

	LIQUID COOLED OPTISPEED™ COMPRESSOR SPEED DRIVE	
SERVICE MANUAL	NEW RELEASE	Form 160.00-M10 (617)

MODELS HYP1100A, HYP1300A



**1100 HP – 50/60 HZ, 380-415 VAC (371-06172-XXX)
1300 HP – 60 HZ, 460 VAC (371-06172-XXX)**

Issue Date:
June 9, 2017



IMPORTANT!

READ BEFORE PROCEEDING!

GENERAL SAFETY GUIDELINES

This equipment is a relatively complicated apparatus. During rigging, installation, operation, maintenance, or service, individuals may be exposed to certain components or conditions including, but not limited to: heavy objects, refrigerants, materials under pressure, rotating components, and both high and low voltage. Each of these items has the potential, if misused or handled improperly, to cause bodily injury or death. It is the obligation and responsibility of rigging, installation, and operating/service personnel to identify and recognize these inherent hazards, protect themselves, and proceed safely in completing their tasks. Failure to comply with any of these requirements could result in serious damage to the equipment and the property in

which it is situated, as well as severe personal injury or death to themselves and people at the site.

This document is intended for use by owner-authorized rigging, installation, and operating/service personnel. It is expected that these individuals possess independent training that will enable them to perform their assigned tasks properly and safely. It is essential that, prior to performing any task on this equipment, this individual shall have read and understood the on-product labels, this document and any referenced materials. This individual shall also be familiar with and comply with all applicable industry and governmental standards and regulations pertaining to the task in question.

SAFETY SYMBOLS

The following symbols are used in this document to alert the reader to specific situations:



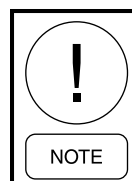
Indicates a possible hazardous situation which will result in death or serious injury if proper care is not taken.



Identifies a hazard which could lead to damage to the machine, damage to other equipment and/or environmental pollution if proper care is not taken or instructions are not followed.



Indicates a potentially hazardous situation which will result in possible injuries or damage to equipment if proper care is not taken.



Highlights additional information useful to the technician in completing the work being performed properly.



External wiring, unless specified as an optional connection in the manufacturer's product line, is not to be connected inside the control cabinet. Devices such as relays, switches, transducers and controls and any external wiring must not be installed inside the micro panel. All wiring must be in accordance with Johnson Controls' published specifications and must be performed only by a qualified electrician. Johnson Controls will NOT be responsible for damage/problems resulting from improper connections to the controls or application of improper control signals. Failure to follow this warning will void the manufacturer's warranty and cause serious damage to property or personal injury.

CHANGEABILITY OF THIS DOCUMENT

In complying with Johnson Controls' policy for continuous product improvement, the information contained in this document is subject to change without notice. Johnson Controls makes no commitment to update or provide current information automatically to the manual or product owner. Updated manuals, if applicable, can be obtained by contacting the nearest Johnson Controls Service office or accessing the Johnson Controls QuickLIT website at <http://cgproducts.johnsoncontrols.com>.

It is the responsibility of rigging, lifting, and operating/service personnel to verify the applicability of these documents to the equipment. If there is any question

regarding the applicability of these documents, rigging, lifting, and operating/service personnel should verify whether the equipment has been modified and if current literature is available from the owner of the equipment prior to performing any work on the chiller.

CHANGE BARS

Revisions made to this document are indicated with a line along the left or right hand column in the area the revision was made. These revisions are to technical information and any other changes in spelling, grammar or formatting are not included.

ASSOCIATED LITERATURE

MANUAL DESCRIPTION	FORM NUMBER
Operation Manual (Unit) Model YK, (Centrifugal)) Style G	160.75-O1
Operation Manual (Control Panel) Model YK, (Centrifugal) Style G	160.54-O1
Service Manual (Control Panel) Model YK, (Centrifugal) Style G	160.54-M1
Wiring Diagram (Control Panel) Model YK, (Centrifugal) Style G	160.75-PW6
Wiring Diagram (Control Panel) Model YK, (Centrifugal) Style G with LTC I/O Board	160.75-PW8
Wiring Field Connections (Variable Speed Drive) Model YK, (Centrifugal) Style F and G	160.54-PW6
Operation Manual Model HYP (Compressor Speed Drive)	160.00-O10
Renewal Parts (Variable Speed Drive)	160.00-RP8

NOMENCLATURE

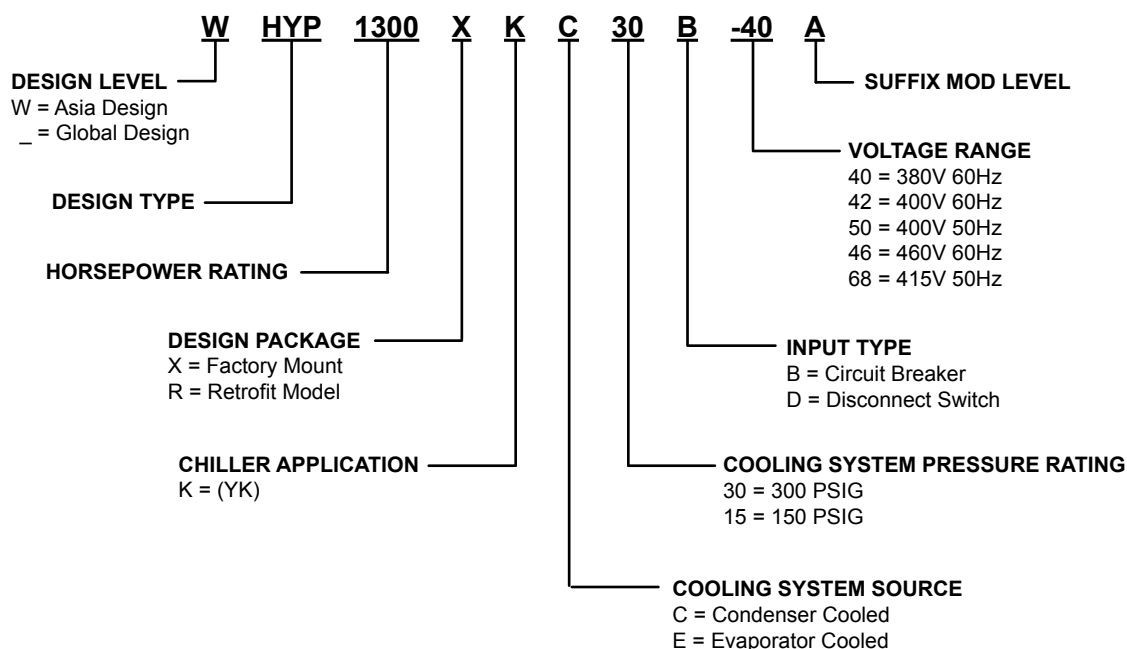


TABLE 1 - VSD PART NUMBERS AND DESCRIPTIONS

MODEL		PART NUMBER		DESCRIPTION
		60 HZ	50 HZ	
1100 HP 380 VAC	HYP1100XKC30B-40A	371-06172-163		Factory Package, YK Filter Model
	HYP1100XKC30B-50A		371-06172-165	Factory Package, YK Filter Model
1100 HP 400 VAC	HYP1100XKC30B-42A	371-06172-181		Factory Package, YK Filter Model
	HYP1100XKC30B-50A		371-06172-183	Factory Package, YK Filter Model
1100 HP 415 VAC	HYP1100XKC30B-68A		371-06172-167	Factory Package, YK Filter Model
1300 HP 460 VAC	HYP1300XKC30B-46A	371-06172-161		Factory Package, YK Filter Model
1100 HP 380 VAC	HYP1100RKC30B-40A	371-06172-173		Retrofit Package, YK Filter Model
	HYP1100RKC30B-50A		371-06172-175	Retrofit Package, YK Filter Model
1100 HP 400 VAC	HYP1100RKC30B-42A	371-06172-185		Retrofit Package, YK Filter Model
	HYP1100RKC30B-50A		371-06172-187	Retrofit Package, YK Filter Model
1100 HP 415 VAC	HYP1100RKC30B-68A		371-06172-177	Retrofit Package, YK Filter Model
1300 HP 460 VAC	HYP1300RKC30B-46A	371-06172-171		Retrofit Package, YK Filter Model

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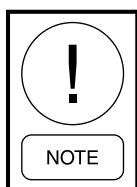
SECTION 1 - GENERAL INFORMATION

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This product contains voltages that could cause injury or death. Follow all NFPA-70E safety rules. Before performing any troubleshooting procedures. Place the compressor switch in the stop position. Wait 5 minutes. Ensure that the DC BUS voltage is 50 VDC or less on the display of the chiller control panel. Ensure that all sources of power to the chiller are removed. These power sources would also include an externally connected 120 VAC supply provided as an option for the chiller. Remove all AC power sources upstream of the VSD and perform lockout / tagout procedures. Use a non-contact voltage sensor to ensure no AC power is present in the VSD enclosure. Use a DVM to measure AC and DC voltage at locations shown below. Measure the three phase connections phase to phase and phase to ground. All values should be zero. Measure voltage from Point A to Point B.

Measure the BUS voltage at J1 pins 1-2 on the VSD logic board using a DVM to ensure that BUS voltage is less than 50 VDC.



Refer to SECTION 8 - TROUBLESHOOTING PROCEDURES on page 75, for the Safe Entry Procedure for the specific model under test.

This instruction is to be used in conjunction with the Operation Instructions for YORK Centrifugal chillers furnished with an optional OptiSpeed™ Compressor Drive (OSCD) see associated literature.

OPTISPEED COMPRESSOR DRIVE OVERVIEW

OptiSpeed Compressor Drive 1100/1300 HP

The YORK® OptiSpeed Compressor Drive (OSCD) is specifically designed for the application of controlling an induction motor used on the YORK Model YK Centrifugal Liquid Chiller. This type of design allows the chiller to be design as a complete system, and take full advantage of the strengths of each major component within the system.

This new OSCD design brings to market a product that uses new light-weight materials, new bus capacitor, compact power assembly design, liquid cooled inductors, greater ease of service, and includes harmonic filtering on all models.

New features include:

- Circuit breaker with ground fault detection.
- Ground fault currents are now monitored by the drive logic board.
- Direct liquid cooling of power modules.

- A more accessible cooling system.
- Variable voltage input.
- Variable voltage output to support a wider voltage range of motors.
- The harmonic filter is standard on all models.
- Modular lighter weight power units that can be repaired in the field without complete replacement.
- Ease of maintenance and setup.

WHAT IS NEW?

The input or rectifier of the HYP model drive does not contain Silicon Control Rectifiers (SCR's). Insulated Gate Bipolar Transistors (IGBT's) are used in the rectifier. The use of IGBT's in the rectifier provides harmonic current correction to IEEE standards, and the use of a common voltage motor regardless of the input voltage provided by the customer. Lower input voltages may de-rate the input power rating of the OSCD, but the OSCD will produce the same output voltage and will use the same motor. The new OSCD control system allows for different motor voltages to be used. In a new production chiller the OSCD will support a 575 VAC motor. In retrofit applications the drive will support a 575 VAC motor or a 460 VAC, motor regardless on the input voltage provided to the OSCD.

At the heart of the compact power unit is the new bus capacitor. The new bus capacitor contains all of the mounting hardware for the rectifier assembly, bus structure, and the inverter assembly. A separate heavy metal structure is not required in this assembly.

The bus capacitor is no longer an electrolytic design that required voltage balancing or the need of many capacitors in parallel due to low current ratings. The new bus capacitor uses a higher voltage rated material so that voltage balancing is not required. The current rating of this new capacitor is much higher, requiring fewer capacitors.

The HYP model has 3 power assemblies. Each power assembly contains 2 bus capacitors. These power assemblies are heavy, and are mounted on a slide out shelf. The typical repair is expected to occur in place with the power assembly slid out away from the enclosure.

This purpose built drive can take full advantage of condenser liquid always being available. Typically, condenser liquid is used as the cooling medium through a shell and tube heat exchanger mounted on the drive. Other cooling mediums can be used, but special considerations must be made to ensure that condensation does not occur in the drive.

Air cooled inductors at these power levels get very hot and very large, which could cause concern. Not anymore. The input and output inductors in this drive are liquid cooled. The inductor is now no hotter than the inside of the drive. Most of the heat from the inductors is rejected directly into the liquid cooling system. The liquid cooled inductors greatly improves the cooling system, and reduces the demand on the air cooling system in the drive.

HARMONIC FILTERING

Harmonic filtering is no longer a question with this new design. The controls for the rectifier IGBT's now provide harmonic filtering standard. A separate heavy power assembly, contactors, fuses, and harmonic filter logic board are no longer required for harmonic filtering. Today all of the controls for the drive and harmonic filtering are contained in the drive logic board. This new board is about the same size as the VSD model drive logic board, but preforms both functions.

COMPONENT OVERVIEW

HYP Compressor Drive

See *Figure 1 on page 11*, *Figure 2 on page 12* and *Figure 3 on page 13*.

The new HYP compressor drive is a liquid cooled, transistorized, PWM (Pulse Width Modulated) inverter in a highly integrated package. The harmonic filtering is now integrated into the standard HYP model drive. This package is small enough to mount directly onto the chiller. The power section of the drive is composed of four major blocks:

- A three phase AC to DC rectifier section with an integrated pre-charge circuit,
- A DC bus filter section,
- A three phase DC to AC inverter section,
- An input harmonic filter.

The following component overview is general to all models of HYP unless otherwise noted.

Disconnect Method

An electronic circuit breaker connects the three phase power to input fuses and then onto the AC line inductor, input filter, load inductor, and then to the DC rectifier section. After the rectifier, power is stored in the bus capacitor until needed by the inverter. The inverter changes the DC into the proper AC voltage and frequency.

Harmonic Filter

The input harmonic filter in the HYP model is much like the harmonic filter used in earlier designs, except the IGBT's used in the harmonic filter are now part of the rectifier. The upper and lower IGBT's in the rectifier are used to command the wave shape of the input current. The input current waveform is commanded to be a sine wave that provides a very low total demand distortion (TDD) value as well as a power factor value of nearly unity.

The AC to DC rectifier uses several IGBT modules in parallel. Each phase has several modules arranged in a parallel connection depending on the amount of input current required for that model.

DC Bus

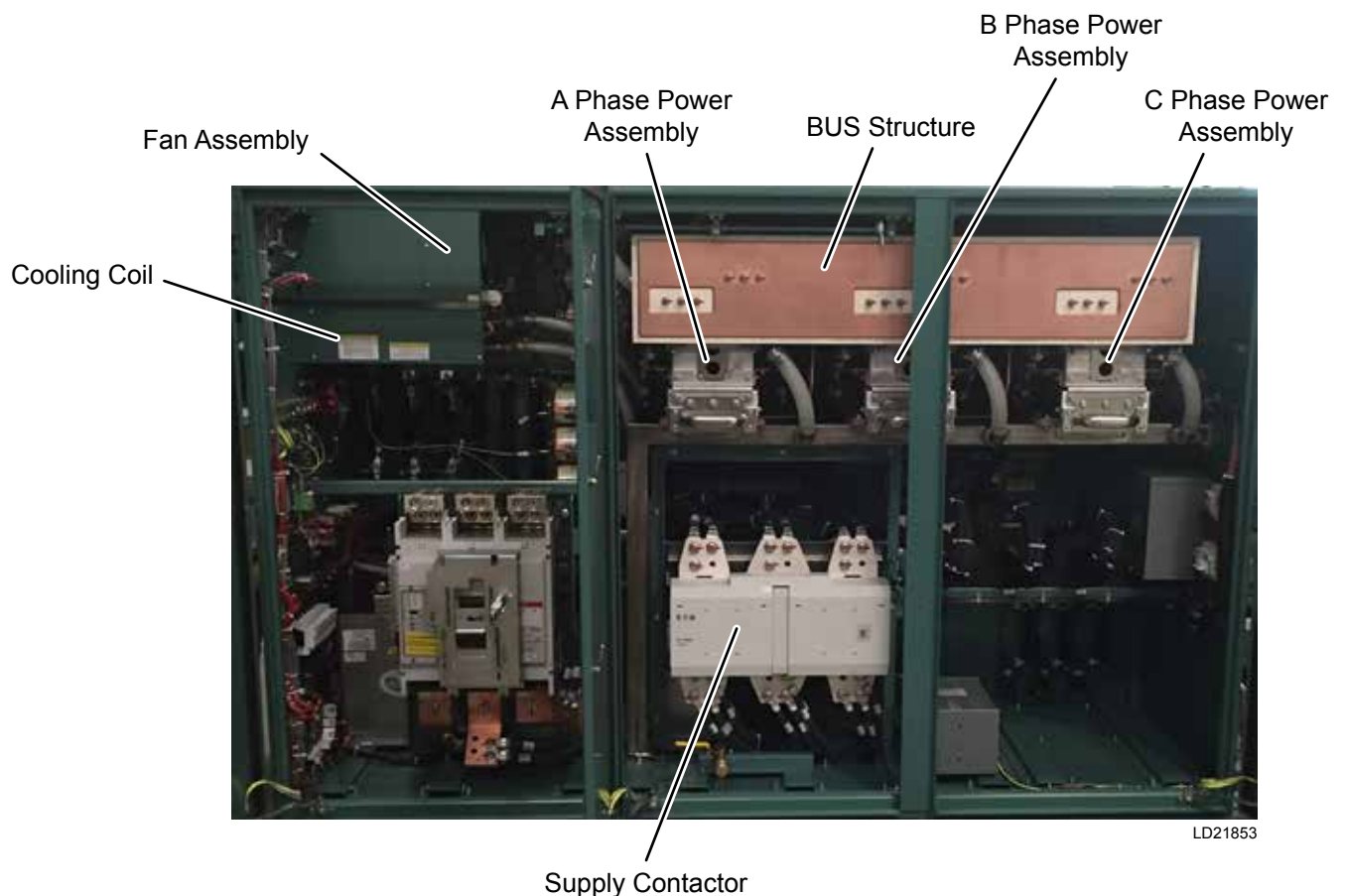
The DC Bus section of the drive consists of one basic component, a large capacitor or capacitors depending on the current requirement of the HYP model. These capacitors provide a large energy reservoir for use by the DC to AC inverter section. These capacitors provide the physical foundation for the power unit. All of the other components in the power unit are connected to the foundation of the bus capacitor.

Drive Output

The output of the drive also uses IGBT's to control the voltage and frequency to the motor. The controls within the drive logic board determine when the output IGBT's are turned on and off. The output of the inverter IGBT's is connected to rate of rise reduction filter. This filter is also called the DV/DT network.

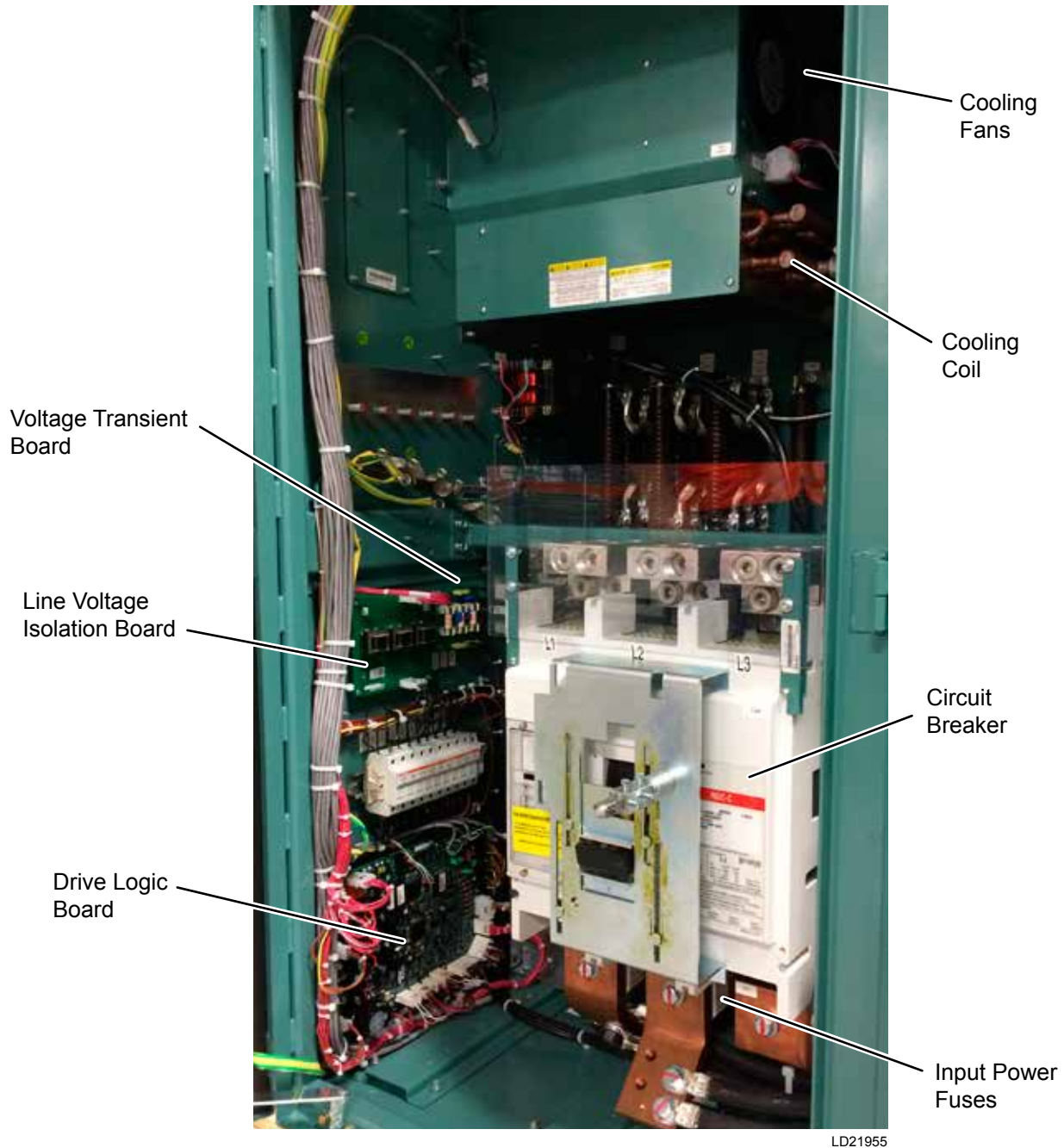


A service hole is now included in each of the drive models. A metal plate covers the service hole so the enclosure will maintain it's NEMA 1 rating. Four nuts must be removed so that the plate can be removed. The intended use for the service hole is so current sensor wiring or voltage leads can be installed, and then the doors closed to provide safe operation of the drive while measurements are made external to the drive. The plate must be reinstalled after test are complete.



