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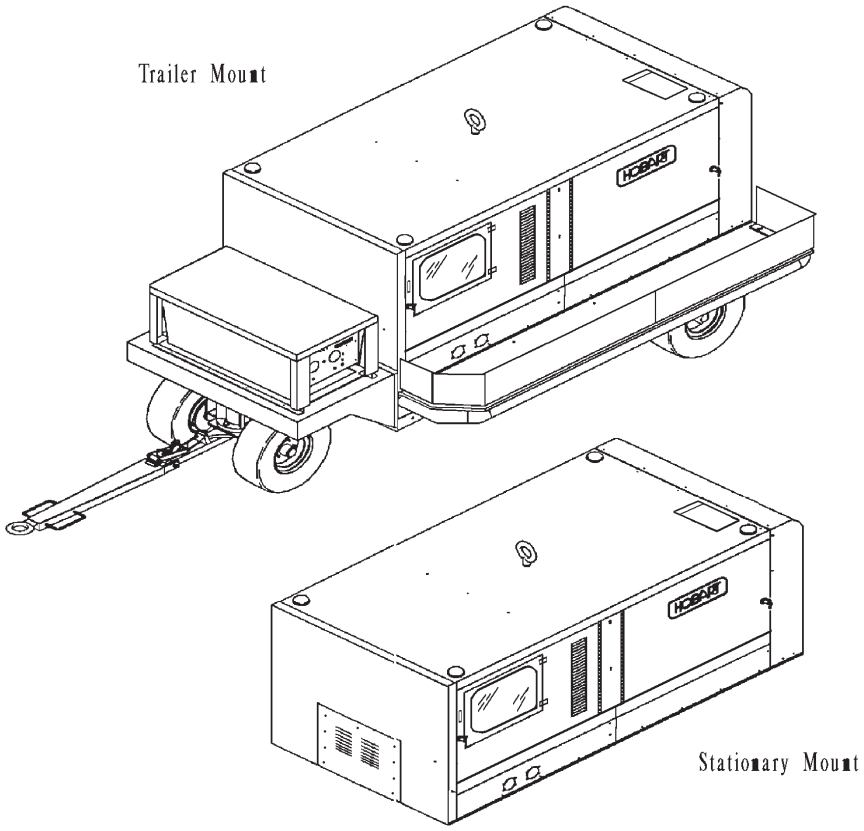
HOBART®
GROUND POWER

Operation and Maintenance Manual



Model 120C24 Generator Sets
Specifications 7131

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

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Safety Warnings and Cautions

WARNING

CALIFORNIA PROPOSITION 65 - GASOLINE ENGINES. The engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects or other reproductive harm.

WARNING

CALIFORNIA PROPOSITION 65 - DIESEL ENGINES. Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects and other reproductive harm.

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

Equipment driven by electric motors *(rather than by diesel or gasoline engines)* 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 and mechanical 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 electrically-powered 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 engine exhaust piping, misuse of batteries and fuel, or unsafe operating or fueling conditions.

a. Electrical Short Circuits and Overloads

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.

b. Batteries

Batteries may explode and/or give off flammable hydrogen gas. Acid and arcing from a ruptured battery can cause fires and additional failures. When servicing, do not smoke, cause sparking, or use open flame near the battery.

c. Engine Fuel

Use only approved fuel container or fueling system. Fires and explosions can occur if the fuel tank is not grounded prior to or during fuel transfer. Shut unit **DOWN** before removing fuel tank cap. **DO NOT** completely fill tank, because heat from the equipment may cause fuel expansion overflow. Remove all spilled fuel **IMMEDIATELY**, including any that penetrates the unit. After clean-up, open equipment doors and blow fumes away with compressed air.

5. Toxic Fume Prevention

Carbon monoxide - Engine exhaust fumes can kill and cause health problems. Pipe or vent the exhaust fumes to a suitable exhaust duct or outdoors. Never locate engine exhausts near intake ducts of air conditioners.

6. Bodily Injury Prevention

Serious injury can result from contact with fans inside some equipment. Shut **DOWN** such equipment for inspection and routine maintenance. When equipment is in operation, use extreme care in doing necessary trouble-shooting and adjustment. Do not remove guards while equipment is operating.

7. 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.

8. Equipment Precautionary Labels

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

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HOBART GROUND POWER

Table of Contents

Introduction

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

The basic generator sets covered by the manual are rated at 120 KVA. This machine is 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.

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 (Parts) (800) 422-4177 (Service)
From Foreign Countries, Call:	(513) 332-5050 (Parts) (513) 332-5060 (Service)
Fax:	(513) 332-5121

Chapter 1. Description / Operation

Section 1. Description

1. General

The generator set covered in this manual are manufactured by Hobart Brothers Company, Ground Power Division, Troy, Ohio 45373, USA. The generator set, is rated at 120 KVA, and identified by Specification Number 7131. It is designed to produce and deliver 115/200-volt, 400 Hz, 3-phase AC power to a parked aircraft or other load.

2. Orientation

For purpose of orientation, the radiator is considered to be at the REAR of the unit. The generator and controls are at the FRONT. RIGHT and LEFT are determined by standing at the REAR end facing the machine. Thus, the control box is mounted on the LEFT side at the FRONT 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 these features are mentioned here and described briefly.

a. Protective Monitor

A single, solid-state device *(14, Fig. 7)* 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. Voltage Regulator

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

c. Electric Governor

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

d. Transformer-Rectifier

The transformer-rectifier (7, Fig. 1) is a compact, enclosed power supply unit employing a transformer and semiconductor diode components to convert 200-V AC, 400-Hz, 3-phase input power to 28.5-V DC output power. This feature on the generator set makes it possible for the generator set to be used in servicing aircraft and other loads requiring 28.5-V DC power. The transformer-rectifier is explained in greater detail at the end of this section.

e. Cold Weather Starting Kit

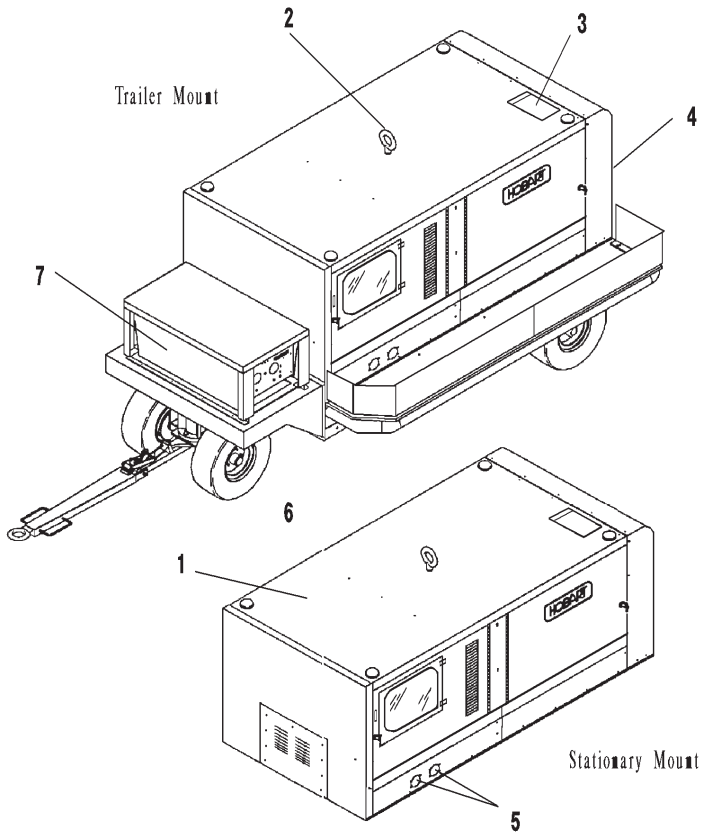
The purpose of this kit is to aid in starting the engine when the generator set is used in very cold temperatures. This cold weather starting aid is a fully automatic engine starting fluid system designed to spray a controlled amount of starting fluid into the engine's air intake system during and immediately after cranking. This feature is explained in greater detail at the end of this section.

f. Low Fuel Indicating Light

The purpose of this light, located on top of the canopy, is to warn the technician who is operating the generator set that its fuel level is low, and that its fuel tank should be filled. When the tank's fuel level is low, this blue light comes on and flashes continuously to warn the technician so that the generator set will not run out of fuel while it is delivering power to an aircraft. This assembly consists only of the light, a low fuel level switch installed in the fuel tank, and the necessary wiring to make it operational.

4. Canopy

A sheet metal enclosure, identified as a canopy 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 machine. 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.



1. Canopy
2. Lifting eye
3. Radiator access cover
4. Exhaust out Rear
5. Output cable clamps
6. Trailer *(Optional)*
7. Transformer-Rectifier, 28.5-V DC

Generator Set

Figure 1

Physical

Basic Unit

Length	91 in. *(2311 mm)*
Width	45 in. *(1143 mm)*
Height	44 in. *(1118 mm)*
Weight without trailer	4340 lbs. *(1969 kg)*

Trailer-Mounted Unit with Transformer-Rectifier(s)

Length	132.5 in. *(3365.5 mm)*
Width	77 in. *(1956 mm)*
Height *(overall)*	63 in. *(1600 mm)*
Weight - one TR (full fuel tank)	4880 lbs. *(2213 kg)*
Weight - two TR's (full fuel tank)	5180 lbs. *(2349 kg)*

Generator

Output power rating *(KVA)*	120
Output voltage *(AC)*	115/200
Rated load capacity *(Amps)*	347
Frequency *(Hz)*	400
Output kilowatts	96
Power factor	0.8
Duty cycle	100%
Operating speed *(RPM)*	2400
Overload capacity, first or second output: 125% rated load *(Amps)*	325
Overload capacity, both outputs: 125% rated load *(Amps)*	434
Output cable size	2/0

Generator Protective System

Overvoltage relay	Trips at 126 volts after a 1-second time delay. Trips at 140 volts in 160 milliseconds. Trips at 180 volts in 50 milliseconds.
Undervoltage relay	Trips at any voltage below 100 volts after 7 seconds.
Overfrequency relay	Trips at any value between 426-Hz and 480-Hz after a 5-second time delay. Trips immediately at any frequency exceeding 480-Hz.
Underfrequency relay	Trips at 375 Hz or less after a 5-second time delay.
Overload time delay	Trips in approximately 5 minutes at 125% load on either output or on both outputs.

Specifications and Capabilities
Figure 2 *(Sheet 1 of 2)*

Engine	
Manufacturer	Cummins Engine Company, Inc. Columbus, Indiana 47201
Cummins Specification No.	88-0444-6BTA
Model No.	6BTA5.9
Type	In-line 6 cylinderDiesel
Bore and stroke	4.02 x 4.72 inches
Displacement	359 cubic inches
Brake horsepower	177
Idle speed	850 +/- 25 RPM
High speed limiting	approx. 2640 RPM
Normal governed speed	2400 RPM
Electrical system	12-V DC
Ground	Negative
Firing order *(RH rotation)*	1-5-3-6-2-4
Lubricating oil capacity *(w/filter)*	24 quarts
Coolant capacity	38 quarts

Specifications and Capabilities
Figure 2 *(Sheet 2 of 2)*

5. Engine, Generator, and Control Box

The engine, generator, and control box comprise the principal components of the generator set. They are mounted on the welded steel frame of the chassis. The engine coolant radiator is also mounted on the frame just forward of the engine-generator combination. Figure 3 is an illustration showing the location of all major components and sub-assemblies.

a. Basic Engine

The basic engine is an in-line 6-cylinder diesel rated at 177 horsepower. See Fig. 2 for general specifications.

b. Engine Manufacturer's Equipment

As received from the engine manufacturer, the engine includes the following equipment which is more fully described in the Cummins "Operation and Maintenance Manual".

(1) Electrical System

The 12-V DC electrical generating and starting system includes an alternator, voltage regulator, and starter with solenoid switch.

(2) Fuel Filter

The fuel filter is a vacuum type connected between the fuel supply and the pump. It has two throwaway type elements located side by side on a single head.

(3) Oil Filter

The engine oil filter is a full-flow type with replaceable cartridge. It is mounted on the right side of the engine.

(4) Automatic shutdown system. This system includes the following:

a. Fuel shutoff valve

The solenoid-operated fuel shutoff valve is mounted on the fuel pump. The pump can supply fuel to the engine only when the solenoid is energized to hold the valve OPEN. The operation of any one of the safety switches will open the solenoid holding circuit and allow the valve to CLOSE and shut down the engine by shutting off the fuel supply. A flyback diode *(CR 13 on schematic diagram)* is connected across the fuel valve to protect other com- ponents in the 12-V DC circuit against accidental high inductive voltage discharge from the solenoid coil.

b. Oil pressure switch

The oil pressure switch is mounted in the engine lubricating oil system at the oil filter. It is diaphragm operated and held in closed position by any normal oil pressure above 12 PSI *(83 KPA)*. It is connected in series with the fuel shutoff valve and will open the holding circuit if oil pressure drops to 12 PSI or below.

(5) Engine overspeed protection

The engine is protected against overspeed by a speed-limiting mechanism in the fuel pump.

(6) Engine-cooling fan

The engine fan is designed to blow air outward through the radiator, rather than draw it in as a conventional fan does.

Refer to the engine Operation and Maintenance Manual in Chapter 6 for more engine details.

c. Hobart Installed Engine Equipment

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

(1) Electric governor system

An electric governor kit is installed on the engine to replace a conventional mechanical type. 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. A brief description is given below:

The governor system consists of the following main components:

a. Magnetic pickup

The magnetic pickup 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

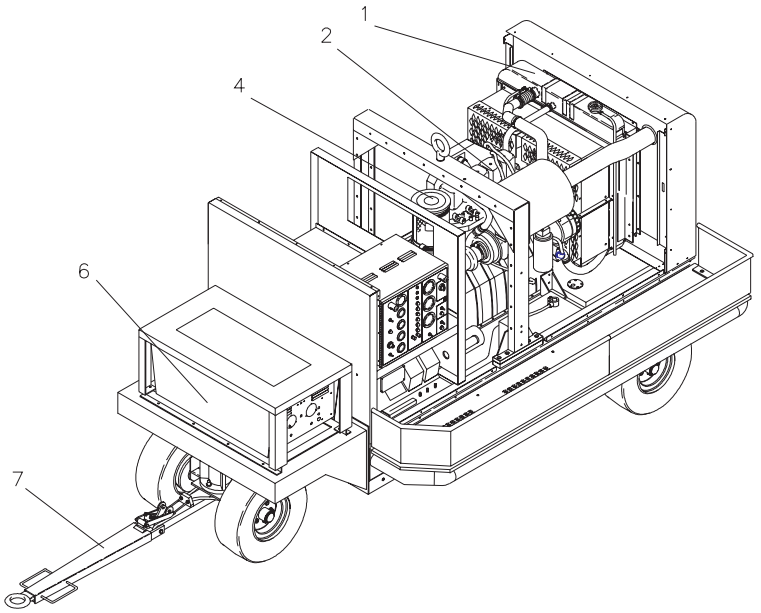
The control unit is a box containing a compact assembly of solid state components. It receives an AC signal from the magnetic pickup and senses speed changes in the engine. It provides a voltage signal to the actuator which causes the actuator to move the fuel control lever as required to maintain a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

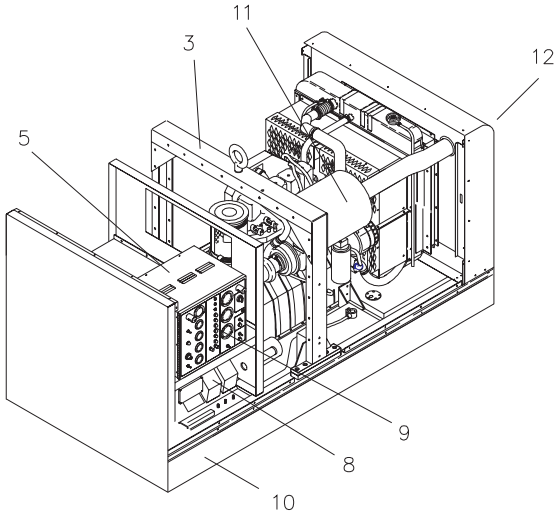
c. Actuator

The actuator 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

In addition to safety devices provided by the engine manufacturer, another engine shutdown feature is added by Hobart Brothers.





1. Radiator
2. Engine
3. Lifting yoke
4. Air cleaner
5. Control box
6. Transformer-rectifier, 28.5-V DC (Optional)
7. Trailer (Optional)
8. Power module panel
9. Engine-generator control panel
10. Mounting frame
11. Muffler
12. Exhaust out rear

Generator Set Components

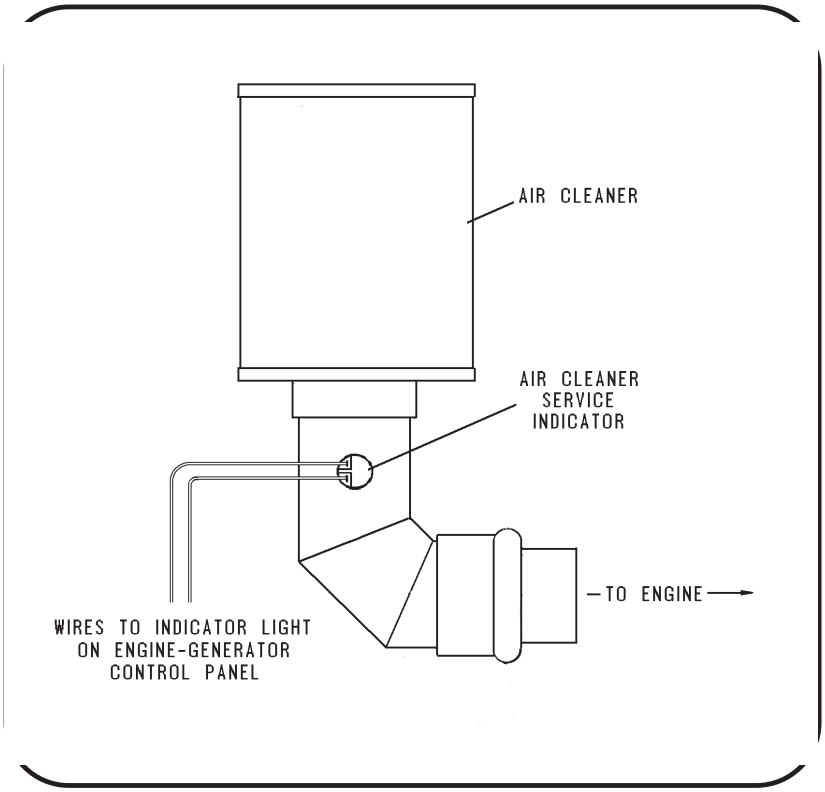
a. Coolant temperature switch

This is a highly sensitive temperature switch mounted at the front of the engine in the coolant crossover system. It is electrically connected in series with the fuel shutoff valve solenoid and is normally closed. The switch will open to stop engine when internal coolant system temperature reaches 205 deg. F *(96 deg C)*.

(3) Air cleaner

The diesel-engine air cleaner *(Fig. 4)* is so constructed that air enters it through the perforated cylindrical body of the air cleaner itself, and is filtered in the process before being passed on to the engine turbo-charge assembly.

An air cleaner service indicator device is mounted on the air cleaner assembly to monitor air flow in the air cleaner. When the air cleaner becomes filled with dust, dirt, and carbon, intake system air flow becomes increasingly restricted. This restriction causes a diaphram inside the indicator to move toward an electrical contact. When the maximum allowable restriction level is reached, the circuit closes and the air cleaner indicator light *(18, Fig. 6)* on the engine-generator control panel is illuminated to warn the operator that the air cleaner must be changed. The electrical indicator automatically resets after a new air cleaner is installed.



Air Cleaner and Service Indicator

Figure 4

(4) Muffler

The muffler is a special design, combining the exhaust muffler and tail pipe into a welded, one-piece, replaceable unit.

(5) Radiator

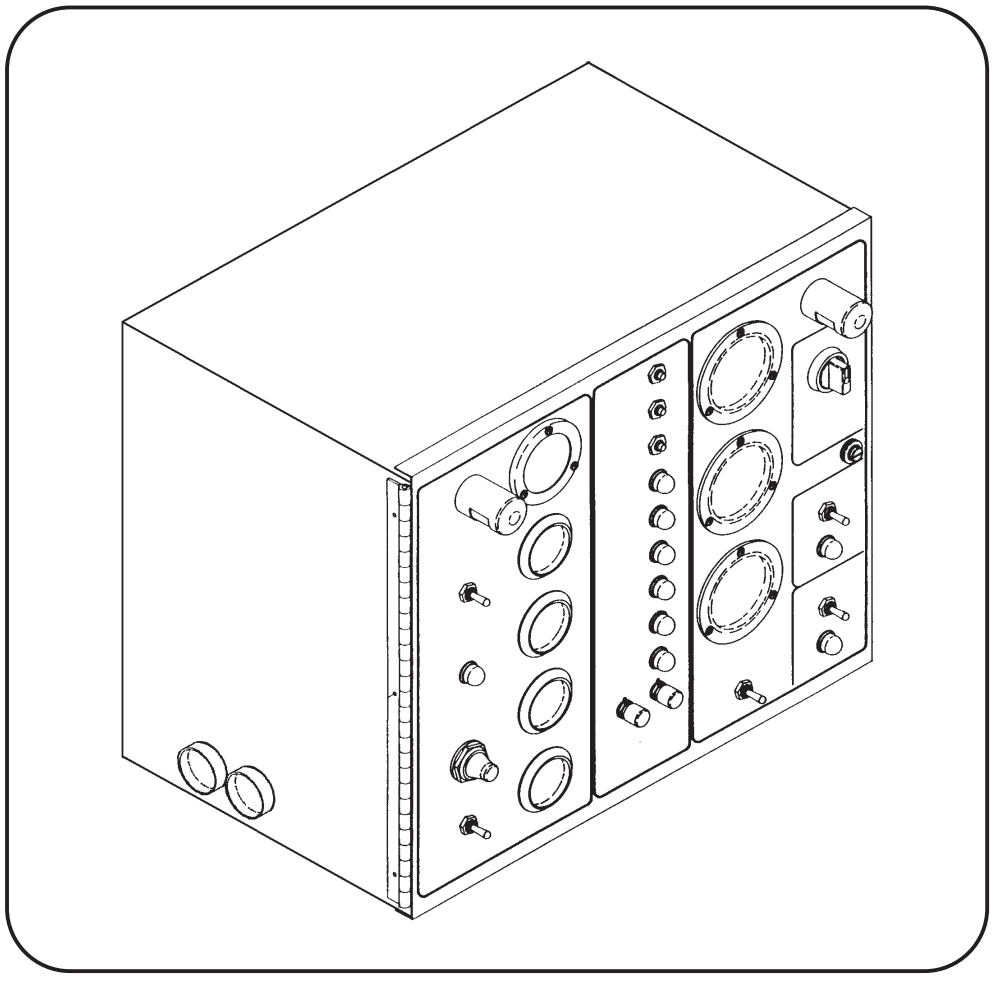
The radiator is a one-piece type designed for long periods of operation without servicing. Refer to Section 2-1 for servicing procedure.

d. Generator

The 400 Hz generator is a brushless, revolving field, three-phase, alternating current type. For the generator set covered by this manual, the generator is a dual-bearing type. The front end of the rotor shaft extends forward betond the front 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 and into the exciter stator housing. The exciter rotor is mounted on this shaft extension with a key and is secured by a washer and 1/2"-13 thread cap screw. A rectifier with three 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 controlled by the amount of DC voltage supplied to exciter fields by the 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.

6. Control Box Assembly

The control box *(Fig. 5)* is a sheet metal enclosure which houses and provides mounting facilities for engine and generator controls and monitoring equipment.



Control Box

Figure 5

(1) Control Panel ***(Fig. 6)***

On the door of this control box is the control panel. The control panel is divided into three sections. On the left side of the control panel, as one faces it, are engine control switches, meters, and indicating lights *(items 1 through 11)*. In the center of the control panel are protective monitor fuses and indicating lights for the generator, along with test and reset buttons *(items 12 through 18)*. Also located on the center section of the control panel is an air cleaner restriction indicating light. On the right side of the control panel are generator control switches, meters, and indicating lights *(items 19 through 28).* The functions of these components are as follow.

a. Panel lights and panel light switch

Two shielded, instrument panel lights *(2)* are mounted on the control panel to illuminate controls, instruments, and indicator lights. They are controlled by a toggle switch *(4)* on the left side of the control panel.

b. Engine hourmeter

The hourmeter *(3)* 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. It is functional only when the engine is running and the oil pressure safety shutdown switch mounted on the engine block is closed.

c. Engine oil pressure gage

The oil pressure gage *(5)* is an electrical type which is connected by a wire to an oil pressure sensor installed in the engine lubricating system.

d. Engine ON indicating light

A green indicating light *(6)* glows when the engine control switch *(25)* is in RUN position.

e. Engine coolant temperature gage

The temperature gage *(7)* is an electrical type which is connected by a wire to a water temperature sensor installed in the engine cooling system. The gage indicates engine coolant temperature in the range of 100 to 220 deg. F *(38 to 104 deg. C).*

f. Engine starter switch

This pushbutton switch *(8)* connects 12-V DC power to the starter solenoid coil which actuates the solenoid switch to connect power to the engine starting motor.

g. Engine control switch

The engine control switch *(9),* sometimes referred to as the permissive-start switch, is a three-position, toggle type. The three positions are identified as START, RUN, and STOP. The switch is spring loaded in START position and must be manually held in this position. When released from START it automatically returns to RUN position. When held in START position, 12-V DC power is supplied directly to the fuel shutoff valve solenoid and engine shutdown safety switches are bypassed. This direct current is necessary for engine starting because the low oil pressure switch is OPEN until the engine is running normally. When released, the switch will automatically reposition to RUN and supply power to the fuel shutoff valve through the engine shutdown safety switch circuit. A green light *(28)* glows to indicate that the engine control switch is in RUN *(or START)* position. In STOP position the switch contacts are open and holding power is disconnected from the fuel valve, allowing the valve to close and shut off fuel to the engine.

h. Engine ammeter

The ammeter *(10)* indicates the direction and value of current flow in the 12-V DC electrical system. Its graduated range is from -60 A through O A, to + 60 A.

i. Engine fuel gage

An electric fuel gauge *(11)* receives its controlling signal from a sending unit in the fuel tank. Twelve volt DC operating power is supplied to the fuel gauge when the engine control switch *(9)* is in RUN position.

j. Circuit breakers

A 10-ampere circuit breaker *(14)* protects the 12-V DC engine control circuit, hourmeter, illuminating light circuit, and 12-V DC system. A 2-ampere circuit breaker *(13)* protects the generator protective system, and another 2 ampere circuit breaker *(12)* protects the circuits of the load contactors.

k. Protective system Indicating lights, test and reset switches

The function of this set of five lights *(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 *(17)* is pushed. All lamps in indicating lights may be tested by pressing test switch *(16)*.

l. Air cleaner indicator

The air cleaner indicator light *(18)* is mounted on the engine control panel, and glows when air flow to the air cleaner is restricted.

m. Generator output monitors *(meters)*

The generator output is monitored by three instruments; a frequency meter *(19)*, a voltmeter *(21)* , and an ammeter *(27)* The frequency meter is an analog type, and indicates the frequency of the generator output alternating current in the range of 360 to 440 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 (20). The voltmeter has a 3-1/2-inch face and the scale is graduated 0 to 300 V. The ammeter is also 3-1/2-inch size and is graduated 0 to 500 A. The amperage value in each of the three phases may be read on the ammeter by selecting the desired phase with meter selector switch *(20)*. Three ammeter current transformers, located beneath the generator control box support panel, 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.

n. Voltmeter-ammeter selector switch

This switch provides 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 *(20)* is a six-position, rotary type. A nameplate, located under the switch knob, is marked and lettered to indicate the six functional positions of the meter switch.

o. Load contactor control switches

Two contactor control toggle switches are mounted at the lower right corner of the control panel, one switch for each of the two independent outputs of the generator set. These are three-position, toggle switches *(23 and 25)* identical to the engine-generator control switch. When one of these switches is placed in the spring loaded ON position, it provides 115-V AC power directly to a rectifier which supplies DC power for closing the load contactor of the circuit it serves. When released it returns to 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.

p. Load contactor power accepted indicating lights

Wired in the holding coil circuit of each of the two output load contactors is an indicating light *(24 and 26)* which glows green when the circuit is energized, is holding the contactor closed, and power is being accepted by the aircraft. When the load contactor opens for any reason, the light is turned OFF.

q. Engine-generator control switch

The engine-generator control switch *(28) (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 BUILD-UP-VOLTS position it performs a dual function. First, it switches the governor control from idle speed to generate speed, which allows the engine to be governed at 2400 RPM for 400-Hz generator output; second, it momentarily supplies current for closing the contacts of the excitation- deenergization relay (2, Fig. 7), to make excitation voltage available to the generator exciter. In GENERATE position, power is maintained to the governor control box and to the excitation deenergization relay When the switch is placed in IDLE position, power is disconnected so that the engine returns to idle speed and the exciter field is deenergized.

r. Air cleaner indicator

The air cleaner indicator *(18)* is mounted on the engine control panel for easy viewing. Its function is explained in Para. 5, C, (3).

(2) Control Box Internal Components ***(Fig. 7)***

a. Excitation Deenergization relay

The purpose of this relay *(2)* is to allow automatic excitation to be connected to the exciter field only when engine speed is being controlled by the electric governor.

b. Protective system interlock relay

The function of the protective system interlock relay *(2)* is to interrupt the load contactor holding coil circuit and remove the load in case the protective relay circuit breaker *(13, Fig. 6)* opens.

c. Auxiliary underfrequency relay

The function of the auxiliary underfrequency relay *(4)* is to automatically open the excitation-deenergization relay and disconnect the voltage regulator anytime generator frequency drops to 375 Hz or below. This protects the voltage regulator *(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.

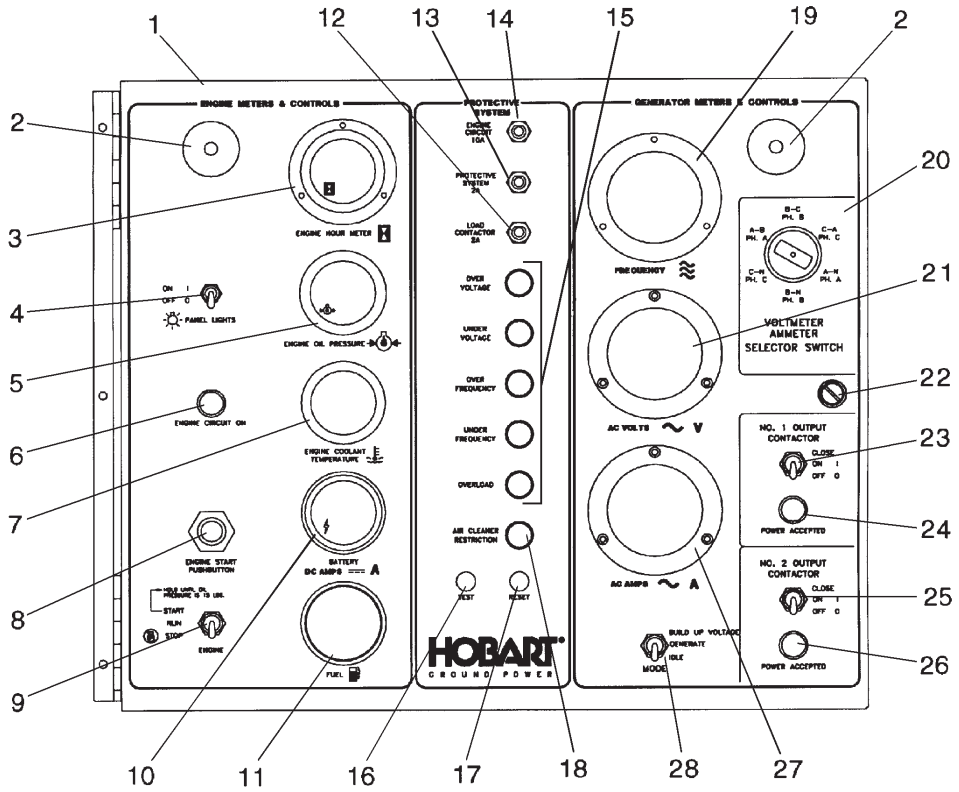
NOTE: If the auxiliary underfrequency relay is tripped, it will be necessary to momentarily place engine-generator control switch *(28, Fig. 6)* in BUILD-UP-VOLTAGE position to restore generator voltage.

d. Plug interlock relays

The function of the plug-interlock relays *(5 and 6)* is to cause the respective output load contactors 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 aircraft to the interlock relay is made through terminals E and F on the output cable plug connector.

e. Test bank- aircraft switches

For each load contactor circuit a single pole, single throw toggle switch *(7 or 8)* provides a means of bypassing the interlock relay *(5 or 6)* for that contactor circuit when supplying power to a load bank or to an aircraft not equipped with a plug interlock system.



1. Front panel
2. Panel light
3. Engine hour meter
4. Panel light switch
5. Oil pressure gage
6. Engine ON indicating light
7. Engine coolant temperature meter
8. Engine start switch
9. Engine control switch
10. Engine ammeter
11. Fuel gage
12. Load contactor circuit breaker
13. Protective system circuit breaker
14. Engine system circuit breaker
15. Protective system indicating lights
16. Test switch, protective system
17. Reset switch, protective system
18. Indicating light, air cleaner restriction
19. Frequency meter
20. Selector switch, voltmeter-ammeter
21. Voltmeter
22. Adjustable grip latch
23. No. 1 contactor switch
24. Power accepted light, No. 1 contactor
25. No. 2 contactor switch
26. Power accepted light, No. 2 contactor
27. Generator ammeter
28. Engine-generator control switch

Engine-Generator Control Panel

Figure 6

f. Regulated-diagnostic switch

When the regulated-diagnostic switch (9) is in the REGULATED (up) position, generator output voltage is regulated by the solid state voltage regulator (12) for 115/200 V-AC output to an aircraft. When this switch is placed in the DIAGNOSTIC (down) position, battery voltage (12-V DC) is applied to the generator exciter with the engine running at rated RPM, in order to check the operation of the generator. By applying this 12 V-DC battery voltage to the exciter and observing generator output voltage, it can be determined if a particular power output malfunction is caused by a defective generator or by a defective voltage regulator.

g. Voltage regulator PC board

- This voltage regulator **(**11, Fig. 7, and Fig. 8) 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. In addition, the voltage regulator PC board circuitry provides line drop compensation. 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.
- When the machine is started, and the voltage build-up switch is pushed, the rotary exciter is excited from alternator residual magnetism through the half-wave rectifier bridge, located on the voltage regulator PC board assembly. As the rotary exciter voltage increases, alternator excitation increases and the alternator voltage builds up. The sensing circuit of the voltage regulator PC board 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.
- 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 reference 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 higher 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.
- The line drop voltage compensation circuit consists of: (1) A current transformer on each phase of the load circuit, and (2) A fixed resistance in parallel with each current transformer. The current transformers detect the magnitude of current flowing through the power cables from the alternator to its load and feed a signal into the voltage regulator PC board. The PC board processes this signal to change the output voltage proportional to the current draw. 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 line drop compensation potentiometer may be adjusted to match exactly the voltage drop of the power cables carrying the load current.
- A receptacle connector at the bottom of the voltage regulator PC board provides a quick connect-disconnect facility for interconnecting wire leads.

h. Memory-time delay module

The memory and time delay module (12) 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 circuit in the sensing modules (16 and 17). 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 (15, Fig. 6) which is turned on when a fault occurs. The module relay will remain energized (OPEN) and the light will remain ON until the reset switch (17, Fig. 6) is pushed to break the module 12-V circuit, and allow the relay to return to normal, CLOSED position.

i. Sensing modules

The voltage sensing module *(17)* and frequency sensing module *(16)* 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 *(14)* to open the load contactor and disconnect output to the aircraft. Trip values are adjustable; however, adjustments should be made ONLY under laboratory conditions.

On the power module, two solid-state overload signaling devices *(11 and 12, Fig. 9),* one for each of the two outputs, are also connected to the protective monitor module and perform a function similar to the voltage and frequency sensing modules.

Trip values for protective circuits are as follows:

- Overvoltage relay — Trips at 126 volts after a 1-second time delay. Trips at 140 volts in 160 milliseconds. Trips at 180 volts in 50 milliseconds.
- Undervoltage relay — Trips at 100 volts after 7 seconds.
- Overfrequency relay — Trips at any value between 426-Hz and 480-Hz after a 5-second time delay. Trips immediately at any frequency exceeding 480-Hz.
- Underfrequency relay — Trips at 375 Hz or less after a 5-second time delay.
- Overload time delay — Trips in approximately 5 minutes at 125% load on either output or on both outputs.

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

j. Electric governor controller

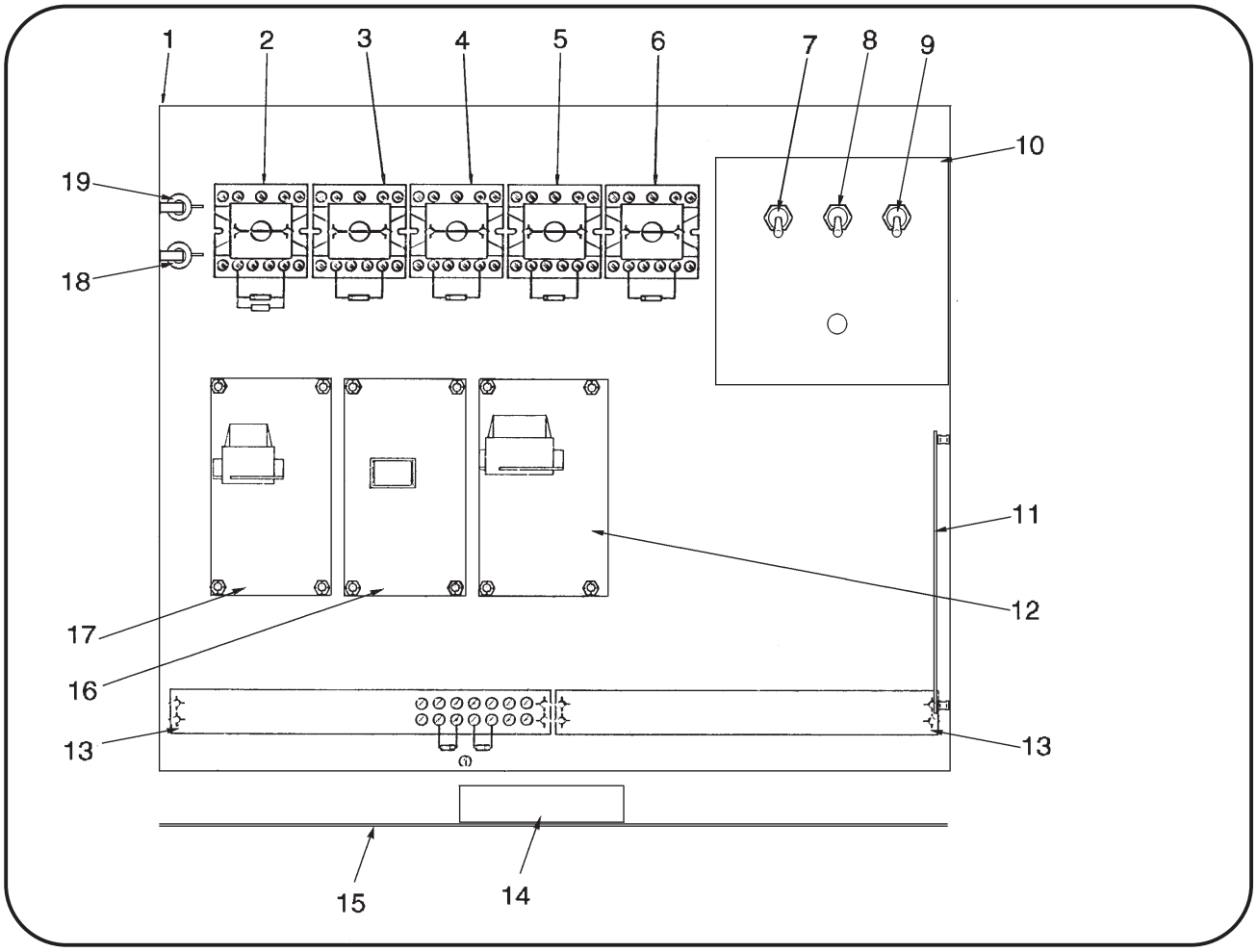
As explained earlier in this section, the control unit *(14, Fig. 7)* is a box containing a compact assembly of solid state components. It receives an AC signal from the magnetic pickup and senses speed changes in the engine. It provides a voltage signal to the actuator which causes the actuator to move the fuel control lever as required to maintain a predetermined engine speed. Its power is received from the 12-V DC battery system. A more detailed illustration of the controller is shown Figure 5 of Section 2-3.

k. Idle speed adjustment potentiometer

Refer to Fig. 5, Section 2-3. The idle speed potentiometer is on the controller. It is connected into the engine's electric circuitry such that, by turning it with a screwdriver, engine idle speed can be set at rated idle speed (850 RPM +/- 25 RPM). Idle speed is INCREASED by turning this potentiometer **CLOCKWISE** and **DECREASED** by turning it **COUNTER-CLOCKWISE.**

l. Resistors, 100-ohm, 25-watt

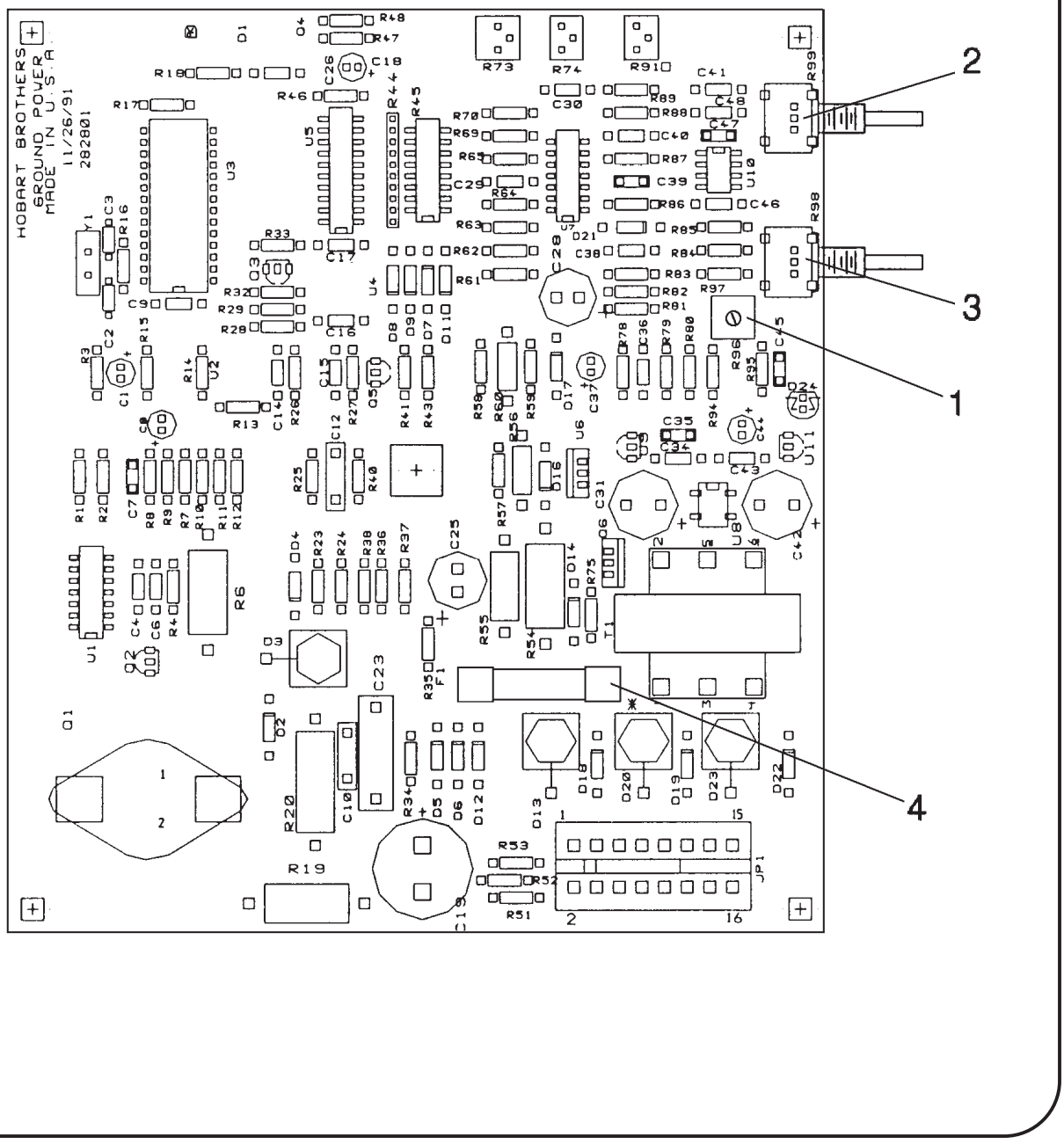
For each load contactor circuit, a 100 ohm, 25 watt resistor *(18 and 19)* is connected in series with the plug interlock relay contacts and the protective system relay contacts for that output to protect the circuit in the event that phase C contacts in the load contactor should fail to close when the contactor ON switch is operated.



1. Rear panel
2. Excitation-deenergization relay
3. Protective system interlock relay
4. Auxiliary underfrequency relay
5. Plug interlock relay, No. 1 contactor
6. Plug interlock relay, No. 2 contactor
7. Test bank-aircraft switch, No. 1 contactor
8. Test bank-aircraft switch, No. 2 contactor
9. Regulated-diagnostic switch
10. Switch bracket
11. Voltage regulator PC board
12. Memory & time delay PC board
13. Terminal block
14. Electric governor controller
15. Support panel, control box
16. Over-underfrequency PC board
17. Over-undervoltage PC board
18. Resistor, 100-ohm, 25-watt, No. 2 contactor circuit
19. Resistor, 100-ohm, 25-watt, No. 1 contactor circuit

Control Box Interior Components

Figure 7



1. Output voltage adjustment (coarse)
2. Output voltage adjustment (fine)
3. Line drop compensation adjustment
4. Fuse (5-amp)

Voltage Regulator PC Board

Figure 8

a. Power Module Panel Assembly

The power module panel assembly *(Fig. 9)*, sometimes referred to as the contactor panel, is located at the left front of the machine under the control box. It is accessible by opening the left front door. 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 contactors

The load contactors *(15 and 16, Fig. 9)* on this dual output machine each contain a magnetic operating coil and four sets of contacts. The three larger contacts conduct three-phase AC generator output. A small 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 contactors by 2/0 cables which pass through three sets of current transformers *(1,2,6 and 9)*.

(2) Current transformers

a. Line-drop current transformers

The three line-drop current transformers *(1, Fig. 9)*, in conjunction with burden resistors *(4)*, 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.

b. Main generator ammeter and overload current transformers

A set of three main current transformers, (2, Fig. 9), in conjunction with a set of burden resistors (3), convert a current signal to a voltage signal which is sent to the ammeter and to the main overload sensing board. The ammeter is really a voltmeter graduated and numbered in amperes to show current proportional to the voltage signal received. This ammeter is so graduated and numbered that, when cables running through the current transformers carry a current of 347 amperes (rated load), 6.67 volts is sent to the ammeter, which shows it as 347 amperes.

When there is load on both outputs and an overload condition develops, wherein load exceeds 434 amperes (125% of rated load) the main overload sensing board sends a signal to the memory and time delay PC board (*14, Fig. 6)*, which interrupts the load contactor circuit to open both load contactors.

c. Main generator overload module

When there is load on both outputs of the generator set, and an overload condition exists which exceeds 125% of the generator's rated load *(150-KVA, or 434 amperes),* this solid-state over- load module *(5)* interprets a signal from the main generator overload current transformers *(2)* and sends a signal to the memory and time delay PC board (*14, Fig. 6)*.

To do this, 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 relay contacts when output current reaches 125% of normal rated output capacity. The closed relay sends a signal to the protective monitor. This signal gates the overload SCR *(silicone-controlled rectifier)* in the protective monitor and opens both contactors *(15 and 16)* .

d. Ammeter and overload current transformers, No 1 and No. 2 output

On each individual output, a set of three current transformers, (6 or 9, Fig. 9), in conjunction with a set of burden resistors (7 or 8), convert a current signal to a voltage signal which is sent to the ammeter and to the overload sensing board (11 or 12) for that output. When cables running through the current transformers for either output carry a current of 260 amperes (rated load for either output), 5 volts is sent to the ammeter, which shows it as 260 amperes.

When an overload condition develops on either output, wherein load exceeds 325 amperes (125% of rated load) the overload sensing board for that circuit sends a signal to the memory and time delay board, which interrupts the load contactor circuit to open the load contactor.

e. Overload modules, No 1 and No. 2 output

When there is load on either of the two outputs of the generator set, and an overload condition exists which exceeds 125% of the rated load capacity of that output circuit, *(112-KVA, or 325 amperes),* the solid-state overload module for that output circuit *(11 or 12)* interprets a signal from the main generator overload current transformers *(2)* and sends a signal to the protective monitor module (*14, Fig. 6)* . The protective monitor module then functions to open the holding circuit of the contactor in the overloaded output circuit.

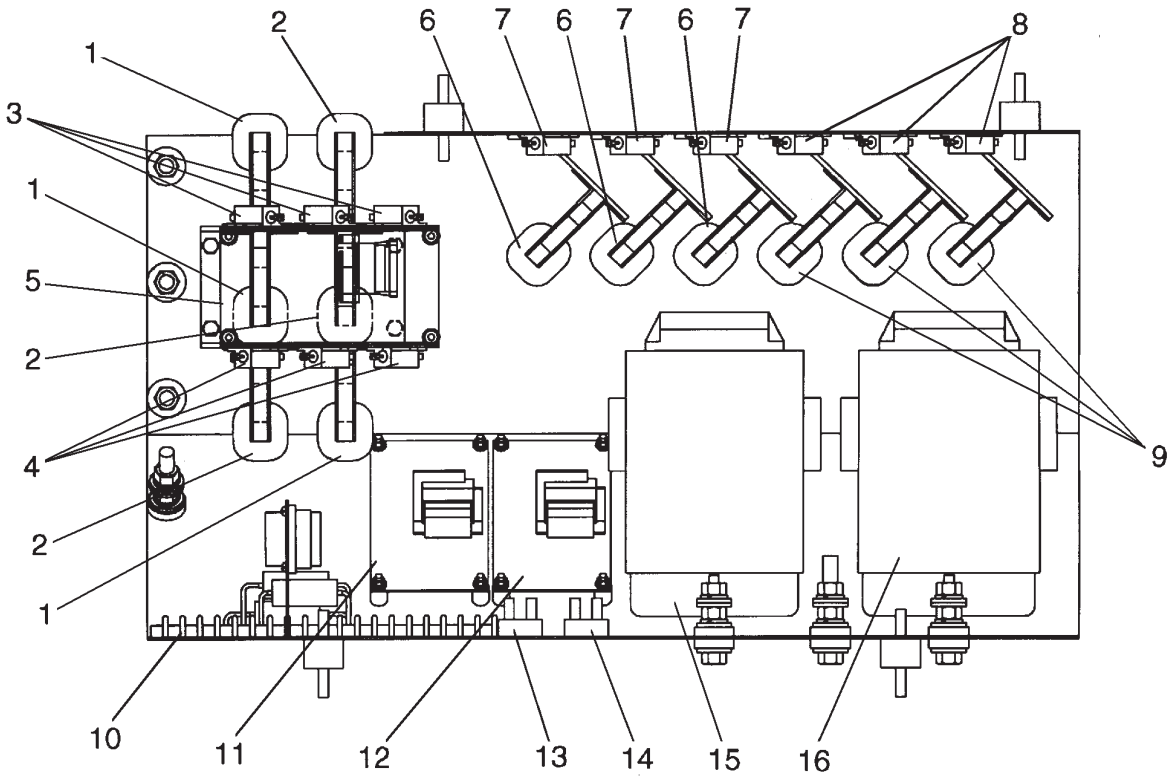
The following is a list of overload module characteristics:

- 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: The overload protective system will function when any phase carries 123% to 127% of rated load. All times are plus or minus 25% and are nonadjustable.

(3) Rectifier

For each output, a diode-bridge rectifier *(13 or 14)* 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 AC circuit is opened. No DC is then available for the load contactor holding coil, hence, the load contactor opens.



1. Line drop current transformers
2. Main generator overload current transformers
3. Main generator overload resistors, 12.5-ohm, 20-watt
4. Line drop resistors, 50-ohm, 20 watt
5. Main generator overload PC board
6. Overload current transformers, No. 1 output
7. Overload resistors, 16.6 ohm, 20-watt No. 1 output
8. Overload resistors, 16.6 ohm, 20-watt No. 2 output
9. Overload current transformers, No. 2 output
10. Terminal block
11. Overload PC board, No. 1 output
12. Overload PC board, No. 2 output
13. Rectifier, No. 1 output
14. Rectifier, No. 2 output
15. Load contactor, No. 1 output
16. Load contactor, No. 2 output

Power Module Panel

Figure 9

7. Description of Some Special Features of the Generator Set

a. Transformer-Rectifier

(1) General

The Transformer-Rectifier, hereafter referred to as a T-R, is a compact, enclosed, power-supply unit employing a transformer and semiconductor diode components to convert 200-Volt, 400-Hz input to 28.5-Volt DC output power *(see Figure 10).* It has many uses including aircraft servicing, which may require high current output for short periods of time, and constant duty power supply applications which require a regulated voltage output at a lesser current rate.

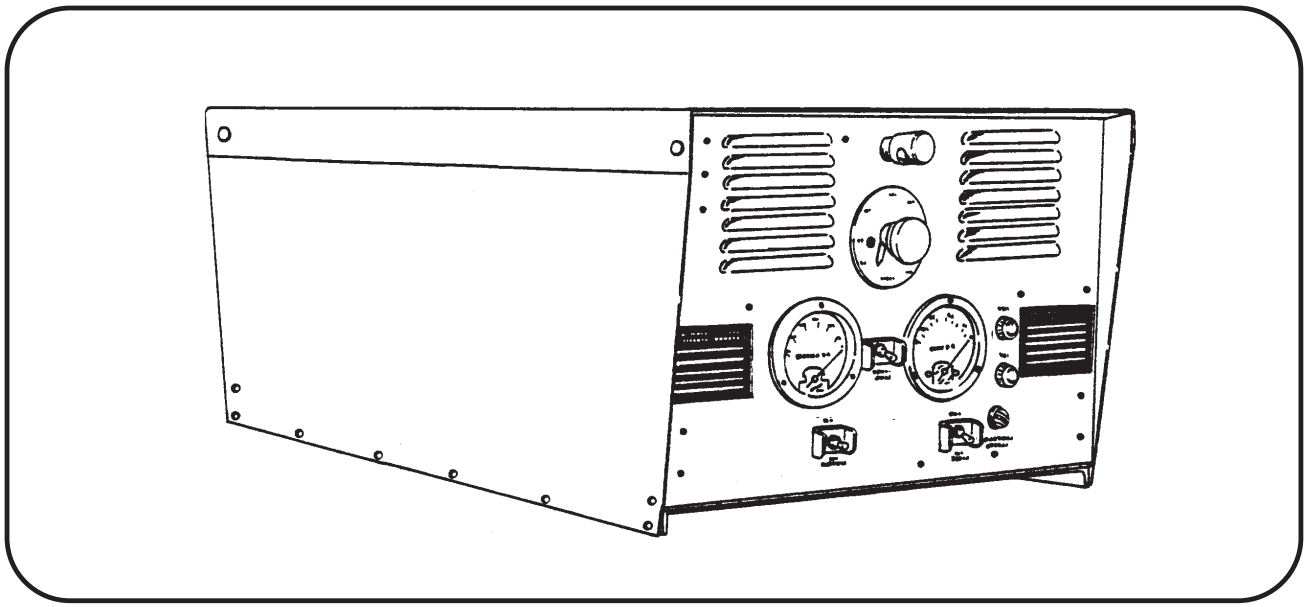
(2) Transformer-Rectifier Assembly

The T-R consists of six main assemblies plus side panels and top, which make up the weatherproof enclosure. Terminal boards, cables, and other miscellaneous items complete the assembly. Main assemblies are identified as follows:

Transformer	**Top Heat Sink**
Panel Front	**Cover Terminal**
Base	

For purposes of orientation, the control panel is considered to be at the **FRONT** of the T-R. The load contactor is at the front and the fans are at the **REAR. RIGHT** and **LEFT** are determined by observing the unit from a position at the **REAR.** Thus the output terminals are on the **LEFT** side.

The T-R is designed to convert the output of a 115/200-Volt AC, 400-Hz, 3-phase generator to regulated 28.5-Volt DC, primarily for operation and/or testing of aircraft on-board electrical equipment. AC input voltage is reduced by a transformer assembly and changed to DC by a 24-diode rectifier identified as a heat sink assembly. The unit rating is 1500 Amperes at 50% duty during a complete 10-minute cycle *(5 minutes ON, & 5 minutes OFF).* At 100% duty *(STEADY OPERATION),* the unit is rated at 1050 Amperes. Refer to Figure 2 for specifications and capabilities.



Transformer-Rectifier (28.5-V DC)

Figure 10

Output voltage is adjustable and controlled by a solid-state, line-drop and current-limiting module. Output current is also adjustable, and is controlled by the same module, however these capabilities are possible only when the T-R is connected to a Hobart generator set. The latter capability allows the operator to adjust output current to as little as 700 Amperes when required for soft-starting an aircraft, or other limited current applications.

Solid state current and voltage sensing modules serve to protect the T-R and aircraft by disconnecting the load under conditions of overload and/or undervoltage. Thermostatic switches provide protection against overheating. Two 200-Volt AC, motor-driven fans provide cooling for internal components. Air is drawn in over the heat sinks and discharged at the rear.

a. Control Panel Assembly

Refer to Figure 3. The control panel *(14)* serves a dual function. It provides a mounting panel for instruments and controls, and when hinged downward, serves as a door for access to internal components. Four screws *(1)* secure the panel in closed position. Louvers *(2)* on each side of the panel admit air to the fans. An instrument light *(4),* controlled by a toggle switch *(12),* provides illumination for controls and instruments. DC power for operation of the light is supplied by the generator set engine circuit through a 2-Ampere fuse *(10).* A three-position toggle switch *(8)* controls operation of a load contactor in the input circuit. The switch is spring loaded in the top **ON**, or start position.

An indicating light *(7)* glows green when the load contactor is closed to indicate that 28.5 Volts DC is available at the output terminals. A fuse *(11)* protects the 115-Volt AC load contactor operating circuit.

Maximum output current may be adjusted from 700 Amperes to 1500 Amperes by a rheostat *(5).* A toggle switch *(9)* controls operation of the rheostat, which is functional only when the switch is in **ON** position. Voltage and current in the output circuit is indicated by a DC voltmeter *(3)* and a DC ammeter *(6).*

Other items are mounted on the inner surface of the control panel and are not visible unless the panel is opened. A resistor *(15)* is connected in the load contactor holding circuit to limit current flow to approximately 0.5 Ampere. Another resistor *(16)* provides a means of adjusting the current limiting range of the rheostat *(5).* A diode-bridge rectifier *(17)* provides DC power for operation of the load contactor. The line-drop compensation and current limiting module *(18)* contains solid state circuitry which interprets signals from current transformers in the AC input circuit and sends a signal to the Hobart generator-set voltage regulator which causes it to regulate generator output voltage to a value which will result in a T-R output of 28.5 Volts DC. Under normal operating conditions the signal from the current limiting transformer does not enter the module circuitry. When soft-start (limited output current) is required, the current limiting signal is allowed to enter the module by placing the control switch *(9)* in the **ON** position. The signal to the voltage regulator is then controlled by the current limiting rheostat *(5)* so that the regulator limits generator output to a value which will produce no more current in the T-R output than that selected by the current limiting rheostat.

PHYSICAL	
Overall dimensions	
Length	34 inches (864 mm)
Width	20 3/8 inches (518 mm)
Height	13 1/8 inches (333 mm)
Mounting dimensions	24-1/8 X 16 inches (613 X 406 mm) center to center. Four 3/8-16 inch tapped mounting holes
Weight approximately	300 pounds (136 kg)

ELECTRICAL	
Input	
Line volts	200 Volts AC
Cycles per second	400 Hz
Amperes	136 Amperes
Kilowatts	50 kw
Output	
Volts	28.5 Volts DC
Load Rating	1500 Amperes at 50% duty cycle, 10 min. cycle (5 min. ON, 5 min. OFF)
Maximum output rating	1050 Amperes at 100% duty cycle, 2000 Amperes for 5 minutes, 2500 Amperes for 30 seconds
Current limiting (Soft-Start Capability)	1500 Amperes to 700 Amperes minimum
Kilowatts (steady state load)	42 kW
Recommended output cable size for normal aircraft servicing	4/0

Specifications and Capabilities
Figure 11

b. Electrical Components

Electrical components of the T-R, other than the control panel which was described above, are illustrated in Figures 13 through 16. A brief description of the function of each component is given here. Theory of operation will be covered in the description where necessary.

(aa) Load Contactor

- The load contactor *(5, Fig. 13)* is a sealed unit similar to the one used on a Hobart generator set. It contains four sets of contacts and an operating coil. The three larger sets of contacts conduct the input power to the transformer. A small, auxiliary set is connected in the 115-Volt input holding circuit to the rectifier *(17, Fig. 12),* which supplies direct current for energization of the load contactor operating coil. In operation, the load contactor is closed by holding the contactor control switch *(8, Fig. 12)* in spring-loaded **ON** *(up)* position momentarily. In this position the switch connects 115-Volt AC power directly to the rectifier *(17, Fig. 12),* which in turn supplies DC power to the contactor operating coil and closes all contacts in the load contactor. When the control switch *(8, Fig. 12)* is released, it automatically returns to center ON position and 115-Volt current is maintained to the rectifier, indirectly, through a resistor *(15, Fig. 12)* and the auxiliary contacts in the load contatcor. This circuit is arranged in such a manner that in case an overloaded condition develoips, the 115-Volt input to the rectifier is lead directly to ground through a relay in the overload module. The load contactor is thus opened because the holding circuit has actually been short circuited. The resistor *(15, Fig. 12)* limits current flow in the holding circuit to 0.5 Ampere and thus prevents damage to any components.

(bb) Transformer

- The primary coils of the transformer *(6, Fig. 13)* consist of three sets of double windings. There are 12 secondary windings, 6 connected in wye, and 6 connected in delta. Normal input voltage is 200 Volts AC and normal output before being rectified is approximately 21 Volts DC. Output voltage of the transformer *(and the T-R)* is dtermined and controlled by adjusting input voltage to the transformer.

(cc) Heat Sink Assembly

- The heat sink assembly consists of two heat sink subassemblies *(2 and 7, Fig. 13)* mounted on two cross member supports and attached by brackets and Hx Hd SF-Tap screws. Observed from the rear of the T-R, the positive heat sink is on the **RIGHT** and the negative on the **LEFT.**
- Each heat sink subassembly consists of a fan, a thermostatic switch, 12 diodes, and the heat sink which is a section of multi-finned, aluminum extrusion, 25 inches *(635 mm)* long. The fan assembly *(10, Fig. 13)* is mounted on the rear of the heat sink. A five-blade, 4-1/4-inch *(108 mm)* dia. fan draws cooling air over the diodes at a rate of 190 cubic feet per minute at 5300 RPM. The fan motor is rated at 200 Volts AC, 400 Hz. Input power is 33 Watts, 0.3 Ampere. The thermostatic switch *(1, Fig. 13)* mounted on the front end of the heat sink, performs a function similar to an overload relay. The switch causes the load contactor to OPEN by interrupting the contactor holding circuit when an overload (or other fault) condition causes ambient temperature to rise to approximately 230 Deg. F *(110 Deg. C).* The switch closes at approximately 210 Deg. F *(99 Deg. C).*
- Two hexagon bars threaded at each end, serve as bus bars to conduct current from the positive (right) heat sink *(13, Fig. 15),* to the positive terminal on the left side of the T-R. The bars pass through holes in the negative heat sink and are protected from shorting by screw-mounted, insulating plates. Bars are threaded into the positive heat sink body and further secured by aluminum nuts. Two aluminum nuts on the left end of the forward bar are used to attach one of the leads to the DC ammeter. The other ammeter lead is attached to the same bar on the other side of the negative heat sink by a screw. The portion of the bar between the lead attaching points serves as a shunt for the ammeter. The shunt is adjustable by changing the location of the two aluminum nuts.

- Two hexagon bars *(3, Fig. 15)* similar to the positive bars, but shorter, are attached to the negative heat sink in the same manner as the positive bars. They conduct current to the negative output terminal. Each diode is attached to the heat sink by an assembled washer nut.

