



# Start-Up and Service Instructions

## SAFETY CONSIDERATIONS

Centrifugal liquid chillers are designed to provide safe and reliable service when operated within design specifications. When operating this equipment, use good judgment and safety precautions to avoid damage to equipment and property or injury to personnel.

Be sure you understand and follow the procedures and safety precautions contained in the machine instructions, as well as those listed in this guide.

### ⚠ DANGER

Failure to follow these procedures will result in severe personal injury or death.

DO NOT VENT refrigerant relief devices within a building. Outlet from rupture disc or relief valve must be vented outdoors in accordance with the latest edition of ANSI/ASHRAE 15 (American National Standards Institute/American Society of Heating, Refrigerating and Air-Conditioning Engineers) (Safety Code for Mechanical Refrigeration). The accumulation of refrigerant in an enclosed space can displace oxygen and cause asphyxiation.

PROVIDE adequate ventilation in accordance with ANSI/ASHRAE 15, especially for enclosed and low overhead spaces. Inhalation of high concentrations of vapor is harmful and may cause heart irregularities, unconsciousness, or death. Intentional misuse can be fatal. Vapor is heavier than air and reduces the amount of oxygen available for breathing. Product causes eye and skin irritation. Decomposition products are hazardous.

DO NOT USE OXYGEN to purge lines or to pressurize a machine for any purpose. Oxygen gas reacts violently with oil, grease, and other common substances.

DO NOT USE air to leak test. Use only refrigerant or dry nitrogen.

NEVER EXCEED specified test pressures. VERIFY the allowable test pressure by checking the instruction literature and the design pressures on the equipment nameplate.

DO NOT VALVE OFF any safety device.

BE SURE that all pressure relief devices are properly installed and functioning before operating any machine.

RISK OF INJURY OR DEATH by electrocution. High voltage is present on motor leads even though the motor is not running when a solid state or inside-delta mechanical starter is used. Open the power supply disconnect before touching motor leads or terminals.

### ⚠ WARNING

Failure to follow these procedures may result in personal injury or death.

DO NOT USE TORCH to remove any component. System contains oil and refrigerant under pressure.

To remove a component, wear protective gloves and goggles and proceed as follows:

- Shut off electrical power to unit.
- Recover refrigerant to relieve all pressure from system using both high-pressure and low pressure ports.
- Traces of vapor should be displaced with nitrogen and the work area should be well ventilated. Refrigerant in contact with an open flame produces toxic gases.
- Cut component connection tubing with tubing cutter and remove component from unit. Use a pan to catch any oil that may come out of the lines and as a gage for how much oil to add to the system.
- Carefully unsweat remaining tubing stubs when necessary. Oil can ignite when exposed to torch flame.

DO NOT USE eyebolts or eyebolt holes to rig machine sections or the entire assembly.

DO NOT work on high-voltage equipment unless you are a qualified electrician.

DO NOT WORK ON electrical components, including control panels, switches, starters, or oil heater until you are sure ALL POWER IS OFF and no residual voltage can leak from capacitors or solid-state components.

LOCK OPEN AND TAG electrical circuits during servicing. IF WORK IS INTERRUPTED, confirm that all circuits are de-energized before resuming work.

AVOID SPILLING liquid refrigerant on skin or getting it into the eyes. USE SAFETY GOGGLES. Wash any spills from the skin with soap and water. If liquid refrigerant enters the eyes, IMMEDIATELY FLUSH EYES with water and consult a physician.

NEVER APPLY an open flame or live steam to a refrigerant cylinder. Dangerous over pressure can result. When it is necessary to heat refrigerant, use only warm (110 F [43 C]) water.

DO NOT REUSE disposable (nonreturnable) cylinders or attempt to refill them. It is DANGEROUS AND ILLEGAL. When cylinder is emptied, evacuate remaining gas pressure, loosen the collar, and unscrew and discard the valve stem. DO NOT INCINERATE.

CHECK THE REFRIGERANT TYPE before adding refrigerant to the machine. The introduction of the wrong refrigerant can cause machine damage or malfunction.

*(Warnings continued on next page.)*

**⚠ WARNING**

Operation of this equipment with refrigerants other than those cited herein should comply with ANSI/ASHRAE 15 (latest edition). Contact Carrier for further information on use of this machine with other refrigerants.

DO NOT ATTEMPT TO REMOVE fittings, covers, etc., while machine is under pressure or while machine is running. Be sure pressure is at 0 psig (0 kPa) before breaking any refrigerant connection.

CAREFULLY INSPECT all relief valves, rupture discs, and other relief devices AT LEAST ONCE A YEAR. If machine operates in a corrosive atmosphere, inspect the devices at more frequent intervals.

DO NOT ATTEMPT TO REPAIR OR RECONDITION any relief valve when corrosion or build-up of foreign material (rust, dirt, scale, etc.) is found within the valve body or mechanism. Replace the valve.

DO NOT install relief devices in series or backwards.

USE CARE when working near or in line with a compressed spring. Sudden release of the spring can cause it and objects in its path to act as projectiles.

**⚠ CAUTION**

Failure to follow these procedures may result in personal injury or damage to equipment.

DO NOT STEP on refrigerant lines. Broken lines can whip about and release refrigerant, causing personal injury.

DO NOT climb over a machine. Use platform, catwalk, or staging. Follow safe practices when using ladders.

USE MECHANICAL EQUIPMENT (crane, hoist, etc.) to lift or move inspection covers or other heavy components. Even if components are light, use mechanical equipment when there is a risk of slipping or losing your balance.

BE AWARE that certain automatic start arrangements CAN ENGAGE THE STARTER, TOWER FAN, OR PUMPS. Open the disconnect *ahead of* the starter, tower fan, and pumps. Shut off the machine or pump before servicing equipment.

USE only repaired or replacement parts that meet the code requirements of the original equipment.

DO NOT VENT OR DRAIN waterboxes containing industrial brines, liquid, gases, or semisolids without the permission of your process control group.

DO NOT LOOSEN waterbox cover bolts until the waterbox has been completely drained.

DOUBLE-CHECK that coupling nut wrenches, dial indicators, or other items have been removed before rotating any shafts.

DO NOT LOOSEN a packing gland nut before checking that the nut has a positive thread engagement.

PERIODICALLY INSPECT all valves, fittings, and piping for corrosion, rust, leaks, or damage.

PROVIDE A DRAIN connection in the vent line near each pressure relief device to prevent a build-up of condensate or rain water.

DO NOT re-use compressor oil or any oil that has been exposed to the atmosphere. Dispose of oil per local codes and regulations.

DO NOT leave refrigerant system open to air any longer than the actual time required to service the equipment. Seal circuits being serviced and charge with dry nitrogen to prevent oil contamination when timely repairs cannot be completed.

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**INTRODUCTION**

The Carrier VFD (variable frequency drive) option Start-Up and Service Manual is intended for trained and qualified service personnel, and is to be used during start-up, operation, and maintenance of the Eaton LCX9000 drive.

**ABBREVIATIONS AND EXPLANATIONS**

Frequently used abbreviations in this manual include:

- CCM** — Chiller Control Module
- DC** — Direct Current
- ICVC** — International Chiller Visual Controller
- I/O** — Inputs/Outputs
- IPWM** — Inverter Pulse Width Modulation
- MCB** — Main Control Board
- MOV** — Metal Oxide Varistor
- SIO** — Sensor Input/Output

**Required Publications** — The Carrier VFD option Start-Up and Service Manual must be used with the latest revision of the Start-Up, Operation, and Maintenance Instructions for the 19XRV or 23XRV chiller with PIC III controls.

**Getting Assistance from Eaton** — When calling the numbers listed below, have the following information available:

- Eaton General Order # (GO#)
- Carrier part number
- Eaton serial number

*Eaton Care HVAC OEM Support Team 1-800-752-5495*

*Direct to drives tech support 800-322-4986*

*Main Eaton Technical Resource Center Number 800-809-2772 (option 6 for drives)*

## IDENTIFYING DRIVE COMPONENTS

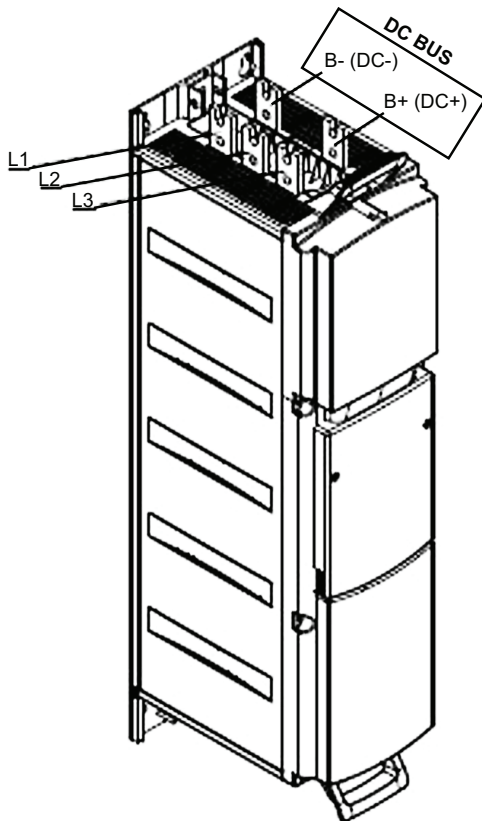
### ⚠ WARNING

DC bus capacitors retain hazardous voltages after input power has been disconnected. After disconnecting input power, wait five (5) minutes for the DC bus capacitors to discharge and then check the voltage with a voltmeter rated for the DC bus voltage to ensure the DC bus capacitors are discharged before touching any internal components. Failure to observe this precaution could result in severe bodily injury or loss of life.

An isolated multimeter will be needed to measure DC bus voltage and to make resistance checks. The drive's DC bus capacitors retain hazardous voltages after input power has been disconnected.

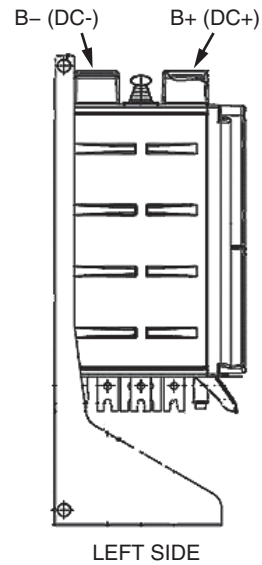
Check to be sure that the voltage between DC+ and DC- and from each DC terminal to the chassis is zero before proceeding. See Fig. 1A, 1B, and 2.

