Control Modules

⚠ CAUTION

Turn controller power off before servicing controls. This ensures safety and prevents damage to the controller.

The CVC, CCM, and ISM modules perform continuous diagnostic evaluations of the hardware to determine its condition. Proper operation of all modules is indicated by LEDs (light-emitting diodes) located on the circuit board of the CVC, CCM, and ISM.

There is one green LED located on the CCM and ISM boards respectively, and one red LED located on the CVC, CCM, and ISM boards respectively.

RED LED (Labeled as STAT) — If the red LED:

- blinks continuously at a 2-second interval, the module is operating properly
- is lit continuously, there is a problem that requires replacing the module
- is off continuously, the power should be checked
- blinks 3 times per second, a software error has been discovered and the module must be replaced

If there is no input power, check the fuses and circuit breaker. If the fuse is good, check for a shorted secondary of the transformer or, if power is present to the module, replace the module.

GREED LED (Labeled as COM) — These LEDs indicate the communication status between different parts of the controller and the network modules and should blink continuously.

Notes on Module Operation

1. The chiller operator monitors and modifies configurations in the microprocessor by using the 4 softkeys and the CVC. Communications between the CVC and the CCM is accomplished through the SIO (Sensor Input/Output) bus, which is a phone cable. The communication between the CCM and ISM is accomplished through the sensor bus, which is a 3-wire cable.
2. If a green LED is on continuously, check the communication wiring. If a green LED is off, check the red LED operation. If the red LED is normal, check the module address switches (SW1) (Fig. 40 and 41). Confirm all switches are in OFF position.

   All system operating intelligence resides in the CVC. Some safety shutdown logic resides in the ISM in case communications are lost between the ISM and CVC. Outputs are controlled by the CCM and ISM as well.
3. Power is supplied to the modules within the control panel via 24-vac power sources.

   The transformers are located within the power panel, with the exception of the ISM, which operates from a 115-vac power source and has its own 24-vac transformer located in the module.

   In the power panel, T1 supplies power to the compressor oil heater, oil pump, and optional hot gas bypass, and T2 supplies power to both the CVC and CCM.

   Power is connected to Plug J1 on each module.

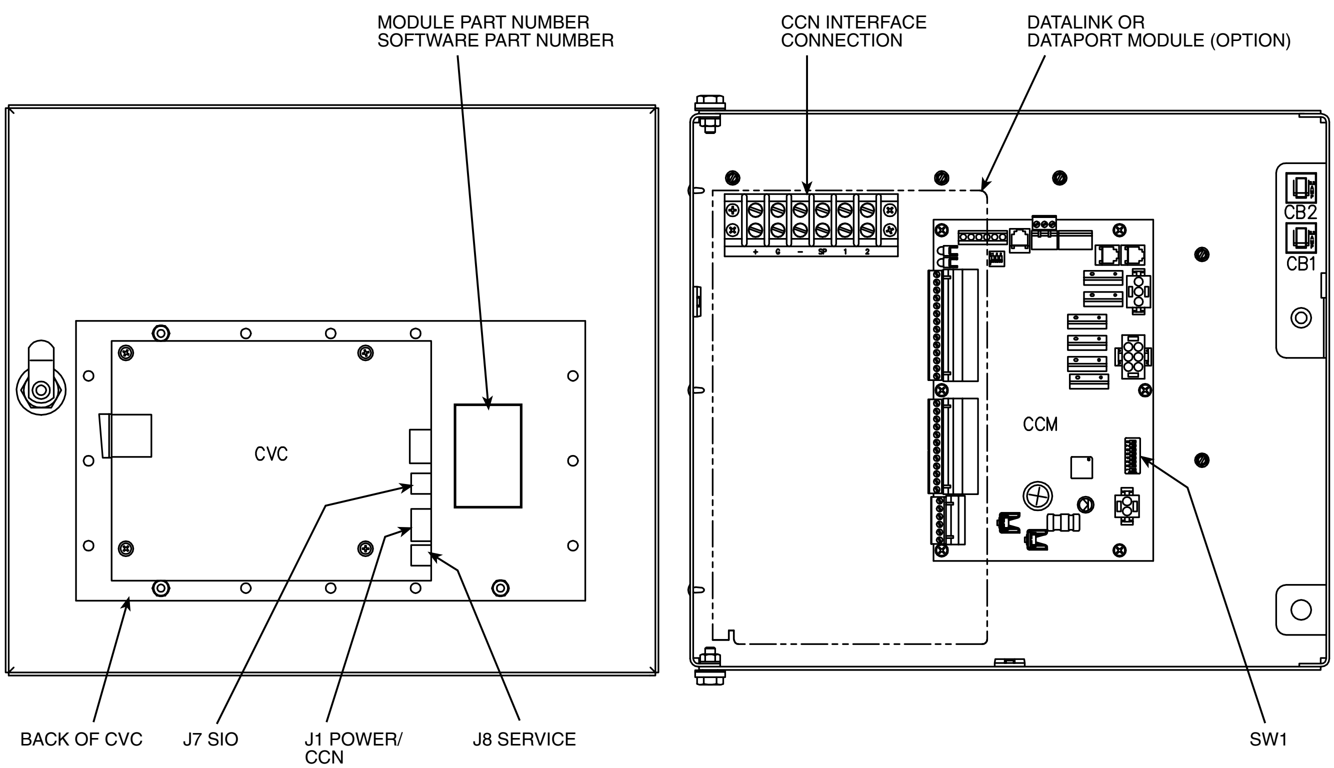


Fig. 40 — Rear of CVC (Chiller Visual Controller)

Chiller Control Module (CCM) (Fig. 41)

INPUTS — Each input channel has 2 or 3 terminals. Refer to individual chiller wiring diagrams for the correct terminal numbers for your application.

OUTPUTS — Output is 24 vac. There are 2 terminals per output. Refer to the chiller wiring diagram for your specific application for the correct terminal numbers.

Integrated Starter Module (Fig. 42)

INPUTS — Inputs on strips J3 through J6 are analog inputs and J2 is discrete (on/off) input. The specific application of the chiller determines which terminals are used. Refer to the individual chiller wiring diagram for the correct terminal numbers for your application.

OUTPUTS — Outputs are 115-277 vac and wired to strip J9. There are 2 terminals per output.

Replacing Defective Processor Modules — The module replacement part number is printed on a small label on the rear of the CVC module. The chiller model and serial numbers are printed on the chiller nameplate located on an exterior corner post. The proper software is factory-installed by Carrier in the replacement module. When ordering a replacement chiller visual control (CVC) module, specify the complete replacement part number, full chiller model number, and chiller serial number. The installer must configure the new module to the original chiller data. Follow the procedures described in the Software Configuration section on page 55.

⚠ CAUTION

Electrical shock can cause personal injury. Disconnect all electrical power before servicing.

INSTALLATION

1. Verify the existing CVC module is defective by using the procedure described in the Troubleshooting Guide section, page 76, and the Control Modules section, page 87. Do not select the ATTACH TO NETWORK DEVICE table if the CVC indicates a communication failure.
2. Data regarding the CVC configuration should have been recorded and saved. This data must be reconfigured into the new CVC. If this data is not available, follow the procedures described in the Software Configuration section.

   If a CCN Building Supervisor or Service Tool is available, the module configuration should have already been uploaded into memory. When the new module is installed, the configuration can be downloaded from the computer.

   Any communication wires from other chillers or CCN modules should be disconnected to prevent the new CVC module from uploading incorrect run hours into memory.
3. To install this module, record values for the *TOTAL COMPRESSOR STARTS* and the *COMPRESSOR ONTIME* from the MAINSTAT screen on the CVC.
4. Power off the controls.
5. Remove the old CVC.
6. Install the new CVC module. Turn the control power back on.
7. The CVC now automatically attaches to the local network device.
8. Access the MAINSTAT table and highlight the *TOTAL COMPRESSOR STARTS* parameter. Press the [SELECT] softkey. Increase or decrease the value to match the starts value recorded in Step 3. Press the [ENTER] softkey when you reach the correct value. Now, move the highlight bar to the *COMPRESSOR ONTIME* parameter. Press the [SELECT] softkey. Increase or decrease the run hours value to match the value recorded in Step 2. Press the [ENTER] softkey when the correct value is reached.
9. Complete the CVC installation. Following the instructions in the Input Service Configurations section, page 55, input all the proper configurations such as the time, date, etc. Check the pressure transducer calibrations. PSIO installation is now complete.

Solid-State Starters — Troubleshooting information pertaining to the Benshaw, Inc., solid-state starter may be found in the following paragraphs and in the Carrier RediStart MICRO™ Instruction Manual supplied by the starter vendor.

Attempt to solve the problem by using the following preliminary checks before consulting the troubleshooting tables found in the Benshaw manual.

⚠ WARNING

1. Motor terminals or starter output lugs or wire should not be touched without disconnecting the incoming power supply. The silicon control rectifiers (SCRs) although technically turned off still have AC mains potential on the output of the starter.
2. Power is present on all yellow wiring throughout the system even though the main circuit breaker in the unit is off.

With power off:

- Inspect for physical damage and signs of arcing, overheating, etc.
- Verify the wiring to the starter is correct.
- Verify all connections in the starter are tight.
- Check the control transformer fuses.

TESTING SILICON CONTROL RECTIFIERS IN THE BENSHAW, INC., SOLID-STATE STARTERS — If an SCR is suspected of being defective, use the following procedure as part of a general troubleshooting guide.

1. Verify power is applied.
2. Verify the state of each SCR light-emitting diode (LED) on the micropower card.

   NOTE: All LEDs should be lit. If any red or green side of these LEDs is not lit, the line voltage is not present or one or more SCRs has failed.
3. Check incoming power. If voltage is not present check the incoming line. If voltage is present, proceed to Steps 4 through 11.

   NOTE: If after completing Steps 4 - 11 all measurements are within specified limits, the SCRs are functioning normally. If after completing Steps 4 - 11 resistance measurements are outside the specified limits, the motor leads on the starter power lugs T1 through T6 should be removed and the steps repeated. This will identify if abnormal resistance measurements are being influenced by the motor windings.
4. Remove power from the starter unit.

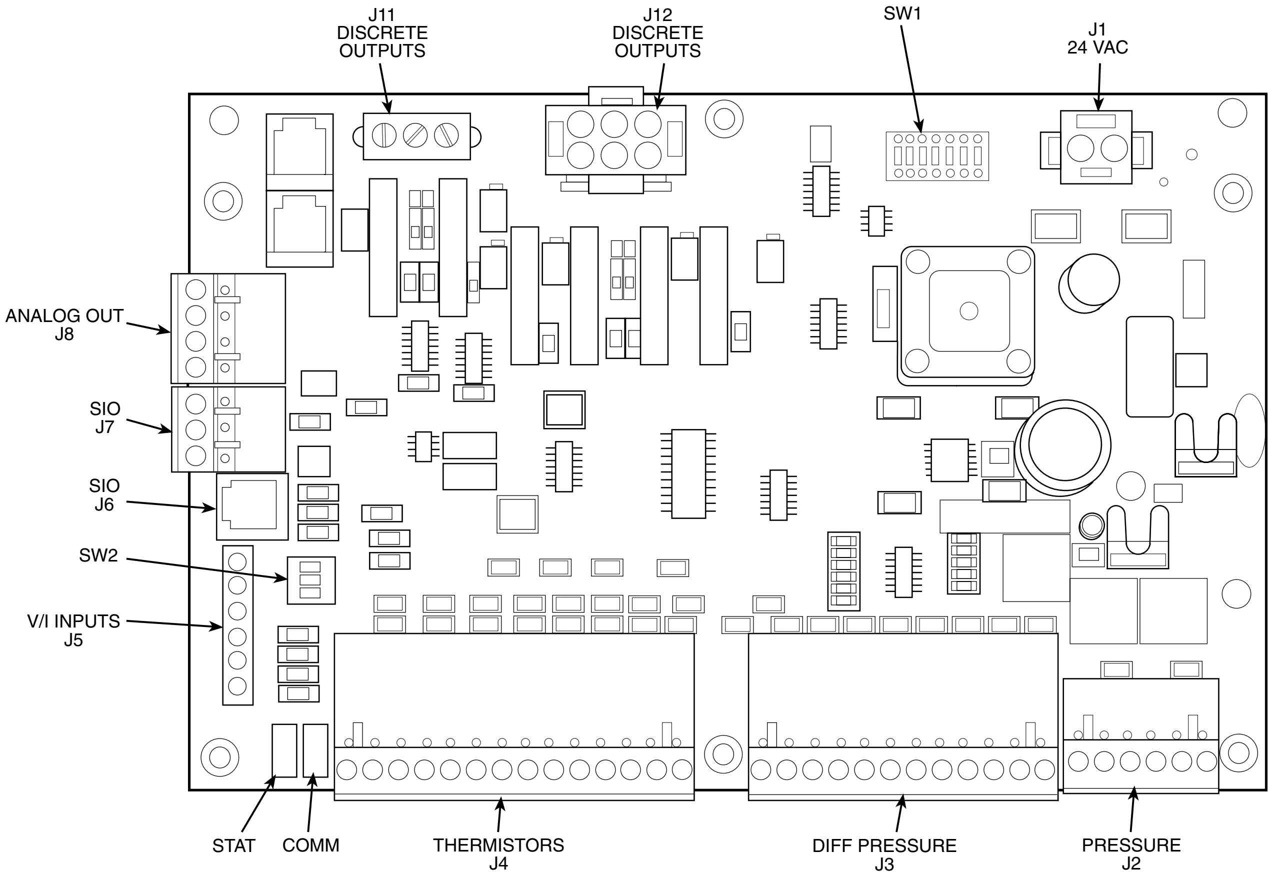


Fig. 41 — Chiller Control Module (CCM)

