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OPERATION AND MAINTENANCE MANUAL

with

ILLUSTRATED PARTS LIST

for

120-kVA Engine-Driven GENERATOR SET

Part Numbers

500033-1/500033-2/500033A-1

Model 120CM24
400-Hz, 115/200-V AC, 3-Phase
with
Cummins 6BTA5.9C200 Diesel Engine

HOBART BROTHERS COMPANY
Ground Power Division
Troy, Ohio 45373 U.S.A.

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Safety Warnings and Cautions

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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Introduction

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

The basic generator set covered by the manual is 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 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 Ground Power Division 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 (513) 3394219

Table of Contents

HOBART® GROUND POWER

SUBJECT CHAPTER/SECTION PAGE

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, U.S.A. The generator set, is rated at 120 KVA, and identified by Part Number 500033-1, 500033-2, or 500033A-1. 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 FRONT of the unit. The generator and controls are at the REAR. RIGHT and LEFT are determined by standing at the REAR end facing the machine. Thus, the FUEL TANK is mounted on the RIGHT side 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 *(4, 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 *(5, Fig. 3 and Fig. 11)* 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 *(27, Fig. 6),* located on the control panel, 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 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.

4. Canopy

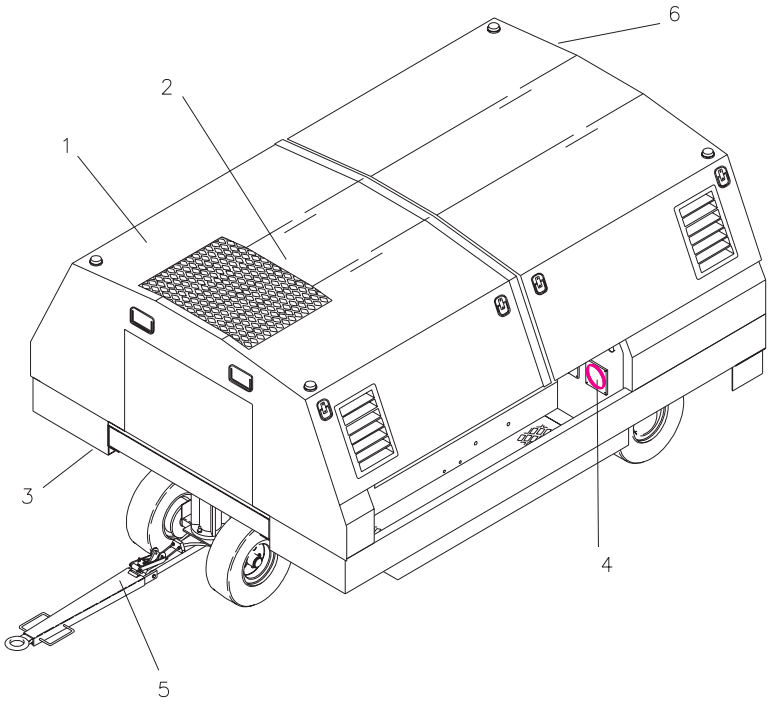
WARNING

The canopy lifting eyes should be used ONLY to LIFT THE CANOPY. DO NOT attempt to lift the entire generator set using the recessed lifting eyes, or to tie down the set for transportation using the lifting eyes.

The sheet metal enclosure, identified as a canopy, provides protection for the engine, generator and electrical controls. The canopy consists of two sections which slide horizontally for access to the engine, generator and electrical controls. Each section of the canopy includes:

- four recessed lifting eyes - two on each side,
- two recessed handles on the end,
- air ducts with louvered openings, and
- two clearance lights with necessary wiring.

The canopy is designed to reduce the operational noise level in the immediate area of the machine.



1. Canopy
2. Radiator access *(Inside Canopy)*
3. Exhaust out Front
4. Output cable clamps
5. Running gear
6. Transformer-Rectifier 28.5 V DC

Generator Set
Figure 1

Physical - Basic Unit	
Length	115.38 in. *(293.06 cm)*
Width	86.5 in. *(219.71 cm)*
Height	62.5 in. *(158.75 cm)*
Weight with running gear (and T-R)	7200 lbs. *(3265.3 kg)*
Generator	
Output power rating (kVA)	120
Output voltage	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	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	Trips at 100 volts after 7 seconds.
Overfrequency	Trips at any value between 420-Hz and 480-Hz after a 5-second time delay. Trips immediately at any frequency exceeding 480-Hz
Underfrequency	Trips at 380-Hz or less after a 7-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
Model No.	6BTA5.9C200
Type	In-line 6 cylinder diesei
Bore and stroke	4.02 x 4.72 inches
Displacement	359 cubic inches
Compression Ratio	16.5:1
Horsepower (kW)	200 HP *(268.1 kW)*
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)*	16.4 liters *(17.3 Quarts)*
Coolant capacity	32 quarts *(30.3 liters)*

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 200 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", provided with OM-2070 and referenced in Chapter 5-1.

(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 disposable, vacuum type connected between the fuel lift pump and injector pump.

(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) 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 governor control system, 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 starter motor

The engine starter is a heavy-duty 12-V DC industrial type located at the right rear of the engine.

(7) Engine alternator

The alternator is a heavy-duty 12-V DC industrial type located at the right front of the engine.

(8) 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, provided with OM-2070 and referenced in Chapter 5-1 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. The governor system consists of the following main components:

a. Magnetic pickup (See 2-3: 2, Fig. 4)

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.

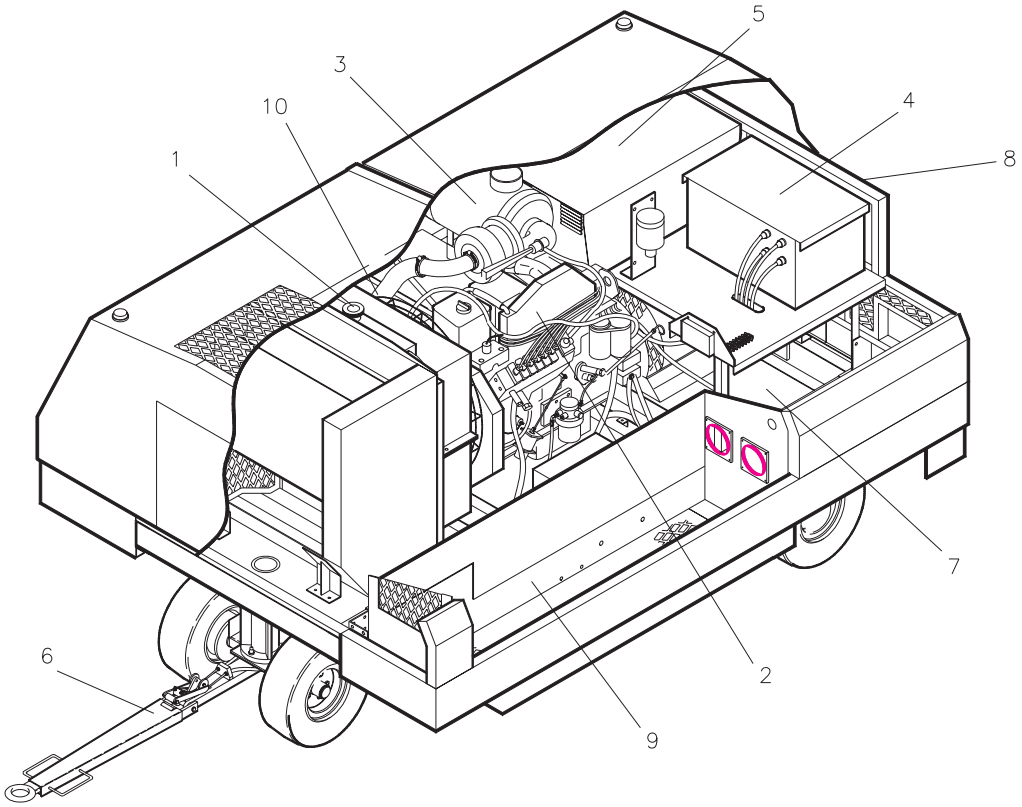
b. Control unit

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 12-V DC battery system. The controller is mounted on the control box support panel behind the control box A brief description is given below:

A detailed illustration of the controller is shown in Section 2-3 as Figure 5.

c. Actuator

The actuator *(2-3: 2, Fig. 3)* supplies the force needed to move and position the fuel lever as required to maintain a constant engine speed. The actuator is operated by a DC signal from the control unit.



1. Radiator
2. Engine
3. Air cleaner
4. Control box
5. Transformer-Rectifier 28.5-V DC
6. Running gear
7. 400-Hz output module panel
8. Engine-generator control panel
9. Mounting frame
10. Mufflers and exhaust

Generator Set Components
(Part No.'s 500033-1 & 500033-2 Shown)
Figure 3

(2) Engine safety devices

In addition to safety devices provided by the engine manufacturer, another engine shutdown feature is added by Hobart Brothers, the **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 governor control system, and is normally closed. The switch will open to stop the engine when internal coolant system temperature reaches 205 deg. F *(96 deg C)*.

(3) 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.

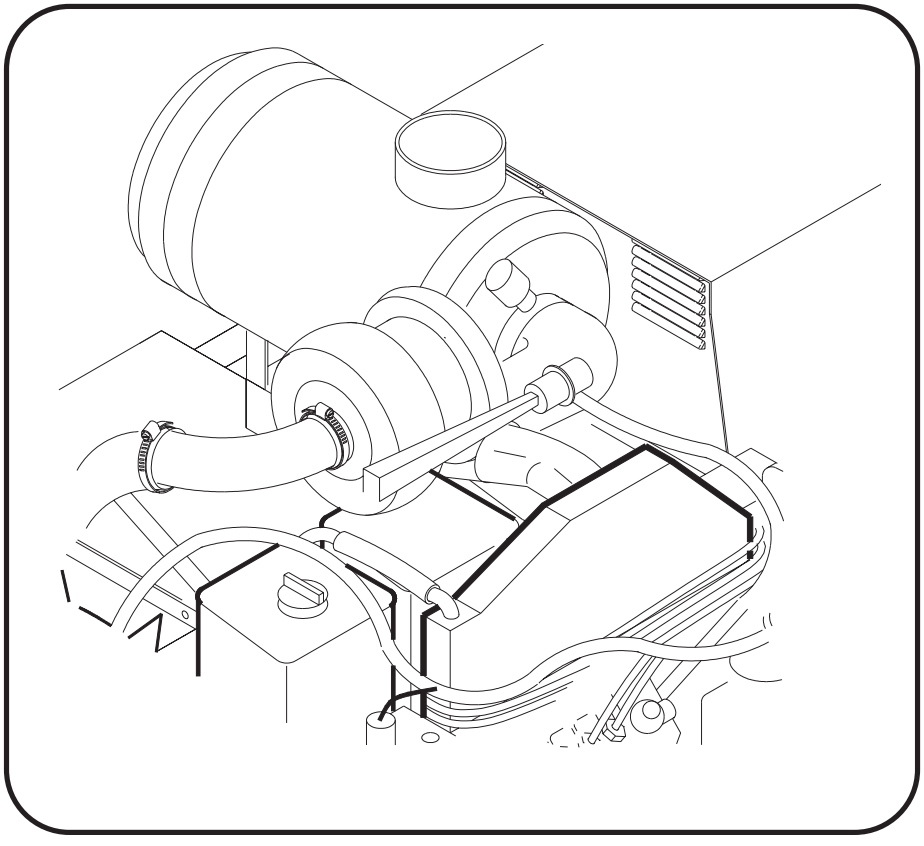
(4) Air cleaner

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 diaphragm 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 *(6, 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.

(5) Mufflers

The two mufflers, mounted in series, are a special design, combining the exhaust mufflers and tail pipes into a welded, one-piece, replaceable unit. Refer to Fig. 13, Chapter 4-3.



Air Cleaner and Service Indicator
Figure 4

(6) Radiator

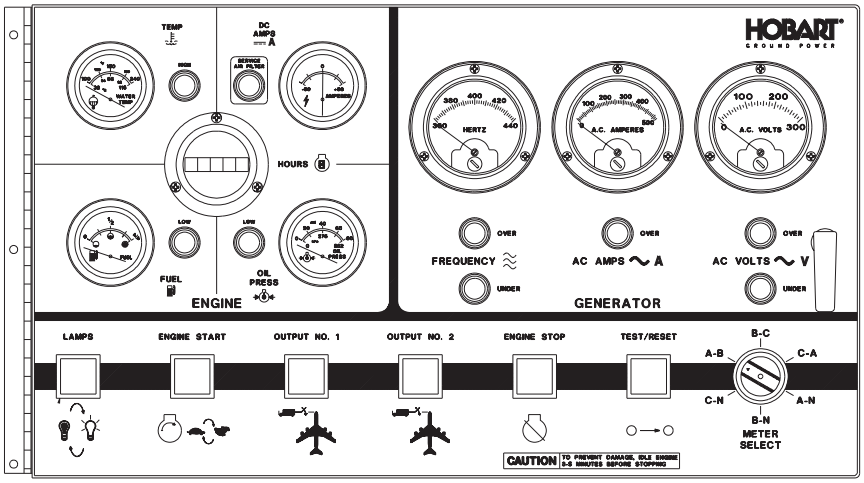
The radiator is a one-piece type designed for long periods of operation without servicing. Refer to Section 2-1 for servicing procedure.

(7) Pre-fuel filter

This device is located between the fuel tank and fuel pump. It's function is to filter the fuel before it reaches the fuel pump.

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 beyond 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.



Control Box
Figure 5

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.

(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 meters and indicating lights. On the right side of the control panel are generator meters and indicating lights. At the bottom of the control panel are switches for operating the engine and generator.

a. Panel lights and panel light switch

Meters are lighted from inside the control panel. They are controlled by a pushbutton switch *(28)* at the bottom left on the control panel.

b. Engine hourmeter

The hourmeter *(5)* 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 *(7)* 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

When the engine control switch *(26)* is pressed to start the engine, a green indicating light within the switch glows .

e. Engine coolant temperature gage

The temperature gage *(3)* 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 start switch

This pushbutton switch *(26),* when pressed, connects 12-V DC power to the starter solenoid coil which actuates the solenoid switch to connect power to the engine starting motor. 12-V DC power is supplied directly to the governor controller and the oil pressure safety shutdown switch is bypassed. This direct current is necessary for engine starting because the low oil pressure switch is OPEN until the engine is running normally.

When pressed a second time, this switch provides a 12-V DC signal to the speed adjust PC board on the governor controller, which causes the governor actuator to adjust the engine speed to 2400 RPM. At the same time, a ground signal is provided to the regulator, enabling the generator to build up voltage for 400-Hz generator output..

Pressing the switch once more removes these signals and the engine reverts to idle speed.

g. Engine stop switch

When the engine stop switch *(20)* is pressed once, the switch contacts are opened, and holding power is disconnected from the governor controller, allowing the governor actuator to close and shut off fuel to the engine, shutting off the engine.

h. Engine ammeter

The ammeter *(8)* 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 *(1)* 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 start switch *(26)* is pressed. The fuel level can be checked when the unit isn't running by pressing the lamps switch *(28).*

j. Protective system Indicating lights, test and reset switches

The function of this set of five lights *(14, 15, 17, 21 and 23),* 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 test/reset switch *(19)* is pushed. All lamps in indicating lights may be tested by pressing the test/reset switch. A lamps test should be performed only when both contactors are open.

k. Engine systems warning lights (red)

Four red indicator lights are illuminated to warn the operator of abnormal engine operations which must be corrected. These indicators are: The overtemperature indicator light *(4)*, air cleaner restriction indicator *(6)*, low oil pressure indicator light *(25)*, and low fuel indicator light *(27).* The function of the air cleaner indicator circuit is explained in detail in Para. 5, C, *(3).*

l. Generator output monitors *(meters)*

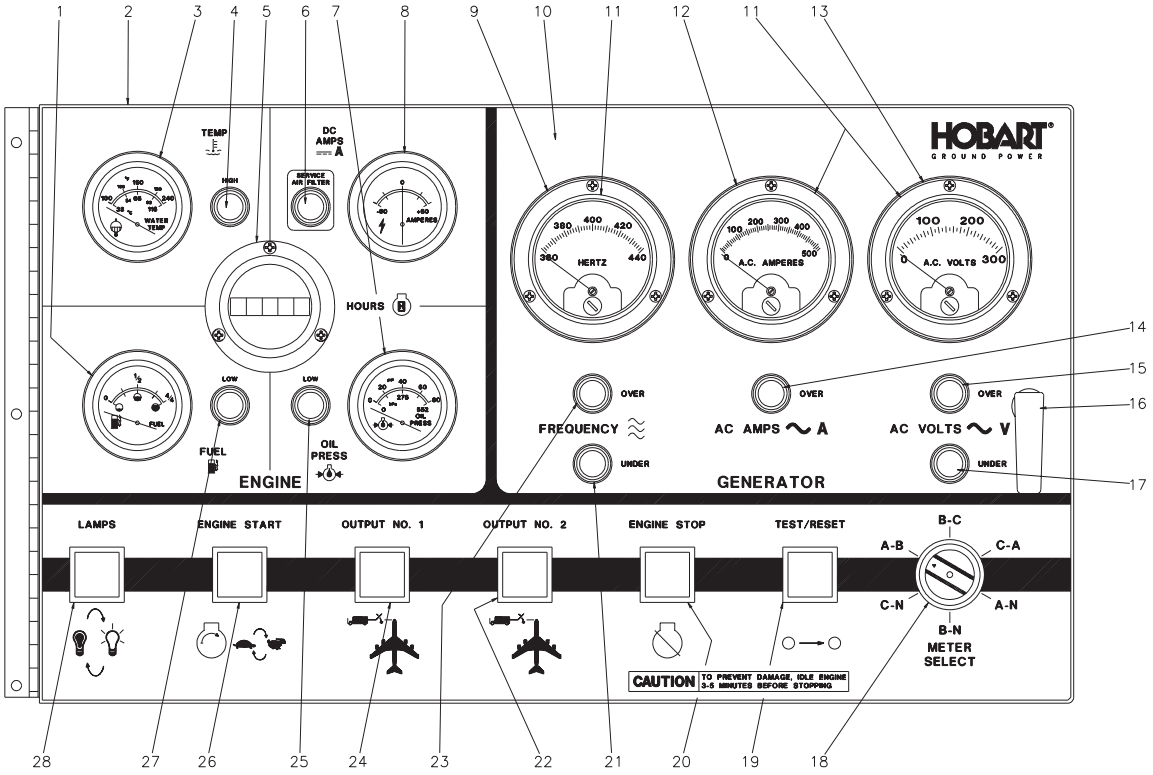
The generator output is monitored by three instruments; a frequency meter *(9)*, a voltmeter *(13)* , and an ammeter *(12).* The frequency meter is an analog type, and indicates the frequency of the generator output alternating current in the range of 360 to 440 Hz *(cycles per second)*. The voltmeter 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 *(18)*. 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 *(18).* Three ammeter current transformers, located on the output module *(Figure 10)* , 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.

m. 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 *(18)* 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.

n. Load contactor power accepted indicating lights

Indicating lights within the respective contactor control switches *(22) glows orange and (24)* glows yellow when the circuit is energized, indicating that power is being accepted by the aircraft. When the load contactor opens for any reason, the light is turned OFF.



1. Fuel gage
2. Front panel
3. Engine coolant temperature meter
4. Overtemperature indicator light *(red)*
5. Engine hour meter
6. Indicating light, air cleaner restriction *(red)*
7. Oil pressure gage
8. Engine ammeter
9. Frequency meter
10. Control box label
11. Strip lights (3)
12. Generator ammeter
13. Voltmeter
14. Overload indicator light *(red)*
15. Overvoltage indicator light *(red)*
16. Adjustable grip latch
17. Undervoltage indicator light *(red)*
18. Meter selector switch
19. Test-reset switch
20. Engine stop switch
21. Underfrequency indicator light *(red)*
22. No. 2 contactor switch *(orange)*
23. Overfrequency indicator light *(red)*
24. No. 1 contactor switch *(yellow)*
25. Low oil pressure indicator light *(red)*
26. Engine start switch *(green)*
27. Low fuel indicator light *(red)*
28. Panel light switch

Operating Controls and Instruments
Figure 6

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

a. Generator Set Control PC Board

The generator control PC board *(19, Fig. 7 and Figure 8)* is a central location for the various plug-in relays used for generator operation. Troubleshooting is thus easier for technicians working on the generator set. This PC board contains the following relays and associated circuitry.

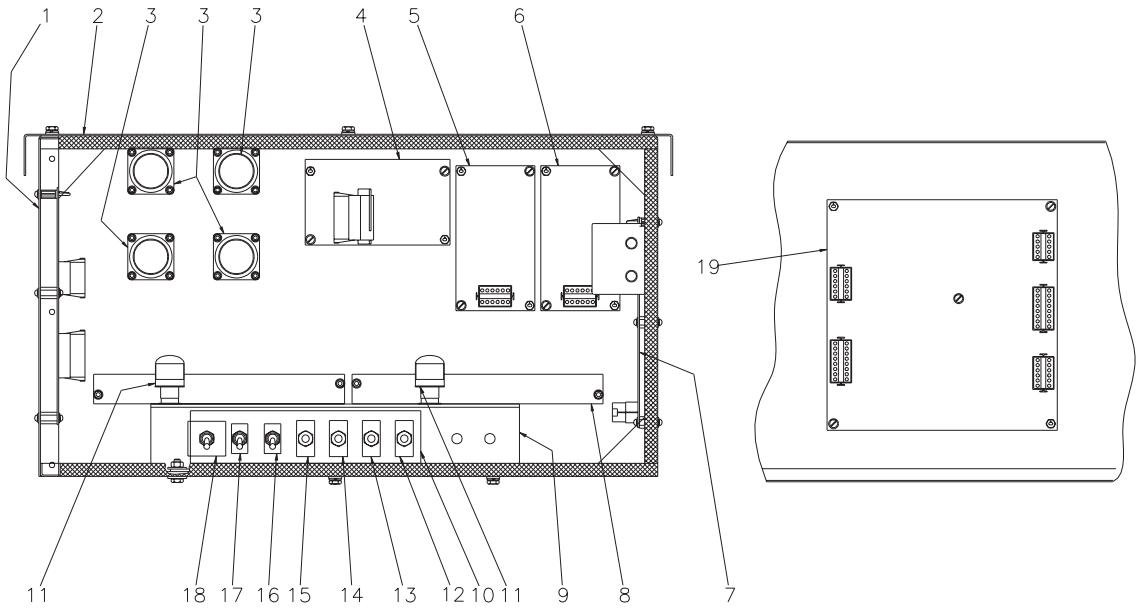
- **Master relay, K69 (1, Fig. 8),** routes 12-V DC power to all circuits, except panel and clearance lights. This relay is operated upon pressing the START switch *(26, Fig. 6)*, and remains in the OPERATE condition until it is RESET by the STOP switch *(20, Fig. 6).*
- **Bypass relay, K73 (9, Fig. 8),** is also activated by pressing the START switch. Relay K73 enables the start signal to the starter solenoid for 5 seconds after it is initially activated. K73 also disables the low oil pressure fault circuit during this 5 second period.
- **Idle-excitation relay, K68 (2, Fig. 8)**, controls engine speed and generator excitation**.** K68 activates to idle the engine and remove excitation from the gen

The circuit which controls K68 also drives a flasher circuit that controls the lamp within the START switch *(26).*

- **Relay K72 (12, Fig. 8)** controls the No. 1 contactor. When the engine is at rated speed, and voltage has built up, K72 changes from OPERATE to RESET, or vice-versa, with each closure of the No. 1 contactor switch. An auxiliary circuit will reset K72 when the No. 1 plug is removed from the aircraft. The No. 2 contactor control relay, K272 operates in the same manner.
- **Relay K70 (6, Fig. 8)**controls panel and clearance lights. This relay changes from OPERATE to RESET, or vice-versa, with each closure of the LAMPS switch*(28).* The fuel gage is also powered by K70 when the engine is at rest. K70 is reset, turning off all lights, when the engine STOP switch is pressed.
- **Relays K65, K66, K67 and K71 (10, 11, 3, and 4, Fig. 8)** are fault relays**.** Each receives a signal from engine sensors, and illuminate panel lights to indicate the presence of a fault. Activation of the overtemperature relay, K67, or low oil pressure relay, K71, result in interruption of 12-V DC power to the governor controller, causing the engine to shut down. Activation of low fuel relay K65 may result in the engine reverting to idle speed or shut-down, depending on the condition set by jumpers JP2 and JP3. The only result of an air filter fault, is that relay K66 causes illumination of the panel light. All engine fault relays remain activated until power is removed by pressing the STOP switch *(20).*
- **The plug-interlock relays on the control PC board *(K2 and K202),* (8 and 7, Fig. 8)** 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 circuit 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 circuit is made through terminals E and F on the output cable plug connector.

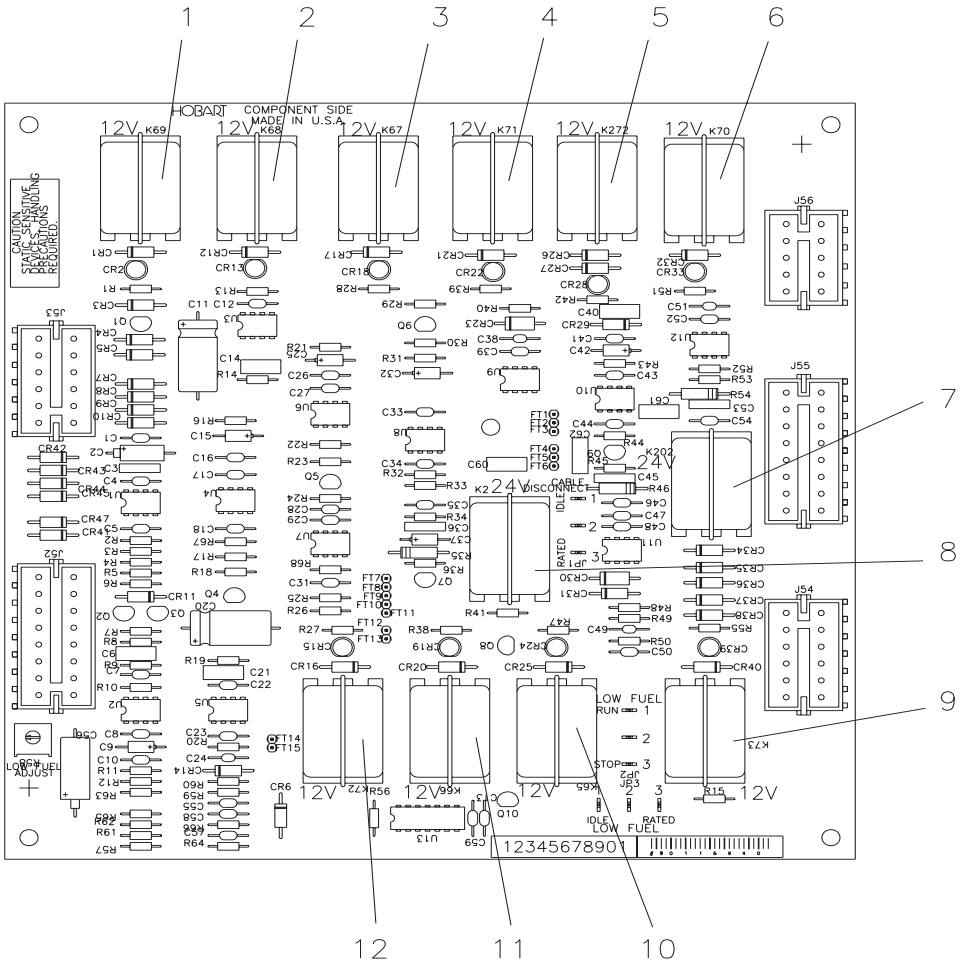
b. Test bank- aircraft switches

For each load contactor circuit, a single-pole, single-throw toggle switch *(16 or 17)* provides a means of bypassing the interlock circuit for that contactor when supplying power to a load bank or to an aircraft not equipped with a plug interlock system.



1. Control box wrapper
2. Top of control box
3. Receptacles *(4)*
4. Memory & time delay PC board
5. Over-underfrequency PC board
6. Over-undervoltage PC board
7. Voltage regulator PC board
8. Terminal blocks *(2)*
9. Switch mounting bracket
10. Label, switch mounting bracket
11. Panel lights *(2)*
12. Engine circuit breaker *(10A)*
13. Controls circuit breaker *(5A)*
14. Marker light circuit breaker *(10A)*
15. Contactors circuit breaker *(5A)*
16. Test bank / aircraft switch, No. 2 output
17. Test bank / aircraft switch, No. 1 output
18. Regulated / diagnostic switch
19. Generator set control PC board

Control Box Interior Components
Figure 7



1. Master relay (K69)
2. Idle-excitation relay (K68)
3. Overtemperature fault relay (K67)
4. Low oil pressure fault relay (K71)
5. No. 2 contactor control relay (K272)
6. Panel and clearance lights relay (K70)
7. No. 2 plug-interlock relay (K202)
8. No. 1 plug-interlock relay relay (K2)
9. Bypass relay (K73)
10. Low fuel fault relay (K65)
11. Air filter fault relay (K66)
12. No. 1 contactor control relay (K72)

Generator Control PC Board
Figure 8

c. Regulated-diagnostic switch

When the regulated-diagnostic switch *(18)* is in the REGULATED *(up)* position, generator output voltage is regulated by the solid state voltage regulator *(7, Fig. 7, and Fig. 9)* 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. When this switch is in the MAINTENANCE *(center)* position, no current is supplied to the generator exciter. However, a low-level, unregulated voltage of approximately 30-V AC will be produced at the generator output terminals due to the residual magnetism of the exciter.

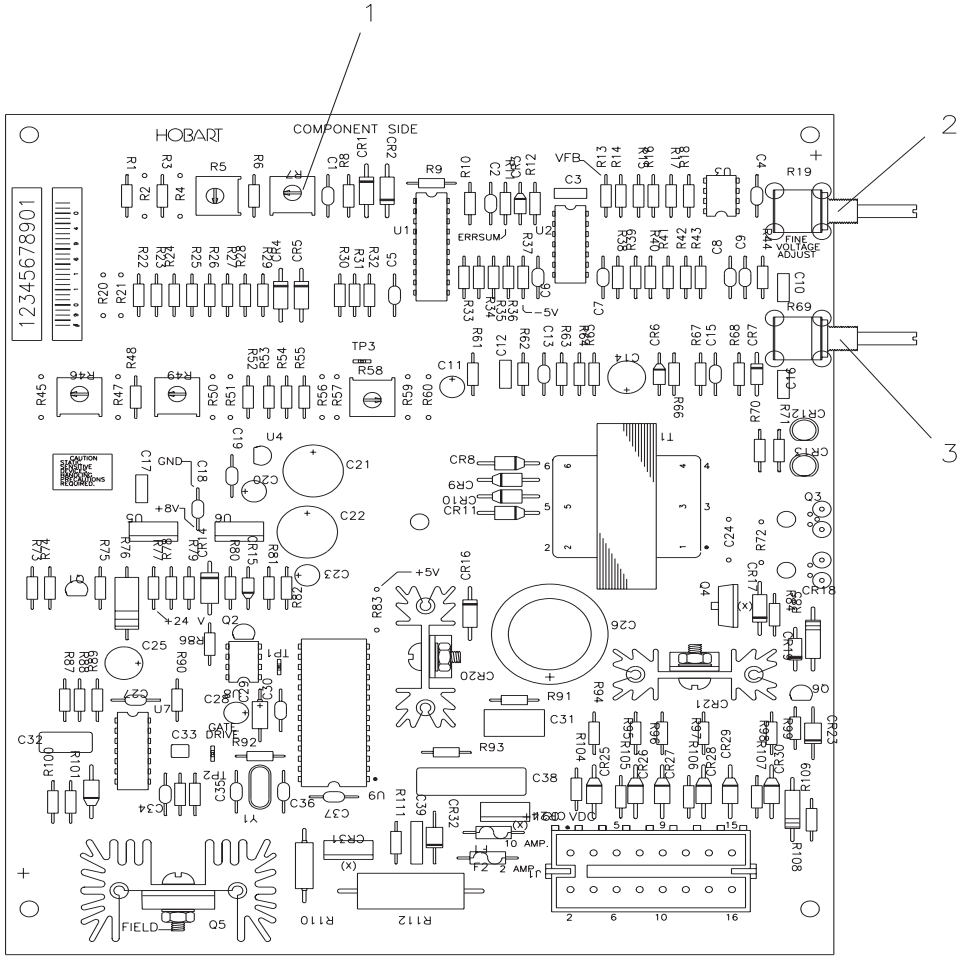
d. Voltage regulator PC board

This voltage regulator *(7, Fig. 7, and Fig. 9)* 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 in regulated mode, and the engine is brought up to rated speed, 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.

e. Circuit breakers

A 10-ampere circuit breaker *(12, Fig. 7)* protects the 12-V DC engine governor and fault circuits, and another 10-ampere circuit breaker *(14)* protects the 12-V DC lighting system. A 5-ampere circuit breaker *(13)* protects the 12-V DC control system, and another 5-ampere circuit breaker *(15)* protects the circuits of the load contactors.



1. Output voltage adjustment *(coarse)*
2. Output voltage adjustment *(fine)*
3. Line drop compensation adjustment

Voltage Regulator PC Board
Figure 9

f. Memory-time delay module

The memory and time delay module *(4)* is sometimes called the protective monitor module. It is a solid-state device with a hermetically-sealed, reed-type circuit. 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 *(5 and 6, Fig. 7, and 17-19, Fig. 10)*. All memory circuits are connected to the module circuit coil, and any one of the circuits can energize the coil to open the circuit contacts. Thus, when a sensing device energizes any one of the module circuits, the module circuit is also energized to break the load contactor holding circuit and allow the load contactor to open. 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 *(14, 15, 17, 21 or 23, FIg. 6),* which is turned on when a fault occurs. The module circuit will remain energized *(OPEN)* and the light will remain ON until the reset switch *(19, Fig. 6)* is pushed to break the module 12-V circuit, and allow the circuit to return to normal, CLOSED position.

g. Sensing modules

The voltage sensing module *(6)* and frequency sensing module *(5)* are connected to generator output leads between the generator and load contactor. These solid-state modules sense any abnormal condition of voltage or frequency and signal the solid-state circuitry of the memory and time delay module *(4)* to open the load contactor and disconnect output to the aircraft. Trip values are adjustable; however, adjustments should be made ONLY under laboratory conditions.

On the 400-Hz output module, two solid-state overload signaling devices *(17 and 18, Fig. 10),* one for each of the two outputs, and a main overload sensing module *(19, Fig. 10),* 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 420-Hz and 480-Hz after a 5-second time delay. Trips immediately at any frequency exceeding 480-Hz.
Underfrequency relay	Trips at 380 Hz or less after a 7-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.

h. 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.**

7. 400-Hz Output Module Panel Assembly

The 400-Hz output module panel assembly *(Fig. 10)*, sometimes referred to as the contactor panel, is located at the left rear of the machine under the control box. It is accessible either by sliding back the rear canopy section or through two rear access panels. 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).*

a. Load contactors

The load contactors *(5 and 8, Fig. 10)* 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 circuits 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 *(2, 11, 14 and 15).*

b. Current transformers

(1) Line-drop current transformers

The three line-drop current transformers *(14, Fig. 10)*, in conjunction with burden resistors *(13)*, 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.

(2) Main generator ammeter and overload current transformers

A set of three main current transformers, *(15, Fig. 10),* in conjunction with a set of burden resistors *(16),* 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 (*4, Fig. 7)*, which interrupts the load contactor circuit to open both load contactors.

(3) Overload current transformers, No 1 and No. 2 output

On each individual output, a set of three current transformers, *(2 or 11, Fig. 10)*, in conjunction with a set of burden resistors *(10 or 12)*, convert a current signal to a voltage signal which is sent to the overload sensing board *(17 or 18)* 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.

c. Overload Modules

(1) 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 overload module *(19)* interprets a signal from the main generator overload current transformers *(15)* and sends a signal to the memory and time delay PC board *(4, Fig. 7)*.

To do this, the overload module is equipped with a hermetically-sealed, reed-type circuit. circuit contacts are normally open. The solid-state circuitry is designed to close circuit contacts when output current reaches 125% of normal rated output capacity. The closed circuit sends a signal to the protective monitor. This signal gates the overload SCR *(silicon-controlled rectifier)* in the protective monitor and opens both contactors *(5 and 8)* .

(2) 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 *(17 or 18)* interprets a signal from the No. 1 or No. 2 overload current transformers *(2 or 11)* and sends a signal to the protective monitor module (*4, Fig. 7)* . The protective monitor module then functions both contactors.

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.

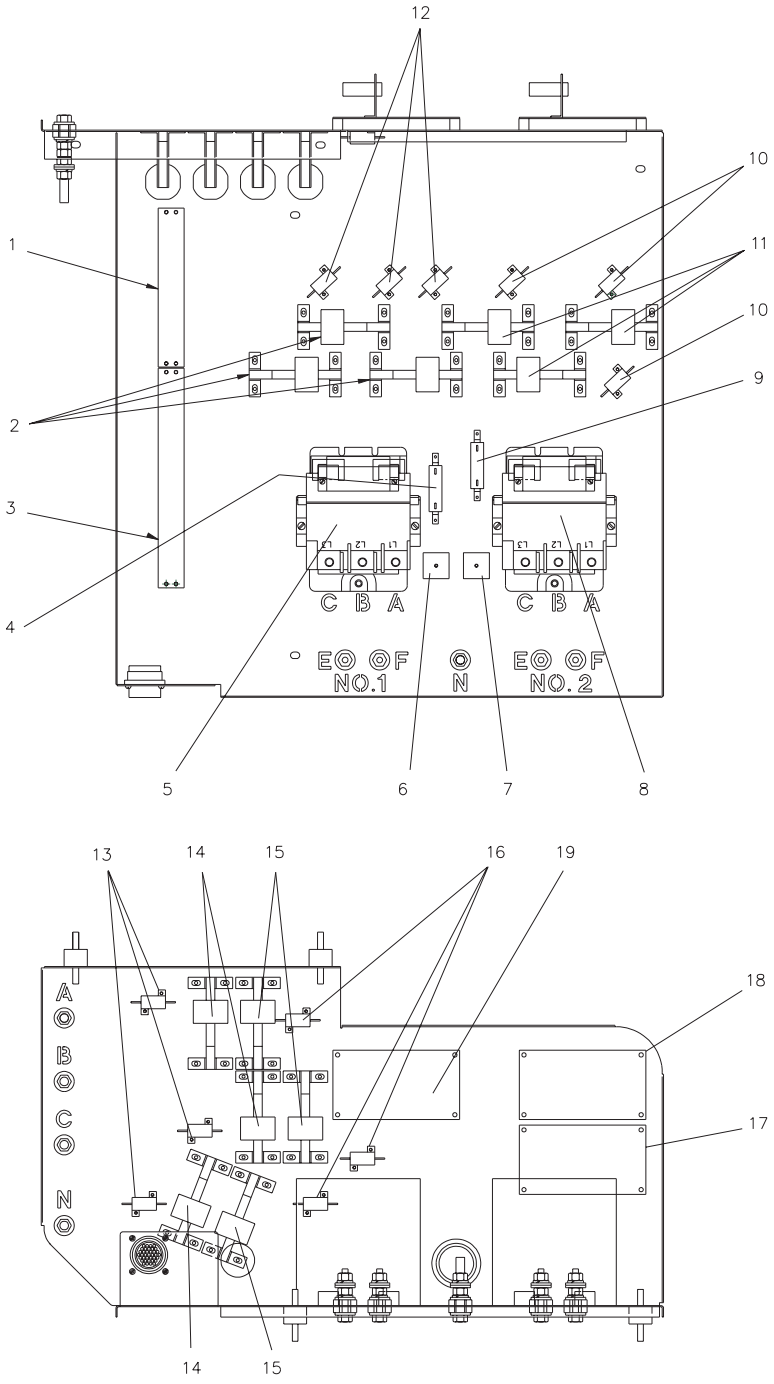
NOTE: The overload protective system will function when any phase carries 123% to 127% of rated load. All times are plus or minus 25% and are nonadjustable.

d. Rectifier

For each output, a diode-bridge rectifier *(6 or 7)* 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 circuit contacts in the protective monitor module to ground cable N. Therefore, any time a protective device functions to open the protective monitor circuit, the rectifier's AC circuit is opened. No DC is then available for the load contactor holding coil, hence, the load contactor opens.

e. Resistors, 100-ohm, 25-watt

For each load contactor circuit, a 100 ohm, 25 watt resistor *(4 or 9)* is connected in series with the plug interlock circuit contacts and the protective system circuit 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. Terminal block, 14-position

2. Generator overload current transformers, No. 1 output *(3)*

3. Terminal block, 20-position

4. Holding circuit resistor, No. 1 output, 100-ohm, 25-watt

5. Load contactor, No. 1 output

6. Rectifier, load contactor, No. 1 output

7. Rectifier, load contactor, No. 2 output

8. Load contactor, No. 2 output

9. Holding circuit resistor, No. 2 output, 100-ohm, 25-watt

10. Overload resistors, No. 2 output, 16.6-ohm, 20-watt *(3)*

11. Generator overload current transformers, No. 2 output *(3)*

12. Overload resistors, No. 1 output, 16.6-ohm, 20-watt *(3)*

13. Line-drop resistors, 50-ohm, 20-watt *(3)*

14. Line-drop current transformers *(3)*

15. Main generator overload current transformers *(3)*

16. Main generator overload re- sistors, 12.5-ohm, 20-watt *(3)*

17. Generator overload PC board, No. 1 output

18. Generator overload PC board, No. 2 output

19. Main generator overload PC board

400-Hz Output Module
Figure 10

8. Description of Some Special Features of the Generator Set

a. Transformer-Rectifier

(1) General

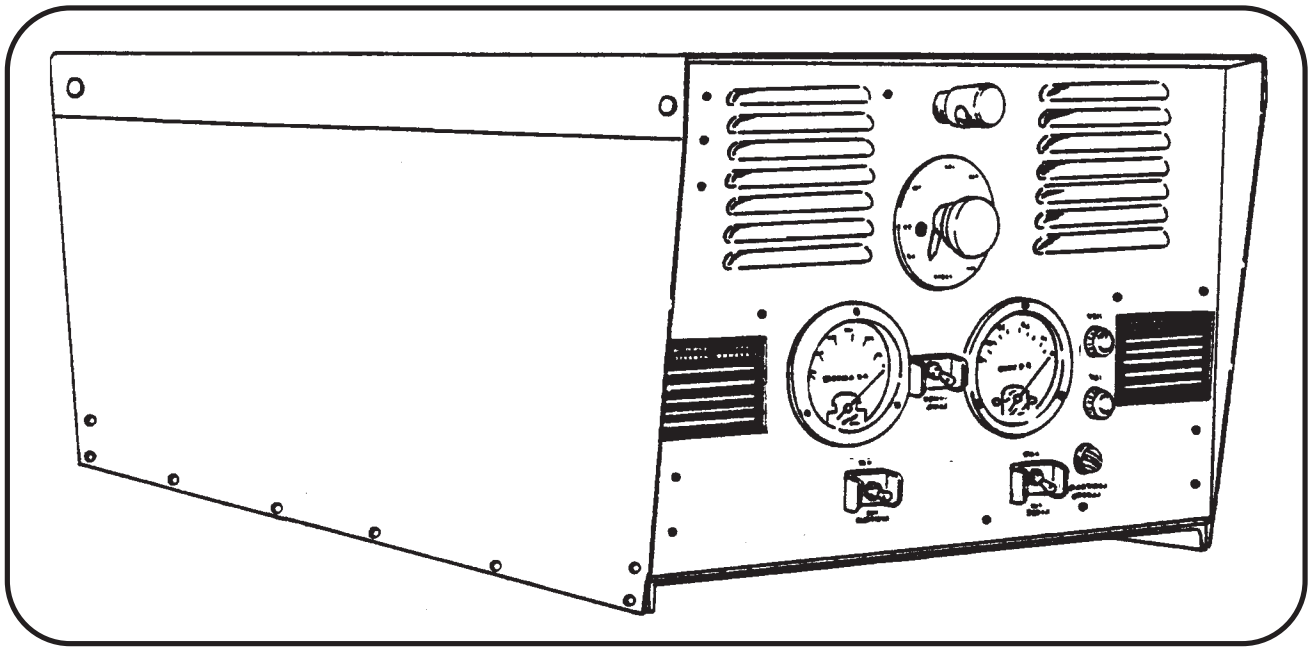
The Transformer-Rectifier, hereafter referred to as a T-R, is a compact, enclosed, power-supply unit employing a transformer and semiconductor diode components to convert 200-Volt, 400-Hz input to 28.5-Volt DC output power *(see Figure 11).* It has many uses including aircraft servicing, which may require 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.



Transformer-Rectifier (28.5 V DC)
Figure 11

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 800 Amperes. Refer to Figure 2 for specifications and capabilities.

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.

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	800 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

T-R Specifications and Capabilities
Figure 12

a. Control Panel Assembly

Refer to Figure 13. 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.

b. Electrical Components

Electrical components of the T-R, other than the control panel which was described above, are illustrated in Figures 14 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. 14)* 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. 13),* 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. 13)* in spring-loaded **ON** *(up)* position momentarily. In this position the switch connects 115-Volt AC power directly to the rectifier *(17, Fig. 13),* 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. 13)* is released, it automatically returns to center ON position and 115-Volt current is maintained to the rectifier, indirectly, through a resistor *(15, Fig. 13)* and the auxiliary contacts in the load contactor. This circuit is arranged in such a manner that in case an overloaded condition develops, the 115-Volt input to the rectifier is lead directly to ground through a circuit in the overload module. The load contactor is thus opened because the holding circuit has actually been short circuited. The resistor *(15, Fig. 13)* 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. 14)* 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 determined 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. 14)* 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. 14)* 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. 14)* mounted on the front end of the heat sink, performs a function similar to an overload circuit. 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 hexagonal bars *(4, Fig. 16)*, threaded at each end, serve as bus bars to conduct current from the positive *(right)* heat sink *(13, Fig. 16),* 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.

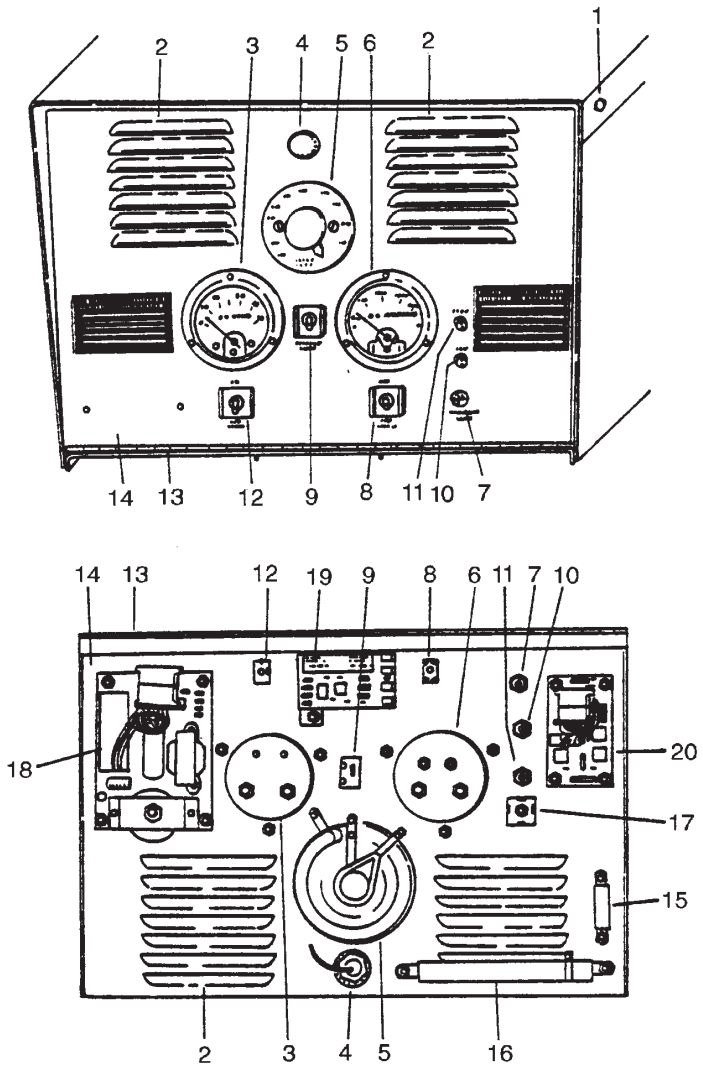
Two hexagonal bars *(3, Fig. 16)* similar to the positive bars, but shorter, are attached to the negative (left) heat sink *(2, Fig. 16)* in the same manner as the positive bars. They conduct current to the negative output terminal. Each diode is attached to the heat sink by an assembled washer nut.

(dd) Overload module

The overload module *(20, Fig. 13)* contains solid state circuitry which interprets signals from three current transformers *(11, Fig. 14)* and functions to close a circuit when an overload condition is detected in the T-R main circuit. The normally open circuit contacts are connected to the load contactor 115-Volt AC holding circuit so that when circuit 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. circuit 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 circuit: 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).*

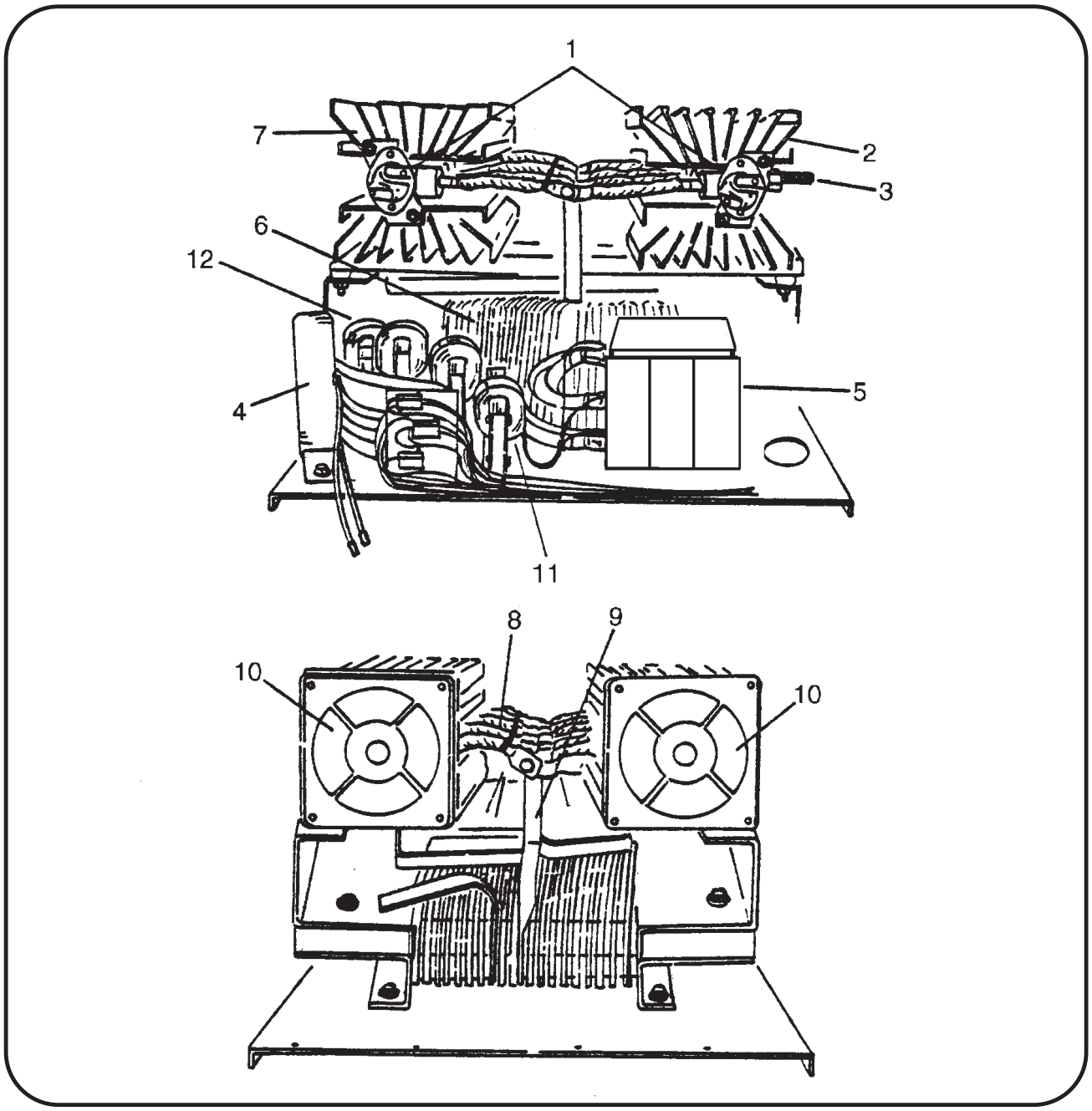
(ee) Overvoltage module

The overvoltage module *(19, Fig. 13)* is another protective device with solid state circuitry which causes a normally **CLOSED** circuit to **OPEN** under a condition of overvoltage in the T-R output circuit. The circuit is connected in the ground circuit of the 115-Volt AC load contactor holding circuit. When an overvoltage condition causes the circuit to **OPEN**, the load contactor holding circuit is broken and the contactor opens automatically to shut off the T-R.



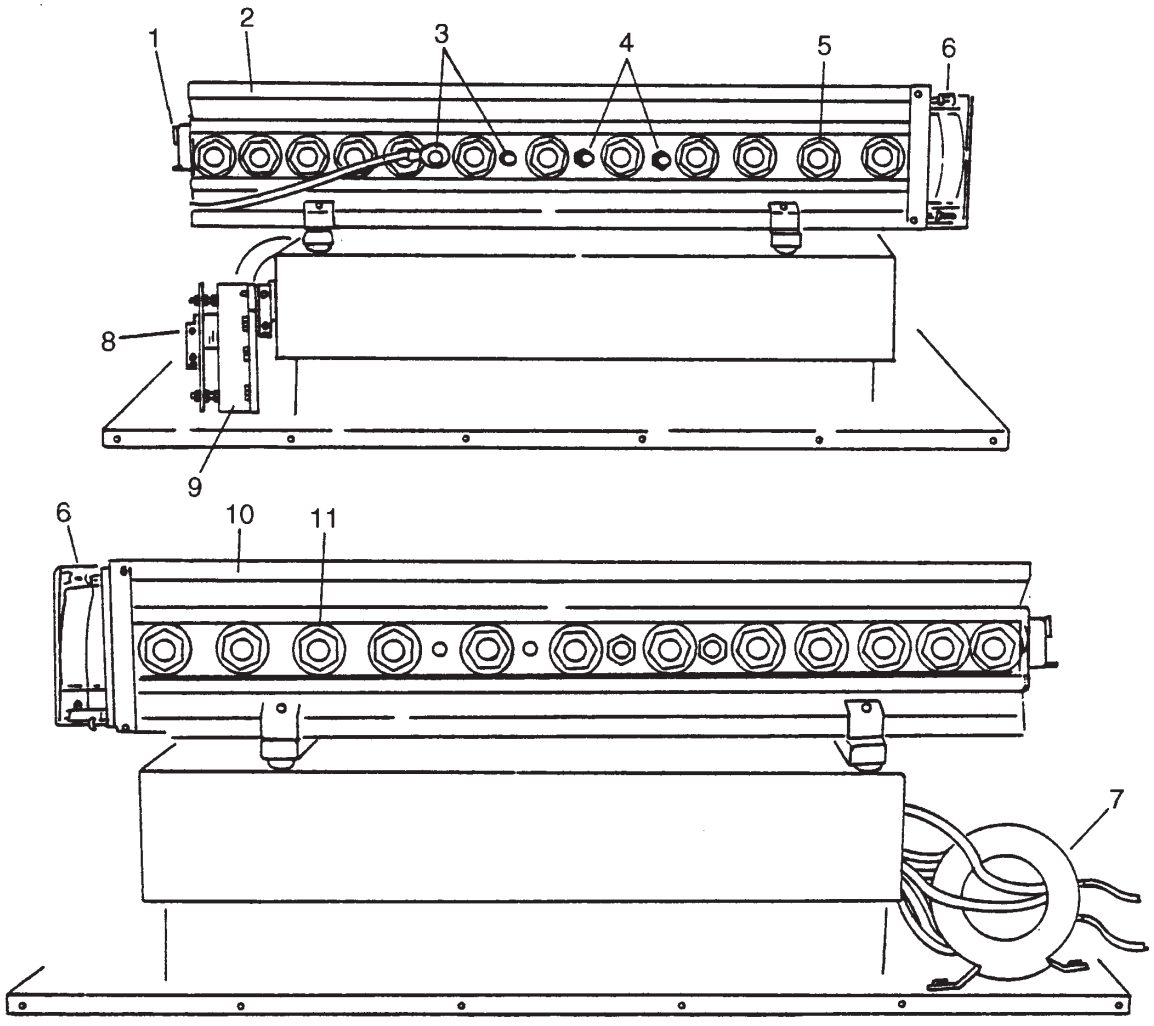
1. Screw
2. Air inlet louver
3. DC voltmeter
4. Instrument light
5. Current limiting rheostat
6. DC ammeter
7. Contactor CLOSED indicating light
8. Contactor control switch
9. Current limiting control switch
10. Fuse *(2A) (DC circuit)*
11. Fuse *(2A) (115-V AC circuit)*
12. Light switch
13. Hinge
14. 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

T-R Control Panel Assembly
Figure 13



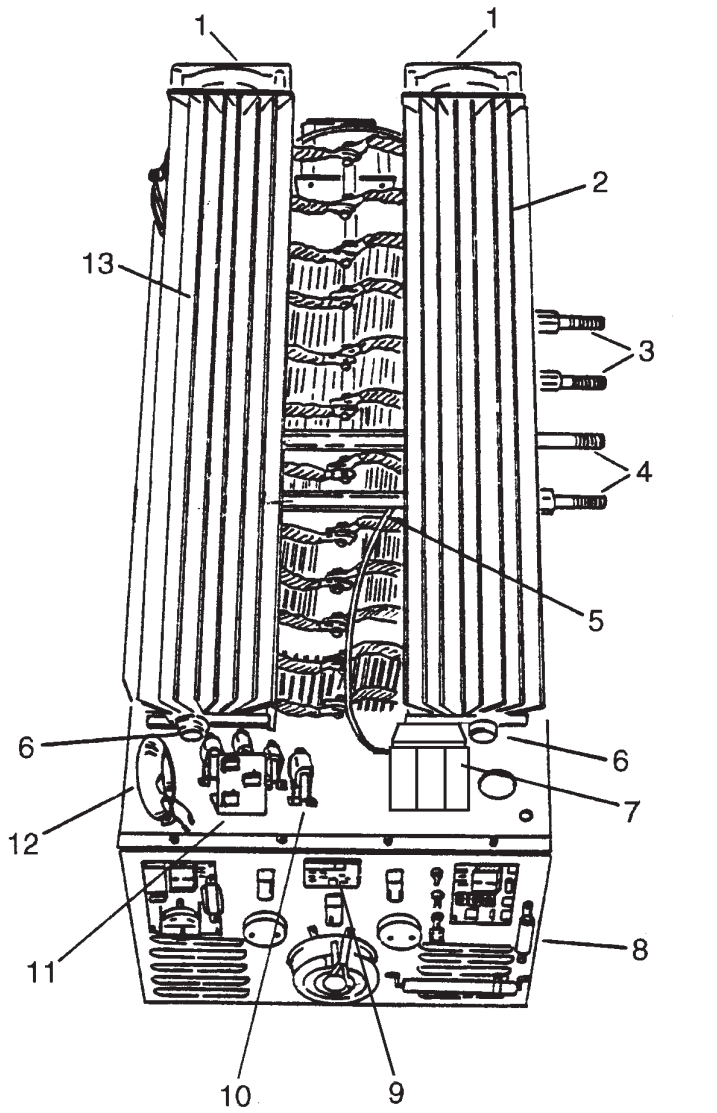
1. Thermal overload circuit
2. Negative heat sink
3. Output terminals
4. Transformer current limiting
5. Load contactor
6. Transformer
7. Positive heat sink
8. Diode leads
9. Bus bars
10. Fan
11. Overload current transformer *(3)*
12. Line drop CT

T-R Components (Front and Rear Views)
Figure 14



1. Thermal overload circuit
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 15



1. Fan
2. Negative heat sink
3. Negative output bus bars *(2)*
4. Positive output bus bars *(2)*
5. Ammeter shunt
6. Thermal overload circuit
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 16

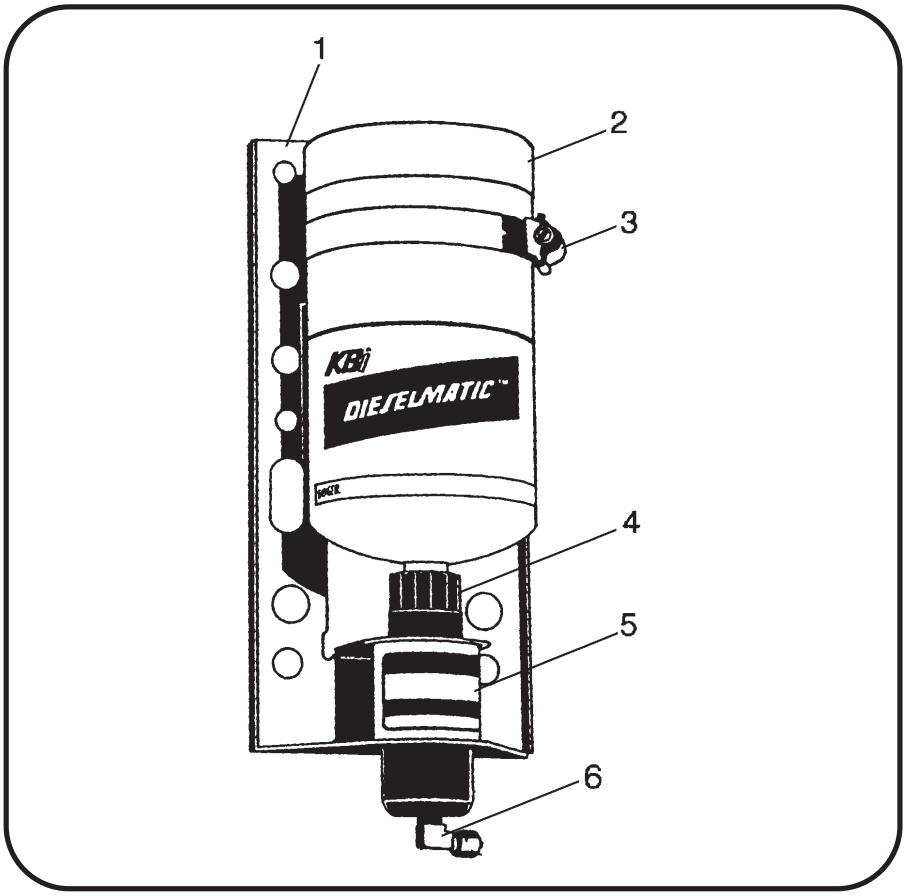
(ff) Base

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.

b. Cold Weather Starting Kit

This cold weather starting-aid kit *(Figure 17)* is used 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 assembly

Cold Weather Starting Aid
Figure 17

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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). For the engine in 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, add Luke oil at the ratio of 2 qts. oil to 10 gals. Jet A-1 fuel.

NOTE: For recommended fuel specifications refer to the Deutz 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

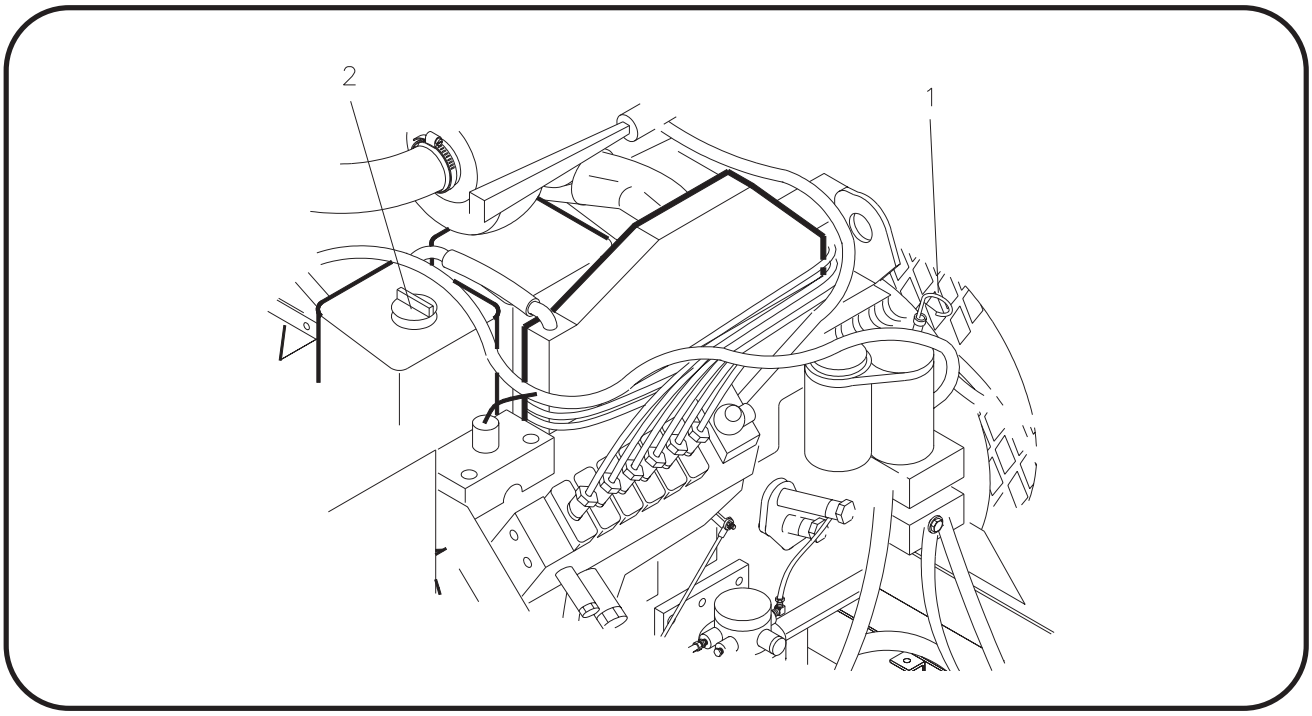
The oil gage rod (1, Fig 1) has H (high) and L (low) level marks to indicate lubricating oil supply. Oil level should be kept as near the H mark as possible.

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 Deutz Operation and Maintenance Manual in Chapter 5 for oil recommendations.

d. Check 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.

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.

(6) Open all circuit breakers

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 Deutz 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.

(7) Disconnect Battery

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. Refer to your company's safety procedures.

2. Operating the Unit

a. Pre-start inspection

(1) Be sure the fuel shutoff valve 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.

(5) Check that all circuit breakers are reset.

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.

