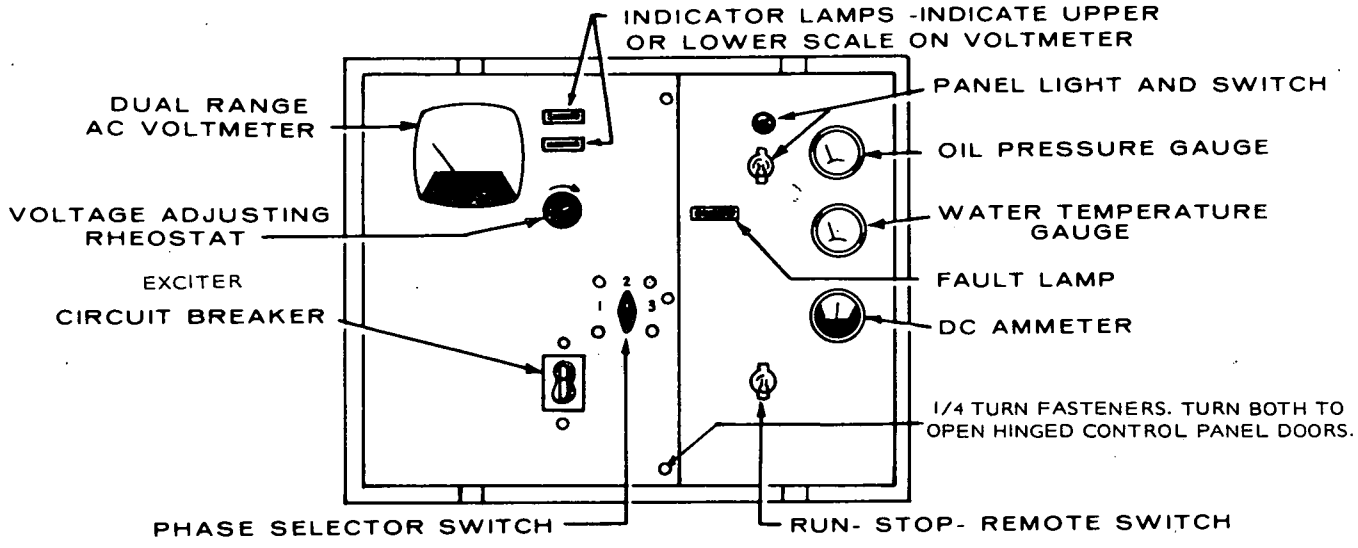


FIGURE 1. TYPICAL CONTROL PANEL (ONE FAULT LAMP)

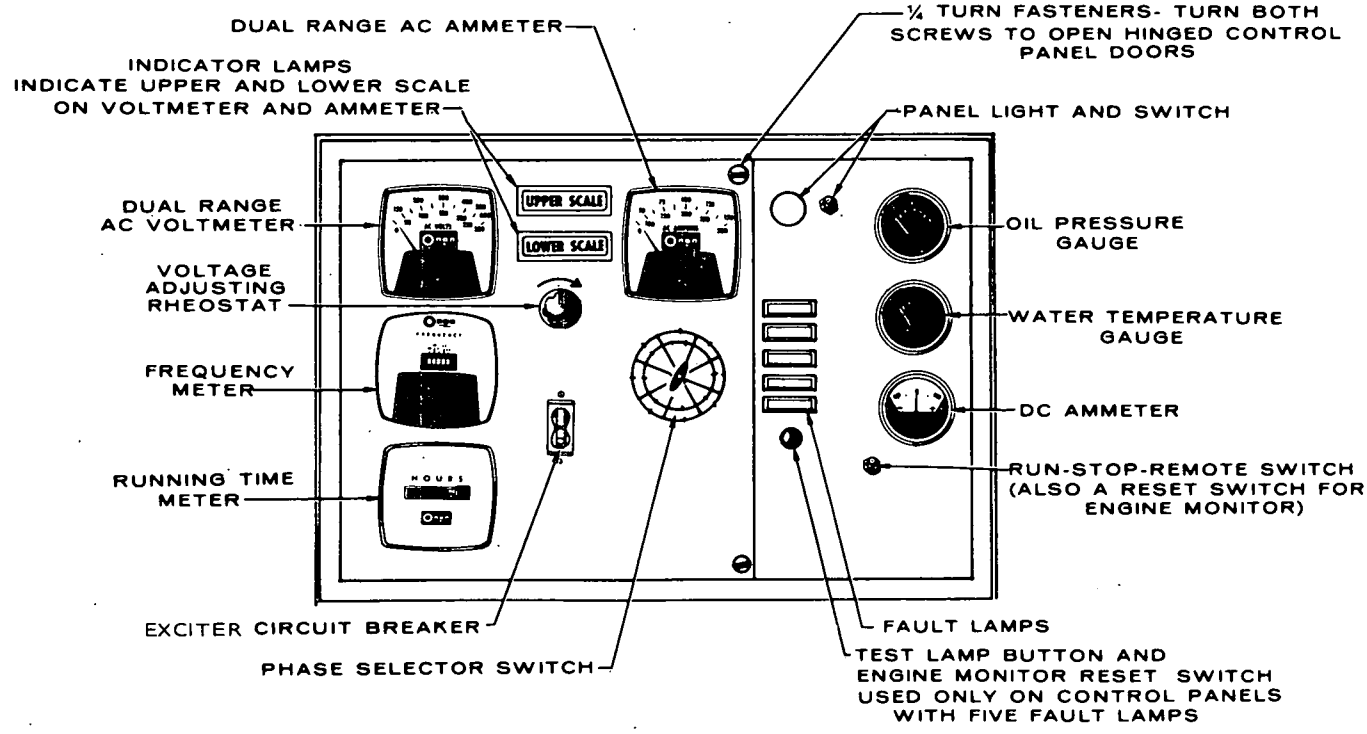


FIGURE 2. OPTIONAL CONTROL PANEL (FIVE FAULT LAMPS)

DESCRIPTION

GENERAL

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

ENGINE

The engine on the DDA is a John. Deere 4219D as described in engine manual. Basic measurements and requirements will be found under Specifications. However, the engine used for your unit may have variations due to optional equipment available, therefore the John Deere manual should be consulted.

AC GENERATOR

The generator is an ONAN Type UR, 12 lead, 4 pole revolving field, reconnectible brushless unit. The alternating current is generated in the stator winding. The alternator rotor, attached directly to the engine flywheel turns at engine speed. Therefore, the speed at which the rotor turns, determines generator output frequency. The 60 hertz set operates at 1800 rpm and the 50 hertz at 1500 rpm. Excitation is achieved by feeding AC output to a voltage regulator, where it is compared with a reference voltage in the regulator, rectified and returned to the field of the exciter, then to the exciter armature, rectified and fed to the generator field. The UR generator is available in 3-phase and single phase. Excitation and regulation are the same for either unit.

CONTROL PANEL

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

DC PANEL

Panel Light and Switch: Illuminates control panel.

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

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

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

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

AC PANEL

AC Voltmeter: Indicates AC generator output voltage. Dual range instrument: measurement range in use shown on indicator light.

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

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

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

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

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

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

OPTIONAL EQUIPMENT

DC PANEL

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

a. Overcrank (failed to start)
b. Overspeed
c. Low oil pressure
d. High engine temperature
e. Low engine temperature

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

Warning Lights: Indicates "Fault" in engine operation.

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

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

CONTROL PANEL INTERIOR

The only equipments discussed in this section will be those which the operator may have reason to adjust or inspect for service.

Terminal Board (TB) 21: Connection of wire W12 to terminals H3, H4, H5, and H6 is made at this point, to change reference voltage when reconnecting generator for different voltages. Refer to Figure 14.

Voltage Regulator: Solid state unit, consisting of VR21, CR21 and L21. Controls AC output from generator at predetermined level regardless of load. Regulation plus or minus 2% from no load to full load, 0.8 P.F.

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

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

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

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.

TABLE 2. FAULT LAMP OPTIONS

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

* - With additional optional sensors.

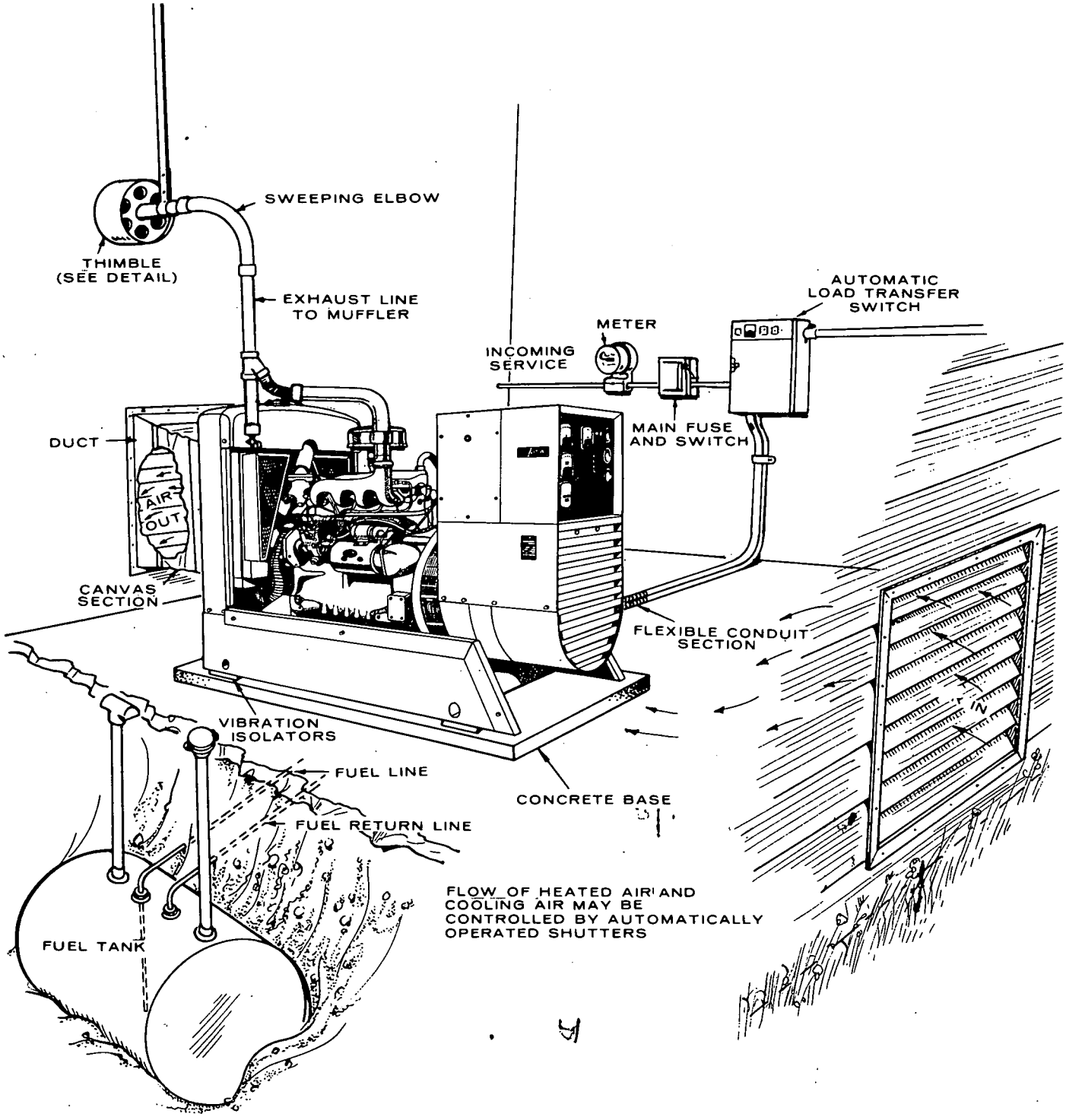


FIGURE 3. TYPICAL INSTALLATION

INSTALLATION

GENERAL

Installations must be considered individually. Use these instructions as a general guide. Meet regulations of local building codes, fire ordinances, etc., which may affect installation details. See Figure 3.

Installation points to consider include:

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

LOCATION

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

MOUNTING

Generating sets are mounted on a rigid skid base which provides proper support. Install vibration isolators between skid base and foundation. For convenience in draining crankcase oil and general servicing, mount set on raised pedestals (at least 6 inches high). If mounting in a trailer, or for other mobile applications, bolt securely in place. Extra support for the vehicle flooring may be necessary. Bolting down is recommended for stationary installations.

VENTILATION

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

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

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

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

A shelter housing with electrically operated louvres 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 louvres. The louvres 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 plant is running) of sufficient size to assure proper air circulation.

CITY WATER COOLING

An optional method of engine cooling, in place of the conventional radiator and fan, uses a constant pressure water supply. This is referred to as CITY WATER COOLING. There are two varieties of city water cooling: the HEAT EXCHANGER SYSTEM and STANDPIPE SYSTEM. See Figures 4 and 5.

