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:

a. Shut off electrical power to unit.

b. Recover refrigerant to relieve all pressure from system using both high-pressure and low pressure ports.

c. 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.

d. 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.

e. 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.)
SAFETY CONSIDERATIONS
INTRODUCTION
ABBREVIATIONS AND EXPLANATIONS
Required Publications
Getting Assistance from Eaton
IDENTIFYING DRIVE COMPONENTS
Components and Application
START-UP
Wire Lugs
Verify Installation
Configure the VFD
Commissioning the Unit
Check Configuration Jumpers
SERVICE

Troubleshooting the Drive
• CHILLER ALERT CODES
• CHILLER ALARM CODES
• TEST EQUIPMENT NEEDED TO TROUBLESHOOT
• VERIFYING THAT DC BUS CAPACITORS ARE DISCHARGED
• HIGH TEMPERATURE ALARMS
• MAIN CONTROL BOARD (MCB) COMPONENTS
Checking Power Modules and Motor Input
with Input Power Off
Servicing the Drive
• REMOVING THE DRIVE FROM THE ENCLOSURE

Parts Identification and Location
APPENDIX A — WIRING SCHEMATICS

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
- **HMI** — Human Machine Interface
- **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
- Carrier chiller serial number
- Eaton serial number
- Detailed description of the issue (ideally while on site)

*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. 1 and 2.

**Components and Application**

See Fig. 3 for component identification and Tables 1 and 2 for application by frame size.

<table>
<thead>
<tr>
<th>EATON FRAME SIZE</th>
<th>CARRIER PART NO. (PIC III)</th>
<th>CARRIER PART NO. (PIC 6)</th>
<th>MAXIMUM CONTINUOUS AMP RATING</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH72</td>
<td>19XVE0485</td>
<td>19XVF0485</td>
<td>485</td>
</tr>
<tr>
<td></td>
<td>19XVE0550</td>
<td>19XVF0550</td>
<td>550</td>
</tr>
<tr>
<td></td>
<td>19XVE0605</td>
<td>19XVF0605</td>
<td>605</td>
</tr>
<tr>
<td></td>
<td>19XVE0680</td>
<td>19XVF0680</td>
<td>680</td>
</tr>
<tr>
<td>CH63</td>
<td>19XVE0765</td>
<td>19XVF0765</td>
<td>765</td>
</tr>
<tr>
<td></td>
<td>19XVE0855</td>
<td>19XVF0855</td>
<td>855</td>
</tr>
<tr>
<td></td>
<td>19XVE0960</td>
<td>19XVF0960</td>
<td>960</td>
</tr>
<tr>
<td></td>
<td>19XVE1070</td>
<td>19XVF1070</td>
<td>1070</td>
</tr>
<tr>
<td>CH74</td>
<td>19XVE1275</td>
<td>19XVF1275</td>
<td>1275</td>
</tr>
<tr>
<td></td>
<td>19XVE1530</td>
<td>19XVF1530</td>
<td>1530</td>
</tr>
</tbody>
</table>

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

Fig. 2 — DC Bus Location (Typical) for Frame CH63

Fig. 3 — Check DC Bus Terminals

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

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.

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

<table>
<thead>
<tr>
<th>EATON FRAME SIZE</th>
<th>CARRIER PART NO.</th>
<th>MAXIMUM CONTINUOUS AMP RATING</th>
<th>VOLTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH72</td>
<td>23XVE0485</td>
<td>485</td>
<td>380-480</td>
</tr>
<tr>
<td></td>
<td>23XVE0550</td>
<td>550</td>
<td></td>
</tr>
<tr>
<td></td>
<td>23XVE0605</td>
<td>605</td>
<td></td>
</tr>
<tr>
<td></td>
<td>23XVE0389</td>
<td>389</td>
<td>575</td>
</tr>
<tr>
<td></td>
<td>23XVE0469</td>
<td>469</td>
<td></td>
</tr>
</tbody>
</table>

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.

