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HOBART®
GROUND POWER

Operation and Maintenance Manual with Illustrated Parts List

for

POWER MASTER

Solid State Frequency Converters
Part Numbers 500013A and 500013B
For
Vertical, Bridge, or Trailer Mounting

Rated Outputs: 90-kVA, 125-kVA, 140-kVA, or 180-kVA, 115/200-V, 3-PHASE, 400-Hz

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

WARRANTY

HOBART BROTHERS COMPANY TROY, OHIO 45373
GROUND POWER DIVISION

1. Hobart Brothers Company (hereinafter called **HOBART**) warrants that each new and unused Hobart Ground Power Equipment, (hereinafter called the **PRODUCT**) is of good workmanship and is free from mechanical defects, provided that (1) the **PRODUCT** is installed and operated in accordance with the printed instructions of **HOBART,** (2) the **PRODUCT** is used under the normal operating conditions for which it is designed, (3) the **PRODUCT** is not subjected to misuse, negligence or accident, and (4) the **PRODUCT** receives proper care, lubrication, protection, and maintenance under the supervision of trained personnel.
2. This warranty expires 15 months after shipment by **HOBART** to the first user, or 12 months after installation, whichever first occurs.
3. This warranty does not apply to: primary and secondary switch contacts, cable connectors, carbon brushes, fuses, bulbs, and filters unless found to be defective prior to use.
4. Hobart **DOES NOT WARRANT THE FOLLOWING COMPONENTS:** Engines (gasoline or diesel),storage batteries, engine starters generators, alternators, regulators, governors, tires, axles,transmissions, and cable retrieving devices. Many of the foregoing components are warranted directly by the manufacturer to the first user and serviced by a worldwide network of distributors and others authorized to handle claims for component manufacturers. A first user's claim should be presented directly to such an authorized component service outlet. In the event any component manufacturer has warranted its component to **HOBART** and will not deal directly with a first user then **HOBART** will cooperate with the first user in the presentation of a claim to such manufacturer. Under **NO** circumstances does **HOBART** assume any liability for any warranty claim against or warranty work done by or in behalf of any manufacturer of the foregoing components.
5. This warranty is extended by **HOBART** only to the purchaser of new **PRODUCTS** from **HOBART** or one of its authorized distributors. The **PRODUCTS** purchased under this warranty are intended for use exclusively by the buyer and his employees and by no other persons and, therefore, there shall be no third party beneficiary to this warranty.
6. A claim of defects in any **PRODUCT** covered by this warranty is subject to **HOBART** factory inspection and judgment. **HOBART'S** liability is limited to repair of any defects found by **HOBART** to exist, or at **HOBART'S** option the replacement of the defective product, F.O.B. factory, after the defective product has been returned by the purchaser at its expense to **HOBART'S** shipping place. Replacement and exchange parts will be warranted for the remainder of the original Warranty, or for a period of ninety (90) days, whichever is greater.
7. **UNDER NO CIRCUMSTANCES** whatsoever shall **HOBART** and its authorized distributors be liable for any special or consequential damages, whether based on lost goodwill, lost resale profits, work stoppage impairment of other goods or otherwise, and whether arising out of breach of any express or implied warranty, breach of contract, negligence or otherwise, except only in the case of personal injury as may be required by applicable law.
8. Continued use of the **PRODUCT(S)** after discovery of a defect **VOIDS ALL WARRANTIES.**
9. Except as authorized in writing, this warranty does not cover any equipment that has been altered by any party other than **HOBART.**
10. **THERE ARE NO WARRANTIES WHICH EXTEND BEYOND THE DESCRIPTION ON THE FACE HERE OF. HOBART MAKES NO WARRANTIES, EXPRESSED OR IMPLIED, OF ERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.**
11. **HOBART** neither assumes nor authorizes any person to assume for **HOBART** any liability in connection with the **PRODUCTS** sold, and there are no oral agreements or warranties collateral to or affecting this written Warranty. This warranty and all undertakings of **HOBART** thereunder shall be governed by the laws of the State of Ohio, United States of America.

WARNING
AT ALL TIMES, SAFETY MUST BE CONSIDERED AN IMPORTANT FACTOR IN THE INSTALLATION, SERVICING AND OPERATION OF THE PRODUCT, AND SKILLED, TECHNICALLY QUALIFIED PERSONNEL SHOULD ALWAYS BE EMPLOYED FOR SUCH TASKS.

Safety Warnings and Cautions

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, 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, and use insulating gloves when dampness or sweat cannot be avoided. Keep clothing dry, and never work alone.

a. Installation and Grounding of Electrically Powered Equipment

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

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

b. Output Cables and Terminals

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

3. Service and Maintenance

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

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

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

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

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

4. Fire And Explosion Prevention

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

5. Bodily Injury Prevention

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

6. Medical and First Aid Treatment

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

EMERGENCY FIRST AID

Call physician immediately. Seek additional assistance. Use First Aid techniques recommended by American Red Cross until medical help arrives.
IF BREATHING IS DIFFICULT, give oxygen, if available, and have victim lie down. FOR ELECTRICAL SHOCK, turn off power. Remove victim; if not breathing, begin artificial respiration, preferably mouth-to-mouth. If no detectable pulse, begin external heart massage. CALL EMERGENCY RESCUE SQUAD IMMEDIATELY.

7. Equipment Precautionary Labels

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

Introduction

This manual contains operation and maintenance information for Hobart PoWerMaster® solid state frequecny converters manufactured by Hobart Brothers Company, Ground Power Division, Troy, Ohio 45373.

This manual is not intended to be a textbook on electricity or electronics. Its primary purpose is to provide information and instructions to experienced operators, electricians, and mechanics who have never operated this equipment. It is the intent of this manual to guide and assist operators and maintenance people in the proper use and care of the equipment.

Use of the manual should not be put off until a trouble or need for help develops. Read the instructions before starting the unit. Learn to use the manual and to locate information contained in it. Its style and arrangement are very similar to commercial aircraft manuals. The manual is divided into five chapters. Each chapter is divided into as many sections as required. Each new section starts with page 1. Each page is identified by chapter, section and page number, which are located in the lower, outside corner. When information located in another portion of the manual is referred to, its location is identified by a chapter, section, and paragraph or figure number.

For example: “(see Section 2-3, Paragraph 1.a.)” refers to information located in Chapter 2, Section 3, Paragraph 1.a. If a chapter and section are not indicated in a reference, the referenced material is located in the same section as the reference, For example: “(see Paragraph 1.a.)”.

In addition to operation and maintenance instructions, the manual contains an illustrated parts list in Chapter 4, and a collection of manufacturer’s literature and supplemental information in Chapter 5.

Content of the manual is arranged as follows:

Chapter 1. Description/Operation

Chapter 2. Servicing/Troubleshooting

Chapter 3. Overhaul/Major Repair

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Service Information

Unusual Service Condition

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Vertical Installation

Remove top, sides and end shipping panels.

Remove nuts and washers (7) from shipping brackets (1) and (2), which secure the unit to the shipping skid (5).

With the use of a suitable lifting device (forklift, hoist, etc.) lift the bottom end of the unit, near the center, up slightly. DO NOT use shipping brackets (1) as lifting point.

Remove the hardware (3) and shipping brackets (1) from unit and discard.

Lower the bottom end of the unit back onto the shipping skid (5).

Insert chain or suitable lifting strap, with at least a 3,000 lb. capacity, through shipping brackets (2) and attach to a suitable hoist or lifting device

Slowly lift the unit up into a vertical position.

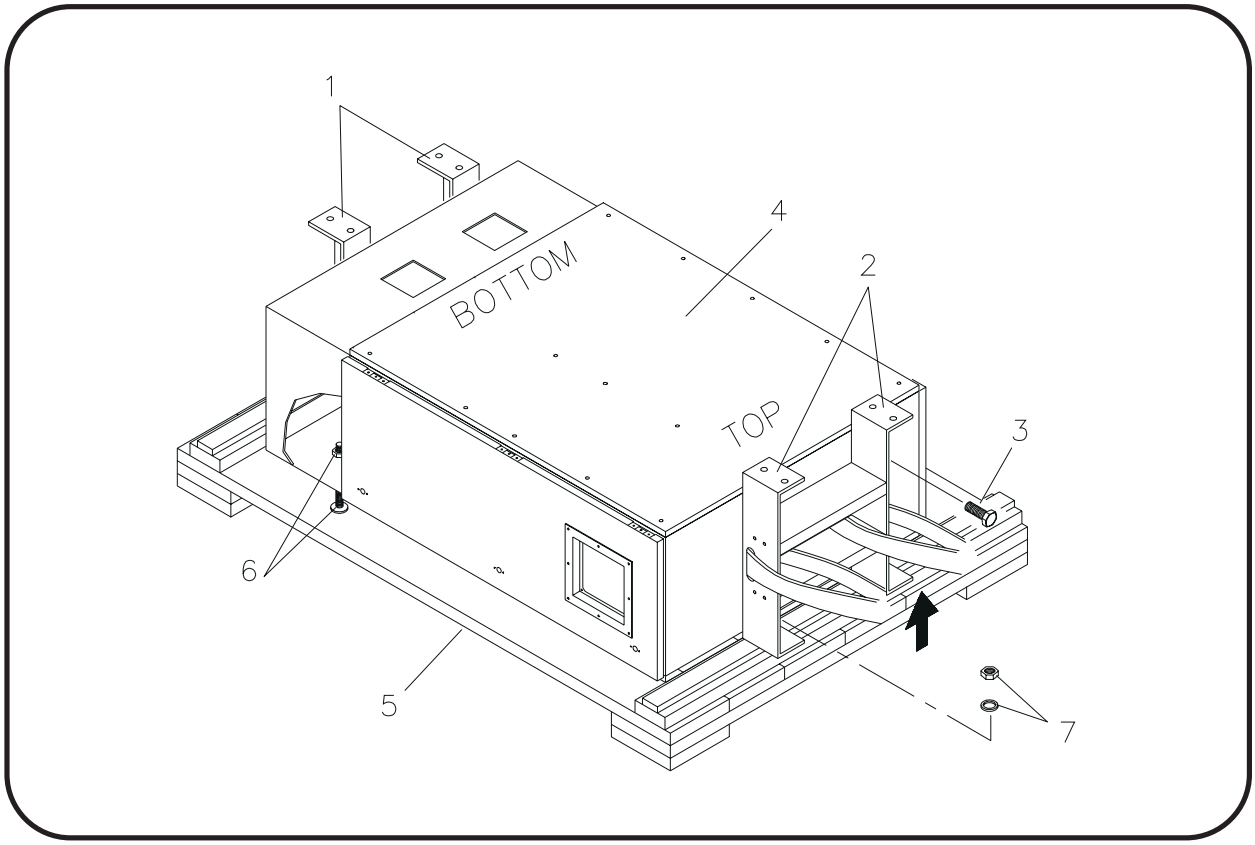
Unhook chains or lifting strap.

Remove hardware (3) and shipping brackets (2) from unit and reinstall hardware (3) into top of unit.

Discard shipping brackets (2) and shipping skid (5).

Remove and discard hardware (6).

Secure unit at its base in your suitable mounting area.



Bridge Installation

Remove top, sides and end shipping panels.

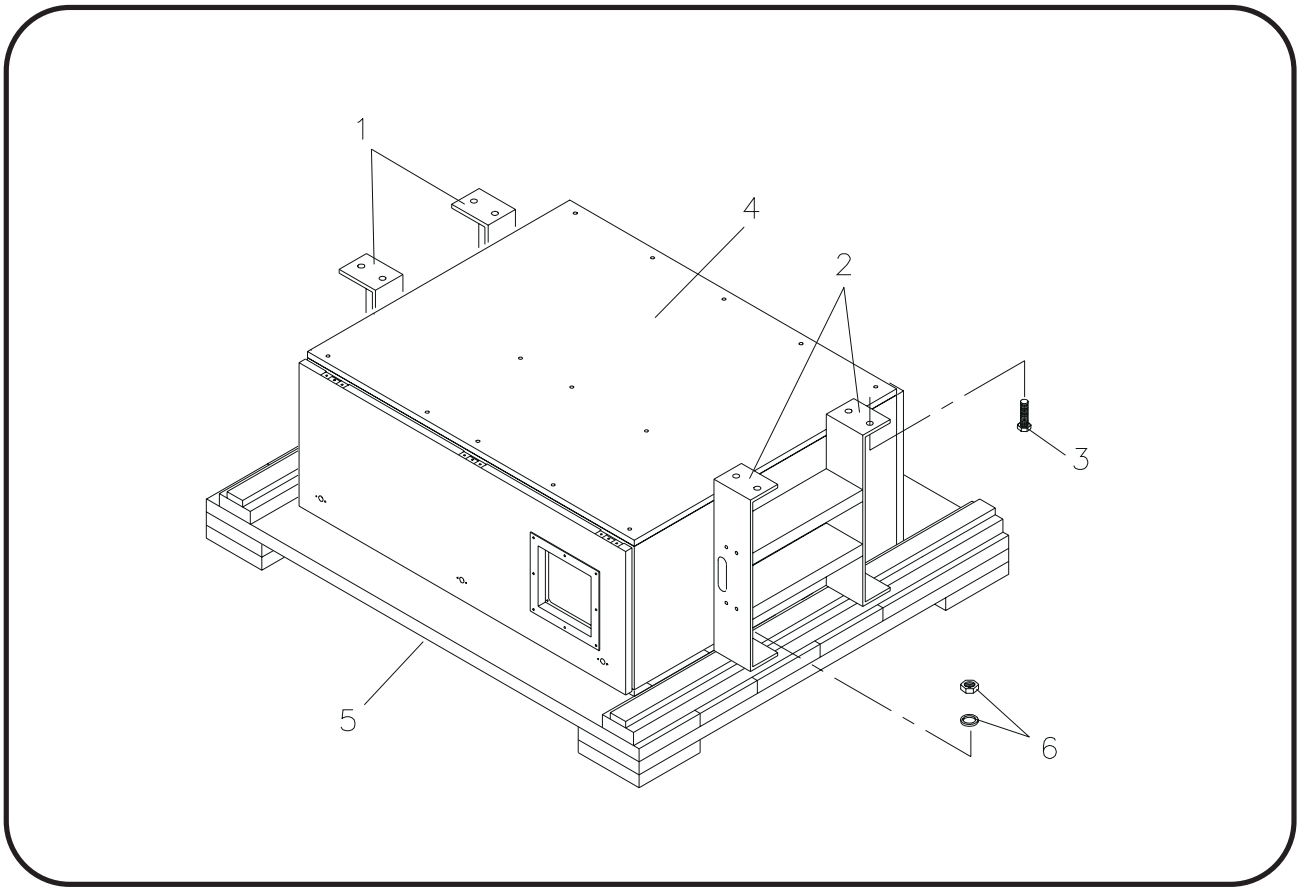
With a suitable lifting device (forklift), lift the unit (4) up under the skid (5) to the mounting position under the bridge.

Using new hardware provided, install 8 (M12 grade 8.8 or equiv.) hardened bolts (3) through bridge brackets (1,2) to bridge mounting structure.

Remove nuts and washers (6) from bridge brackets (1) and (2), which secure the unit to the shipping skid (5).

Lower shipping skid (5) and discard.

Discard all shipping type hardware.



Chapter 1. Description / Operation

Section 1. Description

1. General

The PoWerMaster® Solid State Frequency Converters covered by this manual are manufactured by **Hobart Brothers Company, Airport Systems Group, Ground Power Division, Troy, Ohio 45373**. These converters are designed to provide power for maintenance and startup of aircraft having 115/200-V AC, 3-phase, 400-Hz electrical systems. Depending on when manufactured, converters covered by this manual are are identified by Part Number 500013A or Part No. 500013B. These units are identical in appearance, differing only in that Part No. 500013B converter units have improved construction and circuitry, and are designed for parallelling. The part number is followed by a dash number which indicates output power rating, and the number of outputs of a particular converter All of these units are available with vertical, bridge, or trailer mounting. Various options are available that a customer may select for one particular unit. These options are listed in Paragraph 4, Paragraph 5 lists replacement kits that are available for 500013A and 500013B converter units.

The Hobart PoWerMaster® provides the highest reliability and power conversion efficiency available in today's market, and the latest state-of-the-art controls. It is specifically designed to service the most demanding requirements of wide-bodied aircraft in use today and tomorrow, including those equipped with **No-Break Power Transfer** (NBPT). This is accomplished by using the exclusive Hobart **Advanced Diagnostic Control System** (ADCS). (U.S. Patent Number 5,355,024).

The ADCS permits monitoring and testing of critical circuits prior to and during operation. Fully automatic diagnostic testing is performed each time the converter is started. The ADCS is described in greater detail later in this section.

Advanced electronic circuitry allows the unit to automatically synchronize with on-board power during NBPT, providing successful transfers every time.

A converter's part number is followed by a dash number which indicates output power rating, and the number of outputs of a particular converter. The tables 1 and 2 identify the various units covered by this manual.

a. Advantages Offered by the Solid State Converter

The solid state converter offers numerous advantages when compared to motor-generator type power units. The main advantages are as follows:

(1) Energy Savings

Because the converter is a demand system, it consumes only the energy required. If no aircraft is being serviced, no output power is required, and thus none is generated and very little is consumed. This results in much lower operating costs than that of a motor-generator unit of comparable power output.

(2) Efficiency

The converter provides power to an aircraft at an efficiency of 90% or better, with 1% voltage regulation at the aircraft. Since the unit is used in the vicinity of an aircraft being serviced, expensive 400-Hz cabling is kept to a minimum and no external line drop compensation is required.

(3) Longer Service

The solid state converter operates for longer periods of time without service than do motor-generator units, as there are no mechanical parts to wear out and impair the unit's operation.

(4) Space Requirement

The converter is much smaller in physical size than a motor-generator unit of comparable power output. In addition, it can be mounted horizontally or vertically, thus requiring less space when bridge-mounted, floor-stand mounted, or mounted on a wall. Installation costs are minimal.

(5) Lower Noise Level

The converter, being solid state, is much less noisy in operation than rotating engine/generator equipment.

b. Safety Features

The Hobart Advanced Diagnostic Control System (ADCS) provides the highest available level of protection and safety for the operator, the aircraft, and the converter itself. The ADCS performs complete diagnostic testing upon each start-up and continuous monitoring of all critical circuits and operating electrical values, and automatically shuts down the converter in order to minimize risks to the user, aircraft, and converter.

See Section 2-3, **Troubleshooting** for details on the types and levels of protection provided by the ADCS.

c. Orientation

To avoid confusion in the location of components, for **horizontally** mounted units, the control panel is considered to be at the **right front** of the unit. For **vertically** mounted units, the control panel of the unit is located at the **top front** of the unit. Left and right are determined by looking at the unit from the front

d. Mountings for the Converter

The converter may be mounted in any one of four ways:

- - On a steel floor stand
- - Under a passenger boarding bridge
- - On a trailer to make it mobile
- - On a wall

e. Converter Cabinet

The cabinet which houses the converter apparatus and circuitry is a NEMA 3R or IEC IP 54 enclosure, which means that it is weather resistant. It consists of a sturdy welded steel frame to which 16-gauge sheet metal panels are fastened at the sides or top. Front and rear doors of the unit are hinged to permit opening the unit for easy access to serviceable components.

If the converter is mounted horizontally, both the front and back doors will open upward. If the unit is mounted vertically, the front door will open to the left and the back door will open to the right.

The converter is fan-cooled. The sheet metal panel on the right side of the unit is louvered at the top and at the bottom of the panel. Air enters the unit through the louvers at the bottom of the panel and leaves through the louvers at the top of the panel. Output cables enter the unit through access fittings in the bottom panel (for horizontally mounted units) or in the right side panel (for vertically mounted units).

Part & Dash Number	Output (Kva)	Outputs	Contactor(s)	EFF	Input Volts	Input Amperes	Input Hz
500013A-201	125	One	None	A	380-480	164/140	50/60
500013A-202	125	Two	Two	B	380-480	164/140	50/60
500013A-203	125	Three	Three	C	380-480	164/140	50/60
500013A-205	90	One	None	D	380-480	118/100	50/60
500013A-206	90	Two	Two	E	380-480	118/100	50/60
500013A-207	180	Two	Two	F	380-480	238/200	50/60
500013A-208	180	Three	Three	G	380-480	238/200	50/60
500013A-209 *	180	One	None	H	380-480	238/200	50/60
500013A-210 *	125	Two	Two	J	380-480	171-134	50/60

Table 1: Ratings and Data for 500013A Converter Units (Manufactured before June, 1996)

Part & Dash Number	Output (Kva)	Outputs	Contactor(s)	EFF	Input Volts	Input Amperes	Input Hz
500013B-201	125	One	None	K	380-480	171-134	50/60
500013B-202	125	Two	Two	L	380-480	171-134	50/60
500013B-203	125	Three	Three	M	380-480	171-134	50/60
500013B-205	90	One	None	N	380-480	118-100	50/60
500013B-206	90	Two	Two	P	380-480	118-100	50/60
500013B-207	180	Two	Two	Q	380-480	236-200	50/60
500013B-208	180	Three	Three	R	380-480	236-200	50/60
500013B-209 *	180	One	None	S	380-480	236-200	50/60
500013B-210 *	125	Two	Two	T	380-480	171-134	50/60
500013B-211 *	180	Two	Two	U	380-480	236-200	50/60
500013B-212	180	One	None	V	380-480	236-200	50/60

Table 2: Ratings and Data for 500013B Converter Units (Manufacture began in June, 1996)

*** Units designed especially for parallel operation with one or more other converter units**

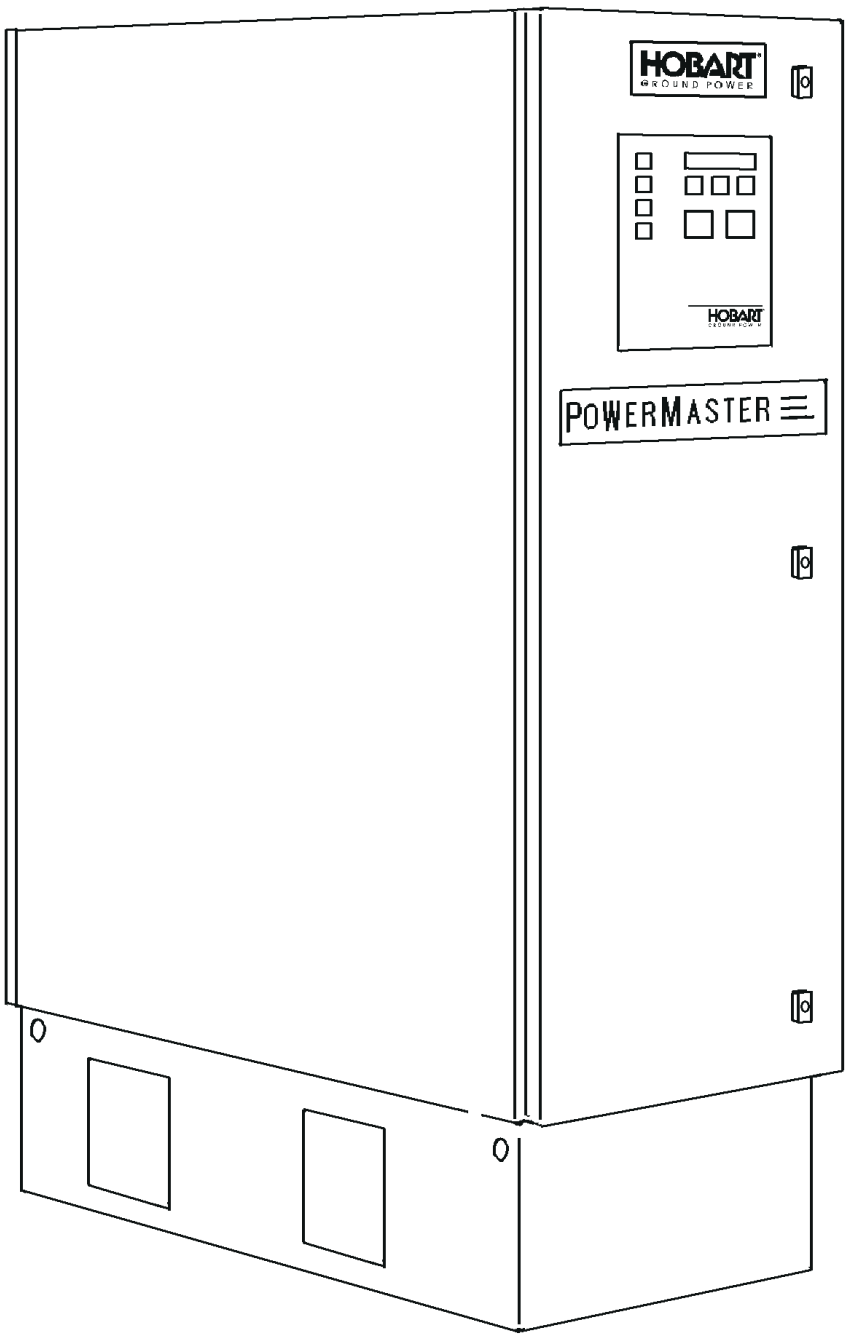


Figure 1: Hobart PoWerMaster® Solid State Frequency Converter

PHYSICAL						
Enclosure			NEMA 3R or IEC IP 54			
Part No. 500013A Units						
Weight ***(Approx.)***	90-kVA		125-kVA		180-kVA	
Bridge Mounted	1005 Kg *(2217 lbs.)*		1132 Kg *(2497 lbs)*		1169 Kg *(2577 lbs)*	
Floor Mounted	1052 Kg *(2320 lbs.)*		1180 Kg *(2602 lbs)*		1215 Kg *(2680 lbs)*	
Trailer Mounted	1497 Kg *(3300 lbs)*		1626 Kg *(3585 lbs)*		1662 Kg *(3665) lbs)*	
Part No. 500013B Units						
Weight ***(Approx.)***	90-kVA		125-kVA		180-kVA	
Bridge Mounted	946 Kg *(2085 lbs.)*		1073 Kg *(2365 lbs)*		1169 Kg *(2577 lbs)*	
Floor Mounted	993 Kg *(2188 lbs.)*		1120 Kg *(2468 lbs)*		1215 Kg *(2680 lbs)*	
Trailer Mounted	1439 Kg *(3173 lbs)*		1566 Kg *(3453 lbs)*		1661 Kg *(3663 lbs)*	
Size						
Bridge Mounted	22.5" high x 60.5" wide x 50" deep *(572 x 1,537 x 1,270 mm)*					
Floor Mounted	78" high x 22.5" wide x 50" deep *(1,981 x 572 x 1,270 mm)*					
Trailer Mounted	109" long x 69.4" wide x 57" high *(tongue raised)* *(2769 mm x 1763 mm x 1448 mm)*					
Trailer Mounted	148" long x 69.4" wide x 57" high *(tongue extended)* *(3759 mm x 1763 mm x 1448 mm)*					
ENVIRONMENTAL						
Acoustical noise			Less than 70dBA @ 1.5 m high, 2 m distance			
Operating temperature			-40^{o} to $+55^{o}$C *(-40^{o} to $+131^{o}$F)*			
Storage temperature			-40^{o} to $+60^{o}$C *(-40^{o} to $+140^{o}$F)*			
Relative humidity			10 to 100% non-condensing			
ELECTRICAL						
Input						
	90kVA		125-kVA		180-kVA	
Voltage *(nominal)*	400	460	400	460	400	460
Frequency *(Hz)*	50	60	50	60	50	60
Amperes *(rated load)*	118	100	164	140	236	200
Voltage *(range)*	+/- 10% nominal					
Starting Current	Less than 100% full load input current					
Power Factor	More than 0.98 lagging					

Table 3: Specifications and Capabilities

ELECTRICAL			
Output			
Voltage		115/200-V AC	
Power rating		90-kVA / 125-kVA / 180-kVA	
Amperes *(at rated load, per power ratings)*		260-A / 362-A / 520-A	
Frequency		400-Hz	
Overload trips	at 125% after 10 min.	at 150% after 30 sec.	at 200% after 10 sec.
Shorted output shutdown		Immediate	
Duty cycle		100%	
Total harmonic distortion *(THD)*		Less than 3%	
Individual harmonic distortion *(IHD)*		Less than 2%	
DC content		Less than 100-mV	
Voltage modulation		Less than 0.05 rms	
Frequency drift		+/- 0.05%	
Phase displacement		120 +/- 1.5^{o}	
Transient performance		Meets Mil Std 704D, Figure 5	
Voltage adjustment range		+/- 15% of rated voltage	
Phase voltage balance *(with balanced load)*		Less than 2% of rated line/neutral voltage	
Voltage unbalance *(10% unbalanced load on phase)*		Less than 3-V *(meets Mil Std 704D, Figure 1 and ARP-1940, 3.1.5.10)*	
Voltage regulation		Less than 1% from no load to rated load	
Crest factor		1.414+/- 0.07	
Line drop compensation		Automatic, up to 8% of rated voltage at maximum rated load	
Frequency modulation		Less than +/- 0.25% of the period of output voltage wave	

Table 3: Specifications and Capabilities (Continued)

2. Theory of Operation

The PoWerMaster® converter is a state-of-the-art, solid-state, 60- (or 50-) Hz to 400-Hz frequency converter. It employs all silicon power semi-conductors and CMOS digital logic. This converter is specifically designed to supply clean, reliable ground power to an aircraft, eliminating the costly need for operating the aircraft's auxiliary power unit. The block diagram in Figure 2 identifies major components of the system, and Figures 8 through 12 show the locations of major components within the converter interior. A more detailed block diagram is provided in Chapter 5-1.

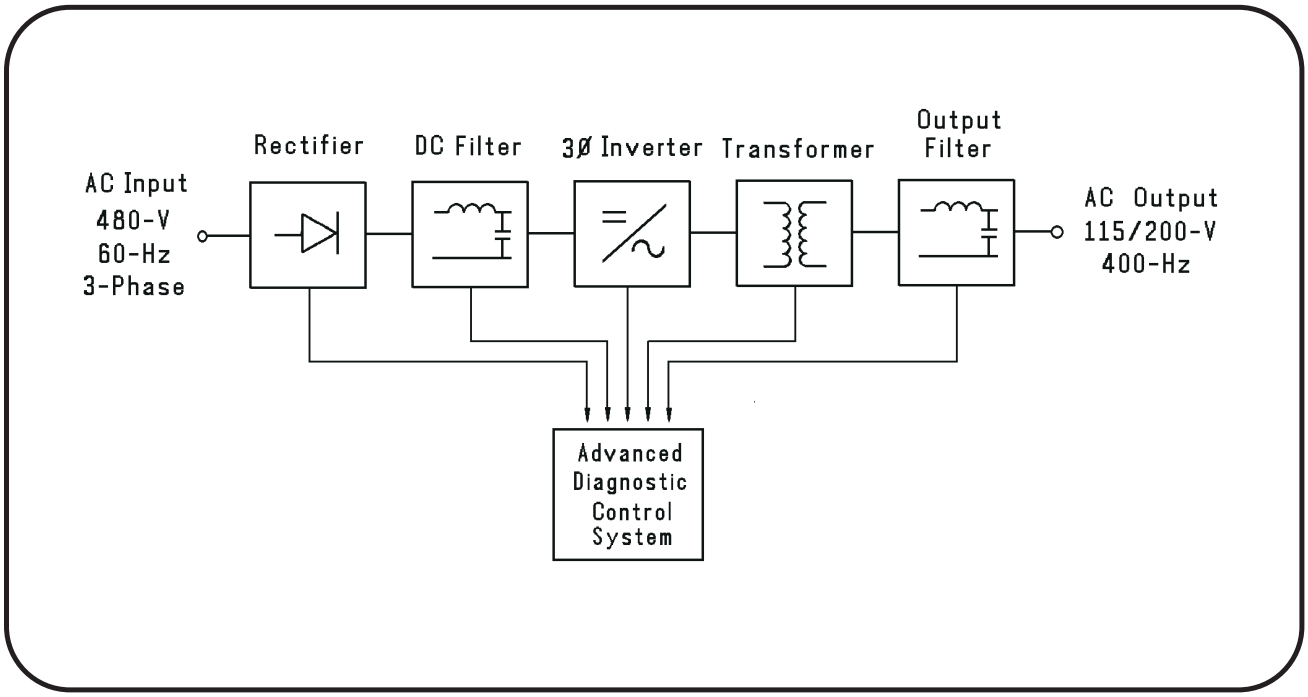


Figure 2: Simplified Block Diagram of Converter

a. Input Rectifier *(Figure 3)*

The 3-phase, 60- (or 50-) Hz AC input voltage is first rectified in a 3-phase bridge configuration. The rectifier circuit consists of rectifiers CR1A, CR1B, and CR1C *(19, Figure 10)*. The resulting unregulated DC voltage (approximately 650-V DC) is then passed through a filter circuit before being fed to the inverter.

b. Input Filter and DC Bus Capacitor Bank *(Figure 4)*

The input filter is a parallel capacitor/resistor bank consisting of DC bus capacitors C1 through C12 *(10, Figure 10)*, resistors R2 through R13 *(11, Figure 10)*, and filter reactors L1 and L2 *(1, Figure 11 and 5, Figure 12)*. A resistor, R15, *(2, Figure 11)* and a varistor are wired in parallel with the filter reactors. Also a part of this circuit is a snubbing network consisting of resistor R14 *(20, Figure 10)* and capacitor C13 *(21, Figure 10)*. The output from the input filter is fed through the DC bus to the 3-phase inverter section.

c. DC Bus Capacitor Charge and Discharge Circuits *(Figures 3 and 4)*

The DC bus capacitor charge circuit charges the bus capacitor bank at a controlled rate when the converter is turned on. The circuit consists of bus charging contactor K2 *(16, Figure 10)* and bus charge resistors R1B and R1C *(10, Figure 11)*. When the unit is turned on, contactor K2 closes, allowing current to pass through the charging resistors to the input filter and DC bus, thereby charging the bus capacitors at a controlled rate. When the capacitors are sufficiently charged (after approximately 3 seconds), charging contactor K2 opens and input contactor K1 *(15, Figure 10)* closes to allow unrestricted power flow.

The DC bus capacitor discharge circuit disharges the bus capacitor bank at a fast but controlled rate after the converter is turned off, to provide safety for the operator and to extend the life of the capacitors. The circuit consists of bus discharge resistor R16 *(11, Figure 11)*, and the bus discharge PC board. When the unit is turned off, the bus capacitors are discharged through the discharge resistor in approximately 3 seconds.

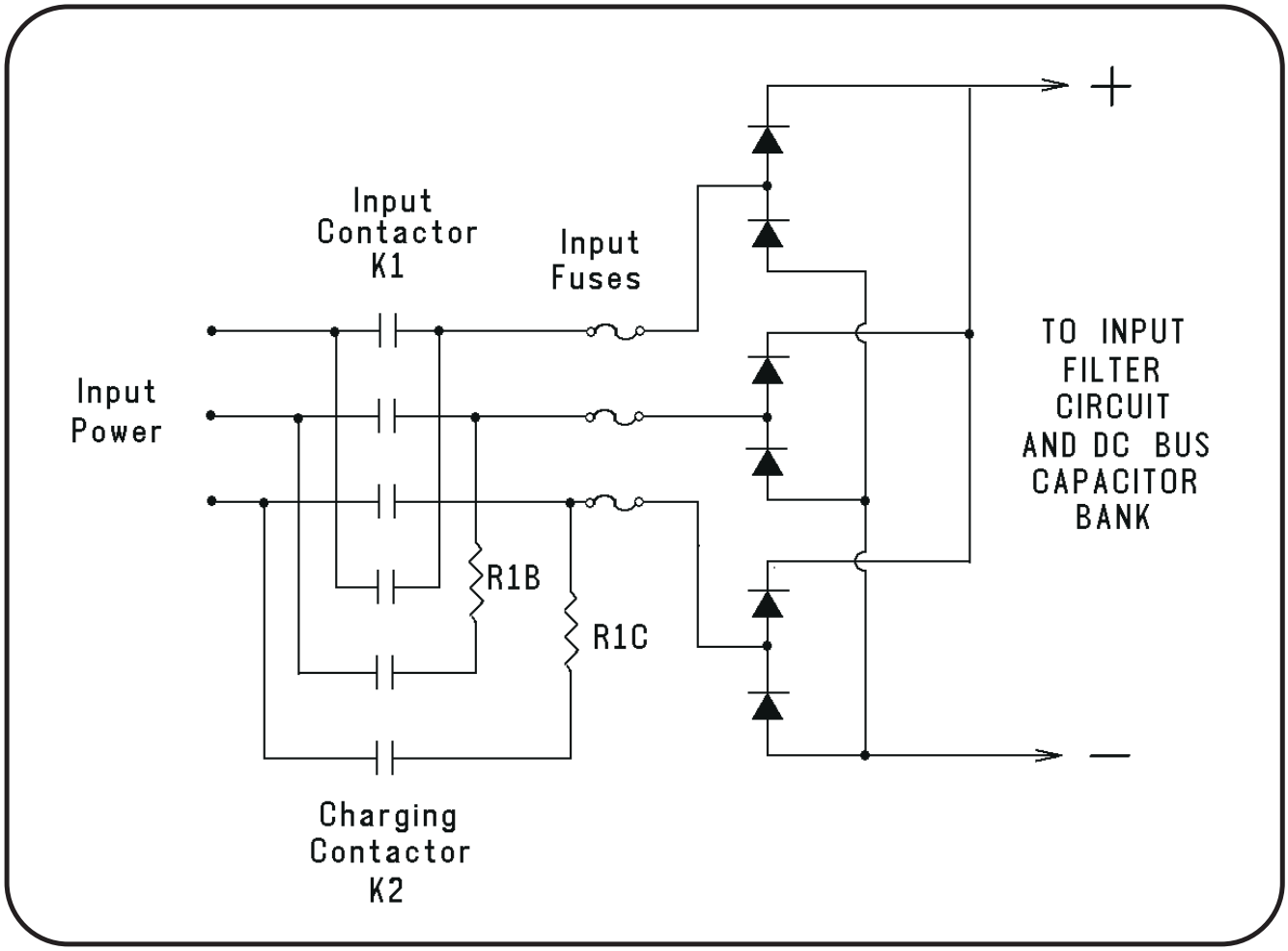


Figure 3: Input Rectifier Circuit

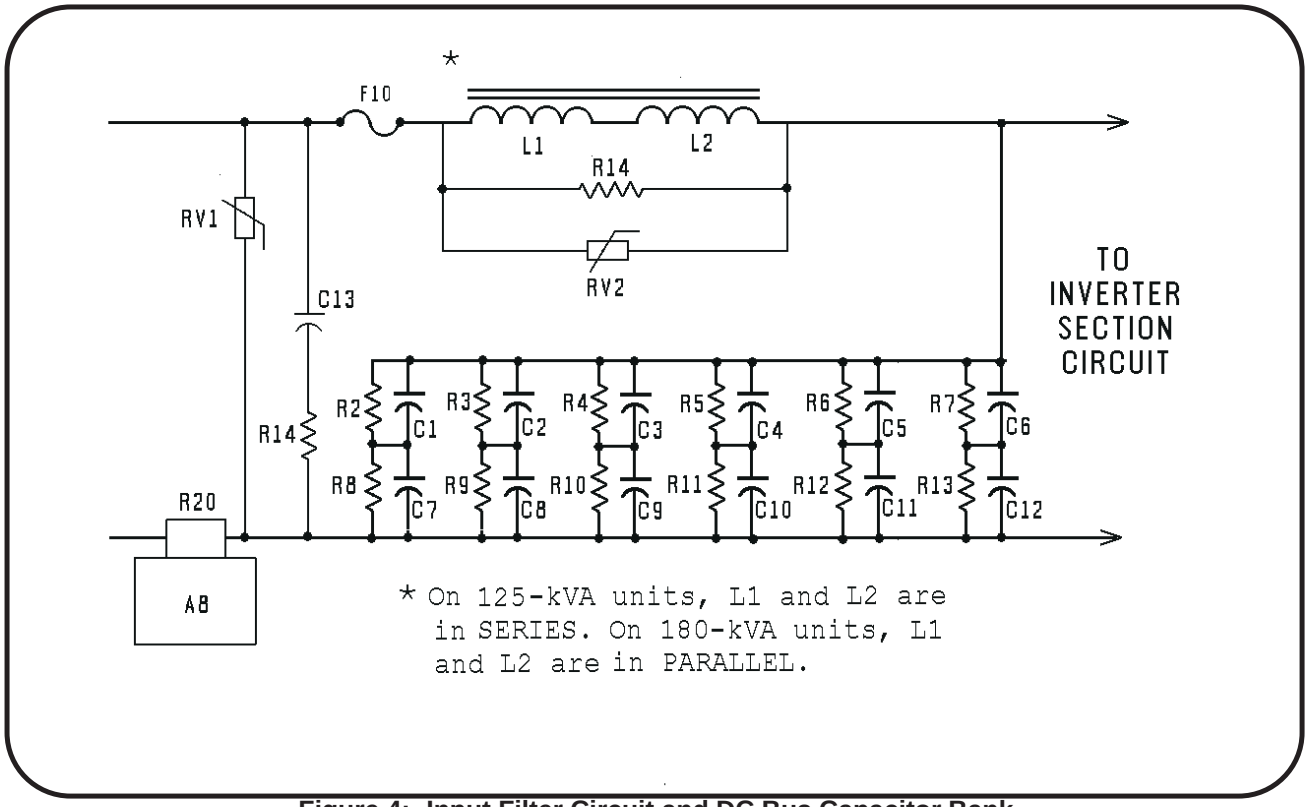


Figure 4: Input Filter Circuit and DC Bus Capacitor Bank (for 90-kVA and 125-kVA units)

d. Inverter Section *(Figure 5)*

The 3-phase inverter section transforms the filtered DC voltage into a 400-Hz regulated output voltage. The method employed in this system is a 12-step waveform inversion. This inversion uses harmonic neutralization, which results in the elimination of all harmonic distortion below the eleventh harmonic without filtering. The system consists of two identical 3-phase/6-transistor bridges *(7, Figure 8)*. The power level of each bridge is *(Total kVA Output)/2*.

As the phase shift between the three phases of each bridge and between the two bridges is digitally generated, no change, and consequently no harmonic lower than the eleventh, appears when line or load is varied, regardless of pulse width variation. Because of the elimination of the lower harmonics, the output filter is very simple electrically.

e. Output Transformers and Output Filter *(Figure 6)*

On 90 kVA and 125 kVA units, the six outputs from the two bridges are fed through filter reactors L3 through L8, *(Figure 6)* to two main transformers, T9 and T10 *(3 and 4, Figure 11)*, each of which has three input windings. Reactors L3 - L8 are not required on 180-kVA units.

Each of the three output windings of T10 are connected in series with two of the six output windings of T9. Twenty of the sixty capacitors in the AC capacitor bank *(C19 through C78)* are connected in parallel between each output phase and neutral to provide output filtering.

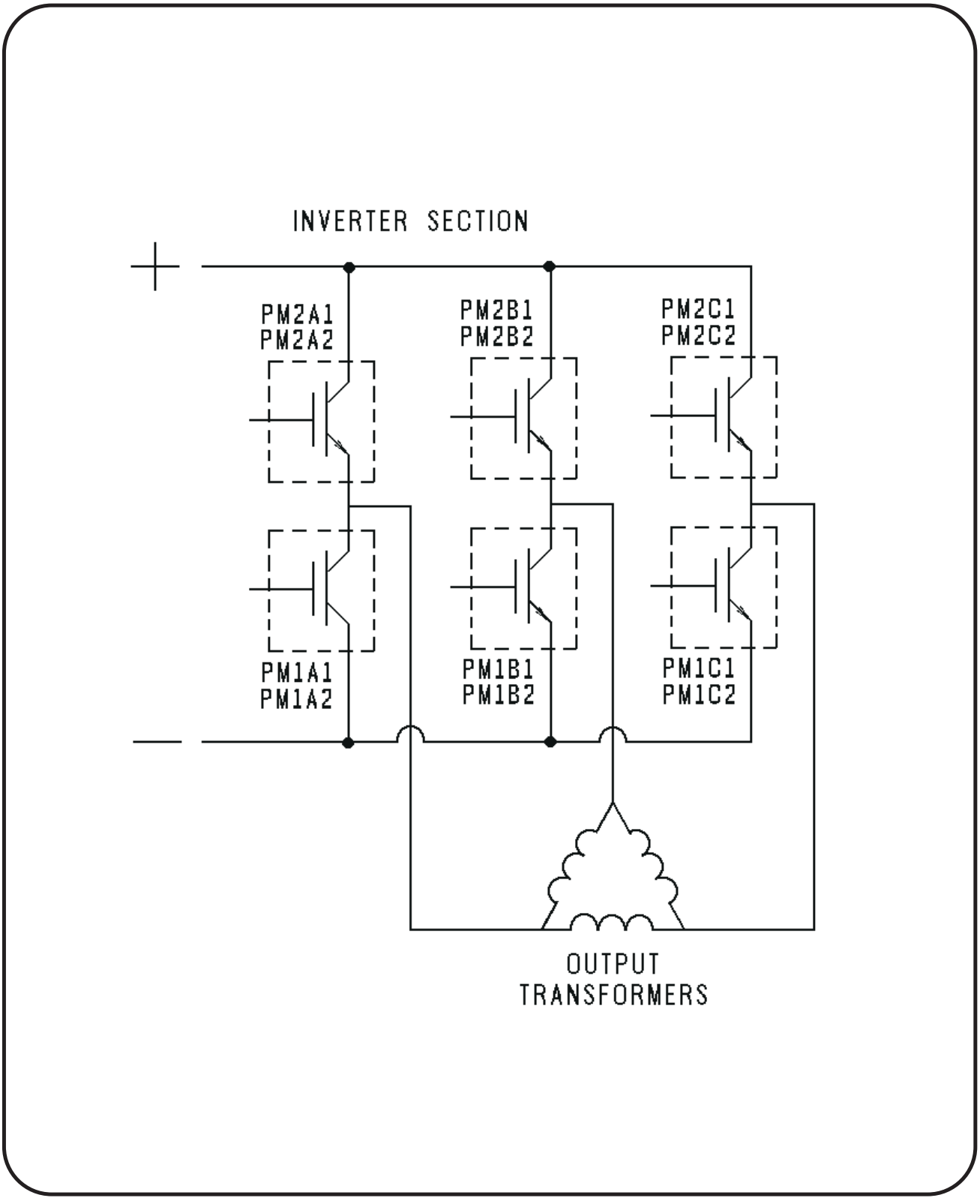


Figure 5: Inverter Section Circuitt

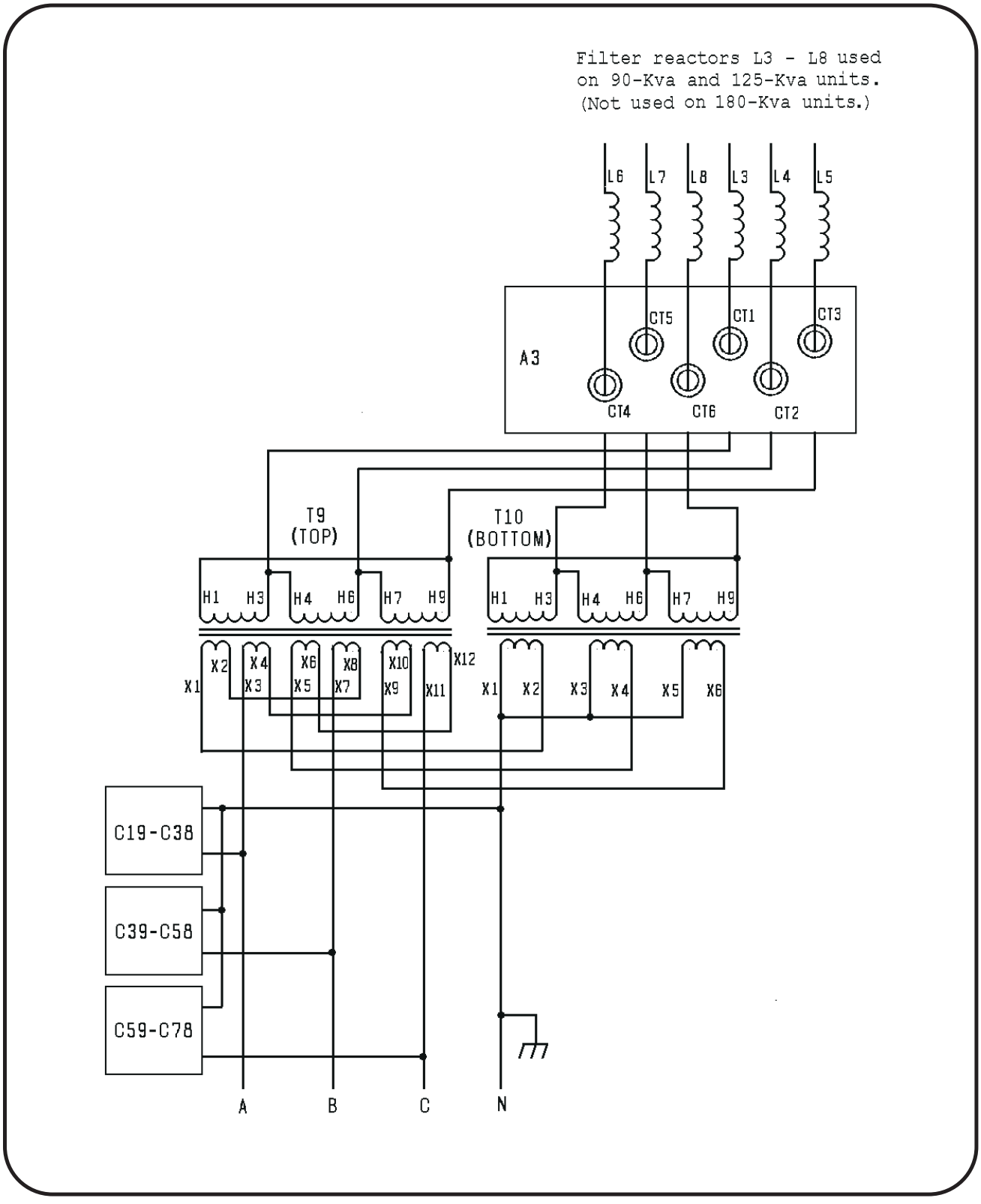


Figure 6: Output Transformers and Output Filter Circuit

f. Advanced Diagnostic Control System (ADCS)

The Advanced Diagnostic Control System (ADCS) performs complete diagnostic testing upon each startup and continuous monitoring of all critical circuits and operating electrical values. Additionally, all functions of the converter are selected through the control panel of the ADCS. Specifically, the ADCS performs the following functions:

(1) Checks all critical components prior to supplying 400-Hz power.

(2) Monitors all critical operating parameters during operation.

(3) Signals an alarm and indicates a potential problem if parameters approach critical levels during operation.

(4) Diagnoses and identifies the cause of a fault and reports prevailing conditions immediately prior to the occurrence of the fault.

(5) Causes the converter to automatically shut down if factory-set output parameters or output characteristics fall outside predetermined safe limits.

(6) Measures power flow for billing purposes if desired. Stores one month's history of power cycles at the gate.

(7) Logs data into its own memory for later downloading to an external computer through an optional modem.

(8) Provides an advanced and easy-to-use interface between the operator and the converter..

g. Flag, Alarm, and Fault Monitoring

The Hobart PoWerMaster® Advanced Diagnostic Control System (ADCS) performs complete diagnostic testing upon each startup and continuous monitoring of all critical circuits and operating electrical values. If the ADCS senses a problem with one of the circuits or if one of the electrical values exceeds its safe operating limit, the ADCS will indicate an alarm and allow the converter to continue operation or will indicate a fault and will shut the converter down, depending on the severity of the condition.

(1) **Flags** indicate a condition that does not need immediate attention, that does not present a safety hazard or denote possible damage to the aircraft or the converter; the operator may remedy the condition whenever it is most convenient. If the ADCS sensed a flag, an appropriate message will be stored in the current operational cycle data record for later review *(see Section 2-2, Paragraph* 3.*)*; otherwise, no other indication of the flag will be given.

(2) **Alarms** are indicated when any of the alarm limits are exceeded. These limits are preset at the factory and are adjustable at the factory. An alarm indication signifies a condition that may soon need operator attention, but is not yet severe enough to indicate a fault and shut the converter down. If the ADCS senses an alarm, the yellow ALARM lamp *(4, Figure 7)* on the control panel will illuminate, an abbreviation of the electrical value which has exceeded its alarm limit will appear in the upper left corner of the control panel display *(8, Figure 7)*, and an appropriate alarm message will be stored in the current operational cycle data record for later review.

(3) **Faults** result when any of the fault limits are exceeded, when an internal problem occurs, or under certain conditions that would cause injury to personnel or damage to an aircraft or the converter. **These limits are preset at the factory.** A fault indication signifies a condition severe enough to discontinue all output power and shut the converter down. An alarm condition may become a fault if the cause is not remedied. If a fault is sensed, the ADCS will shut the converter down, the red FAULT lamp *(3, Figure 7)* will illuminate, an appropriate fault message will appear in the display, and this message will be stored in the current operational cycle data record for later review.

(4) See Section 2-3, **Troubleshooting** for a list of alarm and fault limits and for a list of flag, alarm, and fault messages, their possible causes, and corrective actions.

3. Detailed Description of Converter Components

a. Control Panel (Figure 7)

The function of each of the controls and indicators are as follows:

(1) ON Button

Pressing this button (1, Figure 7) turns the converter on.

NOTE: On a single-output unit, pressing the ON button turns on output power. If the unit has multiple outputs, pressing the ON button will turn input power on, but will NOT close output contactors to provide output power to the aircraft.

(2) INPUT POWER Lamp

The green INPUT POWER lamp (5, Figure 7) indicates the presence of input power.

(3) ALARM Lamp

The yellow ALARM lamp (4, Figure 7) indicates that an alarm limit has been exceeded.

(4) FAULT Lamp

The red FAULT lamp (3, Figure 7) indicates a fault condition.

(5) OUTPUT POWER Lamp

The green OUTPUT POWER lamp (2, Figure 7) indicates the presence of power at the output terminals of the converter.

(6) Up Button (Δ)

Pressing this button (6, Figure 7) permits the user to view menu choices, options, operating parameters, and electrical values on the display by “rolling upward” through the list of items that can be shown on the display.

(7) Down Button (±)

Pressing this button (7, Figure 7) permits the user to view menu choices, options, operating parameters, and electrical values on the display by “rolling downward” through the list of items that can be shown on the display.

(8) Control Panel Display (8, Figure 7)

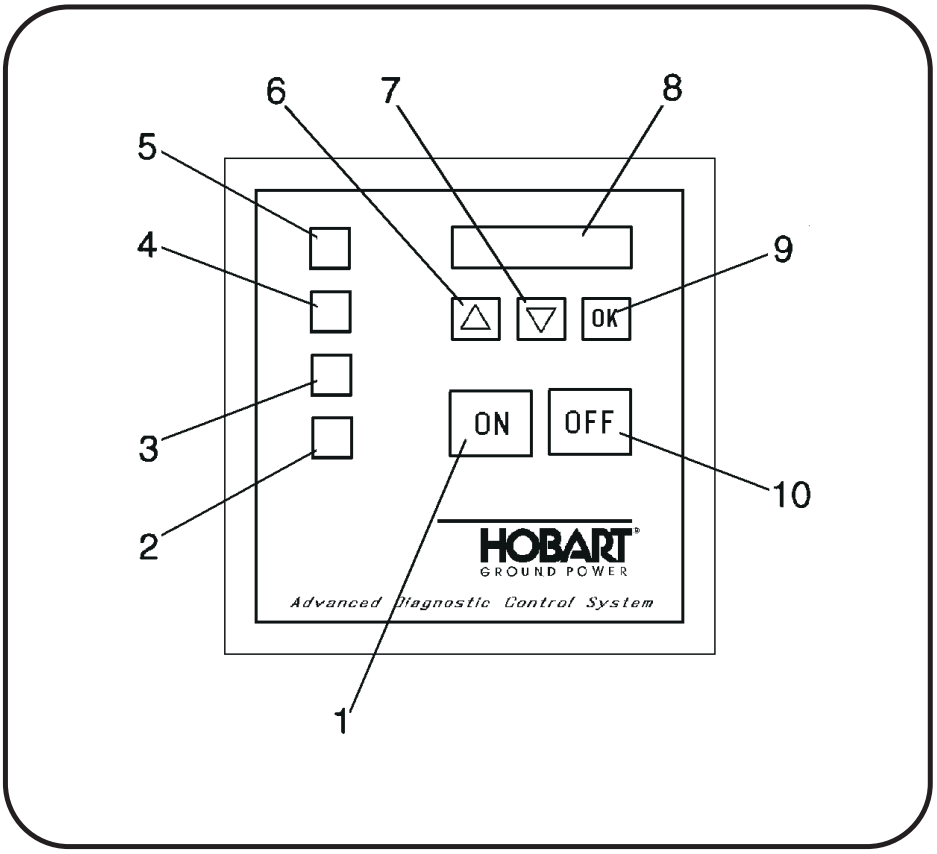
This two-line alpha-numeric display indicates alarm and fault conditions pertinent to the operation of the ADCS, and displays menu choices, options, operating parameters, and electrical values that the operator can select, view, and change.

(9) OK Button

Pressing this button (9, Figure 7) permits the user to select and show any particular option, parameter, or electrical value relevant to the operation of the converter.

(10) OFF Button

Pressing this button (10, Figure 7) turns the converter off, and discharges the DC bus.



1. ON button
2. OUTPUT POWER lamp (green)
3. FAULT lamp (red)
4. ALARM lamp (yellow)
5. INPUT POWER lamp (green)
6. Up button
7. Down button
8. Two-line alpha-numeric display
9. OK button
10. OFF button

Figure 7: Control Panel

b. Printed Circuit Boards

There are 32 printed circuit (PC) boards in various locations inside the converter. The functions and locations of these PC boards are as follows.

(1) Input Voltage PC Board (6, Figure 8 and 7, Figure 10)

The input voltage PC board (7, Figure 10) receives small sensing voltages from the input voltage potential transformers (6, Figure 10) and converts the AC input voltage to a scaled DC signal which is sent to the ADCS PC board for monitoring.

(2) Power Supply PC Board (3, Figure 8)

The power supply PC board draws power from the AC input and converts it to 36-V DC, -12V DC, +12V DC, and +5-V DC power for operation of the ADCS and other control circuits. If input voltage is lost, this board will draw power from the DC bus capacitors, allowing for a controlled shutdown of the converter.

(3) DC Bus PC Board (8, Figure 8)

The DC bus PC board reads DC bus voltage and current and sends optically isolated signals to the ADCS. The ADCS uses bus voltage to check for proper bus charge/discharge operation, and uses bus voltage and current to compute total power consumed by the machine.

(4) Chopper PC Board (2, Figure 8)

The chopper PC board converts the 35-V DC signal from the power supply to a 60-kHz, 35-V AC square wave. The AC signal is transformer-coupled on the driver PC boards to provide isolated power for the drive circuitry.

(5) Modulator PC Board (1, Figure 8)

The modulator PC board generates the drive signal patterns that produce the output voltage sine wave. It has circuitry to produce a stable output voltage, voltage ramp-up and ramp down, soft start, active transistor diagnostics, and fault detection.

(6) Driver PC Boards (7, Figure 8)

Each driver PC board translates the input drive signal from the modulator, via a driver logic PC board, into an optically isolated drive signal for two of the twelve power modules. The driver PC boards also generate “ON” and “SATURATED” signals for each module. Power for each driver PC board is provided by the chopper output.

(7) Driver Logic PC boards (7, figure 8)

Each driver logic PC board is a microprocessor-controlled supervisor for a driver PC board. The processors used are small, extremely fast microcontrollers that monitor the power modules, driver board, and modulator board for proper operation.

(8) Snubber PC Boards (11, Figure 8)

Each of the six snubber PC boards absorb the excess energy from two of the power modules and dissipates it to avoid causing any harm to the unit. These boards are located direcly behind the driver PC boards (5, Figure 8 and 3 Figure 10).

(9) Load Control PC Board

The load control PC board controls input contactor K1, charging contactor K2, and output contactors K5, K6, and K7 under command from the ADCS. This board monitors the START/STOP switches and 28-V interlock signal (EF signal) to control the output contactors. “On” commands are done with approval of ADCS, “Off” commands are done immediately.

(10) Inverter Current PC Board (A-Spec. Only)(6, Figure 9) and Hall Effect Current Transformers (7, Figure 9)

The inverter current PC board and the Hall effect current transformers measure the current in each pair of power modules (each bridge) and provide the modulator PC board with a fully isolated signal that is used to sense and correct an overcurrent or imbalance condition. Output scaling is 1-V/100-A.

(11) Output PC Board (1, Figure 9)The output PC board has potential transformers and scaling for current transformers for the 400-Hz output of the machine. The low level signals are returned to the ADCS for output load monitoring and error checking. The low level signals are used by the modulator to control the 400-Hz output voltage.

(12) Advanced Diagnostic Control System (ADCS) PC Board (3, Figure 9)

The ADCS PC board monitors and tests critical circuits in the converter prior to and during operation. This PC board automatically performs diagnostic testing each time the converter is started, and shows the information it receives on the control panel display (8, Figure 7).

(13) Lamp PC Board *(5, Figure 9)*

The lamp PC board has four status lamps which are visible in Figure 7 on the control panel:

- The green INPUT POWER lamp *(5, Figure 7)* indicates the presence of input power.
- The yellow ALARM lamp *(4, Figure 7)* indicates an alarm condition.
- The red FAULT lamp *(3, Figure 7)* indicates a fault condition.
- The green OUTPUT POWER lamp *(2, Figure 7)* indicates the prescence of power at the output terminals of the converter.

(14) DC Bus Discharge PC Board

The bus discharge PC board discharges the main DC bus when the unit is turned off or when power delivery has been discontinued to all aircraft.

(15) Remote Sensor PC Board *(8, Figure 9)*

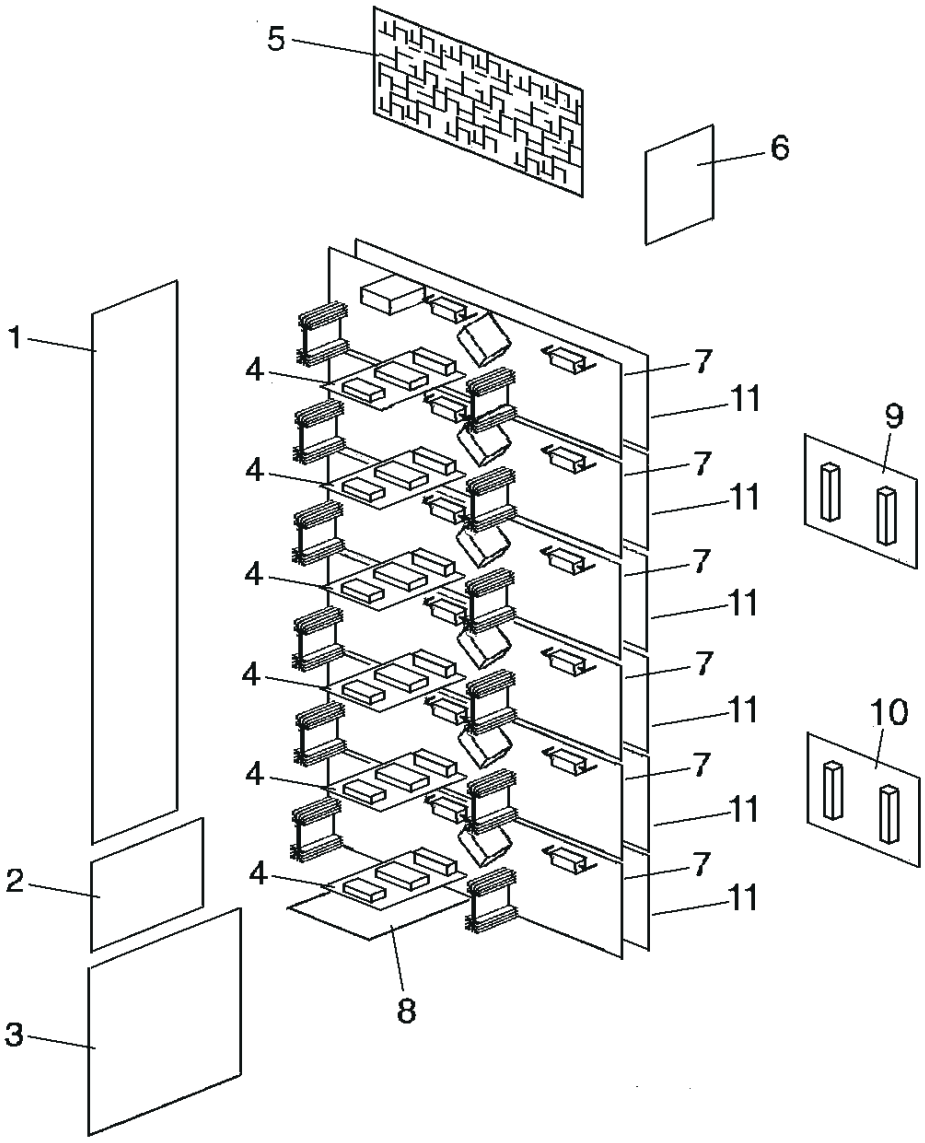
The remote sensor board provides a bridge interlock signal when converter is providing output power. It sends a signal to the bridge to inform personnel that the bridge is not to be moved.

(16) Bus Tap PC Board *(10, Figure 8)*

The bus tap PC board limits inrush current to the power supply when the power supply is being supplied by the DC bus capacitors instead of the AC input voltage.

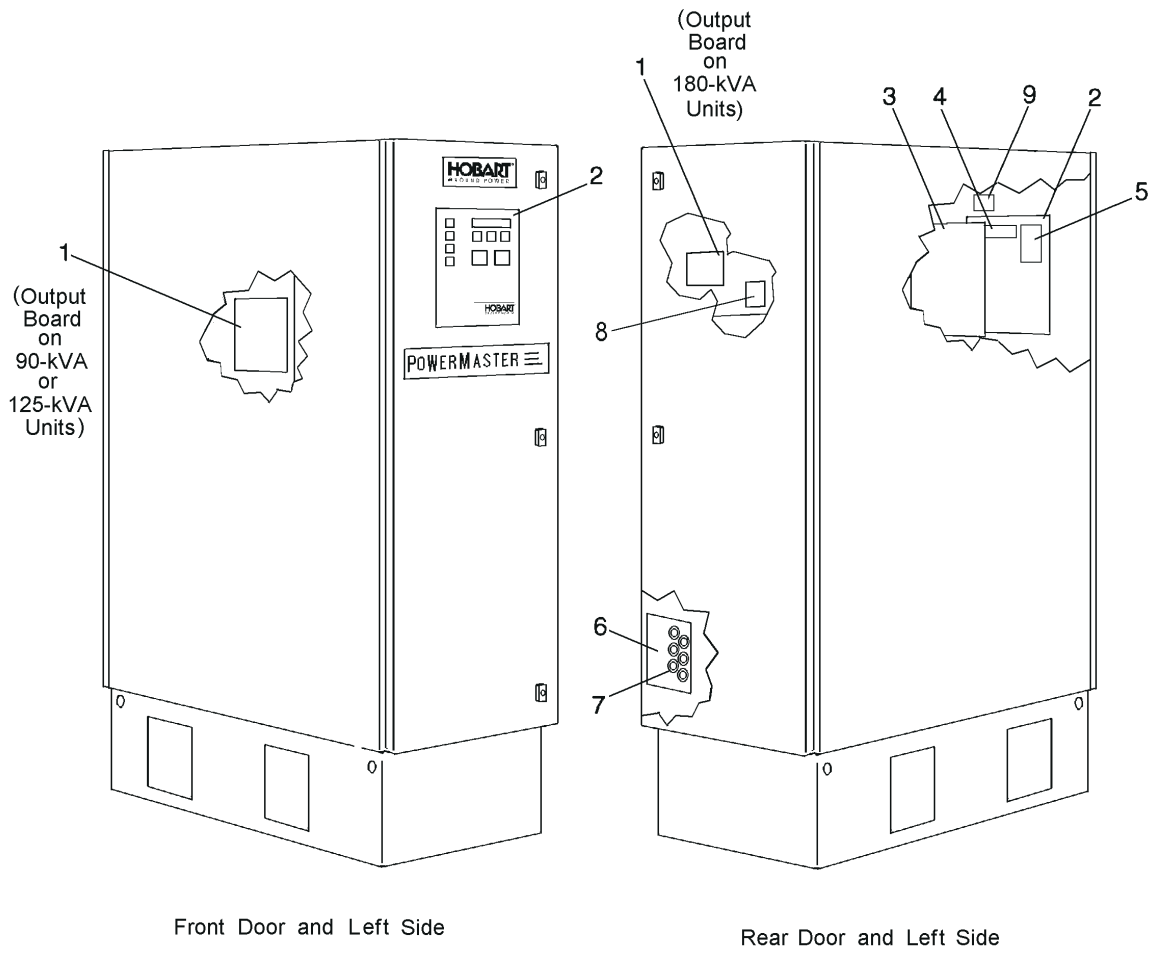
(17) ID PC Board

The ID PC board *(9, Fig. 9)* stores calibration data from the factory final test. It also holds unit serial number and machine type. This allows the ADCS to re-configure itself if removed from one unit to another. The ID PC board also holds accumulated data for the unit.



1. Modulator PC board
2. Chopper PC board
3. Power supply PC board
4. Driver logic PC boards (6)
5. Load control PC board
6. Input voltage PC board
7. Driver PC boards (6)
8. DC bus PC board
9. DC bus discharge PC board
10. DC bus tap PC board
11. Snubber PC boards (6)

Figure 8: PC Boards Inside Front Interior of Unit



1. Output PC board
2. Control label
3. ADCS PC board
4. Control panel
5. Lamp PC board
6. Inverter current PC board
7. Hall effect current transformers
8. Remote sensor PC board
9. ID PC board

Figure 9: PC Boards Located Inside Converter

c. Contactors

(1) Charging Contactor *(K2)(16, Figure 10)*

If the ADCS diagnostic testing performed when the converter is turned on is successful, the ADCS PC board closes this contactor to pre-charge the DC bus, opens it after the bus is nearly charged, and closes the input contactor to fully charge the bus and make output power available.

(2) Output Contactors *(7, 8, and 9, Figure 11)*

The converter may have either zero, two, or three output contactors, depending upon its KVA rating or the number of outputs required by the customer. Each contactor is a sealed unit which contains a magnetic operating coil and four sets of contacts. The three larger contacts conduct 3-phase AC voltage output. The load control PC board monitors the smaller, fourth set of contacts to verify proper operation of the contactors.

NOTE: Some Single output units in the future may be equipped with an output contactor. Such would be the case if two or more units were used in paralleling applications.

d. Transformers

(1) Output/Main Transformers *(T9 and T10) (3 and 4, Figure 11)*

The two output transformers transform the output from the inverter section into the desired 115/200-V AC output voltage. Transformer T9 contains three input and six output windings, while transformer T10 contains three input and three output windings. Each transformer is rated at 62.5 kVA.

(2) Control Transformer *(T1) (1, Figure 10)*

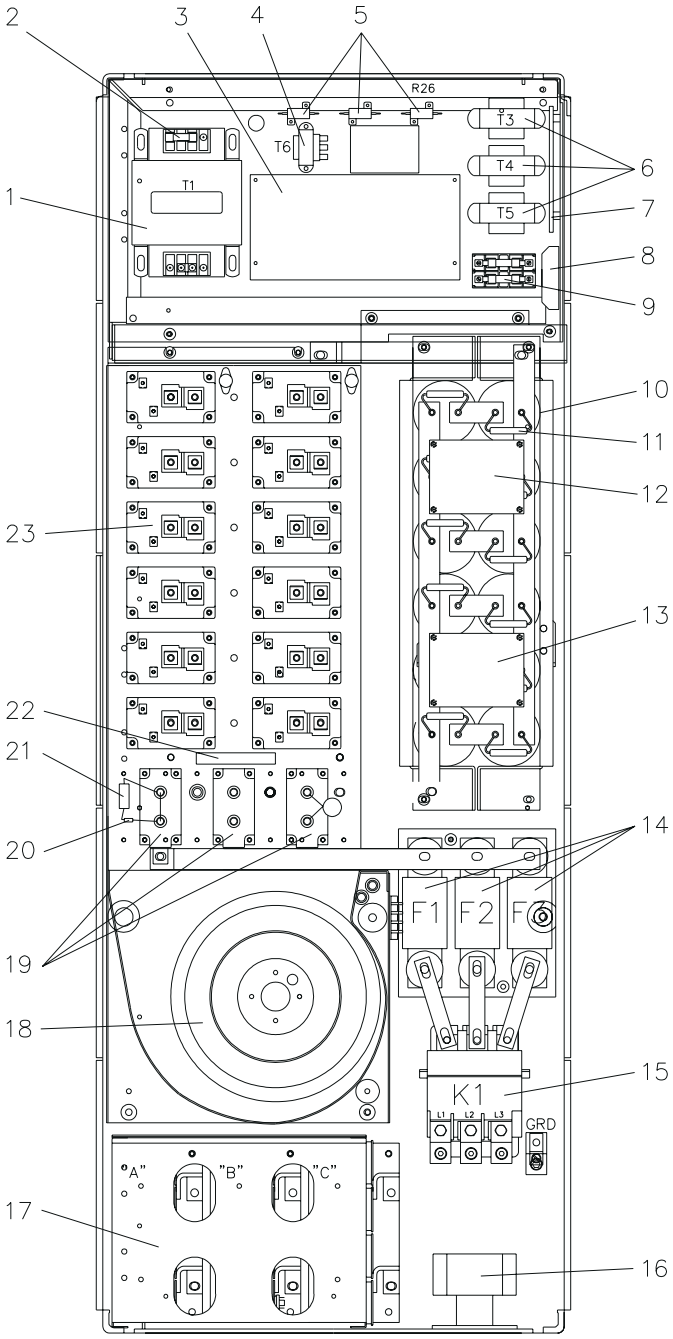
This transformer steps the input voltage down to 115-V AC for operation of the converter's control circuits and other circuits requiring this voltage.

(3) Output Current Sensing Transformers *(1, 2, 3, and 6, Figure 12)*

The cables which conduct output power to each load contactor pass through three sets of current transformers. These current transformers monitor the output load current in each of the three output phases, detect the magnitude of current flowing from the converter to its load and supply a reduced value current signal to the Output PC board. This board processes the information received and sends it to the ADCS PC board, which interprets the signal for those monitoring, testing and control functions which are related to the output circuit.

(4) Neutral Line Current Sensing Transformer *(4, Figure 12)*

To prevent excessive current through the neutral line, current transformer CT4 senses neutral line current and continually sends a signal to the output PC board. This board processes the information received and sends it to the ADCS PC board. When neutral line current exceeds approximately 25% of the converter's full rated load, the ADCS PC board shuts the converter down.