**Components and Application** — See Fig. 3 for component identification and Tables 1 and 2 for application by frame size.

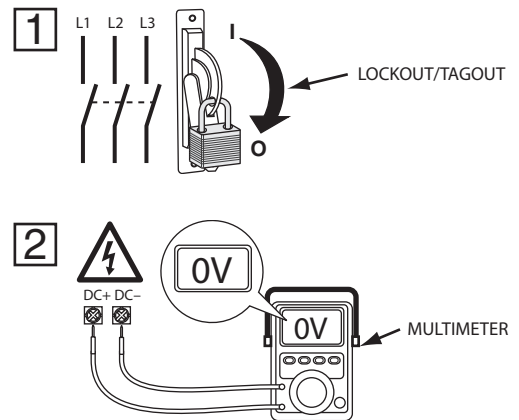


**Fig. 1A — DC Bus Location (Typical) for Frame CH72 and CH74**

CONNECTING BUSBAR OR CABLE



**Fig. 1B — DC Bus Location (Typical) for Frame CH63**



NOTE: DC terminals are on the input end of the CH72 and CH74 drive modules as shown in Fig. 1A. The CH74 drive has 3 modules.

The CH63 drive has 2 modules. The DC bus terminals are located on the top of the module as shown in Fig. 1B while both the input (L<sub>1</sub>, L<sub>2</sub>, L<sub>3</sub>) and output (T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>) terminals are located on the bottom of the drive.

The DC bus terminals for all modules are connected to each other (+) to (+) and (-) to (-).

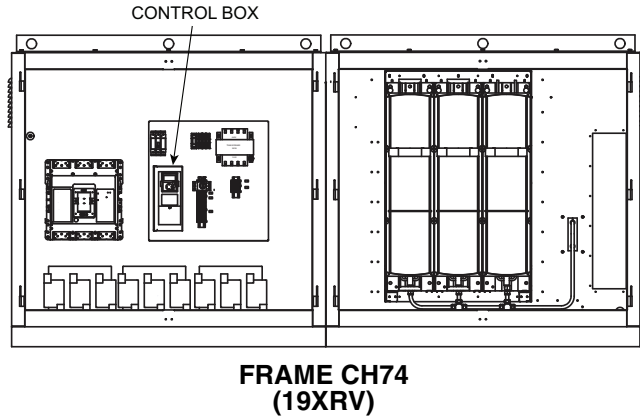
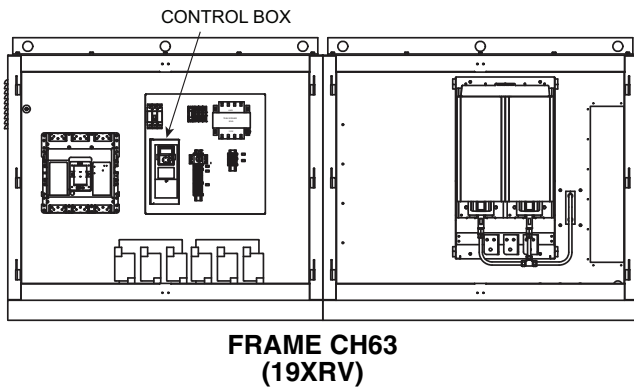
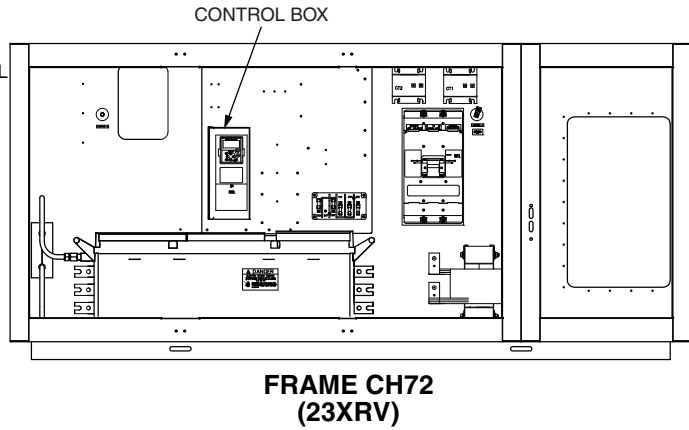
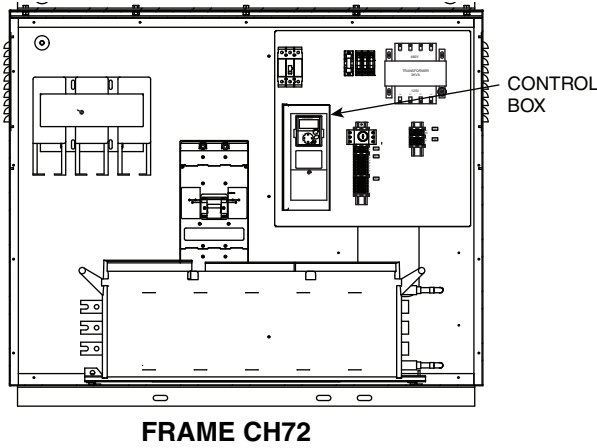
**Fig. 2 — Check DC Bus Terminals**

**Table 1 — VFD Frame Size and Application  
(19XRV, 380-480V)**

EATON FRAME SIZE	CARRIER PART NO.	MAXIMUM CONTINUOUS AMP RATING
CH72	19XVE0485	485
	19XVE0550	550
	19XVE0605	605
	19XVE0680	680
CH63	19XVE0765	765
	19XVE0855	855
	19XVE0960	960
	19XVE1070	1070
CH74	19XVE1275	1275
	19XVE1530	1530

**Table 2 — VFD Frame Size and Application  
(23XRV)**

EATON FRAME SIZE	CARRIER PART NO.	MAXIMUM CONTINUOUS AMP RATING	VOLTAGE
CH72	23XVE0485	485	380-480
	23XVE0550	550	
	23XVE0605	605	
	23XVE0389	389	575
	23XVE0469	469	



**Fig. 3 — Eaton LCX9000 Frame Sizes**

## START-UP

### DANGER

Internal components and circuit boards of the drive are live when the drive is connected to incoming power potential. Coming into contact with this voltage is extremely dangerous and will result in severe personal injury or death.

The motor terminals U, V, W and the DC-link/brake resistor terminals B+/R+, R- are live when the drive is connected to incoming power, even if the motor is not running.

Do not make any connections when the drive is connected to the incoming power.

After having disconnected the drive, wait until the indicators on the keypad go out (if no keypad is attached see the indicator through the keypad base). Wait 5 more minutes before doing any work on drive connections. Do not even open the cover before this time has expired.

Before connecting the drive to incoming power, make sure that the switchgear enclosure door is closed.

### CAUTION

If other than refrigerant cooling is used, before connecting the drive to incoming power, make sure that the coolant is circulating and has no leaks.

Initial startup of the VFD should be completed by a trained technician certified by Eaton and Carrier as a commissioner for the LCX9000 VFD. Proper commissioning forms should be completed for submission to Eaton. The entire VFD parameter set should be collected using the Eaton XDrive utility program (available from Eaton) and submitted to Eaton as part of standard commissioning.

**Wire Lugs** — See Table 3 for wire lug sizes. In the case where the incoming power wire size does not fit the standard lug, alternate lugs may be used. Note that lugs rated for a higher current than the circuit breaker may be used.

### WARNING

The control I/O-terminals are isolated from the incoming power potential. However, the relay outputs and other I/O terminals may have a dangerous control voltage present even when the drive is disconnected from incoming power. Coming into contact with this voltage could result in severe personal injury.

Table 3 — Wire Lug Sizes

EATON FRAME SIZE	CARRIER VFD PART NO.	EATON CIRCUIT BREAKER PART NO. 65kAIC@480V	EATON CIRCUIT BREAKER PART NO. 100kAIC@480V	LINE TERMINAL LUGS	AWG/MCM WIRE RANGE (NO. OF CONDUCTORS)	ALTERNATE LINE TERMINAL LUGS	AWG/MCM WIRE RANGE (NO. OF CONDUCTORS)
CH72	23XVE0389	NGH308033E	NGC308033E	TA1200NB1	4/0-500 (4)	TA1201NB1	1-600 (4)
	23XVE0469						
	23XVE0485						
	19XVE0485						
	23XVE0550	NGH312033E	NGC312033E				
	19XVE0550						
	23XVE0605						
	19XVE0605						
19XVE0680	NGH312033E	NGC312033E					
19XVE0765							
19XVE0855							
19XVE0960							
CH63	19XVE1070	RGH316033E	RGC316033E	TA1600RD	500-1000 (4)	T1600RD*	1-600 (4)
	19XVE1275	RGH316033E	RGC316033E	TA1600RD	500-1000 (4)	T1600RD*	
CH74	19XVE1530	RGH320033E	RGC320033E	TA2000RD	2-600 (6)	N/A	N/A


\*Terminal lug is suitable for copper wire only.

**Verify Installation** — Record the following job information:

1. Job Name
2. Job Number
3. City
4. State
5. Zip Code

Record the following nameplate information:

1. From the VFD nameplate:
  - a. VFD Serial Number
  - b. VFD Part Number
2. From the machine nameplate (Fig. 4) located at the end of the control panel:
  - a. Chiller Serial Number
  - b. Chiller Model
  - c. Motor rated load amps
  - d. Motor nameplate rpm
  - e. Motor nameplate kW
  - f. Motor nameplate voltage
  - g. IPWM (pulse width modulation) frequency
  - h. Voltage
3. From the ICVC control panel screen:
  - a. Carrier Part Number and Revision
  - b. ICVC Software Number

 <b>Carrier</b> <small>A United Technologies Company</small>	
MODEL NUMBER	
SERIAL NUMBER	
<b>MACHINE NAMEPLATE SUPPLY DATA</b>	
VOLTS/PHASE/HERTZ	
LOCKED ROTOR AMPS	
OVERLOAD TRIP AMPS	
MAX FUSE/CIRCUIT BREAKER SIZE	
MIN SUPPLY CIRCUIT CAPACITY	
<b>MACHINE ELECTRICAL DATA</b>	
MOTOR NAMEPLATE VOLTAGE	
COMPRESSOR 100% SPEED	
RATED LINE VOLTAGE	
RATED LINE AMPS	
RATED LINE KILOWATTS	
MOTOR RATED LOAD KW	
MOTOR RATED LOAD AMPS	
MOTOR NAMEPLATE AMPS	
MOTOR NAMEPLATE RPM	
MOTOR NAMEPLATE KW	
INVERTER PWM FREQUENCY	
SAFETY CODE CERTIFICATION <small>THE COMPRESSOR MOTOR CONTROLLER AND OVERLOAD PROTECTION MUST BE IN ACCORDANCE WITH CARRIER SPECIFICATION 7-420.        181955008701 REV. 3</small>	

**Fig. 4 — Machine Nameplate**

**Configure the VFD** — All configurations required by the VFD are supplied by the ICVC through the VFD Gateway. Any configuration changes necessary and possible are made on the ICVC screens. A complete set of configurations is transmitted to the VFD each time the controls are powered up.