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FIGURE 1 - HYP1100A / HYP1300A HP COMPLETE DRIVE CABINET

**FIGURE 2 - LEFT SIDE OF HYP1100A / HYP1300A HP DRIVE CABINET**

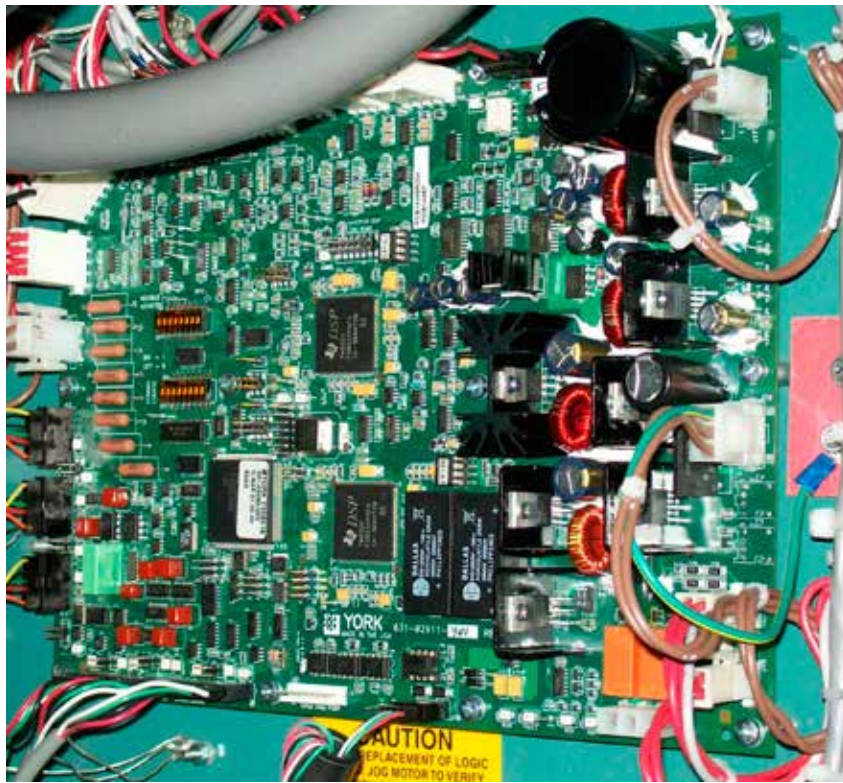


Inlet
Coolant
Hose

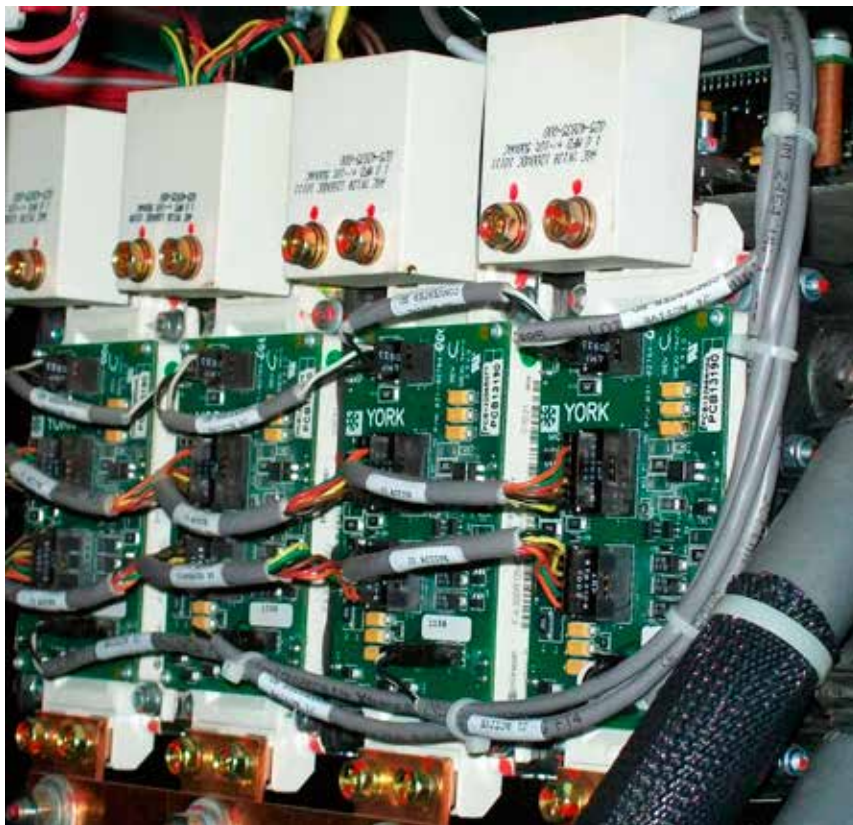
Step Down
Transformers

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FIGURE 3 - RIGHT SIDE OF HYP1100A / HYP1300A HP DRIVE CABINET



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FIGURE 4 - DRIVE LOGIC BOARD

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FIGURE 5 - RECTIFIER SIDE OF THE POWER UNIT HYP1100A AND HYP1300A

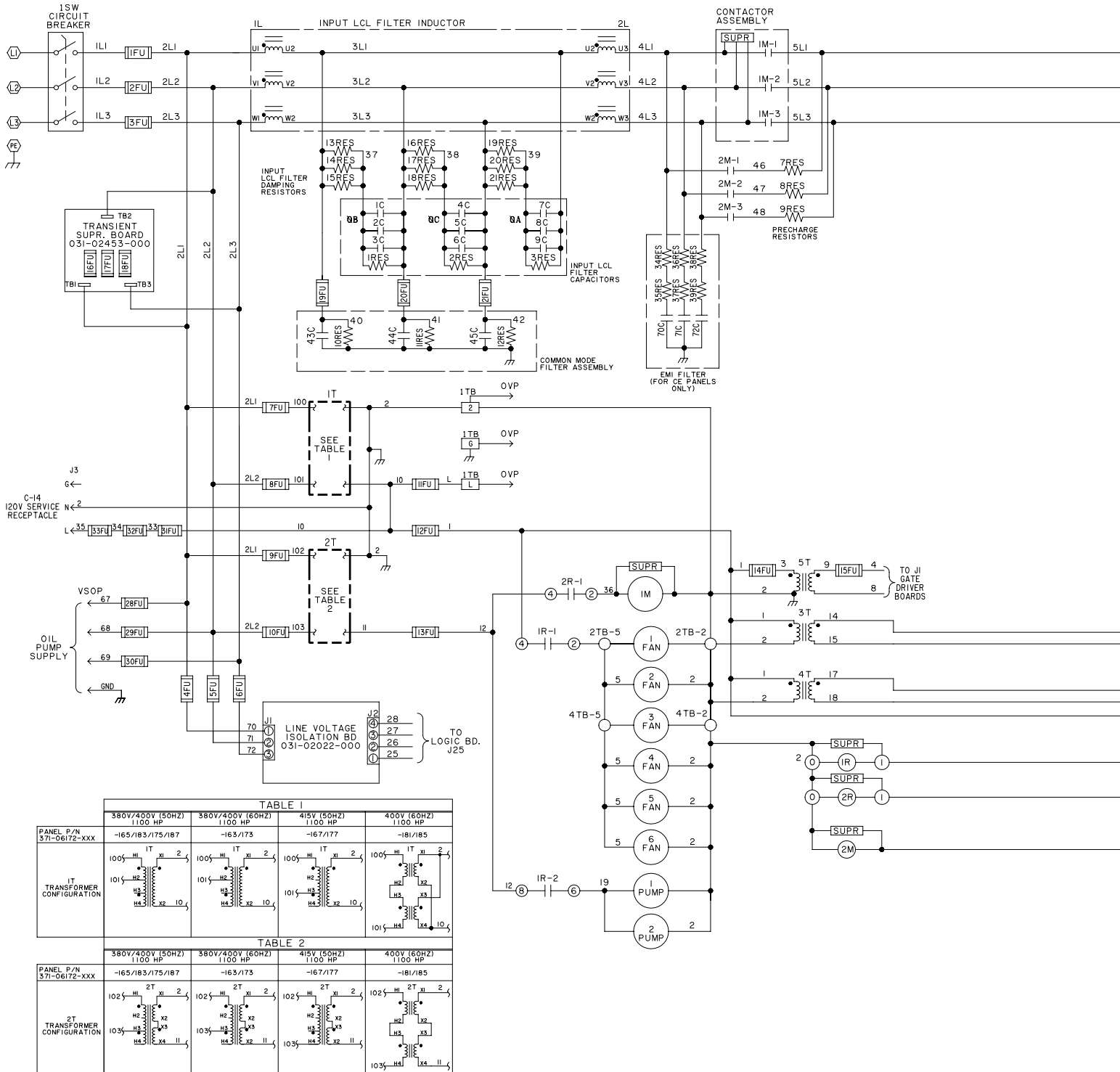
SECTION 2 - DRIVE WIRING DIAGRAMS

Elementary Wiring Diagram HYP1100A 380/400/415VAC Notes

1. Field wiring to be in accordance with the National Electrical Code as well as all other applicable codes and specifications.
2. Terminal block connection points are indicated by numbers within a square, i.e. $\boxed{1}$ 2TB. Main power connection points are indicated by numbers within a hexagon, i.e. $\hexagon{1}$. Component terminal markings are indicated by numbers within a circle, i.e. $\textcircled{2}$. Numbers adjacent to circuit lines are the circuit identification numbers.
3. Terminals L1, L2, L3 and ground are the main power input terminals and are field connected. (See note 6). Terminals T1, T2 and T3 are the compressor motor lead power terminals and are factory connected on factory packaged units.
4. The three phase solid state motor overload protection system provide motor overcurrent protection at 105% full load amps.
5. See YORK Control Center wiring diagram product drawing Form 160.75-PW2.
6. Field Wiring Connections per Product Drawing Form 160.75-PW1.

LEGEND for 035-25085-001, 002, 003, 004, 005 and 600

1C-9C	Capacitor, Film, Input Power Filter, 47 μ F, 65A, 600VAC
10C-15C	Capacitor, Film, DC Link, 1500mF, 530A, 1000VDC
16C-42C	Capacitor, Film, Snubber, 1.0 μ F, 1200VDC
43C-45C	Capacitor, Film, Common Mode, 20 μ F, 530VAC
46C-48C	Capacitor, Film, Output, DV/DT, .06 μ F, 8A, 630VAC
70C-72C	Capacitor, Film, EMI 0.027 μ F, 10%
1SW	Circuit Breaker, 1600A, 600VAC, 100KA Withstand
1DCCT-3DCCT	DC Current Transformer, Input, 5000A to 1A
4DCCT-6DCCT	DC Current Transformer, Output, 5000A to 1A
1FU-3FU	Fuse, Input Power, 1800A, 650VAC, 200KA, Interrupt
4FU-6FU	Fuse, Input Voltage Sense, 1A, 600VAC, 200KA Interrupt
7FU, 8FU	Fuse, Control Supply XFMR Primary, 15A, 600VAC, 200KA Interrupt
9FU, 10FU	Fuse, Control Supply XFMR Primary, 10A, 600VAC, 200KA Interrupt
11FU	Fuse, External Control Supply XFMR Sec, 20A, 600VAC, 200KA Interrupt
12FU	Fuse, Internal Control Supply XFMR Sec, 10A, 600VAC, 200KA Interrupt
13FU	Fuse, Supply, Contactor Coil and Pumps, 10A, 600VAC, 200KA Interrupt
14FU	Fuse, Gate Dr Ctrl Supply XFMR Prim 7A, 600VAC, 200KA Interrupt
15FU	Fuse, Gate Dr Ctrl Supply XFMR Sec 7A, 600VAC, 200KA Interrupt
16FU-18FU	Fuse, Transient Suppressor PCB, 5A, 600VAC, 200KA Interrupt
19FU-21FU	Fuse, Input Voltage Common Mode, 30A, 600VAC, 200Ka Interrupt
28FU-30FU	Fuse, Oil Pump Supply, 7A, 600VAC, 200Ka Interrupt
31FU, 32FU	Fuses are not Populated During Normal Operation
33FU	Fuse, Service Receptacle, 10A, 600VAC, 200KA Interrupt
1L	Inductor, Line, 7 μ H, 1461A, 600VAC
2L	Inductor, Drive, 20 μ H, 1461A, 600VAC
1M	Coil, Supply Contactor, 1600A, 690VDC
2M	Coil, Precharge Contactor, 32A, 690VDC
1MOD-15MOD	Module, Power Dual, Active Converter, 450A, 1200VDC
16MOD-27MOD	Module, Power Dual, Inverter, 450A, 1200VDC
1R	Relay, Cooling Pumps and Fans
2R	Relay, Supply Contactor
1RES-3RES	Resistor, Input Power Filter, Bleeder, 20K, 16W, 5%
4RES-6RES	Resistor, DC Link, 27K, 50W, 5%
7RES-9RES	Resistor, Recharge, 10 OHMS, 375W, 10%
10RES-12RES	Resistor, Input Power Filter, Comm Mode, Bleeder, 20K, 16W, 5%
13RES-21RES	Resistor, Damping, Input Filter, .06 OHMS, 300W, 10%
22RES-27RES	Resistor, Baseplate, 20 OHMS, 30W, 5%
28RES-33RES	Resistor, DV/DT, 10 OHMS, 100W 10%
34RES-39RES	Resistor, EMI, 10 OHMS, 100W, 10%
1RT-2RT	Thermistor, Ambient, 10K at 25°C
1T	Transformer, Control, 3KVA, 120VAC
2T	Transformer, Control, 2KVA, 240AC
3T-4T	Transformer, Class 2, 75VA, 120VAC:24VAC
5T	Transformer, Control, 175VA, 120VAC:32VAC
1TB	Terminal Block, Control Power
2TB	Terminal Block, Fans
3TB	Terminal Block
4TB	Terminal Block, Fan

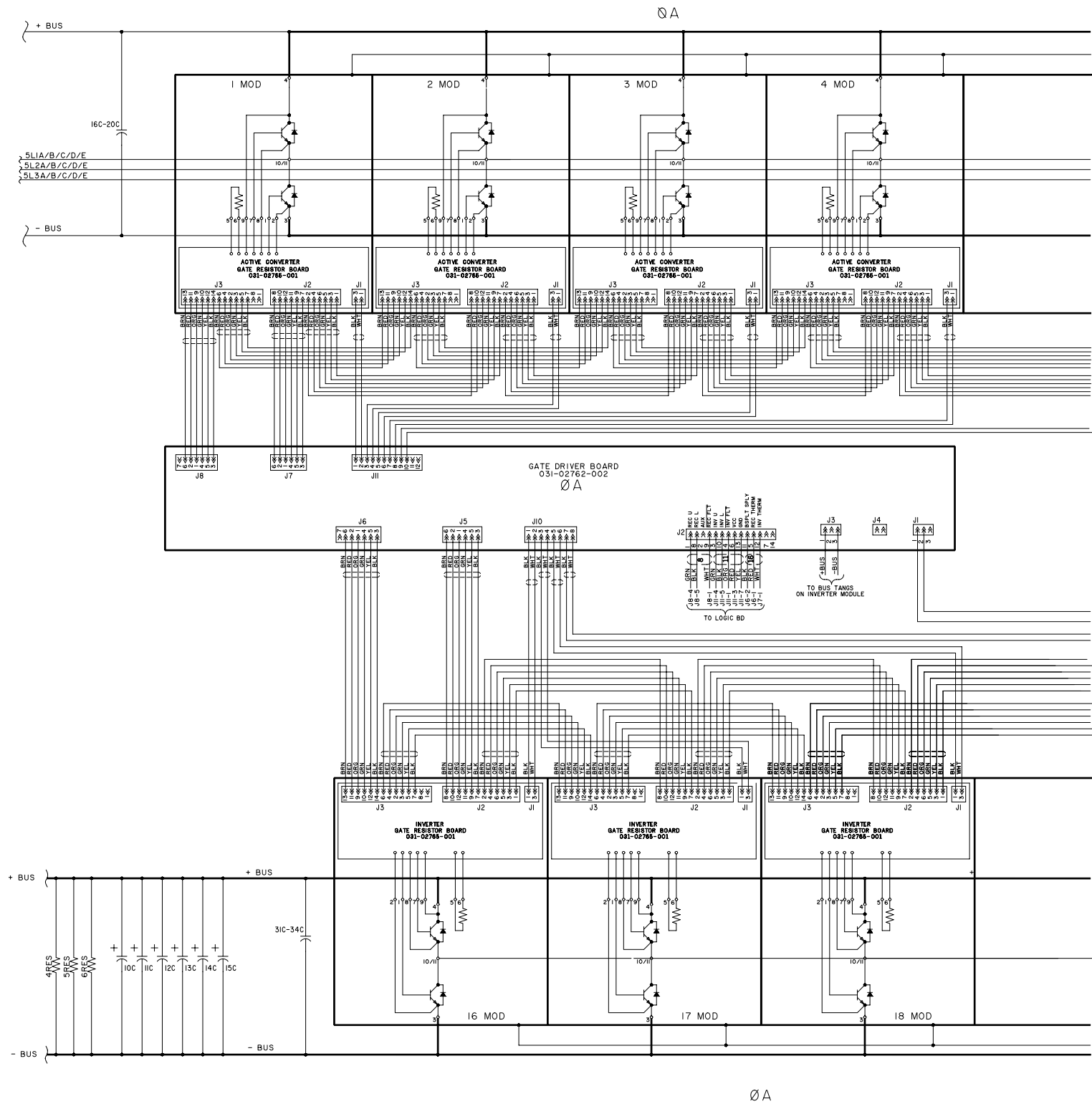


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FIGURE 6 - ELEMENTARY WIRING DIAGRAM HYP1100A



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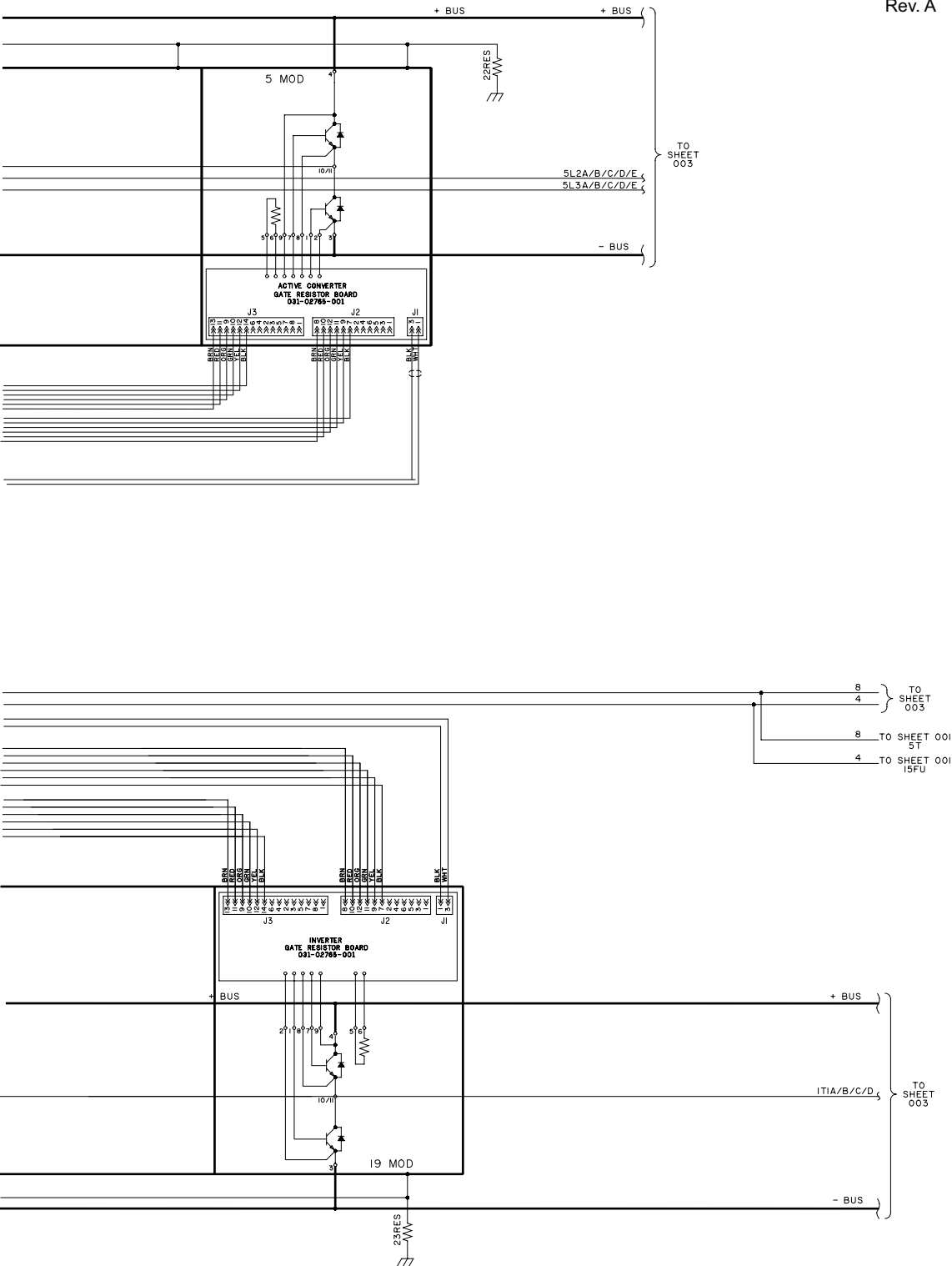


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FIGURE 7 - POWER UNIT PHASE A - ELEMENTARY WIRING DIAGRAM HYP1100A

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Rev. A

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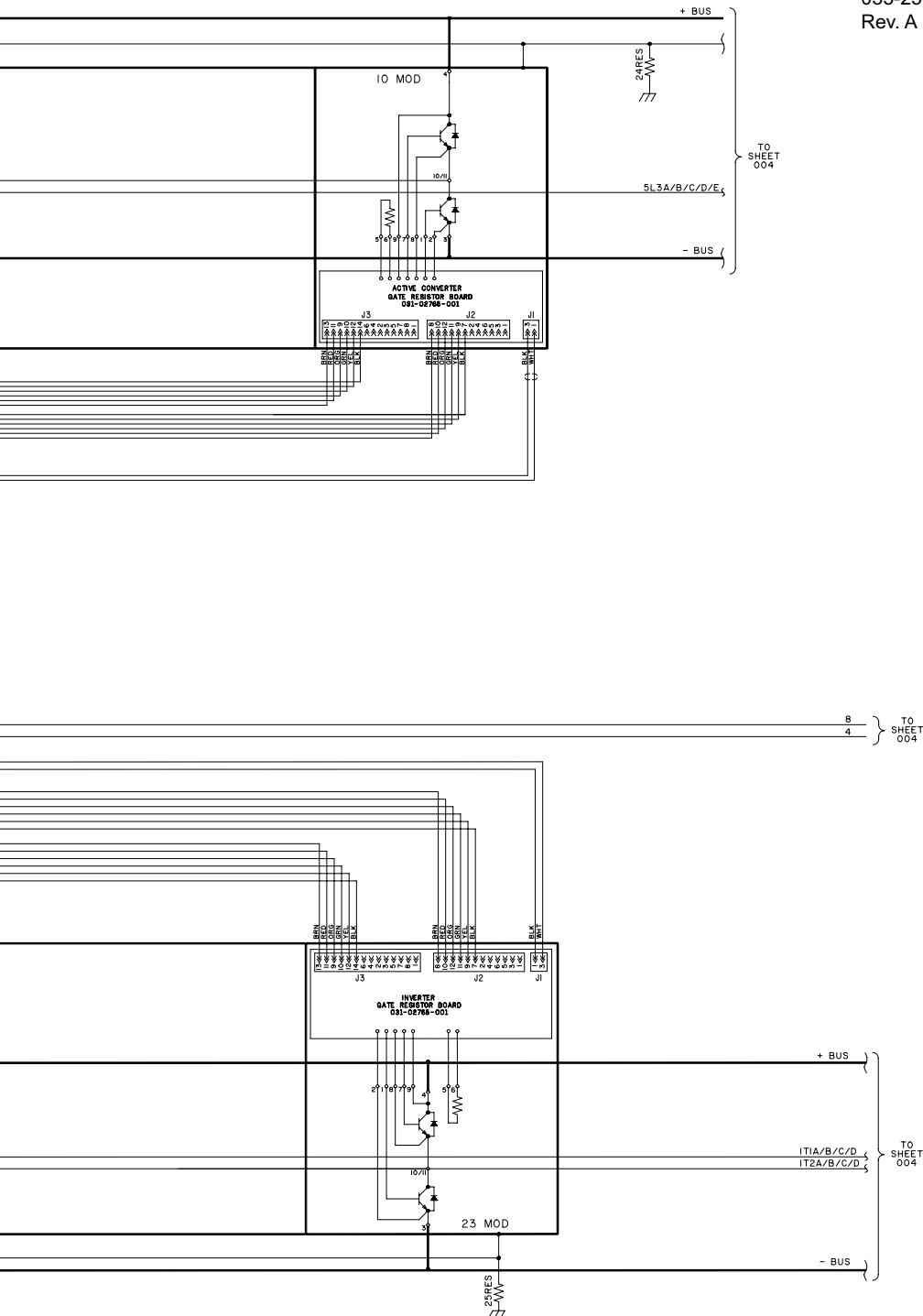
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FIGURE 7 - POWER UNIT PHASE A - ELEMENTARY WIRING DIAGRAM HYP1100A (CONT'D)



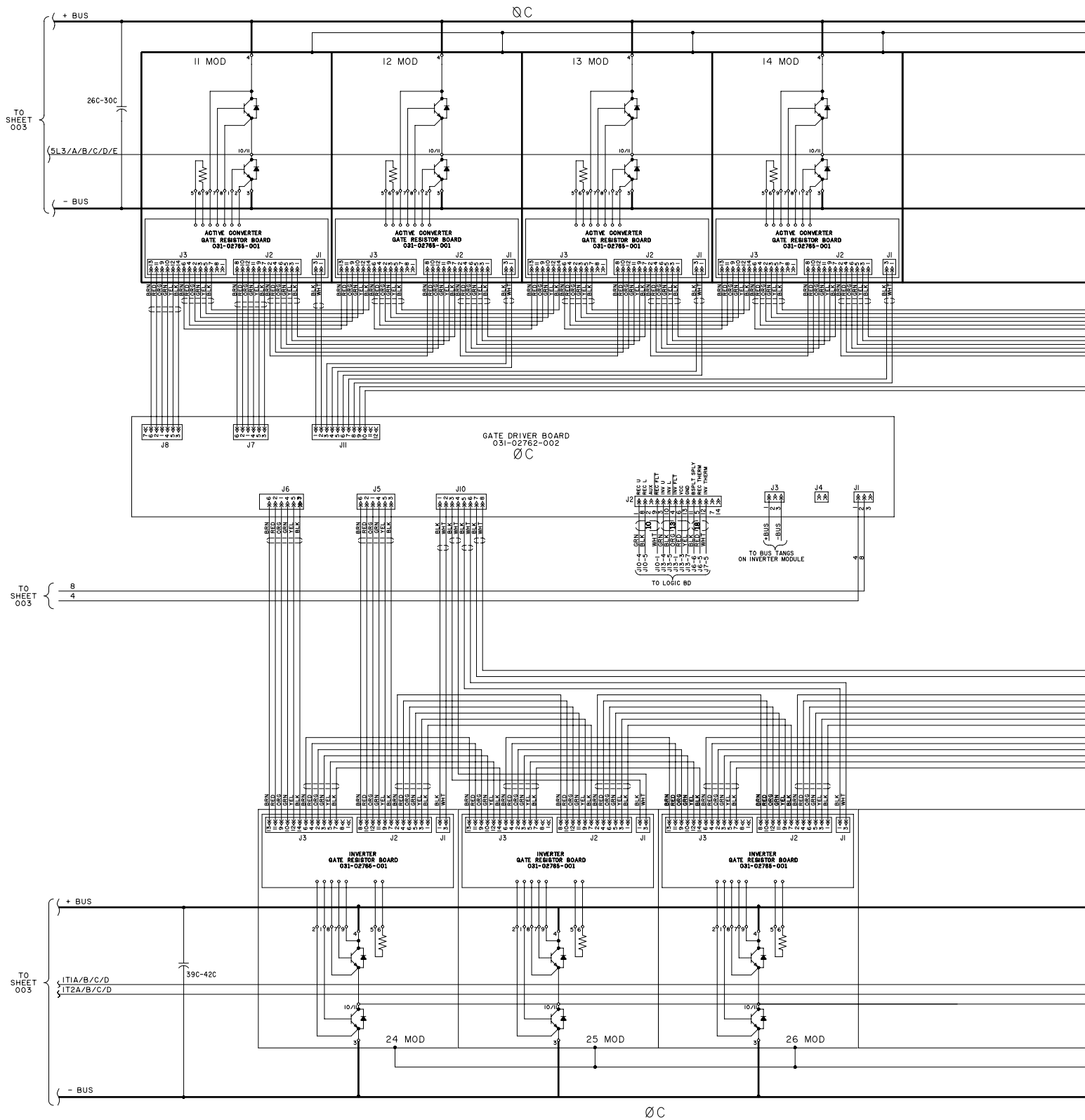
JOHNSON CONTROLS

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Rev. A



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FIGURE 8 - POWER UNIT PHASE B - ELEMENTARY WIRING DIAGRAM HYP1100A (CONT'D)

