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HOBART®
GROUND POWER

Operation and Maintenance Manual
for
Model No. 60G20 Series No. 5384E Trailer and Truck-Mounted Generator Sets
60 kVA, 400 Hz, 3-Phase, 115/200 V AC

SPEC No. (ORDER ENTRY No.)	MOUNTING	VOLTAGE REGULATOR	SPECIAL FEATURES
5384E-1 (-50, -51)	Trailer or Truck	430391C	Basic unit in Series
5384E-4 (-50, -51)	Trailer or Truck	430391C	28.5-V T-R; 2 duplex receptacles
5384E-5 (-50, -51)	Trailer or Truck	430391C	SGX governor
5384E-9 (-50)	Trailer	430391C	Dual output unit
5384E-10 (-50)	Trailer	430391C	Fuel pressure gage and output receptacle
5384E-11 (-52, -53)	Trailer or Truck	489812A	Basic unit in series with solid state voltage regulator
5384E-14 (-52, -53)	Trailer or Truck	489812A	28.5-V T-R; 2 duplex receptacles, and solid state voltage regulator
5384E-15 (-52, -53)	Trailer or Truck	489812A	SGX governor and solid state voltage regulator
5384E-16 (-52, -53)	Trailer or Truck	489812A	Dual output unit, solid state voltage regulator
5384E-17 (-52)	Trailer	489812A	Fuel pressure gage, output receptacles and solid state voltage regulator

Hobart Brothers Company
Airport Systems Group
Troy, OH 45373
U.S.A.

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Safety Instructions and Warnings for Electrical Power Equipment

WARNING

ELECTRIC SHOCK can **KILL**. Do not touch live electrical parts.

ELECTRIC ARC FLASH can injure eyes, burn skin, cause equipment damage, and ignite combustible material. **DO NOT** use power cables to break load and prevent tools from causing short circuits.

IMPROPER PHASE CONNECTION, PARALLELING, OR USE can damage this and attached equipment.

Important: Protect all operating personnel. Read, understand, and follow all instructions in the Operating/Instruction Manual before installing, operating, or servicing the equipment. Keep the manual available for future use by all operators.

1. General

Equipment that supplies electrical power can cause serious injury or death, or damage to other equipment or property. The operator must strictly observe all safety rules and take precautionary actions. Safe practices have been developed from past experience in the use of power source equipment. While certain practices below apply only to electrically-powered equipment, other practices apply to engine-driven equipment, and some practices to both.

2. Shock Prevention

Bare conductors, or terminals in the output circuit, or ungrounded, electrically-live equipment can fatally shock a person. Have a certified electrician verify that the equipment is adequately grounded and learn what terminals and parts are electrically **HOT**. Avoid hot spots on machine. Use proper safety clothing, procedures, and test equipment.

The electrical resistance of the body is decreased when wet, permitting dangerous currents to flow through it. When inspecting or servicing equipment, do not work in damp areas. Stand on a dry rubber mat or dry wood, use insulating gloves when dampness or sweat cannot be avoided. Keep clothing dry, and never work alone

a. Installation and Grounding of Electrically Powered Equipment

This equipment must be installed and maintained in accordance with the National Electrical Code, ANSI/NFPA 70, or other applicable codes. A power disconnect switch or circuit breaker must be located at the equipment. Check the nameplate for voltage, frequency, and phase requirements. If only 3-phase power is available, connect any single-phase rated equipment to only two wires of the 3-phase line. **DO NOT CONNECT** the equipment grounding conductor (lead) to the third live wire of the 3-phase line, as this makes the equipment frame electrically **HOT**, which can cause a fatal shock.

Always connect the grounding lead, if supplied in a power line cable, to the grounded switch box or building ground. If not provided, use a separate grounding lead. Ensure that the current *(amperage)* capacity of the grounding lead will be adequate for the worst fault current situation. Refer to the National Electrical Code ANSI/NFPA 70 for details. Do not remove plug ground prongs. Use correctly mating receptacles.

b. Output Cables and Terminals

Inspect cables frequently for damage to the insulation and the connectors. Replace or repair cracked or worn cables immediately. Do not overload cables. Do not touch output terminal while equipment is energized.

3. Service and Maintenance

This equipment must be maintained in good electrical condition to avoid hazards stemming from disrepair. Report any equipment defect or safety hazard to the supervisor and discontinue use of the equipment until its safety has been assured. Repairs should be made by qualified personnel only. Before inspecting or servicing this equipment, take the following precautions:

a. **Shut OFF all power at the disconnecting switch or line breaker before inspecting or servicing the equipment.**

b. **Lock switch OPEN** *(or remove line fuses)* **so that power cannot be turned on accidentally.**

c. **Disconnect power to equipment if it is out of service.**

d. **If troubleshooting must be done with the unit energized, have another person present who is trained in turning off the equipment and providing or calling for first aid.**

4. Fire And Explosion Prevention

Fire and explosion are caused by electrical short circuits, combustible material near this equipment, or unsafe operating conditions. Overloaded or shorted equipment can become hot enough to cause fires by self destruction or by causing nearby combustibles to ignite. For electrically-powered equipment, provide primary input protection to remove short circuited or heavily overloaded equipment from the line.

5. Bodily Injury Prevention

Serious injury can result from contact with live circuit components inside this equipment. Shut **DOWN** this equipment for inspection and routine maintenance. When equipment is in operation, use extreme care in doing necessary trouble-shooting and adjustment.

6. Medical and First Aid Treatment

First aid facilities and a qualified first aid person should be available for each shift for immediate treatment of all injury victims. Electric shock victims should be checked by a physician and taken to a hospital immediately if any abnormal signs are observed.

EMERGENCY FIRST AID

Call physician immediately. Seek additional assistance. Use First Aid techniques recommended by American Red Cross until medical help arrives.

IF BREATHING IS DIFFICULT, give oxygen, if available, and have victim lie down. FOR ELECTRICAL SHOCK, turn off power. Remove victim; if not breathing, begin artificial respiration, preferably mouth-to-mouth. If no detectable pulse, begin external heart massage. CALL EMERGENCY RESCUE SQUAD IMMEDIATELY.

7. Equipment Precautionary Labels

Inspect all precautionary labels on the equipment monthly. Order and inspect all labels that cannot be easily read.

Introduction

This manual contains operation and maintenance information for 400-Hertz generator sets manufactured by Hobart Brothers Company, Hobart Airport Systems Group, Troy, Ohio 45373.

The basic generator sets covered by the manual are rated at 90 KVA. The machines are described and identified in Chapter 1, Description/Operation.

When applicable, manuals for sub-vendor equipment are included in Chapter 5.

The primary purpose of the manual is to provide information and instructions to experienced operators, electricians, and mechanics who are not familiar with this equipment. The intent of the manual is to guide and assist operators and maintenance personnel in the proper use and care of the equipment.

Read the instructions before starting the unit. Learn to use the manual and to locate information contained in it.

The Table of Contents, which follows this introduction, lists all Chapters, Sections, and the paragraph titles within each Section. The location of each listing is identified by Chapter, Section and page number. A complete list of illustrations, with their locations, follows the Table of Contents.

Each chapter is divided into as many Sections as necessary. Sections are always referred to by a combination Chapter/Section number, for example: 2-3 refers to Chapter 2, Section 3.

The material within each Section is divided into main subjects with applicable paragraph headings and subheadings as required. For example, a portion of the Description Section might logically follow this arrangement and paragraphing:

1. Control

a. Interior Panel

(1) Protective devices

a. Overload relay

(2) Contactors

Page numbers do not run consecutively throughout the manual. Each page is identified by the Chapter/Section number in which it appears, and by a page number within the Chapter/Section. Therefore, the first page in each Section is page 1. These identifying numbers appear in the lower, outside corner of each page. Each page also bears a date located in the corner opposite the page number. This date is either that of original issue, or of the latest revision. Any revision to the original text is identified by a heavy black line in the left-hand margin. Illustrations follow a numbering system similar to page numbering. The first Figure in each Section is Figure 1.

All tables, charts and diagrams, as well as illustrations, are identified by Figure numbers to avoid confusion.

The general location of any particular information can be found quickly by running through the Table of Contents. For example: to locate any adjustment information, a quick look at the Table of Contents shows that “Adjustment/Test” is located in Chapter 2, Section 3 (shown as 2-3).

Portions of the text are referred to by identifying the paragraph in which the referenced material may be found. When referenced material is located in the same Chapter/Section as the reference, only the paragraph identification is given, for example: (Ref. Para 1, A) means that the material is to be found in paragraph 1, A, of the same Section.

When referenced material is located in another Chapter/Section, both the Chapter and Section numbers and the paragraph identification are given, for example: (Ref. 1-2, Para 1, A) means that the referenced material is located in Chapter/Section 1-2, and paragraph 1, A within that Chapter/Section.

Components shown in illustrations, and the illustrations themselves, are referenced in a similar manner. When this type of reference is made, the item number of the part and the Figure number in which it appears are given, for example: (2, Fig. 3) refers to item number 2 in illustration Figure 3 of the same Chapter/Section.

When a referenced figure appears in another Chapter/Section, the reference will include the Chapter/Section number, for example: (2-3; 1, Fig. 4) tells the user that the information is in Chapter/Section 2-3, and to refer to item 1 in Figure 4.

Once a Figure number reference has been established, the Figure number is not repeated and only the item numbers of the parts involved are referenced, for example: “Loosen screw (2, Fig. 6), slide out connector (4), and remove brush (6).”

When an item number is referenced without a Figure number, it always applies to the last preceding Figure number mentioned in the text.

A collection of manufacturer’s literature is supplied as part of the information package in Chapter 6.

If you have any questions concerning your Hobart Airport Systems Group equipment, you are invited to contact our Service Department by mail, telephone or FAX.s

Write:	Hobart Brothers Company Airport Systems Group Service Department 1177 Trade Square East Troy, Ohio 45373 U.S.A
In U.S.A. Call:	(800) 422-4166 (800) 422-4177
From Foreign Countries, Call:	(937) 332-5050 (Parts) (937) 332-5060 (Service)
Fax:	(937) 332-5121

HOBART GROUND POWER

Table of Contents

HOBART GROUND POWER

Chapter - Section Page

Chapter - Section Page

Chapter - Section Page

Chapter - Section Page

Chapter - Section Page

Chapter 3. Overhaul / Major Repair

Chapter - Section Page

Chapter 4. Illustrated Parts List

Chapter 5. Manufacturers Literature

Chapter 1. Description/Operation

Section 1. Description

1. General

This manual describes, first, a basic 60-kVA diesel-powered generator set *(Fig. 1)* , identified by Hobart Specification Number 5384E-1, and designed for trailer or truck mounting. Secondly, this manual describes, if necessary, the specific variation of this basic generator set purchased by the customer. Refer to Paragraph 10 for information on the particular generator set Specification purchased if it is a Specification other than Specification Number 5384E-1.

Depending on customer requirements, within the 5384E generator set series, there are 10 variations (specifications) of generator sets, for trailer or truck mounting, based in design on the Specification 5384E-1 unit.

The purpose of one of this generator set is to produce and deliver regulated 400-Hz, 115/200-V AC power to a parked aircraft for operation of the aircraft's electrical equipment when the on-board generators are not running. See Fig. 2 for basic generator set specifications and capabilities.

2. Orientation

For purpose of orientation and to familiarize operators and maintenance personnel with the location of components, the radiator is considered to be at the FRONT of the unit. The generator and controls are at the REAR.

RIGHT and LEFT are determined by standing at the rear end facing the machine. Thus, the generator control box, output receptacle connector, and engine control panel are mounted on the LEFT side at the REAR of the unit.

3. Special Features

The generator set has many special features which are described more fully under the assemblies in which they appear. Some of the main features are mentioned here and described briefly.

a. Protective Monitor

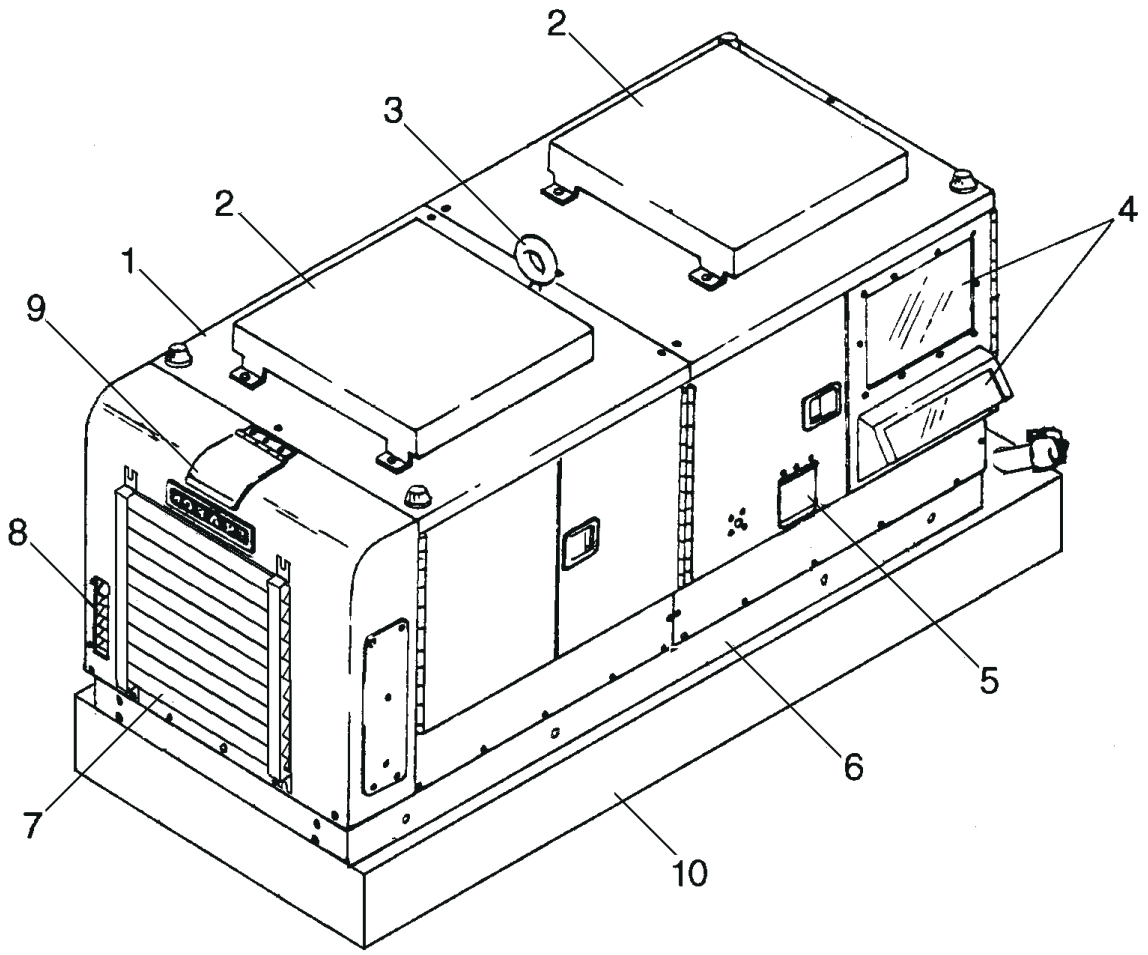
A single, solid-state device *(4, Fig. 9)* receives signals from all of the fault sensing units in the generator output circuit and functions to cause the load to be disconnected from the generator if an abnormal condition of voltage, frequency, or load develops.

b. Pull-out Trays

The control box is equipped with pull-out, drawer-type trays which provide easy access to controls and equipment mounted in them. Each tray may be removed as an assembly by disconnecting a single quick-disconnect connector and tripping two safety latches.

c. Voltage Regulator

A solid-state, adjustable voltage regulator provides automatic voltage regulation at the aircraft. The regulator is also adjustable for a variety of output cable sizes and lengths.



1. Canopy
2. Access - vent covers
3. Lifting eye
4. Windows
5. Output receptacle cover
6. Frame assembly
7. Engine fan exhaust deflectors
8. Engine exhaust pipe
9. Radiator cap access cover
10. Truck mounting body (when ordered by customer for truck mounting)

Generator Set

Figure 1

d. Test Circuitry

A receptacle connector with wiring to various test points throughout the electrical circuitry is provided for the attachment of a test box manufactured by Hobart Brothers. This test circuitry allows electricians to perform as many as twenty-four tests and checks from one location, conveniently and easily.

e. Electric Governor

The engine is equipped with an all electric type governor kit and other special equipment more fully described under the engine description.

4. Identification: Mounting Design and Additional Equipment

To further enhance the capabilities of Series 5384E generator sets, a customer, when ordering the generator set, may select a unit designed for trailer and/or truck mounting with particular additional items of equipment for installation on the unit.

In regard to mounting design and particular items of equipment, generator sets manufactured by Hobart Brothers Company are identified by their Specification Number, which consists of the Series number plus a dash number *(i.e. -1,-2, etc.)* suffix. The suffix number indicates the mounting design of the generator set and also indicates which of one or more items of special or extra equipment are a part of the unit.

Information on this additional equipment, when selected, is provided in pertinent sections of this manual. Included in Paragraph 8 in this Section is list of the Specifications available. Encircled on this list is the Specification covered by this manual, describing its mounting design and additional items of equipment.

5. Canopy

A sheet metal enclosure, identified as a canopy *(1, Fig. 1)*, provides protection for the engine, generator and electrical controls. The canopy is designed to reduce the operational noise level in the immediate area of the generator set. Doors and panels are covered on the inside with fiberglass acoustic material to reduce reflected and conducted noise, and to absorb noise. Noise caused by vibration is most commonly found on doors and movable panels. This has been reduced with the use of two-point slam locks on the most commonly opened doors on the left side of the unit. Insulating strips around all doors also reduce noise. Metal strips are mounted horizontally across the front grille to deflect engine fan exhaust air and noise downward.

Two large openings in the canopy top provide an entrance for cooling air and an access to internal components. A hood-type cover is mounted about two inches above each opening. The cover is flanged downward and extends beyond the edges of the upwardly flanged opening to prevent entrance of blowing rain while still allowing a good flow of air. Air enters the forward opening into the engine compartment and is discharged through the radiator by the engine fan. Air enters the rear opening into the generator compartment. it is then circulated over the generator controls and drawn into the rear exciter and generator housings, where it passes over all windings before being discharged by the fan.

Because this unit is designed to be tractor-mounted, it has two large removable panels on the right side. This is mainly because the right side of the machine is not accessible when mounted on a tow tractor, and secondly, the thick doors would not allow mounting in the limited space available on a tractor.

Panel mounted instruments may be observed through two Plexiglass windows in the left rear door which covers the control box and engine control panels. The lower window is slanted outward at the bottom to provide access to engine controls when the door is closed. A centrally-located lifting eye attached to a lifting yoke extends through the canopy top to provide an attaching point for chains, cables, or hook used to lift and move the generator set.

6. Engine, Generator and Controls Assembly

This assembly includes all components required to generate and regulate 400 Hz, 115/200 V, three-phase power, and is operable when provided with fuel and 12 V-DC power. The engine-generator assembly is mounted on a welded steel frame. A superstructure, attached to the main frame, provides mounting facilities for the canopy, control box and electrical equipment and controls.

a. Basic Engine

This unit is equipped with a three-cylinder, in-line diesel engine, manufactured by Detroit Diesel Corporation, Detroit, Michigan. See Figure 2, Sheet 2 for general specifications.

Physical

Basic Generator Set

Length *(approx.)*	82 inches *(2083 mm)*
Width *(approx.)*	36 inches *(914 mm)*
Height *(approx.)*	43 inches *(1092 mm)*
Weight *(approx.)*	4360 pounds *(1979 kg)*

Generator Capabilities

Output power rating	60 KVA
Output voltage	115/200 V-AC
Rated load capacity	173 A
Frequency *(cycles-per-second)*	400 Hz
Output kilowatts	48 KW
Power factor	0.8 PF
Duty cycle	100%
Operating speed at 400 Hz	2000 RPM
Overload capacity *(125% of rated load capacity)*	216 A
Output cable size required	2/0

Generator Protective System

Overvoltage relay	trips 130 V to 134 V; resets 125 V
Undervoltage relay	trips 100 V or below; resets 102 V
Overfrequency relay	trips 415 Hz to 425 Hz; resets 410 Hz
Underfrequency relay	trips 375 Hz to 385 Hz; resets 385 Hz

Generator Specifications & Capabilities

(Sheet 1 of 2)
Figure 2

Engine

Manufacturer	Detroit Diesel Corporation
Model	3-71N
Type	3-cylinder, 2-cycle Diesel
Bore	4.25 inches *(108 mm)*
Stroke	5.00 inches *(127 mm)*
Displacement	213 cu. in. *(3491.1 cc)*
Compression ratio *(nominal)*	17:1
Firing order	1-3-2
Horsepower at 2000 RPM	148
Governed speed	2000 RPM ±2%
Idle speed	900 RPM ± 25 RPM
Electrical system	12 volt DC
Oil capacity *(with filter)*	15 quarts *(14.2 liters)*
Oil capacity *(without filter)*	13 quarts *(12.3 liters)*
Coolant capacity *(approx.)*	8-1/2 gallons *(32.18 liters)*

Generator Specifications & Capabilities

(Sheet 2 of 2)
Figure 2

b. Engine Manufacturer's Equipment

As received from the engine manufacturer, the engine includes the following equipment which is described in the Engine Operator's Manual *(Chapter 6)*.

(1) Twelve volt electrical system includes starter and alternator with built-in voltage regulator.

(2) Ether starting aid system.

(3) Fuel strainer and fuel filter.

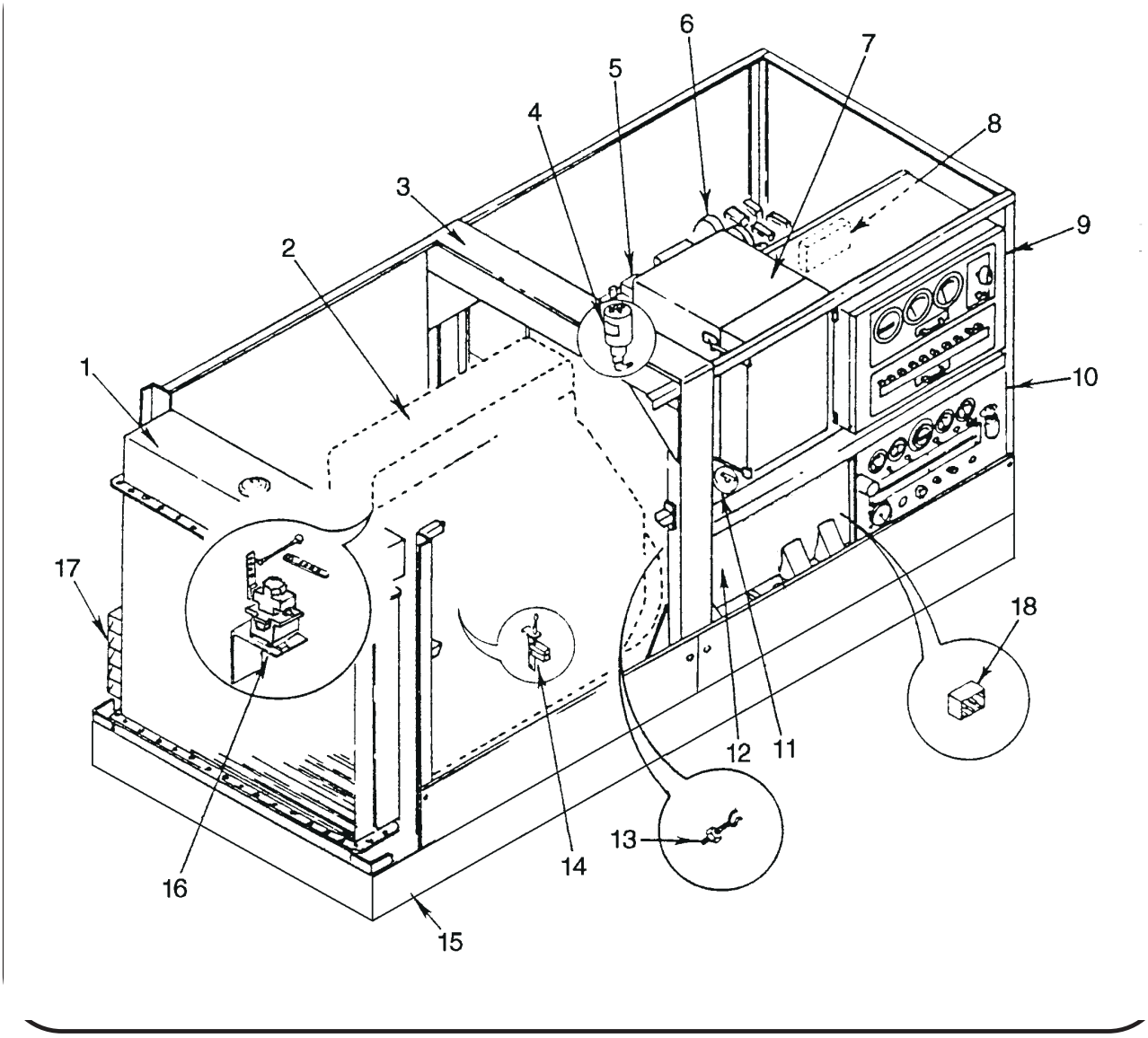
(4) Full-flow oil filter.

(5) Automatic shutdown system including temperature and pressure sensing switches, a "hot-wire" relay, and a solenoid-operated, cam-and-latch type shutdown valve in the blower air intake.

(6) Speed limiting governor.

(7) Reverse-flow, engine-cooling fan to blow air outward through the radiator.

All the above equipment, except the fan, is described in the Detroit Diesel Operator's Manual.



1. Radiator
2. Engine
3. Lifting Yoke
4. Overspeed Governor
5. Voltage Regulator
6. Power Module
7. Air Cleaner
8. Governor control box
9. Generator Control box
10. Engine control panel
11. Engine oil filler pipe
12. Generator
13. Governor magnetic pick-up
14. Starter cut-out switch
15. Mounting frame
16. Governor actuator
17. Engine exhaust pipe
18. Output receptacle (when used)

Generator Set Components

Figure 3

c. Hobart Engine Equipment

The engine is modified at Hobart Brothers by the addition of the following equipment:

(1) Electric governor system

The electric governor was selected for control of engine speed *(and generator output frequency)* because it provides faster engine response to changes in load conditions. This fast response results in very close frequency control. Refer to the Barber-Colman literature in Chapter 6 for a detailed description. As described briefly below, the governor system consists of the following main components:

Magnetic pickup Control unit Actuator

a. Magnetic pickup

The magnetic pickup *(13, Fig. 3)* is a device for detecting the speed of the engine. It is mounted in the flywheel housing directly over the ring gear. It produces an AC signal to the control unit when the ferrous flywheel teeth pass through the magnetic field at the end of the pickup.

b. Control unit

The control unit *(8, Fig. 3)* is a box containing a compact assembly of solid state components. It receives an AC signal from the magnetic pickup and senses speed changes in the engine. It provides a voltage signal to the actuator which causes the actuator to move the fuel control lever as required to maintain a predetermined engine speed. Its power is received from the two 12-V DC battery system.

c. Actuator

The actuator *(16, Fig. 3)* supplies the force needed to move and position the fuel lever as required to maintain a constant engine speed. The actuator is operated by a DC signal from the control unit.

(2) Engine Safety devices

a. Overspeed governor

The overspeed governor (*4, Fig. 3)* is a mechanical fly-weight type, mounted at the rear of the engine and driven through an adapter by the camshaft. Electrical contacts in the governor are connected in parallel with other engine shutdown devices. The governor is adjusted to close the contacts and actuate the shutdown solenoid when an engine speed of 2400 RPM is reached. The governor must be manually reset, after tripping, by pushing a button located on the governor head.

b. Temperature sensing safety switch

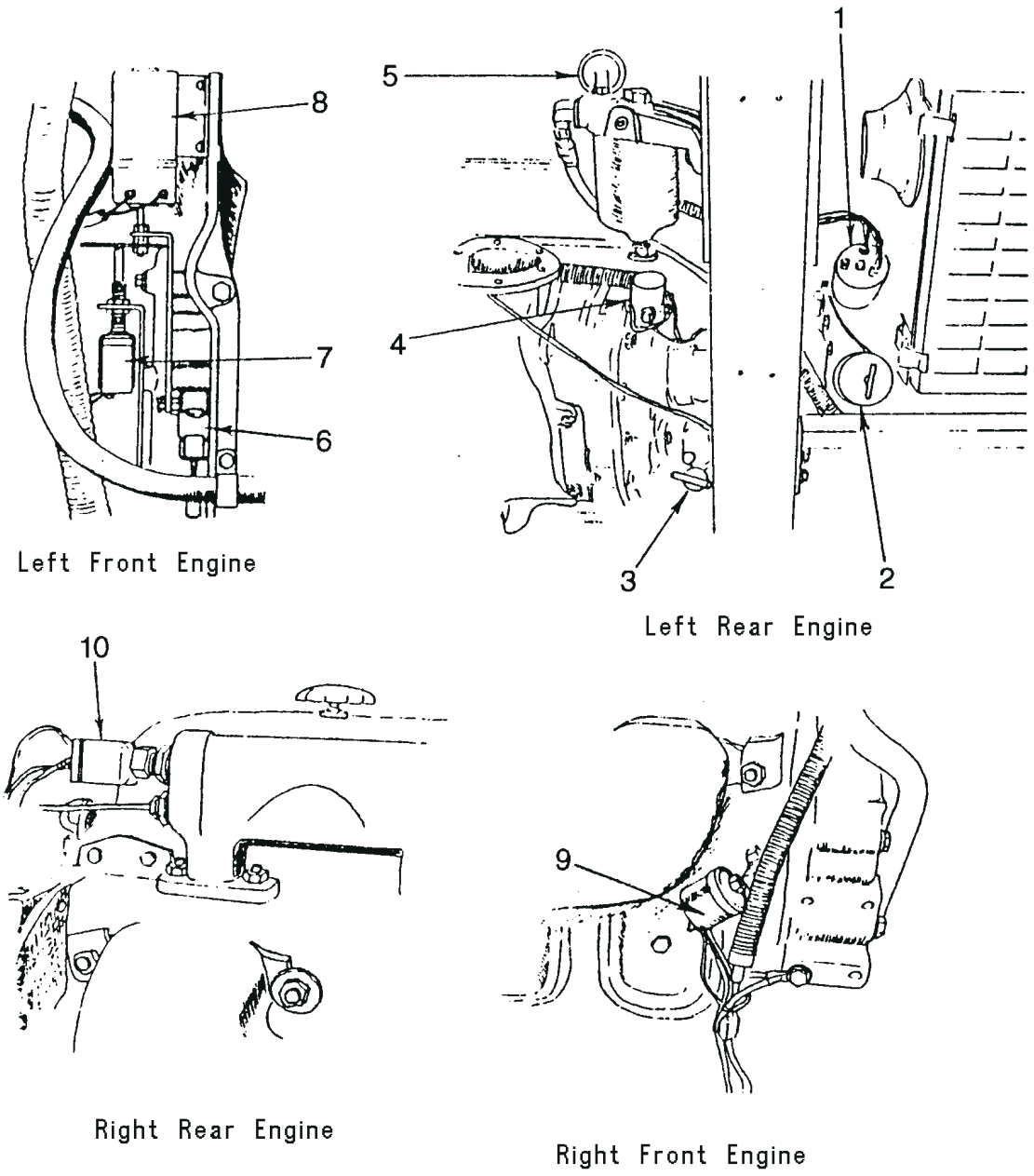
This switch *(10, Fig. 4)* is mounted in the engine water manifold and is identified as an “Alarmstat”. It is very sensitive to temperature changes and functions to protect the engine against overheating caused by low coolant level, broken fan belt, etc. It sends a signal which activates the shut-down solenoid to stop the engine when temperature in the cooling system reaches 205 deg. F.

c. Start circuit cut-out switch

This is a Micro-type switch *(7, Fig. 4)*, mounted just below the air-valve operating lever. The switch is electrically connected in series with the starter switch. In normal operation the switch is CLOSED. In the event the shutdown solenoid is actuated to stop the engine, the shutdown switch is OPENED to prevent operation of the engine starter until the shutdown air valve is LATCHED in OPEN position.

d. Start circuit solenoid switch

This solenoid type switch *(4, Fig. 4)* functions to conduct 12-V DC power to the engine starter solenoid when the panel mounted pushbutton start switch is pushed. The solenoid switch serves to by-pass and protect the pushbutton starter switch against heavy load current in case the starter gear should fail to engage the flywheel ring gear properly.



1. Overspeed governor
2. Oil filler tube
3. Oil level gage rod
4. Start circuit auxiliary solenoid switch
5. Fuel pressure switch
6. Air shut-off valve
7. Start circuit cut-off switch
8. Shut-down solenoid
9. Low-oil-pressure switch
10. High temperature switch

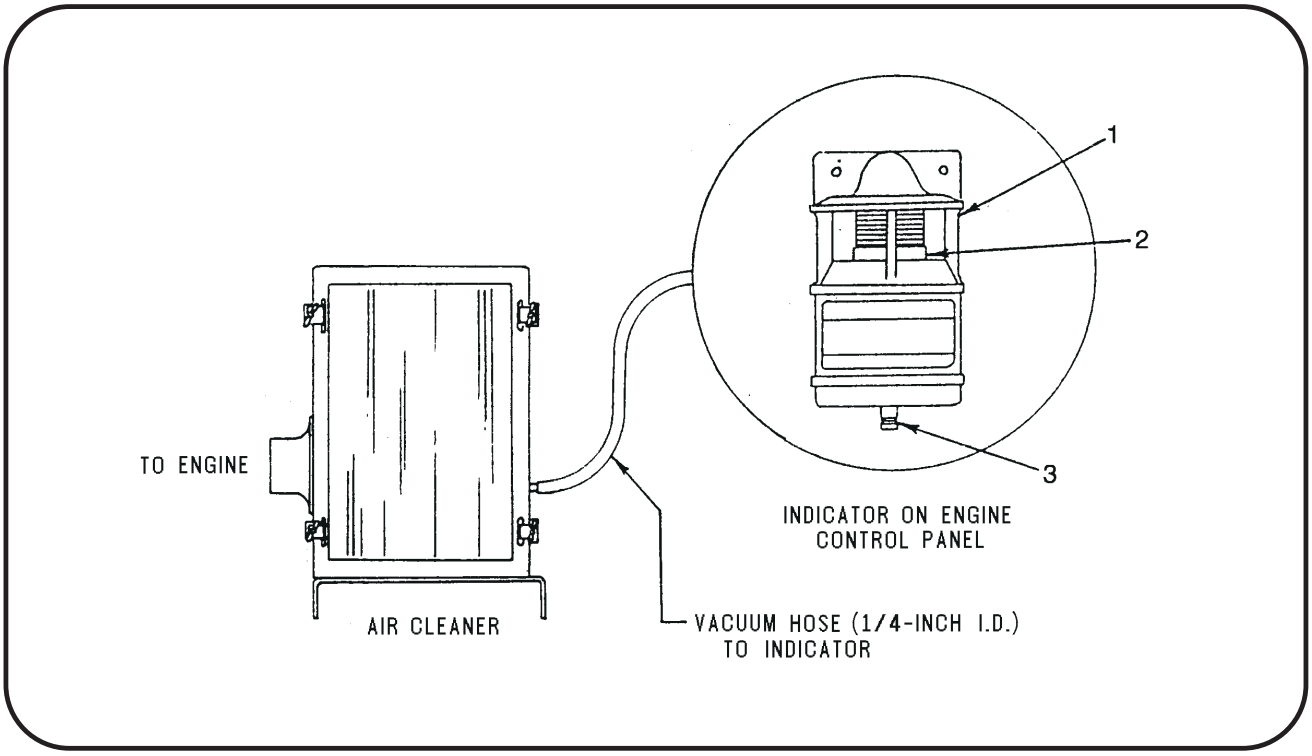
Engine Shut-down Set Components

Figure 4

(3) Air Cleaner

The diesel-engine air cleaner *(Fig. 5)* is a dry-cartridge type. It is equipped with a service indicator which signals the operator when it needs cleaning. A cylindrical "flag" *(2)* is forced upward in a glass enclosed viewing chamber *(1)* when air pressure within the air cleaner drops below the outside air pressure. As the cartridge becomes loaded with dirt and air, pressure within the cleaner lessens, the "flag" gradually rises higher in the glass viewing chamber. When the "flag" reaches the top of the chamber, it locks in that position to warn the operator that the cartridge must be changed. The "flag" is reset *(unlocked)* by pushing the reset button *(3)* located on the indicator.

NOTE: The service indicator is mounted on the engine control panel and connected to the air cleaner by a rubber hose. The indicator flag is visible only when the engine is running or when the flag is locked in **WARNING** position.



1. Viewing chamber 2. Indicator "flag" 3. Reset button

Air Cleaner and Service Indicator

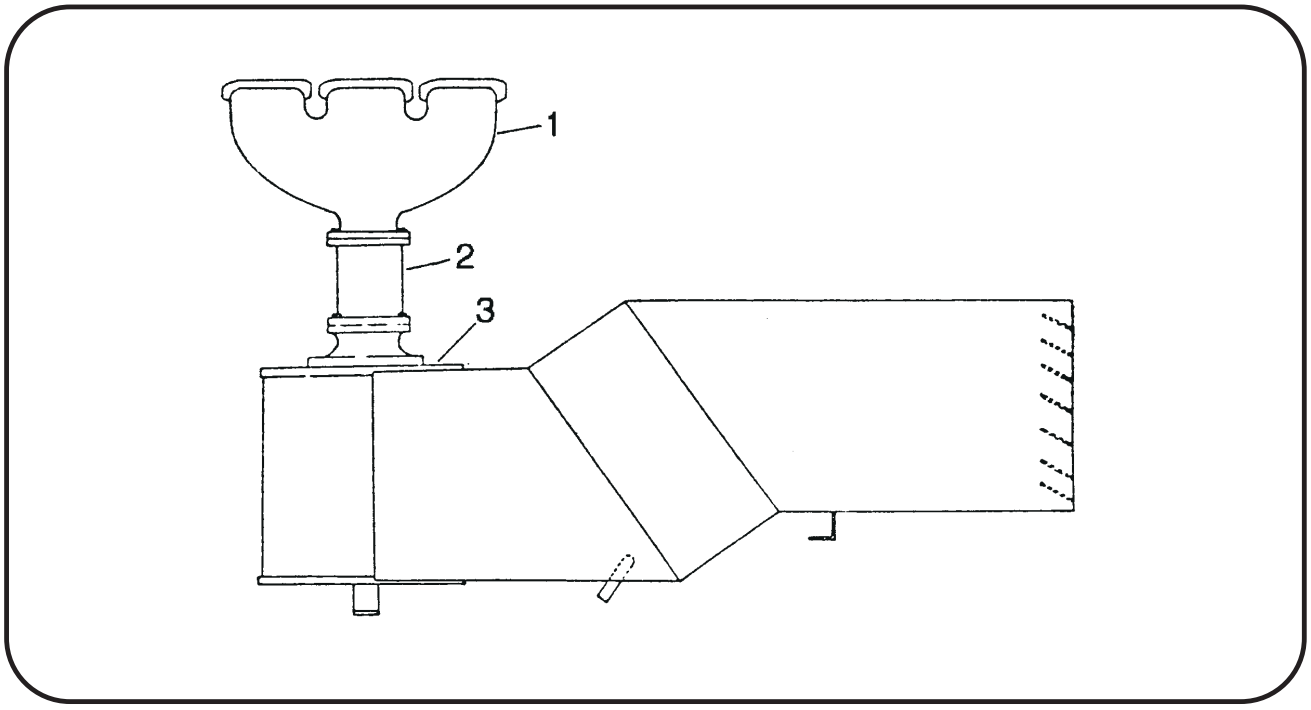
Figure 5

(4) Exhaust system

The exhaust system consists of a special noise reducing muffler *(3, Fig. 6)* which is connected by a flexible pipe *(2)* to a conventional exhaust manifold *(1)*. Baffles in the tail pipe outlet direct exhaust out and noise downward.

(5) Radiator

The radiator *(1, Fig. 3)* is a tube type with bolted-on, top and bottom tanks which permit disassembly for cleaning and repair.



1. Exhaust manifold 2. Exhaust pipe 3. Muffler and tailpipe

Noise Reduction Exhaust System

Figure 6

d. Generator

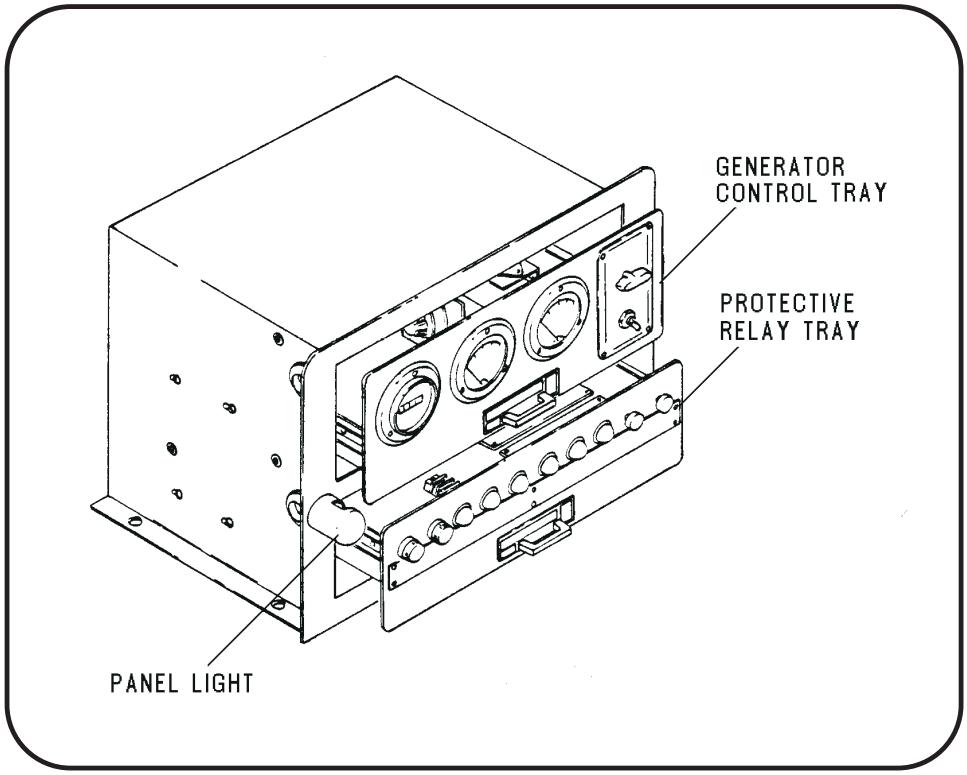
The 400-Hz generator is a brushless, revolving field, three-phase, alternating current type. The rotor assembly is mounted by two, permanently lubricated, sealed ball bearings. The front bearing is supported by the fan housing; the rear bearing is mounted in the exciter housing. Both of these housings are attached to the main generator stator housing. The front end of the rotor shaft extends forward beyond the bearing and is attached to the engine flywheel by a hub and flexible disc coupling assembly. The rear end of the rotor shaft extends rearward beyond the rear bearing into the exciter stator housing. The exciter rotor is mounted on this shaft extension with a standard key and is secured by a washer and 1/2" - 13 thread., cap screw. A rectifier with six diodes is mounted on the exciter rotor and converts exciter AC output to DC for excitation of the generator revolving fields. The exciter DC output to the generator fields, and consequently, the generator output is control led by the amount of DC voltage supplied to exciter fields by the static voltage regulator. A centrifugal, radial-blade fan, which is part of the hub and coupling assembly, draws cooling air over all internal windings. Air enters at the exciter end and is discharged at the drive end. The complete generator is bolted to the engine flywheel housing.

e. Control Box Assembly

The control box *(Fig. 7)* is a sheet metal enclosure which houses and provides mounting facilities for generator and engine controls and monitoring equipment. The box is equipped with two, drawer type trays which contain generator output control devices and monitoring instruments.

Trays slide in and out on nylon rollers for easy access to internally mounted components and are easily removable by disconnecting an “Amphenol” connector and unlocking safety latches.

A shielded, instrument panel light is mounted on the left side of the control box front panel to illuminate controls and instruments within the trays.



Control Box

Figure 7

(1) Generator control tray *(see Figure 8)*

The generator control tray contains instruments and controls for monitoring and controlling the generator output.

a. Resistors

Two, 20-ohm, 100-watt, ballast resistors *(2)* are connected in series in the generator exciter DC field circuit.

A variable resistor *(1)* is connected in series between the manual control rectifier *(14)* and rheostat *(13)*. Its purpose is to adjust the DC voltage to the rheostat and thus determine the voltage range through which the rheostat can control generator output voltage.

b. Generator output monitors (meters)

The generator output is monitored by three instruments; a frequency meter *(10),* a voltmeter *(9)*, and an ammeter *(7)*. The frequency meter is a resonant-reed type which indicates the frequency of the generator output alternating current in the range of 380 to 420 Hz (cycles per second). The voltmeter indicates the generator output voltage in each phase-to-neutral *(A N, B-N and C-N)* or phase-to-phase *(A-B, B-C and C-A)* as selected by the meter selector switch *(6)* and the line selector switch *(5). (These switches will be described below).* The voltmeter has a 3-1/2-inch face and the scale is graduated 0 to 300 V. The ammeter is graduated 0 to 250-A. The amperage value in each of the three phases may be read on the ammeter by selecting the desired phase with switch *(6)*. Three ammeter current transformers, *(Ref. 4, Fig. 11)*, lower the output load current to a lesser value of definite ratio, which will operate the ammeter movement without damage.

The ammeter dial scale is graduated and numbered so that the pointer will indicate the true load current value rather than the meter movement current.

c. Meter and line switches

These switches provide a means of selecting and determining which phase of voltage and current is indicated on the voltmeter and ammeter and whether the voltage is line-to-neutral or line-to-line. The meter switch *(6)* is a four-position, rotary type. A nameplate *(4)*, located under the switch knob is marked and lettered to indicate the three functional positions of the meter switch. *(When the knob is pointing straight down, the switch is OFF.)* The line switch *(5)* is a two-position, toggle switch used to select either line-to-neutral or line-to-line voltage to the voltmeter. The nameplate is also marked to indicate the position of this switch.

d. Receptacle connector

An "Amphenol" connector *(12)* provides a means of quickly disconnecting all wires to control box components.

e. Tray

The tray *(15)* slides in and out on nylon rollers. It is secured in place by a twist-lock, screw fastener *(8)*.

f. Manual voltage control

When the automatic-manual switch *(11)* is placed in **MANUAL** position, AC power is supplied to the rectifier *(14)* rather than to the automatic voltage regulator. The DC output of the rectifier is routed to the exciter field through a rheostat *(13)*. The generator output voltage is manually controlled by adjustment of the rheostat.

g. Excitation-deenergization relay

The purpose of this relay *(3)* is to allow automatic excitation to be connected to the exciter field only when the engine speed is being controlled by the electric governor.

(2) Protective relay tray *(see Figure 9)*

The bottom of the control box is the protective relay tray and contains electrical and electronic safety devices designed to protect the aircraft electrical system against damage which could result from overvoltage, undervoltage, overfrequency, or underfrequency. The tray also contains devices for the protection and control of the generator output electrical system.

a. Sensing modules

The voltage sensing module *(5)* and frequency sensing module *(6)* are connected to generator output leads between the generator and load contactor. These solid-state modules sense any abnormal condition of voltage or frequency and signal the solid-state circuitry of the memory and time delay module *(4)* to open the load contactor and disconnect the generator output to the aircraft.

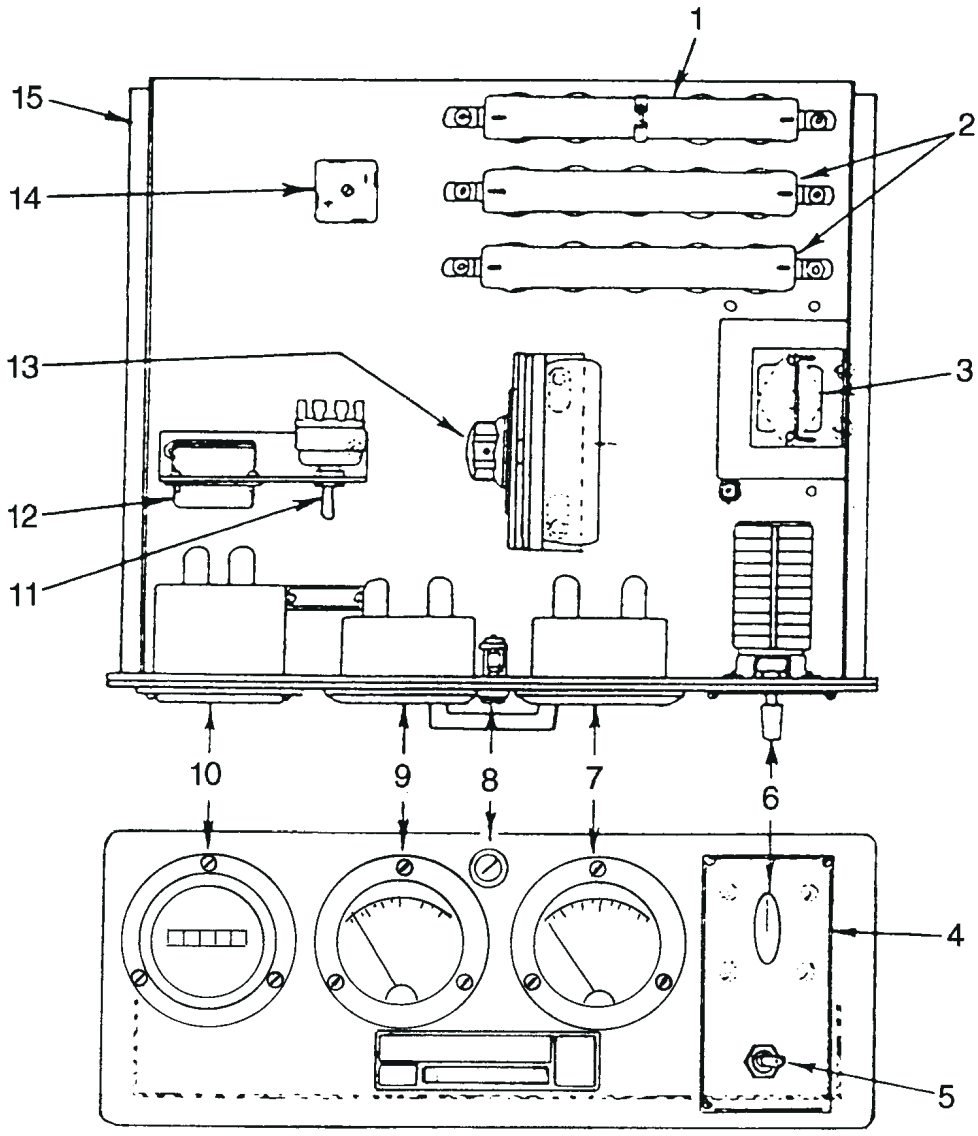
Trip values are adjustable, however, adjustments should be made ONLY under laboratory conditions.

A solid-state overload signaling device *(Ref. 7, Fig. 121* is also connected to the protective monitor module and performs a function similar to the voltage and frequency sensing modules.

Trip values for protective circuits are as follows:

- Overvoltage trips at 130 V to 134 V Undervoltage trips at 102 V or below.
- Overfrequency trips at 415 Hz to 425 Hz. Underfrequency trips at 375 Hz to 385 Hz.
- Undervoltage time delay *(adjustable)* 4 to 12 seconds.
- Overload circuit trips at any value over 125% rated load capacity.

See Para. 6, G, (3) for more specific and detailed information regarding overload device.



1. Resistor, 50-ohm, 100 watt
2. Resistor, 20-ohm, 100 watt
3. Excitation-deenergization relay
4. Instruction plate
5. Line selector toggle switch
6. Meter selector rotary switch
7. AC ammeter
8. Tray fastener
9. Voltmeter
10. Frequency meter
11. Automatic-manual switch
12. Receptacle connector
13. Manual voltage control rheostat
14. Manual control rectifier
15. Tray

Generator Control Tray

Figure 8

b. Memory and time delay module

The memory and time delay module *(4)* is sometimes called the protective monitor module. It is a solid-state device with a hermetically-sealed, reed-type relay. The printed circuit board or "card" includes five memory circuits and a time delay circuit. Each circuit is connected to a corresponding sensing module *(5 and 6)*. All memory circuits are connected to the module relay coil, and any one of the circuits can energize the coil to open the relay contacts. Thus, when a sensing device energizes any one of the module circuits, the module relay is also energized to break the load contactor holding circuit and allow the load contactor to open. All circuits, except the undervoltage circuit, function immediately to open the load contactor. A time delay system is designed into the undervoltage circuit to prevent nuisance opening of the contactor under conditions of momentary undervoltage in the generator output. An undervoltage condition which continues uninterrupted for a period of 4 to 12 seconds (adjustable) will cause the time delay circuit to open the load contactor. Each of the five circuits is connected to a corresponding indicating light *(10, 11, 13, 14, and 15)* which is turned on when a fault occurs. The module relay will remain energized *(OPEN)* until the reset switch *(7)* is pushed to allow the relay to return to normal, **CLOSED** position.

c. Indicating lights

The function of these lights *(10, 11, 13, 14, and 15)* is to indicate to the operator the abnormal condition of overvoltage, underfrequency, etc., which caused the protective monitor system to function. Each of the five lights is connected to an actuating circuit within the memory and time delay module. When one of the circuits is activated, it turns on the applicable indicating light. The light will remain on until the reset switch *(7)* is pushed. All lamps in indicating lights may be tested by pressing switch *(8)*.

d. Plug interlock relay

The function of the plug interlock relay *(1)* is to cause the output load contactor to open in the event the cable plug connector becomes accidentally disconnected from the aircraft during power delivery, or if an attempt is made to deliver power when the output cable is not connected to the aircraft. Twenty-eight volt, direct current for operation of the relay is supplied from the aircraft either through an on-board transformer-rectifier, or from a twenty-eight volt electrical system. Connection from the aircraft to the interlock relay is through terminals E and F on the output plug connector.

e. Test bank switch

A single-pole single-throw toggle switch *(18)* provides a means of by-passing the interlock relay *(1)* when supplying power to a load bank, or to an aircraft not equipped with a plug-interlock system.

f. Resistor

A 100-ohm, 25-watt resistor *(21)* is connected in series with the plug interlock relay to protect the relay in the event that phase "C" contacts in the load contactor should fail to close when the generator ON switch is operated.

g. Fuse-interlock relay

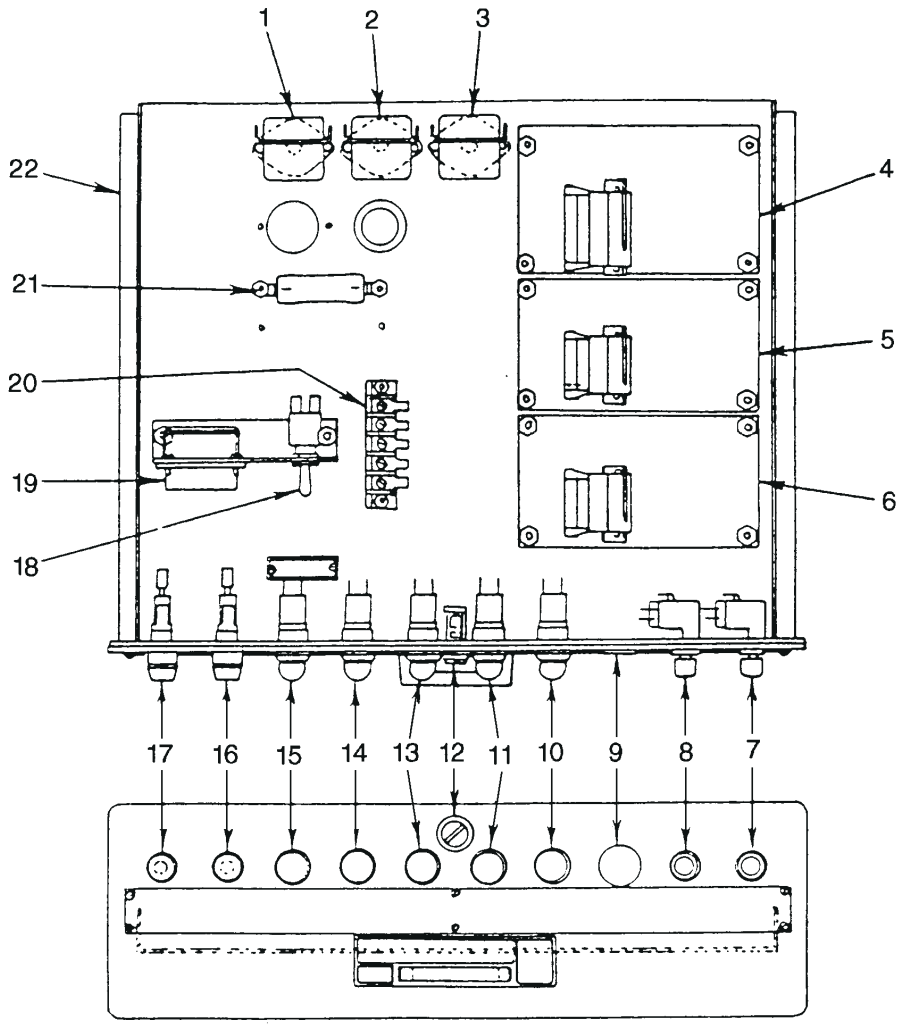
The function of the fuse-interlock relay *(2)* is to interrupt the load contactor holding coil circuit and remove the load in case of a "blown" fuse *(17)* in the protective relay coil circuit.

h. Connector

A twenty-six contact connector *(19)* provides a quick-disconnect facility for all wiring to tray electrical components so that the complete tray assembly may be removed quickly and easily.

i. Auxiliary underfrequency relay

The function of the auxiliary underfrequency relay *(3)* is to automatically open the excitation-deenergization relay and disconnect the voltage regulator anytime generator frequency drops to 375-385 Hz. This protects the voltage regulator *(Fig.12)* and ballast resistors *(2, Fig. 8)* against overload which could be caused by very high voltage regulator output in its attempt to maintain voltage when the generator is operating at a speed which cannot produce normal voltage output.



1. Plug-interlock relay
2. Fuse-interlock relay
3. Auxiliary underfrequency relay
4. Memory and time delay module
5. Over-undervoltage module
6. Over-underfrequency module
7. Reset switch
8. Light test switch
9. Hole plug
10. Overload indicating light
11. Underfrequency indicating light
12. Tray fastener
13. Overfrequency indicating light
14. Undervoltage indicating light
15. Overvoltage indicating light
16. Load contactor circuit fuse *(2 A)*
17. Protective system fuse *(2 A)*
18. Test bank switch
19. Receptacle connector
20. Terminal board
21. Resistor *(100 ohm, 25 watt)*
22. Tray

Protective Relay Tray

Figure 9

NOTE: 1 If the auxiliary underfrequency relay is tripped, it will be necessary to place engine operating mode switch *(5, Fig. 10)* in **BUILD-UP-VOLTAGE** position to restore generator voltage.

f. Engine Control Panel *(See Fig. 10)*

The engine control panel is mounted directly below the control box. In addition to engine controls and instruments, generator output controls are mounted here. A Plexiglass window in the canopy rear door, slants outward at the bottom to form an opening for access to controls when the door is closed.

(1) Engine Instruments

Engine operation is monitored by an ammeter *(4)*, a coolant temperature gage *(8)*, and an oil pressure gage *(10)*. An hourmeter *(6)* records engine operating time.

a. Ammeter

The ammeter *(4)* indicates the direction and value of current flow in the 12-V DC electric system. Its graduated range is from - 60-A through 0 A, to +60-A

b. Temperature gage

The temperature gage *(8)* is a mechanical type of unit construction. It consists of a panel mounted indicating mechanism which is connected by a capillary tube to a bulb mounted in the engine cooling system. The gage indicates engine coolant temperature in the range of 100^{o}F to 220^{o}F.

c. Oil pressure gage and oil pressure switch

The oil pressure gage *(10)* is a bourdon tube type and indicates engine lubricating oil pressure. It is graduated from 0 PSI to 75 PSI. An oil pressure switch is mounted in a tee fitting directly behind the gage.

The switch connects 12-V DC power to the engine control system and 12-V DC control system to the generator when the engine is running.

d. Hourmeter

The hourmeter (6) is electrically driven from the 12 V-DC battery system. The hourmeter measures and records engine running time and will record up to 9999.9 hours on five revolving drums. The hourmeter operates only when the engine is running and the oil pressure switch is closed.

(2) Engine and generator controls

a. Fuse

A 10-ampere fuse *(13)* protects the 12-V DC engine control circuit, hourmeter, illuminating light circuit, and 12-V DC system in the main generator protective system.

b. Engine-generator control switch

The engine-generator control switch *(5) (also identified as the "build-up-voltage, generate, idle" switch)* is a three-position toggle type. It is spring-loaded in one position, **BUILD UP-VOLTAGE**, and will automatically reposition to **GENERATE** position when released. In GENERATE position the switch brings engine up to rated speed.

In **BUILD-UP-VOLTAGE** position it performs a dual function.

First, it supplies power to the governor control box which allows the engine to operate at normal governed speed, second, it momentarily supplies current which closes the excitation-deenergization relay, *(3, Fig. 8)* contacts, to make three-phase, 115-V AC power available to the voltage regulator, or to the manual voltage control circuit for excitation of the generator exciter.

In **GENERATE** position, power is maintained to the governor control box and to the excitation relay *(3, Fig. 8)*. When the switch is placed in **IDLE**, power is disconnected so that the engine returns to idle speed and the exciter field is deenergized.

c. Contactor control switch

This is another three-position toggle switch *(7, Fig. 10)* identical to the engine-generator control switch. When placed in the spring loaded CLOSE position, it provides 115-V AC power directly to a rectifier which supplies DC power for closing the load contactor.

When released, it returns to the normal ON position and continues to provide power to the rectifier, but in this switch position, AC power must pass through the plug interlock and fuse interlock relays. In OFF position the switch opens the AC circuit to the rectifier, thereby cutting off the source of DC power to the contactor coil which allows the contactor to open.

d. Instrument light and switch

A shielded, instrument light *(1)* is mounted on the left side of the control panel. It is controlled by a toggle switch *(3)*, which also controls instrument lights on the control box and canopy light.

e. Engine starting circuit

The start switch *(15)* serves to connect power for closing an auxiliary solenoid switch *(4, Fig. 4)*. The auxiliary switch then connects power to the starter solenoid which functions to engage the starter gear with the flywheel ring gear and apply power to the starter motor to crank the engine. The auxiliary solenoid switch is necessary because the start switch is not capable of carrying the high amperage flow to the starter solenoid which would result if the starter gear and ring gear should fail to engage. The start switch *(15)* is functional only when the shutdown air valve is in latched (open) position, which places the start-circuit, cut-out switch *(7, Fig. 4)* in **CLOSED** position.

f. Indicating lights

A green indicating light *(14)* glows to indicate that power is available to the engine operating system. The light operates only when the engine is running and fuel pressure is sufficiently high to close a fuel pressure switch *(5, Fig. 4)*. The purpose of the pressure switch is to deactivate the protective circuit when the engine is stopped and prevent battery discharge.

Another green indicating light *(9, Fig. 10)* glows when the generator output load contactor is **CLOSED** and power is available at the generator output .

g. Fuel gage and blocking diodes

An electric fuel gage *(2, Fig. 10)* is required on all units except tractor-mounted, since fuel for the tractor mounted unit is supplied by the tow tractor fuel system. A sending unit mounted in the trailer or truck mounted unit fuel tank supplied the signal to the panel mounted gage. twelve-Volt DC operating power is supplied to the fuel gage from two sources. The gage functions when the engine is running, or when the instrument lights are **ON**. Since two power sources are connected to the fuel gage system, a blocking diode *(19)* is required in each power source circuit. One diode prevents energizing the motor-generator control circuit when panel lights are ON. Another diode prevents operation of the panel lights by the engine-generator circuit when the engine is running.

To check fuel quantity when engine is stopped, use switch *(3)* to turn **ON** panel lights.

h. Engine stop control

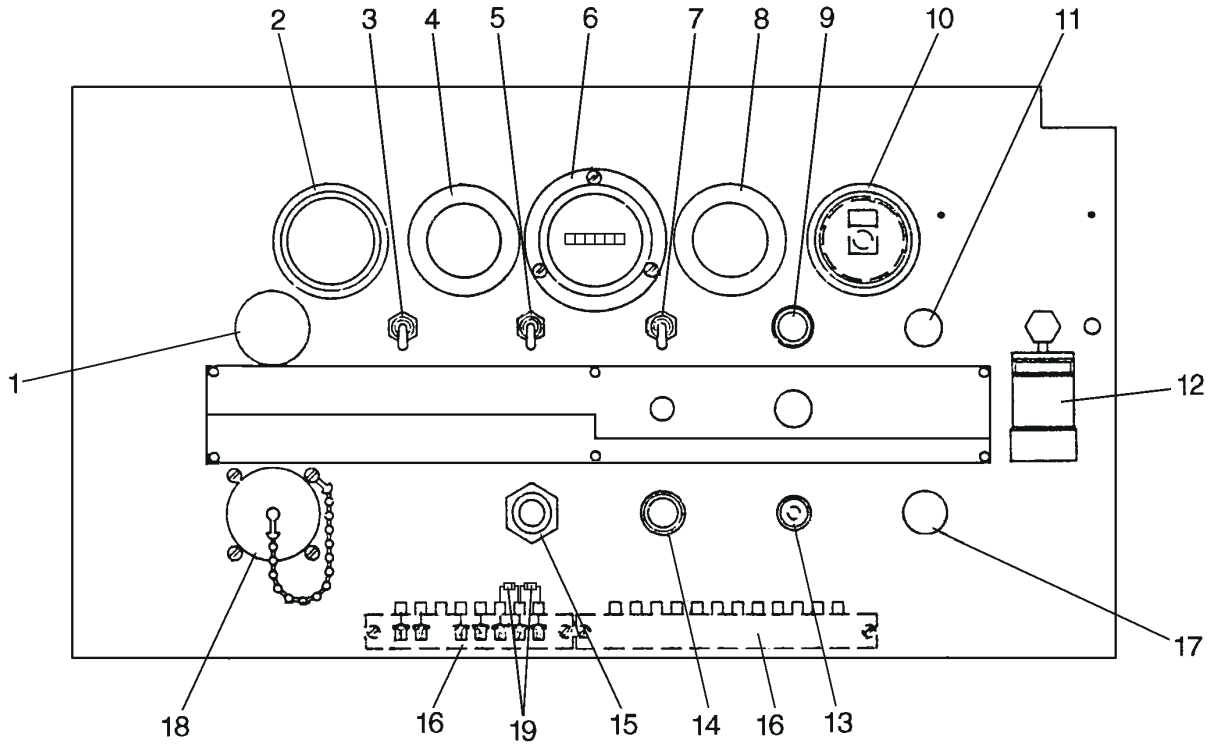
The engine is normally stopped by use of the mechanical stop control *(14)* which is a push-pull control cable connected to the engine fuel rack lever. Pulling the control outward places the rack in “no-fuel” position to stop the engine.

(3) Air cleaner indicator

The air cleaner indicator *(12)* is mounted on the engine control panel for easy viewing. Its function was explained in Para. 6, C, (3), *(See Fig. 5)*.

(4) Test receptacle connector

This amphenol connector *(18)* provides an attaching point for leads which are connected to selected test points throughout the engine and generator electrical systems. Connections and schematic diagrams indicate points at which the leads are connected. The receptacle connector is designed to mate with a test box plug connector *(See Fig. 13)*.



1. Panel light
2. Fuel gage
3. Light switch
4. DC Ammeter
5. Engine-generator control switch
6. Hourmeter
7. Load contactor control switch
8. Coolant temperature gage
9. Load contactor indicating light
10. Engine oil pressure gage
11. Hole plug
12. Air cleaner indicator
13. Engine circuit fuse (10-A)
14. Engine “ON” indicating light
15. Engine starter switch
16. Terminal board
17. Engine stop control
18. Test receptacle
19. Blocking diodes

Engine Control Panel

Figure 10

g. Power Module Panel Assembly

The power module panel assembly *(Fig. 11)*, sometimes referred to as the “contactor panel”, is located at the right rear of the machine behind the control box. On this tractor-mounted unit it is accessible by removing rear access-vent cover *(2, Fig. 1)* on the canopy. The panel assembly provides sensing and overload protection for the output circuit and provides a means of connecting and disconnecting generator output to and from the load *(aircraft)*.

(1) Load contactor

The load contactor *(6, Fig. 11)* is a sealed unit which contains a magnetic operating coil and four sets of contacts. The three larger contacts conduct three-phase AC generator output. A smaller contact set is connected in the protective monitor circuit and supplies 12-V DC power used by sensing relays to signal the protective monitor when a fault occurs. Three-phase, 400-Hz generator output power is conducted to the load contactor by 2/0 cables which pass through 3 sets of current transformers *(3, 4, and 9).*

NOTE: This contactor may be replaced by the old style contactors used in earlier 60 kVA machines. This note is for the benefit of those users who may have old style contactors Part no. 75GH-566 *(Hartman No. A-874C)* or No. 404518 *(Prestolite No. HB-200-B)* in stock.

(2) Current transformers

a. Ammeter current transformers

Three current transformers *(4)* lower the output load current to a lesser value of definite ratio *(250-A to 5-A)* which will operate the ammeter *(7, Fig. 8)* movement without damage. The ammeter dial scale is graduated and numbered so that the ammeter pointer will indicate the load current value rather than the meter movement current.

b. Line-drop current transformers

The three line-drop current transformers *(9, Fig. 11)*, in conjunction with burden resistors *(8)*, detect the magnitude and power factor of current flowing from generator to load. They feed a signal to the voltage regulator which interprets the signal and alters the exciter field current as required to maintain a constant predetermined voltage at the load. *(See voltage regulator Manual information in Section 2-5 of this manual).*

c. Overload current transformers

Three overload current transformers *(3)*, in conjunction with burden resistors *(1)*, monitor the output load current in each of the three output phases, and supply a reduced value current signal to the overload module *(7)*.

(3) Overload module

The overload module *(7)* is a solid-state device designed to interpret a signal from transformers *(3)* and to send a signal to the protective monitor module *(4, Fig. 9)* when an overload condition exists in any generator output phase. A pull-apart electrical connector is mounted on the overload module to provide quick-disconnect facilities for all wiring to the module. The overload module is equipped with a hermetically-sealed, reed-type relay. Relay contacts are normally open.

The solid-state circuitry is designed to close the relay contacts when output current in ANY phase reaches 125% of normal, rated output capacity. The closed relay sends a signal to the protective monitor. This signal “gates” the overload SCR *(silicon-controlled rectifier)* in the protective monitor and causes the load contactor to open. The following is a list of overload module characteristics:

NOTE: The overload protective system will function when any phase carries 123% to 127% of rated current.

At 125% load the module will function in 5 minutes.

At 150% load the module will function in 16 seconds.

At 200% load the module will function in 4 seconds.

NOTE: All times are plus or minus 25% and are nonadjustable.

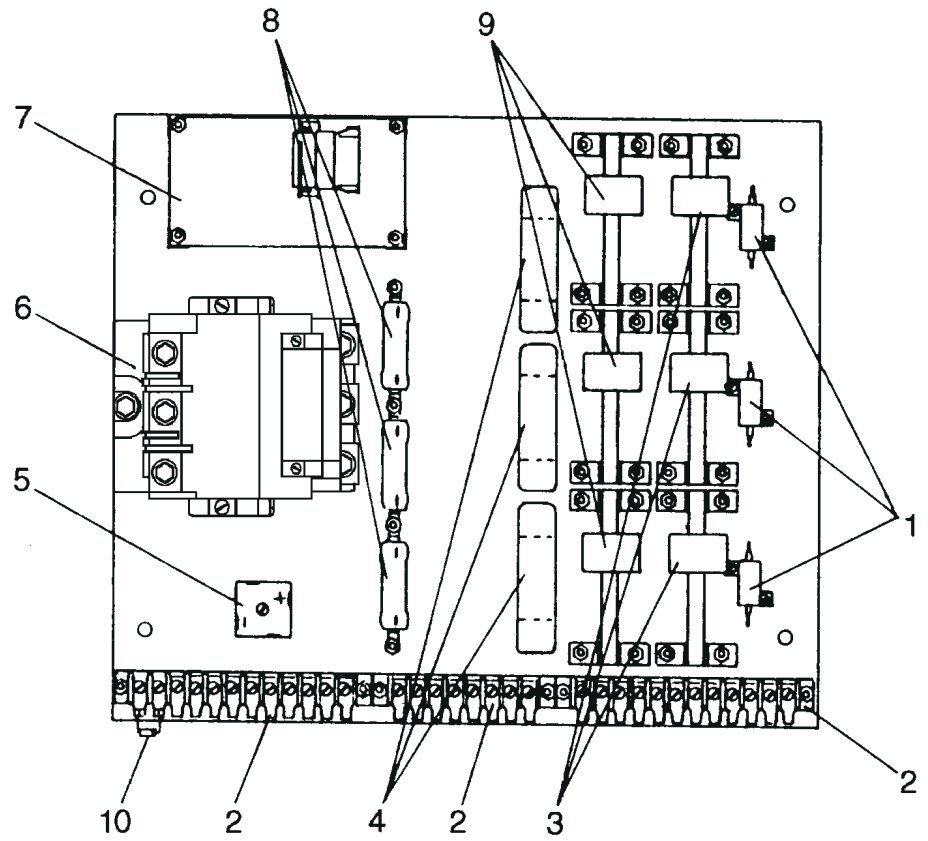
(4) Rectifier

A diode-bridge rectifier *(5)* receives 400-Hz AC from phase C of the generator output and converts it to a pulsating, direct current for energization of the load contactor holding coil only. This DC coil-holding circuit is controlled indirectly by controlling the 400-Hz AC to the rectifier. The ground circuit for the rectifier's AC supply must pass through the relay contacts in the protective monitor module to ground cable N.

Therefore, any time a protective device functions to open the protective monitor relay, the rectifier's circuit is opened. No DC is then available for the load contactor holding coil, hence, the load contactor opens.

(5) Terminal boards

Three terminal boards (2) provide connection facilities for small leads.



