

# Liebert® Challenger™ 3000 with Liebert iCOM®

Operation & Maintenance Manual - 50 & 60Hz



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## IMPORTANT SAFETY INSTRUCTIONS

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### SAVE THESE INSTRUCTIONS

This manual contains important safety instructions that should be followed during the installation and maintenance of the Liebert Challenger 3000 with Liebert iCOM®. Read this manual thoroughly before attempting to install or operate this unit.

Only qualified personnel should move, install or service this equipment.

Adhere to all warnings, cautions and installation, operating and safety instructions on the unit and in this manual. Follow all operating and user instructions.



#### WARNING

Arc flash and electric shock hazard. Open all local and remote electric power disconnect switches, verify with a voltmeter that power is off and wear personal protective clothing per NFPA 70E before working within the electric control enclosure. Failure to comply can cause injury or death.

Before proceeding with installation, read all instructions, verify that all the parts are included and check the nameplate to be sure the voltage matches available utility power.

The Liebert iCOM microprocessor does not isolate power from the unit, even in the “Unit Off” mode. Some internal components require and receive power even during the “Unit Off” mode of the Liebert iCOM.

The factory-supplied optional disconnect switch is inside the unit. The line side of this switch contains live high-voltage.

The only way to ensure that there is NO voltage inside the unit is to install and open a remote disconnect switch. Refer to unit electrical schematic.

Follow all local codes.



#### WARNING

Risk of explosive discharge from high-pressure refrigerant. Can cause injury or death.

This unit contains fluids and gases under high pressure. Relieve pressure before working with piping.



#### WARNING

Risk of refrigerant system rupture or explosion from overpressurization. Can cause equipment damage, injury or death.

Local building or plumbing codes may require that a fusible plug or other type of pressure relief device be installed in the system.

For systems requiring EU CE compliance (50Hz), the system installer must provide and install a discharge pressure relief valve rated for a maximum of 500psig (34bar) in the high side refrigerant circuit. Do not install a shutoff valve between the compressor and the field installed relief valve. The pressure relief valve must be CE certified to the EU Pressure Equipment Directive by an EU “Notified Body.”



#### NOTE

*The compressor has a factory-installed high pressure safety switch in the high side refrigerant circuit. A pressure relief valve is provided with Liebert Lee-Temp™ condensers. Consult your local building code to determine if the Liebert Fan Speed Control and VFD condensers will require field-provided pressure-relief devices. A fusible plug kit for Liebert FSC and VFD condensers is available for field installation.*



## WARNING

Risk of high-speed moving parts. Can cause injury or death.

Open all local and remote electric power disconnect switches, verify with a voltmeter that power is Off and verify that the blower wheel, pulleys and drive belts have stopped rotating before working in the unit.

Do not operate upflow units without installing a plenum, ductwork or guard over the blower opening(s) on the top of the unit cabinet.

Ductwork must be connected to the blower(s), or a plenum must be installed on the blower deck for protection from rotating blower wheel(s) on upflow units.



## CAUTION

Risk of contact with hot surfaces. Can cause injury.

The compressors, refrigerant discharge lines, humidifiers and reheats are extremely hot during unit operation. Allow sufficient time for them to cool before working within the unit cabinet. Use extreme caution and wear protective gloves and arm protection when working on or near hot compressors, discharge lines, humidifiers and reheats.

## NOTICE

Risk of internal system corrosion and frozen coolant fluid. Can cause equipment damage and major fluid leaks resulting in serious building damage, expensive repair costs and costly system down time.

Cooling coils, heat exchangers and piping systems that are connected to open cooling towers or other open water/glycol systems are at high risk of freezing and premature corrosion.

Fluids in these systems must contain the proper antifreeze and inhibitors to prevent freezing and premature coil, piping and heat exchanger corrosion. The water or water/glycol solution must be analyzed by a competent local water treatment specialist before startup to establish the inhibitor and antifreeze solution requirement and at regularly scheduled intervals throughout the life of the system to determine the pattern of inhibitor depletion.

The complexity of water/glycol solution condition problems and the variations of required treatment programs make it extremely important to obtain the advice of a competent and experienced water treatment specialist and follow a regularly scheduled coolant fluid system maintenance program.

Read and follow individual unit installation instructions for precautions regarding fluid system design, material selection and use of field-provided devices. Liebert systems contain iron and copper alloys that require appropriate corrosion protection. It is important to have the system running with flow through exchangers maintained at initial system fill for 24 to 48 hours depending on size and system configuration.

Water chemistry varies greatly by location, as do the required additives, called inhibitors, that reduce the corrosive effect of the fluids on the piping systems and components. The chemistry of the water used must be considered, because water from some sources may contain corrosive elements that reduce the effectiveness of the inhibited formulation.

Sediment deposits prevent the formation of a protective oxide layer on the inside of the coolant system components and piping. The water/coolant fluid must be treated and circulating through the system continuously to prevent the buildup of sediment deposits and or growth of sulfate reducing bacteria.

Proper inhibitor maintenance must be performed in order to prevent corrosion of the system. Consult glycol manufacturer for testing and maintenance of inhibitors.

Commercial ethylene glycol, when pure, is generally less corrosive to the common metals of construction than water itself. It will, however, assume the corrosivity of the water from which it is prepared and may become increasingly corrosive with use if not properly inhibited.

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## **NOTICE**

Risk of damage from forklift. Can cause unit damage.

Keep tines of the forklift level and at a height suitable to fit below the skid and/or unit to prevent exterior and/or underside damage.

## **NOTICE**

Risk of improper storage. Can cause unit damage.

Keep the Liebert Challenger 3000 upright, indoors and protected from dampness, freezing temperatures and contact damage.

## **NOTICE**

Risk of leaking water. Can cause equipment and building damage.

This unit requires a water drain connection. It may also require an external water supply to operate.

Improper installation, application and service practice can result in water leaking from the unit. Water leaks can cause severe property damage and loss of critical data center equipment.

Do not locate unit directly above any equipment that could sustain water damage.

Emerson recommends installing monitored leak detection equipment for unit and supply lines.

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## 1.0 INTRODUCTION

### 1.1 System Descriptions

Liebert Challenger 3000 Thermal Management systems are available in several configurations.

#### 1.1.1 Compressorized Systems

**NOTE**

*Compressorized systems may be a self-contained system, with the compressor in the Liebert Challenger 3000, or a split system, with the compressor in a separate condensing unit.*

These systems may be air-cooled, water-cooled or glycol-cooled, depending on the heat rejection method selected.

**Cooling**—One stage standard; variable capacity with digital scroll, optional.

**Heating**—Two stages of electric reheat standard; SCR controlled electric reheat, hot water reheat, hot gas reheat on water- and glycol-cooled systems optional.

**Humidification**—Infrared standard; steam generating optional.

**Dehumidification**—Hot gas bypass locked out standard

#### 1.1.2 GLYCOOL™ (Chilled Glycol Cooling) Systems

GLYCOOL systems have all of the features of a compressorized water or glycol system, plus a second cooling coil that is connected into the water circuit. When fluid temperature is sufficiently low (below room temperature), cooling is provided by circulating the fluid through the second cooling coil (flow is controlled by a motorized valve.) This is then the primary cooling source, and it greatly reduces the compressor operation.

**Cooling**—Modulated cooling valve opens proportionally to match room needs (primary), one or two stages of mechanical refrigeration (secondary)

**Heating**—Two stages of electric reheat standard; hot water reheat optional

**Humidification**—Infrared standard; steam generating optional

**Dehumidification**—Hot gas bypass locked out standard

#### 1.1.3 Chilled Water Systems

These systems utilize a central chiller and control cooling by modulating a control valve in the chilled water line.

**Cooling**—Proportional in response to room needs

**Heating**—Two stages of electric reheat standard; hot water reheat optional

**Humidification**—Infrared standard; steam generating optional

**Dehumidification**—Chilled water valve opens proportionally in response to room needs

## 2.0 STARTUP

Before beginning startup, make certain that unit was installed according to the instructions in the installation manual, SL-11962. Verify that the fan shipping bolt has been removed, the check valve has been installed (on air-cooled units), and that the scroll compressor is rotating in the proper direction. All exterior panels must be in place with the front panel open.

Locate the startup form supplied with your unit documents. Complete the form during startup and mail it to Liebert when startup is completed. Contact your Liebert supplier if you have any questions or problems during unit installation, startup or operation.



### WARNING

Arc flash and electric shock hazard. Open all local and remote electric power disconnect switches, verify with a voltmeter that power is off and wear personal protective clothing per NFPA 70E before working within the electric control enclosure. Failure to comply can cause injury or death.

Potentially lethal voltages exist within this equipment during operation. Observe all cautions and warnings on unit and in this manual.

The Liebert iCOM does not isolate power from the unit, even in the “Unit Off” mode. The only way to ensure that there is NO voltage inside the unit is to install and open a remote disconnect switch. Refer to unit electrical schematic.

### 2.1 Startup Procedure

1. Disconnect all power to the environmental control unit.
2. Tighten all electrical wiring connections that may have loosened during shipping (on electric panel and at all major components, such as compressor, reheats, humidifier and motor). Retighten according to values listed on component by component manufacturer.
3. Remove all line voltage fuses except the main fan fuses at the far right of the electric panel and the Control Voltage fuses at the far left of the electric panel. For units supplied with circuit breakers, open the circuit breakers instead of removing fuses.
4. Turn on power and check line voltage on main unit disconnect switch. Line voltage must be within 10% of nameplate voltage.
5. Turn On main unit disconnect switch and check secondary voltage at transformer T1. Voltage at T1 must be 24 VAC  $\pm$ 2.5 VAC (check at TB1-1 and TB1-8). If tolerance is exceeded, change the transformer primary tap.
6. Push the On button. Blower will start.
7. If you do not want your unit to operate at factory default settings, set temperature and humidity setpoints, alarms and other control functions. Refer to the iCOM User Manual SL-18835.
8. Stop the unit by depressing the On/Off button on the front display. Turn Off main unit disconnect and main breaker.
9. Replace all fuses (or reset circuit breakers) that were removed in **Step 3**.
10. Restore power to unit; turn On the main unit disconnect switch.
11. Push the On button—putting the unit into operation.
12. Check the current draw on all line voltage components and match with serial tag.
13. Verify that the scroll compressor is rotating in the proper direction.

### NOTICE

Risk of improper wiring/phase sequencing. Can cause backward compressor rotation, poor performance and compressor damage.

Three-phase power must be connected to the unit line voltage terminals in the proper sequence so that the scroll compressor rotates in the proper direction. Rotation in the wrong direction will result in poor performance and compressor damage. Use a phase sequence and motor rotation sensor to ensure that the three-phase power is correctly connected and that the compressor is rotating properly.

14. Check for unusual noises and vibration.
15. Check all refrigerant and fluid lines for leaks.
16. Test all functions of your unit for proper operation.
17. Close high voltage dead front cover and latch.
18. Close front accent panel and latch.

Return completed startup form to:

Liebert Corporation  
Warranty Registration  
1050 Dearborn Drive  
P.O. Box 29186  
Columbus, OH 43229

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## 3.0 COMPONENT OPERATION AND MAINTENANCE

### 3.1 System Testing

#### 3.1.1 Environmental Control Functions

The performance of all control circuits can be tested by actuating each of the main functions. This is done by temporarily changing the setpoints.

##### Cooling

To test the cooling function, set the setpoint for a temperature of 10°F (5°C) below room temperature. A call for cooling should be seen and the equipment should begin to cool. A high temperature alarm may come On. Disregard it. Return setpoint to the desired temperature.

##### Heating

Reheat may be tested by setting the setpoint for 10°F (5°C) above room temperature. A call for heating should be seen and the heating coils should begin to heat. Disregard the temperature alarm and return the setpoint to the desired temperature.

##### Humidification

To check humidification, set the humidity setpoint for an RH 10% above the room humidity reading. For infrared humidifiers, the infrared element should come On. Steam generating humidifiers should click immediately as it energizes. After a short delay, the canister will fill with water. The water will heat and steam will be produced. Return the humidity setpoint to the desired humidity.

##### Dehumidification

Dehumidification can be checked by setting the humidity setpoint for an RH 10% below room relative humidity. The compressor should come On. Return humidity setpoint to the desired humidity.

##### Electric Panel

The electric panel should be inspected for any loose electrical connections.