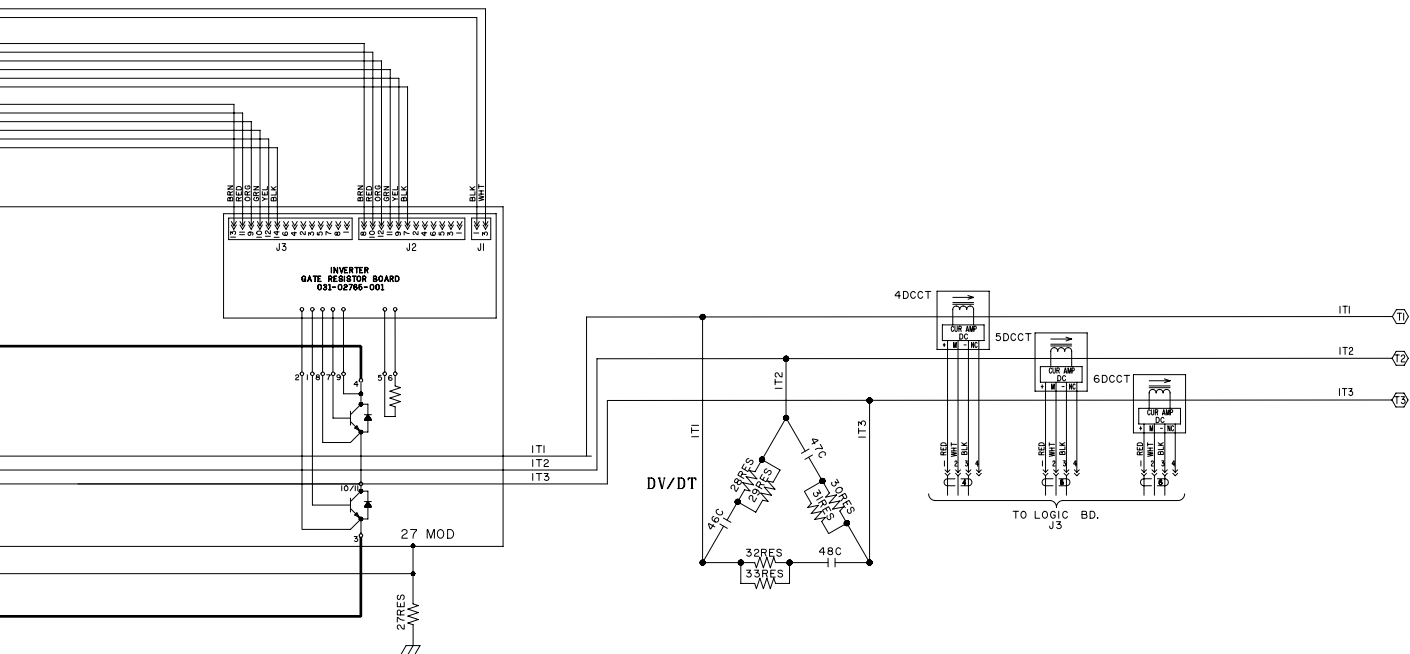
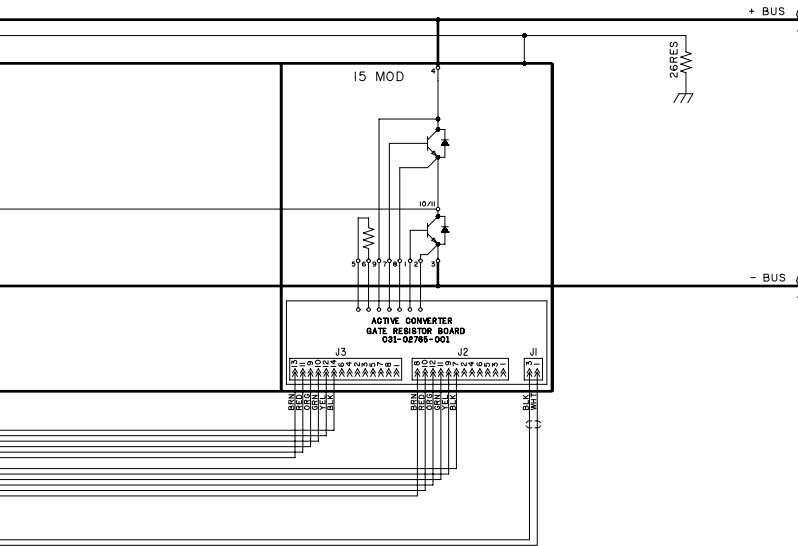


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FIGURE 9 - POWER UNIT PHASE C - ELEMENTARY WIRING DIAGRAM HYP1100A

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Rev. A

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FIGURE 9 - POWER UNIT PHASE C - ELEMENTARY WIRING DIAGRAM HYP1100A (CONT'D)



FIGURE 10 - OUTPUT ELEMENTARY WIRING DIAGRAM HYP1100A

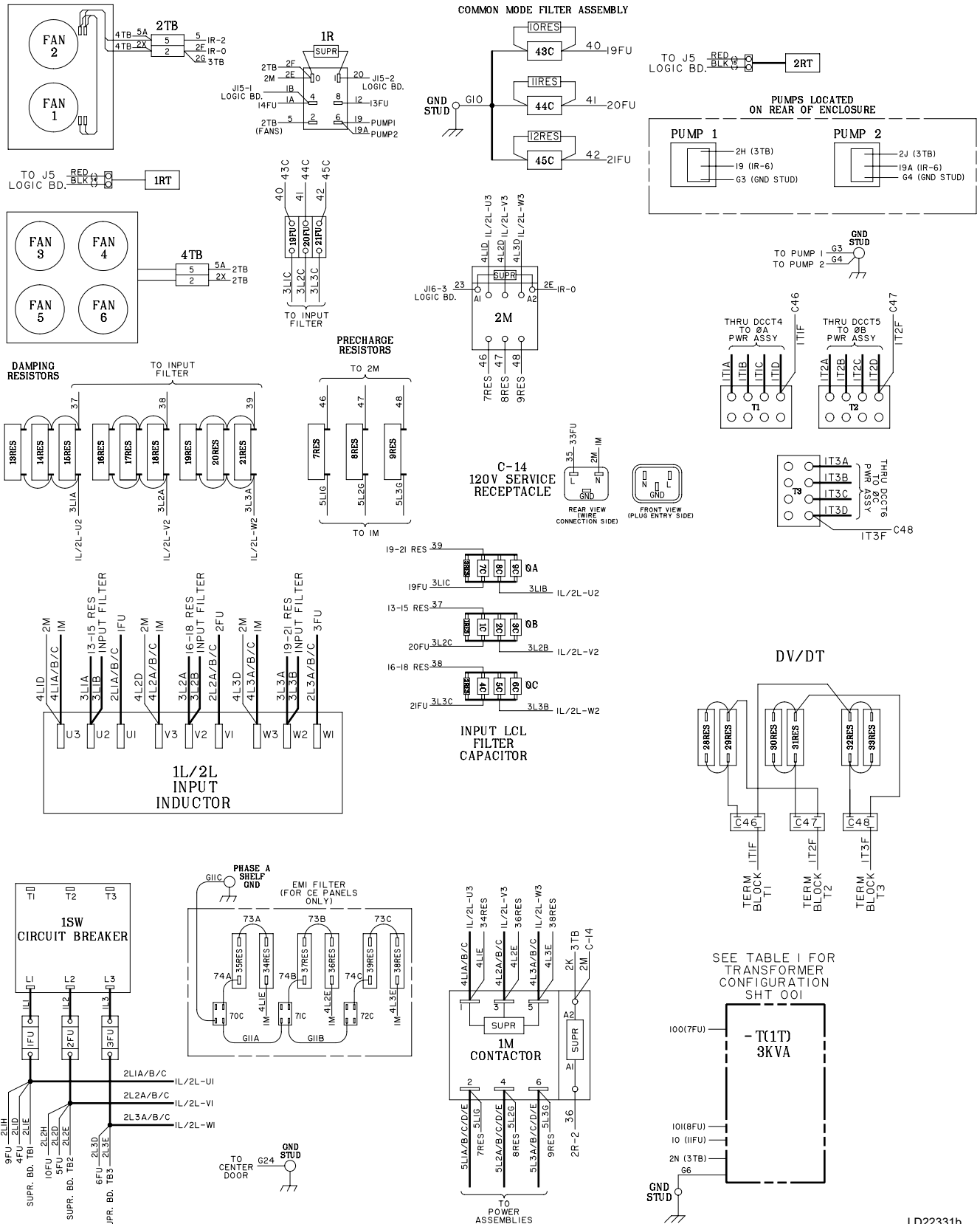
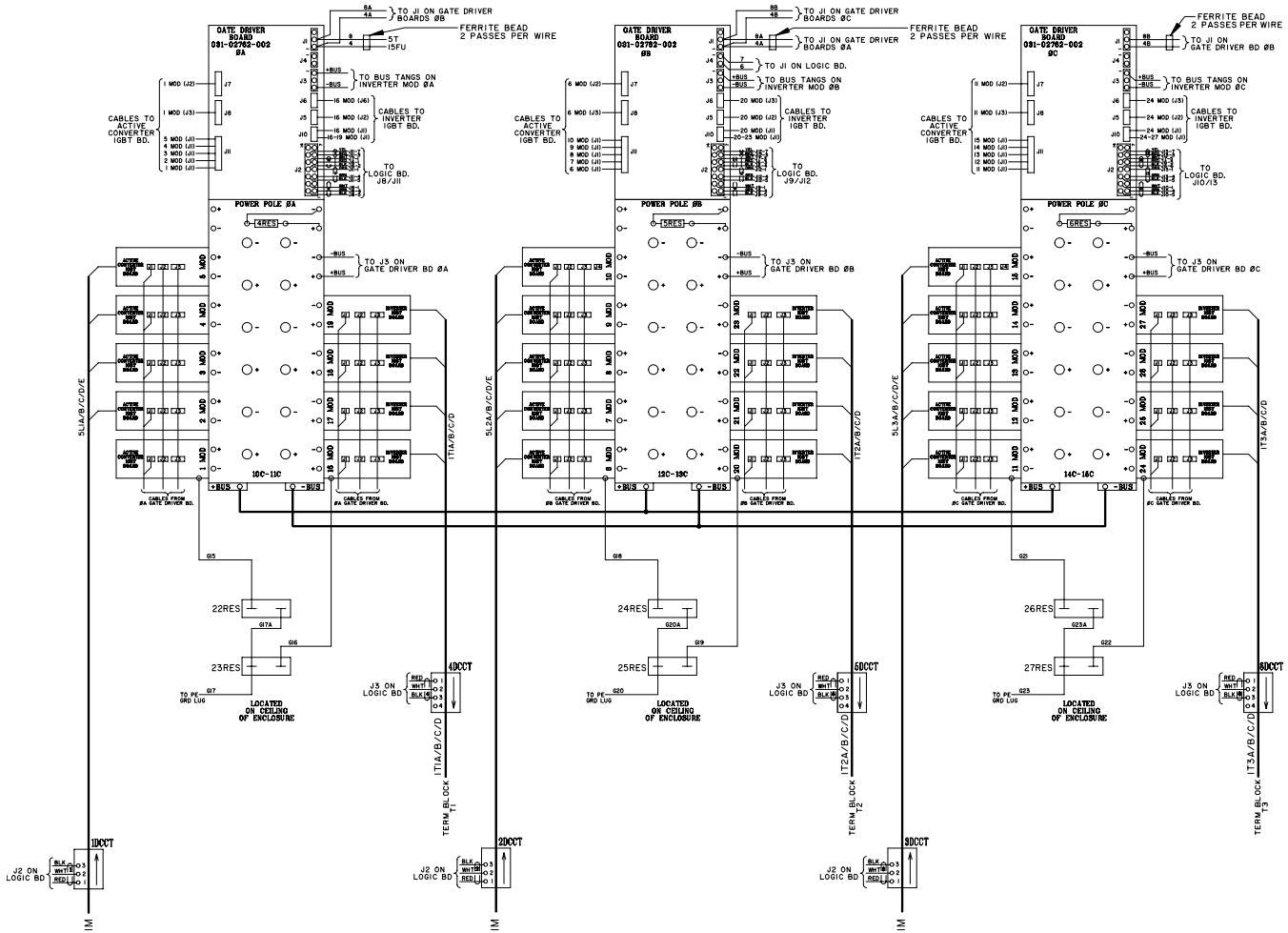


FIGURE 10 - OUTPUT ELEMENTARY WIRING DIAGRAM HYP1100A (CONT'D)

POWER ASSEMBLIES

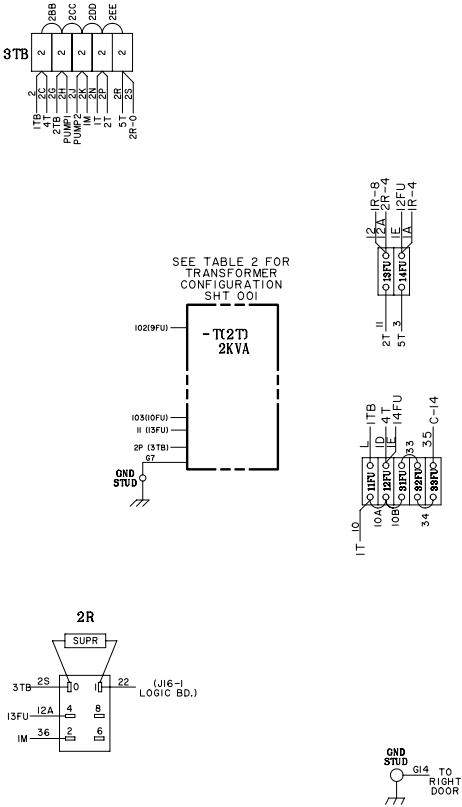


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FIGURE 11 - CONNECTION DIAGRAM HYP1100A

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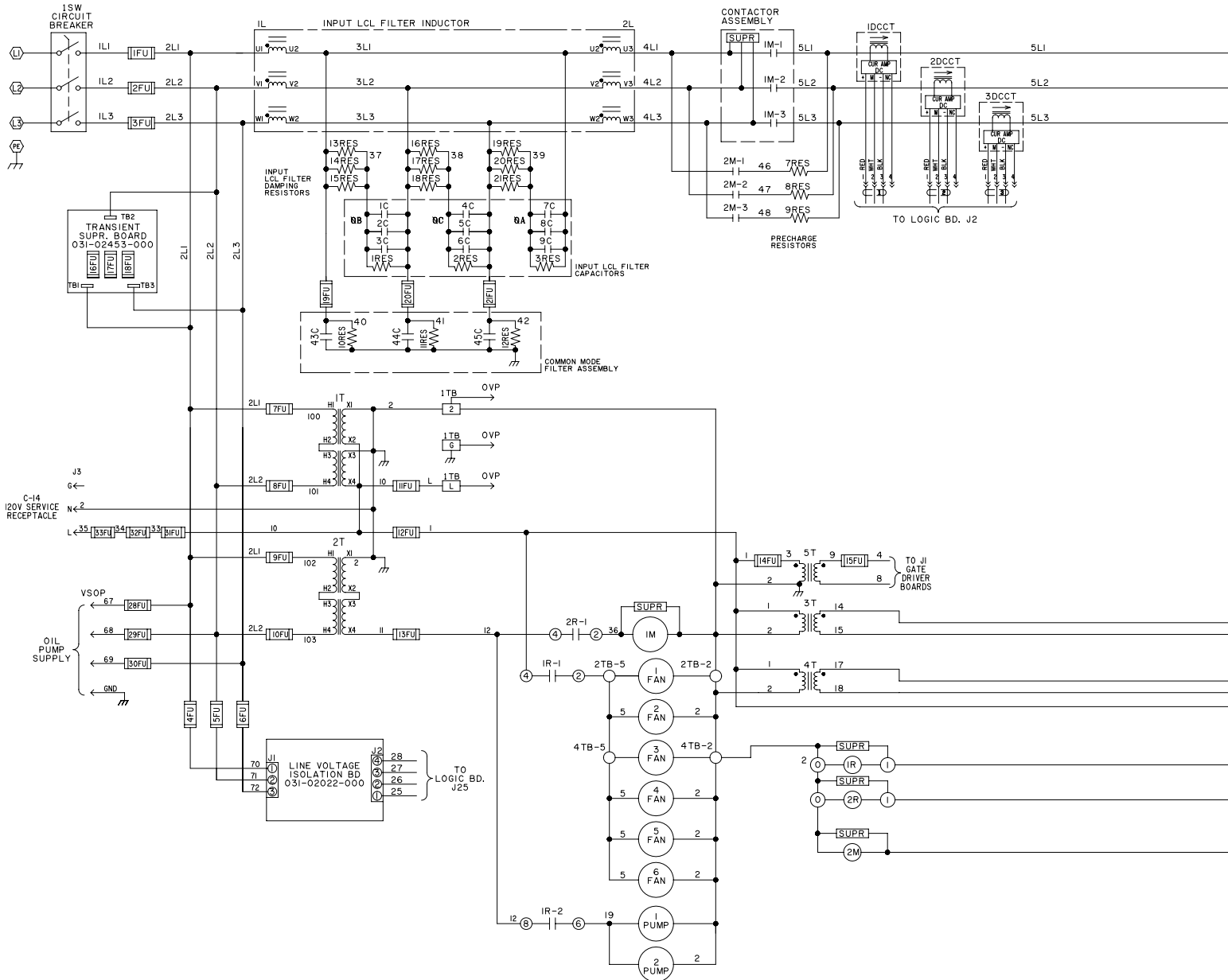
FIGURE 11 - CONNECTION DIAGRAM HYP1100A (CONT'D)

Elementary Wiring Diagram HYP1300A 460VAC Notes

1. Field wiring to be in accordance with the National Electrical Code as well as all other applicable codes and specifications.
2. Terminal block connection points are indicated by numbers within a square, i.e. TB. Main power connection points are indicated by numbers within a hexagon, i.e. . Component terminal markings are indicated by numbers within a circle, i.e. . Numbers adjacent to circuit lines are the circuit identification numbers.
3. Terminals L1, L2, L3 and ground are the main power input terminals and are field connected. (See note 6). Terminals T1, T2 and T3 are the compressor motor lead power terminals and are factory connected on factory packaged units.
4. The three phase solid state motor overload protection system provides motor overcurrent protection at 105% full load amps.
5. See YORK Control Center wiring diagram product drawing Form 160.75-PW2.
6. Field Wiring Connections per Product Drawing Form 160.75-PW1.

LEGEND for 035-23613-001, 002, 003, 004, 005 and 006

1C-9C	Capacitor, Film, Input Power Filter, 47 μ F, 65A, 600VAC
10C-15C	Capacitor, Film, DC Link, 1500mF, 530A, 1000VDC
16C-42C	Capacitor, Film, Snubber, 1.0 μ F, 1200VDC
43C-45C	Capacitor, Film, Common Mode, 20 μ F, 530VAC
46C-48C	Capacitor, Film, Output DV/DT, .06 μ F, 8A, 630VAC
1SW	Circuit Breaker, 1600A, 600VAC, 100KA Withstand
1DCCT-3DCCT	DC Current Transformer, Input, 5000A to 1A
4DCCT-6DCCT	DC Current Transformer, Output, 5000A to 1A
1FU-3FU	Fuse, Input Power, 1800A, 650VAC, 200KA, Interrupt
4FU-6FU	Fuse, Input Voltage Sense, 1A, 600VAC, 200KA Interrupt
7FU, 8FU	Fuse, Control Supply XFMR Primary, 15A, 600VAC, 200KA Interrupt
9FU, 10FU	Fuse, Control Supply XFMR Primary, 10A, 600VAC, 200KA Interrupt
11FU	Fuse, External Control Supply XFMR, 20A, 600VAC, 200KA Interrupt
12FU	Fuse, Internal Control Supply XFMR, 10A, 600VAC, 200KA Interrupt
13FU	Fuse, Supply, Contactor Coil and Pumps, 10A, 600VAC, 200KA Interrupt
14FU	Fuse, Gate Dr Ctrl Supply XFMR Primary, 7A, 600VAC, 200KA Interrupt
15FU	Fuse, Gate Dr Ctrl Supply XFMR Secondary, 7A, 600VAC, 200KA Interrupt
16FU-18FU	Fuse, Transient Suppressor PCB, 5A, 600VAC, 200KA Interrupt
19FU-21FU	Fuse, Input Voltage Common Mode, 30A, 600VAC, 200KA Interrupt
28FU-30FU	Fuse, Oil Pump Supply, 7A, 600VAC, 200KA Interrupt
31FU, 32FU	Fuses are Not Populated During Normal Operation
33FU	Fuse, Service Receptacle, 10A, 600VAC, 200KA Interrupt
1L	Inductor, Line, 7 μ H, 1461A, 600VAC
2L	Inductor, Drive, 20 μ H, 1461A, 600VAC
1M	Coil, Supply Contactor, 1600A, 690VDC
2M	Coil, Precharge Contactor, 32A, 690VDC
1MOD-15MOD	Module, Power Dual, Active Converter, 450A 1200VDC
16MOD-27MOD	Module, Power Dual, Inverter, 450A, 1200VDC
1R	Relay, Cooling Pumps and Fans
2R	Relay, Supply Contactor
1RES-3RES	Resistor, Input Power Filter, Bleeder, 20K, 16W, 5%
4RES-6RES	Resistor, DC Link, 27K, 50W, 5%
7RES-9RES	Resistor, Precharge, 10 Ω , 375W, 10%
10RES-12RES	Resistor, Input Power Filter, Comm Mode Bleeder 20K, 16W, 5%
13RES-21RES	Resistor, Damping, Input Filter, .06 Ω , 300W, 10%
22RES-27RES	Resistor, Baseplate, 20 Ω , 30W, 5%
28RES-33RES	Resistor, DV/DT, 10 Ω , 100W, 10%
1RT-2RT	Thermistor, Ambient, 10K at 25°C
1T	Transformer, Control, 3KVA, 480VAC:120VAC
2T	Transformer, Control, 2KVA, 480VAC:240VAC
3T-4T	Transformer, Class 2, 75VA, 120VAC:24VAC
5T	Transformer, Control, 175VA, 120VAC:32VAC
1TB	Terminal Block, Control Power
2TB	Terminal Block, Fans
3TB	Terminal Block
4TB	Terminal Block, Fans



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FIGURE 12 - ELEMENTARY WIRING DIAGRAM HYP1300A

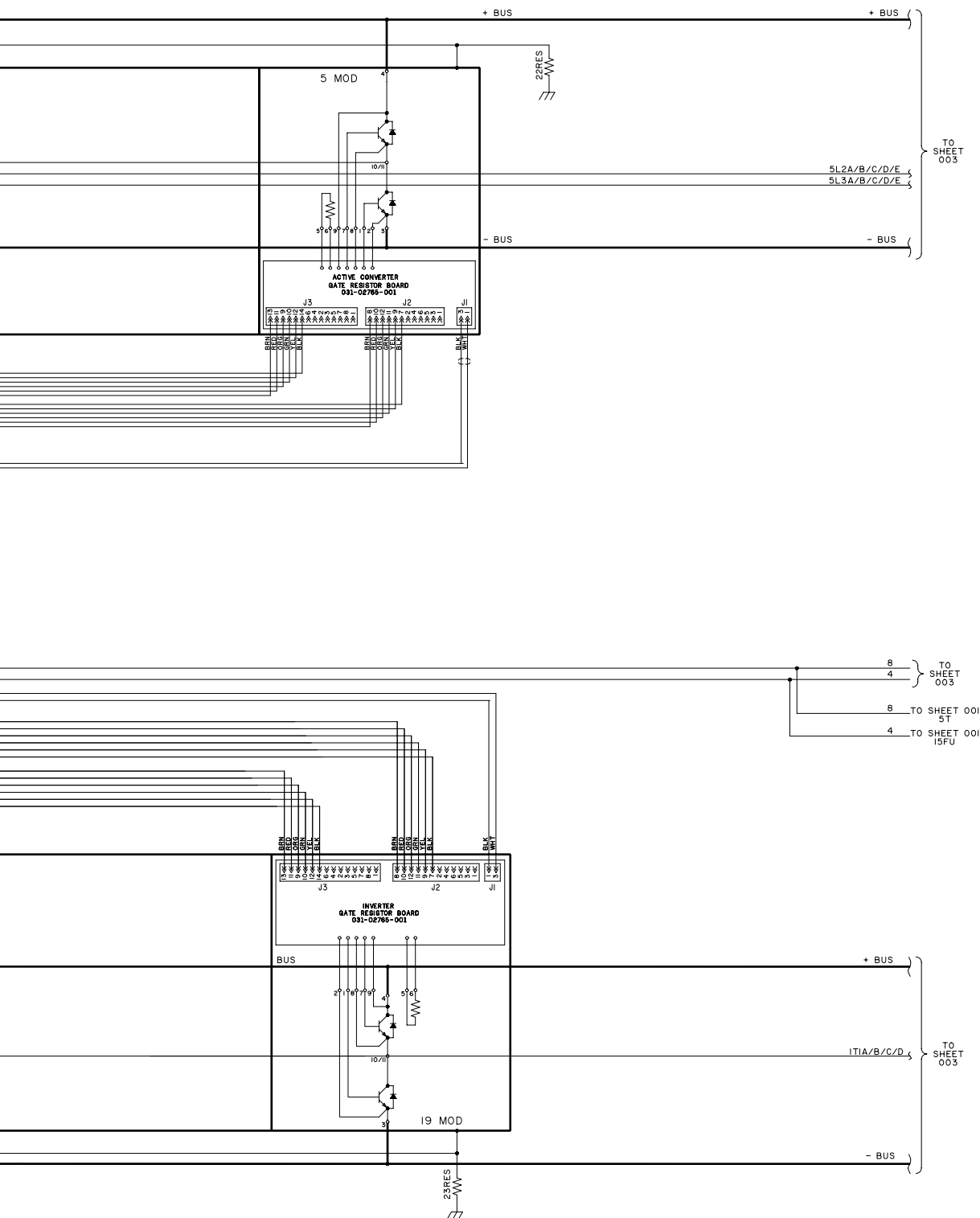


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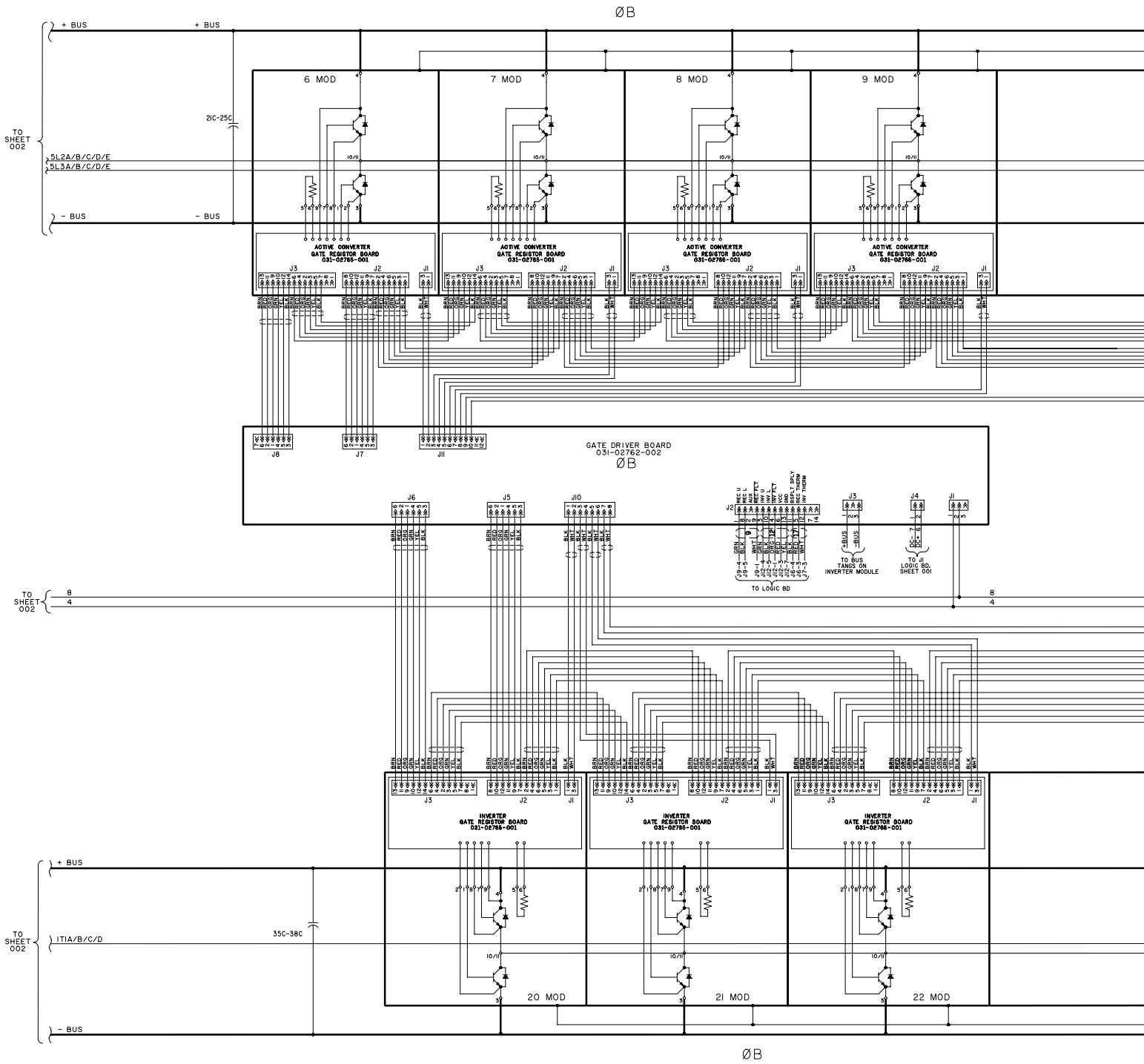
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FIGURE 13 - POWER UNIT PHASE A - ELEMENTARY WIRING DIAGRAM HYP1300A (CONT'D)