1. Overload resistor *(16.6 ohm, 25 watt)*
2. Terminal board
3. Overload current transformer
4. Ammeter current transformer
5. Rectifier
6. Load contactor
7. Overload module
8. Line drop resistor *(50 ohm, 25 watt)*
9. Line drop current transformer
10. Blocking diode

Power Module Panel

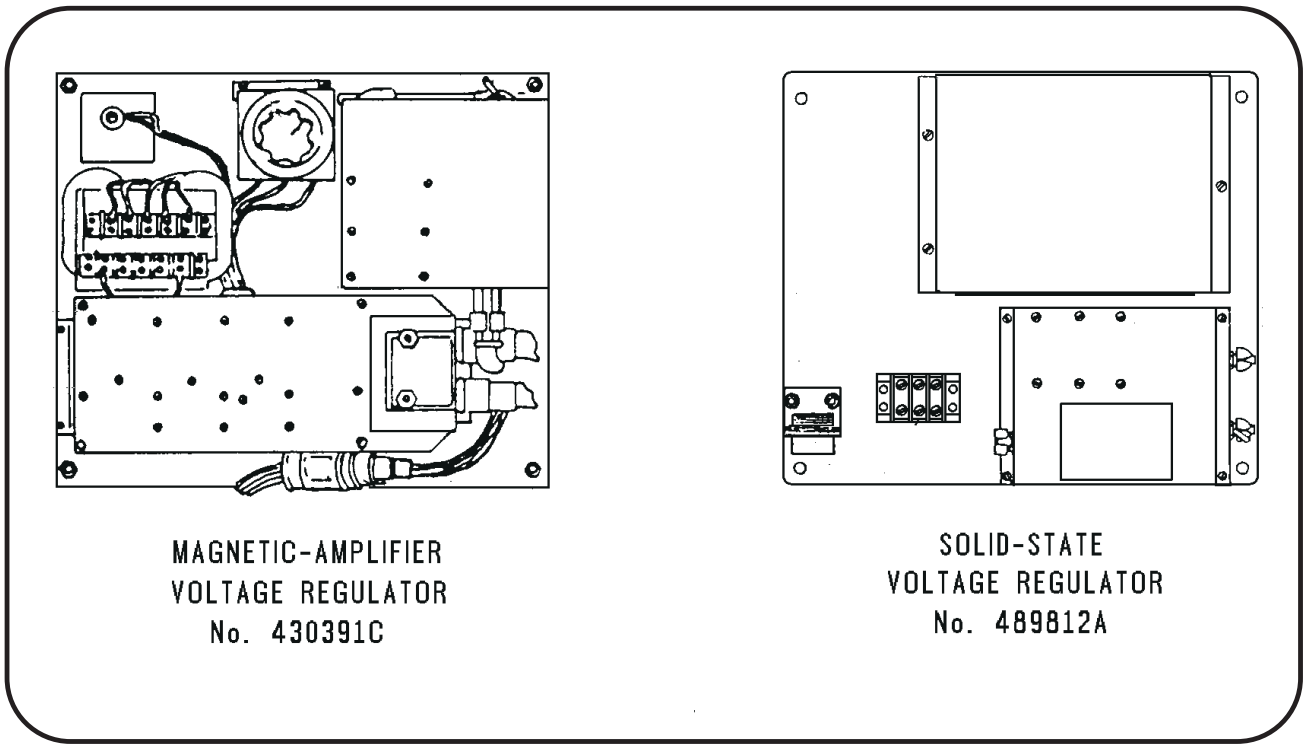
Figure 11

h. Voltage Regulator

The voltage regulator provides field excitation power for the rotary exciter, and regulates generator output voltage by varying the exciter field power as required to meet varying load conditions. Thus, the generator output is held at a constant voltage.

The voltage regulator is located on the right side of the machine just back of the engine compartment near the lifting yoke. (See 5, Fig. 3). On trailer or truck mounted units the regulator is accessible for adjustment by opening rear doors on the right side.

Depending on which specification number a customer selects, the voltage regulator may be either a magnetic amplifier type (Part No. 430391C) or a solid-state type (Part No. 489812A). Both voltage regulators are shown in Figure 12. The regulator used on the particular generator set for which this manual is provided is described and illustrated in detail in Section 2-5.



Voltage Regulators

Figure 12

7. Test Box

The test box is an accessory item used for testing the generator set. All generator sets in this Series are wired to accommodate a test box. However, the box is supplied only when ordered. (Part Number 388318A-2).

a. Description (See Fig. 13)

The test box assembly consists of a rotary selector switch, momentary contact pushbutton switch, and two, insulated-tip test jacks, mounted in a small metal box. Connection to the generator set is made through a wiring harness equipped with a 26-contact plug connector which mates with a receptacle connector.

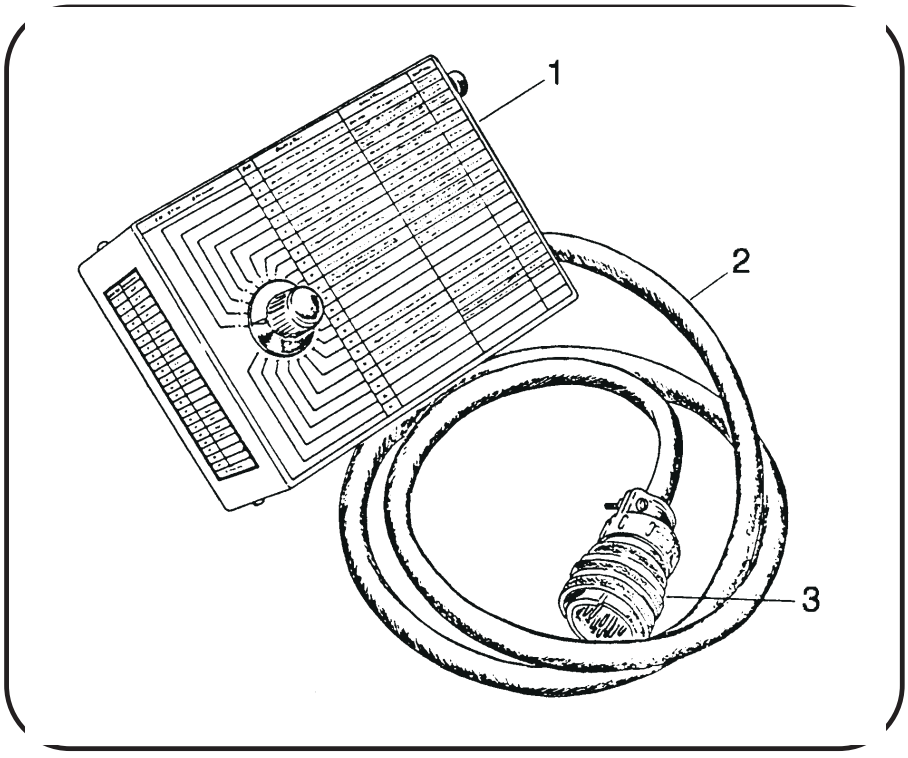
b. Theory of Operation

Wire leads are connected to the electrical circuitry of the generator set at various points and routed to a Receptacle connector mounted on the engine control panel. They are connected to the test box rotary switch by a plug connector and wiring harness.

The rotary selector switch is wired in such a manner that for any switch position, two pre-selected test points in the generator set circuitry are connected for testing. The selector switch may be rotated to any one of 22 positions, however, not all positions are used in this installation. An instruction plate mounted under the switch knob indicates switch positions and component tested in each position. Normal voltage for each test is also indicated.

Two test jacks are provided for connection of the test prods of a voltmeter. After the voltmeter is connected and selector switch positioned, the test circuit is closed by pressing the pushbutton switch. A voltage value may then be observed on the voltmeter. This arrangement prevents energization of test circuitry and equipment for extended periods and allows the operator to reset and adjust the voltmeter without disconnecting it from the box.

For operating instructions, see Sect. 1-3, Para. 3.



1. Test box
2. Cable
3. Plug connector

Test Box Assembly

Figure 13

8. Units with SGX Governor

Two of the units covered by this manual have engines equipped with a Woodward Type SGX governor - Specification 5384E-5 and Specification 5384E-15. To accommodate the SGX governor, units having this governor differ from other units as follows:

a. Governor System

The electric governor system is removed and replaced by a Woodward Type SGX governor, furnished with the engine.

b. Throttle Control

The engine control panel (Fig. 14) is modified by the addition of the throttle control (16) to replace the STOP control, and by changing two of the functions of the MODE switch (13). The center position has been changed to RUN, and the bottom position has been changed to STOP. The BUILD-UP-VOLTAGE function (top position) remains the same. Refer to Figure 14. The THROTTLE control is connected is connected by a flexible cable to the hydraulic governor's fuel control linkage. Pulled all the way out, this control operates the engine at 2000 RPM through the hydraulic governor. Pushed all the way in, it runs the engine at idle speed of 900 RPM.

When the throttle control is pulled all the way out, a disk on the control cable depresses the plunger on a microswitch and closes its normally-open contacts. The closed contacts, wired in series with the excitation-deenergization relay (3, Fig. 8), complete a circuit which closes that relay's contacts. This arrangement insures that the generator will deliver output power ONLY when the engine is running at 2000 RPM and insures the delivery of RATED output power only.

Placing the MODE switch in RUN position closes a solenoid valve which is mounted behind the oil reservoir. This solenoid valve uses the engine's lube oil to maintain the hydraulic pressure required for proper operation of the hydraulic governor. When the mode switch is positioned to OFF, the solenoid valve is opened, oil which maintains hydraulic pressure in the governor is dumped to the crankcase, and the engine is stopped since this shuts off the fuel supply.

9. Dual Output Machines

Two of the units covered by this manual - Specification 5384E-9 and Specification 5384E-16 - have dual outputs for servicing two aircraft simultaneously, or for servicing a single aircraft with two input receptacles. The output terminal boards for these units are arranged as illustrated in Figure 15, with output No. 1 at the rear terminal board and output No. 2 in front. This dual output assembly is mounted in the same location as the single output terminal board on a single output unit.

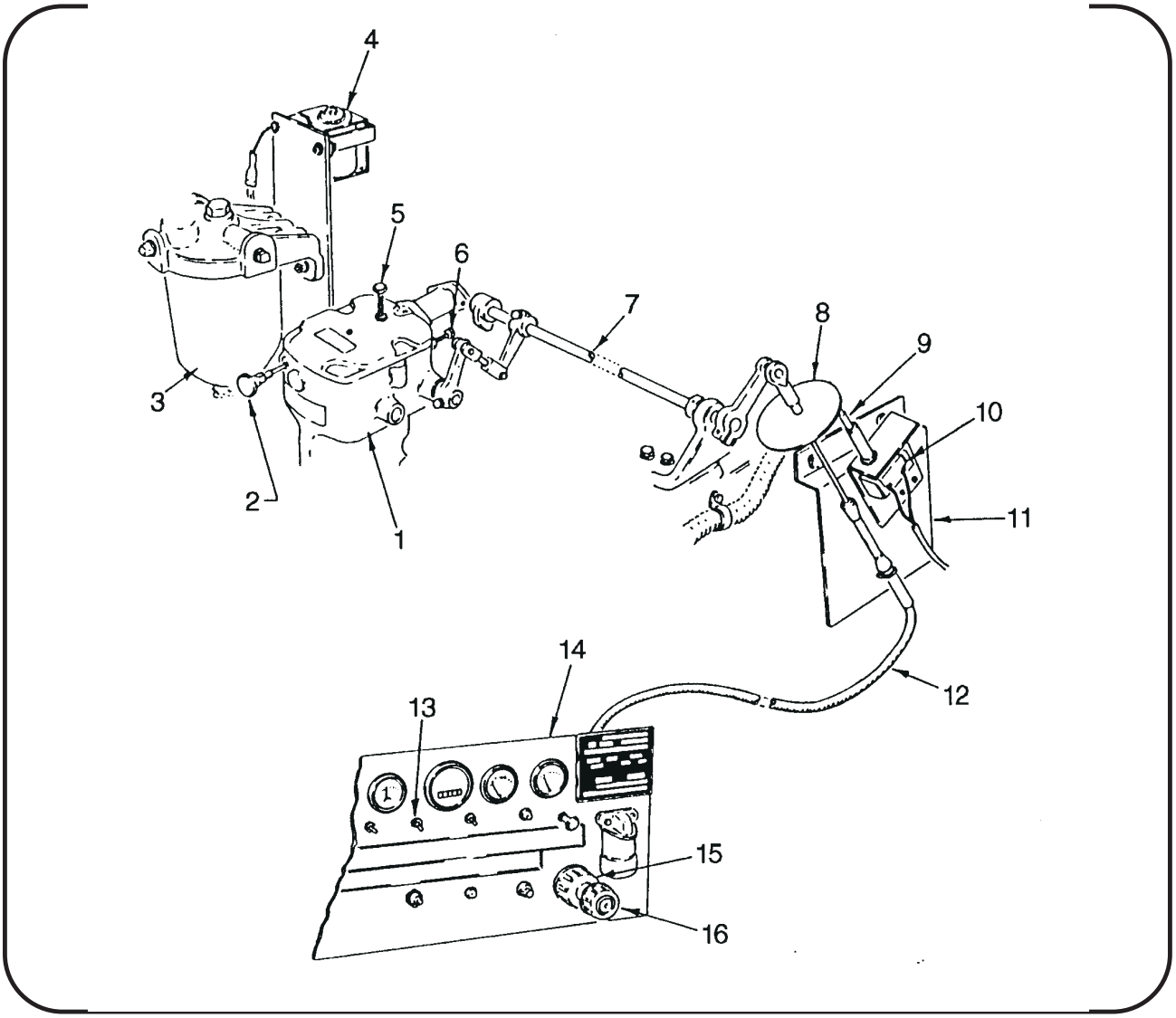
Components of the dual output circuits are identical to the components of the comparable single output units, but are grouped separately as follows:

a. The contactor switch of the second output is located on the control nameplate of the engine control panel. See Fig. 16. Located beside this switch is the No. 2 contactor closed light, which glows green when the No. 2 contactor is closed. These parts are identical to items 7 and 9 on Fig. 9.

b. The power module panel for output No. 2 (Fig. 17) is mounted on brackets directly above the power module panel for output No. 1. (See Fig.11). The load contactor, rectifier and blocking diode are identical to items 6, 5, and 10, Figure . The two relays, TEST BANK switch and resistor are identical to items 1, 2, and 21, Figure 9.

c. The protective circuits described in Para. 6, E. (2) (a) and (b) monitor and protect output No. 2 as well as output No. 1. The output cable clamp for the No. 2 output is mounted next to the cable clamp for the No. 1 output, just to the left of it, as viewed from the side of the unit. See Fig. 15.

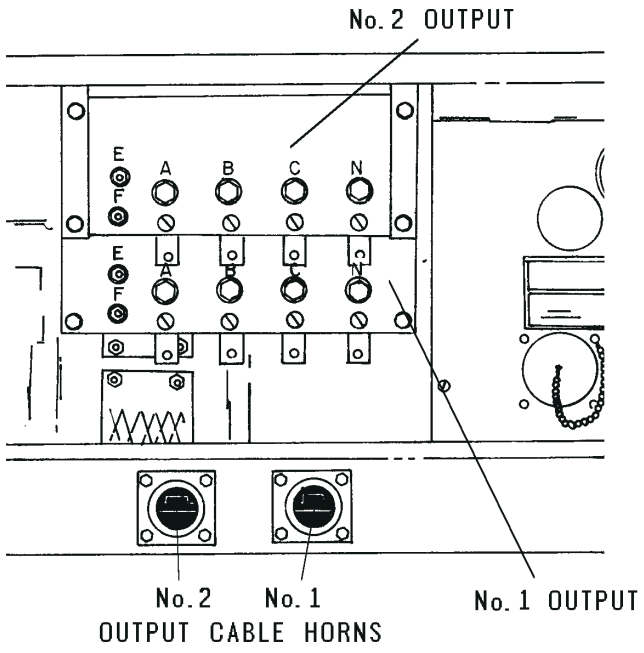
d. A flashback diode has been added to the No. 2 output circuit across pins 2 and 10 of the fuse interlock relay socket. This diode prevents any inductive voltage discharge into the circuit when the relay coil is deenergized.



1. SGX hydraulic governor
2. Fuel rod knob (emergency shutdown
3. Oil reservoir
4. Solenoid valve (L2)
5. Idle screw
6. Maximum speed limit screw
7. Throttle control shaft
9. Actuator plunger
10. Micro switch (S41)
11. Mounting bracket (on engine)
12. Throttle control cable
13. Mode switch
14. Engine control panel
15. Locking ring

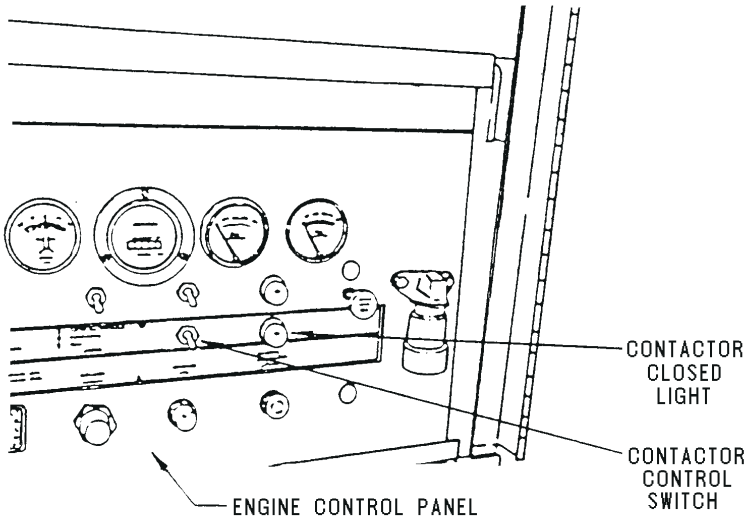
Throttle Control and Hydraulic Governor System

Figure 14



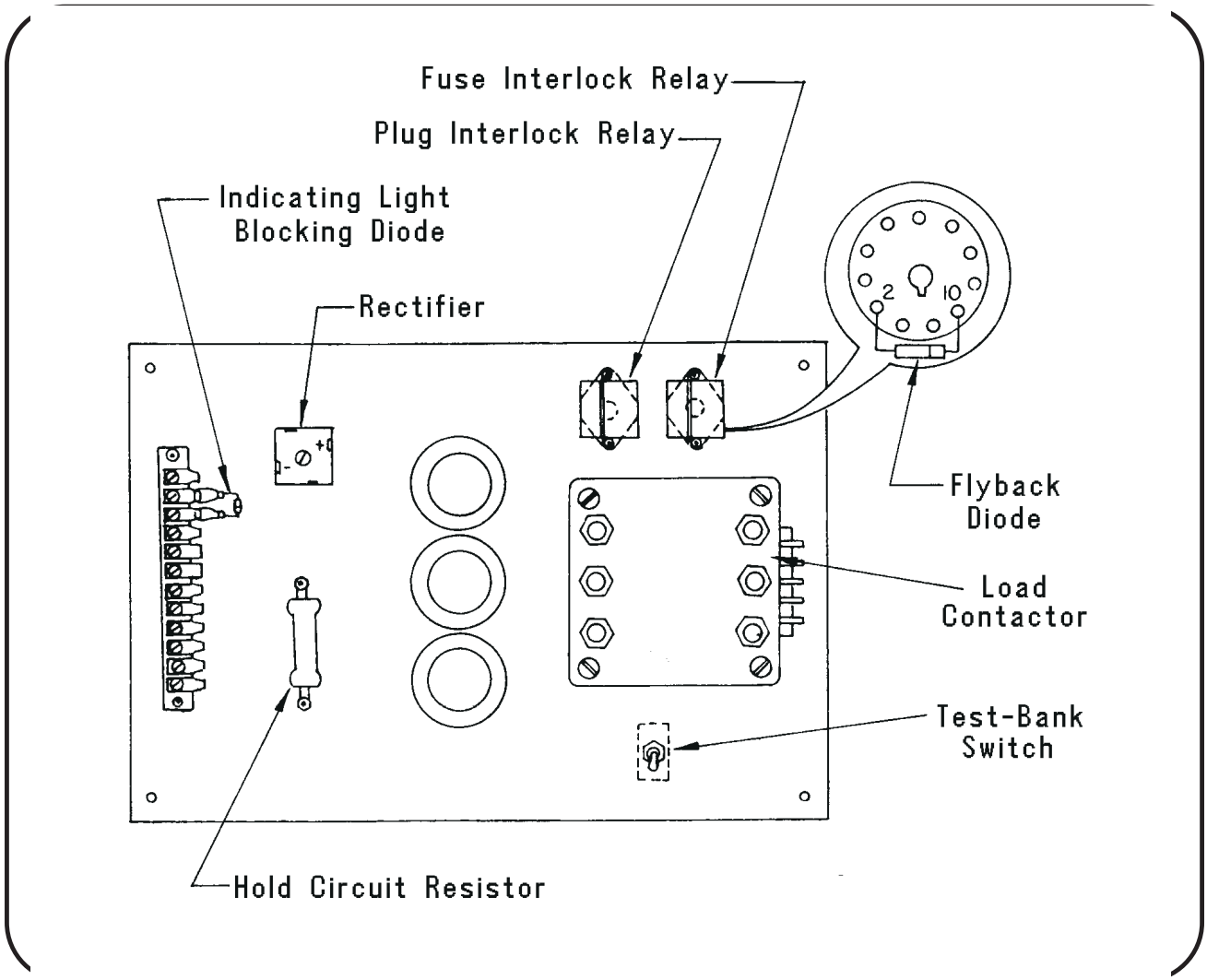
Dual Output Terminal Boards

Figure 15



No. 2 Output Control

Figure 16



Output No. 2 Power Module Panel

(Located atop Output No. 1 Power Module Panel)
Figure 17

10. Generator Set Specifications: Series 5384E

Generator sets in Series 5384E are listed below. In addition to the basic features of the Specification 5384E-1 generator set, additional features are listed. **Encircled** on this list is the generator set covered especially by **this** manual.

Specification	Mounting	Voltage Regulator	Features
5384E-1	Trailer/Truck	430391C	Basic generator set in Series 5384E.
5384E-4	Trailer/Truck	430391C	Has 28.5-V transformer-rectifier, 35-V transformer rectifier, and two duplex receptacles. Differs from Spec. 5384E-1 only in regard to these features.
5384E-5	Trailer/Truck	430391C	Has **SGX GOVERNOR** and special features for United Airlines. Differs from Spec. 5384E-1 only in regard to these features.
5384E-9	Trailer	430391C	Has **DUAL OUTPUTS.** Differs from Spec. 5384E-1 only in regard to this feature.
5384-10	Trailer	430391C	Has **FUEL PRESSURE GAGE and OUTPUT RECEPTACLE**. Differs from Spec. 5384E-1 only in regard to these features.
5384E-11	Trailer/Truck	489812A	Has **SOLID STATE VOLTAGE REGULATOR .** Differs from Spec. 5384E-1 only in regard to this feature.
5384E-14	Trailer/Truck	489812A	Has 28.5-V transformer-rectifier, 35-V transformer rectifier, and two duplex receptacles. Differs from Spec. 5384E-4 only in regard to **SOLID STATE VOLTAGE REGULATOR 489812A**
5384E-15	Trailer/Truck	489812A	Has **SGX GOVERNOR**, **SPECIAL FEATURES** for **UNITED AIRLINES**. Differs from Spec.5384E-5 only in regard to **SOLID STATE VOLTAGE REGULATOR 489812A**
5384E-16	Trailer	489812A	Has **DUAL OUTPUTS**. Differs from Spec. 5384E-9 only in regard to **SOLID STATE VOLTAGE REGULATOR 489812A**
5384E-17	Trailer	489812A	Has **FUEL PRESSURE GAGE and OUTPUT RECEPTACLE**. Differs from Spec. 5384E-10 only in regard to **SOLID STATE VOLTAGE REGULATOR 489812A**
5384E-18	Trailer	489812A	Has special trailer for **FEDERAL EXPRESS** and **SOLID STATE VOLTAGE REGULATOR 489812A**. Differs from Spec. 5384E-1 only in regard to these features.

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Section 2. Preparation For Use, Storage, Or Shipping

1. Preparation for Use

a. General

Generator sets, when ordered with truck or trailer, are mounted at the Hobart factory and are shipped in running condition and ready for operation after inspection and check.

WARNING

Improper operation can **KILL, INJURE, OR CAUSE DAMAGE!** Read and understand operating instructions in section 1-3 before operating the unit.

b. Inspection/Check

Inspect the unit thoroughly prior to operation.

(1) Remove blocking, banding, ties, and other securing material.

(2) Inspect exterior for shipping damage such as broken lights, damaged sheet metal, etc.

(3) Open all canopy doors and inspect interior for foreign material such as rags, tools, shipping paper, etc.

(4) Check fuel, coolant, and oil hoses and connections for visible leaks. Visually inspect the compartment floor and ground surface under the unit for signs of leakage. If leaks are found, correct by tightening hose clamps, tube fittings, etc., as required.

(5) Check the following for sufficient quantity:

a. Fuel

Turn ON engine controls to energize fuel gage when engine is stopped.

b. Engine coolant

The radaitor cap is accessible by opening the hinged access cover on the front canopy housing. Coolant level should be approximately one inch below the filler neck. Allow a capacity for coolant expansion.

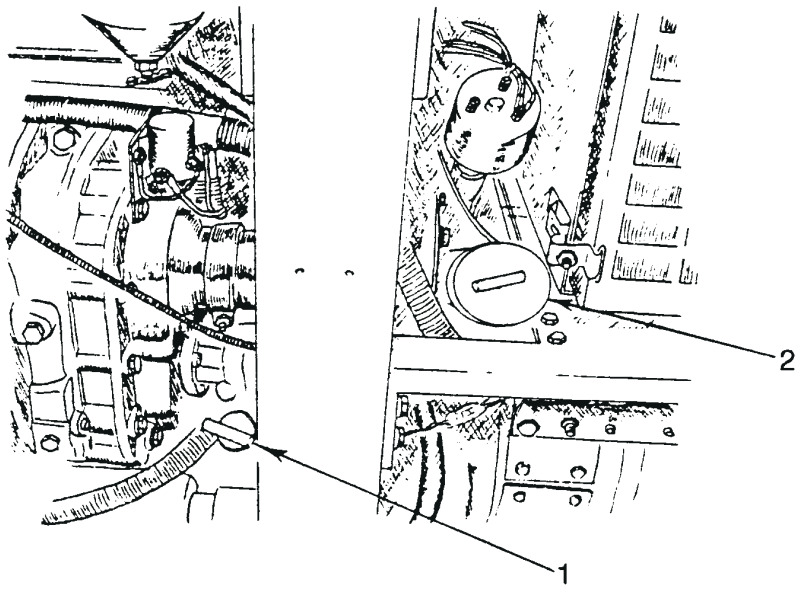
CAUTION

Be sure the cooling sysyem antifreeze solution is adequate to protect below lowest temperature expected.

Note: For antifreeze protection, use a solution of 50% permanent antifreeze (Ethylene glycol) an 50% clean water.

c. Engine lubricating oil

Oil level should be at “full” mark on oil level gage rod (see Fig. 1). See Sect. 2-1, Fig. 2 or the attached Detoit Diesel Operator’s Manual for oil recommendations.



1. Oil level gage rod
2. Oil filler cap

Engine Oil Gage Rod and Filler Cap Figure 1

(6) Check air cleaner

The air cleaner *(Sect. 1-1, Fig.3, item 7)* is a “dry type. Be sure there are papers, tapes or other material covering the air inlet area.

(7) Check battery

c. Installing Output Cables

Units are gennerally shipped without generator set-to-aircraft cables.

Conductor size recommended for AC output is 2/0 size.

2. Preparation for Storage

When a generator set is to be stored or removed from operation, special precautions should be taken to protect the internal and external parts from rust, corrosion, and gumming in the engine fuel system.

a. General

(1) The unit should be prepared for storage as soon as possible after being removed from service.

(2) The unit should be stored in a building which is dry and which may be heated during winter months.

(3) Moisture absorbing chemicals are available for use when excessive dampness is a problem, however the unit must be completely packaged and sealed if moisture absorbing chemicals are to be effective.

b. Temporary Storage

(1) When storing the unit for 30 days or less, prepare as follows:

(2) Lubricate the unit completely in accordance with instructions in Sect. 2-1. This will include changing engine oil, and all filter elements.

(3) Start the engine and operate for about two minutes so that all internal engine components will be coated with new oil.

NOTE: DO NOT drain the fuel system or crankcase after this run.

(4) Make certain the cooling system antifreeze solution is adequate to protect below the lowest temperatures expected during the storage period. See 2-1; Para. 6, D. Be sure the solution is thoroughly mixed.

(5) Clean the exterior of the engine with fuel oil. Dry with clean rags and compressed air.

(6) Seal all engine openings. Use a waterproof, vaporproof material which is strong enough to resist puncture damage from air pressures.

c. Long Time Storage (Over 30 days)

(1) The unit may be stored for long periods with no special preparation if it is possible to operate the engine once each week.

a. Make certain the cooling system is adequately protected.

b. Start the engine and operate at a fast idle (800 to 1000 RPM) until coolant temperature has reached at least 140 deg. F.

WARNING

FUMES AND OXYGEN DEFICIENCY CAN KILL! Make certain of adequate ventilation before starting the engine.

c. Operate normal operating controls.

(2) If weekly operation is not possible, prepare and protect the engine in accordance with instructions in Detroit Diesel Operator's Manual.

(3) To protect the generator and other electrical components, the complete unit should be packaged, using moisture proof packaging and sealing material. Place containers of moisture absorbing chemicals, such as silica-gel, in the unit before packaging.

3. Preparation for Shipment

During long shipments by rail (and other), the generator set retaining hardware may become loosened by vibration, jolting, etc.

WARNING

LOOSE OR FALLING PARTS CAN KILL, INJURE OR DAMAGE! When shipping the unit (mounted in a tow tractor), provide additional retaining materials to make certain the generator set cannot roll out of the tow tractor.

NOTE: It is suggested that strong banding may be used to secure the generator set, or a strong steel bar may be welded or bolted across the front of the generator set frame.

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Section 3. Operation

1. General

This section contains information and instructions for safe, efficient equipment operation. Operating instructions are presented in step-by-step sequence for supplying 400-Hz power to an aircraft.

WARNING

Noise can damage hearing; improper operation can kill! Ear protection equipment may be necessary when working in close proximity to this equipment. Read and understand all of the operating instructions before attempting to operate the equipment.

2. Operating the Generator Set

a. Pre-start Inspection

(1) Be sure the fuel shut-off valve (if used) if OPEN.

(2) Make certain 12-VDC power is available to the engine starting system.

(3) Check the engine and generator compartments to make certain they are free of rags or other foreign materials.

b. Normal Engine Starting Procedures

Engine starting procedures are outlined below. Engine operating controls and monitoring instruments are illustrated in Fig. 1.

(1) If illumination is required, place light switch (16) in ON position.

NOTE: This switch must be ON to check fuel when engine is stopped.

(2) Be sure engine stop control (30) is at IN position.

(3) Be sure engine air shut-off is in LATCHED, open position (See Fig. 2).

NOTE: Push lever (3, Fig. 2) DOWN to LATCH valve OPEN.

(4) Place engine-generator control switch (18) in IDLE position.

(5) Activate engine start switch (28) to crank engine. Release start switch as soon as engine starts. When engine starts, observe engine protective system light (27). When this light glows green it indicates that the fuel pressure switch is closed and the engine protective system is functional.

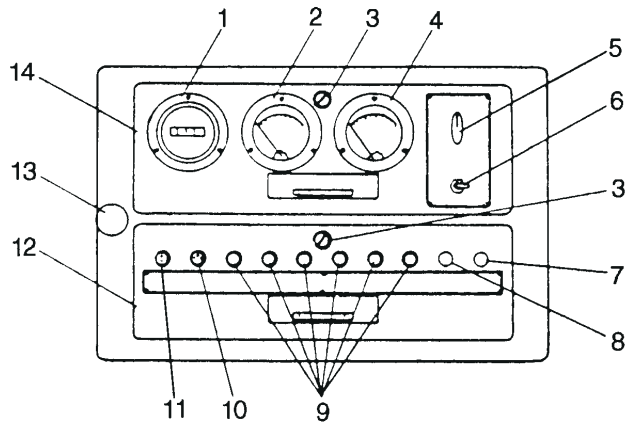
CAUTION

(a) If the engine fails to start within 30 seconds, Release the start switch and allow the starting motor to cool for a few minutes. If the engine fails to start after four attempts, an inspection should be made to determine the cause.
(b) If the engine fires sufficiently to disengage the starter gear, but does not start, release the start button and allow the starting motor to come to a complete stop before attempting to engage the starter again.

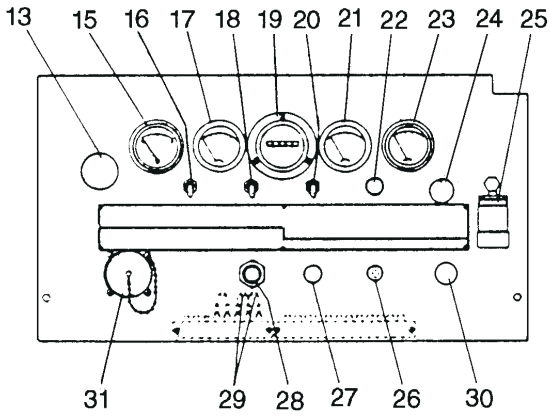
(6) Observe oil presure gage (23). The engine wil be automatically stopped if pressure does not build-up quickly to normal.

(7) Allow the engine to idle and warm for about 5 minutes before applying load.

Note: (a) If the shutdown valve is tripped for any reason during start-up, it will be necessary to latch the valve mechanism by pushing latch lever (3, Fig. 2) down to reset.



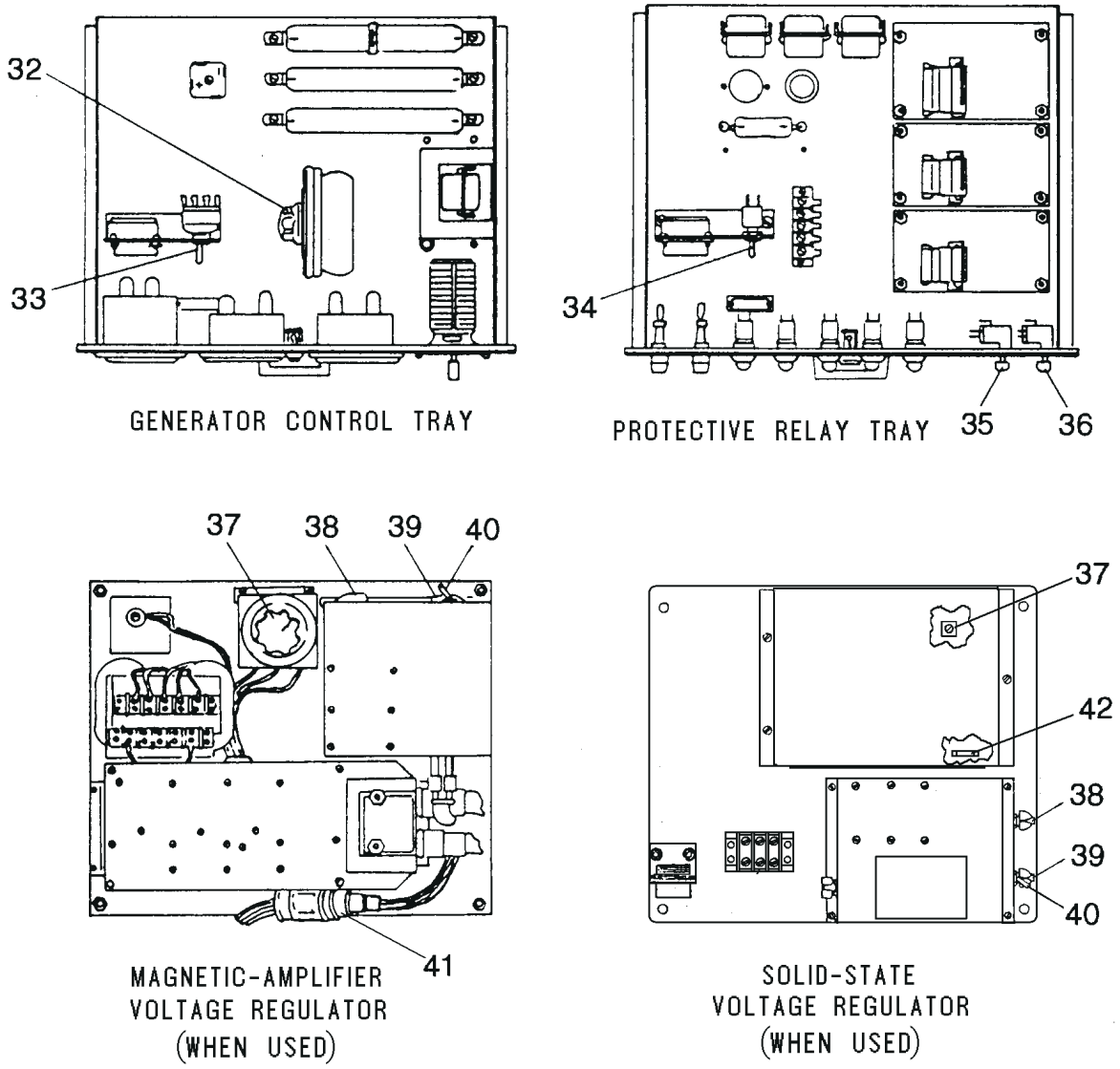
CONTROL BOX



ENGINE CONTROL PANEL

1. Frequency Meter
2. Voltmeter
3. Fastener
4. AC Ammeter
5. Meter Switch
6. Line Switch
7. Reset Switch
8. Light Test Switch
9. Fault Indicating Lights
10. Load Contactor Circuit Fuse (2A)
11. Protective System Fuse (5A)
12. Protective Relay Tray
13. Instrument Panel Light
14. Generator Control Tray
15. Fuel gage
16. Light Switch
17. DC Ammeter
18. Mode Switch
19. Hourmeter
20. Load Contactor Control Switch
21. Coolant Temperature Gage
22. Load Contactor Indicating Light
23. Oil Pressure Gage
24. Hole plug
25. Air Cleaner Indicator
26. Engine Circuit Fuse (10-A)
27. Engine Protective Circuit Indicating Light
28. Engine Starter Switch
29. Blocking Diodes
30. Engine stop switch
31. Test Receptacle Connector

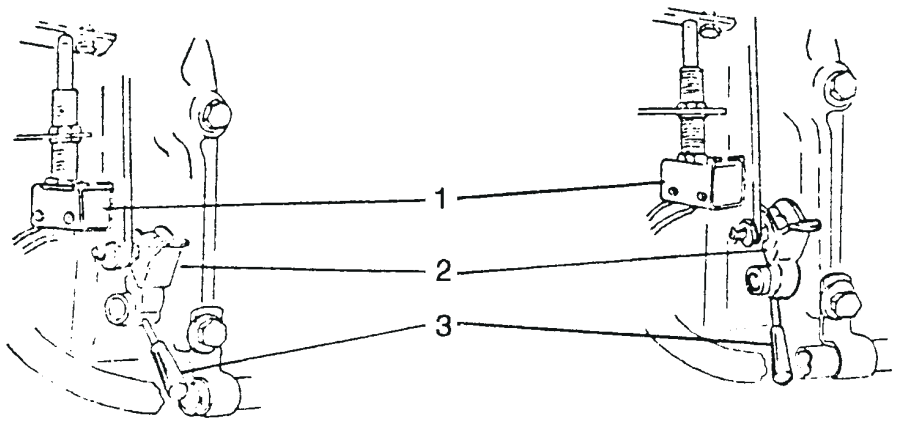
Operating Controls and Instruments
Figure 1 (Sheet 1 of 2)



32. Manual Voltage Control Rheostat
33. Automatic-manual Voltage Control Switch
34. Test Bank Switch
35. Light Test Switch
36. Reset Switch
38. Cable Length Compensation Rheostat
39. Cable Size Compensation Rheostat
40. Line-Drop Compensation On-Off Switch
41. Fuse (5-A)
42. Fuse (10-A)

Operating Controls and Instruments
Figure 1 (Sheet 2 of 2)

(b) If the shutdown valve cannot be latched, check the overspeed govenor (see Fig. 3). It may have been tripped by an overspeed condition.Press reset button on overspeed govenor immediately after an overspeed trip, because the shutdown solenoid will remain energised and discharge the batteries until overspeed govenor is reset.



1. Starter safety switch 2. Shutdown valve latch 3. Latch reset lever

Shutdown Valve Latch and Starter Safety Switch
Figure 2

CAUTION

Do not allow the engine to idle for long periods of time. See SB-41 at end of manual.

c. Preparation for Power Delivery (Normal Automatic Voltage Control) The following are power delivery preparation procedures to be followed after the engine is started.

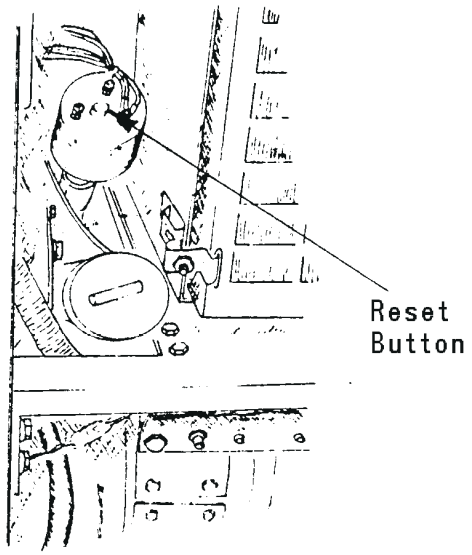
(1) Check and position switches and controls.

a. Loosen fastener (3, Fig. 1) and pull generator control tray outward. Place automatic-manual switch (33) in AUTOMATIC position. Close tray and secure.

b. Loosen fastener (3) and pull protective relay tray outward. Place test-bank switch (34) in AIRCRAFT position, if the aircraft being serviced is equipped with a 28.5-VDC interlock relay system. (If not, place in TEST BANK position.) Slide tray in and secure.

c. Meter switch (5) may be in any position except pointing straight **DOWN**.

(2) Connect output cable plug connector to aircraft receptacle. Be sure connectors are mated fully and securely.



Overspeed Governor
Figure 3

d. Power Delivery (Automatic Voltage Control)

(1) Place engine-generator control switch (18, Fig. 1) in **BUILD-UP-VOLTAGE** position momentarily, then allow it to position itself in GEN position. The electric governor will immediately increase engine speed to 2000 RPM and maintain it.

(2) Observe generator instruments. Frequency meter (1, Fig. 1) should indicate exactly 400 Hz. Voltmeter (2) should indicate 115 VAC when line switch (6) is in LINE-TO-NEUTRAL position.

(3) The final step in delivering power is closing the load contactor. When satisfatory frequency and voltage values are indicated by the instruments, close the load contactor by momentarily placing the load contactor control switch (20) in the top (spring loaded), ON position. The green Indicating light (22) should glow at once to indicate that the load contactor is closed and power is available at the aircraft. As soon as the light glows, release the switch. It will automatically return to the center ON position.

NOTE: If the indicating light (22) should “go out” as soon as the switch is released, and no fault lights are ON, it indicates that 28.5-V DC holding current is not being supplied from the aircraft to the plug-interlock relay. Correct the condition and again operate the load contactor control switch (20) as above.

(4) It is recommended that the operator check output voltage and current in each of the three phases early in the power delivery run. Use the meter switch (5) to select the phase. Use the line switch (6) to select line-to-line or line-to-neutral voltage. If the load is changing, it is good operating practice to observe the instruments until load conditions stabilize.

(5) A condition of overvoltage, undervoltage, underfrequency, overfrequency or overload in the output circuit will automatically open the load contactor and turn on the applicable indicating light to signal the operator which of the above faults caused the protective monitor system to operate. After the fault has been corrected, press the reset switch (7) to turn off the indicating light and reset the protective relay system. Proceed with power delivery by operating the load contactor switch.

(6)

e. Preparation for Power Delivery (Manual Voltage Control)

Preparation for power delivery using manual voltage is exactly the same as for automatic control (Para. 2, D, (1) thru (2) above except:

(1) Place automatic-manual switch (33) in MANUAL position.

(2) Set the manual voltage control rheostat (32) near its mid-range position.

f. Power Delivery (Manual Voltage Control)

Power delivery using manual voltage control is the same as automatic delivery (para. D, (1) thru (5) above except:

(1) Control generator output voltage by adjusting the rheostat (32) to maintain a steady 115-VAC reading on the voltmeter (2). Turn the rheostat knob (32) CLOCKWISE to INCREASE voltage and COUNTERCLOCKWISE to DECREASE voltage.

(2) Adjust voltage to 115 VAC.

(3) During manual power delivery the operator must remain with the generator set to adjust output voltage for varying loads and conditions.

g. Discontinue Power Delivery

(1) Place the load contactor switch (20) in OFF position. Green light (22) should go OFF immediately to indicate that the load contactor has opened and power is no longer being delivered to the aircraft.

(2) Place engine-generator control switch (18) in IDLE position.

(3) Disconnect output cable from aircraft.

WARNING

High voltage: electric shock or fire can kill! Never disconnect the output cable while power is being delivered.

h. Stopping the Engine

(1) Allow the engine to idle a few minutes before stopping to permit cooling.

(2) To stop the engine, pull the stop control (30) OUT and hold until the engine stops. This control is spring-loaded and should return to the IN position when released.

3. Test Box Operation

The test box is useful and convenient in testing the generator set after repair or overhaul and also in troubleshooting. To operate the test box, proceed as follows:

a. Open left, rear canopy doors and connect the test box plug connector (see 1-1; 18, Fig. 10) to the test receptacle connector (Fig. 5).

b. Connect the test prods of a voltmeter at the test jacks (3 and 4, Fig. 4). Test jacks are color coded. Red indicated POSITIVE. BLACK indicates NEGATIVE.

c. Locate the component or circuit to be tested In the DESCRIPTION column on the instruction plate and set the selector switch (1, Fig. 4) to the number indicated opposite the description.

d. Note the normal voltage value and kind of current (AC or DC) to be expected at the position and set voltmeter accordingly.

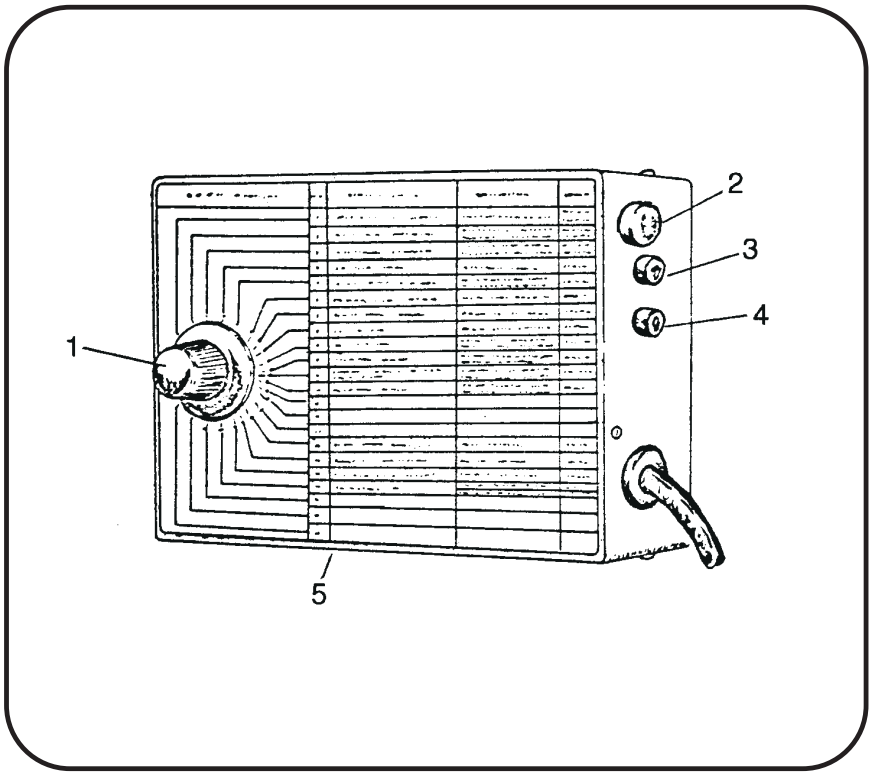
e. Comply with conditions indicated in CONDITIONS column for the particular test being performed.

f. Press the pushbuttons switch (2) and observe voltage indicated by the voltmeter. Compare to normal voltage indicated in VOLTAGE column.

g. Release pushbutton switch.

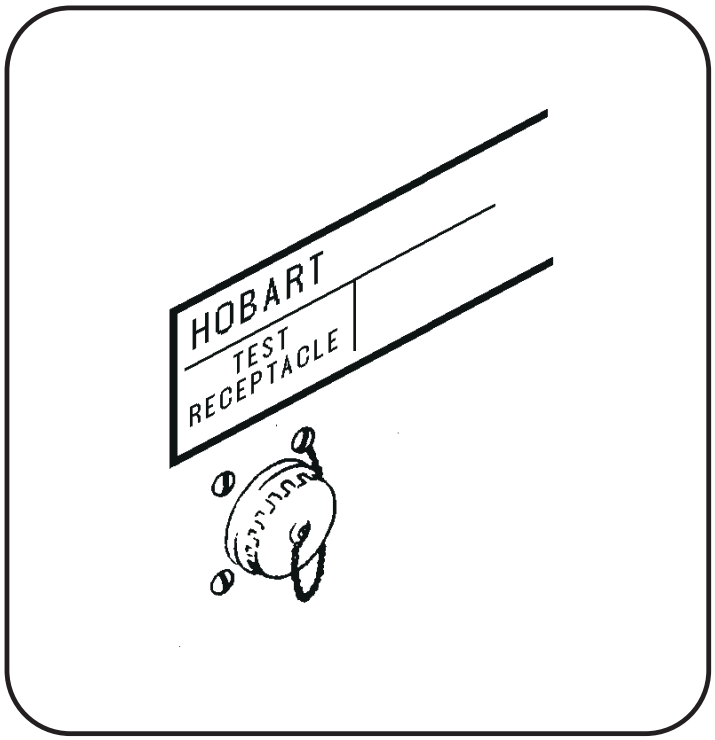
h. Repeat steps A thru G for other tests as required.

i. When tests are completed, disconnect the test equipment and close canopy doors.



1. Selector switch
2. Pushbutton switch
3. Positive test jack (red)
4. Negative test jack (black)

Test Box Operating Controls
Figure 4



Test Receptacle Connector (with protective cap installed)
Figure 5

Chapter 2. Service

Section 1. Maintenance

1. General

To make certain the generator set is always ready for operation, it must be inspected and maintained regularly and systematically so that defects may be discovered and corrected before they result in serious damage or failure of the equipment.

WARNING

Electric shock, flying parts or fire can kill or injure! Stop operation immediately if a serious or possibly dangerous fault is discovered.

2. Inspection

A periodic inspection should be estabilshed and maintained. A suggested inspection/check schedule is provided in 2-2, Figure 1, however it may be modified as required to meet varying operating and environmental conditions. If the generator set is mounted on a tow tractor, it is suggested that inspections be coordinated.

3. Lubrication

a. General

Proper lubrication is one of the most important steps in good maintenance procedures. Proper lubrication means the use of correct lubricants and adherence to a proper time schedule. Lubrication points, recommended lubricants, and frequency of lubrication, are indicated in Figures 1, 2, and 3 respectively.

b. AC Generator

The 400-Hz generator requires NO lubrication. The rotor is supported by two ball bearing assemblies which are lubricated and sealed at the factory for lifetime, maintenance-free operation. It is suggested that generator bearings be checked after 5000 hours of operation.

c. Generator Controls

Generator controls and instruments require no scheduled periodic lubrication. A few drops of oil may be required on door hinges occasionally to insure free and quiet operation.

d. Engine

Although the engine and its accessories require no more attention than any other similar installation, they still inherently require a major portion of the generator set lubrication and maintenance. Recommendations regarding engine lubrication have been taken from the engine manufacturer's "Operation Manual" and incorporated here to make them more readily available to operators and maintenance personnel.

(1) Lubrication schedule

Time schedules indicated on the Lubrication Chart, Fig. 1, are approximate. They are based on average operating conditions. It may be necessary to lubricate more frequently under severe operating conditions such as: low engine temperatures, excessively heavy loads, and high oil temperatures, or intermittent operation.

However, time intervals should not exceed those indicated in the chart without careful evaluation.

(2) Oil specification

Oil recommended by the engine manufacturer is identified by a military specification number, MIL-L-2104B. Because of the substantial increase in additive concentration in some MIL-L-2104B oils to meet service "MS" requirements, recommended oil is qualified still further by the following limitations.

a. Zinc, as zinc diorganodithiophosphate, between a minimum of 0.07 and a maximum of 0.10 percent by weight.

b. Sulfated ash: (ASTM D-874) of 1.00 percent maximum by weight, except lubricants that contain only barium detergent-dispersants where 1.50 percent by weight is allowed. Diesel lubricating oil specifications are discussed further in the Detroit Diesel, "Operator's Manual".

(3) Oil viscosity

The use of an SAE-30 grade oil is recommended for year-round service. The engine is equipped with an ether starting aid to assist in engine during cold weather when SAE-30 oil is used. Multigrade oils are NOT recommended, and should be considered only as a "last resort" to facilitate engine starting.

(4) Change engine oil

The following oil change recommendations are taken from Detroit Diesel Operator's Manual. "It is recommended that new engines be started with 100 hour oil change periods. The drain period may then be gradually increased, or decreased, following the recommendations of an independent oil analysis laboratory, or oil supplier (based upon the sample analysis) until the most practical oil change period for the particular service has been established.

The generator set is equipped with an hourmeter to record actual engine operating time. The ideal time to change oil is soon after a power delivery "run", when the engine is at operating temperature.

NOTE: If lubricating oil is drained immediately after the unit has been run for some time, most of the sediment will be in suspension and will drain readily.

CAUTION

Do not use solvents as flushing oils in running engines.

Change the oil filter cartridge each time the oil is changed.

Change oil as follows:

a. Provide a container for catching used oil. Capacity should be greater than 17 quarts.

b. Remove drain plug located in oil pan.

c. While oil is draining, proceed to change the oil filter. See Para. 3, D, (5) below, for instructions.

d. Clean the drain plug and install securely when engine oil has drained.

e. Remove oil filler cap (Sect. 1-2, Fig. 1) and refill the crankcase with new, clean oil which meets engine manufcturer's recommendations. (See para. 3,D, (2) above, or Detroit Diesel Operator's Manual.) See Fig. 4 for engine oil capacities.

CAUTION

1. Always use clean container, funnels, Etc.
2. Don't forget to :
   - Drain oil oil
   - Reinstall drain plug.
   - Install new oil before starting engine.

f. Install filler cap and check oil level on gage rod. (Sect. 1-2, Fig 1). The gage rod should indicate over FULL until the engine is started and oil is circulated to fill the oil filter.

g. Start engine and check oil pressure at once. Normal pressure should be indicated within 15 seconds. Allow engine to idle for about 5 minutes , then stop.

h. After the engine has been stopped for about 5 minutes, recheck the oil level. Add oil, if required, to bring the level up to the FULL mark on the gage rod.

(5) Change oil filter

a. Unscrew filter cartridge (4, Fig. 5) from filter head casting (1, Fig. 5) , and discard cartridge.

b. Clean filter head.

c. Prime the new cartridge with lubricating oil, allowing time for the oil to filter through the filter element (3, Fig. 5).

d. Using clean engine oil, liberally lubricate the oil filter seal (2, Fig. 5) of the replacement cartridges.

e. Screw replacement cartridge onto the filter head until the seal just touches the head, and then tighten securely by hand. If an oil filter tool is available, tighten to 15 ft/lbs (20 Nm).

f. Run engine and check for leaks.

e. Engine Accessories

See Figure 1 for identification of engine and accessories lubrication points, lubrication intervals and lubricants.

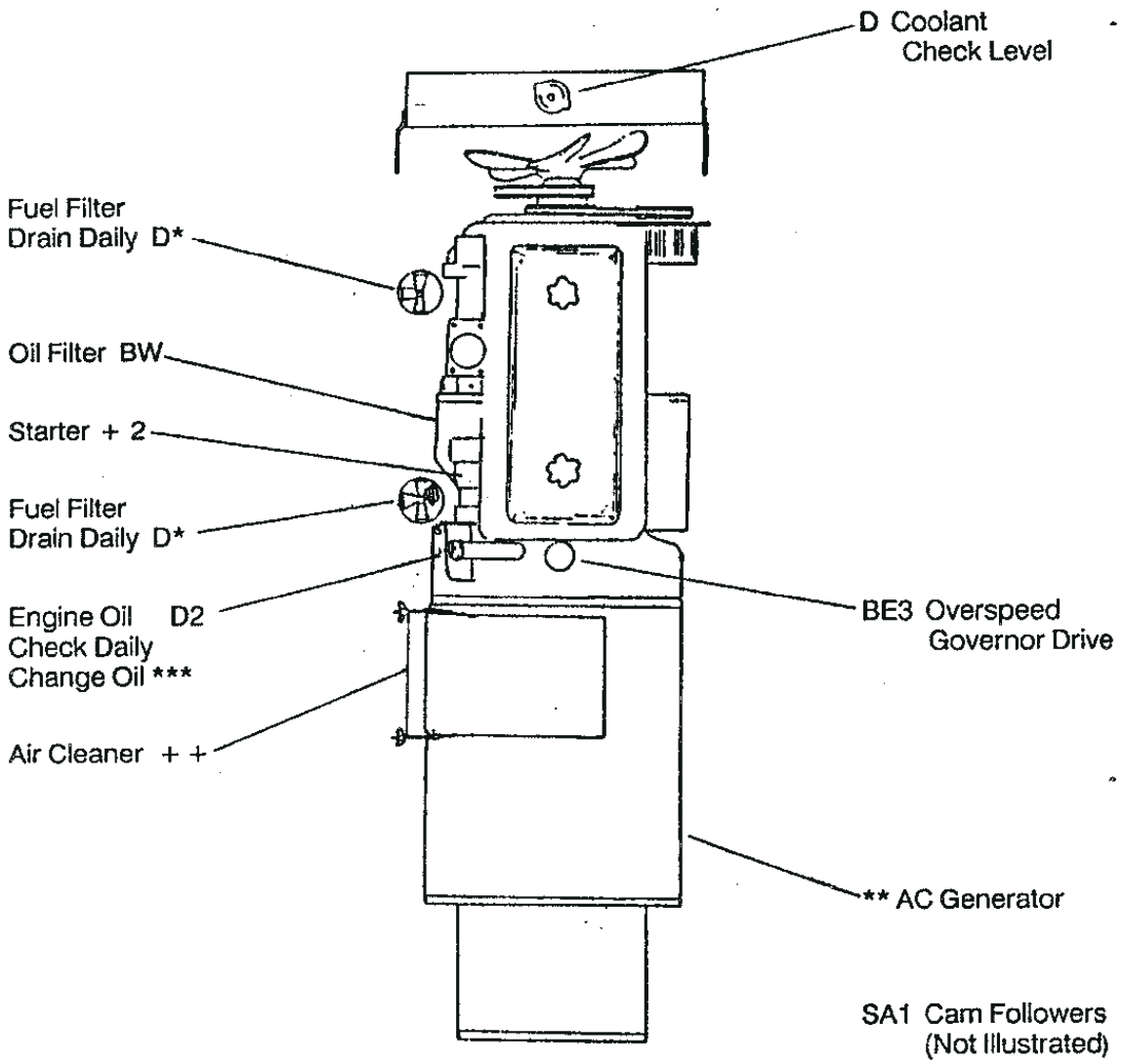
(1) Starter

The starting motor is lubricated at assembly and should be re-lubricated only when the starter is removed from the engine or disassembled

Remove pipe plugs on outside of motor and applt a few drops of light engine oil to the oil wicks.

(2) Overspeed governor and drive

See manufacturer's service instructions in Chapter 5 for lubrication of overspeed governor (1-1; 1, Fig. 4).



* Change elements every 300 hours.

** AC Generator bearings are sealed, and require no periodic lubrication.

*** Change engine oil after each 100 hours, or as recommended in engine manufacturer's operating manual.

\+ Lubricate starter only when removed from the engine.

\+ + Change air cleaner cartridge as required (according to air cleaner service indicator).

Lubrication and Maintenance Chart
Figure 1

Symbol	Name	Specification	Notes
1	Grease, General Purpose		Shell “Alvania” No. 2 or equivalent. (use No. 1 grade at temperature below +30 deg. F.)
2	Oil, Engine, Heavy Duty	Military Mil-L-2104B	SAE 30, use for all temperatures
3	Grease, Aircraft and Instrument	Military Mil-G-23827A	Enco Beacon No. 325 or Equivalent.

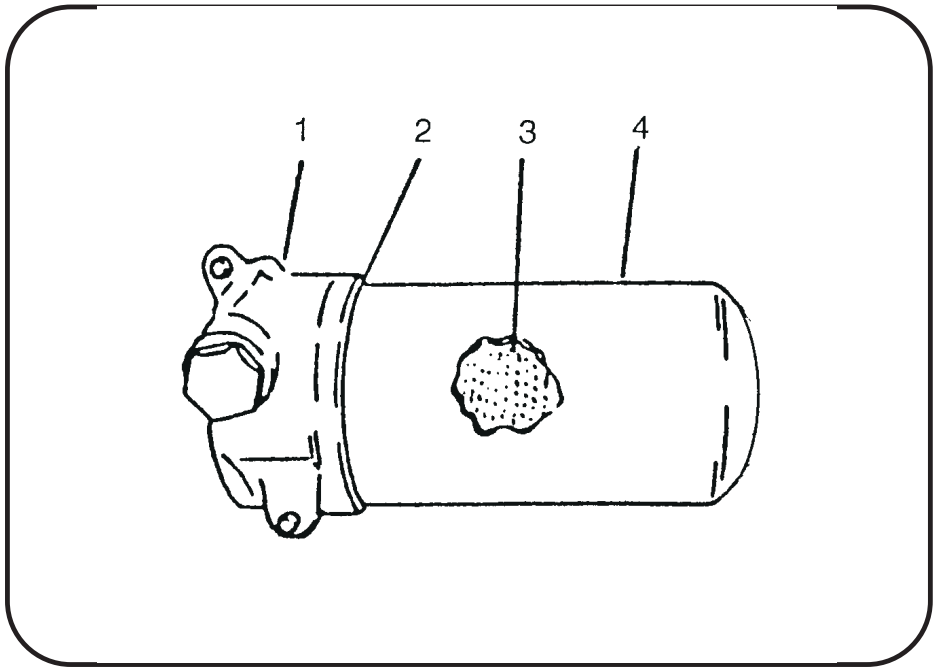
Lubricants
Figure 2

Symbol	Time Interval	
S	Daily	7 hours
W	Weekly, or	50 hours
BW	Biweekly, or	100 hours
M	Monthly, or	200 hours
SA	Semiannually, or	1200 hours
A	Annually, or	2400 hours

Lubrication Chart Symbols and Time Intervals
Figure 3

Coolant Capacity	8-1/2 gallons (32.18s liters)
Oil Capacity (Including Filter)	15 quarts (14.2 liters)
Oil Capacity (without filter)	13 quarts (12.3 liters)

Oil and Coolant Capacities
Figure 4



1. Head casting
2. Oil filter seal
3. Filter element
4. Oil filter canister

Oil Filter
Figure 5

4. Air Cleaner Service

The air cleaner is a dry type with replaceable filter cartridge. A definite time schedule for changing the filter cartridge cannot be determined because of the varying operating conditions. Change the filter cartridge when the red indicator "flag" reaches the top of the viewing chamber and locks in that position. Proceed as follows to change the cartridge.

a. Cartridge Removal (See Fig. 6)

(1) Loosen the four nuts (1), unlatch clamps (3), and swing the tee bolts (4) outward away from the moisture eliminator (7).

(2) Remove the moisture eliminator (7).

(3) Remove the filter cardtridge (6) and discard.

(4) Inspect the interior of the cleaner housing (5). Make certain that it is free from all foreign material.

b. Cartridge Installation (See Fig. 6)

(1) Carefully insert the new cartridge into the housing. Avoid hitting the cartridge tubes against the housing flange. Make certain that the cartridge is seated properly within the housing. Press all edges and corners of the cartridge firmly with the fingers to affect a positive air seal against the sealing flange of the housing.

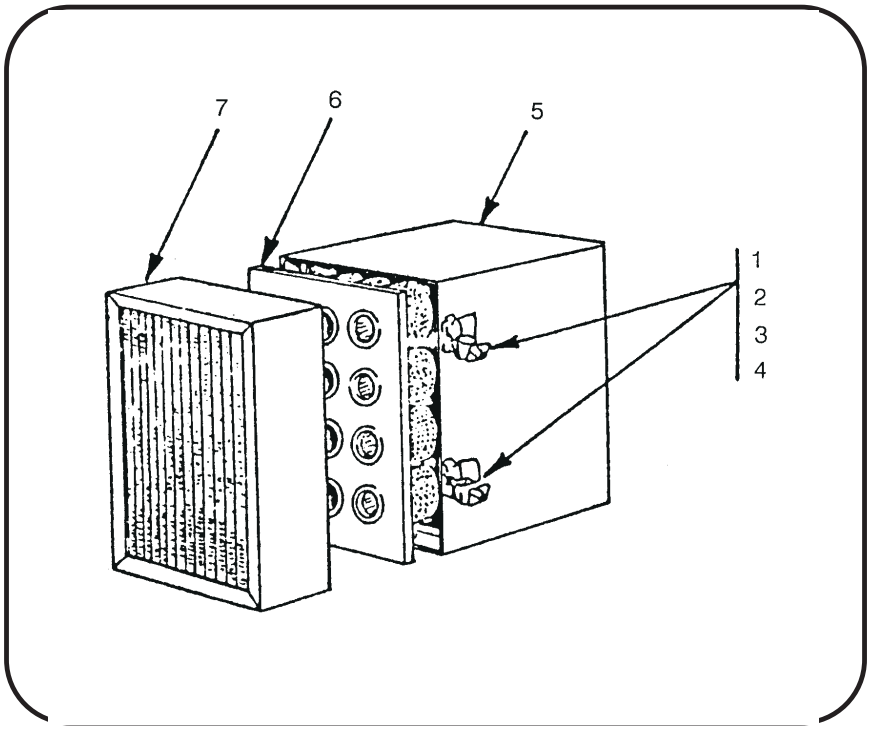
CAUTION

Under no circumstances should the cartridge be pounded or struck in the center to affect a seal.

(2) Lock the cartridge in place by installing the moisture eliminator (7) and clamping in place with the four tee bolts, clamps, and nuts.

(3) Nuts must be tightened evenly, criss-crossing from corner to corner. After tightening the nuts as tightly as possible by hand, turn them two full turns with a small wrench.

NOTE: Check the nuts three or four days later and retighten if required.



1. Nut
2. Spring washer
3. Clamp
4. Tee bolt
5. Housing
6. Cartridge
7. Moisture eliminator

Air Cleaner Cartridge Replacement
Figure 6

5. Engine Fuel

CAUTION

Consult the “fuel oil selection chart” in the engine operator’s manual before substituting another grade of fuel.

a. Quailty

The quality of fuel used in the diesel engine is a major factor in engine performance and life. Fuel oil must be clean, completely distilled, stable and non corrosive. Only distillate fuel No. 1D is recommended for use both summer and winter.

b. Fuel Filters

A primary fuel filter and a secondary fuel filter are used in the fuel system to remove impurities from the fuel. The primary fuel filter is located between the fuel supply tank and the fuel pump. It operates under vacuum and removes larger particles from the fuel. The secondary fuel filter, which removes small particles from the fuel, is located between the fuel pump and fuel inlet manifold. Both of these filters are replaceable cartridgess. Change both filters after each 300 hours of engine operation. This is done as follows, with engine STOPPED:

(1) If generator set’s fuel tank is at a higher level than the filters, close the fuel cock on the fuel tank.

(2) Provide a container for catching fuel oil, and position it beneath each filter as it is being removed.

(3) Unscrew the filters, using a filter wrench if necessary, and discard them.

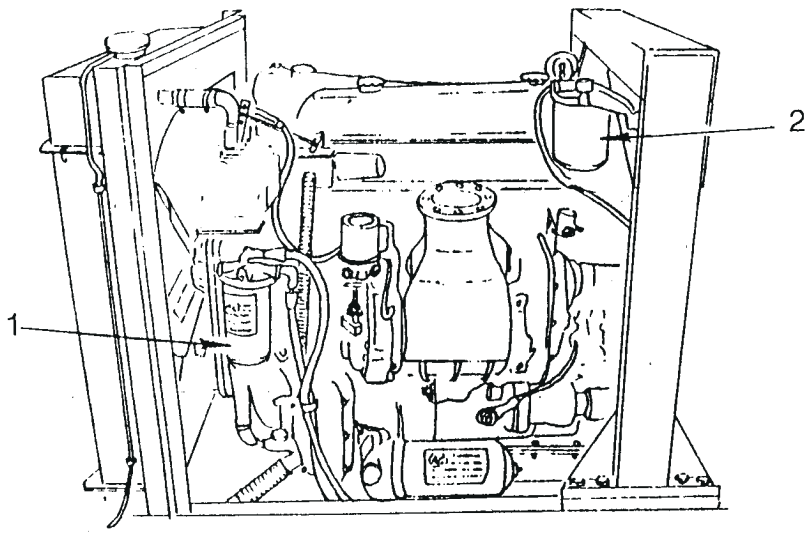
(4) Fill a new replacement cartridge approximately two-thirds full with clean fuel oil.

(5) Coat the seal gasket lightly with clean fuel oil.

(6) Screw the new cartridge in place by hand until gasket is evenly seated, then give cartridge a final half-turn. If a filter wrench is used, do not overtighten.

(7) Open fuel cock on fuel tank.

(8) Start the engine and check the fuel filter(s) to make certain there are no leaks.



1. Primary fuel filter
2. Secondary fuel filter

Fuel Filters
Figue 7

6. Engine Cooling System

a. General

Cooling system service requires much more than maintaining the proper coolant level in the radiator. During warm seasons and in warm climates, plain water can be used as acoolant if the system is protected against rust by a rust inhibitor additive. During cold seasons and in cold climates, the system must, of corse be protected against freezing. At no time sholud the system be operated for any length of time on plain water, without a rust inhibitor or antifreeze. Draining cleaning and filling the cooling system are covered in Para. 6, E through H.

b. Radiator Cap

(1) General

A pressure valve is built into the radiator cap. It is designed to open at a pressure of approximately seven pounds per square inch.

WARNING

Hot steam and fluids will severely burn! When removing cap from a very hot radiator, do not turn cap past safety stop until all pressure or steam has escaped. Use protective clothing. Allow engine to cool before adding coolant.

(2) Removal

To remove, turn the cap to the left (counterclockwise) to the safety stop. When all pressure is released, press down the cap and continue to turn until the cap is free to be removed.

Note: Do not attempt to repair the valve in a radiator cap. Replace with a new cap.

(3) Installation

When installing the cap be sure it is turned clockwise as far as it will go so that the pressure retaining valve will be functional.

c. Warm Weather Operation

During warm weather operation, if water is used in the cooling system instead of an antifreeze solution, keep the cooling system free of rust and sludge by adding a cooling system conditioner that is compatible with aluminum. Instructions for use of the conditioner are printed on each can.

CAUTION

Use only a corrosion inhibitor that is compatable with aluminum. Do not use inhibitors labeled as “acid neutralizer”.

d. Cold Weather Operation

(1) General

A permanent type, (Ethylene Glycol) antifreeze is recommended for use in the cooling system.

CAUTION

(a) Do not use “methanol” or alcohol as an antifreeze.

(b) Do not use two different types of antifreeze. Mixed solutions (two Types) make it impossible to determine if the cooling system has adequate protection against freezing.

(2) Coolant solution check

Check the solution frequently to be sure that the cooling system has sufficient protection against freezing.

Note: (a) When testing the solution, be sure the coolant is at operating temperature.
(b) Follow manufacturer’s instructions on tester.

(3) Coolant solution preparation

The following table (Figure 8) indicates the freezing points of solutions varying from 16% antifreeze to 65% antifreeze. Most antifreeze containers have a similar table printed on the label.

FREEZING POINT (FAHRENHEIT)	PERCENTAGE OF ANTI-FREEZE IN SOLUTION
20	16%
+10	25%
0	33-1/3%
-10	40%
-20	45%
-30	50%
-40	54%
-50	58%
-60	62%
-70	65%

Antifreeze Solution Table
Figure 8

(4) Antifreeze solution installation

Before installing antifreeze in the system, make the following checks:

a. Check the system for signs of leaks.

b. Inspect all hoses and tighten all hose clamps. Install new hoses if necessary.

c. Drain and clean the system. Ref. Paras. 6, E amd 6, F.

d. Check the condition and tension of the fan and water pump belts and alternator belts. Replace the belts if necessary.

e. Be sure radiator and engine drain valves (Ref. Fig. 9) are closed, and all connections are securely tightened.

f. Install the required amount of antifreeze (Ref. Fig. 8). Fill the system with coolant as outlined under Para. 7, H.

e. Drain the Cooling System

Drain the cooling system immediately after stopping the engine, while most of the sediment is in suspension. Proceed as follows:

(1) Remove radiator cap.

(2) Open radiator drain valve and engine drain valves (See Fig. 9).

Note; When draining the systen for storage, remove all drain valves and remove drain plug located in the left side of the engine block near the rear end of the blower.

(3) Allow the systen to drain completely.

Note: Be sure the drain valves do not plug-up during draining.

(4) When the system is completely drained, close all drain valves except when draining for storage.

f. Cooling System Cleaning

Drain and thoroughly flush the cooling system twice a year or more often if necessary. The appearance of rust in the radiator, or in the coolant is an indication that the inhibitor has become weakened and it is possible that some sludge has accumulated in the system. When this condition exists, procede as follows:

(1) Run the engine until it reaches normal operating temperature; then stop the engine and drain the cooling system (Ref. Para. 6, E).

(2) Fill the cooling system with clean coolant (Ref. Para. 6, H).

(3) Add a flushing compound, that is compatable with aluminum, to the cooling system in accordance with the instructions furnished with the compound.

(4) Start the engine and flush the system as directed by the instructions furnished with the compound.

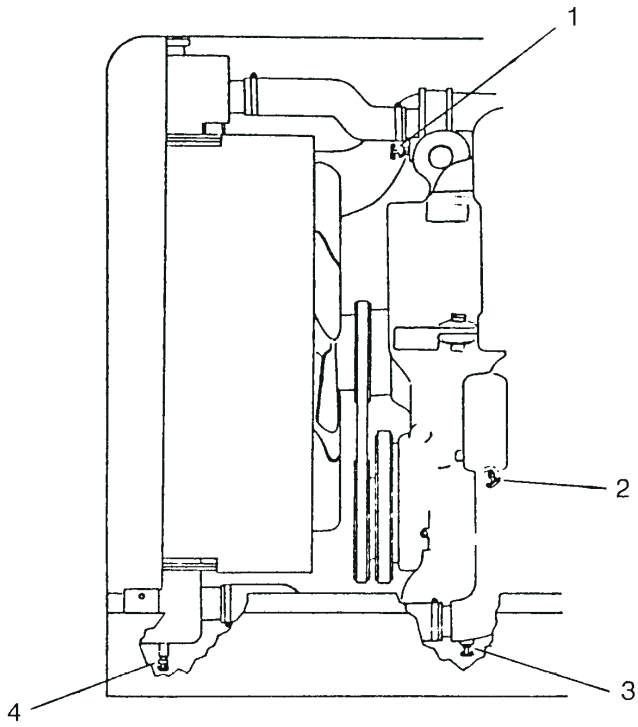
(5) After the system has been flushed and thoroughly cleaned of the compound, refill with clean coolant.

g. Radiator Core Cleaning

Blow out insects and dirt from the radiator core air passages, using air or wates under pressure. Engine overheating often caused by bent or clogged radiator fins. When straightening bent fins, be careful not to damage the tubes or to break the bond between the fins and tubes.

h. Cooling System Filling

Add a cooling system corrosion inhibitor (for warm weather opreation) or permanent antifreeze when the air temperatures expected are at freezing, +32 deg F or lower). Antifreeze may be desired. See Fig. 4 for cooling system capacity.



1. Top engine water outlet drain valve
2. Water pump drain valve
3. Oil cooler housing drain valve

Coolant Drain Valve Location
Figure 9

(1) Engine must be stopped. Close all drain valves except top water outlet valve (1, Fig. 9). Leave this valve OPEN to allow air to escape.

(2) Pour coolant into radiator slowly until system is filled to level of top drain valve (1, Fig. 9). Close valve and continue to fill system until coolant reaches a level, approximatey 1 inch below the radiator filler neck.

Note: If antireeze solution is not premixed, pour required antifreeze in first. Install corrosion inhibitor according to directions on container.

(3) Start the engine and allow it to idle. Add coolant if trapped air escapes fron the system and the coolant level falls.

(4) Continue to check coolant level until the engine reaches operating temperature. Add coolant, if needed, to fill to the required level, 1 inch below filler neck. Install rediator cap.

Note: It is good practice to attach a card, indicating the cooling system contents, and the date serviced to the radiator filler neck.