(dd) Overload module

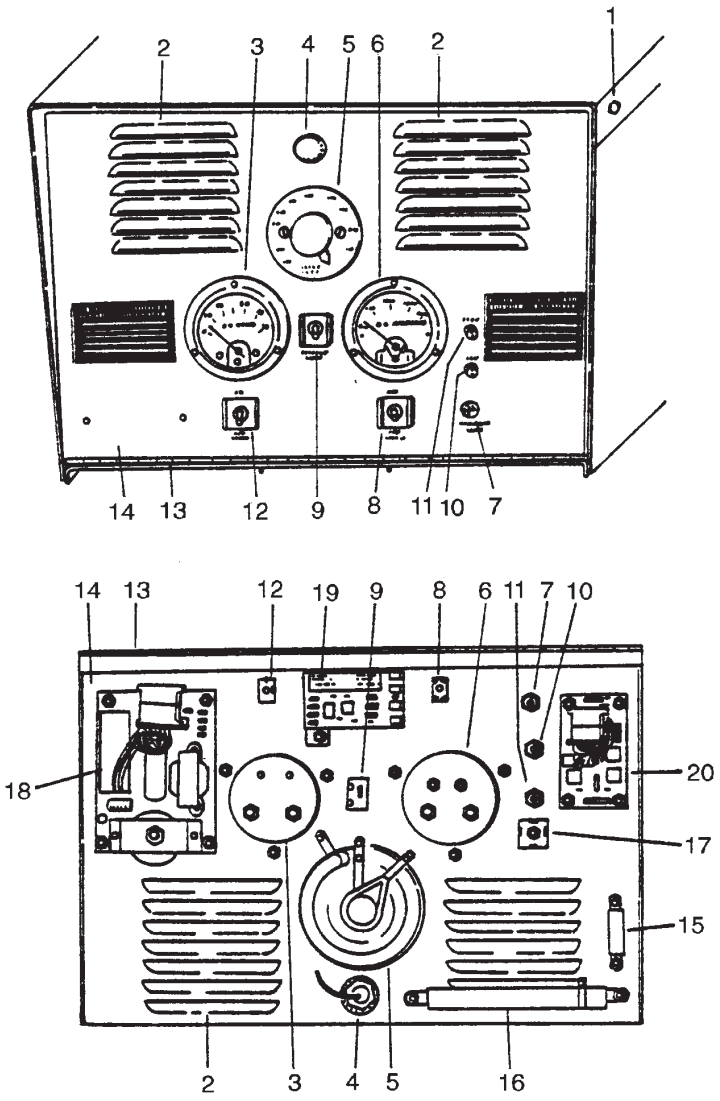
- The overload module *(20, Fig. 12)* contains solid state circuitry which interprets signals from three current transformers *(11, Fig. 13)* and functions to close a relay when an overload condition is detected in the T-R main circuit. The normally open relay contacts are connected to the load contactor 115-Volt AC holding circuit so that when relay contacts are closed by an overload condition, the load contactor holding circuit is short circuited and the load contactor opens for lack of holding power. T-R output power is thus automatically disconnected. Relay contacts return to normally open position when the overload is removed by load contactor holding circuit when it is short circuited. DC power from the generator's engine circuit provides operating power for the overload relay: 12 Volts DC is required for part number 487750-1. This circuit is protected by a 2-Ampere fuse *(10).* The load contactor 115-Volt operating circuit is protected by another 2-Ampere fuse *(11).*

(ee) Overvoltage module

- The overvoltage module *(19, Fig. 12)* is another protective device with solid state circuitry which causes a normally **CLOSED** relay to **OPEN** under a condition of overvoltage in the T-R output circuit. The relay is connected in the ground circuit of the 115-Volt AC load contactor holding circuit. When an overvoltage condition causes the relay to **OPEN**, the load contactor holding circuit is broken and the contactor opens automatically to shut off the T-R.

(ff) Base

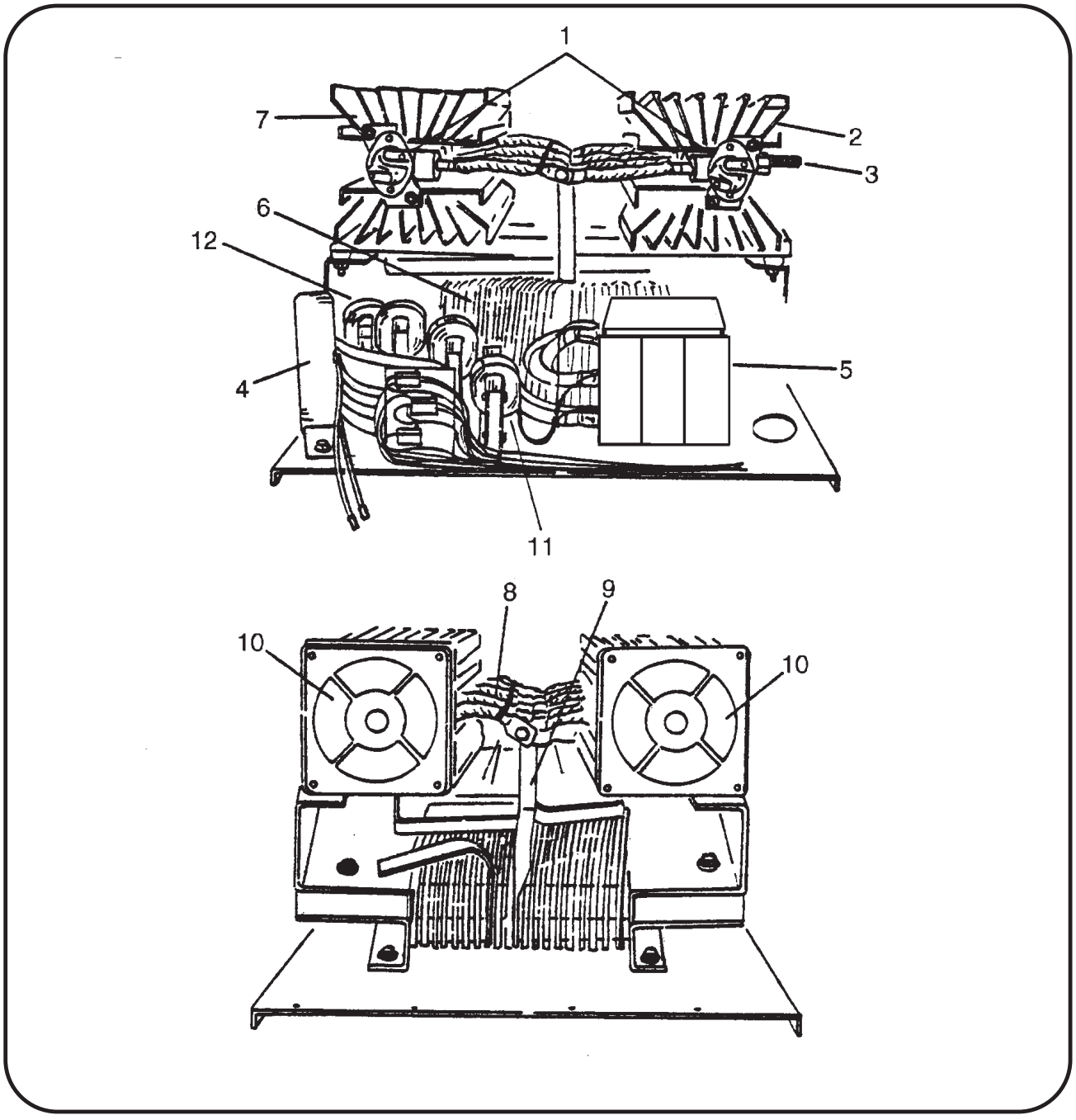
- The T-R base consists of a metal plate mounted on *(4)* spacers. Four 3/8-16 tapped mounting holes in the base *(spacers)* are located 16 inches by 24-1/8 inches *(406 mm by 613 mm),* center to center.



1. Screw
2. Air inlet louver
3. DC voltmeter
4. Instrument light
5. Current limiting rheostat
6. DC ammeter
7. Contactor CLOSED indicating light
8. Contactor control switch
9. Current limiting control switch
10. Fuse (2A) (DC circuit)
11. Fuse (2A) (115-V AC circuit)
12. Light switch
13. Hinge
14. Panel
15. Resistor (200 Ohm, 25 Watt)
16. Resistor (100 Ohm, 100 Watt)
17. Rectifier, silicon
18. Line-drop compensation and current limiting module
19. Board, overvoltage
20. Board, PC overload

Control Panel Assembly

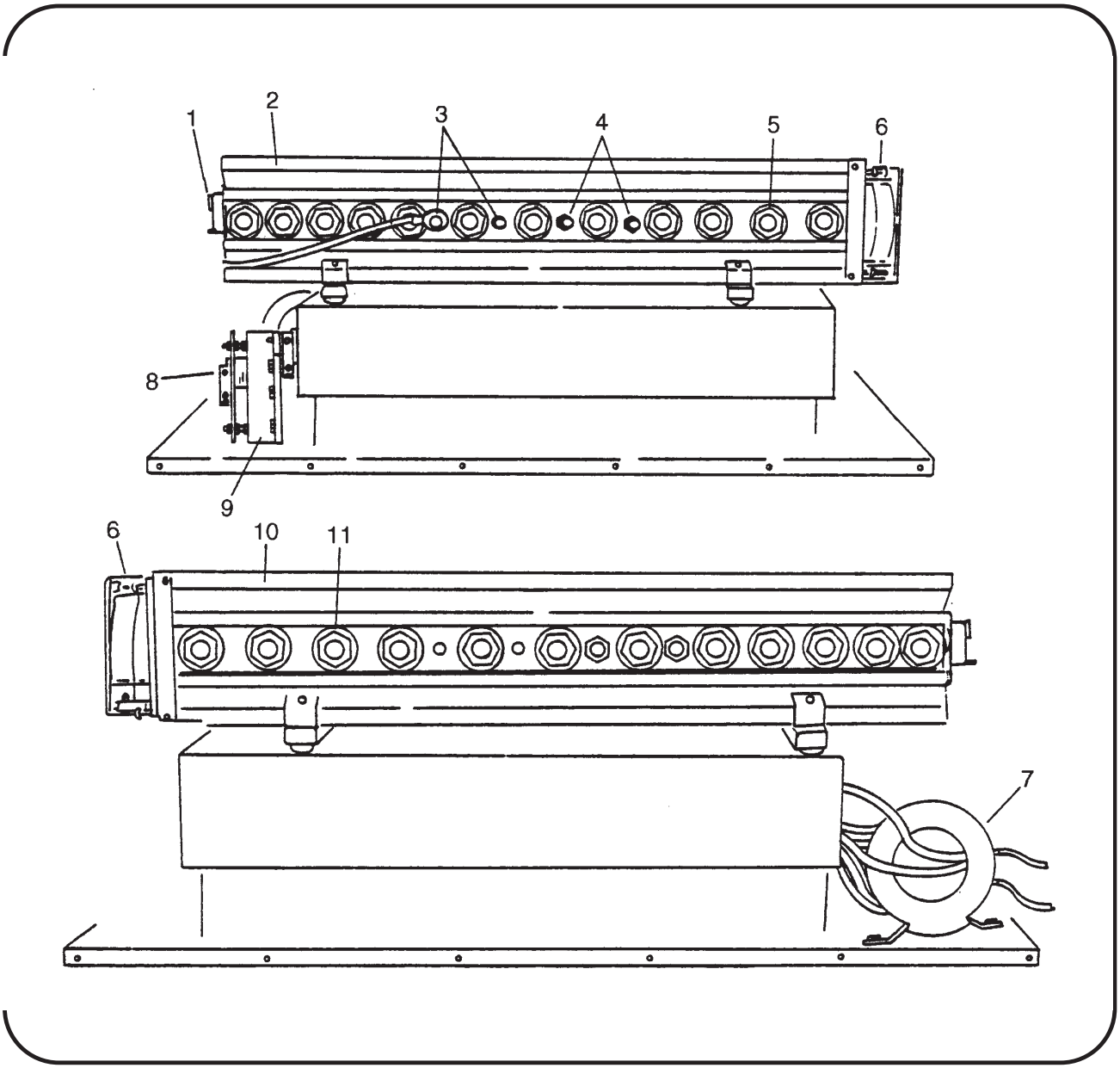
Figure 12



1. Thermal overload relay
2. Negative heat sink
3. Output terminals
4. Transformer current limiting
5. Load contactor
6. Transformer
7. Positive heat sink
8. Diode leads
9. Bus bars
10. Fan
11. Overload current transformer (3)
12. Line drop CT

T-R Components (Front and Rear Views)

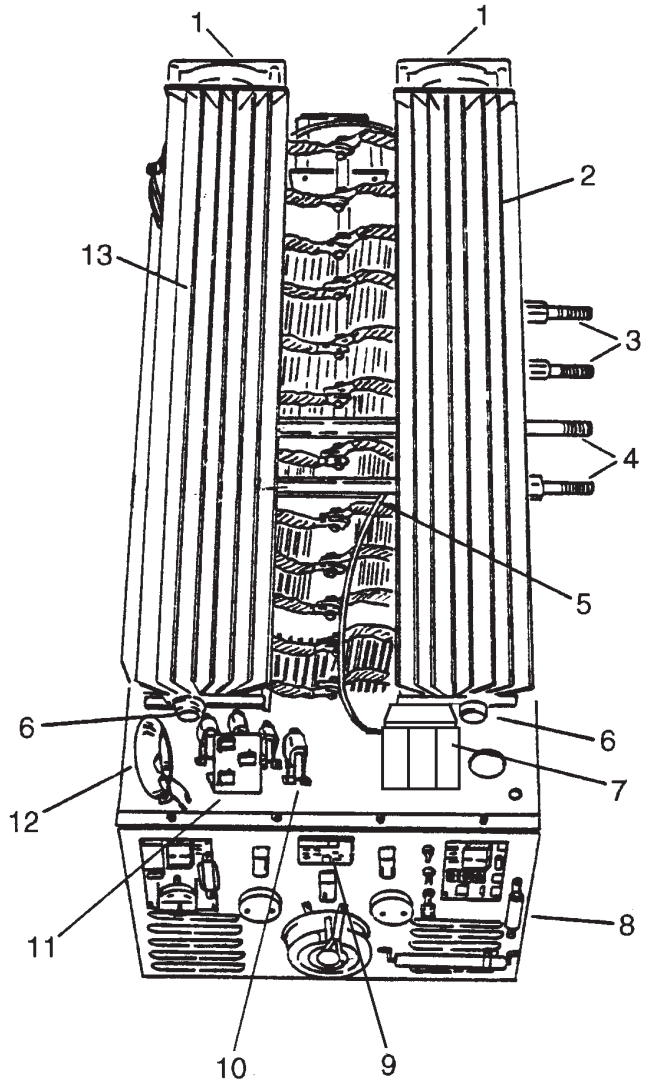
Figure 13



1. Thermal overload relay
2. Negative heat sink
3. Positive output terminals
4. Negative output terminals
5. Negative diode
6. Fan
7. Current limiting transformer
8. Overload current transformer
9. Load contactor
10. Positive heat sink
11. Positive diode

T-R Components (Side Views)

Figure 14



1. Fan
2. Negative heat sink
3. Negative output bus
4. Positive output bus
5. Ammeter shunt
6. Thermal overload relay
7. Load Contactor
8. Control panel
9. Overvoltage module
10. Current transformer
11. Bracket resistors
12. Current transformer
13. Positive heat sink

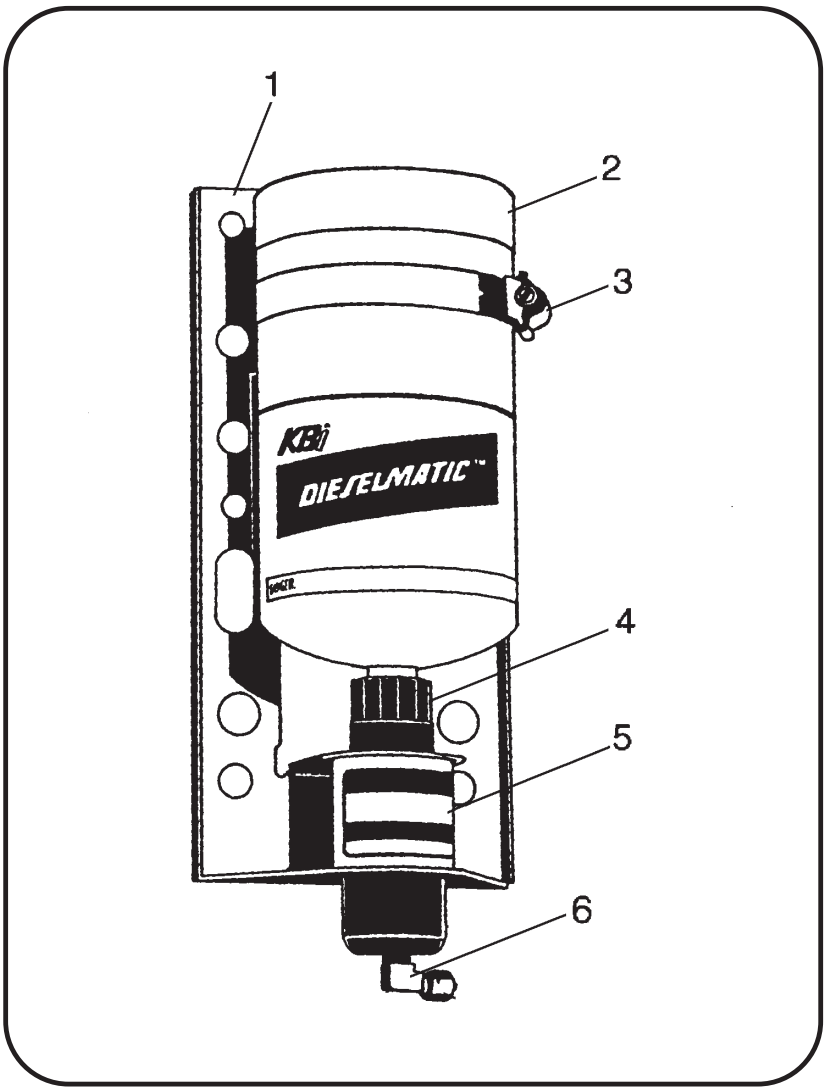
T-R Components (Top View from Front)

Figure 15

b. Cold Weather Starting Kit

This cold weather starting-aid kit (Figure 16) is an option available for starting the engine at very cold temperatures. This cold weather starting system is a fully automatic Engine Starting Fluid System designed to spray a controlled amount of starting fluid into the air intake system of an engine during and immediately after cranking.

The System's engine temperature sensor (ETS) Switch determines when the System should function. When needed, the solenoid valve is activated automatically during engine cranking; then, starting fluid is released from the pressurized cylinder, flows through the valve, through a flow metering orifice fitting at the bottom of the valve through the nylon tubing, and out of an injector nozzle located in the engine's air intake system. A reservoir in the valve maintains a flow of starting fluid after cranking to prevent the just started engine from faltering or dying.



1. Mounting bracket
2. Starting fluid cylinder
3. Cylinder clamp
4. Dieselmatic valve
5. Solenoid
6. Blocker fitting and filter

Cold Weather Starting Aid

Figure 16

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LIST OF FEATURES AVAILABLE FOR SPECIFICATION 7131 GENERATOR SETS

The following is a list of the special features that may be ordered and installed at the factory as components of Specification 7131 generator sets. Those special features that are checked (X) on this list are those which are installed on the generator set which this manual accompanies.

FEATURE	PART NUMBER
Trailer Package Assembly (7131-1)	283673
Transformer-Rectifier Assembly, 112-V DC	482085A-2
Transformer-Rectifier Assembly, 28.5-V DC	487750-1
Cold Weather Start Assembly	282192
Block Heater Assembly, 115-V AC, 60-Hz	283014
Low Fuel Shutdown Assembly	282995
Low Fuel Flashing Light Assembly, Amber	283005-1
Low Fuel Flashing Light Assembly, Blue	283005-2
Low Fuel Flashing Light Assembly, Red	283005-3
Low Fuel Light Assembly, Amber	283006-1
Low Fuel Light Assembly, Blue	283006-2
Low Fuel Light Assembly, Red	283006-3
Fuel/Water Separator Assembly	283125
Block Heater Assembly, 240-V AC, 50-Hz	283472
Snow Shield Assembly	283023
Emergency Stop Assembly	283007
Emergency Stop Assembly (for field installation)	283008
Unit Operating Light Kit, Amber	283004-1
Unit Operating Light Kit, Blue	283004-2
Unit Operating Light Kit, Red	283004-3
Clearance Lights, Red	282732-2
Fire Extinguisher	283012
Pin-Type Hitch	381441
Pintle-Type Hitch	76A-1361
Fixed Mounting Kit	283661
Noise Reduction Package	283474
Variable Height Tow Bar Assembly	283133
Cable Covers Kit	283675
Spotlight Kit	282210
Truck Body Package	283039
Truck, Ford	283114
Truck, Chevrolet	283115
Low Fuel Warning Kit	283692
Transformer-Rectifier Mounting Assembly, Single, on Trailer	282907-1
Transformer-Rectifier Mounting Assembly, Double, on Trailer	282907-2
Transformer-Rectifier Mounting Assembly, Single, on Truck	282907-3
Transformer-Rectifier Mounting Assembly, Double, on Truck	282907-4

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Section 2. Preparation for Use, Storage or Shipping

1. Preparation for Use

a. 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 papers, 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 fitting, etc., as required.

(5) Check security of generator set retaining components.

(6) Check the following for sufficient quantity:

a. Fuel

Turn ON engine control switch to energize fuel gage when engine is stopped. (Fuel is supplied from a customer-furnished source).

NOTE: For recommended fuel specifications refer to the Cummins engine manual in Chapter 5.

b. Engine coolant

Remove radiator cap to check coolant level. Coolant level should be approximately one inch below the filler neck. Allow a capacity for coolant expansion.

CAUTION

BE SURE the cooling system antifreeze solution is adequate to protect below lowest temperature expected.

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

c. Engine lubricating oil level

The oil gage rod (1, Fig 1) has H (high) and L (low) level marks to indicate lubricating oil supply. Oil level should be kept as near the H mark as possible.

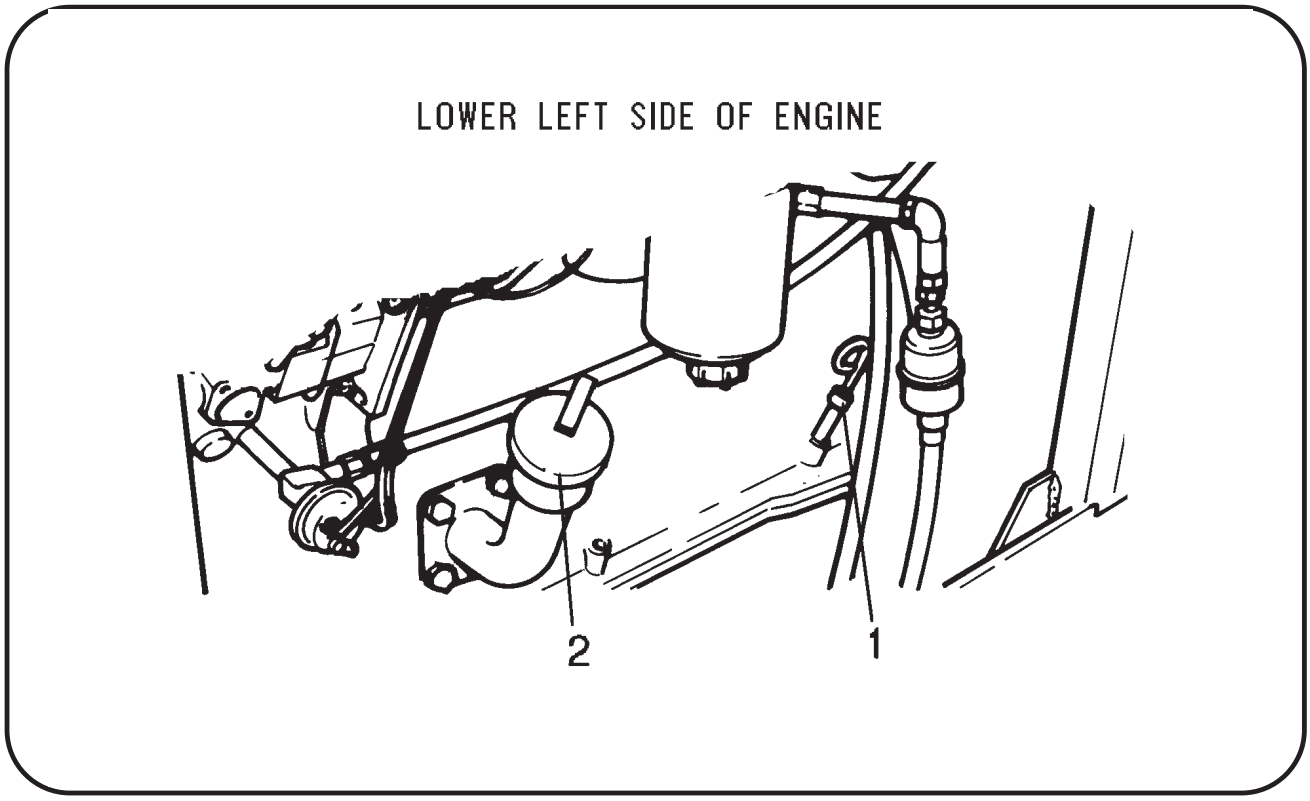
CAUTION

NEVER operate the engine with oil level below the **LOW-LEVEL** mark or above the **HIGH-LEVEL** mark.

See 2-2, Fig. 4, or the Cummins Operation and Maintenance Manual in Chpater 5 for oil recommendations.

d. Check Batteries

12-V DC power is supplied by customer-furnished batteries.



1. Oil Level Gage Rod
2. Oil Filler Cap

Oil Fill and Check Locations
Figure 1

b. Installing Three-phase AC Output Cables

Units are generally shipped without generator set-to-aircraft cables. The load contactors, at which cables must be connected are located on the right side of the unit beneath the engine control panel.

The conductor size recommended for AC output cables is 2/0 AWG. Use No. 12 size for control (E and F terminals). Large cables (A, B, C, N) should be equipped with terminals having at least a 3/8-inch diameter mounting hole. Mounting hole in small leads (E and F) should be at least 1/4-inch diameter.

To install AC output cables proceed as follows.

(1) Open right front canopy door of the generator set.

(2) Loosen screws on cable clamps located on the side panel beneath the right rear canopy door.

(3) Route cables through cable clamp, and up to the load sides (bottoms) of the load contactors.

(4) Connect the phase cable terminal lugs to the appropriate terminal studs on the contactors: cable lug “A” to terminal stud “A”, “B” to “B”, and “C” to “C”.

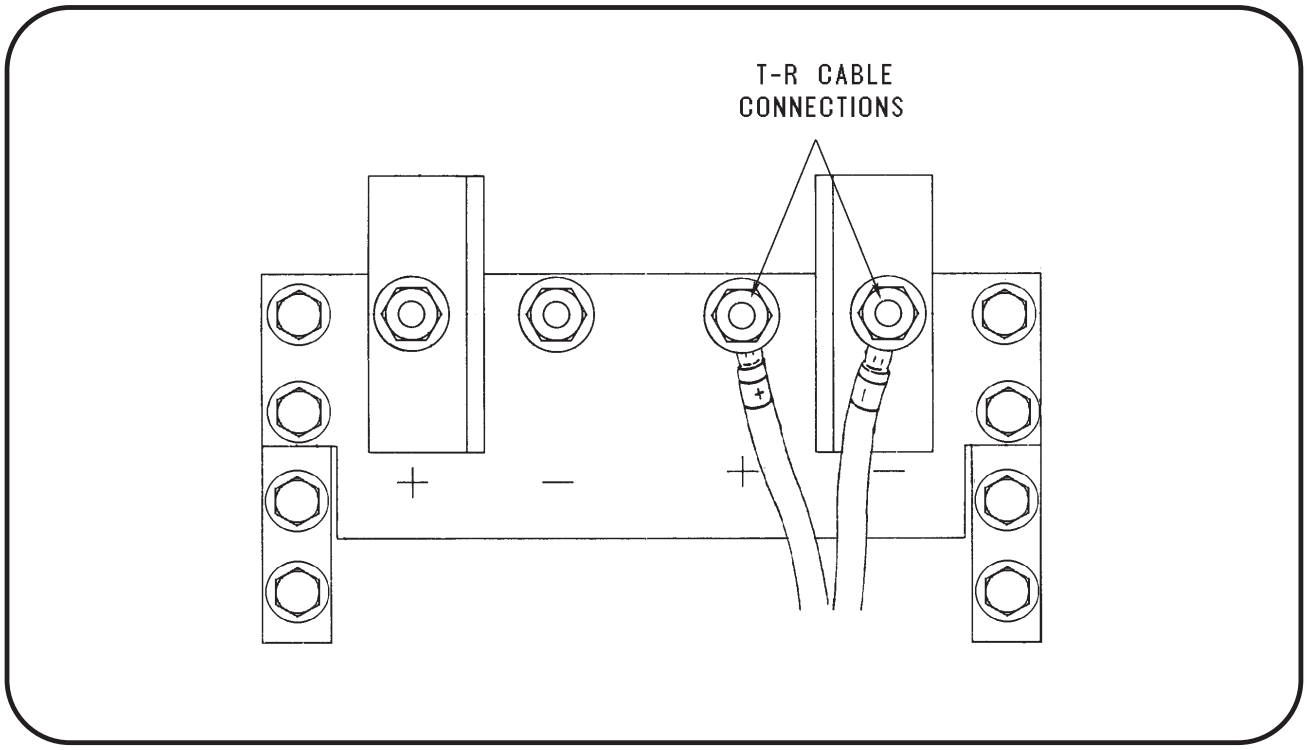
(5) Connect the cable’s neutral terminal lug securely to the neutral (ground) stud on the side of the load contactor mounting bracket.

(6) Tighten terminal nuts securely and replace the terminal cover on the load contactor. Connect small plug interlock leads “E” and “F” to terminal “E-F” on the side of the load contactor mounting bracket.

(7) Tighten clamp screws securely on the side panel, but avoid damage to cable insulation.

c. Transformer-Rectifier *(DC)* Output Cable Installation *(optional equipment)*.

An output terminal panel (Figure 2) for transformer-rectifier cable connections is located inside the right front section of the generator mounting frame. Attach T-R output cable terminals to the output terminal panel as illustrated in Figure 2. Use 4/0 size cables.



Transformer-Rectifier Cable Installation
Figure 2

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 where 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

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

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

(2) 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.

(3) Make certain the cooling system antifreeze solution is adequate to protect below the lowest temperatures expected during the storage period. See 2-2; Para 5, E. Be sure the solution is thoroughly mixed.

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

(5) 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.

(2) Make certain the cooling system is adequately protected.

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

WARNING

ENSURE adequate ventilation before starting the engine.

(4) Operate normal operating controls.

(5) If weekly operation is not possible, contact the nearest Cummins Engine Company distributor for instructions.

(6) 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.

d. Preparation for Shipment

During long shipments, the generator set retaining hardware may become loosened by vibration, jolting, etc.

CAUTION

When shipping the unit, provide sufficient retaining materials to ensure the generator set cannot roll out of the vehicle in which it is being transported.

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.

Section 3. Operation

1. General

This section contains information and instructions for the safe and efficient operation of the equipment. Operating instructions are presented in step-by-step sequence of procedures to be followed in supplying 400-Hz power.

NOTE: Read ALL of the Operating Instructions before attempting to operate the equipment.

CAUTION

Ear protection equipment may be necessary when working close to this equipment.

2. Operating the Unit

a. Pre-start inspection

(1) Be sure the fuel shutoff valve (if used) on the vehicle is open.

(2) Ensure 12-V DC 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.

(4) Make certain there is sufficient lubricating oil and coolant in the engine.

b. Normal Engine Starting Procedures

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

CAUTION

Refer to Operating Instructions in the Cummins Operation and Maintenance Manual, when starting engine for the first time.

NOTE: The Cummins Engine Manual is located in Chapter 5.

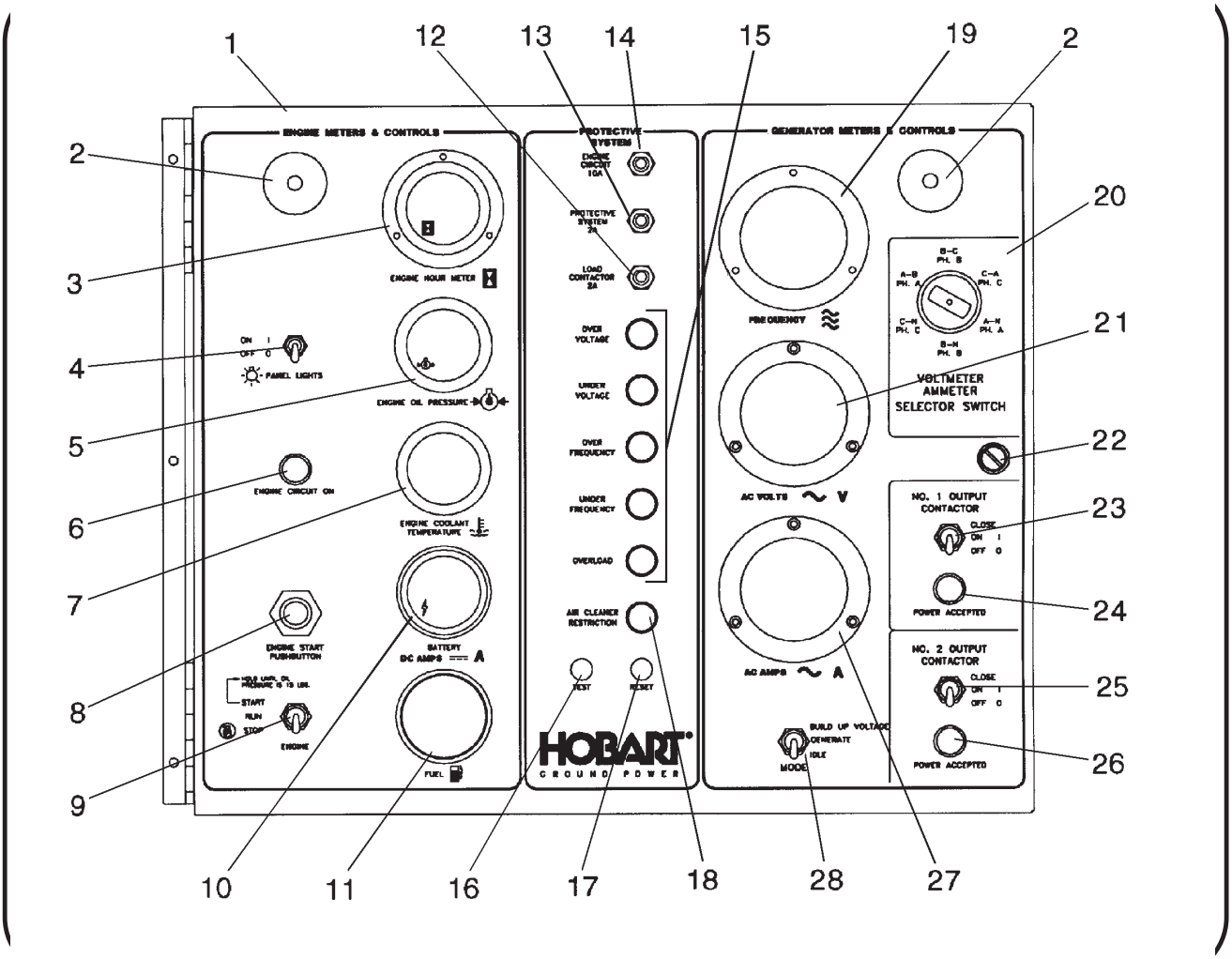
(1) If illumination is required, place light switch (4) in ON position.

(2) Place engine-generator control switch (28) in IDLE position.

(3) Place contactor control switch (23 and 25) in OFF position.

(4) Place and hold engine control switch (9) in START position. The green light (6) should glow to indicate power is available to the engine protective circuit and fuel shut-off valve.

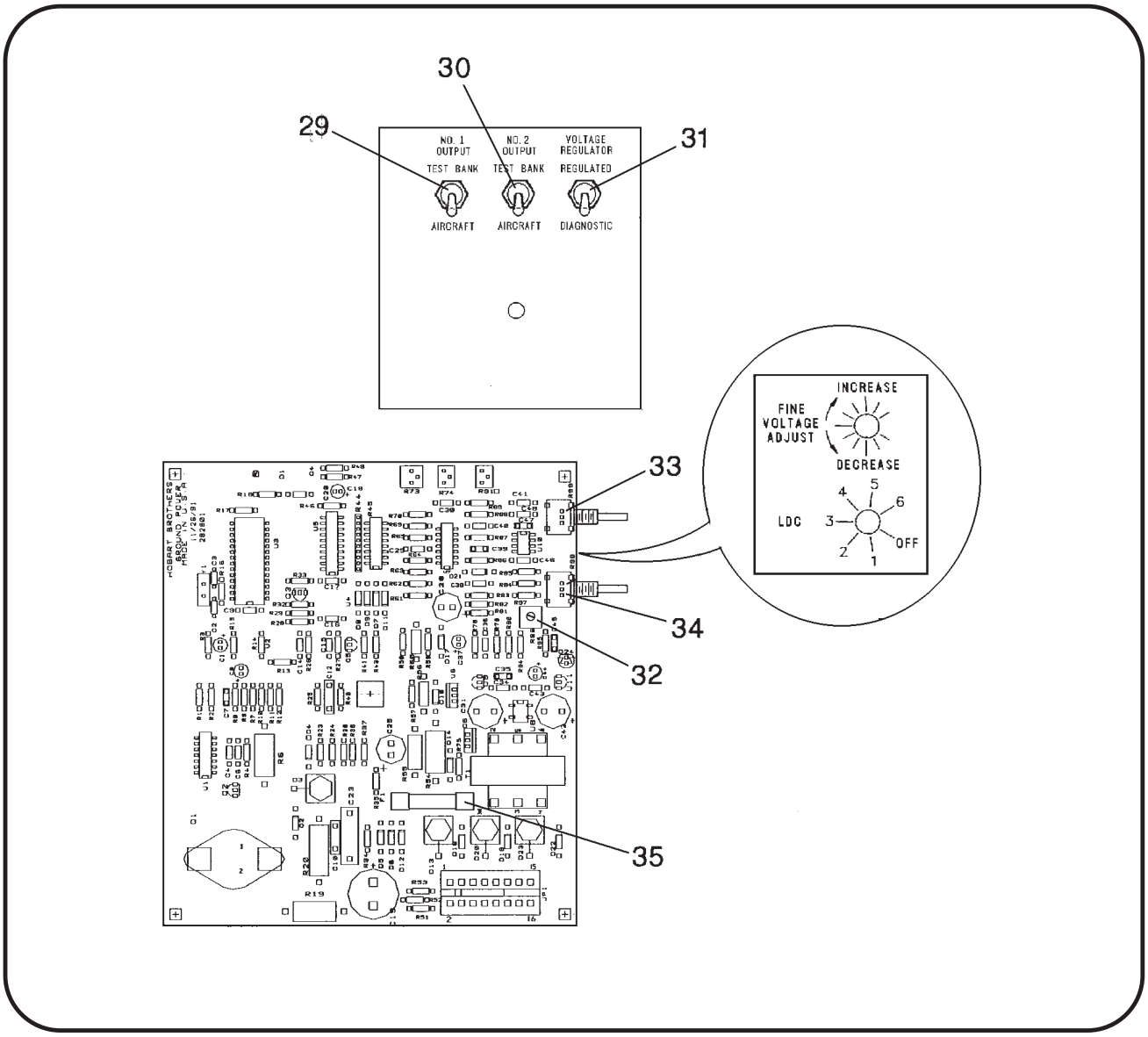
(5) Press start switch button (8) to crank the engine. Release the start switch as soon as the engine starts. Continue to hold the engine control switch in START position until oil pressure is normal.



1. Front panel
2. Panel light
3. Engine hour meter
4. Panel light switch
5. Oil pressure gage
6. Engine ON indicating light
7. Engine coolant temperature meter
8. Engine start switch
9. Engine control switch
10. Engine ammeter
11. Fuel gage
12. Load contactor circuit breaker
13. Protective system circuit breaker
14. Engine system circuit breaker
15. Protective system indicating lights
16. Test switch, protective system
17. Reset switch, protective system
18. Indicating light, air cleaner restriction
19. Frequency meter
20. Selector switch, voltmeter-ammeter
21. Voltmeter
22. Adjustable grip latch
23. No. 1 contactor switch
24. Power accepted light, No. 1 contactor
25. No. 2 contactor switch
26. Power accepted light, No. 2 contactor
27. Generator ammeter
28. Engine-generator control switch

Operating Controls and Instruments

Figure 1 (Sheet 1 of 2)



29. Test bank-aircraft switch, No. 1 output
30. Test bank-aircraft switch, No. 2 output
31. Regulated-diagnostic switch
32. Output voltage adjustment (coarse)
33. Output voltage adjustment (fine)
34. Line drop compensation adjustment
35. Fuse (5-amp)

Operating Control and Instruments

Figure 1 (Sheet 2 of 2)

CAUTION

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.

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) When oil pressure is normal, release the permissive start switch and allow it to return to RUN position. Green indicating light should continue to glow.

(7) Observe all engine instruments for normal operation.

(8) Allow engine to idle and warm before applying load.

CAUTION

DO NOT allow the engine to idle for long periods of time.

c. Cold Weather Engine Starting Procedures

A cold weather starting-aid kit (Fig. 2) is provided to assist in starting the engine at temperatures below 50 degree F. To start the engine, using the starting aid, proceed as follows:

(1) Position switches and controls as instructed in steps (1) through (4), paragraph B, Normal Engine Starting Procedures, above.

(2) Prepare starting aid for use. The starting aid is shipped in a safe condition and is not operable until assembled. Assemble as follows:

WARNING

Fires, fumes, and flying parts can kill or injure! starting fluid is extremely flammable. it is under pressure. Use caution when handling. avoid contact with skin and avoid breathing vapor.

a. Loosen clamp screws (1, Fig. 2) and slide the cylinder (2) upward sufficiently to remove protective cap and plug (3).

b. Use bottle opener to remove cylinder cap (3). Unscrew and remove plug inside it.

c. Slide the cylinder (2) downward and thread into the valve (4). Tighten securely. The starting aid is now ready to use.

Cold weather starting procedures are exactly the same as for normal starting.

CAUTION

Use starting aid only for starting. do not operate while engine is running.

WARNING

Do not “flood” the engine with starting fluid. a serious explosion could result.

Note: Whenever the engine does not start within a normal period of cranking, the starting fluid cylinder may be empty. Refer to starting aid servicing and troubleshooting information in Section 2-2.

(3) Tips On Cold Weather Starting

a. **Battery and Cables**

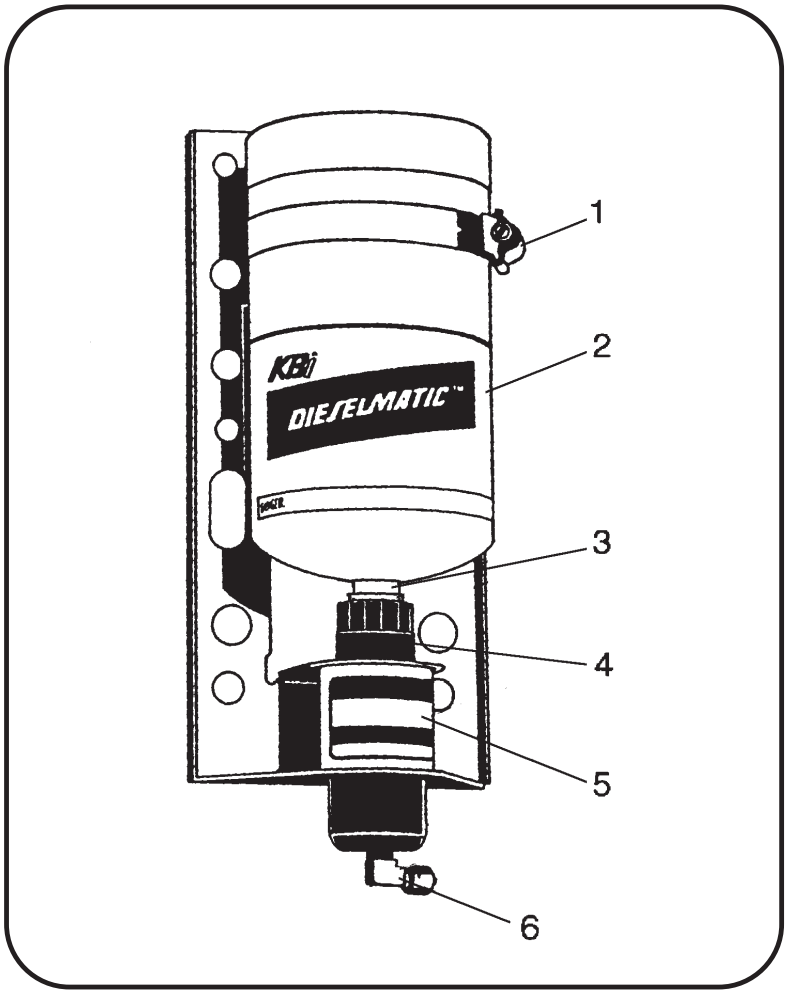
To start in cold weather, a diesel engine must crank at a fairly high speed. Worn out batteries, partially discharged batteries, and poor or loose cable connections will reduce cranking speed. Batteries, cables, and connections should be cleaned and tightened regularly.

b. **Fuel**

For an engine to start and keep running, fuel must flow through the injection system. Unblended #2 diesel fuel, "clouds", forming filter-clogging wax at temperatures around $+15^0$F (-10^0C). This makes starting and running impossible. Most engine manufacturers recommend that fuel have a cloud point at least 10^0F (5^0C) below the coldest anticipated temperature.

c. **Lube Oil**

Engine lubricating oil get thicker at lower temperatures. Many oils that flow freely at 70^0F (21^0C) are extremely thick at 0^0F (-18^0C). Follow your engine manufacturer's recommendations regarding oil viscosity for the coldest temperatures you expect your engine to encounter.



1. Clamp screw
2. Cylinder
3. Protective cap
4. Valve
5. Solenoid
6. Blockor fitting and

Cold Weather Starting Aid

Figure 2

d. Preparation for Power delivery

The following are preparation procedures to be followed after the engine is started.

(1) Check and position switches and controls.

a. Open the right rear door of the generator canopy and open the door on the control box (which is the engine-generator control panel). This allows access to components inside the control box.

b. Place regulated-diagnostic switch (31) in REGULATED position.

c. Place test-bank switches (29 and 30) in AIRCRAFT position if the aircraft being serviced is equipped with 28.5-V DC interlock relay system. (If not, place in TEST BANK position).

d. Close the control panel (door) and fasten it shut. Close also the right rear door of the canopy assembly.

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

e. Power Delivery

(1) Place engine-generator control switch (28) in BUILD-UP-VOLTAGE position momentarily, then allow it to position itself in GEN position. The electric governor will immediately increase engine speed to 2400 RPM and maintain it.

(2) Observe generator instruments. Frequency meter (19) should indicate exactly 400 Hz. With voltmeter-ammeter selector switch (20) in any line-to-neutral position, (A-N, B-N, or C-N), the voltmeter (21) should read 115 volts. With voltmeter-ammeter selector switch switch in any line-to-line position, (A-B, B-C, or C-A), the voltmeter should read 200 volts.

(3) The final step in delivering power is closing one or both of the load contactors. When satisfactory frequency and voltage values are indicated by the instruments, close either load contactor (or both load contactors) by momentarily placing the load contactor control switch (23 or 25) in the top (spring loaded), ON position. The green indicating light (24 or 26) for that contactor 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 (24 or 26) 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 load contactor control switch (23 or 25) 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 (20) to select the phase and 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 (17) to turn off the indicating light and reset the protective relay system. Proceed with power delivery by operating the load contactor switch.

WARNING

NEVER disconnect the output cable while power is being delivered..

f. Discontinue Power Delivery

(1) Place the load contactor switch (23 and/or 25) in OFF position. Green light (24 and/or 26) 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 (28) in IDLE position.

(3) Disconnect output cable from aircraft.

g. Stopping the Engine

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

(2) To stop the engine, place engine control switch (9) in STOP position.

3. Transformer-Rectifier Operation

a. Preparation for DC Power Delivery

Start, and prepare the generator set for power delivery the same as for 400-Hz use. If it is necessary to supply both 28.5-Volt DC and 400-Hz power at the same time, refer to Para. 4 below.

b. DC Power Delivery

(1) Connect DC output cable plug connector to aircraft receptacle connector. Be sure good connection is made.

(2) Operate generator-set controls, as instructed by the applicable manual, to produce 115-Volt AC, 400-Hz output.

(3) If illumination is required at the T-R control panel, turn instrument light (4, Fig. 1) ON with switch (12).

(4) If current-limiting is required for soft-starting an aircraft, position controls as follows:

a. Place current limiting control switch (9, Fig.1) in the ON position.

b. Adjust rheostat (5) to the starting amperage recommended by the engine manufacturer.

(5) If power delivery is to be a load bank, or to an application where full load capacity is desired, place the current limiting control switch (9) in the OFF position. The T-R will then have a load capacity of 2000 Amperes for five minutes, or 2500 Amperes for 30 seconds.

(6) Close the T-R load contactor to deliver power to the output cables by momentarily holding the contactor control switch (8) in the top, ON position until the indicating light (7) glows. Release the switch and allow it ti return to center, ON position.

(7) Apply a load of 1000 Amperes and observe voltmeter (3). If voltage is not 28.5 Volts DC, open the control panel and use rheostat (1, Fig.2) located on the line-drop and current limiting module (4) to adjust. Loosen locknut (2) and turn adjusting screw CLOCKWISE to increase voltage. Turn COUNTERCLOCKWISE to decrease voltage. Adjust output to 28.5 Volts DC. Tighten locknut and close control panel.

(8) Remember that an overload, overvoltage, or overheating will cause the load contactor to disconnect the load and turn OFF the indicating light (7, Fig. 1). If shut-down occurs, check for the condition that caused it and remedy it before restarting the T-R.

c. Discontinue Power Delivery

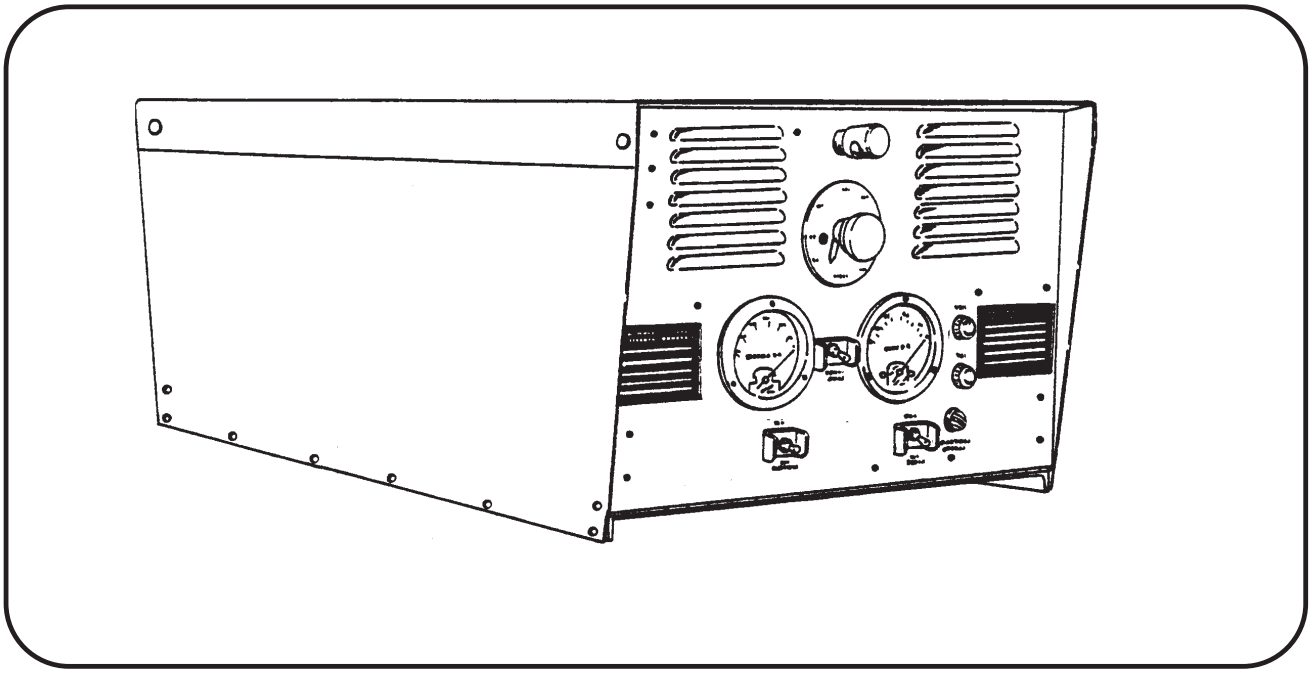
(1) Place contactor control switch (8, Fig. 1) in the OFF position.

(2) Disconnect output cable at aircraft.

WARNING

WARNING: Do not disconnect cable while power is on. Lethal electrical shock hazard exists. Also, opening the connector under load causes arcing and pitting of connector parts.

(3) Operate generator-set controls according to instructions at the beginning of this section.



Transformwer-Rectifier

Figure 3

d. Simultaneous 28.5-Volt DC and 400-Hz AC Power Delivery

If both 28.5-Volt DC and 400-Hz AC power must be delivered at the same time, the following rules and precautions **MUST** be observed.

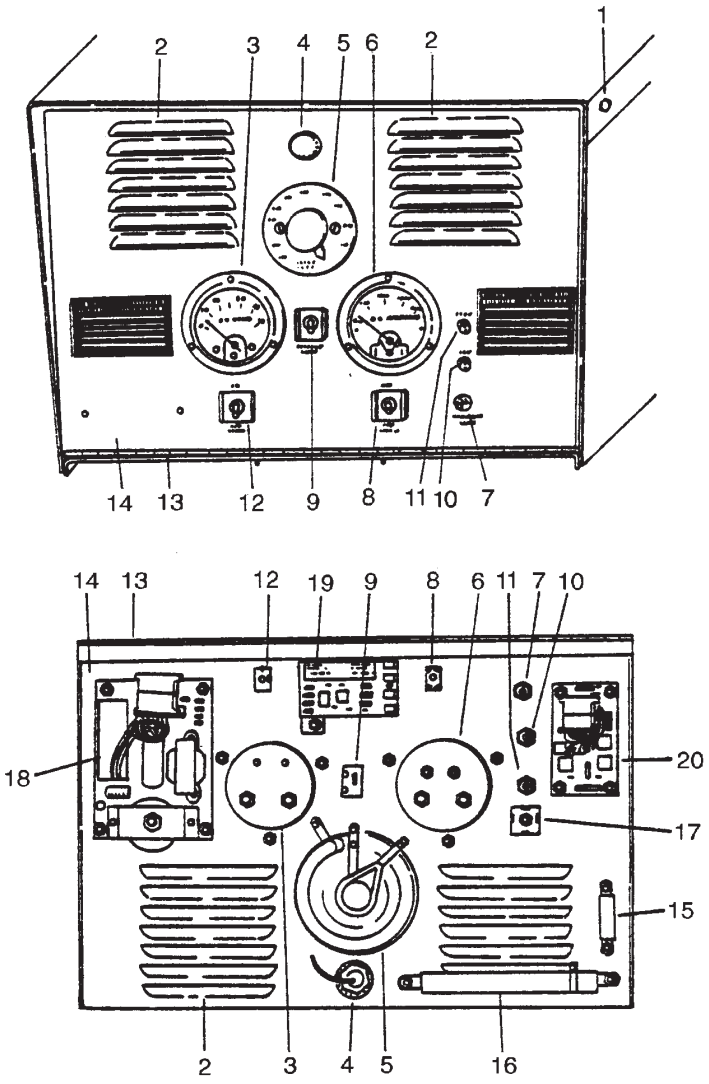
(1) Place DC current limiting switch in the OFF position. This will eliminate the soft-start feature of the T-R, but will prevent AC voltage from dropping low enough to trip the AC load contactor.

(2) Line-drop compensation on the T-R must be REDUCED or turned DOWN completely to prevent the AC load contactor from being opened by an overvoltage condition.

(3) Readjust AC line-drop compensation on the voltage regulator using cable length and cable size compensation rheostats so that AC voltage, as indicated on the voltmeter, does not exceed 118-Volt AC when the DC load is 500 Amperes. (See line-drop co*mpensation adjustment instructions in the Generator Set Manual, Chapter 2).*

(4) If higher DC voltage is needed, adjust the line-drop compensation *(on T-R front panel)* as required. Observe AC voltage while making this adjustment to make certain that it does not go **TOO HIGH** with DC load.

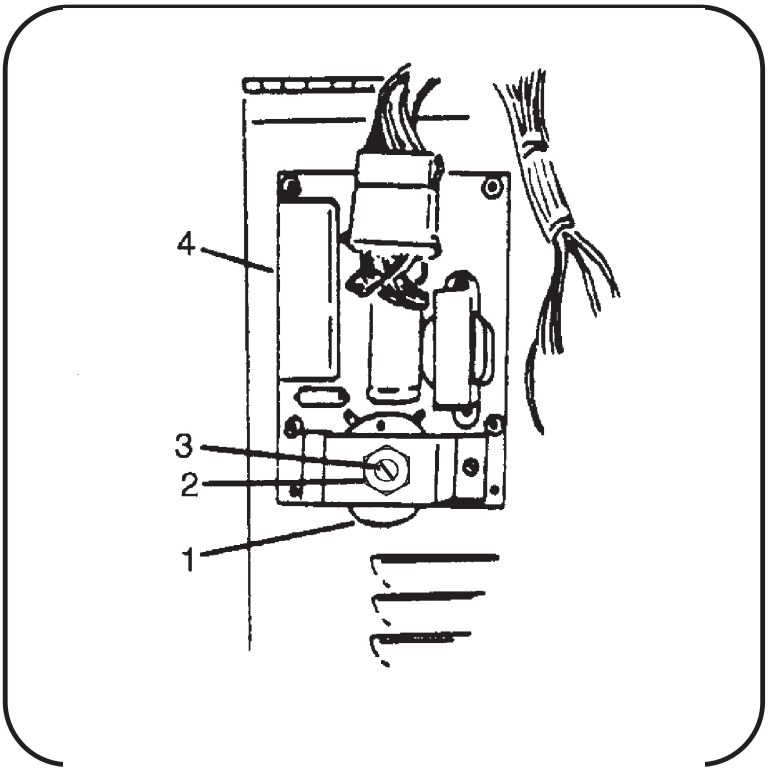
(5) During simultaneous, continuous operation, loads on either circuit are limited only by the capacities of the respective circuits; however, the combined loads should not exceed the rated capacity of the generator set.



1. Screw
2. Air inlet louver
3. DC voltmeter
4. Instrument light
5. Current limiting rheostat
6. DC ammeter
7. Contactor ON indicating light
8. Contactor control switch
9. Current limiting control switch
10. Fuse (2A) (DC circuit)
11. Fuse (2A) (115-V AC circuit)
12. Light switch
13. Hinge
14. Panel
15. Resistor (200 Ohm, 25 Watt)
16. Resistor (100 Ohm, 100 Watt)
17. Rectifier, silicon
18. Line-drop compensation and current limiting module
19. Board, overvoltage

T-R Control Panel Assembly

Figure 4



1. Rheostat
2. Nut
3. Screw

T-R Output Voltage Adjustment

Figure 5

4. Trailer Operation

a. Towing

Observe the following rules when towing the trailer.

(1) Be sure all output cables are disconnected and properly stowed.

(2) Be sure parking brake is released.

(3) Avoid turns which are shorter than the steering linkage will freely allow.

(4) Avoid dangerous speed and sudden turns.

b. Parking

This trailer is equipped with towbar activated brakes. When parking the trailer:

(1) Tow the generator set to the location where it is to be parked.

(2) Disconnect the trailer from the tow vehicle.

(3) Place drawbar in an upright, vertical position to apply the brakes.

Chapter 2. Servicing

Section 1. Maintenance Inspection/Check

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 to components, or failure of the equipment.

WARNING

STOP operations at once if a serious or possibly dangerous fault is discovered.

2. Maintenance Schedule

a. General

A periodic maintenance schedule should be established and maintained. A suggested schedule is provided in Fig. 1 on the following pages. It may be modified, as required to meet varying operating and environmental conditions. It is suggested that generator set and vehicle inspections be coordinated as much as possible.

b. Maintenance Schedule Check Sheet

It is strongly recommended that the customer use a maintenance schedule check sheet such as the one in Cummins Operation and Maintenance Manual. The check sheet will provide a record and serve as a guide for establishment of a schedule to meet the customer's maintenance requirements for his specific operation.

c. Time Intervals

The schedule is based on both hours of operation and calendar intervals. These two intervals are not necessarily the same. For example, in normal operation the oil change period, based on hours of operation, will be reached long before the three months calendar period. The calendar period is included to make certain services are performed regularly when the equipment is stored, or being operated infrequently. Lubricating oil standing in engines that are stored, or used very little, may tend to oxidize and may require changing although it is not dirty. Perform all services on whichever-comes-first basis.

d. Identification of Interval Periods

Each interval period is identified by a letter A, B, C, etc., (See Sect. 2-2). For example, services under B schedule should be performed at the end of each 200 hours of operation, or every three months period. AR service are performed on an AS REQUIRED basis.

HOURLY INTERVAL CALENDAR INTERVAL	As Req'rd.	10 or Daily	200 or 3 Mo.	400 or 6 Mo.	800 or 1 Yr.	1200 or 1Yr.	6000 or 5Yrs.
SYMBOL	**AR**	**A**	**B**	**C**	**D**	**E**	**F**
ENGINE							
Change Air Cleaner Cartridge	X						
Check Engine Blow-by	X						
Check Crankcase Oil Level		X					
Drain Fuel Filter Elements		X					
Check Coolant Level		X					
Check for Leaks and Correct		X					
Check Air Cleaner Indicator		X					
Check Exhaust System		X					
Change Crankcase Oil			X				
Change Oil Filter Element			X				
Check and Record Oil Pressure			X				
Check Crankcase Breather			X				
Change Fuel Filter Elements			X				
Clean Radiator Core (external)			X				
Check Governor Linkage			X				
Change Water Filter			X				
Check/Adjust Serpentine Belt Tension			X				
Tighten Manifold Hardware	X						
Check Fan Hub and Drive Pulley					X		
Steam Clean Engine						X	
Clean Fuel Pump Screen and Magnet						X	
Check Vibration Damper						X	
Adjust Injector and Valves						X	
Check Fuel Manifold Pressure						X	
Check Water Pump						X	
Check Fan Hub						X	
Check Alternator						X	
Check Cranking Motor						X	
Clean/Calibrate/Replace Injectors							X
Check Fuel Pump Calibration							X
Clean Oil Cooler							X
Overhaul Cylinder Heads							X

Maintenance Schedule

Figure 1 (Sheet 1 of 2)

HOURLY INTERVAL CALENDAR INTERVAL	As Req'rd.	10 or Daily	200 or 3 Mo.	400 or 6 Mo.	800 or 1 Yr.	1200 or 1Yr.	6000 or 5Yrs.
SYMBOL	**AR**	**A**	**B**	**C**	**D**	**E**	**F**
ENGINE (continued)							
Replace Piston Rings							X
Inspect Pistons and Cylinder Liners							X
Replace Cylinder Liner Seals							X
Inspect Bearings and Journals							X
Check Fan Mounting			Spring and Fall				
Clean Cooling System			Spring and Fall				
Check Hoses			Spring and Fall				
Clean Electrical Connections			Spring and Fall				
Check Thermostats and Seals				Fall			
Check Starting Aid				Fall			
ELECTRICAL (12-V DC System)							
Check Battery and Fluid Level			X				
Clean Battery Terminals	X		X				
Check all Lights		X					
Check Charging Rate		X					
Check Wiring and Connections				X			
ELECTRICAL (400-Hz System)							
Check Output Cable and Connectors		X					
Check Volt, Amp & Frequency Meters		X					
Check Protective Relays				X			
Inspect Wiring and Connections				X			
Clean and Inspect Generally				X			

Maintenance Schedule

3. Inspection/Check

a. General

Inspections, checks, and maintenance are described in general here. More specific and detailed information contained in 2-2 and 2-3, will be referenced when applicable. See 2-2, Para. 2 for instructions on how to roll the generator set out for service.

b. "AR" Checks and Operations (As Required)

(1) Engine

a. Change air cleaner.

A definite time schedule for changing the air cleaner cannot be established. This air cleaner is a disposable type which, when dirty, may be washed as many as six times before discarding. See 2-2, para 3.

b. Check engine blow-by are required if the engine lacks power or uses oil excessively. Refer to the Cummins Operation and Maintenance Manual.

c. Tighten manifold, muffler, and exhaust pipe attaching hardware (nuts and capscrews) as required.

d. Tighten all attaching hardware as required.

(2) Electrical System (12-V DC)

a. Check battery terminals

Anytime the battery compartment doors are opened for any reason, visually check battery cable connectors and battery posts. If corrosion is observed, disconnect cables and clean battery posts and connectors with a wire brush or special battery post-and-connector cleaning tool. Coat posts and connectors with a light film of petroleum lubricant before reconnecting cables.

c. "A" Checks and Operations (10 Hours or Daily)

(1) Engine

(2) Check crankcase oil level

CAUTION

DO NOT overfill. **DO NOT** operate the engine with oil level below L (low) mark or above H (high) mark.

a. Check oil level daily with oil gage dipstick (See 1-2, Fig. 1.)

b. Oil level should not be checked until 3 to 5 minutes after engine shutdown. Keep oil level as near H mark as possible.

NOTE: If there is any question regarding oil gage dipstick accuracy, check oil level by removing 1/8 inch pipe plug in side of oil pan. Refer to Cummins Operation and Maintenance Manual.

CAUTION

BE SURE to prime and bleed the fuel system after draining the filters, replacing any element in the system, or if the fuel tank has run empty. Failure to do so can cause engine starting problems.

(3) Drain fuel filters

The life of the fuel pump and injectors can be extended if the operator drains about a cup of fuel from each of the fuel filter elements to remove water and sediment before starting the engine each day.

a. Provide a container for catching drained fuel

b. Open the drain valve on the fuel/water filter by turning it counterclockwise.

c. Drain the filter until clear fuel is visible. Tighten the drain valve.

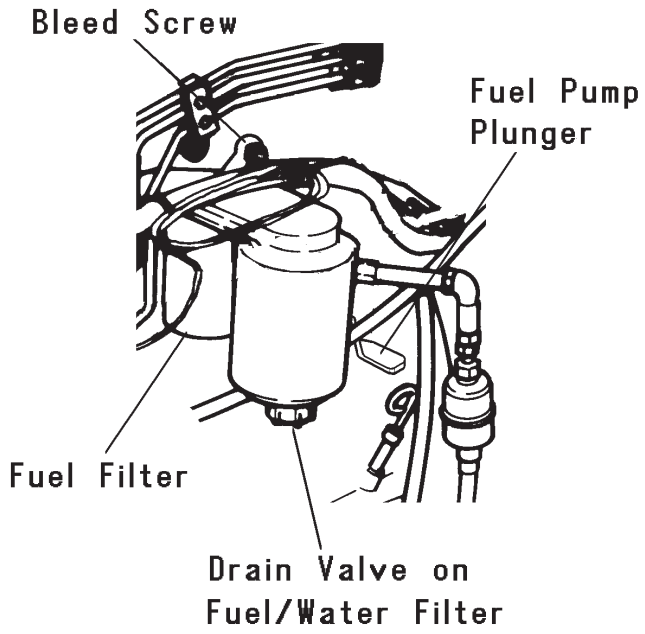
d. The fuel filter must be removed to drain.

e. Safely dispose of drained fuel.

f. Loosen the bleed screw

g. Operate the plunger on the lift pump until the fuel flowing from the fitting is free of air.

h. Tighten the bleed screw.