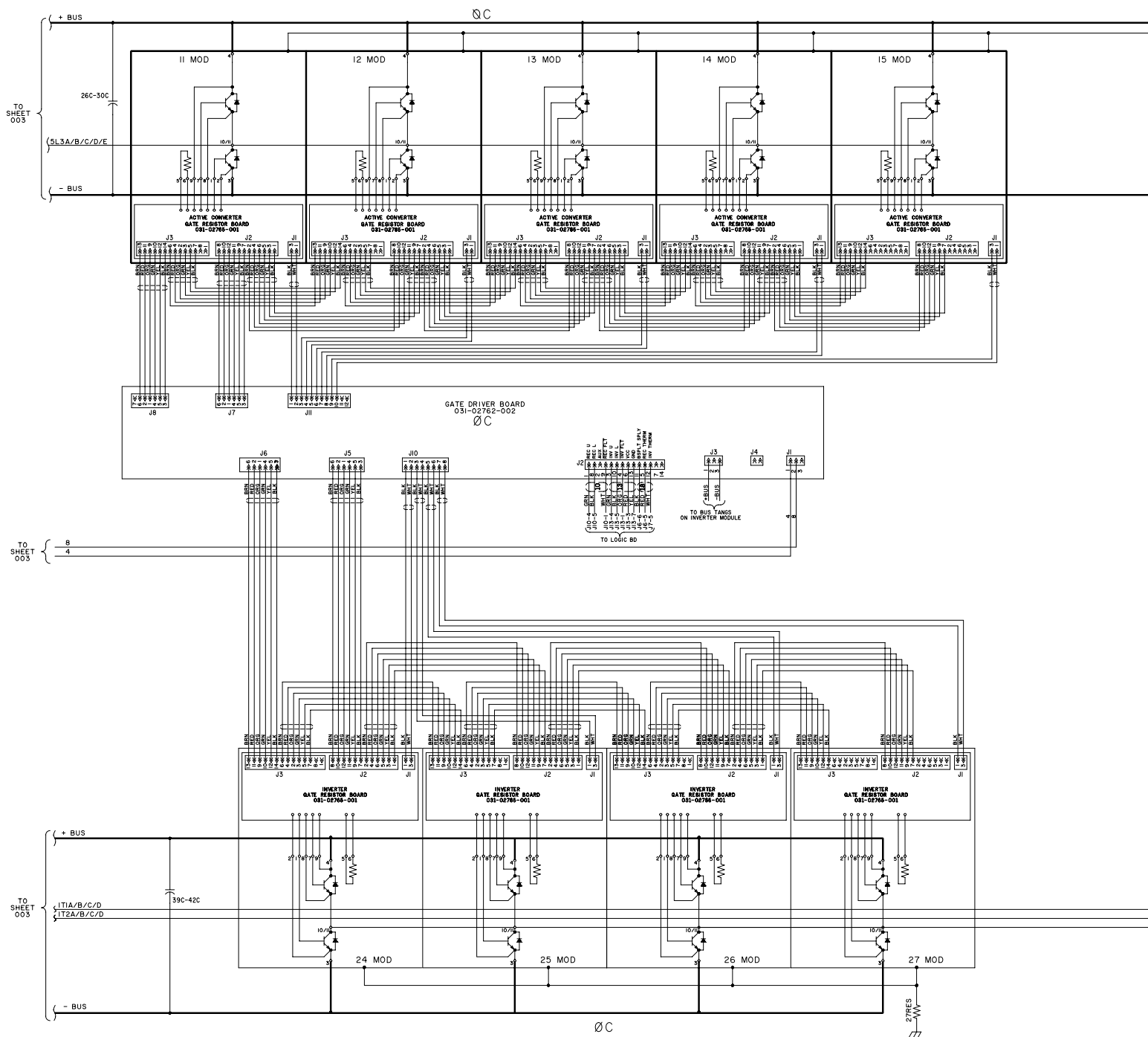


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FIGURE 14 - POWER UNIT PHASE B - ELEMENTARY WIRING DIAGRAM HYP1300A



JOHNSON CONTROLS

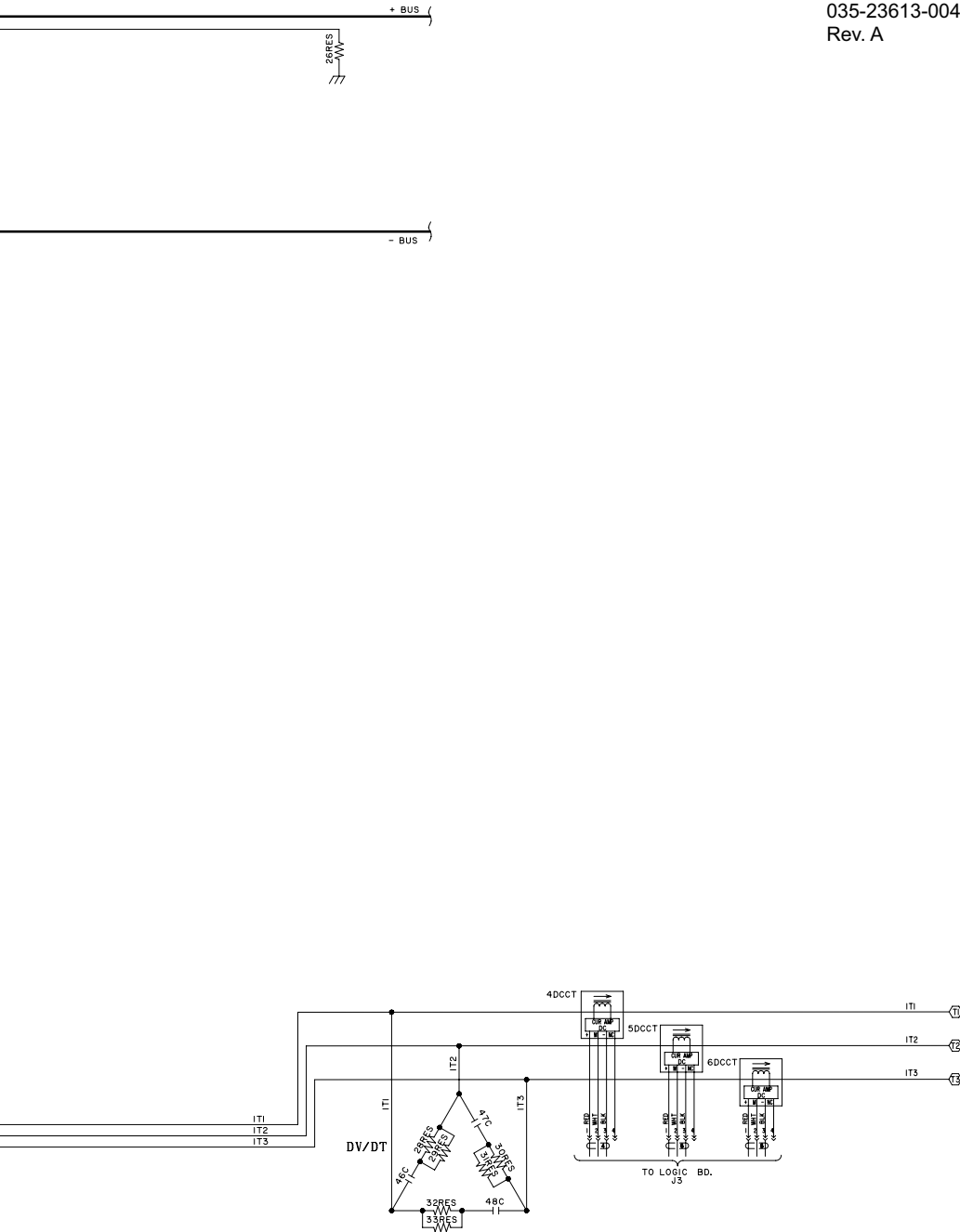


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FIGURE 15 - POWER UNIT PHASE C - ELEMENTARY WIRING DIAGRAM HYP1300A

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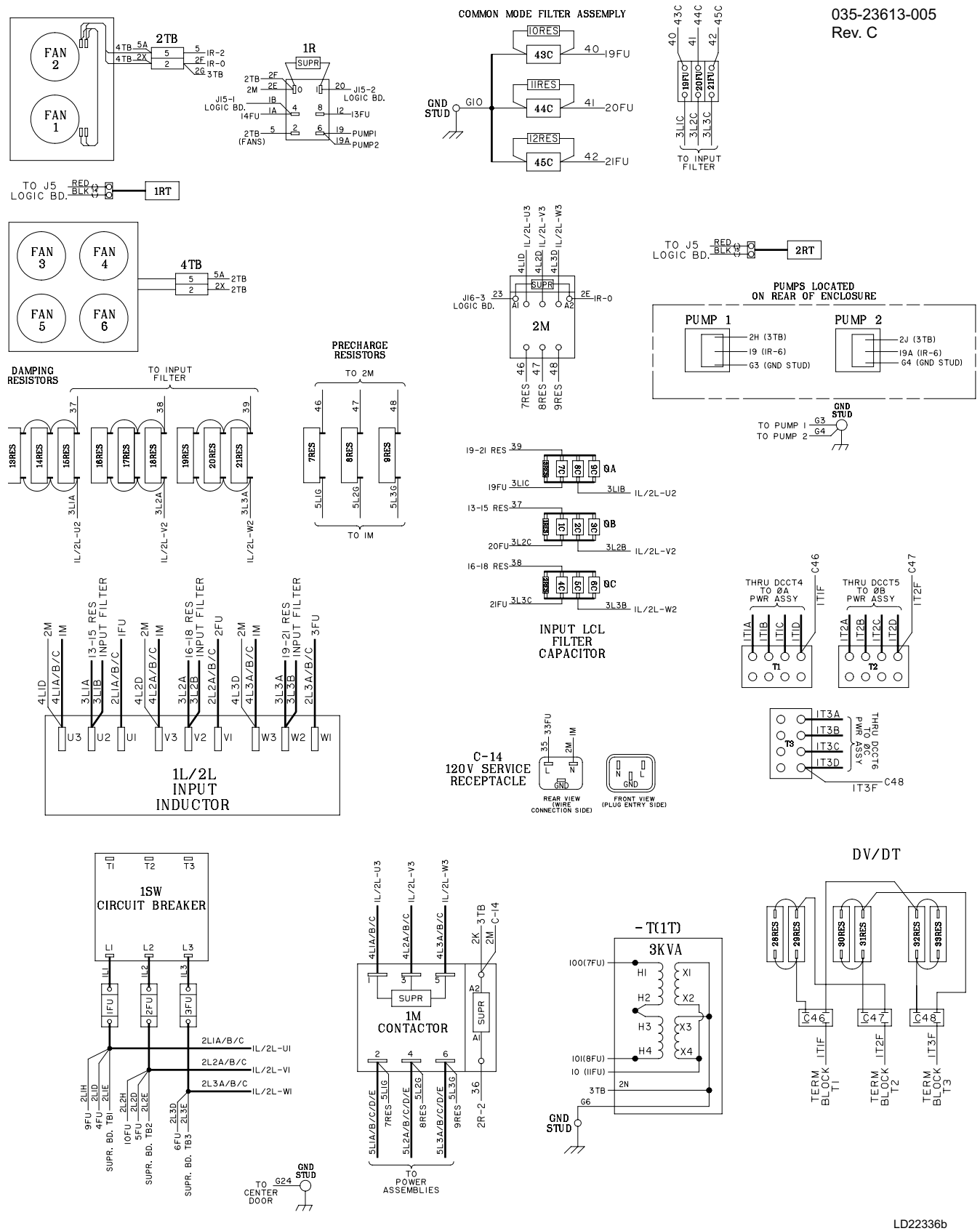


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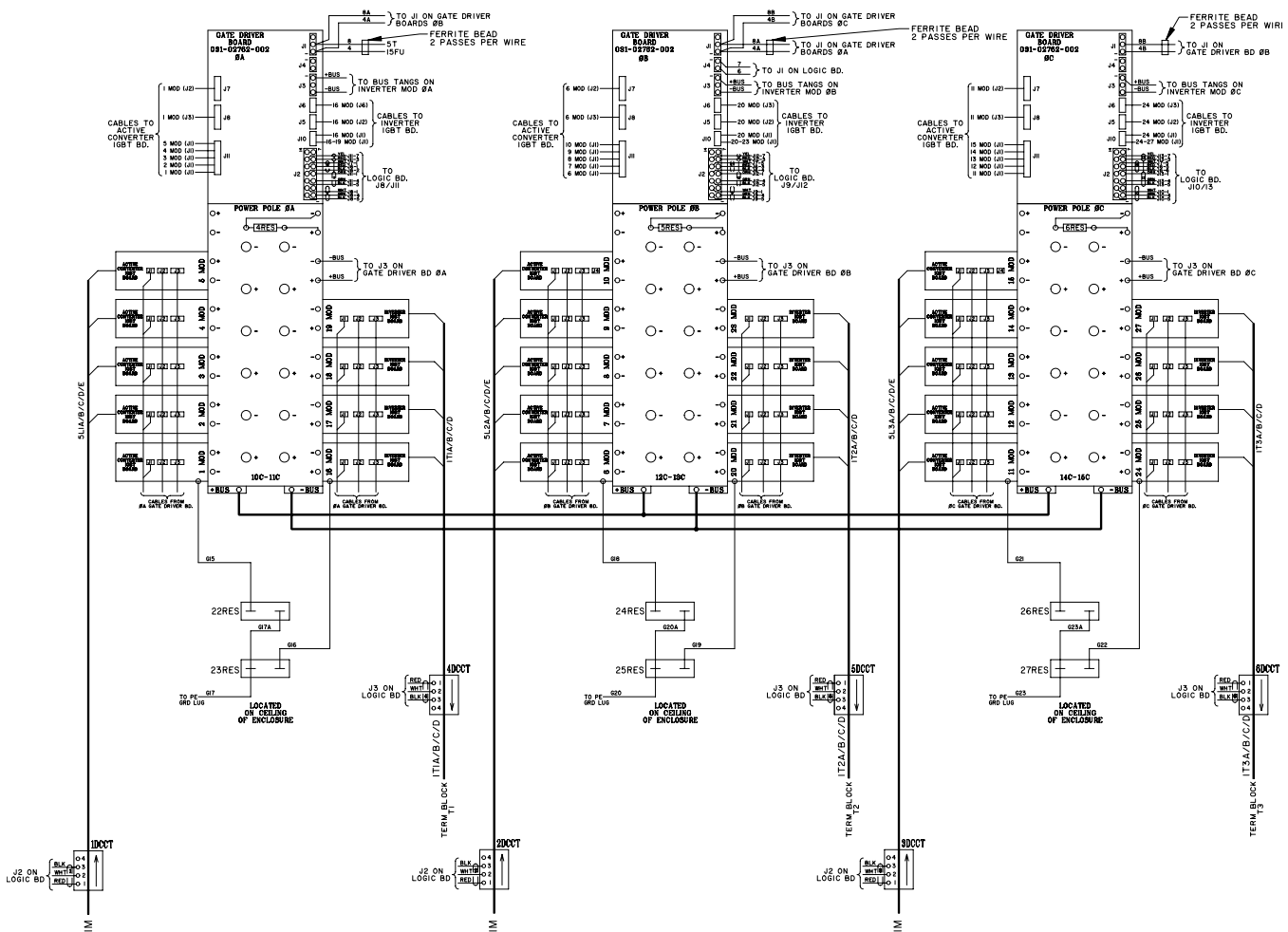
FIGURE 15 - POWER UNIT PHASE C - ELEMENTARY WIRING DIAGRAM HYP1300A (CONT'D)



FIGURE 16 - OUTPUT ELEMENTARY WIRING DIAGRAM HYP1300A



POWER ASSEMBLIES

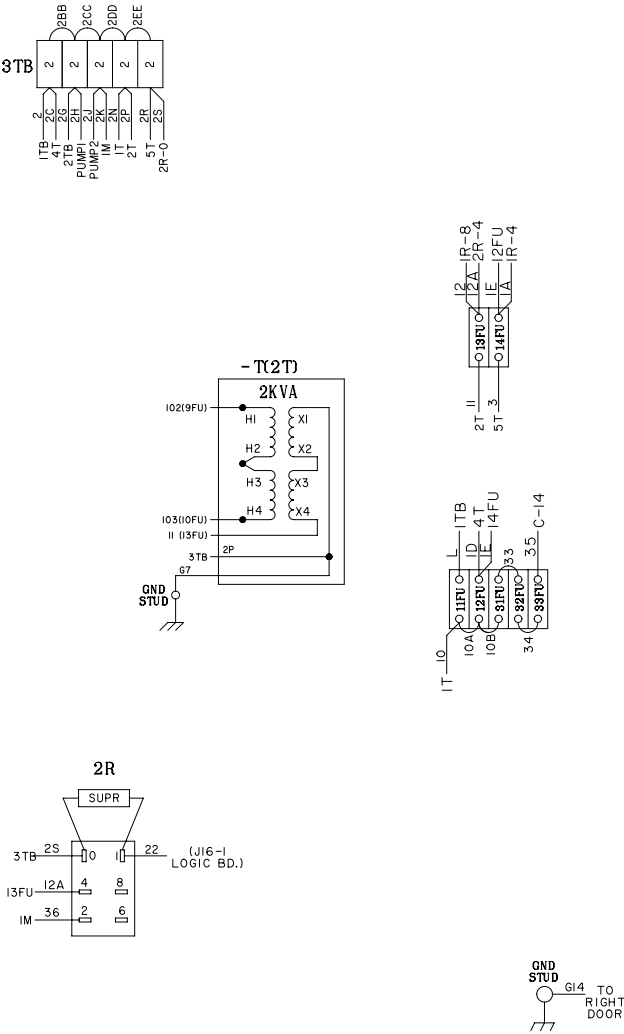


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FIGURE 17 - CONNECTION DIAGRAM HYP1300A

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RIGHT SIDE WALL

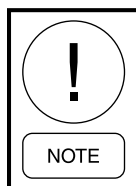


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FIGURE 17 - CONNECTION DIAGRAM HYP1300A (CONT'D)

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SECTION 3 - COMPRESSOR DRIVE OPERATION DETAILS



The following description of operation is general for all models of HYP drives when applied to an YK chiller.

The description of operation will be divided into sections, power, control, and protection. Some components will be discussed in one or all of the sections since they may provide a function in each section.

POWER SECTION DETAILS

When power is applied to the drive, the control circuitry receives power, but the power section is maintained in an off state. The drive will only activate the power section when commanded by the control panel to enter the start mode. When start mode is requested, the drive will enter the pre-charge state.

The pre-charge state is a process of allowing the bus capacitors to be charged up in a manner that limits the amount of current flowing into the bus capacitors. Without limiting the amount of current flowing into the bus capacitors the internal connections in the capacitors could be damaged, and the amount of current flowing into the capacitors will exceed the input current protection device. This device may be the input fuses, or circuit breaker.

A typical method of pre-charge for a larger drive is to use 2 contactors. In *Figure 18 on page 43* see contactor M1 and M2. The M1 contactor is called the

supply contactor because it will carry the full load current. The M2 contactor is called the pre-charge contactor because it will only carry the precharge current. The amount of current flowing into the bus capacitors is determined by the resistance value of R1, R2, and R3. These resistors are called the pre-charge resistors. The M1 and M2 contactors are control by the drive logic board. Although the M1 contactor coil requires more current then the logic board can provide. The logic board will control a small relay that will then provide the amount of current required for the M1 contactor to be energized. The small relay or what is frequently called a pilot relay is the same type of relay used to control the cooling fans and pumps.

Figure 18 on page 43 shows the pre-charge condition. The M2 contactor will be closed during the pre-charge period. The pre-charge period will take 12 seconds. In the condition of *Figure 18 on page 43* all three contacts on M2 are closed, and current will flow through all three phases in and out of the drive based on the line voltage for each phase. *Figure 18 on page 43* indicates that the 'A' phase voltage is positive relative to the 'C' phase voltage. In this condition, when the M2 contactor is closed current will flow through the M2-1 contact, pre-charge resistor R1, IGBT upper 1 diode, and bus capacitor. The current will returned to the 'C' phase through the IGBT lower 3 diode, pre-charge resistor R3, and the M2-3 contact. When the pre-charge time is complete the M2 contactor will open, and the M1 contactor will close, and remain closed for the duration of the run cycle.

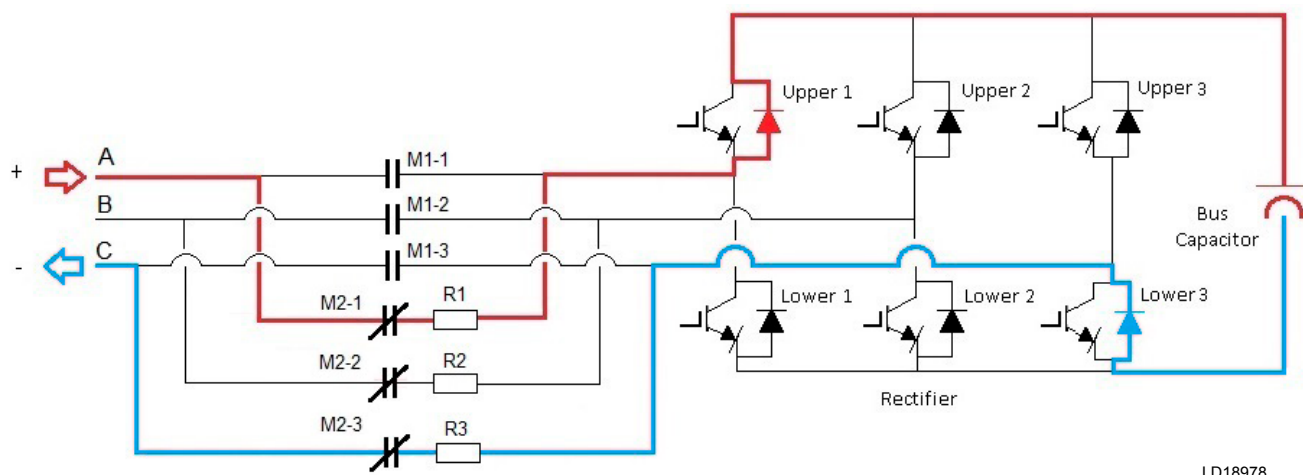


FIGURE 18 - INPUT RECTIFIER ELECTRICAL DIAGRAM HYP-A (DURING PRECHARGE OPERATION)

CONTROLS SECTION DETAILS

The OptiView Panel

The OptiView Panel used with today's HYP model drive provides all of the commands to the drive from the Microboard within the OptiView Panel. A shielded cable is used to provide the communication link between the OptiView Panel and the drive. This drive can only be connected to an OptiView Panel that has MODBUS communications. The new features of the HYP model drive are not supported through the YORK Protocol style of communications. The HYP model drive is built to only function within a chiller system. The drive cannot pre-charge, start, or run without communications from the OptiView Panel.

