Onan™

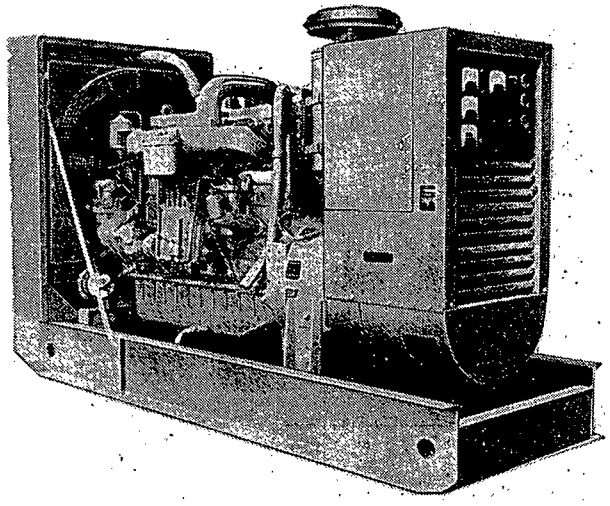
OPERATOR'S MANUAL AND PARTS CATALOG

FOR

DYG

SERIES

ELECTRIC GENERATING SETS



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SAFETY PRECAUTIONS

The following symbols in this manual signal potentially dangerous conditions to the operator or equipment. Read this manual carefully. Know when these conditions can exist. Then, take necessary steps to protect personnel as well as equipment.

ONAN recommends that you read your manual and become thoroughly acquainted with it and your equipment before you start your unit. These recommendations and the following safety precautions are for your protection.

Fuels, electrical equipment, batteries, exhaust gases and moving parts present potential hazards that could result in serious, personal injury. Take care in following these recommended procedures.

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

CAUTION **This symbol refers to possible equipment damage.**

General

- Keep your electric generating set and the surrounding area clean and free from obstructions. Remove any debris from set and 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 adjustment *must* be made while the unit is running, use extreme caution around hot manifolds, moving parts, etc.
- Do not work on this equipment when mentally or physically fatigued.
- Coolants under pressure have a higher boiling point than water. DO NOT open a radiator or heat exchanger pressure cap while the engine is running. Bleed the system pressure first.

Protect Against Moving Parts

- Keep your hands away from moving parts.
- Before starting work on the generating set, disconnect batteries. This will prevent starting the set accidentally.

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.
- 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.
- Be sure all fuel supplies have a positive shutoff valve.

Guard Against Electric Shock

- Remove electric power before removing protective shields or touching electrical equipment. Use rubber insulative mats placed on dry wood platforms over floors that are metal or concrete when around electrical equipment. Do not wear damp clothing (particularly wet shoes) or allow skin surfaces to be damp when handling electrical equipment.
- Use extreme caution when working on electrical components. High voltages cause injury or death. DON'T tamper with interlocks.
- Follow all state and local electrical codes. Have all electrical installations performed by a qualified licensed electrician. Tag open switches.
- DO NOT SMOKE while servicing batteries. Lead acid batteries emit a highly explosive hydrogen gas that can be ignited by electrical arcing or by smoking.

Exhaust Gases Are Toxic

- Provide an adequate exhaust system to properly expel discharged gases. Check exhaust system regularly for leaks. Ensure that exhaust manifolds are secure and not warped. Do not use exhaust gases to heat a compartment.
- Be sure the unit is well ventilated.

Keep the Unit and Surrounding Area Clean

- Make sure that oily rags are not left on or near the engine.
- Remove all oil deposits. Remove all unnecessary grease and oil from the unit. Accumulated grease and oil can cause overheating and subsequent engine damage and may present a potential fire hazard.

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UNLESS INDICATED, ALL SECTIONS WILL APPLY TO 150, 175 AND 200 kW SETS

WARNING

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

INTRODUCTION

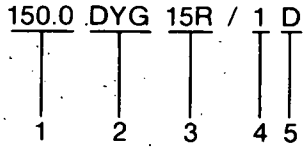
FOREWORD

This manual is applicable to the DYG Series electric generating set, driven by an Allis Chalmers, 17000 MK11 engine. The 150.0 and 175.0 kW set consists of a UR Series Generator, while the 200.0 kW set consists of a YB Series generator.

Information is provided on installation, operation, troubleshooting and parts ordering for the DYG set. The manual should be used in conjunction with the Allis-Chalmers engine manual, as your specific engine may have variations due to optional equipment available.

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 60 Hz 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 Allis-Chalmers nameplate is on the right side, on the engine block.

WARNING

ENGINE EXHAUST GAS (CARBON MONOXIDE) IS DEADLY!

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

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

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

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

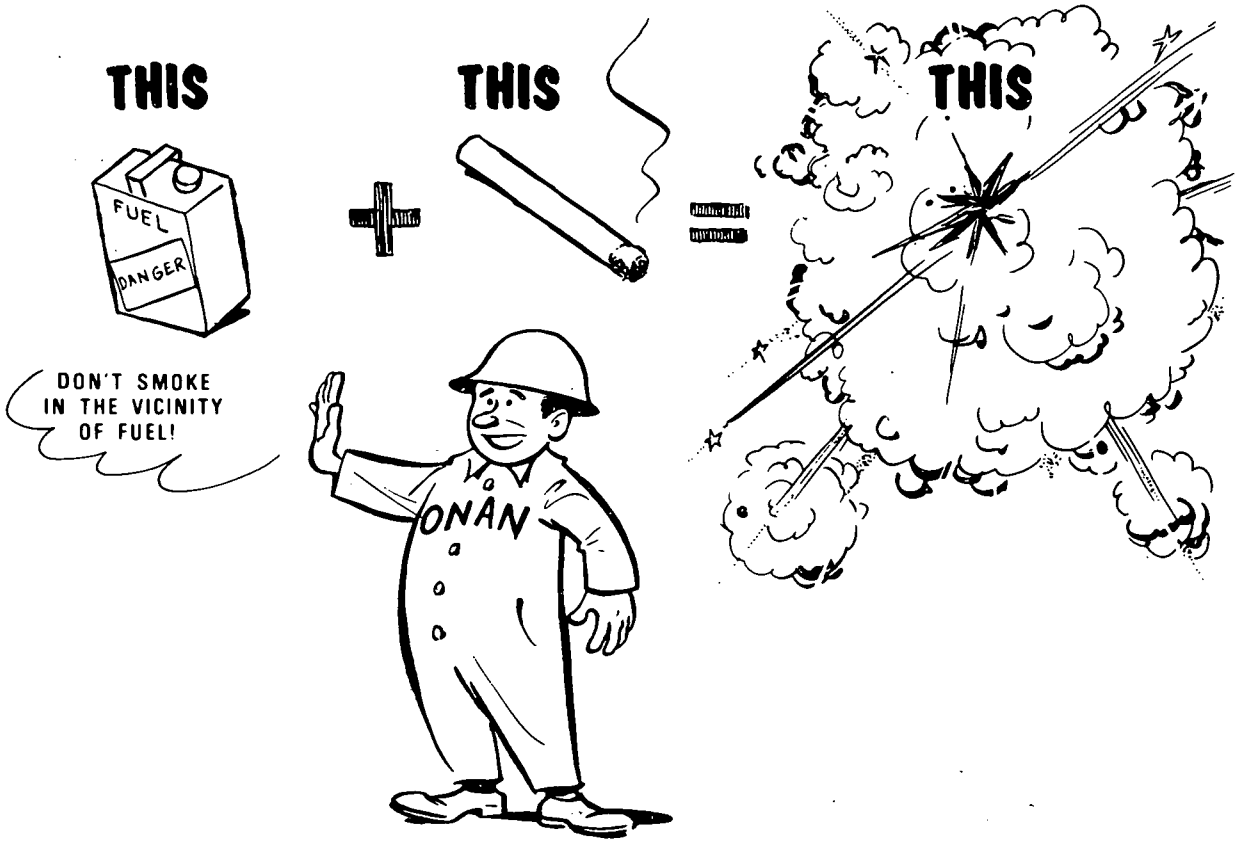
FLAMMABLE LIQUIDS

Carelessness is a deadly habit when handling electric generating sets.

The ingredients of an explosion are simple—a combustible mixture and a means of igniting it. Internal combustion engines operate on natural gas, manufactured gas, gasoline and diesel oil fuel. Liquid fuels alone will not burn. Air has to be mixed with the fuel so that it reaches what is called a "fumic state." Only then will a liquid fuel ignite. So it is good to remember that—

IF YOU CAN SMELL FUMES, YOU HAVE HALF THE INGREDIENTS FOR AN EXPLOSION.

With a combustible mixture, all that is needed is a way of igniting the fumes. There are many: faulty engine-ignition insulation, arcing relays or brushes, welding, dropping a steel wrench on a concrete floor, and of course a cigarette.



The following example is a very real possibility: A loose connection in a fuel line; or dirt in a solenoid valve allows fuel vapors to escape.

An operator smoking a cigarette is in the vicinity of the escaping fuel. Now, coal at the cigarette end has a temperature of 1000° F, and rises up to 1175° F (538° C to 635° C) when air is drawn through it. That coal is hot enough to ignite a fuel vapor mixture.

Could the explosion have been prevented? The answer is obviously "yes." This accident happened because a Planned Maintenance Program was either non-existent, or was not being followed. Most accidents happen because some individual does not follow the simple fundamental rules of safety.

MOST ACCIDENTS CAN BE PREVENTED!

SPECIFICATIONS

	150.0 Kilowatts	175.0 Kilowatts
ENGINE DETAILS		
Engine Manufacturer	Allis-Chalmers	
Engine Series	17000 MKII (Turbocharged)	
Number of Cylinders	6	
Displacement	844-inch^3 (13.8 lit)	
BHP @ 1800 RPM	276 (206 kW)	
Compression Ratio	15.1:1	
Bore	5.25-inches (133.35 mm)	
Stroke	6.50-inches (165.10 mm)	
Fuel	ASTM No 2 Diesel	
Battery Voltage	24 VDC	
Battery Group (Two 12-Volt, 225 A.H.)	8D	
Starting Method	Solenoid Shift	
Governor Regulation	5% Maximum	
Battery Charging Current	35 Amperes	
GENERATOR DETAILS		
Type	UR 15 60 Hz UR 515 50 Hz UR 9X 60 Hz	
Rating (Watts)		
60 Hertz Continuous Standby	150,000	175,000
50 Hertz Continuous Standby	125,000	145,000
AC Voltage Regulation	± 2%	
60 Hertz RPM	1800	
50 Hertz RPM	1500	
Output Rating	0.8 PF	
AC Frequency Regulation	3 Hz Max. No load—Full load	
CAPACITIES AND REQUIREMENTS		
Cooling System (Including Radiator)	16.5-Gallons (62.5 lit)	
Engine Oil Capacity (Filter, Lines, Crankcase)	45-Quarts (42.58 lit)	
Exhaust Connection (inches pipe thread)	6 (Female)	
AIR REQUIREMENTS (1800 RPM)		
Engine Combustion	640-ft^3 (18.13 m^3/min.)	690-ft^3 (19.54 m^3/min)
Radiator Cooled Engine	18,400-ft^3 (521 m^3/min)	
Total for Radiator Cooled Model	20,040-ft^3 (568 m^3/min)	20,090 ft^3 (569 m^3/min)
Alternator Cooling Air (1800 RPM)	1000-ft^3 (28.32 m^3/min)	
(1500 RPM)	833-ft^3 (23.6 m^3/min)	
Fuel Consumption at Rated Load		
ASTM No. 2 Diesel	11.5-GPH (43.5 lit/hr)	13.5-GPH (51.1 lit/hr)
GENERAL		
Height	66.00-inches (1.68 m)	
Width	44.00-inches (1.11 m)	
Length	120.00-inches (3.04 m)	
Weight (Approximate)	5820-lb (2653.5 kg)	6000-lb (2721 kg)

SPECIFICATIONS

200 kW

ENGINE DETAILS

Engine Manufacturer	Allis-Chalmers
Engine Series	17000 MKII (Turbocharged)
Number of Cylinders	6
Displacement	844-inch^3 (13.8 lit)
BHP @ 1800 RPM	310 (231.2 kW)
Compression Ratio	15.4:1
Bore	5.25-inches (133.35 mm)
Stroke	6.50-inches (165.10 mm)
Fuel	ASTM No 2 Diesel
Battery Voltage	24 VDC
Battery Group (Two 12-Volt, 225 A.h)	8D
Starting Method	Solenoid Shift
Governor Regulation	5% Maximum
Battery Charging Current	35 Amperes

GENERATOR DETAILS

Type	YB 17/1 (60 Hz) YB 517/1 (50 Hz)
Rating (Watts)	
60 Hertz Continuous Standby	200,000
50 Hertz Continuous Standby	153,000
AC Voltage Regulation	±2%
60 Hertz RPM	1800
50 Hertz RPM	1500
Output Rating	0.8 PF
AC Frequency Regulation	3 Hz Max. No load—Full load

CAPACITIES AND REQUIREMENTS

Cooling System (Including Radiator)	16.5-Gallons (62.5 lit)
Engine Oil Capacity (Filter, Lines, Crankcase)	15-Gallons (56.8 lit)
Exhaust Connection (inches pipe thread)	6 (Female)

AIR REQUIREMENTS (1800 RPM)

Engine Combustion	670-ft^3/min (18.76 m^3/min)
Radiator Cooled Engine	18,400-ft ^{3}/min (521 m ^{3}/min)
Total for Radiator Cooled Model	20,070-ft ^{3}/min (562 m^3/min)
Alternator Cooling Air (1800 RPM)	1000-ft ^{3}/min (28.32 m^3/min
(1500 RPM)	833-ft ^{3}/min (23.6 m^3/min.)
Fuel Consumption at Rated Load	
ASTM No. 2 Diesel	15.7-GPH (59.5 lit/hr.)

GENERAL

Height	70.00-inches (1778 mm)
Width	44.00-inches (44.00 mm)
Length	109.00-inches (2768 mm)
Weight (Approximate)	6200-lbs. (2814.8 kg)

150 & 175 kW

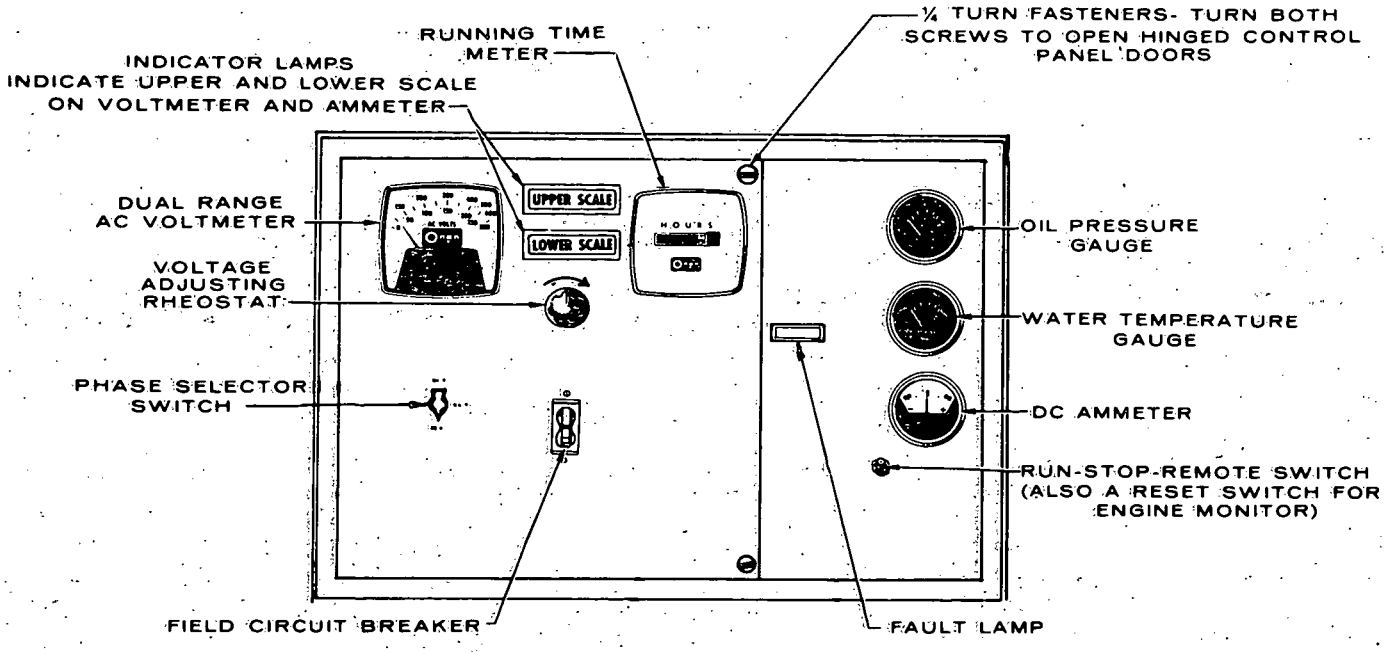


FIGURE 1. STANDARD CONTROL PANEL (ONE FAULT LAMP)

150 & 175 kW

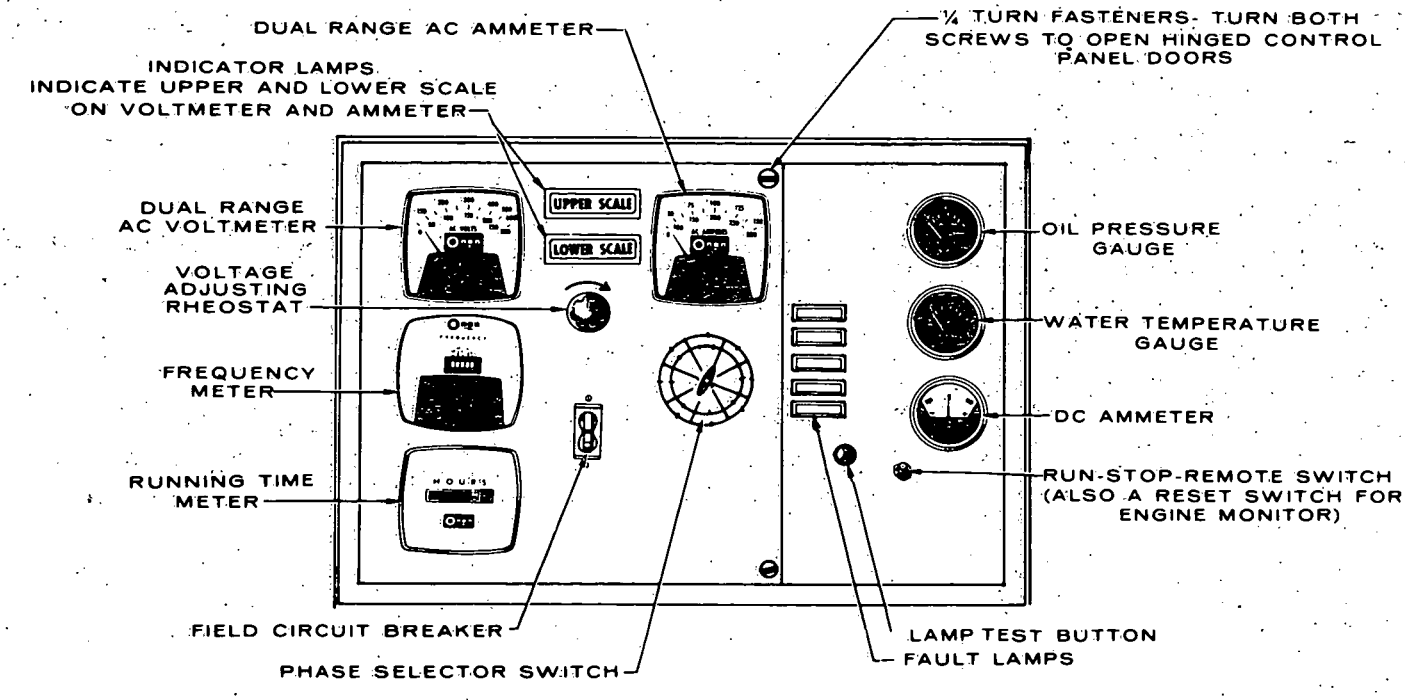


FIGURE 2. OPTIONAL CONTROL PANEL (FIVE FAULT LAMPS)

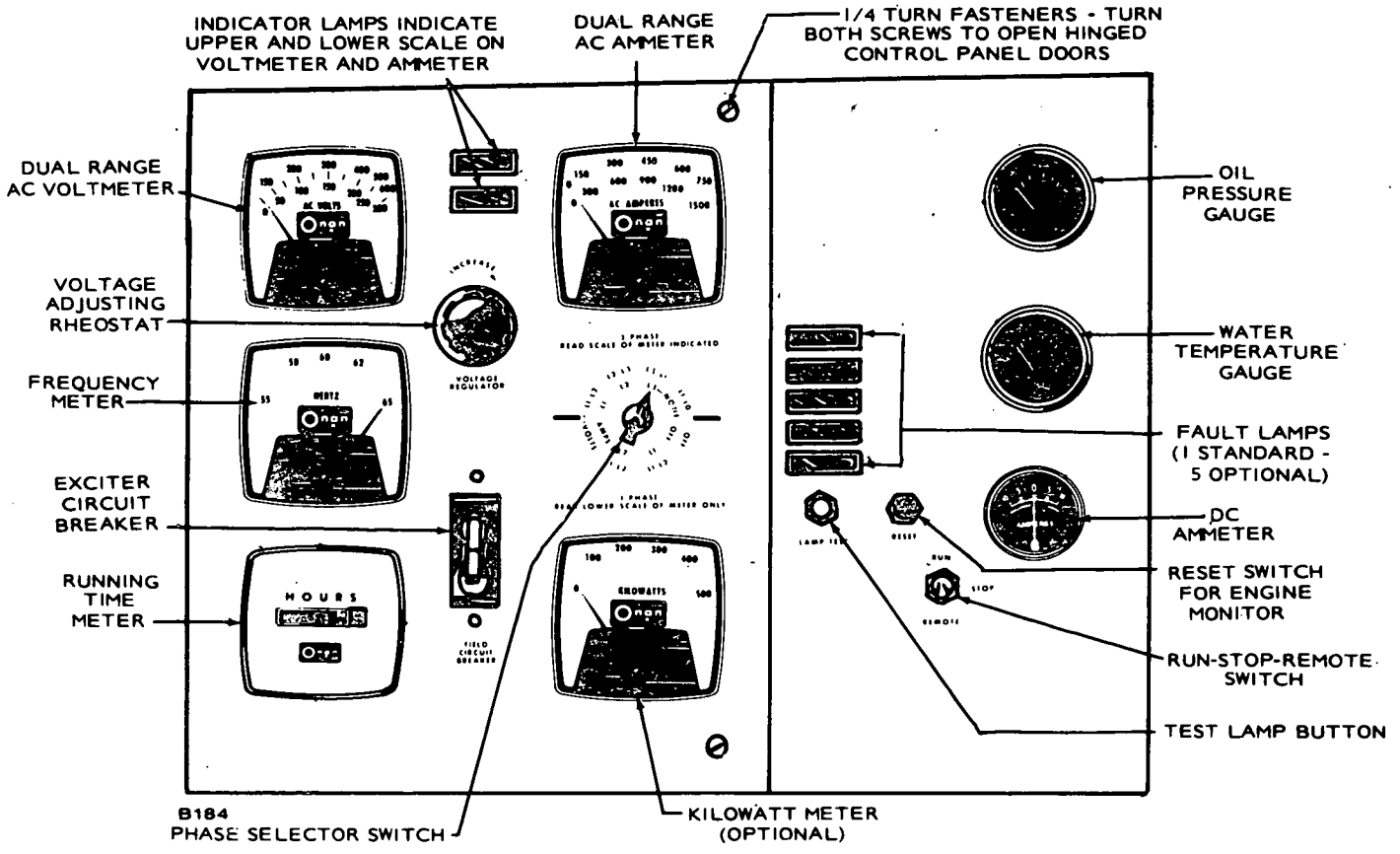


FIGURE 3. CONTROL PANEL

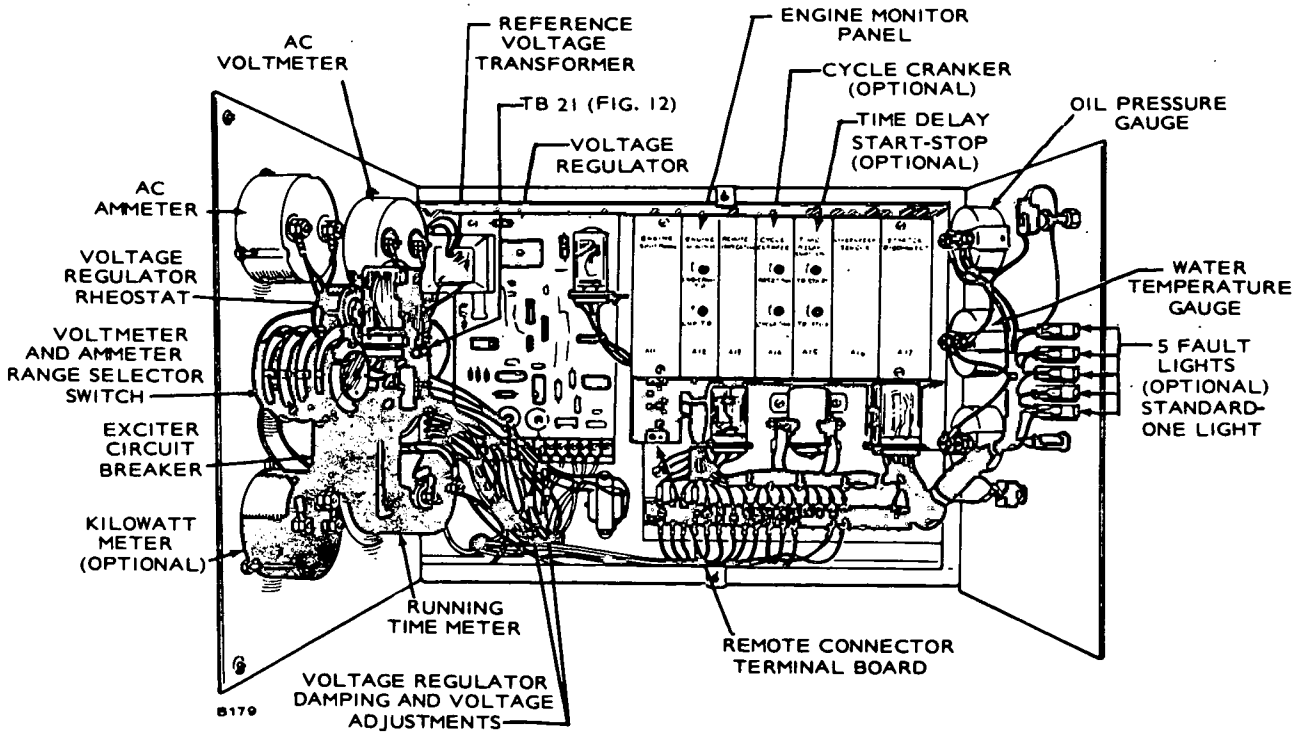


FIGURE 4. CONTROL PANEL INTERIOR

DESCRIPTION

GENERAL

An Onan DYG 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 DYG is an Allis-Chalmers 17000MK I I as described in the 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 Allis-Chalmers manual should be consulted.

AC GENERATOR

The generator is an Onan Type UR (150 & 175 kW) or YB (200 kW). It is a 12 lead, 4 pole revolving field, reconnectible brushless unit. 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, rectified and returned to the field of the exciter. Current induced in the exciter rotor is rectified and fed to the generator rotor. This induces a current in the generator stator which is applied to load. The 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 and 3.

DC Panel

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

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

Battery Charge Rate DC Ammeter: Indicates battery charging current.

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

Warning 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.

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

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

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

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

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

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

OPTIONAL EQUIPMENT

DC Panel

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

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

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

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 16.

Voltage Regulator

Solid state unit, consisting of printed circuit board VR21; an SCR bridge CR21, with a commutating reactor L21 are located in the control panel as part of the voltage regulator system. AC output from generator is controlled at predetermined level regardless of load; regulation is plus or minus 2 percent from no load to full load, at 0.8 PF.

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. Low oil pressure 14 psi (96.5 kPa).
   c. High engine temperature 215° F (102° C).

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

On standard control panels, all four alarms are wired into one common fault lamp; on units with five fault lamps, four have shutdown alarms, the fifth (low engine temperature) lights a fault lamp only. Refer to Table 3.

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. The ON and OFF cycle times are nominal and can be adjusted at potentiometers on the cranker module board.

Pre-Alarm

Gives advance warning for low oil pressure or high engine temperature. Requires two sensors each for engine temperature and oil pressure.

TABLE 1. 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			

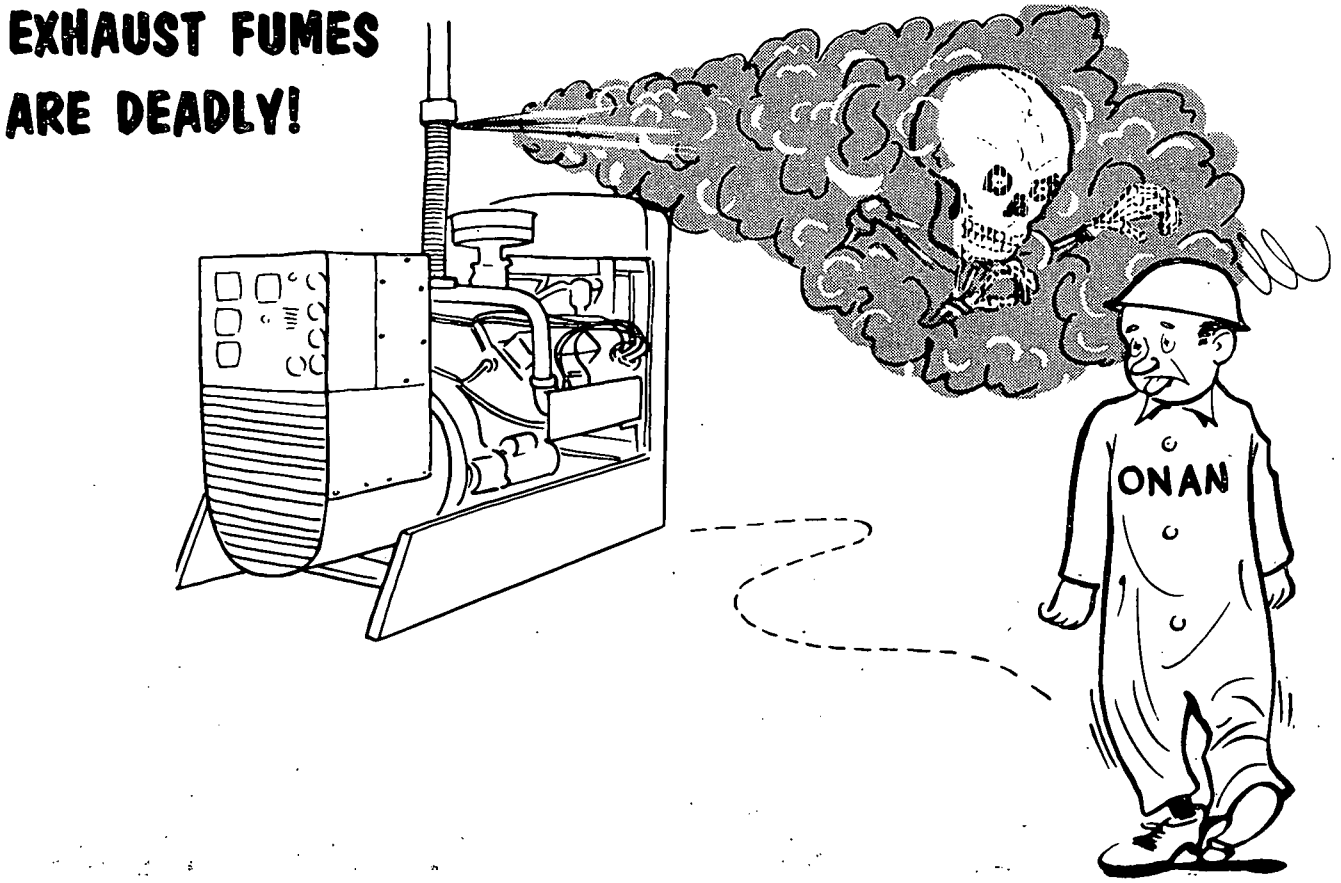
* - With additional optional sensors.

EXHAUST SYSTEM

Exhaust fumes are noxious. Inhalation can cause death.

Carbon monoxide (CO) is an odorless, colorless gas formed by incomplete combustion of hydrocarbon fuels. Design and installation of an exhaust system is important for two reasons: one is fume evacuation; the other reason is the high temperatures the materials must withstand. The gauge or size of materials used is determined by the maximum allowable back pressure, and length of the exhaust system. In cases where an engine is exhausted through the roof of a building, it may be necessary to use an exhaust booster fan to aid fume evacuation, and keep back pressure within specified limits. The pipe attached to the exhaust manifold should be flexible enough to compensate for thermal expansion, contraction. It should also be able to absorb vibrations. This is extremely important on turbo-charged units where a rigid piece of exhaust pipe could impart enough stress and weight to severely damage both turbo-charger and housing.

Where pipe is joined, make sure the joint welds are leak-free. Exhaust ducting which is run along a combustible wall should be far enough from the wall to prevent heat or fire damage. Where pipe is run through a wall, a thimble should be installed which will adjust for thermal movement and also prevent exhaust heat from damaging the wall. Sharp bends should be avoided, but where this is not possible, a condensation trap should be installed. Drain this trap frequently. Do not terminate an exhaust pipe in the vicinity of ventilating air inlet duct or venturi, otherwise exhaust gases will be pulled back into the building.



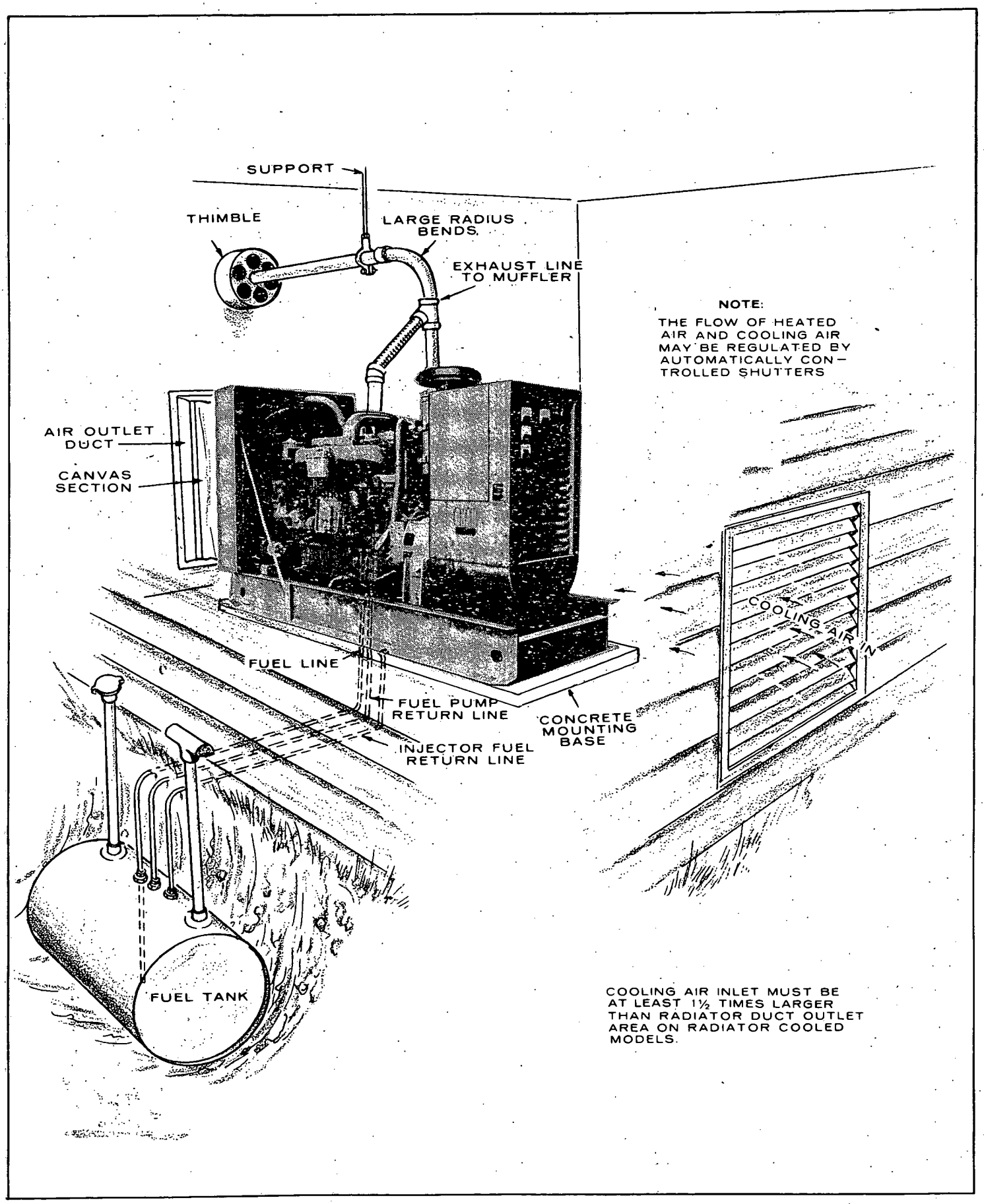


FIGURE 5. A TYPICAL STANDBY INSTALLATION

INSTALLATION

GENERAL

Installations must be considered individually. Use these instructions as a general guide. Meet regulations of local building codes, fire ordinances, etc., which may affect installation details. See Figure 5.

Installation points to consider include:

1. Level mounting surface.
2. Adequate cooling air.
3. Adequate fresh induction air.
4. Discharge of 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 [150 mm] 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 6 and 7.

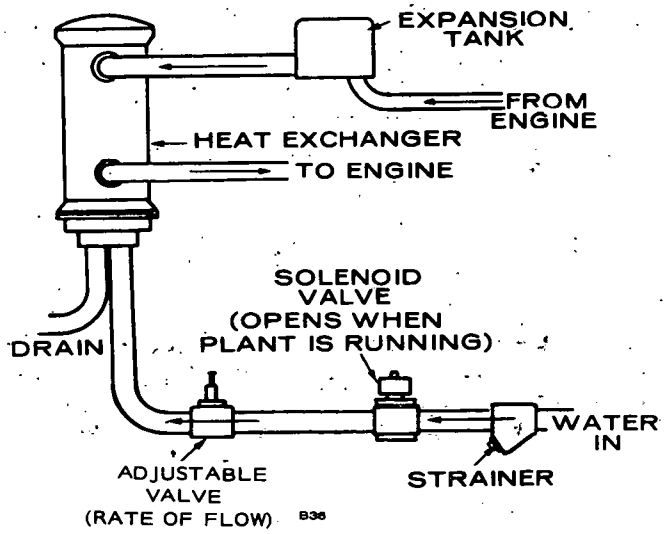


FIGURE 6. TYPICAL HEAT EXCHANGER SYSTEM

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.