1. Control transformer (T1)
2. Fuse, control transformer secondary, 2-A, 600-V (F9)
3. Load control PC board
4. Remote control transformer (T6)
5. Power supply burden resistors (R24 - R26)
6. Voltage sensing transformers (T3 - T5)
7. Input voltage PC board
8. Fuses, input voltage PC board, 2-A, 600-V (F4 - F6)
9. Fuses, control transformer primary, 15-A, 600-V (F7, F8)
10. Capacitors, DC filter, 7,000 µF, 450-V AC (C1 - C12)
11. Resistors, DC filter, 15,000-Ω, 10-W (R2 - R13)
12. DC bus discharge PC board
13. DC bus tap PC board
14. Input fuses, 250-A, 600-V (F1 - F3)
15. Input contactor (K1)
16. Charging contactor (K2)
17. AC capacitor bank, 30 µF, 330-V AC (C19 - C78)
18. Fan (B1)
19. Rectifier modules (CR1 - CR3)
20. Resistor, DC filter snubbing network, 2-Ω, 3-W (R14)
21. Capacitor, DC filter snubbing network, 0.1 µF, 1,000-V DC (C13)
22. Shunt, DC bus circuit board
23. Power modules (PM1A1 - PM2C2)

Figure 10:
Front Interior Components (Driver and Drive Logic Boards not shown)

(5) Voltage Sensing Transformers *(T3 - T5)(6, Figure 10)*

These transformers step down the input voltage to provide a small sensing voltage, proportional to the input voltage, which is sent to the input voltage PC board *(6, Figure 8 and 6, Figure, 10)*, and from there to the ADCS PC board to allow the ADCS to continually monitor input voltage.

(6) Remote Control Transformer *(4, Fig. 10)*

This transformer provides a 28-V DC signal to the load control PC board under control of the remote START/STOP switches.

e. Switches

(1) Door Interlock Switches (S2 and S3)

These switches are mounted inside the converter near the top of each door. They are wired such that the converter cannot be turned on unless both doors are closed securely, and will shut down immediately upon opening either door.

(2) Power Module Thermal Switches *(S4 and S5)*

These switches are located on the heat sink assembly. They send a signal to the ADCS PC board which monitors the temperature of the heat sink assembly and detect overheating. Whenever the temperature on the heat sink assembly exceeds 107°C (225°F), these switches trip, a fault results, and the ADCS shuts the converter down.

(3) Transformer Thermal Switches *(S6 and S7)*

Each of the transformers has a thermal switch that sends a signal to the ADCS PC board to detect overheating. Whenever the temperature on either of the transformers exceed 180°C (356°F), these switches trip, a fault results, and the ADCS shuts the converter down.

f. Other Components

(1) DC Capacitor Bank and Input Filter Reactors *(10, Figure 10, 1, Figure 11, and 5, Figure 12)*

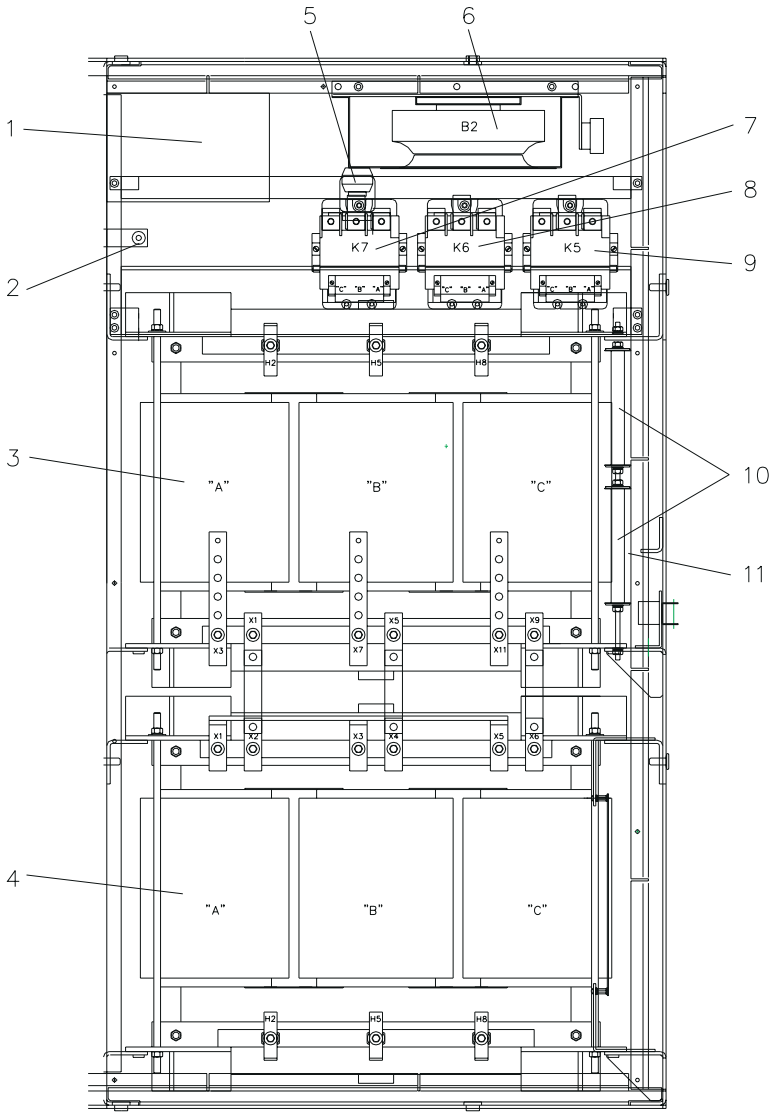
The DC capacitor bank, input filter reactors, and a number of other components provide filtering of the rectified AC input voltage. The bank consists of twelve 7,000-µF, 450-V capacitors (C1 - C12) connected by several copper bars. The bank also maintains sufficient charge to provide several seconds of power for the unit's control circuits, allowing for a controlled shutdown of the unit if input power is lost.

(2) Power Modules *(23, Figure 10)*

The twelve power modules (PM1A1 - PM2C2) provide the actual switching which produces the output voltage sine wave from the filtered DC voltage, under control of the modulator and driver PC boards. Each module is an insulated gate bipolar transistor (IGBT) and two of the twelve are located behind each of the six driver and snubber PC boards.

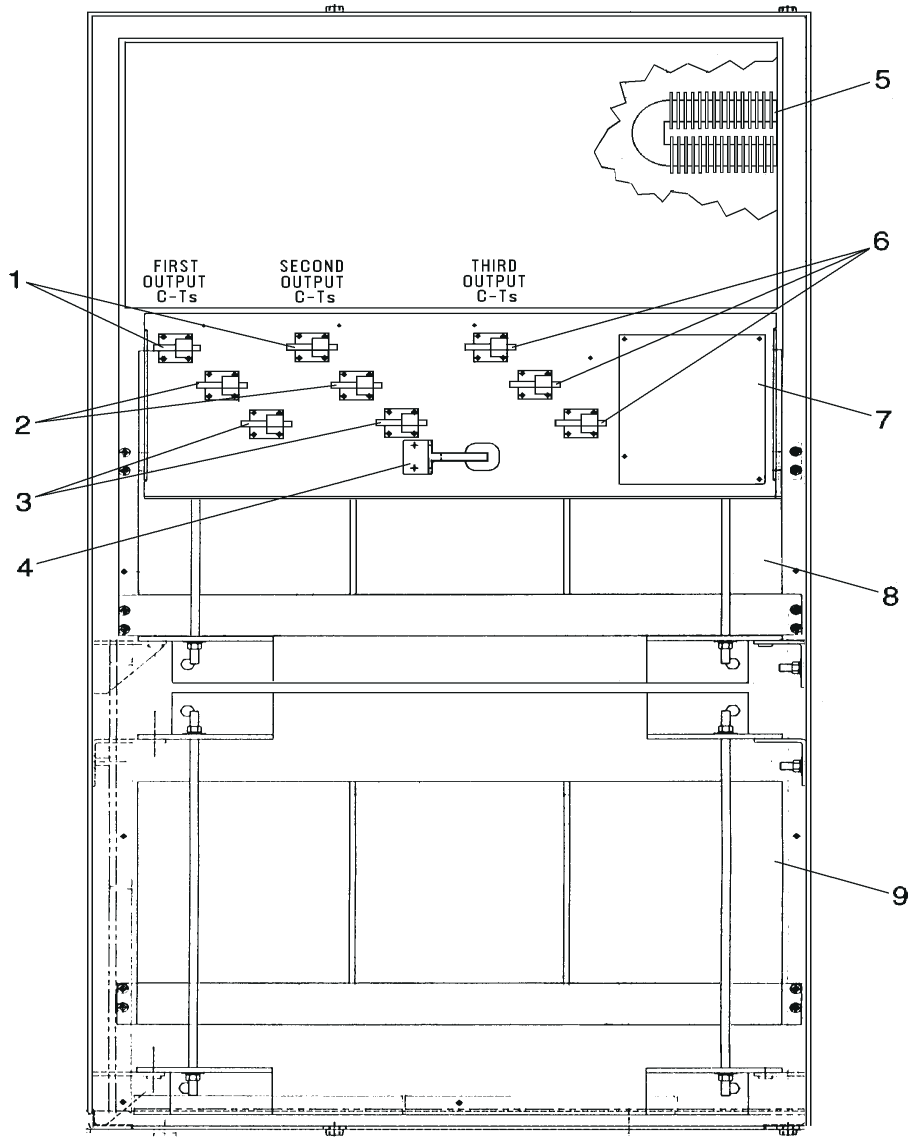
(3) DC Bus

The DC bus is the electrical path between the input filter and the inverter section. Physically, it consists of a number of copper bars which connect the input rectifier modules *(19, Figure 10)*, the DC (input filter) capacitor bank *(9, Figure 10)*, the power modules *(23, Figure 10)*, and a number of other supporting components.



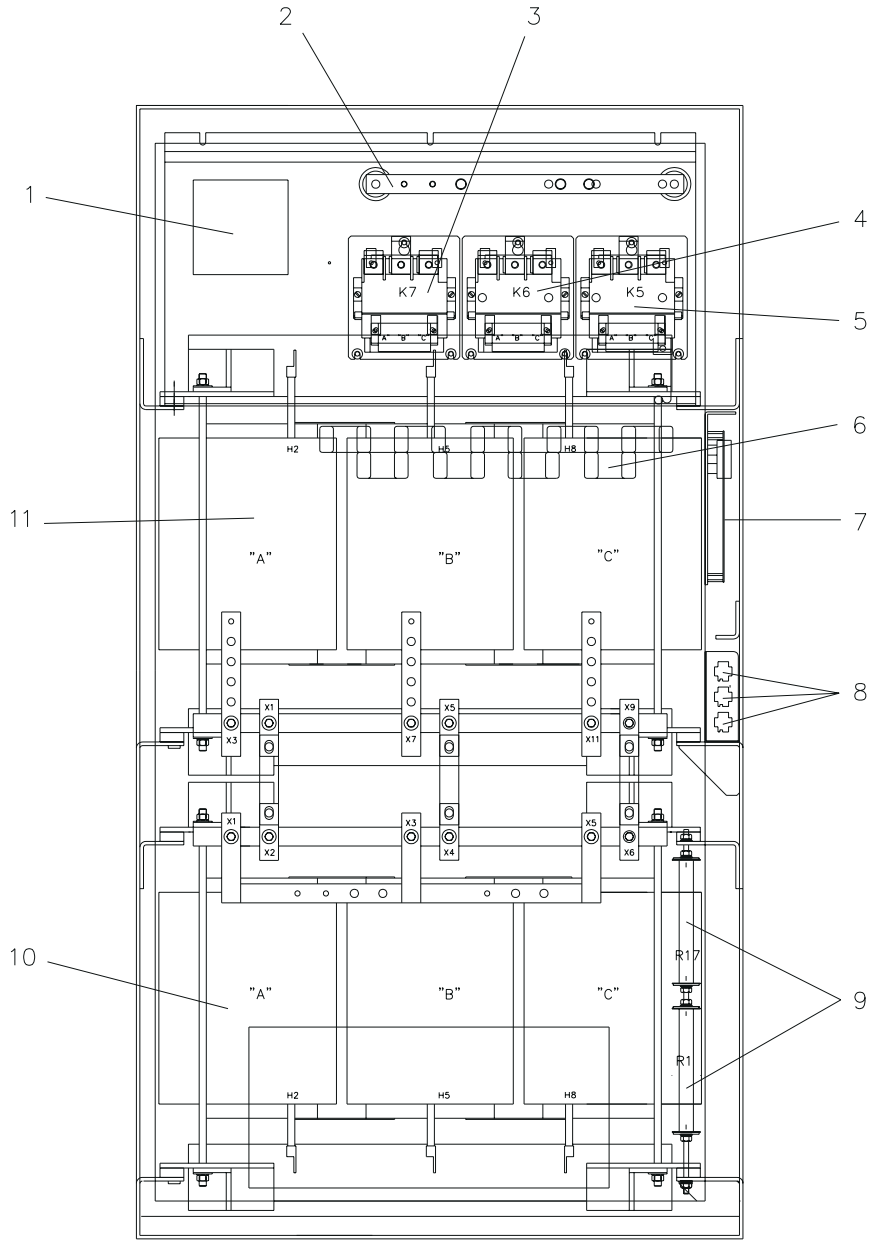
1. DC filter reactor (L2)
2. Resistor, DC filter, 50-Ω, 100-W (R15)
3. Main transformer (T9)
4. Main transformer (T10)
5. Fuse, power modules, 600-A, 700-V (F10)
6. Fan
7. Output contactor No. 3 (K7)
8. Output contactor No. 2 (K6)
9. Output contactor No. 1 (K5)
10. Resistor, DC bus capacitor charging,20-Ω, 100-W (R1, R17)
11. Resistor, DC bus capacitor discharging 50-Ω, 225-W (R16)

Figure 11: Right Side View of Converter Interior



1. Current transformers, C-phase
2. Current transformers, B-phase
3. Current transformers, A-phase
4. Current transformer, neutral
5. Reactor, DC filter (L1)
6. Current transformers, third output
7. Output PC board
8. Main transformer (T9)
9. Main transformer (T10)

Figure 12: Left Side View of Converter Interior (90-kVA and 125-kVA Units)



1. DC reactor
2. Neutral bus bar
3. No. 3 output contactor
4. No. 2 output contactor
5. No. 1 output contactor
6. Current transformers (10)
7. Output PC board
8. Output contactor plug assemblies
9. Resistors, DC bus capacitor pre-charge, 20-Ω, 100-W (R1, R17)
10. Main transformer (T10)
11. Main transformer (T9)

Figure 13: Left Side View of 180-kVA Converter Interior

(4) AC Capacitor Bank and Output Filter Reactors *(17, Figure 10)*

The AC capacitor bank and the output filter reactors provide filtering of the output voltage sine wave. The bank consists of sixty 30-µF, 300-V capacitors (C19A - C38C), twenty of which are connected in parallel between each output phase and the neutral line. The six ouput filter reactors (L1A1 - L1C2) are connected between the outputs of the inverter section and the main transformer primaries.

(5) Fans (Impellers) *(18, Figure 10 and 6, Figure 11)*

These fans are the only rotating parts in the converter unit. The fan illustrated in Figure 10 cools the converter circuitry, and the fan illustrated in Figure 11 cools the output circuitry.

(6) Fuses

Table 5 lists the fuses used in the converter, the circuits these fuses protect, their location, and their types and sizes.

Fuse	Where Illustrated	Size And Rating
Input (F1 - F3)	14, Figure 10	JKS 250-A, 600-V
Control Transformer Secondary Circuit (F9)	2, Figure 10	FNQ 15A, 600-V
Control Transformer Primary Circuit (F7 - F8)	9, Figure 10	FNQ 15A, 600-V
Input Voltage PC Board/Power Supply (F4 - F6	8, Figure 10	FNQ 15A, 600-V
DC Bus/Power Modules (F10	5, Figure 11	SPP-5E 600-A, 700-V

Table 4: Fuses

g. Remote START/STOP Controls *(Figure 14)*

The converter is provided with ON and OFF buttons on the control panel. When the unit is mounted under a bridge these controls are often out of reach of the operator on the ground. Additionally, if the converter is equipped with more than one output, a means of specifying which output should deliver power is necessary. Therefore, the units are equipped for remote START/STOP controls *(see 281338 in Chapter 5)*. The START/STOP control may be mounted on the bridge bogie or a special output cable plug may be provided which has START/STOP buttons or on/off switches mounted in the plug.

h. Bridge Interlock Circuit

For safety, and to prevent damage to equipment, the converter can be interlocked with the bridge drive circuitry so that the bridge can not be moved on the apron while the converter is operating. This is done to prevent the bridge from pulling the output cable from the airplane or driving over the cable.

i. Voltage Suppressor Kit

If requested by the customer, a voltage suppressor kit is available for Hobart solid-state converter units. The purpose of the voltage suppressor kit is to clamp lightning-induced voltage spikes on the AC mains. Units may be purchased with this kit installed, or it may be ordered and installed in the field. Detailed Information on this kit is provided in the Manufacturers Literature Chapter of this manual. Refer to TO-234 in Chapter 5.

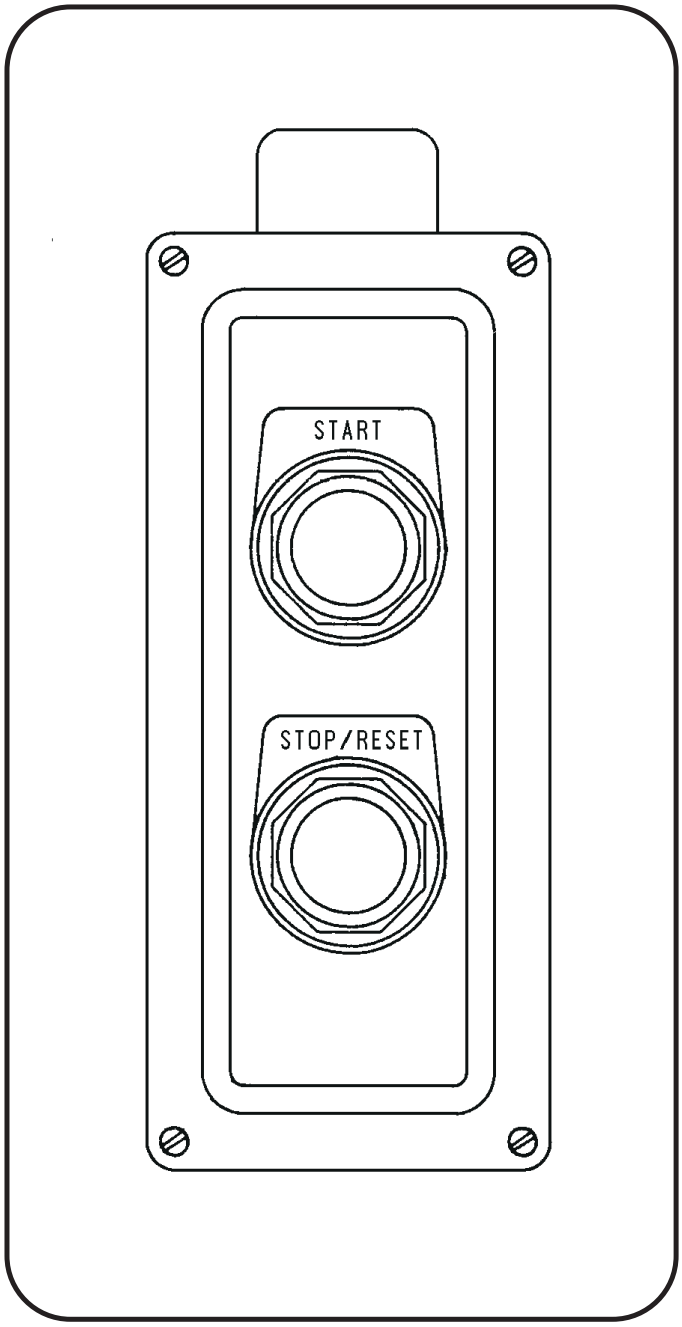


Figure 14: Remote START/STOP Controls

4. List of Options for Part Numbers 500013A and 500013B

a. Mandatory Option

One of the options in the table below must be selected to go with the basic specification.

PART No.	MOUNTING ORIENTATION	OUTPUTS	FOR OUTPUT CABLE	MATES WITH BASIC SPEC.
284431	Vertical	1	Hardware	500013A-201
		2 if parallelled		500013A-207, -209, -210
284405	Vertical	1	Aircraft	500013A-205
283910	Vertical	2	Aircraft	500013A-20
283911	Vertical	3	Aircraft	500013A-203, -208
284423	Bridge	1	Aircraft	500013A-205
283908	Bridge	2	Aircraft	500013A-202, -206, -207
283909	Bridge	3	Aircraft	500013A-203, -208
285054	Trailer	1	Aircraft	500013A-205
285055	Trailer	2	Aircraft	500013A-202, -206, -207
285056	Trailer	3	Aircraft	500013A-203, -208

b. Other Options

The following is a list of the optional assemblies that may be ordered and installed at the factory as components of a 500013A solid state frequency converters.

PART No.	DESCRIPTION	MATES WITH BASIC SPEC.
285230-1	Modem Assembly	All
284828-1	Trailer Assembly, 1 outputs (new design)	500013A-205
284828-2	Trailer Assembly, 2 outputs (new design)	500013A-202, -206, -207
284828-3	Trailer Assembly, 3 outputs (new design)	500013A-203, -208
284528	Trailer Assembly, 1 output (C120)	500013A-205
284528-1	Trailer Assembly, 2 outputs (C120)	500013A-202, -206, -207
284528-2	Trailer Assembly, 3 outputs (C120)	500013A-203, -208
285317-1	Voltage Suppressor Kit	All
284943	Snow Shields Kit	Vertical units only
285399-1	400-Hz Bridge Interlock Kit	Use on ramp mounted converters for bridge applications

(Continued on next page)

Other Options (continued)

PART No.	DESCRIPTION	MATES WITH BASIC SPEC.
285387-1	Autotransformer Kit, 90-kVA, 50-Hz, 3-phase. Input: 220- or 415-V. Output: 380-V. (220-V input requires minimum 210-A service).	500013A-205, -206, for Trailer-Mounted Units
285387-2	Autotransformer Kit, 90-kVA, 60-Hz, 3-phase. Input:208-, 230-, or 575-V. Output: 460-V. (208-V input requires minimum 225-A service).	500013A-205, -206, for Trailer-Mounted Units
285387-3	Autotransformer Kit, 90-kVA, 60-Hz, 3-phase. Input: 600-V, Output: 460-V.	500013A-205, -206, for Trailer-Mounted Units
285387-4	Autotransformer Kit, 125-kVA, 60-Hz, 3-phase. Input: 600-V, Output: 460-V.	500013A-201, -202, -203 for Trailer-Mounted Units
285387-5	Autotransformer Kit, 140-kVA, 60-Hz, 3-phase. Input: 600-V, Output: 460-V.	For Trailer-Mounted Units
285387-6	Autotransformer Kit, 180-kVA, 60-Hz, 3-phase. Input: 600-V, Output: 460-V.	500013A-207, -208, for Trailer-Mounted Units
282368-2	Autotransformer, 90-kVA, 50-Hz, 3-phase. Input: 220- or 415-V. Output: 380-V. (220-V input requires minimum 210-A service).	500013A-205, -206
282090-2	Autotransformer, 90-kVA, 60-Hz, 3-phase. Input:208-, 230-, or 575-V. Output: 460-V. (208-V input requires minimum 225-A service)	500013A-205, -206
285150-1	Autotransformer, 90-kVA, 60-Hz, 3-phase. Input: 600-V, Output: 460-V.	500013A-205, -206
285150-2	Autotransformer, 125-kVA, 60-Hz, 3-phase. Input: 600-V, Output: 460-V.	500013A-201, -202, -203
285150-3	Autotransformer, 140-kVA, 60-Hz, 3-phase. Input: 600-V, Output: 460-V.	
285150-4	Autotransformer, 180-kVA, 60-Hz, 3-phase. Input: 600-V, Output: 460-V.	500013A-207, -208
285440-1	2-Station Remote Pushbutton Assembly	All
285440-2	4-Station Remote Pushbutton Assembly	All
285703	French Language Kit	All
285705-1	AC Mains Momentary Dropout Delay Kit	All
285514-1	90-kVA Parallelling Kit	500013A-209
285514-2	125/180-kVA Parallelling Kit	500013A-207, -210

5. Service Kits

The following replacement kits are available for 500013A and 500013B converter units.

PART No.	UNIT kVA	DESCRIPTION
283919A-2	90	IGBT REPLACEMENT KIT, 300-A
283919A-1	125	IGBT REPLACEMENT KIT, 400-A
283919A-3	180	IGBT REPLACEMENT KIT, 500-A
284775	ALL	OVERLAY ASSEMBLY KIT
285317-2	ALL	VOLTAGE SUPPRESOR KIT (FIELD INSTALLED)
285298	ALL UNITS SHIPPED BEFORE 2-95	SAFETY SCREEN RETROFIT KIT
285339	ALL	DRIVER/SNUBBER REPLACEMENT KIT
285650	ALL	RECTIFIER MODULE KIT

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Section 2. Preparation for Use, Storage or Shipping

1. Receipt and Inspection of Equipment

The converter has been thoroughly inspected and tested at the factory and prepared for shipment in accordance with standard industrial practices for safe shipment. Upon receiving this equipment, inspect it as follows.

a. Visually inspect the shipping crate for damage. If any damage is detected, request that the carrier agent inspect the shipment and note the damage on the delivery receipt. This is for your protection.

b. If there is no obvious damage to the shipping crate, unpack the unit as follows:

2. Unpacking the Unit

a. Remove crate, leaving unit on pallet for lifting it into place for mounting. Take care to avoid damage to the equipment if bars, hammers, etc. are used in uncrating. Remove all unused hardware from the unit.

b. Visually inspect the unit for evidence of external damage such as damaged sheet metal, scratches, dents, etc. Check also for loose connections and components. If the equipment has been damaged in transit, file a claim for damage at once. If you require assistance with a damage claim, furnish Hobart Brothers Company with full information about the claim.

NOTE: Save the shipping container until the unit has been put into service and determined to be operating correctly.

3. Installation

A Hobart converter requires no additional preparation in order to supply power to an aircraft. It needs only to have its input connected to an appropriate source of power and its output cable connected to an aircraft. Proceed as follows for putting the converter unit into service.

WARNING

The method of installation, conductor size, and overcurrent protection shall conform to the requirements of the local electrical code, the national electrical code, or other national codes, as applicable. All installation wiring and machine reconnection shall be done by qualified persons.

4. Input Cable Size and Temperature Requirements

Tables 1 and 2 show input cable size and temperature requirements for converter units covered by this manual. This information is from the U.S. National Elactrical Code ANSI/NFPA 70, 1933 Edition. Install this equiplment per the latest edition, available from the National Fire Protection Association, 470 Atlantic Avenue, Boston, MA 02210.

INPUT VOLTAGE	90-kVA	125-kVA	140-kVA	180-kVA
220 *	210 Am,peres 4/0 AWG *(120 mm^2)* 56 ft.)	N/A	N/A	N/A
380	121 Amperes #1 AWG *(50 mm^2)* 100 ft.	168 Amperes 2/0 AWG *(70) mm^2)* 82 ft.	180 Amperes 3/0 AWG *(95 mm^2)* 68 ft.	242 Amperes 250 MCM *(150 mm^2)* 41 ft.
460	100 Amperes #2 AWG *(35 mm^2)* 100 ft.	139 Amperes 1/0 AWG *(70 mm^2)* 98 ft.	156 Amperes 2/0 AWG *(70 mm^2)* 82ft.	200 Amperes 4/0 AWG *(120 mm^2)* 56 ft.
575 *	80 Amperes #4 AWG *(25 mm^2)* 100 ft.	111 Amperes #2 AWG *(35 mm^2)* 100 ft.	124 Amperes #1 AWG *(50 mm^2)* 100 ft.	Amperes 2/0 AWG *(70 mm^2)* 82 ft.
Values given in this table assume that **90^{0}C rated cables** will be used, with typical wire sizing per table 310-16 of the 1993 National Electrical Code. Wire sizes should be verified by a qualified electrician and should conform to local electrical codes. Table assumes operation at 50^{0}C ambient temperature *(82% of 90^{0}C rating)*. Lengths given are for use on trailer mounted converters only. Total input cable weight is limited to 250-lbs *(113.4 kg)*. Estimated lengths are based on type GGC round cable per noted AWG/MCM. **Maximum lengths for metric cables are different.**				
* With available autotransformer only.				

Table 1: Input Cable Size Requirements - Cables Rated at 90^{0}C

INPUT VOLTAGE	90-kVA	125-kVA	140-kVA	180-kVA
220 *	210 Amperes 300 MCM *(185 mm^2)* 37 ft.	N/A	N/A	N/A
380	121 Amperes 2/0 AWG *(70 mm^2)* 82 ft.	168 Amperes 4/0 AWG *(120) mm^2)*56 ft.	180 Amperes 250 MCM *(150 mm^2)* 41 ft.	242 Amperes 400 MCM *(240 mm^2)* 30 ft.
460	100 Amperes #1 AWG *(50 mm^2)* 100 ft.	139 Amperes 3/0 AWG *(95 mm^2)* 68 ft.	156 Amperes 4/0 AWG *(1200 mm^2)* 56ft.	200 Amperes 300 MCM *(120 mm^2)* 37 ft.
575 *	80 Amperes #2 AWG *(35 mm^2)* 100 ft.	111 Amperes 1/0 AWG *(70 mm^2)* 98 ft.	124 Amperes 2/0 AWG *(70 mm^2)* 82 ft.	Amperes 2/0 AWG *(70 mm^2)* 56 ft.
(1) Values given in this table assume that **75^{0}C rated cables** will be used, with typical wire sizing per table 310-16 of the 1993 National Electrical Code. Wire sizes should be verified by a qualified electrician and should conform to local electrical codes. Table assumes operation at 50^{0}C ambient temperature *(75% of 75^{0}C rating)*. Lengths given are for use on trailer mounted converters only. Total input cable weight is limited to 250-lbs *(113.4 kg)*. Estimated lengths are based on type GGC round cable per noted AWG/MCM. **Maximum lengths for metric cables are different.**.				
* With available autotransformer only.				

Table 2: Input Cable Size Requirements - Cables Rated at 75^{0}C

a. Cable Entry Locations

Preferably, input and output cable entrance should be made through the cable entrance hole(s) provided in the converter cabinet. These panels can be removed to punch alternative hole sizes. If other locations are chosen for cable entrance, consult our Service Department for other arangements.

b. Install Input Cables at Power Supply Service

Before connecting input cables to the power supply service, check voltage, amperage and phase ratings of the service. Make certain that the capacity of the service is adequate for the power requirements of the unit being connected to it. Make certain also that the service used as the source of input power is **grounded**. Refer and conform to your local electrical code when selecting and installing power supply service.

Make sure electrical service is off. Connect the input power cables to the input power source, and connect the grounding conductor to a proper ground.

c. Install Input Cables in Converter

(1) Make sure electrical service is off. Connect the input power cables to the input power source, and connect the grounding conductor to a proper ground.

(2) Open the front door of the unit by turning all three latches counterclockwise with an 8 mm (5/16 inch) allen wrench

(3) Route input cables through the cable clamp in the base at the rear of the unit.

(4) Reach in through the forklift holes in the sides of the base, and pull the cables forward several feet toward the front of the unit.

(5) Route the cable up through the hole in the base and through the cable clamp located in front of the input contactor *(see Figure 1)*.

(6) Connect input cable leads securely to terminals L1, L2, and L3 on input contactor K1.

(7) Connect the ground wire securely to the ground lug located near the input contactor.

(8) Pull the excess cable downward through the clamp in the base, and tighten the clamp around the cables. Leave just enough slack in the cables so there is no strain on them. Avoid damage to cable insulation.

(9) At the rear of the unit, pull the excess cable backward through the rear clamp, and tighten the clamp around the cables. Leave just enough slack in the cables so there is no strain on them.

(10) Close and latch the front door of the unit.

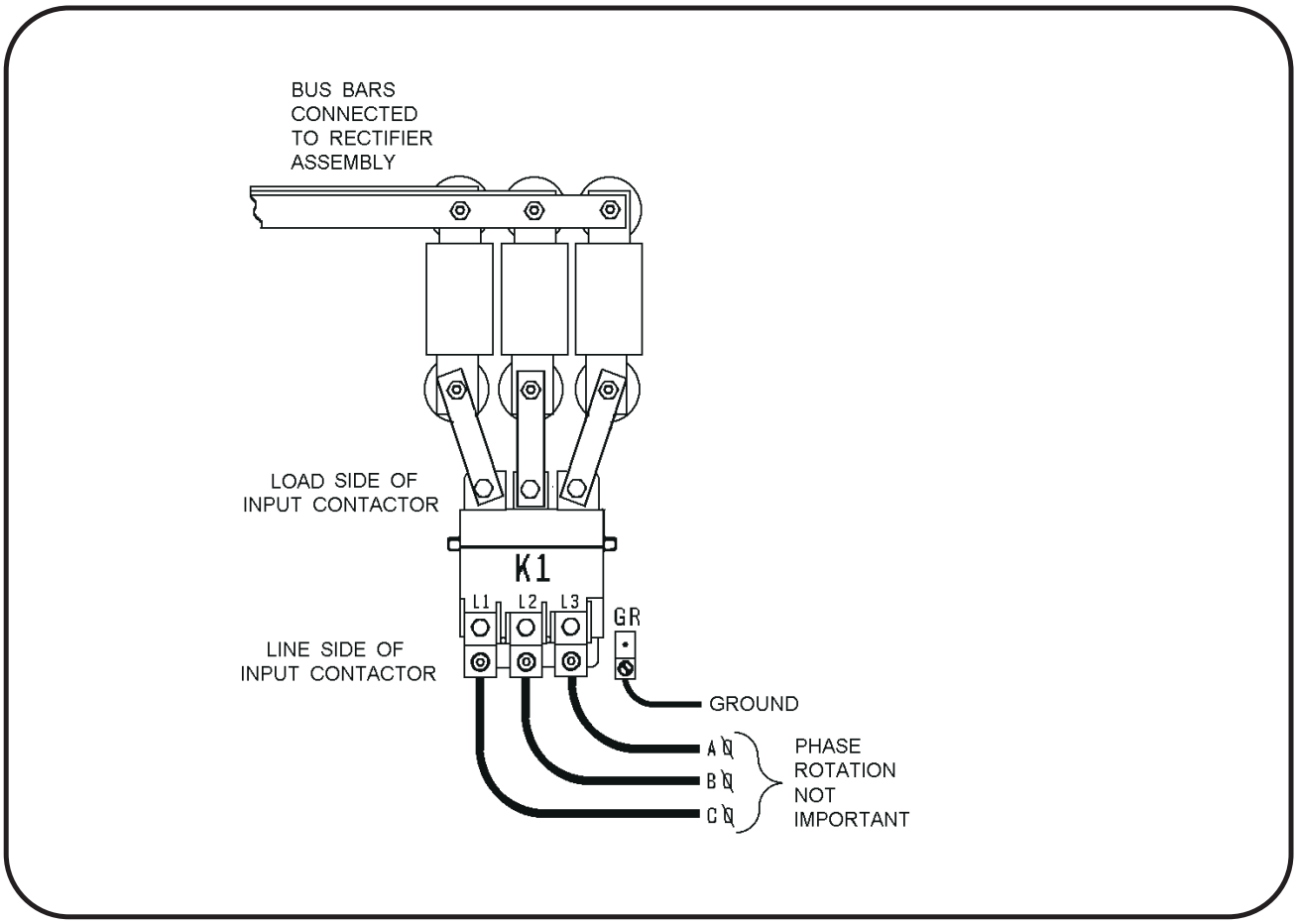


Figure 1: Input Contactor Connections

d. Check Converter No-Load Operation

A no-load check should be made before the output cables are connected to the converter and to a load. Proceed as follows.

(1) Make certain that both converter doors are tightly closed and latched.

(2) Apply input power to the converter from the input power source. The green INPUT POWER lamp *(5, Figure 2)* on the control panel will illuminate.

(3) Press the control panel ON button *(1, Figure 2)*. The unit should start and the green OUTPUT POWER lamp *(2, Figure 2)* will illuminate.

(4) Observe the message on the display *(8, Figure 2)*. The message should be:

```
### RAMP UP SEQUENCE
###      INITIATED
```

The upper number (###) on this display shows DC bus voltage charging up, and the lower number on the display shows the record number.

(5) The message will change after a few seconds to:

```
KWH    RUN  TIME
000    00:00:01
```

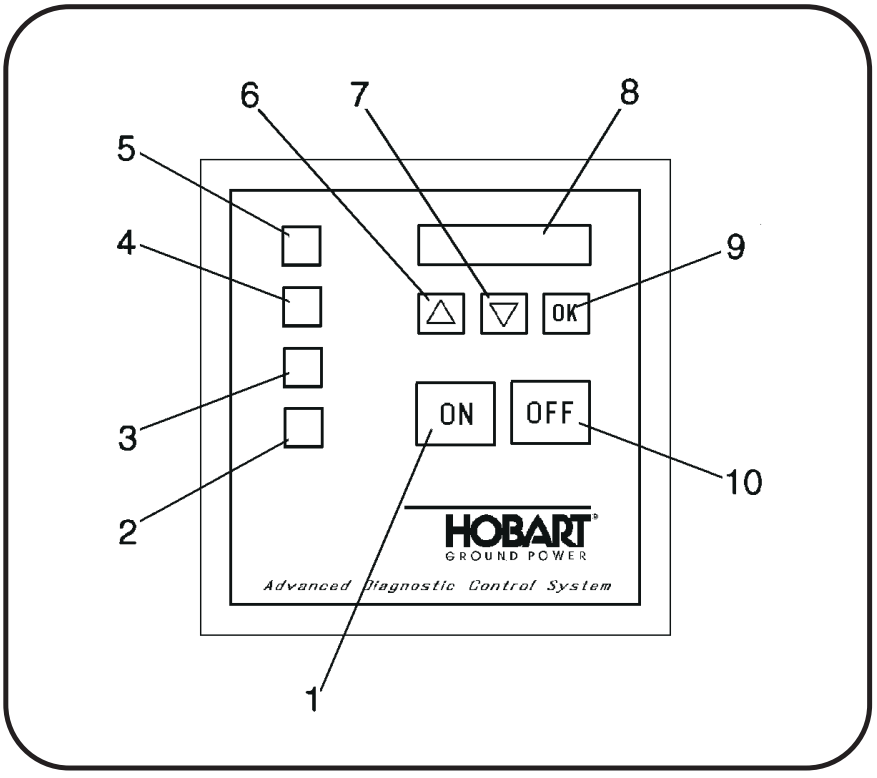
(6) Press the control panel OFF button *(10, Figure 2)*. The OUTPUT POWER lamp should go out while the INPUT POWER remains illuminated and the display below should appear:

```
### POWER TERMINATED
    DISCHARGING BUS
```

The number (###) on this display shows DC bus voltage discharging.

(7) Check optional remote START/STOP controls and bridge interlock feature for proper operation.

(8) Shut off power at the input power source. The INPUT POWER lamp *(5, Figure 2)* will shut off.



1. ON button
2. OUTPUT POWER lamp (green)
3. FAULT lamp (red)
4. ALARM lamp (yellow)
5. INPUT POWER lamp (green)
6. Up button
7. Down button
8. Two-line alpha-numeric display
9. OK button
10. OFF button

Figure 2: Control Panel

e. Install Output Cable and Remote START/STOP Controls

Each output cable and remote control used enters the converter through a cable clamp in the bottom panel (for horizontally mounted units) or the top of the right side panel (for vertically mounted units), and is either connected directly to the top set of terminals of its contactor (for output cables) or to the appropriate terminals of a 6- or 12-station terminal strip located at the top of the converter behind the rear door (for 28-V DC interlock signal (EF signal) and remote control lines).

NOTE: To determine appropriate cable size for single output configurations, consult your local electrical code; for dual or triple outputs, an industry standard aircraft cable is recommended. Use No. 12 AWG for interlock signal (E and F terminals). Output cable leads (A,B,C,N) should be equipped with terminals suitable for a 3/8" diameter terminal stud. Interlock signal (E and F) and remote control leads should be equipped with terminals suitable for a 5/16" diameter terminal stud.

NOTE: If the output cable is installed in conduit, the conduit **MUST** be non-ferromagnetic, ie. aluminum.

(1) Remove the bottom panel (for horizontal mount) or right side panel (for vertical mount) and open the rear door of the unit by turning all three latches counterclockwise with an 8 mm (5/16 inch) Allen wrench.

(2) Loosen the cable clamp screws at the cable horn that is mounted in the bottom panel (for horizontal mount) or the right side panel (for vertical mount).

(3) Route output and remote control cables through the cable horn and clamp and pull enough of this cable through to permit the panel to be moved far enough away to allow working space.

(4) The output contactors can be seen near the top of the unit when the right side (or bottom) panel is removed. Each terminal stud on the contactor is identified by an identification plate. Each cable should be identified by a band-type marker. Connect cable lead “A” to terminal marked “A”, “B” to terminal “B”, and “C” to terminal “C” on the appropriate contactor *(see Figure 4)*. Tighten terminal nuts securely.

(5) One 12-station terminal strip and one 6-station terminal strip are located at the top rear of the unit. Connect interlock leads “E” and/or “F” to the terminal marked “EF” for the corresponding output connected in the previous step *(see Figure 4)*.

(6) At the rear of the unit, connect the three remote control leads to the terminals for the corresponding output.

(7) Remount the right side (or bottom) panel on the unit, pull the excess cable out through the clamp assembly, and tighten the clamp around the cables. Leave just enough slack in the cables so that there is no strain on them. Avoid damage to cable insulation.

(8) Close and latch the rear door of the unit.

The converter is now ready for service. See Section 1-3, **Operation**, for operating instructions.

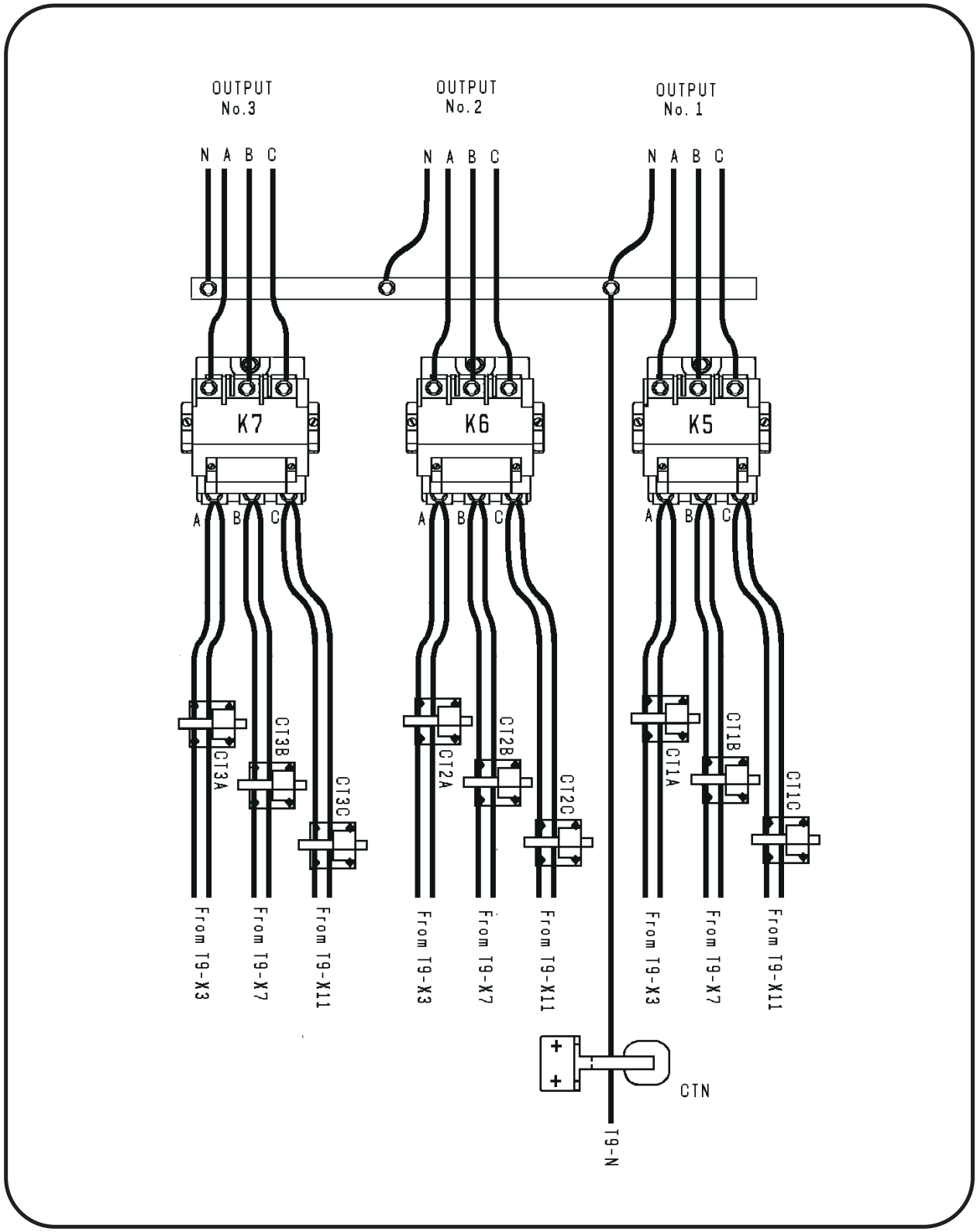


Figure 3: Output Contactor Connection Diagram (90-kVA, 125-kVA and 140-kVA Units)

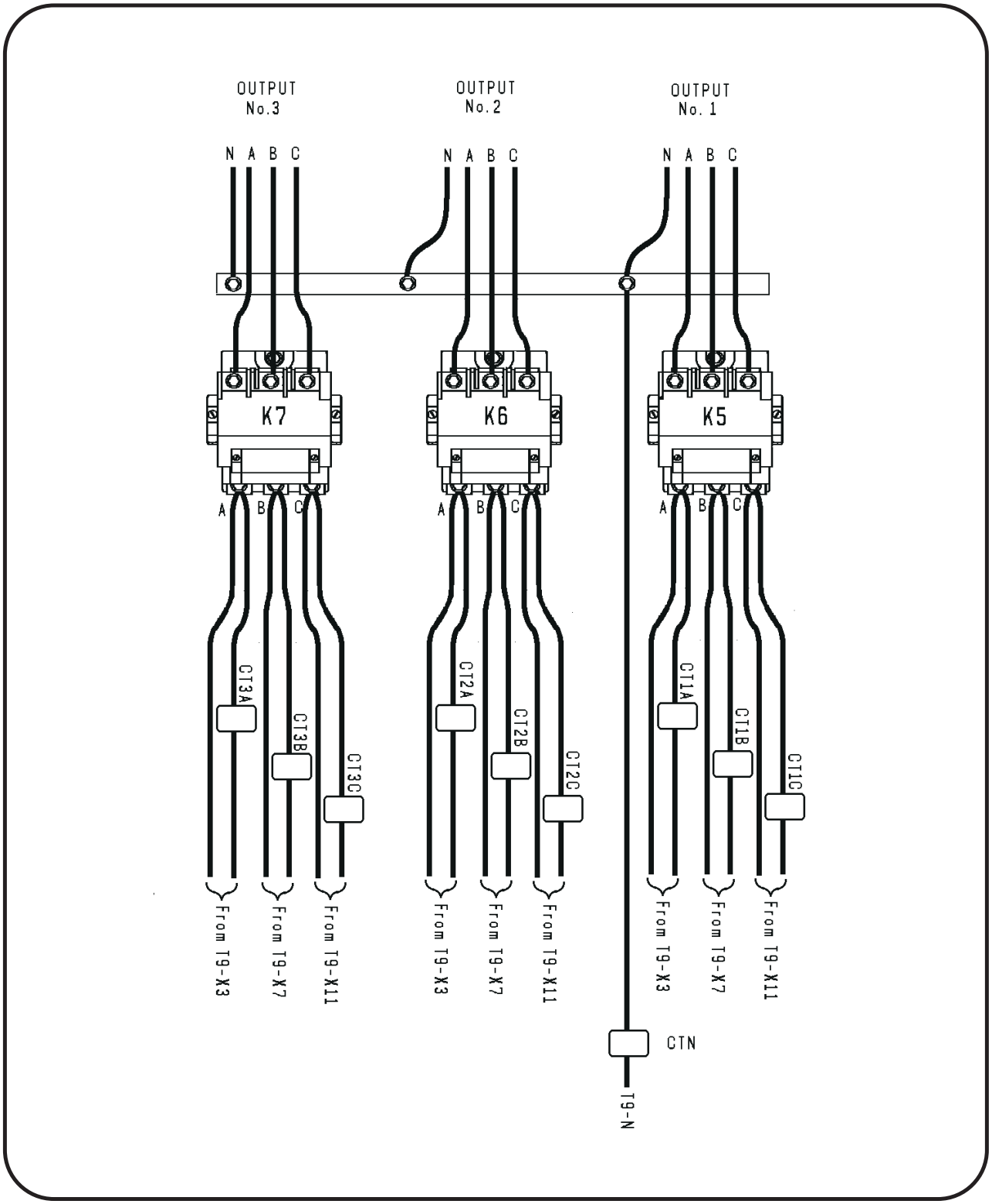


Figure 4: Output Contactor Connection Diagram (180-kVA Units)

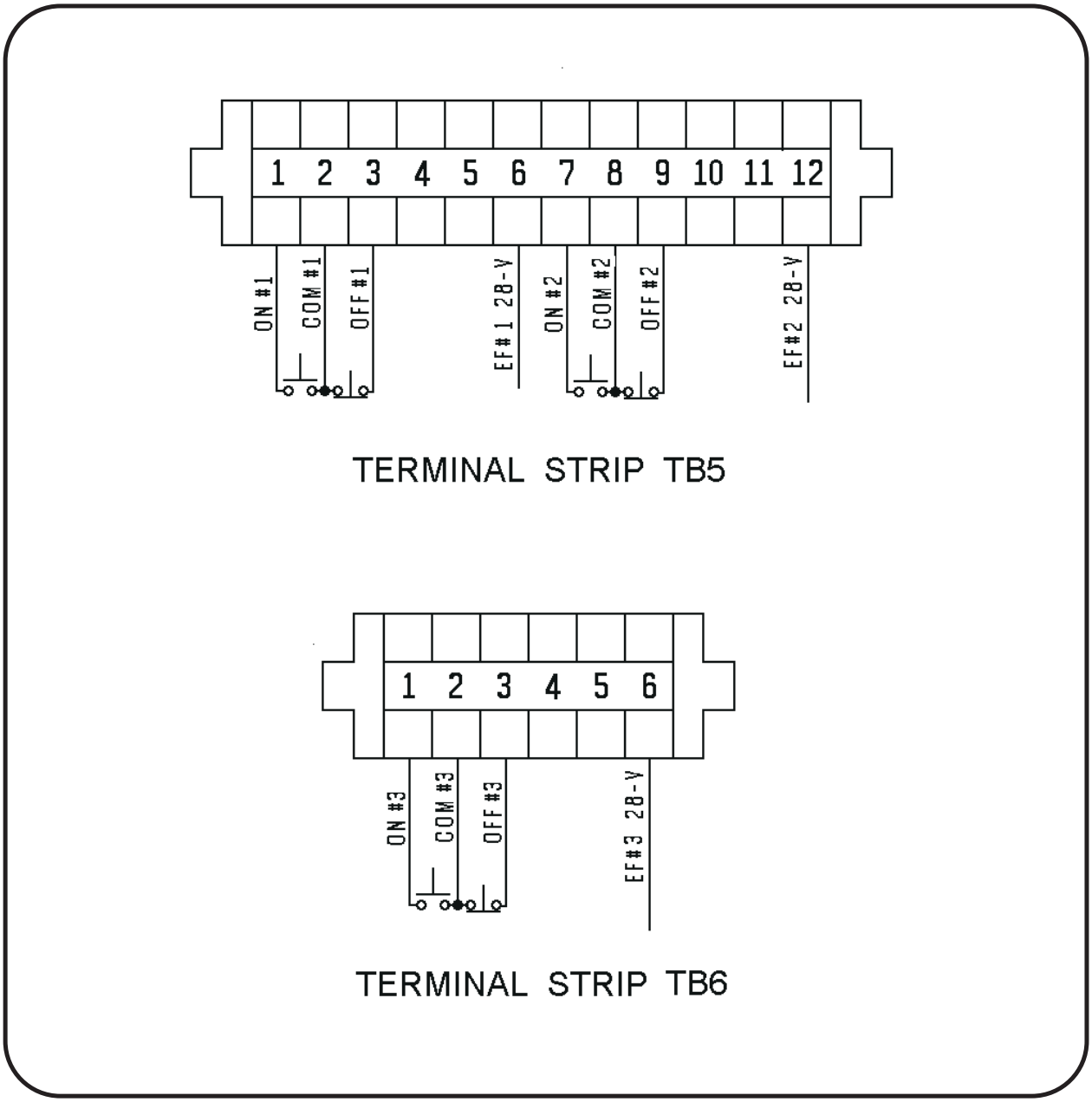


Figure 5: EF Signal and Remote START/STOP Control Connections

5. Preparation for Storage

a. General

(1) The unit should be prepared for storage before installation or 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) Use moisture absorbing chemicals where excessive dampness is a problem. However, the unit must be completely packaged and sealed if moisture absorbing chemicals are to be effective. Seal all openings. Use a waterproof, vapor proof material which is strong enough to resist puncture damage from air presures.

(2) Store the unit in a building which is dry and which may be heated during winter months.

c. Long Time Storage

(1) To protect the converter's 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.

(2) Store the unit in a buildling which is dry and which may be heated during winter months.

6. Preparation for Shipment

During long shipments, the converter unit's retaining hardware may become loosened by vibration, jolting, etc. Check this hardware periodically during the shipment to make certain that retaining hardware is secure.

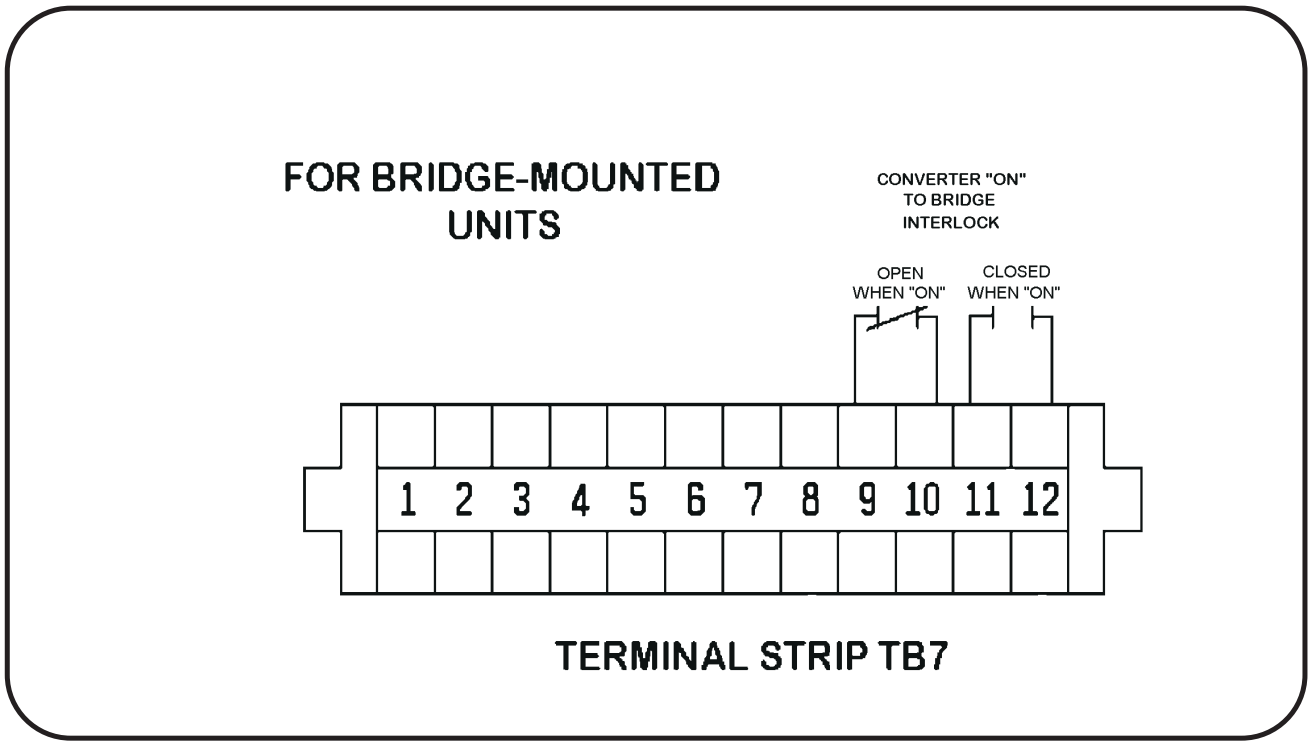


Figure 6: Bridge Interlock Connection Points at Terminal Block TB7

Section 3. Operation

1. General

IMPORTANT

Before attempting to operate the converter, read this entire section to become fully familiar with how the converter operates.

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

2. Basic Converter Operation

The following operating instructions explain basic converter operation from both the control panel and the remote controls.

a. Start-Up Procedure

(1) Make certain that both converter doors are tightly closed. The unit is equipped with two door interlock switches: S2 on the front door and S3 on the back door. Opening either door will cause the input contactor to trip and disable the unit. Therefore **both** doors must be closed to operate the unit. This feature is included for the safety of the user.

(2) Apply rated input power to the converter from the input power source. The green INPUT POWER lamp *(5, Figure 1)* on the control panel will illuminate.

WARNING

Care must be taken not to bypass the door interlock switches. High voltages are present inside the converter, and FATAL SHOCK could rsult

(3) Press the control panel ON button to turn the unit on.

(4) Output voltage (voltage to be delivered to an aircraft) must be set the first time the converter is turned on and delivering power to an aircraft. **Press** and **hold** either the control panel up or down button until the display changes to:

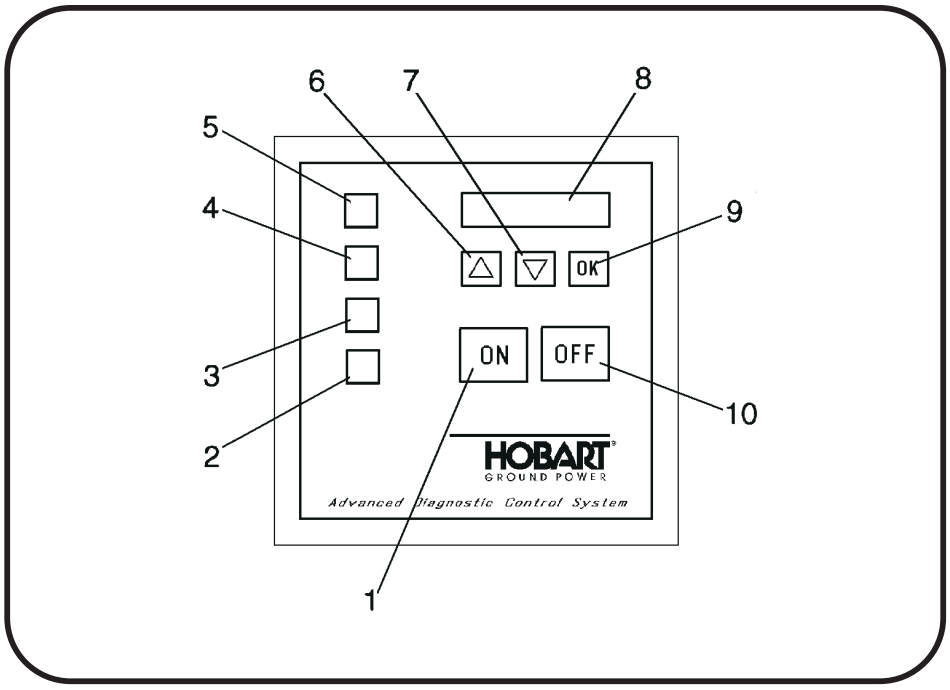
SET OUTPUT VOLTS
& LINE DROP COMP

(5) Then press and hold the OK button until the display changes to:

```
SET  OUTPUT  VOLTS
 95  {115.0}  129
```

The number in the center indicates the output voltage which will be delivered to the aircraft, while the numbers on the left and right indicate the limits within which output voltage can be changed. The converter is preset at the factory to deliver 115-V AC to the aircraft upon its initial startup.

If it is necessary to change the factory set value, hold either the up or down button until the desired output voltage appears in the display, followed by the OK button to store the new voltage level. This value need only be set once; the voltage level will remain the same for all future operations of the converter, even when the unit is turned off or disconnected from input power. It may, however, be changed as often as desired.



1. ON button
2. OUTPUT POWER lamp (green
3. FAULT lamp (red)
4. ALARM lamp (yellow)
5. INPUT POWER LAMP (green)
6. Up button
7. Down button
8. Two-line alpha-numeric display
9. OK button
10. OFF button

Figure 1. Control Panel

(6) Use output cable(s) of proper size and length for this specific converter's power output rating. Connect output cable plug connector(s) to aircraft receptacle(s). Be sure connectors are mated fully and securely.

On a single-output converter, if the output cable from the converter is connected to an aircraft, a 28-V DC interlock signal (EF signal) will be fed back to the converter to allow the converter to operate. If the cable is accidently disconnected from the aircraft while the converter is operating, the converter will shut off. If the cable is not connected to an aircraft, the converter will not operate.

WARNING

Never disconnect an output cable while output power is on.

On a multiple-output converter, **if at least one output cable is connected to an aircraft, the converter will operate and deliver power only through the connected output(s)**. If all the cables are accidently disconnected from the aircraft while the converter is in operation, the converter will shut off. However, **if at least one cable remains connected to an aircraft, the converter will continue to operate and deliver power through that one cable**; only the disconnected cable(s) will stop delivering output power. This feature is included for the safety of the user and should not be used as an alternate method of discontinuing output power to an aircraft.

(7) For converters with one output, either press the control panel ON button *(1, Figure 1)* or the remote control START button. For converters with more than one output, press the remote control START button for each available output. The unit should start and the green OUTPUT POWER lamp *(2, Figure 1)* will illuminate, indicating that power is being delivered from the converter to the aircraft.

For converters with one output, output power may be turned on from either the control panel ON button or a remote control START button.

For converters with more than one output, output power must always be turned on from the remote control START button for each output. For safety reasons, output power may be turned off but cannot be turned on from the control panel on a multiple output unit.

In most cases, remote START/STOP controls will be used to control the converter, because the control panel will be out of reach for a user, and, for a multiple output unit, to specify which of the three outputs should deliver power. The control panel ON and OFF buttons will rarely be used for any purpose other than maintenance, testing, or on a central power system.

(8) Observe the message on the display *(8, Figure 2)*. The message should be:

```
### RAMP  UP  SEQUENCE
###       INITIATED
```

This message indicates that the DC bus is being charged and the converter is preparing to deliver output power. The number on the top line shows the voltage on the DC bus, while the number on the bottom line is the number of the current cycle data record (see Paragraph 3.f., **Review Stored Cycle Data Submenu**). The ADCS will enter the PoWerMaster Measurements submenu and the message on the display will change after a few seconds to:

```
KWH    RUN  TIME
###    hh:mm:ss
```

The first number in the display, KWH, indicates the kilowatt-hours of power used since the converter was connected to the aircraft and powered up. The second number, RUN TIME, indicates the time in hours, minutes, and seconds (hh:mm:ss) for the same period.

(9) Line drop compensation must be set the first time the converter is operated. Line drop compensation allows the converter to automatically make allowance for the voltage drop caused by the resistance of long output cables. Press the OK button on the control panel, then press and hold the control panel up or down button until the display changes to:

```
SET OUTPUT VOLTS
& LINE DROP COMP
```

(10) Then press and hold the OK button until the display changes to:

```
        LDC1   [OK?]
0%   {0.0%}   8%
```

The number in the center indicates the current compensation factor, while the numbers on the left and right indicate the limits within which the compensation factor can be changed. To determine if the compensation factor should be changed, perform the following steps:

a. Turn on all available electrical devices on the aircraft. The aircraft should be drawing the maximum possible amount of current from the converter without exceeding the unit's maximum power rating.

b. Have an assistant measure and report the voltage being delivered to the aircraft through the No. 1 output at the aircraft end of the cable.

c. If the value measured above does not match the value entered through the Set Output Volts display, hold either the up or down buttons on the control panel to change the compensation factor. Have the assistant report when the measured value matches the entered value.

d. Press the OK button to store the new compensation factor.

If the converter has more than one output, the display will change to allow you to set the line drop compensation factor for the second output by following the steps above. In the same manner, the compensation factor for the third output, if one is available, can be set. After the compensation factors for all available outputs have been set, the display will return to the main menu time and date.

(11) After the converter has been operating for four minutes without any intervention (no buttons having been pressed), the control panel display will dim to extend its life. The display will return to its maximum brightness whenever an alarm or fault occurs, or whenever any control panel button is pressed.

b. Operating Procedure

Since the converter is a solid state unit, rather than a rotating, engine/generator type, the unit requires no intervention once it is running normally (i.e., no fuel, oil, etc. is needed). If the ADCS senses a problem, it will indicate it on the control panel and will take the appropriate action automatically.

c. Shut-Down Procedure

(1) To stop power delivery to one of the outputs, press the appropriate remote control STOP button for that output. To turn all outputs and the converter off, either press the control panel OFF button *(10, Figure 1)*, or press all remote control STOP buttons on each remote connected to the converter. The green OUTPUT POWER lamp *(2, Figure 1)* will shut off when no power is being delivered through any of the outputs.

WARNING

Never disconnect an output cable while output power is on.

(2) Disconnect the output power delivery cable(s) from the aircraft.

(3) The DC bus (DC capacitor bank) will be discharged to provide safety and to extend the life of the capacitors, and the display below will appear:

```
### POWER TERMINATED
    DISCHARGING BUS
```

This message indicates that the DC bus is being discharged and the converter is shutting down. The number on the top line shows the voltage on the DC bus.

(4) Shut off power at the input power source, if desired. The green INPUT POWER lamp *(5, Figure 1)* will shut off. It is not necessary to discontinue input power between operations of the converter. When the unit is not delivering output power, it uses only a small amount of input power and may be left connected to input power indefinitely.

3. Operation of the ADCS

a. General

The ADCS control panel features a two-line alpha-numeric status display *(8, Figure 1)* which indicates electrical values and fault conditions pertinent to the operation of the ADCS, and displays menu choices, options, operating parameters, and electrical values that the operator can select, view, and change. While viewing the display *(8, Figure 1)* and by using the OK button *(9, Figure 1)*, the up (Δ) button *(6, Figure 1)*, and the down (∇) button *(7, Figure 1)*, you can have the ADCS select and show any particular option, parameter, or electrical value relevant to the operation of the converter unit.

b. Menus and Submenus

For your convenience, the monitoring and testing information provided by the ADCS is divided into seven **submenus** which may be selected and entered from the **main menu** of the ADCS. From the main menu, you may select whichever submenu you desire by holding either the up (Δ) or down (∇) button on the control panel until the desired choice appears on the display.

After you have selected a submenu from the main menu, you may then press the OK button to enter the submenu and may once again hold the up or down buttons until the desired option, information, or electrical value is shown on the display.

c. Control Panel Buttons

The control panel up and down buttons must be **pressed and held** until the desired option, information, or electrical value is shown on the display, then released. As the up and down buttons are held, the display will cycle through the available selections, changing approximately once every second. After the desired selection appears on the display, the OK button must be **pressed and held** until the display changes to reflect the new choice. The ADCS has been designed to work this way to eliminate the need for repeatedly pressing and releasing any button to make a selection. This makes selection quicker and easier, and extends the life of the control panel buttons.

The remainder of this section is organized into six subsections, each providing details about the choices available from the main menu and within the submenus. Each subsection starts with a menu map showing the route you must take and the buttons you must hold to arrive at any desired item, followed by explanations of each item within the submenu shown on the map. Be aware that information shown in the sample displays, especially numeric data such as voltage and current values, are given as examples only, and may not reflect actual converter display.

The following key lists the meaning of various symbols used in the sample displays:

dd/mm/yy	Date in day, month, and year
hh:mm:ss	Time in hours, minutes, and seconds
###	Indicates that numeric or electrical value data may appear in that location
{# # #}	Indicates a parameter that may be changed.
[Bracketed text]	Indicates a front panel switch.
$	Indicates that a single letter or symbol may appear in that location

NOTE: When moving up or down within a particular submenu, it may or may not be necessary to press the OK button. Pressing this button either selects another submenu or returns to the main menu. Therefore, it will be necessary to closely follow the menu maps on the following pages to determine exactly which buttons to press to get to the desired menu selection.

d. Main Menu

The main menu *(Figure 2)* is the starting point for all operations performed from the control panel. There are several submenus which may be displayed in sequence by pressing either the up or the down button, and entered by holding the OK button. The submenus are briefly described below, and more thoroughly explaned in the rest of this section.

(1) Time/Date Display

```
d/m/y    MAIN  MENU
dd/mm/yy  hh:mm:ss
```

The preceding display shown appears when the converter is connected to input power but is not operating and delivering output power. This is the only main menu item that does not have an associated submenu; it simply shows the current date and time.

If the converter is operating and delivering output power, the time and date display will no longer indicate seconds:

```
d/m/y    MAIN  MENU
  dd/mm/yy  hh:mm
```

(2) Accumulated Usage Display

This display allows you to enter the Accumulated Usage submenu. This submenu contains cumulative converter operating statistics that show various total values from the first application of input power to the converter to the present time. See Paragraph 3.e., **Accumulated Usage Submenu,** on page 10, for explanations of the items within this submenu.

(3) Review Stored Cycle Data Display

This display allows you to enter the Review Stored Cycle Data submenu. This submenu contains up to 199 **records** of **operational cycle data** that have been recorded and stored in the ADCS over a period of time, perhaps several weeks or more. A single record of cycle data is created whenever input power is applied to the converter, whenever an operator finishes use of the converter and turns the unit off, whenever a fault occurs, or whenever the user recali- brates the unit.

Cycle data differs from accumulated usage data in that each individual cycle data record is associated with a specific, individual, operation of the converter (operational cycle) from startup to shutdown, while accumulated usage data contains total values from the first application of input power to the present. See Paragraph 3.f., **Review Stored Cycle Data Submenu**, on page 12, for explanations of the items within this submenu.

(4) PoWerMaster Measurements Display

This display allows you to enter the PoWerMaster Measurements submenu. This submenu displays electrical values at which the converter is presently operating. Note that the displays available through this submenu are also available through the Review Stored Cycle Data submenu. The difference is that the electrical values shown here are values at which the converter is operating at moment by moment, while the values shown in cycle data are values at which the converter was operating when an operational cycle, or period of use, ended. See Paragraph 3.g., **PoWerMaster Measurements Submenu**, on page 21, for explanations of the items within this submenu.

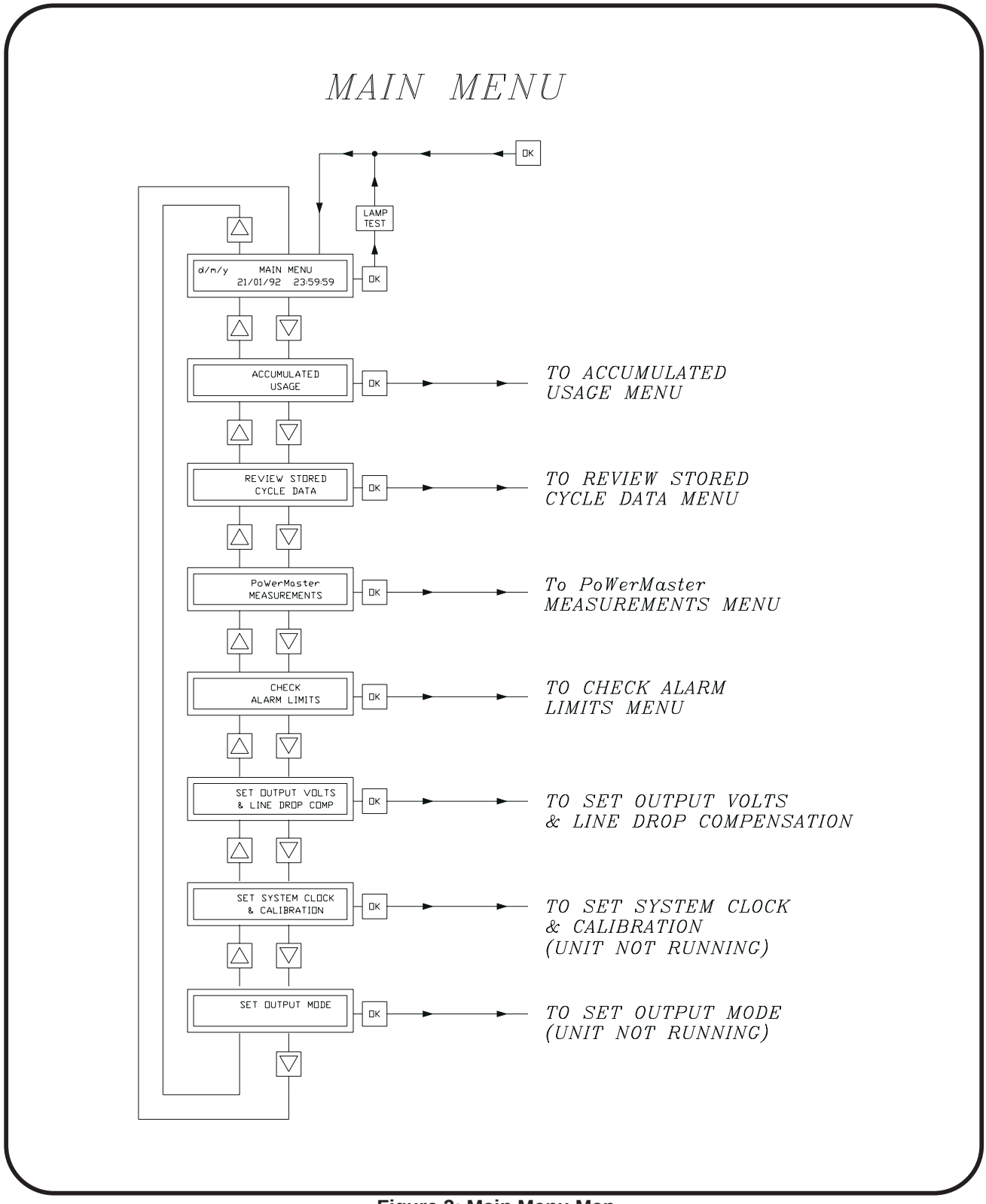


Figure 2: Main Menu Map

(5) Check Alarm Limits Display

This display allows you to enter the Check Alarm Limits submenu. This submenu displays various electrical values above and below which the ALARM lamp on the control panel will illuminate. The limit values can be changed by the operator. See Paragraph 3.h., **Check Alarm Limits Submenu**, on page 25, for explanations of the items within this submenu.