Various sensors located on the chiller provide data to the OptiView Panel. The software within the OptiView Panel determines the optimum operating speed for maximum chiller system efficiency.

The OptiView Panel utilizes a different approach to speed reduction compared to earlier variable speed products. Refer to the specific OptiView Control Panel operation and service book for detailed information. A list of this information can be found in the front of this book.

The Drive Operation

As described earlier, when the chiller enters the start mode, the drive is commanded by the OptiView Panel to pre-charge. The drive is pre-charged by energizing the pre-charge contactor and slowly charging the bus capacitors. This is called the pre-charge period, which last for 12-seconds. After the 12-second time period has expired the supply contactor will energize, and the pre-charge contactor will be de-energized. The supply contactor will remain energized for the duration of the run cycle.

After the 12-second time period has expired, the drive will enter the pre-regulation mode. In this mode, the rectifier IGBT's will start turning on and off and cause the bus voltage to increase to a regulated value of 785 VDC. The rectifier will continue to function until the OptiView Panel enters the stop mode or a drive fault is generated.

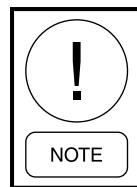
During the run state the drive is constantly monitoring the input voltage, input current, bus voltage, output voltage, output current, temperatures for the IGBT's,

and the internal ambient temperature. There are many devices and boards that are used to provide these functions, and they are described below.

Control Boards

The input line voltage isolator board is used to step down the input line voltage to the proper level that the drive logic board can read. The input line voltage information is compared to the bus voltage value to determine when and for how long the input IGBT's should be turn on or off to maintain the correct bus voltage. This board is also the source for the input line voltage peak, RMS voltage, voltage total harmonic distortion, total power factor, total supply KVA, input power, and input KW hours calculations data displayed on the OptiView panel, and in the fault history.

Input current value and wave shape are determined by a device called a direct current transducer (DCCT). This device is much faster at detecting changes in current than a wire wound AC current transformer. Most current transformers are designed to measure 50/60 Hz currents. The DCCT must be able to measure pulses of current very accurately. Since accuracy of the input current wave form is very important, one DCCT is needed for each phase. Power for this device is supplied from the drive logic board. The input current information is used by the drive logic board to determine when to draw current from the utility so the input current waveform meets the IEEE 519 standard for input current harmonics. These sensors are the source for the input current RMS, supply current total demand distortion, input % full load amps, input power, total power factor, total supply KVA, and the input KW hours calculations data displayed on the OptiView panel, and in the fault history.



If a DCCT needs to be replaced, verify that it is installed in the correct polarity. The DCCT has an arrow on top to indicate polarity. The replacement DCCT must have the arrow pointed in the same direction.

Bus voltage information is collected by the IGBT gate driver board on the B phase power assembly. The gate driver board provides current limiting of the bus voltage back to the drive logic board. This information is used by the drive logic board to ensure the bus voltage is properly regulated during pre-regulation and running states. This board is also the source for the DC bus voltage data displayed on the OptiView Panel.

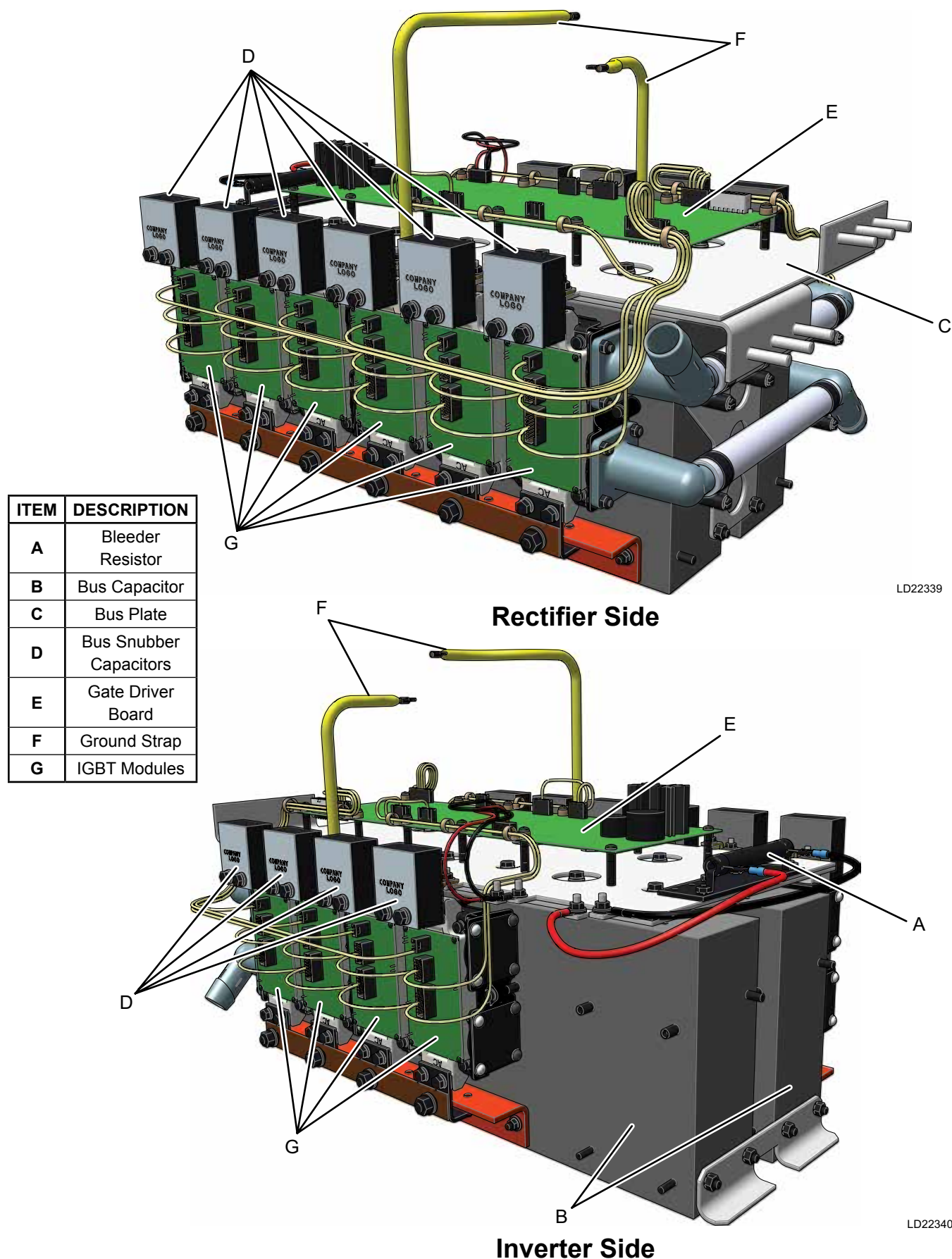
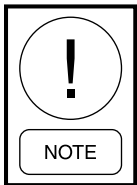


FIGURE 19 - POWER UNIT (MODEL HYP1100/1300A)

The output voltage of the drive is measured by the output voltage isolation board. The design of this board is very similar to the input voltage isolation board. It has 3 transformers on the board to step down the output voltage of the drive to the proper level so that the drive logic board can read the output voltage. The input and output voltage isolation boards are NOT inter-changeable. The output voltage isolation board contains an additional connector location so it cannot be used on the input of the drive. The drive logic board will use this information to determine the rotational speed of the motor rotor, the total harmonic distortion supplied to the motor, and determine how and when to turn on and off the inverter section of the drive. The data from the output voltage isolation board is also used to provide the OptiView Panel with the output motor voltage values.



The output voltage isolation board can be mounted upside down and cause a drive failure. Ensure that the connector installed in the J1 connector is the correct connector.

The output current of the drive is measured by the same type of device used to measure the input current, but it may have a different current range. The drive logic board uses this information to protect the output from instantaneous over current, shorted output, overload on the drive and motor. The data from the motor current transducer is also used to provide the OptiView Panel with the motor current values.

The gate driver board conditions the turn on and turn off commands from the drive logic board to the rectifier and inverter IGBT's, monitor its own power supplies, determine gate driver faults, and provide feedback for the IGBT temperatures. It also isolates the drive logic board from the bus voltage.

This drive contains just one logic board. The functions of controlling the motor and the harmonic filtering are combined into this board. The logic board also performs other numerous functions such as control the cooling fans and pumps, evaluate all fault conditions, when and how to pre-charge the bus capacitor or bus capacitors, maintain the correct bus voltage amplitude, generate the on and off commands for the rectifier and the inverter, and provide communications to the OptiView panel.

When the chiller enters a normal stop command the drive will continue to follow the speed command from the OptiView panel. The OptiView panel will begin to

unload the chiller. As the load and pressure across the compressor starts to go down, the output speed of the drive will go down. The drive will start to decelerate the motor to the programmed soft shutdown frequency. When the programmed soft shutdown frequency is reached all input and output power devices, and the supply contactor will be turned off. After the supply contactor is turn off the DC bus capacitors will start to discharge through the bleeder resistors.

The output DV/DT network is a resistor and capacitor circuit that will reduce the rate of rise in the output voltage of the drive. Without this device the compressor motor windings could be damaged.

The Harmonic Filter Operation

The HYP model drive can now control the input current waveform to a near sine wave shape by controlling when the rectifier is turned on and off. The Harmonic Filter of the past injected harmonic current into the input of the drive so the utility did not need to supply the harmonics.

Since the Harmonic Filter is now basically the input to the drive there is no need for the additional, pre-charge, power unit, Harmonic Filter logic board, and contactors for the harmonic filter of yesterday. The Harmonic Filter does not require its own pre-charge time, thus allowing the chiller to start or restart sooner. This is an important benefit to many customers. The reductions in parts counts will improve the reliability of the drive. The reduced parts count will also improve the ease of repair if a failure were to occur.

A line inductor is still needed to limit the rate of change in the input current. Without the line inductor the input current cannot be properly controlled and harmonic currents will be generated.

The rectifier now will provide two functions, allow current to flow into the DC bus capacitor during pre-charge, run, and control the input current waveform. A separate gate driver board is not needed for each function. One gate driver board is used to control the rectifier and inverter IGBT's for each phase.

The control for the harmonic filter works in such a manner that when current first flows into the drive a magnet field builds around the boost/load inductor. Since the current is flowing into the drive, the amplitude of the current is rising at the same time that the input voltage is rising. When the amplitude of current exceeds the desired value, the rectifier IGBT's switch state will chance. The change in switch state will cause

the magnet field in the boost/load inductor to fall, and it will supply current into the drive. Although, current will continue to flow into the drive the current needed from the input of the drive will go down, since the boost inductor is providing some of the current. Depending on how much of the magnet field of the boost inductor is used, determines if the current is rising or if the current is falling. In the case of the rising current, the switch state will require the current to flow so that the magnet field is building for a longer period of time then it is falling. In the case of the falling current, the switch state will require the current to flow so that the magnet field is falling for a longer period of time then it is building. The same principle is used to generate 20,000 volts from a 12 DC system in a car's ignition system.

The "trap" filter is integrated into all HYP drives. The "trap" filter is composed of a series of capacitors, inductors and resistors. The "trap" filter is used to reduce the effects of the PWM switching frequency from affecting other devices on the same power system.

Other Controls

Running the coolant pump no longer requires removing a plug from the drive logic board. The cooling system fans and pumps are now turned on by the press of a button on the OptiView Panel. Refer to the OptiView panel operations form in the front of this form for the location of this button. The input and output current limits are programmed from the OptiView Panel. This adjustment is no longer made on the drive logic board.

PROTECTION SECTION DETAILS

Many of the boards and sensors in the drive provide protection to the drive or the compressor motor.

The drive logic board is at the heart of the drive protection system. In all cases, the drive logic board makes the determination if there is a condition exists to cause a shutdown. Other boards and sensors provide the information to the drive logic board to make the determination. It is important to understand that the device providing the information about the fault could be causing the fault, or the connection between the device and the logic board could cause the problem as well. Many times the problem can be a bad, loose, or dirty connector. Remove the connector and reinstall the connector to clean the connection.

The line voltage isolator board is used to step down the input line voltage to the proper level so that the drive logic board can read the input voltage. The input line voltage information is compared to the bus voltage set-point value to determine when and for how long the input IGBT's should be turn on or off to maintain the correct bus voltage. Input phase rotation and phase loss information is also collected with this board.

Input current value and wave shape is determined by a device called a direct current transducer (DCCT). This device is needed to provide input current limit, and protect the rectifier from instantaneous over current events.

The gate driver board provides the bus voltage data to the drive logic board. This information is used to protect the drive from high and low bus voltages. The gate driver board generates the gate driver fault if the IGBT does not turn on when commanded, if power supplies within the gate driver circuit have failed, or if the current flowing through the IGBT is extremely high. The gate driver board does process the temperature information from the IGBT, in that it will only provide the highest temperature per phase to the drive logic board. The drive logic board determines if there is a temperature fault.

The output voltage of the drive is measured by the output voltage isolation board. This data is used to protect the motor from high level of voltage harmonics also known as THD.

The output current of the drive is measured by 3 DCCT's. The data from these devices are used to protect the motor and the output of the drive from overload conditions and from instantaneous over current events.

The drive logic board also determines shutdown conditions by monitoring the three phases of input and output current, baseplate temperatures, internal ambient temperatures, logic level power supplies, input and output voltage as well as the DC Bus voltage.

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SECTION 4 - SAFETY SHUTDOWNS

General Information

The Shutdowns are organized in alphabetical order based on the OptiView™ Control Center messages.

Whenever a Safety Shutdown is generated by the OSCD, a series of events will occur.

- If the chiller is not running at the time of the shutdown, the OSCD Logic Board will not turn on the gate drivers.
- The K3 relay on the OSCD logic board will de-energize to indicate to the Control Center that the OSCD has shutdown. The K3 relay will remain de-energized until the cause of the shutdown has been corrected.
- If the chiller is running at the time of the shutdown, the Control Center will start a coastdown

period (150 seconds for centrifugal chillers or shorter for those chillers that contain the optional “Quick Start” feature).

- The message “VSD Shutdown - Requesting Fault Data”...will be displayed when the Control Center is requesting the fault data from the OSCD.
- The OSCD Logic Board will send a shutdown code via the communications link to the Control Center. The Micro Board will interpret the shutdown code and display a shutdown message on the display of the Control Center.

After the coastdown period has timed out, the chiller may be restarted if the shutdown is no longer active, and the CLEAR FAULT key is pressed

4

TABLE 2 - SAFETY SHUTDOWNS MESSAGE

MESSAGE	DESCRIPTION						
VSD – 105% MOTOR CURRENT OVERLOAD	The 105% motor current overload value is based on the highest output current compared to the programmed Motor Current value displayed on the Control panel. The 105% motor current overload value is 1.05 times the programmed Motor Current value displayed on the Control panel. The motor current overload value must be greater than the shutdown value for 40 continuous seconds for this shutdown to occur.						
	<table><tr><th>DRIVE MODEL</th><th>MAXIMUM MOTOR CURRENT OVERLOAD SHUTDOWN VALUE</th></tr><tr><td>1100</td><td>1024 Amps</td></tr><tr><td>1300</td><td>1209 Amps</td></tr></table>	DRIVE MODEL	MAXIMUM MOTOR CURRENT OVERLOAD SHUTDOWN VALUE	1100	1024 Amps	1300	1209 Amps
	DRIVE MODEL	MAXIMUM MOTOR CURRENT OVERLOAD SHUTDOWN VALUE					
	1100	1024 Amps					
	1300	1209 Amps					
Possible Problems: • Ensure that the full load amp rating is properly set for the application. • Verify that the condenser liquid temperature is within the design specification for the application. • Ensure that the refrigerant level sensor system is working properly. • Measure the output current to ensure the drive is measuring the current properly.							

TABLE 2 - SAFETY SHUTDOWNS MESSAGE (CONT'D)

MESSAGE	DESCRIPTION				
VSD – DC BUS LOCKOUT – DO NOT CYCLE POWER	When the unit is stopped in a mode where no command exists to energize the DC bus, the DC bus voltage is monitored and checked against a threshold level of 100 VDC every five minutes. If the DC bus voltage is higher than the threshold value, this shutdown is generated. When the condition clears and the VSD rectifier modules are tested, then the chiller can be started. If power is removed, and then reapplied without correcting this problem more damage will occur to the drive, and the repair will be more costly. Possible Problems: • If the bus voltage value is approximately 600 VDC, then the rectifier IGBT maybe shorted. Refer to the Troubleshooting section near the back of this form. Perform test for Verify a Rectifier Failure. • If the bus voltage value is approximately 350 VDC, then the output of the drive maybe shorted to earth. The problem is typically in the compressor motor. • Ensure moisture does not build up on the motor stator windings. Perform a meg test on the compressor motor as defined in the chiller service manual. • If motor heaters were purchased, then ensure they are connected, and operating properly.				
VSD – DC BUS PRE-REGULATION LOCKOUT	If the unit fails to complete pre-regulation (due to VSD – DC BUS PRE-REGULATION fault), it shall have to repeat pre-charge in order to attempt another pre-regulation. The VSD shall wait 10 seconds before clearing the DC bus voltage pre-regulation fault and allowing another pre-charge to start. The unit's fan(s) and water pump(s) shall remain energized during this wait time. The drive shall allow up to three consecutive pre-regulation related faults (i.e. VSD-DC BUS PRE-REGULATION) to occur. After the third consecutive fault, this shutdown is generated. For details see VSD - DC BUS PRE-REGULATION in the cycling shutdown section.				
VSD – GROUND FAULT	This message is generated when the sum of the 3 phases of instantaneous input current values are greater than the shutdown value for a period of 1 second for the given model of drive listed below. <table border="1"> <thead> <tr> <th>DRIVE MODEL</th><th>GROUND CURRENT SHUTDOWN VALUE</th></tr> </thead> <tbody> <tr> <td>1100/1300</td><td>200 Amps</td></tr> </tbody> </table> Possible Problems: • Verify the input current is being measured properly. • Validate the control wiring between the input DCCT and the VSD logic board. • Phase shorted to ground at the rectifier. Disconnect the wiring from the L2 inductor. Measure the resistance from each phase of the rectifier to ground. A good resistance reading is 10 meg ohms or higher. A low resistance reading indicates a problem. Remove the power wire from the rectifier with the low resistance reading. Measure the resistance at the rectifier with the low resistance reading. If the resistance reading is now high, then inspect the power wiring on that phase for any torn or cut insulation. There may be a burn mark as well. If the resistance reading is still low, then inspect the rectifier assembly for any burn marks or loose hardware. There may be a voltage spacing issue i.e. bent bus bar or lug, any conductor that could have fallen into the normal voltage spacing.	DRIVE MODEL	GROUND CURRENT SHUTDOWN VALUE	1100/1300	200 Amps
DRIVE MODEL	GROUND CURRENT SHUTDOWN VALUE				
1100/1300	200 Amps				

TABLE 2 - SAFETY SHUTDOWNS MESSAGE (CONT'D)

MESSAGE	DESCRIPTION						
VSD – HIGH PHASE A INPUT BASEPLATE TEMPERATURE	The input/rectifier IGBT module temperatures are continuously monitored by the gate driver board where the highest temperature for each phase is read. The highest temperature is sent to the VSD logic board where the temperature is compared against a threshold value. If any IGBT module on the input/rectifier exceeds this threshold then this shutdown will occur. The cooling fans and pumps for the VSD will continue to run until the temperature of all the IGBT modules fall below 165°F (73.8°C). The temperature shutdown threshold value is drive model dependent. In April of 2016 the shutdown control for the fan(s) and pump(s) was changed. The control will now keep the fan(s) and pump(s) running for 2 minutes after the fault occurred. This change occurred in software version C.HYP.01.04.01, and C.HYP.02.04.01. When this happens, the unit's fan(s) and water pumps shall be de-energized. When the condition clears, the chiller can be started after the CLEAR FAULTS key is pressed. <table border="1"> <thead> <tr> <th>DRIVE MODEL</th><th>HIGH PHASE A INPUT BASEPLATE TEMPERATURE SHUTDOWN VALUE</th></tr> </thead> <tbody> <tr> <td>1100</td><td>170°F (76.6°C)</td></tr> <tr> <td>1300</td><td>150°F (65.5°C)</td></tr> </tbody> </table> Possible Problems: • Improper coolant venting, or air in the cooling system. • Improper coolant level for the drive. • Shipping coolant not drained at startup. • Clogged chill plate. • Low condenser liquid flow. This might occur with the head pressure control system. • Dirty shell and tube heat exchanger. Cleaning the heat exchanger is part of the annual maintenance. • Failure of the coolant pump.	DRIVE MODEL	HIGH PHASE A INPUT BASEPLATE TEMPERATURE SHUTDOWN VALUE	1100	170°F (76.6°C)	1300	150°F (65.5°C)
DRIVE MODEL	HIGH PHASE A INPUT BASEPLATE TEMPERATURE SHUTDOWN VALUE						
1100	170°F (76.6°C)						
1300	150°F (65.5°C)						
VSD – HIGH PHASE B INPUT BASEPLATE TEMPERATURE	See “VSD – HIGH PHASE ‘A’ INPUT BASEPLATE TEMPERATURE” message preceding.						
VSD – HIGH PHASE C INPUT BASEPLATE TEMPERATURE	See “VSD – HIGH PHASE ‘A’ INPUT BASEPLATE TEMPERATURE” message preceding.						
VSD – HIGH PHASE A INPUT CURRENT	The 3 phases of input current are constantly monitored. If the A phase current instantaneously exceeds the threshold defined in the cycling shutdowns, then the drive will shutdown. If this shutdown occurs on any of the phases 3 times within a 90 minute period this safety shutdown will occur. For details see VSD – High Phase A Input Current under the cycling shutdown section.						
VSD – HIGH PHASE B INPUT CURRENT	See “VSD – HIGH PHASE A INPUT CURRENT” message preceding.						
VSD – HIGH PHASE C INPUT CURRENT	See “VSD – HIGH PHASE A INPUT CURRENT” message preceding.						

TABLE 2 - SAFETY SHUTDOWNS MESSAGE (CONT'D)

MESSAGE	DESCRIPTION						
VSD – HIGH PHASE A MOTOR BASEPLATE TEMPERATURE	The motor/inverter IGBT module temperatures are continuously monitored by the gate driver board where the highest temperature for each phase is read. The highest temperature is sent to the VSD logic board where the temperature is compared against a threshold value. If any IGBT module on the motor/inverter exceeds this threshold value then this shutdown will occur. The cooling fans and pumps for the VSD will continue to run until the temperature of all the IGBT modules fall below 165°F (73.8°C). In April of 2016 the shutdown control for the fan(s) and pump(s) was changed. The control will now keep the fan(s) and pump(s) running for 2 minutes after the fault occurred. This change occurred in software version C.HYP.01.04.01, and C.HYP.02.04.01. When this happens, the unit's fan(s) and water pumps shall be de-energized. When the condition clears, the chiller can be started after the CLEAR FAULTS key is pressed. <table border="1"> <thead> <tr> <th>DRIVE MODEL</th><th>HIGH PHASE A MOTOR BASEPLATE TEMPERATURE SHUTDOWN VALUE</th></tr> </thead> <tbody> <tr> <td>1100</td><td>160°F (71.1°C)</td></tr> <tr> <td>1300</td><td>150°F (65.5°C)</td></tr> </tbody> </table> Possible Problems: • Improper coolant venting, or air in the cooling system. • Improper coolant level for the drive. • Shipping coolant not drained at startup. • Clogged chill plate. • Low condenser liquid flow. This might occur with the head pressure control system. • Dirty shell and tube heat exchanger. Cleaning the heat exchanger is part of the annual maintenance. • Failure of the coolant pump	DRIVE MODEL	HIGH PHASE A MOTOR BASEPLATE TEMPERATURE SHUTDOWN VALUE	1100	160°F (71.1°C)	1300	150°F (65.5°C)
DRIVE MODEL	HIGH PHASE A MOTOR BASEPLATE TEMPERATURE SHUTDOWN VALUE						
1100	160°F (71.1°C)						
1300	150°F (65.5°C)						
VSD – HIGH PHASE B MOTOR BASEPLATE TEMPERATURE	See “VSD – HIGH PHASE ‘A’ MOTOR BASEPLATE TEMPERATURE” message preceding.						
VSD – HIGH PHASE C MOTOR BASEPLATE TEMPERATURE	See “VSD – HIGH PHASE ‘A’ MOTOR BASEPLATE TEMPERATURE” message preceding.						
VSD – HIGH PHASE A MOTOR CURRENT	The 3 phases of motor current are constantly monitored. If the A phase current instantaneously exceeds 2164 amps, then the drive will shutdown. If this shutdown occurs on any of the phases 3 times within a 90 minute period this safety shutdown will occur. For details see VSD – High Phase A Motor Current under the cycling shutdown section.						
VSD – HIGH PHASE B MOTOR CURRENT	See “VSD – HIGH PHASE A MOTOR CURRENT” message preceding.						
VSD – HIGH PHASE C MOTOR CURRENT	See “VSD – HIGH PHASE A MOTOR CURRENT” message preceding.						
VSD – HIGH TOTAL DEMAND DISTORTION	This shutdown indicates the input current to the VSD is not sinusoidal. This shutdown will occur if the Total Demand Distortion (TDD) exceeds 25% continuously for 45 seconds. The displayed TDD is the sum of the harmonic currents up to the 50th harmonic supplied by the main power to the VSD divided by the Full Load Amps. Possible Problems: • Ensure the input current is measured properly. • Ensure the input current is balanced.						