Fuel Filters

Figure 2

i. Check coolant level

Check coolant level daily or at each fuel fill interval. Investigate for cause of any coolant loss.

j. Check for leaks

At each daily start-up, check for coolant, fuel, and oil leaks. Coolant leaks may be more noticeable when components are cold. Observe pumps, hoses, fittings, gasketed connections, etc., for signs of leakage. Correct as required.

k. Check air cleaner indicator light

At each daily start-up, observe the air cleaner indicator light (1-3; 18, Fig. 1). If this light comes ON, it indicates that the air cleaner should be changed.

l. Check exhaust system

Visually inspect muffler and exhaust pipes for rust and signs of approaching failure. Listen for any gasket or joint leaks.

WARNING

A leaking and defective exhaust system could be a fire hazard.

(4) Electrical (Engine)

a. Check all lights

Check all indicating lights to be sure they will operate when they should. If any light fails to operate, check both the lamp and its protective fuse. Figure 4 lists all lamps with their location and part number. Figure 5 lists all fuses.

b. Check alternator charging rate

Observe the 12-V DC ammeter each time the engine is started. A zero amperage reading or extremely high reading for any length of time indicates trouble in the alternator, regulator, battery, or interconnecting wiring.

(5) Electrical (Generator)

a. Monitoring instruments

Check 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 at each start up. Fault indicating lights on the control panel may be tested by pressing test switch (1-3; 16, Fig. 1). Check fuses if lights fail to operate.

c. Output cable plug connector

Check the output cable plug connection for damaged contacts each time the connector is attached to an aircraft.

d. "B" Check and Operations (200 Hours or 3 Months)

(1) Engine

a. Change crankcase oil. See 2-2, Para. 3, D, (4) for details.

b. Change oil filter element

Change oil filter element each time crankcase oil is changed. See 2-2, Para. 3, D, (5) for details.

c. Check and record oil pressure

After each oil change, check and record oil pressure at idle speed after oil has warmed to approximately 140 deg. F. Record oil pressure under identical conditions at each oil change interval. A comparison of pressure at idle speed with previous readings will give an indication of progressive wear of oil pump, bearings, shafts, etc. Investigate any abnormal change in pressure readings.

d. Alternator and starter lubrication

Most alternators contain sealed bearings and require no periodic lubrication. The starting motor is lubricated at assembly and should be re-lubricated only when the starter is removed and disassembled. Check both of these accessories to determine if they have lubrication fittings.

e. Change fuel filters. Refer to 2-2; Para. 5, B for instructions.

f. Clean radiator core. See 2-2; Para. 6, H for instructions.

g. Check governor linkage

Check all attaching hardware. Check ball joints for wear and looseness. Check linkage for free movement throughout its complete travel range.

h. Change water filter

Change water filter every 200 to 250 hours and at each coolant change. See 2-2; Para. 6, K for service instructions. See Cummins Manual for instructions on how to test coolant chemically.

i. Check and adjust V belts

See 2-2; Para. 7, C for tension check and adjustment instructions.

j. Check and service crankcase breather. Refer to 2-2; Para. 3, F, for service instructions.

(2) Electrical (12-V DC system)

a. Battery electrolyte level

Batter electrolyte level must be maintained above top of plates. Add distilled water as required.

CAUTION

DO NOT overfill.

b. Check battery

If battery requires water frequently, or is low in charge, the reason for the condition must be found and corrected.

c. Battery terminals

Check battery terminals and clean if necessary in accordance with Para. 3, B, (2) (a) above.

e. “C” Checks and Operations (400 Hours or 6 Months)

(1) Electrical (12-V DC system)

a. Wiring

Inspect all cables and leads for worn or damaged insulation.

b. Connectors

Inspect connectors for security and damaged or corroded condition.

(2) Electrical Generator

a. Protective relays

Check operation of all protective relays to make certain they will function if a fault should occur in the output circuit. Procedures for testing these relays are contained in the Adjustment/Test section of this manual.

b. Wiring and connections

- Check all cables, leads, and wiring for broken, worn and damaged insulation.
- Check all connections for tightness.

f. "D" Checks and Operations (800 Hours or 1 Year)

(1) Engine

a. Check fan hub and drive pulley (see Cummins Maintenance Manual).

g. "E" Checks and Operations (1200 Hours or 1 Year)

(1) Engine

a. Steam clean engine

There are several reasons why the engine exterior should be kept clean. Dirt on the outside will enter fuel and oil filter cases and rocker housings when covers are removed unless dirt is removed first. A clean engine will run cooler and develop fewer hot-spots.

Steam cleaning is one of the most satisfactory methods of cleaning and engine; however, there are some CAUTIONS to be observed.

CAUTION

1. If a cleaning compound is used, select one which is free from acid and which will not remove paint.
2. Protect (or remove) all electrical accessories, such as voltage regulator, alternator, and electrical wiring.
3. Seal all openings.

WARNING

1. **DO NOT** use a flammable solvent.
2. Exercise care to avoid injury and damage to eyes and skin.
3. **DO NOT** use mineral spirits or solvents on a hot engine.

b. Check vibration damper.

The damper hub and inertia member are stamped with index marks to permit detection of movement between the two parts (see Fig. 3). There should be no indication of movement between the hub and the inertia member. If index marks are not aligned, replace vibration damper.

c. Adjust injectors and valves

Injectors and valves must be in correct adjustment at all times for best engine performance. Refer to Cummins Operation and Maintenance Manual for injector and valve adjusting instructions.

d. Check fuel manifold pressure

This check is necessary only if there is an apparent or suspected loss of power. Refer to Cummins Operation and Maintenance Manual for tools required and test instructions.

e. Check water pump

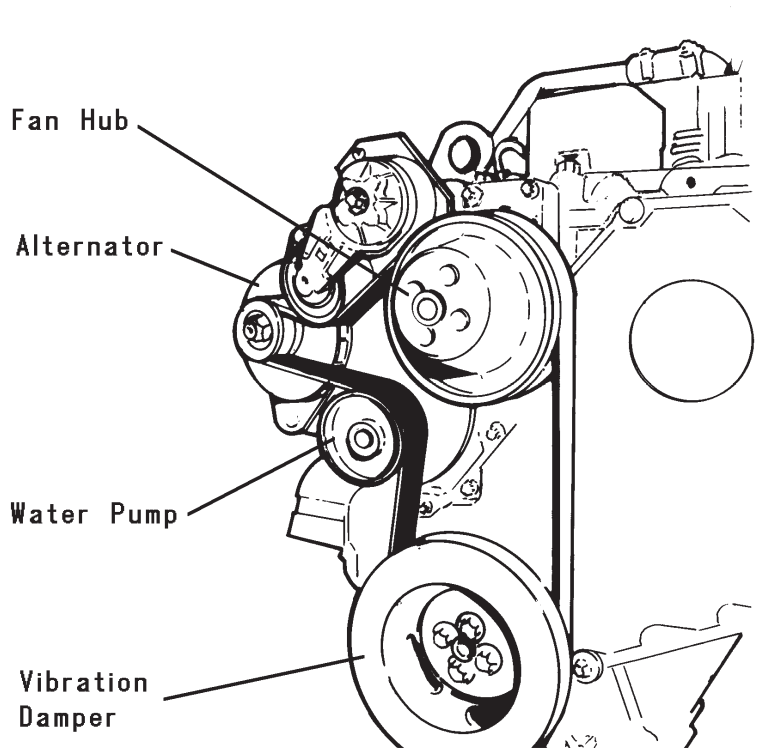
Check water pump for signs of leaking and lubricant loss. Replace with new prelubricated pump if lubricant is being lost.

f. Check fan hub

Check fan hub for signs of lubricant loss. Replace with new prepacked hub if lubricant is leaking.

g. Check alternator and cranking motor.

The alternator and cranking motor on this particular engine require no periodic lubrication. See 2-2, Para. 3, E, (1) and (2) for details.



Engine Check Points

Figure 3

h. "F" Checks and Operations (6000 Hours or 5 Years)

(1) Engine

These checks should determine whether the engine requires a complete overhaul or whether it may be operated for another service period. High oil consumption, low oil pressure at idle speed, oil dilution and other signs of wear must be considered.

Disassemble the engine sufficiently to perform the following inspections and services. Complete overhaul facilities should be available. If the user performs this operation in his own shop, a shop manual should be procured from Cummins Engine Company.

a. Clean and calibrate injectors

Injectors must be cleaned and calibrated regularly to insure proper fuel delivery to combustion chambers. Special tools are required. It is suggested that the Cummins Distributor be consulted for this operation.

b. Check fuel pump calibration

This operation may be performed on an as required basis. Pump calibration also requires special tools and testing equipment. Consult the Cummins Distributor for information.

c. Inspect bearings

d. Inspect cylinder liners

e. Inspect pistons

f. Inspect crankshaft journals

g. Rebuild cylinder heads

h. Replace piston rings

i. Replace cylinder liner seals

j. Replace front and rear crankshaft seals

k. Replace vibration damper

l. Clean oil cooler

i. Seasonal Maintenance Checks (Engine)

(1) Inspect engine cooling fan each spring and fall.

a. Check fan to be sure it is securely mounted.

b. Check for fan wobble and/or bent blades.

c. Check fan hub and crankshaft pulley for secure mounting.

(2) Check cooling system each spring and fall. Clean if necessary. See 2-2, Para. 6, G and H, for cooling system maintenance.

(3) Check all hoses.

In addition to daily checks of hoses for leaks, inspect hoses thoroughly each time the cooling system is cleaned and serviced.

a. Inspect for signs of deterioration and collapse.

b. Inspect for cracks and cuts.

c. Inspect for cutting and deformation caused by hose clamps.

d. Replace hoses as required.

(4) Check and adjust V belts each time the cooling system is cleaned, or on an as required basis. See 2-2, Para. 8, check and adjustment procedures.

(5) Check thermostat and seals.

(6) Check thermostat each fall when cooling system is serviced. See 2-2, Para. 6, L, for instructions.

(7) Check cold weather starting aid each fall.
Refer to 2-2, Para. 5, D, for instructions.

j. Lamps and Fuses

(1) Check all lamps daily and check fuses as required.

(2) A lamp chart (Fig. 4) lists all lamps with their location and identifying trade number in table below.

(3) The fuse chart (Fig. 5) lists all fuses with their location, size, and type.

Light Identification	Location	Lamp Manufacturer	Lamp (Bulb) Number
Instrument Panel Lights	Engine-Generator Control Panel	Lamp Industry Trade Number	67
Engine ON Indicator	Engine-Generator Control Panel	Lamp Industry Trade Number	1815
Power Accepted Indicator	Engine-Generator Control Panel	Lamp Industry Trade Number	1815
FAULT Indicators	Engine-Generator Control Panel	Lamp Industry Trade Number	1815
Clearance Lights	Canopy	Lamp Industry Trade Number	57

Lamp Indentification Chart
Figure 4

Item Protected	Location	Illustration	Size and Type
Instrument Panel and Engine Circuit	Engine-Generator Control Panel	1-1, Fig. 6, Item 14	10A Circuit Breaker
Protective System	Engine-Generator Control Panel	1-1, Fig. 6, Item 13	2A Circuit Breaker
Voltage Regulator	Inside Control Box	1-1, Fig. 8, Item 4	10A Fuse
Load Contactor Circuit	Engine-Generator Control Panel	1-1, Fig. 6, Item 12	2A Circuit Breaker

Circuit Breaker/Fuse Indentification Chart
Figure 5

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Section 2. Maintenance Procedures

1. General

A suggested Maintenance Schedule was provided in Section 1, of this Servicing Chapter. Each step of the schedule was also covered in general in Section 1. This Section covers maintenance in more details where necessary.

WARNING

Stop operation immediately if a serious or possibly dangerous fault is discovered.

2. Lubrication

a. General

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

b. AC Generator

The 400 Hz generator requires NO lubrication.

c. Generator Controls

Generator controls and instruments require no 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 and Maintenance 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. 3, 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, high oil temperatures, or intermittent operation. However, time intervals should not exceed those indicated in the chart without careful evaluation.

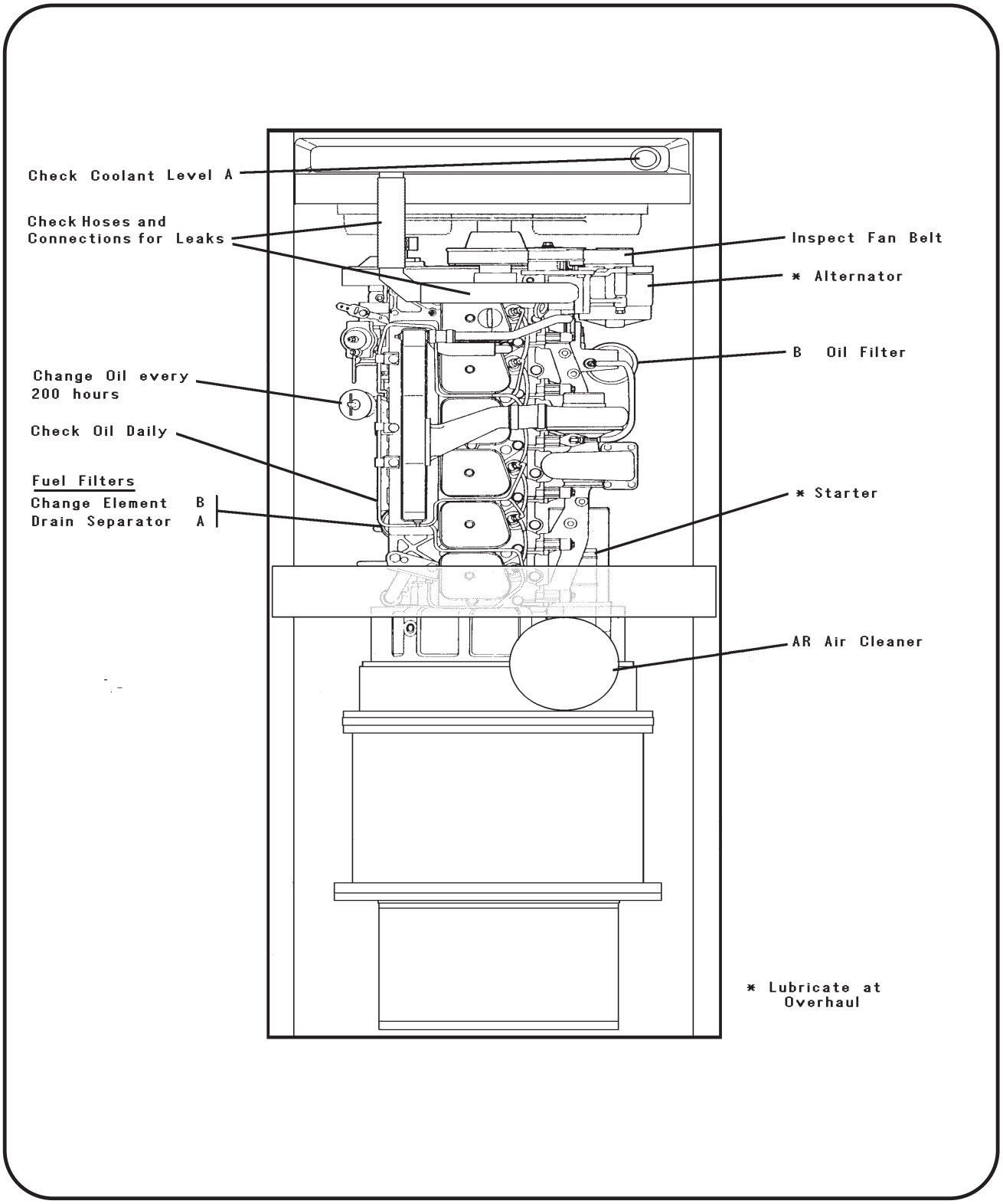
(2) Oil specification

Engine lubricating oil, recommended by the engine manufacturer, is identified by an API (American Petroleum Institute) classification designation. The manufacturer does not recommend any specific brand of lubricating oil.

The use of quality lubricating oil, combined with appropriate lubricating oil drain and filter change intervals are important factors in extending engine life.

Oil recommended for the diesel engines in this application is API Class CC with a maximum ash content of 1.85%. An oil with NO ash content is NOT recommended.

Lubricating oil is discussed in detail in the Cummins Operation and Maintenance Manual.



Lubrication and Maintenance Chart

Figure 1

Symbol	Name	Specification	Notes
1	Grease, General Purpose	MIL-G-3545	Excludes those of sodium or soda soap thickeners
2	Oil, Engine, Heavy Duty	API Class CC	Must contain ash but not more than 1.85%

Lubricants
Figure 2

CAUTION

High ash oils may produce harmful deposits on valves that can cause valve burning.

Ambient Temperature	SAE Viscosity
-13 to +95°F (-25 to +35°C)	10W-30
+14°F and above (0°C and above)	15W-40
+32°F and above (0°C and above)	20W-40

Temperature and Viscosity Chart
Figure 3

(3) Oil viscosity

A temperature and oil viscosity index chart is shown above.

For operation at temperatures consistently below -13 deg. F (-25 deg. C), refer to Arctic Oil Recommendations in the Cummins Operation and Maintenance Manual.

(4) Changing engine oil

Oil should be changed after each 200 hours of engine operation. The generator set is equipped with an hourmeter to record actual engine operating time. The ideal time to change engine oil is soon after a power delivery run, when the engine is at operating temperature.

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

Symbols	Time Intervals	
	Hours	Calendar
AR	As Required	None
A	10 Hours	Daily
B	200 Hours	3 Months
C	400 Hours	6 Months
D	800 Hours	1 Year
E	1200 Hours	1 Year
F	6000 Hours	5 Years
S	Seasonally	Spring and/or Fall

Symbols and Time Intervals
Figure 4

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.

Oil Capacity (including filter)	24 quarts (22.7 liters)
Oil Capacity (oil pan)	20 quarts (18.9 liters)
Coolant Capacity	38 quarts (35.9 liters)

Oil and Coolant Capacities
Figure 5

Change oil as follows:

a. Provide a container for catching used oil. Capacity must be greater than 24 quarts.

b. Remove drain plug located in oil pan.

c. While oil is draining, change the oil filter element. See instructions below.

d. Clean the drain plug and install when engine oil has drained. Torque the drain plug to 35 to 40 foot-pounds (47 to 54 N.m).

e. Remove oil filler cap (Sect. 1-2, Fig. 1). Turn locking screw handle counter- clockwise to loosen cap and lift straight up. Refill the crankcase with new, clean oil which meets engine manufacturer's recommendations. (See Para. 3, D, (2) above, or Cummins Operation and Maintenance Manual).

CAUTION

1. Always use clean containers, funnels, etc.
2. Don't forget to drain old oil, reinstall drain plug and install new oil before starting engine.

f. Install filler cap and check oil level on gage rod (Sect. 1-2, Fig. 1).

g. Start engine and check oil pressure at once. Allow engine to idle for 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 H mark on the gage rod.

(5) Changing oil filter element

a. Provide a container for catching oil.

b. Remove the filter and inspect it.

NOTE: The o-ring can stick to the filter head. Make sure it is removed before installing a new filter.

CAUTION

If bearing metal particles are found on the element or in the shell, the source should be determined before a failure results.

CAUTION

Determine source of moisture, internal leaks; defective seals, gaskets, etc.

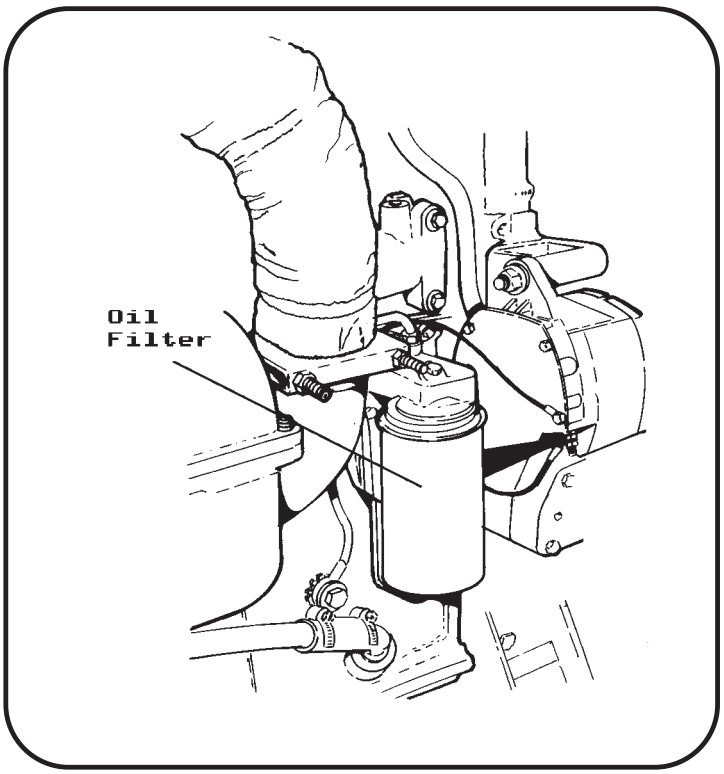
c. Fill the new filter with clean lubricating oil before installation.

d. Apply a light coating of lubricating oil to the gasket sealing surface and install the fillter. DO NOT over tighten the filter.

e. Check crankcase oil level.

f. Start engine and check oil filter for leaks.

g. Stop engine, and after allowing sufficient time for oil to drain to crankcase, recheck oil level. Add oil as required.



Changing the Oil Filter

Figure 6

e. Engine Accessories Lubrication

(1) Alternator

Most alternators contain sealed bearings and require no periodic lubrication, however, CHECK to make certain there are no lubrication points on your particular alternator.

(2) Starter

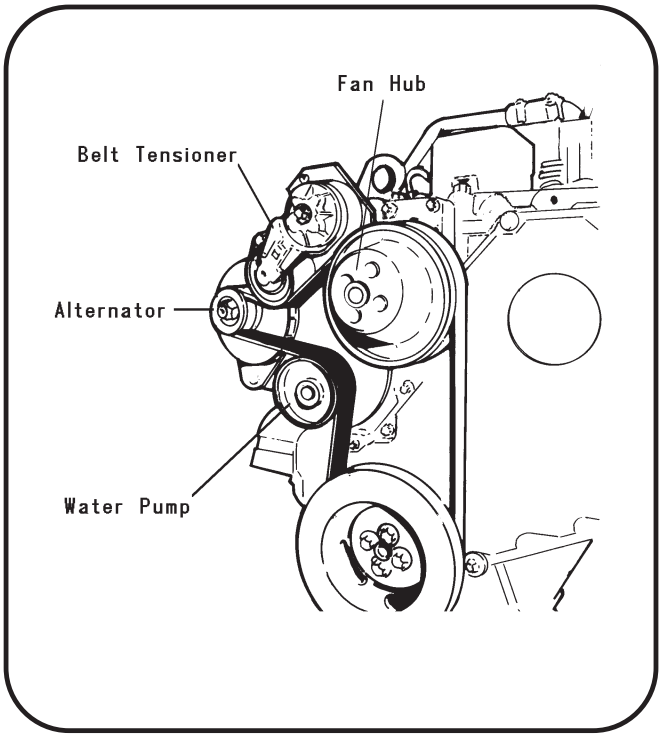
Most starting motors are lubricated at assembly and should be relubricated only when the starter is removed and disassembled, however, INSPECT the starter to make certain it has no lubrication points.

(3) Water Pump

The water pump is packed at assembly and requires no periodic lubrication. Replace pump if signs of lubricant leakage are found.

(4) Fan Hub

The fan hub is also lubricated at assembly and requires no periodic lubrication. Replace hub if lubricant is leaking.



1. Alternator
2. Belt tensioner
3. Water pump
4. Fan hub

Engine Accessories

Figure 7

3. Servicing the Air Cleaner

This air cleaner is a dry type which may be cleaned as many as six times before replacing it with a new air cleaner. A definite time schedule for cleaning or changing the air cleaner cannot be determined because of varying operating conditions. However, since this air cleaner can be removed and replaced without difficulty on this generator set *(simply by loosening one metal clamp on each end of the air cleaner)*, it may be inspected either at prescribed service intervals or at any time deemed necessary.

a. Inspecting the Air Cleaner

(1) Make periodic checks of air cleaner inlet screen for obstructions. If any obstructions are present, remove them.

(2) **Check outlet connection for proper seal.**

NOTE: DO NOT judge the element's life just by looking at it, IT SHOULD LOOK DIRTY, or it's not doing its job.

b. Cleaning Instructions

CAUTION

(1) Do Not Rap The Air Cleaner On A Hard Surface To Clean It, and

(2) Never Leave The Air Inlet Ducting Open Longer Than Necessary During The Service Procedure.

(1) Pressurized air cleaning

After removing the air cleaner from the generator set, blow air into the outlet neck, causing dust to flow off the air cleaner filter media.

CAUTION

(1) Do not use compressed air higher in pressure than 100 psi, and

(2) Do not use compressed air cleaning when the filter media is wet.

(2) **Low pressure water flush**

a. Flow low pressure water, warm or cold, into the air cleaner outlet neck, causing dirt to flow off the filter media. Always be sure not to let any contaminated water back into the outlet neck.

b. A mild detergent may also be used. However, the filter must then be flushed thoroughly with clean water. This cleaning method is recommended by the manufacturer.

c. Always allow filter media to dry before use.

c. Disposal

Normal trash pick-up is acceptable. **NEVER** burn the air filter for disposal.

4. Engine Fuel

a. Quality

The quality of fuel oil 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.

The Cummins engine has been developed to take advantage of the high energy content and generally lower cost of No. 2 Diesel Fuel. The engine will also operate satisfactorily on No. 1 fuel. If other fuels are being considered, refer to the Cummins Operation and Maintenance Manual for fuel specifications and recommended fuel oil properties.

b. Fuel Filter

A double element fuel filter is located between the fuel source and the pump. Its function is to remove foreign material from the fuel before it enters the fuel pump. The filter operates under vacuum. Elements are the throwaway type, in which the case and element are made as one disposable part.

(1) Check fuel filter restriction

The most accurate method of determining filter change requirement and determining change period is by measuring the fuel restriction. As foreign material accumulates in filter elements, fuel flow becomes more and more restricted, and vacuum pressure in the fuel inlet line between the filter and pump rises. Check the degree of filter restriction as follows:

a. Connect a vacuum gage in the inlet fuel line at the pump. An adapter will be required.

NOTE: A vacuum gage No. ST-434, with special adapter, is available from Cummins Engine Company.

b. Operate the engine at governed speed and under full load. If the gage indicates 8 to 8.5 In Hg (27 to 28 kPa), elements require changing (or there are other sources of restriction). When filter restriction becomes great enough to increase vacuum reading to 10 or 11 In Hg (33 to 37 kPa), the engine will lose power.

(2) Changing fuel filter elements

Change elements after each 200 hours of operation unless a restriction test indicates the time period should be extended. Replacement fuel filter elements are Cummins No. FF-105D.

a. Unscrew element and discard.

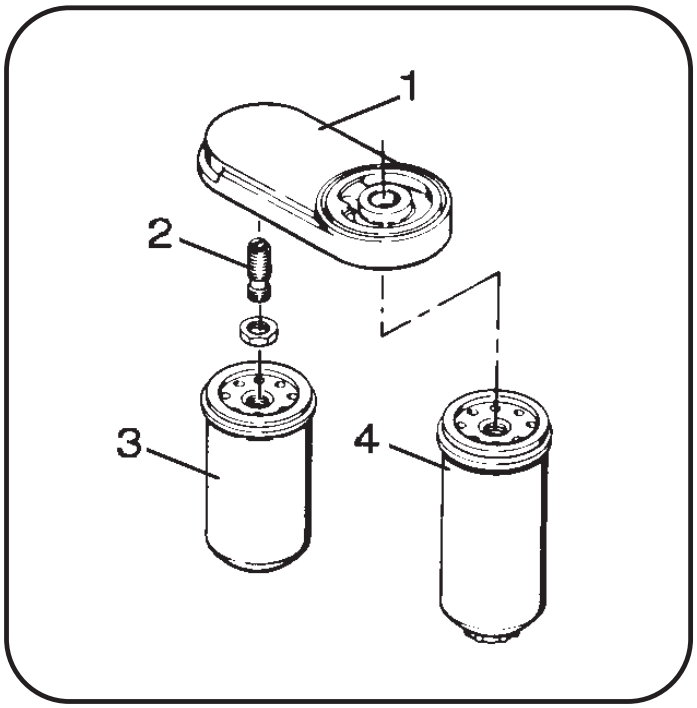
NOTE: The elements should be removable by hand. If not, there are several types of filter element removal tools.

b. Fill NEW element with CLEAN fuel.

c. Install new element and tighten by hand until seal touches filter head. Tighten an additional one-half to three-fourths turn.

CAUTION

Do not overtighten. Tightening with mechanical tools may distort or crack filter head.



1. Head
2. Center bolt
3. Fuel filter
4. Fuel/water filter

Fuel Filter

Figure 8

c. Cold Weather Starting Aid

The cold weather starting aid (Ref. 1-3, Fig. 2) should be checked each fall to make certain it will operate when needed.

5. Engine Cooling System

a. General

Cooling system service requires more than maintaining the proper coolant level in the radiator and protecting the system against freezing. Water should by clean and free of any corrosive chemicals such as chloride, suplphate, and acids. It should be kept slightly alkaline with a pH value in the range of 8.0 to 9.5. Any water which is suitable for drinking can be used in the engine when properly treated as described in Cummins Operation and Maintenance Manual. The Cummins Distributor should be consulted regarding the selection of satisfactory brand, permanent-type antifreeze for use in the cooling system.

b. Radiator Cap

(1) General

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

(2) Removal

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

WARNING

When removing cap from a very hot radiator, do not turn cap past safety stop until all pressure or steam has escaped.

CAUTION

Allow engine to cool before adding coolant.

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. Coolant

The preparation and maintenance of the coolant solution is so important to engine life and is so completely covered in the engine manufacturer's manual, "Operation and Maintenance Manual", that we will not attempt to condense or explain it here. For information regarding coolant specifications, testing equipment, antifreeze, etc., refer to Cummins Operation and Maintenance Manual located in Chapter 6, Manufacturer's Literature, or consult the local Cummins Distributor.

d. Warm Weather Operation (No Antifreeze)

When the unit is operated with plain water coolant during warm seasons, or in climates where anti-freeze protection is not required, the engine must have chromate protection at all times. Change water filter regularly after each 200 to 250 hours of operation.

CAUTION

Never use soluble oil in the cooling system.

e. Cold Weather Operation (Using Antifreeze)

(1) General

A permanent type antifreeze is recommended for use in the cooling system.

WARNING

1. Do not use methanol or alcohol as an antifreeze.

2. Do no mix brands or type of antifreeze. A solution containing two or more types of antifreeze is impossible to test accurately.

(2) Selecting antifreeze

a. Select a permanent type antifreeze know to be satisfactory for use with chromate corrosion resistor.

b. When it is not known if the antifreeze is satisfactory for use with chromate resistor, check with local Cummins Distributor for a list of compatible antifreezes.

CAUTION

Do not use soluble oil in the cooling system

(3) Checking antifreeze solution

Check the solution with a reliable tester when in doubt about antifreeze protection.

NOTE: When testing, be sure coolant is at operating temperature. Follow manufacturer's instructions on tester.

f. Draining the Cooling System

To drain the cooling system, proceed as follows:

(1) Remove radiator cap.

(2) Open the radiator drain valve.

(3) Allow the system to drain completely.

NOTE: Be sure the drain valve does not clog during draining.

(4) When the system is completely drained, close the drain valve.

g. Cleaning the Cooling System

If the water filter has been changed regularly, there should be little need for cooling system internal cleaning. If chemical cleaning becomes necessary, refer to instructions in the Cummins Operation and Maintenance Manual.

h. Cleaning the Radiator Core

Blow out accumulated dirt from the radiator core air passages, using compressed air. Engine overheating is often caused by bent or clogged radiator fins. When straightening bent fins, be careful not to injure the tubes or to break the bond between fins and tubes.

NOTE: Direct the air in a reverse direction to normal air flow. Normal flow on this installation is from the engine compartment outward.

i. Filling the Cooling System

(1) General

a. The water filter element should be changed each time coolant is changed. Before installing coolant, check and inspect the system.

(2) Inspection/Check

a. Check system for evidence of leaks.

b. Inspect all hoses. Install new hoses as necessary. Tighten hose clamps as required.

c. Check the condition of fan and water pump belts. Replace belts if necessary.

(3) Install coolant

a. Remove radiator cap. Be sure the drain valve is closed. Make sure the vent in the water manifold is open to allow air to escape when filling.

b. Pour coolant into radiator very slowly until it reaches level of top drain valve. Close valve and continue filling until coolant reaches a level approximately 1 inch below top of tank. Allow for a 5% expansion when coolant reaches operating temperature.

NOTE: A safety feature built into the tank consists of a pipe attached to the filler neck which extends into the tank approximately 1 inch. If coolant is added after the liquid reaches the bottom of the safety tube, it will immediately overflow.

c. Start the engine and allow it to idle. Add coolant as trapped air escapes from the system and the coolant level falls.

d. Continue to check coolant level until all trapped air escapes. Add coolant, if needed, to fill to the required level, 1 inch below top of tank. Install radiator cap and close the vent valve.

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

j. Thermostat

The thermostat should be checked each fall, or as required. Refer to Cummins Operation and Maintenance Manual for recommended test instructions.

6. Drive Belts

a. General

The engine cooling fan, alternator and water pump are driven by a timing belt which must be replaced if it becomes worn or damaged.

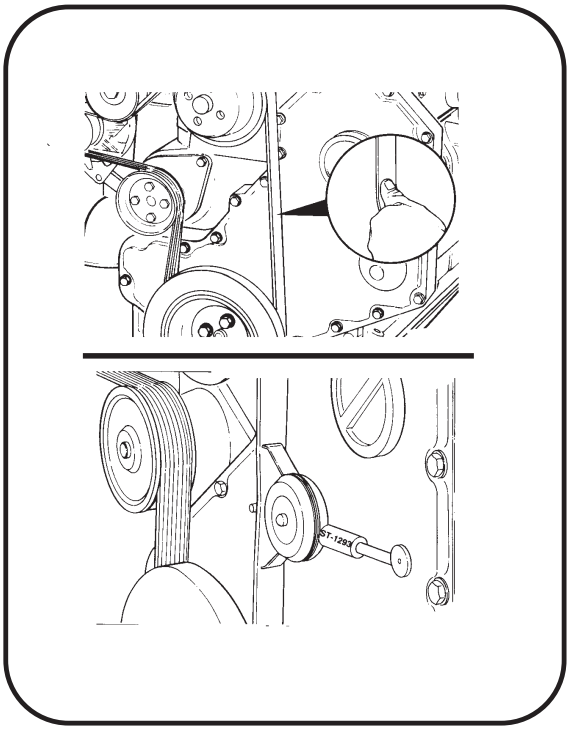
b. Preparation for Belt Check and Adjustment

All driven assemblies must be securely mounted in operating position before checking belt tension.

c. Checking Belt Tension

Check belt tension every 1000 hours, or once a year, whichever comes first. A belt which is too tight is destructive to bearings of the driven part. A loose belt will slip and cause inefficient operation of the part being driven as well as wear to the belt.

Belt tension may be checked either with a gage or manually. Use Cummins Belt Tension Gage no. ST-1293, or equivalent. Gage should indicate 90 to 110 pounds. If a gage is not available, tension may be checked manually by depressing the belt with the index finger to determine the amount of belt deflection obtained when force of approximately at a point halfway between pulleys on the longest span of the belt.



Checking Belt Tension

Figure 9

d. Check Fan Belt

(1) Check belt tension (see Para. 7, C, above).

(2) Remove the drive belt by lifting on the belt tensioner with a 1/2 square drive. The belt can then be slid off the water pump pulley and worked off the other pulleys and around the fan.

(3) Inspect the belt for damage.

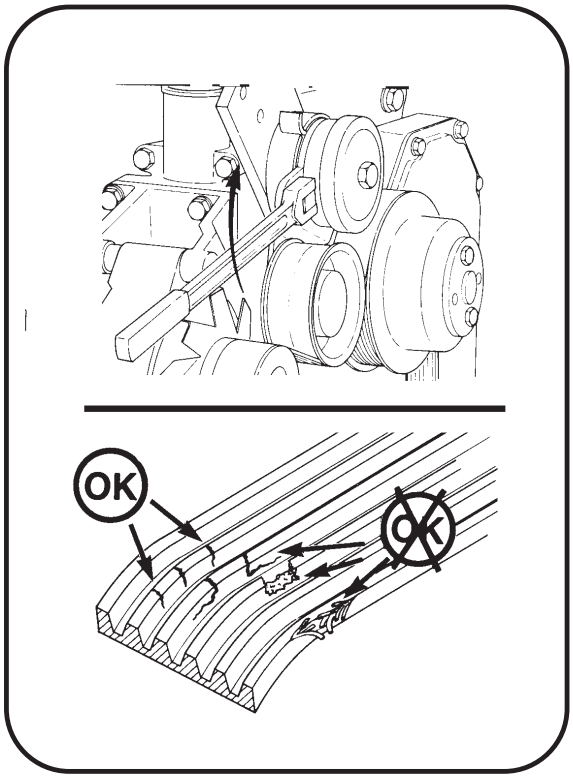
a. Traverse (across the belt width) cracks are acceptable.

b. Longitudinal (direction of belt length) cracks that intersect with transverse cracks are unacceptable.

(4) Replace the belt if it has unacceptable cracks, is frayed or has pieces of material missing.

(5) Check the belt tensioner while the belt is removed. It should spin freely without any wobble or excessive (0.006") end play.

(6) Install the drive belt.



Removing & Inspecting the Drive Belt

Figure 10

7. Generator Maintenance

The 400 Hz generator required 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 not recommended because the use of steam and harsh chemical compounds may result in damage to insulation an other generator components.

WARNING

Do not use a flammable solvent. Be sure the unit is completely dry before operating

b. Adjustment

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

8. Voltage Regulator Maintenance/Repair

When the voltage regulator is working properly, no maintenance is necessary. However, if the generator set is used in a dusty environment, the regulator should be periodically cleaned with compressed air.

The voltage regulator, which is in fact a PC board, does not lend itself to field 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. 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. To remove and replace voltage regulator PC board, proceed as follows:

a. Disconnect the 16-pin connector.

b. Remove the nuts and washers which attach the voltage regulator to the four shock mounts which are attached to the inside right panel of the control box. Exercise care to avoid breaking or dropping the PC board.

c. Place the new voltage regulator PC board on the four shock mounts from which the defective PC board was removed, and fasten the new PC board securely in place with the nuts and washers which were previously used.

d. Re-connect the 16-pin connector, and make certain that this connection is securely made.

9. Transformer-Rectifier Maintenance

a. General

To make certain the transformer-rectifier is ready for operation at all times, it must be inspected and maintained systematically and regularly so that any defects will be discovered and corrected before thay result in serious damage or complete failure of the equipment.

WARNING

Stop operation immediately if a serious or possible dangerous fault is discovered.

b. Lubrication

The T-R requires no lubrication.

c. Inspection

A periodic inspection schedule should be established and maintained. If the T-R is part of a generator set, inspections should be scheduled to coincide with similar inspections for the parent machine. Inspect as follows:

(1) **Open the front control panel. Remove the top cover.** *(Rear panel and side may be removed after the top is removed).*

WARNING

Be sure no input power can reach the t-r. lethal electrical shock hazard exists.

(2) **Inspect leads and cables for deteriorated or damaged insulation and visually inspect all components, terminals, etc., for discoloration and evidence of overheating caused by loose connections, etc.**

(3) **Check all accessible terminals and connectors for security.**

(4) **Check both fuses located on the control panel of the T-R.**

d. Cleaning

Use dry, compressed air to clean the interior of the T-R each time it is inspected.

10. Servicing and Troubleshooting the Cold Weather Starting Aid

CAUTION

When servicing or troubleshooting the cold weather starting kit, make certain that this work is done in a well ventilated area. Goggles should be worn to protect eyes when servicing this kit.

Many vehicle components can affect cold weather starting. The following instructions are limited to troubleshooting of the dieselmatic System. The most common problems are (1) an empty fluid cylinder, and (2) a clogging metering orifice.

a. Check Fluid Cylinder Contents And Valve Gasket.

(1) Clean all dirt from neck of cylinder and top of valve before removing the fluid cylinder. Protect top of valve from dirt when cylinder is removed.

(2) An empty net weight 21 oz. fluid cylinder weighs 16 oz. (454 gr.), and a full fluid cylinder weighs 37 oz. (1049 gr.).

(3) Check that fluid cylinder has pressure.

(4) Check valve gasket. If gasket inside valve is damaged or worn, replace with a new gasket, KBI Part Number 300012. Make sure only one gasket is used, as two gaskets would prevent valve from operating.

(5) Cylinder, or its replacement, should be reinstalled hand tight. Coupling Dirt Eliminator may be transferred from old cylinder to new cylinder or replaced with a new one, KBI Part Number 300830.

b. Check of electrical system.

WARNING

Electrical shock can kill. Do not touch live electrical parts.

(1) Check to see if fuse is blown. Check all wiring for loose connections, shorts, and broken wires.

(2) Check that the Dieselmatic System is wired correctly.

NOTE: To check system for proper operation, the Engine Temperature Sensor (ETS) must be below 40^0F (4^0C) or be bypassed by connecting the valve's black lead directly to a good ground. After checking be sure to reconnect the black lead in accordance with Connection Diagram 281329.

(3) Test valve by removing fluid cylinder and momentarily engaging cranking motor. Valve plunger should move up and remain up while cranking motor is engaged. If valve operates, proceed to step (5).

(4) If valve plunger did not function, check valve by disconnecting leads from cranking motor and ground. Momentarily touch leads directly across battery terminals. The valve plunger should move up and remain up until the leads are disconnected. If the valve does not activate when connected across the battery it is faulty and should be replaced.

(5) Check Engine Temperature Sensors (ETS) Switch by chilling to sub-freezing temperatures. At cold temperatures, the ETS Switch should close (i.e. show continuity). Check with a DC powered test light or ohmmeter. At warm temperatures, the ETS Switch should open (i.e. not show continuity). The closing and opening temperature should be about 40^0F (4^0C). If either continuity test fails, ETS Switch should be replaced.

c. Check for clogging of flow Metering Orifice Fitting

CAUTION

When servicing or troubleshooting the cold weather starting kit, make certain that this work is done in a well ventilated area. Goggles should be worn to protect eyes when servicing this kit.

The Dieselmatic's fluid flow rate is controlled by serviceable filtered metering orifice inside the fitting at the bottom of the valve assembly. See Figure 2. The following procedure is recommended when checking for clogging:

(1) Remove system's nozzle from engine.

(2) If starting fluid does not spray from nozzle when the system is activated, disconnect tubing from valve fitting. If starting fluid sprays from the fitting when the system is activated, check tubing for kinks, burns, cuts, clogs, or for a clogged nozzle. When performing these two operations, be sure to spray fluid into an appropriate container.

(3) If starting fluid does not spray from valve fitting, it should be removed from valve and cleaned.

NOTE: Fitting end installed in valve has left hand threads.

The filter may be removed from the fitting. It can be washed in clean solvent and blown with compressed air. For best results, replace filter with a new one, KBI Part Number 300813. Reassemble filter with "O" ring into fitting.

(4) It is suggested before clean filtered assembly is reinserted into valve, that valve be flushed by activating the system. When performing this operation, be sure to spray fluid into an appropriate container.

(5) Reinsert clean filtered fitting assembly into valve. Remember: left hand threads. Reinstall system's nozzle into engine. Reconnect tubing to valve fitting and nozzle.

(6) Check all fitting and tubing connections for leaks.

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Section 3. Adjustment/Test

1. General

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

2. Testing the Generator Set

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 H mark on gage rod.

(3) Check radiator coolant level (Ref. 2-2, Para. 5).

(4) Check tension of fan and generator V-belts. (See 2-2, Para. 6.)

(5) If governor throttle linkage was disturbed, check all linkage to make certain engine speed may be controlled when the engine is started. Refer to Paragraph 3, e, (1) and see Figures 4 and 4A

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

(7) If the setting of the output voltage coarse adjustment potentiometer (32, Fig.1) on the voltage regulator has been disturbed, set it at CENTER position (halfway between full clockwise position and full counterclockwise position).

(8) Check engine circuit fuse (14, Fig. 1) by placing panel light switch (4) in ON position. If panel lights (2) operate, the circuit breaker, switch, and lamps are good.

(9) Check fault indicating lights (15) by pressing light test switch (16). If lights glow, the protective system circuit breaker (13) and indicating lamps are good.

(10) Make a general inspection of all wiring, and terminals. Inspect the equipment to be certain no damage will result from starting the engine.

CAUTION

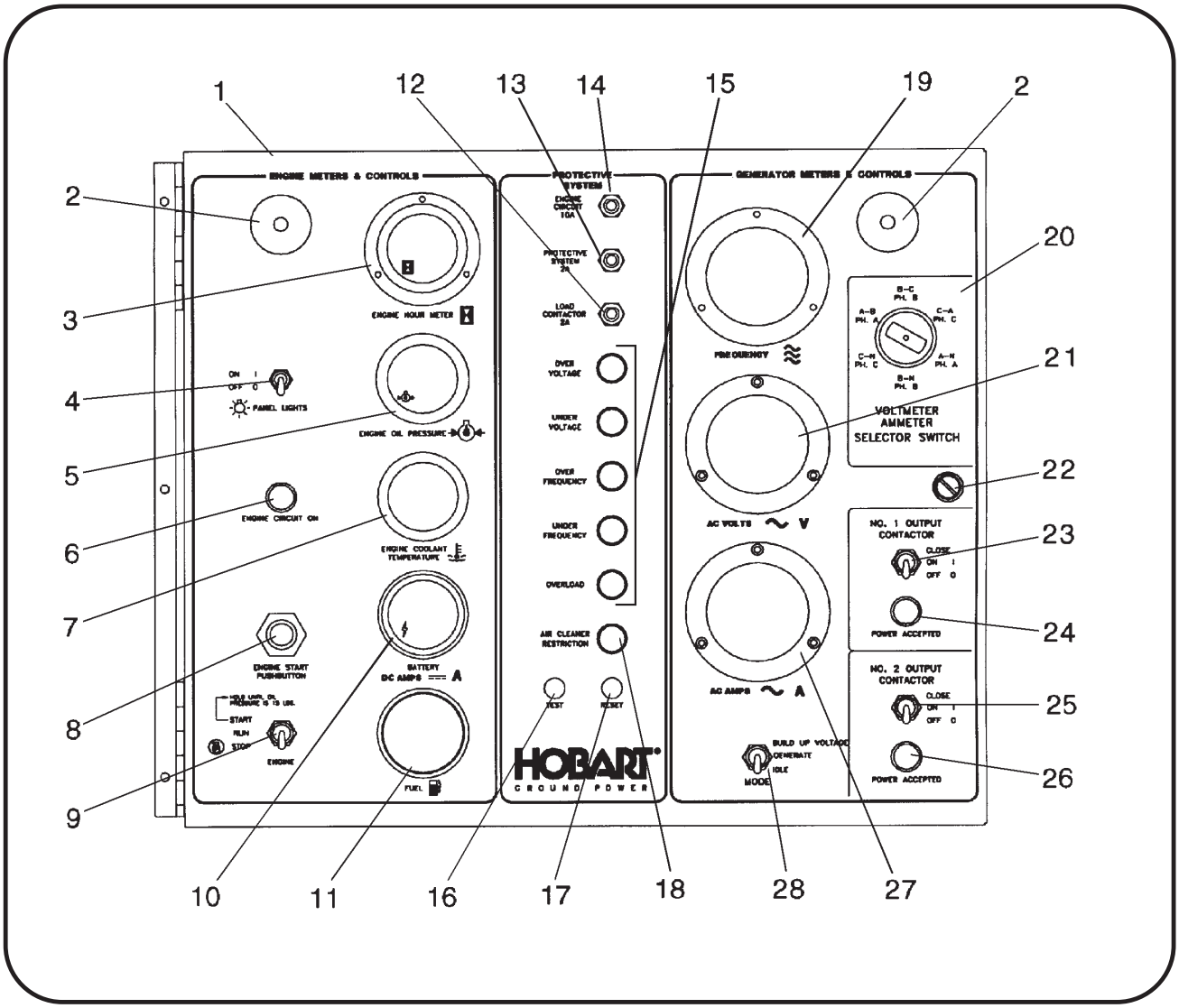
Engine must not be running when flashing exciter field if voltage regulator damage is to be prevented. Do not leave regulated/diagnostic switch in diagnostic position after flashing field.

(11) **At initial start-up after generator overhaul or repair, "flash" the exciter field by momentarily applying 12-V DC to the field windings. To flash the exciter field, place the Regulated/Diagnostic switch** *(31, Fig. 1)* in the **DIAGNOSTIC** position for 3 to 5 seconds. Then return it to the **REGULATED** position.

(12) Check position of load contactor switches (23 and 25, Fig. 1), and engine-generator switch (28).

a. Load contactor switches must be in OFF position.

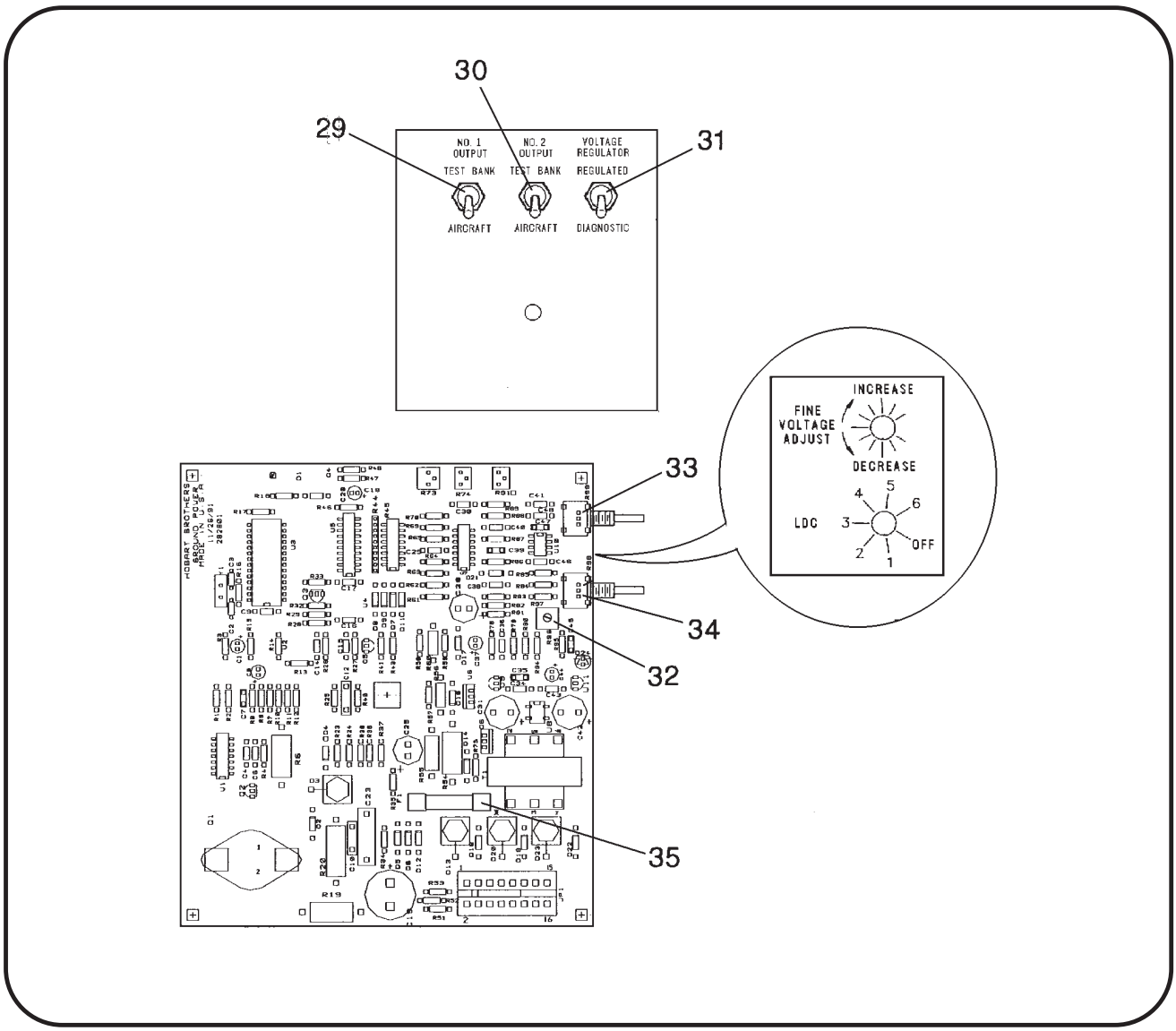
b. Engine-generator control switch must be in IDLE position.



1. Front panel
2. Panel light
3. Engine hour meter
4. Panel light switch
5. Oil pressure gage
6. Engine ON indicating light
7. Engine coolant temperature meter
8. Engine start switch
9. Engine control switch
10. Engine ammeter
11. Fuel gage
12. Load contactor circuit breaker
13. Protective system circuit breaker
15. Protective system indicating lights
16. Test switch, protective system
17. Reset switch, protective system
18. Indicating light, air cleaner restriction
19. Frequency meter
20. Selector switch, voltmeter-ammeter
21. Voltmeter
22. Adjustable grip latch
23. No. 1 contactor switch
24. No. 1 contactor power On light
25. No. 2 contactor switch
26. No. 2 contactor power On light
27. Generator ammeter

Operating Controls and Instruments

Figure 1 (Sheet 1 of 2)



29. Test bank-aircraft switch, No. 1 output
30. Test bank-aircraft switch, No. 2 output
31. Regulated-diagnostic switch
32. Output voltage adjustment (coarse)
33. Output voltage adjustment (fine)
34. Line drop compensation adjustment
35. Fuse (5-amp)

Operating Controls and Instruments

Figure 1 (Sheet 2 of 2)

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 (10, Fig. 1), coolant temperature indicator (7), oil pressure gage (5) and hourmeter (3).

(3) Check engine idle speed. Should be 850 +/- 25 RPM. If adjustment is necessary, adjust the idle speed potentiometer on the governor control box.

NOTE: A stroboscope is required for this check.

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

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

a. Place regulated-diagnostic switch (31, Fig. 1) in REGULATED position.

b. Place test-bank switches (29 and 30) in AIRCRAFT position.

c. If the of the output voltage coarse adjustment potentiometer (32) on the voltage regulator regulator has been disturbed, place the knob at mid-range position.

(6) Bring the engine up to governed speed and also energize the generator by holding the engine-generator control switch (28) in BUILD-UP-VOLTS position momentarily. Release switch and allow it to position in center RUN position.

If the engine comes up to governed speed and a voltage value appears on the voltmeter (), the electric governor and excitation-deenergization relay circuits are functioning.

(7) Observe frequency meter (19). 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. 6.

(8) Observe voltmeter (21). Use output voltage coarse adjustment potentiometer (32) to adjust voltage to 115 or 240 V AC as required.

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

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

(11) Check high-speed limiting governor.

Engine limiting speed governor should limit engine speed to approximately 2640 RPM.

(12) Check adjustable voltage range.

a. Observe voltmeter (21) and turn output voltage coarse adjustment potentiometer (32) to full CLOCKWISE position. Maximum voltage should be 134 volts or higher.

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

b. Observe voltmeter and turn regulator potentiometer knob to full COUNTERCLOCKWISE position. The minimum voltage should be 95 volts or lower.

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

c. Testing the No. 1 output circuit

(1) Make certain that the No. 2 contactor on-off switch (25, Fig. 1) is in the OFF position. Then place the No. 1 load contactor on-off switch (23, Fig. 1) in the top, spring-loaded, ON position. Hold in this position momentarily. The No. 1 contactor power ON indicating light (24) should glow GREEN and an amperage value should appear on the AC ammeter (27).

(2) Release the No. 1 load contactor switch and allow it to return to the center ON position. The No. 1 load contactor should open immediately, and the No. 1 ON indicating light should go OFF. This is because the plug interlock relay (Ref. 1-1; 5, Fig. 7) is not receiving power from an outside source of 28 V DC. It indicates that the No. 1 plug interlock relay's contacts are OPEN as they should be when the interlock coil is not receiving 28 V DC power.

(3) Open the control panel door and place the No. 1 test bank switch (29) in TEST BANK position.

(4) Place the No. 1 load contactor switch (23) in the top, ON position. The No. 1 contactor power ON indicating light (24) should glow GREEN and remain ON when the switch is released and allowed to return to the center ON position. This indicates that the No. 1 test bank switch (29) is functioning to bypass the plug interlock relay.

(5) Return the No. 1 test bank switch to AIRCRAFT position. The load contactor should open at once and the green indicating light (24) should go off.

(6) 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 is important. Connect plus (+) to terminals E or F, and minus (-) to terminal N.

(7) With test-bank switch in AIRCRAFT position, hold the No. 1 contactor operating switch (23) in top, ON position momentarily. The No. 1 contactor power ON indicating light (24) 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.

(8) Apply 1/3 to 1/2 load (30 to 45-KVA) at the load bank and allow the unit to run for 15 to 30 minutes. Observe operation of all monitoring instruments.

(9) Increase load at the load bank to 90-KVA.

(10) Check operation of the governor by observing the frequency meter (19, Fig. 1) when generator is switched from no load to full load. and vice versa. Use the No. 1 contactor control switch (23) 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)).

(11) Follow instructions in Para. 3, B, (2) (b) to set voltage regulator line drop compensation for the length and size of cable being used.

(12) Check voltage regulator, at intervals, from no load to full load and on up to 125% load. Observe and note voltage at various loads. Voltages should vary no more than +/- 1% from normal output voltage.

(13) Operate the No. 1 output circuit of the unit not less than 10 minutes under full 90-KVA load. The overload device (Ref. 1-1; 11, Fig. 9) MUST NOT trip.

(14) Operate the No. 1 output circuit of the unit at 125% load (325 amperes) for 5 minutes immediately following the full load run. The overload device MUST trip within 5 minutes, and the overload indicating light on the engine generator control panel must come ON to indicate an overload condition.

(15) Reduce load to normal. Turn off overload indicating light by pressing reset switch (17, Fig. 1).

d. Testing the No. 2 output circuit

(1) Make certain that the No. 2 contactor on-off switch (23 Fig. 1) is in the OFF position. Then place the No. 1 load contactor on-off switch (25, Fig. 1) in the top, spring-loaded, ON position. Hold in this position momentarily. The No. 2 contactor power ON indicating light (26) should glow GREEN and an amperage value should appear on the AC ammeter (27).

(2) Release the No. 1 load contactor switch and allow it to return to the center ON position. The No. 2 load contactor should open immediately, and the No. 1 ON indicating light should go OFF. This is because the plug interlock relay (Ref. 1-1; 5, Fig. 7) is not receiving power from an outside source of 28 V DC. It indicates that the plug interlock contacts are OPEN as they should be when the interlock coil is not receiving 28 V DC power.

(3) Open the control panel door and place the No. 2 test bank switch (30) in TEST BANK position.

(4) Place the No. 1 load contactor switch (25) in the top, ON position. The No. 2 contactor power ON indicating light (26) should glow GREEN and remain ON when the switch is released and allowed to return to the center ON position. This indicates that the No. 2 test bank switch (30) is functioning to bypass the plug interlock relay.

(5) Return the No. 2 test bank switch to AIRCRAFT position. The load contactor should open at once and the green indicating light (26) should go off.

(6) 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 is important. Connect plus (+) to terminals E or F, and minus (-) to terminal N.

(7) With test-bank switch in AIRCRAFT position, hold the No. 2 contactor operating switch (23) in top, ON position momentarily. The No. 2 contactor power ON indicating light (26) 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.

(8) Apply 1/3 to 1/2 load (30 to 45-KVA) at the load bank and allow the unit to run for 15 to 30 minutes. Observe operation of all monitoring instruments.

(9) Increase load at the load bank to 90-KVA.

(10) Check operation of the governor by observing the frequency meter (19, Fig. 1) when generator is switched from no load to full load. and vice versa. Use the No. 1 contactor control switch (25) 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)).

(11) Follow instructions in Para. 3, B, (2) (b) to set voltage regulator line drop compensation for the length and size of cable being used.

(12) Check voltage regulator, at intervals, from no load to full load and on up to 125% load. Observe and note voltage at various loads. Voltages should vary no more than +/- 1% from normal output voltage.

(13) Operate the No.2 output circuit of the unit not less than 10 minutes under full 90-KVA load. The overload device (Ref. 1-1; 12, Fig. 9) MUST NOT trip.

(14) Operate the No. 2 output circuit of the unit at 125% load (325 amperes) for 5 minutes immediately following the full load run. The overload device MUST trip within 5 minutes, and the overload indicating light on the engine generator control panel must come ON to indicate an overload condition.

(15) Reduce load to normal. Turn off overload indicating light by pressing reset switch (17, Fig. 1).

e. Testing the main generator overload circuit

(1) Place the No. 1 load contactor on-off switch (23, Fig. 1) in the top, spring-loaded, ON position. Hold in this position momentarily. The No. 1 output indicating light (24) should glow GREEN, indicating that the No. 1 load contactor circuit is operational.

(2) Place the No. 2 load contactor on-off switch (25, Fig. 1) in the top, spring-loaded, ON position. Hold in this position momentarily. The No. 2 output indicating light (26) should glow GREEN, indicating that the No. 2 load contactor circuit is also operational.

(3) Operate the unit not less than 10 minutes under 120-KVA load. The main generator overload device (Ref. 1-1; 5, Fig. 9) MUST NOT trip.

(4) Operate the unit at 125% load (434 amperes) for 5 minutes immediately following the full load run. The main generator overload device (Ref. 1-1; 5, Fig. 9) MUST trip within 5 minutes, and overload indicating light on engine-generator control panel must come ON to indicate an overload condition.

(5) Turn off the load at the load bank. Turn off overload indicating light by pressing reset switch (17, Fig. 1).

f. Testing and checking meters, switches, relays, and indicating lights

(1) Check accuracy of voltmeter

a. Open door of control box and connect a master voltmeter of known accuracy to terminals of the voltmeter (21).

b. Compare the unit's voltmeter reading with master meter. Error must not exceed 2% of full scale.

(2) Check accuracy of AC ammeter

a. Connect a master ammeter of known accuracy to the AC ammeter.

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

(3) Check operation of meter selector switch (20). A voltage value should be shown in each switch position.

a. In any LINE-TO-NEUTRAL position, voltmeter reading should be 115 volts.

b. In any LINE-TO-LINE position, voltmeter reading should be 200 volts.

(4) Check accuracy of frequency meter

a. Connect a master frequency meter of known accuracy to the terminals of the frequency meter (19).

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

(5) Check operation of protective system interlock (Ref. 1-1; 3, Fig. 7). With unit operating normally under load, open the protective relay circuit breaker (Ref. 13, Fig. 1). The load contactor should open immediately. This indicates that the protective system interlock relay is functioning properly. Close protective relay circuit breaker and apply load.

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

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

a. With the unit running at normal load, adjust the coarse adjustment potentiometer (32, Fig.1) of the voltage regulator CLOCKWISE to increase voltage until the overvoltage sensing relay actuates the protective monitor to open the load contactor and turn on the overvoltage indicating light. At 126 volts, the relay will trip after a 1-second time delay. At higher values of voltage, time delays for overvoltage trips are as follow:

- At 140 volts, the relay will trip within 160 milliseconds.
- At 180 volts, the relay will trip within 50 milliseconds.

b. If the load contactor does not open under the conditions described in step (a), refer to the Troubleshooting Chart in Section 2-4.

c. Return unit to normal operating conditions by adjusting coarse adjustment potentiometer (turning it counterclockwise) and pressing reset switch (17).

(7) This step checks operation of the undervoltage sensing relay, indicating light, and time delay circuit.

When the voltage is reduced to a predetermined value, the undervoltage sensing relay (1-1; 16, Fig. 7) activates the undervoltage time delay circuit. If the undervoltage condition continues for approximately 7 seconds, the time delay circuitry will open the protective monitor relay, which in turn opens the load contactor to stop power delivery and turns on the undervoltage indicating light (15, Fig. 1).

A stopwatch is required for this check.

a. With the unit running at normal load, use the output voltage coarse adjustment potentiometer (32, Fig. 1) on the voltage regulator to reduce the voltage to 104 volts. The load contactor should NOT open.

b. Reduce voltage in steps of 1 volt, with a time delay of 7 seconds between steps. At a setting of 100 volts, the load contactor will open and the undervoltage light will glow after a 7-second time delay.

c. If the load contactor does not open under the conditions described in step (b), refer to the Troubleshooting Chart in Section 3-1.

d. If the undervoltage circuit performs satisfactorily, return unit to normal operation by adjusting output voltage coarse adjustment potentiometer for normal output voltage, pressing the reset switch, and closing the load contactor.

(8) Check underfrequency sensing relay, protective monitor, and indicating light. At some frequency value from 375 Hz or less, after 5 seconds, the underfrequency sensing relay should 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 governed speed setting potentiometer (Ref. Fig. 6). Turn adjusting screw COUNTERCLOCKWISE gradually to reduce engine speed until frequency meter indicates 380 Hz. Underfrequency protective relay should not open the load contactor at this frequency.

b. Reduce frequency in steps of 1 Hz, , with a time delay of 5 seconds between steps.

c. If the protective system opens the load contactor and turns on the underfrequency light after 5 seconds at 375 Hz, all components of the system are functioning properly.

d. If the load contactor is not opened at 375 Hz after 5 seconds, refer to Troubleshooting Chart to determine which component is defective.

e. Return unit to normal operating condition.

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

At some frequency value from 426 Hz to 480 Hz, after 5 seconds, the overfrequency sensing relay should signal the overfrequency circuit in the protective monitor module to OPEN the load contactor holding circuit, thus OPENING the load contactor.

At any frequency value exceeding 480-Hz, the overfrequency sensing relay should immediately signal the overfrequency circuit in the protective monitor module to OPEN the load contactor holding circuit, thus OPENING the load contactor.

To check the overfrequency protective components, proceed as follows:

a. While the unit is operating normally under load, reduce generator output frequency by reducing engine speed. Use the governed speed setting potentiometer (Ref. Fig. 6). Turn adjusting screw CLOCKWISE gradually to increase engine speed until frequency meter indicates 420 Hz. Underfrequency protective relay should not open the load contactor at this frequency.

b. Increase frequency in steps of 1 Hz, with a time delay of 5 seconds between steps.

c. If the protective system opens the load contactor and turns on the overfrequency light after 5 seconds at 426 Hz, all components of the system are functioning properly.

d. If the load contactor is not opened at 426 Hz after 5 seconds, refer to Troubleshooting Chart to determine which component is defective.

e. Return unit to normal operating condition.