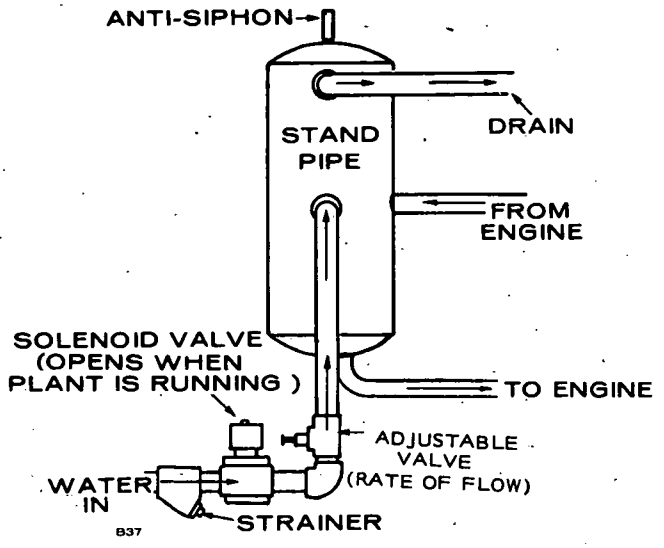


FIGURE 7. TYPICAL STANDPIPE SYSTEM

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 (73.9° C and 90.6° C) while viewing the water temperature gauge.

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

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.

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 8) must be used where exhaust pipes pass through walls or partitions. Pitch exhaust pipes downward or install a condensation trap (Figure 9) at the point where a rise in the exhaust system begins. Avoid sharp bends; use sweeping long radius elbows. Provide adequate support for mufflers and exhaust pipes. Refer to Figure 5 for a typical exhaust installation. Shield or insulate exhaust lines if there is danger of personal contact. Allow at least 9-inches (230 mm) of clearance if the pipes run close to a combustible wall or partition. Use a pipe at least as large as the 6-inch (152 mm) pipe size outlet of the engine with a flexible portion between the engine and the muffler.

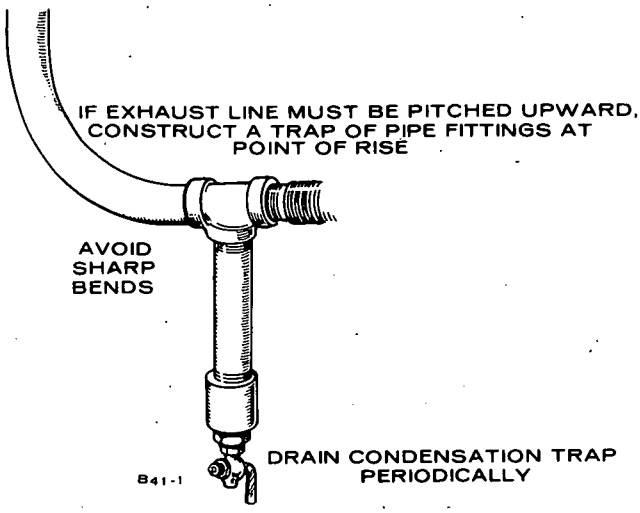


FIGURE 9. EXHAUST CONDENSATION TRAP

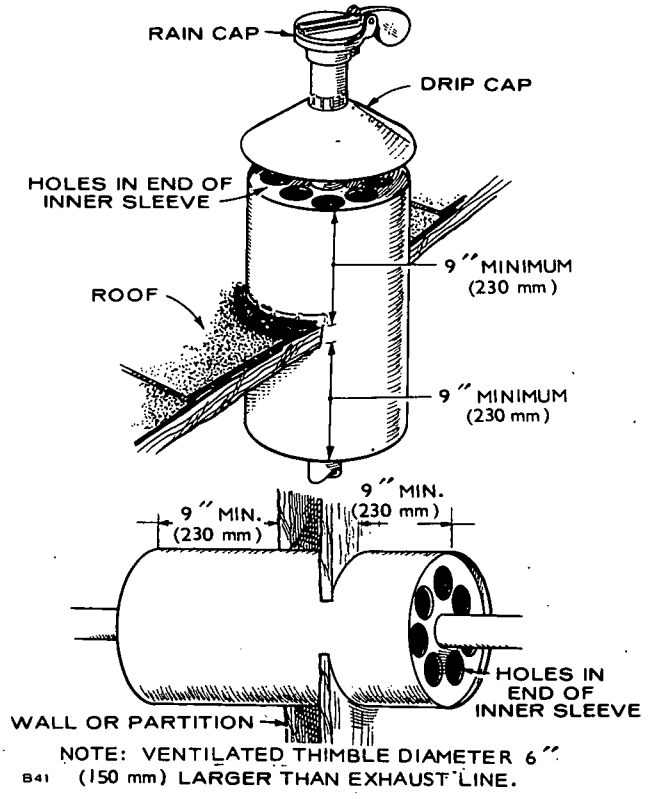


FIGURE 8. EXHAUST THIMBLE

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

Single Exhaust system:

5-inch (127 mm) pipe ..... 50 feet (15 m)
6-inch (152.4 mm) pipe ..... 150 feet (46 m)
8-inch (203.2 mm) pipe ..... 500 feet (152 m)

Maximum permissible exhaust restriction (back pressure) is 2-inches Hg. (6754 N/m²).

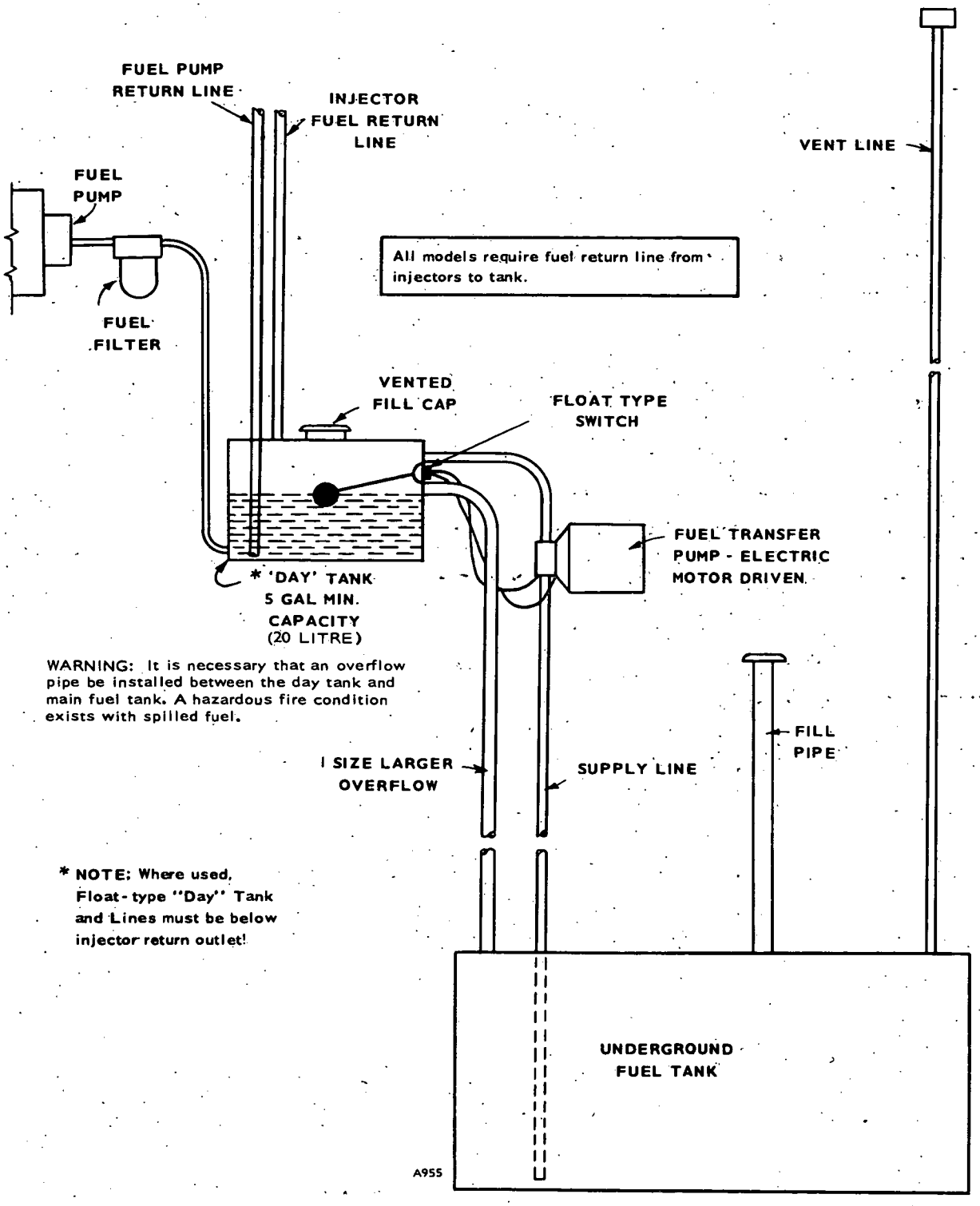


FIGURE 10. DAY TANK INSTALLATION

FUEL SYSTEM

Allis-Chalmers engines used on the DYG sets are designed for use with ASTM No. 2 Diesel fuel. They will however, operate on diesel fuels within the specifications delineated in the Allis-Chalmers 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 8 feet (2.44 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 (7.6 m). However, a day tank is again recommended.

The fuel inlet is to the transfer pump and is threaded for 3/8-inch pipe. Injectors' return line requires a 1/4-inch low pressure hose connection.

DAY TANK

Generator set installations may be equipped with an optional separate fuel day tank. A float operated valve controls fuel flow into the fuel tank. The correct level is maintained to assure a constant source of fuel. It is necessary to install an overflow line between the day tank and the main fuel tank. Refer to the installations included with the tank. See Figure 10 for an example of a day tank installation.

BATTERY

Starting the unit requires 24-volt battery current. Use two 12-volt (see *Specifications*) batteries for a normal installation. Connect the batteries in series (negative post of first battery to positive post of second) as in Figure 11. Necessary battery cables are on unit. Service the batteries as necessary. Infrequent unit use (as in emergency standby service) may allow the batteries to self-discharge to the point where they cannot start the unit. If installing an automatic transfer switch that has no built-in charge circuit, connect a separate trickle charger. Onan automatic transfer switches include such a battery charging circuit.

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

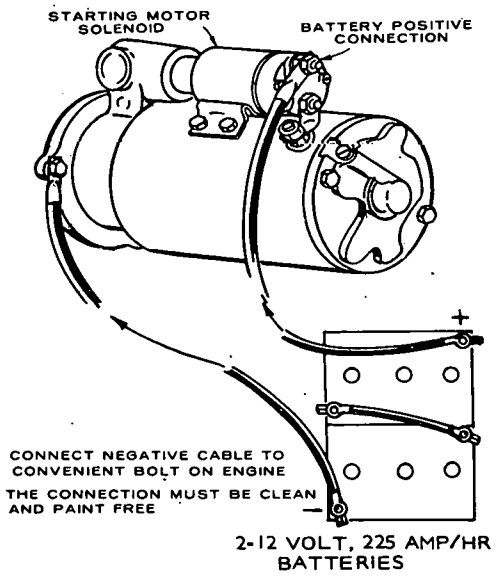


FIGURE 11. BATTERY CONNECTION

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 lengthen battery life, dilute the electrolyte from its normal 1.275 specific gravity reading at full charge to a 1.225 reading. The cranking power is reduced slightly when the electrolyte is so diluted, but if the temperature is above 90° F (32.2° C), this should not be noticed. The lengthened battery life will be worth the effort.

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

ELECTRICAL
150 kW AND 175 kW

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 12. If the distance between the set and remote station is less than 1000-feet (305 m), use No. 18 AWG wire; between 1000- and 2000-feet (305 m and 610 m), use No. 16 AWG wire.

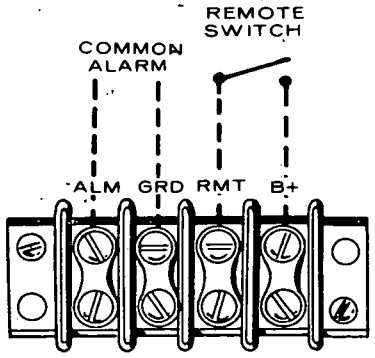
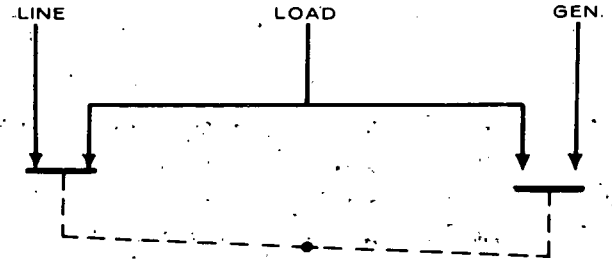


FIGURE 12. REMOTE STARTING

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 13. LOAD TRANSFER SWITCH

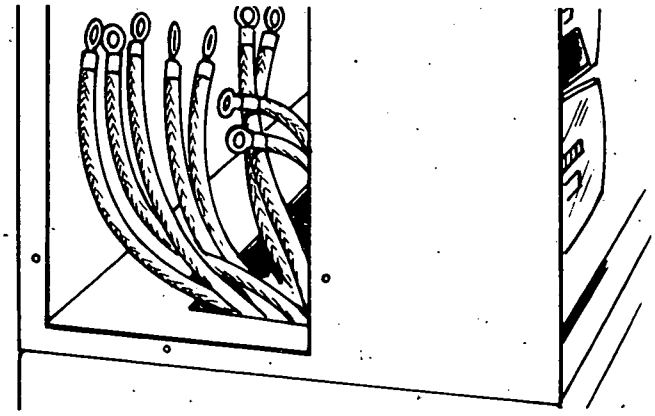


FIGURE 14. CONTROL BOX (SIDE PANEL REMOVED)

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.

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 14.
2. Connect wires together as shown on panel and in Figure 15 according to voltage desired.

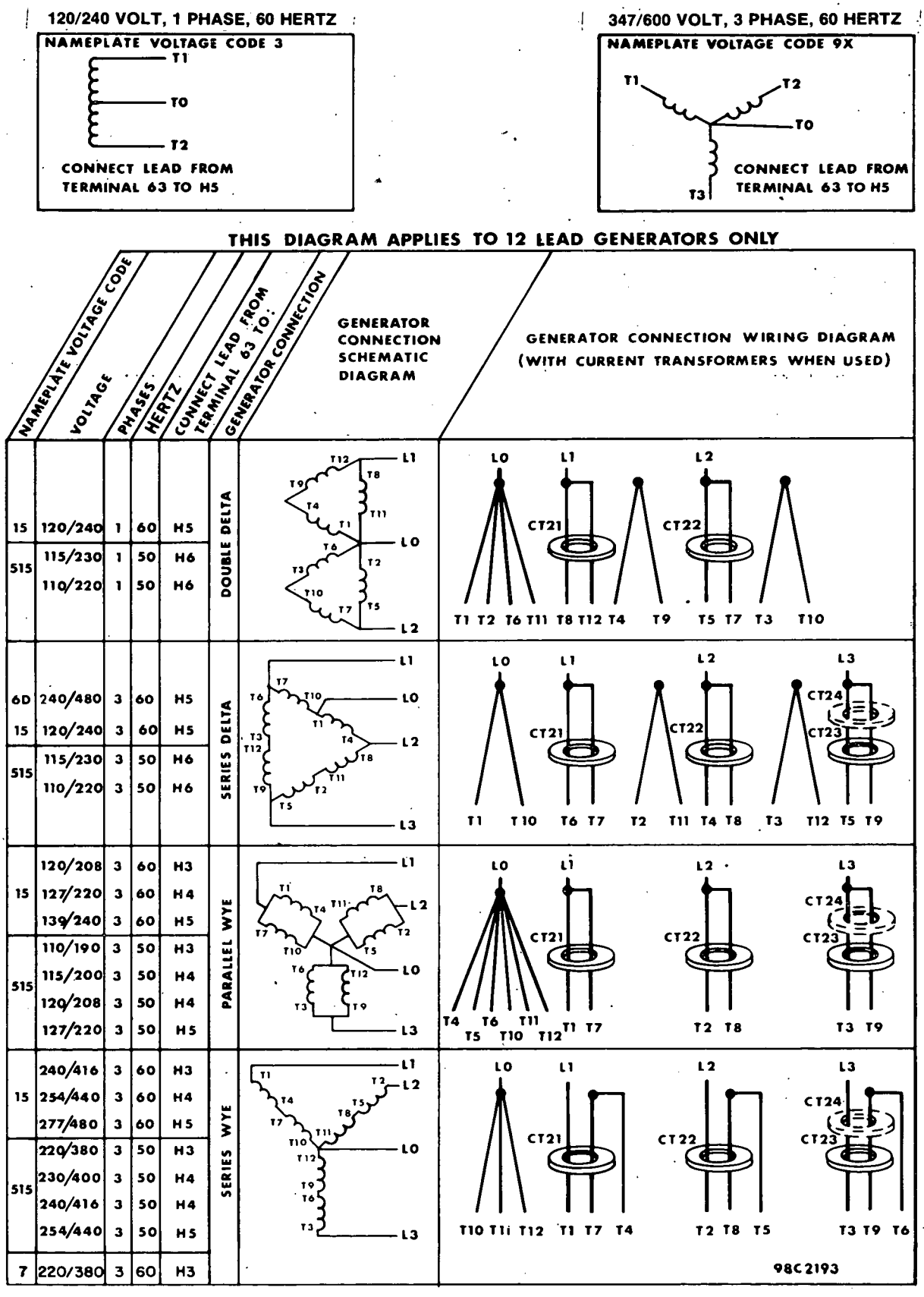


FIGURE 15. VOLTAGE CONNECTIONS

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 16.
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); this connection is made at the factory. The installer must only connect load wires.

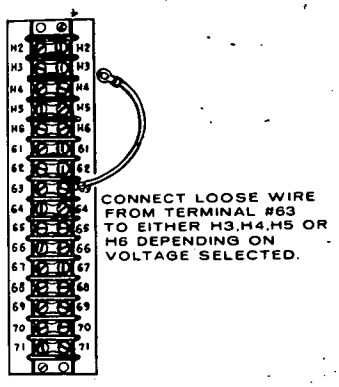


FIGURE 16. CONNECTING LEAD FROM TERMINAL 63

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 17. 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.

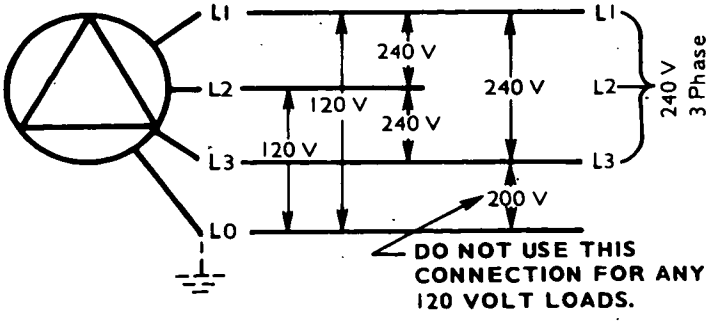


FIGURE 17. 3 PHASE, DELTA CONNECTION, 12 LEAD

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 1/3 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 18 shows load connections for 120/208 voltage. Other voltages are available from either parallel wye or series wye illustration in Figure 15.

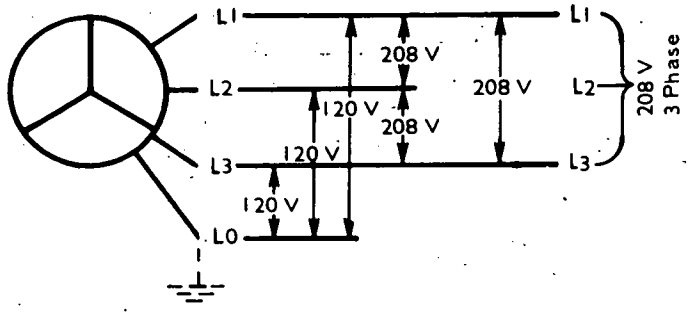


FIGURE 18. 3 PHASE, WYE CONNECTION, 12 LEAD

TABLE 2.
UR GENERATOR VOLTAGE OPTIONS

150.0 kW 187.5 kVA 60 Hz
125.0 kW 156.25 kVA 50 Hz

VOLTS	FREQ	PHASE	AMPERES	SERIES DELTA	PARALLEL WYE	SERIES WYE	REF. VOLTAGE WIRE (W12) TAP
120/240	60 Hz	3	451	x			H5
115/230	50 Hz	3	393	x			H6
120/208	60 Hz	3	520		x		H3
127/220	60 Hz	3	492		x		H4
139/240	60 Hz	3	451		x		H5
110/190	50 Hz	3	475		x		H3
115/200	50 Hz	3	452		x		H4
240/416	60 Hz	3	260			x	H3
254/440	60 Hz	3	246			x	H4
277/480	60 Hz	3	225			x	H5
220/380	50 Hz	3	238			x	H3
230/400	50 Hz	3	226			x	H4
9X 347/600	60 Hz	3	180				H3 Not Reconnectible

TABLE 2A.
UR GENERATOR VOLTAGE OPTIONS

175.0 kW 218.75 kVA 60 Hz
145.0 kW 181.25 kVA 50 Hz

VOLTS	FREQ	PHASE	AMPERES	SERIES DELTA	PARALLEL WYE	SERIES WYE	REF. VOLTAGE WIRE (W12) TAP
120/240	60 Hz	3	527	x			H5
115/230	50 Hz	3	455	x			H6
120/208	60 Hz	3	608		x		H3
127/220	60 Hz	3	575		x		H4
139/240	60 Hz	3	527		x		H5
110/190	50 Hz	3	551		x		H3
115/200	50 Hz	3	523		x		H4
240/416	60 Hz	3	304			x	H3
254/440	60 Hz	3	287			x	H4
277/480	60 Hz	3	263			x	H5
220/380	50 Hz	3	275			x	H3
230/400	50 Hz	3	262			x	H4
9X 347/600	60 Hz	3	211				H3 Not Reconnectible

ELECTRICAL

200 kW

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 19. 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.

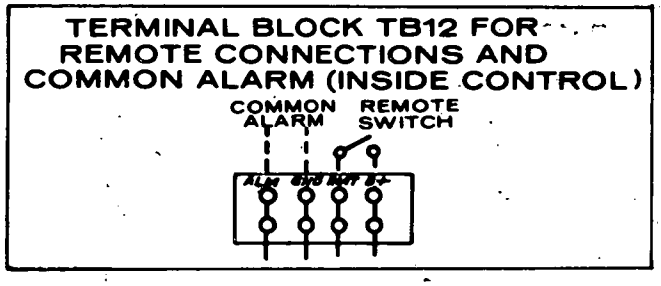


FIGURE 19. REMOTE STARTING

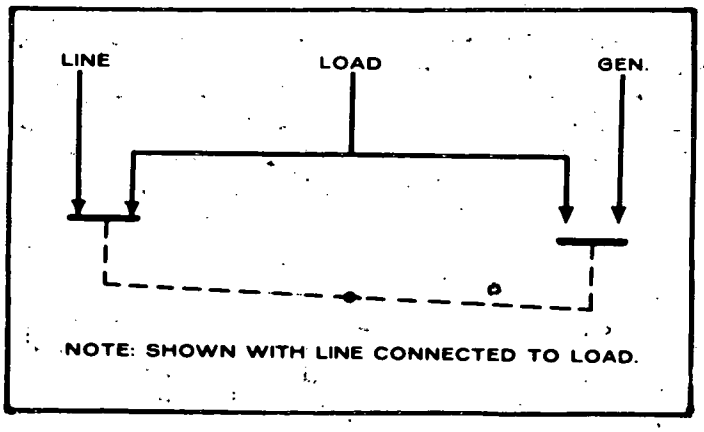


FIGURE 20. LOAD TRANSFER SWITCH

CONTROL BOX CONNECTION

Reconnection lead W12 on TB21 is a jumper which connects a single phase output from the generator to the appropriate tap on the voltage reference transformer. This lead is connected at one end to terminal 63 on the terminal board. The other end will be connected to a terminal marked H3, H4 or H5 depending upon the voltage option required. Refer to Table 3 and Figure 22 for voltages available and correct hookup.

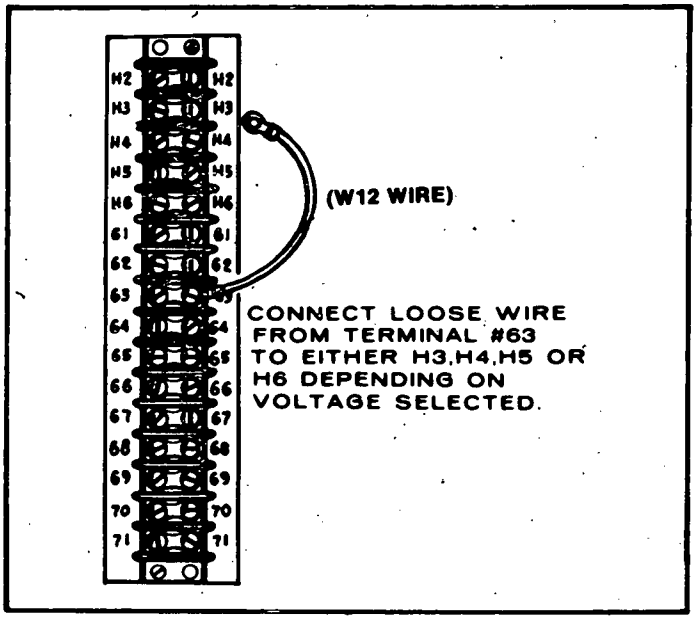


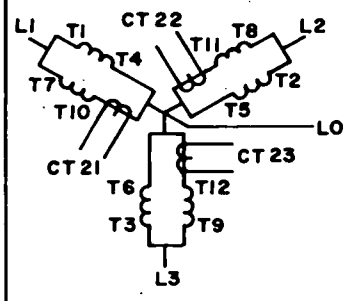
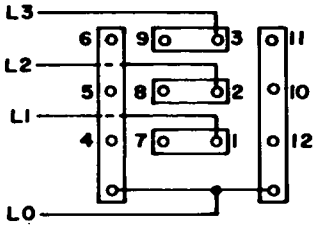
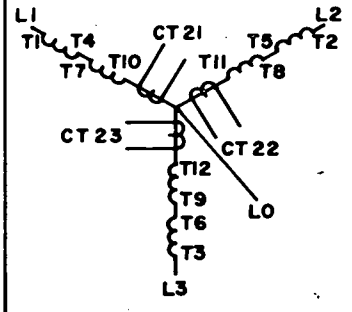
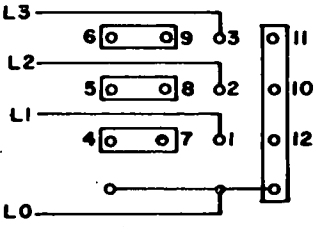
FIGURE 21. CONTROL BOX CONNECTION

WIRING CONNECTIONS

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

If the installation is for standby service, a double throw transfer switch (Figure 20) must always be used. Connect this switch (either automatic or manual) so that it is impossible for commercial power and generator power to be connected to the load at the same time. Instructions for connecting an automatic transfer switch are included with such equipment.

200 kW

NAMEPLATE VOLTAGE CODE	VOLTAGE	PHASE	FREQUENCY	CONNECT LEADS FROM TERMINAL 63 TO:	GENERATOR CONNECTION	GENERATOR CONNECTION SCHEMATIC DIAGRAM	GENERATOR CONNECTION WIRING DIAGRAM
17	120/208	3	60	H3	PARALLEL WYE		
	127/220	3	60	H4			
	139/240	3	60	H5			
517	110/190	3	50	H3			
	115/200	3	50	H4			
	120/208	3	50	H4			
	127/220	3	50	H5			
7	220/380	3	60	H3	SERIES WYE		7 NOT RECONNECTABLE 
17	240/416	3	60	H3			
	254/440	3	60	H4			
	277/480	3	60	H5			
517	220/380	3	50	H3			
	230/400	3	50	H4			
	240/416	3	50	H4			
	254/440	3	50	H5			

SINGLE PHASE —— NOT AVAILABLE

YB SERIES GENERATORS 98-2579(C)

FIGURE 22. VOLTAGE CONNECTIONS

GENERATOR CONNECTIONS

The model YB17 generator is a 3-phase 60-Hertz (or 50-Hertz) set which can be connected in either series wye or parallel wye configuration to give the line to neutral and line to line voltage options referred to in Table 1 and Figure 22. The line to neutral voltage is the lower voltage noted on the unit nameplate, while the line to line voltage is the higher nameplate rating. Refer to Figure 23 for an example of 120/208 voltage.

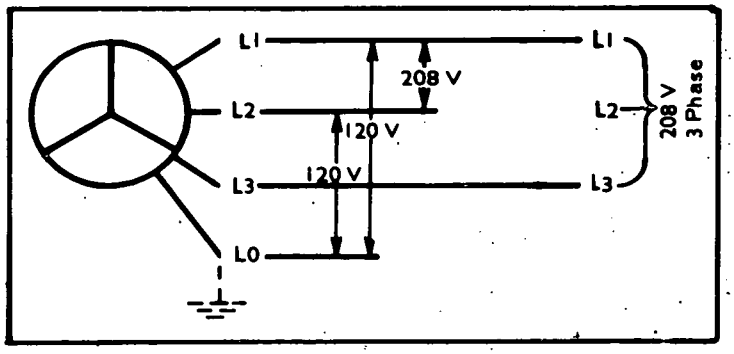


FIGURE 23. 3 PHASE WYE CONNECTION

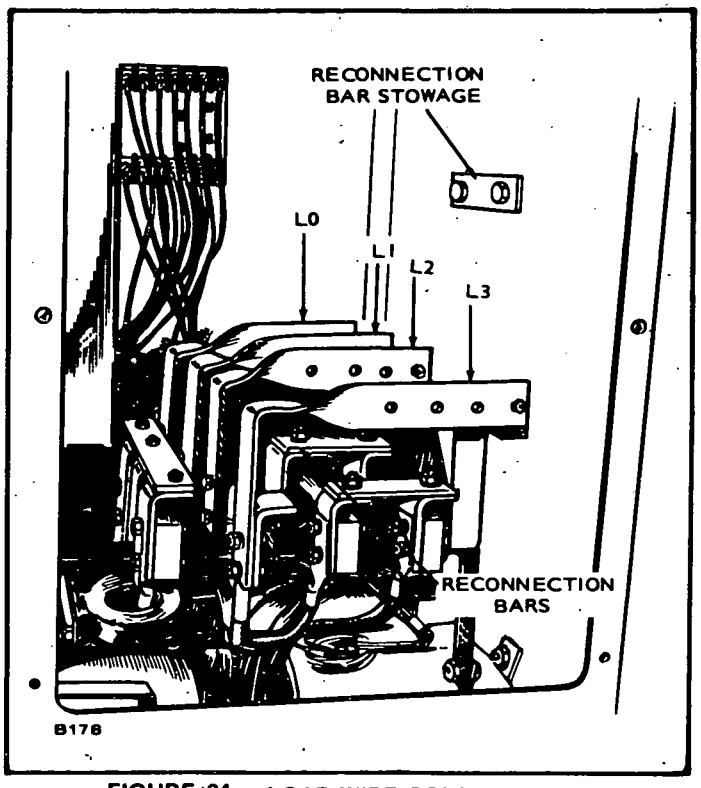


FIGURE 24. LOAD WIRE CONNECTIONS

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

For 3-phase loads connect separate load wires to each of the set terminals L1, L2 and L3 (Figure 22). For a large single phase load only, connect between terminals L1 and L2. Available capacity is 2/3 maximum output.

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

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

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

200 kW

TABLE 3. GENERATOR VOLTAGE OPTIONS

200.0 kW **60 HZ**
153.0 kW **50 HZ**

VOLTAGE	PHASE	FREQUENCY	MAXIMUM CURRENT	PARALLEL WYE	SERIES WYE	CONNECT WIRE W12
(YB17)						
120/208	3	60 Hz	694 **AMPS**	x		H3
127/220	3	60 Hz	656 AMPS	x		H4
139/240	3	60 Hz	600 AMPS	x		H5
240/416	3	60 Hz	347 AMPS		x	H3
254/440	3	60 Hz	328 AMPS		x	H4
277/480	3	60 Hz	300 AMPS		x	H5
(YB517)						
110/190	3	50 Hz	616 AMPS	x		H3
115/200	3	50 Hz	598 AMPS	x		H4
120/208	3	50 Hz	573 AMPS	x		H4
127/220	3	50 Hz	543 AMPS	x		H5
220/380	3	50 Hz	313 AMPS		x	H3
230/400	3	50 Hz	294 AMPS		x	H4
240/416	3	50 Hz	287 AMPS		x	H4
254/440	3	50 Hz	272 AMPS		x	H5

OPERATION

GENERAL

Onan DYG 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. For all operating conditions grade CD lubricating oil is recommended for turbocharged engines. Do not mix brands nor grades of lubricating oils.

Oil Viscosity should be as follows:

AMBIENT TEMPERATURE	USE SAE VISCOSITY
0° F (-17.8° C) and below	10W
0° F to 32° F (-17.8° C) 0° C	20-20W
Above 32° F (0° C)	30W

Oil Capacities (nominal)

Oil Pan and Filter—45-quarts (42.58 lit)

(200 kW) 60-quarts (56.8 lit.)

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

Turbocharger: Remove oil inlet of center housing and pour .089 quarts (.085 lit) to .127 quarts (.120 lit) into the turbocharger housing. Fill oil inlet line with engine lubricating oil before reconnecting. Do this prior to initial start, and before starting if the engine has not been run for 30 days or more.

Cooling System: Cooling system was drained prior to shipment. Fill cooling system before starting. Nominal capacity is 16.5-gallons (62.5 lit). 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 Allis-Chalmers engine manual for additional information.

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

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.

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

Fuel System: Refer to the Allis-Chalmers 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.**

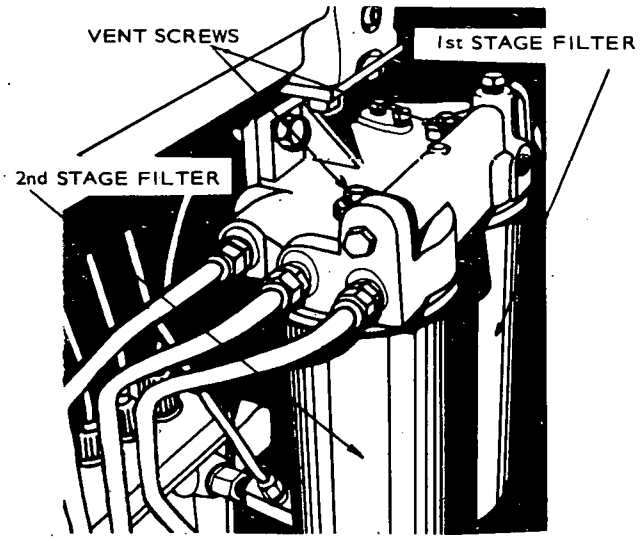


FIGURE 25. FUEL FILTERS

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

1. Loosen 2nd stage filter vent screw (Figure 25).
2. Using hand pump (Figure 26), prime system until fuel flow around filter vent screw is free of bubbles.
3. Secure vent screw and hand pump.

To bleed fuel injection pump sump refer to Figure 26. Disconnect fuel line from overflow valve and actuate hand primer. Continue pumping until fuel flow from valve is free of bubbles. Reconnect fuel line to overflow valve.

Ensure that hand primer pump is screwed in and secured before attempting to start engine.

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.

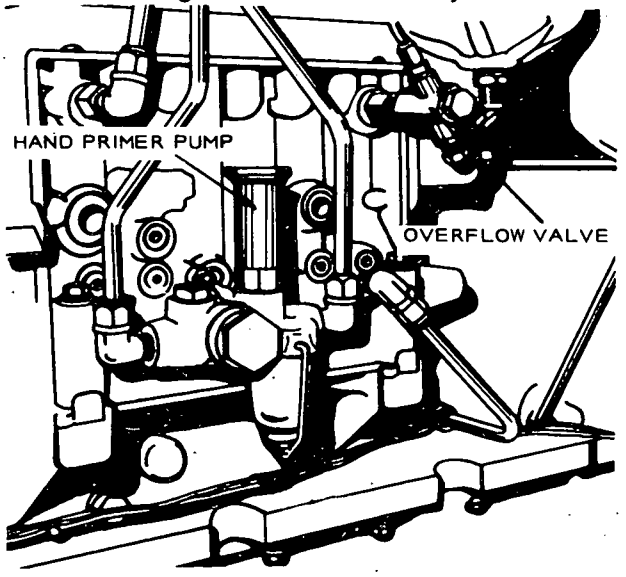


FIGURE 26. FUEL INJECTION SYSTEM

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 80F (26C). 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 30 and 55 psi (207- and 379. 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° - 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 200° F (82.2° - to 93.3° C).

STOPPING

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

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 4 or Table 5.

TABLE 4.
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 5.
TROUBLESHOOTING ENGINE SHUTDOWN
(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.

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

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

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. Liquid cooled units. 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% of rated capacity.
9. Check all gauges to be reading correctly. Unit is ready for service.

HIGH ALTITUDE

Ratings apply to altitudes up to 1000-feet (305 m), 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 (305 m) of altitude above sea level. Use lower power requirement at high altitudes to prevent smoke, over-fueling 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 Allis-Chalmers 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.

GENERAL MAINTENANCE

GENERAL

Follow a definite schedule of inspection and servicing, based on operating hours (Table 6). Keep an accurate logbook of maintenance, servicing, and operating time. Use the running time meter (optional equipment) to keep a record of operation and servicing. Service periods outlined below are recommended for normal service and operating conditions. For continuous duty, extreme temperature, etc., service more frequently. For infrequent use, light duty, etc., service periods can be lengthened accordingly. Refer to Allis-Chalmers engine manual for details of engine service and maintenance procedures.