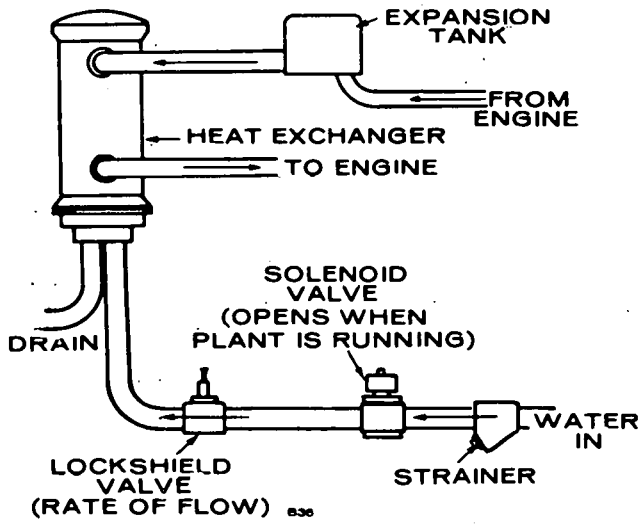


FIGURE 4. TYPICAL HEAT EXCHANGER SYSTEM

The HEAT EXCHANGER provides for a closed engine cooling system. Engine coolant flows through a tubed chamber, keeping the coolant separate from the cool "raw" water supply. The coolant chamber must be filled for operation, as for a radiator cooled set.

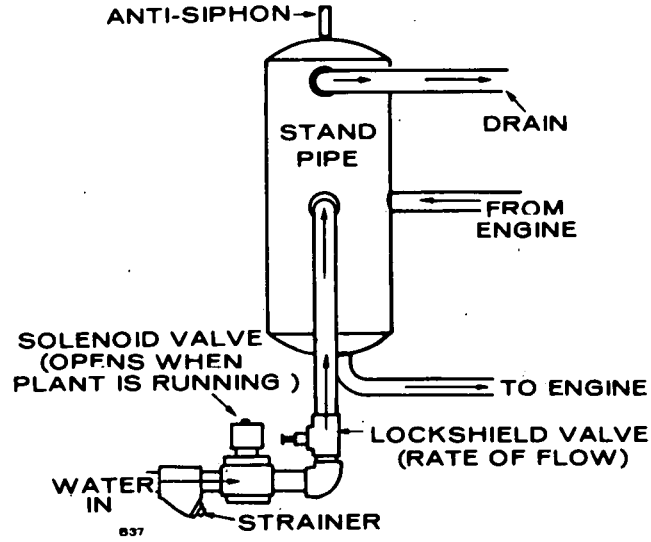


FIGURE 5. TYPICAL STANDPIPE SYSTEM

The STANDPIPE SYSTEM uses a mixing or tempering tank. Cooling water that circulates through the engine mixes with a source of cool "raw" water. The "raw" water supply must be free of scale forming lime or other impurities.

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

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

WATER JACKET HEATER (Optional)

This heater is installed to maintain an elevated engine temperature in lower ambient temperature applications. It heats and circulates engine coolant, and is thermostatically controlled (Figure 19).

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 6) must be used where exhaust pipes pass through walls or partitions. Pitch exhaust pipes downward or install a condensation trap (Figure 7) 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 3 for a typical exhaust installation. Shield or insulate exhaust lines if there is danger of personal contact. Allow at least 9-inches of clearance if the pipes run close to a combustible wall or partition. Use a pipe at least as large as the 3-inch pipe size outlet of the engine with a flexible portion

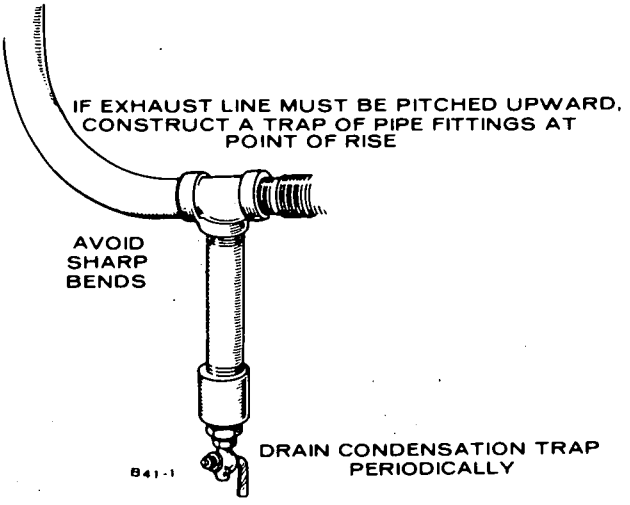


FIGURE 7. EXHAUST CONDENSATION TRAP

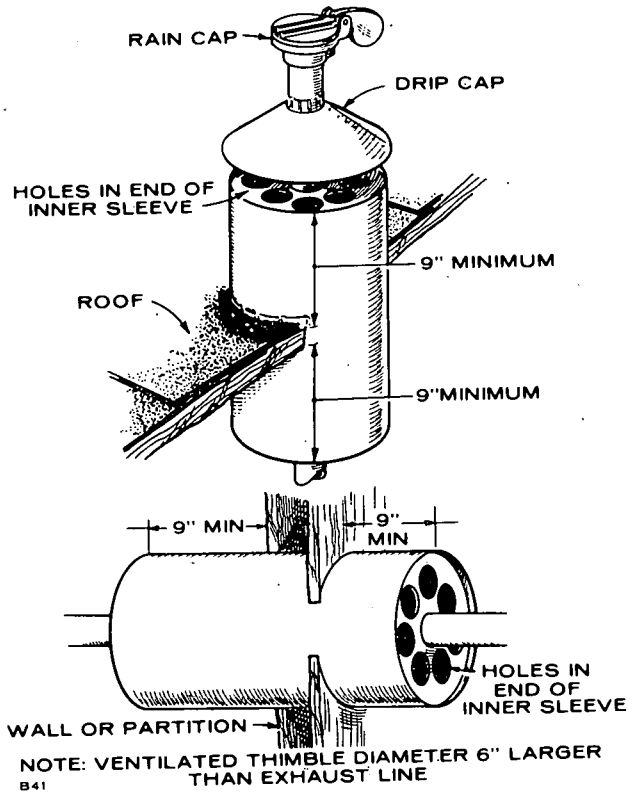


FIGURE 6. EXHAUST THIMBLE

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

Single Exhaust system:

2½-inch pipe	58-feet
3-inch pipe	191-feet
3½-inch pipe	419-feet

Maximum permissible exhaust restriction (back pressure) is 25-inches H_2O (1.84-inches Hg.).

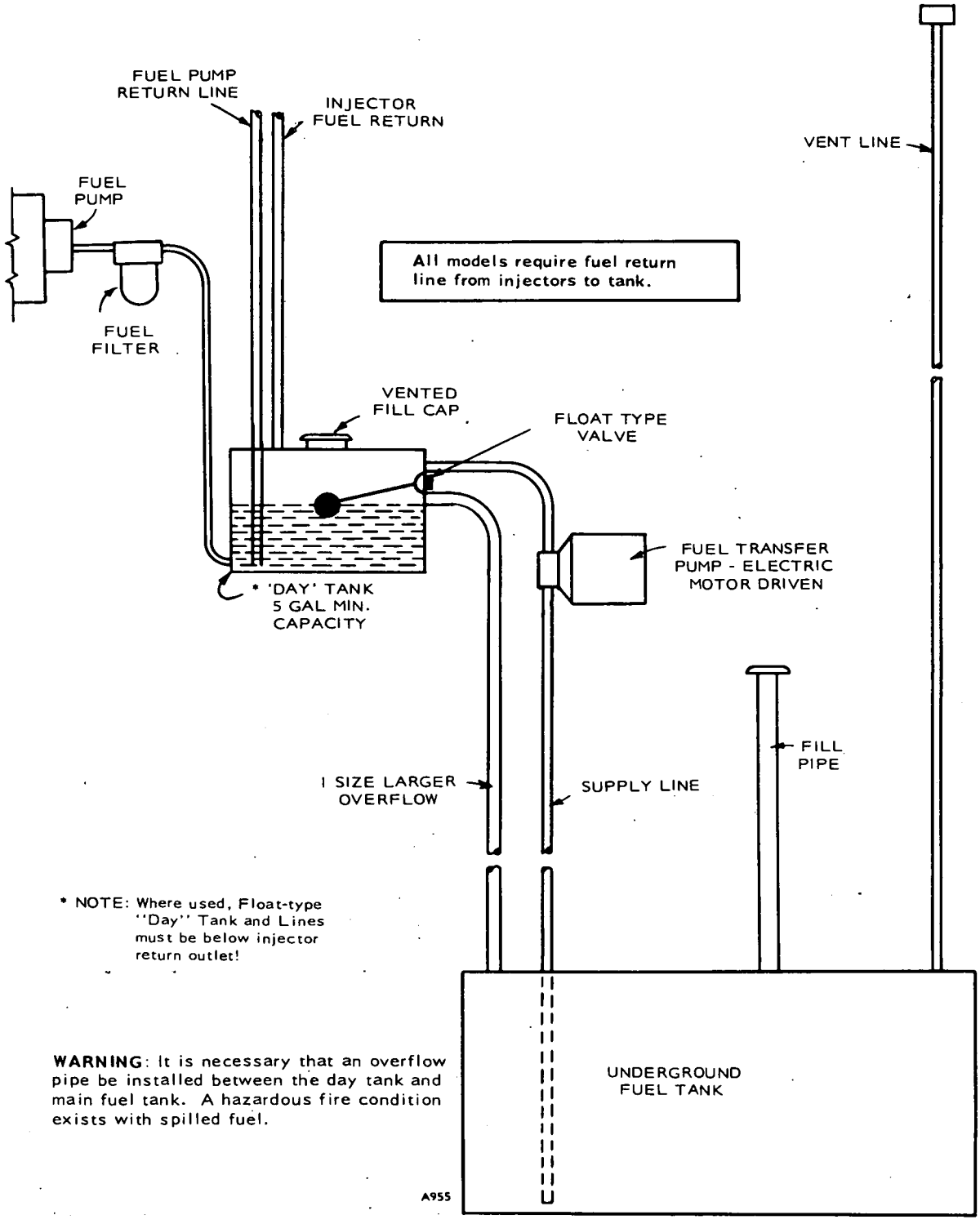


FIGURE 8. DAY TANK INSTALLATION

FUEL SYSTEM

The John Deere engines used on the DDA sets are designed for use with ASTM No.2 Diesel fuel. They will however, operate on diesel fuels within the specifications delineated in the John Deere 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 10-feet is not recommended without a day tank installation, because of fuel drainage. Horizontal run, if the supply tank is level with the fuel pump should not exceed 25-feet. However, a day tank is again recommended.

The fuel inlet is to the transfer pump and is threaded for 1/8-inch pipe. Injector pump return line is common with the injectors' return line, and requires a 1/8-inch low pressure hose connection.

DAY TANK

Generator set installations may be equipped with an optional integral fuel Day tank. A float operated valve controls fuel flow of up to 300 psi 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 the main fuel tank. Refer to the installations included with the tank. See Figure 8 for an example of a Day tank installation.

BATTERY

Starting the plant requires 12-volt battery current. Use two 6-volt (see specification) batteries for a normal installation. Connect the batteries in series (negative post of first battery to positive post of second) as in Figure 9. Necessary battery cables are on unit. Service the batteries as necessary. Infrequent plant use (as in emergency standby service) may allow the batteries to self-discharge to the point where they cannot start the plant. If installing an automatic transfer switch that has no built-in charge circuit, connect a separate trickle charger. Onan automatic transfer switches include such a battery charging circuit.

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

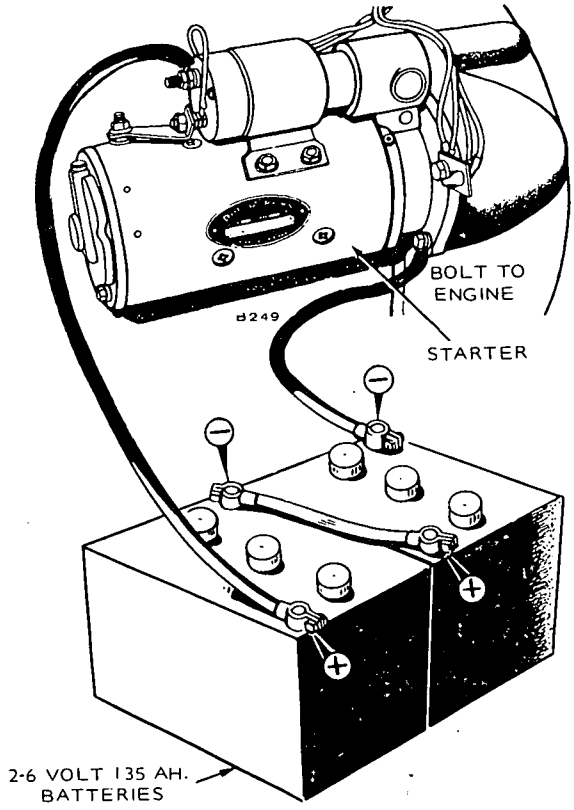


FIGURE 9. BATTERY CONNECTION

BATTERY, HOT LOCATION

Batteries will self discharge very quickly when installed where the ambient temperature is consistently above 90°F, such as in a boiler room. To lenghten battery life, dilute the electrolyte from its normal 1.275 specific gravity reading at full charge to a 1.225 reading. The cranking power is reduced slightly when the electrolyte is so diluted, but if the temperature is above 90°F, this should not be noticed. The lengthened battery life will be worth the effort.