### WARNING

Arc flash and electric shock hazard. Open all local and remote electric power supply disconnect switches, verify with a voltmeter that power is Off and wear personal protective clothing over NFPA 70E before working within the electric control enclosure. Failure to comply can cause injury or death.

The Liebert iCOM does not isolate power from the unit, even in the “Unit Off” mode. Some internal components require and receive power even during the “Unit Off” mode of the Liebert iCOM.

The only way to ensure that there is NO voltage inside the unit is to install and open a remote disconnect switch. Refer to the unit’s electrical schematic.

Verify that all power has been disconnected from the unit before attempting to tighten any fittings or connections.

##### Control Transformer and Fuses

The control system is divided into four separate circuits. The control voltage circuits are individually protected by fuses located on the transformer/fuse board. If any of the fuses are blown, first eliminate shorts, then use spare fuses supplied with unit. Use only type and size of fuse specified for your unit.

The small isolation transformer on the board supplies 24 volts to the main control board. The transformer is internally protected. If the internal protector opens, the transformer/fuse board must be replaced. Also check the control voltage fuse on the main control board before replacing the transformer/fuse board.

##### Fan Safety Switch

The fan safety switch is in the electric compartment and consists of a diaphragm switch and interconnecting tubing to the blower scroll. The fan safety switch is wired directly to the control circuit to activate the alarm system if the airflow is interrupted

### High-Temp Sensor

The optional high-temp sensor is a bimetal-operated sensing device with a normally closed switch. This device will shut down the entire unit when the inlet air temperature exceeds a preset point. It is connected between Terminals 1 and 2 at Plug P39.

### Smoke Detector

The optional smoke detector power supply is located on the base of the upflow units, and at the top of downflow units. It is constantly sampling return air through a tube. No adjustments are required.

### Water Detection Sensor

## WARNING

Risk of fire or explosion. Can cause injury or death.

Do not use near flammable liquids or for flammable liquid detection.

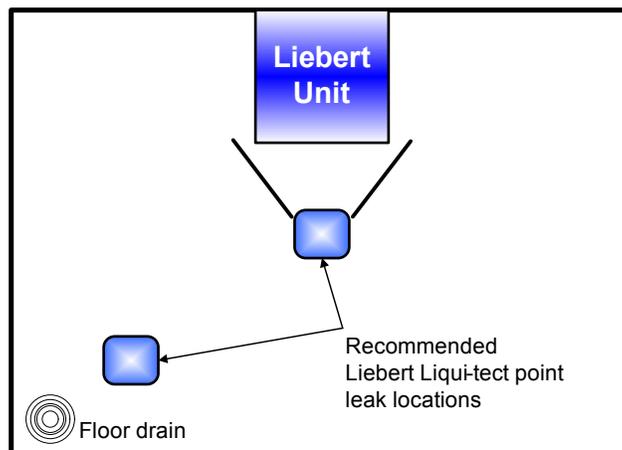
The optional water detection devices available are a point leak detection sensor and a zone leak detection kit. Emerson recommends remote monitoring of these devices for timely detection of water leaks that can cause expensive building and equipment damage if not resolved immediately.

Figure 1 Liebert leak detection units



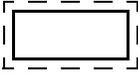
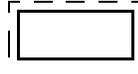
The point leak detection sensor provides leak detection at a critical point. A simple two-wire connection signals the alarms at a Liebert Thermal Management unit or at a monitoring panel. Run wires to the Liebert unit and connect them to terminals 24 and 51, 55 or 56. Use NEC Class 2, 24V wiring. The sensor contains a solid state switch that closes when water is detected by the twin sensor probes. The sensor is hermetically sealed in all thread PVC nipple and is to be mounted where water problems may occur. The sensor should be located 6-8 feet (2-2.5m) from the environmental control unit in a wet trap or near a floor drain. It should not be mounted directly under the unit.

Figure 2 Recommended liquid sensor locations



The zone leak detection kit provides leak detection for a defined zone. This kit is ideal for perimeter sensing or serpentine coverage of small areas. A simple, two-wire connection signals the alarms at a Liebert Thermal Management unit or at a monitoring panel. Run wires to the Liebert unit and connect them to terminals 24 and 51, 55 or 56. The sensor utilizes Liebert's LT500Y leak detection cable. The kit is offered with five different lengths of cable sized specifically for the type of Liebert Thermal Management unit (see matrix below). Refer to matrix below for the recommended location of leak detection cable.

**Table 1 Zone leak detection kit installation scenarios**

	Scenarios			
	Upflow Unit Detection around entire unit  2-ft clearance in front	Upflow Unit Detection on sides and in front of unit  2-ft clearance in front	Downflow Unit Detection around entire unit  6-ft clearance in front	Downflow Unit Detection on sides and in front of unit  6-ft clearance in front
	<b>Distance From Unit, feet (m)</b>			
In back	2 (0.6)	No cable behind	1 (0.3)	No cable behind
On sides	2 (0.6)	2 (0.6)	1 (0.3)	1 (0.3)
In front	2 (0.6)	2 (0.6)	6 (1.8)	6 (1.8)
Unit (footprint-in.)	Part Number			
Liebert Challenger 3000 (32.5 x 32.5)	LT460-Z30	LT460-Z20	LT460-Z30	LT460-Z25

**Remote Shutdown**

A connection point is provided for customer supplied remote shutdown devices. This terminal strip is located at the top of upflow units, and at the base of downflow units. Terminals 37 and 38 on the terminal strip are jumpered when no remote shutdown device is installed.

**3.2 Filters**

Filters are usually the most neglected item in an environmental control system. To maintain efficient operation, they should be checked monthly and changed as required. Because replacement intervals vary with environmental condition and filter type, each unit is equipped with a filter clog switch. This warns of restricted airflow through the filter compartment by activating the Change Filter alarm.

Turn power Off before replacing filters.

Liebert Challenger 3000 filters are 28-1/2" by 29-1/2", either 2" or 4" thick, plus an optional 2" thick pre-filter. The filter is replaced from the front of the unit. On upflow units, the filter is vertical, in front of the lower compartment. Pull the filter out toward you to remove it. On downflow units, the filter is horizontal, above the electrical panel. Slide the filter out toward you to remove it.

After replacing the filter(s), test the operation of the filter clog switch. Turn the adjusting screw counter clockwise to trip the switch — this will energize the Change Filter alarm. To adjust the switch proceed as follows: With the fan running, set the switch to energize the light with clean filters. The unit panels must all be in place and closed to accurately find this point. Then turn the adjusting knob one turn clockwise, or to the desired filter change point.

### 3.3 Blower Package

Periodic checks of the blower package include: belt, motor mounts, fan bearings, and impellers.

#### 3.3.1 Fan Impellers and Bearings

Fan impellers should be periodically inspected and any debris removed. Check to see if they are tightly mounted on the fan shaft. Rotate the impellers and make sure they do not rub against the fan housing.

Bearings used on the units are permanently sealed and self-lubricating. They should be inspected for signs of wear when the belt is adjusted. Shake the pulley and look for movement in the fan shaft. If any excessive movement is noticed, bearings should be replaced. However, the cause of the wear must be determined and corrected before returning the unit to operation.

#### 3.3.2 Belt

The drive belt should be checked monthly for signs of wear and proper tension. Pressing in on belts midway between the sheave and pulley should produce from 1/2" to 1" (12 to 25 mm) of movement. Belts that are too tight can cause excessive bearing wear.

Belt tension can be adjusted by raising or lowering the fan motor base. Loosen nut above motor mounting plate to remove belt. Turn nut below motor mounting plate to adjust belt tension. If belt appears cracked or worn, it should be replaced with a matched belt (identically sized). With proper care, a belt should last several years.

## NOTICE

Risk of improper adjustment. Can cause equipment damage.

After adjusting or changing the belt, check to ensure that the motor base nuts are tightened. The bottom adjustment nut should be finger tight. The top locking nut should be tightened with a wrench. The motor sheave must be parallel to and aligned with the blower wheel pulley to maximize belt life.

#### 3.3.3 Air Distribution

All unit models are designed for constant volume air delivery. Therefore any unusual restrictions within the air circuit must be avoided. For downflow models operating on a raised floor, refer to **Table 2** for recommended free area for proper air flow.

**Table 2 Recommended free area ft<sup>2</sup> (m<sup>2</sup>) for grilles or perforated panels at output velocities of 550 and 600 fpm (2.8 and 3.1 m/s)**

Model	550 FPM (2.8 m/s)	600 FPM (3.1 m/s)
60 Hz Units		
3 Ton	3.3 (0.31)	3.0 (0.28)
5 Ton	5.1 (0.41)	4.7 (0.44)
50 Hz Units		
3 Ton	3.3 (0.31)	3.0 (0.28)
5 Ton	4.7 (0.44)	4.3 (0.40)

Grilles used in raised floors vary in size, the largest being 18" x 6" (46 cm x 15 cm). This type of grille has approximately 56 in<sup>2</sup> (361 cm<sup>2</sup>) of free area. Perforated Panels are usually 2' x 2' (61 cm x 61 cm) and have a nominal free area of approximately 108 to 144 in<sup>2</sup> (697 to 929 cm<sup>2</sup>).

## NOTICE

Risk of airflow restriction. Can cause inefficient operation and equipment overheating.

In raised-floor use, all under-floor restrictions, such as clusters of cables or piping, must be avoided because they may form barriers to airflow. Whenever possible, cables and pipes should be run parallel to the airflow. Never stack cables or piping.

### 3.4 Refrigeration System

Each month, the components of the refrigeration system should be inspected for proper function and signs of wear. Since, in most cases, evidence of malfunction is present prior to component failure, periodic inspections can be a major factor in the prevention of most system failures.

Refrigerant lines must be properly supported and not allowed to vibrate against ceilings, floors or the unit frame. Inspect all refrigerant lines every six months for signs of wear and proper support. Also inspect capillary and equalizer lines from the expansion valve and support as necessary.

Each liquid line has a sight glass that indicates liquid refrigerant flow and the presence of moisture. Bubbles in the sight glass do not indicate a shortage of refrigerant or a restriction in the liquid line. The moisture indicator changes from green to yellow when moisture is present in the system.

#### 3.4.1 Suction Pressure

Suction pressure will vary with load conditions. The low pressure transducer will shut the compressor down if suction pressure falls below the cut-out setting. High suction pressure reduces the ability of the refrigerant to cool compressor components and can result in compressor damage.



**NOTE**

*Liebert Challenger 3000 fan coil units do not monitor suction pressure using a transducer. On these models, low-pressure management is accomplished using freeze stats located on the evaporator coil. See the Liebert iCOM® user manual, SL-18835, for more information.*

Additional low-pressure management routines may apply during compressor start and normal operation. See the Liebert iCOM user manual, SL-18835, for more information. The document is available on Liebert’s Web site: [www.liebert.com](http://www.liebert.com)

#### 3.4.2 Discharge Pressure

Discharge Pressure can be increased or decreased by load conditions or condenser efficiency. The high pressure switch will shut the compressor down at its cut-out setting. Refer to **Table 3**, below.

**Table 3 Discharge pressures**

System Design		Discharge Pressure PSIG (kPa)
Air-Cooled		295 (2035)
Water/Glycol-Cooled	65-75°F (18-24°C) fluid	239 (1650)
	85°F (29°C) fluid	255 (1760)
	115°F (46°C) fluid	335 (2310)
Maximum		365 (2516)
High Pressure Cut-Out		400 (2760)

#### 3.4.3 Superheat

Superheat can be adjusted by the Thermostatic Expansion Value (TEV). To determine superheat:

1. Measure the temperature of the suction line at the point the TEV bulb is clamped.
2. Obtain the gauge pressure at the compressor suction valve.
3. Add the estimated pressure drop between bulb location and suction valve.
4. Convert the sum of the two pressures to the equivalent temperature.
5. Subtract this temperature from the actual suction line temperature. The difference is superheat.

### 3.4.4 Thermostatic Expansion Valve

#### Operation

The thermostatic expansion valve performs one function. It keeps the evaporator supplied with enough refrigerant to satisfy load conditions. It does not effect compressor operation.

Proper valve operation can be determined by measuring superheat. If too little refrigerant is being fed to the evaporator, the superheat will be high; if too much refrigerant is being supplied, the superheat will be low. The correct superheat setting is between 10 and 15°F (5.6 and 8.3°C).

#### Adjustment

To adjust the superheat setting:

1. Remove the valve cap at the bottom of the valve.
2. Turn the adjusting stem counterclockwise to lower the superheat.
3. Turn the adjusting stem clockwise to increase the superheat.