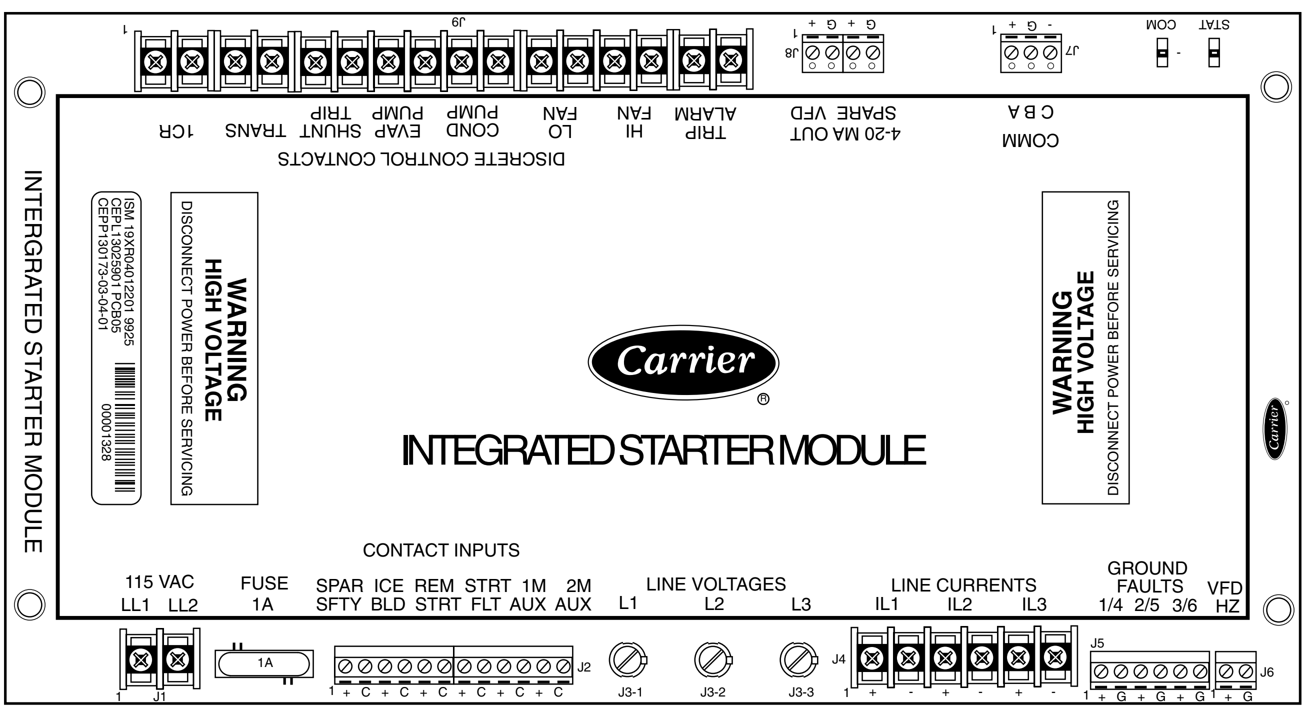


Fig. 42 — Integrated Starter Module (ISM)

5. Using an ohmmeter, perform the following resistance measurements and record the results:

MEASURE BETWEEN	SCR PAIRS BEING CHECKED	RECORDED VALUE
T1 and T6	3 and 6	
T2 and T4	2 and 5	
T3 and T5	1 and 4	

If all measured values are greater than 5K ohms, proceed to Step 10. If any values are less than 5K ohms, one or more of the SCRs in that pair is shorted.

6. Remove both SCRs in the pair (See SCR Removal/ Installation).
7. Using an ohmmeter, measure the resistance (anode to cathode) of each SCR to determine which device has failed.

   NOTE: Both SCRs may be defective, but typically, only one is shorted. If both SCRs provide acceptable resistance measurements, proceed to Step 10.
8. Replace the defective SCR(s).
9. Retest the “pair” for resistance values indicated above.
10. On the right side of the firing card, measure the resistance between the red and white gate/cathode leads for each SCR (1 through 6). A measurement between 5 and 50 ohms is normal. Abnormally high values may indicate a failed gate for that SCR.

⚠ CAUTION

If any red or white SCR gate leads are removed from the firing card or an SCR, care must be taken to ensure the leads are replaced EXACTLY as they were (white wires to gates, and red wires to cathodes on both the firing card and SCR), or damage to the starter and/or motor may result.

11. Replace the SCRs and retest the pair.

SCR REMOVAL/INSTALLATION — Refer to Fig. 43.

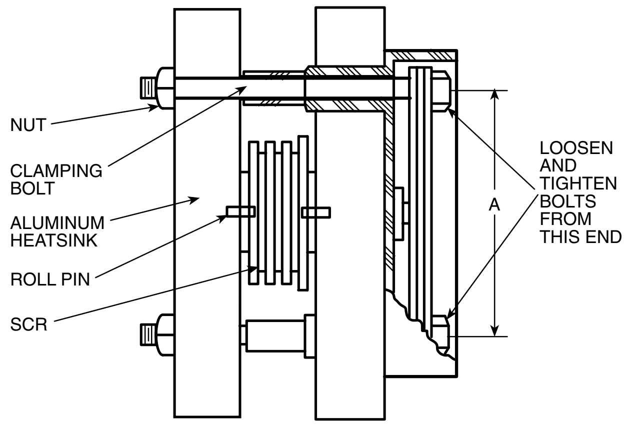
1. Remove the SCR by loosening the clamping bolts on each side of the SCR,
2. After the SCR has been removed and the bus work is loose, apply a thin coat of either silicon based thermal joint compound or a joint compound for aluminum or copper wire connections to the contact surfaces of the replacement SCR. This allows for improved heat dissipation and electrical conductivity.
3. Place the SCR between the roll pins on the heatsink assemblies so the roll pins fit into the small holes in each side of the SCR.

   NOTE: Ensure the SCR is installed so the cathode side is the side from which the red wire extends. The heatsink is labeled to show the correct orientation.
4. Hand tighten the bolts until the SCR contacts the heatsink.
5. Using quarter-turn increments, alternating between clamping bolts, apply the appropriate number of whole turns referencing the table in Fig. 43.

⚠ CAUTION

Care must be taken to prevent nut rotation while tightening the bolts. If the nut rotates while tighting the bolt, SCR replacement must be started over.

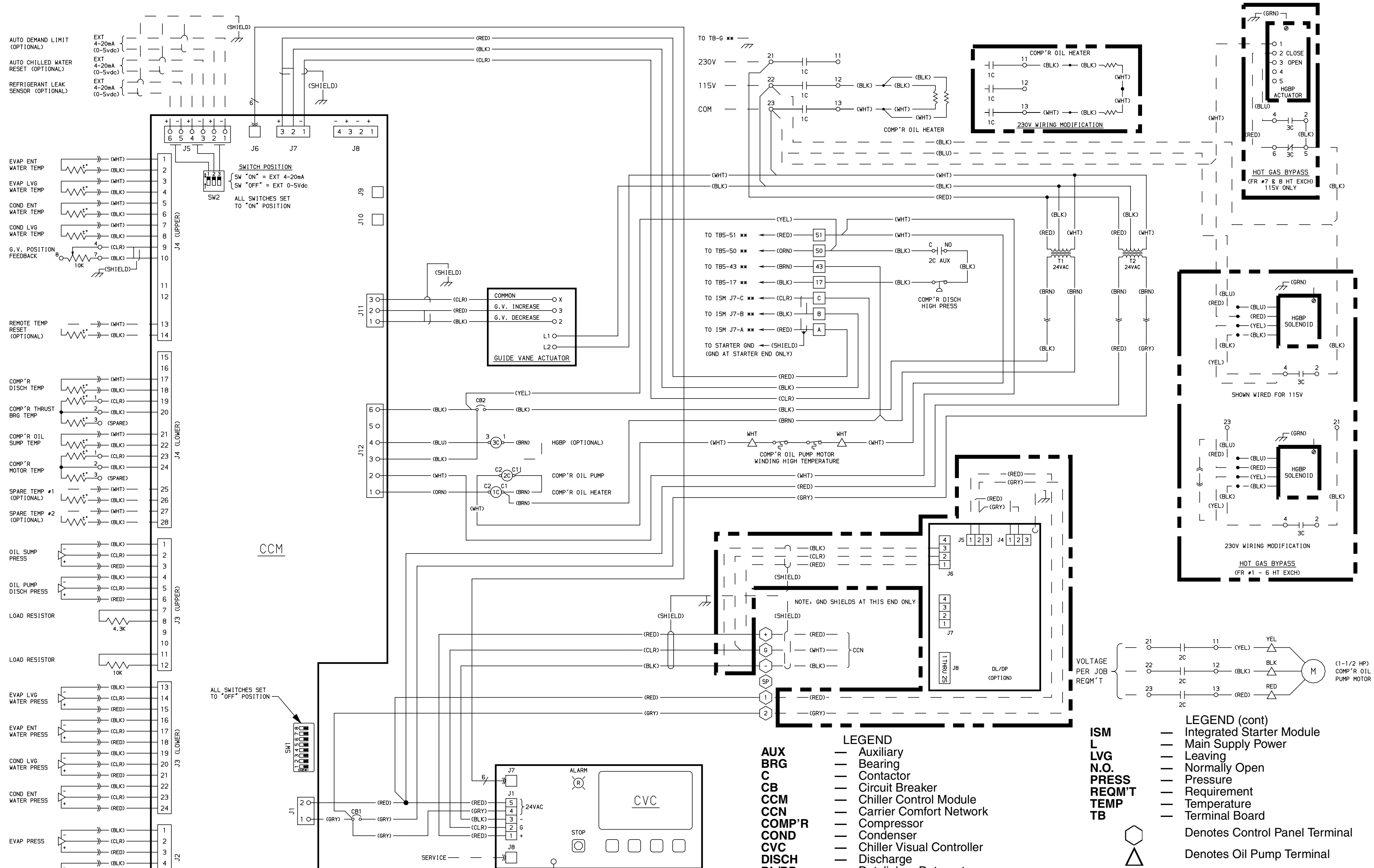
6. Reconnect the red (cathode) wire from the SCR and the white (anode-gate) wire to the appropriate location on the firing card (i.e., SCR1 wires to firing card terminal G1-white wire, and K1-red wire).
7. Reconnect all other wiring and bus work.
8. Return starter to normal operation.