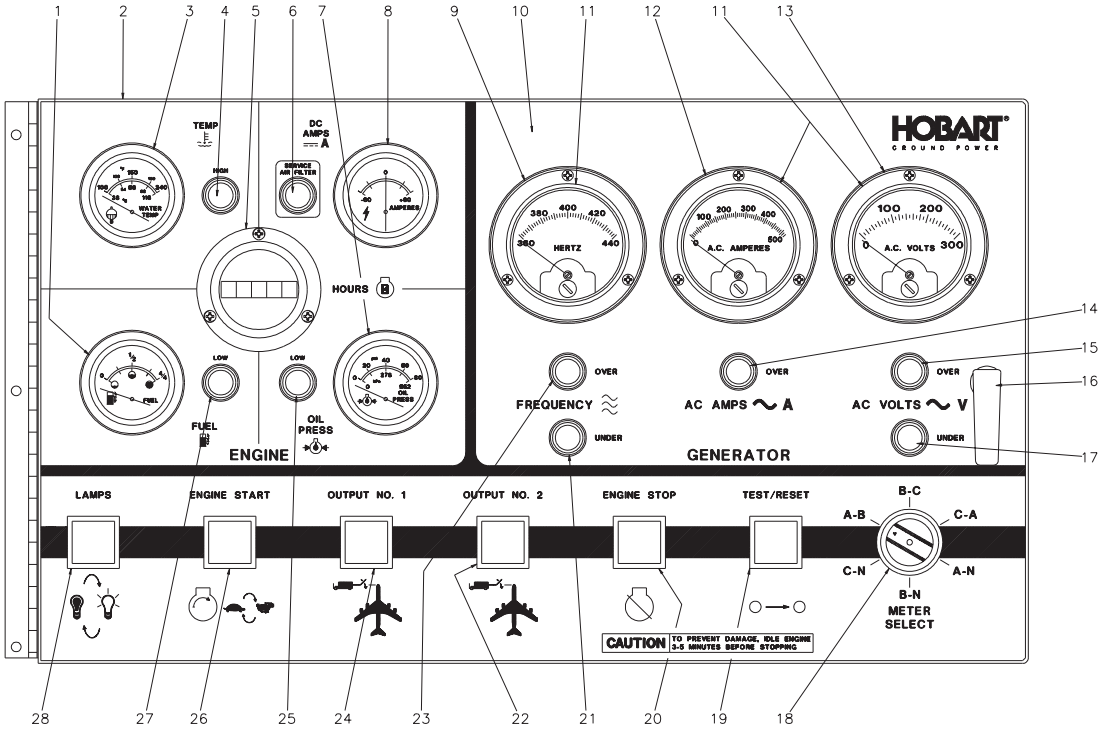
NOTE: The Cummins Engine Manual is referenced in Chapter 5 and provided with this Hobart manual *(OM-2070)*.

(1) If illumination is required, press lamps switch *(28)* one time. Pressing this switch also activates the fuel gage. *(1, Fig. 6).*

(2) Press engine start switch (26) and hold until engine starts. The engine should start at IDLE speed, and the green light in the engine start switch should flash to indicate that power is available to the engine protective circuit and electric governor.

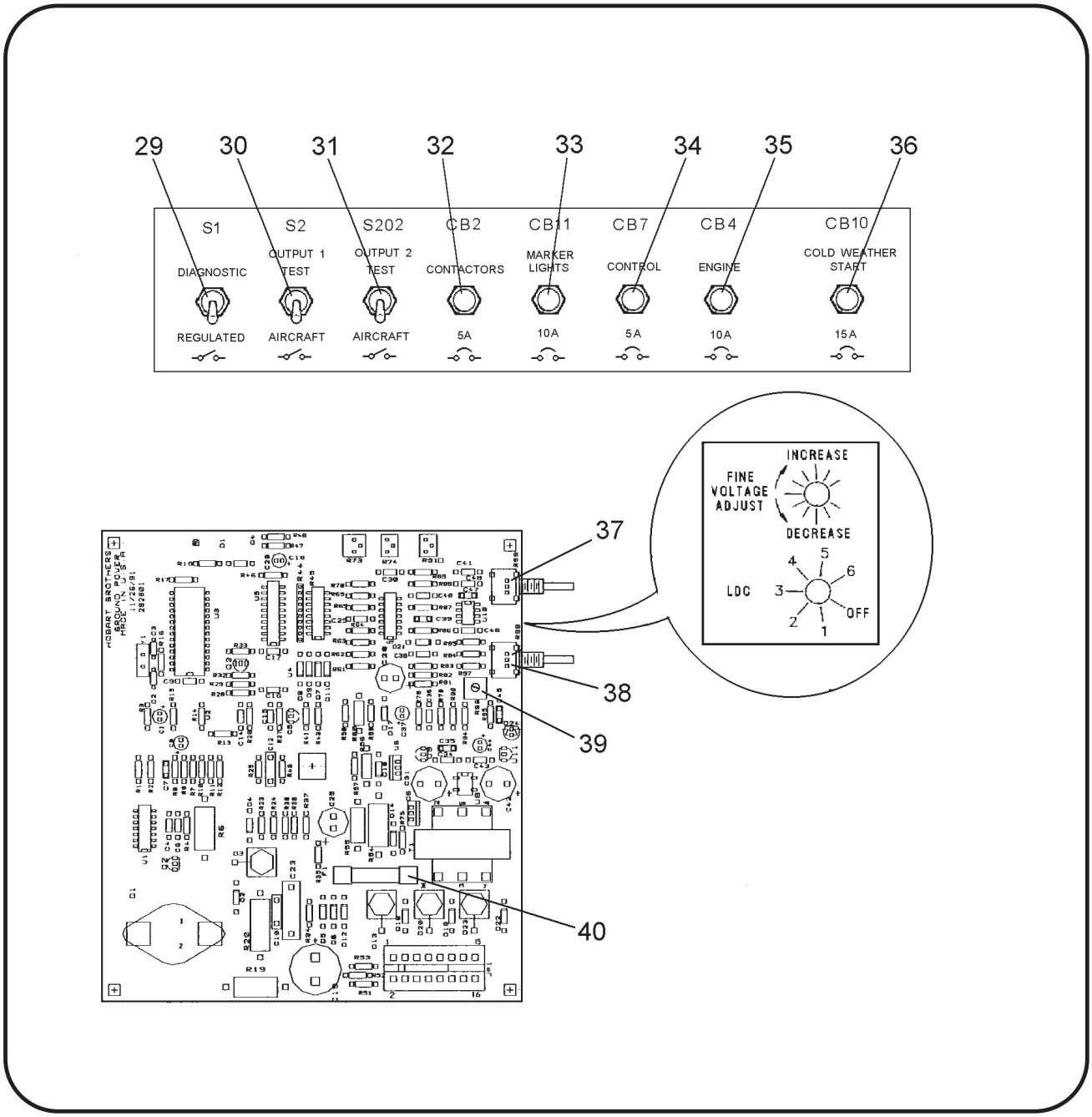
CAUTION

Do not attempt to bring engine to rated speed for **at least 5 seconds** after engine starts. Damage to the starter and flywheel will result.



1. Fuel gage
2. Front panel
3. Engine coolant temperature meter
4. Overtemperature indicator light (red)
5. Engine hour meter
6. Indicating light, air cleaner restriction (red)
7. Oil pressure gage
8. Engine ammeter
9. Frequency meter
10. Control box label
11. Strip lights (3)
12. Generator ammeter
13. Voltmeter
14. Overload indicator light (red)
15. Overvoltage indicator light (red)
16. Adjustable grip latch
17. Undervoltage indicator light (red)
18. Meter selector switch
19. Test-reset switch
20. Engine stop switch
21. Underfrequency indicator light (red)
22. No. 2 contactor switch
23. Overfrequency indicator light (red)
24. No. 1 contactor switch
25. Low oil pressure indicator light (red)
26. Engine start switch
27. Low fuel indicator light (red)
28. Panel light switch

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



29. Regulated-diagnostic switch
30. Test bank-aircraft switch, No. 1 output
31. Test bank-aircraft switch, No. 2 output
32. Circuit breaker, contactors *(5-amp)*
33. Circuit breaker, marker lights *(10-amp)*
34. Circuit breaker, control *(5-amp)*
35. Engine circuit breaker *(10-amp)*
36. Output voltage adjustment *(fine)*
37. Line drop compensation adjustment
38. Output voltage adjustment *(coarse)*

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

CAUTION

If the engine fails to start within 5 seconds, the control system will automatically disable the starting motor and indicate a low oil pressure fault. The engine stop switch *(20)* must be pressed to reset the control system and allow another starting attempt. 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, allow the starting motor to come to a complete stop before attempting to engage the starter again, then press the start switch.

(3) Check oil pressure to make certain that it is normal, and observe all other engine instruments for normal operation.

(4) Allow engine to idle and warm before bringing it up to rated speed.

CAUTION

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

(5) Press engine start switch *(26)* a second time to bring the engine to rated speed *(2400 RPM)*. The green indicating light in the engine start switch should glow continuously.

c. Cold Weather Engine Starting

To assist in starting the engine at temperatures below 50^{o} F *(10^{o}C)*, the generator set is equipped with a fully automatic engine starting fluid system *(Fig. 2)* designed to spray a controlled amount of starting fluid into the air intake system of the engine during and immediately after cranking. The starting aid is shipped in a safe condition and is not operable until assembled. To prepare the starting aid for use, proceed as follows.

(1) Position switches and controls as instructed in steps *(1)* through *(3)*, paragraph B, Normal Engine Starting Procedures, above.

(2) Prepare starting aid for use. 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

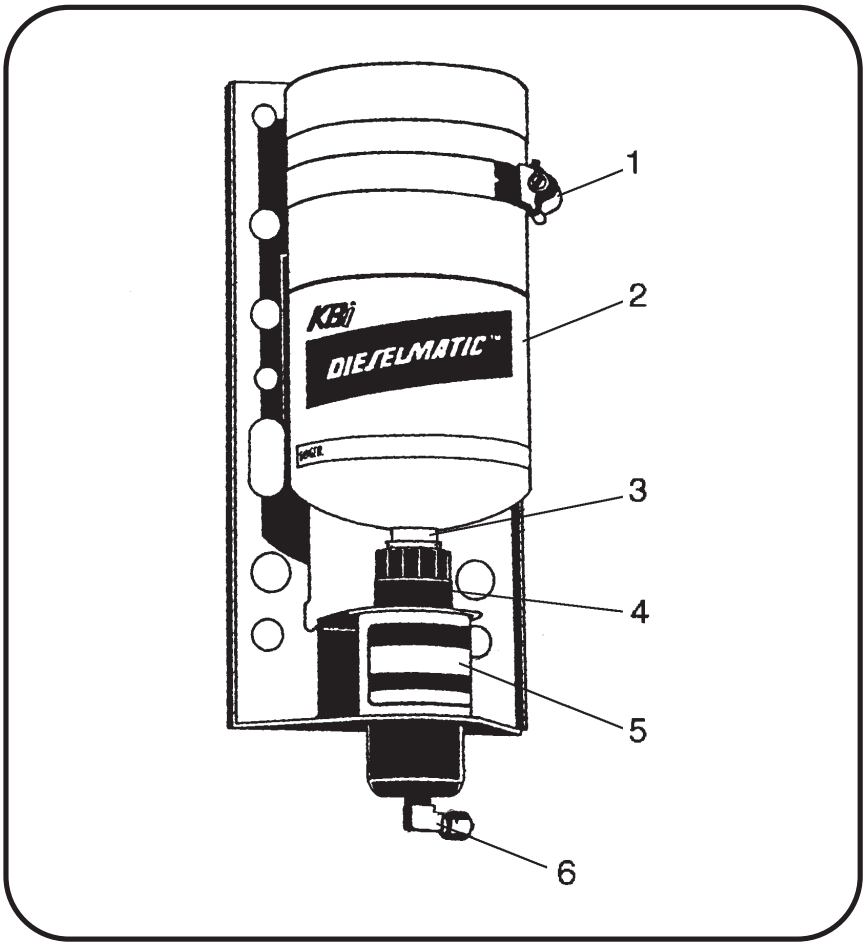
To start in cold weather, a diesel engine must crank at a fairly high speed. Worn out batteries, partially discharged batteries, and poor or loose cable connections will reduce cranking speed. Batteries, cables, and connections should be cleaned and tightened regularly.

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. Lubricating Oil

Engine lubricating oils 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 filter assembly

Cold Weather Starting Aid
Figure 2

(4) Occasional Engine Faults

The following is a table listing faults which may occasionally occur. Column two of the table explains what happens in the engine's circuitry when the fault occurs, and column three tells how to return the generator set to service.

ENGINE FAULTS		
Engine Fault Condition	**What This Fault Condition Does**	**To Put the Generator Set Back into Service:**
Overtemperature or low oil pressure	Automatically removes power from the electric governor controller, shuts down the engine, and turns on the applicable indicating light.	Correct the fault, press the engine stop switch (1-1; 20, Fig.) to turn off the indicating light and reset the protective system.
Low fuel	Turns on the low fuel indicating light (1-1; 27, Fig.). Depending on the position of JP2 and JP3 on the control PC board, a low fuel fault may cause the engine to idle, shut down, or continue to run at rated speed.	Regardless of which of these conditions occur, the low fuel fault indicating function must be reset by pressing the engine stop switch (1-1; 20, Fig. 6). Fuel must be added prior to attempting another engine start.
Clogged air cleaner or other restriction in the combustion air inlet.	Turns on the air cleaner restriction indicating light (1-1; 6, Fig. 6)	Press the engine stop switch (1-1; 20, Fig.). The restriction must be removed prior to attempting another engine start.

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 left plexiglas door at the rear of the generator set, 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 (29, Fig. 1) in REGULATED position.

c. Place test-bank switches (30 and 31, Fig 1) 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) Press engine start switch (26, Fig. 1) a second time to bring engine from idle speed to rated speed. The electric governor will immediately increase engine speed to 2400 RPM and maintain it.

(2) Observe generator instruments. Frequency meter (9, Fig. 1) should indicate exactly 400 Hz. With voltmeter-ammeter selector switch (18, Fig. 1) in any line-to-neutral position, (A-N, B-N, or C-N), the voltmeter (13, Fig. 1) 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.

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 pressing the load contactor control switch (22 and/or 24, Fig. 1). The yellow or orange indicating light of the switch that is pressed 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.

NOTE: If the indicating light 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 (22 or 24, Fig. 1).

(3) 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 (18, Fig. 1)) 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.

WARNING

NEVER press the test/reset switch while power is being delivered. The contactors will open and power to the aircraft will be suddenly interrupted.

(4) 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 test/reset switch (19, Fig. 1) 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 (22 or 24, Fig. 1) in OFF position. The yellow or orange indicating light on that switch should go OFF immediately to indicate that the load contactor has opened and power is no longer being delivered to the aircraft.

(2) Press engine start switch (26, Fig. 1) to bring engine to idle speed.

NOTE: If either or both load contactors are ON, the technician may press the engine start switch (26, Fig 1), to turn off the load contactor(s) AND bring the engine to idle speed at the same time.

(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, press the engine stop switch (20, Fig. 1).

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. 3, (d) 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. 4) ON with switch (12, Fig. 4).

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

a. Place current limiting control switch (9, Fig. 4) in the ON position.

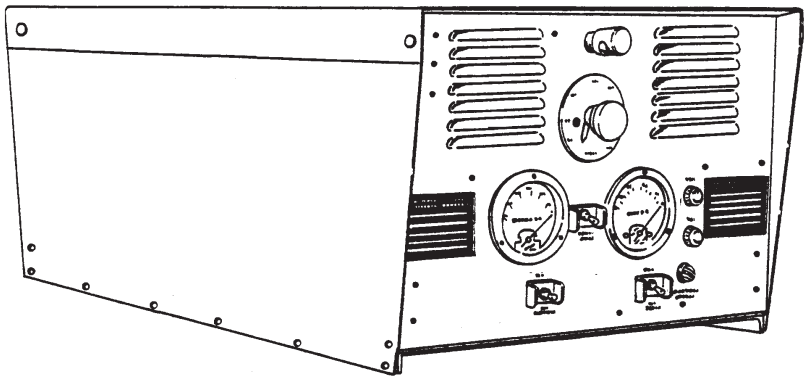
b. Adjust rheostat (5) to the starting amperage recommended by the engine manufacturer.

(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.

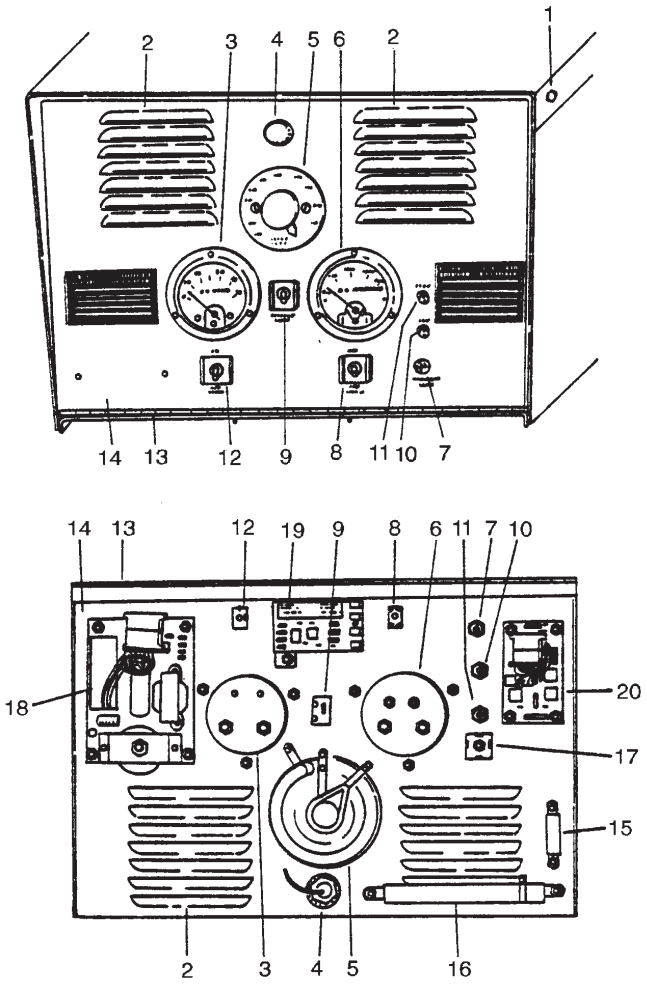
(6) Close the T-R load contactor to deliver power to the output cables by momentarily holding the contactor control switch (8) in the top, ON position until the indicating light (7) glows. Release the switch and allow it to return to center, ON position.

(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. 5) 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. 4). If shut-down occurs, check for the condition that caused it and remedy it before restarting the T-R.

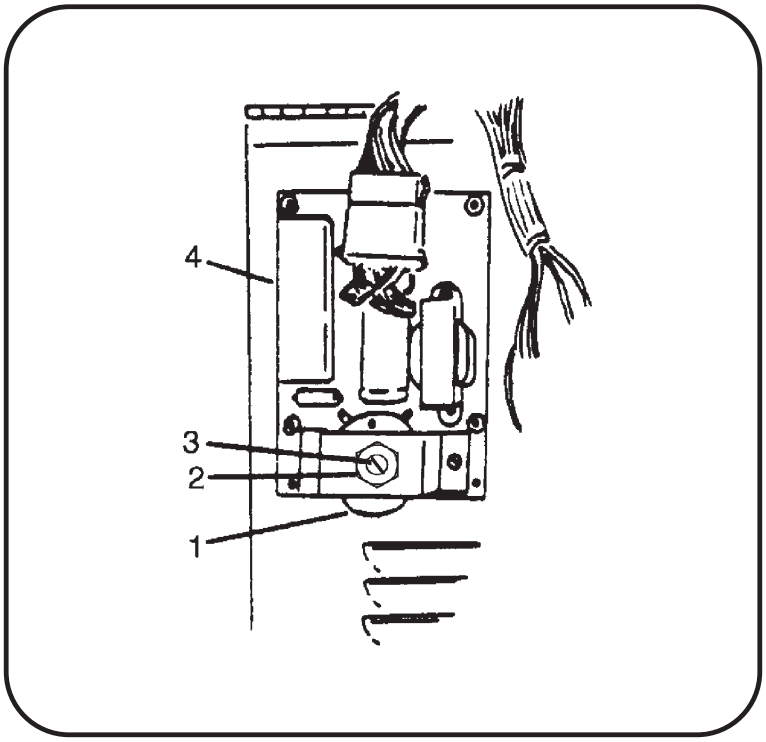


Transformer-Rectifier
Figure 3



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

T-R Control Panel Assembly
Figure 4



1. Rheostat
2. Nut
3. Screw
4. Line drop and current limiting module

T-R Output Voltage Adjustment
Figure 5

c. Discontinue Power Delivery

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

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.

(2) Disconnect output cable at aircraft.

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

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.

4. Running Gear Operation

a. Towing

Observe the following rules when towing the generator set.

(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 running gear is equipped with towbar activated brakes. When parking the generator set:

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

(2) Disconnect the running gear from the tow vehicle.

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

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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 also use the maintenance schedule check sheet provided in the Cummins Operation and Maintenance Manual, provided with OM-2070 and referenced in Chapter 5-1. 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'D	10 or Daily	200 or 3 Mo	400 or 6 Mo	1200 or 1 Yr	6000 or 5 Yrs
SYMBOL	**AR**	**A**	**B**	**C**	**E**	**F**
ENGINE						
Change Air Cleaner Filter	**X**					
Check Engine Blow-by	**X**					
Tighten Manifold Hardware	**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			**X**			
Check and Record Oil Pressure			**X**			
Check Crankcase Breather			**X**			
Check Radiator Core (external)			**X**			
Check Governor Linkage			**X**			
Check Fuel Filter Elements				X		
Check/Adjust Serpentine Belt Tension					X	
Check Fan Hub and Drive Pulley					X	
Steam Clean Engine					**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'D	10 or Daily	200 or 3 Mo	400 or 6 Mo	1200 or 1 Yr	6000 or 5 Yrs
SYMBOL	**AR**	**A**	**B**	**C**	**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			
Check 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**			
Check all Lights		**X**				
Check Charging Rate		**X**				
Check Wiring and Connections				**X**		
ELECTRICAL (400-Hz System)						
Check Output Cable and Connections		**X**				
Check Volt, Amp & Frequency Meters		**X**				
Check Protective Relays				**X**		
Inspect Wiring and Connections				**X**		
Clean and Inspect Generally				**X**		

Maintenance Schedule
Figure 1 (Sheet 2 of 2)

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.

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

(1) Engine

a. Change air cleaner filter.

A definite time schedule for changing the air cleaner filter cannot be established. This air cleaner filter is a disposable type which, when dirty, must be discarded. See 2-2, para 3.

b. Check of engine blow-by is 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 cap screws) 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, provided with manual and references in Chapter 5-1.

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.

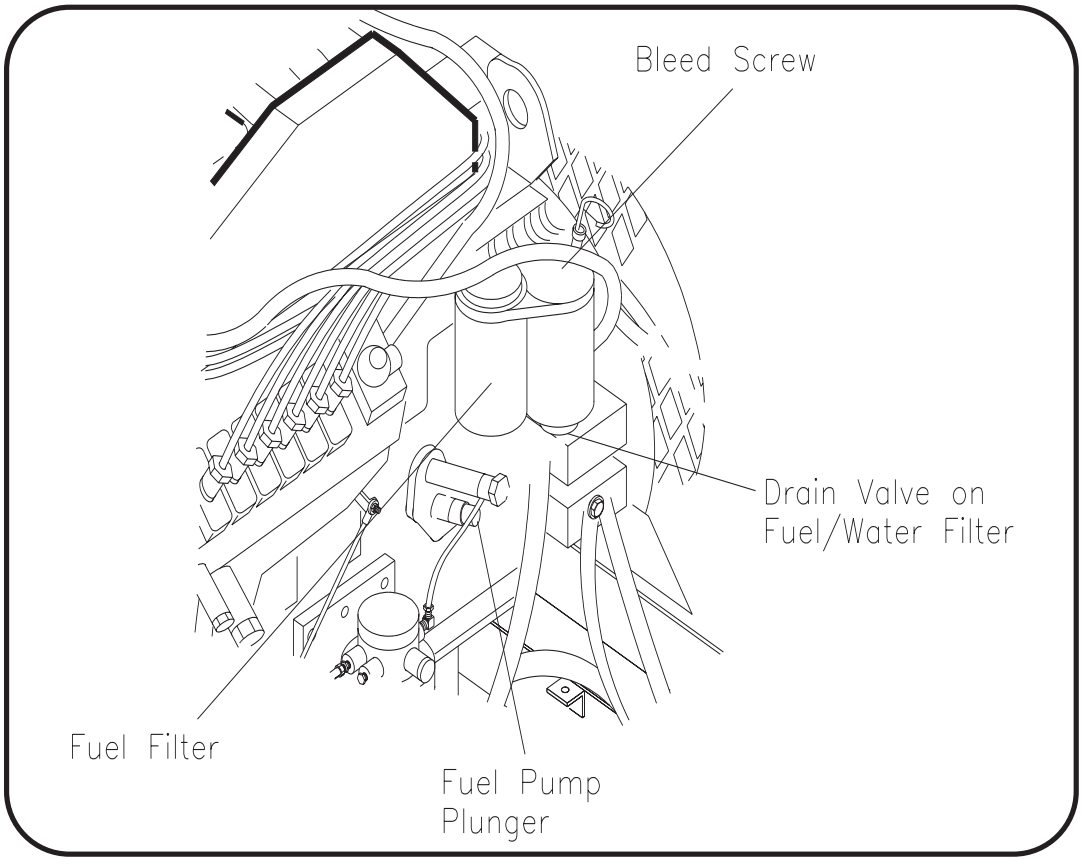
d. The fuel filter must be removed to drain.

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; 6, 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 circut breakers.

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; 19, Fig. 1)*. Check circut breaker (33, Fig. 1) 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. 2, D, (4) for details.

b. Change oil filter

Change oil filter each time crankcase oil is changed. See 2-2, Para. 2, 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. 4, B for instructions.

f. Clean radiator core. See 2-2; Para. 5, 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. Check and adjust V belts

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

i. Check and service crankcase breather.

(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 Owner and Operaters Manual).

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

(1) Engine

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

b. 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.

WARNING

1. Exercise care to avoid injury and damage to eyes and skin.

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.

4. DO NOT use a flammable solvent.

5. DO NOT use mineral spirits or solvents on a hot engine.

c. 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 (See Cummins Operations and Maintenance Manual).

d. 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.

e. 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.

f. Check water pump (see Figure 3, below)

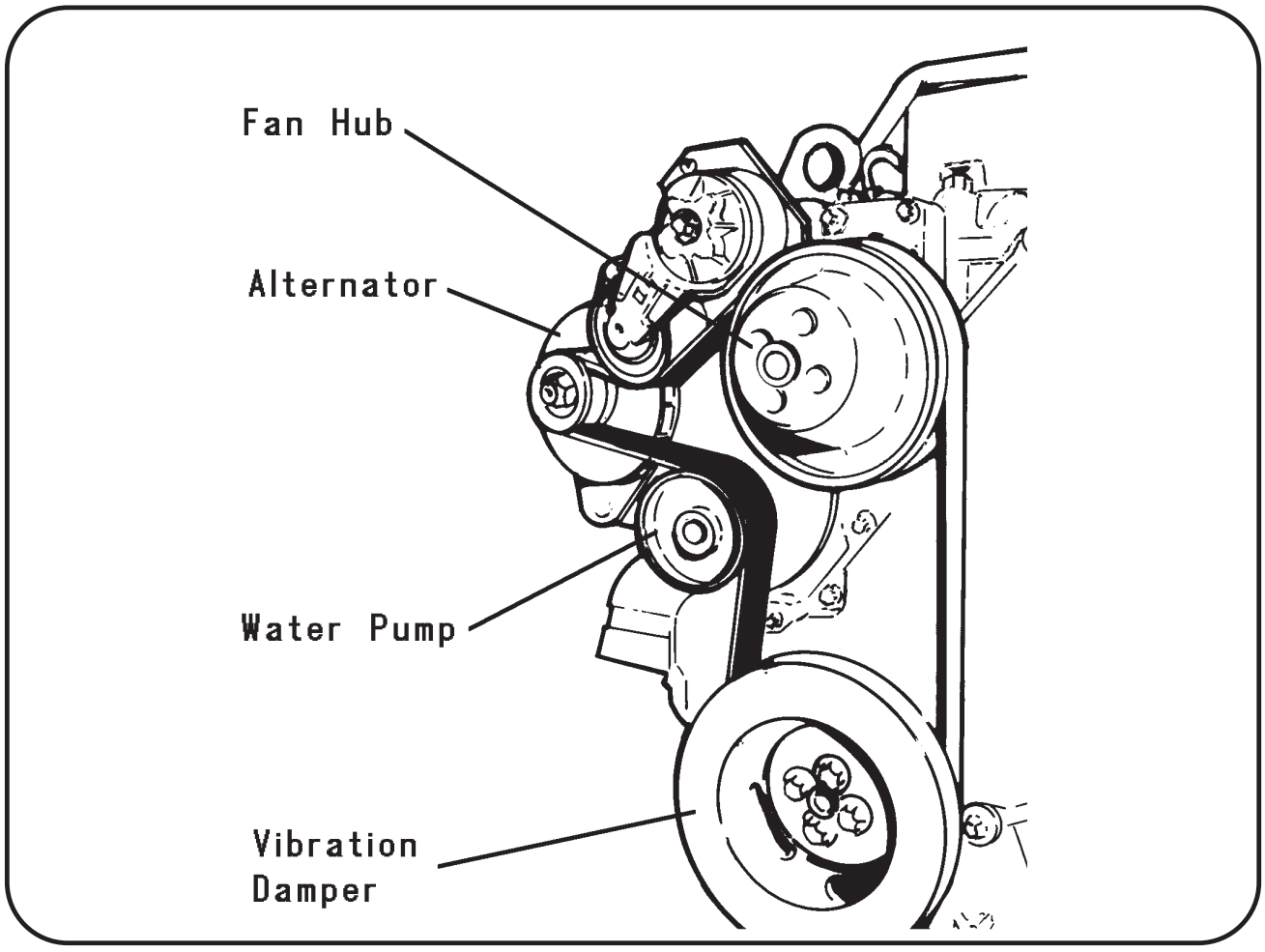
Check water pump for signs of leaking and lubricant loss. Replace with new prelubricated pump if lubricant is being lost.

g. Check fan hub (see Figure 3, below)

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

h. Check alternator and cranking motor.

The alternator and cranking motor on this particular engine require no periodic lubrication. See 2-2, Para. 2, 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 Cummins Manual for instructions on how to test coolant chemically. See 2-2, Para. 5, 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.5, J, for instructions.

(7) Check cold weather starting aid each fall..

j. Lamps and Circut Breakers

(1) Check all lamps daily.

(2) Figure 4 lists all lamps with their locations and identifying trade numbers.

(3) Figure 5 lists all circuit breakers and the one Circut Breaker used in this generator set, with their locations, and amperage ratings.

Light Identification	Location	Lamp (Bulb): as per Lamp Industry Trade Number
Instrument Panel Lights	Control box Interior (1-1; Figure 7, Item 11)	67
Engine Start Indicator	Engine-Generator Control Panel (1-1; Figure 6, Item 26)	1815
No. 2 Load Contactor Switch	Engine-Generator Control Panel (1-1; Figure 6, Item 22)	1815
No. 1 Load Contactor Switch	Engine-Generator Control Panel (1-1; Figure 6, Item 24)	1815
FAULT Indicators (9)	Engine-Generator Control Panel	1815
Clearance (Marker) Lights (4)	Canopy	57

Lamp Identification Chart
Figure 4

Item Protected	Location	Illustration	Size and Type
Engine Circuit and Instrument Panel	Control box Interior	1-1; Figure 7, Item 12	10A Circuit Breaker
Controls	Control box Interior	1-1; Figure 7, Item 13	5A Circuit Breaker
Marker Lights	Control box Interior	1-1; Figure 7, Item 14	10A Circuit Breaker
Load Contactor Circuit	Control box Interior	1-1; Figure 7, Item 15	5A Circuit Breaker

Circuit Breaker Identification Chart
Figure 5

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Section 2. Maintenance Procedures

1. General

A suggested Maintenance Schedule is provided in Figure 1 of Chapter 2-1. 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 "Operator's Guide" and incorporated here to make them more readily available to operators and maintenance personnel.

(1) Lubrication schedule

Time schedules indicated on the Lubrication and Maintenance Chart, Figure 1, are approximate. They are based on average operating conditions. It may be necessary to lubricate more frequently under severe operating conditions such as: low engine temperatures, high oil temperatures, or intermittent operation. However, time intervals should not exceed those indicated in the chart without careful evaluation.

CAUTION

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

(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, which is provided with this manual and referanced in Chapter 5.

(3) Oil viscosity

Figure 1 also provides temperature and oil viscosity recommendations for this engine. For operation at temperatures consistently below -13 deg. F (-25 deg. C), refer to Arctic Oil Recommendations in the Cummins Operation and Maintenance Manual.

ITEM	MAINTENANCE REQUIRED		
Lube Oil	Check oil level daily or after every 10 hours of use. Change oil and the oil filter after 200 hours or one month of use. Use oil specification API Class CE/SF. Lube oil must contain ash, but no more than 1.85%. Refer to chart below for required lube oil viscosity in regard to ambient temperature. Engine lube oil capacity: 16.4 liters *(17.3 quarts)*		
Lube Oil Viscosity Required as per Ambient Temperatures	VISCOSITY	AMBIENT TEMPERATURE	CONDITIONS
	15W40	+10°F (-12°C) and above	For most climates
	10W30	-13°F to +68°F (-25°C to +20°C)	Winter conditions
	5W30	68°F (20°C) and below	Arctic conditions
Fuel Oil Filter	Drain Filter Daily. Change filter element every 800 hours or 6 months of use.		
Coolant	Check coolant level daily. Service and maintain coolant system according to para. 5. Engine coolant capacity: 32 quarts *(30.3 liters)*		
Coolant hoses and connections	Check coolant hoses and connections daily for leaks.		
Air Cleaner	Change air cleaner filter as required when air cleaner indicator *(on engine control panel)* shows that it should be changed.		
Fan Belt	Check fan belt condition and tension every 200 hours or 3 months of use.		
AC Generator	AC generator bearings are sealed and require no periodic lubrication.		
Alternator	Alternator bearings are sealed and require no periodic lubrication.		
Starter Motor	Starter motor bearings are sealed and require no periodic lubrication.		
Water Pump	The water pump is packed at assembly and requires no periodic lubrication.		
Fan Hub	The fan hub is lubricated at assembly and requires no periodic lubrication.		

Lubrication and Maintenance Chart
Figure 1

(4) Changing engine oil

Oil should be changed after each 200 hours of engine operation. The generator set is equipped with an hour meter 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 each time the oil is changed.

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

CAUTION

Do not use solvents as flushing oils in running engines.

Change oil as follows:

CAUTION

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

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

b. Remove oil drain plug. This remote plug is located on the end of a hose which comes out of the front of the unit, behind the fifth-wheel running gear.

c. While oil is draining, change the oil filter. 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 Nm).

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. 2, D, (2) above, or Cummins Operation and Maintenance Manual, referanced in Chapter 5 and provided with OM-2070.

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 (See figure 2, next page).

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 filter, the source should be determined before a failure results.

CAUTION

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

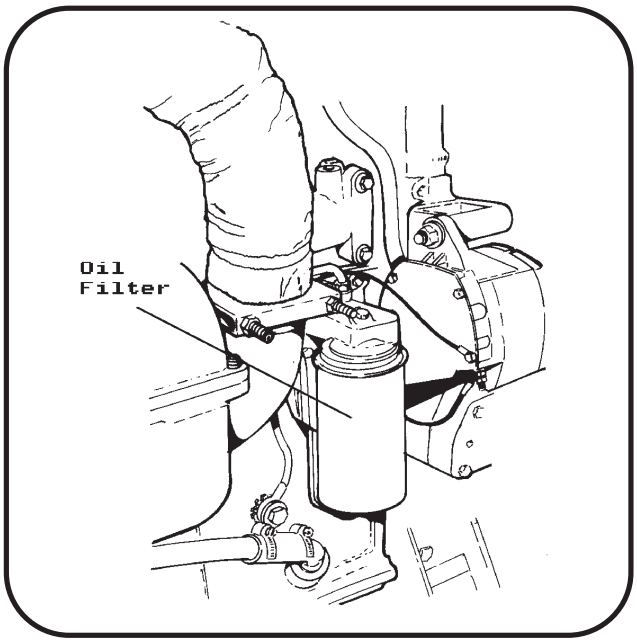
c. Fill the new filter with clean lubricating oil before installation.

d. Apply a light coating of lubricating oil to the gasket sealing surface and install the filter. **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 2

e. Engine Accessories Lubrication (See figure 3, next page).

(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

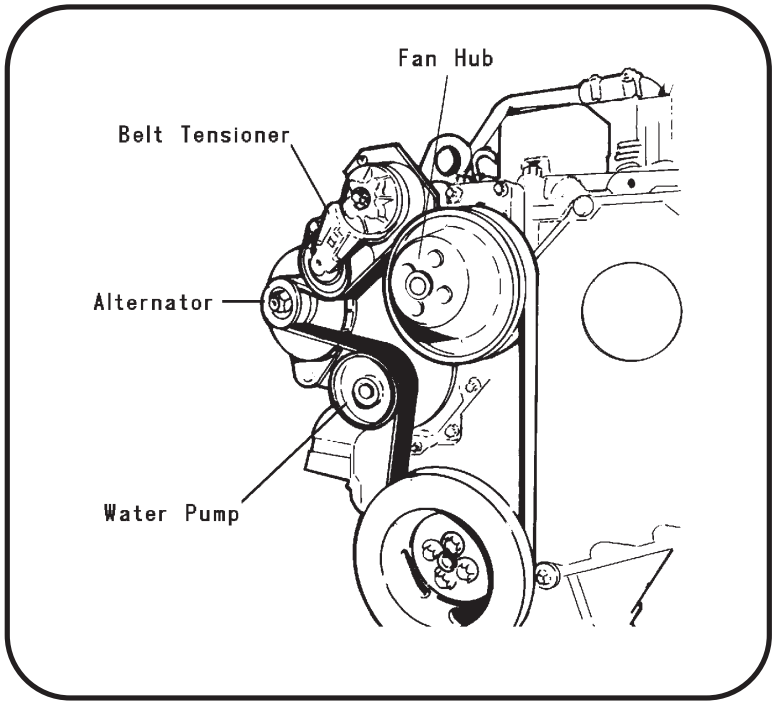
Most starting motors are lubricated at assembly and should be relubricated only when the starter is removed and disassembled, however, INSPECT the starter to make certain it has no lubrication points.

(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.



Engine Accessories
Figure 3

3. Servicing the Air Cleaner

This air cleaner is a disposable type which, when dirty may be discarded. A definite time schedule for cleaning or changing the air cleaner cannot be determined because of varying operating conditions. This air cleaner filter can be removed from the air cleaner 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.

b. 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.

CAUTION

DO NOT use diesel fuel blended with lube oil in engines equipped with a **catalytic converter**. Damage to legally required emission control unit may result.

Jet A-1 fuel may be used **IF** *(and **ONLY** if)* lube oil is added to the Jet A-1 fuel, and the generator set is **NOT** equipped with a catalytic converter. Regarding blends of fuel oil and lube oil, refer to the Cummins Operation and Maintenance Manual for proportions. 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.

Contact your local governmental agency responsible for environmental protection to determine if Jet A-1 fuel is allowed for use. Local emission standards may preclude the use of Jet A-1 fuel.

b. Fuel Filter (see figure 4 on next page)

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 restrictive, 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 400 hours of operation unless a restriction test indicates the time period should be extended. Replacement fuel filter elements are Cummins No. FF-150D.

a. Unscrew element and discard.

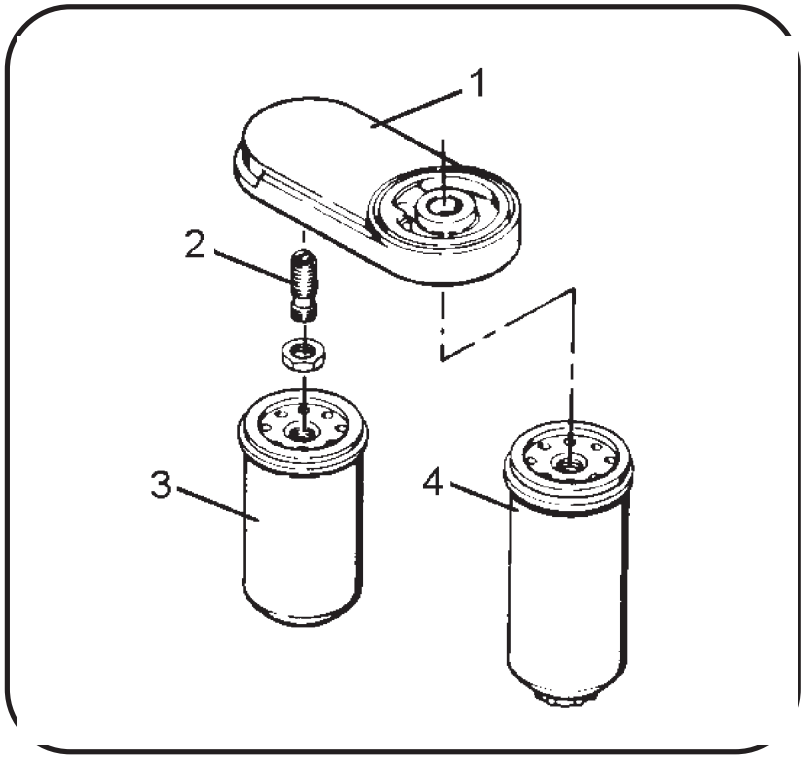
NOTE: The elements should be removable by hand. If not, there are several types of filter element removal tools.

b. Fill NEW element with CLEAN fuel.

CAUTION

Do not over-tighten the new element. Tightening with mechanical tools may distort or crack filter head.

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



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

Fuel Filter
Figure 4

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 be clean and free of any corrosive chemicals such as chloride, sulfate, 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.

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.

(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.

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 "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.

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 not 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.

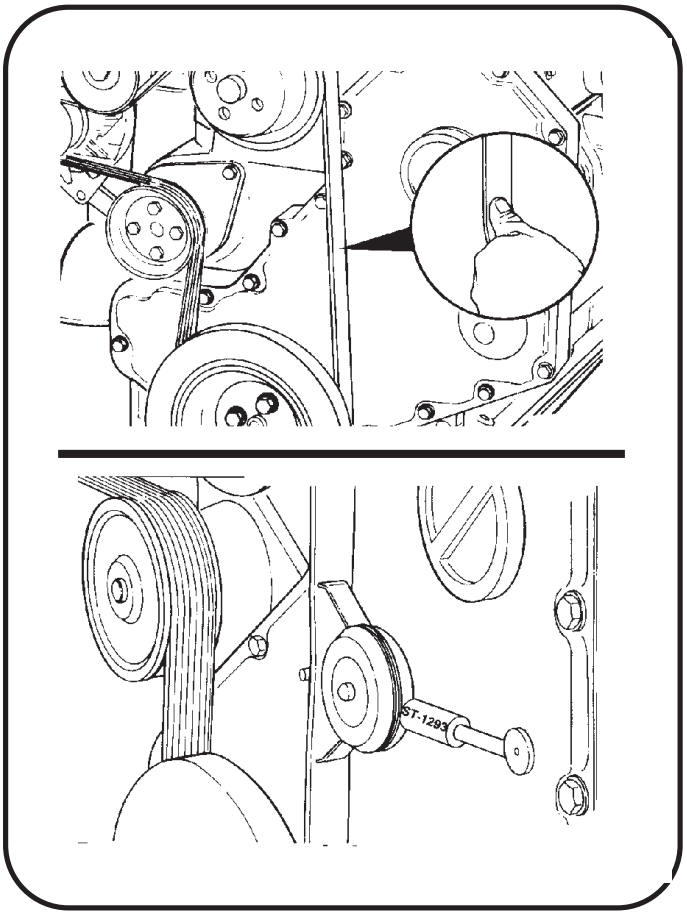
b. Preparation for Belt Check and Adjustment

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

c. Checking Belt Tension

Refer to figure 5. 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 by depressing the belt with your index finger at a point halfway between pulleys on the longest span of the belt. The deflection should be no more than 1/2 inch.



Checking Belt Tension
Figure 5

d. Check Fan Belt

(1) Check belt tension (*see Para. 2, C, above, and refer to Figure 6*).

(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.

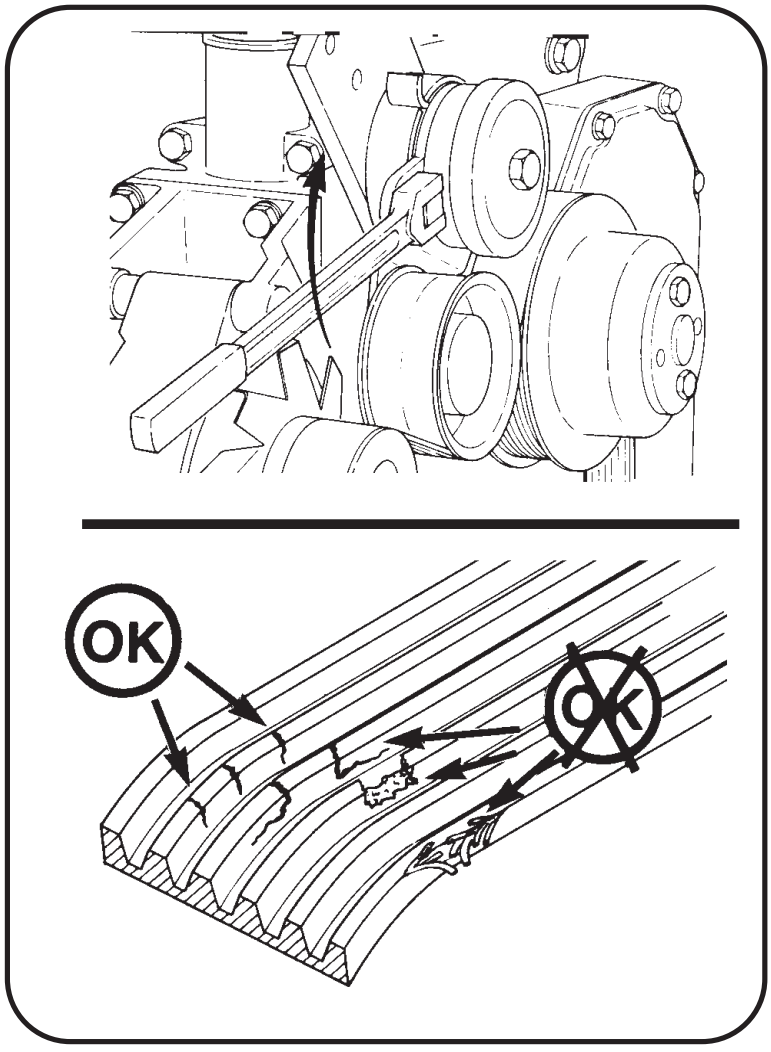
a. Traverse (across the belt width) cracks are acceptable.

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.



Checking Belt Tension
Figure 6

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 five 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 five 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 they 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

WARNING

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 circuit breaker is tripped. 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 the appropriate Connection Diagram.

(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 of Section 1-3. 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.

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 *(38, 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 marker lights circuit breaker *(33, Fig. 1)* by pressing panel light switch *(28).* If panel lights *(1-1; 11 Fig. 7)* operate, the circuit breaker, switch, and lamps are good.

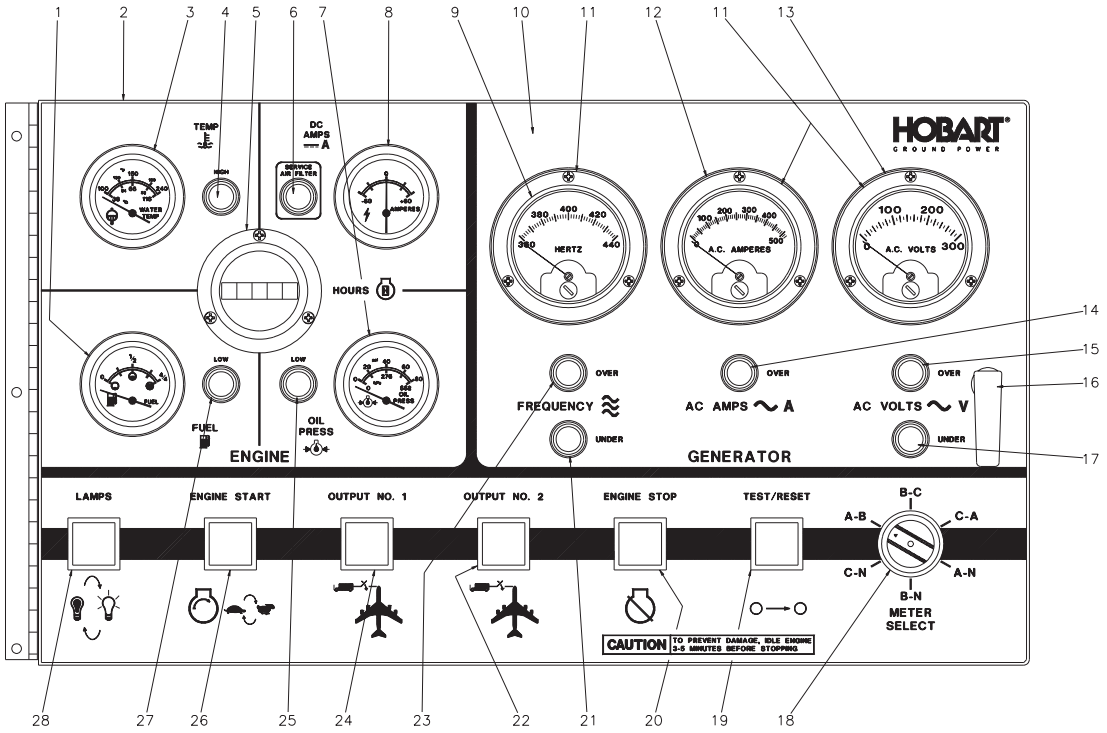
(9) Check fault indicating lights by pressing test/reset switch *(19).* If lights glow, the control circuit breaker *(34)* and indicating lamps are good.

(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

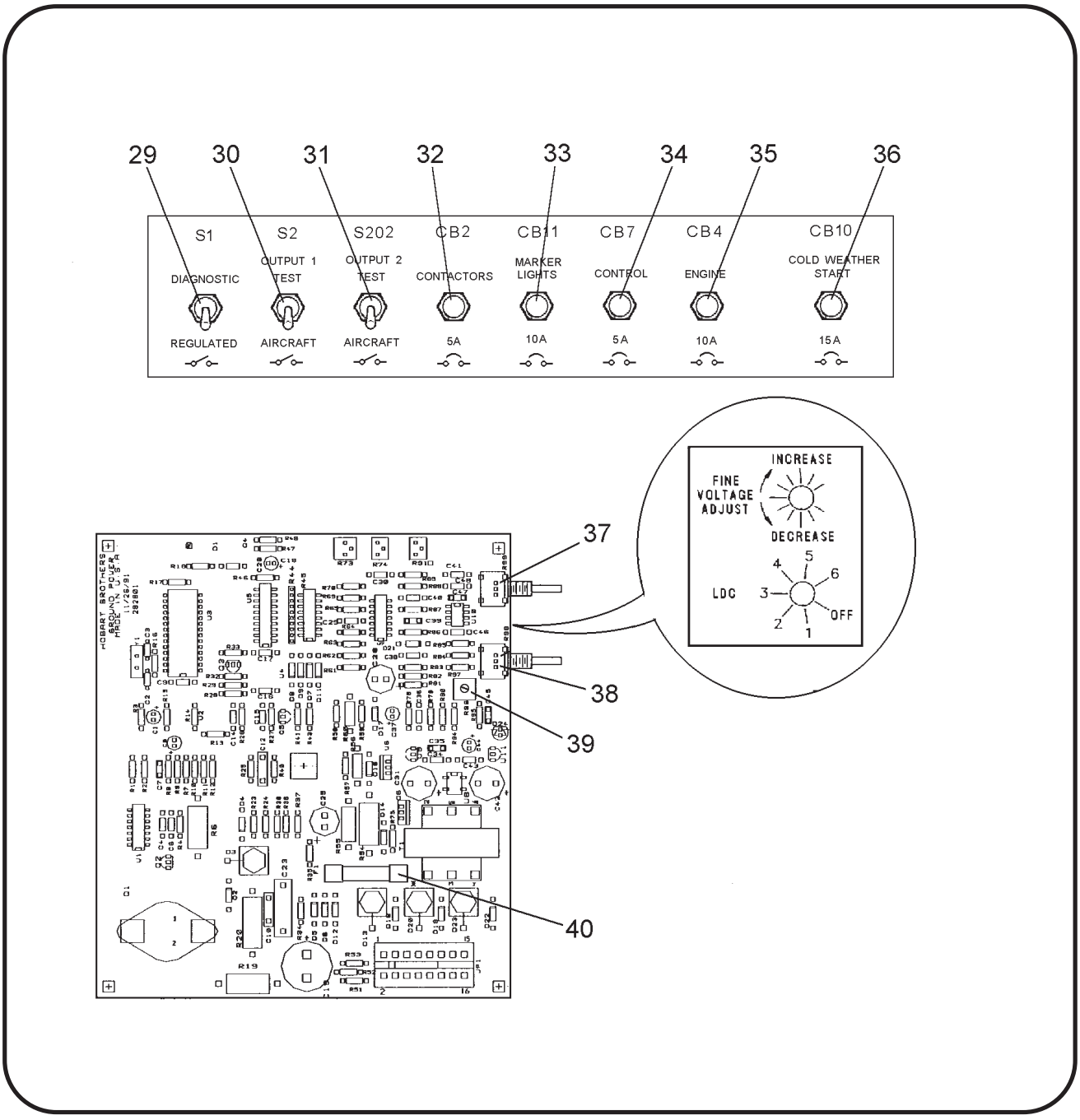
Engine must not be running when flashing exciter field if voltage regulator damage is to be prevented. Do not leave regulated/diagnostic switch in diagnostic position after flashing field.

(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 *(29, Fig. 1)* in the **DIAGNOSTIC** position for 3 to 5 seconds. Then return it to the **REGULATED** position.



1. Fuel gage
2. Front panel
3. Engine coolant temperature meter
4. Overtemperature indicator light (red)
5. Engine hour meter
6. Indicating light, air cleaner restriction (red)
7. Oil pressure gage
8. Engine ammeter
9. Frequency meter
10. Control box label
11. Light strip
12. Generator ammeter
13. Voltmeter
14. Overload indicator light (red)
15. Overvoltage indicator light (red)
16. Adjustable grip latch
17. Undervoltage indicator light (red)
18. Meter selector switch
19. Test-reset switch
20. Engine stop switch
21. Underfrequency indicator light (red)
22. No. 2 contactor switch
23. Overfrequency indicator light (red)
24. No. 1 contactor switch
25. Low oil pressure indicator light (red)
26. Engine start switch
27. Low fuel indicator light (red)
28. Panel light switch

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



29. Regulated-diagnostic switch
30. Test bank-aircraft switch, No. 1 output
31. Test bank-aircraft switch, No. 2 output
32. Circuit breaker, contactors (5-amp)
33. Circuit breaker, marker lights (10-amp)
34. Circuit breaker, control (5-amp)
35. Engine circuit breaker (10-amp)
36. Output voltage adjustment (fine)
37. Line drop compensation adjustment
38. Output voltage adjustment (coarse)

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

(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 *(29, Fig. 1)* in REGULATED position.

b. Place test-bank switches *(30 and 31)* in AIRCRAFT position.

c. If the output voltage coarse adjustment potentiometer *(38)* 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 pressing the engine start switch *(26)* a second time. If the engine comes up to governed speed and a voltage value appears on the voltmeter *(13)*, the electric governor and excitation-deenergization circuits are functioning.

(7) Observe frequency meter *(9)*. 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 *(13)*. Use output voltage coarse adjustment potentiometer *(38)* 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 *(13)* and turn output voltage coarse adjustment potentiometer *(38)* 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 *(22, Fig. 1)* is in the OFF position, which is indicated when its internal indicating light doesn't glow. Then press the No. 1 load contactor switch *(24, Fig. 1)*. The No. 1 contactor power ON indicating light within the switch should glow, and an amperage value should appear on the AC ammeter *(12).* Hold in this position momentarily.

(2) Release the No. 1 load contactor switch. The No. 1 load contactor should open immediately, and the No. 1 ON indicating light within the switch should go OFF. This is because the interlock circuit of the control PC board is not receiving power from an outside source of 28 V DC. It indicates that the No. 1 interlock circuit is OPEN as it should be when the interlock circuit is not receiving 28 V DC power.

(3) Open the control panel door and place the No. 1 test bank switch *(30)* in TEST BANK position.

(4) Press the No. 1 load contactor switch *(24)*. The No. 1 contactor power ON indicating light within the switch should glow and remain ON when the switch is released. This indicates that the No. 1 test bank switch *(30)* is functioning to bypass the plug interlock circuit.

(5) Return the No. 1 test bank switch *(30)* to AIRCRAFT position. The No. 1 load contactor should open at once and the green indicating light within the No. 1 load contactor switch *(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, press the No. 1 contactor operating switch *(24)* . The No. 1 contactor power ON indicating light, within the switch, should glow and remain on when the switch is released. This indicates that the load contactor is closed and the plug interlock circuit 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 *(9, Fig. 1)* when generator is switched from no load to full load. and vice versa. Use the No. 1 contactor control switch *(24)* 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; 17, 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 *(19, Fig. 1)*.

d. Testing the No. 2 output circuit

(1) Make certain that the No. 1 contactor on-off switch *(24, Fig. 1)* is in the OFF position, which is indicated when its internal indicating light doesn't glow. Then press the No. 2 load contactor switch *(22, Fig. 1)*. The No. 2 contactor power ON indicating light within the switch should glow, and an amperage value should appear on the AC ammeter *(12).* Hold in this position momentarily.

(2) Release the No. 2 load contactor switch. The No. 2 load contactor should open immediately, and the No. 2 ON indicating light within the switch should go OFF. This is because the interlock circuit of the control PC board is not receiving power from an outside source of 28 V DC. It indicates that the No. 2 interlock circuit is OPEN as it should be when the interlock circuit is not receiving 28 V DC power.

(3) Open the control panel door and place the No. 2 test bank switch *(31)* in TEST BANK position.

(4) Press the No. 2 load contactor switch *(22)*. The No. 2 contactor power ON indicating light within the switch should glow and remain ON when the switch is released. This indicates that the No. 2 test bank switch *(31)* is functioning to bypass the plug interlock circuit.

(5) Return the No. 2 test bank switch *(31)* to AIRCRAFT position. The No. 2 load contactor should open at once and the green indicating light within the No. 2 load contactor switch *(22)* 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, press the No. 2 contactor operating switch *(22)*. The No. 2 contactor power ON indicating light, within the switch, should glow and remain on when the switch is released. This indicates that the load contactor is closed and the plug interlock circuit 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 *(9, Fig. 1)* when generator is switched from no load to full load. and vice versa. Use the No. 1 contactor control switch *(24)* 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; 18, 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 *(19, Fig. 1)*.

e. Testing the main generator overload circuit

(1) Press the No. 1 load contactor switch *(24, Fig. 1)*. The No. 1 contactor power ON indicating light within the switch should glow, indicating that the No. 1 load contactor circuit is operational.

(2) Press the No. 2 load contactor switch *(22, Fig. 1)*. The No. 2 contactor power ON indicating light within the switch should glow, 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; 19, 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; 19, Fig. 9)* MUST trip within 5 minutes, and the 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 *(14, Fig. 1).*

f. Testing and checking meters, switches, circuits, 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 *(13)*.

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 *(12).*

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 *(18)*. 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 *(9)*.

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

c. Check operation of protective system interlock circuit. With unit operating normally under load, open the control circuit breaker *(Ref. 34, Fig. 1)*. The load contactor should open immediately. This indicates that the protective system is functioning properly. Close control circuit breaker and apply load.

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

(5) Check operation of overvoltage *circuit* and indicating light.

a. With the unit running at normal load, adjust the coarse adjustment potentiometer *(38, Fig.1)* of the voltage regulator CLOCKWISE to increase voltage until the overvoltage sensing *circuit* actuates the protective monitor to open the load contactor and turn on the overvoltage indicating light. At 126 volts, the *circuit* 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 *circuit* will trip within 160 milliseconds.
- At 180 volts, the *circuit* 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 *(19).*

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

When the voltage is reduced to a predetermined value, the undervoltage sensing circuit activates the undervoltage time delay circuit. If the undervoltage condition continues for approximately 7 seconds, the time delay circuitry will activate the protective monitor's undervoltage circuit, which in turn opens the load contactor to stop power delivery and turns on the undervoltage indicating light *(17, Fig. 1).*

A stopwatch is required for this check.

a. With the unit running at normal load, use the output voltage coarse adjustment potentiometer *(38, 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 2-4.

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.

(7) Check underfrequency sensing circuit, protective monitor, and indicating light. At some frequency value from 380 Hz or less, after 7 seconds, the underfrequency condition 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 gradually COUNTERCLOCKWISE to reduce engine speed until frequency meter indicates 385 Hz. Underfrequency protective circuit should not open the load contactor at this frequency.

b. Reduce frequency in steps of 1 Hz, with a time delay of 7 seconds between steps.

c. If the protective circuit opens the load contactor and turns on the underfrequency light after 7 seconds at 380 Hz, all components of the system are functioning properly.

d. If the load contactor is not opened at 380 Hz after 7 seconds, refer to Troubleshooting Chart to determine which component is defective.

e. Return unit to normal operating condition.

(8) Check overfrequency sensing circuit**,** protective monitor, and indicating light.

At some frequency value from 420 Hz to 480 Hz, after 7 seconds, the overfrequency sensing circuit 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 circuit 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, increase generator output frequency by increasing engine speed. Use the governed speed setting potentiometer *(Ref. Fig. 6).* Turn adjusting screw CLOCKWISE gradually to increase engine speed until frequency meter indicates 415 Hz. Overfrequency protective circuit 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.

(9) If the generator is operating under load at this point, place the contactor control switch*(*es) *(22 and 24, 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:

- a coarse output voltage potentiometer,
- a fine output voltage potentiometer, and
- 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 *(36, 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

The Line Drop Compensation label is calibrated for use with 2/0 cables. Make sure that when the potentiometer is turned fully counterclockwise, the arrow on the dial is pointing to **0** *(zero)*. Then turn the knob to the length of cable connected to the generator set.

(2) Test the Voltage Regulator

After necessary 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, provided with manual OM-2070 and referenced 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 following 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 850 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. 6, 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 6BTA5.9C200
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 limiting governor	automotive type
Lubricating oil pressure at 2400 RPM	50 to 90 PSI *(445 to 621 kPa, or 3447 to 6205 millibars).*
Engine coolant temperature	160 to 200 deg F.*(71 to 93 deg C.)*

Engine Specifications
Figure 2

e. Electric Governor System Adjustment

If making governer system adjustments under load, place the REGULATED/DIAGNOSTIC switch in the **REGULATED,** position.

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.

When making governor system adjustments, an important factor in such adjustments is the type of fuel used.. For the engine of this generator set, it is recommended that D-2 diesel fuel be used.

CAUTION

DO NOT use diesel fuel blended with lube oil in engines equipped with a **catalytic converter**. Damage to legally required emission control unit may result.

Jet A-1 fuel may be used **IF** *(and **ONLY** if)* lube oil is added to the Jet A-1 fuel, and the generator set is **NOT** equipped with a catalytic converter. Regarding blends of fuel oil and lube oil, refer to the Cummins Operation and Maintenance Manual for proportions. 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.

Contact your local governmental agency responsible for environmental protection to determine if Jet A-1 fuel is allowed for use. Local emission standards may preclude the use of Jet A-1 fuel.

(1) Actuator linkage adjustment

The proper adjustment of the mechanical linkage between the actuator and the engine throttle linkage arm *(8)* 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 shaft *(3).*
- Linkage must move engine throttle linkage arm *(8)* from **NO FUEL** to **RATED SPEED** *(2400 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 follows:

a. Start the engine, and operate it at idle speed until it is warmed to operating temperature.

b. Loosen the jam nut where the ball joint *(6)* attaches to the threaded rod *(5)* and remove the ball joint connecting screw from the throttle linkage arm.

c. Determine the **NO FUEL** position of the actuator shaft *(3)* inside the actuator *(2)*, by manually pushing the threaded rod *(5)* slowly backward such that the actuator shaft moves slowly into the actuator until the engine shuts off.

d. Hold the threaded rod in the exact position where the actuator shaft shut off the engine, and rotate the ball joint *(6)* — inward or outward on the threaded rod — such that the ball joint connector fits directly into the hole in the engine throttle linkage arm *(8)*.

e. Attach the ball joint connector to the engine throttle linkage arm, using the nut previously removed, and tighten this nut securely. Then tighten the ball joint jam nut on the threaded

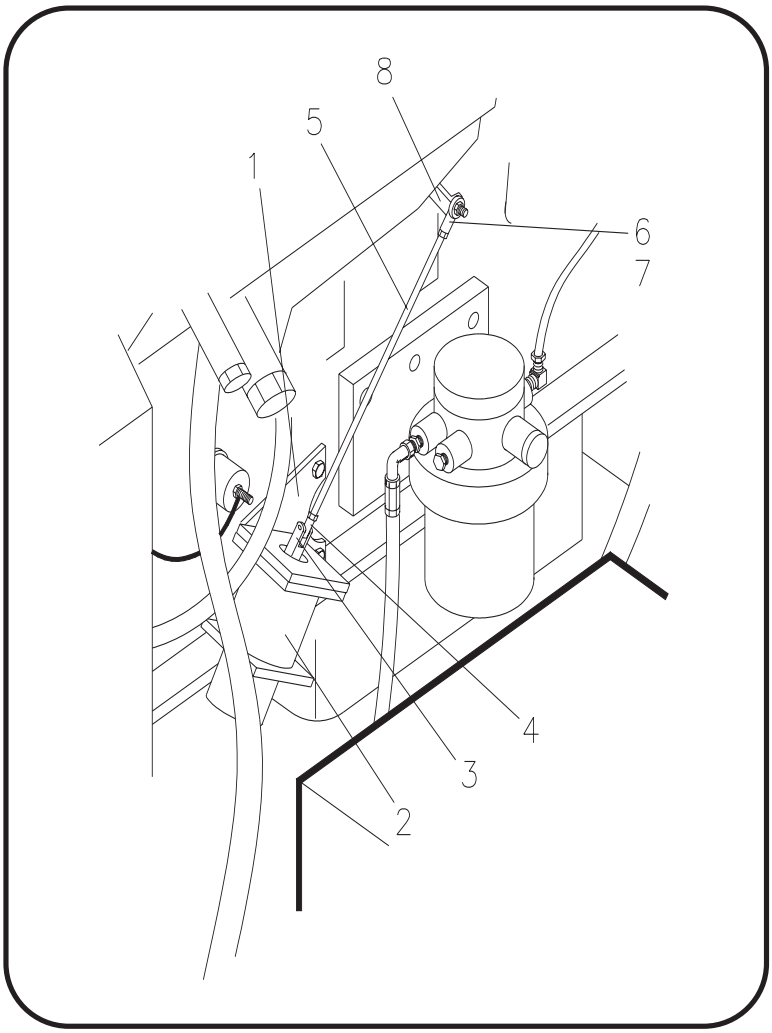
rod firmly against the ball joint.

f. Restart the engine and set idle speed to **850 +/- 25 RPM**. *(Refer to Para. 3, e, (3), (a) for instructions on how to set idle speed).*

g. Press engine start switch *(26, Fig. 1)* a second time to increase engine RPMs to **RATED SPEED** *(2400 RPM).* If the linkage is set properly, the frequency meter *(9, Fig. 1)* should read approximately 400 Hz.

h. Set **RATED SPEED** at the controller. *(Refer to Para.3, e, (3), (c) for instructions on how to set RATED SPEED).*

i. If the linkage, as adjusted, doesn't permit engine RPMs to increase to **RATED SPEED** *(2400 RPM)*, re-adjust linkage as necessary. Do this by again detaching the ball joint from the throttle linkage arm and rotating it inward or outward on the threaded rod as in step **d** above. Then tighten both nuts and repeat steps **f** through **h** above.