7. Generator Maintenance

The 400 -Hz generator requires no maintenance or service other than periodic cleaning. The unit is brushless, and bearings are permanently lubricated and sealed.

a. Cleaning

The generator may be cleaned by careful use of compressed air and/or a good, SAFE commercial cleaner. Steam cleaning of the generator is no longer recommended because the use of steam and harsh chemical compounds may result in damage to insulation and other components.

WARNING

Electiric shock and fire can kill or injure! Be sure the unit is completely dry before operating. Do not use a flammable solvent.

b. Adjustment

The generator itself requires no adjustment. Adjustment procedures for generator controls will be covered in Section 2-3.

8. Drive Belts

The Engine cooling fan is driven by a matched-set of V-belts, which must be replaced as a matched-set. The 12-V DC alternator is driven by a single V-belt.

a. Check Belt Tension

Check belt tension every 200 hours, or bi-weekly. A belt which is too tight is destructive to the bearings of the driven part. A loose belt will slip and cause innefficient opreation of the part being driven. Belts may be checked with a belt tension gage, Detroit Diesel No. BT-33-73FA, or equivalent. (See Fig. 10 for tension values.) Check at midpoint between pulleys. Belt tension may also be checked by a firm push witht the thumb, at a point midway between two pulleys. A properly adjusted belt should be depressed 1/2 to 3/4 inch.

Fan Drive	Alternator Drive
50-60	50-70

Belt Tension Chart (lbs./belt)
Figure 10

b. Belt Adjustment

(1) Alternator belt

Adjust alternator belt drive as follows: (See Fig. 11)

CAUTION

Exercise care to prevent damage to any component.

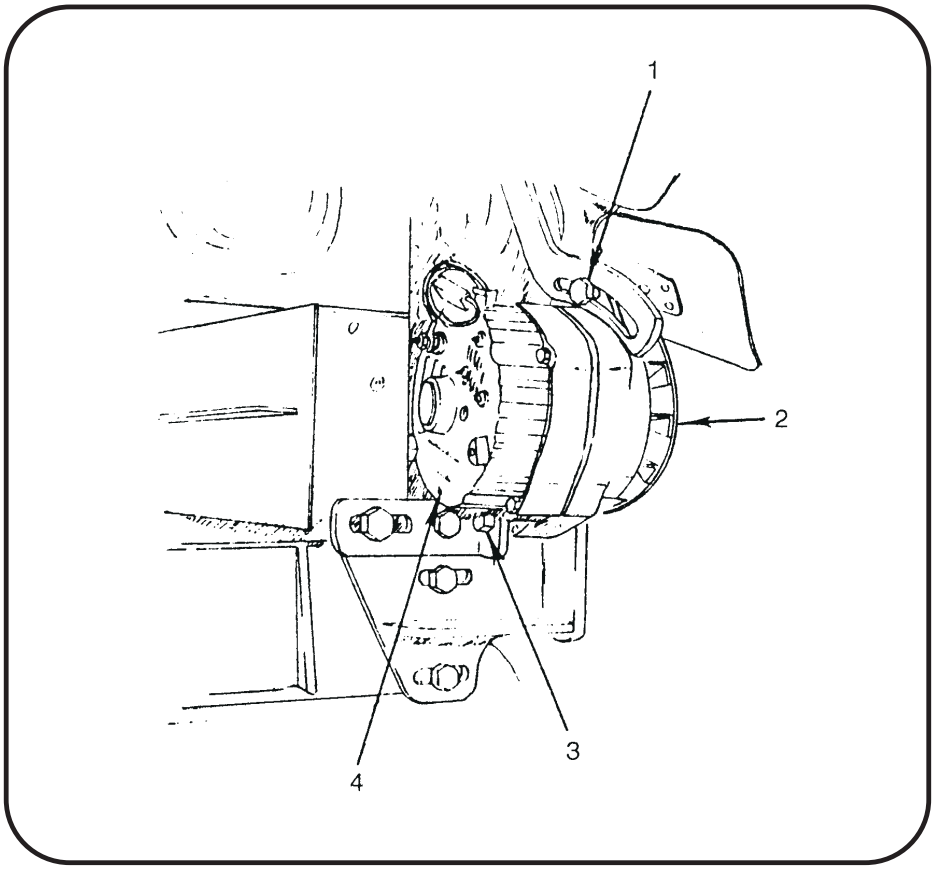
a. loosen pivot screw and nut (3).

b. Loosen adjusting bracket screw (1) and use a lon screwdriver (or pry bar) to pry the alternator (4) outward to increase belt tension.

c. Tighten adjusting bracket screw (1) and check belt tension (See Para. 8, A, above).

d. Repeat steps (b) and (c) until belt (2) is properly adjusted.

e. Tighten pivot screw and nut (3) and retighten adjusting bracket screw (1).



1. Adjusting Bracket Screw
2. Alternator drive belt
3. Alternator pivot nuts and screws
4. Alternator

Alternator Belt Adjustment Figure 11

(2) Fan Belts

Adjust fan drive belt as folows:(See Fig. 12)

a. Loosen four adjusting bracket screws (2) sufficiently to allow adjusting bracket (4) to slide on support bracket (5).

b. Turn adjusting screw (1) clockwise to tighten fan belts (counterclockwise to loosen belts).

c. Check belt tension in accordance with Para. 8, B.

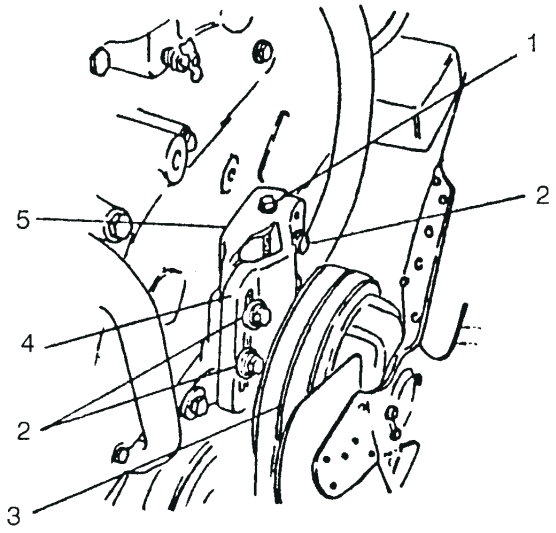
d. Repeat steps (b) and (c) untill belts are properly adjusted.

e. Tighten adjusting bracket screws (2).

9. Service Helps

a. Wiring

All small wire leads are routed through plastic flexible conduit which protects them and makes a neat , easily removable and replaceable wiring harness arrangement. This wiring method allows the replacement of a single wire lead with a minimum of difficulty. All wires are color coded.



1. Adjusting screw
2. Bracket screws
3. Fan belts
4. Adjusting bracket
5. Support bracket

Fan Belt Adjustment
Figure 12

b. Control Box Trays

Control box trays may be removed easily and moved to a work bench for service or replacement of parts.

(1) Tray removal

a. Loosen screw-lock fastener (2, Fig. 13).

b. Slide tray outward and disconnect Amphenol connector (3).

c. Support tray with hands at each side of tray near latches (1). Unlock latches (1) by pressing down with thumbs, then slide tray out of box.

(2) Tray installation

a. Use both hands to support tray as in removal above.

b. Align rails (4) with tracks (5) and slide tray into box. Latches will lock automatically.

c. Connect Amphenol connector (3).

c. Generator Exciter

Provisions have been made to allow removal of the generator exciter without disturbing or removing the complete generator.

(1) Preparation for exciter removal.

a. Remove rear canopy panel.

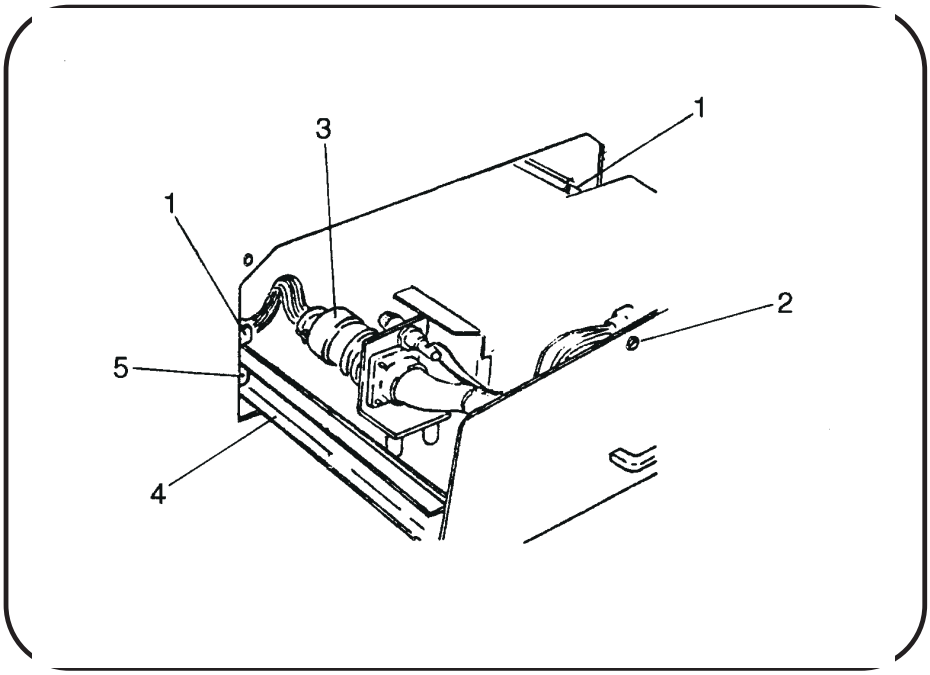
b. Remove main frame rear cross member by removing four attaching cap screws (see Fig.14).

(2) Exciter removal

Refer to Section 3-3 for exciter removal instructions.

(3) Exciter installation

Install exciter in accordance with instructions in Section 3-3, and reinstall rear frame member and tighten screws securely.



1. Latch
2. Fastener
3. Connector
4. Rail
5. Track

Tray Removal (Typical)
Figure 13

Note: It may be necessary to use a large “C” clamp or other arrangement to position frame side rails and align rear frame member mounting holes.

d. Engine Control Panel

The engine control panel is designed and mounted in such a manner that it may be released from its mounted position and tilted outward for access to components mounted on the back side (see Fig. 15). Do not disconnect the wires.

(1) Tilt out engine control panel

a. Remove clamp screw which supports wire conduit above output terminal panel.

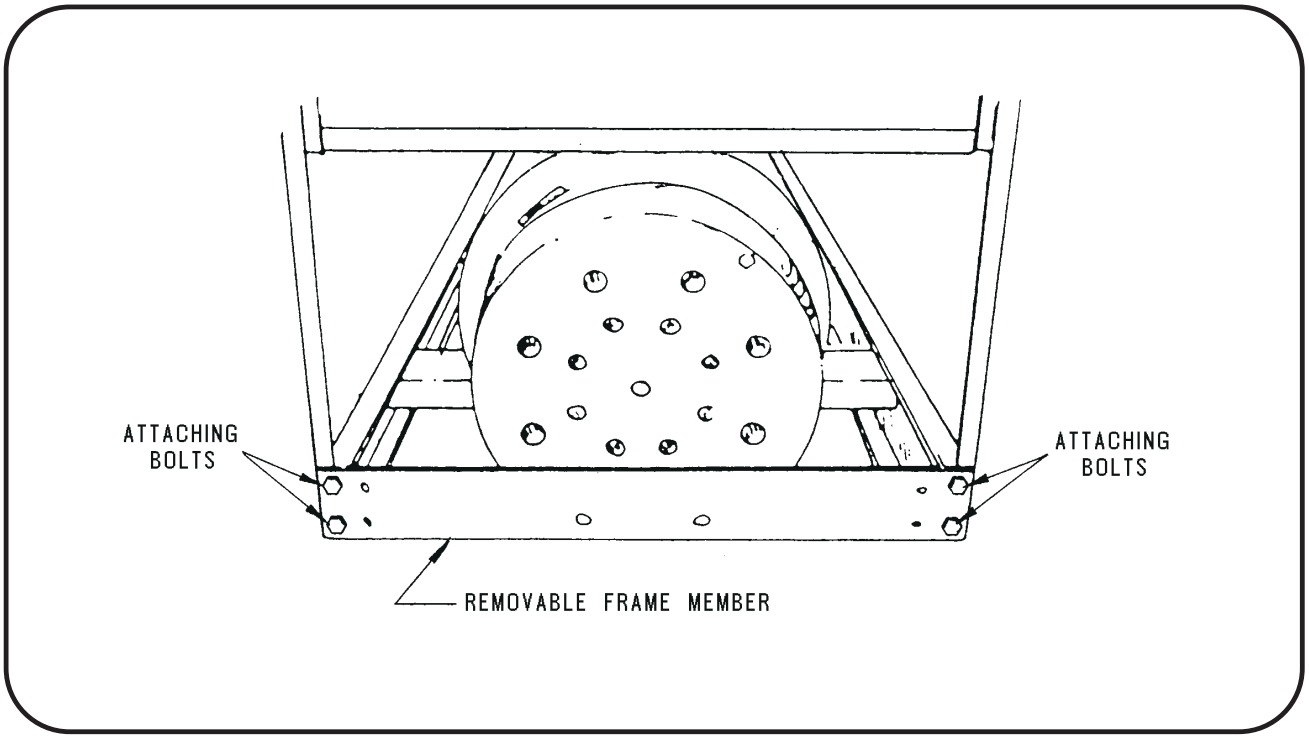
b. Remove four capscrews which attach engine control panel to frame superstructure.

c. Maneuver panel to tilt it inward at the bottom and outward at the top.

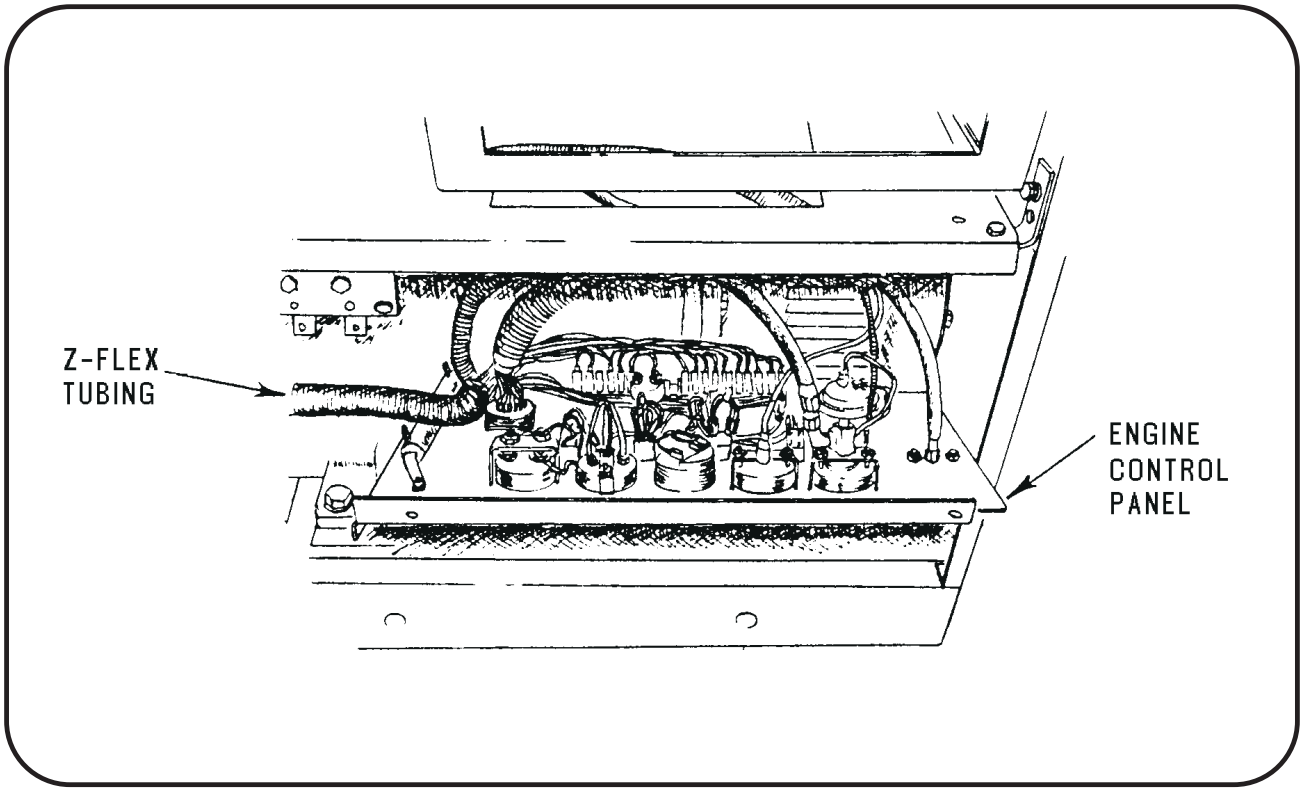
(2) Reinstall engine control panel

a. Maneuver panel into position and align mounting holes. Install mounting screws and secure.

b. Secure wire conduit in its original position with clamp and screw.



Removable Rear Frame Cross-Member
Figure 14



Engine Control Panel in Tilt-out Position
Figure 15

Section 2. Inspection / Check

1. General

This section describes inspections and checks to be performed in conjunction with Inspection/Check Schedule, Figure 1.

2. Engine

a. Fuel (See Fig. 1 for time schedules)

(1) Check fuel quantity DAILY

(2) Drain fuel filters in accordance with 2-1; Para. 5, B.

(3) Change fuel filter elements in accordance with 2-1, Para. 5, B.

(4) Open fuel tank drain every 500 hours to drain off water and sediment.

b. Lubrication

(1) Check crankcase oil level DAILY.

(2) Lubricate in accordance with Lubrication Chart (Ref. 2-1; Fig. 1, 2, 3, and 4).

c. Coolant

(1) Check coolant level DAILY.

(2) Inspect for signs of rust and corrosion. Change coolant if rust and sediment are present. See 2-1; Para. 6, E, F and H.

(3) Inspect hoses for cracks and deterioration. Inspect clamps for tightness.

d. V-Belts

(1) Inspect V-belts for proper tension and adjust if necessary after each 200 hours of operation. (See 2-1; Para. 8, A, B, & C).

WARNING

Exhaust fumes or fire can kill or injure! Immediately repair defective exhaust systems.

e. Exhaust System

(1) Visually inspect muffler and exhaust pipes for signs of approaching failure.

(2) Listen for gasket or joint leaks.

(3) Replace any defective parts at once.

3. Electrical System (12-V DC)

a. Lights

Inspect all lights for proper operation DAILY. Replace any defective lamps (bulbs) as soon as discovered. Figure 2 lists ALL lamps, their location, and part numbers.

b. Fuses

Inspect and replace fuses as required. See Figure 3 for fuse sizes and locations. Figure 3 includes all fuses used in both the engine and generator electrical systems.

Engine	AR	Daily or 8 Hrs	Weekly or 50 Hrs	Bi weekly or 100 Hrs	Monthly or 200 Hrs	Bi-Monthly or 400 Hrs	Six Months or 1200 Hrs
Check fuel quantity		X					
Check crankcase oil level		X					
Check coolant level		X					
Change engine oil filter element			X				
Change engine oil			X				
Replace air cleaner cartridge	X						
Check cooling system hoses, tubes, fittings, clamps				X			
Check V-belt tension						X	
Drain/refill cooling system		TWICE ANNUALLY					
Change fuel filter elements						X	
Lubricate		SEE LUBRICATION CHART					
Check exhaust system					X		
Open fuel tank drain		Every 500 hours					
ELECTRICAL (12-V SYSTEM)							
Check all lights		X					
Clean battery terminals	X						
Check wiring						X	
Check connections						X	
400-HZ GENERATING AND CONTROLS SYSTEM							
Check output cable and connector	X						
Check voltmeter	X						
Check ammeter	X						
Check frequency meter	X						
Check all lights	X						
Check protective relays					X		
Check safety switches					X		
Inspect all wiring and connections							X
Clean and inspect generally							X

Inspection/Check/Maintenance Schedule
Figure 1

Light Identification	Location	Lamp Manufacturer	Lamp (bulb) Number
Instrument Panel Lights	Control Box	Lamp Industry Trade Number	63
Engine “ON” Indicating Light	Engine Control Panel	Lamp Industry Trade Number	1815
Contactor CLOSED Indicating Light (Output No. 1)	Engine Control Panel	Lamp Industry Trade Number	1815
Contactor CLOSED Indicating Light (Output No. 2)	No. 2 Control	Lamp Industry Trade Number	1815
Fault Indicating Lights	Protective Relay Tray	Lamp Industry Trade Number	1815
Clearance Lights	Canopy	Lamp Industry Trade Number	57

Lamp Identification Chart
Figure 2

Item Protected	Location	Illustration	Size and Type
Instrument Panel light and engine circuit	Engine control panel	Sect. 1-1, Fig. 11 item 15	10 A Type AGC
Protective relay system	Protective relay tray	Sect. 1-1, Fig. 10 item 17	2 A Type AGC
Voltage regulator	Voltage regulator tray	Sect. 1-1, Fig. 12 item 12	5 A Type AGC
Load contactor circuit	Protective relay tray	Sect. 1-1, Fig. 10 item 16	2 A Type AGC

Fuse Identification Chart
Figure 3

c. Wiring and Connections

(1) Inspect all cables and leads for broken, worn, and damaged insulation.

(2) Check electrical connections for loose connection.

NOTE: A darkened terminal generally indicates a loose connection.

4. Electrical System (115-V AC)

The 400-Hz generator and controls are designed to be as maintenance free as possible. No lubrication or periodic maintenance adjustments are required. However, some regular checks should be made to be sure all controls, instruments, etc., are working properly.

a. Monitoring Instruments

Observe operation of voltmeter, ammeter, and frequency meter each time the unit is started.

b. Indicating Lights

Check lamps (bulbs) in all of the indicating lights of each start up. Fault indicating lights in the protective relay tray may be tested by pressing test switch (1-1, 8, Fig. 9).

c. Protective Modules

Check operation of all protective modules to make sure they will function if a fault should occur in the output circuit. (see 2-3; Para. 2, B).

d. Wiring and Connections

WARNING

High voltage: Electric shock can kill! Stop operations and stop engine before touching exposed conductors or terminals.

(1) Check all cables, leads, and wiring for broken, worn and damaged insulation.

(2) Check all connections for tightness.

(3) Check the output cable plug connector for damaged contactors in the end of the plug.

Section 3. Adjustment / Test

1. General

These adjustments and test procedures are applicable to testing and adjusting the generator set after major repair, major parts replacement, or overhaul.

2. Generator Set Test

a. Pre-operational Test Procedures

(1) Connect cables from the generator output terminals to a load bank. Use cables of the same size and length as those to be used in service. Be sure the generator output "N" cable is grounded.

(2) Check engine oil level. Oil should be at FULL mark on gage rod.

(3) Check coolant level. (Sect. 2-1, Para. 6, H).

(4) Check tension of fan and fan generator V-belts. (Sect. 2-1, Figure 11 and 12).

(5) If governor throttle linkage was disturbed, check all linkage to make certain engine speed may be controlled when the engine is started. (Figure 7).

(6) Inspect for oil, fuel and coolant leaks.

(7) If the setting of the voltage regulator adjustment potentiometer (37, Fig. 1) has been disturbed, set it at CENTER position (approximately halfway between full clockwise position and full counterclockwise position).

(8) Check engine circuit fuse (26, Fig. 1) by placing panel light switch (16) in ON position. If panel lights (13) operate, the fuse (26), switch (16) and lamps are good.

(9) Check fault indicating lights (9) by pressing test switch (8). If lights glow, fuse (11) and indicating lamps are good.

(10) Make certain the air shut-off valve is latched OPEN by pressing the latch lever (8, Fig. 2) DOWN.

(11) Make a general inspection of all wiring and terminals. Inspect the equipment to be certain damage will result from starting the engine.

Check operation of the shut-down solenoid (1, Fig. 2) by momentarily connecting a jumper wire between the "hot" terminal (4, Fig. 3) on the starter solenoid and the left terminal (2, Fig. 2) on the shut-down solenoid. The solenoid should unlatch the air valve as soon as connection is made.

(12) While the air valve is unlatched, check operation of the starter "cut-out" switch (10, Fig. 2). Press engine start switch (28, Fig. 1). Starter should not crank engine if starter cut-out switch is operating properly. See Para. 3, F, (1) if starter cutout-out switch adjustment is necessary.

(13) At initial start-up after generator overhaul or repair, "flash" the exciter field by momentarily applying 12-V DC to the field windings as follows:

CAUTION

Engine must not be running when field flashing if voltage regulator damage is to be prevented.

a. Flashing exciter field using test box.

If a test box (see Sect. 1-3, Fig. 4) is available, connect it to receptacle connector (Sect. 1-3., Fig. 5).

- Rotate the selector knob (Sect. 1-3, Fig. 4, item 1) to position 8.

CAUTION

Flashing the field in a reverse direction could cause damage to voltage regulator diodes.

- Use two jumper leads, each equipped with alligator test clip and a test prod, to connect 12-V DC power to test jacks (Sect. 1-3, Fig. 4, items 3 and 4) on the box. Connect positive jumper from input terminal (4, Fig. 5) on starter solenoid to red test jack. Connect negative lead from starter ground terminal to black test jack.
- Momentarily pressing pushbutton switch (sect. 1-3, Fig. 4, item 2) will flash the exciter field.
- Disconnect jumper leads.

b. Flashing exciter field without test box.

Remove test receptacle cover (1-3; Fig 5). Use two test leads equipped with a test prod on one end and an “alligator” clip on the other. Insert the test prod of one terminal “D” of the test receptacle (see Fig. 4), and connect the other end of the lead to a good GROUND. insert the test prod of the second lead in the terminal “P” of the test receptacle and momentarily touch the other end (alligator clip) to the “hot” terminal (4, Fig. 3) on the starter solenoid to flash the field. After flashing exciter field, disconnect leads and install receptacle cover.

NOTE: If test leads with test prods are not available, insert short pieces of wire in proper test terminals to make connections.

(14) Check position of load contactor “on-off” switch (20, Fig. 1), and engine-generator control switch (18).

a. Load contactor switch (20) must be in OFF position.

b. Engine-generator control switch (18) must be in IDLE position.

b. Operational Test Procedures

(1) Start the engine in accordance with instructions in 1-3; Para 2, A thru C.

(2) Check operation of engine instruments; DC ammeter (17, Fig. 1), coolant temperature indicator (21), oil pressure gage (23), and hourmeter (19).

(3) Check engine idle speed. Should be 875 to 925 RPM. Adjust, if necessary, in accordance with instructions in Engine Operator’s manual.

NOTE: A stroboscope is required for this check.

(4) Again check for oil, fuel, and coolant leaks and correct any leaking conditions.

(5) Position switches and controls for automatic voltage regulation and power delivery as follows:

a. Place automatic-manual switch (33, Fig. 1) in AUTOMATIC position.

b. Place test-bank switch (34) in AIRCRAFT position.

c. Meter switch (5) may be in any position except pointing straight down.

d. If the adjustment of the voltage regulator adjustment potentiometer (37) has been disturbed, position the knob to mid-range position.

(6) Bring the engine up to governed speed, and also energize the generator by holding the engine-generator control switch (18) in BUILD-UP-VOLTS position momentarily. Release switch and allow it to position in “center” GENERATE position. If the engine “comes up” to governed speed and a voltage value appears on the voltmeter (2), the electric governor and excitation-deenergization relay circuits are functioning.

(7) Observe frequency meter (1). If engine speed is properly adjusted, frequency will be exactly 400 Hz. If not, adjust engine governed speed in accordance with Para. 3, E, (3). See Fig. 11.

(8) Observe voltmeter (3). Use voltage regulator adjustment potentiometer (37) to adjust voltage to 115 V AC line-to-neutral.

(9) Measure governor actuator input signal. See Para. 3, E, (4), (a).

(10) Measure governor magnetic pickup signal. See Para. 3, E,(4),(b).

(11) Check high-speed limiting governor.

Engine limiting speed governor should limit engine speed to just below trip point of overspeed governor. Overspeed device should trip at 2400 RPM. See Synchro-Start Products, Inc. instructions in Chapter 5.

(12) Check adjustable voltage range in automatic operating mode.

a. Observe voltmeter (2, Fig. 1) and turn voltage regulator adjustment potentiometer (37) CLOCKWISE to full clockwise position. Maximum voltage should be at least 134 V AC, or higher.

NOTE: If voltage should decrease when the potentiometer adjustment is turned clockwise, it indicates that internal wiring of the voltage regulator is incorrect. Replace the complete regulator.

b. Observe voltmeter and turn adjustment potentiometer (37) to full COUNTERCLOCKWISE position. Minimum voltage should be 108 V AC, or lower.

(13) Observe voltmeter and turn adjustment potentiometer (37) to obtain 115-V AC voltmeter reading.

(14) Check adjustable voltage range in manual operating mode.

a. Open the generator control tray (14, Fig. 1) and place the automatic manual switch (33) in MANUAL position.

b. Observe voltmeter (2) and turn manual control rheostat (32) CLOCKWISE to full clockwise position. Maximum voltage should be 160 V AC.

c. Observe voltmeter and turn rheostat (32) to full COUNTER CLOCKWISE position. Minimum voltage should be 95 V AC or less.

d. Adjust voltage to 115 V AC, then return the automatic manual switch to AUTOMATIC position.

(15) Position load bank switches, etc., to apply a light load to the generator.

(16) Place the load contactor “on-off” switch (20, Fig. 1) in the top, spring loaded, CLOSE position. Hold in this position momentarily. The indicating light (22) should glow GREEN and an amperage value should appear on the AC ammeter (4).

(17) Release the switch (20) and allow to return to the center ON position. The load contactor should open immediately, and the contactor “on” indicating light should go OFF. This is because the plug interlock relay (Ref. 1-1; 1, Fig. 9) is not receiving power from an outside source of 28 V DC. It indicates that the plug interlock coil is not receiving 28-V DC power.

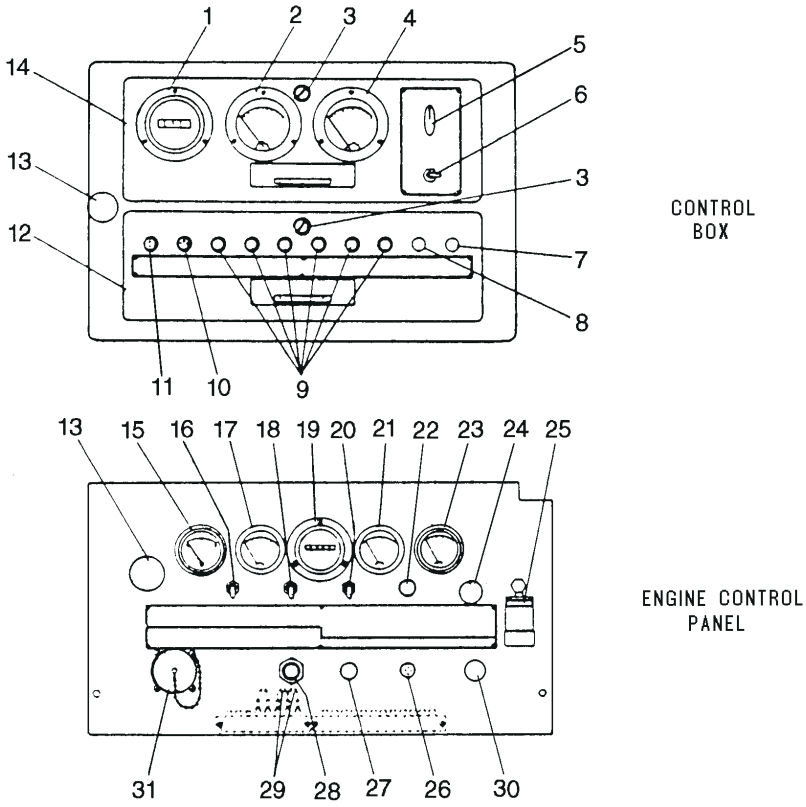
(18) Open the protective relay tray and place the test bank switch (34, Fig. 1) in TEST BANK position.

(19) Again place the load contactor switch (20) in the top, CLOSE position. Light (22) should glow GREEN and remain ON when the switch is released and allowed to return to the center ON position. This indicates that the test bank switch (34) is functioning to by-pass the plug interlock relay.

(20) Return the test bank switch to AIRCRAFT position. The load contactor should open at once and the green indicating light (22) should go off.

(21) Connect a source of 24-V DC power (two twelve-volt batteries connected in series) to terminals “N” and “F” (or “E”) at the output terminal panel. Connection polarity should be: MINUS to terminal N and PLUS to terminal E or F.

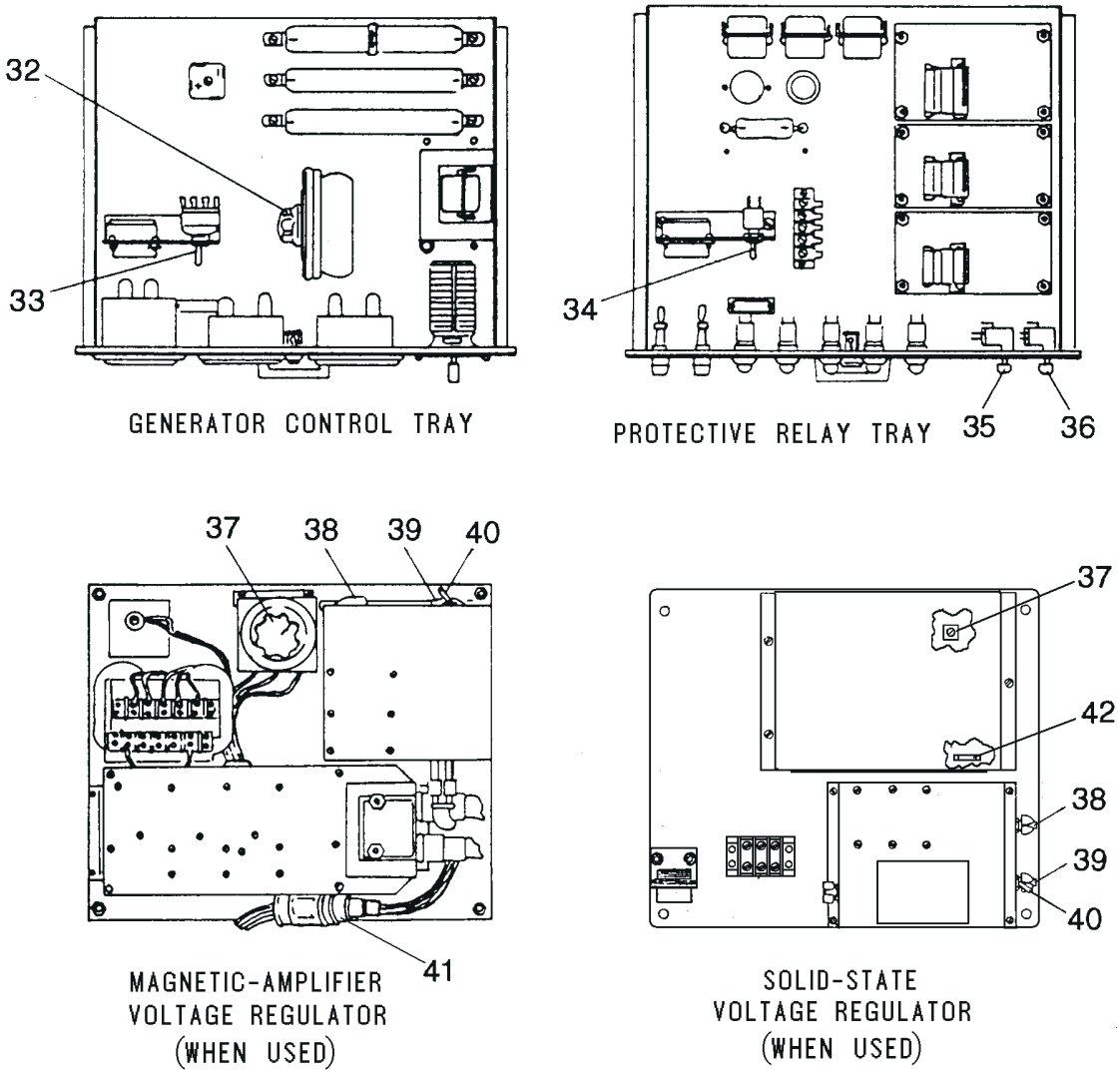
(22) With test-bank switch in AIRCRAFT position, hold the contactor operating switch (20) in top, CLOSE position momentarily. The generator “ON” indicating light (22) should glow GREEN and remain ON when the switch is released and allowed to return to the center ON position. This indicates that the load contactor is closed and the plug interlock relay is functioning properly.



1. Frequency Meter
2. Voltmeter
3. Fastener
4. AC Ammeter
5. Meter Switch
6. Line Switch
7. Reset Switch
8. Light Test Switch
9. Fault Indicating Lights
10. Load Contactor Circuit Fuse (2A)
11. Protective System Fuse (5A)
12. Protective Relay Tray
13. Instrument Panel Light
14. Generator Control Tray
15. Fuel gage
16. Light Switch
17. DC Ammeter
18. Mode Switch
19. Hourmeter
20. Load Contactor Control Switch
21. Coolant Temperature Gage
22. Load Contactor Indicating Light
23. Oil Pressure Gage
24. Hole plug
25. Air Cleaner Indicator
26. Engine Circuit Fuse (10-A)
27. Engine Protective Circuit Indicating Light
28. Engine Starter Switch
29. Blocking Diodes
30. Engine Stop Control
31. Test Receptacle Connector

Operating Controls and Instruments

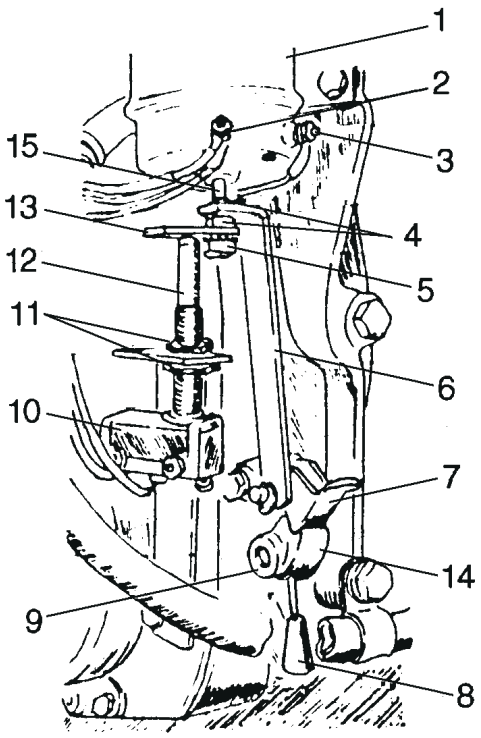
Figure 1 (Sheet 1 of 2)



32. Manual Voltage Control Rheostat
33. Automatic-manual Voltage Control Switch
34. Test Bank Switch
35. Light Test Switch
36. Reset Switch
38. Cable Length Compensation Rheostat
39. Cable Size Compensation Rheostat
40. Line-Drop Compensation On-Off Switch
41. Fuse (5-A)
42. Fuse (10-A)

Operating Controls and Instruments

Figure 1 (Sheet 2 of 2)



1. Shut-down solenoid
2. Solenoid terminal (input)
3. Solenoid terminal (ground)
4. Latch arm adjusting nuts
5. Switch bar attaching nut
6. Latch actuating arm
7. Latch
8. Latch reset lever
9. Air shut-off valve shaft
10. Switch
11. Switch adjusting nuts
12. Switch actuating rod
13. Switch actuating bar
14. Latch cam
15. Solenoid plunger rod

Shut-down Solenoid with Linkage and Starter Cut-out Switch

Figure 2

(23) Apply 1/3 to 1/2 load at the load bank and allow the unit to run for 15 to 30 minutes. Observe operation of all monitoring instruments.

(24) Increase load bank resistance to apply a full load.

(25) Check operation of the governor by observing the frequency meter (1, Fig. 1) when generator is switched from no-load to full-load and vice versa. Use the contactor control switch (20) to apply and remove load several times. Frequency droop should be no more than 1 Hz. Adjust governor if necessary (see Para. 3, E, (3).

(26) Follow instructions in Section 2-5 to set voltage regulator line-drop compensation potentiometers [(Ref. Figure 1, items (38) and (39)]. Set knob pointer on cable size potentiometer (39) to size (2/0, 4/0, etc.) of cable being used. Set knob pointer on cable length potentiometer (38) to length (20 feet, 40 feet, etc.) of cable being used. See instruction plate (mounted below knobs).

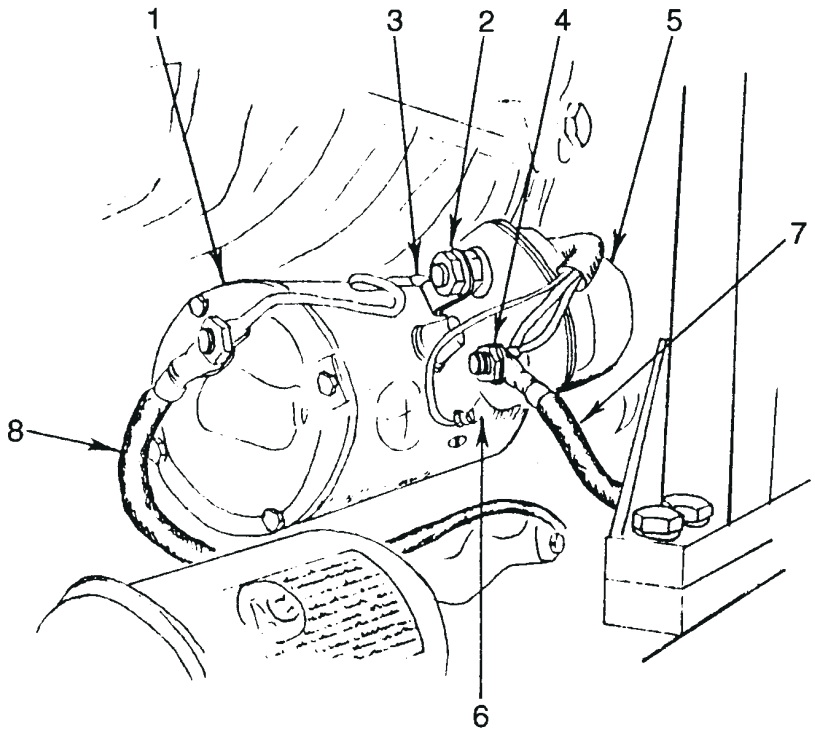
(27) Check voltage regulator, at intervals, from no-load to full load, and on up to 125% load. Observe and note voltage at various loads. Voltage should be 115-V +/- 1%.

(28) Check accuracy of voltmeter.

a. Open generator control tray (14, Fig. 1).

b. Connect a master voltmeter of known accuracy to terminals of the voltmeter (2).

c. Compare unit voltmeter reading with master meter. Error must not exceed 2 % of full scale.



1. Starter
2. Starter solenoid switch to starter terminal
3. Solenoid coil ground terminal
4. Solenoid switch input terminal
5. Starter solenoid switch
6. Solenoid coil terminal
7. Battery cable
8. Starter ground cable

Starter and Solenoid Switch

Figure 3

(29) Check accuracy of AC ammeter.

a. Connect a master ammeter of known accuracy to the AC ammeter (4) terminals.

b. Compare unit ammeter reading with master meter under various loads. Error must not exceed 4% of full scale.

(30) Check operation of meter selector switch (5). A voltage value should be shown in each switch position (except straight down).

(31) Check operation of the line switch (6). A normal voltage of 115 V AC should be indicated when the switch is in LINE-TO-NEUTRAL position. A voltage of approximately 200 V AC should be indicated when the switch is placed in LINE-TO-LINE position.

(32) Check accuracy of frequency meter.

a. Connect a master frequency meter of known accuracy to the frequency meter (1) terminals.

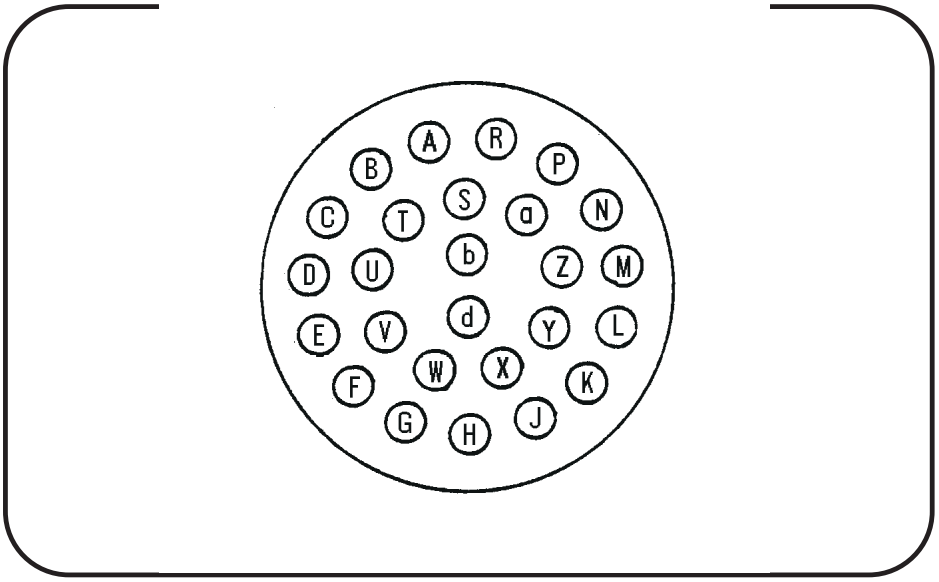
b. Compare meter readings. Error must not exceed 1% of full scale.

(33) Operate the unit for not less than 10 minutes under full load. The overload device (Ref. 1-1; 7, Fig. 12) MUST NOT trip.

(34) Operate at 125% rated load for 5 minutes immediately following the full-load run. The overload device MUST trip within 5 minutes and the overload indicating light (9, Fig. 1) must come ON to indicate an overload condition.

(35) Reduce load to normal. Turn off indicating light by pressing reset switch (7, Fig. 1).

(36) Check engine oil pressure at governor speed (2000 RPM). Gage should indicate at least 38 PSI when the engine is hot. Check engine coolant temperature. Gage should indicate in the range of 180 degrees to 190 degrees depending upon ambient temperature.



Test Receptacle Connector Terminals Identification

Figure 4

(37) Check operation of fuse interlock (Ref. 1-1; 2, Fig. 9). With unit operating normally under load, remove protective relay circuit fuse (Ref. 11, Fig. 1). The load contactor should open immediately, indicating that the fuse interlock relay is functioning properly. Replace fuse and apply load.

NOTE: Make all protective relay tests with the unit operating under load.

(38) Check operation of overvoltage relay and indicating light.

a. With the unit running at normal load in the manual mode, adjust the manual rheostat (32, Fig. 1) to increase voltage (turn clockwise), until the overvoltage sensing relay actuates the protective monitor to open the load contactor and turn on the overvoltage indicating light. The overvoltage sensing relay should trip when voltage reaches 130-V to 134-V.

b. Return unit to normal operating conditions by adjusting manual rheostat and pressing reset switch (7), and switching to AUTOMATIC mode.

(39) Check operation of undervoltage sensing relay, indicating light, and time delay. Before starting this check, let us understand the sequence of events which should happen when voltage is reduced to 103 V or lower. At some value between 103 V and 93 V, the undervoltage sensing relay (Ref. 1-1; 5, Fig. 9) should function to activate the undervoltage time delay circuit. Five seconds after the time delay circuit is activated, (if the undervoltage condition continues) it should function to open the protective monitor relay. Which, in turn will open the load contactor to stop power delivery. As a result of the action, the undervoltage indicating light (9) should be turned ON. A stopwatch or sweep-second hand watch is required for this check. Proceed as follows:

a. With unit operating at normal load in the MANUAL mode, use the manual rheostat (32, Fig. 1) to reduce voltage to 104 V. The load contactor should NOT open after a 5-second delay.

b. Reduce voltage in steps of 1-V, with a delay of at least 5 seconds between steps. Restart stopwatch, or note position of sweep-second hand each time voltage is reduced. At some volt age value between 103 V and 93 V, and 4 to 12 seconds after a new voltage setting is made, the load contactor should be opened and the undervoltage indicating light should be turned on by the step-by-step action of the undervoltage sensing re lay, time delay circuit, and protective monitor relay.

NOTE: The 4 to 12 second time delay is generally set at 5 seconds.

c. If the load contactor is not opened at 103 V to 93 V, it will be necessary to refer to the Troubleshooting Chart, Section 2-4, to determine which component of the undervoltage protective circuit is defective.

d. If the undervoltage circuit performs satisfactorily, return the unit to normal operation by adjusting the voltage to 115 V, pressing the reset switch, and switching to AUTOMATIC mode.

(40) Check underfrequency sensing relay, protective monitor, and indicating light. At some frequency value (Hz, cycles-per-second) from 385 Hz down to 375 Hz, the underfrequency sensing relay should function to signal the underfrequency circuit in the protective monitor module to OPEN the load contactor holding circuit, thus OPENING the load contactor. To check the underfrequency protective components, proceed as follows:

a. While the unit is operating normally under load, reduce generator output frequency by reducing engine speed. Use the governor speed setting potentiometer (Ref. Fig. 11). Turn adjusting screw COUNTERCLOCKWISE gradually to reduce engine speed until frequency meter indicates 386 Hz. Underfrequency protective relay should not function to open the load contactor at this frequency. Reduce frequency in steps of 1 Hz.

b. If the protective system functions to open the load contactor, turn off the voltage regulator, and turn on the underfrequency light after some frequency between 385 Hz and 375 Hz is reached, all components of the system are functioning properly. If the load contactor is not opened within the above frequency range, refer to Troubleshooting Chart to determine which component is defective.

c. Return unit to normal operating condition.

(41) Check overfrequency sensing relay, protective monitor and indicating light.

This protective circuit operates in exactly the same manner as the underfrequency circuit except its operating range is from 415 Hz to 425 Hz. Its purpose also is to open the load contactor and turn on an indicating light.

a. Check procedures are the same for overfrequency as for underfrequency (above) except that engine speed is INCREASED to create a condition of overfrequency.

b. If the overfrequency system functions to open the load contactor and turn on the overfrequency light after some frequency between 415 Hz and 425 Hz is reached, all components of the system are functioning properly. If the load contactor is not opened within the above frequency range, refer to Troubleshooting Chart to determine which component is defective.

(42) If the generator is operating under load at this point, place the contactor control switch (20, Fig. 1) in OFF position to open load contactor and disconnect load. There will be no further need for the load bank in the following checks.

(43) With the engine running at normal governed speed; check the entire unit for vibration and for any parts which may have become loosened during the above checks. Tighten any loose attaching hardware as required.

CAUTION

Electric shock, moving parts, and noise can kill or injure! If a metal sounding rod is used to detect bearing noises, exercise extreme care to avoid injury.

(44) Check 400-Hz generator bearings. Use a stethoscope or metal sounding rod to listen for unusual noises. If using a metal rod, place one end on the generator housing and hold the other end near the ear. Hold the rod with three fingers and use the index finger and thumb to form a “sounding chamber” between the rod and the ear. Do NOT allow the rod to touch the ear. Listen for “grinding” or pounding sounds which would indicate a defective bearing. An engine noise may be “telegraphed” to the generator and misinterpreted as a generator noise. Send the unit to overhaul if in doubt of bearing serviceability.

3. Generator Set Adjustment

a. Generator Adjustment

The 400 Hz generator is a brushless type requiring no adjustments of any kind.

b. Generator Control Adjustments

The following items may require adjustment at some time during the life of the equipment.

(1) Adjust manual voltage control, variable resistor.

The adjustment of this resistor (Ref. 1-1; 1, Fig. 8) determines the maximum generator output voltage obtainable when using the manual control rheostat for voltage control. To adjust maximum voltage potential (160-V AC line-to-neutral) proceed as follows:

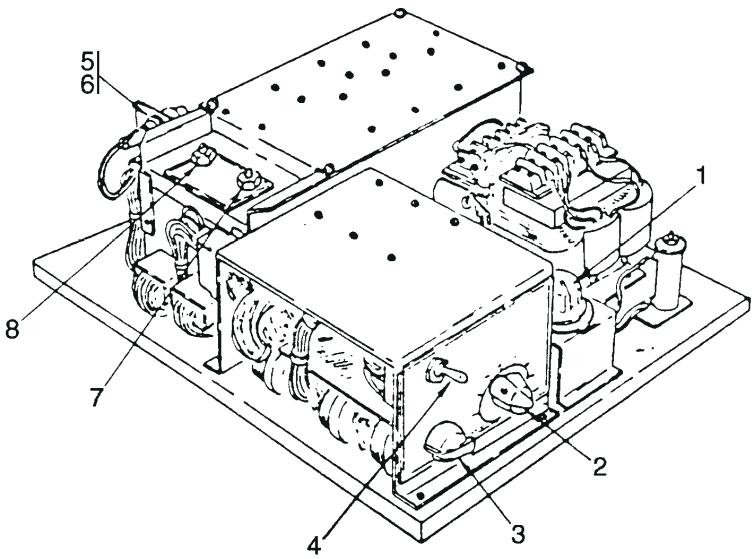
a. Loosen slider-band clamping screw.

b. Move the slider-band toward the single wire end of the resistor to increase voltage potential. Move the band towards the double wire end (two wires connected) to decrease voltage potential.

c. Tighten slider-band clamping screw.

(2) Adjust 400-Hz voltage regulator.

When a voltage regulator is first put into service, or when output (generator-to-aircraft) cables are changed, the regulator may require adjustment. Depending on specification, the voltage regulator may be either the magnetic-amplifier type voltage regulator (Part No. 430391C), shown in Figure 5, or the solid state voltage regulator (Part No. 489812A). Refer to Section 2-5 of this manual for regulator adjustment instructions.



1. Voltage adjusting rheostat
2. Cable length compensation rheostat
3. Cable size compensation rheostat
4. On-Off switch, line-drop compensation
5. Fuse (5-Amp)
6. Fuseholder
7. Damp (gain) adjusting potentiometer
8. Rate adjusting potentiometer

Voltage Regulator Adjustments

Figure 5

c. Basic Engine Adjustments

Specific information for this particular engine application is listed in Figure 6 Adjustment procedures applicable to the following items of the diesel engine are included in the Detroit Diesel Operator's Manual, which is located in Chapter 5.

(1) Exhaust valve adjustment.

(2) Exhaust valve bridge adjustment.

(3) Fuel injector timing adjustment.

(4) Idle speed, speed limiting and overspeed adjustment

Refer to speed limiting mechanical governor adjustment instructions with the Detriot Diesel Operator's Manual. Use instructions which apply to a single weight governor.

Recommended idle speed for this application is 875 to 925 RPM.

NOTE: A stroboscope is required for engine speed tests.

The limiting speed governor should be set at a speed just below the overspeed governor trip point, or approximately 2300 RPM. Refer to manufacturer's instructions in Chap. 5 for "Synchro-Srart" overspeed governor adjustment.

d. Engine Accessories Adjustment

(1) Generator and fan belt adjustment

Refer to 2-1; Para. 9 for belt adjustment instructions.

Engine

Type engine	4-cylinder, 2-cycle Diesel
Manufacturer	Detroit Diesel Corporation
Model	4-71N
Governed speed	2000 RPM ±4.5%
Idle speed	900 RPM ± 25 RPM
Overspeed governor trip point	2400 RPM
Limiting speed governor	2300 RPM
Firing order	1-3-4-2
Type of cylinder head	4 valve
Bore	4.25 inches *(108 mm)*
Stroke	5.00 inches *(127 mm)*
Displacement	284 cu. in. *(4640.5 cc)*
Compression ratio *(nominal)*	18.71:1
Horsepower at 2000 RPM	148
Electrical system	12 volt DC
Oil capacity *(with filter)*	17 quarts *(16 liters)*
Oil capacity *(without filter)*	15 quarts *(14.2 liters)*
Coolant capacity *(approx.)*	9-1/2 gallons *(36 liters)*

Engine Specifications

Figure 6

NOTE: Replace fan belts with a matched set.

e. Electric Governor System Adjustment

Two electric governor system main components, namely the magnetic pickup, and control box, have critical adjustments which can affect engine performance and generator output. Actuator-to-fuel control lever adjustment can also affect engine performance. When the complete system is to be checked, and /or adjusted, a definite sequence of procedures should be followed:

First - Check or adjust actuator linkage.
Second - Check or adjust magnetic pickup.
Third - Check or adjust electric governor controller.

(1) Actuator linkage adjustment

The proper adjustment of the mechanical linkage between the electric actuator and engine speed control lever is important to the satisfactory operation of the complete system. In making the adjustment, make certain that the following rules are observed:

* Adjust linkage to use the FULL TRAVEL of actuator lever (3).

* Linkage must move speed control lever (7) from FULL IDLE to FULL SPEED position, to allow engine to pull 125% load.

With engine stopped, refer to Figure 7 and adjust linkage as follows:

a. Place the ball joint that attaches to the actuator lever (3) in the FOURTH hole from the mounted end of this lever, and place the ball joint that attaches to the fuel control lever (7) in the LAST hole (the hole nearest the mounted end of the lever).

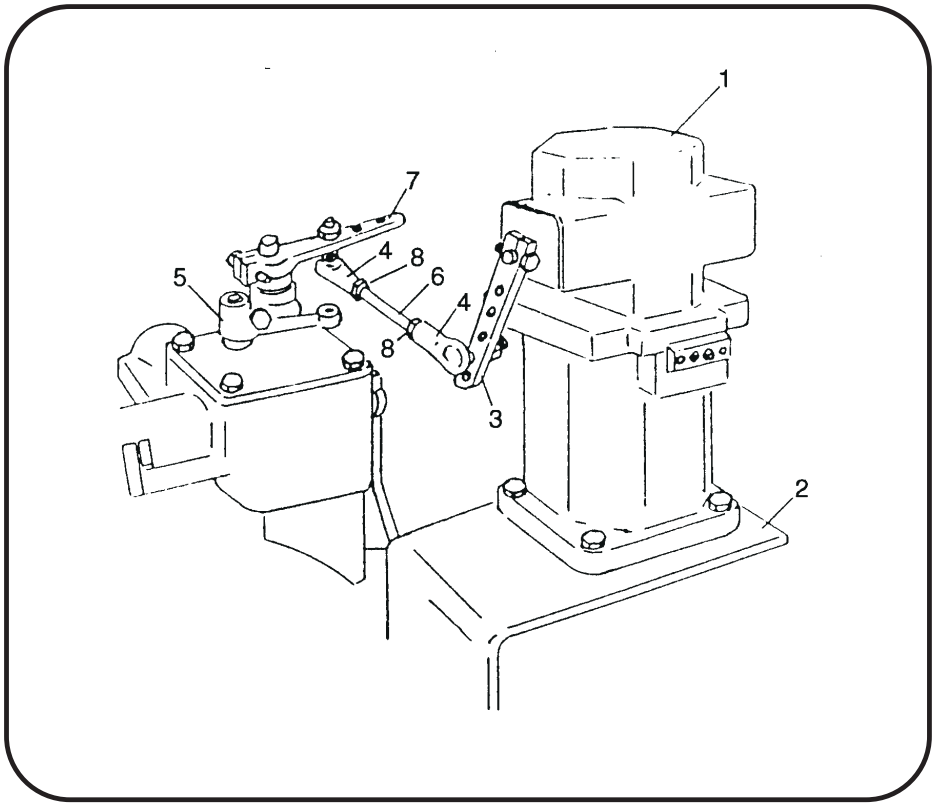
b. Disconnect ball joint (4) from actuator lever (3), and make sure that the levers (3 and 7) have not slipped on shafts. If a lever has slipped, position it correctly and tighten it securely.

c. Place both levers (3 and 7) in FULL IDLE position and attempt to connect ball joint (4) at hole in actuator lever (3) from which it was removed in step (a). If connection cannot be made, loosen nuts, (8) and adjust effective length of rod assembly so that connection may be made.

NOTE: When this adjustment is properly made, the effective length of the rod assembly (items 4, 6, and 8, Fig. 7), - measured between ball joint centers - is generally 6-3/16 inches +/- 1/8 inch (See Fig. 8). When this adjustment is made properly, an angle of approximately 60 degrees is formed between the engine speed control lever (7) and the side of the engine block at idle.

d. Manually operate actuator lever (3) back and forth between FULL IDLE and FULL SPEED positions. With the actuator lever being moved approximately its entire range of travel, speed control lever (7) should move freely through its entire range between FULL IDLE and FULL SPEED. If adjustment is unsatisfactory, try another hole mounting in ACTUATOR lever and readjust rod length.

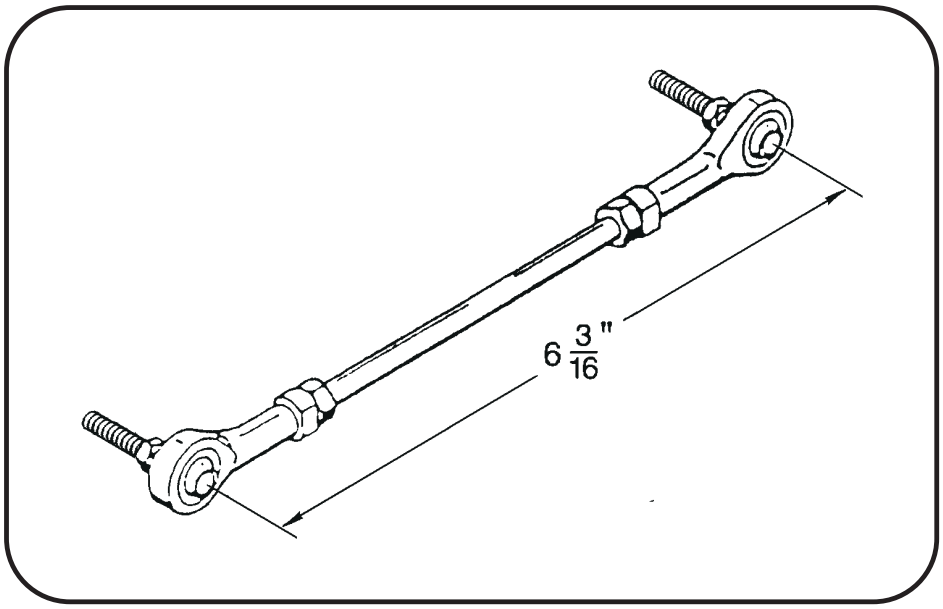
e. Tighten all parts securely when adjustment is completed.



1. Actuator
2. Mounting bracket
3. Actuator lever
4. Ball joint
5. Fuel shut-off lever
6. Rod
7. Engine speed control lever
8. Nut

Actuator Linkage

Figure 7



Length Adjustment of Linkage Rod Assembly

Figure 8

(2) Magnetic pickup adjustment

The strength of the magnetic pickup signal to the control box can be weakened if the tip of the pickup is too far from the flywheel ring gear. If the pickup is to be removed for any reason, or if the signal is weak, as indicated by test in Para. 3, E, (4), (b), refer to Fig. 9 and adjust as follows:

a. Wires from the magnetic pickup to the governor controller are contained in a shielded cable. Separate this shielded cable from other wiring by cutting the plastic wire ties binding it to the other wiring.

b. Disconnect the magnetic pickup at terminals 10 and 11 on the governor controller (Fig. 10).

c. Loosen nut (2) and remove magnetic pickup (1).

d. Inspect to make certain the tip is not damaged from contact with the ring gear teeth (replace pickup if damaged).

e. Rotate the engine as required to locate a ring gear tooth directly below the tapped, pickup mounting hole. An imaginary line should pass through the center of the mounting hole, the center of a flywheel tooth and the center of the flywheel.

f. Install the magnetic pickup and thread into the mounting hole until the tip touches the “in-line” flywheel gear tooth.

CAUTION

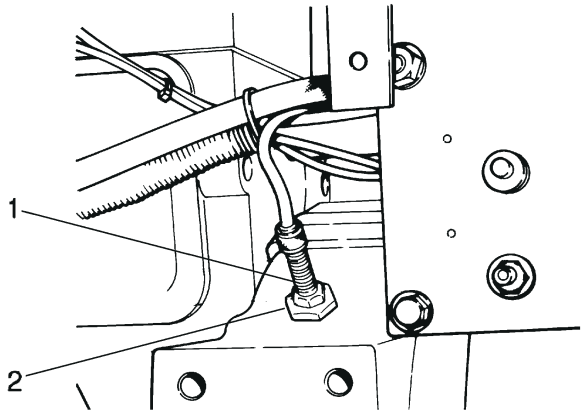
The pickup tip must be directly over a tooth and not between teeth when adjustment is made.

g. Back the pickup outward (counterclockwise) 1/2 turn. Hold the pickup securely in this position and tighten nut (3). this adjustment will result in a clearance of approximately 0.028 inch between the pickup tip and the flywheel teeth and give an operating AC voltage of 4-V to 10-V at control box terminals 10 and 11 when the engine is running at no load and governed speed.

NOTE: As little as 1-V is required for operation of governor control box. Magnetic pickup voltage does not have to be as much as 4-V to 10-V.

h. Tighten nut (2) to firmly attach magnetic pickup (1) to engine flywheel housing.

i. Reconnect terminals of magnetic pickup wires at the controller, and use plastic wire ties to bind the magnetic pickup shielded cable to the other wiring from which it was removed.



1. Magnetic pick-up
2. Nut

Magnetic Pickup

Figure 9

(3) Governor Controller Adjustment

Before making an adjustment to the controller (Fig. 10), make certain that linkage between actuator and fuel control lever (Fig. 8) is free and properly adjusted. There must be no lost motion or "play" in the linkage. Be sure magnetic pickup is producing a strong, normal output.

The controller has three identical control potentiometers: the GAIN potentiometer, the DROOP potentiometer, and the potentiometer marked "I". In addition, a SPEED control potentiometer is located just next to the GAIN potentiometer. Make controller settings as follows:

a. Preliminary Controller Settings

- With the engine of the generator set turned off, Set the "I" ADJUSTMENT one division mark from zero.
- Set GAIN adjustment at the third division mark from zero.
- Set DROOP adjustment COUNTERCLOCKWISE to minimum position as shown in Figure 11.
- Start the engine and adjust the controller's SPEED potentiometer until the engine is operating at rated speed (2000 RPM). Turning the adjustment CLOCKWISE increases engine RPM, and turning it COUNTER-CLOCKWISE decreases engine RPM.
- If the governor system is unstable, reduce slightly the "I" and GAIN settings.

b. Checking No-Load Operation of Controller

- Turn the GAIN adjustment CLOCKWISE until the actuator lever oscillates (a faster oscillation than was observed when the "I" adjustment was first made).
- Reduce the GAIN adjustment slowly COUNTERCLOCKWISE until the actuator lever is stable.
- Upset the lever by hand. If the lever oscillates in 3 to 5 diminishing oscillations and stops, the setting is correct.

c. Checking Operation of Controller Under Load

- Apply a load to the generator set, then remove the load and observe the length of time required for the engine speed to again stabilize. Engine speed should stabilize within 3 to 5 oscillations. If engine speed does not stabilize at the above setting, proceed as follows.
- With generator set operating at no load, reduce GAIN setting COUNTER CLOCKWISE one division mark and turn "I" adjustment fully CLOCKWISE while observing the actuator lever.
- If the lever does not become unstable, upset it by hand. When the lever slowly oscillates, turn the adjustment COUNTERCLOCKWISE slowly until the lever is stable.
- Upset the lever again. It should oscillate 3 to 5 times and then become stable for optimum response.

(4) Electric governor test values

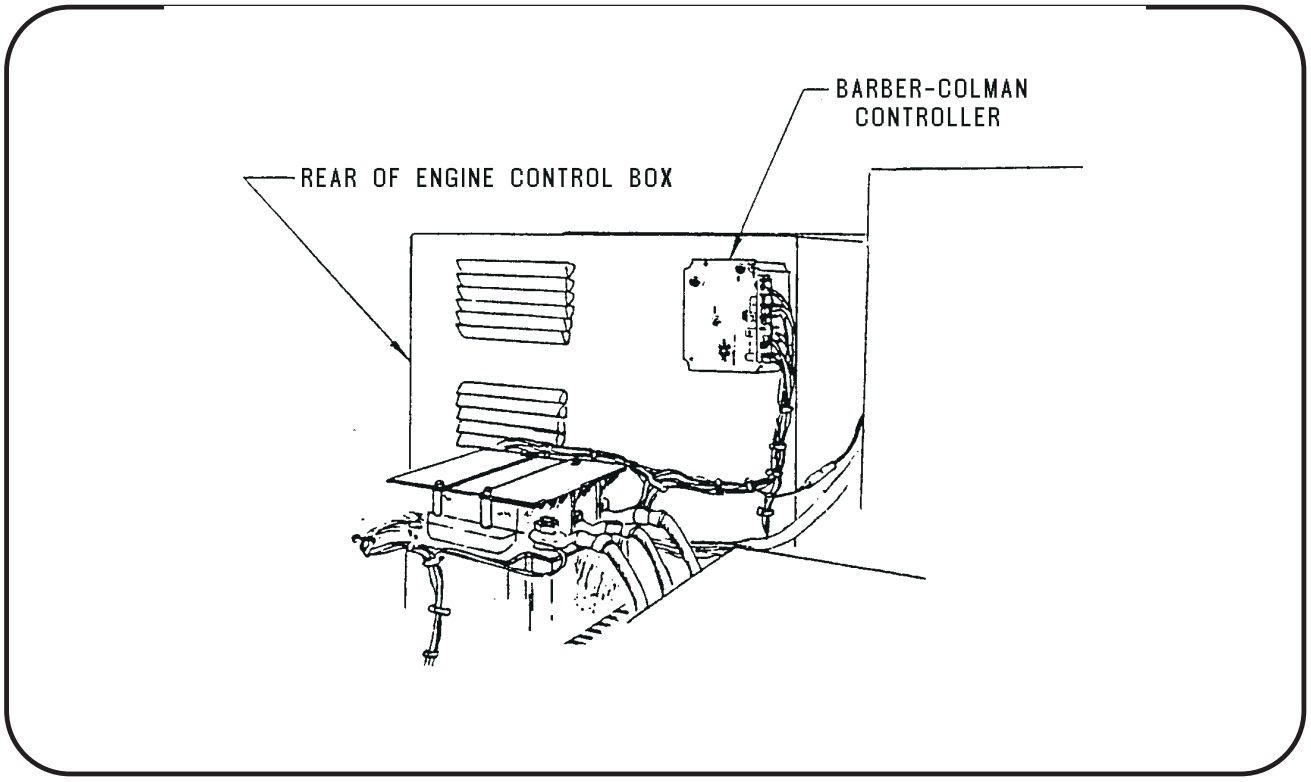
a. Signal to actuator

Refer to Figure 11. With the generator set operating at governed speed (2000 RPM, 400-Hz), check actuator signal voltage, measuring this voltage between terminals 4 and 5 on the control box terminal board. Voltage measured should be approximately 5.2-V DC at no load, and 5.8-V DC at full load.

b. Magnetic pickup signal

Connect a high impedance voltmeter to magnetic pickup input terminals (10 and 11) on control box terminal board. The voltage value at governed speed, no load should be 4-V AC MINIMUM to 10-V AC MAXIMUM.

NOTE: A signal as low as 1-V is sufficient to operate the control unit satisfactorily. If a condition exists wherein no voltage at all is measured, this indicates either that the magnetic pickup is too far from flywheel teeth or that it is defective.



Electric Governor Control Box Location

Figure 10

f. Engine Shut-Down Devices Adjustment

(1) Starter cut-out switch adjustment (see Fig. 2). Engine must be stopped.

a. Lift latch (7) to UNLATCH the shut-down mechanism.

b. Check clearance between switch actuating rod (12) and switch actuating bar (13). Actuating rod (12) must not touch bar (13) when the mechanism is UNLATCHED. Acceptable clearance may be 0.010 to 0.020 inch.

c. If adjustment is required, loosen nuts (11) and adjust to position switch (10) to get acceptable clearance. Tighten nuts securely. Reset mechanism by pressing lever (8) down.

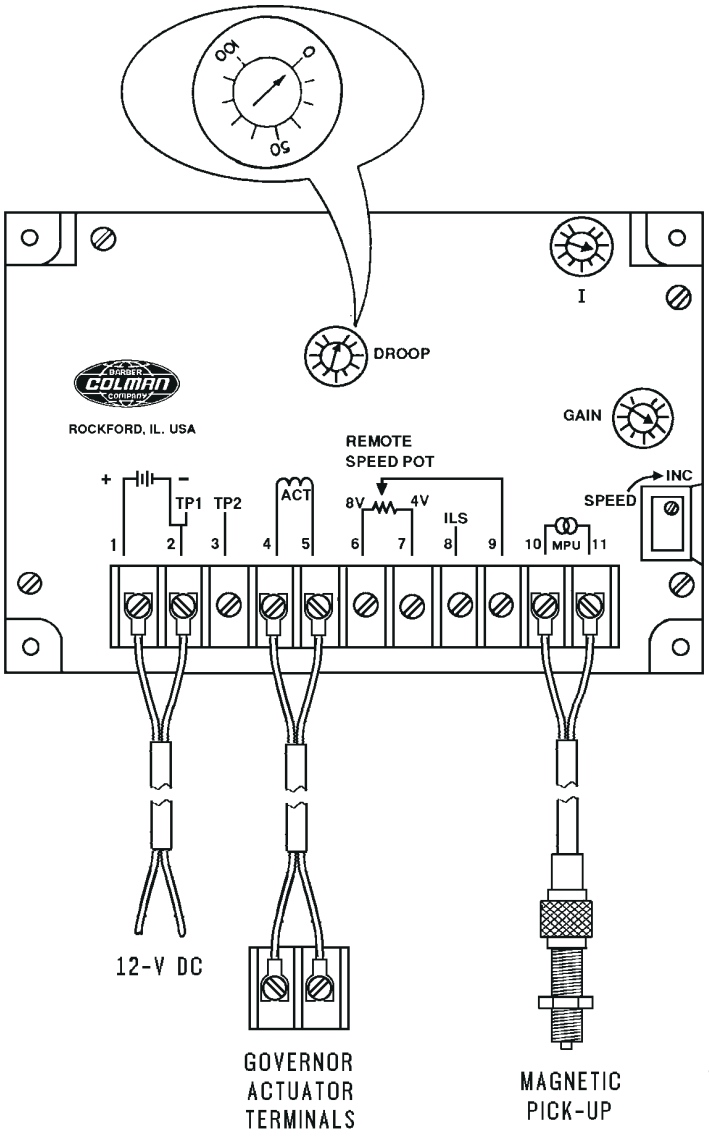
NOTE: Pushing the start switch should operate the starter when the shut-down linkage is latched. It should not operate the starter when linkage is UNLATCHED.

(2) Shut-down linkage adjustment

This linkage should require adjustment only if disassembled or if a shut-down solenoid is replaced. (See Figure 2). Engine must be stopped.

a. Adjustment is required if the latch (7) does not fully seat in cam notch (14) when the mechanism is in LATCHED position with air shutoff valve fully open, or if the solenoid plunger rod (15) is at the end of its downward travel and the air shut-off valve is fully open.

b. If adjustment is required, remove nut (5) and bar (13). Loosen nuts (4) and adjust so that the latch (7) is fully seated in the cam notch (14) when the solenoid plunger rod (15) is at the end of its downward travel and the air shut-off valve is fully open. Tighten nuts. (4).



Electric Governor Control Box

Figure 11

c. To check operation, momentarily apply 12-V DC to terminal (2). Plunger rod (15) must actuate mechanism to lift latch (7) out of notch in cam (14) and allow blower air-valve to close.

d. Install bar (13) and attach with nut (5).

e. Check adjustment of starter cut-off switch (10). Adjust in accordance with Para. 3, F, (1) if necessary

4. Generator and Exciter Test

The generator fields may be tested with a “Kelvin” bridge. This is a double bridge type instrument required for the very low resistances encountered in this test. Zero resistance indicates a SHORT CIRCUITED condition. An infinite resistance reading indicates an OPEN CIRCUITED condition. See Fig. 12 for resistance values.