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 start-up 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. Submission is to be completed at www.eaton.com/vfdcommissioningreport. The entire VFD parameter set should be collected at start-up for possible use later in the equipment life-cycle.

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.
Table 3 — Wire Lug Sizes

<table>
<thead>
<tr>
<th>EATON FRAME SIZE</th>
<th>CARRIER VFD PART NO. (PIC III)</th>
<th>CARRIER VFD PART NO. (PIC 6)</th>
<th>EATON CIRCUIT BREAKER PART NO. 65kAIC AT 480V</th>
<th>EATON CIRCUIT BREAKER PART NO. 100kAIC AT 480V</th>
<th>LINE TERMINAL LUGS</th>
<th>AWG/MCM WIRE RANGE (NO. OF CONDUCTORS)</th>
<th>ALTERNATE LINE TERMINAL LUGS</th>
<th>AWG/MCM WIRE RANGE (NO. OF CONDUCTORS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH72</td>
<td>23XVE0389 —</td>
<td>NGH308033E</td>
<td>NGC308033E</td>
<td>TA1200NB1</td>
<td>4/0-500 (4)</td>
<td>TA1201NB1</td>
<td>1-600 (4)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>23XVE0469 —</td>
<td>NGH308033E</td>
<td>NGC308033E</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>23XVE0485 —</td>
<td>NGH308033E</td>
<td>NGC308033E</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>19XVE0485 19XVF0485</td>
<td>NGH312033E</td>
<td>NGC312033E</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>23XVE0550 —</td>
<td>NGH312033E</td>
<td>NGC312033E</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CH63</td>
<td>19XVE0765 19XVF0765</td>
<td>NGH312033E</td>
<td>NGC312033E</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>19XVE0855 19XVF0855</td>
<td>NGH312033E</td>
<td>NGC312033E</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>19XVE0960 19XVF0960</td>
<td>NGH312033E</td>
<td>NGC312033E</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>19XVE1070 19XVF1070</td>
<td>RGH316033E</td>
<td>RGC316033E</td>
<td>TA1600RD</td>
<td>500-1000 (4)</td>
<td>T1600RD*</td>
<td>1-600 (4)</td>
<td></td>
</tr>
<tr>
<td>CH74</td>
<td>19XVE1275 19XVF1275</td>
<td>RGH316033E</td>
<td>RGC316033E</td>
<td>TA1600RD</td>
<td>500-1000 (4)</td>
<td>T1600RD*</td>
<td>1-600 (4)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>19XVE1530 19XVF1530</td>
<td>RGH320033E</td>
<td>RGC320033E</td>
<td>TA2000RD</td>
<td>2-600 (6)</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
</tr>
</tbody>
</table>

*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. PWM (pulse width modulation) frequency
   h. Voltage
3. From the HMI control panel screen:
   a. Carrier Part Number and Revision
   b. Software Number

Configure the VFD

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

Table 4 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.
**Commissioning the Unit**

The commission 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 (PIC III) / UM VFD Configuration (PIC 6) 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:**
   - Look for signs of corrosion or moisture residue.
   - Remove any dirt or debris.
   - 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 Vdiff.

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

   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:**
   - Turn off and lock out input power. Wait five minutes.
   - Check for a ground in the motor or motor wiring.
   - Check for damage to wiring insulation and that wiring is dry.
   - Verify the motor wiring is separated from ground and there is no connection between phases.

   a. Check for failed IGBTs.

10. **If an Overcurrent fault occurs, then do the following:**
    - Turn off and lock out input power. Wait five minutes.
    - Check for excessive load and verify load limit settings on the ICVC (PIC III) or CFGUMVFD (PIC 6) screen.
    - Check motor and wiring insulation.
    - Check parameter settings on VFD_CONF (PIC III) / CFGUMVFD (PIC 6) screen.

**Check Configuration Jumpers**

Check that configuration jumpers are as shown in Fig. 5.