#### NOTE

*Make no more than one turn of the stem at a time. As long as 30 minutes may be required for the new balance to take place.*

### 3.4.5 Hot Gas Bypass Valve—Not Available on Digital Scroll Units

#### Operation—Self-Contained Units

The hot gas bypass is inserted between the compressor discharge line and the leaving side of the expansion valve through the side outlet distributor. The system, with normal operation when the evaporator is under full load, will maintain enough pressure on the leaving side of the hot gas valve to keep the valve port closed.

If the load on the evaporator decreases, the evaporator will get colder. When the coil is too cold, the internal pressure in the evaporator drops and allows the hot gas bypass valve to open. Hot gas then mixes with the liquid coolant on the discharge side of the expansion valve raising the temperature and pressure in the evaporator. The net result is a reduction in the cooling capacity of the unit to match the load.

To aid in lubricating the compressor, the hot gas bypass solenoid is delayed for 30 seconds on the initial call for cooling and de-energized for 30 seconds during every 60 minutes of continuous operation.



#### NOTE

*These procedures are not applicable to condensing units. For condensing unit information, refer to Liebert's condensing unit manual, SL-10059, available at the Liebert Web site, [www.liebert.com](http://www.liebert.com)*

#### Adjustment

Upon deciding what evaporator temperature is desired, the following procedure should be used to adjust the hot gas bypass valve:

1. Install the suction and discharge pressure gauge.
2. Adjust the temperature setpoint to call for cooling so that the refrigeration compressor will run.
3. Remove the TOP adjusting nut from the valve.
4. Insert an Allen wrench in the brass hole at top of the valve in adjusting port, and turn CLOCKWISE if a higher evaporator temperature is required.
5. After obtaining the suction pressure required, reinstall the cap tightly making sure there are no leaks.
6. Let the evaporator operate for approximately 10 to 15 minutes to make sure the suction pressure is within the desired range.
7. There will be a fluctuation of approximately 3 to 6 PSIG (21 to 41 kPa) on the evaporator due to the differential on the hot gas bypass.
8. Return the temperature setpoint to desired number.

### 3.4.6 Air-Cooled Condenser

Restricted airflow through the condenser coil will reduce the operating efficiency of the unit and can result in high compressor head pressure and loss of cooling.

Clean the condenser coil of all debris that will inhibit air flow. This can be done with compressed air or commercial coil cleaner. Check for bent or damaged coil fins and repair as necessary. In winter, do not permit snow to accumulate around the sides or underneath the condenser.

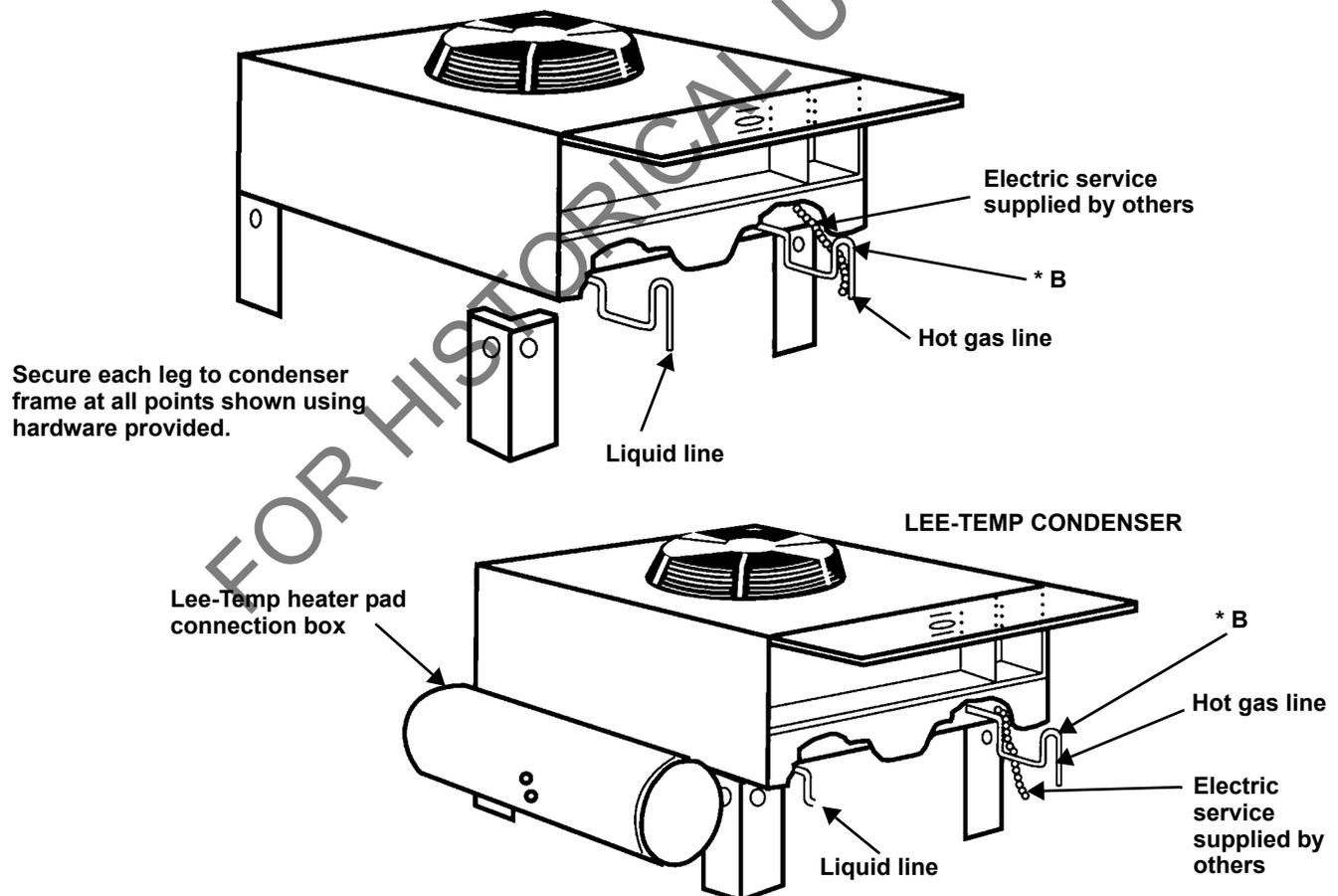
Check all refrigerant lines and capillaries for vibration isolation. Support as necessary. Visually inspect all refrigerant lines for signs of oil leaks.

#### Checking Refrigerant Charge (Liebert Lee-Temp™ /Flood Back Head Pressure Control)

The system refrigerant level must be checked periodically. To do so:

1. Adjust temperature setpoint in the unit so that the compressor will run continuously.
2. The refrigerant level is visible through two sight glasses on the receiver and will vary with ambient temperature.
  - a. 40°F (4.4°C) and lower — Midway on the bottom sight glass.
  - b. 40 to 60°F (4.4 to 15.6°C) — Bottom sight glass should be clear with liquid.
  - c. 60°F (15.6°C) and above — Midway on the top sight glass.
3. Return temperature setpoint to desired number.

**Figure 3 Outdoor fan/condenser configuration**  
**FAN SPEED CONDENSER**



\*B - Inverted traps are to be field-supplied and installed (typical). When installing traps, provide clearance for swing end of access door. Traps are to extend above base of coil by a minimum of 7-1/2" (190 mm).

### 3.4.7 Charging the Liebert MC™ with Refrigerant—Basic and Premium Efficiency Control

Liebert MC condensers are charge-sensitive and require accurate calculation of the system charge to avoid overcharging. To avoid overcharge, additional guidelines are recommended to ensure trouble free operation.

- When charging a system when the outdoor temperature is below 50°F (10°C), recheck the subcooling against **Table 6** when the ambient is above 60°F (15.6°C).
  - The indoor space should be maintained between 70°F and 80°F (21-26.7°C) return air before final charge adjustments are made.
  - Charging a unit when return air temperatures are above 80°F (26.7°C) may result in the unit being overcharged.
  - Charge by subcooling measurement at the indoor unit. See **Table 6** for target subcooling temperatures.
  - Pressure and temperature measuring instruments should be capable of measuring to ±10 psig (68.9kPa) and ± 2°F (1.1°C) for best subcooling measurement.
1. Check indoor nameplate for refrigerant type to be used. Unit control configurations differ depending on refrigerant type.
  2. Completing the refrigerant charging requires operating the system for the latter steps. Refer to the Checklist for Completed Installation in the Liebert Challenger 3000 installation manual, SL-11962.
  3. Calculate the amount of charge for the system. Refer to the Liebert Challenger 3000 installation manual, SL-11962, and to the condenser and refrigerant line charge data in **Tables 4** and **5** in this document.
  4. Accurately weigh in as much of the required system charge as possible before starting the unit. Do not exceed the calculated charge by more than 0.5 lb (.23kg).

## NOTICE

Risk of improper refrigerant charging. Can cause equipment damage.

Refrigerant R-407C and R-410A are blended refrigerants and must be introduced and charged from the cylinder only as a liquid.

When adding liquid refrigerant to an operating system, it may be necessary to add the refrigerant through the compressor suction service valve. Care must be exercised to avoid damage to the compressor. Emerson recommends connecting a sight glass between the charging hose and the compressor suction service valve. This will permit adjustment of the cylinder hand valve so that liquid can leave the cylinder while allowing vapor to enter the compressor.

## NOTICE

Risk of refrigerant overcharge, Can cause equipment damage.

Do not use the sight glass as an indicator when charging Liebert MC systems.

5. Turn On the Liebert MC disconnect switch.
6. Turn On the Liebert Challenger 3000 disconnect switch
7. Operate the system for 30 minutes, using the charging function of the Liebert Challenger 3000 control for each circuit of the system.

The charging function is in the diagnostic section of the Liebert iCOM® control (see the Liebert iCOM user manual, SL-18835). The charging function operates the compressor(s) at full capacity and energizes the liquid line solenoid valve(s). The reheat and humidifier are disabled. Manual operation of the indoor fans from the diagnostic menu of the Liebert iCOM is required. A minimum 20psig (138kPa) must be established and maintained for the compressor to operate. The charging function can be reset as many times as required to complete unit charging.

**Table 4 R-407C (R-22) and R-410A interconnecting piping refrigerant charge**

Line Size O.D., in.	R-407C (R-22), lb/100 ft. (kg/30m)		R-410A, lb/100 ft. (kg/30m)	
	Hot Gas Line	Liquid Line	Hot Gas Line	Liquid Line
3/8	—	3.6 (1.6)	—	3.2 (1.5)
1/2	0.5 (0.2)	6.7 (3.1)	0.7 (0.3)	5.9 (2.7)
5/8	0.8 (0.4)	10.8 (4.9)	1.1 (0.5)	9.6 (4.4)
3/4	1.2 (0.6)	16.1 (7.3)	1.6 (0.7)	14.3 (6.5)
7/8	1.7 (0.8)	22.3 (10.2)	2.3 (1.0)	19.8 (9.1)
1-1/8	2.9 (1.3)	38.0 (17.4)	3.9 (1.8)	33.8 (15.5)
1-3/8	4.4 (2.0)	57.9(26.5)	5.9 (2.7)	51.5 (23.5)
1-5/8	6.2 (2.8)	—	8.4 (3.8)	—

Data based on 50°F (10°C) superheat, 125°F (52°C) SCT, 10°F (-12°C) subcooling.

**Table 5 R-407C (R-22) and R-410A refrigerant required, approximate**

Condenser models	Single Circuit lb (kg)	Dual Circuit lb/circuit (kg/circuit)
<b>Approximate R-407C (R-22) Refrigerant Needed</b>		
MCS 028	2.2 (1.0)	N/A
MCM 040	3.0 (1.4)	N/A
MCM 080	7.5 (3.4)	3.0 (1.4)
MCL 055	5.0 (2.3)	N/A
MCL 110	10.5 (4.8)	5.1 (2.3)
MCM160	NA	7.5(3.4)
MCL 165	18.3 (8.3)	N/A
MCL 220	27.0 (12.3)	12.2 (5.6)
<b>Approximate R-410A Refrigerant Needed</b>		
MCS 028	2.5 (1.2)	N/A
MCM 040	3.5 (1.6)	N/A
MCM 080	8.5 (3.8)	3.5 (1.6)
MCL 055	5.0 (2.3)	N/A
MCL 110	10.7 (4.9)	5.2 (2.4)
MCM160	NA	8.5(3.8)
MCL 165	18.4 (8.4)	N/A
MCL 220	27.0 (12.3)	12.3 (5.6)

- Attach pressure and temperature instruments to the liquid line of the indoor unit. Measure the initial subcooling and continue to add charge until the recommended subcooling for the current outdoor ambient temperature is reached (see **Table 6**. The outdoor ambient can be read from the Liebert MC™ condenser control menu ID F02

**NOTE**

To determine the subcooling measurement, a liquid line pressure reading (at the factory installed Schrader tap) needs to be measured along with obtaining a temperature reading on the liquid line. Convert the liquid line pressure reading into a temperature by utilizing a pressure-temperature guide. The difference between this converted temperature and the actual temperature will determine the system's subcooling. For R-407C, make sure to use the saturated liquid temperature to calculate subcooling.