1. Actuator mounting bracket
2. Actuator
3. Actuator shaft (with clevis)
4. Rod end bearing
5. Threaded rod
6. Ball joint
7. Hex nut, 1/4 - 28
8. Throttle linkage arm

Governor Actuator Linkage
(Part No. 500033-1 & 500033-2 Shown)
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, with the engine shut off:

a. Disconnect magnetic pick-up cable from sensor.

b. Loosen the jam nut *(*2, *Fig. 4)* and remove magnetic pickup sensor *(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. Insert sensor and continue turning 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 cable to sensor.

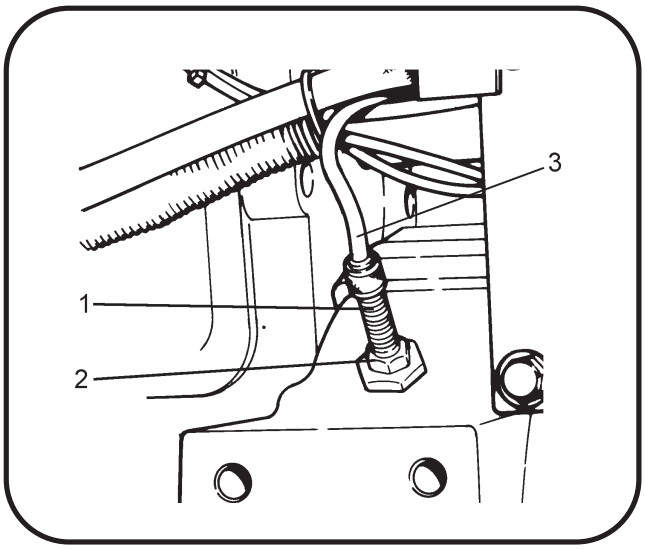
g. Start the engine and run it at idle speed.

h. Check voltage at governor controller terminals 10 and 11. The signal should read between 5-V AC and 10-V AC.

i. If the signal is weaker than 5-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 1.5-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
3. Cable

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 the **"D"** 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

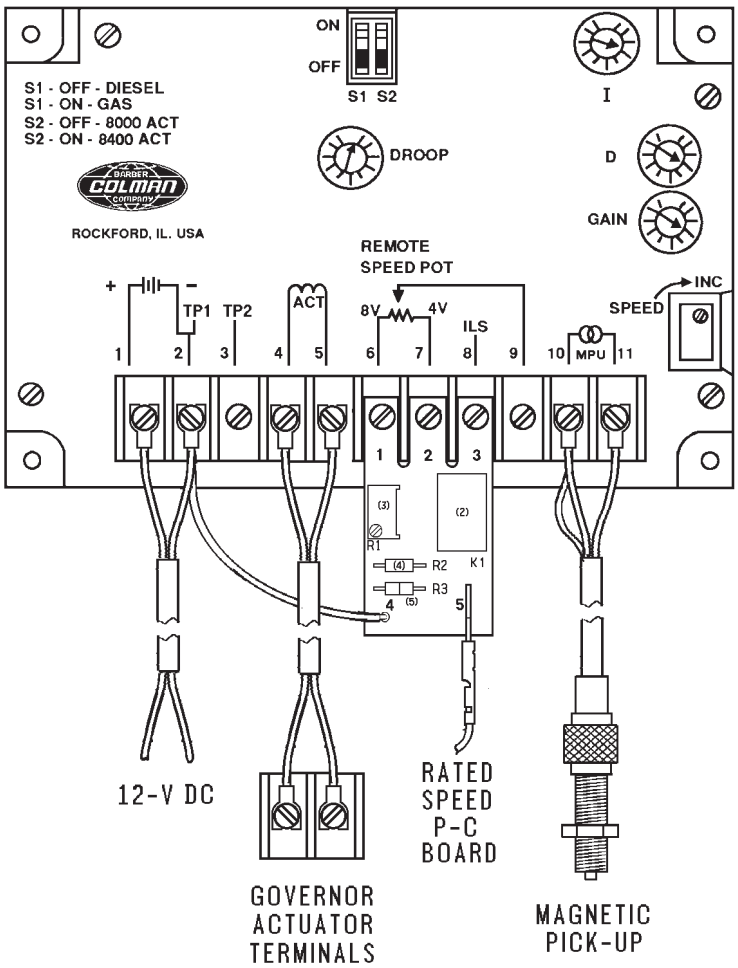
- Press engine start switch (26, Fig. 1) a second time to increase engine RPMs to approximately its rated speed (2400 RPM).
- Turn the **GAIN** potentiometer control slowly **CLOCKWISE** until the governor becomes unstable and the actuator lever oscillates. *(If the actuator lever **DOES NOT** oscillate 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.
- Press engine start switch *(26)* to increase RPMs to **RATED SPEED**. Let the engine stabilize, then press engine start switch again to lower engine speed 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 speed 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, press engine start switch *(26)* to increase RPMs to **RATED SPEED.** The engine should be running at 2400 RPM and output frequency should be 400-Hz.
- 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.



Electric Governor Control Box
Figure 5

- After making any adjustments, switch to **IDLE** speed, allow the engine to stabilize, then switch back to **RATED** speed.

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 impedance 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 400-Hz output module panel.

b. Disconnect the two black exciter field leads from terminal block mounted on 400-Hz output module panel.

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

Test Connection	Resistance (Ohms)
Generator Stator Phase A to N (G1)*P10	0.00235
Generator Stator Phase B to N (G1)*	0.00235
Generator Stator Phase C to N (G1)*P10	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 R X 1.

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, and a 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).

AMMETER SHUNT AMBIENT TEMPERATURE		T-R INDICATED AMPERES	TRUE AMPERES
FAHRENHEIT	CENTIGRADE		
60	16	440	500
70	21	450	500
80	27	460	500
90	32	470	500
100	38	480	500
110	43	490	500
120	49	500	500

Ammeter Shunt Temperature Chart
Figure 7

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 temperature 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.

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 thermal 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 R X 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. 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 resistance 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.

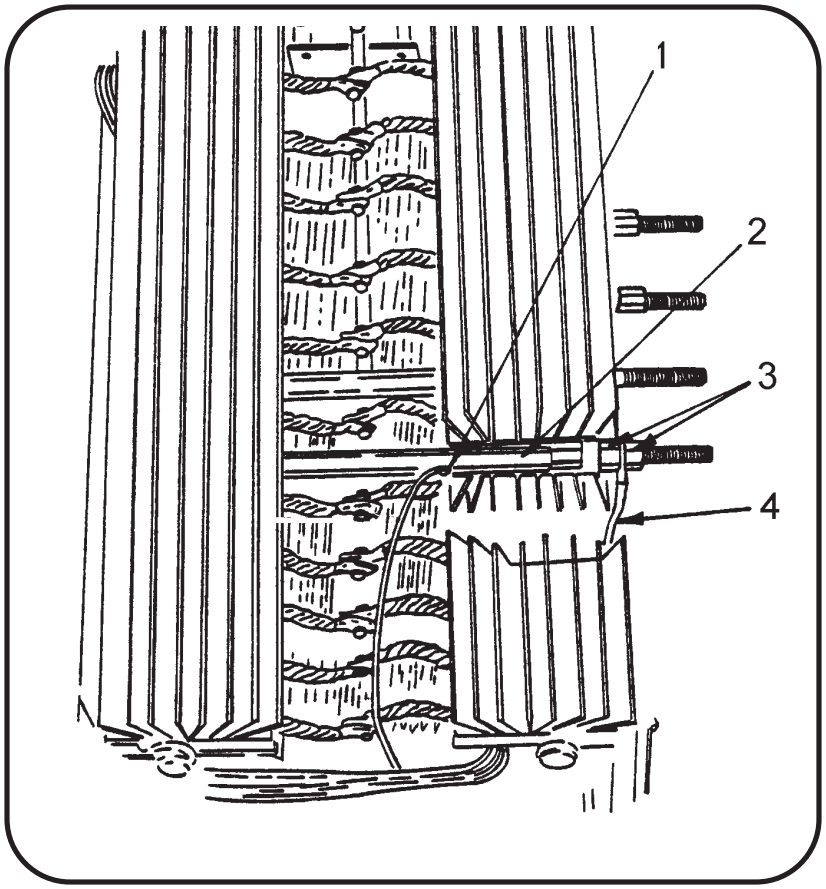
a. Turn all power **OFF.**

b. Open 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

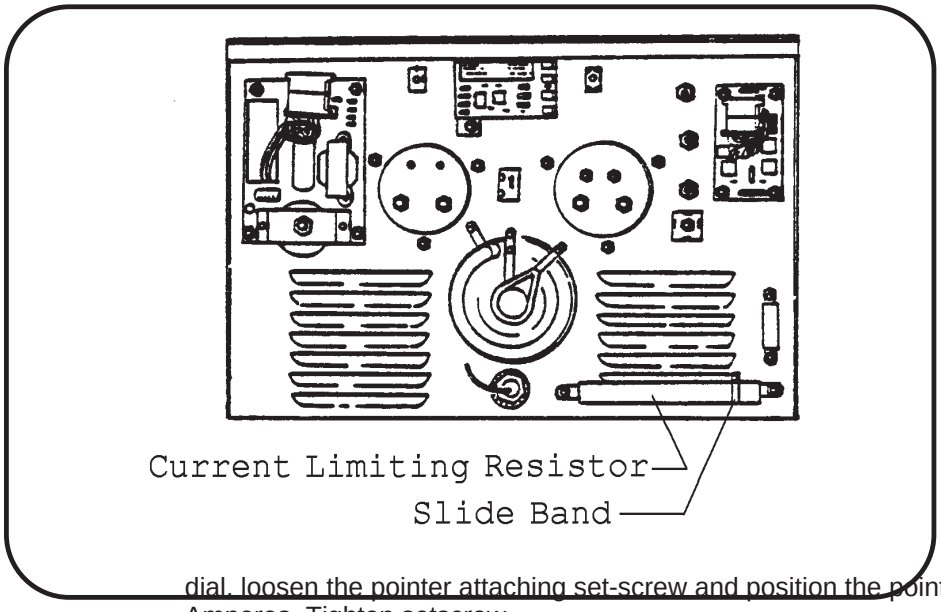
controllable from 700 to 1500 Amperes.



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

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 set-screw and position the pointer to indicate exactly 1000 Amperes. Tighten setscrew.



Current-Limiting Range Adjustment
Figure 9

Section 4. Troubleshooting Procedures

1. General

The Troubleshooting Chart, beginning on Page 7, 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. Assemblies which lend themselves to this concept are:

- Electric governor control box
- Electric governor actuator
- Voltage regulator PC board
- Generator control PC board
- Memory and Time Delay PC board
- Over-Underfrequency PC board
- Overload PC boards
- Over-Undervoltage PC board

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	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	Trips at 100 volts after 7 seconds.
Overfrequency	Trips at any value between 420-Hz and 480-Hz after a 5-second time delay. Trips immediately at any frequency exceeding 480-Hz.
Underfrequency	Trips at 380 Hz or less after a 7-second time delay. Trips immediately at any frequency exceeding 480-Hz.
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, or 3447 to 6205 millibars).*	
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 OFF or SHUTDOWN 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 governor controller and actuator.

(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

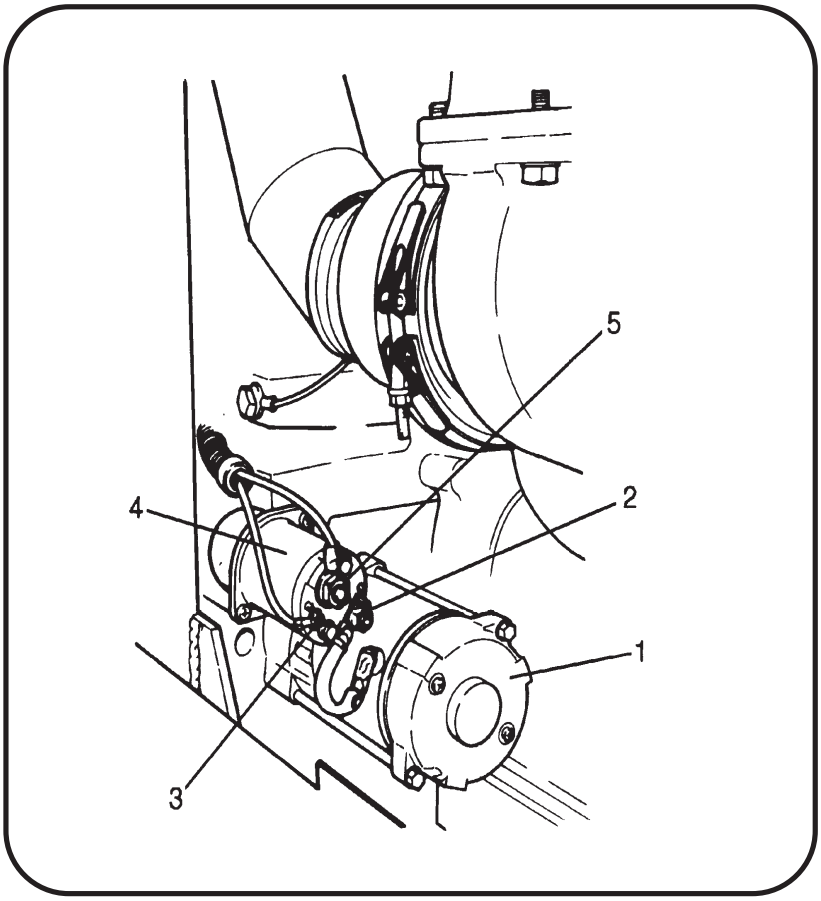
When troubleshooting the engine, keep these requirements in mind.

8. Illustrations

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

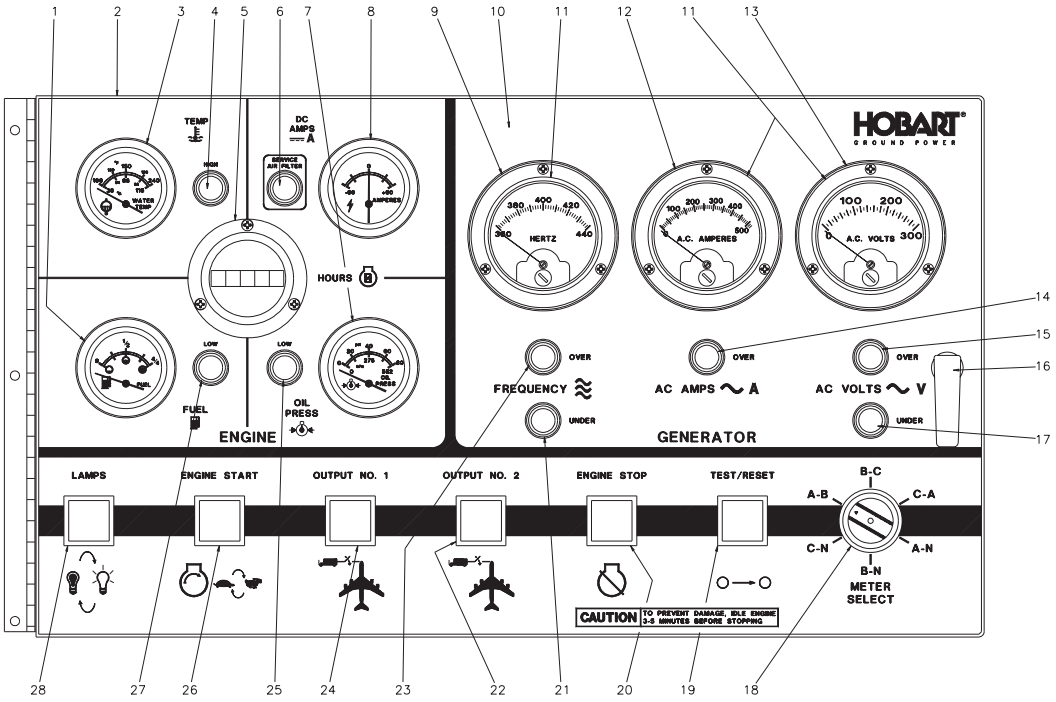
9. Connection and Schematic Diagrams

All connection and schematic diagrams for generator, engine, lights, and all controls are located in Chapter 5.



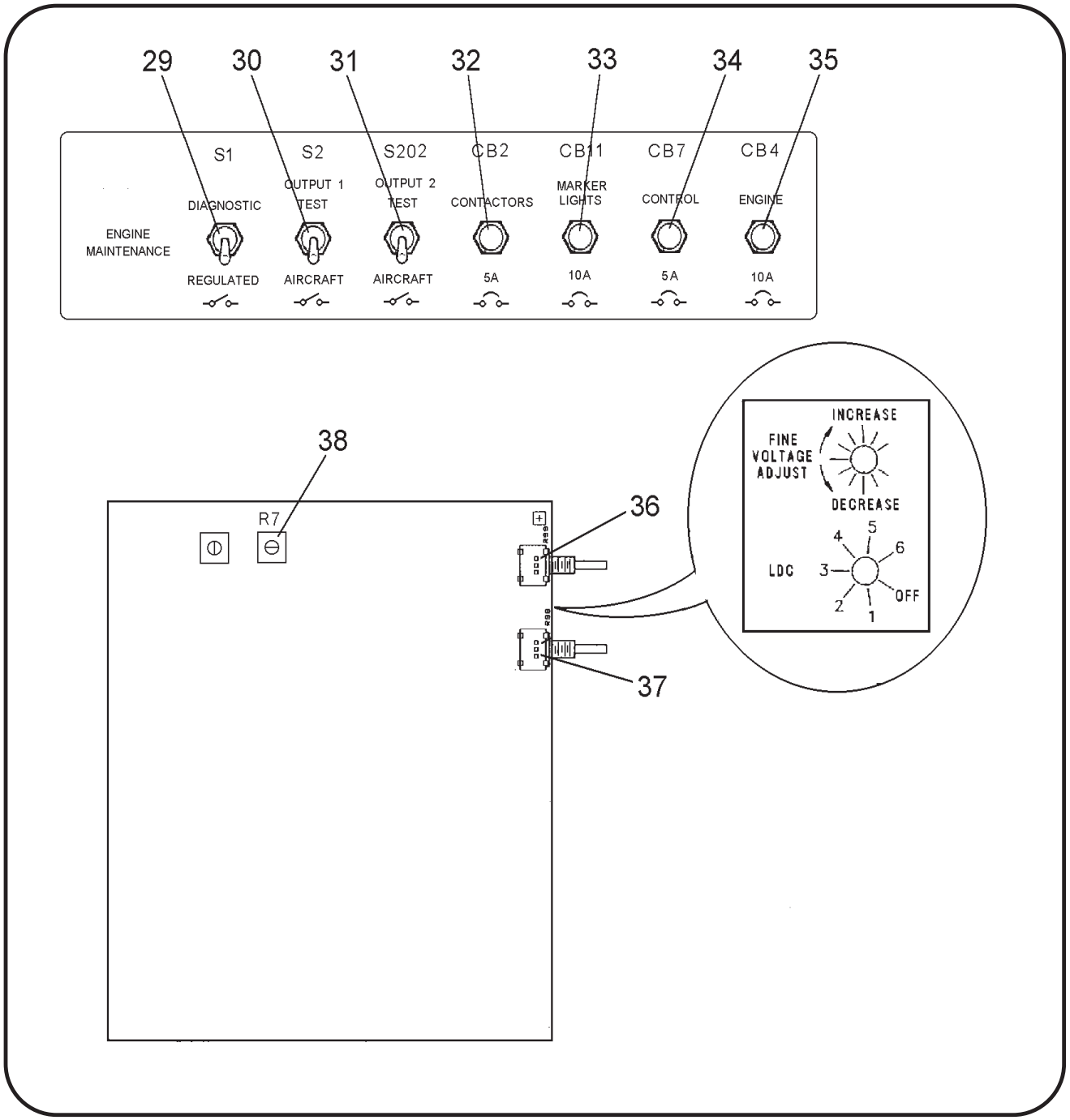
1. Starter
2. Starter Terminal
3. Switch to starter terminal
4. Starter solenoid
5. Solenoid switch input terminal

Starter and Solenoid Switch
(Front View)
Figure 1



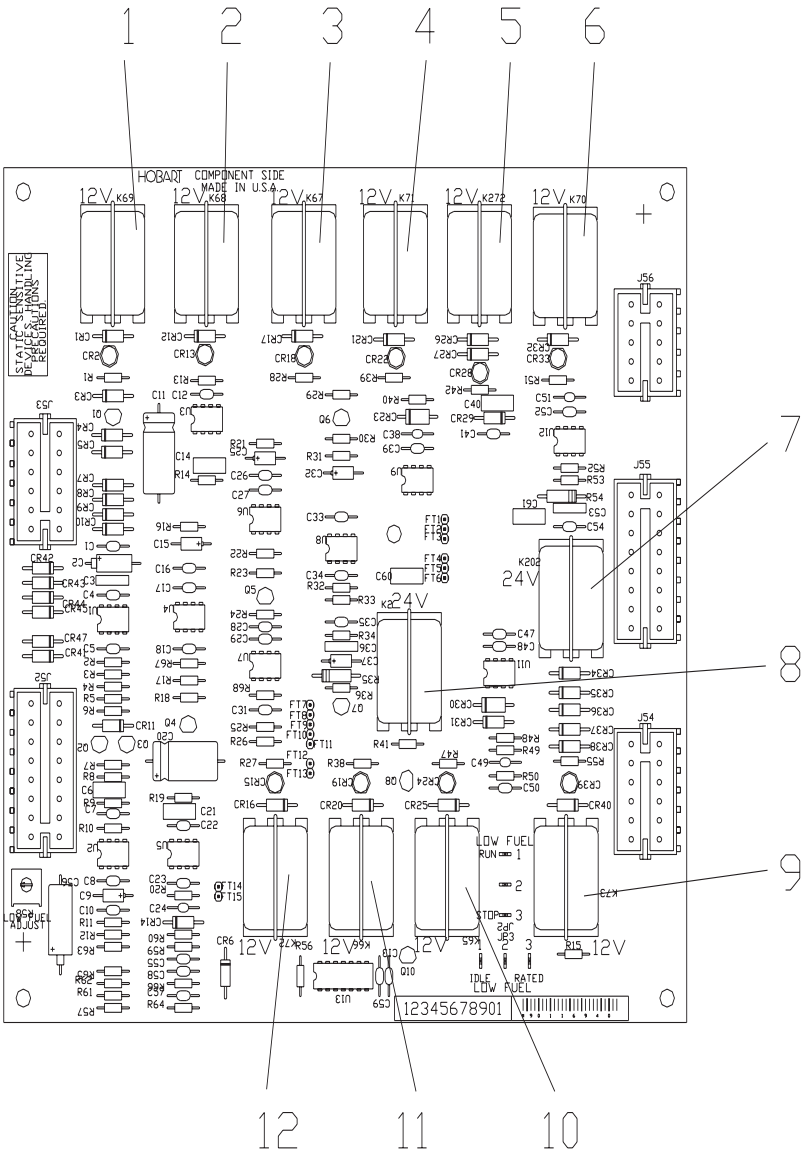
1. Fuel gage
2. Front panel
3. Engine coolant temperature meter
4. Overtemperature indicator light (red)
5. Engine hour meter
6. Indicating light, air cleaner restriction (red)
7. Oil pressure gage
8. Engine ammeter
9. Frequency meter
10. Control box label
11. Strip lights (3)
12. Generator ammeter
13. Voltmeter
14. Overload indicator light (red)
15. Overvoltage indicator light (red)
16. Adjustable grip latch
17. Undervoltage indicator light (red)
18. Meter selector switch
19. Test-reset switch
20. Engine stop switch
21. Underfrequency indicator light (red)
22. No. 2 contactor switch
23. Overfrequency indicator light (red)
24. No. 1 contactor switch
25. Low oil pressure indicator light (red)
26. Engine start switch
27. Low fuel indicator light (red)
28. Panel light switch

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



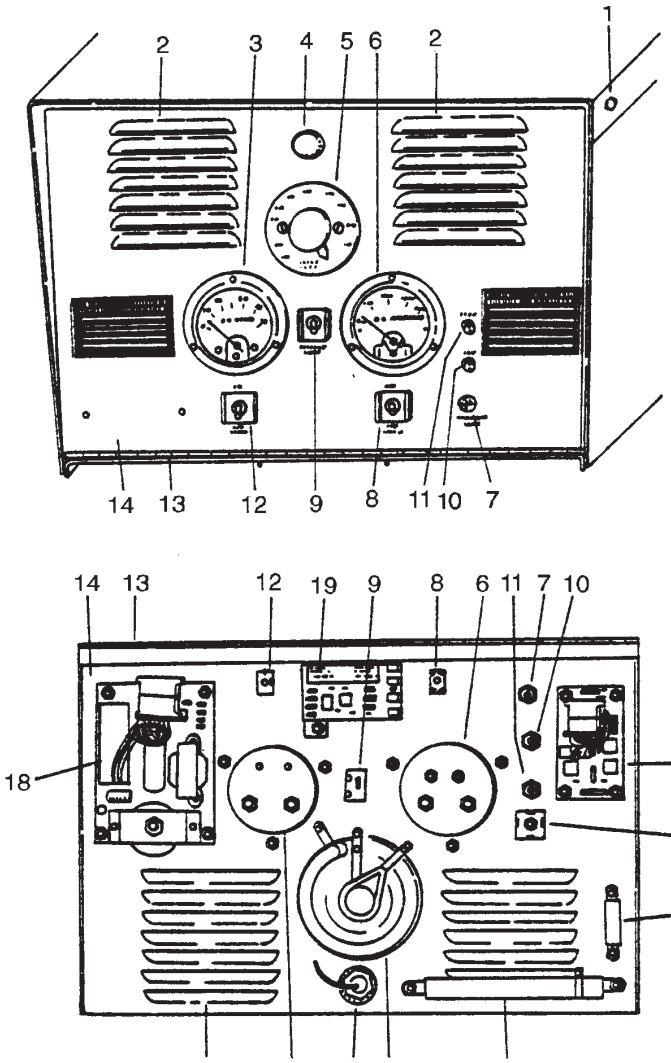
29. Regulated-diagnostic switch
30. Test bank-aircraft switch, No. 1 output
31. Test bank-aircraft switch, No. 2 output
32. Contactors circuit breaker (5-amp)
33. Marker lights circuit breaker (10-amp)
34. Control circuit breaker (5-amp)
35. Engine circuit breaker (10-amp)
36. Output voltage adjustment (fine)
37. Line drop compensation adjustment
38. Output voltage adjustment (coarse)

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



1. Master relay (K69)
2. Idle-excitation relay (K68)
3. Overtemperature fault relay (K67)
4. Low oil pressure fault relay (K71)
5. No. 2 contactor control relay (K272)
6. Panel and clearance lights relay (K70)
7. No. 2 plug-interlock relay (K202)
8. No. 1 plug-interlock relay (K2)
9. Bypass relay (K73)
10. Low fuel fault relay (K65)
11. Air filter fault relay (K66)
12. No. 1 contactor control relay (K72)

Generator Control PC Board
(Located inside control box on left wall)
Figure 3



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

28.5-V DC Transformer-Rectifier Control Panel Assembly

Figure 4

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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. Electrical defect in starter.	Momentarily connect a large capacity jumper cable (No. 1/0 minimum) between hot side of starter solenoid and starter input terminal. If starter does not crank engine, proceed to step **c.** If starter does crank engine, proceed to step **e.**
	c. Mechanical defect in starter.	Remove starter motor from engine and apply 12-V DC to test it. If it doesn't operate, it is defective. Replace it. If starter motor does operate, proceed to step **d**.
	d. Internal seizure.	If battery and starter are good and starter is unable to crank engine, internal seizure is indicated. Attempt to hand crank engine with a 3/4 inch square drive on a long flex handle on crankshaft pulley. If engine cannot be turned one complete revolution, internal siezure is indicated. Remove engine and disassemble to locate problem.
	e. Defective starter solenoid.	Momentarily connect a large capacity jumper cable (No. 1/0 minimum) between the auxiliary solenoid terminals (one on each side). If engine does not crank, replace starter solenoid. If engine cranks, proceed to step **f** below.
	f. Defective auxiliary starter solenoid.	Momentarily jumper small lug on front of auxiliary solenoid to ground. If engine does not crank, replace auxiliary starter solenoid. If engine cranks, proceed to step **g** below.

Engine Controls

Trouble, Symptom and Condition		Probable Cause	Test, Check, And/or Remedy
	Engine will not start. Starter will NOT crank engine. (continued)	**g.** Either of two defective relays on the generator control PC board (Fig. 3) could cause this trouble: either master relay K69 (1, Fig. 3) or bypass relay K73 (9, Fig. 3) . Or the PC board itself could have developed a malfunction.	Press lamps switch. If clearance lights do not come on, replace relay K69.with a relay known to be good, and attempt to crank the engine. If engine still won't crank, replace bypass relay K73 and try once more to crank the engine. If engine still won't crank, proceed to step **h** below.
		h. Defective engine start switch, S24 (26, Fig. 3) .	Depress switch and check continuity between switch contacts. If no continuity exists, replace switch. If there is continuity, replace generator control PC board.
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.
3.	Engine WILL NOT start. Cranking speed normal. LOW OIL indicating lamp on after 5 seconds.	**a.** Fuel shut-off valve closed	Make certain valve is OPEN.
		b. No fuel or insufficient fuel in tank. LOW FUEL indicating lamp comes ON 10 seconds after cranking is initiated.	Fill fuel tank if it is empty or if amount of fuel in it is low. If necessary, fill each filter with fuel oil and prime fuel pump according to instructions in Chapter 2-1. If engine will not start after priming, mechanical pump trouble is indicated. If engine starts and stops after a short time, trouble between fuel source and suction side of pump is indicated. Check and/or remedy as follows.

Engine Controls

Trouble, Symptom and Condition	Probable Cause	Test, Check, And/or Remedy
Engine WILL NOT start. Cranking speed normal. LOW OIL indicating lamp on after 5 seconds. (continued)	**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 unit may be functioning to prevent any signal from reaching the actuator. To check the magnetic pickup for 500033-1, refer to diagram 284029. To check magnetic pickup for 500033-2, refer to diagram 286137 sheets 1 and 6. To check magnetic pickup for 500033A-1, refer to diagram 286698. Use these diagrams to disconnect pickup input leads at terminals 10 and 11 on controller. Connect a high impedance AC voltmeter to 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 two actuator input leads (terminals 4 and 5 on terminal strip). Actuator lever should move immediately to full speed position. If lever does not move, replace actuator.
	e. Faulty controller	Connect a DC voltmeter to terminals 4 and 5 on the controller terminal strip. Crank engine. Voltmeter should indicate within two (2) volts of system voltage. If not, replace controller.
	f. Loose connections, damaged hoses or fuel lines between tank and fuel pump	Tighten all fittings and connections. Replace any damaged hoses or fuel links.
	g. Plugged or defective filter	Do not overlook possibility of restricted flow through fuel filters. Also check gaskets for leaking or damaged condition.

	Trouble, Symptom and Condition	Probable Cause	Test, Check, And/or Remedy
	Engine WILL NOT start. Cranking speed normal. LOW OIL indicating lamp on after 5 seconds. (continued)	**h.** Faulty fuel pump.	Replace fuel pump if defective.
4.	Engine cranks, but will not start. LOW OIL indicating lamp comes on immediately.	**a.** Either of two relays, the bypass relay, K73 (9, Fig. 3), or the low oil pressure fault relay, K71 (4, Fig. 3), or the engine control PC board could be defective.	Attempt to correct this malfunction by replacing, in sequence, each of these relays and the PC board. Replace the component found to be defective.
5.	Engine cranks, but will not start. LOW FUEL indicating lamp comes on immediately.	**a.** Either the low fuel fault relay, K65 (10, Fig. 3), or the engine control PC board is defective.	Attempt to correct this malfunction by replacing low fuel fault relay, K65. If this does not correct the malfunction, replace the engine control PC board.
		b. Defective or misadjusted magnetic pickup (Chapter 2-3, Fig.5).	The control unit may not be receiving a signal from magnetic pickup and "fail-safe" feature of unit may be functioning to prevent any signal from reaching actuator. To check magnetic pickup for 500033-1, refer to diagram 284029. To check magnetic pickup for 500033-2, refer to diagram 286137 sheets 1 and 6. To check magnetic pickup for 500033A-1, refer to diagram 286698. Use these diagrams to disconnect pickup input leads at terminals 10 & 11 on controller. Connect a high impedance AC voltmeter to pickup output leads. Open engine circuit breaker and crank engine, but do not 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 isproperly adjusted and voltage is still zero, replace pickup.
		c. Defective actuator	Remove input leads from terminals 4 and 5 on the controller terminal strip. Apply 12-V DC across these input leads. 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
6. Engine cranks, but will not start. HIGH TEMPERATURE indicating lamp comes ON immediately.	**a.** Defective or incorrectly wired high temperature switch (S49, located on engine block on 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 wires and check resistance between terminals C and N.O. A resistance of less than 10 ohms indicates a defective switch. Replace switch if defective.
	b. Defective overtemperature fault relay, K67 (3, Fig. 3) or engine control PC board.	Attempt to correct this malfunction by replacing overtemperature fault relay (K67). If this does not correct the malfunction, replace the engine control PC board.
7. Engine is HARD to start. Cranking speed normal, fuel supply adequate.	**a.** Low compression, which may be caused by any one of 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 Cummins Operation and Maintenance Manual. Overhaul engine to make repairs as necessary.
8. Engine starts. Stops after a few seconds by automatic shutdown.	**a.** The shut-down circuit may have functioned normally to stop engine because of low lubricating oil pressure or due to a defective oil pressure switch (S46, located on engine block on right side).	Restart engine, and observe oil pressure gage. If oil pressure is 12 psi or more, disconnect wire from oil pressure switch terminal N.C. Restart engine. If engine continues to run, oil pressure switch is defective. Replace oil pressure switch. If engine stops, check for following malfunctions:
	b. Failure of fault relays on the generator control PC board can cause this malfunction: The low oil pressure relay, K71, (4, Fig. 3), or the PC board itself could have developed a malfunction.	In search of this malfunction, replace, in sequence, the low oil pressure fault relay, and the generator control PC board itself.

Engine Controls

Trouble, Symptom and Condition	Probable Cause	Test, Check, And/or Remedy
9. All panel and clearance lights are either always ON or always OFF.	**a.** Marker lights circuit breaker ,CB11 (33, Fig. 2) won't close	Replace marker lights circuit breaker (CB11) if defective.
	b. Clearance/panel lights relay, K70 (6, Fig 3) could be defective, or the PC board itself could have developed a malfunction.	Replace relay K70 in attempt to make the lights function correctly. If replacement of this relay doesn't correct the malfunction, replace the generator control PC board.
10. Engine will not come "up" to governed speed in GEN mode.	**a.** Governor linkage binding or governor throttle sticking	Check governor linkage and throttle shaft for binding and sticking. Repair as required.
	b. 12-V DC power not reaching governor control box due to defective engine start switch (26, Fig. 2)	Apply 12-V DC directly to terminal 6 on governor control box. If engine comes-up to speed, check following:
	c. Idle-excitation relay (K68) (2, Fig 3) could be defective or the PC board itself could have developed a malfunction.	Replace relay K68 and attempt again to bring unit up to rated speed. If replacement of this relay doesn't correct the malfunction, replace the generator control PC board.
11. Engine, when at rated speed, does not return to idle speed.	**a.** Idle-excitation relay, K68 (2, Fig 3), or the generator control PC board itself, could be defective	Replace relay K68 and attempt again to bring unit up to rated speed and back to idle speed. If fault remains, replace the PC board.
12. Engine either goes from rated speed to idle speed, or shuts down.	**a.** Low fuel relay, K65 (10, Fig. 3), or the generator control PC board itself, could be defective.	Replace relay K65 and restart unit. If fault remains, replace the PC board.
13. 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 (2400 RPM, 400-Hz) is attained. If engine still goes to overspeed, proceed to Step **B**.

Engine Controls

Trouble, Symptom and Condition	Probable Cause	Test, Check, And/or Remedy
Engine goes to overspeed when control switch (28, Fig. 2) is in GEN mode.	**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.
14. Engine is unsteady, (surges) under load	**a.** Fault in engine	Before condemning governor system for surging, make certain fault is not in 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.
	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)
15. 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.

Engine Controls

Trouble, Symptom and Condition	Probable Cause	Test, Check, And/or Remedy
16. 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.
17. Engine lacks power	**a.** Improper engine adjustments and gear train timing	“Tune-up” 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.** Idle-excitation relay (K68) (2, Fig 3), or the generator control PC board itself, could be defective. A defect in this circuitry can prevent power from reaching voltage regulator	Replace relay K68, bring unit up to rated speed. Proper voltage should now be generated. If not, replace generator control PC board, and recheck voltage. If this doesn't correct the problem, proceed to Step **b**
	b. Defective generator or excitation circuit.	Place REGULATED/ DIAGNOSTIC switch (29,Fig. 2) in DIAGNOSTIC position. This applies 12-V DC from battery to exciter field, which should produce an indicated output voltage of 100 +/- 20- V AC line-to-neutral. If voltage produced is within this range, generator is good, and trouble is in voltage regulator circuit. Proceed to step B.
	c. Defective voltage regulator	Disconnect rectangular plug connector of regulator wiring assembly from suspect PC board, and connect a properly working PC board to regulator wiring assembly, while avoiding short circuiting bottom of properly working PC board to installed PC board. Then start generator set and perform tests and adjustments according to instructions in Section 2-3. If generator set works properly with properly working PC board temporarily connected, shut off generator set and replace defective PC board with one that is properly working (preferably, same PC board used for this troubleshooting check).
	d. Defective REGULATED/ DIAGNOSTIC switch (29, Fig. 2)	Check switch thoroughly. A defective switch may prevent current reaching and/or leaving voltage regulator. Replace switch 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 (continued).	**e.** 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 and Connection Diagrams in Chapter 5). If generator will NOT produce at least 80 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 output No. 1 switch (24, Fig. 2) is held in CLOSE position. Generator running at normal voltage. Rectifier circuit breaker CB2 (32, Fig. 2) closed. No fault lights on.	**a.** Defective circuit breaker CB2 (32, Fig. 2)	Remove terminal leads from circuit breaker, press circuit breaker button to close circuit breaker, and use an ohmmeter to check for continuity. Replace circuit breaker if defective.
	b. In addition to defective wiring and connections in AC and DC load contactor actuating circuits, load contactor may be prevented from closing for any one of following reasons:	Check all wiring and connections in load contactor circuits. Then check components as follows:
	c. Defective (open) relay in memory and time delay PC board (1-1; 4, Fig. 7)	Replace memory and time delay PC board with a board known to be operating properly. If contactor still doesn't close, proceed to step (d).
	d. Defective output No. 1 switch (S75) (24 Fig. 2)	Check AC voltage input to contactor rectifier CR6 (1-1: 6, Fig.10). If voltage isn't approxi mately 115-V AC, output No. 1 switch is defective and must be replaced.

No. 1 Load Contactor Operating Circuit

	Trouble, Symptom and Condition	Probable Cause	Test, Check, And/or Remedy
	Load contactor (K1) will not close when output No. 1 switch (24, Fig. 2) is held in CLOSE position. Generator running at normal voltage. Rectifier circuit breaker (CB2) (32, Fig. 2) closed. No fault lights on (continued).	**e.** Defective rectifier (CR6) (1-1: 6, Fig.10)	After making certain that output No. 1 switch (S75) is providing 115-V AC to 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) (5, Fig. 10)	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 complete load contactor.
2.	Load contactor (K1) will close when output No. 1 switch (24, Fig. 2) is held in CLOSE position. Opens immediately when switch is released.	**a.** No. 1 plug interlock relay (K2) (8, Fig. 3) on generator control PC board could be defective	Place test bank/aircraft switch, No. 1 output (S2) (30, Fig. 2) in TEST BANK position. If load contactor will now remain closed, replace plug interlock relay, K2. If not, proceed to step **b.**
		b. No. 1 load contactor relay (K72) (12, Fig. 3) on generator control PC board, or the board itself, could be defective	Replace relay K72 and again close contactor. If contactor still opens, replace generator control PC board. If this doesn't correct the problem, proceed to step **c.**
		c. 28.5-V DC is not reaching No. 1 plug interlock relay (K2) from aircraft for following reasons:	Proceed as follows to find the cause of this malfunction.
		d. 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 plug is fully mated with aircraft receptacle connector and making good contact.
		e. Aircraft rejecting power.	Check aircraft on-board electrical equipment and controls.

No. 1 Load Contactor Operating Circuit

Trouble, Symptom and Condition	Probable Cause	Test, Check, And/or Remedy
Load contactor (K1) will close when No. 1 power accepted switch (24, Fig. 2) is held in CLOSE position. Opens immediately when switch is released to center ON position (continued).	**f.** Defective contacts in N.O. auxiliary switch mounted on right side of contactor.	Connect a jumper lead between terminals of N.O. auxiliary switch. If load contactor will now remain closed, replace N.O. auxiliary switch or complete load contactor.
	g. Defective No. 1 output hold circuit resistor (R46) (1-1; 4, Fig. 10) .	Connect a 100-ohm resistor across R46. If contactor will now remain closed, replace No. 1 output hold circuit resistor (R46). If not, replace contactor.
3. Load contactor opens during power delivery. NO fault indicating lights on.	**a.** No. 1 load contactor relay (K72) (12, Fig. 3) on generator control PC board, or the PC board itself, could be defective	Replace relay K72 and again close contactor. If contactor still opens, try replacing the PC board to correct this malfunction. Proceed with trouble-shooting as follows if malfunction is not corrected.
	b. A fault has developed in load contactor holding circuit.	If load contactor cannot be closed by operation of output No. 1 switch (S75) (24, 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 (S75) 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 (22, Fig. 2) is held in CLOSE position. Generator running at normal voltage. Rectifier circuit breaker (CB2) (12, Fig. 2) closed. No fault lights on.	**a.** Defective rectifier circuit breaker (CB2) (32, Fig. 2)	Remove terminal leads from circuit breaker, press circuit breaker button to close circuit breaker, and use an ohmmeter to check for continuity. Replace circuit breaker if defective.
	b. In addition to defective wiring and connections in AC and DC load contactor actuating circuits, load contactor may be prevented from closing for any one of following reasons:	Check all wiring and connections in load contactor circuits. then check components as follows:
	c. Defective (open) relay in memory and time delay PC board (1-1; 4 Fig. 7)	Replace memory and time delay PC board with a board known to be operating properly. If contactor still doesn't close, proceed to step **(d)**.
	d. Defective output No. 2 switch (S275) (22, Fig. 2)	Check AC voltage input to contactor rectifier CR206 (1-1:7, Fig. 10). If voltage isn't approximately 115-V AC, contactor output No. 2 switch is defective and must be replaced.
	e. Defective rectifier (CR206) (1-1; 7, Fig. 10)	After making certain that output No. 2 switch (S275) is providing 115-V AC to 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; 8 Fig. 10)	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 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 output switch (22, Fig. 2) is held in CLOSE position. Opens immediately when switch is released.	**a.** No. 2 plug interlock relay K202 (7, Fig. 3) on generator control PC board or the board itself, could be defective	Place test bank/aircraft switch, No. 2 output (S202) (31, Fig. 2) in TEST BANK position. If load contactor will now remain closed, replace plug interlock relay K202. If not proceed to step **b**.
	b. No. 2 load contactor relay K272 (5, Fig. 3) on generator control PC board defective.	Replace relay K272 and again close contactor. If contactor still opens, replace generator control PC board. If this doesn't correct the problem, proceed to step **c.**
	c. 28.5-V DC is not reaching No. 2 plug interlock relay (K202) from aircraft for following reasons:	Proceed as follows to find cause of this malfunction.
	d. 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 plug is fully mated with aircraft receptacle connector and making good contact.
	e. Aircraft rejecting power.	Check aircraft on-board electrical equipment and controls.
	f. Defective contacts in N.O. auxiliary switch mounted on right side of contactor.	Connect a jumper lead between terminals of N.O. auxiliary switch. If load contactor will now remain closed, replace N.O. auxiliary switch or complete load contactor.
	g. Defective No. 2 output hold circuit resistor (R246) (1-1; 9, Fig. 10) .	Connect a 100-ohm resistor across R46. If contactor will now remain closed, replace No. 1 output hold circuit resistor (R46). If not, replace contactor.

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.** No. 2 load contactor relay (K272) (5, Fig. 3) on generator control PC board, or the PC board itself, could be defective	Replace relay K272 and again close contactor. If contactor still opens, try replacing the PC board to correct this malfunction. Proceed with trouble-shooting as follows if malfunction is not corrected.
	b. A fault has developed in load contactor holding circuit.	If load contactor cannot be closed by operation of output No. 2 switch (S275) (22, 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 (S275) 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: protective relays and protective monitor are not completely functional until load contactor is CLOSED. Since it is not advisable to vary voltages for test purposes while delivering power to an aircraft, generator should be connected to a load bank for trouble shooting protective circuits. To avoid repetition, it will be assumed that reset switch (19, Fig. 2) has been pushed and load contactor has been closed before commencing each test.		
1. Load contactor opens during power delivery. Overvoltage indicating light ON.	**a.** Overvoltage condition may have been result of a sudden drop in load, or possible tampering with voltage regulator potentiometer (38, Fig. 2), and may have been a normal action.	Press reset switch (19, Fig. 2) and resume power delivery. Observe voltmeter (13, Fig. 2) to be certain voltage is normal 115 V-AC. Adjust to normal if necessary. If load contactor is opened again and an over-voltage condition is indicated by OV indicating light, proceed to step b.

Protective Circuit

	Trouble, Symptom and Condition	Probable Cause	Test, Check, And/or Remedy
	Load contactor opens during power delivery. Overvoltage indicating light ON.	**b.** Defective over-under-voltage PC board (K26) (1-1; 6, Fig. 7)	Use voltage adjusting potentiometer (38, Fig. 2) to reduce voltage to 110 V AC. Observe voltmeter and gradually increase voltage with potentiometer. If sensing circuit in over-undervoltage PC board (K26) functions to open load contactor at any value less than 125-VAC, it is defective. Replace over- undervoltage PC board.
2.	Load contactor opens during power delivery. Undervoltage indicating light ON.	**a.** An undervoltage condition has caused sensing circuit in 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 (38, Fig. 2). Resume normal operation. If 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 (38, Fig. 1) to reduce voltage to 95-V. Undervoltage indicating light should NOT come on during a time delay of 4 to 12 seconds. If light comes on before a delay of 4 to 12 seconds, undervoltage relay is defective. Replace over-undervoltage PC board (K26).
		c. Defective memory and time delay (protective monitor) PC board (K14)(4, Fig. 7).	With unit running normally, use potentiometer (38, Fig. 2) to reduce voltage quickly to 90 V. If undervoltage indicating light (DS38) on control panel is turned ON immediately, 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).

Protective Circuit

Trouble, Symptom and Condition	Probable Cause	Test, Check, And/or Remedy
4. Load contactor opens during power delivery. Overfrequency indicating light (DS40) ON.	**a.** Electric governor system malfunctioning	Check and adjust or repair in accordance with governor system information listed in this chapter under ENGINE AND CONTROLS.
	b. Defective over-under-frequency PC board (K27)(1-1; 5, Fig. 7).	If over-underfrequency tripping continues after governor system is proven to be good, and an overfrequency condition does not exist, replace over-under frequency PC board(K27)
5. Load contactor opens during power delivery. Under-frequency 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 underfrequency tripping continues after governor system is proven to be good, and an underfrequency condition does not exist, replace over-underfrequency PC board.
6. Load contactor opens during power delivery. Overload indicating light ON.	**a.** There may have been an overload condition which caused overload device (K4 for No. 1 output, or K204 for No. 2 output) to function normally.	Observe ammeter (12, Fig. 2). Check for abnormal overload condition and correct. If overload device functions to open load contactor when an overload does not exist, proceed to step B.
	b. One of resistors across an overload transformer may be open circuited. For No. 1 output, check resistors (R26, R27, and R28). For No. 2 output, check resistors (R226, R227, and R228)	An open resistor will cause a higher than normal voltage. Refer to 1-1; items 10 and 12, Fig. 10 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; 17 or 18, Fig. 10) with an overload module known to be operating properly.

Protective Circuit

Trouble, Symptom and Condition	Probable Cause	Test, Check, And/or Remedy
Load contactor opens during power delivery. Overload indicating light ON.	**d.** Faulty overload resistors in main overload circuit. Check resistors.	Replace faulty resistors - R33, R34, R35 - if any. If none of these resistors are defective, replace main overload PC board, K3 (1-1; 19, Fig. 10).

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.

Generator

Trouble, Symptom and Condition	Probable Cause	Test, Check, And/or Remedy
Unbalanced output	**a.** Defective connection in output circuit.	Check plug and receptacle connectors at aircraft. Tighten, repair, or replace as required.
	b. Break or cut in output cable assembly.	Inspect. Repair or replace as required.
	c. 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. 4) defective	Remove and inspect fuse. Replace if defective.
	c. Defective load contactor control switch (8, Fig. 4)	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. 4)	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 rectifier.
	e. Relay in overvoltage module (19, Fig. 4) 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 theromostatic switches for continuity. If the switch is open circuited, replace.

28.5-V DC Transformer-Rectifier

	Trouble, Symptom and Condition	Probable Cause	Test, Check, And/or Remedy
	Transformer-rectifier inoperative. Load contactor will NOT close.	**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.
2.	Load contactor closes normally. Opens as soon as control switch is released.	**a.** Defective control switch (8, Fig. 4)	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. 4)	Place control switch (8, Fig. 4) in center ON position and check voltage at resistor (15, Fig. 4) 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. 4) 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. 4) 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 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. 4), or linedrop current transformer defective	Apply a load of 1000A to T-R. Check input voltage at contactor. At a load of 1000A, input voltage, line-to-line, should be approx. 220-V AC. If input voltage IS that, line drop module and current transformer are OK and trouble is in main transformer and heat sink (rectifier) circuit. Proceed to step B below. If input voltage is only 200-V AC, trouble is in line-drop module and current transformer circuit. Check as follows:
	b. Line-drop current transformer defective	Use an ohmmeter to check transformer. Replace if open or short circuited.
	c. Line-drop and current-limiting module (18, Fig. 4) 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 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 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. 4) 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 overload module.	Check each resistor. Replace as required.

Chapter 3. Overhaul/Major Repair

Section 1. Table of Contents

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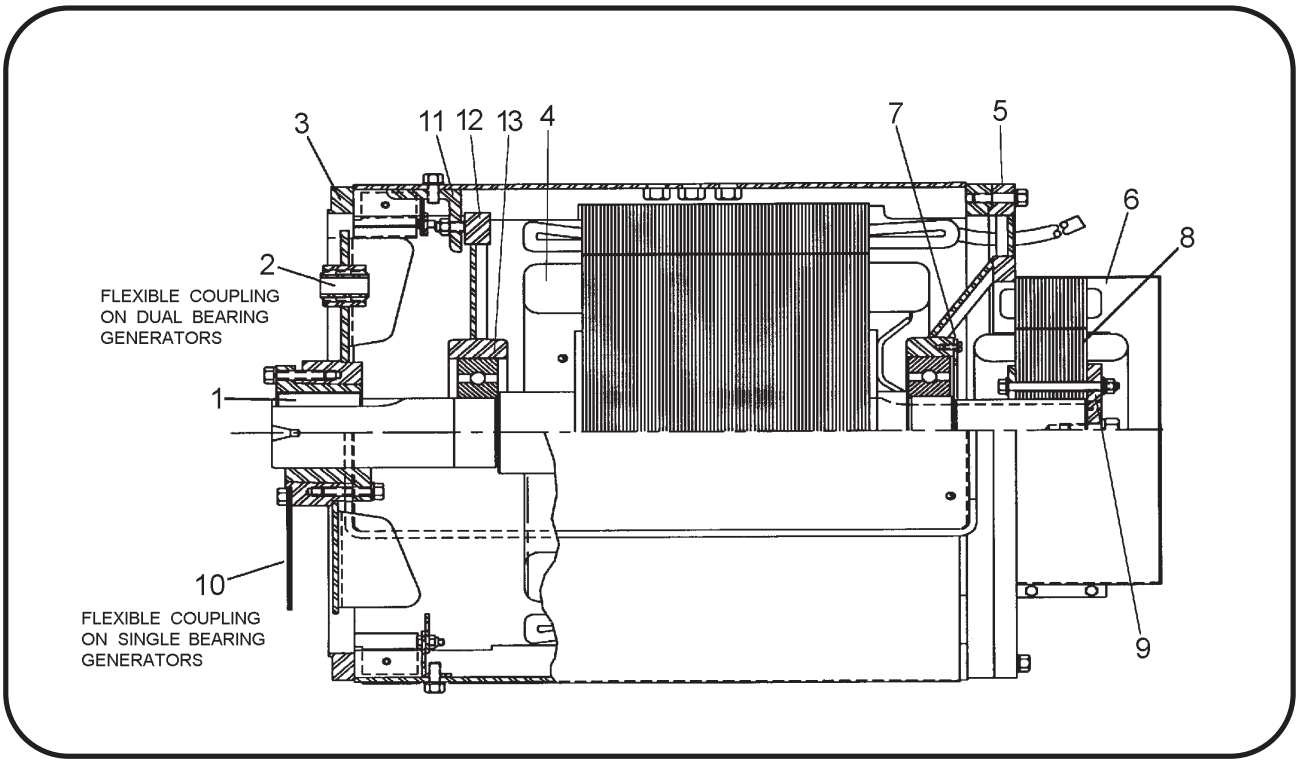
Section 2. Exciter Armature

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)
14. Front Bearing retainer

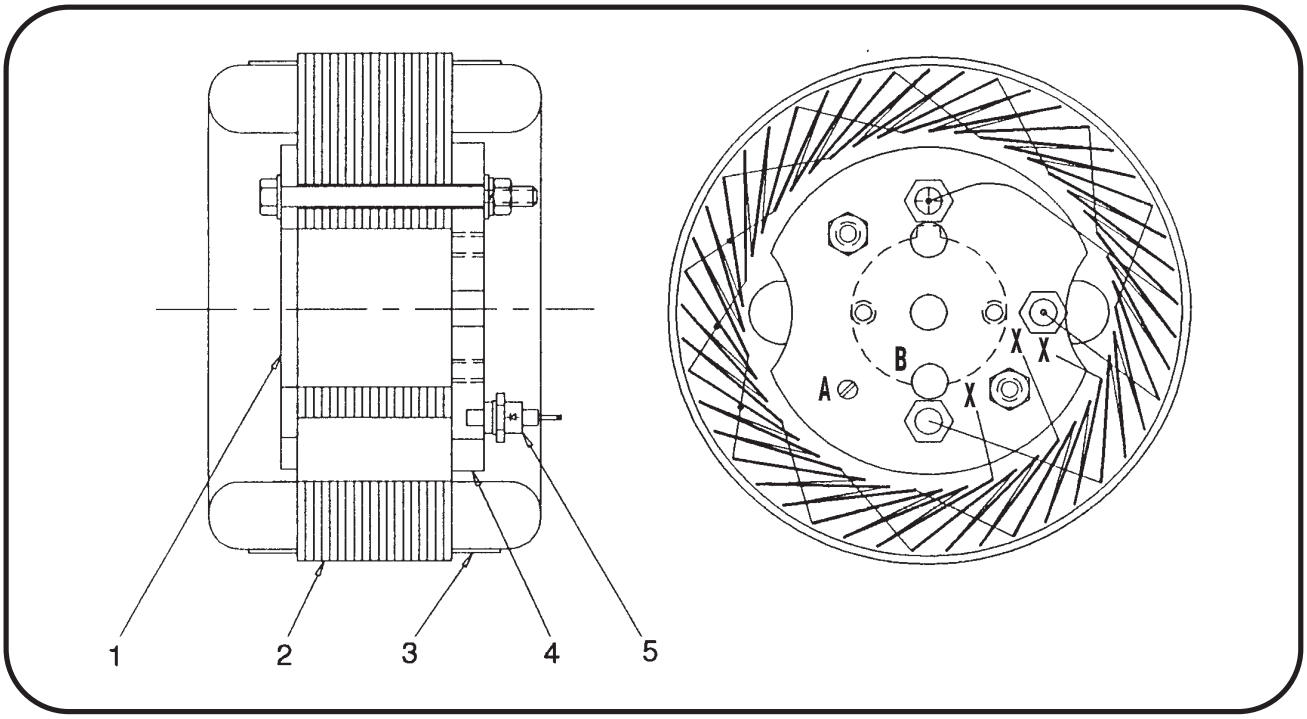
Generator (Top Half Section)
Figure 1

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

Exiter Armiture
Figure 2

3. Exciter Armature Replacement

a. General

Reasons for exciter armature removal — other than for bearing replacement — are: generator armature replacement, general overhaul, etc. But most often when the exciter armature is removed, it is for rear bearing replacement.

b. Tools for Exciter Armature Removal and Installation

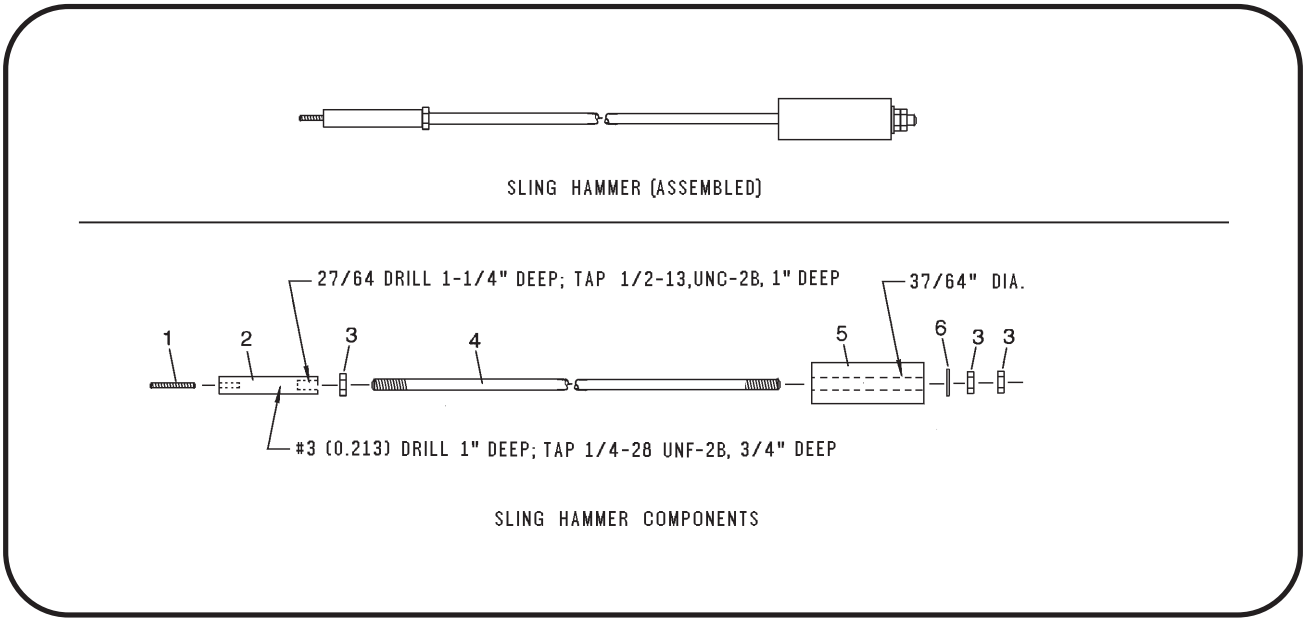
In addition to the standard mechanic's hand tools such as wrenches, etc., you will need only the following items for removing the exciter armature:

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, 4-1/2" Long
3. Nut, 1/2-13 Hex, Steel (3 Required)
4. Rod, 1/2" Round, CR Steel, 28" Long
5. Hammer, 2" Round, CR Steel, 4-1/2" Long
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. In a great majority of cases, as stated previously, 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. Both leads have ring type terminals and one is attached to the rectifier mounting plate with a screw (“A”, Fig. 2) and the other lead is attached to a lead with a ring type terminal *(which connects to the three leads “X” Fig. 2).*

(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. 3)* 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

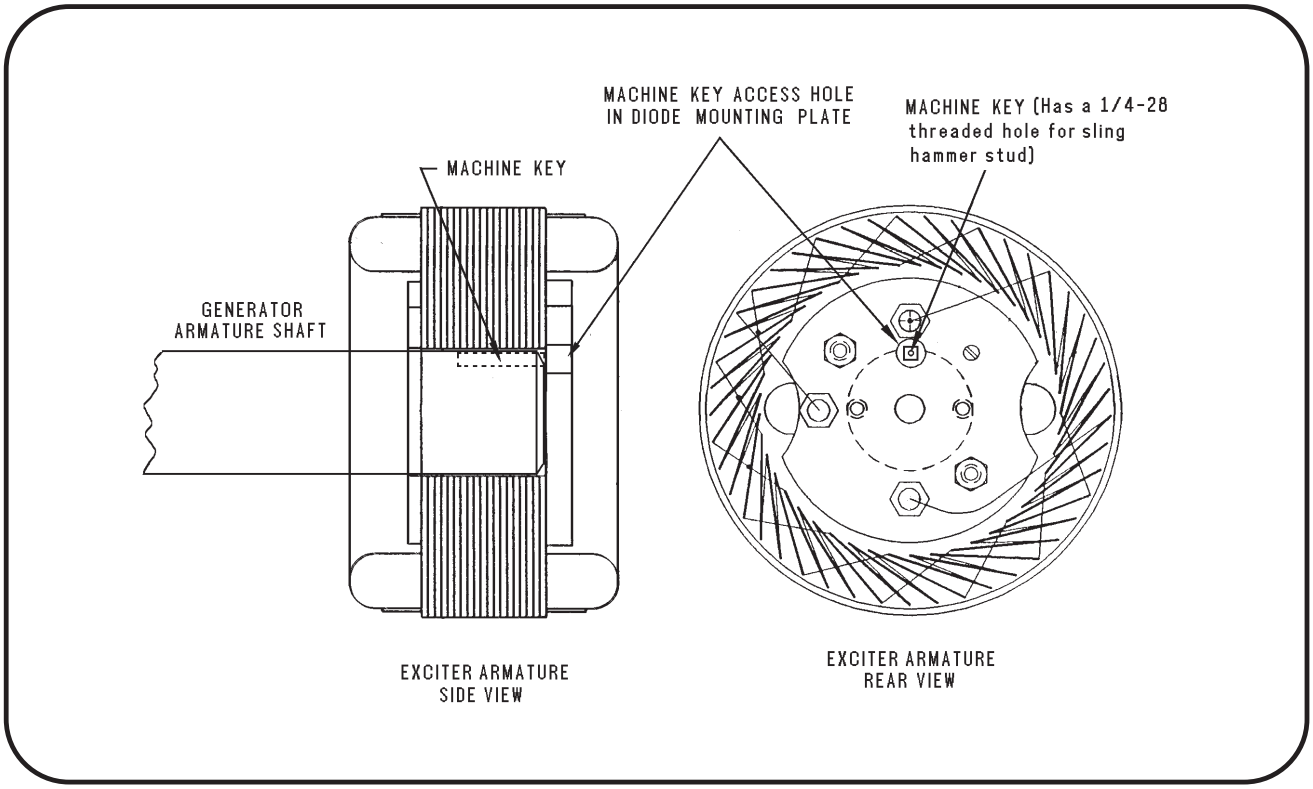
Exercise care to prevent breaking or damaging stud.

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

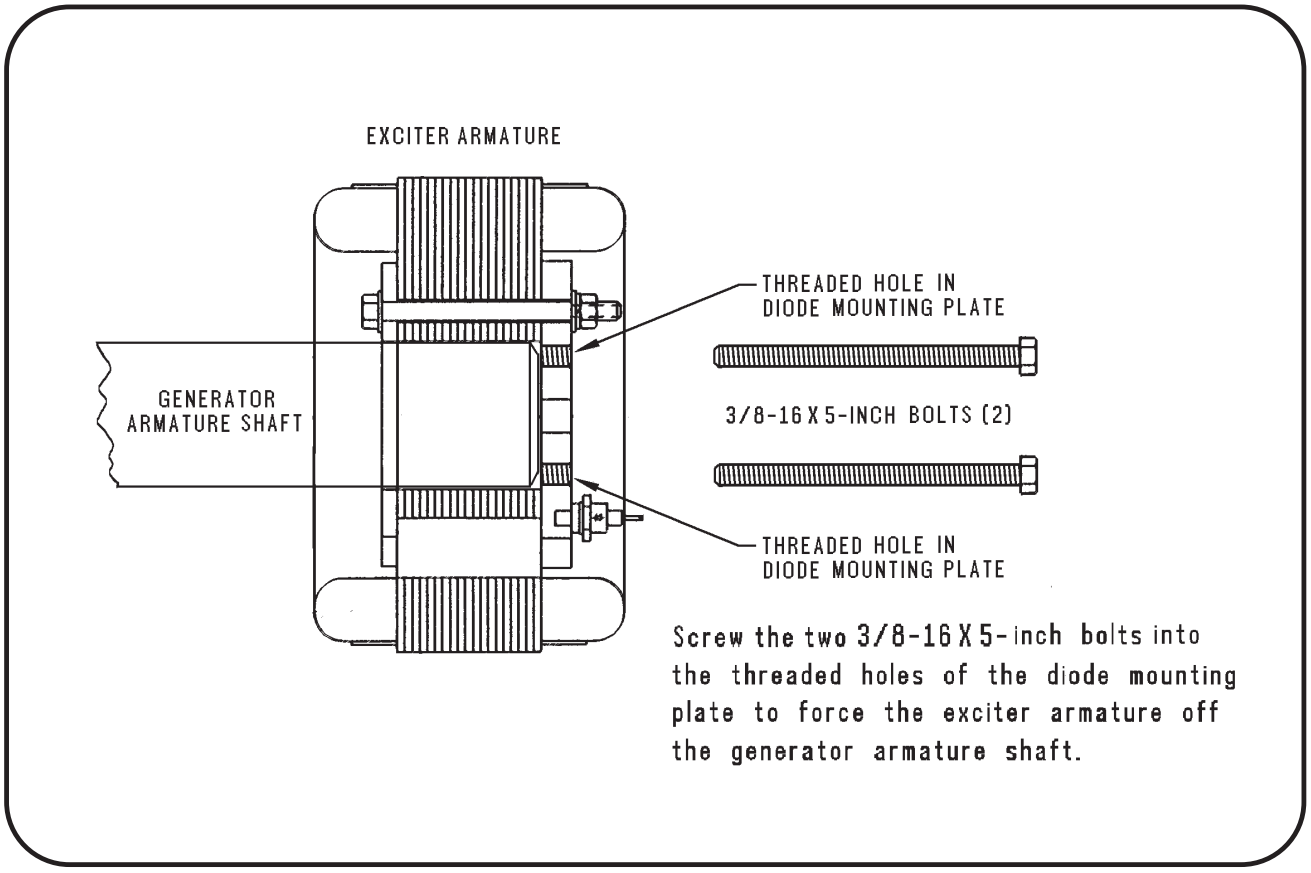
CAUTION

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 one field lead to the screw provided to the diode mounting plate (“A”, Fig. 2).

b. Connect the other field lead to the neutral ring tongue terminal (“X”, Fig. 2) of the exciter armature windings . Enclose connection with nomex insulator and secure with a conduit clamp.

(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 anti-rust products.