The following is from the PIC III VFD\_CONF screen. Parameters in *italics>* are to be entered or confirmed at start-up. Parameters in **bold** are to be changed only after consulting with Carrier service engineering. See Table 4.

**Table 4 — VFD Configurations**

PARAMETER	DEFAULT VALUE
Motor Nameplate Voltage	460
<b>Compressor 100% Speed</b>	
Line Freq=60 Hz? (No=50)	Yes
<i>Rated Line Voltage*</i>	460
<i>Rated Line Amps*</i>	200
Rated Line Kilowatts *	100
Motor Rated Load kW*	100
Motor Rated Load Amps*	200
Motor Nameplate Amps	100
<i>Motor Nameplate RPM</i>	3456
<i>Motor Nameplate KW</i>	100
<b>Inverter PWM Frequency (0 = 4 kHz, 1 = 2 kHz)</b>	1
<b>Skip Frequency 1 (Hz)</b>	102.0
<b>Skip Frequency 2 (Hz)</b>	102.0
<b>Skip Frequency 3 (Hz)</b>	102.0
<b>Skip Frequency Band Line (Hz)</b>	0.0
<b>Voltage % Imbalance</b>	10
<b>Line Volt Imbalance Time (sec)</b>	10
<b>Line Current % Imbalance</b>	40
<b>Line Current Imbal Time (sec)</b>	10
<b>Motor Current % Imbalance</b>	40
<b>Motor Current Imbal Time</b>	10
Increase Ramp Time (sec)	30
Decrease Ramp Time (sec)	30
Single Cycle Dropout (DSABLE/ENABLE)	DSABLE

\* Parameters marked with an \* are not downloadable to the VFD but are used in other calculations and algorithms in the ICVC.

NOTES:

1. Parameters in *italics* are to be entered or confirmed at start-up.
2. Parameters in **bold** are to be changed only after consultation with service engineering.

**Commissioning the Unit** — The commissioning procedure is as follows:

1. If the chiller has been stored outdoors, allow at least 24 hours room temperature stabilization prior to commissioning. Ensure any condensation that occurs as a result of the ambient temperature is allowed to evaporate.
2. Enter parameters in the VFD\_CONF screen.
3. Install surge suppression devices if required.
4. Review the power wiring and grounding to ensure that it has been properly connected.
5. Visually examine the inside of the drive enclosure to:
  - a. Look for signs of corrosion or moisture residue.
  - b. Remove any dirt or debris.
  - c. Make sure all vents are clear.
6. Apply power to the drive and take thermal measurements of the power connections. Do this again before start-up.
7. Measure and record the incoming line voltages Vab, Vbc, Vca.

$$V_{avg} = \frac{(V_{ab} + V_{bc} + V_{ca})}{3}$$

Pick the line voltage of the greatest difference from the average voltage. Subtract the smaller from the larger to get  $V_{diff}$ .

$$\frac{(V_{diff} \times 100)}{V_{avg}} = \% \text{ voltage imbalance}$$

Voltage imbalance must be 2% or less.

8. Take a final thermal measurement of the termination after finalizing the installation to ensure all connections are good.
9. If a ground fault occurs, then do the following:
  - a. Turn off and lock out input power. Wait five minutes.
  - b. Check for a ground in the motor or motor wiring.
  - c. Check for damage to wiring insulation and that wiring is dry.
  - d. Verify the motor wiring is separated from ground and there is no connection between phases.
  - e. Check for failed IGBTs.
10. If an Overcurrent fault occurs, then do the following:
  - a. Turn off and lock out input power. Wait five minutes.
  - b. Check for excessive load and verify load limit settings on the ICVC.
  - c. Check motor and wiring insulation.
  - d. Check parameter settings on VFD\_CONF screen in the ICVC.

**Check Configuration Jumpers** — Check that configuration jumpers are as shown in Fig. 5.

OPTA9 MULTI-PURPOSE APPLICATION		A9—
REFERENCE OUTPUT	X1	+10V [1]
ANALOG INPUT VOLTAGE (RANGE 0–10 VDC)	A	Vin+ [2]
I/O GROUND	B	GND [3]
	C	Lin+ [4]
	D	Lin– [5]
ANALOG INPUT CURRENT (RANGE 4–20mA)	X2	24Vout [6]
CONTROL VOLTAGE OUTPUT	A	GND [7]
I/O GROUND	B	DIN1 [8]
OPEN	C	DIN2 [9]
OPEN	D	DIN3 [10]
EXTERNAL FAULT		CMA [11]
DIN1–DIN3 COMMON		24Vout [12]
CONTROL VOLTAGE OUTPUT		GND [13]
I/O GROUND		DIN4 [14]
SPARE SAFETY		DIN5 [15]
ICE BUILD		DIN6 [16]
REMOTE START		CMB [17]
DIN4–DIN6 COMMON	X6	Lout+ [18]
OUTPUT FREQUENCY	A	Lout– [19]
ANALOG OUTPUT	B	D01 [20]
DIGITAL OUTPUT READY	C	
	D	

**Fig. 5 — Check Configuration Jumpers**

## SERVICE

### ⚠ WARNING

DC bus capacitors retain hazardous voltages after input power has been disconnected. After disconnecting input power, wait five (5) minutes for the DC bus capacitors to discharge and then check the voltage with a voltmeter to ensure the DC bus capacitors are discharged before touching any internal components. Failure to observe this precaution could result in severe bodily injury or loss of life.

**Troubleshooting the Drive** — The drive can display two kinds of error codes on the ICVC called the Alert and Alarm codes. These codes signal a problem detected during self tuning or drive operation. Alert and Alarm codes are located in the 19XRV or 23XRV Start-Up, Operation and Maintenance Instructions.

- A warning message on the ICVC is an ALERT.
- The same warning viewed with the Eaton 9000x software tool is a VFD ALARM.
- A failure resulting in a shutdown is seen as an ALARM on the ICVC and as a VFD FAULT when viewed with Eaton 9000x software.

#### CONDITION CODES

ICVC ALERT = VFD ALARM

ICVC ALARM = VFD FAULT

The ICVC displays the Eaton code in the VFD HIST screen. Other ICVC screens will display the ICVC codes. Eaton codes that do not have a corresponding ICVC code will appear on the ICVC default and Alarm history screens as code 206. The fault can be identified by the Eaton code in the VFD\_HIST screen.

**ICVC ALERT CODES** — An alert condition is indicated by a message at the top of the ICVC default screen. In addition, an exclamation point (!) will appear next to any affected point on an ICVC display screen. The drive will continue to operate during the alert condition. Investigate the cause of the alert to ensure it does not lead to a fault condition. The alert code will automatically be cleared from the ICVC when the condition causing the alert no longer exists.

**ICVC ALARM CODES** — An alarm condition is also indicated by a message at the top of the ICVC default screen. If an alarm occurs, the drive coasts to stop and the RUN LED on the keypad will turn off. The detected fault message is maintained on the display until it is cleared by pressing the RESET softkey. For Eaton default code descriptions, see Table 5.

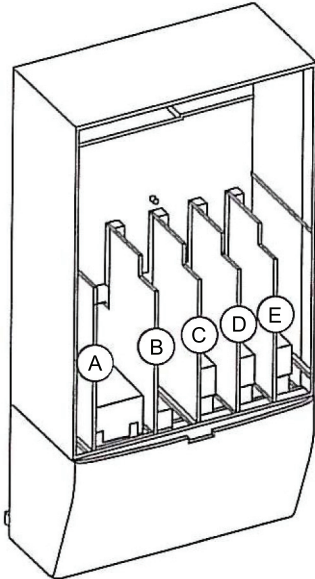
**TEST EQUIPMENT NEEDED TO TROUBLESHOOT** — An isolated multimeter adequately rated for the DC bus voltage will be needed to measure DC bus voltage and to make resistance checks. Note that dedicated troubleshooting test points are not provided.

**VERIFYING THAT DC BUS CAPACITORS ARE DISCHARGED** — The drive's DC bus capacitors retain hazardous voltages after input power has been disconnected. Perform the following steps before touching any internal components:

1. Turn off and lock out input power. Wait five minutes.
2. Verify that there is no voltage at the drive's input power terminals.
3. Measure the DC bus potential with a voltmeter while standing on a non-conductive surface and wearing insulated gloves (1000 v). Measure the DC bus potential. See Fig. 1. The voltage between DC+ and DC–, and from each DC terminal to the chassis must be zero before proceeding.
4. Once the drive has been serviced, reapply input power.

**HIGH TEMPERATURE ALARMS** — Coolant flow through the cold plate is controlled by an orifice in the refrigerant line leaving the cold plate. The orifice looks like one of the O-ring face seal connectors and in fact is used as one of the connections on the coolant tubing. The difference is that the passage through the fitting is 0.375 in. (9.5 mm). If the orifice is present and condenser liquid flow is present, the liquid will flash to cooler temperature at the orifice. This temperature difference is great enough to be easily felt.