(10) If the generator is operating under load at this point, place the contactor control switch(es) (23 and 25, Fig. 1) in OFF position to open load contactors and disconnect load. There will be no further need for the load bank in the following check.

g. Re-checking the entire unit after testing

(1) 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.

(2) Check engine oil pressure at rated speed (2400 RPM). Gage should indicate at least 45 PSI when engine is hot. Check engine coolant temperature. Gage should indicate in the range of 180^{o} F to 190^{o} F, depending upon ambient temperature.

WARNING

If a metal sounding rod is used to detect bearing noises, exercise extreme care to avoid injury.

(3) Check 400 Hz generator bearings. Use a stethoscope or metal sounding rod to listen for unusual noises. If using a metal rod, place on 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. 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 adjustments of output voltage value and line-drop compensation. For making these adjustments, the voltage regulator has three potentiometers: (1) a coarse output voltage potentiometer, (2) a fine output voltage potentiometer, and (3) a line-drop compensation potentiometer. See Figure 1, Sheet 2 for identification of components used for regulator adjustment. For this adjustment, the generator set must be running at rated RPM, under no-load conditions. Adjust the regulator as follows:

(1) Adjustment

a. Adjust Voltage Control

The output voltage at which the generator is regulated is adjustable by the PC board fine output voltage adjustment potentiometer (33, Fig. 1). Turn the potentiometer adjustment clockwise (CW) to increase generator output voltage, and counterclockwise (CCW) to decrease voltage.

Observe the output voltage as indicated by the voltmeter which is located on the control panel of the generator set. Set output voltage at 115-V AC line-to-neutral (200-V AC line-to-line).

b. Adjust Line Drop Compensation

Adjustment of line drop compensation is made with the line drop compensation potentiometer (34, Fig. 1). Turning the potentiometer knob clockwise increases the magnitude of the compensation, and turning the potentiometer knob counterclockwise decreases the magnitude. To adjust the line drop compensation, proceed as follows:

- Connect the generator set output cables to a load. Load the generator set with the largest available three-phase load of rated power factor not exceeding the maximum rating of the generator set.
- Measure output voltage at the load end of the cables. If the load voltage rises or drops more than 1% at the load end of the cables, decrease or increase the line drop compensation until the regulation is flat (115-V AC line-to-neutral and 200-V AC line-to-line).
- If the line drop compensation adjustments have affected the no-load voltage output, adjust the fine output voltage control potentiometer (34, Fig. 1) to the desired value.

(2) Test the Voltage Regulator

After necesssary adjustments have been completed, re-test the voltage regulator as follows:

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

b. Operate the generator set at no-load and observe voltage reading.

c. Operate the generator set under load and observe voltage reading.

d. Voltage under load should vary no more than 1% at the load end of the cables from voltage under no-load.

c. Basic Engine Adjustments

Adjustment procedures applicable to the diesel engine are included in the Cummins Operation and Maintenance Manual, which is located in Chapter 5. Specific information for these engines is listed in Figure 3. Refer to the Cummins Operation and Maintenance Manual for detailed information on the follwing engine adjustments.

(1) Exhaust valve adjustment

(2) Exhaust valve crosshead adjustment

(3) Fuel injector timing adjustment

(4) Engine idle speed adjustment

Engine idle speed is set at the factory. The adjustment is then sealed to discourage tampering. Idle speed should not be changed by the user. If adjustment is required, contact the local Cummins Distributor. The recommended idle speed is 650 RPM, +/- 25 RPM.

NOTE: A stroboscope is required for engine idle speed checks.

(5) Engine speed limiting adjustment

The speed limiting adjustment is also set and sealed at the factory. Speed should be limited to approximately 2640 RPM. If adjustment is required, contact your local Cummins Distributor.

d. Engine Accessories Adjustment

(1) Generator and fan belt adjustment

Refer to 2-2, Para. 7, D, and E, for belt adjustment instruction.

NOTE: Replace fan belts with a matched set if replacement is necessary.

Type engine	In-line 6 cylinder diesel
Model	Modified 6BTA5.9
Cummins specification no.	88-044-6BTA
Engine governed speed	2400 RPM
Idle speed	850 RPM (25 RPM
Speed limiting governor	approximately 2640 RPM
Firing order	1-5-3-6-2-4
Fuel pump speed limitimg governor	automotive type
Lubricating oil pressure at 2400 RPM	50 to 90 PSI
Engine coolant temperature	160 to 200 deg F. (71 to 93 deg C.)

Engine Specifications
Figure 2

e. Electric Governor System Adjustment

Two of the electric governor system main components, namely the magnetic pickup and electric control box, have critical adjustments which can affect engine performance and, therefore, generator output. Actuator-to-engine stop 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 control box.

NOTE: When making governor system adjustments, an important factor in such adjustments is the type of fuel used in the generator set. For the engine of this generator set, it is recommended that D-2 diesel fuel be used. However, Jet A-1 fuel may be used **IF** (and **ONLY** if) lube oil is added to the Jet A-1 fuel. Whenever there is a change in the type of fuel used - from D-2 diesel fuel to Jet A-1 fuel, or vice versa - it will be necessary to readjust the governor system for optimum performance.

(1) Acutator linkage adjustment

The proper adjustment of the mechanical linkage between the electric actuator and engine stop lever is important to the satisfactory operation of the complete system. Two definite rules must be followed in making the adjustment:

- Adjust linkage to use the full travel of actuator output shaft (1).
- Linkage must move engine fuel control lever from **NO FUEL** to **MAXIMUM SPEED** (2750 RPM) position to allow engine to pull 125% load.

Refer to Figure 3 while making linkage adjustments. With engine stopped, check and adjust linkage as folllows:

a. Before making adjustment, observe and note which hole in actuator lever (3) is used to mount ball joint (4). It does not necessarily have to be the same holes as previously used. Loosen the jam nut (5) that fastens the ball joint (4) to the threaded rod (6), and remove the ball joint (4) from the actuator lever (3).

b. Be sure neither lever (the actuator lever (3), or the engine stop lever) has slipped on shafts. If a lever has slipped, position it correctly and tighten securely.

c. Place both levers (3 and 7) in **NO FUEL** position and attempt to place ball joint (4) in the hole in actuator lever (3) from which it was removed in step (a). If placement cannot be made, loosen nut (5) and rotate the ball joint - inward or outward on the threaded rod - as necessary for making the placement.

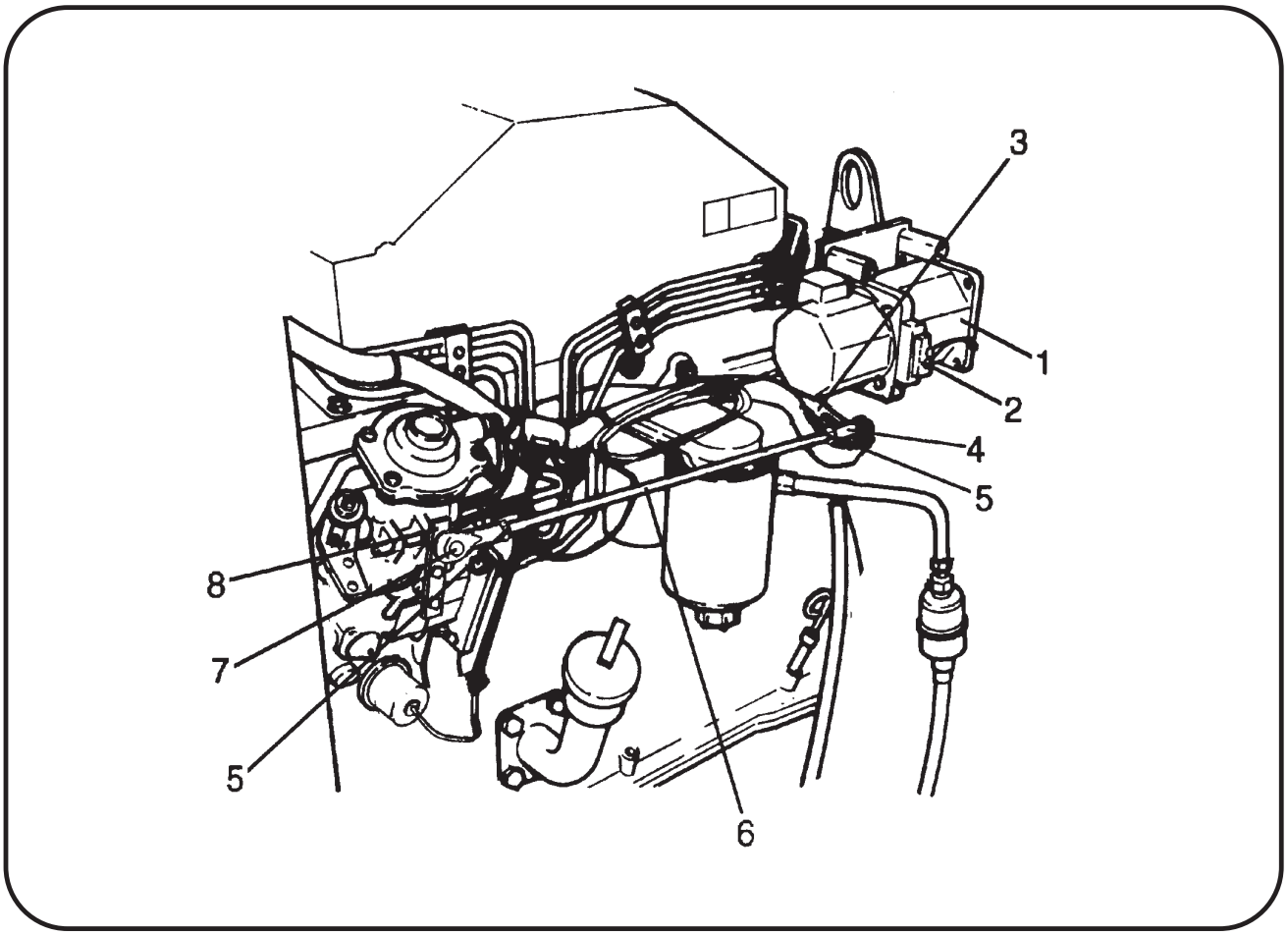
d. While holding the removed ball joint in its mounting hole in the actuator lever, manually operate actuator lever back and forth between **NO FUEL** and **FULL SPEED** to compare the **TRAVEL OF THE ACTUATOR LEVER** (3) with the **TRAVEL OF THE ENGINE STOP LEVER** (8). If adjustment is unsatisfactory, try another hole in the actuator lever and readjust the rod length.

e. When proper adjustment has been completed, tighten the jam nut on the threaded rod firmly against the ball joint.

f. Check governor linkage for freedom of travel. Move the rod assembly manually to see that there isn't any binding or lost motion in the linkage. Make corrections if and as required. At **NO FUEL** position, the actuator shaft shouls be pulled **ALL THE WAY FORWARD.** For MAXIMUM RPM, the actuator shaft should move far enough to force the engine stop lever to use **ALL OF ITS TRAVEL** as it moves **BACKWARD.**

NOTE: It may be necessary to comprimise on the adjustment if the amount of movement of both levers is not the same. If such compromise is necessary, the **NO FUEL** position should be compromised, and **NOT MAXIMUM RPM.**

g. Start the engine, and set idle speed to **850 +/- 25 RPM,** (Refer to Para. 3 (e) (3) (i) for procedure for setting idle speed). Operate engine at idle speed until it is warmed to operating temerature.



1. Actuator
2. Signal input connector
3. Actuator lever
4. Ball joint, acruator
5. Nuts (2)
6. Rod
7. Ball joint, engine stop lever
8. Engine stop lever

Governor Actuator Linkage

Figure 3

(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 or if it becomes damaged. If the pickup is removed for any reason, or if the signal is weak, as indicated by test in Para. 3, E, (4), (b), adjust the pickup as follows:

a. Disconnect magnetic pick-up wires at the terminal strip on the governor controller (terminals 10 and 11).

b. Loosen the jam nut (2, Fig. 4) and remove magnetic pickup (1).

c. Inspect to make certain the tip is not damaged from contact with the ring gear teeth. Replace pickup if it is damaged. If it isn't, clean the tip of it and re-install.

CAUTION

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

d. Rotate the engine as required to locate a ring gear tooth directly below the tapped, pickup mounting hole. Continue turning pick-up **CLOCKWISE** until it bottoms out (hits a ring gear tooth).

e. Back the magnetic pick-up outward 1/4 to 3/4 of a turn COUNTERCLOCKWISE. This creates a gap of approximately 0.028 inch between the tip of the magnetic pick-up and the ring gear.

f. Re-connect the pick-up wires to terminals 10 and 11 on the governor controller.

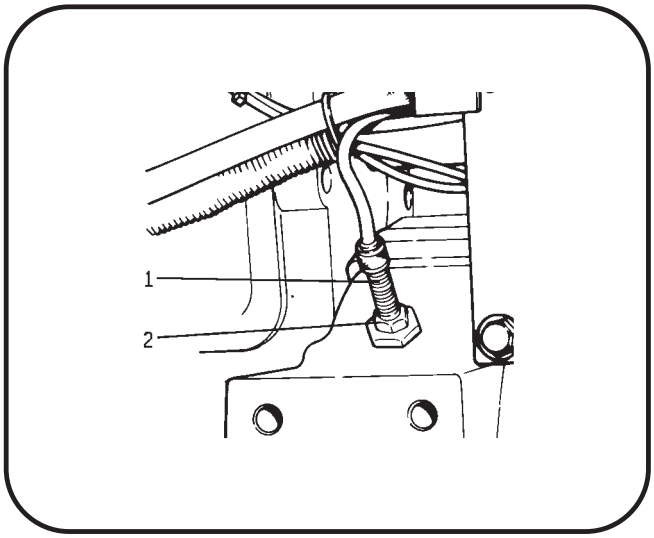
g. Start the engine and run it at idle speed.

h. Check voltage at terminals 10 and 11. The signal should read between10-V AC and 15-V AC.

i. If the signal is weaker than 10-V AC, check connections. If necessary, check magnetic pick-up continuity with an ohmmeter. If magnetic pick-up is open-circuited, replace it.

j. Tighten the jam nut when the pick-up is known to be good and is properly adjusted.

NOTE: A minimum of 2.5-V AC is required during engine cranking. This minimum voltage is necessary to energize the internal electronics of the control box. At rated speed, the magnetic pick-up voltage could go as high as 25-30-V AC without damage to the internal electronics of the control box.



1. Magnetic pickup
2. Nut

Magnetic Pick-up Adjustment

Figure 4

(3) Governor control unit adjustment

Refer to Fig. 5. The controller has three control potentiometers used to control the **IDLE** speed: 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. The new speed control board is used to adjust RPM's at the **RATED** speed setting. Make controller settings as follows:

a. Preliminary Controller Settings

- With the engine **OFF**, set the **"I"** adjustment at the **FOURTH** increment mark from zero.
- Set the **GAIN** adjustment at the **THIRD** increment mark from zero.
- Set **DROOP** adjustment **COUNTERCLOCKWISE** to minimum *(zero)* position.
- Turn the adjustment pot on the speed control board, all the way **COUNTERCLOCKWISE.** Then, turn the pot twelve (12) full turns **CLOCKWISE.**
- Start the engine, leave at **IDLE** and adjust the controller's **SPEED** potentiometer until the engine is operating at 850 RPM. Turning the adjustment **CLOCKWISE** increases engine RPM and turning it **COUNTERCLOCKWISE** decreases engine RPM.

b. Checking No-Load Operation of Controller

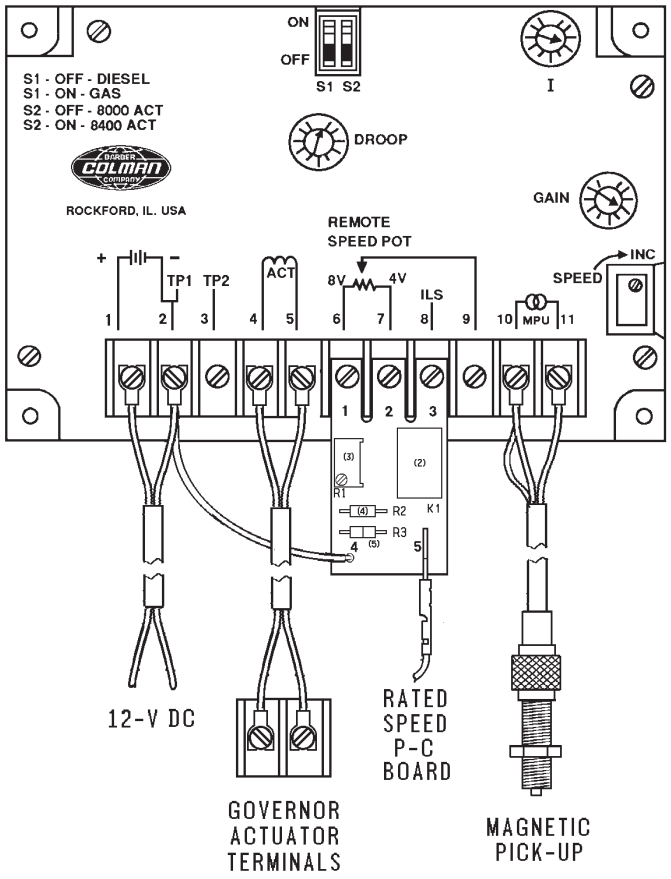
- Turn the **GAIN** potentiometer control slowly **CLOCKWISE** until the governor becomes unstable and the actuator lever oscillates. (If the actuator lever **DOES NOT** oscillate at this setting, upset the lever manually to cause it to oscillate).
- Next, turn the same **GAIN** potentiometer control slowly **COUNTERCLOCKWISE** until the governor becomes stable and the oscillations cease.
- Turn "I" potentiometer control slowly **CLOCKWISE** until the governor again becomes unstable and the actuator lever oscillates.
- If the governor **DOES NOT** become unstable and the lever **DOES NOT** oscillate, place **"I"** potentiometer control setting at approximately **EIGHT** increment marks from zero (or TWO increment marks from maximum setting).
- If the governor **DOES** become unstable, and the actuator lever **DOES** oscillate, turn the **"I"** potentiometer control slowly **COUNTERCLOCKWISE** until the governor becomes stable and the oscillations cease.
- Flip the engine MODE switch to the **BUILD-UP VOLTAGE** position. Let the engine stabilize, then flip the switch back to **IDLE.** Engine speed should stabilize within 3 to 5 diminishing oscillations. If it doesn't, repeat the first three steps above.

NOTE: For more accurate and dependable settings, when making **GAIN** and **"I"** adjustments, **ALWAYS** adjust **GAIN** before adjusting **"I"** and upset the throttle lever in between adjustments. If engine speed **STILL** doesn't stabilize, recheck governor linkage. If linkage is set properly, the governor controller is probably defective.

c. Adjusting for **RATED** Speed Operation

The function of the new soeed control board, is to govern the engine at **RATED** speed. To check for proper adjustment, proceed with the following steps:

- With the engine running and properly adjusted for **IDLE** speed, flip the engine **MODE** switch to the **BUILD-UP VOLTAGE** setting. The engine should be running at 2400 RPM and output frequency should be 400Hz.
- If the reading is high or low, operate the generator set at **RATED** speed, turn the adjustment pot on the speed control board in the **CLOCKWISE** direction to increase RPM's or **COUNTERCLOCKWISE** direction to decrease RPM's.
- After making any adjustments, switch to **IDLE** speed, allow the engine to stabilize, then switch back to **RATED** speed.



Electric Governor Control Box

Figure 5

d. Checking the Actuator

The actuator does not require any adjustments. An actuator malfunction, when it occurs, will result in the actuator being totally inoperative, either due to the actuator coil being open or shorted to the actuator case. Resistance measurements will reveal either of these conditions.

e. 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 engine speed to stabilize. Engine speed should stabilize within 3 to 5 diminishing oscillations. If this does not happen, proceed as follows:

- With the generator set operating at no load, turn the GAIN setting slightly in the **COUNTERCLOCKWISE** direction.
- Apply a load again to the generator set. Then remove the load again and observe the length of time required for engine speed to stabilize. It should now stabilize in 3 to 5 diminishing oscillations.

NOTE: If engine speed STILL doesn't stabilize, recheck governor linkage. If the linkage is set properly, the governor controller is probably defective.

f. Checking Magnetic Pick-up Signal

Connect a high inpedance voltmeter to magnetic pick-up input terminals *(10 and 11, Fig. 6)* on controller terminal board. The voltage value at no load, governed speed should be **4-V AC MINIMUM.**

NOTE: A signal as low as 2.5-V is sufficient to operate the control unit satisfactorily. If a no-voltage condition is indicated, the magnetic pick-up is too far away from flywheel teeth, or it is defective.

4. Generator and Exciter Test

The generator fields and exciter stators may be tested with a Kelvin bridge. This is a double-bridge type instrument required for the very low resistances encountered in this test. It is understood that 0 resistance indicates a **SHORT CIRCUITED** condition. An infinite resistance reading indicates an **OPEN CIRCUITED** condition. See Fig. 6 for resistance values.

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

b. Disconnect the two black exciter field leads from terminal block mounted on power module panel.

c. Check resistance and compare to values given in Figure 6.

Test Connection	Resistance (Ohms)
Generator Stator Phase A to N (G1)*	0.00235
Generator Stator Phase B to N (G1)*	0.00235
Generator Stator Phase C to N (G1)*	0.00235
Exciter Stator Field (RED to YELLOW-BLACK) (L2)	26.5
A - B, B - C, C - A Exciter Armature (G2)	0.1
Generator Revolving Field (L1)	2.1

***NOTE:** The two leads of a phase must be connected when test is made. Take readings when unit is cold and in an ambient temperature of 70 deg. F. (21 deg. C.)

Generator and Exciter Stator Tests
Figure 6

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:

a. Disconnect diode lead(s).

b. 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.

c. Hold one ohmmeter lead point on the threaded end of the diode. Hold the other lead point on the wire terminal end. Observe and note the indicated resistance. Now reverse the lead connection 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.

6. Transformer-Rectifier Test and Adjustment

a. General

This Section contains information for testing and adjusting the T-R after major parts replacement, or repair.

b. Test

The following test procedures may be used for testing the T-R following repair, or for checking performance.

(1) Preparation for Test

a. Connect the T-R to a load bank using two each, size 4/0 cables from each output terminal to the load bank rather than single 4/0 cables ordinarily used for aircraft service.

NOTE: It is recommended that this higher capacity output cable arrangement be used for applications where very large loads are connected to the T-R.

b. Check diode leads. Make certain they are not touching bus bars.

c. Make certain that each transformer bus has clearance between windings and other busing.

(2) Operational Test Procedure

a. Start generator set and adjust voltage to 115/200 Volts AC.

b. Operate the T-R by placing switch *(1-3; 8, Fig. 4)* in top **ON** position momentarily, then release. The green indicating light should glow to indicate power is available at output terminals.

c. Observe the voltmeter *(1-3; 3, Fig. 4).* It should indicate approx. 28.5-Volts DC. Attach a master voltmeter and compare meter reading. Voltmeter should be accurate to within plus or minus 2%.

d. Observe operation of fans and check direction of rotation. Air intake is at control panel end *(front).* Exhaust is at *(fan)* end *(rear).* If fan rotation is incorrect, reverse the connection of any two fan input leads.

e. Check adjustment of ammeter shunt.

Adjust the load bank to apply a load of **EXACTLY** 500 Amperes. Use a reliable master ammeter.

Observe the T-R ammeter *(1-3; 6, Fig. 4).* At 70 deg F *(21 deg C)* ambient temperature, the shunt should be adjusted to produce an indicated 450 Amperes on the ammeter. This rule for adjusting the shunt was selected to provide a more accurate reading through the entire ammeter scale range of 0 to 2500 Amperes and to provide a minimal error at rated 1050 Amperes continuous load.

If adjustment is required, refer to Ammeter Shunt Adjustment, Para. 6, C, (2).

NOTE: The aluminum bus bar, a portion of which serves as a shunt, is sensitive to both ambient temperature, and current-induced thermal changes. This means that under sustained heavy loads the ammeter reading could change considerably from the reading indicated at the beginning of a power delivery period. The ambient temperature selected for a true ammeter reading is 70 deg F (21 deg C). It has been determined that a temperature change of 9 deg F (approx. 3 deg C) will change the ammeter reading 2%. An increase in temperature results in an increase in indicated amperage, and a decrease in temperarue decreases the amperage reading. As a rule-of-thumb for approx. conversions, each degree of temperature change results in a change of 1 ampere in the indicated amperage, when the load is in the 500-Ampere range.

AMMETER SHUNT AMBIENT TEMPERATURE DEG. F	INDICATED DEG. C	T-R TRUE AMPERES	AMPERES
60 16	440	500	
70 21	450	500	
80 27	460	500	
90 32	470	500	
100	38	480	500
110	43	490	500

Ammeter Shunt Temperature Chart

Figure 7

f. Place current limiting control switch *(1-3; 9, Fig. 4)* in the **OFF** position. Adjust line drop compensation to minimum *(See 1-3; Fig. 5).* Loosen nut *(2)* and turn screw *(3)* fully CCW. Tighten nut.

g. With 500-Ampere load, observe the generator set ammeter. Input current to the T-R should be approx. 44 Amperes. Observe DC output voltage on T-R voltmeter. Indicated voltage should be approx. 26.5-Volts DC with line-drop compensation set to minimum.

h. Increase load to 1000 Amperes, and adjust the line-drop compensation *(See 1-3; Fig. 5).* Loosen nut *(2)* and turn adjusting screw *(3)* CW until 28.5-Volts DC is indicated on the voltmeter. Tighten nut *(2).*

i. Check current limiting rheostat and resistor adjustment.

With current-limiting switch *(1-3; 9, Fig. 4)* in the **OFF** position, apply a load of 1500 Amperes to the T-R.

Place current-limiting switch *(9)* in the **ON** position.

Observe ammeter *(6)* while operating the rheostat *(5).* If output amperage can be controlled through a range of 700 to 1500 Amperes, the resistor *(16)* is properly adjusted. The pointer which is attached to the rheostat knob is properly adjusted if it points to the same amperage value on the dial as that indicated on the ammeter.

If output current cannot be controlled through a range of 700 to 1500 Amperes, or if the pointer indicates a value other than that shown on the ammeter, adjustment is required. Refer to Para. 6, C, (3) for procedures.

j. Test overvoltage module

Place current limiting switch *(1-3; 9, Fig. 4)* in the **OFF** position. Operate switch *(8)* to close the load contactor. No load is required.

Observe T-R output voltmeter and gradually increase AC input voltage by adjusting the generator set voltage control rheostat.

Overvoltage module should function to open the T-R load contactor when output voltage reaches 32 to 34 Volts DC. Module should function in 2 to 10 seconds after trip voltage is reached.

k. Test themal overload thermostatic switches *(6, Fig. 15).*

Remove DC circuit fuse *(1-3; 10, Fig. 4).*

NOTE: Removing the fuse prevents operation of overload module

Apply a 2500-Ampere load.

Thermostatic switches should function to open the load contactor in less than 20 seconds**.**

CAUTION

Do not maintain 2500-ampere load for more than 2 minutes. damage to equipment may result.

l. Replace the DC circuit fuse and allow T-R to cool 15 to 20 minutes, or until exhaust air is the same temperature as ambient intake air.

m. Test overload module.

Use a jumper lead to short-out the thermostat switches.

Apply a sustained minimum load of 2250 Amperes to the T-R. The overload module should function to open the load contactor within 5 minutes.

NOTE: An output load of 2500 Amperes DC will cause the overload module to function in approx. 30 seconds.

A line current (input) of 182 Amperes is required to produce 8.25-Volts AC across the burden resistors for this test.

CAUTION

Do not run this test for more than 7 minutes.

Remove the jumper lead across the thermostat switches.

(3) Test Silicon Diodes

CAUTION

Do not apply a megger or any high potential test equipment in any manner that subjects the silicon diodes and other components to abnormal voltages. Silicon diodes must be isolated or shorted with extremely short leads. Such tests must be made under the supervision of a factory representative.

a. Disconnect diode leads

b. Use a good quality ohmmeter (preferably one having a mid-scale value of approx. 50 ohms) to measure resistance values.

c. Zero the instrument on the RX 1 scale.

d. Take and note a reading by placing either ohmmeter lead on the threaded end of the diode and the other lead on the diode lead.

e. Reverse the ohmmeter leads on the diode, take and note another reading.

f. The diode may generally be considered good if:

- One reading is infinite or very high.
- The other reading is extremely low.

NOTE: An acceptable low ohmic value or range cannot be given because ohmmeter readings may vary between meters, or even between diodes with the same rating.

c. Adjustment

(1) Line-Drop Compensation

Adjustment procedures, which were outlined in a previous Section, are repeated here.

a. Apply a 1000-Ampere DC load to the T-R.

b. Open control panel.

c. Refer to 1-3; Fig. 5 and loosen nut *(2).* Adjust screw *(3)* to produce a voltmeter reading of 28.5-Volts DC. Turn screw CW to increase voltage; CCW to decrease voltage.

d. Tighten nut *(2)* when adjustment is completed.

(2) Ammeter Shunt

No adjustment of the shunt should be required unless it has been disassembled.

a. Apply a load of exactly 500 Amperes. Use a reliable ammeter to make certain the load is 500 Amperes.

b. Indicated amperage as observed on the T-R ammeter should be 450 Amperes. Use chart Figure 7, and Para. 6, B, 2, *(e) (f)* to compensate for ambient temperature.

c. Stop all operations; T-R and generator set. Remove T-R top, and reposition adjusting nuts *(4, Fig. 2)* to adjust shunt. Lengthen the shunt to increase the ammeter reading. Shorten the shunt to decrease the reading. Tighten the adjusting nuts.

d. Start the generator set and reapply load to check ammeter reading.

e. Turn both generator set and T-R **OFF** and repeat step *(3)* if further adjustment is required.

WARNING

Do not adjust while the generator is running. lethal electrical shock hazard exists.

f. Install T-R top after adjustment is satisfactorily completed.

(3) Range of Current Limiting Rheostat

This adjustment should be required only if the resistor is replaced or if the adjustment is tampered with.

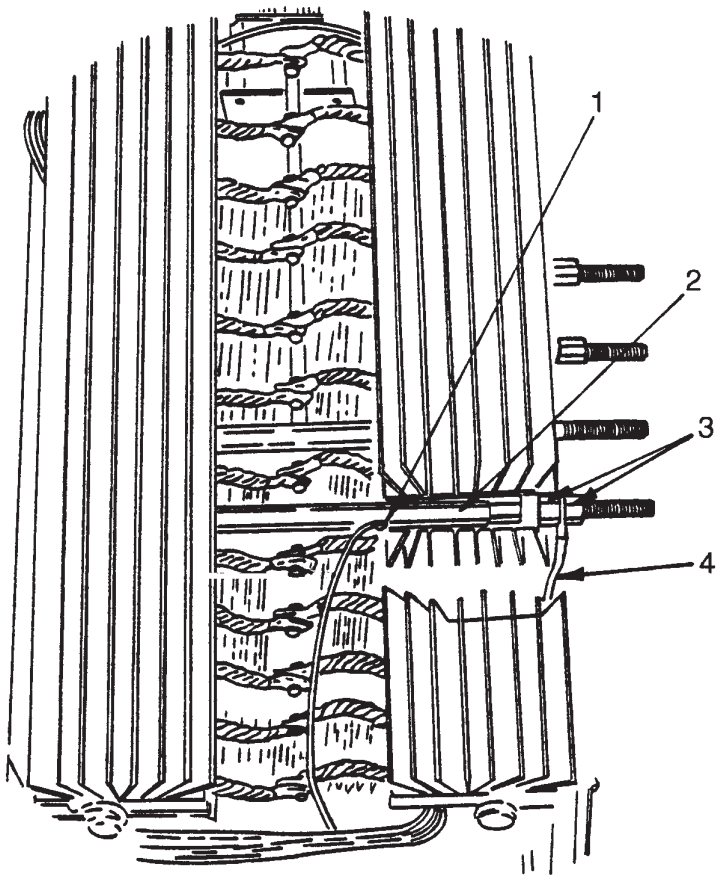
a. Turn all power **OFF.**

b. Open the control panel and use a reliable ohmmeter to check resistance across current-limiting, range-adjusting resistor *(Fig. 9).* Resistance should be 40 Ohms. If not, loosen the adjusting band *(2)* and slide it toward the end of the resistor where the band lead is connected, to increase resistance. Slide the opposite direction to decrease resistance. When a resistance of 40 Ohms is indicated, tighten the band clamping screw. Close the control panel.

c. With current-limiting switch **OFF**, apply a load of 1500 Amperes to the T-R.

d. Turn current-limiting switch **ON.** Observe ammeter *(1-3; 6, Fig. 4)* and operate the current-limiting rheostat *(5)* throughout its complete range. Output current should be controllable from 700 to 1500 Amperes.

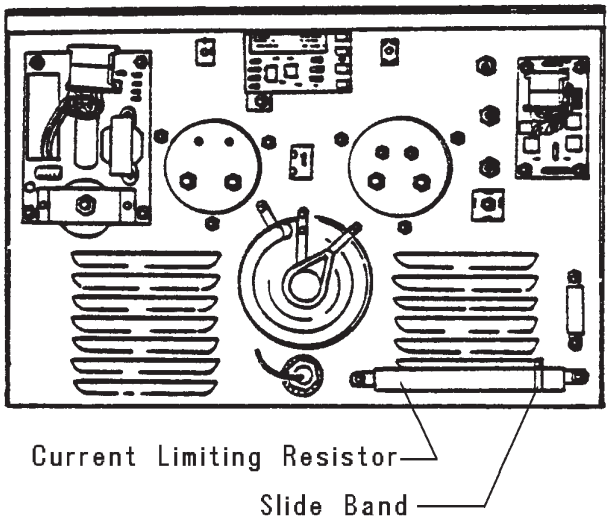
e. Rotate rheostat to obtain an ammeter reading of 1000 Amperes. Observe amperage indicated by the rheostat knob pointer. If the pointer does not indicate 1000 Amperes, on the dial, loosen the pointer attaching setscrew and position the pointer to indicate exactly 1000 Amperes. Tighten setscrew.



1. Lead attaching screw
2. Ammeter shunt [(the portion of aluminum rod between screw (1) and nuts (3)]
3. Adjusting nuts
4. Ammeter leads

Ammeter Shunt Adjustment

Figure 8



Current-Limiting Range Adjustment

Figure 9

Section 4. Troubleshooting Procedures

1. General

The Troubleshooting Chart, beginning on Page 6, covers the common malfunctions which you may find during operation or maintenance of this equipment. It cannot list all malfunctions that may occur. If a malfunction is not listed in the chart, start looking for the cause at the source of power in the affected circuit. Refer to the schematic and connection diagrams in Chapter 5 and test the circuit, step by step, until the source of the malfunction is isolated.

The Troubleshooting Chart is arranged under 3 headings: Malfunction, Test or Inspection, and Corrective Action. Malfunctions are described and numbered. Tests and Inspections are indented to the right and listed in numbered steps below Malfunctions. Corrective Action provides instructions for correcting the malfunction, and is listed below each Test or Inspection procedure. Tests and inspections called for in the Troubleshooting Chart are to be performed as described in section 2-3 of this manual.

2. Equipment for Troubleshooting

WARNING

Exercise extreme care to avoid contact with high voltage leads and components. High voltage can kill!

CAUTION

Maintenance personnel must be very careful when performing terminal-to-terminal checks to be certain the proper terminals are being used, especially when using jumper leads. Damage to electrical components may result from the application of improper voltage and current.

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

3. Parts Replacement

To lessen end item down time and to get a faulty machine back on line as quickly as possible, the black-box concept of parts replacement is reflected in the Troubleshooting Chart. For example, if a component is 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 to stock. Assemblies which lend themselves to this concept are:

- Electric governor control box
- Electric governor actuator
- Voltage regulator
- Over-Undervoltage PC board
- Protective monitor PC board
- Over-Underfrequency PC board
- Overload PC boards

4. Test Values

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

Generator output voltage at maximum voltage regulator potentiometer setting: 134 volts or higher.

Generator output voltage at minimum voltage regulator potentiometer setting: 108 volts or lower.

Overvoltage relay	Trips at 126 volts after a 1-second time delay. Trips at 140 volts in 160 milliseconds. Trips at 180 volts in 50 milliseconds.
Undervoltage relay	Trips at 100 volts after 7 seconds.
Overfrequency relay	Trips at any value between 426-Hz and 480-Hz after a 5-second time delay. Trips immediately at any frequency exceeding 480-Hz.
Underfrequency relay	Trips at 375 Hz or less after a 5-second time delay.
Overload time delay	Trips in approximately 5 minutes at 125% load on either output or on both outputs.

Frequency at rated speed of 2400 RPM is 400 +/- 2 Hz at no load and rated load.

Engine oil pressure (warm and at rated speed 2400 RPM) 50 to 90 PSI (445 to 621 kPa).

Engine coolant temperature (normal operation) 160 to 200 deg. F. (71 to 93 deg. C.).

5. 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.

6. Electric Governor Troubleshooting

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.

(1) The system requires two sources of power to operate normally.

a. 12 V DC input power (from engine electrical system)

b. 4 V AC input power (from magnetic pickup)

(2) Assuming other conditions are normal, the actuator will go to, or remain in IDLE position under the following conditions:

a. No 12 V DC power

b. No voltage from control box to actuator

(3) The actuator will surge under the following conditions:

a. Stability or gain adjustment set too high

b. Actuator linkage loose

c. Actuator linkage binding

7. Engine Troubleshooting

The ability of the engine to start and run properly depends upon a number of things.

(1) An adequate supply of 12 V DC power reaching a good starter and starter switch.

(2) Sufficient 12 V DC power reaching the fuel shutoff solenoid valve.

(3) An adequate supply of air, compressed to a sufficiently high pressure.

(4) The injection of the correct amount of clean fuel at the proper time

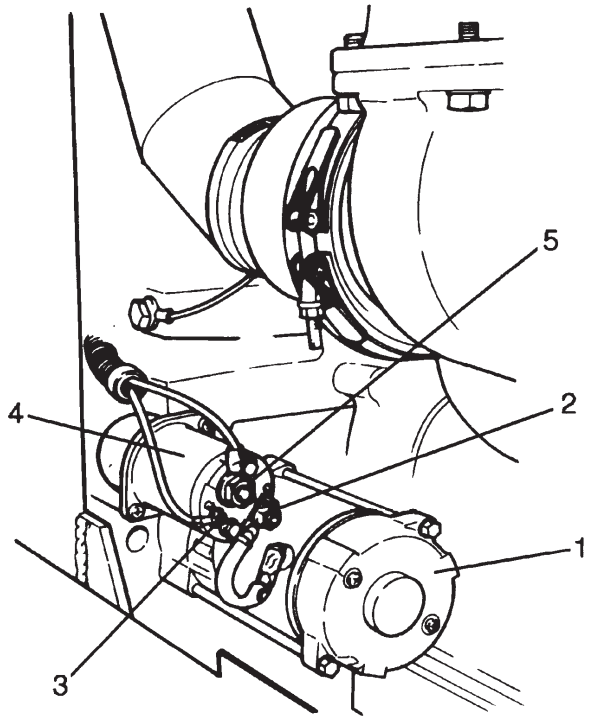
When troubleshooting the engine, keep these requirements in mind.

8. Illustrations

Illustrations, Figures 1 and 2, are referred to throughout the Troubleshooting Chart.

9. Connection and Schematic Diagrams

All connection and schematic diagrams for generator, engine, lights, and all controls are located at the end of this chapter.

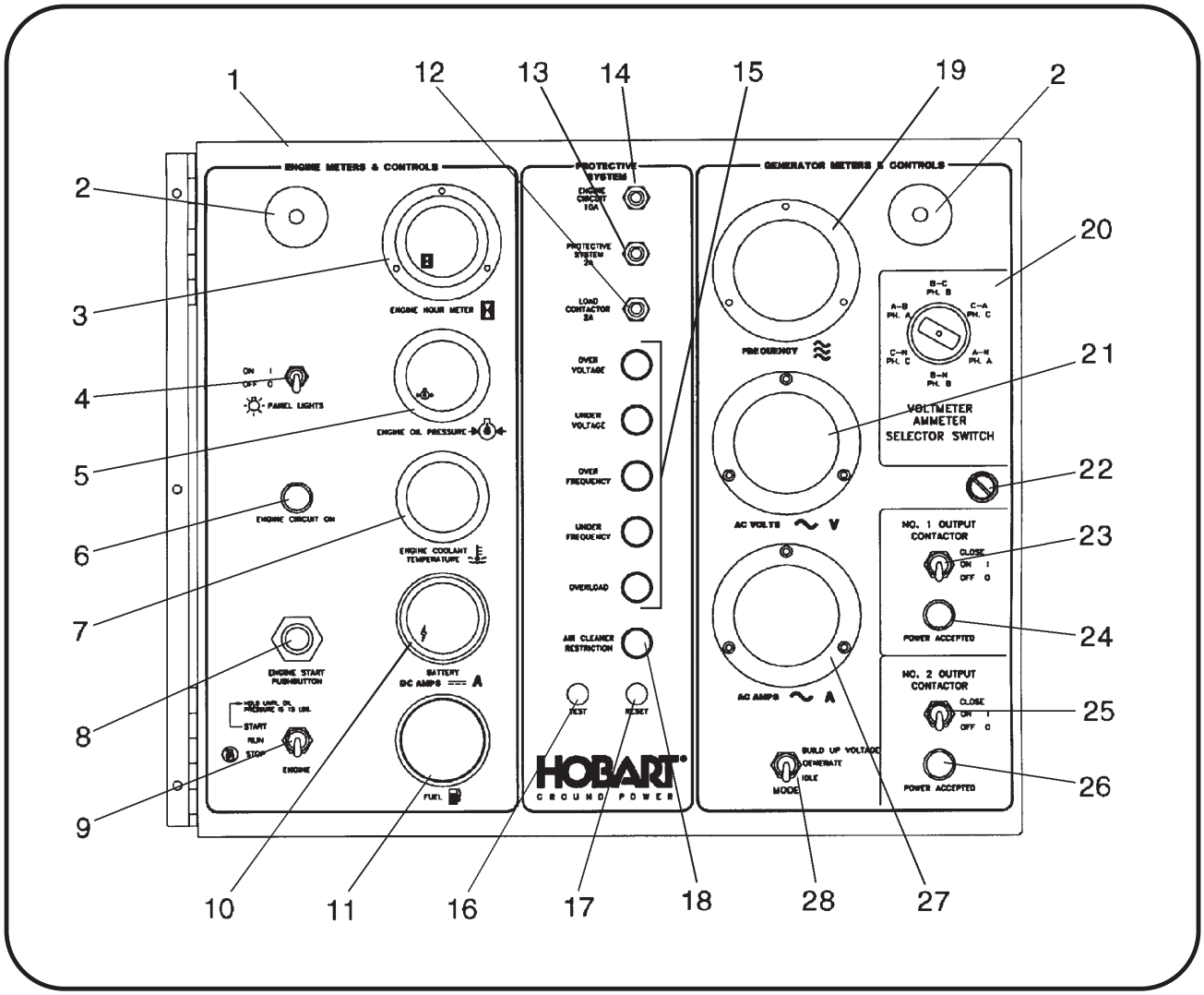


1. Starter
2. Starter Terminal
3. Switch to starter terminal
4. Starter solenoid
5. Solenoid switch input terminal

Starter and Solenoid Switch

(Front View)

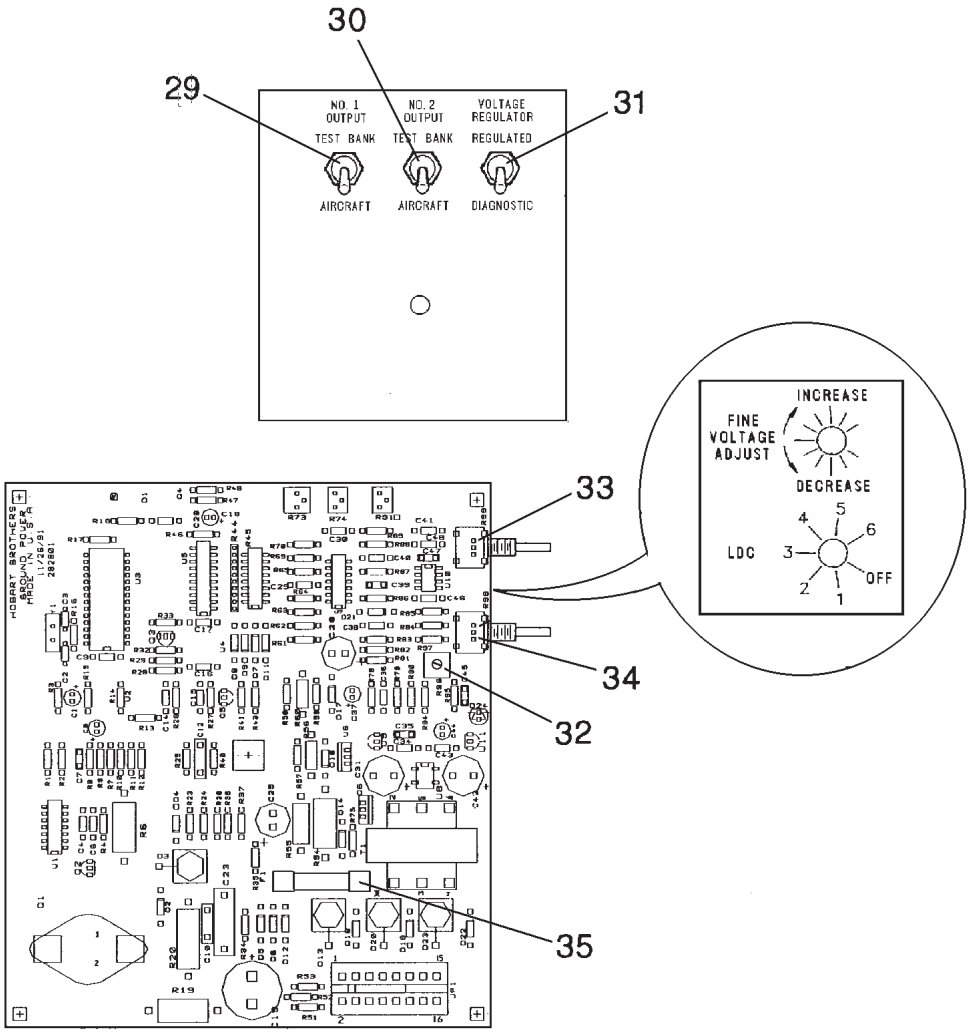
Figure 1



1. Front panel
2. Panel light
3. Engine hour meter
4. Panel light switch
5. Oil pressure gage
6. Engine ON indicating light
7. Engine coolant temperature meter
8. Engine start switch
9. Engine control switch
10. Engine ammeter
11. Fuel gage
15. Protective system indicating lights
16. Test switch, protective system
17. Reset switch, protective system
18. Indicating light, air cleaner restriction
19. Frequency meter
20. Selector switch, voltmeter-ammeter
21. Voltmeter
22. Adjustable grip latch
23. No. 1 contactor switch
24. Power accepted light, No. 1 contactor
25. No. 2 contactor switch

Operating Controls and Instruments

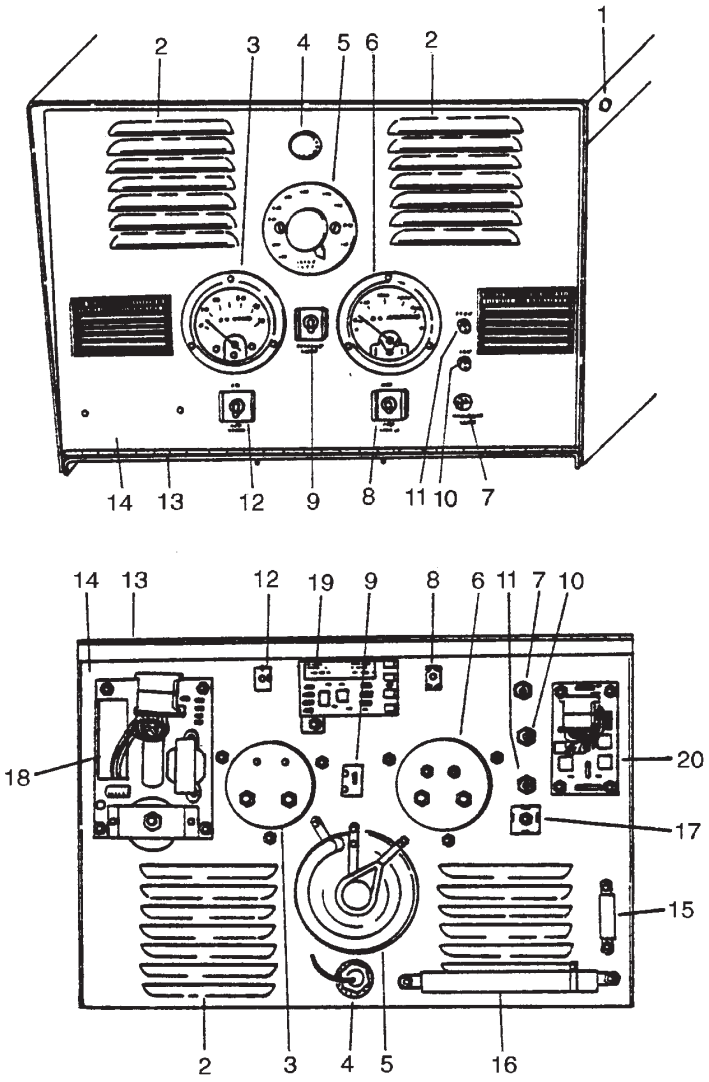
Figure 2 (Sheet 1 of 2)



29. Test bank-aircraft switch, No. 1 output
30. Test bank-aircraft switch, No. 2 output
31. Regulated-diagnostic switch
32. Output voltage adjustment (coarse)
33. Output voltage adjustment (fine)
34. Line drop compensation adjustment
35. Fuse (5-amp)

Operating Controls and Instruments

Figure 2 (Sheet 2 of 2)



1. Screw
2. Air inlet louver
3. DC voltmeter
4. Instrument light
5. Current limiting rheostat
6. DC ammeter
7. Contactor CLOSED indicating light
8. Contactor control switch
9. Current limiting control switch
10. Fuse (2A) (DC circuit)
11. Fuse (2A) (115-V AC circuit)
12. Light switch
13. Hinge
14. Panel
15. Resistor (200 Ohm, 25 Watt)
16. Resistor (100 Ohm, 100 Watt)
17. Rectifier, silicon
18. Line-drop compensation and current limiting module
19. Board, overvoltage

28.5-V DC TRansformer-Rectifier Control Panel Assembly

Figure 3

Engine Controls

Trouble, Symptom and Condition	Probable Cause	Test, Check, And/or Remedy
NOTE: Diesel engine trouble shooting is covered in Cummins Operation and Maintenance Manual under Fault Diagnosis.		
1. Engine will not start. Starter will NOT crank engine.	**a.** Batteries discharged, or loose battery or ground connection	Check voltage across batteries. Voltage should be approximately 13.5 volts DC. Check all battery terminals. Be sure 13.5 volts DC is reaching solenoid input teminal.
	b. Defective starter solenoid	Momentarily connect a large capacity jumper cable (No. 1/0 minimum) between the hot side of the starter solenoid and the starter input terminal. If the starter attempts to crank the engine, it indicates the starter solenoid is defective. Replace. If the starter did not operate, proceed to step C.
	c. Defective starter	If starter did not operate in check B above, the starter is defective. Replace.
	d. 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 with a 3/4 inch square drive on a long flex handle on the crankshaft pulley. If the engine cannot be turned one complete revolution, internal siezure is indicated. Remove engine and disassemble to locate problem.
2. Engine will not start. Cranking speed low.	**a.** Low battery output	Check battery. Recharge 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 Chapter 2-2, Fig. 3. Remove and replace oil if/as necessary.

Engine Controls

Trouble, Symptom and Condition	Probable Cause	Test, Check, And/or Remedy
3. Engine WILL NOT start. Cranking speed normal.	**a.** No fuel or insufficient fuel in tank	Fill fuel tank if it is empty or if the amount of fuel in it is low. If necessary, fill each filter with fuel oil and prime the fuel pump according to instructions in Chapter 2-1. 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.
	b. Fuel shut-off valve closed	Make certain valve is OPEN.
	c. Loose connections, damaged hoses or fuel lines between tank and fuel pump	Tighten all fittings and connections. Replace any damaged hoses or fuel links.
	d. Plugged or defective filter	Do not overlook the possibility of restricted flow through the fuel filters. Also check gaskets for leaking or damaged condition.
	e. Clogged or damaged check valve	Replace check valve if it is clogged or damaged.
	f. Check fuel solenoid valve mounted on the fuel pump. Also engine control switch and circuitry.	Replace defective valve or switch.
	g. Faulty fuel pump	Check pump for worn gears, damaged pump drive, and open relief valve. Replace pump if defective.
4. Engine is HARD to start. Cranking speed normal, fuel supply adequate.	**a.** Low compression, which may be caused by any one of the following: Sticking or burned exhaust valves, worn or broken compression rings, leaking cylinder head gasket, or improper valve clearance adjustment.	Check compression in accordance with instructions in the Cummins Operation and Maintenance Manual. Overhaul engine to make repairs as necessary.

Engine Controls

Trouble, Symptom and Condition	Probable Cause	Test, Check, And/or Remedy
5. Engine starts. Stops after a few seconds by automatic shutdown.	**a.** The shut-down circuit may have functioned normally to stop the engine because of low lubricating oil pressure or due to a defective oil pressure switch (S46, located on the engine block on the right side).	Restart the engine, hold permissive start switch in START position, and observe oil pressure gage. If oil pressure is 12 psi or more, and the engine shuts down when the permissive start switch is released to the run position, put a jumper wire across oil pressure switch terminals “C” and “NO”. Restart engine. If the engine continues to run when the permissive start switch is released to the RUN position, the oil pressure switch is defective. Replace oil pressure switch. If the engine stops, check for the following malfunctions:
	b. Defective or incorrectly wired high temperature switch (S 49, located on the engine block on the right side).	Check wiring to high temperature switch according to connection diagram in Chapter 6, and see that wiring is correct. If wiring is correct, remove the wires and check resistance between terminals C and N.C. A resistance reading of zero indicates a good temperature switch. A readable resistance, indicates a defective switch. Replace switch if defective. If the engine stops, check for defective engine control switch.
	c. Defective engine control switch (S7) (9, Fig. 2).	Check the engine control switch by removing its wires and checking resistance between terminals. Replace switch if defective.

Engine Controls

Trouble, Symptom and Condition	Probable Cause	Test, Check, And/or Remedy
6. Engine will not come “up” to governed speed in GEN mode.	**a.** 12-V DC power not reaching governor control box due to defective operating mode switch (28, Fig. 2)	Apply 12-V DC directly to terminal 6 on governor control box. If engine comes-up to speed, check following:
	b. Governor linkage binding or governor throttle sticking	Check governor linkage and throttle shaft for binding and sticking. Repair as required.
	c. Defective or misadjusted magnetic pickup (Chapter 2-3, Fig.5).	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 magnetic pickup, refer to diagram 283122 and disconnect pickup input leads at terminals 10 and 11 on the controller. Connect a high impedance AC voltmeter to the pickup output leads. Crank engine but don’t start. Voltage reading should be a minimum of one (1) volt. If no or low voltage is indicated, check pickup adjustment [see 2-3,Para. 3, e,(2)]. If pickup is properly adjusted and voltage is still zero, replace pickup.
	d. Defective actuator	Apply 12-V DC to the two actuator input leads (terminals 4 and 5 on the terminal strip). Actuator lever should move immediately to full speed position. If lever does not move, replace actuator.

Engine Controls

Trouble, Symptom and Condition	Probable Cause	Test, Check, And/or Remedy
Engine will not come “up” to governed speed in GEN mode. (Continued)	**e.** Defective controller	At terminals 4 and 5 on the terminal strip next to the controller, connect a DC voltmeter. 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 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 controller.
7. Engine goes to overspeed when control switch (28, Fig. 2) is in GEN mode.	**a.** Governed speed control adjustment set too high (see 2-3, Fig. 5)	Turn speed control adjusting screw fully counterclockwise. Start engine. Place control switch (28, Fig. 2) in GEN position. If engine speed is now well below governed speed, turn adjusting screw clockwise until correct speed (2000 RPM, 400-Hz) is attained. 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 controller	Replace controller. Check it in accordance with governor instruction book.
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.
	b. Governor system faulty or misadjusted	Check and adjust as follows:
	c. 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.

Engine Controls

Trouble, Symptom and Condition	Probable Cause	Test, Check, And/or Remedy
Engine is unsteady, (surges) under load (continued)	**d.** GAIN and "I" control improperly adjusted	Adjust GAIN and "I" control on controller in accordance with 2-3, Para. 3, e,(3)
	e. Magnetic pickup signal weak	Check and adjust pickup. See 2-3, Para. 4, E, (2)
9. Engine has slow response time	**a.** Governor controller 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 Cummins Operation and Maintenance Manual.
10. Engine "misses". Runs unevenly.	**a.** Insufficient fuel	Check fuel flow in accordance with Cummins Operation and Maintenance Manual. Repair or replace parts as required. Also see Engine, Trouble 3.
	b. Faulty injector	Check injectors in accordance with Cummins Operation and Maintenance Manual. See causes of low compression listed under ENGINE CONTROLS.
	c. Low compression pressure	Check compression in accordance with Cummins Operation and Maintenance Manual. See causes of low compression listed under ENGINE CONTROLS.
11. Engine lacks power	**a.** Improper engine adjustments and gear train timing	"Tune-up" the engine in accordance with Cummins Operation and Maintenance Manual.
	b. Insufficient fuel	See ENGINE CONTROLS
	c. Insufficient inlet air due to damaged air cleaner.	Check air cleaner for "plugging" and/or damage.
	d. Restricted exhaust system	Check exhaust pipes for restrictions. Check muffler for clogged condition. Replace as required.

Generator Excitation Circuits

Trouble, Symptom and Condition	Probable Cause	Test, Check, And/or Remedy
1. No (or low) generator output voltage in all phases. Generator operating at 400 Hz.	**a.** Defective generator or excitation circuit.	Place the REGULATED/ DIAGNOSTIC switch (31,Fig. 2) in DIAGNOSTIC position. This applies 12-V DC from the battery to the exciter field, which should produce an indicated output voltage of 59 V-AC +/- 5 V-AC line-to-neutral (102-V AC +/- 8-V AC line to line). If the voltage produced is within this range, the generator is good, and the trouble is in the voltage regulator circuit. Proceed to step B.
	b. Blown regulator fuse (35, Fig. 2)	Check fuse with an ohmmeter. If it is open, replace it.
	c. Defective voltage regulator	Disconnect the rectangular plug connector of the regulator wiring assembly from the suspect PC board, and connect a properly working PC board to the regulator wiring assembly, while avoiding short circuiting the bottom of the properly working PC board to the installed PC board. Then start the generator set and perform the tests and adjustments according to instructions in Section 2-3. If the generator set works properly with the properly working PC board temporarily connected, shut off the generator set and replace the defective PC board with one that is properly working (preferably, the same PC board used for this troubleshooting check).
	d. Defective REGULATED/ DIAGNOSTIC switch (31, Fig. 2)	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; 2, Fig. 7)	Check EDR contacts. A faulty EDR can prevent power from reaching the voltage regulator. Replace relay if defective.

Generator Excitation Circuits

Trouble, Symptom and Condition	Probable Cause	Test, Check, And/or Remedy
No (or low) generator output voltage in all phases. Generator operating at 400 Hz.	**f.** Defective connector at voltage regulator, or defective wiring from regulator to exciter field	Disconnect plug from voltage regulator PC board. Using jumper leads with clip and prod terminals, connect 12-V DC to terminals 1 and 4 in loose plug. Connect NEGATIVE to terminal 4 Connect POSITIVE lead to terminal 1 (see Schematic/ Connection Diagram in Chapter 5). If the generator will NOT produce at least 50 V-AC, replace or repair connector and wiring between voltage regulator and exciter field as required.

No. 1 Load Contactor Operating Circuit

Trouble, Symptom and Condition	Probable Cause	Test, Check, And/or Remedy
1. Load contactor (K1) will not close when No. 1 power accepted switch (23, Fig. 2) is held in CLOSE position. Generator running at normal voltage. Rectifier circuit breaker (CB3) (12, Fig. 2) closed. 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 one of the following reasons:	After checking circuit breaker (CB3) in step (b) below, check all wiring and connections in the load contactor circuits. Then check components as follows:
	b. Defective rectifier circuit breaker (CB3) (12, Fig. 2)	Remove terminal leads from circuit breaker, press the circuit breaker button to close the circuit breaker, and use an ohmmeter to check for continuity. Replace circuit breaker if defective.
	c. Defective (open) relay in memory and time delay PC board (1-1; 12 Fig. 7)	Replace memory and time delay PC board a board known to be operating properly. If contactor still doesn't close, proceed to step (d).
	d. Defective load contactor power accepted switch (S5) (23, Fig. 2)	Set Regulated/Diagnostic switch (S1) (31, Fig. 2) in REGULATED position. Check AC voltage input to contactor rectifier (CR6). If voltage isn't approxi- mately 115-V AC, contactor power accepted switch is defective and must be replaced.
	e. Defective rectifier (CR6) (1-1; 13, Fig. 9)	After making certain that contactor switch (S5) is providing 115-V AC to the rectifier (CR6), measure DC out put voltage between positive (+) and negative (-) terminals of rectifier. If voltage measured isn't approximately 90-V DC, replace rectifier.
	f. Defective coil in load contactor (K1) (1-1; 15 Fig. 9)	Disconnect leads at load contactor terminals V and W. Check coil resistance between these terminals. Resistance should be approximately 50 ohms. If coil is defective, replace the complete load contactor.

No. 1 Load Contactor Operating Circuit

Trouble, Symptom and Condition	Probable Cause	Test, Check, And/or Remedy
2. Load contactor (K1) will close when No. 1 power accepted switch (23, Fig. 2) is held in CLOSE position. Opens immediately when switch is released to center ON position.	**a.** 28.5-V DC is not reaching No. 1 plug interlock relay (K2) from aircraft for the following reasons:	Proceed as follows to find the cause of this malfunction.
	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.
	d. Defective protective system circuit breaker (CB2) (13, Fig. 2)	Remove terminal leads from circuit breaker, press its button to close it, and use an ohm-meter to check for continuity. Replace circuit breaker if defective.
	e. Defective plug interlock relay, No. 2 output (K2) , (1-1; 5, Fig. 7)	Place test bank/aircraft switch, No. 1 output (S2) (29, Fig. 2) in TEST BANK position. If load contactor will now remain closed, replace the plug interlock relay.
	f. Defective contacts in the small interlock device mounted on the right side of the contactor (the device having blue-yellow and black-yellow wires).	Connect a jumper lead between the terminals of the small interlock device. If load contactor will now remain closed, replace the complete load contactor.
	g. Defective protective system interlock relay (K17) or hold circuit resistor (R46) for the No. 1 output	Connect a jumper across resistor R46 (1-1; 19, Fig. 7). If the contactor will now remain closed, replace No. 1 output hold circuit resistor (R46). If the contactor does NOT remain closed, replace protective system interlock relay (K17).

No. 1 Load Contactor Operating Circuit

Trouble, Symptom and Condition	Probable Cause	Test, Check, And/or Remedy
3. Load contactor opens during power delivery. NO fault indicating lights on.	**a.** Protective system circuit breaker (13, Fig 2) or load contactor circuit breaker (12, Fig. 2) defective	To test each circuit breaker, remove terminal leads from circuit breaker, press its button to close it, and use an ohmmeter to check for continuity. Replace either circuit breaker found to be defective.
	b. A fault has developed in the load contactor holding circuit.	If load contactor cannot be closed by operation of power accepted switch (S5) (23, Fig. 2), check circuit in accordance with instructions in Trouble 1, above under LOAD CONTACTOR OPERATING CIRCUIT. If load contactor can be closed, but opens as soon as power accepted switch (S5) is released, check for trouble under Trouble 2, above.
	c. Cable accidentally disconnected from aircraft.	Reconnect cable.

No. 2 Load Contactor Operating Circuit

Trouble, Symptom and Condition	Probable Cause	Test, Check, And/or Remedy
1. Contactor (K201) will not close when No. 2 power accepted switch (25, Fig. 2) is held in CLOSE position. Generator running at normal voltage. Rectifier circuit breaker (CB3) (12, Fig. 2) closed. 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 one of the following reasons:	After checking circuit breaker (CB3) in step (b) below, check all wiring and connections in the load contactor circuits. Then check components as follows:
	b. Defective rectifier circuit breaker (CB3) (12, Fig. 2)	Remove terminal leads from circuit breaker, press the circuit breaker button to close the circuit breaker, and use an ohmmeter to check for continuity. Replace circuit breaker if defective.
	c. Defective (open) relay in memory and time delay PC board (1-1; 12 Fig. 7)	Replace memory and time delay PC board a board known to be operating properly. If contactor still doesn't close, proceed to step (d).
	d. Defective load contactor power accepted switch (S205) (25, Fig. 2)	Set Regulated/Diagnostic switch (S1) (31, Fig. 2) in REGULATED position. Check AC voltage input to contactor rectifier (CR6). If voltage isn't approximately 115-V AC, contactor power accepted switch is defective and must be replaced.
	e. Defective rectifier (CR6) (1-1; 14, Fig. 9)	After making certain that contactor switch (S205) is providing 115-V AC to the rectifier (CR206), measure DC out put voltage between positive (+) and negative (-) terminals of rectifier. If voltage measured isn't approximately 90-V DC, replace rectifier.
	f. Defective coil in load contactor (K201) (1-1; 16 Fig. 9)	Disconnect leads at load contactor terminals V and W. Check coil resistance between these terminals. Resistance should be approximately 50 ohms. If coil is defective, replace the complete load contactor.