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

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

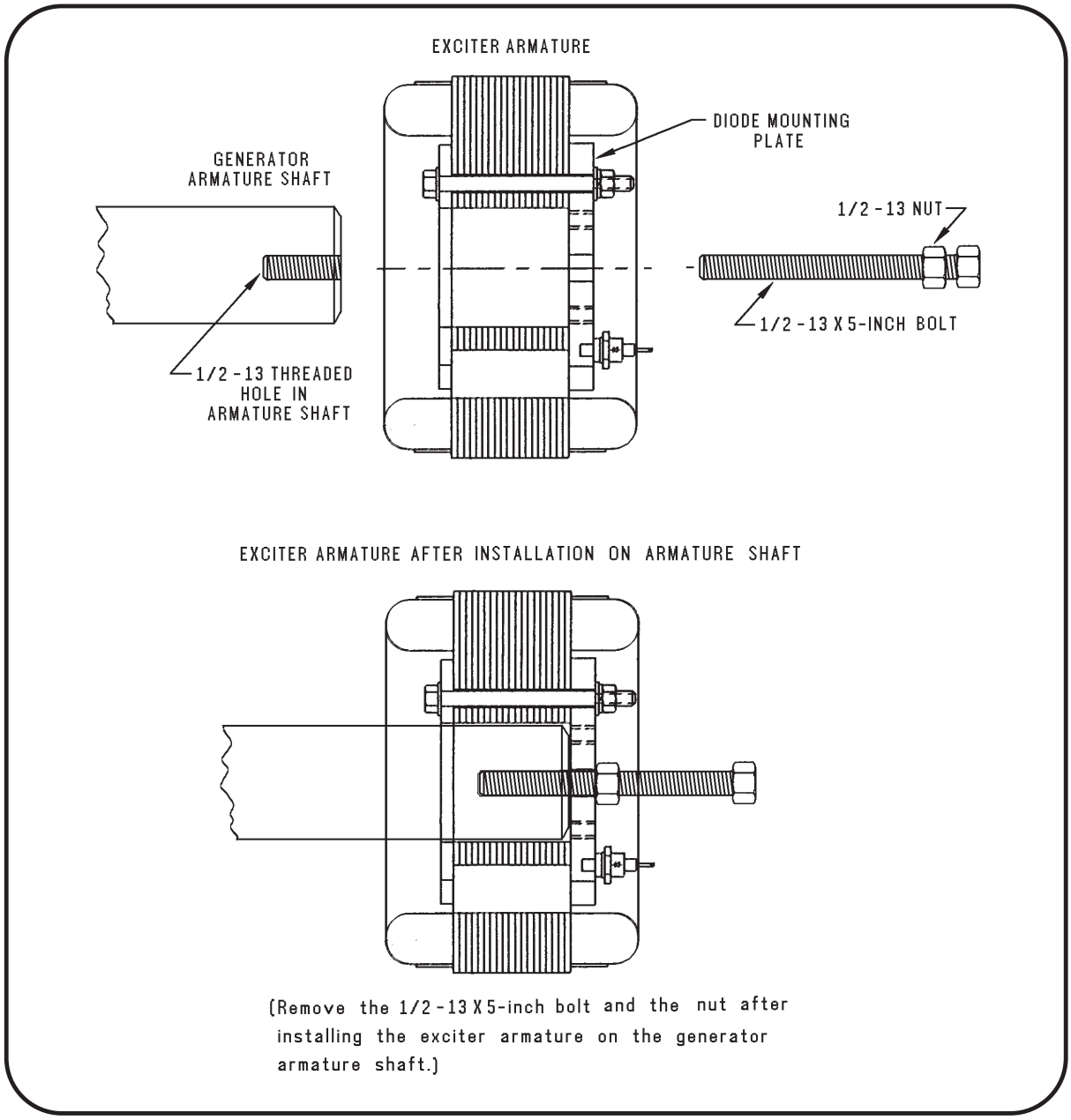
(4) Secure the exciter armature on generator shaft with the 1/2-13 cap screw.

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

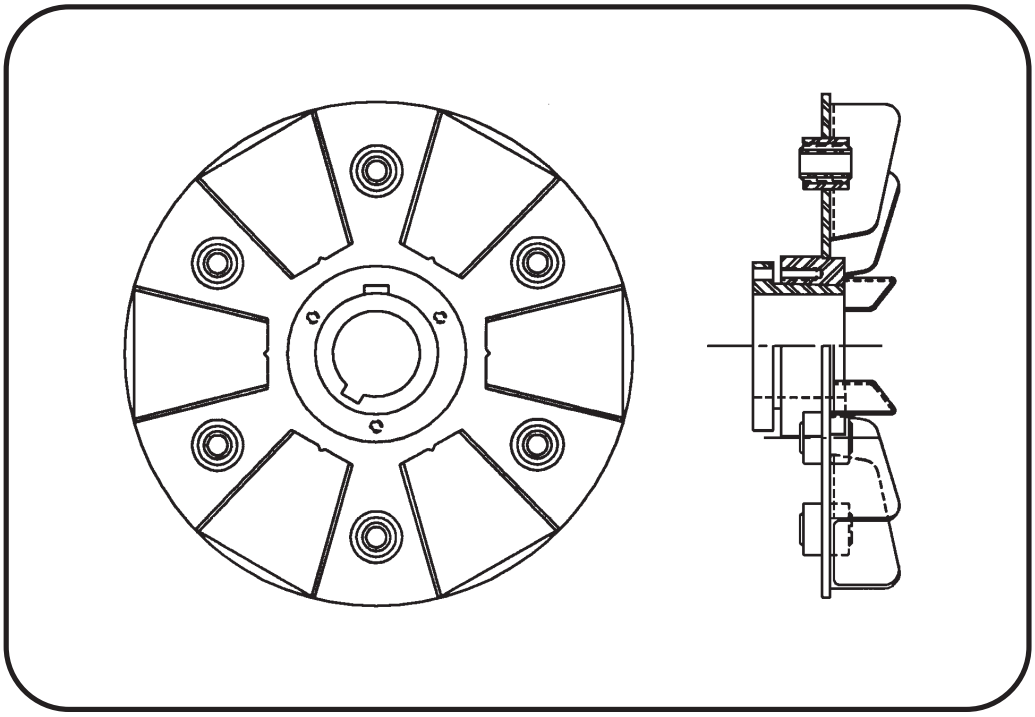


Installing the Exciter Armature
Figure 6

Section 3. 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 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 misalignment between the engine and the generator, due to manufacturing tolerances. A tapered bushing and hub secures the coupling to the generator shaft.



Coupling Assembly
Figure 1

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.

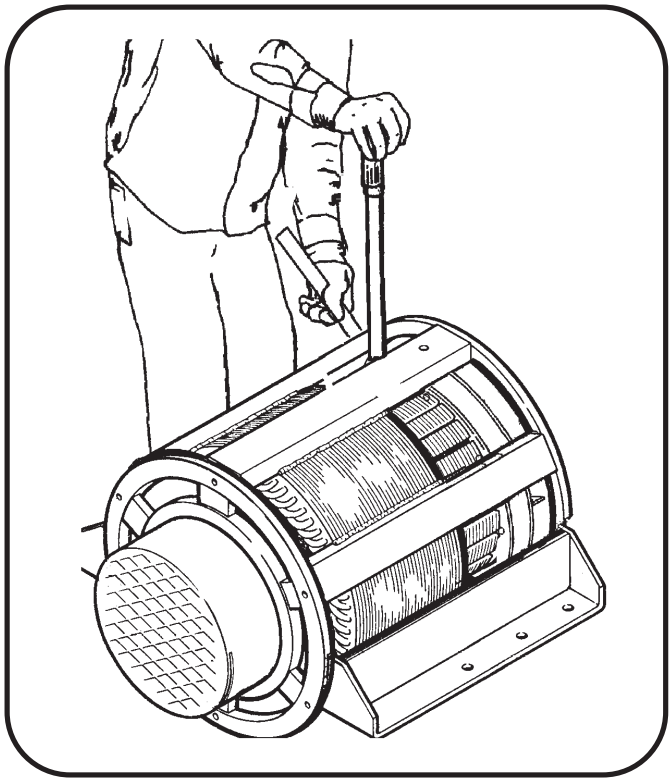
(2) Remove the fan housing cover from the generator fan housing.

(3) Refer to Figure 2. Use a 15/16-inch socket on a long-handled ratchet and remove the six 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.



Access to Coupling Bolts
(for Removal and Installation)
Figure 2

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 split-taper bushing *(2)* to the hub *(3).*

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

(3) 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 split-taper bushing. With socket wrench, screw these bolts into the bushing such that the bushing pops loose from the hub.

(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:

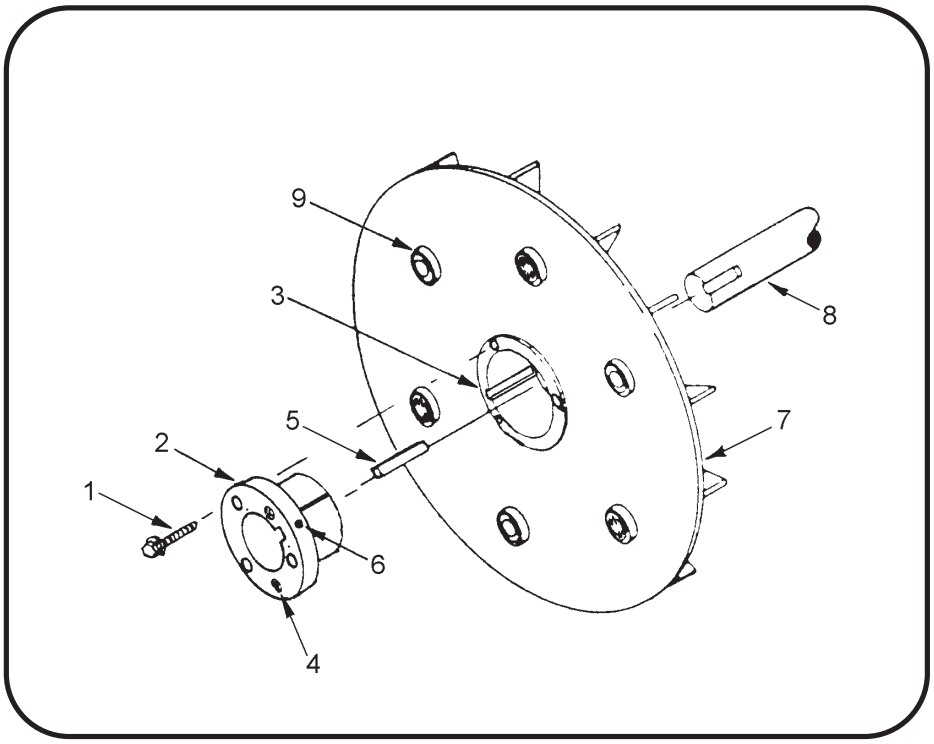
a. Check for deformed fan blades and damage to the disk.

b. Check the rubber exposed at both ends of the bushings (9) 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.

(7) Refer to Figure 7. Place a straightedge across the mounting face of the generator fan housing, and, with a ruler, measure the distance from the adaptor to the mounting face. Take and record this measurement.

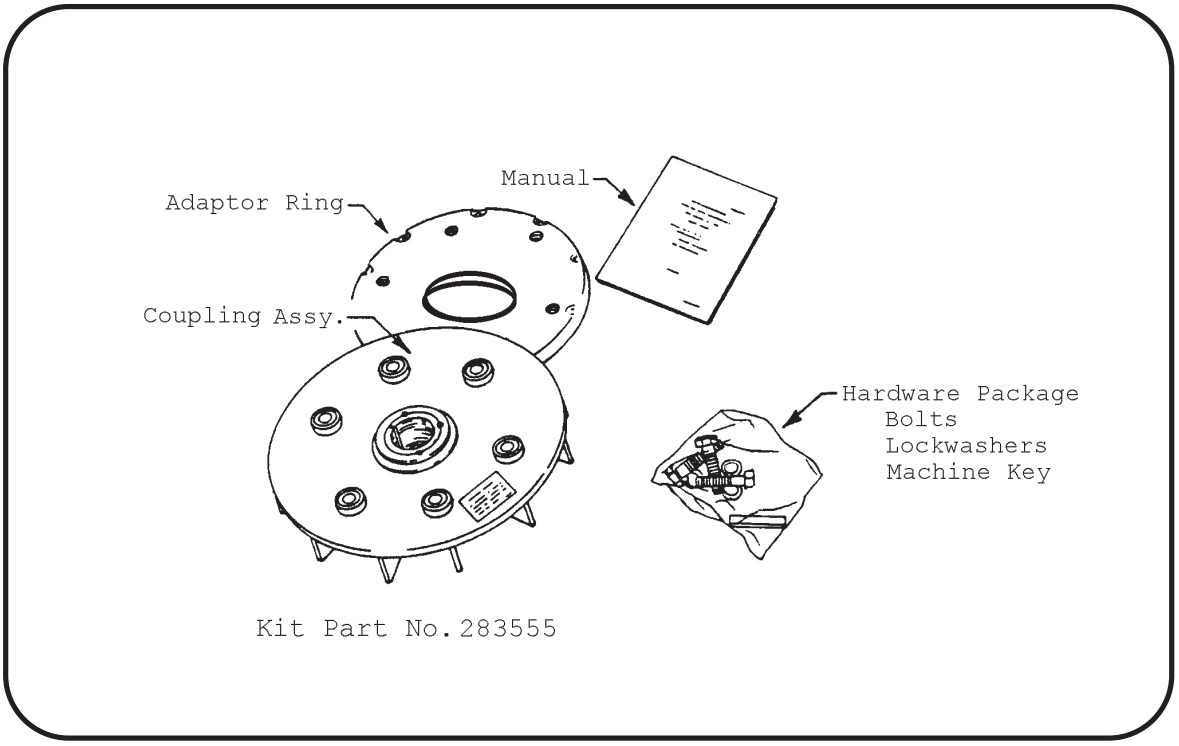


1. Bolts, 3/8-16 *(3)*
2. Bushing, split taper
3. Hub
4. Tapped holes *(2)*
5. Key
6. Set screw
7. Coupling disk
8. Armature shaft
9. Bushing, rubber *(6)*

Hub and Bushing
Figure 3

c. 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 illustrated in Figure 4



Coupling Kit
Figure 4

d. Rubber Bushing Kit

A kit is available from Hobart Brothers Company for replacing only the rubber bushings *(9, Fig. 3)* in the coupling assembly. If bushing replacement only is required, the kit part number is **480290.** Each kit contains six bushings, a container of lubrication, and installation instructions.

Bushing Replacement

To replace bushings only, proceed as follows:

(1) Press out **ALL** old bushings.

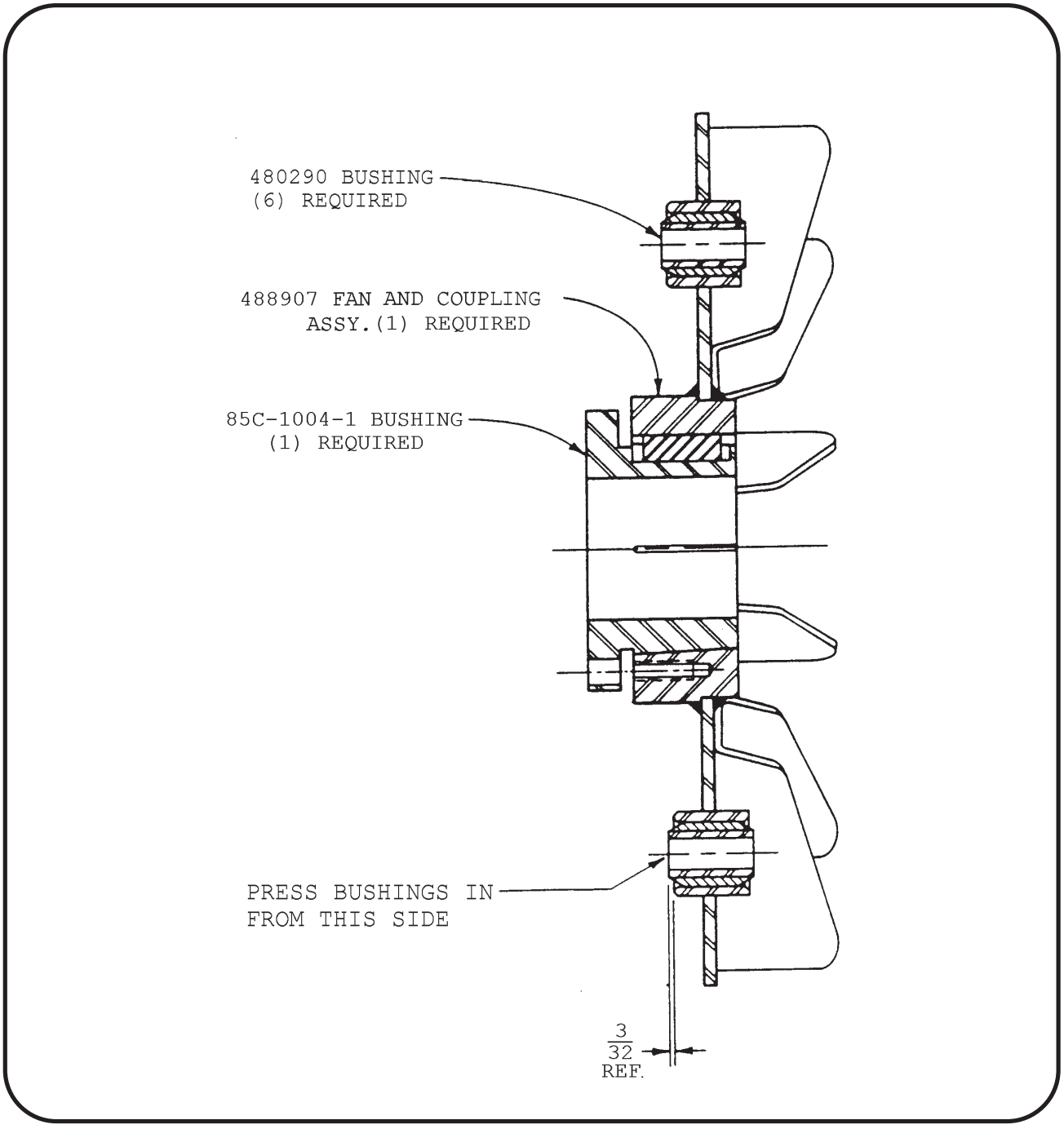
(2) Refer to Figure 5. Clean each bushing socket thoroughly, removing all traces of old rubber. **DO NOT** scratch or deform the bore of the bushing socket.

(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 six new bushings are installed.

(6) Balance the complete coupling assembly to 1/2 inch-ounce *(360 mg-m)* minimum.



Bushing Installation
Figure 5

3. Coupling Installation

CAUTION

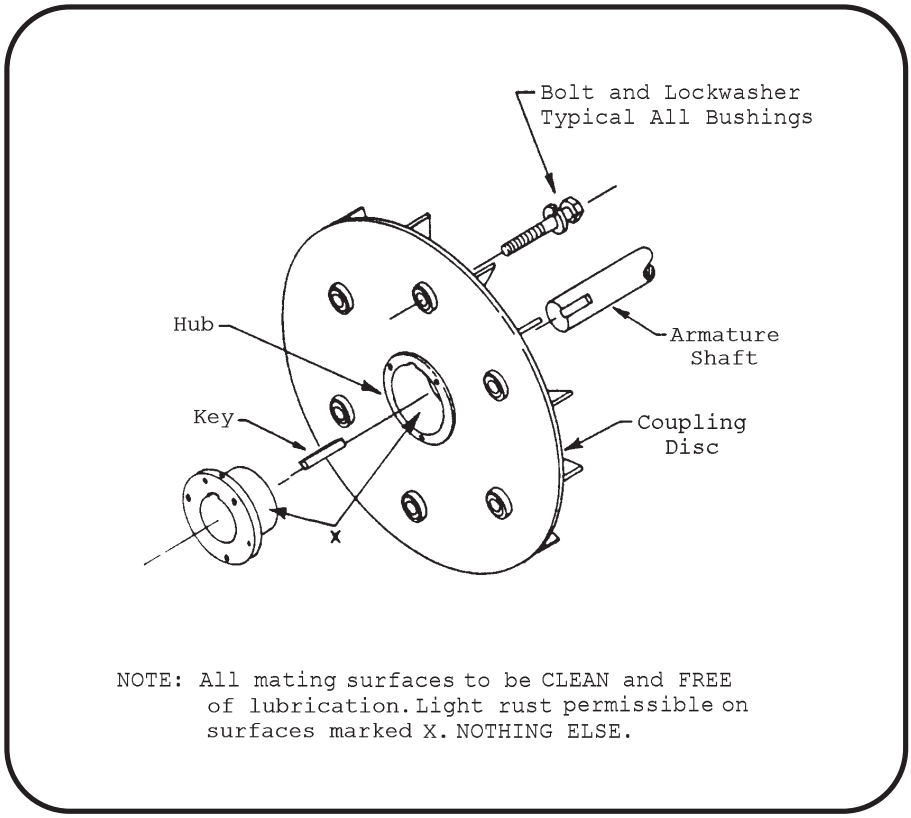
Improper installation of the coupling assembly can result in serious damage to the equipment. Follow these installation instructions exactly.

a. Cleaning

Refer to Figure 6. It is **VERY IMPORTANT** that the shaft, the bore and the outside of the split bushing, and the tapered inside of the hub be thoroughly **CLEANED FREE OF DIRT AND GRIT.**

CAUTION

Do not l any of the surfaces listed above. Lubrication of these surfaces can cause the coupling to fail and damage the generator set.



Assembly Procedure
Figure 6

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

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

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-taper bushing approximately flush with the end of the shaft.

(7) Using a 3/16-inch Allen wrench, tighten the set screw *(6)* in the split-taper bushing *(2)* to apply pressure on the key *(5).*

(8) Refer to Figure 8. 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 **2, b,** *(7).* 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. 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.

CAUTION

Remove armature block installed in para. 4.**b**.*(4)*, a. Otherwise, damage to the armature could result.

4. Reassemble Engine and Generator

CAUTION

Use of the proper coupling bolts is very important. Failure to use the proper bolts, as outlined below, can result in coupling failure and damage to the generator set.

a. 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.

WARNING

Secure the armature such that it doesn't rotate while installing bolts in the flywheel. Otherwise, serious injury to hands and fingers could result.

b. Insert the proper coupling bolts with lockwashers through the bushings from the FAN side of the coupling.

c. Insert a long piece of wood through the fan housing to block the armature against clockwise rotation.

d. 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.

e. Turn all of the coupling bolts into the tapped holes in the flywheel, finger tight. DO NOT tighten with a wrench.

f. Insert all remaining attaching bolts *(two installed in Step D, above)* **through the generator flange, engaging the tapped holes in the flywheel housing, and tighten them all securely.**

g. Refer to Figure 2. Torque all of the coupling bolts to 85 foot-pounds *(115 N-m).*

5. 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.

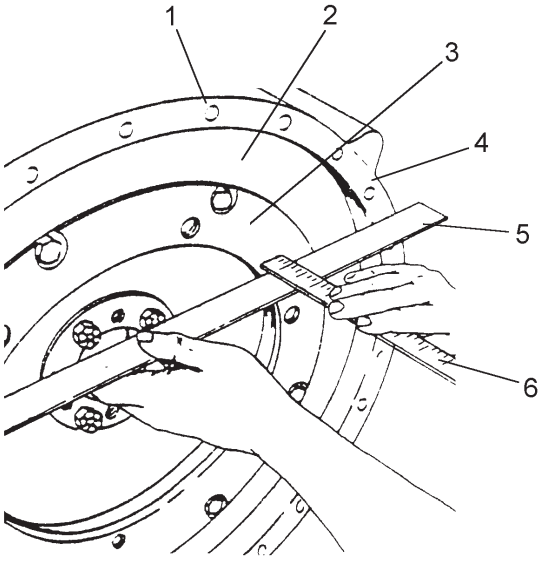
b. Shut down the engine after 2 hours and re-torque all coupling bolts to 85 foot-pounds *(115 N-m)* **to compensate for normal torque relaxation.**

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).*

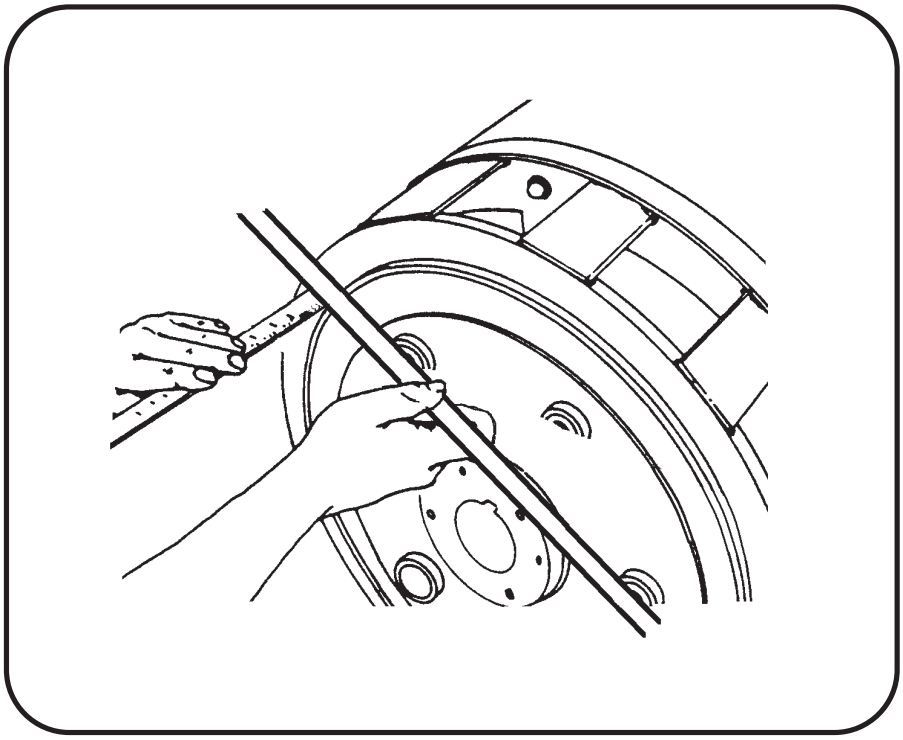
e. Return the unit to normal service.

f. After each additional 2,000 hours of operation *(or every year)* **recheck all coupling bolts to maintain the same torque value.**



1. Flywheel housing
2. Flywheel adapter
3. Adapter Ring
4. Mounting face
5. Straight Edge
6. Ruler

Measuring From Mounting Face to Adaptor Ring
Figure 7



Measuring From Mounting Face to Bushing
Figure 8

6. Coupling Service

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 Ground Power Division 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 Other Countries Call:	(513) 332-5050 (Parts) (513) 332-5060 (Service)
FAX:	(513) 332-5335 (Parts) (513) 332-5121 (Service)

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Section 4. Generator Assembly

1. General

This section provides information and instructions for removal and installation of the generator assembly used on Specification 500033-1, 500033-2, and 500033A-1 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 1000 pounds (454 kg), which is the weight of the generator assembly.

NOTE: It is helpful to use a small tray with numerous compartments for collecting the hardware (screws, nuts, washers) when removing these items from their respective assemblies. This will make reassembly easier later.

To gain access to the generator assembly, refer to Figure 1 and applicable wiring diagrams in Chapter 5 and proceed as follows:

(1) Close fuel shut-off valve on fuel tank, disconnect battery cables from battery, and disconnect clearance light cable at its connector next to the governor controller *(10)*.

(2) Remove rear canopy section *(1)*. To do this, lightly support canopy by lifting eyes with overhead hoist. Then remove the hardware *(four bolts on each side of the generator set)* that fastens canopy slide mounting plates to control box support.

NOTE: DO NOT remove the slides from the canopy slide mounting plates.

(3) Remove air cleaner *(3)* and its mounting brackets *(4)* from control box support panel *(5)*.

(4) Disconnect transformer-rectifier *(T-R)* control wire harness from option terminal strip on control box support panel.

(5) Using the overhead hoist, remove the T-R *(6)* from the generator set.

(6) (500033-1 and 500033-2) Remove cold weather starting aid *(ether start) (7)* and its mounting bracket.

(500033A-1) Remove cold weather starting aid/governor controller bracket (13) from control box support (5).

(7) Disconnect four plug connectors *(P43, P47, P48 and P53)* from rear of control box *(8)*, and disconnect wiring for any optional equipment that is connected to option terminal strip.

(8) Disconnect output cables from contactors.

(9) Disconnect stator leads and field leads from output module *(9)*.

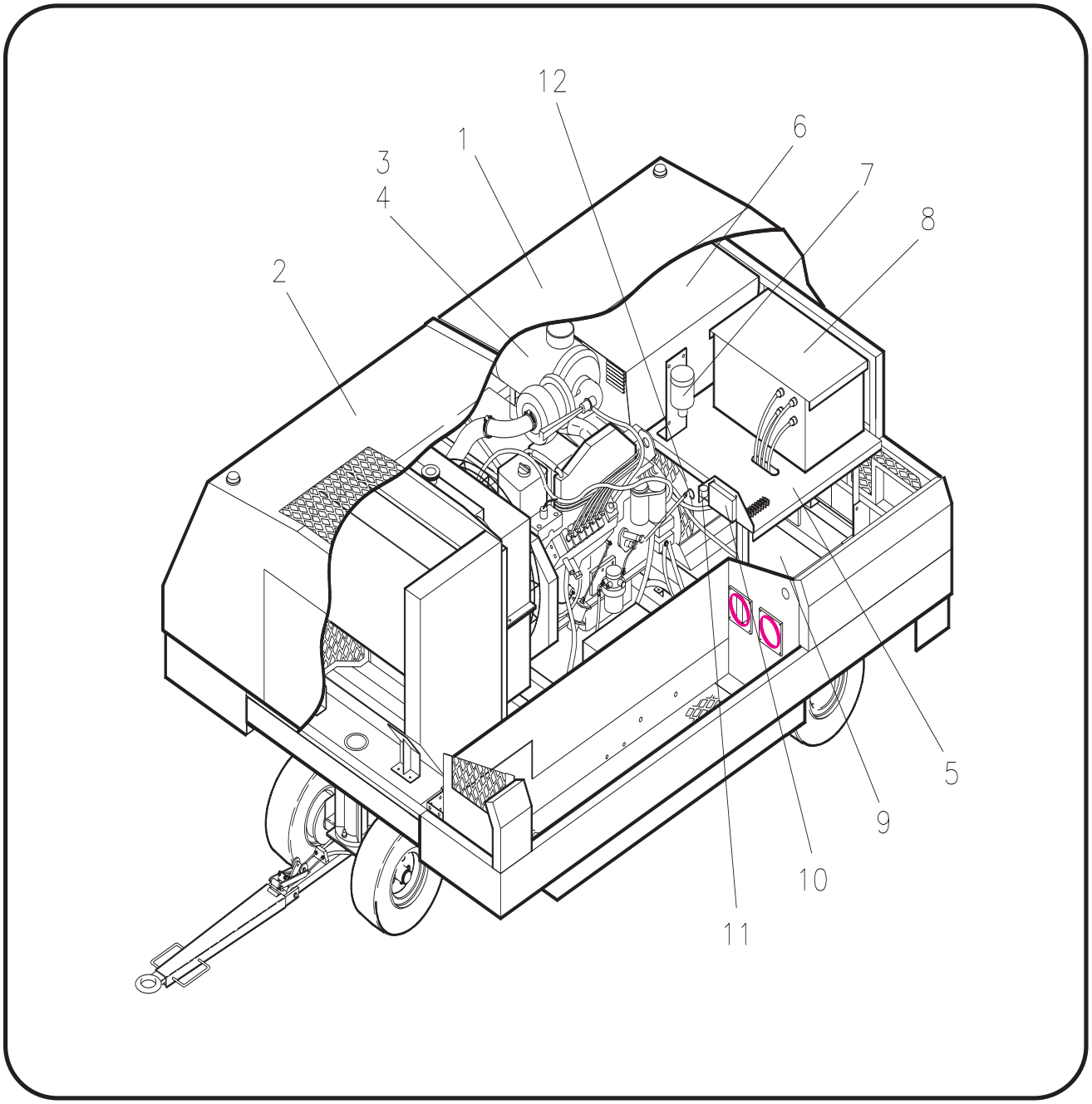
(10) Disconnect output module control cable and remove output module *(9)*.

(11) Disconnect wiring from the governor control box *(10)*.

(12) Remove starter solenoid *(11)* from control box support *(5)*.

(13) Remove control support mounting hardware, and then the support *(5)*.

(14) Remove generator wrapper *(12)*.



1. Rear canopy section
2. Front canopy section
3. Air cleaner
4. Air cleaner mounting brackets
5. Control box support
6. Transformer-Rectifier (T-R)
7. Cold weather starting aid
8. Control box
9. Output module
10. Governor control box
11. Starter solenoid
12. Generator wrapper

Assembly Removal Procedure Drawing for Access to Generator
Figure 1

(500033-1 and 500033-2 Shown)

b. Removing the Generator Assembly

(1) For lifting convenience, 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.

(2) Remove the four M16 - 2 X 90 generator mounting bolts from shock mounts on the mounting frame.

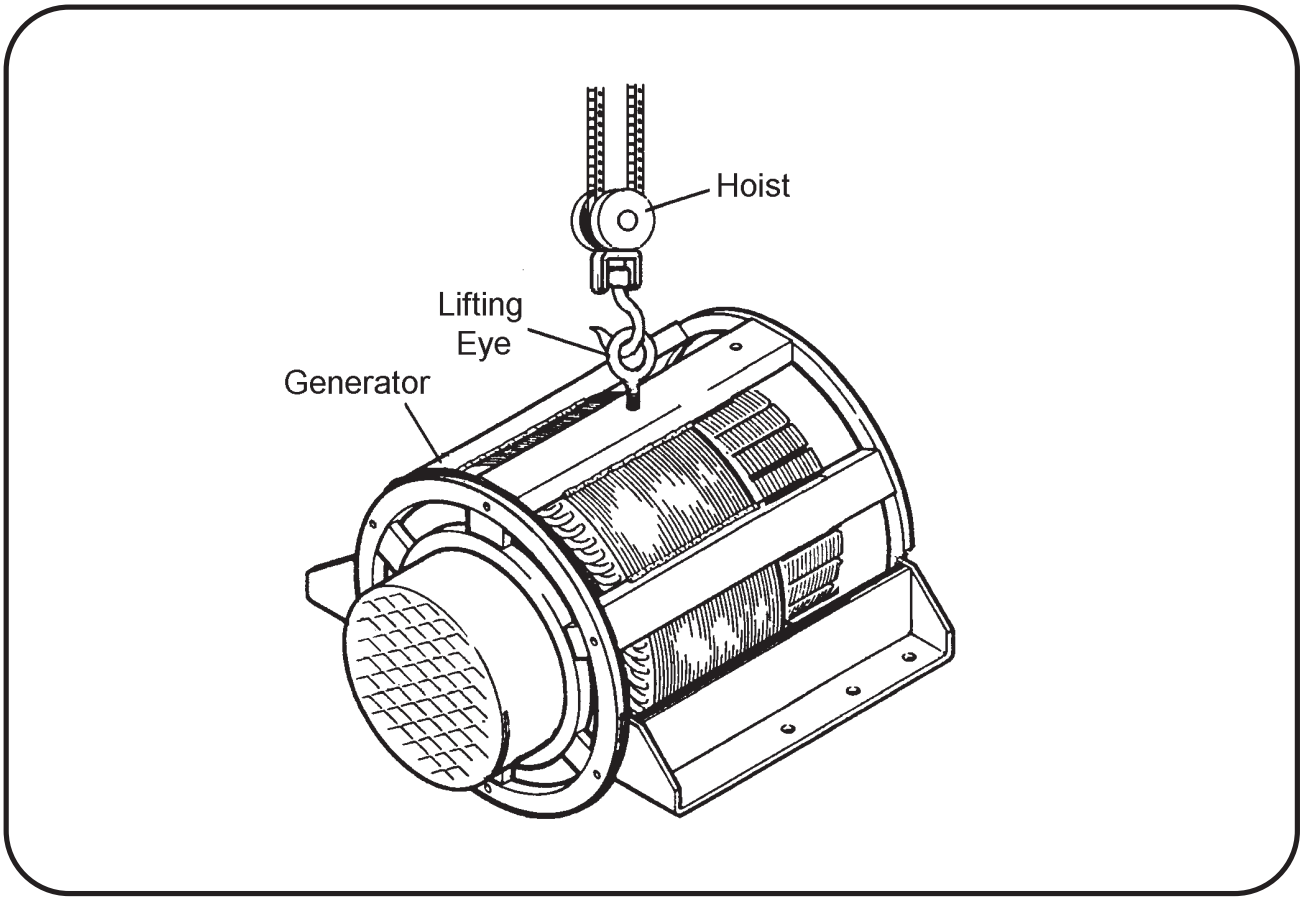
(3) Support engine flywheel housing *(at rear of engine)* with wooden blocks.

(4) Remove the eight 5/8 - 11 X 2 - 3/4 bolts that attach the generator coupling assembly *(with adaptor)* to the engine flywheel.

(5) Remove the six M10 - 1.5 X 35 bolts that attach the generator housing to the flywheel housing.

(6) Using the hoist, carefully lift and separate the generator from the engine.

For additional information on generator assembly removal, refer to Chapter 3-3, Para. 2.



Generator Lifting Arrangement
Figure 2

3. Installing a Generator Assembly

Installation of a generator assembly is essentially a reversal of procedures 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 the applicable wiring diagrams in Chapter 5 then proceed as follows:

a. Remounting the Generator Assembly

(1) Insert the 1/2 - 13 eye-bolt previously used into 1/2 - 13 threaded hole drilled in the top of the generator housing, and attach the hoist chain to the eye-bolt as shown in Figure 2.

(2) Using the hoist, carefully lift the generator and lower it into place for mounting to the engine.

(3) With the six M10 - 1.5 X 35 bolts that were previously used, attach the generator housing to the flywheel housing.

(4) With the eight 5/8 - 11 X 2 - 3/4 bolts that were previously used, attach the generator coupling assembly *(with adaptor)* to the engine flywheel.

(5) Support engine flywheel housing *(at rear of engine)* with wooden blocks.

(6) With the four M16 - 2 X 90 mounting bolts previously used, attach the generator to the shock mounts on the mounting frame.

For additional information on generator assembly remounting, refer to Chapter 3-3, Para. 5.

b. Remounting the Previously Removed Assemblies

(1) Re-install generator wrapper *(12)*.

(2) Re-install control box support *(5)*, using panel mounting hardware.

(3) Re-attach starter solenoid *(11)* to control box support.

(4) Reconnect wiring to governor control box *(10)*. (500033-1, 500033-2)

(5) Remount output module *(9)*.

(6) Connect output module control cable.

(7) Connect field leads to output module *(9)*.

(8) Connect stator leads to output module.

(9) Connect output cables to contactors.

(10) Connect any optional equipment connected to option terminal strip.

(11) Connect four plug connectors *(P43, P47, P48 and P53)* to rear of control box *(8)*.

(12) (500033-1, 500033-2) Remount cold weather starting aid *(ether start) (7)* with its mounting bracket.

(500033A-1) Remount cold weather starting aid/governor controller bracket (13) to Control Box Support (5)

(13) Using an overhead hoist, remount the T-R *(6)* onto the generator set.

(14) Connect transformer-rectifier *(T-R)* control wire harness to option terminal strip on control box support *(5)*.

(15) Remount air cleaner mounting bracket *(4)* to control box support panel *(5)*.

(16) Remount air cleaner *(3)* on its mounting bracket *(4)*.

(17) Support rear canopy section *(1)* with overhead hoist, using canopy lifting eyes. Re-install the hardware that fastens canopy slide mounting plates to control box support. Then remount rear canopy.

(18) Open fuel shut-off valve on fuel tank.

(19) Connect battery cables to battery(s).

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 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. Turn off the disconnect switch which provides power to the generator set. Otherwise a lethal electrical shock hazard exists.

(1) Disconnect DC cables at output terminals.

(2) Slide back the rear canopy section and disconnect the 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, located beneath the control box support, directly under the control box.

(3) Disconnect plug connector P403. See connection diagrams in Chapter 5 of this manual.

(4) Remove the mounting screws which attach the T-R to its mounting bracket on the generator set.

(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. Be sure that 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 previously.

(3) Reconnect plug connector P403.

(4) Reconnect three AC input leads at the contactor.

(5) Reconnect DC cables at output terminals.

(6) Slide the rear canopy section forward and fasten in place.

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 repairs in 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 Chapter 5 of this manual. When reconnecting wires to a component, use the connection diagrams to make certain connections are made correctly.

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, Ground Power 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 individual 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. The effectiv column code letters for this manual are as follows:

Parts coded "A" are useable on Part No. 500033-1 only.

Parts coded "B" are useable on Part No. 500033-2 only.

Parts coded "C" are useable on Part No. 500033A-1 only.

All non-coded parts are useable on all unit Part Numbers.

(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
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
18265	Donaldson Co., 400 W. 94th St., P.O. Box 1299, Minneapolis, MN 55440
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
22938	Prototype Development, Inc., 7750 Hub Parkway, Cleveland, OH 44125
24248	South Chester Corporation, South Company Division, 3d Street & Governor Printz Blvd. Lester, PA 19113

Code	Vendor's Name & Address
26403	Grinnell Company Inc., 260 W. Exch., Providence, Rhode Island
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	Modine 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
59730	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	Mallory 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

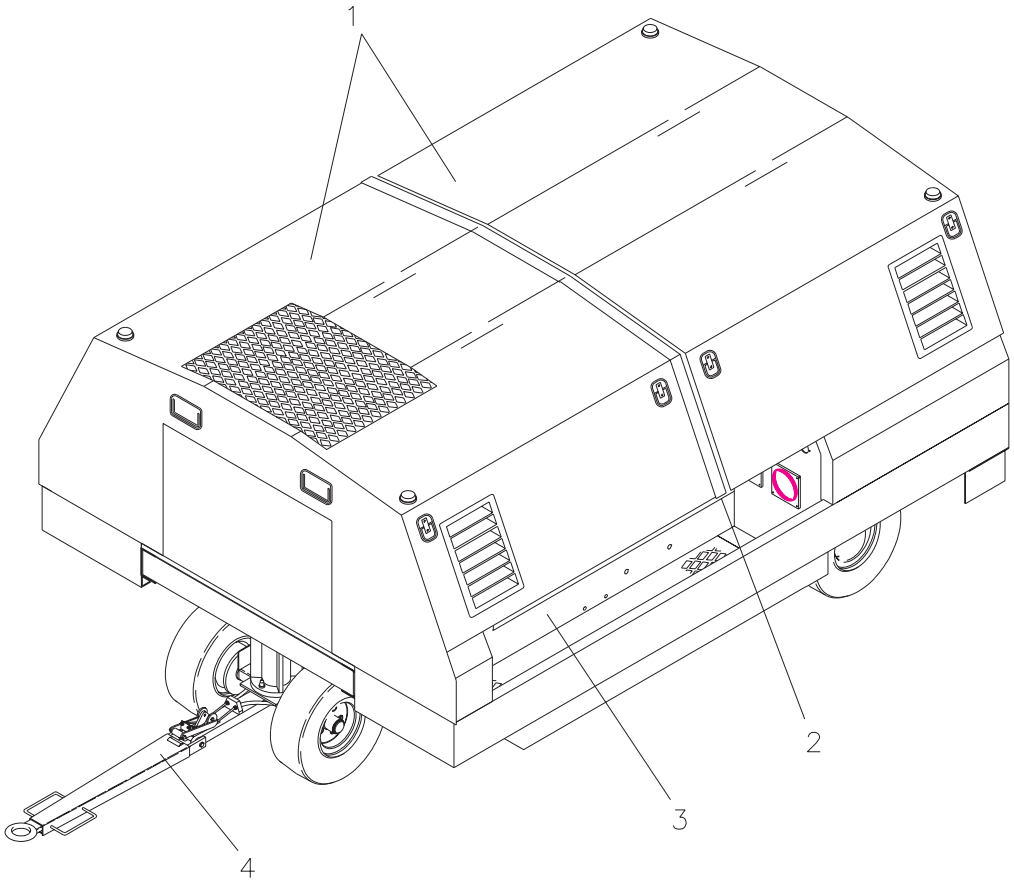
The parts list is arranged so that the illustration will appear on a left-hand page and the applicable parts list will appear on the opposite right-hand page. Unless the list is unusually long, the user will be able to look at the illustration and read the parts list without turning a page.

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
OM		Owners Manual
PRV	-	peak reverse voltage
PSI	-	pounds per square inch
Ref	-	reference (the item has been listed previously)
TM	-	Technical Manual
T-R	-	transformer-rectifier
V	-	volt (when used as a prefix to a five-digit number, indicates vendor code)

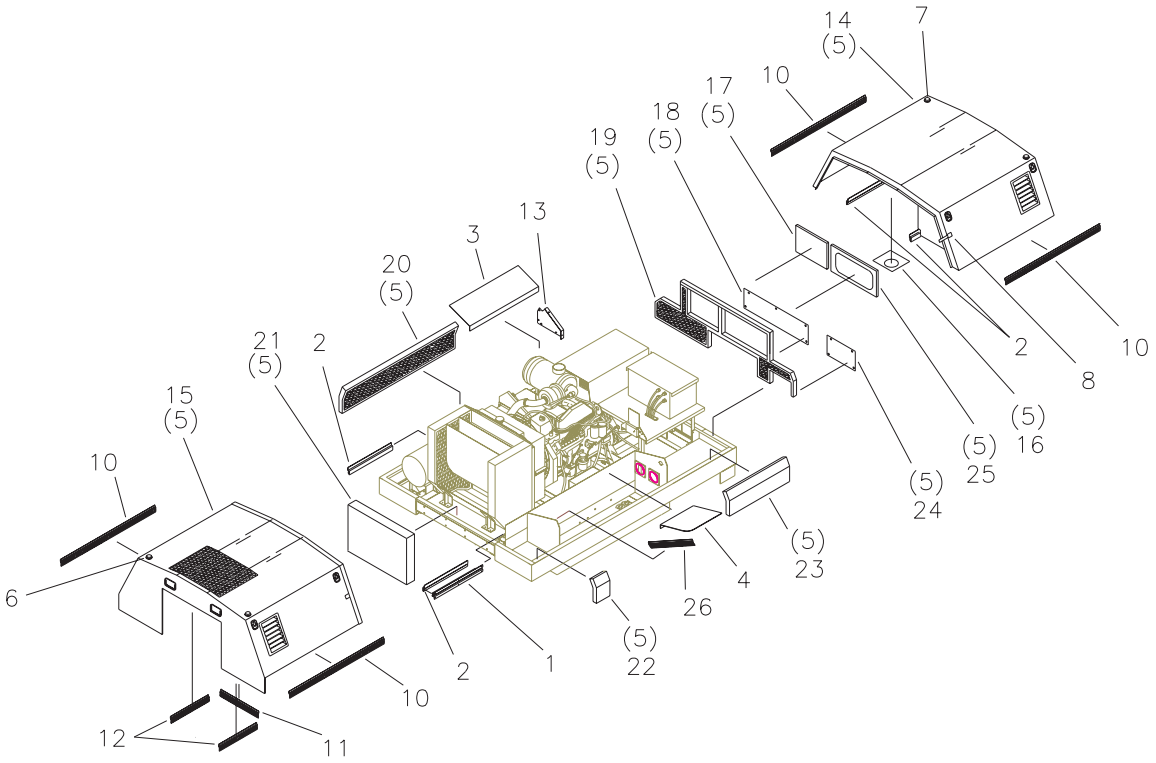
NOTE: An item which does not reflect an index number is a assembly which is not illustrated in its assembled state, or it is similar (right-hand, left-hand, top, etc.) to an item which is illustrated.



Generator Set
Figure 1

FIGURE & ITEM NO.	HOBART PART NO.	AIRLINE PART NO.	NOMENCLATURE 1 2 3 4 5 6	EFF	UNITS PER ASSY
1-	**500033-1** **500033-2** **500033A-1**		**GENERATOR SET, RUNNING GEAR MOUNTED, DUAL-OUTPUT, WITH 75 GALLON FUEL TANK**	**A** **B** **C**	**REF**
1-1	No Number		. ENCLOSURE ASSEMBLY *(For Details See Fig. 2)*		1
1-2	No Number		. GENERATOR SET without Canopy *(For details See Fig. 3)*		1
1-3	285173		. FRAME PARTS FAMILY *(For details See Fig. 14)*	A,B	1
	284269		. FRAME PARTS FAMILY *(For details See Fig. 14)*	C	1
1-4	285187-1		. RUNNING GEAR PARTS FAMILY *(For details See Fig. 15)*	A,B	1
	286655		. RUNNING GEAR PARTS FAMILY *(For details See Fig. 15)*	C	1

*** Not Illustrated**



Enclosure Assembly
Figure 2

FIGURE & ITEM NO.	HOBART PART NO.	AIRLINE PART NO.	NOMENCLATURE 1 2 3 4 5 6	EFF	UNITS PER ASSY
2	**285185-1**		**ENCLOSURE ASSEMBLY (For Details See Fig. 1)**	**A,B**	**REF**
2	**286645**		**ENCLOSURE ASSEMBLY (For Details See Fig. 1)**	**C**	**REF**
2- 1	285401		. BRACKET, MOUNTING, SLIDE, FRONT LEFT, ASSY.		1
*	405071-1		. . SCREW, HHC, M8-1.25 X 20		6
*	281930-5		. . WASHER, LOCK, M8		6
*	405787-2		. . NUT, HEX, FULL, M8-1.25		6
2- 2	285383		. SLIDE, CANOPY		4
*	285426-1		. . SCREW, FLAT-HD, SOCKET, 5/16 - 24 X 1", ST		40
2- 3	285413		. PANEL, TOP, CABLE BOX, DC	A,B	1
	284237		. PANEL, TOP, CABLE BOX, DC	C	1
*	203378-1		. . SCREW, HH, SF-TAP, TYPE 2, M6 X 12		8
2- 4	285414		. PANEL, TOP, REAR, CABLE BOX, AC		1
*	282184-1		. . SCREW, TAP-TITE, FLAT-HD, M5 X 20		4
*	406735-1		. . SCREW, CAP, HEX-HD, M6-1 X 20		6
*	281930-4		. . WASHER, LOCK, M6		6
*	405787-1		. . NUT, HEX, FULL, M6-1		6
2- 5	285188-1		. CANOPY, GPU, ENGINE-GENERATOR	A,B	1

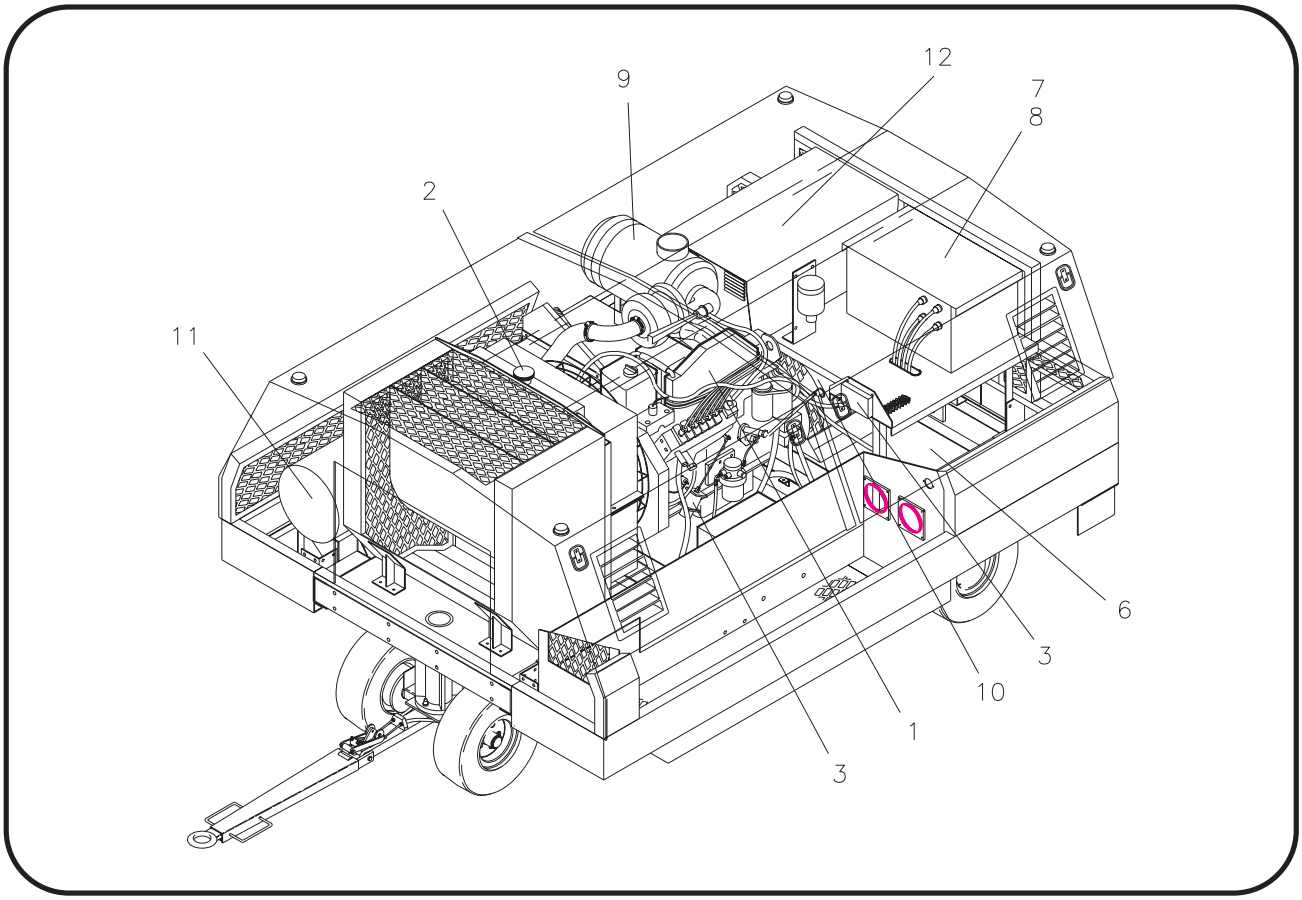
NOTE: *The canopy for Part Numbers 500033-1 and 500033-2 is Part number 285188-1. This encludes all parts identified in figure 2 by (5). The canopy parts for Part No. 500033A-1 are broken down by individual part numbers. Some canopy parts are compatible to all generator set part numbers.*

2- 6	285311		. LIGHTS, CLEARANCE, FRONT		2
2- 7	285312		. LIGHTS, CLEARANCE, REAR		2
2- 8	285288		. LATCH, DRAW, FLEXIBLE,		2
*	77A-1049-1		. . SCREW, TAP-TITE, HEX-HD, M5-12		8
* 2- 9	50984		. SEAL, TRIM-LOC		36.33’
2-10	285433-1		. SEAL, BRUSH, NYLON, CANOPY SIDE		4
*	282183-1		. . SCREW, TAP-TITE, HEX-HD, M5-12		
2-11	285433-2		. SEAL, BRUSH, NYLON, AIR OUTLET		1
*	282183-1		. . SCREW, TAP-TITE, HEX-HD, M5-12		4
2- 12	285433-3		. SEAL, BRUSH, NYLON, AIR OUTLET		2
*	282183-1		. . SCREW, TAP-TITE, HEX-HD, M5-12		6
2-13	285456		. PANEL, DC CABLE, REAR WALL		1
2-14	286651		. CANOPY, REAR AY.	C	1
2-15	285467		. CANOPY, FRONT AY.		1
2-16	286650		. PLATE, AIR FILTER COVER	C	1
2-17	286027		. DOOR, TR, SIDE	C	1
2-18	286649		. PLATE, REAR, BOLT-ON	C	1
2-19	286648		. PANEL, REAR, STATIONARY	C	1
2-20	285459		. PANEL, SIDE, LEFT		1

*** Not Illustrated**

FIGURE & ITEM NO.	HOBART PART NO.	AIRLINE PART NO.	NOMENCLATURE 1 2 3 4 5 6	EFF	UNITS PER ASSY
2	**285185-1**		**ENCLOSURE ASSEMBLY (For Details See Fig. 1) (Continued)**	**A,B**	**REF**
2	**286645**		**ENCLOSURE ASSEMBLY (For Details See Fig. 1) (Continued)**	**C**	**REF**
	2-21	285465	PANEL, PLENUM BOX		1
	2-22	285461	PANEL, SIDE, RIGHT FRONT		1
	2-23	285460	PANEL, SIDE, RIGHT REAR		1
	2-24	286041	PLATE, REAR, BOLT-ON		1
	2-25	285463	DOOR, ENG-GEN CONTROL		1
	2-26	285443-5	SEAL, BRUSH, NYLON		1
*	2-27	283887	LABEL, HOBART		4
*	2-28	430077-2	LABEL, HANDLING		1
*	2-29	408665-1	REFLECTOR, RECTANGULAR, RED		4
*	2-30	286063	LABEL, CAUTION, LIFTING		4
*	2.31	408665-2	REFLECTOR, RECTANGULAR, AMBER		4
*	2-32	430077-2	LABEL, HANDLING		1

*** Not illustrated**



Generator Set Without Canopy
Figure 3

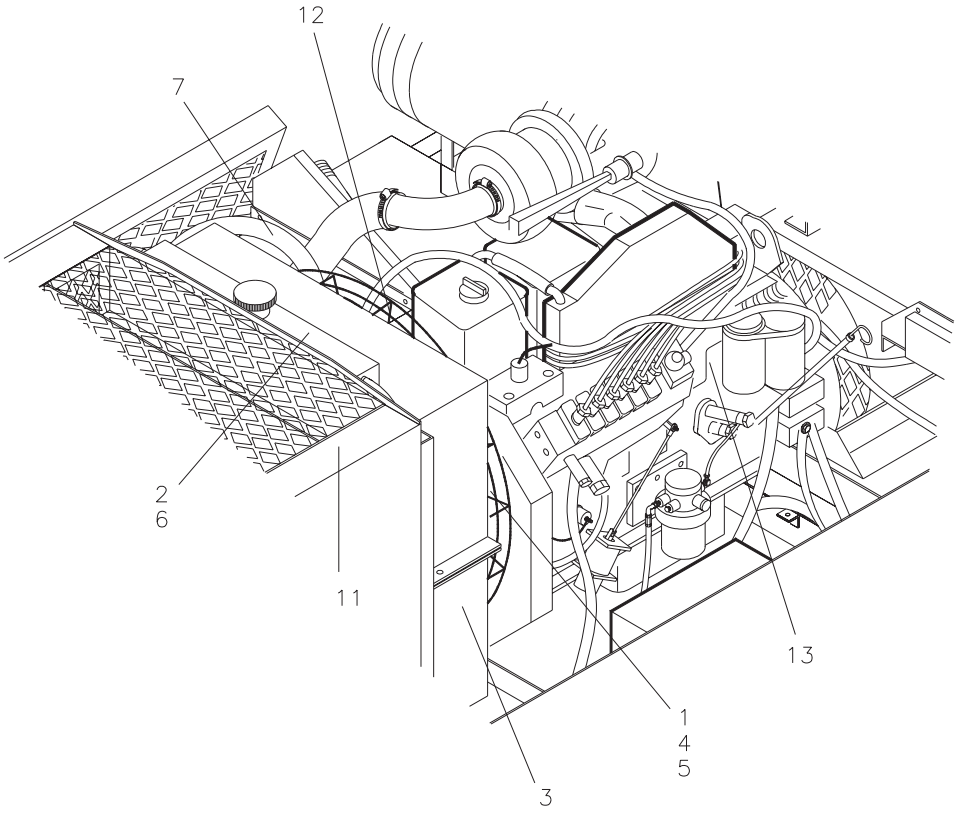
	FIGURE & ITEM NO.	HOBART PART NO.	AIRLINE PART NO.	NOMENCLATURE 1 2 3 4 5 6	EFF	UNITS PER ASSY
	3 -	**No Number**		**GENERATOR SET WITHOUT CANOPY (For NHA See Fig. 1)**		**REF**
	3- 1	284924		. ENGINE, DIESEL, CUMMINS MODEL NO. 6BTA5.9C200 *(See Cummins Parts Catalog)*	A,B	1
		286093		. ENGINE, DIESEL, CUMMINS MODEL NO. 6BTA5.9C200 *(See Cummins Parts Catalog*)	C	1
		406684-1		. . SCREW, HHC, M12 - 1.75 X 30		6
		281930-7		. . WASHER, LOCK, M12		6
	3- 2	No Number		. RADIATOR & COOLING SYSTEM GROUP *(For Details See See Fig. 4)(Part of Engine Parts Family)*		*1*
	3- 3	No Number		. KIT, GOVERNOR ASSY. *(For Details See Fig. 5) (Part of Engine Parts Family)*		*1*
*	3- 4	No Number		. LINES ASSEMBLY, OIL *(For details See Fig. 6) (Part of Engine Parts Family*)		1
*	3- 5	No Number		. LINES ASSEMBLY, FUEL *(For details See Fig. 7) (Part of Engine Parts Family)*		*1*
	3- 6	285199		. PANEL, 400-Hz OUTPUT MODULE *(For details See Fig. 8)*		1
	3- 7	285008		. CONTROL BOX DOOR ASSY. *(For details See Fig. 9)*	A,B	1
		286691		. CONTROL BOX DOOR ASSY. (For details See Fig. 9)	C	1
	3- 8	284929		. CONTROL BOX INTERIOR ASSY. *(For details See Fig. 10)*	A	1
		286131		. CONTROL BOX INTERIOR ASSY. *(For details See Fig. 10)*	B	1
		286690		. CONTROL BOX INTERIOR ASSY. *(For details See Fig. 10)*	C	1
	3- 9	No Number		. AIR CLEANER GROUP *(For details see Fig. 11)*		1
	3-10	285120-6		. GENERATOR, 2400 RPM, 120kVA, DUAL BEARING *(For details See Fig. 12)*		1
	3- 11	No Number		MUFFLER & EXHAUST ASSEMBLY *(For Details See Fig. 13)*		1
	3-12	487750-1		. TRANSFORMER-RECTIFIER, 28.5-V DC *(When provided)*		1

*** Not Illustrated**

FIGURE & ITEM NO.	HOBART PART NO.	AIRLINE PART NO.	NOMENCLATURE 1 2 3 4 5 6	EFF	UNITS PER ASSY
	3 -	No Number	GENERATOR SET WITHOUT CANOPY (For NHA See Fig. 1)		REF
*	3-13	282852	. MOUNT, ENGINE, LEFT	A,B	1
*		286158	. MOUNT, ENGINE, LEFT	C	1
*		W-11148-3	. . SCREW, HHC, 1/2-13 X 3.00"		1
*		W-11242-12	. . WASHER, FLAT, 1/2		1
*		W-11269-11	. . NUT, HEX, LOCK, 1/2-13		1
*	3-14	282853	. MOUNT, ENGINE, RIGHT		1
*		286160	. MOUNT, ENGINE, RIGHT		1
*		W-11148-3	. . SCREW, HHC, 1/2-13 X 3.00"		1
*		W-11242-12	. . WASHER, FLAT, 1/2		1
*		W-11269-11	. . NUT, HEX, LOCK, 1/2-13		1
*	3-15	284371-4	. MOUNT, SHOCK, ENGINE		2
*		405071-6	. . SCREW, HHC, M8 - 1.25 X 30		4
*		281930-5	. . WASHER, LOCK, M8		4
*		405787-2	. . NUT, HEX, FULL, M8 - 1.25		4
*	3-16	284785	. SUPPORT, MOUNTING, ENGINE, ASSY.	A,B	1
*		405061-7	. . SCREW, HHC, M10 - 1.5 X 30	A,B	4
*		281930-6	. . WASHER, LOCK, M10	A,B	4
*		405787-8	. . NUT, HEX, FULL, M10 - 1.5	A,B	4
*	3-17	286155	. MOUNT, ENGINE AY.	C	2
*		W-11097-35	. . SCREW, HHC, 3/8-16 X 1-1/4"	C	8
*		50MS-732-2	. . NUT, KEPS, 3/8-16	C	8
*	3-18	281871-1	. BATTERY, 12-V	A,B	1
*	3-19	285361	. TRAY, BATTERY	A,B	1
*		405061-7	. . SCREW, HHC, M10 - 1.5 X 30	A,B	4
*		281930-6	. . WASHER, LOCK, M10	A,B	4
*		405787-8	. . NUT, HEX, FULL, M10 - 1.5	A,B	4
*	3-20	181831	. KIT, HOLD-DOWN, BATTERY, KIT	A,B	1
*	3-21	494295	. ROD, BATTERY SUPPORT	A,B	2
*		W-12242-6	. . WASHER, FLAT, 5/16	A,B	2
*		W-12254-5	. . WASHER, LOCK, 5/16	A,B	2
*		W-12278-6	. . NUT, HEX, 5/18 - 18	A,B	2
*	3-22	481209-1	. CABLE, BATTERY, POSITIVE, ASSY.	A,B	1
*		286620-2	. CABLE, BATTERY, POSITIVE	C	1
*		76A-1132	. . TUBING, Z-FLEX, 3/4" DIAMETER		56"
*	3-23	383067-5	. CABLE, BATTERY, NEGATIVE, ASSY.	A,B	1
*		286621-2	. CABLE, BATTERY, NEGATIVE	C	1
*		406684-1	. . SCREW, HHC, M12 - 1.75 X 30		1
*		283467-7	. . WASHER, LOCK, IET, M12		1
*		281929-7	. . WASHER, FLAT, M12		1
*		281930-7	. . WASHER, LOCK, M12		1
*		405787-9	. . NUT, HEX, FULL, M12 - 1.75		1
*	3-24	281881-1	. BATTERY, 12-V	C	2
*	3-25	284298	. CABLE, BATT., CONNECTING, POSITIVE	C	1

FIGURE & ITEM NO.	HOBART PART NO.	AIRLINE PART NO.	NOMENCLATURE 1 2 3 4 5 6	EFF	UNITS PER ASSY
	3 -	No Number	**GENERATOR SET WITHOUT CANOPY (For NHA See Fig. 1)**		REF
*	3-26	284297	. CABLE, BATT., CONNECTING, NEGITIVE	C	1
*	3-27	491687	. ROD, BATTERY SUPPORT	C	2
*		W-11242-6	. . WASHER, FLAT, 5/16	C	2
*		W-11254-5	. . WASHER, LOCK, 5/16	C	2
*		W-11278-6	. . NUT, HEX, 5/16-18	C	2
*	3-28	W-9407-446	. CABLE, ENGINE-TO-GROUND		1
*		400852-1	. . SCREW, HH, SF-TAP, 3/8 - 12 X 7/8		1
*		W-12263-6	. . WASHER, LOCK, IET, 3/8		1
*		W-12242-10	. . WASHER, FLAT, 3/8		1
*		W-12254-6	. . WASHER, LOCK, 3/8		1
*	3-29	W-9360-289	. CABLE, ENGINE-TO-NEUTRAL		1
*	3-30	285195	. HARNESS, WIRE, ENGINE, ASSY.	A,B	1
*		286693	. HARNESS, WIRE, ENGINE ASSY	C	1
*		283466-2	. . SCREW, MACHINE, PHILLIPS, PAN-HD., M3.5 X 12		8
*		281929-14	. . WASHER, FLAT, M3.5		16
*		281930-10	. . WASHER, LOCK, M3.5		8
*		405787-14	. . NUT, HEX. HD., M3.5		8
*		203378-1	. . SCREW, HH, SF-TAP, M6 - 12		4
*		281929-4	. . WASHER, FLAT, M6		4
*	3-31	285291	. BRACKET, MOUNTING, RECEPTACLE		1
*	3-32	285200	. DIODE, STARTER SOLENOID, ASSY.		1
*	3-33	408173	. SOLENOID, STARTER		1
*		406735-7	. . SCREW, HHC, M6 - 1 X 16		2
*		281929-4	. . WASHER, FLAT, M6		
*		283467-4	. . WASHER, LOCK, M6		2
*		405787-1	. . NUT, HEX, FULL, M6 - 1		2
*	3-34	78A-1000	. LABEL, ID		1
*	3-35	79A-1110	. LABEL, OPTION		1
*	3-36	76B-1148	. LABEL, DIESEL FUEL		1
*	3-37	282731	. LABEL, RADIATOR CORE		1
*	3-38	81B-1063	. LABEL, WARNING, HOT WATTER		1
*	3-39	351541	. LABEL, CAUTION, FAN		2
*	3-40	406001	. LABEL, WARNING, MOVING PARTS		2
*	3-41	80A-1104	. LABEL, DANGER, HIGH VOLTAGE		1
*	3-42	81B-1061	. LABEL, WARNING, ELECTRICAL SHOCK		1
*	3-43	406000	. LABEL, WARNING, EXHAUST GASES		1
*	3-44	282659	. LABEL, GOVERNOR, DEISEL FUEL		1
*	3-45	84B-1045	. LABEL, WARNING, HOT EXAUST		2
*	3-46	81B-1064	. LABEL, WARNING, ENGINE DRIVE		1
*	3-47	283533	. LABEL, SUPPORT, CENTER		1
*	3-48	282658	. LABEL, WARNING, CLEARANCE		1