(6) Set Output Volts and Line Drop Compensation and Set Output Frequency Display

This display allows you to enter the Set Output Volts and Line Drop Compensation submenu. This set gives you the ability to change the output voltage being delivered through all available outputs, and to compensate for voltage losses in various lengths of output cable. See Paragraph 3.i., **Set Output Volts and Line Drop Compensation Submenu**, on page 26 for explanations of the items within this submenu.

(7) Set System Clock and Calibration Display

The preceding display allows you to enter the Set System Clock and Converter Calibration submenu. This submenu, which can only be entered when the converter is not running, gives a qualified technician the ability to change many converter operating values, such as the time, date, and calibration factors, etc. See Section 2-2, Paragraph 3., **Calibration**, for explanations of the items within this submenu.

(8) Set Output Mode Display

This display allows you to enter the Set Output Mode submenu. The converter may have as many as three separate outputs. This submenu, which can only be entered when the converter is not running, gives a qualified technician the ability to set the output mode for each of the outputs to either “NORMAL”, for delivery of power to an aircraft or aircrafts, or to “28-V BYPASS”, which bypasses the normal EF signal checking . See paragraph entitled ,**Set Output Mode Submenu** for explanations of the items within this submenu.

e. Accumulated Usage Submenu

The Accumulated Usage submenu *(Figure 3)* contains cumulative converter operating statistics that show various total values from initial converter startup to the present time. As can be seen from the menu map, you may cycle through the data by holding the up and down buttons, and return to the main menu by pressing the OK button.

(1) Total Kilowatt Hours

This display shows the total number of kilowatt-hours of power consumed by the converter from the time it was initially put into service to the present time.

(2) Total Starts

This display shows the total number of times the converter was turned on by either pressing the control panel ON button or pressing one of the remote control START buttons, from the time it was initially put into service to the present time.

(3) Total Power Deliveries

This display shows the total number of times the converter was turned on and delivered output power, from the time it was put into service to the present time.

(4) Total Running Hours

This display shows the total number of running hours for the converter from the time it was initially put into service to the present time.

f. Review Stored Cycle Data Submenu

REVIEW STORED
CYCLE DATA

The Review Stored Cycle Data submenu *(Figure 4)* contains up to 199 **records** of **operational cycle data** that have been recorded and stored in the ADCS over a period of time, perhaps several weeks or more. When the ADCS has reached its storage limit of 199 records, the earliest record will be overwritten to provide storage space for any newly created record. Therefore, the ADCS will continually retain the 199 most recent cycle data records in storage.

There are six types of cycle data records which may be created, stored by the ADCS and viewed, indicated by two symbols in the lower left corner of the display. The first symbol will always be an "R", which indicates that the data in the display is under review only and cannot be changed from that location.

R No symbol following the "R" indicates a record created when the converter was shut down and ended operation normally.

R* An asterisk (*) following the "R" indicates that the current record contains **power up data**, which is created each time input power is applied to the converter. As the converter will normally be left connected to input power continually, there will usually be only one record of this type.

RC A "C" following the "R" indicates that the record contains **calibration data**, which is created each time the user enters the calibration submenu, whether or not any of the parameters are changed.

Rf An "f" following the "R" indicates a **flag** message.

RF An "F" following the "R" indicates a record created when a **fault** occurred, such as converter door being opened. See Section 2-3, **Troubleshooting**, for detailed explanations, possible causes, and resolutions of faults.

RA An "A" following the "R" indicates that an **automatic record** is created after 24 hours of continuous operation.

(1) Select Review Type

When you enter the Review Stored Cycle Data submenu, you must select one of the three following types of data reviews described before proceeding to the actual review of data. As can be seen from the menu map, you may select the review type by holding the up and down buttons until the desired choice appears in the display, followed by the OK button to advance to the record or date selection display.

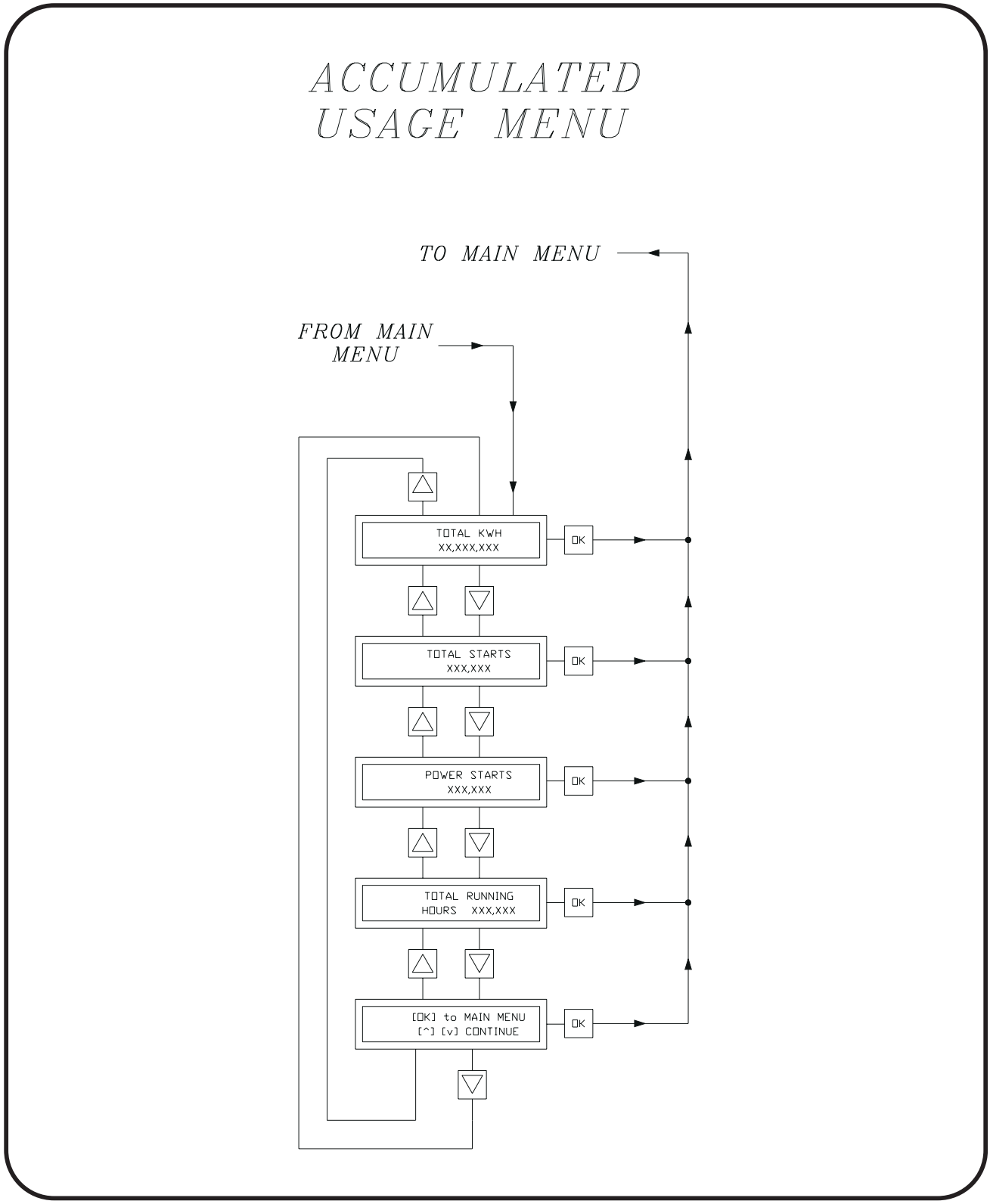


Figure 3: Accumulated Usage Submenu Map

a. Review All Cycle Data

This display allows you to select a review of all 199 records of stored cycle data, regardless of the type of record. If the converter has not been operating long enough since initial startup to store 199 records of cycle data, certain of the records displayed may contain invalid data. The differences between invalid and valid data will be obvious when this data is reviewed. If you wish to review all cycle data, you can advance to the record selection display, discussed below, by pressing the OK button.

b. Review Fault Data Only

This display allows you to select a review of only fault records. The fault records are a subset of all converter cycle data; therefore, there will likely be far fewer than 199 fault records. If you wish to review only fault data, you can advance to the record selection display, discussed below, by pressing the OK button. If there are no fault records, the display below will appear when you attempt to advance:

You may then press OK to select another method of reviewing cycle data.

c. Review Data for a Specific Date

This display allows you to select a review of all cycle data stored on a specific date. When this option is chosen, by pressing the OK button, the display changes to:

You can select the date on which you wish to review cycle data by holding the up and down buttons, followed by the OK button when the proper day and month is displayed. Only dates on which records were created and stored (i.e., on which the converter was operated) can be displayed and selected.

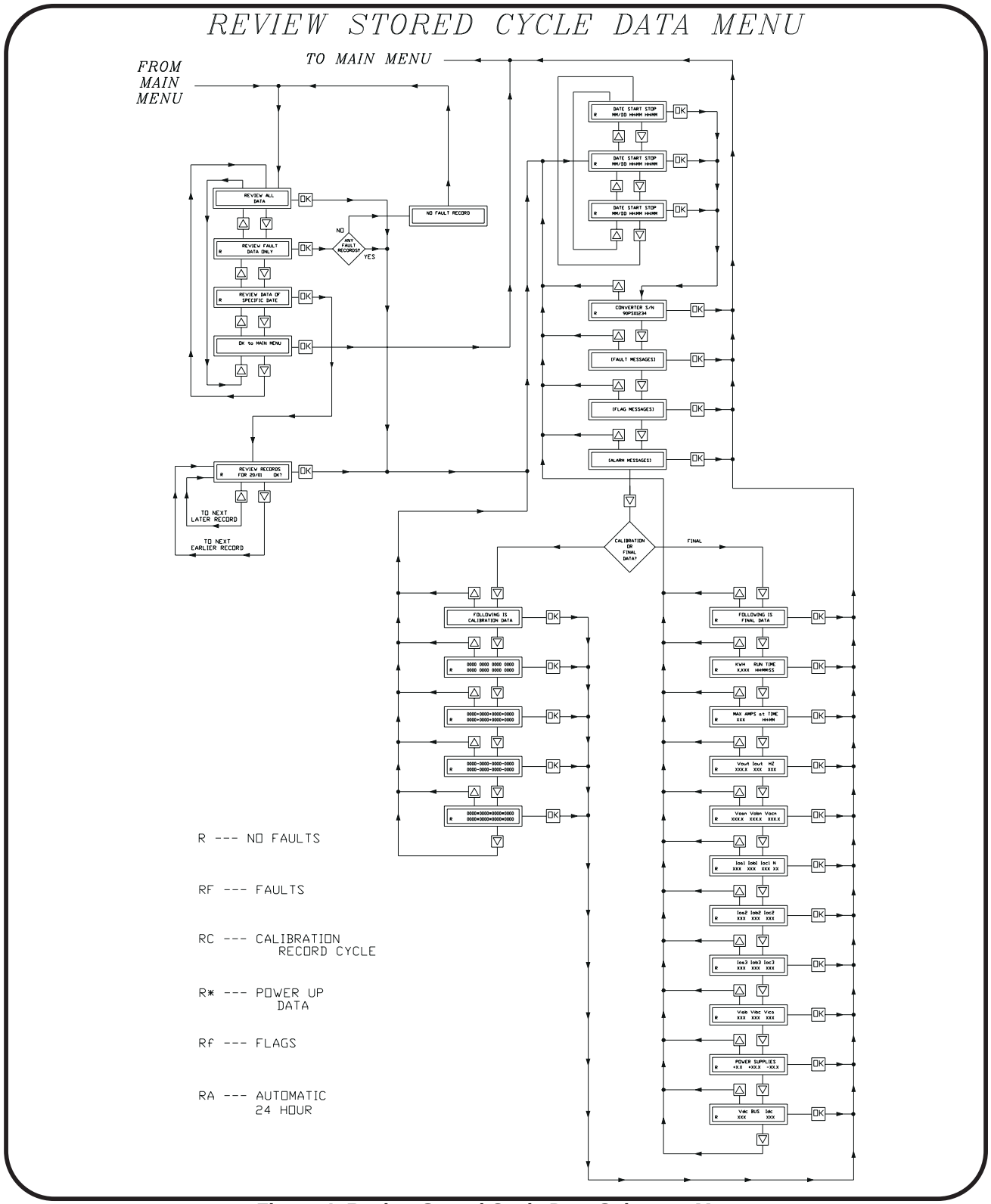


Figure 4: Review Stored Cycle Data Submenu Map

(2) Record Selection Display

After you have selected one of three methods of reviewing cycle data, and have selected the date on which cycle data is desired, if necessary, the display changes to:

```
### DATE  START  STOP
 R$ dd/mm  hh:mm  hh:mm
```

This display indicates the record number (###) of a particular record of cycle data, along with the date, start, and stop times for that cycle of converter operation. The first record displayed is the record most recently created and stored by the ADCS. You may press the up and down buttons to select previously stored records, and the OK button to review the cycle data stored within the selected record.

(3) Cycle Data

The following sample displays indicate the cycle data that is available once you have advanced to this point. As can be seen from the menu map *(Figure 4)*, you may hold the down button to see in order all data stored in the particular record selected, the up button to return the record selection display and select another record, and the OK button to return the main menu.

a. Converter Serial Number

```
###    CONVERTER  S/N
 R$        90PSO1234
```

The preceding display shows the serial number of the converter. A typical serial number is shown in the second line of the display.

b. Fault Message

```
###   [Fault  Message]
          R$
```

This display shows a fault message if the record that was selected is a fault record: one created and stored because of a converter fault. If the current record is not a fault record, the following display will appear:

```
###       NO  FAULTS
           R$
```

Note that if Review Fault Data Only was chosen as the review method, all records viewed will display a fault message here.

c. Flag Messages

```
###    [Flag Messages]
R$
```

This display shows a flag message if a flag occurred during the cycle of converter operation under review. If there is more than one flag, successive flag messages will appear as the operator continues to advance. The messages that appear here do not indicate either a fault or an alarm; they do indicate conditions to which you may wish to attend to at a later time. If the current record contains no flags, the following display will appear:

```
###        NO  FLAGS
R$
```

See Section 2-3, **Troubleshooting**, for detailed explanations, possible causes, and resolutions of flags.

d. Alarm Messages

```
### [Alarm  Messages]
R$
```

This display shows an alarm message if an alarm occurred during the current cycle of converter operation. If there is more than one alarm, successive alarm messages will appear as you continue to advance. If the current record contains no alarms, the following display will appear:

```
###        NO ALARMS
R$
```

See Section 2-3, **Troubleshooting**, for detailed explanations, possible causes, and resolutions of alarms.

e. Data Type

```
###     FOLLOWING  IS
R$   CALIBRATION  DATA
```

```
###     FOLLOWI  NG  IS
 R$        FINAL DATA
```

One of the two displays above will appear when you advance to this point.

Calibration data, when displayed here, signifies that the following data is a listing of the calibration factors entered and stored through the Set System Clock and Calibration submenu (Section 2-2, Paragraph 3., **Calibration**). Calibration data is indicated here whenever the current record is a power-up data record (created when input power is applied to the converter) or whenever the current record is a calibration data record (created when the user enters the calibration submenu. This provides users with a listings of the calibration factors in effect when the converter is first installed and each time calibrations are performed on the unit, allowing you to compare previous calibration factors to newly entered factors and make sure that new factors have been stored properly. A power-up or a calibration data record does not indicated a stop time since it is a record of set factors, not a summary of an operation cycle.

Final data, when displayed here, signifies that the following data is a listing of the electrical conditions or values in effect when an operational cycle was ended (i.e. when the converter was shut down normally or because of a fault). This provides you with a listing of the electrical conditions in effect at the end of an operational cycle.

If “CALIBRATION DATA” was indicated above, the following four displays will appear when you advance. Each display shows eight of the 32 calibration factors. The meaning of the data displayed here is not important; as mentioned above, it allows you to compare previous and new factors and insure that changes were stored correctly. Additionally, the data on these displays may be requested by service personnel when a service call is placed, allowing them to more quickly and accurately determine the cause of a problem.

```
#### #### #### ####
#### #### #### ####
```

```
####+####+####+####+
####+####+####+####+
```

```
####-####-####-####-
####-####-####-####-
```

```
####*####*####*####*
####*####*####*####*
```

If “FINAL DATA” was indicated above, the following displays will appear when you advance. Each display is identical to the displays available through the PoWerMaster Measurements submenu (Paragraph 3.g.); however, the values displayed here refer to the conditions that were in effect when an operational cycle ended, rather than current operating conditions.

g. Powermaster Measurements Submenu Map

The PoWerMaster Measurements submenu *(Figure 5)* displays electrical values at which the converter is presently operating. Note that the displays available through this submenu are also available through the Review Stored Cycle Data submenu. The difference is that the electrical values shown here are values at which the converter is operating at moment by moment, while the values shown in cycle data are values at which the converter was operating when an operational cycle, or period of use, ended. When you enter this set, the following information may be selected and viewed on the display. Only the first three displays can be selected if the converter is not delivering output power. As can be seen from the menu map, you may cycle through the data by holding the up and down buttons, and return to the main menu by pressing the OK button.

NOTE: These values should be checked especially after major repair, major parts replacement, overhaul, and/or re-calibration, to make certain that the converter is operating properly under load.

(1) Input Phase Voltages

```
###   Viab  Vibc  Vica
R$     460   460   460
```

This display shows the line-to-line input voltage the converter was receiving when the recorded operational cycle ended. The values shown are for a converter which has 460-V AC applied at its input.

(2) Internal Power Supply Voltages

```
###   POWER  SUPPLIES
 R$   +5.0  +12.0  -12.0
```

This display shows the internal power supply voltages when the recorded operational cycle ended. The values shown are normal values. Actual values may be slightly greater or slightly less.

(3) DC Bus Voltage and Current

```
###   Vdc   BUS   Idc
R$    650         150
```

This display shows DC bus voltage and current when the recorded operational cycle ended. The values shown are normal values. Actual values may be slightly more or slightly less.

(4) Kilowatt-Hours Used/Run Time of the Cycle

```
###     KWH   RUN  TIME
 R$     ###   hh:mm:ss
```

This display shows the length of the recorded operational cycle in hours, minutes, and seconds, and how many kilowatt-hours (kWH) of power were used during that time period.

(5) Maximum Current During the Cycle

```
### MAX  AMPS  at  TIME
 R$     ###     hh:mm:ss
```

The preceding display shows the peak amps output by the converter during the recorded operational cycle, and how long, in hours and minutes, after startup that peak usage occurred.

(6) Output Voltage, Current, and Frequency

```
###  Vout   Iout    Hz
R$   115.0   362   400
```

This display shows the output voltage, output current, and output frequency the converter was delivering when the recorded operational cycle ended. The voltage and frequency values shown are normal values for most converters manufactured by Hobart Brothers Company. The current may be different from that shown above.

(7) Line-to-Neutral Output Voltages

```
### Voan   Vobn   Vocn
 R$ 115.0 115.0 115.0
```

This display shows, for each of the three output phases, line-to-neutral output voltage when the recorded operational cycle ended. The values shown are those which would normally appear.

(8) Output Current in Each Phase: No. 1 Output

```
 ### Ioa1 Iob1 Ioc1 N
R$   260  260  260  0
```

This display shows the No. 1 output line current the converter was delivering when the recorded operational cycle ended. The values shown are rated output current for a 90-kVA load. Actual values may be less or slightly greater.

(9) Output Current in Each Phase: No. 2 Output

```
 ### Ioa2 Iob2 Ioc2
R$   260  260  260
```

This display shows the No. 2 output line current the converter was delivering when the recorded operational cycle ended. The values shown are rated output current for a 90-kVA load. Actual values may be less or slightly greater.

(10) Output Current in Each Phase: No. 3 Output

```
 ### Ioa3 Iob3 Ioc3
R$   260  260  260
```

This display shows the No. 3 output line current the converter was delivering when the recorded operational cycle ended. The values shown are rated output current for a 90-kVA load. Actual values may be less or slightly greater.

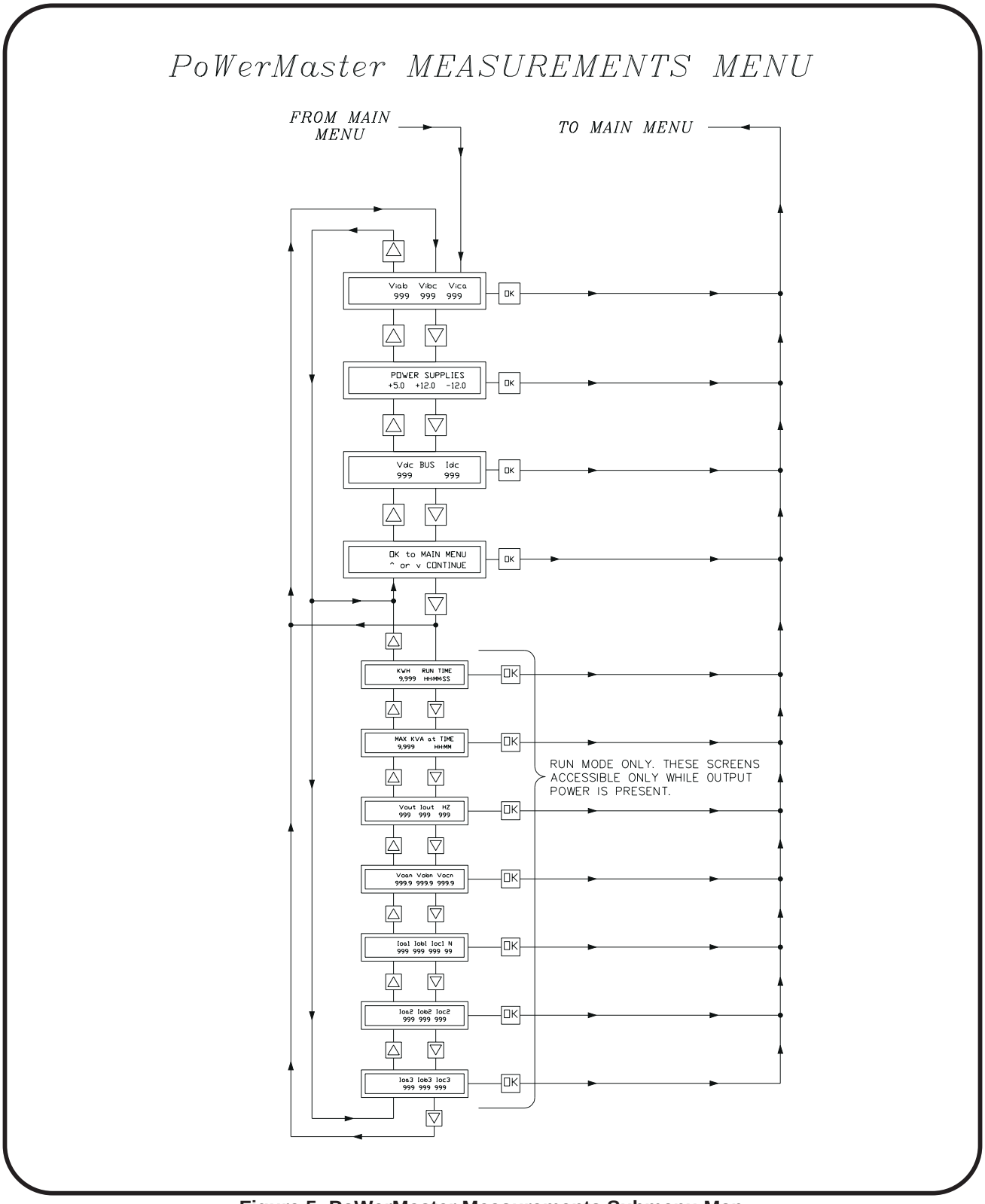


Figure 5: PoWerMaster Measurements Submenu Map

h. Check Alarm Limits Submenu

The Check Alarm Limits submenu *(Figure 6)* displays various electrical values above and below which the ALARM lamp on the control panel will illuminate and an alarm message will be stored in the current cycle data record. The limit values are displayed from this submenu; they can be changed. When you enter this set, the following information may be selected and viewed on the display. As can be seen from the menu map, you may make adjustments by using the up arrow key to increase the value and the down arrow key to decrease the value. Once the values desired are set, press the OK button. This maintains the limits that have been set.

(1) Converter Line-to-Neutral Output Voltage Range

```
Vout    HI   [OK]?
 118  {121.9}  124
```

```
Vout   LO   [OK]?
 101  {111.8}  112
```

This display shows the allowable line-to-neutral output voltage range within which the unit operates. Whenever output voltage falls below the low limit or exceeds the high limit, the ALARM lamp is illuminated. Default limit values are shown in the display.

(2) Maximum Allowable Output and Neutral Line Currents

```
Iout   HI   [OK]?
259    {261}  323
```

```
IoN   HI   [OK]?
 25  {65}   125
```

This shows the maximum allowable output current at which the unit operates and the maximum allowable neutral current at which the converter operates. For line or neutral, whenever current exceeds the high limit, the ALARM lamp is illuminated. Typical limit values are shown in the display.

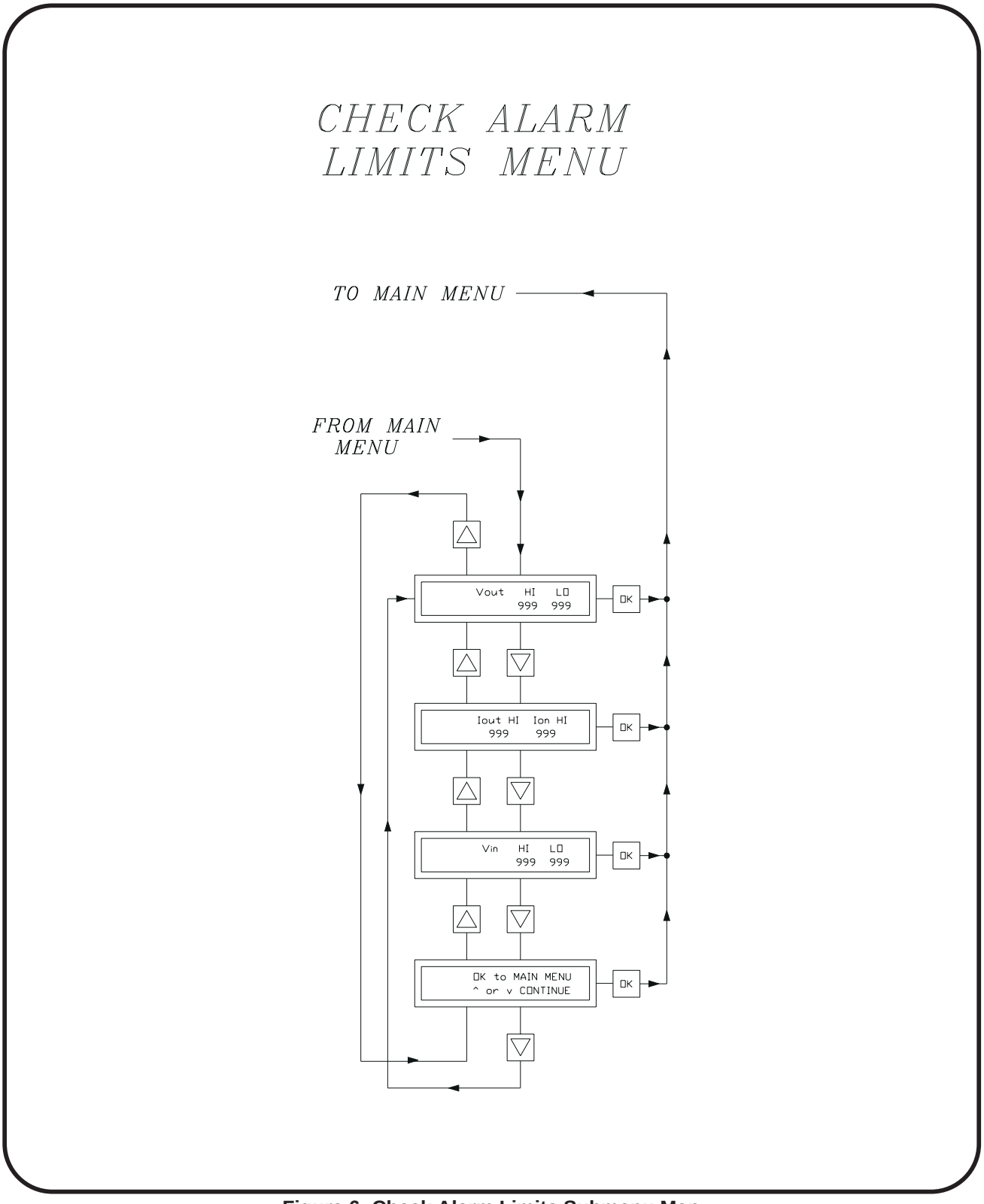
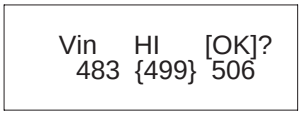
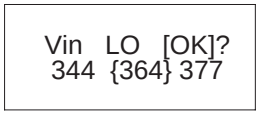


Figure 6: Check Alarm Limits Submenu Map

(3) Converter Line-to-Line Input Voltage Range



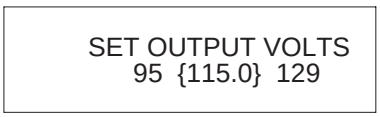


This display shows the allowable line-to-line input voltage range within which the unit operates. Whenever input voltage falls below the low limit or exceeds the high limit, the ALARM lamp is illuminated. Typical limit values are shown in the display.

i. Set Output Volts and Line Drop Compensation Submenu

The Set Output Volts and Line Drop Compensation submenu *(Figure 7)*, which can only be entered when the converter is on but not delivering output power, gives you the ability to change the output voltage being delivered through all available converter outputs, and to compensate for voltage losses in various lengths of output cable. This procedure is normally only performed once, when the converter is first installed. The value entered here is retained in the converter, even when the unit is turned off or input power is removed. The output voltage is preset at the factory to 115.0-V AC, but may be changed to any value within the range 95.0 to 130.0-V AC.

(1) When you enter this submenu, the following display appears:



You may change the output voltage by holding the up and down buttons, followed by the OK button, when the correct voltage appears in the parentheses. If you attempt to enter this submenu while the converter is not on, the following display appears:

Additionally, if you attempt to enter this submenu while the unit is on and delivering output power, the following display appears:

(2) Once output voltage has been set, line drop compensation may also be changed, if necessary. Line drop compensation allows the converter to automatically make allowance for voltage drop caused by the resistance of long output cables. Once compensation values have been entered correctly, the converter will continually monitor and vary its output to provide an unchanging voltage at the aircraft, regardless of cable length or current drawn by the aircraft. After you have set output voltage, the display below appears:

```
          LDC1  [OK?]
0%    {0.0%}    8%
```

The numbers on the left and right indicate the lower and upper output compensation limits, respectively, while the number in the center indicates the current compensation factor. This figure represents the maximum allowable change in output voltage at the converter which will provide a constant output voltage at the aircraft. To determine if the compensation factor should be changed, perform the following steps:

a. Connect output cable(s) to aircraft(s). Turn on all available electrical devices on the aircraft. The aircraft should be drawing the maximum possible current from the converter without exceeding the unit's maximum power rating.

b. Have an assistant measure and report the voltage being delivered to the aircraft through the No. 1 output at the aircraft end of the cable.

c. If the value measured above does not match the value entered through the Set Output Volts display, hold either the up or down buttons on the control panel to change the compensation factor. Have the assistant report when the measured value matches the entered value.

d. Press the OK button to store the new compensation factor.

If the converter has more than one output, the UP and DOWN buttons will change the display to allow you to set the line drop compensation factor for the second output by following the steps above. In the same manner, the compensation factor for the third output, if one is available, can be set. After the compensation factors for all available outputs have been set, the display will return to the main menu time and date. Note that the output voltage entered above is the voltage being delivered to all aircraft through all available outputs and is only set once for all outputs, while line drop compensation can be set individually and differently for each available output.

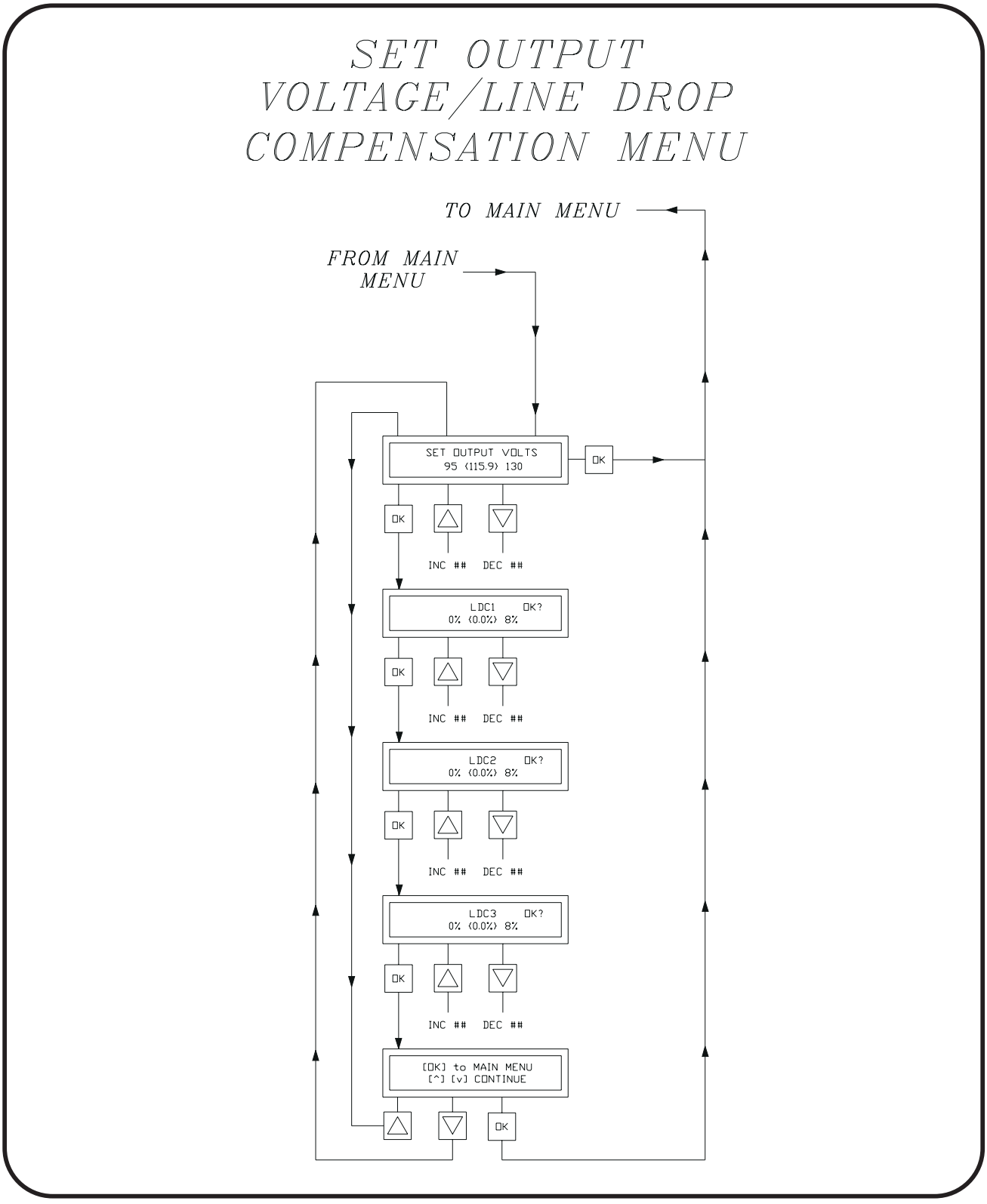


Figure 7: Set Output Volts, Line Drop Compensation Submenu Map

j. Set Output Mode Submenu

WARNING

Output cables may be LIVE when maintenancemode is selected. Exercise extreme caution or FATAL SHOCK may result.

The converter may have as many as three separate outputs. The Set Output Mode submenu *(Figure 8)*, which can only be entered while the converter is not running, permits a qualified technician to set the output mode for each of the outputs to either “NORMAL”, for delivery of power to an aircraft, or to “28-V BYPASS", which bypasses the normal EF signal checking and permits setting and checking of various converter parameters which would normally only be accessible while the signal is present (i.e., when an output is connected to an aircraft). An output cannot be switched to 28-V bypass mode while an EF signal is present for that output; additionally, if an EF signal is applied while the converter is in 28-V bypass mode (e.g., by connecting an output cable to an aircraft), the unit will automatically switch that output to normal mode. Be aware that if 28-V bypass mode is selected, it is possible to deliver voltage to an output cable whether or not that cable is connected to an aircraft or load bank. Exercise extreme caution when selecting 28-V bypass mode.

When you enter this submenu, the following display appears.

```
OUTPUT1  MODE  [OK?]
         NORMAL
```

This display indicates that the No. 1 output is set for normal operation. Holding either the up or down button changes the display to:

```
OUTPUT1  MODE  OK?
         28-V BYPASS
```

When this message appears, EF signal checking is bypassed for maintenance purposes. If, however, the output cable is connected to an aircraft or load bank in which the EF signal is present, the output mode for that output will automatically change to “NORMAL”.

If the converter has a second or third output, you may check and modify its operation by pressing the OK button to select the additional outputs and following the steps above.

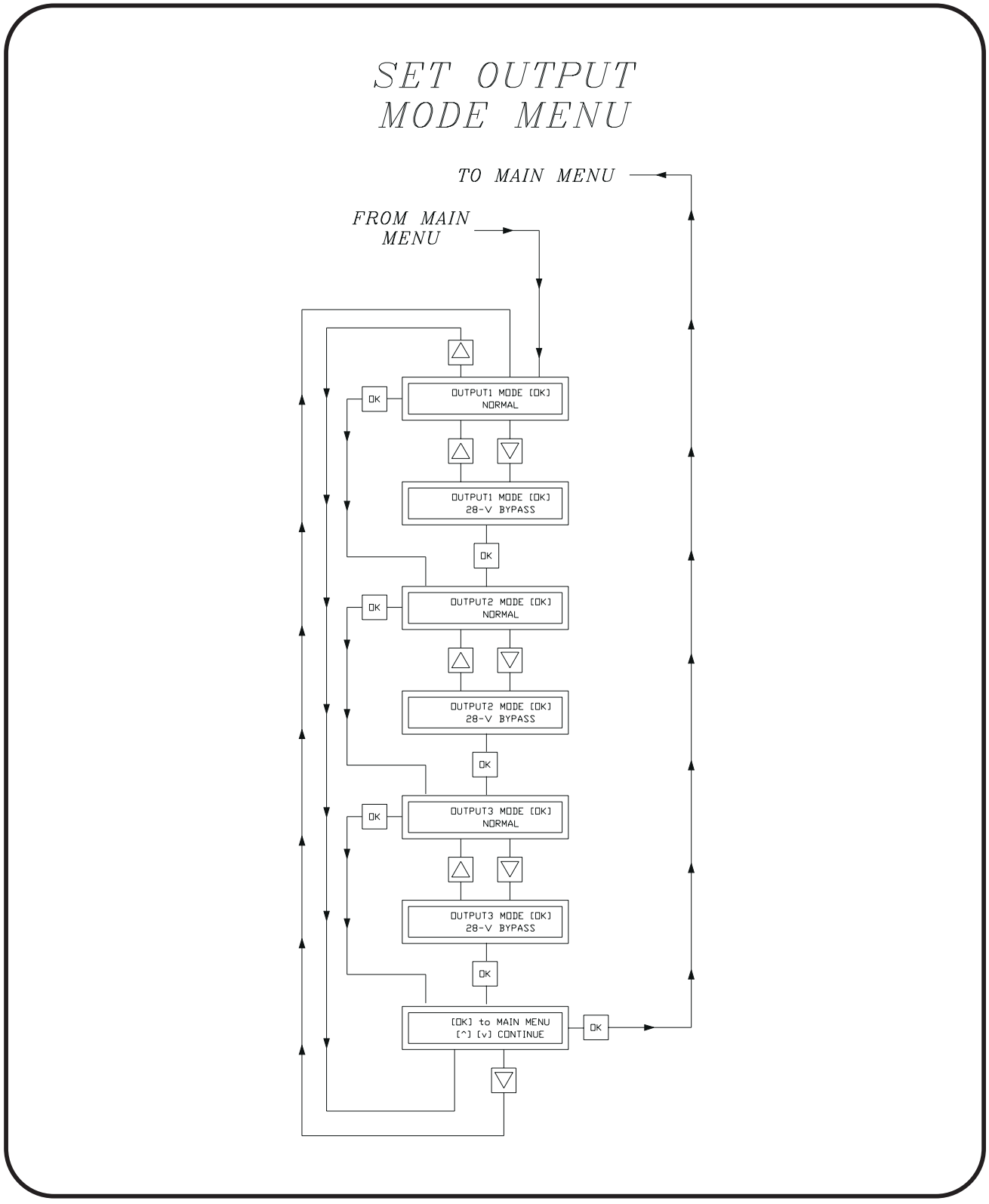


Figure 8: Set Output Mode Submenu Map

Instructions for Paralleling Two SF Converters

1. Purpose

The purpose of these instructions is to explain the factors and considerations for parallel operation of two solid state frequency converters. Except where noted, the operation is identical for 90-kVA, 125-kVA and 180-kVA "SF" converters. Paralleled systems are tested at the factory before shipment to customers.

2. Technical Definition of Paralleling System

Hobart Ground Power uses a variant of hard paralleling as the basis for operating two SF converters in parallel. By definition, hard paralleling means that one SF converter is designated as the Master while the other SF converter is the Slave. In a dedicated Master/Slave situation, the Master unit will always accumulate more running hours than the Slave.

Hobart has developed its paralleling system so that the first SF converter turned ON is the Master. Since either SF converter can be a Master, the converters can be operated so that both converters accumulate running hours at an even pace.

The Hobart paralleling system works best under the following conditions:

Both SF converters have the same power (kVA) rating, and similar date of construction.

Both SF converters are located within 25 feet (8 meters) of each other.

Input power for operation of both SF converters comes from the same place on the power grid.

Any differences in the SF converters will cause circulating current to flow between them. By meeting the above conditions, the user will minimize circulating current. Circulating current is an exchange of real and/or reactive power between the SF converters (instead of the load). Real power flow is only troublesome during no-load conditions; reactive power flow is only troublesome during full-load conditions. Excessive circulating current can limit the amount of available power for loads (aircraft), and must be limited.

3. Explanation of Parallel Operations

a. General

The first converter must be manually started from the front panel. It will remain on until it is manually stopped or a fault is detected. The second converter will be automatically started and stopped by the first converter, depending on the load.

In usual operation, the first converter ON becomes the master. It runs by itself until its output power level reaches 90% of rated load. When the Master nears this output power level, it requests that the other converter come on and share the load. The second converter will ramp-up (takes 5 seconds), then phase lock (2 seconds), and then be brought on-line as the Slave converter. The two converters are now in parallel, and are both providing power to the load.

The first converter will not trip off from overload in less than 10 seconds (at 200% or greater load), so the chance of overloading the first converter is extremely small.

When the Master senses that the load demand has fallen below a specific load point, the Master sheds the Slave converter by commanding it to turn OFF, and the master takes all the load itself.

Specifically, the Master provides its signals to the Slave. The Slave then replaces its internal signals with those from the Master. This ensures that the converters stay synchronized.

Each SF converter in a paralleled system has a Parallel PC Board (A220) attached to the Modulator PC Board (A2). The SF converters parallel boards are linked together by five pairs of fiber-optic cables. These cables allow the converter to operate in parallel. Four control signals are passed over four pairs of fiber-optic cables. The fifth pair of fiber-optic cables provides a communication path between the two SF converters. These signals allow the converters to synchronize their power flow.

If the converters are never turned OFF, the Master converter will always be the Master converter, and it will accumulate more running hours than the Slave.

Hobart recommends that the user should periodically alternate the Master and Slave converters. The converters will then wear evenly, and, when necessary, be rebuilt or replaced together. This ensures that the converters will be as similar as possible, and will minimize the circulating current between the converters.

b. Operating Strategies

There are two operating strategies for using paralleled converters: either the Slave converter will be turned ON by the Master when needed, or both converters will be ON all day. (See Table 1).

(1) Slave Converter Turned ON by the Master When Needed

This method requires the user to turn ON the Master converter ONLY.

a. Advantage

- Less power is consumed by the converters.

b. Disadvantages

- It takes about 5 seconds for the Slave converter to ramp-up and come on-line when the Master commands the Slave to turn on.
- If the Master converter faults, the Slave converter does not automatically turn on, so the user will have to start the Slave converter manually.

(2) Operation With Both Converters ON all Day

To operate the paralleled converters in this method, the user starts both converters. The first converter ON will be the Master. The Slave converter will remain ON until the user turns it off.

a. Advantages

- More power is continuously available.
- The Slave converter is always ready to take over if the Master converter faults.

b. Disadvantages

- Running both converters continuously will use 2-kW of standby load.
- With the higher power available during NBPT event, there is a potential for damage to the aircraft if a fault occurs during the NBPT event.

Parallel Method and Fault Correction	
Mode 1:	Master always on, slave started only when extra power is needed. Slave unit will shut down when extra power no longer required.
Operator Set-up:	Start one unit from front panel. Unit is master.
Mode 2:	Master and slave always on.
Operator Set-up:	Start one unit from front panel. Unit becomes master. Start the other unit from front panel. That unit becomes slave.
Machine Faults:	
Mode 1:	If the master faults or is shut off by the front panel control while the slave is running, the slave will automatically take-over and become the master. The old master (which faulted) will not restart (it will be 'locked out' from restarting) when extra power is needed because it has a fault and requires service. If the slave faults or is shut off by the front panel while it is running, it will be locked out of restarting.
Mode 2:	If the master faults or is shut off by the front panel control while the slave is running, the slave will automatically take-over and become the master. The old master (which faulted) will be 'locked out' from restarting. If the slave faults or is shut off by the front panel while it is running, it will be locked out of restarting.
Lockout Clearing:	The lockout is cleared automatically when either: (a) the master unit is turned off, (b) when AC mains power is removed from the faulted unit, (c) or when the unit is restarted from the front panel. The lockout-clearing methods must be done by an operator who is physically near the faulted unit; the operator will see the red "fault" indicator on the faulted unit and should call maintenance personnel to check the faulted unit. If a slave's fault is cleared by method c), the units will enter Mode 2 paralleling.

Table 1: Explanation of Operating Strategies

4. Installation and Operation

a. Wiring Considerations

(1) Isolation of Converter Mains for Converter Input

The customer must isolate converter mains (50/60-Hz power) with disconnect switches or circuit breakers. Both disconnect switches or circuit breakers should be fed from the same 50/60-Hz power source (same transformer, or tied into the grid at the same point).

WARNING

DO NOT jumper the outputs together inside either converter. The con-converter outputs must be wired DIRECTLY TO THE DISTRIBUTION PANEL. The contactor output bus bars are not rated to carry twice the current of an individual converter, and the output currents wouldn't balance.

(2) Capacity of output Terminal Lugs on Distribution Panel(s)

The Hobart distribution panel(s) have terminal lugs that require a 1/2" Allen wrench. The maximum cable size that the terminals will accept is #500 MCM (240 mm²).

(3) Wiring Outputs of 125-kVA and 180-kVA Converters

For 125-kVA and 180-kVA converters, two output contactors are used in each converter. Therefore, seven cables from each converter will be tied into the distribution system; three cables each (A, 8, and C) from the two output contactors, and one neutral (N) cable per converter. Thus the two converters would require a total of 14 output cables (7 cables X 2).

These converters can be connected using either one or two distribution panels, as shown in Figures 1 an 2 respectively. Cables for these converters should be #4/0 THHN (90ºC), or 250 MCM THW (75ºC), or 120mm² (75ºC or higher).

(4) Wiring Outputs of 90-kVA Converters

For 90-kVA Converters, only one output is needed per converter. Thus, only a total of eight (8) cables are required. Each converter needs four cables (One cable each for Phases A, B, C, & N). Cables for these converters should be #4/0 THHN (90ºC), or 250 MCM THW (75ºC), or 120mm² (75ºC or higher).

(5) Conduit for Fiber-Optic Cable

For the converters, 10 meters of fiber-optic cable assembly (Hobart Part No. 285695) are required. The customer must provide 3/4" or 1“ conduit between the converters for the cable.

The fiber-optic cables have been precut and tagged. Do not trim or strip. Left over cable may be neatly looped in either unit.

b. Converter Protection:

Each converter maintains its own protection system. The protection includes the ADCS, Load Control Board, Modulator Board and Driver Logic Boards. The usual signals are monitored: output over/under voltage, output overload, input under/over voltage, internal power supplies, board failures, and so on.

c. Maintenance Interlock

A “parallel-disable” switch is located inside the front door of the converter. This is the standard pin-locked maintenance switch used in output panels, distribution panels, etc. When this switch is set, the converter will not respond to nor generate paralleling commands. it is used during maintenance

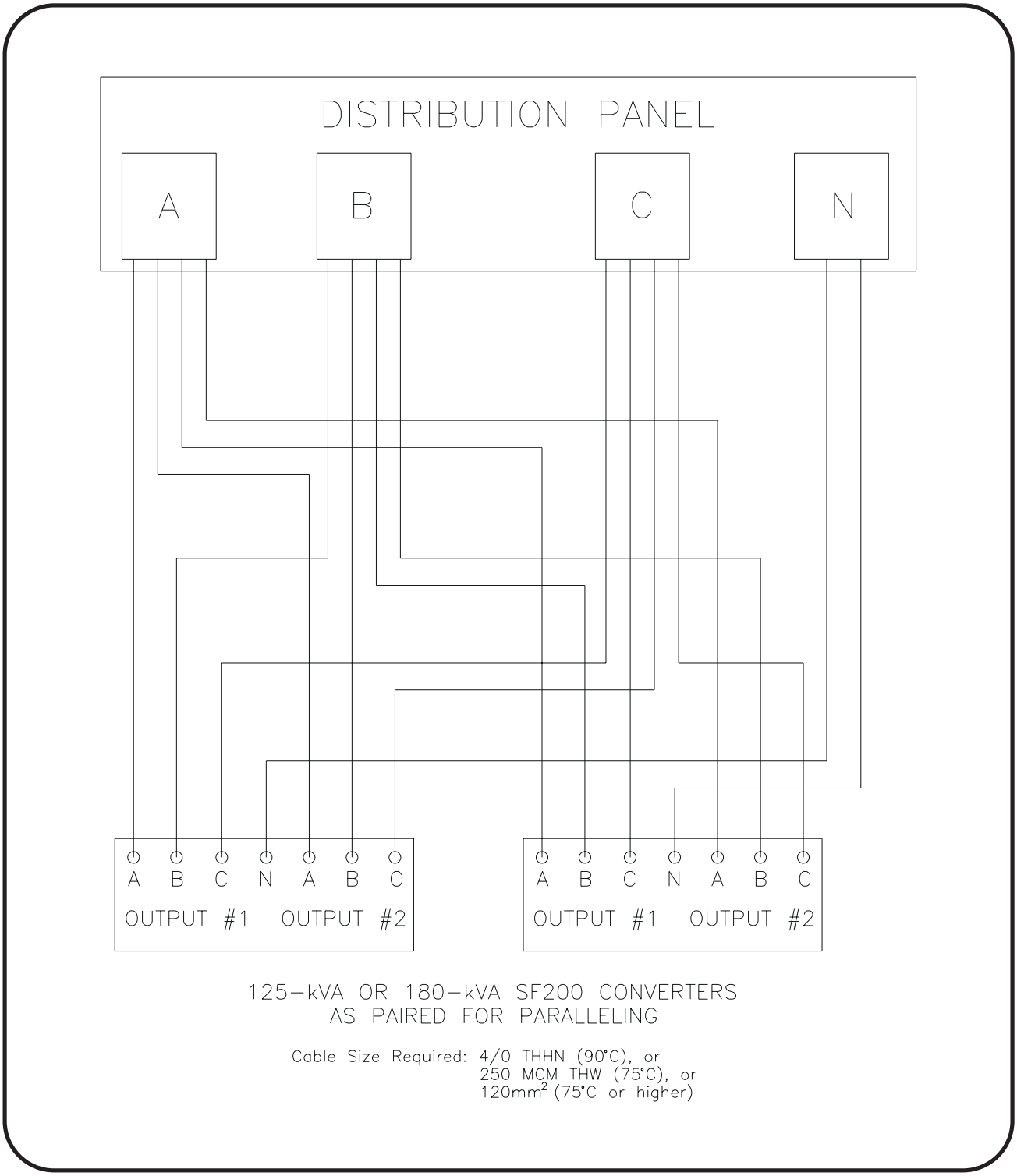


Figure 1: Output Connections for Paralleling
125-kVA or 180-kVA SF Converters
(One Distribution Panel)

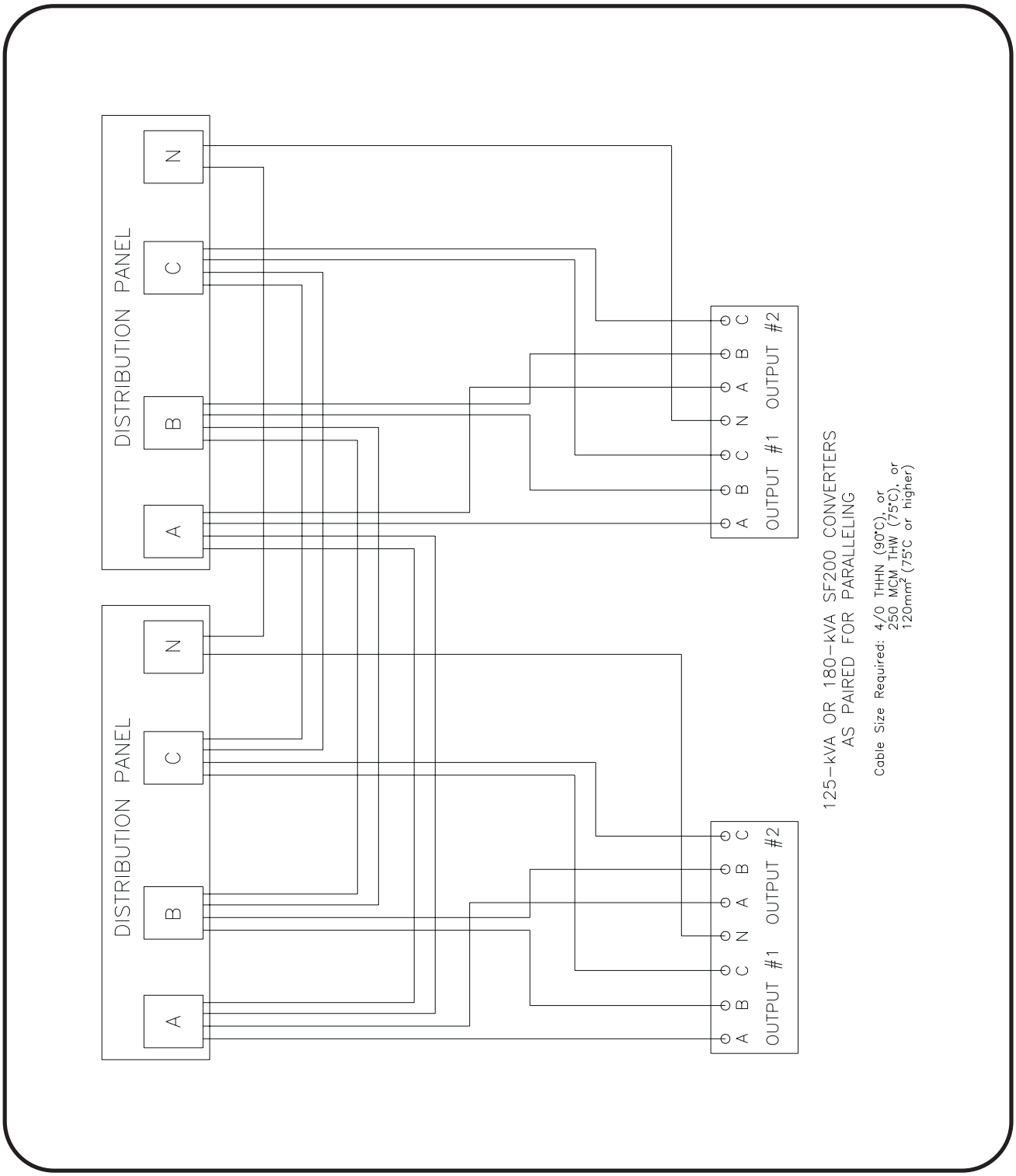


Figure 2: Output Connections for Paralleling
125-kVA or 180-kVA SF Converters
(Two Distribution Panel)

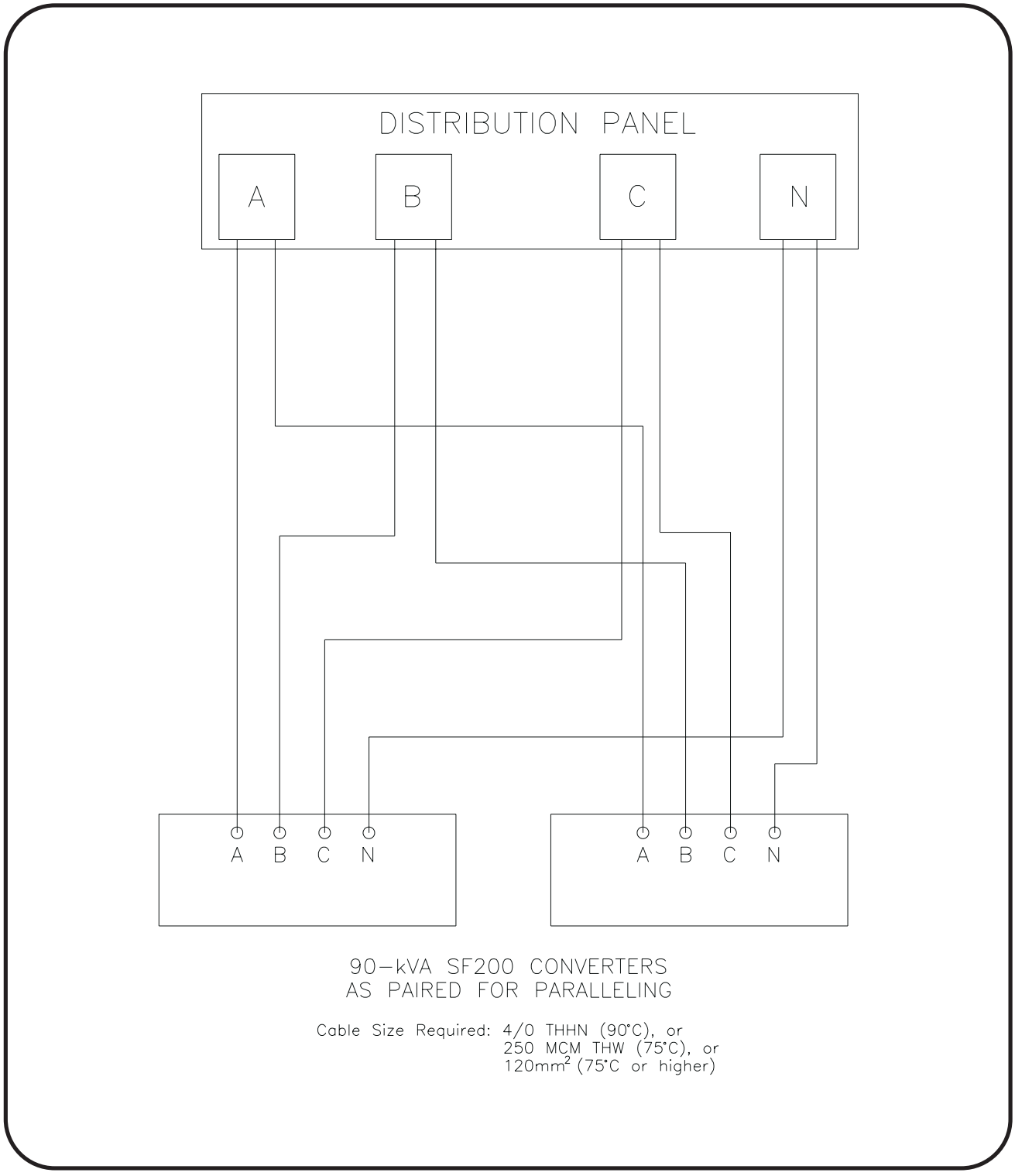


Figure 3: Output Connections for Paralleling
90-kVA SF Converters
(One Distribution Panel)

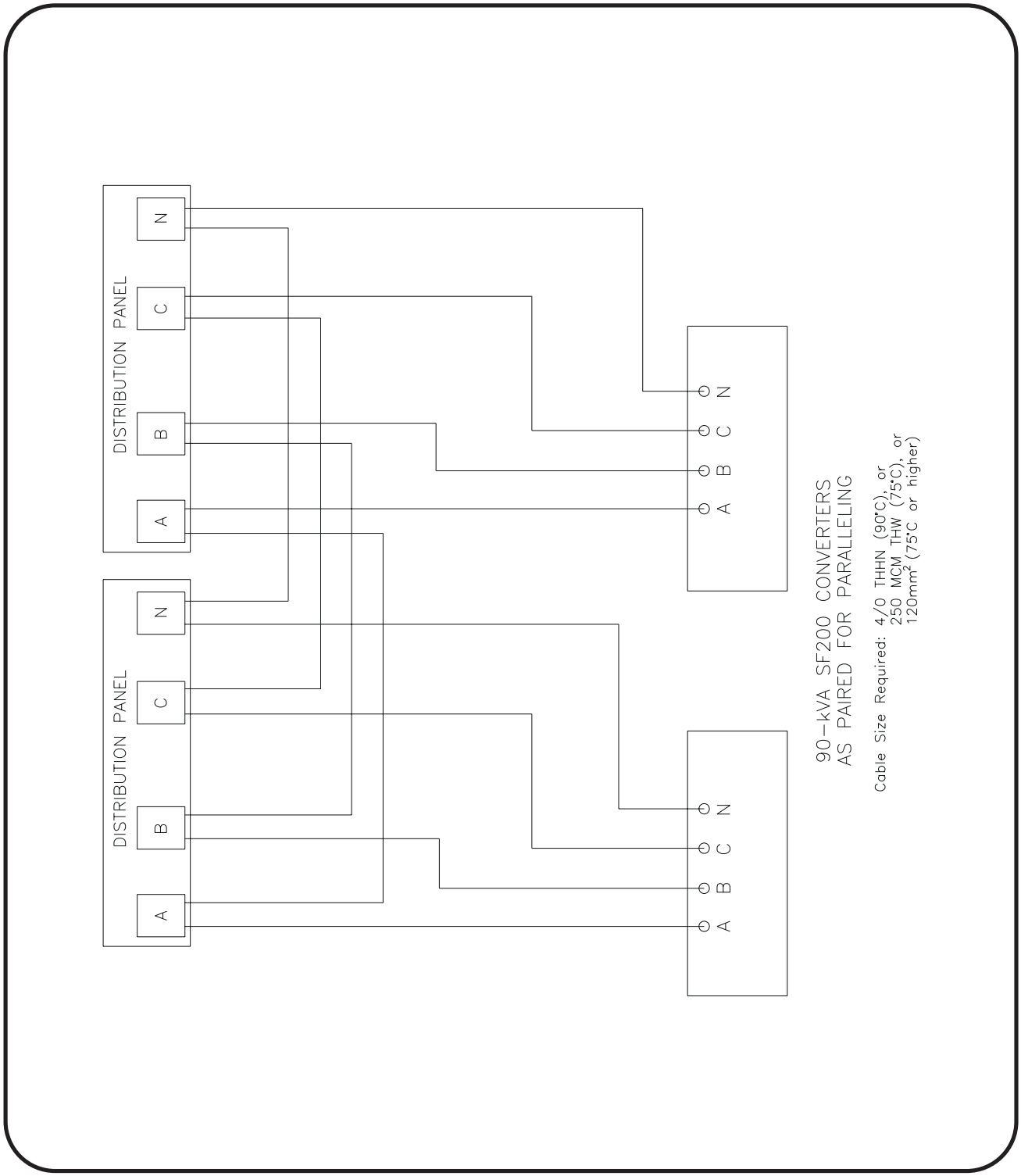


Figure 4: Output Connections for Paralleling
90-kVA SF Converters
(Two Distribution Panel)

d. NBPT Operation During Paralleling

NBPT operation will be approximately the same as normal NBPT operation. There are two major caveats, however.

(1) A single unit with both outputs tied together through the paralleling bus has 1/2 the sensitivity of a single output unit: the sensed output current is divided by two because the output current is split between both outputs. The NBPT levels will be twice as high as they are normally.

(2) Two units in parallel look like a machine with 1/4 sensitivity since output current is divided among 4 outputs (2 in each machine). The NBPT trip levels will be VERY high. The converters will not be damaged, but will not offer as much protection for the aircraft.

In summary, the paralleled converters will be a much stiffer source than a single point-of-use converter, and higher circulating currents during NBPT will be observed.

e. Voltage transients during parallel on & off operation:

When the second unit is either paralleled or de-paralleled, there will be a small voltage transient on the 400-Hz bus. It is caused by simple physics, and cannot be eliminated in a hard-paralleled system. The system transient will be 10 V maximum and last for 20 ms maximum.

f. Voltage transients during master faults:

There will be a significant voltage transient if the master faults off while paralleled. The slave will pick up the load using its own voltage reference and set-point. The slave tracking system is designed to produce 90-135 V during the fault transient. The output voltage will be restored to a normal voltage within 30 ms. This transient is designed to be within the transient limits for normal operation according to MIL-STD-704E.

5. Service Information

If you have any questions concerning your **Hobart Ground Power Division** equipment, you are invited to contact our **Service Department** by mail, telephone or FAX.

Write:	Hobart Brothers Company Ground Power Division 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:	(937) 332-5050 (Parts). (937) 332-5060 (Service)
FAX:	**(937) 332-5335 (Parts)** (937) 332-5121 (Service)

Chapter 2. Servicing / Troubleshooting

Section 1. Troubleshooting

1. General

The troubleshooting information provided in this section is limited to procedures for determining the cause of flags and alarms, and for restoring the converter to operation after a fault develops which shuts off the unit. For this purpose, a diagnostic table is provided in Paragraph 4.

All calibration, service, and repair is to be done by Hobart Brothers Service Department personnel, authorized distributors of Hobart Brothers ground power equipment, or trained, qualified electronic technicians.

2. ADCS Monitoring Features and Protection

The Hobart PoWerMaster® Advanced Diagnostic Control System (ADCS) performs complete diagnostic testing upon each startup and continuous monitoring of all critical circuits and operating electrical values. If the ADCS senses a problem with one of the circuits or if one of the electrical values exceeds its safe operating limit, the ADCS will indicate an alarm and allow the converter to continue operation or will indicate a fault and will shut the converter down, depending on the severity of the condition.

a. Flags, Alarms, and Faults

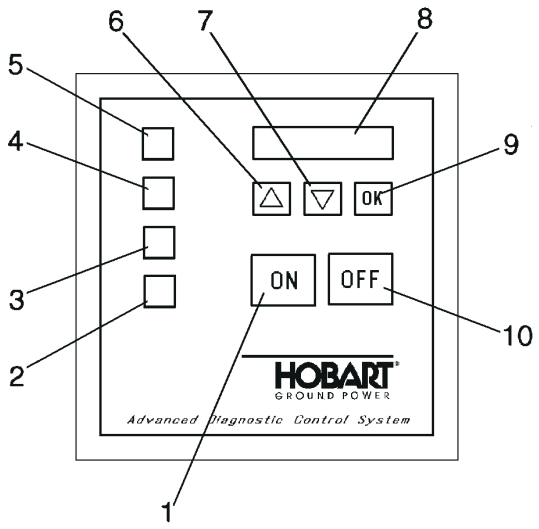
(1) **Flags** indicate a condition that does not need immediate attention, that does not present a safety hazard or denote possible damage to the aircraft or the converter; the operator may remedy the condition whenever it is most convenient. If the ADCS sensed a flag, an appropriate message will be stored in the current operational cycle data record for later review *(see Section 1-3, Paragraph* 3.f.*),* otherwise, no other indication of the flag will be given.

(2) **Alarms** are indicated when any of the alarm limits are exceeded. These limits are preset at the factory. An alarm indication signifies a condition that may soon need operator attention, but is not yet severe enough to indicate a fault and shut the converter down. If the ADCS senses an alarm, the yellow ALARM lamp *(4, Figure 1)* on the control panel will illuminate, an abbreviation of the electrical value which has exceeded its alarm limit will appear in the upper left corner of the control panel display *(8, Figure 1)*, and an appropriate alarm message will be stored in the current operational cycle data record for later review.

(3) **Faults** result when any of the fault limits are exceeded, when an internal problem occurs, or under certain conditions that would cause injury to personnel or damage to an aircraft or the converter. These limits are preset at the factory. A fault indication signifies a condition that is severe enough to discontinue all output power and shut the converter down. An alarm condition may become a fault if the cause is not remedied. If a fault is sensed, the ADCS will shut the converter down, the red FAULT lamp *(3, Figure 1)* will illuminate, an appropriate fault message will appear in the display, and this message will be stored in the current operational cycle data record for later review.

For example: The converter is operating and delivering power to an aircraft when the input voltage between phase A and B (Viab) begins to rise. When Viab exceeds the alarm limit of 5%, the ALARM lamp on the control panel will illuminate, Viab will appear in the upper left corner of the display, and an appropriate alarm message will be stored in the current operational cycle data record for review later.

If the voltage (Viab) continues to rise and exceeds the fault limit of 10%, the converter will discontinue output power and shut down, the red FAULT lamp will illuminate, an appropriate fault message will appear in the display, and this message will be stored in the current cycle data record for review later.



1. ON button
2. OUTPUT POWER lamp (green)
3. FAULT lamp (red)
4. ALARM lamp (yellow)
5. INPUT POWER lamp (green)
6. Up button
7. Down button
8. Two-line alpha-numeric display
9. OK button
10. OFF button

Figure 1: Control Panel

b. Alarm and Fault Sensing and Limits

WARNING

To prevent injury to personnel or permanent damage to the aircraft or converter, make certain that calibration factors are correct.

Alarm and fault limits are described below and listed in Table 1. As stated in Section 2-2, Paragraph 3.c., alarm and fault limits are based on the calibration factors entered throught the Set System Clock and Calibration submenu. If the calibration factors are incorrect, alarms and faults may not be sensed in time to prevent injury to personnel or permanent damage to the aircraft or converter.

(1) Input Voltage

(2) Input phase (line-to-line) voltage is monitored with a resolution of 1-V AC. An alarm is indicated if the phase voltage exceeds 5 percent of its rated value. A fault results if the input voltage exceeds 10 percent of its rated value for 1 second or more.

(3) Output Voltage

Output voltage is monitored with a resolution of 0.1-V AC. An alarm is indicated if the output voltage drops below 112-V AC or exceeds 122-V AC. A fault results if the voltage drops below 100-V AC for 7 seconds or exceeds 125-V AC for 1 second. Additionally, a fault results if the voltage difference between any two output phases is greater than 3-V AC.

(4) Output Current

The output current is measured in each line and the neutral line with a resolution of 1-A. Output current overload limits are based on the total of output current for all available output, and on individual outputs. Neutral current is monitored independently.

- An **alarm** is indicated if the **total output current** exceeds 100 percent of full rated load.
- An **alarm** is indicated if the **current for an individual output** exceeds its rated load.
- A **fault** results if the **total output current** exceeds 125 percent for 10 minutes.
- A **fault** results if the current for an **individual output** exceeds 125% for 10 minutes.
- A **fault** results if the **total output current** exceeds 150 percent for 30 seconds.
- A **fault** results if the current for an **Individual output** exceeds 150 percent for 30 seconds.
- A **fault** results if the **total output current** exceeds 200 percent for 10 seconds.
- A **fault** results if the current for an **individual output** exceeds 200 percent for 10 seconds.
- A **fault** results if the **output is shorted**.
- A **fault** results if **neutral current** exceeds 25 percent of full rated load for 1 second.

(5) Output Frequency

Output frequency is monitored with a resolution of 1-Hz. A fault results if output frequency exceeds 5 percent (380 to 420-Hz) for 1 second or more. There are no alarm limits for output frequency.

(6) Internal +5-V DC Power Supply

Since the internal +5-V DC power supply provides power to the ADCS, no monitoring of this supply can be provided. If this supply exceeds its operating limits, the ADCS will not work and will not be able to record this fault.

(7) Internal 12-V DC Power Supplies

The 12-V DC driver power supply voltage is monitored to a resolution of 0.1-V DC. For each supply, an alarm is indicated if the voltage exceeds 5 percent (11.4 to 12.6-V or -12.6 to -11.4-V), and a fault results if the voltage exceeds 10 percent (10.8 to 13.2-V or -13.2 to -10.8-V) for 1 second or more.

(8) Internal Component Monitoring and Protection

a. The ADCS monitors the status of the 6 driver boards, the 6 driver logic boards, the 12 power modules, the internal clock, and various other PC boards. A fault results if a problem develops.

b. A fault results if there is a trip of any of the four thermal switches in the converter.

(9) Additional Monitoring

A fault results if input power is lost.

Value	Resolution	Alarmt Limits	Fault tLimits
Input Vtoltage	1-V	344 - 377-V AC LO 483 - 506-V AC HI	< 342-V AC > 508-V AC
Output Voltage	0.1-V	Below 112–V AC or above 122-V AC.	
Output Current, Phase	1-A	Above 100 percent rated load	+125 percent rated load for 10 minutes +150 percent rated load for 20 seconds +200 percent rated load for 10 seconds Shorted output
Output Current, Neutral	1-A	25% of rated load	+25 percent rated load for 1 second
Output Frequency	1-Hz	None	5 percent (380 to 420-Hz)
+5-V Power Supply Voltage		None	None
+12-V Power Supply Voltage	0.1-V	5 percent (11.4 to 12.6-V)	10 percent (10.8 to 13.2-V)
–12-V Power Supply Voltage	0.1-V	5 percent (-12.6 to -11.4-V)	10 percent (-13.2 to -10.8-V)

Table 1: Alarm and Fault Limits

a. On a single output converter, a fault results if 28-V DC interlock signal (EF signal) is lost while the unit is delivering output power to an aircraft (e.g., if the output cable is accidently disconnected). On a multiple output machine, a flag is indicated if one EF signal is lost while at least one other EF signal is present; a fault results if all EF signals are lost while the unit is delivering output power.

b. A fault results if either the front or back converter door is opened.

3. Location: Driver & Driver Logic PC Boards, Power Modules, Rectifier Modules

For operator convenience in troubleshooting and repairing the converter, the illustration on the following page, (Figure 2), shows the location of specific driver PC boards, driver logic PC boards, power modules and rectifier modules on the converter unit.