---

**Table 4 — VFD Configurations (PIC3/VFD_CONF)**

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>DEFAULT VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MOTOR NAMEPLATE VOLTAGE</td>
<td>460</td>
</tr>
<tr>
<td>COMPRESSOR 100% SPEED</td>
<td></td>
</tr>
<tr>
<td>LINE FREQ=60 HZ? (NO=50)</td>
<td>YES</td>
</tr>
<tr>
<td>RATED LINE VOLTAGE*</td>
<td>460</td>
</tr>
<tr>
<td>RATED LINE AMPs*</td>
<td>200</td>
</tr>
<tr>
<td>RATED LINE KW</td>
<td>100</td>
</tr>
<tr>
<td>RATED LINE RPM</td>
<td>3456</td>
</tr>
<tr>
<td>MOTOR NAMEPLATE AMPs</td>
<td>100</td>
</tr>
<tr>
<td>MOTOR NAMEPLATE RPM</td>
<td>100</td>
</tr>
<tr>
<td>MOTOR NAMEPLATE KW</td>
<td>100</td>
</tr>
<tr>
<td>INVERTER PWM FREQUENCY (0=4 KHZ, 1=2 KHZ)</td>
<td>1</td>
</tr>
<tr>
<td>SKIP FREQUENCY 1 (HZ)</td>
<td>20.0</td>
</tr>
<tr>
<td>SKIP FREQUENCY 2 (HZ)</td>
<td>20.0</td>
</tr>
<tr>
<td>SKIP FREQUENCY 3 (HZ)</td>
<td>20.0</td>
</tr>
<tr>
<td>SKIP FREQUENCY BAND LINE (HZ)</td>
<td>0.0</td>
</tr>
<tr>
<td>VOLTAGE % IMBALANCE</td>
<td>10</td>
</tr>
<tr>
<td>LINE VOLT IMBALANCE TIME (SEC)</td>
<td>10</td>
</tr>
<tr>
<td>LINE CURRENT % IMBALANCE</td>
<td>40</td>
</tr>
<tr>
<td>LINE CURRENT IMBAL TIME (SEC)</td>
<td>10</td>
</tr>
<tr>
<td>MOTOR CURRENT % IMBALANCE</td>
<td>40</td>
</tr>
<tr>
<td>MOTOR CURRENT IMBAL TIME</td>
<td>10</td>
</tr>
<tr>
<td>DECREASE RAMP TIME (SEC)</td>
<td>30</td>
</tr>
<tr>
<td>SINGLE CYCLE DROPOUT (DISABLE/ENABLE)</td>
<td>DISABLE</td>
</tr>
</tbody>
</table>

* 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.

---

**Table 5 — VFD Configuration (PIC6/UM VFD Configuration) CFGUMVFD - UM VFD Configuration**

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>DEFAULT VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMPRESSOR 100% SPEED</td>
<td>60</td>
</tr>
<tr>
<td>RATED LINE VOLTAGE*</td>
<td>460</td>
</tr>
<tr>
<td>MOTOR NAMEPLATE CURRENT</td>
<td>200</td>
</tr>
<tr>
<td>MOTOR RATED LOAD CURRENT</td>
<td>200</td>
</tr>
<tr>
<td>MOTOR NAMEPLATE VOLTAGE</td>
<td>460</td>
</tr>
<tr>
<td>MOTOR NAMEPLATE RPM</td>
<td>3000</td>
</tr>
<tr>
<td>MOTOR NAMEPLATE KW</td>
<td>1500</td>
</tr>
<tr>
<td>SKIP FREQUENCY 1</td>
<td>30</td>
</tr>
<tr>
<td>SKIP FREQUENCY 2</td>
<td>30</td>
</tr>
<tr>
<td>SKIP FREQUENCY 3</td>
<td>30</td>
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<tr>
<td>SKIP FREQUENCY BAND</td>
<td>0</td>
</tr>
<tr>
<td>INCREASE RAMP TIME</td>
<td>30</td>
</tr>
<tr>
<td>DECREASE RAMP TIME</td>
<td>30</td>
</tr>
<tr>
<td>LINE VOLTAGE IMBALANCE%</td>
<td>10</td>
</tr>
<tr>
<td>LINE VOLT IMBALANCE TIME</td>
<td>10</td>
</tr>
<tr>
<td>LINE CURRENT IMBALANCE%</td>
<td>40</td>
</tr>
<tr>
<td>LINE CURRENT IMBAL TIME</td>
<td>10</td>
</tr>
<tr>
<td>MOTOR CURRENT IMBALANCE%</td>
<td>40</td>
</tr>
<tr>
<td>MOTOR CURRENT IMBAL TIME</td>
<td>10</td>
</tr>
<tr>
<td>SINGLE CYCLE DROPOUT</td>
<td>DISABLE</td>
</tr>
<tr>
<td>PWM SWITCH FREQUENCY (0=2 KHZ, 1=4 KHZ)</td>
<td>0</td>
</tr>
</tbody>
</table>