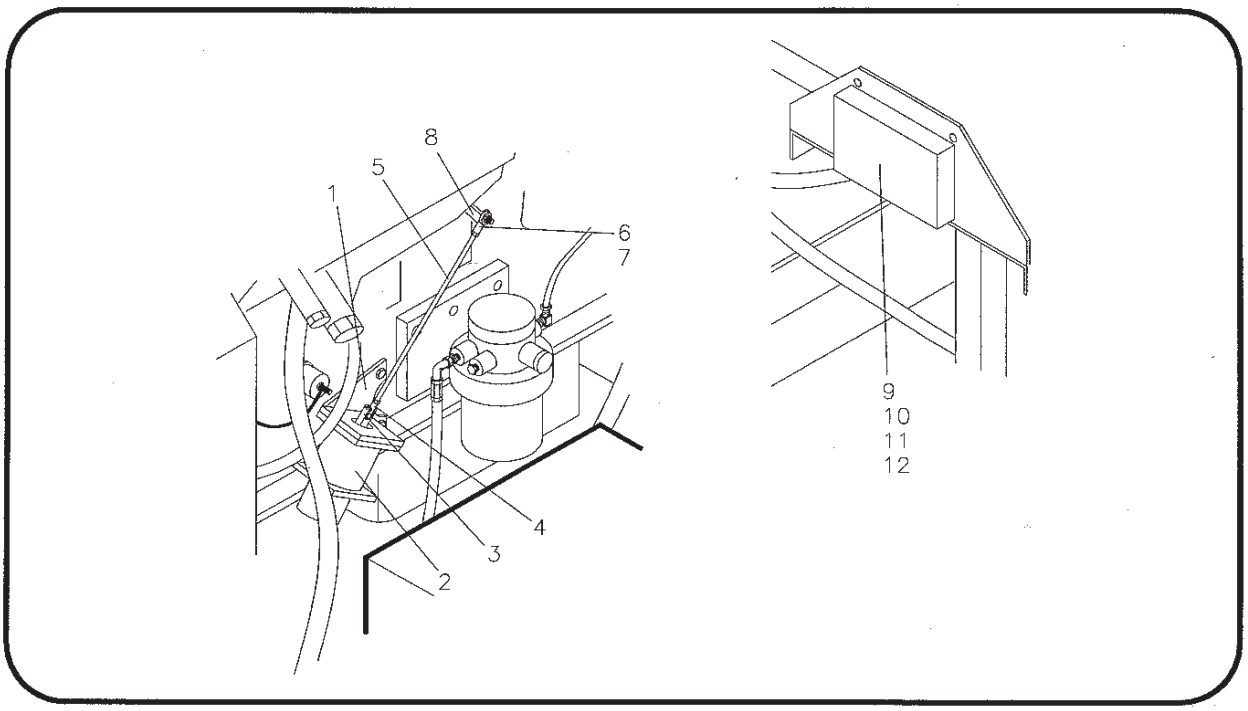
*** Not Illustrated**



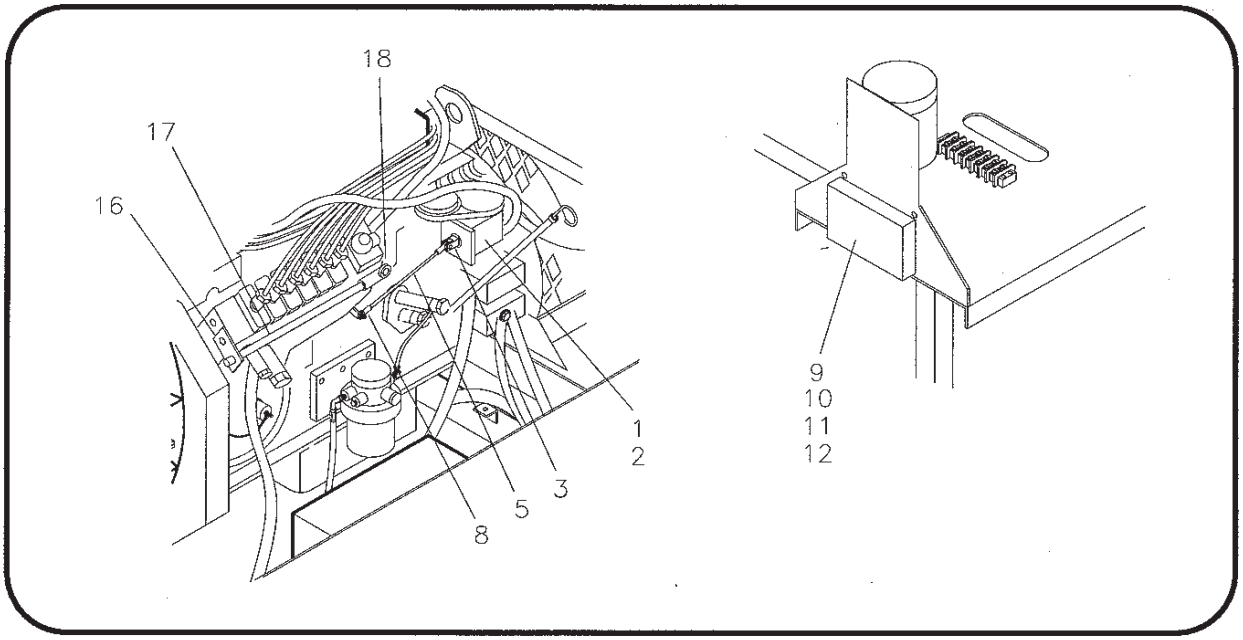
Radiator and Cooling System Group
(500033-1 and 500033-2 Shown)
Figure 4

	FIGURE & ITEM NO.	HOBART PART NO.	AIRLINE PART NO.	NOMENCLATURE 1 2 3 4 5 6	EFF	UNITS PER ASSY
	4 -	No Number		RADIATOR & COOLING SYSTEM GROUP (For NHA See Fig. 3)(Part of Engine Parts Family)		REF
	4- 1	285237		. FAN, COOLING, 28"		1
		405061-6		. . SCREW, HHC, M10 - 1.5 X 65		4
		281929-6		. . WASHER, FLAT, M10		4
	4- 2	285204		. RADIATOR ASSEMBLY		1
		400852-1		. . SCREW, HH, SF-TAP, 3/8 - 12 X 3/4		2
	4- 3	286644		. SHROUD, FAN		2
		5CW-1308-3		. . SCREW, HHC, 5/16 - 18 X 3/4		10
		W-11242-6		. . WASHER, FLAT, 5/16		10
		W-11254-5		. . WASHER, LOCK, 5/16		10
		406735-7		. . SCREW, HHC, M6 - 1.00 X 16		2
		281930-4		. . WASHER, LOCK, M6		2
		405787-1		. . NUT, HEX, FULL, M6 - 1.25		2
	4- 4			DELETED		
	4- 5	286643		. GUARD, FAN, BOTTOM		1
		405061-8		. . SCREW, HHC, M10 - 1.5 X 20		4
		281929-6		. . WASHER, FLAT, M10		4
		281930-6		. . WASHER, LOCK, M10		12
	4- 6	283873		. VALVE, RADIATOR DRAIN		1
	4- 7	286000		. HOSE, RADIATOR, TOP		1
*	4- 8	286001		. HOSE, RADIATOR, BOTTOM,		1
*	4- 9	W-10869-3		. CLAMP, HOSE		2
*	4-10	W-10869-5		. CLAMP, HOSE		2
	4-11	285225		. OUTLET, AIR, RADIATOR, ASSY.	A,B	1
		285225A		. OUTLET, AIR, RADIATOR, ASSY.	C	1
		405061-3		. . SCREW, HHC, M10 - 1.5 X 16		10
		281929-6		. . WASHER, FLAT, M10		10
		281930-6		. . WASHER, LOCK, M10		10
		203378-1		. . SCREW, HH, SF-TAP, M6 - 12		4
	4-12	403782-2		. SWITCH, SHUT-DOWN, HIGH WATER TEMPERATURE		1
	4-13	78B-1119-1		. SENDER, WATER TEMPERATURE		1
*	4-14	400902		. ANTI-FREEZE		5 QT.
*	4-15	56537		. HOSE, VENT		21"
*	4-16	W-10893-3		. FITTING, HOSE, SWIVEL, FEMALE		1
*	4-17	W-10886-7		. CONNECTOR, MALE		1
*	4-18	W-10882-2		. ADAPTER, PIPE		1
*	4-19	W-10869-1		. CLAMP, HOSE		1
*	4-20	W-10869-9		. CLAMP, HOSE		1
*	4-21	W-10902-9		. PLUG, PIPE, 1/4"		1
	4-22	W-7814-4		. BUSHING, 1/2" X 3/8"		1

*** NOT ILLUSTRATED**



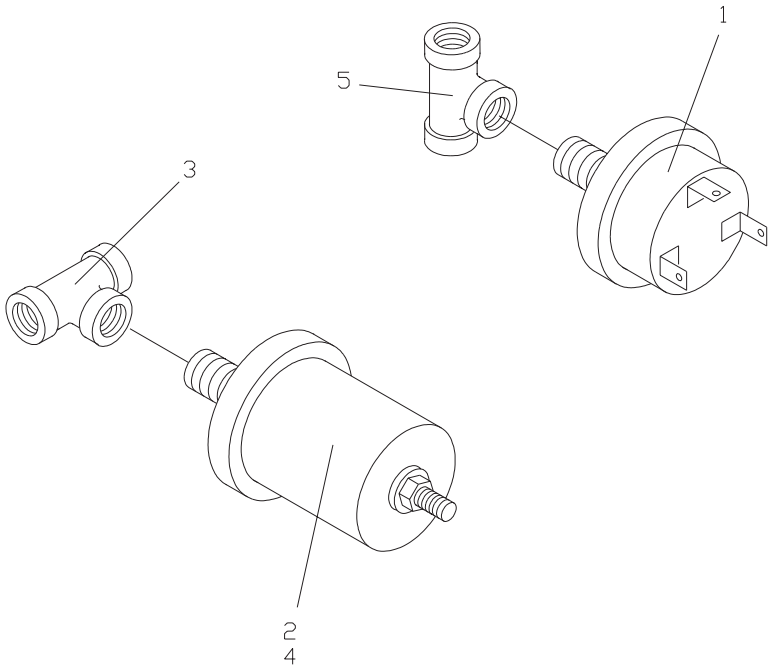
Governor Kit Assembly
(500033-1 & 500033-2)
Figure 5a



Governor Kit Assembly
(500033A-1)
Figure 5b

FIGURE & ITEM NO.	HOBART PART NO.	AIRLINE PART NO.	NOMENCLATURE 1 2 3 4 5 6	EFF	UNITS PER ASSY
5a & b -	**No Number**		**GOVERNOR KIT ASSEMBLY (For NHA See Fig. 4) (Part of Engine Parts Family)**		**REF**
5a- 1	284865		. BRACKET, MOUNTING, ACTUATOR	A,B	1
5b-1	284223		. BRACKET, MOUNTING, ACTUATOR	C	1
	406684-2		. . SCREW, HHC, M12 - 1.75 X 20		2
	281930-7		. . WASHER, LOCK, M12		2
5a & b-2	281772		. ACTUATOR, GOVERNOR, ELECTRIC		1
	406735-2		. . SCREW, HHC, M6 - 1 X 20		4
	281930-4		. . WASHER, LOCK, M6		4
	405787-1		. . NUT, HEX, FULL, M6 - 1		4
5a & b-3	281775		. CLEVIS, ACTUATOR ROD		1
5a- 4	281776		. BEARING, ROD END	A,B	1
	402119-4		. . SCREW, HHC, 1/4 - 20 X 3/4	A,B	1
	W-11254-4		. . WASHER, LOCK, 1/4 - 20	A,B	1
	W-11280-2		. . NUT, HEX, 1/4 - 20	A,B	1
5a- 5	W-9476-33		. ROD, THREADED, 1/4-28	A,B	1
5b- 5	W-9476-18		. ROD, THREADED, 1/4-28	C	1
	W-11280-3		. . NUT, HEX, 1/4-28		3
5a- 6	402908		. JOINT, BALL, GOVERNOR LINKAGE	A,B	1
	W-11254-4		. . WASHER, LOCK, 1/4 - 20	A,B	1
5a- 7	W-11280-3		. NUT, HEX, 1/4-28	A,B	1
5a- 8	284868		. ARM, THROTTLE, LINKAGE	A,B	1
5b-8	286616		. LEVER, FUEL PUMP STOP	C	1
	405071-1		. . SCREW, HHC, M8 - 1.25 X 20	A,B	1
	281930-5		. . WASHER, LOCK, M8	A,B	1
	406735-3		. . SCREW, HHC, M6 - 1 X 3	A,B	1
	405787-1		. . NUT, HEX, FULL, M6 - 1	A,B	1
5a&b- 9	84A-1075		. MOUNT, SHOCK, RUBBER		4
	50MS-732-1		. . NUT, HEX, KEPS, #8 - 32		4
5a&b-10	482989		. STRAP, CONTROLLER, ASSY.		2
5a&b-11	283990-1		. CONTROLLER, GOVERNOR, ELECTRIC		1
	50MS-732-1		. . NUT, HEX, KEPS, #8 - 32		4
5a&b-12	181891-3		. BOARD, PC, SPEED CONTROL		1
*5a&b-13	281751-3		. ADAPTER, MAGNETIC PICK-UP		1
*5a&b-14	285062-1		. PICK-UP, MAGNETIC		1
*5a&b-15	285063A-2		. CABLE, MAGNETIC PICK-UP, ASSY.		1
5b-16	285436		. BRACKET, LEVER STOP	C	1
5b-17	286840-1		. ROD, THREADED	C	1
5b-18	281776		. JOINT, BALL, LINKAGE	C	1
	W-11280-3		. . NUT, HEX, 1/4-28	C	6
	W-11242-5		. . WASHER, FLAT, 1/4	C	2
	W-11254-4		. . WASHER, LOCK, 1/4	C	2
	W-11269-3		. . NUT, NYLOCK, 1/4-20	C	1
	402119-6		. . SCREW, 1/4-20 X 1	C	1

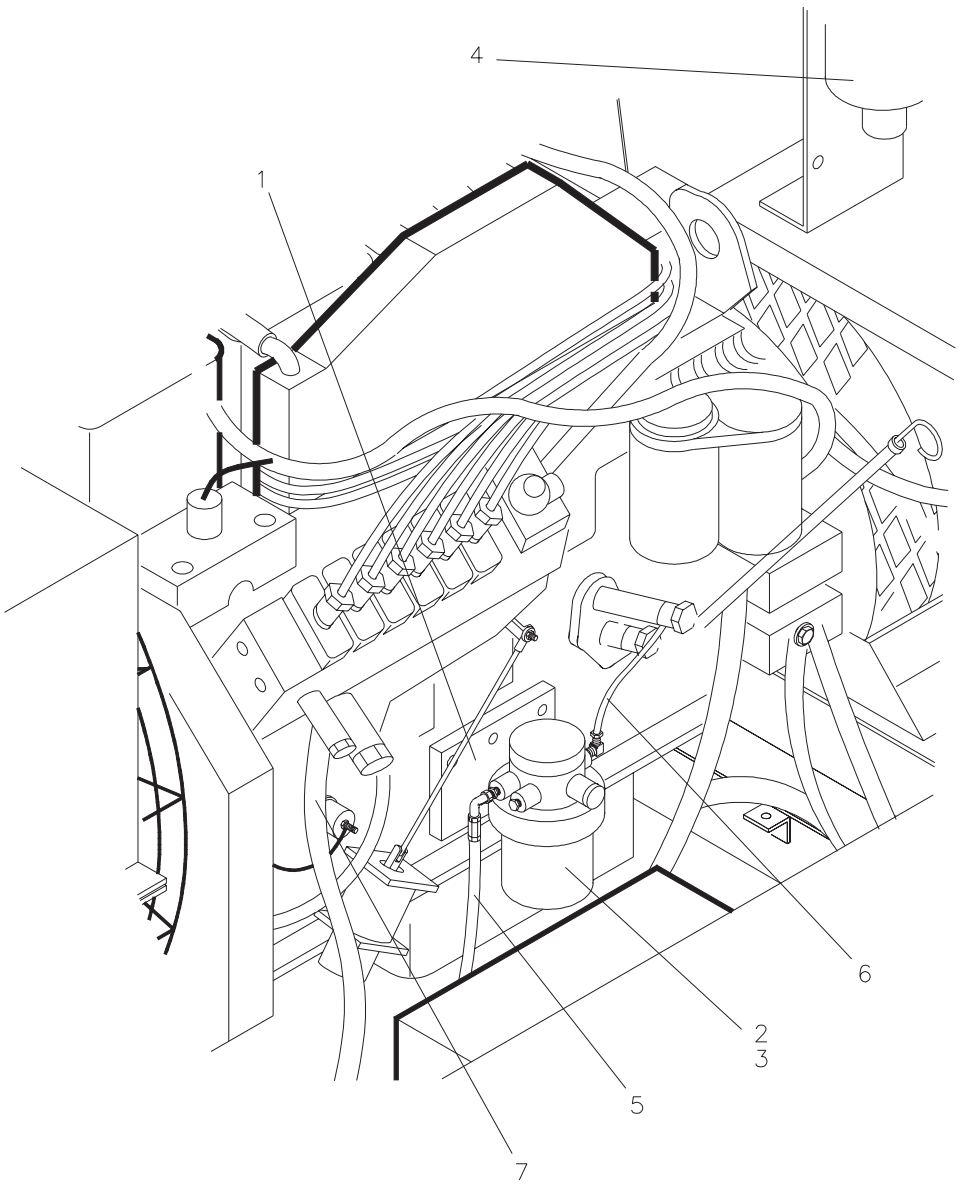
*** Not Illustrated**



Oil Lines Assembly
(500033-1 & 500033-2)
Figure 5a

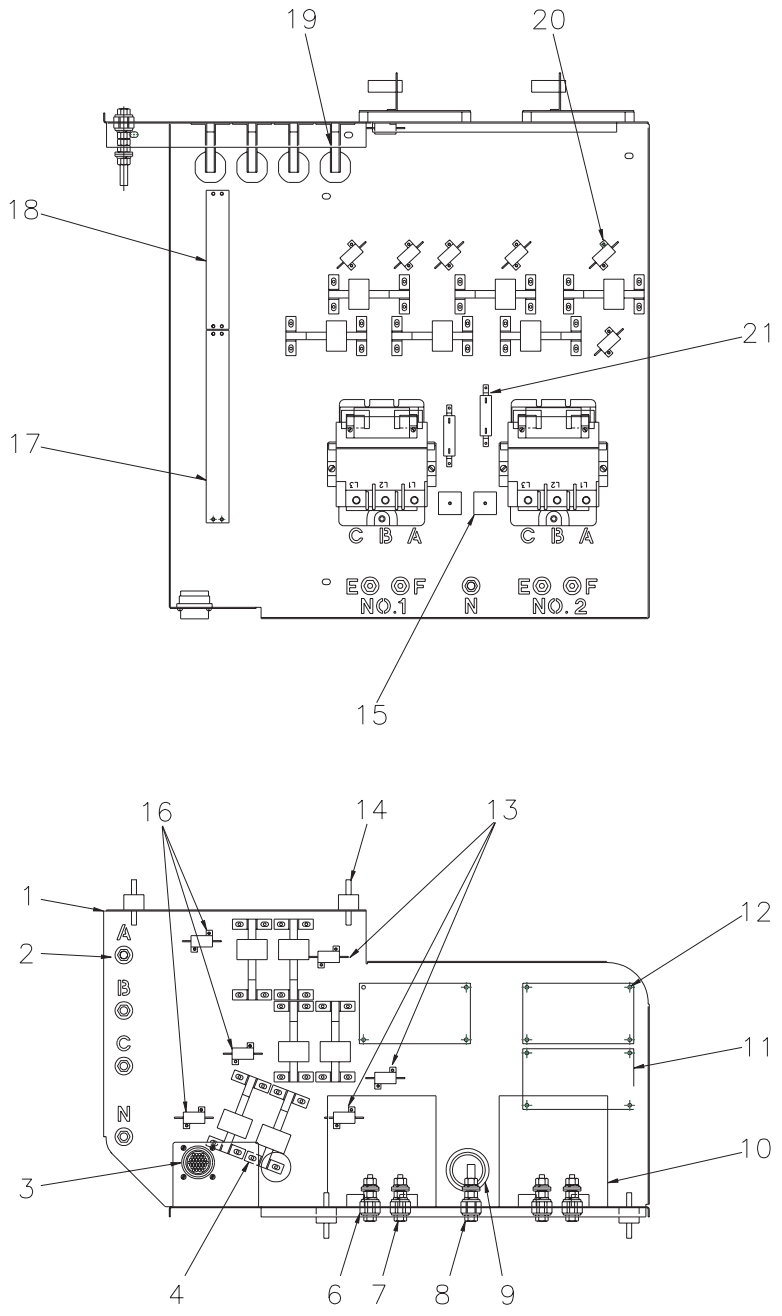
FIGURE & ITEM NO.	HOBART PART NO.	AIRLINE PART NO.	NOMENCLATURE 1 2 3 4 5 6	EFF	UNITS PER ASSY
	6-	**NO NUMBER**	**LINES ASSEMBLY, OIL (For NHA see Fig. 3) (Part of Engine Parts Family)**		**REF**
	6- 1	403809-1	. SWITCH, LOW OIL PRESSURE		2
	6- 2	78B-1118-1	. SENDER, OIL PRESSURE, (Left side of engine)	A,B	1
		78B-1118-2	. SENDER, OIL PRESSURE (Left side of engine)	C	1
	6- 3	W-10910-0	. . TEE, PIPE, 1/8, BRASS (Left side of engine}		1
	6- 4	W-10750-2	. . NIPPLE, CLOSE, 1/8 X 1-1/2, (Left side of engine)		1
	6- 5	W-10909-1	. . TEE, STREET, PIPE, 1/8 (Top of oil filter)		1
*	6- 6	No Number	. LINE, OIL DRAIN, (OIL PAN TO OUTLET)		1
*	6- 7	285369	. . LINE, OIL DRAIN, ASSY.		1
*	6- 8	181158	. . TUBING, Z-FLEX, 1" DIAMETER		24"
*	6- 9	No Number	. . COUPLING, PIPE, 1/2 (WELDED TO FRAME		REF
*	6-10	12CW-2077-3	. . ELBOW, STREET, 1/2, 90^{o}		1
*	6-11	No Number	. . PLUG, PIPE, 1/2 (REMOVED FROM ENGINE		REF
*	6-12	83A-1004	. . OIL, LUBRICATING, 15W40		5 gal.

*** Not Illustrated**



Fuel Line Assembly
(500033A-1)
Figure 5a

FIGURE & ITEM NO.	HOBART PART NO.	AIRLINE PART NO.	NOMENCLATURE 1 2 3 4 5 6	EFF	UNITS PER ASSY
7 -	**No Number**		**LINES ASSEMBLY, FUEL (For NHA see Fig 3) (Part of Engine Parts Family)**		**REF**
7- 1	285338		. BRACKET, MOUNTING, FUEL FILTER		1
	406684-1		. . SCREW, HHC, M10 - 1.75 X 30		2
	281929-7		. . WASHER, FLAT, M12		10
	281930-7		. . WASHER, LOCK, M12		2
7- 2	285293		. FILTER, FUEL		1
	W-7814-3		. . BUSHING, PIPE, 1/4 X 1/2		1
	401061-7		. . SCREW, HHC, M10 - 1.5 X 30		2
	281929-6		. . WASHER, FLAT, M10		2
	281930-6		. . WASHER, LOCK, M10		2
7- 3	285364		. FILTER, FUEL, REPLACEMENT (SUPPLY ONLY)		1
7- 4	284959		. KIT, COLD WEATHER START	A,B	1
	286627		. KIT, COLD WEATHER START	C	1
7- 5	No Number		. LINE, FUEL SUPPLY, (TANK TO FILTER)		1
	400818-2		. . NIPPLE, HEX, PIPE, STEEL, 1/2 X 3/4		1
	400819-1		. . VALVE, BALL, 3/4		1
	285368		. . LINE, FUEL SUPPLY, ASSY.		1
7- 6	285367		. LINE, FUEL FILTER, ASSY. (FILTER TO ENGINE)		1
7- 7	No Number		. LINE, FUEL RETURN (ENGINE TO TANK)		1
	285287		. . LINE, FUEL RETURN, ASSY.	A,B	1
	286660		. . LINE, FUEL RETURN ASSY.	C	1
	76A-1132		. . TUBING, Z-FLEX, 3/4 DIAMETER		60"
	W-10869-15		. . CLAMP, HOSE	C	1



400-Hz Output Module Assembly
(Oil Pressure Sensing System Shown)

FIGURE & ITEM NO.	HOBART PART NO.	AIRLINE PART NO.	NOMENCLATURE 1 2 3 4 5 6	UNITS PER ASSY
8-	**285199**		**PANEL ASSEMBLY, 400-Hz OUTPUT MODULE (For NHA See Fig. 3)**	**REF**
8- 1	284900		. PANEL, 400-Hz OUTPUT MODULE	1
8- 2	AW-626		. BUSHING, INSULATING, A-B-C-N (INPUT)	4
	W-11097-12		. . SCREW, CAP, HEX-HD., 3/8-16 X 3-1/2	4
	W-11242-10		. . WASHER, FLAT, 3/8	16
	W-11254-6		. . WASHER, LOCK, 3/8	8
	W-11278-5		. . NUT, HEX.HD., 3/8-16	11
8- 3	284836		. HARNESS, RECEPTACLE, ASSY.	1
	283466-2		. . SCREW, MACHINE, PHILLIPS, PAN-HD., M3.5 X 12	4
	281929-14		. . WASHER, FLAT, M3.5	4
	281930-10		. . WASHER, LOCK, M3.5	4
	405787-14		. . NUT, HEX. HD., M3.5	4
8- 4	1CZ-148		. TRANSFORMER, CURRENT LINE DROP & OVERLOAD V14831, NO. E-6170	12
	W-11263-2		. WASHER, IET, #8	1
8- 5			DELETED	
8- 6	A25		. WASHER, INSULATING	18
8- 7	DW-1704		. BUSHING, INSULATING, E-F	4
	402119-7		. . SCREW, CAP, HEX-HD., 1/4-20 X 1-1/2	4
	W-11242-4		. . WASHER, FLAT, 1/4	16
	W-11254-4		. . WASHER, LOCK, 1/4	8
	W-11280-2		. . NUT, HEX.HD., 1/4-20	8
8- 8	AW-626		. BUSHING, INSULATING, NEUTRAL (OUTPUT)	1
	W-112097-22		. . SCREW, CAP, HEX-HD., 3/8-16 X 2-1/2	1
	W-11242-10		. . WASHER, FLAT, 3/8	4
	W-11254-6		. . WASHER, LOCK, 3/8	2
	W-11278-5		. . NUT, HEX.HD., 3/8-16	2
8- 9	402037-14		. GROMMET, RUBBER	1
8-10	282130-1		. CONTACTOR, LINE, 3-POLE	2
	282183-2		. . SCREW, TAP-TITE, HEX-HD., M6 X 12	2
	W-11097-18		. . SCREW, HEX-HD., 3/8-16 X 3/4	12
	W-11254-6		. . WASHER, LOCK, 3/8	12
	W-11242-10		. . WASHER, FLAT, 3/8	12
8-11	387738A		. BOARD, PC, OVERLOAD, ASSY.	3
	W-11245-3		. . WASHER, FLAT, #10, BRASS	12
	50MS-732-1		. . NUT, #8 - 32, HEX, KEPS, ST.	12
8-12	84A-1075		. MOUNT, SHOCK, RUBBER	12
	50MS-732-1		. . NUT, #8 - 32, HEX, KEPS, ST.	12
8-13	404402-9		. RESISTOR,12.5 OHM, 20 WATT	3
	285160-2		. . SCREW, TAP-TITE, PAN-HD., M3 X 6	6

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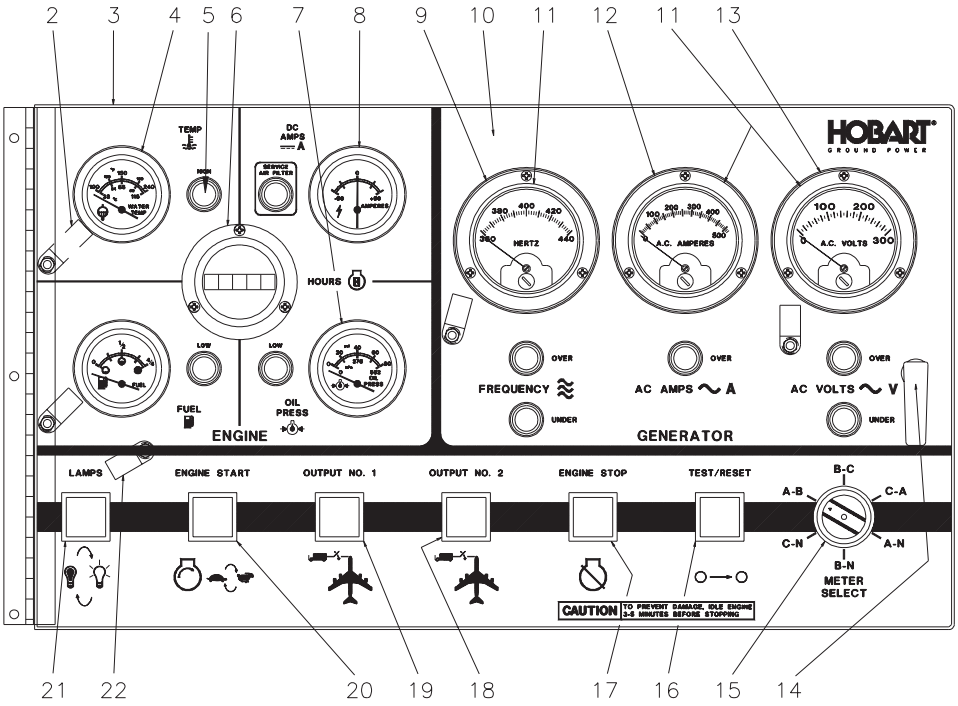
	FIGURE & ITEM NO.	HOBART PART NO.	AIRLINE PART NO.	NOMENCLATURE 1 2 3 4 5 6	UNITS PER ASSY
	8 -	**285199**		**PANEL ASSEMBLY, 400-Hz OUTPUT MODULE (CONTINUED)**	**REF**
	8-14	HF-2752		. MOUNT, SHOCK, RUBBER	6
		50MS-732-0		. . NUT, KEPS, 1/4-20	12
	8-15	404065-2		. RECTIFIER, SILICON	2
		285160-1		. . SCREW, TAP-TITE, PAN-HD., M3 X 20	2
	8-16	404402-8		. RESISTOR, 50 OHM, 20 WATT	3
		285160-4		. . SCREW, TAP-TITE, PAN-HD., M2.5 X 5	6
	8-17	401911-20		. BLOCK, TERMINAL	1
		285160-6		. . SCREW, TAP-TITE, PAN-HD., M4 X 20	2
	8-18	401911-14		. BLOCK, TERMINAL	1
		285160-6		. . SCREW, TAP-TITE, PAN-HD., M4 X 20	2
	8-19	76A-1131		. . TUBING, Z-FLEX, 1/2" DIAMETER (Six 4.5" pieces)	27"
	8-20	404402-1		. RESISTOR, 16.6 OHM, 20 WATT	6
		285160-4		. . SCREW, TAP-TITE, PAN-HD., M2.5 X 5	12
	8-21	W-9746-3		. RESISTOR, 100 OHM, 25 WATT	2
		285160-2		. . SCREW, TAP-TITE, PAN-HD., M3 X 6	4
		283466-3		. . SCREW, MACHINE, PHILLIPS, PAN-HEAD, M3.5 X 8	4
		281930-10		. . WASHER, LOCK, M3.5	4
		405787-14		. . NUT, HEX-HD, M3.5	4
*	8-22	282089-8		. DIODE, FLYBACK, ASSY.	1
*	8-23	180593-2		. CAPACITOR, 0.1 MFD, 500-V AC, ASSY.	3
*	8-24	401564-4		. HOUSING, SOCKET	3
*	8-25	283197		. CABLE, ASSEMBLY, POWER	1
*		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
*		76A-1131		. . TUBING, Z-FLEX, 1/2" DIAMETER (Six 7" pieces)	42"

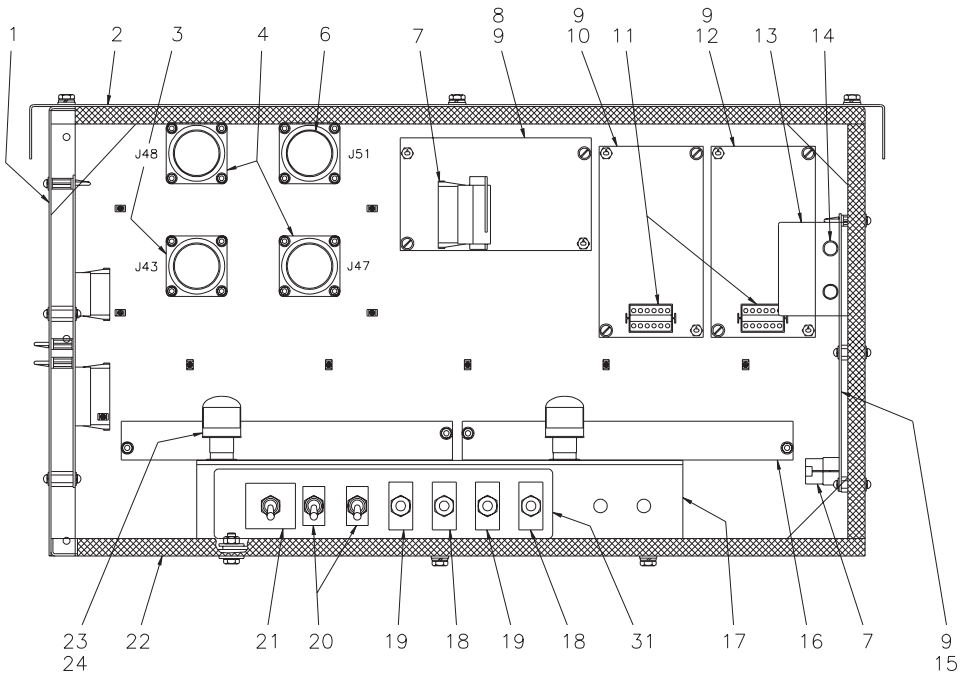
*** Not Illustrated**

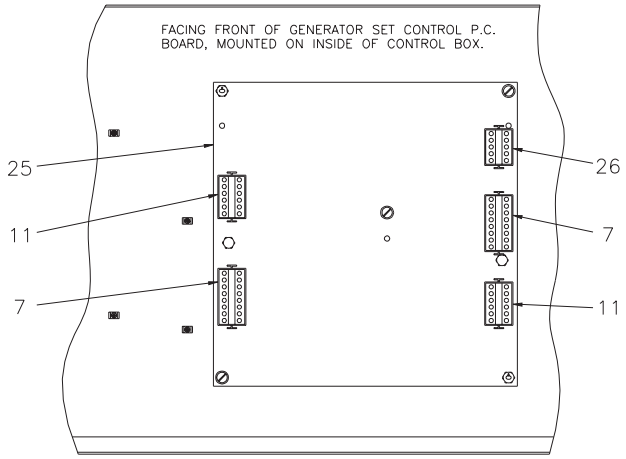


Control Box Door Assembly
Figure 6

	FIGURE & ITEM NO.	HOBART PART NO.	AIRLINE PART NO.	NOMENCLATURE 1 2 3 4 5 6	EFF	UNITS PER ASSY
	9 -	**285008**		**CONTROL BOX DOOR ASSEMBLY (For NHA See Fig. 10)**	**A,B**	**REF**
		286691		**CONTROL BOX DOOR ASSEMBLY (For NHA See Fig. 10)**	**C**	**REF**
	9- 1	494134-1		. GAUGE, FUEL LEVEL		1
	9- 2	W-10051-13		. CLAMP, WIRE, 7/8"		3
	9- 3	284930		. PANEL, DOOR, CONTROL BOX, ASSY.		1
	9- 4	78A-1116-1		. GAUGE, WATER TEMPERATURE		1
	9- 5	HF-2518-2		. LIGHT, PILOT, RED, ASSY.		9
	9- 6	181358		. METER, RUNNING TIME	A,B	1
		W-9917-18		. METER, RUNNING TIME	C	1
	9- 7	78A-1117-1		. GAUGE, OIL PRESSURE	A,B	1
		78A-1117-2		. GAUGE, OIL PRESSURE	C	1
	9- 8	78A-1115-1		. AMMETER, ENGINE		1
	9- 9	283167		. METER, FREQUENCY		1
	9-10	285080		. LABEL, CONTROL BOX		1
	9-11	285172		. LIGHT, STRIP		3
	9-12	283165		. AMMETER, GENERATOR, AC		1
	9-13	W-8105A-4		. VOLTMETER, AC		1
	9-14	285501		. LATCH, SWELL		1
	9-15	79C-1158		. SWITCH, SELECTOR, METER		1
	9-16	See Table Below		. SWITCH,TEST/RESET (Items A-G, L)		1 set
	9-17	See Table Below		. SWITCH, ENGINE STOP (Items A-G)		1 set
	9-18	See Table Below		. SWITCH, OUTPUT CONTACTOR No. 2 (Items A, C-F, I, J, M)		1 set
	9-19	See Table Below		. SWITCH, OUTPUT CONTACTOR No. 1(Items A, C-F, I, J, K)		1 set
	9-20	See Table Below		. SWITCH, ENGINE START (Items A, C-E, F[2], H-J)		1 set
	9-21	See Table Below		. SWITCH, LAMPS (Items A, C-F, K)		1 set
	9-22	W-10051-10		. CLAMP, WIRE, 5/8"		2
*	9-23	284486-1		. LIGHT, GAUGE *(Engine Instruments)*		4

ITEM	PART No.	PUSHBUTTON SWITCH COMPONENTS
A	285029-1	FRAME, BEZEL
B	285030-1	LENS, RED
C	285031-1	HOLDER, LENS
D	285032-1	ACTUATOR, SLEEVE
E	285033	FLANGE, MOUNTING
F	284475-1	BLOCK, CONTACT, N.O.
G	284475-2	BLOCK, CONTACT, N.C.
H	285030-3	LENS, GREEN
I	285034-1	LAMP HOLDER
J	400613-4	BULB, TYPE 1815
K	285030-2	LENS, YELLOW
L	284475-3	BLOCK, CONTACT, N.O.
M	285030-4	LENS, ORANGE





Control Box Interior Components
(500033-1 and 500033-2 Shown)

FIGURE & ITEM NO.	HOBART PART NO.	AIRLINE PART NO.	NOMENCLATURE 1 2 3 4 5 6	EFF	UNITS PER ASSY
10 -	284929		INTERIOR COMPONENTS, CONTROL BOX, ASSEMBLY (For NHA See Fig. 3)	A	REF
	286131		INTERIOR COMPONENTS, CONTROL BOX, ASSEMBLY (For NHA See Fig. 3)	B	REF
	286690		INTERIOR COMPONENTS, CONTROL BOX, ASSEMBLY (For NHA See Fig. 3)	C	REF
10- 1	284970		. WRAPPER, CONTROL BOX, ASSY		1
10- 2	284935		. TOP, CONTROL BOX		1
	406735-6		. . SCREW, M6 - 1 X 12mm, HEX-HD.,		8
	281929-4		. . WASHER, FLAT, M6		12
	281930-4		. . WASHER, LOCK, M6		8
10- 3	79B-1159-1		. RECEPTACLE, 37-PIN		1
10- 4	79B-1159-2		. RECEPTACLE, 37-SOCKET		2
* 10- 5	79A-1164		. PLUG, KEYING		2
	283466-2		. . SCREW, M3.5 - 0.6 X 12mm, PHILLIPS PAN-HD.		16
	281929-14		. . WASHER, FLAT, M3.5		32
	281930-10		. . WASHER, LOCK, M3.5		16
	405787-14		. . NUT, M3.5 - 0.6, HEX		16
10- 6	79B-1159-6		. RECEPTACLE, 7-PIN		1
10- 7	401564-5		. HOUSING, CONNECTOR, 16-CIRCUIT		4
10- 8	387736C		. BOARD, PC, MEMORY & TIME DELAY		1
10- 9	375426-3		. SPACER, PC BOARD		24
	W-11110-3		. . SCREW, #6 - 32 X 3/8 RD-HD		46
	W-11245-2		. . WASHER, FLAT, #6		46
	W-11254-1		. . WASHER, LOCK, #6		46
10-10	482039C		. BOARD, PC, OVER-UNDERFREQUENCY		1
10-11	401564-4		. HOUSING, CONNECTOR, 12-CIRCUIT		4
10-12	482038A		. BOARD, PC, OVER-UNDERVOLTAGE		1
10-13	285627		. LABEL, REGULATOR		1
10-14	406807-2		. KNOB, RED		2
10-15	282800A-1		. BOARD, PC, VOLTAGE REGULATOR, ASSY.		1
10-16	401911-20		. BLOCK, TERMINAL, 20-STATION		2
	203376-2		. . SCREW, M4 - 0.7 X 20mm, PHILLIPS PAN-HD		4
	281929-2		. . WASHER, FLAT, M4		8
	281930-2		. . WASHER, LOCK, M4		4
	405787-7		. . NUT, M4 - 0.7, HEX		4
10-17	284937		. BRACKET, MOUNTING, SWITCHES		1
10-18	283978-2		. CIRCUIT BREAKER, 10A		2
10-19	283978-1		. CIRCUIT BREAKER, 5A		2
10-20	400292-4		. SWITCH, TOGGLE, SPDT		2

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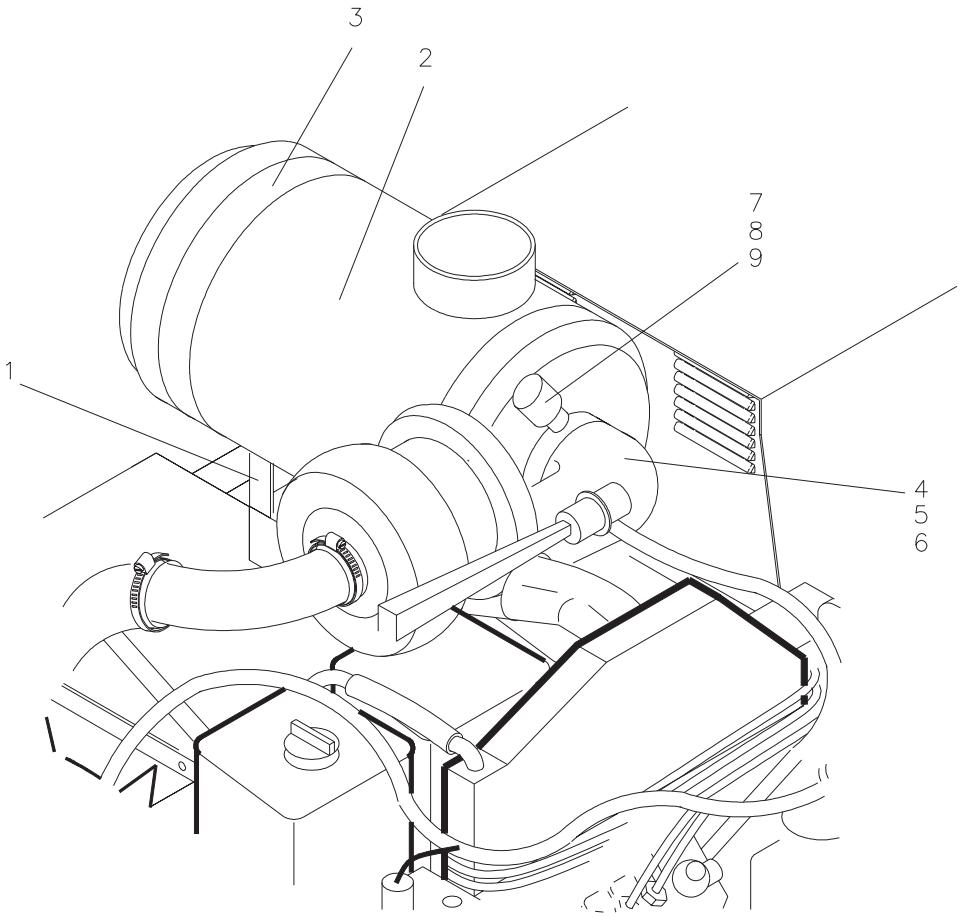
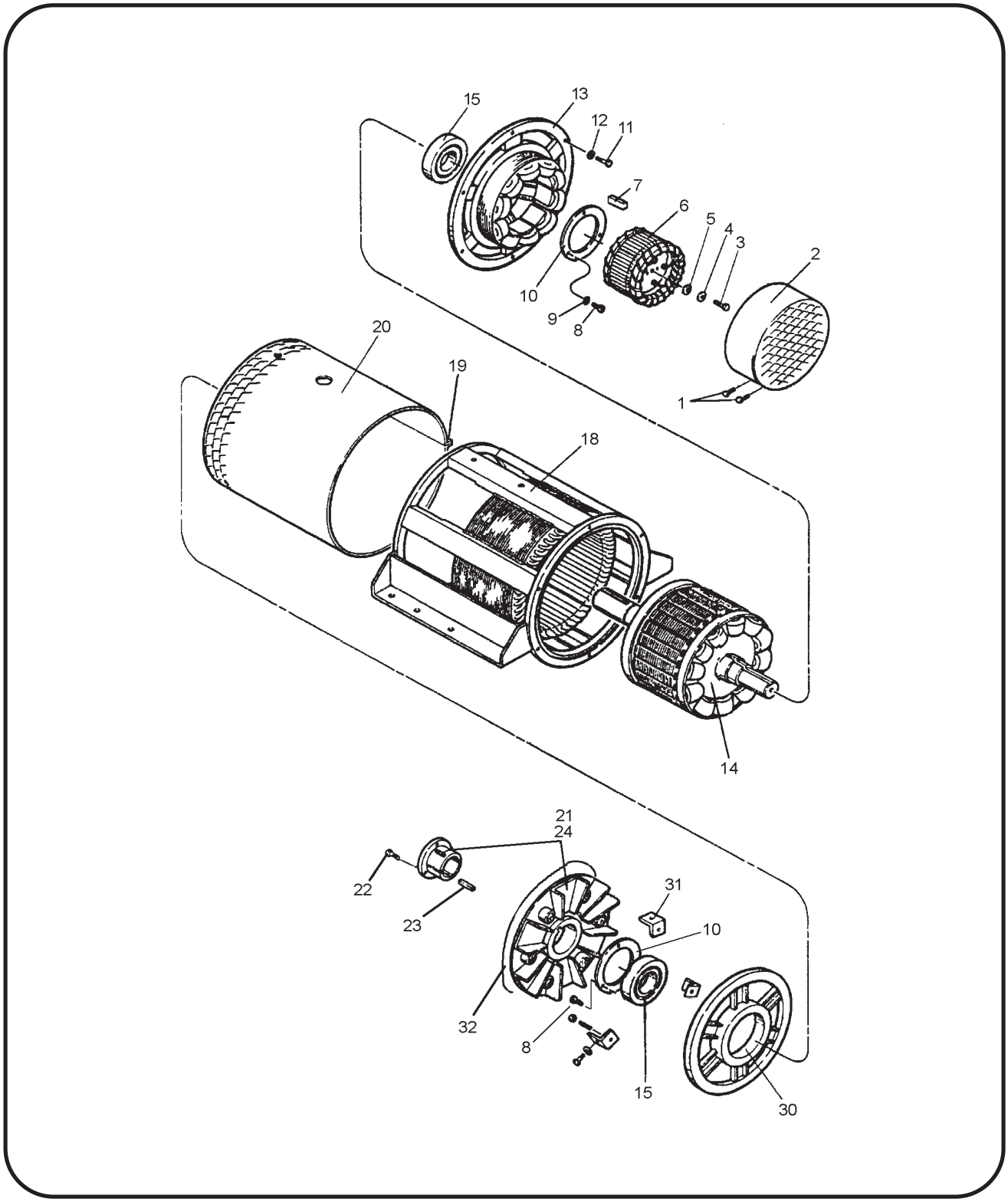
	FIGURE & ITEM NO.	HOBART PART NO.	AIRLINE PART NO.	NOMENCLATURE 1 2 3 4 5 6		UNITS PER ASSY
	10-	**284929**		**INTERIOR COMPONENTS, CONTROL BOX, ASSEMBLY (Continued)**	**A**	**REF**
		286131		**INTERIOR COMPONENTS, CONTROL BOX, ASSEMBLY (Continued)**	**B**	**REF**
		286690		**INTERIOR COMPONENTS, CONTROL BOX, ASSEMBLY (Continued)**	**C**	**REF**
	10-21	400292-6		. SWITCH, TOGGLE, 4PDT		1
		406735-1		. . SCREW, M6 - 1 X 20mm		1
		283467-4		. . WASHER, LOCK, M6		2
		405787-1		. . NUT, M6 - 1		1
	10-22	40201		. INSULATION, STRIP, NEOPRENE, 1/8 X 1/2		58"
	10-23	30GH-1262		. SOCKET, LIGHT PANEL		2
	10-24	50GPH-206		. LAMP, PILOT LIGHT		2
	10-25	284908		. BOARD, PC, GENERATOR SET CONTROL, ASSY.		1
	10-26	401564-3		. HOUSING, CONNECTOR, 10-CIRCUIT		1
	10-27			DELETED		
	10-28	285008		. DOOR, CONTROL BOX, ASSY. (For Details See Fig. 9)	A,B	1
		286691		. DOOR, CONTROL BOX ASSY. (For Details See Fig. 9)	C	1
		203494-2		. . SCREW, M5 - 0.8 X 12mm		3
		281929-3		. . WASHER, FLAT, M5		6
		281930-3		. . WASHER, LOCK, M5		3
		405787-3		. . NUT, M5 - 0.8, HEX		3
	10-29	489658-2		. DIODE, ASSY.		1
	10-30	401923-3		. CONNECTOR, WIRE, CLOSED-IN		1
	10-31	285186		. LABEL, SWITCH BRACKET		1
	10-32	181158		. TUBING, Z-FLEX, 1"		4"
*	10-33	400826-1		. TIE, ANCHOR, CABLE, PLASTIC		23
*	10-34	285160-2		. . SCREW, M3 X 6, TAPTITE, PAN-HD		23
*	10-35	400828-1		. TIE, CABLE, PLASTIC		100

*** NOT ILLUSTRATED**



Air Cleaner Group
Figure 7

FIGURE & ITEM NO.	HOBART PART NO.	AIRLINE PART NO.	NOMENCLATURE 1 2 3 4 5 6	EFF	UNITS PER ASSY
11-	No Number		AIR CLEANER GROUP (Part of Engine Parts Family) (For NHA See Fig. 3)		REF
11- 1	284839		. SUPPORT, AIR CLEANER	A,B	2
	284268		. BRACKET, AIR CLEANER	C	1
	405071-1		. . SCREW, HHC, M8 - 1.25 X 20	A,B	4
	281930-5		. . WASHER, LOCK, M8	A,B	4
	405787-2		. . NUT, HEX, FULL, M8 - 1.25	A,B	4
	282183-4		. . SCREW, TAPTITE, M10 X 25	C	3
11- 2	284922		. CLEANER, AIR	A,B	1
	286060		. CLEANER, AIR	C	1
11- 3	284923		. MOUNT, BAND, AIR CLEANER		2
	405071-1		. . SCREW, HHC, M8 - 1.25 X 20		4
	281930-5		. . WASHER, LOCK, M8		8
	405787-2		. . NUT, HEX, FULL, M8 - 1.25		4
11- 4	284925		. REDUCER, RUBBER, 90^{o} ELBOW		1
11- 5	280732-6		. CLAMP, REDUCER, HOSE		1
11- 6	280732-7		. CLAMP, REDUCER, HOSE		1
11- 7	282919		. ADAPTER, INDICATOR		1
11- 8	12CW-2125		. ELBOW, STREET, 1/8 X 45^{o}		1
11- 9	282918		. INDICATOR, RESTRICTION, ELECTRIC		1



120-kVA, 2400 RPM, Dual-Bearing Generator

	FIGURE & ITEM NO.	HOBART PART NO.	AIRLINE PART NO.	NOMENCLATURE 1 2 3 4 5 6	EFF	UNITS PER ASSY
	12 -	**285120-6**		**GENERATOR, 2400 RPM, 120kVA, DUAL BEARING**		**1**
	12- 1	W-11236-2		. SCREW, 1/4-20 x 5/8, HWH, SF-TAP, TYPE F		2
	12- 2	281698		. COVER, EXCITER		1
	12- 3	W-11100-3		. SCREW, 1/2-12 x 1-1/4, HHC, ST.		1
	12- 4	W-11254-8		. WASHER, LOCK, STD., 1/2		1
	12- 5	W-11242-12		. WASHER, FLAT, 1/2		1
	12- 6	282132		. ARMATURE, EXCITER, ASSEMBLY		1
	12- 7	180696-2		. KEY, EXCITER		1
	12- 8	409175-2		. SCREW, #10-24 x 5/8, FLAT HD, MH, ST.		6
	12- 9			DELETED		
*	12- 10	282128		. RETAINER, BEARING		2
	12- 11	W-11097-5		. SCREW, 3/8-16 x 1-1/2, HHC, ST.		6
	12- 12	W-11254-6		. WASHER, LOCK, STD., 3/8		6
	12- 13	285121		. HOUSING & COILS, EXCITER, ASSY.		1
	12- 14	281690A-6		. ARMATURE, ASSY. ,DUAL. BEAR.		1
	12- 15	W-10072-68		. . BEARING		2
	12- 16	405061-5		. SCREW, M10-1.5 x 35		6
	12- 17	84B-1034		. WASHER, LOCK		6
	12- 18	281691-3		. HOUSING & STATOR, ASSY., 120kVA, S.B.		1
	12- 19	W-11236-7		. SCREW, 1/4-20 x 3/4, HWH, SF-TAP, TYPE F		3
	12- 20	281699		. COVER, GENERATOR		1
	12- 21	281701		. KIT, FLEX COUPLING, ASSY.		1
	12- 22	W-11097-33		. . SCREW, 3/8-16 x 1-3/4, HHC, ST., GRADE 5		3
	12- 23	85B-1039		. KEY, COUPLING		1
	12- 24	W-11102-18		. SCREW, 5/8-11 x 2-3/4, HD.		6
*	12- 25	283546		. SHROUD, FAN		1
*	12- 26	283560		. BRACKET, MTG., SHROUD, FAN		3
*	12- 27	42517		. SLEEVING, NEG. EXC. LEAD #0		3"
*	12- 28	41507		. SLEEVING, NEG. EXC. LEADS #7		12"
*	12- 29	283620		. DEFLECTOR, AIR, GENERATOR EXHAUST		6
	12- 30	281705-1		. RETAINER, BEARING, FRONT		1
	12- 31	281700		'. BRACKET, MOUNTING, ANGLE		3
	12-32	386612		. RING, SPACER, FLEXIBLE COUPLING		1
		W-11097-35		. . SCREW, HHC, 3/8 - 16 X 1-1/4		8
		W-11254-6		. . WASHER, LOCK, 3/8		8
		No Number		. HARDWARE, FLEXIBLE COUPLING- TO-SPACER RING		
	12-33	W-11102-18		. . SCREW, HHC, 5/8 - 11 X 2-3/4		6
	12-34	W-11254-10		. . WASHER, LOCK, 5/8		6

NOTE: Items 16, 17, and 24 vary by engine to account for English/Metric or coarse/fine thread.

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	FIGURE & ITEM NO.	HOBART PART NO.	AIRLINE PART NO.	NOMENCLATURE 1 2 3 4 5 6	EFF	UNITS PER ASSY
	12 -	**285120-6**		**GENERATOR, 2400 RPM, 120kVA, DUAL BEARING (Continued)**		**1**
		No Number		. HARDWARE, GENERATOR HOUSING-TO-ENGINE		
*	12-35	405061-5		. . SCREW, M10 - 1.5 X 35		6
*	12-36	84A-1034		. . WASHER, LOCK		6
		No Number		. HARDWARE, GENERATOR HOUSING-TO-SHOCK MOUNTS		
*	12-37	284312-3		. . SCREW, HHC, M16 - 2.0 X 90		2
*	12-38	281929-16		. . WASHER, FLAT, , M16		2
*	12-39	281930-11		. . WASHER, LOCK, M16		2
*	12-40	405787-11		. . NUT, HEX, M16 - 2.0		2
*	12-41	284372-4		. MOUNT, SHOCK, GENERATOR		2
*	12-42	405061-5		. . SCREW, M10 - 1.5 X 35		4
*	12-43	284930-6		. . WASHER, LOCK, M10		4
*	12-44	405787-8		. . NUT, HEX, FULL, M10 - 1.5		4

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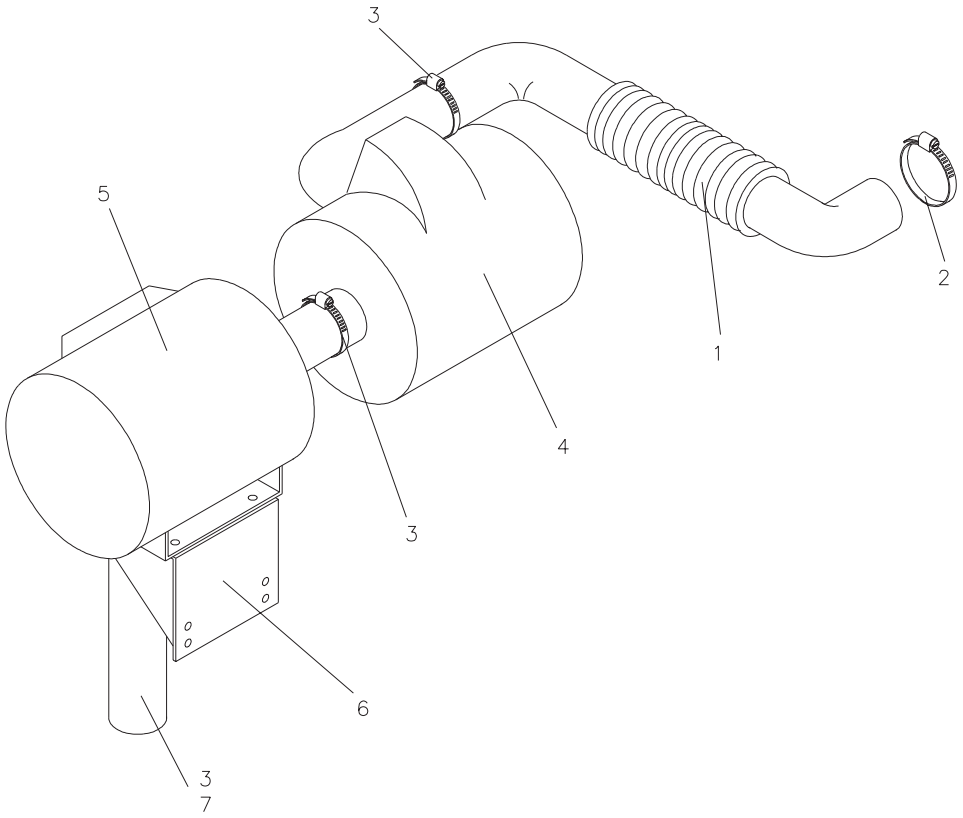
3
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7

FIGURE & ITEM NO.	HOBART PART NO.	AIRLINE PART NO.	NOMENCLATURE 1 2 3 4 5 6	EFF	UNITS PER ASSY
13 -	**No Number**		**MUFFLER & EXHAUST ASSEMBLY (For NHA See Fig. 3) (Part of Engine Parts Family)**		**REF**
13- 1	285283		. PIPE, EXHAUST, RESONATOR INLET		1
13- 2	404154-13		. CLAMP, EXHAUST		1
13- 3	404154-16		. CLAMP, EXHAUST		3
13- 4	285385		. MUFFLER, IN-LINE ASSY.		1
	285382		. . MUFFLER, EXHAUST		1
	405061-10		. . SCREW, HHC, M10 - 1.5 X 25		4
	281929-6		. . WASHER, FLAT, M10		4
	281930-6		. . WASHER, LOCK, M10		4
	405787-8		. . NUT, HEX, FULL, M10 - 1.5		4
13- 5	285286		. MUFFLER, ASSY.		1
	285252		. . MUFFLER, EXHAUST		1
	286624		. . INSULATION, MUFFLER, IN-LINE		1
	405061-10		. . SCREW, HHC, M10 - 1.5 X 25		4
	281929-6		. . WASHER, FLAT, M10		4
	281930-6		. . WASHER, LOCK, M10		4
	405787-8		. . NUT, HEX, FULL, M10 - 1.5		4
13- 6	284853		. BRACKET, MOUNTING, MUFFLER, ASSY.	A,B	1
	400852-1		. . SCREW, HH, SF-TAP, 3/8 - 12 X 7/8	A,B	4
13- 7	284939		. PIPE, EXHAUST, MUFFLER, ASSY		1

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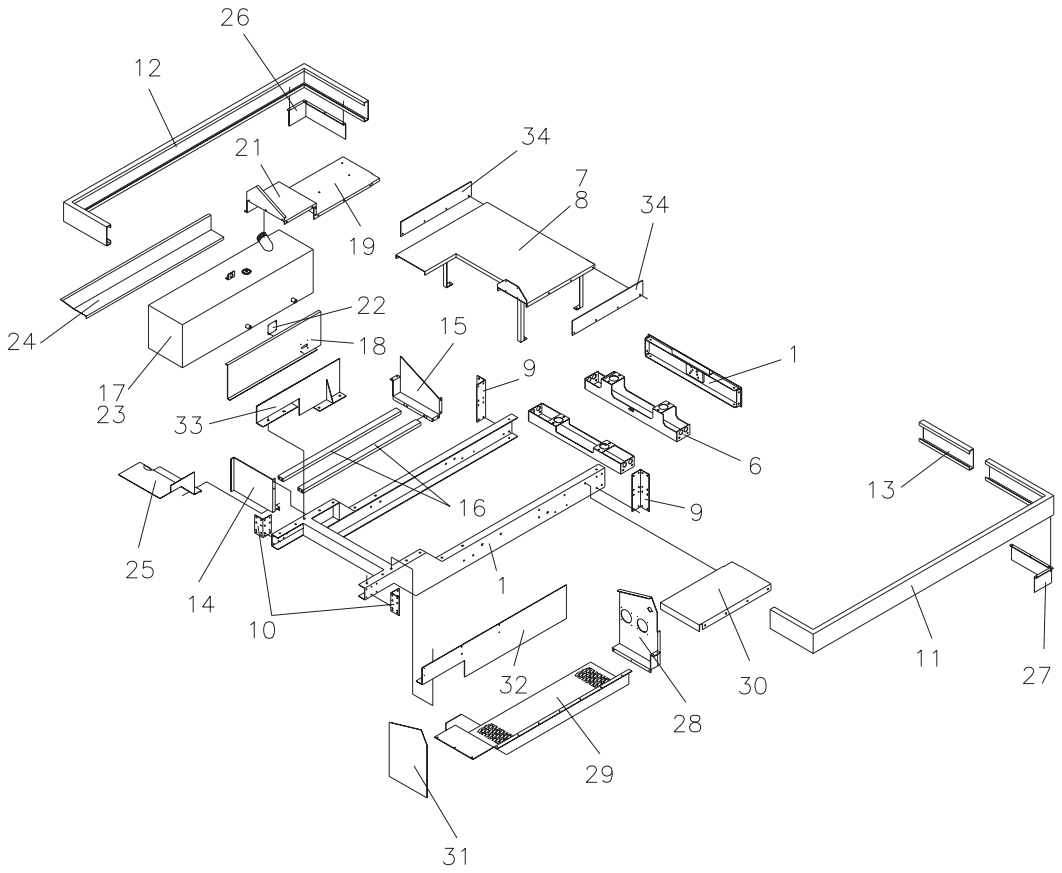


Frame Assembly

	FIGURE & ITEM NO.	HOBART PART NO.	AIRLINE PART NO.	NOMENCLATURE 1 2 3 4 5 6	EFF	UNITS PER ASSY
	14-	NO NUMBER		FRAME ASSY (For NHA See Fig. 1)		REF
	14- 1	284735		. FRAME MOUNTING ASSEMBLY	A,B	1
		286163		. FRAME MOUNTING ASSEMBLY	C	1
*	14- 2	285040		. PANEL, BOTTOM, FRONT, ASSY.		1
		282183-2		. . SCREW, HEX HD., TAPTITE, M6 X 12		12
*	14- 3	285301A		. PANEL, BOTTOM, REAR, ASSY.		1
		282183-2		. . SCREW, HEX HD., TAPTITE, M6 X 12		1
	14- 4			DELETED		
	14- 5			DELETED		
	14- 6	284776		. SUPPORT, GENERATOR, ASSY.		1
		405061-8		. . SCREW, HHC, M10 - 1.5 X 20		4
		281930-6		. . WASHER, LOCK, M10		4
		405787-8		. . NUT, HEX, FULL, M10 - 1.5		4
	14- 7	284821		. SUPPORT, CONTROL BOX/T-R ASSY.	A,B	1
		284264		. SUPPORT, CONTROL BOX/T-R ASSY.	C	1
		400852-1		. . SCREW, 3/8 - 12 X 7/8 HH, ST	A,B	4
		282183-4		. . SCREW, HEX HD., TAPTITE, M10 X 25	C	4
	14- 8	HF-2752		. MOUNT, SHOCK, CONTROL BOX		4
	14- 9	284674		. BRACKET, MOUNTING, REAR BUMPER		2
		400852-1		. . SCREW, 3/8 - 12 X 7/8 HH, ST,	A,B	8
		282183-4		. . SCREW, HEX HD., TAPTITE, M10 X 25	C	8
	14-10	284673		. BRACKET, MOUNTING, FRONT BUMPER	A,B	2
		284219		. BRACKET, MOUNTING, FRONT BUMPER	C	2
		400852-1		. . SCREW, 3/8 - 12 X 7/8 HH, ST,	A,B	8
		282183-4		. . SCREW, HEX HD., TAPTITE, M10 X 25	C	8
	14-11	284894		. BUMPER, LEFT, ASSY.	A,B	1
		286174		. BUMPER, LEFT, ASSY	C	1
		400852-1		. . SCREW, 3/8 - 12 X 7/8 HH, ST,	A,B	8
		282183-4		. . SCREW, HEX HD., TAPTITE, M10 X 25	C	8
	14-12	284857		. BUMPER, RIGHT, ASSY.	A,B	1
		286175		. BUMPER, RIGHT, ASSY	C	1
		400852-1		. . SCREW, 3/8 - 12 X 7/8 HH, ST,	A,B	8
		282183-4		. . SCREW, HEX HD, TAPTITE, M10 X 25	C	8
	14-13	284902		. RAIL, BUMPER, CENTER REAR	A,B	1
		285932		. RAIL, BUMPER, CENTER REAR	C	1
		282183-4		. . SCREW, HEX HD., TAPTITE, M10 X 25	C	2
	14-14	284914		. SUPPORT, FRONT, FUEL TANK, ASSY.	A,B	1
		284204		. SUPPORT, FUEL TANK/MUFFLER ASSY.	C	1
		400852-1		. . SCREW, 3/8 - 12 X 7/8 HH, ST,	A,B	4
		282183-4		. . SCREW, HEX HD., TAPTITE, M10 X 25	C	4
	14-15	284843		. SUPPORT, REAR, FUEL TANK ASSY.		1
		400852-1		. . SCREW, 3/8 - 12 X 7/8 HH, ST,		8