**Table 6 Target subcooling for ambient outdoor temperature**

Ambient Temp °F (C°)	Subcooling °F (C°)	Ambient Temp °F (C°)	Subcooling °F (C°)
0 (-17.8)	22 (12.0)	80 (26.7)	13 (7.2)
10 (-12.2)	22 (12.0)	90 (32.2)	9 (5.0)
20 (-6.7)	22 (12.0)	95 (35.0)	7 (3.9)
30 (-1.1)	22 (12.0)	100 (37.8)	5 (2.9)
40 (4.4)	22 (12.0)	105 (40.6)	3 (1.8)
50 (10.0)	21 (11.7)	110 (43.3)	1 (0.7)
60 (15.6)	19 (10.8)	125 (51.7)	0 0
70 (21.1)	17 (9.3)		

9. Verify the subcooling calculated from measured values at the evaporator against the subcooling reading of the Liebert MC™ control [menu ID F50 & F51]. If the subcooling calculated with gauges differs from the Liebert MC subcooling by more than 3°F (1.7°C), then adjust the charge amount to achieve the target subcooling per **Table 6** based the Liebert MC control subcooling.

Failure to check measured subcooling with refrigerant gauges against the Liebert MC subcooling may result in an overcharged system. See **NOTE** below and **Table 7** for correction to Liebert MC subcooling that may be required based on condenser elevation above the indoor evaporator.



**NOTE**

*If the condenser is part of an R-22 system, the configuration of the condenser must be changed to read the subcooling correctly. The value of menu ID C09 of the Liebert MC control must be changed to “1”.*



**NOTE**

*The evaporator subcooling will be greater than the condenser subcooling when the Liebert MC is mounted higher than the indoor evaporator. Subcooling adjustment is needed when the Liebert MC is located greater than 40 ft above evaporator.*

**Sample Calculations**

The Liebert MC is 40 ft. above the evaporator of an R-407C system. The outdoor ambient from the Liebert MC condenser control menu ID F02, is 94.8°F. The liquid pressure is 300 psig and the liquid temperature is 113°F. The subcooling from the Liebert MC control is 5°F. Determine the subcooling and verify the calculated subcooling against the reading of the Liebert MC control [menu ID F50 & F51].

**Evaporator Subcooling Calculation**

Refrigerant Type: R-407C

- a. Ambient Temperature: 94.8°F
- b. Condenser Elevation: 40 ft.
- c. Condenser Elevation Temperature Correction: 4°F
- d. Liquid Line Pressure: 300
- e. Liquid Pressure converted to Saturated Liquid Temperature: 120.3°F
- f. Measured Liquid Line Temperature: 113.2°F
- g. MC Condenser Subcooling Reading: 5°F  
(Menu ID F50 for Circuit #1 or Menu ID F51 for Circuit #2)

Subtract Line **f** (Measured Line Temperature) from Line **e**. (Liquid Pressure converted to Temperature) to obtain Calculated Subcooling.

- Line **e**: 120.3°F
- Line **f**: -113.2°F
- h. Calculated Subcooling: 7.1°F or 7°F

**Elevation Correction**

Subtract Line **c**. (Correction for Condenser Elevation above Evaporator) from Line **h**. (Calculated Subcooling) to obtain Corrected Subcooling.

- Line **h**: 7°F
- Line **c**: -4°F
- i. Corrected Subcooling 3°F

**Verification Against MC Condenser**

Subtract Line **g**. (MC Condenser Subcooling Reading) from Line **i**. (Corrected Subcooling) to obtain Difference.

- Line **i**: 3°F
- Line **g**: -5°F
- j. Difference -2°F

- If Line **j** (Difference value) is less than ±3°F, NO charge adjustment is needed.
- If Line **j** (Difference value) is less than -3°F, add additional charge.
- If Line **j** (Difference value) is greater than +3°F, the system is overcharged and charge must be removed.

**Table 7 Difference in subcooling measurements—Indoor minus outdoor**

Liebert MC™ elevation above evaporator, ft. (m)		Elevation subcooling correction - °F(°C)			
		80 (24)	60 (18)	40 (12)	20 (6)
Refrigerant Type	R-22	12 (6.6)	9 (5.0)	5 (2.8)	1 (0.6)
	R-407C	10 (5.5)	7 (3.8)	4 (2.2)	1 (0.6)
	R-410A	6 (3.3)	4 (2.2)	2 (1.1)	0 (0.0)

10. As head pressure builds, the variable fan speed controlled condenser fan begins rotating. The fan will run at full speed when sufficient head pressure is developed.

FOR HISTORICAL USE ONLY

**Table 8 Liquid pressure and temperature chart**

Pressure	R407C *	R410A *	R22
Psig (Bar)	°F (°C)	°F (°C)	°F (°C)
170 (11.7)	81.5 (27.5)	59.8 (15.4)	90.6 (32.6)
180 (12.4)	85.1 (29.5)	63.1 (17.3)	94.3 (34.6)
190 (13.1)	88.6 (31.5)	66.3 (19.1)	97.9 (36.6)
200 (13.8)	92.0 (33.3)	69.5 (20.8)	101.4 (38.6)
210 (14.5)	95.2 (35.1)	72.5 (22.5)	104.7 (40.4)
220 (15.2)	98.3 (36.8)	75.4 (24.1)	108.0 (42.2)
230 (15.9)	101.4 (38.5)	78.2 (25.7)	111.1 (44.0)
240 (16.6)	104.3 (40.2)	80.9 (27.2)	114.2 (45.7)
250 (17.2)	107.2 (41.8)	83.6 (28.7)	117.1 (47.3)
260 (17.9)	109.9 (43.3)	86.2 (30.1)	120.0 (48.9)
270 (18.6)	112.6 (44.8)	88.7 (31.5)	122.8 (50.4)
280 (19.3)	115.3 (46.3)	91.1 (32.8)	125.5 (52.0)
290 (20.0)	117.8 (47.7)	93.5 (34.2)	128.2 (53.4)
300 (20.7)	120.3 (49.1)	95.8 (35.5)	130.8 (54.9)
310 (21.4)	122.8 (50.4)	98.1 (36.7)	133.3 (56.3)
320 (22.1)	125.2 (51.8)	100.3 (38.0)	135.8 (57.7)
330 (22.8)	127.5 (53.1)	102.5 (39.2)	138.2 (59.0)
340 (23.4)	129.8 (54.3)	104.6 (40.3)	140.6 (60.3)
350 (24.1)	132.1 (55.6)	106.7 (41.5)	142.9 (61.6)
360 (24.8)	134.3 (56.8)	108.7 (42.6)	145.2 (62.9)
370 (25.5)	136.4 (58.0)	110.7 (43.7)	147.4 (64.1)
380 (26.2)	138.6 (59.2)	112.7 (44.8)	149.6 (65.4)
390 (26.9)	140.6 (60.3)	114.5 (45.9)	151.8 (66.5)
400 (27.6)	142.7 (61.5)	116.4 (46.9)	153.9 (67.7)
500 (34.5)	161.3 (71.8)	133.5 (56.4)	173.1 (78.4)
600 (41.4)	177.4 (80.8)	148.1 (64.5)	189.5 (87.5)

\* Values are for saturated liquid

### 3.4.8 Water/Glycol-Cooled Condensers

#### Coaxial Condenser

Each water- or glycol-cooled module has a coaxial condenser that consists of a steel outside tube and a copper inside tube.

Coaxial condensers do not normally require maintenance or replacement if the water supply is clean. If your system operates at high head pressure with reduced capacity, and all other causes have been eliminated, the coaxial condenser may be obstructed and needs to be replaced.

### 3.4.9 Motorized Ball Valve—Digital Scroll Compressor

On water-cooled and glycol-cooled digital scroll units, the discharge pressure is controlled by a motorized ball valve. During unloaded operation, the pressure changes during each digital cycle could result in excessive repositions with a pressure operated water regulating valve. The control algorithm for the motorized ball valve uses an intelligent sampling rate and adjustable pressure thresholds to reduce valve repositions. The valve assembly consists of the brass valve, linkage and actuator.

## Control

The valve actuator operates on 24VAC power and is controlled by a 2-10VDC proportional control signal. The valve full open to full close time is 60 seconds. At 2VDC the valve is closed; at 10VDC the valve is fully open. There is a 20-second delay to position the motorized ball valve before starting the compressor.

## Control Method

The control utilizes an upper and lower pressure threshold with a 35 PSI (241 kPa) deadband to reduce valve movement. If the liquid pressure is between the upper and lower threshold the valve remains at the current position. If the liquid pressure exceeds the upper threshold the valve opens, and if the pressure falls below the lower threshold the valve closes. There are multiple adjustment bands to ease discharge pressure back into control range.

## Adjustment

Both pressure thresholds can be shifted simultaneously over a 50 PSI (345 kPa) range (the 35 PSI [241 kPa] differential remains constant). The ball valve setpoint offset parameter in the Service menu can be adjusted from 0 to 50 PSI (345 kPa) to raise or lower the control band similar to the pressure adjustment on a water regulating valve. Units are factory set at a 30 PSI (207 kPa) setpoint offset (30 PSI [207 kPa] above minimum). This results in a 220 PSIA (1517 kPa) lower threshold and a 255 PSIA (1758 kPa) upper threshold pressure.

## Startup

The setpoint offset is adjusted to the minimum value during startup, then transitions to the set value once the compressor reaches normal operating pressures. Additionally changes in fluid temperature could cause pressure changes that do not result in valve movement within the dead band on drycoolers. Fan cycling stats should be set to prevent continuous fluid temperature swings greater than 10°F (5.6°C) (see **3.4.11 - Drycooler Settings**).

## Location

The motorized ball valves are located in the condenser fluid return line. The three-way valve is piped in a mixing arrangement with the common port at the valve outlet.

## Manual Control

The valve can be manually set by disconnecting AC power, depressing the manual override button on the valve actuator, and adjusting the valve position with the handle. You also have the option to control the motorized ball valves through the Service menu using manual mode to override the normal control.

### 3.4.10 Regulating Valve—Scroll Compressor

The water regulating valve automatically regulates the amount of fluid necessary to remove the heat from the refrigeration system, permitting more fluid to flow when load conditions are high and less fluid to flow when load conditions are low. The valve consists of a brass body, balance spring, valve seat, valve disc holders, capillary tube to discharge pressure, and adjusting screw.

