Precision Cooling
For *Business-Critical Continuity™*

Liebert® CRV™

User Manual—60Hz, 24-Inch Wide, Air-Cooled, Water/Glycol-Cooled and Chilled Water

EMERSON™
Network Power

MODEL NUMBER NOMENCLATURE - 25 DIGIT CONFIGURATION NUMBER

Model # Part 1 *										Model Details											Model # Part 2 *			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
C	R	0	2	0	R	A	1	C	7	S	D	1	8	1	1	E	L	1	0	P	A	*	*	*

Digits 1-2 - Unit Family

Liebert® CRV™ = CR

Digits 3-5 - Nominal Capacity, kW

DX = 020, 035

CW = 040

Digit 6

R = Row-Based, 1100mm unit depth

Digit 7 - System Type

A = Air Cooled

W = Water\Glycol Cooled

C = Chilled Water Cooled

Digit 8 - Fan Type

Variable Speed EC Plug Fans = 1

Digit 9 - Power Supply

A = 460V / 3ph / 60Hz

C = 208V / 3ph / 60Hz

Digit 10 - Cooling System

2 = Two-Way Valve (CW Only)

3 = Three-Way Valve (CW Only)

7 = R-410A Digital Scroll Single Circuit (DX Only)

Digit 11 - Humidifier

0 = None

S = Steam Generating Canister

Digit 12 - Display Type

D = Liebert iCOM Control with Large Graphic Display

Digit 13 - Reheat

0 = None

1 = Electric Reheat

Digit 14 - Air Filter

8 = 4" MERV 8 + Clogged Filter Alarm

9 = 4" MERV 11 + Clogged Filter Alarm

Digit 15 - Water/Glycol Valve Type

1 = Two-Way Valve (W/G only) OR Default Air-Cooled Selection

7 = Three-Way Valve (W/G only)

H = Default CW Selection

Digit 16 - Unit Color

1 = Standard Color (Z-7021 Black)

2 = Non-Standard Color

Digit 17 - High-Voltage Options

L or A = NO dual-float condensate pump (for units without humidifier), 5kA SCCR**

5 or E = Dual-float condensate pump (for units with or without humidifier), 5kA SCCR**

M = No dual-float condensate pump (for units without humidifier), 65kA SCCR, 600 series only

P = Dual-float condensate Pump (for units with or without humidifier), 65kA SCCR, 600 series only

Digit 18 - Option Package

0 = None

H = Reheat and Humidifier Lockout

C = Reheat and Humidifier Lockout Additional Alarm Contact

D = Low Sound Package (20kW and 35kW only)

L = Low Sound Package & Reheat and Humidifier Lockout and Additional Alarm Contact (20kW and 35kW only)

Digit 19 - Liebert IntelliSlot® Housing

0 = No Cards

1 = (1) Web Card

2 = (2) Web Cards

3 = (1) 485 Card

4 = (2) 485 Cards

5 = (1) Web Card and (1) 485 Card

C = (1) Liebert SiteLink-E Card

D = (1) Liebert SiteLink-E Card and (1) Web Card

E = (1) Liebert SiteLink-E Card and (1) IS-485 Card

F = (1) Building Management Card

G = (2) Building Management Cards

H = (1) Building Management Card and (1) Web Card

J = (1) Building Management Card and (1) IS-485 Card

K = (1) Building Management Card and (1) Liebert SiteLink-E Card

Digit 20 - Future Options

0 = None

Digit 21 - Packaging

P = Domestic

S = Export (Seaworthy)

Digit 22 - Special Features

A = No SFAs, Standard Unit

X = SFA Included

Digits 23-25 - Factory Configuration Number

* The 14-digit model number consists of the first 10 digits and last four digits of the Configuration Number.

** L and 5 for CW models; A and E for DX models.

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FIGURES

TABLES

IMPORTANT SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS

This manual contains important safety instructions that should be followed during the installation and maintenance of the Liebert CRV. Read this manual thoroughly before attempting to carry out any operations on the Liebert CRV, including installation and operation. Retain this manual for the entire service life of the Liebert CRV.

Only properly trained and 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.

Any operation that requires opening doors or equipment panels must be carried out only by properly trained and qualified personnel.

Each machine is equipped with an electric insulation device that allows the operator to work safely. Switch Off the machine with this electric insulation device before beginning any maintenance operation to eliminate remaining risks (electric shocks, burns, automatic restarting, moving parts and remote control).

The panel key supplied with the unit must be kept by the person responsible for maintenance. To identify the unit by model and serial number in order to obtain assistance or spare parts, locate the identification label on the outside of the unit.

A warning label on the front and back panels reminds users that:

- the Liebert CRV restarts automatically
- the main switch must be opened before opening the internal compartments for any operation.

WARNING

Risk of high temperatures, extreme cold and high-speed rotating fan blades. Can cause equipment damage, injury and death.

Disconnect all local and remote electrical power supplies, confirm that all fan blades have stopped rotating and allow the component temperatures to become safe for human contact before opening doors and/or removing protective covers and working within.

If the doors are opened immediately after the Liebert CRV has been switched Off:

- some components, such as electrical heaters, compressor, outlet area and outlet piping, may remain at high temperature about 212°F (100°C);
- some components, such as the evaporator, may remain at low temperature;
- fan blades may continue to rotate by inertia.

These residual risks are highlighted by warning labels on the Liebert CRV.

WARNING

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

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

WARNING

Risk of hair, clothing and jewelry entanglement with high speed rotating fan blades. Can cause equipment damage, serious injury or death.

Keep hair, jewelry and loose clothing secured and away from rotating fan blades during operation.

WARNING

Arc flash and electric shock hazard. Can cause injury and death.

Disconnect local and remote power supplies and wear appropriate personal protective equipment per NFPA 70E before working within.

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 control.

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

Install and open a remote disconnect switch and verify with a voltmeter that live hazardous voltage potential is not present inside the unit cabinet before working within. Refer to the unit electrical schematic.

Follow all national and local codes.

WARNING

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

A pressure relief valve is required for compliance with the EU Pressure Equipment Directive and may be required for compliance with local codes. If a discharge pressure relief device is not provided with the condenser unit, the system installer must install one in the high side of the refrigerant circuit and rated for a maximum of:

- 675psig (46.5bar) for water/glycol-cooled units
- 700psig (48.3bar) for air-cooled units

A shutoff valve must not be installed between the compressor and the field-installed relief valve.

One or more additional pressure relief valves are required downstream of any and all field-installed isolation. Do not isolate any refrigerant circuits from overpressurization protection.

WARNING

Risk of top-heavy unit falling over. Can cause equipment damage, personal injury and death.

Read all of the following instructions before attempting to move, lift or remove packaging from the Liebert CRV.

CAUTION

Risk of sharp edges, splinters and exposed fasteners. Can cause personal injury.

Only properly trained and qualified personnel wearing appropriate safety headgear, gloves, shoes and glasses should attempt to move, lift or remove packaging from the Liebert CRV or prepare the unit for installation.

NOTICE

Risk of overhead interference. Can cause unit and/or building damage.

The unit may be too tall to fit through a doorway while on the skid. Measure the unit and doorway heights and refer to the installation plans prior to moving the unit to verify clearances.

NOTICE

Risk of improper storage, Can cause unit damage.

Keep the unit upright, indoors and protected from dampness, freezing temperatures and contact damage.

NOTICE

Risk of water leakage. Can cause severe property damage and loss of critical data center equipment.

This unit requires a water drain connection. It may require an external water supply to operate the humidifier. Improper installation, application and service practices can result in water leakage from the unit.

Do not locate the Liebert CRV directly above any equipment that could sustain water damage. Emerson recommends installing monitored leak detection equipment for the unit and supply lines.

NOTICE

Risk of frozen fluids. Can cause equipment damage and building damage.

Freezing system fluids can rupture piping. Complete system drain-down cannot be ensured. When the field piping or unit may be exposed to freezing temperatures, charge the system with the proper percentage of glycol and water for the coldest design ambient.

Automotive antifreeze is unacceptable and must NOT be used in any glycol fluid system.

NOTICE

Risk of corrosion. Can cause equipment damage.

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.

Contact a local water consultant regarding water quality, corrosion and freeze protection requirements.

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.

Preferably, surface waters that are classified as soft and are low in chloride and sulfate ion content should be employed. 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 (Union Carbide Ucartherm, Dow Chemical Dowtherm SR-1 and Texaco E.G. Heat Transfer Fluid 100), 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.

NOTICE

Risk of no-flow condition. Can cause equipment damage.

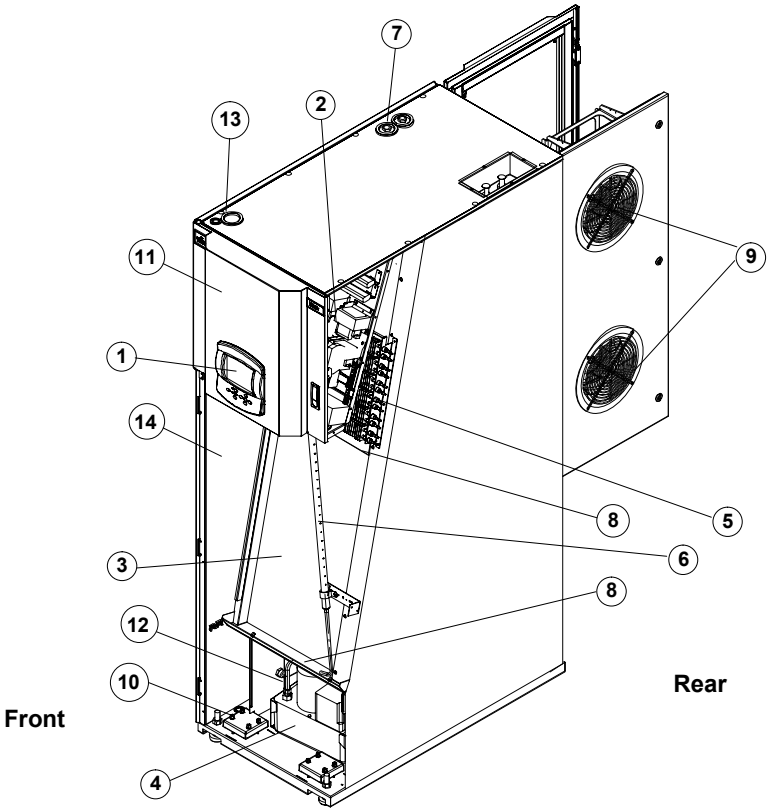
Do not leave the unit in a no-flow condition. Idle fluid allows the collection of sediment that prevents the formation of a protective oxide layer on the inside of tubes. Keep unit switched On and system pump operating.

NOTE

The Liebert indoor cooling unit 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 VFD condensers will require field-provided pressure-relief devices. A fusible plug kit for Liebert VFD condensers is available for field installation.

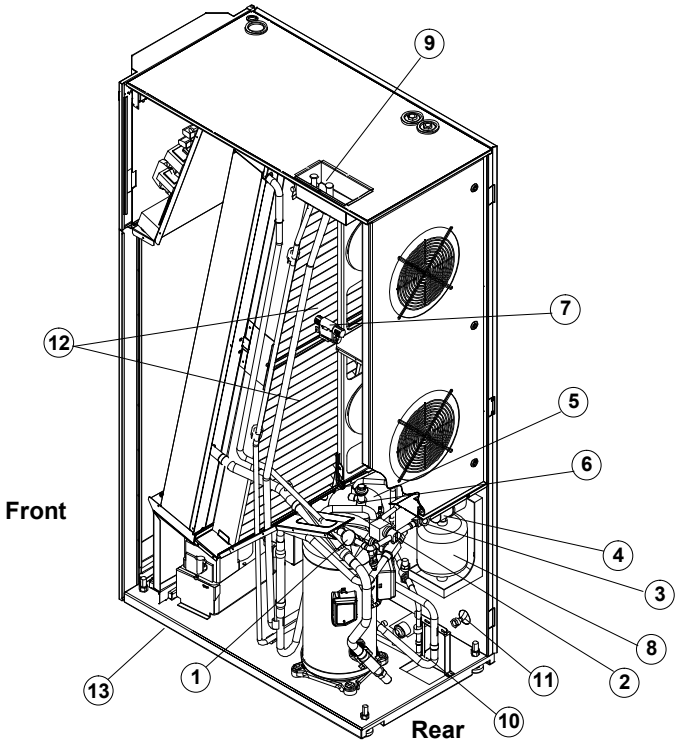
1.0 LIEBERT CRV COMPONENT LOCATION

Figure 1 Component location, common components—All models



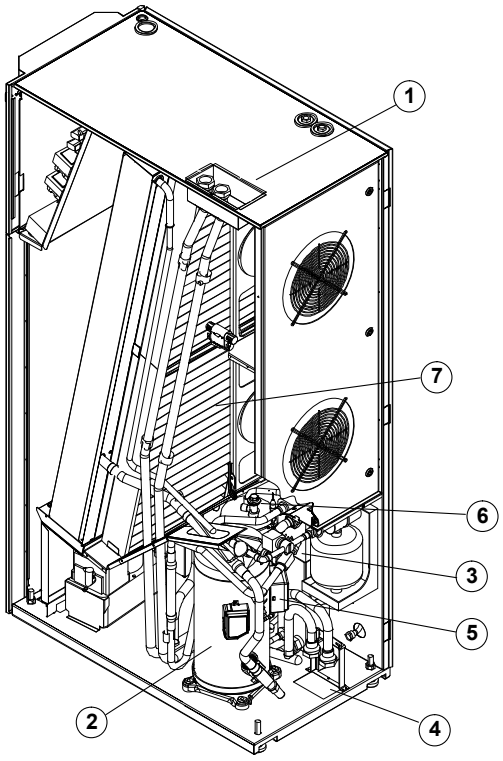
1	Liebert iCOM® control display
2	Electric box
3	Evaporator / CW coil
4	Condensate pump
5	Electric heaters
6	Humidifier distributor
7	Top humidifier water supply, condensate pump drain
8	Drain trays, two places
9	EC plug fans
10	Bottom electrical entrance
11	Serial tag inside door
12	Bottom condensate pump drain
13	Top electrical entrance
14	Supply air temperature sensor location (sensor not shown)

Figure 2 Component location - Liebert CR035RA, CR020RA air-cooled units



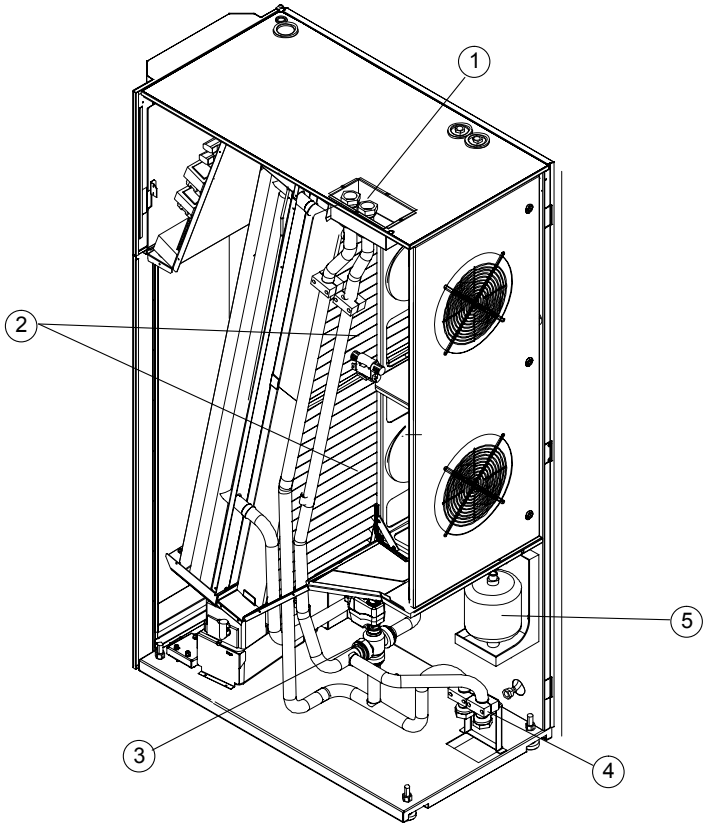
1	Thermostatic expansion valve
2	Solenoid valve
3	Sight glass
4	Filter dryer
7	Humidity/temperature sensor
8	Humidifier
9	Top refrigerant connections
10	Bottom refrigerant connections
11	Bottom humidifier water supply
12	Air filters
13	Bottom drain
14	Compressor
15	Vibasorber

Figure 3 Component location - Liebert CR035RW, CR020RW water/glycol-cooled units



1	Top water/glycol connections
2	Compressor
3	Brazed plate condenser
4	Bottom water/glycol connections
5	Water/glycol valve
6	Refrigerant receiver
7	Air filters
8	Vibasorber
9	Thermostatic expansion valve
10	Sight glass
11	Filter dryer
12	Humidity/temperature sensor
13	Bottom humidifier water supply

Figure 4 Component location - Liebert CR040RC chilled water units



1	Top CW connections
2	Air filters
3	Three-way CW valve
4	Bottom CW connections
5	Humidifier
6	Humidity/temperature sensor
7	Bottom humidifier water supply