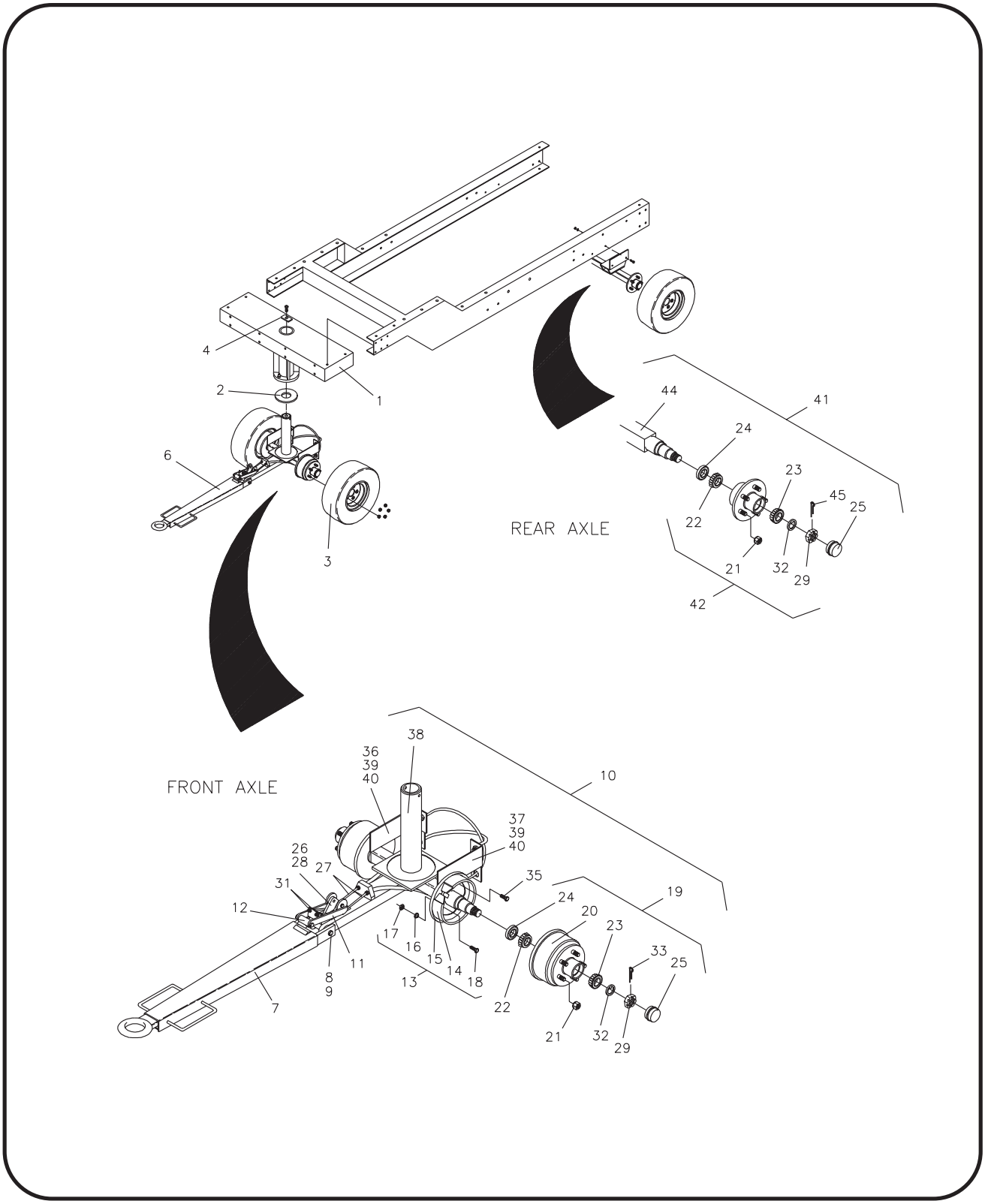
*** NOT ILLUSTRATED**

FIGURE & ITEM NO.	HOBART PART NO.	AIRLINE PART NO.	NOMENCLATURE 1 2 3 4 5 6	EFF	UNITS PER ASSY
14-	NO NUMBER		FRAME ASSY (For NHA See Fig. 1) (CONT)		REF
14-16	284899		. SUPPORT, FUEL TANK	A,B	2
	284216		. SUPPORT, FUEL TANK	C	2
	400852-1		. . SCREW, 3/8 - 12 X 7/8 HH, ST,		8
14-17	284891		. TANK, FUEL, ASSY.		1
14-18	285003		. PANEL, SIDE, CABLE BOX, DC	A,B	1
	284220		. PANEL, SIDE, CABLE BOX, DC	C	1
	282183-2		. . SCREW, HEX HD., SF-TAP, M6 X 12		5
14-19	284994		. PANEL, BOTTOM, CABLE BOX, DC	A,B	1
	284199		. PANEL, BOTTOM, CABLE BOX, DC	C	1
	203378-1		. . SCREW, HEX HD., SF-TAP, M6 X 12		10
14-20			DELETED		
14-21	285001		. PANEL, FRONT, CABLE BOX, DC	A,B	1
	284238		. PANEL, FRONT, CABLE BOX, DC	C	1
	402119-2		. . SCREW, 1/4 - 20 X 1/2, HH, ST	A,B	3
	50MS-732-0		. . NUT, 1/4 - 20 X 1/2, HEX, KEPS, ST	A,B	3
	282183-2		. . SCREW, HEX HD., TAPTITE, M6 X 1	C	3
14-22	488799		. COVER, OUTPUT CABLE, DC		1
	282183-2		. . SCREW, HH, TAP-TITE, M6 - 1 X 12		2
14-23	282562		. CAP, FUEL TANK		1
14-24	285015		. COVER, FUEL TANK	A,B	1
	285015A		. COVER, FUEL TANK	C	1
	282183-2		. . SCREW, HEX HD., TAPTITE, M6 X 12		13
14-25	285016		. COVER, EXHAUST, ASSY.	A,B	1
	285016A		. COVER, EXHAUST, ASSY.	C	1
	282183-2		. . SCREW, HEX HD., TAPTITE, M6 X 12		7
14-26	284998		. FENDER, RIGHT REAR	A,B	1
	284202		. FENDER, RIGHT REAR	C	1
	282183-2		. . SCREW, HEX HD., TAPTITE, M6 X 12		5
14-27	284997		. FENDER, LEFT REAR	A,B	1
	284201		. FENDER, LEFT REAR	C	1
	282183-2		. . SCREW, HEX HD., TAPTITE, M6 X 12		5
14-28	284988		. PANEL, BULKHEAD, ASSY.		1
	400852-1		. . SCREW, 3/8 - 12 X 7/8 HH, ST, TYPE 25		4
14-29	285004		. TRAY, CABLE ASSY, AC		1
	282183-2		. . SCREW, HEX HD., TAPTITE, M6 X 12		20
14-30	284995		. COVER, REAR WHEEL	A,B	1
	284222		. COVER, REAR WHEEL	C	1
	203378-1		. . SCREW, HEX HD., TAPTITE, M6 X 12		11

*** NOT ILLUSTRATED**

FIGURE & ITEM NO.	HOBART PART NO.	AIRLINE PART NO.	NOMENCLATURE 1 2 3 4 5 6	EFF	UNITS PER ASSY
14-	NO NUMBER		FRAME ASSY (For NHA See Fig. 1)		REF
14-31	285009		. PANEL, FRONT, AC CABLE BOX		1
	282183-2		. . SCREW, HEX HD., TAPTITE, M6 X 12		5
14-32	285217		. PANEL, SUPPORT, TRACK, LEFT, FRONT, ASSY.		1
	400852-1		. . SCREW, 3/8 - 12 X 7/8 HH, ST, TYPE 25		6
14-33	285221		. PANEL, SUPPORT, TRACK, RIGHT, FRONT, ASSY.		1
	400852-1		. . SCREW, 3/8 - 12 X 7/8 HH, ST, TYPE 25		4
14-34	285363		. PANEL, SLIDE, MOUNT, REAR, ASSY.		2
	405061-10		. . SCREW, HHC, M10 - 1.5 X 25		8
	281930-6		. . WASHER, LOCK, M10		8
	405787-8		. . NUT, HEX, FULL, M10 - 1.5		8

*** NOT ILLUSTRATED**



Running Gear Group

	FIGURE & ITEM NO.	HOBART PART NO.	AIRLINE PART NO.	NOMENCLATURE 1 2 3 4 5 6	EFF	UNITS PER ASSY
	15-	**285187**		**RUNNING GEAR GROUP (For NHA See Fig. 1)**	**A,B**	**REF**
		286655		**RUNNING GEAR GROUP (For NHA See Fig. 1)**	**C**	**REF**
	15 - 1	284734		. SUPPORT, 5TH WHEEL, ASSY	A,B	1
		286657		. SUPPORT, 5TH WHEEL, ASSY	C	1
		400852-1		. . SCREW, 5/8 - 12 X 7/8, HH, ST, TYPE 25		8
		405061-8		. . SCREW, HHC, M10 - 1.5 X 20		8
		281930-6		. . WASHER, LOCK, M10		8
		W-11439-1		. . FITTING GREASE		1
	15 - 2	280763		. PLATE, BEARING		1
	15 - 3	285418		. WHEEL, ASSY		4
	15 - 4	285912		. PLATE, RETAINING, 5TH WHEEL		1
*	15 - 5	81B-1062		. . LABEL, WARNING, DRAWBAR		
				(AFFIXED TO DRAWBAR)		1
	15 - 6	284062		. RUNNING GEAR, 5TH & REAR AXLES ASSY.		1
		406684-6		. . SCREW, HHC, M12 - 1.75 X 40		1
		406684-1		. . SCREW, HHC, M12 - 1.75 X 30		4
		281930-7		. . WASHER, LOCK, M12		4
		405787-9		. . NUT, HEX, FULL, M12 - 1.75		4
	15 - 7	284399-35		. . DRAWBAR ASSEMBLY, V22938, NO.21-3500		1
	15 - 8	284399-36		. . . PIN, COTTER, V22938, NO. 4800-6		2
	15 - 9	79A-1057		. . . PIN, HINGE		1
	15 - 10	284399-7		. . AXLE, STRG, ASSY., V22938, NO.845-20010F		1
	15 - 11	284399-8		. . . LEVER, BRAKE, V22938, NO. 1-5929		1
	15 - 12	284399-37		. . . ROLLER, BRAKE LEVER, V22938, NO.5929-41		
	15 - 13	284399-9		. . . BRAKE ASSEMBLY, V22938, NO.1-8209		2
	15 - 14	284399-10		. . . . BRAKE SHOES & SPRINGS, V22938,NO.4-8209		2
	15 - 15	284399-11		. . . . SHIELD, DUST, V22938, NO. 8210		2
	15 - 16	284399-12		. . . . LOCKWASHER, V22938, NO. 4700-4		8
	15 - 17	80A-1066		. . . . NUT, HEX, V22938, NO. 4601-47		8
	15 - 18	284399-14		. . . . BOLT, HEX, V22938, NO. 4901-7		4
	15 - 19	284399-15		. . . HUB & DRUM ASSEMBLY, V22938, NO. 24-3615		2
	15 - 20	284399-16		. . . . DRUM, BRAKE, V22938, NO. 8221-2		2
	15 - 21	85A-1024		. . . . NUT, STUD, V22938, NO. 4603-1		10
	15 - 22	284399-17		. . . . BEARING CONE (INNER), V22938, NO. 6063		2
	15 - 23	284399-18		. . . . BEARING CONE (OUTER), V22938, NO. 6067		2
	15 - 24	284399-19		. . . . SEAL, GREASE, V22938, NO. 6317		2
	15 - 25	284399-20		. . . . CAP, GREASE, V22938, NO. 6323		2
	15 - 26	284399-21		. . . PEDAL, LATCH, V22938, NO. 3853-2		1
	15 - 27	284399-22		. . . CABLE & CONDUIT, V22938, NO. 4-8351		2
	15 - 28	181840		. . . SPRING, COIL, V22938, NO. 4006		1
	15 - 29	85A-1031		. . . NUT, SPINDLE, V22938, NO. 4600-1		2
*	15 - 30	284399-23		. . . NUT, LOCK, V22938, NO. 4601-11		1
	15 - 31	80A-1066		. . . NUT, HEX, V22938, NO. 4601-47		4

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	FIGURE & ITEM NO.	HOBART PART NO.	AIRLINE PART NO.	NOMENCLATURE 1 2 3 4 5 6		UNITS PER ASSY
	15 -	**285187**		**RUNNING GEAR GROUP (Continued)**	**A,B**	**REF**
		286655		**RUNNING GEAR GROUP (CONTINUED)**	**C**	**REF**
	15 - 32	284399-24		. . . WASHER, SPINDLE, V22938, NO. 4702-1		2
	15 - 33	80A-1034		. . . PIN, COTTER, V22938, NO. 4800-2		2
*	15 - 34	284399-25		. . . BOLT, HEX, V22938, NO. 4901-1		1
	15 - 35	284399-26		. . . BOLT, HEX, V22938, NO. 4901-37		4
	15 - 36	284399-27		. . . BRACKET & HANGER, CABLE, RH, V22938, NO. 8209-15		1
	15 - 37	284399-28		. . . BRACKET & HANGER, CABLE, LH, V22938, NO. 8209-16		1
	15 - 38	284399-29		. . . AXLE, STRG., WLDMT, V22938, NO.845-20010F2		1
	15 - 39	284399-30		. . . PIN, YOKE, V22938, NO. MS2039-5C21		2
	15 - 40	80A-1052		. . . PIN, COTTER, V22938, NO. 4800-5		2
	15 - 41	284399-31		. . AXLE, REAR ASSEMBLY, V22938, N0. 845-20410		1
	15 - 42	284399-32		. . . HUB ASSEMBLY, V22938, NO. 15-3615		2
	*15 - 43	284399-33		. . . . HUB, CAP, STUDS, V22938, NO. 3615-15		2
	15 - 44	284399-34		. . . AXLE, REAR, WLDMT., V22938, NO.845-20410-2		1

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Section 4. Numerical Index

Explanation of Numerical Index

The purpose of this index is to assist the user in finding the illustration and description of a part when the part number is known. Part numbers are arranged in alpha-numeric sequence. Thus, any number beginning with the letter “A” would be located toward the beginning of the index 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
W-11280-3	5a & b- 5
W-11280-3	5a- 7
W-11280-3	5b-18
W-11439-1	15- 1
W-11242-5	5b-18
W-12242-6	3-21
W-12242-10	3-28
W-11254-4	5a- 4
W-11254-4	5a- 6
W-11254-4	5b-18
W-12254-5	3-21
W-12254-6	3-28
W-12263-6	3-28
W-11269-3	5b-18
W-12278-6	3-21
W-7814-3	7-2
W-7814-4	4-22
W-8105A-4	9-13
W-9350-201	8-21
W-9350-205	8-21
W-9350-224	8-21
W-9350-301	8-21
W-9350-302	8-21
W-9350-305	8-21
W-9360-289	3-29
W-9407-446	3-28
W-9476-18	5b- 5
W-9476-33	5a- 5
W-9746-3	8-16
W-9917-18	9-6
1CZ-148	8- 5
12CW-2077-3	6-10
12CW-2125	11- 8
180593-2	8-23
180696-2	12- 7
181158	6- 8, 10-32
181358	9- 6
181831	3-20
181891-3	5a & b-12
203376-2	10-16
203378-1	2- 3
203378-1	3-30
203378-1	4-11
203494-2	10-28
280732-6	11- 5
280732-7	11- 6
280763	15- 3
281282-1	2-10
281690A-6	12-14
281691-3	12-18
281698	12- 2
281699	12-20
281700	12-31
281701	12-21
281705-1	12-30
281751-3	5a & b-13
281772	5a & b- 2
281775	5a & b- 3
281776	5a- 4
281776	5b-18
281871-1	3-18
281929-2	10-16
281929-3	10-28
281929-4	3-30
281929-4	3-33
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281929-4	10- 2
281929-6	4- 1
281929-6	4- 5
281929-6	4-11
281929-6	7- 7
281929-6	8- 2
281929-6	8- 3
281929-6	13- 4
281929-6	13- 5
281929-7	3-14
281929-7	3-13
281929-7	3-23
281929-7	7- 3
281929-14	3-30
281929-14	8- 4
281929-14	10- 5
281929-16	12-40
281930-2	10-16

Part Number	Figure & Item Number	Part Number	Figure & Item Number
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281930-4	4-3	282183-2	14-2
281930-4	5a & b- 2	282183-2	14-3
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281930-5	2- 1	282183-2	14-18
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281930-5	11- 3	282183-2	14-24
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281930-6	3-16	282183-2	14-26
281930-6	3-19	282183-2	14-27
281930-6	4- 5	282183-2	14-29
281930-6	4-11	282183-2	14-30
281930-6	7- 8	282183-2	14-31
281930-6	8- 2	282183-2	11-1
281930-6	8- 3	282183-4	4-2
281930-6	13- 4	282183-4	14-9
281930-6	13- 5	282183-4	14-10
281930-6	14- 6	282183-4	14-11
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281930-6	15- 1	282183-4	14-13
281930-7	3- 1	282183-4	14-14
281930-7	3-13	282184-1	2- 4
281930-7	3-14	282562	14-23
281930-7	3-23	282658	3-48
281930-7	5a & b- 1	282659	3-44
281930-7	7- 4	282731	3-37
281930-7	15- 2	282800	10-15
281930-10	3-30	282852	3-13
281930-10	8- 4	282853	3-14
281930-10	10- 5	282919	11- 7
281930-11	12-41	282918	11- 9
281931-4	8- 8	283165	9-12
281931-6	8- 2	283167	9- 9
281931-6	8- 3	283197	8-21
282089-8	8-22	283466-2	3-30
282130-1	8-10	283466-2	8- 4
282132	12- 6	283466-2	10- 5
282183-1	2-10	283467-4	3-33

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283546	12-25
283560	12-26
283620	12-29
283873	4- 6
283887	2-27
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283978-2	10-18
283990-1	5a & b-11
284062	15- 2
284099	1-1
284199	14-19
284201	14-27
284202	14-26
284204	14-14
284216	14-16
284219	14-10
284220	14-18
284223	5b-1
284237	2-3
284238	14-21
284264	14-7
284268	11-1
284269	1-3
284312-3	12-39
284371-4	3-15
284372-4	12-35
284475-1	9-16 thru 9-21
284475-2	9-16 thru 9-21
284475-3	9-16 thru 9-21
284673	14-10
284674	14- 9
284734	15- 1
284735	14- 1
284776	14- 6
284785	3-16
284821	14- 7
284831	8-18
284836	8- 4
284839	11- 1
284843	14-15
284853	13- 6
284857	14-12
284894	14-11
284865	5a- 1
284868	5a- 8
284891	14-17
284899	14-16
284900	8- 1
284902	14-13
284914	14-14
284924	3- 1
284925	11- 4
284929	3- 8
284929	10 -0
284930	9- 3
284930-6	12-37
284935	10- 2
284937	10-17
284939	13- 7
284949	7-10
284970	10- 1
284995	14-30
284997	14-27
284998	14-26
284988	14-28
285000	14-19
285001	14-21
285003	14-18
285004	14-29
285008	3- 7
285008	9- 0
285008	10-28
285009	14-31
285015	14-24
285015A	14-24
285016	14-25
285029-1	9-16 thru 9-21
285030-1	9-16 thru 9-21
285030-2	9-16 thru 9-21
285030-3	9-16 thru 9-21
285031-1	9-16 thru 9-21

Part Number	Figure & Item Number
285032-1	9-16 thru 9-21
285033	9-16 thru 9-21
285034-1	9-16 thru 9-21
285040	14- 2
285062-1	5a & b-14
285063A-2	5a & b-15
285080	9-10
285120-6	3-10
285120-6	12 -0
285121	12-13
285160-1	8-15
285160-1	8-17
285160-2	8-16
285160-3	8- 5
285160-4	8-13
285160-4	8-14
285160-4	8-20
285172	9-11
285173	1-3
285185-1	2- 0
285186	10-31
285187-1	1-4
285187	15- 0
285188-1	2- 5
285195	3-30
285199	3- 6
285199	8- 0
285200	3-32
285204	4- 2
285217	14-32
285221	14-33
285225	4-11
285225A	4-11
285237	4- 1
285283	13- 1
285286	13- 5
285287	7-15
285288	2- 8
285291	3-31
285293	7- 5
285301A	14- 3
285311	2- 6
285312	2- 7
285338	7- 1
285361	3-19
285363	14-34
285364	7- 9
285367	7-14
285368	7-13
285369	6- 7
285383	2- 2
285385	13- 4
285401	2- 1
285413	2- 3
285414	2- 4
285426-1	2- 2
285433-1	2-10
285433-2	2-11
285433-3	2-12
285436	5b-16
285443-5	2-26
285456	2-13
285459	2-20
285460	2-23
285461	2-22
285463	2-25
285465	2-21
285467	2-15
285627	10-13
285932	14-13
286000	4-7
286001	4-8
286027	2-17
286041	2-24
286060	11-2
286063	2-30
286093	3-1
286131	10-0
286158	3-13
286160	3-14
286163	14-1
286174	14-11
286175	14-12
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286621-2	3-23
286624	13-5
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286627	7-4
286643	4-5
286644	4-3
286655	15-0
286660	7-7
286690	3-8
286690	10-0
286691	3-7
286691	9-0
286691	10-28
286693	3-30
286648	2-19
286649	2-18
286650	2-16
286651	2-14
286655	1-4
286657	15-1
286840-1	5b-17
30GH-1262	10-23
351541	3-39
375426-3	10- 9
383067-5	3-23
386612	12-32
387736C	10- 8
387738A	8-11
400292-4	10-20
400292-6	10-21
400600	3-43
400613-4	9-16 thru 9-21
400818-2	7-11
400819-1	7-12
400852-1	3-28
400852-1	4- 2
400852-1	13- 6
400852-1	14- 7
400852-1	14- 9
400852-1	14-10
400852-1	14-28
400852-1	14-33
400852-1	15- 1
400852-1	14-32
400852-1	14-11
400852-1	14-12
400852-1	14-13
400852-1	14-15
400852-1	14-16
400902	4-14
401061-7	7- 6
401564-3	10-26
401564-4	8-24
401564-4	10-11
401564-5	10- 7
401911-20	10-16
401923-3	10-30
401991-20	8-17
40201	10-22
402037-14	8- 9
402119-2	14-21
402119-4	5a- 4
402119-6	5b-18
402908	5a- 6
402987	1-5
403034	4-20
403782-2	4-12
403809-1	6- 1
404065-2	8-15
404402-1	8-20
404402-8	8-14
404402-9	8-13
404154-13	13- 2
404154-16	13- 3
404568	3-28
405061-10	4- 5
405061-10	13- 4
405061-10	13- 5
405061-10	14-34
405061-12	8- 2
405061-1	8- 3
405061-3	4-11
405061-5	12-16

Part Number	Figure & Item Number
405061-5	12-36
405061-5	12-43
405061-6	4- 1
405061-7	3-16
405061-7	3-19
405061-8	4- 5
405061-8	14- 6
405061-8	15- 1
405535-6	10-27
405071-1	2- 1
405071-1	5a- 8
405071-1	11- 1
405071-1	11- 3
405071-6	3-15
405787-1	2- 4
405787-1	3-33
405787-1	4-3
405787-1	5a & b- 2
405787-1	5a- 8
405787-1	10-21
405787-2	2- 1
405787-2	3-15
405787-2	11- 1
405787-2	11- 3
405787-3	10-28
405787-7	10-16
405787-8	3-19
405787-8	4- 5
405787-8	12-38
405787-8	13- 4
405787-8	13- 5
405787-8	14- 6
405787-8	14-34
405787-9	3-13
405787-9	3-14
405787-9	3-23
405787-11	12-42
405787-14	3-30
405787-14	8- 4
405787-14	10- 5
406001	3-40
406684-1	3- 1
406684-1	3-23
406684-1	7- 2
406684-1	15- 2
406684-2	5a & b- 1
406684-6	15- 2
406684-8	3-13
406684-8	3-14
406684-8	3-15
406735-1	2- 4
406735-1	10-21
406735-2	5a & b-2
406735-3	5a- 8
406735-4	8- 8
406735-7	3-33
406735-7	4-3
406735-6	10- 2
406807-2	10-14
408173	3-33
408665-1	2-29
408665-2	2-31
409175-2	12- 8
41507	12-28
42517	12-27
430077-2	2-28
481209-1	3-22
482038A	10-12
482039B	10-10
482989	5a & b-10
487750-1	3-12
488799	14-22
489658-2	10-29
494134-1	9- 1
494295	3-21
500033-1	1-0
50984	2- 9
5CW-1308-3	4- 3
56537	4-15
50GPH-206	10-24
50MS-732-0	8- 6
50MS-732-0	14-21
50MS-732-1	5a & b- 9
50MS-732-1	5a & b-11

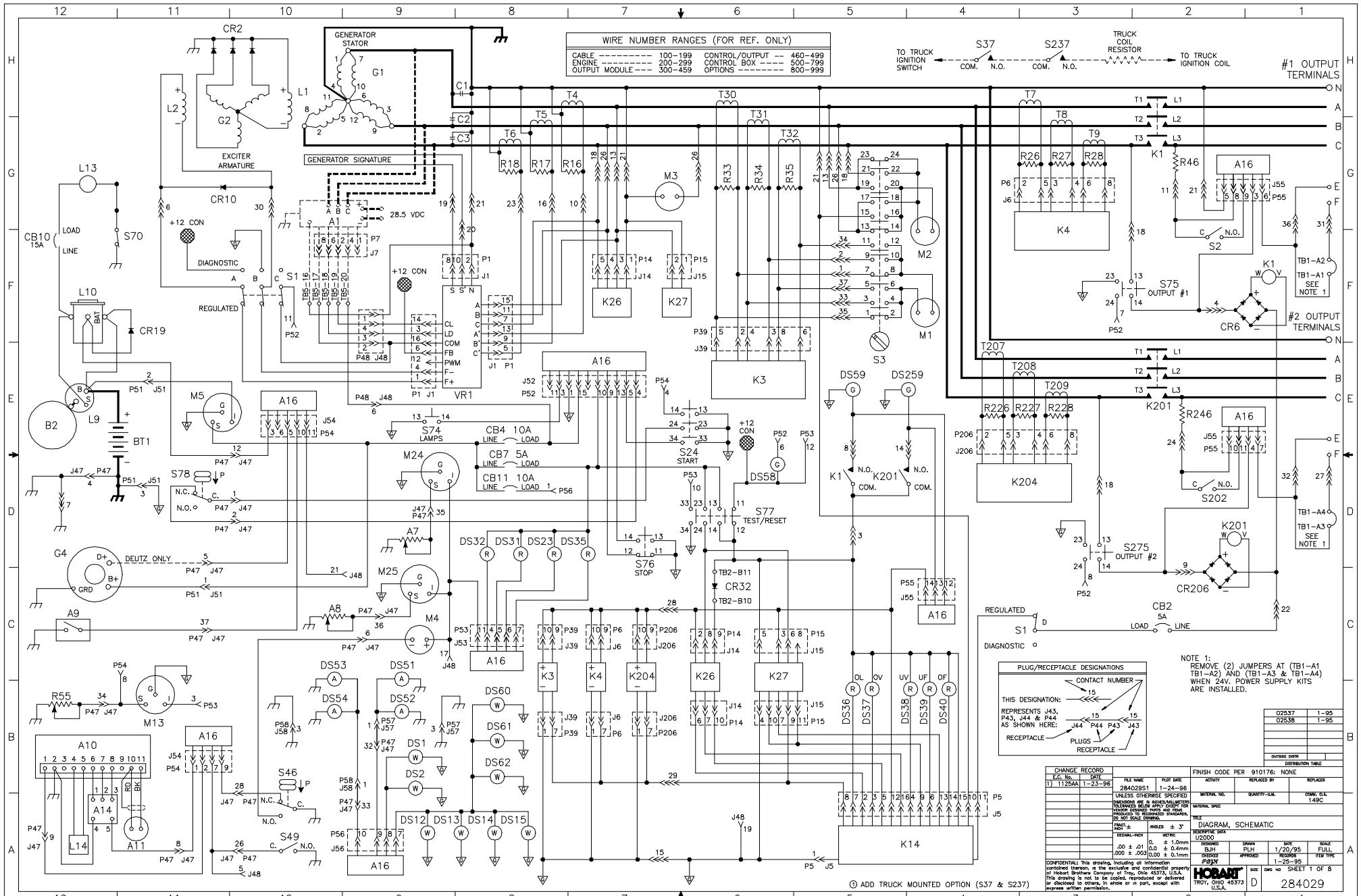
50MS-732-1	8-11	79A-1164	10- 5
50MS732-1	8-12	79B-1159-1	10- 3
76A-1131	8-19	79B-1159-2	10- 4
76A-1131	8-21	79B-1159-6	10- 6
76A-1132	3-22	79C-1158	9-15
76A-1132	7-16	80A-1101	9-14
76A-1132	10-33	80A-1104	9-41
76B-1148	3-36	81A-1061	3-42
77A-1049-1	2-8	81B-1063	3-38
78A-1000	3-34	81B-1064	3-46
78A-1115-1	9- 8	83A-1004	6-12
78A-1116-1	9- 4	84A-1034	12-44
78A-1117-1	9- 7	84A-1075	5a & b- 9
78A-1117-2	9-7	84A-1075	8-12
78B-1118-1	6- 2	84B-1034	12-17
78B-1118-2	6-2	84B-1045	3-45
78B-1119-1	4-13	85B-1039	12-23
79A-1110	3-35		

Chapter 5. Manufacturer's Literature

MANUFACTURERS' LITERATURE
Cummins Engine Operation and Maintenance Manual 3810205-10

HOBART DIAGRAMS		
MODEL NO.	**DIAGRAM**	**DIAGRAM DESCRIPTION**
500033-1	284029, Sheet 1	Schematic Diagram, Engine and Generator
500033-1	284029, Sheet 2	Schematic Diagram, Engine and Generator, Legend
500033-1	284029, Sheet 3	Connection Diagram, Control Panel
500033-1	284029, Sheet 4	Connection Diagram, Control Box Interior
500033-1	284029, Sheet 5	Connection Diagram, 400-Hz Output Module
500033-1	284029, Sheet 6	Connection Diagram, Engine and Generator
500033-1	284029, Sheet 7	Connection Diagram, Options
500033-1	284029, Sheet 8	Connection Diagram, Options
ALL	487747	Connection Diagram, 28.5-V DC Transformer-Rectifier
ALL	487748	Schematic Diagram, 28.5-V DC Transformer-Rectifier
ALL	487749	Connection Diagram, Front Panel, 28.5-V DC Transformer-Rectifier
ALL	285189	Dimensional Layout, U-2000
500033-2	286137, Sheet 1	Schematic Diagram, Engine and Generator
500033-2	286137, Sheet 2	Schematic Diagram, Legend
500033-2	286137, Sheet 3	Connection Diagram, Control Panel
500033-2	286137, Sheet 4	Connection Diagram, Control Box Interior
500033-2	286137, Sheet 5	Connection Diagram, Output Module
500033-2	286137, Sheet 6	Connection Diagram, Engine and Generator
500033-2	286137, Sheet 7	Connection Diagram, Options
500033-2	286137, Sheet 8	Connection Diagram, Options
500033A-1	286698, Sheet 1	Schematic Diagram, Engine and Generator
500033A-1	286698, Sheet 2	Schematic Diagram, Engine and Generator, Legend
500033A-1	286698, Sheet 3	Connection Diagram, Options
500033A-1	286698, Sheet 4	Connection Diagram, Options
500033A-1	286698, Sheet 5	Connection Diagram, Options

HOBART DIAGRAMS		
MODEL NO.	**DIAGRAM**	**DIAGRAM DESCRIPTION**
500033A-1	286685, Sheet 1	Connection Diagram, Control Box Interior
500033A-1	286685, Sheet 2	Connection Diagram, Control Panel
500033A-1	286685, Sheet 3	Connection Diagram, Control Box Legend
500033A-1	286686, Sheet 1	Connection Diagram, Output Module
500033A-1	286686, Sheet 2	Connection Diagram, Output Module Legend


WIRE NUMBER RANGES (FOR REF. ONLY)
CABLE ---------- 100-199
ENGINE ---------- 200-299
OUTPUT MODULE --- 300-459
CONTROL/OUTPUT -- 460-499
CONTROL BOX ----- 500-799
OPTIONS --------- 800-999
TO TRUCK IGNITION SWITCH
S37
S237
TRUCK COIL RESISTOR
TO TRUCK IGNITION COIL
#1 OUTPUT TERMINALS
#2 OUTPUT TERMINALS
GENERATOR STATOR
EXCITER ARMATURE
GENERATOR SIGNATURE
28.5 VDC
DIAGNOSTIC
REGULATED
+12 CON
S1
S2
S74 LAMPS
S24 START
S77 TEST/RESET
S76 STOP
S78
S46
S49
S75 OUTPUT #1
S275 OUTPUT #2
S202
S3
CB10 15A
CB4 10A
CB7 5A
CB11 10A
CB2 5A
BT1
B2
G4
DEUTZ ONLY
M1
M2
M3
M4
M5
M24
M25
M13
K1
K3
K4
K14
K26
K27
K201
K204
CR2
CR6
CR10
CR19
CR32
CR206
VR1
A1
A7
A8
A9
A10
A11
A14
A16
R55
R246
DS1
DS2
DS32
DS31
DS23
DS35
DS53
DS54
DS51
DS52
DS60
DS61
DS62
DS12
DS13
DS14
DS15
DS36
DS37
DS38
DS39
DS40
DS58
DS59
DS259
PLUG/RECEPTACLE DESIGNATIONS
CONTACT NUMBER
THIS DESIGNATION:
REPRESENTS J43, P43, J44 & P44 AS SHOWN HERE:
RECEPTACLE
PLUGS
NOTE 1:
REMOVE (2) JUMPERS AT (TB1-A1 TB1-A2) AND (TB1-A3 & TB1-A4) WHEN 24V. POWER SUPPLY KITS ARE INSTALLED.
① ADD TRUCK MOUNTED OPTION (S37 & S237)
CHANGE RECORD
E.C. No. 1) 1125AA 1-23-96
FINISH CODE PER 910176: NONE
28402951 1-24-96
DIAGRAM, SCHEMATIC
U2000
HOBART
TROY, OHIO 45373 U.S.A.
SIZE D
DWG NO 284029
SHEET 1 OF 8
02537 1-95
02538 1-95
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LEGEND

A1	TRANSFORMER–RECTIFIER, 28.5V. (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 ADJUSTMENT, ELECTRIC GOVERNOR
A16	GENERATOR SET CONTROL P.C. BOARD
B2	STARTER, ENGINE, 12 V.
BT1	BATTERY, 12 V.
C1–C3	CAPACITOR, GENERATOR, 0.1 MFD., 500 V.
CB2	CIRCUIT BREAKER, CONTACTORS, 5 A.
CB4	CIRCUIT BREAKER, ENGINE ELECTRICAL, 10 A.
CB7	CIRCUIT BREAKER, CONTROL CIRCUIT, 5 A.
CB10	CIRCUIT BREAKER, COLD WEATHER START, 15 A.
CB11	CIRCUIT BREAKER, MARKER LIGHTS, 10 A.
CR2	RECTIFIER, GENERATOR REVOLVING FIELD
CR6	RECTIFIER, LOAD CONTACTOR, NO. 1 OUTPUT
CR10	DIODE, FLYBACK
CR19	DIODE, FLYBACK, AUXILIARY STARTER SOLENOID
CR32	DIODE, BLOCKING
CR206	RECTIFIER, LOAD CONTACTOR, NO. 2 OUTPUT
DS1–DS2	LIGHT, PANEL (WHITE)
DS12	INDICATOR, CHARGING AMP METER (WHITE)
DS13	INDICATOR, OIL PRESSURE GAUGE (WHITE)
DS14	INDICATOR, TEMPEERATURE GAUGE (WHITE)
DS15	INDICATOR, FUEL GAUGE (WHITE)
DS23	INDICATOR, AIR CLEANER SERVICE (RED)
DS31	INDICATOR, HIGH TEMPERATURE (RED)
DS32	INDICATOR, LOW OIL (RED)
DS35	INDICATOR, LOW FUEL LEVEL (RED)
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)
DS58	INDICATOR, PUSHBUTTON, ENGINE START (GREEN)
DS59	INDICATOR, PUSHBUTTON, OUTPUT NO. 1 (GREEN)
DS60	LIGHT, STRIP, FREQUENCY METER
DS61	LIGHT, STRIP, AMMETER
DS62	LIGHT, STRIP, VOLTMETER
DS259	INDICATOR, PUSHBUTTON, OUTPUT NO. 2 (GREEN)
G1	GENERATOR STATOR
G2	EXCITER ARMATURE, GENERATOR
G4	ALTERNATOR, ENGINE, 12 V.
GP1	GROUND PLATE

J1	RECEPTACLE, VOLTAGE REGULATOR
J5	RECEPTACLE, MEMORY AND TIME DELAY BOARD
J6	RECEPTACLE, OVERLOAD BOARD (NO. 1 OUTPUT)
J7	RECEPTACLE, T–R CONTROL, 28.5V. (WHEN FURNISHED)
J14	RECEPTACLE, OVER–UNDERVOLTAGE BOARD
J39	RECEPTACLE, OVERLOAD BOARD, GENERATOR, MAIN
J15	RECEPTACLE, OVER–UNDERFREQUENCY BOARD
J43	RECEPTACLE, POWER MODULE (AT CONTROL BOX)
J44	RECEPTACLE, POWER MODULE
J47	RECEPTACLE, ENGINE
J47A	RECEPTACLE, ENGINE, EXTENSION (WHEN FURNISHED)
J48	RECEPTACLE, OPTIONS
J51	RECEPTACLE, POWER
J51A	RECEPTACLE, POWER, EXTENSION (WHEN FURNISHED)
J52–J56	RECEPTACLE, GENERATOR SET CONTROL BOARD
J57	RECEPTACLE, FRONT MARKER LIGHTS
J58	RECEPTACLE, REAR MARKER LIGHTS
J206	RECEPTACLE, OVERLOAD BOARD (NO. 2 OUTPUT)
K1	LOAD CONTACTOR, NO. 1 OUTPUT
K3	RELAY, OVERLOAD, GENERATOR, MAIN
K4	RELAY, OVERLOAD, GENERATOR, S.S., NO. 1 OUTPUT
K14	RELAY, MEMORY AND TIME DELAY, SOLID STATE
K26	RELAY, OVER–UNDERVOLTAGE, SOLID STATE
K27	RELAY, OVER–UNDERFREQUENCY, SOLID STATE
K201	LOAD CONTACTOR, NO. 2 OUTPUT
K204	RELAY, OVERLOAD, GENERATOR, S.S., NO. 2 OUTPUT
L1	FIELD, REVOLVING, GENERATOR
L2	FIELD, EXCITER, GENERATOR
L9	SOLENOID, STARTER
L10	SOLENOID, STARTER, AUXILIARY
L13	SOLENOID, COLD WEATHER START
L14	ACTUATOR, ELECTRIC GOVERNOR
M1	AMMETER, GENERATOR
M2	VOLTMETER, GENERATOR
M3	FREQUENCY METER
M4	RUNNING TIME METER, ENGINE–GENERATOR
M5	AMMETER, BATTERY
M13	GAUGE, FUEL, ELECTRIC
M24	GAUGE, WATER TEMPERATURE (OIL TEMP. FOR DEUTZ)
M25	GAUGE, OIL PRESSURE
P1	PLUG, VOLTAGE REGULATOR
P5	PLUG, MEMORY AND TIME DELAY BOARD
P6	PLUG, OVERLOAD BOARD, NO. 1 OUTPUT
P7	PLUG, T–R CONTROL, 28.5V. (WHEN FURNISHED)
P14	PLUG, OVER–UNDERVOLTAGE BOARD
P15	PLUG OVER–UNDERFREQUENCY BOARD
P39	PLUG, OVERLOAD BOARD, GENERATOR, MAIN
P43	PLUG, POWER MODULE (AT CONTROL BOX)
P44	PLUG, POWER MODULE
P47	PLUG, ENGINE
P47A	PLUG, ENGINE, EXTENSION (WHEN FURNISHED)
P48	PLUG, OPTIONS
P51	PLUG, POWER
P51A	PLUG, POWER, EXTENSION (WHEN FURNISHED)
P57	PLUG, FRONT MARKER LIGHTS
P58	PLUG, REAR MARKER LIGHTS
P52–P56	PLUG, GENERATOR SET CONTROL BOARD
P206	PLUG, OVERLOAD BOARD, NO. 2 OUTPUT

R16–R18	RESISTOR, LINE DROP, 50 OHM, 20 WATT
R26–R28	RESISTOR, OVERLOAD, 16.6 OHM, 20 WATT, NO. 1 OUTPUT
R33–R35	RESISTOR, OVERLOAD, MAIN GENERATOR, 12.5 OHM, 20 WATT
R46	RESISTOR, HOLD CIRCUIT, 100 OHM, 25 WATT, NO. 1 OUTPUT
R55	SENDER, ELECTRIC FUEL GAUGE
R226–R228	RESISTOR, OVERLOAD, 16.6 OHM, 20 WATT, NO. 2 OUTPUT
R246	RESISTOR, HOLD CIRCUIT, 100 OHM, 25 WATT, NO. 2 OUTPUT
S1	SWITCH, REGULATED–DIAGNOSTIC
S2	SWITCH, TEST BANK, NO. 1 OUTPUT
S3	SWITCH, METER SELECTOR
S24	SWITCH, ENGINE START
S37	SWITCH, MICRO, PLUG BOX, #1 OUTPUT (WHEN FURNISHED)
S46	SWITCH, LUBE OIL PRESSURE, ENGINE
S49	SWITCH, ENGINE HIGH TEMPERATURE
S70	SWITCH, ENGINE TEMPERATURE SENSOR
S74	SWITCH, PUSHBUTTON, LAMPS AND FUEL CHECK
S75	SWITCH. PUSHBUTTON, OUTPUT NO. 1
S76	SWITCH, PUSHBUTTON, ENGINE STOP & ENGINE FAULT RESET
S77	SWITCH, PUSHBUTTON, TEST/RESET
S78	SWITCH, LUBE OIL PRESSURE, STARTER CUTOUT
S202	SWITCH, TEST BANK, NO. 2 OUTPUT
S237	SWITCH. MICRO, PLUG BOX, #2 OUTPUT (WHEN FURNISHED)
S275	SWITCH. PUSHBUTTON, OUTPUT NO. 2
T4–T6	TRANSFORMER, CURRENT, LINE DROP
T7–T9	TRANSFORMER, CURRENT, OVERLOAD, GENERATOR, NO. 1 OUTPUT
T30–T32	TRANSFORMER, CURRENT, OVERLOAD, MAIN GENERATOR
T207–T209	TRANSFORMER, CURRENT, OVERLOAD, GENERATOR, NO. 2 OUTPUT
TB1–TB2	TERMINAL BLOCK, CONTROL BOX
TB3–TB4	TERMINAL BLOCK, OUTPUT MODULE
TB5	TERMINAL BLOCK, OPTIONS
VR1	VOLTAGE REGULATOR, GENERATOR

② ADD J39, J47A, J51A, P47A, P51A, S37 AND S237.
① ADD "GP1 --- GROUND PLATE"

02537	1–95
02538	1–95

OUTSIDE DISTR
DISTRIBUTION TABLE

CHANGE RECORD			
E.C. No.	DATE	FILE NAME	PLOT DATE
1) AA6998	6–7–95	284029S2	1–24–96
2) 1125AA	1–23–96		

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.

FINISH ± INCH
ANGLES ± 3°
DECIMAL–INCH
METRIC
.00 ± .01 / 0. ± 1.0mm
.000 ± .003 / 0.00 ± 0.1mm
0.0 ± 0.4mm

FINISH CODE PER 910176: NONE

ACTIVITY	REPLACED BY	REPLACES
MATERIAL NO.	QUANTITY–U.M.	COMM. CLS. 149C

MATERIAL SPEC

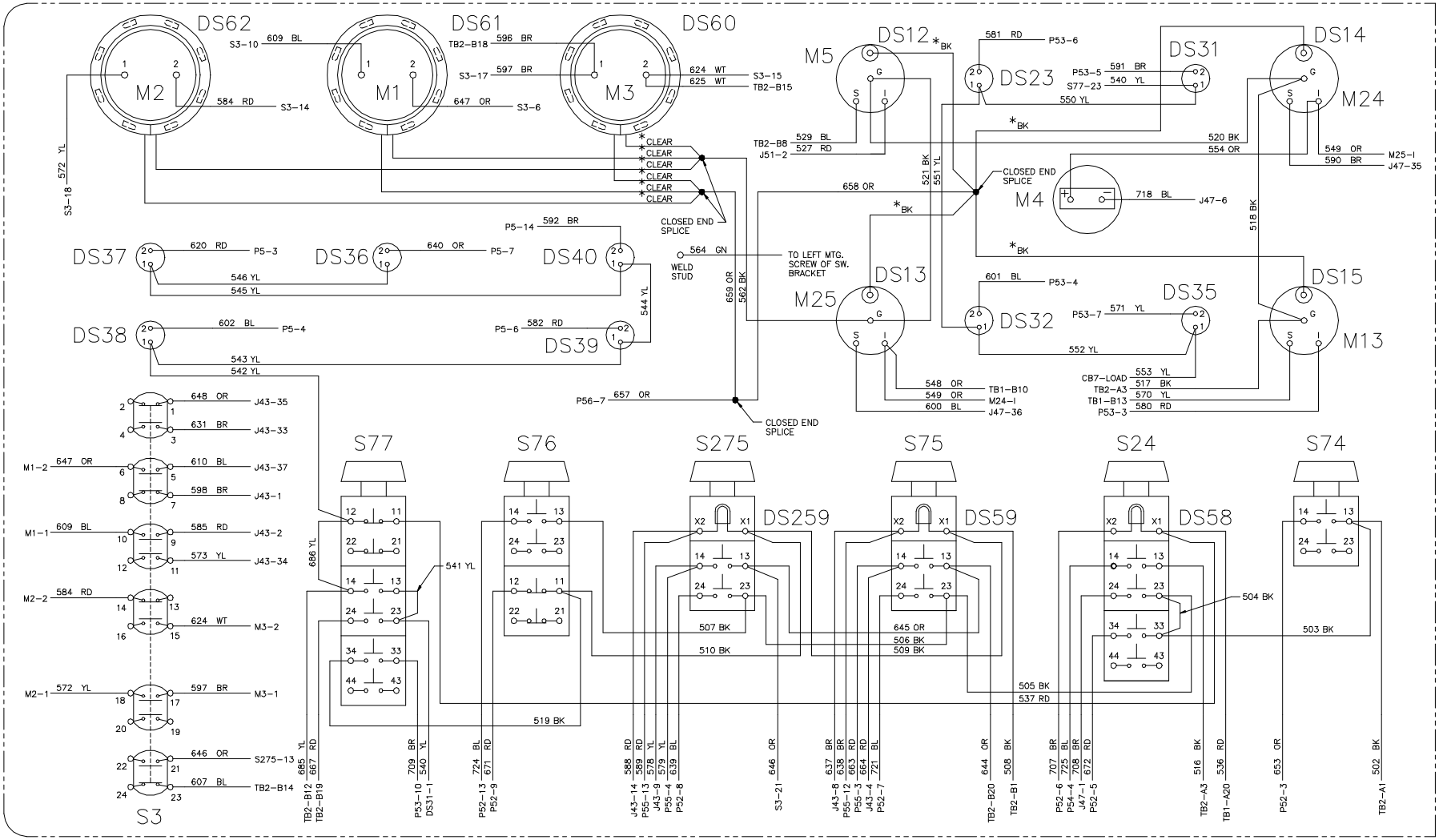
TITLE
DIAGRAM, SCHEMATIC

DESCRIPTIVE DATA
LEGEND, U2000

DESIGNED	DRAWN	DATE	SCALE
BJH	PLH	9/7/94	FULL
CHECKED	APPROVED	RECORDS	ITEM TYPE
djk		1–25–95	

HOBART®
TROY, OHIO 45373
U.S.A.

SIZE D
DWG NO 284029
SHEET 2



NOTES:

1. * WIRES FURNISHED.
2. ALL ENDS OF WIRE CONNECTING TO DS58, DS59, DS259, S24, S74, S75, S76, S77 AND S275 ARE TO BE TWISTED AND FOLDED BACK TO END OF INSULATION TO OBTAIN A DOUBLE WIRE STRAND 3/8" LONG.
3. WHEN ROUTING WIRES THAT ARE CONNECTED TO THE TOP OF DS58, DS59, DS259, S24, S74, S75, S76, S77 AND S275 MAKE SURE THEY ARE BELOW LEGEND SLOTS IN DOOR.

JUMPERS FURNISHED ON S3:

INTERNAL	EXTERNAL
2 TO 4	2 TO 6
10 TO 12	8 TO 12
14 TO 16	13 TO 17
22 TO 24	16 TO 20
	18 TO 22
	19 TO 23

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)

DIAGRAM EXPLANATION

PART DESIGNATOR (END OF WIRE)
WIRE NUMBER
WIRE COLOR
TB4 27 RD ABOVE OR LEFT OF WIRE

④ UPDATE PICTORAL ON S76
③ CHANGE "SHEET 3 OF 7" TO "SHEET 3"
② ADD NOTES 2 AND 3.
① RECONNECT #564 GN WIRE TO WELD STUD INSTEAD OF FREQUENCY METER MOUNTING SCREW. CHANGE #708 FROM ORANGE TO BROWN.

CHANGE RECORD			
E.C. No.	DATE	FILE NAME	PLOT DATE
1) AA6748	4-24-95	284029S3	6-21-96
2) 1018AA	1-9-96		
3) 1125AA	1-23-96		
4) 1380AA	6-21-96		

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.

FRACT ±	ANGLES ±
DECIMAL-INCH	METRIC
.00 ± .01	0. ± 1.0mm
.000 ± .003	0.0 ± 0.4mm
	0.00 ± 0.1mm

FINISH CODE PER 910176: NONE

ACTIVITY	REPLACED BY	REPLACES
MATERIAL NO.	QUANTITY-U.M.	COMM. CLS. 149C
MATERIAL SPEC		

TITLE: DIAGRAM, CONNECTION, CONTROL PANEL
DESCRIPTIVE DATA: U2000

DESIGNED	DRAWN	DATE	SCALE
BJH	PLH	1/20/95	FULL
CHECKED	APPROVED	RECORDS	ITEM TYPE
495		1-25-95	~

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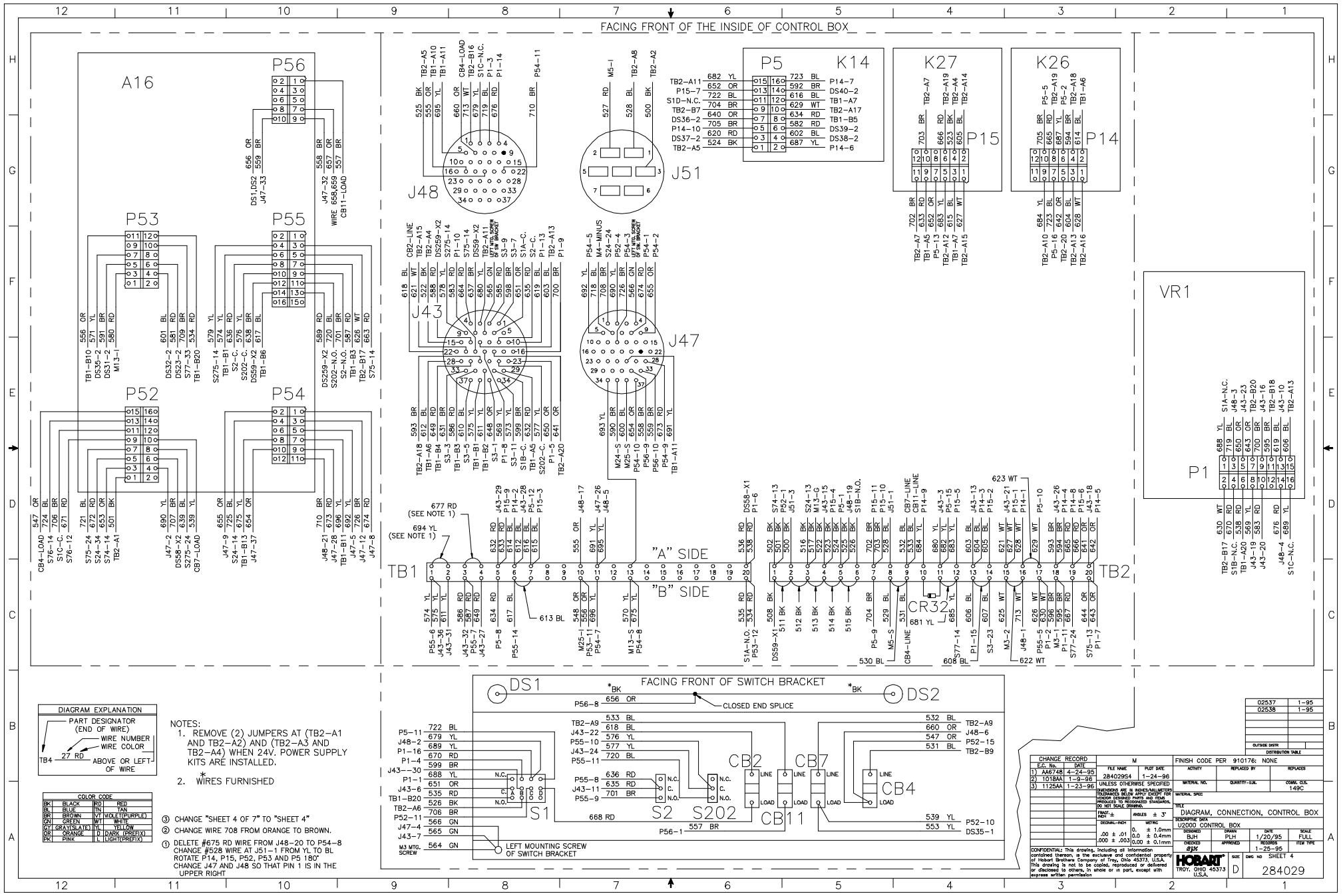
HOBART TROY, OHIO 45373 U.S.A.

SIZE D | DWG NO 284029 | SHEET 3

04-537	NFC
02-538	1/95
04-537 SUB	6/96

OUTSIDE DISTR
DISTRIBUTION TABLE


FACING FRONT OF THE INSIDE OF CONTROL BOX
A16
P56
P53
P55
P52
P54
J48
J51
J43
J47
P5
K14
K27
K26
P15
P14
VR1
P1
TB1
TB2
"A" SIDE
"B" SIDE
677 RD (SEE NOTE 1)
694 YL (SEE NOTE 1)
613 BL
CR32
681 YL
530 BL
608 BL
622 WT
623 WT
FACING FRONT OF SWITCH BRACKET
DS1
DS2
*BK
P56-8 656 OR
CLOSED END SPLICE
S1
S2
S202
CB2
CB7
CB11
CB4
LINE
LOAD
N.C.
C.
N.O.
668 RD
P56-1 557 BR
LEFT MOUNTING SCREW OF SWITCH BRACKET
M3 MTG. SCREW
DIAGRAM EXPLANATION
PART DESIGNATOR (END OF WIRE)
WIRE NUMBER
WIRE COLOR
TB4
27 RD
ABOVE OR LEFT OF WIRE
COLOR CODE
BK BLACK
BL 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 (2) JUMPERS AT (TB2–A1 AND TB2–A2) AND (TB2–A3 AND TB2–A4) WHEN 24V. POWER SUPPLY KITS ARE INSTALLED.
2. * WIRES FURNISHED
③ CHANGE "SHEET 4 OF 7" TO "SHEET 4"
② CHANGE WIRE 708 FROM ORANGE TO BROWN.
① DELETE #675 RD WIRE FROM J48–20 TO P54–8 CHANGE #528 WIRE AT J51–1 FROM YL TO BL ROTATE P14, P15, P52, P53 AND P5 180° CHANGE J47 AND J48 SO THAT PIN 1 IS IN THE UPPER RIGHT
02537 1-95
02538 1-95
OUTSIDE DISTR
DISTRIBUTION TABLE
CHANGE RECORD
E.C. No. DATE
1) AA6748 4-24-95
2) 1018AA 1-9-96
3) 1125AA 1-23-96
M
FILE NAME 284029S4
PLOT DATE 1-24-96
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.
DECIMAL-INCH ± ANGLES ± 3°
.00 ± .01
.000 ± .003
METRIC
0. ± 1.0mm
0.0 ± 0.4mm
0.00 ± 0.1mm
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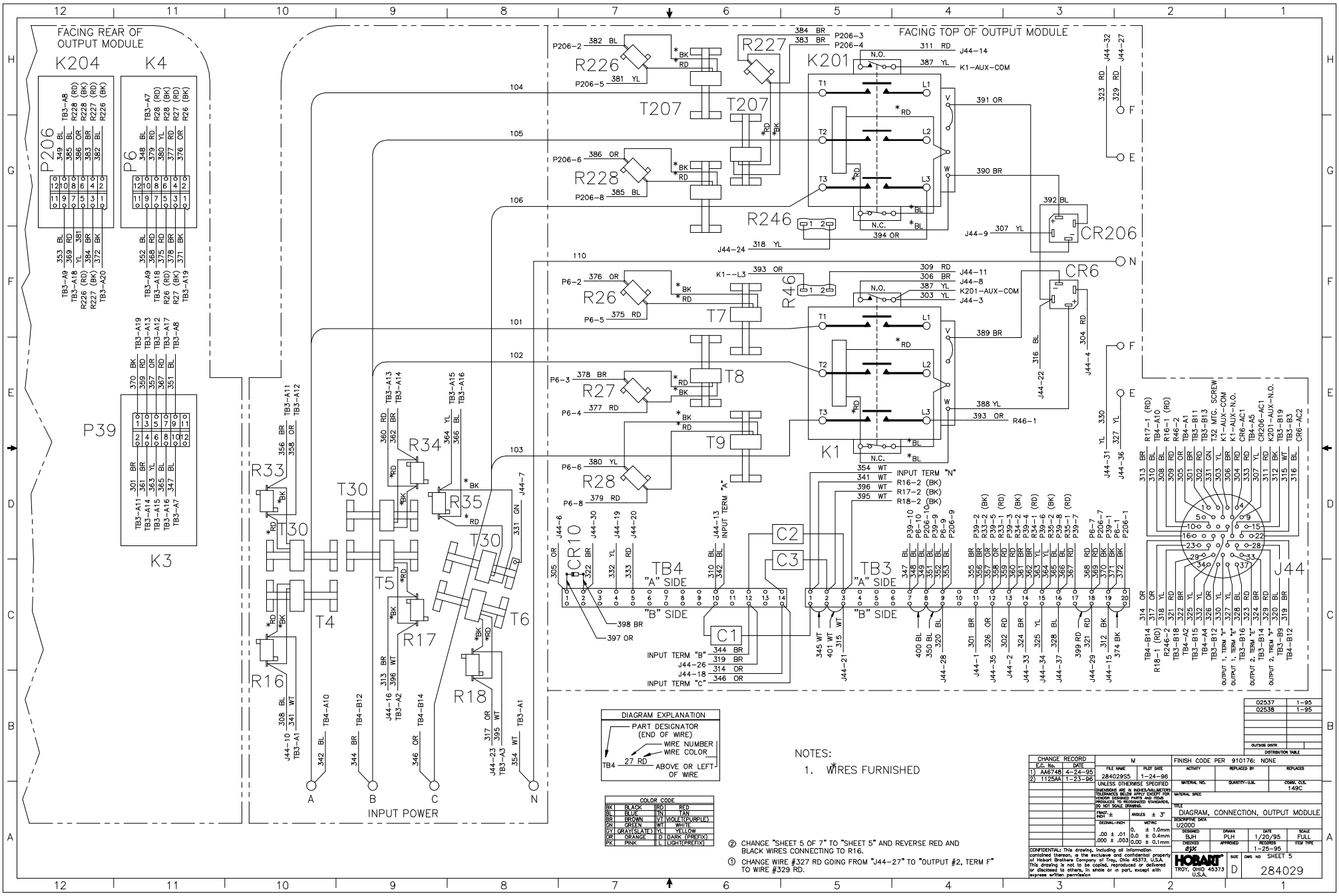
FINISH CODE PER 910176: NONE
ACTIVITY 495K
REPLACED BY
REPLACES
MATERIAL NO.
QUANTITY-U.M.
COMM. CLS. 149C
MATERIAL SPEC
TITLE
DIAGRAM, CONNECTION, CONTROL BOX
DESCRIPTIVE DATA
U2000 CONTROL BOX
DESIGNED BJH
DRAWN PLH
DATE 1/20/95
CHECKED
APPROVED
RECORDS 1-25-95
SCALE FULL
ITEM TYPE
HOBART TROY, OHIO 45373 U.S.A.
SIZE D
DWG. NO 284029
SHEET 4


FACING REAR OF OUTPUT MODULE
K204
K4
P206
P6
P39
K3
FACING TOP OF OUTPUT MODULE
K201
K1
CR206
CR6
R46
T207
R226
R227
R228
R246
T7
T8
T9
R26
R27
R28
T30
R33
R34
R35
T5
T6
R17
R18
R16
T4
CR10
C1
C2
C3
TB4 "A" SIDE
TB4 "B" SIDE
TB3 "A" SIDE
TB3 "B" SIDE
J44
INPUT TERM "A"
INPUT TERM "B"
INPUT TERM "C"
INPUT TERM "N"
INPUT POWER
A
B
C
N
DIAGRAM EXPLANATION
PART DESIGNATOR (END OF WIRE)
WIRE NUMBER
WIRE COLOR
ABOVE OR LEFT OF WIRE
COLOR CODE
BK BLACK
BL 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. *WIRES FURNISHED
② CHANGE "SHEET 5 OF 7" TO "SHEET 5" AND REVERSE RED AND BLACK WIRES CONNECTING TO R16.
① CHANGE WIRE #327 RD GOING FROM "J44-27" TO "OUTPUT #2, TERM F" TO WIRE #329 RD.
02537 1-95
02538 1-95
OUTSIDE DISTR
DISTRIBUTION TABLE
CHANGE RECORD
E.C. No. DATE
1) AA6748 4-24-95
2) 1125AA 1-23-96
M
FILE NAME 28402955
PLOT DATE 1-24-96
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.
FRACT ± 1/64
ANGLES ± 3°
DECIMAL-INCH
.00 ± .01
.000 ± .003
METRIC
0. ± 1.0mm
0.0 ± 0.4mm
0.00 ± 0.1mm
FINISH CODE PER 910176: NONE
ACTIVITY
REPLACED BY
REPLACES
MATERIAL NO.
QUANTITY-U.M.
COMM. CLS. 149C
MATERIAL SPEC
TITLE
DIAGRAM, CONNECTION, OUTPUT MODULE
DESCRIPTIVE DATA
U2000
DESIGNED BJH
DRAWN PLH
DATE 1/20/95
SCALE FULL
CHECKED
APPROVED
RECORDS 1-25-95
ITEM TYPE
493K
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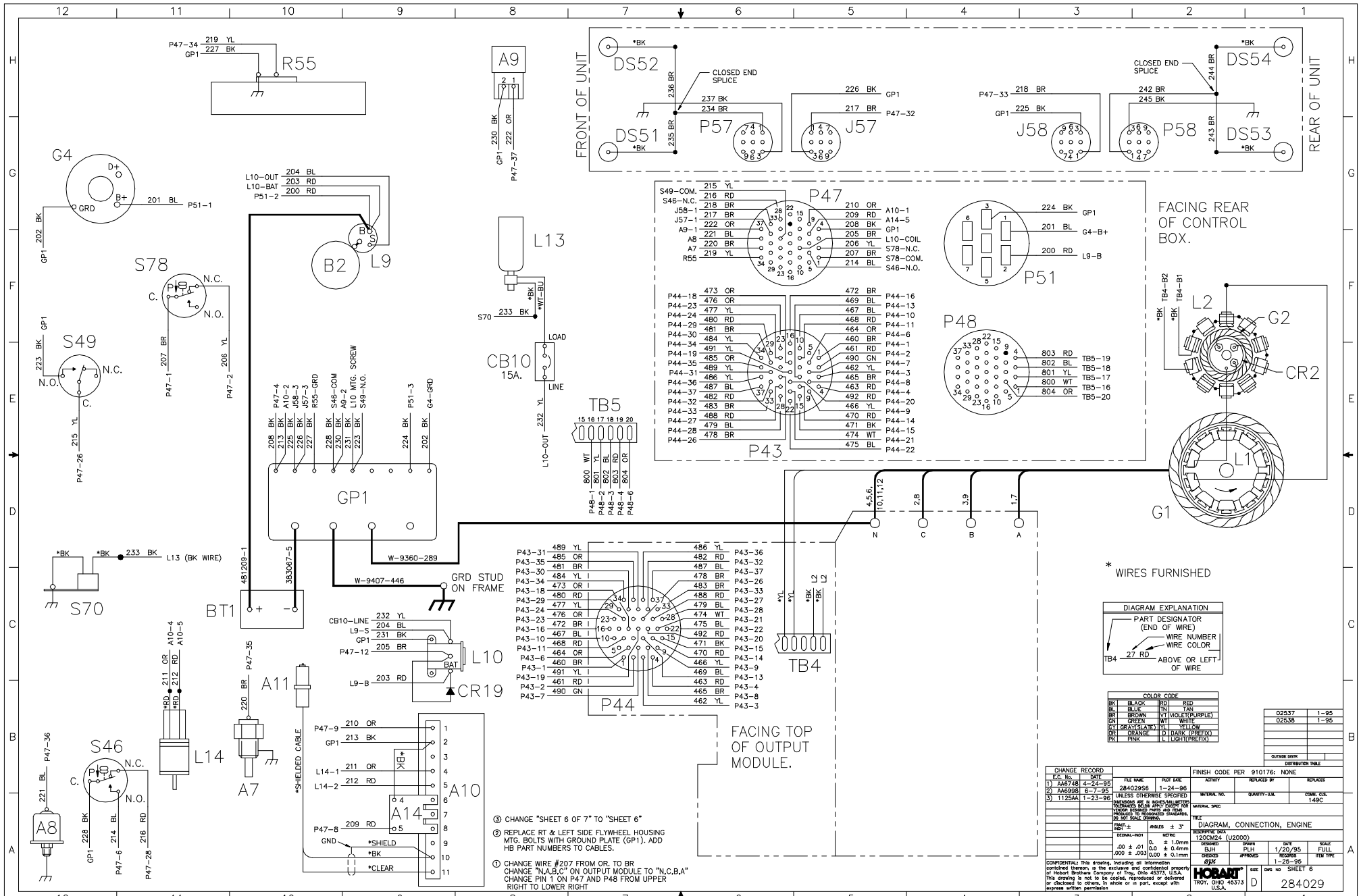
HOBART
TROY, OHIO 45373 U.S.A.
SIZE D
DWG NO 284029
SHEET 5



CHANGE RECORD			
E.C. No.	DATE	FILE NAME	PLOT DATE
1) AA6748	4-24-95	284029S6	1-24-96
2) AA6998	6-7-95		
3) 1125AA	1-23-96		

③ CHANGE "SHEET 6 OF 7" TO "SHEET 6"

② REPLACE RT & LEFT SIDE FLYWHEEL HOUSING MTG. BOLTS WITH GROUND PLATE (GP1). ADD HB PART NUMBERS TO CABLES.