1. Fully charge the battery.
2. With the battery still on charge, draw off the electrolyte above the plates in each cell. DO NOT ATTEMPT TO POUR OFF; use an hydrometer or filler bulb and dispose of it in a safe manner. Avoid skin or clothing contact with the electrolyte.
3. Refill each cell with distilled water, to normal level.
4. Continue charging for 1 hour at a 4 to 6 hour rate.
5. Test each cell. If the specific gravity is still above 1.255, repeat steps 2, 3, 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 10. If the distance between the set and remote station is less than 1000-feet, use No. 18 AWG wire; between 1000- and 2000-feet, use No. 16AWG wire.

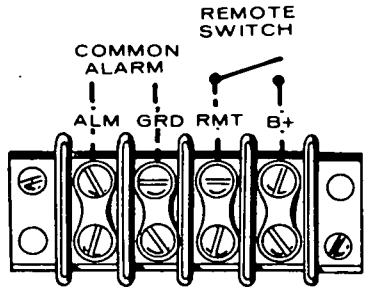
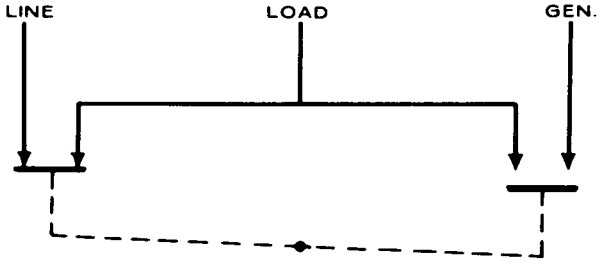


FIGURE 10. REMOTE STARTING

WIRING CONNECTIONS

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

If the installation is for standby service, a double throw transfer switch must always be used. Connect this switch (either automatic or manual) so that it is impossible for commercial power and generator current to be connected to the load at the same time. Instructions for connecting an automatic load transfer control are included with such equipment.



NOTE: SHOWN WITH LINE CONNECTED TO LOAD.

FIGURE 11. LOAD TRANSFER SWITCH

Control Box Connections: The factory ships these 12 lead generators with load connection wires NOT connected together in the control box. These 12 wires are labeled T1 through T12 and must be brought together before making load connections. Proceed as follows:

1. Remove either right, left or top panel from control box. See Figure 12.
2. Connect wires together as shown on panel and in Figure 13 according to voltage desired.
3. Open hinged control panel doors. Connect lead from terminal 63 to correct terminal for voltage desired. These terminals are labeled H2, H3, H4, H5 and H6. See Figure 14.

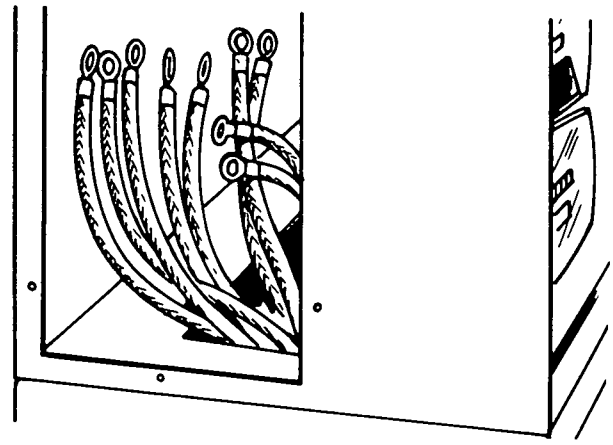
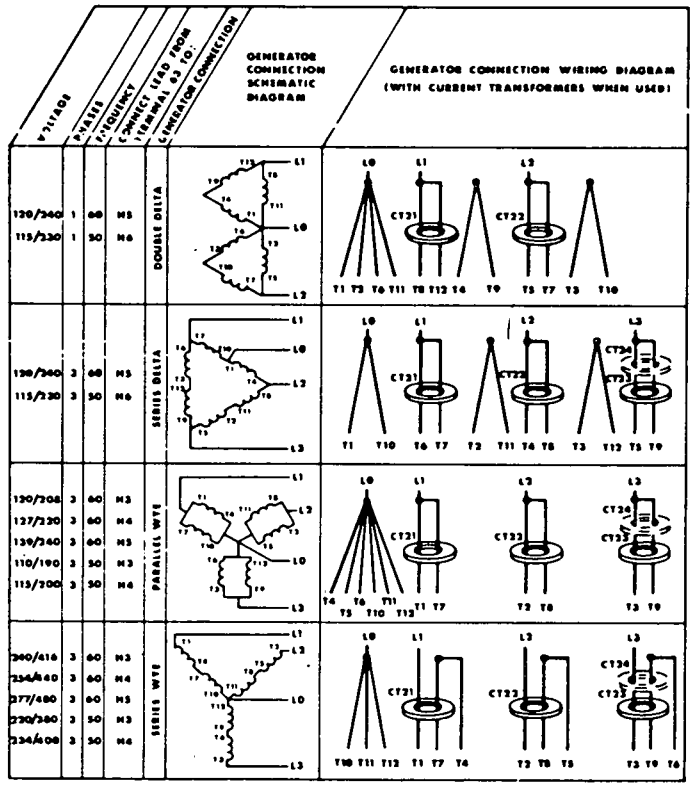


FIGURE 12. CONTROL BOX (SIDE PANEL REMOVED)

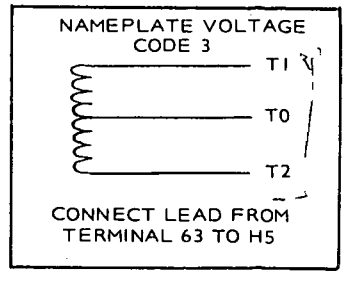
4. Close front panel and secure with 1/4 turn fasteners.
5. Connect load wires to generator leads.

Preceding instructions do not apply to models with a 347/600 voltage (designated 9X) or a 120/240 voltage (designated 3R); these connections are made at the factory. The installer must only connect load wires.



120/240 VOLT, 1 PHASE, 60 CYCLE

347/600 VOLT, 3 PHASE, 60 CYCLE



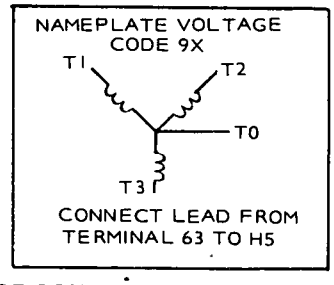


FIGURE 13. VOLTAGE CONNECTIONS

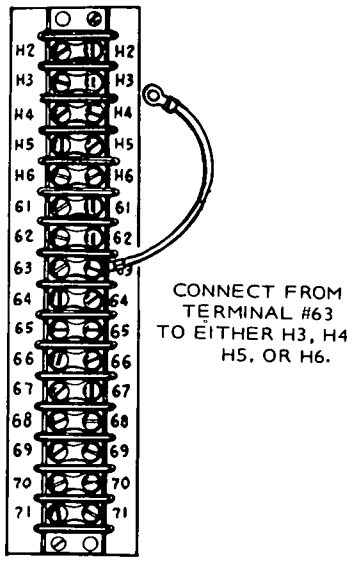


FIGURE 14. CONNECTING LEAD FROM TERMINAL 63

120/240 Volt, Single Phase, 12 Lead: Terminal connection L0 can be the ground (neutral). For 120 volts, connect the hot load wires to either the L1 or L2 connection, Figure 15. Connect the neutral load wire to the L0 connection. Two 120 volt circuits are thus available, with not more than 1/3 the rated capacity of the set available on either circuit. If using both circuits, be sure to balance the load between them.

For 240 volts, connect one load wire to the L1 connection and the second load wire to the L2 connection. Terminal connection L0 is not used for 240 volt service.

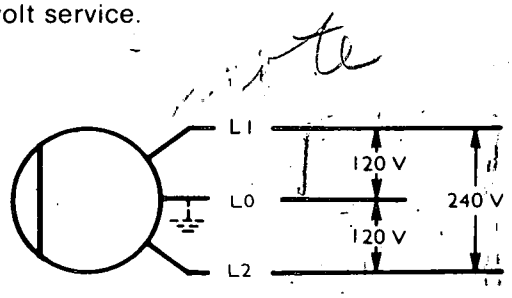


FIGURE 15. 120/240 VOLT, SINGLE PHASE, 12 LEAD

120/240 Volt, 3 Phase, 4 Wire Delta Connected Set; 12 Lead: The 3 phase Delta connected set is designed to supply 120- and 240 volt, 1 phase current and 240 volt, 3 phase current, Figure 16. For 3 phase operation, connect the three load wires to generator terminals L1, L2 and L3 — one wire to each terminal. For 3 phase operation the L0 terminal is not used.

For 120/240 volt, 1 phase, 3 wire operation, terminals L1 and L2 are the "hot" terminals. The L0 terminal is the neutral, which can be grounded if required. For 120 volt service, connect the black load wire to either the L1 or L2 terminal. Connect the neutral (white) wire to the L0 terminal. Two 120 volt circuits are available.

Any combination of 1 phase and 3 phase loading can be used at the same time as long as no terminal current exceeds the NAMEPLATE rating of the generator. If no 3 phase output is used, usable 1 phase output is 2/3 of 3 phase KVA.

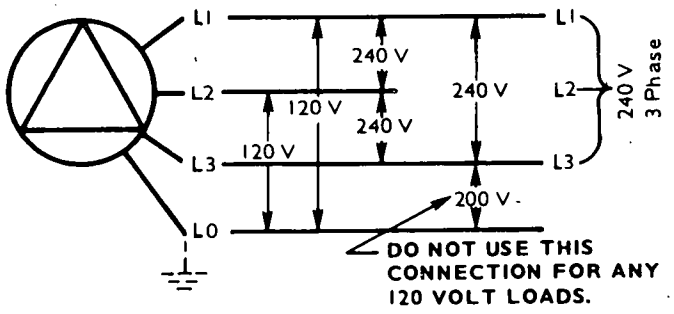


FIGURE 16. 3 PHASE, DELTA CONNECTION, 12 LEAD

3 Phase, 4 Wire, Wye Connected Set; 12 Lead: The 3 phase, 4 wire set produces line to neutral voltage and line to line voltage. The line to neutral voltage is the lower voltage as noted on the unit nameplate, and the line to line voltage is the higher nameplate voltage.

For 3 phase loads, connect separate load wires to each of the set terminals L1, L2 and L3. Single phase output is obtained between any two 3 phase terminals.

The terminal marked L0 can be grounded. For 1 phase loads, connect the neutral (white) load wire to the L0 terminal. Connect the black load wire to any one of the other three terminals — L1, L2 or L3. Three separate 1 phase circuits are available, with not more than 1/6 the rated capacity of the set from any one circuit.

If using 1 phase and 3 phase current at the same time, use care to properly balance the 1 phase load, and not to exceed rated line current.

Figure 17 shows load connections for 120/208 voltage. Other voltages are available from either parallel wye or series wye illustration in Figure 13.

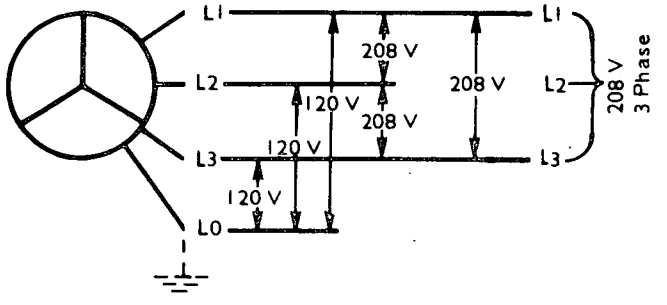


FIGURE 17. 3 PHASE, WYE CONNECTION, 12 LEAD

OPERATION

GENERAL

ONAN DDA 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 engine to capacities shown. After engine has been run, check dipstick, add oil to bring level to full mark. Record total capacity for future oil changes. Do not mix brands or grades of lubricating oils.

AMBIENT TEMPERATURE	SINGLE VISCOSITY	MULTI-VISCOSITY
Below -10°F (-23°C)	SAE 5W	SAE 5W20
Between -10°F and 32°F (-23°C and 0°C)	SAE 10W	SAE 10W30
Above 32°F (0°C)	SAE 30	Not Recommended
Use oil conforming to these specifications	API CD/SD MIL-L-2104C* Series 3* *API CC or CD	API CC/SE, CC/SD or SD MIL-L-46152

Oil capacities (nominal)

Oil Pan and Filter — 6 quarts

Cooling System: Cooling system was drained prior to shipment. Fill cooling system before starting. Nominal capacity is 4.25 gallons. For units using either a radiator or heat exchanger (city water cooled), fill the system with clean soft water. Use a good rust and scale inhibitor additive. If a possibility exists of a radiator cooled set being exposed to freezing temperatures use anti-freeze with an ethylene-glycol base. During initial engine run, check the coolant level several times and replenish if necessary to compensate for air pockets which may have formed during filling. Refer to John Deere engine manual for additional information.

CAUTION **1. Verify that the electric solenoid valve used with city water cooled plants is open before initial starting of plant to allow coolant chambers to fill. Overheating and damage to the engine could result from non-compliance.**

2. 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.