SCR PART NUMBER BISCR	CLAMP SIZE	A DIMENSION (in.)	NO. OF TURNS	BOLT LENGTH (in.)
6601218	1030	2.75 (70 mm)	1 1/2	3.0 (76 mm)
6601818	1030	2.75 (70 mm)	1 1/2	3.0 (76 mm)
8801230	1035	2.75 (70 mm)	1 3/4	3.5 (89 mm)
8801830	1035	2.75 (70 mm)	1 3/4	3.0 (89 mm)
15001850	2040	4.00 (102 mm)	2 3/4	4.0 (102 mm)
15001850	2050	4.00 (102 mm)	2 3/4	5.0 (127 mm)
220012100	Consult Benshaw Representative			
330018500	Consult Benshaw Representative			

Fig. 43 — SCR Installation

Physical Data — Tables 13A-20 and Fig. 44-56 provide additional information on component weights, compressor fits and clearances, physical and electrical data, and wiring schematics for the operator’s convenience during troubleshooting.



LEGEND

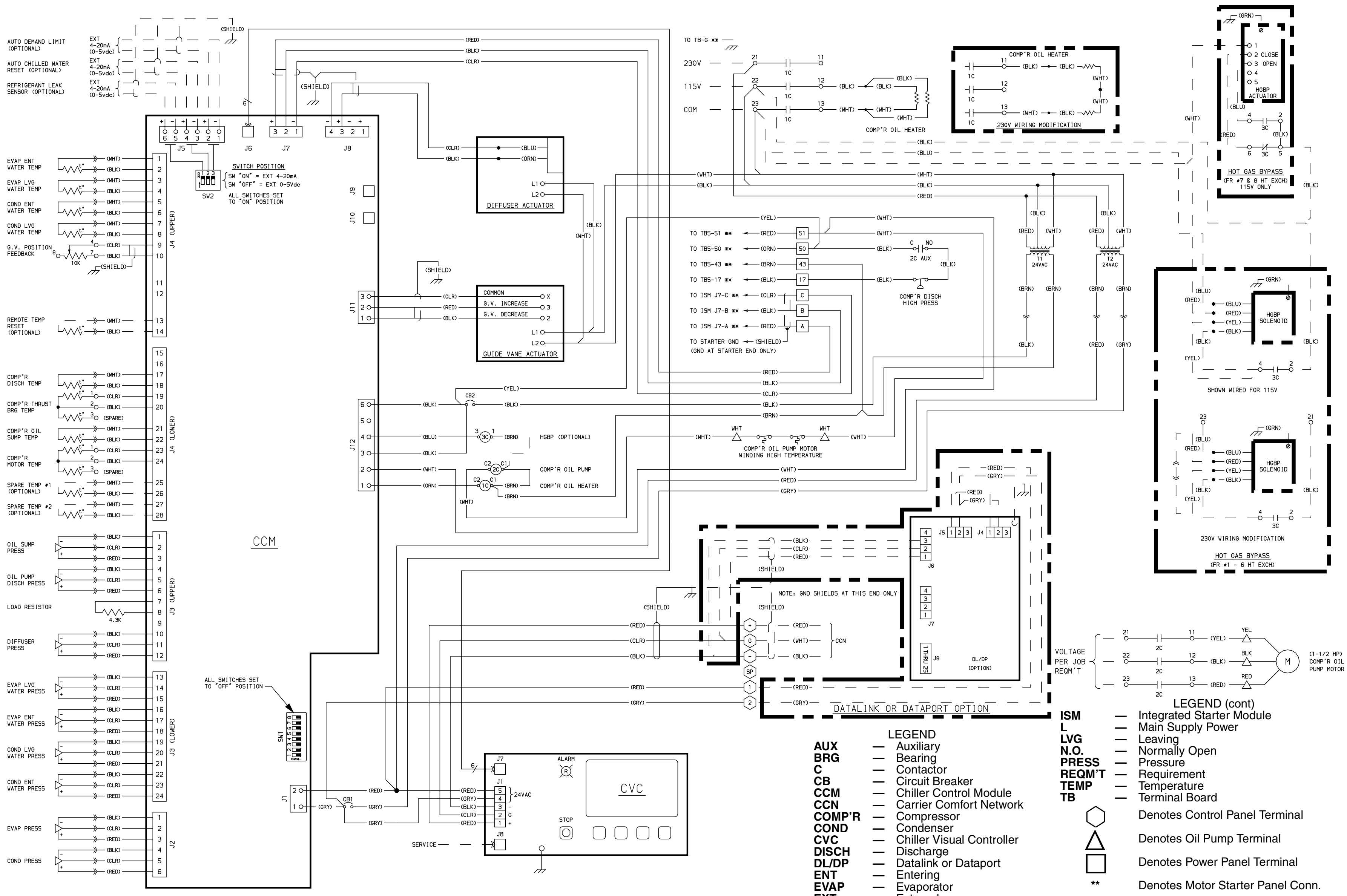
AUX — Auxiliary
BRG — Bearing
C — Contactor
CB — Circuit Breaker
CCM — Chiller Control Module
CCN — Carrier Comfort Network
COMP'R — Compressor
COND — Condenser
CVC — Chiller Visual Controller
DISCH — Discharge
DL/DP — Datalink or Dataport
ENT — Entering
EVAP — Evaporator
EXT — External
FR — Frame
GND — Ground
G.V. — Guide Vane
HGBP — Hot Gas Bypass
HT EXCH — Heat Exchanger

LEGEND (cont)

ISM — Integrated Starter Module
L — Main Supply Power
LVG — Leaving
N.O. — Normally Open
PRESS — Pressure
REQM'T — Requirement
TEMP — Temperature
TB — Terminal Board

⬡ Denotes Control Panel Terminal
△ Denotes Oil Pump Terminal
□ Denotes Power Panel Terminal
** Denotes Motor Starter Panel Conn.
○ Denotes Component Terminal
● Wire Splice
Denotes Conductor
Male/Female Connector
Option Wiring

Fig. 45 — Electronic PIC II Control Panel Wiring Schematic (Frame 2, 3, 4 Compressor)



LEGEND

AUX — Auxiliary
BRG — Bearing
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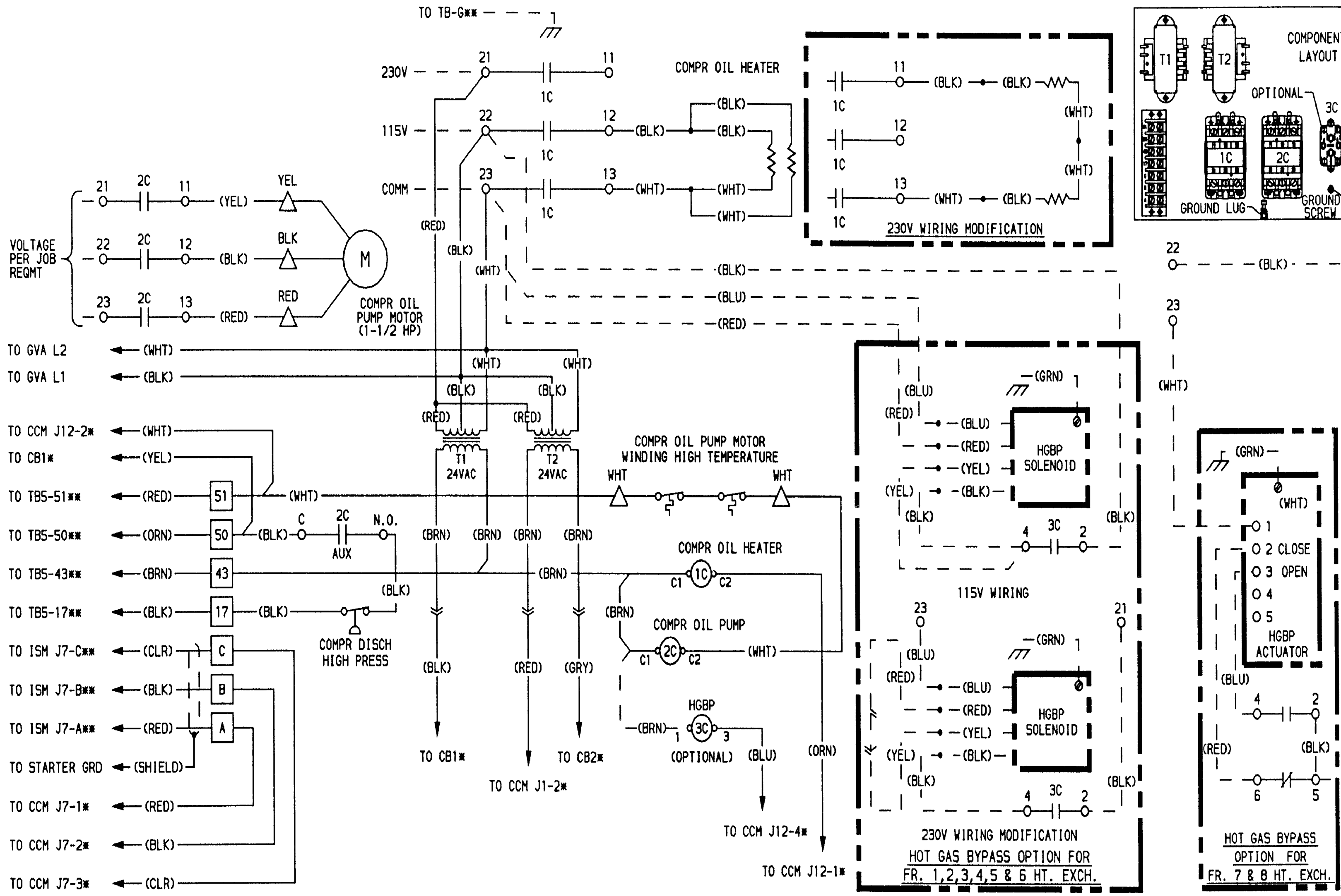
DISCH — Discharge
DL/DP — Datalink or Dataport
ENT — Entering
EVAP — Evaporator
EXT — External
FR — Frame
GND — Ground
G.V. — Guide Vane
HGBP — Hot Gas Bypass
HT EXCH — Heat Exchanger

LEGEND (cont)

ISM — Integrated Starter Module
L — Main Supply Power
LVG — Leaving
N.O. — Normally Open
PRESS — Pressure
REQM'T — Requirement
TEMP — Temperature
TB — Terminal Board

⬡ Denotes Control Panel Terminal
△ Denotes Oil Pump Terminal
□ Denotes Power Panel Terminal
** Denotes Motor Starter Panel Conn.
○ Denotes Component Terminal
● Wire Splice
→≻ Denotes Conductor Male/Female Connector
▬ ▬ Option Wiring

Fig. 46 — Electronic PIC II Control Panel Wiring Schematic (Frame 5 Compressor)