* 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.
Troubleshooting the Drive

The drive can display two kinds of error codes on the HMI 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 HMI 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**

CHILLER ALERT = VFD ALARM

CHILLER ALARM = VFD FAULT

For PIC III the ICVC displays the Eaton code in the VFD HIST screen. Other ICVC screens will display the ICVC codes. For PIC6 all alert/alarm codes are located under History Alarms. Eaton codes that do not have a corresponding ICVC code will appear on the ICVC default and Alarm history screens as code 206 or Alarm code 449 for PIC 6.

**CHILLER ALERT CODES** — An alert condition is indicated by a message on the HMI 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 fault code descriptions, see Table 6.

**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. 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.
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.

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. 8 and 9. 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. 10. 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.

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.

NOTE: DC terminals are on the input end of the CH72 and CH74 drive modules as shown in Fig. 1. 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. 2 while both the input (L1, L2, L3) and output (T1, T2, T3) terminals are located on the bottom of the drive.

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

<table>
<thead>
<tr>
<th>BOLT</th>
<th>RECOMMENDED TORQUE</th>
<th>MAXIMUM INWARD THREAD LENGTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>M8</td>
<td>20 N·m (177 in.-lb)</td>
<td>10 mm</td>
</tr>
<tr>
<td>M10</td>
<td>40 N·m (354 in.-lb)</td>
<td>22 mm</td>
</tr>
<tr>
<td>M12</td>
<td>70 N·m (620 in.-lb)</td>
<td>22 mm</td>
</tr>
</tbody>
</table>