Figure 5 Overall dimensions / service area

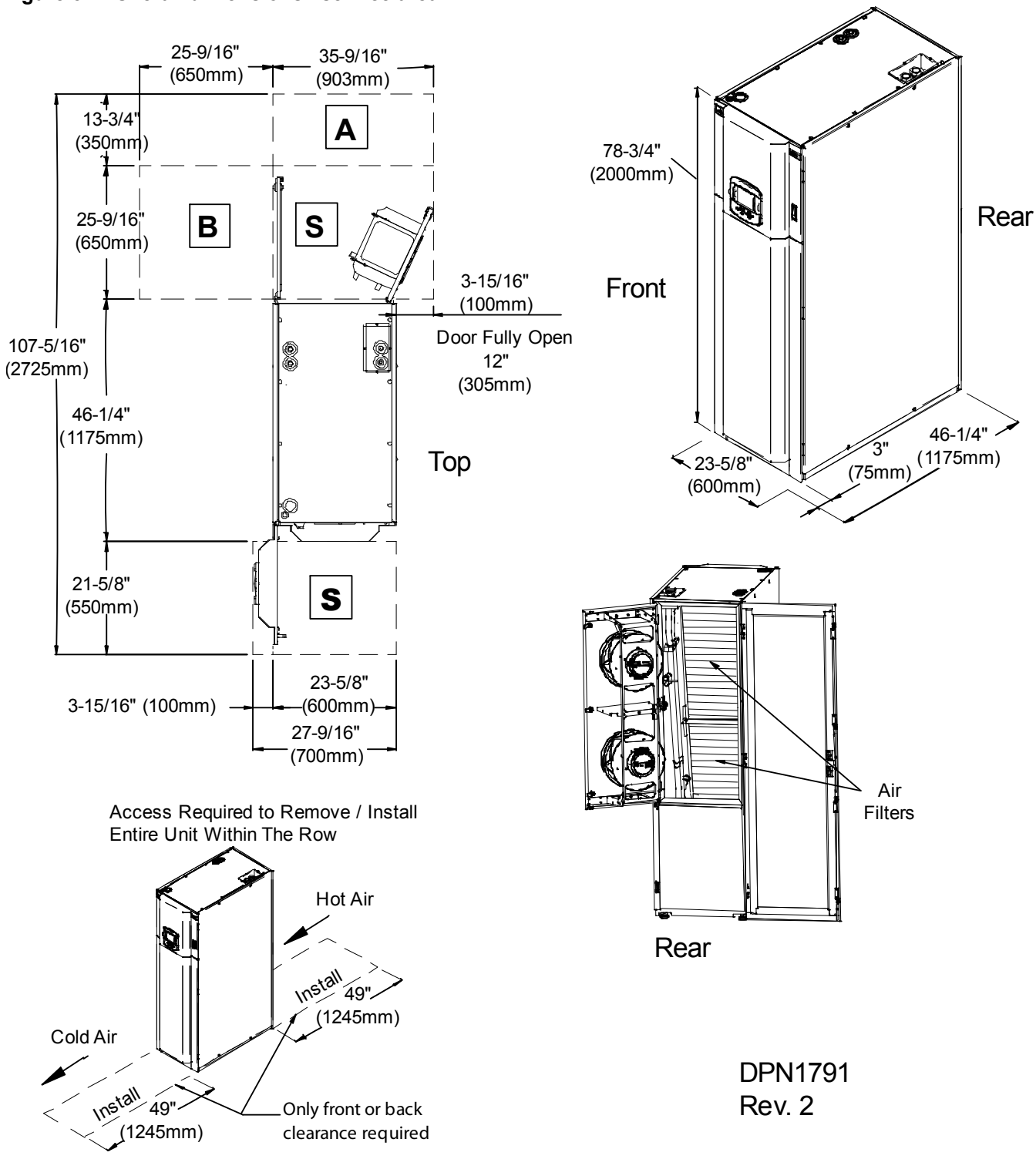


Table 1 Dry weight, all model types, ± 5%

Model No.	Model Type		
	Air Cooled lb (kg)	Water/Glycol lb (kg)	Chilled Water lb (kg)
CR020R	739 (335)	772 (350	—
CR035R	805 (365)	849 (385)	—
CR040R	—	—	728 (330)

Source: DPN001791, Rev. 2

2.0 INTRODUCTION

2.1 Product Description

The Liebert CRV is a precision cooling unit available in compressorized (air-, water- or glycol-cooled) and chilled water configurations to be installed within a row of high-density computing racks in a "hot aisle-cold aisle" configuration.

Air enters the rear of the Liebert CRV from the hot aisle, is filtered, cooled and conditioned, then discharged into the cold aisle. The Liebert CRV provides all the necessary functions of a standard precision air conditioner, including cooling, heating, humidification, dehumidification, air filtration, condensate management, temperature control, alarm monitoring and data communication. The Liebert CRV is optimized for maximum cooling capacity in a minimal footprint.

Figure 6 Liebert CRV, front and rear views

3.0 INSPECTION AND UNPACKING

WARNING

Risk of top-heavy unit falling over. Can cause equipment damage, personal injury and death.

Read all of the following instructions before attempting to move, lift or remove packaging from the Liebert CRV.

CAUTION

Risk of sharp edges, splinters and exposed fasteners. Can cause personal injury.

Only properly trained and qualified personnel wearing appropriate safety headgear, gloves, shoes and glasses should attempt to move, lift or remove packaging from the Liebert CRV or prepare the unit for installation.

NOTICE

Risk of overhead interference. Can cause unit and/or building damage.

The unit may be too tall to fit through a doorway while on the skid. Measure the unit and doorway heights and refer to the installation plans prior to moving the unit to verify clearances.

NOTICE

Risk of improper storage. Can cause unit damage.

Keep the unit upright, indoors and protected from dampness, freezing temperatures and contact damage.

3.1 Equipment Inspection

After the Liebert CRV unit arrives and before it is unpacked, verify that the delivered equipment matches the bill of lading. Examine the packaging for any signs of mishandling or damage. Inspect all items for damage, visible or concealed. Report any damage immediately to the carrier and file a damage claim. Send a copy of the claim to Emerson Network Power or your Emerson representative.

3.1.1 Packing Material

All material used to package this unit is recyclable. Please save this material for future use or dispose of it appropriately.

3.2 Handling

Figure 7 Liebert CRV center of gravity

- Always keep the packaged Liebert CRV upright and never leave it outdoors.
- Be aware of the center of gravity indicated on the package and in **Table 2** below:

Table 2 Center of gravity

Model no.	Distance from lower right front corner, ± 2 in. (51m)		
	X, in. (mm)	Y, in. (mm)	Z, in. (mm)
CR020	20 (508)	12 (305)	28 (711)
CR035	20 (508)	12 (305)	32 (813)
CR040	21 (533)	12 (305)	32 (813)

The center of gravity on the Liebert CRV varies with the options and the model's size.

Table 3 Weights without packaging

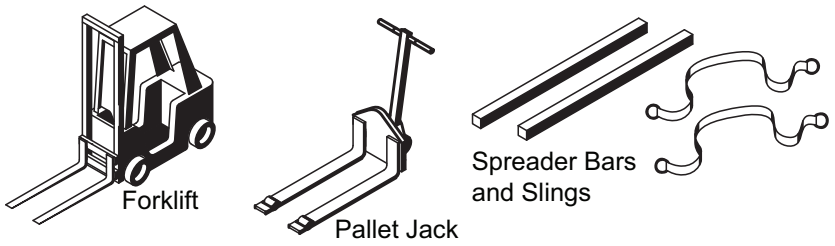
Model No.	Electrical Data	Weight ± 5%, lb (kg)		
		Air-Cooled	Water/Glycol-Cooled	Chilled Water
CR020	460/3/60	739 (335)	772 (350)	—
	208/3/60	739 (335)	772 (350)	—
CR035	460/3/60	805 (365)	849 (385)	—
	208/3/60	805 (365)	849 (385)	—
CR040	460/3/60	—	—	728 (330)
	208/3/60	—	—	728 (330)

Table 4 Shipping weights

Model No.	Domestic Packaging, lb (kg)			Export Packaging, lb (kg)		
	Air	Water/Glycol	Chilled Water	Air	Water/Glycol	Chilled Water
CR020	846 (384)	879 (399)	—	953 (432)	986 (447)	—
CR035	912 (414)	956 (434)	—	1019 (462)	1063 (482)	—
CR040	—	—	835 (379)	—	—	942 (427)

3.2.1 Handling the Unit While it is Packaged

Figure 8 Recommended unit handling equipment



- Transport the packaged unit using a forklift, pallet jack or by overhead lift with slings and spreader bars that are rated for the weight of the unit (see tables above).
- When using a forklift or pallet jack, make sure the forks (if adjustable) are spread to the widest allowable distance to still fit under the skid. Make sure the fork length is suitable for the skid length. Skid length is 60" (1524mm).
- Do not lift the packaged unit any higher than 4" (102mm). All personnel except those moving the Liebert CRV must be kept 12' (3.7m) or more from the unit while it is being moved.
- If the unit must be lifted higher than 4" (102mm) all personnel not directly involved in moving the Liebert CRV must be 20' (5m) or more from the unit.

3.3 Moving the Unit Using Rigging

CAUTION

Risk of sharp edges, splinters and exposed fasteners. Can cause personal injury.

Only properly trained and qualified personnel wearing appropriate safety headgear, gloves, shoes and glasses should attempt to move, lift or remove packaging from the Liebert CRV or prepare the unit for installation.

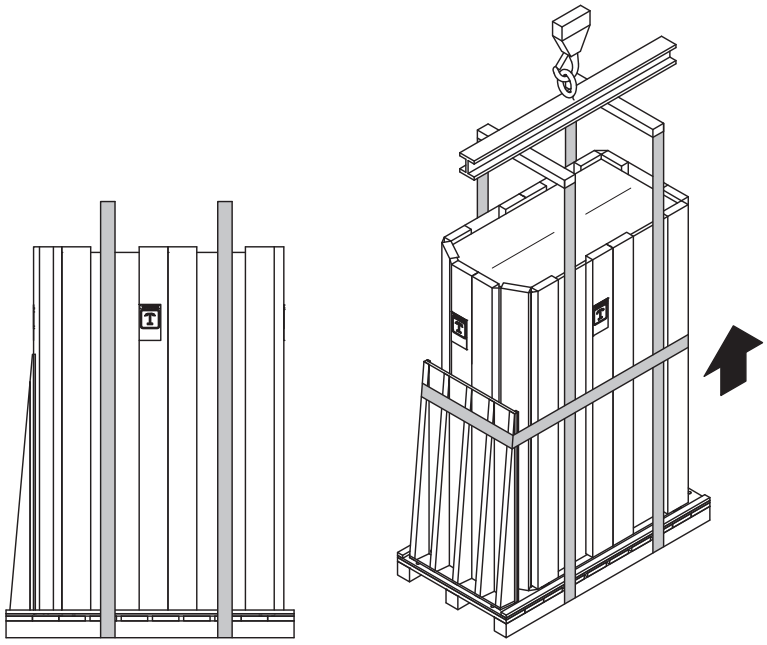
1. Use a pallet jack or forklift to raise the packaged unit.
2. Place slings under the skid runners, equally spacing the slings to make sure the unit is balanced (see **Figure 9**).
3. Lower the unit and remove the pallet jack or forklift.
4. Connect the slings to the lifting device, using spreader bars or similar equipment to protect the unit (see **Figure 9**).

NOTE

Wrapping one or two more straps around the middle of the Liebert CRV will improve stability when it is lifted.

5. Move the unit to its installation location. Two or more properly trained and qualified personnel are required to move the Liebert CRV to its installation location.
6. Lower the Liebert CRV and remove the slings.

Figure 9 Moving the unit using rigging



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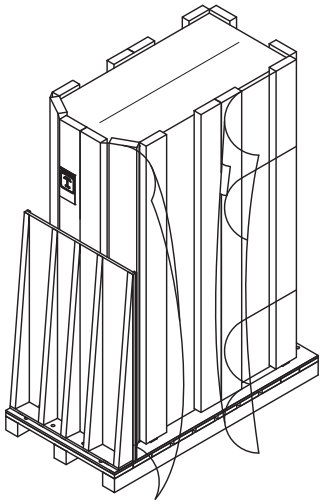
Rev. 4

3.4 Unpacking the Liebert CRV

1. Remove the lag bolts securing ramp to skid.
2. Place the ramp and and the plastic bag with orange clips to the side for use in removing the unit from the skid.
3. Remove the stretch film and corner/side packaging planks from around the unit.
4. Remove the unit bag when ready to install the unit.

Figure 10 Unpacking the Liebert CRV



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3.5 Removing the Unit from the Skid

WARNING

Risk of top-heavy unit falling over. Can cause equipment damage, personal injury and death.

Read all of the following instructions before attempting to move, lift or remove packaging from the Liebert CRV.

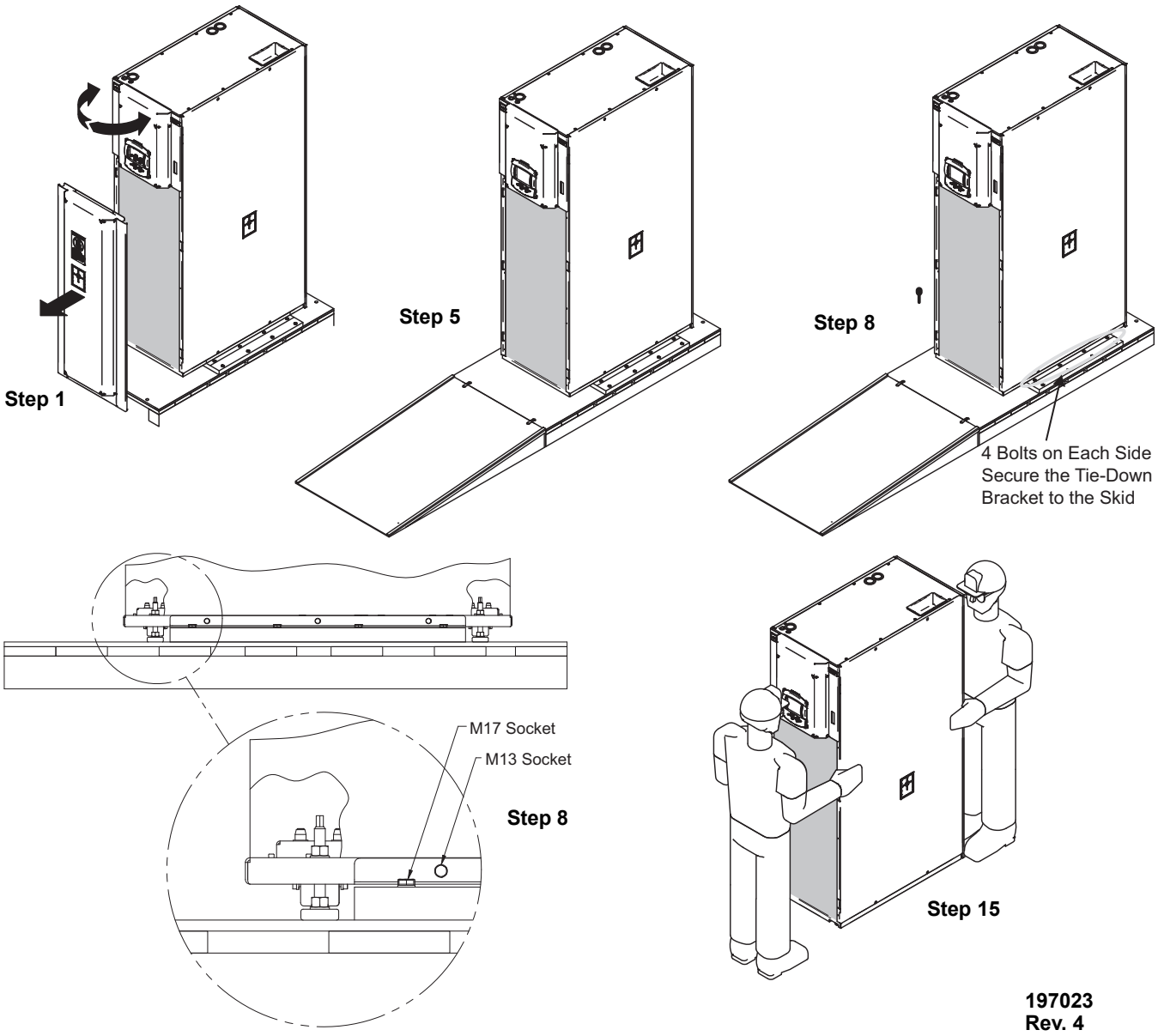
CAUTION

Risk of sharp edges, splinters and exposed fasteners. Can cause personal injury.

Only properly trained and qualified personnel wearing appropriate safety headgear, gloves, shoes and glasses should attempt to move, lift or remove packaging from the Liebert CRV or prepare the unit for installation.

1. Open the top panel door with the mounted control (refer to **Figure 11**).
2. Remove the bottom baffle panel assembly by removing the screws with a T30 Torx screwdriver.
3. Set the baffle panel assembly aside until the Liebert CRV is ready for it to be to reattached.
4. Close and latch the top panel door.
5. Place the ramp against the skid as shown in **Figure 11**.
6. Remove the orange clips from the plastic bag.
7. Insert clips into holes of the skid and ramp.
8. Remove the eight bolts, four on each side, that secure side tie-down brackets to skid.
   Bolts can be removed using a 17mm socket wrench, open-end wrench or pliers.
9. Lower the four stabilizer feet until the side tie-down brackets no longer contact the skid.
10. Remove the six bolts, three on each side), that secure the side tie-down brackets to the unit base.
    The bolts can be removed using a 13mm socket wrench, open-end wrench or pliers.
11. Remove the side tie-down brackets.
12. Remove the eight bolts, four on each side, that secure the lift block to the skid.
    The bolts can be removed using a 17mm socket wrench, open-end wrench or pliers.
13. Remove the lift blocks from the skid.
14. Using the stabilizer feet, lower the unit to the skid.
15. Move the unit to its installation location. Two or more properly trained and qualified personnel are required to move the Liebert CRV to its installation location.

Figure 11 Removing the unit from the skid



3.6 Reattach the Baffle Panel

Once the Liebert CRV has been moved to where it will be installed, the baffle panel can be reattached.

1. Open top panel door (the one with the Liebert iCOM®).
2. Reattach the bottom baffle panel assembly with screws, using a T30 Torx drive.
3. Close and latch top panel door.

4.0 PREPARE THE LIEBERT CRV FOR INSTALLATION

1. Open the display door and remove the lower front baffle panel using a 10mm nutdriver or T30 Torx Bit to prepare for installation.
2. Open the rear panel, referring to **Figure 10**. The documents are located inside the display door.
3. After the Liebert CRV is in its final installation position, adjust the four base supports, or feet, with an adjustable wrench. Ensure that the unit is level to avoid corrosion or health hazards caused by condensate accumulation.
   a. Turning the base supports, or feet, clockwise, will extend them, lifting the unit one corner at a time.
   b. Tighten the nut on the top of each adjustable foot, inside the Liebert CRV, to lock the feet.

Figure 12 Adjust leveling feet

5.0 PIPING

All fluid and refrigeration connections to the unit, with the exception of the condensate drain, are sweat copper. Factory-installed piping brackets must not be removed. Field-installed piping must be installed in accordance with local codes and must be properly assembled, supported, isolated and insulated. Avoid piping runs through noise-sensitive areas, such as office walls and conference rooms.

Refer to specific text and detailed diagrams in this manual for other unit-specific piping requirements.

All piping below the elevated floor must be arranged so that it offers the least resistance to airflow. Careful planning of the piping layout under the raised floor is required to prevent the airflow from being blocked. When installing piping on the subfloor, Emerson recommends installing the pipes in a horizontal plane rather than stacked one above the other. Whenever possible, the pipes should be run parallel to the airflow.

5.1 Fluid Connections

NOTICE

Risk of water leakage. Can cause severe property damage and loss of critical data center equipment.

This unit requires a water drain connection. It may require an external water supply to operate the humidifier. Improper installation, application and service practices can result in water leakage from the unit.

Do not locate the Liebert CRV directly above any equipment that could sustain water damage. Emerson recommends installing monitored leak detection equipment for the unit and supply lines.