NOTE: The equipment should be COLD or at normal ambient temperature when tests are made.

a. Disconnect generator stator leads at the power module panel.

b. Disconnect exciter leads from terminal board mounted on rear of engine control panel. Positive lead is RED. Negative lead is YELLOW-BLACK.

c. Check resistance and compare to values given in Fig. 12.

TEST CONNECTION	**NOMINAL RESISTANCE IN OHMS**
GENERATOR STATOR	
Phase A to N	0.008
Phase B to N	0.008
Phase C to N	0.008
NOTE: The two leads of a phase must be connected when test is made.	
EXCITER A-B, B-C, A-C	**0.1**
Field (RED to YELLOW-BLACK)	7.23
L1 Field	2.2 +/- 5%

Generator and Exciter Stator Test Values

(70F Ambient Temperature)
Figure 12

5. Diode Test

Test values for diodes are not given here because they could be misleading.

Test values may vary even between diodes of the same part number, rating, and manufacturer. General instructions for testing diodes follow:

(1) Disconnect diode lead(s).

CAUTION

The regulator output must never be grounded when the generator is turning.

(2) Use a good quality ohmmeter. An instrument which indicates 50 ohms at the center of the scale is preferable.

NOTE; Make certain the battery is in good condition and the pointer is adjusted to zero when the test lead points are shorted together. Set the scale selector to RX1.

(3) Hold one ohmmeter lead point on the threaded end of the diode. hold the other lead point on the wire terminal end. Observe the note and the indicated resistance. Now reverse the lead connections on the diode. Again observe and note the ohmmeter indicated resistance. Generally speaking, if an infinite or very high resistance was indicated with the leads connected one way and a low, readable resistance was indicated with the leads connected the opposite way, the diode may be considered good.

TEST BOX POINTER POSITON	TEST POINTS CONNECTOR TERMINALS	TEST DESCRIPTION	CONDITION	VOLTAGE
1	K-M	Phase “A” input for reg. and trays	Unit in “GEN” mode	115-V AC 400 HZ
2	K-P	Phase “B” input for reg.and trays	Unit in “GEN mode & auto-man sw. in ”AUTO"	115-V AC 400HZ
3	K-S	Phase “C” input for reg. and trays	Unit in “GEN mode & auto-man sw. in ”AUTO"	115-V AC 400HZ
4	K-A	Protective monitor fuse	Battery voltage	12-VDC
5	K-B	Fuse interlock relay	Test bank sw. Closed & contactor closed	12-V DC
6	H-S	Protective monitor contacts	Auto-man sw. in “AUTO position	115-V AC
7	K-Z	Plug interlock relay	Plug in aircraft	28-V DC
8	D-F	Exciter input	Unit in “GEN mode	8-12 VDC
9	V-X	Regulator output**	Unit in “GEN mode & auto-man sw.in ”AUTO"	50-70 V DC*
10	K-B	Contactor operation	Test bank sw. Closed & contactor closed	115-V AC
11	K-E	Overload contacts at less than 125% load	Test bank sw. Closed & contactor closed	O-V DC
12	K-R	Contactor switch	Test bank sw. closed & contactor sw. closed in “ON” position	115-V AC
13	K-N	Battery voltage and engine circuit fuse	All conditions	12-V DC
14	K-J	Shut-down solenoid	Engine running	O-V DC
15	K-G	Governor and EDR	Unit in “GEN” mode	12-V DC
16	U-W	Governor actuator	Unit at idle speed	O-V DC
			Unit in “GEN” mode, no load	2-4 V DC

*** For units with 20 ohm, 100 watt ballast resistors in protective relay tray.**
**** Caution: The regulator output must never be grounded when the generator is turning.**

Typical Test Values at Test Receptacle Connector or Test Box

Figure 13

Section 4. Troubleshooting

1. General

a. Troubleshooting is an orderly process of checking and eliminating possible causes of trouble until the exact cause is located. When looking for the cause of a trouble in a circuit or system begin at the source of power or supply. Continue testing and checking the circuit, or system, step-by-step, in an orderly manner, until the cause of trouble is located.

b. The chapter provides information for diagnosing and correcting certain troubles which cause unsatisfactory operation or failure of the equipment.

c. Minor troubles may be remedied by the operator, however, major repairs must be undertaken by experienced mechanics and electricians only.

2. Troubleshooting

a. Description

The troubleshooting chart lists information under three headings as follows:

(1) Trouble, Symptom, and Condition

(2) Probable cause

(3) Test, Check, and/or Remedy

b. Use of the Troubleshooting Chart

(1) A troubleshooting chart is furnished to provide maintenance and repair personnel with a time-saving guide for locating trouble. To use the chart, proceed as follows:

a. Locate the symptom(s) of trouble in the “Trouble” column.

b. Check the probable causes of trouble in the “Probable Cause” column.

c. Test, check, repair, or correct the trouble as indicated in the “Remedy” column.

(2) If the cause of a trouble is an uncommon one and cannot be located by use of the chart, start at the source of power or supply and check the affected circuit or system completely. Use schematic and connection diagrams supplied with this manual.

(3) Electrical components mentioned in the troubleshooting chart are identified by a noun name and a corresponding symbol which allows the user to identify the item more easily on schematic diagrams.

(4) It is assumed that wiring and connections in defective circuits have been thoroughly checked before condemning any other components.

NOTE: Reference symbols (S9, etc.), used in the Troubleshooting Chart, are identified on Schematic and Connections Diagrams.

3. Equipment for Troubleshooting

A good quality multi-scale volt-ohmmeter is the only instrument required for troubleshooting. At least two “jumper” leads with “alligator” clips and test prods will be required. The 12-V, engine electrical system may be used as a 12-V DC power source.

If a test box, part number 388318A -2, is available tests may be made more quickly and accurately, however, the test receptacle connector may be used by inserting the test points of a volt-ohmmeter into proper terminals of the connector. Refer to Fig. 8.

4. Safety

WARNING

Electric shock and moving parts can kill! Exercise extreme care to avoid contact with high voltage parts or leads and moving parts when trouble shooting or operating the equipment. Remove jewelry such as rings and watch.

5. Parts Replacement

To lessen end item “down” time and to get a faulty machine back “on-the-line” as quickly as possible, the “black-box” concept of parts replacement is reflected in the troubleshooting chart. For example, if a component in the protective relay tray is defective, the quickest way to remedy the situation is to replace the complete tray assembly and send the old tray for repair.

Assemblies which lend themselves to this concept are:

- Generator control tray
- Protective relay tray
- Voltage regulator
- Overload module
- Protective monitor module
- Electric governor control “box”
- Governor actuator
- Over-undervoltage module
- Over-underfrequency module

The above items are in addition to normally replaced items such as fuel pump, injectors, relays, etc.

6. Test Values

Although test values are provided, where applicable, throughout the troubleshooting chart additional information and values are given here.

- Generator output at maximum voltage regulator rheostat setting 134 V or higher
- Generator output at minimum voltage regulator rheostat setting 108 V or lower
- Overload relay trips at any value above 125% load in 5 minutes or less.
- Overload relay trips at 130 to 134 V AC, resets at 125 V AC.
- Undervoltage relay trips at 93 to 102 V AC, resets at 110 V AC.
- Undervoltage time delay circuit functions in 4 to 12 seconds.
- Overfrequency relay trips at 415 to 425 Hz, resets at 410 Hz.

- Underfrequency relay trips at 375 to 385 Hz, resets at 385 Hz.
- Overload relay trips at 125% rated load in 5 minutes.

See 2-3 Fig. 13 for typical test values at test receptacle and test box.

7. Check Connections and Leads

ALWAYS make a check of connections and leads to a component suspected of being faulty. With the exception of a few instances, we will assume that connections and wiring have always been checked first and that power has not been lost as a result of defective wiring or connections.

8. Electric Governor Trouble Shooting

The following facts concerning the operation of the electric governor may be helpful in understanding the system and in determining which unit in the system is faulty in case of troubles.

a. The system requires two sources of power to operate normally.

(1) 12-V DC input power (from engine electrical system)

(2) AC input power (from magnetic pickup)

b. Assuming other conditions are normal, the actuator will go to, or remain in, IDLE position under the following conditions.

(1) No 12-V DC power to control box.

(2) No voltage from control box to actuator.

(3) No signal from magnetic pickup.

c. The actuator will "surge" under the following conditions:

(1) "Stability" or "gain" adjustment set too "high".

(2) Throttle linkage binding.

9. Engine Trouble Shooting Procedures

a. General

The following engine troubleshooting procedures were taken from Detroit Diesel's "Field Service Data Book". Certain abnormal conditions which may interfere with satisfactory engine operation, together with methods of determining the cause of such conditions, are covered in the Trouble Shooting Chart.

The ability of the engine to start and operate properly depends primarily on two things:

(1) The presence of an adequate supply of air, compressed to a sufficiently high compression pressure.

(2) The injection of the proper amount of fuel at the right time.

Lack of power, even running, excessive vibration, stalling, and hard starting may be caused by low compression, faulty injection in one or more cylinders, faulty timing or valves, or lack of sufficient air.

Since proper compression, fuel injection, and the proper amount of air are important to good engine performance, procedures for checking them are given here.

b. Locating a Misfiring Cylinder

(1) Start engine and allow it to run until it reaches normal operating temperatures.

(2) Remove valve cover.

(3) Run engine at IDLE speed and check valve clearance.

(4) Hold the No. 1 injector follower down with a screwdriver, or with a special injector cut-out tool, thus preventing operation of the injector.

If the cylinder has been misfiring, there will be no noticeable difference in the sound and operation of the engine. If the cylinder has been firing properly there will be a noticeable difference in the sound and operation when the plunger is held down. This is similar to short-circuiting a spark plug in a gasoline engine.

(5) If cylinder No. 1 is firing properly, repeat the procedure on the other cylinders until the faulty one has been located.

(6) Providing that the injector operating mechanism of the faulty cylinder is functioning satisfactorily, remove the fuel injector and install a new injector.

c. Checking Compression Pressure

(1) Start engine and run until normal operating temperature is reached.

(2) With engine stopped, remove fuel pipes from the injector and fuel connectors of No. 1 cylinder.

(3) Remove the injector from No. 1 cylinder and install the proper adapter of the pressure gage (tool J6692) in its place.

(4) Use one of the two fuel pipes as a jumper connection between the fuel inlet and return manifold to permit fuel to flow directly to the return manifold. On some cylinder heads it is necessary to fabricate a jumper connection from a fuel pipe.

(5) Start the engine and run at idle speed.

CAUTION

Do not crank the engine with cranking (starting) motor to obtain compression pressure.

Record compression pressure indicated.

NOTE: A guide to minimum compression pressures to be expected is included in Sect. 2-3, Fig. 6.

(6) Remove pressure gage, install injector, and reinstall fuel lines.

(7) Repeat steps (2) through (6) for each cylinder.

d. Interpretation of Compression Pressure Records

Compression pressure in any one cylinder should not be less than specified in Sect. 2-3, Fig. 6. Variation in compression pressures between cylinders must not exceed 25 PSI. A low compression pressure in one cylinder indicates that something unusual has occurred and that a pressure leak has developed.

e. Causes of Low Cylinder Pressure

Low cylinder pressures may result from any one of several causes:

(1) Piston rings may be stuck or broken. To determine the condition of the rings, remove the air box cover and press on the compression rings with a blunt tool. A broken or stuck ring will not have a spring-like action.

(2) Compression pressure may be leaking past the cylinder head gasket, valves and valve seals, injector tube, or through a hole in the piston or combustion chamber.

To correct any of these conditions, consult your Detroit Diesel Service Outlet.

f. Fuel Flow Test (see Fig. 7)

Check fuel pump and fuel flow as follows:

(1) Disconnect the fuel return tube at, or near, the tank. Hold the open end in a convenient container of over 1-gallon capacity.

(2) Start and run the engine at governed speed 2000 RPM. Measure the fuel flow from the return tube for 1 minute. Flow should be 0.8 gallon (based on 0.080 restriction). If fuel flow is below this amount, it indicates that the fuel strainer, fuel filter or fuel pump requires servicing or repair.

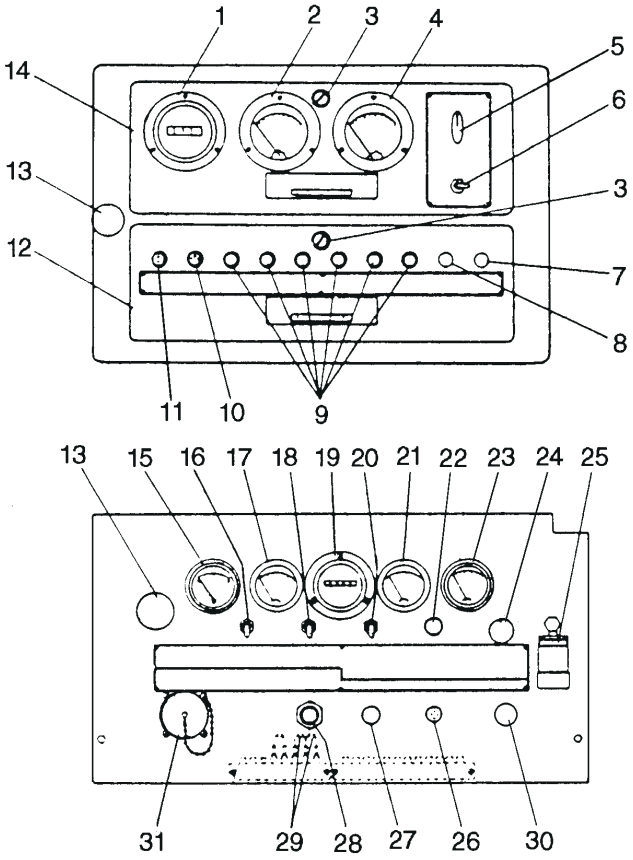
(3) To check suction side of the pump, immerse the end of the return tube in a container of fuel. If air bubbles rise to the surface of the fuel, it indicates that air is being drawn into the fuel system on the suction side of the pump. If air is present, tighten all fuel connections between the fuel tank and the fuel pump. Check for defective tubes, hoses, etc.

10. Illustrations

Illustrations, Figures 1 through 8, are referred to throughout the Trouble Shooting Chart

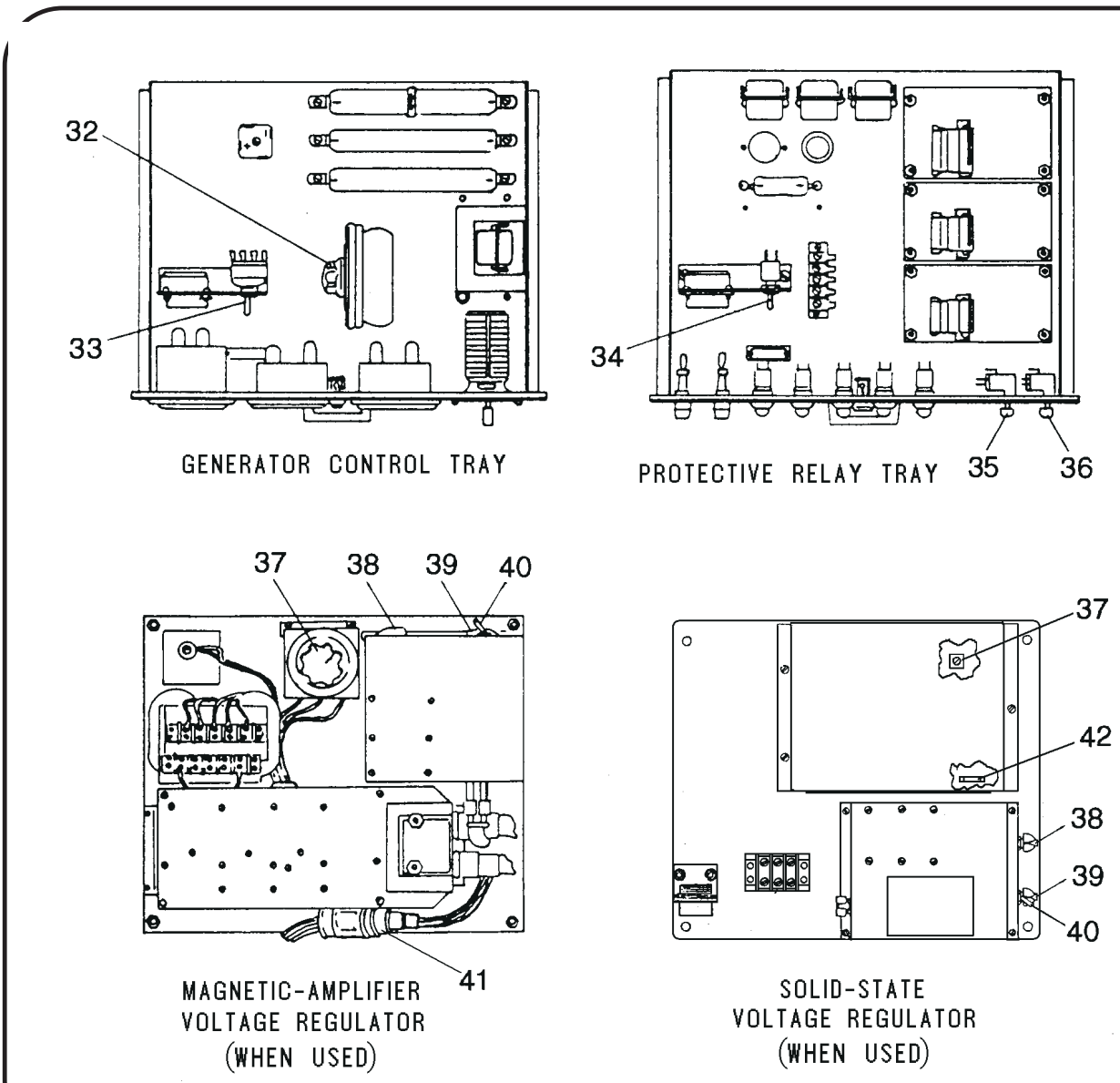
11. Troubleshooting Chart

The troubleshooting chart is provided on pages 13 through 27.



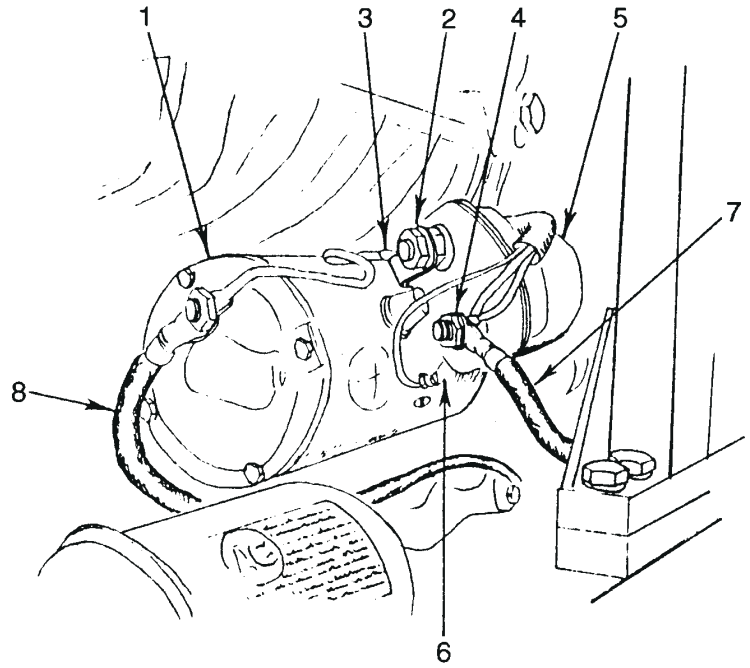
1. Frequency Meter
2. Voltmeter
3. Fastener
4. AC Ammeter
5. Meter Switch
6. Line Switch
7. Reset Switch
8. Light Test Switch
9. Fault Indicating Lights
10. Load Contactor Circuit Fuse (2A)
11. Protective System Fuse (5A)
12. Protective Relay Tray
13. Instrument Panel Light
14. Generator Control Tray
15. Fuel gage
17. DC Ammeter
18. Mode Switch
19. Hourmeter
20. Load Contactor Control Switch
21. Coolant Temperature Gage
22. Load Contactor Indicating Light
23. Oil Pressure Gage
24. Hole plug
25. Air Cleaner Indicator
26. Engine Circuit Fuse (10-A)
27. Engine Protective Circuit Indicating Light
28. Engine Starter Switch
29. Blocking Diodes
30. Engine Stop Control
31. Test Receptacle Connector

Operating Controls and Instruments
Figure 1 (Sheet 1 of 2)



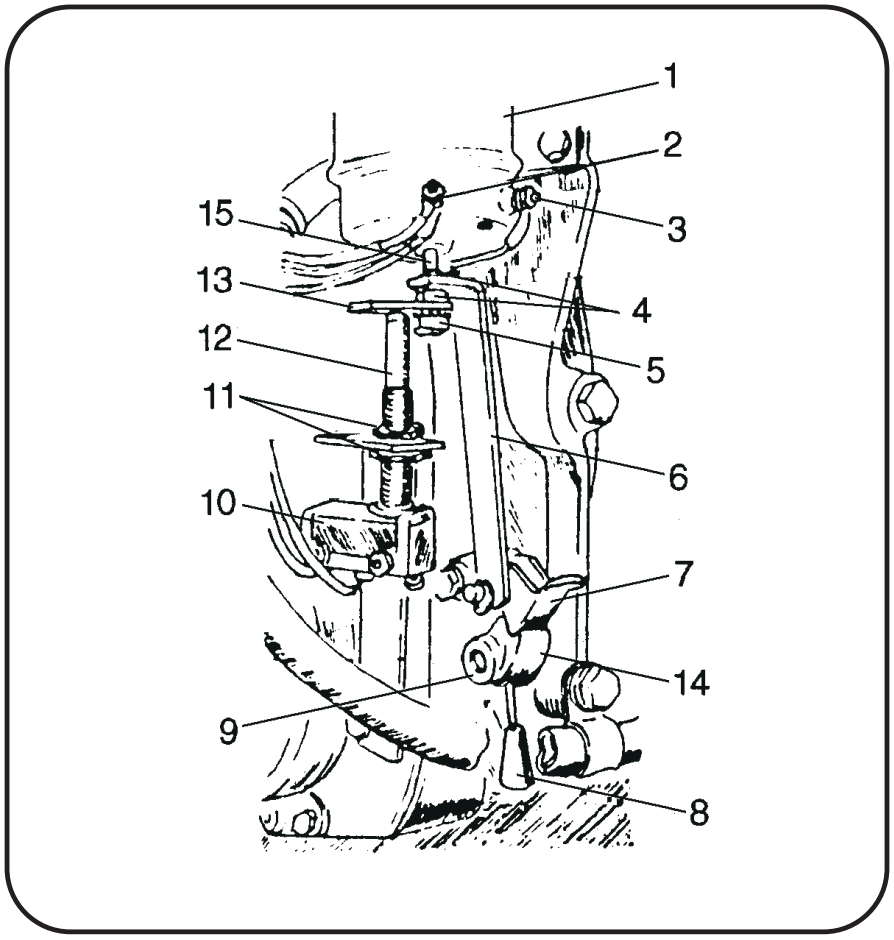
32. Manual Voltage Control Rheostat
33. Automatic-manual Voltage Control Switch
34. Test Bank Switch
35. Light Test Switch
36. Reset Switch
38. Cable Length Compensation Rheostat
39. Cable Size Compensation Rheostat
40. Line-Drop Compensation On-Off Switch
41. Fuse (5-A)
42. Fuse (10-A)

Operating Controls and Instruments
Figure 1 (Sheet 2 of 2)



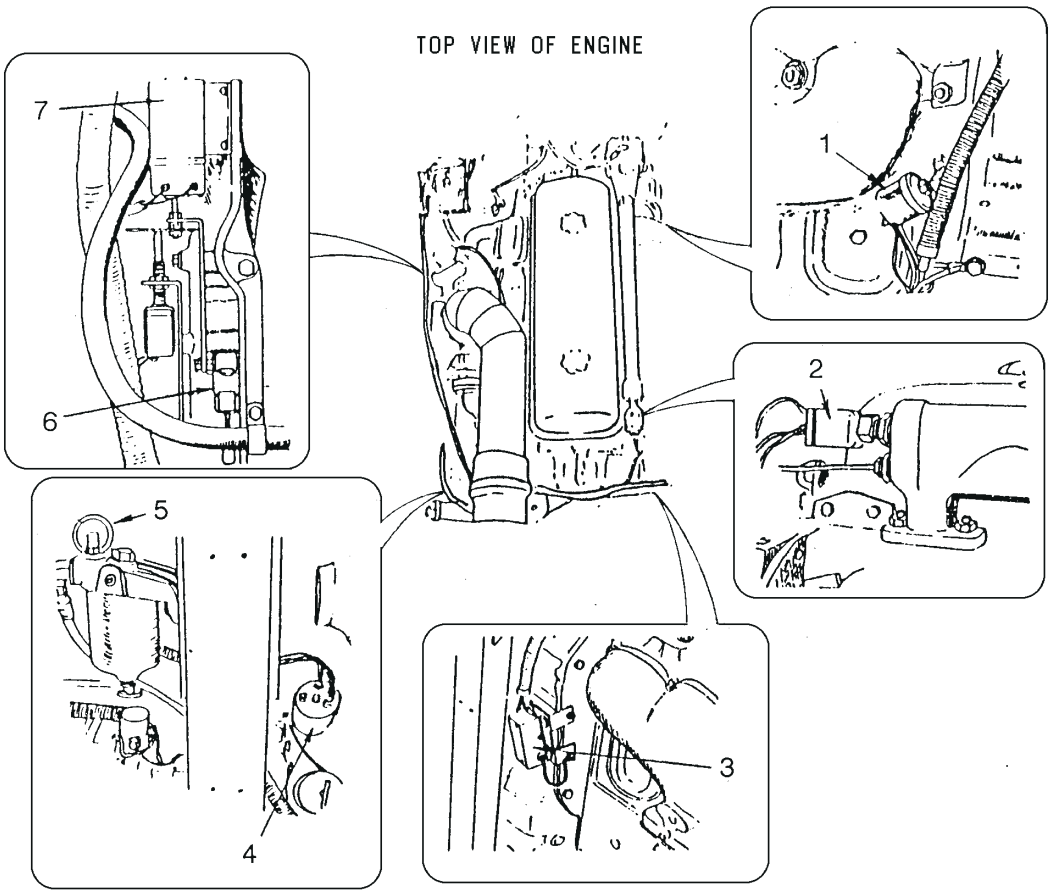
1. Starter
2. Starter solenoid switch to starter terminal
3. Solenoid coil ground terminal
4. Solenoid switch input terminal
5. Starter solenoid switch
6. Solenoid coil terminal
7. Battery cable
8. Starter ground cable

Starter and Solenoid Switch
Figure 2



1. Shut-down solenoid
2. Solenoid terminal (input)
3. Solenoid terminal (ground)
4. Latch arm adjusting nuts
5. Switch bar attaching nut
6. Latch actuating arm
7. Latch
8. Latch reset lever
9. Air shut-off valve shaft
10. Switch
11. Switch adjusting nuts
12. Switch actuating rod
13. Switch actuating bar
14. Latch cam
15. Solenoid plunger rod

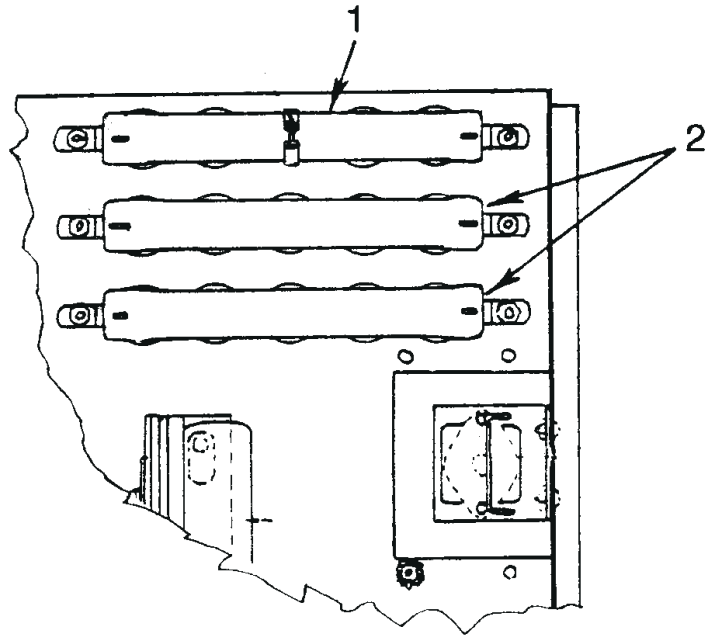
Shut-down Solenoid with Linkage and Starter Cut-out Switch
Figure 3



1. Low-oil-pressure switch
2. High temperature switch
3. “Hot wire” shut-down relay
4. Overspeed governor
5. Fuel pressure switch
6. Air shut-off valve latch
7. Shut-down solenoid

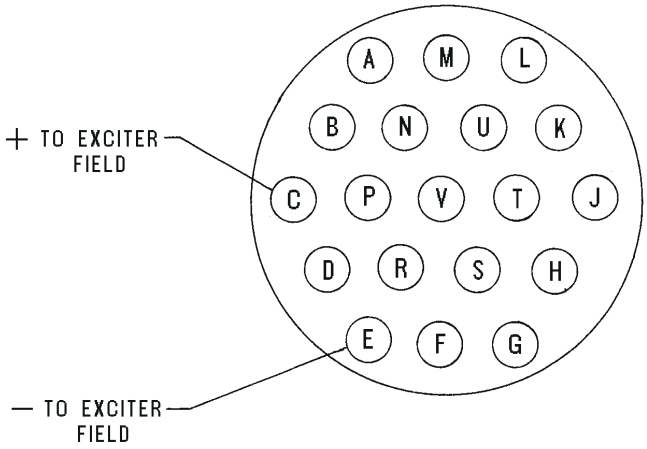
	Switch Contact Positions		
Switch	**Engine Stopped**	**Engine Running**	**Under Fault Condition**
1	Closed	Open	Closed
2	Open	Open	Closed
3	Open	Open	Closed
4	Open	Open	Closed
5	Open	Closed	Cpen

Engine Shut-Down and Safety Devices
Figure 4

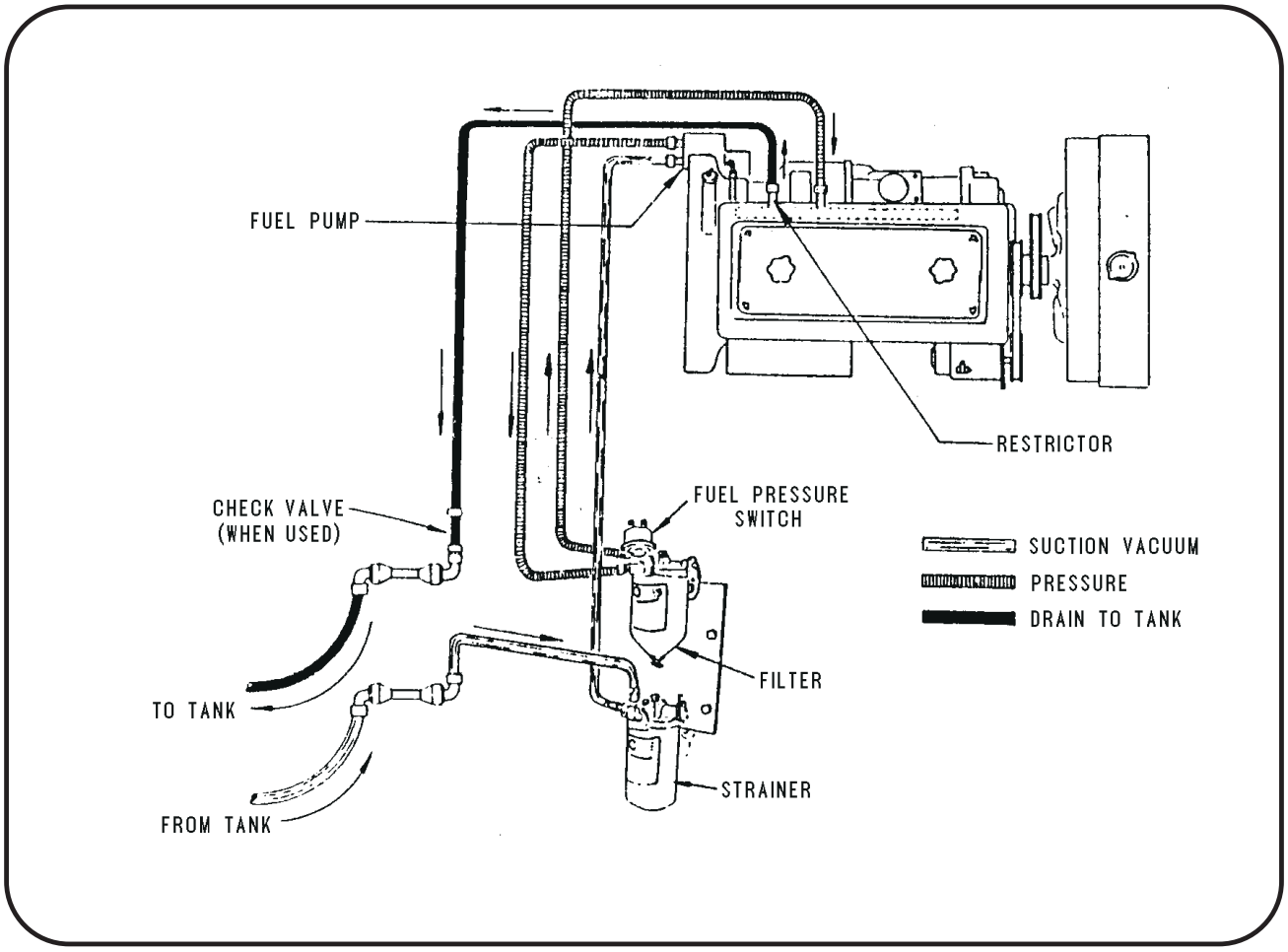


1. Manual control voltage potential adjusting resistor
2. Exciter field ballast resistors

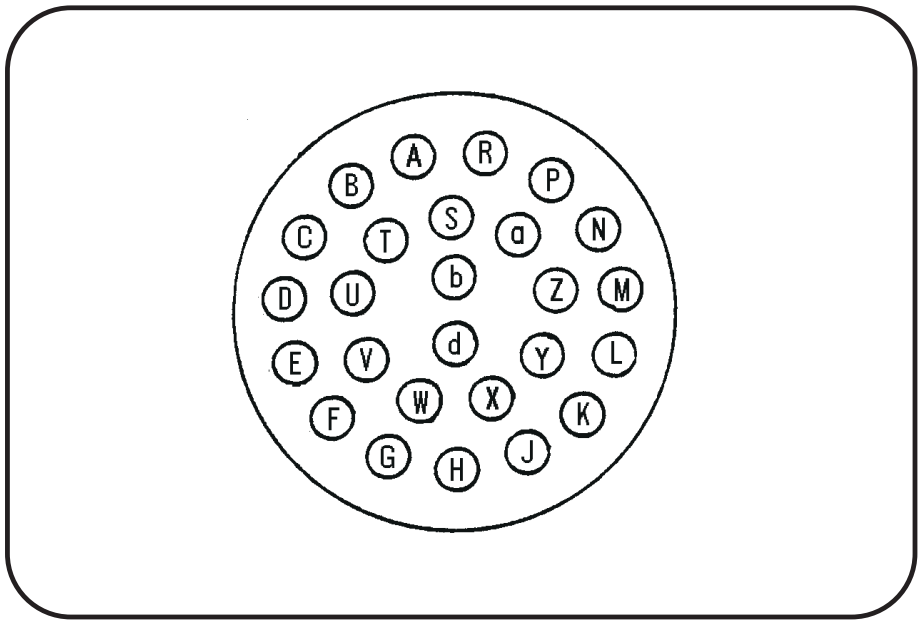
Excitation Resistors
Figure 5



End View of Voltage Regulator Amphenol Connector
Figure 6



Fuel Flow Schematic (Typical)
Figure 7



Test ReceptacleConnector Terminals Identification
Figure 8

Engine and Controls

Trouble, Symptom & Condition	Test or Inspection	Corrective Action
1. Engine will not start. Starter will not crank engine.	**a.** Battery or batteries discharged or faulty.	Check battery voltage and specific gravity. Recharge or replace.
		12-V DC power not reaching starter solenoid. Check voltage at starter solenoid input terminal (4, Fig. 2). Voltage should be approximately 13.5 V. If no voltage, check cables and connections between starter solenoid and power source. Replace or repair cables and connectors as required.
	b. Batteries or starter not properly grounded.	Check cable and all connections.
	c. Air shut-off valve unlatched and holding starter cut-out switch open (see Fig. 3).	Latch air shut-off valve by pushing latch lever (8, Fig. 3) down. If valve will not latch, check for tripped overspeed governor.
	d. Starter cut-out switch improperly adjusted, or defective.	Adjust in accordance with Sect. 2-3, Para.34, F, (1), or replace switch.
	e. Defective start switch (S24) or defective auxiliary solenoid (L10).	Check voltage at terminal (6, Fig. 2) while operating start switch (28, Fig. 1). If no voltage is indicated, replace switch (S24) or solenoid switch (L10) as required.
	f. Defective starter solenoid, or starter.	Momentarily connect a large size starter cable between terminals 2 and 4, Fig. 2. If the starter cranks the engine, the solenoid (5, Fig. 2) is defective. If the starter does not crank the engine, the starter (1) is defective. In either case, replace starter and solenoid as an assembly.

Engine and Controls (cont.)

	Trouble, Symptom & Condition	Test or Inspection	Corrective Action
	Engine will not start. Starter will not crank engine (continued).	**g.** Internal seizure	If all engine starting components are good and the starter is unable to crank the engine, internal seizure is indicated. Attempt to hand-crank the engine, using a socket wrench with long flex handle on the crank shaft pulley screw. If the engine cannot be turned a complete revolution, remove engine and disassemble to find damage and cause.
2.	Engine will not start. Cranking speed low.	**a.** Low battery output or faulty starter.	Check battery and starter. Recharge, repair, or replace.
		b. Loose starting circuit connections or faulty cables.	Check all connections and cables. Tighten or replace as required.
		c. Improper lubricating oil viscosity.	Check oil. See Sect. 2-1, Para. 3, D, (3).
3.	Engine will not start. Cranking speed normal.	**a.** No fuel.	Before attempting to find the cause of “no fuel”, prime the fuel filters by removing pipe plug in the cover of each. Fill each filter with fuel oil. If the engine will not start after priming, mechanical pump trouble is indicated. If the engine starts and then stops after a short time, trouble between the fuel source and the suction side of the pump is indicated. Check and/or remedy as follows (see Fig. 7).
		b. Low compression which may be caused by any of the following:	Check compression in accordance with Para. 9, C and D.
		c. Sticking or burned exhaust valves .	Cylinder head must be removed and overhauled to correct this condition.
		d. Compression rings worn or broken.	Check rings in accordance with Para. 9, E, (1).
		e. Cylinder head gasket leaking.	Check gasket in accordance with Para. 9, E, (2).

Engine and Controls (cont).

	Trouble, Symptom & Condition	Test or Inspection	Corrective Action
	Engine will not start. Cranking speed normal. (cont.)	**f.** Improper valve clearance adjustment.	Check and adjust valve clearance in accordance with instructions in Detriot Diesel Operator's Manual.
		g. Blower not functioning.	Inspect blower drive shaft and drive coupling. Replace parts as required.
4.	Engine starts. Stops after a few seconds by automatic shut-down.	**a.** The shut-down circuit may have functioned normally to stop the engine because of low lubricating oil pressure.	Reset shut-down valve latch (7, Fig. 3). Start the engine and observe oil pressure gage. if pressure is less than 12 PSI, stop engine at once and check for cause of low pressure. Repair as required..
		b. Defective low oil pressure switch (1, Fig. 4).	Reset shut-down valve latch (7, Fig. 3). Disconnect ORANGE wire at low oil pressure switch. Start engine. Observe oil pressure. If pressure is 38 PSI, or more, check voltage from oil pressure switch terminal (one which had ORANGE wire removed) to ground. If approximately 12-V DC is indicated, the oil pressure switch is defective. Stop engine and replace switch (1, Fig. 4).
		c. Defective or incorrectly wired high temperature switch (2, Fig. 4)	Check wiring to high temperature switch. Two yellow-blue wires should be connected to N.O. terminal. Yellow wire should be connected to C terminal. Check resistance between terminals N. O. and C with wires removed. Infinite resistance indicates a good temperature switch. A readable resistance indicates a defective switch. Replace switch.
5.	Engine runs at idle speed. Engine "ON" indicating light (27, Fig. 1) does not glow.	**a.** Lamp defective.	Replace lamp.
		b. Indicating light body poorly grounded.	Be sure light is grounded properly.
		c. Defective fuel pressure switch (5, Fig. 4).	Check switch. Replace if defective.

Engine and Controls(cont.)

Trouble, Symptom & Condition	Test or Inspection	Corrective Action
6. Engine will not come “up” to governed speed in GEN mode.	**a.** 12-V DC power not reaching governor control box for following reasons:	Apply 12-V DC directly to terminal “1" on governor control box. If engine comes-up to speed, check following:
	b. Engine circuit fuse (26, Fig. 1) is blown.	Replace fuse (10 Amp).
	c. Oil pressure switch (S53) (located behind oil gage) is defective.	Check switch and replace if defective.
	d. Defective operating mode switch (18, Fig. 1)	Check switch. Replace if defective.
	e. Governor linkage binding or governor throttle sticking.	Check governor linkage and throttle shaft for binding and sticking. Repair as required.
	f. Defective or mis-adjusted magnetic pickup.	The control unit may not be receiving a signal from the magnetic pickup and the “fail -safe” feature of the unit may be functioning to prevent any signal from reaching the actuator. To check the mag-netic pick-up, disconnect pickup from control unit and connect a high impedance AC voltmeter to the pickup output leads. Crank engine but don’t start. Voltage reading should be a minimum of (1) volt. If no voltage or low voltage is indicated, check pickup adjustment [See 2-3, Para. 4, E, (2)]. If pickup is properly adjusted and voltage is still zero, replace pickup.
	g. Defective actuator.	Apply 12-V DC to the two actuator input leads. Actuator lever should move immediately to full speed position. If lever does not move, replace actuator

Engine and Controls (cont.)

	Trouble, Symptom & Condition	Test or Inspection	Corrective Action
	Engine will not come “up” to governed speed in GEN mode. (Continued)	**h.** Defective control unit.	Connect a DC voltmeter to the leads from the control unit to the actuator. Start the engine and manually control speed. At speeds below governed speed the voltmeter should indicate within two (2) volts of the system voltage. If voltage is at or near zero, turn speed adjusting screw several turns clockwise to be sure speed setting is not too low because of tampering. If voltage remains low or at zero, replace control unit. Refer to the Barber-Coleman Handbook for control unit bench tests and adjustments.
7.	Engine goes to overspeed when control switch (18, Fig. 1) is in GEN position.	**a.** Governed speed control adjustment set too high (see 2-3, Fig. 11).	Turn speed control adjusting screw 22 turns counterclockwise. Start engine. Place control switch (18, Fig. 1) in GEN position. If engine speed is now well below governed speed, turn adjusting screw clockwise until correct speed (2000 RPM, 400 Hz) is reached. If engine still goes to overspeed, proceed to step B.
		b. Defective linkage or actuator.	Check governor linkage and actuator for sticking or binding in full-speed position. Repair as required.
		c. Defective control unit.	Replace control unit. Check unit in accordance with Barber-Colman operating instructions.
8.	Engine is unsteady (surges) under load.	**a.** Fault in engine.	Before condemning the governor system for surging, make certain the fault is not in the engine. Make certain all cylinders are firing properly and air and fuel supply is proper.
		b. Governor system faulty or mis-adjusted.	Check and adjust as follows:

Engine and Controls (cont.)

Trouble, Symptom & Condition	Test or Inspection	Corrective Action
	d. Loose or binding governor linkage.	Check linkage ball joints and all connections for looseness or binding. Be sure linkage will move from idle speed to full speed without lost motion or binding.
	e. GAIN and STABILITY controls improperly adjusted.	Adjust GAIN and STABILITY controls on control unit in accordance with 2-3; Para. 4, E, (3).
	f. Magnetic pickup signal weak.	Check and adjust pickup. See 2-3, Para. 3, E, (2).
9. Engine has slow response time.	**a.** Governor control unit improperly adjusted.	Adjust. See 2-3; Para. 3, E, (3).
	b. Actuator linkage binding.	Inspect and repair as required.
	c. Engine needs tune-up.	Tune up as required. Refer to Detroit Diesel Operator's Manual.
10. Engine "misses". Runs unevenly.	**a.** Insufficient fuel.	Check fuel flow in accordance with Para. 9, F. Repair or replace parts as required. Also see ENGINE, Trouble 3.
	b. Faulty injector.	Check injectors in accordance with Para. 9, B.
	c. Low compression pressure.	Check compression in accordance with Para. 9, C. See causes of low compression listed under ENGINE, Trouble 3, B, above.
11. Engine lacks power.	**a.** Improper engine adjustment and gear train timing.	"Tune-up" the engine in accordance with Detroit Diesel Operator's Manual.
	b. Insufficient fuel.	See ENGINE, Trouble 3.
	c. Insufficient inlet air.	Check as follows:
	d. Damaged air cleaner.	Check air cleaner for "plugging" and/or other damage.
	e. Defective blower to-cylinder block gasket	Replace the gasket if necessary. If the blower is removed, install a new gasket.
	f. Plugged cylinder liner ports.	Clean ports if they are over 50% obstructed.
	g. Faulty air blower.	Repair or replace.
	h. Worn Engine.	See engine overhaul instructions in engine manual.

Generator and Excitation Circuit

Trouble, Symptom & Condition	Test or Inspection	Corrective Action
1. No (or low) generator output voltage in all phases. Generator operating at 400 Hz in AUTOMATIC mode.	**a.** Defective generator or excitation circuit.	The first check is an easy one which will allow the mechanic to reach some definite conclusions about where the trouble is. Place the AUTO-MAN switch (33, Fig. 1) in MANUAL position. If a normal voltage (for the rheostat setting) is now produced, the generator is good, and the trouble is in the voltage regulator circuit. Proceed to step C. If switching to MANUAL control did not affect generator output, the trouble is likely in the generator, but to prove the generator is defective, proceed to step B.
	b. Defective generator. **CAUTION: DO NOT** use battery on unit to flash field with generator turning voltage regulator. Damage results from the introduced ground	Use the test receptacle (31, Fig.. 1) to connect ungrounded 12-V DC to the exciter field. Using leads with alligator clips and test prods, connect 12-V DC NEGATIVE lead to terminal “D”. Terminal identifying letters are plainly visible on the face of the test receptacle. Connect POSITIVE lead to terminal “F”. If no output voltage change is indicated when the exciter field is energized, the generator is defective. Stop operations and see 2-3, Para. 4 for further generator testing. If the generator produces approximately 140-V AC when the exciter field is energized, the trouble is in the voltage regulator-excitation circuit. Proceed to step C.
	c. Defect in VOLTAGE REG. excitation circuit.	Check as follows:
	d. Defective AUTO-MANUAL switch (33, Fig. 1)	Check the switch thoroughly. A defective switch may prevent current reaching and/or leaving the voltage regulator. Replace switch if defective.
	e. Defective excitation deenergization relay (K16) (1-1; 3, Fig. 8).	Check EDR contacts. A faulty EDR can prevent power from reaching the voltage regulator. Replace relay if defective.

Generator and Excitation Circuit (cont.)

Trouble, Symptom & Condition	Test or Inspection	Corrective Action
No (or low) generator output voltage in all phases. Generator operating at 400 Hz in AUTOMATIC mode. (Continued)	**f.** Defective ballast resistor(s), (See Fig. 5).	If output voltage was produced when the generator set was operated in MANUAL mode, the resistors are good. If no voltage was produced in MANUAL mode, resistors could be defective. Refer to Fig. 5 and connect a jumper lead across the ballast resistors. If an output voltage is now produced, replace resistor(s) as required.
	g. Defective Amphenol connector at voltage regulator, or defective wiring from regulator to exciter field.	Disconnect voltage regulator Amphenol connector (see 1-1; Fig. 12). Using jumper leads with clip and prod terminals, connect ungrounded 12-V DC to terminals “E” and “C” in loose plug. Connect NEGATIVE to terminal “E”. Connect POSITIVE lead to “C” terminal (See Fig. 6). If the generator will NOT produce a normal voltage, replace or repair Amphenol connector and wiring between voltage regulator and exciter field as required.
	h. Defective voltage regulator.	All components in the excitation circuit except the voltage regulator have been tested in steps (1) through (4) above. This leaves only the regulator as a cause of trouble. Replace complete voltage regulator if the magnetic amplifier regulator 430391C is used. If solid state amplifier 489812A is used, replace PC board.

Generator and Excitation Circuit

Trouble, Symptom & Condition	Test or Inspection	Corrective Action
2. No (or low) output voltage when operating in MANUAL mode.	**a.** Defective generator manual control excitation circuit.	Place AUTO-MANUAL control switch (33, Fig. 1) in AUTO position. If a normal voltage is NOT produced, perform checks as instructed in GENERATOR AND EXCITATION CIRCUIT TROUBLE 1, above. If a normal voltage is produced, proceed to step “B” below
	b. Defect in manual voltage control portion of excitation circuit.	Check as follows:
	c. Defective AUTO-MANUAL switch (33, Fig. 1).	Check contacts and operation of AUTO- MANUAL switch. Replace if defective.
	d. Defective rectifier (CR3) (Sect. 1-1; 14, Fig. 8).	Check diodes (see 2-3, Para.. 6). Replace rectifier if defective.
	e. Defective resistor (R11) (See 1, Fig. 5).	Jumper resistor (1, Fig. 5). If normal voltage (depending on rheostat) is produced, replace resistor.
	f. Defective rheostat (R61) (32, Fig. 1)	Connect a jumper across rheostat. If maximum (manual control) voltage is produced, replace rheostat.
3. Load contactor (K1) will not close when control switch (20, Fig. 1 is held in CLOSE position. Generator running at normal voltage. No fault lights on.	**a.** In addition to defective wiring and connections in the AC and DC load contactor actuating circuits, the load contactor may be prevented from closing for any of the following reasons:	After checking fuse (F1) in step (1) below, check all wiring and connections in the load contactor circuits on the engine control panel, the protective relay tray and power module. Then check components as follows:
	b. Blown fuse (F1))1-1; 16, Fig. 9)	Remove and inspect fuse. Replace if blown.
	c. Defective (open) relay in protective module (1-1; 4, Fig. 9).	Use a jumper with clip and prod terminals to GROUND terminal “H” in the test receptacle. If contactor will now close, replace module or complete protective relay tray (12, Fig. 1)

Generator and Excitation Circuit (cont.)

	Trouble, Symptom & Condition	Test or Inspection	Corrective Action
	Load contactor (K1) will not close when control switch (20, Fig. 1 is held in CLOSE position. Generator running at normal voltage. No fault lights on. (cont.)	**d.** Defective load contactor control switch (S5) (20, Fig. 1).	Set AUTO-MANUAL switch (S1) to AUTO position. connect a jumper with test prods between terminals “S” and “R” on the test receptacle. If the contactor closes, replace control switch.
		e. Defective rectifier (CR6) 1-1; 5, Fig. 11).	Check rectifier output as follows: With test receptacle terminals “S” and “R” connected as above, check voltage to rectifier between terminals “R” and “H”. Voltage should be 115-V AC. With test receptacle terminals “S” and “R” connected as above, check rectifier output at load contactor terminals X and Y. If voltage is not at least 90 V DC, replace rectifier. Defective load contactor coil (K1))1-1; 6, Fig. 11) Disconnect leads at load terminals W and V. Check coil resistance between these terminals. Resistance should be approximately 50 ohms. If coil is defective, replace the complete load contactor.
4.	Load contactor (K1) will close when control switch (20, Fig. 1 is held in momentary CLOSE position. Opens immediately when switch is released to center ON position.	**a.** 28.5-V DC is not reaching plug-interlock relay (K2) from aircraft for the following reasons:	Check voltage at terminal Z on test receptacle. Voltage should be 28.5-V DC. If not, voltage is not being supplied from aircraft. Check causes as follows:
		b. Generator to aircraft cable connector defective or not plugged into aircraft receptacle connector.	Inspect cable connector plug thoroughly for damaged E and F terminals. Be sure the plug is fully mated with the aircraft receptacle connector and making good contact.
		c. Aircraft rejecting power.	Check aircraft on board electrical equipment and controls.

Generator and Excitation Circuit (cont.)

Trouble, Symptom & Condition	Test or Inspection	Corrective Action
Load contactor (K1) will close when control switch (20, Fig. 1 is held in momentary CLOSE position. Opens immediately when switch is released to center ON position. (cont.)	**d.** "Blown" fuse (F2) (1-1; 17, Fig. 9) in protective relay tray.	Press lamp test switch (8, Fig. 1). If lamps do not glow, replace fuse (F2).
	e. Defective plug-interlock relay (K2).	Place test-bank switch (S2) (34, Fig. 1) in ON position. If load contactor will now remain closed, replace the plug-interlock relay (K2) (Sect. 1-1; 1, Fig. 9) or the complete protective relay tray.
	f. Small contacts in load contactor (K1) defective.	Connect a jumper lead between small terminals N.O. and C on the load contactor. If the load contactor will now remain closed, replace the complete load contactor (K1).
	g. Defective fuse interlock relay (K 17) or resistor (R46).	Open protective relay tray and connect a jumper across the resistor (R46) (Sect. 1-1; 21 Fig. 9). If the contactor will now remain closed, replace fuse interlock relay (K17) (Sect. 1-1; 2, Fig 9) or replace the protective relay tray assembly.
5. Load contactor opens during power delivery. NO fault indicating lights on.	**a.** Fuse (F1 or F2) blown.	Remove and inspect fuses (1-1; 16 and 17, Fig. 9.) Replace as required.
	b. A fault has developed in the load contactor holding circuit.	If the load contactor cannot be closed by operation of the control switch (S5) (20, Fig. 1), check the circuit in accordance with instructions in Trouble 1, above under LOAD CONTACTOR OPERATING CIRCUIT. If the load contactor can be closed but opens as soon as control switch (S5) is released, check for trouble under Trouble 2, above.
	c. Cable accidentally disconnected from aircraft.	Reconnect cable.

Protective Circuit

NOTE: The protective relays and protective monitor are not completely functional until the load contactor is closed. Since it is not advisable to vary voltages for test purposes while delivering power to an aircraft, the generator should be connected to a load bank for troubleshooting the protective circuits.

To avoid repetition, it will be assumed that the reset switch [(36), Fig. 1] has been pushed and the load contactor has been closed before commencing each test.

Trouble, Symptom & Condition	Test or Inspection	Corrective Action
1. Load contactor opens during power delivery. Overvoltage indicating light ON.	**a.** The over voltage condition may have been the result of a sudden drop in the load, or possible tampering with voltage regulator adjustment potentiometer (37, Fig. 1), and may have been a normal action.	Use voltage adjusting rheostat (37, Fig. 1) to reduce voltage to 110-V AC. Observe voltmeter and gradually increase voltage with rheostat. If the over-under-voltage sensing module (K26) functions to open the load contactor at any value less than 130-V AC, it is defective. Replace over-under-voltage module or complete protection relay tray.
	b. Defective protective monitor module (K14).	If overvoltage light comes on at 110-V, unplug over-under voltage module and close contactor. If the Overvoltage light comes on, the protective monitor module (K14) is defective. **NOTE:** it is normal for the undervoltage light to come on during this test.
2. Load contactor opens during power delivery. Undervoltage indicating light ON.	**a.** An undervoltage condition caused the over-under-voltage sensing module (K26) to function normally.	Observe generator voltage on voltmeter and adjust to normal 115-V AC with voltage regulator adjustment potentiometer (37, Fig. 1). Resume normal operation. If the load contactor opens again and an under-voltage condition is indicated by light (DS38) proceed to step B.
	b. Defective over-under-voltage module (K26).	Use voltage regulator adjustment potentiometer(38, Fig. 1) to reduce voltage to 104-V. Wait 12 seconds. The undervoltage indicating light should NOT be turned on. If the light is turned on, the undervoltage relay is defective. Replace the module (K26) or the protective relay tray.

Protective Circuit (Continued)

	Trouble, Symptom & Condition	Test or Inspection	Corrective Action
	Load contactor opens during power delivery. Undervoltage indicating light ON. (Continued)	**c.** Defective protective monitor module (K14).	With unit running normally, use voltage regulator adjustment potentiometer (37, Fig. 1) to reduce voltage quickly to 90-V. If the light is turned ON immediately, the protective monitor circuitry is defective. Replace the protective relay tray.
3.	Load contactor opens during power delivery. Overfrequency indicating light (DS 40) ON.	**a.** Electric governor improperly adjusted, or malfunctioning.	Proceed as follows:
		b. Governor improperly adjusted.	Adjust in accordance with Sect. 2-3, Para. 3, E, (3).
		c. Electric Governor System Malfunctioning.	Check and adjust or repair in accordance with ENGINE AND CONTROLS Troubles 8 and 9.
		d. Defective over-under-frequency sensing module (K27).	If overfrequency nuisance tripping continues after governor system is proven to be good, and an overfrequency condition does not exist, replace over- underfrequency module (K27), or complete protective relay tray.
4.	Load contactor opens during power delivery. Under-frequency light (DS39) ON.	**a.** Electric governor improperly adjusted, or malfunctioning.	Proceed as follows:
		b. Governor Improperly adjusted.	Adjust in accordance with Sect. 2-3. Para. 3, E, (3).
		c. Electric governor system malfunctioning.	Check and adjust or repair in accordance with ENGINE AND CONTROLS Troubles 8 and 9.
		d. Defective over-under frequency sensing module (K27).	If overfrequency nuisance tripping continues after governor system is proven to be good, and an under frequency condition does not exist, replace over- under frequency module (K27), or complete protective relay tray.
5.	Load contactor opens during power delivery. Indicating light ON.	**a.** There may have been an overload condition which caused the overload device (k4) to function normally.	Observe ammeter (4, Fig. 1). Check for abnormal overload condition and correct. If overload device functions too open the load contactor when an overload does not exist, proceed to step B.

Protective Circuit (Continued)

Trouble, Symptom & Condition	Test or Inspection	Corrective Action
Load contactor opens during power delivery. Indicating light ON	**a.** One of the resistors (R26, R27 or R28) across overload transformer is open Circuited.	An open resistor will cause a higher than normal Voltage. Check Resistors (Sect. 1-1; 1, Fig. 13). Replace if defective.
	b. Overload device printed circuit board defective.	With unit off, measure resistance between terminals B and E, Fig. 8. If zero ohms resistance is measured, replace Overload device (K4)(Section 1-1; 7, Fig. 11).

Generator

Trouble, Symptom & Condition	Test or Inspection	Corrective Action
1. No (or low) voltage output.	**a.** Shorted diode in exciter rectifier (CR2).	Check diodes in accordance with sect. 2-3, Para. 6 If diodes are good, proceed to step B.
	b. Open or shorted exciter rotor winding (G2).	Use ohmmeter to check for open or shorted condition. If rotor windings are good, proceed to step C.
	c. Open or shorted exciter field windings (L2).	Check for field resistance. See Sect. 2-3. Fig. 14 for normal values.
	d. Open or shorted generator rotor windings (L1).	Check resistance with ohmmeter to determine if open or short circuited.
2. Generator operates single phase.	**a.** An open or short circuited winding in generator stator (G1).	Check stator winding resistances. See Sect. 2-3, Fig. 12 for normal values.
3. Generator overheats.	**a.** Loose connection causing high resistance.	Check all output connections for looseness. Look for discoloration caused by heat. Tighten or replace as required.
	b. Improper or blocked ventilation.	Check for foreign materials (rags, etc.) blocking air flow. Provide adequate ventilation.
	c. Check Stator windings short circuited.	Check Stator windings. See Sect. 2-3, Fig 12.

Generator

Trouble, Symptom & Condition	Test or Inspection	Corrective Action
1. Unbalanced output.	**a.** Loose connection in output circuit.	Check all output connections, Discolored connectors indicate a loose connection. Tighten or replace as required.
	b. Open or short circuited stator Phase.	Check stator windings in accordance with Sect. 2-3, Para. 4. Repair or replace as required.
	c. Defective connection in output circuit.	Check plug and receptacle connectors at aircraft. Tighten, Repair or replace as required.
	d. Unbalanced load.	Check aircraft 400-Hz components.

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Section 5. Voltage Regulator

1. Unit Assembly

The 430391C voltage regulator (Figure 1) is designed to provide 1% voltage regulation with 0.25 second recovery time for all loads up to 100% of rated load on a three-phase, four-wire 115/200 volt, 400-Hz brushless alternator. This regulator provides field excitation power for a rotary exciter and regulates alternator voltage by varying the exciter field power as required to meet varying alternator load conditions to hold the alternator voltage constant. The maximum continuous rating of this regulator is 4.0 amperes at 125-V DC. The voltage regulator consists of seven basic interconnected circuits. They are:

(1) Voltage detection circuit

(2) Voltage comparison circuit

(3) Transistorized pre-amplifier

(4) Power stage full-wave single-phase magnetic amplifier

(5) Damping circuit

(6) Line drop compensation circuit

(7) Voltage build-up circuit

Any deviation of the alternator voltage from its set, regulated level is sensed by the voltage detection and comparison circuits. A signal is fed from the comparison circuit into the transistorized pre- amplifier, amplified, and used to drive the magnetic amplifier. The magnetic amplifier output changes in response to this signal, changing the field power of the rotary exciter long enough to return the alternator voltage to its regulated value. The voltage at which the alternator is regulated may be adjusted with the voltage adjustment rheostat.

2. Components

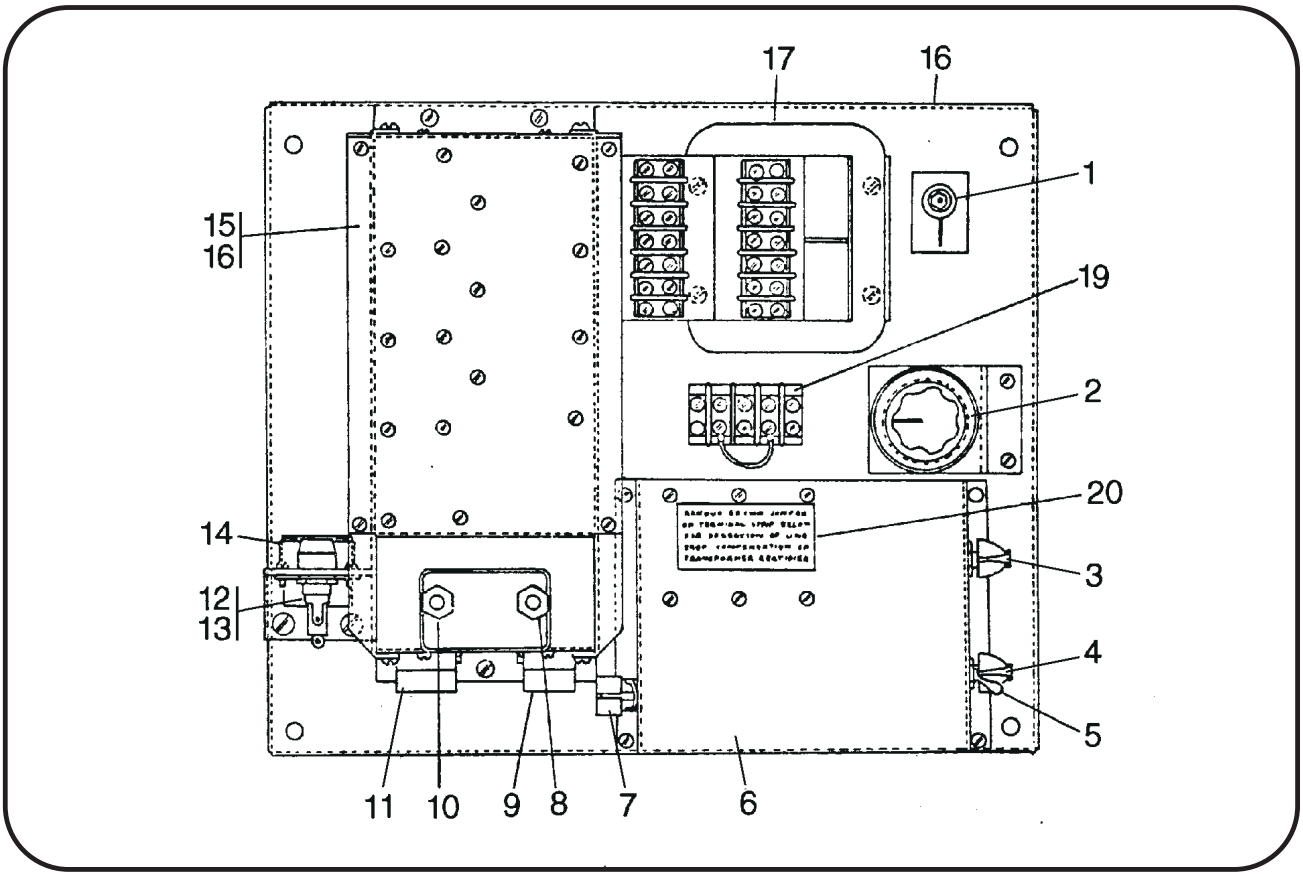
Refer to Figure 1. Components of these basic circuits are mounted in two major subassemblies which are the line drop compensation chassis assembly (6) and the sensing and pre-amplifier chassis assembly (15). Receptacle connectors (7, 9, and 11) provide quick connect-disconnect facilities for interconnecting wire leads. The two subassemblies are mounted on a chassis (18) along with other main components of the regulator, which include a resistor (1), voltage adjusting rheostat (2), fuse (12) and fuseholder (13), nineteen-pin receptacle connector (14), and reactor (17). (Field ballast resistors and line drop current transformer loading resistors are located at a point remote from the voltage regulator and are not supplied with the regulator).

3. Detailed Circuit Descriptions

a. Voltage Detection Circuit

Refer to schematic and connection diagrams at the end of this section. This circuit consists of three single-phase transformers (T501, T502, T503), three diodes (CR501, CR502, CR503) connected as a three-phase, half-wave rectifier, six diodes (CR504 through CR509) connected as three single-phase, full wave center-tap rectifiers, and four blocking diodes (CR510 through CR513). The transformer primaries are connected as a three-phase, four wire Y to the alternator output voltage. The transformer secondaries are center-tapped with the center taps joined together to for a common negative for the three single-phase rectifiers and the three-phase, half-wave rectifier. The filtered output of each of the single-phase rectifiers is pro- portioned to a given phase voltage. The output of the three-phase, half-wave rectifier is pro- portioned to the average of the three generator phase voltages. The positive outputs of the three single-phase rectifiers are connected to a common point through blocking diodes (CR511 and CR513). Part of the three-phase, half-wave rectifier voltage, as determined by the ratio of the resistors (R501 and R502) is connected through blocking diode CR510 to this same point. The blocking diodes prevent current flow from one of the four rectifiers into the filter circuit of any other rectifier.

The functions of the voltage detection circuit are to provide a filtered DC voltage proportional to the alternator voltage and to sense the highest single alternator phase voltage if the phase voltages are not balanced. The three-phase, half-wave rectifier senses the average phase voltage, and the three single-phase, full-wave rectifiers each sense a single phase. Resistors (R501 and R502) are scaled such that the portion of the three-phase half-wave fed through the blocking diode (CR510) is slightly higher than the three single-phase outputs when the alternator phase voltages are balanced. If the three phase voltages are not equal, the rectifier voltage corresponding to the highest phase voltage is higher than the average voltage signal. The output of the voltage detection circuit is thus a filtered DC voltage proportional to the average alternator phase voltage if the voltages are not balanced.



1. Resistor
2. Regulator
3. Cable length compensation rheostat
4. Cable size compensation rheostat
5. On-off switch
6. Line drop compensation chassis assembly
7. Receptacle connector
8. Damping circuit gain potentiometer
9. Receptacle connector
10. Damping circuit rate potentiometer
11. Receptacle connector
12. Fuse
13. Fuseholder
14. Receptacle connector
15. Sensing and pre-amplifier chassis assembly
16. High-phase sensing board assembly
17. Reactor
18. Chassis
19. Terminal board
20. Instruction label

Static Voltage Regulator
Figure 1

b. The Voltage Comparison Circuit

The comparison circuit is a simple voltage reference bridge consisting of three fixed resistors (R506, R508, R509), a potentiometer (R571) and a reference diode (VR501). These components are connected to form a bridge in which the DC output of the voltage detection circuit is compared to a fixed voltage reference. A voltage proportional to the difference between the reference and the input voltage to the bridge appears between the slider of the potentiometer and the positive side of the reference diode. This voltage is a function both og the generator voltage and the position of the potentiometer slider.

The function of the voltage comparison circuit is to compare part of the DC output voltage of the detection circuit with a fixed DC reference voltage and derive from their difference a signal suitable for driving a DC amplifier. It is in this circuit that the voltage at which the alternator regulates is established. Varying the position of the slider on the potentiometer changes the fraction of the voltage compared to the reference and varies the driving signal to the DC amplifier.

c. The Transistor Pre-Amplifier

The pre-amplifier consists of two transistors (Q501, Q501), two resistors (R507, R511), a zener diode (VR502), a 'freewheeling" diode (CR514) and a filter capacitor (C505). These components are connected in a two-stage DC amplifier circuit obtaining power from the three-phase, half-wave rectifier of the voltage detection circuit and using the power to drive the control winding of the magnetic amplifier in response to a signal from the voltage comparison bridge. Resistors (R507 and R511) limit the transistor currents to safe levels, the filter capacitor keeps the ripple low in the input signal, and the zener diode and "freewheeling" diode protect the output transistor from the voltage spikes from the reactor control coil. The transistorized pre-amplifier amplifies the output signal from the voltage comparison circuit and drives the magnetic amplifier with this amplifier output.

d. The Power State Fule-wave, Single-phase Magnetic Amplifier

This circuit consists of a single-phase, full-wave reactor (L505) and a full rectifier (CR531 through CR534) connected to a self-saturating magnetic amplifier. The saturable reactor has two load windings (1-2, 3-4) on separate cores and two control windings (5-6, 7-8) linking both cores.

The load windings are connected with the rectifiers in such a manner that only one of the load windings conducts for each half cycle of alternator voltage. This results in a net DC voltage on each reactor load winding, causing the reactor cores to saturate in the absence of a control signal. The control winding is driven with DC power in such a manner to oppose this self saturation, partially or completely desaturating the amplifier cores in response to the pre-amplifier output.

The magnetic amplifier rectifies AC voltage from the alternator and uses the DC voltage thus obtained to excite the rotary exciter in response to a control signal from the DC pre-amplifier. The impedence of the reactor load windingsin series with the magnetic amplifier rectifier, is varied by the control signal to control exciter field power.

e. The damping circuit

The damping circuit includes a transformer (T504), a limiting resistor (R510), a variable resistor (R551), a potentiometer (R572), and two capacitors (C506 and C507). The transformer primary is connected to the regulator output through resistors (R510 and R551). The transformer secondary is connected across the potentiometer. That part of the potentiometer between the slider and one end is in series with the input of the transistor pre-amplifier and is filtered by one of the capacitors. The other capacitor connects from the positive side of the voltage comparison circuit to the potentiometer.

The damping circuit detects changes in the regulator output and feeds energy pulses opposing the changes into the transistor pre-amplifier. The damping circuit affects the transient behavior of the regulated alternator system, preventing hunting, oscillation, and excessive overshoot of the alternator voltage following load changes. The damping rheostat affects mostly the amplitude of the damping signal. The rate potentiometeraffects both phasing and amplitude of the signal. Capacitor (C506) serves to shift the phase of the sensing signal, reducing the system response time.

f. The Line Voltage Drop Compensation Circuit

The line drop compensation circuit consists of a current transformer (T1, T2, T3) on each phase of the load circuit, a fixed inductance (L506, L507, L508) and variable resistance (R553) in series with each of the three phase lines leading to the voltage detection circuit, a toggle switch (S502) for bypassing the line drop compensation, a variable resistance (R554) in series with each current transformer input to the regulator and fixed resistance in parallel with each current transformer. Each of the three current transformer secondaries are connected through a variable resistor to the fixed inductance and other variable resistors.

The current transformers detect the magnitude and power factor of current flowing through the power cables from the alternator to its load and feed a signal into the resistance with inductance ahead of the voltage detection circuit opposing the voltage sensed by that circuit. The voltage actually sensed by the detection circuit is therefore lower than the actual alternator voltage by an amount proportional to the magnitude and power factor of the load current and thus proportional to the voltage drop between the alternator and its load. The regulator output increases slightly so that the alternator output voltage is equal to the regulated voltage plus the voltage drop in the liness. The variable resistances may be adjusted to match exactly the impedance of the power cables carrying the load current.

g. The Voltage Build-Up Circuit

The voltage build-up circuit of a relay (K501) with normally closed contacts connected across the load windings of the power reactor and a resistor (R12) in series with the relay coil. When the machine is first started, the alternator voltage from residual magnetism is applied through the relay contacts and the magnetic amplifier rectifier to the exciter field circuit. This causes the exciter voltage to increase and makes the alternator voltage build up. When the alternator voltage rises high enough to power the regulator, the relay coil, connected to the voltage detection circuit, is energized. This actuates the relay and opens the normally closed contacts shunting the reactor load coils, allowing the magnetic amplifier to control the exciter field power.

h. Terminal Board Circuit

This terminal board circuitry allows a signal from a Transformer-Rectifier (T-R), when used, to enter the regulator and control generator output as required by the T-R load when the jumper lead (Shown in Fig. 2) is disconnected. When the jumper lead is connected, the regulator functions normally as controlled by signals from the line drop current transformer at the generator.

4. Installation And Preparation For Use

a. Installation

(1) General

a. This voltage regulator is designed primarily for drawer-type mounting. However, it is not attitude sensitive and may be mounted in any position without affecting its operation. In some installations it is mounted in what appears to be a backward position, which may make reading the instruction plate for cable compensation adjustment somewhat difficult.

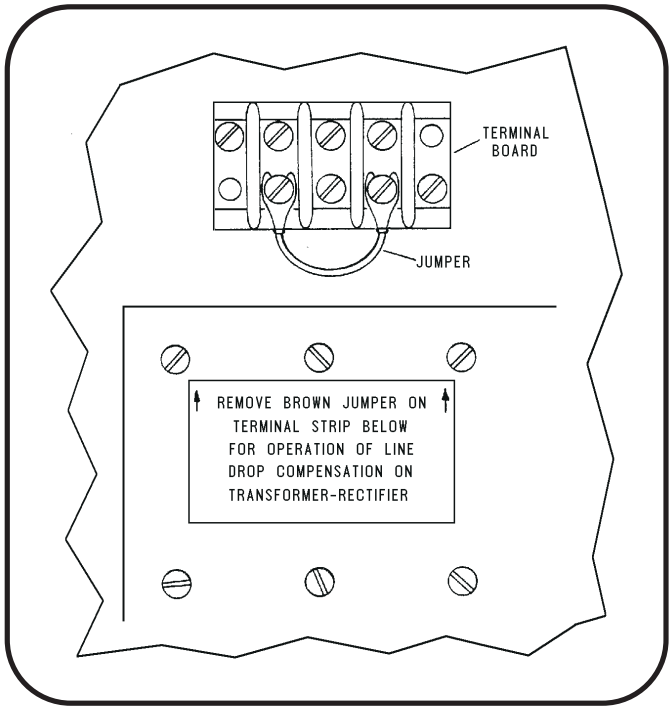
b. The regulator does not dissipate large amounts of power, but certain components, especially the line drop compensator rheostats and regulator power transistor, need a reasonable amount of air for convection cooling. For this reason, the regulator should not be mounted in a small airtight enclosure which would prevent air circulation around the line drop chassis assembly.

c. Four mounting holes (one in each corner of the main chassis) are provided for attaching the regulator.

d. Position the regulator in its mounted location and install with appropriate attaching hardware (nuts and/or screws, and washers)

(2) Connections

All electrical connections to the regulator are made through a nineteen pin receptacle connector *(14, Fig. 1)* which is bracket mounted on the chassis.