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

Fig. 9 — Removing Drive — Frame CH72, 23XRV

Fig. 10 — Removing Drive — Frame CH63 and CH74 (Frame CH74 Shown)
<table>
<thead>
<tr>
<th>VFD FAULT CODE ON VFD_HIST SCREEN</th>
<th>ICVC_FAULT STATE (PIC III)</th>
<th>PIC 6 FAULT STATE</th>
<th>FAULT TYPE</th>
<th>DESCRIPTION</th>
<th>SOLUTION</th>
<th>CORRECTIVE ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>217</td>
<td>434</td>
<td>Overcurrent</td>
<td>Drive has detected too high a current in the motor cable: • sudden heavy load increase • short circuit in the motor cable • unsuitable motor</td>
<td>Check loading. Check motor. Check cables.</td>
<td>Check VFD configurations. Alarm occurs if phase current exceeds 106% of configured motor amps. Check current imbalance, check entering condenser water temperature and water flow rates. Verify settings in VFD_CONF (PIC III) / CFGUMVFD (PIC 6).</td>
</tr>
<tr>
<td>2</td>
<td>205 (166)</td>
<td>430</td>
<td>Overvoltage</td>
<td>The DC-link voltage has exceeded the defined limits. See Eaton User Manual for LCX9000 VFD. • too short a deceleration time • high overvoltage spikes in supply</td>
<td>Set the deceleration time longer.</td>
<td>Monitor the AC line for high line voltage or transient conditions. Bus over-voltage can also be caused by motor regeneration. Extend the decel time.</td>
</tr>
<tr>
<td>3</td>
<td>220</td>
<td>432</td>
<td>Ground Fault*</td>
<td>Current measurement has detected that the sum of motor phase currents is not zero. • insulation failure in cables or motor</td>
<td>Check motor cables and motor.</td>
<td>Check the motor and external wiring to the drive output terminals for a grounded condition.</td>
</tr>
<tr>
<td>5</td>
<td>206</td>
<td>449</td>
<td>Charging Switch</td>
<td>The charging switch is open, when the START command has been given. • Faul operation • component failure</td>
<td>Reset the fault and restart. Should the fault re-occur, contact Eaton.</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>206</td>
<td>449</td>
<td>Emergency stop</td>
<td>Stop signal has been given from the option board.</td>
<td>Check option board.</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>206</td>
<td>449</td>
<td>Saturation trip</td>
<td>Various causes: • component failure • brake resistor short circuit or overload</td>
<td>Cannot be reset from the key-pad. Switch off power.</td>
<td>DO NOT RE-CONNECT POWER! Contact Eaton.</td>
</tr>
<tr>
<td>8</td>
<td>206</td>
<td>449</td>
<td>System fault</td>
<td>• component failure • faulty operation Note: exceptional fault data record, see Eaton User Manual for LCX9000 VFD.</td>
<td>Reset the fault and restart.</td>
<td>Should the fault reoccur, contact Eaton.</td>
</tr>
<tr>
<td>9</td>
<td>215 (165)</td>
<td>429</td>
<td>Under-voltage*</td>
<td>DC-link voltage is under the defined voltage limits. See Eaton User Manual for LCX9000 VFD. • most probable cause: too low a supply voltage • drive internal fault</td>
<td>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.</td>
<td>Monitor the incoming AC line for low voltage or line power interruption. If voltage is adequate an internal failure has occurred.</td>
</tr>
<tr>
<td>11</td>
<td>225 (143)</td>
<td>445</td>
<td>Output phase supervision*</td>
<td>Current measurement has detected that there is no current in one motor phase.</td>
<td>Check motor cable and motor.</td>
<td>Check motor cable and motor. Check motor current % imbalance in VFD_CONF (PIC III) / CFGUMVFD (PIC 6) screen.</td>
</tr>
<tr>
<td>12</td>
<td>206</td>
<td>449</td>
<td>Brake chopper supervision</td>
<td>• no brake resistor installed • brake resistor is broken • brake chopper failure</td>
<td>Check brake resistor.</td>
<td>If the resistor is okay, the chopper is faulty. Contact Eaton.</td>
</tr>
<tr>
<td>13</td>
<td>206</td>
<td>449</td>
<td>Drive under-temperature</td>
<td>Heatsink temperature is under 14°F (–10°C)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>219</td>
<td>444</td>
<td>Drive over-temperature</td>
<td>• Heatsink temperature is over 158°F (70°C). Overtemperature warning is issued when the heatsink temperature exceeds 149°F (65°C) • Circuit board temperature is over 185°F (85°C). Overtemperature warning is issued when the board temperature exceeds 158°F (70°C).</td>
<td>Check the coolant flow and temperature.</td>
<td>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.</td>
</tr>
<tr>
<td>15</td>
<td>206</td>
<td>449</td>
<td>Motor stalled*</td>
<td>Motor stall protection has tripped.</td>
<td>Check motor.</td>
<td>Check VFD_HIST (PIC III) or Alarm History (PIC 6).</td>
</tr>
</tbody>
</table>
Table 6 — Eaton LCX9000 Fault Code Descriptions and Corrective Actions (PIC III Controls) (cont)