5.1.1 Condensate Piping—Field-Installed

- Do not reduce drain lines
- Do not expose drain line to freezing temperatures
- Drain line may contain boiling water. Use copper or other suitable material
- Drain line must comply with local building codes
- Emerson recommends installing under-floor leak detection equipment

Gravity Drain—Units Without Factory-Installed Condensate Pump

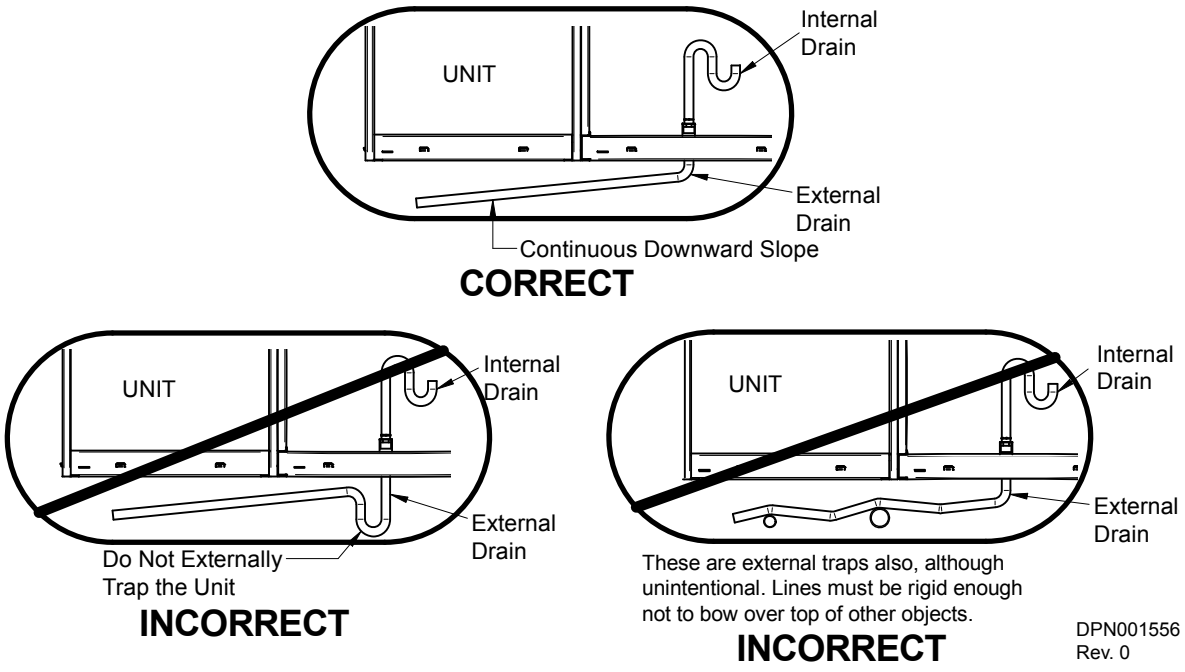
- 3/4" FPT drain connection is provided on units **without** optional factory-installed condensate pump with infrared humidifier or no humidifier; 1-1/4" FPT connection is provided on units with steam generating humidifier
- Pitch the drain line toward the drain a minimum of 1/8" (3mm) per 1 foot (305mm) of length
- Drain is trapped internally. Do not trap the drain external to equipment
- Drain line must be sized for 2 gpm (7.6 l/m) flow

NOTICE

Risk of improper piping connections. Can cause damage to the equipment and to the building.

The drain line has an internal trap and must not be trapped outside the unit or water may back up into the drain pan and overflow the unit cabinet.

Figure 13 Gravity drain



Condensate Pump

- 1/2" copper sweat connection is provided on units **with** optional factory-installed condensate pump
- Condensate pump is rated for approximately 6 GPM (22.7 l/min) at 30 ft (9m) total head
- Size piping based on available condensate head

5.1.2 Humidifier Supply Water—Optional Steam Generating Canister

- 1/4" supply line; maximum water pressure is 145psi (1000kPa)
- Fill valve is sized for pressure range of 30 to 120psi (207-827kPa)
- Do not supply steam generating humidifier with softened water
- Do not use hot water source
- Water conductivity must be in the range of 330-670 micro-siemens

5.1.3 Requirements of Systems Using Water or Glycol

These guidelines apply to the field leak checking and fluid requirements for field piping systems, including Liebert chilled water, condenser (water or glycol) and drycooler circuits.

General Guidelines

- Equipment damage and personal injury can result from improper piping installation, leak checking, fluid chemistry and fluid maintenance.
- Follow local piping codes, safety codes.
- Qualified personnel must install and inspect system piping.
- Contact a local water consultant regarding water quality, corrosion protection and freeze protection requirements.
- Install manual shutoff valves at the supply and return line to each indoor unit and drycooler to permit routine service and emergency isolation of the unit.

NOTICE

Risk of frozen fluids. Can cause equipment damage and building damage.

Freezing system fluids can rupture piping. Complete system drain-down cannot be ensured. When the field piping or unit may be exposed to freezing temperatures, charge the system with the proper percentage of glycol and water for the coldest design ambient.

Automotive antifreeze is unacceptable and must NOT be used in any glycol fluid system.

NOTICE

Risk of corrosion. Can cause equipment damage.

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.

Contact a local water consultant regarding water quality, corrosion and freeze protection requirements.

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 build up of sediment deposits and or growth of sulfate reducing bacteria.

Preferably, surface waters that are classified as soft and are low in chloride and sulfate ion content should be employed. 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 (Union Carbide Ucartherm, Dow Chemical Dowtherm SR-1 and Texaco E.G. Heat Transfer Fluid 100), 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.

NOTICE

Risk of no-flow condition. Can cause equipment damage.

Do not leave the unit in a no-flow condition.

Idle fluid allows the collection of sediment that prevents the formation of a protective oxide layer on the inside of tubes. Keep unit switched ON and system pump operating.

Leak Checking of Unit and Field Piping

Liebert unit fluid systems are factory-checked for leaks and may be shipped with a nitrogen holding charge. Liebert unit fluid circuits should be checked for leaks at installation as described below.

NOTE

During leak checking of field-installed piping, Emerson recommends that the unit be isolated using field-installed shutoff valves. When the Liebert units are included in a leak test, use of fluid for pressure testing is recommended. When pressurized gas is used for leak testing the Liebert unit, the maximum recommended pressure is 30 psig (2 bars) and tightness of the unit should be verified by pressure decay over time, (<2 psig/hour [0.3 bars/hour]) or sensing a tracer gas with suitable instrumentation. Dry seals in fluid valves and pumps may not hold a high gas pressure.

6.0 REFRIGERANT CONNECTIONS

WARNING

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

This unit contains fluids and/or 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 and death.

A pressure relief valve is required for compliance with the EU Pressure Equipment Directive and may be required for compliance with local codes. If a discharge pressure relief device is not provided with the condenser unit, the system installer must install one in the high side of the refrigerant circuit and rated for a maximum of:

- 675psig (46.5bar) for water/glycol-cooled units
- 700psig (48.3bar) for air-cooled units

A shutoff valve must not be installed between the compressor and the field-installed relief valve.

One or more additional pressure relief valves are required downstream of any and all field-installed isolation. Do not isolate any refrigerant circuits from overpressurization protection.

NOTICE

Risk of oil contamination with water. Can cause equipment damage.

The piping must not be open to the atmosphere for extended periods because the Liebert CRV requires POE (polyol ester) oil. POE oil absorbs water at a much faster rate when exposed to air than previously used oils. Because water is the enemy of a reliable refrigeration system, extreme care must be used when opening systems during installation or service. If water is absorbed into the POE oil, it will not be easily removed and will not be removed through the normal evacuation process. If the oil is too wet, it may require an oil change. POE oils also have a property that makes them act as a solvent in a refrigeration system. Maintaining system cleanliness is extremely important because the oil will tend to bring any foreign matter back to the compressor.

The Liebert CRV can be connected to a condenser through either the top or bottom of the unit. The unit is piped for connections at the top of the unit as shown in **Figure 14**, with provision for connection through the bottom of the unit.

Connecting through the bottom of the unit requires cutting the liquid and suction lines as shown in **Figure 15**. Cutting these lines disconnects the top connections from the rest of the refrigeration system.

Air-cooled units are shipped with a holding charge of nitrogen.

6.1 Piping Guidelines—Air-Cooled Units

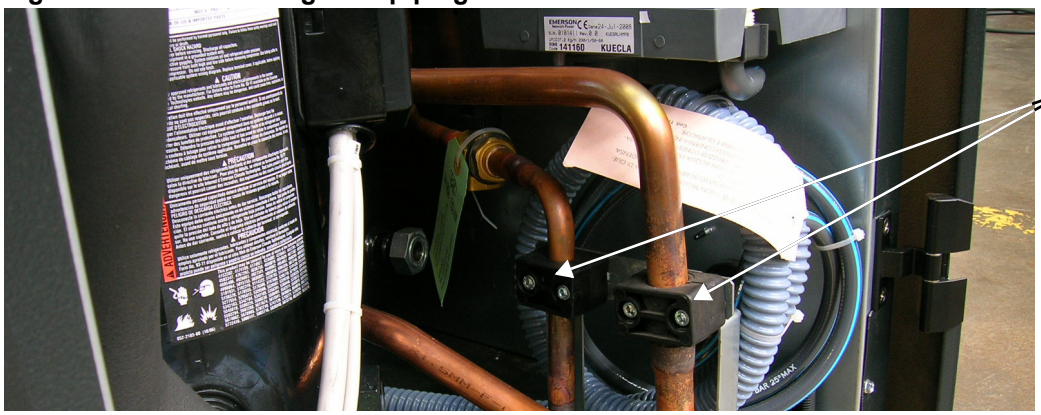
- Indoor unit ships with a nitrogen holding charge; do not vent the evaporator until all refrigerant piping is in place, ready for connection to the unit and condenser
- Use copper piping with high temperature brazed joints
- Isolate piping from building using vibration-isolating supports
- Refer to **Tables 7** through **10** for piping sizes
- Refer to condenser installation manual for charging information
- Install traps on hot gas (discharge) lines at the base of vertical risers and every 15 feet (4.6m) of vertical rise.
- See **Table 6** for the allowable elevation difference between the condenser and the Liebert CRV.
- Consult factory if piping run exceeds 300 feet (91m) equivalent length
- Keep piping clean and dry, especially on units with R-410A refrigerant
- Avoid piping runs through noise-sensitive areas
- Do not run piping directly in front of airstream of any air conditioner
- Refrigerant oil – do not mix oil types

Refer to ASHRAE Refrigeration Handbook for general, good-practice refrigeration piping.

6.2 Refrigerant Piping—Air-Cooled Models

Figure 14 Top refrigerant piping connections

Figure 15 Bottom refrigerant piping connections



If using bottom connections, cut the pipes just below the black pipe clamps

6.2.1 General Layout

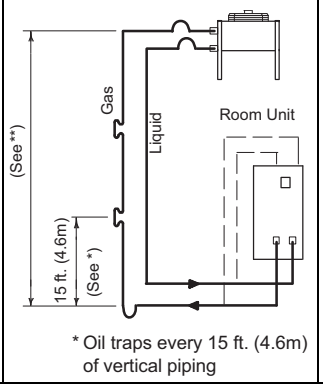
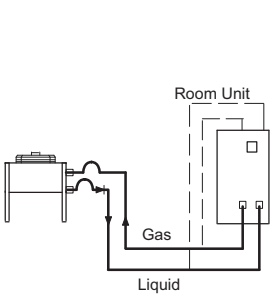
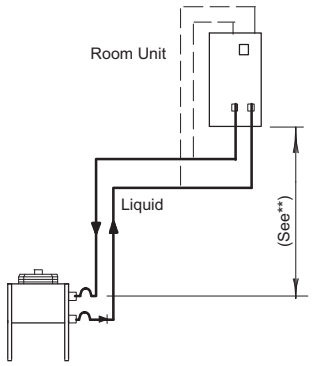
1. Piping must be Type ACR copper tubing and sized per **Tables 7**, **8**, **9** and **10**.

NOTE
All field-installed piping must comply with applicable national, state and local codes.

Use the shortest possible refrigeration pipelines to minimize the total charge of refrigerant and the number of pressure drops.

2. Minimize the number of bends and make the bends the largest radius practical to prevent constricting refrigerant flow.
3. Insulate the piping as specified in **Table 5**. If the pipes are installed next to electrical cables, they must be isolated from the building using vibration-isolating supports to avoid damage to cable insulation.
4. There must be at least one inch (25mm) separation between the gas and liquid pipelines. If this is not possible, insulate both lines.
5. Support both horizontal and vertical pipes with vibration-damping clamps, which include rubber gaskets. Place these clamps every 5 to 7 ft. (1.5 to 2m).

Table 5 Condenser positioning

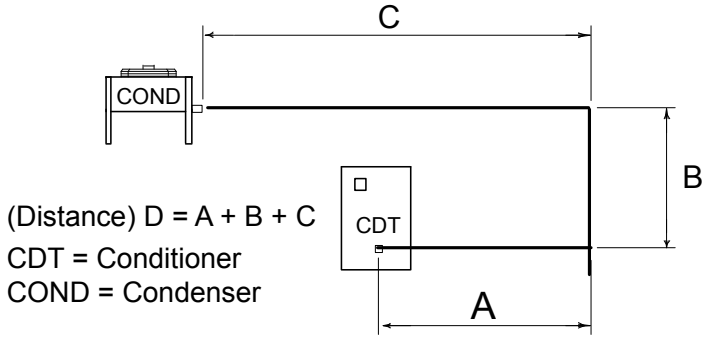
Condenser Position			Condenser Above Liebert CRV	Condenser and Liebert CRV at Same Level	Condenser Below Liebert CRV (Not Recommended)
Insulation	Discharge Line	Indoor	necessary	necessary	necessary
		Outdoor	only for aesthetic reasons	only for aesthetic reasons	only for aesthetic reasons
	Liquid Line	Indoor	only for aesthetic reasons	only for aesthetic reasons	no (expose to cold under-floor air)
		Outdoor	only for aesthetic reasons	only if exposed to sun	only if exposed to sun
Layout					

** See **Table 6**

Table 6 Liebert CRV position relative to the remote condenser

Parameter	Maximum Distances, ft. (m)	
From Liebert CRV to condenser	300 (91.4) equivalent length	
From Liebert CRV to VFD condenser	Above: 60 (18.3)	Below: 15 (4.5)
From Liebert CRV to Liebert Lee-Temp™ condenser	Above: 60 (18.3)	Below: 0 (0)
Requirements		
Oil traps on vertical line of gas refrigerant	Every 15 (4.6)	

Figure 16 Pipeline air conditioner - condenser



6.2.2 Pipe Diameter and Thickness

WARNING

Risk of explosive discharge. Can cause equipment damage, injury or death.

Use only Type ACR copper tubing sized per **Tables 7**, **8**, **9** and **10** for pipes connecting the Liebert CRV and the condensing unit.

Table 7 Piping and refrigerant sizes for Liebert Lee-Temp™ condensers with R-410A

Condenser Piping Connection Sizes						
Condenser Connections, O.D., in.				Liebert Lee-Temp Connections, I.D., in.		
Condenser Model #	Hot Gas	Liquid	Liebert Lee-Temp Size, in. (mm)	Hot Gas Tee	Liquid To L-T Valve	Receiver Out
DCSL28K	1-1/8	7/8	9 x 36 (229 x 914)	1-1/8	5/8	7/8
DCSL60K	1-1/8	7/8	11 x 36 (279 x 914)	1-1/8	5/8	7/8
DCSL90K	1-1/8	7/8	11 x 48 (279 x 1219)	1-1/8	5/8	7/8

Source: DPN001623, Rev. 6, Page 3

Table 8 Recommended refrigerant line sizes for Liebert Lee-Temp condensers with R-410A Cu, OD

Liebert CRV Model #	Total Equivalent Length, ft. (m)	Hot Gas Line, in. (mm)	Liquid Line, in. (mm)
CR020RA	50 (15.2)	3/4 (19.1)	5/8 (15.9)
	100 (30.5)	3/4 (19.1)	5/8 (15.9)
	150 (45.7)	3/4 (19.1)	5/8 (15.9)
	300 (91.4)	7/8 (22.2)*	3/4 (19.1)
CR035RA	50 (15.2)	7/8 (22.2)	3/4 (19.1)
	100 (30.5)	7/8 (22.2)	3/4 (19.1)
	150 (45.7)	7/8 (22.2)	3/4 (19.1)
	300 (91.4)	1-1/8 (28.6)*	7/8 (22.2)

Consult factory for proper line sizing for runs longer than 300 ft. (91.4m) equivalent length.

* Must downsize vertical riser one trade size (1-1/8" to 7/8" or 7/8" to 3/4").

Source: DPN001623, Rev. 6, Page 3

Table 9 Piping and refrigerant sizes for Liebert air-cooled, VFD control condensers with R-410A

Condenser Piping Connection Sizes, Cu, O.D.		
Condenser Model #	**Entering Hot Gas Line, in. (mm)**	**Returning Liquid Line, in. (mm)**
TCSV28K	1-1/8 (28.6)	7/8 (22.2)
TCSV60K	1-1/8 (28.6)	7/8 (22.2)
TCSV90K	1-1/8 (28.6)	7/8 (22.2)

Source: DPN001624, Rev. 5, Page 3

Table 10 Recommended refrigerant line sizes for Liebert air-cooled, VFD control condensers with R-410A, Cu, OD

Liebert CRV Model #	Total Equivalent Length, ft. (m)	Hot Gas Line, in. (m)	Liquid Line, in. (m)
CR020RA	50 (15.2)	3/4 (19.1)	5/8 (15.9)
	100 (30.5)	3/4 (19.1)	5/8 (15.9)
	150 (45.7)	3/4 (19.1)	5/8 (15.9)
	300 (91.4)	7/8 (22.2) [2]	3/4 (19.1)
CR035RA	50 (15.2)	7/8 (22.2)	3/4 (19.1)
	100 (30.5)	7/8 (22.2)	3/4 (19.1)
	150 (45.7)	7/8 (22.2)	3/4 (19.1)
	300 (91.4)	1-1/8 (28.6) [2]	7/8 (22.2)

1. Consult factory for proper line sizing for runs longer than 300 ft. (91.4m) equivalent length.
2. Must downsize vertical riser one trade size (1-1/8" to 7/8" or 7/8" to 3/4").

Source: DPN001624, Rev. 5, Page 3

6.2.3 Installing Piping

The following operations must be carried out by an experienced refrigeration technician.

NOTICE

Risk of oil contamination with water. Can cause equipment damage.