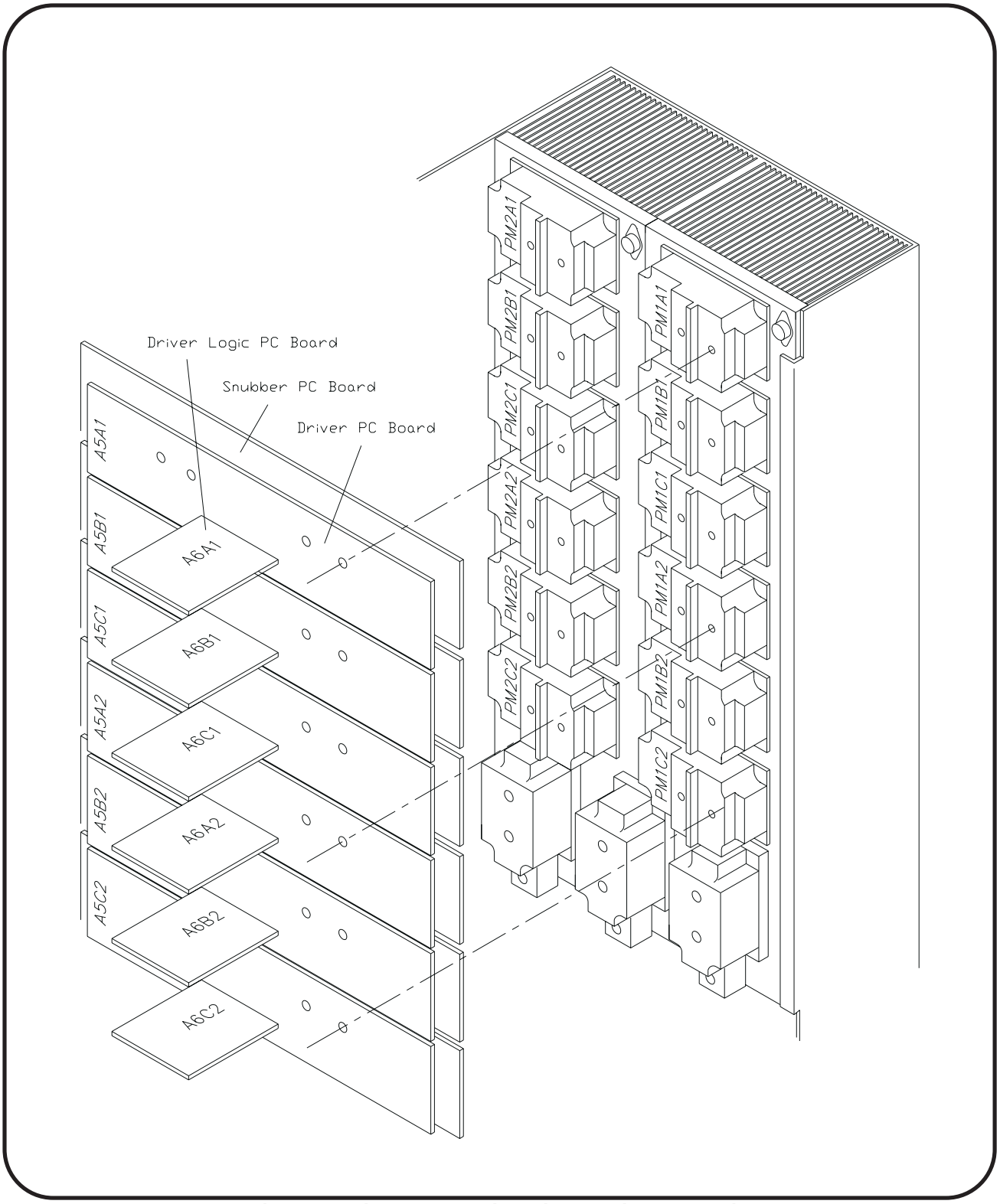


Figure 2: Driver PC Boards, Driver Logic PC Boards, Power Modules and Rectifier Modules

4. Diagnostic Table

After Figure 2, The following diagnostic table provides a quick reference for determining the cause of flags and alarms, and for restoring the converter to operation after a fault develops which shuts off the unit. The table is divided into four sections: general troubleshooting, fault messages, alarm messages, and flag messages. The messages in each section are listed in alphabetical order.

Column 1 shows the symptom, or a flag, alarm, or fault message, exactly as it appears in the control panel display. Column 2 provides a description of what the message signifies. Column 3 lists possible causes of the symptom or message in column 1. Column 4 describes how to determine the exact cause of the symptom and possible corrective actions to restore the converter to normal operations. Finally, column 5 indicates the paragraph which provides detailed procedures regarding the corrective actions listed in the previous column. Unless otherwise noted, all paragraphs listed in column 5 are within this section.

When multiple possible causes (column 3) are listed for a single symptom or message (column 1), the causes are given in decreasing order of probability. In other words, the first possible cause listed is also the most likely cause of that symptom, while the last cause is the least likely.

Note that this table is a quick reference only, it does not provide complete information for solving the problems listed in it. Always refer to the detailed procedures given in Paragraph 5., Troubleshooting Procedures.

Diagnostic Table

Symptom / Message	Description	Possible Cause	Corrective Action	Refer to
General Troubleshooting				
Control panel lamps and display do not illuminate		Input power is not present	Determine if input power is available at the converter.	
		Input voltage fuses blown	Check fuses. Replace if necessary.	Chapter 3
		Power supply PC board inoperative	Replace.	Page 37, Paragraph 5, n
INPUT POWER lamp illuminates, display remains dark		Loose cable between ADCS and display module	Check cable between ADCS and display module	Chapter 3
		ADCS PC board inoperative	Replace.	
Fault Messages				
FREQ < 380 Hz	Output frequency is less than fault limit	Modulator PC board inoperative.	Restart converter; if condition reoccurs, replace modulator PC board.	Page 23, Paragraph 5, a
FREQ > 404 Hz	Output frequency is greater than fault limit	Modulator PC board inoperative.	Restart converter; if condition reoccurs, replace modulator PC board.	Page 23, Paragraph 5, a

Symptom / Message	Description	Possible Cause	Corrective Action	Refer to
INTERLOCK TRIP CHECK DOORS	A door interlock switch has been tripped	One or both of the converter doors are open	Close and latch converter doors; restart unit.	Page 23, Paragraph 5, b
		Door interlock switch(es) faulty	Check door interlock switch(es) S2 and S3 for proper operation. Replace if necessary.	Page 23, Paragraph 5, b
INTERNAL PROBLEM CHECK A/D INPUTS	Problem with analog to digital converters on ADCS board	ADCS board inoperative	Restart converter; if condition reoccurs, replace ADCS PC board.	Page 24, Paragraph 5, c
INTERNAL PROBLEM FIBER OPTICS	Optically connected PC boards not communicating properly	Fiber optic cable(s) disconnected or damaged	Repair and/or reconnect cable(s).	Page 24, Paragraph 5, d
		Load control PC board inoperative	Replace.	Page 24, Paragraph 5, d
		Modulator PC board inoperative	Replace.	Page 24, Paragraph 5, d
		DC bus PC board inoperative	Replace.	Page 32, Paragraph 5, g

Symptom / Message	Description	Possible Cause	Corrective Action	Refer to
Iout OVERLOAD	Output current greater than fault limits	Aircraft load greater than converter or output cable power rating	Turn off unnecessary accessories on aircraft; restart converter.	Page 28, Paragraph 5, e
		Shorted output or output cable	Replace cable.	Page 29, Paragraph 5, e
IoN > LIMIT	Neutral line current is greater than fault limit	Unbalanced load	Balance aircraft load on each phase.	Page 29, Paragraph 5, f
		Open or shorted output cable	Replace cable.	Page 29, Paragraph 5, f
LOW BUS VOLTAGE CHECK FUSE F10	Voltage on DC bus too low for power delivery	DC bus charging fuse F10 blown	Replace.	Page 29, Paragraph 5, g
		Control transformer fuses blown	Replace.	Page 31, Paragraph 5, g
		Input voltage low	Check input voltage between each phase. If it is low, correct the external cause. If it is within nominal values, check converter calibration.	Page 3, Paragraph 5, g

Symptom / Message	Description	Possible Cause	Corrective Action	Refer to
LOW BUS VOLTAGE CHECK FUSE F10	Voltage on DC bus too low for power delivery	DC bus PC board inoperative	Replace	Page 32, Paragraph5, g
		Charging contactor K2 inoperative	Check charging contactor K2 for proper operation. Replace if necessary.	Page 31, Paragraph 5, g
MODULATOR FAULT REPLACE PCB A5A1	Driver PC board A5A1 (phase A, inverter 1) has failed	Check all connections	Restart converter. If condition recurs, replace driver PC board A5A1 and snubber PC board.	Page 35 Paragraph 5, i
MODULATOR FAULT REPLACE PCB A5A2	Driver PC board A5A2 (phase A, inverter 2) has failed	Check all connections	Restart converter. If condition recurs, replace driver PC board A5A2 and snubber PC board.	Page 35 Paragraph 5, i
MODULATOR FAULT REPLACE PCB A5B1	Driver PC board A5B1 (phase B, inverter 1) has failed	Check all connections	Restart converter. If condition recurs, replace driver PC board A5B1 and snubber PC board.	Page 35 Paragraph 5, i
MODULATOR FAULT REPLACE PCB A5B2	Driver PC board A5B2 (phase B, inverter 2) has failed	Check all connections	Restart converter. If condition recurs, replace driver PC board A5B2 and snubber PC board.	Page 35 Paragraph 5, i

Symptom / Message	Description	Possible Cause	Corrective Action	Refer to
MODULATOR FAULT REPLACE PCB A5C1	Driver PC board A5C1 (phase C, inverter 1) has failed	Check all connections	Restart converter. If condition recurs, Replace driver PC board A5C1 and snubber PC board.	Page 35 Paragraph 5, i
MODULATOR FAULT REPLACE PCB A5C2	Driver PC board A5C2 (phase C, inverter 2) has failed	Check all connections	Restart converter. If condition recurs, Replace driver PC board A5C2 and snunner PC board.	Page 35 Paragraph 5, i
MODULATOR FAULT REPLACE PCB A6A1	Driver logic PC board A6A1 (phase A, inverter 1) has failed	Check all connections	Restart converter. If condition recurs, Replace driver logic PC boardA6A1.	Page 35, Paragraph 5, j.
MODULATOR FAULT REPLACE PCB A6A2	Driver logic PC board A6A2 (phase A, inverter 2) has failed	Check all connections	Replace driver logic PC board Restart converter. If condition recurs,A6A2.	Page 35, Paragraph 5, j.
MODULATOR FAULT REPLACE PCB A6B1	Driver logic PC board A6B1 (phase B, inverter 1) has failed	Check all connections	Restart converter. If condition recurs, replace driver logic PC board ,A6B1.	Page 35, Paragraph 5, j.
MODULATOR FAULT REPLACE PCB A6B2	Driver logic PC board A6B2 (phase B, inverter 2) has failed	Check all connections	Restart converter. If condition recurs, replace driver logic PC board A6B2.	Page 35, Paragraph 5, j.

Symptom / Message	Description	Possible Cause	Corrective Action	Refer to
MODULATOR FAULT REPLACE PCB A6C1	Driver logic PC board A6C1 (phase C, inverter 1) has failed	Check all connections	Restart converter. If condition recurs, replace driver logic PC board A6C1.	Page 35, Paragraph 5, j.
MODULATOR FAULT REPLACE PCB A6C2	Driver logic PC board A6C2 (phase C, inverter 2) has failed	Check all connections	Restart converter. If condition recurs, replace driver logic PC board A6C2.	Page 35, Paragraph 5, j.
MODULATOR FAULT REPLACE PM1A1	Power module 1A1 (top/left, phase A, inverter 1) has failed	Check all connections	Restart converter. If condition recurs, replace power module PM1A1	Page 35, Paragraph 5, k.
MODULATOR FAULT REPLACE PM1A2	Power module 1A2 (top/left, phase A, inverter 2) has failed	Check all connections	Restart converter. If condition recurs, replace power module PM1A2	Page 35, Paragraph 5, k
MODULATOR FAULT REPLACE PM1B1	Power module 1B1 (top/left, phase B, inverter 1) has failed	Check all connections	Restart converter. If condition recurs, replace power module PM1B1	Page 35, Paragraph 5, k
MODULATOR FAULT REPLACE PM1B2	Power module 1B2 (top/left, phase B, inverter 2) has failed	Check all connections	Restart converter. If condition recurs, replace power module PM1B2	Page 35, Paragraph 5, k
MODULATOR FAULT REPLACE PM1C1	Power module 1C1 (top/left, phase C, inverter 1) has failed	Check all connections	Restart converter. If condition recurs, replace power module PM1C1	Page 35, Paragraph 5, k

Symptom / Message	Description	Possible Cause	Corrective Action	Refer to
MODULATOR FAULT REPLACE PM1C2	Power module 1C2 (top/left, phase C, inverter 2) has failed	Check all connections	Restart converter. If condition recurs, replace power module PM1C2	Page 35, Paragraph 5, k
MODULATOR FAULT REPLACE PM2A1	Power module 2A1 (bottom/right, phase A, inverter 1) has failed	Check all connections	Restart converter. If condition recurs, replace power module PM2A1	Page 35, Paragraph 5, k
MODULATOR FAULT REPLACE PM2A2	Power module 2A2 (bottom/right, phase A, inverter 2) has failed	Check all connections	Restart converter. If condition recurs, replace power module PM2A2	Page 35, Paragraph 5, k
MODULATOR FAULT REPLACE PM2B1	Power module 2B1 (bottom/right, phase B, inverter 1) has failed	Check all connections	Restart converter. If condition recurs, replace power module PM2B1	Page 35, Paragraph 5, k
MODULATOR FAULT REPLACE PM2B2	Power module 2B2 (bottom/right, phase B, inverter 2) has failed	Check all connections	Restart converter. If condition recurs, replace power module PM2B2	Page 35, Paragraph 5, k
MODULATOR FAULT REPLACE PM2C1	Power module 2C1 (bottom/right, phase C, inverter 1) has failed	Check all connections	Restart converter. If condition recurs, replace power module PM2C1	Page 35, Paragraph 5, k

Symptom / Message	Description	Possible Cause	Corrective Action	Refer to
MODULATOR FAULT REPLACE PM2C2	Power module 2C2 (bottom/right, phase C, inverter 2) has failed	Check all connections	Restart converter. If condition recurs, replace power module PM2C2	Page 35, Paragraph 5, k
OUTPUT1 EF LOST	Output 1 EF signal was lost while it output 1 was delivering power	Disconnected output cable	Reconnect output cable; restart converter.	Page 35, Paragraph 5, h
OUTPUT1 NO EF	No EF signal for output 1 was present when an output 1 was turned on	Disconnected output cable	Connect output cable; restart converter.	Page 36, Paragraph 5, l
OUTPUT2 EF LOST	Output 2 EF signal was lost while output 2 was delivering power	Disconnected output cable	Reconnect output cable; restart converter.	Page 35, Paragraph 5, h
OUTPUT2 NO EF	No EF signal for output 2 was present when output 2 was turned on	Disconnected output cable	Connect output cable; restart converter.	Page 36, Paragraph 5, l
OUTPUT3 EF LOST	Output 3 EFsignal was lost while outtput 3 was delivering power	Disconnected output cable	Reconnect output cable; restart converter.	Page 35, Paragraph 5, h
OUTPUT3 NO EF	No EF signal for output 3 was present when output 3 was turned on	Disconnected output cable	Connect output cable; restart converter.	Page 36, Paragraph 5, l

Symptom / Message	Description	Possible Cause	Corrective Action	Refer to
OUTPUT1 RELAY DID NOT OPEN	Output contactor K7 did not open	Contactor faulty	Replace.	Page 36, Paragraph 5, l
OUTPUT1 RELAY DID NOT CLOSE	Output contactor K7 did not close	Contactor faulty	Connect another output to aircraft and check for proper operation. If converter operates normally, replace contactor K7.	Page 36, Paragraph 5, l
		Cable between contactor K7 and load control PC board loose or disconnected	Make sure both ends of cable are properly connected	Page 36, Paragraph 5, l
OUTPUT1 RELAY DID NOT CLOSE	Output contactor K7 did not close	Load control PC board inoperative	Replace.	Page 36, Paragraph 5, l
OUTPUT2 RELAY DID NOT OPEN	Output contactor K6 did not open	Contactor faulty	Replace.	Page 36, Paragraph 5, l

Symptom / Message	Description	Possible Cause	Corrective Action	Refer to
OUTPUT2 RELAY DID NOT CLOSE	Output contactor K6 did not close	Contactor faulty	Connect another output to aircraft and check for proper operation. If converter operates normally, replace contactor K6.	Page 36, Paragraph 5, l
		Load control PC board inoperative	Replace.	Page 36, Paragraph 5, l
OUTPUT3 RELAY DID NOT OPEN	Output contactor K5 did not open	Contactor faulty	Replace .	Page 36, Paragraph 5, l
OUTPUT3 RELAY DID NOT CLOSE	Output contactor K5 did not close	Contactor faulty	Connect another output to aircraft and check for proper operation. If converter operates normally, replace contactor K5	Page 36, Paragraph 5, l
		Load control PC board inoperative	Replace.	Page 36, Paragraph 5, l

Symptom / Message	Description	Possible Cause	Corrective Action	Refer to
OVERTEMPERATURE CHECK FANS	A thermal switch has been tripped	High ambient temperature	Check for high ambient temperature; correct, if possible. Allow converter to cool, then restart.	Page 36, Paragraph 5, m
		Fans inoperative	Allow converter to cool, then restart. Check fans for proper operation. Repair or replace, as necessary.	Page 36, Paragraph 5, m
		Airflow filters dirty	Inspect both airflow filters (located on the lower right side of the converter) for cleanliness	Chapter 2-3, Para. 2,e.
PS+12V < 10.8V	Internal +12-V DC power less than fault limit	Power supply PC board inoperative	Restart converter; if condition reoccurs, replace power supply PC board.	Page 37, Paragraph 5, n
		Input voltage fuses blown	Check fuses. Replace if necessary.	Page 37, Paragraph 5, n
PS+12V > 13.2V	Internal +12-V DC power greater than fault limit	Power supply PC board inoperative	Restart converter; if condition reoccurs, replace power supply PC board.	Page 37, Paragraph 5, n

Symptom / Message	Description	Possible Cause	Corrective Action	Refer to
PS-12V < -13.2V	Internal -12-V DC power less than fault limit	Power supply PC board inoperative	Restart converter; if condition reoccurs, replace power supply PC board.	Page 37, Paragraph 5, n
PS-12V > -10.8V	Internal -12-V DC power greater than fault limit	Power supply PC board inoperative	Restart converter; if condition reoccurs, replace power supply PC board.	Page 37, Paragraph 5, n
		Input voltage fuses blown	Check fuses. Replace if necessary.	Page 37, Paragraph 5, n
UNKNOWN FAILURE	A fault occured which the ADCS could not interpret	Unknown	Restart converter; if condition reoccurs, replace ADCS PC board. If condition reoccurs, call Hobart service.	
Viab < LIMIT	Input voltage between phases A and B is less than fault limit	Input power unbalanced or incorrect	Check and correct input power; restart converter.	Page 37, Paragraph 5, o.
		Input voltage fuses blown	Check fuses. Replace if necessary .	Page 37, Paragraph 5, o.
		Calibration factors incorrect	Calibrate input phase voltages.	Page 37, Paragraph 5, o.

Symptom / Message	Description	Possible Cause	Corrective Action	Refer to
Viab > LIMIT	Input voltage between phases A and B is greater than fault limit	Input power unbalanced or incorrect	Check and correct input power; restart converter	Page 37, Paragraph 5, o.
		Calibration factors incorrect	Calibrate input phase voltages.	Page 37, Paragraph 5, o.
Vibc < LIMIT	Input voltage between phases B and C is less than fault limit	Input power unbalanced or incorrect	Check and correct input power; restart converter.	Page 37, Paragraph 5, o.
		Input voltage fuses blown	Check fuses. Replace if necessary.	Page 37, Paragraph 5, o.
		Calibration factors incorrect	Calibrate input phase voltages.	Page 37, Paragraph 5, o.
Vibc > LIMIT	Input voltage between phases B and C is greater than fault limit	Input power unbalanced or incorrect	Check and correct input power; restart converter.	Page 37, Paragraph 5, o.
		Calibration factors incorrect	Calibrate input phase voltages.	Page 37, Paragraph 5, o.

Symptom / Message	Description	Possible Cause	Corrective Action	Refer to
Vica < LIMIT	Input voltage between phases C and A is less than fault limit	Input power unbalanced or incorrect	Check and correct input power; restart converter.	Page 37, Paragraph 5, o.
		Input voltage PC board fuses blown	Check fuses. Replace if necessary.	Page 37, Paragraph 5, o.
		Calibration factors incorrect	Calibrate input phase voltages.	Page 37, Paragraph 5, o.
Vica > LIMIT	Input voltage between phases C and A is greater than fault limit	Input power unbalanced or incorrect	Check and correct input power; restart converter.	Page 37, Paragraph 5, o.
		Calibration factors incorrect	Calibrate input phase voltages.	Page 37, Paragraph 5, o.
Vout LOW	Output voltage is less than fault limit	Aircraft load greater than converter or output power rating	Turn off unnecessary accessories on aircraft and restart converter.	Page 38, Paragraph 5, p.
Vout HIGH	Output voltage is greater than fault limit	Modulator PC board inoperative	Restart converter; if condition reoccurs, check output voltage setting.	Page 38, Paragraph 5, p.
Vout UNBALANCED	Difference of greater than 3-V between output phases	Incorrect loading at aircraft		Page 38, Paragraph 5, p.

Symptom / Message	Description	Possible Cause	Corrective Action	Refer to
WARNING DC BUS NOT DISCHARGED	The DC bus did not discharge normally	DC bus discharge resistor R16 faulty	Replace.	Page 29, Paragraph 5, g
		DC bus discharge PC board inoperative	Replace.	Page 29, Paragraph 5, g
Flag Messages				
WATCH STOPPED CHECK DATE/TIME	The internal date/time clock has stopped	Clock inadvertently stopped	Reset clock	Chapter 3
		Clock battery dead	Replace ADCS PC board.	

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5. Troubleshooting Procedures

The remainder of this section provides further explanation of the troubleshooting information given in the preceding table. When necessary, detailed testing procedures are given to help determine which of several possible components may be in need of repair or replacement. Actual removal and replacement instructions are given in Chapter 3.

Note that there are no procedures listed for testing or replacing individual components on any PC board. Inoperative PC boards cannot be repaired in the field, but must be replaced as a complete unit. PC boards may be returned to the factory for replacement. Contact Hobart Brothers service for parts and replacement instructions.

WARNING

High voltages may be present inside the converter cabibet, even when the unit is off. Exercise extreme caution when testing and replacing components or FATAL SHOCK may result.

Before testing any components inside the converter, always make certain that the DC bus is fully discharged. In certain circumstances, such as a failure of the DC bus discharge PC board, the DC bus may not be discharged when the converter shuts down. Several hundred volts may still be present at the bus.

The DC bus can be tested at the two long aluminum bars on each side of the DC capacitor bank. If the bus is not discharged, close the converter door, wait at least 15 minutes, and test it again. Do not perform any work inside the converter while the DC bus remains charged. See Figure 3 for the proper test points.

a. Output Frequency Faults

Output frequency is monitored with a resolution of 1-Hz. A fault results if output frequency exceeds 5 percent (380 to 420-Hz) for 1 second or more. Output frequency faults can be caused by sudden fluctuations in input power or output load, or may be caused by a failure of the modulator PC board. If an output frequency fault occurs, follow the procedure below to determine the cause and restore the converter to normal operation.

(1) Press the control panel OFF button to reset the converter.

(2) Restart the converter normally and attempt to deliver output power.

(3) Monitor the operation of the converter.

(4) If this fault reoccurs several times within an hour, the modulator PC board is faulty and must be replaced. For replacement procedures, see Chapter 3.

b. Door Interlock Fault

The converter is equipped with two door interlock switches: S2 on the front door and S3 on the back door. Opening either door will cause the input contactor to trip and disable the unit. Therefore both doors must be closed to operate the unit. If a door interlock fault occurs, follow the procedure below to determine the cause and restore the converter to normal operation.

(1) Make sure both the front and back converter doors are tightly closed and all six latches are fastened. To fasten the latches, turn each one clockwise with an 8 mm (5/16 inch) Allen wrench until it stops.

(2) Restart the converter normally and attempt to deliver output power.

(3) If this fault reoccurs, one or both of the door interlock switches may be faulty. To test the switches, follow these steps:

(4) Press the control panel OFF button.

WARNING

High voltages may be present inside the converter cabibet, even when the unit is off. Exercise extreme caution when testing and replacing components or FATAL SHOCK may result.

(5) Open the front and back doors by turning all three latches counterclockwise with an 8 mm (5/16 inch) Allen wrench. Exercise extreme caution while the doors is open, as high voltages may be present, even when the unit is off.

(6) Test the DC bus with a voltmeter to be sure that it is fully discharged. The bus can be tested at the two long aluminum bars on each side of the DC capacitor bank. If the bus is not discharged, close the converter door, wait at least 15 minutes, and test it again. Do not perform any work inside the converter while the DC bus remains charged. See Figure 3 for the proper test points.

(7) Check the continuity of each door interlock switch with an ohmmeter. When the doors are open, the switch contacts will also be open, and there should be approximately 100-Ω across the terminals.

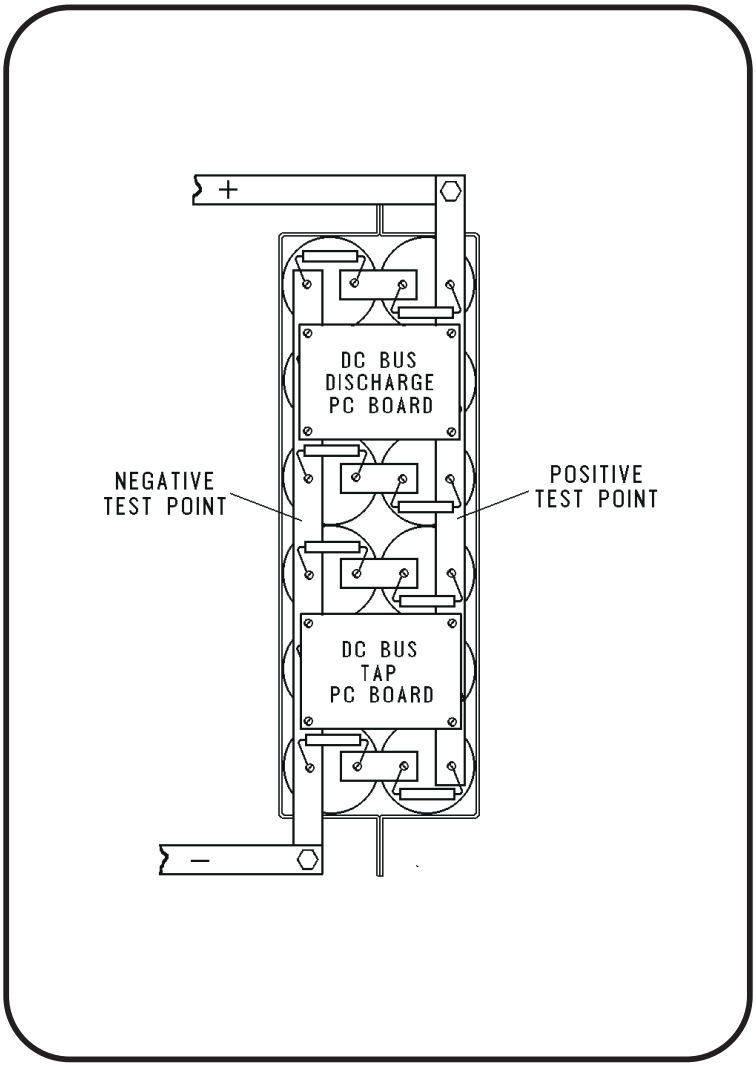


FIGURE 3: DC Bus Test Points

(8) Press and hold the white post in front of each switch and measure the continuity. The switch contacts will be closed, and there should be no resistance across the terminals.

(9) If the switches are faulty, they must be replaced. See Chapter 3 for replacement procedures.

c. A/D Input Fault

The ADCS receives status information from the various PC boards in the converter. A 32-channel analog-to-digital converter on the ADCS PC board converts the information to a format the ADCS can use. If an A/D fault occurs, the A/D converter is faulty and the ADCS PC board must be replaced. The converter will not operate until this has been done. For replacement procedures, see Chapter 3.

d. Fiber Optic Fault

The ADCS, load control, and modulator PC boards communicate with each other through three fiber optic cables. Each cable ends at either an emitter or detector mounted next to each other at one edge of each board. A fiber optic fault may be caused by damaged or disconnected fiber optic cables, a faulty load control PC board, or a faulty modulator PC board. If a fiber optic fault occurs, follow the procedure below to determine the cause and restore the converter to normal operation.

(1) Press the control panel OFF button to reset the converter.

WARNING

High voltages may be present inside the converter cabibet, even when the unit is off. Exercise extreme caution when testing and replacing components or FATAL SHOCK may result.

(2) Open the front door by turning all three latches counterclockwise with an 8 mm (5/16 inch) Allen wrench. Exercise extreme caution while the doors is open, as high voltages may be present, even when the unit is off.

(3) Bypass door interlock switch S2 by pressing the end of the white post behind the switch until it locks into place (see Figure 4).

(4) Press the control panel ON button to turn the converter on.

A pair of light emitting diodes (LED's) are mounted next to each pair of fiber optic emitters and detectors at the edge of the ADCS, load control, and modulator PC boards. These LED's illuminate to indicate whether or not the emitters (GREEN LED) and detectors (YELLOW LED) are transmitting and receiving signals properly.

To trace the path of signals being sent to and from each board, follow these steps:

(5) Locate the emitter/detector pair and the yellow and green LED's near the edge of the ADCS PC board (see Figure 5). This board is located on the reverse side of the control panel behind the front door.

(6) Observe the green LED on the ADCS PC board. It should flash every few seconds to indicate that it is transmitting data to the load control PC board.

(7) Locate the emitter/detector pair and the LED's near the edge of the load control PC board. This board is located behind the front door at center right (for horzontal mount) or at the top center of the unit (for vertical mount) (see Figure 5).

(8) Observe the yellow LED on the load control PC board. It should flash in sync with the green LED on the ADCS PC board to indicate that it is receiving data from that board. If it is not flashing, the fiber optic cable may be damaged or disconnected. See below for the proper reconnection procedure.

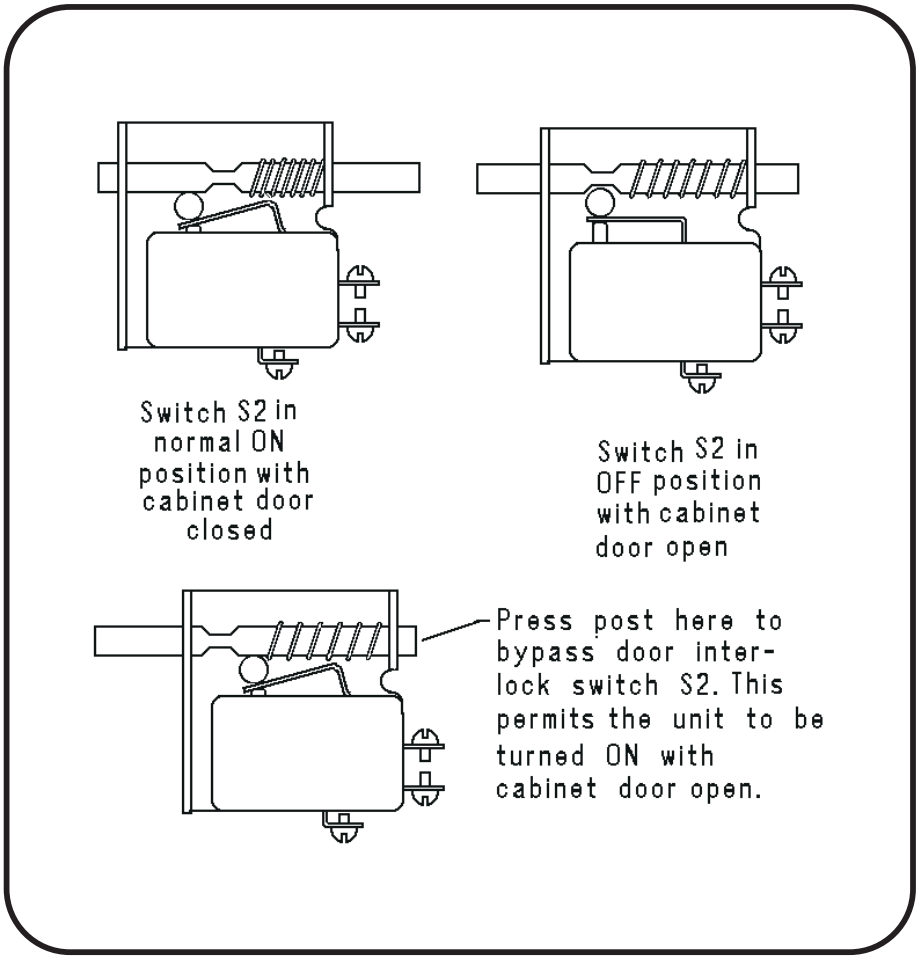


FIGURE 4: Bypassing Door Interlock Switch (S2)

(9) Observe the green LED on the load control PC board. It should flash in sync with the yellow LED to indicate that it is transmitting data to the modulator PC board. If it is not flashing, the load control PC board is faulty and must be replaced. See Chapter 3 for replacement procedures.

(10) Locate the emitter/detector pair and the LED's near the edge of the modulator control PC board. This board is the long, narrow board located behind the front door on the top panel (for horizontal mount) or on the left side panel (for vertical mount) (see Figure 7).

(11) Observe the yellow LED on the modulator PC board. It should flash in sync with the green LED on the load control PC board to indicate that it is receiving data from that board.If it is not flashing, the fiber optic cable may damaged or disconnected. See below for the proper reconnection procedure.

(12) Observe the green LED on the modulator PC board. It should flash in sync with the yellow LED to indicate that it is transmitting data to the ADCS PC board. If it is not flashing, the modulator PC board is faulty and must be replaced. See Chapter 3 for replacement procedures.

If a fiber optic cable has become damaged or disconnected, follow these steps to repair and reconnect the cable.

a. Remove each end of the damaged cable by turning the emitter and detector collets counterclockwise until the cable and collet can be removed.

b. Pull the cable from the emitter and detector and slide the collets several inches up each end of the cable to move them out of the way.

c. Carefully cut approximately 1/2 - inch from each end of the cable with a sharp knife or a razor blade. Do not use scissors or wire cutters, as these will not give a clean, square cut.

d. Strip approximately 0.1 - 0.18 inches from each end of the cable with wire strippers set for 18 awg wire.

e. Reinsert each end of the cable into the emitter and detector, slide each collet to the end of the cable, and tighten by turning clockwise.

After repairs have been performed, restart the converter normally and attempt to deliver output power.

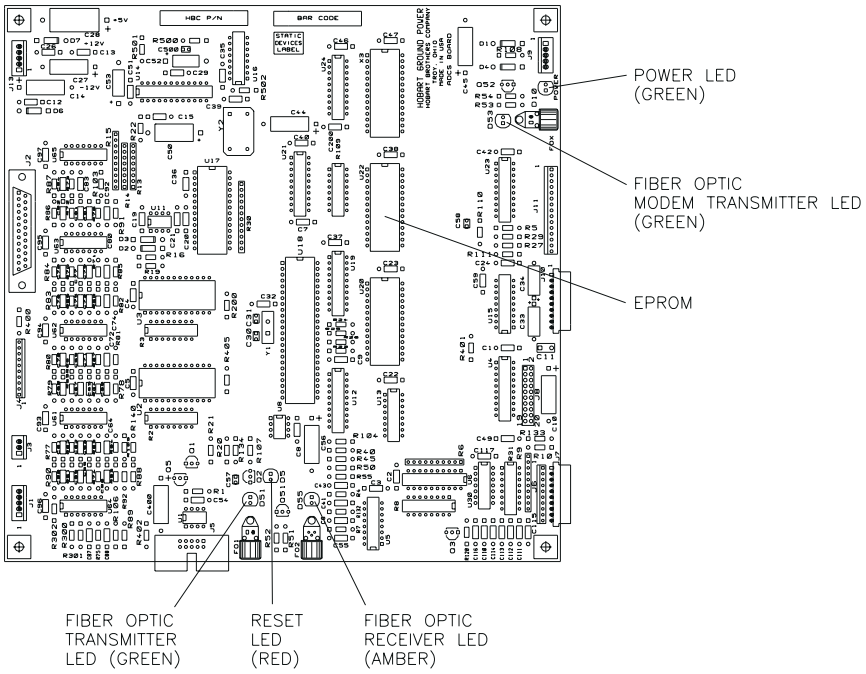
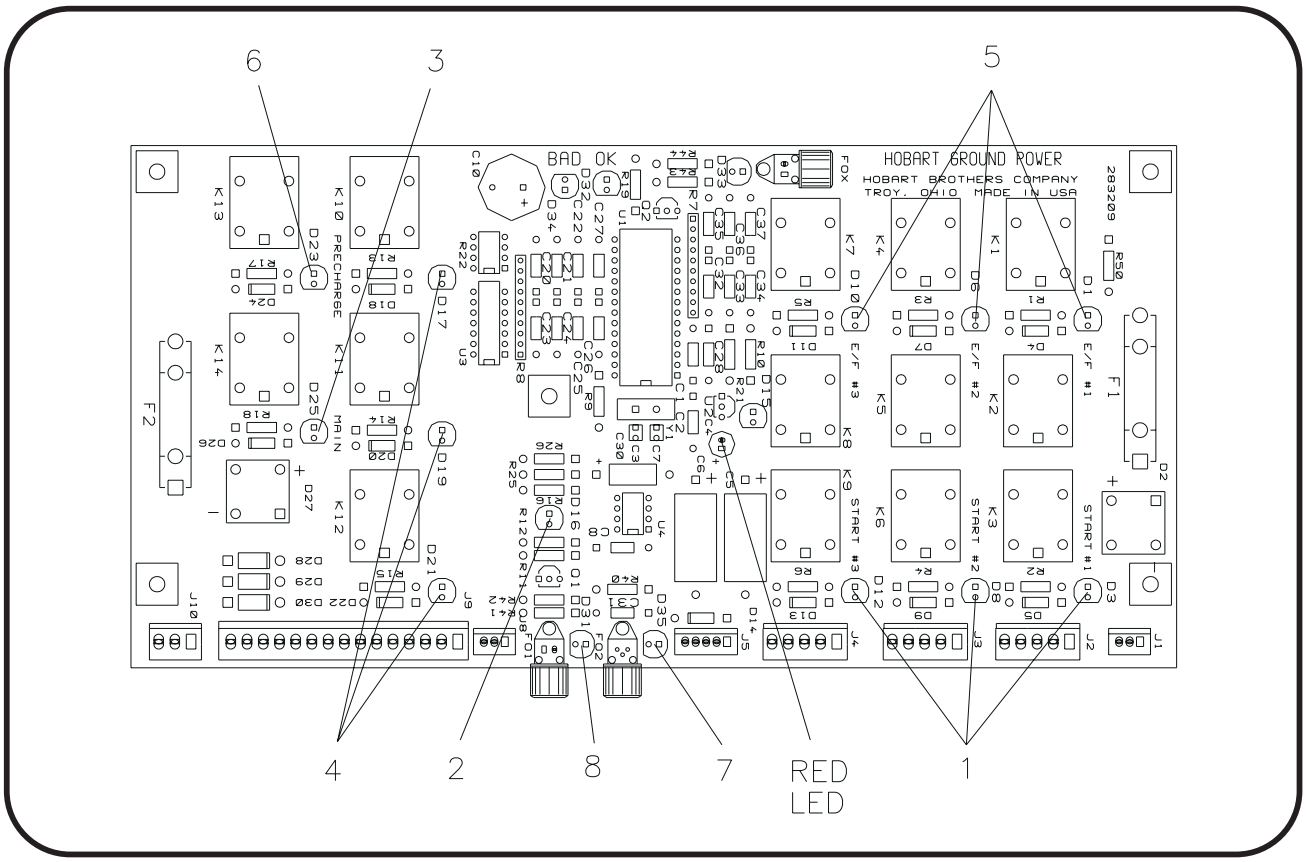


FIGURE 5: ADCS PC Board



1. Remote start (green) LEDs
2. Bus discharge (amber) LED
3. Main contactor (green) LED
4. Output contactors ON (green) LEDs
5. Remote E/F (green) LEDs
6. Precharge contactor (amber) LED
7. Fiber optic receiver LED (amber)
8. Fiber optic transmitter LED (green)

Figure 6: Load Control PC Board

e. Output Current Overload Fault

The output current is measured in each line with a resolution of 1-A. Output current overload limits are based on the total of output current for all available outputs, and not on individual outputs. Neutral current is monitored independently. Refer to Paragraph 2, , b, (3) for alarm and fault limits.

If an output current fault occurs, follow the procedure below to determine the cause and restore the converter to normal operation.

(1) Press the control panel OFF button to reset the converter.

(2) Make sure the aircraft is not placing a load on the converter greater than the unit's power rating. Turn off unnecessary accessories on the aircraft, if necessary. Check for a shorted output or output cable.

(3) Restart the converter normally and attempt to deliver output power.

f. Neutral Line Current Fault

Neutral line current is measured in amperes with a resolution of 1-A, independently of output current measurement. A fault results if neutral current exceeds 10 percent of the converter's maximum rated load for 1 second. A neutral line current fault may be cause by unequal loading of the output phases by the aircraft, or one or two open or shorted phases in the output cable or at the aircraft. If a neutral line current fault occurs, follow the procedure below to determine the cause and restore the converter to normal operation.

(1) Press the control panel OFF button to reset the converter.

(2) Make sure the aircraft is not placing an excessive load on one output phase. The loads placed on each phase should be nearly equal.

(3) Restart the converter normally and attempt to deliver output power.

(4) If the fault reoccurs, and the phase loads are equal, one or two output phases may be open or shorted. Check the output cable, aircraft plug, and contactor connections, and repair as necessary.

g. DC Bus Faults

The DC bus is the electrical path between the input filter and the inverter section. Physically, it consists of a number of copper bars which connect the input rectifier modules, the DC (input filter) capacitor bank, the power modules, and a number of other supporting components. The DC capacitor bank, besides providing filtering of the rectified AC input voltage, also maintains sufficient charge to provide several seconds of power for the unit's control circuits, allowing for a controlled shutdown of the unit if input power is lost.

When the converter is turned on, the DC capacitor bank must be charged before output power can be delivered. Likewise, when the converter is turned off, the DC capacitor bank will be discharged If a low bus voltage fault occurs, follow the procedure below to determine the cause and restore the converter to normal operation.

WARNING

High voltages may be present inside the converter cabinet, even when the unit is off. Exercise extreme caution when testing and replacing components or FATAL SHOCK may result.

(1) Open the front door by turning all three latches counterclockwise with an 8 mm (5/16 inch) Allen wrench. Exercise extreme caution while the doors is open, as high voltages may be present, even when the unit is off.

(2) Test the DC bus with a voltmeter to be sure that it is fully discharged. The bus can be tested at the two long copper bars on each side of the DC capacitor bank. If the bus is not discharged, close the converter door, wait at least 15 minutes, and test it again. Do not perform any work inside the converter while the DC bus remains charged. See Figure 3 for the proper test points.

(3) Open the rear door of the unit and check DC bus fuse F10 (see Figure 9). This fuse is located near the left side (for horizontal mount) or top (for vertical mount) of the unit. Replace it with an SPP-5E 600-A, 700-V fuse, if necessary.

(4) If fuse F10 is acceptable, check control transformer primary circuit fuses F7 and F8. These fuses are installed in the double fuse block located near the left side of the unit (for horizontal mount) or top (for vertical mount) behind the front door *(see Figure 10)*. Replace both with FNQ 5-A, 600-V fuses, if necessary.

(5) If fuses F7 and F8 are acceptable, check control transformer secondary circuit fuse F9. This fuse is installed on the control transformer located near the left side of the unit (for horizontal mount) or top (for vertical mount) behind the front door. Replace it with an FNM 15-A, 600-V fuse, if necessary.

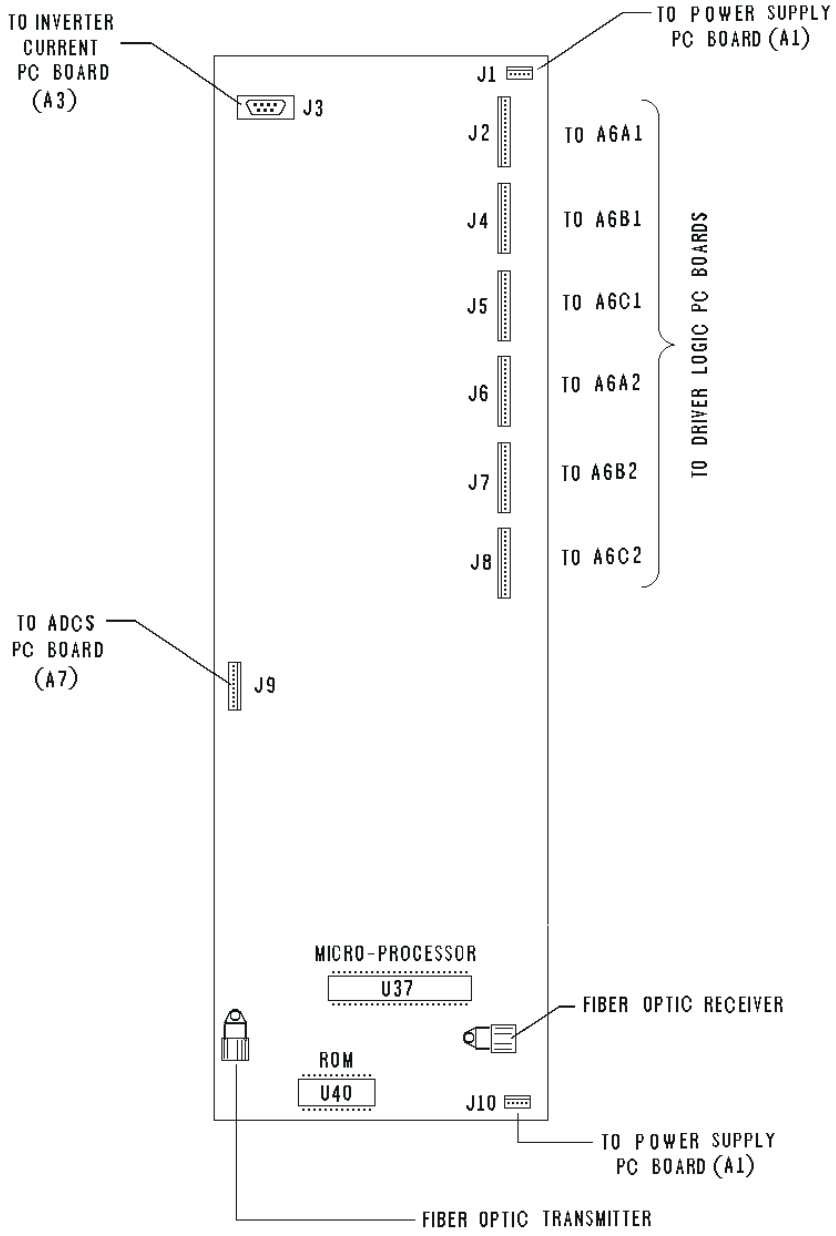


Figure 7: Modulator PC Board

(6) If fuse F9 is acceptable, check charging contactor K2. This contactor is located behind the front door on the left side panel (for horizontal mount) or the bottom panel (for vertical mount). To check this contactor, measure the voltage between terminals A, B, and C on the output side of this contactor. Figure 10 shows the proper test points. Voltage measured between any two phases should be at rated input voltage. If the voltage between any two phases is zero, the contactor is faulty and must be replaced. See Chapter 3 for replacement procedures.

(7) If charging contactor K2 is acceptable, check input contactor K1. This contactor is located behind the front door on the interior partition near the left side of the unit (for horizontal mount) or near the bottom panel (for vertical mount). To check this contactor, measure the voltage between fuses F1, F2 and F3. Take these measurements at the fuse terminals closest to contactor K1. See Figure 12. If the voltage is zero, the contactor is faulty and must be replaced. See Chapter 3 for replacement procedures.

(8) If input contactor K1 is acceptable, check DC bus charging resistors R1 and R17. These resistors are located behind the rear door near the center of the unit *(see Figure 12)*. To check each resistor, measure its resistance with an ohmmeter. The resistance of each should be approximately 15 ohms. If it is not, the resistor is faulty and must be replaced. See Chapter 3 for

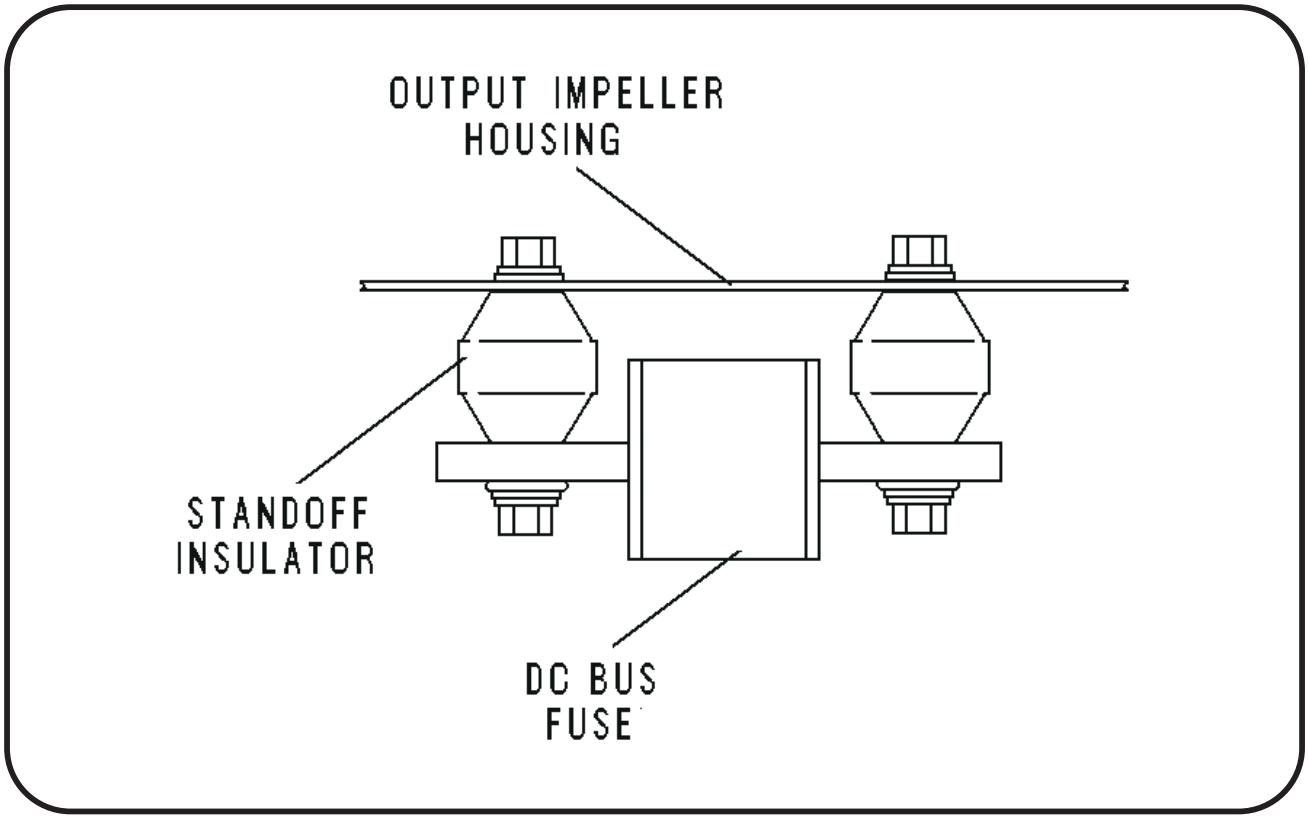


FIGURE 8: DC Bus Fuse F10

replacement procedures.

(9) If input contactor K1 is acceptable, the DC bus PC board is faulty and must be replaced. See Chapter 3 for replacement procedures. Figure 2 shows location of DC bus PC board. If the DC bus does not discharge, use the procedure to determine the cause and restore the converter to normal operation.

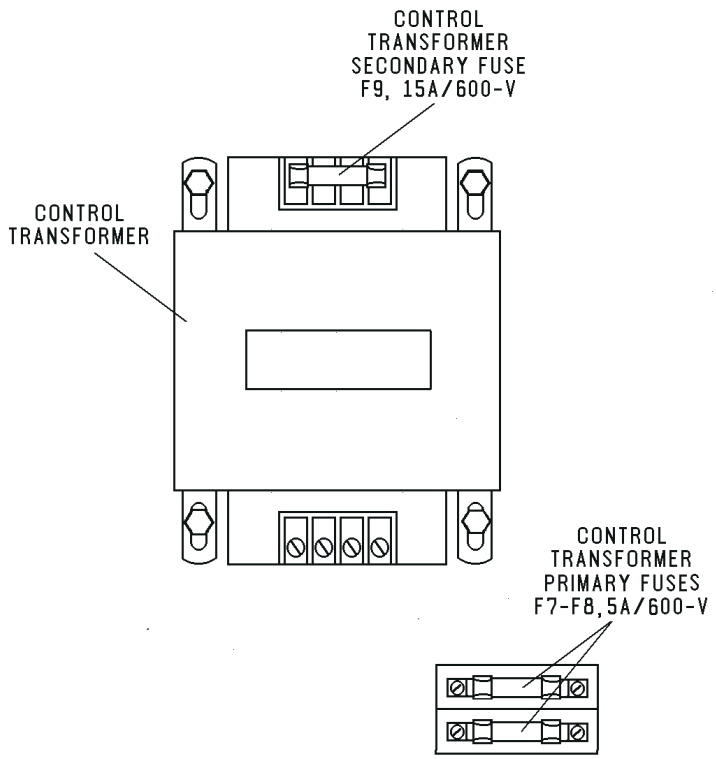


FIGURE 9: 35-V Control Transformer Fuses (F7-F9)

WARNING

High voltages may be present inside the converter cabinet, even when the unit is off. Exercise extreme caution when testing and replacing components or FATAL SHOCK may result.

(10) Open the front door by turning all three latches counterclockwise with an 8 mm (5/16 inch) Allen wrench. Exercise extreme caution while the doors is open, as high voltages may be present, even when the unit is off.

(11) Test the DC bus with a voltmeter to be sure that it is fully discharged. The bus can be tested at the two long copper bars on each side of the DC capacitor bank. If the bus is not discharged, close the converter door, wait at least 15 minutes, and test it again. Do not perform any work inside the converter while the DC bus remains charged. See Figure 3 for the proper test points.

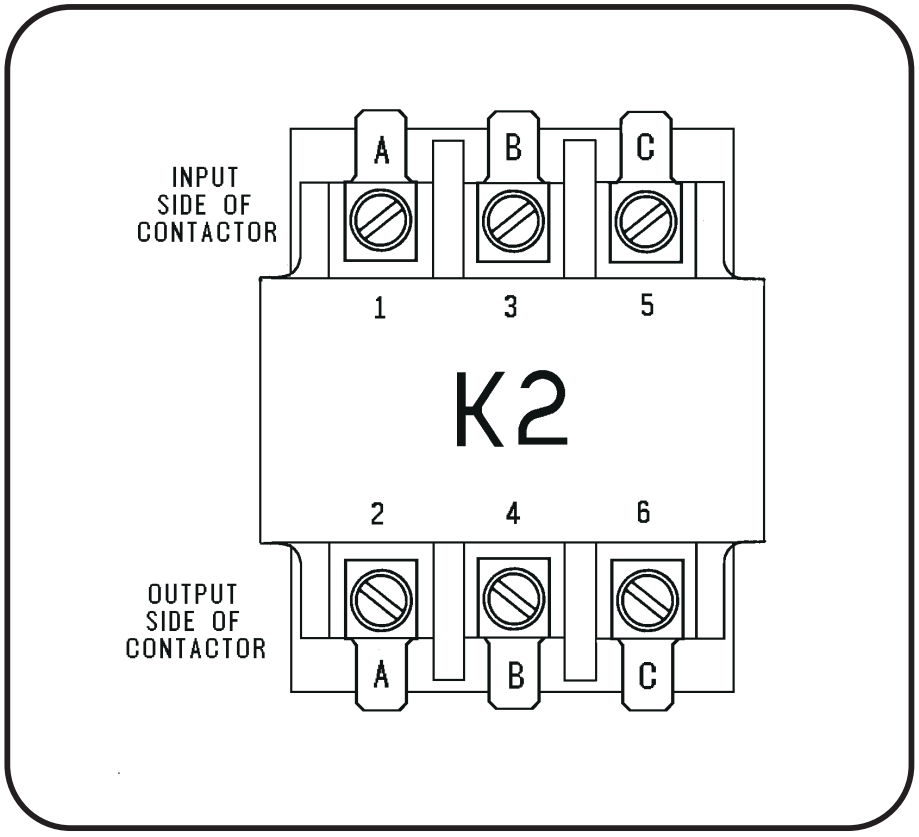


FIGURE 10: Charging Contactor K2 Test Points

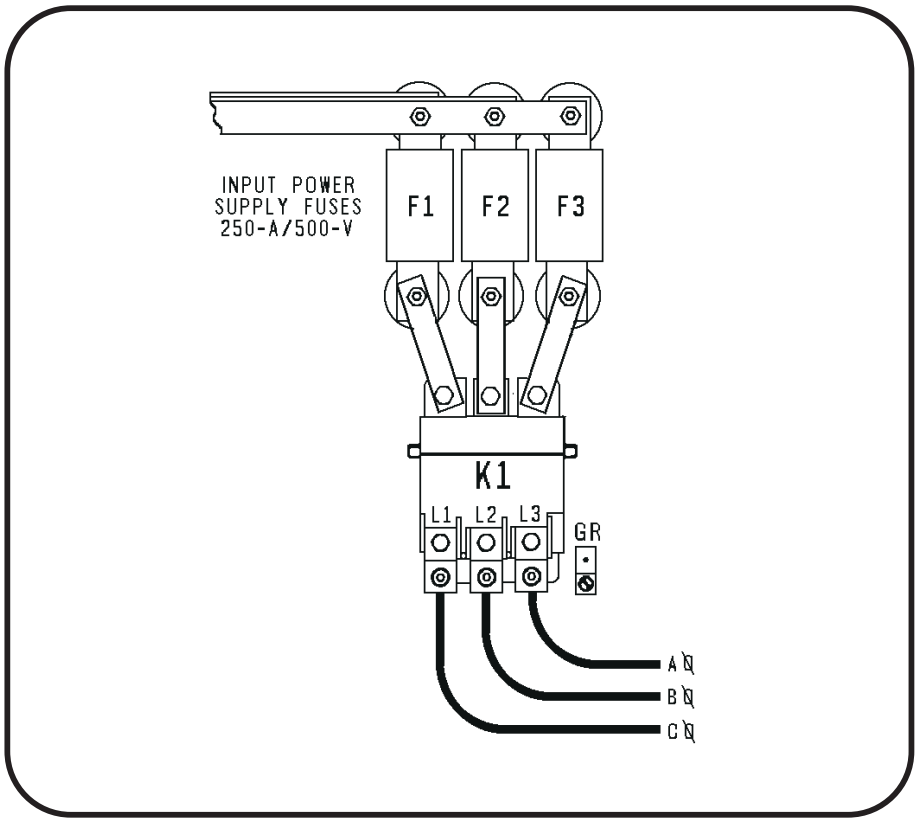


FIGURE 11: Input Contactor K1 Circuit Components

(12) Open the rear door and check DC bus discharge resistor R16. This resistor is the single, long resistor located directly behind the rear door, next to the pair of DC bus charge resistors *(see Figure 12)*. To check it, measure the resistance with an ohmmeter. The resistance should be approximately 50 ohms. If it is not, the resistor is faulty and must be replaced. See Chapter 3 for replacement procedures.

(13) If resistor R16 is acceptable, the DC bus discharge PC board is faulty and must be replaced. See Chapter 3 for replacement procedures.

h. EF Signal Faults

If an output cable from the converter is connected to an aircraft, a 28-V DC interlock signal (EF signal) will be fed back to the converter to allow the output to deliver power. If that signal is missing, the output will not deliver power, or the converter will not operate.

If an EF signal fault occurs, follow the procedure below to determine the cause and restore the converter to normal operation.

(1) Make sure the output cable is connected securely to the aircraft.

(2) Restart the converter normally and attempt to deliver output power.

(3) If the fault reoccurs, the output cable may be faulty. Check the cable, plug, and contactor connections, and replace as necessary.

(4) If the cable is acceptable, the load control PC board may be faulty and must be replaced. See Chapter 3 for replacement procedures.

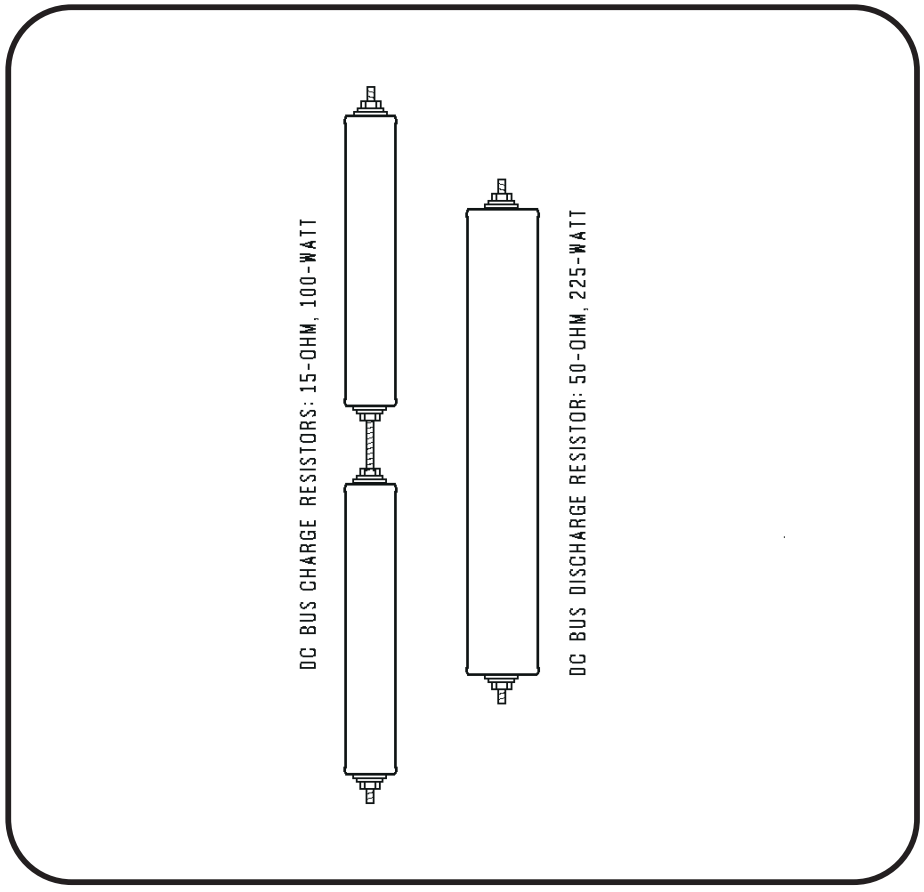


FIGURE 12: DC Bus Charge and Discharge Resistors

i. Driver PC Board Faults

Each of the six driver PC boards (A5A1 - A5C2) translate the input drive signal from the modulator, via the driver logic PC boards, into an optically isolated drive signal for two of the twelve power modules. Each driver PC board also generates “ON”, “SATURATED”, and “REGENERATION” signals for each module. Power for each driver PC board is derived from the chopper PC board output.

If a driver PC board fault occurs, the board named in the display is faulty and must be replaced. See Chapter 3 for replacement procedures.

j. Driver Logic PC Board Faults

Each of the six driver logic PC boards (A6A1 - A6C2) is a microprocessor-controlled supervisor for a driver PC board. The processors used are small, extremely fast microcontrollers that monitor the power modules, the driver board, and the modulator board for proper operation.

If a driver logic PC board fault occurs, the board named in the display is faulty and must be replaced. See Chapter 3 for replacement procedures.

k. Power Module Faults

The twelve power modules (PM1A1 - PM2C2) provide the actual switching which produces the output voltage sine wave from the filtered DC voltage, under control of the modulator and driver PC boards. Each module is an insulated-gate bipolar transistor (IGBT) and two of the twelve are located behind each of the six driver and snubber PC boards.

If a power module fault occurs, the module named in the display is faulty and must be replaced along with it’s complementary module (example: PM1A1 and PM2A1 must both be replaced). See Chapter 3 for replacement procedures.

l. Output Contactor Faults

The outputs on a multiple-output converter are turned on and off through two or three output contactors under control of the ADCS. Each contactor is a sealed unit which contains a magnetic operating coil and four sets of contacts. The three larger contacts conduct 3-phase AC voltage output. The load control PC board monitors the smaller, fourth set of contacts to verify proper operation of the contactors.

If an output contactor does not close, follow the procedure below to determine the cause and restore the converter to normal operation.

(1) Press the control panel OFF button to reset the converter.

(2) Connect another output to the aircraft, restart the converter normally, and attempt to deliver power through this output.

(3) If the converter operates normally, the output contactor for the inoperative output is faulty and must be replaced. See Chapter 3 for replacement procedures.

(4) If the fault reoccurs, the cable between the modulator and inverter current PC boards may be loose or disconnected. Make sure both ends of the cable are properly seated in their sockets: J9 on the modulator PC board and J1 on the inverter current PC boards (see connection diagram).

(5) If the two boards are connected properly, either the load control or the modulator PC board is faulty and must be replaced. See Chapter 3 for replacement procedures.

If an output contactor does not open, follow the procedure below to determine the cause and restore the converter to normal operation.

(6) Press the control panel OFF button to reset the converter.

(7) Connect another output to the aircraft, restart the converter normally, and attempt to deliver power through this output.

(8) If the converter operates normally, the output contactor for the inoperative output is faulty and must be replaced. See Chapter 3 for replacement procedures.

m. Overtemperature Fault

Both the power modules and the main transformers may generate large amounts of heat. Both fans must run continuously while the converter is operating to keep the interior of the unit cool and avoid damage to the components. If an overtemperature fault occurs, follow the procedure below to determine the cause and restore the converter to normal operation.

(1) Press the control panel OFF button to reset the converter.

(2) Check for a high temperature in the immediate environment or an excessive aircraft load. The converter is designed to handle the temperature ranges and loads at which the unit will usually be used; however, extremely high outside temperatures or excessive loading may prevent the unit from working. If the temperature or load is excessively high, locate the unit in a cooler environment or turn off unnecessary accessories on the aircraft.

(3) Allow the unit to cool for several minutes, restart normally, and attempt to deliver power.

(4) If the fault reoccurs, repeat the preceding step until the unit operates properly.

Once the converter is operating, check both fans for proper operation. Repair or replace any inoperative fan. For replacement procedures, see Chapter 3.36-V Control Transformer Circuit Faults. The control transformer and power supply draw power from the AC input and convert it to 36-V DC, 12-V DC, and +5-V DC power for operation of the ADCS and other control circuits. If input voltage is lost, the power supply board will draw power from the DC bus capacitors, allowing for a controlled shutdown of the converter. If a power supply fault occurs, follow the procedure below to determine the cause and restore the converter to normal operation.Press the control panel OFF button to reset the converter.

WARNING

High voltages may be present inside the converter cabinet, even when the unit is off. Exercise extreme caution when testing and replacing components or **FATAL SHOCK** may result.

(5) Open the front door by turning all three latches counterclockwise with an 8 mm (5/16 inch) Allen wrench. Exercise extreme caution while the doors is open, as high voltages may be present, even when the unit is off.

(6) Test the DC bus with a voltmeter to be sure that it is fully discharged. The bus can be tested at the two long copper bars on each side of the DC capacitor bank. If the bus is not discharged, close the converter door, wait at least 15 minutes, and test it again. Do not perform any work inside the converter while the DC bus remains charged. See Figure 3 for the proper test points.

(7) Check the three control transformer fuses (see Figure 10). Replace transformer primary fuses with FNM 5-A, 600-V fuses, if necessary. Replace transformer secondary fuse with FNM 15-A, 600-V fuse, if necessary.

(8) If the fuses are acceptable, the power supply PC board is faulty and must be replaced. See Chapter 3 for replacement procedures.

n. Input Voltage Faults

Input phase (line-to-line) voltage is monitored with a resolution of 1V-AC. An alarm is indicated if the phase voltage exceeds 5 percent of its rated value. A fault results if the phase voltage exceeds10 percent of its rated value for 1 second or more. Input voltage faults can be caused by sudden fluctuations in input power, a permanent change in input power, or a corruption of the calibration data stored by the converter. If an input voltage fault occurs, follow the procedure below to determine the cause and restore the converter to normal operation.

(1) Press the control panel OFF button to reset the converter.

(2) Restart the converter normally and attempt to deliver output power.

(3) If this fault reoccurs, open the front door and measure the input phase voltages at terminals L1, L2, and L3 on input contactor K1. The input contactor is located inside the front door near the lower left-hand corner (for horizontal mount) or the lower right-hand corner (for vertical mount). Figure 11 shows the proper test points.

(4) If the voltages are correct, the calibration data stored by the ADCS may be corrupted. Lightning, static electricity, and power surges can all cause a loss of stored data. Perform the calibration procedures described in Section 2-2 to determine if the calibration data has been corrupted.

o. Output Voltage Faults

Output voltage is monitored with a resolution of 0.1-V. An **alarm** is indicated if the voltage exceeds 122-V AC or falls below 112-V AC. A **fault** results if the voltage exceeds 125-V AC for one second or falls below 100-V AC for 7 seconds. Additionally, a **fault** results if the voltage difference between any two output phases is greater than 3-V AC.

If an output voltage fault occurs, follow the procedure below to determine the cause and restore the converter to normal operation.

(1) Press the control panel OFF button to reset the converter.

(2) Make sure the aircraft is not placing an excessive load on the converter.

(3) Restart the converter normally and attempt to deliver output power.

(4) If the fault reoccurs, the output voltage may be set too high. Check and reset the output voltage being delivered to the aircraft. See Section 1-3, **Operation**, for the proper procedure.

(5) If the output voltage is correct, the modulator PC board is faulty and must be replaced. For replacement procedures, see Chapter 3.

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Section 2. Calibration

1. General

IMPORTANT

Before attempting to make tests and adjustments on the converter, READ THS ENTIRE SECTION to become familiar with the proper procedures.

As explained in Section 1-1, the ADCS permits monitoring and testing of critical circuits prior to and during operation. After major repair, major parts replacement, or overhaul, the ADCS should be used to perform a thorough analysis of converter circuits. If adjustments are required, calibrations may be made from the control panel of the ADCS.

2. Test Preparation

a. All test measurements can be taken behind the front door of the converter or at the ends of the output cables. It is not necessary to have access to the back door. Open the front door and make sure the back door is tightly closed. The unit is equipped with two door interlock switches: S2 on the front door and S3 on the back door. Opening either door will prevent the unit from operating. Therefore, S2 must be bypassed while performing measurements inside the front of the unit.

WARNING

High voltages nmay be present inside the converter cabinet even when the unit is off. Exercise extreme caution when taking measurements or FATAL SHOCK may result.

To bypass S2, press the end of the white post **behind** switch S2 until it locks into place *(see Figure 1)*. S2 is now bypassed and will allow the converter to operate while the front door is open. Exercise extreme caution while the front door is open, as high voltages are present.

b. **Apply rated input power to the converter from the input power source. The green INPUT POWER lamp** *(5, Figure 2)* on the control panel will illuminate.

c. Use output cable of proper size and length for the converter's power output rating. Connect output cable plug connectors from all available outputs to aircraft receptacle(s) or load bank(s). Be sure the converter output "N" cable is grounded. Be sure connectors are mated fully and securely. Make a general inspection of all wiring and terminals.