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

ENGINE SPEED

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

A Woodward SG governor is standard equipment on the DYG 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. Refer to Figure 27.

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 Hz sets and 1500 rpm for 50 Hz sets.

Engine crankcase oil flows through the governor. Dirty oil can degrade governor operation.

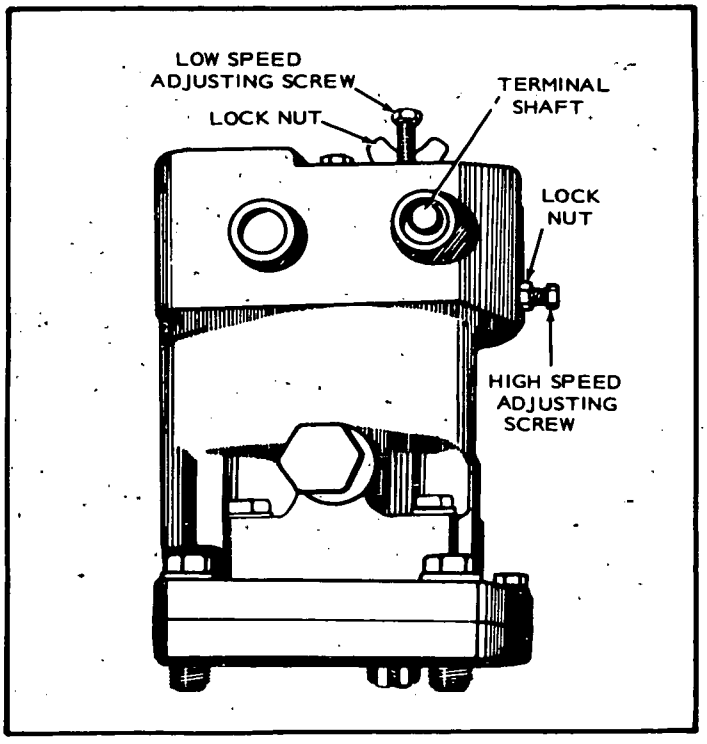


FIGURE 27. WOODWARD GOVERNOR

DUST AND DIRT

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

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. (3.4 N•m) 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 the electrolyte at the proper level above the plates by adding distilled water. Check specific gravity, recharge if below 1.280.

CONNECTIONS (Fuel, Exhaust, etc.)

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

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

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

TABLE 6. OPERATOR MAINTENANCE SCHEDULE

MAINTENANCE ITEMS	OPERATIONAL HOURS			
	8	50	100	200-250
Inspect Plant	x5			
Check Radiator Coolant	x			
Check Oil Level	x4			
Check Air Cleaner (Clean if Required)		x1		
Clean and Inspect Crankcase Breather			x	
Inspect Fan Belt			x2	
Check Cooling System			x3	
Clean and Inspect Battery Charging Alternator				x
Change Crankcase Oil			x1	
Replace Oil Filter Element			x1	
Check Batteries		x		

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

x2 - Or every 3 months, adjust to 1/2-inch (12 mm) depression between pulleys.

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

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

x5 - Check Exhaust

NOTE: The above schedule is a minimum requirement. For the recommended service periods for your engine, refer to Topic 8 of the Allis-Chalmers engine manual.

PARTS CATALOG

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

SET DATA TABLE

MODEL AND SPEC NO.	ELECTRICAL DATA					KEY
	WATTS	VOLTS	HERTZ	WIRE	PHASE	
125.0DYG-515R/*	125,000	£	50	12	1 or 3	
145.0DYG-515R/*	145,000	£	50	12	1 or 3	2
150.0DYG-9XR/*	150,000	347/600	60	4	3	3
150.0DYG-15R/*	150,000	£	60	12	1 or 3	4
175.0DYG-9XR/*	175,000	347/600	60	4	3	5
175.0DYG-15R/*	175,000	£	60	12	1 or 3	6
153.0DYG-517R/*	153,000	£	50	12	3	7
200.0DYG-17R/*	200,000	£	60	12	3	8

* - The Specification Letter advances (A to B, B to C, ... Z to AA, etc.) with manufacturing changes.
£ - These sets are reconnectible; refer to Specifications (Generator Details) for Electrical Data.
NOTE: Hertz is a unit of frequency equal to one cycle per second.

REPLACEMENT ENGINE

100-0987	1	Engine, Replacement (Allis-Chalmers Model 17000) Keys 1,2,3,4,5,6
100-1447	1	Engine, Replacement (Allis-Chalmers Model 17000, Spec 4395205) - Keys 7,8

General Description:

Includes—Complete Cylinder Block, Fuel Pump, Fuel Filter, Oil Filter, Governor, Fan Blades (pusher type), Flywheel, Water Pump, Oil Pan, Exhaust Manifold, Fan Belt and Fuel Shut-off Valve.

Excludes—Alternator, Alternator Mounting Brackets, Alternator Belt, Temperature Sender, Oil Pressure Sender, Starter, Radiator and Air Cleaner

NOTE: Replacement engine is for standard Spec 1 generator sets. For all other Specs refer to factory.

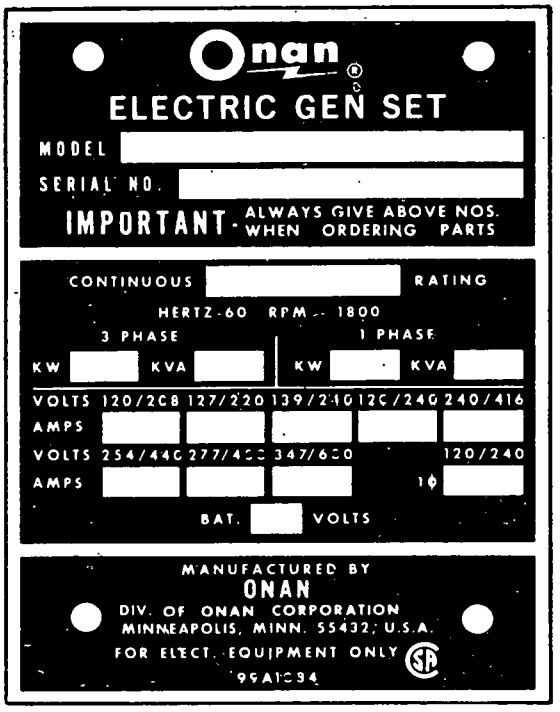
NOTICE!

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 REPAIR PARTS

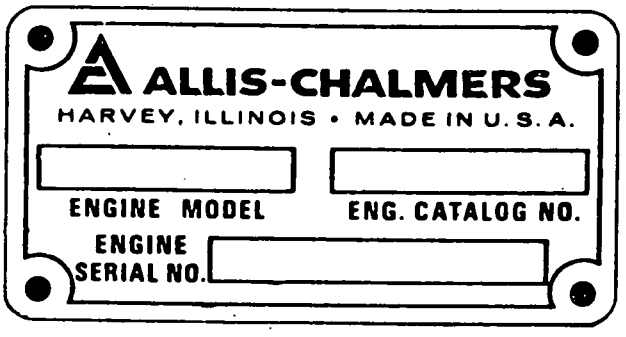
ONAN PARTS

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, SERIAL and SPECIFICATION NUMBER.



ALLIS-CHALMERS PARTS

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



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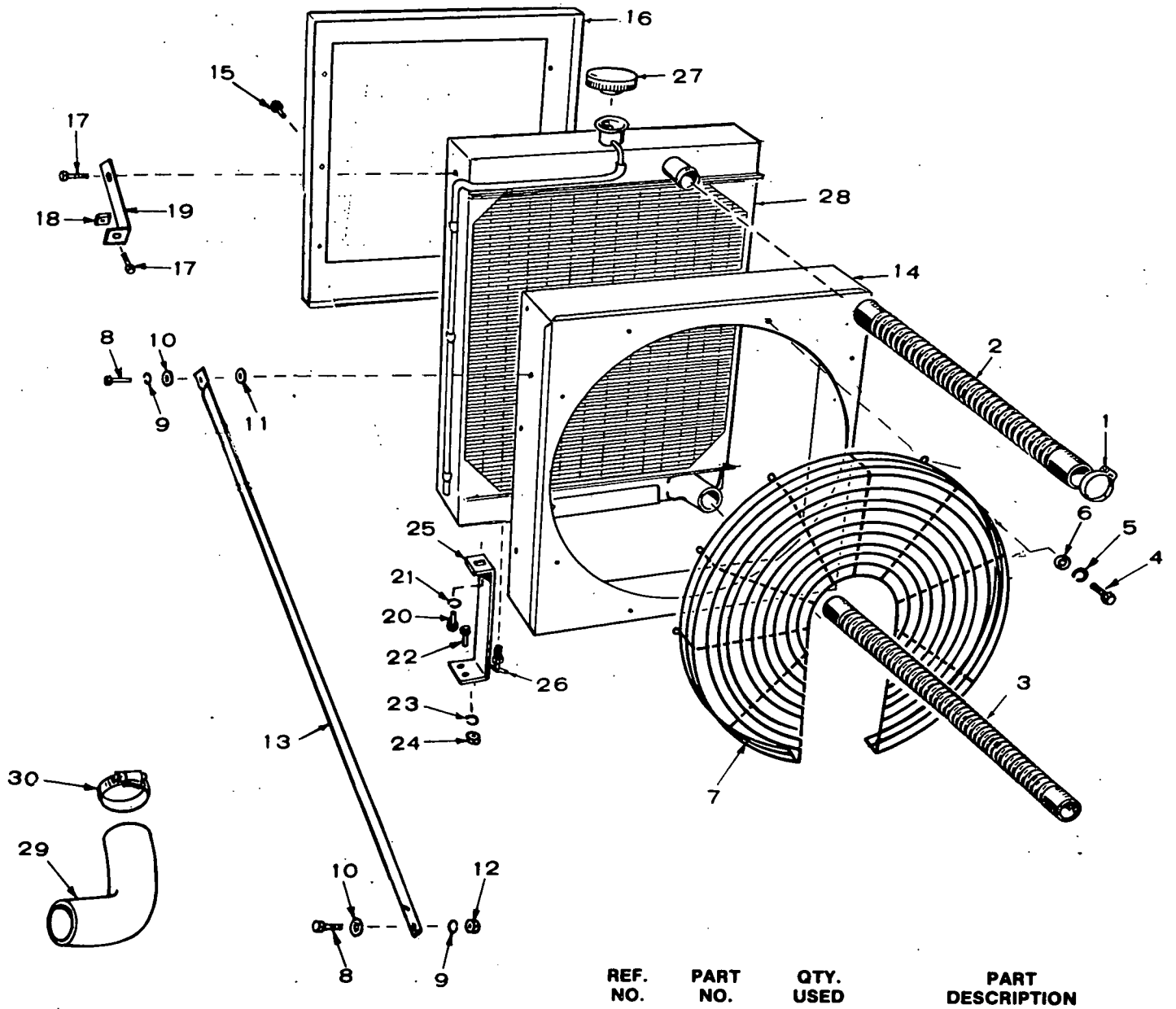
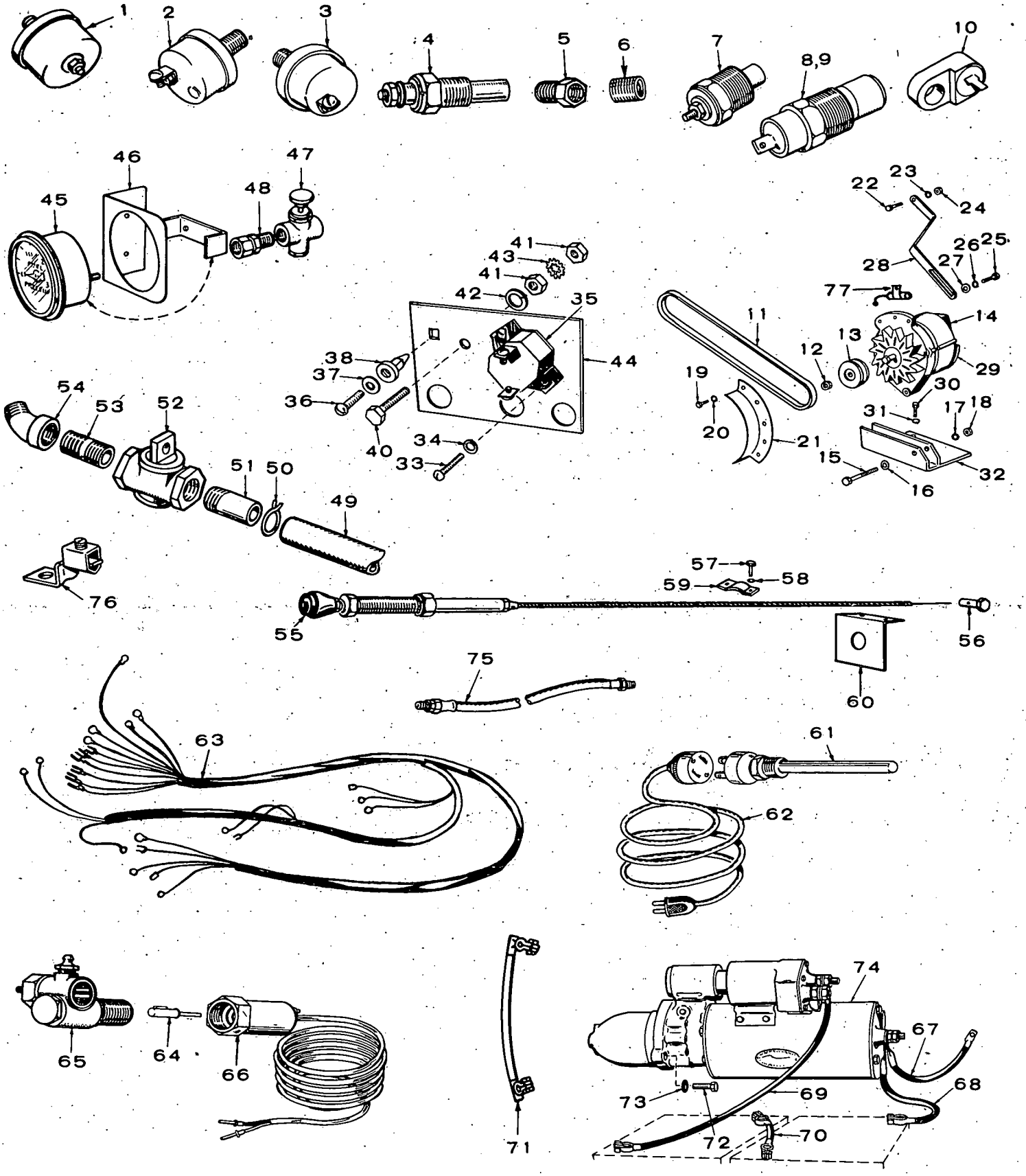
COOLING SYSTEM GROUP



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	503-0354	4	Clamp, Hose
2	503-0616	1	Hose, Radiator - Upper
3	503-0615	1	Hose, Radiator - Lower
4	800-0005	8	Screw, Cap - Hex Head (1/4-20 x 3/4")
5	850-0040	8	Washer, Lock - Spring (1/4")
6	526-0018	8	Washer, Flat (17/64" ID x 5/8" OD x 1/16" Thk)
7	130-0924	1	Guard, Fan
8	800-0050	4	Screw, Cap - Hex Head (3/8-16 x 1")
9	850-0050	4	Washer, Lock - Spring (3/8")
10	526-0013	4	Washer, Flat (25/64" ID x 1" OD x 1/16" Thk)
11	526-0077	2	Washer, Flat (13/32" ID x 1-1/4" OD x 1/4" Thk)
12	862-0003	2	Nut, Hex (1/4-20)
13	405-1888	2	Support, Radiator (Unhoused Sets Only)
14	SHROUD, FAN		
	130-0841	1	Keys 1,2,3,4,5,6
	130-0918	1	Keys 7,8

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
15	821-0014	6	Screw, Self-locking - Hex Head (5/16-18 x 2")
16	130-0842	1	Shroud, Radiator
17	821-0016	4	Screw, Self-locking - Hex Head (5/16-18 x 3/4")
18	870-0257	2	Nut, Self-locking - Hex (5/16-18)
19	130-0848	2	Brace, Radiator
20	800-0130	4	Screw, Cap - Hex Head (5/8-11 x 1")
21	850-0070	4	Washer, Lock - Spring (5/8")
22	800-0092	4	Screw, Cap - Hex Head (1/2-13 x 1-1/2")
23	850-0060	4	Washer, Lock - Spring (1/2")
24	862-0016	4	Nut, Hex (1/2-13)
25	BRACKET, SUPPORT - RADIATOR		
	130-0843	2	Keys 1,2,3,4,5,6
	130-0917	2	Keys 7,8
26	504-0028	1	Cock, Drain
27	130-0449	1	Cap, Radiator
28	130-0836	1	Radiator, Engine Coolant
29	503-0441	1	Hose, Radiator - Keys 7,8
30	503-0365	1	Clamp, Hose - Keys 7,8

MISCELLANEOUS ENGINE PARTS GROUP (Includes Optionals)



MISCELLANEOUS ENGINE PARTS GROUP (Includes Optionals)

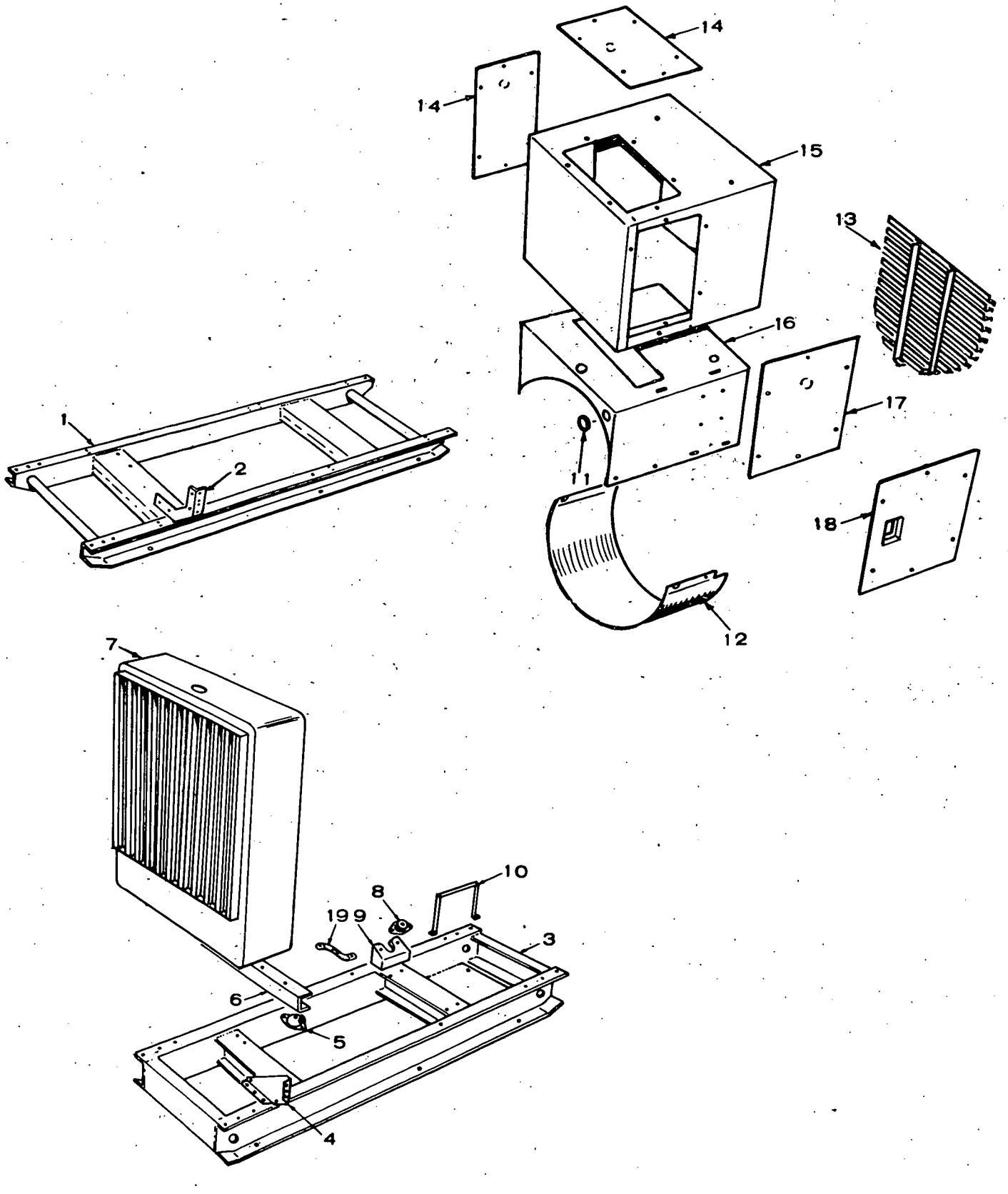
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	SENDER, OIL PRESSURE TO GAUGE		
	193-0244	1	Begin Spec F
	193-0108	1	Spec A Through E
2	309-0169	1	Switch, Low Oil Pressure - Shutdown (Optional)
3	309-0272	1	Switch, Low Oil Pressure - Alarm (Optional)
4	SENDER, OIL TEMPERATURE TO GAUGE (OPTIONAL)		
	193-0249	1	Begin Spec F
	193-0202	1	Spec A Through E
5	502-0175	2	Adapter, Pipe (1/8" NPT)
6	505-0117	1	Reducer, Pipe - Brass (1/2" NPT x 3/8" NPT)
7	SENDER, COOLANT TEMPERATURE TO GAUGE		
	193-0247	1	Begin Spec F
	193-0109	1	Spec A Through E
8	309-0179	1	Switch, High Coolant Temperature Shutdown (Optional)
9	309-0178	1	Switch, High Coolant Temperature Alarm (Optional)
10	309-0269	1	Switch, Low Engine Temperature
11	511-0092	1	Belt, Drive
12		1	Nut, Hex (5/8-18 UNF2A x 1/4" Thk) Part of Alternator
13	191-0781	1	Pulley
14	191-0733	1	Regulator, Voltage (Supplied with Alternator)
15	800-0095	1	Screw, Cap - Hex Head (1/2-13 x 2-1/4")
16	526-0010	1	Washer, Flat (9/16" ID x 1-3/8" OD x 1/2" Thk)
17	850-0060	1	Washer, Lock - Spring (1/2")
18	862-0016	1	Nut, Hex (1/2-13)
19	800-0025	2	Screw, Cap - Hex Head (5/16-18 x 5/8")
20	850-0045	2	Washer, Lock - Spring (5/16")
21	191-0725	1	Guard, Belt
22	800-0050	1	Screw, Cap - Hex Head (3/8-16 x 1")
23	850-0050	1	Washer, Lock - Spring (3/8")
24	862-0003	1	Nut, Hex (3/8-16)
25	800-0027	1	Screw, Cap - Hex Head (5/16-18 x 7/8")
26	850-0045	1	Washer, Lock - Spring (5/16")
27	526-0022	1	Washer, Flat (21/64" ID x 9/16" OD x 1/16" Thk)
28	191-0856	1	Bracket, Adjusting - Alternator
29	191-0688	1	★Alternator - Includes Fan & Regulator (Motorola #70D44039B04)
30	800-0050	3	Screw, Cap - Hex Head (3/8-16 x 1")
31	850-0050	3	Washer, Lock - Spring (3/8")
32	191-0858	1	Bracket, Mounting - Alternator
33	811-0103	2	Screw, Tapping - Round Head (#10-32 x 3/4")
34	850-0030	2	Washer, Lock - Spring (#10)
35	320-0240	1	Breaker, Circuit
36	809-0035	1	Screw, Tapping - Round Head (#8 x 3/4")
37	508-0015	1	Washer, Insulating - Fibre
38	870-0196	1	Nut, Non-Metallic - Insulating
40	800-0007	1	Screw, Cap - Hex Head (1/4-20 x 1")
41	862-0001	2	Nut, Hex (1/4-20)
42	850-0040	1	Washer, Lock - Spring (1/4")
43	856-0006	1	Washer, Lock - External/ Internal Tooth (1/4")
44	332-1382	1	Bracket, Mounting - Circuit Breaker
45	193-0200	1	Gauge, Fuel Pressure (Optional)
46	193-0029	1	Bracket, Mounting - Gauge (Optional)
47	504-0064	1	Valve, Test (Optional)
48	502-0118	1	Connector, Compression - Male (Optional)
49	503-0564	1	Hose, Rubber - Oil Drain (7" Lg)
50	503-0197	1	Clamp, Hose
51	505-0185	1	Nipple, Pipe - Half (1/2" NPT x 1-1/2")
52	504-0011	1	Valve, Gate - Brass, Oil Drain
53	505-0100	1	Nipple, Pipe - Close (1/2" NPT x 1-1/8")
54	505-0022	1	Reducer, Pipe (1/2" NPT x 1" NPT)
	VERNIER THROTTLE ASSEMBLY - OPTIONAL (Includes Parts Marked +)		
55	152-0120	1	+Cable, Throttle
56	152-0158	1	+Swivel
57	815-0104	2	+Screw, Machine - Fillister Head (#8-32 x 5/16")
58	526-0052	2	+Washer, Flat - Brass (17/64" ID x 9/16" OD x 1/32" Thk)
59	152-0036	1	+Clamp, Cable
60	151-0230	1	+Bracket, Angle - Throttle Mounting
61	333-0108	1	Heater, Oil Base (Optional)
62	333-0017	1	Cord, Electrical - Heater (Optional)
63	WIRING HARNESS - ENGINE TO CONTROL		
	338-0600	1	Standard - Keys 1,2,3,4,5,6
	338-0706	1	Standard - Keys 7,8
	338-0601	1	Optional - Keys 1,2,3,4,5,6 Used with Pre-Alarm Switches
64	302-0753	1	Tang, Drive - Tachometer Sender (Optional)
65	302-0756	1	Drive, Angle - 90°, Tachometer Tang (Optional)
66	302-0750	1	Sender, Tachometer (Optional)
67	416-0632	1	Cable, Electrical - Starter
68	416-0445	1	Cable, Battery - Negative
69	CABLE, BATTERY - POSITIVE		
	416-0444	1	Keys 1,2,3,4,5,6
	416-0636	1	Keys 7,8
70	416-0473	1	Cable, Battery - Jumper - Begin Spec D
71	416-0446	1	Cable, Battery - Jumper - Spec A Through C
72	800-0135	3	Screw, Cap - Hex Head (5/8-11 x 2-1/2")
73	850-0070	3	Washer, Lock - Spring (5/8")
74	191-0852	1	*Starter (Delco Remy #1113892)
75	501-0229	1	Line, Fuel - Begin Spec F
76	332-1473	1	Lug, Solderless - Ground Begin Spec F
77	312-0201	1	Capacitor, Alternator - Key 1,2,4,6 Spec A Through Serial #956693 During Spec E

+ - 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 Motorola Dealer or Motorola Automotive Products, Inc., 9401 W. Grand Ave., Franklin Park, Illinois 60131.

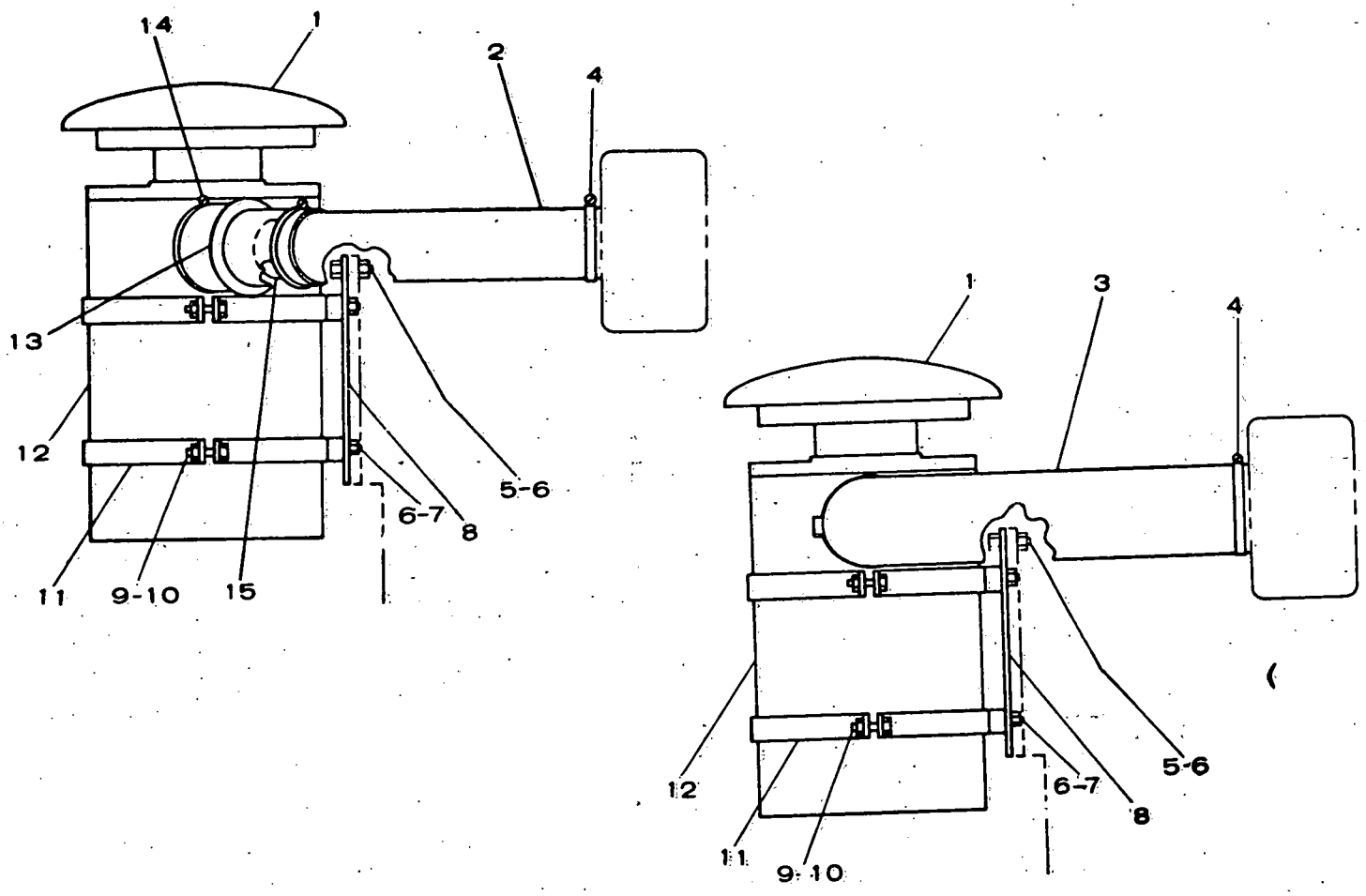
CHASSIS GROUP - KEYS 1,2,3,4,5,6



CHASSIS GROUP - KEYS 1,2,3,4,5,6

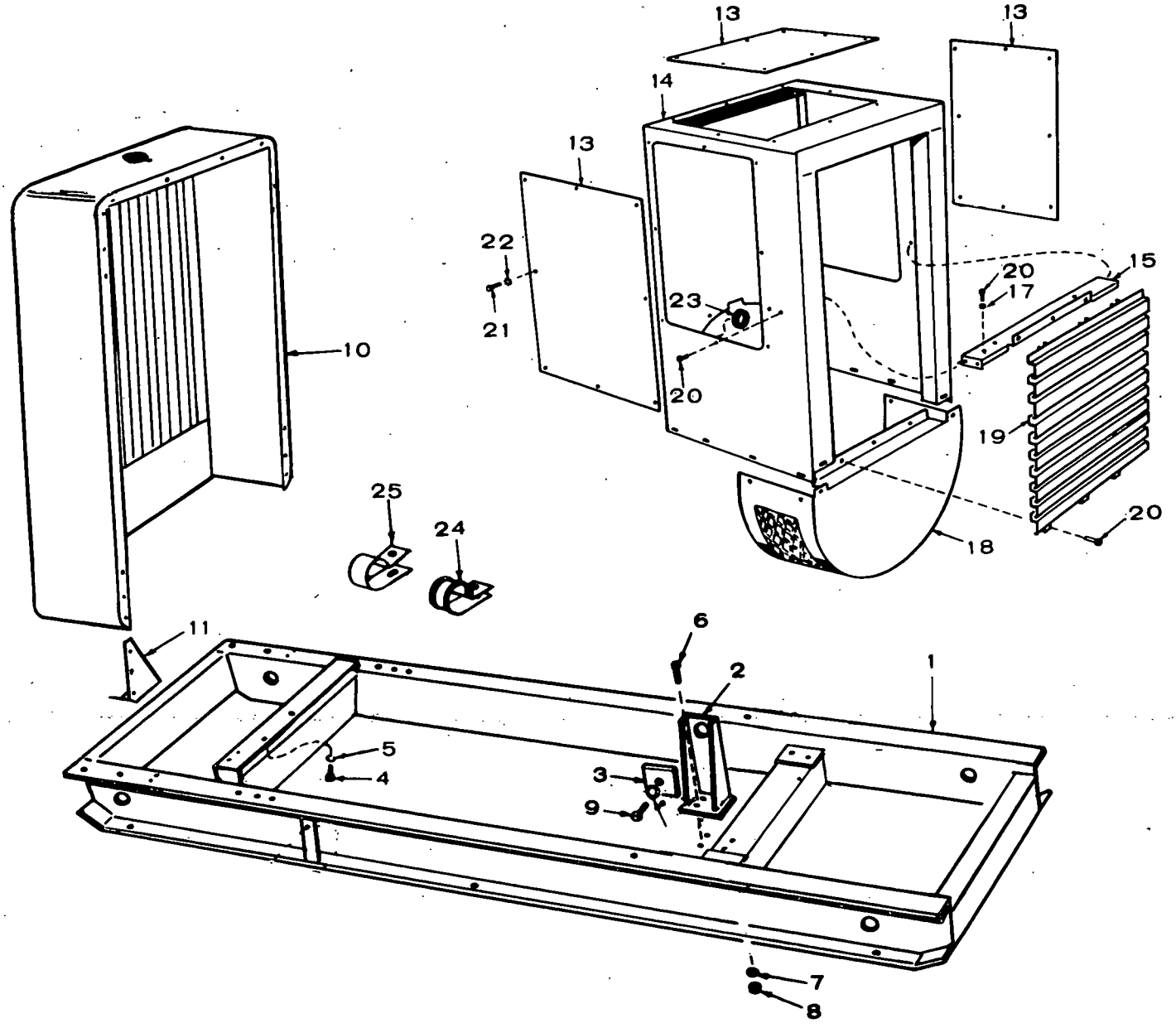
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	403-0967	1	Base, Skid - Spec A through C
2	405-1854	2	Bracket, Front Panel - Spec A through C
3	403-1133	1	Base, Skid - Begin Spec D
4	405-2016	2	Bracket, Front Panel - Begin Spec D
5	402-0371	2	Mount, Vibration
6	403-0966	1	Support, Engine
7	405-1884	1	Panel, Housing - Front
8	402-0384	2	Mount, Vibration
9	232-2208	2	Support, Generator
10	416-0635	2	Strap, Hold-down - Battery - Begin Spec D
11	508-0001	1	Grommet, Rubber
12	234-0361	1	Wrapper, End Bell
13	234-0370	1	Grille, Inlet Air
14	301-3156	2	Panel, Blank - Top and Left Sides
15	301-3155	1	Housing, Control Box
16	301-3154	1	Saddle, Control Box
17	301-3156	1	Panel, Blank - Right Side
18	301-3192	1	Panel, Circuit Breaker - Right Side - Optional
19	337-0090	1	£Strap, Electrical - Grounding
	ATTACHING HARDWARE - NOT ILLUSTRATED (Select as Applicable)		
	800-0003	As Reqd	Screw, Cap - Hex Head (1/4-20 x 1/2")
	800-0030	As Reqd	Screw, Cap - Hex Head (5/16-18 x 1-1/4")
	800-0035	As Reqd	Screw, Cap - Hex Head (5/16-18 x 2-1/2")
	800-0090	As Reqd	Screw, Cap - Hex Head (1/2-13 x 1")
	800-0092	As Reqd	Screw, Cap - Hex Head (1/2-13 x 1-1/2")
	800-0132	As Reqd	Screw, Cap - Hex Head (5/8-11 x 1-1/2")
	800-0135	As Reqd	Screw, Cap - Hex Head (5/8-11 x 2-1/4")
	800-0153	As Reqd	Screw, Cap - Hex Head (3/4-10 x 1-1/2")
	800-0163	As Reqd	Screw, Cap - Hex Head (3/4-10 x 4")
	812-0146	As Reqd	Screw, Machine - Round Head (1/4-20 x 3/8")
	815-0026	As Reqd	Screw, Machine - Truss Head (#10-32 x 3/8") - Spec A through C
	815-0350	As Reqd	Screw, Tapping - Hex Washer Head (#10-32 x 3/8") - Begin Spec D
	821-0010	As Reqd	Screw, Self-locking - Hex Washer Head (1/4-20 x 1/2")
	821-0014	As Reqd	Screw, Self-locking - Hex Washer Head (5/16-18 x 1/2")
	821-0016	As Reqd	Screw, Self-locking - Hex Washer Head (5/16-18 x 3/4")
	850-0040	As Reqd	Washer, Lock - Spring (1/4")
	850-0045	As Reqd	Washer, Lock - Spring (5/16")
	850-0060	As Reqd	Washer, Lock - Spring (1/2")
	850-0070	As Reqd	Washer, Lock - Spring (5/8")
	850-0079	As Reqd	Washer, Lock - Spring (3/4")
	853-0008	As Reqd	Washer, Lock - External Tooth (#10) - Spec A thru C
	856-0013	As Reqd	Washer, Lock - External/ Internal Tooth (1/2")
	526-0018	As Reqd	Washer, Flat (1/4")
	526-0238	As Reqd	Washer, Flat (3/4")
	862-0001	As Reqd	Nut, Hex (1/4-20)
	862-0007	As Reqd	Nut, Hex (5/8-11)
	862-0015	As Reqd	Nut, Hex (5/16-18)
	862-0016	As Reqd	Nut, Hex (1/2-13)
	862-0020	As Reqd	Nut, Hex (3/4-10)
	870-0257	As Reqd	Nut, Self-locking, Hex (5/16-18)
	818-0076	As Reqd	Rivet, Tubular (1/8" DIA)