No. 2 Load Contactor Operating Circuit

Trouble, Symptom and Condition	Probable Cause	Test, Check, And/or Remedy
2. Contactor (K201) will close when No. 2 power accepted switch (25, Fig. 2) is held in CLOSE position. Opens immediately when switch is released to center ON position.	**a.** 28.5-V DC is not reaching No. 2 plug interlock relay (K202) from aircraft for the following reasons:	Proceed as follows to find the cause of this malfunction.
	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.
	d. Defective protective system circuit breaker (CB2) (13, Fig. 2)	Remove terminal leads from circuit breaker, press its button to close it, and use an ohm-meter to check for continuity. Replace circuit breaker if defective.
	e. Defective plug interlock relay, No. 2 output (K202) , (1-1; 6, Fig. 7)	Place test bank/aircraft switch, No. 2 output (S202) (30, Fig. 2) in TEST BANK position. If load contactor will now remain closed, replace the plug interlock relay.
	f. Defective contacts in the small interlock device mounted on the right side of the contactor (the device having orange-yellow and black-yellow wires).	Connect a jumper lead between the terminals of the small interlock device. If load contactor will now remain closed, replace the complete load contactor.
	g. Defective protective system interlock relay (K17) or hold circuit resistor (R246) for the No. 2 output	Connect a jumper across resistor R246 (1-1; 18, Fig. 7). If the contactor will now remain closed, replace No. 2 output hold circuit resistor (R46). If the contactor does NOT remain closed, replace protective system interlock relay (K17).

No. 2 Load Contactor Operating Circuit

Trouble, Symptom and Condition	Probable Cause	Test, Check, And/or Remedy
3. Contactor opens during power delivery. NO fault indicating lights on.	**a.** Protective system circuit breaker (13, Fig 2) or load contactor circuit breaker (12, Fig. 2) defective	To test each circuit breaker, remove terminal leads from circuit breaker, press its button to close it, and use an ohmmeter to check for continuity. Replace either circuit breaker found to be defective.
	b. A fault has developed in the load contactor holding circuit.	If load contactor cannot be closed by operation of power accepted switch (S205) (25, Fig. 2), check circuit in accordance with in- structions in Trouble 1, above under LOAD CONTACTOR OPERATING CIRCUIT. If load contactor can be closed, but opens as soon as power accepted switch (S205) is released, check for trouble under Trouble 2, above.
	c. Cable accidentally disconnected from aircraft.	Reconnect cable.

Protective Circuit

Trouble, Symptom and Condition	Probable Cause	Test, Check, And/or Remedy
NOTE: The protective relays and protective monitor are not completely functional until the loadcontactor 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 trouble shooting the protective circuits. To avoid repetition, it will be assumed that the reset switch [17), Fig. 2] has been pushed and the load contactor has been closed before commencing each test.		
1. Load contactor opens during powerdelivery. Overvoltage indicating light ON.	**a.** The overvoltage condition may have been the result of a sudden drop in the load, or possible tampering with voltage regulator potentiometer (32, Fig. 2), and may have been a normal action.	Press reset switch (17, Fig. 2) and resume power delivery. Observe voltmeter (21, Fig. 2) to be certain voltage is normal 115 V-AC. Adjust to normal if necessary. If the load contactor is opened again and an overvoltage condition is indicated by OV indicating light, proceed to step b.
	b. Defective over-under-voltage PC board (K26) (1-1; 17, Fig. 7)	Use voltage adjusting potentiometer (32, Fig. 2) to reduce voltage to 110 V AC. Observe voltmeter and gradually increase voltage with potentiometer. If the sensing circuit in the overundervoltage PC board (K26) functions to open the load contactor at any value less than 134 VAC, it is defective. Replace over-undervoltage PC board.
2. Load contactor opens during power delivery. Undervoltage indicating light ON.	**a.** An undervoltage condition caused the If the sensing circuit in the over-under-voltage PC board (K26) to function normally.	Observe generator voltage on voltmeter and adjust to normal 115 V AC with voltage regulator potentiometer (32, Fig. 2). Resume normal operation. If the load contactor opens again and an undervoltage condition is indicated by UV indicating light, proceed to step B.
	b. Defective over-under-voltage PC board (K26).	Use potentiometer (27, Fig. 1) to reduce voltage to 104 V. The undervoltage indicating light should NOT come on during a time delay of 4 to 12 seconds. If the light comes on before a delay of 4 to 12 seconds, the undervoltage relay is defective. Replace the over-undervoltage PC board (K26).

Protective Circuit

Trouble, Symptom and Condition	Probable Cause	Test, Check, And/or Remedy
Load contactor opens during power delivery. Undervoltage indicating light ON. (continued)	**c.** Defective memory and time delay (protective monitor) PC board (K14)	With unit running normally, use potentiometer (32, Fig. 2) to reduce voltage quickly to 90 V. If the undervoltage indicating light (DS38) on the control panel is turned ON immediately, the memory and time delay PC board is defective. Replace PC board (K14).
3. Load contactor opens during power delivery. Overfrequency indicating light (DS40) 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 governor system information listed in this chapter under ENGINE AND CONTROLS.
	d. Defective over-under-frequency PC board (K27)(1-1; 16, Fig. 7).	If overfrequency nuisance tripping continues after the governor system is proven to be good, and an overfrequency condition does not exist, replace the over-under frequency PC board (K27).
4. Load contactor opens during power delivery. Underfrequency light 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 governor system information listed in this chapter under ENGINE AND CONTROLS.
	d. Defective over-under-frequency PC board (K27)	If overfrequency nuisance tripping continues after the governor system is proven to be good, and an under-frequency condition does not exist, replace over-under-frequency PC board.

Protective Circuit

Trouble, Symptom and Condition	Probable Cause	Test, Check, And/or Remedy
5. Load contactor opens during power delivery. Overload indicating light ON.	**a.** There may have been an overload condition which caused the overload device (K4 for No. 1 output, or K204 for No. 2 output) to function normally.	Observe ammeter (27, Fig. 2). Check for abnormal overload condition and correct. If overload device functions to open the load contactor when an overload does not exist, proceed to step B.
	b. One of the resistors across an overload transformers is open circuited. For No. 1 output, check resistors (R26, R27, and R28). For No. 1 output, check resistors (R226, R227, and R228)	An open resistor will cause a higher than normal voltage. Refer to 1-1; items 7 and 8, Fig. 9 for exact location of these resistors. Check resistors. Replace any resistors found to be defective.
	c. Overload device printed circuit board defective (K4 for No. 1 output, or K204 for No. 2 output)	Replace overload PC board (Sect. 1-1; 11 or 12, Fig. 9) with an overload module known to be operating properly.
6. Contactor opens during power delivery. Underfrequency fault list is on, but no under-frequency fault exists.	**a.** Governor not adjusted properly.	Check governor adjustment. Follow instruction in Section 2-3; Para. 3, E (3).
	b. Check complete governor system.	Check and adjust or repair in accordance with governor system information listed in this chapter under ENGINE AND CONTROLS.
	c. Defective ove-runder-frequency PC board (K27)(1-1; 16, Fig. 7)	If underfrequency tripping continues after completion of Steps a and b above, the over-underfrequency PC board is defective. Replace PC board.
7. No. 1 Load contactor opens during power delivery. Overload fault light in on, but no overload fault exists.	**a.** Faulty overload resistor(s) in the No. 1 overload circuit. Check resistors (R26, R27, or R28)(1-1; 7, Fig. 9).	Replace faulty resistor(s) if any. If none of these resistors is defective, the No. 1 overload PC board (1-1; 11, Fig. 9) is defective. Replace PC board.
8. No. 2 Load contactor opens during power delivery. Overload fault light in on, but no overload fault exists.	**a.** Faulty overload resistor(s) in No. 2 overload circuit. Check resistors (R226, R227, or R228)(1-1; 8, Fig. 9).	Replace faulty resistor(s) if any. If none of these resistors is defective, the No. 2 overload PC board (1-1; 12, Fig. 9) is defective. Replace PC board.
9. Both load contactors open during power delivery. Overload fault light in on, but no overload fault exists.	**a.** Faulty overload resistor(s) in the main overload circuit. Check resistors (R33, R34, or R35)(1-1; 3, Fig. 9).	Replace faulty resistor(s) if any. If none of these resistors is defective, the main overload PC board (1-1; 5, Fig. 9) is defective.

Generator

Trouble, Symptom and Condition	Probable Cause	Test, Check, And/or Remedy
1. No (or low) voltage output	**a.** Shorted diode in exciter rectifier (CR2).	Check diodes in accordance with Sect. 2-3, para. 5. 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 exciter rotor windings are good, proceed to step C.
	c. Open or shorted exciter field windings (L2)	Check field resistance. See Sect. 2-3, Fig. 7 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.** Open or short circuited winding in generator stator (G1)	Check stator winding resistances. See Sect. 2-3, Fig. 7 for normal values.
3. Generator overheats	**a.** Loose connection causing high resistance.	Check all output connections. Look for discoloration caused by heat. Tighten or replace as required.
	b. Improper or blocked ventilation.	Check for foreign material (rags, etc.) blocking air flow. Provide adequate ventilation.
	c. Generator stator windings short circuited.	Check stator windings. See Sect. 2-3, Fig. 7.
4. 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 phase	Check stator windings in accordance with 2-3, Para. 5. 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. Break or cut in output cable assembly.	Inspect. Repair or replace as required.
	e. Unbalanced load	Check aircraft 400-Hz components.

28.5-V DC Transformer-Rectifier

Trouble, Symptom and Condition	Probable Cause	Test, Check, And/or Remedy
1. Transformer-rectifier inoperative. Load contactor will NOT close.	**a.** No input power from AC power source (generator-set)	Check voltage at contactor (See 1-1, Fig.15, item 7). Input should be 200-V AC line-to-line. Check voltage from line C to ground terminal stud on base. If not approx. 115-V AC, correct fault in T-R ground circuit.
	b. Fuse (11, Fig. 3) defective	Remove and inspect fuse. Replace if defective.
	c. Defective load contactor control switch (8, Fig. 3)	Check voltage at control switch terminal (brown-red wire) while holding switch in top ON position. If voltage is not approx. 115-V AC, replace switch.
	d. Defective diode-bridge rectifier (17, Fig.3)	Check rectifier DC output voltage at output terminals (blue-red wires). Hold contactor control switch in top ON position while testing. If voltage is not approx. 100-V DC, replace the rectifier.
	e. Relay in overvoltage module (19, Fig.3) defective	With switch held in ON position, check voltage at terminal T (brown-white wire) on over-voltage module. If voltage is not approx. 115-V AC, replace overvoltage module.
	f. Defective (open-circuited) thermostatic switch (1-1, Fig.15, item 6)	Check thermostatic switches for continuity. If either switch is open circuited, replace.
	g. Coil in load contactor (1-1, Fig.15, item 7) defective	Check load contactor coil resistance between terminals X1 and X2. (See connection diagram at rear of manual). Zero resistance indicates a short circuit. Very high (infinite) resistance indicates an open circuit. Replace complete load contactor if coil is defective.

28.5-V DC Transformer-Rectifier

Trouble, Symptom and Condition	Probable Cause	Test, Check, And/or Remedy
2. Load contactor closes normally. Opens as soon as control switch is released.	**a.** Defective control switch (8, Fig. 3)	Place switch in center ON position. Check voltage at switch (S403) (See connection diagram). If there is no voltage, replace switch.
	b. Defective resistor (15, Fig. 3)	Place control switch (8,Fig. 3) in center ON position and check voltage at resistor (15, Fig. 3) output end (orange-black wire). If resistor is open or short circuited, replace.
	c. Small contacts in load contactor defective	With control switch (8, Fig. 3) held in top ON position to keep load contactor closed, check voltage at terminal No.2 (red-white wire) on load contactor. If no voltage is indicated, replace complete load contactor.
3. Fuse (11, Fig. 3) blows when load contactor switch is operated to ON position.	**a.** Short circuited condition in load contactor holding circuit.	Check all leads in this circuit for damaged insulation and shorting. Check all terminals and connections for shorting. Repair as required.
	b. Defective relay (contacts closed) in overload module	Disconnect plug connector on overload module. If contactor will now close and remain closed without blowing fuse, replace overload module.
4. Output voltage unsteady. Green indicating light blinks.	**a.** Voltage regulator on 200-V AC power source requires adjustment.	Refer to the generator-set instruction manual. Adjust voltage regulator to stabilize output voltage. Voltage is steady when indicating light ceases to blink.

28.5-V DC Transformer-Rectifier

Trouble, Symptom and Condition	Probable Cause	Test, Check, And/or Remedy
5. Normal output voltage (28.5V DC) decreases as load increases. Current-limiting switch in OFF position.	**a.** Line-drop and current-limiting module (18, Fig. 3), or linedrop current transformer defective	Apply a load of 1000A to the T-R. Check input voltage at the contactor. At a load of 1000A, the input voltage, line-to-line, should be approx. 220-V AC. If input voltage IS that, the line-drop module and current transformer are OK and the trouble is in the main transformer and heat sink (rectifier) circuit. Proceed to step B below. If input voltage is only 200-V AC, the trouble is in the line-drop module and current transformer circuit. Check as follows:
	b. Line-drop current transformer defective	Use an ohmmeter to check the transformer. Replace if open or short circuited.
	c. Line-drop and current-limiting module (18, Fig. 3) defective	If line-drop current transformer checked good in test **b** above, replace line-drop and current-limiting module.
	d. Defect in transformer and rectifier circuit	If line-drop circuitry was proven to be good in check **a** above, check as follows:
	e. Defective transformer	Check all input and output connections to the transformer. Use an ohmmeter to check transformer windings. Repair or replace as required.
	f. Defective diodes or diode connections	Check all diodes for open or short circuited condition. Check all connections. Check installation of diodes (torque values). NOTE: Torque Westinghouse diodes to 25 foot-lbs. Torque International diodes to 13-1/2 foot-lbs. (threads lubricated with Penetrox). Check factory for other manufacturer's diodes. Replace diodes and/or correct installation and connections as required.

28.5-V DC Transformer-Rectifier

Trouble, Symptom and Condition	Probable Cause	Test, Check, And/or Remedy
6. Overload module does not operate	**a.** Module not receiving DC power.	Check and correct as follows:
	b. Fuse (10, Fig. 3) defective	Place instrument light switch (12) in ON position. If instrument light does not operate, check fuse. Replace if defective.
	c. Defect in DC circuit	Check wiring and connections from DC power source to overload module. Repair as required.
7. Overload module operates to open load contactor when no overload exists.	**a.** An open resistor is allowing higher than normal voltage to enter the overload module.	Check each resistor. Replace as required.

Chapter 3. Overhaul/Major Repair

Section 1. Table of Contents

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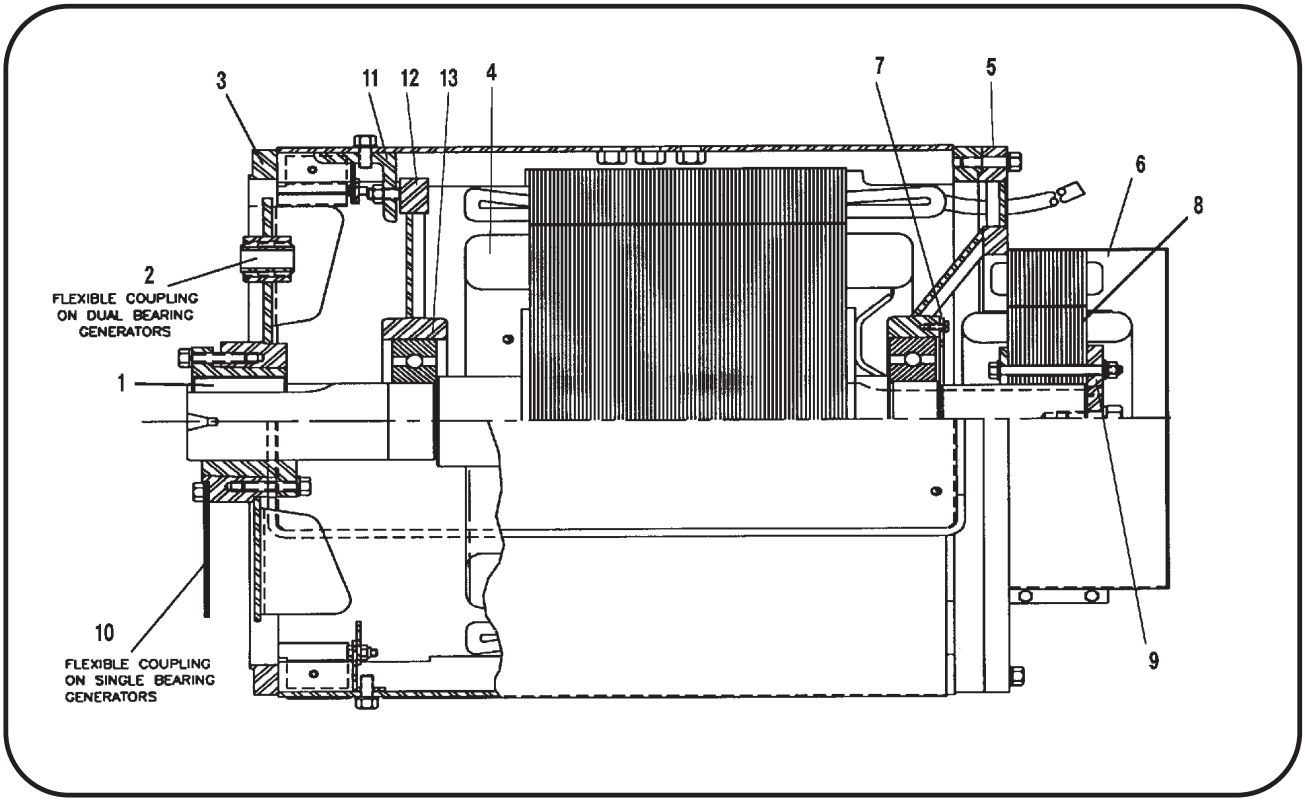
Section 2. Exciter Armature

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 rear 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 rear main bearing replacement. The exciter armature has two 3/8-16 tapped holes in its diode mounting plate to accommodate pulling it off the shaft.



1. Coupling Key
2. Flex Coupling Assembly (Dual ONLY)
3. Generator Housing & Stator Assembly
4. Armature Assembly
5. Exciter Housing & Coils Assembly
6. Exciter Cover
7. Rear Bearing Retainer
8. Exciter Armature Assembly
9. Exciter Key
10. Flex Coupling Assembly (Single ONLY)
11. Mounting Bracket (Dual ONLY)
12. Front Bearing Retainer (Dual ONLY)
13. Front Bearing (Dual ONLY)

Generator (Top Half Section)

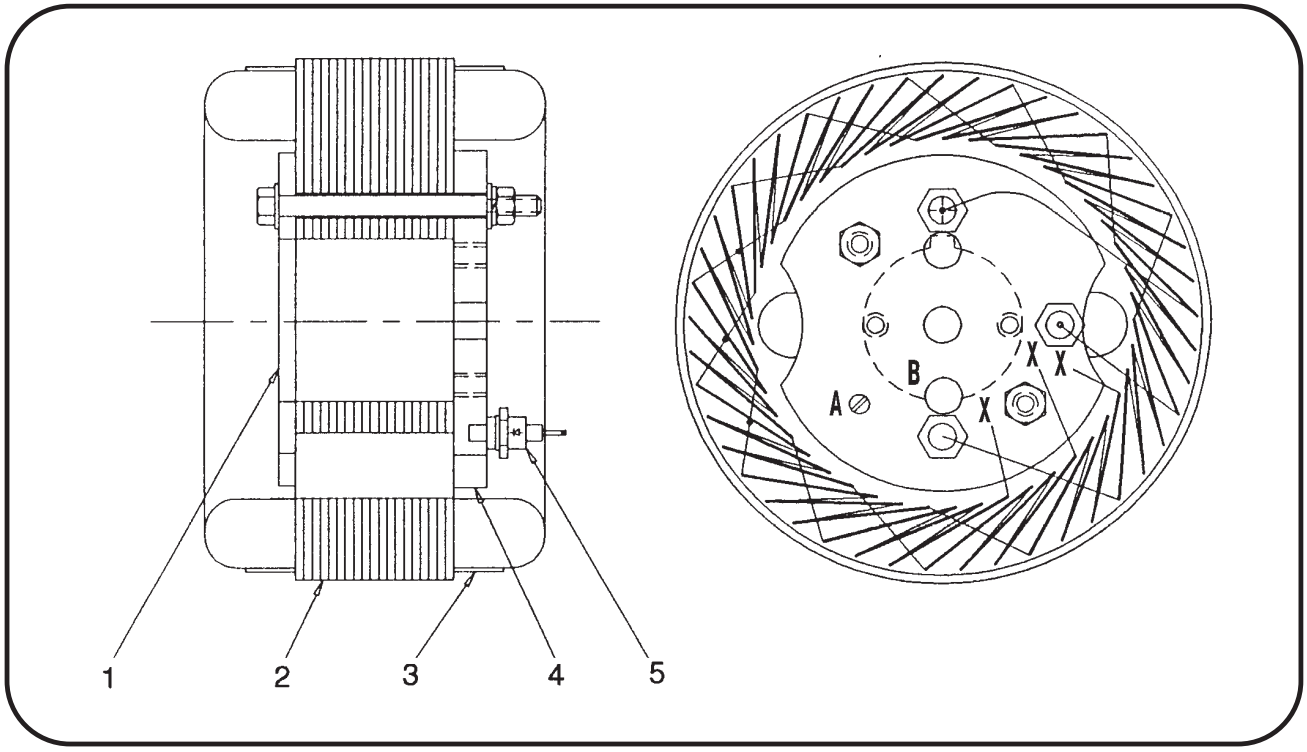
Figure 1

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 mounting flange. The flange, core, and diode mounting plate are bolted together to make the complete exciter armature.

The exciter armature is mounted on the main generator armature shaft with a 3/8-inch square machine key and is held in place by a 1/2-13 hex head cap screw in the center of the diode mounting plate.



1. Exciter Core Flange
2. Exciter Core Lamination
3. Banding Glass Tape
4. Diode Mounting Plate
5. Silicon Diode

Exciter Armature

Figure 2

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. Tools for Exciter Armature Removal and Installation

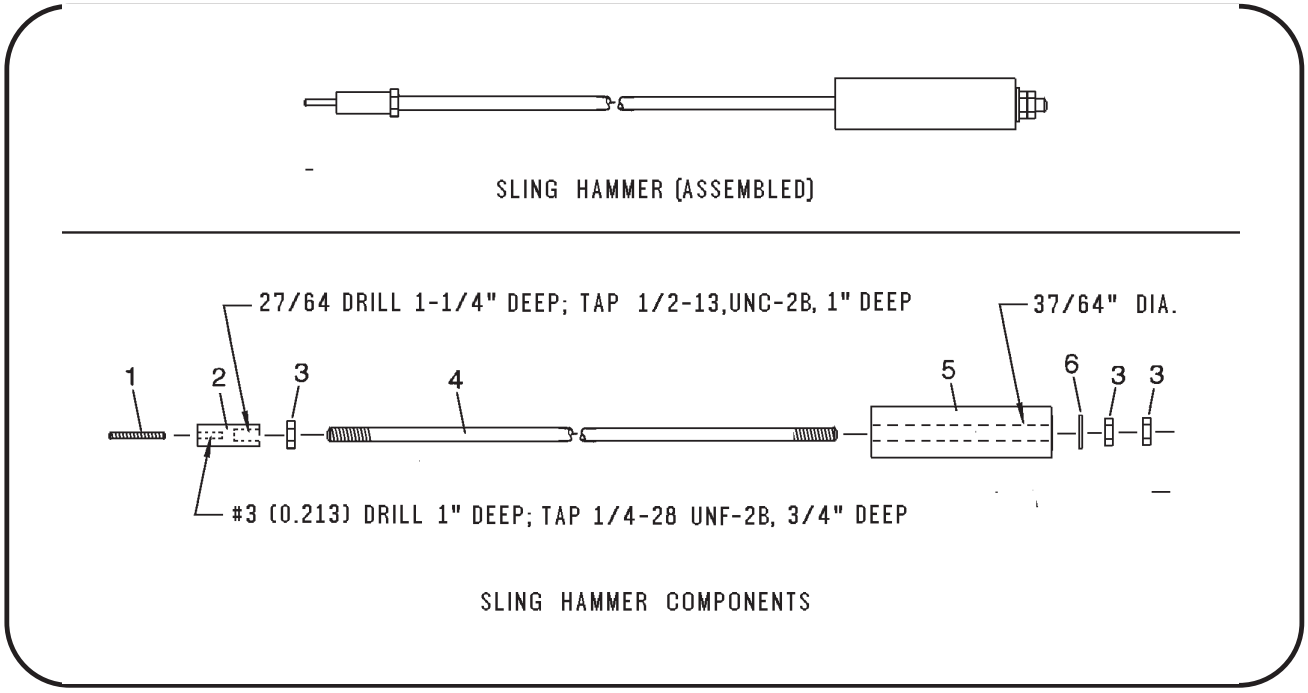
In addition to the standard mechanic's hand tools such as wrenches, etc., you will need only the following items for removing the exciter armature:

A small, lightweight, sling-hammer puller

Two 3/8 - 16 X 5-inch fully-threaded hex-head bolts

A small, lightweight, sling-hammer puller is shown in Figure 3. This tool is necessary for removing the threaded machine key which tightens the exciter armature on the generator armature shaft. You may have such a puller in your equipment. If not, Figure 3 also illustrates components and dimensions for fabricating such a tool. Sling-hammer pullers are also commercially available. Instructions for using tool are provided in Paragraph **e, (1)**

Once the threaded machine key is removed, No other special tools are required for removing the exciter from the generator shaft. This can be done using two 3/8 - 16 X 5-inch fully-threaded hex-head bolts. Instructions for doing this are provided in Paragraph **e, (2)**.



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

c. 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 the rear bearing. This operation can also be accomplished without removing the generator. Replacement of the front bearing requires removal of the generator from the unit.

d. Preparation for Exciter Armature Removal

(1) Remove louvered exciter cover from end canopy.

(2) Remove exciter housing cover as required. Remove the 1/2-13 cap screw which holds the exciter armature on the generator shaft.

(3) Refer to Figures 1 and 2. Disconnect the two rectifier-to-generator field leads. One lead with a ring type terminal is attached to the rectifier mounting plate with a screw (“A”, Fig. 2) and the other lead goes into a splice type connector with three other leads (“X”, Fig. 2) coming from the exciter armature windings. Cut the leads at the connector for removal of the one field lead. Cut as close as possible to the connection as to preserve lead length for reconnection later during exciter armature installation.

(4) **EXERCISE CARE** to prevent damage to leads. Remove kinks in the two generator leads as much as possible before starting removal operation.

e. Exciter Armature Removal

(1) Removing the Threaded Key with Sling-Hammer Puller

Refer to Figure 4 for location of threaded machine key. Attachment of the assembled puller to the key 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. This could result in cross-threading and damage to key and stud. It is safer and easier to attach as follows:

a. Thread stud (1, Fig. 4) into adapter (2) 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 adapter 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 full threaded, then lock together.

WARNING

Be very careful during removal process (slide-hammering) to avoid injury to hands.

CAUTION

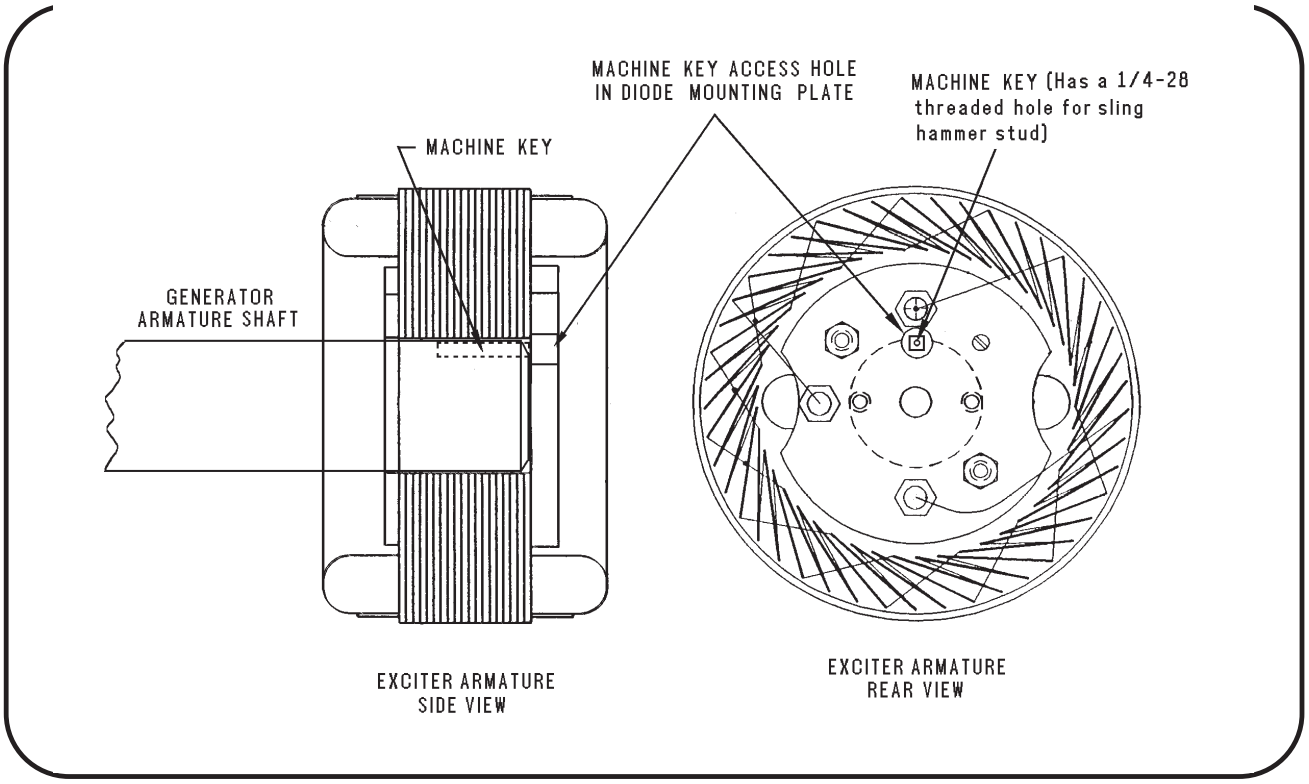
Exercise care to prevent breaking or damaging stud.

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. Repeat steps (c) and (d) as required to loosen key, then remove key and slide-hammer puller.

f. After key is removed, apply penetrating oil in the armature and shaft keyways.



Location of Exciter Armature Machine Key

Figure 4

(2) Removing the Exciter Armature

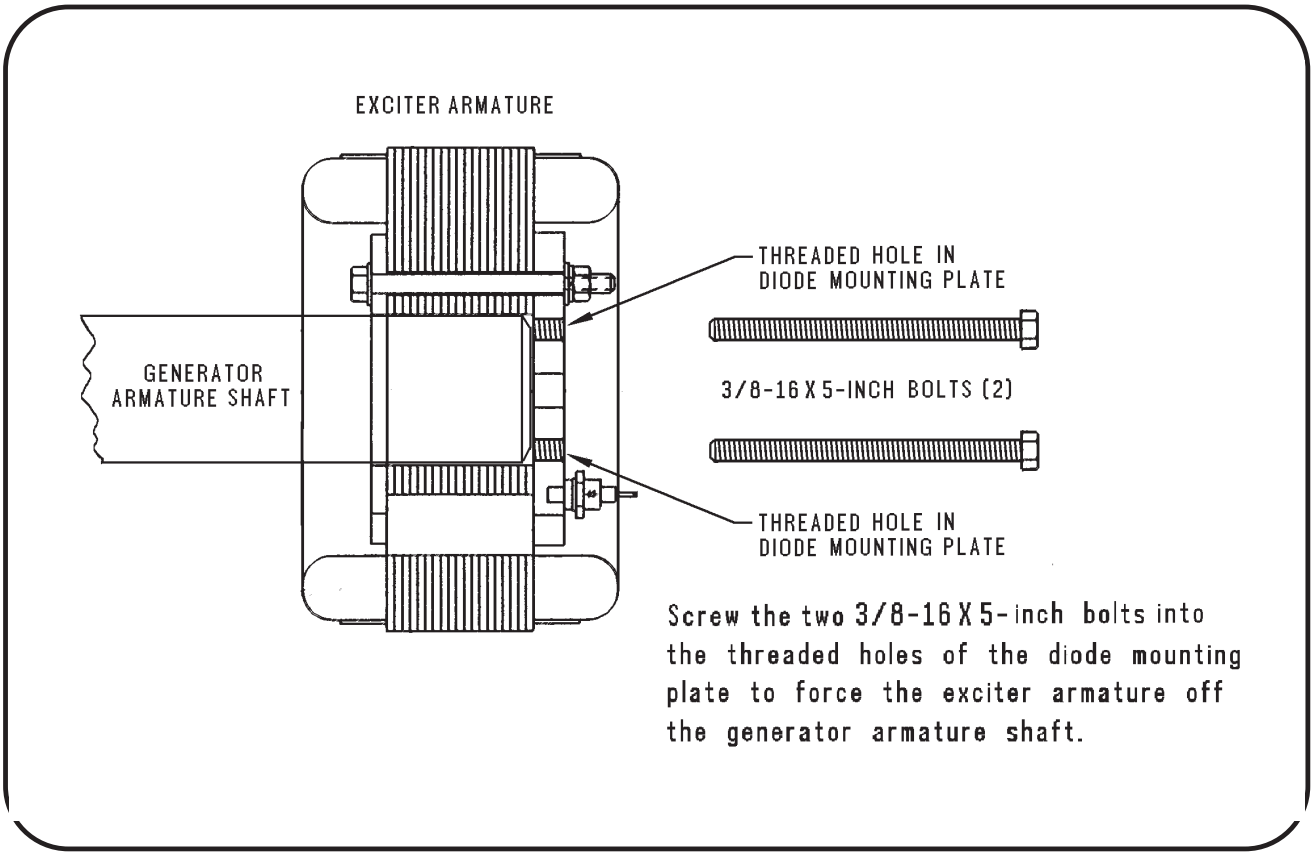
CAUTION

Leads may be damaged if armature is turned too far in either direction.

Attempt to loosen exciter armature on shaft by rotating it slightly back and forth. If armature cannot be loosened by hand, use two 3/8 - 16 X 5-inch hex-head bolts as shown in Figure 5 to force the exciter armature off the shaft. Turn each of the two screws a few turns at a time into the threaded holes of the diode mounting plate until the exciter armature is sufficiently loosened from the shaft to be removed from it by hand. Remove it slowly from the shaft and at the same time observe the following **CAUTION.**

CAUTION

Pay close attention to field leads while pulling exciter armature from shaft. Make **CERTAIN** that the leads stay in the 1/2" keyway. One mechanic should watch them constantly while another operates the puller. Make certain that leads do not catch and be sure that they slide smoothly through hole (“B”, Fig. 2) Straighten leads and remove kinks as required to avoid damage to insulation.



Removing Exciter Armature from Generator Armature Shaft

Figure 5

4. Installing the Exciter Armature

a. Preparation for Exciter Armature Installation

(1) Clean generator shaft and exciter armature bore. Remove all rust, corrosion, etc.

(2) Make **CERTAIN** that the leads are tucked into the 1/2" keyway, which is opposite from the 3/8" keyway in the generator armature shaft.

(3) Route the revolving field leads (step 2 above) through exciter armature hole (“B”, Fig. 2), which is opposite the keyway.

(4) Align armature keyway with key in shaft and start armature on shaft.

b. Exciter Armature Installation

(1) If the exciter armature-to-generator shaft fit is such that the exciter armature may be pushed on by hand, push it on very slowly while another mechanic carefully watches and pulls field leads through hole in the exciter armature diode mounting plate. Continue installation until the diode mounting plate contacts the end of the generator shaft. If the exciter armature cannot be pushed on by hand, use a 1/2 - 13 X 5-inch hex-head bolt and 1/2 - 13 nut as shown in Figure 6 to pull the exciter armature onto the generator shaft. Put the exciter armature on slowly and at the same time pull field leads through hole (“B”, Fig. 2) in the diode mounting plate. Screw the nut onto the bolt until it is near the head of the bolt. Insert the bolt through the hole in the center of the diode mounting plate as far as it will go, and screw it into the 1/2 - 13 threaded hole in the end of the armature shaft. Screw the 1/2 - 13 nut up against the diode mounting plate. Continue turning the nut until the diode mounting plate contacts the end of the generator shaft, just as is shown in the lower portion of Figure 6. After installation, remove the 1/2 - 13 bolt and nut.

(2) Connect the two generator field leads to the exciter armature as follows:

a. Connect lead with ring type terminal with screw provided to the rear mounting plate (“A”, Fig. 2).

b. Connect the other field lead to the three leads coming off of the exciter armature windings (“X”, Fig. 2). Use parallel splice connector, crimp and solder for a good connection.

c. Insulate with sleeving material or wrap with electrical tape.

(3) Install the Machine Key

a. Clean the machine key thoroughly. All mounting surfaces must be free of rust, corrosion, oil, grease, etc.

b. Apply **LOCQUIC** primer, No. 47-56 grade T to **SIDES** of machine key. Do not overprime. A thin film is best. Allow to dry three to four minutes.

c. Apply a thin coating of **LOCTITE**, No. 242 adhesive to **SIDES** of keyways in shaft and armature. Be certain to remove any excess from mounting surfaces on shaft and bore of armature.

NOTE: Application of “Loctite” is to compensate for any looseness in machine key and keyway (up to 0.005 inch). Manufacturers of **LOCTITE** and other recommended products are listed below.

When exciter armature removal is for the replacement of bearings and no kit is involved, be sure that **LOCTITE** No. 242 is recommended, which is a milder adhesive than that recommended in the manual.

When kits are involved, the correct grade of **LOCTITE** is included in the Kit.

The application of **NEVER-SEEZ** to the shaft and armature bore is **NOT** recommended because there is a danger that it may mix with and contaminate the **LOCTITE.** Application of **NEVER-SEEZ** will be at the customer’s risk. **LOCTITE** can lose its adhesive and tightening properties if contaminated by rust preventatives, oil, or other lubricants and antirust products.

d. d. Apply **LOCTITE**, No. 242 to **SIDES** of new type threaded machine key. A thin film 0.005 to 0.010 inch thick is adequate and desirable.

e. e. Ensure keyways in the generator armature shaft and exciter armature are aligned.

f. f. Insert **UNTHREADED** end of key in keyways, then tap lightly until threaded end is flush with end of shaft.

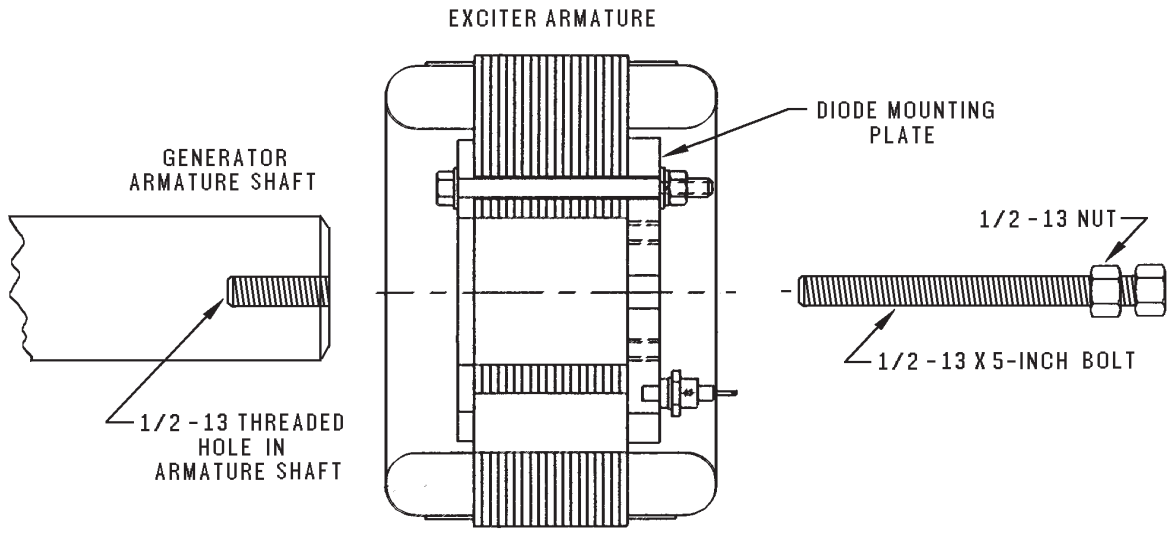
(4) Secure the exciter armature on generator shaft with the 1/2-13 cap screw.

CAUTION

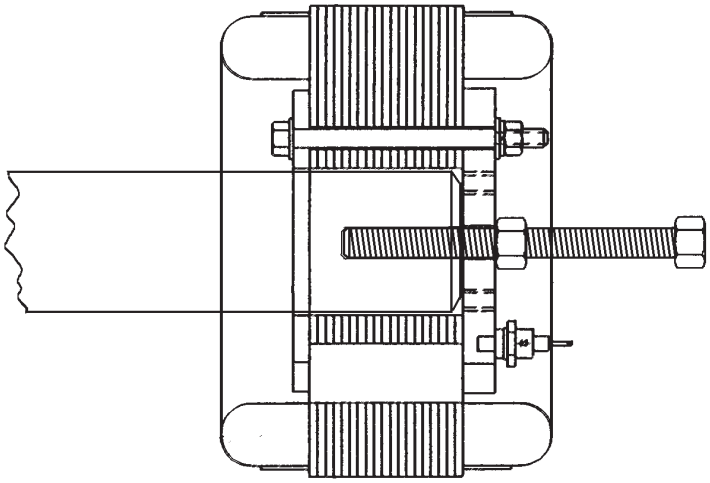
Allow at least 6 hours for complete cure and set up of Loctite before operating machine.

Recommended Products Manufacturers

- “LOCQUIC” No. 47-56, Primer Grade T
- “LOCTITE” No. 40-31, Retaining Compound, Manufactured by Loctite Corporation, Newington, Connecticut 06111
- “NEVER-SEEZ” No. NSBT-8 (8 oz. can), Manufactured by Never-Seez Compound Corporation, Broadview, Illinois 60153
- “NOCO10" Varnish No. T-211 (clear, air dry), Manufactured by Sterling Division of Reichhold Chemical Incorporated, Marysville, Pennsylvania 17053



EXCITER ARMATURE AFTER INSTALLATION ON ARMATURE SHAFT



(Remove the 1/2 -13 X 5-inch bolt and the nut after installing the exciter armature on the generator armature shaft.)

Installating the Exciter Armature

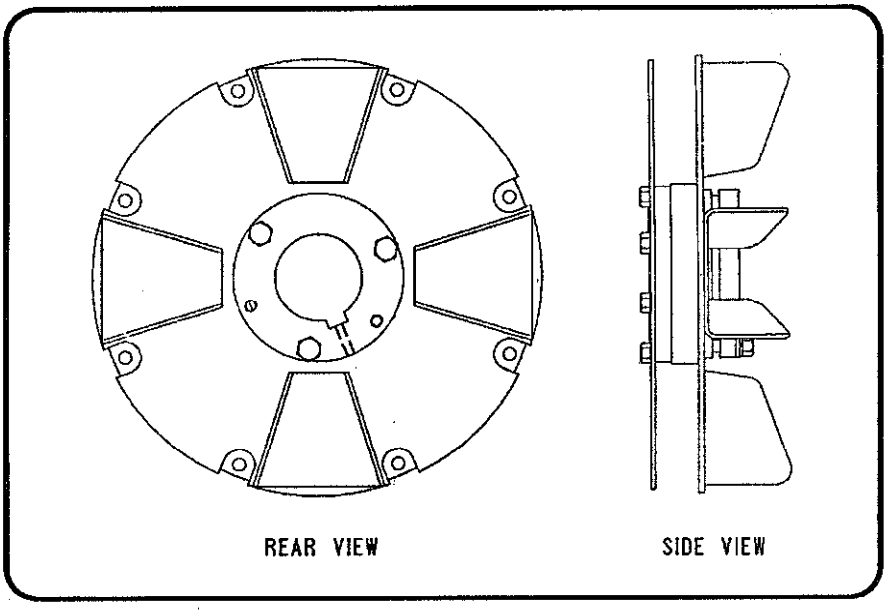
Figure 6

HOBART GROUND POWER

Section 3A. Single Bearing Flexible Coupling

1. General

This manual provides basic instructions for removal, service and installation of a single bearing generator flexible coupling assembly, with fan attached, manufactured by **Hobart Brothers Company** as **Part Number 281702**. This assembly is illustrated 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 split taper bushing secures the coupling to the generator's armature shaft. (See Fig. 5).



Coupling Assembly Single Bearing Generator Part No. 281702

Figure 1

2. Coupling Screws (Routine Coupling Maintenance)

CAUTION

Failure to verify proper coupling screw installation may result in coupling failure and damage to the equipment.

If the generator set is functioning properly, servicing the coupling assembly will be essentially limited to checking the screws which attach the flexible coupling to the engine flywheel of the generator set. These screws should be checked periodically to make certain that: (1) screws of proper type, length, and hardness are installed, (2) that the threads of the screws are not stripped, and (3) that they are torqued properly. Proceed as follows to check coupling screws.

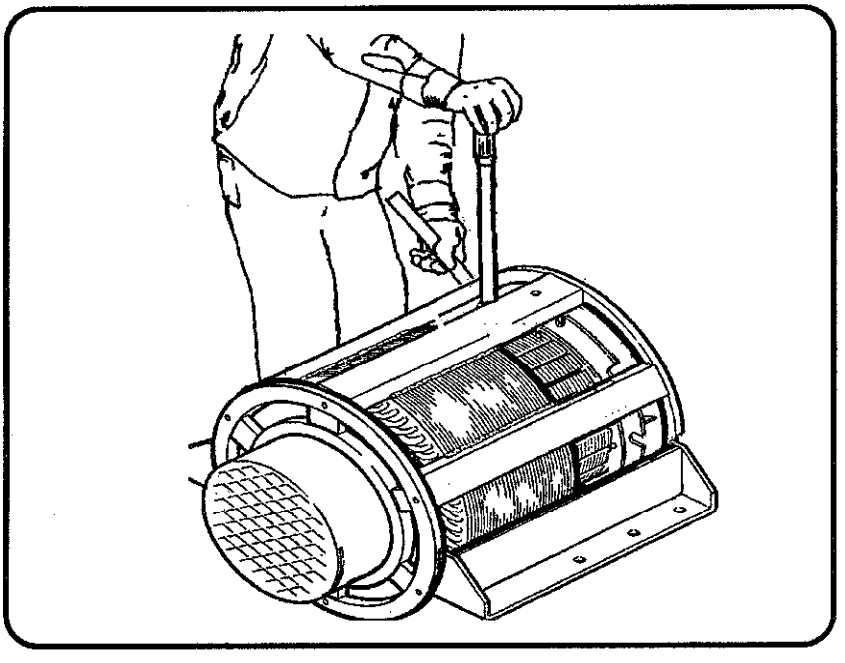
a. Refer to Figure 2. Hold a short iron bar through the generator housing against the fan blades of the fan and coupling assembly to block the armature against clockwise rotation. Do this carefully to avoid damaging the fan blades.

b. Use a long-handled, reversible ratchet drive fitted with a 5/16-inch Allen wrench to remove one coupling screw. Examine the screw and washers. Screws specified for this coupling are Hobart Part No. 283130, which are socket-head, self-locking 3/8 - 16 X 3/4 inch long. The vibration-proof washers are Hobart Part No. 283459, which must be installed in pairs with their cam faces together.

NOTE: Use of the proper coupling screws and washers for replacement is very important. Replacement screws and washers **MUST** be those specified above, torqued to 45 foot-pounds (61 Nm). There is **NO ACCEPTABLE SUBSTITUTE** for these screws or washers.

c. Check the threads of the screw for stripping and replace it if the threads are stripped. If the screw is not stripped, reinstall it and torque it to 45 foot-pounds (61 Nm).

d. Repeat the steps **a, b**, and **c** above for the remaining seven screws.



Access to Coupling Screws (for removal and installation)

Figure 2

3. 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 separate the engine and generator. Many mechanics prefer to remove the engine and generator as an assembly, and then separate them. Others may prefer to remove the engine or the generator separately 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 cables or wires if/as necessary and tag them for reassembly.

a. Separate Engine and Generator

(1) Remove the sheet metal cover from around the generator housing.

(2) Install a lifting eye with 1/2-13 threads in the rear-most tapped hole on top of the generator housing, and attach a hoist to it. Lifting eyes are available from Hobart as Part Number CTW-116A.

(3) Use a long-handled, reversible ratchet drive fitted with a 5/16-inch Allen wrench to remove the screws which attach the flexible coupling disk to the engine flywheel.

(4) Support the rear of the engine with a jack.

(5) Remove the bolts and shock mounts attaching the generator housing to the frame.

(6) Remove the bolts attaching the generator housing to the engine flywheel housing.

(7) Separate 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 screws (3) that secure the bushing (1) to the hub of the fan and coupling assembly.

(2) To separate the bushing from the hub, lubricate two of the 3/8-16 screws and insert them into the threaded holes (4) in the bushing. With socket wrench, screw these screws into the bushing such that the bushing pops loose from the hub.

(3) Using a 3/16-inch Allen wrench, loosen the set screw (6) in the bushing to release pressure on the key (5).

(4) When the bushing (1) is loose in the hub, 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) Using a 5/16-inch Allen wrench, remove the screws and washers which attach the flexible disks to the hub.

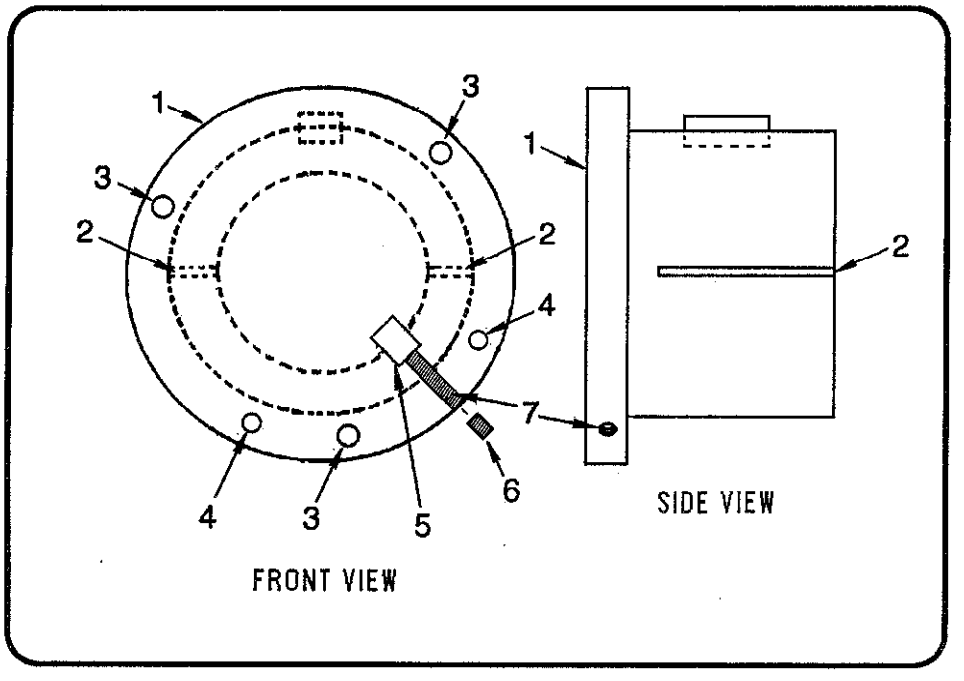
(7) Inspect the coupling assembly components carefully as follows:

a. Check for deformed fan blades and damage to the disk.

b. 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.

c. Check the flexible coupling disks for warping, cracks, or worn mounting holes.

d. Check the screws and washers which attach the flexible disks to the hub. The screws are Hobart Part No. 283130, which are socket-head, self-locking 3/8 - 16 X 3/4 inch long. If they are cracked, stretched, or have stripped threads, replace them. The vibration-proof washers are Hobart Part No. 283459, which must be installed in pairs with their cam faces together.



1. Bushing
2. Split
3. Mounting holes (3)
4. Tapped holes (2)
5. Key
6. Setscrew
7. Tapped setscrew hole

Split Taper Bushing

Figure 3

NOTE: Use of the proper coupling screws and washers for replacement is very important. Replacement screws and washers **MUST** be those specified above, torqued to 45 foot-pounds (61 Nm). There is **NO ACCEPTABLE SUBSTITUTE** for these screws or washers.

e. Check the shaft for any damage or deformation where the coupling was mounted on it.

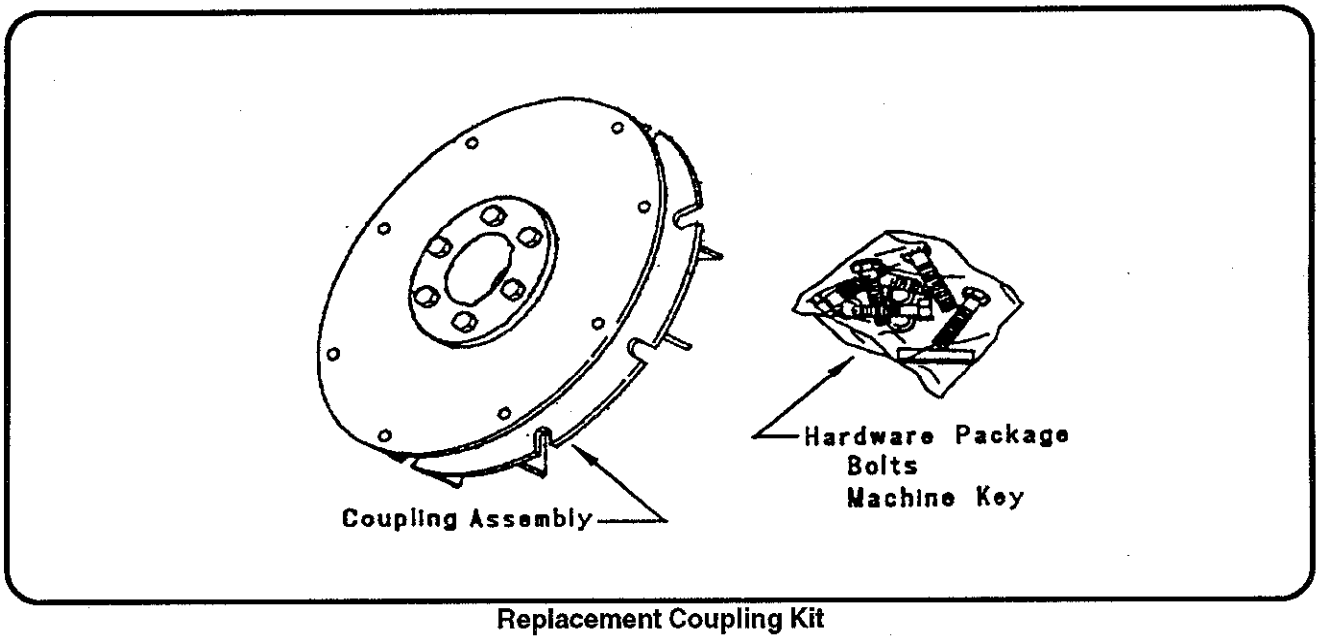
4. Coupling Service

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:	(513) 332-5050 (Parts) (513) 332-5060 (Service)
Fax:	(513) 332-5121

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 **283554.** This kit is illustrated in Figure 4.



Replacement Coupling Kit

Part No. 283554

Figure 4

5. 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 5. 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 only on the bushing, but nothing else.

b. Assembly

(1) Using a 5/16-inch Allen wrench, attach the four flexible disks to the coupling hub with the socket-head, self-locking 3/8 - 16 X 3/4 inch screws (Hobart Part No. 283130) and the 3/8-inch vibration-proof washers (Hobart Part No. 283459). The washers must be installed in pairs with their cam faces together, and the screws must be torqued to 45 foot-pounds (61 Nm).

(2) Position armature shaft in generator housing so that the generator fields and stator core are aligned, and the exciter fields and exciter armature core are aligned. The engine end of the armature shaft should be 2 inches from the face (not the seat flange) of the generator housing.

(3) Install the key in the keyway of the armature shaft.

(4) Place the bushing in the hub of the fan and coupling assembly such that the keyway of the bushing lines up with the keyway in the hub.

(5) Install the coupling assembly on the armature shaft over the installed key, pushing it on until the engine side of the flexible disks are approximately 1-5/8 inch from the face (not the seat flange) of the generator housing.

CAUTION

Make certain that only the screws are lubricated, and that no lubricant is permitted to get inside the bushing where the armature shaft will enter the bushing.

(6) Lubricate the three 3/8-16 X 3/4 screws **SPARINGLY** and start them into the three (unthreaded) holes finger-tight.

(7) Tighten the 3/8-16 X 3/4 screws alternately and evenly as follows:

a. Set a torque wrench to 30 foot-pounds *(41 N-m)* and tighten all three 3/8-16 screws to that value. As illustrated in Figure 2, insert and hold a short iron bar through the fan housing against the fan blades of the fan and coupling assembly to block the coupling against clockwise rotation. Do this carefully to avoid damaging the fan blades. Note that as these screws are tightened, the coupliing hub, along with the fan and flexible disks, will move toward the rear of the generator.

b. Repeat step *(a)* above until 3/8-16 screws can no longer be tightened.

(8) Measure the distance from the engine side of the flexible disks to the face (not the seat flange) of the generator housing. **THIS DISTANCE MUST BE 1-1/2-INCH!**

(9) If the 1-1/2-inch distance is not achieved, loosen the three screws in step (7), relocate the coupling on the armature shaft, and repeat steps (7) and (8) until the distance is achieved.

(10) Using a 3/16-inch Allen wrench, tighten the set screw in the bushing to apply pressure on the key.

6. Reassemble Engine and Generator

CAUTION

Use of the proper coupling screws and washers is very important. Failure to use the proper screws and washers, as outlined below, can result in coupling failure and damage to the generator set.

Screws specified for this coupling are Hobart Part No. 283130, which are socket-head, self-locking 3/8 - 16 X 3/4 inch long. The vibration-proof washers are Hobart Part No. 283459, and must be installed in pairs with their cam faces together. These screws and washers are included in the coupling kit.

a. Using a hoist, align the generator housing flange with the flange on the engine flywheel housing and insert two of the attaching screws, one on each side of the flange. Start the screws into the tapped holes in the flywheel housing just enough to ensure thread engagement. **DO NOT TIGHTEN.**

b. Insert the proper coupling screws and washers through the flexible disc at the front of the coupling and into the flywheel.

c. Turn all of the coupling screws into the tapped holes in the flywheel, finger tight. **DO NOT** tighten with a wrench.

d. Insert all remaining attaching screws (two installed in Step **a**, above) through the generator flange, engaging the tapped holes in the flywheel housing, and tighten them all securely.

e. Refer to Figure 2. Insert and hold a short iron bar through the housing against the fan blades of the fan and coupling assembly to block the armature against clockwise rotation. Do this carefully to avoid damaging the fan blades. Torque all of the coupling screws to 45 foot-pounds (61 N-m). Be sure the flexible disks are all seated evenly into the seat of the flywheel.

7. 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.

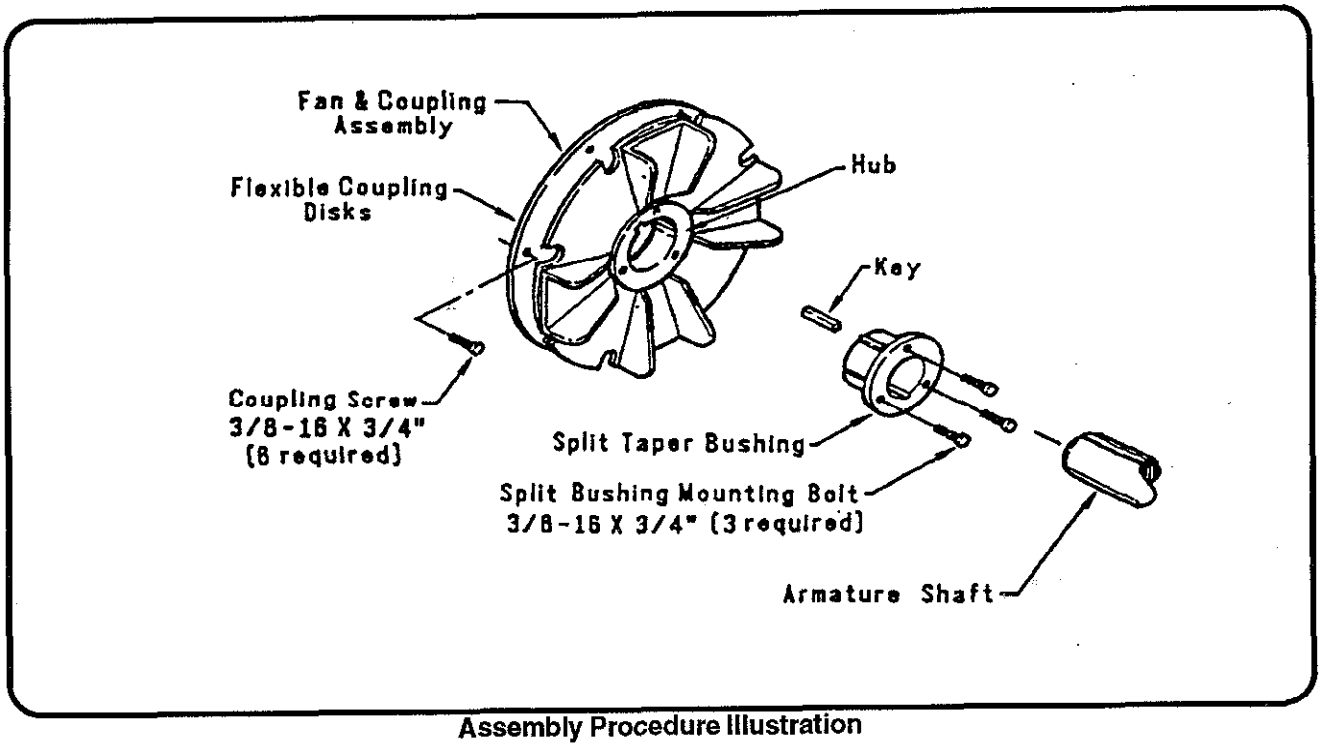
b. Shut down the engine after 2 hours and re-torque all coupling screws to 45 foot-pounds (61 N-m) to compensate for normal torque relaxation.

c. Return the unit to normal service.

d. After 200 hours of operation, check all coupling screws with a torque wrench set at 45 foot-pounds (61 N-m).

e. Return the unit to normal service.

f. After each additional 2,000 hours of operation (or every year) recheck all coupling screws to maintain the same torque value.



Assembly Procedure Illustration

Figure 5

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Section 3B. Dual Bearing Flexible Coupling

1. General

This manual provides basic instructions for removal, service and installation of a flexible coupling assembly, with fan attached, manufactured by **Hobart Brothers Company** as **Part Number 281701.** 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.

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 separate 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 3-1/2 inches *(89 mm)* long, reinstall it and torque **ALL** three 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).* **Only three bolts must be used and they must be equally spaced.** There is **NO ACCEPTABLE SUBSTITUTE** for these bolts. Hobart Brothers stocks these bolts as Part Number W-11102-18.

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 separate the engine and generator. On self-propelled units, many mechanics prefer to remove the engine and generator as an assembly, and then separate them. Others may prefer to remove the engine or the generator separately to reach the coupling. However, separating 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. Separate Engine and Generator

(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) Remove the fan housing cover from the generator fan housing.

(3) Refer to Figure 2. Use a 15/16-inch socket ona long-handled ratchet and remove the three hex-head bolts which attach the coupling to the spacer ring.

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) Separate 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:

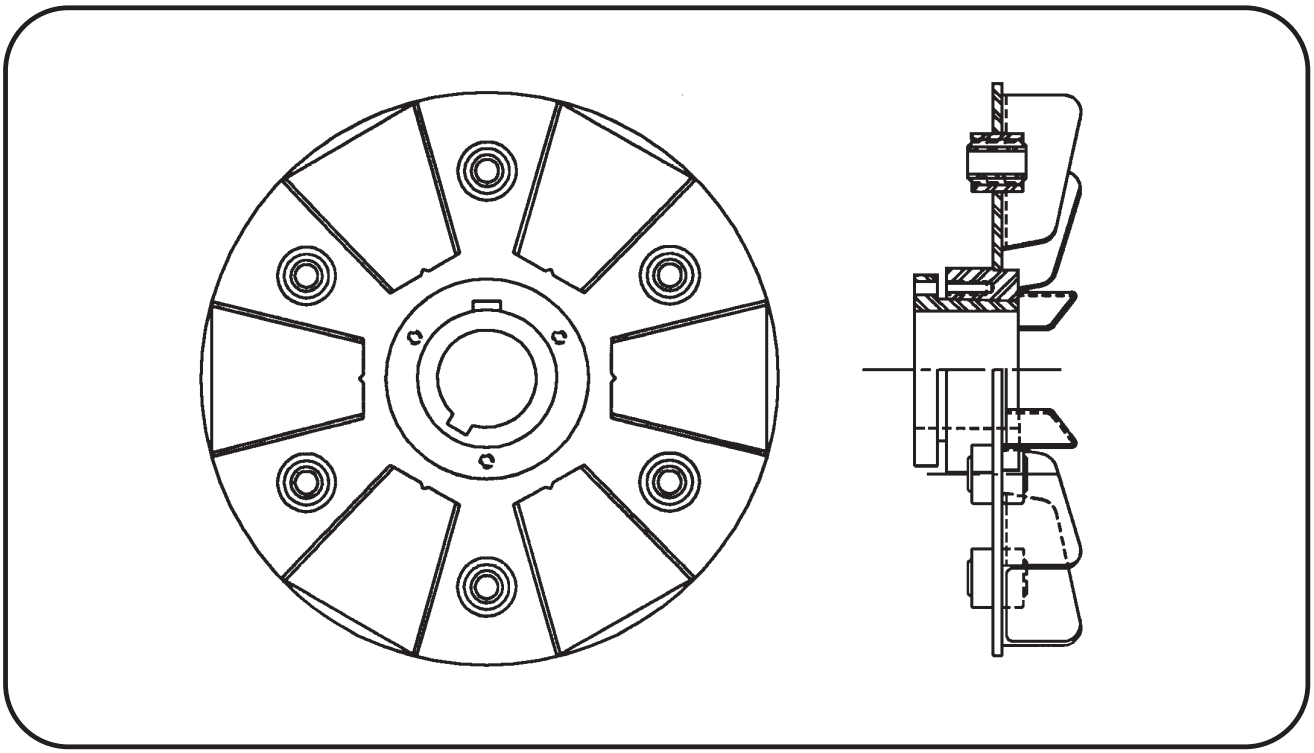
a. Check for deformed fan blades and damage to the disk.