TABLE 2 - SAFETY SHUTDOWNS MESSAGE (CONT'D)

MESSAGE	DESCRIPTION				
VSD – INPUT CURRENT OVERLOAD	The input current overload value is variable based on the Input Job Full Load Amps value programmed at the Control Panel. The input current overload value is 1.16 times the Input Job Full Load Amps value, but not to exceed the value for the given model of drive listed below. This calculation takes into account installations where the input line voltage could be up to 10% below the nominal value. An additional 5% of current is added to reduce nuisance shutdowns due to power fluctuations. To provide addition time for the chiller too unload, the input current overload value must be greater than the shutdown value for 10 continuous seconds for this shutdown to occur. <table border="1"> <thead> <tr> <th>DRIVE MODEL</th><th>INPUT CURRENT OVERLOAD MAXIMUM SHUTDOWN VALUE</th></tr> </thead> <tbody> <tr> <td>1100/1300</td><td>1305 Amps</td></tr> </tbody> </table> Possible Problems: • Verify in the fault history that the input voltage is balanced. A sag in one phase can cause this problem. • Verify in the fault history that the input voltage did not sag on all three phases. • Ensure that the input current is balanced in the fault history. Run the IGBT rectifier test function to ensure that the input/rectifier IGBT are turning on and off. (This test function can be found under <i>SECTION 8 - TROUBLESHOOTING PROCEDURES</i>) • Ensure that the Variable Geometry Diffuser (VGD) is working properly. • Verify if there was a quick change in condenser liquid flow or condenser liquid temperature.	DRIVE MODEL	INPUT CURRENT OVERLOAD MAXIMUM SHUTDOWN VALUE	1100/1300	1305 Amps
DRIVE MODEL	INPUT CURRENT OVERLOAD MAXIMUM SHUTDOWN VALUE				
1100/1300	1305 Amps				
VSD – INPUT DCCT OFFSET LOCKOUT	If three consecutive VSD – Phase A, B or C Input DCCT Offset cycling faults occur, this safety shutdown is generated to require investigation and manual reset. See Input DCCT Offset Cycling shutdown for more details.				
VSD – INVERTER PROGRAM FAULT	This drive will be used on 2 different motor designs. It is necessary to validate that the inverter software is correct for the motor designed used in the application. To ensure that the correct software is installed in the VSD logic board, three pieces of data must state that the correct inverter software is installed in the VSD logic board for this shutdown not to occur. The software in the VSD logic board U38, must match the condition on J2 pin 14, and the programmed motor selection from the chiller control center. Possible Problems: • For this application a wire should be connected to J2 pin 14 on the VSD logic board. • Verify that the chiller model number is correct on the Contract Screen of the control panel. • Verify that the correct chip is installed in U38.				
VSD – LINE VOLTAGE PHASE ROTATION	The drive will automatically determine the input voltage frequency. The information about the input voltage frequency is provided to the drive logic board by the line voltage isolation board. If the drive logic board cannot determine that the input voltage frequency is 50 or 60 Hz then this shutdown will occur. Possible Problems: • Verify that line voltage is balanced on the control panel. If the line voltages are balanced, then there may be a wiring problem at the line voltage isolation board, or the VSD logic board. Input wire L1, must be connected to J1 pin #1 on the line voltage isolation board, and J2 pin #1 on the line voltage isolation board must be connected to J25 pin #1 on the drive logic board. The wiring cannot be in any other order. The phases cannot be rotated or reversed within the drive wiring. Use the wiring diagrams found in this form to determine if all wiring between the input of the drive, through the line voltage isolation board, and to the drive logic board is correct. • Verify that the fuses that supply power to the line voltage isolation board are good. If a fuse is bad, then determine the reason for the fuse failure, and then replace the fuse.				

TABLE 2 - SAFETY SHUTDOWNS MESSAGE (CONT'D)

MESSAGE	DESCRIPTION
VSD – LOGIC BOARD HARDWARE	After power is applied to the chiller, the VSD logic board performs several internal tests to ensure proper operation of the input power device. If the tests fail, then this shutdown is generated. Possible Solution: • Replace the drive logic board.
VSD – LOGIC BOARD PLUG	For this drive to work properly input and output current waveforms are required by the drive logic board. To ensure that the drive logic board receives this information, a jumper is connected across the connector where the input and output currents are connected to the drive logic board. This way the drive logic board can prove that the connector is installed. Possible Problem: • Ensure that J2 is installed on the drive logic board. • Ensure that J3 is installed on the drive logic board. • Validate that a jumper is installed on J2 pin 11 to 13. • Validate that a jumper is installed on J3 pin 13 to 18. • Ensure that the pins and sockets for J2 and J3 are in good condition. • Replace the drive logic board.
VSD – MOTOR CURRENT IMBALANCE	Each phase of motor current is compared against the average of the three phases of motor current to determine the current imbalance value. If the current imbalance value is greater than 32 amps for a period of 45 seconds, then this shutdown is generated. For example: The three motor current RMS values are 200, 240, and 260 amps. This would be calculated to an average current of $(200 + 260 + 240)/3 = 233$ amps. Subtract the real current value from the average value. $200 - 233 = 33$, $260 - 233 = 33$, $240 - 233 = 7$. If this condition or worse were maintained for 45 seconds, then this shutdown is generated, because the motor current imbalance is 33 amps. Possible Problem: • Measure motor current to ensure the imbalance is real or a report error. • If one phase of motor current is consistently measuring wrong, then switch the position of the DCCT into one of the other phase position. • Ensure connectors J11-J13 are properly installed on the drive logic board. • Ensure the J1 connector is properly installed on each gate driver board. • Ensure the connectors are properly installed at the motor DCCT's. • Replace the drive logic board.
VSD – MOTOR CURRENT THD FAULT	This shutdown is designed to protect the compressor motor from overheating due to the effects of current harmonics produced by the VSD. Information from the output voltage isolation board is used to determine the output frequency of the drive. Then information from the output DCCT's is used within the drive logic board to determine the current harmonics presented to the motor. If the current harmonics are above a preset value determined by the drive logic board, then this shutdown will occur. Possible Problems: • In the shutdown history is the output voltage balanced? If the output voltage is not balanced, then ensure the fuses that provide power to the output voltage isolation board are good, and verify the wiring between the output of the drive to the output voltage isolation board, and then to the VSD logic board. Check for rotation of phase voltage in the wiring and for good electrical connections on all connectors. • In the shutdown history is the output current balanced? If the output current is not balanced, then verify the wiring between the outputs of the DCCT's to the VSD logic board. Check for rotation of phase current in the wiring and for good electrical connections on all connectors. • Ensure that the upper and lower gate drivers are working properly. Inverter Test Mode will test the motor/inverter gate drivers. See SECTION 8 - TROUBLESHOOTING PROCEDURES for details. • Ensure that the DCCT's are installed so that the direction arrow is pointing toward the motor terminal connection.

TABLE 2 - SAFETY SHUTDOWNS MESSAGE (CONT'D)

MESSAGE	DESCRIPTION												
VSD – PHASE A INPUT DCCT	This shutdown determines if the cable at the input DCCT is connected. The input current in each phase to the VSD is measured during the precharge time. If the input current does not exceed 5 amps in each phase, then this shutdown is generated. Possible Problems: • Cable is not properly installed on the input/rectifier DCCT for the phase reported in the message. • Ensure the pre-charge contactor is energized during the pre-charge period. • Ensure that the pins and sockets are not damaged inside the housing on the DCCT, or the socket on the cable. • The DCCT is provided with a +20 VDC supply, it is connected to pin #2 on the DCCT. Validate that the power supply is present at the input DCCT on pin 2. If the power supply is not present, then ensure that the power supply is present at the drive logic board on J2 pins 1, 4, and 7. If the power supply is not present, the replace the drive logic board. • The DCCT is provided with a -20 VDC supply, it is connected to pin #3 on the DCCT. Validate that the power supply is present at the input DCCT on pin 3. If the power supply is not present, then ensure that the power supply is present at the drive logic board on J2 pins 3, 6, and 9. If the power supply is not present, the replace the drive logic board. • Perform a resistance test on the sensor wire of the input DCCT. This wire is connected to pin 4 on the DCCT housing. The input at the drive logic board depends on which phase this shutdown is occurring on. See the chart below for the appropriate connection on the logic board. Replace the harness if this test fails. <table><tr><th>PHASE THAT SHUTDOWN OCCURS ON</th><th>DCCT ASSOCIATED WITH SHUTDOWN</th><th>INPUT TO DRIVE LOGIC BOARD</th></tr><tr><td>Phase A</td><td>1 DCCT</td><td>J2 – Pin 2</td></tr><tr><td>Phase B</td><td>2 DCCT</td><td>J2 – Pin 5</td></tr><tr><td>Phase C</td><td>3 DCCT</td><td>J2 – Pin 8</td></tr></table> • Failure of the DCCT - Rotate the input DCCT that is always having the shutdown into one of the other phases. This will require the removal of the DCCT and the installation of this DCCT into one of the other phases. Just switching the control wiring to the DCCT will cause a failure in the input/rectifier. If this shutdown occurs on the same phase, then replace the drive logic board. If this shutdown follows the placement of the DCCT, then replace the DCCT.	PHASE THAT SHUTDOWN OCCURS ON	DCCT ASSOCIATED WITH SHUTDOWN	INPUT TO DRIVE LOGIC BOARD	Phase A	1 DCCT	J2 – Pin 2	Phase B	2 DCCT	J2 – Pin 5	Phase C	3 DCCT	J2 – Pin 8
	PHASE THAT SHUTDOWN OCCURS ON	DCCT ASSOCIATED WITH SHUTDOWN	INPUT TO DRIVE LOGIC BOARD										
	Phase A	1 DCCT	J2 – Pin 2										
Phase B	2 DCCT	J2 – Pin 5											
Phase C	3 DCCT	J2 – Pin 8											
VSD – PHASE B INPUT DCCT	See “VSD –PHASE A INPUT DCCT” message preceding.												
VSD – PHASE C INPUT DCCT	See “VSD –PHASE A INPUT DCCT” message preceding.												

TABLE 2 - SAFETY SHUTDOWNS MESSAGE (CONT'D)

MESSAGE	DESCRIPTION												
VSD – PHASE A MOTOR DCCT	This shutdown determines if the cable at the motor DCCT is connected. This shutdown is generated 1.5 seconds after the motor is commanded to run command if the motor current does not exceed 25 amps. Possible Problems: • Measure the output current to ensure that the drive is starting to run. • Cable is not properly installed on the output/motor DCCT for the phase reported in the message. • Ensure that the pins and sockets are not damaged inside the housing on the DCCT. • The DCCT is provided with a +20 VDC supply, it is connected to pin #2 on the DCCT. Validate the power supply is present at the input DCCT on pin 2. If the power supply is not present, then ensure that the power supply is present at the drive logic board on J3 pins 1, 4, and 7. If the power supply is not present, the replace the drive logic board. • The DCCT is provided with a -20 VDC supply, it is connected to pin #3 on the DCCT. Validate the power supply is present at the input DCCT on pin 3. If the power supply is not present, then ensure that the power supply is present at the drive logic board on J3 pins 3, 6, and 9. If the power supply is not present, the replace the drive logic board. • Perform a resistance test on the sensor wire of the input DCCT. This wire is connected to pin 4 on the DCCT housing. The input at the drive logic board depends on which phase this shutdown is occurring on. See the chart below for the appropriate connection on the logic board. Replace the harness if this test fails. <table><tr><th>PHASE THAT SHUTDOWN OCCURS ON</th><th>DCCT ASSOCIATED WITH SHUTDOWN</th><th>INPUT TO DRIVE LOGIC BOARD</th></tr><tr><td>Phase A</td><td>4 DCCT</td><td>J3 – Pin 2</td></tr><tr><td>Phase B</td><td>5 DCCT</td><td>J3 – Pin 5</td></tr><tr><td>Phase C</td><td>6 DCCT</td><td>J3 – Pin 8</td></tr></table> • Failure of the DCCT - Rotate the input DCCT that is always having the shutdown into one of the other phases. This will require the removal of the DCCT and the installation of this DCCT into one of the other phases. Just switching the control wiring to the DCCT will cause a failure in the motor/inverter. If this shutdown occurs on the same phase, then replace the drive logic board. If this shutdown follows the placement of the DCCT, then replace the DCCT.	PHASE THAT SHUTDOWN OCCURS ON	DCCT ASSOCIATED WITH SHUTDOWN	INPUT TO DRIVE LOGIC BOARD	Phase A	4 DCCT	J3 – Pin 2	Phase B	5 DCCT	J3 – Pin 5	Phase C	6 DCCT	J3 – Pin 8
PHASE THAT SHUTDOWN OCCURS ON	DCCT ASSOCIATED WITH SHUTDOWN	INPUT TO DRIVE LOGIC BOARD											
Phase A	4 DCCT	J3 – Pin 2											
Phase B	5 DCCT	J3 – Pin 5											
Phase C	6 DCCT	J3 – Pin 8											
VSD – PHASE B MOTOR DCCT	See “VSD –PHASE A MOTOR DCCT” message preceding.												
VSD – PHASE C MOTOR DCCT	See “VSD –PHASE A MOTOR DCCT” message preceding.												
VSD – PHASE LOCKED LOOP	The drive will automatically determine the input voltage frequency. The information about the input voltage frequency is provided to the drive logic board by the line voltage isolation board. If the drive logic board cannot determine that the input voltage frequency is 50 or 60 Hz then this shutdown will occur. Possible Problems: • Verify that line voltage is balanced on the control panel. If the line voltages are balanced, then there may be a wiring problem at the line voltage isolation board, or the VSD logic board. Input wire L1, must be connected to J1 pin #1 on the line voltage isolation board, and J2 pin #1 on the line voltage isolation board must be connected to J25 pin #1 on the drive logic board. The wiring cannot be in any other order. The phases cannot be rotated or reversed within the drive wiring. Use the wiring diagrams found in this form to determine if all wiring between the input of the drive, through the line voltage isolation board, and to the drive logic board is correct. • Verify that the fuses that supply power to the line voltage isolation board are good. If a fuse is bad, then determine the reason for the fuse failure, and then replace the fuse.												

TABLE 2 - SAFETY SHUTDOWNS MESSAGE (CONT'D)

MESSAGE	DESCRIPTION
VSD – PRECHARGE LOCKOUT	If the unit fails to complete pre-charge (due to VSD – PRECHARGE – LOW DC BUS VOLTAGE, the VSD shall time 10 seconds before clearing the fault and allowing another pre-charge to start. The unit's fan(s) and water pump(s) shall remain energized during this time. The VSD shall allow up to three consecutive pre-charge related faults to occur. After the third consecutive pre-charge-related fault, this shutdown is generated.
VSD – RECTIFIER PROGRAM FAULT	After power is applied, the drive logic board will verify that the two software programs on the drive logic board are compatible with each other, and that the application of the software is the same as the application of the VSD. If these items are not compatible, then this shutdown will occur. Possible Problems: • Wrong software version is installed. Review the shutdown history for this shutdown. Under the VSD section of the history is the software version numbers for the inverter and rectifier software. The inverter software version must be in the following format, C.HYP.02.xx.xx. The rectifier software version must be in the following format, C.HYP.01.xx.xx. The values that replace the xx.xx in the software version must have the same numbers. • The drive is configured for the wrong application. This drive will be used to control a permanent magnet motor or an induction motor. The induction motor application requires a jumper connected to J2 pin 14 on the drive logic board. If a wire is not installed in J2 pin 14, then a jumper should be installed.
VSD SHUTDOWN – REQUESTING FAULT DATA	The VSD has shut down the chiller and the control center has not yet received the cause of the fault from the VSD, via the serial communications link. The VSD shuts down the chiller by opening the Motor Controller “VSD Stop Contacts” (located on the VSD Logic Board and connected between TB6-16 and TB6-53 in the control center). The Microboard in the control center then sends a request for the cause of the fault to the VSD Logic Board over the serial link. Since serial communications are initiated every 2 seconds, this message is typically displayed for a few seconds and then replaced with one of the other VSD fault messages.

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SECTION 5 - CYCLING SHUTDOWNS

General Information

The Shutdowns are organized in alphabetical order based on the OptiView Control Center Panel messages. The Microcomputer Control Panel messages are also included under these headings.

Whenever the OSCD or Harmonic Filter Logic Board generates a Cycling Shutdown a series of events will occur.

- If the chiller is not running at the time of the shutdown, the OSCD Logic Board will not turn on the output transistors.
- The K1 relay on the OSCD logic board will de-energize. This action will indicate to the Control Center that the OSCD has shutdown. The K1 relay will remain de-energized until the cause of the shutdown has been corrected.

- If the chiller is running at the time of the shutdown, the Control Center will start a coastdown period (150 seconds for centrifugal chillers).
- The message “VSD Shutdown - Requesting Fault Data”...will be displayed when the Control Center is requesting the fault data from the OSCD.
- The OSCD or Harmonic Filter Logic Board will send a shutdown code to the Control Center. The Micro Board will interpret the shutdown code, and display a shutdown message on the display of the Control Center.

After the coastdown period has timed out, the chiller will automatically restart if the shutdown is no longer active.

TABLE 3 - CYCLING SHUTDOWN MESSAGE

MESSAGE	DESCRIPTION												
VSD – DC BUS PRE-REGULATION	The DC bus voltage has not increased to a value of +/- 50 volts of the DC bus voltage setpoint within 2 seconds after entering the pre-regulation state. The setpoint value is dependent on the rated input voltage of the VSD, and the rated motor voltage. If this condition does not pass, then this shutdown is generated. The VSD will attempt another pre-charge and pre-regulation cycle after a delay of 10 seconds. If this shutdown occurs three consecutive times, then the chiller will lock out on a “VSD – DC BUS PRE-REGULATION LOCKOUT”.												
	<table><tr><th>RATED INPUT VOLTAGE</th><th>RATED MOTOR VOLTAGE</th><th>DC BUS VOLTAGE SETPOINT</th></tr><tr><td>380-415</td><td>380-460</td><td>680</td></tr><tr><td>460</td><td>380-460</td><td>750</td></tr><tr><td>380-460</td><td>575</td><td>820</td></tr></table>	RATED INPUT VOLTAGE	RATED MOTOR VOLTAGE	DC BUS VOLTAGE SETPOINT	380-415	380-460	680	460	380-460	750	380-460	575	820
	RATED INPUT VOLTAGE	RATED MOTOR VOLTAGE	DC BUS VOLTAGE SETPOINT										
	380-415	380-460	680										
	460	380-460	750										
380-460	575	820											
Possible Problems: • Verify the gate driver LED’s are lit on each gate driver board. Each board should have 4 lit LED’s whenever power is applied to the VSD. If the LED’s are not lit, then ensure J1 is installed on each gate driver board. Ensure 24 VAC is available on the secondary of T5. • Ensure the J2 connectors are properly seated on each gate driver board, and all wires properly inserted into the connector. • Ensure J8, J9 and J10 are properly installed on the drive logic board. • Verify in manual Pre-Regulation that the bus voltage is increasing. If the bus voltage is not increasing verify the rectifier IGBT gate driver LED’s are flashing on the drive logic board. Perform the rectifier LED test found in the <i>SECTION 8 - TROUBLESHOOTING PROCEDURES</i>. If the rectifier gate driver LED’s are not flashing then replace the drive logic board.													

TABLE 3 - CYCLING SHUTDOWN MESSAGE (CONT'D)

MESSAGE	DESCRIPTION				
VSD – HIGH DC BUS VOLTAGE	If the DC bus voltage exceeds the HIGH DC BUS VOLTAGE SHUTDOWN VALUE, then this shutdown will occur. Typically, this shutdown will occur when there is a sudden change in the input voltage due to storms, utility power problems, or site power problems. <table border="1"> <tr> <th>DRIVE MODEL</th><th>HIGH DC BUS VOLTAGE SHUTDOWN VALUE</th></tr> <tr> <td>1100/1300</td><td>985 VDC</td></tr> </table> Possible Problem: • A rapid line voltage event has occurred. If the VSD restarts automatically and runs until the chiller is stopped, then the line voltage event is most likely the cause. • The output of the VSD is shorted to earth. Disconnect the motor from the VSD, and try to start the chiller. If a different shutdown occurs, then the motor is shorted to earth. If the same shutdown occurs, then there maybe a problem with the DV/DT network. • Motor/Inverter IGBT shorted to earth. Measure resistance from the output of the motor/ inverter IGBT to earth. A measurement of 5 Meg ohms or higher is not a failure. A lower resistance value will require an inspection of this area of the VSD. A loose wire or washer may cause a ground connection. If an inspection does not reveal a problem, then replace the Motor/Inverter assembly that has the low resistance reading.	DRIVE MODEL	HIGH DC BUS VOLTAGE SHUTDOWN VALUE	1100/1300	985 VDC
DRIVE MODEL	HIGH DC BUS VOLTAGE SHUTDOWN VALUE				
1100/1300	985 VDC				
VSD – HIGH INTERNAL AMBIENT TEMPERATURE	The variable speed drive contains two ambient temperature sensors, which monitor the unit's internal ambient temperature. This shutdown is generated when the higher of the two ambient temperatures exceeds a high limit of 158°F (70°C). The unit's fan(s) and water pump(s) remain energized until the internal temperature drops below 148°F (64°C), after which they shall be de-energized and the fault can be cleared. Possible Problems: • Improper coolant level for the VSD. • Failure to replace the shipping inhibitor with the running inhibitor. • Failure of the internal fan. • Failure of the fan/pump relay. • Loose or improper wire connections on the circuit breaker. • Improper purging of air from the cooling system causing the input inductor to overheat. • Dirty shell and tube heat exchanger. Regular maintenance of the shell and tube heat exchanger is required. It is recommended that the tubes of the heat exchanger are cleaned at least once a year. • Low condenser water flow. The VSD requires 8 feet of head on the condenser to maintain adequate flow through the heat exchanger. • Using higher than designed condenser liquid temperature.				

TABLE 3 - CYCLING SHUTDOWN MESSAGE (CONT'D)

MESSAGE	DESCRIPTION						
VSD – HIGH PHASE A INPUT CURRENT	If the A phase input current exceeds the value for the given model of drive, then a cycling shutdown will occur. If three high input current cycling shutdown faults occur on any phase within 90 minutes, the third fault in the 90 minute period will cause a Safety Shutdown. If the safety shutdown occurs, the chiller can be restarted after the CLEAR FAULTS key is pressed. <table border="1"> <thead> <tr> <th>DRIVE MODEL</th><th>INPUT CURRENT FAULT VALUE</th></tr> </thead> <tbody> <tr> <td>1100</td><td>3304 Amps</td></tr> <tr> <td>1300</td><td>2796 Amps</td></tr> </tbody> </table> Possible Problems: If the high current shutdown occurs on different phases. • Large power consuming equipment connected to the same power source is causing a line voltage sag. • Storm event can cause a surge in the line voltage. • The switching of power factor correction capacitors at the customer site or at the utility. Possible Problems: If the high current shutdown occurs on the same phase. • There may be a problem in the measurement of the input current. Rotate the input DCCT that is always having the shutdown into one of the other phases. This will require the removal of the DCCT and the installation of this DCCT into one of the other phase. Just switching the control wiring to the DCCT will cause a failure in the input/rectifier. If the high current shutdown occurs on the same phase, then replace the drive logic board. If the high current shutdown follows the placement of the DCCT, then replace the DCCT.	DRIVE MODEL	INPUT CURRENT FAULT VALUE	1100	3304 Amps	1300	2796 Amps
DRIVE MODEL	INPUT CURRENT FAULT VALUE						
1100	3304 Amps						
1300	2796 Amps						
VSD – HIGH PHASE B INPUT CURRENT	See "VSD – HIGH PHASE A INPUT CURRENT" message preceding.						
VSD – HIGH PHASE C INPUT CURRENT	See "VSD – HIGH PHASE A INPUT CURRENT" message preceding.						
VSD – HIGH PHASE A MOTOR CURRENT	If the A phase motor current exceeds the value for the given model of drive, then a cycling shutdown will occur. If three high motor current cycling shutdown faults occur on any phase within 90 minutes, the third fault in the 90 minute period will cause a Safety Shutdown. If the safety shutdown occurs, the chiller can be restarted after the CLEAR FAULTS key is pressed. <table border="1"> <thead> <tr> <th>DRIVE MODEL</th><th>MOTOR CURRENT FAULT VALUE</th></tr> </thead> <tbody> <tr> <td>1100/1300</td><td>2164 Amps</td></tr> </tbody> </table> Possible Problems: If the high current shutdown occurs on different phases. • Large power consuming equipment connected to the same power source is causing a line voltage sag. • Storm event can cause a surge in the line voltage. • The switching of power factor correction capacitors at the customer site or at the utility. • One phase on the output of the VSD is not turning on. This problem will cause the two phases that are working to have high current values. If the C phase is not turning on, then sometimes the A phase will cause the high current shutdown and other times the B phase will cause the high current shutdown. Ensure that the gate driver LED's are lit for all phases on the gate driver boards. Perform the Inverter Test found in <i>SECTION 8 - TROUBLESHOOTING PROCEDURES</i> of this form. Possible Problems: If the high current shutdown occurs on the same phase. • Ensure that the motor is not shorted across a phase.	DRIVE MODEL	MOTOR CURRENT FAULT VALUE	1100/1300	2164 Amps		
DRIVE MODEL	MOTOR CURRENT FAULT VALUE						
1100/1300	2164 Amps						
VSD – HIGH PHASE B MOTOR CURRENT	See "VSD – HIGH PHASE A MOTOR CURRENT" message preceding.						
VSD – HIGH PHASE C MOTOR CURRENT	See "VSD – HIGH PHASE A MOTOR CURRENT" message preceding.						