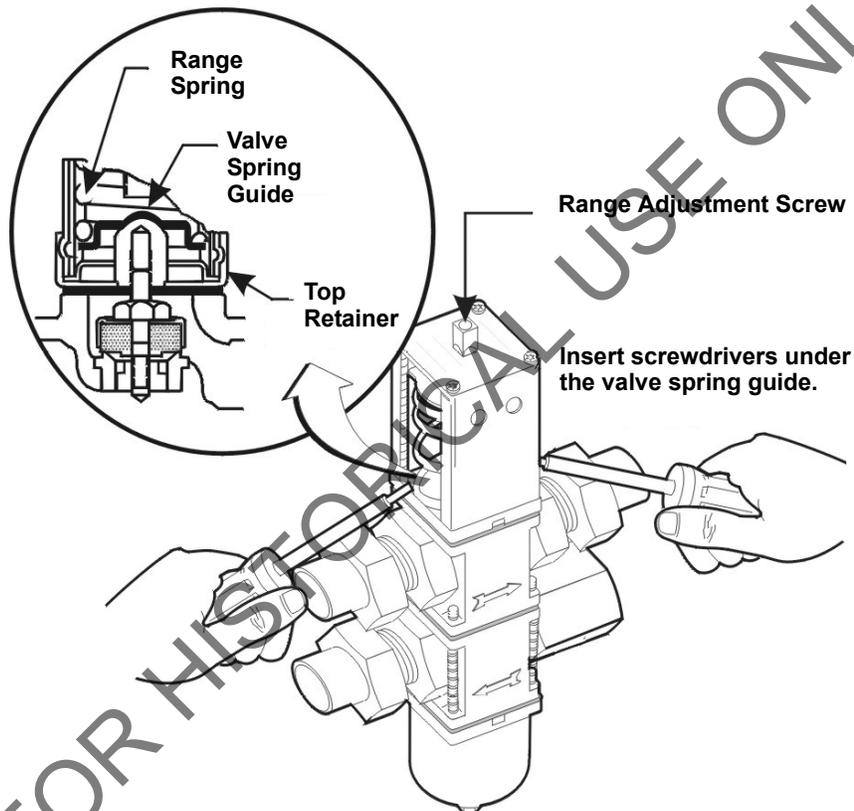
**Standard Valve - 150 psig (1034 kPa) system for 3 & 5 ton units (Johnson Controls Valve)**  
**High Pressure Valve - 350 psig (2413 kPa) system for 5 ton units (Johnson Controls Valve)**

**Adjustment**—The valve may be adjusted with a standard refrigeration service valve wrench or screw driver. Refer to **Table 3** for recommended refrigerant pressures.

To lower the head pressure setting, turn the square adjusting screw clockwise until the high pressure gauge indicates the desired setting.

To raise the head pressure setting, turn the adjusting screw counterclockwise until the desired setting is obtained.

**Figure 4 Johnson Controls valve adjustment**



**Manual Flushing**—The valve may be flushed by inserting a screwdriver or similar tool under the two sides of the main spring and lifting. This action will open the valve seat and flush any dirt particles from the seat. If this fails, it will be necessary to disassemble the valve and clean the seat.

**High Pressure Valve - 350 PSIG System (2413 kPa) for 3 Ton Units (Metrex Valve)**

**Adjustment**—The valve may be adjusted using a 1/8" diameter rod. Turn adjusting collar nut counterclockwise to raise head pressure. Turn it clockwise to lower head pressure. Rotation directions are as viewed from top of valve spring housing.

Figure 5 Metrex valve adjustment



**Manual Flushing**—The valve may be flushed by rotating the socket head screw clockwise. This screw must be in the OUT position (counterclockwise) for normal valve operation.

#### Valve Disassembly

1. Shut off the water supply by using isolating valves.
2. Relieve the tension on the main spring by turning the adjusting screw (or collar) as far as it will go (provide a container to catch water below the valve).
3. Remove four screws extending through the main spring housing.
4. Remove the center assembly screws for access to all internal parts.
5. Clean the seat if possible. If the seat is pitted or damaged, replace the valve rubber disc and valve seat.
6. After valve is reassembled check for leaks.
7. Readjust head pressure control.

**Testing Function of Valve**—When the refrigeration system has been Off for approximately 10 to 15 minutes, the water flow should stop.

If the water continues to flow, the valve is either improperly adjusted (with head pressure too low) or the pressure sensing capillary is not connected properly to the condenser.

### 3.4.11 Drycooler Settings

Applications with the Optional Stat Setting require field piping to be insulated to prevent condensation. **Table 9** shows acceptable applications where stats must be adjusted to Optional Setting. Aquastats must be field-adjusted to Optional Setting for:

- GLYCOOL/Dual Cool applications
- Single Drycooler loops with motor ball valve flow controls (motor ball valves are used on all Liebert Challenger 3000 units with digital compressors).

**Table 9 Water/glycol system conditions requiring optional settings for aquastats**

Cooling Type	Glycol				Glycol			
	MBV		WRV		MBV		WRV	
Drycoolers in Loop	1	Multiple	1	Multiple	1	Multiple	1	Multiple
Stat Setting <sup>1</sup>	Optional	Optional	Optional	Optional	Optional	Factory	Factory	Factory
Insulate Field Piping	Yes	Yes	Yes	Yes	Yes	No	No	No

1. See **Table 10**.
2. MBV=motor ball valve; WRV=water regulating valve

**Table 10 Aquastat settings—two-fan through four-fan drycoolers**

Dial Setting (Stat Open Temp) Set for Mid Differential 8°F (4.4°C) Rise to Close			
Aquastat #	Fans	Factory Setting (Glycol) (see Notes 1 and 2)	Optional Setting (GLYCOOL) (see Note 3)
AQ1	F1	65°F (18.3°C)	35°F (1.7°C)
AQ2	F2 & F3	75°F (23.9°C)	45°F (7.2°C)
AQ3	F4	70°F (21.1°C)	40°F (4.4°C)



**NOTE**

1. All drycoolers are shipped at Factory Setting.
2. Factory Setting is used for all glycol applications, except single drycooler loops with motor ball valve controls.
3. Stats must be field-adjusted to Optional Setting for GLYCOOL/Dual Cool applications and all single drycooler loops using motor ball valve flow controls.

### 3.4.12 Compressor Oil

## NOTICE

Risk of improper compressor lubrication. Can cause compressor and refrigerant system damage.

Failure to use oil types, viscosities and quantities recommended by the compressor manufacturer may reduce compressor life and void the compressor warranty. See oil types specified in **Table 11**.

- Do NOT mix polyol ester (POE) and mineral-based oils.
- Do NOT mix oils of different viscosities.

Consult Emerson or the compressor manufacturer if you have questions.

**Table 11 Compressor oil types**

Compressor Type	R-407c
Copeland Scroll and Digital Scroll	POE Oil - ISO 22 Viscosity *

Use Copeland POE Oil ULTRA 22CC, Mobil EAL Arctic 22CC or other Copeland-approved oils.

## 3.5 Compressor Replacement

Replacement compressors are available through your local Emerson office. Compressors are shipped in reusable packaging. If unit is under warranty, complete and include Liebert Service Credit Application (LSCA) with the compressor that is being returned. The original compressor should be returned in the same packaging.

### Before Replacing or Returning a Compressor

Be certain that the compressor is actually defective. At a minimum, recheck a compressor returned from the field in the shop or depot for Hipot, winding resistance and ability to start before returning it. More than one-third of compressors returned for warranty analysis are determined to have nothing wrong. They were misdiagnosed in the field as being defective. Replacing working compressors unnecessarily costs everyone.

### 3.5.1 Compressor Functional Check

The following diagnostic procedure should be used to evaluate whether the compressor is working properly.

1. Proper voltage to the unit should be verified.
2. The normal checks of motor winding continuity and short to ground should be made to determine if the inherent overload motor protector has opened or if an internal motor short or ground fault has developed. If the protector has opened, the compressor must be allowed to cool sufficiently to allow it to reset.
3. Proper indoor and outdoor blower/fan operation should be verified. Condenser glycol flow should be verified.
4. With service gauges connected to suction and discharge pressure fittings, turn On the compressor. If suction pressure falls below normal levels, either the system charge is low on or there is a flow blockage in the system.
5. If suction pressure does not drop and discharge pressure does not rise to normal levels, reverse any two of the compressor power leads and reapply power to make sure compressor was not wired to run in reverse direction. If pressures still do not move to normal values, system is properly charged and solenoid valves function, the compressor is faulty. Reconnect the compressor leads as originally configured and use normal diagnostic procedures to check operation of the reversing valve.
6. To test if the compressor is pumping properly, the compressor current draw must be compared to published compressor performance curves using the operating pressures and voltage of the system. If the measured average current deviates more than  $\pm 15\%$  from published values, a faulty compressor may be indicated. A current imbalance exceeding 15% of the average on the three phases should be investigated further.

### 3.5.2 Standard Scroll Compressor Replacement

Infrequently a fault in the motor insulation may result in a motor burn, but burnouts rarely occur in a properly installed system. Of those that do, most are the effects of mechanical or lubrication failures, resulting in the burnout as a secondary consequence.

If problems that can cause compressor failures are detected and corrected early, a large percentage can be prevented. Periodic maintenance inspections by alert service personnel on the lookout for abnormal operation can be a major factor in reducing maintenance costs. It is easier and far less costly to take the steps necessary to ensure proper system operation than it is to allow a compressor to fail and require replacement.

When troubleshooting a compressor, check all electrical components for proper operation.

1. Check all fuses and circuit breakers.
2. Check Hi switch operation.
3. Check the accuracy of the suction transducer reading (not applicable on fan coil units). Verify suction pressure reading with manifold gauge. Compare gauge reading to what is shown in the Service Menus, Diagnostic / Service Mode.
4. If a compressor failure has occurred, determine whether it is an electrical or mechanical failure.

#### Mechanical Failure

A mechanical compressor failure will be not be indicated by a burned odor. The motor will attempt to run. If you have determined that a mechanical failure has occurred, the compressor must be replaced.

If a burnout occurs, correct the problem that caused the burnout and clean the system. It is important to note that successive burnouts of the same system are usually caused by improper cleaning.

#### Electrical Failure

An electrical failure will be indicated by a distinct pungent odor. If a severe burnout has occurred, the oil will be black and acidic.

In the event that there is an electrical failure and a complete burnout of the refrigeration compressor motor, the proper procedures must be performed in order to clean the system to remove any acids that would cause a future failure.

For clean-out warnings and procedures, see Copeland Application Engineering Bulletin 24-1105 "Principles of Cleaning Refrigeration Systems".



#### WARNING

Risk of explosive discharge from high-pressure refrigerant. Can cause injury or death.

This unit contains fluids and gases under high pressure. Relieve pressure before working with piping. Do not loosen any refrigeration or electrical connections before relieving pressure.



#### CAUTION

Risk of contact with hot substances or surfaces. Can cause injury.

Avoid touching or contacting the gas and oils with exposed skin. Severe burns will result. Use long rubber gloves in handling contaminated parts. Use extreme caution and wear protective gloves and arm protection when working on or near hot compressors, discharge lines, humidifiers and reheats.



#### NOTE

*Release of refrigerant to the atmosphere is harmful to the environment and is unlawful. Refrigerant must be recycled or discarded in accordance with federal, state, and local regulations.*



#### NOTE

*Damage to a replacement compressor caused by improper system cleaning constitutes abuse under the terms of the warranty, and the warranty will be void.*

## NOTICE

Risk of improper wiring/phase sequencing. Could cause backward compressor rotation, poor performance and compressor damage.

Three-phase power must be connected to the unit line voltage terminals in the proper sequence so that the scroll compressor rotates in the proper direction. Rotation in the wrong direction will result in poor performance and compressor damage.

Record compressor motor connections when removing a failed compressor. Wire the replacement compressor motor the same way to maintain proper rotation direction.

### 3.5.3 Digital Scroll Compressor Replacement Procedure

1. Disconnect power and follow all warnings at front of this manual.
2. Attach suction and discharge gauges to access fittings.
3. Front-seat service valves to isolate the compressor. Reclaim charge from compressor.
4. Remove marked pressure transducer and discharge pressure switch. Disconnect all electrical connections.
5. Detach service valves from compressor.
6. Remove failed compressor.
7. If required, follow compressor manufacturer's suggested clean-out procedures.
8. Install replacement compressor and make all connections. Replace gaskets or seals on service valves. Replace unloading solenoid.
9. Evacuate and charge as detailed in the user manual, SL-11962.

## NOTICE

Risk of improper component reinstallation. Can cause equipment damage.

Identify and mark location of suction pressure transducer and discharge pressure switch. These devices look similar and they must be reinstalled in their original location.

### Digital Compressor Unloading Solenoid(s)—Models 040, 042, 047, 049, 061 and 072

When replacing a digital scroll compressor, digital solenoid valve and coil must be replaced. Compressor and valve kit are shipped separately. Valve kit must be field-brazed to top of compressor in proper orientation and supported with original factory bracket.

## 3.6 Facility Fluid and Piping Maintenance for Water and Glycol Systems

Facility water and glycol quality remain a requirement throughout the life of the piping system. Fluid and piping system maintenance schedules must be established and performed. A local fluid maintenance program must be established that will evaluate fluid chemistry and apply necessary treatment. A periodic leak inspection of facility and unit fluid piping is recommended.

### Glycol Solution Maintenance

It is difficult to establish a specific schedule of inhibitor maintenance since the rate of inhibitor depletion depends upon local water conditions. Analysis of water samples at time of installation and every six months should help to establish a pattern of depletion. A visual inspection of the solution and filter residue is often helpful in judging whether or not active corrosion is occurring.