AIR CLEANER GROUP - BEGIN SPEC F



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	140-1347	1	Cap, Air Cleaner
2	503-0820	1	Hose, Flexible Keys 1,2,3,4,5,6
3		1	Hose, Flexible - Keys 7,8 (Order 18" of Bulk Hose Number 503-0641)
4	CLAMP, HOSE		
	503-0612	2	Keys 1,2,3,4,5,6
	503-0748	2	Keys 7,8
5	821-0030	1	Screw, Cap - Hex Head Locking (3/8-16 x 1")
6	870-0281	5	Nut, Hex - Locking (3/8-16)
7	821-0029	4	Screw, Cap - Hex Head - Locking (3/8-16 x 3/4")
8	140-1475	1	Bracket, Air Cleaner
9	800-0031	2	Screw, Cap - Hex Head (5/16-18 x 1-1/2")
10	870-0257	2	Nut, Hex - Locking (5/16-18)
11	140-1345	2	Band, Air Cleaner
12	140-1346	1	Cleaner, Air
13	503-0821	1	Hose, Reducer - Keys 1,2,3,4,56
14	503-0648	1	Clamp, Hose
15		1	Tube, Steel (Order 3" of Bulk Tube Number 45-0098) - Keys 1,2,3 4,5,6

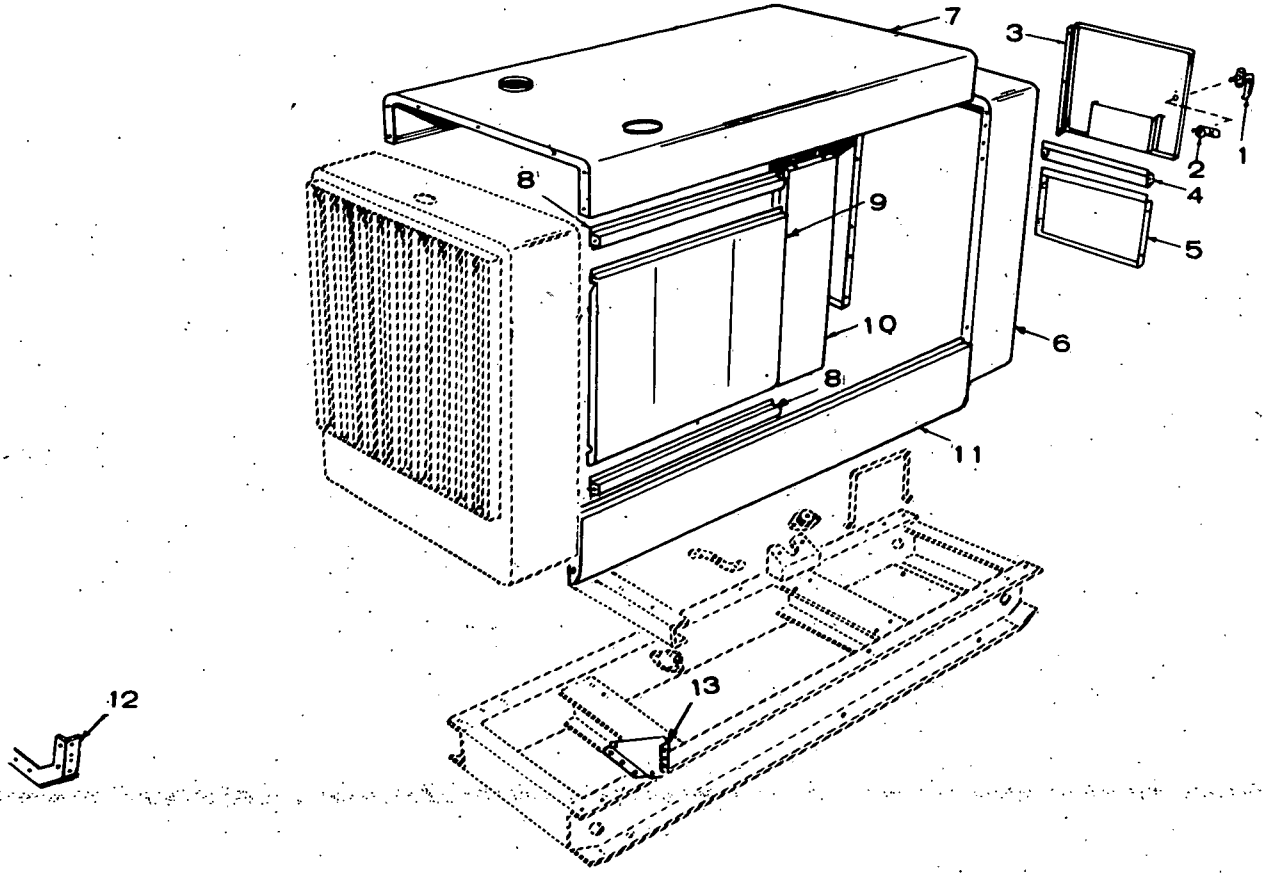
CHASSIS GROUP - KEYS 7,8



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	403-1025	1	Base, Skid
2	232-2389	2	Bracket, Generator Mounting
3	232-2385	2	Plate, Generator Mounting Retainer
4	800-0132	2	Screw, Cap - Hex Head (5/8-11 x 1-1/2")
5	850-0070	2	Washer, Lock Spring (5/8")
6	800-0156	4	Screw, Cap - Hex Head (3/4-10 x 2-1/4") Generator to Skid
7	850-0079	6	Washer, Lock - Spring (3/4")
8	862-0020	4	Nut, Hex (3/4-10)
9	800-0153	2	Screw, Cap - Hex Head (3/4-10 x 1-1/2") Retainer Plate
10	405-1884	1	Panel, Front

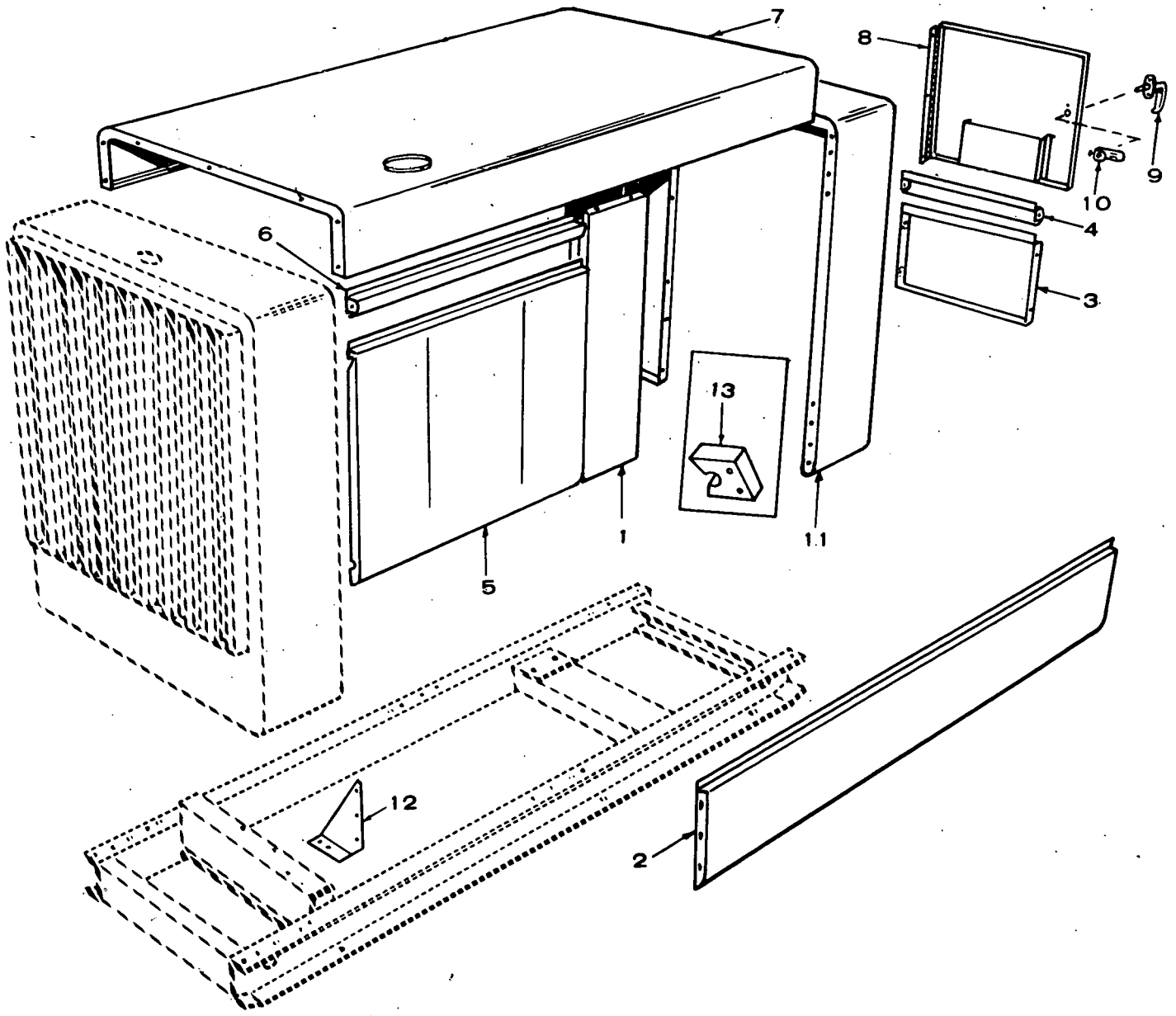
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
11	405-2016	1	Bracket, Panel Mounting
13	301-3731	3	Plate, Control Box
14	301-3605	1	Housing, Control Box
15	301-3604	1	Shelf, Control Box Housing
17	856-0006	2	Washer (1/4"), Shakeproof EIT
18	234-0489	1	Cover, End Bell
19	234-0490	1	Grille, Generator Air Inlet
20	821-0010	9	Screw, Cap - Hex Head 1/4-20 x 1/2")
21	815-0241	24	Screw Machine (1/4-20 x 1/2") Truss Head
22	853-0013	24	Washer, Lock ET (1/4")
23	508-0001	1	Grommet, Rubber
24	332-0052	2	Clip, Rubber Coated
25	332-1402	1	Clamp, Cable

HOUSING GROUP - KEYS 1,2,3,4,5,6 - OPTIONAL EQUIPMENT



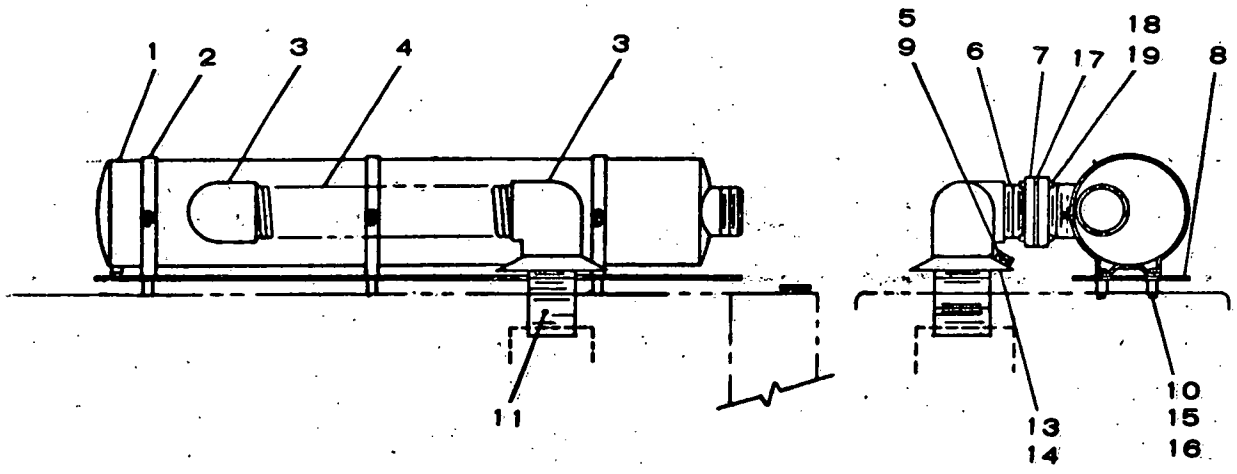
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	406-0157	1	Handle, Latch (With Keys)
2	406-0089	1	Catch, Latch
3	405-1880	1	Door, Rear
4	405-1858	1	Panel, Rear - Center
5	405-1856	1	Panel, Rear - Lower
6	405-1883	1	Housing, Rear
7	405-1882	1	Housing, Top
8	405-1875	8	Panel, Louver
9	405-1877	4	Door, Removable
10	405-1873	2	Panel, Center
11	PANEL, SIDE - BRASS		
	405-2165	2	Begin Spec D
	405-1878	2	Spec A through C
12	405-1854	6	Bracket, Panel - Spec A through C
13	405-2016	6	Bracket, Panel - Begin Spec D
	ATTACHING HARDWARE - NOT ILLUSTRATED (Select as Applicable)		
	870-0212	As Reqd	Nut, Self-locking - Hex (1/4-20)

HOUSING GROUP - KEYS 7,8 - OPTIONAL EQUIPMENT



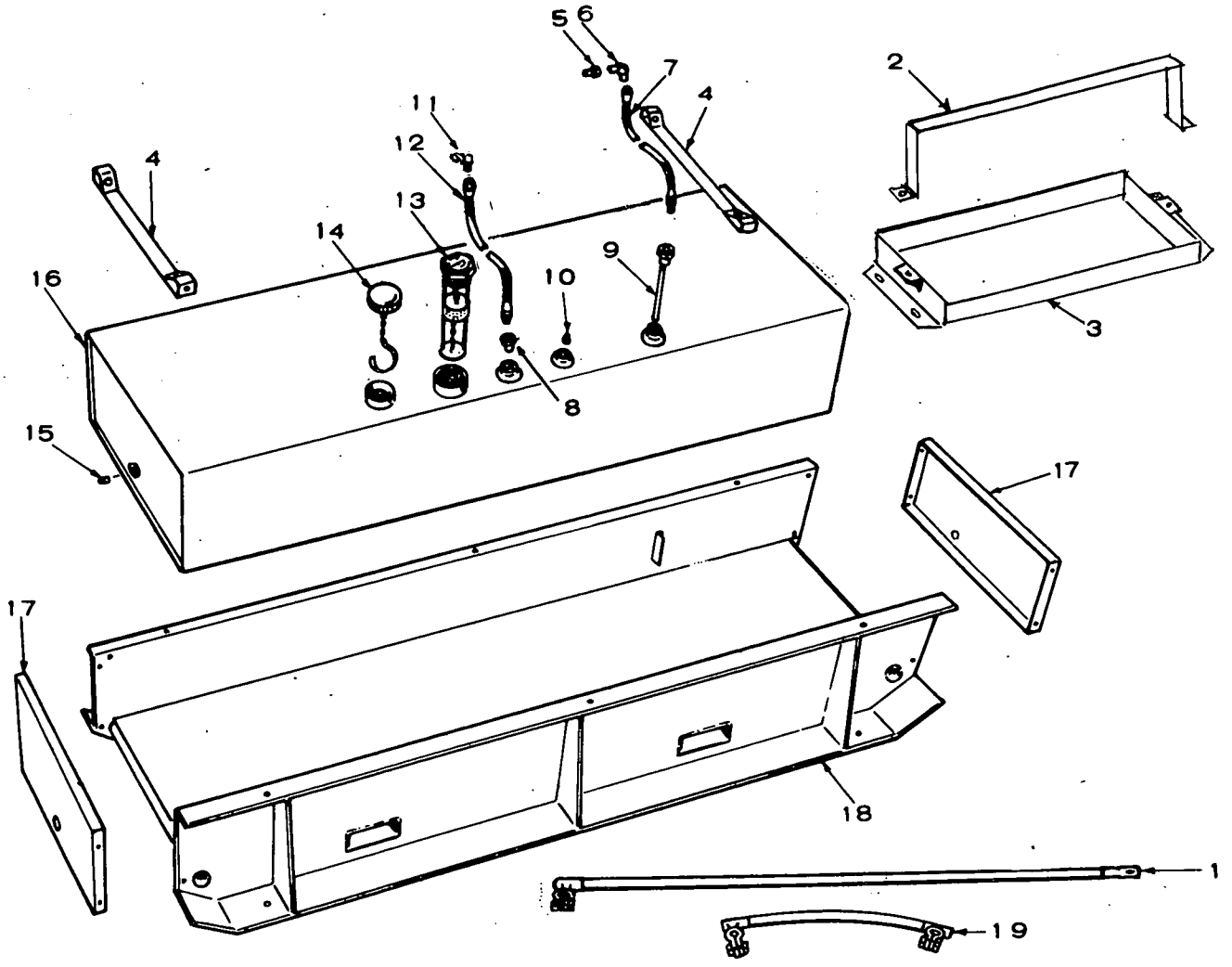
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	405-1873	2	Panel, Center
2	405-2015	2	Panel, Base
3	405-1856	1	Panel, Lower Rear Housing
4	405-1858	2	Panel, Rear Louver
5	405-2011	4	Door, Housing (Each Include 4 Door Clips)
6	405-2014	8	Panel, Louver
7	405-2013	1	Panel, Top
8	405-1880	1	Panel, Rear Door
9	406-0157	1	Handle, Door
10	406-0089	1	Catch, Door
11	405-1883	1	Panel, Rear
12	405-2016	4	Bracket, Panel Mounting
13	405-1872	16	Clip, Door

179-0393 INSTALLATION EXHAUST MUFFLER (HOUSED SETS) - OPTIONAL EQUIPMENT



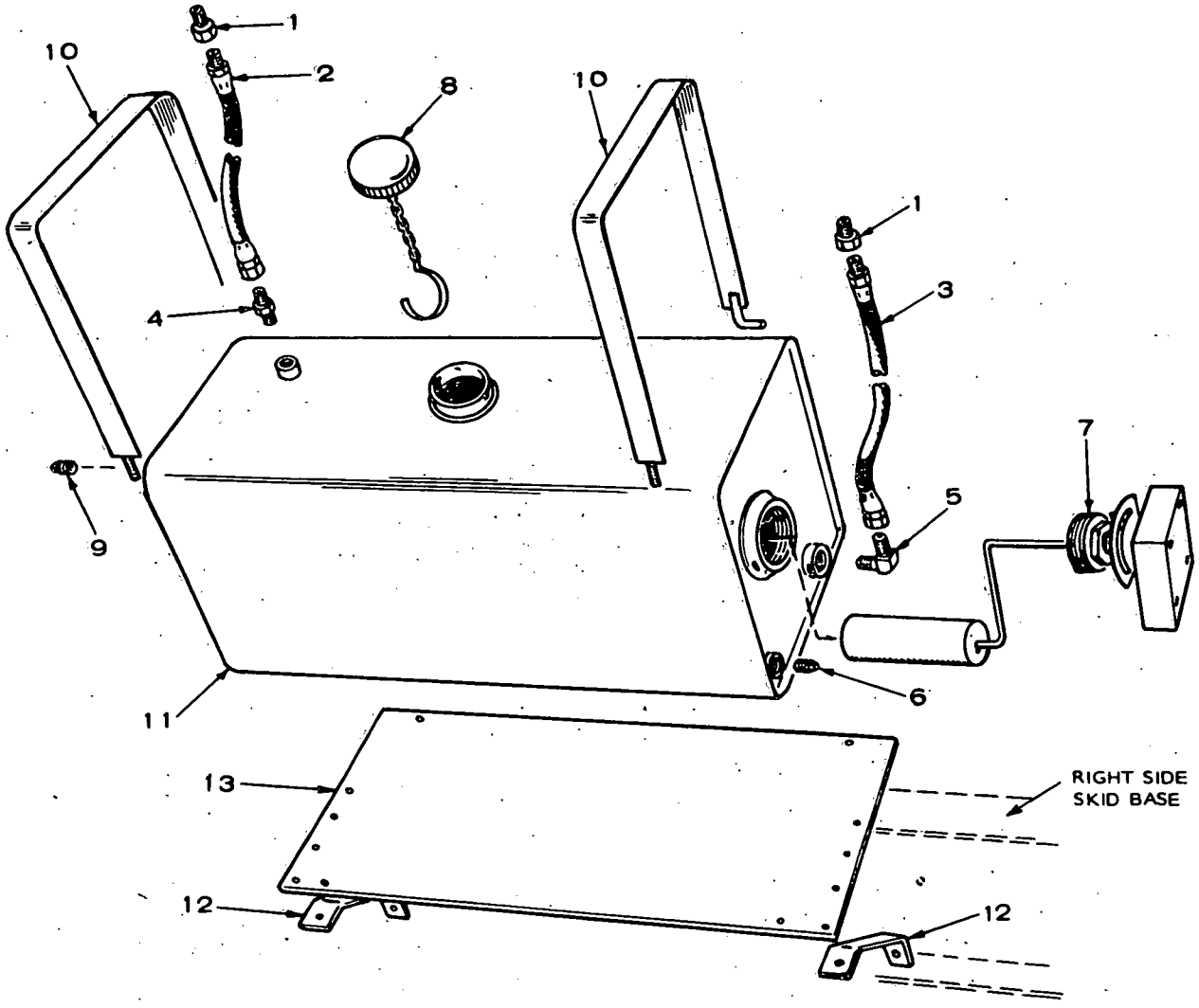
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	155-1158	1	Muffler
2	140-0757	3	Clamp, Muffler Mounting
3	505-0741	2	Elbow, Pipe (8" x 90°)
4	155-1160	1	Tube Assembly, Exhaust
5	813-0105	2	Screw, Machine - Round Head (#10-32 x 1")
6	505-0740	1	Nipple, Pipe (8 x 4-1/2")
7	155-0652	2	Flange, Companion
8	155-1404	1	Shield, Muffler Heat
9	870-0188	1	Nut, Hex Locking (#10-32)
10	155-1430	6	Spacer, Muffler
11	505-0821	1	Nipple, Pipe (6 x 6-1/2")
13	155-1426	1	Shield, Rain
14		1	Asbestos (Order 21" of Bulk Asbestos #895-0007)
15	800-0508	6	Screw, Cap - Hex Head (5/16-18 x 2-3/4")
16	870-0048	6	Nut, Hex - Locking (5/16-18)
17	155-0676	1	Gasket, Flange
18	800-0160	8	Screw, Cap - Hex Head (3/4-10 x 3-1/4")
19	862-0008	8	Nut, Hex (3/4-10)

159-1003 FUEL TANK AND SUB BASE GROUP—OPTIONAL EQUIPMENT



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	CABLE, BATTERY - SPEC A THROUGH C		
	416-0636	1	Positive
	416-0637	1	Negative
2	416-0635	2	Strap, Hold-down - Spec A through C
3	416-0461	2	Rack, Battery - Spec A thru C
4	159-1002	2	Strap, Hold-down - Fuel Tank
5	502-0270	1	Adapter
6	502-0218	1	Elbow, Pipe
7	501-0192	1	Line, Fuel - Flexible
8	505-0018	1	Bushing, Reducer
9	415-0317	1	Pipe, Suction
10	505-0334	1	Plug, Pipe
11	502-0183	1	Elbow, Pipe
12	501-0193	1	Line, Fuel - Flexible
13	193-0216	1	Gauge, Liquid Level
14	159-0020	1	Cap, Tank
15	505-0247	1	Plug, Pipe
16	159-1001	1	Tank, Fuel - 101 Gallon
17	403-1004	2	Plate, End - Sub Base
18	403-1003	1	Base, Sub - Fuel Tank
19	416-0446	1	Cable, Battery - Jumper - Spec A through C
	ATTACHING HARDWARE—NOT ILLUSTRATED (Select as Applicable)		
	800-0050	As Reqd	Screw, Cap - Hex Head (3/8-16 x 1")
	800-0051	As Reqd	Screw, Cap - Hex Head (3/8-16 x 1-1/4")
	800-0156	As Reqd	Screw, Cap - Hex Head (3/4-10 x 2-1/4")
	821-0016	As Reqd	Screw, Self-locking - Hex Washer Head (5/16-18 x 3/4")
	850-0050	As Reqd	Washer, Lock - Spring (3/8")
	850-0079	As Reqd	Washer, Lock - Spring (3/4")
	526-0013	As Reqd	Washer, Flat (25/64" ID x 1" OD x 1/16" Thk)
	862-0003	As Reqd	Nut, Hex (3/8-16)
	862-0020	As Reqd	Nut, Hex (3/4-10)

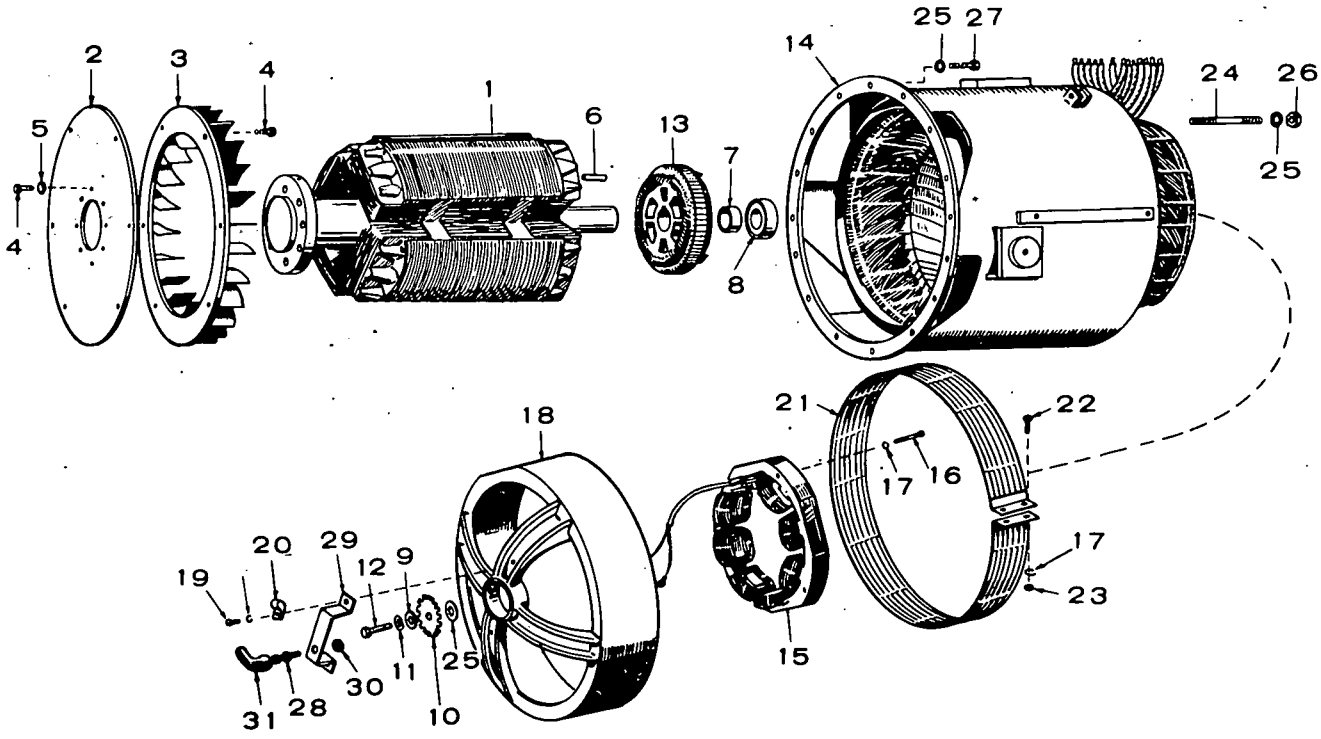
179-0443 INSTALLATION DAY FUEL TANK—OPTIONAL EQUIPMENT



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	502-0143	As Reqd	Adapter, Reducer
2	501-0085	1	Line, Fuel - Flexible
3	501-0083	1	Line, Fuel - Flexible
4	502-0173	1	Connector, Pipe
5	502-0268	1	Elbow, Pipe - 90°
6	505-0110	1	Plug, Pipe (3/8" NPT)
7	415-0170	1	Switch, Fuel Level
8	159-0020	1	Cap, Fuel Tank
9	505-0056	1	Plug, Pipe (1/2" NPT)
10	415-0331	2	Strap, Hold-down
11	415-0322	1	Tank, Fuel - 8 Gal
12	415-0329	2	Brace, Fuel Tank
13	415-0330	1	Plate, Fuel Tank
	ATTACHING HARDWARE — NOT ILLUSTRATED		
	(Select as Applicable)		
	800-0005	As Reqd	Screw, Cap - Hex Head (1/4-20 x 3/4")
	800-0007	As Reqd	Screw, Cap - Hex Head (1/4-20 x 1")
	850-0040	As Reqd	Washer, Lock - Spring (1/4")
	862-0001	As Reqd	Nut, Hex (1/4-20)

GENERATOR GROUP - KEYS 7,8

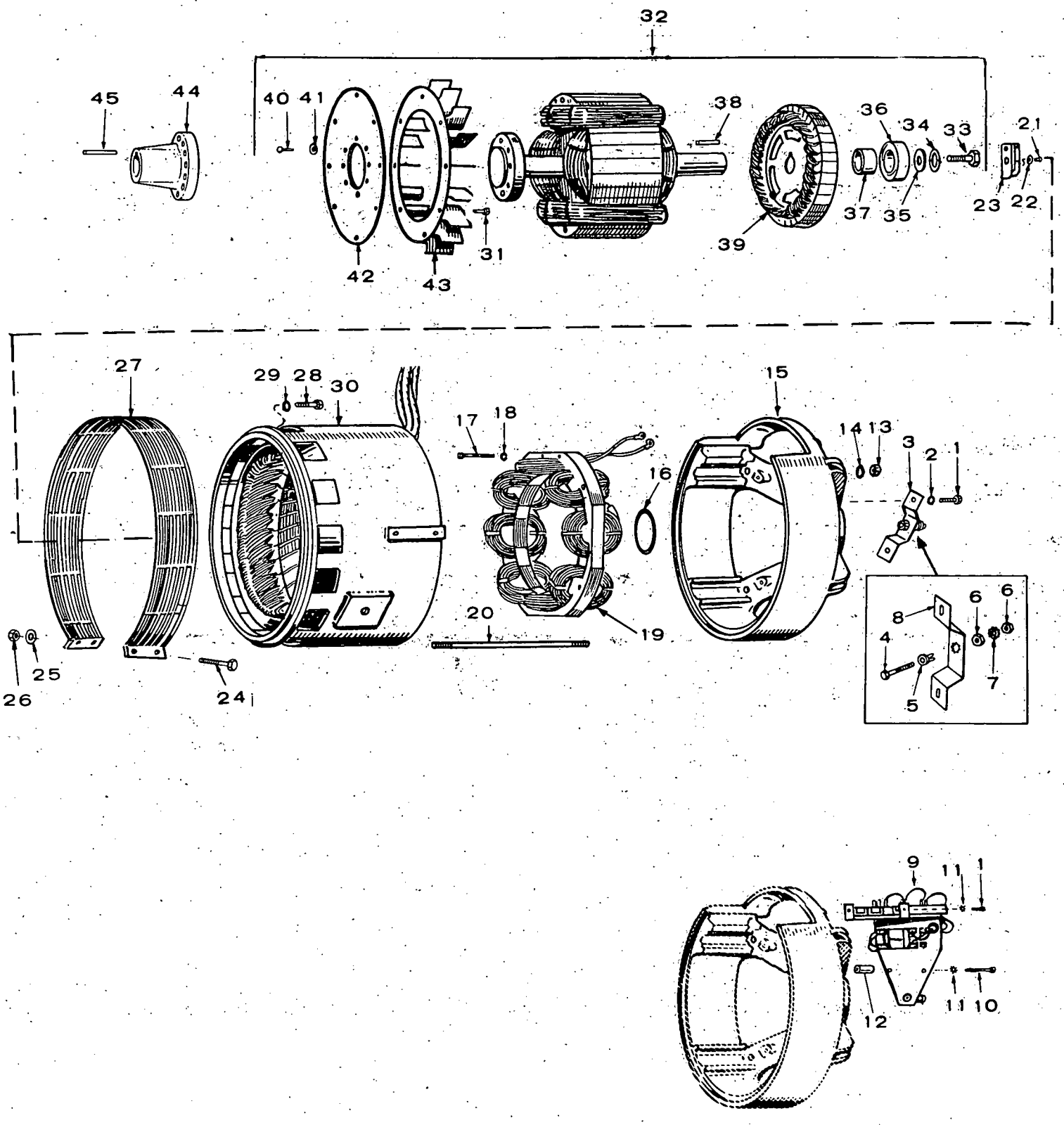
NOTE: See separate group for bus bar and exciter rotor parts.



REF. NO.	PART NO.	QTY. USED	PART description
1	201-1940	1	Rotor Assembly, Wound (Includes Parts Marked *)
2	232-2580	1	*Disc, Generator
3	205-0095	1	*Fan, Generator
4	805-0035	14	*Bolt, Place (5/8-11 x 1-1/2")
5	526-0002	8	*Washer, Flat - (.156 ID x 3/8" OD x 3/64" Thk)
6	515-0145	1	*Key, Exciter Rotor
7	232-2317	1	*Spacer, Bearing
8	510-0106	1	*Bearing
9	526-0252	1	*Washer, Flat - (13/16" ID x 2-3/8" OD x 5/32" Thk)
10	150-1405	1	*Wheel, Speed Sensor
11	850-0060	1	*Washer, Lock - Spring (1/2")
12	800-0092	1	*Screw, Cap - Hex Head (1/2-13 x 1-1/2")
13	201-1902	1	*Rotor Assembly, Wound - Exciter (See Separate Group for Components)
14	220-1902	1	Stator Assembly, Wound
15	220-1920	1	Stator Assembly, Wound - Exciter
16	800-0009	4	Screw, Cap - Hex Head (1/4-20 x 1-1/2")
17	850-0040	12	Washer, Lock - Spring (1/4")
18	211-0214	1	Bell, End
19	800-0005	2	Screw, Cap - Hex Head (1/4-20 x 3/4")
20	332-1554	1	Clamp, Loop
21	234-0455	1	Screen, Fan
22	800-0008	2	Screw, Cap - Hex Head (1/4-20 x 1-1/4")
23	862-0001	2	Nut, Hex - (1/4-20)
24	520-0780	4	Stud, End Bell Mounting (1/2 x 6-1/2")
25	850-0060	20	Washer, Lock - Spring (1/2")
26	862-0016	4	Nut, Hex - (1/2-13)
27	800-0092	16	Screw, Cap - Hex Head (1/2-13 x 1-1/2")
28	150-1406	1	Sensor, Speed
29	150-1407	1	Bracket, Speed Sensor
30	868-0011	1	Nut, Hex - (3/4-16)
31	150-1410	1	Cap, Insulator

* - Parts Included in the 201-1940 Rotor Assembly.