<table>
<thead>
<tr>
<th>VFD FAULT CODE ON VFD HIST SCREEN</th>
<th>ICVC FAULT STATE (PIC III)</th>
<th>PIC 6 FAULT STATE</th>
<th>FAULT TYPE</th>
<th>DESCRIPTION</th>
<th>SOLUTION</th>
<th>CORRECTIVE ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>217</td>
<td>449</td>
<td>Motor overload trip</td>
<td>Motor is overloaded. If no motor overload exists, check the temperature model parameters.</td>
<td>Decrease the motor load. If no motor overload exists, check the temperature model parameters.</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>202</td>
<td>440</td>
<td>Motor Amps not sensed.</td>
<td>Motor underload protection has tripped.</td>
<td>Check main Circuit breaker for trip. Increase Current % imbalance in VFD CONF (PIC III)/CFGUMVFD (PIC 6) screen.</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>206</td>
<td>449</td>
<td>EEPROM checksum fault†</td>
<td>Parameter save fault • faulty operation • component failure</td>
<td>Attempt to reset.</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>206</td>
<td>449</td>
<td>Counter fault</td>
<td>Values displayed on counters are incorrect.</td>
<td>Check value of counters.</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>206</td>
<td>450</td>
<td>Microprocessor watchdog fault</td>
<td>• faulty operation • component failure</td>
<td>Reset the fault and restart. Should the fault re-occur, contact Eaton.</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>206</td>
<td>449</td>
<td>Start-up prevented</td>
<td>Start-up of the drive has been prevented.</td>
<td>Cancel prevention of start-up.</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>206</td>
<td>449</td>
<td>Thermostor fault*</td>
<td>The thermostor input of option board has detected increase of the motor temperature.</td>
<td>Check motor cooling and loading Check thermostor connection. If thermostor input of the option board is not in use, it must be short-circuited.</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>206</td>
<td>444</td>
<td>IGBT temperature (hardwire)</td>
<td>IGBT Inverter Bridge over-temperature protection has detected too high a short term overload current. This is a measured value.</td>
<td>Check loading. Check motor size. Check VFD_CONF/CFGUMVFD (PIC 6) screen.</td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>206</td>
<td>449</td>
<td>Control unit</td>
<td>Control Unit can not control Power Unit and vice versa.</td>
<td>Change control unit. See Eaton manual for location of control unit.</td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>206</td>
<td>449</td>
<td>Device change (same type)†</td>
<td>• option board or control unit changed. • same type of board or same power rating of drive</td>
<td>Reset Note: No fault time data record! Press ICVC reset key.</td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>206</td>
<td>449</td>
<td>Device added (same type)†</td>
<td>• option board or drive added. • drive of same power rating or same type of board added</td>
<td>Reset Note: No fault time data record!</td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>206</td>
<td>449</td>
<td>Device removed†</td>
<td>• option board removed • drive removed</td>
<td>Reset Note: No fault time data record! Check option board.</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>206</td>
<td>449</td>
<td>Device unknown</td>
<td>Unknown option board or drive.</td>
<td>Contact Eaton. Check option board.</td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>206</td>
<td>444</td>
<td>IGBT temperature</td>
<td>IGBT Inverter Bridge over-temperature protection has detected too high a short term overload current. This is a calculated value.</td>
<td>Check VFD_CONF (PIC III)/CFGUMVFD (PIC 6) parameters.</td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>206</td>
<td>449</td>
<td>Brake resistor overtemperature*</td>
<td>Brake resistor overtemperature protection has detected too heavy braking.</td>
<td>Set the deceleration time longer. Use external brake resistor. Check VFD_CONF (PIC III)/CFGUMVFD (PIC 6) parameters.</td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>206</td>
<td>449</td>
<td>Encoder fault</td>
<td>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</td>
<td>Check encoder channel connections. Check the encoder board.</td>
<td></td>
</tr>
<tr>
<td>44</td>
<td>206</td>
<td>449</td>
<td>Device changed (different type)†</td>
<td>• option board or control unit changed • option board of different type or different power rating of drive</td>
<td>Reset Note: No Fault Time Data Record is made. Press the reset key. Note: Application parameter values restored to default.</td>
<td></td>
</tr>
</tbody>
</table>
### Table 6 — Eaton LCX9000 Fault Code Descriptions and Corrective Actions (PIC III Controls) (cont)