3. 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 John Deere 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 Fuel System: Verify that all connections in the fuel system are secure and no leaks exist. Proceed with priming as follows:

1. Loosen bleed plug on top of fuel filter. Pump primer lever (Figure 18) until a solid stream of fuel, free of air bubbles, flows from bleed plug.
2. Secure bleed plug.
3. Loosen inlet fuel line on injector pump. Operate primer lever on fuel transfer pump until a solid stream of fuel, free of air bubbles, flows from inlet line opening.
4. Secure injector pump fuel inlet line.
5. Leave fuel transfer pump priming lever at lowest point of stroke.

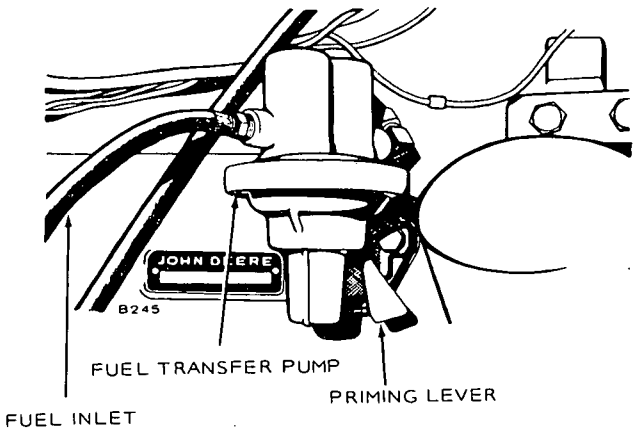


FIGURE 18. PRIMING FUEL SYSTEM

If the primer lever will not pump and no resistance is felt at upper end of stroke, turn engine over with starter to change position of fuel pump drive lobe on camshaft.

Check all connections in fuel system for security, to ensure that pressure will not bleed off when engine is not in use. Pressure should be maintained for immediate starting if unit is on standby service.

BATTERIES

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

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

STARTING

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

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

To start, move the "run-stop/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 45 and 65 psi. 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 180° to 195°F. On city water cooled units an adjustable valve is connected in the water supply line. Adjust the hand wheel valve to provide a water flow that will keep the water temperature gauge reading within the range of 180°F to 220°F.

STOPPING

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

Move the run-stop/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 appropriate troubleshooting chart, Table 3 or Table 4.

EXERCISE PERIOD

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

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

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

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

SYMPTOM	CORRECTIVE ACTION
1. Fault lamp lights and engine stops cranking after approximately 75 seconds.	1. See engine service manual for troubleshooting fuel system, ignition system, etc. After correcting problem, reset the engine monitor by moving run-stop/reset-remote switch to reset position. Release and return to run position.
2. Fault lamp lights immediately after engine starts.	2. Check for: a. overspeed condition as engine starts. b. high temperature condition. c. faulty high engine temperature sensor or overspeed switch. d. faulty starter disconnect.
3. Fault lamp lights after engine is running.	3. Check the following: a. Oil level-engine will shut down after approximately 12-1/2 seconds if low oil pressure sensor does not open. b. Oil pressure sensor may be defective. c. High engine temperature - caused by low coolant level, faulty thermostat, etc. d. Faulty high engine temperature sensor. e. Faulty starter disconnect.
4. Fault lamp lights - no fault condition exists.	4. Be certain that no fault condition exists. Disconnect lead 29, 30 and 31 from TB11 inside control box (refer to wiring diagram). If fault lamp still lights with leads disconnected, remove and replace engine monitor plug-in printed circuit board.

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

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

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.

OUT-OF-SERVICE PROTECTION

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

1. Run set until thoroughly warm.
2. Drain oil from oil base while still warm. Refill and attach a warning tag stating oil viscosity used.
3. Remove each injector. Pour 1 ounce (two tablespoons) of rust inhibitor (or SAE #10 oil) into each cylinder. Crank engine over several times. Install injectors.
4. Service air cleaner
5. Clean throttle linkage and protect by wrapping with a clean cloth.
6. Plug exhaust outlets to prevent entrance of moisture, bugs, dirt, etc.
7. Wipe entire unit. Coat parts susceptible to rust with a light film of grease or oil.
8. Disconnect battery and follow standard battery storage procedure.
9. Provide a suitable cover for the entire unit.
10. See engine operation and maintenance manual.

HIGH ALTITUDE

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

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

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 John Deere manual for further information.

Water Jacket Heater: The function of this optional heater is to keep the engine warm enough to assure starting under adverse weather conditions. Connect the heater to a source of power that will be on during the time the engine is not running. Be sure the voltage rating is correct for the heater element rating (Figure 19).

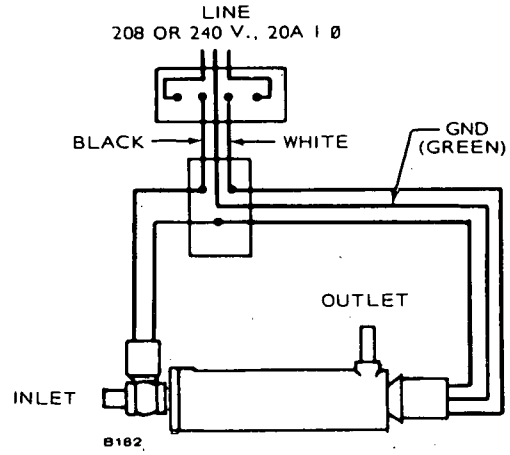


FIGURE 19. ENGINE HEATER

GENERAL MAINTENANCE

GENERAL

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

CAUTION **When changing oil filters, it is important that the replacement filter is a bypass type. Failure to use a bypass filter could cause the filter material to rupture during heavy pressures on cold starts, resulting in non-filtered oil and subsequent engine damage.**

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	MAINTENANCE PERIOD						
	10 hrs.	50 hrs.	100 hrs.	200 hrs.	500 hrs.	1000 hrs.	6 mths.
Inspect plant	x						
Check coolant level	x						
Check oil level	x						
Air cleaner	x1						
Fuel filter	x						
Batteries		x					
Alternator and fan belt			x2				
Engine crankcase - drain - refill			x1				
Crankcase oil filter			x1				
Crankcase vent tube					x		
Valve tappets					x		
Hoses					x		
Injection pump - check timing						x	
Injection nozzles						x	
Fuel filter - change						x	
Starter						x	
Cooling system - drain, flush, refill							x3
Clean and inspect battery charging alternator				x			
Air cleaner - replace			x				

x1 - or every 3 months, perform more often in extremely dusty conditions.
x2 - or every 3 months. Adjust to 3/4 depression with 20 pounds force.
x3 - More often in extremely dusty conditions.

NOTE: The above schedule is a minimum requirement for your engine. Refer to the John Deere service manual for recommended service periods.

ENGINE SPEED

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

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

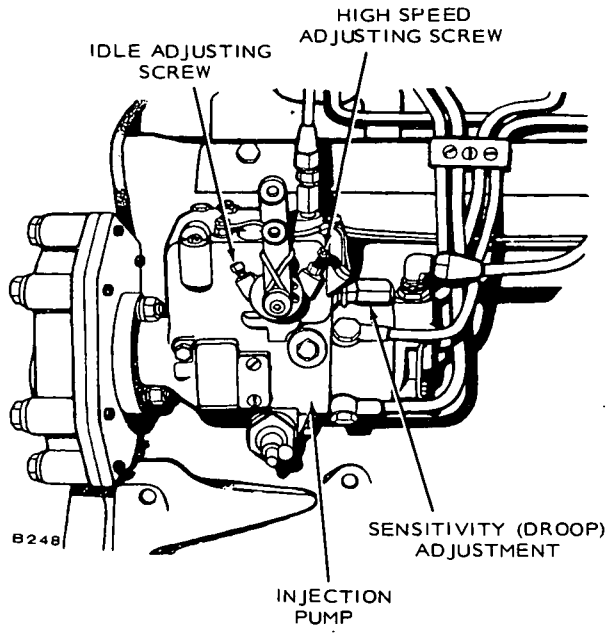


FIGURE 20. ROOSA-MASTER GOVERNOR

Governor sensitivity is adjusted by rotating an external knurled knob at the rear of the injector pump housing. Turning inward (clockwise) shortens governor control spring making it less sensitive, thereby increasing speed droop. Turning outward (counterclockwise) has opposite effect. Adjustment can be made with engine running. The speed droop is set at the ONAN plant to give a regulation of 3 percent to 5 percent from no-load to full-load.

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

Example: 30 x 61 (Hz) = 1830 rpm.

Adjust engine speed to 1800 rpm for 60 Hertz sets 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. Blow dust out of control panel.

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 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.

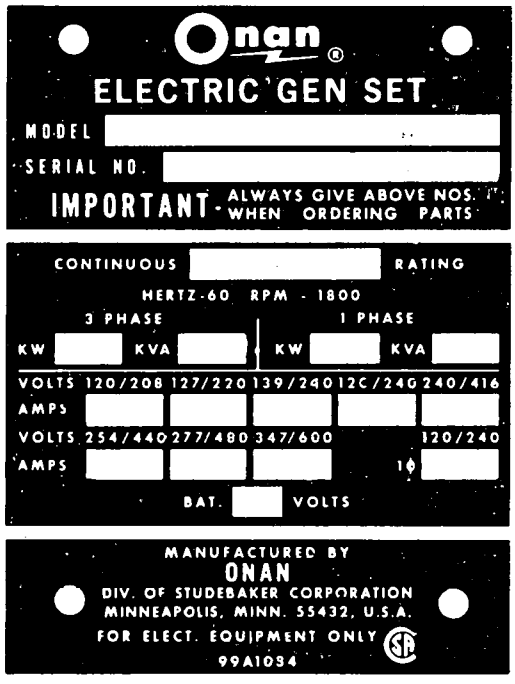
PARTS CATALOG

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

INSTRUCTIONS FOR ORDERING REPAIR PARTS

ONAN PARTS

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



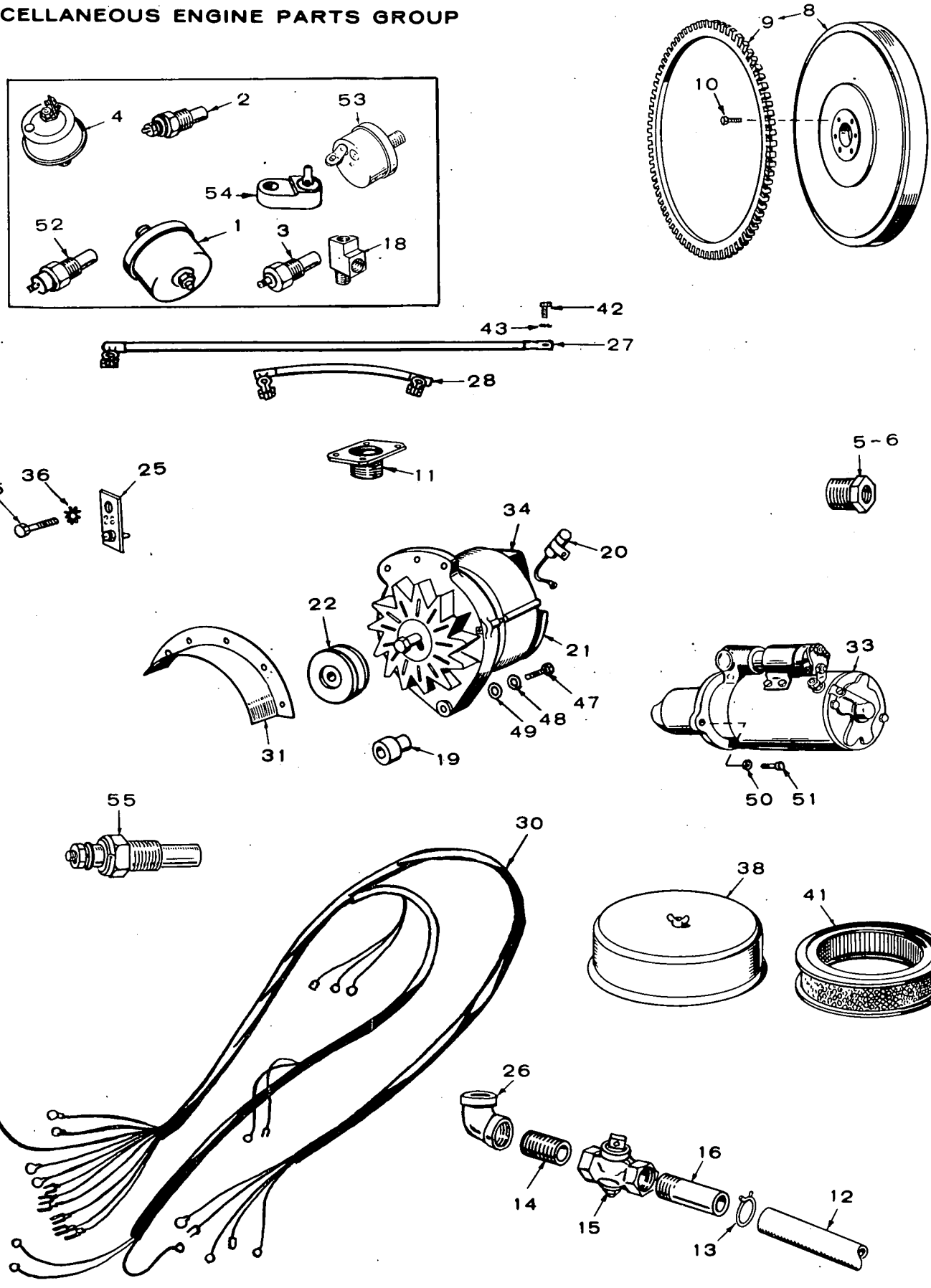
MODEL AND SPECIFICATION**	WATTS
30.0DDA-15R/*	30,000
30.0DDA-9XR/*	30,000
25.0DDA-515R/*	25,000