① CHANGE WIRE #207 FROM OR. TO BR. CHANGE "N,A,B,C" ON OUTPUT MODULE TO "N,C,B,A" CHANGE PIN 1 ON P47 AND P48 FROM UPPER RIGHT TO LOWER RIGHT

02537	1-95
02538	1-95

FINISH CODE PER 910176: NONE

ACTIVITY	REPLACED BY / REPLACES
MATERIAL NO.	QUANTITY-U.M. / COMM. CLS. 149C
MATERIAL SPEC	
TITLE	DIAGRAM, CONNECTION, ENGINE
DESCRIPTIVE DATA	120CM24 (U2000)
DESIGNED BJH	DRAWN PLH
CHECKED	APPROVED
DATE 1/20/95	SCALE FULL
RECORDS 1-25-95	ITEM TYPE

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.

FRACT ± 1/64 — ANGLES ± 3°
DECIMAL-INCH: .00 ± .01, .000 ± .003 — METRIC: 0. ± 1.0mm, 0.0 ± 0.4mm, 0.00 ± 0.1mm

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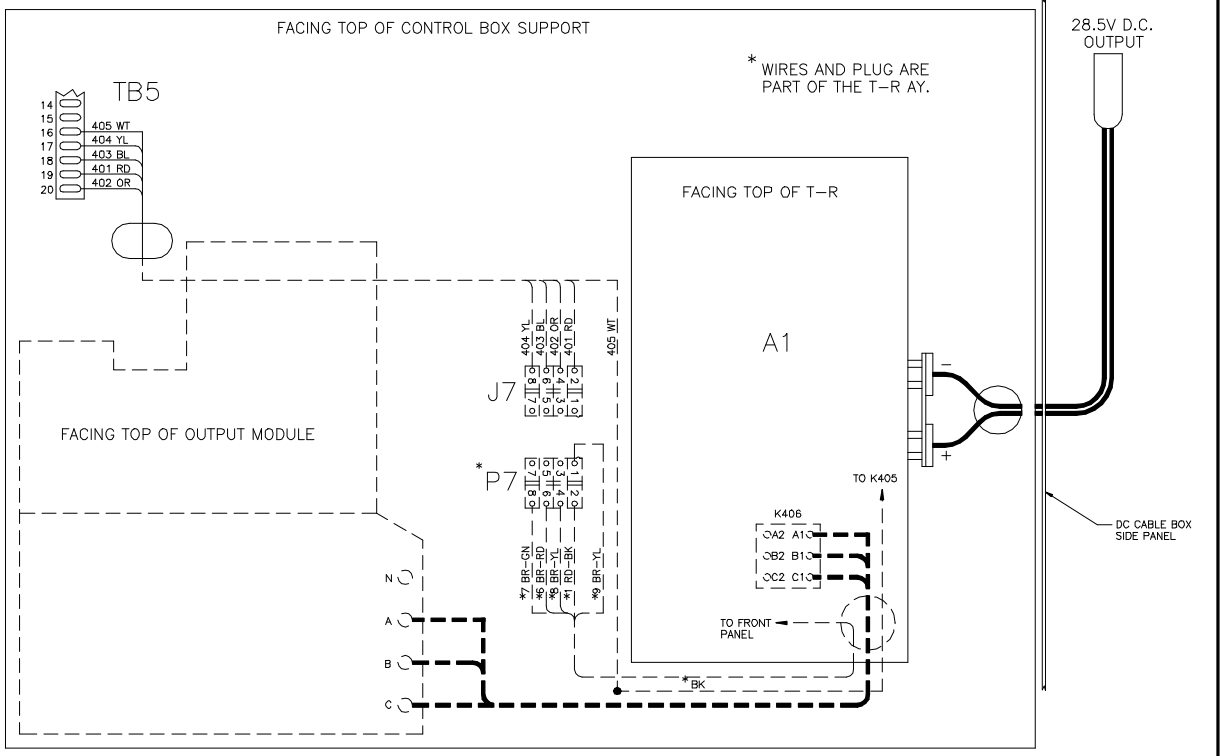
HOBART® TROY, OHIO 45373 U.S.A.

SIZE D — DWG NO 284029 — SHEET 6

OUTSIDE DISTR — DISTRIBUTION TABLE

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)



SEE SHEET 8 FOR MORE OPTIONS

DIAGRAM EXPLANATION

PART DESIGNATOR (END OF WIRE)
WIRE NUMBER
WIRE COLOR
TB4 — 27 RD — ABOVE OR LEFT OF WIRE

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)

02537	1-95
02538	1-95

OUTSIDE DISTR
DISTRIBUTION TABLE

CHANGE RECORD	
E.C. No.	DATE
1) 1125AA	1-23-96

FILE NAME: 284029S7 | PLOT DATE: 1-24-96

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.

FRACT ± | ANGLES ± 3°
DECIMAL-INCH: .00 ± .01, .000 ± .003
METRIC: 0. ± 1.0mm, 0.0 ± 0.4mm, 0.00 ± 0.1mm

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FINISH CODE PER 910176: NONE

ACTIVITY	REPLACED BY	REPLACES
MATERIAL NO.	QUANTITY-U.M.	COMM. CLS. 149C

MATERIAL SPEC

TITLE: DIAGRAM, CONNECTION, OPTIONS

DESCRIPTIVE DATA: U2000

DESIGNED	DRAWN	DATE	SCALE
BJH	PLH	1/20/95	FULL
CHECKED	APPROVED	RECORDS	ITEM TYPE
@JK		1-25-95	

HOBART® TROY, OHIO 45373 U.S.A. | SIZE D | DWG NO 284029 | SHEET 7

① CHANGE "SHEET 7 OF 7" TO "SHEET 7" AND ADD "SEE SHEET 8 FOR MORE OPTIONS".

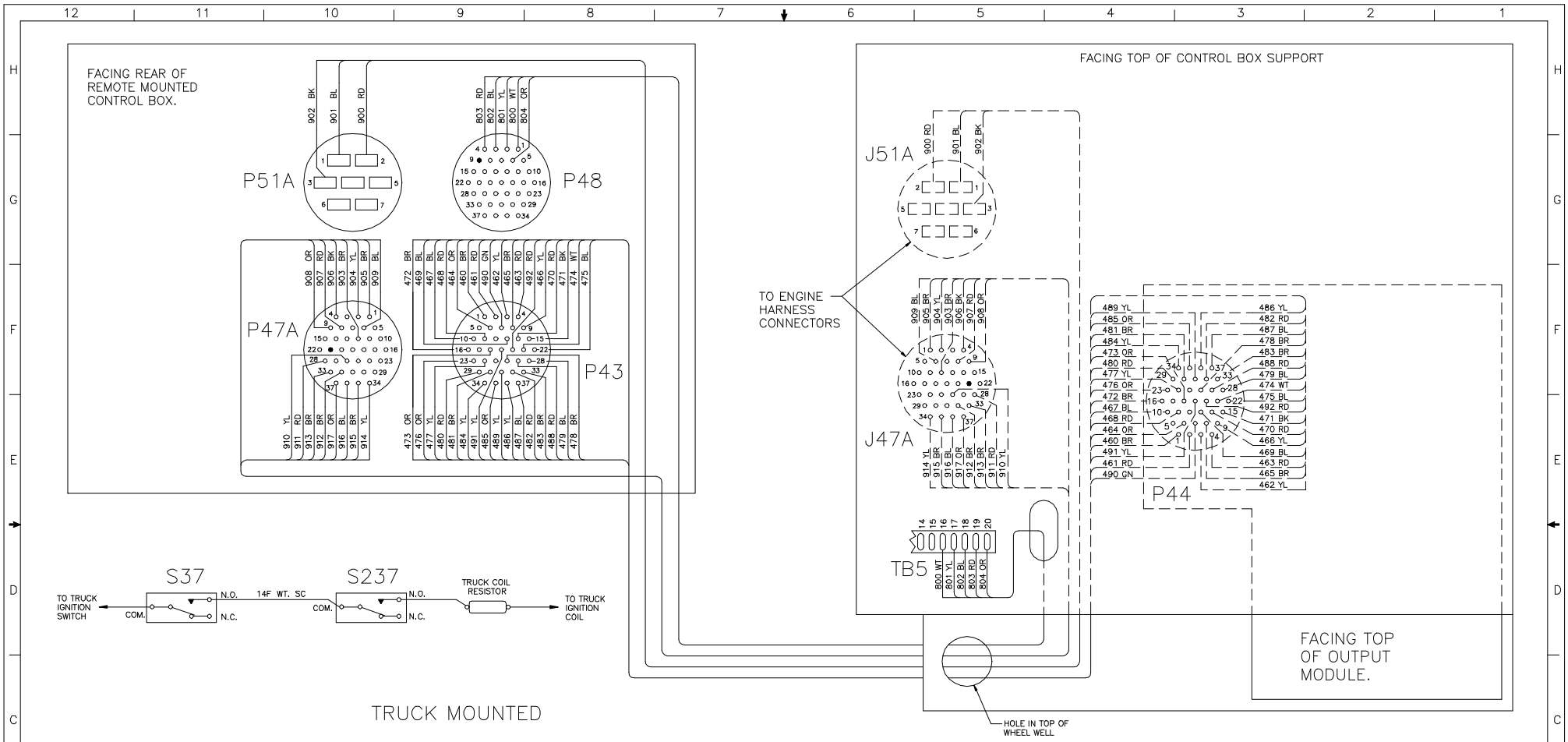


DIAGRAM EXPLANATION

PART DESIGNATOR (END OF WIRE)
WIRE NUMBER
WIRE COLOR
TB4 — 27 RD — ABOVE OR LEFT OF WIRE

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)

① ADDED SHEET 8

CHANGE RECORD		
E.C. No.	DATE	
1) 1125AA	1-23-96	

M		
FILE NAME	PLOT DATE	
284029S8	1-24-96	

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.

FRACT. INCH ±
ANGLES ± 3°
DECIMAL-INCH
.00 ± .01
.000 ± .003
METRIC
0. ± 1.0mm
0.0 ± 0.4mm
0.00 ± 0.1mm

FINISH CODE PER 910176: NONE

ACTIVITY	REPLACED BY	REPLACES
MATERIAL NO	QUANTITY-U/M	COMM CUS.
		149C

MATERIAL SPEC.

TITLE: DIAGRAM, CONNECTION, OPTIONS

DESCRIPTIVE DATA: 120CM24 (U2000)

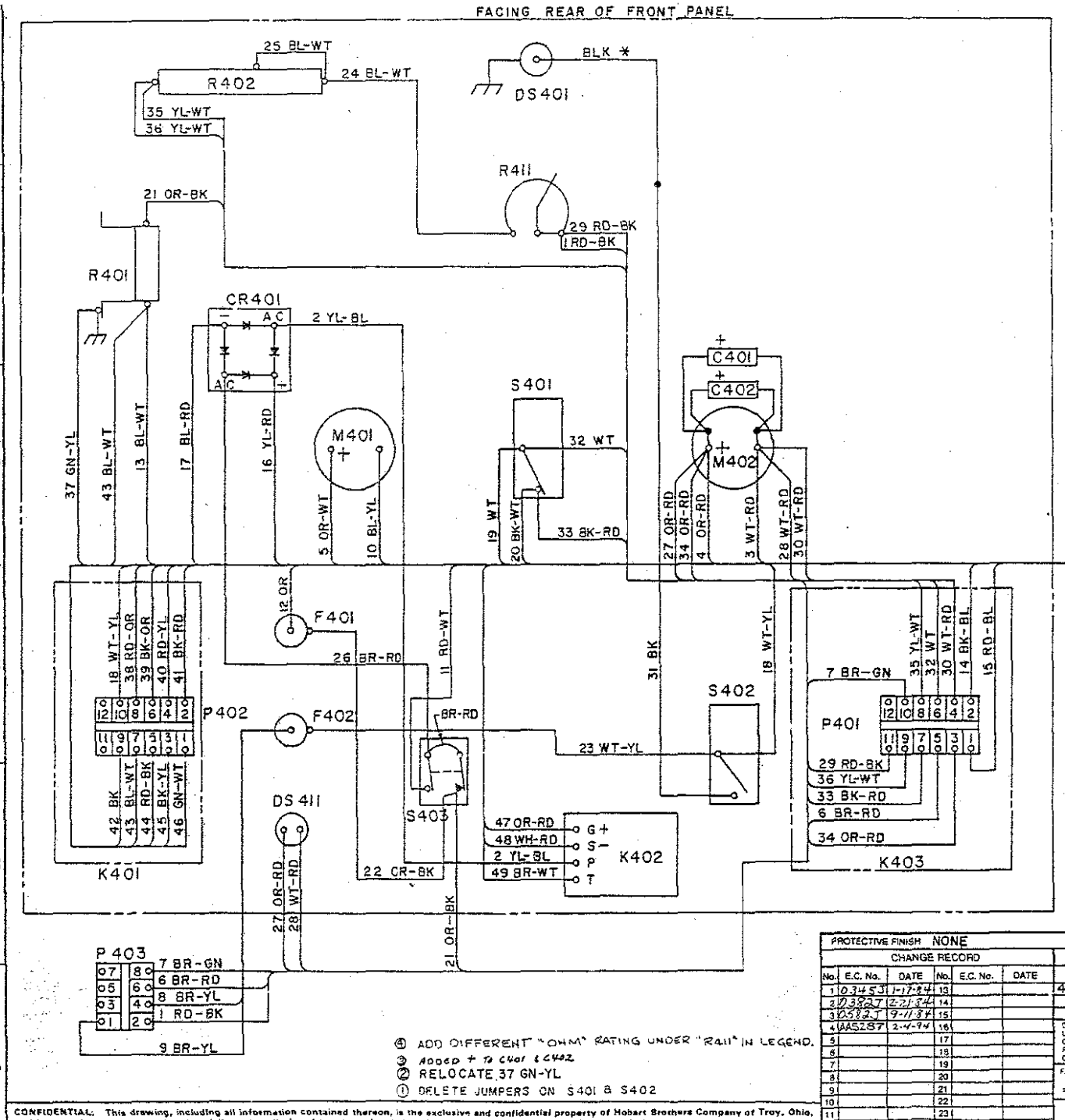
DESIGNED	DRAWN	DATE	SCALE
BJH	PLH	1-23-96	FULL
CHECKED	APPROVED	RECORDS	ITEM TYPE

OUTSIDE DISTR.
DISTRIBUTION TABLE

HOBART TROY, OHIO 45373 U.S.A.

SIZE D

DWG. NO. 284029 SHEET 8



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

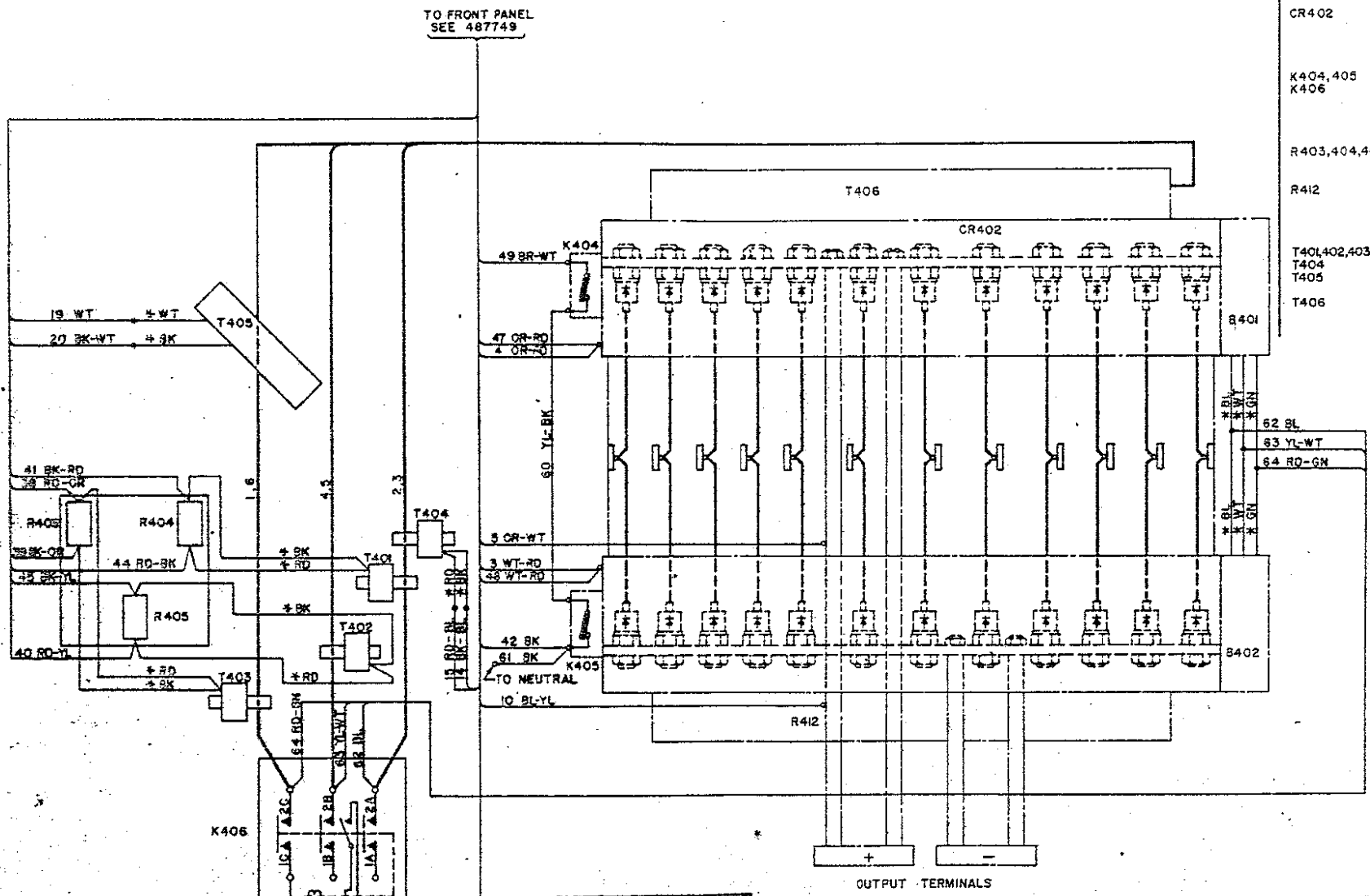
M | COMM.CLS.

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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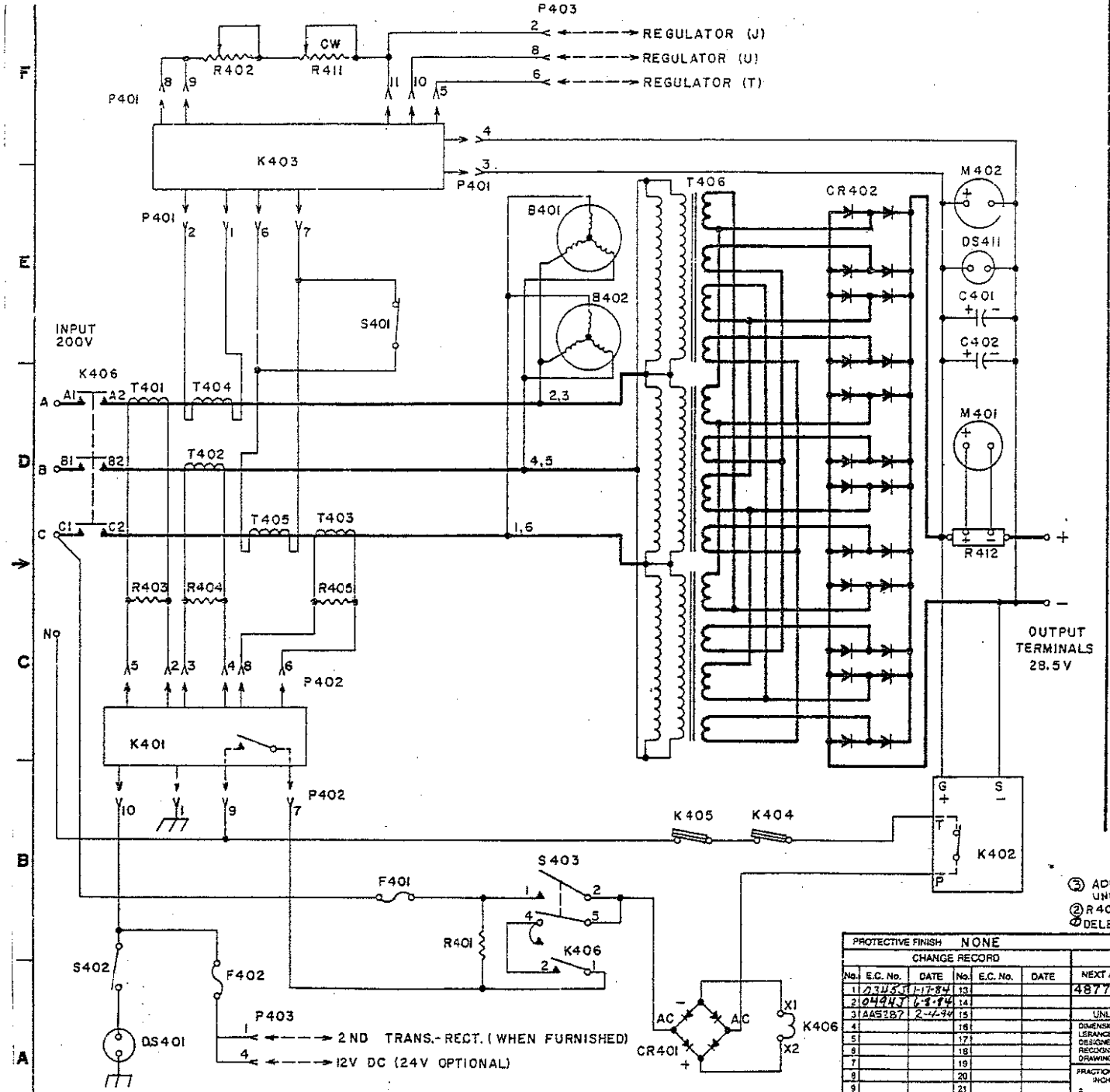


LEGEND

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	

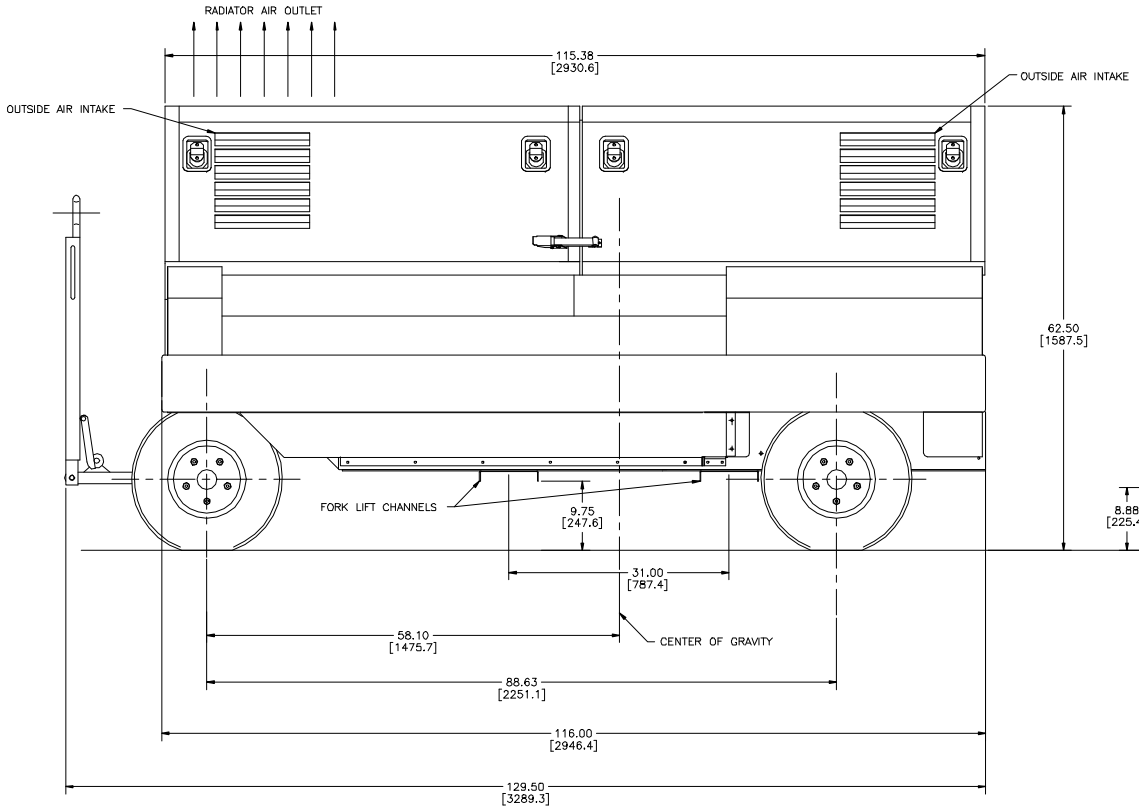
ACTIVITY	REPLACED BY	REPLACES	QUANT.
MATERIAL NO.	MATERIAL SPEC.		

TITLE DIAGRAM, SCHEMATIC
INDEX DATA

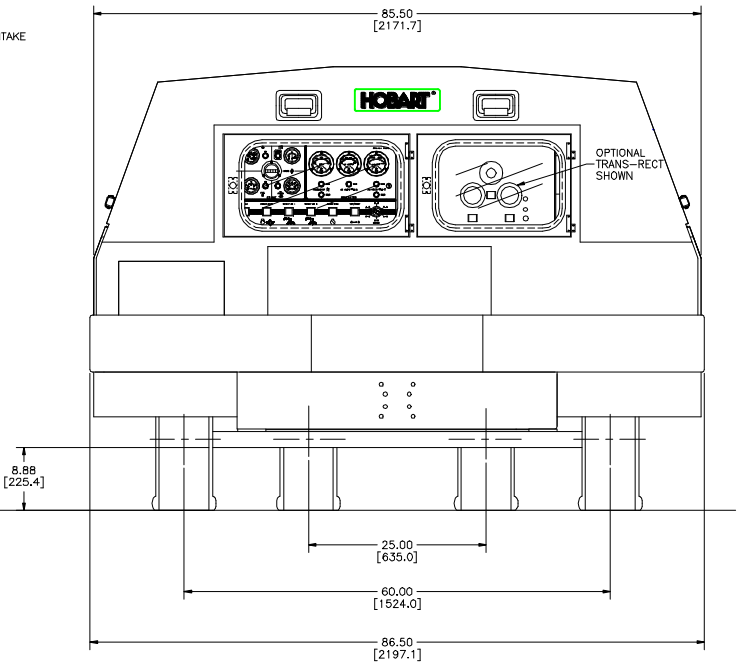
DESIGNED	DRAWN	DATE	NO.
JRM	JLC	9-16-83	
CHECKED	DATE	APPROVED	BASE
			3894
RECORDS	MFG. ENGR.	M.F.	LT

HOBART BROS. CO. TROY, OHIO 45373 U.S.A.
SIZE C DWG. NO. 487748

LEFT SIDE VIEW



REAR VIEW



CHANGE RECORD	
E.C. No.	DATE

FILE NAME 285189 | PLOT DATE 2-7-95

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.

FRACT.	±	ANGLES ± 3°
DECIMAL-INCH		METRIC
.00	± .01	0. ± 1.0mm
.000	± .003	0.0 ± 0.4mm
		0.00 ± 0.1mm

FINISH CODE PER 910176:

ACTIVITY	REPLACED BY	REPLACES

MATERIAL NO	QUANTITY-U.M.	COMM. CLS
		610D

MATERIAL SPEC.
–

TITLE
LAYOUT, DIMENSIONAL, U2000

DESCRIPTIVE DATA
120 KVA GPU

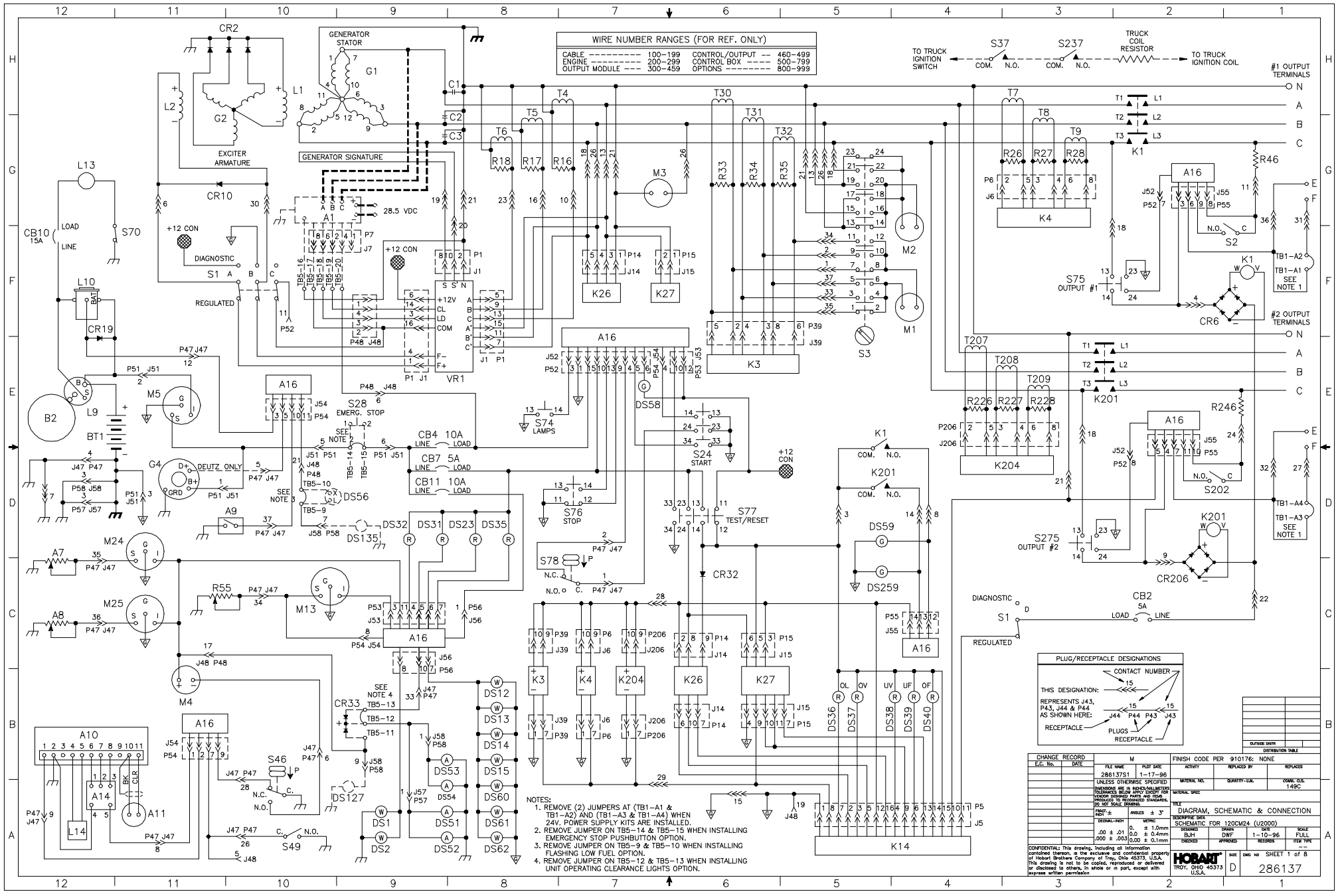
DESIGNED	DRAWN	DATE	SCALE
JRM	JJS	2-7-95	EIGHTH
CHECKED	APPROVED	RECORDS	ITEM TYPE

OUTSIDE DISTR.
DISTRIBUTION TABLE

HOBART
TROY, OHIO 45373
U.S.A.

SIZE D

DWG NO. 285189 SHEET 1 OF 1


WIRE NUMBER RANGES (FOR REF. ONLY)
CABLE ---------- 100-199
ENGINE ---------- 200-299
OUTPUT MODULE --- 300-459
CONTROL/OUTPUT -- 460-499
CONTROL BOX ----- 500-799
OPTIONS --------- 800-999
TO TRUCK IGNITION SWITCH
S37
S237
TRUCK COIL RESISTOR
TO TRUCK IGNITION COIL
#1 OUTPUT TERMINALS
#2 OUTPUT TERMINALS
GENERATOR STATOR
GENERATOR SIGNATURE
EXCITER ARMATURE
28.5 VDC
DIAGNOSTIC
REGULATED
DEUTZ ONLY
EMERG. STOP
LAMPS
START
STOP
TEST/RESET
PLUG/RECEPTACLE DESIGNATIONS
CONTACT NUMBER
THIS DESIGNATION:
REPRESENTS J43, P43, J44 & P44 AS SHOWN HERE:
RECEPTACLE
PLUGS
NOTES:
1. REMOVE (2) JUMPERS AT (TB1–A1 & TB1–A2) AND (TB1–A3 & TB1–A4) WHEN 24V. POWER SUPPLY KITS ARE INSTALLED.
2. REMOVE JUMPER ON TB5–14 & TB5–15 WHEN INSTALLING EMERGENCY STOP PUSHBUTTON OPTION.
3. REMOVE JUMPER ON TB5–9 & TB5–10 WHEN INSTALLING FLASHING LOW FUEL OPTION.
4. REMOVE JUMPER ON TB5–12 & TB5–13 WHEN INSTALLING UNIT OPERATING CLEARANCE LIGHTS OPTION.
CHANGE RECORD
FINISH CODE PER 910176: NONE
DIAGRAM, SCHEMATIC & CONNECTION
SCHEMATIC FOR 120CM24 (U2000)
HOBART
TROY, OHIO 45373 U.S.A.
SHEET 1 of 8
286137

LEGEND

A1	TRANSFORMER–RECTIFIER, 28.5V. *
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 ADJUSTMENT, ELECTRIC GOVERNOR
A16	GENERATOR SET CONTROL P.C. BOARD
B2	STARTER, ENGINE, 12 V.
BT1	BATTERY, 12 V.
C1–C3	CAPACITOR, GENERATOR, 0.1 MFD., 500 V.
CB2	CIRCUIT BREAKER, CONTACTORS, 5 A.
CB4	CIRCUIT BREAKER, ENGINE ELECTRICAL, 10 A.
CB7	CIRCUIT BREAKER, CONTROL CIRCUIT, 5 A.
CB10	CIRCUIT BREAKER, COLD WEATHER START, 15A.
CB11	CIRCUIT BREAKER, MARKER LIGHTS, 10 A.
CR2	RECTIFIER, GENERATOR REVOLVING FIELD
CR6	RECTIFIER, LOAD CONTACTOR, NO. 1 OUTPUT
CR10	DIODE, FLYBACK, EXCITER
CR19	DIODE, FLYBACK, AUXILIARY STARTER SOLENOID
CR32	DIODE, BLOCKING
CR33	RECTIFIER, BLOCKING *
CR206	RECTIFIER, LOAD CONTACTOR, NO. 2 OUTPUT
DS1–DS2	LIGHT, PANEL (WHITE)
DS12	LIGHT, CHARGING AMP METER (WHITE)
DS13	LIGHT, OIL PRESSURE GAUGE (WHITE)
DS14	LIGHT, TEMPERATURE GAUGE (WHITE)
DS15	LIGHT, FUEL GAUGE (WHITE)
DS23	INDICATOR, AIR CLEANER SERVICE (RED)
DS31	INDICATOR, HIGH TEMPERATURE (RED)
DS32	INDICATOR, LOW OIL (RED)
DS35	INDICATOR, LOW FUEL LEVEL (RED)
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)
DS56	FLASHER, LOW FUEL LEVEL BEACON LIGHT *
DS58	INDICATOR, PUSHBUTTON, ENGINE START (GREEN)
DS59	INDICATOR, PUSHBUTTON, OUTPUT NO. 1 (GREEN)
DS60	LIGHT, STRIP, FREQUENCY METER
DS61	LIGHT, STRIP, AMMETER
DS62	LIGHT, STRIP, VOLTMETER
DS127	INDICATOR, BEACON, UNIT RUNNING (AMBER, RED OR BLUE) *
DS135	INDICATOR, BEACON, LOW FUEL LEVEL (AMBER, RED OR BLUE) *
DS259	INDICATOR, PUSHBUTTON, OUTPUT NO. 2 (GREEN)
G1	GENERATOR STATOR
G2	EXCITER ARMATURE, GENERATOR
G4	ALTERNATOR, ENGINE, 12 V.
GP1	GROUND PLATE

J1	RECEPTACLE, VOLTAGE REGULATOR
J5	RECEPTACLE, MEMORY AND TIME DELAY BOARD
J6	RECEPTACLE, OVERLOAD BOARD, NO. 1 OUTPUT
J7	RECEPTACLE, T–R CONTROL, 28.5V. *
J14	RECEPTACLE, OVER–UNDERVOLTAGE BOARD
J15	RECEPTACLE, OVER–UNDERFREQUENCY BOARD
J39	RECEPTACLE, OVERLOAD BOARD, GENERATOR, MAIN
J43	RECEPTACLE, POWER MODULE (AT CONTROL BOX)
J44	RECEPTACLE, POWER MODULE
J47	RECEPTACLE, ENGINE
J47A	RECEPTACLE, ENGINE, EXTENSION *
J48	RECEPTACLE, OPTIONS
J51	RECEPTACLE, POWER
J51A	RECEPTACLE, POWER, EXTENSION *
J52–J56	RECEPTACLE, GENERATOR SET CONTROL BOARD
J57	RECEPTACLE, FRONT MARKER LIGHTS
J58	RECEPTACLE, REAR MARKER LIGHTS
J206	RECEPTACLE, OVERLOAD BOARD, NO. 2 OUTPUT
K1	LOAD CONTACTOR, NO. 1 OUTPUT
K3	RELAY, OVERLOAD, GENERATOR, MAIN
K4	RELAY, OVERLOAD, GENERATOR, S.S., NO. 1 OUTPUT
K14	RELAY, MEMORY AND TIME DELAY, SOLID STATE
K26	RELAY, OVER–UNDERVOLTAGE, SOLID STATE
K27	RELAY, OVER–UNDERFREQUENCY, SOLID STATE
K201	LOAD CONTACTOR, NO. 2 OUTPUT
K204	RELAY, OVERLOAD, GENERATOR, S.S., NO. 2 OUTPUT
L1	FIELD, REVOLVING, GENERATOR
L2	FIELD, EXCITER, GENERATOR
L9	SOLENOID, STARTER
L10	SOLENOID, STARTER, AUXILIARY
L13	SOLENOID, COLD WEATHER START
L14	ACTUATOR, ELECTRIC GOVERNOR
M1	AMMETER, GENERATOR
M2	VOLTMETER, GENERATOR
M3	FREQUENCY METER
M4	RUNNING TIME METER, ENGINE–GENERATOR
M5	AMMETER, BATTERY
M13	GAUGE, FUEL, ELECTRIC
M24	GAUGE, WATER TEMPERATURE
M25	GAUGE, OIL PRESSURE
P1	PLUG, VOLTAGE REGULATOR
P5	PLUG, MEMORY AND TIME DELAY BOARD
P6	PLUG, OVERLOAD BOARD, NO. 1 OUTPUT
P7	PLUG, T–R CONTROL, 28.5V. *
P14	PLUG, OVER–UNDERVOLTAGE BOARD
P15	PLUG OVER–UNDERFREQUENCY BOARD
P39	PLUG, OVERLOAD BOARD, GENERATOR, MAIN
P43	PLUG, OUTPUT MODULE (AT CONTROL BOX)
P44	PLUG, OUTPUT MODULE
P47	PLUG, ENGINE
P47A	PLUG, ENGINE, EXTENSION *
P48	PLUG, OPTIONS
P51	PLUG, POWER
P51A	PLUG, POWER, EXTENSION *
P52–P56	PLUG, GENERATOR SET CONTROL BOARD
P57	PLUG, FRONT MARKER LIGHTS
P58	PLUG, REAR MARKER LIGHTS
P206	PLUG, OVERLOAD BOARD, NO. 2 OUTPUT

R16–R18	RESISTOR, LINE DROP, 50 OHM, 20 WATT
R26–R28	RESISTOR, OVERLOAD, 16.6 OHM, 20 WATT, NO. 1 OUTPUT
R33–R35	RESISTOR, OVERLOAD, MAIN GENERATOR, 12.5 OHM, 20 WATT
R46	RESISTOR, HOLD CIRCUIT, 100 OHM, 25 WATT, NO. 1 OUTPUT
R55	SENDER, ELECTRIC FUEL GAUGE
R226–R228	RESISTOR, OVERLOAD, 16.6 OHM, 20 WATT, NO. 2 OUTPUT
R246	RESISTOR, HOLD CIRCUIT, 100 OHM, 25 WATT, NO. 2 OUTPUT
S1	SWITCH, REGULATED–DIAGNOSTIC
S2	SWITCH, TEST BANK, NO. 1 OUTPUT
S3	SWITCH, METER SELECTOR
S24	SWITCH, ENGINE START
S28	SWITCH, PUSHBUTTON, EMERGENCY STOP *
S37	SWITCH, MICRO, PLUG BOX, #1 OUTPUT *
S46	SWITCH, LUBE OIL PRESSURE, ENGINE
S49	SWITCH, ENGINE HIGH TEMPERATURE
S70	SWITCH, ENGINE TEMPERATURE SENSOR
S74	SWITCH, PUSHBUTTON, LAMPS AND FUEL CHECK
S75	SWITCH. PUSHBUTTON, OUTPUT NO. 1
S76	SWITCH, PUSHBUTTON, ENGINE STOP & ENGINE FAULT RESET
S77	SWITCH, PUSHBUTTON, TEST/RESET
S78	SWITCH, LUBE OIL PRESSURE, STARTER CUTOUT
S202	SWITCH, TEST BANK, NO. 2 OUTPUT
S237	SWITCH. MICRO, PLUG BOX, #2 OUTPUT *
S275	SWITCH. PUSHBUTTON, OUTPUT NO. 2
T4–T6	TRANSFORMER, CURRENT, LINE DROP
T7–T9	TRANSFORMER, CURRENT, OVERLOAD, GENERATOR, NO. 1 OUTPUT
T30–T32	TRANSFORMER, CURRENT, OVERLOAD, MAIN GENERATOR
T207–T209	TRANSFORMER, CURRENT, OVERLOAD, GENERATOR, NO. 2 OUTPUT
TB1–TB2	TERMINAL BLOCK, CONTROL BOX
TB3–TB4	TERMINAL BLOCK, OUTPUT MODULE
TB5	TERMINAL BLOCK, OPTIONS
VR1	VOLTAGE REGULATOR, GENERATOR

* WHEN FURNISHED

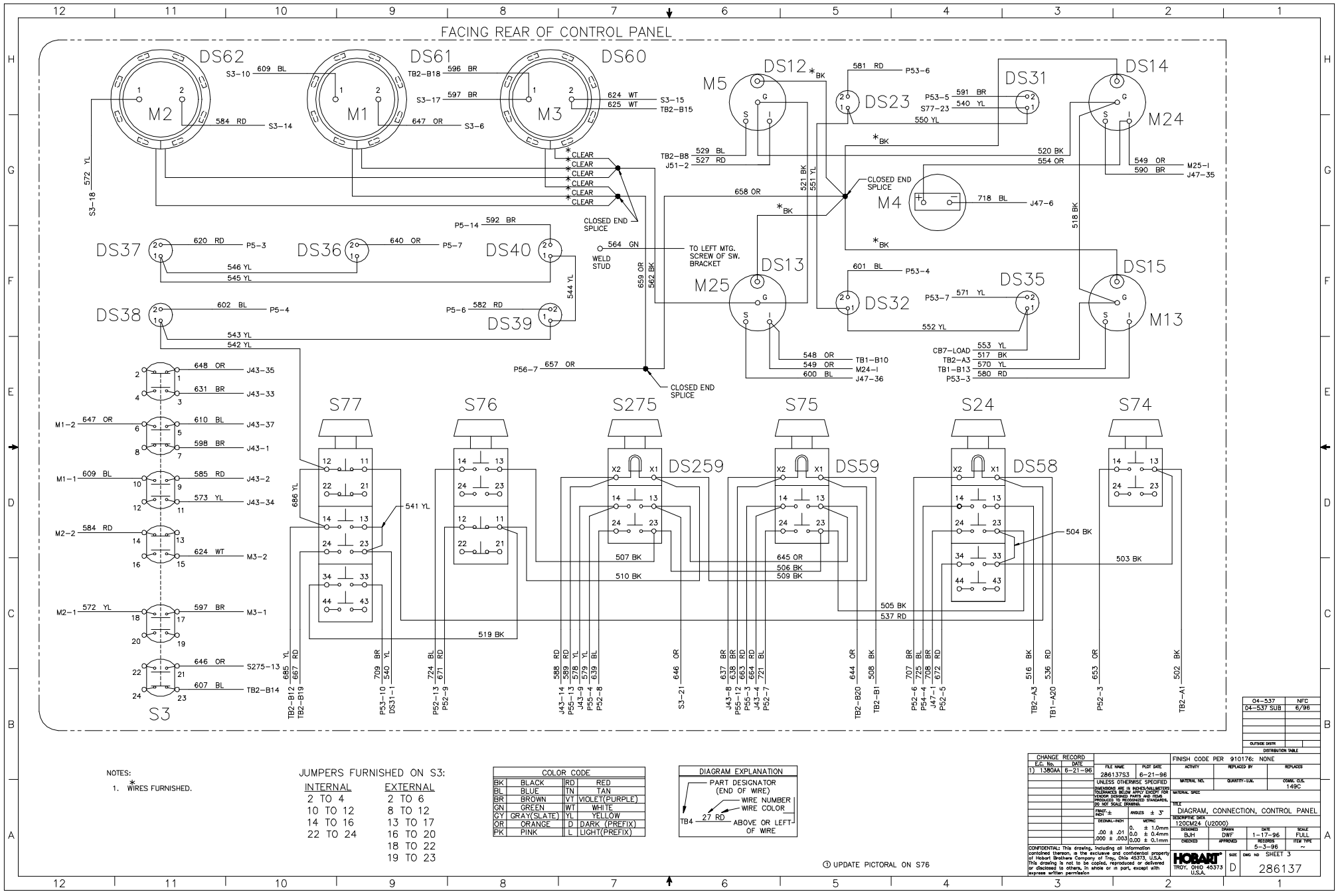
CHANGE RECORD		M		FINISH CODE PER 910176: NONE			
E.C. No.	DATE	FILE NAME	PLOT DATE	ACTIVITY	REPLACED BY	REPLACES	
		286137S2	1-17-96				
		UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES/MILLIMETERS TOLERANCES BELOW APPLY EXCEPT FOR VENDOR DESIGNED PARTS AND ITEMS PRODUCED TO RECOGNIZED STANDARDS. DO NOT SCALE DRAWING.		MATERIAL NO.	QUANTITY-U.M.	COMM. CLS. 149C	
		FRAC ±	ANGLES ± 3°	MATERIAL SPEC			
		DECIMAL-INCH	METRIC	TITLE DIAGRAM, SCHEMATIC & CONNECTION			
		.00 ± .01	0. ± 1.0mm	DESCRIPTIVE DATA LEGEND FOR 120CM24 (U2000)			
		.000 ± .003	0.0 ± 0.4mm	DESIGNED BJH	DRAWN DWF	DATE 1-17-96	SCALE FULL
			0.00 ± 0.1mm	CHECKED	APPROVED	RECORDS	ITEM TYPE -- --

HOBART® TROY, OHIO 45373 U.S.A.

SIZE D | DWG NO 286137 | SHEET 2

OUTSIDE DISTR

DISTRIBUTION TABLE



NOTES:

1. * WIRES FURNISHED.

JUMPERS FURNISHED ON S3:

INTERNAL	EXTERNAL
2 TO 4	2 TO 6
10 TO 12	8 TO 12
14 TO 16	13 TO 17
22 TO 24	16 TO 20
	18 TO 22
	19 TO 23

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)

DIAGRAM EXPLANATION

PART DESIGNATOR (END OF WIRE)
WIRE NUMBER
WIRE COLOR
TB4 — 27 RD — ABOVE OR LEFT OF WIRE

① UPDATE PICTORAL ON S76

E.C. No.	DATE
04-537	NFC
04-537 SUB	6/96

OUTSIDE DISTR.
DISTRIBUTION TABLE

CHANGE RECORD		
E.C. No.	DATE	
1) 1380AA	6-21-96	

FINISH CODE PER 910176: NONE

FILE NAME	PLOT DATE
286137S3	6-21-96

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.

FRACT ±	ANGLES ± 3°
DECIMAL—INCH	METRIC
.00 ± .01	0. ± 1.0mm
.000 ± .003	0.0 ± 0.4mm
	0.00 ± 0.1mm

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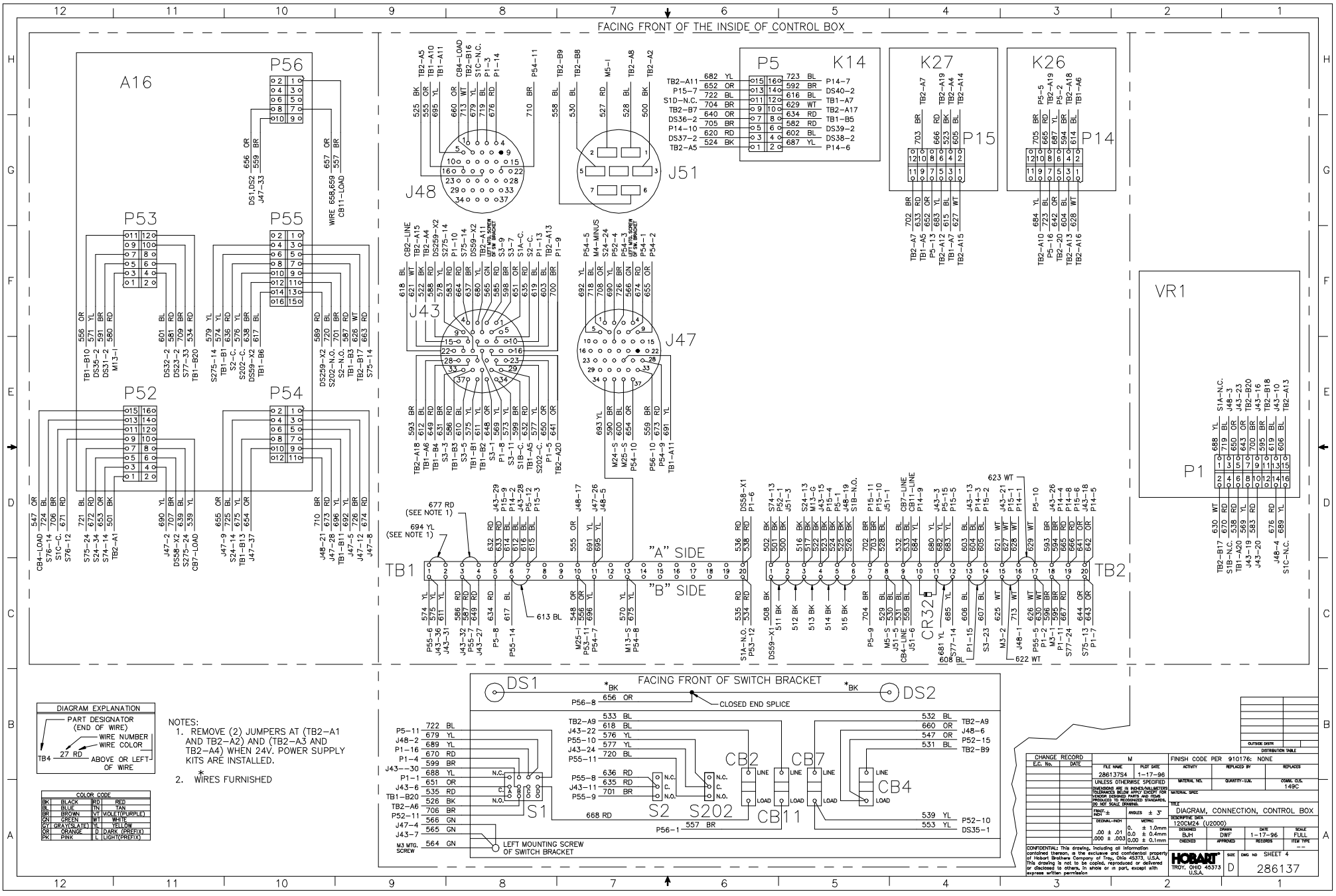
ACTIVITY	REPLACED BY	REPLACES
MATERIAL NO.	QUANTITY-U.M.	COMM. CLS. 149C
MATERIAL SPEC		

TITLE: DIAGRAM, CONNECTION, CONTROL PANEL
DESCRIPTIVE DATA: 120CM24 (U2000)

DESIGNED	DRAWN	DATE	SCALE
BJH	DWF	1-17-96	FULL
CHECKED	APPROVED	RECORDS 5-3-96	ITEM TYPE ~

HOBART TROY, OHIO 45373 U.S.A.

SIZE D | DWG. NO 286137 | SHEET 3


FACING FRONT OF THE INSIDE OF CONTROL BOX
A16
P56
P53
P55
P52
P54
J48
J51
J43
J47
P5
K14
K27
K26
P15
P14
VR1
P1
TB1
TB2
"A" SIDE
"B" SIDE
677 RD (SEE NOTE 1)
694 YL (SEE NOTE 1)
613 BL
CR32
CB2
CB7
CB4
CB11
S1
S2
S202
DS1
DS2
FACING FRONT OF SWITCH BRACKET
*BK
CLOSED END SPLICE
LEFT MOUNTING SCREW OF SWITCH BRACKET
M3 MTG. SCREW
DIAGRAM EXPLANATION
PART DESIGNATOR (END OF WIRE)
WIRE NUMBER
WIRE COLOR
27 RD
TB4
ABOVE OR LEFT OF WIRE
NOTES:
1. REMOVE (2) JUMPERS AT (TB2-A1 AND TB2-A2) AND (TB2-A3 AND TB2-A4) WHEN 24V. POWER SUPPLY KITS ARE INSTALLED.
2. * 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)
CHANGE RECORD
FINISH CODE PER 910176: NONE
DIAGRAM, CONNECTION, CONTROL BOX
120CM24 (U2000)
HOBART
TROY, OHIO 45373 U.S.A.
SIZE D
DWG NO 286137
SHEET 4
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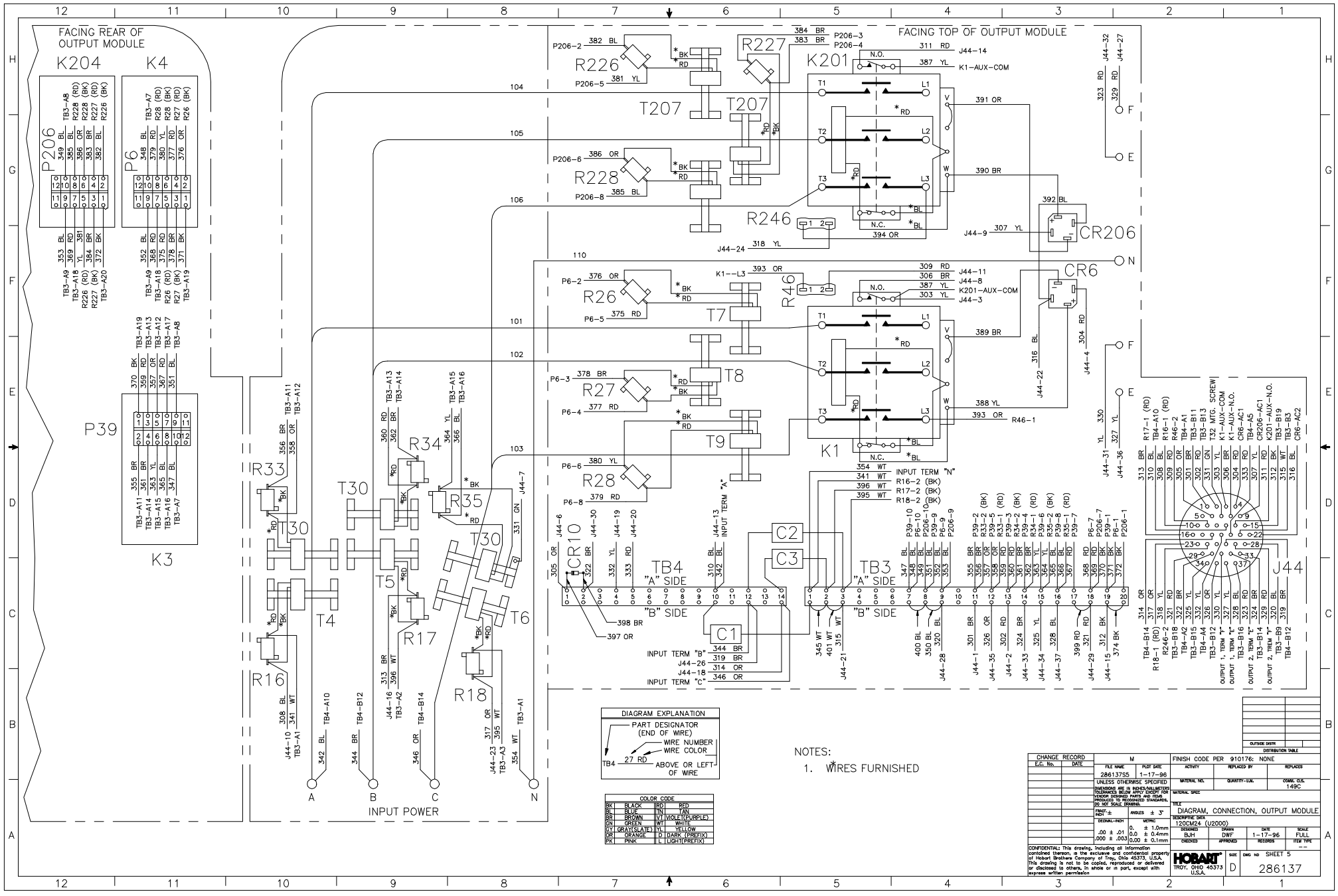
FACING REAR OF OUTPUT MODULE
K204
K4
P206
P6
P39
K3
FACING TOP OF OUTPUT MODULE
K201
K1
CR206
CR6
R46
R226
R227
R228
R246
R26
R27
R28
T207
T7
T8
T9
R33
R34
R35
T30
T5
T6
R17
R16
R18
T4
CR10
C1
C2
C3
TB4 "A" SIDE
TB4 "B" SIDE
TB3 "A" SIDE
TB3 "B" SIDE
J44
INPUT POWER
A
B
C
N
INPUT TERM "A"
INPUT TERM "B"
INPUT TERM "C"
INPUT TERM "N"
DIAGRAM EXPLANATION
PART DESIGNATOR (END OF WIRE)
WIRE NUMBER
WIRE COLOR
ABOVE OR LEFT OF WIRE
COLOR CODE
BK BLACK
BL BLUE
BR BROWN
GN GREEN
GY GRAY(SLATE)
OR ORANGE
PK PINK
RD RED
TN TAN
WT WHITE
YL YELLOW
D DARK (PREFIX)
L LIGHT(PREFIX)
NOTES:
1. *WIRES FURNISHED
CHANGE RECORD
E.C. No.
DATE
FILE NAME 286137S5
PLOT DATE 1-17-96
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.
FRACT ± 1/64
ANGLES ± 3°
DECIMAL-INCH .00 ± .01 .000 ± .003
METRIC 0. ± 1.0mm 0.0 ± 0.4mm 0.00 ± 0.1mm
FINISH CODE PER 910176: NONE
ACTIVITY
REPLACED BY
REPLACES
MATERIAL NO.
QUANTITY-U.A.
COMM. CLS. 149C
MATERIAL SPEC
TITLE
DIAGRAM, CONNECTION, OUTPUT MODULE
DESCRIPTIVE DATA 12OCM24 (U2000)
DESIGNED BJH
DRAWN DWF
DATE 1-17-96
SCALE FULL
CHECKED
APPROVED
RECORDS
ITEM TYPE
SIZE D
DWG NO 286137
SHEET 5
OUTSIDE DISTR
DISTRIBUTION TABLE
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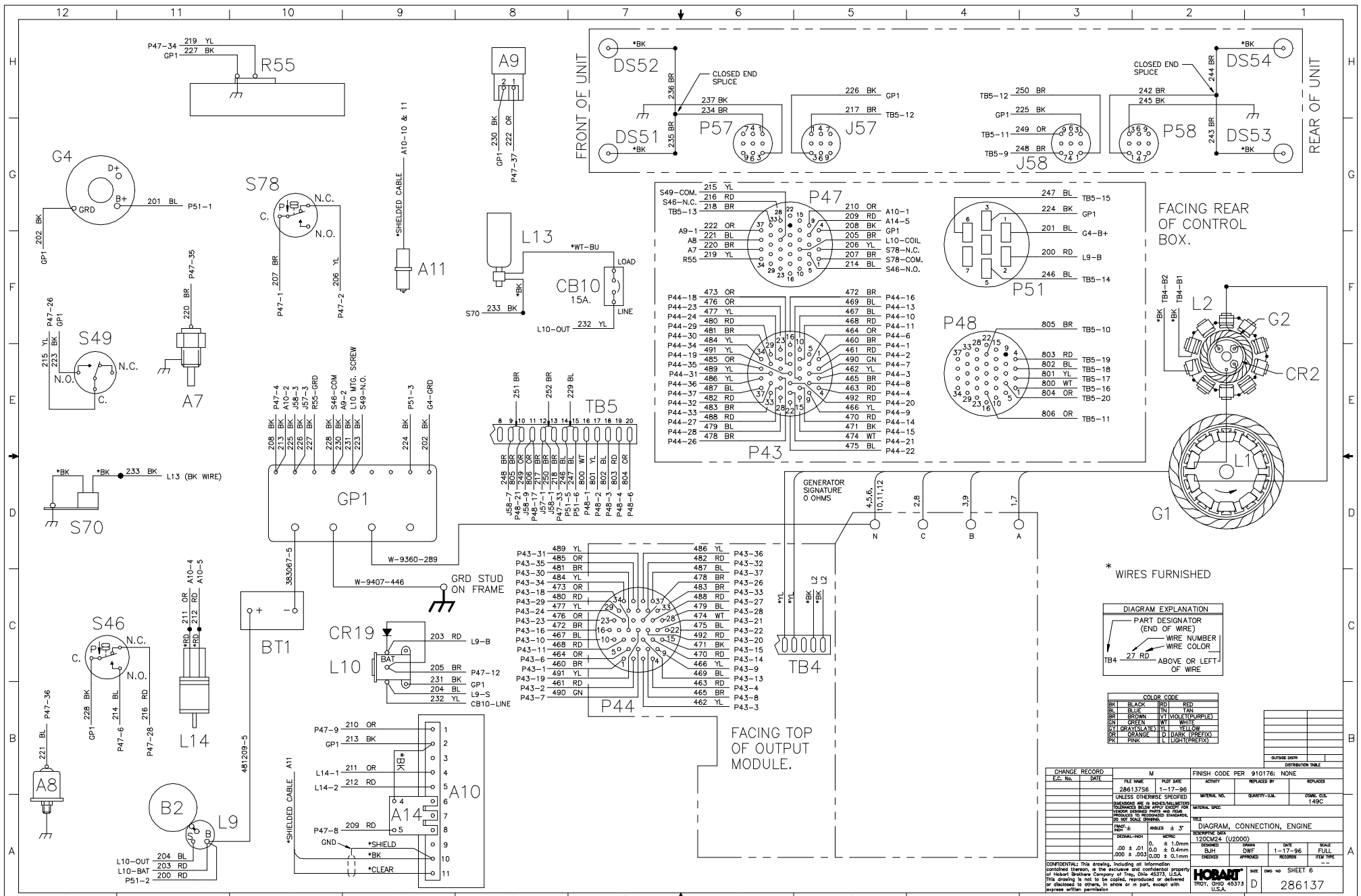
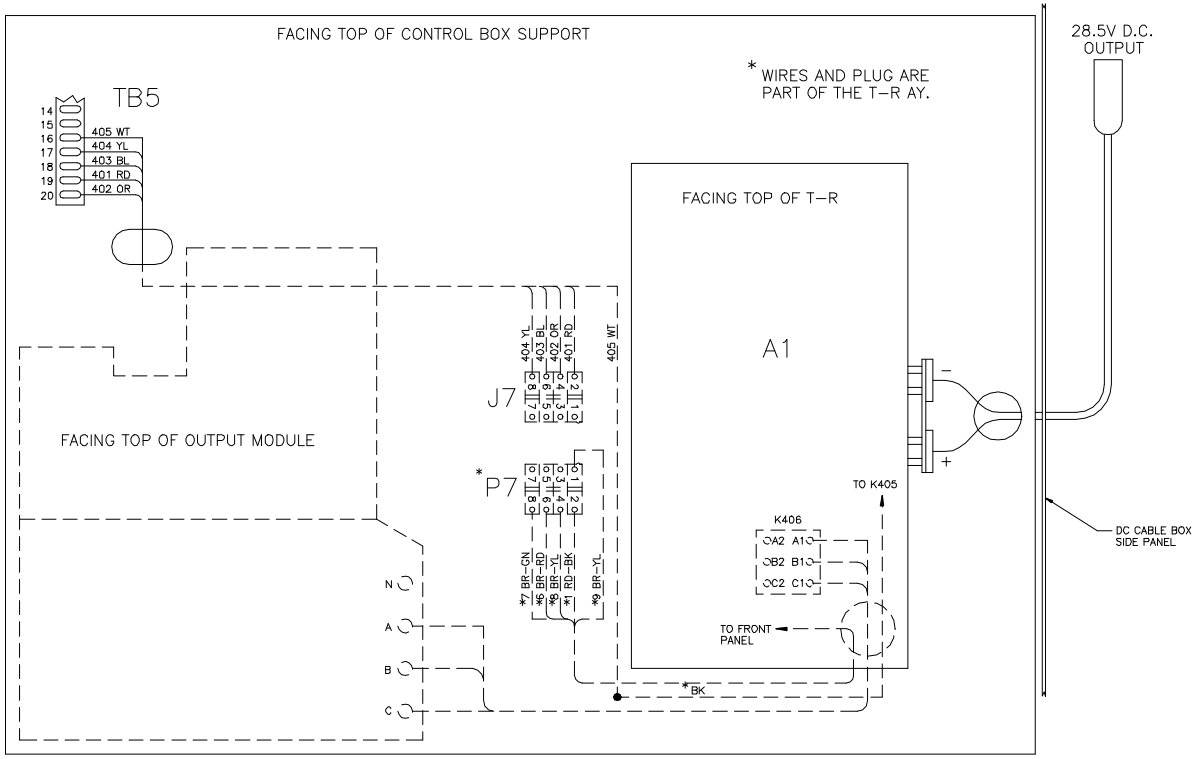
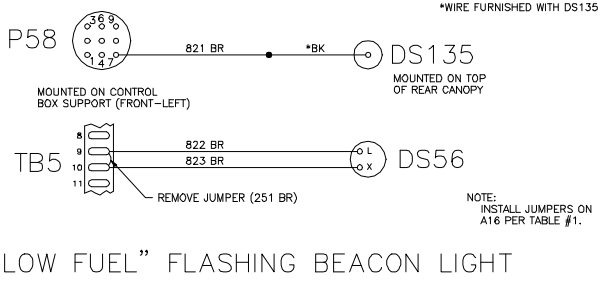
HOBART
TROY, OHIO 45373 U.S.A.