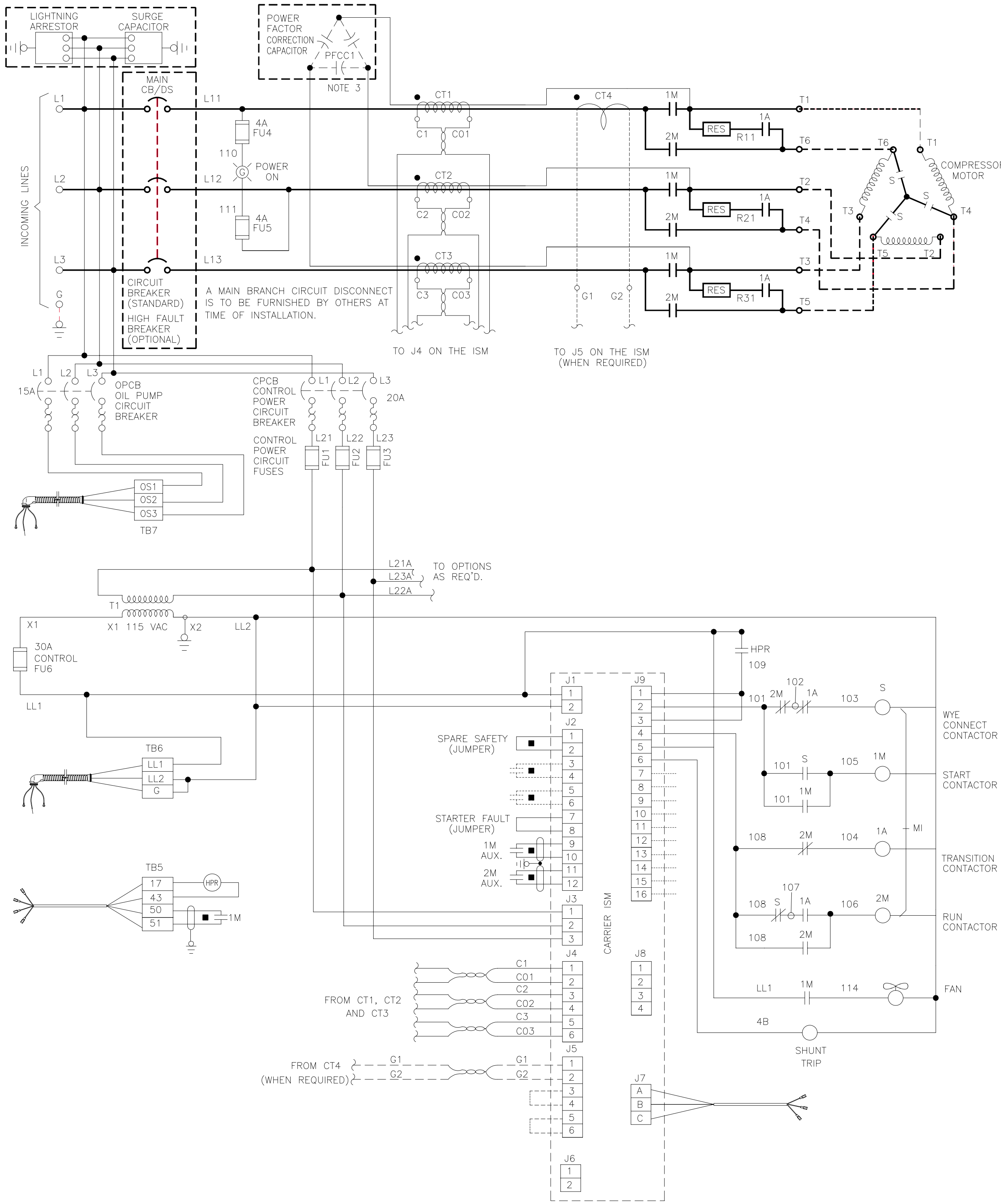


LEGEND

AUX	—	Auxiliary
C	—	Contactor
CB	—	Circuit Breaker
CCM	—	Chiller Control Module
COMM	—	Communication
COMPR	—	Compressor
DISCH	—	Discharge
FR	—	Frame
G	—	Ground
GRD	—	Ground
GVA	—	Guide Vane Actuator
HGBP	—	Hot Gas Bypass
HT EXCH	—	Heat Exchanger
ISM	—	Integrated Starter Module
L	—	Main Supply Power
N.O.	—	Normally Open
PRESS	—	Pressure
REQM'T	—	Requirement
T	—	Transformer
TB	—	Terminal Board

△	Denotes Oil Pump Terminal
□	Denotes Power Panel Terminal
*	Denotes Mach. Control Panel Conn.
**	Denotes Motor Starter Panel Conn.
○	Denotes Component Terminal
●	Wire Splice
→≻	Denotes Conductor Male/Female Connector
▬ ▬	Option Wiring

Fig. 47 — Power Panel Wiring Schematic

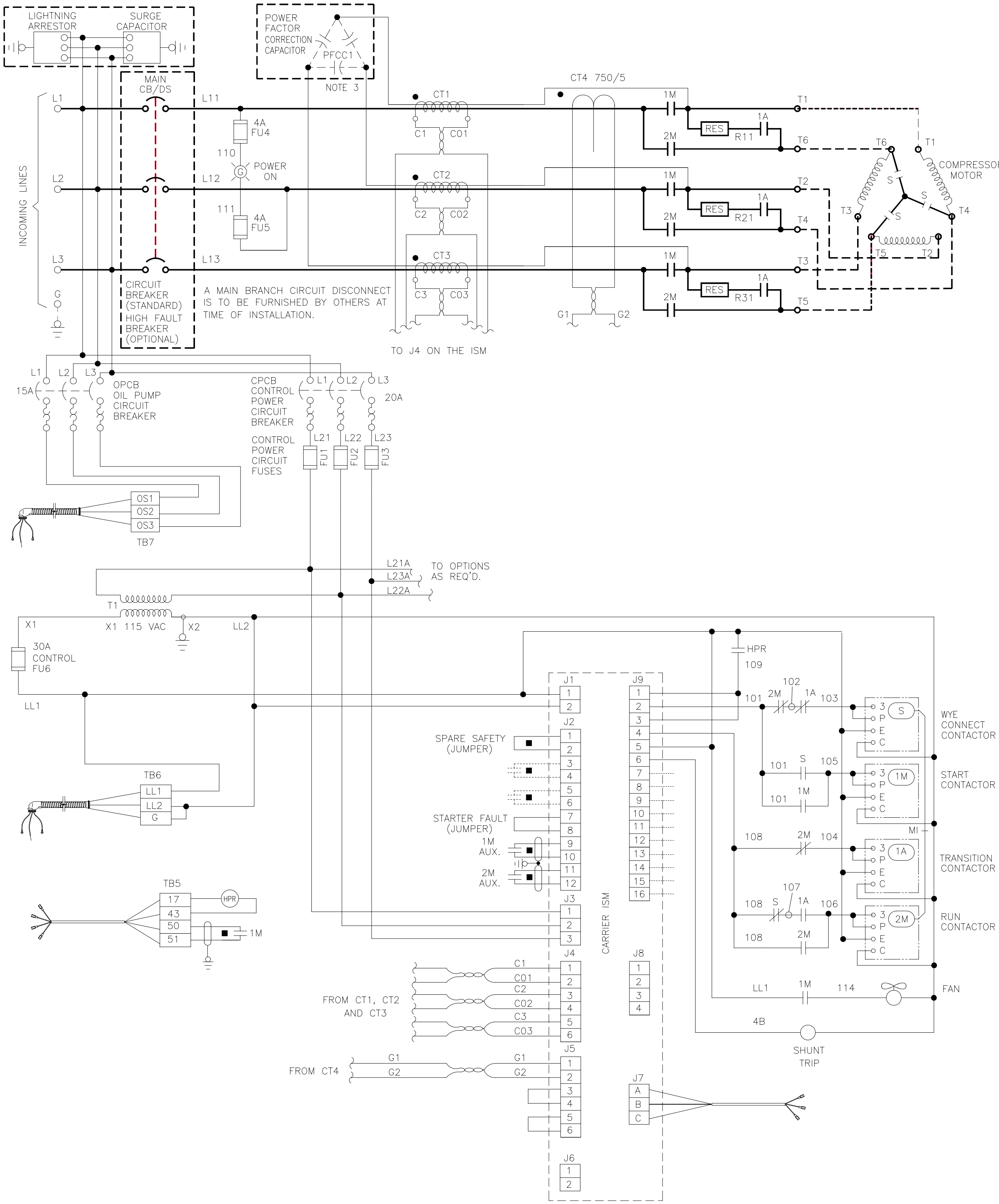


LEGEND

AUX — Auxiliary
C — Contactor
CB — Circuit Breaker
CT — Current Transformer
DS — Disconnect Switch
FU — Fuse
G — Ground
HPR — High Pressure Relay
ISM — Integrated Starter Module
L — Main Supply Power
LL — Control Power Supply
M — Contactor
RES — Resistor
S — Contactor
TB — Terminal Block

NOTES:
1. Power factor correction capacitors (when required) are connected ahead of all current transformers for proper calibration and sensing by the ISM and IQDP4130.
2. For phase to phase ground fault protection refer to Fig. 50.
3. For metering information refer to Fig. 51.

Fig. 48 — Cutler-Hammer Wye Delta Unit Mounted Starter Sizes 3-5DP



LEGEND

AUX	—	Auxiliary
C	—	Contactor
CB	—	Circuit Breaker
CT	—	Current Transformer
DS	—	Disconnect Switch
FU	—	Fuse
G	—	Ground
HPR	—	High Pressure Relay
ISM	—	Integrated Starter Module
L	—	Main Supply Power
LL	—	Control Power Supply
M	—	Contactor
RES	—	Resistor
S	—	Contactor
TB	—	Terminal Block

NOTES:
1. Power factor correction capacitors (when required) are connected ahead of all current transformers for proper calibration and sensing by the ISM and IQDP4130.
2. For metering option see Fig. 51.

Fig. 49 — Cutler-Hammer Wye Delta Unit Mounted Starter Size 6DP

LEGEND

AM — Ammeter
CT — Current Transformer
ISM — Integrated Starter Module
LL — Control Power Supply
VFD — Variable Frequency Drive
VM — Voltmeter
-○○○< Represents Twisted Wire To Door

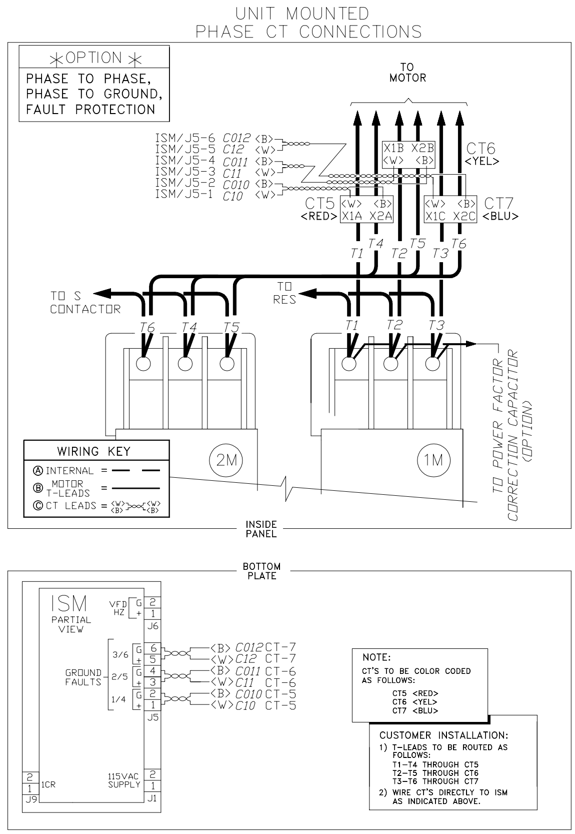


Fig. 50 — Ground Fault Phase Current Option

LEGEND

AM — Ammeter
CT — Current Transformer
ISM — Integrated Starter Module
LL — Control Power Supply
VFD — Variable Frequency Drive
VM — Voltmeter
-○○○< Represents Twisted Wire To Door