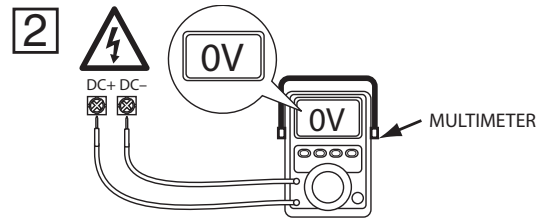
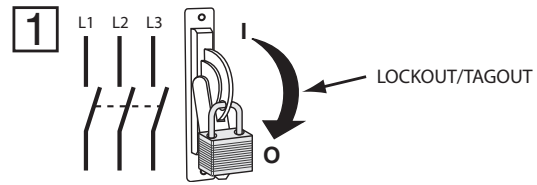
**MAIN CONTROL BOARD (MCB) COMPONENTS** — Refer to Fig. 6 for the location at the I/O board and relay boards which are installed in slots A-D. The OPTCC communication board is installed in slot E. Typical wiring schematics are shown in Appendix A.



**Fig. 6 — Basic and Option Board Connections of the Control Board**

**Checking Power Modules and Motor Input with Input Power Off** — Use the following procedure to check the drive’s power module circuitry with power off:

1. Turn off and lock out input power. Wait five minutes.
2. Verify there is no voltage at the drive’s input power terminals.
3. Using a voltmeter, check the DC bus potential as described in Fig. 7 to ensure the DC bus capacitors are discharged.
4. Disconnect the motor from the drive.
5. Check all AC line and DC bus fuses.
6. Check motor impedance.
7. Reconnect the motor to the drive.
8. Reapply input power.



**NOTE:** DC terminals are on the input end of the CH72 and CH74 drive modules as shown in Fig. 1A. The CH74 drive has 3 modules.

The CH63 drive has 2 modules. The DC bus terminals are located on the top of the module as shown in Fig. 1B while both the input (L<sub>1</sub>, L<sub>2</sub>, L<sub>3</sub>) and output (T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>) terminals are located on the bottom of the drive.

The DC bus terminals for all modules are connected to each other (+) to (+) and (-) to (-).

**Fig. 7 — Check DC Bus Terminals**

### Servicing the Drive

**⚠ WARNING**

To guard against possible personal injury and/or equipment damage:

1. Inspect all lifting hardware for proper attachment before lifting drive.
2. Do not allow any part of the drive or lifting mechanism to make contact with electrically charged conductors or components.
3. Do not subject the drive to high rates of acceleration or deceleration while transporting to the mounting location or when lifting.

Do not allow personnel or their limbs directly underneath the drive when it is being lifted and mounted.

**⚠ WARNING**

DC bus capacitors retain hazardous voltages after input power has been disconnected. After disconnecting input power, wait five (5) minutes for the DC bus capacitors to discharge and then check the voltage with a voltmeter to ensure the DC bus capacitors are discharged before touching any internal components. Failure to observe this precaution could result in severe bodily injury or loss of life.

**REMOVING THE DRIVE FROM THE ENCLOSURE** — The weights specified must be taken into consideration when removing the drive. All lifting equipment and lifting components (hooks, bolts, lifts, slings, chains, etc.) must be properly sized and rated to safely lift and hold the weight of the drive while removing it. The drive weights are as follows:

- Drive weight for CH72: 198 lb
- Drive weight for CH63: 264 lb
- Drive weight for CH74: 617 lb



**Frame CH72** — Refer to Fig. 8A and 8B. Frame CH72 has one drive module which is mounted horizontally to the bottom surface of the enclosure. The input end of the module is on the left and the output end is on the right.

To remove the drive:

1. Remove all power cabling from the top power connections bus bars.
2. Remove all power bussing from the bottom power connections bus bars.
3. Close refrigerant cooling isolation valves. Remove the two refrigerant lines (supply and return) from the output end of the drive.
4. Remove the cabinet center door bracket.
5. Remove the bolts holding the drive chassis to the cabinet.
6. Attach tag lines to the handles to prevent the drive from swinging as it is lifted free of the cabinet bottom.
7. Connect lifting chains to the handles at the left and right sides of the drive (as mounted).
8. Lift the drive with the hoist.

To reinstall the drive chassis, reverse the above procedure.

**Frames CH63 and CH74** — Refer to Fig. 9.

Frame CH63 has 2 modules on the chassis. The chassis is held to the two Z brackets by two bolts in each bracket.

Frame CH74 has 3 modules on the chassis. The chassis is held to the two Z brackets by four bolts in each bracket.

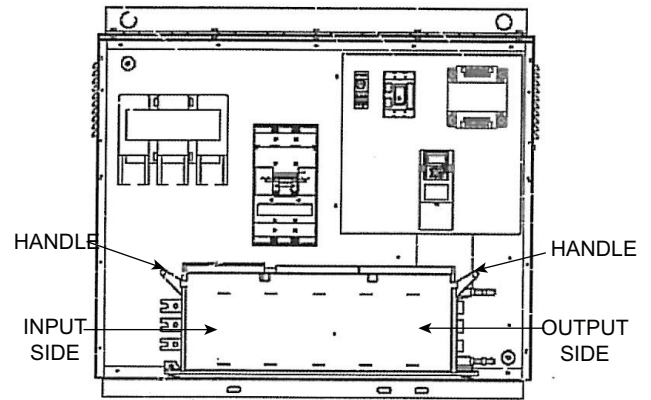
To remove the drive:

1. Remove all power cabling from the top power connections bus bars.
2. Remove all power bussing from the bottom power connections bus bars.
3. Close refrigerant cooling isolation valves. Remove the two refrigerant lines (supply and return) from the bottom of the drive.
4. Remove the cabinet ceiling and center door bracket.
5. Connect lifting chains to the top two 1.15-in. diam lifting holes.
6. Lift hoist until chains have slight tension.
7. Loosen and remove bolts that hold the bottom of the drive to the Z bracket (2 bolts on CH63, 4 bolts on CH74).
8. Loosen the 2 or 4 bolts that hold the top of the drive to the Z bracket. The drive may drop down a little to rest on the top Z bracket.
9. Lift the drive chassis with the hoist until the chassis is free from the Z bracket. Remove the 2 or 4 top bolts.
10. Pull the drive forward of the Z bracket and lift the drive chassis from the cabinet.

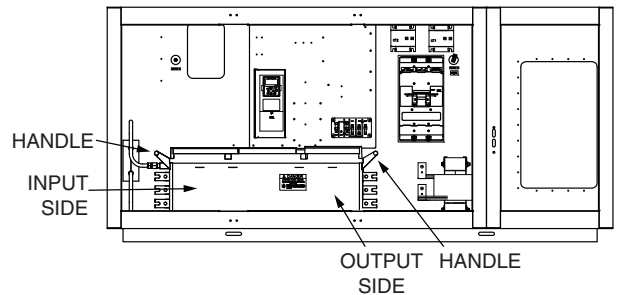
To reinstall the drive chassis, reverse the above procedure.

Tighten terminal bolts to the torque shown in table below.

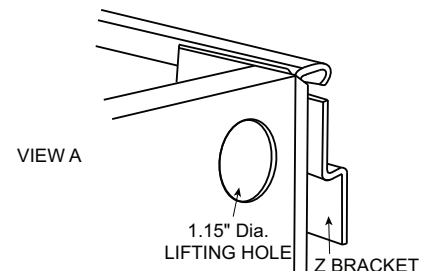
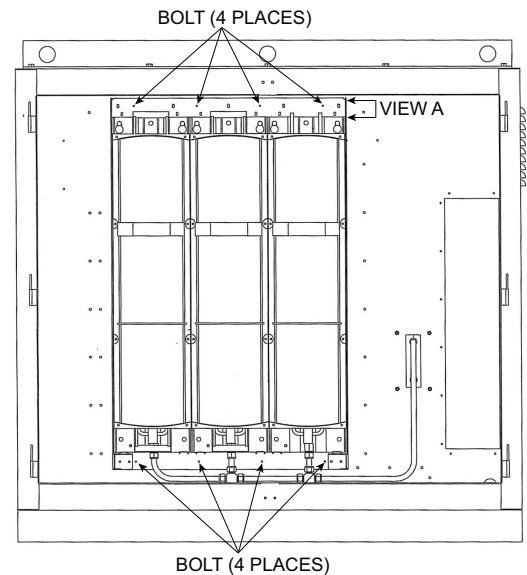
BOLT	RECOMMENDED TORQUE	MAXIMUM INWARD THREAD LENGTH
M8	20 N·m (177 in.-lb)	10 mm
M10	40 N·m (354 in.-lb)	22 mm
M12	70 N·m (620 in.-lb)	22 mm