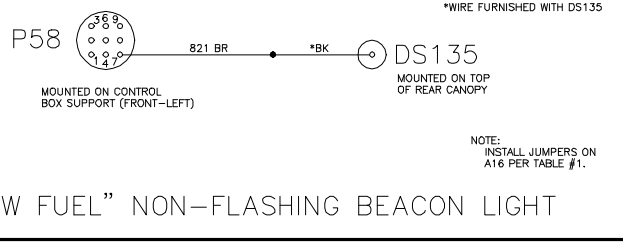

FRONT OF UNIT
REAR OF UNIT
DS52
DS51
DS54
DS53
P57
J57
J58
P58
CLOSED END SPLICE
P47
P51
P48
P43
FACING REAR OF CONTROL BOX.
L2
G2
CR2
L1
G1
G4
S78
S49
S70
S46
A7
A8
A9
A10
A11
A14
L13
CB10
15A.
GP1
TB5
TB4
P44
BT1
CR19
L10
L14
B2
L9
R55
GENERATOR SIGNATURE 0 OHMS
GRD STUD ON FRAME
W-9360-289
W-9407-446
383067-5
481209-5
*SHIELDED CABLE
*WT-BU
*CLEAR
FACING TOP OF OUTPUT MODULE.
* WIRES FURNISHED
DIAGRAM EXPLANATION
PART DESIGNATOR (END OF WIRE)
WIRE NUMBER
WIRE COLOR
ABOVE OR LEFT OF WIRE
COLOR CODE
BK BLACK
BL 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)
DIAGRAM, CONNECTION, ENGINE
120CM24 (U2000)
HOBART
TROY, OHIO 45373 U.S.A.
SHEET 6
286137



28.5V. TRANSFORMER-RECTIFIER



"LOW FUEL" FLASHING BEACON LIGHT



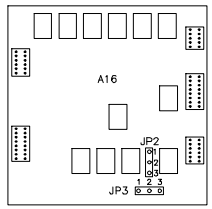
"LOW FUEL" NON-FLASHING BEACON LIGHT

INSTALL JUMPERS JP2 & JP3 ON GENERATOR CONTROL P.C. BOARD (A16) PER TABLE #1 (BELOW) TO OBTAIN DESIRED ACTION.

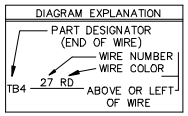
DESIRED ACTION FOR "LOW FUEL" CONDITION	TERMINAL CONNECTIONS FOR JUMPER	
	JP2	JP3
ENGINE SHUT-DOWN	2-3 (STOP)	2-3 (RATED)
ENGINE IDLE	1-2 (RUN)	1-2 (IDLE)
INDICATION ONLY	1-2 (RUN)	2-3 (RATED)

TABLE #1

NOTE: BEACON LIGHT MAY BE INSTALLED FOR ANY MODE.



"LOW FUEL" SHUT-DOWN / IDLE / INDICATION

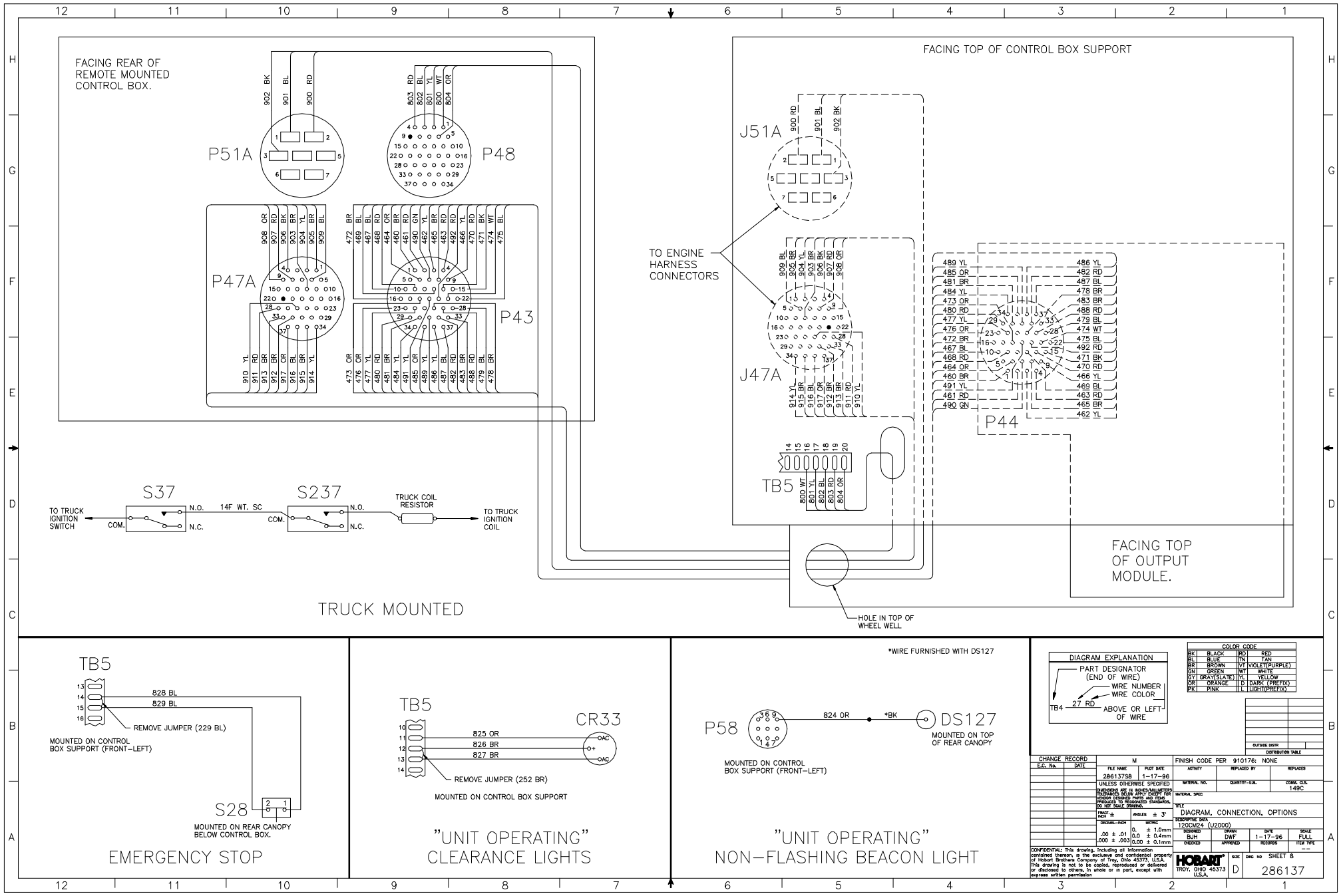


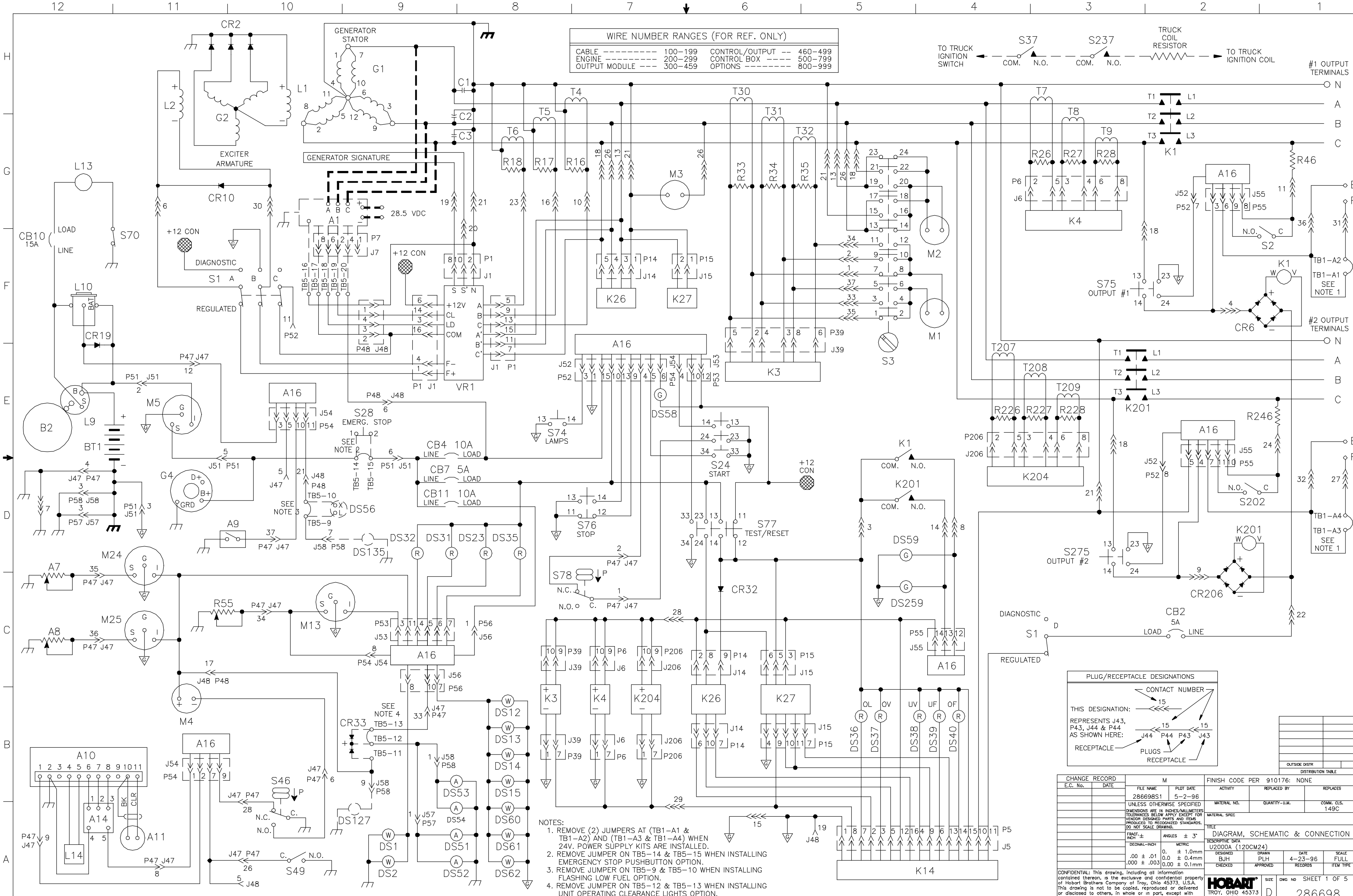
COLOR CODE			
BK	BLACK	RD	RED
BL	BLUE	TN	TAN
BR	BROWN	VT	VIOLET(PURPLE)
GN	GREEN	WT	WHITE
GY	GRAY(SLATE)	YL	YELLOW
OR	ORANGE	D	DARK (PREFIX)
PK	PINK	L	LIGHT(PREFIX)

CHANGE RECORD			M	FINISH CODE PER 910176: NONE
E.C. No.	DATE		FILE NAME: 286137S7 PLOT DATE: 1-17-96	ACTIVITY / REPLACED BY / REPLACES
			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.	MATERIAL NO. / QUANTITY-U.M. / COMM. CLS. 149C
				MATERIAL SPEC
			FRACT ± INCH / ANGLES ± 3°	TITLE: DIAGRAM, CONNECTION, OPTIONS
			DECIMAL-INCH: .00 ± .01, .000 ± .003 / METRIC: 0. ± 1.0mm, 0.0 ± 0.4mm, 0.00 ± 0.1mm	DESCRIPTIVE DATA: 120CM24 (U2000)
				DESIGNED: BJH / DRAWN: DWF / DATE: 1-17-96 / SCALE: FULL
				CHECKED / APPROVED / RECORDS / ITEM TYPE

OUTSIDE DISTR / DISTRIBUTION TABLE

HOBART® TROY, OHIO 45373 U.S.A. | SIZE D | DWG NO 286137 | SHEET 7


FACING REAR OF REMOTE MOUNTED CONTROL BOX.
P51A
P48
P47A
P43
FACING TOP OF CONTROL BOX SUPPORT
J51A
J47A
P44
TO ENGINE HARNESS CONNECTORS
TB5
S37
S237
TO TRUCK IGNITION SWITCH
14F WT. SC
TRUCK COIL RESISTOR
TO TRUCK IGNITION COIL
N.O.
N.C.
COM.
FACING TOP OF OUTPUT MODULE.
HOLE IN TOP OF WHEEL WELL
TRUCK MOUNTED
TB5
828 BL
829 BL
REMOVE JUMPER (229 BL)
MOUNTED ON CONTROL BOX SUPPORT (FRONT-LEFT)
S28
MOUNTED ON REAR CANOPY BELOW CONTROL BOX.
EMERGENCY STOP
TB5
CR33
825 OR
826 BR
827 BR
REMOVE JUMPER (252 BR)
MOUNTED ON CONTROL BOX SUPPORT
"UNIT OPERATING" CLEARANCE LIGHTS
*WIRE FURNISHED WITH DS127
P58
824 OR
*BK
DS127
MOUNTED ON CONTROL BOX SUPPORT (FRONT-LEFT)
MOUNTED ON TOP OF REAR CANOPY
"UNIT OPERATING" NON-FLASHING BEACON LIGHT
DIAGRAM EXPLANATION
PART DESIGNATOR (END OF WIRE)
WIRE NUMBER
WIRE COLOR
TB4 27 RD
ABOVE OR LEFT OF WIRE
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)
CHANGE RECORD
E.C. No. DATE
M
FILE NAME 286137S8
PLOT DATE 1-17-96
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.
FRACT ± 1/64
ANGLES ± 3°
DECIMAL-INCH
.00 ± .01
.000 ± .003
METRIC
0. ± 1.0mm
0.0 ± 0.4mm
0.00 ± 0.1mm
CONFIDENTIAL: This drawing, including all information contained thereon, is the exclusive and confidential property of Hobart Brothers Company of Troy, Ohio 45373, U.S.A. This drawing is not to be copied, reproduced or delivered or disclosed to others, in whole or in part, except with express written permission
FINISH CODE PER 910176: NONE
ACTIVITY
REPLACED BY
REPLACES
MATERIAL NO.
QUANTITY-U.M.
COMM. CLS. 149C
MATERIAL SPEC
TITLE
DIAGRAM, CONNECTION, OPTIONS
DESCRIPTIVE DATA
120CM24 (U2000)
DESIGNED BJH
DRAWN DWF
DATE 1-17-96
SCALE FULL
CHECKED
APPROVED
RECORDS
ITEM TYPE
HOBART
TROY, OHIO 45373 U.S.A.
SIZE D
DWG NO 286137
SHEET 8
OUTSIDE DISTR
DISTRIBUTION TABLE



WIRE NUMBER RANGES (FOR REF. ONLY)

CABLE	100-199	CONTROL/OUTPUT	460-499
ENGINE	200-299	CONTROL BOX	500-799
OUTPUT MODULE	300-459	OPTIONS	800-999

NOTES:
1. REMOVE (2) JUMPERS AT (TB1-A1 & TB1-A2) AND (TB1-A3 & TB1-A4) WHEN 24V. POWER SUPPLY KITS ARE INSTALLED.
2. REMOVE JUMPER ON TB5-14 & TB5-15 WHEN INSTALLING EMERGENCY STOP PUSHBUTTON OPTION.
3. REMOVE JUMPER ON TB5-9 & TB5-10 WHEN INSTALLING FLASHING LOW FUEL OPTION.
4. REMOVE JUMPER ON TB5-12 & TB5-13 WHEN INSTALLING UNIT OPERATING CLEARANCE LIGHTS OPTION.

PLUG/RECEPTACLE DESIGNATIONS

THIS DESIGNATION: CONTACT NUMBER 15

REPRESENTS J43, P43, J44 & P44 AS SHOWN HERE: RECEPTACLE J44 P44 P43 J43 PLUGS RECEPTACLE

CHANGE RECORD — E.C. No. — DATE

FINISH CODE PER 910176: NONE

FILE NAME: 286698S1 — PLOT DATE: 5-2-96

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.

FRACT. ± — ANGLES ± 3°

DECIMAL-INCH: .00 ± .01, .000 ± .003 — METRIC: 0. ± 1.0mm, 0.0 ± 0.4mm, 0.00 ± 0.1mm

COMM. CLS. 149C

TITLE: DIAGRAM, SCHEMATIC & CONNECTION

DESCRIPTIVE DATA: U2000A (120CM24)

DESIGNED: BJH — DRAWN: PLH — DATE: 4-23-96 — SCALE: FULL

HOBART TROY, OHIO 45373 U.S.A.

SIZE: D — DWG NO: 286698 — SHEET 1 OF 5

LEGEND

A1	TRANSFORMER–RECTIFIER, 28.5V. *
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 ADJUSTMENT, ELECTRIC GOVERNOR
A16	GENERATOR SET CONTROL P.C. BOARD
B2	STARTER, ENGINE, 12 V.
BT1	BATTERY, 12 V.
BT2	BATTERY, 12 V.
C1–C3	CAPACITOR, GENERATOR, 0.1 MFD., 500 V.
CB2	CIRCUIT BREAKER, CONTACTORS, 5 A.
CB4	CIRCUIT BREAKER, ENGINE ELECTRICAL, 10 A.
CB7	CIRCUIT BREAKER, CONTROL CIRCUIT, 5 A.
CB10	CIRCUIT BREAKER, COLD WEATHER START, 15A.
CB11	CIRCUIT BREAKER, MARKER LIGHTS, 10 A.
CR2	RECTIFIER, GENERATOR REVOLVING FIELD
CR6	RECTIFIER, LOAD CONTACTOR, NO. 1 OUTPUT
CR10	DIODE, FLYBACK, EXCITER
CR19	DIODE, FLYBACK, AUXILIARY STARTER SOLENOID
CR32	DIODE, BLOCKING
CR33	RECTIFIER, BLOCKING *
CR206	RECTIFIER, LOAD CONTACTOR, NO. 2 OUTPUT
DS1–DS2	LIGHT, PANEL (WHITE)
DS12	LIGHT, CHARGING AMP METER (WHITE)
DS13	LIGHT, OIL PRESSURE GAUGE (WHITE)
DS14	LIGHT, TEMPERATURE GAUGE (WHITE)
DS15	LIGHT, FUEL GAUGE (WHITE)
DS23	INDICATOR, AIR CLEANER SERVICE (RED)
DS31	INDICATOR, HIGH TEMPERATURE (RED)
DS32	INDICATOR, LOW OIL (RED)
DS35	INDICATOR, LOW FUEL LEVEL (RED)
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)
DS56	FLASHER, LOW FUEL LEVEL BEACON LIGHT *
DS58	INDICATOR, PUSHBUTTON, ENGINE START (GREEN)
DS59	INDICATOR, PUSHBUTTON, OUTPUT NO. 1 (GREEN)
DS60	LIGHT, STRIP, FREQUENCY METER
DS61	LIGHT, STRIP, AMMETER
DS62	LIGHT, STRIP, VOLTMETER
DS127	INDICATOR, BEACON, UNIT RUNNING (AMBER, RED OR BLUE) *
DS135	INDICATOR, BEACON, LOW FUEL LEVEL (AMBER, RED OR BLUE) *
DS259	INDICATOR, PUSHBUTTON, OUTPUT NO. 2 (GREEN)
G1	GENERATOR STATOR
G2	EXCITER ARMATURE, GENERATOR
G4	ALTERNATOR, ENGINE, 12 V.
GP1	GROUND PLATE

J1	RECEPTACLE, VOLTAGE REGULATOR
J5	RECEPTACLE, MEMORY AND TIME DELAY BOARD
J6	RECEPTACLE, OVERLOAD BOARD, NO. 1 OUTPUT
J7	RECEPTACLE, T–R CONTROL, 28.5V. *
J14	RECEPTACLE, OVER–UNDERVOLTAGE BOARD
J15	RECEPTACLE, OVER–UNDERFREQUENCY BOARD
J39	RECEPTACLE, OVERLOAD BOARD, GENERATOR, MAIN
J43	RECEPTACLE, POWER MODULE (AT CONTROL BOX)
J44	RECEPTACLE, POWER MODULE
J47	RECEPTACLE, ENGINE
J47A	RECEPTACLE, ENGINE, EXTENSION *
J48	RECEPTACLE, OPTIONS
J51	RECEPTACLE, POWER
J51A	RECEPTACLE, POWER, EXTENSION *
J52–J56	RECEPTACLE, GENERATOR SET CONTROL BOARD
J57	RECEPTACLE, FRONT MARKER LIGHTS
J58	RECEPTACLE, REAR MARKER LIGHTS
J206	RECEPTACLE, OVERLOAD BOARD, NO. 2 OUTPUT
K1	LOAD CONTACTOR, NO. 1 OUTPUT
K3	RELAY, OVERLOAD, GENERATOR, MAIN
K4	RELAY, OVERLOAD, GENERATOR, S.S., NO. 1 OUTPUT
K14	RELAY, MEMORY AND TIME DELAY, SOLID STATE
K26	RELAY, OVER–UNDERVOLTAGE, SOLID STATE
K27	RELAY, OVER–UNDERFREQUENCY, SOLID STATE
K201	LOAD CONTACTOR, NO. 2 OUTPUT
K204	RELAY, OVERLOAD, GENERATOR, S.S., NO. 2 OUTPUT
L1	FIELD, REVOLVING, GENERATOR
L2	FIELD, EXCITER, GENERATOR
L9	SOLENOID, STARTER
L10	SOLENOID, STARTER, AUXILIARY
L13	SOLENOID, COLD WEATHER START
L14	ACTUATOR, ELECTRIC GOVERNOR
M1	AMMETER, GENERATOR
M2	VOLTMETER, GENERATOR
M3	FREQUENCY METER
M4	RUNNING TIME METER, ENGINE–GENERATOR
M5	AMMETER, BATTERY
M13	GAUGE, FUEL, ELECTRIC
M24	GAUGE, WATER TEMPERATURE
M25	GAUGE, OIL PRESSURE
P1	PLUG, VOLTAGE REGULATOR
P5	PLUG, MEMORY AND TIME DELAY BOARD
P6	PLUG, OVERLOAD BOARD, NO. 1 OUTPUT
P7	PLUG, T–R CONTROL, 28.5V. *
P14	PLUG, OVER–UNDERVOLTAGE BOARD
P15	PLUG OVER–UNDERFREQUENCY BOARD
P39	PLUG, OVERLOAD BOARD, GENERATOR, MAIN
P43	PLUG, OUTPUT MODULE (AT CONTROL BOX)
P44	PLUG, OUTPUT MODULE
P47	PLUG, ENGINE
P47A	PLUG, ENGINE, EXTENSION *
P48	PLUG, OPTIONS
P51	PLUG, POWER
P51A	PLUG, POWER, EXTENSION *
P52–P56	PLUG, GENERATOR SET CONTROL BOARD
P57	PLUG, FRONT MARKER LIGHTS
P58	PLUG, REAR MARKER LIGHTS
P206	PLUG, OVERLOAD BOARD, NO. 2 OUTPUT

R16–R18	RESISTOR, LINE DROP, 50 OHM, 20 WATT
R26–R28	RESISTOR, OVERLOAD, 16.6 OHM, 20 WATT, NO. 1 OUTPUT
R33–R35	RESISTOR, OVERLOAD, MAIN GENERATOR, 12.5 OHM, 20 WATT
R46	RESISTOR, HOLD CIRCUIT, 100 OHM, 25 WATT, NO. 1 OUTPUT
R55	SENDER, ELECTRIC FUEL GAUGE
R226–R228	RESISTOR, OVERLOAD, 16.6 OHM, 20 WATT, NO. 2 OUTPUT
R246	RESISTOR, HOLD CIRCUIT, 100 OHM, 25 WATT, NO. 2 OUTPUT
S1	SWITCH, REGULATED–DIAGNOSTIC
S2	SWITCH, TEST BANK, NO. 1 OUTPUT
S3	SWITCH, METER SELECTOR
S24	SWITCH, ENGINE START
S28	SWITCH, PUSHBUTTON, EMERGENCY STOP *
S37	SWITCH, MICRO, PLUG BOX, #1 OUTPUT *
S46	SWITCH, LUBE OIL PRESSURE, ENGINE
S49	SWITCH, ENGINE HIGH TEMPERATURE
S70	SWITCH, ENGINE TEMPERATURE SENSOR
S74	SWITCH, PUSHBUTTON, LAMPS AND FUEL CHECK
S75	SWITCH. PUSHBUTTON, OUTPUT NO. 1
S76	SWITCH, PUSHBUTTON, ENGINE STOP & ENGINE FAULT RESET
S77	SWITCH, PUSHBUTTON, TEST/RESET
S78	SWITCH, LUBE OIL PRESSURE, STARTER CUTOUT
S202	SWITCH, TEST BANK, NO. 2 OUTPUT
S237	SWITCH. MICRO, PLUG BOX, #2 OUTPUT *
S275	SWITCH. PUSHBUTTON, OUTPUT NO. 2
T4–T6	TRANSFORMER, CURRENT, LINE DROP
T7–T9	TRANSFORMER, CURRENT, OVERLOAD, GENERATOR, NO. 1 OUTPUT
T30–T32	TRANSFORMER, CURRENT, OVERLOAD, MAIN GENERATOR
T207–T209	TRANSFORMER, CURRENT, OVERLOAD, GENERATOR, NO. 2 OUTPUT
TB1–TB2	TERMINAL BLOCK, CONTROL BOX
TB3–TB4	TERMINAL BLOCK, OUTPUT MODULE
TB5	TERMINAL BLOCK, OPTIONS
VR1	VOLTAGE REGULATOR, GENERATOR

* WHEN FURNISHED

① ADDED BT2

CHANGE RECORD		M		FINISH CODE PER 910176: NONE			
E.C. No.	DATE	FILE NAME	PLOT DATE	ACTIVITY	REPLACED BY	REPLACES	
1) 1417AA	8-13-96	286698S2	8-15-96				
		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.		MATERIAL NO.	QUANTITY-U.M.	COMM. CLS. 149C	
		FRACT ±	ANGLES ± 3°	MATERIAL SPEC			
		DECIMAL–INCH	METRIC	TITLE DIAGRAM, SCHEMATIC & CONNECTION			
		.00 ± .01	0. ± 1.0mm	DESCRIPTIVE DATA LEGEND FOR U2000A (1200M24)			
		.000 ± .003	0.0 ± 0.4mm	DESIGNED BJH	DRAWN PLH	DATE 4-23-96	SCALE FULL
			0.00 ± 0.1mm	CHECKED	APPROVED	RECORDS 5-3-96	ITEM TYPE

OUTSIDE DISTR

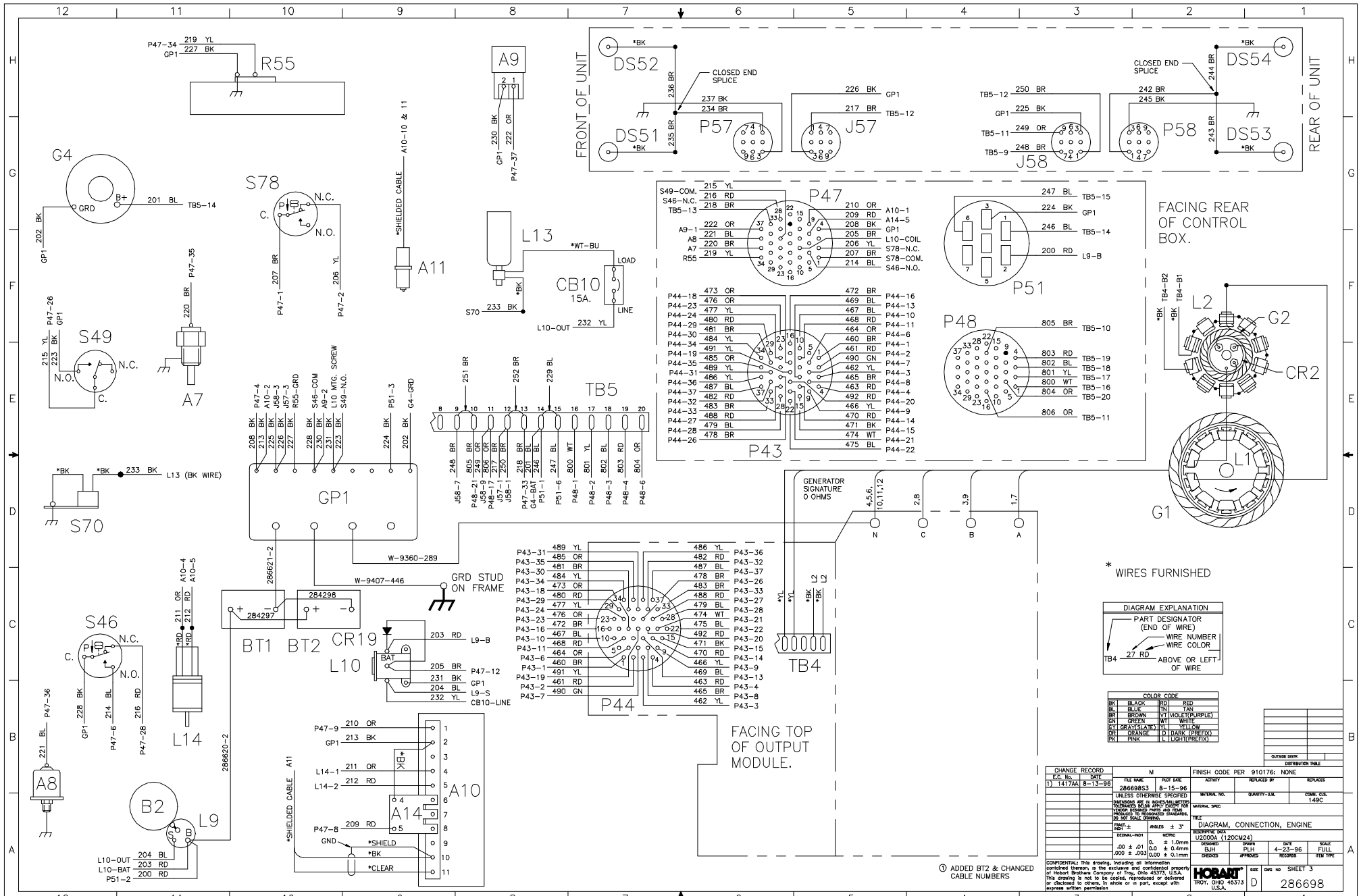
DISTRIBUTION TABLE

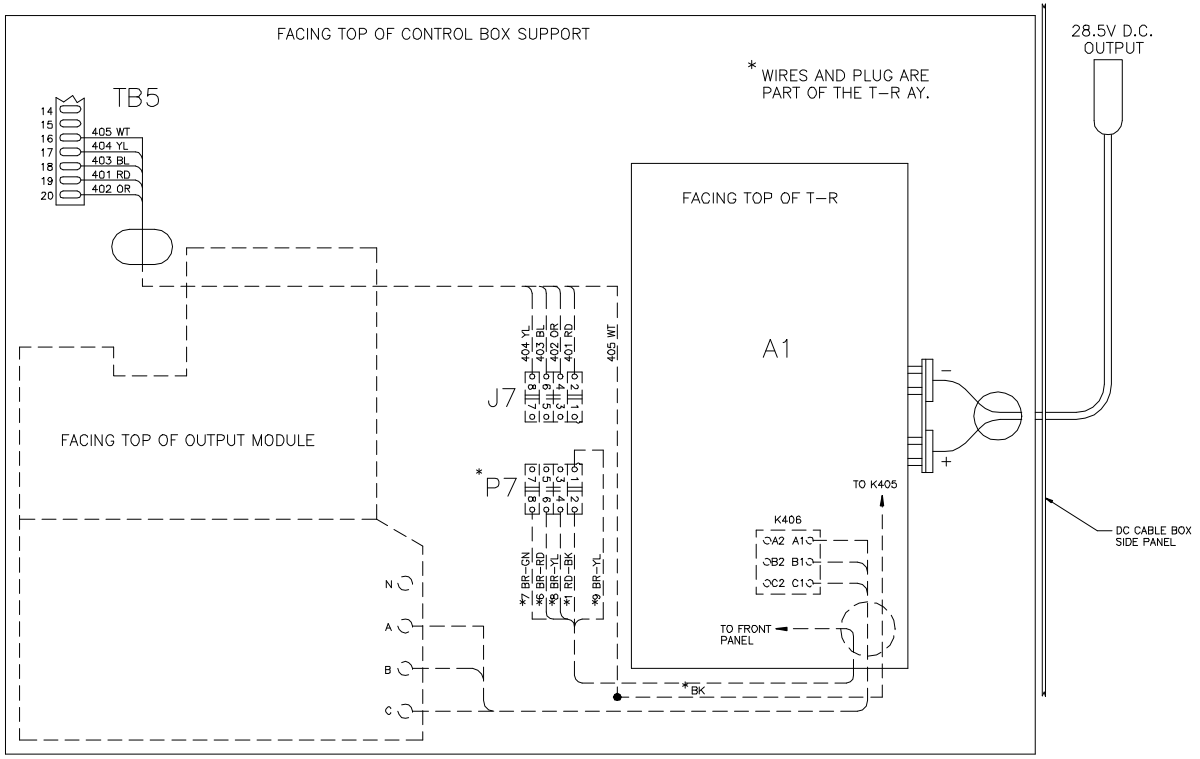
HOBART® TROY, OHIO 45373 U.S.A.

SIZE D

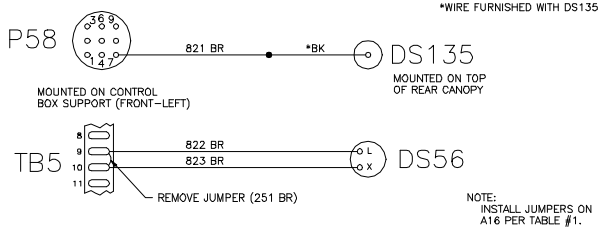
DWG. NO 286698

SHEET 2

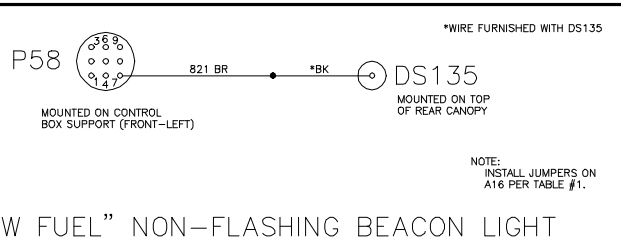

FRONT OF UNIT
REAR OF UNIT
DS52
DS51
DS54
DS53
P57
J57
J58
P58
CLOSED END SPLICE
R55
A9
A11
A10
A14
A7
A8
G4
S78
L13
CB10
15A.
LOAD
LINE
S49
S70
S46
B2
L9
L14
BT1
BT2
CR19
L10
GP1
P47
P48
P43
P44
P51
TB5
TB4
L2
G2
CR2
L1
G1
FACING REAR OF CONTROL BOX.
FACING TOP OF OUTPUT MODULE.
GENERATOR SIGNATURE 0 OHMS
GRD STUD ON FRAME
* WIRES FURNISHED
DIAGRAM EXPLANATION
PART DESIGNATOR (END OF WIRE)
WIRE NUMBER
WIRE COLOR
ABOVE OR LEFT OF WIRE
COLOR CODE
BK BLACK
BL 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)
① ADDED BT2 & CHANGED CABLE NUMBERS
DIAGRAM, CONNECTION, ENGINE
U2000A (120CM24)
HOBART
TROY, OHIO 45373 U.S.A.
SHEET 3
286698



28.5V. TRANSFORMER-RECTIFIER



"LOW FUEL" FLASHING BEACON LIGHT



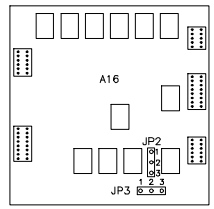
"LOW FUEL" NON-FLASHING BEACON LIGHT

INSTALL JUMPERS JP2 & JP3 ON GENERATOR CONTROL P.C. BOARD (A16) PER TABLE #1 (BELOW) TO OBTAIN DESIRED ACTION.

DESIRED ACTION FOR "LOW FUEL" CONDITION	TERMINAL CONNECTIONS FOR JUMPER	
	JP2	JP3
ENGINE SHUT-DOWN	2-3 (STOP)	2-3 (RATED)
ENGINE IDLE	1-2 (RUN)	1-2 (IDLE)
INDICATION ONLY	1-2 (RUN)	2-3 (RATED)

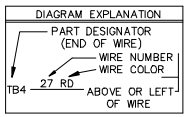
TABLE #1

NOTE:
BEACON LIGHT MAY BE INSTALLED FOR ANY MODE.



"LOW FUEL" SHUT-DOWN / IDLE / INDICATION

DIAGRAM EXPLANATION



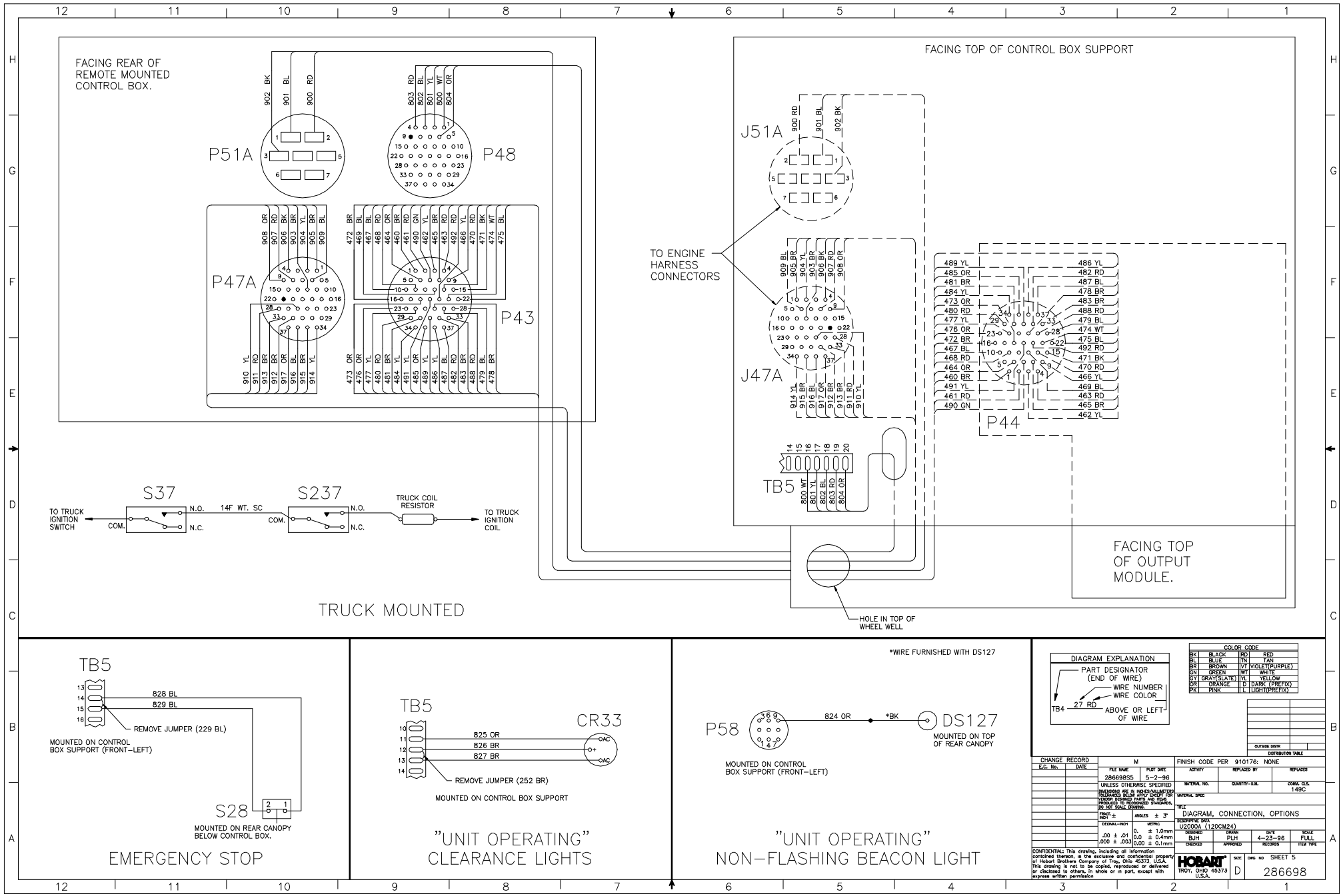
COLOR CODE			
BK	BLACK	RD	RED
BL	BLUE	TN	TAN
BR	BROWN	VT	VIOLET(PURPLE)
GN	GREEN	WT	WHITE
GY	GRAY(SLATE)	YL	YELLOW
OR	ORANGE	D	DARK (PREFIX)
PK	PINK	L	LIGHT(PREFIX)

CHANGE RECORD		M	FINISH CODE PER 910176: NONE
E.C. No.	DATE	FILE NAME / PLOT DATE: 286698S4 5-2-98	ACTIVITY / REPLACED BY / REPLACES
		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.	MATERIAL NO. / QUANTITY-U.M. / COMM. CLS. 149C
		FRACT. ± INCH: ANGLES ± 3°	MATERIAL SPEC
		DECIMAL-INCH: .00 ± .01, .000 ± .003 / METRIC: 0. ± 1.0mm, 0.0 ± 0.4mm, 0.00 ± 0.1mm	TITLE: DIAGRAM, CONNECTION, OPTIONS
			DESCRIPTIVE DATA: U2000A (120CM24)
			DESIGNED BJH / DRAWN PLH / DATE 4-23-96 / SCALE FULL
			CHECKED / APPROVED / RECORDS / ITEM TYPE

OUTSIDE DISTR / DISTRIBUTION TABLE

HOBART® TROY, OHIO 45373 U.S.A.

SIZE D / DWG NO 286698 / SHEET 4


FACING REAR OF
REMOTE MOUNTED
CONTROL BOX.
P51A
P48
P47A
P43
FACING TOP OF CONTROL BOX SUPPORT
J51A
J47A
TO ENGINE
HARNESS
CONNECTORS
P44
TB5
FACING TOP
OF OUTPUT
MODULE.
S37
S237
TO TRUCK
IGNITION
SWITCH
COM.
N.O.
N.C.
14F WT. SC
TRUCK COIL
RESISTOR
TO TRUCK
IGNITION
COIL
HOLE IN TOP OF
WHEEL WELL
TRUCK MOUNTED
TB5
828 BL
829 BL
REMOVE JUMPER (229 BL)
MOUNTED ON CONTROL
BOX SUPPORT (FRONT-LEFT)
S28
MOUNTED ON REAR CANOPY
BELOW CONTROL BOX.
EMERGENCY STOP
TB5
CR33
825 OR
826 BR
827 BR
REMOVE JUMPER (252 BR)
MOUNTED ON CONTROL BOX SUPPORT
"UNIT OPERATING"
CLEARANCE LIGHTS
*WIRE FURNISHED WITH DS127
P58
824 OR
*BK
DS127
MOUNTED ON TOP
OF REAR CANOPY
MOUNTED ON CONTROL
BOX SUPPORT (FRONT-LEFT)
"UNIT OPERATING"
NON-FLASHING BEACON LIGHT
DIAGRAM EXPLANATION
PART DESIGNATOR
(END OF WIRE)
WIRE NUMBER
WIRE COLOR
TB4 27 RD
ABOVE OR LEFT
OF WIRE
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)
OUTSIDE DISTR
DISTRIBUTION TABLE
CHANGE RECORD
E.C. No.
DATE
M
FILE NAME
28669855
PLOT DATE
5-2-96
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.
FINISH ± INCH
ANGLES ± 3°
DECIMAL-INCH
METRIC
.00 ± .01
.000 ± .003
0. ± 1.0mm
0.0 ± 0.4mm
0.00 ± 0.1mm
FINISH CODE PER 910176: NONE
ACTIVITY
REPLACED BY
REPLACES
MATERIAL NO.
QUANTITY-U.M.
COMM. CLS.
149C
MATERIAL SPEC
TITLE
DIAGRAM, CONNECTION, OPTIONS
DESCRIPTIVE DATA
U2000A (120CM24)
DESIGNED
BJH
DRAWN
PLH
DATE
4-23-96
SCALE
FULL
CHECKED
APPROVED
RECORDS
ITEM TYPE
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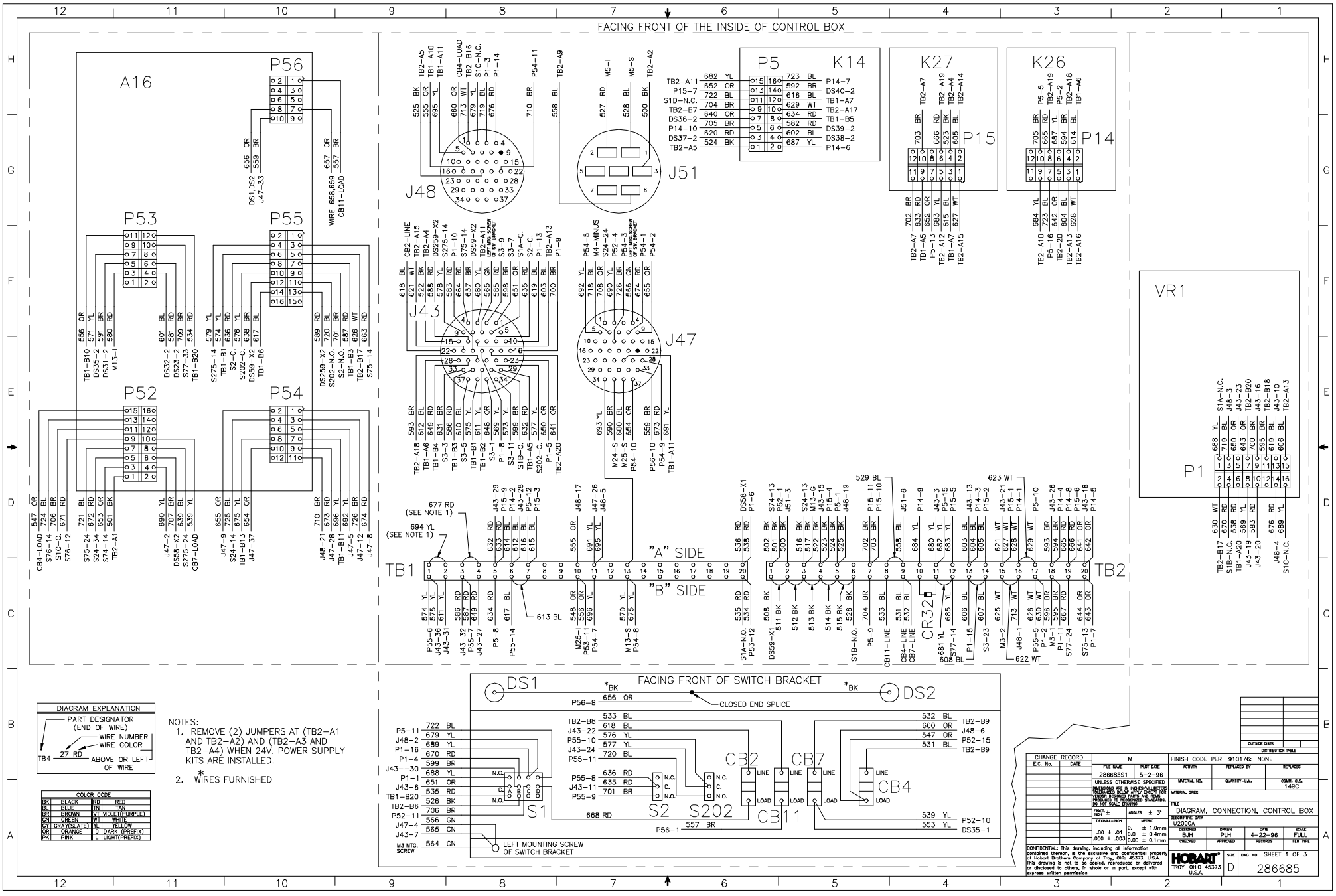
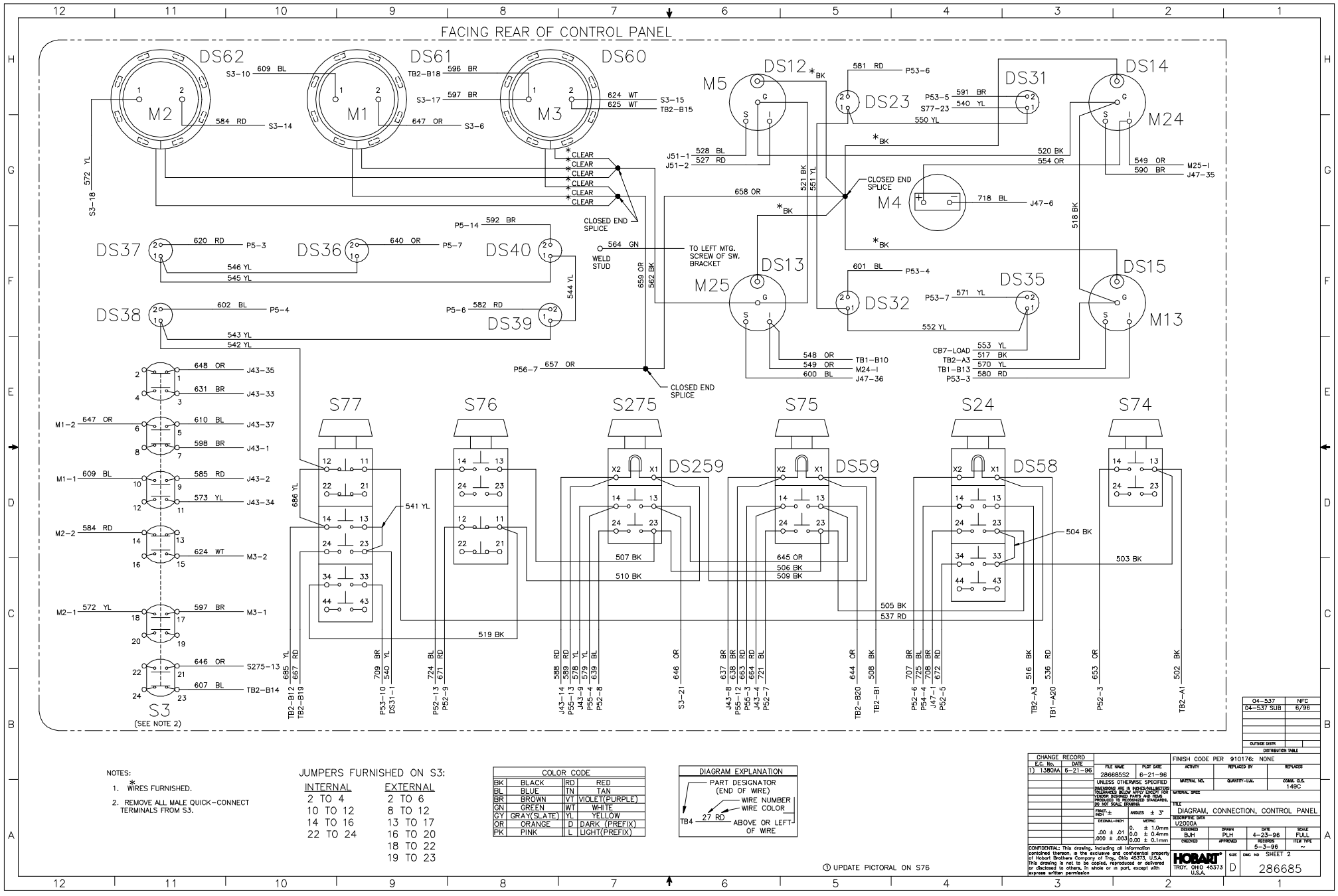
express written permission
HOBART
TROY, OHIO 45373
U.S.A.
SIZE
D
DWG NO
286698
SHEET 5


FACING FRONT OF THE INSIDE OF CONTROL BOX
A16
P56
P53
P55
P52
P54
J48
J51
J43
J47
P5
K14
K27
K26
P15
P14
VR1
P1
TB1
TB2
"A" SIDE
"B" SIDE
677 RD (SEE NOTE 1)
694 YL (SEE NOTE 1)
613 BL
CR32
CB2
CB7
CB4
CB11
S1
S2
S202
DS1
DS2
FACING FRONT OF SWITCH BRACKET
*BK
CLOSED END SPLICE
668 RD
557 BR
LEFT MOUNTING SCREW OF SWITCH BRACKET
M3 MTG. SCREW
DIAGRAM EXPLANATION
PART DESIGNATOR (END OF WIRE)
WIRE NUMBER
WIRE COLOR
27 RD
TB4
ABOVE OR LEFT OF WIRE
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)
NOTES:
1. REMOVE (2) JUMPERS AT (TB2–A1 AND TB2–A2) AND (TB2–A3 AND TB2–A4) WHEN 24V. POWER SUPPLY KITS ARE INSTALLED.
2. * WIRES FURNISHED
CHANGE RECORD
FINISH CODE PER 910176: NONE
DIAGRAM, CONNECTION, CONTROL BOX
U2000A
HOBART TROY, OHIO 45373 U.S.A.
SIZE D
DWG NO 286685
SHEET 1 OF 3



NOTES:

1. * WIRES FURNISHED.
2. REMOVE ALL MALE QUICK-CONNECT TERMINALS FROM S3.

JUMPERS FURNISHED ON S3:

INTERNAL	EXTERNAL
2 TO 4	2 TO 6
10 TO 12	8 TO 12
14 TO 16	13 TO 17
22 TO 24	16 TO 20
	18 TO 22
	19 TO 23

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)

DIAGRAM EXPLANATION

PART DESIGNATOR (END OF WIRE)
WIRE NUMBER
WIRE COLOR
TB4 27 RD ABOVE OR LEFT OF WIRE

① UPDATE PICTORAL ON S76

04-537	NFC
04-537 SUB	6/96

OUTSIDE DISTR

DISTRIBUTION TABLE

CHANGE RECORD		
E.C. No.	DATE	
1) 1380AA	6-21-96	

FINISH CODE PER 910176: NONE

FILE NAME	PLOT DATE	ACTIVITY	REPLACED BY	REPLACES
286685S2	6-21-96			

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.

MATERIAL NO.	QUANTITY-U.M.	COMM. CLS.
		149C

MATERIAL SPEC

FINISH ± INCH: ANGLES ± 3°

DECIMAL-INCH	METRIC
	0. ± 1.0mm
.00 ± .01	0.0 ± 0.4mm
.000 ± .003	0.00 ± 0.1mm

TITLE
DIAGRAM, CONNECTION, CONTROL PANEL

DESCRIPTIVE DATA
U2000A

DESIGNED	DRAWN	DATE	SCALE
BJH	PLH	4-23-96	FULL
CHECKED	APPROVED	RECORDS	ITEM TYPE
		5-3-96	~

HOBART TROY, OHIO 45373 U.S.A.

SIZE D

DWG. NO 286685

SHEET 2

LEGEND

A16	GENERATOR SET CONTROL P.C. BOARD
CB2	CIRCUIT BREAKER, CONTACTORS, 5 A.
CB4	CIRCUIT BREAKER, ENGINE ELECTRICAL, 10 A.
CB7	CIRCUIT BREAKER, CONTROL CIRCUIT, 5 A.
CB11	CIRCUIT BREAKER, MARKER LIGHTS, 10 A.
CR32	DIODE, BLOCKING
DS1–DS2	LIGHT, PANEL (WHITE)
DS12	LIGHT, CHARGING AMP METER (WHITE)
DS13	LIGHT, OIL PRESSURE GAUGE (WHITE)
DS14	LIGHT, TEMPERATURE GAUGE (WHITE)
DS15	LIGHT, FUEL GAUGE (WHITE)
DS23	INDICATOR, AIR CLEANER SERVICE (RED)
DS31	INDICATOR, HIGH TEMPERATURE (RED)
DS32	INDICATOR, LOW OIL (RED)
DS35	INDICATOR, LOW FUEL LEVEL (RED)
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)
DS58	INDICATOR, PUSHBUTTON, ENGINE START (GREEN)
DS59	INDICATOR, PUSHBUTTON, OUTPUT NO. 1 (GREEN)
DS60	LIGHT, STRIP, FREQUENCY METER
DS61	LIGHT, STRIP, AMMETER
DS62	LIGHT, STRIP, VOLTMETER
DS259	INDICATOR, PUSHBUTTON, OUTPUT NO. 2 (GREEN)
J43	RECEPTACLE, POWER MODULE
J47	RECEPTACLE, ENGINE
J48	RECEPTACLE, OPTIONS
J51	RECEPTACLE, POWER
K14	RELAY, MEMORY AND TIME DELAY, SOLID STATE
K26	RELAY, OVER–UNDERVOLTAGE, SOLID STATE
K27	RELAY, OVER–UNDERFREQUENCY, SOLID STATE
M1	AMMETER, GENERATOR
M2	VOLTMETER, GENERATOR
M3	FREQUENCY METER
M4	RUNNING TIME METER, ENGINE–GENERATOR
M5	AMMETER, BATTERY
M13	GAUGE, FUEL, ELECTRIC
M24	GAUGE, WATER TEMPERATURE
M25	GAUGE, OIL PRESSURE
P1	PLUG, VOLTAGE REGULATOR
P5	PLUG, MEMORY AND TIME DELAY BOARD
P14	PLUG, OVER–UNDERVOLTAGE BOARD
P15	PLUG OVER–UNDERFREQUENCY BOARD
P52–P56	PLUG, GENERATOR SET CONTROL BOARD
S1	SWITCH, REGULATED–DIAGNOSTIC
S2	SWITCH, TEST BANK, NO. 1 OUTPUT
S3	SWITCH, METER SELECTOR
S24	SWITCH, ENGINE START
S74	SWITCH, PUSHBUTTON, LAMPS AND FUEL CHECK
S75	SWITCH. PUSHBUTTON, OUTPUT NO. 1
S76	SWITCH, PUSHBUTTON, ENGINE STOP & ENGINE FAULT RESET
S77	SWITCH, PUSHBUTTON, TEST/RESET
S202	SWITCH, TEST BANK, NO. 2 OUTPUT
S275	SWITCH. PUSHBUTTON, OUTPUT NO. 2
TB1–TB2	TERMINAL BLOCK

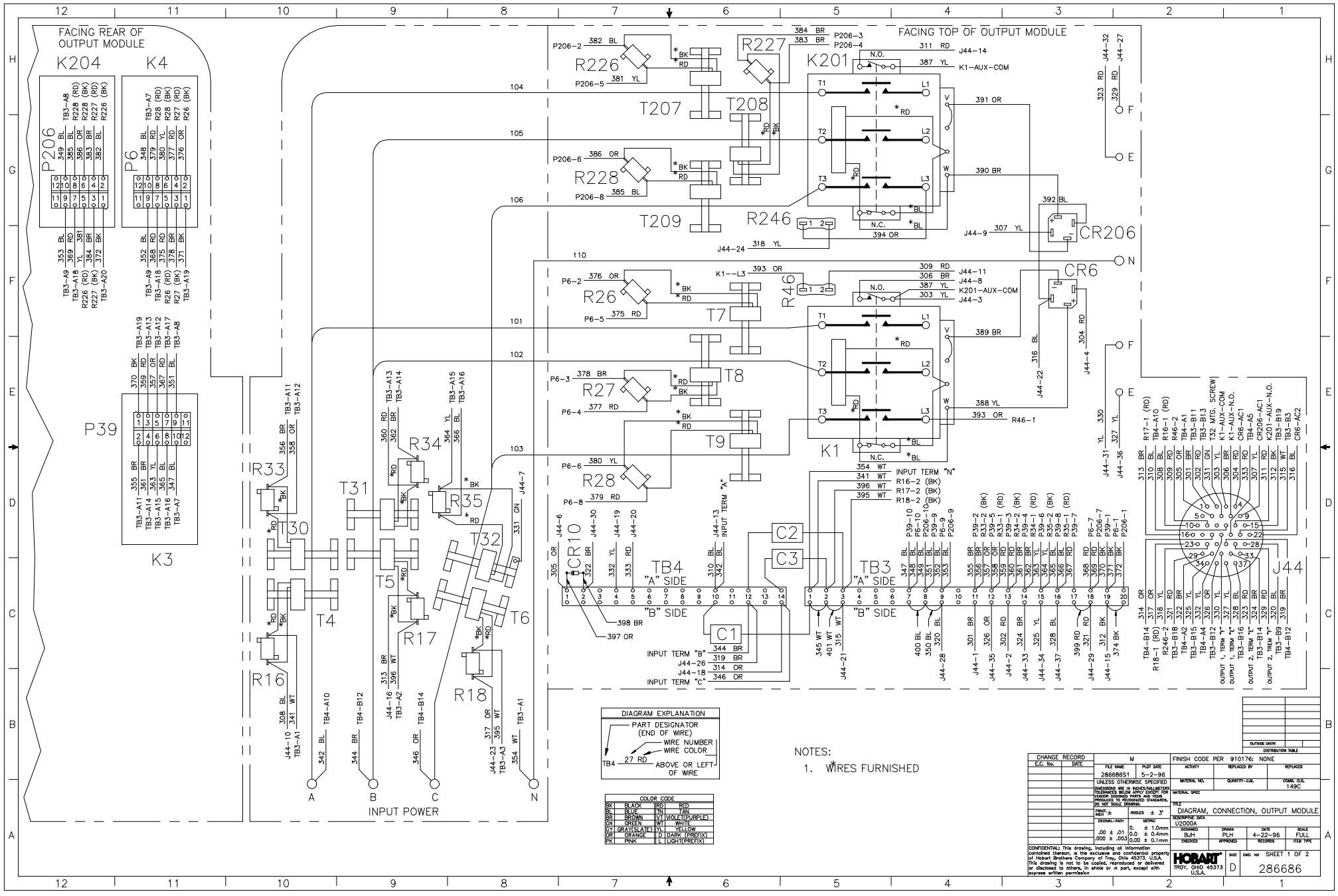
OUTSIDE DISTR.

DISTRIBUTION TABLE

CHANGE RECORD		M		FINISH CODE PER 910176: NONE		
E.C. No.	DATE	FILE NAME	PLOT DATE	ACTIVITY	REPLACED BY	REPLACES
		28668553	5-2-96			
		UNLESS OTHERWISE SPECIFIED		MATERIAL NO.	QUANTITY-U.M.	COMM. CLS. 149C
		DIMENSIONS ARE IN INCHES/MILLIMETERS TOLERANCES BELOW APPLY EXCEPT FOR VENDOR DESIGNED PARTS AND ITEMS PRODUCED TO RECOGNIZED STANDARDS. DO NOT SCALE DRAWING.		MATERIAL SPEC.		
		FRACT. INCH ±	ANGLES ± 3°	TITLE DIAGRAM, CONNECTION, CONTROL BOX		
		DECIMAL–INCH	METRIC	DESCRIPTIVE DATA U2000A		
		.00 ± .03	0.0 ±0.8mm	DESIGNED BJH	DRAWN PLH	DATE 4-23-96
		.000 ± .010	0.00 ±0.25mm	CHECKED	APPROVED	RECORDS
						SCALE FULL
						ITEM TYPE

HOBART® TROY, OHIO 45373 U.S.A.

SIZE C | DWG NO 286685 | SHEET 3


FACING REAR OF OUTPUT MODULE
FACING TOP OF OUTPUT MODULE
K204
K4
K3
K201
K1
CR206
CR6
CR10
R46
P206
P6
P39
J44
TB4
TB3
T4
T5
T6
T7
T8
T9
T30
T31
T32
T207
T208
T209
R16
R17
R18
R26
R27
R28
R33
R34
R35
R226
R227
R228
R246
C1
C2
C3
INPUT POWER
A
B
C
N
"A" SIDE
"B" SIDE
INPUT TERM "A"
INPUT TERM "B"
INPUT TERM "C"
INPUT TERM "N"
DIAGRAM EXPLANATION
PART DESIGNATOR (END OF WIRE)
WIRE NUMBER
WIRE COLOR
ABOVE OR LEFT OF WIRE
COLOR CODE
BK BLACK
BL BLUE
BR BROWN
GN GREEN
GY GRAY(SLATE)
OR ORANGE
PK PINK
RD RED
TN TAN
WT WHITE
YL YELLOW
D DARK (PREFIX)
L LIGHT(PREFIX)
NOTES:
1. *WIRES FURNISHED
CHANGE RECORD
FINISH CODE PER 910176: NONE
DIAGRAM, CONNECTION, OUTPUT MODULE
U2000A
HOBART
TROY, OHIO 45373 U.S.A.
SIZE D
DWG NO 286686
SHEET 1 OF 2
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LEGEND

C1–C3	CAPACITOR, GENERATOR, 0.1 MFD., 500 V.
CR6	RECTIFIER, LOAD CONTACTOR, NO. 1 OUTPUT
CR10	DIODE, FLYBACK, EXCITER
CR206	RECTIFIER, LOAD CONTACTOR, NO. 2 OUTPUT
J44	RECEPTACLE, POWER MODULE
K1	LOAD CONTACTOR, NO. 1 OUTPUT
K3	RELAY, OVERLOAD, GENERATOR, MAIN
K4	RELAY, OVERLOAD, GENERATOR, S.S., NO. 1 OUTPUT
K201	LOAD CONTACTOR, NO. 2 OUTPUT
K204	RELAY, OVERLOAD, GENERATOR, S.S., NO. 2 OUTPUT
P6	PLUG, OVERLOAD BOARD, NO. 1 OUTPUT
P39	PLUG, OVERLOAD BOARD, GENERATOR, MAIN
P206	PLUG, OVERLOAD BOARD, NO. 2 OUTPUT
R16–R18	RESISTOR, LINE DROP, 50 OHM, 20 WATT
R26–R28	RESISTOR, OVERLOAD, 16.6 OHM, 20 WATT, NO. 1 OUTPUT
R33–R35	RESISTOR, OVERLOAD, MAIN GENERATOR, 12.5 OHM, 20 WATT
R46	RESISTOR, HOLD CIRCUIT, 100 OHM, 25 WATT, NO. 1 OUTPUT
R226–R228	RESISTOR, OVERLOAD, 16.6 OHM, 20 WATT, NO. 2 OUTPUT
R246	RESISTOR, HOLD CIRCUIT, 100 OHM, 25 WATT, NO. 2 OUTPUT
T4–T6	TRANSFORMER, CURRENT, LINE DROP
T7–T9	TRANSFORMER, CURRENT, OVERLOAD, GENERATOR, NO. 1 OUTPUT
T30–T32	TRANSFORMER, CURRENT, OVERLOAD, MAIN GENERATOR
T207–T209	TRANSFORMER, CURRENT, OVERLOAD, GENERATOR, NO. 2 OUTPUT
TB3–TB4	TERMINAL BLOCK

OUTSIDE DISTR.

DISTRIBUTION TABLE

CHANGE RECORD		M		FINISH CODE PER 910176: NONE			
E.C. No.	DATE	FILE NAME	PLOT DATE	ACTIVITY	REPLACED BY		REPLACES
		28668652	5-2-96				
		UNLESS OTHERWISE SPECIFIED		MATERIAL NO.	QUANTITY-U.M.		COMM. CLS. 149C
		DIMENSIONS ARE IN INCHES/MILLIMETERS TOLERANCES BELOW APPLY EXCEPT FOR VENDOR DESIGNED PARTS AND ITEMS PRODUCED TO RECOGNIZED STANDARDS. DO NOT SCALE DRAWING.		MATERIAL SPEC.			
		FRACT. ± INCH	ANGLES ± 3°	TITLE: DIAGRAM, CONN., OUTPUT MODULE			
		DECIMAL-INCH	METRIC	DESCRIPTIVE DATA: U2000A			
		.00 ± .03	0.0 ±0.8mm	DESIGNED: BJH	DRAWN: PLH	DATE: 4-22-96	SCALE: FULL
		.000 ± .010	0.00 ±0.25mm	CHECKED	APPROVED	RECORDS	ITEM TYPE

HOBART® TROY, OHIO 45373 U.S.A.

SIZE C

DWG NO 286686 SHEET 2

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.

j. High electromagnetic fields.

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.

g. Operation where low acoustical noise levels are required.

3. Operation with:

a. Improper fuel, lubricants or coolant.

b. Parts or elements unauthorized by the manufacturer.

c. Unauthorized modifications.

4. Operation in poorly ventilated areas.

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Wet-Stacking in Generator Set

1. 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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