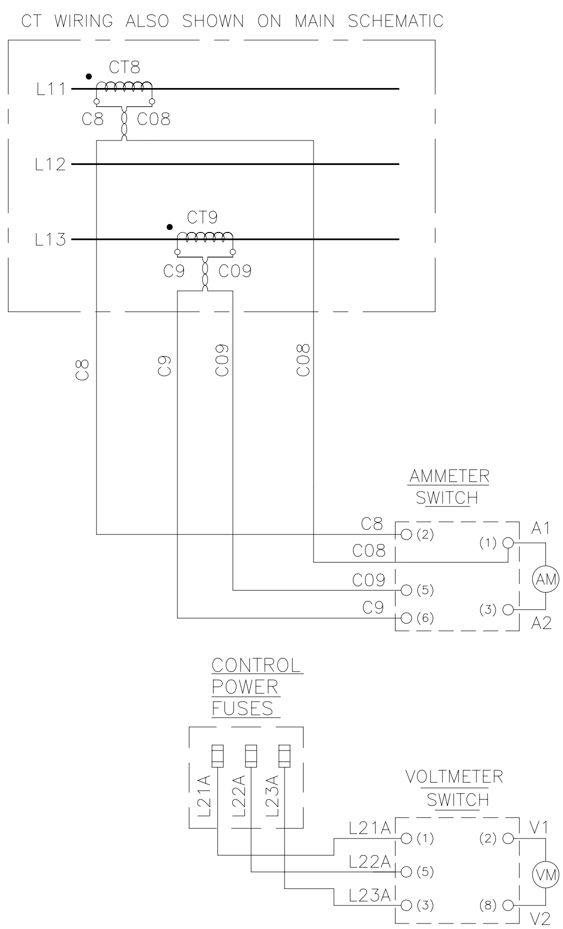


Fig. 51 — Separate Metering Option

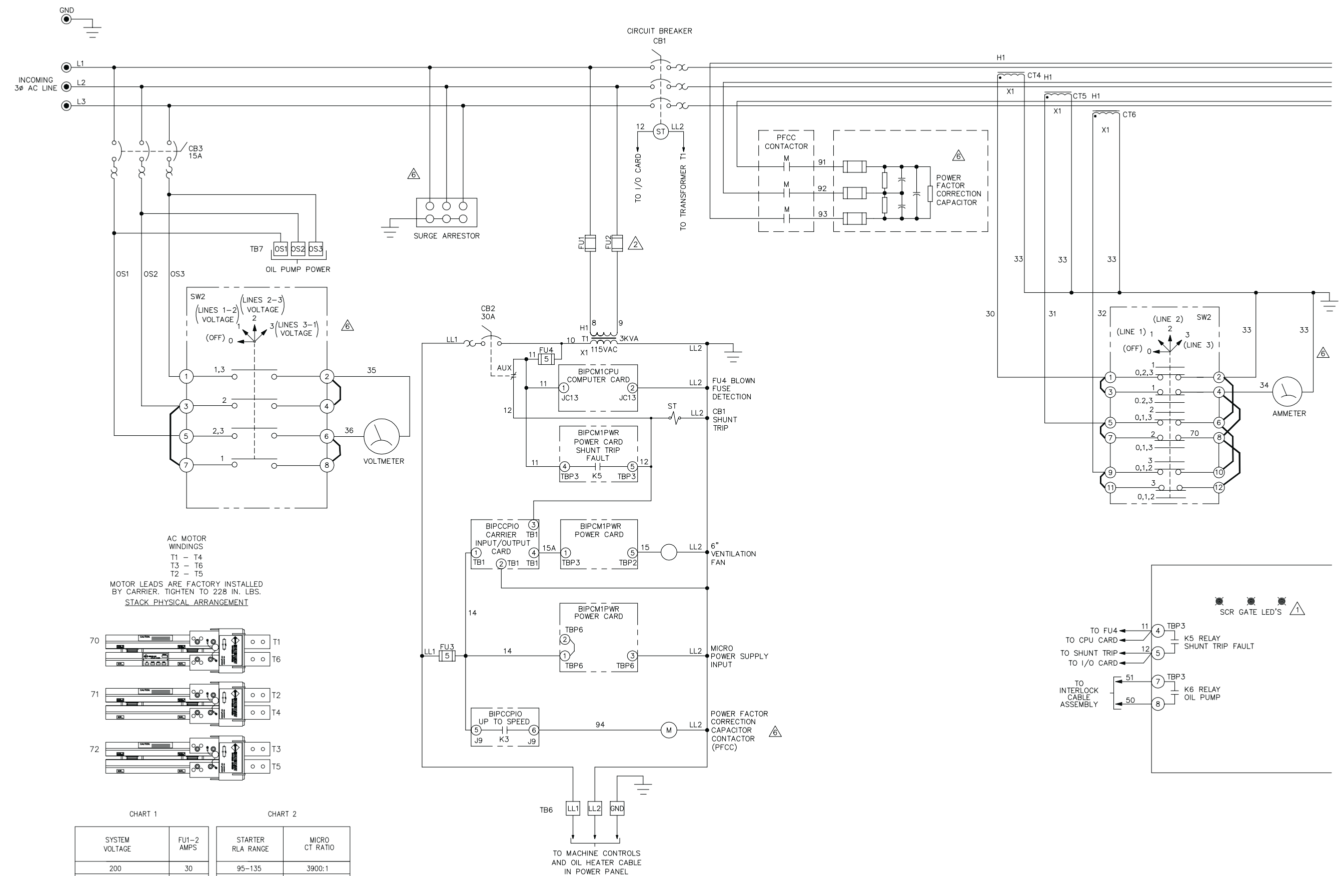


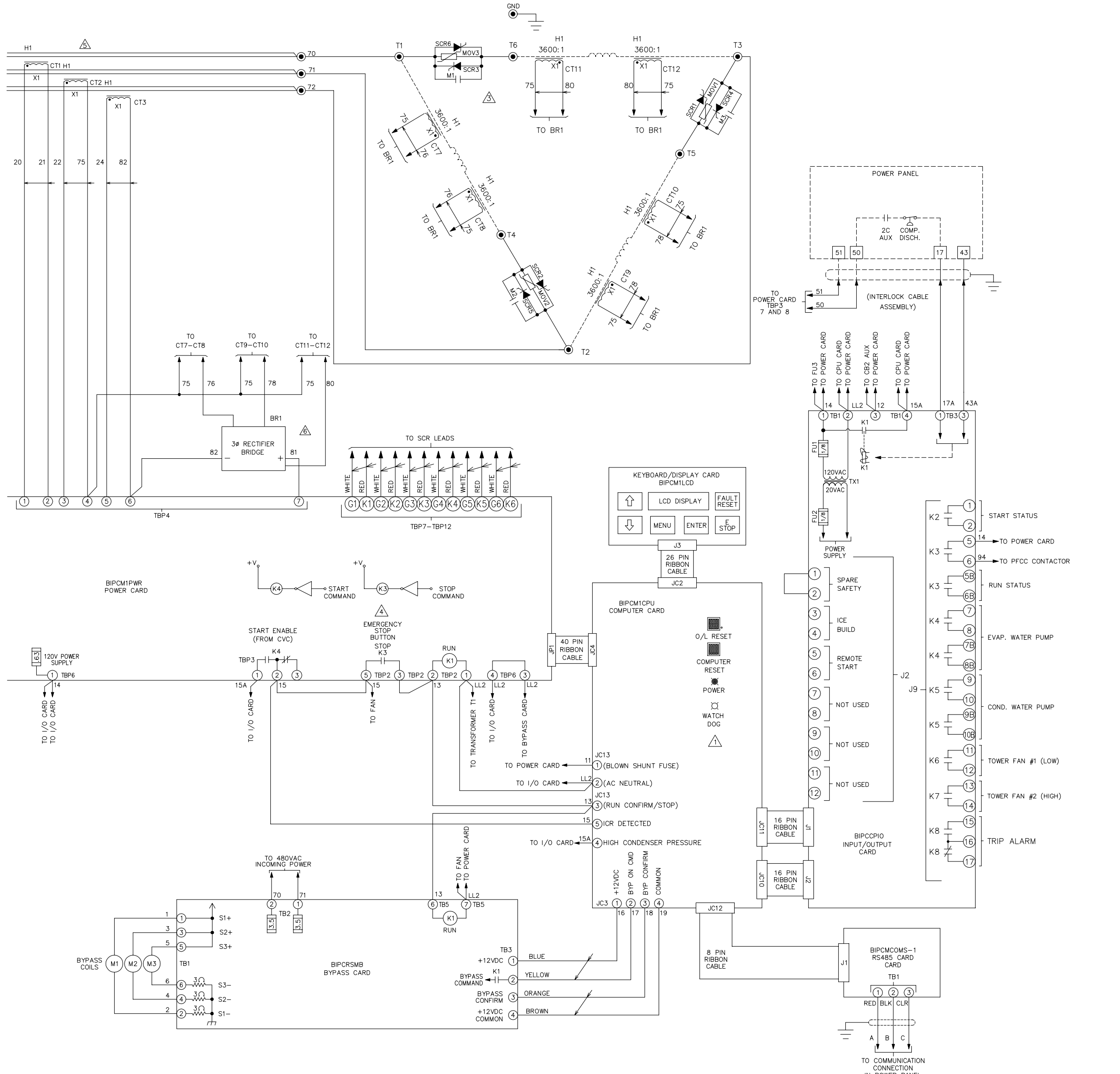
CHART 1

SYSTEM VOLTAGE	FU1–2 AMPS
200	30
230 60Hz	30
230 50Hz	30
346	20
380	20
400	15
416	15
460	15
575	12

CHART 2

STARTER RLA RANGE	MICRO CT RATIO
95–135	3900:1
136–200	5760:1
201–231	2640:1
232–300	3900:1
301–340	3900:1
341–480	5760:1
481–580	2640:1
581–600	3900:1
601–740	3900:1
741–855	3900:1
856–1250	5760:1

Fig. 52 — Benshaw, Inc. Solid-State Unit Mounted Starter Wiring Schematic (Low Voltage)



LEGEND

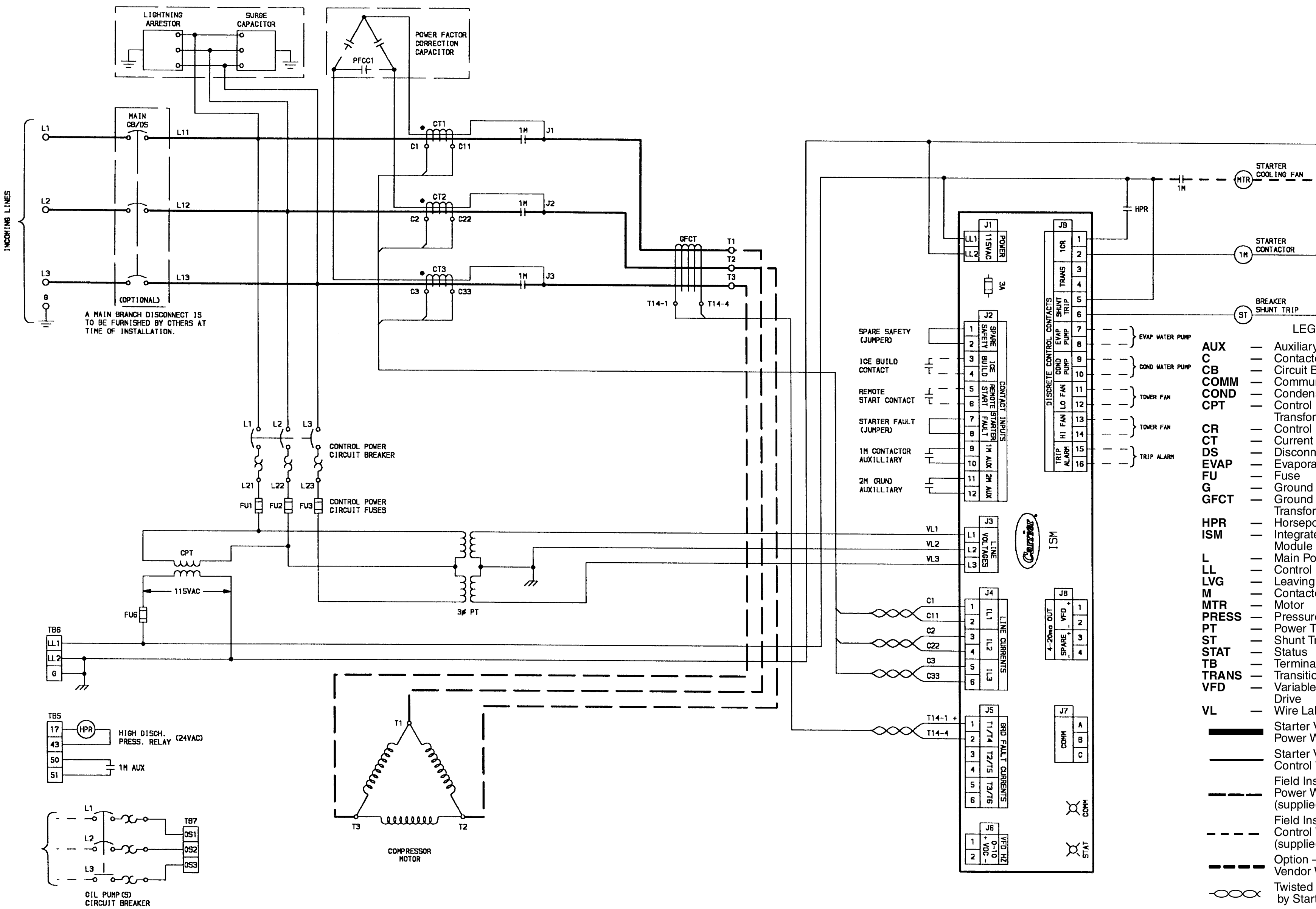
AUX	— Auxiliary	**L**	— Main Supply Power
BR	— Bridge Rectifier	**LL**	— Control Power Supply
CB	— Circuit Breaker	**M**	— Contactor
COND	— Condenser	**O/L**	— Overload Reset
CPU	— Central Processing Unit	**PFCC**	— Power Factor Correction Capacitor
CVC	— Chiller Visual Controller	**RLA**	— Rated Load Amps
CT	— Current Transformer	**SCR**	— Silicone Controller Rectifier
EVAP	— Evaporator	**ST**	— Shunt Trip
FU	— Fuse	**TB**	— Terminal Block
GND	— Ground		

Wire Node Symbol may have terminal block
Benshaw supplied terminal block
Terminal Strip
Power Connection
PC Board Terminals
Twisted Pair
Twisted Shielded Pair
Shield Wire
Field Wiring

NOTES:

1. LED status with power applied and prior to run command. "ON" "OFF"
2. Transformer T1 primary fuses FU1/FU2 value dependent on system voltage and model, per Chart 1. Transformer connections per transformer nameplate connection diagram.
3. MOVs are used on power stack assemblies for system voltages of 200 through 460 vac (as shown). Resistor/capacitor networks (DVDTs) are used on power stack assemblies in place of MOVs for a system voltage of 575 vac (not shown).
4. K3 relay shown in deenergized state. K3 contact will close when power is supplied. K3 contact will open on stop command or system fault.
5. CT1-CT3 are sized per Chart 2.
6. Optional.