**Fig. 8A — Removing Drive — Frame CH72, 19XRV**



**Fig. 8B — Removing Drive — Frame CH72, 23XRV**



**Fig. 9 — Removing Drive — Frame CH63 and CH74 (Frame CH74 Shown)**

**Table 5 — Eaton LCX9000 Fault Code Descriptions and Corrective Actions**

VFD FAULT CODE ON VFD HIST SCREEN	ICVC FAULT STATE	FAULT TYPE	DESCRIPTION	SOLUTION	CORRECTIVE ACTION
1	212 (146)	Overcurrent	Drive has detected too high a current in the motor cable: <ul style="list-style-type: none"> <li>• sudden heavy load increase</li> <li>• short circuit in the motor cables</li> <li>• unsuitable motor</li> </ul>	Check loading. Check motor. Check cables.	See ICVC Fault State 219, 220.
2	205 (166)	Overvoltage	The DC-link voltage has exceeded the defined limits. See Eaton User Manual for LCX9000 VFD. <ul style="list-style-type: none"> <li>• too short a deceleration time</li> <li>• high overvoltage spikes in supply</li> </ul>	Set the deceleration time longer. Add a brake chopper or brake resistor.	Monitor the AC line for high line voltage or transient conditions. Bus overvoltage can also be caused by motor regeneration. Extend the decel time or install dynamic brake option.
3	220	Ground Fault*	Current measurement has detected that the sum of motor phase currents is not zero. <ul style="list-style-type: none"> <li>• insulation failure in cables or motor</li> </ul>	Check motor cables and motor.	Check the motor and external wiring to the drive output terminals for a grounded condition.
5	206	Charging Switch	The charging switch is open, when the START command has been given. <ul style="list-style-type: none"> <li>• faulty operation</li> <li>• component failure</li> </ul>	Reset the fault and restart. Should the fault re-occur, contact Eaton.	
6	206	Emergency stop	Stop signal has been given from the option board.		Check option board.
7	206	Saturation trip	Various causes: <ul style="list-style-type: none"> <li>• component failure</li> <li>• brake resistor short circuit or overload</li> </ul>	Cannot be reset from the keypad. Switch off power. If this fault appears simultaneously with Fault 1, check motor cables and motor.	<b>DO NOT RE-CONNECT POWER!</b> Contact Eaton.
8	206	System fault	<ul style="list-style-type: none"> <li>• component failure</li> <li>• faulty operation</li> </ul> Note: exceptional fault data record, see Eaton User Manual for LCX9000 VFD.	Reset the fault and restart.	Should the fault reoccur, contact Eaton.
9	215 (165)	Under-voltage*	DC-link voltage is under the defined voltage limits. See Eaton User Manual for LCX9000 VFD. <ul style="list-style-type: none"> <li>• most probable cause: too low a supply voltage</li> <li>• drive internal fault</li> </ul>	In case of temporary supply voltage break, reset the fault and restart the drive. Check the supply voltage. If it is adequate, an internal failure has occurred. Contact Eaton.	Monitor the incoming AC line for low voltage or line power interruption. If voltage is adequate an internal failure has occurred.
10	210 (144)	Single Cycle dropout or Line Current imbalance	Input line phase is missing.	Check supply voltage and cable.	Disable Single Cycle Dropout in VFD_CONF. Check phase-to-phase and phase-to-ground power distribution bus voltage. Check Line Current % imbalance in VFD_CONF screen. Consult power company.
11	225 (143)	Output phase supervision*	Current measurement has detected that there is no current in one motor phase.	Check motor cable and motor.	Check motor cable and motor. Check motor current % imbalance in VFD_CONF screen.
12	206	Brake chopper supervision	<ul style="list-style-type: none"> <li>• no brake resistor installed</li> <li>• brake resistor is broken</li> <li>• brake chopper failure</li> </ul>	Check brake resistor.	If the resistor is okay, the chopper is faulty. Contact Eaton.
13	206	Drive under-temperature	Heatsink temperature is under 14°F (-10°C)		
14	219	Drive over-temperature	<ul style="list-style-type: none"> <li>• Heatsink temperature is over 158°F (70°C). Overtemperature warning is issued when the heatsink temperature exceeds 149°F (65°C).</li> <li>• Circuit board temperature is over 185°F (85°C). Overtemperature warning is issued when the board temperature exceeds 158°F (70°C).</li> </ul>	Check the coolant flow and temperature.	Check the ambient temperature. Make sure that the switching frequency is not too high in relation to ambient temperature and motor load. Circulation of air in the drive is blocked. The cooling fans are defective.

\* Programmable fault.

† Alarm fault. This type of fault is a sign of unusual operating condition. It does not cause the drive to stop, nor does it require any special actions. The alarm fault remains in the display for ~30 seconds.

**NOTES:**

1. ICVC fault in ( ) indicates fault shown when Auto-restart is enabled.
2. When the ICVC Fault State is 206 the fault code must be read from the drive keypad or with the 9000X software tool.

**Table 5 — Eaton LCX9000 Fault Code Descriptions and Corrective Actions (cont)**

VFD FAULT CODE ON VFD HIST SCREEN	ICVC FAULT STATE	FAULT TYPE	DESCRIPTION	SOLUTION	CORRECTIVE ACTION
15	206	Motor stalled*	Motor stall protection has tripped.	Check motor.	Check VFD_HIST.
16	217	Motor overload trip	Motor is overloaded	Decrease the motor load. If no motor overload exists, check the temperature model parameters.	Decrease the motor load. If no motor overload exists, check the temperature model parameters.
17	202	Motor Amps not sensed.	Motor underload protection has tripped.		Check main Circuit breaker for trip. Increase Current % imbalance in VFD CONF screen.
22	206	EEPROM checksum fault†	Parameter save fault • faulty operation • component failure	Attempt to reset.	
24	206	Counter fault	Values displayed on counters are incorrect.	Check value of counters.	
25	206	Microprocessor watchdog fault	• faulty operation • component failure	Reset the fault and restart. Should the fault re-occur, contact Eaton.	Reset the fault and restart. Should the fault re-occur, contact Eaton.
26	206	Start-up prevented	Start-up of the drive has been prevented.	Cancel prevention of start-up.	
29	206	Thermistor fault*	The thermistor input of option board has detected increase of the motor temperature.	Check motor cooling and loading Check thermistor connection.	If thermistor input of the option board is not in use, it must be short circuited.
31	206	IGBT temperature	IGBT Inverter Bridge overtemperature protection has detected too high a short term overload current. This is a measured value.	Check loading. Check motor size.	Check VFD_CONF parameters.
36	206	Control unit	Control Unit can not control Power Unit and vice versa.	Change control unit.	See Eaton manual for location of control unit.
37	206	Device change (same type)†	• option board or control unit changed. • same type of board or same power rating of drive	Reset Note: No fault time data record!	Press ICVC reset key.
38	206	Device added (same type)†	• option board or drive added. • drive of same power rating or same type of board added	Reset Note: No fault time data record!	
39	206	Device removed†	• option board removed • drive removed	Reset Note: No fault time data record!	Check option board.
40	206	Device unknown	Unknown option board or drive.	Contact Eaton.	Check option board.
41	206	IGBT temperature	IGBT Inverter Bridge overtemperature protection has detected too high a short term overload current. This is a calculated value.	Check loading. Check motor size.	Check VFD_CONF parameters.
42	206	Brake resistor overtemperature*	Brake resistor overtemperature protection has detected too heavy braking.	Set the deceleration time longer. Use external brake resistor.	Check VFD_CONF parameters.

\* Programmable fault.

† Alarm fault. This type of fault is a sign of unusual operating condition. It does not cause the drive to stop, nor does it require any special actions. The alarm fault remains in the display for ~30 seconds.

**NOTES:**

1. ICVC fault in ( ) indicates fault shown when Auto-restart is enabled.
2. When the ICVC Fault State is 206 the fault code must be read from the drive keypad or with the 9000X software tool.

**Table 5 — Eaton LCX9000 Fault Code Descriptions and Corrective Actions (cont)**

VFD FAULT CODE ON VFD HIST SCREEN	ICVC FAULT STATE	FAULT TYPE	DESCRIPTION	SOLUTION	CORRECTIVE ACTION
43	206	Encoder fault	Note: the exceptional fault data record, see Eaton User Manual for LCX9000 VFD. Additional codes: 1 = Encoder 1 channel A is missing 2 = Encoder 1 channel B is missing 3 = Both encoder 1 channels are missing 4 = Encoder reversed	Check encoder channel connections.	Check the encoder board.
44	206	Device changed (different type)†	• option board or control unit changed • option board of different type or different power rating of drive	Reset. Note: No Fault Time Data Record is made.	Press ICVC reset key. Note: Application parameter values restored to default.
45	206	Device added (different type)†	• option board or device added • option board of different type or drive of different power rating added	Reset. Note: No Fault Time Data Record is made.	Press ICVC reset key. Note: Application parameter values restored to default.
50	206	Analog input sel. signal range 4 to 20 mA)*	Current at the analog input is <4 mA. • control cable is broken or loose • signal source has failed.	Check the current loop and signal source.	Check wiring to terminal.
51	207	External fault	Digital input failed.	Check source of trigger.	Check I/O board.
52	206	Keypad communication fault	There is no connection between the control keypad and the drive.	Check the keypad connection and keypad cable.	Check for bent connector pins.
53	206	Comm Fault	The data connection between the fieldbus master and the fieldbus board is broken.	Check installation.	If installation is correct contact Eaton.
54	206	Slot fault	Defective option board or slot.	Check that the board is properly installed and seated in slot.	If the installation is correct, contact Eaton.
56	206	PT100 board temperature fault	Temperature limit values set for the PT100 board parameters have been exceeded.	Determine the cause of the high temperature.	

\* Programmable fault.

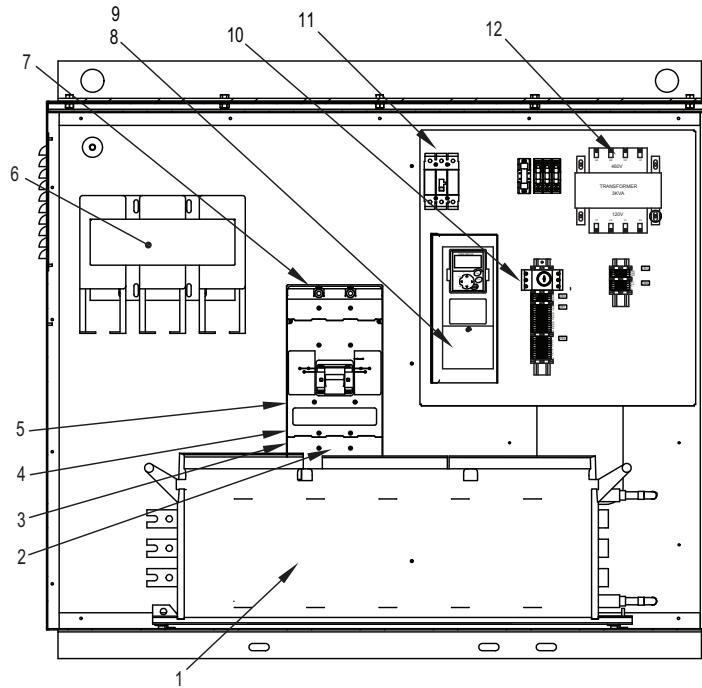
† Alarm fault. This type of fault is a sign of unusual operating condition. It does not cause the drive to stop, nor does it require any special actions. The alarm fault remains in the display for ~30 seconds.

**NOTES:**

1. ICVC fault in ( ) indicates fault shown when Auto-restart is enabled.
2. When the ICVC Fault State is 206 the fault code must be read from the drive keypad or with the 9000X software tool.