TABLE 3 - CYCLING SHUTDOWN MESSAGE (CONT'D)

MESSAGE	DESCRIPTION
VSD – INITIALIZATION FAILED	Upon application of power, all boards go through the initialization process. At this time, memory locations are cleared, program jumper positions are checked and serial communications links are established. If this process is not completed the OptiView panel will indicate this fault. There are several causes for an unsuccessful initialization as follows: Serial data communications must be established. Refer to VSD – Serial Communications fault. If communications between the VSD Logic Board, and control center Microboard does not take place during initialization, this message will be generated. The Serial communications can be verified by selecting the VSD DETAILS screen from the MOTOR screen and observing the Full Load amps value. A zero displayed for this and other VSD parameters, indicates a serial communications link problem. Possible Problems: • Configuration problem on the drive logic board. Verify that all of the switches for SW1 and SW2 are in the off position. • Configuration problem on the control center. Verify that the communication setting are properly setup as per Form 160.54-M1.
VSD – INVALID SETPOINTS	The VSD Logic Board is able to determine which model of drive can run which model of motor. If the Control Center provides a model of motor that is not compatible with this model of VSD, then this shutdown is generated. When this condition clears, the chiller can be started after the CLEAR FAULTS key is pressed. Possible Problems: • Validate that the chiller model number is correct on the chiller control center. • Validate that the drive model number is correct on the chiller control center. • For this application, ensure that is a wire installed on the drive logic board at J2 pin 14 in the harness connector. • Ensure a wire jumper is installed from J3 pin 12 to J3 pin 17, and a jumper from J3 pin 13 to J3 pin 18 in the harness connector. Ensure that the sockets are properly seated in the housing, and that the socket is not bent. The socket may need to be removed from the housing using the correct tool to ensure that the wire is properly crimped. The table below will show the correct wire jumper setting.
VSD – LOGIC BOARD POWER SUPPLY	The drive logic board determines if the low voltage power supplies on the drive logic board are maintained within specification. If any one of the low voltage power supplies is running outside the specification this shutdown will occur. It is normal for this shutdown message to be present in the fault history every time control power is applied to the VSD. Possible Problems: • Loss of power to the drive logic board. The drive logic board has 2 separate power supply sections. Each section requires a 24 VAC source. The 24 VAC source is provided to the drive logic board on J17 and J19. Ensure that these connectors are properly connected to the drive logic board. Inspect the pins, sockets, and housings on these connectors to ensure that nothing is damaged. • Loss of power to the drive logic board. Two separate transformers provide power to the drive logic board. Transformer 3T provides power to J17, and 4T provides power to J19. Ensure 24 VAC is present on J17 and J19. If the voltage is not present, then verify the connections at the transformers. • Ensure 120 VAC is provide to the primary of this transformer. If 120 VAC is present on the primary of the transformer, but 24 VAC is not present on the secondary, then replace the transformer. • Power supply failure. The drive logic board contains several test points for power supplies. These test points are located between J17 and J19 on the drive logic board. Each test point has the power supply voltage written by the pin. Measure each test point, if any of the voltages to do read properly then replace the drive logic board.

TABLE 3 - CYCLING SHUTDOWN MESSAGE (CONT'D)

MESSAGE	DESCRIPTION
VSD – LOGIC BOARD PROCESSOR	The drive logic board contains several microprocessors. This shutdown is generated when the communications between these microprocessors stop communicating for a period of 1.5 seconds. Possible Problems: • Failure of the drive logic board. Replace the drive logic board.
VSD – LOW PHASE A INPUT BASEPLATE TEMPERATURE	This shutdown is generated anytime input/rectifier modules temperature drops below 37°F (2.7°C). This shutdown cannot be reset until the temperature of all modules exceeds 42°F (5.5°C). The fans and pumps for the VSD will continue to run until the temperature exceeds the reset level. Possible Problem: • Loose wire – Each IGBT module contains a temperature sensor. The highest of the temperatures for each phase is reported to the drive logic board. So, a loose wire on a single IGBT module cannot cause this problem. • Loose or broke connector – • Verify the J1 connector is installed on each of the gate resistor boards. • Ensure the J11 connector is properly installed on the gate driver board. • Ensure that the wires on J2 pin 5 and pin 11 are properly installed on the gate driver board. Verify that the J6 connector is properly connected on the drive logic board. Any loose or broken wire on the J6 connector can cause this shutdown.
VSD – LOW PHASE B INPUT BASEPLATE TEMPERATURE	See “VSD – LOW PHASE A INPUT BASEPLATE TEMPERATURE” message preceding.
VSD – LOW PHASE C INPUT BASEPLATE TEMPERATURE	See “VSD – LOW PHASE A INPUT BASEPLATE TEMPERATURE” message preceding.
VSD – LOW PHASE A MOTOR BASEPLATE TEMPERATURE	This shutdown is generated anytime motor / inverter modules temperature drops below 37°F (2.7°C). This shutdown cannot be reset until the temperature of all modules exceeds 42°F (5.5°C). The fans and pumps for the VSD will continue to run until the temperature exceeds the reset level. Possible Problem: • Loose wire – Each IGBT module contains a temperature sensor. The highest of the temperatures for each phase is reported to the drive logic board. So, a loose wire on a single IGBT module cannot cause this problem. • Loose or broke connector - • Verify the J1 connector is installed on each of the gate resistor boards. • Ensure the J10 connector is properly installed on the gate driver board. • Ensure the wires on J2 pin 11 and pin 12 are properly installed on the gate driver board. • Verify the J6 and J7 connectors are properly connected on the drive logic board. Any loose or broken wire on the J6 connector can cause this shutdown.
VSD – LOW PHASE B MOTOR BASEPLATE TEMPERATURE	See “VSD – LOW PHASE A MOTOR BASEPLATE TEMPERATURE” message preceding.
VSD – LOW PHASE C MOTOR BASEPLATE TEMPERATURE	See “VSD – LOW PHASE A MOTOR BASEPLATE TEMPERATURE” message preceding.
VSD – NOT RUNNING	The OptiView panel will determine this fault when the VSD has not reported run state via serial communications for 8 seconds while the microboard issues a VSD run command. The fault is released when the microboard command is “Stopped State”. Possible Problem: • The VSD has not received a run command from the OptiView panel. Verify wiring in the OptiView panel.
VSD – PHASE A INPUT DCCT OFFSET	See “VSD – PHASE A INPUT DCCT OFFSET LOCKOUT” In the Safety Shutdown Message section for details.

TABLE 3 - CYCLING SHUTDOWN MESSAGE (CONT'D)

MESSAGE	DESCRIPTION
VSD – PHASE B INPUT DCCT OFFSET	See “VSD – PHASE A INPUT DCCT OFFSET LOCKOUT” In the Safety Shutdown Message section for details.
VSD – PHASE C INPUT DCCT OFFSET	See “VSD – PHASE A INPUT DCCT OFFSET LOCKOUT” In the Safety Shutdown Message section for details.
VSD – PHASE A INPUT GATE DRIVER	This shutdown is generated when one of the input gate driver power supplies is operating outside of tolerance, or the voltage across the input / rectifier IGBT is too high. The gate driver board determines this shutdown, and provides feedback to the VSD logic board that this shutdown occurred. Possible Problems: • One of the gate driver LED's are not lit. Ensure that all of the gate driver LED's are lit on each phase for the input/rectifier. There are 2 LED's for each phase. If only one LED is lit, then replace that gate driver board. • If none of the gate driver LED's are lit on one phase. Measure 24 VAC at the J1 connector of the gate driver board. If 24 VDC is present. Inspect the housing, pins and sockets for the J1 connector. Replace any damaged parts associated with the J1 connector. If no problem exist with the connector, then replace the gate driver board. • If none of the gate driver LED's are lit on any of the phases. Ensure 14FU are 15FU are not open. Determine root cause of the fuse failure and then replace the fuse. If 14FU or 15FU are not open, then verify that 24 VAC is present on the output of 5T. If 24 VAC is not present on the output of 5T, then verify 120 VAC is present on the input of 5T. If 120 VAC is present on the input of 5T, and 24 VAC is not present on the output of 5T, then replace 5T. • If the gate driver fault occurs on the same phase all of the time and is present when power is applied. Rotate the gate drive connectors on the drive logic board J8, J9, and J10.  WARNING <i>Only apply power for this test. Do not attempt to run the chiller. Failure of the input/rectifier will occur. If the shutdown remains on the same phase, then re-place the drive logic board, If the shutdown follows the gate driver board, then verify the wiring between J8, J9, and J10 on the drive logic board to J2 on the gate driver board. J8, J9, J10 must be returned to their original positions before running the chiller.</i> • Perform the Rectifier Test found in SECTION 8 - TROUBLESHOOTING PROCEDURES.
VSD – PHASE B INPUT GATE DRIVER	See “VSD – PHASE A INPUT GATE DRIVER” message preceding.
VSD – PHASE C INPUT GATE DRIVER	See “VSD – PHASE A INPUT GATE DRIVER” message preceding.

TABLE 3 - CYCLING SHUTDOWN MESSAGE (CONT'D)

MESSAGE	DESCRIPTION
VSD – PHASE A MOTOR GATE DRIVER	This shutdown is generated when one of the motor gate driver power supplies is operating outside of tolerance, or the voltage across the motor IGBT is too high. The gate driver board determines this shutdown, and provides feedback to the VSD logic board that this shutdown occurred. Possible Problems: • One of the gate driver LED's are not lit. Ensure that all of the gate driver LED's are lit on each phase for the motor. There are 2 LED's for each phase. If only one LED is lit, then replace that gate driver board. • If none of the gate driver LED's are lit on one phase. Measure 24 VAC at the J1 connector of the gate driver board. If 24 VDC is present. Inspect the housing, pins and sockets for the J1 connector. Replace any damaged parts associated with the J1 connector. If no problem exist with the connector, then replace the gate driver board. • If none of the gate driver LED's are lit on any of the phases. Ensure 14FU are 15FU are not open. Determine root cause of the fuse failure and then replace the fuse. If 14FU or 15FU are not open, then verify that 24 VAC is present on the output of 5T. If 24 VAC is not present on the output of 5T, then verify 120 VAC is present on the input of 5T. If 120 VAC is present on the input of 5T, and 24 VAC is not present on the output of 5T, then replace 5T. • If the gate driver fault occurs on the same phase all of the time and is present when power is applied. Rotate the gate drive connectors on the drive logic board J11, J12, and J13. <i>Only apply power for this test. Do not attempt to run the chiller. Failure of the input/rectifier will occur. If the shutdown remains on the same phase, then re-place the drive logic board, If the shutdown follows the gate driver board, then verify the wiring between J11, J12, and J13 on the drive logic board to J2 on the gate driver board. J11, J12, and J13 must be returned to their original positions before running the chiller.</i> • Perform the Motor/Inverter Test found in SECTION 8 - TROUBLESHOOTING PROCEDURES.
VSD – PHASE B MOTOR GATE DRIVER	For details see "VSD – Phase A Motor Gate Driver" message preceding.
VSD – PHASE C MOTOR GATE DRIVER	For details see "VSD – Phase A Motor Gate Driver" message preceding.

TABLE 3 - CYCLING SHUTDOWN MESSAGE (CONT'D)

MESSAGE	DESCRIPTION									
VSD – PRECHARGE – LOW DC BUS VOLTAGE	During precharge, the DC bus voltage must exceed 2 minimum threshold which is based on Line Voltage Setpoint. The first minimum threshold occurs 4 seconds after the precharge signal has been commanded. The second minimum threshold occurs 12 seconds after the precharge signal has been commanded. If either of these conditions are not met, this shutdown is generated. The VSD logic board shall wait 10 seconds before clearing the fault before starting another precharge event. The VFD’s fan(s) and water pump(s) shall remain energized during this time. The VSD logic board shall allow up to three consecutive precharge related faults to occur. After the third consecutive precharge related fault, a Safety Shutdown message “VSD – PRECHARGE LOCKOUT” is generated. <table><tr><th>LINE VOLTAGE SETPOINT</th><th>FIRST THRESHOLD</th><th>SECOND THRESHOLD</th></tr><tr><td>380-415</td><td>41 VDC</td><td>414 VDC</td></tr><tr><td>460</td><td>50 VDC</td><td>500 VDC</td></tr></table> Possible Problems: • Ensure the precharge contactor is energized. If the precharge contactor is not energized, validate the coil wiring at the contactor, and the J16 connector on the drive logic board. Ensure 120 VAC is available on J16 pin 2 at all times. • Ensure the precharge resistors are 10 ohms each. • Measure the resistance across the bus capacitors. The resistance value should be around 9K ohms. A lower resistance could be caused by a failed bleeder resistor, bus capacitor, or shorted IGBT. • Remove the bus structure to determine which power assembly has failed. • Ensure that J3 on the gate driver board is connected to both sides of the bus capacitor. J3 pin 1 is connect to the positive bus. J3 pin 3 is connected to the negative bus. Ensure J4 on the gate driver board is connected. This connection is only made on the B phase power assembly. Ensure J1 on the drive logic board is connected, and that pin 1 is positive, and pin 2 is negative.	LINE VOLTAGE SETPOINT	FIRST THRESHOLD	SECOND THRESHOLD	380-415	41 VDC	414 VDC	460	50 VDC	500 VDC
LINE VOLTAGE SETPOINT	FIRST THRESHOLD	SECOND THRESHOLD								
380-415	41 VDC	414 VDC								
460	50 VDC	500 VDC								
VSD – RUN SIGNAL	The drive requires the receipt of a run command through the communication system, and a run command through hardware. Regardless of which command is received first, the second command must be received within 5 seconds. This shutdown will occur if the second command is not received with the 5 second time period. Possible Problems. • Typically this problem is not associated with the communication system. If the communication system was the problem, then no data would be communicated between the control center and the drive. • Hardware run signal not getting to the drive logic board. Wire 24 is the hardware run signal. When the hardware run signal is received wire 24 will have 120 VAC applied to it. Ensure wire 24 is connected to J14 pin 2 of the drive logic board. Also ensure wire 24 is connected to both sides of terminal block 1TB. One side of 1TB should have wire 24 coming from the control center. The other side of 1TB should be connected to the drive logic board, (J14 pin 2). • Wire 24 does not change state to 120 VAC. In the control center find wire 24 on I/O board. Connect a voltage meter between the wire 24 connection and earth. Start the chiller. Does wire 24 change from 0 VAC to 120 VAC. If it does not, then verify that the wire 24 signal from the micro board is changing state. If the voltage does not change on the micro board, then replace the micro board. If the voltage does change, then validate the ribbon cable between the micro board and the I/O board. If the cable is bad, then replace the cable. If the cable is properly connected, and is in good condition, then replace the I/O board.									

TABLE 3 - CYCLING SHUTDOWN MESSAGE (CONT'D)

MESSAGE	DESCRIPTION						
VSD – SERIAL COMMUNICATIONS	This shutdown is generated when serial communication is missing or corrupt for 10 continuous seconds between the control center and the drive logic board. Possible Problems. • Communications is not working on the drive logic board. The drive logic contains 2 LED's near the J18 connector. The LED's are noted at RCV and XMT. Both of these LED's should be flashing after the control center has booted up. If only the RCV is flashing, then ensure that the U66 chip is properly installed. Replace the U66 chip. If the U66 does not solve the problem, then replace the drive logic board. • Communications not working on the control center. The micro board contains communication LED's. Ensure that the send and receive LED's are flashing. If the send LED is not flashing, then remove the communication cable. If the send LED is not flashing, then replace the micro board. • Communication cable failure. Verify that the communications cable is properly connected from J18 on the drive logic board, to terminal block 2TB in the drive, and over to the control center.						
VSD – SINGLE PHASE INPUT POWER	This shutdown is generated when the RMS phase to phase voltage drops to a low limit based on the input line voltage for a period of one line cycle. <table border="1"> <thead> <tr> <th>INPUT LINE VOLTAGE</th><th>LOW LIMIT VALUE</th></tr> </thead> <tbody> <tr> <td>380/415</td><td>264</td></tr> <tr> <td>460</td><td>295</td></tr> </tbody> </table> Possible Problems. • Loose connection on the input wiring. Verify that the wire between the input of the drive up to the line voltage isolation board is tight and properly connected. • Loose connection on the control wiring. Ensure that the wiring between the line voltage isolation board, and the drive logic board is properly connected. • Loose or failed fuse holder. Fuses 4FU, 5FU, and 6FU protect the input to the line voltage isolation board. Ensure that the fuses are tight in the fuse holder, and that there are no problems with the fuses. • Failure of the line voltage isolator board. Measure AC voltage on J25 of the drive logic board. The voltage should be around 5.3 VAC when measured phase to phase. Phase to phase measurement is from pin 1-2, 2-3 and 3-1. The value of 5.3 VAC is not absolute, but the 3 values should be balanced within a few tenth of a volt. Typically, a bad reading would be ½ the normal value on one phase. If the readings are not balanced, then disconnect the J2 connector on the line voltage isolator board and repeat these measurements at the line voltage isolator board. If the voltage is not balanced when measured at the line voltage isolation board, then replace the line voltage isolation board. If the voltage is balanced, then replace the drive logic board.	INPUT LINE VOLTAGE	LOW LIMIT VALUE	380/415	264	460	295
INPUT LINE VOLTAGE	LOW LIMIT VALUE						
380/415	264						
460	295						
VSD – STOP CONTACTS OPEN	When the drive indicates a shutdown, the fault relay on the drive logic board will open and the Fault LED will turn off. When the fault relay opens 120 VAC is no longer present on terminal block 1TB wire 53. The loss of the 120 VAC on wire 53 in the control center indicates that the drive has shutdown. If the drive does not respond with a reason why the fault relay is open, then this message will appear. Possible Problems: • Drive logic board failure. Is the fault LED lit? If the LED is lit, then verify if 120 VAC is present at terminal 16 and 53 on J14 pin 4 and 3 of the drive logic board. If voltage is present on both pins, then the drive logic board is good. If voltage is present on J14 pin 4 and not on pin 3, then replace the drive logic board. If voltage is not present on J14 pin 4 or pin 3, then verify the wiring connections between J14, 1TB and the I/O board in the control center. • I/O board failure in the Control Center. • Failure of the ribbon cable between the I/O board and the microboard.						

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SECTION 6 - WARNING MESSAGES

GENERAL INFORMATION

A WARNING message will indicate that the operation of the Drive is affected in some manner, but the Drive is still functioning.

TABLE 4 - WARNING MESSAGES

MESSAGE	DESCRIPTION
WARNING – VSD – DC BUS ACTIVE	This warning is displayed anytime the DC bus voltage is greater than 50 volts and the drive is not in the run state. If this warning is still active 10 minutes after the precharge command has been removed from the drive, then typically, this warning indicates a shorted motor. Possible Problems: Perform a megger test on the compressor motor.

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SECTION 7 - START-UP PREPARATIONS

CIRCUIT BREAKER SETUP

The circuit breaker used on the HYP model drive has many settings for overload, short circuit, and ground fault protection. Generally, these settings are adjusted by the manufacture but should be verified before starting the chiller or replacing a defective circuit breaker. Details for the circuit breaker settings are listed below.

TABLE 5 - SETTINGS FOR CIRCUIT BREAKER

SETTING FOR THE 1100/1300 HP CIRCUIT BREAKER 224-38096-001		
NAME OF ADJUSTMENT	ABBREVIATION OF ADJUSTMENT	SETTING VALUE
Long Time Pickup	"IR"	"D"
Long Time Delay	"TR"	"2"
Short Time Pickup	"ISD"	"2"
Ground Fault Pickup	"IG"	"0.2"
Ground Fault Delay	"TSD"	"J"

OPTIVIEW CONTROL CENTER

Make certain the correct EPROMs are all installed in the proper locations. Be sure the dimple in the end of the chip is oriented in the correct direction.

Perform a visual inspection of the drive. Ensure all wiring and wiring connectors are tight and properly seated. Check power wiring and hoses to ensure they will not be damaged by rubbing against sharp surfaces. Verify that no coolant leaks are present in the drive. Inspect the power assemblies, coolant headers, and liquid cooled inductors for any signs of a coolant leak.

Apply power to the chiller, and check the System Status Line on the Control Center. After a few seconds the following message will appear on the display, "System Ready to Start".

If you do not see this message, "System Ready to Start", then turn off power, wait five minutes for the voltage to discharge, verify voltage is no longer present, and then double check all wiring and connections.

1. If initial power-up is successful, verify that the programmed motor current is the same as listed on the contract screen. The motor current is now programmed from the control center. The drive logic board does not have a trimpot for this adjustment any more.
2. Next, drain the coolant from the drive. Follow the drain procedure found below. The drive is shipped with a 50/50 mix of Propylene Glycol and YORK Corrosion Inhibitor. This type of coolant is being used to protect the cooling loop from damage due to freezing conditions during the shipping process. This coolant mixture does not have the thermodynamic properties required by the drive, and may cause it to overheat. Thus, this 50/50 mixture must be drained and replaced with YORK Corrosion Inhibitor as currently used in the drive. **Propylene Glycol is the same material used to winterize recreational vehicles. Although, it is non-toxic we suggest permission should be obtained before discarding it into a sewer.**
3. Next, fill the coolant loop using YORK's Corrosion Inhibitor, part number 013-02987-000. Follow the fill procedure found in this form. The coolant pump/pumps can be turn on and off from a selection on the control panel.

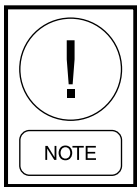
SERVICE PROCEDURES

General

The following are detailed steps required to drain, fill and vent the cooling loop for the HYP model of drive. These basic steps need to be followed on every model of HYP VSD. All of these steps are to be followed completely to prevent the introduction of air into this system. There are individual components of this system that by their design may contribute to air entrapment, and may cause the VSD to overheat some specific piping components that are not thermally protected.

VSD COOLING SYSTEM COMPONENTS

Draining The System



All fluids drained containing Propylene Glycol or Inhibited Water should be collected and disposed of properly according to facility procedures.

If two hoses are available, the heat exchanger and the output filter can be drained at the same time. (Refer to *Figure 20 on page 72* and *Figure 21 on page 72*.)

1. Remove coolant reservoir cap.
2. Attach drain hose to GHT faucet valve on the bottom of the shell and tube heat exchanger.
3. Ensure supply manifold valve(s) are open.
4. Open the heat exchanger drain valve to allow coolant to drain. Once coolant stops flowing close the valve, and remove drain hose.
5. Attach drain hose to the top fitting of the output inductor inside the VSD cabinet.
6. Open top valve of the output inductor to allow coolant to drain. Once coolant stops flowing close the valve, and remove drain hose.
7. Attach drain hose to the bottom fitting of the output inductor.
8. Open bottom valve of the output inductor to allow coolant to drain.
9. Install coolant reservoir cap to prevent too much air leaking out.
10. Apply 5 PSI compressed air in the top fitting on the output inductor to blow residual liquid out of the output inductor.



LD22325

Drain from Input Inductor with
Garden Hose Thread

**FIGURE 20 - COOLANT DRAIN CONNECTION
INSIDE OF VSD**



LD22326

Shell and Tube
Heat Exchanger Drain Valve with
Garden Hose Thread

**FIGURE 21 - COOLANT DRIVE CONNECTION AT
HEAT EXCHANGER**

Warning – Do NOT exceed the 5 PSI rating. Damage to the cooling system may result.

Once coolant stops flowing turn off the air supply, close the valve, and remove drain hose.

11. Attach drain hose to the valve on the bottom of the shell and tube heat exchanger.
12. Open heat exchanger drain valve, repeat step #10 to allow remaining coolant to drain from the shell and tube heat exchanger.
13. Close all valves and replace all caps. System is now drained.

COOLANT FILL PROCEDURE

Part Numbers

Inhibited Water (Pink)

1 gal = 013-02987-000

55 gal = 013-03346-000



Coolants may foam up when cycled through the system or when the pumps are shut off and the coolants tend to rise. Do not fill reservoir to top while unit is running or it may overflow when pumps are shut off.

1. Confirm that the heat exchanger drain valve and both of the output inductor drain valves are closed.
2. Open supply manifold valve(s).
3. Remove the cap from the coolant reservoir.
4. Connect a low volume pump to the bottom fitting on the output inductor.
5. Use the low volume pump to fill the coolant loop. Open the valve for the bottom fitting on the output inductor. Slowly, fill the cooling system until coolant is within 1 inch from the top of the coolant reservoir.
6. Close the valve for the bottom fitting on the output inductor, and remove the low volume pump. Wipe up any inhibitor that may have dripped.

7. Apply power to the chiller.

8. Start pumps using the OptiView panel.

Press: Home > VSD > VSD Details > Manual Cooling > Enable.

9. Allow pumps to run for 15 seconds.

10. Disable the pumps.

Press: Home > VSD > VSD Details > Manual Cooling > Disable.

11. Check the fill pipe and add more inhibitor if needed to bring the level back to the within 1 inch from the top.

12. Start the pumps and run for 5 minutes.

13. Disable the pumps and check the fill pipe. Add more inhibitor if needed to bring the level back to the within 1 inch from the top.

14. Close the supply manifold valve(s).

15. Start the pumps and run for 5 minutes.

16. Disable the pumps and check the fill pipe. Add more inhibitor if needed to bring the level back to the within 1 inch from the top.

17. Open the supply manifold valve(s).

18. Start the pumps and run for 10 minutes.

19. Disable the pumps and check the fill pipe. Add more inhibitor if needed to bring the level back to the within 1 inch from the top.

20. Close the supply manifold valve(s).

21. Start the pumps and run for 10 minutes.

22. Disable the pumps and check the fill pipe. Add more inhibitor if needed to bring the level back to the within 1 inch from the top.

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SECTION 8 - TROUBLESHOOTING PROCEDURES

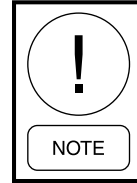
GENERAL INFORMATION

The following procedures are designed to guide the service technician along the path that leads to the identification of the cause for the problem. The service technician should understand the operation of the HYP model drive and function of each major component. It is recommended that the service technician read and understand the information contained in this instruction prior to troubleshooting this product. Also, the service technician must understand the system interface and be able to utilize system wiring diagrams to follow signal flow throughout the system. Due to the integration of the HYP model drive with the Graphic Control Center, a good working knowledge of the Control Center is also necessary (Refer to the Associated Literature listed at the beginning of this document).

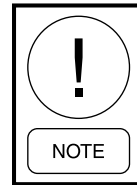
Several levels of documentation are required for the troubleshooting process. The HYP model drive wiring diagram, (Form 160.54-PW6) supplied with every drive is the top level document. It provides the overall wiring and configuration. Sections of this instruction

provide the required lower level understanding. Specifically, block diagrams provide signal flow and simplified representations of all board circuitry.

Begin the troubleshooting process by selecting the appropriate procedure. It is not necessary to sequentially perform all of them. Perform a procedure only if there is a problem with that function.



Some of the protection circuitry for the drive is protected by fuses. If these fuses are open, then the protection circuit will not protect the drive. A failure of these fuses will not cause the drive to perform differently, and no faults will occur. It is best practice to verify that all fuses are still in working order every time the drive is entered.