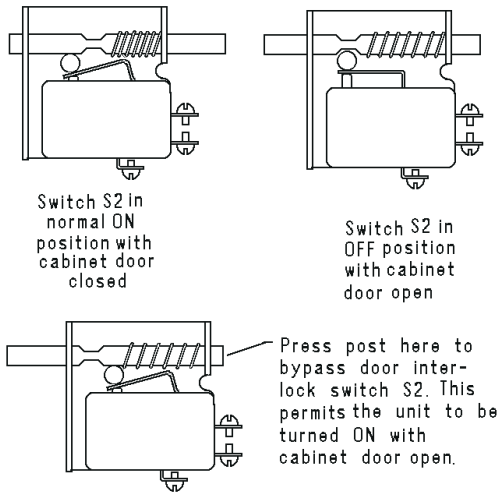
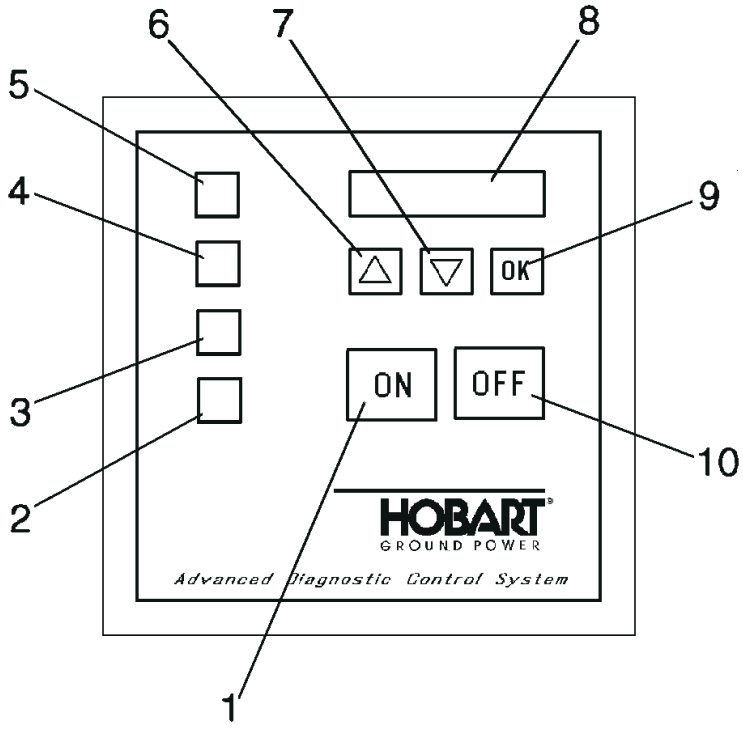


Figure 1, Front Door Interlock Switch (S2)



1. ON button
2. OUTPUT POWER lamp (green)
3. FAULT lamp (red)
4. ALARM lamp (yellow)
5. INPUT POWER lamp (green)
6. Up button
7. Down button
8. Two-line alpha-numeric display
9. OK button
10. OFF button

Figure 2: Control Panel

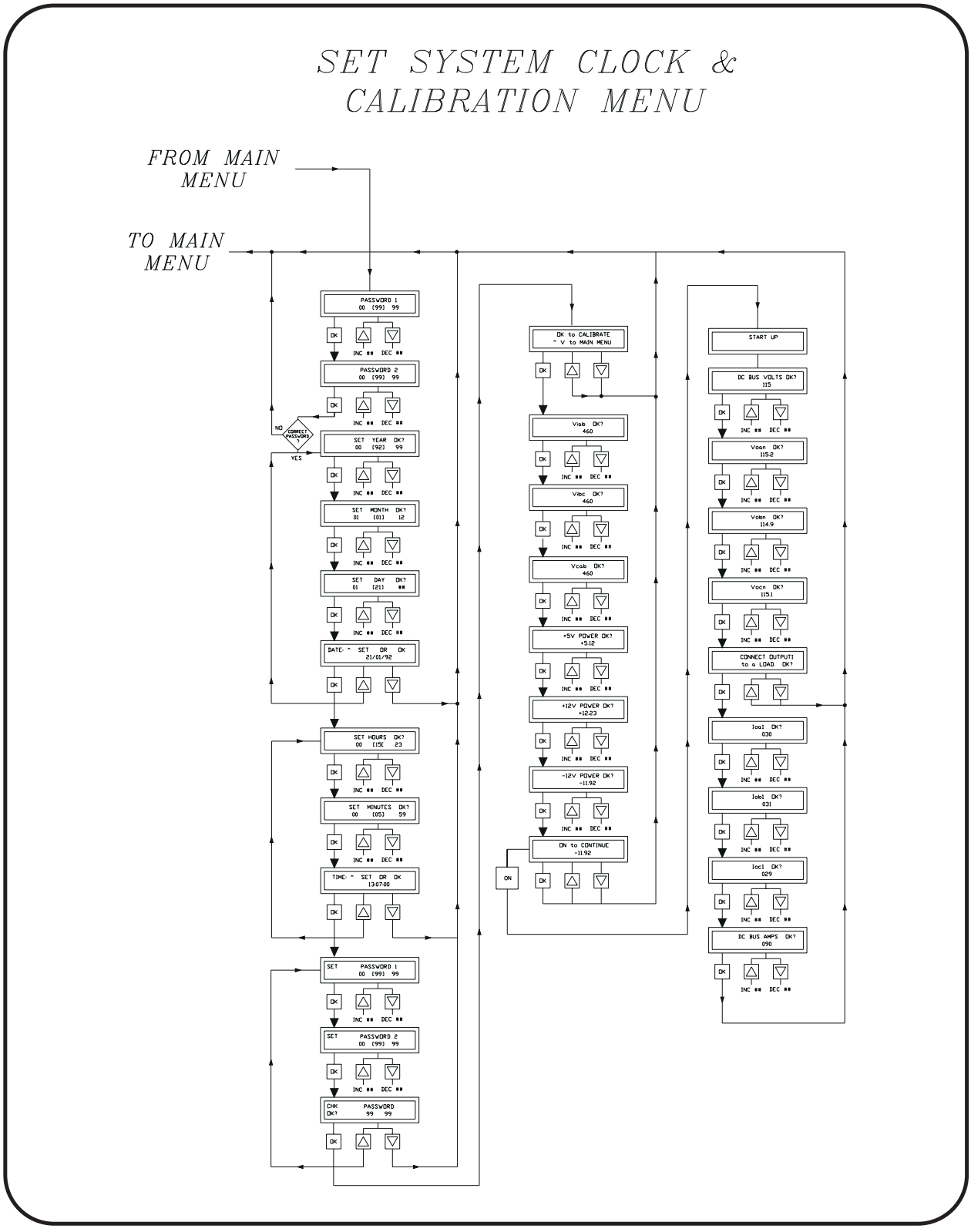


Figure 3: Set System Clock and Calibration Submenu Map

WARNING

Never disconnect an output cable while output power is on.

d. Do not turn the converter on, and do not place a load on any of the converter outputs. To begin the calibration procedure, the converter must be OFF and no load may be present. The unit will be turned on and place under load later in the calibration process.

3. Calibration Procedure

It is extremely important that the converter's operating parameters remain constant. Thus the ADCS is designed to discourage tampering with these parameters. When it is desired that any operating parameters be changed, it is necessary to use two 2-digit password numbers to gain access to the Set System Clock and Calibration submenu *(Figure 3)*. These password numbers should be known and accessible only to personnel who are authorized and qualified to make calibration changes.

When the converter is shipped, the two 2-digit password numbers needed to gain access to the system clock and calibration menu are taken from the last four digits of the converter serial number. For example: If the converter serial number is 90PSO1234, the **first** 2-digit password number is **12** and the **second** 2-digit password number is **34**. These numbers may be changed for extra security *(see Paragraph* 3.b.*)*.

When you enter the Set System Clock and Calibration submenu, which can only be entered when the converter is not running, the following display appears:

```
PASSWORD 1
00 {50} 00
```

Enter the first 2-digit password number by holding the up and down buttons until the correct number is displayed in the brackets, followed by the OK button. The display then changes to:

```
PASSWORD 2
00 {50} 00
```

Enter the second 2-digit password number by again holding the up and down buttons until the correct number is displayed, followed by the OK button. If either password is incorrect, the display changes to the main menu time and date, and the operator must repeat the procedure from the main menu. If both passwords are correct, calibrations may be performed.

a. Setting the Date and Time

The following display allows you to change the internal clock year. As with password settings, hold the up and down buttons until the correct year is displayed in the parentheses, followed by the OK button.

```
SET  YEAR    [OK?]
 00   {92}    99
```

The display changes to:

```
SET  MONTH    [OK?]
 00   {09}    12
```

In the same manner, the month may be changed. The display then changes to:

```
SET  DAY    [OK?]
 00   {21}    31
```

After the day is changed, the display changes to:

```
DATE:[^]  SET  or  [OK]
          21/09/92
```

You may press the up button to return to the SET YEAR OK? display and reenter the date, the down button to return to the main menu, or the OK button to continue the calibration procedure. The following displays appear, and the time may be changed in the same manner as the date.

```
SET  HOURS    [OK?]
 00   {23}    23
```

```
SET  MINUTES  [OK?]
 00   {59}    59
```

```
TIME:[^]  SET  or  [OK]
          23:59:30
```

After the time is displayed and changed, if necessary, you may hold the up button to reenter the time, the down button to return to the main menu, or the OK button to continue the calibration procedure.

b. Changing the Passwords

For extra security, the passwords required to enter the Set System Clock and Calibration may be changed from their initial values when the converter is shipped, or at regular intervals. Change each password by holding the up and down buttons until the desired number appears in the parentheses, followed by the OK button to store the new number. After password is changed, the new password should be written down and kept in a separate, safe place to protect against unauthorized access to the converter unit to operate it. If the new password is forgotten and one cannot find where it is written down, Hobart Service Department should be called for information on how to gain access to the converter unit to operate it.

```
SET PASSWORD 1
   00 {##} 99
```

```
SET PASSWORD 2
   00 {##} 99
```

```
CODE:[^] SET or [OK]
          ##   ##
```

```
OK > CALIBRATION
[^] > MAIN MENU
```

After the passwords have been displayed and changed, if desired, you may press the up button to reenter the passwords, the down button to return to the main menu, or the OK button to continue the calibration procedure.

c. Voltage and Current Calibration

The ADCS provides automatic and continuous monitoring of numerous critical electrical operating values. These values can be displayed through the PoWerMaster Measurements submenu, and are recorded at various intervals for future review through the Review Stored Cycle Data submenu.

WARNING

Exercise extreme caution while performing calibrations. **FATAL SHOCK OR PERMANENT DAMAGE TO EQUIPMENT** may result if proper pro- cedures and precautions are not taken.

If a qualified technician, after measuring various voltage or current values with his own testing equipment, discovers that the readings he obtained do not match the values displayed by the ADCS, he may change the calibration of the unit to bring the displayed values into agreement with the measured values. This procedure should be performed especially after major repair, major parts replacement, and overhaul.

WARNING

Only QUALIFIED personnel using ACCURATE test equipment should perform calibrations. Otherwise, PERMANENT DAMAGE to the converter could result.

If the calibration factors are changed incorrectly or by to great a degree, however, it is possible to "fool" the ADCS into "believing" that electrical conditions are normal, while in reality they are not. For example, an technician enters the PoWerMaster Measurements submenu and observes that the +12-V power supply voltage is being displayed as 13.1-V. Without bothering to check this value with his own testing equipment and confirm that the actual voltage is indeed 13.1-V, he simply enters the calibration submenu and adjusts the calibration factor until the ADCS displays 12-V instead of 13.1-V. Now the ADCS "believes" that conditions are normal, while in reality, the opposite may be true. If the actual voltage now rises past its original safe operating fault limit of 13.2-V, the ADCS will **NOT** indicate a fault and shut the converter down, since it believes that the voltage is perhaps only 12.1.V; instead, the converter may be permanently damaged. Therefore, only **ACCURATE** test equipment should be used to perform converter calibrations, and **ACCURATE** measurements **MUST** be taken before changing any of the calibration factors.

WARNING

Exercise extreme caution while performing calibrations. **FATAL SHOCK OR PERMANENT DAMAGE TO EQUIPMENT** may result if proper pro- cedures and precautions are not taken.

Most fault checking is bypassed when the calibration submenu is entered and calibrations are performed. Therefore, many conditions which would normally result in a fault and shut the converter down to prevent injury and damage to equipment will not be monitored by the ADCS during calibration. For example, a shorted or grounded output cable, causing excessive current which exceeds the fault limit, would normally result in a fault condition and shut the converter down; however, during calibrations, fault checking is bypassed and this situation could cause an overload and permanently damage the converter. Only **QUALIFIED** personnel should perform calibrations.

WARNING

Output cables may be LIVE when maintenance mode is selected. Exercise extreme caution or FATAL SHOCK could result.

Additionally, when the calibration submenu is entered and calibrations are performed, the converter automatically switches each available output to “maintenance” mode, bypassing the normal 28-V interlock signal (EF signal) checking (see Section 1-3, Paragraph 3.j., page 29). Therefore, output cables may be LIVE and FATAL SHOCK may result if proper procedures are not followed. When the calibration submenu is exited and calibrations are completed, each available output returns to its original mode, whether “maintenance” or “normal”.

The method of calibration for any or all user-adjustable values is as follows:

(1) Enter Set System Clock and Calibration submenu. Advance to the value to be calibrated.

(2) Using appropriate and **ACCURATE** test equipment, measure the displayed electrical value and note the reading.

(3) Press the up and down buttons to match the displayed value with the measured value.

(4) Press OK button to store the new calibration value. Advance to the next item to be calibrated.

(5) Repeat the above steps for each item to be calibrated. If any value does not need calibration, it may be skipped by simply pressing the OK button. The calibration procedure may be ended and the new calibration values stored at any time by pressing the OFF button.

(6) Since the procedure for calibrating each value is the same, a detailed explanation of the order of buttons to press is not provided below. The menu map provides a complete diagram of the order of the displays and the buttons to press to reach any desired point in the calibration submenu.

d. Input and Power Supply Voltage Calibration

WARNING

High voltages nmay be present inside the converter cabinet even when the unit is off. Exercise extreme caution when taking measurements or FATAL SHOCK may result.

The six displays below allow a qualified technician to calibrate input voltage between the three phases and to calibrate the three internal power supply voltages.

(1) Input Phase Voltages

Measure each of the input phase voltages at terminals L1, L2, and L3 on input contactor K1. The input contactor is located inside the front door near the lower left-hand corner (for horizontal mount) or the lower right-hand corner (for vertical mount). Figure 4 shows the proper test points. Typical input phase voltage displays appear as follows:

Viab	[OK]? 400
Vibc	[OK?] 400
Vica	[OK?] 400

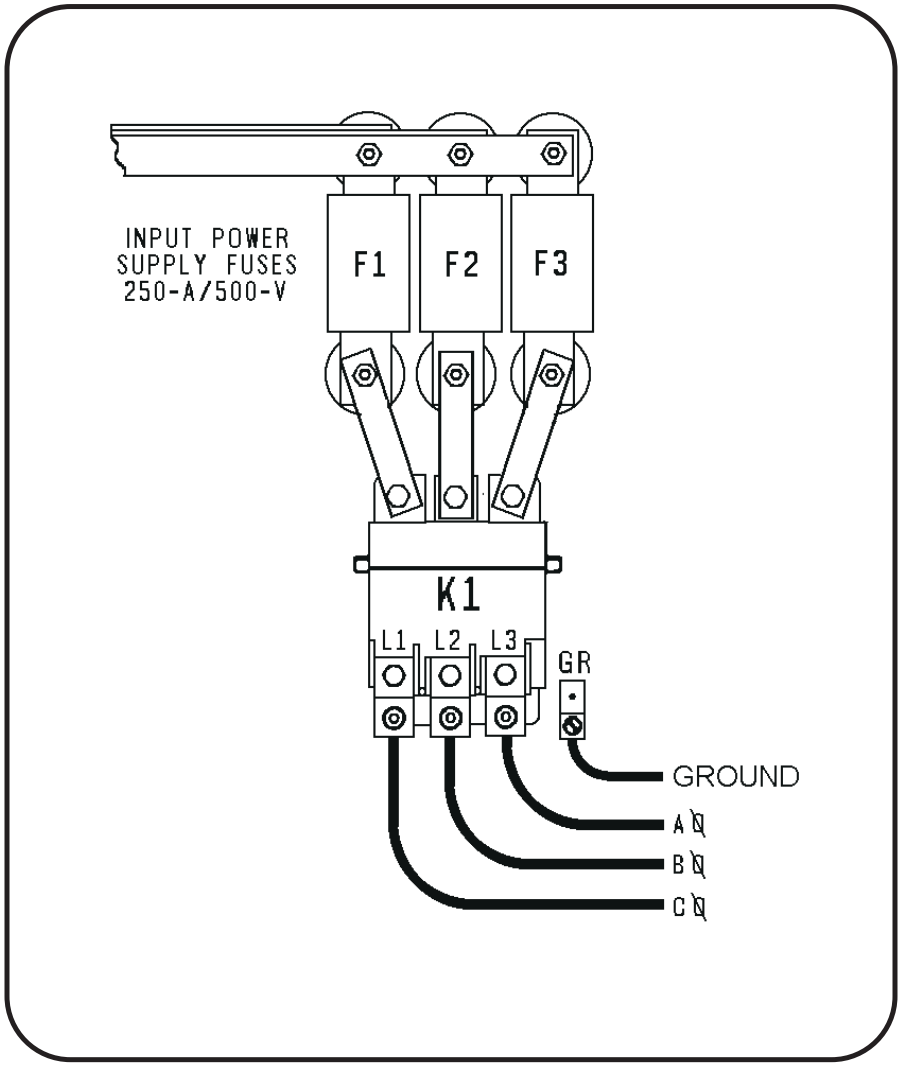


Figure 4: Input Phase Voltage Test Points

(2) Internal Power Supply Voltages

Measure each of the power supply voltages at the connecter marked “POWER SUPPLY” on the ADCS PC board. The ADCS PC board is located on the reverse side of the control panel behind the front door and the power supply connector is at the right-hand side of the board (for horizontal mount) or the top of the board (for vertical mount). Do not disconnect this connector to take measurements. Figure 5 shows both the location of this connector on the ADCS board and the terminal connections.

Typical internal power supply voltage displays appear below:

```
+5V  POWER  [OK?]
      +5.12
```

```
+12V  POWER  [OK?]
      +12.23
```

```
-12V  POWER  [OK?]
      -11.92
```

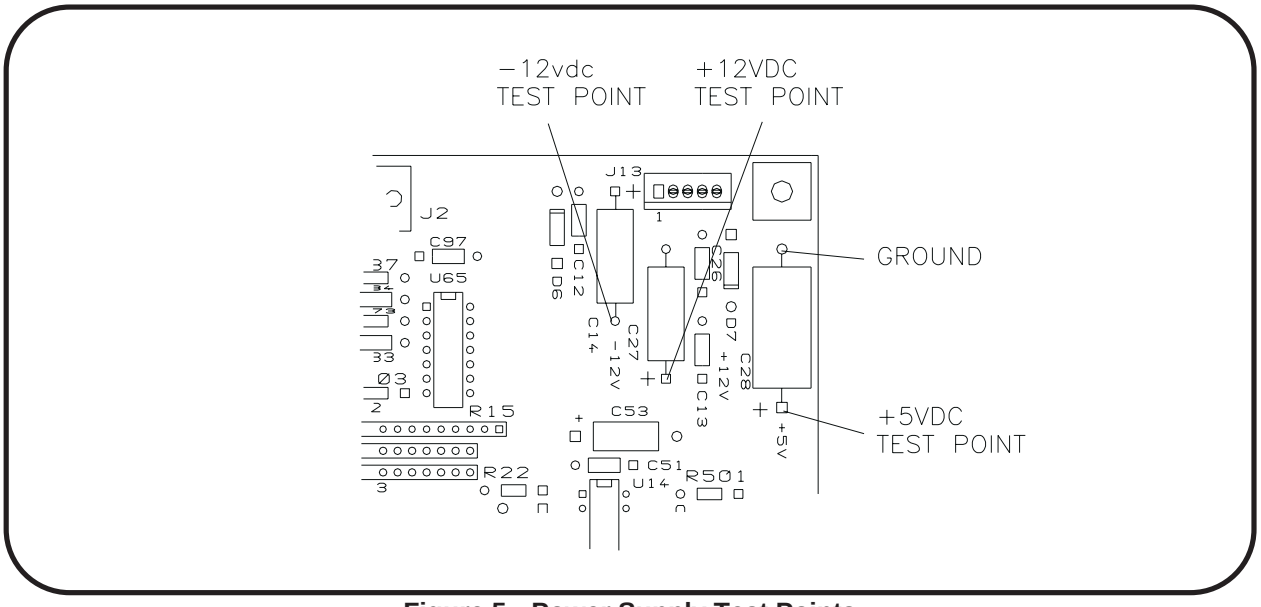


Figure 5: Power Supply Test Points

e. DC Bus and Output Voltage Calibration

After the above values have been calibrated, the following display appears:

```
[ON] to CONTINUE
[^]  MAIN MENU
```

For all converters, regardless of the number of outputs, press the control panel ON button to continue calibrations, or any other button to end the calibration procedure and return to the main menu time and date display. If ON is pressed, the unit should start and the following display will appear:

```
### RAMP UP SEQUENCE
###      INITIATED
```

After a few seconds, the display will change again and the calibration procedure may be continued.

WARNING

High voltages nmay be present inside the converter cabinet even when the unit is off. Exercise extreme caution when taking measurements or FATAL SHOCK may result.

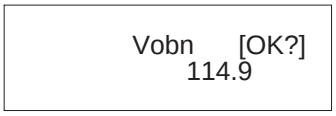
(1) DC Bus Voltage

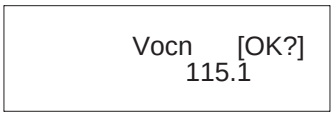
Measure DC bus voltage at the two long copper bus bars connecting the DC capacitor bank. The capacitor bank is located inside the front door at bottom center (for horizontal mount) or right center (for vertical mount). Exercise extreme caution when taking this measurement, as the DC bus voltage is approximately 650-V DC. A typical voltage reading is shown in the display below. Figure 6 shows proper test points.

```
DC BUS VOLTS [OK?]
        630
```

(2) Output Phase Voltages

Measure each of the output phase voltages between each phase and neutral at the aircraft end of the output cable. Typical voltage readings are shown in the following displays.





f. Output Current Calibration

After the above values have been calibrated, the following display appears:

WARNING

Output cables may be LIVE when maintenance mode is selected. Exercise extreme caution or FATAL SHOCK could result.

The first converter output must be connected to an aircraft or a load bank, if this has not been done already, do it NOW before proceeding.

Since the converter is automatically switched to maintenance mode during calibrations, the 28-V interlock signal checking will be bypassed and output cables will be **LIVE** during the following steps, whether or not they are connected to an aircraft or load bank. Press the control panel OK button to continue the calibration procedure, or the up, down, or OFF buttons to end calibrations and return to the main menu time and date display.

WARNING

Output cables may be **LIVE** when maintenance mode is selected. Exercise extreme caution or **FATAL SHOCK** could result.

The displays below allow a qualified technician to calibrate output current and DC bus current. These values can only be correctly displayed and measured when the converter is on and delivering output power. For best results, set load to draw approximately 100% of rated current for the output (i.e. 90-Kva).

(1) Output Phase Currents

Measure each output phase using a clamp-on ammeter. Clamp the meter around each conductor of the output cable individually. Readings on the ammeter should approximate typical readings on the display as shown below.

Ioa1 [OK?] 260

Iob1 [OK?] 260

Ioc1 [OK?] 260

(2) Neutral Current

WARNING

Output cables may be **LIVE. Exercise extreme caution or FATAL SHOCK** could result.

Output cables may be **LIVE**. Exercise extreme caution or **FATAL SHOCK** could result.

Clamp the meter around the neutral conductor of the output cable assembly. Then apply a single-phase load of approximately 40 to 50 amperes. (No load on the other two phases). A single-phase load produces neutral current, since, in a three-phase system the neutral current is equal to the difference (unbalance) between the three phases. The 50-ampere current flow produces a reading of 50 amperes in one phase and 50 amperes in neutral. Only the 50 amperes of neutral current will be displayed:

IoN [OK?] 50

(3) DC Bus Current

WARNING

When this calibration is being done, the DC bus will be **LIVE** and at a voltage potential that may be **LETHAL.** Exercise extreme caution or **FATAL SHOCK** could result.

The following display shows a typical DC bus current reading.

```
DC  BUS  AMPS  [OK?]
          090
```

NOTE: This shunt is factory-calibrated for accuracy. It very rarely needs calibration. This step may be bypassed in the overall calibration procedure.

If the converter has more than one output, the following display appears after the above values have been calibrated:

```
CONNECT  OUTPUT2
to  a  LOAD.   [OK?]
```

Connect the second converter output to an aircraft or a load bank, if this has not been done already, and follow the previous steps to calibrate the second output. The “1” in each of the displays will change to a “2”, indicating the second output is being calibrated. In the same manner, the third output, if available, may be calibrated.

After calibrating current for all available outputs, press any button to return to the main menu time and date display.

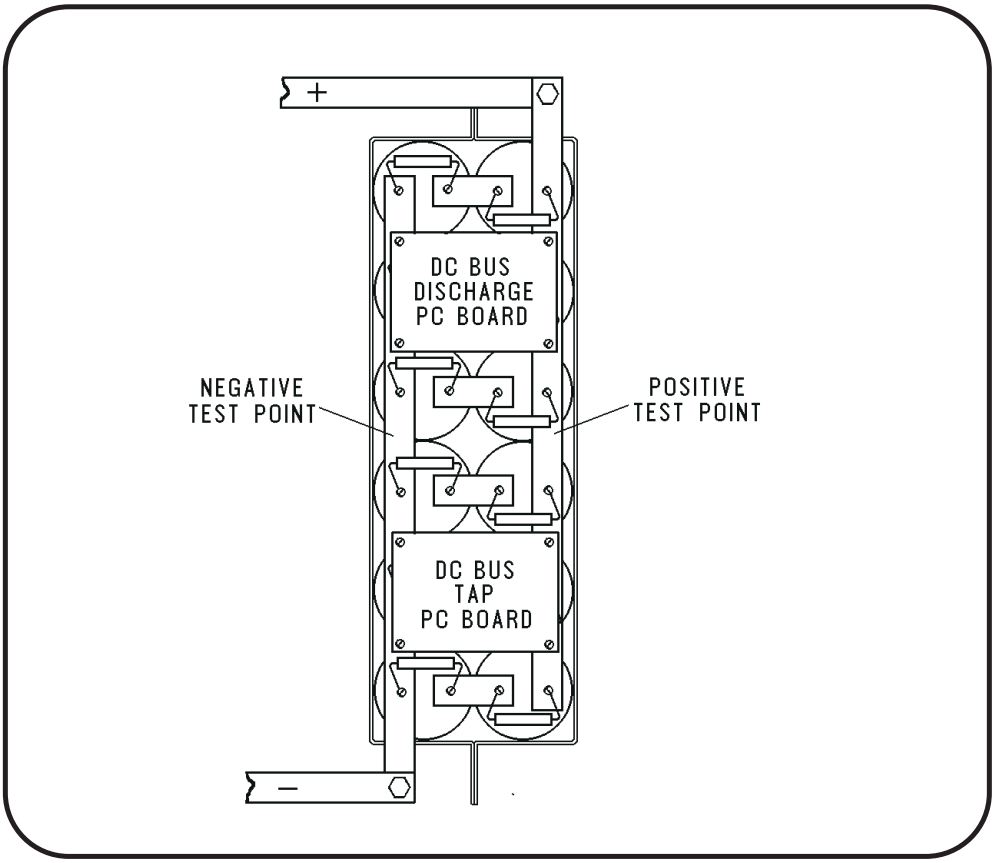


Figure 6: DC Bus Test Points

4. Shut-Down Procedure

a. Either press the control panel OFF button *(10, Figure 2)*, or press all remote control STOP buttons on each remote connected to the converter. The green OUTPUT POWER lamp *(2, Figure 2)* will shut off when no power is being delivered through any of the outputs. If the converter is not restarted within 15 minutes, the DC bus (DC capacitor bank) will be discharged to provide safety and to extend the life of the capacitors, and the display below will appear:

```
### POWER TERMINATED
### DISCHARGING BUS
```

b. Close and latch the front converter door. Door interlock switch S2 will unlock automatically when the door is fully closed.

WARNING

Output cables will be **LIVE** when output power is on. Never disconnect an output cable while output power is on, or **FATAL SHOCK** could result.

c. Disconnect the output cable(s) from the aircraft or load bank.

d. Shut off power at the input power source, if desired. The green INPUT POWER lamp *(5, Figure 2)* will shut off. It is not necessary to discontinue input power between operations of the converter. When the unit is not delivering output power, it uses only a small amount of input power to maintain various settings stored in the unit's memory, and may be left connected to input power indefinitely.

NOTE: The red fault indicator will flash momentarily when the control panel "OFF" button or the last remote control STOP button is pushed. This is normal and does not indicate a problem.

Section 3. Scheduled Maintenance

1. General

The Hobart PoWerMaster® Solid State Frequency Converter is designed to be as maintenance free as possible. Therefore there are few maintenance requirements. Field maintenance of the converter should be done only by qualified service personnel, and should be limited to cleaning and inspection of the unit and its components, and the replacement of lamps and fuses. All servicing and repair work, including testing and calibration, should be referred to the Service Department of Hobart Brothers Company, or to an authorized service shop of Hobart Brothers ground power equipment, or to qualified electronic technicians.

2. Scheduled Maintenance Procedure

The converter should be cleaned and inspected once every six months, or more frequently if operating conditions warrant it. Proceed as follows with cleaning and inspection.

a. Turn off input power at the source. Make sure that power cannot be inadvertently turned back on.

WARNING

High voltage may be oresent inside the converter cabinet, even when the unit is off. Exercise extreme caution or **FATAL SHOCK** may result.

b. Open the front and rear doors by turning all six latches counterclockwise with an 8 mm (5/16 inch) Allen wrench. Exercise extreme caution while the doors is open, as high voltages may be present, even when the unit is off.

c. Test the DC bus with a voltmeter to be sure that it is fully discharged. The bus can be tested at the two long aluminum bars on each side of the DC capacitor bank. If the bus is not discharged, close the converter doors, wait at least 15 minutes, and test it again. Do not perform any work inside the converter while the DC bus remains charged. See Figure 1 for the proper test points.

d. Carefully clean dust from the interior of the converter by blowing low pressure compressed air into the interior from the bottom of the unit first and then from the top. Wear eye protection and be careful to avoid blowing debris where it could cause harm or injury.

e. Inspect both airflow filters (located on the lower right side of the converter) regularly for cleanliness. Good airflow is necessary to provide adequate cooling for the unit to operate properly. If the filters need to be cleaned, flush with water and recoat the filter with Research Products Corporation's RP Super Filter Coat Adhesive. This produce will increase the arrestance of the filter by 10%. This product can be found by calling Research Products Corporation at (608) 257-8801, and the name the name of a local suppler of their products will be furnished.

The air filters should be replaced annually. When replacing them, DO NOT do so from inside the machine. They can be removed from outside the machine.

f. Clean heat sinks and printed circuit boards using compressed air or a soft brush.

g. Inspect terminal blocks for evidence of overheating due to loose electrical connections.

h. Inspect electrical and mechanical connections for tightness. Inspect closely all compression-type connectors.

i. Inspect printed circuit boards for evidence of overheating, such as burned resistors or capacitors. Note that the printed circuit boards are coated with a fungus and moisture-proof coating which turns brown on hot components. This is a normal occurrence, especially on resistors exceeding 1-watt in rating.

j. Check and inspect all front panel components, including indicator lamps.

k. Inspect the long hinge at the right front and rear of the unit. If these hinges stick and are difficult to operate, spray hinges with a good silicone spray lubricant.

l. Inspect all wiring, leads, and cables. Inspect for cuts, abrasions, and signs of deterioration and overheating. Inspect leads for broken strands at terminals.

m. Check to be sure that all fans are operational and do not exhibit excess bearing wear. The unit contains two fans: one in the front lower interior section of the unit, and the other at the upper rear of the unit.

n. After inspection has been completed, close and latch the front and rear doors, and turn on input power at the source.

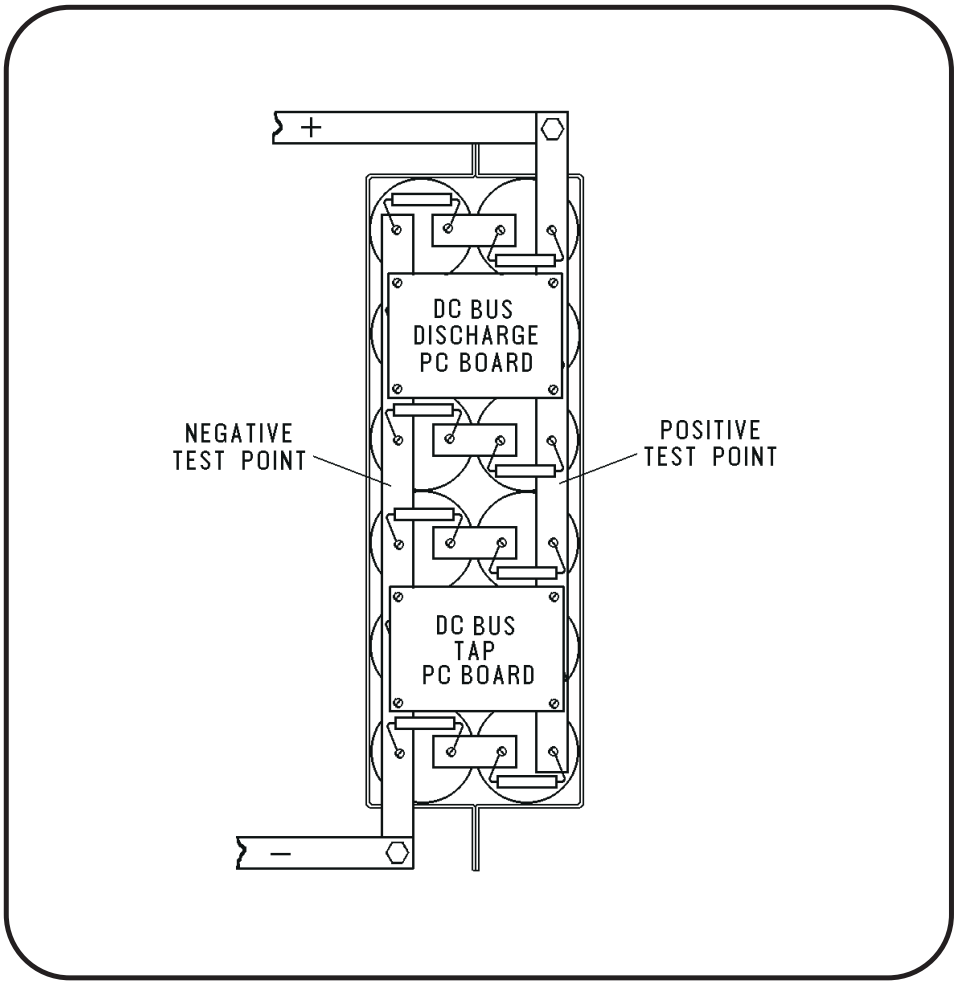


Figure 1: DC Bus Test Points

Chapter 3. Overhaul / Major Repair

1. General

Repair of the converter will consist primarily of parts replacement. Most of the components used in the converter cannot be disassembled and repaired, and must be replaced if faulty. Additionally, inoperative PC boards cannot be repaired in the field, but must be replaced as a complete unit. PC boards may be returned to the factory for replacement. Contact Hobart Brothers service for parts and replacement instructions.

2. Service Information and Factory Repair

Questions concerning the operation, repair, and/or servicing of this converter should be directed to the Service Department of Hobart Brothers Company. When making such an inquiry, be sure to provide the service department with the model number, serial number, and approximate date of receipt of the unit. If it is deemed necessary to return the unit to the factory for servicing, contact the Service Department for authorization. It is often unnecessary to return a failed converter since the unit uses plug-in type assemblies throughout its systems. Replacement assemblies for systems covered by this manual are usually in stock at the factory and available for immediate shipment. For details on the warranty which covers this unit, refer to the warranty statement in the rear of this manual or contact the Service Department *(see Introduction, page 1)*.

3. 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 wire ties, cable clamps, etc.

4. Converter Removal and Installation

If extensive repairs are to be made to a unit which is mounted on a trailer or boarding bridge, it is suggested that the unit be removed and placed on a solid supporting structure of some kind.

WARNING

High voltages may be pesent inside the cabinet, even when the unit is off. Exercise extreme caution or **FATAL SHOCK** may result.

a. Turn off input power at the source. Make sure that power cannot be inadvertently turned back on.

b. Open the front door by turning all three latches counterclockwise with an 8 mm (5/16 inch) allen wrench.

c. Test the DC bus with a voltmeter to be sure that it is fully discharged. The bus can be tested at the two long copper bars on each side of the DC capacitor bank. If the bus is not discharged, close the converter door, wait at least 15 minutes, and test it again. Do not perform any work inside the converter while the DC bus remains charged. See Figure 1 for the proper test points.

d. Disconnect the three AC input leads at terminals L1, L2, and L3 of input contactor K1 and the grounding wire at the grounding lug *(see Figure 2)***.**

e. Loosen the clamp in the base and pull the input cable from the clamp.

f. Loosen the cable clamp at the rear of the unit, if so equipped, and pull the input cable from the unit *(see Figure 3)***.**

g. Close and latch the front door, and open the rear door.

h. Disconnect all output cables from the output contactors or transformer.

i. Disconnect EF signal and any remote control leads from the terminal strips near the top rear (or left rear) of the unit.

j. Loosen the cable clamp(s) on the right side panel (for vertical mount) or bottom panel (for horizontal mount), and remove the output, EF signal, and remote control cables from the unit.

k. Close and latch the rear door.

l. Remove the mounting screws or bolts which attach the converter to its mounting.

m. Attach a lifting hoist or forklift and carefully lift the converter. Be sure all leads are free and do not become entangled. Move the unit to a clear working area where it can be placed on a solid supporting structure.

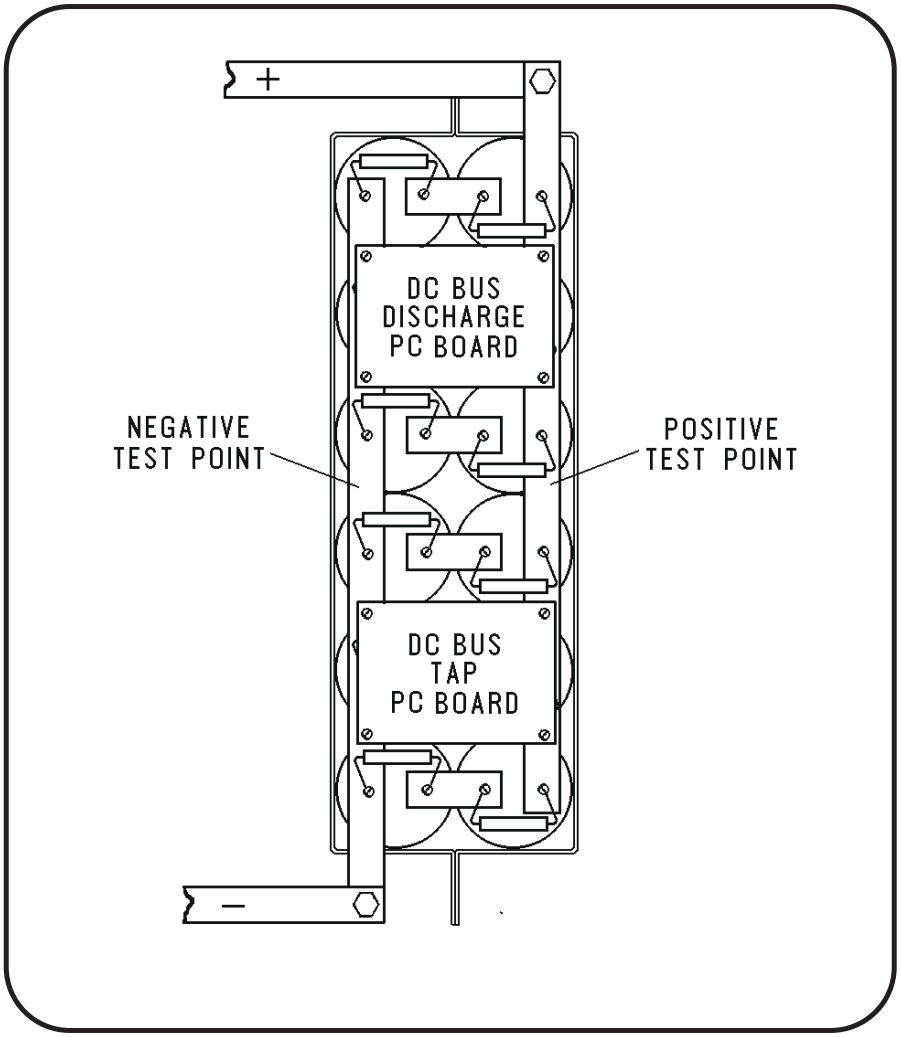


Figure 1: DC Bus Test Points

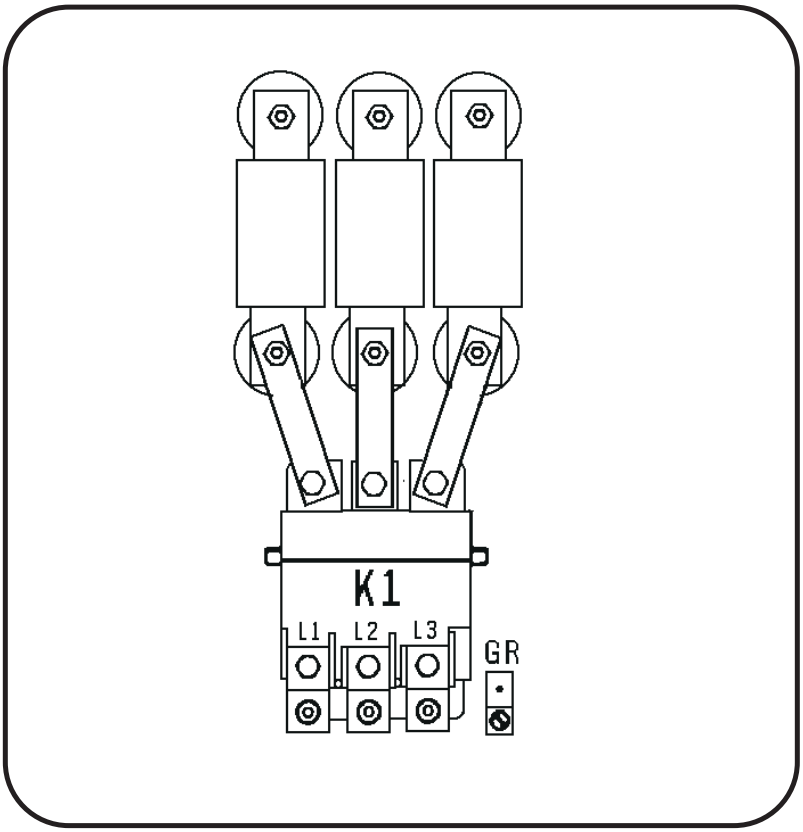


Figure 2: Input Contactor K1

n. Installation is in the reverse order of removal. See Section 1-2, Installation and Setup, for additional information on installing the converter.

5. Component Removal and Replacement

Many of the components in the converter are easily replaced when necessary. Section 1-1 provides a description of the major components used in the unit, while Figures 1, 3-6, 8-12, and 14 of Section 1-1 show the location of the components used in the converter. All the procedures in this section assume that your converter is mounted horizontally; any necessary descriptions for vertically mounted units appear in parentheses throughout this section. Before removing or replacing any component, follow these steps:

(1) Turn off input power at the source. Make sure that power cannot be inadvertently turned back on.

WARNING

High voltages may be pesent inside the cabinet, even when the unit is off. Exercise extreme caution or **FATAL SHOCK** may result.

The converter draws a small amount of input power even when the unit is off. Components and PC boards throughout the unit can be permanently damaged if anything is removed or replaced while input power is present. Therefore, always make sure input power is off before removing or installing any parts inside the unit.

(2) Open the front door by turning all three latches counterclockwise with an 8 mm (5/16 inch) Allen wrench.

(3) Test the DC bus with a voltmeter to be sure that it is fully discharged. The bus can be tested at the two long copper bars on each side of the DC capacitor bank. If the bus is not discharged, close the converter door, wait at least 15 minutes, and test it again. Do not perform any work inside the converter while the DC bus remains charged. See Figure 1 for the proper test points.

Remove and replace components as follows.

a. Capacitors

The only capacitors which may need to be replaced under normal use are those that make up the DC capacitor bank. This bank is located behind the front door near the center of the unit. For components involved in capacitor removal and replacement installation, refer to Figure 4 of Section 4-3. After determing which capacitor is defective, proceed as follows to remove and replace it.

(1) Remove the two PC boards from the front of the DC capacitor bank.

(2) Remove the six resistors (14, Fig. 4, Section 4-3) that are connected across the two vertical bus bars (13, Fig. 4, Section 4-3) that are attached to the capacitors.

(3) Remove the bus bars from the capacitor bank.

(4) Loosen the two screws (8, Fig. 4, Section 4-3) at the BOTTOM of the left capacitor support bracket (2, Fig. 4, Section 4-3), and pry these apart slightly to permit removal of the defective capacitor.

CAUTION

Capacitors are **POLARITY SENSITIVE**. Make certain that capacitors are installed **EXACTLY** as they were previously installed.

(5) Remove defective capacitor and replace it.

(6) Installation is in the reverse order of removal. Make certain that components are installed exactly as they were previously installed, and make certain that screws and nuts are tightened securely. The mounting face of each auminum terminal stud, but not the threads of the capacitors, must be coated with Penetrox or an equivalent anti-oxidation compound at installation.

b. Contactors

As many as five contactors may be used in the converter. All models of the unit use input contactor K1 and charging contactor K2. Single output units do not use output contactors, while multiple output units use one output contactor for each available output.

(1) Input Contactor K1

Input contactor K1 is located on the interior partition, near the right side (bottom) of the unit behind the front door. It is fastened with three M6-1.0 nuts and M6 flat washers, lockwashers and IET washers. To remove and replace this contactor, follow these steps:

a. Open the front door by turning all three latches counterclockwise with an 8 mm (5/16 inch) Allen wrench.

b. Loosen the three socket head set screws which fasten the input leads to the contactor with an 8 mm Allen wrench and remove the leads from the contactor.

c. Remove the three copper bars which connect the contactor to the input fuses.

d. Remove the three nuts which hold the contactor in place and remove the contactor.

e. Installation is in the reverse order of removal. See pertinent connection diagram for lead connections.

(2) Charging Contactor K2

Charging contactor K2 is located on the right side (bottom) panel behind the front door. It is fastened with four M5-0.8 nuts, and M5 lockwashers, flat washers, and IET washers. To remove and install this contactor, follow these steps:

a. Open the front door by turning all three latches counterclockwise with an 8 mm (5/16 inch) Allen wrench.

b. Clearly label each of the leads connected to the contactor and remove each one.

c. Remove the four nuts which hold the contactor in place and remove the contactor.

d. Installation is in the reverse order of removal. See pertinent connection diagram to verify lead connections.

(3) Output Contactors K5 - K7

Output contactors, if used, are located on the top (left side) panel behind the rear door. Each is fastened with three M6-1.0 nuts and M6 flat washers, lockwashers, and IET washers. To remove and install this contactor, follow these steps:

a. Open the rear door by turning all three latches counterclockwise with an 8 mm (5/16 inch) Allen wrench.

b. Clearly label each of the leads connected to the contactor and disconnect each one.

c. Loosen, but do not remove, the three nuts which hold the contactor in place, then slide the contactor to the left (up) until the contactor can be removed.

d. Installation is in the reverse order of removal. If necessary, verify connections by referring to pertinent connection diagram.

c. Control Panel

(1) Open the front door by turning all three latches counterclockwise with an 8 mm (5/16 inch) Allen wrench.

(2) Remove the eight M5-0.8 hex nuts, along with the M5 flat washers, lock washers, and IET washers.

(3) Detach leads that are attached to the control panel.

(4) Pull the control panel backward to remove it from the M-5 studs attached to the front door.

(5) Installation is in the reverse order of removal. If necessary, verify wiring by referring to pertinent connection diagram.

d. Fans

(1) Output Fan

Refer to Figure 9, Section 4-3 to view the various components of the output fan assembly, and proceed as follows to remove and install the fan.

a. Remove fan housing by using a socket wrench with 10mm (3/8") socket to remove the four hex-head bolts which attach the housing to the large fan mounting plate.

b. Remove the mounting bracket to which the fan is attached from the fan mounting plate by removing the four M5-0.8 X 12 mm pan-head screws along with the M5 flat washers, lock washers, and IET washers.

c. Carefully pull out the fan and mounting plate and detach the wiring from the fan.

d. Remove the fan from the mounting bracket by removing the four M4-0.7 X 8 mm pan-head cross-recess screws, along with the M4 flat washers, lock washers, and IET washers, that attach the fan to the mounting bracket.

e. Installation is in the reverse order of removal.

If fan blades rotate in the wrong direction, reverse connection of any **two** fan input leads.

(2) Rectifier/Inverter Fan

Refer to Figure 7, Section 4-3 to view the various components of the rectifier/inverter section fan assembly, and proceed as follows to remove and install the fan.

a. Remove the six M5-0.8 X 12 mm pan-head screws, along with the M5 flat washers, lock washers, and IET washers, which attach the venturi mounting plate to the unit.

b. Remove the four M5-0.8 hex-nuts, along with the M5 flat washers, lock washers, and IET washer, which attach the fan mounting plate to the unit, and carefully pull out the fan and mounting plate.

c. Detach the wiring from the fan.

d. Remove the four M4-0.7 X 16 mm pan-head cross-recess screws, along with the M4 flat washers, lock washers, and IET washer, that attach the fan to the mounting bracket.

e. Installation is in the reverse order of removal.

If fan blades rotate in the wrong direction, reverse connection of any **two** fan input leads.

e. Fiber Optic Cables

The ADCS, load control, and modulator PC boards communicate with each other through three fiber optic cables. Each cable ends at either an emitter or detector mounted next to each other at one edge of each board. To remove and replace a fiber optic cable, follow these steps:

(1) Remove each end of the damaged cable by turning the emitter and detector collets counterclockwise until the cable and collet can be removed.

(2) Pull the cable from the emitter and detector and slide the collets from the cable.

(3) Pull the cable from the wire ties, cable clamps, or plastic wire guide.

(4) Installation is in the reverse order of removal. See pertinent connection diagram for cable connections and routing.

If the ends of the cable become damaged, the cable can easily be repaired. To repair damaged ends, follow these steps:

a. Carefully cut approximately ½ - inch from each end of the cable with a sharp knife or a razor blade. Do not use scissors or wire cutters, as these will not give a clean, square cut.

b. Strip approximately 0.1 - 0.18 inches from each end of the cable with wire strippers.

c. Reinstall the cable following the steps above.

f. Fuses

(1) Input Contactor Fuses

a. Refer to Figure 3, Section 4-3 to view the input contactor fuses, and proceed as follows to remove and install one or more of these fuses.

b. Remove each defective fuse by removing the two M8-1.25 X 20 mm hex-head bolts which attach it to its two insulators.

c. Installation is in the reverse order of removal.

(2) Front Interior Panel Fuses (2A)

Refer to Figure 6, Section 4-3 to view the front interior panel fuses. These fuses are removed and replaced simply by pulling them from the fuseholder and pushing the replacement fuses into the fuseholder.

g. Input Rectifiers

Table 1 shows the torque values recommended by the manufacturer for the rectifier modules used in this converter. Rectifier torque values are shown in inch-pounds (inch-lbs), newton-meters (Nm), and centimeter-kilograms (cm-kg).

Location	Torque Values		
Mounting screws	27 inch-lbs	3.0 Nm	31 cm-kg
Electrical connection screws	90 - 100 inch-lbs	10 - 11 Nm	104 - 115 cm-kg

Table 1: Input Rectifier Torque Requirements

h. Power Modules

Figure 1 shows the locations of screw terminals on the power module and the sizes of screws which are used at these terminals. Power modules used in the converter are the Toshiba brand. Table 2 shows the torque values recommended for the power modules. Power module torque values are shown in inch-pounds (inch-lbs), newton-meters (Nm), and centimeter-kilograms (cm-kg).

Location	Torque Values		
Case to Heat Sink	27 inch-lbs	3.0 Nm	31 cm-kg
Terminal, M4 Screws	17 inch-lbs	1.9 Nm	20 cm-kg
Terminal, M6 Screws	27 inch-lbs	3.0 Nm	31 cm-kg

Table 2: Power Module Torque Values

i. Resistors

(1) DC Bus Charge Resistors

The DC bus charge resistors, R1B and R1C, are located near the middle of the unit behind the rear door. They are fastened with a long, threaded bar through their centers. To remove and replace these resistors, follow these steps:

a. Open the rear door by turning all three latches counterclockwise with an 8 mm (5/16 inch) allen wrench.

b. Clearly label each of the leads connected to the resistors, then disconnect each one by gently pulling the connector away from the resistor.

c. Remove the nut, lockwasher, and flat washer at one end of the long threaded bar.

d. Slide the bar out from the unit while holding the resistors to prevent them from falling.

e. Installation is in the reverse order of removal. If necessary, verify connections by referring to pertinent connection diagram.

(2) DC Bus Discharge Resistor

The DC bus discharge resistor, R16, is located near the middle of the unit behind the rear door. It is fastened with a long, threaded bar through its centers. To remove and replace this resistor, follow these steps:

a. Open the rear door by turning all three latches counterclockwise with an 8 mm (5/16 inch) Allen wrench.

b. Disconnect the two leads by gently pulling the connector away from the resistor.

c. Remove the nut, lockwasher, and flat washer at one end of the long threaded bar.

d. Slide the bar out from the unit while holding the resistor to prevent it from falling.

e. Installation is in the reverse order of removal. If necessary, verify connections by referring to the pertinent connection diagram.

(3) DC Capacitor Bank Resistors

Refer to Figure 4, Section 4-3 to see location of the twelve capacitor bank resistors. Any one of these resistors can be removed simply by removing the two 10-32 X 5/8" pan-head cross-recess screws and the washers which attach the resistor to the vertical DC capacitor bus bars. Installation is, of course, in the reverse order of removal.

j. Switches

(1) Door Interlock Switches

The converter is equipped with two door interlock switches: S2 on the front door and S3 on the back door. To remove and replace a switch, follow these steps:

a. Open the front or rear door by turning all three latches counterclockwise with an 8 mm (5/16 inch) Allen wrench.

b. Disconnect the two leads from the switch.

c. Remove the two screws holding the switch to the frame of the converter.

d. Installation is in the reverse order of removal. Make sure that the leads are connected to the "COMMON" and "N.O." terminals. If necessary, verify connections by referring to the pertinent connection diagram.

(2) Power Module Thermal Switches

Two small thermal switches are located near the top of the heat sink behind the power modules, snubber PC boards, and driver PC boards, behind the front door. To remove and replace a switch, follow these steps:

a. Open the front door by turning all three latches counterclockwise with an 8 mm (5/16 inch) Allen wrench.

b. Remove the rightmost (top) driver PC board (A5A2). Refer to Section 1-1, Paragraph 3, b (6), Driver PC Boards, for details.

c. Remove the rightmost (top) snubber PC board. Refer to Section 1-1, Paragraph 3, b (8) for details.

d. Remove the short bus bar connecting the two power modules.

e. Disconnect the two leads from the faulty switch.

f. Remove the two small screws on each side of the switch.

g. Installation is in the reverse order of removal. Be certain to torque the power modules according to the manufacturer's requirements. See Paragraph 6, h, Power Modules, (and Table 2), for torque requirement.

(3) Transformer Thermal Switches

Each of the main transformers has a thermal switch, tucked in the coils of the transformer, that detects overheating and sends a signal to the ADCS PC board. Each thermal switch has two wire leads. These wire leads are connected to a small (2-station) terminal strip attached to the large bar at the top of the transformer.

To remove and replace one of these switches, carefully pull upward on the switch that is tucked in the coils of the transformer, then disconnect the thermal switch wire leads from the small terminal strip. Installation is in the reverse order of removal.

k. Transformers

(1) Control Transformer

The control transformer is shown in Section 1-1, in Figure 10, as Item 11. Proceed as follows to remove and replace the control transformer.

a. Clearly label each of the leads connected to the control transformer and disconnect each one.

b. Remove the four M6-1.0 hex-nuts, along with the M6 flat washers, lock washers, and IET washer, which attach the contol transformer to the cabinet frame.

c. Remove the control transformer.

d. Installation is in the reverse order of removal. If necessary, verify connections by referring to the pertinent connection diagram.

(2) Output Current Sensing Transformers

Refer to Figure 10, Section 4-3 to view the output voltage sensing transforners. Proceed as follows to remove and replace one or more of these sensing transformers.

a. Disconnect the large cable that runs through the transformer.

b. Clearly label each of the leads connected to the transformer that is to be removed, and disconnect each lead.

c. Remove the four M3-0.5 X 10 mm pan-head cross-recess screws, along with the M3 flat washers, lock washers, and IET washers, which attach the transformer to the mounting panel.

d. Remove the transformer.

e. Installation is in the reverse order of removal. If necessary, verify connections by referring to the pertinent connection diagram.

Follow the same procedure as above for removing and replacing the neutral current transformer.

(3) Output/Main Transformers

Except for physical damage, it is improbable that either of the main transformers will fail. In any event, it is not recommended that attempts be made to remove and replace one or both of the main transformers in the field.

(4) Voltage Sensing Transformers

Refer to Figure 6, Section 4-3, and item 13 of Figure 10 in Section 1-1, to locate and view the voltage sensing transformer. Proceed as follows to remove and replace one or more of the three voltage sensing transformers.

a. Clearly label each of the leads connected to the transformer and disconnect each one.

b. Remove the four M4-0.7 X 12 mm pan-head cross-recess screws, along with the M4 flat washers, lock washers, and IET washer, which attach the transformer to the cabinet frame.

c. Remove the transformer.

d. Installation is in the reverse order of removal. If necessary, verify connections by referring to the pertinent connection diagram.

(5) Remote Control Transformer

Refer to Figure 10, Section 1-1 to locate and view the remote control transformer. This is the tiny transformer located just to the right of the control transformer. Proceed as follows to remove and replace this transformer.

a. Clearly label each of the leads connected to the transformer and disconnect each one.

b. Remove the two M4-0.7 X 10 mm pan-head cross-recess screws, along with the M4 flat washers, lock washers, and IET washer, which attach the transformer to the cabinet frame.

c. Remove the transformer.

d. Installation is in the reverse order of removal. If necessary, verify connections by referring to the pertinent connection diagram.

6. PC Board Removal and Replacement

There are 32 printed circuit (PC) boards in various locations inside the converter. Section 1-1 provides a description of each board, with figures showing the location of the boards in the converter. All the procedures in this section assume that your converter is mounted horizontally; any necessary descriptions for vertically mounted units appear in parentheses () throughout this section. Before removing or replacing any of the boards, follow these steps:

WARNING

High voltages may be pesent inside the cabinet, even when the unit is off. Exercise extreme caution or **FATAL SHOCK** may result.

(1) Turn off input power at the source. Make sure that power cannot be inadvertently turned back on.

The converter draws a small amount of input power even when the unit is off. Components and PC boards throughout the unit can be permanently damaged if anything is removed or replaced while input power is present. Therefore, always make sure input power is off before removing or installing any parts inside the unit.

(2) Open the front door by turning all three latches counterclockwise with an 8 mm (5/16 inch) Allen wrench.

(3) Test the DC bus with a voltmeter to be sure that it is fully discharged. The bus can be tested at the two long copper bars on each side of the DC capacitor bank. If the bus is not discharged, close the converter door, wait at least 15 minutes, and test it again. Do not perform any work inside the converter while the DC bus remains charged. See Figure 1 for the proper test points.

(4) Remove and replace each board as follows.

a. ADCS PC Board

The ADCS PC board (A7) is located on the reverse side of the control panel behind the front door. *(Refer to Section 1-1, Figure 9, item 3).* The board is mounted on four hexagonal nylon spacers and fastened with four #6-32 x 1/2" machine screws, four #6 lock washers, and four #6 flat washers. To remove and replace this board, follow these steps:

(1) Open the front door by turning all three latches counterclockwise with an 8 mm (5/16 inch) Allen wrench.

(2) Clearly label each of the cables connected to the ADCS PC board, then disconnect each one by gently pulling the plug away from the board. Disconnect the fiber optic cables by turning each collet counterclockwise until the cable can be removed.

(3) Remove the four machine screws, lockwashers, and flat washers at each corner of the board.

(4) Installation is in the reverse order of removal. If necessary, verify wiring by referring to the pertinent connection diagram.

b. Chopper PC Board

The chopper PC board (A9) is the small board located on the top (left side) panel between the modulator and power supply PC boards behind the front door. *(Refer to Section 1-1, Figure 8, item 2).* The board is mounted on four hexagonal nylon spacers and fastened with four #6-32 x 1/2" machine screws, four #6 lock washers, and four #6 flat washers. To remove and replace this board, follow these steps:

(1) To gain access to this PC board, open the front door by turning all three latches counterclockwise with an 8 mm (5/16 inch) Allen wrench.

(2) Clearly label each of the cables connected to the chopper PC board, then disconnect each one by gently pulling the plug away from the board.

(3) Remove the four machine screws, lockwashers, and flat washers at each corner of the board.

(4) Installation is in the reverse order of removal. If necessary, verify wiring by referring to the pertinent connection diagram.

c. DC Bus PC Board

The DC bus PC board (A8) is located to the left of (beneath) the driver and driver logic PC boards behind the front door. *(Refer to Section 1-1, Figure 8, item 8).* The board is mounted on To remove and replace this board, follow these steps:

(1) To gain access to this PC board, open the front door by turning all three latches counterclockwise with an 8 mm (5/16 inch) Allen wrench.

(2) Clearly label each of the cables connected to the DC bus PC board, then disconnect each one by gently pulling the plug away from the board.

(3) Remove the two bolts, lockwashers, and flat washers at each corner of the board.

(4) Installation is in the reverse order of removal. If necessary, verify wiring by referring to the pertinent connection diagram.

d. DC Bus Discharge PC Board

The DC bus discharge PC board (A13) is located in front of the DC capacitor bank behind the front door. *(Refer to Section 1-1, Figure 8, item 9).* The board is mounted on four hexagonal steel spacers and fastened with four #6-32 x 1/2" machine screws, four #6 lock washers, and four #6 flat washers. To remove and replace this board, follow these steps:

(1) To gain access to this PC board, open the front door by turning all three latches counterclockwise with an 8 mm (5/16 inch) Allen wrench.

(2) Clearly label each of the cables connected to the DC bus discharge PC board, then disconnect each one by gently pulling the plug away from the board.

(3) Remove the four machine screws, lockwashers, and flat washers at each corner of the board.

(4) Installation is in the reverse order of removal. If necessary, verify wiring by referring to the pertinent connection diagram.

When removing any of the following three PC boards - driver logic, driver, or snubber PC boards - these boards should be removed in sequence. The driver logic boards are easily removed without removing any other converter components. Then the driver PC board must be removed to gain access to a snubber PC board behind it.

NOTE: When removing driver and snubber PC boards , carefully guide them around the modulator PC board to avoid inadvertent damage to this board.

e. Driver Logic PC Boards

The six driver logic PC boards (A6) are the small boards located in the center of the unit behind the front door. *(Refer to Section 1-1, Figure 8, item 4).* Starting from the right side (top), the boards are numbered A6A2, A6B2, A6C2, A6A1, A6B1, and A6C1, corresponding to the bridge number and phase. Each board is plugged into a driver PC board and fastened with two captive screws. To remove and replace these boards, follow these steps:

CAUTION

The driver PC board is static sensitive. Handle only with static-safe techniques

(1) To gain access to this PC board, open the front door by turning all three latches counterclockwise with an 8 mm (5/16 inch) Allen wrench.

(2) Remove a driver logic PC board by loosening the two captive screws on J1, and gently pulling the board out of the connecto. If necessaru, the driver logic board can be rocked slightly in its socket to remove it.

(3) When remounting this board or mounting its replacement, installation is in the reverse order of removal.

f. Driver and Snubber PC Board Replacement

CAUTION

On vertically mounted units, cover the AC capacitors with cardboard or other appropriate means to catch any dropped hardware.

The driver and snubber PC boards are static sensitive. Handle only with static-safe techniques

Depending on the model of the converter and when it was made, two types of IGBT modules are used. The type of module used determines how the new driver and snubber PC boards will be mounted. When replacement is necessary, both of these PC boards are removed and replaced at the same time. For customer convenience, a driver/snubber replacement kit with installation instructions, identified by kit number 285339, is available from Hobart Brothers. Installation instructions are included in Chapter 5-1 of this manual.

g. Input Voltage PC Board

The input voltage PC board (A11) is located on the bottom panel near the right side (right side panel near the top) behind the front door. *(Refer to Section 1-1, Figure 8, item 6).* The board is mounted on four hexagonal nylon spacers and fastened with four #6-32 x 1/2" machine screws, four #6 lock washers, and four #6 flat washers. To remove and replace this board, follow these steps:

(1) Open the front door by turning all three latches counterclockwise with an 8 mm (5/16 inch) Allen wrench.

(2) Clearly label each of the cables connected to the input voltage PC board, then disconnect each one by gently pulling the plug away from the board.

(3) Remove the four machine screws, lockwashers, and flat washers at each corner of the board.

(4) Installation is in the reverse order of removal. If necessary, verify wiring by referring to the pertinent connection diagram.

h. Inverter Current PC Board

The inverter current PC board (A3) is located at bottom right (bottom left) behind the rear door. *(Refer to Section 1-1, Figure 9, item 6).* The board is mounted on four hexagonal nylon spacers and fastened with four #6-32 x 1/2" machine screws, four #6 lock washers, and four #6 flat washers. To remove and replace this board, follow these steps:

(1) Open the rear door by turning all three latches counterclockwise with an 8 mm (5/16 inch) Allen wrench.

(2) Six large cables run from the output filter reactors to the output transformers. One end of each of these cables must be disconnected to remove the inverter current PC board.

(3) Follow each of the six cables from the back of the inverter current PC board to where they are fastened to output transformer T9 or T10 *(see Figure 11 of Section 1-1)*.

(4) Label and remove each cable from the transformers.

(5) Disconnect the 9-pin plug on the PC board by turning the posts on each side of the plug counterclockwise.

(6) Remove the four machine screws, lockwashers, and flat washers at each corner of the board.

(7) Installation is in the reverse order of removal. If necessary, verify wiring by referring to the pertinent connection diagram.

i. Lamp PC Board

The lamp PC board (A10) is located between the reverse side of the control panel and the ADCS PC board, behind the front door. *(Refer to Section 1-1, Figure 9, item 5).* The board is mounted on four hexagonal nylon spacers and fastened with four #6-32 nuts, four #6 lock washers, and four #6 flat washers. To remove and replace this board, follow these steps:

(1) Open the front door by turning all three latches counterclockwise with an 8 mm (5/16 inch) Allen wrench.

(2) Remove the ADCS PC board. Refer to Paragraph 7,a, preceding for the removal procedure.

(3) Disconnect the cable from the lamp PC board by gently pulling the plug away from the board.

(4) Remove the four nuts, lockwashers, and flat washers at each corner of the board.

(5) Installation is in the reverse order of removal. If necessary, verify wiring by referring to the pertinent connection diagram.

j. Load Control PC Board

The load control PC board (A12) is located at the far right (top) of the unit behind the front door. *(Refer to Section 1-1, Figure 8, item 5).* The board is mounted on four hexagonal nylon spacers and fastened with four #6-32 x 1/2" machine screws, four #6 lock washers, and four #6 flat washers. To remove and replace this board, follow these steps:

(1) Open the front door by turning all three latches counterclockwise with an 8 mm (5/16 inch) Allen wrench.

(2) Clearly label each of the cables connected to the load control PC board, then disconnect each one by gently pulling the plug away from the board. Disconnect the fiber optic cables by turning each collet counterclockwise until the cable can be removed.

(3) Remove the four machine screws, lockwashers, and flat washers at each corner of the board.

(4) Installation is in the reverse order of removal. If necessary, verify wiring by referring to the pertinent connection diagram.

k. Modulator PC Board

The modulator PC board (A2) is the long, narrow board located on the top (left side) panel behind the front door. *(Refer to Section 1-1, Figure 8, item 1).* The board is mounted on nine hexagonal nylon spacers.

CAUTION

The modulator PC board is static sensitive. Handle only with static-safe techniques

To remove and replace this board, follow these steps:

(1) Disconnect all connectors, J1 through J10.

(2) Disconnect both fiber optic cables.

(3) Remove modulator PC board by unscrewing its nine mounting screws.

(4) When remounting this board or remounting its replacement, installation is in the reverse order of removal,

l. Output PC Board

The output PC board (A4)is located behind the bottom (left side) panel. *(Refer to Section 1-1, Figure 9, item 1).* The board is mounted on four hexagonal nylon spacers and fastened with four #6-32 x 1/2" machine screws, four #6 lock washers, and four #6 flat washers. To remove and replace this board, follow these steps:

(1) Remove the bottom (right side) panel.

(2) Clearly label each of the cables connected to the output PC board, then disconnect each one by gently pulling the plug away from the board. Disconnect the grey, 9-pin connector by turning the posts on each side of the plug counterclockwise.

(3) Remove the four machine screws, lockwashers, and flat washers at each corner of the board.

(4) Installation is in the reverse order of removal. If necessary, verify wiring by referring to the pertinent connection diagram.

m. Power Supply PC Board

The power supply PC board (A1) is the large square board located on the top (left side) panel behind the front door *(Refer to Section 1-1, Figure 8, item 3).* The board is mounted on four hexagonal nylon spacers and fastened with four #6-32 x 1/2" machine screws, four #6 lock washers, and four #6 flat washers. To remove and replace this board, follow these steps:

(1) Open the front door of the converter cabinet by turning all three latches counterclockwise with an 8 mm (5/16 inch) Allen wrench.

(2) Clearly label each of the cables connected to the power supply PC board, then disconnect each one by gently pulling the plug away from the board.

(3) Remove the four machine screws, lockwashers, and flat washers at each corner of the board.

(4) Installation is in the reverse order of removal. If necessary, verify wiring by referring to the pertinent connection diagram.

n. Remote Sensor PC Board

The Remote Sensor PC board *(A16)* is located in the rear interior of the converter unit. *(Refer to Section 1-1, Figure 9, Item 8).* The board is mounted on four hexagonal nylon spacers and fastened with four #6-32 x 1/2" machine screws, four #6 lock washers, and four #6 flat washers. To remove and replace this board, follow these steps:

(1) Open the rear door by turning all three latches counterclockwise with an 8 mm *(5/16 inch)* Allen wrench.

(2) Clearly label each of the cables connected to the remote sensor PC board, then disconnect each one by gently pulling the plug away from the board.

(3) Remove the four machine screws, lockwashers, and flat washers at each corner of the board.

(4) Installation is in the reverse order of removal. If necessary, verify wiring by referring to the pertinent connection diagram.

o. Bus Tap PC Board

The Bus Tap PC board *(A15)* is located in front of the DC capacitor bank in the front interior of the converter unit. *(Refer to Section 2-3, Figure 1).* The board is mounted on four hexagonal nylon spacers and fastened with four #6-32 x 1/2" machine screws, four #6 lock washers, and four #6 flat washers. To remove and replace this board, follow these steps:

(1) Open the front door by turning all three latches counterclockwise with an 8 mm *(5/16 inch)* Allen wrench.

(2) Clearly label each of the cables connected to the bus tap PC board, then disconnect each one by gently pulling the plug away from the board.

(3) Remove the four machine screws, lockwashers, and flat washers at each corner of the board.

(4) Installation is in the reverse order of removal. If necessary, verify wiring by referring to the pertinent connection diagram.

p. ID PC Board

The ID PC board is the small PC board located inside the converter cabinet door just above the ADCS PC board (1-1; 9, Fig. 9). This PC board stores calibration data from the factory final test. It also holds unit serial number and machine type. This allows the ADCS to re-configure itself if removed from one unit to another. The ID PC board also holds accumulated data for the unit.

If the ADCS diagnosis indicates that the ID PC board should be replaced, information must be collected for programming its replacement. For this purpose, a Calibration Form is provided on the next page. On this form, begin by filling in information from the ACCUMULATOR MENU (KWH, hours, power starts and starts). Then proceed as follows:

(1) Return to MAIN MENU and press the hidden key just to the left of the UP (Δ) arrow on the ADCS panel. Eight 4-digit calibration factors will appear, separated by the letter “i”. Enter these letters on the calibration form.

(2) Press the DOWN (∇) arrow and eight more 4-digit calibration factors will appear, separated by the letter “i”. Enter these letters on the calibration form.

(3) Press the DOWN (∇) arrow and eight more 4-digit calibration factors will appear, separated by the letter “j”. Enter these letters on the calibration form.

(4) Press the DOWN (∇) arrow and eight more 4-digit calibration factors will appear, separated by the letter “k”. Enter these letters on the calibration form.

(5) Press the DOWN (∇) arrow and eight more 4-digit calibration factors will appear, separated by the letter “l”. Enter these letters on the calibration form.

(6) Return to the MAIN MENU by pressing the hidden key**.**

To receive a replacement ID PC board, call Hobart Brothers, Airport Systems Group**,** Service Department**,** and you will be informed as to where to FAX the information collected on the calibration form**.** In U.S.A. call: (800) 422-4177**.** From other countries call: (513) 332-5060.

When replacing the ID PC board proceed as follows:

a. Open the front door by turning all three latches counterclockwise with an 8 mm *(5/16 inch)* Allen wrench.

b. Remove the four machine screws, lockwashers, and flat washers at each corner of the board.

c. Installation is in the reverse order of removal. If necessary, verify wiring by referring to the pertinent connection diagram.

ID PC BOARD CALIBRATION FORM

DATE: / /
CUSTOMER

LOCATION:

S/N:
__ PSO _____

# of OUTPUTS: 1 2 3 4
POWER RATING: 60-kVA 90-kVA 125-kVA 140-kVA 180-kVA

ACCUMULATORS:
KWH . . . . . ____ , _____ , _____
HOURS . . . . . _____, _____
POWER STARTS . . . . . _____, _____
STARTS . . . . . _____, _____

CALIBRATION FACTORS:

GND	IOX1	IOX2	IOX3
_____ i	_____ i	_____ i	_____ i
IOX	-12V	+12V	+5V
_____ i	_____ i	_____ i	_____ i
VIAB	VIBC	VICA	VOAN
_____ j	_____ j	_____ j	_____ j
VOBN	VOCN	IOA3	IOB3
_____ j	_____ j	_____ j	_____ j
SP7	SP6	SP5	SP4
_____ k	_____ k	_____ k	_____ k
VOX	XXX	DCV	DCI
_____ k	_____ k	_____ k	_____ k
IOC3	IOA2	IOB2	IOC2
_____ l	_____ l	_____ l	_____ l
IOA1	ION	IOB1	IOC1
_____ l	_____ l	_____ l	_____ l

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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 the Hobart PoWerMaster® Solid State Frequency Converters manufactured by Hobart Brothers Company, Ground Power Division, Troy, Ohio 45373, and identified by Part Numbers 500013A and 500013B.

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. 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.

(2) "**Hobart Part No.**" Column

Part numbers appearing in this column are Hobart numbers. These are the numbers to which a customer should refer when purchasing replacement parts, or identifying a part for servicing or replacement.

(3) "**Airline Part No.**" Column

Part numbers appearing in this column are manufacturer part numbers.

(4) "**Nomenclature**" Column

The item identifying name appears in this column. The indenture method is used to indicate item relationships. Thus, components of an assembly are listed directly below the assembly name and indented one space.

(5) "**Eff**" (Effectivity) 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 only on 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 on which they are used. Uncoded parts are usable on all models.

Parts coded "A" are usable on Part Number 500013A-201 only.

Parts coded "B" are usable on Part Number 500013A-202 only.

Parts coded "C" are usable on Part Number 500013A-203 only.

Parts coded "D" are usable on Part Number 500013A-205 only.

Parts coded "E" are usable on Part Number 500013A-206 only.

Parts coded "F" are usable on Part Number 500013A-207 only.

Parts coded "G" are usable on Part Number 500013A-208 only.

Parts coded "H" are usable on Part Number 500013A-209 only.

Parts coded "J" are usable on Part Number 500013A-210 only.

Parts coded "K" are usable on Part Number 500013B-201 only.

Parts coded "L" are usable on Part Number 500013B-202 only.

Parts coded "M" are usable on Part Number 500013B-203 only.

Parts coded "N" are usable on Part Number 500013B-205 only.

Parts coded "P" are usable on Part Number 500013B-206 only.

Parts coded "Q" are usable on Part Number 500013B-207 only.

Parts coded "R" are usable on Part Number 500013B-208 only.

Parts coded "S" are usable on Part Number 500013B-209 only.

Parts coded "T" are usable on Part Number 500013B-210 only.

Parts coded "U" are usable on Part Number 500013B-211 only.

Parts coded "V" are usable on Part Number 500013B-212 only.