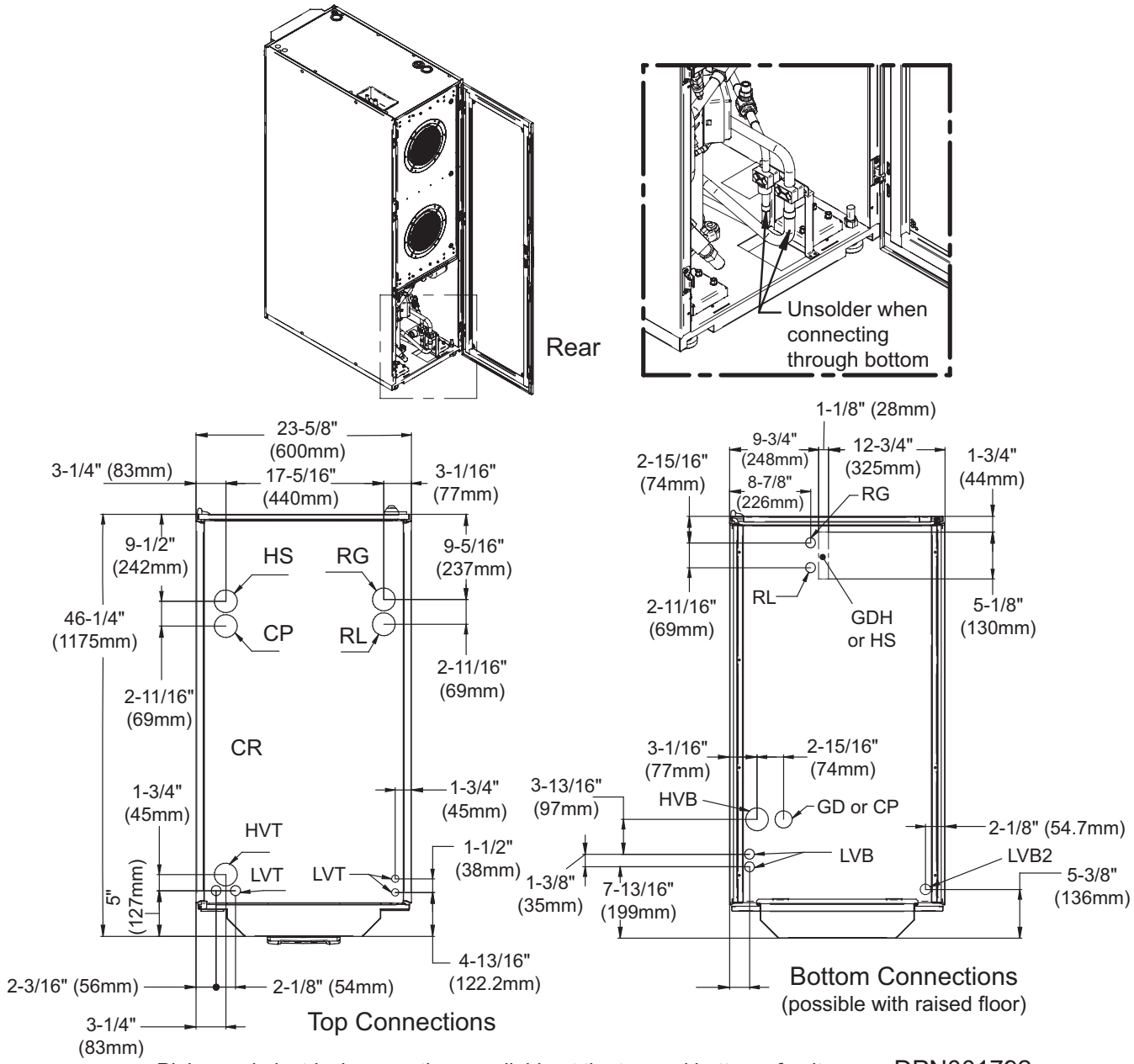
The piping must not be open to the atmosphere for extended periods because the Liebert CRV requires POE (polyol ester) oil. POE oil absorbs water at a much faster rate when exposed to air than previously used oils. Because water is the enemy of a reliable refrigeration system, extreme care must be used when opening systems during installation or service. If water is absorbed into the POE oil, it will not be easily removed and will not be removed through the normal evacuation process. If the oil is too wet, it may require an oil change. POE oils also have a property that makes them act as a solvent in a refrigeration system. Maintaining system cleanliness is extremely important because the oil will tend to bring any foreign matter back to the compressor.

1. When installing the refrigerant piping, note the following:
   - Brazing:
     - All joints must be brazed.
     - Avoid butt brazes by using couplings or swaging one of the pipes with a swaging tool.
     - Ensure that all brazed joints are leak-free.
     - Flow dry nitrogen through the pipes during brazing.
   - Always use large-radius curves (bending radius at least equal to pipe diameter). Bend the pipes as follows:
     - soft copper: bend by hand or use bending device;
     - hard copper: use preformed curves.
   - To minimize oxidation, avoid overheating the pipes when brazing.
2. Connect the pipes to the condenser:
   - Condensers with butt-brazed pipe connections: Cut the pipe, enlarge it and braze it to the pipeline.

   Respect the direction of refrigerant flow. (See labels on refrigerant.)
3. Wash out the pipelines as follows:
   a. Plug up the free ends of the pipes.
   b. Connect a helium or nitrogen cylinder, fitted with a reducer (max. pressure 10 bar), to the 1/4" SAE Schrader valve of the condenser.
   c. Pressurize the pipes with helium or nitrogen.
   d. Unplug the pipes instantaneously.
   e. Repeat **Steps a** through **d** several times.

   This operation is especially important when hard copper piping is used.
4. Open all the shutoff valves on the room unit.
5. Discharge the room unit pressurized with helium (at 1 bar) by opening the charge valves so that all the branches of the circuit are discharged (e.g., on the receiver, on the low pressure side and on the compressor delivery).
6. Debraze the bottoms from the connections of the room unit.
7. Fix (braze) the pipes to the connections on the air conditioner.
8. Connect the refrigerant safety pressure relief valve to the outdoors with a 16 mm (5/8") copper pipe. Only water/glycol units have a indoor relief valve. Air cooled units do not have an indoor pressure relief valve.

Figure 17 Connections—air-cooled models



Piping and electrical connections available at the top and bottom of unit. Air-cooled systems may require oil to be added in the field to allow sufficient compressor lubrication.

DPN001792
Rev. 2

Table 11 Unit connections, air-cooled models

Unit Connections		CR20A (50Hz)	CR35A (50Hz)	CR20A (60Hz)	CR35A (60Hz)
RL	Refrigerant Liquid Line Inlet	12mm O.D. Cu Sweat	16mm O.D. Cu Sweat	1/2" O.D. Cu Sweat	5/8" O.D. Cu Sweat
RG	Refrigerant Gas Line Outlet	16mm O.D. Cu Sweat	22mm O.D. Cu Sweat	5/8" O.D. Cu Sweat	7/8" O.D. Cu Sweat
GD	Gravity Coil Pan Drain	20mm I.D.		1" MPT	
GDH	Gravity Humidifier Drain	22mm I.D.		N/A	
CP	Condensate Pump	1/2" GAS F		1/2" FPT	
HS	Humidifier Supply	1/2" GAS F (top connection) 3/4" GAS F (bottom connection)		1/2" FPT (top connection) 1/4" Compression Fitting (bottom connection)	
HVT	High Voltage Top Connection	Combination Knockout Hole Diameter 1-3/8" (35mm) 1-3/4" (44.5mm) and 2-1/2" (63.5mm)		Combination Knockout Hole Diameter 1-3/8" (35mm) 1-3/4" (44.5mm) and 2-1/2" (63.5mm)	
HVB	High Voltage Bottom Entrance (feed through the base of the unit)	Hole Diameter 2-1/2" (63.5mm)		Knockout Hole Diameter 2-1/2" (63.5mm)	
LVT	Low Voltage Top Connection	Hole Diameter 7/8" (22mm) 2 places		Knockout Hole Diameter 7/8" (22mm) 2 places	
LVB	Low Voltage Bottom Entrance (feed through the base of the unit)	Hole Diameter 1-7/64" (28mm) 2 places		Knockout Hole Diameter 1-3/32" (27.8mm) 2 places	
LVB 2	Low Voltage Bottom Entrance (feed through the base of the unit)	—		Knockout Hole Diameter 1-3/4" (44.5mm) 1 place	

Source: DPN001792, Rev.2

6.3 Vacuum and Refrigerant Charge

NOTICE

Risk of improper refrigerant charge. Can cause equipment damage and reduced efficiency.
Check the refrigerant type to be used on the data plate of the air conditioner and on the refrigerating compressor.

Table 12 R-410A refrigerant and oil charge for air-cooled models

Model	Base Refrigerant Charge [1] lb (kg)	Base Oil Charge [1]		Max. System Refrigerant Charge before Oil Addition, lb (kg)	Weight of Oil to Add for Every 10lb (4.5kg) of Refrigerant over Max System Charge, oz (kg)
		Initial Oil Charge oz (kg)	Max. Topping Up oz (kg)		
CR020RA	7 (3.2)	60 (1.68)	56 (1.57)	38 (17.1)	1.6 (.045)
CR035RA	10 (4.5)	110 (3.08)	106 (2.97)	28 (12.6)	4 (.113)

1. The recommended oil is EMKARATE RL 32-3MA.

Table 13 Refrigerant charge [1]

External Pipe Diameter in (mm)	Gas R-410A, lb/feet (kg/m)	Liquid (+), at Different Condensing Temperatures - R-410A, lb/ft (kg/m)		
		95°F (35°C)	115°F (46°C)	135°F (57°C)
1/2" x 0.049 (12 x 1)	-	0.05 (0.08)	0.05 (0.07)	0.04 (0.07)
9/16" x 0.049 (14 x 1)	0.0084 (0.0124)	0.07 (0.11)	0.07 (0.11)	0.06 (0.10)
5/8" x 0.049 (16 x 1)	0.0114 (0.0169)	0.10 (0.16)	0.10 (0.14)	0.09 (0.13)
3/4" x 0.049 (18 x 1)	0.0149 (0.0221)	0.14 (0.20)	0.13 (0.19)	0.11 (0.17)
7/8" x 0.065 (22 x 1.25)	0.0232 (0.0346)	—	—	—
1-1/8" x 0.065 (28 x 1.5)	0.0392 (0.0584)	—	—	—

(+) Liquid pressure and density varies according to condensing temperature (see refrigerant tables).
1. For distance D see **Figure 16 Pipeline air conditioner - condenser**

Table 14 Air-cooled condenser refrigerant charge

Model	VFD	Liebert Lee-Temp™ (inc. receiver)
	lb (kg)	lb (kg)
28 K	7 (3.2)	41 (18.6)
60 K	16 (7.3)	75 (34.0)
90 K	25 (11.3)	109 (49.4)

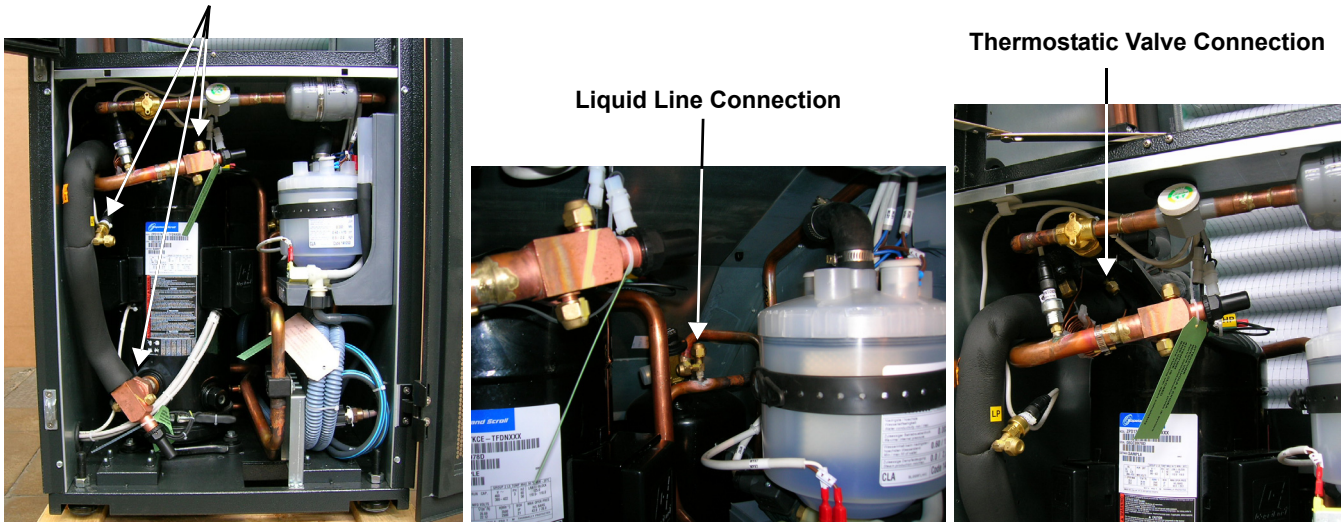
Topping up is requested for short pipeline, too, due to the extra-charge of refrigerant.
The air conditioner is supplied pressurized with helium at 1 bar.

Table 15 Refrigerant and oil charge for water-cooled models

Model	R-410A Refrigerant Charge	Initial Oil Charge [1]
	lb (kg)	oz (kg)
CR020RW	13.0 (5.9)	60 (1.68)
CR035RW	17.0 (7.7)	110 (3.08)

The air conditioner is supplied complete with refrigerant and oil.
1. The recommended oil is EMKARATE RL 32-3MA.

Figure 18 Connections for vacuum creation and refrigerant charge



6.3.1 Evacuation Air-Cooled Models

Variable Fan Speed Control Leak Check and Evacuation Procedure

Proper leak check and evacuation can be accomplished only with all system solenoid valves open and check valves accounted for.

NOTE

The system include a factory-installed check valve and an additional downstream Schrader valve with core in the compressor discharge line. Proper evacuation of the condenser side of the compressor can be accomplished only using the downstream Schrader valve. See piping schematic.

1. If unit power is available, open the unit liquid line solenoid valves using the evacuation function for System #1 in the diagnostic section of the Liebert iCOM® control (see **Figure 68**). If unit power is not available, a field-supplied 24VAC / 75VA power source must be directly connected to the unit solenoid valve.
2. Connect refrigerant gauges to the suction rotalock valves and discharge line Schrader valves.
3. Open the service valves and place a 150 PSIG (1034 kPa) of dry nitrogen with a tracer of refrigerant. Check system for leaks with a suitable leak detector.
4. After completion of leak testing, release the test pressure (per local code) and pull an initial deep vacuum on the system with a suitable pump.
5. After four hours, check the pressure readings and, if they have not changed, break vacuum with dry nitrogen. Pull a second and third vacuum to 250 microns or less. Recheck the pressure after two hours. After completing this step, proceed to **Variable Fan Speed Charging on page 28**.

Variable Fan Speed Charging

1. Check unit nameplate for refrigerant type to be used. Unit control configurations differ depending on refrigerant type.
2. Charging the system with refrigerant requires the unit to be in an operational state..
3. Calculate the amount of charge for the system. Refer to the unit, condenser and refrigerant line charge data in **Tables 12**, **13** and **14**.
4. Weigh in as much of the system charge as possible before starting the unit.

NOTICE

Risk of improper refrigerant charging. Can cause equipment damage.

Refrigerant R-410A is a blend of two components 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.

5. Turn on unit disconnect switch. Operate the unit for 30 minutes using the charging function in the diagnostic section of the Liebert iCOM® control (see **Figure 68**). The charging function operates the compressor at full capacity and energizes the blower motor and the liquid line solenoid valve. The reheat and humidifier are disabled. 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.
6. Charge the unit until the liquid line sight glass becomes clear, then add one additional pound (2.2kg) of refrigerant.

NOTE

A digital scroll compressor will have a clear sight glass only when operating at 100% capacity. When operating below 100%, the sight glass may show bubbles with each 15-second unloading cycle.

7. 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—fan starts to rotate at 310psig (2137kPa) and is full speed at 400psig (2758kPa).

7.0 WATER CONNECTIONS

Table 16 Water connection options

Liebert CRV Option	Top Connections	Bottom Connections
Condensate Pump and Humidifier	Available	Available
Condensate Pump and No Humidifier	Available	Available
No Condensate Pump and No Humidifier	Not Available	Available

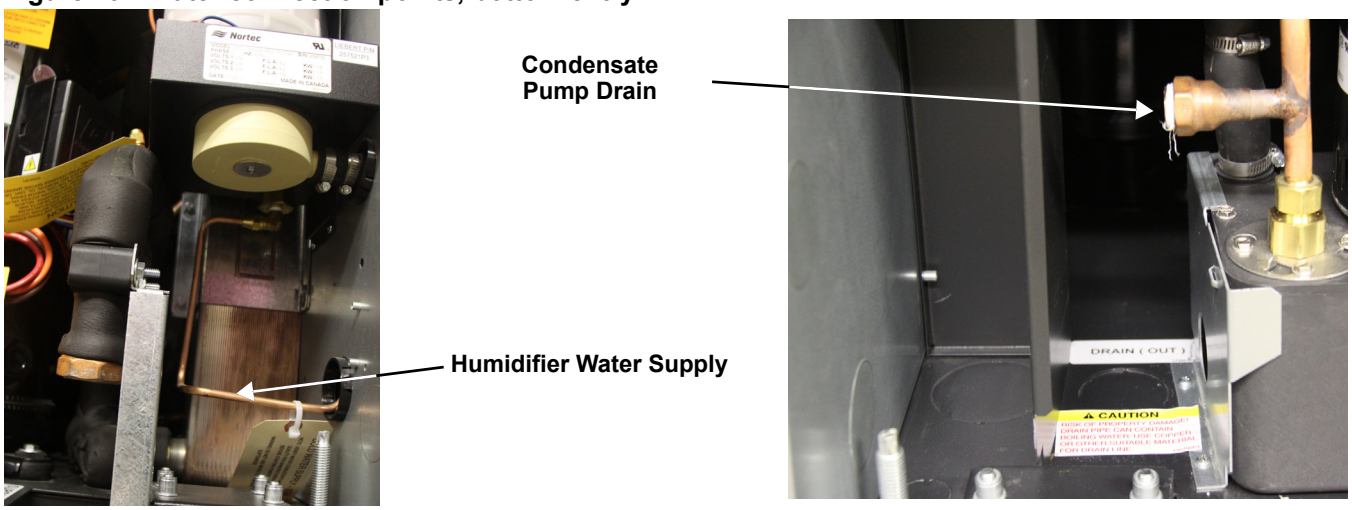
Table 17 Volume of CRV internal water circuits

Model	Volume
CR020RW	4.8 liters, 1.27 gallons
CR035RW	5.7 liters, 1.51 gallons
CR040RC	17.6 liters, 4.65 gallons

7.1 Water Connections—Supply Humidifier and Drain Water, All Models

Units with a condensate pump and humidifier are preset to be connected from the top. If floor connections are used, the water lines can be intercepted at the following points:

Figure 19 Water connection points, bottom entry



- Condensate drain without pump:
  - Use tubing rated to carry water up to 212°F (100°C) copper, PVC or flexible polythene tubing.
  - Allow a 2% gradient toward the drain.
  - Drain is trapped internally. Do not trap the drain external to the equipment.
  - Fill the drain trap with water.
- Humidifier (optional): See **Appendix A - Humidifier**.