Terminal Board
Figure 2

b. Preparation for Use

No special preparation is necessary to place the regulator in service other than the following checks and inspections:

(1) Check all terminal lug type connections for security.

(2) Check all plug and receptacle type connectors to make certain they are firmly mated.

(3) It may be necessary to adjust a new regulator at initial start-up after installation.

5. Operating Procedures

This voltage regulator requires no start, stop, or extensive operating instructions. For initial start-up procedures, refer to Section 1-3 of this manual.

6. Adjustment Procedures

a. General

When a voltage regulator is first put into service, or when output (generator-to-aircraft) cables are changed, the regulator may require as many as five separate adjustments. The five adjustments are for (1) generator output voltage value, (2) cable length line drop compensation, (3) cable size line drop compensation, (4) “rate” adjustment, and (5) “damp” adjustment. See Figure 3 for identification of components used for regulator adjustment.

b. Adjust generator output voltage.

Perform this adjustment with the generator set operating at rated speed with no load applied. Rotate the rheostat knob (1) CLOCKWISE to INCREASE voltage and COUNTERCLOCKWISE to DECREASE voltage. Observe the AC voltmeter and adjust output voltage to 115 V AC.

c. Adjust Line Drop Compensation for Cable Length

Adjustment of line drop compensation magnitude is made with the knob marked “Foot Compensation” (2) on the line drop compensation module. The knob dial is calibrated for approximate cable length in feet. The “Foot Compensation” knob controls a rheostat which limits the current flowing in the compensation circuit. The setting of the rheostat resistance determines the magnitude of the compensation. Rotating the knob clockwise increases the magnitude of the compensation, and rotating it counterclockwise decreases the magnitude. To adjust the line drop compensation gain, proceed as follows:

(1) Connect the generator output cables to a balanced, three-phase load of 30 kilowatts.

(2) Make sure that the line drop compensation switch (4, Fig. 3) is in the ON position.

(3) Set the “Foot Compensation” knob to a dial setting corresponding to the length of the output cables being used.

d. Adjust Line Drop Compensation for Cable Size

The compensation circuit must be adjusted to match not only the voltage drop in the power cables to the load, but must be adjusted to match the phase of the voltage drop. This is done by adjusting the relative magnitude of the reactive and resistive compensation with the “Cable Size” knob (3). This knob is calibrated incable sizes and controls a varied resistance in series with a fixed reactance. The power factor of the compensation circuit is varied by varying the resistance and leaving the reactance constant. Rotating the knob clockwise increases the resistive component of the compensation circuit and simulates a smaller cable. Rotating the knob counterclockwise decreases the resistive component of the compensation. Adjust line drop compensation phase as follows:

(1) Set the “cable size” knob (3) to a dial setting corresponding to the size of the output cables.

(2) Re-adjust the generator voltage control (2) to the desired value if the line drop compensation adjustments have affected the no-load voltage output.

(3) Load the machine the machine with the largest available three-phase load of rated power factor not exceeding the maximum rating of the machine. If the load voltage rises or drops more than one percent (1%) at the load end of the cables, decrease or increase the setting of the load “Foot Compensation” knob until the regulation is flat.

(4) Load the machine the machine with the largest available three-phase unity power factor load within the rating of the machine. IF the voltage rises or drops more than one percent (1%) at full load, adjust the “Cable Size” setting until flat regulation is obtained. If it is necessary to adjust the cable setting, repeat step (3) above.

e. Adjust Damping Gain

The gain adjustment for the damping circuit is a 1500 ohm variable resistance (R551) in series with the primary winding of the damping transformers. This resistor is in the form of a screwdriver-adjustable potentiometer (7, Fig. 3) with a locking nut, located on the right side of the end of the sensing andd preamplifier assembly. Turning the potentiometer screw clockwise increases the resistance, decreasing the system damping, and making the regulator less stable. Turning the adjustment screw counterclockwise decreases the resistance, improving regulator stability, but slowing regulator response. This resistance is set at the factory for satisfactory response times, and should not ordinarily require adjustment. However, if adjustment becomes necessary, proceed as follows:

(1) Loosen the potentiometer adjusting screw locknut.

(2) Connect the generator output to a balanced, three-phase load of 30 kilowatts.

(3) With generator running at 115-V AC no load, operate the contactor “on-off” switch on the engine control panel.

(4) Turn the adjusting screw counterclockwise with a screwdriver to improve generator output stability.

(5) Turn the adjusting screw clockwise to decrease regulator response time. Best adjustment is approximately 3/4 of full travel clockwise.

(6) Tighten the locknut securely after the adjustment has been completed.

f. Adjust Damping Rate

The rate adjustment is a potentiometer (8) is a potentiometer connected across the secondary oo the damping transformer. Both the amplitude of the damping signal and its phasing are affected by this potentiometer. Because of this, a relatively large change in system performance is obtained with a relatively small change in its setting. When the screw is turned fully counterclockwise, the amplitude of the damping signal fed into the transistor preamplifier is at a minimum. When the screw is set fully clockwise, the signal is at maximum. The system may be unstable with this potentiometer set at either maximum or minimum because of the phase shift. The potentiometer is set and locked at the factory for good system transient response and should not need further adjustment. If the potentiometer does need adjustment, proceed as follows:

(1) Loosen the adjusting screw locknut.

(2) With a dcrewdriver, turn the adjusting screw to near its full counterclockwise position.

(3) Turn the adjusting screw slowly clockwise while observing generator output voltage on the generator voltmeter. The generator output voltage will oscillate until a certain point of adjustment is reached, at which it will abruptly become steady. The best adjustment for the system will usually be reached when the screw is turned just slightly (5^o to 10^o) beyond this point in a clockwise position.

(4) Tighten the locknut securely after the adjustment has been completed.

g. Test the Voltage Regulator

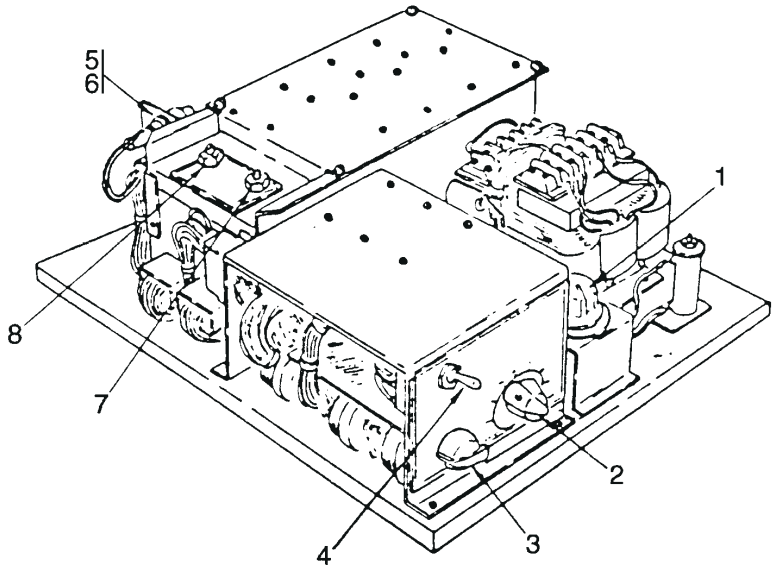
After necessary adjustments have been completed, test the regulator as follows:

(1) Connect a voltmeter at the load end of the generator output cables.

(2) Operate the machine at no load and observe voltage reading.

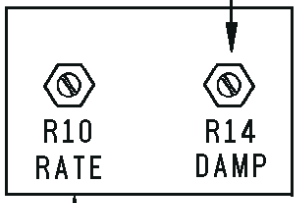
(3) Operate the machine under load and observe voltage reading. Voltage under load and no load should vary no more than 1% at the load end of the cables.

NOTE: The panel mounted voltmeter will indicate a higher voltage than indicated by a voltmeter at the load end of the output cables. The amount of variance will depend upon cable length and size.



1. Voltage adjusting rheostat
2. Cable length compensation rheostat
3. Cable size compensation rheostat
4. On-Off switch, line-drop compensation
5. Fuse (5-Amp)
6. Fuseholder
7. Damp (gain) adjusting potentiometer
8. Rate adjusting potentiometer

Voltage Regulator Adjustments Figure 3



DAMP (Gain) - Affects response and stability

When this screw is turned CLOCKWISE, regulator becomes MORE RESPONSIVE, LESS STABLE

When this screw is turned COUNTERCLOCKWISE, regulator becomes MORE STABLE (steadier), LESS RESPONSIVE

Best adjustment is approximately 3/4 of full travel clockwise

RATE (Affects stability)

Regulator will likely be unstable if adjusting screw is at either limit of adjustment CLOCKWISE or COUNTERCLOCKWISE. From a point near full COUNTERCLOCK-WISE position, turn the screw CLOCKWISE until a point is reached where the voltage regulator abruptly becomes STEADY. Best adjustment for the system is usually 5^{o} to 6^{o} beyond this point in a CLOCKWISE direction.

Voltage Regulator Damping Adjustments
Figure 4

7. Maintenance Procedures

a. Inspection

(1) General

Inspect the voltage regulator periodically, at the same time other inspections of the generator set are made.

(2) Inspect Connectors and Terminals

a. Inspect connectors for full engagement.

b. Inspect terminals for security.

(3) Inspect Wiring

Inspect wire insulation for cracks and damage.

(4) Inspect Attaching Parts

Inspect attaching hardware for security

(5) Inspect regulator fuse. When replacing this fuse, replace it with the EXACT SAME type and rating of fuse.

b. Cleaning

WARNING

Electric shock can kill! Remove power before cleaning regulator.

A. Make certain that compressed air is clean and dry.

B. Do not use flammable or conductive cleaners.

C. Exercise care to avoid damage to components.

Under normal operating conditions, very little cleaning is required; however, when operating under dusty conditions, it may be necessary to periodically clean the regulator with compressed air.

c. Painting

(1) General

Only the sheet metal components of the voltage regulator are painted. Electrical and electronic components should never be painted.

(2) Preparation for Painting

a. Remove regulator from control box (or from its mounted position) and place it on a clean workbench.

b. Disassemble as required to remove the component (s) to be painted.

c. Prepare the surface to be painted by sanding. Remove all rust.

d. Use tape to mask any electronic or electrical components not removed in step (2) above.

e. Prime all bare metal surfaces with red oxide primer, Hobart No. 903318, or equivalent.

(3) Painting the Unit

a. Make certain that all surfaces are clean and dry.

b. Paint all prepared surfaces with gray enamel paint, Hobart No. 903316, or equivalent.

d. Repair

For the convenience of maintenance personnel, this voltage regulator is designed to be trouble-free and simple to put back into service once it has malfunctioned or if it is not functioning properly. Flight line repair is usually limited to removal and replacement of the entire voltage regulator assembly, and adjustments of the newly-installed voltage regulator if necessary.

For customers that have facilities that permit repair of voltage regulators, the regulators may be repaired according to malfunctions disclosed through troubleshooting. Refer to the troubleshooting procedure that follows:

8. Troubleshooting

Troubleshooting is an orderly process of checking and eliminating possible causes of trouble until the exact cause is located. When looking for the cause of a trouble in a circuit or system begin at the source of power or supply. Continue testing and checking the voltage regulator, step-by-step, in an orderly manner, until the cause of trouble is located.

a. Description

The troubleshooting chart lists information under three headings as follows:

(1) Trouble, Symptom, and Condition

(2) Probable cause

(3) Test, Check, and/or Remedy

b. Use of the Troubleshooting Chart

The troubleshooting chart that follows is furnished to provide maintenance and repair personnel with a time-saving guide for locating trouble. To use the chart, proceed as follows:

(1) Locate the symptom(s) of trouble in the “Trouble” column.

(2) Check the probable causes of trouble in the “Probable Cause” column.

(3) Test, check, repair, or correct the trouble as indicated in the “Remedy” column.

If the cause of a trouble is an uncommon one and cannot be located by use of the chart, start at the source of power or supply and check the affected circuit or system completely. Use schematic and connection diagrams supplied with this manual.

Electrical components mentioned in the troubleshooting chart are identified by a noun name and a corresponding symbol which allows the user to identify the item more easily on schematic diagrams.

It is assumed that wiring and connections in defective circuits have been thoroughly checked before condemning any other components.

NOTE: Reference symbols (S9, etc.), used in the Troubleshooting Chart, are identified on Schematic and Connections Diagrams at the end of this section.

Following the troubleshooting chart is a list of electrical checks which may be performed to locate defective components in the regulator. Use the list in conjunction with the schematic and connection diagrams at the end of this section.

Trouble, Symptom & Condition	Test or Inspection	Corrective Action
1. Generator voltage will not build up to normal.	**a.** Fuse (F1) open.	Replace fuse.
	b. Shorted diode (CR531 through C534).	Replace the shorted diode.
	c. Exciter field circuit shorted or grounded.	Repair as necessary.
	d. Sensing and pre-amplifier plug (P503 or P504) not connected.	Connect plug.
	e. Generator field circuit open	Restore continuity to field circuit.
	f. Generator field circuit ballast resistor open.	Replace defective resistor.
	g. Voltage build-up circuit relay (K501) normally-closed contacts open.	Replace relay.
	h. Generator residual voltage too low, or reversed.	“Flash” exciter fields with 12-V DC from a storage battery.
	j. Shorted or open power diode (CR531 through CR534).	Replace defective diode.
2. Generator voltage builds up until relay actuates, then falls back.	**a.** Voltage reference diode (VR501) shorted.	Replace diode.
	b. Pre-amplifier transistor (Q501 or Q502) shorted	Replace transistor.
	c. Pre-amplifier diode (VR502) shorted	Replace diode.
	d. Stability capacitor (C507) shorted	Replace capacitor.
3. Generator voltage builds to a dangerously high level. Flashing relay does not actuate.	**a.** Voltage build-up relay: 1. Coil open 2. Contacts “welded”	Replace relay.
	b. Line-drop coupling plug (P502) not in socket.	Connect plug securely.
	c. Sensing diode (CR501, CR502, CR503) shorted.	Replace diode and check sensing trtansformers for damage.

Trouble, Symptom & Condition	Test or Inspection	Corrective Action
4. Generator voltage builds to a dangerously high level; flashing relay actuated, but voltage is not controllable with voltage adjusting potentiometer.	**a.** Magnetic amplifier reactor (L505) winding open.	Replace reactor.
	b. Line drop coupling plug (P502) not in socket.	Connect plug.
	c. Damping potentiometer (R572) open.	Replace potentiometer
	d. Voltage comparison potentiometer (R571) circuit open.	Restore continuity.
	e. Voltage comparison resistor (R509) open.	Replace resistor.
	f. Voltage comparison reference diode (VR501) open.	Replace diode.
	g. Pre-amplifier transistor (Q501, Q502) open.	Replace transistor.
	h. Pre-amplifier resistor (R507 or R511) open.	Replace resistor.
	i. Pre-amplifier diode (CR514) shorted.	Replace diode and check transformers (T501, T502, T503) for damage.
5. Poor voltage regulation when generator is loaded (droop at regulator input terminals more than 1%).	**a.** Voltage comparison resistor (R506 or R508) open.	Replace resistor
	b. Voltage sensing choke (L501, L502, L503 or L504) partially shorted.	Replace choke.
	c. Voltage sensing diode (CR501 through CR509) open.	Replace diode.
	d. Voltage comparison reference diode (VR501) has high dynamic resistance.	Replace diode.
	e. Pre-amplifier transistor (Q501 or Q502) low gain.	Replace transistor.

Trouble, Symptom & Condition	Test or Inspection	Corrective Action
6. Generator voltage unstable.	**a.** Damping transformer (T504) open.	Replace transformer.
	b. Damping rheostat (R551) incorrectly adjusted or open.	Adjust or replace rheostat.
	c. Damping resistor (R510) open.	Replace resistor.
	d. Damping potentiometer (R572) incorrectly adjusted or open.	Check continuity. If good, adjust. If not, replace potentiometer.
7. Voltage on one phase rises above 130 volts, line-to-neutral, with balanced load.	**a.** Voltage detection resistor (R502) open.	Replace resistor.
	b. Voltage detection transformer (T501, T502, T503) coils shorted or open.	Replace transformer.
	c. Voltage detection choke (L502, L503, L504) coil open.	Replace choke.
	d. Voltage detection diode (CR511, CR512, or CR513) shorted.	Replace diode.
8. Generator voltage becomes erratic. Smoke comes from voltage detection transformers.	**a.** Voltage detection diode (CR501 throuugh CR509) shorted.	Replace capacitor and transformers (T501, T502, and T503).
	b. Voltage detection capacitor (C501 through C504) shorted	Replace capacitor and transformers (T501, T502, and T503).

c. Checking the Voltage Regulator

(1) General

The following pages provide electrical checks which may be performed to locate defective components in the regulator. Use the list in conjunction with the schematic and connection diagrams at the end of this section.

(2) Conditions for Check

a. The generator must have no load other than the regulator.

b. Rhe voltage regulator must be regulated at 120 volts, with four-wire, three-phase voltage at 400-Hz.

c. A Triplett No. 630 volt-ohmmeter or equivalent is recommended for measuring voltages.

NOTE: The operating voltages listed in the chart were observedwhen the regulator was supplying low amperes of direct current to the generator exciter fields. This current value may be different for some installations of the regulator and, consequently, the voltage check values may vary slightly.

Reference Designator	Location for Component	Voltage Measurement	Voltage Value
C501	Capacitor, 3mF, 50-Volt	Across Capacitor	16.0 V-DC
C502	Capacitor, 3mF, 50-Volt	Across Capacitor	12.5 V-DC
C503	Capacitor, 3mF, 50-Volt	Across Capacitor	12.5 V-DC
C504	Capacitor, 3mF, 50-Volt	Across Capacitor	12.5 V-DC
C505	Capacitor, 20mF, 50-Volt	Across Capacitor	0.58 V-DC
C506	Capacitor, 20mF, 50-Volt	Across Capacitor	5.4 V-DC
C507	Capacitor, 20mF, 50-Volt	Across Capacitor	Too low to read
CR501	Diode, IN4820	Across Diode	16.8 V-DC
CR502	Diode, IN4820	Across Diode	16.8 V-DC
CR503	Diode, IN4820	Across Diode	16.8 V-DC
CR504	Diode, IN4820	Across Diode	13.0 V-DC
CR505	Diode, IN4820	Across Diode	13.0 V-DC
CR506	Diode, IN4820	Across Diode	13.0 V-DC
CR507	Diode, IN4820	Across Diode	13.0 V-DC
CR508	Diode, IN4820	Across Diode	13.0 V-DC
CR509	Diode, IN4820	Across Diode	13.0 V-DC
CR510	Diode, IN4820	Across Diode	0.65 V-DC
CR511	Diode, IN4820	Across Diode	0.60 V-DC
CR512	Diode, IN4820	Across Diode	0.60 V-DC
CR513	Diode, IN4820	Across Diode	0.60 V-DC
CR514	Diode, IN4820	Across Diode	3.80 V-DC
CR515	Diode, IN4820	Across Diode	7.2 V-DC
CR531	Diode, S2040	Across Diode	33 V-DC
CR532	Diode, S2040	Across Diode	33 V-DC
CR533	Diode, S2040	Across Diode	33 V-DC
CR534	Diode, S2040	Across Diode	33 V-DC
K501	Relay	Across Relay Coil	13-0 V-DC
L501	Choke, 1CZ-93	Across Choke Coil	0.60 V-DC
L502	Choke, 1CZ-93	Across Choke Coil	0.60 V-DC
L503	Choke, 1CZ-93	Across Choke Coil	0.60 V-DC
L504	Choke, 1CZ-93	Across Choke Coil	0.60 V-DC
L505	Reactor	Accross Winding 1-2	140 V-AC, 0.4 V-DC
		Accross Winding 3-4	140 V-AC, 0.4 V-DC
		Accross Winding 5-6	6.0 V-AC, 0.38 V-DC
		Accross Winding 7-8	11V-AC
L506	Choke, Line Drop	Across Choke Coil	0.70 V-DC
L507	Choke, Line Drop	Across Choke Coil	0.70 V-DC

Reference Designator	Component	Location for Voltage Measurement	Voltage Value
L508	Choke, Line Drop	Across Choke Coil	0.78 V-DC
Q501	Transistor, 2N3904	Emitter to Base	0.55 V-DC
		Base to Collector	9.2 V-DC
		Emitter to Collector	9.8 V-DC
Q502	Transistor, 2N-5416	Emitter to Base	0.55 V-DC
		Base to Collector	12.0 V-DC
		Emitter to Collector	12.6 V-DC
R501	Resistor 150-Ohm, 5-Watt	Across Resistor	1.8 V-DC
R502	Resistor 1000-Ohm, 5-Watt	Across Resistor	12.5 V-DC
R503	Resistor, 1000-Ohm, 5-watt	Across Resistor	12.5 V-DC
R504	Resistor, 1000-Ohm, 5-watt	Across Resistor	12.5 V-DC
R505	Resistor, 1000-Ohm, 5-watt	Across Resistor	12.5 V-DC
R506	Resistor, 1000-Ohm, 5-watt	Across Resistor	5.9 V-DC
R507	Resistor, 1000-Ohm, 5-watt	Across Resistor	0.15 V-DC
R508	Resistor, 470-Ohm, 5-watt	Across Resistor	6.0 V-DC
R509	Resistor, 500-Ohm, 5-watt	Across Resistor	3.0 V-DC
R510	Resistor, 1000-Ohm, 25-watt	Across Resistor	65 V-AC, 44 V-DC
R511	Resistor, 100-Ohm, 5-Watt	Across Resistor	3.4 V-DC
R512	Resistor, 47-Ohm, 1-Watt	Across Resistor	7.2 V-AC, 3.3 V-DC
R513	Resistor, 1000-Ohm, 1/2-Watt	Across Resistor	7.2 V-DC
R514	Resistor, 470-Ohm, 1/2-Watt	Across Resistor	0 V-DC
R551	Rheostat, 1500-Ohm, 25-Watt	Across Rheostat	20 V-AC, 15 V-DC
R553	Rheostat, (Triple Tandem)		
	10-Ohm, 25-Watt	Across Rheostat	0.15 V-AC
R554	Rheostat, (Triple Tandem)		
	250-Ohm, 25-Watt	Across Rheostat	0.55 V-AC
R571	Potentiometer, 500-Ohm, 2-Watt	R509 End to Slider	2.4 V-DC
		R506 End to Slider	0.7 V-DC
		Across Potentiometer	3.1 V-DC
R572	Potentiometer, 2500-Ohm, 2-Watt	Slider to R571	Too Low to Read
		Across Potentiometer	3.1 V-DC
T501	Transformer, High Phase	Green to Black	120 V-AC
		Red to Orange	30 V-AC
		Red to Blue	15 V-AC
T502	Transformer, High Phase	Green to Black	120 V-AC
		Red to Orange	30 V-AC
		Red to Blue	15 V-AC

Reference Designator	Component	Location for Voltage Measurement	Voltage Value
T503	Transformer, High Phase	Green to Black	120 V-AC
		Red to Orange	30 V-AC
		Red to Blue	15 V-AC
T504	Transformer, Damping	Orange to Blue	6.0 V DC
		Red to Brown	11.0 V-AC, 1.1 V-DC
VR501	Diode, Zener, 6.2-Volt, 1-Watt	Across Diode	6.1 V-DC
VR502	Diode, Zener, 80-Volt, 1-Watt	Across Diode	0.25 V-DC

9. Illustrated Parts List

a. Introduction

(1) Scope

The Illustrated Parts List identifies, describes, and illustrates all components of the Static Voltage Regulator, Hobart Part No. 430391C, with the exception of attaching hardware.

(2) Purpose

The purpose of the Illustrated Parts List is to provide maintenance and provisioning personnel with identification and descriptive data for use in the provisioning, requisitioning, storing, and issuing of spare parts.

(3) Explanation of Parts List Form

This form is divided into five columns. Beginning at the left side of the form and proceeding to the right, columns are identified as follows:

a. "FIGURE/ITEM NO." Column

This column lists the figure number of the illustration applicable to the list and also identifies each part in the illustration by an item number which appears on the illustration. Assemblies and subassemblies which are illustrated in their disassembled state will not be identified by an item number.

b. "HOBART PART NUMBER" Column

ALL part numbers appearing in this column are Hobart numbers. In all instances where the part is a purchased item, the vendor's identifying five-digit code and his part number will appear in the **"NOMENCLATURE"** column. Vendor parts which are modified by Hobart Brothers will be identified as such in the **"NOMENCLATURE"** column. In case Hobart Brothers does not have an identifying part number for a purchased part, the **"HOBART PART NUMBER"** column will reflect **"NO NUMBER"** and the vendor's number will be shown in the **"NOMENCLATURE"** column. Parts manufactured by Hobart Brothers reflect no vendor code or vendor part number in the **"NOMENCLATURE"** column.

c. "NOMENCLATURE" Column

The item identifying name appears in this column. The indenture method is used to indicate item relationship. Thus, components of an assembly are listed directly below the assembly and indented one space. Vendor codes and part numbers for purchased parts are shown in this column. Hobart modification to vendor items is also noted in this column.

d. "EFF" (Effectivity) Code

Code letters *("A", "B", "C", etc.)* are used in this column to indicate the use of parts where more than one model or type of machine is covered by the parts list. Since this manual covers only one model of voltage regulator, this column is not used in this manual.

e. "UNITS PER ASSEMBLY" Column

This column indicates the quantity of parts required for an assembly or subassembly in which the part appears. This column does not necessarily reflect the total used in the complete end item.

(4) Manufacturer's Codes

The following list is a compilation of vendor codes with names and addresses for suppliers of purchased parts listed in this publication. The codes are in accordance with the Federal Supply Codes for Manufacturers' Cataloging Handbook H4-1, and are arranged in numerical order.

Code	Vendor's Name And Address
01746	Electronics Engineers, Inc., 5615 Division, Chicago, Illinois 60651
02660	Amphenol Corporation, 2801 S. 25th Avenue, Broadview, Illinois 60153
15605	Cutler-Hammer, 1391 W. St. Paul Avenue, Milwaukee, Wisconsin 53223
44655	Ohmite Manufacturing Co. 3601 W. Howard St. Skokie, IL 60076
50508	Magnetic Components, Inc. 9520 Ainslie St. Schiller Park, IL 60176
71044	Bussmann Manufacturing, Division of McGraw-Edison Company, 2536 W. University Street, St. Louis, Missouri 63017
77342	Potter & Brumfield Division, AMF Company, 1200 E. Broadway, Princeton, Indiana 47570
96682	Genisco Technology Corporation, 18435 Susana Road, Compton, California 90221

b. Explanation of Parts List Arrangement

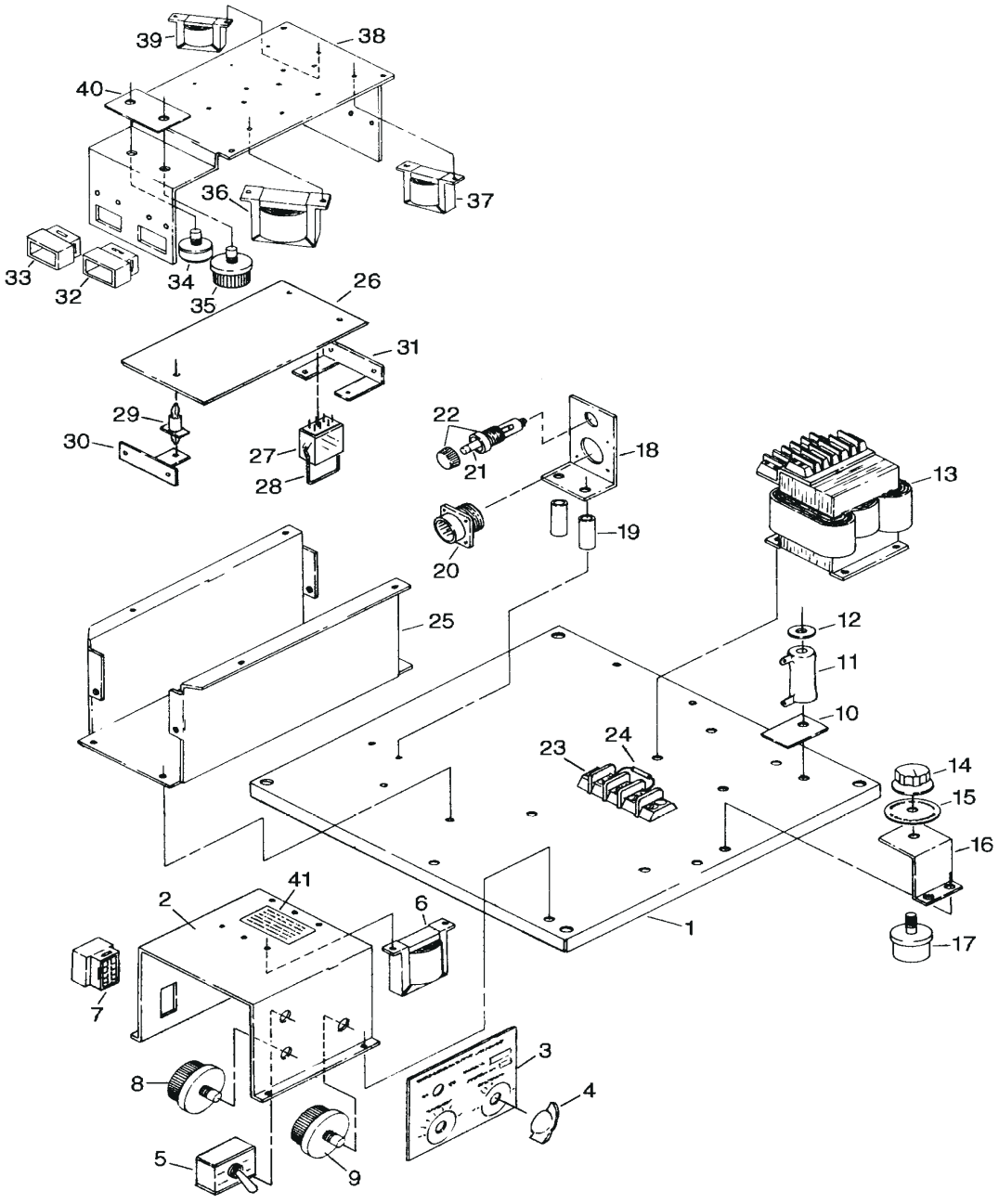
The parts list is arranged so that the illustration will appear on a left hand page and the applicable parts list will appear on the opposite right hand page. Unless the list is unusually long, the user will be able to look at the illustration and read the parts list without turning a page.

c. Symbols and Abbreviations

The following is a list of symbols and abbreviations used in the parts list.

* - item not illustrated
A, or AMP - ampere
AC - alternating current
AR - as required
DC - direct current
Fig. - Figure
hd. - head
hex - hexagon
Hz - Hertz (cycles-per-second)
I.D. - inside diameter
IN - inch
kVA - kilovolt-ampere
F - microfarad
No. - number
NHA - next higher assembly
Ω - Ohm
OM - Owners Manual
PRV - peak reverse voltage
PSI - pounds per square inch
Ref - reference (the item has been listed previously) TM - Technical Manual
T-R - transformer-rectifier
V - volt (when used as a prefix to a five-digit number, indicates vendor code)

NOTE: An item which does not reflect an index number is an assembly which is not illustrated in its assembled state, or it is similar (right-hand, left-hand, top, etc.) to an item which is illustrated.



Voltage Regulator Assembly
Figure 5

FIGURE ITEM NO.	HOBART PART NO.	NOMENCLATURE 1 2 3 4 5 6 7	EFF	UNITS per ASSY
5 -	430391C	REGULATOR, VOLTAGE (MAG-AMP) (For NHA See Fig. 3)	REF	
1	430469	CHASSIS, REGULATOR		1
	430340	. CHASSIS, LINE DROP COMPENSATION ASSEMBLY		1
2	430470	. CHASSIS		1
3	402373	. NAMEPLATE, LINE DROP COMPENSATION		1
4	W-11597	. KNOB, POINTER, V75376, No. S-292-3L		2
5	1CZ-70	. SWITCH, ON-OFF, V15605, No. 7610K2		1
6	1CZ-97	. REACTOR, LINE-DROP, V86151, No. E3963		3
7	401563-3	. HOUSING, PIN CONNECTOR		1
8	1CZ-105	. RHEOSTAT, TRIPLE TANDEM, V44655, No. H-10-F2-T3		1
9	1CZ-128	. . RHEOSTAT, TRIPLE TANDEM, V44655, No. 6610		1
10	430476	. INSULATION, BOTTOM, RESISTOR		1
11	W-9746-9	. RESISTOR, V44655, No. 0205		1
12	1CZ-74	. INSULATOR, TOP, RESISTOR		1
13	402342	. REACTOR, REGULATOR, V96682, No. 70-8532		1
14	16DA-2162	. KNOB, RHEOSTAT, V44655, No. 5150		1
15	HF-745	. NAMEPLATE		1
16	30GH-734	. BRACKET, MOUNTING, RHEOSTAT		1
17	W-9712-13	. RHEOSTAT, REGULATOR, 750-OHM, 25-WATT, V44655, MODEL H		1
18	370141	. BRACKET, MOUNTING, PLUG		1
19	25MS-328	. SPACER		2
20	402376	. RECEPTACLE, V02660, No. MS-1302A-22-14P	1	
21	400782-1	. FUSE, 5-AMP, FAST-ACTING, GLASS TUBE, MTH		1
22	HF-2407	. FUSEHOLDER, V71400, No. HKP		1
23	401911-3	. TERMINAL BOARD, V88223, No. 441-3		1
24	W-10827-8	. RESISTOR, 470-OHM, 1/2-WATT		1
	430472A	CHASSIS, SENSING & PRE-AMP, ASSEMBLY		1
25	430341	. BRACKET, MOUNTING, CHASSIS		1
26	485053	. BOARD, PC, HIGH PHASE SENSING		1
27	79B-1140	. RELAY, V77342, No. KHU17D11		1
28	79A-1142	. SPRING, RETAINING, RELAY,V77342		1
29	404460-1	. SUPPORT, PC BOARD, LOCKING		3
30	485282	. BRACKET, MOUNTING, PC BOARD, FRONT		1
31	485283	. BRACKET, MOUNTING, PC BOARD, REAR		1

FIGURE ITEM NO.	HOBART PART NO.	NOMENCLATURE 1 2 3 4 5 6 7	EFF	UNITS per ASSY
5-	430391C	REGULATOR, VOLTAGE (MAG-AMP) (Continued)		REF
32	401563-2	. HOUSING, PIN CONNECTOR		1
33	402563-3	. HOUSING, PIN CONNECTOR		1
34	400698-2	. POTENTIOMETER, 2500-OHM, 2-WATT, V44655, No. CLU-2521		1
35	W-9712-30	. RHEOSTAT, 1500-OHM, 25-WATT, V44655, No. H		1
36	1CZ-60	. TRANSFORMER, DAMPING, V50508 No. E3196-A		1
37	402357	. TRANSFORMER, HIGH PHASE, V50508, No. 40-8583		3
38	430473	. PANEL, CHASSIS		1
39	1CZ-63	. REACTOR, FILTER, HIGH PHASE, V50508 No. E3661-A		4
40	402358	. NAMEPLATE, ADJUST		1
41	480725	. LABEL, INSTRUCTION		1
*	401564-2	. HOUSING, SOCKET CONNECTOR		1
*	401564-3	. HOUSING, SOCKET CONNECTOR		2

*** Not Illustrated**

Section 5. Voltage Regulator

1. General

This section contains information and instructions for a solid state voltage regulator, Part No. 489812A, manufactured by **Hobart Brothers Company, Power Systems Division, Troy, Ohio 45373, U.S.A.** An illustrated parts list is contained at the end of this section.

This voltage regulator *(Figure 1)* is designed to provide 1% voltage regulation for all loads up to 100% of rated load on a three-phase, four-wire, 115/200-volt, 400-Hz brushless alternator. This regulator provides field excitation power as required to meet varying alternator load conditions to hold the alternator voltage constant. The voltage regulator consists of two basic interconnected assemblies, the **Line Drop Compensator Assembly** and the **Voltage Regulator PC Assembly**

Any deviation of the alternator voltage from its set, regulated level is sensed at the voltage regulator PC board. The sensing signal is compared to a reference signal, and, with associated circuitry, varies the field power supplied to the rotary exciter.

2. Components

Refer to Figure 1. The line drop compensator assembly *(5)* and the voltage regulator PC board assembly, *(4)* and *(2),* are mounted on a chassis along with a terminal board *(10)* and 19-pin receptacle connector *(11).* The PC board assembly consists of the PC board itself *(4)* and its protective cover *(2).*

a. Line Drop Compensator Circuit Components

Refer to Schematic Diagram 280003 and Connection Diagram 181440 at the end of this section.The line drop voltage compensation circuit consists of:

(1) A current transformer *(T1, T2, T3)* on each phase of the load circuit.

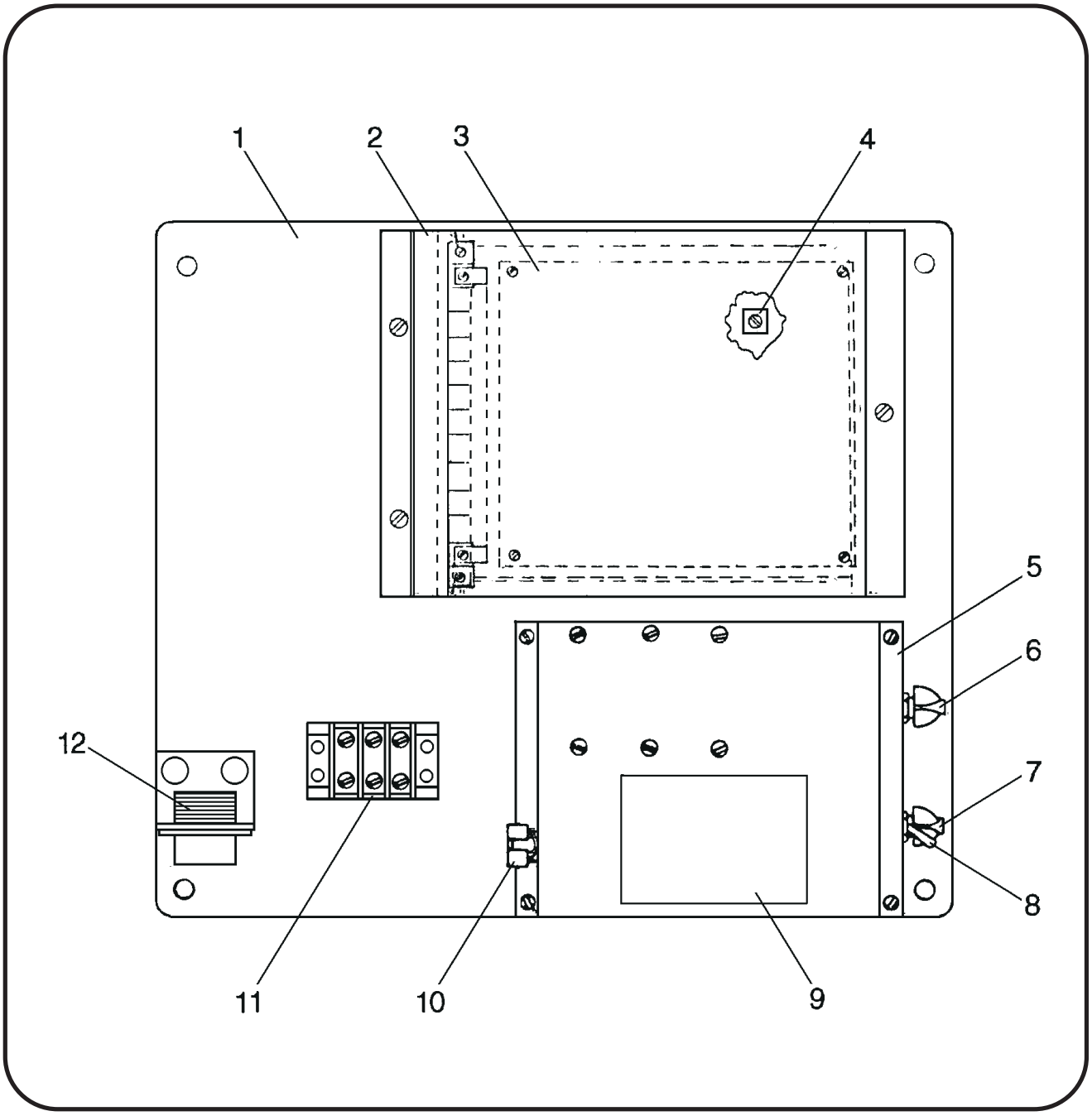
(2) A fixed inductance *(L6, L7, L8),* and variable resistance *(R6)* in series with each of the phase lines leading to the voltage detection circuit.

(3) A toggle switch *(S1)* for bypassing the line drop compensator.

(4) A variable resistance *(R7)* in series with each current transformer input to the regulator.

(5) A fixed resistance *(R3, R4, R5)* in parallel with each current transformer.

The current transformers detect the magnitude and power factor of current flowing through the power cables from the alternator to its load and feed a signal into the resistance and inductance ahead of the voltage detection circuit opposing the voltage sensed by that circuit. The voltage actually sensed by the voltage detection circuit is therefore lower than the actual alternator voltage by an amount proportional to the magnitude and power factor of the load current and thus proportional to the voltage drop between the alternator and its load. The regulator output increases slightly so that the alternator output voltage is equal to the regulated voltage plus the voltage drop in the lines. The variable resistances may be adjusted to match exactly the impedence of the power cables carrying the load current.

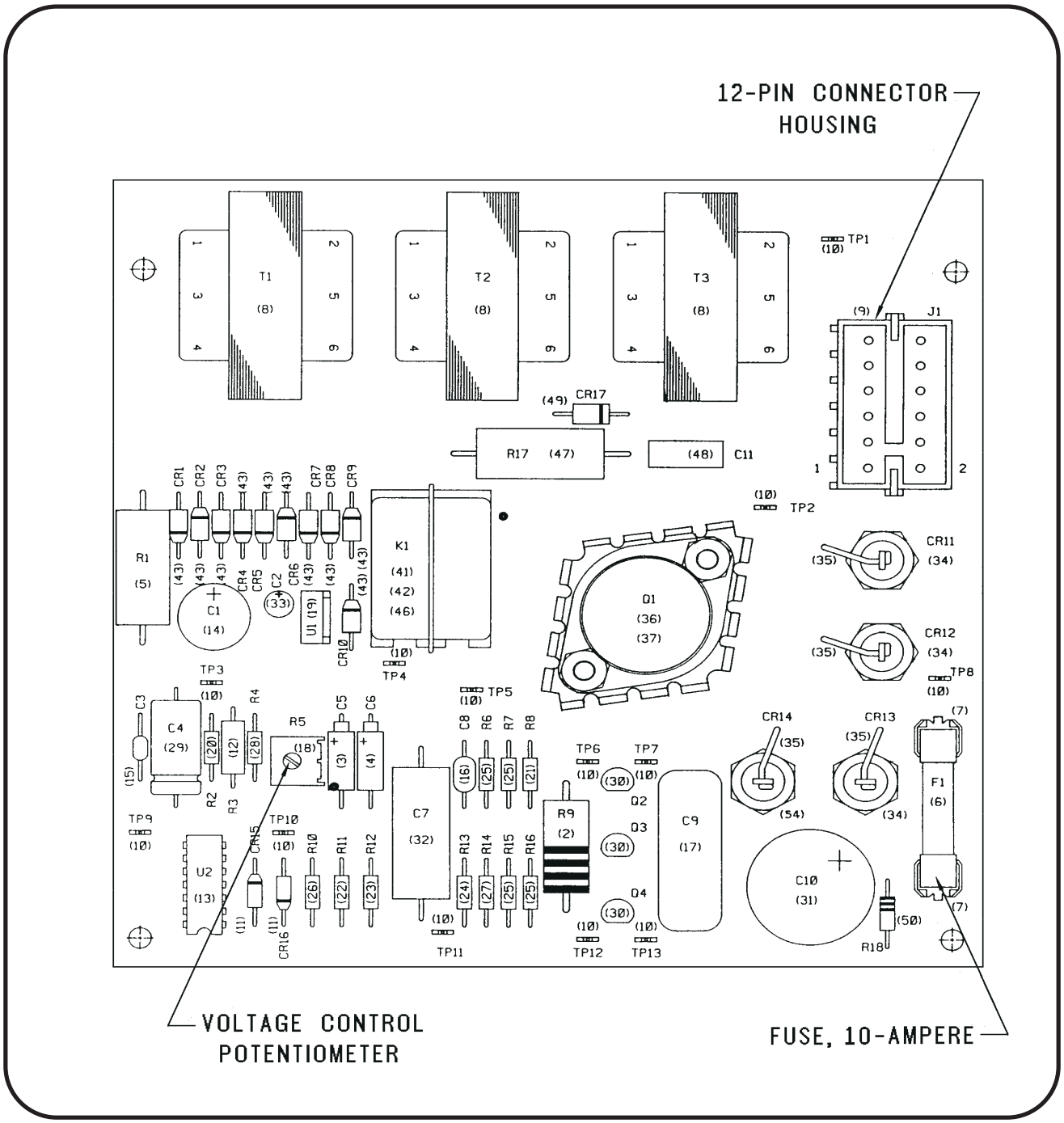


1. Voltage Regulator Chassis
2. Cover, Regulator PC Board
3. Regulator PC Bord (under item 2)
4. Voltage Control Potentiometer
5. Line Drop Compensator Assembly
6. Cable length compensation rheostat
7. Cable size compensation rheostat
8. On-Off switch
9. Nameplate
10. Receptacle Connector (19-pin)
11. Terminal Strip
12. Connector Housing (10-pin)

Solid State Voltage Regulator
Figure 1

b. Voltage Regulator PC Board (3, Fig. 1, and Fig. 2))

The voltage regulator PC board assembly is a non-reparable assembly, and includes circuitry for voltage build-up, voltage regulation, voltage recovery, and line drop compensation using signals from the line drop compensator assembly.



Voltage Regulator PC Board
Figure 2

3. Installation And Preparation For Use

a. Installation

(1) General

This voltage regulator is designed primarily for drawer-type mounting. However, it is not attitude sensitive and may be mounted in any position without affecting its operation. In some installations it is mounted in what appears to be a backward position, which may make reading the instruction plate for cable compensation adjustment somewhat difficult.

The regulator does not dissipate large amounts of power, but certain components, especially the line drop compensator rheostats and regulator power transistor, need a reasonable amount of air for convection cooling. For this reason, the regulator should not be mounted in a small airtight enclosure which would prevent air circulation around the line drop chassis assembly.

Four mounting holes *(one in each corner of the main chassis)* are provided for attaching the regulator. Position the regulator in its mounted location and install with appropriate attaching hardware *(nuts and/or screws, and washers)*.

(2) Connections

All electrical connections to the regulator are made through a nineteen pin receptacle connector *(1-2, Fig. 1)* which is bracket mounted on the chassis.

b. Preparation for Use

No special preparation is necessary to place the regulator in service other than the following checks and inspections.

(1) Check all terminal lug type connections for security.

(2) Check all plug and receptacle type connectors to make certain they are firmly mated.

It may be necessary to adjust a new regulator at initial start-up after installation. *(See Chapter 2, Section 4).*

4. Operating Procedures

Operating procedures, as such, are not applicable to the solid state voltage regulator because it requires no start, stop, or operating instructions. See Section 1-3 for initial start-up adjustments and procedures. Make certain that the line drop compensator switch *(1-2; 5, Fig. 1)* is in the **ON** position when operating the generator set.

5. Sequence and Theory of Operation

A description of the sequence of events, which occur when the solid state regulator is in operation, is presented here to give maintenance personnel a better understanding of how and why the unit operates, and thus assist them in the adjustment and troubleshooting of the equipment.

When the machine is started, the rotary exciter is excited from alternator residual magnetism through the starting relay and the half-wave rectifier bridge, both located on the voltage regulator PC board assembly. As the rotary exciter voltage increases, alternator excitation increases and the alternator voltage builds up. When this voltage becomes high enough, the build-up relay switches the voltage regulator into the circuit. The sensing circuit of the voltage regulator PC then compares the input voltage to a reference voltage and adjusts the field power of the rotary exciter to bring the voltage into regulation limits.

The voltage at which the alternator is regulated may be varied by changing the position of the slider on the “Volts Adjust” potentiometer.

When the alternator is loaded, its terminal voltage decreases, lowering the rectified three-phase voltage of the voltage sensing circuit. The sensing voltage is low in respect to its referencce voltage, causing the voltage regulator PC circuitry to increase the power to the field of the rotary exciter. The alternator voltage increases until the voltage returns to its regulated value.

When a load is removed from the alternator, the alternator voltage rises. The rectified three-phase voltage sensing signal increases, causing this signal to be larger than the reference signal. The associated voltage regulator circuitry causes the field power of the rotary exciter to decrease, lowering the alternator voltage until the voltage returns to regulated value.

6. Troubleshooting

a. General

For the convenience of maintenance personnel, this voltage regulator is designed to be trouble-free and simple to put back into service once it has malfunctioned or if it is not functioning properly. The heart of the solid state voltage regulator is the regulator PC board (Section 1-2, 4, Fig. 1, and Fig. 2). Most malfunctions of the voltage regulator will be corrected by *(1)* removing and replacing the PC board, and *(2)* making voltage and line-drop adjustments after installing the new board.

b. Preliminary Checks

Before determining that the voltage regulator is defective, perform the following checks:

(1) Check the 5A fuse on the regulator PC board to be certain that it is good.

(2) Check all connections on the regulator to make certain that they are tight and secure.

(3) Make certain also that the line drop compensator switch (1-2; 8, Fig. 1) is in the ON position for checking line drop compensation.

c. Troubleshooting the Voltage Regulator

Troubleshooting of the solid-state voltage regulator begins logically with a check of the regulator PC board. In most instances this check can be made without removing the voltage regulator from the generator set. This is simply a matter of disconnecting the suspect PC board from the regulator wiring assembly and connecting in its place a PC board which works properly. Proceed as follows:

CAUTION

Shut off the generator set before working on the voltage regulator.

(1) A. Carefully disconnect the rectangular plug connector of the regulator wiring assembly from the suspect PC board. This can be done, if done carefully, without removing the regulator PC cover *(Section 1-2; 2, Fig. 1).*

(2) B. Connect a properly working PC board to the regulator wiring assembly.

(3) C. Place a piece of insulating material between the properly working PC board and the metal PC board cover *(Section 1-2; 2, Fig. 1).* Do this to avoid short circuiting the bottom of the properly working PC board to the cover

(4) D. Start the generator set and perform the tests and adjustments according to instructions in Section 2-4.

(5) E. If the generator set works properly with the properly working PC board temporarily connected to the voltage regulator, shut off the generator set and replace the defective PC board with one that is properly working. On most Hobart generator sets, it is possible to remove and replace the PC board quickly without removing the voltage regulator from the generator set. See Section 2-7, Para. 3 for removal and replacement instructions.

NOTE: Preferably, the defective PC board should be replaced with the same PC board used for this troubleshooting check. This would eliminate the need for again doing tests and adjustments, as would be required with another PC board.

(6) **F.** If these tests and adjustments with the properly working PC board fail to correct the regulator malfunction, follow the same procedure as above for checking the line drop compensator assembly. Refer to Section 2-4 for test and adjustment procedure, and to Section 2-7, Para. 2 for removal and replacement procedure.

7. Voltage Regulator Removal And Installation

a. General

Due to the design of this solid state voltage regulator, and because of its compact size, troubleshooting and repair can often be done without removing it from the generator set. This on-the-unit troubleshooting and repair is explained in Sections 2-2 and 2-4. However, if removal and replacement of the entire voltage regulator is necessary, follow the procedure given below.

b. Removal of Voltage Regulator from Generator Set

(1) Disconnect the 19-pin connector *(1-2; 11, Fig. 1).*

(2) Remove the regulator's attaching hardware, and exercise care to avoid dropping the unit.

(3) Place the unit on a clean workbench, allowing enough room to work on it.

c. Replacement of Assemblies on the Voltage Regulator

Refer to repair instructions in Section 2-7 for procedures for replacement of assemblies on the voltage regulator.

d. Installation of Voltage Regulator on Generator Set

(1) Place the voltage regulator in its proper mounting position.

(2) Fasten the voltage regulator in place with its attaching hardware, and make certain that it is mounted securely.

(3) Re-connect the 19-pin connector, and make certain that this connection is securely made.

8. Adjustment And Test

a. Adjustment

(1) General

When a voltage regulator is first put into service, it may require an adjustment of the regulated output voltage. The generator set must be running at rated RPM, under no-load conditions, when voltage regulation adjustment is made. Adjust the regulator as follows:

(2) Adjust Voltage Control

The output voltage at which the generator is regulated is adjust table by the PC board potentiometer adjustment *(Fig. 2).*

a. Turn the potentiometer adjustment counterclockwise *(CCW)* to increase generator output voltage, and clockwise *(CW)* to decrease voltage.

b. Observe the output voltage as indicated by the voltmeter which is located on the control panel of the generator set.

c. Set output voltage at 115-V AC line-to-neutral *(200-V AC line-to-line).*

(3) Adjust Line Drop Compensation Gain

Adjustment of line drop compensation magnitude is made with the knob marked "Foot Compensation" *(6)* on the line drop compensator module. The knob dial is calibrated for approximate cable length in feet. The "Foot Compensation" knob controls a rheostat which limits the current flowing in the compensation circuit. The setting of the rheostat resistance determines the magnitude of the compensation. Rotating the knob clockwise increases the magnitude of the compensation, and rotating counterclockwise decreases the magnitude. To adjust the line drop compensation gain, proceed as follows:

a. Connect the generator set output cables to a load.

b. Make certain that the line compensation switch (8) is in the **ON** *position.*

c. Set the "Foot Compensation" knob to a dial setting corresponding to the length of the output cables being used.

(4) Adjust Line Drop Compensation Phase

The compensation circuit must be adjusted to match not only the voltage drop in the power cables to the load, but must be adjusted to match the phase of the voltage drop. This is done by adjusting the relative magnitude of the reactor and resistive compensation with the "Cable Size" knob *(7).* This knob is calibrated in cable sizes, and controls a varied resistance in series with a fixed reactance. The power factor of the compensation circuit is varied by varying the resistance and leaving the reactance constant. Rotating the knob clockwise increases the resistive component of the compensation circuit, and simulates a smaller cable. Rotating the knob counterclockwise decreases the resistive component of the compensation. Adjust the line drop compensation phase as follows:

a. Set the "Cable Size" knob (7) to a dial setting corresponding to the size of the output cables.

b. Adjust the generator voltage control potentiometer (13) to the desired value if the line drop compensator adjustments have affected the no-load voltage output.

9. Inspection and Check

a. Inspection

(1) General

Inspect the voltage regulator periodically, at the same time other inspections of the generator set are made.

(2) Inspect Connectors and Terminals

a. Inspect connectors for full engagement.

b. Inspect terminals for security.

(3) Inspect Wiring

Inspect wire insulation for cracks and damage.

(4) Inspect Attaching Parts Inspect attaching hardware for security

(5) Inspect Regulator Fuse on PC Board

When replacing this fuse, replace it with the **EXACT SAME** type and rating of fuse.

b. Check the Voltage Regulator Unit

If it is necessary to check electrical operation of the voltage regulator, refer to Section 2-4 for the test and adjustment procedure to be used.

10. Cleaning And Painting

a. Cleaning

WARNING

Electric shock can kill! Remove power before cleaning regulator.

A. Make certain that compressed air is clean and dry.

B. Do not use flammable or conductive cleaners.

C. Exercise care to avoid damage to components.

Under normal operating conditions, very little cleaning is required; however, when operating under dusty conditions, it may be necessary to periodically clean the regulator with compressed air.

b. Painting

(1) General

Only the sheet metal components of the voltage regulator are painted. Electrical and electronic components should never be painted.

(2) Preparation for Painting

a. Remove regulator from control box *(or from its mounted position)* and place it on a clean workbench.

b. Disassemble as required to remove the component *(s)* to be painted.

c. Prepare the surface to be painted by sanding. Remove all rust.

d. Use tape to mask any electronic or electrical components not removed in step *(2)* above.

e. Prime all bare metal surfaces with red oxide primer, Hobart No. 903318, or equivalent.

(3) Painting the Unit

a. Make certain that all surfaces are clean and dry.

b. Paint all prepared surfaces with gray enamel paint, Hobart No. 903316, or equivalent.

11. Repair

a. General

For the convenience of maintenance personnel, this voltage regulator is designed to be trouble-free and simple to put back into service once it has malfunctioned or if it is not functioning properly. Flight line repair is limited to removal and replacement of either the Voltage Regulator PC Board assembly or the Line Drop Compensator assembly, depending on whether the malfunction of the voltage regulator is poor voltage regulation or poor line drop compensation. Refer to Figure 1, Section 1-2.

It is not recommended that repairs be attempted on the voltage regulator PC board, because voltage regulation could be seriously affected if replacement parts are not identical to the original parts. Therefore a defective PC board assembly should be replaced with a PC board assembly known to be good.

The line drop compensator assembly, like the PC board, does not lend itself to flight line repair. To put the voltage regulator back into service after a line drop malfunction, the line drop compensator assembly should be replaced with an assembly known to be good.

b. Removal/Replacement of Line Drop Compensator Assembly

Removal of this assembly *(1-2; 5, Fig. 1)* from the voltage regulator requires only that one disconnect the 10-pin connector housing *(1-2; 12, Fig. 1)* and remove the four screws which fasten the assembly to the regulator. Replacement of this assembly with one known to be good is simply a matter of mounting the replacement assembly in place, re-installing the four attaching screws securely, and re-connecting the 10-pin amphenol connector, making certain that the this connection is secure.

Refer to Section 2-3, Para. 4 for instructions on installing the voltage regulator on the generator set after replacement of the line drop compensator assembly. Install the voltage regulator accordingly.

c. Removal/Replacement of Voltage Regulator PC Board Assembly

(1) To remove this assembly *(1-2; 5, Fig. 1)* from the voltage regulator, proceed as follows:

a. Remove the attaching hardware *(four hex nuts, lock-washers and flat washers)* which fasten the PC board cover *(2)* to the voltage regulator (on 489812 Regulator's).

b. Disconnect the regulator wiring assembly from the PC board. The wiring assembly attaches to the PC board at a socket connector on the board similar to the one which is mounted on the line drop compensator assembly.

c. The voltage regulator PC board is fastened to the voltage regulator unit with four plastic PC locking supports, one in each corner of the board. To remove the PC board, use a small screwdriver to push in the tab of each PC support, one at a time, while lifting the PC board from the supports.

(2) To install the replacement PC board on the voltage regulator, proceed as follows:

a. Make certain that the PC board is positioned properly *(such that the 12-pin connector of the PC board is close to the line drop compensator assembly)* and press the PC board gently down onto the plastic locking PC supports.

b. Connect the regulator wiring assembly to the newly-installed PC board. Make certain that this connection is securely made.

c. Re-mount the PC board cover, and tighten it down onto the voltage regulator with its attaching hardware *(hex nuts, locknuts, and flat washers).*

d. Make compensation and voltage adjustments, if required, in accordance with instructions in Section 2-4.

e. Refer to Section 2-3, Para. 4 for instructions on installing the voltage regulator on the generator set after the replacement of the PC board. Install the voltage regulator accordingly.

12. Illustrated Parts List

a. Introduction

(1) Scope

The Illustrated Parts List identifies, describes, and illustrates all components of the Solid State Voltage Regulator, Hobart Part No. 489812A, with the exception of attaching hardware.

(2) Purpose

The purpose of the Illustrated Parts List is to provide maintenance and provisioning personnel with identification and descriptive data for use in the provisioning, requisitioning, storing, and issuing of spare parts.

(3) Explanation of Parts List Form

This form is divided into five columns. Beginning at the left side of the form and proceeding to the right, columns are identified as follows:

a. "FIGURE/ITEM NO." Column

This column lists the figure number of the illustration applicable to the list and also identifies each part in the illustration by an item number which appears on the illustration. Assemblies and subassemblies which are illustrated in their disassembled state will not be identified by an item number.

b. "HOBART PART NUMBER" Column

ALL part numbers appearing in this column are Hobart numbers. In all instances where the part is a purchased item, the vendor's identifying five-digit code and his part number will appear in the **"NOMENCLATURE"** column. Vendor parts which are modified by Hobart Brothers will be identified as such in the **"NOMENCLATURE"** column. In case Hobart Brothers does not have an identifying part number for a purchased part, the **"HOBART PART NUMBER"** column will reflect **"NO NUMBER"** and the vendor's mumber will be shown in the **"NOMENCLATURE"** column. Parts manufactured by Hobart Brothers reflect no vendor code or vendor part number in the **"NOMENCLATURE"** column.

c. "NOMENCLATURE" Column

The item identifying name appears in this column. The indenture method is used to indicate item relationship. Thus, components of an assembly are listed directly below the assembly and indented one space. Vendor codes and part numbers for purchased parts are shown in this column. Hobart modification to vendor items is also noted in this column.

d. "EFF" (Effectivity) Code

Code letters *("A", "B", "C", etc.)* are used in this column to indicate the use of parts where more than one model or type of machine is covered by the parts list. Since this manual covers only one model of voltage regulator, this column is not used in this manual.

e. "UNITS PER ASSEMBLY" Column

This column indicates the quantity of parts required for an assembly or subassembly in which the part appears. This column does not necessarily reflect the total used in the complete end item.

(4) Manufacturer's Codes

The following list is a compilation of vendor codes with names and addresses for suppliers of purchased parts listed in this publication. The codes are in accordance with the Federal Supply Codes for Manufacturers' Cataloging Handbook H4-1, and are arranged in numerical order.

Code	Vendor's Name And Address
02660	**Bunker-Ramo Eltra Corp.** Amphenol Division 2801 S. 25th Avenue Broadview, Il 60153
15605	**Eaton Corporation** Operations and Technical Center 4201 N. 27th St. Milwaukee, WI 53216
44655	**Ohmite Manufacturing Co.** 3601 W. Howard St. Skokie, IL 60076
50508	**Magnetic Components, Inc.** 9520 Ainslie St. Schiller Park, IL 60176
52238	**Richlok Corporation** 5825 N. Tripp Avenue Chicago, IL 60646
75376	**Kurz-Kash, Inc.** 2271 Arbor Blvd., P.O. Box 1246 Dayton, OH 45401
88223	**General Products Corp.** 107 Salem St. Union Springs, NY 13160

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b. Parts List

(1) Explanation of Parts List Arrangement

The parts list is arranged so that the illustration will appear on a left hand page and the applicable parts list will appear on the opposite right hand page. Unless the list is unusually long, the user will be able to look at the illustration and read the parts list without turning a page.

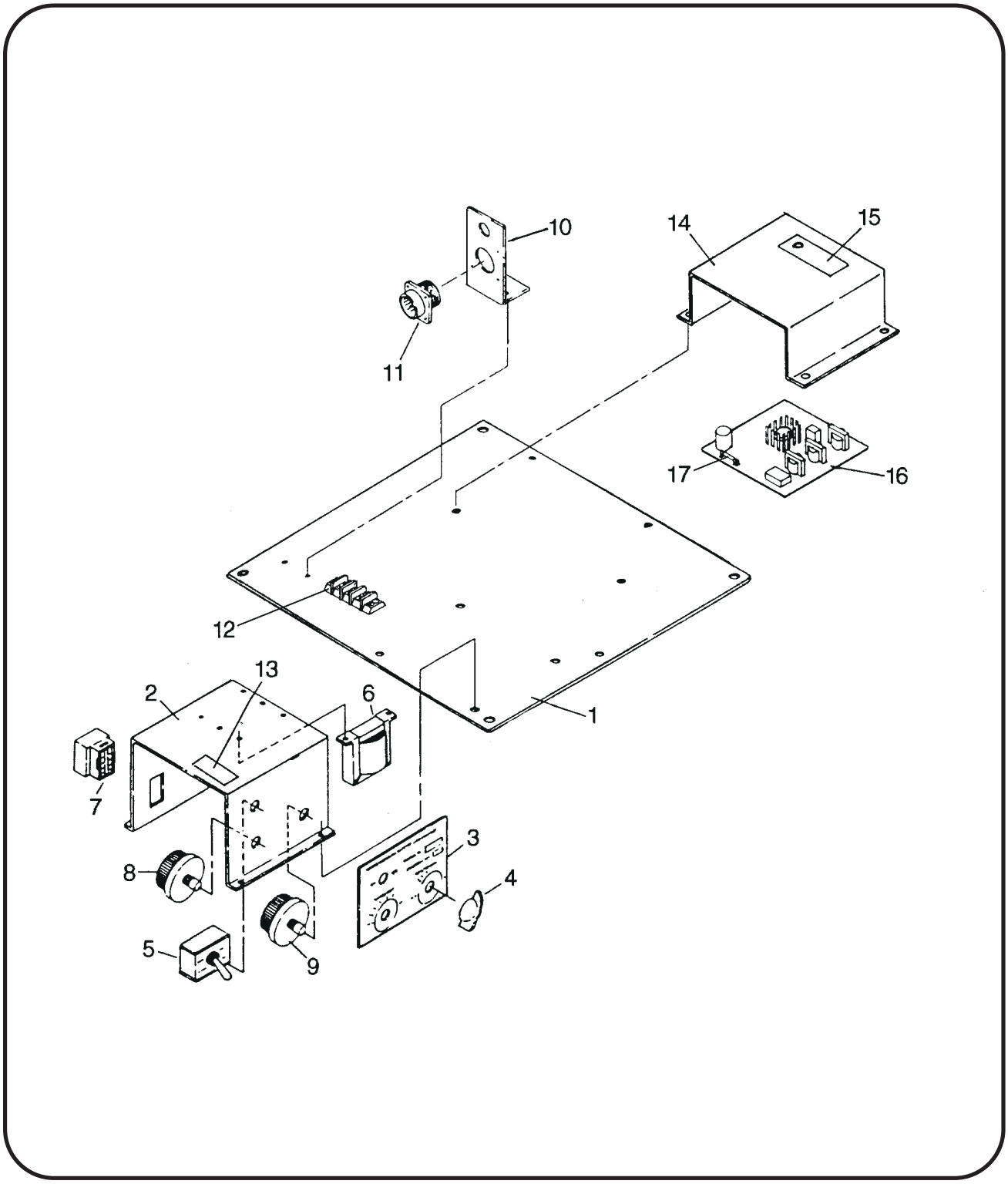
This parts list is **all-inclusive**, in that it covers parts for **all sixteen** of the **trailer and/or truck-mounted generator set specifications** available in generator set Series 5359F. For parts used only on one particular generator set, refer to the effectivity (EFF) code in this parts list for that generator set.

(2) Symbols and Abbreviations

The following is a list of symbols and abbreviations used in the parts list.

*	-	item not illustrated
A, or AMP	-	ampere
AC	-	alternating current
AR	-	as required
DC	-	direct current
Fig.	-	Figure
hd.	-	head
hex	-	hexagon
Hz	-	Hertz (cycles-per-second)
I.D.	-	inside diameter
IN	-	inch
kVA	-	kilovolt-ampere
F	-	microfarad
No.	-	number
NHA	-	next higher assembly
Ω	-	Ohm
OM	-	Owners Manual
PRV	-	peak reverse voltage
PSI	-	pounds per square inch
Ref	-	reference (the item has been listed previously) TM - Technical Manual
T-R	-	transformer-rectifier
V	-	volt (when used as a prefix to a five-digit number, indicates vendor code)

NOTE: An item which does not reflect an index number is an assembly which is not illustrated in its assembled state, or it is similar (right-hand, left-hand, top, etc.) to an item which is illustrated.



Solid State Voltage Regulator Assembly
Figure 3

FIGURE ITEM NO.	HOBART PART NO.	NOMENCLATURE 1 2 3 4 5 6 7	EFF	UNITS per ASSY
3-	489812A	REGULATOR, VOLTAGE (SOLID STATE) (For NHA See Fig. 3)		REF
1	180075	CHASSIS, REGULATOR		1
	430340	. CHASSIS, LINE DROP COMPENSATION, ASSY		1
2	430470	. . CHASSIS		1
3	402373	. . NAMEPLATE, LINE COMPENSATION		1
4	W-11597	. . KNOB, POINTER, V75376, NO. S-292-3L		2
5	1CZ-70	. . SWITCH, ON-OFF, V15605, NO. 7610K2		1
6	1CZ-97	. . REACTOR, LINE DROP, V50508, NO. E-3963		3
7	401563-3	. . HOUSING, PIN CONNECTOR		1
8	1CZ-105	. . RHEOSTAT, TRIPLE TANDEM, V44655, NO. H-10-F2-T3		1
9	1CZ-128	. . RHEOSTAT, TRIPLE TANDEM, V44655, NO. 6610		1
10	370141	. BRACKET, MOUNTING, PLUG		1
11	402376	. RECEPTACLE, V02660, NO. MS-1302A-22-14P		1
12	401911-3	. TERMINAL BOARD, V88223, NO. 441-3		1
13	180074	. NAMEPLATE, MODEL, SERIAL NO.		1
14	181419	. BOX, P.C. BOARD, ASSEMBLY		1
15	408537	. LABEL, CAUTION		1
16	489811	. BOARD, PC, VOLTAGE REGULATOR,		1
17	400647-8	. . FUSE, TYPE ABC-10, 10-A, 250-V		1
*18	408542-1	. GUARD, STRIP TERMINAL		4

*** Not Illustrated**

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Chapter 3. Overhaul / Major Repair

Section 1. Table of Contents

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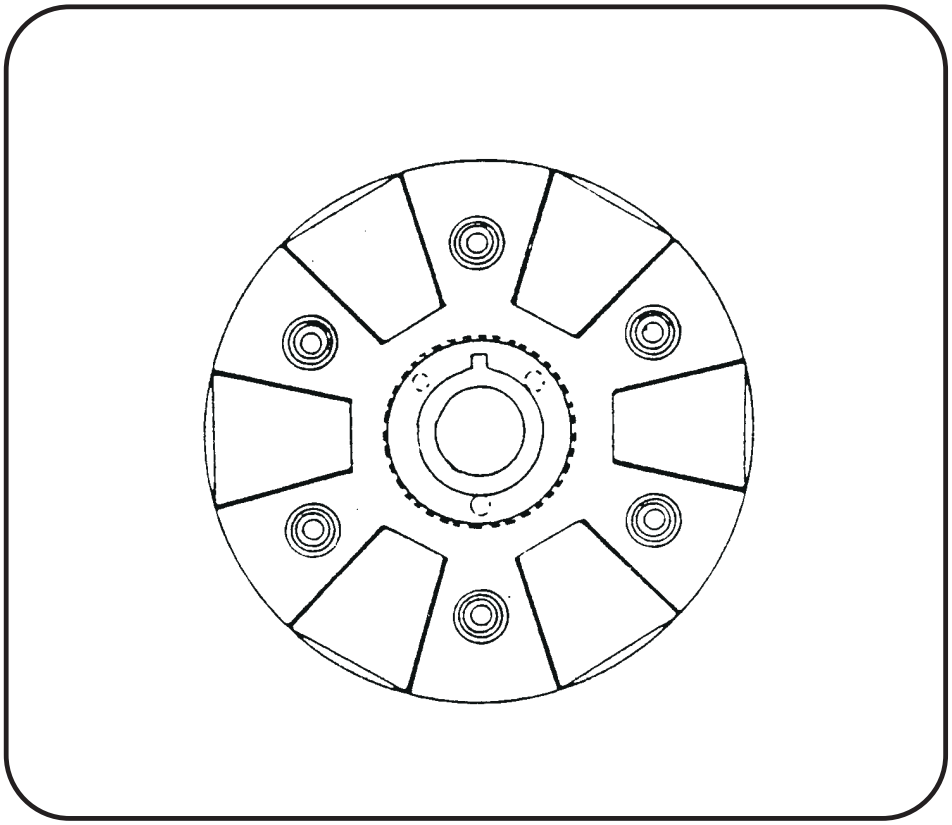
Section 2. Flexible Coupling

1. General

This section provides basic instructions for removal, service and installation of a flexible coupling assembly, with fan attached, manufactured by **Hobart Brothers Company** as **Part Number 488908.** This assembly is illustarted in Figure 1. The primary function of this assembly is to couple a Hobart Generator Set to a Diesel engine. The flexible coupling assembly compensates for slight misaligment between the engine and the generator, due to manufacturing tolerances. A tapered bushing and hub secures the coupling to the generator shaft.



Coupling Assembly
Figure 1

a. Coupling Bolts

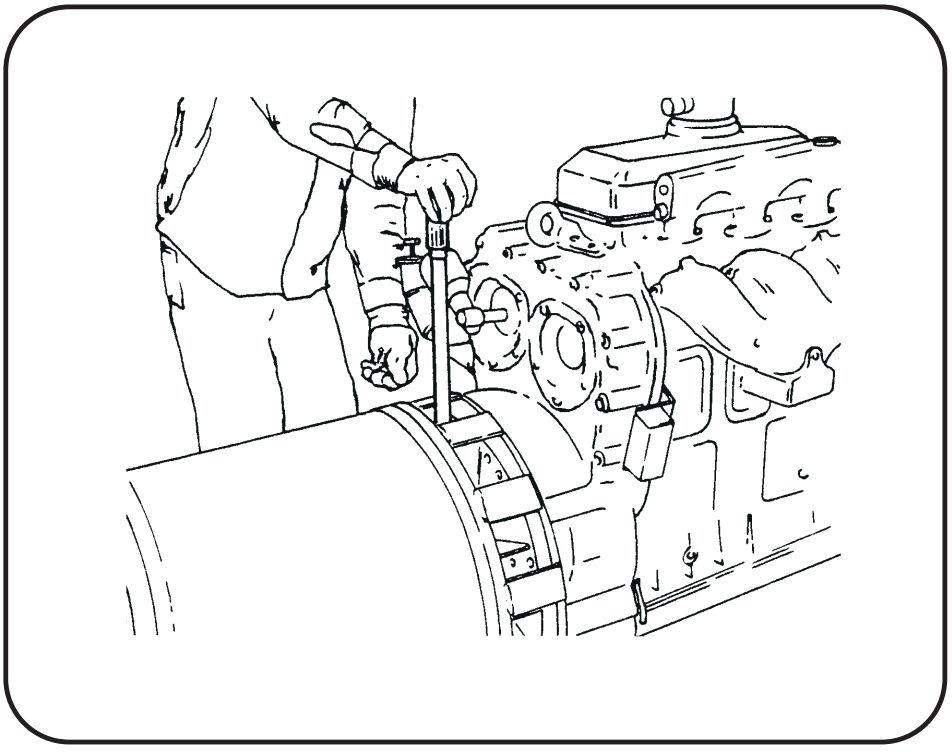
CAUTION

Failure to verify proper coupling bolt installation may result in coupling failure and damage equipment.

NOTE: It is not necessary to seperate the engine and generator if all that is being done is checking and replacing the coupling bolts. Removal of the perforated cover over the fan housing provides access to the coupling bolts for removal and installation.