Fig. 52 — Benshaw, Inc. Solid-State Unit Mounted Starter Wiring Schematic (Low Voltage) (cont)



LEGEND

AUX	—	Auxiliary
C	—	Contactor
CB	—	Circuit Breaker
COMM	—	Communication
COND	—	Condenser
CPT	—	Control Power Transformer
CR	—	Control Relay
CT	—	Current Transformer
DS	—	Disconnect Switch
EVAP	—	Evaporator
FU	—	Fuse
G	—	Ground
GFCT	—	Ground Fault Current Transformer
HPR	—	Horsepower
ISM	—	Integrated Starter Module
L	—	Main Power Supply
LL	—	Control Power Supply
LVG	—	Leaving
M	—	Contactor
MTR	—	Motor
PRESS	—	Pressure
PT	—	Power Transformer
ST	—	Shunt Trip
STAT	—	Status
TB	—	Terminal Block
TRANS	—	Transition
VFD	—	Variable Frequency Drive
VL	—	Wire Label
		Starter Vendor Power Wiring
		Starter Vendor Control Wiring
		Field Installed Power Wiring (supplied by others)
		Field Installed Control Wiring (supplied by others)
		Option — Starter Vendor Wiring
		Twisted Pair Wiring by Starter Vendor
		Customer Terminal Connection

Fig. 53 — Typical Across-the-Line Starter Wiring Schematic (Medium Voltage)

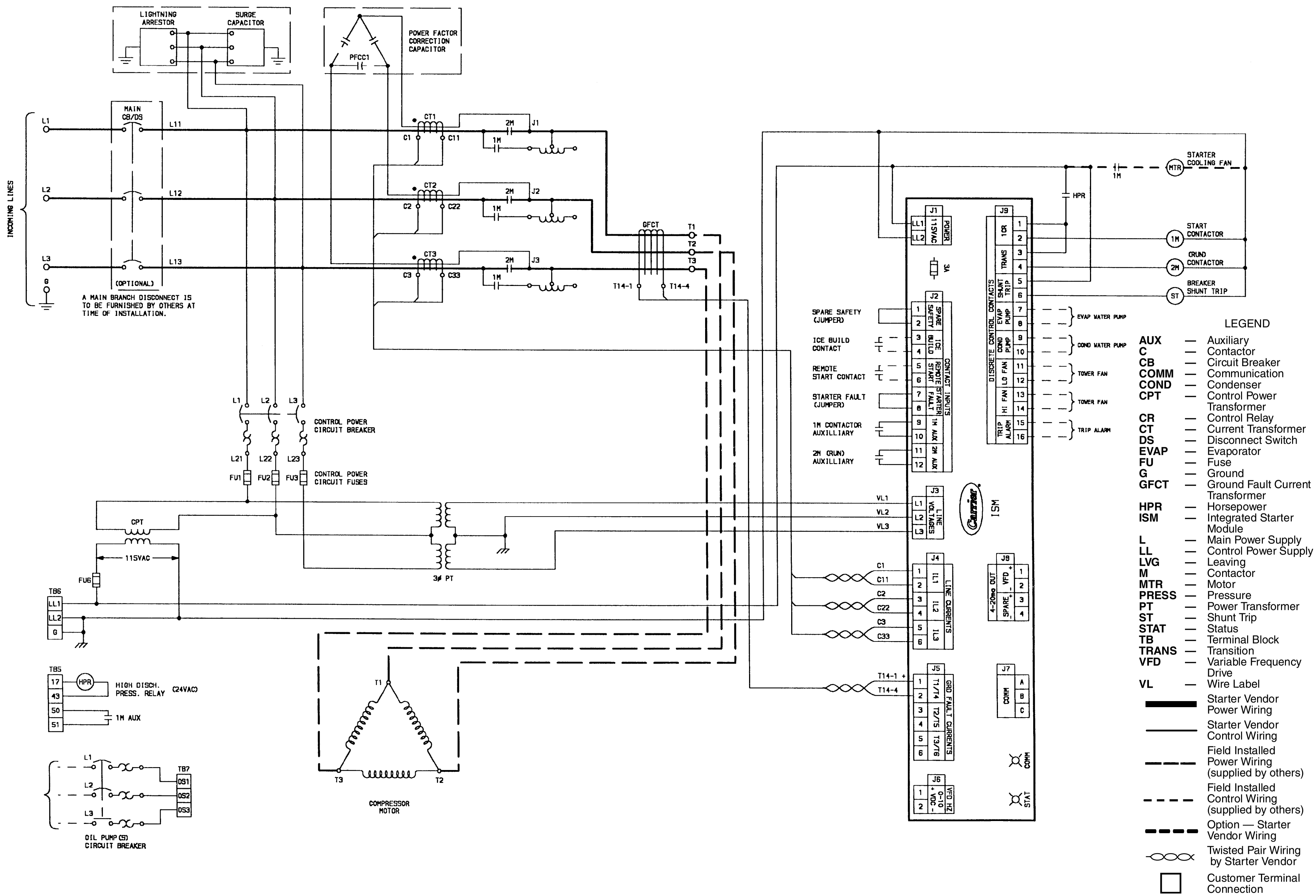


Fig. 54 — Typical Primary Reactor Starter Wiring Schematic (Medium Voltage)

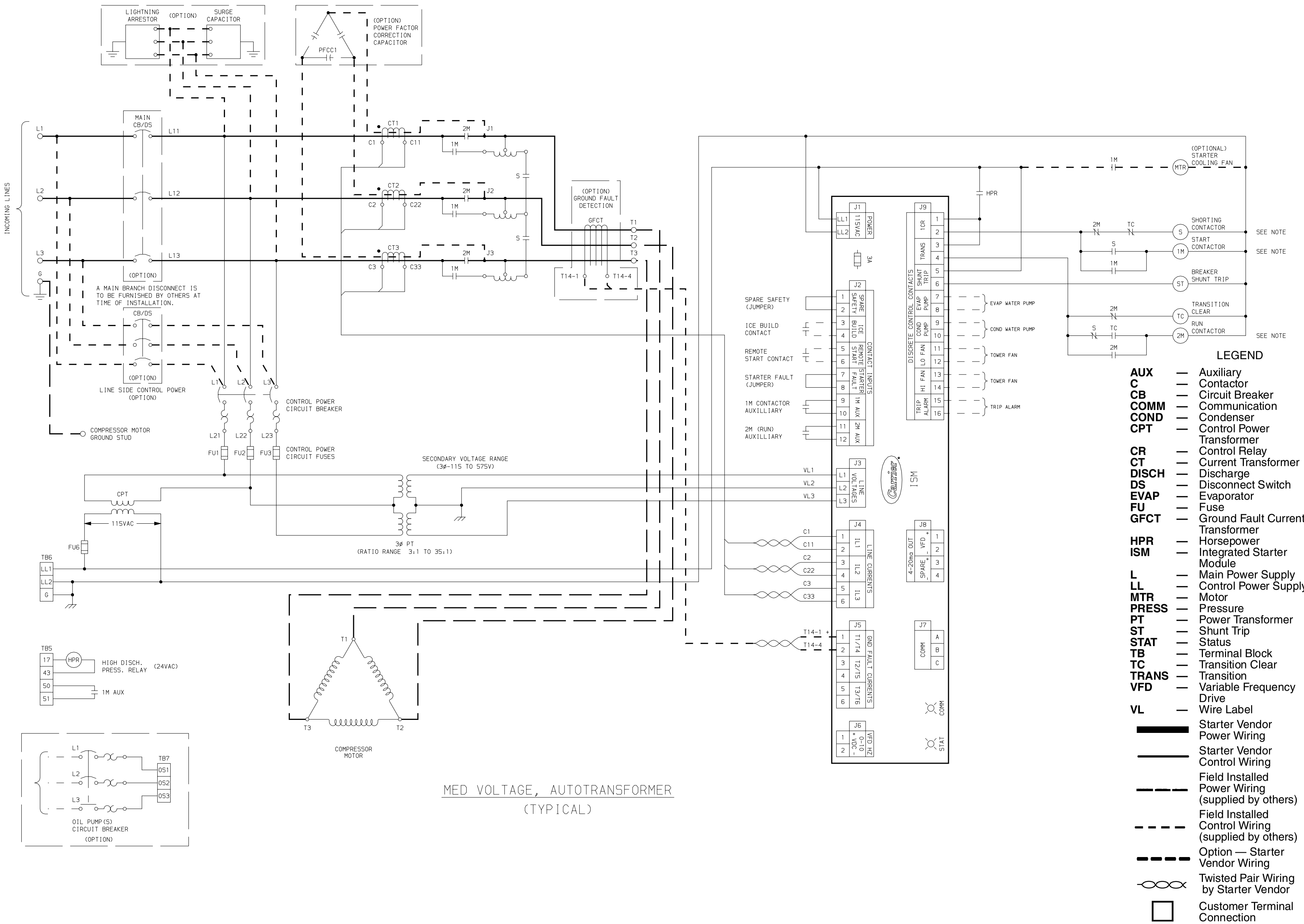


Fig. 55 — Typical Autotransformer Starter Wiring Schematic (Medium Voltage)