7.2 Glycol Mixture

Add ethylene glycol or propylene glycol to the circuit in the percentages shown in **Table 18**.

Table 18 Glycol mixtures

Glycol Percentage * by Volume	Ethylene Glycol - Freezing Temperature, °F (°C)	Propylene Glycol - Freezing Temperature, °F (°C)
0%	32 (0)	32 (0)
10%	25.3 (-3.7)	28.9 (-1.7)
20%	16 (-8.9)	18.7 (-7.4)
30%	3.7 (-15.7)	8.4 (-13.1)
40%	-12.6 (-24.8)	-6.7 (-21.5)

* Freezing temperatures may vary slightly among commercially available glycol products; refer to manufacturer's specifications.

7.3 Water Connections: Water/Glycol-Cooled Models

The unit must receive cooling water as follows:

- From an external cooling water source, in open circuit.
- Using a drycooler, in closed circuit.

1. Connect the piping as shown in **Appendix D - Refrigeration and Hydraulic Circuits**.
2. Use hoses connected with three-piece joints to the condenser water inlet and outlet couplings.
3. Install a 16-20 mesh strainer on the water/glycol supply to the Liebert CRV. The strainer is needed to prevent particles in the water from entering the unit's heat exchanger.
4. Place shutoff ball valves at the conditioner inlet and outlet to allow easy maintenance.
5. Install a water drain system at the lowest point in the circuit.
6. Fully drain the piping before connecting it to the air conditioner.

7.3.1 Notes for Open-Circuit Applications

- Use the unit with mains or well water. Do not use water from an evaporative cooling tower unless the water hardness is controlled.
- The water pressure must be 29-145psi (2-10 bar). If water pressure is outside this range, contact Emerson for technical support.
- The required water flow at different temperatures is available from Emerson.
- If water temperature is very low, insulate both pipes.

7.3.2 Notes for Closed-Circuit Applications

The installation in **Figure 3** is illustrative only; for individual installations follow the project diagram.

- Install a pump system calculated on the basis of the flow and total head of the system (see site plan data) and controlled by the compressor running (see label on the Liebert CRV).
- Insulate both pipes.
- **Very important**: Add water and ethylene glycol to the circuit when the ambient temperature is below 32°F (0°C); refer to the Liebert CRV technical data manual, SL-11978). Do not exceed the nominal operating pressure of the circuit components.
- Bleed air out of the circuit.

7.4 Chilled Water Connections: Chilled Water Units

Figure 20 Chilled water connections

Top Connections

Bottom Rear Connections

Refer to **Figure 21** when performing these installation steps:

- Use copper tubing or steel pipe.
- Place the tubing on supporting saddles.
- Insulate both tubes
- Install shutoff ball valves on the inlet and outlet pipes to ease maintenance.
- Install optional thermostats and pressure gauges on the inlet and outlet pipes.
- Install a water drain tap at the lowest point in the circuit.
- Fill the circuit with water or glycol.

Figure 21 Chilled water circuit

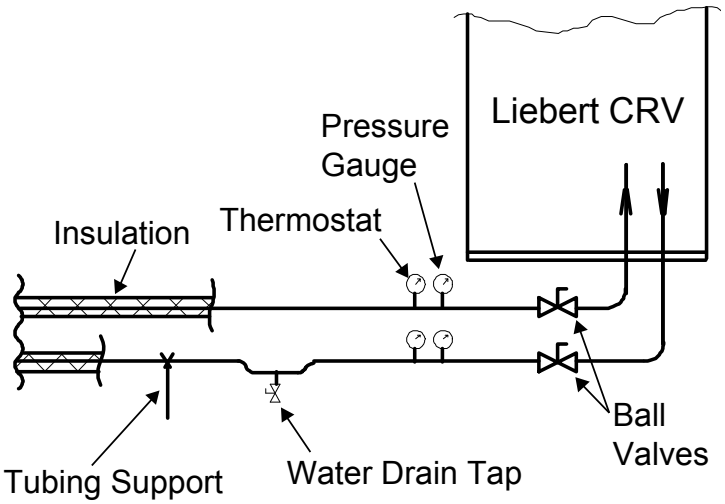


Figure 22 Air bleeding valve position CW

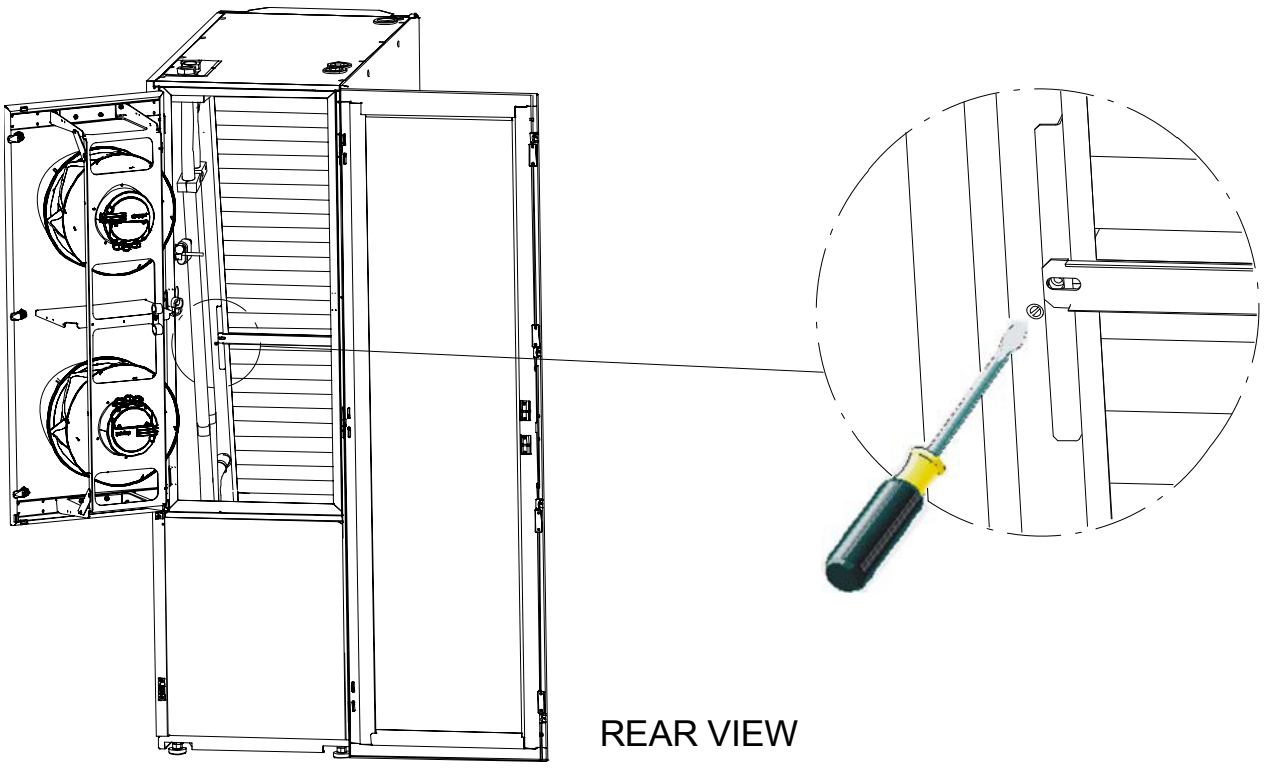
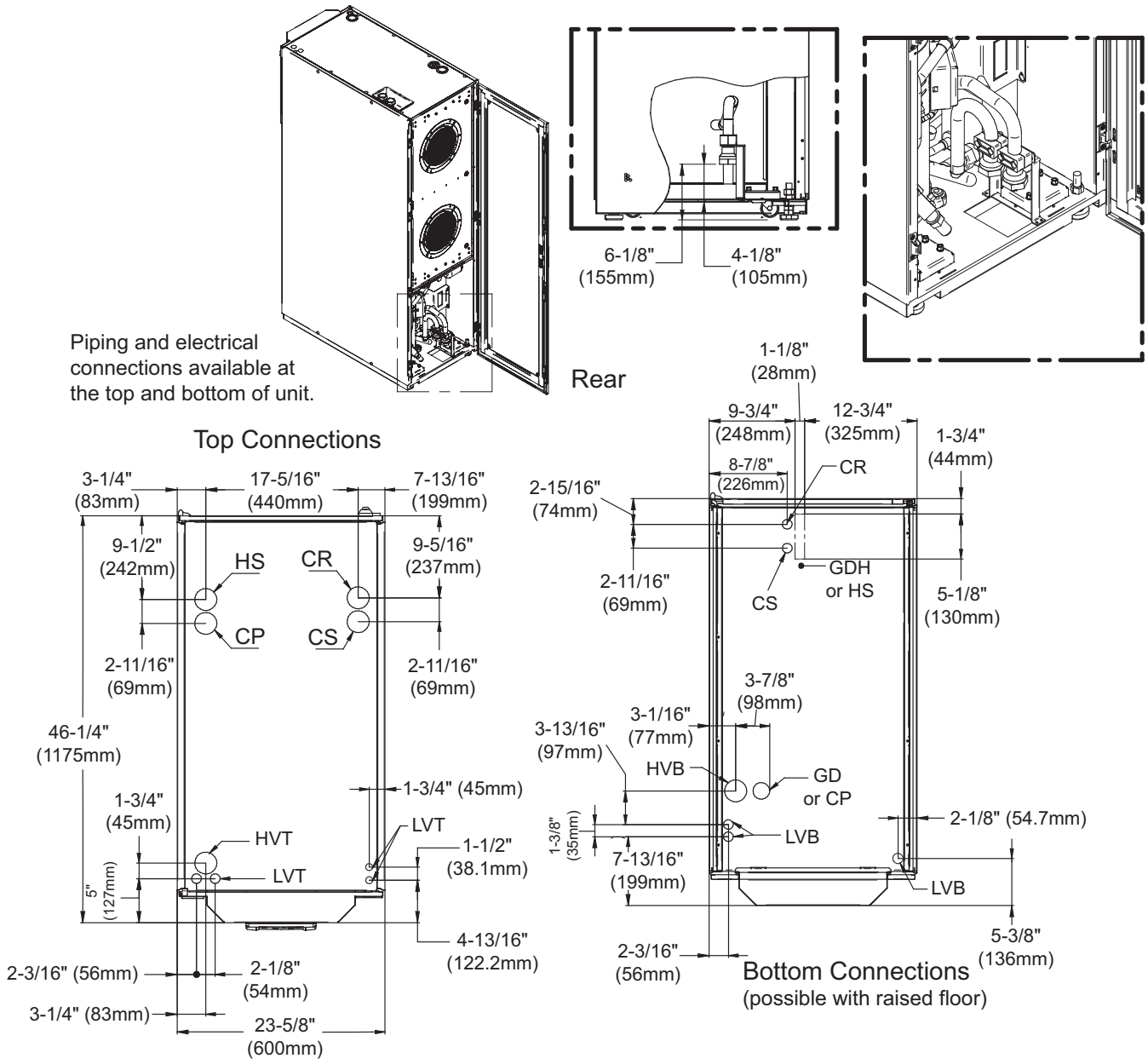


Figure 23 Connections—water/glycol models



* Install a 35 mesh strainer, in an easily accessible location, on the Water/Glycol Supply to prevent particles from entering the heat exchanger. Strainer bypass valves are recommended to allow the strainer to be cleaned while maintaining flow to the cooling unit.

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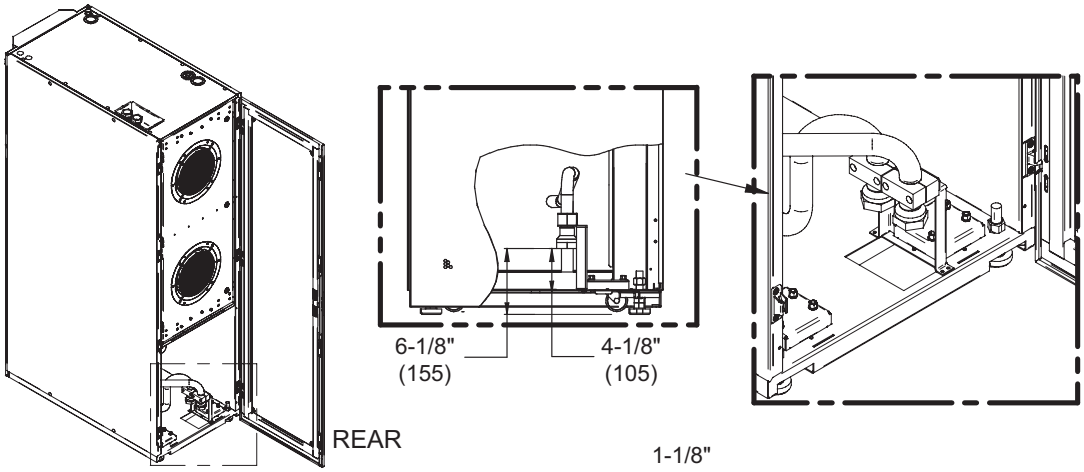
Table 19 Unit connections, water/glycol-cooled models

Unit Connections		CR20W (50Hz)	CR35W (50Hz)	CR20W (60Hz)	CR35W (60Hz)
CS	Water/Glycol Coolant Supply	32mm GAS F		1-1/4" FPT	
CR	Water/Glycol Coolant Return	32mm GAS F		1-1/4" FPT	
GD	Gravity Coil Pan Drain	20mm I.D.		1" MPT	
GDH	Gravity Humidifier Drain	22mm I.D.		N/A	
HS	Humidifier Supply	1/2" GAS F (top connection) 3/4" GAS F (bottom connection)		1/2" FPT (top connection) 1/4" Compression Fitting (bottom connection)	
CP	Condensate Pump	1/2" GAS F		1/2" FPT	
HVT	High Voltage Top Connection	Combination Knockout Hole Diameter 1-3/8" (35mm) 1-3/4" (44.5mm) and 2-1/2" (63.5mm)		Combination Knockout Hole Diameter 1-3/8" (35mm) 1-3/4" (44.5mm) and 2-1/2" (63.5mm)	
HVB	High Voltage Bottom Entrance (feed through the base of the unit)	Hole Diameter 2-1/2" (63.5mm)		Knockout Hole Diameter 2-1/2" (63.5mm)	
LVT	Low Voltage Top Connection	Hole Diameter 7/8" (22mm) 2 places		Knockout Hole Diameter 7/8" (22mm) 2 places	
LVB	Low Voltage Bottom Entrance (feed through the base of the unit)	Hole Diameter 1-7/64" (28mm) 2 places		Knockout Hole Diameter 1-3/32" (27.8mm) 2 places	
LVB2	Low Voltage Bottom Entrance (feed through the base of the unit)	—		Knockout Hole Diameter 1-3/4" (44.5mm) 1 place	

Source: DPN001793, Rev. 2

Figure 24 Connections—chilled water models

Piping and electrical connections available at the top and bottom of the unit.



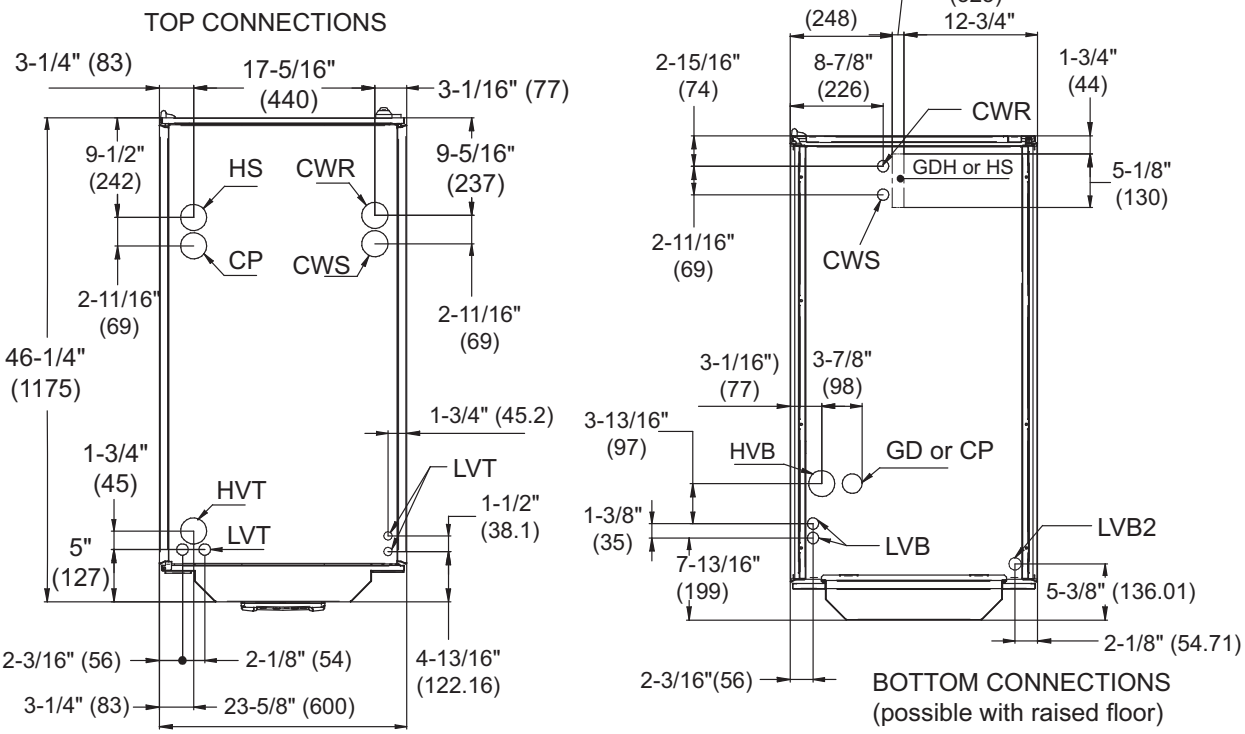


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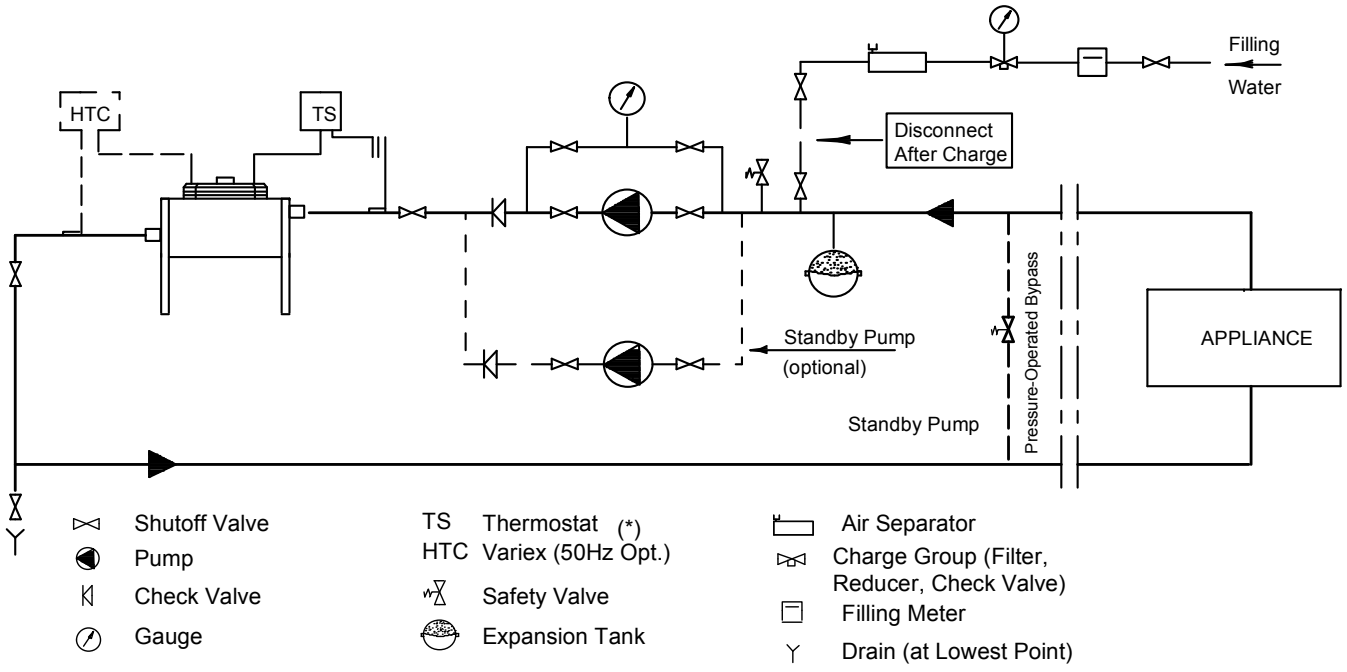
Table 20 Unit connections, chilled water models