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

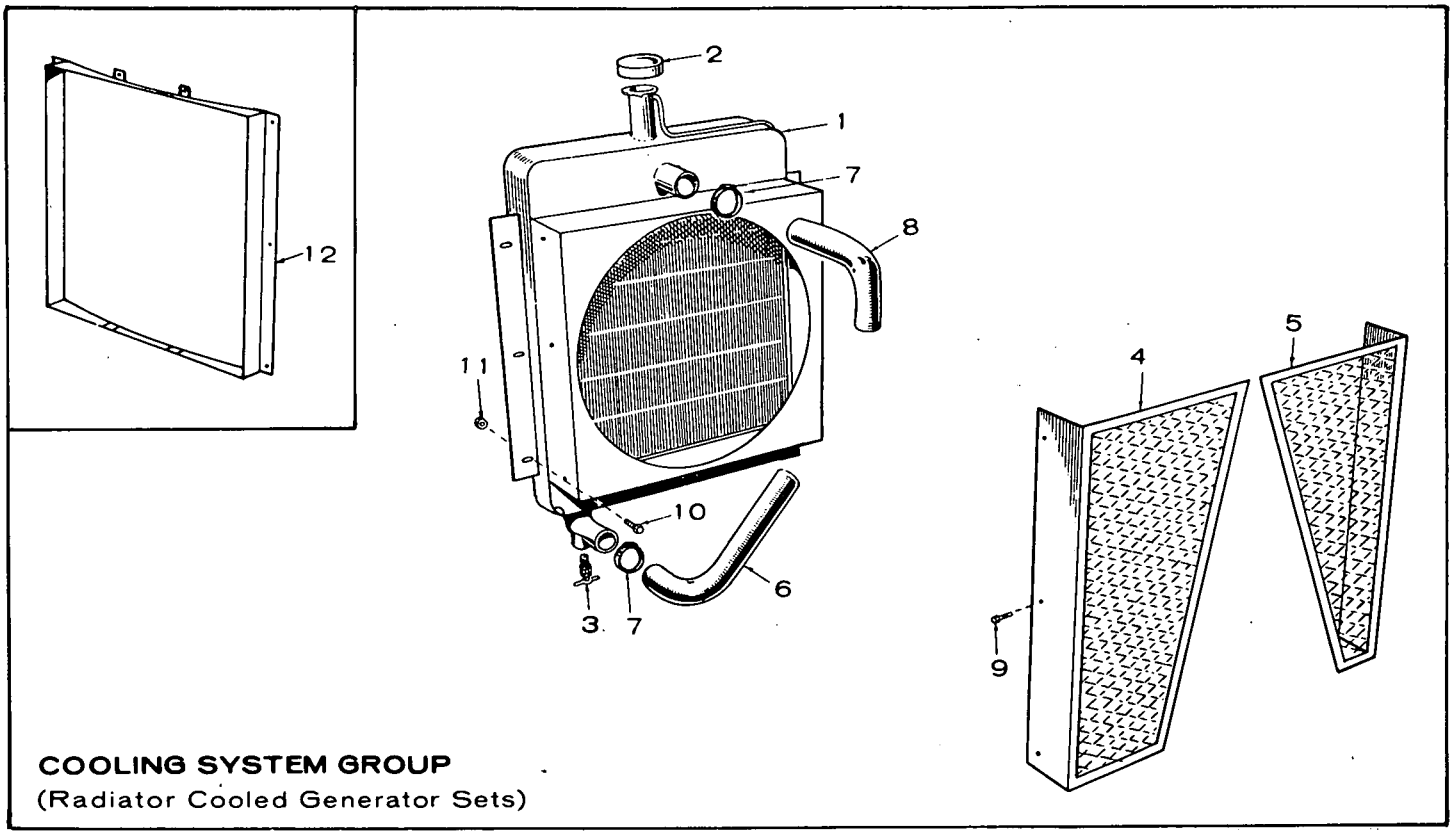
JOHN DEERE PARTS

All John Deere parts must be ordered from your nearest authorized John Deere distributor. When ordering parts, refer to the John Deere nameplate giving the complete engine TYPE and SERIAL NUMBER.

MISCELLANEOUS ENGINE PARTS GROUP



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	193-0108	1	Sender, Oil Pressure Gauge
2	193-0104	1	Sender, Water Temperature Gauge
3	309-0179	1	Switch, High Water Temperature
4	309-0169	1	Switch, Low Oil Pressure
5	505-0131	1	Bushing (3/4 x 3/8"), Reducer
6	505-0019	1	Bushing (1/2 x 3/8"), Reducer
8	104-0871	1	Flywheel (Includes Ring Gear)
9	104-0858	1	Gear, Ring
10	800-0094	4	Screw (1/2-13 x 2") - Flywheel Mounting
11	154-1674	1	Manifold, Exhaust
12	503-0098	1	Hose, Oil Drain
13	503-0197	1	Clamp, Oil Drain
14	505-0100	1	Nipple (1/2"), Close - Oil Drain
15	504-0011	1	Valve, Oil Drain
16	505-0185	1	Nipple (1/2 x 1-1/2"), Half - Oil Drain
18	502-0058	1	Tee (1/8") - Oil Sender and Switch
19	232-2183	1	Spacer, Alternator Mounting
20	312-0058	1	Condenser, Alternator
21	191-0665	1	Alternator, Charge (Includes Fan)
22	191-1099	1	Pulley, Alternator
25	332-1292	1	Bracket, Terminal Mounting
26	505-0050	1	Elbow (1/2 x 90°), Street - Oil Drain
27	CABLE, BATTERY		
	416-0531	1	Positive (24")
	416-0530	1	Negative (16")
28	416-0446	1	Cable, Battery Jumper
30	338-0771	1	Harness, Wiring - Engine
31	191-0725	1	Guard, Alternator Belt
33	191-1097	1	Motor, Starting
34	191-0732	1	Regulator, Voltage (Part of Alternator)
35	800-0026	1	Screw (5/16-18 x 3/4") - Terminal Bracket Mounting
36	856-0008	1	Washer (5/16"), Shakeproof EIT
38	140-1083	1	Cleaner, Air (Includes Element)
41	140-1089	1	Element, Air Cleaner
42	800-0090	1	Screw (1/2-13 x 1") - Battery Cable to Ground
43	856-0013	1	Washer (1/2"), Shakeproof EIT
47	SCREW, ALTERNATOR MOUNTING		
	800-0030	1	5/16-18 x 1-1/4"
	800-0024	1	5/16-18 x 1/2"
48	850-0045	2	Washer (5/16"), Lock
49	526-0115	2	Washer (5/16"), Flat
50	800-0051	3	Screw (3/8-16 x 1-1/4") - Starter Motor Mounting
51	850-0050	3	Washer (3/8"), Lock
52	309-0178	1	Switch, High Water Temperature Alarm - Optional
53	309-0064	1	Switch, Low Oil Pressure Shutdown - Optional
54	309-0269	1	Switch, Low Engine Temperature - Optional
55	193-0202	1	Sender, Oil Temperature - Optional

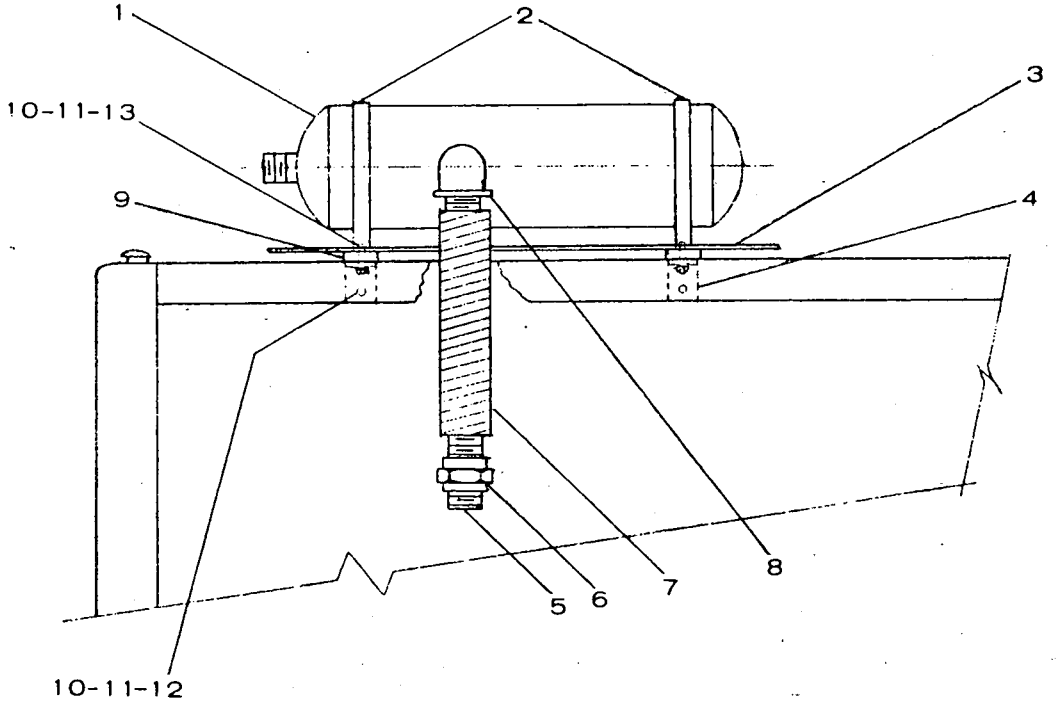


COOLING SYSTEM GROUP
(Radiator Cooled Generator Sets)

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	130-0815	1	Radiator
2	130-0449	1	Cap, Radiator
3	504-0028	1	Valve, Radiator Drain
4	130-0934	1	Guard, Fan - Right Hand
5	130-0935	1	Guard, Fan - Left Hand
6	503-0635	1	Hose, Lower Radiator
7	503-0365	4	Clamp, Hose
8	503-0724	1	Hose, Upper Radiator
9	815-0181	8	Screw (10-32 x 1/2") - Fan Guard Mounting
10	821-0014	8	Screw (5/16-18 x 1/2"), Self Locking - Radiator Mounting
11	870-0113	8	Nut (5/16-18), Retainer - Radiator Mounting
12	405-1054	1	Flange, Radiator - Optional