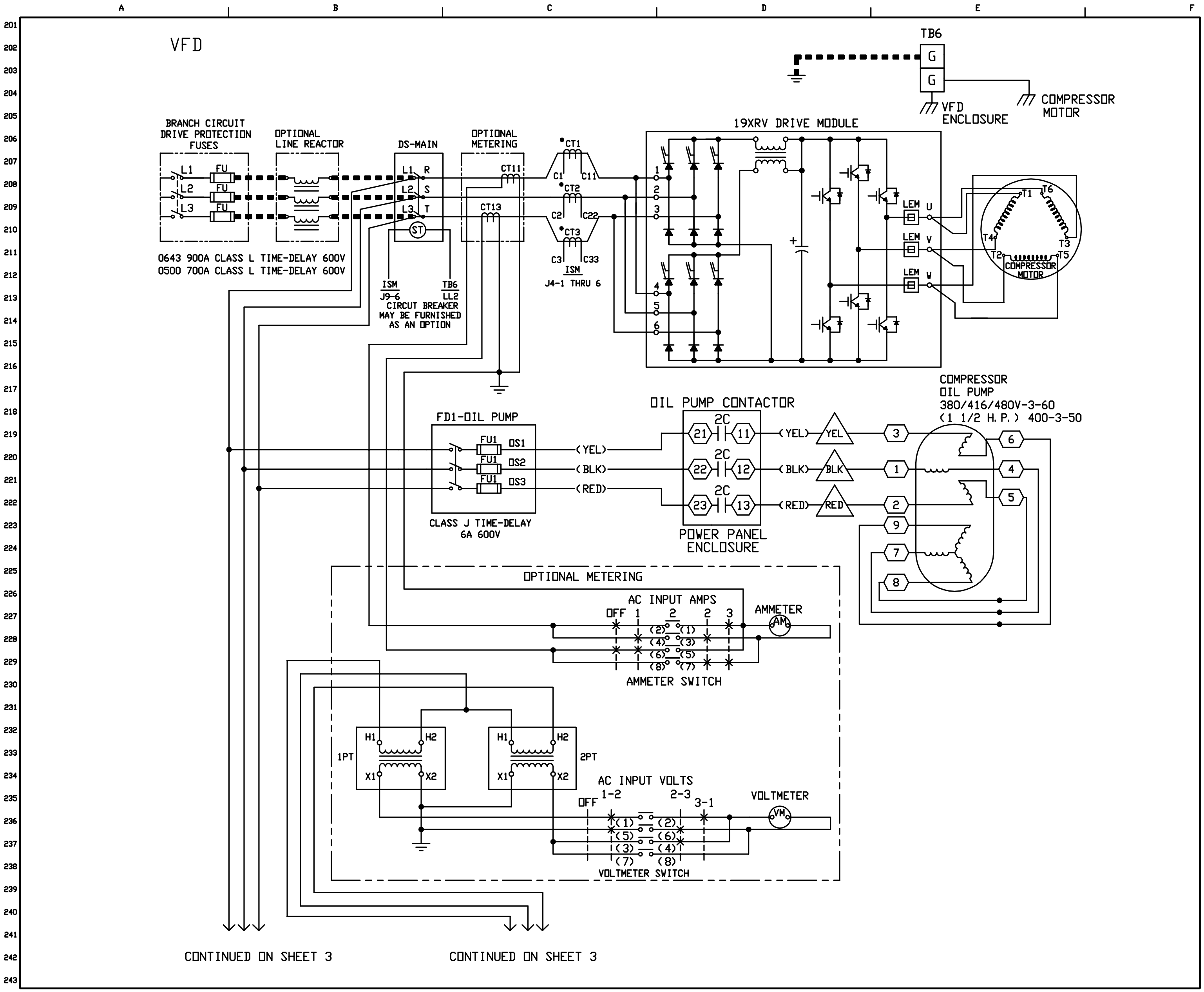


Fig. 56 — Typical Variable Frequency Drive (VFD) Wiring Schematic

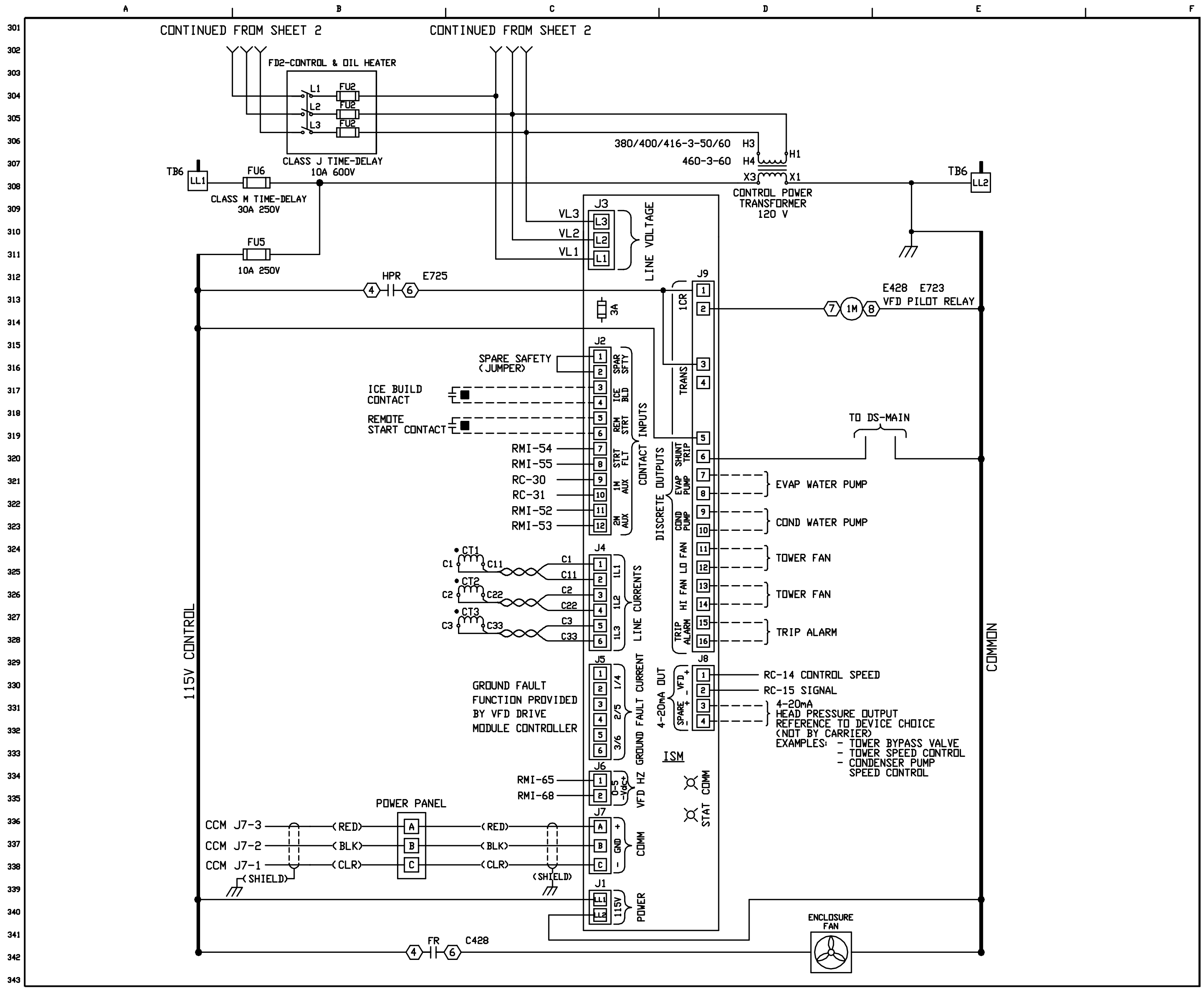


Fig. 56 — Typical Variable Frequency Drive (VFD) Wiring Schematic (cont)

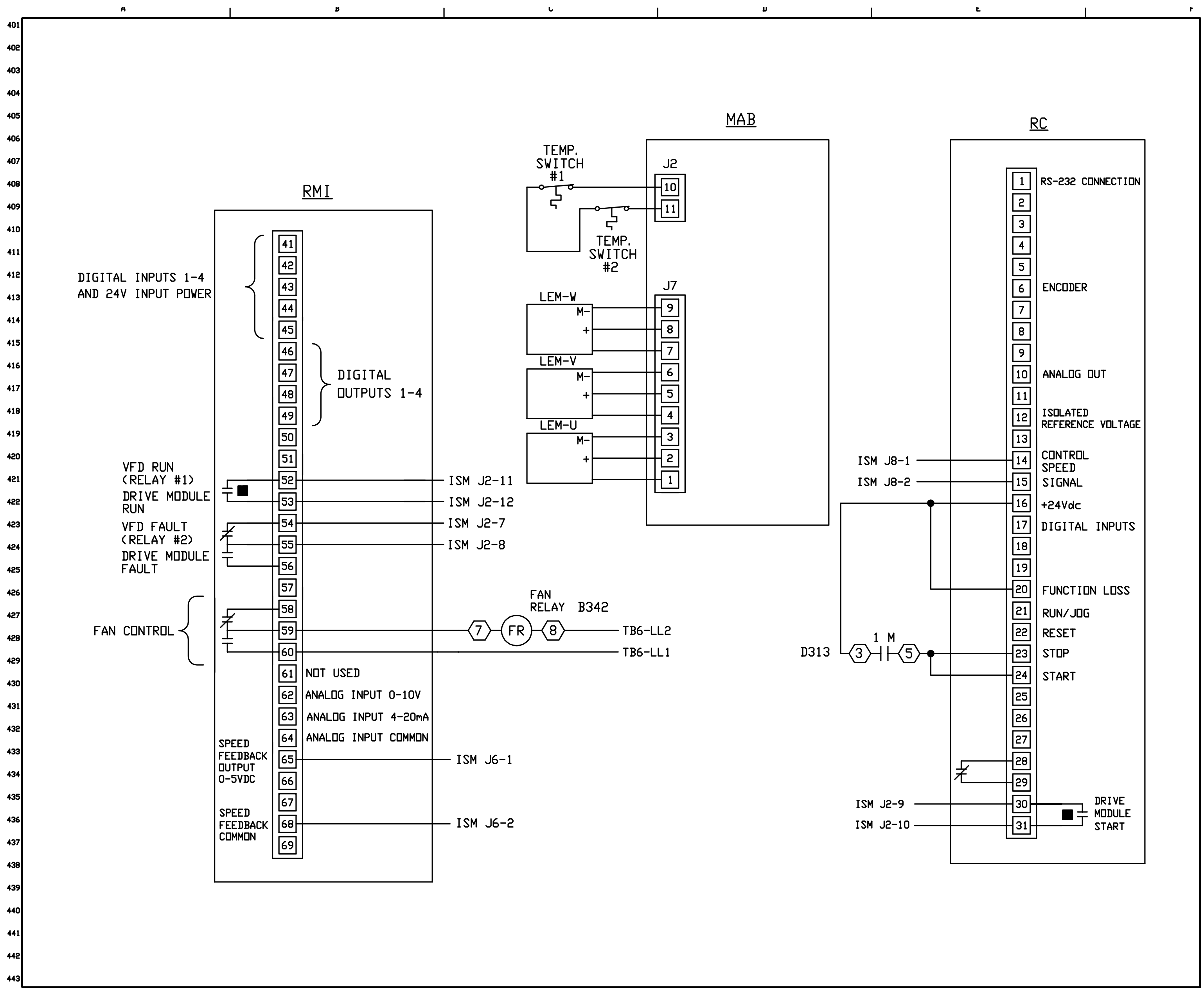


Fig. 56 — Typical Variable Frequency Drive (VFD) Wiring Schematic (cont)