Unit Connections		CR040C (50 Hz)	CR040C (60 Hz)
CWS	Chilled Water Supply	32mm GAS F	1-1/4" FPT
CWR	Chilled Water Return	32mm GAS F	1-1/4" FPT
GD	Gravity Coil Pan Drain	20mm I.D.	1" MPT
GDH	Gravity Humidifier Drain	22mm I.D.	N/A
HS	Humidifier Supply	1/2" GAS F (top connection) 3/4" GAS F (bottom connection)	1/2" FPT (top connection) 1/4" Compression Fitting (bottom connection)
CP	Condensate Pump	1/2" GAS F	1/2" FPT
HVT	High Voltage Top Connection	Combination Knockout Hole Diameter 1-3/8" (35mm) 1-3/4" (44.5mm) and 2-1/2" (63.5mm)	Combination Knockout Hole Diameter 1-3/8" (35mm) 1-3/4" (44.5mm) and 2-1/2" (63.5mm)
HVB	High Voltage Bottom Entrance (feed through the base of the unit)	Hole Diameter 2-1/2" (63.5mm)	Knockout Hole Diameter 2-1/2" (63.5mm)
LVT	Low Voltage Top Connection	Hole Diameter 7/8" (22mm) 2 places	Knockout Hole Diameter 7/8" (22mm) 4 Places
LVB	Low Voltage Bottom Entrance (feed through the base of the unit)	Hole Diameter 1-7/64" (28mm) 2 places	Knockout Hole Diameter 1-3/32" (27.8mm) 2 Places
LVB2	Low Voltage Bottom Entrance (feed through the base of the unit)	—	Combination Knockout Hole Diameter 1-3/4" (44.5mm) 1 Place

Source: DPN001794, Rev. 2

Figure 25 Recommended drycooler Installation



See hydraulic drawings in the Appendix D

8.0 ELECTRICAL CONNECTIONS

8.1 Electrical connections

WARNING

Arc flash and electric shock hazard. Can cause injury and death.

Disconnect local and remote power supplies and wear appropriate personal protective equipment per NFPA 70E before working within.

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 control.

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

Install and open a remote disconnect switch and verify with a voltmeter that live hazardous voltage potential is not present inside the unit cabinet before working within. Refer to the unit electrical schematic.

Follow all national and local codes.

WARNING

Risk of electric shock. Can cause injury or death.

This unit has a high leakage current potential. Proper earth ground connection per national and local codes is required before connection to the electric power supply.

Figure 26 Remove electrical panel and lower front panel

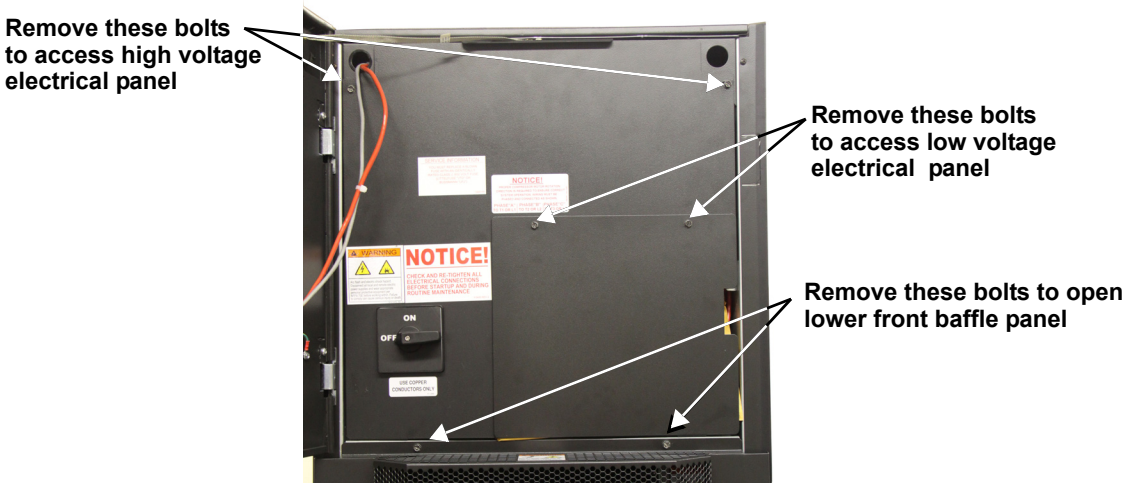
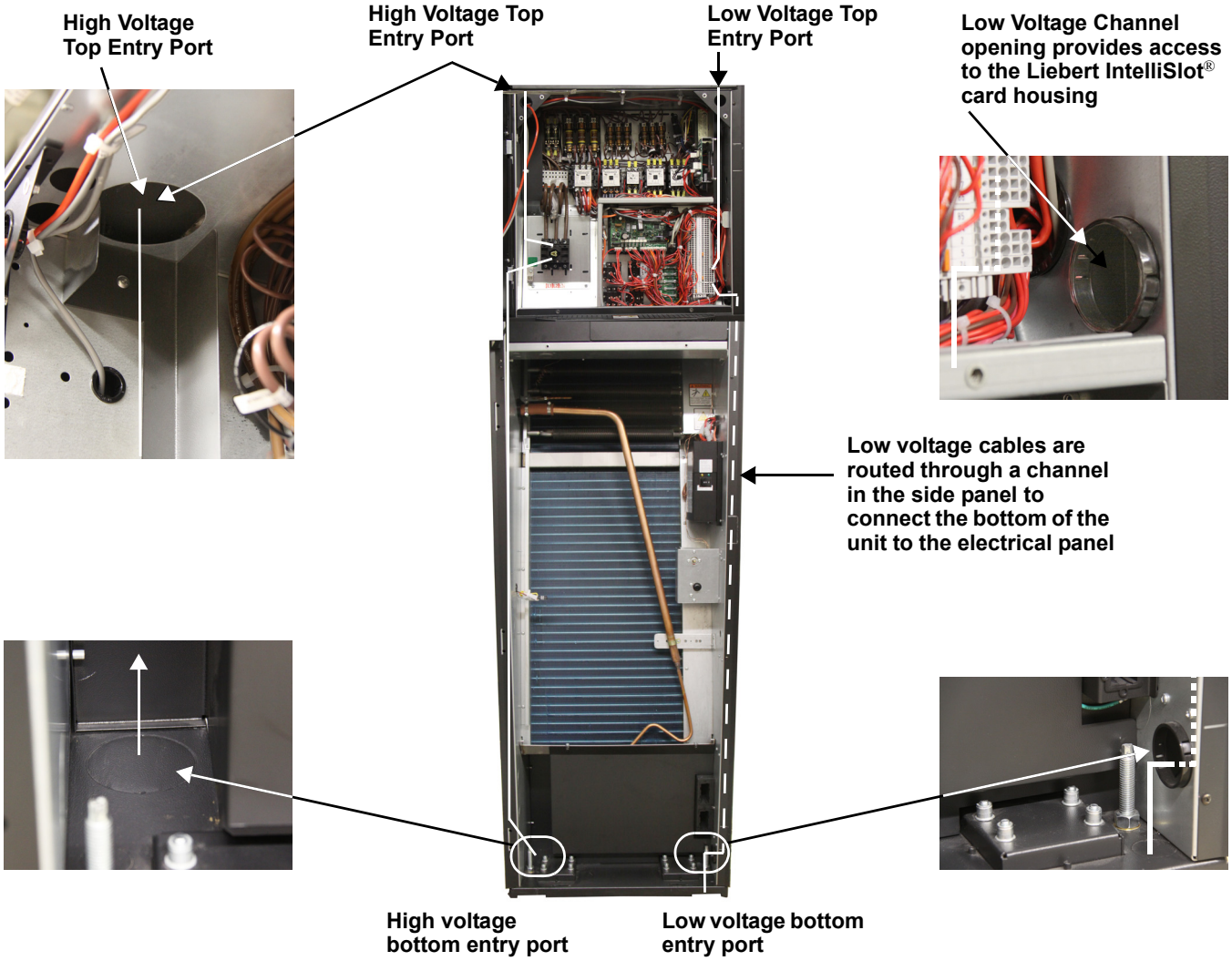


Figure 27 Power and control cable entry points and routing



Before proceeding with the electrical connections, ensure that:

- all electrical components are undamaged
- all terminal screws are tight
- the supply voltage and frequency are as indicated on the unit

8.1.1 Power Supply Cable Connections

- Connect the cable to the line inlet terminal board.
- Use the appropriate cable size for the current draw, supply voltage and installation type.
- Protect the supply using a backup fuse or circuit breaker.
- Do not fit the supply cable in the raceways inside the machine electric board.
- Use only multipolar cables with sheath (CEI20-22).

Wiring Connections

- Remote On/Off connections must be provided by the installer.
- The General Alarm terminals allow remote alarm signalling.

In case of short circuit, check the affected switch for sticking and replace it if necessary.

See electrical data in **Appendix B - Electrical Data**.

8.2 Protective Features of the Electrically Commutated Fans

The EC fans are protected against:

- Overtemperature of electronics
- Overtemperature of motor
- Locked rotor protection
- Short circuit at the motor output

When any of these failures occurs, the motor stops, electronically, with no potential for separation, and the status relay is released.

The unit does not restart automatic automatically. To reset the alarm, the power supply must be switched Off for 20 minutes once motor is at standstill.

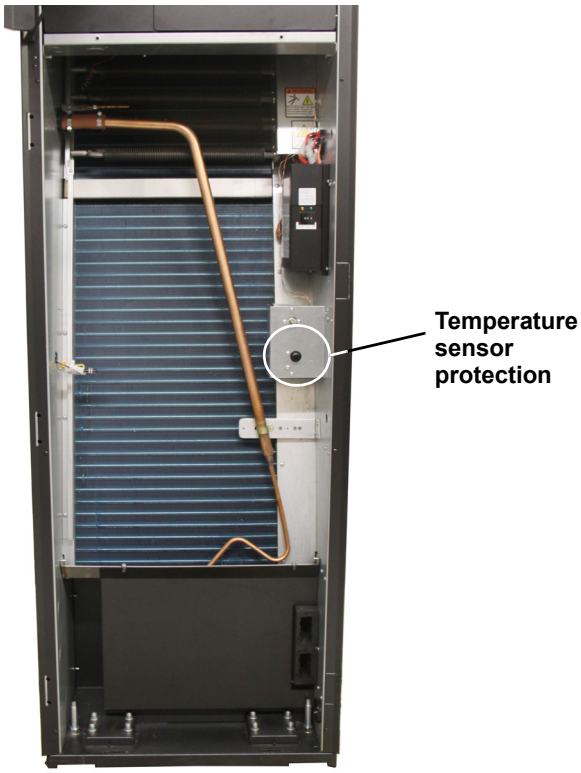
- Input power undervoltage detection:
  If the utility power falls below 3ph/290VAC (typical value) for 5 seconds or longer, the motor is switched Off, electronically, with no potential for separation, and the status relay is released.
  When the utility voltage returns to a correct value, the motor restarts automatically.
- Phase failure recognition:
  If one phase fails for 5 seconds or longer, the motor is switched Off, electronically, with no potential for separation, and the status relay is released.
  When all three phases return to correct values, the motor restarts automatically in 10 to 40 seconds.

The power supply for an external speed-setting potentiometer is protected against short-circuiting.

The motor is overload-protected via motor current limitation.

8.3 Protective Features of Electrical Heaters

Figure 28 Electrical heating with temperature sensor protection



When the temperature sensor detects overtemperature of electrical heating, the thermal protection turns Off the current. To reset the thermal protection, push the button on the front of the unit (see **Figure 28**).

9.0 STARTUP

9.1 Initial Startup

WARNING

Risk of hair, clothing and jewelry entanglement with high speed rotating fan blades. Can cause equipment damage, serious injury or death.

Keep hair, jewelry and loose clothing secured and away from rotating fan blades during unit operation.

WARNING

Risk of contact with rotating fan blades. Can cause injury or death.

The Liebert CRV's fan blades will continue spinning after the unit is shut Off. Wait until the fan blades have stopped before working on the unit.

To start the Liebert CRV:

1. Open all valves in the refrigeration circuit according to the instruction label attached to the valve.
2. **W Models Only**: Open all valves in the water circuit according to the instruction label attached to the valve.
3. Ensure that the refrigerant charge is correct (see **6.0 Refrigerant Connections**).
4. Using a leak detector, verify that there are no refrigerant leaks. If any leaks are detected, repair them and recharge as described in **6.0 Refrigerant Connections**.
5. At least 4 hours before startup, close the main switch and the compressor switch on the electrical panel.

NOTE

The default setting for the Liebert iCOM® control is for stand-alone operation. The stand-alone mode allows users to turn on the unit simply by rotating the main switch on the electrical panel. The yellow LED on the Liebert iCOM will light after the unit is turned on because electrical power is present.

If the LED does not light:

- *check the electrical panel power supply*
- *check the protection devices (e.g., thermal switches)*
- *check the fuses.*

6. Verify that the crankcase heater is working.
7. Check to ensure that there are no water leaks.
8. If an external condenser or drycooler is installed, start it by supplying power to it.
9. Close all MCBs on the electrical panel.
10. Check the supply voltage on all phases.
11. Check the supply voltage on all phases for the external condenser or drycooler, if fitted.
12. Start the unit by pressing the On/Off switch.
13. Check the amp draw of all components (see **8.0 Electrical Connections**).
14. Check the amp draw of the external condenser/drycooler, if fitted.
15. If the compressor makes a loud, unusual noise, invert the electrical connections of the phases supplying the corresponding digital scroll compressor, which accepts only one direction of rotation.
16. Ensure that the fans rotate in the correct direction (see arrow on fan).
17. Ensure that all control system settings are correct and that there are no alarms (see **Figure 48**).
18. **W Models Only**: Verify the water flow is adequate.
19. **W Models Only**: For closed circuit units, ensure that the water pump starts when the compressor starts.

Checks to Perform after Startup

Once the system is operating under load, check the various components, as follows:

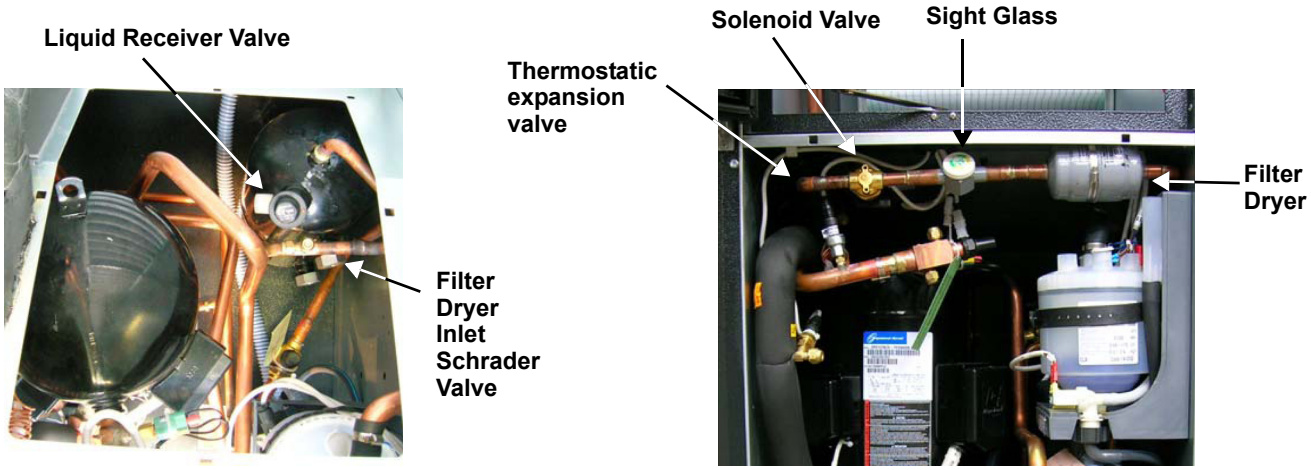
1. Verify that the fans are operating properly.
2. Ensure that the temperature and relative humidity are being controlled, and that the humidifier (optional) and heating steps (optional) operate when required.
3. Ensure that the compressor operates when required.
4. Ensure that the fan operation controller on the external condenser/drycooler (if fitted) is calibrated correctly, and that it controls the fan operation.
5. Record all of the following on the warranty inspection form:
   a. All component voltages and current draws
   b. All air / water temperatures indoor and outdoor
   c. All refrigerant and water / glycol pressures,
   d. All levels of refrigerant and oil in sight glasses
   e. Record refrigerant pressure switch settings and operating pressures
   f. Record superheat and sub-cooling.