GENERATOR GROUP - KEYS 1,2,3,4,5,6



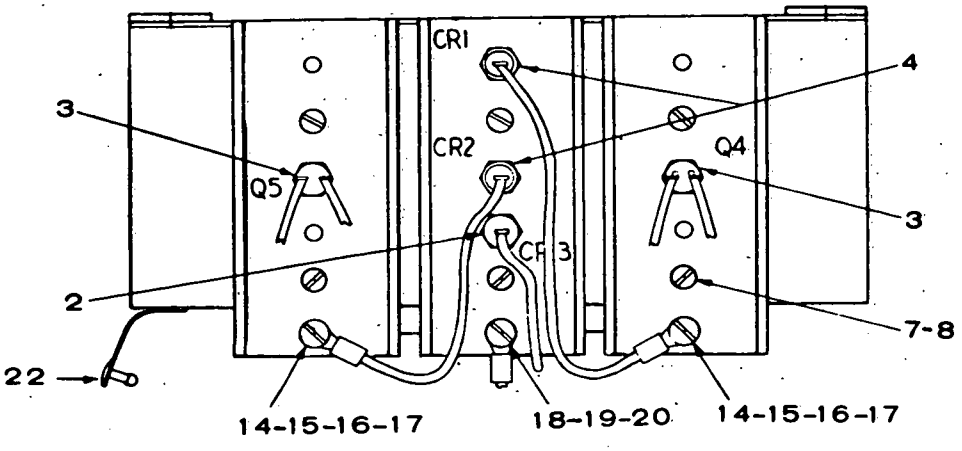
GENERATOR GROUP - KEYS 1,2,3,4,5,6

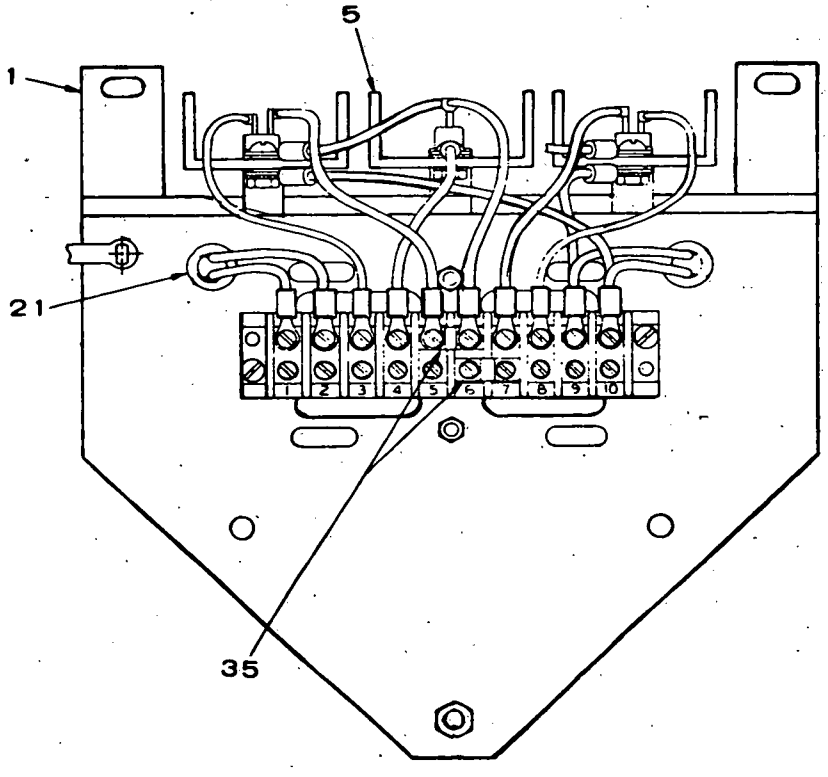
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	800-0003	2	Screw, Cap - Hex Head (1/4-20 x 1/2")
2	850-0040	2	Washer, Lock - Spring (1/4")
3	150-1456	1	Contact Assembly - Overspeed Switch (Includes Parts Marked †) Begin Spec D
4	150-0723	1	†Point, Overspeed Switch
5	870-0250	1	†Nut, Insulated - Overspeed Switch
6	862-0001	2	†Nut, Hex (1/4-20)
7	853-0013	1	†Washer, Lock - External Tooth (1/4")
8	150-1356	1	†Bracket, Overspeed Switch Begin Spec D
9	305-0491	1	Regulator Assembly, Voltage (See Separate Group for Components) - Spec A Through C
10	800-0009	2	Screw, Cap - Hex Head (1/4-20 x 1-1/2")
11	853-0013	4	Washer, Lock - External Tooth (1/4")
12	305-0481	2	Spacer, Sleeve
13	862-0011	4	Nut, Hex - Special, Grade 8 (3/8-16)
14	850-0050	4	Washer, Lock - Spring (3/8")
15	211-0185	1	End Bell - Generator
16	509-0125	1	Seal, Oil - "O" Ring
17	800-0009	4	Screw, Cap - Hex Head (1/4-20 x 1-1/2")
18	850-0040	4	Washer, Lock - Spring (1/4")
19	220-2353	1	Stator, Exciter - Brushless Generator
20	520-0735	4	Stud (3/8-16 x 3/8-16 x 5-3/4")
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
24	800-0008	2	Screw, Cap - Hex Head (1/4-20 x 1-1/4")
25	850-0040	2	Washer, Lock - Spring (1/4")
26	862-0001	2	Nut, Hex (1/4-20)
27	234-0368	1	Screen, Air Outlet - Generator
28	800-0173	12	Screw, Cap - Hex Head (7/16-14 x 1-3/8")
29	850-0055	12	Washer, Lock - Spring (7/16")
30	STATOR ASSEMBLY, GENERATOR		
	220-1990	1	Key 1
	220-1991	1	Key 2
	220-1613	1	Key 3
	220-1518	1	Key 4
	220-1614	1	Key 5
	220-1519	1	Key 6
31	805-0032	8	Bolt, Place - Hex Head (1/2-13 x 1-1/4")
32	ROTOR ASSEMBLY, GENERATOR (Includes Parts Marked *)		
	201-1730	1	Key 1, 3 & 4
	201-2478	1	Key 2, 5 & 6 - Begin Spec E
	201-1844	1	Key 2, 5 & 6 - Spec A thru D
33	800-0513	1	*Screw, Cap - Hex Head, Special Heat Treated, Unplated (3/4-10 x 1-1/2")
34	850-0079	1	*Washer, Lock - Spring (3/4")
35	526-0238	1	*Washer, Flat - Steel Alloy (13/16" ID x 2" OD x 3/16" THK)
36	510-0101	1	*Bearing, Ball
37	232-2102	1	*Spacer, Sleeve
38	515-0145	1	*Key, Machine (1/4" x 1/4" x 7/8")
39	201-1739	1	*Rotor Assembly, Exciter - (See Separate Group for Components)
40	*BOLT, HEX HEAD - GRADE 8 (Hardened)		
	805-0033	8	Key 1, 3 & 4 (5/8-11 x 1")
	805-0035	12	Key 2, 5 & 6 - Spec A thru D
	805-0035	8	Key 2, 5 & 6 - Begin Spec E (5/8-11 x 1-1/2")
41	526-0259	As Reqd	*Washer, Flat - Special Hardened Steel (5/8")
42	*DISK, DRIVE - GENERATOR		
	232-2037	1	Key 1, 3 & 4
	232-1394	1	Key 2, 5 & 6 - Spec A thru D
	232-2580	1	Key 2, 5 & 6 - Begin Spec E
43	205-0095	1	*Fan, Centrifugal - Generator
44	232-1393	1	Hub, Rotor Drive - Key 5
45	515-0211	1	Key, Rotor Drive Hub - Key 5

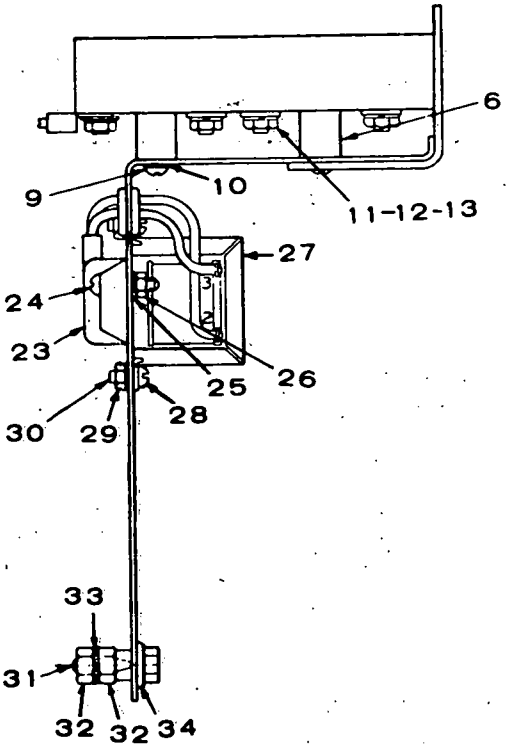
† - Included in Overspeed Contact Assembly #150-1456.

* - Included in Generator Rotor Assembly.

VOLTAGE REGULATOR GROUP - KEY 1,2,3,4,5,6
SPEC A THROUGH C





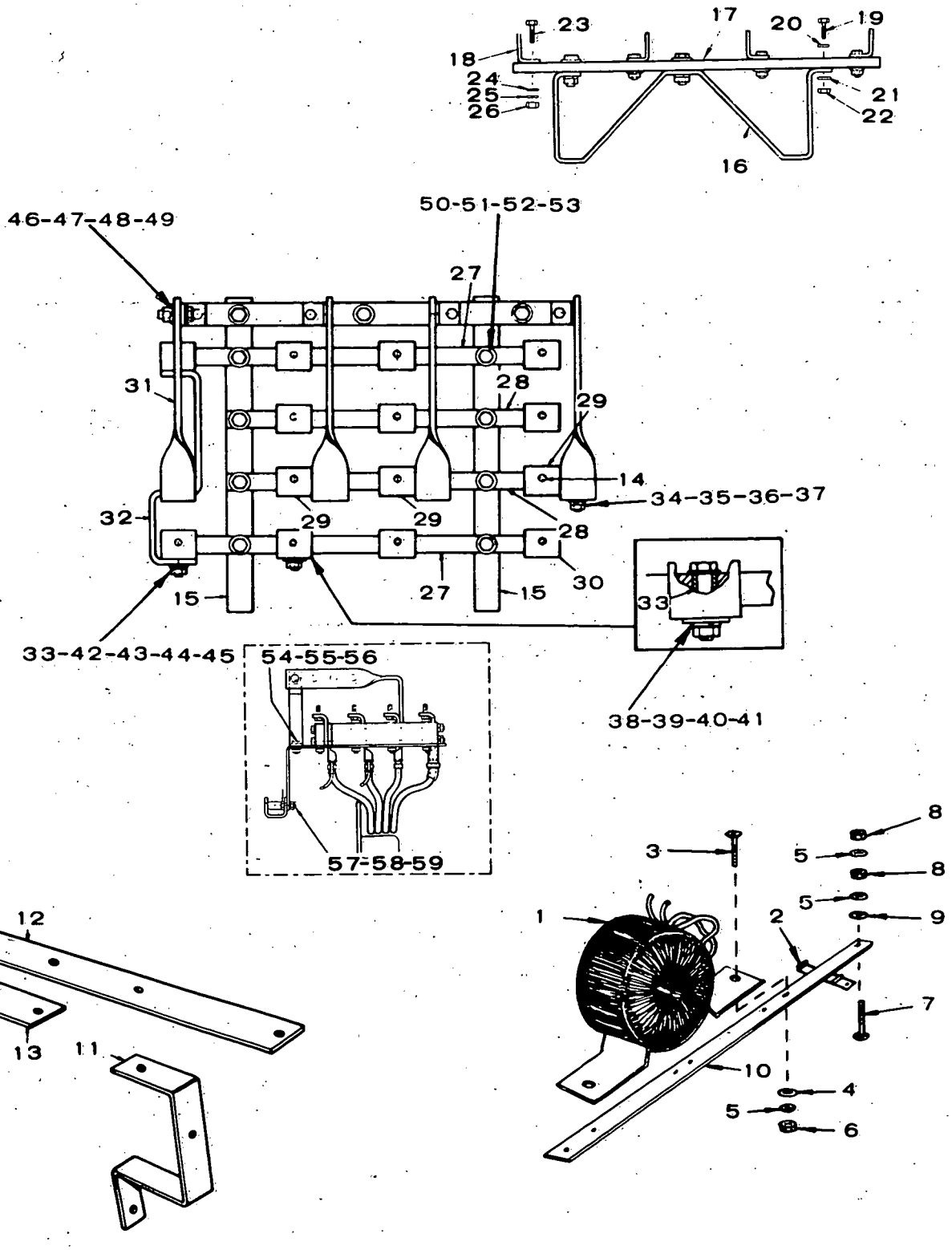


VOLTAGE REGULATOR GROUP - KEYS 1,2,3,4,5,6
SPEC A THROUGH C

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	305-0491	1	Regulator Assembly, Voltage (includes Parts Marked †)
1	305-0482	1	†Chassis, Voltage Regulator
2	358-0029	1	†Rectifier, Silicon (CR3)
3	RECTIFIER, SILICON CONTROLLED		
	364-0014	2	†Brushless Generator (Q4 & Q5)
4	RECTIFIER, SILICON		
	358-0035	2	†Brushless Generator (CR1 & CR2)
5	363-0048	3	†Heat Sink, Rectifier
6	332-1265	6	†Insulator, Stand off
7	812-0077	6	†Screw, Roundhead - Heat Sink Mtg. (8-32 x 3/8")
8	853-0005	6	†Washer, Lock - External Tooth (#8)
9	812-0077	6	†Screw, Machine Roundhead - Stand off Insulator Mtg. (#8-32 x 3/8")
10	853-0005	6	†Washer, Lock - External Tooth (#8)
11	871-0010	3	†Nut, Hex - Rectifier Mounting (CR1, CR2 & CR3) (#10-32)
12	526-0009	3	†Washer, Flat (7/32" I D x1/2" O D x 1/16" Thk) - Rectifier Mtg. (CR1, CR2 & CR3)
13	850-0030	3	†Washer, Lock - Spring - Rectifier Mtg. (CR1, CR2 & CR3) (#10)
14	812-0079	2	†Screw, Machine - Roundhead - Rectifier Lead to Heat Sink (#8-32 x 1/2")
15	526-0048	2	†Washer, Flat (Brass) (.172" I D x 3/8" O D x 1/32" Thk)
16	853-0005	2	†Washer, Lock - External Tooth (#8)
17	871-0007	2	†Nut, Hex - Rectifier Lead to Heat Sink (#8-32)
18	812-0079	1	†Screw, Machine Roundhead - Terminal Block Lead to Heatsink (#8-32 x 1/2")
19	853-0005	1	†Washer, Lock - External Tooth (#8) Terminal Block to Heat Sink
20	871-0007	1	†Nut, Hex - Terminal Block Lead to Heat Sink (#8-32)
21	508-0002	2	†Grommet, Rubber
22	332-1415	1	†Clamp, Cable
23	332-1266	1	†Block, Terminal
24	812-0081	2	†Screw Machine - Roundhead - Terminal Block Mounting (#8-32 x 5/8")
25	853-0005	2	†Washer, Lock - External Tooth (#8)
26	860-0008	2	†Nut, Hex - Terminal Block Mounting (#8-32)
27	REACTOR ASSEMBLY, COMMUTATOR		
	315-0343	1	†Brushless Generator
28	812-0077	2	†Screw, Machine - Roundhead - Reactor Mtg. (#8-32 x 3/8")
29	853-0005	2	†Washer, Lock - External Tooth (#8)
30	860-0008	2	†Nut, Hex - Reactor Mtg. (#8-32)
31	150-0723	1	†Point, Contact - Overspeed Switch
32	862-0001	2	†Nut, Hex - Contact Point (1/4-20)
33	853-0013	1	†Washer, Lock - External Tooth (1/4)
34	870-0250	2	†Nut, Insulator - Contact Point (1/4)
35	332-1043	2	†Jumper - Terminal Block

† - Parts included in 305-0491 Voltage Regulator.

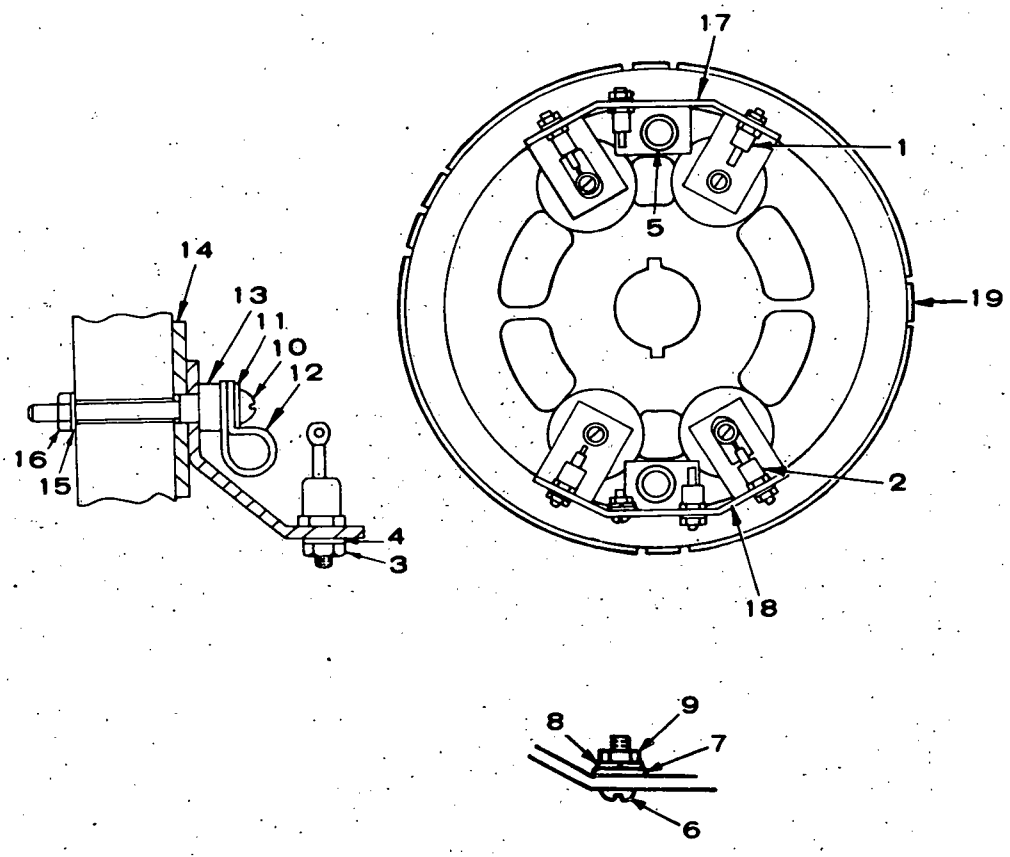
BUS BAR GROUP - KEYS 7,8



BUS BAR GROUP - KEYS 7,8

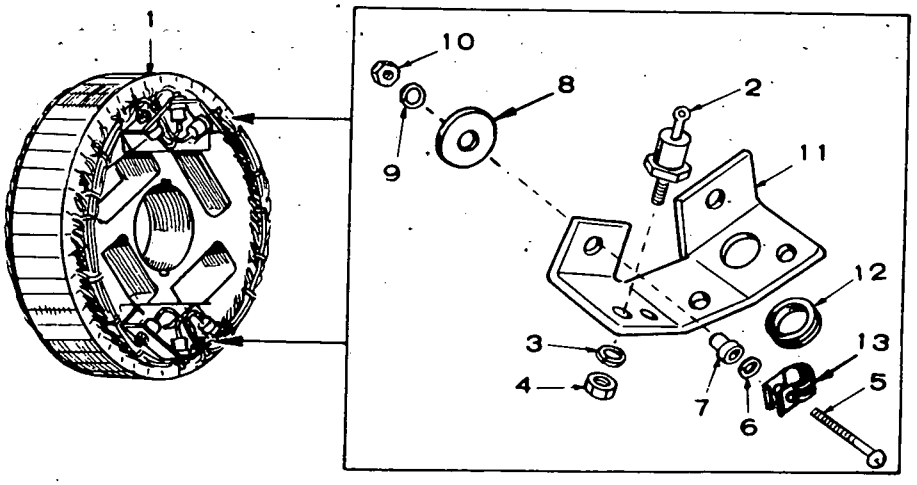
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	302-0608	3	Transformer, Current
2	232-2342	2	Bracket, Terminal Board Mtg.
3	SCREW, MACHINE - ROUND HEAD TRANSFORMER MOUNTING		
	813-0100	4	#10-32 x 1/2"
	813-0103	2	#10-32 x 3/4"
4	526-0008	6	Washer, Flat - (13/64" ID x 7/16" OD x 1/32" Thk)
5	856-0003	8	Washer, Lock - EIT (#10)
6	870-0053	6	Nut, Hex - (#10-32)
7	815-0203	1	Screw, Machine - Round Head Brass (#10-32 x 7/8")
8	871-0010	2	Nut, Hex - Brass (#10-32)
9	526-0049	1	Washer, Flat - Brass (.200" ID x 7/16" OD x 1/32" Thk)
10	315-0389	1	Plate, Transformer Mounting
11	332-1402	1	Clamp
12	232-2246	2	Bar, Reconnection
13	232-2248	3	Bar, Reconnection
14	520-0142	14	Stud (5/16 x 1-1/4")
15	232-2249	2	Bracket, Terminal Board Mtg.
16	232-2237	1	Bracket, Bus Bar Support
17	232-2245	1	Board, Insulating - Bus Bar
18	232-2387	4	Bracket, Bus Bar
19	800-0051	3	Screw, Cap - Hex Head (3/8-16 x 1-1/4")
20	526-0029	3	Washer, Flat (25/64" ID x 7/8" OD x 1/16" Thk)
21	850-0050	3	Washer, Lock - Spring (3/8")
22	862-0003	3	Nut, Hex - (3/8-16)
23	800-0007	4	Screw, Cap - Hex Head (1/4-20 x 1")
24	526-0018	4	Washer, Flat (21/64 ID x 3/4 OD x 1/16" Thk)
25	850-0040	4	Washer, Lock - Spring (1/4)
26	862-0001	4	Nut, Hex - (1/4-20)
27	232-2243	2	Board, Insulating
28	232-2242	2	Board, Insulating
29	232-2343	3	Bar, Bus
30	232-2241	11	Bar, Bus
31	232-2240	4	Bar, Bus
32	232-2238	1	Bracket, Bus Bar
33	232-2344	32	Spacer, Terminal Connection
34	800-0028	4	Screw, Cap - Hex Head (5/16-18 x 1")
35	526-0115	8	Washer, Flat - (11/32" ID x 11/16" OD x 1/16" Thk)
36	850-0045	4	Washer, Lock - Spring (5/16")
37	862-0015	4	Nut, Hex - (5/16-18)
38	800-0032	24	Screw, Hex Cap - Steel (5/16-18 x 1-3/4")
39	526-0115	24	Washer, Flat (11/32" ID x 11/16" OD x 1/16" Thk)
40	850-0045	24	Washer, Lock - Spring (5/16")
41	862-0015	24	Nut, Hex - (5/16-18)
42	800-0033	8	Screw, Cap - Hex Head (5/16-18 x 2")
43	526-0115	16	Washer, Flat - (11/32" ID x 11/16" OD x 1/16" Thk)
44	850-0045	8	Washer, Lock - Spring (5/16")
45	862-0015	8	Nut, Hex - (5/16-18)
46	800-0051	4	Screw, Cap - Hex Head (3/8-16 x 1-1/4")
47	526-0029	8	Washer, Flat (25/64" ID x 7/8" OD x 1/16" Thk)
48	850-0050	4	Washer, Lock - Spring (3/8")
49	862-0003	4	Nut, Hex - (3/8-16)
50	800-0056	8	Screw, Cap - Hex Head (3/8-16 x 2-1/2")
51	526-0029	8	Washer, Flat - (25/64" ID x 7/8" OD x 1/16" Thk)
52	850-0050	8	Washer, Lock - Spring (3/8")
53	862-0003	4	Nut, Hex - (3/8-16 x 1")
54	800-0050	2	Screw, Cap - Hex Head (3/8-16 x 1")
55	850-0050	2	Washer, Lock - Spring (3/8")
56	862-0003	2	Nut, Hex - (3/8-16)
57	800-0050	2	Screw, Cap - Hex Head (3/8-16 x 1")
58	850-0050	2	Washer, Lock - Spring (3/8")
59	862-0003	2	Nut, Hex - (3/8-16)

EXCITER ROTOR GROUP - KEYS 1,2,3,4,5,6



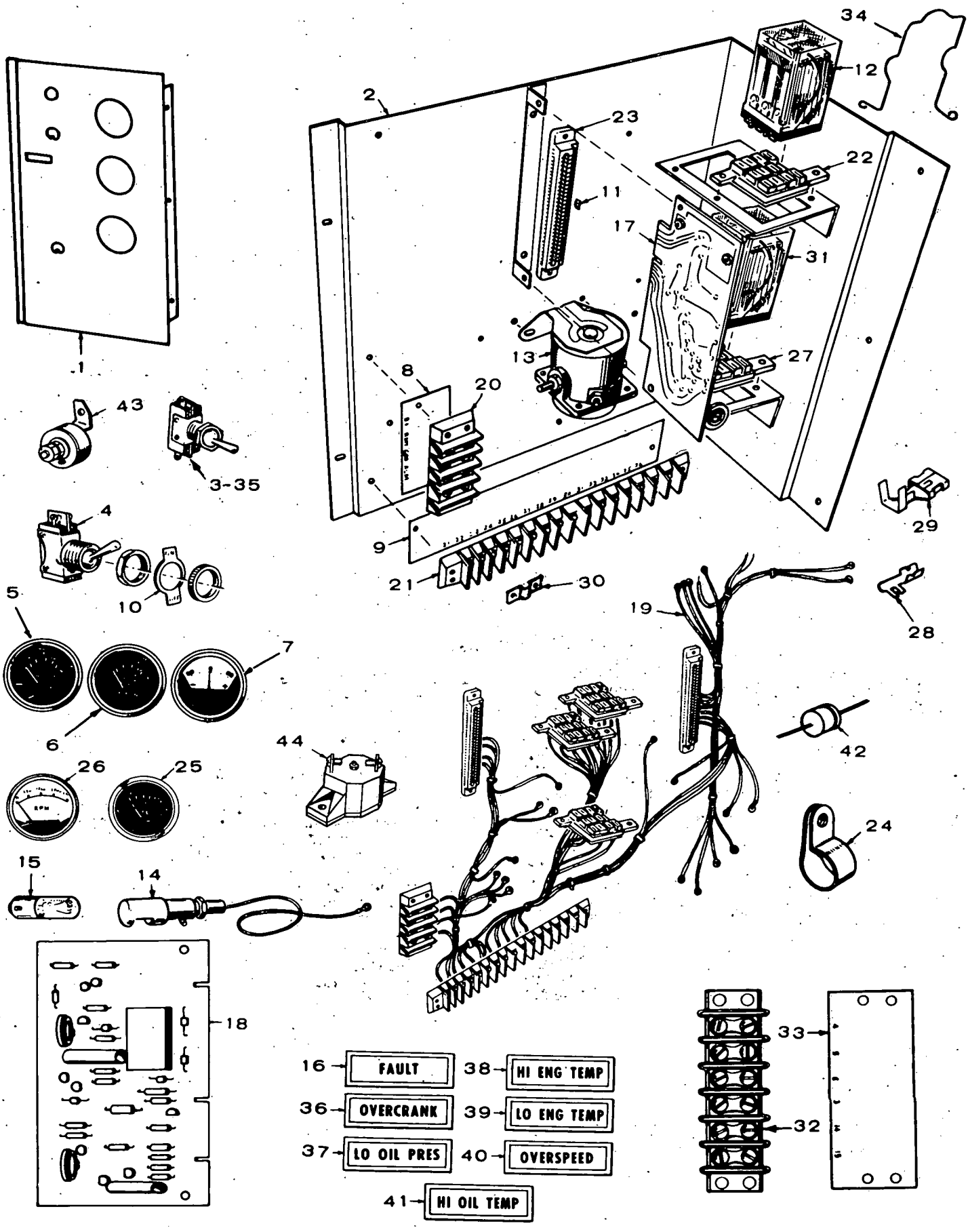
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	358-0016	3	Rectifier, Diode - Positive
2	358-0015	3	Rectifier, Diode - Negative
3	870-0053	6	Nut, Hex (#10-32)
4	850-0030	6	Washer, Lock - Spring (#10)
5	508-0093	2	Grommet, Rubber
6	813-0100	2	Screw, Machine - Round Head (#10-32 x 1/2")
7	526-0008	2	Washer, 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

EXCITER ROTOR GROUP - KEYS 7,8



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	201-1902	1	Rotor Assembly, Exciter - Complete (Also shown in Generator Group)
2	RECTIFIER, DIODE		
	358-0011	3	Positive Stud
	358-0012	3	Negative Stud
3	850-0040	6	Washer, Lock - Spring (1/4")
4	868-0001	6	Nut, Hex - (1/4-20)
5	813-0110	4	Screw, Machine - Round Head (#10-32 x 2")
6	526-0009	4	Washer, Flat (7/32" ID x 1/2" OD x 1/16" Thk)
7	508-0124	4	Busing, Insulating
8	508-0156	4	Washer, Insulating
9	850-0030	4	Washer, Lock - Spring (#10)
10	870-0053	4	Nut, Hex (#10-32)
11	SINK, HEAT		
	363-0049	1	Positive
	363-0050	1	Negative
12	508-0093	2	Grommet, Rubber
13	332-0050	2	Clip, Wire

CONTROL GROUP (Engine Portion) - KEYS 1,2,3,4,5,6

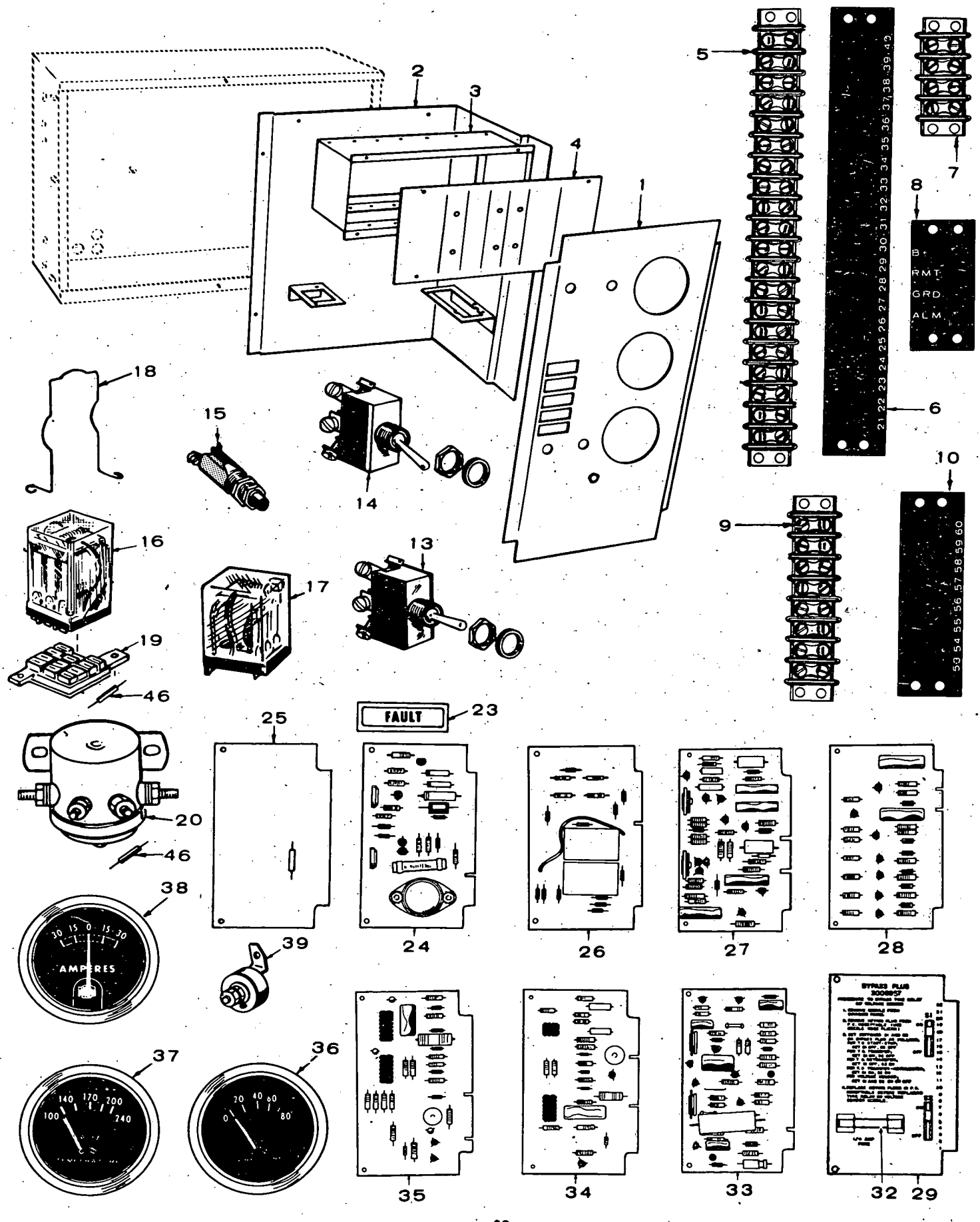


CONTROL GROUP (Engine Portion) - KEYS 1,2,3,4,5,6

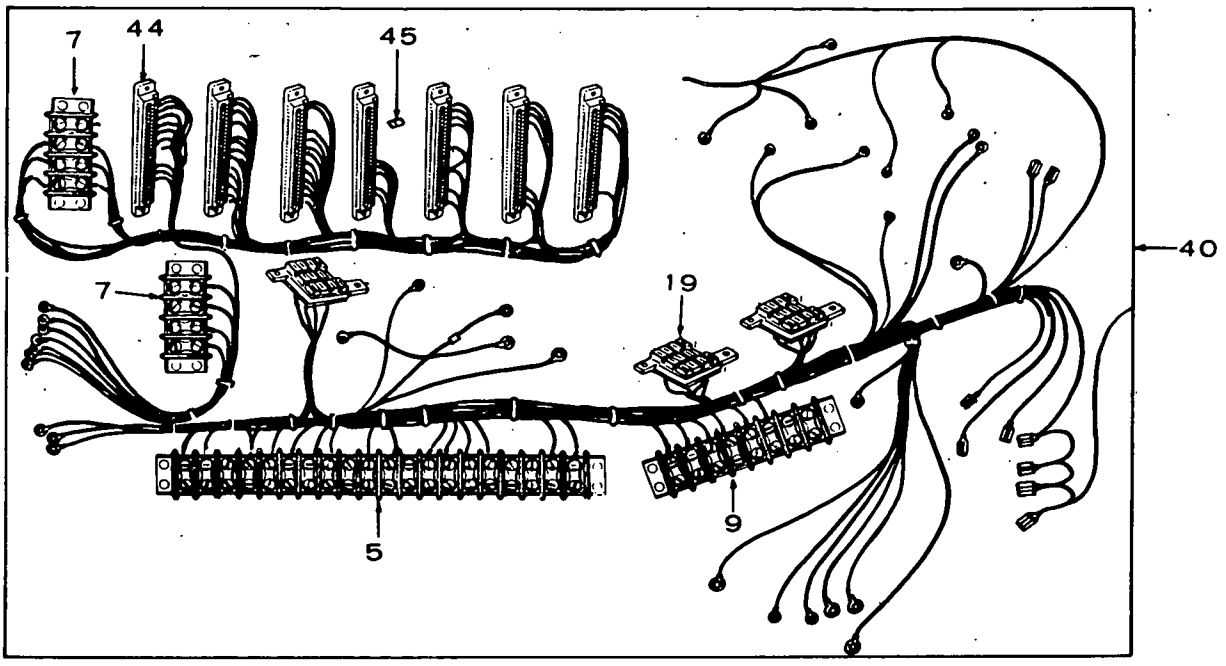
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	PANEL ONLY, ENGINE CONTROL		
	301-3165	1	Sets With One Fault Light
	301-3267	1	Sets With Five Fault Lights - Optional
2	301-3253	1	Bracket, Angle - Control Mounting
3	308-0138	1	Switch, Toggle (SPDT)
4	308-0002	1	Switch, Toggle (SPST)
5	GAUGE, OIL PRESSURE		
	193-0243	1	Begin Spec F
	193-0107	1	Spec A Through E
6	GAUGE, WATER TEMPERATURE		
	193-0245	1	Begin Spec F
	193-0106	1	Spec A Through E
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	332-0003	4	Plug, Key
12	307-1056	2	Relay, Armature
13	307-0061	1	Relay, Armature
14	322-0149	1	Light, Panel
15	322-0017	1	Lamp, Incandescent
16	322-0129	1	Light, Indicator (Fault)
17	CONTROL, CRANKER (See Separate Group for Components)		
	300-0751	1	Standard
	300-0715	1	Optional Cycle Cranker
18	CONTROL, ENGINE MONITOR (See Separate Group for Components)		
	300-0680	1	Standard (1 Light)
	300-0682	1	Optional (5 Light)
	300-0731	1	Penn State Approved (1 Light)
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	†Board, Terminal (4 Place)
21	332-0795	1	†Board, Terminal (16 Place)
22	332-0765	2	†Socket, Relay (Includes Terminals(
23	332-1271	2	†Housing, Connector (PC Boards)
24	332-0051	1	Clamp, Loop
25	GAUGE, OIL TEMPERATURE - OPTIONAL		
	193-0250	1	Begin Spec F
	193-0187	1	Spec A Through E
26	302-0749	1	Tachometer, Electrical - Optional
27	323-0764	1	†Socket, Relay (Includes Terminals)
28	332-1269	As Reqd	†Contact, Electricul - PC Board Connector
29	332-1280	As Reqd	†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	322-0119	1	Light, Indicator (Overcrank)
37	322-0120	1	Light, Indicator (Low Oil Pressure)
38	322-0121	1	Light, Indicator (Hi Engine Temp)
39	322-0122	1	Light, Indicator (Low Engine Temp)
40	322-0123	1	Light, Indicator (Overspeed)
41	322-0124	1	Light, Indicator (Hi Oil Temp)
42	357-0004	1	Diode, Rectifier
43	RESISTOR - GAUGES		
	193-0250	2	Begin Spec F
	193-0189	2	Spec A Through E
44	320-0240	1	Breaker, Circuit - 12.5 Amp

† - Included in Wiring Harness.

CONTROL GROUP (Engine Instruments Portion) - KEYS 7,8



CONTROL GROUP (Engine Instruments Portion) - KEYS 7,8

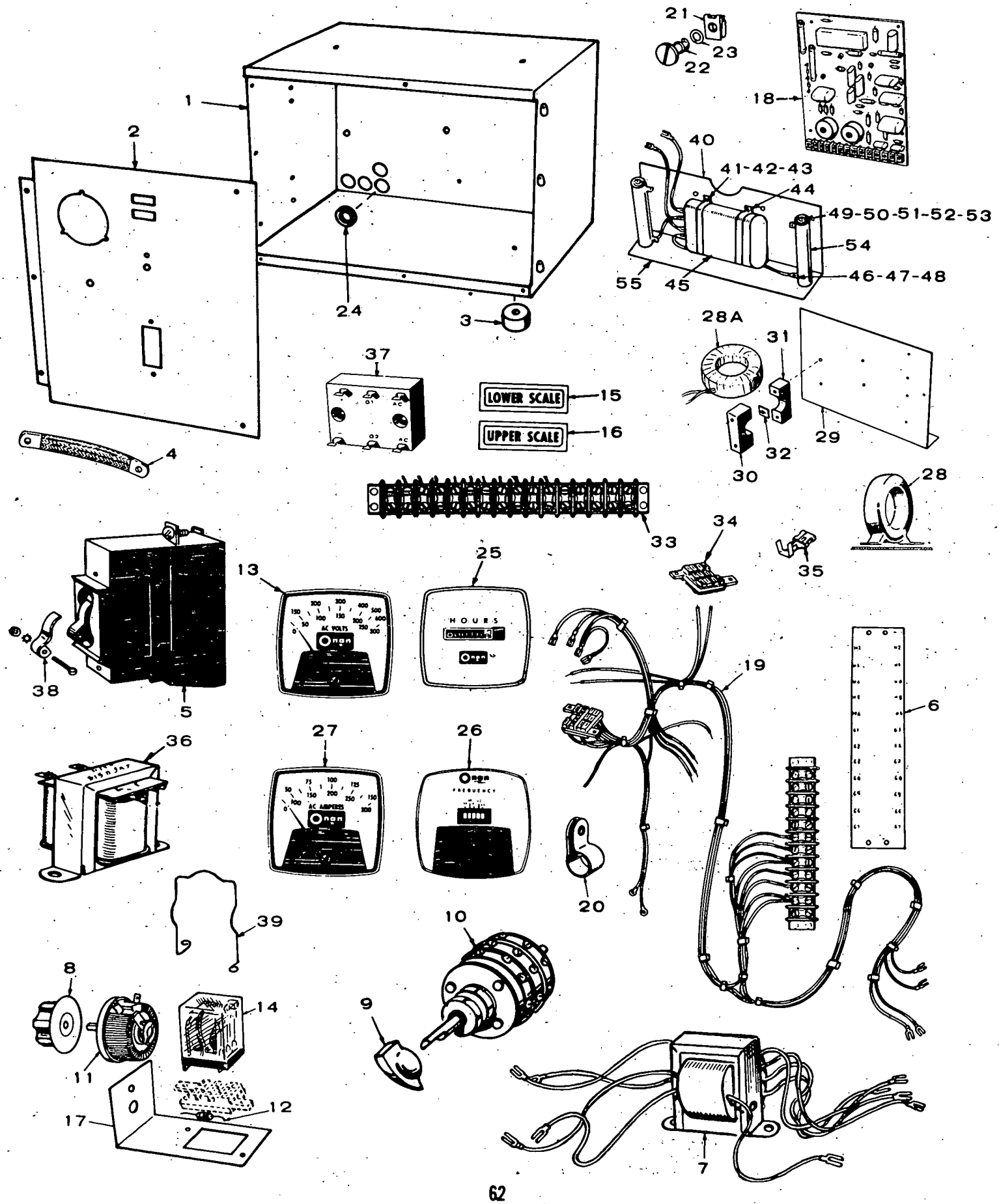


REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	PANEL, ENGINE CONTROL		
	301-3661	1	Sets With One Fault Light
	301-3629	1	Sets With Five Fault Lights
2	301-3621	1	Bracket, Engine Control
3	301-3588	1	Rack, Module
4	301-3635	1	Cover Assembly, Rack
5	332-1005	1	*Block, Terminal - 20 Place
6	332-1559	1	Strip, Terminal Block Marker (21-40)
7	332-0537	2	*Block, Terminal - 4 Place
8	STRIP, TERMINAL BLOCK MARKER (4-Place)		
	332-1239	1	B+, Remote, Ground, Alarm
	332-1561	1	1-4
9	332-0699	1	*Block, Terminal - 8 Place - Set With Five Fault Lights
10	332-1560	1	Strip, Terminal Block Marker (53-60) - Sets With Five Fault Lights
13	SWITCH, SELECTOR		
	308-0220	1	Standard Control
	308-0347	1	Penn State Models (Optional)
14	308-0337	1	Switch, Lamp Test
15	308-0091	1	Switch, Reset
16	307-1056	2	Relay (1) Start Disconnect (1) Ignition
17	307-1061	1	Relay, Starter Protection
18	307-1157	3	Spring, Relay Holddown
19	323-0765	3	*Socket, Relay - 11 Place (Includes Terminals)
20	307-0061	1	Relay, Start Solenoid
23	LAMP, FAULT		
	322-0129	1	Standard
	322-0119	1	Overcrank (Optional)
	322-0123	1	Overspeed (Optional)
	322-0120	1	Low Oil Pressure (Opt.)
	322-0121	1	High Engine Temperature (Optional)
	322-0122	1	Low Engine Temperature (Optional)

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
24	300-0956	1	Control, Cycle Cranker (Optional)
25	300-0977	1	Control, Standard Cranker
26	300-0954	1	Control, Engine Shutdown
27	300-0953	1	Control, Engine Monitor
28	300-0955	1	Control, Remote Indicator - Sets With Five Fault Lights
29	300-0987	1	Module, Bypass Plug
32	321-0168	1	Fuse, 1/4 Amp (Part of 300-0987 Module)
33	300-0973	1	Module, Time Delay Start-Stop (Optional)
34	300-0957	1	Control, Overspeed Sensor
35	300-0958	1	Control, Starter Disconnect
36	193-0243	1	Gauge, Oil Pressure
37	193-0245	1	Gauge, Water Temperature
38	302-0061	1	Ammeter, Charge (30-0-30)
39	193-0250	2	Resistor, Gauge (1) Start Solenoid (1) Start Disconnect Relay
40	Harness, Wiring (Includes Parts Marked *)		
	338-0715	1	Sets With One Fault Light
	338-0705	1	Sets With Five Fault Lights
44	332-1271	6	*Housing, Printed Circuit Board Terminal (Seven on Sets With Five Fault Lights)
45	332-1276	As Reqd	*Plug, Keying
46	357-0004	2	*Rectifier, Diode
48	323-0814	12	Guide, Printed Circuit Board (14 Used on Sets with Five Fault Lights)

* - Included in Wiring Harness Assembly.