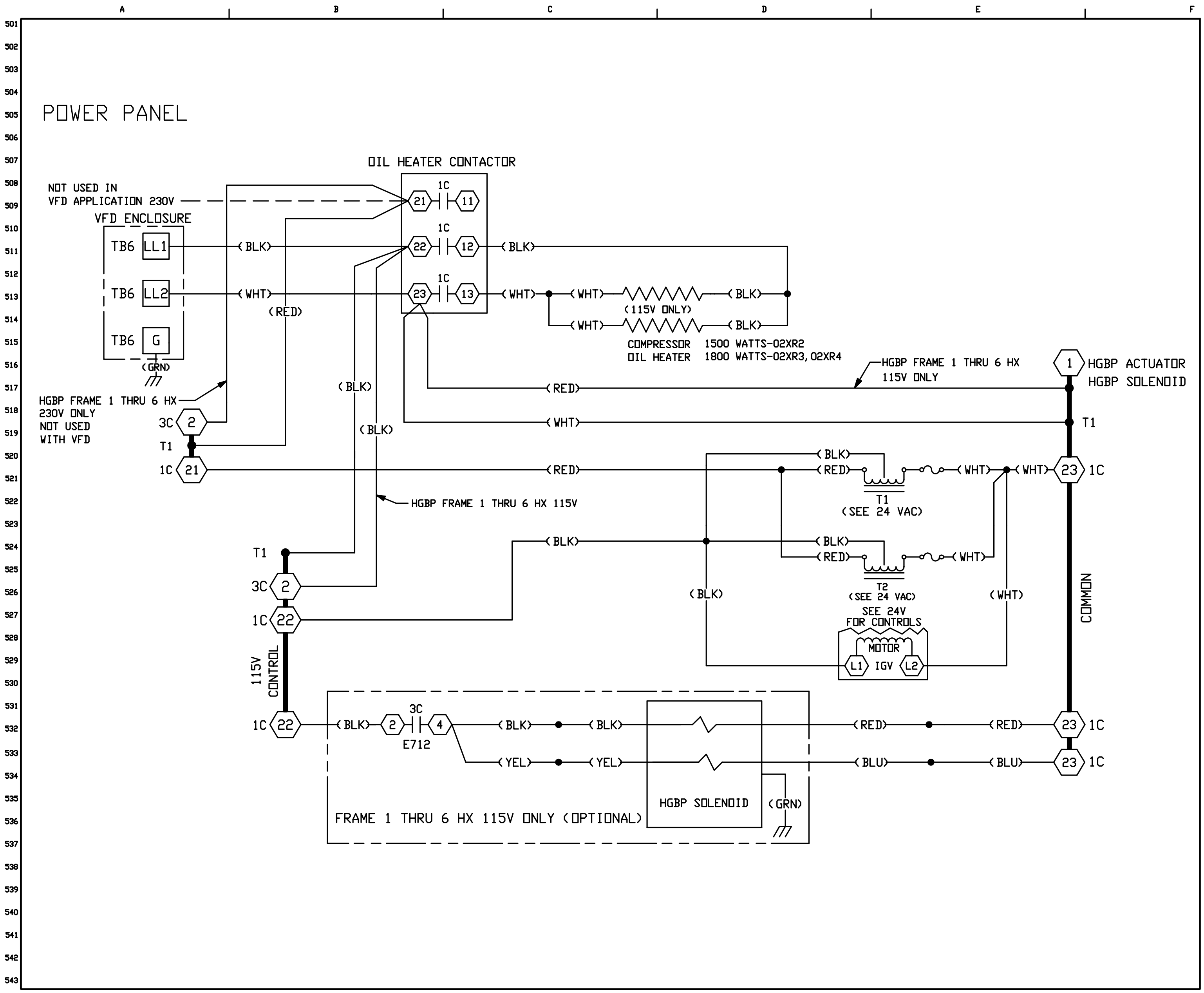
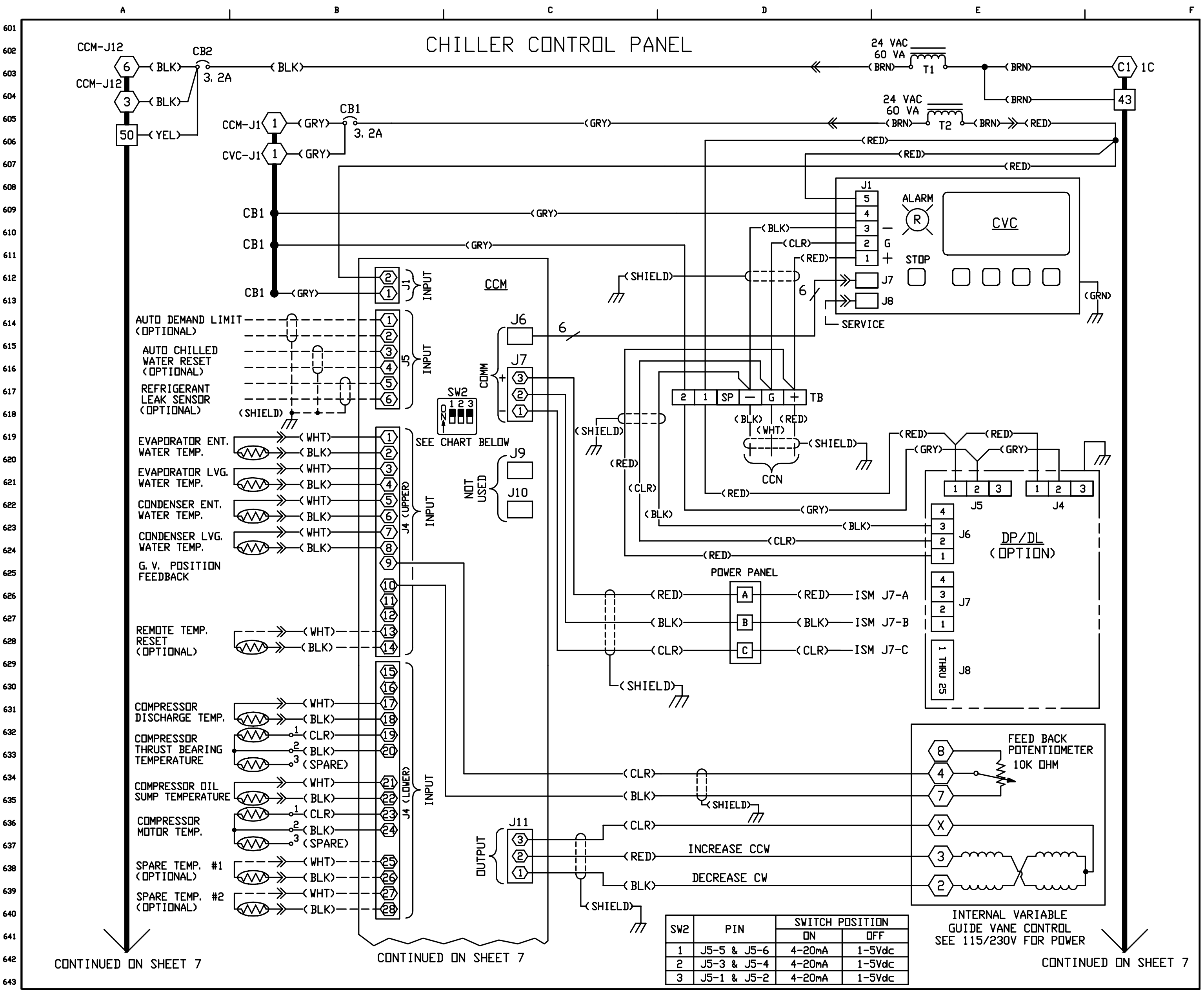


Fig. 56 — Typical Variable Frequency Drive (VFD) Wiring Schematic (cont)



SW2	PIN	SWITCH POSITION ON	SWITCH POSITION OFF
1	J5-5 & J5-6	4-20mA	1-5Vdc
2	J5-3 & J5-4	4-20mA	1-5Vdc
3	J5-1 & J5-2	4-20mA	1-5Vdc

Fig. 56 — Typical Variable Frequency Drive (VFD) Wiring Schematic (cont)

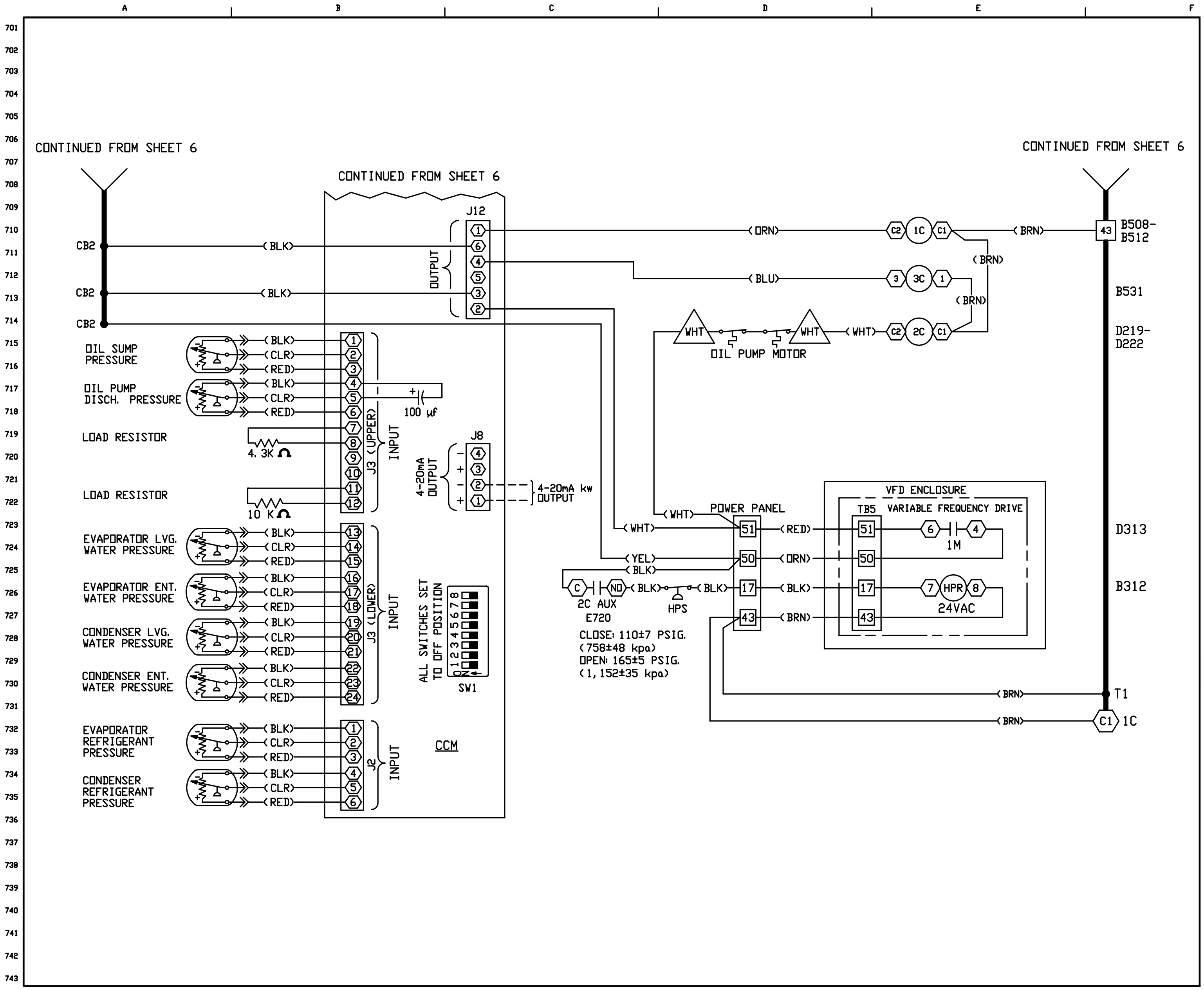
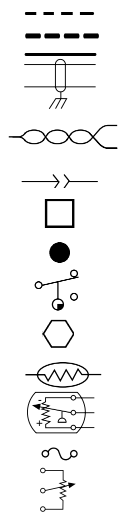


Fig. 56 — Typical Variable Frequency Drive (VFD) Wiring Schematic (cont)

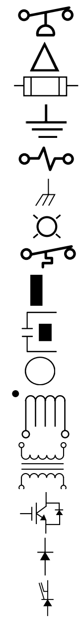
LEGEND FOR FIG. 56

AUX — Auxiliary
CB — Circuit Breaker
CCM — Chiller Control Module
CCN — Carrier Comfort Network
COMM — Communications
CT — Currrent Transformer
CVC — Chiller Visual Controller
DP/DL — Data Port/Data Link
DS — Disconnect Switch
FD — Fused Disconnect
FR — Fan Relay
FU — Fuse
G — Chassis Ground
GV — Guide Vane
HGBP — Hot Gas Bypass
HPR — High Discharge Pressure Relay
HPS — High Pressure Switch
HX — Heat Exchanger
IGBT — Insulated Gate Bipolar Transitor
IGV — Inlet Guide Vane
ISM — Integrated Starter Module
J — Junction
LEM — Current Detector
MAB — Module Adapter Board
RC — Regulator Controller
RMI — Remote Metering Interface
ST — Shunt Trip
T — Transformer
TB — Terminal Block

VFD — Variable Frequency Drive
1C — Compressor Oil Heater Contactor
1M — Start Contactor
2C — Oil Pump Contactor
3C — Hot Gas Bypass Relay



Field Control Wiring
Field Power Wiring
Factory Wiring
Shielded Cable
Twisted Pair Wiring
Male/Female Connector
Terminal Block Connection
Wire Splice or Junction
Cam Switch
Component Terminal
Thermistor
Transducer
Fusible Link
Potentiometer



Pressure Switch
Compr Oil Pump Terminal
Cartridge Fuse
Earth Ground
Resistor
Chassis Ground
Light
Temperature Switch
Common Potential
Dry Contact
VFD Terminal
Current Transformer, Polarized (Direction Determined by •)
Transformer
IGBT
Diode
Silicone Control Rectifier