## Parts Identification and Location

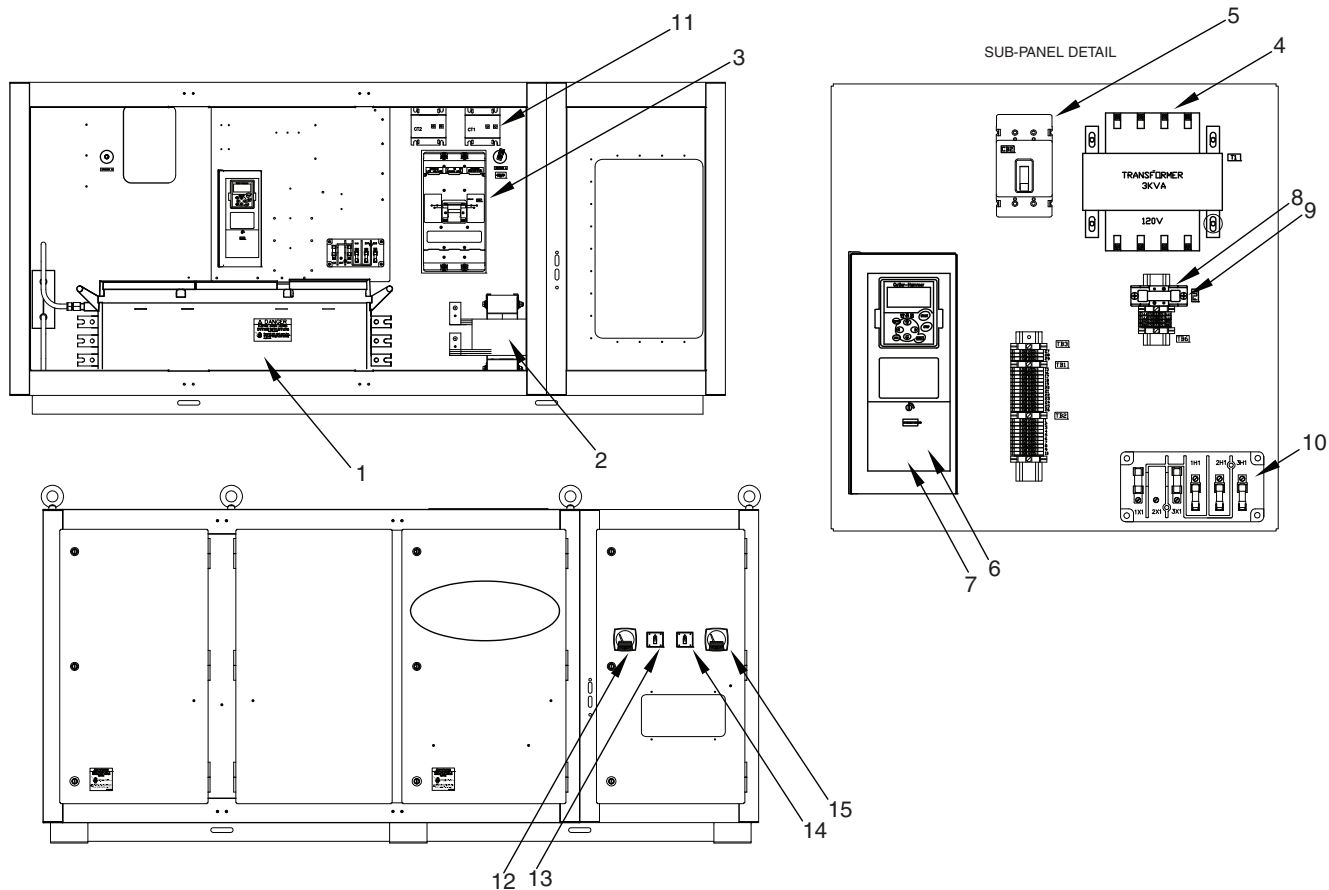
See Fig. 10A-11B.



### LEGEND

- 1 — Inverter (198 lb; 485, 550, 605, or 680 amp)
- 2 — Shunt Trip
- 3 — Breaker Lug Kit (Load Side)
- 4 — Breaker Lug Kit (Line Side)
- 5 — Breaker Rating Plug
- 6 — Line Choke (500 amp, 118 lb; 600 amp, 175 lb; 750 amp, 190 lb)
- 7 — Circuit Breaker, (45 lb; 800 or 1200 amp)
- 8 — Communication Card (ICVC)
- 9 — I/O Cards
- 10 — Oil Pump Circuit Breaker, CB4 (20 amp Fuse, 30 amp Fuse Block)
- 11 — Oil Heater Circuit Breaker, CB2 (15 amp)
- 12 — Control Transformer (53 lb)

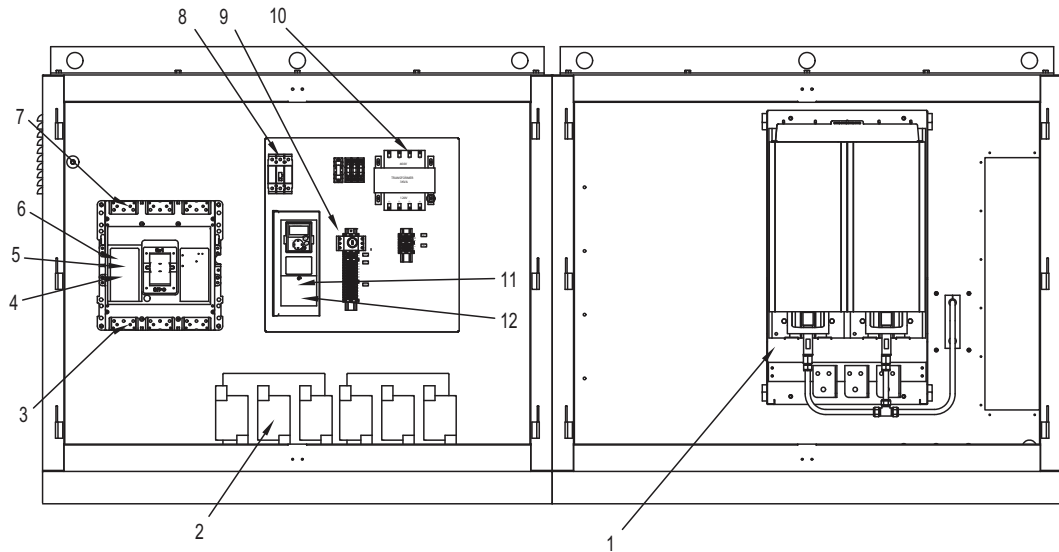
**Fig. 10A — Frame CH72 Component Identification — 19XRV**



LEGEND

- 1 — Inverter (198 lb; 416 or 502 amp)
- 2 — Line Choke, 3% nominal impedance (414 amp reactor, 98 lb; 515 amp reactor, 175 lb)
- 3 — Main Breaker Kit
- 4 — Control Transformer (53 lb)
- 5 — Oil Heater Circuit Breaker, CB2 (15 amp)
- 6 — I/O Cards
- 7 — Communication Card (ICVC)
- 8 — Fuse, 25 amp, 250 v
- 9 — Fuse Block, 30 amp, 250 v
- 10 — Meter Kit
- 11 — Control Transformer
- 12 — Voltmeter, 0 to 600 vac scale
- 13 — Camswitch, 4-position (voltmeter)
- 14 — Camswitch, 4-position (ammeter)
- 15 — Ammeter, 0 to 600 amp scale (0 to 5 amp)

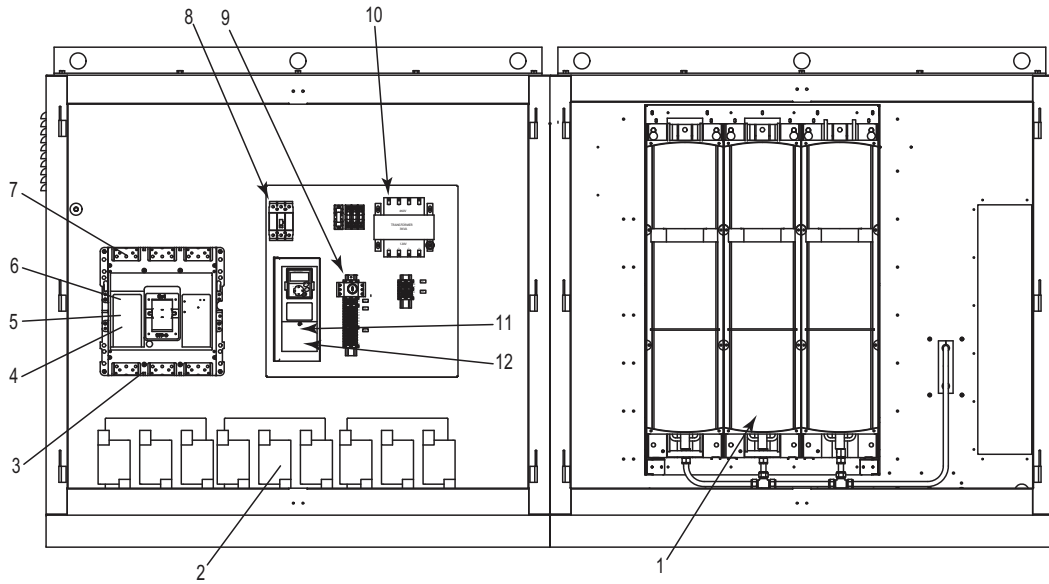
Fig. 10B — Frame CH72 Component Identification — 23XRV



**LEGEND**

- 1 — Inverter (264 lb; 765, 855, 960, or 1070 amp)
- 2 — Line Choke (400 amp, 118 lb; 500 amp, 118 lb; 600 amp, 175 lb)
- 3 — Shunt Trip
- 4 — Breaker Lug Kit (Load Side)
- 5 — Breaker Rating Plug
- 6 — Circuit Breaker (45 lb, 1200 amp)
- 7 — Breaker Lug Kit (Line Side)
- 8 — Oil Heater Circuit Breaker, CB2 (15 amp)
- 9 — Oil Pump Circuit Breaker, CB4 (20 amp Fuse, 30 amp Fuse Block)
- 10 — Control Transformer (53 lb)
- 11 — I/O Cards
- 12 — Communication Card (ICVC)