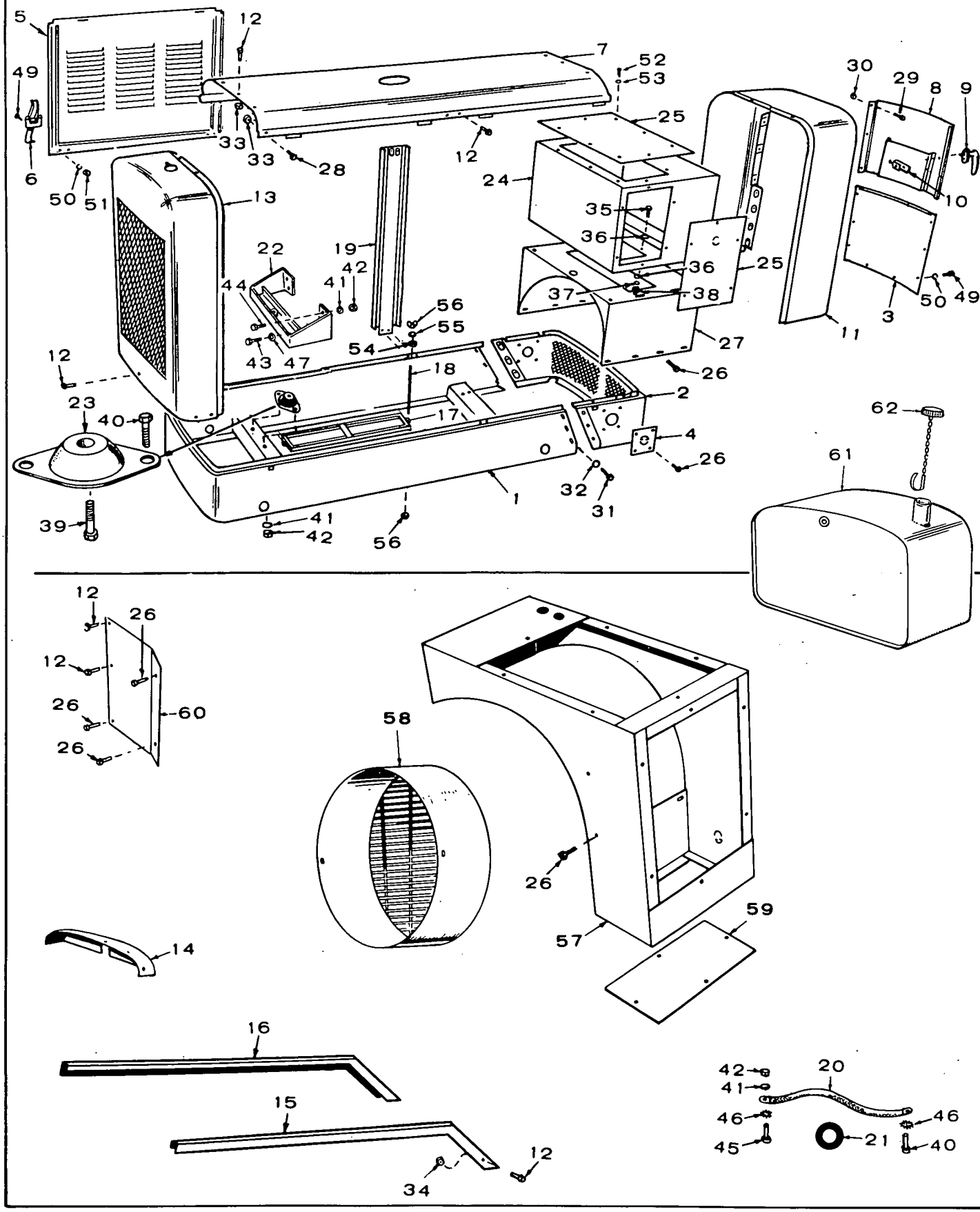
179-1520

MUFFLER INSTALLATION



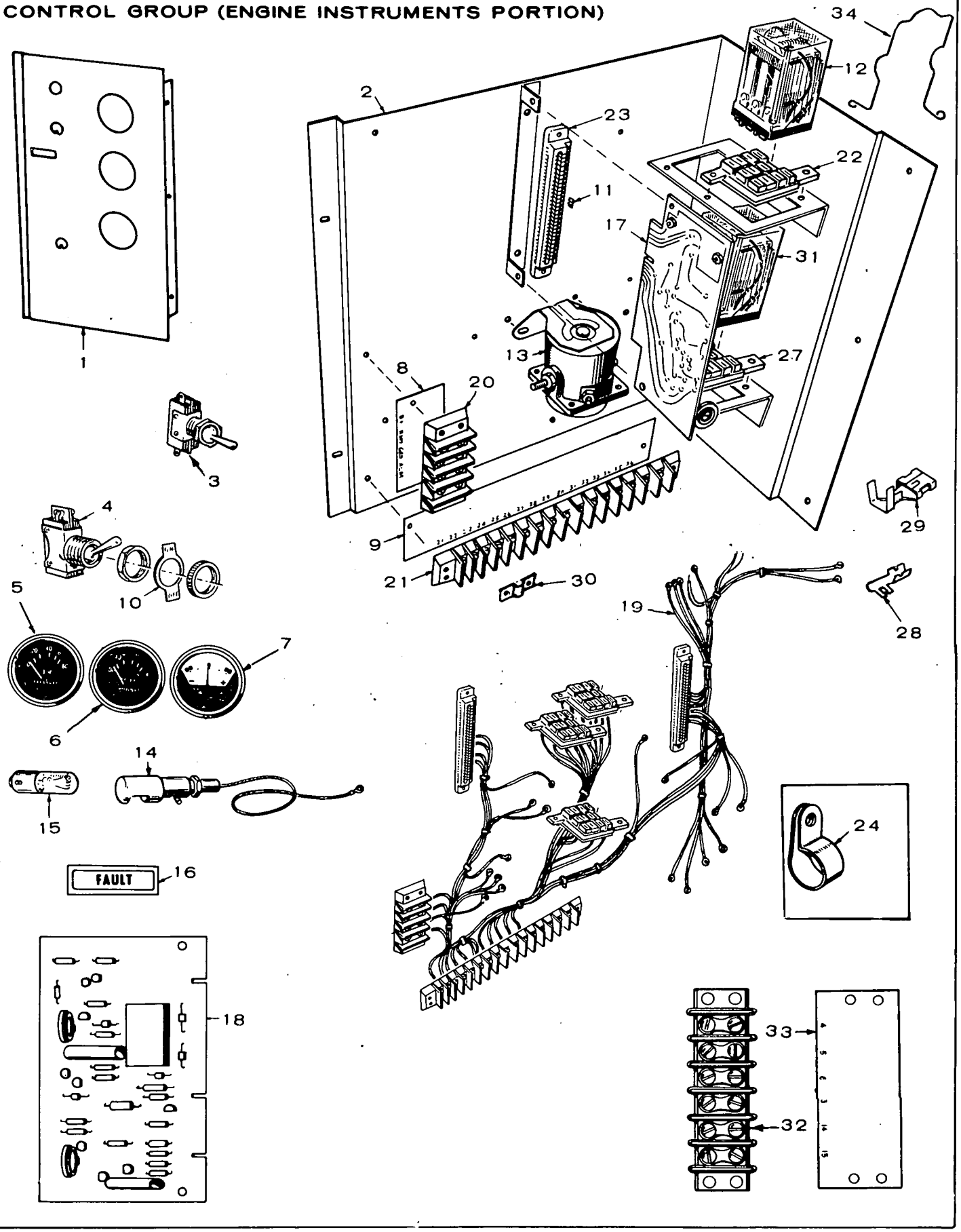
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	155-1268	1	Muffler
2	140-0649	2	Band, Muffler
3	155-1340	1	Shield, Heat
4	155-0789	2	Support
5	505-0172	1	Nipple (2"), Close
6	505-0454	1	Union (2")
7	155-1115	1	Tube, Exhaust
8	505-0175	1	Elbow (2" x 90°), Pipe
9	526-0172	4	Spacer
10	862-0015	10	Nut (5/16-18)
11	850-0045	10	Washer (5/16"), Lock
12	800-0026	6	Screw (5/16-18 x 3/4")
13	800-0028	4	Screw (5/16-18 x 1")

MOUNTING AND HOUSING GROUP



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	403-1111	1	Chassis, Front Mounting
2	403-0894	1	Chassis, Rear Mounting - Housed Sets
3	405-1780	1	Panel, Rear Housing Access - Housed Sets
4	403-0895	2	Cover, Conduit Opening - Housed Sets
5	PANEL (SIDE),DOOR - HOUSED SETS		
	405-1808	2	Engine End
	405-1832	2	Generator End
6	406-0105	8	Clamp, Door - Housed Sets
7	405-2151	1	Panel, Top - Housed Sets
8	405-1777	1	Panel, Rear Door - Housed Sets
9	406-0157	1	Handle (Includes Keys), Door - Housed Sets
10	406-0089	1	Catch, Door - Housed Sets
11	405-1812	1	Panel, Rear - Housed Sets
12	821-0014	As Req.	Screw (5/16-18 x 1/2"), Self Locking
13	405-1811	1	Panel, Front - Radiator Cooled Sets
14	405-1409	1	Extension, Radiator Hood - Unhoused Radiator Cooled Sets
15	403-0913	1	Trim, Right Hand Chassis - Unhoused Sets
16	403-0914	1	Trim, Left Hand Chassis - Unhoused Sets
17	416-0480	1	Frame, Battery Hold-down
18	520-0663	2	Stud, Battery Hold-down
19	405-1814	2	Support, Housing Center - Housed Sets
20	337-0090	1	Strap, Ground
21	508-0001	1	Grommet, Control Box Housing (2 used on Housed Models)
22	403-1110	1	Support, Engine Mount
23	402-0371	1	Mount, Vibration
24	301-3155	1	Housing, Control Box - Unhoused Sets
25	PANEL, CONTROL BOX HOUSING		
	301-3156	3	Unhoused Sets
	301-3156	2	Housed Sets
26	821-0010	As Req.	Screw (1/4-20 x 1/2"), Self Locking
27	301-3154	1	Saddle, Control Box Housing - Unhoused Sets
28	821-0016	4	Screw (5/16-18 x 3/4"), Self Locking - Housed Sets
29	809-0059	3	Screw (#14 x 1/2"), Self Locking - Housed Sets
30	870-0106	3	Nut (#14), Speed
31	800-0048	6	Screw (3/8-16 x 3/4") - Housed Sets
32	850-0050	6	Washer (3/8"), Lock - Housed Sets
33	870-0113	As Req.	Nut (5/16-18), Retainer
34	870-0020	6	Nut (5/16-18)
35	800-0003	4	Screw (1/4-20 x 1/2") - Unhoused Sets
36	526-0018	8	Washer (1/4"), Flat
37	850-0040	4	Washer (1/4"), Lock
38	862-0001	4	Nut (1/4-20), Hex
39	800-0520	1	Screw (3/4-10 x 1") - Vibration Mount to Support
40	800-0090	3	Screw (1/2-13 x 1") - Vibration Mount and Ground Strap
41	850-0060	5	Washer (1/2"), Lock
42	862-0016	5	Nut (1/2-13), Hex
43	800-0132	2	Screw (5/8-11 x 1-1/2") - Engine Mount Support
44	800-0095	2	Screw (1/2-13 x 2-1/4") - Engine Mount Support
45	800-0091	1	Screw (1/2-13 x 1-1/4") - Ground Strap
46	856-0013	2	Washer (1/2"), Shakeproof EIT
47	850-0070	2	Washer (5/8"), Lock
49	813-0098	22	Screw (10-32 x 3/8") - Housed Sets
50	850-0030	22	Washer (#10), Lock - Housed Sets
51	870-0053	16	Nut (10-32) - Housed Sets
52	815-0026	As Req.	Screw (10-32 x 3/8"), Truss Head - Control Box Panel Mounting
53	853-0008	As Req.	Washer (#10), Shakeproof E T
54	526-0115	2	Washer (5/16"), Flat
55	850-0045	2	Washer (5/16"), Lock
56	865-0007	2	Nut (5/16-18), Wing - Battery Hold-down Stud
57	301-3191	1	Box, Junction - Housed Sets
58	234-0369	1	Cover, End Bell - Housed Sets
59	301-3195	1	Plate, Junction Box Bottom - Housed Sets
60	301-3196	1	Bracket, Junction Box
61	159-1025	1	Tank, Fuel - Housed Sets
62	159-0020	1	Cap, Fuel Tank

CONTROL GROUP (ENGINE INSTRUMENTS PORTION)