(1) Refer to Figure 2. Use a long-handled, reversible ratchet drive with a 15/16-inch hex socket wrench to remove one coupling bolt. Measure its length. If it is 2-3/4 inches *(70mm)* long, reinstall it and torque **ALL** of the coupling bolts to 85 foot-pounds *(115 N-m).*

(2) Use of the proper coupling bolts for replacement is **VERY IMPORTANT**. Replacement bolts **MUST** be 5/8-11, SAE Grade 5, hex-head bolts, 2-3/4-inches *(70 mm)* long, reinstall it and torque **ALL** of the coupling bolts to 85 foot-pounds *(115 N-m).* There is **NO ACCEPTABLE SUBSTITUTE** for these bolts. Hobart Brothers stocks these bolts as Part Number W-11102-18.



Access to Coupling Bolts
(for Removal and Installation)
Figure 2

2. Disassembly

Removal of the flexible coupling is required for servicing the generator armature, generator bearings, or the coupling itself. To remove the coupling, for any reason, it is necessary to seperate the engine and generator. On self-propelled units, many mechanics prefer to remove the engine and generator as an assembly, and then seperate them. Others may prefer to remove the engine or the generator seperately to reach the coupling. However, seperating the engine and generator while they are installed in the Ground Power Unit is **VERY DIFFICULT** because of the limited working space.

During removal **DO NOT** cut any cables or wires. Disconnect and tag them for reassembly.

a. Seperate Engine and Generator

(1) **(1)** Install a lifting eye with 1/2-13 threads in the tapped hole on top of the generator frame, and attach a hoist to it. Lifting eyes are available from Hobart as Part Number CTW-116A.

(2) **(2)** Remove the fan housing cover from the generator fan housing.

(3) **(3)** Refer to Figure 2. Use a 15/16-inch socket ona long-handled ratchet and remove the hex-head bolts which attach the coupling to the engine flywheel.

NOTE: These bolts were torqued to 85-foot pounds (115 N-m) at installation. Therefore it may be necessary to block the armature against counterclockwise rotation to remove them.

(4) Remove bolts attaching the generator fan housing to the engine flywheel housing.

(5) Seperate the generator from the engine with a hoist and move it to a clear working area.

b. Remove Coupling Assembly

(1) Refer to Figure 3. Using a socket wrench, remove all three of the 3/8-16 bolts *(1)* that secure the bushing *(2)* to the hub *(3).*

(2) To separate the housing from the hub, lubricate two of the 3/8-16 bolts and insert them into the threaded holes (4) in the bushing. With socket wrench, screw these bolts into the bushing such that the bushing pops loose from the hub.

(3) Using a 3/16-inch Allen wrench, loosen the set screw *(7)* in the bushing to release pressure on the key (5).

(4) When the bushing *(2)* is loose in the hub *(3),* use a mallet to **GENTLY** tap the bushing out of the hub.

(5) Slide the coupling assembly off the shaft and remove the key *(5).*

(6) Inspect the coupling assembly components carefully as follows:

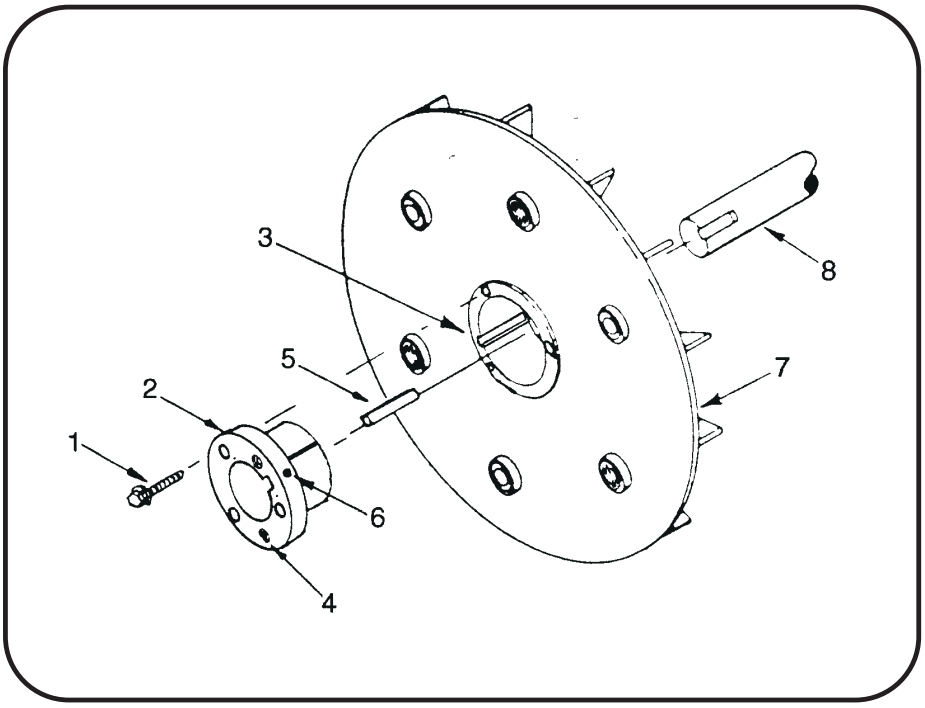
a. Check for deformed fan blades and damage to the disk.

b. Check the rubber exposed at both ends of the bushings for signs of deterioration.

c. Check hub and split bushing for cracks, evidence of galling, and rust pits. Light rust is permissible on the split bushing and the tapered bore of the hub.

d. Check the shaft for any damage or deformation where the coupling was mounted on it.

e. Check bushing alignment to make sure that the dimension illustarted in Figure 6 is maintained.



1. Bolts, 3/8 - 16 (3)
2. Bushing
3. Hub
4. Tapped holes (2)
5. Key
6. Set screw
7. Coupling disk

Hub and Bushing
Figure 3

3. Coupling Service

When ordering coupling kits or other parts from your Hobart Brothers Company Distributor, be sure to include all pertinent information from the unit's identification plate: Specification No., Model No., and unit rating.

If you have any questions concerning your **Hobart Power Systems Group** equipment, you are invited to contact our **Service Department** by mail, telephone or FAX.

Write:
Hobart Brothers Company
Airport Systems Group
Service Department
1177 Trade Square East
Troy, Ohio 45373
U.S.A

In U.S.A. Call:
(800) 422-4166
(800) 422-4177

From Foreign Countries, Call:
(937) 332-5050 (Parts)
(937) 332-5060 (Service)

Fax:
(937) 332-5121

a. Coupling Kits

A replacement coupling kit is available from your **Hobart Brothers Company Distributor.** This kit provides a replacement coupling assembly with attaching hardware and installation instructions. The Part Number for this kit is **488908.** This kit is illustarted in Figure 4.

b. Bushing Kit

A bushing kit is available from Hobart Brothers Company for replacing the rubber bushing only in the coupling assembly. However, it should be noted that the finished coupling assembly must be balanced to 1/2 inch-ounce *(360 mg-m)* minimum, which may be a problem in the field. If bushing replacement only is required, the kit part number is **480290.** Each kit contains the required number of bushings, a container of lubrication, and installation instructions. To replace bushings only, proceed as follows:

(1) Press out **ALL** old bushings.

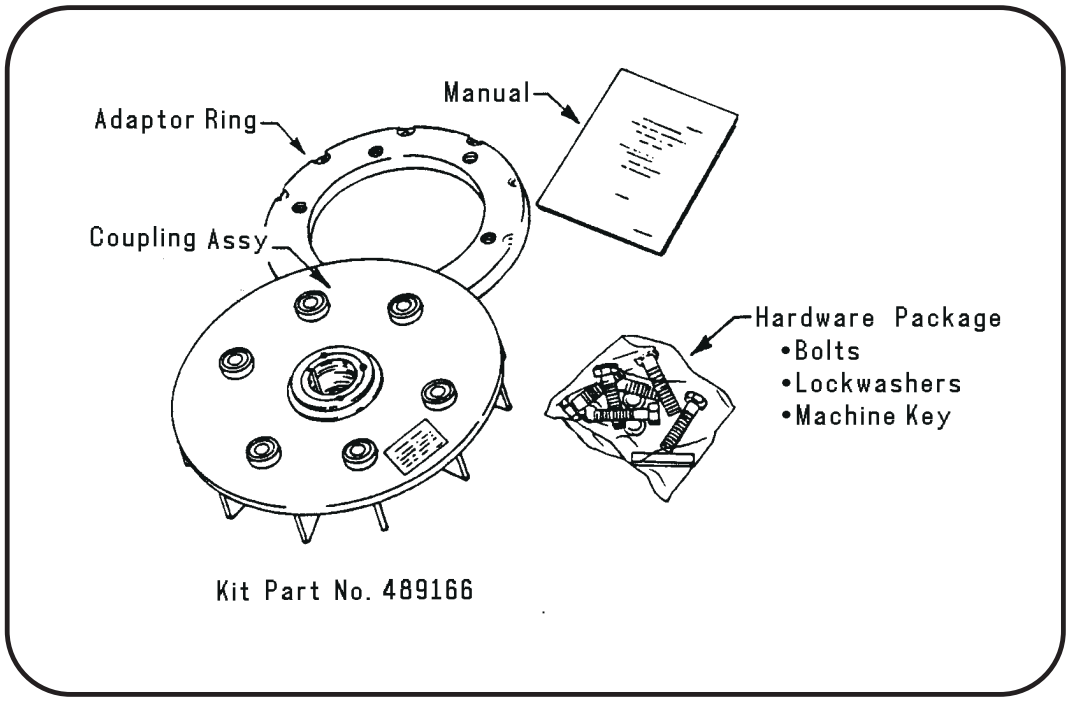
(2) Refer to Figure 5. Clean each bushing socket thoroughly, removing all traces of old rubber. **DO NOT** scratch or deform the bore of the bushing socket.

(3) Shake the container of lubricant vigorously and pour it into a small shallow dish.

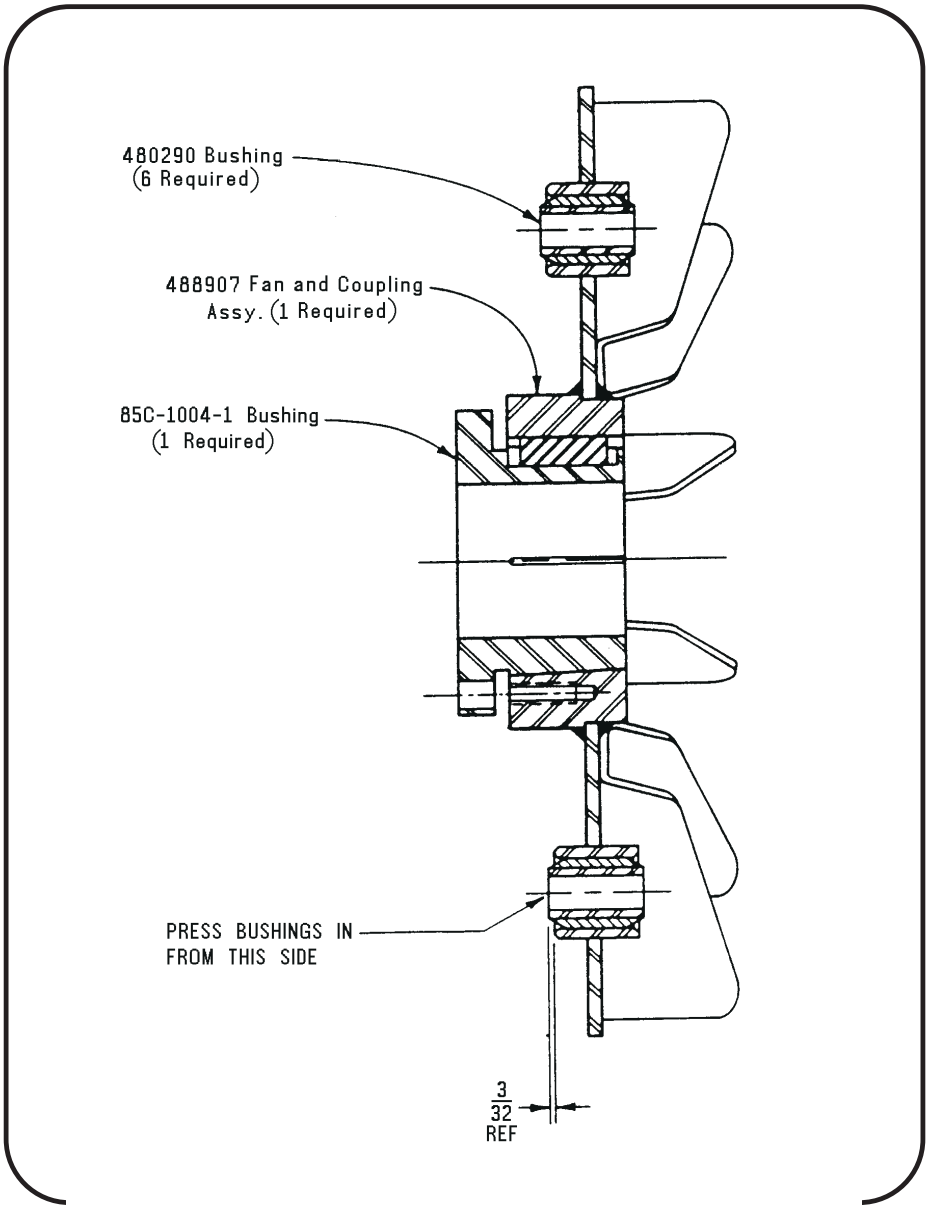
(4) Roll a bushing in the lubricant to coat it thoroughly, and press it into a socket *(from the chamfered end)* to the dimension shown in Figure 5: 3/32 +/- 1/64th-inch *(2.381 +/- 0.397 mm)* from the face of the bushing socket to the face of the bushing, on the side opposite the fan blades.

(5) Repeat step 4 until all new bushings are installed.

(6) Balance the complete coupling assembly to 1/2 inch-ounce *(360 mg-m)* minimum.



Coupling Kit
Figure 4



Bushing Installation
Figure 5

4. Coupling Installation

CAUTION

Improper installation of the coupling assembly can result in serious damage to the equipment. Follow these installation instructions exactly.

a. Cleaning

Refer to Figure 6. It is **VERY IMPORTANT** that the shaft, the bore and the outside of the split bushing, and the tapered inside of the hub be thoroughly **CLEANED FREE OF DIRT AND GRIT.**

CAUTION

Do not lubricate any of the surfaces listed above. Lubrication of these surfaces can cause the coupling to fail and damage the generator set. Slight traces of rust are permissible on the surfaces marked "x", but nothing else.

b. Assembly

(1) **(1)** If an adaptor ring must be replaced, remove the 8 bolts which secure it to the flywheel. Discard the old adaptor ring and bolts. Install the new adaptor ring Part No. **386612** using the new bolts Part No. **W-11097-34** *(Kit 489166)* or Part No. **W-11259-6** *(Kit 180504).* The new adaptor ring and bolts are included in the kits.

(2) Torque all 8 bolts to 30 foot-pounds *(41 N-m).*

(3) Refer to Figure 3. Assemble the split bushing *(2)* into the hub *(3).*

CAUTION

Make certain that only the bolts are lubricated, and that no lubricant is permitted to get inside the bushing where the armature shaft will enter the bushing.

(4) Lubricate the three 3/8-16 bolts **SPARINGLY** and start them into the three *(unthreaded)* holes finger-tight.

(5) Slide the generator armature as far as it will go toward the fan housing. Block the armature to maintain this forward position throughout the installation procedure. Block the armature with a wooden block or wedge, being careful not to damage any components of the armature or exciter.

CAUTION

Do not rotate the armature while this block is installed.

(6) Install the key in the shaft keyway.

(7) Place the bushing in the hub over the installed key *(5),* and install the coupling assembly on the shaft, with the split bushing approximately flush with the end of the shaft.

(8) Using a 3/16-inch Allen wrench, tighten the set screw *(7)* in the bushing *(2)* to apply pressure on the key *(5).*

(9) Refer to Figure 9. Place a straightedge across the two adjacent bushings and measure the distance from the bushings to the mounting face of the generator fan housing. Slide the coupling assembly on the shaft until this dimension is 1/16-inch *(1.6 mm)* **LESS** than the dimension recorded in step 7 above. The tapered hub will be pulled onto the split bushing 1/16-inch *(1.6 mm)* when the 3/8-16 bolts are completely tightened.

(10) Tighten the 3/8-16 bolts *(1, Figure 3)* alternately and evenly as follows:

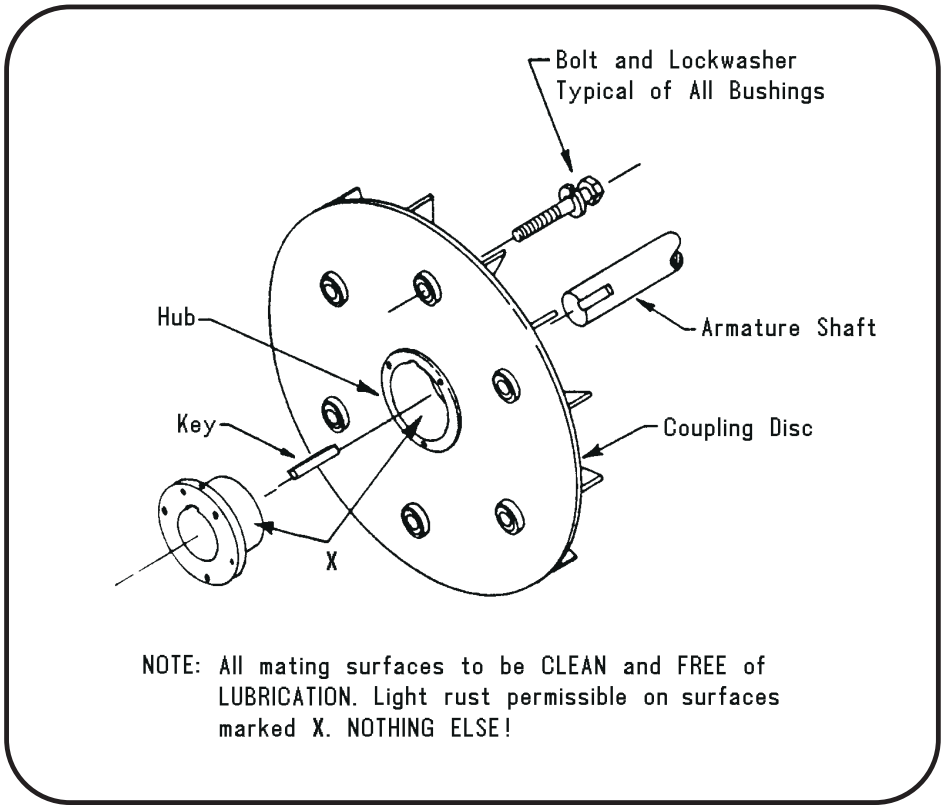
a. Set a torque wrench to 30 foot-pounds (41 N-m) and tighten all three 3/8-16 bolts to that value. Block the coupling against clockwise rotation with a bar, as illustrated in Figure 10. Observe the **CAUTION** *above when it is necessary to rotate the shaft.*

b. Repeat step (a) above until 3/8-16 bolts can no longer be tightened.

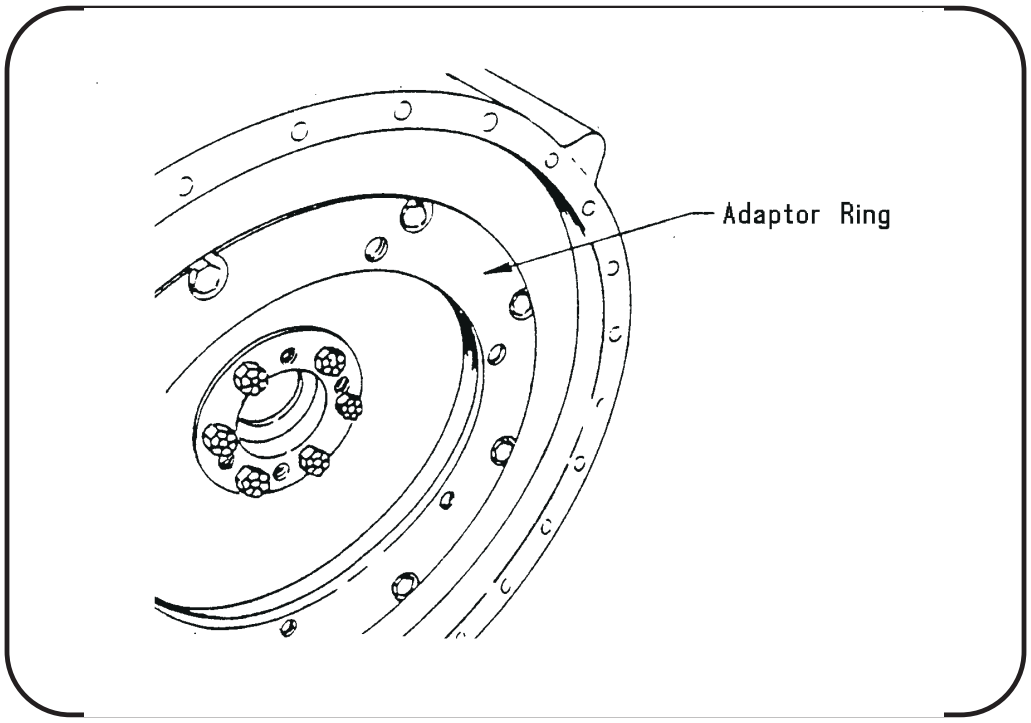
c. Recheck the dimension in Figure 9 to be sure it is the same as the dimension in (7) above.

CAUTION

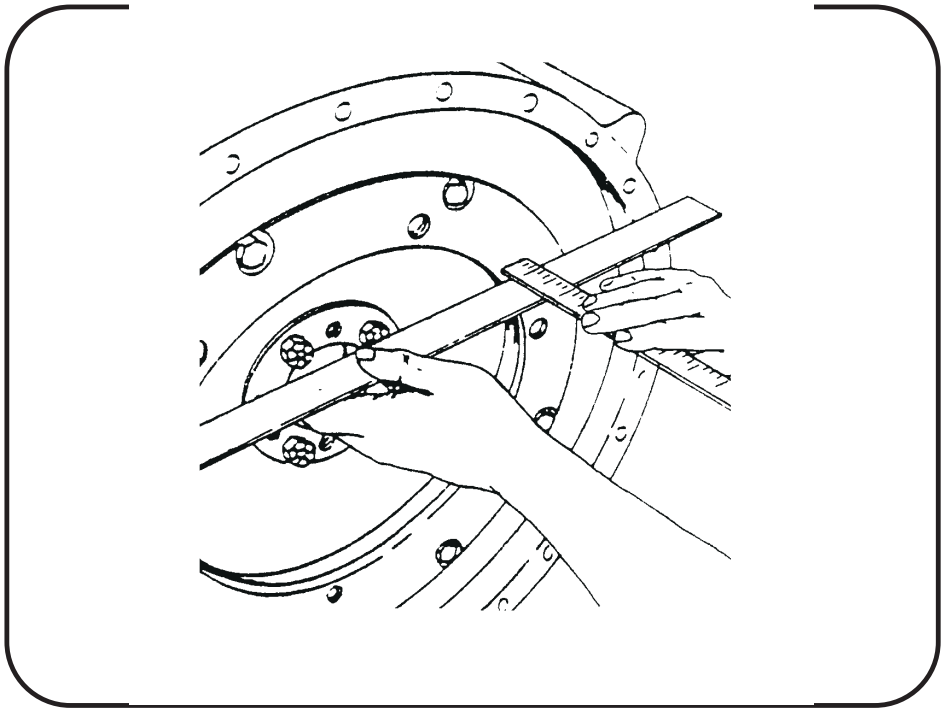
Remove armature block installed in para. 4, b, (3). Otherwise, damage to the armature could result.



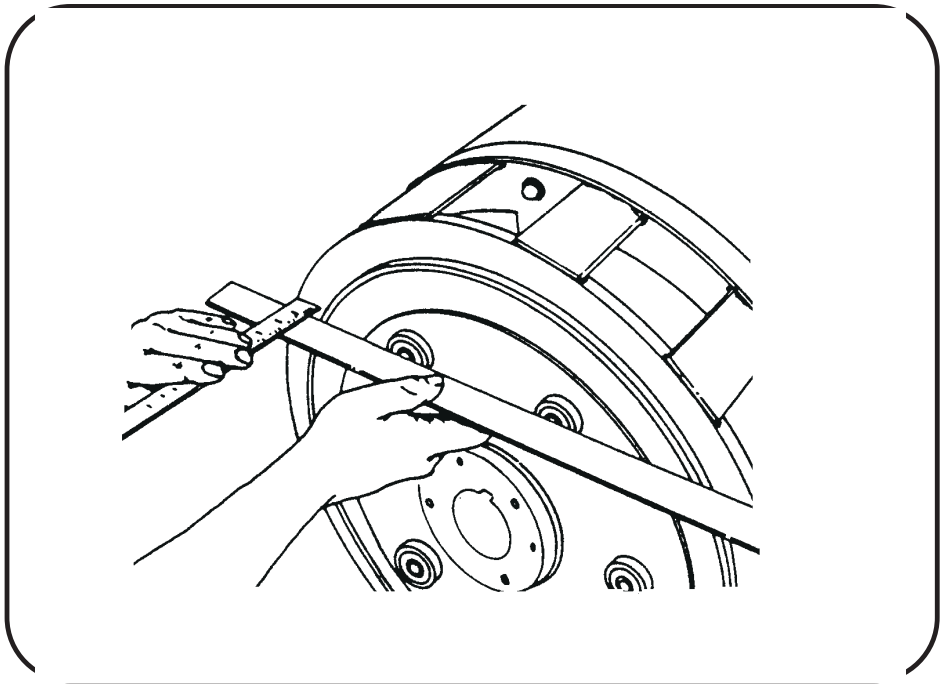
Assembly Procedure
Figure 6



Flywheel Adaptor
Figure 7



Engine Measurement
(Measuring from mounting face to adaptor ring)
Figure 8



Measuring from Mounting Face to Bushing
Figure 9

5. Reassemble Engine and Generator

CAUTION

Use of the proper coupling bolts is very important. Failure to use the proper bolts, as outlined below, can result in coupling failure and damage to the generator set.

Use **5/8-11 SAE GRADE 5** hex-head bolts **2-3/4 inches** *(70 mm)* long. These bolts are included in the coupling kit, and are available from **Hobart Brothers** as Part No. **W-11102-18.**

a. **Insert the proper coupling bolts with lockwashers through the bushings from the FAN side of the coupling.**

b. **Using a hoist, align the generator fan housing flange with the flange on the engine flywheel housing and insert two of the attaching bolts, one on each side of the flange. Start the bolts into the tapped holes in the flywheel housing just enough to ensure thread engagement. DO NOT TIGHTEN.**

c. **Turn all of the coupling bolts into the tapped holes in the flywheel, finger tight. DO NOT tighten with a wrench.**

d. **Insert all remaining attaching bolts** *(two installed in Step B, above)* **through the generator flange, engaging the tapped holes in the flywheel housing, and tighten them all securely.**

e. **Refer to Figure 2. Insert a long piece of wood through the fan housing to block the armature against clockwise rotation. Torque all of the coupling bolts to 85 foot-pounds** *(115 N-m).*

6. Run-in and Periodic Check

a. **Mount the engine-generator assembly in a suitable test area and operate it for a 2-hour run-in.**

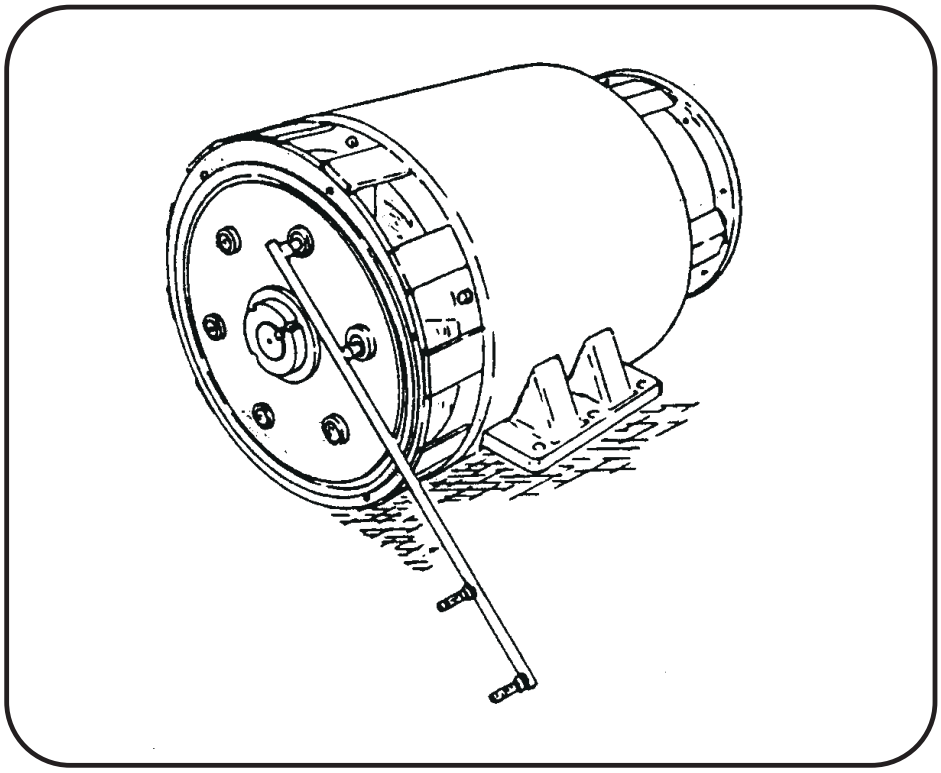
b. **Shut down the engine after 2 hours and re-torque all coupling bolts to 85 foot-pounds** *(115 N-m)* **to compensate for normal torque relaxation.**

c. **Return the unit to normal service.**

d. **After 200 hours of operation, check all coupling bolts with a torque wrench set at 85 foot-pounds** *(115 N-m).*

e. **Return the unit to normal service.**

f. **After each additional 2,000 hours of operation** *(or every year)* **recheck all coupling bolts to maintain the same torque value.**



Blocking Coupling Assembly Against Rotation
Figure 10

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Section 3. Exciter Armature Removal and Installation

1. General

This section provides information and instructions for removal and installation of the exciter armature used on this generator set. Through design improvements, the exciter and main bearing can now be removed without removing the generator from the generator set. The name exciter armature refers to the shaft-mounted, revolving three-phase windings of the exciter.

The exciter armature covered by the manual is mounted on the rear portion of the main generator armature shaft which extends rearward, beyond the rear generator bearing, into the exciter housing (See Fig. 1). Because of its location on the shaft, the exciter armature must be removed for main bearing replacement.

Since the removal and installation of exciter armatures can be rather complicated, this manual has been prepared to assist mechanics in the operation. It may be necessary to remove the exciter armature several times for bearing replacement during the life of a generator set.

2. Exciter Armature

The exciter armature used in this generator set consists of a revolving winding assembly on a laminated core, a rectifier assembly (diode mounting plate with diodes), and a one-piece flywheel and mounting sleeve (or hub) casting. See Figure 2. The field core and rectifier are mounted on the sleeve of the flywheel casting.

3. Exciter Armature Replacement

a. General

As stated earlier, exciter armature removal is often required for rear bearing replacement rather than for replacement of the exciter armature itself. Other reasons for exciter armature removal are: generator armature replacement, general overhaul, etc.

b. Conditions for Exciter Removal

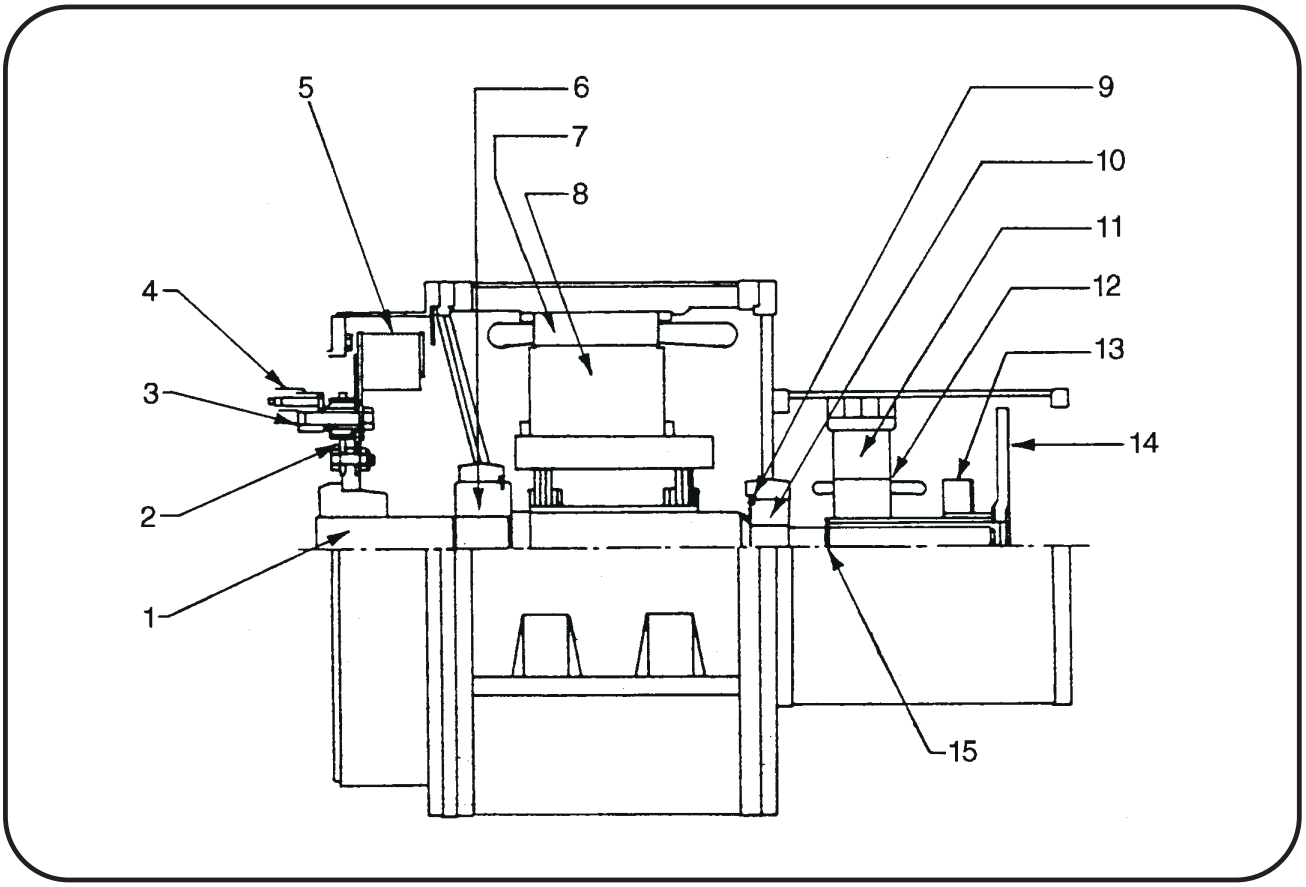
The mechanics performing the work must decide upon the best and most convenient method of removing the exciter armature. If the exciter armature is being replaced, then the work may be performed without removing the generator from the machine. In a great majority of cases, exciter removal will be for the replacement of bearings. This operation can also be accomplished without removing the generator.

c. Tools for Exciter Armature Removal and Installation

In addition to the standard mechanic's hand tools such as wrenches, etc., you will need only the following items for removing the exciter armature: A small lightweight sling-hammer puller, and a gear puller with pilot plug and 5/16 - 18 puller attaching screws.

The sling-hammer puller (Fig. 3) is required for removing the threaded machine key (8, Fig.2) from the exciter armature. If the technician doesn't have such a puller in his equipment, Figure 3 also shows components and dimensions for fabricating such a tool. Figure 4 shows a gear puller with pilot plug and 5/16 - 18 puller attaching screws such as will be needed for pulling the exciter armature from the generator armature shaft.

To install an armature, in most cases, a fabricated tool for pushing the armature onto the generator shaft is required. The armature should NEVER be hammered onto the shaft. If only a single machine is being maintained, a a simple installation tool such as shown in Fig. 10 may be sufficient. If several machines are being maintained, it may be feasable to fabricate a tool which will make armature installation easier and faster. Figue 11 illustrates a typical tool of this type, and gives dimensions, materials, and instructions for fabricating such a tool.



1. Armature shaft
2. Flexible coupling and hub
3. Flywheel adapter
4. Engine flywheel
5. Fan
6. Front bearing
7. Generator stator
8. Generator revolving field
9. Rear bearing snap ring
10. Generator rear bearing
11. Exciter stator
12. Exciter armature revolving fields
13. Rectifier
14. Exciter armature flywheel (clutch mounts here)
15. Armature locating snap ring

Generator (Top Half Sectioned)
Figure 1

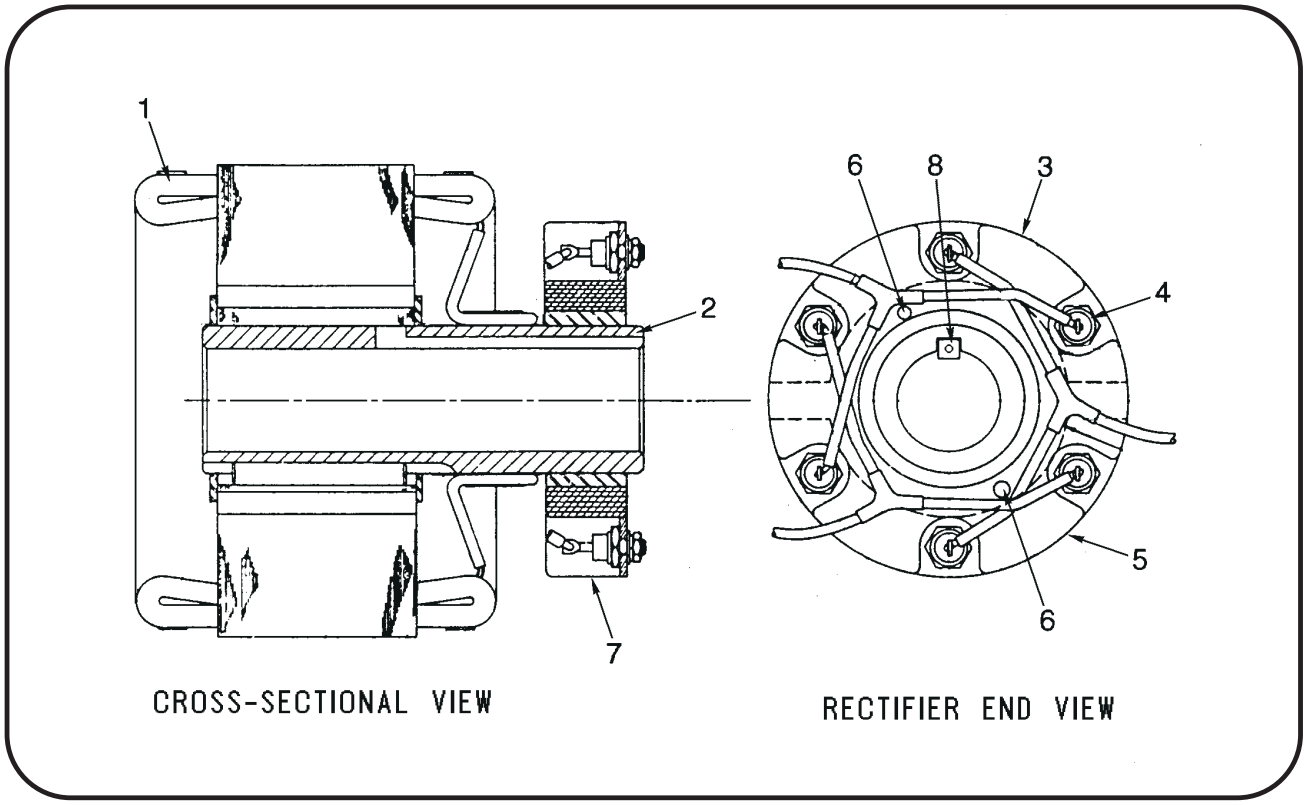
d. Preparation for Exciter Armature Removal

(1) Remove louvered exciter cover from end of canopy.

(2) Remove exciter housing cover as required. Then remove the 1/2-13 cap screw which holds the exciter armature on the generator shaft.

(3) Refer to Figure 3. Disconnect the two rectifier-to-generator field leads (1) from diodes (9) to which they are attached. Cut off terminal lugs (2) from the two leads so that leads will pass through routing holes in rectifier body and armature core as armature is removed. CUT AS CLOSE TO LUGS AS POSSIBLE to conserve leads and to prevent the need for splicing.

(4) Cut and remove tape (3) which binds generator field leads to rotor sleeve. **EXERCISE CARE** to prevent damage to leads. Remove kinks in the two generator leads as much as possible before starting removal operation.



1. Rotor windings
2. Rotor core
3. Positive heat sink
4. Diode
5. Negative heat sink
6. Leads routing holes
7. Rectifier
8. Threaded machine key

Exciter Armature
Figue 2

e. Exciter Armature Removal

(1) Removing the Threaded Key With Sling-Hammer Puller

Attachment of the assembled puller to the threaded key (8, Fig.2) in one operation is not recommended because the weight and bulk of the assembly make threading the 1/4-inch stud into the key rather clumsy. To do so could result in cross-threading and damage to the key and stud. It is safer and easier to attach as follows:

a. Thread stud (1, Fig. 3) into adapter (2, Fig. 3) until it bottoms, then thread this assembly (1) and (2) into key until stud bottoms in key threads. Tighten securely.

b. If hammer (5) and rod (4) are not already assembled, thread one nut (3) onto addapter end of rod (4). Thread rod into adapter until it bottoms, then tighten nut securely against adapter. Slide hammer (5) onto rod and install washer (6) and two nuts (3). Thread nuts onto rod until both nuts are fully threaded, then lock together.

WARNING

Be very careful during removal process (slide-hammering) to avoid injury to hands.

CAUTION

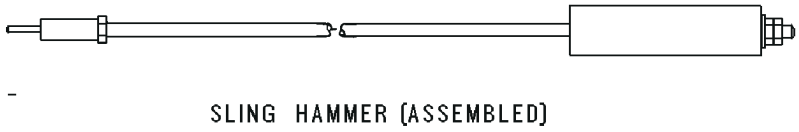
Exercise care to prevent breaking or damaging stud.

c. Position hammer at adapter end of rod.

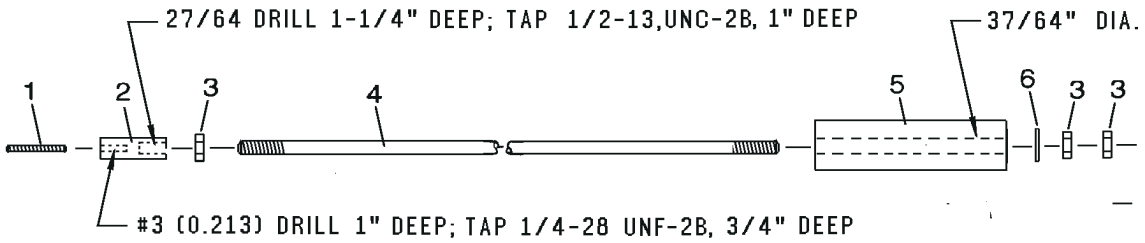
d. Quickly move hammer to outer end of rod with a rapid, slinging motion. HOLD the hammer through the entire motion. If hammer is allowed to slide free on the rod, the stud could be DAMAGED or BROKEN.

e. Repead steps (c) and (d) as required to loosen key, then remove key and slide hammer and puller.

f. After key is removed, apply penetrating oil in the armature and shaft keyways.



SLING HAMMER (ASSEMBLED)



SLING HAMMER COMPONENTS

1. Stud, 1/4-28 UNF 2A, grade 5 or 8 only
2. Adapter, 3/4" round CR steel
3. Nut, 1/2-13 hex, steel (3 required)
4. Rod, 1/2" round, CR steel
5. Hammer, 2"round CR steel
6. Washer, flat, 1/2: steel

Sling-Hammer Puller
Figure 3

(2) Removing the Armature with Gear Puller

Figure 5 shows the location of the holes into which gear puller screws must be inserted for removing the exciter armature from the generator armature shaft. This figure also shows the gear puller installed for pulling the exciter armature. Proceed as follows to remove the exciter armature.

a. *Attach gear puller (Fig. 4) to the exciter armature using 5/16 - 18 puller attaching screws, just as shown . BE CERTAIN to install a plug in the end of the generator shaft to protect threads and pilot bushing.*

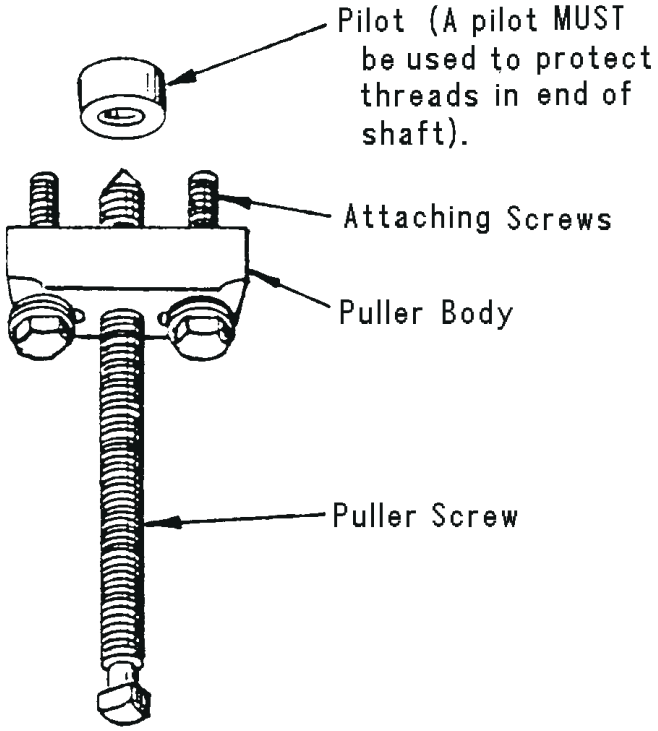
b. *Attach puller attaching screws so that pulling force is equally divided between them and so that the puller is mounted squarely.*

c. *Turn the main puller screw to apply pulling pressure. If the armature does not break loose, strike the end of the main puller screw with a heavy hammer. Continue to alternately tighten puller screw and strike the screw head until the armature breaks loose from the shaft.*

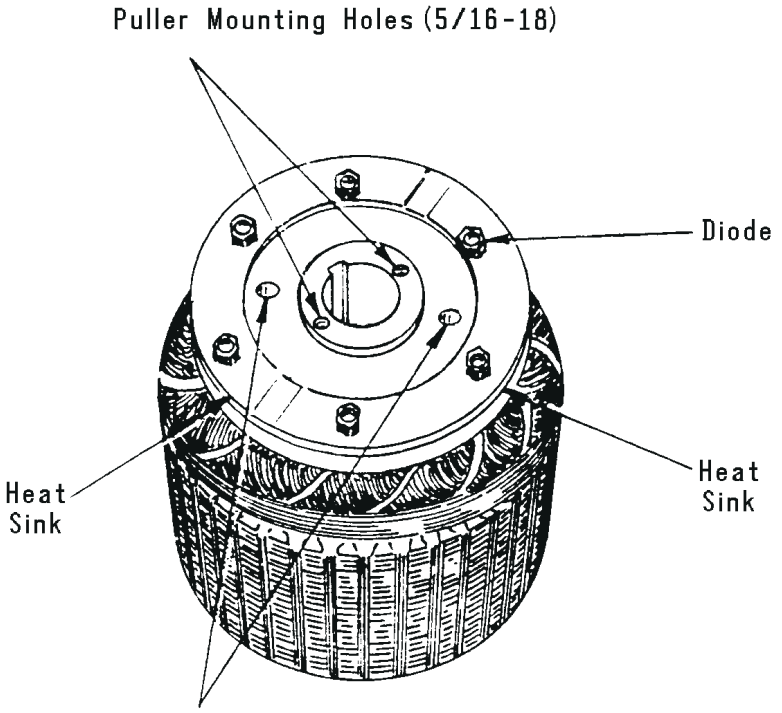
d. *When exciter armature is loosened, use the puller to remove it slowly from the shaft and at the same time observe the following CAUTION.*

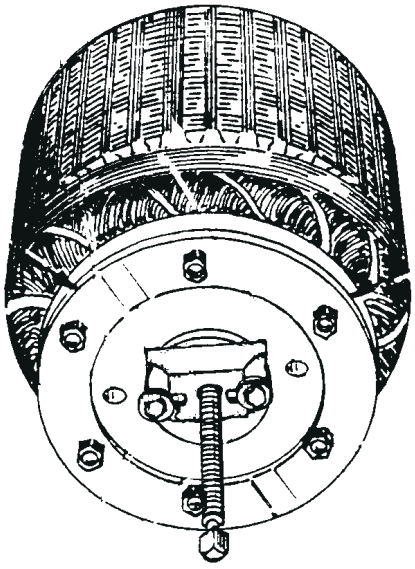
CAUTION

Pay close attention to field leads (1, Fig. 3) while pulling exciter rotor from shaft. One mechanic should watch them constantly while another mechanic operates the puller. Make certain that leads do not catch and be sure that they slide smoothly through tubes (6, Fig. 3). Straighten leads and remove kinks to avoid damage to insulation.



Typical Gear Puller
Figure 4





Exciter Armature With Puller Attached

Pulling the Exciter Armature
Figure 5

4. Installing the Exciter Armature

a. Preparation for Exciter Armature Installation

(1) Clean generator shaft, exciter armature bore, and machine key. Remove all rust, corrosion, etc.

(2) Apply **LOCQUIC** primer, No. 47-56 grade T to exciter armature key and keyway (See Fig. 6). Clean excess from armature bore mounting surface.

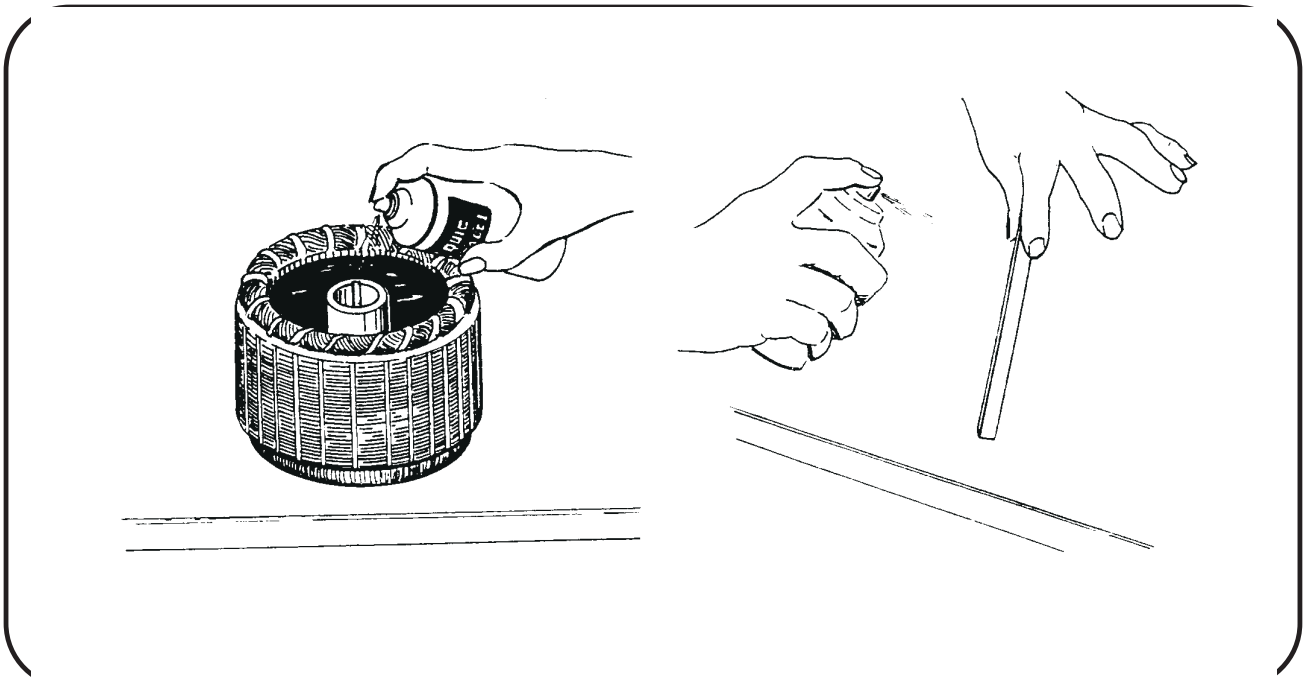
(3) Apply LOCQUIC retaining compound, No. 40-31 to SIDES of machine key (See Fig. 7) and spread evenly. Remove excess LOCQUIC from shaft and key.

NOTE Manufacturers of recommended products are listed on the last page in this section.

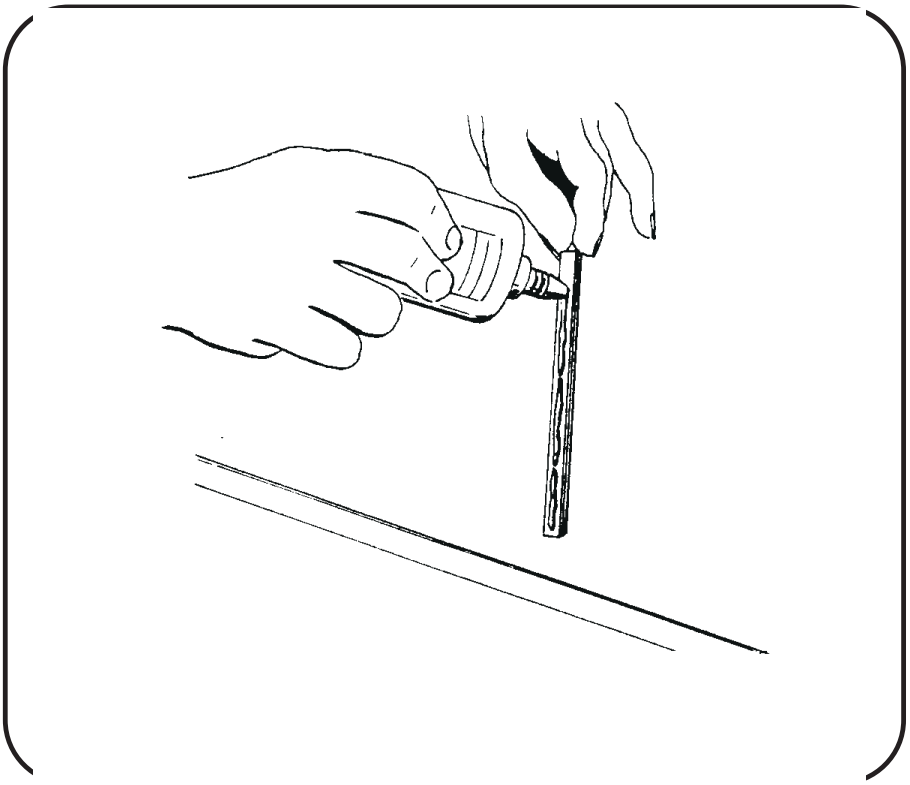
(4) Remove 3/8 inch of insulation from ends of revolving field leads (See Fig. 8) and attach a 2-foot length of small soft wire to each. Attachment may be made by wrapping wire tightly around lead by soldering. These wires are necessary to start and pull leads through routing holes (6, Fig. 2) in rotor core.

(5) Install rotor locating snap ring (if used) on generator shaft.

NOTE: Application of LOCTITE is to compensate for any looseness in machine key and keyway (up to 0.005 inch).



Applying "Locquic" Primer
Figure 6



Applying "Loctite" to Machine Key
Figure 7

b. Exciter Armature Installation

After exciter armature has been prepared for installation according to preceding instructions, proceed with installation as follows:

(1) Align armature keyway with keyway in armature shaft and start armature onto shaft.

(2) Route the revolving field “pull” wires (installed in step 4 preceding) through routing holes (6, Fig. 2) and carefully pull leads into these routing holes. Figure 9 shows how this should be done.

(3) If the armature-to-generator shaft fit is such that the armature may be pushed on by hand, push it on very slowly while another mechanic carefully watches and pulls the field leads through the routing holes. Continue installation until armature core contacts the shoulder of the shaft.

If the rotor cannot be pushed by hand, mount an installation tool on the generator shaft. (See Figures 10, 11, and 12). Push the armature on slowly and, at the same time, pull field leads through armature tubes. Stop pushing as soon as armature core contacts the shoulder of the shaft. Remove installation tool.

(4) Route field leads through holes in rectifier base. Remove “pull” wires and clamp ring type terminals on field leads (See Fig. 13). Attach one lead to the nearest diode in the POSITIVE group of three and attach the other lead to the nearest diode in the NEGATIVE group of three (See Fig. 14). It makes no difference to which group of diodes (POSITIVE or NEGATIVE) a lead is attached. The important thing is - DO NOT ATTACH BOTH LEADS TO DIODES INTHE SAME GROUP. BE SURE ONE LEAD IS ATTACHED TO THE POSITIVE GROUP AND THE OTHER TO THE NEGATIVE GROUP.

(5) When field leads are properly attached to diodes, pull the excess lead back through the rectifier body so that any looseness is between the rectifier and exciter armature windings. Press loose part of leads down against rotor shaft between rectifier and exciter armature windings. Wrap 4 or 5 turns of linen tape around the armature shaft (See Fig.15) to position and secure leads. Tie tape ends together in a secure knot and cut off excess tape ends. Apply a coat of clear, air-drying varnish to the tape wrap. (See Fig. 16).

CAUTION

Do not use adhesive tape for securing leads. It may come loose and cause damage to exciter armature.

(6) Insert UNTHREADED end of machine key (8, Fig. 2) in the keyway to tighten the exciter armature to the generator shaft, then tap it lightly until the threaded end of the key is flush with the end of the shaft.

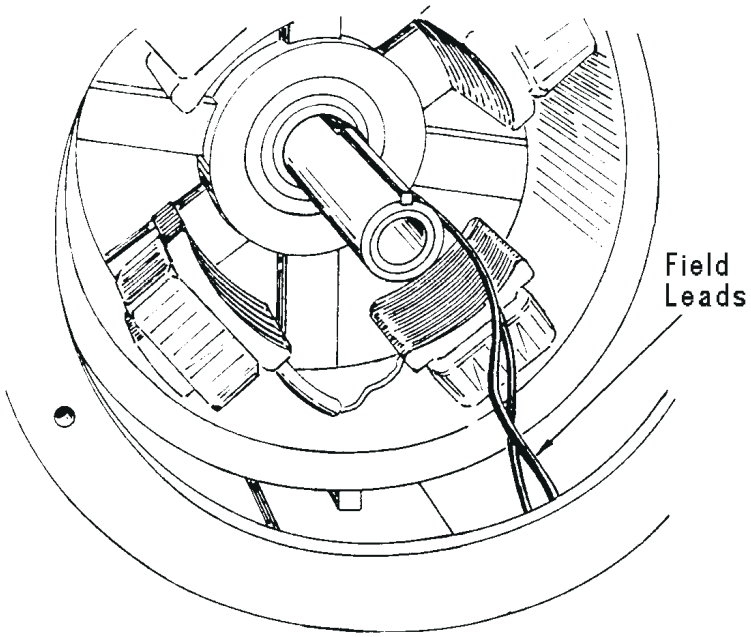
(7) Secure the exciter armature on generator shaft with the 1/2-13 cap screw.

(8) Install exciter housing cover.

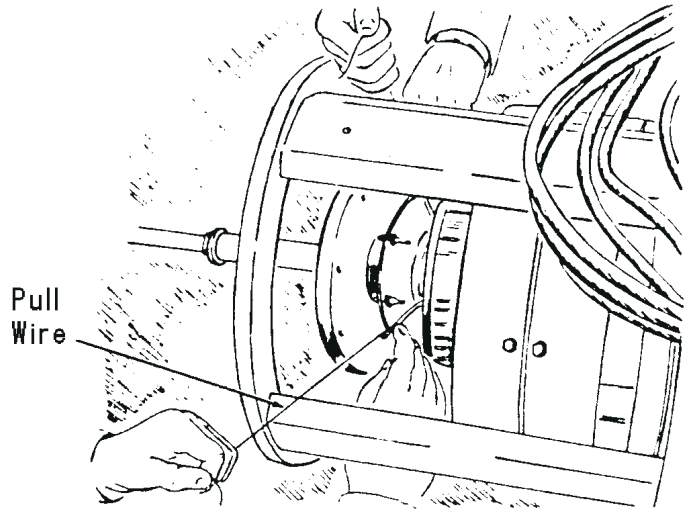
(9) Install louvered exciter cover on end of canopy.

CAUTION

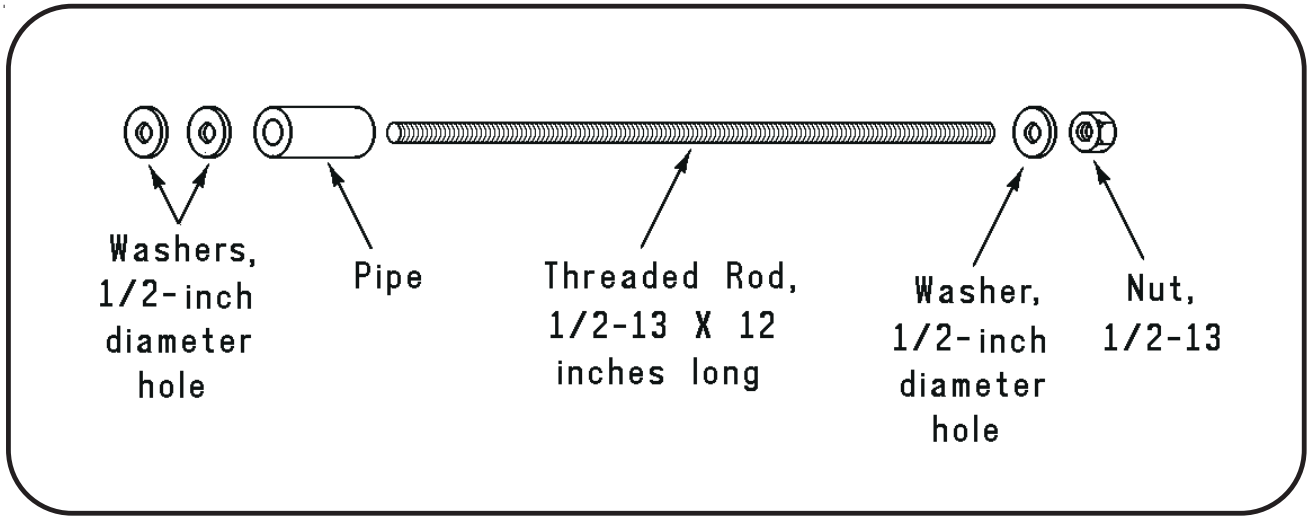
Allow at least 6 hours for complete cure and set up of Loctite before operating machine.



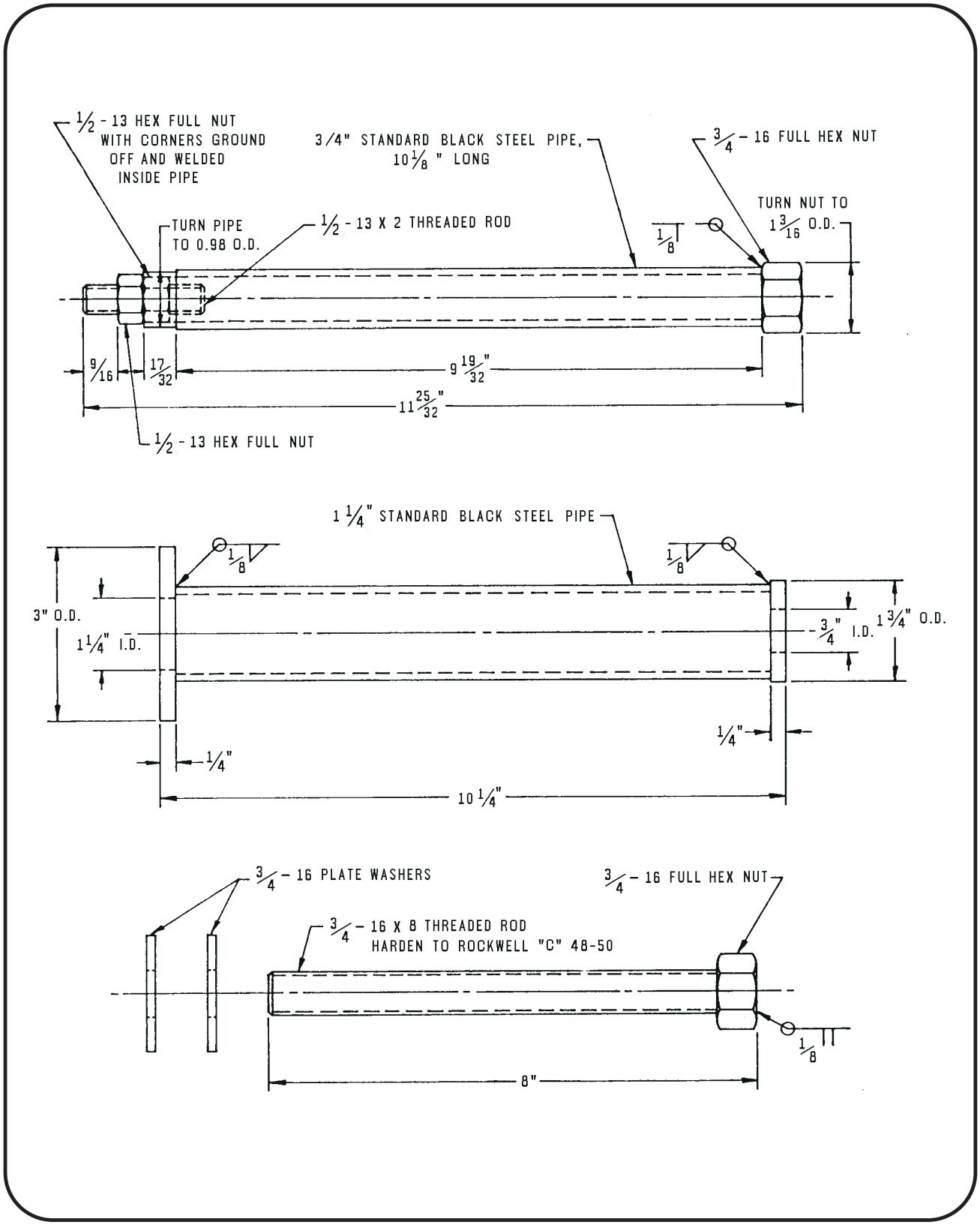
**Generator
Revolving Field
Leads
Figure 8**



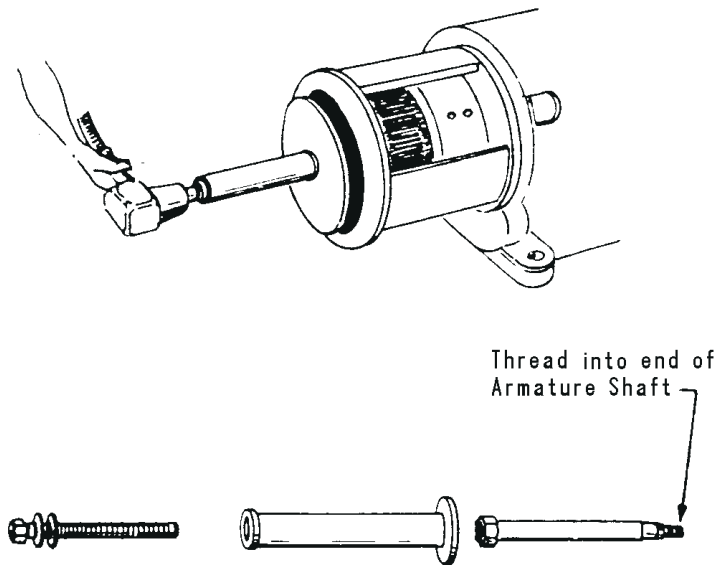
Pulling Generator Field Leads Through Armature
Figure 9



Simple Tool for Armature Installation
Figure 10

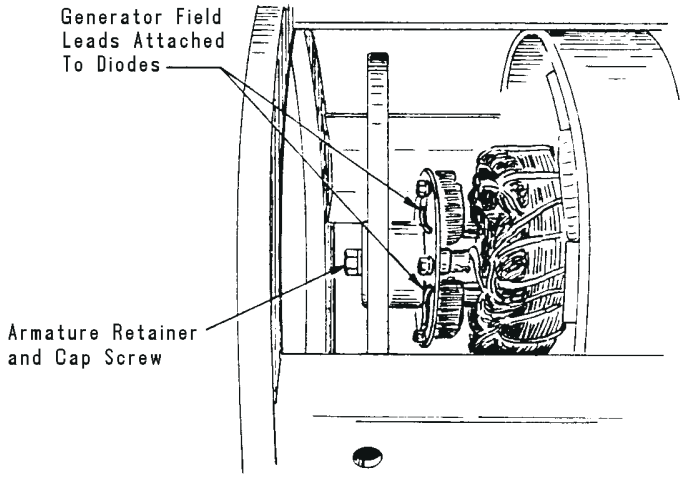


Instructions for Making Exciter Armature Installation Tool
Figure 11

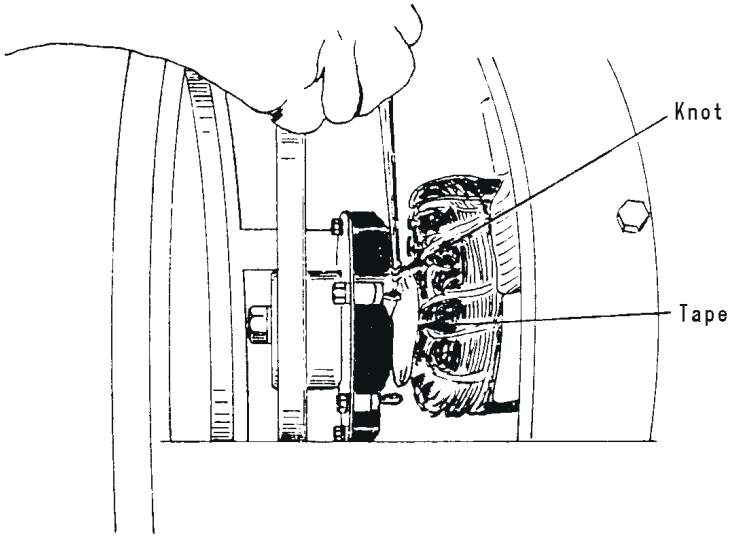


Pushing Armature onto Shaft With Special Tool
Figure 12

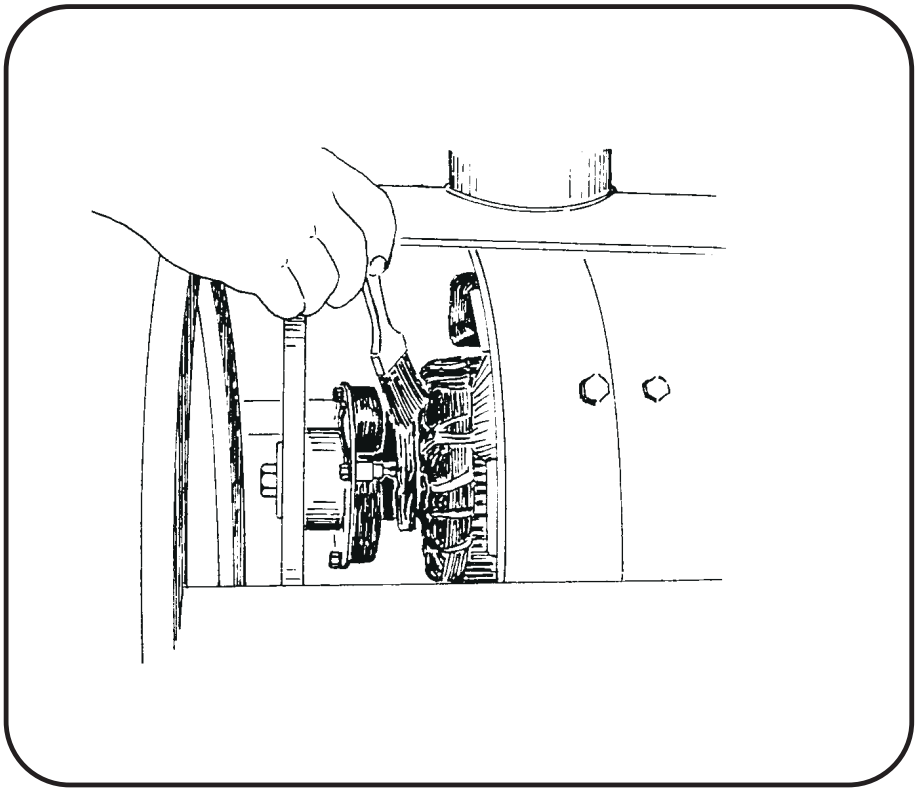
Attaching Field Lead Terminals
Figure 13



Armature installed, Field Leads Attached, and Armature Retainer Installed
Figure 14



Securing Leads to Shaft with Tape
Figure 15



Applying Varnish to Tape
Figure 16

5. Recommended Products Manufacturers

"LOCQUIC" No. 47-56, Primer Grade T, Manufactured by Loctite Corporation, Newington, Connecticut 06111

"LOCTITE" No. 40-31, Retaining Compound, Manufactured by Loctite Corporation, Newington, Connecticut 06111

"NOCO10" Varnish No. T-211 (clear, air dry), Manufactured by Sterling Division of Reichhold Chemical Incorporated, Marysville, Pennsylvania 17053

Chapter 4. Illustrated Parts List

Section 1. Introduction

1. General

The Illustrated Parts List identifies, describes, and illustrates main assemblies, subassemblies, and detail parts of Series 5384E trailer and/or truck-mounted Diesel Engine Generator Sets manufactured by Hobart Brothers Company, Power Systems Division, Troy, Ohio, 45373.

2. Purpose

The purpose of this list is to provide parts identification and descriptive information to maintenance and provisioning personnel for use in provisioning, requisitioning, purchasing, storing, and issuing of spare parts.

3. Arrangement

Chapter 4 is arranged as follows:

Section 1- Introduction
Section 2 - Manufacturer's Codes
Section 3 - Parts List
Section 4 - Numerical Index

4. Explanation of Parts List

a. Contents

The parts list contains a breakdown of the equipment into assemblies, subassemblies, and detail parts. All parts of the equipment are listed except:

(1) Standard hardware items (attaching parts) such as nuts, screws, washers, etc., which are available commercially.

(2) Bulk items such as wire, cable, sleeving, tubing, etc., which are also commercially available.

(3) Permanently attached parts which lose their identity by being welded, soldered, riveted, etc., to other parts, weldments, or assemblies.

b. Parts List Form

This form is divided into five columns. Beginning at the left side of the form and proceeding to the right, columns are identified as follows:

(1) "FIGURE-ITEM NO." Column

This column lists the figure number of the illustration applicable to a particular parts list and also identifies each part in the list by an item number. These item numbers also appear on the illustration. Each item number on an illustration is connected to the part to which it pertains by a leader line. Thus the figure and item numbering system ties the parts lists to the illustrations and vice versa. The figure and index numbers are also used in the numerical index to assist the user in finding the illustration of a part when the part number is known.

(2) "HOBART PART NUMBER" Column

ALL part numbers appearing in this column are Hobart numbers. In all instances where the part is a purchased item, the vendor's identifying five-digit code and his part number will appear in the "NOMENCLATURE" column. Vendor parts which are modified by Hobart will be identified as such in the "NOMENCLATURE" column. In case Hobart does not have an identifying part number for a purchased part, the "HOBART PART NUMBER" column will reflect "No Number" and the vendor's number will be shown in the "NOMENCLATURE" column. Parts manufactured by Hobart reflect no vendor code or part number in the "NOMENCLATURE" column.

(3) "NOMENCLATURE" Column

The item identifying name appears in this column. The indenture method is used to indicate item relationship. Thus, components of an assembly are listed directly below the assembly and indented one space. Vendor codes and part numbers for purchased parts are shown in this column. Hobart modification to vendor items is also noted in this column.