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 9 is maintained.



Coupling Assembly

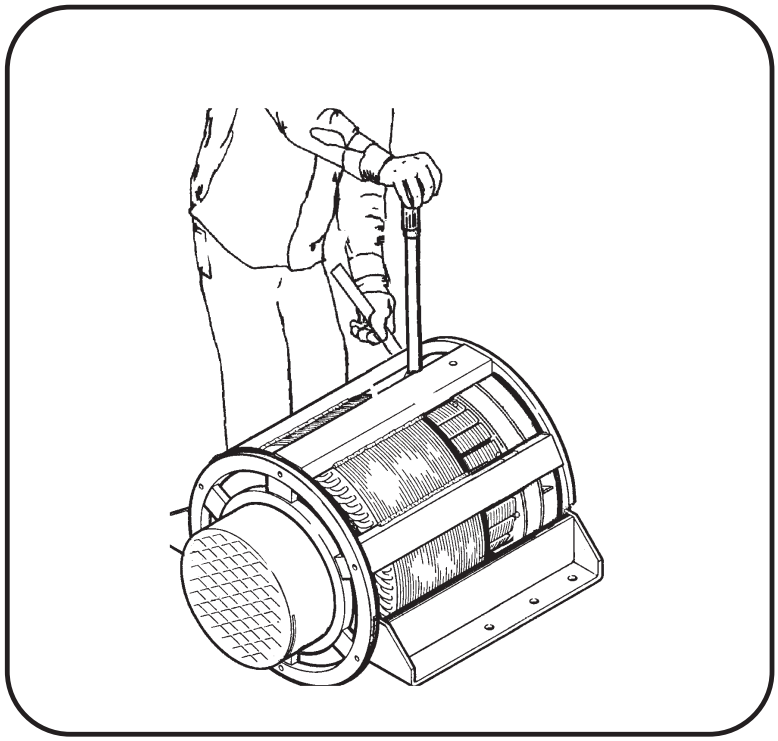
Figure 1

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 Brother Company** **Airport Systems Group** **Service Department** **1177 Trade Square East** **Troy, Ohio 45373** **U.S.A.**
In U.S.A. Call:	**(800) 422-4166 (Parts)** **(800) 422-4177 (Service)**
From Foreign Countries Call:	**(513) 332-5050 (Parts)** **(513) 332-5060 (Service)**
FAX:	**(513) 332-5121**



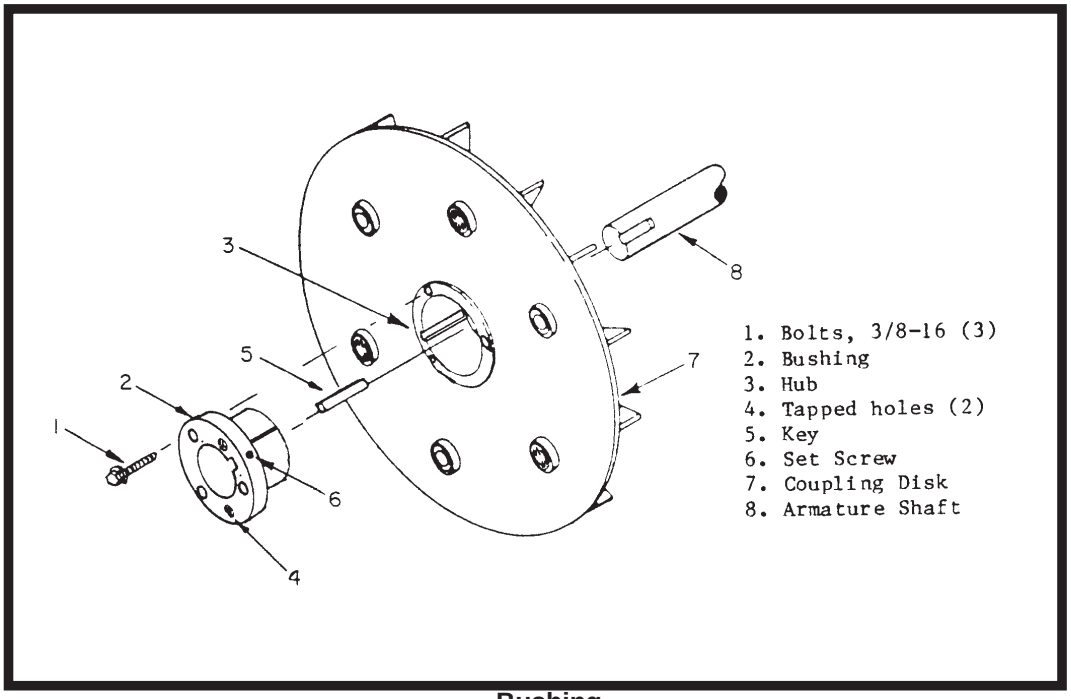
Access to Coupling Bolts

(for removal and installation)

Figure 2

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 **283555.** This kit is illustarted in Figure 4.



Hub and Bushing

Figure 3

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 instaructions.

Bushing Replacement

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 poor 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 three new bushings are installed. The three bushings must be equally spaced.

(6) Balance the complete coupling assembly to 1/2 inch-ounce *(360 mg-m)* minimum.

4. Coupling Installation

CAUTION

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

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) 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. 402789-3** (3/8-16 X 2-1/2 Socket Head Cap Screws).

Torque all 8 bolts to 45 foot-pounds *(61 N-m).*

The new adaptor ring and bolts are included in the kit.

(2) Refer to Figure 3. Assemble the split bushing *(2)* into the hub *(3).*

CAUTION

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.

(3) Lubricate the three 3/8-16 bolts **SPARINGLY** and start them into the three *(unthreaded)* holes finger-tight.

(4) 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.

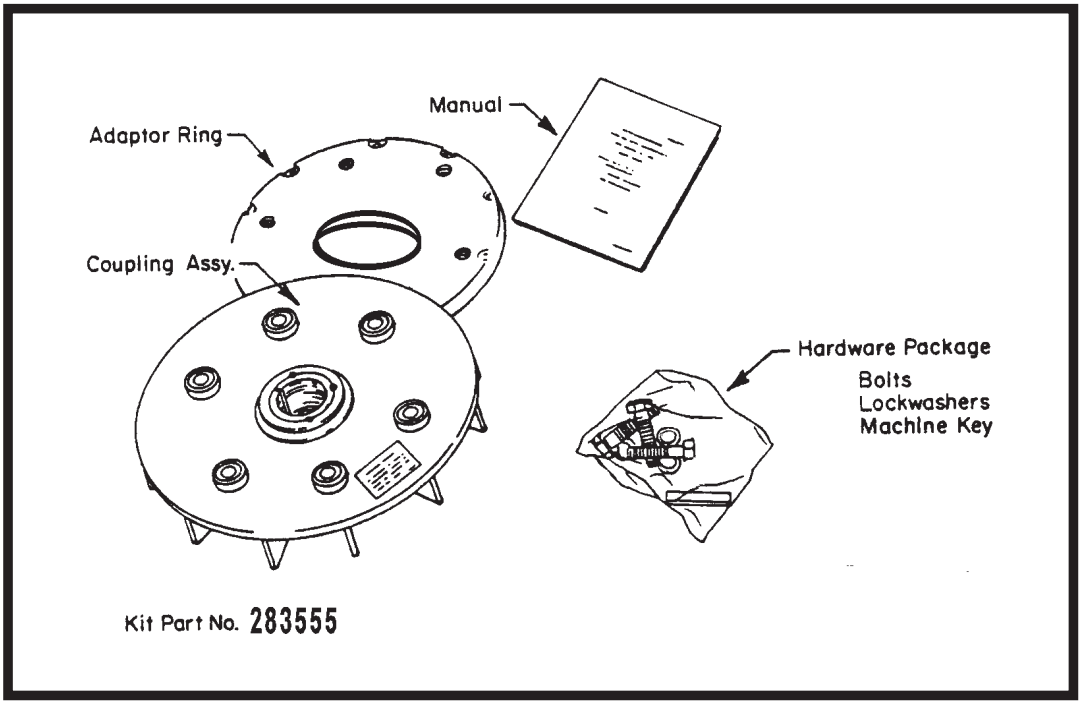
CAUTION

CAUTION: DO NOT ROTATE THE ARMATURE WHILE THIS BLOCK IS INSTALLED.

(5) Install the key in the shaft keyway.

(6) 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.

(7) Using a 3/16-inch Allen wrench, tighten the set screw *(6)* in the bushing *(2)* to apply pressure on the key *(5).*



Coupling Kit

Figure 4

(8) 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.

(9) Tighten the 3/8-16 bolts *(1, Figure 3)* alternately and evenly as follows:

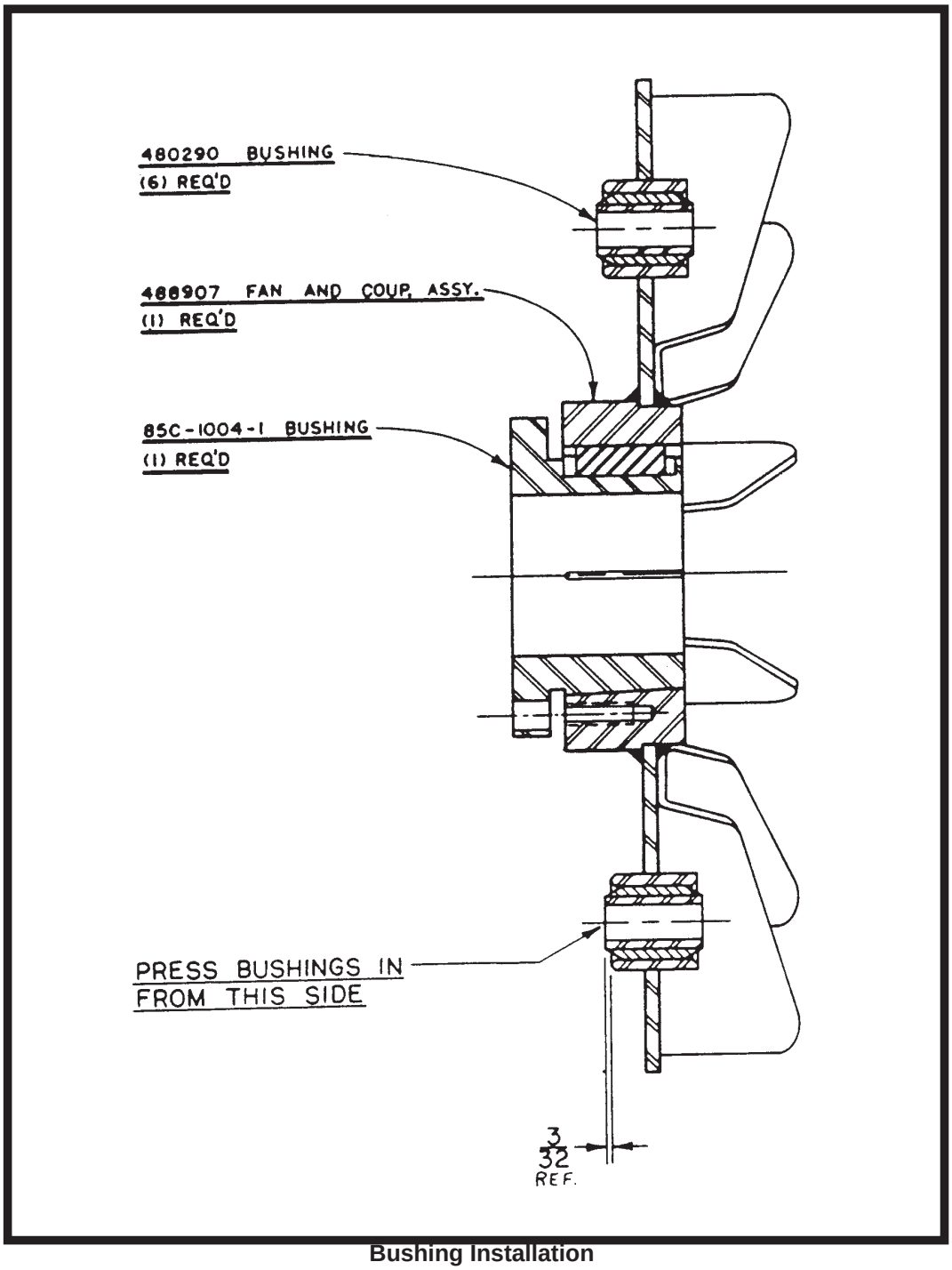
a. Set a torque wrench to 30 foot-pounds *(41 N-m)* and tighten all three 3/8-16 bolts to that value. Block the coupling against clockwise rotation with a bar, as illustrated in Figure 10. Observe the **CAUTION** above when it is necessary to rotate the shaft.

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.

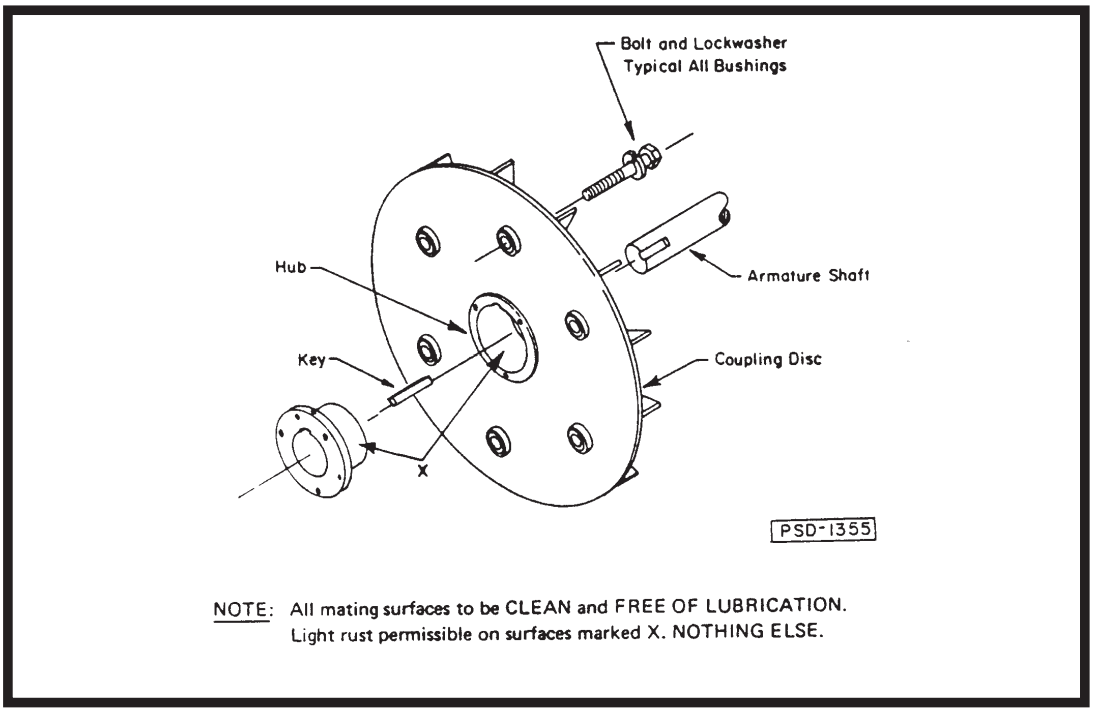
CAUTION

CAUTION: REMOVE ARMATURE BLOCK INSTALLED IN PARA. 4.B.(3). OTHERWISE, DAMAGE TO THE ARMATURE COULD RESULT.



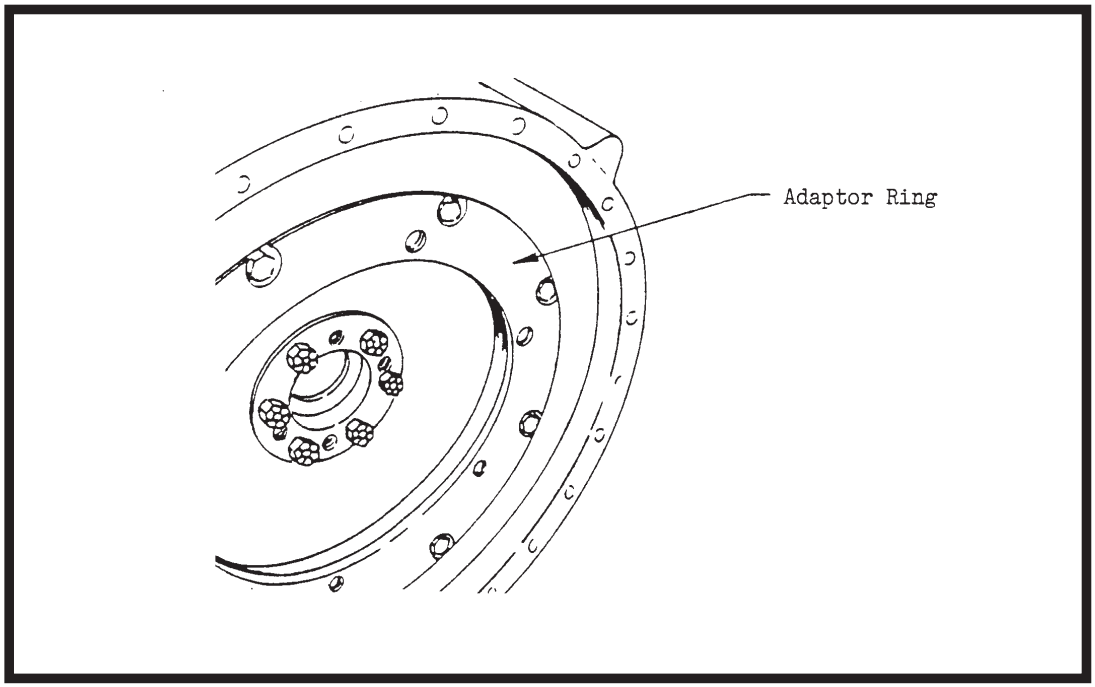
Bushing Installation

Figure 5



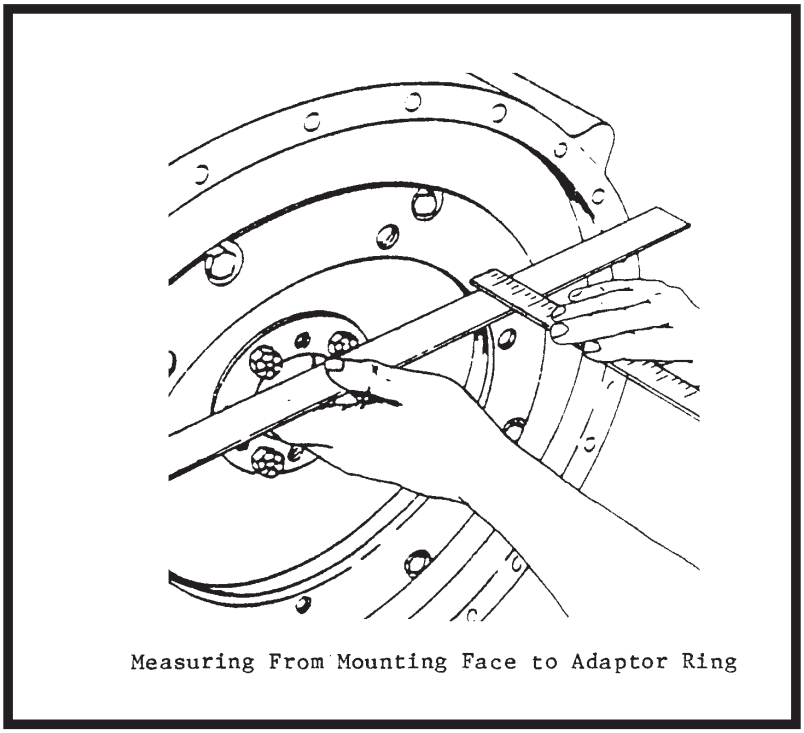
Assembly Procedure

Figure 6



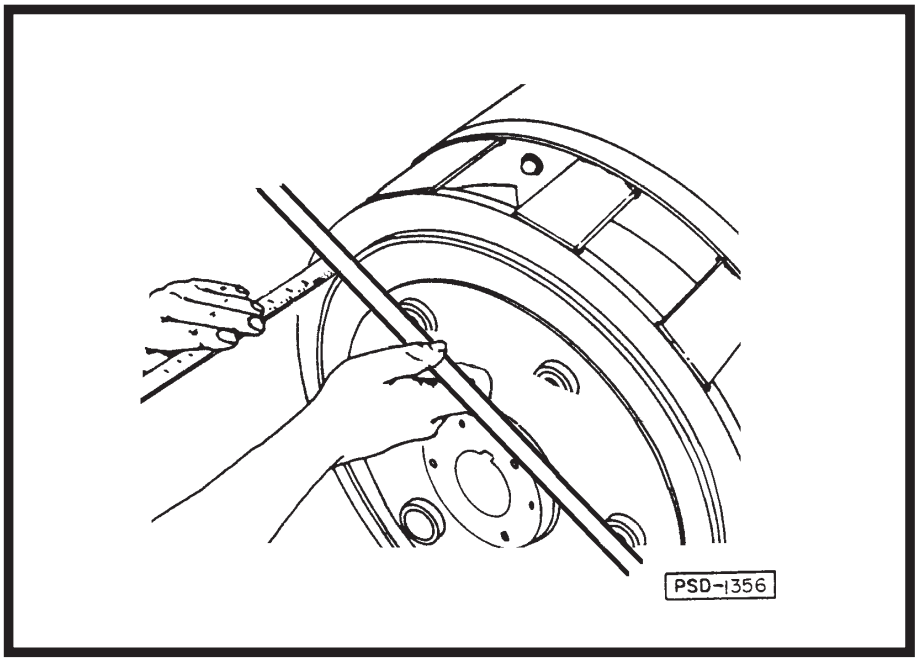
Flywheel Adaptor

Figure 7



Engine Measurement

Figure 8



Measuring from Mounting Face to Bushing

Figure 9

5. Reassemble Engine and Generator

CAUTION

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.

Section 4. Generator Assembly

1. General

This section provides information and instructions for removal and installation of the generator assembly used on Specification 7130 generator sets.

2. Procedure for Generator Assembly Removal

a. Procedure for Gaining Access to the Generator

WARNING

Before starting removal of the generator assembly, position the front section of the generator set under a hoist which is capable of lifting at least 940 pounds (426 kg), which is the weight of the generator assembly.

To gain access to the generator assembly, refer to Figure 1 and Connection Diagram 283122 in Chapter 5 and proceed as follows:

(1) Disconnect battery leads from the generator set.

(2) If a transformer-rectifier (T-R) assembly is mounted on the generator set, remove T-R assembly. Remove both T-R assemblies if two are mounted on the generator set.

(3) Disconnect clearance light wires from the top canopy (1).

(4) Remove top canopy panel (1). Do this by removing the 1/4 - 20 x 1/2 tap-tite screws which are used to mount it to the frame of the generator set.

(5) Disconnect plug connectors (P11 and P12) from receptacles (3) on the side of control box.

(6) Disconnect harness wires from the terminal block (TB-1) inside the control box.

(7) Remove the control box (2). Do this by removing the 1/4 - 20 keps nuts which are used to mount it to the frame of the generator set.

(8) Remove wires from terminal block TB-4.

(9) Remove the control box support panel (4) by removing the 1/4 - 20 x 3/4" self-tap screws which are used to mount it to the frame of the generator set

(10) Remove left side panel (5) from the generator set. Do this by removing the 1/4 - 20 x 1/2 tap-tite screws which are used to mount it to the frame of the generator set.

(11) Disconnect output cables from load contactors (8), loosen cable clamps (9), and remove the cables from the generator set.

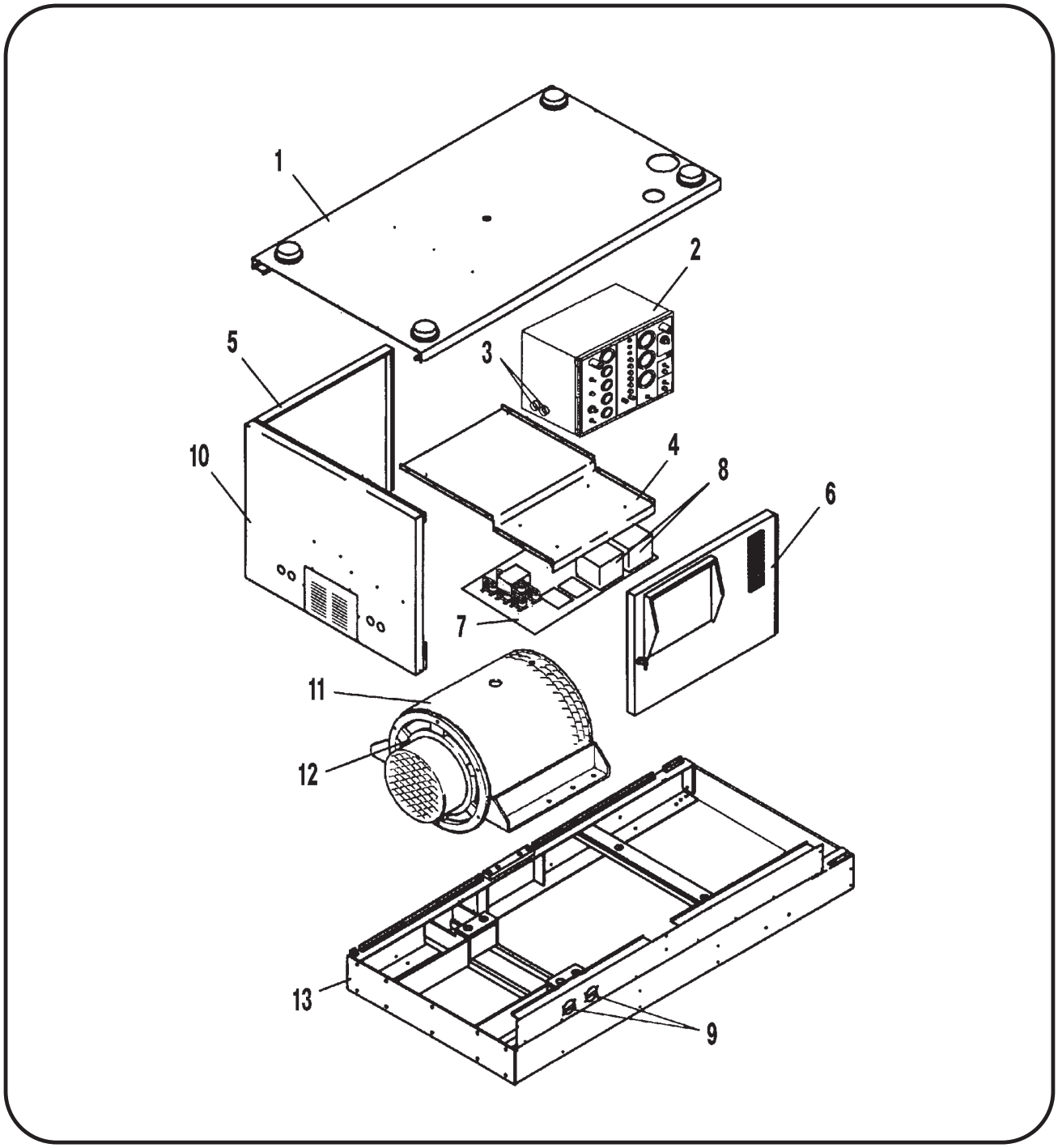
(12) Remove the right front door (6) from the generator set. Do this by removing the 1/4 - 20 x 1/2 tap-tite screws which are used to mount it to the frame of the generator set.

(13) Disconnect stator leads and control cable from the power module (7).

(14) Remove power module assembly (7). Do this by removing the 1/4 - 20 keps nuts which are used to mount it to the frame of the generator set.

(15) Remove front canopy panel (10). Do this by removing the 1/4 - 20 x 1/2 tap-tite screws which are used to mount it to the frame of the generator set.

(16) Remove generator wrapper (11). Do this by removing the 1/4 - 20 x 1-1/4 tap-tite screws which are used to mount it to the frame of the generator set.



1. Top canopy panel
2. Control box
3. Receptacles, control box
4. Support panel, control box
5. Left side panel
6. Right side door
7. Power module panel
8. Load ciontactors
9. Cable clamps
10. Front canopy panel
11. Generator wrapper
12. Generator assembly
13. Frame assembly

Assembly Removal Procedure Drawing for Access to Generator

Figure 1

b. Removing the generator Assembly

(1) Remove the four 5/8 - 11 x 4-1/2 bolts which mount the generator assembly (12) to the frame (13) of the generator set.

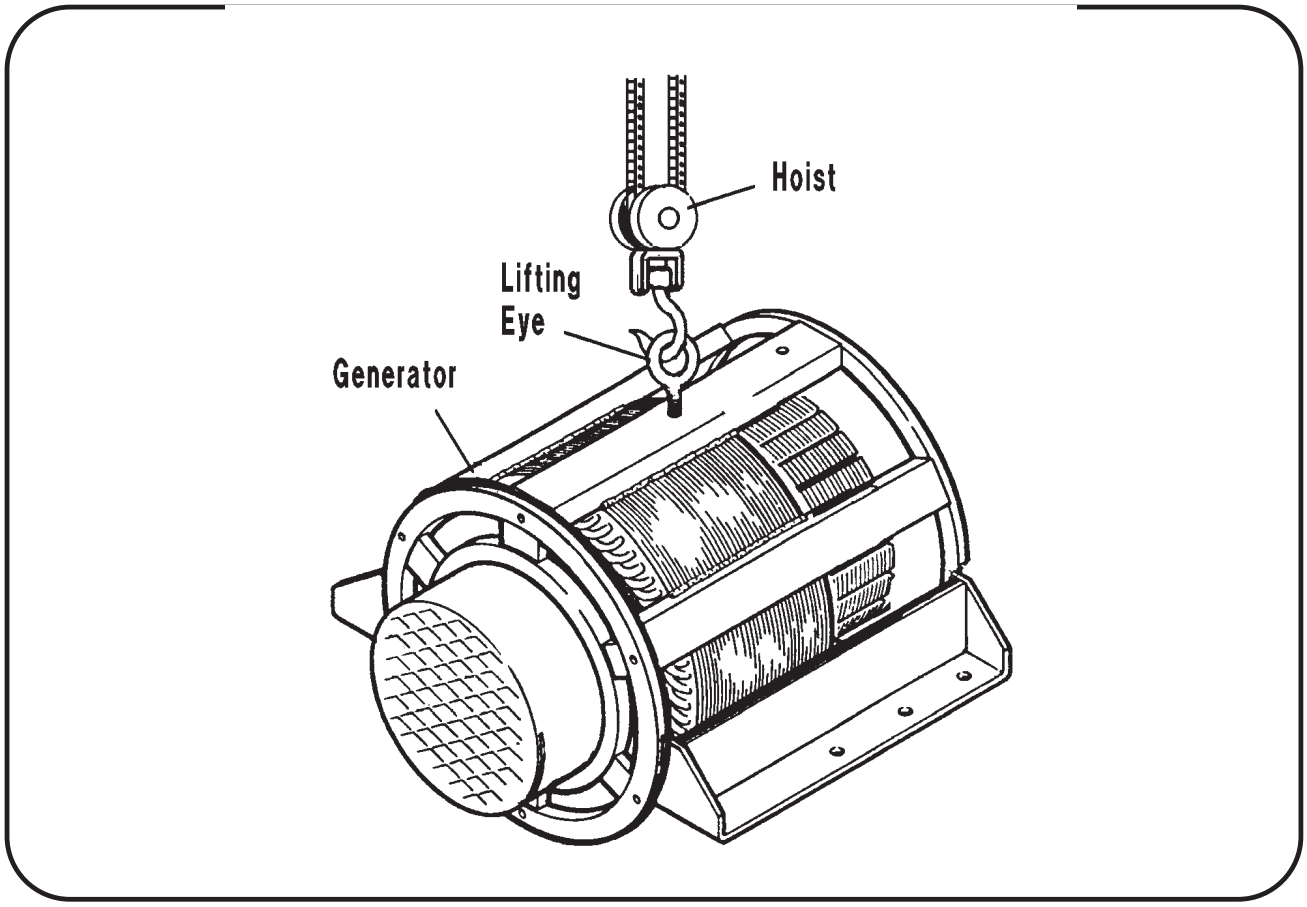
(2) Support the engine at the flywheel housing with wooden blocks.

(3) Using the hoist, support the generator assembly as shown in Figure 2. For lifting con- venience, a 1/2 - 13 threaded hole is drilled in the top of the generator housing. Insert a 1/2 - 13 eye-bolt in the hole and attach the hoist chain to the eye-bolt as shown in Figure 2.

(4) Remove the 5/8 - 11 x 4-1/2 bolts generator-to-flywheel coupling bolts.

(5) Detach the generator housing from the engine. Do this by removing the six M10 - 1.5 x 35 metric bolts.

(6) Carefully lift and separate the generator from the engine.



Generator Lifting Arrangement

Figure 2

3. Installing a Generator Assembly

Installation of a generator assembly is essentially a reversal of the procedure for removal of the generator assembly: the re-mounting of the generator assembly to the frame of the generator set, and the re-mounting of the assemblies that were removed to gain access to the generator assembly. To install the generator assembly, refer to Connection Diagram 283122, and proceed as follows:

a. Remounting the Generator Assembly

(1) Support engine at flywheel housing with wooden blocks.

(2) Using the hoist, support the generator assembly and lower it carefully and slowly into position for attachment to the engine.

(3) While still supporting the generator assembly with the hoist, attach the generator housing to the engine, using the six M10 - 1.5 x 35 metric bolts.

(4) Attach the generator to the flywheel coupling, using the six 5/8 - 11 x 4-1/2 bolts.

(5) Mount the generator housing to the frame of the generator set, using the four 5/8 - 11 x 4-1/2 bolts.

(6) Install the generator wrapper (11, Fig. 1) on the generator assembly (12, Fig. 1), using 1/4 - 20 x 1/2 tap-tite screws.

b. Remounting the Previously Removed Assemblies

(1) Install power module assembly, using 1/4 - 20 keps nuts to mount it to the frame of the generator set.

(2) Install left side panel (5), using 1/4 - 20 x 1/2 tap-tite screws.

(3) Route output cables through cable clamps (9) and connect them to the load contactors (8). Make certain that these cables are connected properly in regard to phases A, B, and C, and that connections are securely made.

(4) Connect stator leads and control cable to the power module.

(5) Install front canopy panel (10), using 1/4 - 20 x 1/2 tap-tite screws.

(6) Install the control box support panel (4), using 1/4 - 20 x 3/4 tap-tite screws.

(7) Connect wires to terminal block TB-4 that were previously removed from it.

(8) Install the control box (2), using 1/4 - 20 keps nuts to mount it to the control box support panel.

(9) Connect harness wires to the terminal block (TB-1) inside the control box.

(10) Connect plug connectors (P11 and P12) to receptacles (3) on the side of the control box.

(11) Install top canopy panel (1), using 1/4 - 20 x 1/2 tap-tite screws to mount it to the frame of the generator set.

(12) Install right side door (6), using 1/4 - 20 x 1/2 tap-tite screws.

(13) Connect clearance light wires to the top canopy panel.

(14) Install transformer-rectifier (if the unit is equipped with this feature).

(15) Connect battery leads to the generator set.

Section 5. Transformer-Rectifier Repair

1. General

Repair of the transformer-rectifier (T-R) will consist primarily of parts replacement. The only rotating parts in the unit are the two cooling fans and the only other moving parts are switches, relays, rheostats, and meters.

2. Removal and Installation

It is suggested that if extensive repairs are to be made to a T-R which is mounted on a mobile machine such as a self-propelled generator-set, etc., the unit be removed and placed on a workbench or other supporting structure.

a. Removal Procedures

WARNING

Make certain input power cannot reach the T-R. lethal electrical shock hazard exists.

(1) Disconnect DC cables at output terminals.

(2) Open the control panel and disconnect three AC input leads at the contactor (1-1; 7, Fig. 15).

WARNING

If the mobile generator set is to be operated while t-r is removed, disconnect also the T-R supply leads at the generator set terminal board.

(3) Disconnect plug connector P403. See connection diagrams at the rear of this manual.

(4) Remove the mounting screws which attach the T-R to the mobile unit.

(5) Attach a lifting hoist and carefully lift the T-R. Lifting holes are accessible when plug buttons are removed in sides of the top. Be sure all leads are free and do not become entangled. Move the unit to a workbench or clear working area.

b. Installation Procedures

(1) Attach a lifting hoist to the T-R and carefully lower it to its mounting position on the generator set. Again, be sure all leads are free and do not become entangled.

(2) Remount the T-R to its mounting position on the generator set, using the same mounting screws which were removed preciously.

(3) Reconnect plug connector P403.

(4) Reconnect three AC input leads at the contactor

(5) Reconnect DC cables at output terminals.

3. Parts Replacement

a. Access

All parts which might normally require replacement are easily accessible by opening the front and rear hinged access panels. Output diodes are accessible by removing the housing top.

b. Parts Removal

(1) Modules

The overload, and line-drop and current-limiting modules are equipped with quick-disconnect lead connectors so that input and output lead identification for these units is not a problem. Identify and mark leads to the overvoltage module before removal.

(2) Miscellaneous parts

a. When removing a defective part, carefully disconnect any wire leads that are connected to the defective part, after marking the leads so that they can be properly reconnected when the part is replaced.

b. Carefully remove the defective part, after removing any other part(s) as necessary for gaining access to the defective part.

c. Parts Installation

Check new parts physically and electrically, if possible, before installation.

(1) Position part carefully in mounting location and attach securely.

(2) Be certain all leads are connected properly. If any doubt exists, refer to the applicable connection diagram located at the rear of this manual.

(3) If it is necessary to replace any of the diodes mounted on the heat sinks *(1-1; 3 and 13, Fig. 15)* torque the Westinghouse diodes to 25 foot-lbs., or the International Rectifier diodes to 13-1/2 foot-lbs.. For other manufacturer's diodes, contact the factory at the address given in the Introduction of this manual for installation torque requirements.

NOTE: The torque value for these diodes is a critical requirement. The torque requirements vary widely among the various suppliers of these diodes and, in addition, the suppliers change. Therefore, it is impracticable to provide torque values for all diodes in this manual.

(4) If the bus bars *(1-1; 2 and 13, Fig. 15)* and aluminum nuts which secure them are removed for any reason, they must be torqued in place at installation to 20 to 25 lb.-feet *(27 to 34 N-m).* The mounting face of each aluminum nut and the threads on the bus bars must be coated with Penetrox or an equivalent heat sink compound at installation.

d. Fan Installation

If fan blades rotate in the wrong direction, reverse connection of any **TWO** fan input leads.

4. Workmanship

Perform all repairsin accordance with good electrical repair practices. All interconnecting lead connections to components must be made with proper wire terminations. Route all leads neatly and secure with ties, clamps, etc.

5. Connection Diagrams

A complete set of connection diagrams are included in the rear of this manual. When reconnecting wires to a component, use the connection diagrams to make certain connections are made correctlly.

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 a Diesel Engine-Generator Set manufactured by Hobart Brothers Company, Power Systems Division, Troy, Ohio.

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 six 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 will reflect no vendor or part number in the "NOMENCLATURE" column.

(3) AIRLINE PART NUMBER Column

This column will appear blank. Eleven character spaces have been reserved for filling in part numbers that may have been assigned by indvidual airlines.

(4) 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 also listed in this column when applicable. Hobart modification to vendor items is also noted in this column.

(5) 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. Since this manual covers only one generator set specification, this column is not used in this manual.

(6) 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 inserted in the nomenclature column of the parts list directly following the item name and description. In case a manufacturer does not have a 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, PA 17105
01428	Superior Ball Joint Corporation 1202 S. Quality Drive P.O. Box 227 New Haven, IN 46774
01843	American Bosch Marketing Div. of Ambac Industries Inc. 3664 Main Street Springfield, Mass 01107
02231	Anchor Rubber Company 840 S. Patterson Boulevard Dayton, OH 45402
03924	STRATOFLEX, Inc. Fort Wayne, IN
04009	Arrow-Hart & Hegeman Electric Co. 103 Hawthorne Street Hartford, CT 06106
04713	Motorola Inc. Semiconductor Products Division Phoenix, AZ
05277	Westinghouse Electric Corp. Semi & Conductor Department Youngwood, PA 15697
08108	Lamp Industry for use with Industry Designations and Abbreviations for Lamps
09393	Rochester Gauges, Inc. P.O. Box 20180 Dallas, TX 75220

Code	Vendor's Name & Address
14101	Sprague Electric Company 300 W. National Road Vandalia, OH 45377
15434	Cummins Engine Company 1000 Fifth Street Columbus, IN 47201
15605	Cutler-Hammer 1391 W. St. Paul Avenue Milwaukee, WI 53233
16238	Lord Mfg. Co. Inc. Sterling Road South Lancaster, Mass 01561
19220	Eberhard Manufacturing Company 2734 Tennyson Road Cleveland, OH 44104
20038	ESB Inc. Philadelphia Pa. 2 Penn Center Plaza P.O. Box 8109 Philadelphia, PA 19101
21335	Fafnir Bearing Company Div. of Textron 37 Booth Street New Britain, CT 06050
21585	Farr Company 2301 E. Rosecrans El Segundo, CA 90245
24248	South Chester Corporation South Company Division 3d Street & Governor Printz Blvd. Lester, PA 19113

Code	Vendor's Name & Address
26992	Hamilton Watch Company Columbia & West End Avenues Lancaster, Pennsylvania 17604
27191	Cutler-Hammer Inc. Power Distribution & Control Division 4201 N. 27th Street Milwaukee, Wisconsin 53216
28520	Heymarr Mfg. Co. 1000 Michigan Avenue Kenilworth, New Jersey 07033
30327	Imperial Eastman Corporation 6300 W. Howard Street Chicago, IL 60648
31356	J-B-T Instruments, Inc. 424 Chapel Street P.O. Box 1818 New Haven, CT 06508
35738	Charles Lentz & Sons 3330 N. Broad Philadelphia, PA 19140
41197	Madine Manufacturing Company 1500 Dekoven Avenue Racine, Wisconsin 53401
44655	Ohmite Manufacturing Company 3601 W. Howard Street Skokie, Illinois 60076
49234	Protectoseal Company 1920 S. Western Chicago, Illinois 60608
57448	Stephens & Adamson Mfg. Company 275 Ridgeway Avenue Aurora, Illinois 60507
57733	Stewart-Warner Corporation 1826 Diversey Parkway Chicago, Illinois 60614
58849	Syntron Company 1938 Block Street Homer City, Pennsylvania 15748
5970	The Thomas & Betts Company 36 Butler Street Elizabeth, New Jersey 07207
60741	Triplett Electrical Instrument Co. Harmon Road Bluffton, Ohio 45817
61112	Turner Corporation 821 Park Avenue Sycamore, Illinois 60178
66295	Wittek Manufacturing Company 4309 W. 24th Chicago, Illinois 60623
70485	Atlantic India Rubber Works Inc. 571 W. Polk Street Chicago, Illinois 60607
71400	Bussmann Mfg. Division of McGraw & Edison Company 2536 W. University Street St. Louis, Missouri 63017
71744	Chicago Miniature Lamp Works 4433 Ravenswood Avenue Chicago, Illinois 60640
74559	Carling Electric, Inc. 505 New Park Avenue Hartford, Connecticut 06110
74063	Hartman Electrical Manf. Co. P.O. Box 8 Mansfield, Ohio 44901
74400	John W. Hobbs Corporation Ash Street & Yale Boulevard Springfield, Illinois 62703
75358	Knape & Vogt Mfg. Company 2700 Oak Industrial Drive Grand Rapids, Michigan 49505
75418	Kysor Industrial Corporation 1100 W. Wright Street Cadillac, Michigan 49601
77342	American Machine & Foundry Co. Potter & Brumfield Division 1200 E. Broadway P.O. Box 522 Princeton, Indiana 47570
78225	Stant Manufacturing Company Inc. 1620 Columbia Connersville, Indiana 47331

Code	Vendor's Name & Address
78553	Tinnerman Products Inc. 8700 Brookpark Road Cleveland, Ohio 44129
79470	The Weatherhead Company 300 East 131st Street Cleveland, Ohio 44108
81074	Holub Industries, Inc. 413 DeKalb Avenue Sycamore, Illinois 60178
81082	Electric Auto Lite Company Lebanon Road Cincinnati, Ohio 45241
81860	Barry Controls Division of Barry Wright Corp. 700 Pleasant Street Watertown, Massachusetts 02172
81861	Burton Electrical Engineering Co. Maryland & El Segundo Blvd. El Segundo, California 90246
84970	Sharkes Tarzian Inc. Broadcast Equipment Division E. Hillside Drive Bloomington, Indiana 47401
85925	Electro Mechanical Instrument Co., Inc. 8th and Chestnut Street Perkasie, Pennsylvania 18944
89110	AMP Incorporated 155 Parks Street Elizabethtown, Pennsylvania 17022
89373	United States Rubber Company Detroit, Michigan
89616	United States Rubber Company Consumer Industrial and Plastics Products Div. Mishawaka, Indiana 46544
90201	Mallary Capacitor Company 3029 East Washington Street P.O. Box 372 Indianapolis, Indiana 46206
90763	United-Carr Inc. 4258 N. Cicero Chicago, Illinois 60640
91637	Dale Electronics, Inc. P.O. Box 609 Columbus, Nebraska 68601
91929	Honeywell, Inc. Buildings Controls and Components Group Micro Switch Division Freeport, Illinois 61032
92242	Willard Mfg. Company Miamisburg, Ohio 45342
92563	McGill Manufacturing Company, Inc. Bearing Division 907 Lafayette Valparaiso, Indiana 46383
95879	Alemite Instrument Division of Stewart-Warner Corporation 1826 Diversey Parkway Chicago, Illinois 60614
97576	The Lenz Co. 3301 Klepinger Road P.O. Box 1044 Dayton, Ohio 45401
98410	E.T.C. Inc. 990 E. 67th Street Cleveland, Ohio 44103
98738	Stewart-Warner Electronics Division of Stewart-Warner Corp. 1300 N. Kostnr. Chicago, Illinois 60651
98991	Worcester Valve Company, Inc. 16 Parker Street Worcester, Massachusetts 01610

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Section 3. Illustrated Parts List

1. Explanation of Parts List Arrangement

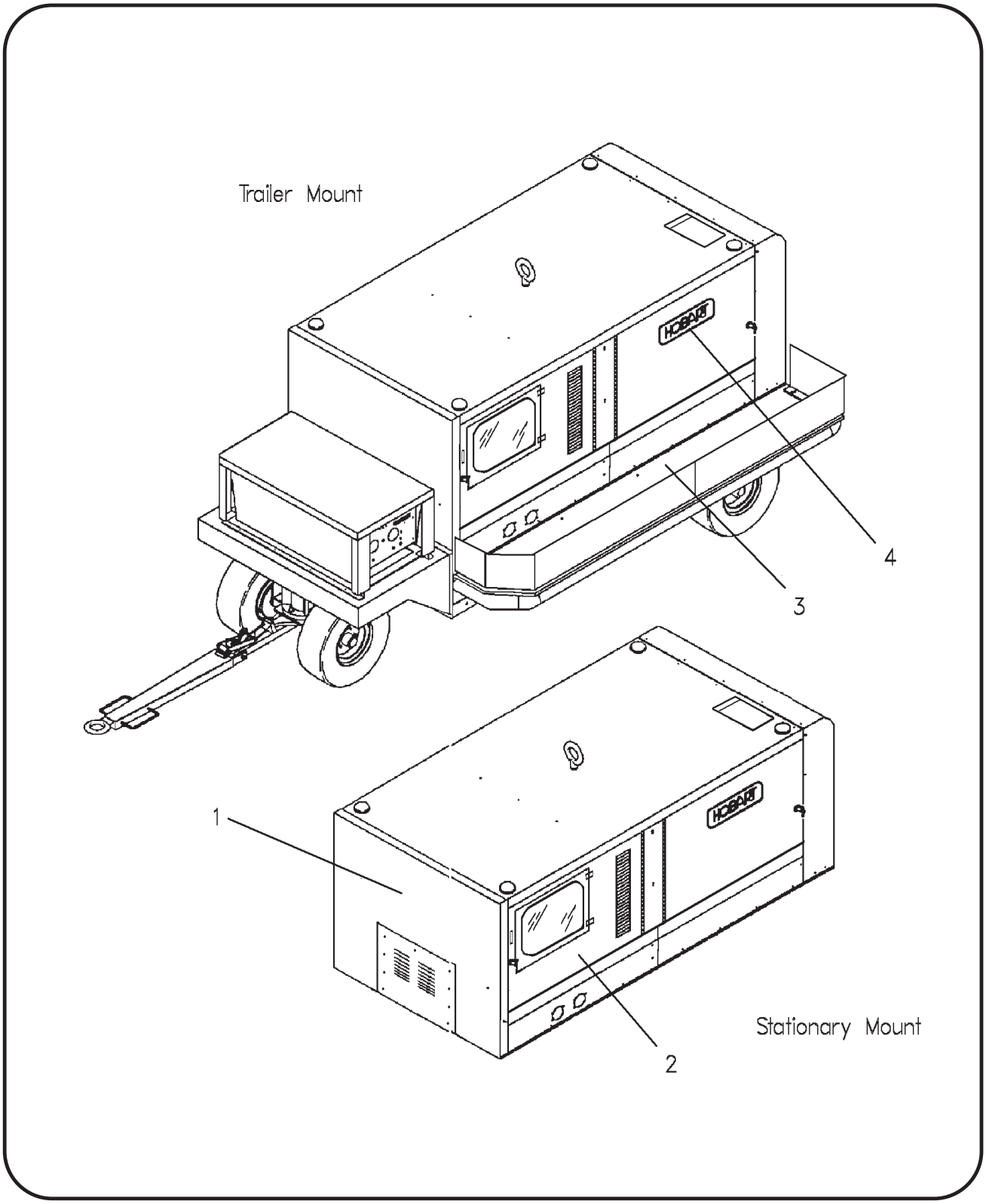
The parts list is arranged so that the illustration will appear on a left-hand page and the applicable parts list will appear on the opposite right-hand page. Unless the list is unusually long, the user will be able to look at the illustration and read the parts list without turning a page.

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
uF	-	Microfarad
No.	-	Number
NHA	-	Next higher assembly
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 a 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.

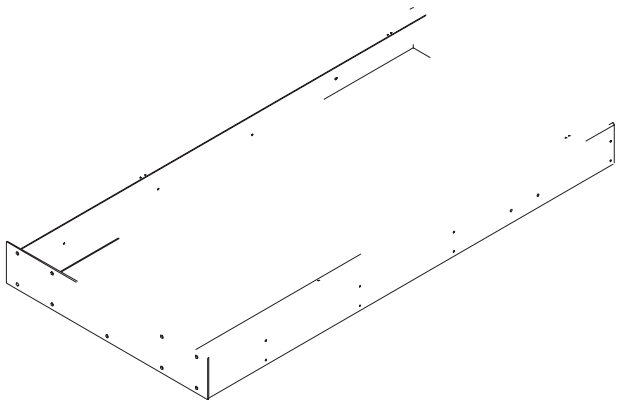


Generator Set

Figure 1

	FIGURE & ITEM NO.	HOBART PART NO.	AIRLINE PART NO.	NOMENCLATURE 1 2 3 4 5 6	UNITS PER ASSY
	1 -	**7131-1**		**GENERATOR SET FOR TRAILER OR TRUCK MOUNTING (Optional Trailer Mounting Shown)**	**REF**
	1 - 1	No Number		. FRAME AND CANOPY ASSEMBLY *(See Fig. 2)*	1
	1 - 2	No Number		. GENERATOR SET without Canopy *(See Fig. 3)*	1
	1 - 3	283673		. TRAILER PACKAGE *(OPTIONAL)*	1
	1 - 4	402987		. NAMEPLATE, HOBART	3
*	1 - 5	408665-1		. REFLECTOR, RED	6
*	1 - 6	408665-2		. REFLECTOR, AMBER	8

*** NOT ILLUSTRATED**



Frame and Canopy Assembly
Figure 2

FIGURE & ITEM NO.	HOBART PART NO.	AIRLINE PART NO.	NOMENCLATURE 1 2 3 4 5 6	UNITS PER ASSY
2 -	NO NUMBER		FRAME & CANOPY ASSEMBLY SPECIFICATION 7131 (For NHA See Fig. 1)	REF
2 - 1	283584		. TANK, FUEL ASSEMBLY	1
* 2 - 2	282939		. CAP, FUEL, TANK	1
2 - 3	282747		. PLATE, FRONT, MTG., FRAME ASSY.	1
2 - 4	282834		. YOKE, LIFTING ASSY.	1
2 - 5	DDW-155		. EYEBOLT, LIFTING	1
2 - 6	282689		. FRAME MOUNTING ASSEMBLY	1
	283613		. CANOPY ASSEMBLY	1
2 - 7	283612		. . CANOPY, REAR ASSEMBLY	1
2 - 8	283645		. . TOP, CANOPY ASSEMBLY	1
2 - 9	282732-1		. . LIGHTS, CLEARANCE, AMBER	4
2 - 10	283591		. . DOOR, REAR, RIGHT ASSEMBLY	1
2 - 11	283633		. . PANEL, SUPPORT, DOORS	2
2 - 12	283588		. . DOOR, RIGHT FRONT, LEFT REAR	2
2 - 13	283634		. . CANOPY, FRONT ASSEMBLY	1
2 - 14	283642		. . PANEL, SIDE, LEFT FRONT, UPPER	1
2 - 15	283638		. . PANEL, SIDE, RIGHT, CANOPY ASSEMBLY	1
2 - 16	282876		. . PANEL, BULKHEAD	1
2 - 17	282915		. . SUPPORT, CONTROL BOX	1
2 - 18	283637		. . PANEL, SIDE, RIGHT REAR	1
2 - 19	283622		. . SUPPORT, REAR CANOPY ASSEMBLY	1
2 - 20	283640		. . PANEL, SIDE, LEFT, REAR	1
2 - 21	283641		. . PANEL, SIDE, LEFT FRONT, LOWER	1
* 2 - 22	100GH-118		. . HORN, CABLE CLAMP	2
* 2 - 23	100GH-121		. . BRACKET, CABLE CLAMP	2
* 2 - 24	7J-422-0		. . CLAMP, CABLE	4
* 2 - 25	387859		. . ROD, DOOR HOOK	4
* 2 - 26	HJ-129A		. . JOINT, BALL	4
* 2 - 27	HF-530		. . KNOB, DOOR	1
2 - 28	283647		. . DOOR, ACCESS, RADIATOR ASSEMBLY	1
2 - 29	401911-20		. . BLOCK, TERMINAL	1
2 - 30	283425		. . LABEL, TERMINAL BLOCK	1
* 2 - 31	401923-3		. . CONNECTOR	2
* 2 - 32	402037-24		. . GROMMET, RUBBER	2
* 2 - 33	402037-14		. . GROMMET, RUBBER	1
* 2 - 34	283593		. . DOOR, FRONT, LEFT ASSEMBLY	1
2 - 35	283594		. . . DOOR, LEFT FRONT	1
2 - 36	283595		. . . DOOR, ACCESS	1
2 - 37	283598		. . . SEAL, ACCESS DOOR	1
2 - 38	283599		. . . WINDOW, PLEXIGLASS	1
2 - 39	283597		. . . HINGE, ACCESS DOOR	1

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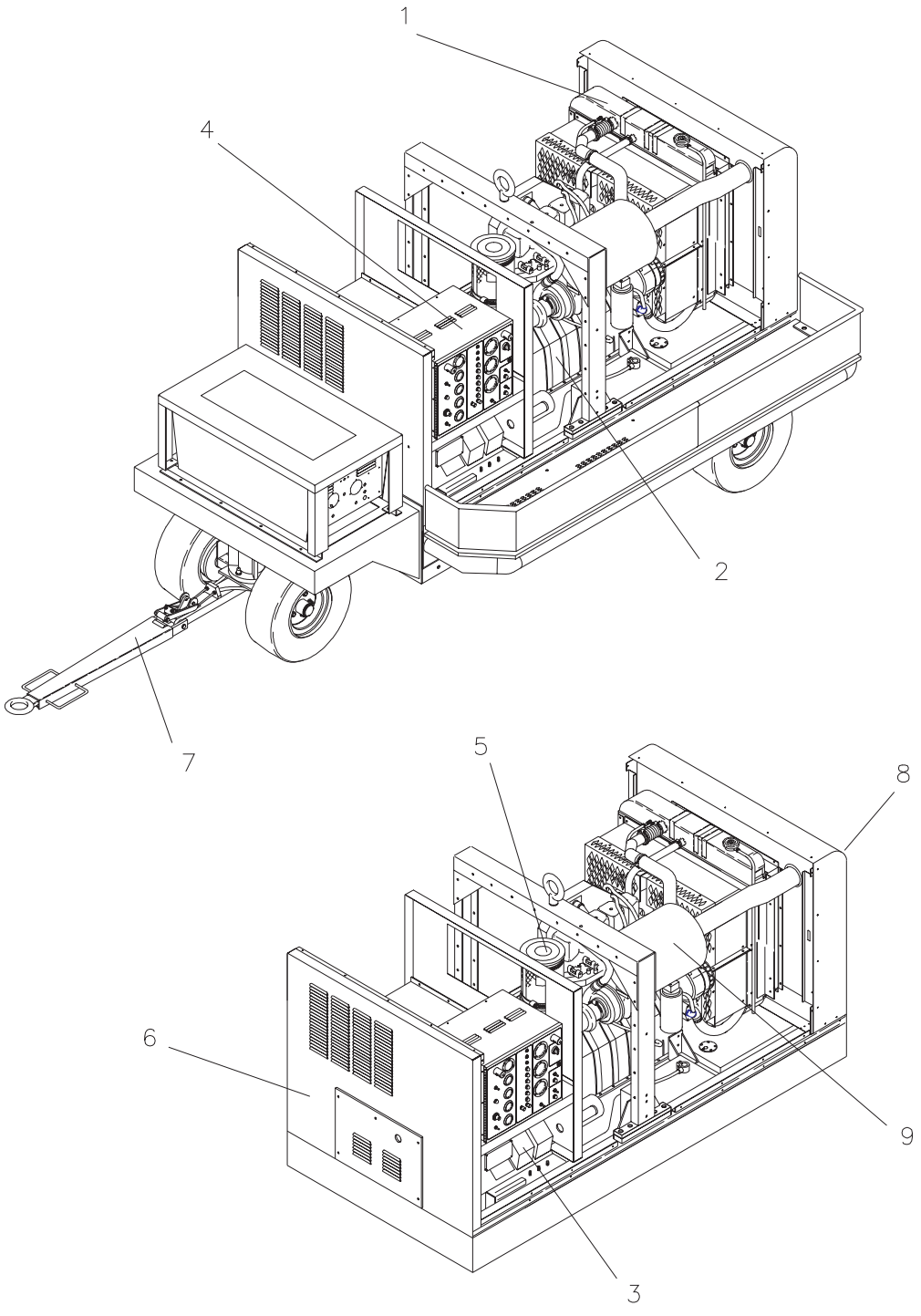
FIGURE & ITEM NO.	HOBART PART NO.	AIRLINE PART NO.	NOMENCLATURE 1 2 3 4 5 6	UNITS PER ASSY
2 -	**CONTINUED**		**FRAME & CANOPY ASSEMBLY SPECIFICATION 7131 (For NHA See Fig. 1)**	**REF**
2 - 40	283824		. . . HINGE, ACCESS DOOR	1
2 - 41	80A-1134		. . . LATCH, ADJUSTABLE, GRIP	2
2 - 42	283604		. . . HANDLE, ACCESS DOOR	1
2 - 43	81B-1019		. . . LATCH, T-HANDLE	1
2 - 44	488307		. . . PLATE, ROD HOLDER	1
2 - 45	488306		. . . BRACKET, DOOR ROD	1
2 - 46	283647		. . DOOR, ACCESS, RADIATOR	1



Generator Set Without Canopy
Figure 3

FIGURE & ITEM NO.	HOBART PART NO.	AIRLINE PART NO.	NOMENCLATURE 1 2 3 4 5 6	UNITS PER ASSY
3 -	**No Number**		**GENERATOR SET WITHOUT CANOPY (For NHA See Fig. 1)**	**REF**
3 - 1	No Number		. RADIATOR & COOLING SYSTEM GROUP *(See Fig. 4)*	1
3 - 2	408773		. ENGINE, DIESEL, CUMMINS MODEL NO. 88-044-6BTA *(See Cummins Parts Catalog)*	1
3 - 3	282866B		. PANEL, POWER MODULE *(See Fig. 8)*	1
3 - 4	282763		. CONTROL BOX GROUP *(See Fig. 9)*	1
3 - 5	282883		. AIR CLEANER GROUP *(See Fig. 12)*	1
3 - 6	No Number		. FRAME AND CANOPY ASSEMBLY *(See Fig. 2)*	1
3 - 7	283673		. TRAILER PACKAGE *(OPTIONAL)*	1
3 - 8	283613		. CANOPY ASSEMBLY *(See Fig. 2)*	
3 - 9	No Number		. MUFFLER AND EXHAUST ASSEMBLY *(See Fig. 14)*	1
* 3 - 10	282852		. MOUNT, ENGINE, LEFT	1
* 3 - 11	282853		. MOUNT, ENGINE, RIGHT	1
* 3 - 12	480603-3		. MOUNT, SHOCK, GENERATOR	4
* 3 - 13	480603-2		. MOUNT, SHOCK, ENGINE	2
* 3 - 14	480628		. WASHER, SHOCK MOUNT	6
* 3 - 15	282895		. BATTERY CABLE MTG. ASSEMBLY	1
* 3 - 16	282896		. . TRAY, BATTERY	1
* 3 - 17	481209-4		. . CABLE, BATTERY, POS.	1
* 3 - 18	281871-1		. . BATTERY, 12V., DEKA	1
* 3 - 19	181831		. . KIT, HOLD DOWN, BATTERY FRAME	1
* 3 - 20	5CW-2048		. . ROD, BATTERY, SUPPORT	2
* 3 - 21	383067-5		. . CABLE, BATTERY, NEG.	1
* 3 - 22	W-9407-23		. CABLE, ENGINE TO GROUND	1
* 3 - 23	489658-9		. DIODE, SOLENOID ASSEMBLY	1
* 3 - 24	181204		. STRAINER, FUEL	1
* 3 - 25	283358		. KIT, GOVERNOR ASSEMBLY *(See Fig. 5)*	1
* 3 - 26	180895		. LINES ASSEMBLY, OIL *(See Fig. 6)*	1
* 3 - 27	283099		. LINES ASSEMBLY, FUEL *(See Fig. 7)*	1
* 3 - 28	281689-6		. GENERATOR GROUP *(See Fig. 13)*	1
* 3 - 29	403782-2		. SWITCH, SHUTDOWN	1
* 3 - 30	W-7814-4		. BUSHING, PIPE	1
* 3 - 31	78A-1000		. LABEL, I.D.	1
* 3 - 32	79A-1110		. LABEL, OPTION	1
* 3 - 33	76B-1148		. LABEL, DIESEL FUEL	1
* 3 - 34	430077-2		. LABEL, HANDLING	1
* 3 - 35	486270-26		. LABEL, WARNING, COMP.	1
* 3 - 36	HF-2752		. MOUNT, RUBBER	6
* 3 - 37	78B-1119-1		. SENDER, WATER TEMP.	1
* 3 - 38	282966		. BRACKET, CLAMP, CABLE	2
* 3 - 39	283301		. HARNESS, C. BOX TO POWER MODULE	1

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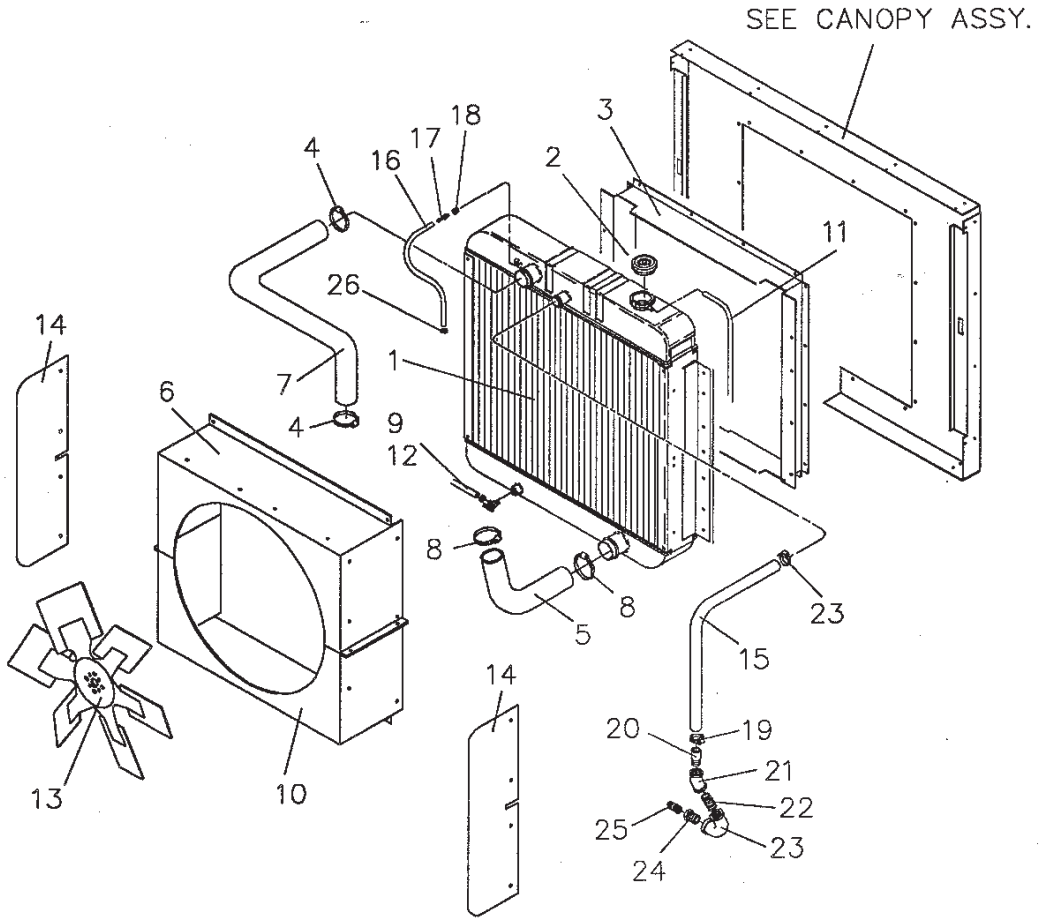

Radiator and Cooling System Group

Figure 4

FIGURE & ITEM NO.	HOBART PART NO.	AIRLINE PART NO.	NOMENCLATURE 1 2 3 4 5 6	UNITS PER ASSY
4 -	**No Number**		**RADIATOR & COOLING SYSTEM GROUP (For NHA See Fig. 3)**	**REF**
4 - 1	283246		. RADIATOR ASSEMBLY	1
4 - 2	405743		. CAP, RADIATOR, V78225, NO. AAX-4018	1
4 - 3	282888		. SUPPORT, RADIATOR ASSEMBLY	1
4 - 4	W-10869-3		. CLAMP, HOSE, RADIATOR, 2-1/2"	2
4 - 5	56531		. HOSE, OUTLET, RADIATOR, 2-1/4"	16"
4 - 6	282891		. SHROUD, FAN, TOP	1
4 - 7	56533		. HOSE, INLET, RADIATOR, 1-3/4"	27"
4 - 8	W-10869-5		. CLAMP, HOSE, RADIATOR, 3-1/4"	2
4 - 9	386751		. CLAMP, HOSE, DRAIN	1
4 - 10	282892		. SHROUD, FAN, BOTTOM	1
4 - 11	56534		. HOSE, OVERFLOW,	60"
4 - 12	56535		. HOSE, DRAIN,	26"
4 - 13	283497		. FAN, COOLING, 23"	1
4 - 14	283832		. GUARD, FAN	2
4 - 15	56501		. HOSE, LOW PRESSURE	35"
4 - 16	56535		. HOSE	20"
4 - 17	W-10893-0		. FITTING, HOSE, SWIVEL, FEMALE	1
4 - 18	W-10886-3		. CONNECTOR, MALE	1
4 - 19	W-10869-2		. CLAMP, HOSE	2
4 - 20	385275		. PIPE, CONNECTING, WATER RETURN	1
4 - 21	402077-4		. ELBOW, 45 DEG., 3/4"	1
4 - 22	W-10761-1		. NIPPLE, CLOSE, 1" X 3/4"	1
4 - 23	W-10890-6		. ELBOW, 90 DEG., 3/4"	1
4 - 24	W-7814-5		. BUSHING, 1/2" X 3/4"	1
4 - 25	W-10760-1		. NIPPLE, CLOSE, 1" X 1/2"	1
4 - 26	W-10869-14		. CLAMP, HOSE	1
* 4 - 27	W-7814-4		. BUSHING, PIPE	2
* 4 - 28	283873		. VALVE, RADIATOR DRAIN	1
* 4 - 29	400902		. ANTI-FREEZE	5 QT.