The complexity of water caused problems and their correction makes it important to obtain the advice of a water treatment specialist and follow a regularly scheduled maintenance program. It is important to note that improper use of water treatment chemicals can cause problems more serious than using none.

Proper inhibitor maintenance must be performed in order to prevent corrosion of the glycol system. Consult glycol manufacturer for testing and maintenance of inhibitors. Do not mix products from different manufacturers. For further details, refer to filling instructions in the installation manual, Liebert part number SL-11925, available at the Liebert Web site, [www.liebert.com](http://www.liebert.com)

### 3.7 Humidifier—Infrared

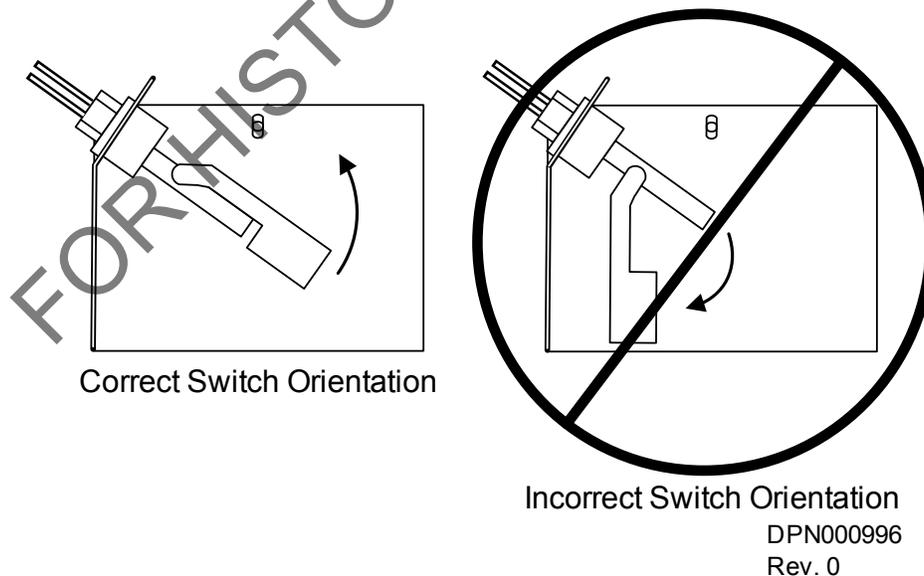
During normal humidifier operation, deposits of mineral solids will collect in humidifier pan and on the float switch. These must be cleaned periodically to ensure proper operation. Frequency of cleaning must be locally established since it is dependant on humidifier usage and local water quality. A spare pan is recommended to reduce maintenance time at unit. The Liebert autoflush system can greatly increase the time between cleanings, but does not eliminate the need for periodic checks and maintenance (see Liebert iCOM® user manual SL-18835 for autoflush setup). To help reduce excessive scaling in locations with difficult water quality, the use of Vapure is recommended (contact your local Emerson representative).

#### 3.7.1 Cleaning Humidifier Pan and Float Switch

Before turning off unit:

1. With unit operating, remove call for humidification at the Liebert iCOM.
2. Let the blower operate 5 minutes to allow the humidifier and water to cool.
3. If unit has a condensate pump, turn unit OFF at the Liebert iCOM.
4. Pull out the humidifier standpipe in pan.
5. Inspect the O-ring (replace if necessary).
6. Let the pan drain and condensate pump operate (if applicable).
7. Disconnect power from the unit.
8. Disconnect the drain coupling from the bottom of the pan.
9. Remove the thermostat from the bottom of the pan and the retaining screws from the sides of the pan.
10. Slide the pan out.
11. Loosen scale on side and bottom of pan with a stiff nylon brush or plastic scraper.
12. Flush with water.
13. Carefully clean scale off float switch (make sure to reinstall correctly (see **Figure 6**)).
14. Reinstall the pan, thermostat, standpipe, drain coupling and screws into the humidifier.
15. Operate the humidifier and check for leaks.

**Figure 6** Correct orientation of float switch



### 3.7.2 Changing Humidifier Lamps

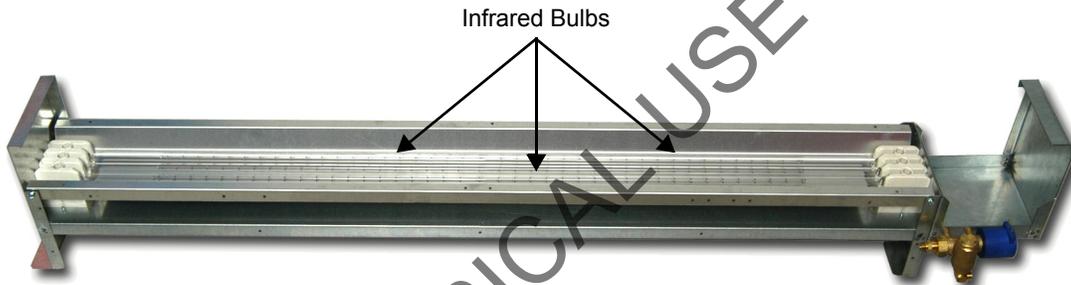


#### NOTE

*Touching quartz lamps with bare hands will severely shorten bulb life. Skin oils create hot spots on lamp surface. Wear clean cotton gloves when handling lamps.*

1. Remove humidifier pan (see **3.7.1 - Cleaning Humidifier Pan and Float Switch, Steps 1 through 10**).
2. Disconnect power from unit.
3. At humidifier, remove screws and cover from high-voltage compartment.
4. Disconnect one end of purple jumper wires.
5. Using a continuity meter, locate burned out lamp.
6. Remove lamp brackets under lamps.
7. Loosen two screws securing lamp lead wires to junction block.
8. Pull bulb straight down and discard.
9. Wrap lead wires once around new lamp's metal ends. This will support lamp and allow for thermal expansion. Insert lead wires into junction block and torque screws to 30 in-lb.
10. Reassemble by reversing **Steps 1 through 9**.

**Figure 7 Infrared humidifier lamps**



#### Autoflush Infrared Humidifier Cleaning System

### NOTICE

Risk of low water flow/pressure. Can cause improper humidifier operation.

To operate properly, the Autoflush Humidifier requires a water source that can deliver at least 1 gpm (0.063 l/s) with a minimum pressure of 20 psig (138 kPa).

The autoflush system will periodically flush the humidifier pan with water to prevent the buildup of water minerals due to saturation. Because water conditions vary, the amount of water flushing through the system may be programmed to match local needs.

Water amounts between 110% and 500% of the amount needed for humidification may be selected. Operation of the flushing system is then automatic and no further adjustments need to be made.

## Autoflush Operation

The operation of the autoflush is divided into four steps, beginning with a call for humidification.

1. If the humidifier has not been activated for over 30 hours, the autoflush will flow water into the pan for about 30 seconds. This will provide a minimum amount of water in the pan and prevent heat damage to the humidifier pan. Humidifier lamps are Off.
2. If the humidifier has been activated within the last 30 hours, **Step 1** is bypassed. The autoflush will flow water into the pan for about 4 minutes. The humidifier lamps are On and the humidifier is operational during this period. When the pan is filled (the fill cycle has timed out), the water make-up valve is closed.
3. The water make-up valve remains Off and the humidifier lamps are On for a maximum of 9-1/2 minutes.
4. After the 9-1/2 minute delay, the autoflush adds water to the pan to replenish the water used in humidification and flush the pan of mineral solids. This amount of water is adjustable from 110% to 500% in increments of 10%. At the end of this cycle, the make-up valve is closed. **Steps 3 and 4** repeat as long as humidification is required.

## Autoflush Controls

Use the LCD display, menu, and keys on the front control panel to program the autoflush controls.

### 3.7.3 Steam Generating Humidifier

Steam generating humidifiers are designed to operate in voltage ranges from 200 to 575 volts and generate 11 pounds (5 kg) of steam per hour. These humidifiers operate efficiently over a wide range of water quality conditions and automatically adjust to changes in the conductivity of water. The humidifiers drain and refill to maintain an amperage setpoint and alert the operator when the humidifier canister needs to be replaced. The humidifier is in the lower section of upflow units; it is in the middle section of downflow units.

Figure 8 Steam generating humidifier



## Operation

1. During startup, when the humidity control calls for humidification, the fill valve opens and allows water to enter the canister. When the water level reaches the electrodes, current flows and the water begins to warm. The canister fills until the amperage reaches the setpoint and the fill valve closes. As the water warms, its conductivity increases and the current flow, in turn, rises. If the amperage reaches 115% of the normal operating amperage, the drain valve opens and flushes some of the water out of the canister. This reduces electrode contact with the water and lowers the current flow to the amperage setpoint. Boiling soon commences, and the canister operates normally.
2. If the conductivity of the water is low, the canister fills and the water level reaches the canister full electrode before the amperage setpoint is reached. The humidifier stops filling to prevent overflow. Boiling should commence in time. As water is boiled off, the mineral concentration in the canister increases and current flow also increases. The canister eventually reaches full output and goes to normal operation. No drain is permitted until then.
3. When full output is reached the circuit board starts a time cycle which is factory set at 60 seconds. During this repeating time cycle, the fill valve will open periodically to replenish the water being boiled off and maintain a “steady state” output at the set point. The amperage variance will depend on the conductivity of the water.
4. After a period of time, the mineral concentration in the canister becomes too high. When this occurs, the water boils too quickly. As the water quickly boils off and less of the electrode is exposed, the current flow decreases. When the current crosses the low threshold point (factory set at 90%) before the end of the time cycle, the drain valve opens, draining the mineral laden water out and replacing it with fresh water. This lowers the mineral concentration and returns the canister to “steady state” operation and prolongs canister life. The frequency of drains depends on water conductivity.
5. Over a period of time, the electrode surface will become coated with a layer of insulating material, which causes a drop in current flow. As this happens, the water level in the canister will slowly rise exposing new electrode surface to the water to maintain normal output. Eventually, the steady state water level will reach the canister full electrode and indicate so by activating the canister full alarm. At this point, all of electrode surface has been used up and the canister should be replaced.
6. After the entire electrode surface has been coated, the output will slowly begin to fall off. This usually occurs in the last several hours of electrode life and should allow enough time to schedule maintenance. During these last hours, the mineral concentration can increase. If the mineral concentration is too high, arcing can occur. If the electrodes start to arc, turn Off the humidifier immediately and replace the canister with the identical part.

## Controls

The humidifier RUN/DRAIN switch is located at the upper right of the humidifier assembly. This switch should be in the RUN position when the humidifier is in normal operation, and in the DRAIN position when a manual drain sequence is required. The electronic control board for the humidifier is located on the right side of the humidifier assembly. When the main unit is energized, power is available to the humidifier circuits.

## Replacing the Canister

Over a period of operation, the humidifier electrodes become coated with mineral solids. This coating insulates the electrodes and decreases the current flow. To maintain humidifier capacity, the water level slowly rises to expose fresh electrode. Eventually, the entire electrode becomes coated and the water level reaches the top. At this point, the canister full alarm is activated and the output begins to fall. When this happens, it is necessary to replace the full canister.

To replace the canister:

1. Turn the humidifier Off by lowering the humidity setpoint below the ambient humidity level. Record the original setpoint.
2. Place the RUN/DRAIN switch in the DRAIN position to drain the water from the canister.
3. Return the RUN/DRAIN switch to the RUN position after the canister has drained.



### WARNING

Risk of electric shock. Can cause injury or death.

Open all local and remote electric power supply disconnect switches before proceeding with the canister replacement procedure.

4. Turn Off the power at the main unit.
5. Remove the cover from the humidifier cabinet.



### CAUTION

Risk of contact with hot surfaces. Can cause injury.

The canister and steam hose may be hot. Allow sufficient time for them to cool before working within the unit cabinet. Use extreme caution and wear protective gloves and arm protection when working on or near the canister or steam hose.

6. Locate the power wires to the steam canister. They are connected to the canister with 1/4" quick connects. Make note of the wiring configuration before removing any wires. Refer to the schematic on the unit. Slide the rubber boot back to expose the connections. Remove the three power wires and the two canister full wires. Do not loosen the screws that secure the electrodes.
7. Loosen the steam outlet hose clamp and slide the steam hose away from the canister top fitting.
8. The canister is now ready to be removed. Pull the canister straight up and out of the cabinet toward you.
9. Replace the canister with the part indicated in **Table 12**.