(4) "EFF" (Effective) Column

This column is used to indicate the applicability of parts to different models of equipment. When more than one model of equipment is covered by a parts list, there are some parts which are used on only one model. This column is used for insertion of a code letter "A", "B", etc., to indicate these parts and to identify the particular model they are used on.

Uncoded items are used on all models.

Items coded A are used on Speficication 5384E-1 (-50, -51) units.

Items coded B are used on Speficication 5384E-4 (-50, -51) units.

Items coded C are used on Speficication 5384E-5 (-50, -51) units.

Items coded D are used on Speficication 5384E-9 (-50) units.

Items coded E are used on Speficication 5384E-10 (-50) units.

Items coded F are used on Speficication 5384E-11 (-52, -53) units.

Items coded G are used on Speficication 5384E-14 (-52, -53) units.

Items coded H are used on Speficication 5384E-15 (-52, -53) units.

Items coded J are used on Speficication 5384E-16 (-52, -53) units.

Items coded K are used on Speficication 5384E-17 (-52) units.

Items coded L are used on Speficication 5384E-18 (-52) units.

(5) "UNITS PER ASSEMBLY" Column

This column indicates the quantity of parts required for an assembly or subassembly in which the part appears. This column does not necessarily reflect the total used in the complete end item.

Section 2. Manufacturer's Codes

1. Explanation of Manufacturer's (Vendor) Code List

The following list is a compilation of vendor codes with names and addresses for suppliers of purchased parts listed in this publication. The codes are in accordance with the Federal Supply Codes for Manufacturer's Cataloging Handbook H4-1, and are arranged in numerical order. Vendor codes are insert ed in the nomenclature column of the parts list directly following the item name and description. In case a manufacturer does not have a vendor code, the full name of the manufacturer will be listed in the nomenclature column.

Code	Vendor's Name & Address
00779	AMP Inc. P.O. Box 3608 Harrisburg, Pennsylvania 17105
01428	Tuthill Corporation - Linkage Div. 2110 Summit Street P.O. Box 227 New Haven, Indiana 46774
01843	American Bosch Marketing Division of Ambac Industries Inc. 3664 Main Street Springfield, Mass. 01107
02231	Anchor Rubber Company 840 South Patterson Boulevard P.O. Box 832 Dayton, Ohio 45401
02660	Bunker Ramo Corporation Borg Electronics North Am. Div. 2801 South 25th Ave. Broadview, Illinois 60153
03924	STRATOFLEX, INC. Ft. Wayne, Indiana
04009	Crouse-Hinds Arrow-Hart Corporation Arrow Hart Division 103 Hawthorne Street Hartford, Connecticut 06105
04713	Motorola, Inc. Semiconductor Products Division Phoenix, Arizona 85008
05277	Westinghouse Electric Corp. Semiconductor Div. Hill St. Youngwood, PA 15697
07088	Kelvin Electric Co. 5907 Noble Avenue Van Nuys, California 91411
08108	Lamp Industry for use with Industry Designations and Abbreviations for Lamps
13445	Cole-Hersee Company 20 Old Colony Avenue Boston, Massachusetts 02127
14101	Sprague Electric Company 87 Marshall St. North Adams, Mass. 01247
14831	Magnetic Components, Inc. 5907 Noble Avenue Van Nuys, California 91411
15434	Cummins Engine Company 1000 Fifth St. Columbus, IN 47201
15605	Eaton Corp., Cutler-Hammer Div. 4201 N. 27th St. Milwaukee, Wisconsin 53216
16238	Lord Manufacturing Co, Inc. Sterling Road South Lancaster, Mass. 01561
16764	Delco Remy Div. of General Motors Corp. 2401 Columbus Avenue P.O. Box 2439 Anderson, Indiana 46018

Code	Vendor's Name & Address
19220	Eberhard Manufacturing Company 21944 Drake Road Strongsville, Ohio 44136
20038	ESB Inc. 5 Penn Center Plaza P.O. Box 8109 Philadelphia, Penn. 19101
21335	Fafnir Bearing Company Div. of Textron 37 Booth Street New Britain, Connecticut 06050
21585	Farr Company, Airport Station P.O. Box 92187 Los Angeles, California 90009
21678	Uniroyal Inc. Plastic Products Division 312 N. Hill St. Mishawaka, Indiana 46544
24161	The Gates Rubber Co. 999 S. Broadway P.O. Box 5887 Denver, CO 80217
24248	Southco Inc. 210 N. Brinton Lake Road Concordville, PA 19331
24617	General Motors Corp. General Motors Bldg. 3044 Grand Blvd. W. Detroit, Michigan 48202
26403	ITT-Grinnell Corp. 260 W. Exchange Street Providence, RI 02901
26992	Hamilton Watch Company 941 Wheatland Avenue P.O. Box 3420 Lancaster, Pennsylvania 17604
27191	Cutler-Hammer Inc. Power Distribution & Control Division 4201 N. 27th Street Milwaukee, Wisconsin 53216
28520	Heyman Mfg. Company 147 Michigan Avenue P.O. Box 160 Kenilworth, N.J. 07033

Code	Vendor's Name & Address
30327	Imperial Clevite Inc. Fluid Components Division 6300 W. Howard Street Chicago, Illinois 60648
31356	J-B-T Instruments, Inc. 394 East Street P.O. Box 1818 New Haven, CT 06508
31510	Main Line Supply Co. 905 E. 3rd St. Dayton, OH 45402
35738	Charles Lentz & Sons 3330 N. Broad Philadelphia, Pennsylvania 19140
41197	Modine Manufacturing Company 1500 Dekoven Avenue Racine, Wisconsin 53401
41625	INCOM International Inc. Morse Controls Division 21 Clinton Street Hudson, Ohio 44236
44655	Ohmite Manufacturing Company 3601 W. Howard Street Skokie, Illinois 60076
49234	Protectoseal Company 225 W. Foster Avenue Bensenville, Illinois 60106
51589	Sarkes Tarzian Semicon Inc. Broadcast Equipment Division 415 N. College Avenue Bloomington, Indiana 47401
56289	Sprague Electric Company 87 Marshall St. North Adams, Mass. 01247
57448	Allis Chalmers Corp. Stephens & Adamson Mfg. Subsidiary 275 Ridgeway Avenue P.O. Box 1367 Aurora, Illinois 60507
57733	Hobbs Division, Stewart-Warner Corporation 1826 Diversey Parkway Chicago, IL 60614

Code	Vendor's Name & Address
58849	FMC Corp. Material Handling Equipment Division 446 Lexington Avenue Homer City, Pennsylvania 15748
59730	The Thomas & Betts Company Hwy. 218 South Iowa City, Iowa 52240
60741	Triplett Electrical Instrument Company Harmon Rd. Bluffton, Ohio 45817
61112	Cleanweld Products Co., Turner Division 821 Park Avenue Sycamore, Illinois 60178
66295	Wittek Microdot Fastening Systems Special Components Division 1421 Barnsdale Road La Grange Park, Illinois 60525
70040	AC Spark Plug Division General Motors Corporation 1300 N. Dort Highway Flint, Michigan 48556
70485	Atlantic India Rubber Works, Inc. 571 W. Polk Street Chicago, Illinois 60607
71400	Bussman Manufacturing Division of McGraw & Edison Company 114 Old State Road P.O. Box 14460 St. Louis, Missouri 63178
71744	General Instrument Corp, Lamp Division 443 North Ravenswood Avenue Chicago, Illinois 60640
72582	Detroit Diesel Allison Division General Motors Corporation 13400 W. Outer Drive Detroit, Michigan 48228
72619	Dialight Division Amperex Corp. 203 Harrison Place Brooklyn, New York 11237
73559	Carlingswitch Inc. 505 New Park Avenue West Hartford, Connecticut 06110
74063	Figgie International Inc. Hartman Electrical Manufacturing Div. 175 N. Diamond P.O. Box 8 Mansfield, Ohio 44902
74400	Stewart Warner Corp, Hobbs Division Ash Street & Yale Boulevard Springfield, Illinois 62705
75175	K-D Lamp Company 1910 Elm St. Cincinnati, Ohio 45210
75358	Knape & Vogt Manufacturing Co. 2700 Oak Industrial Drive Grand Rapids, Michigan 49505
75418	Kysor Industrial Corporation One Madison Avenue Cadillac, Michigan 49601
77342	American Machine & Foundry Inc. Potter & Brumfield Division 200 Richland Creek Dr. P.O. Box 522 Princeton, Indiana 47670
77910	Speareflex Flexible Controls Div. CR Industries Inc. 241 E. Kalamazoo Avenue Kalamazoo, Michigan 49007
78225	Stant Manufacturing Company Inc. 1620 Columbia Avenue Connersville, Indiana 47331
78553	Eaton Corp, Tinnerman Products Div. 8700 Brookpark Road P.O. Box 6688 Cleveland, Ohio 44101
79470	Dana Corp., The Weatherhead Division 767 Beta Drive Cleveland, Ohio 44143
80996	ITT-Grinnel Corp. 260 W. Exchange St. Providence, RI 02901

Code	Vendor's Name & Address
81074	ITT_Holub Industries, Inc. 413 Elm St. Sycamore, Illinois 60178
81082	Electric Auto-Lite Company Lebanon Road Cincinnati, Ohio 45241
81703	Mulberry Metal Products, Inc. 2199 Stanley Terrace Union, NJ 07083
81860	Barry Wright Corp. Barry Controls Div. 700 Pleasant St. Watertown, Mass. 02172
81861	Wyle Laboratories Burton Electrical Engineering Div 111 Maryland St. El Segundo, CA 90245
81872	Olympic Plastics Co. Sub. of Intercontinental Diamond Corp. 5800 W. Jefferson Blvd. Los Angeles, CA 90016
83315	Hubbel Corporation 407 E. Howly Mundetein, Ill. 60060
84970	Sarkes Tarzian Semicon Inc. Broadcast Equipment Division 415 N. College Avenue Bloomington, Indiana 47401
85925	Emico Inc. (Electro Mechanical Instrument Company, Inc.) 123 N. Main St. P.O. Box 368 Dublin, PA 18917
89110	AMP Inc., Capitron Div. 1595 South Mt. Joy Street Elizabethtown, Pennsylvania 17022
89373	United States Rubber Tire Company Division of Uniroyal Inc. 3920 Big Beaver Rd., Suite 200 P.O. Box 3939 Troy, Michigan 48084
89616	Uniroyal Inc. Plastic Products Division 312 N. Hill St. Mishawaka, Indiana 46544
90201	Emhart Ind. Inc., Mallory Capacitor 4760 Kentucky Ave., P.O. Box 372 Indianapolis, Indiana 46206
90763	TRW Inc., United Carr Division 10544 W. Lunt Avenue Rosemont, Illinois 60618
91637	Dale Electronics, Inc. P.O. Box 609 Columbus, Nebraska 68601
91929	Honeywell, Inc. Buildings Controls & Components Group Micro Switch Division Freeport, Illinois 61032
92563	McGill Manufacturing Company, Inc. Bearing Division 909 N. Lafayette Valparaiso, Indiana 46383
94222	Southco Inc. 210 N. Brinton Lake Road Concordville, PA 19331
95879	Alemite Instrument Division of Stewart-Warner Corporation 1826 Diversey Parkway Chicago, Illinois 60614
98110	Naval Air Facility El Centro, California 92243
98410	E.T.C.- Molex Inc. 5201 Richmond Rd. Bedford Heights, Ohio 44146
98738	Stewart-Warner Electronics Div. of Stewart-Warner Corp. 1300 N. Kostner Chicago, Illinois 60651
98991	Worchester Controls Corporation Worchester Valve Division 125 Hartwell Street West Boyleston, Massachusetts 01583

Section 3. Parts List

1. Explanation of Parts List Arrangement

The parts list is arranged so that the illustration will appear on a left hand page and the applicable parts list will appear on the opposite right hand page. Unless the list is unusually long, the user will be able to look at the illustration and read the parts list without turning a page.

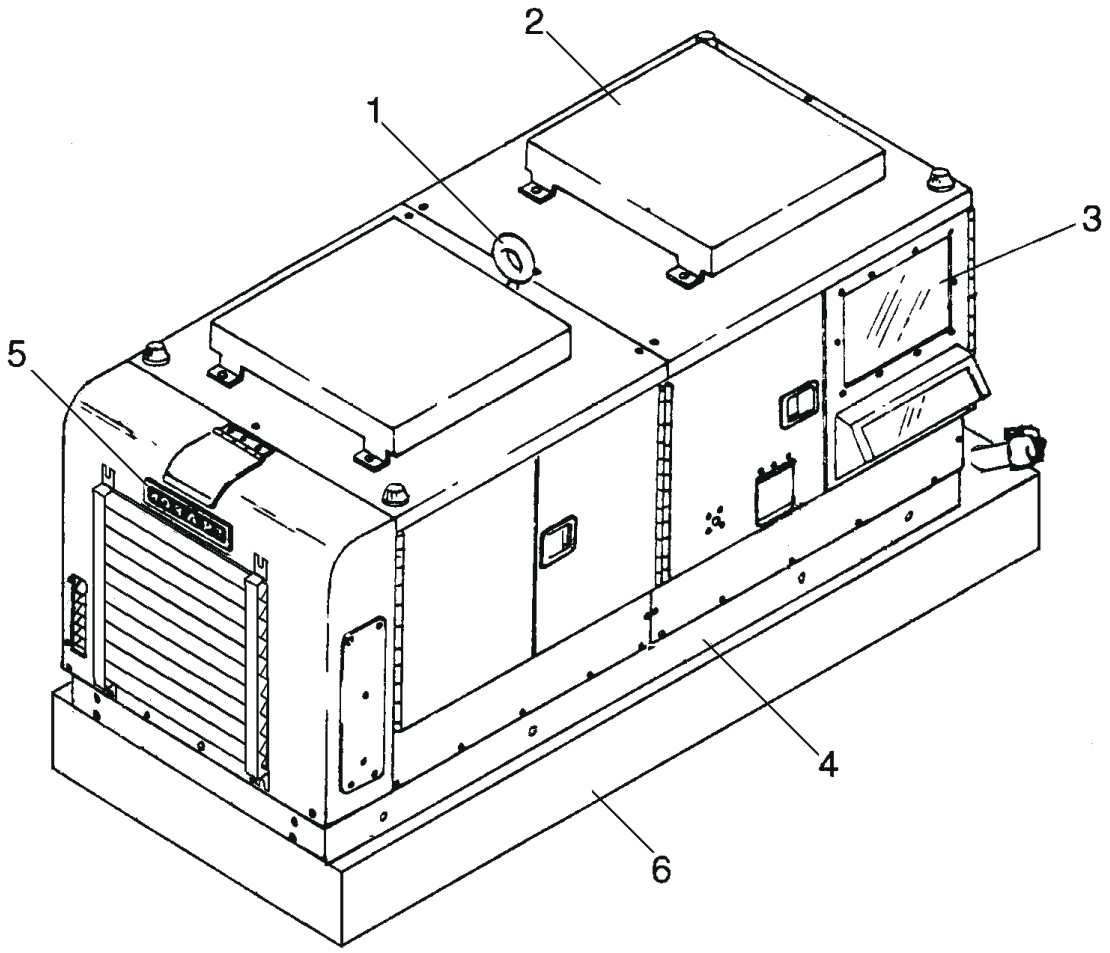
This parts list is **all-inclusive**, in that it covers parts for **all sixteen** of the **trailer and/or truck-mounted generator set specifications** available in generator set Series 5384E. For parts used only on one particular generator set, refer to the effectivity (EFF) code in this parts list for that generator set.

2. Symbols and Abbreviations

The following is a list of symbols and abbreviations used in the parts list.

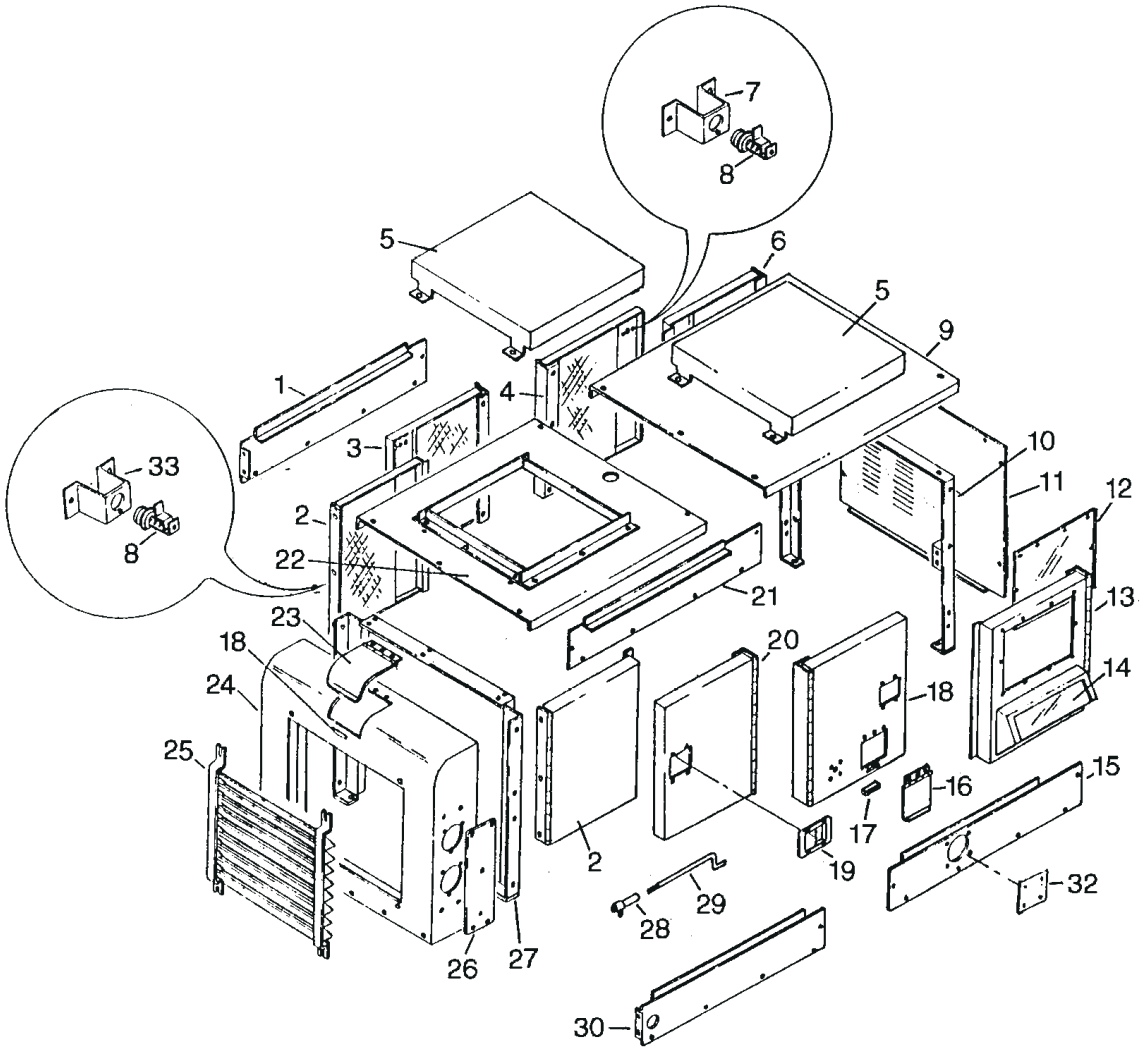
*	-	item not illustrated
A, or AMP	-	ampere
AC	-	alternating current
AR	-	as required
DC	-	direct current
Fig.	-	Figure
hd.	-	head
hex	-	hexagon
Hz	-	Hertz (cycles-per-second)
I.D.	-	inside diameter
IN	-	inch
kVA	-	kilovolt-ampere
F	-	microfarad
No.	-	number
NHA	-	next higher assembly
Ω	-	Ohm
OM	-	Owners Manual
PRV	-	peak reverse voltage
PSI	-	pounds per square inch
Ref	-	reference (the item has been listed previously) TM - Technical Manual
T-R	-	transformer-rectifier
V	-	volt (when used as a prefix to a five-digit number, indicates vendor code)

NOTE: An item which does not reflect an index number is an assembly which is not illustrated in its assembled state, or it is similar (right-hand, left-hand, top, etc.) to an item which is illustrated.



Generator Set
Figure 1

FIGURE & ITEM NO.	HOBART PART NO.	NOMENCLATURE 1 2 3 4 5 6 7	EFF	UNITS per ASSY
1 -	5384E-1	GENERATOR SET, TRAILER/TRUCK MOUNTING	A	1
	5384E-4	GENERATOR SET, TRAILER/TRUCK MTG, WITH 28.5V TRANSFORMER-RECTIFIER , 35-V TRANSFORMER RECTIFIER, AND TWO DUPLEX RECEPTACLES	B	1
	5384E-5	GENERATOR SET, TRAILER/TRUCK MOUNTING, WITH SGX GOVERNOR	C	1
	5384E-9	GENERATOR SET, TRAILER MOUNTING WITH DUAL OUTPUTS	D	1
	5384E-10	GENERATOR SET, TRAILER MOUNTING WITH FUEL PRESSURE GAGE AND OUTPUT RECEPTACLE	E	1
	5384E-11	GENERATOR SET, TRAILER/TRUCK MTG	F	1
	5384E-14	GENERATOR SET, TRAILER/TRUCK MOUNTING WITH 28.5V TRANSFORMER-RECTIFIER , 35-V TRANSFORMER-RECTIFIER AND TWO DUPLEX RECEPTACLES	G	1
	5384E-15	GENERATOR SET, TRAILER/TRUCK MTG, WITH SGX GOVERNOR	H	1
	5384E-16	GENERATOR SET, TRAILER/TRUCK MOUNTING, WITH DUAL OUTPUTS	J	1
	5384E-17	GENERATOR SET, TRAILER MOUNTING, WITH FUEL PRESSURE GAGE AND OUTPUT RECEPTACLE	K	1
	5384E-18	GENERATOR SET, TRAILER MOUNTING WITH SPECIAL TRAILER FOR FEDERAL EXPRESS	L	1
1-1	DDW-155	. EYE, LIFTING		1
1-2	489825	. CANOPY ASSY (For Details See Fig. 2)	A,C,E,F H,K,L	1
	489823	. CANOPY ASSY (For Details See Fig. 2)	D,J	1
	489868	. CANOPY ASSY (For Details See Fig. 2)	B,G	1
1-3	No Number	. GENERATOR SET WITHOUT CANOPY (For Details See Fig. 3)		1
1-4	No Number	. FRAME ASSY, MOUNTING & LIFTING YOKE (For Details See Fig. 19)		1
1-5	402987	. NAMEPLATE, HOBART		3
1-6	481386-5	. BODY, TRUCK (For Details See Fig. 20)		1



Canopy Assembly
Figure 2

FIGURE & ITEM NO.	HOBART PART NO.	AIRLINE PART NO.	NOMENCLATURE 1 2 3 4 5 6 7	EFF	UNITS per ASSY
2 -	489825		. CANOPY ASSY (For NHA see Fig. 1)	A,C,E,F, H,K,L	REF
	489823		. CANOPY ASSY (For NHA see Fig. 1)	D,J	REF
	489868		. CANOPY ASSY (For NHA see Fig. 1)	B,G	REF
2 - 1	482333		. PANEL ASSY, SIDE, RIGHT, FRONT CANOPY		1
2 - 2	482320		. DOOR ASSY, LEFT & RIGHT, FRONT CANOPY		2
2 - 3	482321		. DOOR ASSY, RIGHT, FRONT, CANOPY		1
2 - 4	482322		. DOOR ASSY, RIGHT, REAR, CANOPY		1
2 - 5	482376		. COVER ASSY, OPENING, TOP		2
2 - 6	482323		. DOOR ASSY, RIGHT REAR, CANOPY		1
2 - 7	482327		. BRACKET, MTG., LATCH, DOOR		3
2 - 8	76A-1115		. LATCH, ADJUSTABLE GRIP, V94222 NO. 48-99-126-11		4
2 - 9	481418		. TOP ASSY, REAR, CANOPY		1
2 -10	481419		. SUPPORT, MTG., REAR, CANOPY		1
2 -11	482469		. PANEL ASSY, END, REAR, CANOPY		1
	489443		. PANEL ASSY, END, REAR, CANOPY		1
2 -12	482401		. COVER, PLEXIGLASS, GENERATOR CONTROLS		1
2 -13	489032		. DOOR ASSY, LEFT, REAR, CANOPY		1
2 -14	489030		. COVER, PLEXIGLASS, ENGINE CONTROLS		1
2 -15	482426		. PANEL ASSY, SIDE, LEFT, REAR, CANOPY	A,C,E,F, H,K,L	1
	482029		. PANEL ASSY, SIDE, LEFT, REAR, CANOPY	D,J	1
	482877		. PANEL ASSY, SIDE, LEFT, REAR, CANOPY	B,G	1
2 -16	480695		. DOOR ASSY, ACCESS, RECEPTACLE		1
2 -17	403127		. CATCH, MAGNETIC, V94222, NO. 02-10-201-10		2
2 -18	482386		. DOOR ASSY, LEFT, REAR, CANOPY		1
	484076		. DOOR ASSY, LEFT, REAR, CANOPY		1
2 -19	489052		. LATCH, DOOR, RECESSED, V19220, NO. 3-4886		2
2 -20	482372		. DOOR ASSY, LEFT, FRONT, CANOPY		1
2 -21	482328		. PANEL ASSY, SIDE, RIGHT, REAR, CANOPY		1
2 -22	481417		. TOP ASSY, FRONT, CANOPY		1

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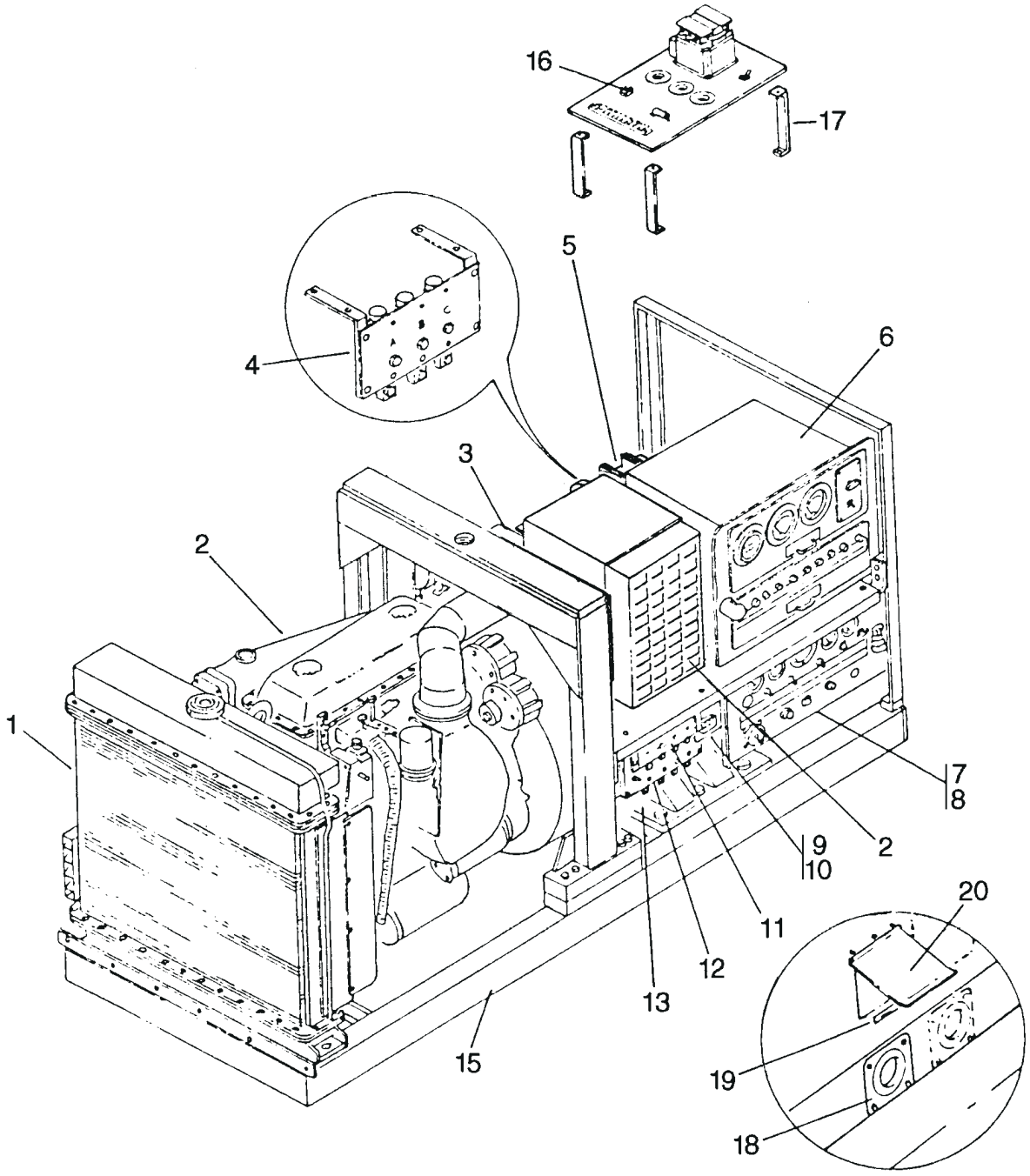
FIGURE & ITEM NO.	HOBART PART NO.	AIRLINE PART NO.	NOMENCLATURE 1 2 3 4 5 6 7	EFF	UNITS per ASSY
2 -			(CONTINUED)		
2 -23	387450		. COVER ASSY, HOLE, RADIATOR		1
2 -24	482437		. FRONT ASSY, CANOPY		1
2 -25	482429		. PANEL ASSY, LOUVERED, FRONT, CANOPY		1
2 -26	389284		. COVER, HOLE, FRONT, CANOPY		1
2 -27	481416		. SUPPORT ASSY, MTG. FRONT		1
2 -28	HJ-129A		. JOINT, BALL, V01428, NO. SPS1002CP		8
2 -29	482407		. ROD, STOP, DOOR		6
2 -31	482424		. PANEL ASSY, SIDE, LEFT, FRONT		1
* 2 -31	480701		. SPACER, LATCH, DOOR		5
2 -32	482428		. PLATE, COVER		1
2 -33	482482		. BRACKET, MTG., LATCH, DOOR		1
* 2 -34	76A-1125		. LABEL, HAND, TACH		1
* 2 -35	482507		. ROD, STOP, DOOR		1
* 2 -36	488863		. ROD, STOP, DOOR		1
* 2 -37	403091-8		. PLUG, PLASTIC, 1-3/4, V28520, NO. P-1750		6
* 2 -38	404101-1		. LIGHT CLEARANCE, V75175, NO. 514-0168		4

*** Not Illustrated**



Generator Set Without Canopy
Figure 3

FIGURE & ITEM NO.	HOBART PART NO.	NOMENCLATURE 1 2 3 4 5 6 7	EFF	UNITS per ASSY
3 -	**No Number**	**GENERATOR SET WITHOUT CANOPY (For NHA see Fig. 1)**		REF
3 - 1	No Number	. RADIATOR AND COOLING SYSTEM GROUP (For Details See Fig. 4)		1
3 - 2	No Number	. ENGINE AND AIR CLEANER GROUP (For Details see Fig. 5)		1
** 3 - 3	430391C	. REGULATOR ASSY, VOLTAGE (For Details See Section 2-5)	A-G,R	1
	489812A	. REGULATOR ASSY, VOLTAGE (For Details See Section 2-5)	H-Q	1
** 3 - 4	482319	. PANEL ASSY, TERMINAL, STATOR (For Details See Fig. 11)		1
* 3 - 5	482075-1	. PANEL ASSY, POWER MODULE (For Details See Fig.12)		1
* 3 -6	482235-4	. GENERATOR CONTROL BOX GROUP (For Details see Fig. 12)	A,B,D-G, J-L	
	482235-3	. GENERATOR CONTROL BOX GROUP (For Details see Fig. 12)	C,H	
3 - 7	482296-2	. PANEL ASSY, CONTROL, ENGINE (For Details See Fig. 17)	A,F	1
	482296-8	. PANEL ASSY, CONTROL, ENGINE (For Details See Fig. 17)	B,G	1
	482296-9	. PANEL ASSY, CONTROL, ENGINE (For Details See Fig. 17)	C,H	1
	482296-11	. PANEL ASSY, CONTROL, ENGINE (For Details See Fig. 17)	D,J	1
	482296-15	. PANEL ASSY, CONTROL, ENGINE (For Details See Fig. 17)	E,K	1
	482296-23	. PANEL ASSY, CONTROL, ENGINE (For Details See Fig. 17)	L	1
3 - 8	482325	. BRACKET, MOUNTING, PANEL, CONTROL		2
3 - 9	482314	. BRACKET, MOUNTING, RECEPTACLE	E,K	1
3 -10	400162	. RECEPTACLE, V81861, NO. AN-3114-1B	E,K	1
3 -11	482318	. COVER, PANEL, OUTPUT TERMINAL AND STATOR TERMINAL		2
3 -12	482317	. PANEL ASSEMBLY, OUTPUT TERMINAL (For Details See Fig. 10)	A-C,F-H,L	1
	484107	. PANEL ASSEMBLY, OUTPUT TERMINAL (For Details See Fig. 10)	D,J	1
3 -13	280786A	. GENERATOR ASSY (For Details See Fig. 18)		1

*** Not Illustrated**

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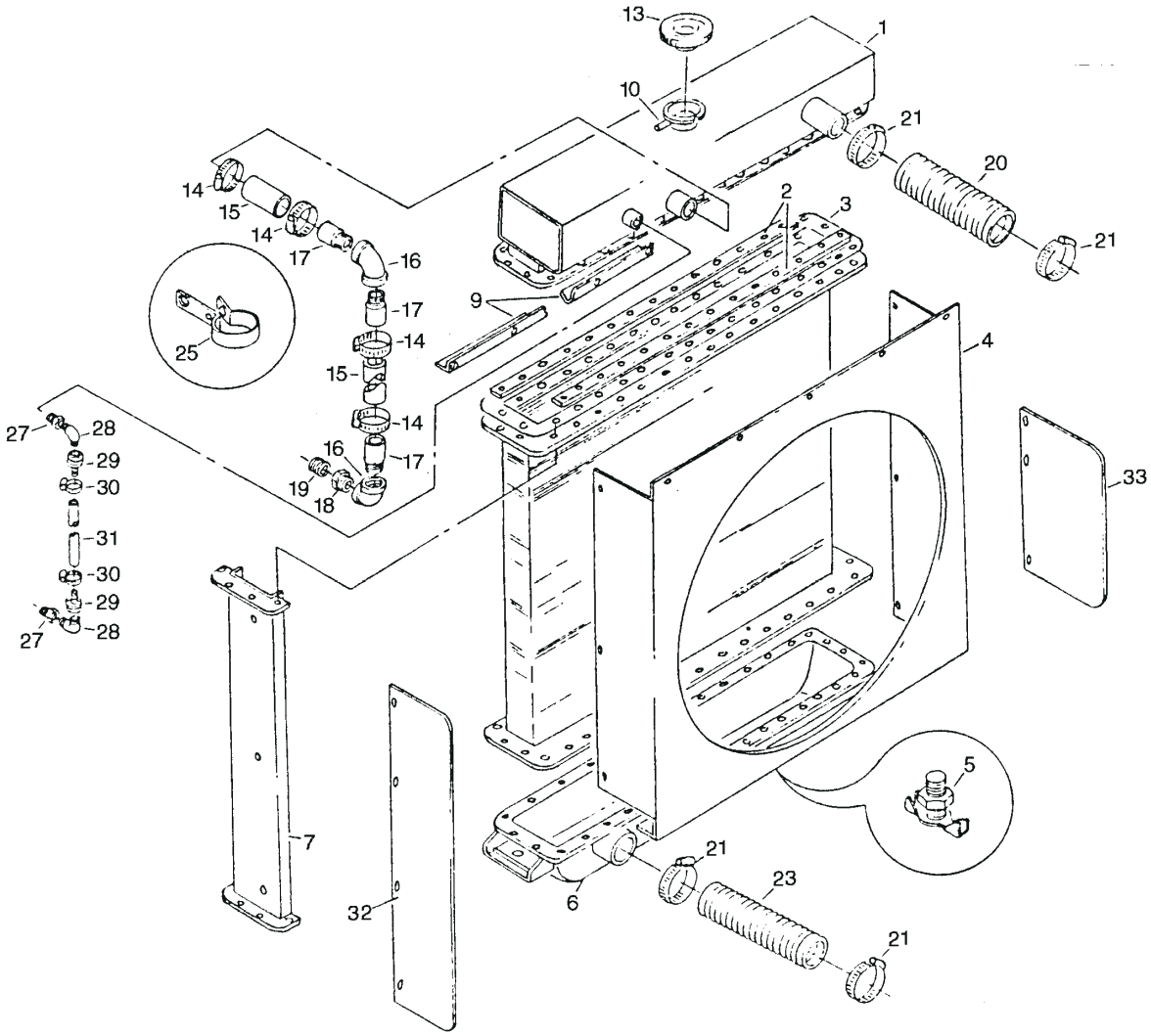
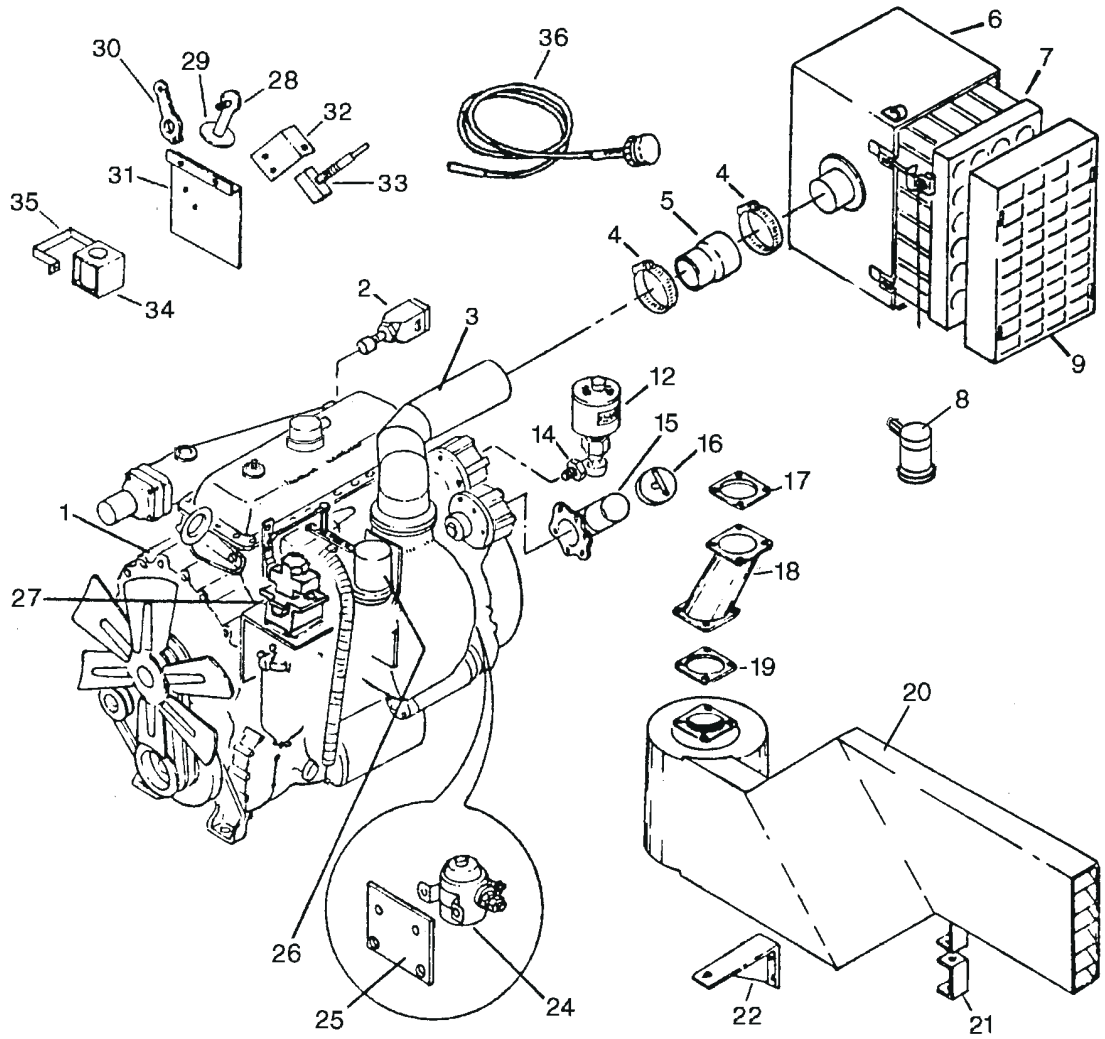
FIGURE ITEM NO.	HOBART PART NO.	NOMENCLATURE 1 2 3 4 5 6 7	EFF	UNITS per ASSY
3 -	No Number	GENERATOR SET WITHOUT CANOPY (Continued)		
* 3 -14	HF-2752	. MOUNT, RUBBER (Used to mount electrical panels on control box support panel) V16238, No. 4624-105		12
3 -15	No Number	. FRAME ASSY, MOUNTING & LIFTING		
		YOKE (For Details See Fig. 19)		REF
	484066-1	. SECOND OUTPUT	D,J	1
3 -16	484067	. . PANEL, POWER MODULE ASSY. (For Details See Fig. 12)		1
3 -17	484070	. . SUPPORT, POWER MODULE, MOUNTING	D,J	4
	484086	. . BRACKET, SWITCH & LIGHT ASSY	D,J	1
3 -18	482326	. . HORN, CABLE CLAMP, ASSY	D,J	1
3 -19	403127	. . CATCH, MAGNETIC, V94222, No. 02-10-201-10	D,J	1
3 -20	480695	. . DOOR, ACCESS, RECEPTACLE, ASSY	D,J	1
* 3 -21	484244A	. . HARNESS, WIRE, SECOND OUTPUT	D,J	1
* 3 -22	76B-1127	. LABEL, OPERATING INSTRUCTIONS		1
* 3 -23	286629	. SWITCH, FUEL PRESSURE		1



Radiator and Cooling System Group
Figure 4

FIGURE ITEM NO.	HOBART PART NO.	NOMENCLATURE 1 2 3 4 5 6 7	EFF	UNITS per ASSY
4 -	No Number	**RADIATOR AND COOLING SYSTEM (For NHA See Fig. 3)**		REF
	388425	. RADIATOR ASSEMBLY		1
4 - 1	387878	. . HEAD ASSEMBLY, RADIATOR		1
4 - 2	50GHP-89	. . STRIP, REINFORCING		4
4 - 3	50GHP-82	. . GASKET, RADIATOR		2
4 - 4	387913	. . SHROUD, RADIATOR		1
4 - 5	5CW-1932-0	. . VALVE, DRAIN, V79470, NO. 145		1
4 - 6	387914	. . BASE ASSEMBLY, RADIATOR		1
4 - 7	387313	. . RAIL ASSEMBLY, SIDE, RADIATOR		2
4 - 8	402958	. . CORE, RADIATOR, V41197, SIZE 26 In. X 28 In. X 2-11/32 In.		1
4 - 9	387881	. . ANGLE, MOUNTING		1
4 -10	355194	. . PIPE, OVERFLOW		1
* 4 -11	56555	. . HOSE, OVERFLOW, (LENGTH 45 IN.)		1
* 4 -12	386751	. . CLAMP, RETAINER		2
4 -13	403034	. CAP, RADIATOR, V78225, NO. AAX-0B48		1
	388219-1	. LINE ASSEMBLY, SUPPLY		1
4 -14	W-10869-2	. . CLAMP, HOSE, V66295, NO. C52P		4
4 -15	56501	. . HOSE, RUBBER, RADIATOR, 3 PLY 1 IN. I.D. 34"		
4 -16	W-10890-6	. . ELBOW, PIPE		2
4 -17	385275	. . PIPE, LINE		2
4 -18	W-7814-5	. . BUSHING, PIPE, 3/4 O.D. X 1/2 I.D.		1
4 -19	W-10760-1	. . NIPPLE, PIPE, 1/2-14		1
4 -20	56532	. HOSE, RADIATOR, INLET		11"
4 -21	W-10869-3	. CLAMP, HOSE, RADIATOR, V66295, NO. C32P		4
* 4 -22	W-10869-2	. CLAMP, HOSE, RADIATOR, V66295, NO. C20P		2
4 -23	56532	. HOSE, RADIATOR, OUTLET		14"
* 4 -24	389421	. BRACE, LINE, SUPPLY		1
4 -25	HF-2962	. CLAMP, HOSE, BRACE		1
* 4 -26	12CW-908	. CLAMP, LINE, VENT		1
4 -27	W-7814-2	. . BUSHING, PIPE, 3/8 O.D. TO 1/4 I.D.		2
4 -29	W-10893-2	. . SWIVEL, FEMALE, SAE-45, V30327, NO. KA04-04NS		2
4 -30	402499-1	. . CLAMP, HOSE, V35738, NO. J340		2
4 -31	56534	. . HOSE, LOW-PRESSURE, HIGH-TEMP 1/4 I.D. LENGTH 18-1/2 IN.		1
4 -32	389909	. GUARD, FAN, LEFT		1
4 -33	180132	. GUARD, FAN, RIGHT		1
* 4 -34	351541	. LABEL, CAUTION, FAN		2

*** NOT ILLUSTRATED**



Engine and Air Cleaner Group
Figure 5

FIGURE ITEM NO.	HOBART PART NO.	NOMENCLATURE 1 2 3 4 5 6 7	EFF	UNITS per ASSY
5 -	No Number	**ENGINE & AIR CLEANER GROUP (For NHA See Fig. 3)**		REF
5 - 1	404006	. ENGINE, DETROIT DIESEL, 3-CYLINDER, MODEL NO. 3-71N	A,B,D-G, J-L	1
	78B-1076	. ENGINE, DETROIT DIESEL, 3-CYLINDER WITH SGX GOVERNOR, MODEL NO. 3-71N	C,H	1
5 - 2	403782-0	. DEVICE, TEMPERATURE, HIGH, V75418, NO. 33080-205		1
5 - 3	387607A	. PIPE, AIR CLEANER		1
	388535	. KIT, ASSY, AIR CLEANER		1
5 - 4	403064	. . CLAMP, FITTING, V21585, NO. L-4690-11		1
5 - 5	403065	. . COUPLING, RUBBER, V21585, No. A-19054-10		1
5 - 6	387629	. . HOUSING, CLEANER, AIR, V21585, No. C24625-7		1
5 - 7	403156	. . CARTRIDGE, FILTER, V21585, No. P-24		1
5 - 8	83A-1026	. . INDICATOR, SERVICE FILTER, CARTRIDGE V21585, NO.L-14440-001		1
5 - 9	403157	. . ELIMINATOR, MOISTURE, V21585, No. D56519-16		1
5 -10	403774	. . FASTENER		
* 5 -11	402436	. . KIT, INSTALLATION, INDICATOR, SERVICE, V21585, No. L-14439		1
5 -12	403264	. GOVERNOR ASSY, OVERSPEED, V78388, NO. SA503A-P		1
* 5 -13	W-7814-9	. BUSHING, HIGH TEMP. DEVICE		1
5 -14	403412	. ADAPTER, TACH, DRIVE, V72582, NO. 1565170		1
5 -15	482529	. PIPE, OIL FILL		1
5 -16	403409	. CAP, OIL FILL, V24617, NO. 5117362		1
5 -17	480629	. GASKET, MANIFOLD		1
5 -18	480630	. PIPE, MUFFLER TO MANIFOLD		1
5 -19	480621	. GASKET, MUFFLER		1
5 -20	480648	. MUFFLER		1

*** Not Illustrated**

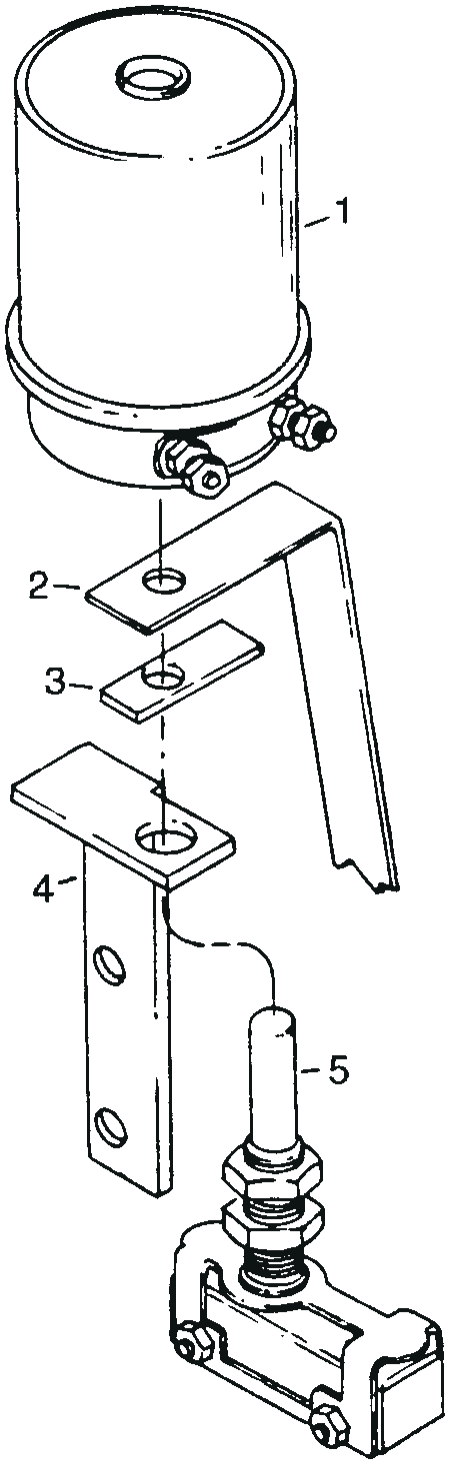
**** Located or connected at rear of engine control panel**

FIGURE ITEM NO.	HOBART PART NO.	NOMENCLATURE 1 2 3 4 5 6 7	EFF	UNITS per ASSY
5 -	No Number	**ENGINE & AIR CLEANER GROUP (Continued)**		
5 -21	480618	. BRACKET, MOUNTING, EXHAUST, OUTLET		1
5 -22	480619	. BRACKET, MOUNTING, MUFFLER		1
* 5 -23	30GH-417	. MOUNT, SHOCK, V21678, NO. 314C		2
5 -24	404568	. SOLENOID, STARTER, AUX. V16764, NO. 1114537		1
5-25	482093	. BRACKET, MOUNTING, SOLENOID		1
5-26	387293	. SWITCH ASSY, STARTER CUT-OUT (For Details See Fig. 6)		1
5-27	181018	. KIT ASSEMBLY, GOVERNOR, ELECTRIC (For Details See Fig.7)	A,B,D-G, J-L	1
5-28	402908	. JOINT, BALL, THROTTLE CONTROL, V57448, No. TF-4Y	C,H	1
5-29	483991	. DISK, ACTUATOR, MICRO-SWITCH	C,H	1
5-30	78A-1085	. ARM, LEVER, THROTTLE, V72582	C,H	1
5-31	483989	. BRACKET, MOUNTING, THROTTLE CONTROL	C,H	1
5-32	483990	. PLATE, MOUNTING, MICRO-SWITCH	C,H	1
5-33	DW-4866	. SWITCH, MICRO THROTTLE, V91929, No. BZ-2RA2	C,H	1
5-34	78A-1092	. VALVE, SHUTDOWN, ENGINE	C,H	1
5-35	484014	. BRACKET, MOUNTING, VALVE	C,H	1
5-36	30GH-1189-1	. CONTROL, THROTTLE, V41625, No. D44196	C,H	1
* 5-37	483914	. BRACKET, MOUNTING, FILTER GOVERNOR	C,H	1
* 5-38	483916	. LINES, OIL FILTER, GOVERNOR, ASSY	C,H	1
* 5-39	483958	. SPACER, AIR CLEANER, PIPE	C,H	1
* 5-40	388437	. GASKET, INTAKE MANIFOLD	C,H	1
* 5-41	483959	. SPACER, AIR CLEANER	C,H	1
* 5-42	483992	. ADAPTER, THROTTLE CONTROL	C,H	1
* 5-43	5AW-989	. NAMEPLATE, THROTTLE	C,H	1
* 5-44	78A-1093	. TOP, GOVERNOR	C,H	1
* 5-45	484265-1	. SPACER, TUBING, 1/4	C,H	1
* 5-46	484015	. LINES, VALVE, SHUTDOWN	C,H	1
* 5-47	79A-1015	. COVER, CYLINDER HEAD, GOVERNOR	C,H	1
* 5-48	12CW-908	. CLAMP, FUEL LINE	C,H	1
* 5-49	30GH-1259	. CLAMP, MOUNTING, THROTTLE	C,H	1
* 5-50	402119-30	. SCREW, 1/4 - 20 X 1 HHC, GRADE 8	C,H	3
* 5-51	483971	. COLLAR, SHAFT THROTTLE	C,H	1
* 5-52	79A-1000	. LEVER, THROTTLE SHAFT	C,H	1

*** Not Illustrated**

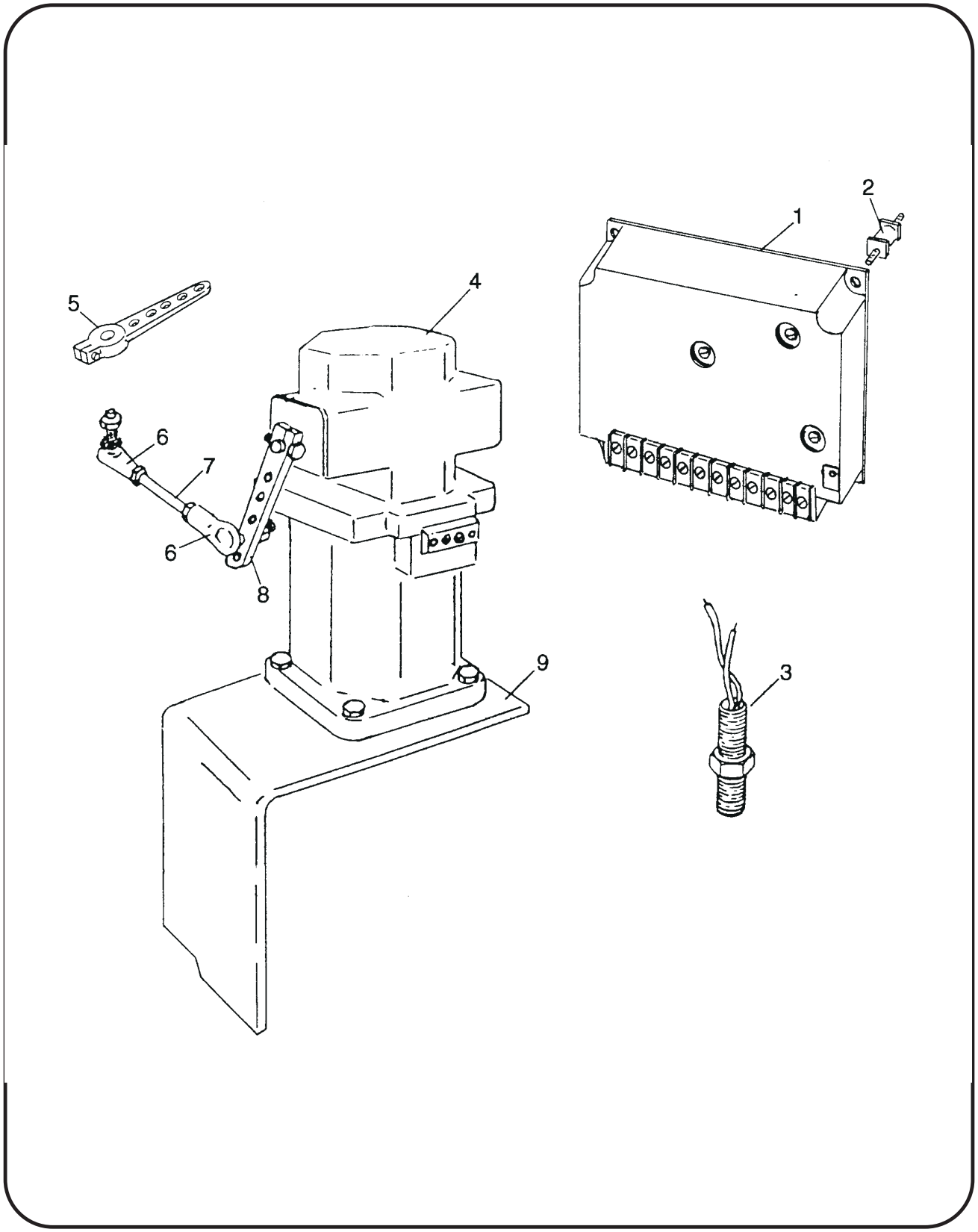
	FIGURE ITEM NO.	HOBART PART NO.	NOMENCLATURE 1 2 3 4 5 6 7	EFF	UNITS per ASSY
	5 -	No Number	ENGINE & AIR CLEANER GROUP (Continued)		
*	5-53	79A-1001	. LEVER, THROTTLE SHAFT	C,H	1
*	5-54	79A-1002	. LINK, GOVERNOR LEVER-TO-THROTTLE ARM	C,H	1
*	5-55	484464-1	. SHAFT, THROTTLE	C,H	1
*	5-56	79A-1003	. BRACKET, THROTTLE SHAFT	C,H	1
*	5-57	W-11563	. PIN, CLEVIS	C,H	1
*	5-58	486192	. SCREW, SGX GOVERNOR	C,H	1
*	5-59	486191	. TUBE, OUTLET, ASSEMBLY	C,H	1
*	5-60	6FW-5047	. SPACER, FUEL FILTER		6
*	5-61	W-9234-55	. CABLE, STARTER TO GROUND		1
*	5-62	484838	. KEY, TACH DRIVE V24617, NO. 6478641		1
*	5-63	482506	. LINES ASSEMBLY, FUEL (For Details See Fig. 8)		1
*	5-64	482494	. LINES ASSEMBLY, OIL (For Details See Fig. 9)	1	
*	5-65	60GHP-416	. BRACKET, MTG., FUEL LINES		2
*	5-66	60GHP-424	. BRACKET, MTG., FUEL LINES		2

*** Not Illustrated**



Starter Cut-out Switch Assembly
Figure 6

FIGURE ITEM NO.	HOBART PART NO.	NOMENCLATURE 1 2 3 4 5 6 7	EFF	UNITS per ASSY
6 -	**387293**	**SWITCH ASSEMBLY, STARTER CUT-OUT (For NHA See Fig. 5)**		**REF**
6 -1	No Number	. SOLENOID (For details See Engine Operator's Manual)		1
6 -2	No Number	. ARM SUPPORT (Furnished with engine)		1
6 -3	387295	. ACTUATOR, SWITCH		1
6 -4	387294	. BRACKET, MOUNTING, SWITCH		1
6 -5	DW-4866	. SWITCH, MICRO V91929, No. BZ-2RA2 WITH ACTUATOR No. MC-7711		1

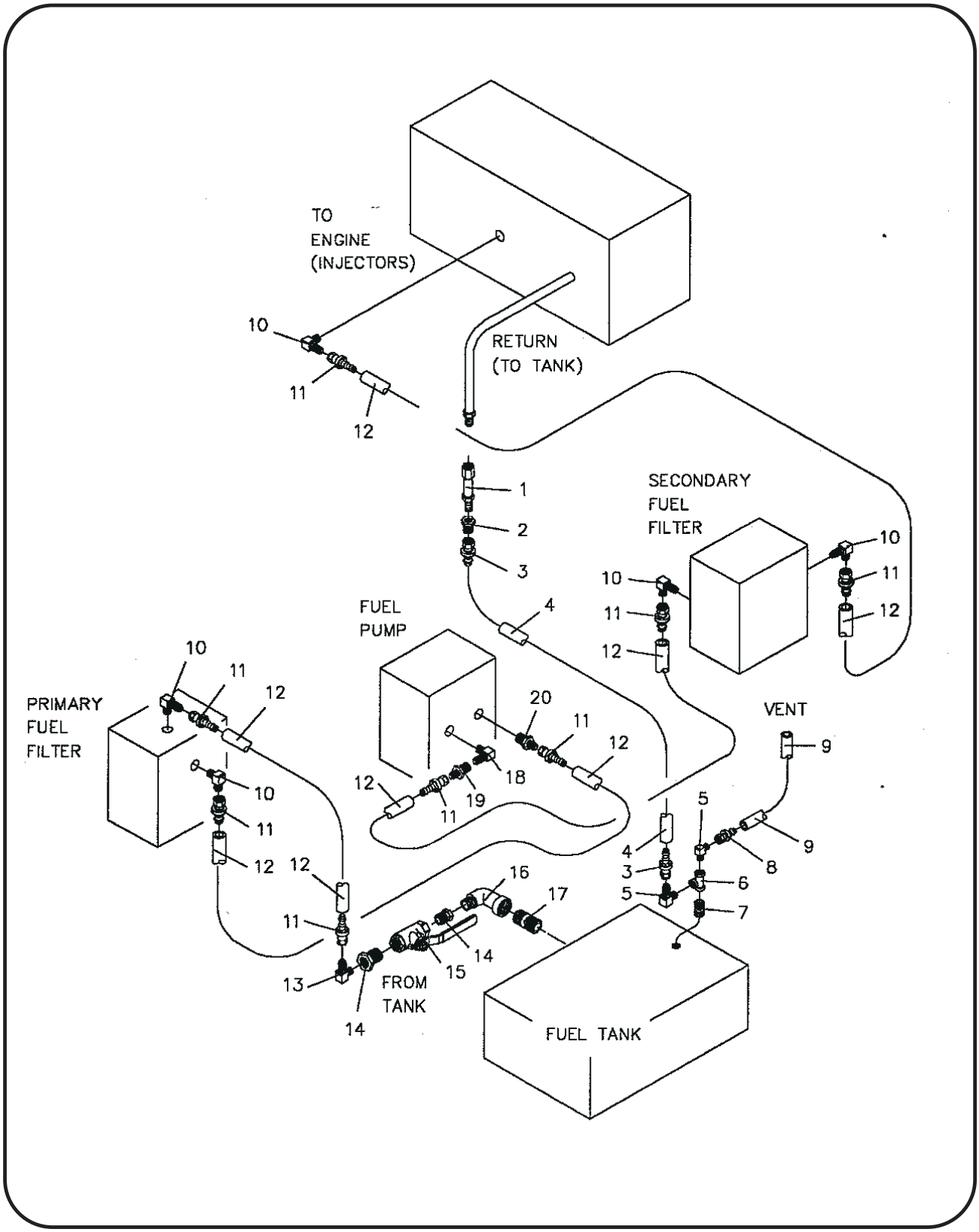


Electric Governor Assembly
Figure 7

	FIGURE ITEM NO.	HOBART PART NO.	NOMENCLATURE 1 2 3 4 5 6 7	EFF	UNITS per ASSY
	7 -	**181018**	**KIT, ASSEMBLY, GOVERNOR, ELECTRIC (For NHA See Fig.3)**	**A,B,D-G, J-L**	**REF**
**	7 - 1	181020	. CONTROLLER, ELECTRIC GOVERNOR		1
	7 - 2	84A-1075	. MOUNT, SHOCK, RUBBER		4
	7 - 3	404595	. SENSOR, MAGNETIC, GOVERNOR		1
	7 - 4	181019	. ACTUATOR, ELECTRIC GOVERNOR		1
	7 - 5	404594	. ARM, THROTTLE, ENGINE		1
	7 - 6	402908	. JOINT, BALL, GOVERNOR LINKAGE V57448, No. TF-4Y		2
	7 - 7	W-9476-16	. ROD, THREADED, 1/4-28 X 3-7/8		1
	7 - 8	85A-1047	. LEVER, ACTUATOR		1
	7 - 9	482152	. BRACKET, MOUNTING, ACTUATOR		1
*	7 -10	482989	. STRAP, WIRE, GROUND		2
*	7 -11	482170	. SPACER, HOLE, BALL JOINT		1
*	7 -12	W-799F-110	. SPRING, THROTTLE CONTROL		1

*** Not Illustrated**

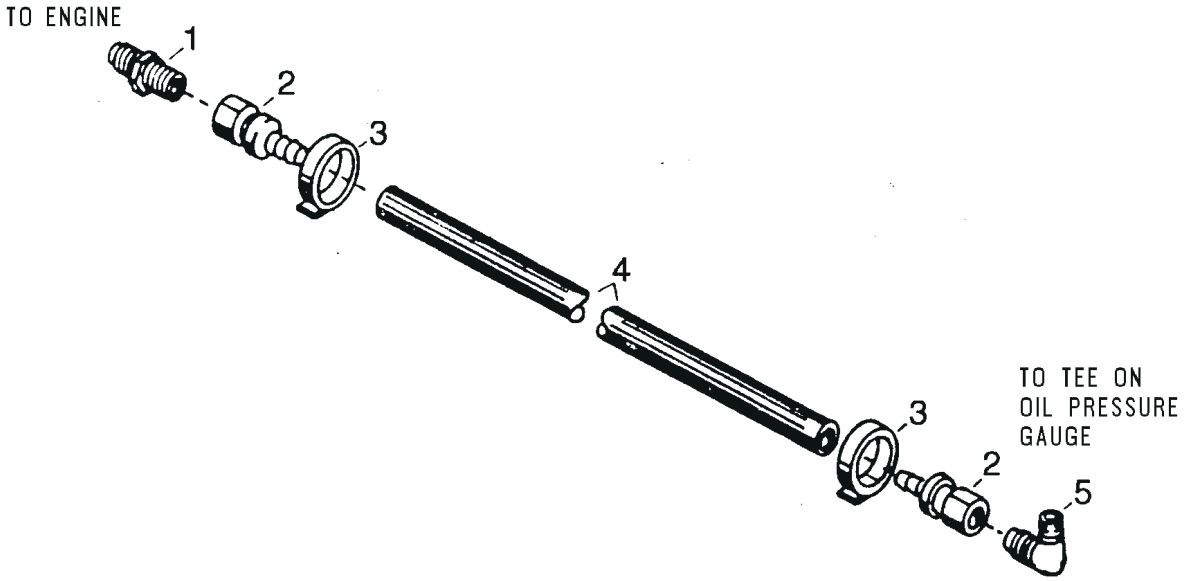
** This unit is mounted to back of generator control box.