**Fig. 11A — Frame CH63 Component Identification**

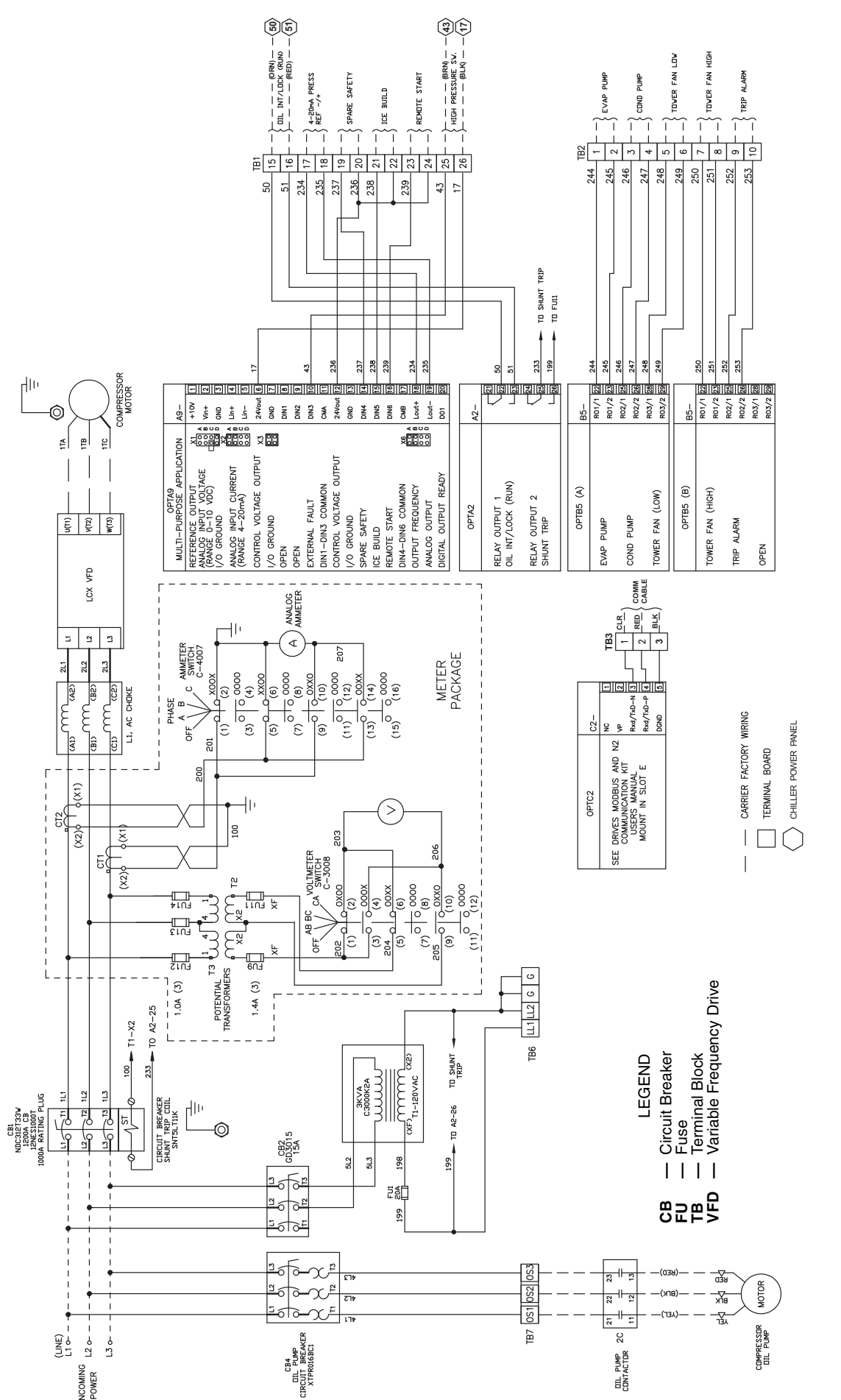


**LEGEND**

- 1 — Inverter (617 lb; 1275 or 1530 amp,)
- 2 — Line Choke (400 amp, 118 lb; 500 amp, 118 lb; 600 amp, 175 lb)
- 3 — Shunt Trip
- 4 — Breaker Lug Kit (Load Side)
- 5 — Breaker Rating Plug
- 6 — Circuit Breaker (1600 amp, 102 lb)
- 7 — Breaker Lug Kit (Line Side)
- 8 — Oil Heater Circuit Breaker, CB2 (15 amp)
- 9 — Oil Pump Circuit Breaker, CB4 (20 amp Fuse, 30 amp Fuse Block)
- 10 — Control Transformer (53 lb)
- 11 — I/O Cards
- 12 — Communication Card (ICVC)

**Fig. 11B — Frame CH74 Component Identification**

# APPENDIX A — WIRING SCHEMATICS EATON LCX9000 WIRING SCHEMATIC, 19XRV (Typical)



- LEGEND**
- CB — Circuit Breaker
  - FU — Fuse
  - TB — Terminal Block
  - VFD — Variable Frequency Drive

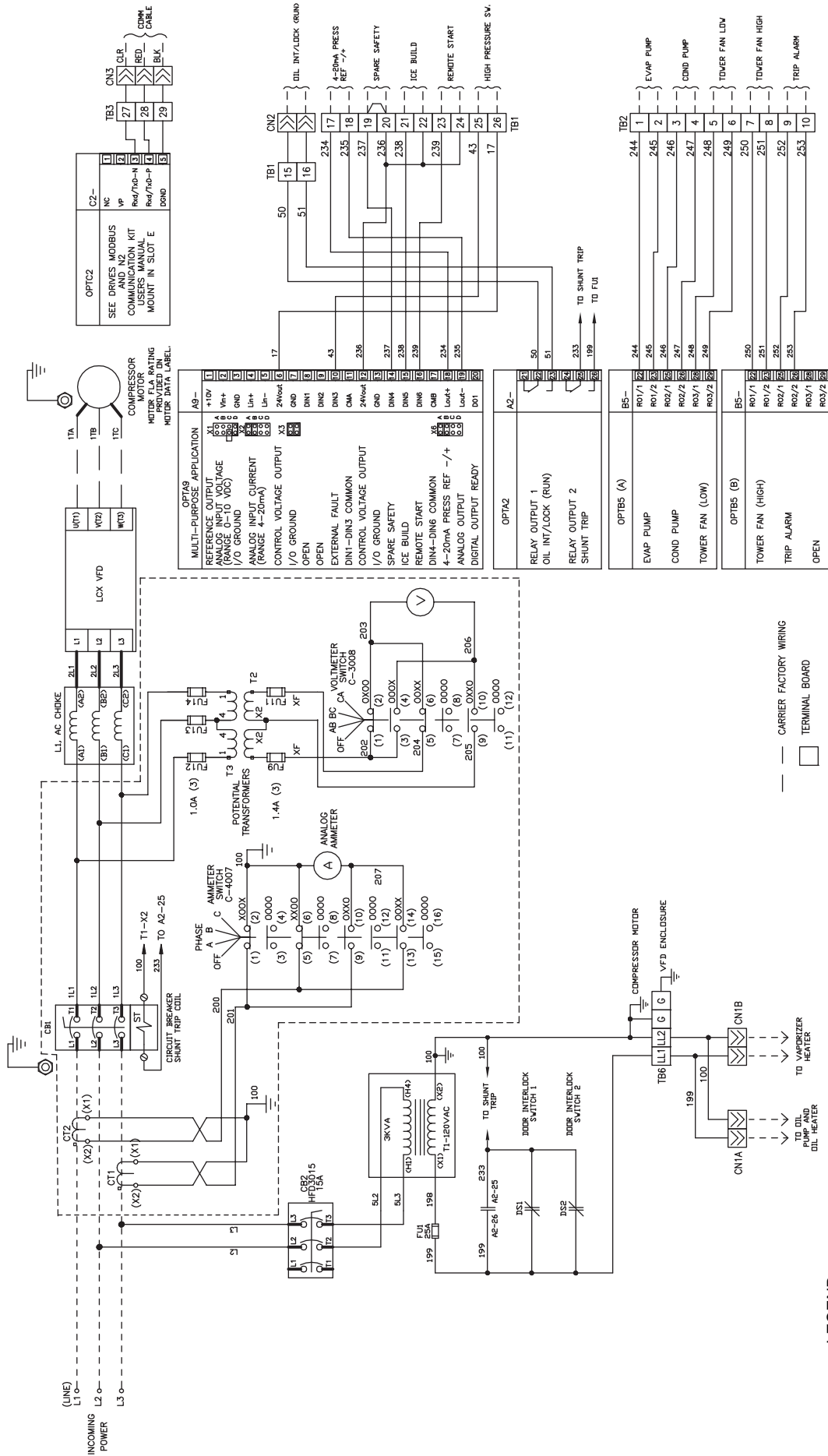
- CARRIER FACTORY WIRING
- TERMINAL BOARD
- CHILLER POWER PANEL

OPTAG	MULTI-PURPOSE APPLICATION	AG—
X1	REFERENCE OUTPUT	+10V
X2	ANALOG INPUT VOLTAGE	Vref
X3	I/O GROUND	GND
X4	ANALOG INPUT CURRENT	Iref
X5	ANALOG INPUT CURRENT (RANGE 4-20mA)	Iref
X6	CONTROL VOLTAGE OUTPUT	24Vout
X7	I/O GROUND	GND
X8	OPEN	OPEN
X9	EXTERNAL FAULT	DIN1
X10	DIN1-DIN3 COMMON	DIN2
X11	CONTROL VOLTAGE OUTPUT	DIN3
X12	I/O GROUND	DIN4
X13	SPARE SAFETY	DIN5
X14	ICE BUILD	DIN6
X15	REMOTE START	DIN7
X16	DIN4-DIN6 COMMON	DIN8
X17	OUTPUT FREQUENCY	DIN9
X18	ANALOG OUTPUT	DIN10
X19	DIGITAL OUTPUT READY	DIN11
X20		DIN12
X21		DIN13
X22		DIN14
X23		DIN15
X24		DIN16
X25		DIN17
X26		DIN18
X27		DIN19
X28		DIN20
X29		DIN21
X30		DIN22
X31		DIN23
X32		DIN24
X33		DIN25
X34		DIN26
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X40		DIN32
X41		DIN33
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X81		DIN73
X82		DIN74
X83		DIN75
X84		DIN76
X85		DIN77
X86		DIN78
X87		DIN79
X88		DIN80
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X96		DIN88
X97		DIN89
X98		DIN90
X99		DIN91
X100		DIN92
X101		DIN93
X102		DIN94
X103		DIN95
X104		DIN96
X105		DIN97
X106		DIN98
X107		DIN99
X108		DIN100