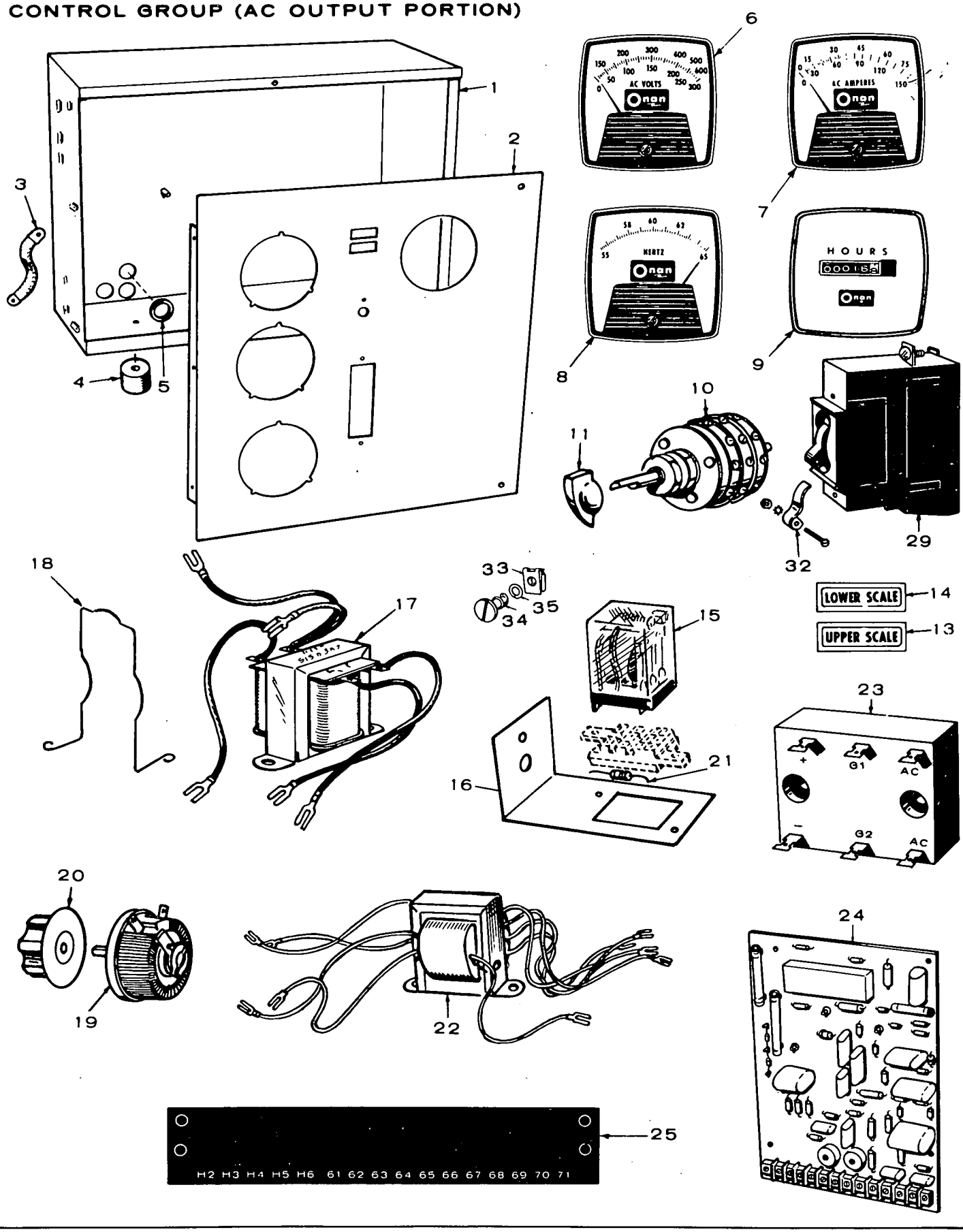


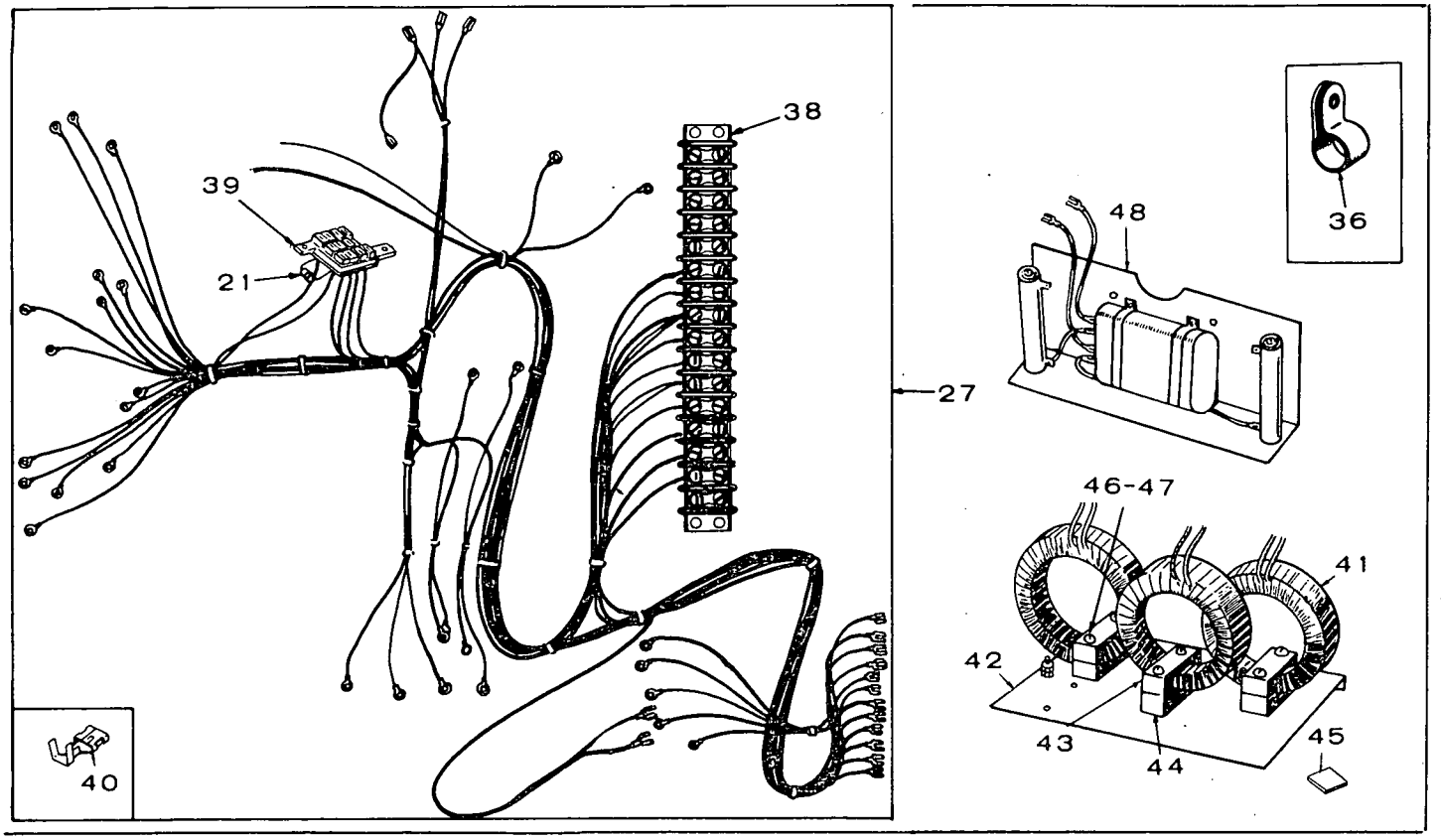
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	PANEL ONLY, ENGINE CONTROL		
	301-3165	1	Sets With One Fault Light
	301-3267	1	Sets With Five Fault Lights - Optional
2	301-3253	1	Bracket, Engine Control
3	SWITCH (S.P.D.T.), TOGGLE		
	308-0138	1	Standard Units
	308-0327	1	Penn State Units - Optional
4	308-0002	1	Switch, Panel Light
5	193-0107	1	Gauge, Oil Pressure
6	193-0106	1	Gauge, Water Temperature
7	302-0061	1	Ammeter, Charge (30-0-30)
8	332-1239	1	Strip, Marker (B+, Remote, Ground Alarm)
9	332-1241	1	Strip, Marker (21 through 36)
10	308-0003	1	Plate, Switch (On-Off)
11	332-1276	2	Plug, Keying (Sets With Five Fault Lights Use Quantity of 1)
12	307-1058	2	Relay (1) Start Disconnect, (1) Ignition
13	307-1031	1	Relay, Start Solenoid
14	322-0149	1	Holder, Lamp
15	322-0004	1	Lamp, Panel
16	LAMP, FAULT		
	322-0128	1	Standard Sets
	322-0107	1	Overcrank (Optional)
	322-0111	1	Overspeed (Optional)
	322-0108	1	Low Oil Pressure (Optional)
	322-0109	1	High Engine Temperature (Optional)
	322-0110	1	Low Engine Temperature (Optional)

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
17	CONTROL, CRANKER		
	300-0733	1	Standard Cranker
	300-0714	1	Cycle Cranker (Optional)
18	MONITOR, ENGINE CONTROL		
	300-0679	1	Sets With One Fault Light - Standard
	300-0730	1	Sets With One Fault Light - Penn State Units - Optional
	300-0681	1	Sets With Five Fault Lights - Optional
19	HARNESS ASSEMBLY, WIRING - CONTROL (Includes Parts Marked *)		
	338-0528	1	Sets With One Fault Light - Standard
	338-0534	1	Sets With Five Fault Lights - Optional
20	332-0537	1	*Block, Terminal - 4 Place
21	332-0795	1	*Block, Terminal - 16 Place
22	323-0765	2	*Socket, Relay - 11 Place
23	332-1271	2	*Housing, Printed Circuit Board Terminal
24	332-0051	1	Clip, Tinnerman
27	323-0764	1	*Socket, Relay - 8 Place
28	332-1269	As Req.	*Terminal, PC Board
29	332-1280	As Req.	*Terminal, Crimp
30	332-1043	1	*Jumper, Terminal - Sets With One Fault Light
31	307-1061	1	Relay, Starter Protection
32	332-0699	1	*Block, Terminal (6 Place) - Sets With Five Fault Lights
33	332-1240	1	Strip, Marker (53 through 58) - Sets With Five Fault Lights
34	307-1157	3	Spring, Relay Hold-down

* - Included in Wiring Harness Assembly.

CONTROL GROUP (AC OUTPUT PORTION)

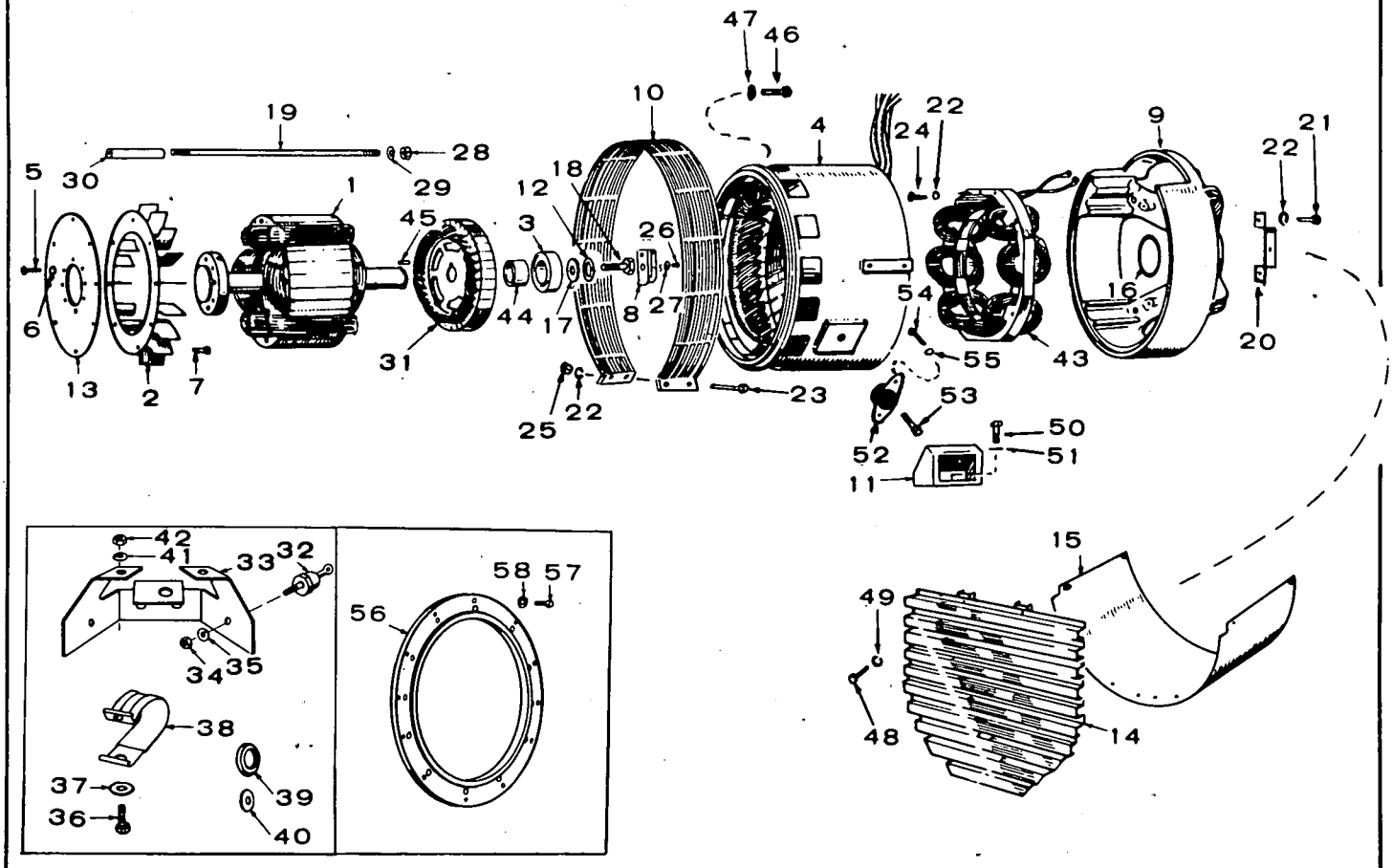




REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	301-3158	1	Box, Control
2	PANEL, CONTROL BOX		
	301-3170	1	Sets With Meter Panel
	301-3168	1	Sets Without Meter Panel
3	337-0049	1	Strap, Bond
4	402-0078	4	Dampener, Vibration
5	508-0001	4	Grommet (1-1/16"), Rubber
6	302-0718	1	Voltmeter, AC - Dual Scale 0-300, 0-600
7	302-0719	1	★Ammeter, AC - Dual Scale 0-75, 0-150
8	★METER, FREQUENCY		
	302-0221	1	60 Hertz
	302-0256	1	50 Hertz
9	★METER, RUNNING TIME		
	302-0466	1	60 Hertz
	302-0469	1	50 Hertz
10	SWITCH, SELECTOR		
	308-0012	1	Voltmeter - Sets Without Meter Panel
	308-0284	1	Voltmeter and Ammeter - Sets With Meter Panel
11	303-0076	1	Knob, Selector Switch
13	322-0131	1	Light, Upper Scale
14	322-0130	1	Light, Lower Scale
15	307-1061	1	Relay, Voltage Selector
16	301-3244	1	Bracket, Relay Mounting
17	315-0384	1	Reactor Assembly, Commutator
18	307-1157	1	Spring, Relay Hold-down
19	303-0170	1	Rheostat, Voltage Adjusting
20	303-0032	1	Knob, Rheostat
21	350-0556	1	*Resistor
22	315-0342	1	Transformer, Voltage
23	305-0524	1	Bridge, Rectifier
24	332-1268	1	Board Assembly, Printed Circuit - Voltage Regulator

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
25	STRIP, MARKER		
	332-1248	1	(H2-H6, 61-67) - Sets Without Meter Panel
	332-1242	1	(H2-H6, 61-71) - Sets With Meter Panel
27	HARNESS, WIRING - AC CONTROL (Includes Parts Marked *)		
	338-0764	1	Sets Without Meter Panel
	338-0730	1	Sets With Meter Panel
29	320-0431	1	Breaker (2 Amp), Circuit (Exciter)
32	320-0307	1	Lock, Circuit Breaker Handle (Penn State Models) - Optional
33	406-0332	2	Receptacle, Fastener
34	406-0333	2	Stud, Fastener
35	406-0334	2	Washer, Stud Fastener
36	332-0050	1	Clip, Tinnerman
38	*BLOCK, TERMINAL		
	332-0607	1	12 Place - Sets Without Meter Panel
	332-0795	1	16 Place - Sets With Meter Panel
39	323-0764	1	*Socket, Relay
40	332-1280	As Req.	*Terminal, Crimp
41	302-0079	3	★Transformer, Current
42	302-0729	1	★Bracket, Transformer Mounting
43	302-0235	3	★Clamp, Transformer Mounting - Upper
44	302-0236	3	★Clamp, Transformer Mounting - Lower
45	302-0253	As Req.	★Shim, Transformer Mounting
46	813-0110	6	★Screw (10-32 x 2"), Round Head
47	854-0010	6	★Washer (#10), Shakeproof IT
48	232-2219	1	Filter Assembly (For SCR Switched Loads) - Optional

★ - Units With Meter Panel Only.
* - Included in Wiring Harness Assembly.