9.2 Automatic Restart

If desired, the unit will automatically restart on the return of power after a supply interruption (see **Figure 90**).

To avoid an automatic cold restart of the compressor if a power interruption of several hours is expected, stop the unit before the blackout. After power returns, allow the compressor to preheat before restarting the unit.

Figure 29 Refrigerant line components



9.3 Chilled Water Valve: Chilled Water Models

The 3-way valve controls the chilled water flow and operates as follows (refer to **Figure 4**):

- When the valve is fully open (i.e., maximum chilled water flow), the actuator slot is set to "1."
- When the valve is closed (i.e., no chilled water flow), the actuator slot is set to "0."

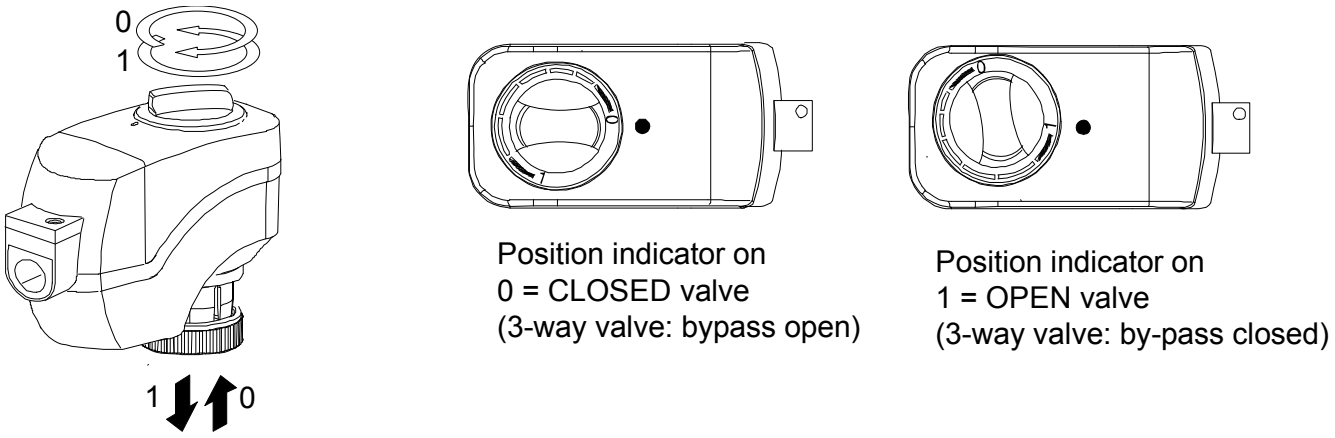
The valve running time is set to the value specified in the control manual.

For more details, see the technical bulletin for chilled water valves and related actuators. Technical bulletins are enclosed with documentation onboard the unit.

NOTE

1. *In the unlikely event of control system failure, the valve can be manually controlled with the rotary knob. It can be used to drive the actuator into any position between 0 and 1.*
2. *When the actuator stem is completely down, the valve is open and chilled water coil is supplied.*

Figure 30 Position of the chilled water valve actuator (for 2- or 3-way valve)



9.4 Adjust Baffles to Direct Air Properly

WARNING

Risk of electric shock. Can cause injury or death.

Disconnect all local and remote electric power supplies before working within.

Ensure that the Liebert CRV is shut down and power has been disconnected before beginning any work on the unit.

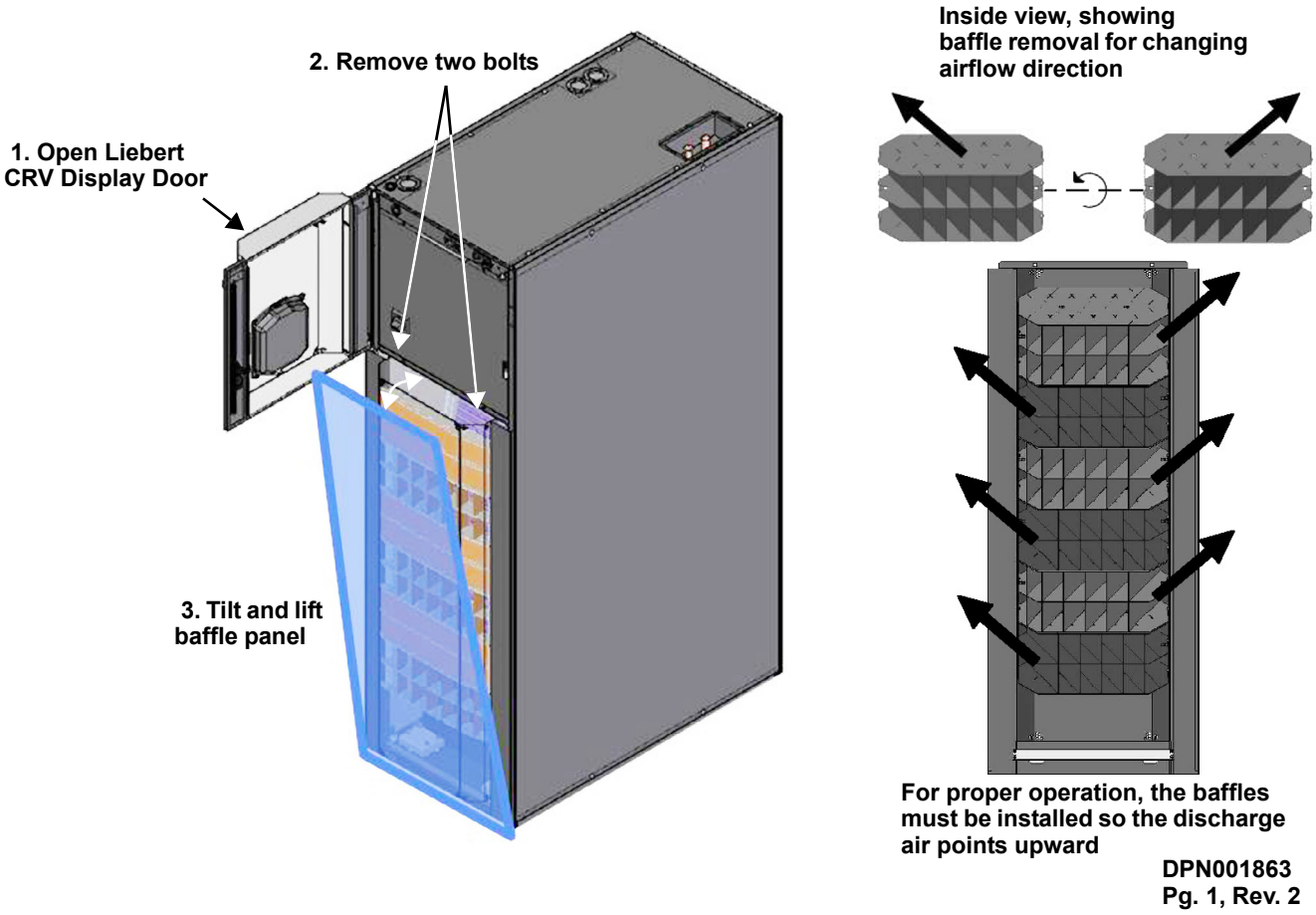
The Liebert CRV has been equipped with an adjustable, modular supply air baffle system. The baffles should be adjusted prior to start-up to direct air towards the racks the cooling unit is intended to condition. Ideally, these should be the same racks the cooling unit is pulling hot air from. The baffles can be readjusted at any time as cooling needs change.

The Liebert CRV is shipped with the baffles in an alternating pattern to direct cold air left and right. This configuration should be used when the cooling unit is located between racks. If a Liebert CRV is installed at the end of a row, all the baffles should be adjusted to blow air down the cold-aisle, toward the racks. The baffle segments at the top of the panel will direct more air than the segments at the bottom. The supply air will travel the furthest when all baffle segments are pointed in the same direction, left or right.

To adjust the baffles:

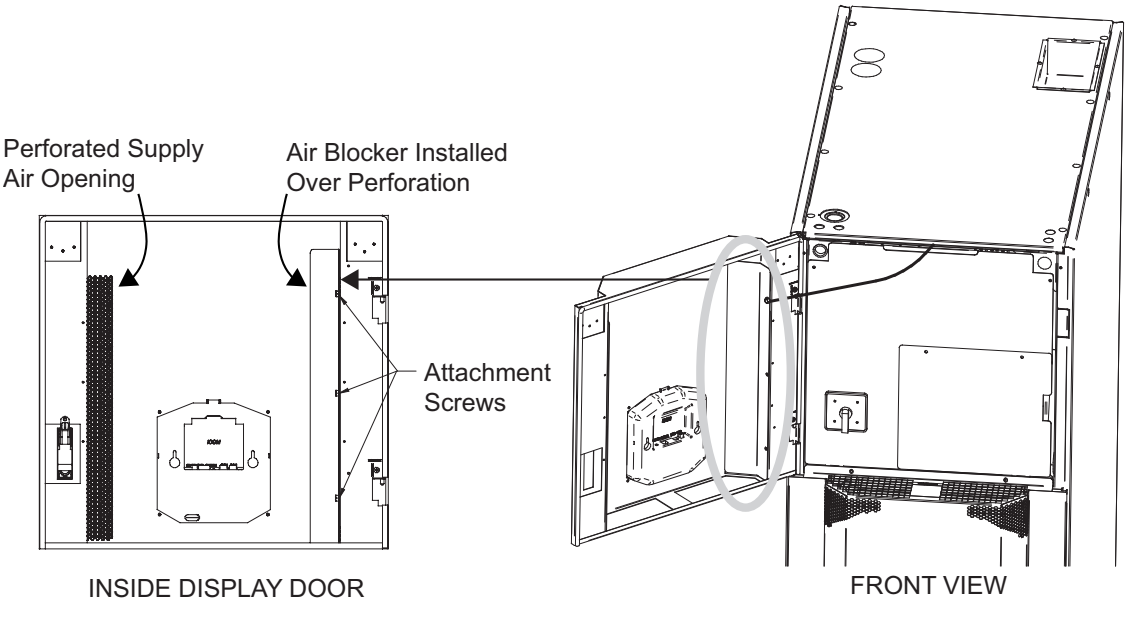
1. Open the door containing the Liebert iCOM® display.
2. Remove the two screws holding a baffle panel segment in place.
3. Slide out the baffle segment.
4. There is one screw on each side of the baffle, as shown in **Figure 31**. Remove the screws and rotate the baffle segment around its horizontal axis to change the airflow direction.
5. Reinsert the baffle segment and reinstall the screws.

Figure 31 Adjust the baffles to ensure correct airflow direction



A blocker plate inside the display door should also be adjusted to direct air towards the racks the Liebert CRV is intended to condition. The blocker plate can be installed on the left or right side of the display door, or it can be removed to discharge air left and right.

Figure 32 Adjust air-blocking plate



Instructions to adjust the air blocker:

1. Remove the three screws that attach the blocker plate to the display door.
2. Reattach the blocker plate to the other side of the display door or remove entirely.

9.5 Remote Rack Sensor Wiring

The Liebert CRV is capable of supporting up to ten (10) 2T remote rack temperature sensor housings. It is recommended that one (1) 2T housing be attached to each rack the Liebert CRV is intended to cool. The sensors provide feedback directly to the cooling unit to improve efficiency and performance. Rack sensors help combat cooling problems related to recirculation air, uneven rack loading and air distribution. The 2T rack sensors are intended for cold aisle use only.

While installing the rack sensors is optional, Emerson recommends that they be installed. Installations with multiple Liebert CRV cooling units should be connected in a Unit-to-Unit (U2U) Ethernet network to leverage all of the Liebert iCOM® control benefits, see **11.3 Wiring a Liebert iCOM® U2U Network**.

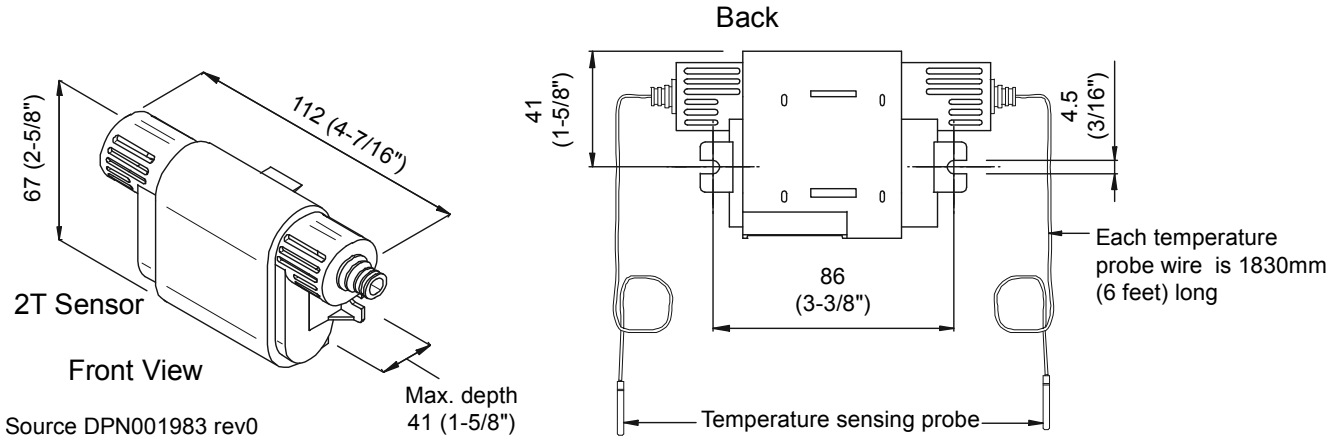
A sensor network can be extended at any time by connecting additional 2T sensors to the last 2T sensor on the network. Sensors connect in a daisy chain fashion back to the cooling unit; individual wires

from each sensor to the cooling unit are avoided.

There are two steps to setting up a remote rack sensor:

- The DIP switches of the remote rack sensor must be configured to have a unique ID
- The Liebert iCOM control must be set to use the remote rack sensor as either a controlling sensor or as a reference sensor.

Figure 33 Figure 2T rack sensor



Source DPN001983 rev0

9.5.1 DIP Switch Settings

Three 2T sensor housings are included with each Liebert CRV. The DIP switches in these sensors have been preset at the factory. It is recommended that you confirm that the DIP switches have been set correctly using the below table. Any additional 2T sensor housings will need their dip switches set per the below table. If the dip switches are not set correctly, the control will not operate properly.

Figure 34 DIP switches in 2T sensors

Switch Up = ON

Switch Down = OFF

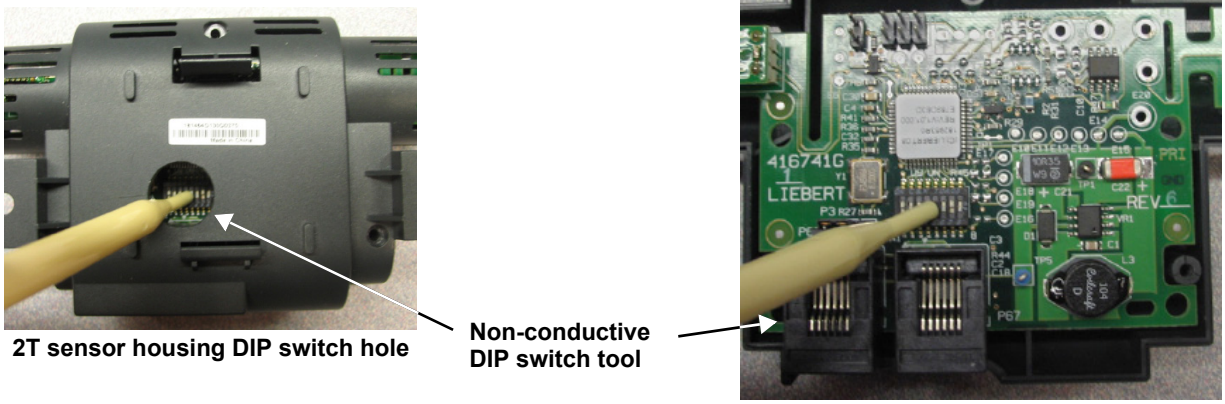
Table 21 DIP switch settings

2T Rack Sensor	DIP Switch Position								Factory-Set to Terminated
	1	2	3	4	5	6	7	8	
Included with Liebert CRV									
Sensor # 1	Off	Off	ON	Off	ON	off	off	off	—
Sensor # 2	ON	Off	ON	Off					—
Sensor # 3	Off	ON	ON	Off					Yes
Optional 2T Rack Sensors									
Sensor # 4	ON	ON	ON	Off	ON	off	off	off	—
Sensor # 5	Off	Off	Off	ON					—
Sensor # 6	ON	Off	Off	ON					—
Sensor # 7	Off	ON	Off	ON					—
Sensor # 8	On	ON	Off	ON					—
Sensor # 9	Off	Off	ON	ON					—
Sensor # 10	ON	Off	ON	ON					—

9.5.2 Set 2T Rack Sensor Identities—DIP Switch settings

1. Confirm the DIP switches are set correctly for 2T sensors numbered 1, 2 and 3.
2. If additional sensors are to be connected to a cooling unit:
   a. Apply numbered stickers to the sensor housings, corresponding to sensor chain position.
   b. Based on the sensor number, use the included DIP switch tool to set the DIP switches according to the table above. If you are having difficulty setting switches through the opening in the housing or if the hole is not present, you may open the case by removing the three Phillips-head screws. Reassemble housing once complete.

Figure 35 Setting 2T Sensor DIP Switches



Note: Use included DIP switch tool (or similar tool). DO NOT insert any metal object into the sensor case.

9.5.3 Terminating the Last 2T Sensor on a Network

The last 2T sensor on the network, which can be identified by only having one CAN cable plugged into it, needs to be "Terminated". All other 2T sensors on the network need to remain "Un-terminated". Sensor #3 is setup as "Terminated" when it leaves the factory. As long as Sensor #3 is the last sensor on the network, none of the other termination jumpers in the other sensors need to be adjusted.

Note: The sensors do not need to be connected in numerical order.