**Table 12 Humidifier canister part numbers**

Part Number	Voltage	Capacity lb/hr (kg/hr)
136798P1	200-460*	11 (5)
136798P2	380-575	11 (5)

\* Can operate on 575V unit with transformer

10. Replace the canister by reversing the above procedure. Make special note of the following:



#### NOTE

When replacing the canister:

1. Make sure the two "O" rings are lubricated and properly seated on the bottom neck.
2. Always check the fill and drain solenoids for proper operation.



#### NOTE

When replacing the wiring, connect the red wire from Terminal #1 on the interface to the red top terminal on the canister. It is in the middle of a group of three terminals. The black wire from Terminal #2 on the interface connects to the power terminal farthest from the red terminal/wire. The power wire to this terminal is routed through the current sensing coil.

## Circuit Board Adjustments



### WARNING

Arc flash and electric shock hazard. Open all local and remote electric power supply disconnect switches, verify with a voltmeter that power is Off and wear personal protective clothing per NFPA 70E before working within the electric control enclosure. Failure to comply can cause injury or death.

The Liebert iCOM does not isolate power from the unit, even in the “Unit Off” mode. The only way to ensure that there is NO voltage inside the unit is to install and open a remote disconnect switch. Refer to unit electrical schematic.

Only properly trained and qualified personnel should perform adjustment of the circuit board. Hazardous voltages are present in the equipment throughout the procedure. Disconnect all power from the unit before working within the cabinet.

Humidifier operation is governed by the humidifier control board. This board is located on the right side of the humidifier compartment. There are three potentiometers mounted on the board. These pots can be used to adjust for extreme water conductivity conditions and capacity.

The “%” pot controls the amperage at which the drain will energize. The pot is clearly marked in percentages. This adjustment is factory set at 90%, which indicates that the unit will drain when the amperage falls off to 90% of the capacity setpoint. Raising the value increases the frequency of drain cycles. Lowering the value decreases the frequency of drain cycles. The frequency should be increased for highly conductive water and decreased for less conductive water. If adjustment is necessary, and a change of three to four percent in either direction does not permit normal operation of the unit, consult your Liebert supplier.

The pot marked “SEC” controls the duration of the drain cycle. The pot is clearly marked in seconds. This adjustment is factory set at 60 seconds and should not be readjusted without consulting your Liebert supplier.

The pot marked “CAP ADJ” is factory set at 100%. The maximum capacity is determined by a fixed resistor (R4) which is factory selected based on unit voltage.

### Drain Tempering Feature

All units are equipped with a drain tempering feature which mixes cold fill water with hot drain water to protect drain piping. This feature can lower drain water temperature to as low as 140°F (60°C), depending on water pressure. To deactivate this feature, remove the diode from socket CR18 on the circuit board (lower left, above LED).

## 4.0 TROUBLESHOOTING

Use this section to assist in troubleshooting your unit. Suggestions are grouped by product function for convenience.



### WARNING

Arc flash and electric shock hazard. Open all local and remote electric power supply disconnect switches, verify with a voltmeter that power is Off and wear personal protective clothing per NFPA 70E before working within the electric control enclosure. Failure to comply can cause injury or death.

The Liebert iCOM does not isolate power from the unit, even in the Unit Off mode. Some internal components require and receive power even during the Unit Off mode of Liebert iCOM®.

The only way to ensure that there is NO voltage inside the unit is to install and open a remote disconnect switch. Refer to unit electrical schematic.

Only properly trained and qualified personnel should service these units. Lethal voltage is present in some circuits. Use caution when troubleshooting with power On. Disconnect and lock out power before replacing components.



### WARNING

Risk of explosive discharge from high-pressure refrigerant. Can cause injury or death.

This unit contains fluids and gases under high pressure. Relieve pressure before working with piping.

### NOTICE

Risk of improper control connection. Can cause equipment damage.

When using jumpers for troubleshooting, always remove jumpers when maintenance is complete. Jumpers left connected could override controls and cause equipment damage.

**Table 13 Blower troubleshooting**

Symptom	Possible Cause	Check or Remedy
Blower will not start	No main power	Check L1, L2 and L3 for rated voltage.
	Blown fuse or tripped circuit breaker (CB)	Check fuses or CBs to main fan.
	Overloads tripped	Push reset button on main fan overload. Check amp draw.
	No output voltage from transformer	Check for 24 VAC between P24-2 and P24-1. If no voltage, check primary voltage.
	Control fuse blown or circuit breaker tripped	Check for 24 VAC between P4-4 and E1. If no voltage, check for short. Replace fuse or reset circuit breaker.

**Table 14 Chilled water troubleshooting**

Symptom	Possible Cause	Check or Remedy
Chilled water or hot water/steam valve not opening	Motor operates but valve won't open	Check linkage for adjustment and be sure that it is tight on the valve.
Modulating Motors	No 24 VAC power to motor	Check linkage for adjustment and be sure that it is tight on the valve.
	No signal from control	Check DC voltage on printed circuit board in motor. Terminal No. 1 is grounded and No. 3 is positive. DC voltage should vary from 0.8 to 2.0 VDC or above as temperature control is varied below room temperature on cooling valve or above room temperature on heating valve.
	Motor not working	Remove wires on Terminal No. 1 and No. 3 from the motor (do not short). With 24 VAC power from TR to TR jumper terminal 1 and 2 on motor to drive open. Remove jumper to drive closed, if motor fails to work, replace it.
Actuator Motors	No 24 VAC power to motor	Check for 24 VAC between P22-3 and P22-5 (open), or P22-1 and P22-5 (closed).

**Table 15 Compressor and refrigeration system troubleshooting**

Symptom	Possible Cause	Check or Remedy
Compressor will not start	Power Off	Check main switch, fuses or CBs and wiring
	Current overload open	Re-set units with overload option manually. Allow compressor to cool for internal overloads to reset.
	Loose electrical connections	Tighten connections
	Compressor motor burned out	Check and replace compressor if defective.
Compressor will not operate, contactor not pulling in	No call for cooling	Check monitor status.
	Solenoid valve not energizing	Hold screwdriver over solenoid and check for magnetic field. This indicates solenoid is energized.  Get the unit in a call for cooling or place the compressor into charge mode through the Diagnostics / Service Mode (see SL-18835). Check control voltage across the compressor contractor coil. Check freeze stat continuity as needed.
Compressor will not operate, contact not pulling in	High pressure switch open	Reset switch. Refer to other refrigeration troubleshooting suggestions.
Compressor contactor pulled in but compressor will not operate	Blown fuse or tripped CB	Check for line voltage after fuses or CBs, and after contactors.
Compressor runs for three minutes then stops; contactor drops out.	Inadequate suction pressure- Low Pressure alarm	iCOM has built in positive start kit (see Low-Pressure Time Delay in SL-18835).
	Liquid line solenoid valve not opening	Check magnetic field to see if energized.
High discharge pressure	Dirty condenser or drycooler fins	Clean coil.
	Condenser equipment not operating	Check operation.
	High refrigerant charge	Check refrigerant charge.
	Hot gas bypass valve adjusted improperly	Adjust properly.
	Water regulating valve adjusted improperly	Adjust properly.
Low discharge pressure	Excessive fluid flow through condenser	Adjust fluid regulating valve
	Suction service valve partially closed	Open the valve.
	Faulty head pressure control valve or condenser fan speed control	Replace if defective.
	Compressor rotation in reverse direction	Check for proper power phase wiring to unit and to compressor motor.
Low suction pressure	Insufficient refrigerant in system	Check for leaks, repair, and add refrigerant for air-cooled. Evacuate and recharge for water/glycol unit.
	Dirty air filters	Change filters.
	Plugged filter-drier	Replace filter.
	Improper superheat adjustment	Reset expansion valve for 10-15°F (6-8°C)
	Defective expansion valve sensing element	Replace element
	Poor air distribution	Check duct work for closed dampers. Check for under-floor restrictions at or near the unit.
	Low condensing pressure	Check head pressure control device.
	Slipping belts	Inspect and adjust

**Table 15 Compressor and refrigeration system troubleshooting (continued)**

Symptom	Possible Cause	Check or Remedy
Flooding	Defective or improperly set expansion valve	Increase superheat or replace valve
	Evaporator fan motor or belt	Correct problem or replace fan motor and/or belts.
	Low condensing pressure	Check head pressure control device
	Slipping belts	Inspect and adjust
Low compressor capacity or inability to pull down system	Compressor rotation in reverse direction.	Check for proper power phase wiring to unit and to compressor motor.
	Leaking liquid line solenoid valve or dirt in valve	Replace valve if clean; clean out valve if dirty.
Compressor noisy	Loose compressor or piping support	Tighten clamps.
Pipe rattle	Loose pipe connections	Check pipe connections
Compressor running hot	Compression ratio too high	Check refrigerant pressures. Check setting of high pressure switch. Confirm low pressure transducer (where applicable) is reading correctly compared to gauge pressure. Check condenser -- is it plugged? Check that all evaporator and condenser fans are operating properly.
Compressor cycles intermittently	Insufficient refrigerant in system	Check for leaks, fix, and add refrigerant on air-cooled unit. Evacuate and recharge water/glycol unit.
	Suction service valve closed	Open valve.
	Insufficient fluid flowing through condenser or clogged condenser, or dirty air-cooled condenser coils	Adjust fluid regulating valve to condenser. Flush the condenser.
	Discharge service valve not fully open	Open valve
Compressor cycles continually	Dirt or restriction in tubing to pressure stat	Check and clean tubing.
	Defective liquid line solenoid valve	Check valve and solenoid operator; replace if necessary.
	Plugged filter-drier	Replace filter.
Compressor motor protectors tripping or cycling	High discharge pressure	Check for loss of condenser water or blocked condenser fan or coil.
	Defective overload relay	Replace.
	High suction temperature	Reduce suction temperature by expansion valve adjustment or provide desuperheating.
	Loose power or control circuit wiring connection	Check all power and control circuit connections.
	Defective motor	Check for motor ground or short. Replace compressor, if either condition is found.
Compressor cycles on locked rotor	Low line voltage	Check line voltage and determine location of voltage drop.
	Compressor motor defective	Check for motor winding short or ground.
	Single phasing	Check voltage across all 3 legs at contactor. Correct source problem.
Motor burnout	Check control panel for welded contactor contacts or welded overload contacts	Replace defective components

**Table 16 Dehumidification troubleshooting**

Symptom	Possible Cause	Check or Remedy
No dehumidification	Control not calling for dehumidification	Check monitor status.
	Compressor contactor not pulling in	See <b>3.5.1 - Compressor Functional Check</b> and <b>Table 15</b> .
	Compressor won't run; fuse blown or CB tripped	See <b>3.5.1 - Compressor Functional Check</b> and <b>Table 15</b> . Check fuses or CBs and contacts. Check line voltage

**Table 17 Glycol pump troubleshooting**

Symptom	Possible Cause	Check or Remedy
Suddenly stops pumping	Clogged strainer or impeller	Clean out debris.
Suddenly slow pumping	Clogged impeller, diffuser, or line	Clean out debris and use strainer.
Excessive leakage around the pump shaft while operating	Worn seal or packing	Replace seal or packing.
Performance poor	Worn impeller or seal	Replace with new impeller or seal.
	Suction lift too high	Relocate pump closer to supply.
	Motor not up to speed; low voltage	Larger lead wires may be required. Check for proper line voltage ( $\pm 10\%$ ).
	Worn bearings	Replace pump
Noisy operation	Worn motor bearings	Replace pump
	Low discharge head	Throttle discharge-improve suction conditions.
	Debris lodged in impeller	Remove cover and clean out.
	Cavitating pumps	Adjust system pressures.

**Table 18 Infrared humidifier troubleshooting**

Symptom	Possible Cause	Check or Remedy
No humidification	Humidifier pan not filling	Check water supply.
		Check fill valve operation
		Check drain stand pipe adjustment
		Check for clogged waterline
	Control not calling for humidity	Check monitor status
	Humidity contact not pulling in	Check visually. If contact is made, check line voltage after contactor and fuses or CBs.
		Check for open humidifier safety stat. Jumper between terminals P35-6 and P35-5. If contactor pulls in, replace safety. Remove jumper.
Humidifier bulb burned out	Replace bulb. Loosen lead on old bulb. Trim excess lead length on new bulb to avoid shorts.	