CONTROL GROUP (AC Output Portion) - KEYS 1,2,3,4,5,6



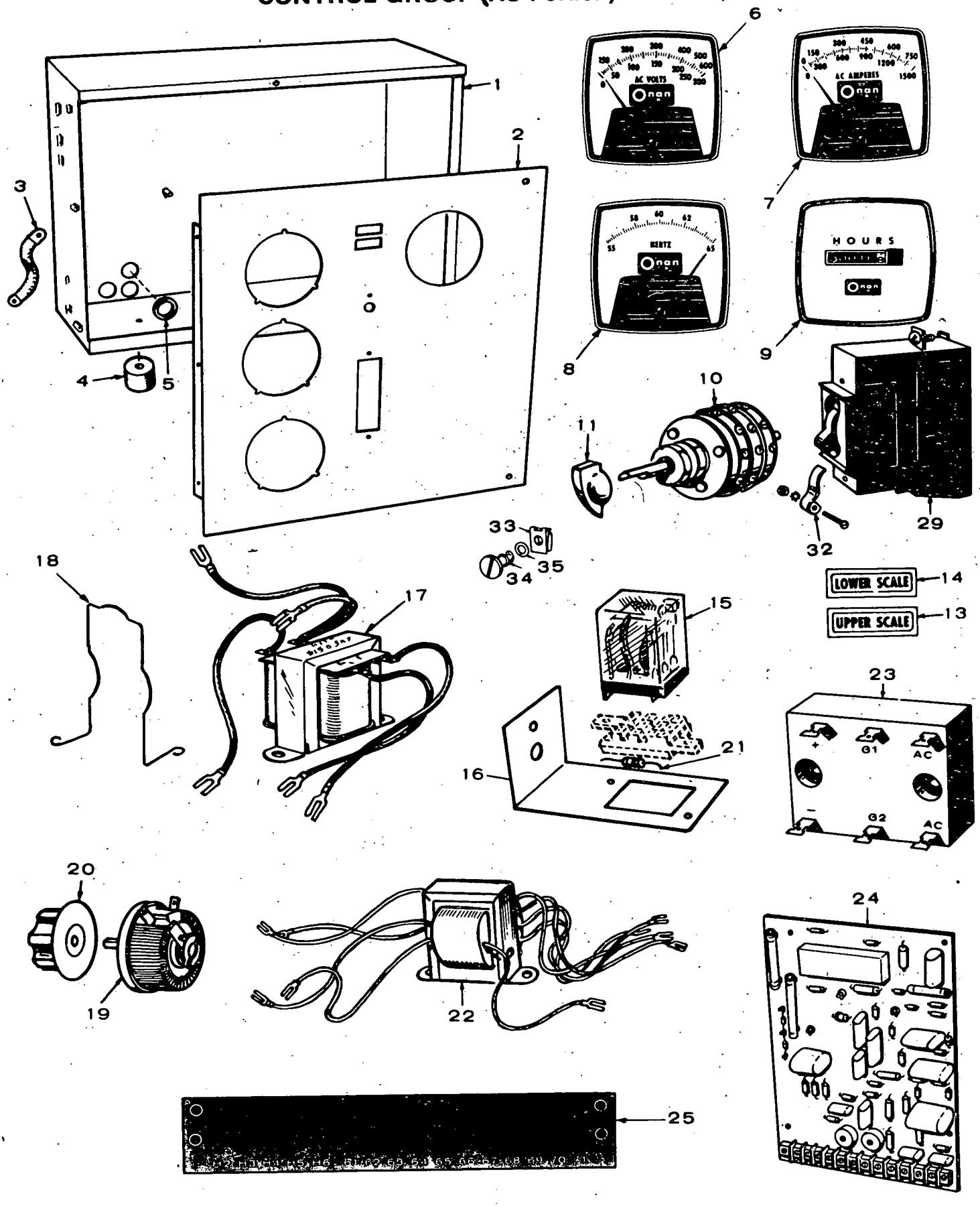
CONTROL GROUP (AC Output Portion) - KEYS 1,2,3,4,5,6

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	301-3158	1	Box, Control
2	PANEL, CONTROL BOX		
	301-3170	1	Key 1,2,4 and 6
	301-3342	1	Key 3 and 5
3	402-0078	4	Mount, Vibration
4	337-0049	1	Lead, Electrical - Ground
5	320-0431	1	Breaker, Circuit
6	332-1242	1	Strip, Marker (16 Place)
7	315-0342	1	Transformer, Voltage
8	303-0032	1	Knob
9	303-0076	1	Knob, Pointer
10	308-0284	1	Switch, Rotary - 4 Pole, 4 Position
11	303-0170	1	Rheostat
12	350-0556	1	†Resistor, Composition (47,000-Ohm, 1/2 Watt, 5%)
13	VOLTMETER		
	302-0718	1	(0-300 Volt, 0-600 Volt) Key 1,2,4, and 6
	302-0779	1	(0-750 Volt) - Key 3 and 5
14	307-1061	1	Relay, Armature
15	322-0130	1	Light, Indicator - Key 1,2,4 and 6 (Lower Scale)
16	322-0131	1	Light, Indicator - Key 1,2,4 and 6 (Upper Scale)
17	301-3244	1	Bracket, Angle - Relay Socket
18	REGULATOR, VOLTAGE (See Separate Group for Components)		
	332-1956	1	Begin Spec F
	332-1268	1	Spec A Through E
19	HARNESS, WIRING - AC CONTROL (Includes Parts Marked †)		
	338-0730	1	Key 1, 2, 4 and 6 - Begin Spec D
	338-0525	1	Key 1, 2, 4 and 6 - Spec A through C
	338-0759	1	Key 3 and 5 - Begin Spec D
	338-0571	1	Key 3 and 5 - Spec A through C
20	332-0051	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		
	302-0723	1	Key 1
	302-0411	1	Key 3
	302-0724	1	Key 2, 4 and 6
	302-0412	1	Key 5
28	CURRENT TRANSFORMER		
	302-0547	3	Key 1
	302-0471	3	Key 2, 4 and 6
28A	CURRENT TRANSFORMER		
	302-0106	3	Key 3
	302-0209	3	Key 5
29	BRACKET, ANGLE - TRANSFORMER MOUNTING		
	302-0764	1	Key 1, 2, 4 and 6
	302-0729	1	Key 3 and 5
30	302-0235	3	Clamp, Retaining, Transformer - Upper
31	302-0236	3	Clamp, Retaining, Transformer - Lower
32	302-0253	As Reqd	Shim - Transformer Mounting
33	332-0795	1	†Board, Terminal (16 Place)
34	323-0764		†Socket, Relay (Includes Terminals)
35	332-1280	As Reqd	†Terminal, Lug
36	315-0384	1	Reactor - Begin Spec D
37	305-0524	1	Rectifier Assembly - Begin Spec D
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

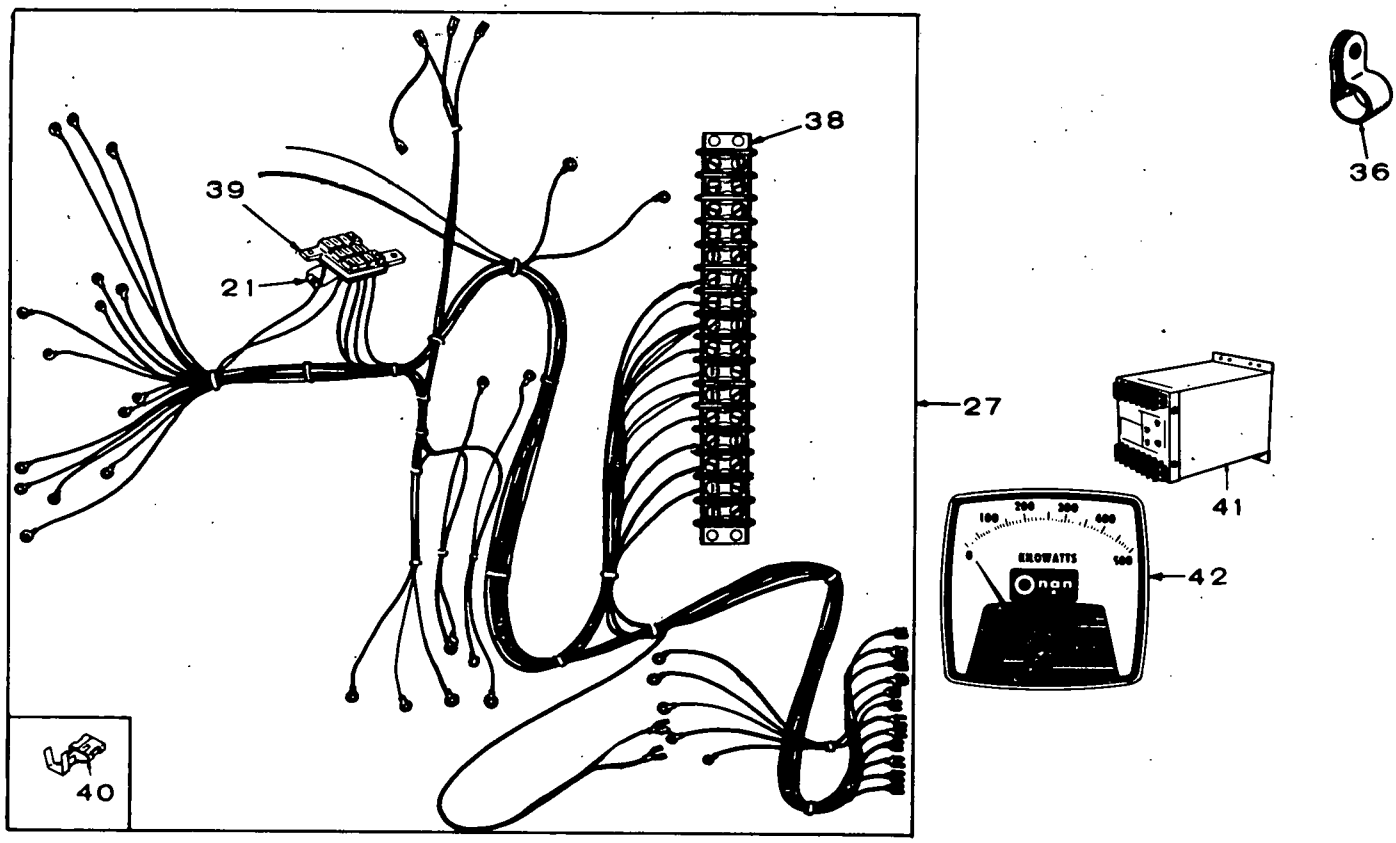
+ - Included in Filter.

† - Included in Wiring Harness.

CONTROL GROUP (AC Portion) - KEYS 7,8



CONTROL GROUP (AC Portion) - KEYS 7,8

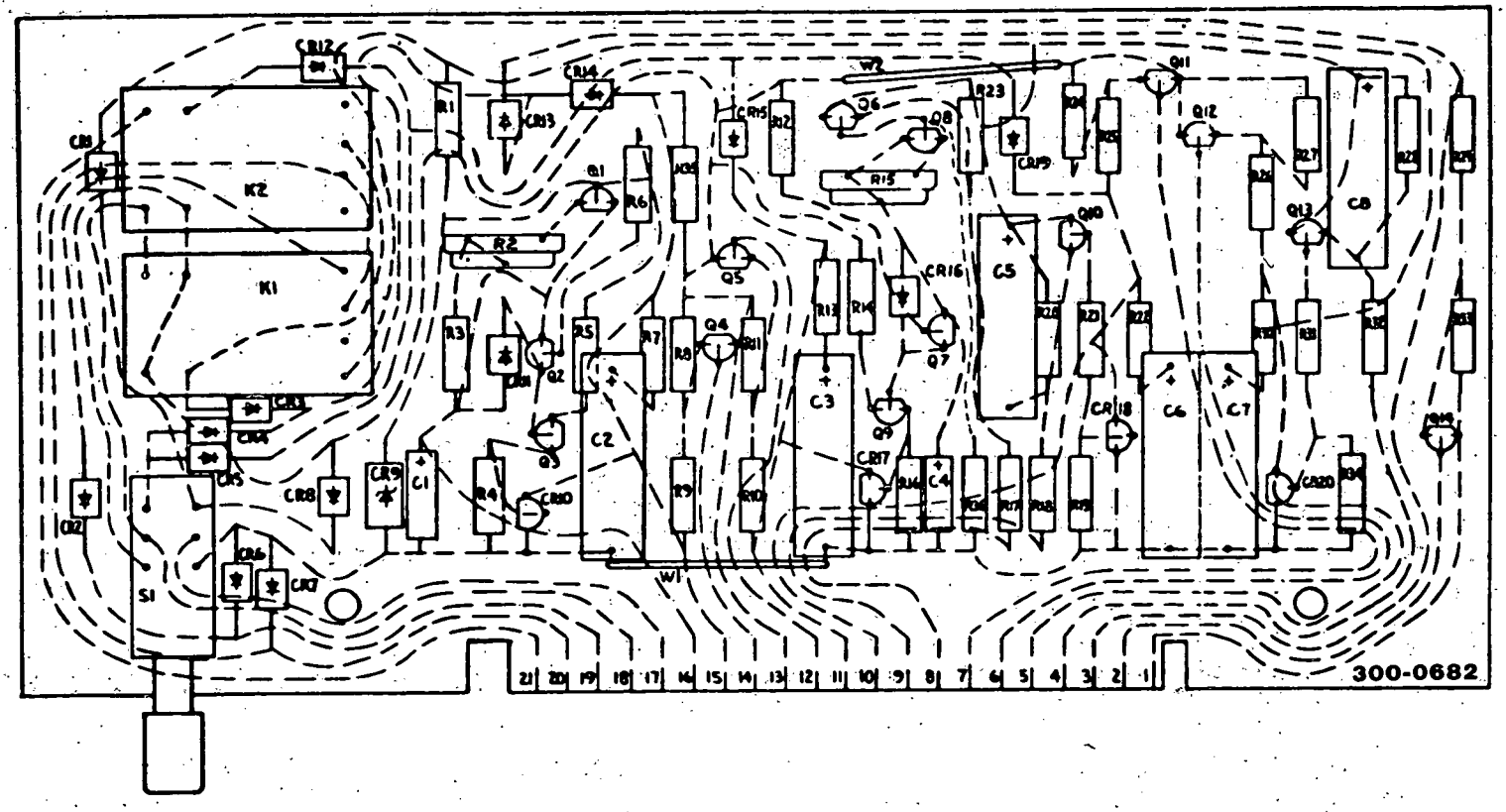


REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	301-3158	1	Box, Control
2	PANEL, CONTROL BOX		
	301-3170	1	Standard Units
	301-3312	1	Units With Wattmeter
3	337-0049	1	Strap, Bond
4	402-0078	4	Dampener, Vibration
5	508-0001	4	Grommet (1-1/16"), Rubber
6	302-0718	1	Voltmeter, AC - Dual Scale 0-300, 0-600
7	302-0877	1	Ammeter, AC - Dual Scale (0-400, 0-800)
8	METER, FREQUENCY		
	302-0810	1	60 Hertz
	302-0894	1	50 Hertz
9	METER, RUNNING TIME		
	302-0466	1	60 Hertz
	302-0469	1	50 Hertz
10	308-0284	1	Switch, Voltage & Ammeter
11	303-0076	1	Knob
13	322-0131	1	Light, Upper Scale
14	322-0130	1	Light, Lower Scale
15	307-1061	1	Relay, Voltage Selector
16	301-3244	1	Bracket, Relay Mounting
17	315-0384	1	Reactor Assembly, Comm
18	307-1157	1	Spring, Relay Holddown
19	303-0170	1	Rheostat, Voltage Adj.
20	303-0032	1	Knob, Rheostat
21	350-0556	1	*Resistor

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
22	315-0431	1	Transformer, Voltage
23	305-0524	1	Bridge, Rectifier
24	332-1956	1	Board Assembly, Printed Circuit Voltage Regulator
25	332-1242	1	Strip, Marker (H2-H6, 61-71)
27	338-0730	1	Harness, Wiring - AC Control (Includes Parts Marked *)
29	320-0455	1	Circuit Breaker (3 Amp)
32	320-0307	1	Lock, Circuit Breaker Handle (Penn State Models) - Optional
33	406-0332	2	Receptacle, Fastener
34	406-0333	2	Stud, Fastener
35	406-0334	2	Washer, Stud Fastener
36	332-0050	1	Clip, Tinnerman
38	332-0795	1	*Block, Terminal - 16 Place
39	323-0764	1	*Socket, Relay (Includes Terminals)
40	332-1280	As Req.	*Terminal, Crimp
41	302-0921	1	Transducer, Watt - Optional
42	302-0926	1	Wattmeter, AC (Scale Reads 0-300 - Optional)

* - Included in Wiring Harness Assembly.

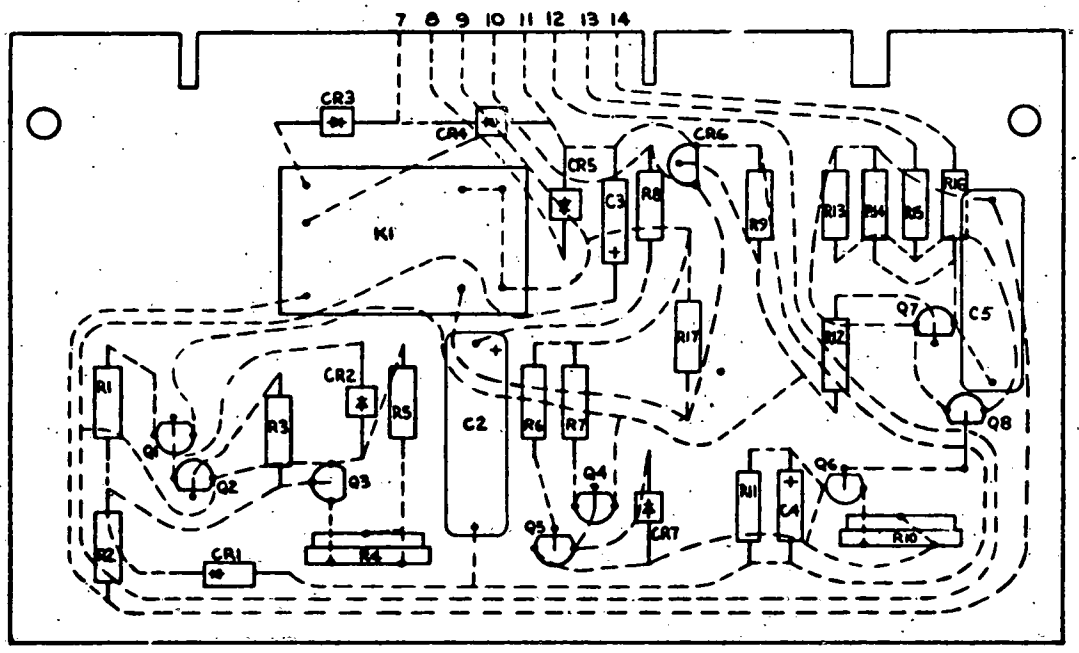
ENGINE CONTROL MONITOR GROUP - 24 VOLT - OPTIONAL EQUIPMENT - KEYS 1,2,3,4,5,6 (5 Fault Lights)



ENGINE CONTROL MONITOR GROUP - 24 VOLT - OPTIONAL EQUIPMENT - KEYS 1,2,3,4,5,6 (5 Fault Lights)

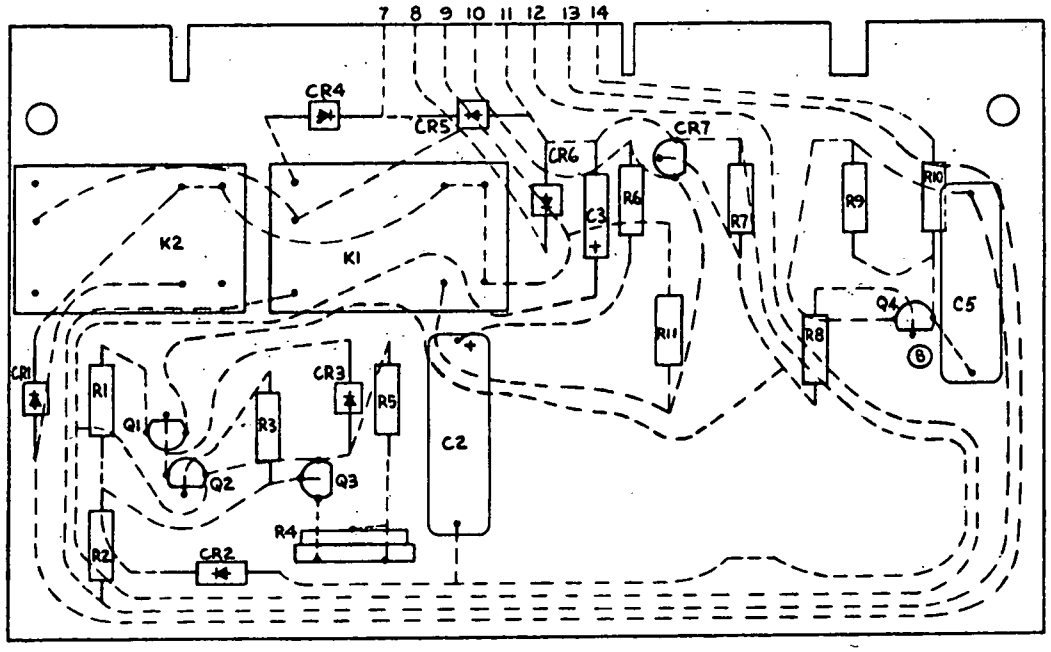
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	300-0682		Monitor, Engine Control - 24 Volt - Optional (5 Fault Light Sets)
C1	356-0040	1	Capacitor, Electrolytic (10 Mfd, 20 Volt)
C2	355-0005	1	Capacitor, Plastic Dielectric (.22 Mfd, 200 VDC, 10%)
C3	355-0005	1	Capacitor, Plastic Dielectric (.22 Mfd, 200 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	364-0011	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	364-0011	1	Diode, Rectifier (.8 Amp, 30 Volt)
CR18	364-0011	1	Diode, Rectifier (.8 Amp, 30 Volt)
CR19	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
CR20	364-0011	1	Diode, Rectifier (.8 Amp, 30 Volt)
CR21	357-0004	1	Diode, Rectifier (400 MA, 400 Volt)
K1	307-1076	1	Relay, Armature (24 Volt)
K2	307-1076	1	Relay, Armature (24 Volt)
Q1	362-0025	1	Transistor
Q2	362-0025	1	Transistor
Q3	361-0003	1	Transistor
Q4	362-0027	1	Transistor
Q5	362-0027	1	Transistor
Q6	362-0027	1	Transistor
Q7	362-0031	1	Transistor
Q8	362-0031	1	Transistor
Q9	361-0003	1	Transistor
Q10	362-0027	1	Transistor
Q11	362-0027	1	Transistor
Q12	362-0027	1	Transistor
Q13	362-0027	1	Transistor
Q14	362-0027	1	Transistor
R1	350-0534	1	Resistor, Composition (680-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	350-0544	1	Resistor, Composition (4700-Ohm, 1/2 Watt, 10%)
R10	350-0686	1	Resistor, Composition (910-Ohm, 1 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	303-0182	1	Potentiometer (1 Megohm, 1/4 Watt, 30%)
R16	350-0517	1	Resistor, Composition (27-Ohm, 1/2 Watt, 10%)
R17	350-0544	1	Resistor, Composition (4700-Ohm, 1/2 Watt, 10%)
R18	350-0544	1	Resistor, Composition (4700-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	350-0380	1	Resistor, Composition (510-Ohm, 1/2 Watt, 5%)
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	350-0389	1	Resistor, Composition (1200-Ohm, 1/2 Watt, 5%)
R26	350-0686	1	Resistor, Composition (910-Ohm, 1 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	350-0544	1	Resistor, Composition (4700-Ohm, 1/2 Watt, 10%)
R30	350-0505	1	Resistor, Composition (2.7-Ohm, 1/2 Watt, 10%)
R31	350-0380	1	Resistor, Composition (510-Ohm, 1/2 Watt, 5%)
R32	350-0544	1	Resistor, Composition (4700-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	350-0980	1	Resistor, Composition (510-Ohm, 2 Watt, 5%)
R36	350-0540	1	Resistor, Composition (2200-Ohm, 1/2 Watt, 10%)
S1	308-0280	1	Switch, Push - DPDT (1A, 28 VDC/.45A, 115 VAC)

ENGINE CONTROL MONITOR GROUP - 24 VOLT - STANDARD - KEYS 1,2,3,4,5,6



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	300-0680	1	Printed Circuit Board - Complete
R10	303-0182	1	Potentiometer (1.0 Megohm)
Q5, 6	362-0031	2	Transistor, Field Effect
R3	350-0548	1	Resistor (10,000-Ohm)
R17	350-0980	1	Resistor (510-Ohm)
R12	350-0380	1	Resistor (510-Ohm)
R15, R16	350-0544	2	Resistor (4,700-Ohm)
R13, 14	350-0529	2	Resistor (270-Ohm)
R11	350-0587	1	Resistor (18 Megohm)
R9	350-0517	1	Resistor (27-Ohm)
R8	350-0505	1	Resistor (2.7-Ohm)
R5	350-0572	1	Resistor (1.0 Megohm)
R4	303-0169	1	Potentiometer (3.5 Megohm)
R6	350-0552	1	Resistor (22,000-Ohm)
R2	350-0534	1	Resistor (680-Ohm)
R1, R7	350-0536	2	Resistor (1000-Ohm)
Q7, Q8	362-0027	2	Transistor, Silicon
Q2, 3	362-0025	2	Transistor, Field Effect
Q1, Q4	361-0003	2	Transistor
CR6	364-0011	1	Rectifier, Gate Control
CR2,3,4, 5,7	357-0004	5	Rectifier, Diode
CR1	359-0027	1	Diode, Zener
C4	356-0030	1	Capacitor (1 Mfd.)
C3	356-0040	1	Capacitor (10 Mfd.)
C2,5	355-0005	2	Capacitor (.22 Mfd.)
K1	307-1076	1	Relay

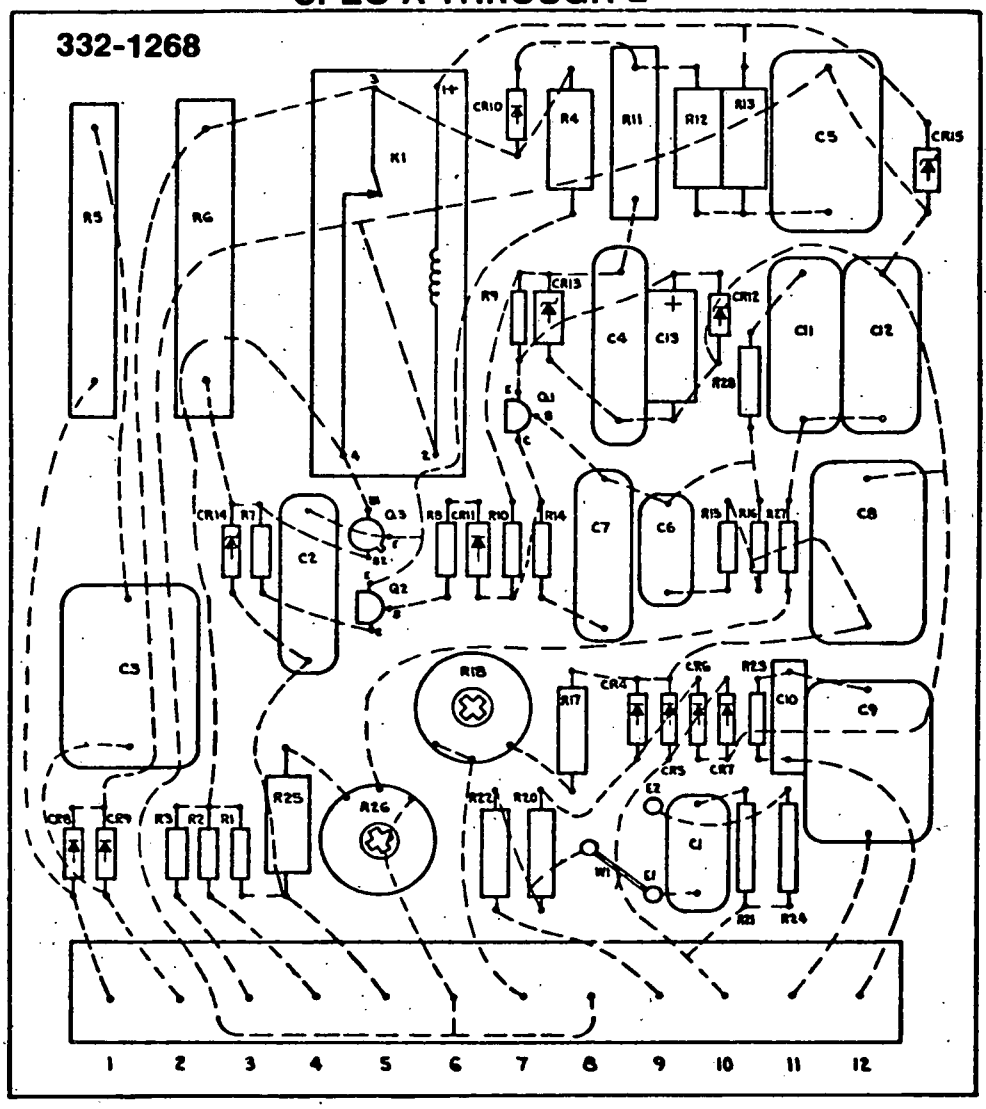
ENGINE CONTROL MONITOR GROUP — 24 VOLT — PENN STATE
KEYS 1,2,3,4,5,6



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	300-0731		Monitor, Engine Control - 24 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	364-0011	1	Diode, Rectifier (.8 Amp, 30 Volt)
K1	307-1076	1	Relay, Armature (24 Volt)
K2	307-1076	1	Relay, Armature (24 Volt)

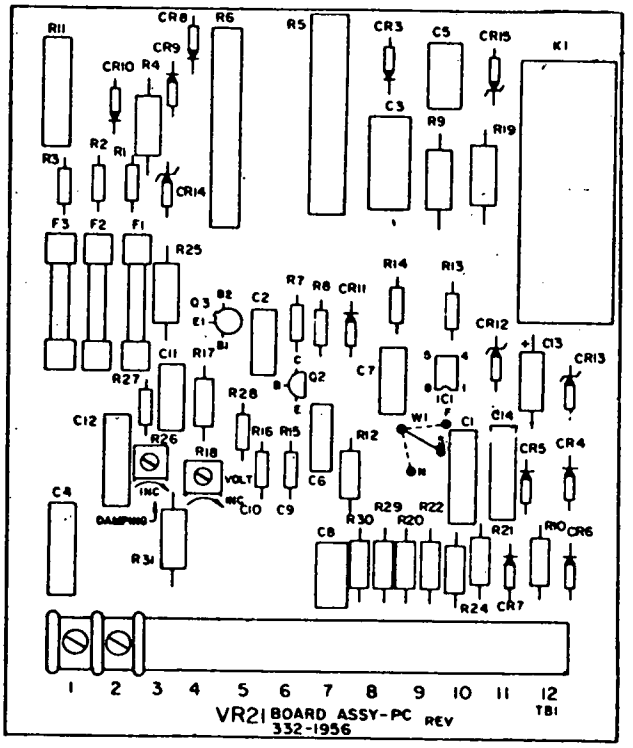
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
Q1	361-0003	1	Transistor
Q2	362-0025	1	Transistor
Q3	362-0025	1	Transistor
Q4	362-0027	1	Transistor
R1	350-0536	1	Resistor, Composition (1000-Ohm, 1/2 Watt, 10%)
R2	350-0534	1	Resistor, Composition (680-Ohm, 1/2 Watt, 10%)
R3	350-0552	1	Resistor, Composition (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	350-0380	1	Resistor, Composition (510-Ohm, 1/2 Watt, 5%)
R9	350-0529	1	Resistor, Composition (270-Ohm, 1/2 Watt, 10%)
R10	350-0544	1	Resistor, Composition (4100-Ohm, 1/2 Watt, 10%)
R11	350-0980	1	Resistor, Composition (510-Ohm, 2 Watt, 5%)

PRINTED CIRCUIT BOARD ASSEMBLY GROUP - KEYS 1,2,3,4,5,6 - SPEC A THROUGH E



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
TB1	332-1252	1	Terminal Block
C1	355-0018	1	Capacitor (.47 Mfd., 100 Volt)
C2, C7	355-0005	2	Capacitor (.22 Mfd., 200 Volt)
C3, C9	355-0017	2	Capacitor (.47 Mfd., 400 Volt)
C4, C12	355-0006	2	Capacitor (.47 Mfd., 200 Volt)
C5, C8	355-0016	2	Capacitor (1 Mfd., 100 Volt)
C6	355-0015	1	Capacitor (.1 Mfd., 200 Volt)
C10	355-0014	1	Capacitor (.047 Mfd., 200 Volt)
C11	355-0020	1	Capacitor (.1 Mfd., 400 Volt)
C13	356-0039	1	Capacitor (100 Mfd., 10 Volt)
CR4 thru 11	357-0014	8	Rectifier, Silicon
CR12	359-0016	1	Diode, Zener (6.8 Volt)
CR13	359-0025	1	Diode, Zener (20 Volt)
CR14	359-0026	1	Diode, Zener (18 Volt)
CR15	359-0015	1	Diode, Zener (24 Volt)
K1	307-1063	1	Relay, Magnetic Reed
Q1, Q2	362-0017	2	Transistor, Silicon (NPN)
Q3	361-0004	1	Transistor, Unijunction
R1, R23	350-0355	2	Resistor (47-Ohm, 1/2 Watt)
R2, R3	350-0351	2	Resistor (33-Ohm, 1/2 Watt)
R4	350-1075	1	Resistor (4.7 Megohm, 2 Watt)
R5	353-0040	1	Resistor, Fixed (270-Ohm, 10 Watt)
R6	353-0039	1	Resistor, Fixed (5,000-Ohm, 15 Watt)
R7	350-0398	1	Resistor (3,000-Ohm, 1/2 Watt)
R8, R16	350-0447	2	Resistor (330,000-Ohm, 1/2 Watt)
R9, R10	350-0423	2	Resistor (33,000-Ohm, 1/2 Watt)
R11 R12	352-0151	2	Resistor, Fixed (15,000-Ohm, 5 Watt)
R13	350-1007	1	Resistor (6,800-Ohm, 2 Watt)
R14	350-0443	1	Resistor (220,000-Ohm, 2 Watt)
R15, R27	350-0435	2	Resistor (100,000-Ohm, 1/2 Watt)
R17	351-0521	1	Resistor, Metal Film (12,100 Ohm, 1/4 Watt)
R18	303-0168	1	Potentiometer
R20, R22	351-0520	2	Resistor, Metal Film (28,000-Ohm, 1/4 Watt)
R21	351-0522	1	Resistor, Metal Film (5,110-Ohm, 1/4 Watt)
R24	351-0523	1	Resistor, Metal Film (8,870-Ohm, 1/4 Watt)
R25	350-1011	1	Resistor (10,000-Ohm, 2 Watt)
R26	303-0164	1	Potentiometer
R28	350-0459	1	Resistor (1.0 Megohm, 1 Watt)
	517-0127	2	Cover, Potentiometer (Not Illustrated)