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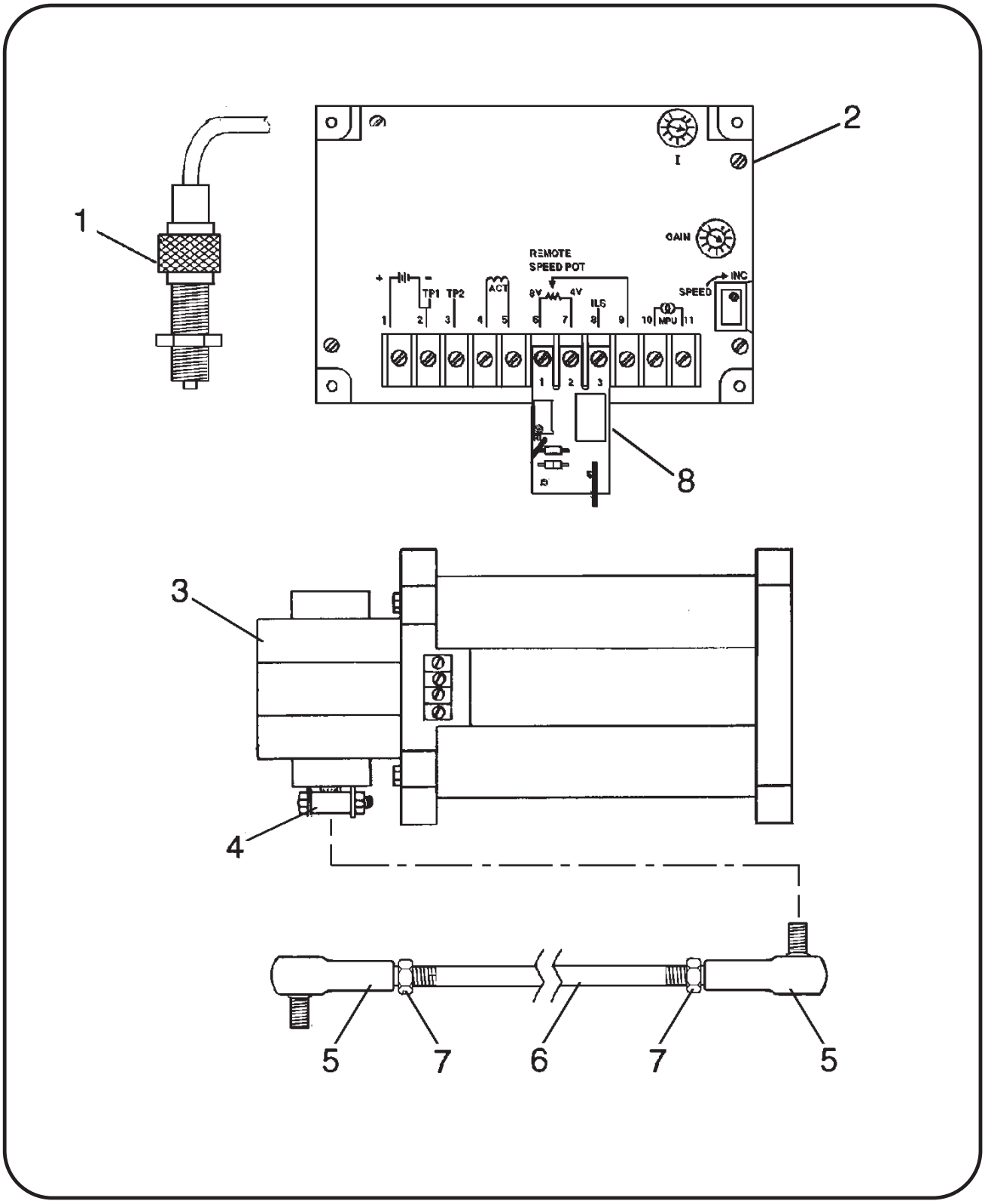

Governor Kit Assembly

Figure 5

FIGURE & ITEM NO.	HOBART PART NO.	AIRLINE PART NO.	NOMENCLATURE 1 2 3 4 5 6	UNITS PER ASSY
5 -	**283358**		**GOVERNOR KIT ASSEMBLY (For NHA See Fig. 4)**	**REF**
5 - 1	281881-3		. SENSOR, MAGNETIC PICK-UP	1
5 - 2	280448		. CONTROLLER, GOVERNOR, ELECTRIC, MODEL ESD 2120	1
5 - 3	280447		. GOVERNOR, ACTUATOR, ELECTRIC	1
5 - 4	84A-1091		. ARM, THROTTLE, GOVERNOR	1
5 - 5	402908		. JOINT, BALL, GOVERNOR LINKAGE, V57448, NO. TF-4Y	2
5 - 6	283462		. ROD, THREADED, 1/4-28	1
5 - 7	W-11280-3		. NUT, HEX, 1/4-28	4
5 - 8	181891-1		. BOARD, PC, SPEED CONTROL	1
* 5 - 9	84A-1075		. MOUNT, SHOCK, RUBBER, TECH. PRODUCTS CORP., NO. 50-DURO	4
* 5 - 10	280449		. BRACKET, GOVERNOR, MTG.	1
5 - 11	283463		. LEVER, THROTTLE	1
* 5 - 12	281751-1		. ADAPTER	1
* 5 - 13	482496-2		. CLAMP	2
* 5 - 14	400829-5		. TERMINAL, SPADE	3
* 5 - 15	283464		. BRACKET, THROTTLE	1

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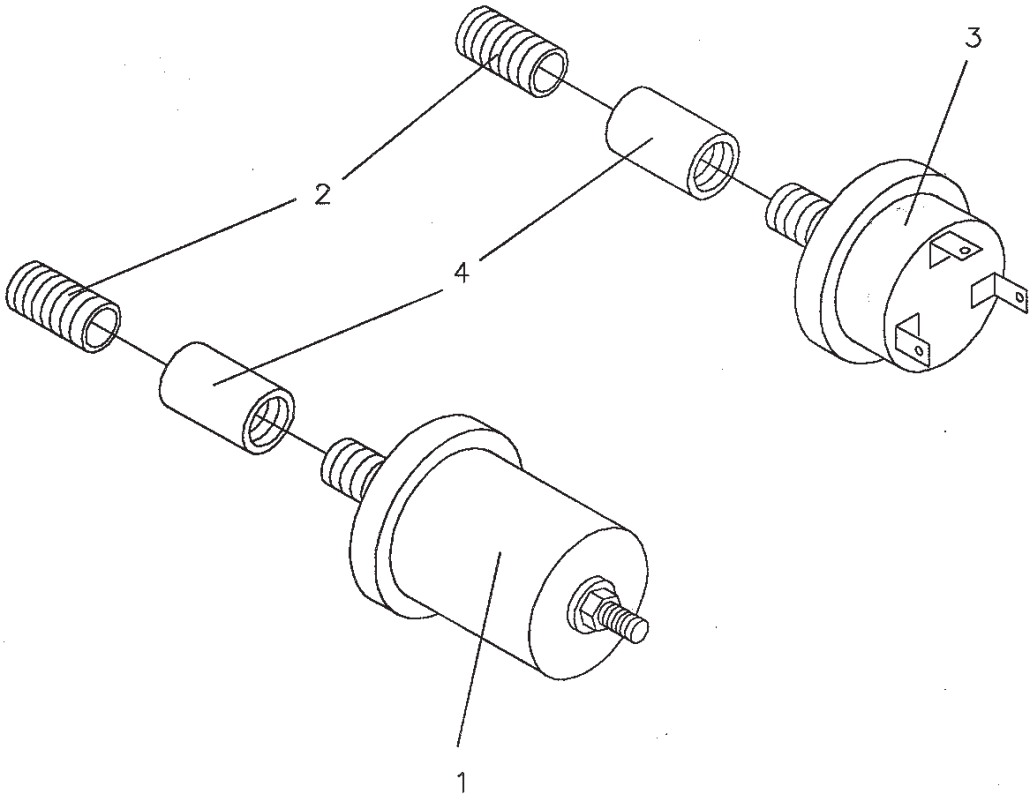
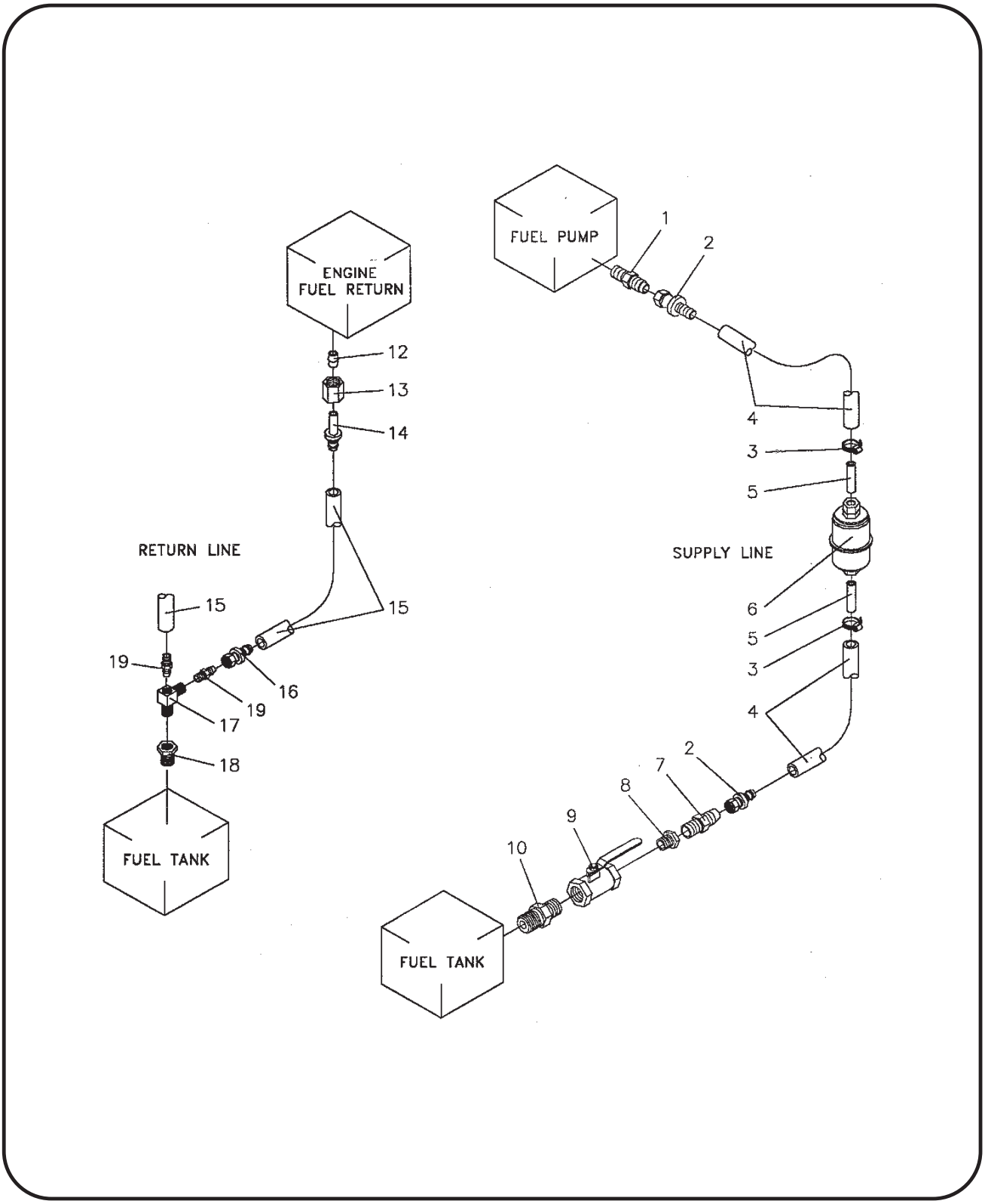


Pressure Sensing System

Figure 6

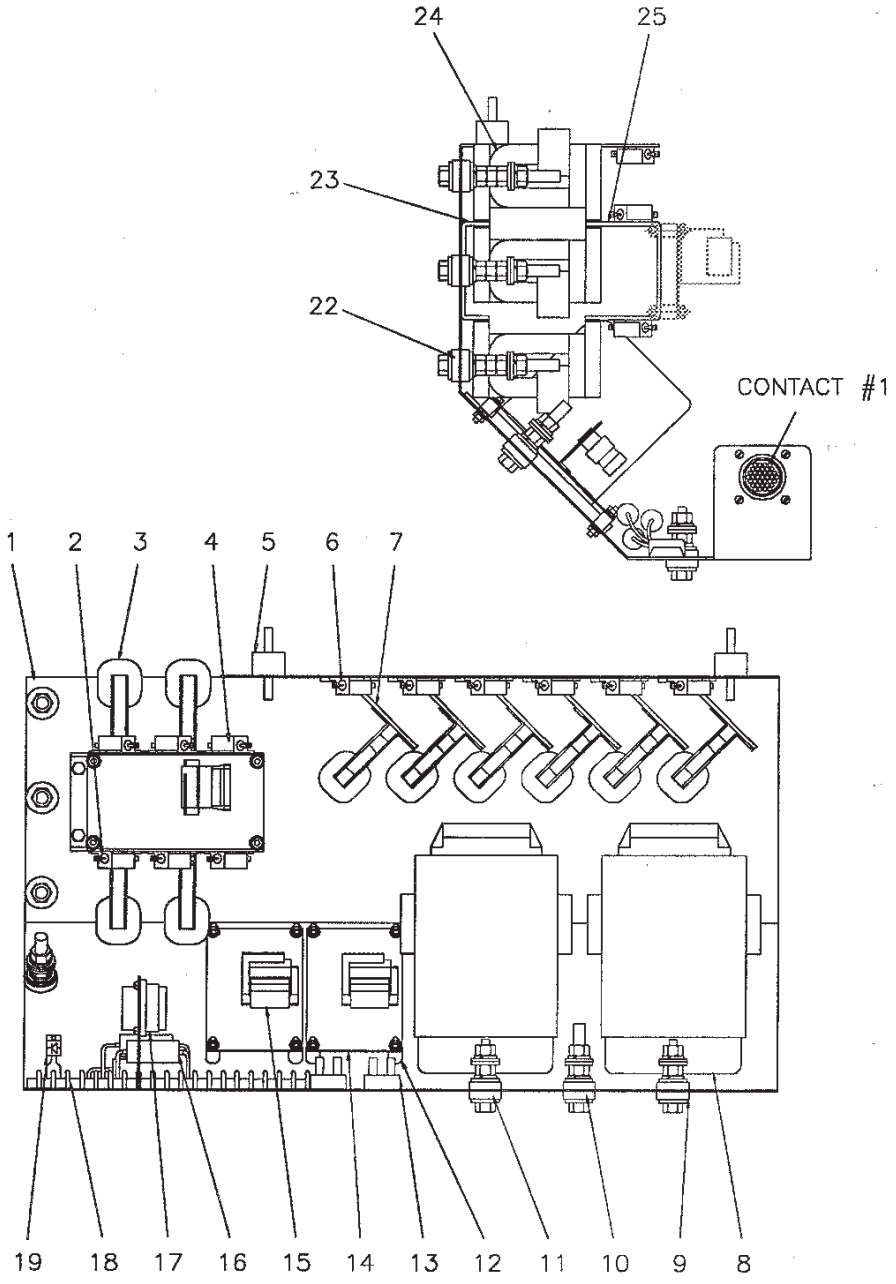
FIGURE & ITEM NO.	HOBART PART NO.	AIRLINE PART NO.	NOMENCLATURE 1 2 3 4 5 6	UNITS PER ASSY
6 -	**NO NUMBER**		**PRESSURE SENSING SYSTEM**	**REF**
6 - 1	78B-1118-1		. SENDER, OIL PRESSURE	1
6 - 2	W-10750-1		. NIPPLE, CLOSE, 1/8 X 3/4	2
6 - 3	403809-1		. SWITCH, LOW OIL PRESSURE	1
6 - 4	W-10119-1		. COUPLING, 1/8"	2



Fuel Line Assembly

Figure 7

FIGURE & ITEM NO.	HOBART PART NO.	AIRLINE PART NO.	NOMENCLATURE 1 2 3 4 5 6	UNITS PER ASSY
7 -	**283099**		**FUEL LINE ASSEMBLY**	**REF**
7 - 1	W-10886-3		. CONNECTOR, MALE	1
7 - 2	W-10893-0		. FITTING, HOSE, SWIVEL, FEMALE	2
7 - 3	W-10869-14		. CLAMP, HOSE	2
7 - 4	56535		. HOSE, LOW PRESSURE, 3/8 I.D.	30"
7 - 5	280990		. TUBE, FUEL LINE	2
7 - 6	181204		. STRAINER, FUEL	1
7 - 7	W-10886-8		. CONNECTOR, MALE	1
7 - 8	W-7814		. BUSHING, PIPE	1
7 - 9	400819-2		. VALVE, SHUTOFF	1
7 - 10	400818-1		. NIPPLE, HEX, PIPE	1
7 - 12	W-10905-2		. SLEEVE, COMPRESSION	1
7 - 13	W-10901-2		. NUT, FITTING	1
7 - 14	78B-1019-3		. FITTING, HOSE, MALE	1
7 - 15	56534		. HOSE, LOW PRESSURE, 1/4 I.D.	63"
7 - 16	W-10893-2		. FITTING, SWIVEL, FEMALE	2
7 - 17	W-10909-1		. FITTING, TEE	1
7 - 18	W-7814-3		. REDUCER, PIPE	1
7 - 19	W-10886-1		. CONNECTOR, MALE	2
* 7 - 20	80A-1117		. CLAMP, FILTER	1



Power Module Panel Assembly

Figure 8

FIGURE & ITEM NO.	HOBART PART NO.	AIRLINE PART NO.	NOMENCLATURE 1 2 3 4 5 6	UNITS PER ASSY
8 -	**282866B**		**POWER MODULE PANEL ASSEMBLY (For NHA See Fig. 3)**	**REF**
8 - 1	283127		. PANEL, POWER MODULE	1
8 - 2	404402-8		. RESISTOR, 50 OHM, 20 WATT	3
8 - 3	1CZ-148		. TRANSFORMER, CURRENT LINE DROP & OVERLOAD V14831, NO. E-6170	12
8 - 4	404402-9		. RESISTOR,12.5 OHM, 20 WATT	3
8 - 5	HF-2752		. MOUNT, SHOCK, RUBBER	2
8 - 6	404402-1		. RESISTOR, 16.6 OHM, 20 WATT	6
8 - 7	283195		. BRACKET, MTG., CURRENT TRANSFORMER	12
8 - 8	282130-1		. CONTACTOR, LINE, 3-POLE	2
8 - 9	A-25		. WASHER, INSULATING	14
8 - 10	AW-626		. BUSHING, INSULATING, NEUTRAL	2
8 - 11	DW-1704		. BUSHING, INSULATING, E-F	2
8 - 12	84A-1075		. MOUNT, SHOCK, RUBBER	12
8 - 13	404065-2		. RECTIFIER, SIICON	2
8 - 14	387738A		. BOARD, PC, OVERLOAD, ASSEMBLY	3
8 - 15	401564-3		. HOUSING, SOCKET	3
8 - 16	180593-2		. CAPACITOR, 0.1 MFD, 500 VAC, ASSEMBLY	3
8 - 17	283128		. HARNESS, RECEPTACLE, ASSEMBLY	1
8 - 18	401911-20		. BLOCK, TERMINAL	1
8 - 19	282089-2		. DIODE, FLYBACK	1
* 8 - 20	403069		. TERMINAL, QUICK CONNECT	2
* 8 - 21	400828-2		. TIE, WIRE, PLASTIC	2
8 - 22	AW-626		. BUSHING, INSULATING, A-B-C	3
8 - 23	283193		. BRACKET, MTG., BOTTOM, C.T.	1
8 - 24	76A-1131		. TUBING, Z-FLEX, 1/2 DIA *(Six 4.5" pieces)*	2.25'
8 - 25	283192		. BRACKET, MTG., TOP, C.T	1
* 8 - 26	283197		. CABLE, ASSEMBLY, POWER	
	W-9350-302		(No. 101) “A” Stator Terminal to “T1" No. 1 Contactor	1
	W-9350-301		(No. 102) ”B" Stator Terminal to “T2" No. 1 Contactor	1
	W-9350-201		(No. 103) ”C" Stator Terminal to “T3" No. 1 Contactor	1
	W-9350-224		(No. 104) “A” Stator Terminal to “T1" No. 2 Contactor	1
	W-9350-205		(No. 105) “B” Stator Terminal to “T2" No. 2 Contactor	1
	W-9350-305		(No. 106) “C” Stator Terminal to “T3" No. 2 Contactor	1
	W-9350-301		(No. 110) “N” Stator Terminal to “N” Terminal to ground	1

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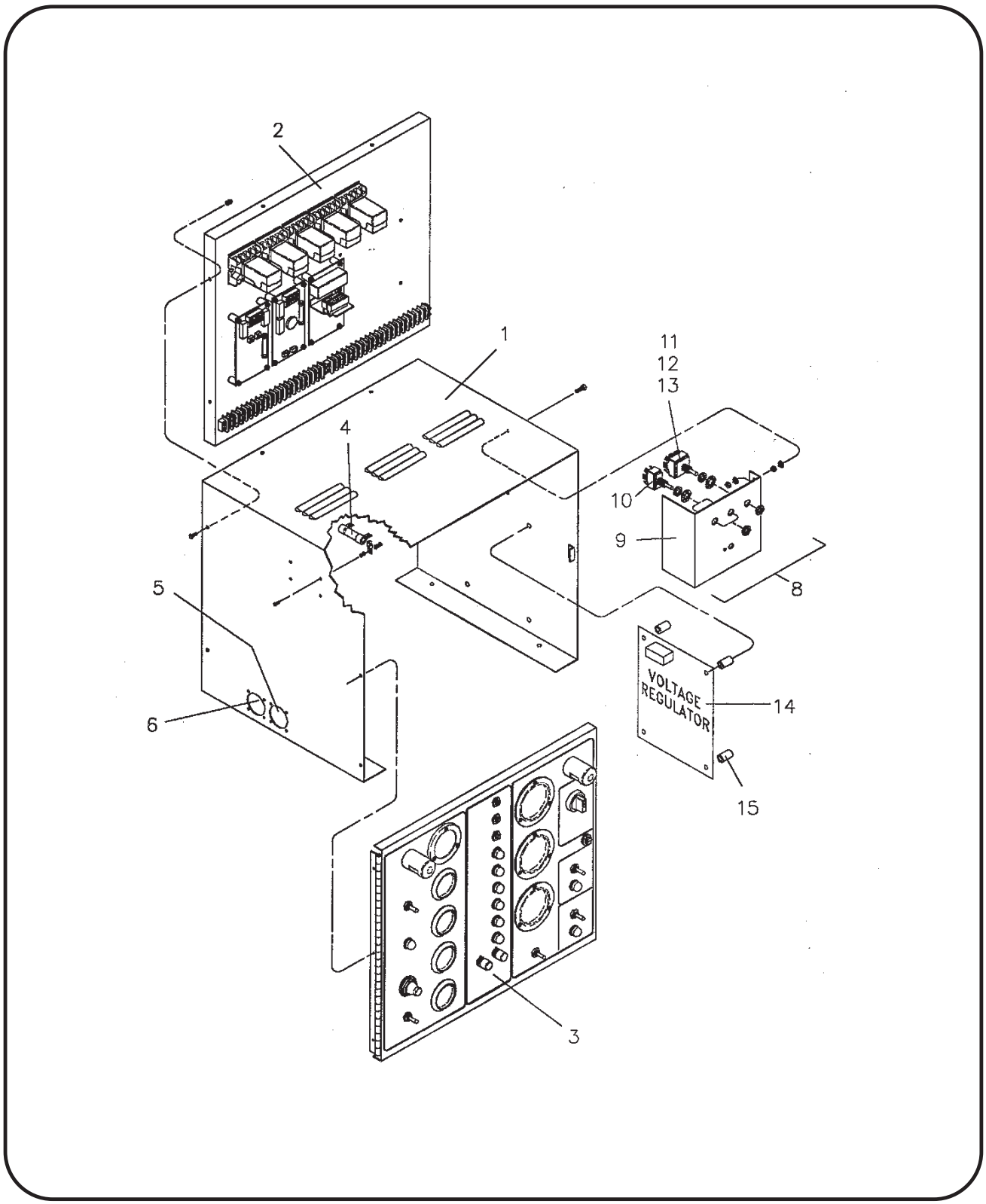

Control Box Group

Figure 9

FIGURE & ITEM NO.	HOBART PART NO.	AIRLINE PART NO.	NOMENCLATURE 1 2 3 4 5 6	UNITS PER ASSY
9 -	**282763**		**CONTROL BOX GROUP (For NHA See Fig. 3)**	**REF**
9 - 1	282791		. WRAPPER ASSEMBLY, CONTROL BOX	1
9 - 2	282794		. PANEL, REAR ASSEMBLY *(For Details See Fig. 11)*	1
9 - 3	282762		. DOOR ASSEMBLY *(For Details See Fig. 10)*	1
9 - 4	W-9746-3		. RESISTOR, 100 OHM, 25 WATT	2
9 - 5	283337		. HARNESS, RECEPTACLE	1
9 - 6	283339		. HARNESS, RECEPTACLE	1
* 9 - 7	401564-5		. HOUSING, SOCKET	1
9 - 8	282799		. BRACKET, SWITCH ASSEMBLY	1
9 - 9	280184		. BRACKET, SWITCH	1
9 - 10	402662		. SWITCH, TOGGLE	2
9 - 11	402826		. SWITCH, TOGGLE	1
9 - 12	402665-1		. HOUSING, RECEPTACLE	6
9 - 13	282089-2		. DIO1DE, FLYBACK	1
9 - 14	282800		. REGULATOR ASSEMBLY	1
9 - 15	84A-1075		. MOUNT, SHOCK, RUBBER	5
* 9 - 16	482989		. STRAP, GROUND *(Install on top)*	2

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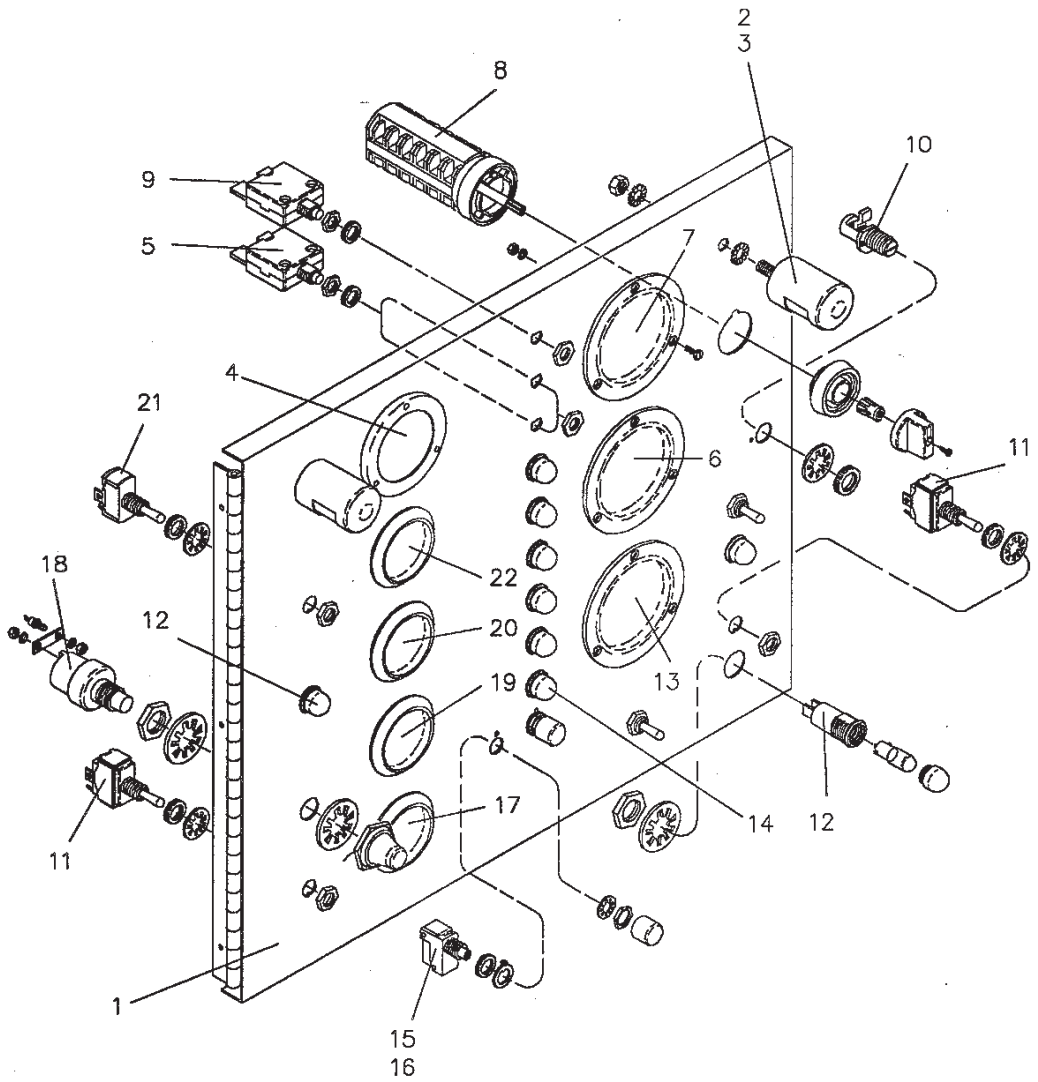
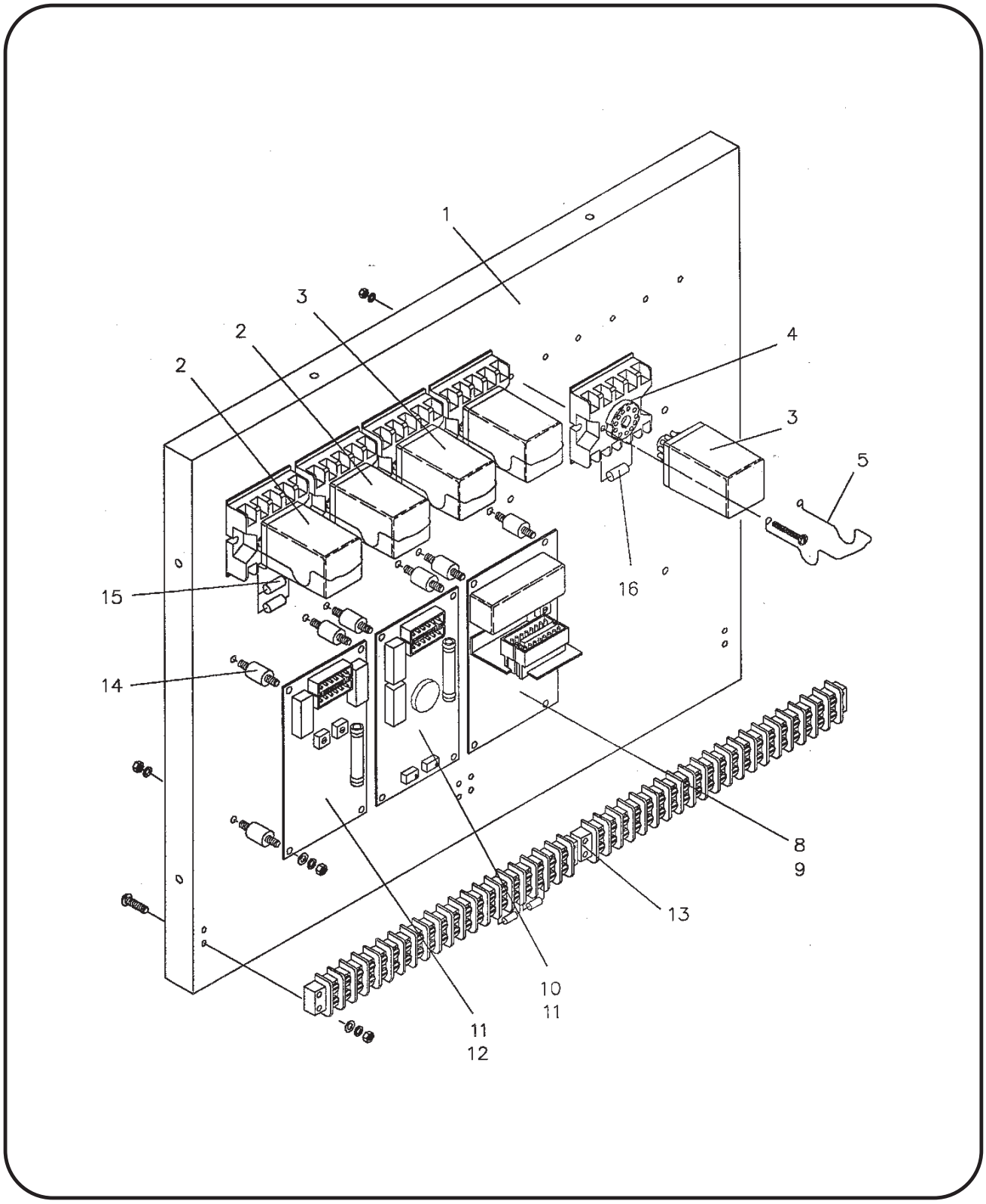


Control Box Door Assembly

Figure 10

FIGURE & ITEM NO.	HOBART PART NO.	AIRLINE PART NO.	NOMENCLATURE 1 2 3 4 5 6	UNITS PER ASSY
10 -	**282762**		**DOOR ASSEMBLY (For NHA See Fig. 9)**	**REF**
10 - 1	282767		. PANEL, CONTROL ASSEMBLY	1
10 - 2	82B-1047		. LIGHT, PANEL, 12V	2
10 - 3	W-11263-5		. WASHER, LOCK, IET, 5/16	2
10 - 4	78A-1120-1		. METER, RUNNING TIME	1
10 - 5	409527-5		. CIRCUIT BREAKER, 2 AMP	2
10 - 6	W-8105A-4		. METER, AC VOLTS	1
10 - 7	283167		. METER, FREQUENCY	1
10 - 8	79C-1158		. SWITCH, METER SELECTOR	1
10 - 9	409527-6		. CIRCUIT BREAKER, 10 AMP	1
10 - 10	76A-1115		. LATCH, ADJUSTABLE GRIP	1
10 - 11	403189		. SWITCH, TOGGLE	4
10 - 12	HF-2518-8		. LIGHT, PILOT ASSEMBLY, GREEN	3
10 - 13	283165		. METER, AC AMPS	1
10 - 14	HF-2518-2		. LIGHT, PILOT ASSEMBLY, RED	6
10 - 15	76A-1118		. SWITCH, SNAP, PUSHBUTTON	2
10 - 16	283494-5		. PLATE, ADAPTER	2
10 - 17	494134-1		. GAUGE, FUEL, ELECTRIC	1
10 - 18	404100		. SWITCH, PUSHBUTTON, STARTER	1
10 - 19	78A-1115-1		. METER, AMPS	1
10 - 20	78A-1116-1		. GAUGE, WATER TEMPERATURE	1
10 - 21	405365-1		. SWITCH, TOGGLE	1
10 - 22	78A-1117-1		. GAUGE, OIL PRESSURE	1
*10 - 23	403091-11		. PLUG, HOLE, PLASTIC	1

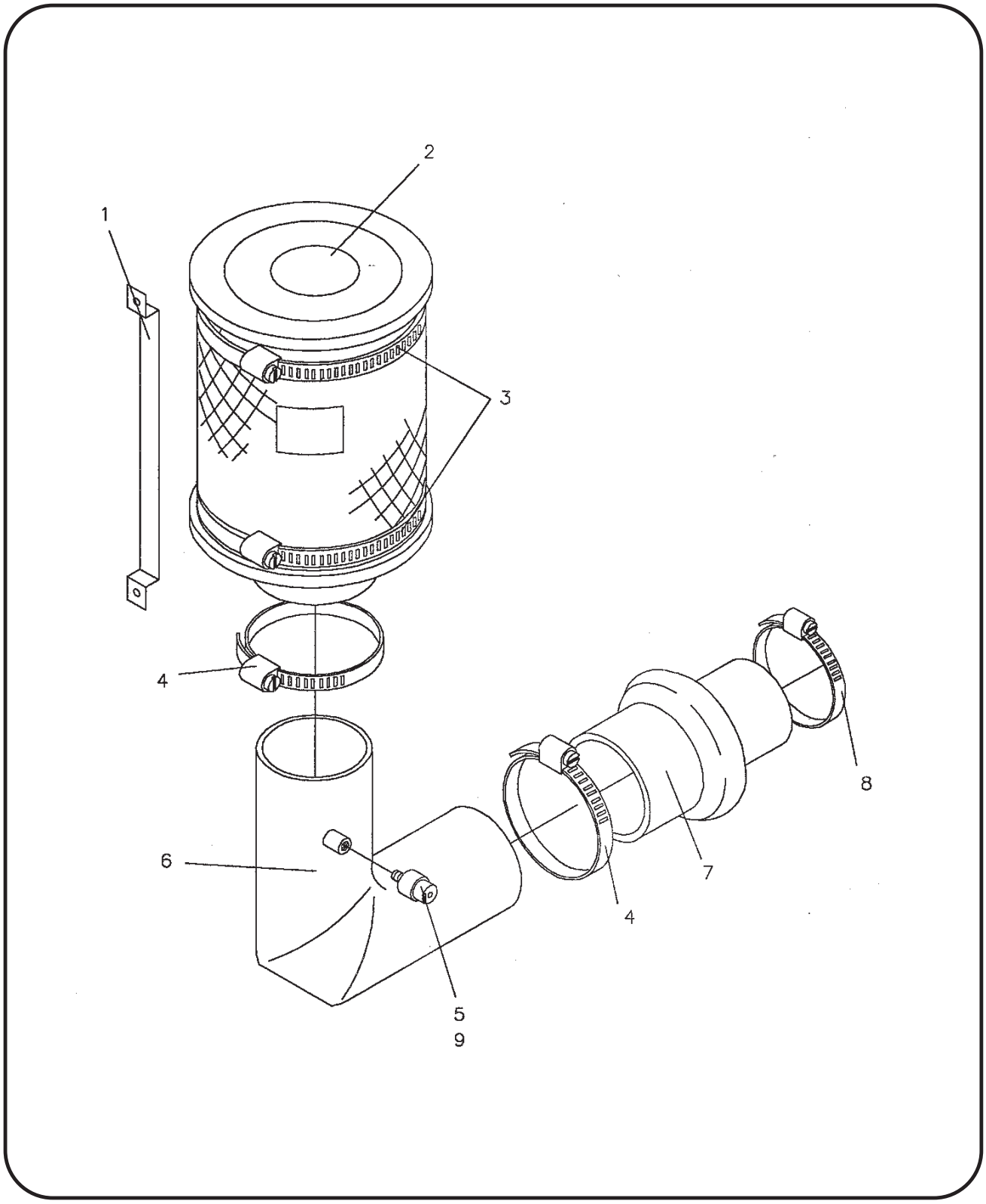


Control Box Rear Panel Assembly

Figure 11

FIGURE & ITEM NO.	HOBART PART NO.	AIRLINE PART NO.	NOMENCLATURE 1 2 3 4 5 6	UNITS PER ASSY
11 -	**282794**		**CONTROL BOX REAR PANEL ASSEMBLY**	**REF**
11 - 1	282795		. PANEL, REAR	1
11 - 2	16DA-4004A-10		. RELAY, ENCLOSED, PLUG-IN, 12VDC	3
11 - 3	16DA-4004A-3		. RELAY, ENCLOSED, PLUG-IN, 24VDC	2
11 - 4	79B-1138		. SOCKET, RELAY, 11 PIN	5
11 - 5	16DA-4253-1		. RETAINER, SPRING, RELAY	5
11 - 8	387736C		. BOARD, MEMORY & TIME DELAY ASSEMBLY	1
11 - 9	401564-5		. HOUSING, SOCKET	1
11 - 10	482039B		. BOARD, OVER/UNDER FREQUENCY ASSEMBLY	1
11 - 11	401564-4		. HOUSING, SOCKET	2
11 - 12	482038A		. BOARD, OVER-UNDER VOLTAGE ASSEMBLY	1
11 - 13	282869		. BLOCK, TERMINAL	2
11 - 14	84A-1075		. MOUNT, SHOCK, RUBBER	12
11 - 15	180329-1		. CAPACITOR & DIODE ASSEMBLY	1
11 - 16	489658-2		. DIODE ASSEMBLY	6
*11 - 17	406006		. CLAMP, WIRE	2

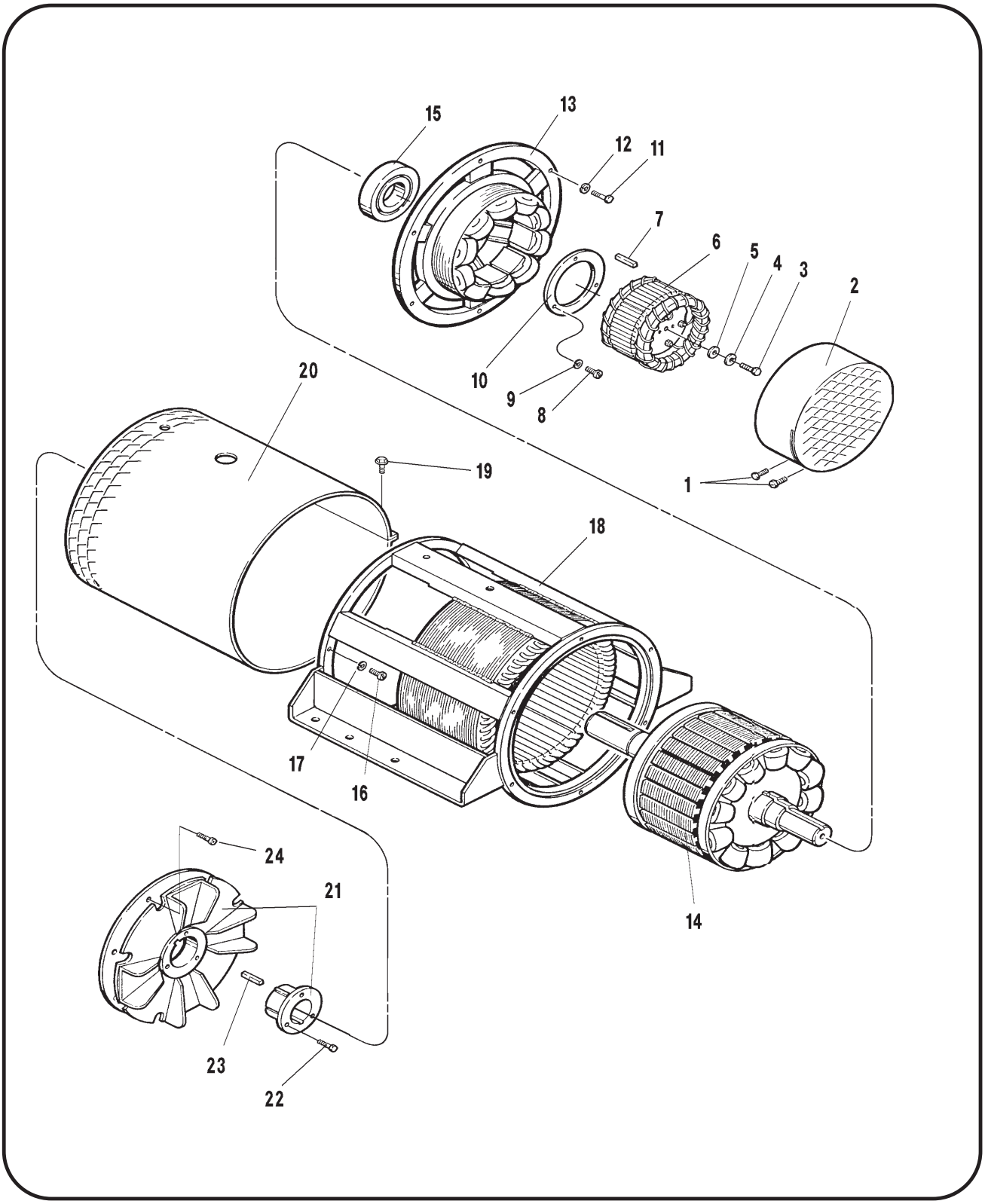
*** NOT ILLUSTRATED**



Air Cleaner Group

Figure 12

FIGURE & ITEM NO.	HOBART PART NO.	AIRLINE PART NO.	NOMENCLATURE 1 2 3 4 5 6	UNITS PER ASSY
12 -	**282883**		**AIR CLEANER GROUP (For NHA See Fig. 3)**	**REF**
12 - 1	282884		. BRACKET, MTG., AIR CLEANER	1
12 - 2	181128		. CLEANER, AIR	1
12 - 3	181129		. CLAMP, HOSE	2
12 - 4	280732-6		. CLAMP, HOSE	2
12 - 5	282918		. INDICATOR, REST. ELECTRIC	1
12 - 6	282877		. PIPE, AIR CLEANER ASSEMBLY	1
12 - 7	85A-1045		. REDUCER, RUBBER	1
12 - 8	280732-4		. CLAMP, HOSE	1
12 - 9	282919		. ADAPTER, INDICATOR	1



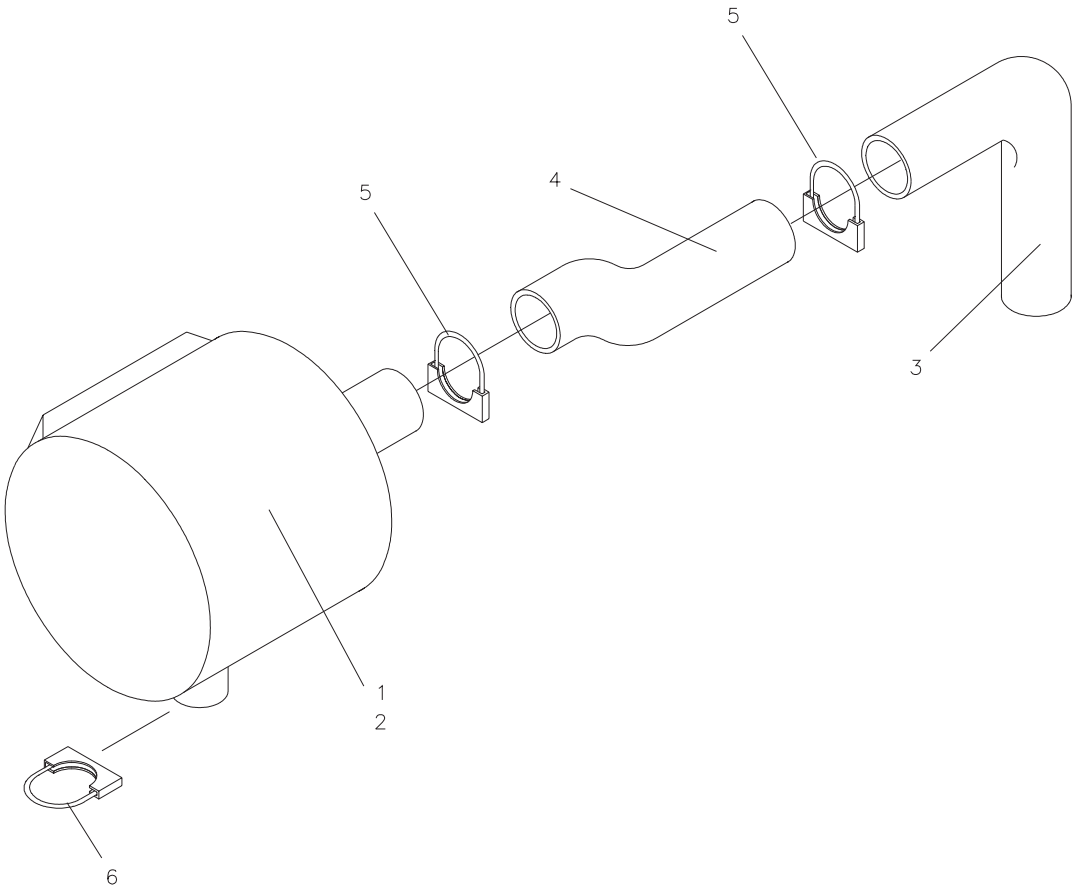
Generator Group

Figure 13

FIGURE & ITEM NO.	HOBART PART NO.	AIRLINE PART NO.	NOMENCLATURE 1 2 3 4 5 6	UNITS PER ASSY
13 -	**281689-6**		**GENERATOR, 2400 RPM, 120kVA, DUAL BEARING**	**1**
13 - 1	W-11236-2		. SCREW, 1/4-20 x 5/8, HWH, SF-TAP, TYPE F	2
13 - 2	281698		. COVER, EXCITER	1
13 - 3	W-11100-3		. SCREW, 1/2-13 x 1-1/4, HHC, ST.	1
13 - 4	W-11254-8		. WASHER, LOCK, STD., 1/2	1
13 - 5	W-11242-12		. WASHER, FLAT, 1/2	1
13 - 6	282132		. ARMATURE, EXCITER, ASSEMBLY	1
13 - 7	180696-2		. KEY, EXCITER	1
13 - 8	W-11112-14		. SCREW, #10-24 x 3/8, RD HD, MH, ST.	3
13 - 9	W-11254-3		. WASHER, LOCK, STD., #10	3
13 - 10	282128		. RETAINER, BEARING, REAR	1
13 - 11	W-11097-5		. SCREW, 3/8-16 x 1-1/2, HHC, ST.	6
13 - 12	W-11254-6		. WASHER, LOCK, STD., 3/8	6
13 - 13	281697		. HOUSING & COILS, EXCITER, ASSY.	1
13 - 14	281690A-6		. ARMATURE, ASSY. ,DUAL. BEAR.	1
13 - 15	W-10072-68		. . BEARING	2
13 - 16	405061-5		. SCREW, M10-1.5 x 35	6
13 - 17	84B-1034		. WASHER, LOCK	6
13 - 18	281691-3		. HOUSING & STATOR, ASSY., 120kVA, S.B.	1
13 - 19	W-11236-7		. SCREW, 1/4-20 x 3/4, HWH, SF-TAP, TYPE F	3
13 - 20	281699		. COVER, GENERATOR	1
13 - 21	281701		. KIT, FLEX COUPLING, ASSY.	1
13 - 22	W-11097-33		. . SCREW, 3/8-16 x 1-3/4, HHC, ST., GRADE 5	3
13 - 23	85B-1039		. KEY, COUPLING	1
13 - 24	W-11102-18		. SCREW, 5/8-11 x 2-3/4, HD.	6
*13 - 25	283546		. SHROUD, FAN	1
*13 - 26	283560		. BRACKET, MTG., SHROUD, FAN	3
*13 - 27	42517		. SLEEVING, NEG. EXC. LEAD #0	3"
*13 - 28	41507		. SLEEVING, NEG. EXC. LEADS #7	13"
*13 - 29	283620		. DEFLECTOR, AIR, GENERATOR EXHAUST	6
13 - 30	281705-1		. RETAINER, BEARING, FRONT	1
13 - 31	281700		. BRACKET, MOUNTING, ANGLE	3

*** NOT ILLUSTRATED**

NOTE: Items 16, 17, and 24 vary by engine to account for English/Metric or course/fine thread.



Muffler and Exhaust Assembly

Figure 14

FIGURE & ITEM NO.	HOBART PART NO.	AIRLINE PART NO.	NOMENCLATURE 1 2 3 4 5 6	UNITS PER ASSY
14 -	**NO NUMBER**		**MUFFLER & EXHAUST ASSEMBLY**	**REF**
14 - 1	282873		. MUFFLER & INSULATION WRAP ASSEMBLY	1
14 - 2	282874		. . MUFFLER ASSEMBLY	1
14 - 3	283836		. PIPE, EXHAUST ASSEMBLY	1
15 - 4	283837		. PIPE, MUFFLER ASSEMBLY	1
14 - 5	404154-15		. CLAMP, MUFFLER, 3-1/2"	2
14 - 6	404154-13		. CLAMP, MUFFLER, 3"	1

*** NOT ILLUSTRATED**

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Section 4. Numerical Index

1. 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 known. 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. On the other hand, a part number starting with a “1” would be listed near the beginning 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 beginning with the first is listed.

Part Number	Figure & Item Number
100GH-118	2 - 22
100GH-121	2 - 23
16DA-4004A-10	11 - 2
16DA-4004A-3	11 - 3
16DA-4253-1	11 - 5
180329-1	11 - 15
180593-2	8 - 16
180696-2	13 - 7
180895	3 - 25
181128	12 - 2
181129	12 - 3
181204	7 - 6
181204	3 - 23
181831	3 - 18
181891-1	5 - 8
1CZ-148	8 - 3
280184	9 - 9
280447	5 - 3
280448	5 - 2
280449	5 - 10
280732-4	12 - 8
280732-6	12 - 4
280990	7 - 5
281689-6	13 -
281689-6	3 - 27
281690A-6	13 - 14
281691-3	13 - 18
281697	13 - 13
281698	13 - 2
281699	13 - 20
281700	13 - 31
281701	13 - 21
281705-1	13 - 30
281751-1	5 - 12
281871-1	3 - 17
281881-3	5 - 1
282089-2	9 - 13
282089-2	8 - 19
282128	13 - 10
282130-1	8 - 8
282132	13 - 6
282689	2 - 6
282732-1	2 - 9
282747	2 - 3
282762	10 -
282762	9 - 3
282763	9 -
282763	3 - 4
282767	10 - 1
282791	9 - 1
282794	11 -
282794	9 - 2
282795	11 - 1
282799	9 - 8
282800	9 - 14
282834	2 - 4
282852	3 - 10
282853	3 - 11

Part Number	Figure & Item Number
282863	3 - 37
282866B	8 -
282866B	3 - 3
282869	11 - 13
282873	14 - 1
282874	14 - 2
282876	2 - 16
282877	12 - 6
282883	12 -
282883	3 - 5
282884	12 - 1
282888	4 - 3
282891	4 - 6
282892	4 - 10
282895	3 - 14
282896	3 - 15
282915	2 - 17
282918	12 - 5
282919	12 - 9
282939	2 - 2
282966	3 - 38
283099	7 -
283099	3 - 26
283127	8 - 1
283128	8 - 17
283165	10 - 13
283167	10 - 7
283192	8 - 25
283193	8 - 23
283195	8 - 7
283197	8 - 26
283246	4 - 1
283301	3 - 39
283337	9 - 5
283339	9 - 6
283358	5 -
283358	3 - 24
283425	2 - 30
283462	5 - 6
283463	5 - 11
283464	5 - 15
283494-5	10 - 16
283497	4 - 13
283546	13 - 25
283560	13 - 26
283584	2 - 1
283588	2 - 12
283591	2 - 10
283593	2 - 34
283594	2 - 35
283595	2 - 36
283597	2 - 39
283598	2 - 37
283599	2 - 38
283604	2 - 42
283612	2 - 7
283613	3 - 8
283620	13 - 29
283622	2 - 19
283633	2 - 11
283634	2 - 13
283637	2 - 18
283638	2 - 15
283640	2 - 20
283641	2 - 21
283642	2 - 14
283645	2 - 8
283647	2 - 46
283647	2 - 28
283673	1 - 3
283673	3 - 7
283824	2 - 40
283832	4 - 14
283836	14 - 3
283837	14 - 4
283873	4 - 28
383067-5	3 - 20
385275	4 - 20
386751	4 - 9
387736C	11 - 8

Part Number	Figure & Item Number
387738A	8 - 14
387859	2 - 25
400818-1	7 - 10
400819-2	7 - 9
400828-2	8 - 21
400829-5	5 - 14
400902	4 - 29
401564-3	8 - 15
401564-4	11 - 11
401564-5	9 - 7
401564-5	11 - 9
401911-20	8 - 18
401911-20	2 - 29
401923-3	2 - 31
402037-14	2 - 33
402037-24	2 - 32
402077-4	4 - 21
402662	9 - 10
402665-1	9 - 12
402826	9 - 11
402908	5 - 5
402987	1 - 4
403069	8 - 20
403091-11	10 - 23
403189	10 - 11
403782-2	3 - 28
403809-1	6 - 3
404065-2	8 - 13
404100	10 - 18
404154-13	14 - 6
404154-15	14 - 5
404402-1	8 - 6
404402-8	8 - 2
404402-9	8 - 4
405061-5	13 - 16
405365-1	10 - 21
405743	4 - 2
406006	11 - 17
408773	3 - 2
409527-5	10 - 5
409527-6	10 - 9
41507	13 - 28
42517	13 - 27
430077-2	3 - 33
480603-1	3 - 12
480628	3 - 13
481209-4	3 - 16
482038A	11 - 12
482039B	11 - 10
482496-2	5 - 13
482989	9 - 16
486270-26	3 - 34
488306	2 - 45
488307	2 - 44
489658-2	11 - 16
489658-9	3 - 22
494134-1	10 - 17
56501	4 - 15
56531	4 - 5
56533	4 - 7
56534	7 - 15
56534	4 - 11
56535	7 - 4
56535	4 - 12
56535	4 - 16
5CW-2048	3 - 19
76A-1115	10 - 10
76A-1118	10 - 15
76A-1131	8 - 24
76B-1148	3 - 32
78A-1000	3 - 30
78A-1115-1	10 - 19
78A-1116-1	10 - 20
78A-1117-1	10 - 22
78A-1120-1	10 - 4
78B-1019-3	7 - 14
78B-1118-1	6 - 1
78B-1119-1	3 - 36
79A-1110	3 - 31
79B-1138	11 - 4

Part Number	Figure & Item Number
79C-1158	10 - 8
7J-422-0	2 - 24
80A-1117	7 - 20
80A-1134	2 - 41
81B-1019	2 - 43
82B-1047	10 - 2
84A-1075	5 - 9
84A-1075	11 - 14
84A-1075	8 - 12
84A-1075	9 - 15
84A-1091	5 - 4
84B-1034	13 - 17
85A-1045	12 - 7
85B-1039	13 - 23
A-25	8 - 9
AW-626	8 - 22
AW-626	8 - 10
DDW-155	2 - 5
DW-1704	8 - 11
HF-2518-2	10 - 14
HF-2518-8	10 - 12
HF-2752	3 - 35
HF-2752	8 - 5
HF-530	2 - 27
HJ-129A	2 - 26
No Number	3 - 6
No Number	1 - 2
W-10072-68	13 - 15
W-10119-1	6 - 4
W-10750-1	6 - 2
W-10760-1	4 - 25
W-10761-1	4 - 22
W-10869-14	4 - 26
W-10869-14	7 - 3
W-10869-2	4 - 19
W-10869-3	4 - 4
W-10869-5	4 - 8
W-10886-1	7 - 19
W-10886-3	4 - 18
W-10886-3	7 - 1
W-10886-8	7 - 7
W-10890-6	4 - 23
W-10893-0	7 - 2
W-10893-0	4 - 17
W-10893-2	7 - 16
W-10901-2	7 - 13
W-10905-2	7 - 12
W-10909-1	7 - 17
W-11097-33	13 - 22
W-11097-5	13 - 11
W-11100-3	13 - 3
W-11102-18	13 - 24
W-11112-14	13 - 8
W-11236-2	13 - 1
W-11236-7	13 - 19
W-11242-12	13 - 5
W-11254-3	13 - 9
W-11254-6	13 - 12
W-11254-8	13 - 4
W-11263-5	10 - 3
W-11280-3	5 - 7
W-7814	7 - 8
W-7814-3	7 - 18
W-7814-4	3 - 29
W-7814-4	4 - 27
W-7814-5	4 - 24
W-8105A-4	10 - 6
W-9407-23	3 - 21
W-9746-3	9 - 4

Chapter 5. Manufacturer's Literature

VENDOR LITERATURE

Engine	Cummins Engine Operation and Maintenance Manual 3810205-07
	Cummins Engine Parts Manual 383822008-00

HOBART DIAGRAMS:

283121	Schematic Diagram, Engine and Generator (2 sheets)
283122	Connection Diagram, Engine and Generator (2 sheets)
283123	Connection Diagram, Control Box (3 sheets)
283124	Connection Diagram, Power Module
487748	Schematic Diagram, 28.5-V DC Transformer-Rectifier
487747	Connection Diagram, 28.5-V DC Transformer-Rectifier
487749	Connection Diagram, Front Panel, 28.5-V DC Transformer-Rectifier

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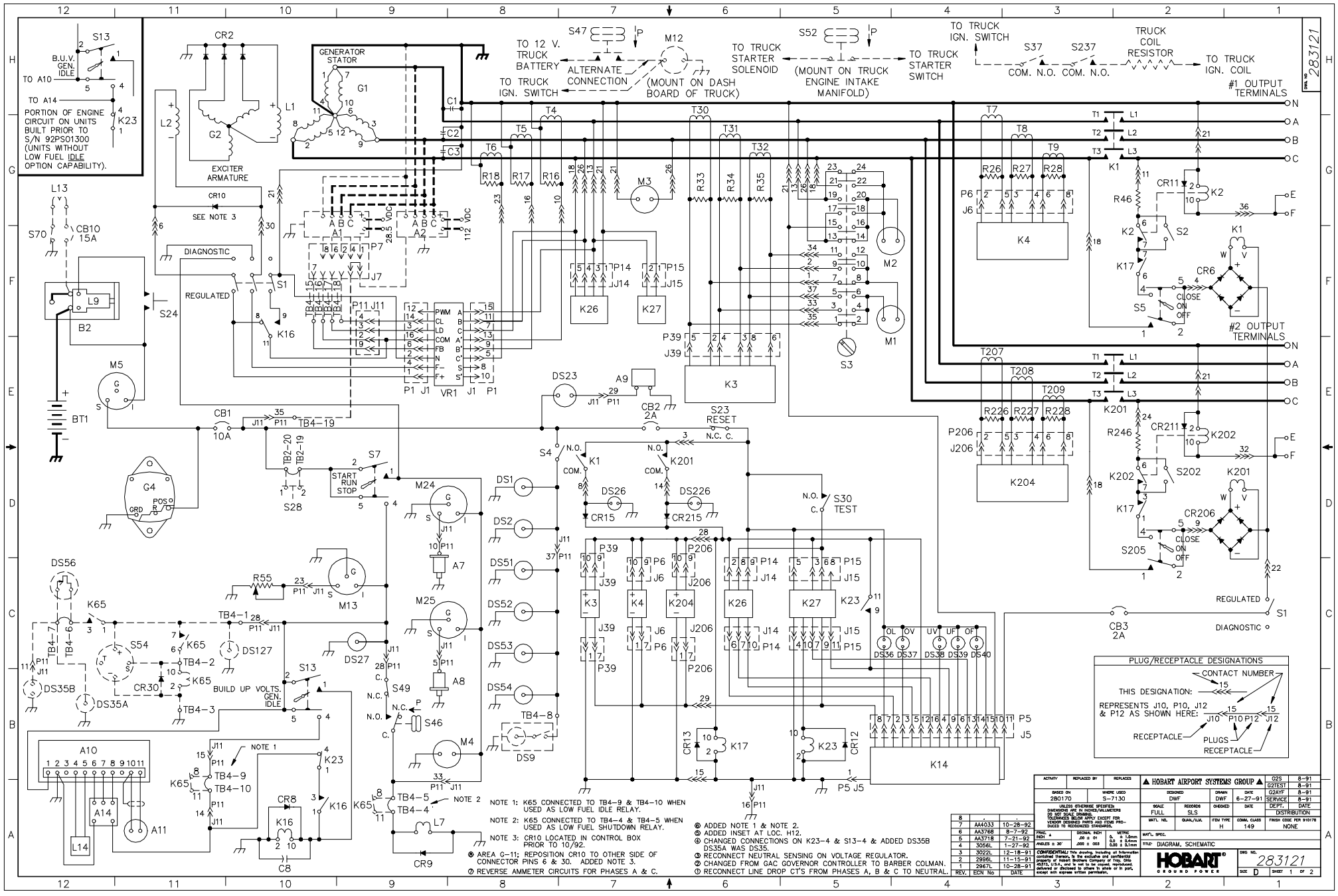
PORTION OF ENGINE CIRCUIT ON UNITS BUILT PRIOR TO S/N 92PS01300 (UNITS WITHOUT LOW FUEL IDLE OPTION CAPABILITY).
B.U.V. GEN. IDLE
TO A10
TO A14
K23
EXCITER ARMATURE
SEE NOTE 3
DIAGNOSTIC
REGULATED
GENERATOR STATOR
TO 12 V. TRUCK BATTERY
TO TRUCK IGN. SWITCH
ALTERNATE CONNECTION
(MOUNT ON DASH BOARD OF TRUCK)
TO TRUCK STARTER SOLENOID
(MOUNT ON TRUCK ENGINE INTAKE MANIFOLD)
TO TRUCK STARTER SWITCH
TO TRUCK IGN. SWITCH
COM. N.O. COM. N.O.
TRUCK COIL RESISTOR
TO TRUCK IGN. COIL
#1 OUTPUT TERMINALS
#2 OUTPUT TERMINALS
START RUN STOP
CLOSE ON OFF
BUILD UP VOLTS. GEN. IDLE
RESET
TEST
PLUG/RECEPTACLE DESIGNATIONS
CONTACT NUMBER
THIS DESIGNATION:
REPRESENTS J10, P10, J12 & P12 AS SHOWN HERE:
RECEPTACLE
PLUGS
RECEPTACLE
NOTE 1: K65 CONNECTED TO TB4-9 & TB4-10 WHEN USED AS LOW FUEL IDLE RELAY.
NOTE 2: K65 CONNECTED TO TB4-4 & TB4-5 WHEN USED AS LOW FUEL SHUTDOWN RELAY.
NOTE 3: CR10 LOCATED IN CONTROL BOX PRIOR TO 10/92.
⑥ AREA G-11: REPOSITION CR10 TO OTHER SIDE OF CONNECTOR PINS 6 & 30. ADDED NOTE 3.
⑦ REVERSE AMMETER CIRCUITS FOR PHASES A & C.
⑥ ADDED NOTE 1 & NOTE 2.
⑤ ADDED INSET AT LOC. H12.
④ CHANGED CONNECTIONS ON K23-4 & S13-4 & ADDED DS35B DS35A WAS DS35.
③ RECONNECT NEUTRAL SENSING ON VOLTAGE REGULATOR.
② CHANGED FROM GAC GOVERNOR CONTROLLER TO BARBER COLMAN.
① RECONNECT LINE DROP CT'S FROM PHASES A, B & C TO NEUTRAL.
HOBART AIRPORT SYSTEMS GROUP
HOBART GROUND POWER
DIAGRAM, SCHEMATIC
283121