**Table 19 Steam generating humidifier troubleshooting**

Symptom	Possible Cause	Check or Remedy
False canister full indication	Foaming	Check drain valve to ensure that it drains freely. Check and replace if defective.
		Check water supply. If commercially softened, reconnect to raw water supply. If connected to hot water reconnect to cold water.
Main 24 VAC fuse or circuit breaker trips	Shorts or loose connections	Check the wiring connections of the 24 VAC circuit.
	Faulty circuit board	Replace the circuit board.
Main fuses blow approximately 15 seconds after unit is activated	Faulty solenoid	Check for magnetic field at coil.
	Conductivity too high	Check amp draw of humidifier on startup. If it exceeds rated amps, increase setting of the % pot on the circuit board
Main fuses blow when drain valve is activated.	Mineral deposits obstruct drain valve	Check drain valve for obstructions and clean if necessary.
	Faulty solenoid	Check for magnetic field at coil.
	Faulty circuit board	Replace circuit board.
Unit On, humidifier will not operate	Humidifier not receiving power	Verify that RUN/DRAIN switch is in the RUN position.
		Check fuses or CBs and replace or reset if necessary.
		Make sure molex connector is securely plugged into circuit board and that no wires are loose.
Contactor pulled in, but no water enters canister	No water available to unit	Check external shutoff valves.
	Clogged fill line strainer	Clean or replace fill line strainer.
	Wiring breaks or loose connections	Check for faulty wiring and loose connections.
	Faulty circuit board	Replace circuit board.
Water enters canister, but canister full circuit activates at a low water level	Foaming	Check drain valve and water supply.
	Canister interface connections incorrect	Check connection on component plate in humidifier cabinet. Terminal #1 on the square block interface device must be connected to L2 of the power terminal block. L2 must also be connected to the electrode closest to the steam outlet port.
		Verify that the red wire from Terminal #2 on the interface connects to the red top terminal on the canister. This is the one farthest from the steam outlet port and is the high water sensor probe.
	Full isolation has broken down	Remove red canister full wire from canister. If normal operation resumes, canister must be replaced. Remove the wire from Terminal #3 on the interface. If normal operation resumes, canister full interface must be replaced.
	Drain assembly not operating freely	Check and replace coil or valve if necessary.
Faulty circuit board	Replace circuit board	
Canister fills but overflows	Canister full circuit does not activate	Check wiring of canister full interface. Replace circuit board.

**Table 19 Steam generating humidifier troubleshooting (continued)**

Symptom	Possible Cause	Check or Remedy
Excessive arcing in the canister	Drain valve clogged or defective	Verify that drain valve operates freely when activated. Clean valve and replace coil or valve if defective. Flush canister several times and replace if arcing persists.
	Improper water supply	If water is commercially softened, reconnect humidifier to raw water supply, drain canister, and restart. If connected to hot supply, reconnect to cold water.
	Insufficient drain rate	Increase drain rate by adjusting % pot on circuit board above the preset 70% to roughly 80%.
	Excessive iron content in water	Analyze iron content of water. If it exceeds 0.1 mg./l, install a filter to remove iron from water supply.
On cold startup, canister fills, high water alarm activates and humidifier fails to reach full amperage	Conductivity of water too low	Drain canister and add one Alka-Seltzer tablet to canister. Refill. Turn the % pot to roughly 60%. Restart humidifier. If amperage rises rapidly, it may be necessary to dilute the water to prevent blown fuses. If it rises too slowly, add another Alka-Seltzer tablet.
On cold startup, canister fills, high water alarm activates and humidifier fails to reach full amperage	Fill solenoid not closing tightly	If humidifier returns to canister full condition, verify that the fill solenoid closes tightly.

**Table 20 Reheat troubleshooting**

Symptom	Possible Cause	Check or Remedy
Reheat will not operate; contactor not pulling in	Control not calling for heat	Check monitor status.
	Reheat safety stat open	Jumper between terminals P34-1 and P34-2. If reheat operates, safety is open. Remove jumper. Replace safety.
Reheat not operating; contactor pulling in	Heater burned out	Turn Off power and check heater continuity with Ohm meter.



**NOTE:**

*Reheat element sheaths and fins are manufactured with stainless steel. Regular inspections are necessary to ensure proper cleanliness of the reheating element. Should inspection reveal corrosion particles on the reheating element or adjoining surfaces (including ducts and plenums), appropriate cleaning should be performed. Periodic reheating element replacement may be required to meet specific application requirements.*

## 5.0 MAINTENANCE WORKSHEET

Inspection Date	Job Name
Indoor Unit Model #	Indoor Unit Serial #
Condenser/Drycooler Model #	Condenser/Drycooler Serial #
EconoPhase Model #	#EconoPhase Serial #
Room Temperature/Humidity ° / %	Ambient Temperature, F°(°C)

### Source: DPN002952-Rev. 0

Good maintenance practices are essential to minimizing operation cost and maximizing product life. Read and follow all applicable maintenance checks listed below. At a minimum, these checks should be performed semiannually. However, maintenance intervals may need to be more frequent based on site-specific conditions. Review the unit user manual for further information on unit operation. Emerson recommends the use of trained and authorized service personnel, extended service contracts and factory-certified replacement parts. Contact your local Emerson representative for more details.

### Check All That Apply

#### EVAPORATOR / FILTERS

- 1. Check/replace filters
- 2. Grille area unrestricted
- 3. Wipe section clean
- 4. Coil clean
- 5. Clean condensate pan
- 6. Clean trap in condensate drain
- 7. Check/test filter clog switch operation (if equipped)

#### BLOWER SECTION (Centrifugal) (If Equipped)

- 1. Blower wheels free of debris
  - 2. Check belt tension and condition (replace if needed)
  - 3. Check/lube bearings. (DS bearings are sealed and do not require lubrication even though grease fittings are present)
  - 4. Check/Lube motor (if supplied with grease ports). Check motor manufacturer's Web site for procedure, amount and type of grease required.
  - 5. Check sheave/pulley (replace if worn)
  - 6. Check motor mount
  - 7. Check/test air sail switch (if equipped)
- |  |    |    |    |
|--|----|----|----|
| <input type="checkbox"/> 8. Motor #1 amp draw  | L1 | L2 | L3 |
| <input type="checkbox"/> 9. Motor #2 amp draw  | L1 | L2 | L3 |
| <input type="checkbox"/> 10. Motor #3 amp draw | L1 | L2 | L3 |
- 11. Compare to nameplate amps



**CONTROLS**

- 1. Check/verify control operation (sequence)
- 2. Check/test changeover device(s) (if equipped)
- 3. Check/test water detection device(s) (if equipped)
- 4. Check/test CAN connection between indoor and outdoor units (if equipped)

**REFRIGERATION PIPING**

- 1. Check refrigerant lines (clamps secure/no rubbing/no leaks)
- 2. Check for moisture (sight glass)
- 3. Check for restriction/temperature drop across filter driers

**DRAIN LINES**

- 1. Check for obstructions and sediment buildup
- 2. Check for external damage and corrosion
- 3. Check for leaks

**COMPRESSOR SECTION**

- 1. Check oil level
- 2. Check for oil leaks
- 3. Check compressor mounts (springs/bushings)
- 4. Cap tubes (not rubbing)
- 5. Check/re-torque wire connections (inside compressor box)
- 6. Compressor operation (vibration/noise)
- 7. Check crankcase heater fuses/operation (if equipped)
- 8. Check condenser fan cycling (Liebert IntelleCool™)
- 9. Check for refrigerant leaks

<input type="checkbox"/> 10. Suction pressure	Circuit 1	Circuit 2	
<input type="checkbox"/> 11. Discharge pressure	Circuit 1	Circuit 2	
<input type="checkbox"/> 12. Superheat	Circuit 1	Circuit 2	
<input type="checkbox"/> 13. Low-Pressure switch cut-out	Circuit 1	Circuit 2	
<input type="checkbox"/> 14. Low-pressure cut-in	Circuit 1	Circuit 2	
<input type="checkbox"/> 15. High pressure cut-out	Circuit 1	Circuit 2	
<input type="checkbox"/> 16. Compressor amp draw			
Circuit 1A	L1	L2	L3
Circuit 1B (if tandem)	L1	L2	L3
Circuit 2A	L1	L2	L3
Circuit 2B (If Tandem)	L1	L2	L3

**WATER-COOLED CONDENSERS (If Equipped)**

- 1. Verify proper water/glycol maintenance/treatment is performed at scheduled intervals.
- 2. Check water regulating valve operation
- 3. Verify water flow
- 4. Cap tubes (not rubbing)
- 5. Check for water/glycol leaks
- 6. Entering water temp \_\_\_\_\_°F (°C) leaving water temp \_\_\_\_\_°F (°C)

**CHILLED WATER / ECON-O-COIL (If Equipped)**

- 1. Verify proper water maintenance is being performed
- 2. Check for water/glycol leaks
- 3. Stroke freecooling valve open and closed

**AIR-COOLED FIN AND TUBE CONDENSER / DRYCOOLER (if Equipped)**

- 1. Coil free of debris (clean is required)
- 2. Motor mounts tight
- 3. Bearings in good condition (motor)
- 4. Piping support/clamps secure
- 5. Check/retorque wire connections
- 6. Check contactors for pitting (replace if pitted)
- 7. Check fuses
- 8. Verify fan speed control operation (if equipped)
- 9. Check surge protection device status indicator lights (if equipped)
- 10. Stat settings (if equipped) \_\_\_\_\_
- 11. Refrigerant level \_\_\_\_\_ Ambient temperature \_\_\_\_\_ °F (°C)  
(Liebert Lee-Temp™) \_\_\_\_\_
- 12. Glycol level \_\_\_\_\_
- 13. Glycol solution \_\_\_\_\_%
- 14. Water/glycol solution flowing continuously/clean and free of debris
- 15. Water treatment plan established and followed for open cooling tower application
- 16. Check refrigerant/glycol lines for signs of leaks
- 17. Motor amp draw

#	L1	L2	L3
#1	L1	L2	L3
(L1 and L2 on Fan Speed Control Motor)			
#2	L1	L2	L3
#3	L1	L2	L3
#4	L1	L2	L3
#5	L1	L2	L3
#6	L1	L2	L3
#7	L1	L2	L3
#8	L1	L2	L3
#9	L1	L2	L3
#10	L1	L2	L3

**LIEBERT MC™ (if Equipped)**

- \_\_\_ 1. Coil clean
- \_\_\_ 2. Fans free of debris
- \_\_\_ 3. Fans Securely Mounted
- \_\_\_ 4. Motor bearings in good condition
- \_\_\_ 5. Check all refrigerant lines for vibration isolation. support as necessary.
- \_\_\_ 6. Check for refrigerant leaks
- \_\_\_ 7. Check surge protection device (if installed) status indicator lights
- \_\_\_ 8. Check/retorque wire connections
- \_\_\_ 9. Check contactors for pitting (replace if pitted)
- \_\_\_ 10. Verify operational sequence/set points
- \_\_\_ 11. Charge verification

Outdoor ambient temp \_\_\_\_\_

Subcooling \_\_\_\_\_

Indoor unit return air temp \_\_\_\_\_

Sight glass level (if Liebert Lee-Temp™ or pumped refrigerant) \_\_\_\_\_

- \_\_\_ 12. Motor amp draw

#1	L1	L2	L3
#2	L1	L2	L3
#3	L1	L2	L3
#4	L1	L2	L3

**GLYCOL PUMP (If Equipped)**

- \_\_\_ 1. Check pump rotation
- \_\_\_ 2. Check for glycol leaks
- \_\_\_ 3. Pump pressures

#1	Suction	Discharge
#2	Suction	Discharge
#3	Suction	Discharge

- \_\_\_ 4. Amp Draw

#1	L1	L2	L3
#2	L1	L2	L3
#3	L1	L2	L3

- \_\_\_ 5. Verify Pump Changeover (If Multiple Pumps)

**LIEBERT ECONOPHASE™ PUMPED REFRIGERANT ECONOMIZER (If Equipped)**

- \_\_\_ 1. Check for refrigerant leaks
- \_\_\_ 2. Check/retorque wire connections
- \_\_\_ 3. Check contactors for pitting (replace if pitted)
- \_\_\_ 4. Verify pump speed control operation
- \_\_\_ 5. Check pump mounting



FOR HISTORICAL USE ONLY

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