<table>
<thead>
<tr>
<th>VFD FAULT CODE ON VFD HIST SCREEN</th>
<th>ICVC FAULT STATE (PIC III)</th>
<th>PIC 6 FAULT STATE</th>
<th>FAULT TYPE</th>
<th>DESCRIPTION</th>
<th>SOLUTION</th>
<th>CORRECTIVE ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>45</td>
<td>206</td>
<td>449</td>
<td>Device added (different type)†</td>
<td>• option board or device added&lt;br&gt; • option board of different type or drive of different power rating added</td>
<td>Reset. Note: No Fault Time Data Record is made.</td>
<td>Press the reset key. Note: Application parameter values restored to default.</td>
</tr>
<tr>
<td>50</td>
<td>206</td>
<td>449</td>
<td>Analog input sel. signal range 4 to 20 mA)*</td>
<td>Current at the analog input is &lt;4 mA.&lt;br&gt; • control cable is broken or loose&lt;br&gt; • signal source has failed.</td>
<td>Check the current loop and signal source.</td>
<td>Check wiring to terminal.</td>
</tr>
<tr>
<td>51</td>
<td>207</td>
<td>439</td>
<td>External fault</td>
<td>Digital input failed.</td>
<td>Check source of trigger.</td>
<td>Check I/O board.</td>
</tr>
<tr>
<td>52</td>
<td>206</td>
<td>449</td>
<td>Keypad communication fault</td>
<td>There is no connection between the control keypad and the drive.</td>
<td>Check the keypad connection and keypad cable.</td>
<td>Check for bent connector pins.</td>
</tr>
<tr>
<td>53</td>
<td>206</td>
<td>449</td>
<td>Comm Fault</td>
<td>The data connection between the fieldbus master and the fieldbus board is broken.</td>
<td>Check installation.</td>
<td>If installation is correct contact Eaton.</td>
</tr>
<tr>
<td>54</td>
<td>206</td>
<td>449</td>
<td>Slot fault</td>
<td>Defective option board or slot.</td>
<td>Check that the board is properly installed and seated in slot.</td>
<td>If the installation is correct, contact Eaton.</td>
</tr>
<tr>
<td>56</td>
<td>206</td>
<td>449</td>
<td>PT100 board temperature fault</td>
<td>Temperature limit values set for the PT100 board parameters have been exceeded.</td>
<td>Determine the cause of the high temperature.</td>
<td></td>
</tr>
</tbody>
</table>

* Programmable fault.<br>† 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.

### Parts Identification and Location

See Fig. 11-14.
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. 11 — 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. 12 — Frame CH72 Component Identification — 23XRV
**Fig. 13 — Frame CH63 Component Identification**

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. 14 — Frame CH74 Component Identification**

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

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

Use TB1/TB2 for PIC III. For PIC6 controls with exception for 50/51 and 17/43 use terminal blocks in Carrier Control panel for input and output control signals (see PIC6 Control Schematic).
APPENDIX A — WIRING SCHEMATICS (cont)

23XRV CHILLER CONTROL SCHEMATIC

Continued on next page
APPENDIX A — WIRING SCHEMATICS (cont)

23XRV CHILLER CONTROL SCHEMATIC (cont)

Continued from previous page

**LEGEND**

**CB-XX** — Circuit Breaker (Example: CB-1B)

**CCM** — Chiller Control Module

**CCN** — Carrier Comfort Network

**HGBP** — Hot Gas Bypass

**ICVC** — International Chiller Visual Controller

**OPT** — VFD Terminal Board Location

**OPTC2, OPTA9, OPTA2**

**UPC** — Universal Protocol Converter

**VFD** — Variable Frequency Drive

**VFG** — Variable Frequency (Drive) Gateway

Denotes Control Panel Terminal

Denotes Oil Pump Terminal

Denotes Power Panel Terminal

Denotes VFD to Control Panel Connector

Denotes 115 V Component Terminal

Wire Splice

Denotes Conductor Male/Female Connector

Option Wiring

Field Wiring

Denotes Humidity Sensor