OPTAG	MULTI-PURPOSE APPLICATION	AG—
A1	RELAY OUTPUT 1	AO1
A2	OIL INT/LOCK (RUN)	AO2
A3	RELAY OUTPUT 2	AO3
A4	SHUNT TRIP	AO4
A5		AO5
A6		AO6
A7		AO7
A8		AO8
A9		AO9
A10		AO10
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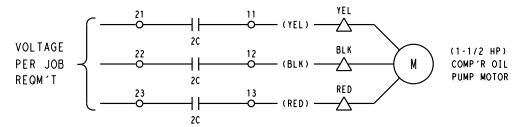
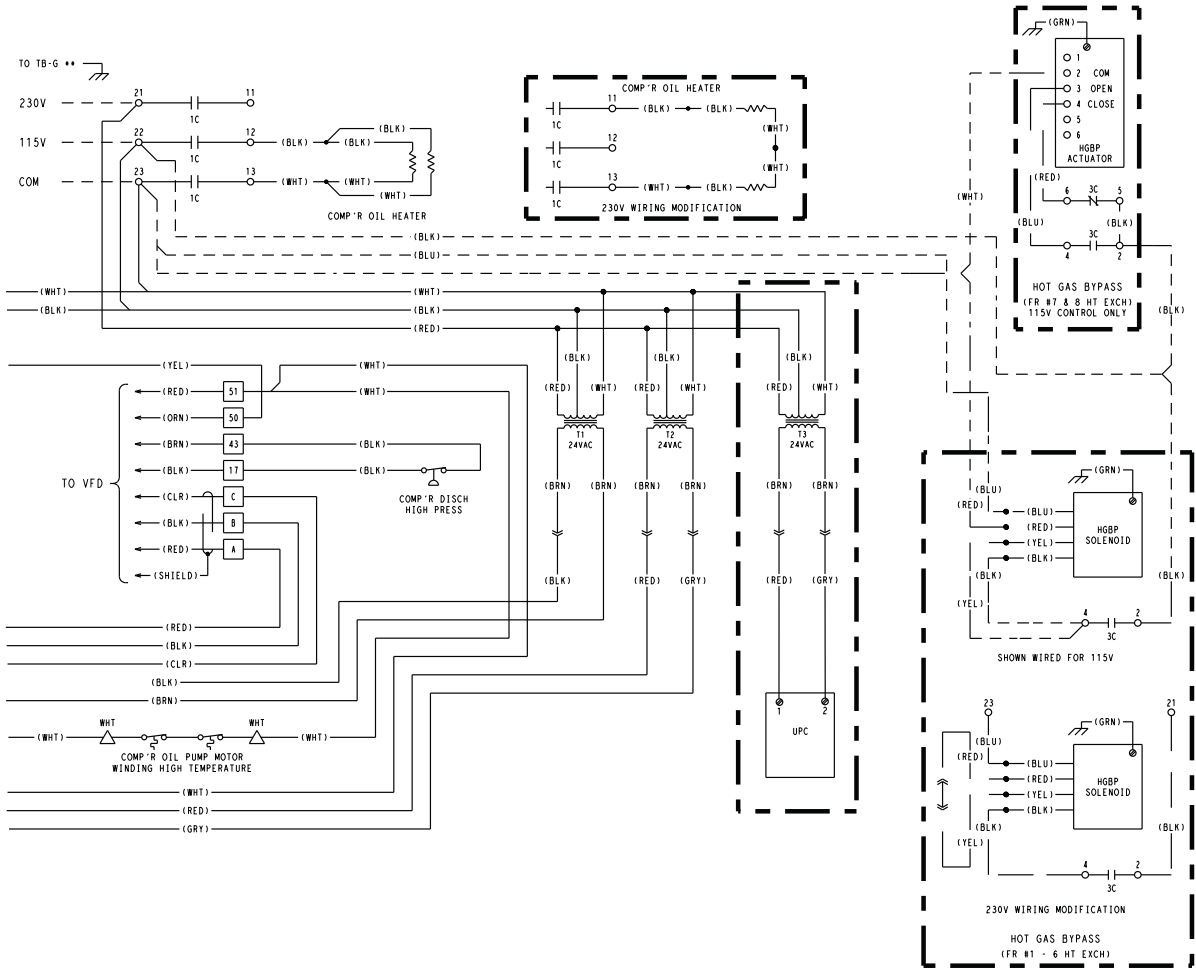
# APPENDIX A — WIRING SCHEMATICS (cont) EATON LCX9000 WIRING SCHEMATIC, 23XRV (Typical)





# APPENDIX A — WIRING SCHEMATICS (cont)

## 19XRV CHILLER CONTROL SCHEMATIC (cont)



Continued from previous page

### LEGEND

- CB** Circuit Breaker
- CCM** Chiller Control Module
- HGBP** Hot Gas Bypass
- ICVC** International Chiller Visual Controller
- RHS** Relative Humidity Sensor
- UPC** Universal Protocol Controller
- VFD** Variable Frequency Drive

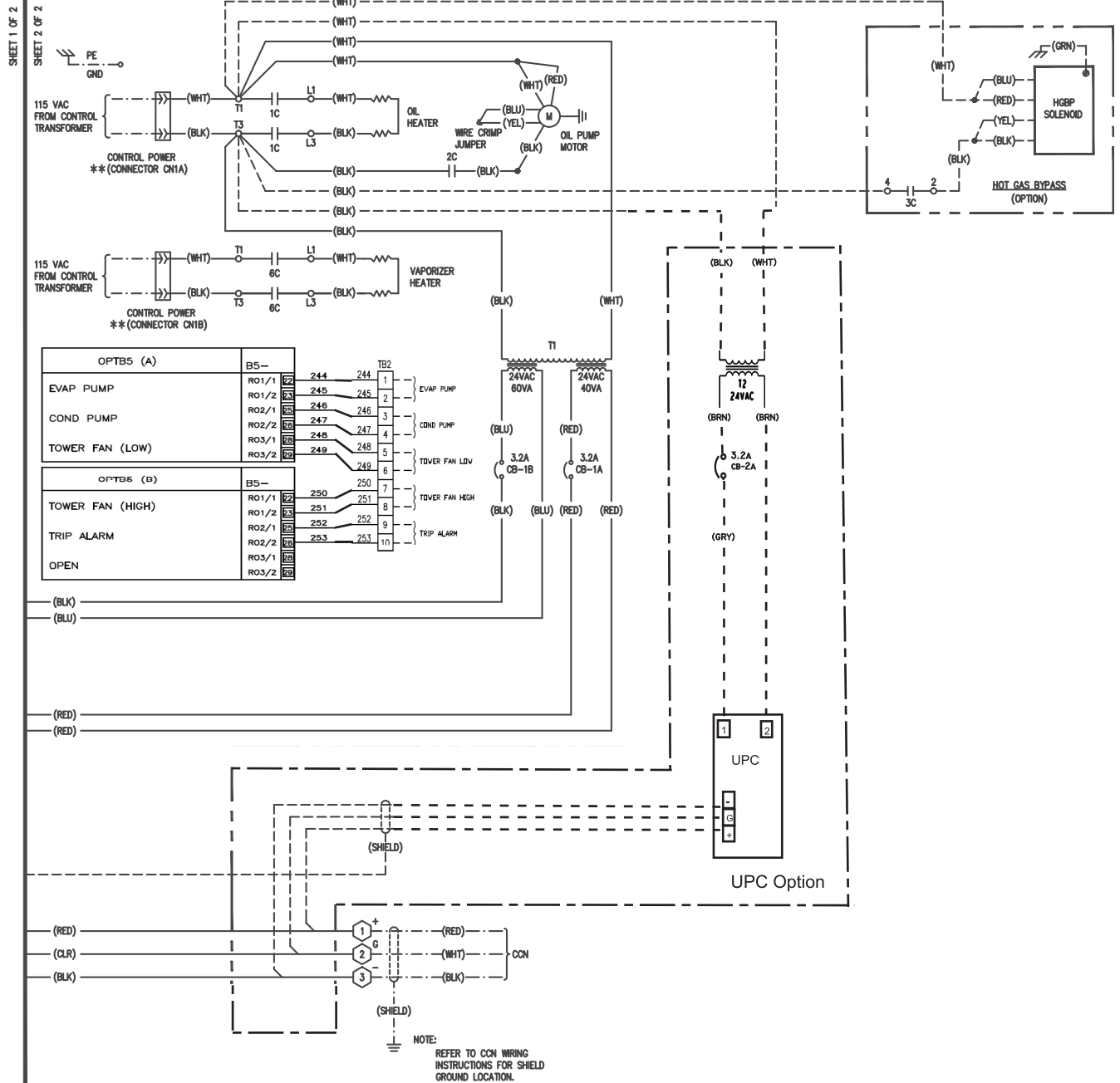
- Denotes Control Panel Terminal
- Denotes Oil Pump Terminal
- Denotes Power Panel Terminal
- \*\*** Denotes Motor Starter Panel Conn
- Denotes Component Terminal
- Wire Splice
- Denotes Conductor male/Female Connector
- Option Wiring

\* Standard on LF2 drive; optional on machines equipped with other VFDs.



# APPENDIX A — WIRING SCHEMATICS (cont)

## 23XRV CHILLER CONTROL SCHEMATIC (cont)



*Continued from previous page*

### LEGEND

- |              |   |           |   |
|--------------|---|-----------|---|
| <b>CB-XX</b> | Circuit Breaker (Example: CB-1B)                  |           | Denotes Control Panel Terminal          |
| <b>CCM</b>   | Chiller Control Module                            |           | Denotes Oil Pump Terminal               |
| <b>CCN</b>   | Carrier Comfort Network                           |           | Denotes Power Panel Terminal            |
| <b>HGBP</b>  | Hot Gas Bypass                                    | <b>**</b> | Denotes VFD to Control Panel Connector  |
| <b>ICVC</b>  | International Chiller Visual Controller           |           | Denotes 115 V Component Terminal        |
| <b>OPT**</b> | VFD Terminal Board Location (OPTC2, OPTA9, OPTA2) |           | Wire Splice                             |
| <b>UPC</b>   | Universal Protocol Converter                      |           | Denotes Conductor Male/Female Connector |
| <b>VFD</b>   | Variable Frequency Drive                          |           | Option Wiring                           |
| <b>VFG</b>   | Variable Frequency (Drive) Gateway                |           | Field Wiring                            |
|              |   |           | Denotes Humidity Sensor                 |