DWG. NO. 283121

LEGEND

A1	TRANSFORMER–RECTIFIER, 28.5V. (WHEN FURNISHED)
A2	TRANSFORMER–RECTIFIER, 112V. (WHEN FURNISHED)
A7	SENSOR, WATER TEMPERATURE
A8	SENSOR, OIL PRESSURE
A9	SENSOR, AIR CLEANER SERVICE
A10	CONTROL BOX, ELECTRIC GOVERNOR
A11	MAGNETIC PICKUP, ELECTRIC GOVERNOR
A14	SPEED CONTROL, IDLE, ELECTRIC GOVERNOR
B2	STARTER, ENGINE, 12 V.
BT1	BATTERY, 12 V.
C1–C3	CAPACITOR, GENERATOR, 0.1 MFD., 500 V.
C8	CAPACITOR, 6.8 MFD., 35 V.
CB1	CIRCUIT BREAKER, ENGINE CIRCUIT, 10 A.
CB2	CIRCUIT BREAKER, PROTECTIVE SYSTEM, 2 A.
CB3	CIRCUIT BREAKER, LOAD CONTACTOR RECTIFIER, 2 A.
CB10	CIRCUIT BREAKER, COLD WEATHER START, 15A. (WHEN FURNISHED)
CR2	RECTIFIER, GENERATOR REVOLVING FIELD
CR6	RECTIFIER, LOAD CONTACTOR, #1 OUTPUT
CR8–CR13	DIODE, FLY–BACK
CR15	DIODE, BLOCKING
CR30	DIODE, FLY–BACK, LOW FUEL LEVEL RELAY (WHEN FURNISHED)
CR206	RECTIFIER, LOAD CONTACTOR, #2 OUTPUT
CR211	DIODE, FLYBACK
CR215	DIODE, BLOCKING
DS1,DS2	LIGHT, PANEL (WHITE)
DS9	LIGHT, SPOT W/SWITCH (WHITE) (WHEN FURNISHED)
DS23	INDICATOR, AIR CLEANER SERVICE (RED)
DS26	INDICATOR, LOAD ON, #1 OUTPUT (GREEN)
DS27	INDICATOR, ENGINE RUNNING (GREEN)
DS35A	INDICATOR, LOW FUEL LEVEL (AMBER, RED OR BLUE) BEACON MTG. (WHEN FURNISHED)
DS35B	INDICATOR, LOW FUEL LEVEL, (RED) PANEL MTG. (WHEN FURN.)
DS36	INDICATOR, OVERLOAD FAULT (RED)
DS37	INDICATOR, OVERVOLTAGE FAULT (RED)
DS38	INDICATOR, UNDERVOLTAGE FAULT (RED)
DS39	INDICATOR, UNDERFREQUENCY FAULT (RED)
DS40	INDICATOR, OVERFREQUENCY FAULT (RED)
DS51–DS54	LAMP MARKER (AMBER OR RED)
DS56	FLASHER, LOW FUEL LEVEL LIGHT, (WHEN FURNISHED)
DS127	INDICATOR, BEACON, ENGINE CIRCUIT ON (AMBER, RED OR BLUE) (WHEN FURNISHED)
DS226	INDICATOR, LOAD ON, #2 OUTPUT (GREEN)
G1	GENERATOR STATOR
G2	EXCITER ARMATURE, GENERATOR
G4	ALTERNATOR, ENGINE, 12 V.
J1	RECEPTACLE, VOLTAGE REGULATOR
J5	RECEPTACLE, MEMORY & TIME DELAY BOARD
J6	RECEPTACLE, OVERLOAD BOARD, #1 OUTPUT
J7	RECEPTACLE, T–R CONTROL, 28.5V. (WHEN FURNISHED)
J10	RECEPTACLE, POWER MODULE
J11,J12	RECEPTACLE, CONTROL BOX
J14	RECEPTACLE, OVER–UNDERVOLTAGE BOARD
J15	RECEPTACLE, OVER–UNDERFREQUENCY BOARD
J39	RECEPTACLE, OVERLOAD BOARD, GEN., MAIN
J206	RECEPTACLE, OVERLOAD BOARD, #2 OUTPUT
K1	LOAD CONTACTOR, #1 OUTPUT
K2	RELAY, PLUG INTERLOCK, #1 OUTPUT
K3	RELAY, OVERLOAD, SOLID STATE, GENERATOR, MAIN
K4	RELAY, OVERLOAD, SOLID STATE, #1 OUTPUT
K14	RELAY, MEMORY & TIME DELAY, SOLID STATE
K16	RELAY, EXCITATION DE–ENERGIZATION
K17	RELAY, PROTECTIVE SYSTEM INTERLOCK
K23	RELAY, UNDERFREQUENCY AUXILIARY
K26	RELAY, OVER–UNDERVOLTAGE, SOLID STATE
K27	RELAY, OVER–UNDERFREQUENCY, SOLID STATE
K65	RELAY, LOW FUEL LEVEL (WHEN FURNISHED)
K201	LOAD CONTACTOR, #2 OUTPUT
K202	RELAY, PLUG INTERLOCK, #2 OUTPUT
K204	RELAY, OVERLOAD, SOLID STATE, #2 OUTPUT
L1	FIELD, REVOLVING, GENERATOR
L2	FIELD, EXCITER, GENERATOR
L7	SOLENOID, FUEL VALVE
L9	SOLENOID, STARTER, 12 V.
L13	SOLENOID, COLD WEATHER START (WHEN FURNISHED)
L14	ACTUATOR, ELECTRIC GOVERNOR
M1	AMMETER, GENERATOR
M2	VOLTMETER
M3	FREQUENCY METER
M4	RUNNING TIME METER
M5	AMMETER, BATTERY
M12	RUNNING TIME METER, TRUCK (WHEN FURNISHED)
M13	GAGE, FUEL, ELECTRIC
M24	GAGE, WATER, TEMPERATURE
M25	GAGE, OIL PRESSURE
P1	PLUG, VOLTAGE REGULATOR
P5	PLUG, MEMORY & TIME DELAY BOARD
P6	PLUG, OVERLOAD BOARD, #1 OUTPUT
P7	PLUG, T–R CONTROL, 28.5V. (WHEN FURNISHED)
P10	PLUG, POWER MODULE
P11,P12	PLUG, CONTROL BOX
P14	PLUG, OVER–UNDERVOLTAGE BOARD
P15	PLUG, OVER–UNDERFREQUENCY BOARD
P39	PLUG, OVERLOAD BOARD, GEN., MAIN
P206	PLUG, OVERLOAD BOARD, #2 OUTPUT
R16–R18	RESISTOR, LINE DROP, 50 OHM, 20 WATT
R26–R28	RESISTOR, OVERLOAD, 16.6 OHM, 20 WATT, #1 OUTPUT
R33–R35	RESISTOR, OVERLOAD, MAIN GEN., 12.5 OHM, 20 WATT
R46	RESISTOR, HOLD CIRCUIT, 100 OHM, 25 WATT, #1 OUTPUT
R55	SENDER, ELECTRIC FUEL GAGE
R226–R228	RESISTOR, OVERLOAD, 16.6 OHM, 20 WATT, #2 OUTPUT
R246	RESISTOR, HOLD CIRCUIT, 100 OHM, 25 WATT, #2 OUTPUT
S1	SWITCH, REGULATED–DIAGNOSTIC
S2	SWITCH, TEST BANK, #1 OUTPUT
S3	SWITCH, METER SELECTOR
S4	SWITCH, PANEL LIGHT
S5	SWITCH, CONTACTOR, #1 OUTPUT
S7	SWITCH, PERMISSIVE START
S13	SWITCH, IDLE–GEN–BUILD UP VOLTS
S23	SWITCH, PUSHBUTTON, RESET, PROTECTIVE SYSTEM
S24	SWITCH, PUSHBUTTON, ENGINE START
S28	SWITCH, PUSHBUTTON, EMERGENCY STOP (WHEN FURNISHED)
S30	SWITCH, PUSHBUTTON, TEST, PROTECTIVE SYSTEM
S37	SWITCH, MICRO, PLUG BOX, #1 OUTPUT (WHEN FURNISHED)
S46	SWITCH, LUBE OIL PRESSURE, ENGINE
S47	SWITCH, LUBE OIL PRESSURE, TRUCK (WHEN FURNISHED)
S49	SWITCH, ENGINE HIGH TEMPERATURE
S52	SWITCH, VACUUM, TRUCK (WHEN FURNISHED)
S54	SWITCH, LOW FUEL LEVEL (WHEN FURNISHED)
S70	SWITCH, ENGINE TEMP. SENSOR (WHEN FURNISHED)
S202	SWITCH, TEST BANK, #2 OUTPUT
S205	SWITCH, CONTACTOR, #2 OUTPUT
S237	SWITCH, MICRO, PLUG BOX, #2 OUTPUT (WHEN FURNISHED)
T4–T6	TRANSFORMER, CURRENT, LINE DROP
T7–T9	TRANSFORMER, CURRENT, OVERLOAD, GENERATOR, #1 OUTPUT
T30–T32	TRANSFORMER, CURRENT, OVERLOAD, MAIN GENERATOR
T207–T209	TRANSFORMER, CURRENT, OVERLOAD, GENERATOR, #2 OUTPUT
TB2	TERMINAL BLOCK, CONTROL BOX
TB4	TERMINAL BLOCK, OPTIONS
VR1	VOLTAGE REGULATOR, OUTPUT

① ADDED DS35B
DS35B WAS DS35. ADDED "BEACON" TO DESCRIPTION.

REV.	ECN No	DATE
1	3056L	1-27-92

ACTIVITY	REPLACED BY	REPLACES			
BASED ON 280170	WHERE USED S-7130				
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES/MILLIMETERS DO NOT SCALE DRAWING. TOLERANCES BELOW APPLY EXCEPT FOR VENDOR DESIGNED PARTS AND ITEMS PRODUCED TO RECOGNIZED STANDARDS.			DESIGNED DWF	DRAWN DWF	DATE 6-27-91
			SCALE FULL	RECORDS -	CHECKED -
			MATL. NO. -	QUAL./CLAS. -	ITEM TYPE H
					COMM. CLASS 149
FRAC. INCH ± .	DECIMAL INCH .00 ± .01 .000 ± .003	METRIC .x ± 1.2mm .0.x ± 0.4mm .0.0x ± 0.1mm	MATL. SPEC. LEGEND		
ANGLES ± 30'			TITLE: DIAGRAM, SCHEMATIC		

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HOBART AIRPORT SYSTEMS GROUP

HOBART® GROUND POWER

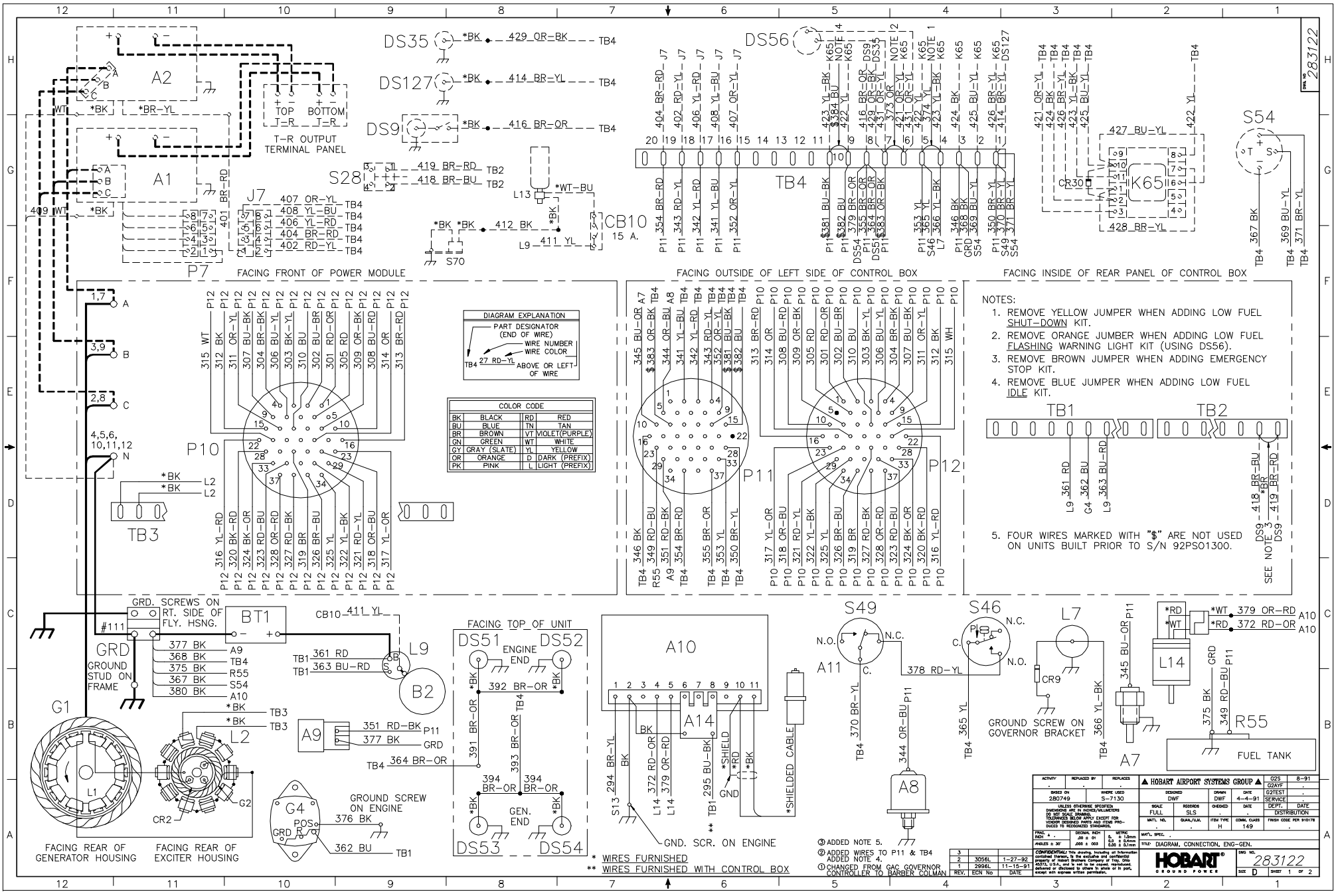
DWG NO. 283121

SIZE D SHEET 2 OF 2

DEPT. DATE

DISTRIBUTION

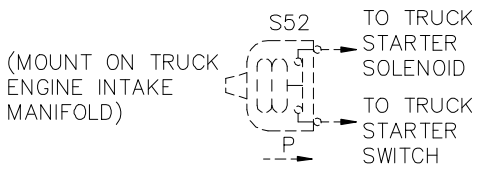
FINISH CODE PER 910178

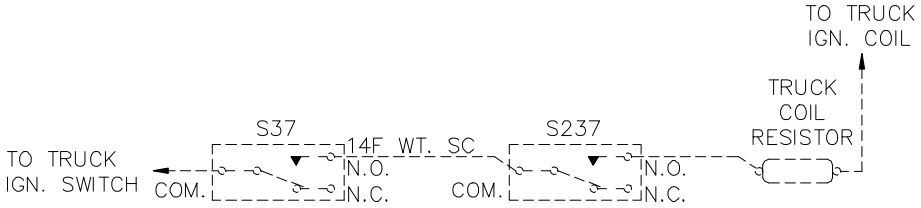

DWG NO. 283122
A2
A1
TOP T-R
BOTTOM T-R
T-R OUTPUT TERMINAL PANEL
DS35
DS127
DS9
DS56
S28
S70
CB10 15 A.
L13
L9
TB4
J7
P7
K65
K6
S54
FACING FRONT OF POWER MODULE
FACING OUTSIDE OF LEFT SIDE OF CONTROL BOX
FACING INSIDE OF REAR PANEL OF CONTROL BOX
P10
P11
P12
TB3
DIAGRAM EXPLANATION
PART DESIGNATOR (END OF WIRE)
WIRE NUMBER
WIRE COLOR
ABOVE OR LEFT OF WIRE
TB4 27 RD–YL
COLOR CODE
BK BLACK
BU BLUE
BR BROWN
GN GREEN
GY GRAY (SLATE)
OR ORANGE
PK PINK
RD RED
TN TAN
VT VIOLET(PURPLE)
WT WHITE
YL YELLOW
D DARK (PREFIX)
L LIGHT (PREFIX)
NOTES:
1. REMOVE YELLOW JUMPER WHEN ADDING LOW FUEL SHUT–DOWN KIT.
2. REMOVE ORANGE JUMBER WHEN ADDING LOW FUEL FLASHING WARNING LIGHT KIT (USING DS56).
3. REMOVE BROWN JUMPER WHEN ADDING EMERGENCY STOP KIT.
4. REMOVE BLUE JUMPER WHEN ADDING LOW FUEL IDLE KIT.
5. FOUR WIRES MARKED WITH "$" ARE NOT USED ON UNITS BUILT PRIOR TO S/N 92PS01300.
TB1
TB2
GRD. SCREWS ON RT. SIDE OF FLY. HSNG.
#111
GRD
GROUND STUD ON FRAME
BT1
L9
B2
G1
L1
L2
G2
CR2
A9
G4
POS
GRD
GROUND SCREW ON ENGINE
FACING REAR OF GENERATOR HOUSING
FACING REAR OF EXCITER HOUSING
FACING TOP OF UNIT
DS51
DS52
DS53
DS54
ENGINE END
GEN. END
A10
A14
A11
S49
S46
L7
CR9
GROUND SCREW ON GOVERNOR BRACKET
A7
A8
L14
R55
FUEL TANK
GND. SCR. ON ENGINE
*SHIELDED CABLE
* WIRES FURNISHED
** WIRES FURNISHED WITH CONTROL BOX
① CHANGED FROM GAC GOVERNOR CONTROLLER TO BARBER COLMAN
② ADDED WIRES TO P11 & TB4 ADDED NOTE 4.
③ ADDED NOTE 5.
HOBART AIRPORT SYSTEMS GROUP
TITLE: DIAGRAM, CONNECTION, ENG–GEN.
HOBART GROUND POWER
283122
SIZE D SHEET 1 OF 2

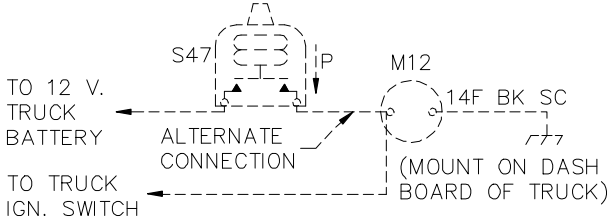
DWG. NO. 283122

LEGEND

A1	TRANSFORMER–RECTIFIER, 28.5V. (WHEN FURNISHED)
A2	TRANSFORMER–RECTIFIER, 112V. (WHEN FURNISHED)
A7	SENSOR, WATER TEMPERATURE
A8	SENSOR, OIL PRESSURE
A9	SENSOR, AIR CLEANER SERVICE
A10	CONTROL BOX, ELECTRIC GOVERNOR
A11	MAGNETIC PICKUP, ELECTRIC GOVERNOR
A14	SPEED CONTROL, IDLE, ELECTRIC GOVERNOR
B2	STARTER, ENGINE, 12 V.
BT1	BATTERY, 12 V.
CB10	CIRCUIT BREAKER, COLD WEATHER START, 15A. (WHEN FURNISHED)
CR2	RECTIFIER, GENERATOR REVOLVING FIELD
CR9	DIODE, FLY–BACK
CR30	DIODE, FLY–BACK, LOW FUEL LEVEL RELAY (WHEN FURNISHED)
DS9	LIGHT, SPOT W/SWITCH (WHITE) (WHEN FURNISHED)
DS35A	INDICATOR, LOW FUEL LEVEL (AMBER, RED OR BLUE) BEACON MTG. (WHEN FURN.)
DS51–DS54	LAMP MARKER (AMBER OR RED)
DS56	FLASHER, LOW FUEL LEVEL LIGHT, (WHEN FURNISHED)
DS127	INDICATOR, BEACON, ENGINE CIRCUIT ON (AMBER, RED OR BLUE) (WHEN FURNISHED)
G1	GENERATOR STATOR
G2	EXCITER ARMATURE, GENERATOR
G4	ALTERNATOR, ENGINE, 12 V.
J7	RECEPTACLE, T–R CONTROL, 28.5V. (WHEN FURNISHED)
K65	RELAY, LOW FUEL LEVEL (WHEN FURNISHED)
L1	FIELD, REVOLVING, GENERATOR
L2	FIELD, EXCITER, GENERATOR
L7	SOLENOID, FUEL VALVE
L9	SOLENOID, STARTER, 12 V.
L13	SOLENOID, COLD WEATHER START (WHEN FURNISHED)
L14	ACTUATOR, ELECTRIC GOVERNOR
M12	RUNNING TIME METER, TRUCK (WHEN FURNISHED)
P7	PLUG, T–R CONTROL, 28.5V. (WHEN FURNISHED)
P10	PLUG, POWER MODULE
P11,P12	PLUG, CONTROL BOX
R55	SENDER, ELECTRIC FUEL GAGE
S28	SWITCH, PUSHBUTTON, EMERGENCY STOP (WHEN FURNISHED)
S37	SWITCH, MICRO, PLUG BOX, #1 OUTPUT (WHEN FURNISHED)
S46	SWITCH, LUBE OIL PRESSURE, ENGINE
S47	SWITCH, LUBE OIL PRESSURE, TRUCK (WHEN FURNISHED)
S49	SWITCH, ENGINE HIGH TEMPERATURE
S52	SWITCH, VACUUM, TRUCK (WHEN FURNISHED)
S54	SWITCH, LOW FUEL LEVEL (WHEN FURNISHED)
S70	SWITCH, ENGINE TEMP. SENSOR (WHEN FURNISHED)
S237	SWITCH, MICRO, PLUG BOX, #2 OUTPUT (WHEN FURNISHED)
TB1,TB2	TERMINAL BLOCK, CONTROL BOX
TB3	TERMINAL BLOCK, POWER MODULE
TB4	TERMINAL BLOCK, OPTIONS







① DS35A WAS DS35, ADDED BEACON MTG. TO DESCRIPTION.

REV.	ECN No.	DATE
1	3056L	1–27–92

ACTIVITY: .	REPLACED BY: .	REPLACES: .	
BASED ON: 280749	WHERE USED: S–7130		

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES/MILLIMETERS. DO NOT SCALE DRAWING. TOLERANCES BELOW APPLY EXCEPT FOR VENDOR DESIGNED PARTS AND ITEMS PRODUCED TO RECOGNIZED STANDARDS.

FRAC. INCH ± . | DECIMAL INCH .00 ± .01, .000 ± .003 | METRIC 0. ± 1.0mm, 0.0 ± 0.4mm, 0.00 ± 0.1mm

ANGLES ± 30'

HOBART AIRPORT SYSTEMS GROUP

DESIGNED: DWF		DRAWN: DWF	DATE: 8–15–91	G2S	8–91
SCALE: FULL	RECORDS: SLS	CHECKED: .	DATE: .	G2TEST	.
MAT'L. NO.: .	QUAN./U.M.: .	ITEM TYPE: H	COMM. CLASS: 149	G2AYF	.
				SERVICE	.
				DEPT.	DATE
				DISTRIBUTION	
				FINISH CODE PER 910176: .	

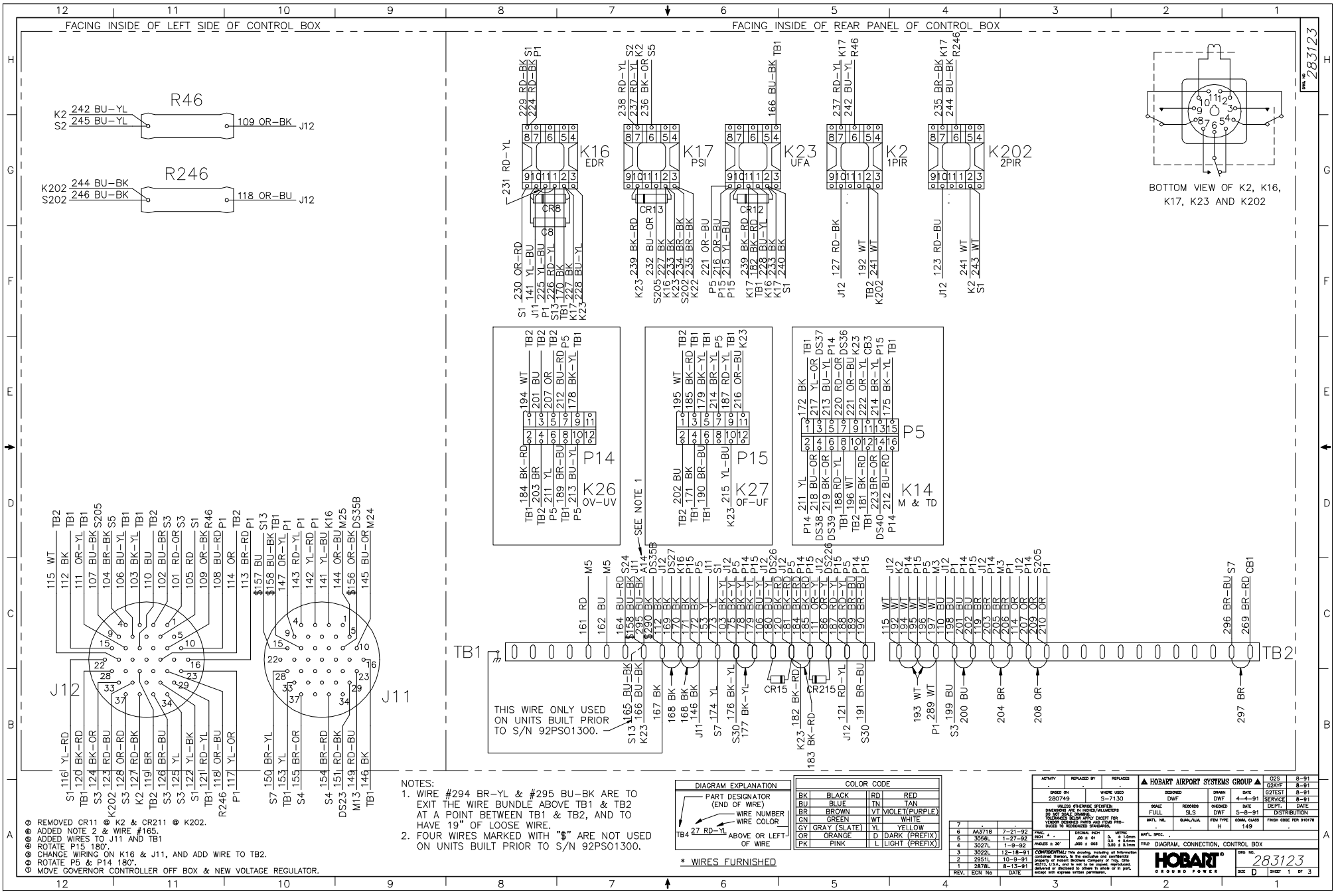
MAT'L. SPEC.: .

TITLE: DIAGRAM, CONNECTION, ENG–GEN

HOBART® GROUND POWER

DWG. NO. 283122

SIZE: C SHEET 2 OF 2



NOTES:
1. WIRE #294 BR-YL & #295 BU-BK ARE TO EXIT THE WIRE BUNDLE ABOVE TB1 & TB2 AT A POINT BETWEEN TB1 & TB2, AND TO HAVE 19" OF LOOSE WIRE.
2. FOUR WIRES MARKED WITH "$" ARE NOT USED ON UNITS BUILT PRIOR TO S/N 92PS01300.

DIAGRAM EXPLANATION
PART DESIGNATOR (END OF WIRE)
WIRE NUMBER
WIRE COLOR
TB4 27 RD-YL
ABOVE OR LEFT OF WIRE

* WIRES FURNISHED

COLOR CODE			
BK	BLACK	RD	RED
BU	BLUE	TN	TAN
BR	BROWN	VT	VIOLET(PURPLE)
GN	GREEN	WT	WHITE
GY	GRAY (SLATE)	YL	YELLOW
OR	ORANGE	D	DARK (PREFIX)
PK	PINK	L	LIGHT (PREFIX)

REV.	ECN No	DATE
7	.	.
6	AA3718	7-21-92
5	3056L	1-27-92
4	3027L	1-9-92
3	3022L	12-18-91
2	2951L	10-8-91
1	2878L	8-13-91

ⓖ REMOVED CR11 @ K2 & CR211 @ K202.
ⓕ ADDED NOTE 2 & WIRE #165.
ⓔ ADDED WIRES TO J11 AND TB1
ⓓ ROTATE P15 180°.
ⓒ CHANGE WIRING ON K16 & J11, AND ADD WIRE TO TB2.
ⓑ ROTATE P5 & P14 180°.
Ⓐ MOVE GOVERNOR CONTROLLER OFF BOX & NEW VOLTAGE REGULATOR.

ACTIVITY	REPLACED BY	REPLACES
.	.	.
BASED ON	WHERE USED	
280749	S-7130	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES/MILLIMETERS DO NOT SCALE DRAWING. TOLERANCES BELOW APPLY EXCEPT FOR VENDOR DESIGNED PARTS AND ITEMS PRODUCED TO RECOGNIZED STANDARDS.

FRAC. ± . | DECIMAL INCH: .00 ± .01 | METRIC: 0. ± 1.0mm, 0.0 ± 0.4mm, 0.00 ± 0.1mm
ANGLES ± 30' | .000 ± .003

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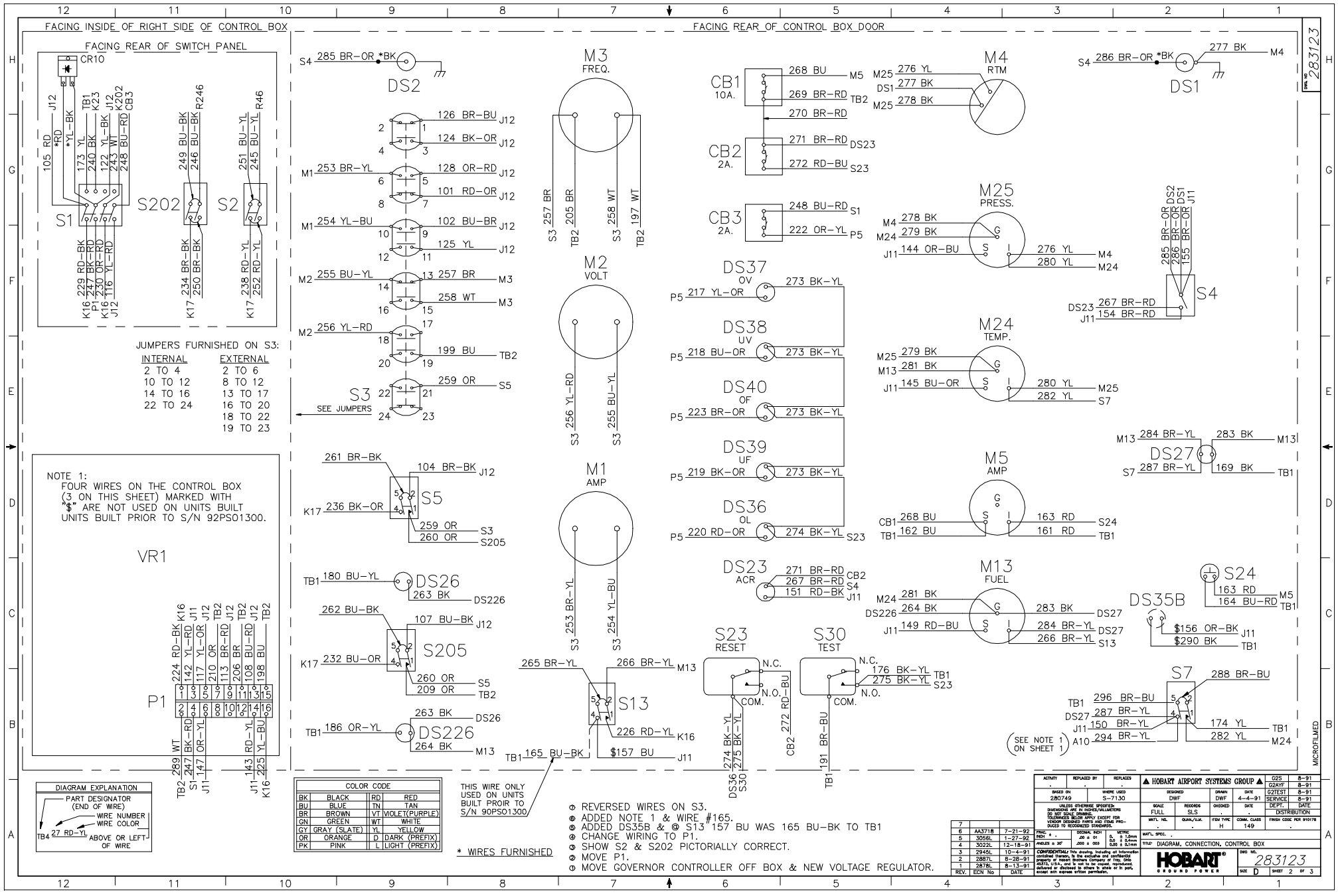
HOBART AIRPORT SYSTEMS GROUP

DESIGNED	DRAWN	DATE	G2S 8-91
DWF	DWF	4-4-91	G2AYF 8-91
SCALE	RECORDS	CHECKED	DATE G2TEST 8-91
FULL	SLS	DWF	5-8-91 SERVICE 8-91
MAT'L NO.	QUAN./ASM.	ITEM TYPE	CONN. CLASS DEPT. DATE
.	.	H	149 . DISTRIBUTION
MAT'L. SPEC.	.		FINISH CODE PER 910178

TITLE: DIAGRAM, CONNECTION, CONTROL BOX

HOBART® GROUND POWER

DWG NO. 283123
SIZE D SHEET 1 OF 3


FACING INSIDE OF RIGHT SIDE OF CONTROL BOX
FACING REAR OF CONTROL BOX DOOR
FACING REAR OF SWITCH PANEL
CR10
S1
S202
S2
JUMPERS FURNISHED ON S3:
INTERNAL
2 TO 4
10 TO 12
14 TO 16
22 TO 24
EXTERNAL
2 TO 6
8 TO 12
13 TO 17
16 TO 20
18 TO 22
19 TO 23
S3
SEE JUMPERS
DS2
M3
FREQ.
M2
VOLT
M1
AMP
CB1
10A.
CB2
2A.
CB3
2A.
M4
RTM
DS1
M25
PRESS.
S4
M24
TEMP.
M5
AMP
M13
FUEL
DS37
OV
DS38
UV
DS40
OF
DS39
UF
DS36
OL
DS23
ACR
S5
S205
DS26
DS226
S13
S23
RESET
S30
TEST
S7
DS35B
S24
NOTE 1:
FOUR WIRES ON THE CONTROL BOX (3 ON THIS SHEET) MARKED WITH "$" ARE NOT USED ON UNITS BUILT UNITS BUILT PRIOR TO S/N 92PS01300.
VR1
P1
DIAGRAM EXPLANATION
PART DESIGNATOR (END OF WIRE)
WIRE NUMBER
WIRE COLOR
ABOVE OR LEFT OF WIRE
COLOR CODE
BK BLACK
BU BLUE
BR BROWN
GN GREEN
GY GRAY (SLATE)
OR ORANGE
PK PINK
RD RED
TN TAN
VT VIOLET(PURPLE)
WT WHITE
YL YELLOW
D DARK (PREFIX)
L LIGHT (PREFIX)
THIS WIRE ONLY USED ON UNITS BUILT PRIOR TO S/N 90PS01300
* WIRES FURNISHED
REVERSED WIRES ON S3.
ADDED NOTE 1 & WIRE #165.
ADDED DS35B & @ S13 157 BU WAS 165 BU-BK TO TB1
CHANGE WIRING TO P1.
SHOW S2 & S202 PICTORIALLY CORRECT.
MOVE P1.
MOVE GOVERNOR CONTROLLER OFF BOX & NEW VOLTAGE REGULATOR.
HOBART AIRPORT SYSTEMS GROUP
DIAGRAM, CONNECTION, CONTROL BOX
HOBART GROUND POWER
283123
MICROFILMED

DWG. NO. 283123

LEGEND

** A10	CONTROL BOX, ELECTRIC GOVERNOR	M1	AMMETER, GENERATOR
** A14	SPEED CONTROL, IDLE, ELECTRIC GOVERNOR	M2	VOLTMETER
		M3	FREQUENCY METER
C8	CAPACITOR, 6.8 MFD., 35 V.	M4	RUNNING TIME METER
		M5	AMMETER, BATTERY
CB1	CIRCUIT BREAKER, ENGINE CIRCUIT, 10 A.	M13	GAGE, FUEL, ELECTRIC
CB2	CIRCUIT BREAKER, PROTECTIVE SYSTEM, 2 A.	M24	GAGE, WATER, TEMPERATURE
CB3	CIRCUIT BREAKER, LOAD CONTACTOR RECTIFIER, 2 A.	M25	GAGE, OIL PRESSURE
CR8,CR10, CR12,CR13	DIODE, FLY-BACK	P1	PLUG, VOLTAGE REGULATOR
CR15	DIODE, BLOCKING		
CR215	DIODE, BLOCKING		
		P5	PLUG, MEMORY & TIME DELAY BOARD
DS1,DS2	LIGHT, PANEL (WHITE)	P14	PLUG, OVER-UNDERVOLTAGE BOARD
DS23	INDICATOR, AIR CLEANER SERVICE (RED)	P15	PLUG, OVER-UNDERFREQUENCY BOARD
DS26	INDICATOR, LOAD ON, #1 OUTPUT (GREEN)		
DS27	INDICATOR, ENGINE RUNNING (GREEN)	R46	RESISTOR, HOLD CIRCUIT, 100 OHM, 25 WATT, #1 OUTPUT
DS35B	INDICATOR, LOW FUEL, (RED) PANEL MOUNT (WHEN FURN.)	R246	RESISTOR, HOLD CIRCUIT, 100 OHM, 25 WATT, #2 OUTPUT
DS36	INDICATOR, OVERLOAD FAULT (RED)		
DS37	INDICATOR, OVERVOLTAGE FAULT (RED)	S1	SWITCH, REGULATED-DIAGNOSTIC
DS38	INDICATOR, UNDERVOLTAGE FAULT (RED)	S2	SWITCH, TEST BANK, #1 OUTPUT
DS39	INDICATOR, UNDERFREQUENCY FAULT (RED)	S3	SWITCH, METER SELECTOR
DS40	INDICATOR, OVERFREQUENCY FAULT (RED)	S4	SWITCH, PANEL LIGHT
DS226	INDICATOR, LOAD ON, #2 OUTPUT (GREEN)	S5	SWITCH, CONTACTOR, #1 OUTPUT
		S7	SWITCH, PERMISSIVE START
J11,J12	RECEPTACLE, CONTROL BOX	S13	SWITCH, IDLE-GEN-BUILD UP VOLTS
		S23	SWITCH, PUSHBUTTON, RESET, PROTECTIVE SYSTEM
K2	RELAY, PLUG INTERLOCK, #1 OUTPUT	S24	SWITCH, PUSHBUTTON, ENGINE START
K14	RELAY, MEMORY & TIME DELAY, SOLID STATE	S30	SWITCH, PUSHBUTTON, TEST, PROTECTIVE SYSTEM
K16	RELAY, EXCITATION DE-ENERGIZATION	S202	SWITCH, TEST BANK, #2 OUTPUT
K17	RELAY, PROTECTIVE SYSTEM INTERLOCK	S205	SWITCH, CONTACTOR, #2 OUTPUT
K23	RELAY, UNDERFREQUENCY AUXILIARY		
K26	RELAY, OVER-UNDERVOLTAGE, SOLID STATE	TB1, TB2	TERMINAL BLOCK, CONTROL BOX
K27	RELAY, OVER-UNDERFREQUENCY, SOLID STATE		
K202	RELAY, PLUG INTERLOCK, #2 OUTPUT	VR1	VOLTAGE REGULATOR, OUTPUT

** THESE ITEMS ARE MOUNTED OUTSIDE THE CONTROL BOX.

③ DELETED CR211 AND CR11, DIODE, FLY-BACK FROM LEGEND

② ADDED DS35B

① MOVE GOVERNOR CONTROLLER OFF BOX & NEW VOLTAGE REGULATOR.

REV.	ECN No.	DATE
3	.	.
2	3056L	1-27-92
1	2878L	8-13-91

ACTIVITY: .	REPLACED BY: .	REPLACES: .
BASED ON: 280749	WHERE USED: S-7130	

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES/MILLIMETERS. DO NOT SCALE DRAWING. TOLERANCES BELOW APPLY EXCEPT FOR VENDOR DESIGNED PARTS AND ITEMS PRODUCED TO RECOGNIZED STANDARDS.

FRAC. INCH ± .	DECIMAL INCH .00 ± .01	METRIC 0. ± 1.0mm
ANGLES ± 30'	.000 ± .003	0.0 ± 0.4mm 0.00 ± 0.1mm

▲ HOBART AIRPORT SYSTEMS GROUP ▲

DESIGNED	DRAWN	DATE
DWF	DWF	7-15-91

SCALE	RECORDS	CHECKED	DATE	DEPT.	DATE
FULL	.	.	.	DISTRIBUTION	

MAT'L. NO.	QUAN./U.M.	ITEM TYPE	COMM. CLASS	FINISH CODE PER 910176
.	.	H	149	.

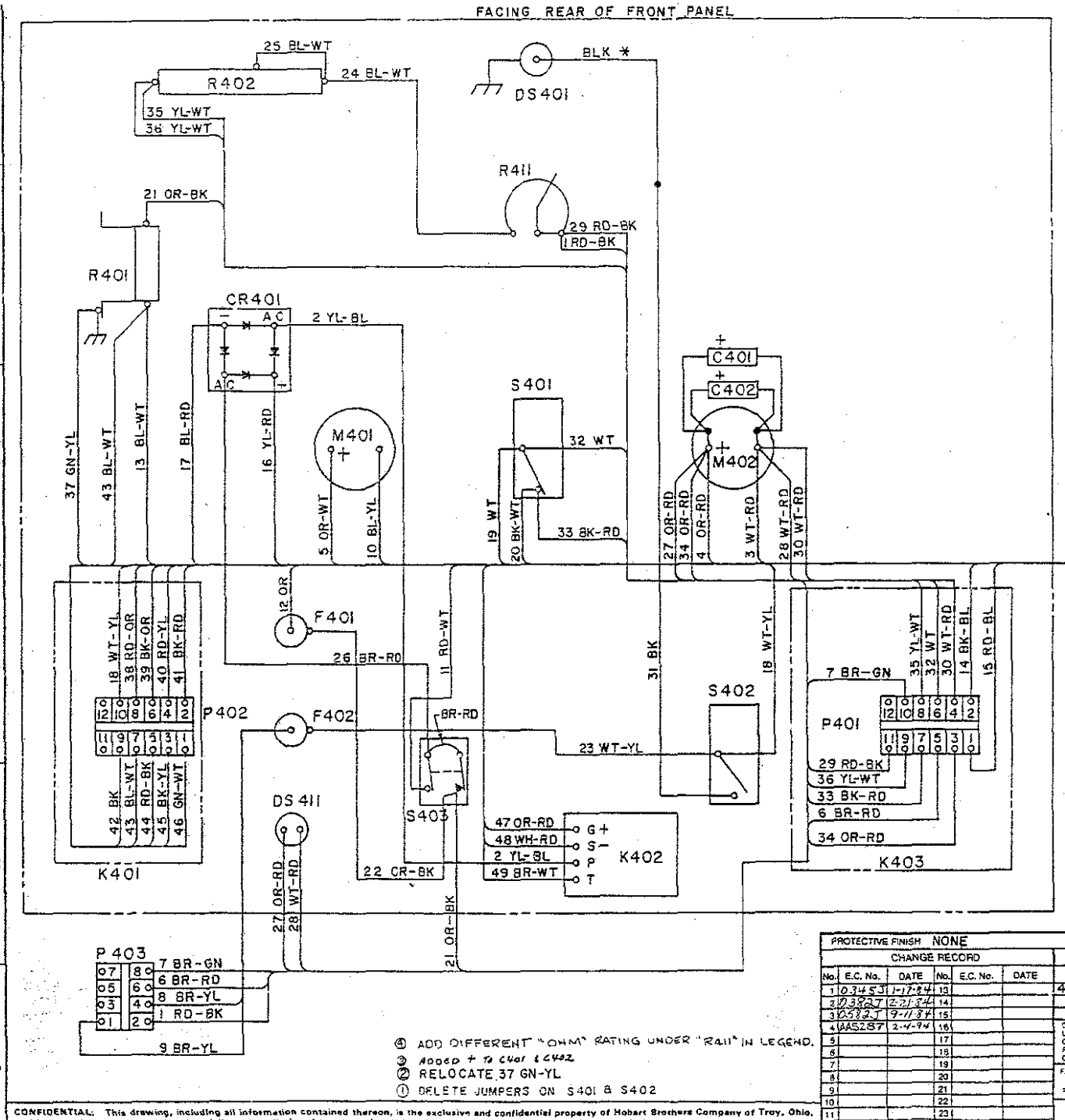
MAT'L. SPEC.: .

TITLE: DIAGRAM, CONNECTION, CONTROL BOX

HOBART® GROUND POWER

DWG. NO. 283123

SIZE: C SHEET 3 OF 3



C401,402	CAPACITOR, 6.8 MFD, 35 WVDC
CR401	RECTIFIER, CONTACTOR
DS401	LIGHT, ILLUMINATING
DS411	INDICATOR, CONT CLOSE (GREEN)
F401,F402	FUSE, 2A
K-401	RELAY, OVERLOAD
K-402	RELAY, OVERVOLTAGE
K-403	RELAY, LDC & CURRENT LIMIT
M401	AMMETER
M402	VOLTMETER
P401	PLUG, LDC & CURRENT LIMIT
P402	PLUG, OVERLOAD
P403	PLUG, REGULATOR & 12V DC
R401	RESISTOR, HOLD CIRCUIT, 200 OHM, 25W
R402	RESISTOR, CURRENT LIMIT, 100 OHM, 100W
R411	RHEOSTAT, MANUAL, 150W 75 OHM FOR 487750-1 AND -2 100 OHM FOR 487750-3
S401	SWITCH, CURRENT LIMIT
S402	SWITCH, ILLUMINATING LIGHT
S403	SWITCH, CONTACTOR

* WIRES FURNISHED

COLOR CODE			
BK	BLACK	RD	RED
BL	BLUE	TN	TAN
BR	BROWN	VT	VIOLET (PURPLE)
GN	GREEN	WT	WHITE
GY	GRAY (SLATE)	YL	YELLOW
OR	ORANGE	D	DARK (PREFIX)
PK	PINK	L	LIGHT (PREFIX)

④ ADD DIFFERENT "OHM" RATING UNDER "R411" IN LEGEND.
③ ADDED + TO CHAS & C402
② RELOCATE 37 GN-YL
① DELETE JUMPERS ON S401 & S402

MICROFILMED

02-537	10-83
02-536	10-83
02337 TEST	10-83
04-610	10-83

OUTSIDE DISTR.
PRODUCT CODE
DISTRIBUTION TABLE

PROTECTIVE FINISH NONE

CHANGE RECORD

No.	E.C. No.	DATE	No.	E.C. No.	DATE
1	03453	1-17-84	13		
2	03827	2-21-84	14		
3	05826	9-11-84	15		
4	AA52187	2-4-94	16		
5			17		
6			18		
7			19		
8			20		
9			21		
10			22		
11			23		

WHERE USED

NEXT ASSY.	NO. REQ.	USED ON
487750-1		

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES/MILLIMETERS. TOLERANCES BELOW APPLY EXCEPT FOR VENDOR DESIGNED PARTS AND ITEMS PRODUCED TO RECOGNIZED STANDARDS. DO NOT SCALE DRAWING.

FRACTIONAL ± INCH | DECIMAL - INCH .00 ± .01, .000 ± .003 | MET... 0. ± 0.1 mm, 0.0 ± 0.4 mm, 0.00 ± 0.1 mm | ANGLES ± ° | SURFACE TEXTURE

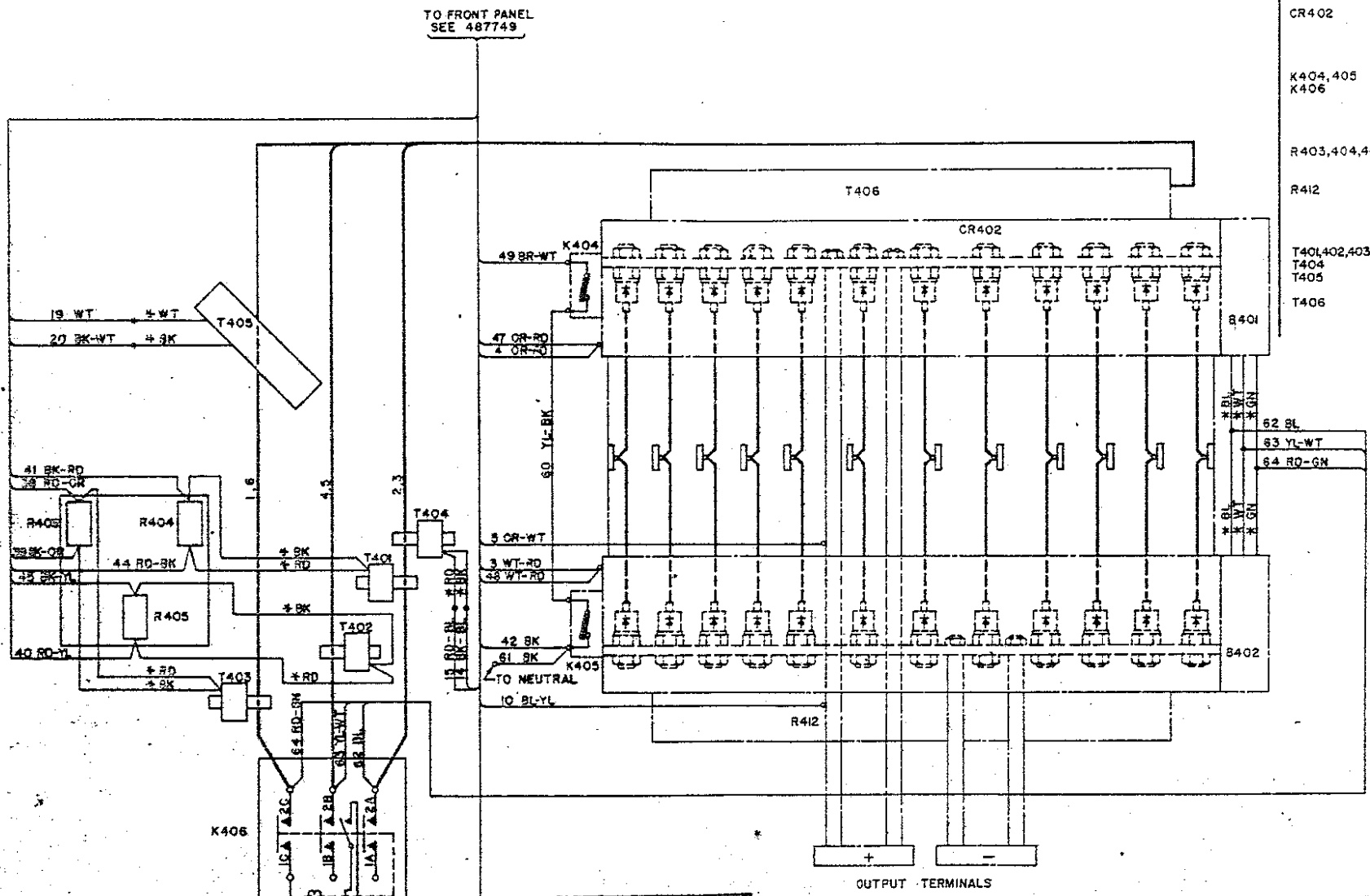
M | COMM.CLS.

ACTIVITY	REPLACED BY	REPLACES	QUANTITY/U.M.
MATERIAL NO.	MATERIAL SPEC.		

TITLE DIAGRAM, CONN, FRONT PNL
INDEX DATA

DESIGNED	DRAWN	DATE	SCALE
JRM	JLC	8-29-83	NONE
CHECKED	DATE	APPROVED	BASED ON
KC	10/28/83		389486
RECORDS	MFG. ENGRG.	M. P.	LT.	REVISION

HOBART BROS. CO. | SIZE | DWG NO



LEGEND

B401,402	FAN, COOLING
CR402	RECTIFIER, OUTPUT
K404,405	RELAY, THERMAL OVERLOAD
K406	CONTACTOR, LOAD
R403,404,405	RESISTOR, OL, 30 OHM, 5 W
R412	SHUNT, AMMETER
T401,402,403	TRANSFORMER, CURRENT, OL
T404	TRANSFORMER, CURRENT, LINE DR
T405	TRANSFORMER, CURRENT, CURREN LIMITING
T406	TRANSFORMER

COLOR CODE			
BR	BROWN	RD	RED
BL	BLUE	TN	TAN
OR	ORANGE	VT	VIOLET (PURPLE)
GN	GREEN	WT	WHITE
GY	GRAY (SLATE)	YL	YELLOW
GR	GRAPHITE	G	DARK (PREFIX)
PK	PINK	L	LIGHT (PREFIX)

NOTE ALL WIRES 18F-HT UNLESS OTHERWISE SPECIFIED.

② R403 WAS 7.5 W
①RELOCATE 37 GN-YL

PROTECTIVE FINISH NONE

CHANGE RECORD

NO.	E.C. NO.	DATE	NO.	E.C. NO.	DATE
1	10194	4-11-84	13		
2	10494	4-24-84	14		
3			15		
4			16		
5			17		
6			18		
7			19		
8			20		
9			21		
10			22		
11			23		
12			24		

WHERE USED

NEXT ASSY	NO. REQ	USED ON
487750-1		

UNLESS OTHERWISE SPECIFIED

DIMENSIONS ARE IN INCH SINGLE LIMITS TO LEARNCES BELOW APPLY EXCEPT FOR VENDOR DESIGNED PARTS AND ITEMS PRODUCED TO RECOGNIZED STANDARDS DO NOT SCALE DRAWING

FRACTIONAL	DECIMAL - INCH	METRIC
±	.XX ± .01 .XXX ± .005	0.X ± 0.25 0.XX ± 0.13 0.XXX ± 0.13

ANGLES ± 30'

SURFACE TEXTURE

TITLE DIAGRAM, CONNECTION

DRAWN JRH 7-5-83

CHECKED JCG 7-5-83

ENGR APPR. DATE 10/28/83

MFG APPR. DATE

HOBART BROS. CO. TROY, OHIO 45373 U.S.A.

SIZE D

DRAWING NO. 46774

SHEET 1

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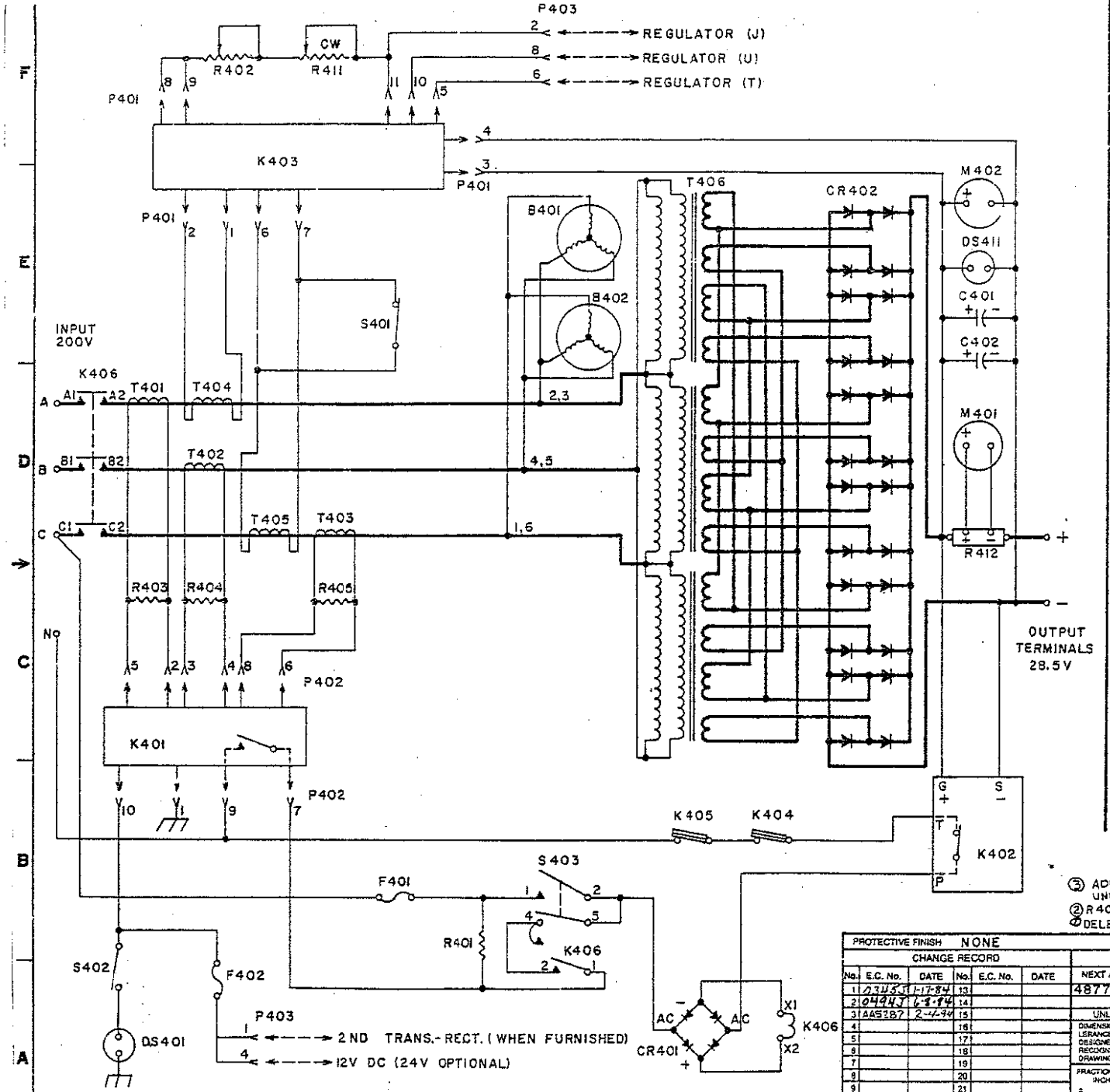

LEGEND

B401,402	FAN, COOLING
C401,402	CAPACITOR, 6.8 MFD, 35 WVDC
CR401	RECTIFIER, CONTACTOR
CR402	RECTIFIER, OUTPUT
DS401	LIGHT, ILLUMINATING
DS411	INDICATOR, CONT. CLOSE (GREEN)
F401,402	FUSE, 2A
K401	RELAY, OVERLOAD
K402	RELAY, OVERVOLATGE
K403	RELAY, LDC & CURRENT LIMIT
K404,405	RELAY, THERMAL OVERLOAD
K406	CONTACTOR, LOAD
M401	AMMETER
M402	VOLTMETER
P401	PLUG, LDC & CURRENT LIMIT
P402	PLUG, OVERLOAD
P403	PLUG, REGULATOR, AND 12V DC
R401	RESISTOR, HOLD CIRCUIT, 200Ω, 2
R402	RESISTOR, CURRENT LIMIT, 100Ω, X
R403,404,405	RESISTOR, OVERLOAD, 30Ω, 5 WAT
R411	RHEOSTAT, MANUAL, 150 W 75 OHM FOR 487750-1 75 OHM FOR 487750-2 100 OHM FOR 487750-3
R412	SHUNT, AMMETER
S401	SWITCH, CURRENT LIMIT
S402	SWITCH, ILLUMINATING LIGHT
S403	SWITCH, CONTACTOR
T401, 402, 403	TRANSFORMER, CURRENT, OL
T404	TRANSFORMER, CURRENT, LINE DRO
T405	TRANSFORMER, CURRENT, CUR. LIM
T406	TRANSFORMER

③ ADD DIFFERENT "OHM" RATING UNDER "R411" IN LEGEND.
② R403 WAS 7.5W
① DELETE JUMPERS FROM S401 & S402

PROTECTIVE FINISH NONE

CHANGE RECORD

No.	E.C. No.	DATE	No.	E.C. No.	DATE
1	03145	1-17-84	13		
2	04944	6-8-84	14		
3	AA5187	2-4-94	15		
4			16		
5			17		
6			18		
7			19		
8			20		
9			21		
10			22		
11			23		
12			24		

WHERE USED

NEXT ASSY.	NO. REQ.	USED ON
487750	1	

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES/MILLIMETERS. TOLERANCES BELOW APPLY EXCEPT FOR VENDOR DESIGNED PARTS AND ITEMS PRODUCED TO RECOGNIZED STANDARDS. DO NOT SCALE DRAWING.

FRACTIONAL ±	DECIMAL ± INCH	METRIC
INCH	.00 ± .01 .000 ± .003	0 ± 1.0 mm 0.0 ± 0.4 mm 0.00 ± 0.1 mm
ANGLES ± 30'	SURFACE TEXTURE	

ACTIVITY	REPLACED BY	REPLACES	QUANT.
MATERIAL NO.	MATERIAL SPEC.		

TITLE DIAGRAM, SCHEMATIC
INDEX DATA

DESIGNED	DRAWN	DATE	NO.
JRM	JLC	9-16-83	
CHECKED	DATE	APPROVED	BASE
			3894
RECORDS	MFG. ENGR.	M.F.	LT

HOBART BROS. CO. TROY, OHIO 45373 U.S.A.
SIZE C DWG. NO. 487748

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 :

1. Exposure to:

A. Combustible, explosive, abrasive or conducting dusts.

B. Environments where the accumulation of lint or excessive dirt will interfere with normal ventilation.

C. Chemical fumes, flammable or explosive gases.

D. Nuclear radiation.

E. Steam, salt-laden air, or oil vapor.

F. Damp or very dry locations, radiant heat, vermin infestation, or atmospheres conducive to fungus growth.

G. Abnormal shock, vibration or mechanical loading from external sources during equipment operation.

H. Abnormal axial or side thrust imposed on rotating equipment shafts.

I. Low and/or high ambient temperatures.

2. Operation at:

A. Voltages above or below rated voltage.

B. Speeds other than rated speed.

C. Frequency other than rated frequency.

D. Standstill with rotating equipment windings energized.

E. Unbalanced voltages.

F. Operation at loads greater than rated.

3. Operation where low acoustical noise levels are required.

4. Operation with:

A. Improper fuel, lubricants or coolant.

B. Parts or elements unauthorized by the manufacturer.

C. Unauthorized modifications.

5. Operation in poorly ventilated areas.

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Wet-Stacking in Generator Set Diesel Engines

All diesel engines operated for extended periods under light load may develop a condition commonly referred to as wet-stacking. This condition results from the accumulation of unburned fuel in the exhaust system. It is recognizable by fuel oil wetness around the exhaust manifold, pipes, and muffler. Liquid fuel, in the form of droplets, may be spewed from the exhaust outlet.

Wet-stacking is common, and may be expected in diesel engines operated under light load. Light loads do not allow the engine to reach most efficient operating temperature for complete combustion of fuel. The unburned fuel collects in the exhaust system to create the wet condition known as wet-stacking.

To alleviate wet-stacking in lightly loaded engines, it is recommended that the machine be connected to a load bank after each 200 hours of use and operated under full rated load for one hour. This will burn away and evaporate the accumulation of fuel in the exhaust system. This clean-out procedure should be considered as a regular maintenance operation for machines operated under light load. The time schedule of 200 hours may be changed as required to suit each user's particular needs and operating conditions.

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