Fuel Lines Assembly
Figure 8

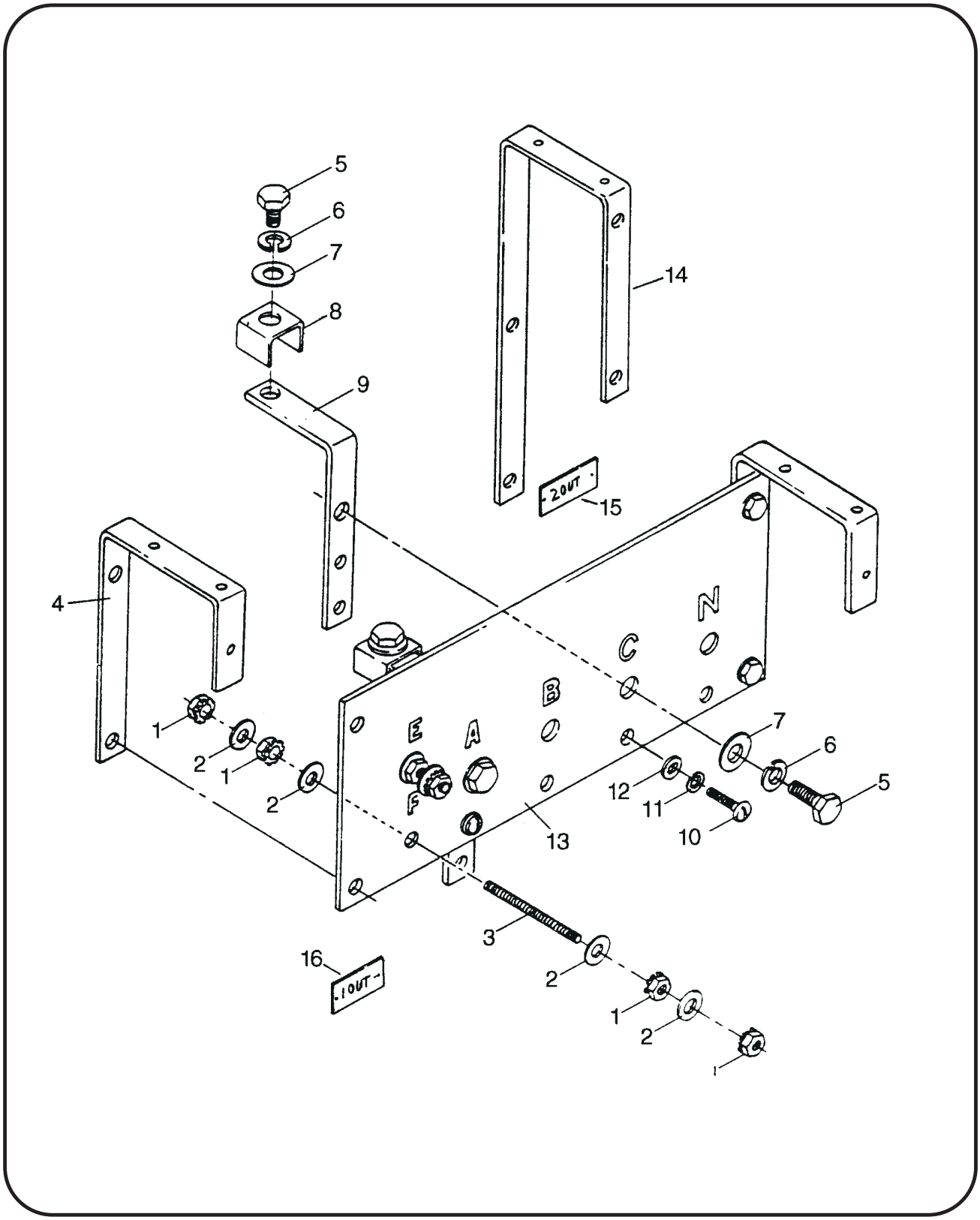
FIGURE ITEM NO.	HOBART PART NO.	NOMENCLATURE 1 2 3 4 5 6 7	EFF	UNITS per ASSY
8 -	**No Number**	**LINES, FUEL, ASSEMBLY (For NHA See Fig.5)**		**REF**
8 - 1	403592	. VALVE, CHECK V72582, No. 5122279		1
8 - 2	400059-1	. CONNECTOR, FEMALE V79470, No. 46 X 6		1
8 - 3	403590-3	. FITTING, SWIVEL, FEMALE V03924, No. 7115-6S		2
8 - 4	56550	. HOSE, #6, 5/16 I.D. Length 65"		1
8 - 5	W-10891-10	. ELBOW, MALE V79470, No.		2
8 - 6	W-11608-3	. TEE, PIPE, 1/2 IN.		1
8 - 7	W-10760-1	. NIPPLE, CLOSE 1/2 IN.		1
8 - 8	W-10893-0	. SWIVEL, FEMALE V30327, No. KA 06-06NS		1
8 - 9	56535	. HOSE, LOW PRESSURE 3/8 IN. I.D. Length 33-inch		1
8 -10	W-10891-10	. ELBOW MALE V79470, No. 49 X 8 X 4		5
8 -11	403590-4	. FITTING, SWIVEL, FEMALE V03924, No. 7115-8S		8
8 -12	56551	. HOSE #8, 13/32 In. I.D.		53.5"
8 -13	W-10891-9	. ELBOW, MALE V79470, No. 49 X 8 X 8		1
8 -14	W-7814-5	. BUSHING, PIPE 3/4 X 1/2		2
8 -15	400819-1	. VALVE, MALE (ECON-O-MITE) V98991, No.4211B		1
8 -16	12CW-2077-3	. ELBOW, STREET, 1/2IN. V26403, 90[		1
8 -17	W-10760-3	. NIPPLE, PIPE, 1/2 IN.		1
8 - 18	W-10892-2	. ELBOW, STREET, 3400 X 4, V26403, #3400 X 4		1
8 - 19	W-10886-4	. CONNECTOR, MALE, WEATHERHEAD		1
8 - 20	W-10886-6	. CONNECTOR, MALE, WEATHERHEAD		1

*** Not Illustrated**



Oil Line Assembly
Figure 9

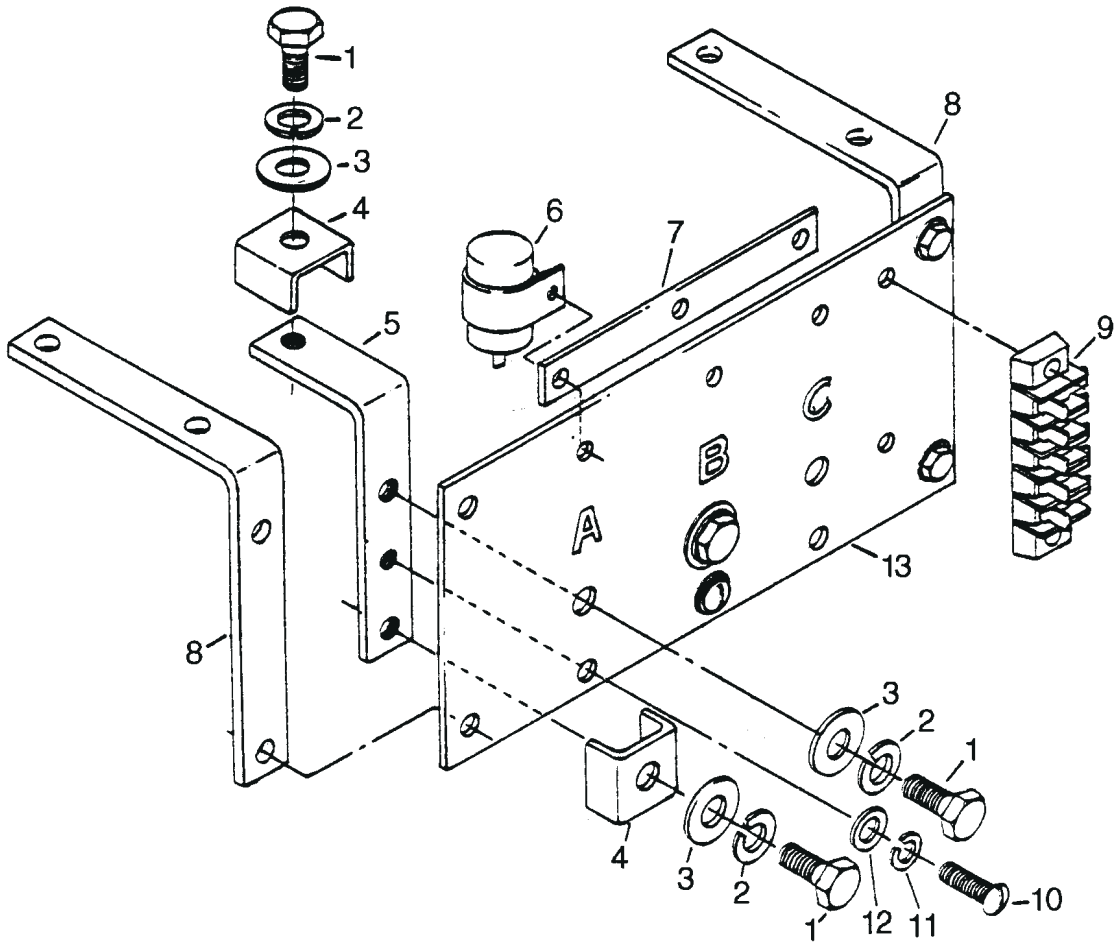
FIGURE ITEM NO.	HOBART PART NO.	NOMENCLATURE 1 2 3 4 5 6 7	EFF	UNITS per ASSY
9 -	**482494**	**. LINE ASSEMBLY, OIL (For NHA See Fig.5)**		**REF**
9 -1	W-10886-1	. CONNECTOR, MALE, V79470, 48 X 4		1
9 -2	403590-1	. SWIVEL, FEMALE, SAE 45, FLARED, V03924, NO. 7115-4S		2
9 -3		DELETED		
9 -4	56548	. HOSE, 3/16 IN. I.D.		51"
9 -5	W-10891-7	. ELBOW, MALE, V79470, #49 X 4		1



Output Terminal Panel Assembly
Figure 10

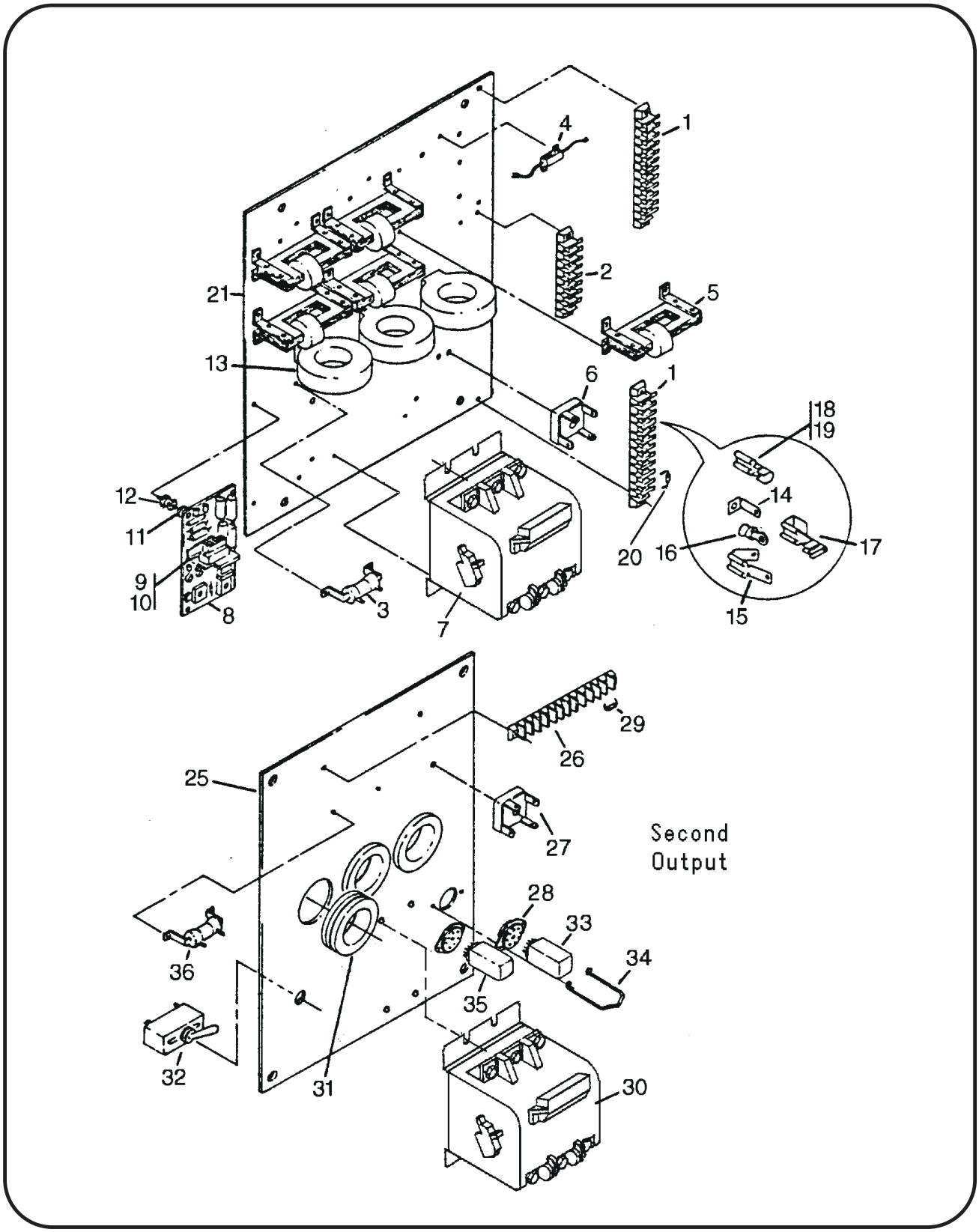
FIGURE ITEM NO.	HOBART PART NO.	NOMENCLATURE 1 2 3 4 5 6 7	EFF	UNITS per ASSY
10 -	**482317**	**PANEL, TERMINAL, OUTPUT, ASSEMBLY(For NHA See Fig. 3)**	**A-C,F-H,L**	**REF**
10 -	**484107**	**PANEL, TERMINAL, OUTPUT, ASSEMBLY (For NHA See Fig. 3)**	**D,J**	**REF**
10 - 1	50MS-732-0	. NUT, HEX, 1/4-20, KEPS, MH, STEEL	A-C,F-H,L	12
	50MS-732-0	. NUT, HEX, 1/4-20, KEPS, MH, STEEL	D,J	30
10 - 2	W-11242-5	. WASHER, FLAT, 1/4 IN., STEEL	A-C,F-H,L	12
	W-11242-5	. WASHER, FLAT, 1/4 IN., STEEL	D,J	30
10 - 3	W-9549-19	. ROD, TERMINAL 1/4-20 X 2-1/4	A-C,F-H,L	2
	W-9549-19	. ROD, TERMINAL 1/4-20 X 2-1/4	D,J	6
10 - 4	482445	. BRACKET, MOUNTING, BOARD, TERM., OUTPUT		2
10 - 5	W-11097-18	. SCREW, HHC, STEEL, 3/8-16 X 3/4	A-C,F-H,L	8
	W-11097-18	. SCREW, HHC, STEEL, 3/8-16 X 3/4	D,J	16
10 - 6	W-11254-6	. WASHER, LOCK, STEEL, 3/8 IN.	A-C,F-H,L	8
	W-11254-6	. WASHER, LOCK, STEEL, 3/8 IN.	D,J	16
10 - 7	W-11242-10	. WASHER, FLAT, STEEL, 3/8 IN.	A-C,F-H,L	8
	W-11242-10	. WASHER, FLAT, STEEL, 3/8 IN.	D,J	16
10 - 8	482446	. RETAINER, CABLE	A-C,F-H,L	8
	482446	. RETAINER, CABLE	D,J	16
10 - 9	482443	. BAR, BUS, PHASE	A-C,F-H,L	4
	482443	. BAR, BUS, PHASE	D,J	8
10 -10	W-11112-3	. SCREW, RD. HD., MH, STEEL, 10-24 X 3/4	A-C,F-H,L	4
	W-11112-3	. SCREW, RD. HD., MH, STEEL, 10-24 X 3/4	D,J	8
10 -11	W-11254-3	. WASHER, 10, LOCK, STEEL	A-C,F-H,L	4
	W-11254-3	. WASHER, 10, LOCK, STEEL	D,J	8
10 -12	W-11245-3	. WASHER, 10, FLAT, BRASS	A-C,F-H,L	4
	W-11245-3	. WASHER, 10, FLAT, BRASS	D,J	8
10 -13	482444	. BOARD, TERMINAL, OUTPUT	A-C,F-H,L	1
	482444	. BOARD, TERMINAL, OUTPUT	D,J	2
10 -14	484071	. BRACKET, MOUNTING, BOARD, TERMINAL, OUTPUT		2
10 -15	75NH-307	. NAMEPLATE, #2 OUTPUT	D,J	1
10 -16	75NH-306	. NAMEPLATE, #1 OUTPUT	A-C,F-H,L	1
*	482400	. COVER, OUTPUT TERMINALS		1

*** Not Illustrated**



Terminal Stator Panel Assembly
Figure 11

FIGURE ITEM NO.	HOBART PART NO.	NOMENCLATURE 1 2 3 4 5 6 7	EFF	UNITS per ASSY
11 -	**482319**	**PANEL ASSEMBLY, TERMINAL, STATOR (For NHA See Fig. 3)**		**REF**
11 - 1	W-11097-18	. SCREW, STEEL, 3/8-16 X 3/4, HHC		9
11 - 2	W-11254-6	. WASHER, LOCK, STEEL, 3/8 IN.		9
11 - 3	W-11242-10	. WASHER, FLAT, 3/8 IN.		9
11 - 4	482446	. RETAINER, CABLE		6
11 - 5	482443	. BAR, BUS		3
11 - 6	W-10854-4	. CAPACITOR, 0.1 MFD, 500 V. V90201, No. B-206143		3
11 - 7	482471	. STRAP, CONNECTING, CAPACITORS		1
11 - 8	482449	. BRACKET, MOUNTING, BOARD		2
11 - 9	401937-1	. BLOCK, TERMINAL V98410, No. 35005-3526		1
11 -10	W-11112-3	. SCREW, ROUND HEAD, MH, STEEL, #10-24 X 3/4		3
11 -11	W-11254-3	. WASHER, LOCK, #10, STEEL		3
11 -12	W-11245-3	. WASHER, FLAT, BRASS		3
11 -13	482450	. PANEL, TERMINAL, OUTPUT		1



Power Module Panel Assembly
Figure 12

FIGURE ITEM NO.	HOBART PART NO.	NOMENCLATURE 1 2 3 4 5 6 7	EFF	UNITS per ASSY
12 -	**482075-1**	**. PANEL, ASSY, POWER MODULE (For NHA See Fig. 3)**		**REF**
12 - 1	401937-3	. STRIP, TERMINAL, V98410, NO. 35012-3536		2
12 - 2	401937-2	. STRIP, TERMINAL, V98410, NO. 35008-3536		1
12 - 3	W-9746-1	. RESISTOR, LINE DROP BURDEN, 50 OHM, 25 WATT, V44655, NO. 0200D		3
12 - 4	404402-2	. RESISTOR OVERLOAD BURDEN, 25 OHMS V91637, NO. RH-25, 20 WATT		3
12 - 5	1CZ-148	. TRANSFORMER, CURRENT LINE DROP & OVERLOAD, V14831, NO. E-6170		6
12 - 6	404065-2	. RECTIFIER, SILICON, V04713, NO. SDA 10270-2		1
12 - 7	282130-1	. CONTACTOR, LOAD, Furnas Electric Co., NO. 421F109137R		1
12 - 8	387738A	. BOARD ASSEMBLY, PC OVERLOAD		1
12 - 9	401564-4	. HOUSING, SOCKET, CONNECTOR, V89110, NO. 1-480287-0		1
12 -10	401566-11	. TERMINAL, SOCKET, V89110, NO. 60619-1		10
12 -11	403763-1	. WASHER, FIBER, SHOULDER		4
12 -12	401556	. MOUNT, SHOCK, RUBBER, V89616, NO. B-323 OR V81860, NO. SS-01		4
12 -13	363136-2	. TRANSFORMER, CURRENT, AMMETER		3
12 -14	400701	. CONNECTOR, RIGHT ANGLE V59730, NO. TA-250-8		5
12 -15	401939	. ADAPTER, TERMINAL, V98410, NO. VWA-0		1
12 -16	400830-15	. TERMINAL, RING TONGUE, V89110, NO. 31159		3
12 -17	402197-1	. TERMINAL, QUICK CONNECT, PIGGYBACK, V89110, NO. 61944-2		1
12 -18	400480-2	. TERMINAL, QUICK CONNECT, V00779, NO. 41274		5
12 -19	400480-3	. TERMINAL, QUICK CONNECT, V00779, NO. 42640-2		2
* 12 -20	1CZ-93B	. DIODE, SILICON, V05277, NO. IN4820		1
12 -21	482076	. PANEL, POWER MODULE		1
* 12 -22	W-9060-279	. CABLE ASSEMBLY, POWER ELECTRICAL (No. 101) “A” Stator Terminal Panel to “A” Contactor; (No. 102) “B” Stator Terminal Panel “B” Contactor; (N0. 103 “C” Stator Terminal Panel to “C” Contactor; (No. 110) “N” Terminal to “N” Output Terminal Panel		4

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FIGURE ITEM NO.	HOBART PART NO.	NOMENCLATURE 1 2 3 4 5 6 7	EFF	UNITS per ASSY
12 -	**482075-1**	**. PANEL, ASSY, POWER MODULE (Continued)**		**REF**
*** 12 -23**	***W-9360-211**	**. CABLE ASSEMBLY, POWER ELECTRICAL** (No. 104) "A" Contactor to "A" Output Terminal Panel; (No. 105) "B" Contactor to "B" Output Terminal Panel; (No.106)		
		"C" Contactor to "C" Output Terminal Panel		3
*12 **-24**	**W-9360-278**	**. CABLE ASSEMBLY, POWER ELECTRICAL** (No. 111) "N" Terminal to Ground		1
	484067	PANEL ASSEMBLY, POWER MODULE (for NHA See Fig. 4)	D,J	REF
12 -25	482069	. PANEL, POWER MODULE ASSY.	D,J	1
12 -26	401937-3	. STRIP, TERMINAL, V98410, NO. 35012-3526	D,J	1
12 -27	404065-2	. RECTIFIER, SILICON, V04713 NO. SDA10270-2	D,J	1
12 -28	16DA-4052-0	. SOCKET, RELAY, V02660, NO. 77-MIP-11	D,J	2
12 -29	1CZ-93B	. DIODE, SILICON, V05277, NO. IN4820	D,J	1
12 -30	282130-1	. CONTACTOR, LOAD, Furnas Electric Co., No. 421F109137R	D,J	1
12 -31	402037-14	. GROMMET, RUBBER	D,J	3
12 -32	402662	. SWITCH, TOGGLE, DPST, V74559, NO. 2GK71-73	D,J	1
12 -33	16DA-4004A-3	. RELAY, PLUG INTERLOCK, 24V DC V77342, NO. KAP-14DG	D,J	1
12 -34	16DA-4253-1	. RETAINER, SPRING, RELAY V77342, NO. 20C206	D,J	2
12 -35	16DA-4004A-10	. RELAY, FUSE INTERLOCK, 12V V77342, NO. KAP-14DG	D,J	1
12 -36	W-9746-3	. RESISTOR, 100 OHM, 25 WATT V44655, NO. 0200F	D,J	1
*12 -37	1CZ-93B	. DIODE, SILICON, V05277, NO. IN4820	D,J	1
*12 -38	400480-3	. TERMINAL, QUICK CONNECT, V00779, NO. 42640-2	D,J	2

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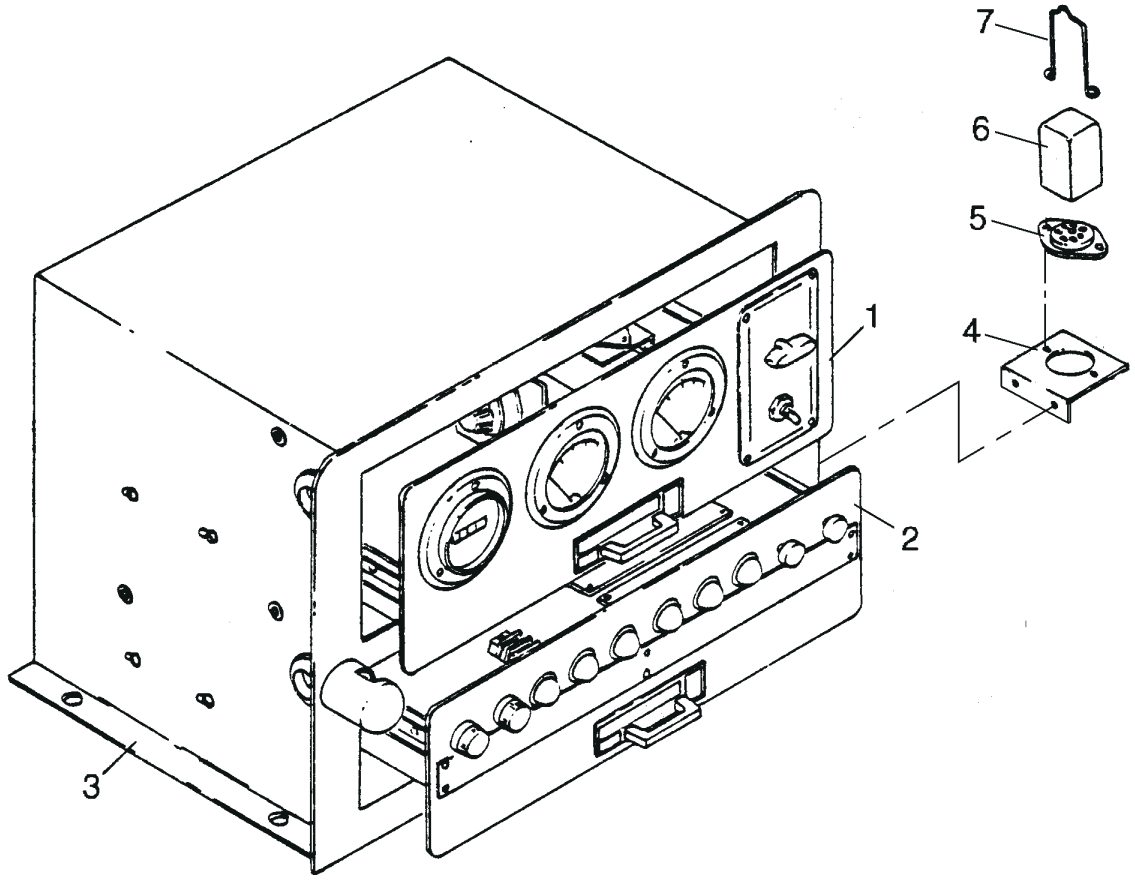

Generator Control Box Group
Figure 13

FIGURE ITEM NO.	HOBART PART NO.	NOMENCLATURE 1 2 3 4 5 6 7	EFF	UNITS per ASSY
13 -	**482235-4**	**GENERATOR CONTROL BOX GROUP (For NHA see Fig. 3)**	**A,B,D-G J-L**	**REF**
13 -	**482235-3**	**GENERATOR CONTROL BOX GROUP (For NHA see Fig. 3)**	**C,H**	**REF**
13 - 1	482278-4	. TRAY ASSEMBLY, GENERATOR CONTROLS (For details see Fig. 14)	A,B,D-G J-L	1
13 - 1	482278-5	. TRAY ASSEMBLY, GENERATOR CONTROLS (For details see Fig. 14)	C,H	1
13 - 2	482285-1	. TRAY ASSEMBLY, PROTECTIVE RELAYS (For details see Fig. 15)		1
13 - 3	NO NUMBER	. CONTROL BOX AND INTERNAL COMPONENTS ASSY. (For details see Fig. 16)		1

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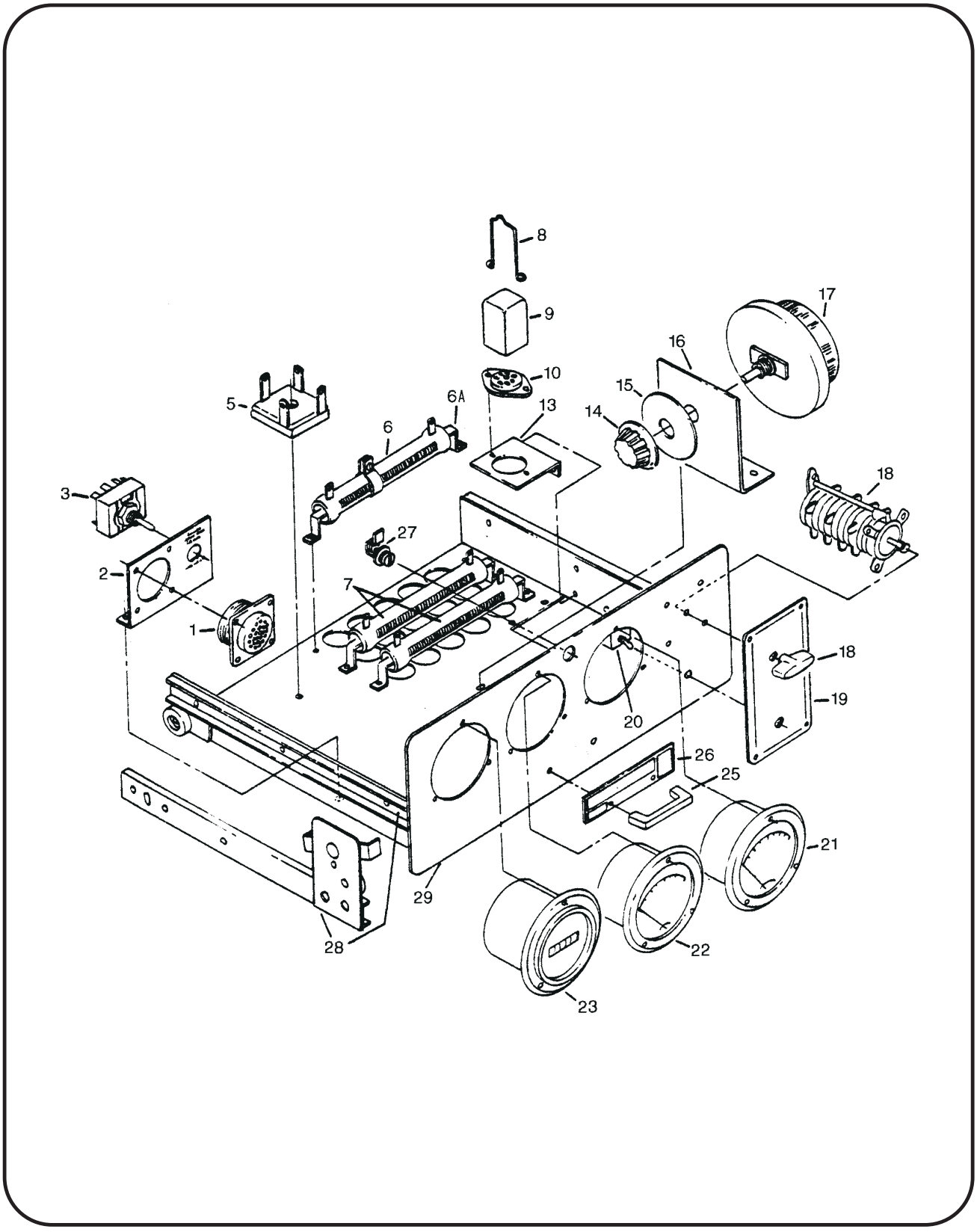

Generator Controls Tray Assembly
Figure 14

FIGURE ITEM NO.	HOBART PART NO.	NOMENCLATURE 1 2 3 4 5 6 7		EFF	UNITS per ASSY
14 -	**482278-4**	**TRAY ASSEMBLY, GENERATOR CONTROLS (For NHA see Fig. 13)**		**A,B,D-G J-L**	**REF**
	482278-5	TRAY ASSEMBLY, GENERATOR CONTROLS (For NHA see Fig. 13)	C,H	REF	
14 - 1	482355	. HARNESS, WIRE, RECEPTACLE		A,B,D-G J-L	1
14 - 1	484501	. HARNESS, WIRE, RECEPTACLE		C,H	
14 - 2	482284-1	. BRACKET, MTG., RECEPTACLE & SWITCH			1
14 - 3	402826	. SWITCH, AUTOMATIC, MANUAL, V15605, NO. 8926K425			1
* 14 - 4	402665-1	. HOUSING, RECEPTACLE, V00779, NO. 1-480416-0			6
14 - 5	404065-2	. RECTIFIER, SILICON, V04713, NO. SDA10270-2			1
14 - 6	W-2974-L	. RESISTOR, MANUAL, 50 OHM, 100 WATT V44655, NO. 0959			1
14 - 6A	400078	. BRACKET, MOUNTING, RESISTOR			6
14 - 7	W-2974-N	. RESISTOR, BALLAST, V44655, 100 WATT			2
14 - 8	16DA-4253-1	. RETAINER, SPRING, RELAY, V77342, NO. 20C206			1
14 - 9	16DA-4004A-10	. RELAY, EXCITATION, DEENERGIZATION 12V, V77342, NO. KAP-14DG			1
14 -10	16DA-4052-0	. SOCKET, RELAY, V02660, NO. 77-MIP-11			1
*14 -11	363771-5	. SLEEVING, PLASTIC, 1/8 IN. I.D.			6
*14 -12	363770-1	. SLEEVING, PLASTIC, 3/16 IN. I.D.			2
14 -13	16DA-4029	. BRACKET, MOUNTING, SOCKET, RELAY			1
14 -14	16DA-2162	. KNOB, RHEOSTAT, V44655, NO. 5150			1
14 -15	10J-178	. NAMEPLATE, FIELD, RHEOSTAT			1
14 -16	381439	. BRACKET, MOUNTING, RHEOSTAT			1
14 -17	402218	. RHEOSTAT, MANUAL, MODEL L, V44655, 100 OHMS, 150 WATTS			1
14 -18	HF-1459	. SWITCH, METER SELECTOR, V04009, NO. 81579-FT			1
14 -19	15GH-433	. NAMEPLATE, METER, SELECTOR SWITCH			1
14 -20	400400	. SWITCH, TOGGLE, V74559, NO. 26L61TABS			1
14 -21	W-8095A-8	. AMMETER, V60741, NO. 331LH			1

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FIGURE ITEM NO.	HOBART PART NO.	NOMENCLATURE 1 2 3 4 5 6 7	EFF	UNITS per ASSY
14 -		(Continued)		REF
14 -22	W-8105A-4	. VOLTMETER, V60741, NO. 331LH		1
14 -23	W-9916-10	. METER, FREQUENCY, V31356, NO. 36-FX		1
14 -24	388328-51	. NAMEPLATE, IDENTIFICATION	A,B,D-G	
			J-L	1
14 -24	388328-65	. NAMEPLATE, IDENTIFICATION	C,H	1
	482279	. TRAY, SUB-ASSY, GENERATOR CONTROL		1
14 -25	370382A	. . HANDLE, TRAY		1
14 -26	404028	. . NAMEPLATE, HOBART		1
14 -27	76A-1115	. . LATCH, ADJUSTABLE GRIP, V94222, NO. 48-99-126-11		1
14 -28	402383	. . SLIDE ASSY, TRAY, (Consists of four parts marked CR, CL, DR, & DL) V75358, NO. 1336-12		1 SET
14 -29	482280	. . TRAY ASSEMBLY		1
*14 -30	400030-1	. CAPACITOR, TANTALUM 6.8 F, 35V, V56289, NO. 150D685X9035B2		1
*14 -31	482306	. HARNESS ASSY, WIRE, GEN. CONTROL TRAY		1
*14 -32	402379	. . PLUG, STRAIGHT, 20 CONTACT V02660, NO. MS-3106A-28-16S		1
*14 -33	402382	. . CLAMP, CABLE, V02660, NO. MS-3057-16		1
*14 -34	484689-1	. . SLEEVING, SHRINKABLE, 1/8 ID		AR

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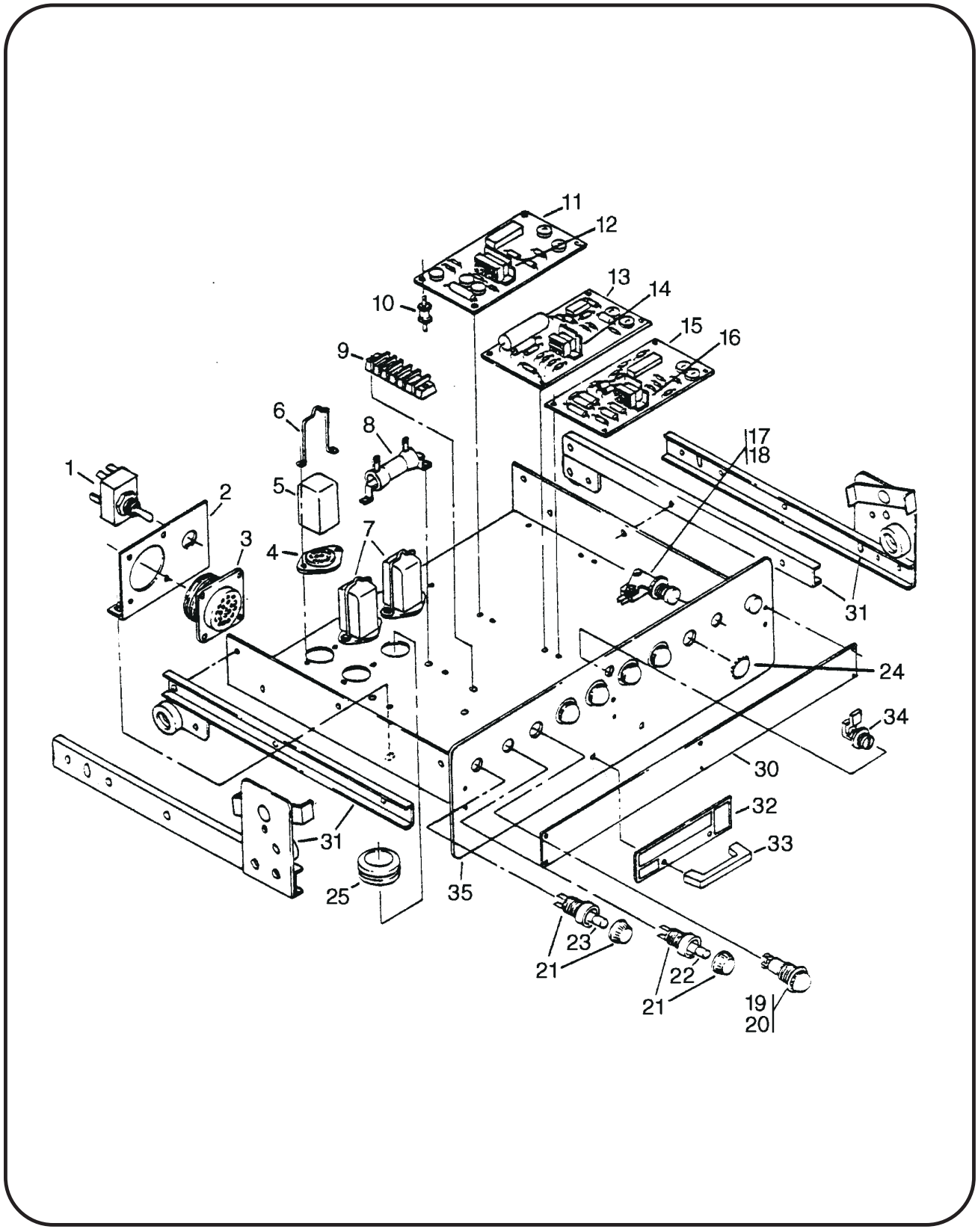

Protective Relays Tray Assembly
Figure 15

FIGURE ITEM NO.	HOBART PART NO.	NOMENCLATURE 1 2 3 4 5 6 7	EFF	UNITS per ASSY
15 -	**482285-1**	**. TRAY ASSEMBLY, PROTECTIVE RELAYS (For NHA see Fig. 13)**		**REF**
15 - 1	402662	. SWITCH, TEST BANK, V73559, NO. 2GK71-73		1
15 - 2	492284-2	. BRACKET, MTG., RECEPTACLE & SWITCH		1
15 - 3	482356	. RECEPTACLE, HARNESS, WIRE		1
15 - 4	16DA-4052-0	. SOCKET, RELAY V02660, NO. 77-MIP-11		3
15 - 5	16DA-4004A-3	. RELAY, PLUG INTERLOCK, 24 VDC		1
15 - 6	16DA-4253-1	. RETAINER, SPRING, RELAY V77324, NO. 20C206		3
15 - 7	16DA-4004A-10	. RELAY, FUSE INTERLOCK, NO. KAP-14DG		2
15 - 8	W-9746-3	. RESISTOR, 100 OHM, 25 WATT, V44655, NO. 0200F		1
15 - 9	401937-1	. STRIP TERMINAL, V98410, NO. 35005-3526		1
15 -10	401556	. MOUNT, SHOCK, RUBBER, V98373, NO. B-323 OR SS-01		12
15 -11	387736C	. BOARD, ASSY, MEMORY AND TIME DELAY		1
15 -12	401563-5	. . HOUSING, PIN, CONNECTOR		1
15 -13	482038	. BOARD ASSY, OVER-UNDERVOLTAGE		1
15 -14	401563-4	. . HOUSING, PIN, CONNECTOR		1
15 -15	482039A	. BOARD, ASSY, OVER-UNDERFREQUENCY		1
15-16	401563-4	. . HOUSING, PIN, CONNECTOR		1
15-17	76A-1118	. SWITCH, SNAP, PUSHBUTTON, V27191, NO. SA35BCB34-9		2
15-18	403336	. RING, LOCKING SWITCH V91929, TS10020		2
15-19	HF-2518-2	. LIGHT, PILOT, FAULT, 12-V, RED		5
15-19A	404172-1	. . LENS, RED, V72619, NO. 26-1101-300		1
15-20	400613-4	. . BULB, V7144, TYPE 1815		1
15- 21	402658	. HOLDER, FUSE, V71400, NO. HKP-HH		2
15-22	W-11166-1	. FUSE, AGC, 2A.		1
15-23	W-11166-1	. FUSE, AGC, 2A.		1
15-24	403091-6	. BUTTON, PLUG, HOLE		1
15-25	402037-9	. GROMMET, RUBBER, V02231, NO. AGW-4211	1	
*15-26	388328-52	. NAMEPLATE, IDENTIFICATION		1
*15-27	401566-11	. TERMINAL, SOCKET, V89110, N. 60619-1		35
*15-28	401564-4	. HOUSING, SOCKET, CONNECTOR, V89110 NO. 1-480287-0		2

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FIGURE ITEM NO.	HOBART PART NO.	NOMENCLATURE 1 2 3 4 5 6 7	EFF	UNITS per ASSY
15 -		(Continued)		REF
* 15 -29	401564-5	. HOUSING, SOCKET, CONNECTOR, V89110 NO. 1-480438-0		2
15 -30	482291	. NAMEPLATE, PROTECTIVE SYSTEM		1
	482286	. TRAY, ASSY, PROTECTIVE RELAYS		1
15 -31	402383	. . SLIDE ASSY, TRAY, (Consists of four parts marked CR, CL, DR & DL) V75358, NO. 1336-12		1 Set
15 -32	404028	. . NAMEPLATE, HOBART		1
15 -33	370382A	. . HANDLE, TRAY		1
15 -34	76A-1115	. . LATCH, ADJUSTABLE GRIP, V94222 NO. 48-99-126-11		1
15 -35	482287	. . TRAY ASSEMBLY		1
* 15 -36	482307	. HARNESS ASSY, WIRE, PROTECTIVE RELAYS TRAY		1

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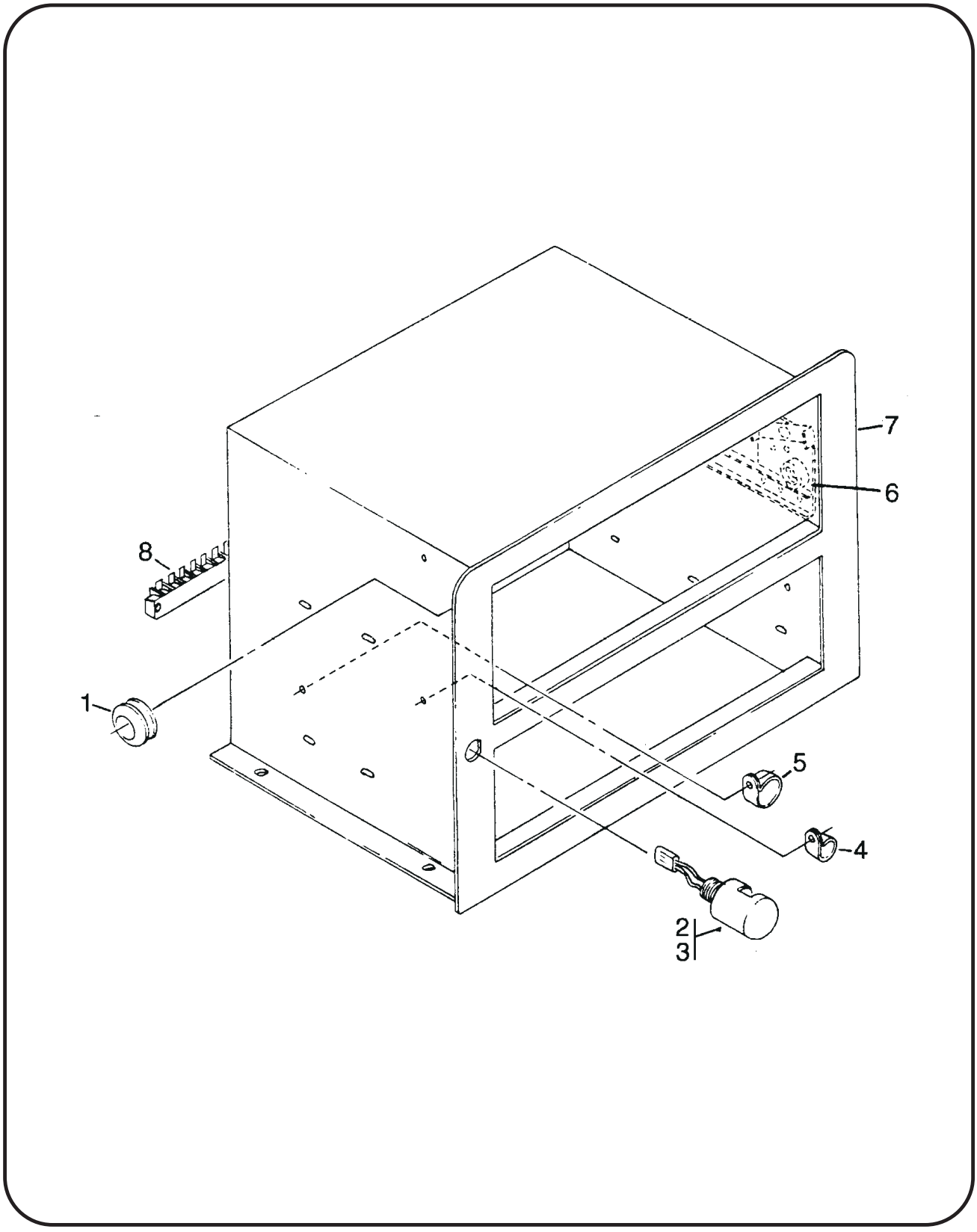
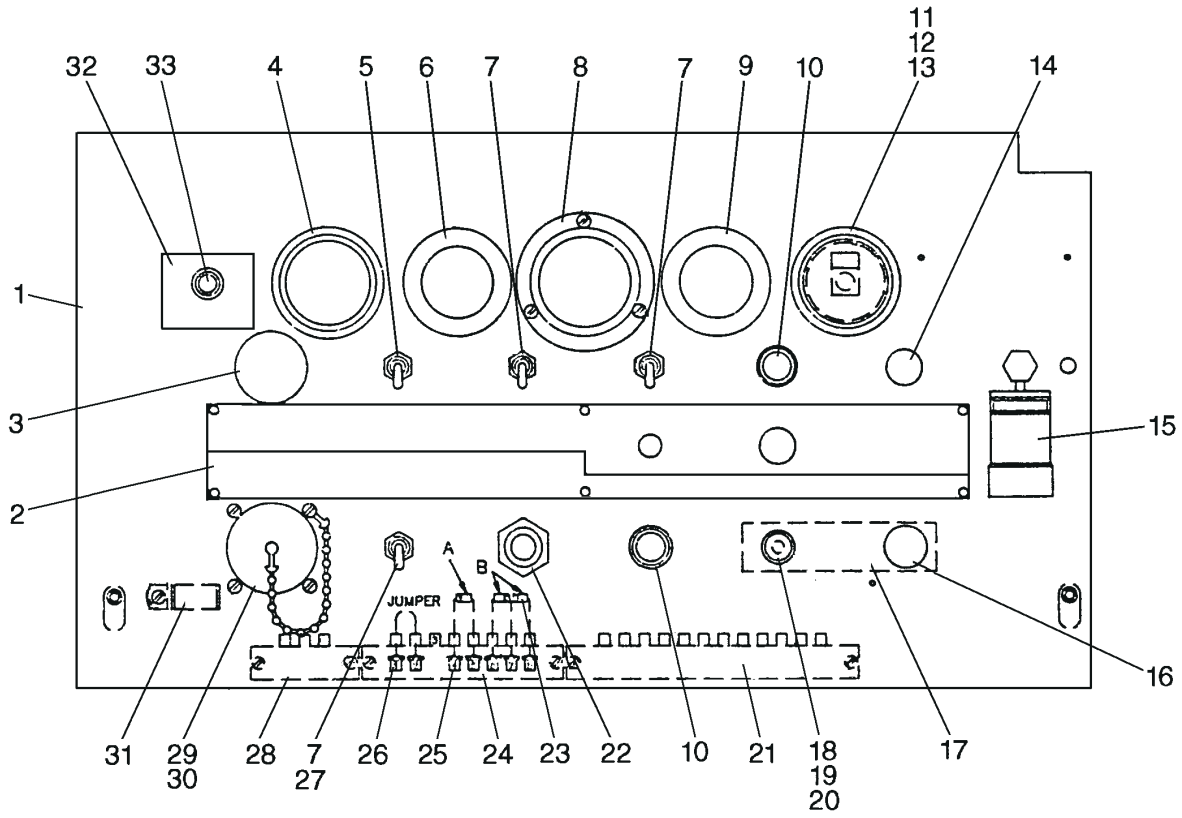


Control Box and Internal Components Group
Figure 16

FIGURE ITEM NO.	HOBART PART NO.	NOMENCLATURE 1 2 3 4 5 6 7	EFF	UNITS per ASSY
16 -	**No Number**	**CONTROL BOX AND INTERNAL COMPONENTS ASSEMBLY (For NHA see Fig. 13)**		**REF**
16 - 1	402037-9	. GROMMET, RUBBER V02231, NO. AGW-4211	2	
16 - 2	82B-1047	. LIGHT ASSY, PANEL V75175, NO. 261-3306		2
16 -2A	82A-1048	. . LENS, CLEAR, V75175, NO. 40944-001		1
16 - 3	50GHP-206	. . BULB V08108, NO. 67 OR T631		1
16 - 4	W-10051-10	. CLAMP, WIRE, PLASTIC V81074, NO. EC-10		3
16 - 5	W-10051-13	. CLAMP, WIRE, PLASTIC V81074, NO. EC-14		2
16 - 6	402383	. SLIDE ASSY, TRAY (For Details see Tray Assemblies, Fig. 17 or 18)		REF
16 - 7	482236	. BOX ASSY, CONTROL		1
16 - 8	401937-3	. STRIP, TERMINAL V98410, NO. 35012-3526		1
* 16 - 9	401556	. MOUNT, SHOCK, RUBBER V81860, NO. SS-01 OR V89373, NO. B-323		REF



Engine Control Panel
Figure 17

FIGURE ITEM NO.	HOBART PART NO.	NOMENCLATURE 1 2 3 4 5 6 7	EFF	UNITS per ASSY
17	**482296-2**	**PANEL ASSY, CONTROL, ENGINE (For NHA see Fig. 3)**	**A,F**	**REF**
17	**482296-8**	**PANEL ASSY, CONTROL, ENGINE (For NHA see Fig. 3)**	**B,G**	**REF**
17	**482296-9**	**PANEL ASSY, CONTROL, ENGINE (For NHA see Fig. 3)**	**C,H**	**REF**
17	**482296-11**	**PANEL ASSY, CONTROL, ENGINE (For NHA see Fig. 3)**	**D,J**	**REF**
17	**482296-15**	**PANEL ASSY, CONTROL, ENGINE (For NHA see Fig. 3)**	**E,K**	**REF**
17	**482296-23**	**PANEL ASSY, CONTROL, ENGINE (For NHA see Fig. 3)**	**L**	**REF**
17 - 1	482297	. PANEL, CONTROL, ENGINE	A,D,F,J,L	1
17 - 1	482855	. PANEL, CONTROL, ENGINE	B,G	1
17 - 1	484016	. PANEL, CONTROL, ENGINE	C,H	1
17 - 1	485660	. PANEL, CONTROL, ENGINE	E,K	1
17 - 2	482300	. NAMEPLATE, CONTROLS	ABEFGKL	1
17 - 2	485388	. NAMEPLATE, CONTROLS	D,J	1
17 - 3	82B-1047	. LIGHT ASSY, PANEL, V75175, NO. 261-3306		1
	82A-1048	. . LENS, CLEAR, V75175, NO. 40944-001		1
	50GHP-206	. . BULB, V08108, NO. 67 FOR 12V		1
17 - 4	12CW-1320A-5	. GAUGE, FUEL V98738, NO. 301-4		1
17 - 5	FW-1312	. SWITCH, TOGGLE V27191, NO. 7320K3		1
17 - 6	402889-2	. AMMETER V85925, NO. 730-D-5	A-D,F-J,L	1
17 - 7	403189	. SWITCH, TOGGLE V91929, NO. 312TS1-59	A-C,E-H,KL	2
	403189	. SWITCH, TOGGLE V91929, NO. 312TS1-59	D,J	3
17 - 8	W-9917-18	. METER, ENGINE, HOUR V26992, NO. 771-4/50	A-K	1
17 - 8	181358	. METER, ENGINE, HOUR V57733, NO. 80001	L	1
17 - 9	DW-4304	. GAUGE, TEMP, WATER V81082, NO. 8585A		1
17-10	HF-2518-8	. LIGHT, PILOT, ENGINE & GEN. (GRN)		2
	400613-4	. . BULB, V08108 NO. 1815		1
	404172-3	. . LENS, GREEN V72619, NO. 26-1192-300		1

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FIGURE ITEM NO.	HOBART PART NO.	NOMENCLATURE 1 2 3 4 5 6 7	EFF	UNITS per ASSY
17 -		(Continued)		
17 -11	DW-6080	. GAUGE, PRESSURE, OIL V81082, NO. 75, TYPE "C"		1
* 17 -12	W-10910-0	. TEE, PIPE V79470, NO. 3700 X 2		1
* 17 -13	402130	. SWITCH, PRESSURE, OIL, V74400, NO. M-4006		1
17 -14	403091-4	. BUTTON, PLUG, HOLE		1
17 -15	83A-1026	. INDICATOR, SERVICE FILTER, AIR CLEANER, V21585, NO. L-14440-001		REF
17 -16	76B-1129	. CONTROL, ENGINE STOP V41625 NO. B048701-000-0108	AB,D-G,J-L	1
17 -17	W-11166-3	. FUSE, AGC, 10 AMP.		1
17 -18	402658	. HOLDER, FUSE V71400, NO. HKP-HH		1
17-19	401937-3	. STRIP, TERMINAL V98410, NO. 35012-3526		1
17 -20	404100	. SWITCH, PUSHBUTTON, STARTER V700400, NO. 1996027	A,C-F,H-L	1
17 -21	1CZ-93B	. DIODE, SILICON V05277, NO. IN4820		2
17 -24	401937-2	. STRIP, TERMINAL V98410, NO. 35008-3526		1
17 -22	400480-3	. TERMINAL, QUICK CONNECT V00779, NO. 42640-2		3
17 -23	400701	. CONNECTOR, RT. ANGLE, V59730, NO. TA-250-8		5
17 -25	403091-2	. BUTTON, PLUG, HOLE		1
17 -26	403380	. CAP & CHAIN ASSEMBLY V02660, NO. 9760-28		1
17 -27	482304	. HARNESS ASSY, WIRE TEST RECEPTACLE		1
17 -28	W-10051-13	. CLAMP, WIRE, PLASTIC		1

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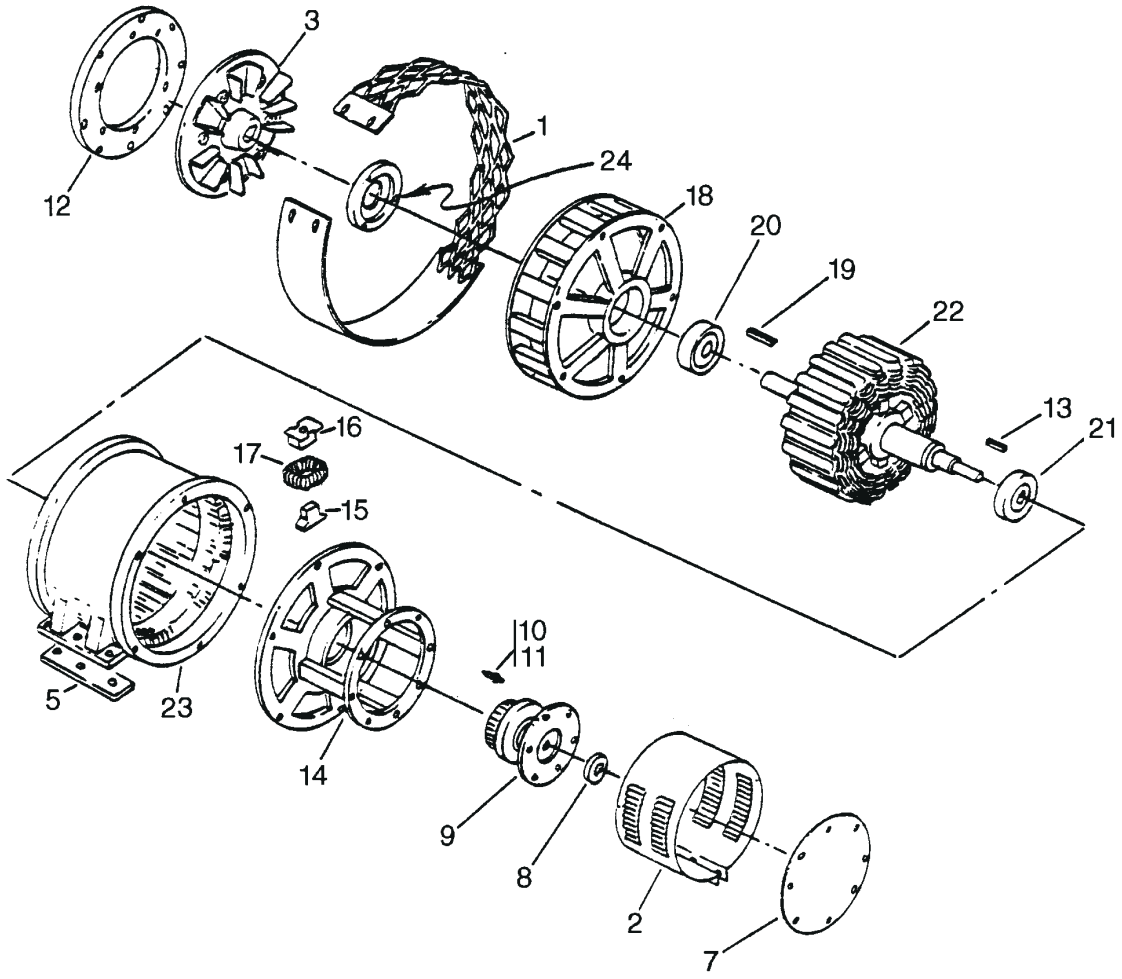
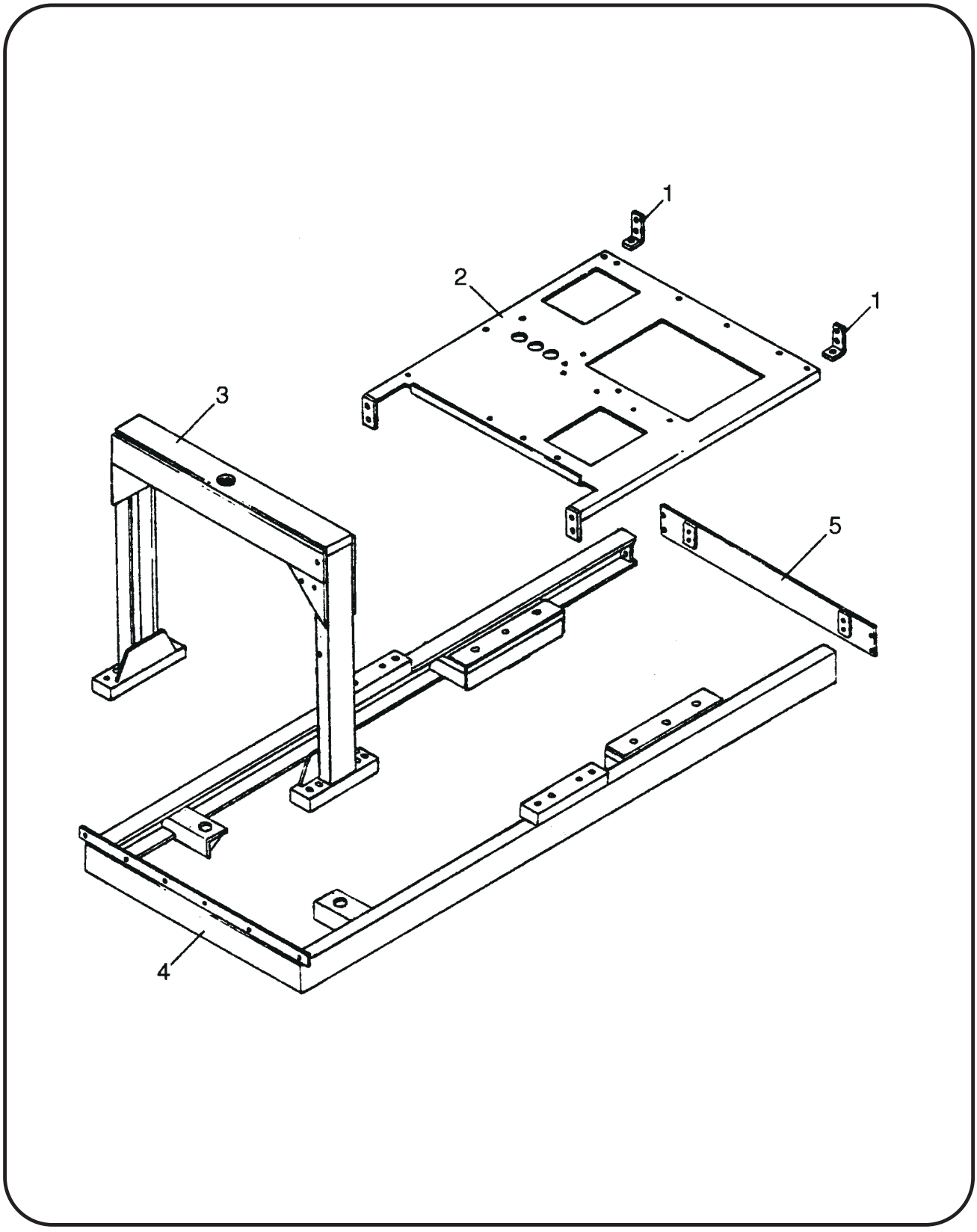


Generator Assembly
Figure 18

FIGURE ITEM NO.	HOBART PART NO.	NOMENCLATURE 1 2 3 4 5 6 7	EFF	UNITS per ASSY
18 -	**280786A**	**GENERATOR ASSY (For NHA See Fig. 3)**		**REF**
18 - 1	387617A	. COVER, FAN, HOUSING		1
18 - 2	387621	. COVER, EXCITER HOUSING		1
18 - 3	488908	. FAN & COUPLING ASSEMBLY		1
**18 -3A	W-11102-18	. SCREW, FLEXIBLE COUPLING		6 *
* 18 - 4	482483	. SCREW, RETAINING		1
18 - 5	480669	. ADAPTER, FOOT, GEN.		2
* 18 - 6	W-11102-8	. SCREW, GEN. MTG.		6
18 - 7	488755	. COVER, END, EXCITER HOUSING		1
18 - 8	100GHP-66	. WASHER, RETAINING		1
18 - 9	387623-1	. CORE, ARMATURE ASSEMBLY		1
18 - 10	W-10875-1	. . DIODE, SILICON, 35 AMP, NEGATIVE BASE, V51589, #ST460N		3
18 - 11	W-10874-1	. . DIODE, SILICON, 35 AMP, POSITIVE BASE, V51589, #ST460P		3
18 - 12	386612	. RING, SPACER, COUPLING		1
*18 -12A	W-11097-34	. . SCREW, SPACER RING		8
18 - 13	481379	. KEY, EXCITER		1
18 - 14	387624A-1	. HOUSING, EXCITER		1
18 - 15	100NH-2	. POLEPIECE, EXCITER		4
18 - 16	100NH-3	. INSULATION, EXCITER, WRAPPER		4
18 - 17	DATA 3190	. COIL, FIELD, EXCITER		1 SET
18 - 18	387620A-1	. HOUSING, FAN ASSEMBLY		1
18 - 19	85B-1039	. KEY, FLEXIBLE, COUPLING		1
18 - 20	W-10072-68	. BEARING, FRONT		1
18 - 21	W-10072-1	. BEARING, REAR		1
18 - 22	181786	. ARMATURE, AC/DC		1
18 - 23	387748-2	. HOUSING & STATOR ASSEMBLY		1
18 - 24	483993	. BRACKET, RETAINING BEARING		1
*18 - 25	385950	. INSULATION, TOE		16
*18 - 26	480603-1	. MOUNT, RUBBER		6
$18 - 27	480628	. WASHER, MOUNT		6

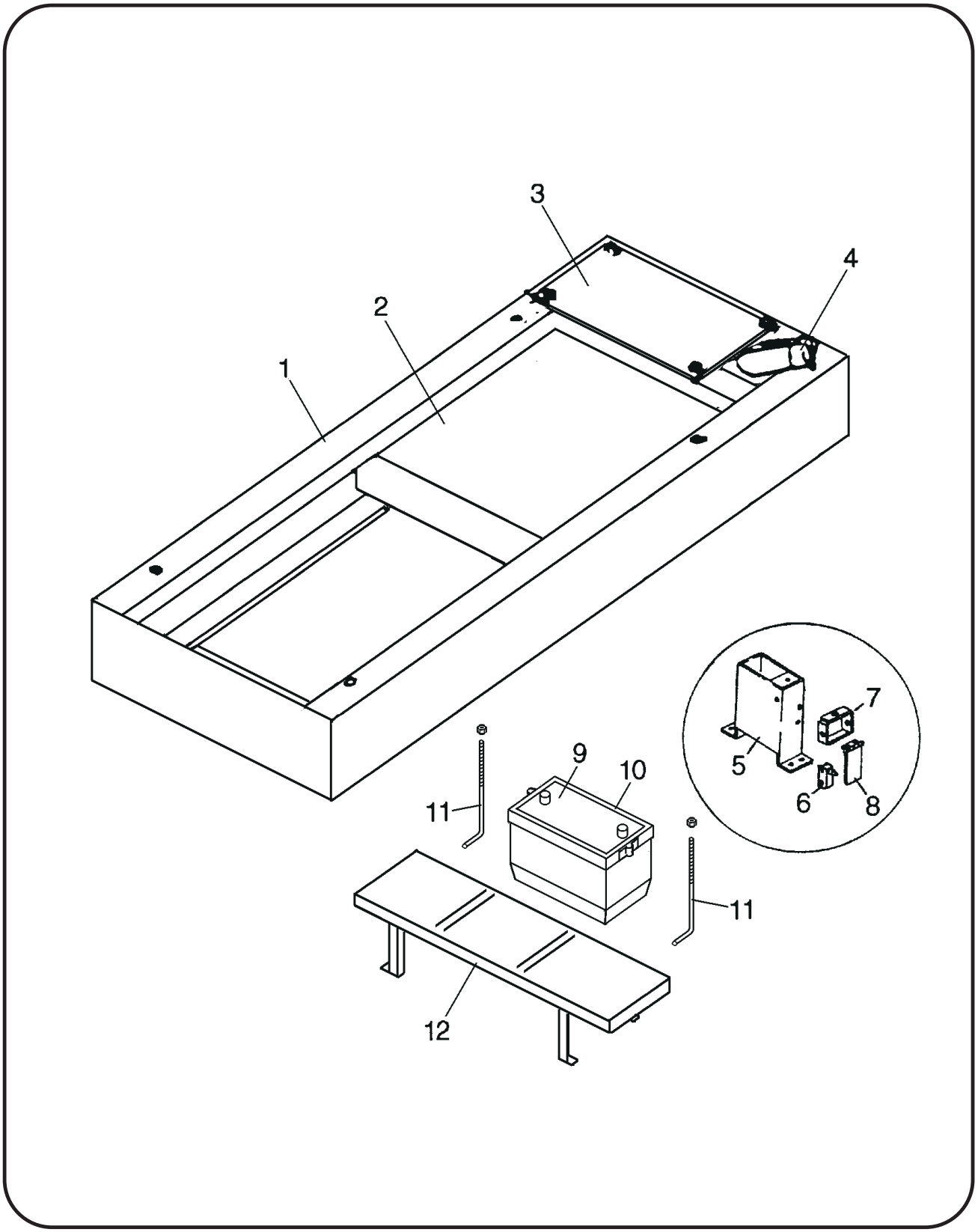
*** Not Illustrated**

** Do Not Substitute - Requires 5/8 - 11 X 2-3/4 Sae Grade 5 For Safety.



Frame Assembly, Mounting & Lifting Yoke
Figure 19

FIGURE ITEM NO.	HOBART PART NO.	NOMENCLATURE 1 2 3 4 5 6 7	EFF	UNITS per ASSY
19 -	**No Number**	**FRAME ASSEMBLY, MOUNTING & LIFTING YOKE (For NHA See Fig. 1)**		**REF**
19 - 1	482316	. BRACKET, MOUNTING, SUPPORT, BOX, CONTROL		2
19 - 2	482315	. PANEL, SUPPORT, CONTROL BOX		1
19 - 3	482311A	. YOKE, LIFTING		1
19 - 4	480586A	. FRAME, MOUNTING		1
19 - 5	481113	. PLATE, END, REAR, (Part of Item 4 Assembly)		1



Truck Body Assembly
Figure 20

FIGURE ITEM NO.	HOBART PART NO.	NOMENCLATURE 1 2 3 4 5 6 7	EFF	UNITS per ASSY
20 -	481386-5	BODY, TRUCK, ASSEMBLY FOR TRUCK-MOUNTING OF GENERATOR SET BY CUSTOMER (For NHA See Fig. 1)		REF
20 - 1	482741	. FRAME, MOUNTING		1
20 - 2	482706	. TANK, FUEL, ASSEMBLY		1
20 - 3	481032	. PLATE, COVER, REAR		1
20 - 4	76A-1152	. CAP, PROTECTOSEAL, FILL		1
20 - 5	485477	. BOX, PLUG		1
20 - 6	83A-1069	. . SWITCH, MICRO		1
20 - 7	485474	. . PANEL, INTERIOR, PLUG BOX		1
20 - 8	485475	. . ACTUATOR, SWITCH		1
20 - 9	281871-1	. BATTERY, 12-V		1
20 -10	181831	. CLAMP, BATTERY, HOLD-DOWN		1
20 -11	5CW-2048	. ROD, BATTERY, HOLD-DOWN		2
20 -12	480711	. SUPPORT, BOX BATTERY, ASSEMBLY		1
* 20 -13	76B-1149	. LABEL, GASOLINE		1
* 20 -14	HF-530	. KNOB, PANEL, BATTERY BOX		1

* Not Illustrated

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Section 4. Numerical Index

Explanation of Numerical Index

The purpose of this index is to assist the user in finding the illustration and description of a part when the part number is know. Part numbers are arranged in numeric-alpha sequence. Thus, any number beginning with the letter “A” would be located toward the end of the index list. Likewise a part number “1" would be listed near the end of the list. The figure number and item number location of the part is directly opposite the part. If the part is used more than one place, each location is listed commencing with the first location the part is listed.

PART NUMBER	FIGURE - ITEM No.
W-10854-4	11-6
W-10869-2	4-14, 4-22
W-10869-3	4-21
W-10874-1	18-11
W-10875-1	18-10
W-10886-1	9-1
W-10886-4	8 - 19
W-10886-6	8 - 20
W-10890-6	4-16
W-10891-7	9-5
W-10891-9	8-13
W-10891-10	8-5
W-10891-10	8-10
W-10893-0	8-8
W-10893-2	4-29, 5-8
W-10910-0	17-12
W-11097-18	10-5, 11-1
W-11097-34	18-12A
W-11102-8	18-6
W-11102-18	18-3A
W-11166-1	15-22, 15-23
W-11166-3	17-17
W-11112-3	10-10, 11-10,
W-11242-5	10-2
W-11242-10	10-7, 11-3
W-11245-3	10-12, 11-12
W-11254-3	10-11, 11-11
W-11254-6	10-6, 11-2
W-11608-3	8-6
W-2974-L	14-6
W-2974-N	14-7
W-7814-2	4-27
W-7814-5	4-18, 8-14
W-7814-9	5-13
W-799F-110	7-12
W-8095A-8	14-21
W-8105A-4	14-22
W-9060-279	12-22

PART NUMBER	FIGURE - ITEM No.
W-9234-55	5-61
W-9360-211	12-23
W-9360-278	12-24
W-9476-16	7-7
W-9549-19	10-3
W-9746-1	12-3
W-9746-3	12-36, 15-8
W-9916-10	14-23
W-9917-18	17-8
1CZ-148	12-5
1CZ-93B	12-20, 12-29,12-37, 17-21
10J-178	14-15
100GHP-66	18-8
100NH-2	18-15
100NH-3	18-16
12CW-1320A-5	17-4
12CW-2077-3	8-16
12CW-908	4-26, 5-50
15GH-433	14-19
16DA-2162	14-14
16DA-4004A-3	12-33, 15-5
16DA-4004A-10	12-35, 14-9, 15-7
16DA-4029	14-13
16DA-4052-0	12-28, 14-10, 15-4
16DA-4253-1	12-34, 14-8, 15-6
180132	4-33
181018	5-27, 7-0
181019	7-4
181020	7-1
181358	17-8
181786	18-22
181831	20-10
280786A	3-13, 18-0
281871-1	20-9
282130-1	12-7, 12-30
30GH-1189-1	5-36
30GH-1259	5-49
30GH-417	5-23

PART NUMBER	FIGURE - ITEM No.
351541	4-34
355194	4-10
363136-2	12-13
363770-1	14-12
363771-5	14-11
370382A	14-25, 15-33
381439	14-16
385275	4-17
385950	18-25
386612	18-12
386751	4-12
387293	5-26, 6-0
387294	6-4
387295	6-3
387313	4-7
387450	2-23
387607A	5-3
387617A	18-1
387620A-1	18-18
387621	18-2
387623-1	18-9
387624A-1	18-14
387629	5-6
387736C	15-11
387738A	12-8
387748-2	18-23
387878	4-1
387881	4-9
387913	4-4
387914	4-6
388219-1	4-13
388328-51	14-24
388328-52	15-26
388328-65	14-24
388425	4-0
388437	5-40
388535	5-3
389284	2-26

PART NUMBER	FIGURE - ITEM No.
389421	4-24
389909	4-32
400030-1	14-30
400059-1	8-2
400162	3-10
400078	14-6A
400400	14-20
400480-2	12-18
400480-3	12-19, 12-38, 17-22
400613-4	15-20, 17-10
400701	12-14, 17-23
400819-1	8-15
400830-15	12-16
401556	12-12, 15-10, 16-9
401563-4	15-14, 15-16
401563-5	15-12
401564-4	12-9, 15-28
401564-5	15-29
401566-11	12-10, 15-27
401937-1	11-9, 15-9,
401937-2	12-2, 17-24
401937-3	12-1, 12-26, 16-8, 17-19
401939	12-15
402037-9	15-25
402037-9	16-1
402037-14	12-31
403091-6	15-24
402119-30	5-50
402130	17-13
402197-1	12-17
402218	14-17
402379	14-32
402382	14-33
402383	14-28
402383	16-6
402436	5-11
402499-1	4-30

PART NUMBER	FIGURE - ITEM No.
402658	15-21
402658	17-18
402662	12-32
402662	15-1
402665-1	14-4
402826	14-4
402889-2	17-6
402908	5-28, 7-6
402958	4-8
402987	1-5
403034	4-13
403064	5-4
403065	5-5
403091-2	17-25
403091-4	17-14
403091-8	2-37
403127	2-17, 3-19
403156	5-7
403157	5-9
403189	17-7
403264	5-12
403336	15-18
403380	17-26
402383	15-31
403409	5-16
403412	8-11
403590-1	9-2
403590-3	8-3
403592	8-1
403763-1	12-11
403774	5-10
403782-0	5-2
404006	5-1
404595	7-3
404028	14-26, 15-32
404065-2	12-6, 12-27, 14-5
404100	17-20
404101-1	2-38

PART NUMBER	FIGURE - ITEM No.
404172-1	15-19A
404172-3	17-10
404402-2	12-4
404568	5-24
404594	7-5
430391C	3-3
456548	9-4
480586A	19-4
480603-1	18-26
480618	5-21
480619	5-22
480621	5-19
480628	18-27
480629	5-17
480630	5-18
480648	5-20
480669	18-5
480695	2-16, 3-20
480701	2-31
480711	20-12
481032	20-3
481113	19-5
481379	18-13
481386-5	1-6, 20-0
481416	2-27
481417	2-22
481418	2-9
481419	2-10
482029	2-15
482038	15-13
482039A	15-15
482069	12-25
482075-1	3-5, 12-0
482076	12-21
482093	5-25
482152	7-9
482170	7-11
482235-3	3-6, 13-0

PART NUMBER	FIGURE - ITEM No.
482235-4	3-6, 13-0
482236	16-7
482278-4	13-1, 14-0
482278-5	13-1, 14-0
482279	14-24
482280	14-29
482284-1	14-3
492284-2	15-2
482285-1	13-2, 15-0
482286	15-30
482287	15-35
482291	15-30
482296-2	3-7
482296-2	17-0
482296-8	3-7
482296-8	17-0
482296-9	3-7
482296-9	17-0
482296-11	3-7
482296-11	17-0
`482296-15	3-7
482296-15	17-0
482296-23	3-7
482296-23	17-0
482297	17-1
482300	17-2
482304	17-27
482306	14-31
482307	15-36
482311A	19-3
482314	3-9
482315	19-2
482316	19-1
482317	3-12
482317	10-0
482318	3-11
482319	3-4
482319	711-0

PART NUMBER	FIGURE - ITEM No.
482320	2-2
482321	2-3
482322	2-4
482323	2-6
482325	3-8
482326	3-18
482327	2-7
482328	2-21
482333	2-1
482355	14-1
482356	15-3
482372	2-20
482376	2-5
482386	2-18
482400	10-16
482401	2-12
482407	2-29
482424	2-31
482426	2-15
482428	2-32
482429	2-25
482437	2-24
489443	2-11
482443	10-9
482443	11-5
482444	10-13
482445	10-4
482446	10-8
482446	11-4
482449	11-8
482450	11-13
482469	2-11
482471	11-7
482482	2-33
482483	18-4
482494	5-64, 9-0
484501	14-1
482506	5-63

PART NUMBER	FIGURE - ITEM No.
482507	2-35
482529	5-15
482706	20-2
482741	20-1
482855	17-1
482877	2-15
482989	7-10
483914	5-37
483916	5-38
483958	5-39
483959	5-41
483971	5-51
483989	5-31
483990	5-32
483991	5-29
483992	5-42
483993	18-24
484014	5-35
484015	5-46
484016	17-1
484066-1	3-15
484067	3-16, 12-24
484070	3-17
484071	10-14
484076	2-18
484086	3-17
484107	3-12, 10-0
484244A	3-21
484265-1	5-45
484464-1	5-55
484689-1	14-34
484838	5-62
485388	17-2
485474	20-7
485475	20-8
485477	20-5
485660	17-1
486191	5-59

PART NUMBER	FIGURE - ITEM No.
486192	5-58
488755	18-7
488863	2-36
488908	18-3
489030	2-14
489032	2-13
489052	2-19
489812A	3-3
489825	1-2, 2-0
489823	1-2, 2-0
489868	1-2, 2-0
5AW-989	5-43
5CW-1932-0	4-5
5CW-2048	20-11
50GHP-89	4-2
50GHP-82	4-3
50GHP-206	16-3, 17-3
50MS-732-0	10-1
5384E-1	1-0
5384E-4	1-0
5384E-5	1-0
5384E-9	1-0
5384E-10	1-0
5384E-11	1-0
5384E-14	1-0
5384E-15	1-0
5384E-16	1-0
5384E-17	1-0
5384E-18	1-0
56501	4-15
56532	4-20
56532	4-23
56534	4-31
56534	5-7
56535	8-9
56550	8-4
56551	8-12
56555	4-11

PART NUMBER	FIGURE - ITEM No.
6FW-5047	5-60
60GHP-416	5-65
60GHP-424	5-66
75NH-306	10-16
75NH-307	10-15
76A-1115	2-8
76A-1115	14-27
76A-1115	15-34
76A-1118	15-17
76A-1125	2-34
76B-1127	3-22
76B-1129	17-16
76A-1152	20-4
76B-1149	20-13
78A-1085	5-30
78A-1092	5-34
78A-1093	5-44
78B-1076	5-1
79A-1000	5-52
79A-1001	5-53
79A-1002	5-54
79A-1003	5-56
79A-1015	5-47
82A-1048	16-2A, 17-3
82B-1047	16-2, 17-3
83A-1026	5-6, 17-15
83A-1069	20-6
84A-1075	7-2
85A-1047	7-8
85B-1039	18-19

Chapter 5. Manufacturer's Literature

Voltage Regulator	Hobart Brothers Company OM-2011B, Section 2-5
Electric Governor	Barber-Colman Electric Governor Instructions
Engine	Detroit Diesel Corporation In-Line Engine Operator's Manual
Overspeed Governor	Synchro-Start Products Instructions for Overspeed Governor
Flexible Coupling	Hobart Brothers Company OM-2011B, Section 3-3
Exciter Rotor	Hobart Brothers Company OM-2011B, Section 3-2

Hobart Diagrams

482360 482856	Schematic, Generator (All units except S-5384E- 4 & -14), or Schematic, Generator (S-5384E-4 & -14)
180894 181073 484017	Connection, Generator (All units except S-5384E-4, -5, -14, -15), or Connection, Generator (S-5384E-4 & -14), or Connection, Generator (S-5384E-5 & -15)
181071 483973 486658	Schematic, Engine (All units except S-5384E-5, -10, -15, -17), or Schematic, Engine (S-5384E-5 & -15), or Schematic, Engine (S-5384E-10 & -17)
482362 483974 486657	Connection, Engine (All units except S-5384E-5, -10, -15, -17), or Connection, Engine (S-5384E-5 & -15), or Connection, Engine (S-5384E-10 & -17)
482365 484018	Connection, Generator Control Tray (All units except S-5384E-5, -15), or Connection, Generator Control Tray (S-5384E-5 & -15), or
482366	Connection, Protective Relays Tray (All units)
482099	Connection, Power Module (All units)
484226	Connection, Second Output (S-5384E-9, -16)

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Unusual Service Conditions

This information is a general guideline and cannot cover all possible conditions of equipment use. The specific local environments may be dependent upon conditions beyond the manufacturer's control. The manufacturer should be consulted if any unusual conditions of use exist which may affect the physical condition or operation of the equipment. Among such conditions are :

a. Exposure to:

(1) Combustible, explosive, abrasive or conducting dusts.

(2) Environments where the accumulation of lint or excessive dirt will interfere with normal ventilation.

(3) Chemical fumes, flammable or explosive gases.

(4) Nuclear radiation.

(5) Steam, salt-laden air, or oil vapor.

(6) Damp or very dry locations, radiant heat, vermin infestation, or atmospheres conducive to fungus growth.

(7) Abnormal shock, vibration or mechanical loading from external sources during equipment operation.

(8) Abnormal axial or side thrust imposed on rotating equipment shafts.

(9) Low and/or high ambient temperatures.

b. Operation at:

(1) Voltages above or below rated voltage.

(2) Speeds other than rated speed.

(3) Frequency other than rated frequency.

(4) Standstill with rotating equipment windings energized.

(5) Unbalanced voltages.

(6) Operation at loads greater than rated.

c. Operation where low acoustical noise levels are required.

d. Operation with:

(1) Improper fuel, lubricants or coolant.

(2) Parts or elements unauthorized by the manufacturer.

(3) Unauthorized modifications.

e. Operation in poorly ventilated areas.

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