(6) "**Units Per Assy**" (Quantity) Column

Numbers in this column indicate the quantity of parts required for an assembly or subassembly in which the part appears. Numbers in this column do not necessarily indicate the total number of parts used in the complete end item.

Section 2. Manufacturer's Codes

The following list is a compilation of vendor codes with names and addresses for suppliers of purchased parts listed in this publication. The codes are iith 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 vendor code, the full name of the manufacturer will be listed in the nomenclature column.

Code	Vendor's Name & Address
02231	Anchor Rubber Company 840 South Patterson Boulevard P.O. Box 832 Dayton, OH 45401
02329	Glastic Corporation 4319 Glenridge Cleveland, OH 44121
03743	Appleton Electric Company 2105 Fifth Avenue South Milwaukee, WI 53172
04713	Motorola Semiconductor Products, Inc. 5005 East McDowell Road Phoenix, AZ 85008
06915	Richco Plastic Company 5825 North Tripp Avenue Chicago, IL 60646
08323	Service Supply Company 603 East Washington Street Indianapolis, IN 46206
14601	Power Devices, Inc. 27071 Cabot Road, Building 114 Laguna Hills, CA 92653
14604	Elmwood Sensors, Inc. 500 Narragansett Park Drive Pawtucket, RI 02861
14831	Magnetic Components, Inc. 5907 Noble Avenue Van Nuys, CA 91411
15605	Eaton Corporation Cutler-Hammer Division 4201 North 27th Street Milwaukee, WI 53216
16741	Magnetex-Triad Transformer Corporation Huntington, IN 46750
23826	Furnas Electric Company 1000 McKee Street Batavia, IL 60510
26794	Connectron, Inc. 12 Industrial Drive Laurance Harbor, NJ 08879
30882	Micron Industries Corporation 1830 32nd Avenue Stone Park, IL 60165
44655	Ohmite Manufacturing Co. 3601 Howard Street Skokie, IL 60076
56289	Commonwealth Sprague Capacitor, Inc. 11 Brown Street, Department CS North Adams, MA 01247
58687	Semikron International P.O. Box 66 Hudson, NH 03051
57587	Homac Manufacturing Company #12 Southland Road P.O. Box 1118 Ormand Beach, FL 32074
59730	Thomas & Betts Corporation Highway 218 South Iowa City, IA 52240
61129	Research Products International Corporation 410 North Business Center Drive Mount Prospect, IL 60056

Code	Vendor's Name & Address
61802	Toshiba International 13131 West Little York Road P.O. Box 40906 Houston, TX 77041
62292	EBM Industries, Inc. 537 New Britain Avenue Unionville, CT 06085
71400	McGraw-Edison Company Bussmann Manufacturing Division 114 Old State Road P.O. Box 14460 St. Louis, MO 63178
72149	Electronic Transformer Company 460 Totowa Avenue Eddington, PA 19020
73978	Memcor-Truohm, Inc. 1320 Flaxmill Road Huntington, IN 46750
74445	Holokrome/Allen #31 Brook Street, Box H06110 West Hartford, CT 06110
77060	General Motors Corporation Packard Electric Division 408 Dana Street N.E. P.O. Box 431 Warren, OH 44482
77569	North American Philips 100 East 42nd Street New York, NY 10017
80174	ITT - Holub Industries, Inc. 423 Elm Street Sycamore, IL 60178

Code	Vendor's Name & Address
81483	International Rectifier, 9220 Sunset Boulevard Los Angeles, CA 90069
82942	Rubatex Corporation Railroad Avenue Bedford, VA 24523
89110	Amp, Inc. Capitron Division Elizabethtown, PA 17022
94422	Southco, Inc. 210 N. Brinton Lake Road Concordville, PA 19331
No Number	Vernitron Corporation Beau Products Division P.O. Box 10 Laconia, NH 03247
No Number	Bossard International, Inc. 235 Heritage Avenue Portsmouth, NH 03801
No Number	Basler Electric Company P.O. Drawer 269 Highland, IL 62249
No Number	Ferraz Corporation 14 Eastmans Road Parsippany, NJ 07054
No Number	Futaba Corporation of America 555 W. Victoria Street Compton, CA 90220
No Number	Homac Manufacturing Company P.O. Box 1118 Ormand Beach, FL 32074

Section 3. Illustrated Parts List

1. 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. Horizontal lines throughout the list are added only to make reading easier and do not signify any relationship between parts.

2. Symbols and Abbreviations

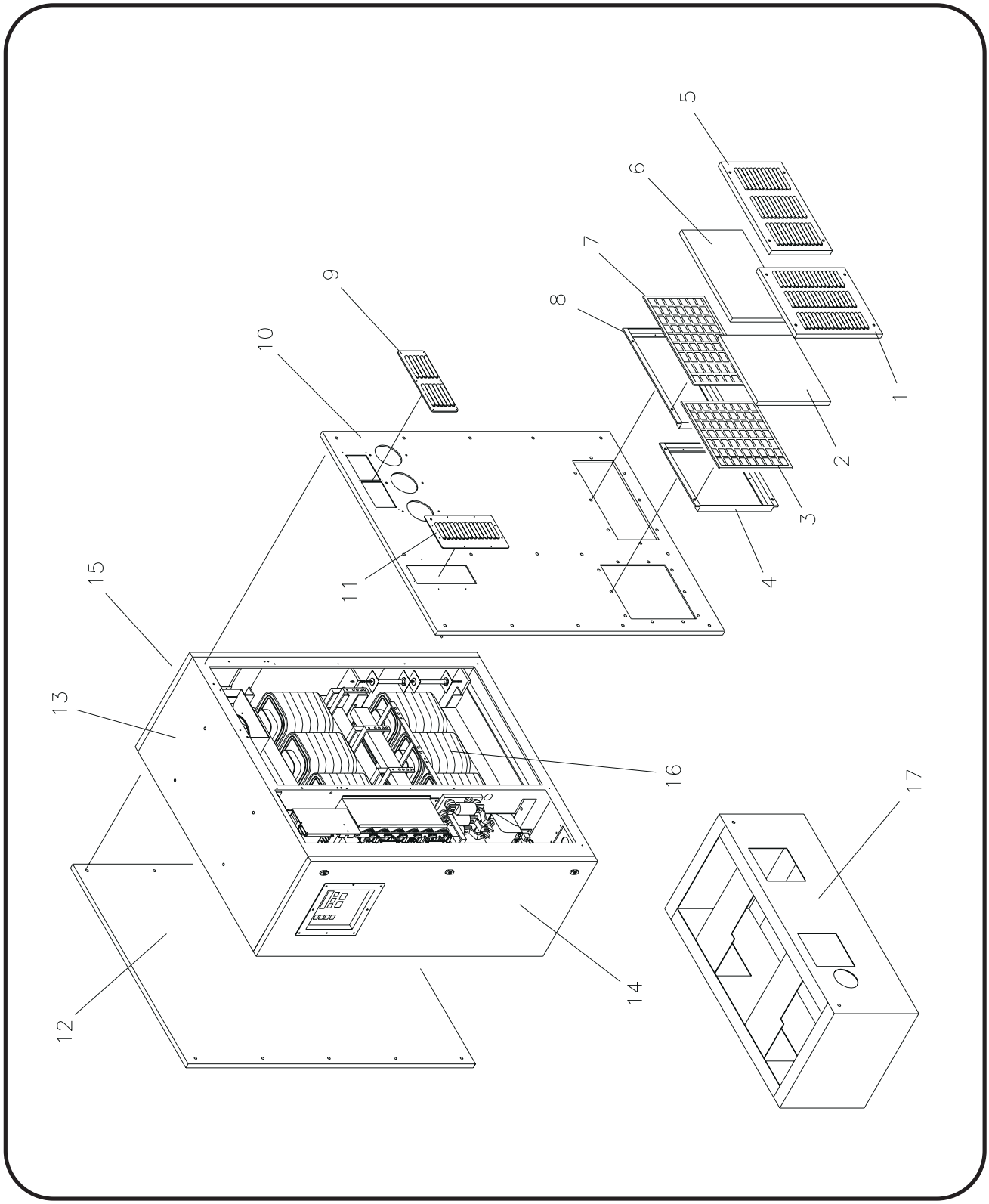
The following is a list of abbreviations used in the parts list:

*	-	Item not illustrated
A or AMP	-	Ampere
AC	-	Alternating current
AR	-	As required
ASSY.	-	Assembly
DC	-	Direct current
HD.	-	Head
HEX	-	Hexagon
HZ	-	Hertz (cycles per second)
IN	-	Inch
KVA	-	Kilovolt-ampere
MFD	-	Microfarad
MTG.	-	Mounting
NO.	-	Number
NHA	-	Next higher assembly
OZ.	-	Ounce
REF	-	Reference (the item has been listed previously)
V	-	Volt

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

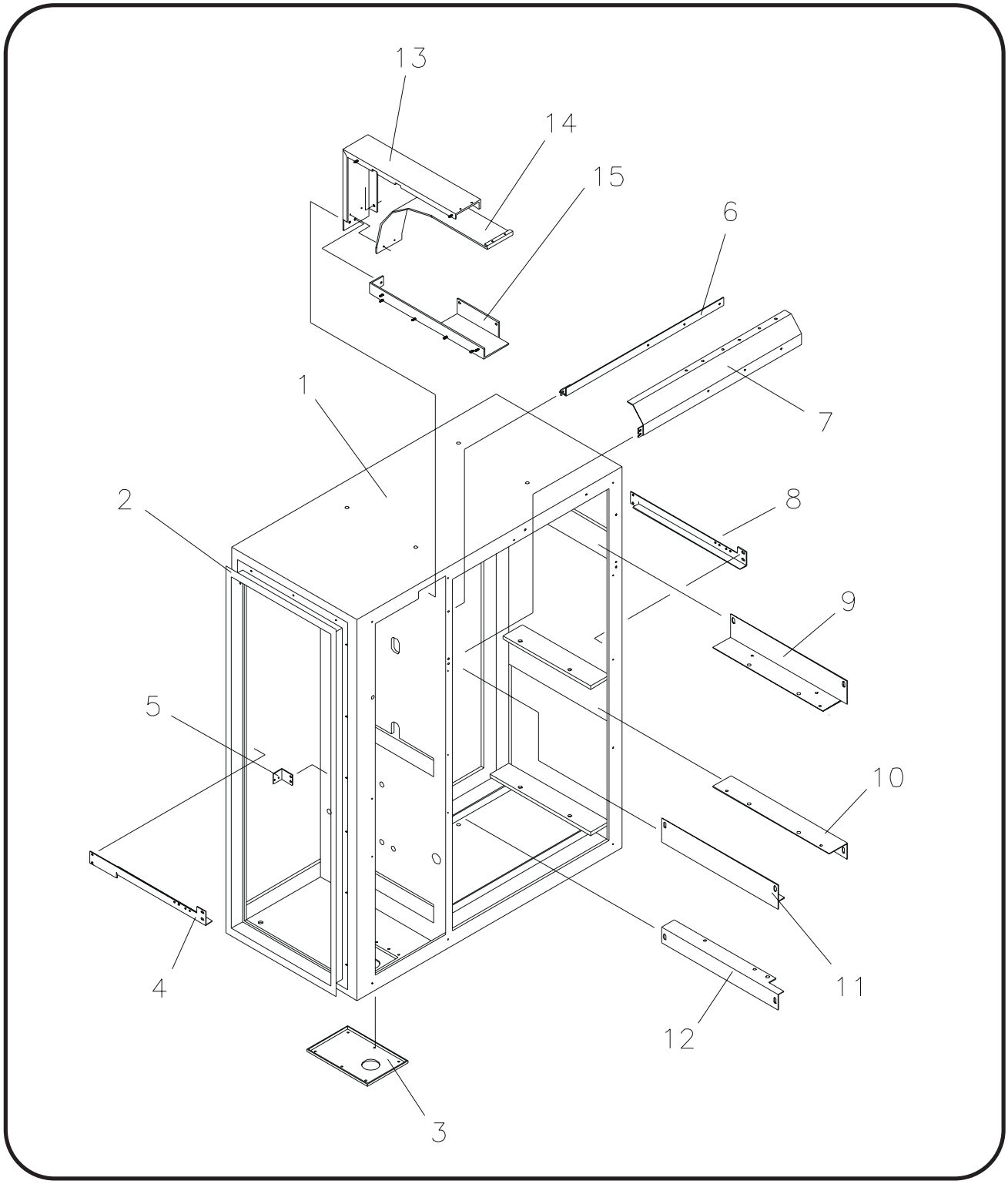
3. Illustrated Parts List

The illustrated part list occupies the remainder of this section.



PoWerMaster Solid State Converter
Figure 1

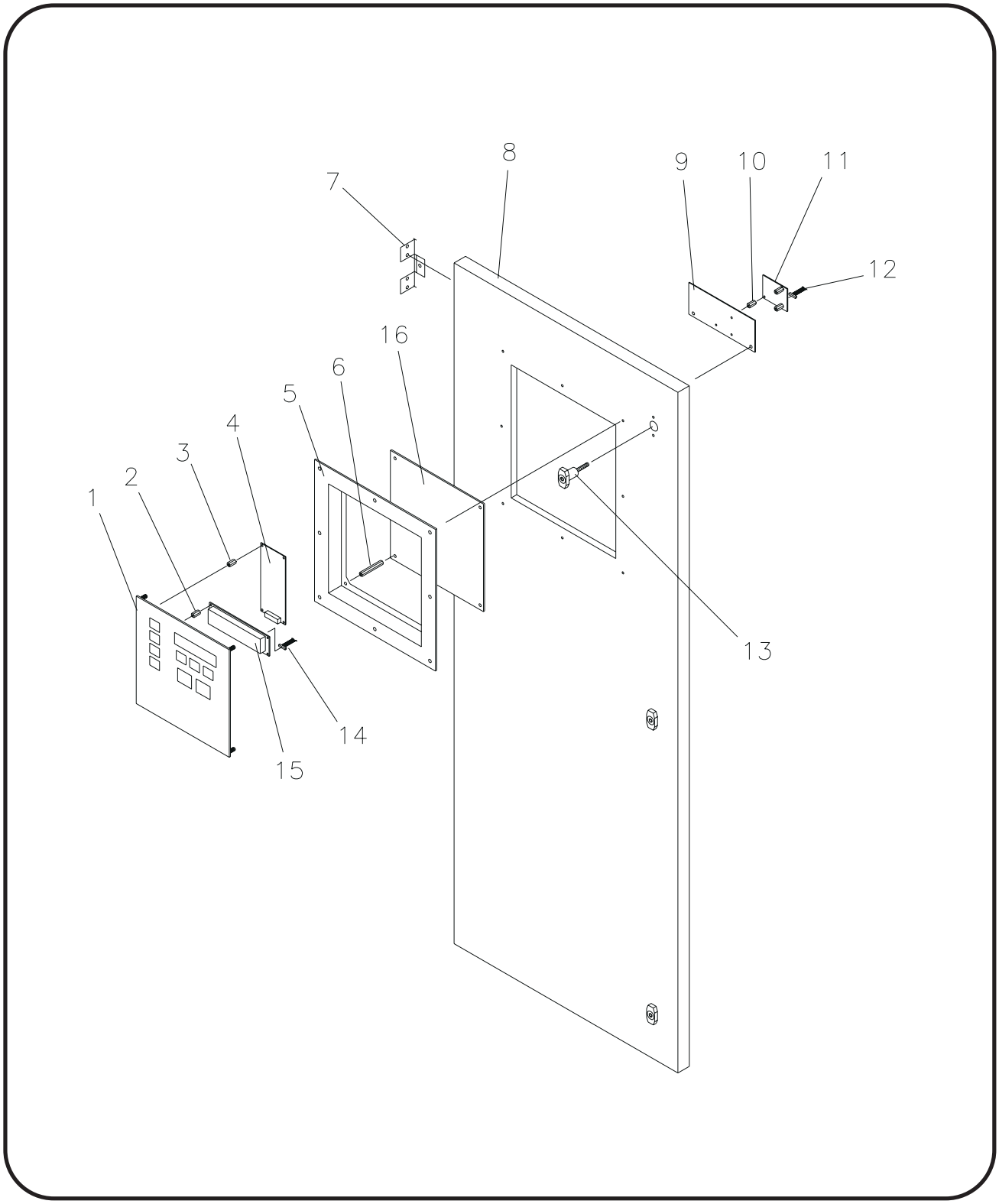
Figure & Item No.	Hobart Part No.	Airline Part No.	Nomenclature 1 2 3 4 5 6	Eff	Units Per Assy
1-	500013B-201		125-KVA - AC/AC CONVERTER SINGLE-, NO CONTACTOR	K	1
1-	500013B-202		125-KVA - AC/AC CONVERTER DUAL-OUTPUT, 2 CONTACTORS	L	1
1-	500013B-203		125-KVA - AC/AC CONVERTER TRIPLE-OUTPUT, 3 CONTACTORS	M	1
1-	500013B-205		90-KVA - AC/AC CONVERTER SINGLE-OUTPUT, NO CONTACTOR	N	1
1-	500013B-206		90-KVA - AC/AC CONVERTER DUAL-OUTPUT, 2 CONTACTORS	P	1
1-	500013B-207		180-KVA - AC/AC CONVERTER DUAL-OUTPUT, 2 CONTACTORS	Q	1
1-	500013B-208		180-KVA - AC/AC CONVERTER TRIPLE-OUTPUT, 3 CONTACTORS	R	1
1-	500013B-209		180-KVA - AC/AC CONVERTER SINGLE-OUTPUT, 2 CONTACTOR	S	1
1-	500013B-210		125-KVA - AC/AC CONVERTER DUAL-OUTPUT, 2 CONTACTORS	T	1
1-	500013B-211		180-KVA - AC/AC CONVERTER DUAL-OUTPUT, 2 CONTACTORS	U	1
1-	500013B-212		180-KVA - AC/AC CONVERTER SINGLE- OUTPUT, NO CONTACTOR	V	1
1-1	283305		. INPUT FILTER COVER		1
1-2	283159-2		. INPUT AIR FILTER		1
1-3	285296		. INPUT FILTER SAFETY SCREEN		1
1-4	283307		. INPUT FILTER ENCLOSURE		1
1-5	283304		. OUTPUT FILTER COVER		1
1-6	283159-1		. OUTPUT AIR FILTER		1
1-7	285297		. OUTPUT FILTER SAFETY SCREEN		1
1-8	283306		. OUTPUT FILTER ENCLOSURE		1
1-9	283725		. OUTPUT FAN LOUVER PANEL		1
1-10	285545		. RIGHT SIDE CABINET PANEL		1
1-11	283726		. INPUT FAN LOUVER PANEL		1
1-12	285544		. LEFT SIDE CABINET PANEL		1
1-13	285526		. FRAME ASSEMBLY (SEE FIG. 2)		REF
1-14	285527		. FRONT DOOR ASSEMBLY (SEE FIG. 3)		REF
*	283320		. DOOR SPACER		6
*	284606-1		. DOOR SUPPORT (CLOSER)		1
*	280673		. DOOR INTERLOCK SWITCH		1
1-15	285538		. REAR DOOR ASSEMBLY (SEE FIG. 4)		REF
*	283320		. DOOR SPACER		6
*	284606-1		. DOOR SUPPORT (CLOSER)		1
*	280673		. DOOR INTERLOCK SWITCH		1
1-16	NO NUMBER		. CONVERTER INTERIOR COMPONENTS (SEE FIGURE 5)		REF
1-17	285562-X		MOUNTING CONFIGURATIONS (SEE FIG 19A & 19B)		REF



Frame Assembly
Figure 2

Figure & Item No.	Hobart Part No.	Airline Part No.	Nomenclature 1 2 3 4 5 6	Eff	Units Per Assy
2-1	285526		FRAME ASSEMBLY		1
*	283747		. GASKET, SIDE PANEL		2
2-2	284612		. RAIN GUARD ASSEMBLY		2
2-3	283293		. INPUT MTG. PANEL ASSEMBLY		1
*	283746		. GASKET, INPUT PANEL		1
2-4	284651A		CONTROL DOOR STOP BRACKET		1
2-5	282146		DOOR INTERLOCK SUPPORT		2
2-6	283282		TOP OUTPUT SUPPORT ASSEMBLY		1
2-7	283286		BOTTOM OUTPUT SUPPORT ASSEMBLY		1
2-8	284650A		TRANS. DOOR STOP BRACKET		1
2-9	285546		TRANS. SUPPORT, UPPER REAR		1
2-10	285092		TRANS. SUPPORT, LOWER REAR		1
2-11	283272		TRANS. SUPPORT, UPPER FRONT		1
2-12	285528		TRANS. SUPPORT, LOWER FRONT		1
2-13	283433		TOP INTERIOR PANEL SUPPORT ASSY.		1
2-14	283430		AIR DEFLECTOR		1
2-15	283432		BOTTOM INTERIOR PANEL SUPPORT ASSY.		1

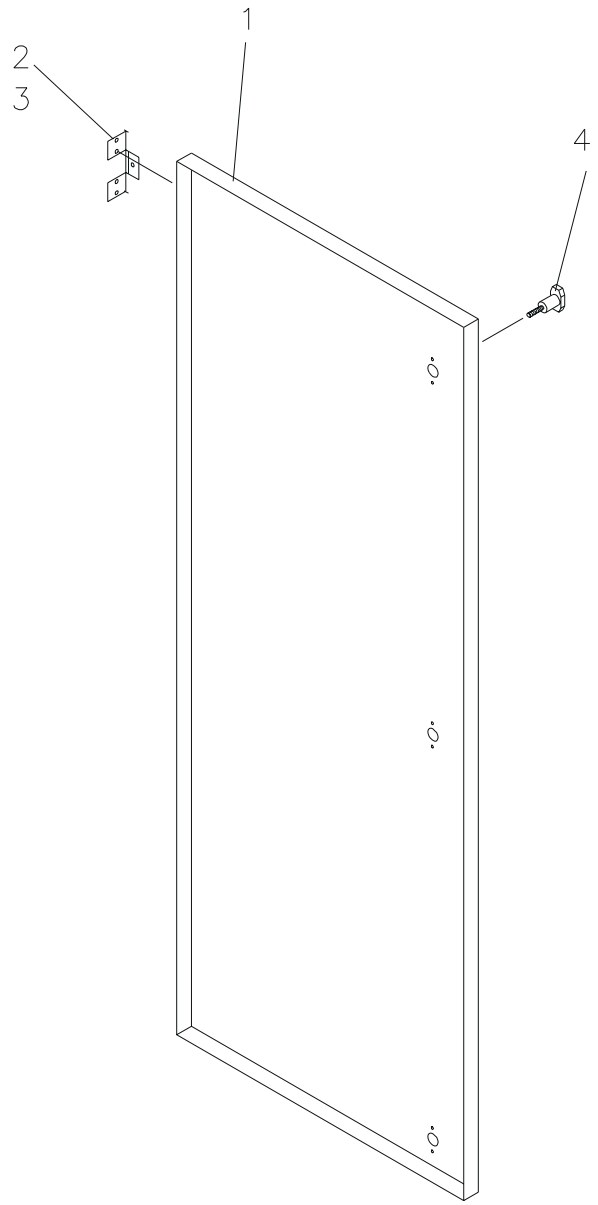
*** NOT ILLUSTRATED**



Front Door Assembly
Figure 3

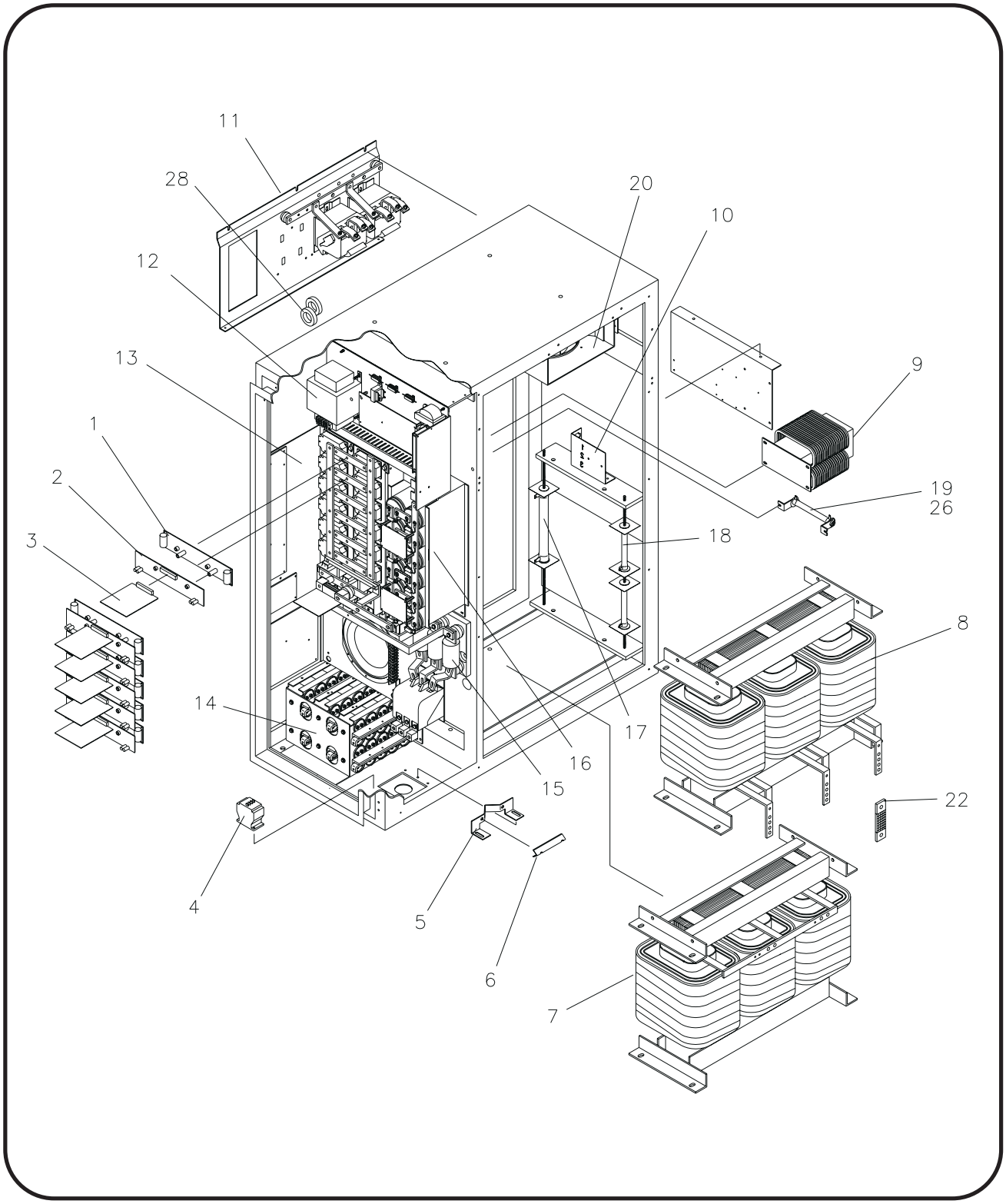
Figure & Item No.	Hobart Part No.	Airline Part No.	Nomenclature 1 2 3 4 5 6	Eff	Units Per Assy
3-	**285527**		**FRONT DOOR ASSEMBLY**		**1**
3-1	282199		. CONTROL PANEL		1
3-2	282195-1		. SPACER, STANDOFF		4
3-3	284317-1		. SPACER, NYLON		4
3-4	283357A		. ADCS LAMP P.C.B. ASSEMBLY		1
3-5	282198		. CONTROL PANEL MTG. PANEL		1
3-6	282195-2		. SPACER, STANDOFF		4
3-7	283368		. DOOR HINGE		3
*	283321		. SPACER, HINGE		3
3-8	284582		. CONTROL PANEL DOOR ASSY..		1
3-9	284460		. BRACKET, I.D. BOARD		1
3-10	375426-3		. SPACER, NYLON		3
3-11	284386		. I.D. BOARD ASSEMBLY		1
3-12	204247-1		. RIBBON CABLE ASSEMBLY		1
3-13	283160		. DOOR LATCH		3
3-14	204247-2		. RIBBON CABLE ASSEMBLY		1
3-15	283461-1		. FLUORESCENT DISPLAY MODULE		1
3-16	283216A		ADCS P.C.B. ASSEMBLY		1
*	283705-1		ADCS TO OUTPUT CABLE ASSEMBLY		1

*** NOT ILLUSTRATED**



Rear Door Assembly
Figure 4

	Figure & Item No.	Hobart Part No.	Airline Part No.	Nomenclature 1 2 3 4 5 6	Eff	Units Per Assy
	4-	**285538**		**REAR DOOR ASSEMBLY**		**1**
	4-1	284584		. REAR DOOR PANEL ASSEMBLY		1
	4-2	283368		. HINGE DOOR		3
*	4-3	283321		. SHIM, HINGE		3
	4-4	283160-1		. DOOR LATCH		3



Converter Interior Components
Figure 5

Figure & Item No.	Hobart Part No.	Airline Part No.	Nomenclature 1 2 3 4 5 6	Eff	Units Per Assy
5 -	NO NUMBER		CONVERTER INTERIOR COMPONENTS		REF
5-1	283864A		SNUBBER P.C.B. ASSEMBLY		6
5-2	283211A		DRIVER P.C.B. ASSEMBLY		6
5-3	283212A		DRIVER LOGIC P.C.B. ASSEMBLY		6
5-4	285739		SHORTING CONTACTOR		1
5-5	285733		CABLE CLAMP SUPPORT ASSEMBLY		1
5-6	285568		CABLE CLAMP BRACKET		1
5-7	284221-1		MAIN TRANSFORMER, TOP (90 KVA)	N,P	1
	284221-3		MAIN TRANSFORMER, TOP (125 KVA)	K,L,M,T	1
	284221-5		MAIN TRANSFORMER, TOP (180 KVA)	Q,R,S,U,V	1
*	285103-1		TRANSFORMER VIBRATION PAD		8
5-8	284221-2		MAIN TRANSFORMER, BOTTOM (90 KVA)	N,P	1
	284221-4		MAIN TRANSFORMER, BOTTOM (125 KVA)	K,L,M,T	1
	284221-6		MAIN TRANSFORMER, BOTTOM (180 KVA)	Q,R,S,U,V	1
*	285103-1		TRANSFORMER VIBRATION PAD		8
5-9	493712		REACTOR FILTER ASSEMBLY		2
5-10	285093		CONNECTORS SUPPORT BRACKET		1
	401937-1		TERMINAL BLOCK, 5 POS.		1
5-11	285549-1		OUTPUT BUS BARS PANEL ASSY.. (WITH OUT BOX CONNECTORS) (SEE FIG. 6)	N	1
	285549-2		OUTPUT BUS BARS PANEL ASSY.. (WITH BOX CONNECTORS) (SEE FIG. 6)	K,V	1
	285751-1		OUTPUT CONTACTOR PANEL ASSY.. (2 OUTPUTS) (SEE FIG. 7)	L,P,Q	1
	285751-2		OUTPUT CONTACTOR PANEL ASSY.. (3 OUTPUTS) (SEE FIG. 7)	M,R	1
	285752-1		OUTPUT CONTACTOR PARALLELING ASSY.. (1 OUTPUT, 90 KVA) (SEE FIG. 8)	S	1
	285752-2		OUTPUT CONTACTOR PARALLELING ASSY.. (2 OUTPUT, 125/180 KVA) (SEE FIG. 8)	T,U	1
5-12	285524		INTERIOR PANEL ASSEMBLY (SEE FIG. 9)		1
5-13	285535-1		INVERTER RECTIFIER ASSEMBLY (90 KVA) (SEE FIG. 10)	N,P	1
	285535-2		INVERTER RECTIFIER ASSEMBLY (125 KVA) (SEE FIG. 10)	K,L,M,T	1
	285531		INVERTER RECTIFIER ASSEMBLY (180 KVA) (SEE FIG. 10)	Q,R,S,U,V	1
5-14	285558-1		AC CAPACITORS ASSEMBLY (SEE FIG. 11)		1
5-15	NO NUMBER		FUSE AND INPUT CONTACTOR COMPONENTS (SEE FIG. 12)		REF
5-16	285522		DC CAPACITOR BANK ASSY.. (SEE FIG. 13)		1
5-17	285517-1		RESISTOR ASSEMBLY (SEE FIG. 14)		1
5-18	285518-1		RESISTOR ASSEMBLY (SEE FIG. 15)		1
5-19	285516-1		RESISTOR ASSEMBLY (SEE FIG. 16)		1
5-20	285525		OUTPUT AND REMOTE BD. ASSY.. (SEE FIG. 17)		1

*** NOT ILLUSTRATED**

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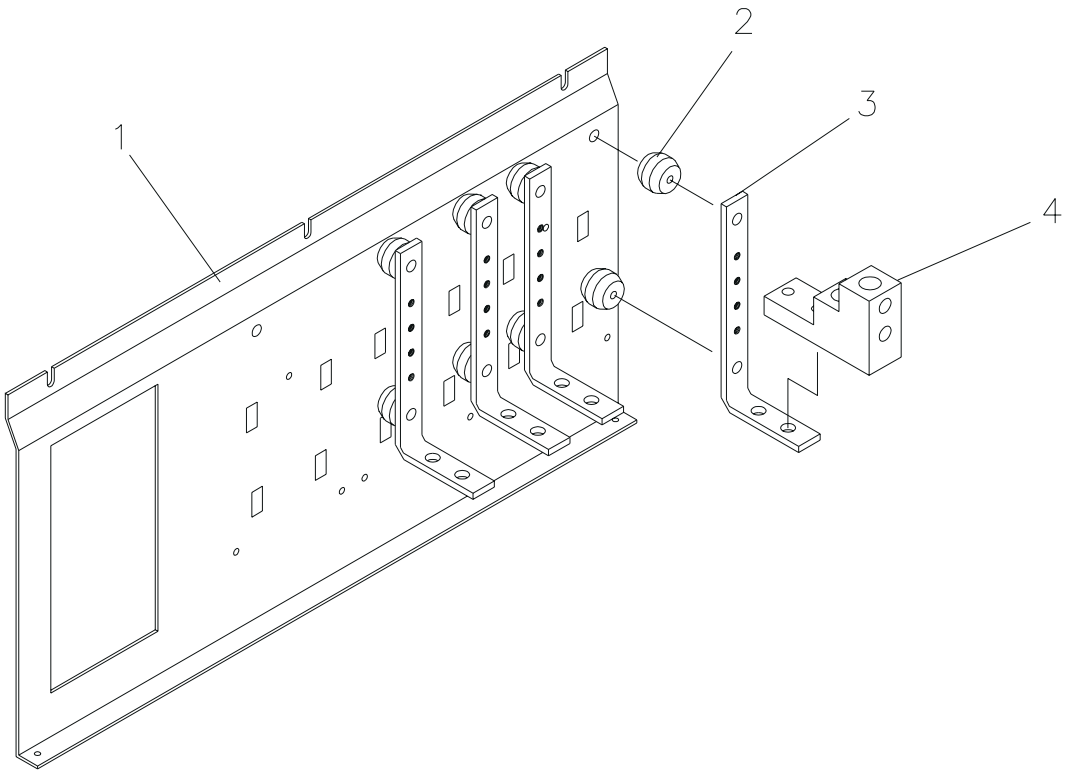
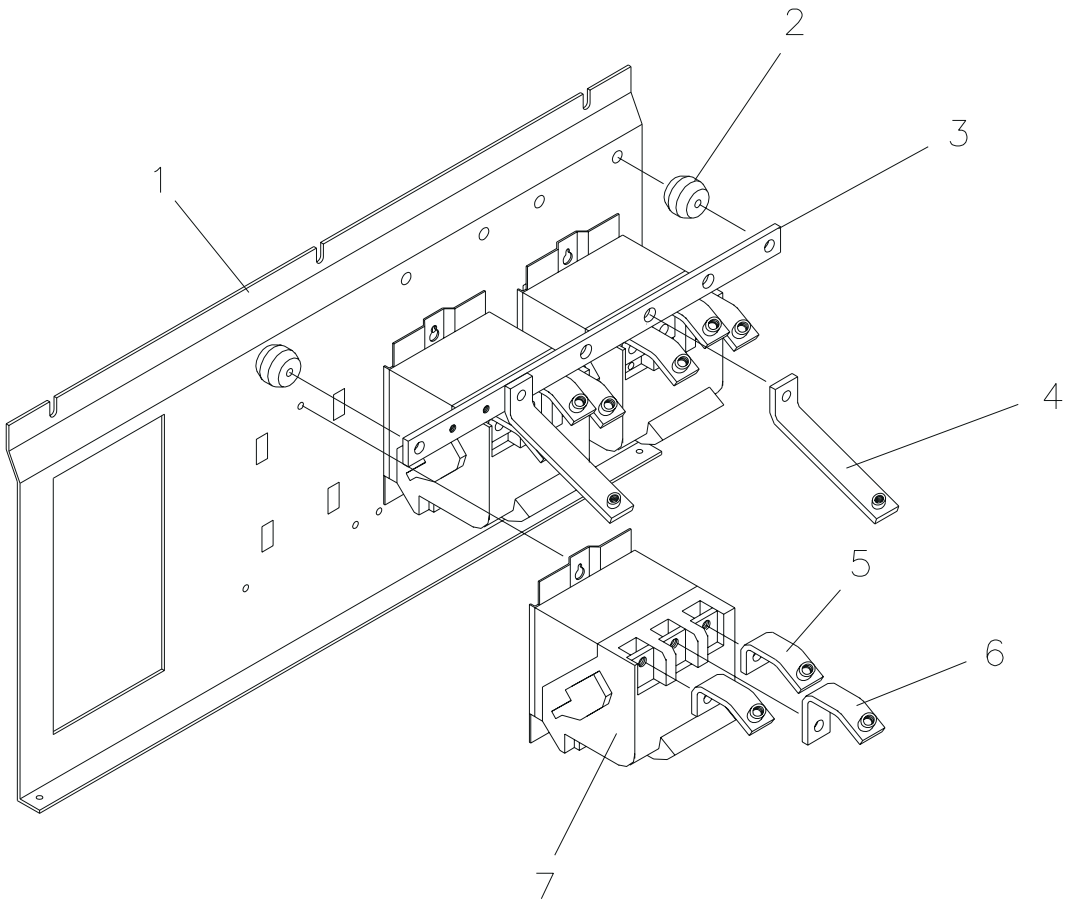
	Figure & Item No.	Hobart Part No.	Airline Part No.	Nomenclature 1 2 3 4 5 6	Eff	Units Per Assy
	5 -	**NO NUMBER**		**CONVERTER INTERIOR COMPONENTS (cont.)**		**REF**
	5-21	285560		OUTPUT FAN ASSY.(90/125 KVA) (SEE FIG. 18)	K,L,M,N,P,T	1
		285561		OUTPUT FAN ASSY.. (180 KVA) (SEE FIG. 18)	Q,R,S,U,V	1
	5-22	285128-1		TRANSFORMER BUS BAR, CONNECTING, TOP TO BOTTOM		3
*	5-23	285540-4		CABLE SUMMARY		1
*	5-24	192266-1		SUPPRESSOR		10
*	5-25	285705-1		MOMENTARY DROPOUT DELAY KIT		1
*	5-26	408373		VARISTOR		1
*	5-27	283067-6		SEMICONDUCTOR SUPPRESSOR ASSY.		2
	5-28	285102-1		CURRENT TRANSFORMER	K,L,P,Q V,S,T,U	7
		285102-1		CURRENT TRANSFORMER	N	4
		285102-1		CURRENT TRANSFORMER	M,R	10

*** Not illustrated**



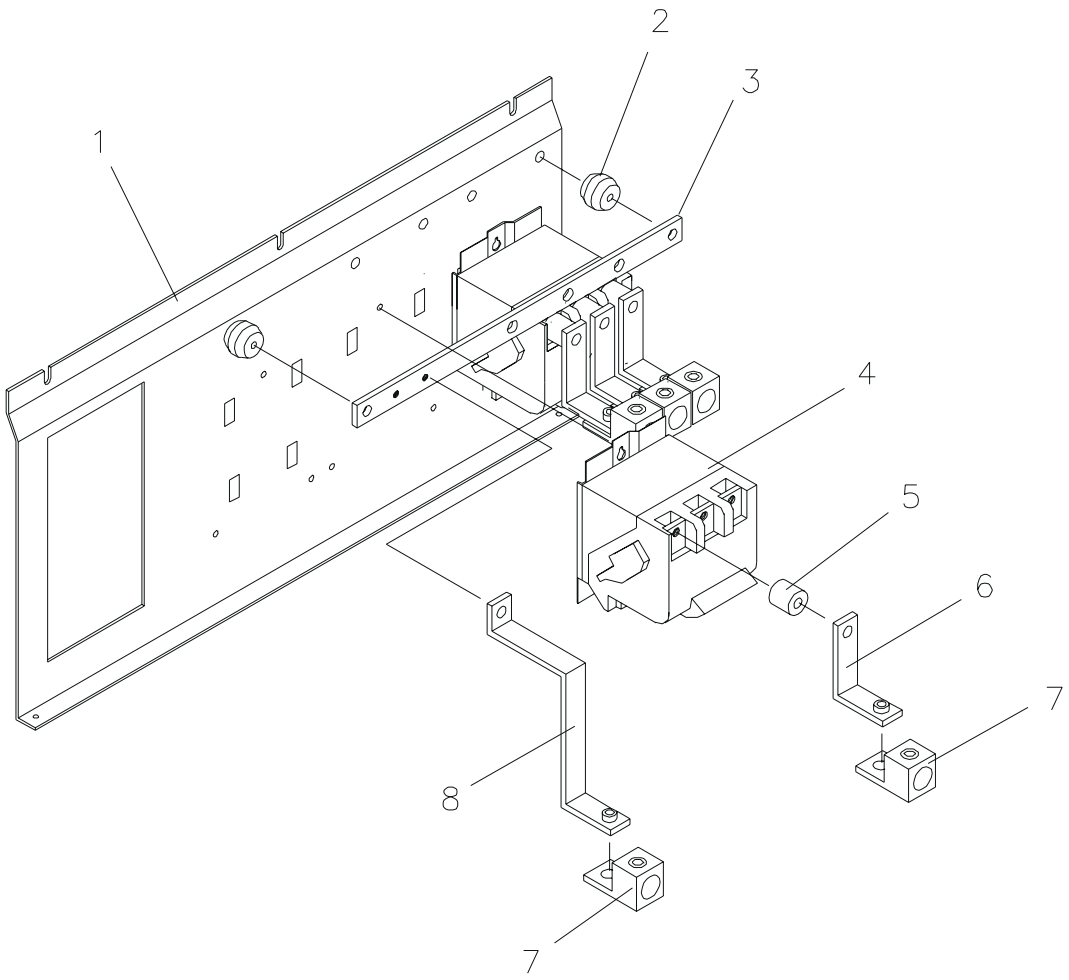
Output Bus Bars Panel Assembly
Figure 6

Figure & Item No.	Hobart Part No.	Airline Part No.	Nomenclature 1 2 3 4 5 6	Eff	Units Per Assy
6-	285549-1		OUTPUT BUS BAR PANEL ASSY.. (W/OUT BOX CONNECTORS)	N	REF
6-1	285547		. OUTPUT BUS BARS PANEL	N	1
6-2	283154-1		. STANDOFF INSULATOR	N	8
6-3	285548		. OUTPUT BUS BAR	N	4
6-	285549-2		OUTPUT BUS BAR PANEL ASSY.. (WITH BOX CONNECTORS)	K,V	REF
6-1	285547		. OUTPUT BUS BARS PANEL	K,V	1
6-2	283154-1		. STANDOFF INSULATOR	K,V	8
6-3	285548		. OUTPUT BUS BAR	K,V	4
6-4	78A-1126		. ALUMINUM CABLE LUG	K,V	4



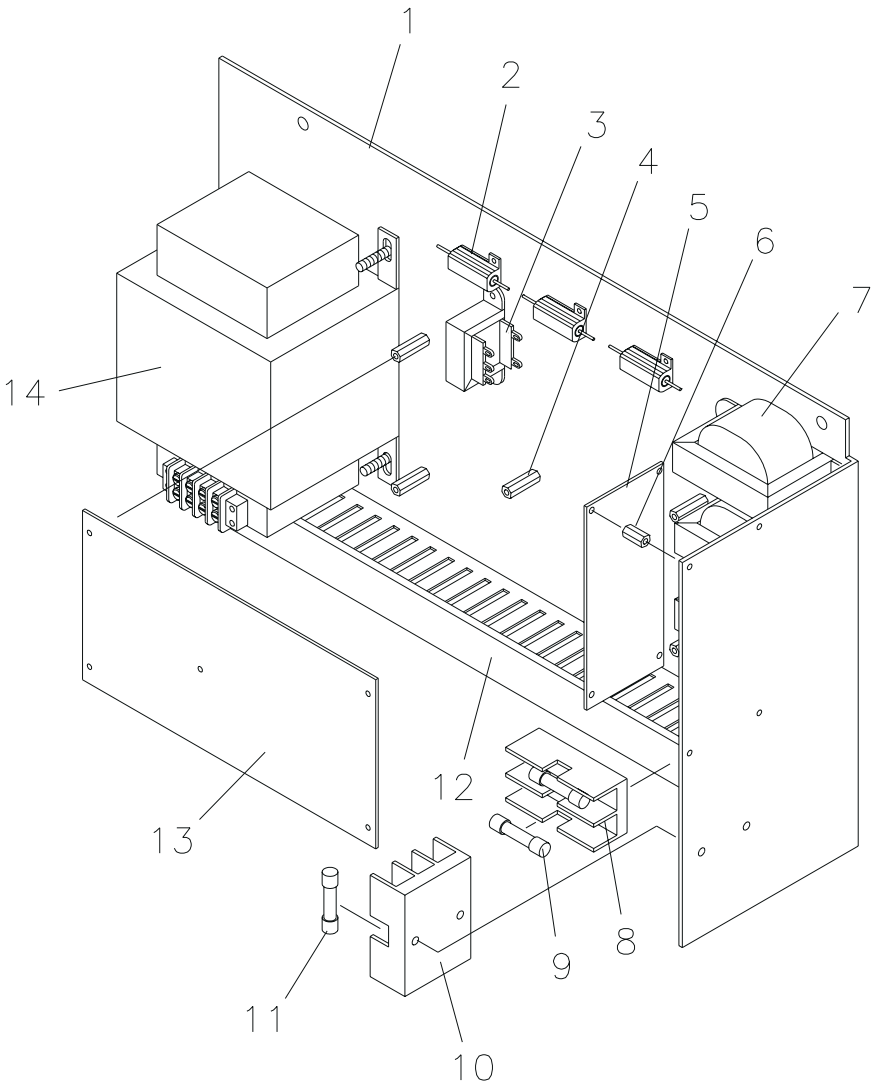
Output Contactor Panel Assembly
Figure 7

Figure & Item No.	Hobart Part No.	Airline Part No.	Nomenclature 1 2 3 4 5 6	Eff	Units Per Assy
7-	**285751-1**		**OUTPUT CONTACTOR PANEL ASSY. (2 OUTPUTS)**	**L,P,Q**	**REF**
7-1	285547		. OUTPUT BUS BAR PANEL	L,P,Q	1
7-2	283154-1		. STANDOFF INSULATOR	L,P,Q	2
7-3	285750		. OUTPUT BUS BAR, NEUTRAL	L,P,Q	1
7-4	285753		. OUTPUT BUS BAR, NEUTRAL	L,P,Q	2
7-5	283889		. OUTPUT BUS BAR, PHASE A & C	L,P,Q	4
7-6	283891		. OUTPUT BUS BAR, PHASE B	L,P,Q	2
7-7	282130-1		. CONTACTOR	L,P,Q	2
*	285099		. BRACKET, CONTACTOR	L,P,Q	2
*	283067-2		. SUPPRESSOR, SEMICONDUCTOR	L,P,Q	2
*	287018		. CAPACITOR ASSEMBLY	L,P,U	2
7-	**285751-2**		**OUTPUT CONTACTOR PANEL ASSY. (3 OUTPUTS)**	**M,R**	**REF**
7-1	285547		. OUTPUT BUS BAR PANEL	M,R	1
7-2	283154-1		. STANDOFF INSULATOR	M,R	2
7-3	285750		. OUTPUT BUS BAR, NEUTRAL	M,R	1
7-4	285753		. OUTPUT BUS BAR, NEUTRAL	M,R	2
7-5	283889		. OUTPUT BUS BAR, PHASE A & C	M,R	6
7-6	283891		. OUTPUT BUS BAR, PHASE B	M,R	3
7-7	282130-1		. CONTACTOR	M,R	3
*	285099		. BRACKET, CONTACTOR	M,R	3
*	283067-2		. SUPPRESSOR, SEMICONDUCTOR	M,R	3
*	287018		. CAPACITOR ASSEMBLY	M,R	3



Paralleling Contactor Panel Assembly
Figure 8

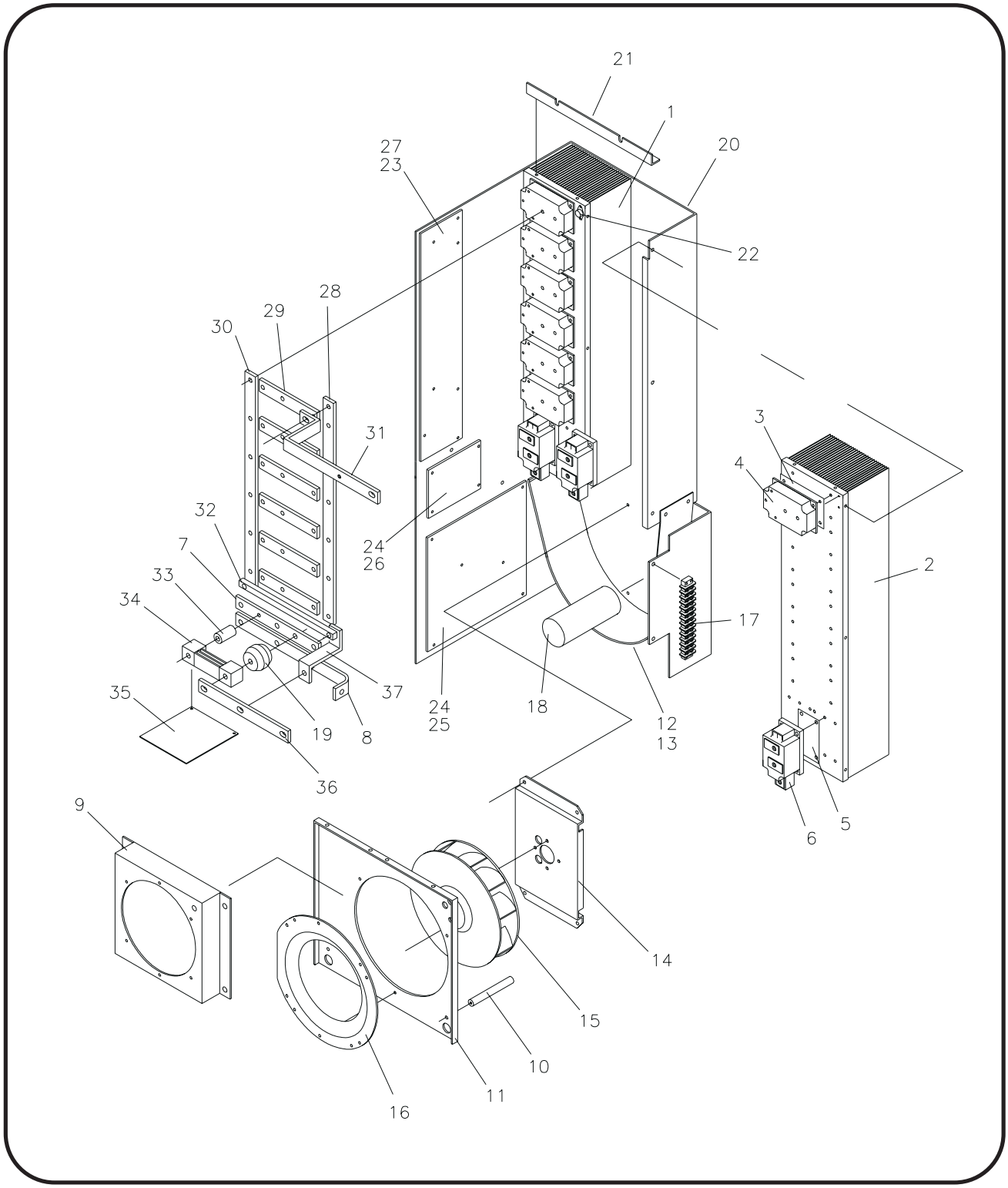
Figure & Item No.	Hobart Part No.	Airline Part No.	Nomenclature 1 2 3 4 5 6	Eff	Units Per Assy
	8-	**285752-1**	**PARALLELING CONTACTOR PANEL ASSY. (90 KVA, 1 OUTPUT)**	**S**	**REF**
	8-1	285547	. OUTPUT BUS BAR PANEL	S	1
	8-2	283154-1	. STANDOFF INSULATOR	S	2
	8-3	285750	. OUTPUT BUS BAR, NEUTRAL	S	1
	8-4	282130-1	. CONTACTOR	S	2
*		285099	. CONTACTOR BRACKET	S	2
*		287018	. CAPACITOR ASSEMBLY	S	1
	8-5	285085	. SPACER, BUS BAR	S	3
	8-6	285754	. OUTPUT BUS BAR, PHASE	S	3
	8-7	402945	. ALUMINUM CABLE LUG	S	4
	8-8	285755	. OUTPUT BUS BAR, NEUTRAL	S	1
	8-	**285752-2**	**PARALLELING CONTACTOR PANEL ASSY.. (125/180 KVA, 2 OUTPUT)**	**T,U**	**REF**
	8-1	285547	. OUTPUT BUS BAR PANEL	T,U	1
	8-2	283154-1	. STANDOFF INSULATOR	T,U	2
	8-3	285750	. OUTPUT BUS BAR, NEUTRAL	T,U	1
	8-4	282130-1	. CONTACTOR	T,U	2
*		285099	. CONTACTOR BRACKET	T,U	2
*		287018	. CAPACITOR ASSEMBLY	T,U	2
	8-5	285085	. SPACER, BUS BAR	T,U	6
	8-6	285754	. OUTPUT BUS BAR, PHASE	T,U	6
	8-7	402945	. ALUMINUM CABLE LUG	T,U	7
	8-8	285755	. OUTPUT BUS BAR, NEUTRAL	T,U	1



Interior Panel Assembly
Figure 9

Figure & Item No.	Hobart Part No.	Airline Part No.	Nomenclature 1 2 3 4 5 6	Eff	Units Per Assy
9-	**285524**		**INTERIOR PANEL ASSEMBLY**		**REF**
9-1	283431		. INTERIOR PANEL		1
9-2	404402-2		. 25 OHM, 25 W. RESISTOR		3
9-3	408584		. SIGNAL TRANSFORMER		1
9-4	375426-5		. P.C. BOARD SUPPORT		5
9-5	283855		. INPUT VOLTAGE P.C.B. ASSY..		1
9-6	375426-3		. P.C. BOARD SUPPORT		4
9-7	282092-1		. POWER TRANSFORMER		3
9-8	281664-2		. 2 STATION FUSE HOLDER		1
9-9	W-10502-31		. 15 A. FUSE		2
9-10	281664-1		. 3 STATION FUSE HOLDER		1
9-11	W-10502-31		. 15 A. FUSE		3
9-12	282143-1		. WIRING CONDUIT		1
9-13	283219A		LOAD CONTROL P.C.B. ASSY..		1
9-14	404960-34		CONTROL TRANSFORMER		1
*	W-10502-31		15 A. FUSE		1

*** Item Not Illustrated**



Inverter Rectifier Assembly
Figure 10

Figure & Item No.	Hobart Part No.	Airline Part No.	Nomenclature 1 2 3 4 5 6	Eff	Units Per Assy
10-	**285535-1**		**INVERTER RECTIFIER ASSY. (90 KVA)**	**N,P**	**REF**
	285535-2		**INVERTER RECTIFIER ASSY. (125 KVA)**	**K,L,M,T**	**REF**
	285531		**INVERTER RECTIFIER ASSY. (180 KVA)**	**Q,R,S,U,V**	**REF**
10-1	285408-2		. LEFT BONDED FIN. HEATSINK		1
10-2	285408-2		. RIGHT BONDED FIN. HEATSINK		1
10-3	283196-2		. THERMAL TRANSISTOR PAD		12
10-4	283920-1		. IGBT TRANSISTOR, 1200 V.	N,P	12
	283920-2		. IGBT TRANSISTOR, 1200 V.	K,L,M,T	12
	283920-3		. IGBT TRANSISTOR, 1200 V.	Q,R,S,U,V	12
10-5	283196-1		. RECTIFIER THERMAL PAD		3
10-6	408501		. RECTIFIER MODULE		3
10-7	282157		. RECTIFIER BUS BAR (A2)		1
10-8	282156		. RECTIFIER BUS BAR (K1)		1
*	283067-1		. METAL OXIDE VARISTOR		1
*	284347		. RESISTOR CAPACITOR ASSEMBLY		1
10-9	285394		. VENTURI MOUNTING ADAPTER	Q,R,S,U,V	1
10-10	282153		. VENTURI MOUNTING SPACER		2
10-11	285537		. VENTURI MOUNTING PLATE	N,P,K,L,M,T	1
	285393		. VENTURI MOUNTING PLATE	Q,R,S,U,V	1
10-12	285534		. DEFLECTOR, IMPELLER		1
* 10-13	285532		. DEFLECTOR BRACKET		3
10-14	283261		. IMPELLER MOUNTING PLATE		1
10-15	283155-1		. MOTORIZED IMPELLER	N,P,K,L,M,T	1
	283155-2		. MOTORIZED IMPELLER	Q,R,S,U,V	1
10-16	283157-1		. IMPELLER INPUT RING	N,P,K,L,M,T	1
	283157-2		. IMPELLER INPUT RING	Q,R,S,U,V	1
10-17	401911-14		. TERMINAL BLOCK, 14 POS.		1
10-18	283156-1		. MOTOR START CAPACITOR	N,P,K,L,M,T	1
	283156-2		. MOTOR START CAPACITOR	Q,R,S,U,V	1
10-19	283154-1		. STANDOFF INSULATOR		1
10-20	285536		. HEATSINK MOUNTING CHASSIS AY.		1
10-21	282154		. HEATSINK SUPPORT		1
10-22	404044-4		. OVERLOAD THERMAL SWITCH		2
10-23	375426-4		. P.C.B. SUPPORT		9
10-24	375426-3		. P.C.B. SUPPORT		10
10-25	283214A		POWER SUPPLY P.C.B. ASSY..		1
10-26	283215A		CHOPPER P.C.B. ASSEMBLY		1
10-27	285262		MODULATOR P.C.B. ASSEMBLY		1
10-28	282162		COLLECTOR BUS BAR		1
10-29	282161		EMMITTER-COLLECTOR BUS BAR		6
10-30	282168		EMMITTER BUS BAR		1
10-31	283400		POSITIVE DC BUS BAR		1
10-32	285400		EMITTER LINK BUS BAR		1

*** Item not illustrated**

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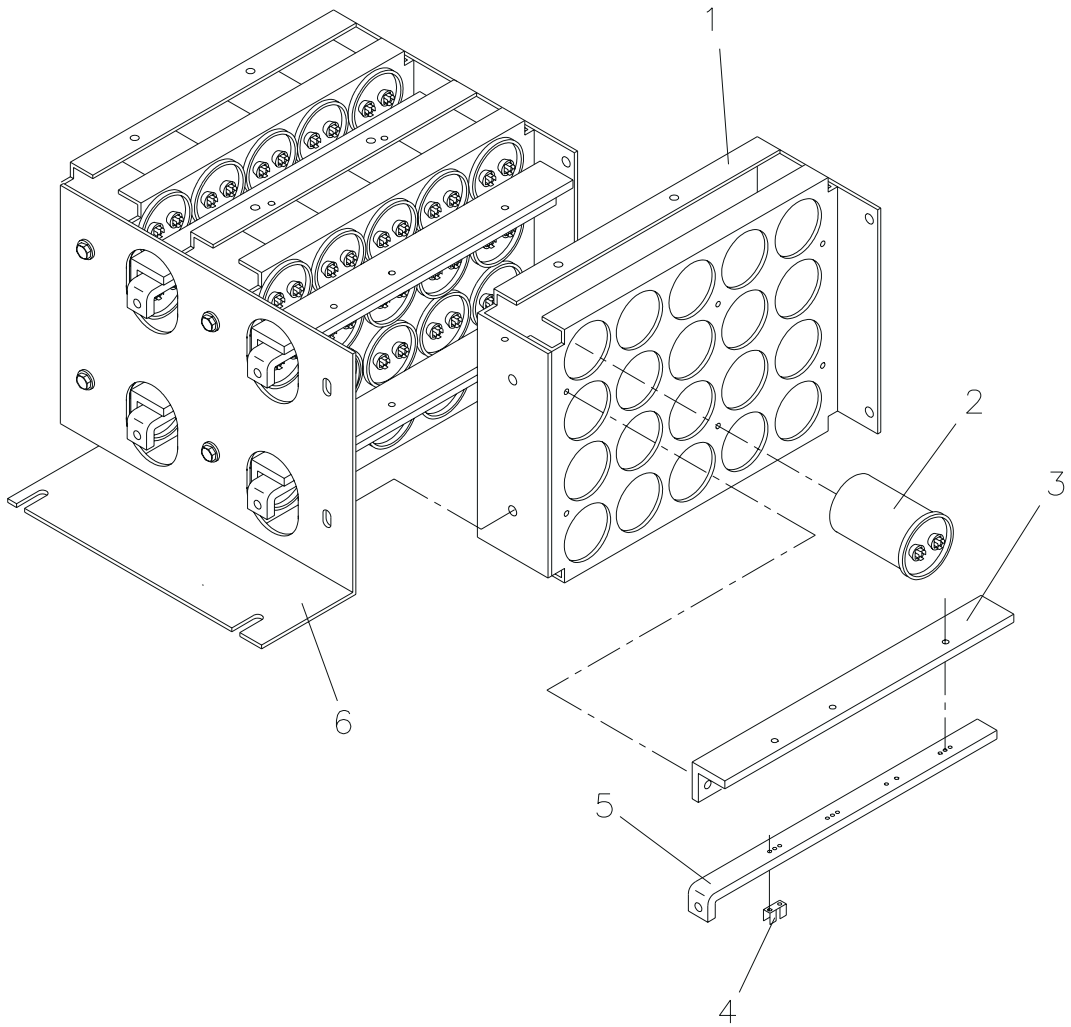
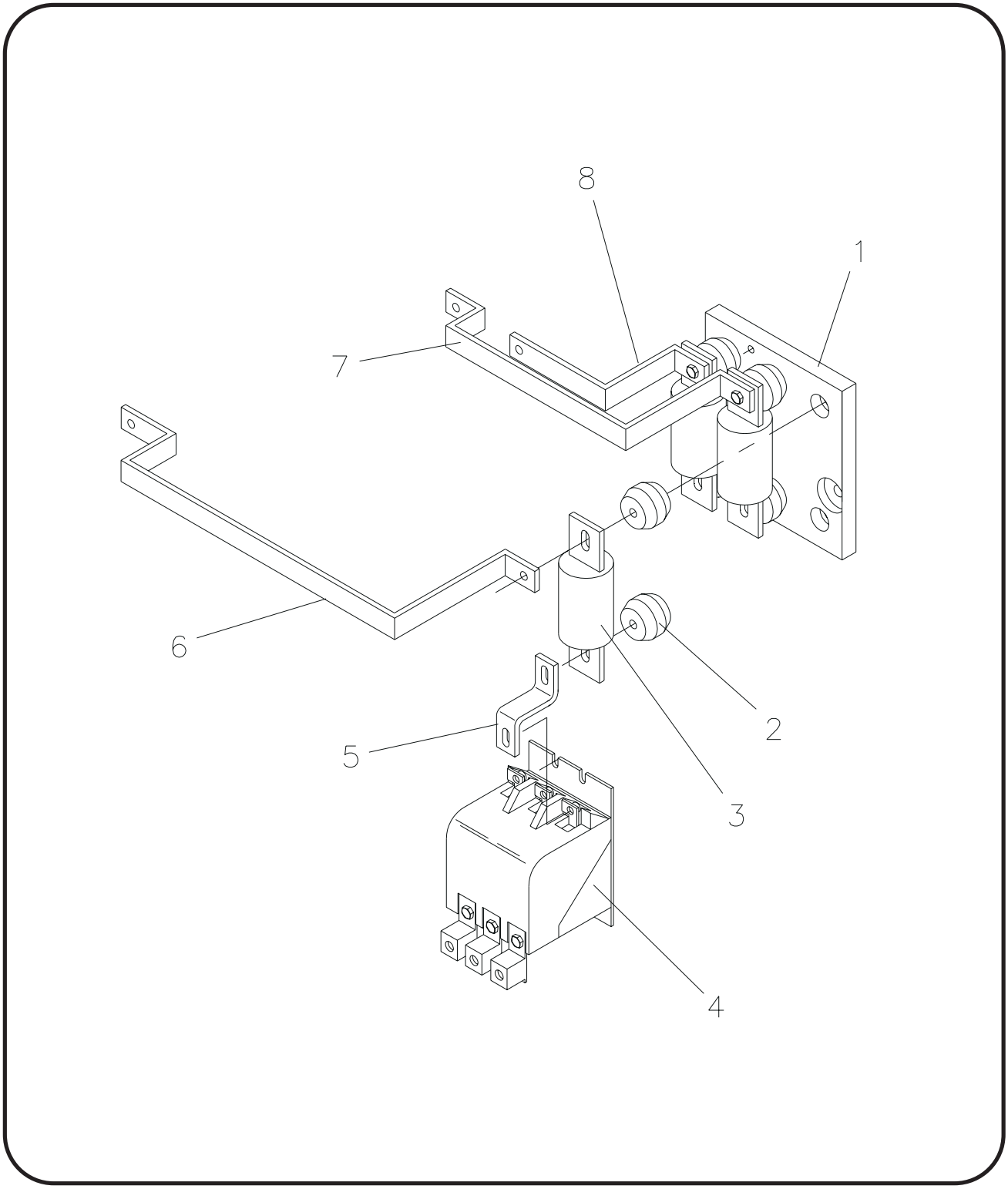
Figure & Item No.	Hobart Part No.	Airline Part No.	Nomenclature 1 2 3 4 5 6	Eff	Units Per Assy
10-	**285535-1**		**INVERTER RECTIFIER ASSY. (90 KVA)**	**N,P**	**REF**
	285535-2		**INVERTER RECTIFIER ASSY. (125 KVA)**	**K,L,M,T**	**REF**
	285531		**INVERTER RECTIFIER ASSY. (180 KVA)**	**Q,R,S,U,V**	**REF**
10-33	282155-1		SHUNT SPACER		1
10-34	203380		SHUNT, 350 A.		1
10-35	283218A		BUS INTERFACE P.C.B. ASSEMBLY		1
10-36	283399		NEGATIVE DC BUS BAR		1
10-37	282160		LINK, NEG. DC BUS BAR		1



AC Capacitors Assembly
Figure 11

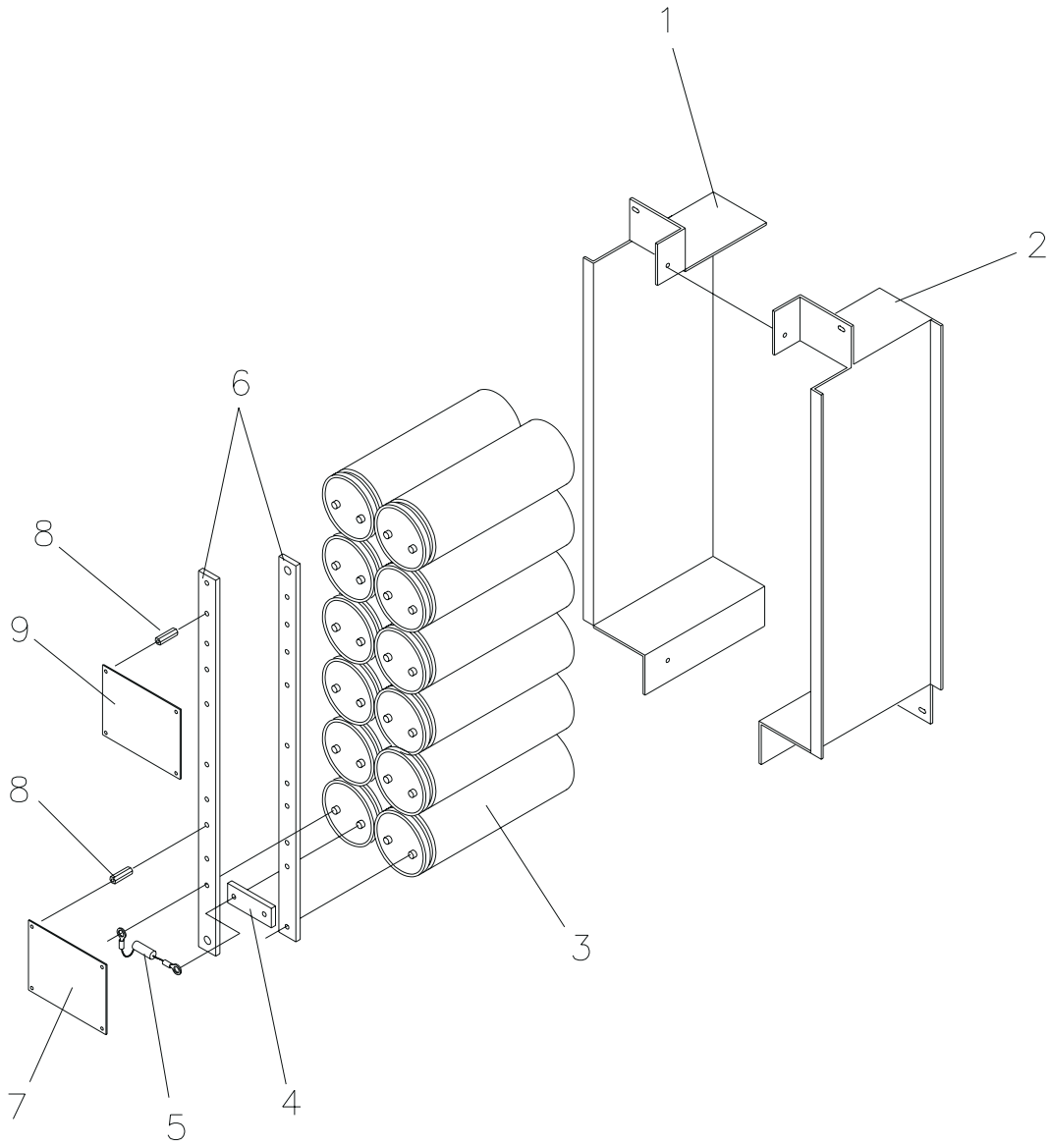
Figure & Item No.	Hobart Part No.	Airline Part No.	Nomenclature 1 2 3 4 5 6	Eff	Units Per Assy
11 -	**285558-1**		**AC CAPACITORS ASSEMBLY**		**REF**
11- 1	283406		. AC CAPACITORS MTG. CHASSIS		3
11- 2	283164-1		. AC CAPACITOR, 30 MFD.		60
11- 3	283413		. BUS BAR SUPPORT		6
11- 4	283191-1		. QUICK CONNECT TAB		24
11- 5	283412		. AC CAPACITOR BUS BAR		6
11- 6	283409		. AC CAPACITOR SUPPORT		1



Fuse and Input Contactor Components
Figure 12

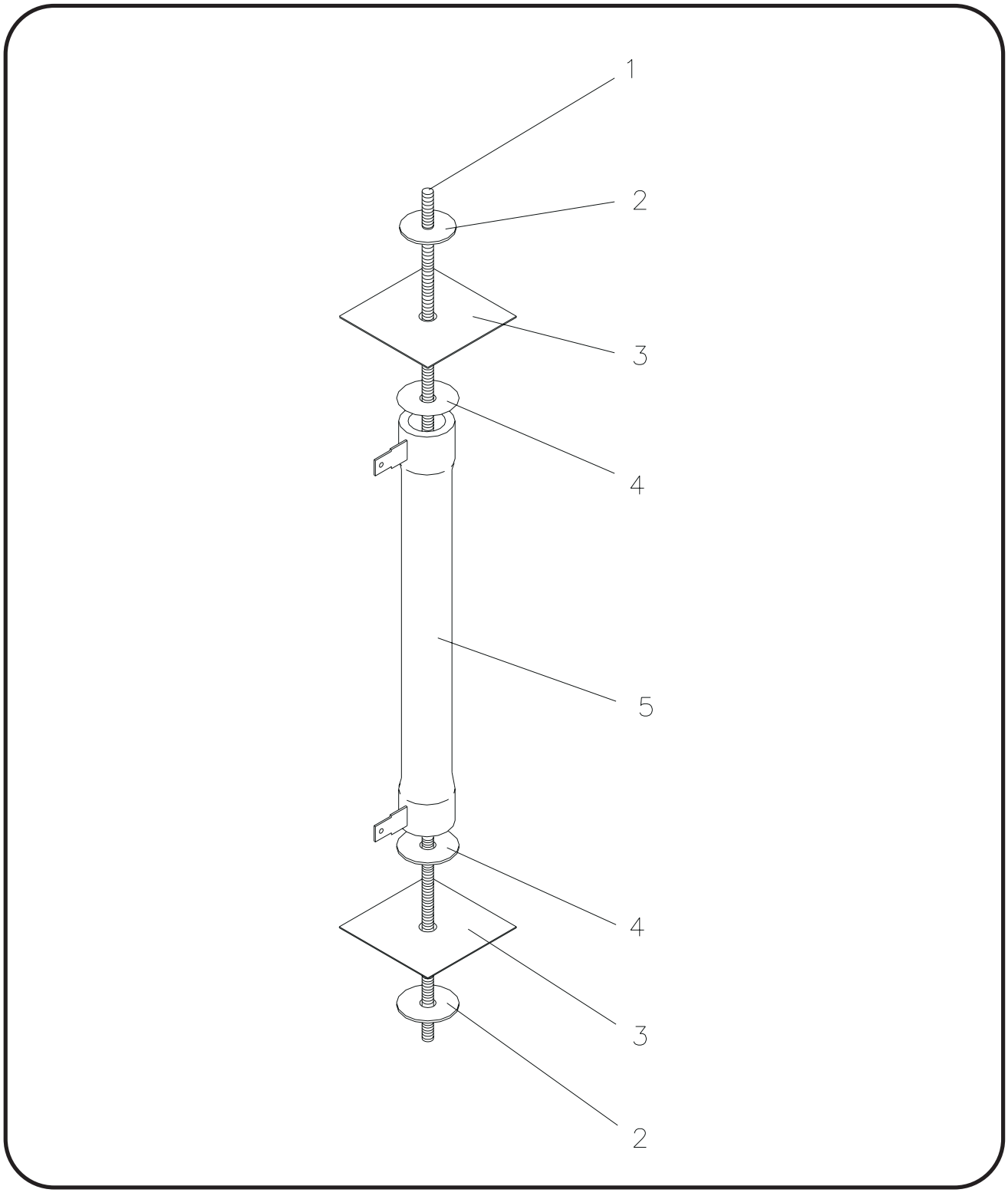
Figure & Item No.	Hobart Part No.	Airline Part No.	Nomenclature 1 2 3 4 5 6	Eff	Units Per Assy
12 -	NO NUMBER		FUSE AND INPUT CONTACTOR COMPONENTS		REF
12- 1	285520		FUSE HOLDER ASSEMBLY		1
*	283295		. FUSE MOUNTING BLOCK		1
12- 2	283154-1		. STANDOFF INSULATOR		6
12- 3	281575-1		QUICK ACTING FUSE		3
12- 4	285743-1		INPUT CONTACTOR, 3 POLE		1
12- 5	285746		BUS BAR		3
12- 6	282179		OUTSIDE BUS BAR		1
12-7	282178		CENTER BUS BAR		1
12-8	282177		INSIDE BUS BAR		1