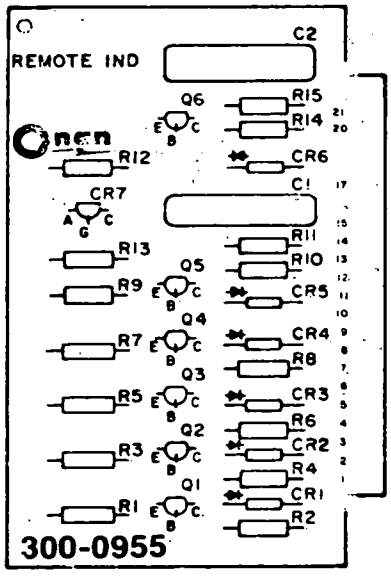
PRINTED CIRCUIT BOARD ASSEMBLY GROUP (332-1956)
BEGIN SPEC F



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	332-1956	1	Board Assembly, Printed - Complete
C1,14	355-0042	2	Capacitor - 47 Mfd, 250 Volt
C2, C7	355-0043	2	Capacitor - 22 Mfd, 250 Volt
C3	355-0047	1	Capacitor - 47 Mfd, 400 Volt
C4, C12	355-0044	2	Capacitor - 47 Mfd, 250 Volt
C5, C8	355-0046	2	Capacitor - 1 Mfd, 100 Volt
C6	355-0056	1	Capacitor - .33 Mfd, 250 Volt
C11	355-0048	1	Capacitor - 1 Mfd, 400 Volt
C13	356-0039	1	Capacitor - Electrolytic 100 Mfd, 10 Volt
CR3 Thru 11	357-0014	9	Rectifier - Silicon
CR12	359-0036	1	Diode - Zener 5.6 Volt
CR13	359-0025	1	Diode - Zener 20 Volt
CR14	359-0026	1	Diode - Zener 18 Volt
F1, F2, F3	321-0204	3	Fuse 1/4 Amp
1C1	367-0005	1	Integrated Circuit
Q2	362-0017	1	Transistor - Silicon NPN
Q3	361-0004	1	Transistor - Unijunction
R1	350-0355	1	Resistor - 1/2 Watt, 47-Ohm
R2, R3	350-0351	2	Resistor - 1/2 Watt, 33-Ohm
R4	350-1075	1	Resistor - 2 Watt, 4.7 Meg-Ohm
R5	353-0040	1	Resistor - Fixed 10 Watt, 270-Ohm
R6	353-0039	1	Resistor - Fixed 15 Watt, 5,000-Ohm
R7	350-0398	1	Resistor - 1/2 Watt, 3,000-Ohm
R8, R16	350-0447	2	Resistor - 1/2 Watt, 330,000-Ohm
R10	351-0885	1	Resistor - 1/2 Watt, 51,100-Ohm

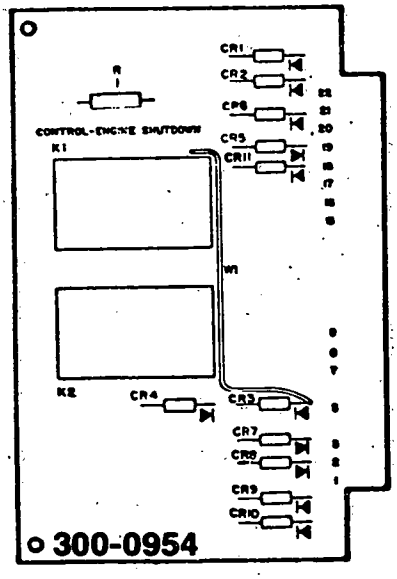
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
R11	352-0151	1	Resistor - Fixed 5 Watt, 15,000-Ohm
R12	351-0909	1	Resistor - 1/2 Watt, 90,900-Ohm
R13	350-0411	1	Resistor - 1/2 Watt, 10,000-Ohm
R14	350-0443	1	Resistor - 1/2 Watt, 220,000-Ohm
R15, R27	350-0435	2	Resistor - 1/2 Watt, 100,000-Ohm
R17	351-0521	1	Resistor, Metal Film - 1/4 Watt, 12,100-Ohm
R18	303-0210	1	Potentiometer - 5,000-Ohm, 1/2 Watt
R20, 22 29 & 30	351-0520	4	Resistor - 1/4 Watt, 28,000-Ohm
R21	351-0522	1	Resistor - Metal Film - 1/4 Watt, 5,110-Ohm
R24	351-0523	1	Resistor - Metal Film - 1/4 Watt, 8,870-Ohm
R25, R31	350-1011	2	Resistor - 2 Watt, 10,000-Ohm
R26	303-0211	1	Potentiometer - 1/2 Watt, 100,000-Ohm
R28	350-0568	1	Resistor - 1/2 Watt .47 Meg-Ohm
TB1	332-1252	1	Terminal Block
CR15	359-0015	1	Diode - Zener - 24 Volt
	321-0163	6	Clip - Fuse
K1	307-1063	1	Relay, Magnetic Reed
R9	350-1014	1	Resistor - 2 Watt, 13,000-Ohm
R19	350-1007	1	Resistor - 2 Watt, 6,800-Ohm

REMOTE INDICATOR CONTROL MODULE (UNITS WITH 5 FAULT LIGHTS) - KEYS 7,8



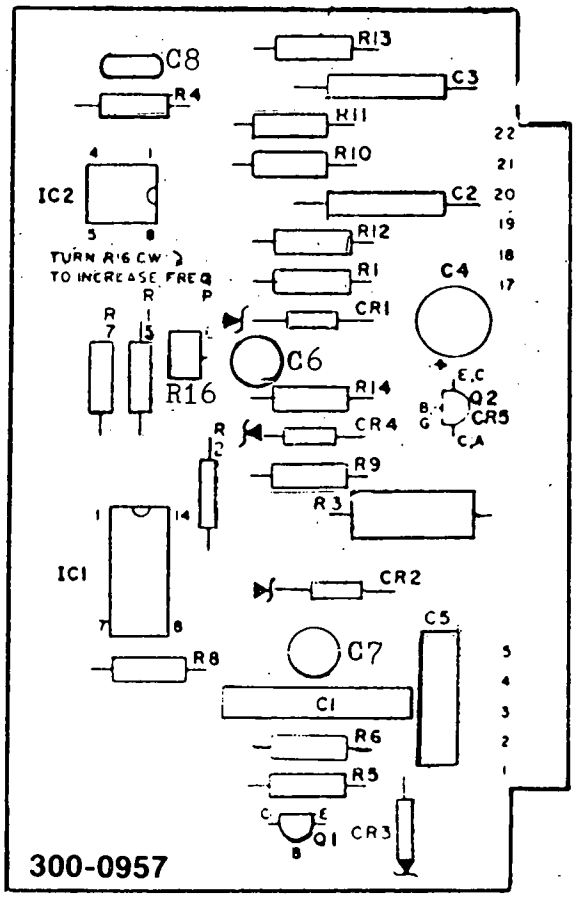
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	300-0955	1	Module, Remote Indicator
CR1 thru 6	357-0004	6	Rectifier, Diode (400 MA, 400 Volt)
CR7	364-0011	1	Rectifier, Gate Control
Q1 thru 6	362-0034	6	Transistor, PNP
R1,3,5,7, 9,14	350-0529	6	Resistor (270-Ohms, 1/2 Watt)
R2,6,8	350-0544	3	Resistor (4,700-Ohms, 1/2 Watt)
R11	350-0505	1	Resistor (2,700-Ohms, 1/2 Watt)
R12	350-0380	1	Resistor (510-Ohms, 1/2 Watt)
R13	350-0517	1	Resistor (27-Ohms, 1/2 Watt)
R15	350-0540	1	Resistor (2,200-Ohms, 1/2 Watt)
C1,2	355-0005	2	Capacitor, Composition (.22 Mfd., 200 Volt)
R4,10	350-0389	2	Resistor (1,200-Ohms, 1/2 Watt)

ENGINE SHUTDOWN CONTROL MODULE - KEYS 7,8



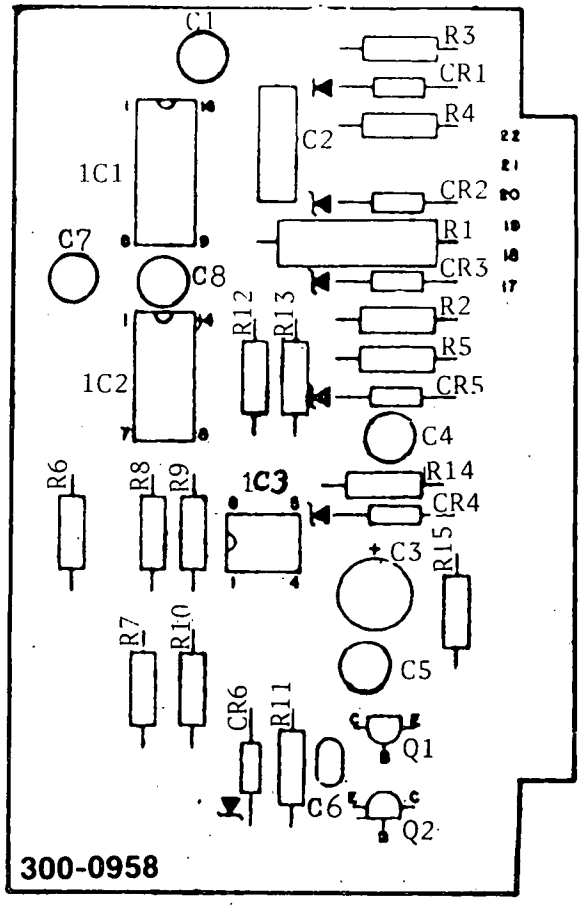
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	300-0954	1	Control, Engine Shutdown (Complete)
CR1 thru 11	357-0004	11	Rectifier, Diode
K1,2	307-1076	2	Relay
R1	350-1128	1	Resistor (220-Ohms, 2 Watt)

OVERSPEED SENSOR CONTROL MODULE - KEYS 7,8



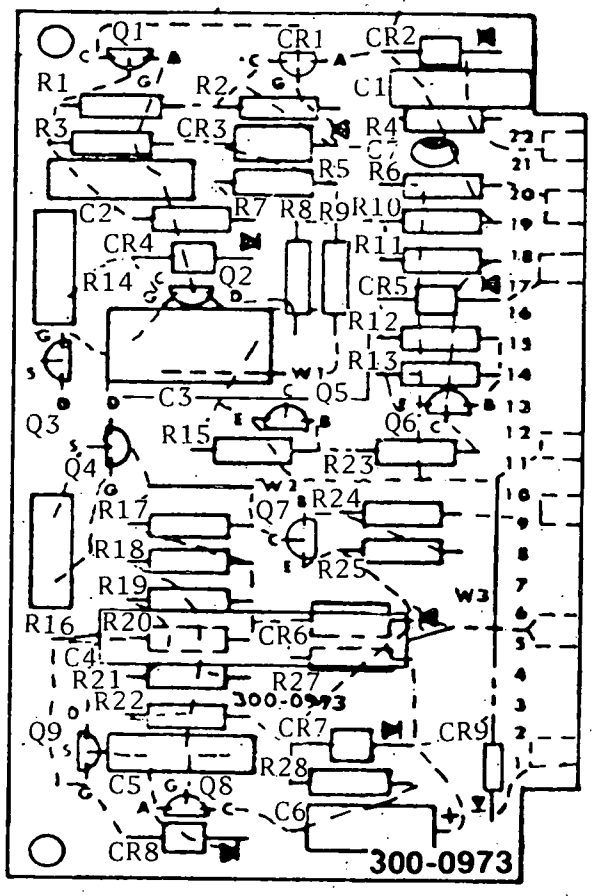
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	300-0957	1	Control, Overspeed Sensor (Complete)
1C1	367-0002	1	Circuit, Integrated
1C2	367-0001	1	Circuit, Integrated
C1	355-0005	1	Capacitor, Composition (.22 Mfd., 200 Volt)
C2,3	355-0010	2	Capacitor, Composition (.0022 Mfd., 100 Volt)
C4	356-0066	1	Capacitor, Electrolytic (47 Mfd., 20 Volt)
CR1	359-0002	1	Diode, Zener (400 MW, 13 Volt)
CR2	359-0017	1	Diode, Zener (400 MW, 5.1 Volt)
CR3	359-0016	1	Diode, Zener (400 MW, 6.8 Volt)
CR4	359-0032	1	Diode, Zener (400 MW, 8.2 Volt)
Q1,2	362-0011	2	Transistor, Signal
R1	350-0382	1	Resistor (620-Ohms, 1/2 Watt)
R15	350-0414	1	Resistor (13,000-Ohms, 1/2 Watt)
R3	350-0977	1	Resistor (390-Ohms, 2 Watt)
R4	350-0451	1	Resistor (.47 Megohm, 1/2 Watt)
R5,14	350-0394	2	Resistor (2000-Ohms, 1/2 Watt)
R6,7,8,9,2 10,11	350-0411	7	Resistor (10,000-Ohms, 1/2 Watt)
R16	303-0191	1	Potentiometer (5,000-Ohms, 1/4 Watt)
C8	355-0049	1	Capacitor (22 pf, 1000 VDC)
C6,7	356-0051	2	Capacitor (6.8 Mfd., 35 VDC)
R12,13	350-0512	2	Resistor (10-Ohm, 1/2 Watt)
C5	355-0057	1	Capacitor (.47 Mfd, 100 VDC)

STARTING MOTOR DISCONNECT MODULE - KEYS 7,8

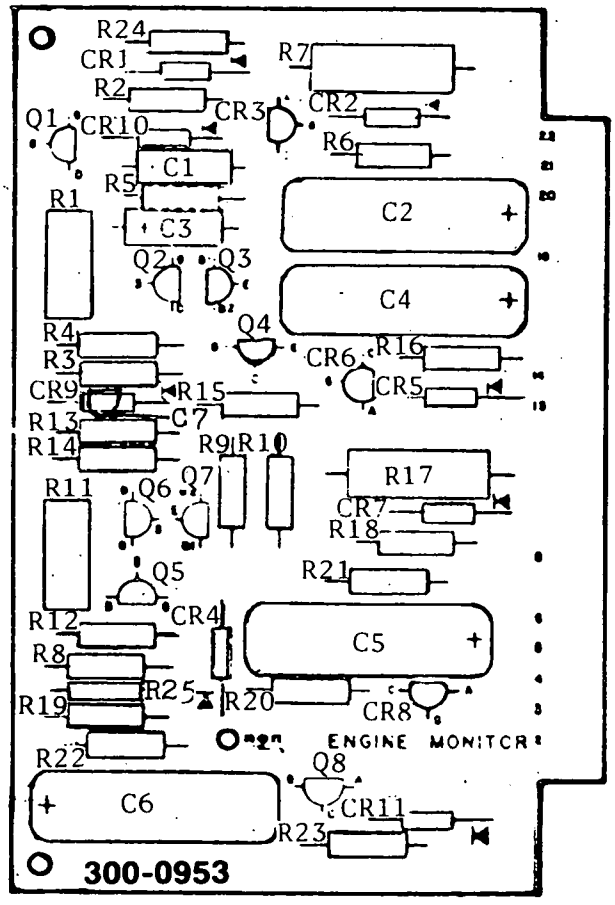


REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	300-0958	1	Module, Starter Motor Disconnect
1C1	367-0003	1	Integrated Circuit
1C2	367-0004	1	Integrated Circuit
1C3	367-0001	1	Integrated Circuit
C1,4,7,8	356-0051	4	Capacitor, Electrolytic (6.8 Mfd., 35 Volt)
C2	355-0057	1	Capacitor, omposition (.47 Mfd., 100 Volt)
C3	356-0066	1	Capacitor, Electrolytic (47 Mfd., 20 Volt)
Q1,2	362-0011	2	Transistor, Signal
CR1	357-0004	1	Rectifier, Diode (400 MA, 400 Volt)
CR2,3	359-0017	2	Diode, Zener (5.1 Volt, 400 MW)
CR4	359-0032	1	Diode, Zener (8.2 Volt, 400 MW)
CR5	359-0002	1	Diode, Zener (13 Volt, 400 MW)
CR6	359-0028	1	Diode, Zener (3.9 Volt 500 MW)
R5	350-0383	1	Resistor (680-Ohms, 1/2 Watt)
R2	350-0389	1	Resistor (1,200-Ohms, 1/2 Watt)
R3,7,15	350-0422	3	Resistor (30,000-Ohms, 1/2 Watt)
R6,11,12,13	350-0411	4	Resistor (10,000-Ohms, 1/2 Watt)
R8,9	350-0418	2	Resistor (20,000-Ohms, 1/2 Watt)
R10	350-0394	1	Resistor (2,000-Ohms, 1/2 Watt)
R14	350-0404	1	Resistor (5,100Ohms, 1/2 Watt)
R1	350-0975	1	Resistor (330-Ohms, 2 Watt)
R4	350-0420	1	Resistor (24,000-Ohms, 1/2 Watt)
C5	356-0059	1	Capacitor, Electrolytic (2.2 Mfd., 35 Volt)
C6	355-0039	1	Capacitor, Comp. (.0033 Mfd., 50 VDC)

TIME DELAY (START-STOP) MODULE - OPTIONAL KEYS 7,8



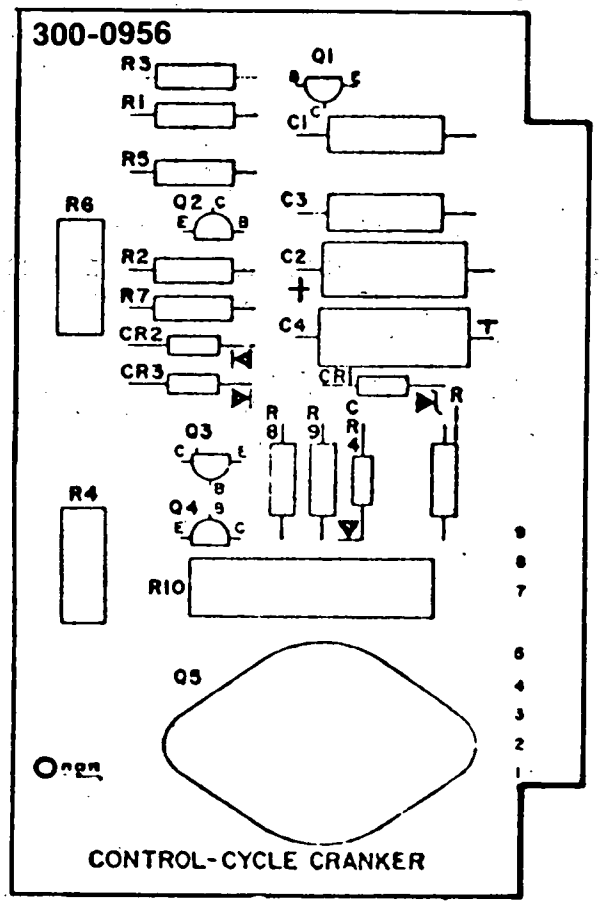
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	300-0973	1	Module, Time Delay - Complete (Start-Stop) - Optional
C1,2,5	355-0025	3	Capacitor (.1 Mfd., 100 Volt)
C3	355-0028	1	Capacitor (.5 Mfd., 100 Volt)
C4	355-0027	1	Capacitor (10.0 Mfd., 50 Volt)
C6	356-0046	1	Capacitor (5 Mfd., 35 Volt)
C7	356-0053	1	Capacitor (1.0 Mfd., 35 Volt)
CR1	364-0011	1	Rectifier, Gate Control
CR2,4,5 7,8,9	357-0004	6	Rectifier, Diode (400 MA 400 Volt)
CR3,6	359-0015	2	Diode, Zener (24 Volt)
Q1,8	361-0006	2	Transistor
Q2,3,4,9	362-0031	4	Transistor
Q5,6,7	362-0007	3	Transistor, Signal
R1,3,18,22	350-0411	4	Resistor (10,000-Ohms, 1/2 Watt)
R2	350-0379	1	Resistor (470Ohms, 1/2 Watt)
R4	350-0524	1	Resistor (100Ohms, 1/2 Watt)
R5, 19	352-0200	2	Thermistor (10,000-Ohms)
R6	350-0537	1	Resistor (1,200-Ohms, 1/2 Watt)
R7,R21	350-0391	2	Resistor (1,500-Ohms, 1/2 Watt)
R8,12,20,24	350-0548	4	Resistor (10,000-Ohms, 1/2 Watt)
R13,15,25,28	350-0536	4	Resistor (1,000-Ohm, 1/2 Watt)
R10,27	350-0528	2	Resistor (220-Ohms, 1/2 Watt)
R9,17	350-0540	2	Resistor (2200-Ohms, 1/2 Watt)
R14,16	303-0169	2	Potentiometer (3.5 Megohm)
R23,11	350-0545	2	Resistor (5600-Ohm, 1/2 Watt)



ENGINE MONITOR CONTROL MODULE KEYS 7,8

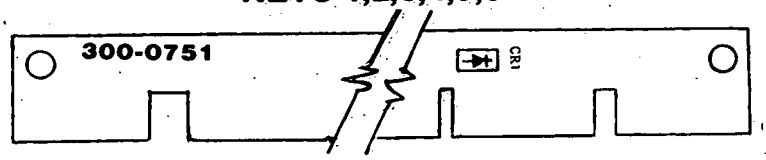
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	300-0953	1	Control, Engine Monitor (Complete)
C1,3	356-0040	2	Capacitor, Electrolytic (10 Mfd., 20 Volt)
C2,4,5,6	355-0005	4	Capacitor, Composition (.22 Mfd., 200 Volt)
CR1,2,4,5 7,10,11	357-0004	6	Rectifier, Diode
CR3,6,8	364-0011	3	Rectifier, Gate Control
CR9	359-0033	1	Diode, Zener (5 Watt, 14 Volt)
Q1,5	362-0025	2	Transistor, Field Effect (30 MA)
Q3,7	361-0003	2	Transistor, Unijunction
Q4	362-0014	1	Transistor, NPN
Q8	362-0027	1	Transistor, PNP
R1,11	303-0169	2	Potentiometer (3.5 Megohm)
R2,3,12,13	350-0548	4	Resistor (10,000-Ohm, 1/2 Watt)
R4,14,10,24, 25	350-0536	5	Resistor (1,000-Ohm, 1/2 Watt)
R5,15,21	350-0517	3	Resistor (27-Ohms, 1/2 Watt)
R6,16,18	350-0505	3	Resistor (2.7-Ohms, 1/2 Watt)
R7,17	350-0980	2	Resistor (510-Ohms, 2 Watt)
R8	350-0403	1	Resistor (4,700-Ohms, 1/2 Watt)
R9	350-0405	1	Resistor (5,600-Ohms, 1/2 Watt)
R19	350-0534	1	Resistor (680-Ohms, 1/2 Watt)
R20,22	350-0533	2	Resistor (560-Ohms, 1/2 Watt)
R23	350-0395	1	Resistor (2,200-Ohms, 1/2 Watt)
Q2,6	362-0031	2	Transistor, Field Effect (.05 MA)
C7	356-0051	1	Capacitor (6.8 Mfd, 35 VDC)

CYCLE CRANKER MODULE - KEYS 7,8



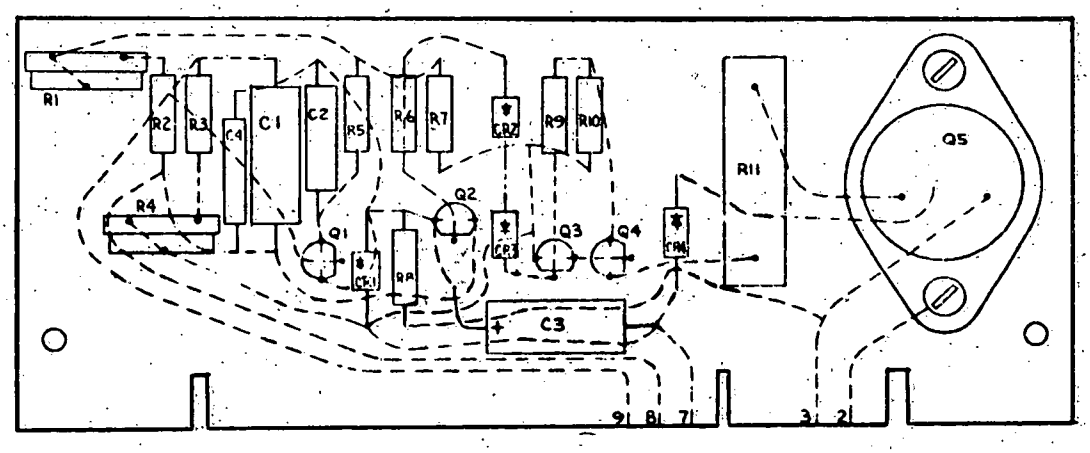
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	300-0956	1	Module, Cycle Cranker
C3	355-0010	1	Capacitor, Composition (.0022 Mfd., 100 Volt)
C2	356-0039	1	Capacitor, Electrolytic (100 Mfd., 10 Volt)
C4	356-0045	1	Capacitor, Electrolytic (25 Mfd., 15 Volt)
CR1	359-0027	1	Diode, Zener (1.0 Watt, 7.5 Volt)
CR2,3,4	357-0004	3	Rectifier, Diode (400 MA, 400 Volt)
Q1,2	362-0008	2	Transistors, Signal
Q3	362-0011	1	Transistor, Signal
Q4	362-0026	1	Transistor, Signal
Q5	362-0033	1	Transistor, Power
R1	350-0558	1	Resistor (68,000-Ohms, 1/2 Watt)
R2	350-0546	1	Resistor (6,800-Ohms, 1/2 Watt)
R3,8	350-0548	2	Resistor (10,000-Ohms, 1/2 Watt)
R4,6	303-0171	2	Potentiometer (100,000-Ohms)
R5	350-0560	1	Resistor (100,000-Ohms, 1/2 Watt)
R7	350-0420	1	Resistor (24,000-Ohms, 1/2 Watt)
R9	350-0500	1	Resistor (1-Ohm, 1/2 Watt)
R10	352-0155	1	Resistor (100-Ohms, 5 Watt)
R11	350-0534	1	Resistor (680-Ohms, 1/2 Watt)
C1	355-0029	1	Capacitor, Composition (.015 Mfd., 100 Volt)

CRANKER CONTROL GROUP — 24 VOLT — STANDARD
KEYS 1,2,3,4,5,6



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	300-0751		Control, Cranker - 24 Volt
CR1	357-0004	1	Diode, Rectifier (400 MA. 400 Volt)

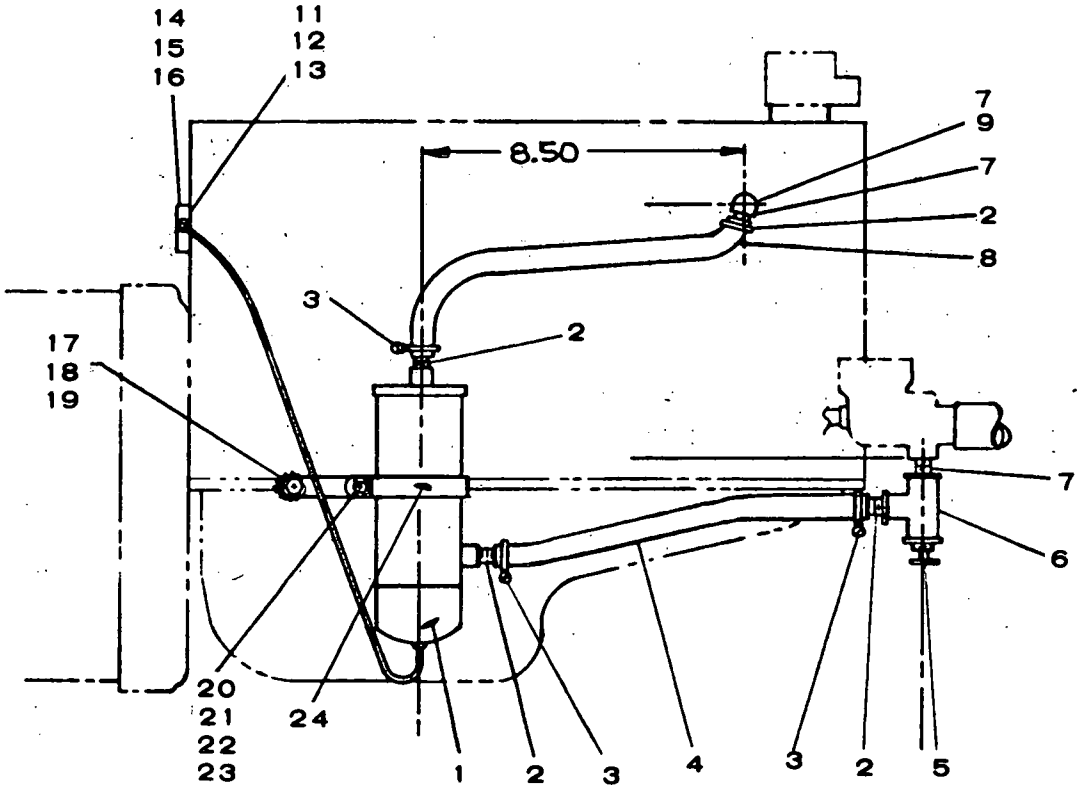
CYCLE CRANKER CONTROL GROUP—24 VOLT—OPTIONAL EQUIPMENT
KEYS 1,2,3,4,5,6



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	300-0715	1	**Printed Circuit Board, Complete**
C4	355-0010	1	Capacitor, Composition (.0022 Mfd, 100 Volt DC)
C3	356-0045	1	Capacitor, Electrolytic (.25 Mfd, 15 Volt)
C2	355-0029	1	Capacitor, Composition (.015 Mfd, 100 Volt)
R11	352-0135	1	Resistor, Fixed (5 Watt, 100-Ohm)
R10	350-0500	1	Resistor, Fixed - Composition (1.0-Ohm)
R8	350-0534	1	Resistor, Fixed (6.8-Ohm)
R7	350-0546	1	Resistor, Fixed - Composition (6,800-Ohm)

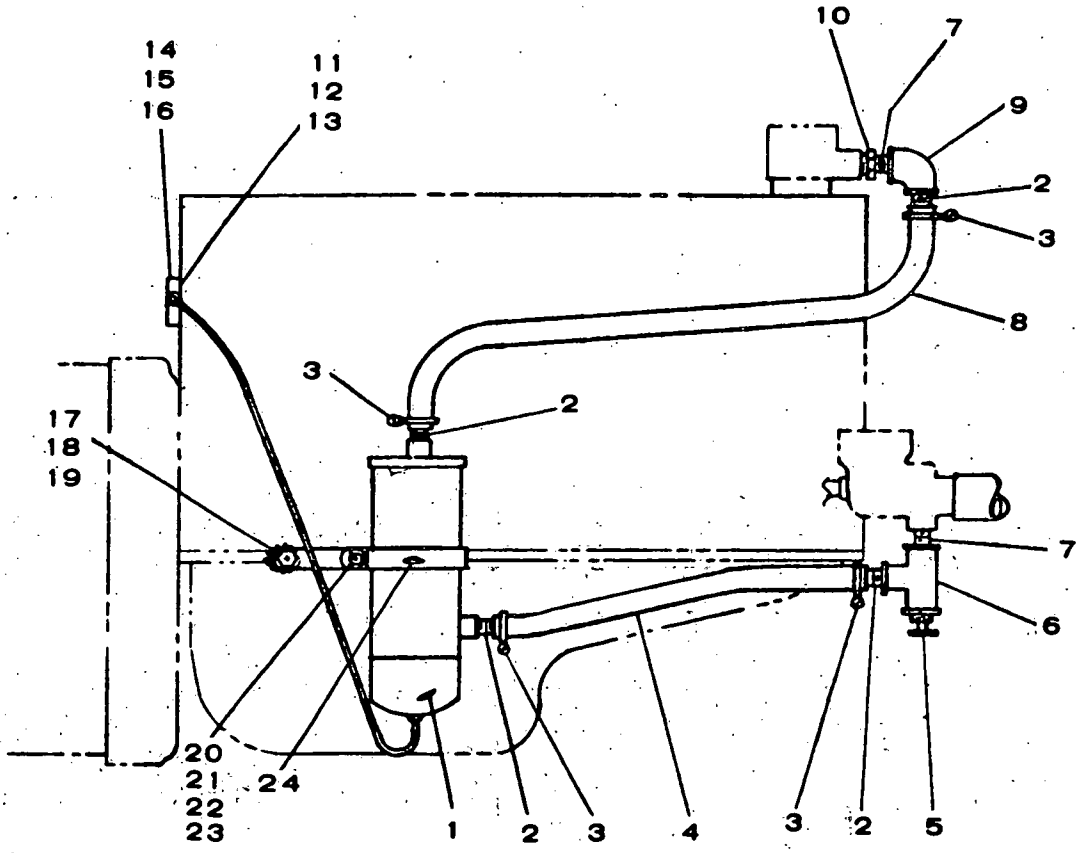
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
R6	350-0420	1	Resistor, Fixed - Composition (24,000-Ohm)
R5	350-0558	1	Resistor, Fixed - Composition (68,000-Ohm)
R3, R9	350-0548	2	Resistor, Fixed - Composition (10,000-Ohm)
R2	350-0550	1	Resistor, Fixed - Composition (100,000-Ohm)
R1, R4	303-0171	2	Potentiometer (100,000-Ohm)
Q5	362-0033	1	Transistor, Power
Q4	362-0026	1	Transistor, Signal
Q3	362-0011	1	Transistor
Q1, Q2	362-0008	2	Transistor, Signal
CR2,3,4	357-0004	3	Rectifier, Diode
CR1	359-0027	1	Diode, Zener
C1	356-0039	1	Capacitor, Electrolytic (100 Mfd)

179-0326 INSTALLATION, 120 VOLT WATER JACKET HEATER - OPTIONAL EQUIPMENT



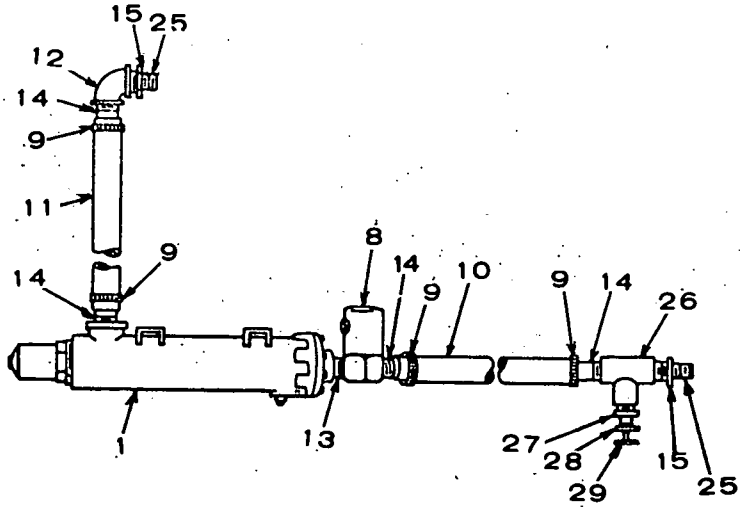
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	333-0053	1	Heater, Water Jacket (2000 Watt, 120 Volt)
2	505-0135	4	Nipple, Half (3/8 x 1-1/2")
3	503-0183	4	Clamp, Hose
4		1	Hose, (Order 7" of Bulk Hose #503-0386)
5	504-0028	1	Valve, Drain
6	505-0060	1	Tee, Pipe (3/8")
7	505-0101	2	Nipple, Close (3/8 x 1")
8		1	Hose (Order 17" of Bulk Hose #503-0386)
9	505-0039	1	Elbow, Pipe (3/8 x 90°)
11	520-0446	2	Stud
12	850-0030	2	Washer, Lock (#10)
13	870-0053	2	Nut, Hex (#10-32)
14	309-0106	1	Thermostat
15	333-0012	1	Box, Thermostat
16	333-0013	1	Cover, Thermostat Box
17	856-0013	1	Washer, Lock - EIT (1/2")
18	850-0060	1	Washer, Lock - Spring (1/2")
19	800-0091	1	Screw, Cap - Hex Head (1/2-13 x 1-1/4")
20	800-0031	1	Screw, Cap - Hex Head (5/16-18 x 1-1/2")
21	526-0115	2	Washer, Flat (11/32" ID x 11/16" OD x 1/16" Thk)
22	856-0008	2	Washer, Lock - EIT (5/16")
23	862-0015	1	Nut, Hex (5/16-18)
24	130-0755	1	Bracket, Tank Mounting

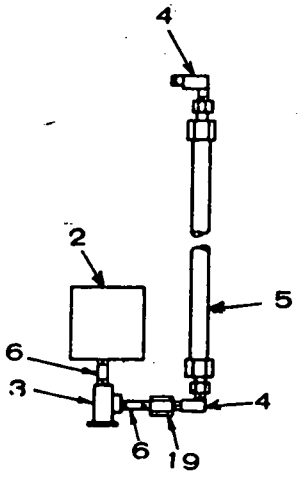
179-2000 INSTALLATION, 240 VOLT WATER JACKET HEATER - OPTIONAL EQUIPMENT



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	333-0073	1	Heater, Water Jacket (2000 Watt, 240 Volt)
2	505-0135	4	Nipple, Half (3/8 x 1-1/2")
3	503-0183	4	Clamp, Hose
4		1	Hose, (Order 19" of Bulk Hose #503-0386)
5	504-0028	1	Valve, Drain
6	505-0060	1	Tee, Pipe (3/8")
7	505-0101	2	Nipple, Close (3/8 x 1")
8		1	Hose (Order 44" of Bulk Hose #503-0386)
9	505-0039	1	Elbow, Pipe (3/8" x 90°)
10	505-0455	1	Bushing, Reducer (1 to 3/8")
11	520-0672	2	Stud
12	850-0030	2	Washer, Lock (#10)
13	870-0053	2	Nut, Hex (#10-32)
14	309-0256	1	Thermostat
15	333-0057	1	Box, Thermostat
16	333-0056	1	Cover, Thermostat Box
17	856-0013	1	Washer, Lock - EIT (1/2")
18	850-0060	1	Washer, Lock - Spring (1/2")
19	800-0091	1	Screw, Cap - Hex Head (1/2-13 x 1-1/4")
20	800-0031	1	Screw, Cap - Hex Head (5/16-18 x 1-1/2")
21	526-0115	2	Washer, Flat (11/32" ID x 11/16" OD x 1/16" Thk)
22	856-0008	2	Washer, Lock-EIT (5/16")
23	862-0015	1	Nut, Hex (5/16-18)
24	130-0755	1	Bracket, Tank Mounting