GENERATOR GROUP

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	*	1	Rotor Assembly, Wound (Includes Parts Marked ★)
2	205-0089	1	★Blower
3	510-0101	1	★Bearing
4	*	1	Stator Assembly, Wound
5	805-0033	8	★Bolt, Place - Drive Disc to Hub
6	526-0259	8	★Washer (5/8")
7	805-0018	8	Bolt, Place - Drive Disc to Engine
8	150-0717	1	Switch Assembly, Overspeed
9	211-0185	1	Bell, End
10	234-0365	1	Screen, Generator
11	232-2106	2	Bracket, Generator Mounting
12	850-0079	1	★Washer (3/4"), Lock
13	232-2078	1	★Disc, Generator Drive
14	234-0370	1	Grille, Generator Air Inlet - Unhoused Sets
15	234-0361	1	Wrapper, Generator End Bell - Unhoused Sets
16	509-0125	1	Seal, O-Ring - Bearing
17	526-0238	1	★Washer, Bearing Retainer
18	800-0513	1	★Screw, Bearing Retainer
19	STUD, GENERATOR THROUGH		
	520-0718	4	Three Phase Sets
	520-0721	4	Single Phase Sets
20	150-1456	1	Bracket and Point Assembly, Overspeed Switch

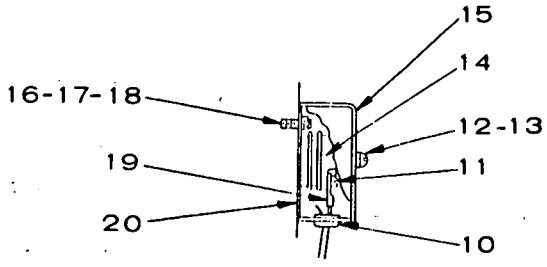
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
21	800-0003	2	Screw (1/4-20 x 1-1/4") - Bracket Mounting
22	850-0040	8	Washer (1/4"), Lock
23	800-0008	2	Screw (1/4-20 x 1-1/4") - Screen Mounting
24	800-0009	4	Screw (1/4-20 x 1-1/2") - Stator Mounting
25	862-0001	2	Nut (1/4-20) - Generator Screen
26	812-0189	1	Screw (3/8-16 x 3/4"), Round Head - Overspeed Switch Mounting
27	856-0010	1	Washer (3/8"), Shakeproof EIT
28	862-0011	4	Nut (3/8-16) - Generator Through Stud
29	850-0050	4	Washer (3/8")
30	503-0611	4	Hose, Insulator
31	201-1739	1	★Rotor Assembly, Wound - Exciter (Includes Diodes)
32	RECTIFIER, DIODE (Part of Exciter Rotor)		
	358-0015	3	Negative
	358-0016	3	Positive
33	HEAT SINK, DIODE		
	363-0055	1	Negative
	363-0054	1	Positive
34	870-0053	6	Nut (10-32) - Diode Mounting
35	850-0030	6	Washer (#10) - Diode Mounting

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
36	813-0110	4	Screw (10-32 x 2"), Round Head - Heat Sink Mounting
37	526-0140	4	Washer (#10)
38	332-0050	2	Clip, Wire
39	508-0124	4	Bushing, Insulating
40	508-0156	4	Washer, Insulating
41	850-0030	4	Washer (#10)
42	870-0053	4	Nut (10-32) - Heat Sink Mounting
43	220-2353	1	Stator Assembly, Wound - Exciter
44	232-2102	1	★Spacer, Bearing
45	515-0145	1	★Key, Exciter Rotor
46	800-0051	8	Screw (3/8-16 x 1-1/4") - Stator Assembly to Generator Adapter
47	850-0050	8	Washer (3/8"), Lock
48	812-0146	4	Screw (1/4-20 x 3/8"), Round Head - Air Inlet Grille Mounting
49	850-0040	4	Washer (1/4"), Lock
50	800-0091	4	Screw (1/2-13 x 1-1/4") - Generator Support to Chassis
51	850-0060	4	Washer (1/2"), Lock
52	402-0030	2	Mount, Vibration
53	800-0520	2	Screw (3/4-10 x 1") - Vibration Mount to Stator Assembly
54	800-0071	4	Screw (7/16-14 x 1") - Generator Support to Vibration Mount
55	850-0055	4	Washer (7/16"), Lock
56	231-0188	1	Adapter, Generator
57	802-0072	12	Screw (3/8-16 x 1"), Socket Head - Generator Adapter to Engine
58	850-0050	12	Washer (3/8"), Lock

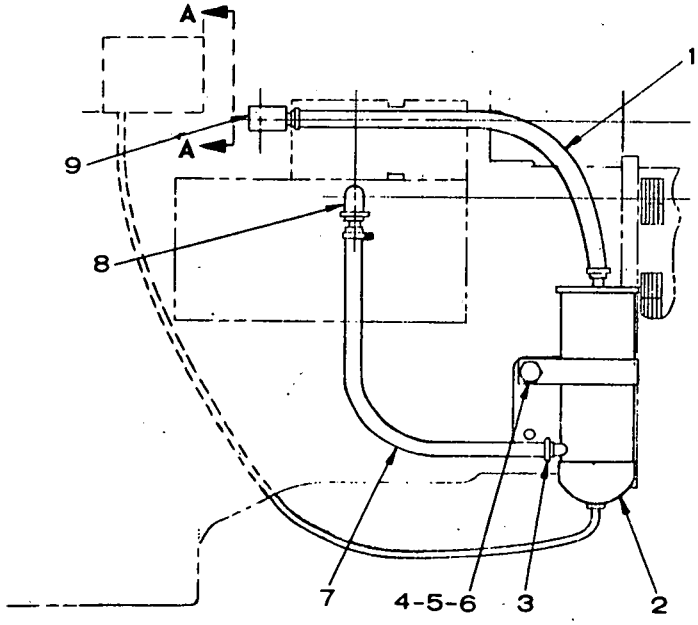
* - Refer to factory giving complete Model, Spec and Serial Number from the Onan Nameplate.
★ - Included in Wound Rotor Assembly.

179-2021

WATER JACKET HEATER INSTALLATION - 120 VOLT



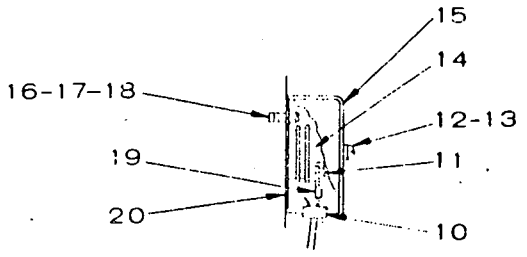
DETAIL A-A



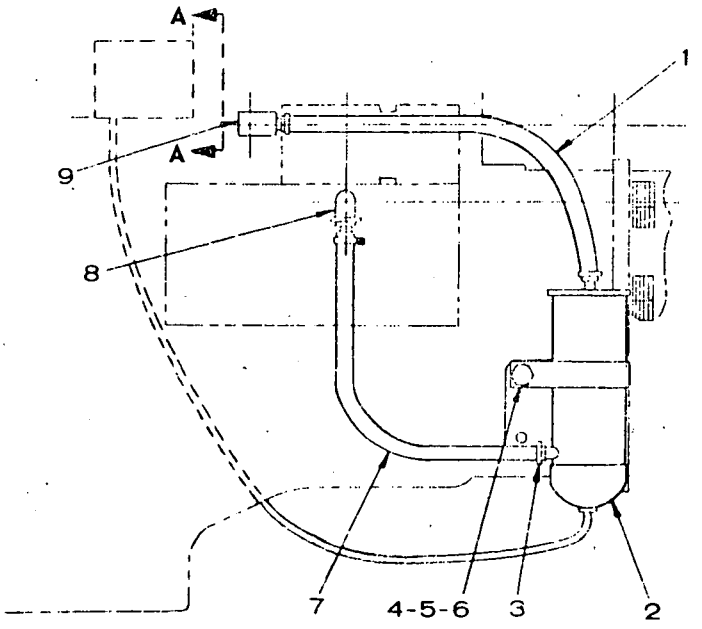
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1		1	Hose (Order 19" of Bulk Hose #503-0386)
2	333-0052	1	Heater, 1500 Watt
3	503-0183	4	Clamp, Hose
4	850-0060	1	Washer (1/2"), Lock
5	856-0013	1	Washer (1/2"), Shake-proof EIT
6	800-0088	1	Screw (1/2-13 x 3/4")
7		1	Hose (Order 15" of Bulk Hose #503-0386)
8	505-0011	1	Elbow (1/4"), Street
9	502-0054	1	Elbow, Street
10	508-0008	1	Grommet
11		2	Screw (Part of #14)
12	812-0076	2	Screw (#8-32)
13	850-0025	2	Washer (#8), Lock
14	309-0285	1	Thermostat
15	333-0013	1	Cover, Thermostat Mounting Box
16	520-0446	2	Stud (#10-32)
17	850-0030	2	Washer (#10), Lock
18	870-0053	2	Nut (#10-32)
19	332-0149	1	Terminal
20	333-0012	1	Box, Thermostat Mounting

179-2024

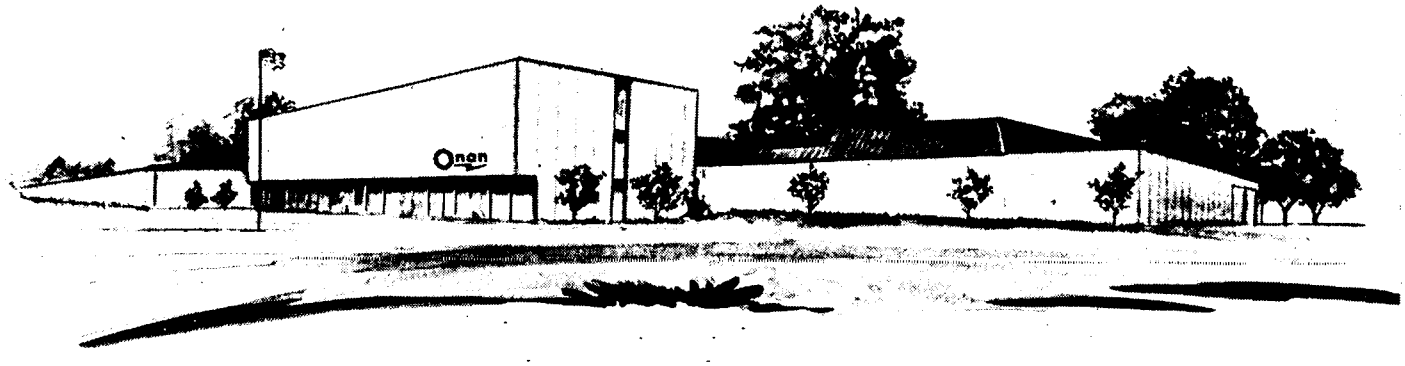
WATER JACKET HEATER INSTALLATION - 240 VOLT



DETAIL A-A



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1		1	Hose (Order 19" of Bulk Hose #503-0386)
2	333-0073	1	Heater, 2000 Watt
3	503-0183	4	Clamp, Hose
4	850-0060	1	Washer (1/2"), Lock
5	856-0013	1	Washer (1/2"), Shake-proof EIT
6	800-0088	1	Screw (1/2-13 x 3/4")
7		1	Hose (Order 15" of Bulk Hose #503-0386)
8	505-0011	1	Elbow (1/4"), Street
9	502-0054	1	Elbow, Street
10	508-0008	1	Grommet
11		2	Screw (Part of #14)
12	812-0076	2	Screw (#8-32)
13	850-0025	2	Washer (#8), Lock
14	309-0256	1	Thermostat
15	333-0056	1	Cover, Thermostat Mounting Box
16	332-0672	2	Stud (#10-32)
17	850-0030	2	Washer (#10), Lock
18	870-0053	2	Nut (#10-32)
19	332-0149	1	Terminal
20	333-0057	1	Box, Thermostat Mounting



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