*** NOT ILLUSTRATED**



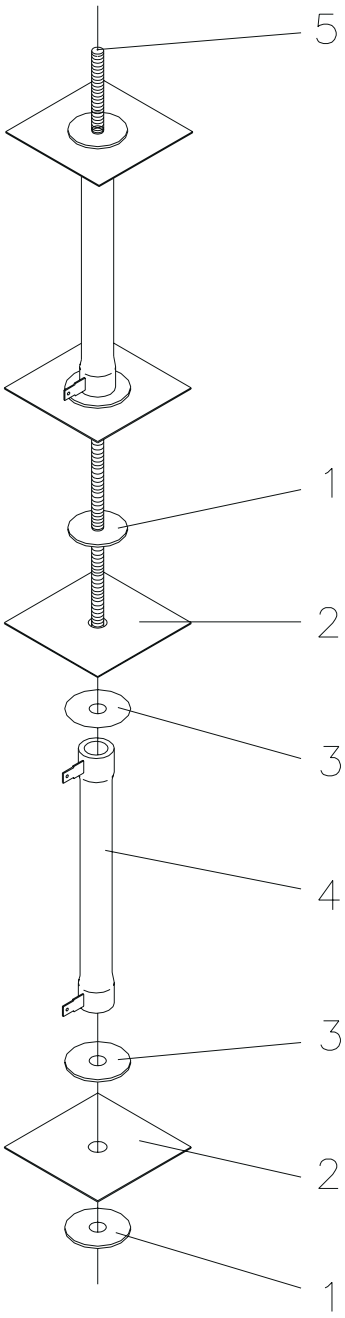
DC Capacitor Bank Assembly
Figure 13

Figure & Item No.	Hobart Part No.	Airline Part No.	Nomenclature 1 2 3 4 5 6	Eff	Units Per Assy
13 -	**285522**		**DC CAPACITOR BANK ASSEMBLY**		**REF**
13- 1	283414		. LEFT SIDE DC CAPACITOR SUPPORT		1
13- 2	283398		. RIGHT SIDE DC CAPACITOR SUPPORT		1
13- 3	281848-1		. DC CAPACITOR, 7000 MFD		12
13- 4	282163		. DC CAP. PLUS-MINUS BUS BAR		6
13- 5	281971-1		. RESISTOR ASSEMBLY		12
13- 6	282171		. DC CAP. LONG BUS BAR		2
13-7	284419		DC BUS TAP P.C.B. ASSEMBLY		1
13-8	284316-1		MALE-FEMALE STANDOFF		8
13-9	283845		DISCHARGE P.C.B. ASSEMBLY		1



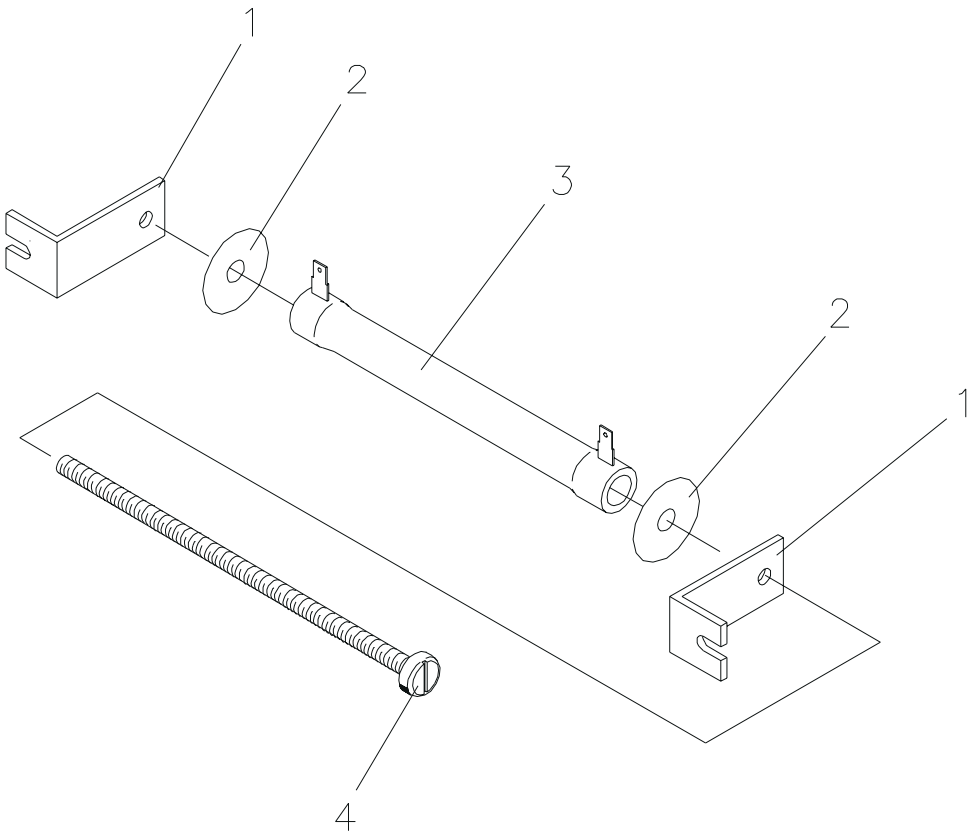
Resistor Assembly
Figure 14

Figure & Item No.	Hobart Part No.	Airline Part No.	Nomenclature 1 2 3 4 5 6	Eff	Units Per Assy
14 -	**285517**		**RESISTOR ASSEMBLY**		**REF**
14- 1	283387-1		. THREADED ROD		1
14-2	281929-8		. FLAT WASHER		2
14-3	283710		. RESISTOR INSULATOR		2
14-4	283380		. RESISTOR INSULATOR		2
14-5	404249-3		. RESISTOR, 225W, 50 OHM		1



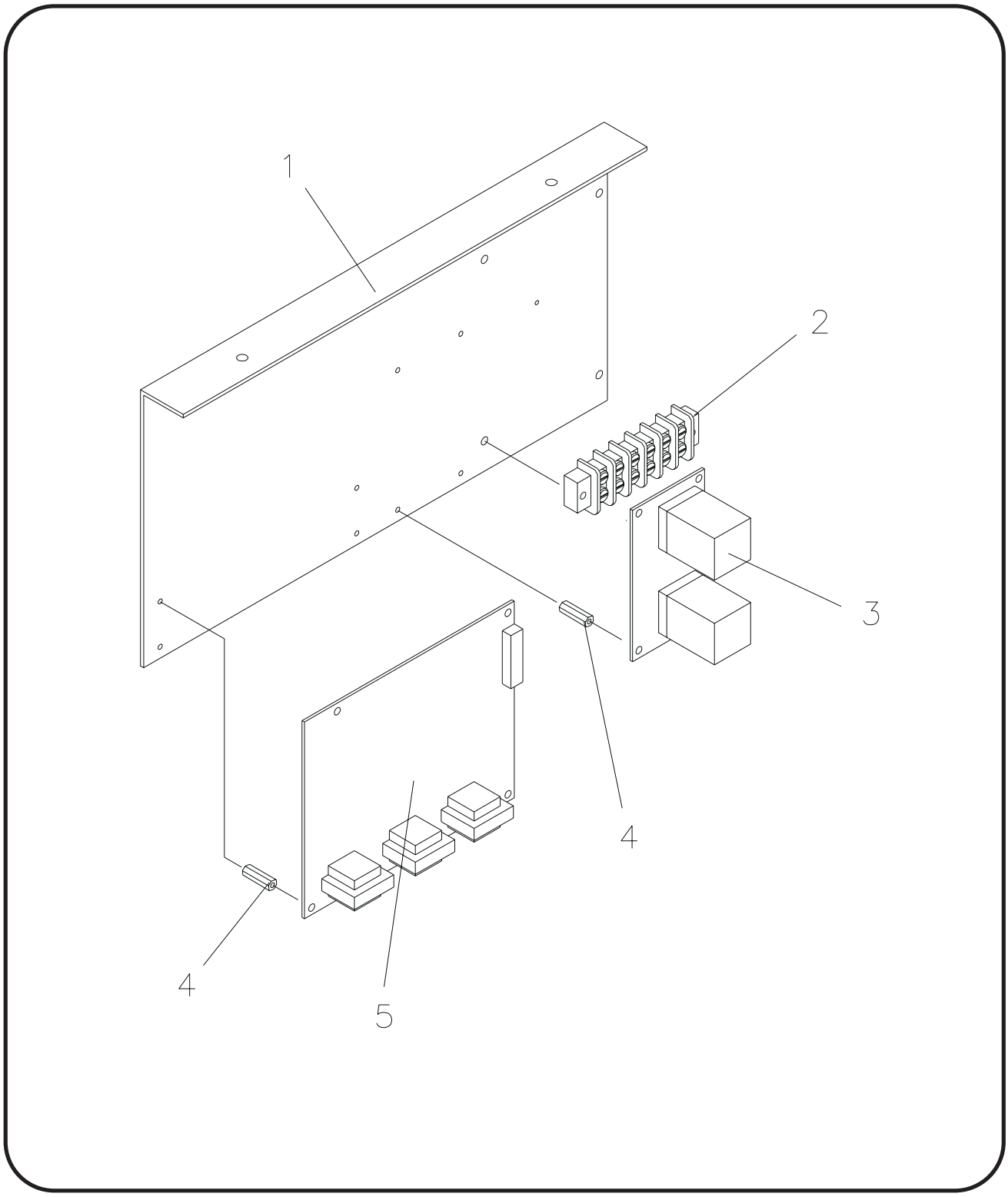
Resistor Assembly
Figure 15

Figure & Item No.	Hobart Part No.	Airline Part No.	Nomenclature 1 2 3 4 5 6	Eff	Units Per Assy
15 -	**285518**		**RESISTOR ASSEMBLY**		**REF**
15- 1	281929-8		. FLAT WASHER		4
15-2	283710		. RESISTOR INSULATOR		4
15-3	283380		. RESISTOR INSULATOR		4
15-4	405154-7		. RESISTOR, 100W, 15 OHM		2
15-5	283387-1		. THREADED ROD		1



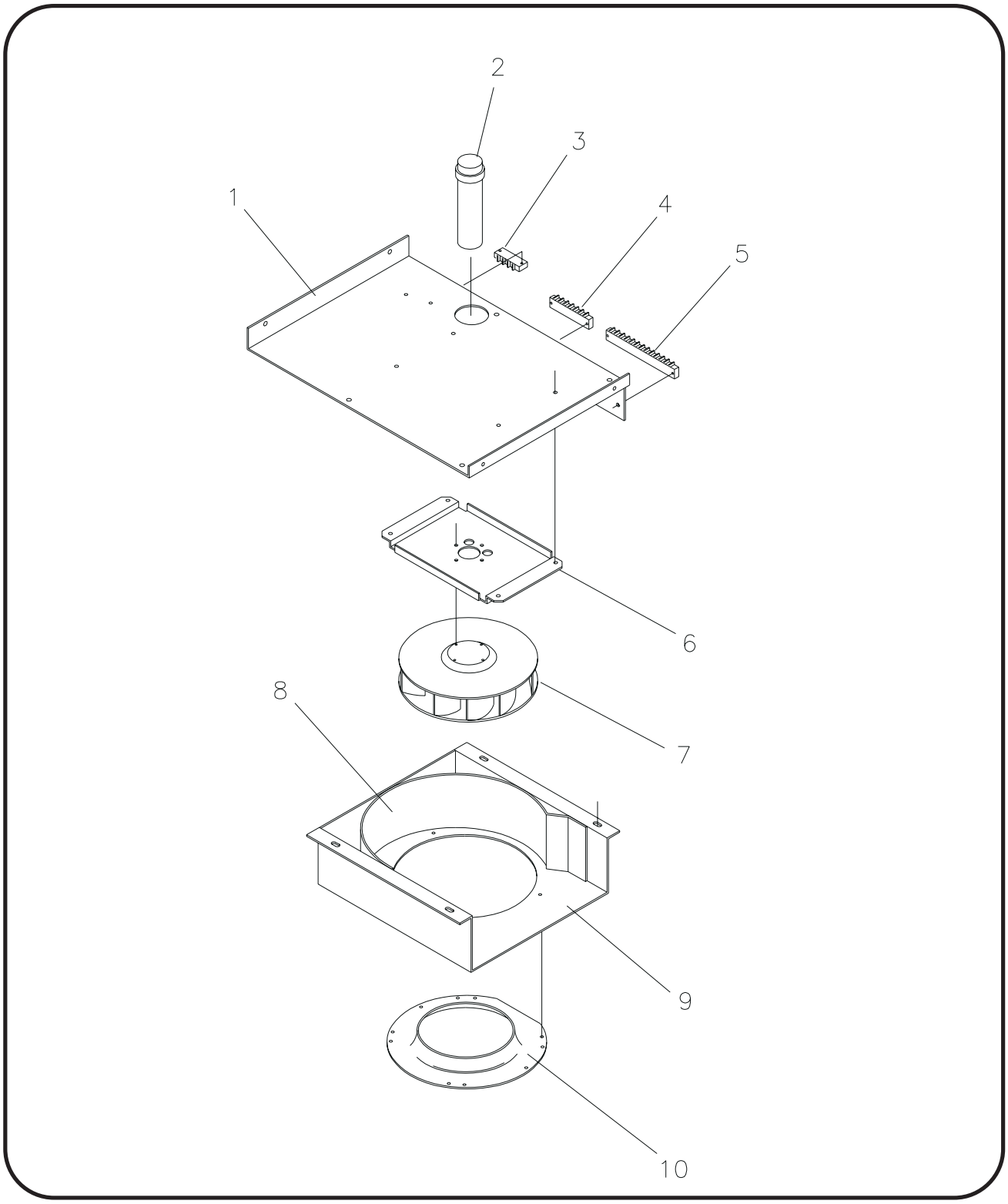
Resistor Assembly
Figure 16

Figure & Item No.	Hobart Part No.	Airline Part No.	Nomenclature 1 2 3 4 5 6	Eff	Units Per Assy
16 -	**285516**		**RESISTOR ASSEMBLY**		**REF**
16- 1	282181		. RESISTOR BRACKET		2
16-2	283380		. RESISTOR INSULATOR		2
16-3	405154-1		. RESISTOR, 100W, 50 OHM		1
16-4	W-11114-12		. SCREW, PAN HD.		1



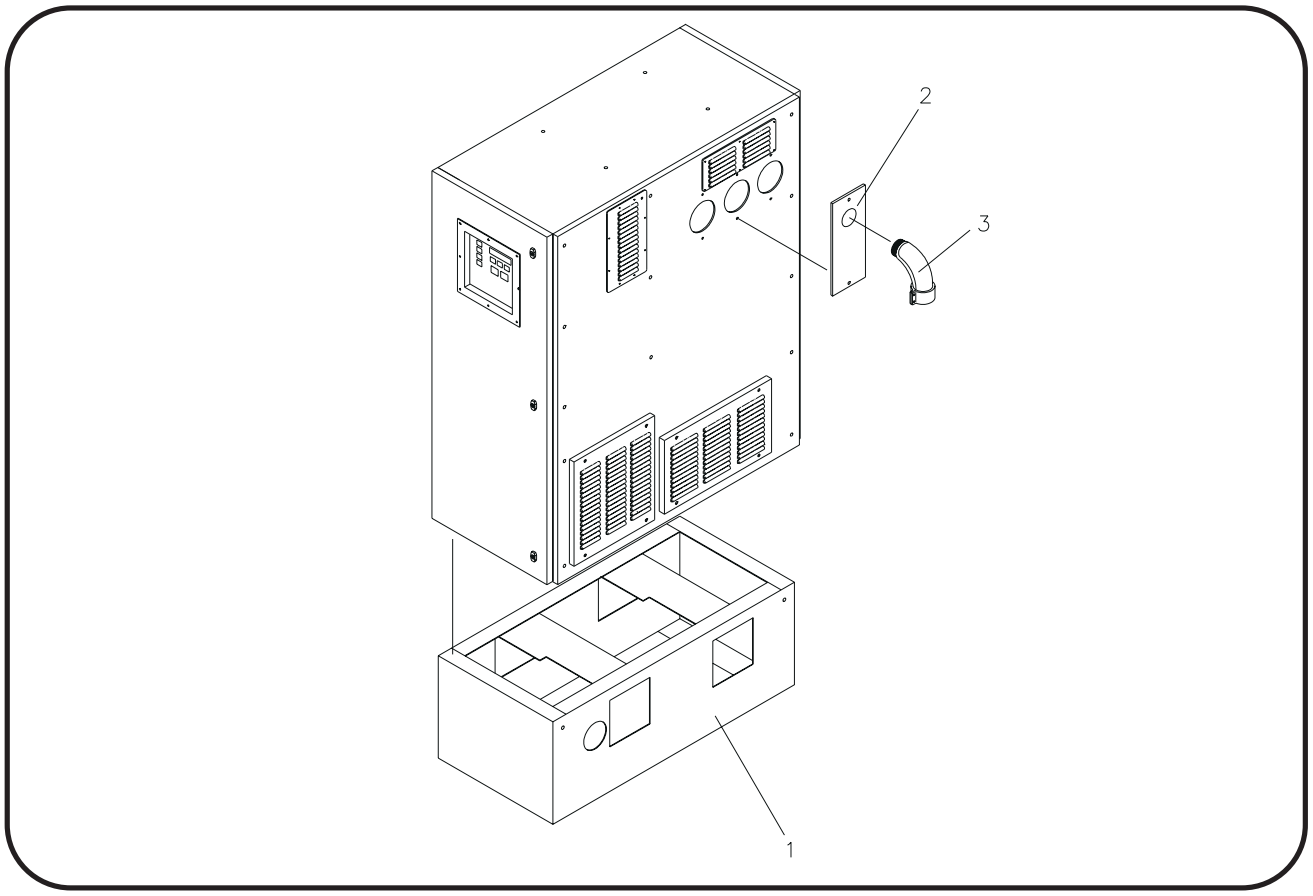
Output and Remote Bd. Assembly
Figure 17

Figure & Item No.	Hobart Part No.	Airline Part No.	Nomenclature 1 2 3 4 5 6	Eff	Units Per Assy
17 -	**285525**		**OUTPUT AND REMOTE BD. ASSY..**		**REF**
17- 1	285097		. OUTPUT PANEL SUPPORT		1
17-2	283066-1		. TERMINAL BLOCK		1
17-3	282369A		. REMOTE SENSING P.C.B. ASSY..		1
17-4	375426-3		. P.C.B. SPACER		8
17-5	285267		. OUTPUT P.C.B. ASSEMBLY		1

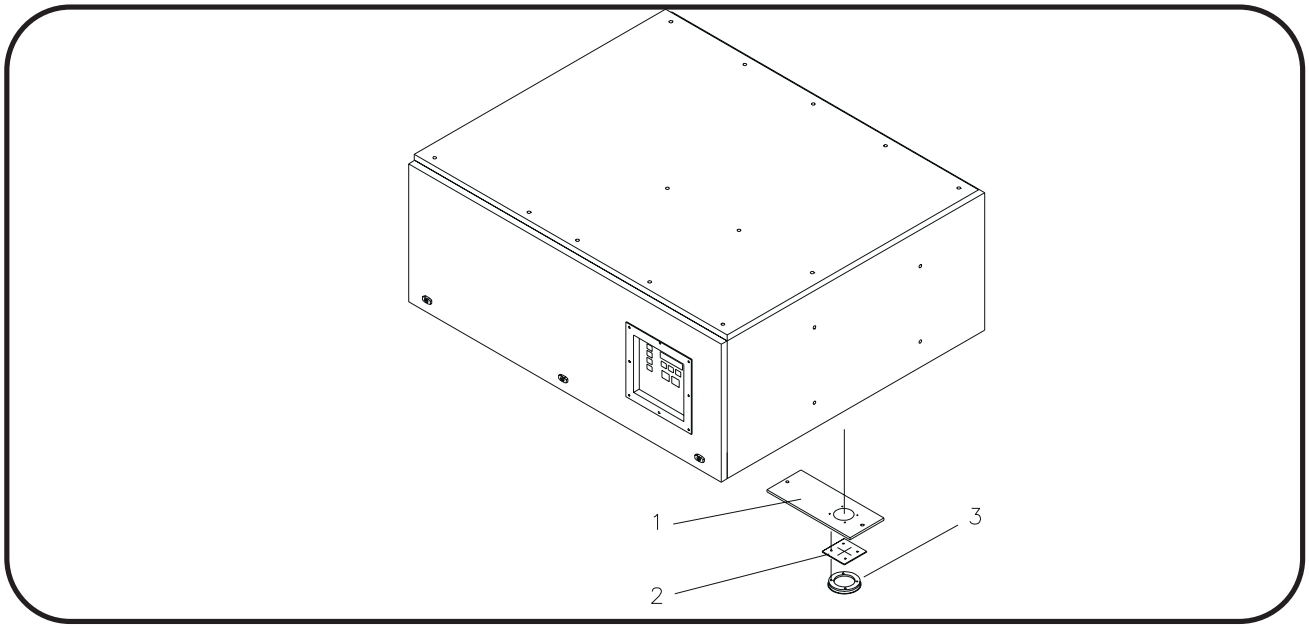


Output Fan Assembly
Figure 18

Figure & Item No.	Hobart Part No.	Airline Part No.	Nomenclature 1 2 3 4 5 6	Eff	Units Per Assy
18 -	**285560**		**OUTPUT FAN ASSEMBLY (90/125 KVA)**	**K,L,M,N,P,T**	**REF**
	285561		**OUTPUT FAN ASSEMBLY (180 KVA)**	**Q,R,S,U,V**	**REF**
18-1	285389		. OUTPUT IMPELLER MTG. PLATE		1
18-2	283156-1		. MOTOR STARTING CAPACITOR	K,L,M,N,P,T	1
	283156-2		. MOTOR STARTING CAPACITOR	Q,R,S,U,V	1
18-3	401911-3		. TERMINAL BLOCK, 3 STATION		1
18-4	283066-1		. TERMINAL BLOCK, 6 STATION		1
18-5	283066-2		. TERMINAL BLOCK, 12 STATION		1
18-6	283251		. IMPELLER MOUNTING PLATE	K,L,M,N,P,T	1
	285388		. IMPELLER MOUNTING PLATE	Q,R,S,U,V	1
18-7	283155-1		. MOTORIZED IMPELLER	K,L,M,N,P,T	1
	283155-2		. MOTORIZED IMPELLER	Q,R,S,U,V	1
18-8	285530		. AIR OUTPUT DEFLECTOR	K,L,M,N,P,T	1
	285391		. AIR OUTPUT DEFLECTOR	Q,R,S,U,V	1
18-9	285529		. IMPELLER OUTPUT HOUSING	K,L,M,N,P,T	1
	285390		. IMPELLER OUTPUT HOUSING	Q,R,S,U,V	1
18-10	283157-1		. IMPELLER INLET RING	K,L,M,N,P,T	1
	283157-2		. IMPELLER INLET RING	Q,R,S,U,V	1



Vertical Mounting
Figure 19A



Horizontal/Bridge Mounting
Figure 19B

	Figure & Item No.	Hobart Part No.	Airline Part No.	Nomenclature 1 2 3 4 5 6	Eff	Units Per Assy
	19A -	**285562-1**		**VERTICAL MOUNT 1 OUTPUT KIT**	**K,N,S,V**	**REF**
		285562-2		**VERTICAL MOUNT 2 OUTPUTS KIT**	**L,P,Q,T,U**	**REF**
		285562-3		**VERTICAL MOUNT 3 OUTPUTS KIT**	**M,R**	**REF**
	19A-1	282185		. CONVERTER MOUNTING BASE ASSY.		1
	19A-2	283291		. OUTPUT CIRCUIT PANEL ASSY.		3
	19A-3	W-10088-8		. OUTPUT ELBOW CONNECTOR	K,N,S,V	1
*		78B-1081-3		. CONNECTOR GASKET	K,N,S,V	1
		W-10088-8		. OUTPUT ELBOW CONNECTOR	L,P,Q,T,U	2
*		78B-1081-3		. CONNECTOR GASKET	L,P,Q,T,U	2
		W-10088-8		. OUTPUT ELBOW CONNECTOR	M,R	3
*		78B-1081-3		. CONNECTOR GASKET	M,R	3
	19B -	**285562-4**		**HORIZONTAL MOUNT 1 OUTPUT KIT**	**K,N,V**	**REF**
		285562-5		**HORIZONTAL MOUNT 2 OUTPUTS KIT**	**L,P,Q**	**REF**
		285562-6		**HORIZONTAL MOUNT 3 OUTPUTS KIT**	**M,R**	**REF**
	19B-1	283906		. OUTPUT CIRCUIT PANEL ASSY.		3
	19B-2	285379		. OUTPUT RUBBER COVER	K,N,V	1
		285379		. OUTPUT RUBBER COVER	L,P,Q	2
		285379		. OUTPUT RUBBER COVER	M,R	3
	19B-3	100GH-118		. CABLE HORN	K,N,V	1
		100GH-118		. CABLE HORN	L,P,Q	1
		100GH-118		. CABLE HORN	M,R	1

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Section 4. Numerical Index

1. Explanation of Numerical Index

The purpose of this index is to assist the user in finding the illustration and description of a part when the part number is known. Part numbers are arranged in numeric-alpha sequence. Thus, any number beginning with the letter “A” would be located toward the end of the index list. On the other hand, a part number starting with a “1” would be listed near the beginning of the list. The figure number and item number location of the part is directly opposite the part. If the part is used more than one place, each location beginning with the first is listed.

Figure & Item Number	Part Number
19B-3	100GH-118
19B-3	100GH-118
19B-3	100GH-118
5-24	192266-1
10-34	203380
3-12	204247-1
3-14	204247-2
1-14	280673
1-15	280673
12- 3	281575-1
9-10	281664-1
9-8	281664-2
13- 3	281848-1
14-2	281929-8
15- 1	281929-8
13- 5	281971-1
9-7	282092-1
7-7	282130-1
7-7	282130-1
8-4	282130-1
8-4	282130-1
9-12	282143-1
2-5	282146
10-10	282153
10-21	282154
10-33	282155-1
10-8	282156
10-7	282157
10-37	282160
10-29	282161
10-28	282162
13- 4	282163
10-30	282168
13- 6	282171
12-8	282177
12-7	282178
12- 6	282179

Figure & Item Number	Part Number
16- 1	282181
19A-1	282185
3-2	282195-1
3-6	282195-2
3-5	282198
3-1	282199
17-3	282369A
17-2	283066-1
18-4	283066-1
18-5	283066-2
10-8	283067-1
7-7	283067-2
7-7	283067-2
5-27	283067-6
10-19	283154-1
12- 2	283154-1
6-2	283154-1
6-2	283154-1
7-2	283154-1
7-2	283154-1
8-2	283154-1
8-2	283154-1
10-15	283155-1
18-7	283155-1
10-15	283155-2
18-7	283155-2
10-18	283156-1
18-2	283156-1
10-18	283156-2
18-2	283156-2
10-16	283157-1
18-10	283157-1
10-16	283157-2
18-10	283157-2
1-6	283159-1
1-2	283159-2
3-13	283160

Figure & Item Number	Part Number
4-4	283160-1
11- 2	283164-1
11- 4	283191-1
10-5	283196-1
10-3	283196-2
5-2	283211A
5-3	283212A
10-25	283214A
10-26	283215A
3-16	283216A
10-35	283218A
9-13	283219A
18-6	283251
10-14	283261
2-11	283272
2-6	283282
2-7	283286
19A-2	283291
2-3	283293
12-1	283295
1-5	283304
1-1	283305
1-8	283306
1-4	283307
1-14	283320
1-15	283320
3-7	283321
4-3	283321
3-4	283357A
3-7	283368
4-2	283368
14-4	283380
15-3	283380
16-2	283380
14- 1	283387-1
15-5	283387-1
13- 2	283398
10-36	283399
10-31	283400
11- 1	283406
11- 6	283409
11- 5	283412
11- 3	283413
13- 1	283414
2-14	283430
9-1	283431
2-15	283432
2-13	283433
3-15	283461-1
3-16	283705-1
14-3	283710
15-2	283710
1-9	283725
1-11	283726
2-3	283746
2-1	283747
13-9	283845
9-5	283855
5-1	283864A
7-5	283889
7-5	283889
7-6	283891
7-6	283891
19B-1	283906
10-4	283920-1
10-4	283920-2
10-4	283920-3
5-7	284221-1
5-8	284221-2
5-7	284221-3
5-8	284221-4
5-7	284221-5
5-8	284221-6
13-8	284316-1
3-3	284317-1
10-8	284347
3-11	284386
13-7	284419
3-9	284460
3-8	284582
4-1	284584
1-14	284606-1
1-15	284606-1
2-2	284612
2-8	284650A
2-4	284651A
8-5	285085
8-5	285085
2-10	285092
5-10	285093
17- 1	285097
7-7	285099
7-7	285099
8-4	285099
8-4	285099
5-28	285102-1
5-28	285102-1
5-28	285102-1
5-7	285103-1
5-8	285103-1

Figure & Item Number	Part Number
5-22	285128-1
10-27	285262
17-5	285267
1-3	285296
1-7	285297
19B-2	285379
19B-2	285379
19B-2	285379
18-6	285388
18-1	285389
18-9	285390
18-8	285391
10-11	285393
10-9	285394
10-32	285400
10-1	285408-2
10-2	285408-2
16 -	285516
5-19	285516-1
14 -	285517
5-17	285517-1
15 -	285518
5-18	285518-1
12- 1	285520
13 -	285522
5-16	285522
5-12	285524
9-	285524
17 -	285525
5-20	285525
1-13	285526
2-1	285526
1-14	285527
3-	285527
2-12	285528
18-9	285529
18-8	285530
10-	285531
5-13	285531
10-13	285532
10-12	285534
10-	285535-1
5-13	285535-1
10-	285535-2
5-13	285535-2
10-20	285536
10-11	285537
1-15	285538
4-	285538
5-23	285540-4

Figure & Item Number	Part Number
1-12	285544
1-10	285545
2-9	285546
6-1	285547
6-1	285547
7-1	285547
7-1	285547
8-1	285547
8-1	285547
6-3	285548
6-3	285548
5-11	285549-1
6-	285549-1
5-11	285549-2
6-	285549-2
11 -	285558-1
5-14	285558-1
18 -	285560
5-21	285560
18-	285561
5-21	285561
19A -	285562-1
19A-	285562-2
19A-	285562-3
19B -	285562-4
19B -	285562-5
19B -	285562-6
1-17	285562-X
5-6	285568
5-25	285705-1
5-5	285733
5-4	285739
12- 4	285743-1
12- 5	285746
7-3	285750
7-3	285750
8-3	285750
8-3	285750
5-11	285751-1
7-	285751-1
5-11	285751-2
7-	285751-2
5-11	285752-1
8-	285752-1
5-11	285752-2
8-	285752-2
7-4	285753
7-4	285753
8-6	285754
8-6	285754

Figure & Item Number	Part Number
8-8	285755
8-8	285755
7-7	287018
7-7	287018
8-4	287018
8-4	287018
10-24	375426-3
17-4	375426-3
3-10	375426-3
9-6	375426-3
10-23	375426-4
9-4	375426-5
10-17	401911-14
18-3	401911-3
5-10	401937-1
8-7	402945
8-7	402945
10-22	404044-4
14-5	404249-3
9-2	404402-2
9-14	404960-34
16-3	405154-1
15-4	405154-7
5-26	408373
10-6	408501
9-3	408584
5-9	493712
1-	500013B-201
1-	500013B-202
1-	500013B-203
1-	500013B-205
1-	500013B-206
1-	500013B-207
1-	500013B-208
1-	500013B-209
1-	500013B-210
1-	500013B-211
1-	500013B-212
6-4	78A-1126
19A-3	78B-1081-3
19A-3	78B-1081-3
19A-3	78B-1081-3
19A-3	W-10088-8
19A-3	W-10088-8
19A-3	W-10088-8
9-11	W-10502-31
9-14	W-10502-31
9-9	W-10502-31
16-4	W-11114-12

Figure & Item Number	Part Number

Chapter 5. Manufacturer's Literature

DIAGRAM NUMBER	TYPE OF DIAGRAM
285386	Converter Block Diagram, Part No. 500013A
285523	Converter Block Diagram, Part No. 500013A
282672	Diagrams, Schematic and Connection, Part No. 500013A, 90-Kva and 125 Kva units (12 sheets)
285126	Diagrams, Schematic and Connection, Part No. 500013A, 180 Kva units (9 sheets)
285521	Diagrams, Schematic and Connection, Part No. 500013B All units (12 sheets)
285523	Converter Block Diagram, Part No. 500013B
285782	Converter Installation/Outline Drawing, 500013B (3 sheets)
281338	Remote Pushbutton Station - Parts List
281339	Remote Pushbutton Station - Connection Diagram
285317-1 and -2	Voltage Suppressor Kits (TO-234)

Refer to Section 1-1, Pages 27-29 for specific information on converter optional equipment and service kits.

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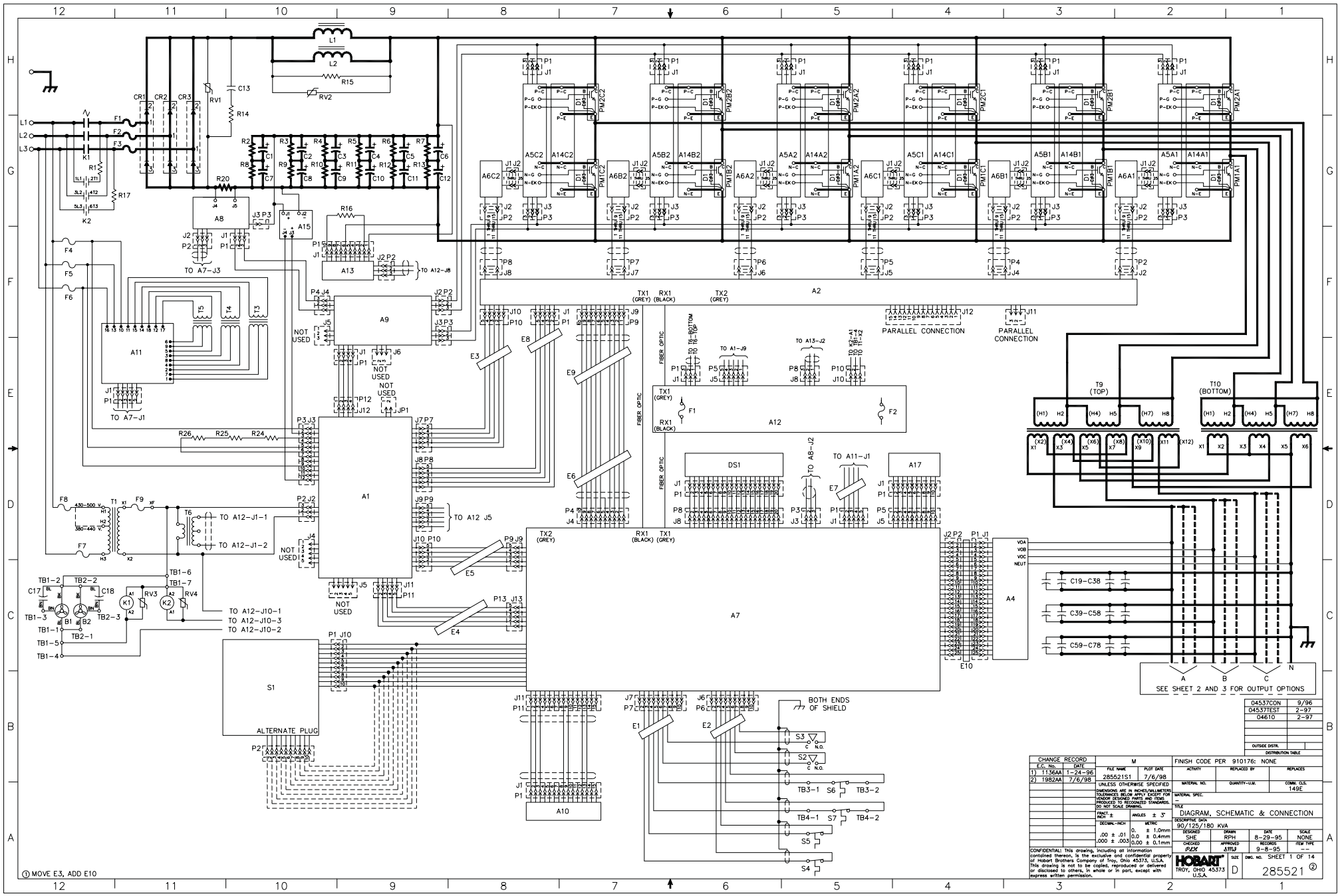


① MOVE E3, ADD E10

04537CON	9/96
04537TEST	2-97
04610	2-97

OUTSIDE DISTR.

DISTRIBUTION TABLE

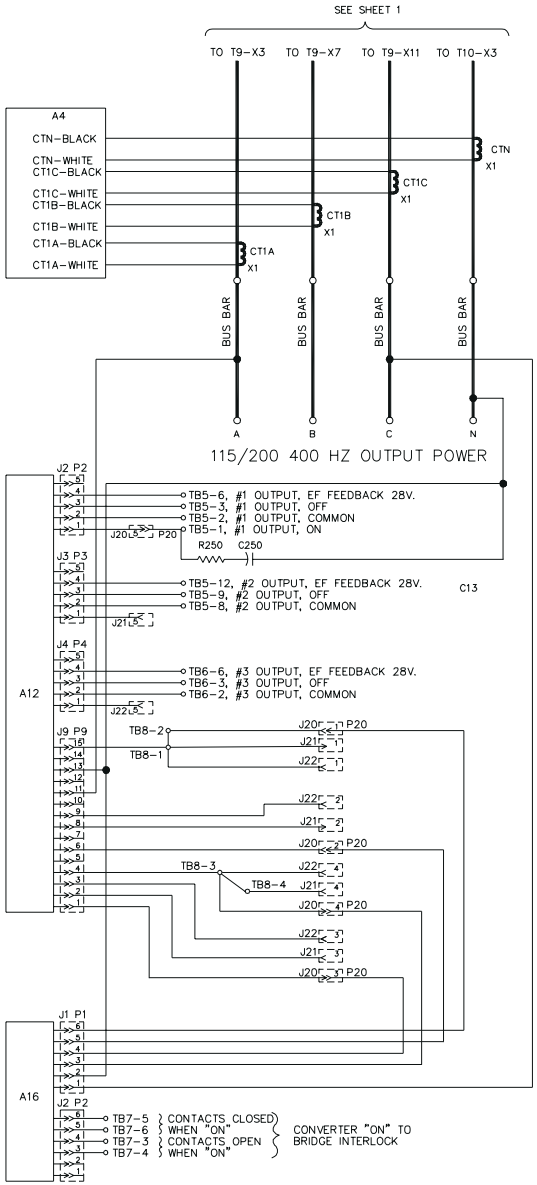
CHANGE RECORD			M	FINISH CODE PER 910176: NONE			
E.C. No.	DATE	FILE NAME	PLOT DATE	ACTIVITY	REPLACED BY	REPLACES	
1) 1136AA	1-24-96	285521S1	7/6/98				
2) 1982AA	7/6/98	UNLESS OTHERWISE SPECIFIED		MATERIAL NO.	QUANTITY-U.M.	COMM. CLS.	
		DIMENSIONS ARE IN INCHES/MILLIMETERS TOLERANCES BELOW APPLY EXCEPT FOR VENDOR DESIGNED PARTS AND ITEMS PRODUCED TO RECOGNIZED STANDARDS. DO NOT SCALE DRAWING.				149E	
		FRACT. ±	ANGLES ± 3°	MATERIAL SPEC.			
		DECIMAL-INCH	METRIC	TITLE	DIAGRAM, SCHEMATIC & CONNECTION		
		.00 ± .01	0. ± 1.0mm	DESCRIPTIVE DATA	90/125/180 KVA		
		.000 ± .003	0.0 ± 0.4mm	DESIGNED	DRAWN	DATE	SCALE
			0.00 ± 0.1mm	SHE	RPH	8-29-95	NONE
				CHECKED	APPROVED	RECORDS	ITEM TYPE
				JLK	[illegible]	9-8-95	--

HOBART
TROY, OHIO 45373
U.S.A.

SIZE D | DWG. NO. 285521 ② | SHEET 1 OF 14

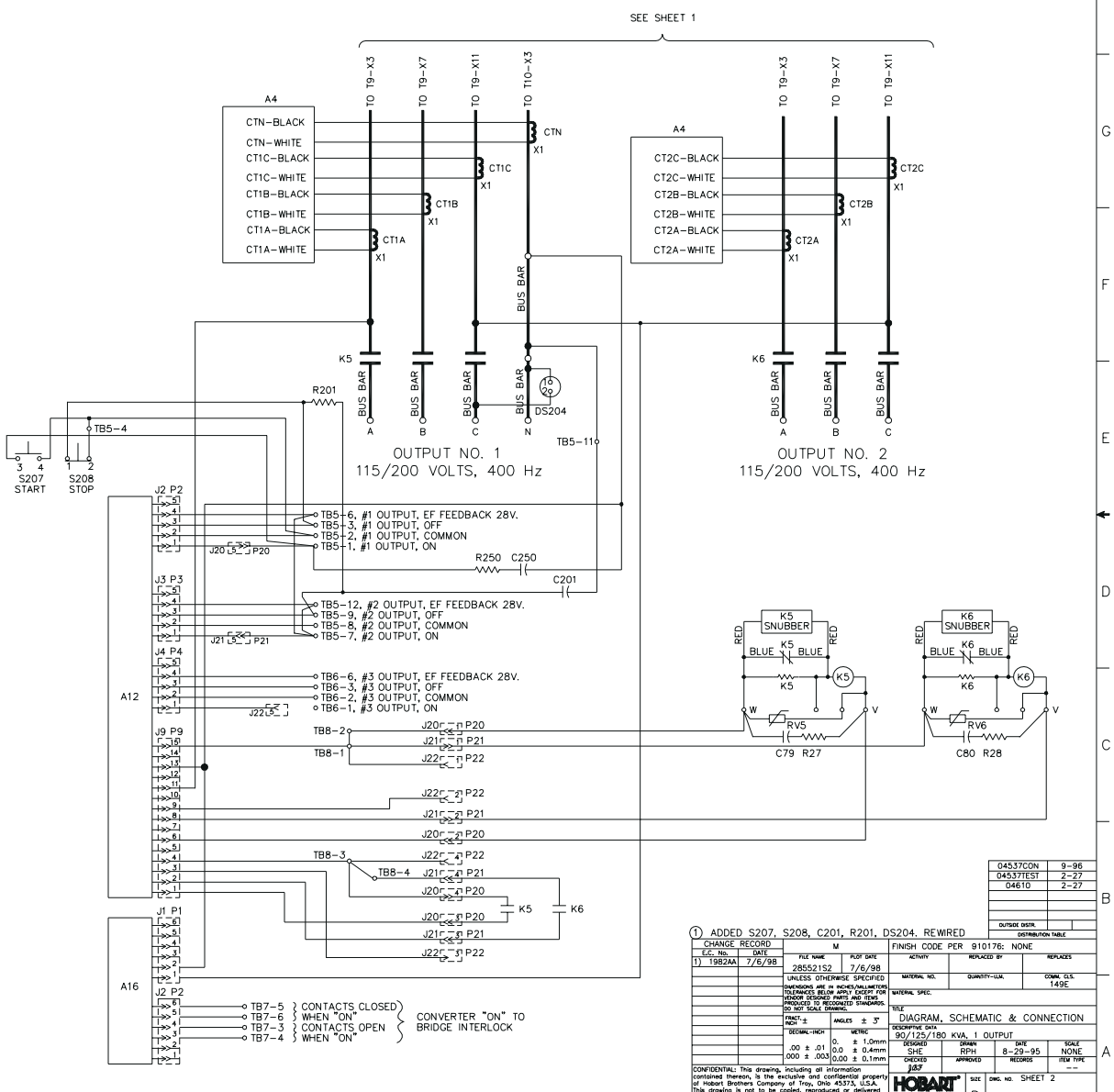
90 KVA 1 OUTPUT SHOWN

WITHOUT CONTACTORS



125/180 KVA 1 OUTPUT FOR DISTRIBUTION PANEL

WITH 2 CONTACTORS



04537CON	9-96
04537TEST	2-27
04610	2-27

OUTSIDE DISTR.

DISTRIBUTION TABLE

① ADDED S207, S208, C201, R201, DS204. REWIRED

CHANGE RECORD		M	FINISH CODE PER 910176: NONE
E.C. No.	DATE	FILE NAME / PLOT DATE	ACTIVITY / REPLACED BY / REPLACES
1) 1982AA	7/6/98	285521S2 7/6/98	

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES/MILLIMETERS
TOLERANCES BELOW APPLY EXCEPT FOR VENDOR DESIGNED PARTS AND ITEMS INTRODUCED TO RECOGNIZED STANDARDS. DO NOT SCALE DRAWING.

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

MATERIAL NO. | QUANTITY-U.M. | COMM. CLS. 149E
MATERIAL SPEC.

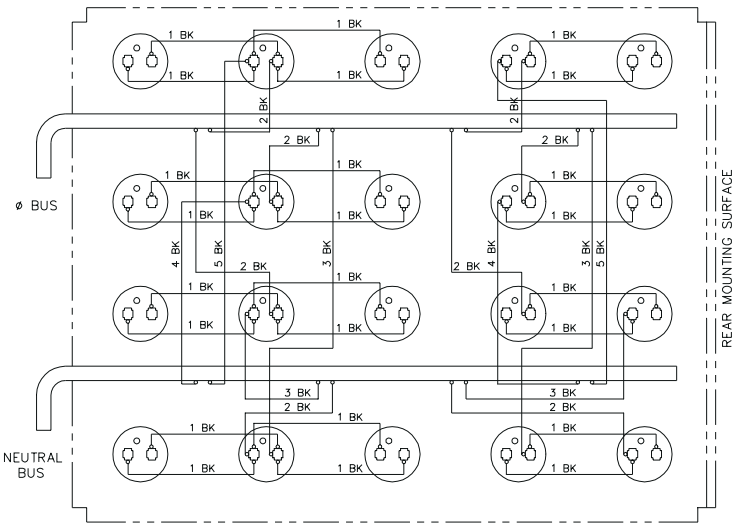
TITLE: DIAGRAM, SCHEMATIC & CONNECTION
90/125/180 KVA, 1 OUTPUT

DESCRIPTIVE DATA

DESIGNED	DRAWN	DATE	SCALE
SHE	RPH	8-29-95	NONE
CHECKED	APPROVED	RECORDS	ITEM TYPE
jdd			--

HOBART TROY, OHIO 45373 U.S.A.

SIZE D | DWG. NO. SHEET 2 | 285521



FACING FRONT OF AC CAPACITOR BANK

USE THIS DIAGRAM FOR COMPONENTS:
C19 THRU C38 – øA & NEUTRAL OR
C39 THRU C58 – øB & NEUTRAL OR
C59 THRU C78 – øC & NEUTRAL

① ZONE C-1,2 & 3: ADDED C79, C80 & C81 AND R27, R28 & R29.

90/125/180 KVA 2 OUTPUTS SHOWN

125/180 KVA 3 OUTPUTS SHOWN ——— AND - - - - - - - - - -

SEE SHEET 1

A4
CTN–BLACK
CTN–WHITE
CT1C–BLACK
CT1C–WHITE
CT1B–BLACK
CT1B–WHITE
CT1A–BLACK
CT1A–WHITE
CTN
CT1C
CT1B
CT1A
X1
TO T9–X3
TO T9–X7
TO T9–X11
TO T10–X3
BUS BAR
K5
A B C N

OUTPUT NO. 1
115/200 VOLTS, 400 Hz

A4
CT2C–BLACK
CT2C–WHITE
CT2B–BLACK
CT2B–WHITE
CT2A–BLACK
CT2A–WHITE
CT2C
CT2B
CT2A
K6

OUTPUT NO. 2
115/200 VOLTS, 400 Hz

A4
CT3C–BLACK
CT3C–WHITE
CT3B–BLACK
CT3B–WHITE
CT3A–BLACK
CT3A–WHITE
CT3C
CT3B
CT3A
K7

OUTPUT NO. 3
115/200 VOLTS, 400 Hz

A12
J2 P2
TB5–6, #1 OUTPUT, EF FEEDBACK 28V.
TB5–3, #1 OUTPUT, OFF
TB5–2, #1 OUTPUT, COMMON
TB5–1, #1 OUTPUT, ON
J20 P20
R250 C250
J3 P3
TB5–12, #2 OUTPUT, EF FEEDBACK 28V.
TB5–9, #2 OUTPUT, OFF
TB5–8, #2 OUTPUT, COMMON
TB5–7, #2 OUTPUT, ON
J21 P21
J4 P4
TB6–6, #3 OUTPUT, EF FEEDBACK 28V.
TB6–3, #3 OUTPUT, OFF
TB6–2, #3 OUTPUT, COMMON
TB6–1, #3 OUTPUT, ON
J22 P22
J9 P9
TB8–2
TB8–1
TB8–3
TB8–4
J20 P20
J21 P21
J22 P22

K5 SNUBBER
K6 SNUBBER
K7 SNUBBER
RED
BLUE
W
V
RV5
RV6
RV7
C79 R27
C80 R28
C81 R29

A16
J1 P1
J2 P2
TB7–5 } CONTACTS CLOSED
TB7–6 } WHEN "ON"
TB7–3 } CONTACTS OPEN
TB7–4 } WHEN "ON"
CONVERTER "ON" TO BRIDGE INTERLOCK

04537 CON	9–96
04537TEST	2–97
04610	2–97

OUTSIDE DISTR.
DISTRIBUTION TABLE

CHANGE RECORD		M	FINISH CODE PER 910176: NONE			
E.C. No.	DATE	FILE NAME	PLOT DATE	ACTIVITY	REPLACED BY	REPLACES
1) 1489AA	10–2–96	285521S3	10–7–96			
		UNLESS OTHERWISE SPECIFIED		MATERIAL NO.	QUANTITY–U.M.	COMM. CLS. 149E
		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, SCHEMATIC & CONNECTION		
		DECIMAL–INCH	METRIC	DESCRIPTIVE DATA 2 & 3 OUTPUTS		
		.00 ± .01	0. ± 1.0mm	DESIGNED SHE	DRAWN RPH	DATE 8–29–95
		.000 ± .003	0.0 ± 0.4mm 0.00 ± 0.1mm	CHECKED	APPROVED	RECORDS
						SCALE NONE
						ITEM TYPE –

HOBART TROY, OHIO 45373 U.S.A.

SIZE D

DWG. NO. SHEET 3
285521

LEGEND

FOUND ON PAGE #		
8	A1	BOARD, P.C., POWER SUPPLY
8	A2	BOARD, P.C., MODULATOR
9,11,13	A4	BOARD, P.C., OUTPUT
8	A5	BOARD, P.C., DRIVER
8	A6	BOARD, P.C., DRIVER LOGIC
6	A7	BOARD, P.C., A.D.C.S.
7	A8	BOARD, P.C., D.C. BUS
8	A9	BOARD, P.C., CHOPPER
6	A10	BOARD, P.C., LAMP
5	A11	BOARD, P.C., INPUT VOLTAGE
5	A12	BOARD, P.C., LOAD CONTROL
8	A13	BOARD, P.C., DISCHARGE
8	A14	BOARD, P.C., SNUBBER
8	A15	BOARD, P.C., BUS TAP
9,11,13	A16	BOARD, P.C., REMOTE SENSE
6	A17	BOARD, P.C., I.D.
7	B1	IMPELLER, MOTORIZED, RECTIFIER, 115 V.A.C., 550 C.F.M.
9,11,13	B2	IMPELLER, MOTORIZED, OUTPUT, 115 V.A.C., 550 C.F.M.
7	C1-C12	CAPACITOR, 7000 MFD., 450 V.A.C.
3,7,12,14	C13, C79-C81	CAPACITOR, 0.1 MFD., 1000 V.D.C.
7,9,11,13	C17, C18	CAPACITOR, MOTOR START, 16 MFD.
3,7	C19-C38	CAPACITOR, PHASE "A", 30 MFD., 330 V.A.C.
3,7	C39-C58	CAPACITOR, PHASE "B", 30 MFD., 330 V.A.C.
3,7	C59-C78	CAPACITOR, PHASE "C", 30 MFD., 330 V.A.C.
11,13	C250	CAPACITOR, 220 MFD., 50 V.
13	C201	CAPACITOR, 100 MFD., 100V.
7	CR1-CR3	MODULE, RECTIFIER
10,12,14	CT1A	CURRENT TRANS., PHASE "A", NO. 1 OUTPUT
10,12,14	CT1B	CURRENT TRANS., PHASE "B", NO. 1 OUTPUT
10,12,14	CT1C	CURRENT TRANS., PHASE "C", NO. 1 OUTPUT
10,12,14	CT2A	CURRENT TRANS., PHASE "A", NO. 1 OR 2 OUTPUT (WHEN FURNISHED)
10,12,14	CT2B	CURRENT TRANS., PHASE "B", NO. 1 OR 2 OUTPUT (WHEN FURNISHED)
10,12,14	CT2C	CURRENT TRANS., PHASE "C", NO. 1 OR 2 OUTPUT (WHEN FURNISHED)
10	CT3A	CURRENT TRANS., PHASE "A", NO. 3 OUTPUT (WHEN FURNISHED)
10	CT3B	CURRENT TRANS., PHASE "B", NO. 3 OUTPUT (WHEN FURNISHED)
10	CT3C	CURRENT TRANS., PHASE "C", NO. 3 OUTPUT (WHEN FURNISHED)
10,12,14	CTN	CURRENT TRANS., NEUTRAL
7	D1	SUPPRESSOR, TRANSIENT VOLTAGE
6	DS1	DISPLAY MODULE, FLOURESCENT
13	DS204	INDICATOR, OUTPUT, LOCAL, AMBER
6,8	E1-E10	FERRITE BEAD RING
5	F1, F2 ON A12	FUSE, AGC, 3 A., 250 V.
7	F1-F3	FUSE, INPUT, 250 A., 600 V.A.C.
5	F4-F9	FUSE, 15 A., 500 V.
8	GATE N ON A5	RECEPTACLE, DRIVER, P.C. BOARD
8	GATE P ON A5	RECEPTACLE, DRIVER, P.C. BOARD
8	J2-J5, J7-J12, JP1 ON A1	RECEPTACLE, POWER SUPPLY P.C. BOARD
8	J1,J2,J4-J12 ON A2	RECEPTACLE, MODULATOR P.C. BOARD
9,11	J1 ON A4	RECEPTACLE, OUTPUT P.C. BOARD
8	J1-J3 ON A5	RECEPTACLE, DRIVER P.C. BOARD
8	J1, J2 ON A6	RECEPTACLE, DRIVER LOGIC P.C. BOARD
6	J1-J11, J13 ON A7	RECEPTACLE, A.D.C.S. P.C. BOARD
7	J1-J5 ON A8	RECEPTACLE, D.C. BUS P.C. BOARD
8	J1-J6 ON A9	RECEPTACLE, CHOPPER P.C. BOARD
6	J1 ON A10	RECEPTACLE, LAMP P.C. BOARD
5	J1 ON A11	RECEPTACLE, INPUT VOLTAGE P.C. BOARD
5	J1-J5, J8-J10 ON A12	RECEPTACLE, LOAD CONTROL P.C. BOARD
8	J1, J2 ON A13	RECEPTACLE, DISCHARGE P.C. BOARD
9,11	J1, J2 ON A16	RECEPTACLE, REMOTE SENSE P.C. BOARD
6	J1 ON A17	RECEPTACLE, I.D. P.C. BOARD
6	J1 ON DS1	RECEPTACLE, DISPLAY MODULE
9,11,13	J20, J21, J22	RECEPTACLE, OUTPUT CONTACTOR DISABLE
7	K1	CONTACTOR, INPUT
7	K2	CONTACTOR, POWER
10,14	K5	CONTACTOR, LOAD, NO. 1 OUTPUT (WHEN FURNISHED)
10,14	K6	CONTACTOR, LOAD, NO. 2 OUTPUT (WHEN FURNISHED)
10	K7	CONTACTOR, LOAD, NO. 3 OUTPUT (WHEN FURNISHED)
9,11,13	L1, L2	REACTOR, FILTER

FOUND ON PAGE #		
8	P2, P3, P7-P12 ON A1	PLUG, POWER SUPPLY P.C. BOARD
8	P1,P2,P4-P10 ON A2	PLUG, MODULATOR P.C. BOARD
9,11	P1 ON A4	PLUG, OUTPUT P.C. BOARD
8	P1, P3 ON A5	PLUG, DRIVER P.C. BOARD
8	P2 ON A6	PLUG, DRIVER LOGIC P.C. BOARD
6	P1-P11, P13 ON A7	PLUG, A.D.C.S. P.C. BOARD
7	P1-P3 ON A8	PLUG, D.C. BUS P.C. BOARD
8	P1-P4 ON A9	PLUG, CHOPPER P.C. BOARD
6	P1 ON A10	PLUG, LAMP P.C. BOARD
5	P1 ON A11	PLUG, INPUT VOLTAGE P.C. BOARD
5	P1-P5, P8-P10 ON A12	PLUG, LOAD CONTROL P.C. BOARD
8	P1, P2 ON A13	PLUG, DISCHARGE P.C. BOARD
9,11	P1,P2 ON A16	PLUG, REMOTE SENSE P.C. BOARD
6	P1 ON A17	PLUG, I.D. P.C. BOARD
6	P1 ON DS1	PLUG, DISPLAY MODULE
6	P1, P2 ON S1	PLUG, CONTROL LABEL
9,11	P20	PLUG, NO. 1 OUTPUT CONTACTOR DISABLE
9,13	P21, P22	PLUG, NO. 2 & 3 OUTPUT CONTACTOR DISABLE (WHEN FURNISHED)
7	PM1A1, PM1B1, PM1C1	MODULE, IGBT, BRIDGE 1
7	PM2A1, PM2B1, PM2C1	
7	PM1A2, PM1B2, PM1C2	MODULE, IGBT, BRIDGE 2
7	PM2A2, PM2B2, PM2C2	
9,11,13	R1, R17	RESISTOR, 15 OHM, 100 W.
7	R2-R13	RESISTOR, 15K OHM, 10 W.
3,7,12,14	R14, R27-R29	RESISTOR, 2 OHM, 3 W.
9,11,13	R15	RESISTOR, 50 OHM, 100 W.
9,11,13	R16	RESISTOR, 50 OHM, 225 W.
7	R20	SHUNT, 300 A.
5	R24-R26	RESISTOR, POWER SUPPLY, PRELOAD, 25 OHM, 25 W.
11,13	R250	RESISTOR, 470 OHM, 2 W.
13	R201	RESISTOR, 150 OHM, 1/2 W.
7	RV1	VARISTOR, METAL OXIDE, RECTIFIER
9,11	RV2	VARISTOR, METAL OXIDE, FILTER CHOKE
7	RV3	VARISTOR, METAL OXIDE, K1
7	RV4	VARISTOR, METAL OXIDE, K2
10,14	RV5	VARISTOR, METAL OXIDE, K5 (WHEN FURNISHED)
10,14	RV6	VARISTOR, METAL OXIDE, K6 (WHEN FURNISHED)
10	RV7	VARISTOR, METAL OXIDE, K7 (WHEN FURNISHED)
8	RX1 ON A2	RECEIVER, FIBER OPTIC CABLE
6	RX1 ON A7	RECEIVER, FIBER OPTIC CABLE
5	RX1 ON A12	RECEIVER, FIBER OPTIC CABLE
6	S1	LABEL, CONTROL
7	S2	SWITCH, DOOR, INTERLOCK, FRONT
9,11,13	S3	SWITCH, DOOR, INTERLOCK, REAR
7	S4, S5	SWITCH, THERMAL, HEATSINK
10,12,14	S6	SWITCH, THERMAL, BOTTOM TRANSFORMER, 180°C
10,12,14	S7	SWITCH, THERMAL, TOP TRANSFORMER, 180°C
13	S207	SWITCH, PUSHBUTTON, START, LOCAL, OUTPUT
13	S208	SWITCH, PUSHBUTTON, STOP, LOCAL, OUTPUT
5	T1	TRANSFORMER, CONTROL
5	T3-T5	TRANSFORMER, SENSING, VOLTAGE
5	T6	TRANSFORMER, 24V.
10,12,14	T9	TRANSFORMER, MAIN, TOP
10,12,14	T10	TRANSFORMER, MAIN, BOTTOM
7	TB1	TERMINAL BLOCK, RECTIFIER IMPELLAR
9,11	TB2	TERMINAL BLOCK, OUTPUT IMPELLAR
9,11,13	TB3	TERMINAL BLOCK, BOTTOM TRANSFORMER
9,11,13	TB4	TERMINAL BLOCK, TOP TRANSFORMER
9,11,13	TB5	TERMINAL BLOCK, 12 STATION, REMOTE CONTROLS
9,11,13	TB6	TERMINAL BLOCK, 6 STATION, REMOTE CONTROLS
9,11,13	TB7	TERMINAL BLOCK, 6 STATION, REMOTE CONTROLS
9,11,13	TB8	TERMINAL BLOCK, 5 STATION, OUTPUT CONTACTOR DISABLE
8	TX1 ON A2	TRANSMITTER, FIBER OPTIC CABLE
6	TX1 ON A7	TRANSMITTER, FIBER OPTIC CABLE
5	TX1 ON A12	TRANSMITTER, FIBER OPTIC CABLE
6	TX2 ON A7	TRANSMITTER, FIBER OPTIC CABLE, REMOTE MODEM OUTPUT
8	TX2 ON A2	TRANSMITTER, FIBER OPTIC CABLE, MODULATOR DIAGNOSTIC

③ ADDED C201, DS204, R201, S207, S208
② ADDED C79-C81 AND R27-R29
① ADD E10

04537 CON	9-96
04537TEST	2-97
04610	2-97

DISTRIBUTION TABLE
OUTSIDE DISTR.

CHANGE RECORD					
E.C. No.	DATE	FILE NAME	PLOT DATE	ACTIVITY	REPLACED BY
1) 1136AA	1-24-96	285521S4	10-7-96		
2) 1489AA	10-2-96				
3) 1982AA	7/6/98				

M — FINISH CODE PER 910176: NONE

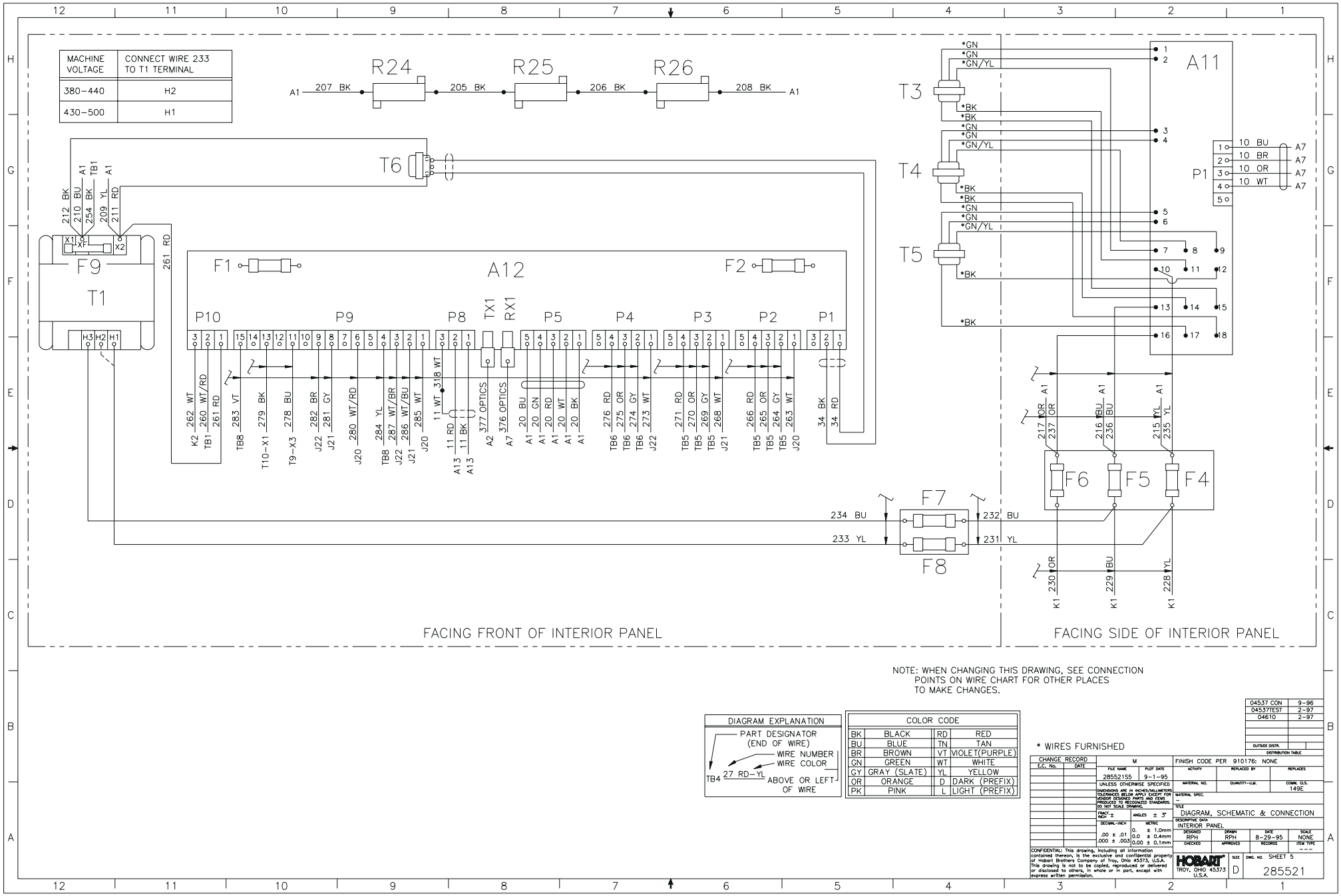
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES/MILLIMETERS. TOLERANCES BELOW APPLY EXCEPT FOR VENDOR DESIGNED PARTS AND ITEMS INRODUCED TO RECOGNIZED STANDARDS. DO NOT SCALE DRAWING.
FRACT. ± INCH ± — ANGLES ± 3°
DECIMAL-INCH: .00 ± .01; .000 ± .003
METRIC: 0. ± 1.0mm; 0.0 ± 0.4mm; 0.00 ± 0.1mm

REPLACES: 149E
MATERIAL NO. — QUANTITY-U.M. — COMM. CLS.
MATERIAL SPEC. –
TITLE: DIAGRAM, SCHEMATIC & CONNECTION
DESCRIPTIVE DATA: 90/125/180 KVA

DESIGNED	DRAWN	DATE	SCALE
RPH	RPH	8-29-95	FULL
CHECKED	APPROVED	RECORDS	ITEM TYPE
RPH	8-29-95	9-8-95	--

HOBART TROY, OHIO 45373 U.S.A.

SIZE D — DWG. NO. 285521 — SHEET 4



NOTE: WHEN CHANGING THIS DRAWING, SEE CONNECTION POINTS ON WIRE CHART FOR OTHER PLACES TO MAKE CHANGES.

DIAGRAM EXPLANATION

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

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

* WIRES FURNISHED

04537 CON	9–96
04537TEST	2–97
04610	2–97

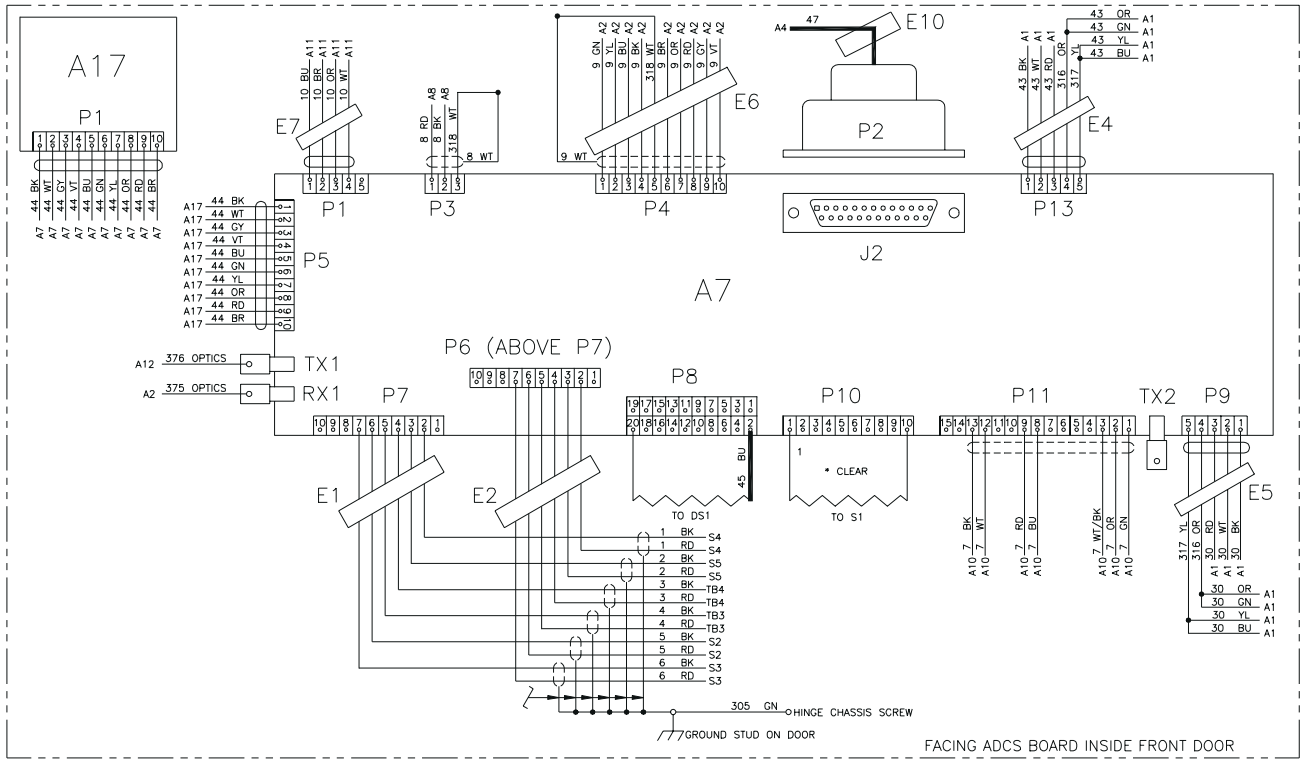
OUTSIDE DISTR.
DISTRIBUTION TABLE

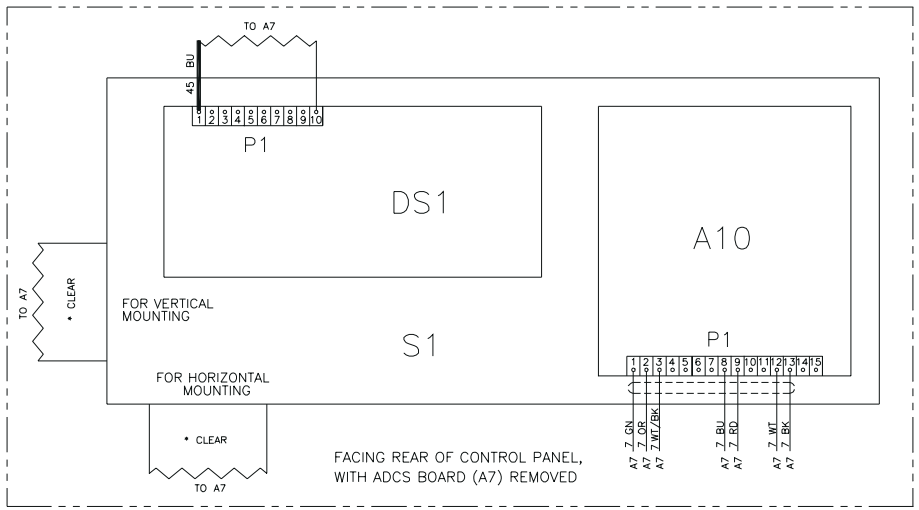
CHANGE RECORD
E.C. No. | DATE

M
FINISH CODE PER 910176: NONE

FILE NAME: 285521S5 | PLOT DATE: 9–1–95
ACTIVITY | REPLACED BY | REPLACES
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES/MILLIMETERS. TOLERANCES BELOW APPLY EXCEPT FOR VENDOR DESIGNED PARTS AND ITEMS MANUFACTURED TO RECOGNIZED STANDARDS. DO NOT SCALE DRAWING.
MATERIAL NO. | QUANTITY–U.M. | COMM. CLS. 149E
MATERIAL SPEC. –
FRACT. ± INCH ± | ANGLES ± 3°
TITLE: DIAGRAM, SCHEMATIC & CONNECTION
DESCRIPTIVE DATA: INTERIOR PANEL
DECIMAL–INCH: .00 ± .01, .000 ± .003 | METRIC: 0. ± 1.0mm, 0.0 ± 0.4mm, 0.00 ± 0.1mm
DESIGNED: RPH | DRAWN: RPH | DATE: 8–29–95 | SCALE: NONE
CHECKED | APPROVED | RECORDS | ITEM TYPE ---

HOBART TROY, OHIO 45373 U.S.A.
SIZE D | DWG. NO. 285521 | SHEET 5





NOTE: WHEN CHANGING THIS DRAWING, SEE CONNECTION POINTS ON WIRE CHART FOR OTHER PLACES TO MAKE CHANGES.

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

DIAGRAM EXPLANATION

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

* WIRES FURNISHED

04537 CON	9/96
04537TEST	2-97
04610	2-97

OUTSIDE DISTR.
DISTRIBUTION TABLE

CHANGE RECORD					
E.C. No.	DATE				
1) 1136AA	1-24-96				

M

FILE NAME: 285521S6 | PLOT DATE: 1-26-96

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES/MILLIMETERS
TOLERANCES BELOW APPLY EXCEPT FOR VENDOR DESIGNED PARTS AND ITEMS MANUFACTURED TO RECOGNIZED STANDARDS.
DO NOT SCALE DRAWING.