179-2012 INSTALLATION 480 VOLT WATER JACKET HEATER—OPTIONAL EQUIPMENT

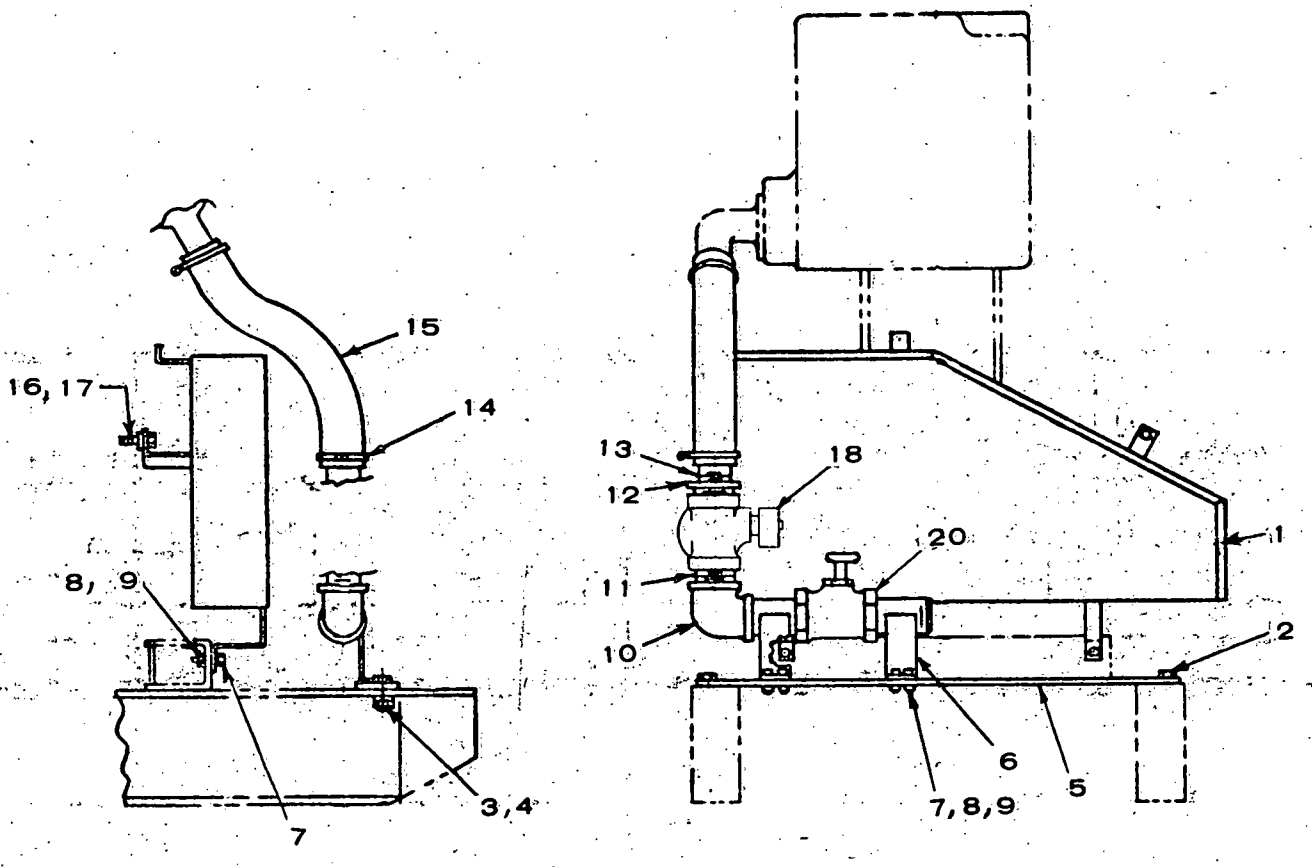




REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	333-0147	1	Heater, Water - Engine (480 Volt)
2	309-0271	1	Switch, Oil Pressure
3	333-0142	1	Support, Pressure Switch
4	502-0287	2	Elbow, Pipe - 90° (1/4 NPT x 5/16 SAE)
5	501-0188	1	Line, Flexible (24" Lg)
6	505-0099	2	Nipple, Pipe - Close (1/8" NPT x 3/4")
7	307-1164	1	*Relay (480 Volt, 30 Amp)
8	309-0253	1	Thermostat
9	503-0429	4	Clamp, Hose
10		1	Hose, Rubber (Order 35" of Bulk Hose #503-0249)
11		1	Hose, Rubber (Order 35" of Bulk Hose #503-0249)
12	505-0041	1	Elbow, Pipe - 90° (1" NPT)
13	505-0107	1	Nipple, Pipe (1" NPT x 2")
14	505-0759	4	Nipple, Pipe - Half (1" NPT x 4-3/4")
15	505-0129	2	Reducer, Pipe (1" NPT x 3/4" NPT)
19	505-0027	1	Coupling, Pipe (1/4" NPT)
20		1	*Conduit, Flexible (Order 6 feet of Bulk Conduit #331-0062)
21	331-0010	2	*Connector, Conduit - 90° (1/2")
24	331-0007	3	*Connector, Conduit (1/2")
25	505-0102	2	Nipple, Pipe (3/4" NPT x 1-3/8")
26	505-0304	1	Tee, Pipe (1" NPT)
27	505-0022	1	Reducer, Pipe (1" NPT x 1/2" NPT)
28	505-0019	1	Reducer, Pipe (1/2" NPT x 3/8" NPT)
29	504-0028	1	Cock, Drain (3/8" NPT)

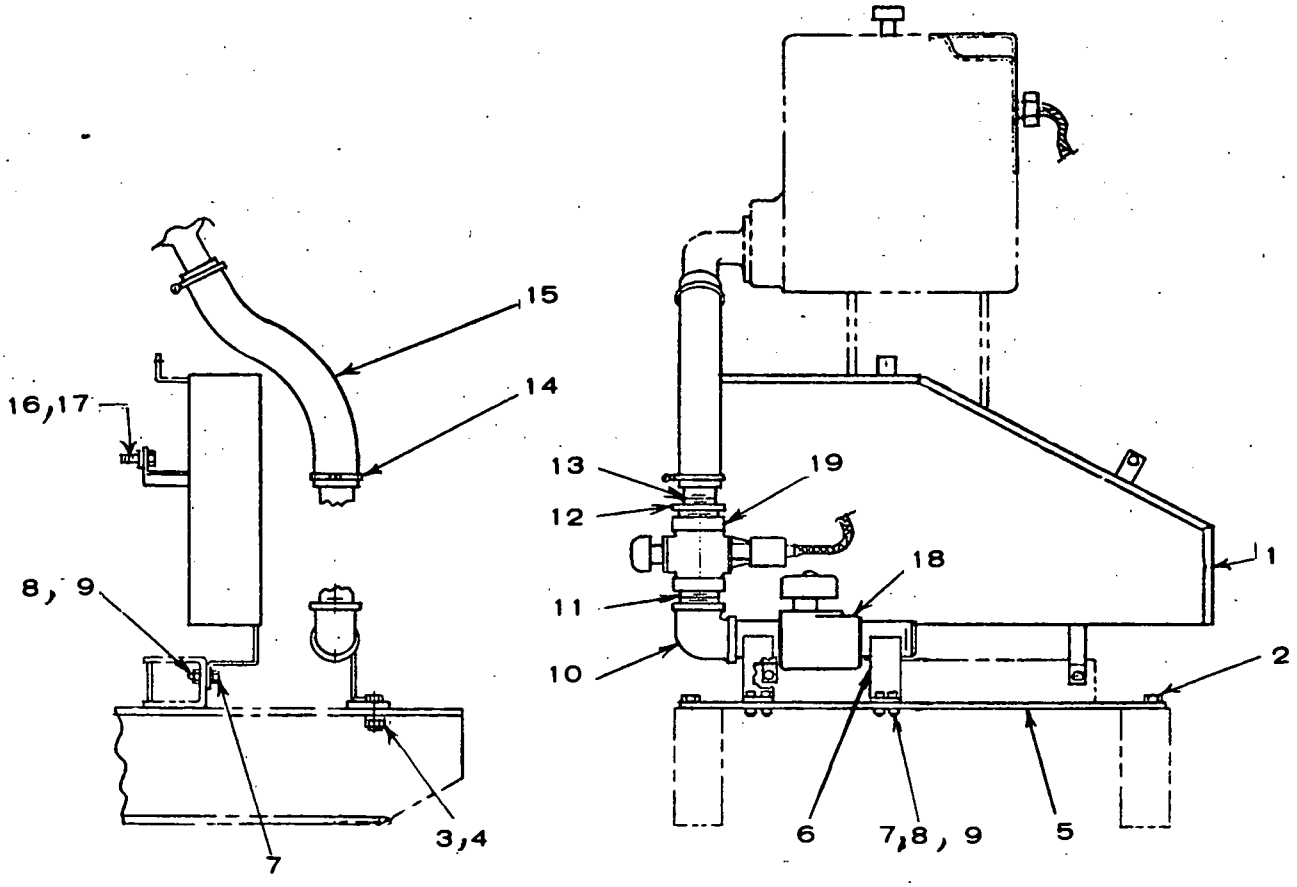
* - Not Shown on Illustration.

179-0423 INSTALLATION HEAT EXCHANGER COOLING — OPTIONAL EQUIPMENT



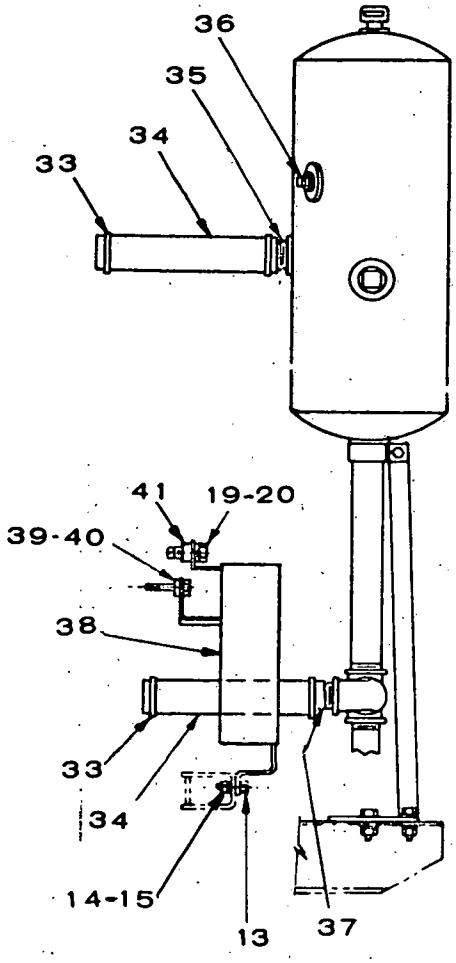
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	191-0878	1	Guard, Belt
2	800-0092	2	Screw, Cap - Hex Head (1/2-13 x 1-1/2")
3	850-0060	2	Washer, Lock - Spring (1/2")
4	862-0005	2	Nut, Hex (1/2-13)
5	130-0875	1	Plate, Mounting - Solenoid
6	130-0801	2	Bracket and Pipe Nipple Assembly
7	800-0007	6	Screw, Cap - Hex Head (1/4-20 x 1")
8	850-0040	6	Washer, Lock - Spring (1/4")
9	862-0001	6	Nut, Hex (1/4-20)
10	505-0175	1	Elbow, Pipe (2" NPT x 90°)
11	505-0172	1	Nipple, Pipe - Close (2" NPT x 2")
12	505-0187	1	Bushing, Reducer (2" NPT x 1-1/2" NPT)
13	505-0385	1	Nipple, Pipe - Half (1-1/2" NPT x 2")
14	503-0365	2	Clamp, Hose
15	503-0635	1	Hose, Radiator
16	526-0030	1	Washer, Flat (29/64" ID x 1" OD x 1/16" Thk)
17	800-0058	1	Screw, Cap - Hex Head (3/8-16 x 3")
18	307-0844	1	Valve, Solenoid
20	504-0057	1	Valve, Globe

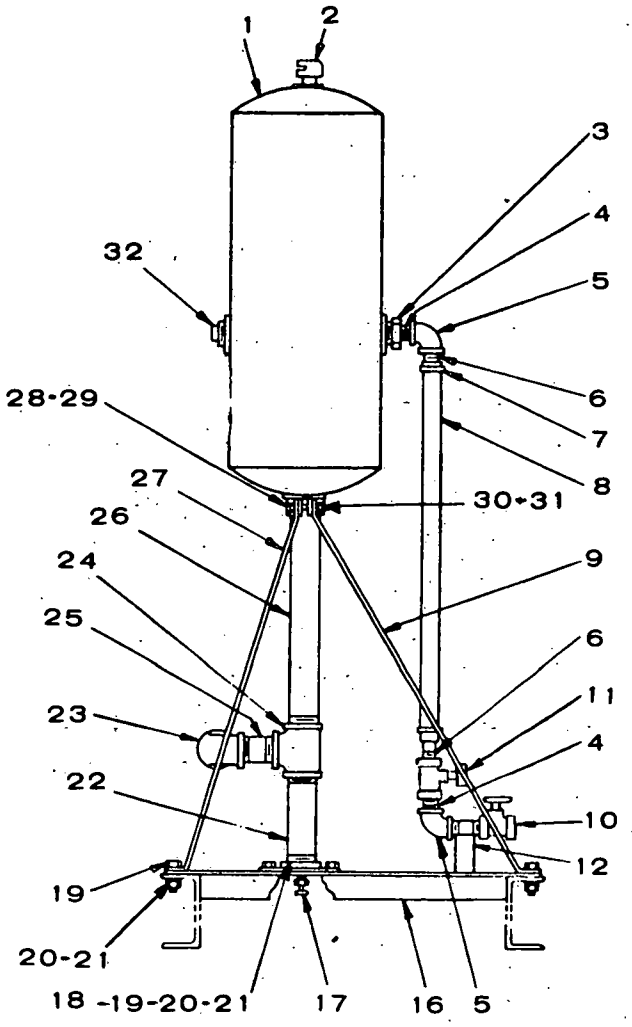
179-0424 INSTALLATION HEAT EXCHANGER COOLING WITH REGULATOR— OPTIONAL EQUIPMENT



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	191-0878	1	Guard, Belt
2	800-0092	2	Screw, Cap - Hex Head (1/2-13 x 1-1/2")
3	850-0060	2	Washer, Lock - Spring (1/2")
4	862-0005	2	Nut, Hex (1/2-13)
5	130-0875	1	Plate, Mounting - Solenoid
6	130-0801	2	Bracket and Pipe Nipple Assembly
7	800-0007	6	Screw, Cap - Hex Head (1/4-20 x 1")
8	850-0040	6	Washer, Lock - Spring (1/4")
9	862-0001	6	Nut, Hex (1/4-20)
10	505-0175	1	Elbow, Pipe (2" NPT x 90°)
11	505-0172	1	Nipple, Pipe - Close (2" NPT x 2")
12	505-0187	1	Bushing, Reducer (2" NPT x 1-1/2" NPT)
13	505-0385	1	Nipple, Pipe - Half (1-1/2" NPT x 2")
14	503-0365	2	Clamp, Hose
15	503-0635	1	Hose, Radiator
16	526-0030	1	Washer, Flat (29/64" ID x 1" OD x 1/16" Thk)
17	800-0058	1	Screw, Cap - Hex Head (3/8-16 x 3")
18	307-0844	1	Valve, Solenoid
19	309-0245	1	Valve, Water Temperature Control

179-0422 INSTALLATION STANDPIPE COOLING — KEYS 1,2,3,4,5,6 OPTIONAL EQUIPMENT

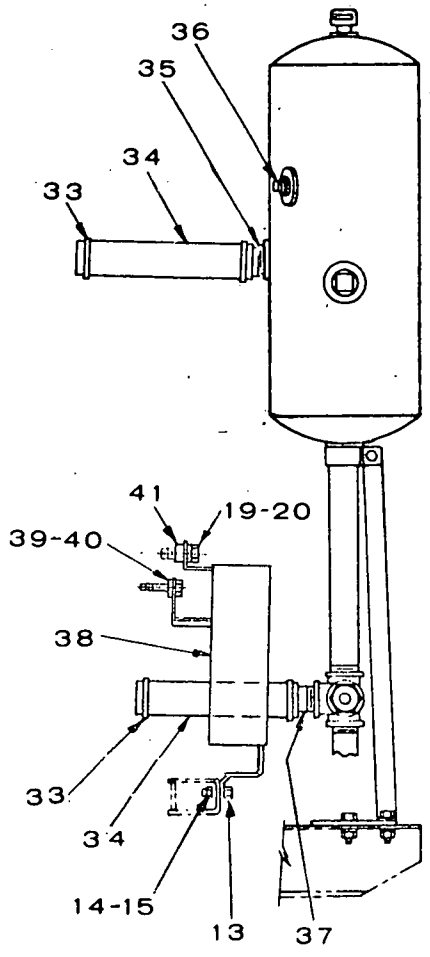


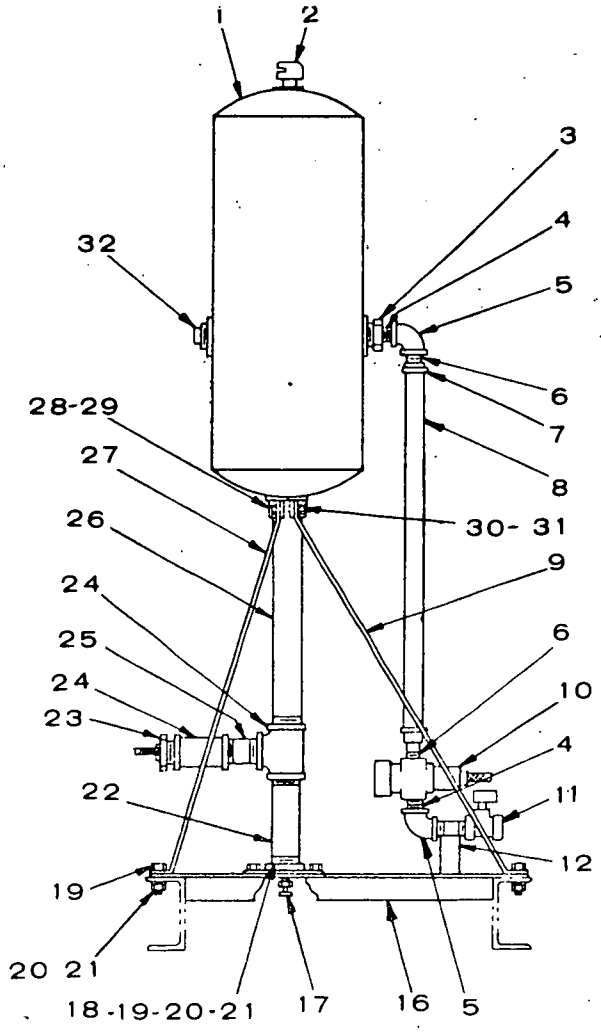


REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	130-0425	1	Tank, Stand Pipe
2	504-0062	1	Valve, Vacuum Relief
3	505-0023	1	Bushing, Reducer (1-1/4" NPT x 1" NPT)
4	505-0004	2	Nipple, Pipe - Closed (1" NPT x 1-1/2")
5	505-0041	2	Elbow, Pipe (1" NPT x 90°)
6	505-0330	2	Nipple, Pipe - Half (1" NPT x 2")
7	503-0189	2	Clamp, Hose
8	503-0361	As Reqd	Hose, Rubber (Order 36")
9	130-0869	1	Brace, Standpipe
10	504-0090	1	Valve, Globe
11	307-1135	1	Valve, Solenoid
12	130-0797	1	Bracket and Pipe Nipple Assembly
13	800-0007	4	Screw, Cap - Hex Head (1/4-20 x 1")
14	850-0040	4	Washer, Lock - Spring (1/4")
15	862-0001	4	Nut, Hex (1/4-20)
16	130-0857	1	Support, Standpipe
17	504-0006	1	Valve, Drain
18	130-0442	1	Base, Standpipe
19	800-0092	9	Screw, Cap - Hex Head (1/2-13 x 1-1/2")
20	856-0060	9	Washer, Lock - Spring (1/2")
21	865-0005	8	Nut, Hex (1/2-13)

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
22	505-0421	1	Nipple, Pipe (2" NPT x 8")
23	505-0175	1	Elbow, Pipe (2" NPT x 90°)
24	505-0374	1	Tee, Pipe (2" NPT x 2" NPT x 2" NPT)
25	505-0405	1	Nipple, Pipe (2" NPT x 5")
26	505-0377	1	Nipple, Pipe (2" NPT x 18-1/2")
27	130-0870	1	Brace, Standpipe
28	130-0871	1	Clamp, Loop
29	800-0051	1	Screw, Cap - Hex Head (3/8-16 x 1-1/4")
30	850-0050	1	Washer, Lock - Spring (3/8")
31	862-0003	1	Nut, Hex (3/8-16)
32	505-0359	1	Plug, Pipe (1-1/4" NPT)
33	503-0354	4	Clamp, Hose
34	503-0631	2	Hose, Rubber
35	505-0204	1	Nipple, Pipe - Half (2" NPT x 2")
36	505-0140	1	Plug, Pipe (1" NPT)
37	505-0764	1	Nipple, Pipe - Half (2" NPT x 4")
38	191-0878	1	Guard, Belt
39	526-0030	1	Washer, Flat (29/64" ID x 1" OD x 1/16" Thk)
40	800-0058	1	Screw, Cap - Hex Head (3/8-16 x 3")
41	191-0879	1	Spacer, Bolt Guard

179-0421 INSTALLATION STANDPIPE COOLING WITH REGULATOR - KEYS 1,2,3,4,5,6 OPTIONAL EQUIPMENT

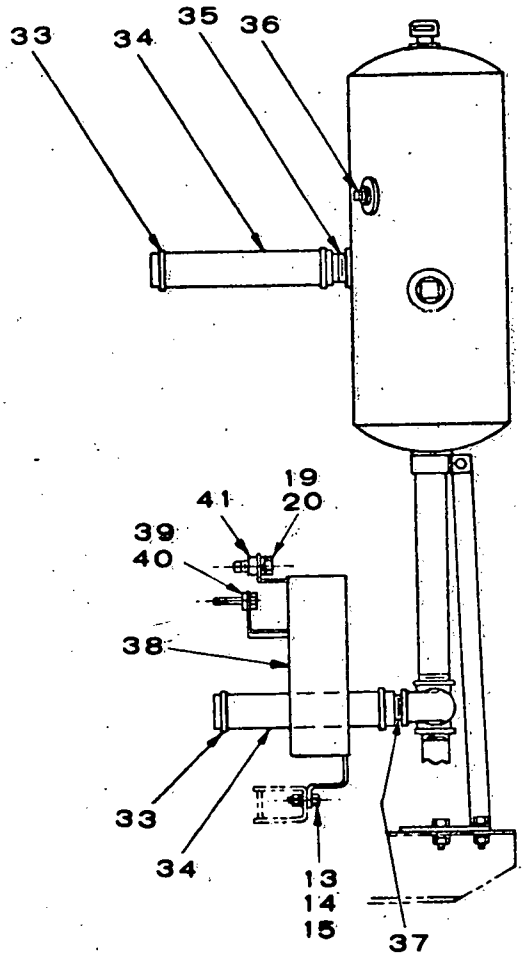


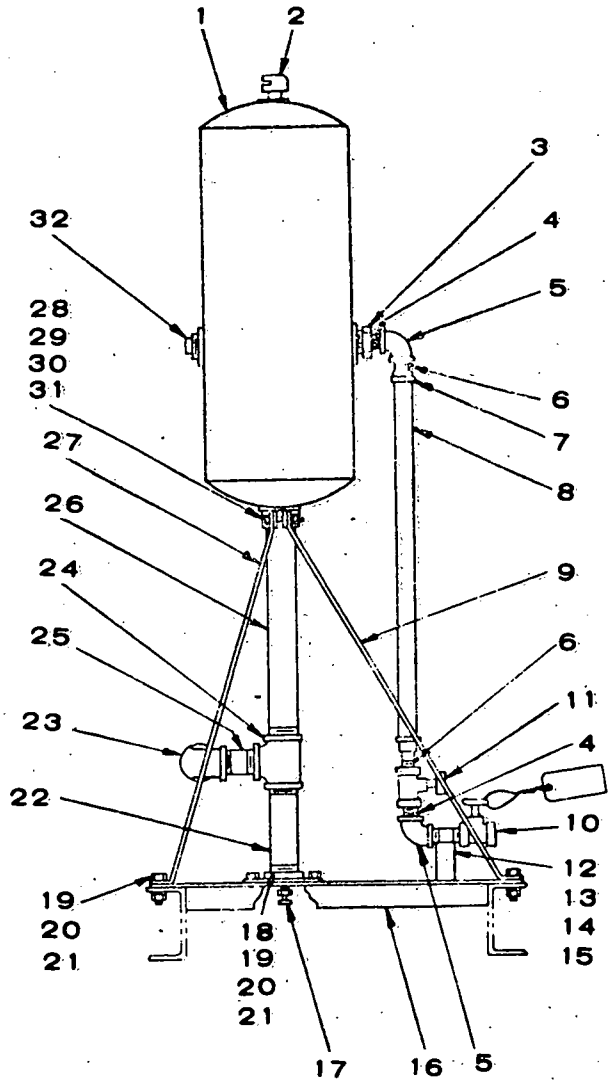


REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	130-0425	1	Tank , Stand Pipe
2	504-0062	1	Valve, Vacuum Relief
3	505-0023	1	Bushing, Reducer (1-1/4" NPT x 1" NPT)
4	505-0004	2	Nipple, Pipe - Closed (1" NPT x 1-1/2")
5	505-0041	2	Elbow, Pipe (1" NPT x 90°)
6	505-0330	2	Nipple, Pipe - Half (1" NPT x 2")
7	503-0189	2	Clamp, Hose
8	503-0361	As Reqd	Hose, Rubber (Order 36")
9	130-0869	1	Brace, Standpipe
10	309-0242	1	Valve, Regulator - Water Temperature
11	307-1135	1	Valve, Solenoid
12	130-0797	1	Bracket and Pipe Nipple Assembly
13	800-0007	4	Screw, Cap - Hex Head (1/4-20 x 1")
14	850-0040	4	Washer, Lock - Spring (1/4")
15	862-0001	4	Nut, Hex (1/4-20)
16	130-0857	1	Support, Standpipe
17	504-0006	1	Valve, Drain
18	130-0442	1	Base, Standpipe
19	800-0092	9	Screw, Cap - Hex Head (1/2-13 x 1-1/2")
20	856-0060	9	Washer, Lock - Spring (1/2")

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
21	865-0005	8	Nut, Hex (1/2-13)
22	505-0421	1	Nipple, Pipe (2" NPT x 8")
23	505-0351	1	Bushing, Reducer (2" NPT x 3/4")
24	505-0374	2	Tee, Pipe (2" NPT x 2" NPT x 2" NPT)
25	505-0405	1	Nipple, Pipe (2" NPT x 5")
26	505-0377	1	Nipple, Pipe (2" NPT x 18-1/2")
27	130-0870	1	Brace, Standpipe
28	130-0871	1	Clamp, Loop
29	800-0051	1	Screw, Cap - Hex Head (3/8-16 x 1-1/4")
30	850-0050	1	Washer, Lock - Spring (3/8")
31	862-0003	1	Nut, Hex (3/8-16)
32	505-0359	1	Plug, Pipe (1-1/4" NPT)
33	503-0354	4	Clamp, Hose
34	503-0631	2	Hose, Rubber
35	505-0204	1	Nipple, Pipe - Half (2" NPT x 2")
36	505-0140	1	Plug, Pipe (1" NPT)
37	505-0764	1	Nipple, Pipe - Half (2" NPT x 4")
38	191-0878	1	Guard, Belt
39	526-0030	1	Washer, Flat (29/64" ID x 1" OD x 1/16" Thk)
40	800-0059	1	Screw, Cap - Hex Head (3/8-16 x 3")
41	191-0879	1	Spacer, Belt Guard

179-2015 INSTALLATION STANDPIPE COOLING - KEYS 7,8 - OPTIONAL EQUIPMENT

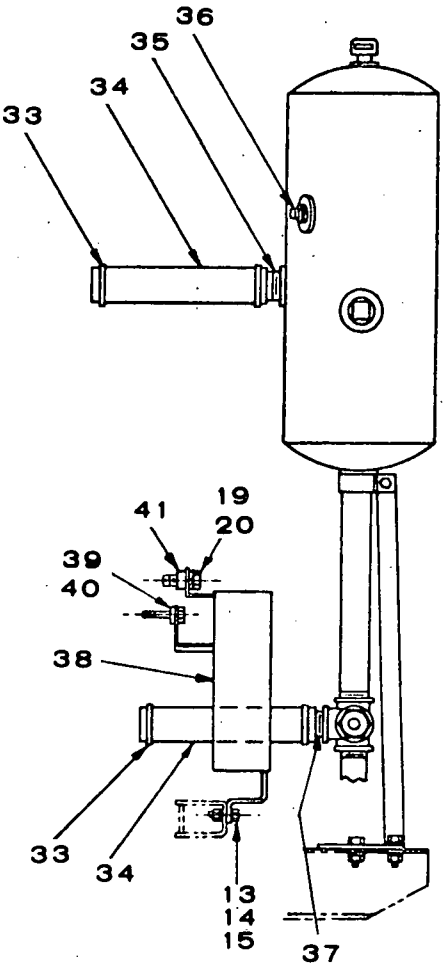


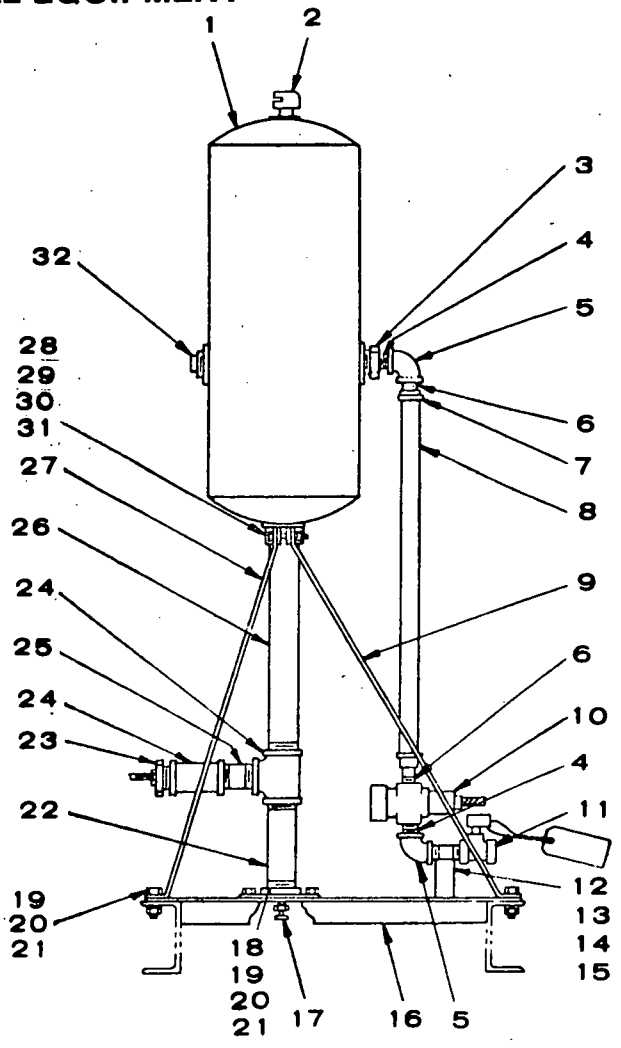


REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	130-0425	1	Standpipe
2	504-0062	1	Valve, Vacuum Relief
3	505-0023	1	Bushing, Pipe (1-1/4 x 1")
4	505-0004	2	Nipple, Close (1 x 1-1/2")
5	505-0041	2	Elbow, Pipe (1" x 90°)
6	505-0330	2	Nipple, Half (1 x 2")
7	503-0189	2	Clamp, Hose
8	503-0361	1	Hose (1-1/4 ID x 36")
9	130-0869	1	Brace, Standpipe
10	504-0090	1	Valve, Glove
11	307-1135	1	Valve, Solenoid
12	130-0797	1	Nipple Assembly, Waterline
13	800-0007	4	Screw - Cap Hex Head (1/4-20 x 1")
14	850-0040	4	Washer, Lock - Spring (1/4")
15	862-0001	4	Nut, Hex (1/4-20)
16	130-0927	1	Support, Standpipe Mounting
17	504-0006	1	Valve, Drain
18	130-0442	1	Base, Standpipe
19	800-0092	9	Screw, Cap, - Hex Head (1/2-13 x 1-1/2")
20	850-0060	9	Washer, Lock - Spring (1/2")
21	862-0005	8	Nut, Hex (1/2-13)
22	505-0421	1	Nipple, Pipe (2 x 8")

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
23	505-0175	1	Elbow, Pipe (2" x 90°)
24	505-0374	1	Tee, Pipe (2")
25	505-0405	1	Nipple, Pipe (2 x 5")
26	505-0377	1	Nipple, Pipe (2 x 18-1/2")
27	130-0870	1	Brace, Standpipe
28	130-0871	1	Clamp, Standpipe Mounting
29	800-0051	1	Screw, Cap - Hex Head (3/8-16 x 1-1/4")
30	850-0050	1	Washer, Lock - Spring (3/8")
31	862-0003	1	Nut, Hex (3/8-16)
32	505-0359	1	Plug, Square Head - (1-1/4")
33	503-0354	4	Clamp, Hose
34	503-0631	2	Hose, Radiator
35	505-0204	1	Nipple, Half (2 x 2")
36	505-0140	1	Plug, Square Head (1")
37	505-0764	1	Nipple (2 x 4"), Half
38	191-0878	1	Guard, Belt
39	526-0030	1	Washer, Flat (13/32" ID x 7/8" OD x 1/8" Thk)
40	800-0058	1	Screw, Cap - Hex Head (3/8 x 16 x 3")
41	191-0879	1	Spacer, Belt Guard

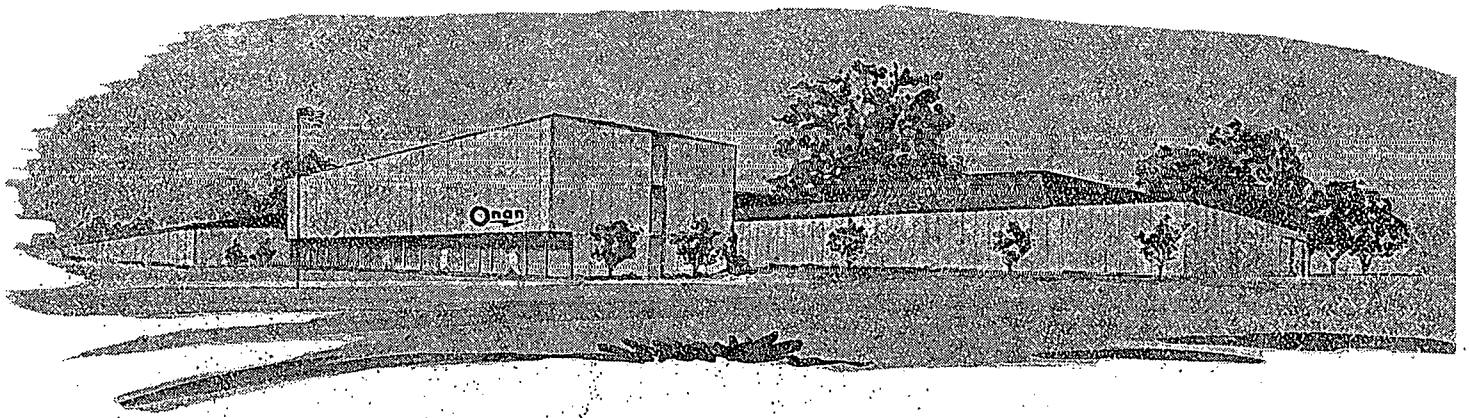
179-2014 INSTALLATION STANDPIPE COOLING WITH REGULATOR - KEYS 7,8 - OPTIONAL EQUIPMENT





REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	130-0425	1	Standpipe
2	504-0062	1	Valve, Vacuum Relief
3	505-0023	1	Bushing, Pipe (1-1/4 x 1")
4	505-0004	2	Nipple, Close (1 x 1-1/2")
5	505-0041	2	Elbow, Pipe (1" x 90°)
6	505-0330	2	Nipple, Half (1 x 2")
7	503-0189	2	Clamp, Hose
8	503-0361	1	Hose (1-1/4 ID x 36")
9	130-0869	1	Brace, Standpipe
10	309-0242	1	Valve, Water Temperature Control
11	307-1135	1	Valve, Solenoid
12	130-0797	1	Nipple Assembly, Waterline
13	800-0007	4	Screw, Cap - Hex Head (1/4-20 x 1")
14	850-0040	4	Washer, Lock (1/4")
15	862-0001	4	Nut, Hex (1/4-20)
16	130-0927	1	Support, Standpipe Mounting
17	504-0006	1	Valve, Drain
18	130-0442	1	Base, Standpipe
19	800-0092	9	Screw, Cap - Hex Head (1/2-13 x 1-1/2")
20	850-0060	9	Washer, Lock - Spring (1/2")

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
21	862-0005	8	Nut, Hex (1/2-13)
22	505-0421	1	Nipple, Pipe (2 x 8")
23	505-0351	1	Bushing, Reducer (2 x 3/4")
24	505-0374	2	Tee, Pipe (2")
25	505-0405	1	Nipple, Pipe (2 x 5")
26	505-0377	1	Nipple, Pipe (2 x 18-1/2")
27	130-0870	1	Brace, Standpipe
28	130-0871	1	Clamp, Standpipe Mounting
29	800-0051	1	Screw, Cap - Hex Head (3/8-16 x 1-1/4")
30	850-0050	1	Washer, Lock - Spring (3/8")
31	862-0003	1	Nut, Hex (3/8-16)
32	505-0359	1	Plug, Square Head (1-1/4")
33	503-0354	4	Clamp, Hose
34	503-0631	2	Hose, Radiator
35	505-0204	1	Nipple, Half (2 x 2")
36	505-0140	1	Plug, Square Head (1")
37	505-0764	1	Nipple, Half (2 x 4")
38	191-0878	1	Guard, Belt
39	526-0030	1	Washer, Flat (23/32" ID x 7/8" OD x 1/8" Thk)
40	800-0058	1	Screw, Cap - Hex Head (3/8-16 x 3")
41	191-0879	1	Spacer, Belt Guard



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