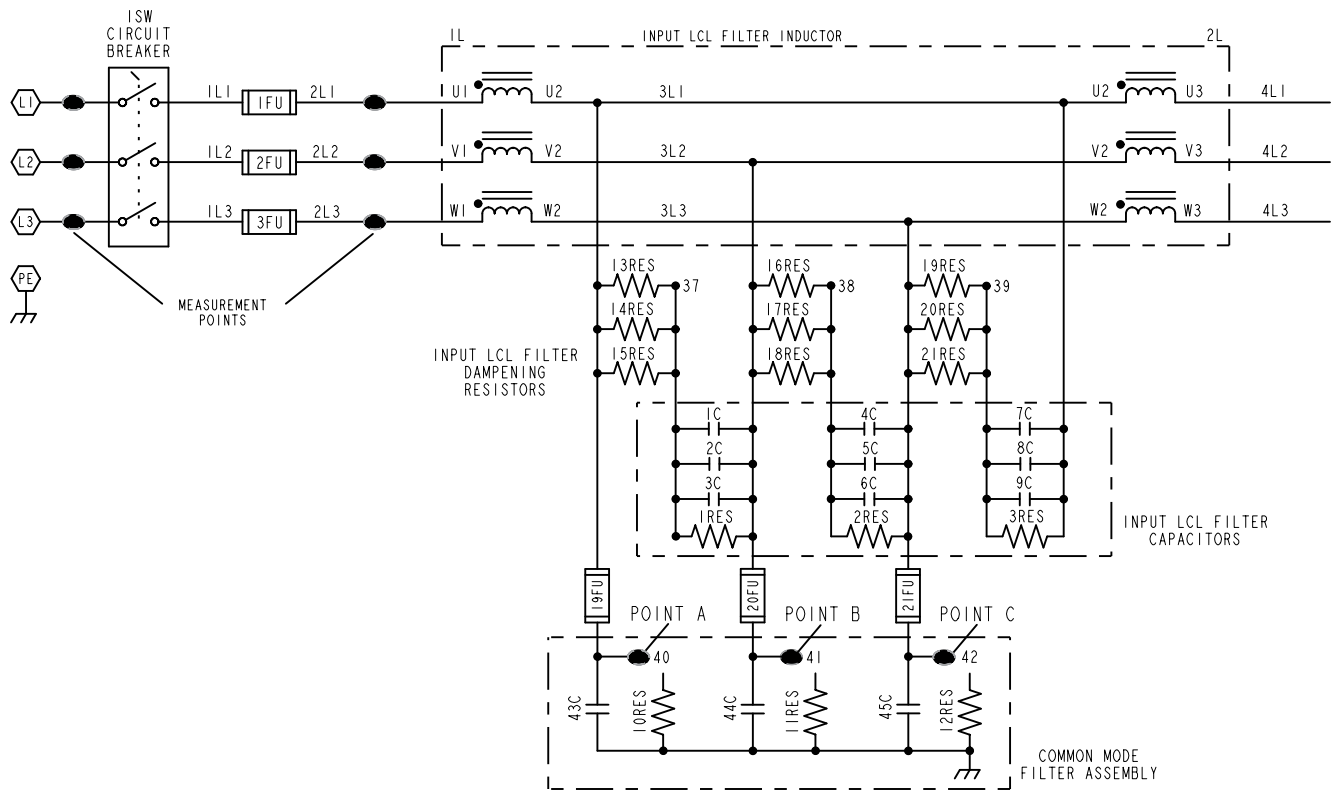


Due to the way the input fuses are manufactured, if any of the fuses are open, then all three fuses must be replaced.

SAFE ENTRY PROCEDURE



This product contains voltages that could cause injury or death. Follow all NFPA-70E safety rules. Before performing any troubleshooting procedures. Place the compressor switch in the stop position. Wait 5 minutes. Ensure that the DC BUS voltage is 50 VDC or less on the display of the chiller control panel. Ensure that all sources of power to the chiller are removed. Remove all AC power sources upstream of the VSD and perform lockout / tagout procedures. Use a non-contact voltage sensor to ensure no AC power is present in the enclosure. Use a DVM to measure AC and DC voltage at locations shown below. Measure the three phase connections phase to phase and phase to ground. All values should be zero Measure the BUS voltage at J1 pins 1-2 on the VSD logic board using a DVM to ensure that BUS voltage is less than 50 VDC.



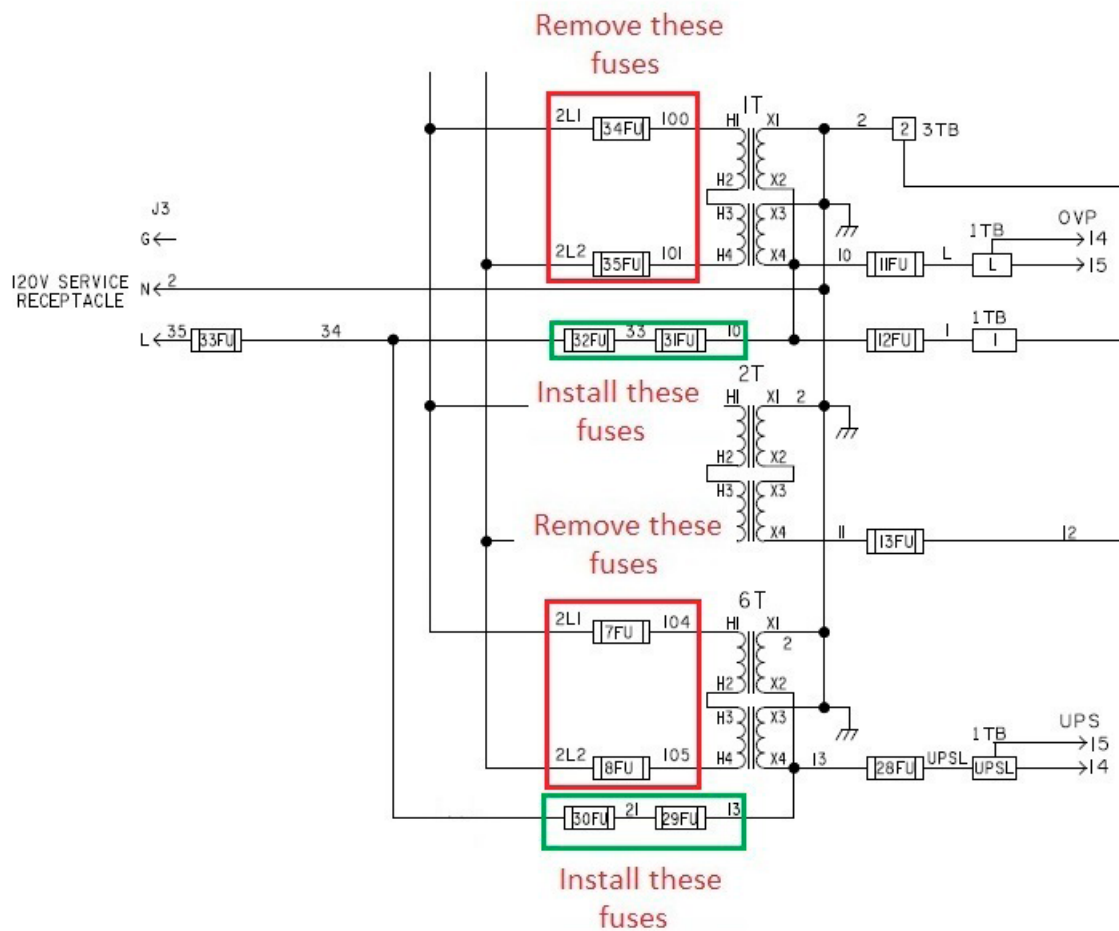
NOTE: Ensure voltage measured from point A, B and C, to ground is zero.

LD21999

FIGURE 22 - SAFE ENTRY MEASUREMENTS FOR MODEL HYP1100/1300A

SINGLE PHASE POWER PROCEDURE (MODEL 1100/1300)

- Perform the “Safe Entry Procedure” found in this form before continuing.
- Refer to *Figure 23 on page 77* for model.
- 1100/1300 below for reference.
- Remove fuses 7FU, 8FU, 34FU and 35FU from the circuit. These fuses are located on the left wall of the enclosure. Ensure to close the touch safe fuse holder after the fuse is removed.
- Install the fuses that were removed from 7FU, 8FU, 34FU and 35FU, and install them into 29FU – 32FU. They are located on the right wall of the enclosure. 29FU – 32FU fuse holders do not normally have fuses installed. **These fuses are only installed when the 120 VAC service power is applied.**
- Apply 120 VAC to the J3 plug. This plug is located by the output DCCT's.
- After testing is complete remove the fuses from 29FU – 32FU, and reinstall them in the fuse holder for 7FU, 8FU, 34FU and 35FU.



Models 1100/1300

LD22000a

FIGURE 23 - SINGLE PHASE POWER PROCEDURE (MODEL HYP1100/1300A)

RECTIFIER TEST MODE

This feature will only work if software version C.HYP.01.03.02 and C.HYP.02.03.02 or later are installed in the drive logic board.

This test will only function after the Single Phase Power Procedure is performed for the model drive under test.

The following requirements must be present before this test will function.

- The chiller system must be in the off state.
- The DC bus voltage must be below 50 VDC.
- No VSD faults can be present except for “Line Voltage Single-Phase”, “Line Voltage Phase Lock Loop”, or “Line Voltage Phase Rotation”. One or all of these faults may be present if line voltage is removed, and single phase power is connected. Single phase power is required for this test to function.
- At least 4 minutes since the chiller was last stopped, or power was applied to the VSD logic board.

Once the above requirements are met, then follow these steps below to use the “Rectifier Test Mode”.

- Place the chiller control panel into “Service Mode”.
- Navigate to the “Variable Speed Drive Details Screen”.
- Press the “Test Mode” button. A drop down box will appear to select “Enable”. The LED on the Test Mode button will turn on when the VSD acknowledges test mode through communications. Test Mode will run until it is disabled or unless one of the above requirements is no longer valid.

- The input/rectifier and motor/inverter gate driver LED’s on the drive logic board will turn on, but only 3 LED’s for the input/rectifier and the motor/inverter at a time. These LED’s are located near connectors J8 - J13. These LED’s will remain lit for 1 second, and then turn off for 1 second. None of the gate drive LED’s should be lit at this time. The other set of 6 LED’s will now turn on for 1 second and then turn off for 1 second. None of the gate drive LED’s should be lit at this time. The LED’s on the gate driver board will respond in the same manner, except the off state for the gate driver will have the LED lit. So instead of there being a time when all 12 LED’s are off, there will be a time when all 12 LED’s are lit. Verify that the LED’s are flashing on the drive logic board and on the gate driver boards for the input/rectifier.
- If the LED’s do not function properly on the drive logic board, then replace the drive logic board.
- If the LED’s do not function properly on one of the gate driver boards, then rotate the non-functioning gate driver board onto a phase where the gate driver board is working. Repeat the above test. If the problem follows the non-functioning gate driver board, then replace the non-functioning gate driver board. If the problem appears on a gate driver board that was working, then replace the gate driver cable between the gate driver board and the drive logic board.
- Once this test is complete, press the “Test Mode” button. A drop down box will appear to select “Disable”. The LED on the Test Mode button will turn off.

INVERTER TEST MODE

This test should be conducted after the Single Phase Power Procedure is preformed for the model drive under test.

The following requirements must be present before this test will function.

- The chiller system must be in the off state.
- The DC bus voltage must be below 50 VDC.
- No VSD faults can be present except for “Line Voltage Single-Phase”, “Line Voltage Phase Lock Loop”, or “Line Voltage Phase Rotation”. One or all of these faults maybe present if line voltage is removed, and single phase power is connected. Single phase power is not required for this test to function. If single phase power is used during this test the rectifier gate driver LED’s will flash during the test below.
- At least 4 minutes since the chiller was last stopped, or power was applied to the VSD logic board.

Once the above requirements are met, then follow these steps below to use the “Inverter Test Mode”.

- Place the chiller control panel into “Service Mode”.
- Navigate to the “Variable Speed Drive Details Screen”.
- Press the “Test Mode” button. A drop down box will appear to select “Enable”. The LED on the Test Mode button will turn on when the VSD acknowledges test mode through communications. Test Mode will run until it is disabled or unless one of the above requirements is no longer valid.

- The motor/inverter gate driver LED’s on the drive logic board will turn on, but only 3 LED’s at a time. These LED’s are located near connectors J11, J12, and J13. These LED’s will remain lit for 1 second, and then turn off for 1 second. None of the inverter gate drive LED’s should be lit at this time. The other set of 3 LED’s will now turn on for 1 second and then turn off for 1 second. None of the inverter gate drive LED’s should be lit at this time. The LED’s on the gate driver board will respond in the same manner, except the off state for the gate driver will have the LED lit. So instead of there being a time when all 6 LED’s are off, there will be a time when all 6 LED’s are lit. Verify that the LED’s are flashing on the drive logic board and on the gate driver boards for the motor/inverter.
- If the LED’s do not function properly on the drive logic board, then replace the drive logic board.
- If the LED’s do not function properly on one of the gate driver boards, then rotate the non-functioning gate driver board onto a phase where the gate driver board is working. Repeat the above test. If the problem follows the non-functioning gate driver board, then replace the non-functioning gate driver board. If the problem appears on a gate driver board that was working, then replace the gate driver cable between the gate driver board and the drive logic board.
- Once this test is complete, press the “Test Mode” button. A drop down box will appear to select “Disable”. The LED on the Test Mode button will turn off.

**VERIFY A RECTIFIER OR INVERTER FAILURE
FOR MODEL 1100/1300 HP**

The rectifier and inverter use the same IGBT modules. The same test will be performed on each module regardless of its position in the power assembly.

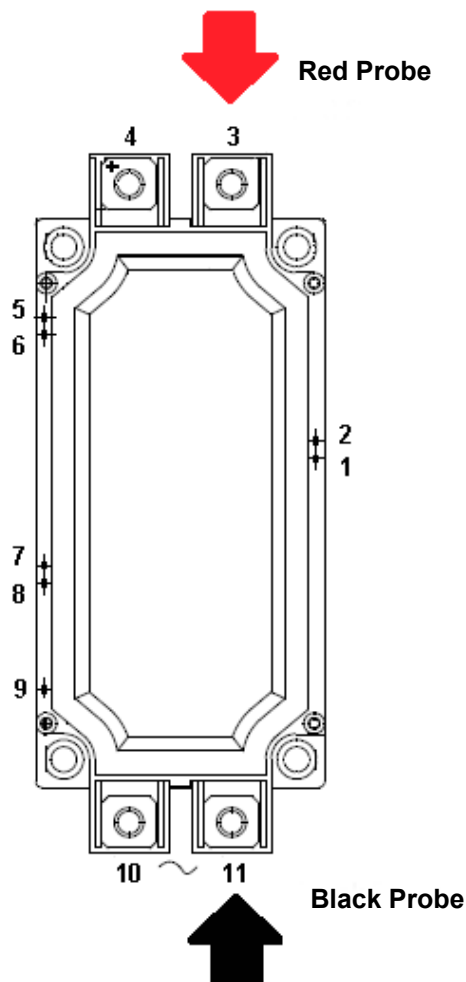
Test Details

The procedure below should only be used after all Lockout and Tag out procedures are performed, and performed the SAFE ENTRY PROCEDURE. The steps below provide information on where to connect a digital ohm meter or an analog ohm meter. The digital ohm meter will need to be set to the diode reading. The analog ohm meter will need to be set to read resistance on the Rx1 scale.

The resistance readings for these tests will indicate the diode in the device is turned on or turned off. The absolute resistance values are not important. The digital meter will indicate a low voltage reading when the diode is turned on such as 0.3-0.4 volts. With the digital meter the voltage will be higher when the diode is turned off such as a reading of 2.0 to 3.0 volts or overload. The analog meter will read resistance of 5 – 15 ohms when the diode is turned on. The analog meter will read greater than 70 ohms when the diode is turned off. For reading the meter when the diode is off, it may take a few seconds for the meter to respond correctly because of the bus capacitors in the circuit.

Remove the power wiring and shorting bars from the IGBT modules under test.

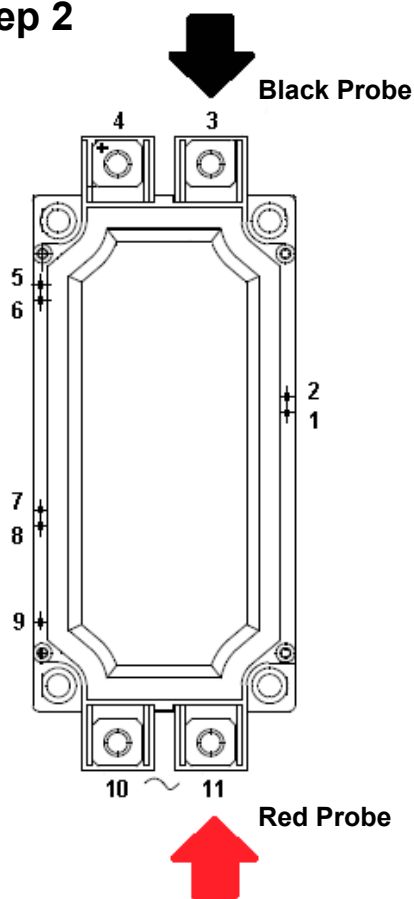
Make a copy of the Diode Check Table form found at the end of this test. Fill in the Diode Check Table while performing these tests.

Step 1

1. Place the Red or Positive probe of the meter on Pin 3 of the IGBT assembly.
2. Place the Black or Negative probe of the meter on Pin 11 of the IGBT assembly.
3. A normal reading will indicate that the switch is "ON".

LD16802

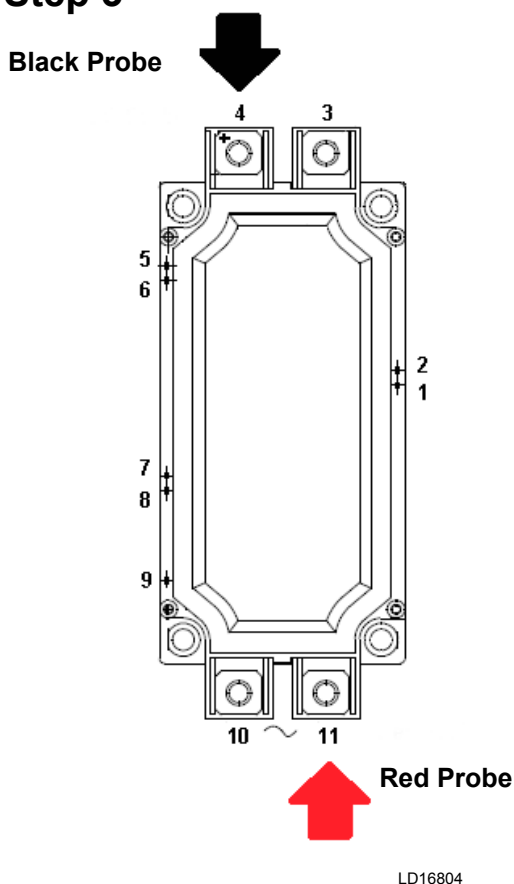
Step 2



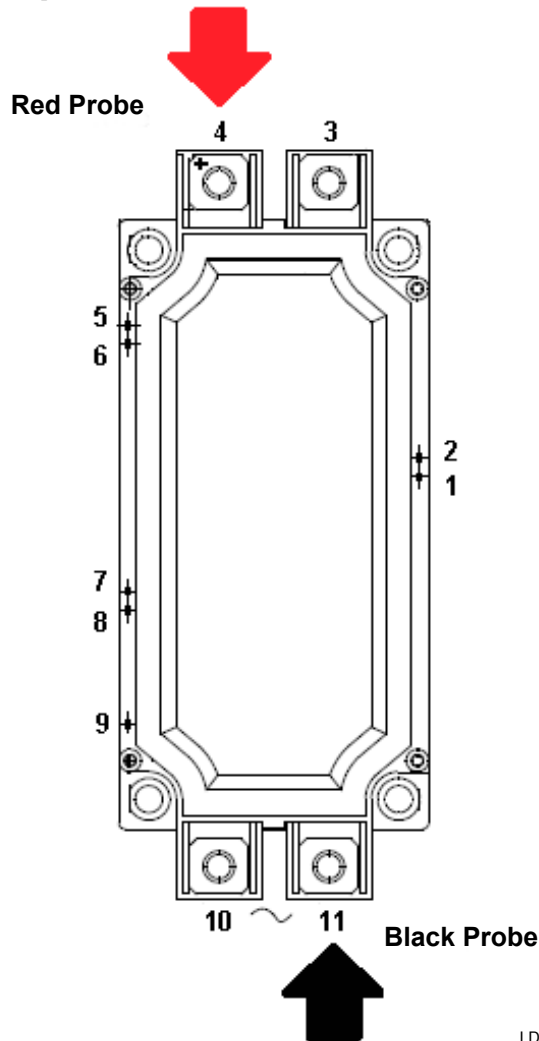
1. Place the Black or Negative probe of the meter on Pin 3 of the IGBT assembly.
2. Place the Red or Positive probe of the meter on Pin 11 of the IGBT assembly.
3. A normal reading will indicate that the switch is "OFF".

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Step 3



1. Place the Black or Negative probe of the meter on Pin 4 of the IGBT assembly.
2. Place the Red or Positive probe of the meter on Pin 11 of the IGBT assembly.
3. A normal reading will indicate that the switch is "ON".

Step 4

1. Place the Black or Negative probe of the meter on Pin 4 of the IGBT assembly.
2. Place the Red or Positive probe of the meter on Pin 11 of the IGBT assembly.
3. A normal reading will indicate that the switch is "OFF".

LD16805

Repeat this test for each IGBT module in the suspected phase. If any of the modules fail this test then the complete rectifier or inverter assembly for that phase must be replaced.

When the test is complete reinstall the shorting bar/bars and power wiring to the assembly under test. The torque value for the power wiring and the shorting bar is 75-100 In. - Lbs. (9-11Nm).

IGBT / DIODE CHECK SHEET FOR ALL HYP MODEL 1100/1300 HP VSD'S

	Positive Probe Location	Negative Probe Position	Digital Meter Correct Answer	Analog Meter Correct Answer	Front				Back
PHASE A	Rectifier								
	3	11	0.3-0.4 Volts	5-15 ohms					
	11	3	2.0-3.0 Volts	> 70 ohms					
	11	4	0.3-0.4 Volts	5-15 ohms					
	4	11	2.0-3.0 Volts	> 70 ohms					
	Inverter								
	3	11	0.3-0.4 Volts	5-15 ohms					
	11	3	2.0-3.0 Volts	> 70 ohms					
	11	4	0.3-0.4 Volts	5-15 ohms					
	4	11	2.0-3.0 Volts	> 70 ohms					
	Rectifier								
	3	11	0.3-0.4 Volts	5-15 ohms					
PHASE B	11	3	2.0-3.0 Volts	> 70 ohms					
	11	4	0.3-0.4 Volts	5-15 ohms					
	4	11	2.0-3.0 Volts	> 70 ohms					
	Inverter								
	3	11	0.3-0.4 Volts	5-15 ohms					
	11	3	2.0-3.0 Volts	> 70 ohms					
	11	4	0.3-0.4 Volts	5-15 ohms					
	4	11	2.0-3.0 Volts	> 70 ohms					
	Rectifier								
	3	11	0.3-0.4 Volts	5-15 ohms					
	11	3	2.0-3.0 Volts	> 70 ohms					
PHASE C	11	4	0.3-0.4 Volts	5-15 ohms					
	4	11	2.0-3.0 Volts	> 70 ohms					
	Inverter								
	3	11	0.3-0.4 Volts	5-15 ohms					
	11	3	2.0-3.0 Volts	> 70 ohms					
	11	4	0.3-0.4 Volts	5-15 ohms					
	4	11	2.0-3.0 Volts	> 70 ohms					
	Rectifier								
	3	11	0.3-0.4 Volts	5-15 ohms					
	11	3	2.0-3.0 Volts	> 70 ohms					
	11	4	0.3-0.4 Volts	5-15 ohms					
	4	11	2.0-3.0 Volts	> 70 ohms					

VSD FREQUENTLY ASKED QUESTIONS

Is a Condenser Water Strainer used with the shell and tube heat exchanger?

Since the shell and tube heat exchanger can be cleaned with a rifle brush, no extra precautions are needed to keep the heat exchanger cleaned. No strainer is provided with this OSCD. The intent is to have the heat exchanger cleaned annually. Gaskets are available (refer to the service parts list).

What is the timing of the Anti-Recycle when an OSCD is applied?

The anti-recycle time is much quicker with an OSCD than with a starter. The reason is the elimination of inrush current on start-up. The OptiSpeed compressor drive slowly accelerates the compressor motor so that the motor does not consume more than 100% of the motor's nameplate full load amps. The anti-recycle time is five (5) starts in succession, followed by a ten minute wait. After ten minutes, the OSCD can be started five more successive starts. This is permitted on OSCD units only, due to the low current draw and reduced motor heating during startup.

Should the customer install isolation between the Power Conduits and the OptiSpeed Compressor Drive?

We no longer require a section of non-metallic conduit at the entrance and exit of the OSCD as we did on previous products. If any customer or installer wishes to continue to follow this practice, we have no objections as long as the OSCD is properly grounded.

Can I apply an OptiSpeed Compressor Drive to a generator?

Yes, the OSCD can be applied to a generator. No modifications are required for a generator application. We have several OSCD installations running on generator power without difficulty. It is necessary that the generator's output voltage and frequency be maintained within the specified range for that particular OSCD. This is usually not a problem for most generators, since motor current at startup is limited to less than 1X the Full Load Amps (FLA). Although no changes are required for the generator, the generator will need to support a level of harmonic current. Also, a time delay is required between the switching of power supplies of 10 seconds. This delay applies to switch between utility power to generator power and generator power back to utility power.

Do I have a problem with my coolant? The pink color is no longer visible?

The coolant normally has a pink or rose color when new. After several months of operation, this color may dissipate, and the coolant may appear almost colorless. The lack of the color in the coolant does not necessarily indicate a problem. Most colorless samples test above 1000 PPM nitrite, which is normal. There is no need to flush the system unless you find the coolant becoming opaque or cloudy. In this case we suggest you obtain a sample for analysis, then flush the system with coolant and install fresh coolant. The coolant must be changed every year regardless of color or test results. The coolant is required to be changed every year.

NOTES



5000 Renaissance Drive, New Freedom, Pennsylvania USA 17349
Copyright © by Johnson Controls 2017
Form 160.00-M10 (617)
Issue Date: June 9, 2017
New Release

800-861-1001
www.johnsoncontrols.com

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