FRACT. ± INCH 1/32 | 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. 149E

MATERIAL SPEC. –

TITLE: DIAGRAM, SCHEMATIC & CONNECTION

DESCRIPTIVE DATA: 90/125/180 KVA

DESIGNED	DRAWN	DATE	SCALE
RPH	RPH	8-29-95	FULL
CHECKED	APPROVED	RECORDS	ITEM TYPE
PJK	STM	9-8-95	---

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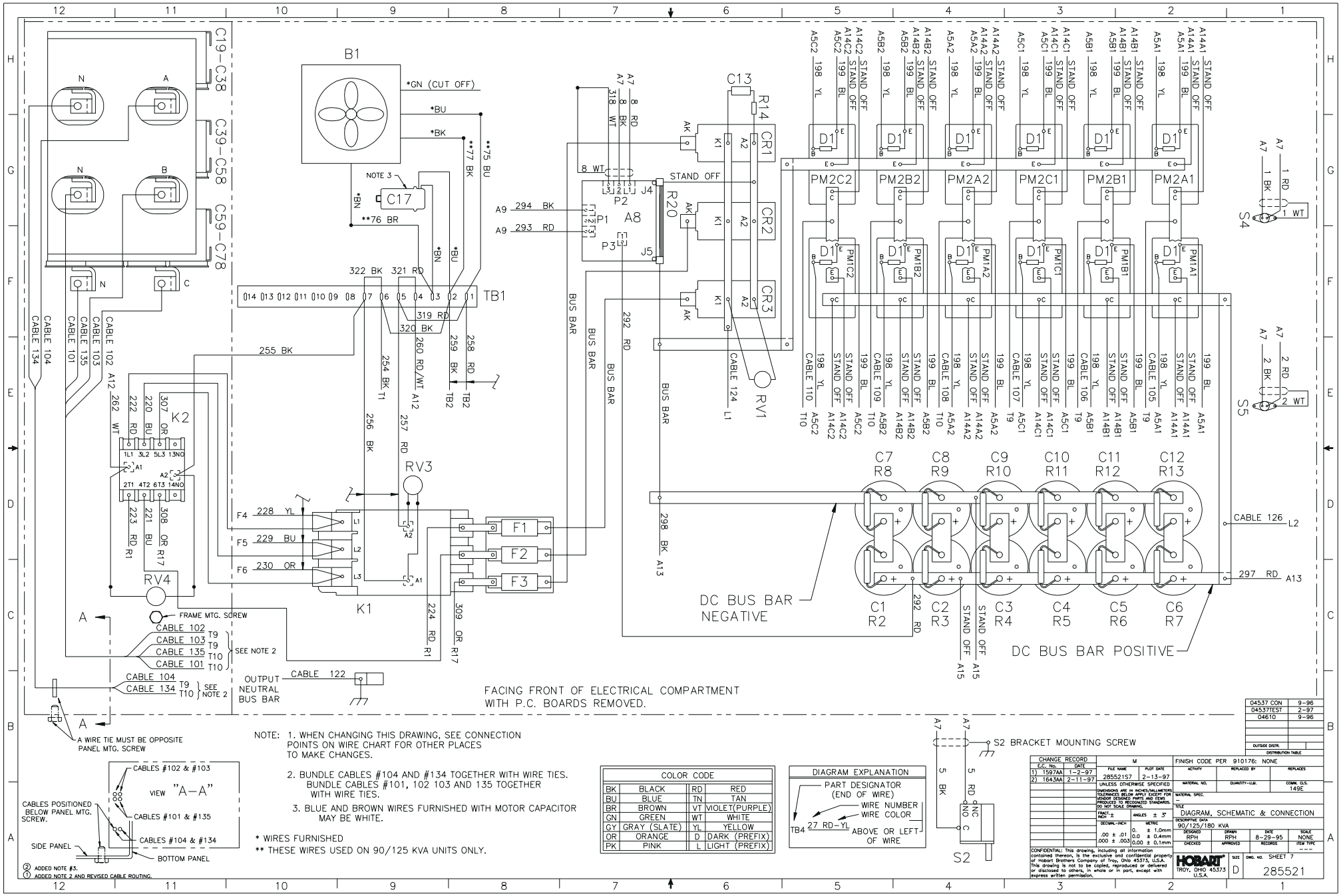
HOBART TROY, OHIO 45373 U.S.A.

SIZE D | DWG. NO. 285521 | SHEET 6

① DELETE E3, ADD E10



NOTE: 1. WHEN CHANGING THIS DRAWING, SEE CONNECTION POINTS ON WIRE CHART FOR OTHER PLACES TO MAKE CHANGES.

2. BUNDLE CABLES #104 AND #134 TOGETHER WITH WIRE TIES. BUNDLE CABLES #101, 102 103 AND 135 TOGETHER WITH WIRE TIES.

3. BLUE AND BROWN WIRES FURNISHED WITH MOTOR CAPACITOR MAY BE WHITE.

* WIRES FURNISHED

** THESE WIRES USED ON 90/125 KVA UNITS ONLY.

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

DIAGRAM EXPLANATION

PART DESIGNATOR (END OF WIRE)

WIRE NUMBER

WIRE COLOR

ABOVE OR LEFT OF WIRE

TB4 27 RD-YL

04537 CON	9-96
04537TEST	2-97
04610	9-96

OUTSIDE DISTR.

DISTRIBUTION TABLE

CHANGE RECORD			M	FINISH CODE PER 910176: NONE			
E.C. No.	DATE	FILE NAME	PLOT DATE	ACTIVITY	REPLACED BY		REPLACES
1) 1597AA	1-2-97	28552157	2-13-97				
2) 1643AA	2-11-97	UNLESS OTHERWISE SPECIFIED		MATERIAL NO.	QUANTITY-U.M.		COMM. CLS. 149E
		DIMENSIONS ARE IN INCHES/MILLIMETERS TOLERANCES BELOW APPLY EXCEPT FOR VENDOR DESIGNED PARTS AND ITEMS MANUFACTURED TO RECOGNIZED STANDARDS. DO NOT SCALE DRAWING.		MATERIAL SPEC. –			
		FRACT. ± INCH ±	ANGLES ± 3°	TITLE DIAGRAM, SCHEMATIC & CONNECTION			
		DECIMAL-INCH	METRIC	DESCRIPTIVE DATA 90/125/180 KVA			
		.00 ± .01	0.0 ± 0.4mm	DESIGNED RPH	DRAWN RPH	DATE 8-29-95	SCALE NONE
		.000 ± .003	0.00 ± 0.1mm	CHECKED	APPROVED	RECORDS	ITEM TYPE ---

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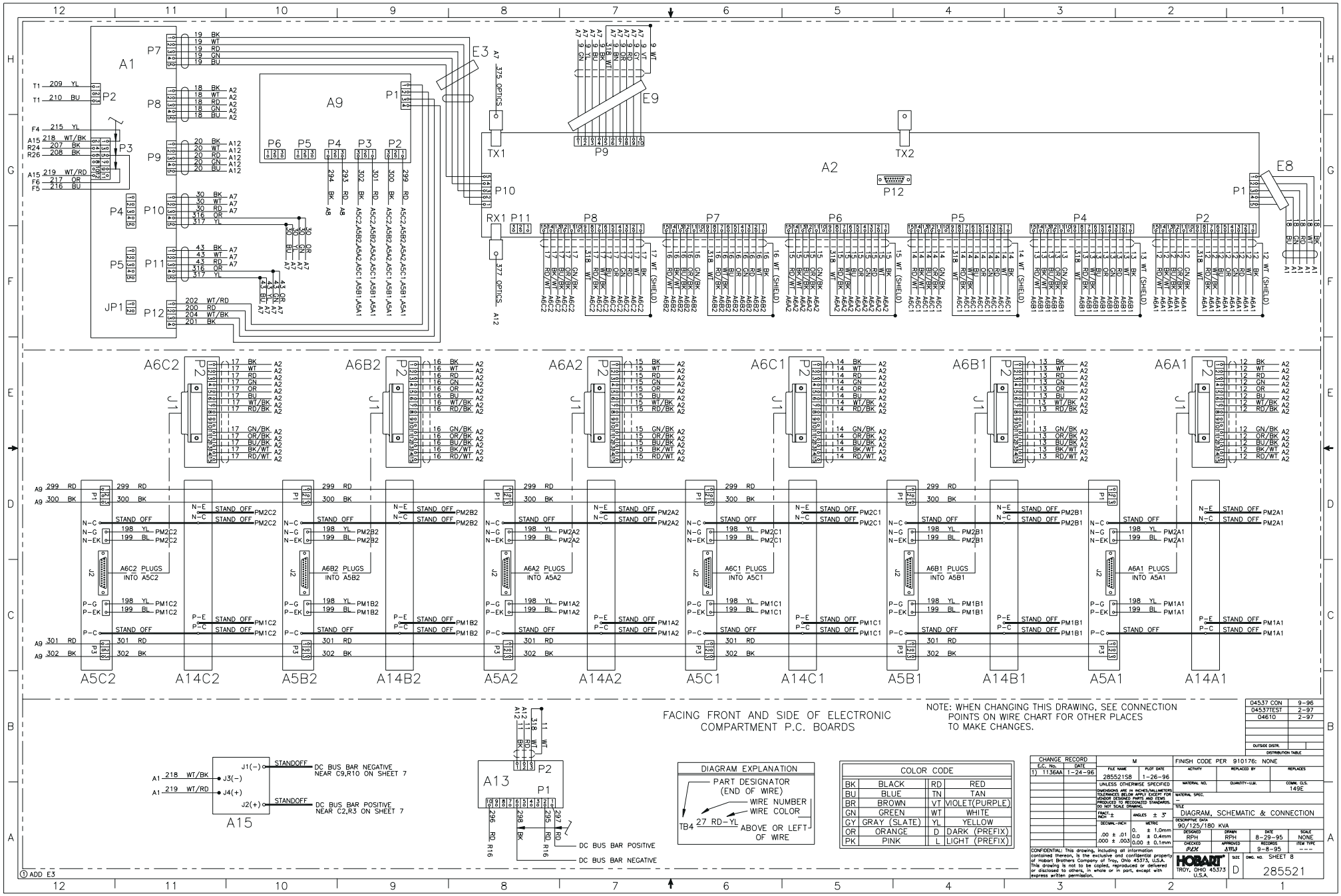
HOBART TROY, OHIO 45373 U.S.A.

SIZE D

DWG. NO. 285521 SHEET 7

③ ADDED NOTE #3.
② ADDED NOTE 2 AND REVISED CABLE ROUTING.



FACING FRONT AND SIDE OF ELECTRONIC COMPARTMENT P.C. BOARDS

NOTE: WHEN CHANGING THIS DRAWING, SEE CONNECTION POINTS ON WIRE CHART FOR OTHER PLACES TO MAKE CHANGES.

DIAGRAM EXPLANATION

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

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

04537 CON	9-96
04537TEST	2-97
04610	2-97

CHANGE RECORD

E.C. No.	DATE
1) 1136AA	1-24-96

M

FILE NAME 285521S8 | PLOT DATE 1-26-96

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES/MILLIMETERS
TOLERANCES BELOW APPLY EXCEPT FOR VENDOR DESIGNED PARTS AND ITEMS INTRODUCED TO RECOGNIZED STANDARDS.
DO NOT SCALE DRAWING.

FRACT. ± INCH 1/32 | 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. 149E

MATERIAL SPEC. –

TITLE DIAGRAM, SCHEMATIC & CONNECTION

DESCRIPTIVE DATA 90/125/180 KVA

DESIGNED	DRAWN	DATE	SCALE
RPH	RPH	8-29-95	NONE
CHECKED	APPROVED	RECORDS	ITEM TYPE
RPH	[illegible]	9-8-95	---

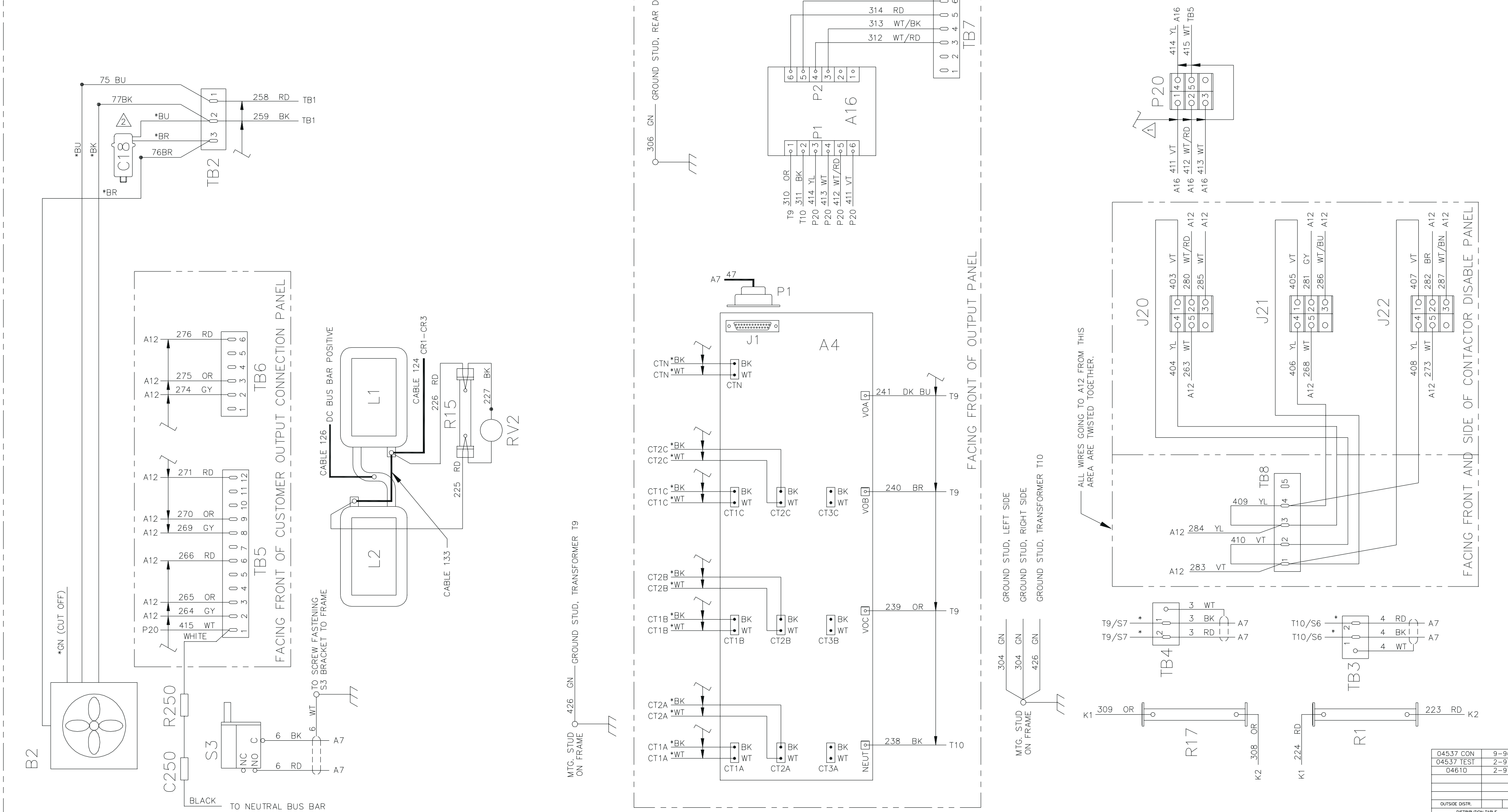
HOBART TROY, OHIO 45373 U.S.A.

SIZE D | DWG. NO. 285521 | SHEET 8

DISTRIBUTION TABLE
OUTSIDE DISTR.

① ADD E3

NOTE: WHEN CHANGING THIS DRAWING, SEE CONNECTION POINTS ON WIRE CHART FOR OTHER PLACES TO MAKE CHANGES.



NOTES:

1. LEAVE 660mm/26.0 INCHES OF WIRE NO. 415 WHITE UNTWISTED ON TB5 END.
2. BLUE AND BROWN WIRES FURNISHED WITH MOTOR CAPACITOR MAY BE WHITE.

* WIRES FURNISHED

② REMOVED ** NOTE & 125/180 KVA
① ADDED NOTE #2.

FACING REAR OF UNIT

90 KVA 1 OUTPUT SHOWN

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

DIAGRAM EXPLANATION

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

CHANGE RECORD	
E.C. No.	DATE
1) 1643AA	2-11-97
2) 1982AA	7/6/98

DISTRIBUTION TABLE	
04537 CON	9-96
04537 TEST	2-97
04610	2-97

FILE NAME 285521S9 PLOT DATE 2-12-97 M

FINISH CODE PER 910176: NONE

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

COMM. CLS. 149E

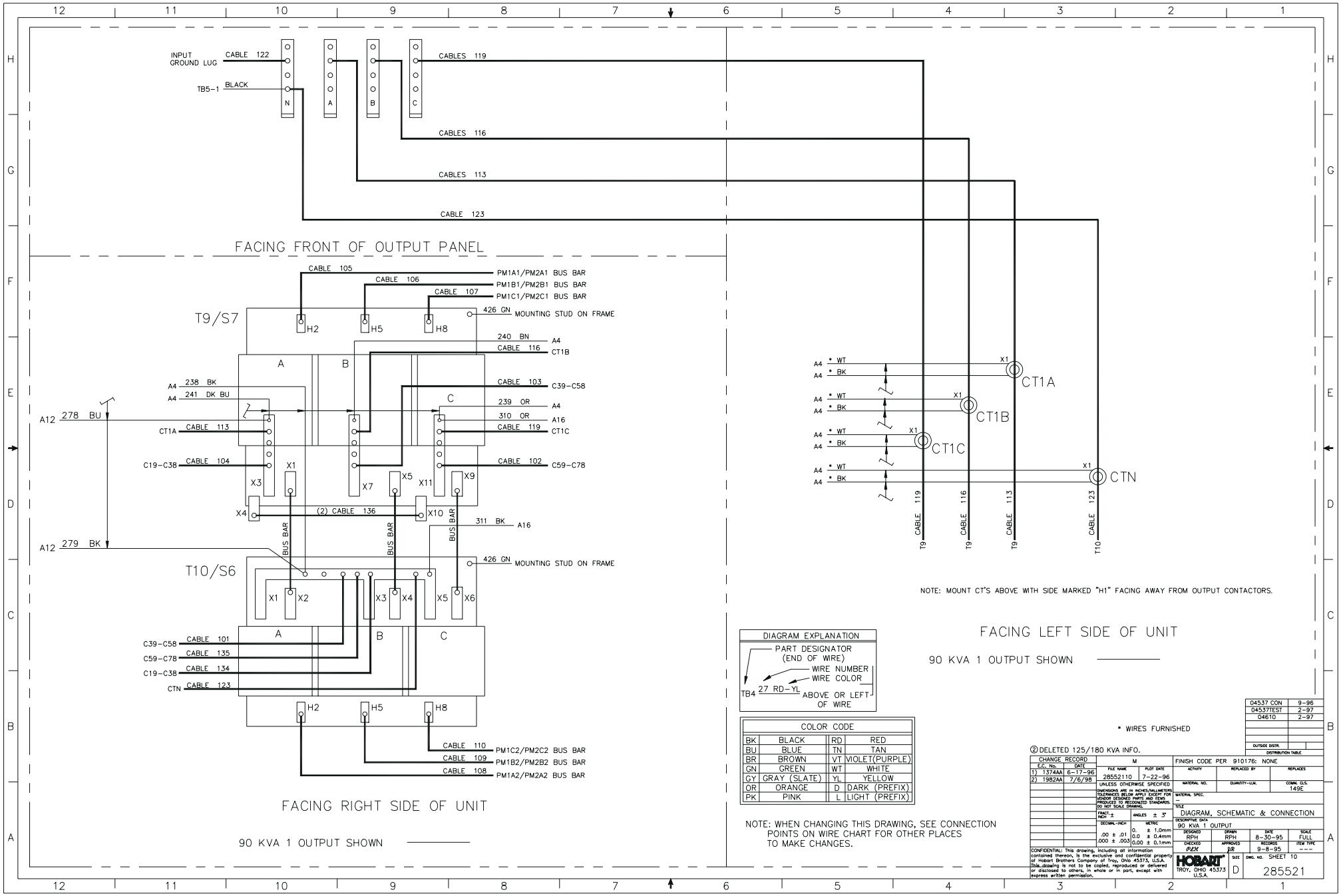
TITLE DIAGRAM, SCHEMATIC & CONNECTION

DESCRIPTIVE DATA 90 KVA 1 OUTPUT

DESIGNED RPH DRAWN RPH DATE 8-30-95 SCALE NONE

CHECKED PLK APPROVED SMJ RECORDS 9-8-95 ITEM TYPE ---

HOBART TROY, OHIO 45373 U.S.A. SIZE D DWG. NO. SHEET 9 285521


INPUT GROUND LUG
CABLE 122
TB5-1
BLACK
N
A
B
C
CABLES 119
CABLES 116
CABLES 113
CABLE 123
FACING FRONT OF OUTPUT PANEL
CABLE 105
CABLE 106
CABLE 107
PM1A1/PM2A1 BUS BAR
PM1B1/PM2B1 BUS BAR
PM1C1/PM2C1 BUS BAR
T9/S7
H2
H5
H8
426 GN
MOUNTING STUD ON FRAME
240 BN
A4
CABLE 116
CT1B
A
B
C
A4 238 BK
A4 241 DK BU
CABLE 103
C39-C58
239 OR
A4
310 OR
A16
CABLE 119
CT1C
A12 278 BU
CT1A CABLE 113
C19-C38 CABLE 104
CABLE 102
C59-C78
X1
X3
X7
X5
X11
X9
X4
(2) CABLE 136
X10
BUS BAR
311 BK
A16
A12 279 BK
T10/S6
426 GN
MOUNTING STUD ON FRAME
X1
X2
X3
X4
X5
X6
A
B
C
C39-C58 CABLE 101
C59-C78 CABLE 135
C19-C38 CABLE 134
CTN CABLE 123
H2
H5
H8
CABLE 110
PM1C2/PM2C2 BUS BAR
CABLE 109
PM1B2/PM2B2 BUS BAR
CABLE 108
PM1A2/PM2A2 BUS BAR
FACING RIGHT SIDE OF UNIT
90 KVA 1 OUTPUT SHOWN
A4 * WT
A4 * BK
X1
CT1A
CT1B
CT1C
CTN
CABLE 119
CABLE 116
CABLE 113
CABLE 123
T9
T10
NOTE: MOUNT CT'S ABOVE WITH SIDE MARKED "H1" FACING AWAY FROM OUTPUT CONTACTORS.
FACING LEFT SIDE OF UNIT
90 KVA 1 OUTPUT SHOWN
DIAGRAM EXPLANATION
PART DESIGNATOR (END OF WIRE)
WIRE NUMBER
WIRE COLOR
TB4 27 RD-YL
ABOVE OR LEFT OF WIRE
COLOR CODE
BK BLACK
BU BLUE
BR BROWN
GN GREEN
GY GRAY (SLATE)
OR ORANGE
PK PINK
RD RED
TN TAN
VT VIOLET(PURPLE)
WT WHITE
YL YELLOW
D DARK (PREFIX)
L LIGHT (PREFIX)
NOTE: WHEN CHANGING THIS DRAWING, SEE CONNECTION POINTS ON WIRE CHART FOR OTHER PLACES TO MAKE CHANGES.
* WIRES FURNISHED
② DELETED 125/180 KVA INFO.
04537 CON 9-96
04537TEST 2-97
04610 2-97
CHANGE RECORD
E.C. No. DATE
1) 13744A 6-17-96
2) 1982AA 7/6/98
FILE NAME 28552110
PLOT DATE 7-22-96
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES/MILLIMETERS
TOLERANCES BELOW APPLY EXCEPT FOR VENDOR DESIGNED PARTS AND ITEMS MANUFACTURED 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. 149E
MATERIAL SPEC. –
TITLE
DIAGRAM, SCHEMATIC & CONNECTION
DESCRIPTIVE DATA
90 KVA 1 OUTPUT
DESIGNED RPH
DRAWN RPH
DATE 8-30-95
SCALE FULL
CHECKED RPH
APPROVED JJB
RECORDS 9-8-95
ITEM TYPE ---
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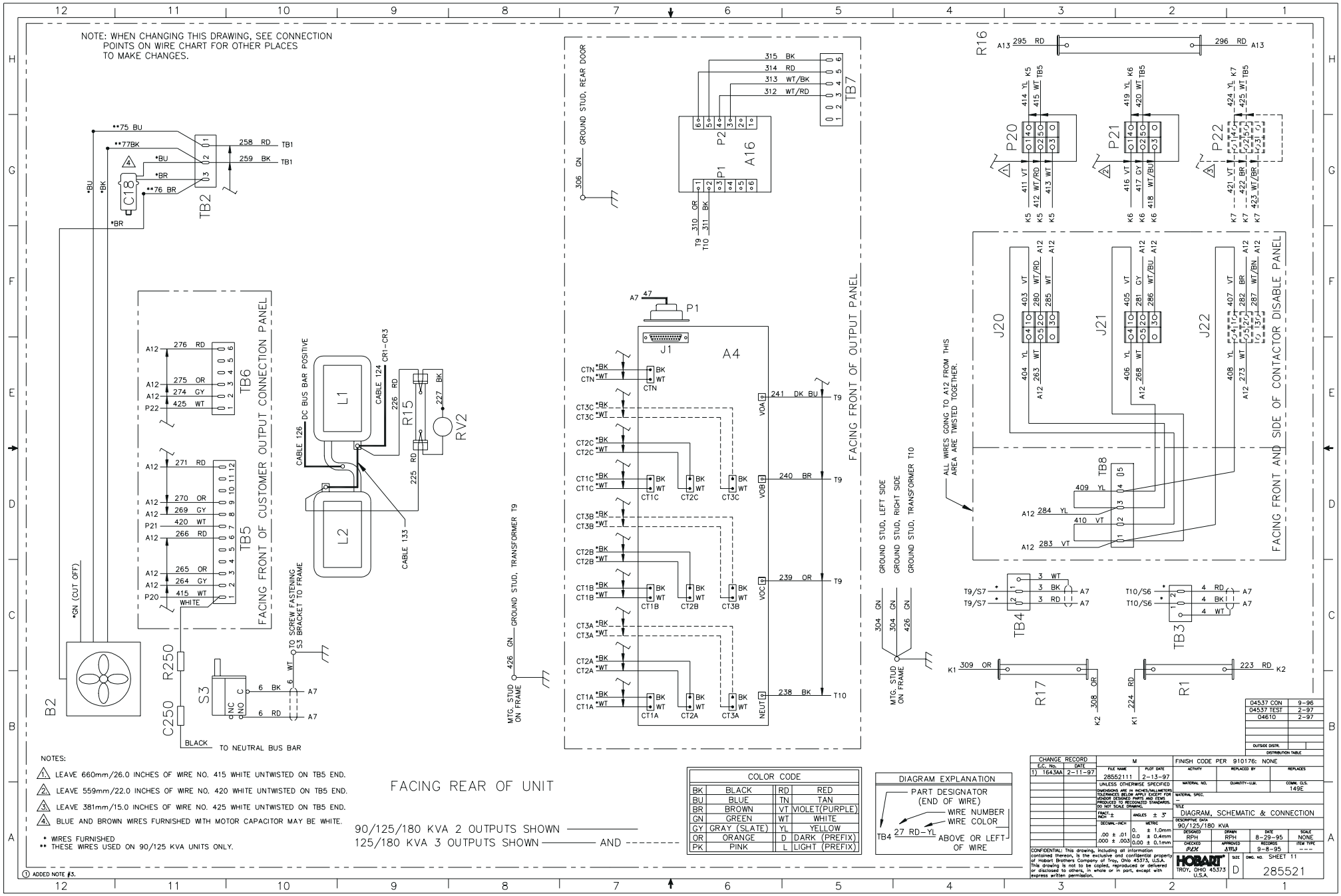
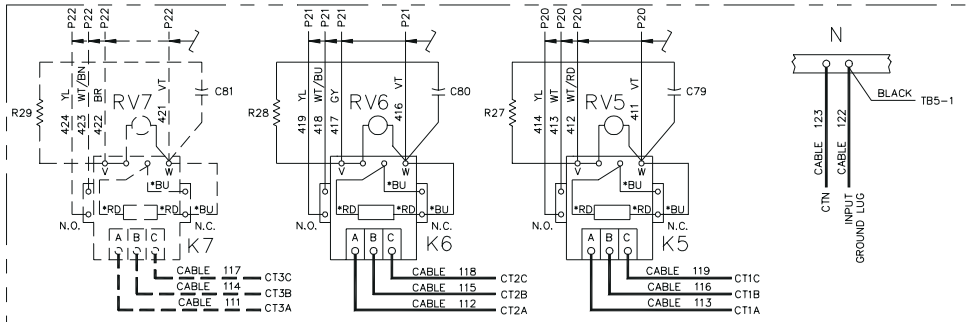
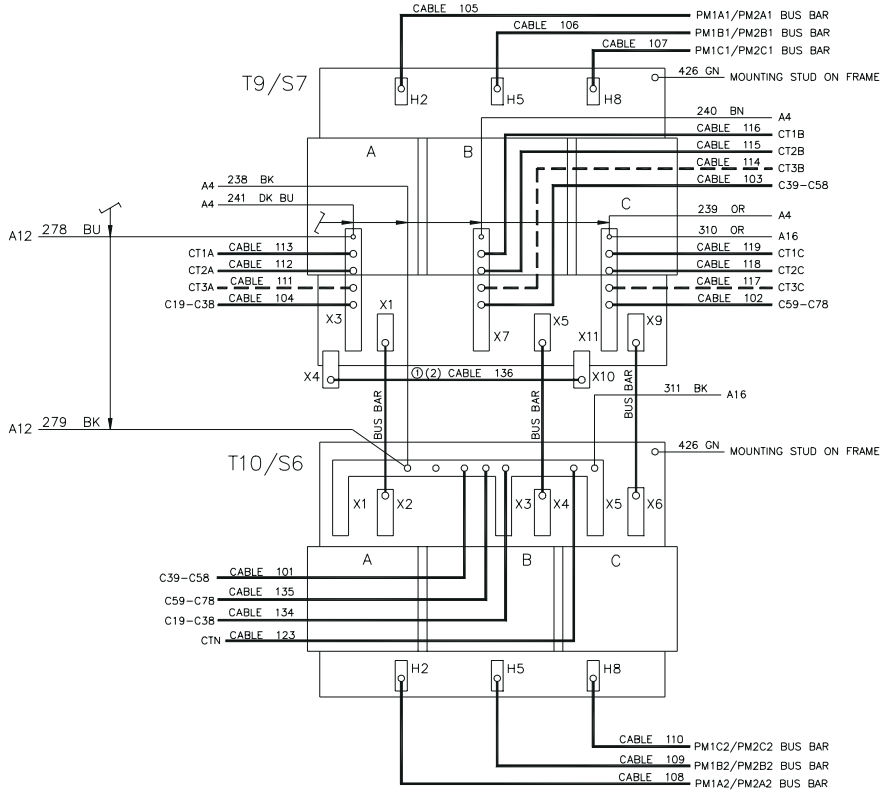
HOBART
TROY, OHIO 45373 U.S.A.
SIZE D
DWG. NO. 285521
SHEET 10


NOTE: WHEN CHANGING THIS DRAWING, SEE CONNECTION POINTS ON WIRE CHART FOR OTHER PLACES TO MAKE CHANGES.
FACING FRONT OF CUSTOMER OUTPUT CONNECTION PANEL
TB5
TB6
FACING FRONT OF OUTPUT PANEL
A4
A16
TB7
P1
P2
J1
R16
P20
P21
P22
J20
J21
J22
TB8
FACING FRONT AND SIDE OF CONTACTOR DISABLE PANEL
ALL WIRES GOING TO A12 FROM THIS AREA ARE TWISTED TOGETHER.
TB2
C18
TB4
TB3
R17
R1
R15
RV2
L1
L2
CR1-CR3
CABLE 124
CABLE 126
CABLE 133
DC BUS BAR POSITIVE
B2
R250
C250
S3
TO SCREW FASTENING S3 BRACKET TO FRAME
TO NEUTRAL BUS BAR
*GN (CUT OFF)
GROUND STUD, REAR DOOR
GROUND STUD, LEFT SIDE
GROUND STUD, RIGHT SIDE
GROUND STUD, TRANSFORMER T10
GROUND STUD, TRANSFORMER T9
MTG. STUD ON FRAME
FACING REAR OF UNIT
90/125/180 KVA 2 OUTPUTS SHOWN
125/180 KVA 3 OUTPUTS SHOWN — AND --------
NOTES:
1. LEAVE 660mm/26.0 INCHES OF WIRE NO. 415 WHITE UNTWISTED ON TB5 END.
2. LEAVE 559mm/22.0 INCHES OF WIRE NO. 420 WHITE UNTWISTED ON TB5 END.
3. LEAVE 381mm/15.0 INCHES OF WIRE NO. 425 WHITE UNTWISTED ON TB5 END.
4. BLUE AND BROWN WIRES FURNISHED WITH MOTOR CAPACITOR MAY BE WHITE.
* WIRES FURNISHED
** THESE WIRES USED ON 90/125 KVA UNITS ONLY.
① ADDED NOTE #3.
COLOR CODE
BK BLACK RD RED
BU BLUE TN TAN
BR BROWN VT VIOLET(PURPLE)
GN GREEN WT WHITE
GY GRAY (SLATE) YL YELLOW
OR ORANGE D DARK (PREFIX)
PK PINK L LIGHT (PREFIX)
DIAGRAM EXPLANATION
PART DESIGNATOR (END OF WIRE)
WIRE NUMBER
WIRE COLOR
TB4 27 RD-YL
ABOVE OR LEFT OF WIRE
CHANGE RECORD
E.C. No. DATE
1) 164JAA 2-11-97
04537 CON 9-96
04537 TEST 2-97
04610 2-97
FINISH CODE PER 910176: NONE
DIAGRAM, SCHEMATIC & CONNECTION
90/125/180 KVA
HOBART TROY, OHIO 45373 U.S.A.
285521



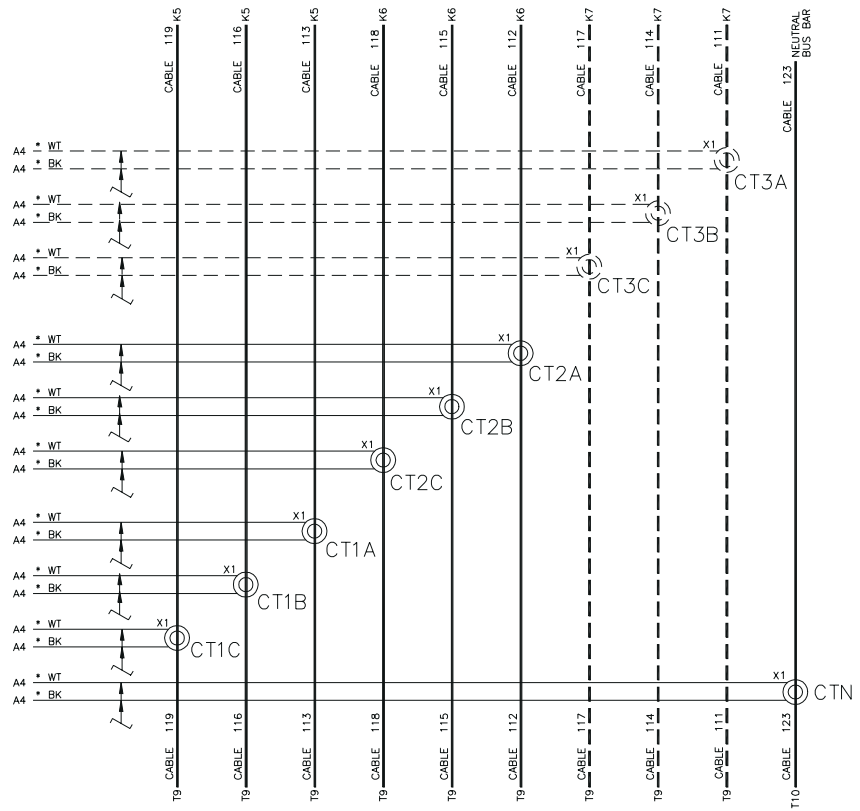
FACING FRONT OF CONTACTOR PANEL



FACING RIGHT SIDE OF UNIT

90/125/180 KVA 2 OUTPUTS SHOWN ———

125/180 KVA 3 OUTPUTS SHOWN ——— AND - - - - -



NOTE: MOUNT CT'S ABOVE WITH SIDE MARKED "H1" FACING AWAY FROM OUTPUT CONTACTORS.

FACING LEFT SIDE OF UNIT

90/125/180 KVA 2 OUTPUTS SHOWN ———

125/180 KVA 3 OUTPUTS SHOWN ——— AND - - - - -

DIAGRAM EXPLANATION

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

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

NOTE: WHEN CHANGING THIS DRAWING, SEE CONNECTION POINTS ON WIRE CHART FOR OTHER PLACES TO MAKE CHANGES.

* WIRES FURNISHED

04537 CON	9-96
04537TEST	2-97
04610	2-97

OUTSIDE DISTR.

DISTRIBUTION TABLE

CHANGE RECORD			
E.C. No.	DATE		
1) 137AA	6-17-96		
2) 1489AA	10-2-96		

M

FINISH CODE PER 910176: NONE

FILE NAME	PLOT DATE
28552112	10-7-96

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. 149E

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

MATERIAL SPEC. –

TITLE
DIAGRAM, SCHEMATIC & CONNECTION

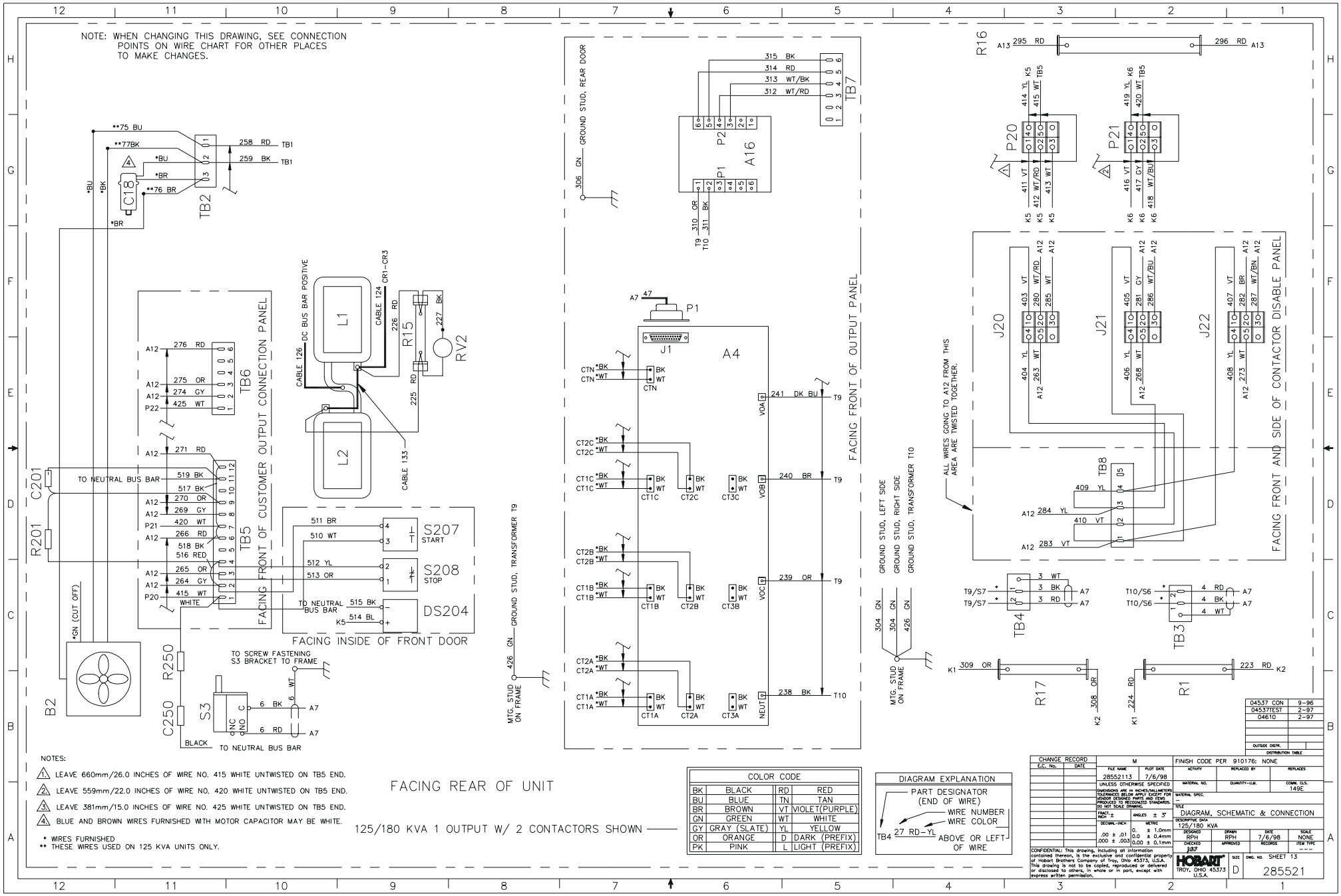
DESCRIPTIVE DATA
90/125/180 KVA 2 & 3 OUTPUTS

DESIGNED	DRAWN	DATE	SCALE
RPH	RPH	8-30-95	FULL
CHECKED	APPROVED	RECORDS	ITEM TYPE
JPM	GB	9-8-95	---

HOBART TROY, OHIO 45373 U.S.A.

SIZE D | DWG. NO. 285521 | SHEET 12

② ZONE H–12, 10 & 9: ADDED C79, C80 & CB1 AND R27, R28 & R29.



NOTES:

1. LEAVE 660mm/26.0 INCHES OF WIRE NO. 415 WHITE UNTWISTED ON TB5 END.
2. LEAVE 559mm/22.0 INCHES OF WIRE NO. 420 WHITE UNTWISTED ON TB5 END.
3. LEAVE 381mm/15.0 INCHES OF WIRE NO. 425 WHITE UNTWISTED ON TB5 END.
4. BLUE AND BROWN WIRES FURNISHED WITH MOTOR CAPACITOR MAY BE WHITE.

* WIRES FURNISHED
** THESE WIRES USED ON 125 KVA UNITS ONLY.

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

DIAGRAM EXPLANATION

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

CHANGE RECORD		
E.C. No.	DATE	

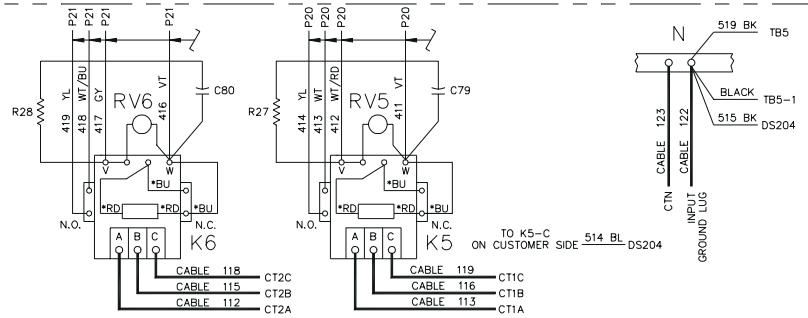
04537 CON	9-96	
04537TEST	2-97	
04610	2-97	

OUTSIDE DISTR.
DISTRIBUTION TABLE

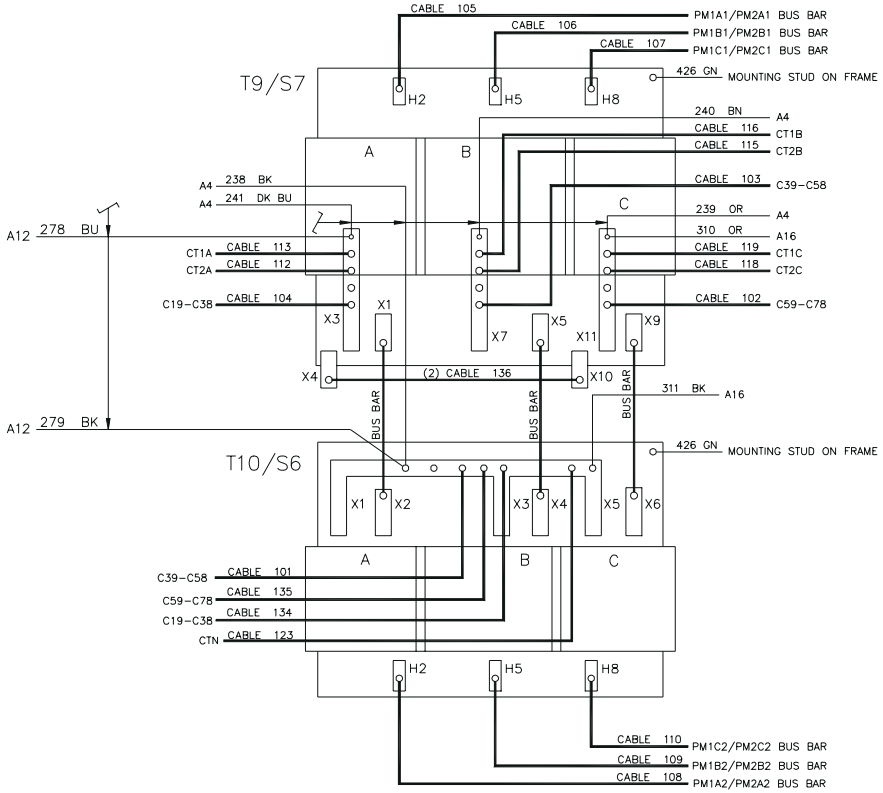
M
FILE NAME: 28552113 PLOT DATE: 7/6/98
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES/MILLIMETERS. TOLERANCES BELOW APPLY EXCEPT FOR VENDOR DESIGNED PARTS AND ITEMS MANUFACTURED TO RECOGNIZED STANDARDS. DO NOT SCALE DRAWING.
FRACT. ± INCH ± ANGLES ± 3°
DECIMAL-INCH .00 ± .01 .000 ± .003
METRIC 0. ± 1.0mm .0 ± 0.4mm .00 ± 0.1mm

FINISH CODE PER 910176: NONE
ACTIVITY | REPLACED BY | REPLACES
MATERIAL NO. | QUANTITY-U.M. | COMM. CLS. 149E
MATERIAL SPEC. –
TITLE: DIAGRAM, SCHEMATIC & CONNECTION
DESCRIPTIVE DATA: 125/180 KVA
DESIGNED RPH | DRAWN RPH | DATE 7/6/98 | SCALE NONE
CHECKED jdd | APPROVED | RECORDS | ITEM TYPE ---

HOBART TROY, OHIO 45373 U.S.A.
SIZE D
DWG. NO. 285521 SHEET 13

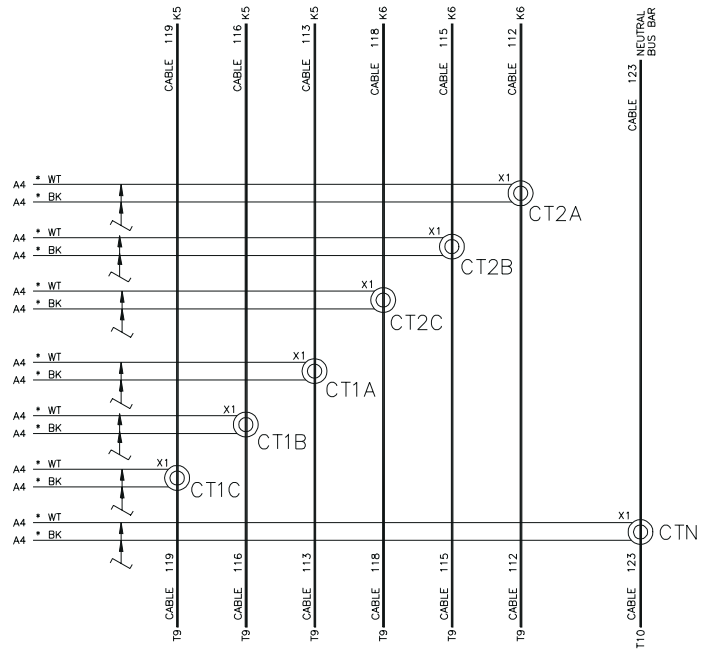


FACING FRONT OF CONTACTOR PANEL



FACING RIGHT SIDE OF UNIT

125/180 KVA 1 OUTPUT W/ 2 CONTACTORS SHOWN

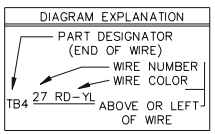


NOTE: MOUNT CT'S ABOVE WITH SIDE MARKED "H1" FACING AWAY FROM OUTPUT CONTACTORS.

FACING LEFT SIDE OF UNIT

125/180 KVA 1 OUTPUT W/ 2 CONTACTORS SHOWN

DIAGRAM EXPLANATION



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

NOTE: WHEN CHANGING THIS DRAWING, SEE CONNECTION POINTS ON WIRE CHART FOR OTHER PLACES TO MAKE CHANGES.

* WIRES FURNISHED

04537 CON	9-96
04537TEST	2-97
04610	2-97

OUTSIDE DISTR.

DISTRIBUTION TABLE

CHANGE RECORD

E.C. No. | DATE

M

FINISH CODE PER 910176: NONE

FILE NAME	PLOT DATE
28552114	7/6/98

ACTIVITY | REPLACED BY | REPLACES

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES/MILLIMETERS TOLERANCES BELOW APPLY EXCEPT FOR VENDOR DESIGNED PARTS AND ITEMS MANUFACTURED TO RECOGNIZED STANDARDS. DO NOT SCALE DRAWING.

MATERIAL NO. | QUANTITY-U.M. | COMM. CLS. 149E

MATERIAL SPEC. –

FRACT. ± INCH ± | ANGLES ± 3°

DECIMAL-INCH: .00 ± .01, .000 ± .003

METRIC: 0. ± 1.0mm, 0.0 ± 0.4mm, 0.00 ± 0.1mm

TITLE: DIAGRAM, SCHEMATIC & CONNECTION

DESCRIPTIVE DATA: 125/180 KVA 2 & 3 OUTPUTS

DESIGNED	DRAWN	DATE	SCALE
RPH	RPH	7/6/98	FULL

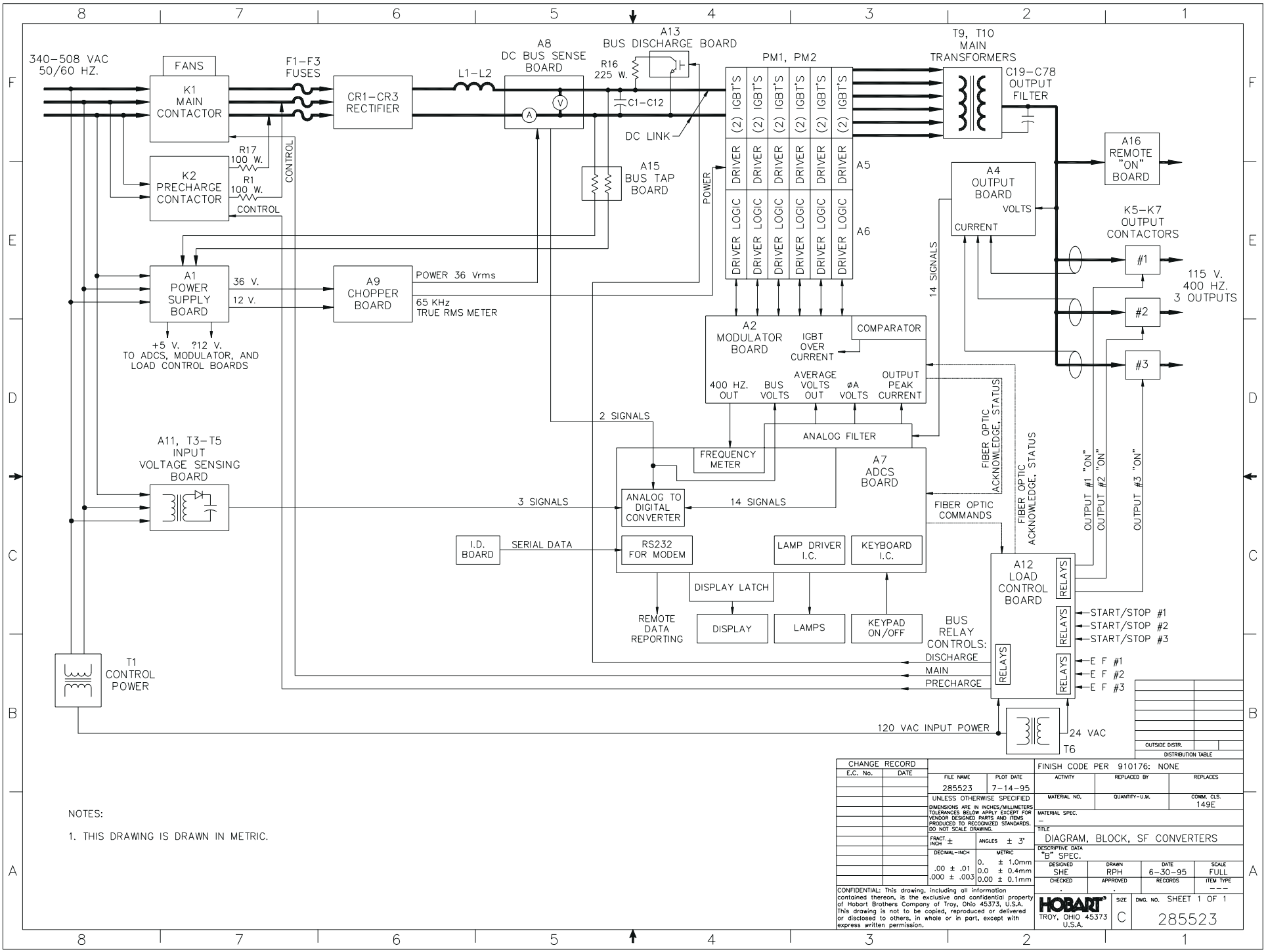
CHECKED jdf | APPROVED | RECORDS | ITEM TYPE – – –

HOBART TROY, OHIO 45373 U.S.A.

SIZE D

DWG. NO. SHEET 14

285521



NOTES:

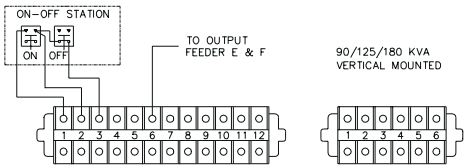
1. THIS DRAWING IS DRAWN IN METRIC.

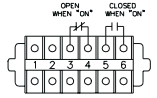
CHANGE RECORD						
E.C. No.	DATE	FILE NAME	PLOT DATE	FINISH CODE PER 910176: NONE		
		285523	7-14-95	ACTIVITY	REPLACED BY	REPLACES
		UNLESS OTHERWISE SPECIFIED		MATERIAL NO.	QUANTITY-U.M.	COMM. CLS. 149E
		DIMENSIONS ARE IN INCHES/MILLIMETERS TOLERANCES BELOW APPLY EXCEPT FOR VENDOR DESIGNED PARTS AND ITEMS PRODUCED TO RECOGNIZED STANDARDS. DO NOT SCALE DRAWING.		MATERIAL SPEC. –		
		FRACT. ±	ANGLES ± 3°	TITLE DIAGRAM, BLOCK, SF CONVERTERS		
		DECIMAL–INCH	METRIC	DESCRIPTIVE DATA "B" SPEC.		
		.00 ± .01	0. ± 1.0mm	DESIGNED SHE	DRAWN RPH	DATE 6-30-95
		.000 ± .003	0.0 ± 0.4mm	CHECKED	APPROVED	RECORDS
			0.00 ± 0.1mm			ITEM TYPE – – –

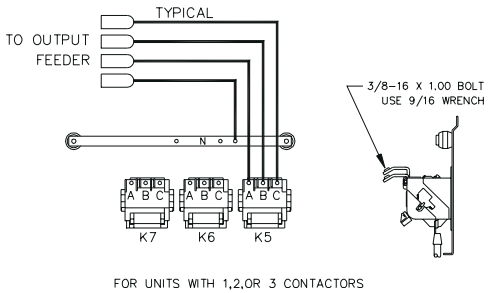
HOBART®
TROY, OHIO 45373 U.S.A.

SIZE C | DWG. NO. 285523 | SHEET 1 OF 1

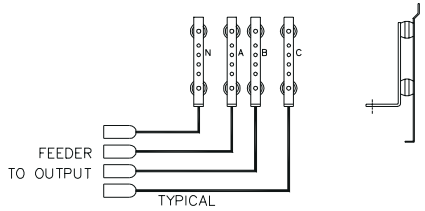
TYPICAL 1 OF 3





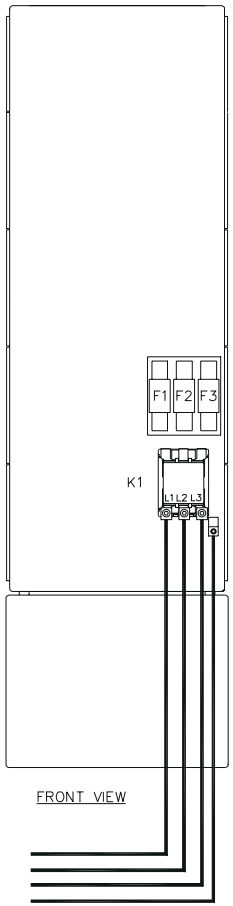


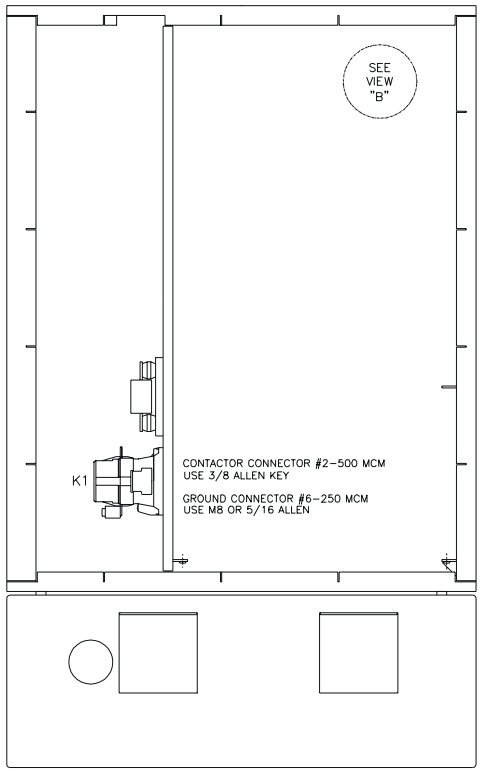
FOR UNITS WITH 1,2,OR 3 CONTACTORS

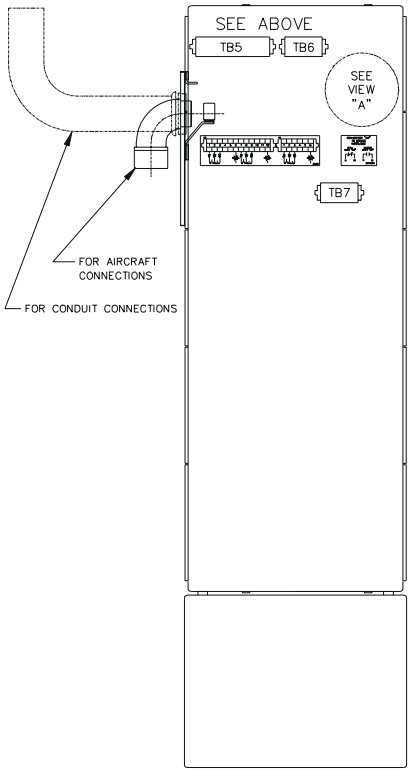


FOR UNITS WITHOUT CONTACTORS
FOR UNITS WITH CABLE LUGS

①







CHANGE RECORD		
E.C. No.	DATE	
1) 1982AA	7/6/98	

FINISH CODE PER 910176: NONE

FILE NAME	PLOT DATE
285782S1	8-31-95

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. INCH ±
ANGLES ± 3°

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

ACTIVITY	REPLACED BY	REPLACES

MATERIAL NO.	QUANTITY-U.M.	COMM. CLS.
		261

MATERIAL SPEC.
–

TITLE
INSTRUCTIONS, INSTALL/OUTLINE

DESCRIPTIVE DATA
SF 200

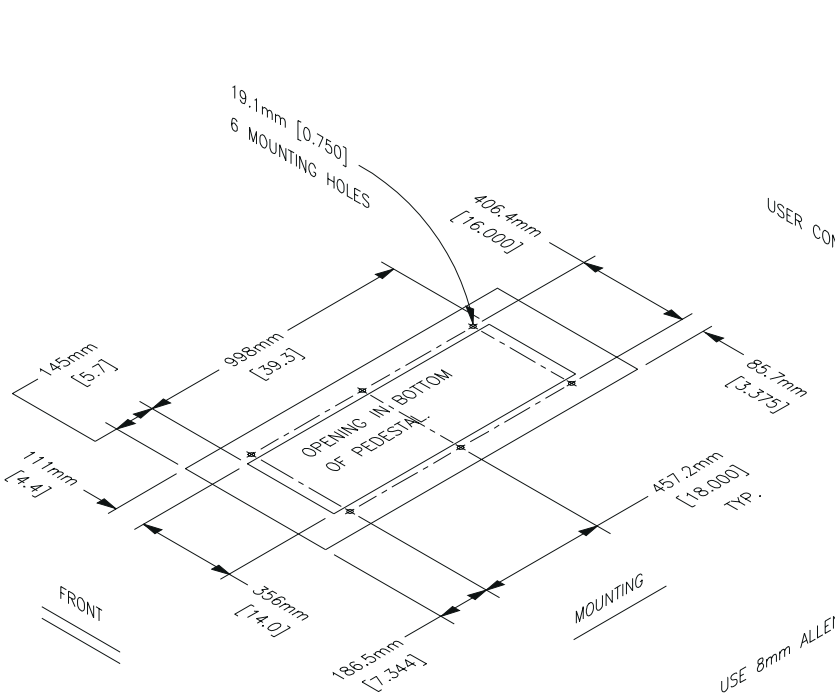
DESIGNED	DRAWN	DATE	SCALE
RPH	RPH	8-24-95	1=12
CHECKED	APPROVED	RECORDS	ITEM TYPE
jdf			---

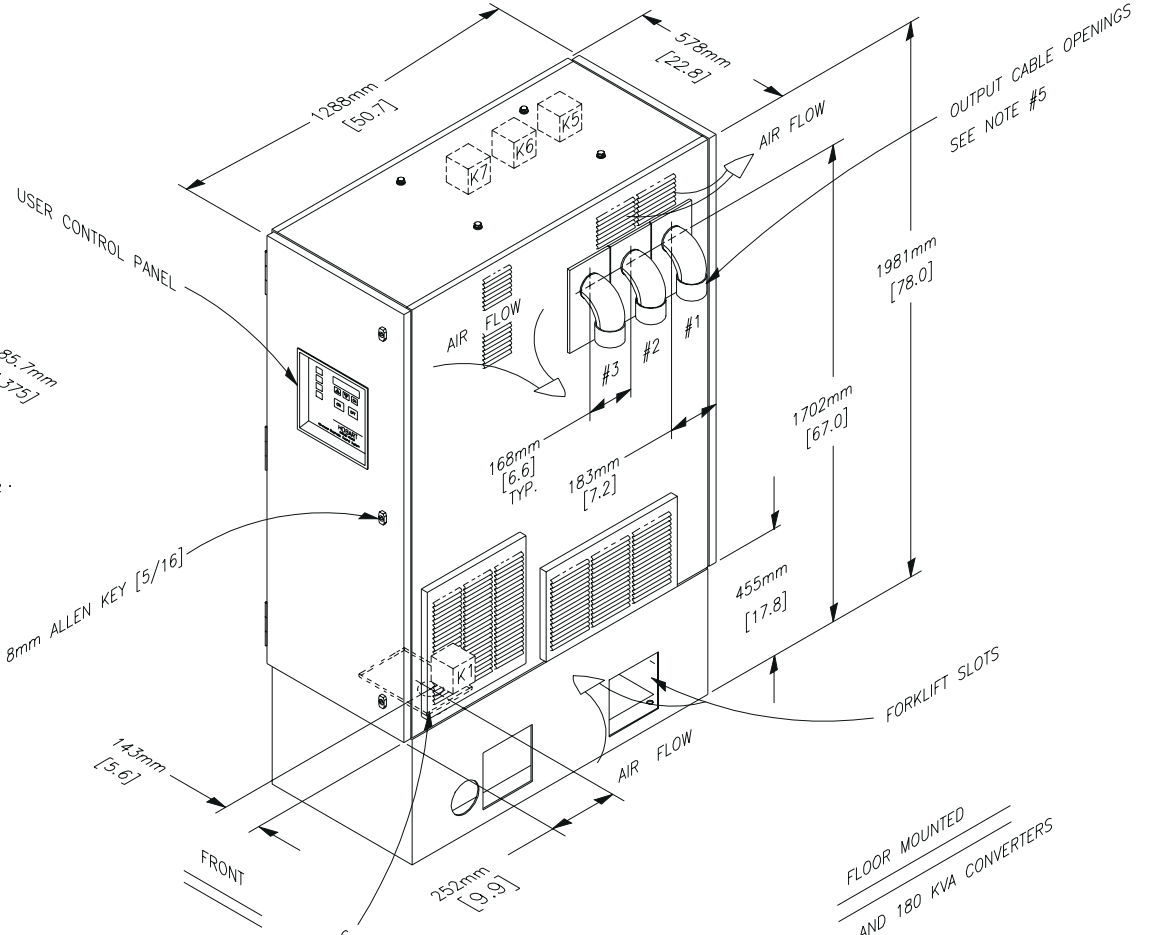
OUTSIDE DISTR.
DISTRIBUTION TABLE

HOBART
TROY, OHIO 45373
U.S.A.

SIZE D

DWG. NO. 285782 SHEET 1 OF 3





FLOOR MOUNTED
90, 125, AND 180 KVA CONVERTERS

NOTES:

1. THIS DRAWING IS DRAWN IN MILLIMETERS, DIMENSIONS IN [ ] ARE INCHES.
2. ALL DIMENSIONS ARE ROUNDED EXCEPT MOUNTING DIMENSIONS.
3. APPROX. WEIGHT – 180 KVA – FLOOR MOUNTED – 1215 Kg (2680 LBS.).
   – 125 KVA – FLOOR MOUNTED – 1120 Kg (2468 LBS.).
   – 90 KVA – FLOOR MOUNTED – 993 Kg (2188 LBS.).
4. INPUT CABLE CONNECTIONS ARE LOCATED 214mm [8.4] ABOVE THE INPUT CABLE OPENING.
5. MAIN OUTPUT CABLE CONNECTIONS ARE LOCATED 441mm [17.4] BEHIND THE OUTPUT CABLE OPENINGS.
6. WHEN FACING FRONT SIDE OF UNIT, FRONT AND REAR DOORS ARE HINGED ON THE LEFT HAND SIDE.

CHANGE RECORD	
E.C. No.	DATE

FILE NAME	PLOT DATE
285782S2	8-31-95

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES/MILLIMETERS
TOLERANCES BELOW APPLY EXCEPT FOR VENDOR DESIGNED PARTS AND ITEMS INTRODUCED TO RECOGNIZED STANDARDS.
DO NOT SCALE DRAWING.

FRACT. INCH ±
ANGLES ± 3°

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.
		261

MATERIAL SPEC.

TITLE
INSTRUCTIONS, INSTALL/OUTLINE

DESCRIPTIVE DATA
FLOOR MOUNTED CONVERTERS

DESIGNED	DRAWN	DATE	SCALE
RPH	RPH	8-25-95	1=8

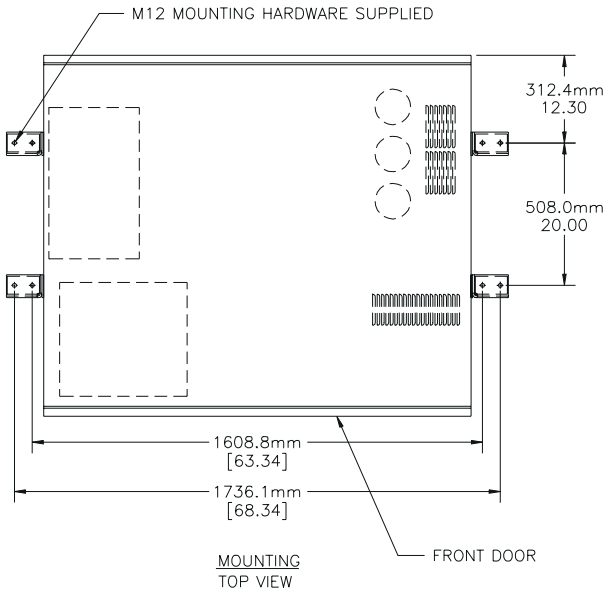
CHECKED	APPROVED	RECORDS	ITEM TYPE

OUTSIDE DISTR.
DISTRIBUTION TABLE

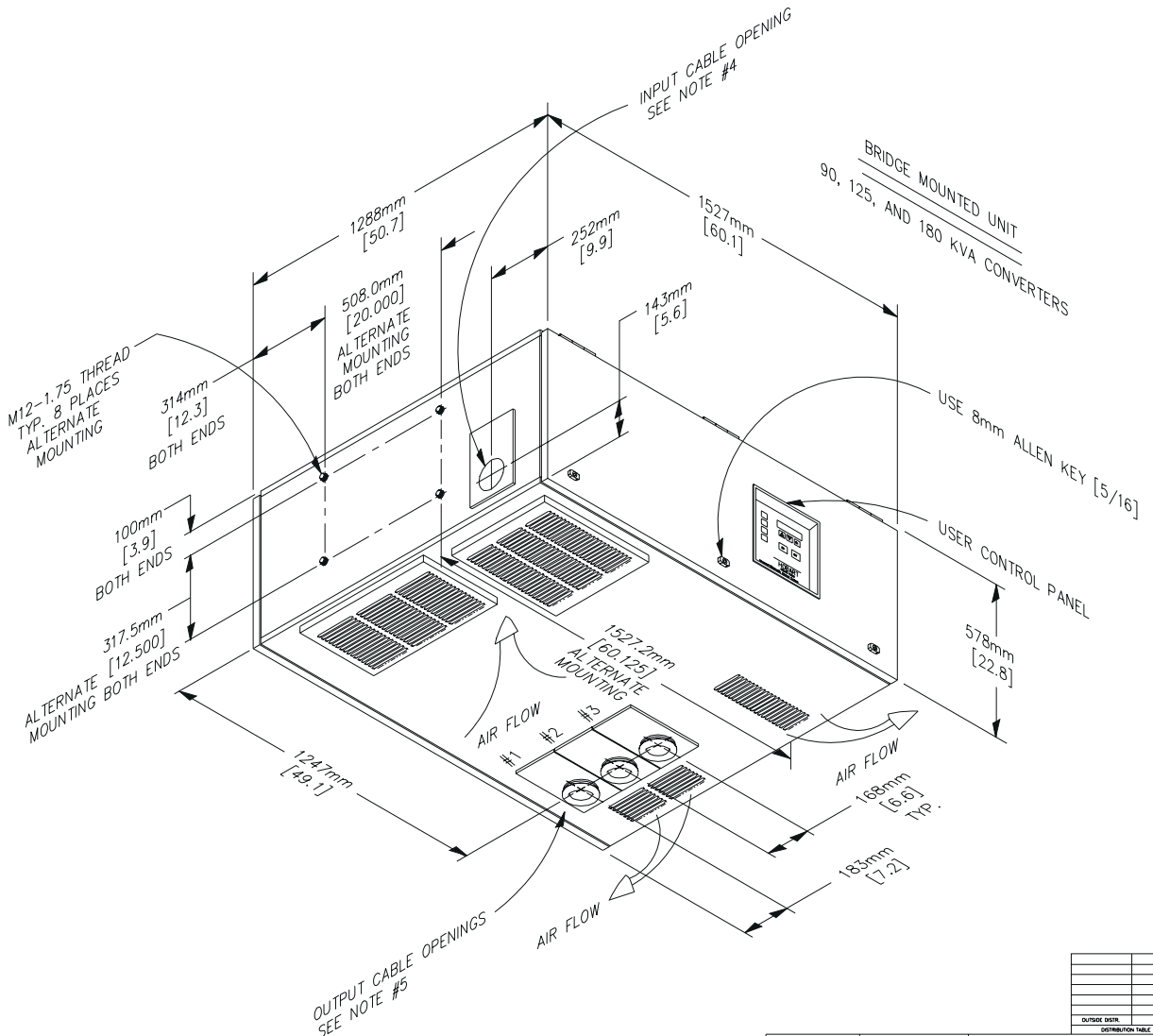
HOBART®
TROY, OHIO 45373
U.S.A.

SIZE D

DWG. NO. SHEET 2
285782



MOUNTING
TOP VIEW



NOTES:

1. THIS DRAWING IS DRAWN IN MILLIMETERS,
   DIMENSIONS IN [ ] ARE INCHES.
2. ALL DIMENSIONS ARE ROUNDED EXCEPT MOUNTING DIMENSIONS.
3. APPROXIMATE WEIGHT – BRIDGE MOUNTED
   180 KVA – 1169 Kg (2577 LBS).
   125 KVA – 1073 Kg (2365 LBS).
   90 KVA – 946 Kg (2085 LBS.)
4. INPUT CABLE CONNECTIONS ARE LOCATED 214mm [8.4]
   BEHIND THE INPUT CABLE OPENING.
5. MAIN OUTPUT CABLE CONNECTIONS ARE LOCATED 441mm [17.4]
   ABOVE THE OUTPUT CABLE OPENINGS.
6. FRONT AND REAR DOORS OPEN UPWARD.

CHANGE RECORD					
E.C. No.	DATE				
		FILE NAME	PLOT DATE		
		28578253	8-31-95		

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES/MILLIMETERS
TOLERANCES BELOW APPLY EXCEPT FOR VENDOR DESIGNED PARTS AND ITEMS MANUFACTURED TO RECOGNIZED STANDARDS.
DO NOT SCALE DRAWING.

FRACT. INCH ±	ANGLES ± 3°
DECIMAL-INCH	METRIC
.00 ± .01	0. ± 1.0mm
.000 ± .003	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. 261
MATERIAL SPEC.		

TITLE
INSTRUCTIONS, INSTALL/OUTLINE
DESCRIPTIVE DATA
BRIDGE MOUNTED CONVERTERS

DESIGNED	DRAWN	DATE	SCALE
RPH	RPH	8-25-95	1=8
CHECKED	APPROVED	RECORDS	ITEM TYPE M

OUTSIDE DISTR.
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