For example, if five sensors are purchased, they can be connected in the following pattern:

CRV Cooling Unit → Sensor #5 → Sensor #2 → Sensor #4 → Sensor #1 → Terminated Sensor #3

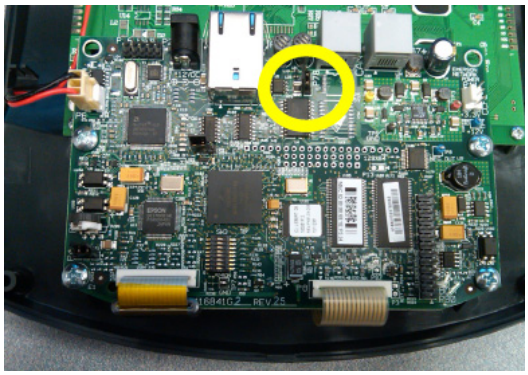
Note: In the above example, if additional sensors are added at a later time to extend the existing sensor network, Sensor #3 will have to be "Un-terminated". The additional sensors can then be connected, and the new last sensor on the network will have to be "Terminated".

- the last sensor in the new network must be terminated.

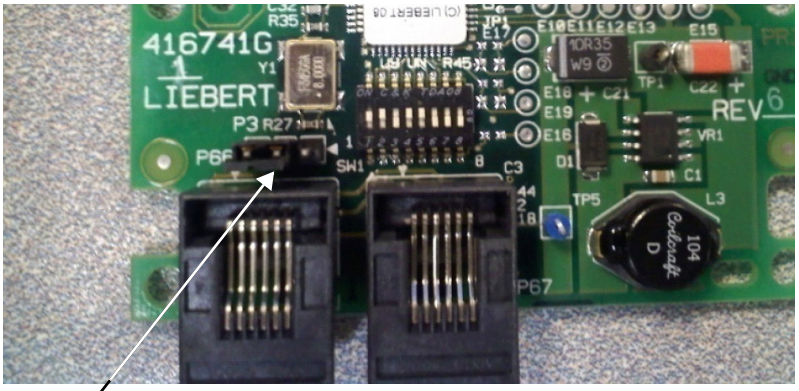
To terminate a 2T sensor:

1. Open the sensor's case by removing the three screws that hold it together.
2. Pull the black jumper off the circuit board from Pins 1 and 2 (see **Figure 36**).
3. Install the jumper on Pins 2 and 3.
4. Reassemble the sensor housing.

Figure 36 Termination jumper setting

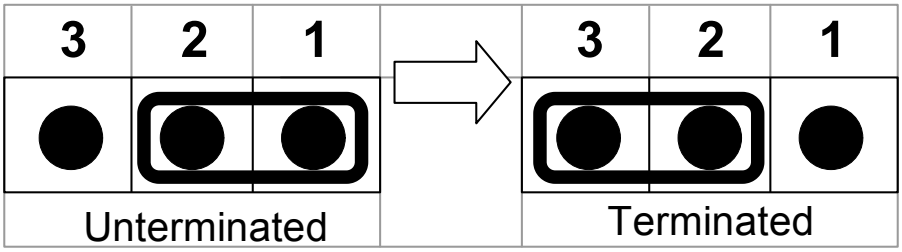


Circuit board inside display housing



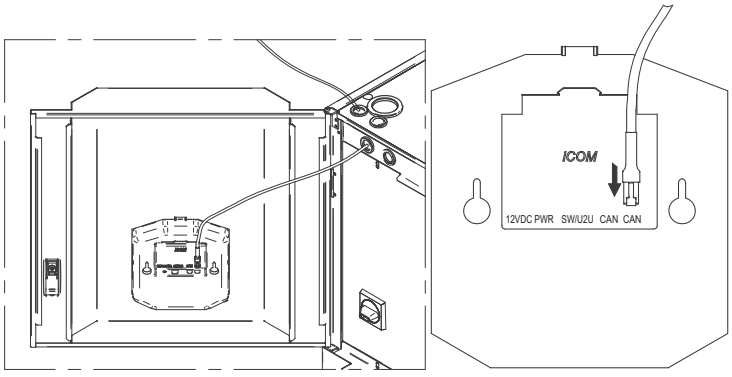
Circuit board inside 2T sensor housing

Termination Jumper
in the Terminated Position



9.5.4 Route the CAN bus wire into the cooling unit

The CAN bus sensors connect to the open CAN port on the back of the unit display panel. The Display comes "Terminated" from the factory and will have to be "Un-terminated' to allow for additional sensors to be added. See photo above for termination jumper location for front panel display and sensor boards. Note that connecting the CAN bus sensors will require entering the High Voltage electrical compartment of the Liebert CRV. If you are not comfortable with the installation procedure, it is recommended that you hire a certified electrician.



Inside of Display Door

Rear of Large Graphic Display

Source DPN001983 Rev. 0

Connect the 10ft CAN wire to the open CAN bus port on the rear of the iCOM graphic display.

Ensure there is enough slack in the wire to allow the door to open and close freely, but not too much slack to bind or pinch when the door is shut. It is recommended that a cable tie is used to secure the wiring.

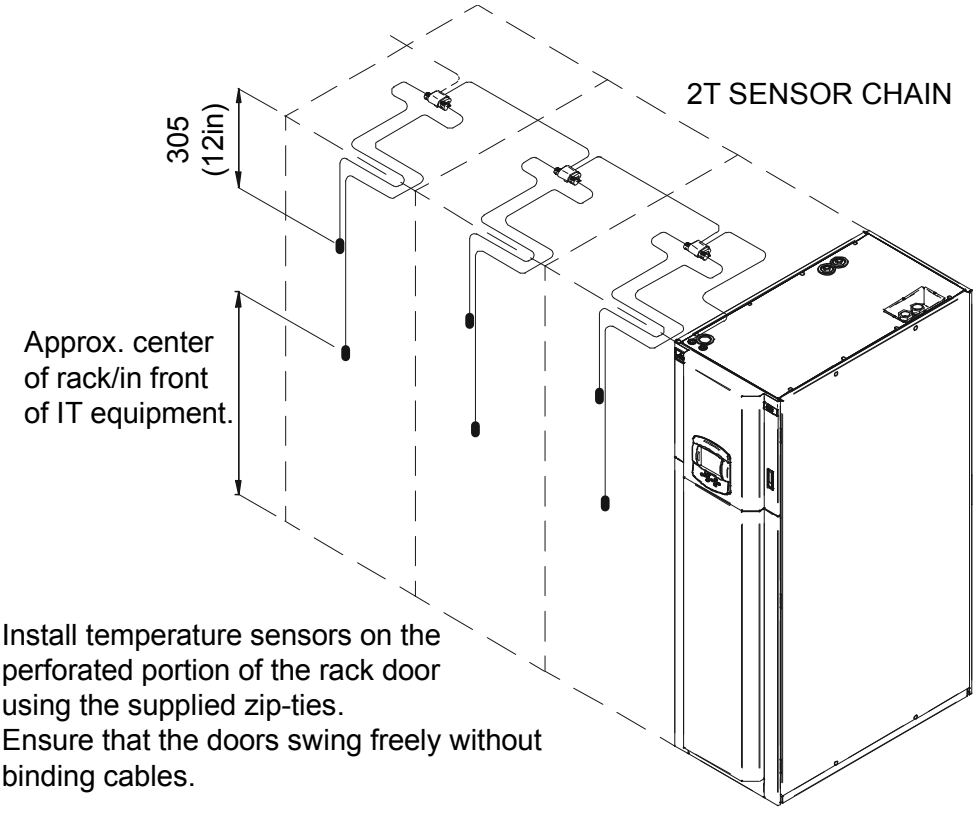
Connect the other end of the 10ft CAN cable to the nearest 2T rack sensor. Use additional CAN cables to connect the remaining 2T rack sensors to each other. The order in which the 2T sensors are attached does not matter; however, be sure that the last sensor connected is the one set to "terminated". As a best practice, avoid using excessive lengths of cable between sensors.

9.5.5 Installing 2T sensors on racks

Both temperature sensors attached to a 2T sensor housing are to be installed on 1 rack. The sensor can be attached to the inside or outside of the rack's front door.

- One temperature sensor is to be attached near the top of the rack's front door by using a cable tie to secure the wire to the perforation (approx. 12" [305mm] from the top). Do not wrap a cable tie around the actual sensor on the end of the wire. This sensor will monitor for hot air wrapping over the top of the rack from the hot aisle.
- The other temperature sensor is to be attached to the rack's front door, centered in front of the heat generating equipment that will be drawing in air.
  - If the rack is completely filled with equipment, locate the sensor in the middle of the door, width and height.
  - If the rack is partially filled with equipment, locate the sensor in the center of the equipment on the front door.
- Do NOT
  - Install a sensor in the hot aisle
  - Leave a sensor coiled on top of or inside the rack.
- With the temperature sensors in place, neatly route the wires up the rack door and into the rack using the supplied cable ties. Be sure to leave an appropriate amount of slack in the cable to allow the rack door to open and close without binding or pinching the wires.
- Affix the 2T sensor housing to the rack using the supplied hook-and-loop fastener. It is recommended that the housing be installed in an easily accessible space with the sensor number label visible in case the housing needs accessed at a later time.
- Repeat this process until all sensors have been installed.

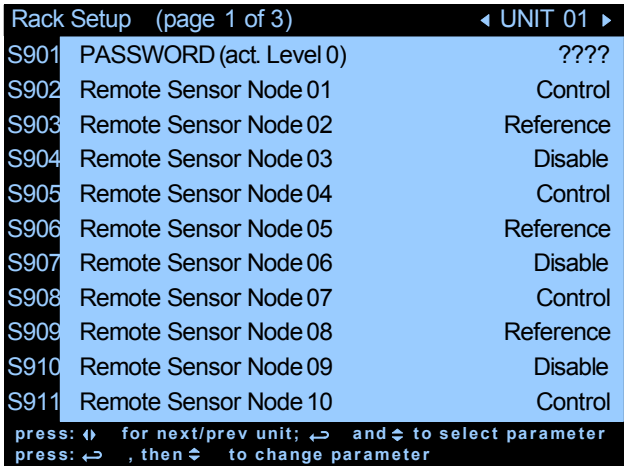
Figure 37 2T rack sensors installed on neighboring racks



Located in the Service / Rack Setup Menu of the Liebert iCOM® display, the sensors can be set up to either display or control temperature, give them a rack name and draw a rack layout that can be viewed in the User menu.

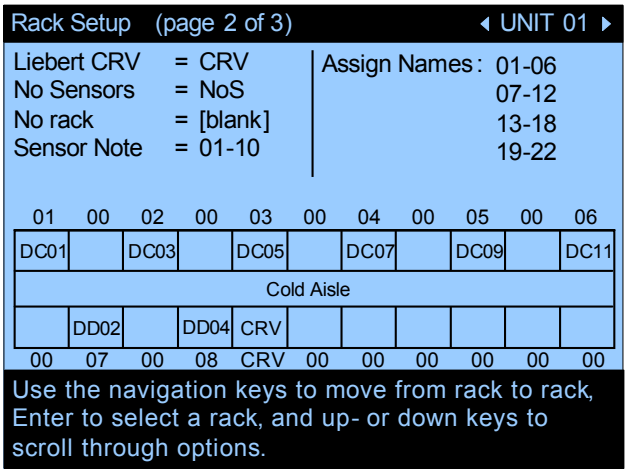
9.5.6 Remote Rack Sensor Operation and Rack View Setup

Figure 38 Rack setup screen, page 1 of 3



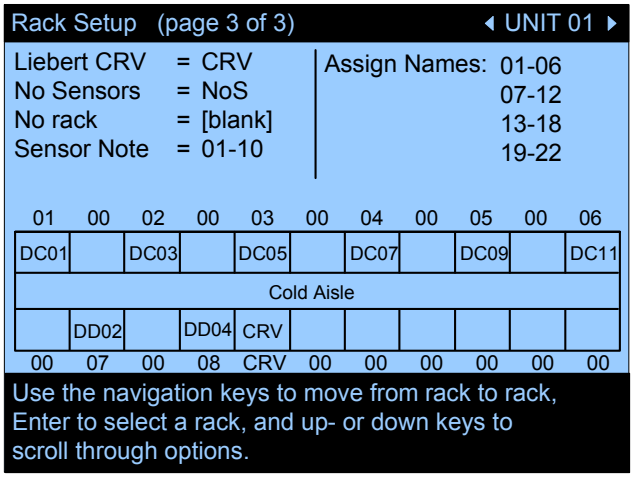
Once the remote rack sensors have been configured and plugged into the CAN bus network, the control can be configured to use the sensor for either control or reference. If the sensor is set to "Disable," it will be ignored. The sensor node number corresponds to the DIP switch assignment of the sensor.

Figure 39 Rack setup screen, page 2 of 3



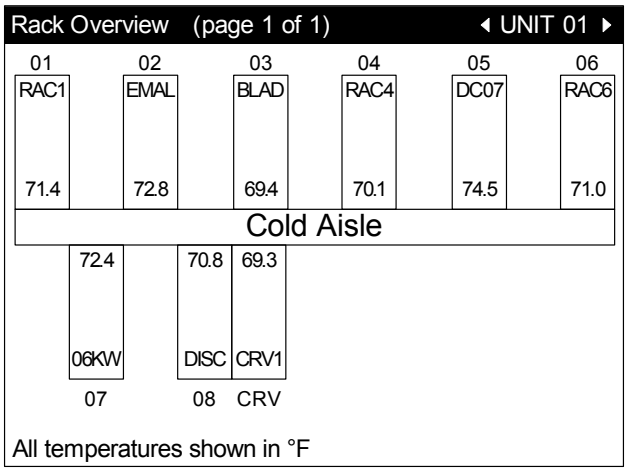
Once a sensor has been assigned to either control or display its temperature data a virtual position can then be assigned to the sensor. This screen configures the Rack View layout in the User menu. This step is not required for the sensor to operate but does provide a logical position in the row for quickly referencing affected racks near the Liebert CRV. To set up navigate using the arrow and enter keys to highlight the Assign Sensors number range. Once the range is selected then press the enter key to move to the rack location blocks at the bottom of the screen. The Up and Down arrow keys can be used to select the sensor node number. For the Liebert CRV select "CRV."

Figure 40 Rack setup screen, page 3 of 3



Once a sensor has been assigned to either control or display its temperature data, a custom label can be assigned to the sensor. This step is not required for the sensor to operate but does provide a logical name for identification. Navigate using the arrow and enter keys to highlight the Assign Names number range. Once the range is selected then press the Enter key to move to the rack location blocks at the bottom of the screen. The Up and Down arrow keys can be used to select any alpha or numeric value up to four positions.

Figure 41 Rack overview screen



If the Rack Setup menus are configured in the Service menu to locate and label the remote rack sensors, then the Rack View in the User menu should look similar to the screen above. This screen will show the node number at the top of each block, the label and the actual temperature that each sensor is currently measuring.

10.0 LIEBERT iCOM® CONTROL

The Liebert CRV is equipped with the most advanced Liebert iCOM control system. The large Liebert iCOM display is standard on the Liebert CRV.

Each Liebert CRV contains a return air temperature and humidity sensor, supply air temperature sensor and three remote rack sensors. Up to an additional 7 remote rack sensors can be added to the sensor network. Each rack sensor takes two temperature readings and reports either the average or the maximum temperature of the two sensors.

The 2T rack temperature sensors provide feedback to the cooling unit about the condition of the air entering the server racks. This information allows the Liebert CRV to ensure it is providing just enough cold air to each rack, virtually eliminating hot spots. Overcooling and excessive airflow are avoided, greatly reducing unnecessary energy consumption.

Each Liebert CRV includes three 2T rack temperature sensors to monitor three racks. A total of ten 2T temperature sensors can be connected to each cooling unit to monitor every rack a Liebert CRV is protecting. When multiple cooling units are connected in a Unit-to-Unit iCOM control network, all sensor data is shared to optimize their performance as a system.

2T rack sensors can also be initially installed on empty racks reserved for future growth with the control set to ignore these sensor readings. The extra 2T temperature sensor readings can also be displayed on the local display and reported remotely for monitoring purposes only; not impacting unit operation. This function provides users with a built-in mini-monitoring system.

Table 22 Keyboard icons and functions

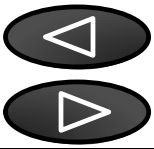
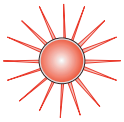
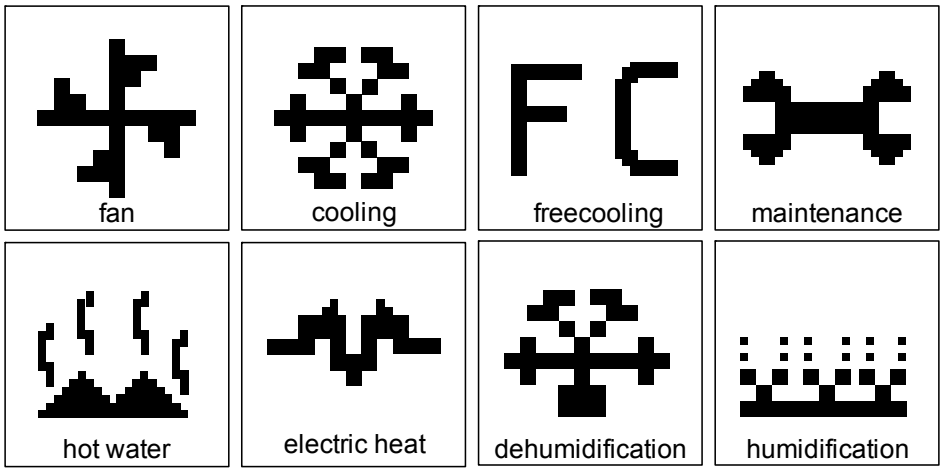
Icon	Key Name	Function
	On/Off Key	Controls the operational state of the cooling unit.
	Alarm Key	Silences an alarm.
	Help Key	Accesses integrated Help menus.
	ESCape Key	Returns to the previous display view.
	Enter Key	Confirms all selections and selects icons or text.
	Increase Key (Up Arrow)	Moves upward in a menu or increases the value of a selected parameter.
	Decrease Key (Down Arrow)	Moves downward in a menu or reduces the value of a selected parameter.
	Left and Right Arrow Keys	Navigates through text and sections of the display.
	Upper LED	Blinking Red—Active, unacknowledged alarm exists
		Solid Red—Active, acknowledged alarm exists
	Lower LED	Amber—Power is available to the unit; unit is NOT operating
		Green—Unit is operating with no alarms

Figure 42 Liebert iCOM® default screen symbols



10.1 Navigating Through the Liebert iCOM Menus

Liebert iCOM shows icons and text for monitoring and controlling your Liebert cooling units or network of cooling units. The number of icons and amount of text shown depends on the display size.

10.1.1 Control Interface

When the buttons on the Liebert iCOM control have not been pressed for a short period, the display backlight turns off. Pressing any key will turn the backlight on (wake up the screen) and display the Status menu of the last cooling unit viewed. The Status menu will show the cooling unit's operational mode(s), return air temperature and humidity readings, temperature and humidity setpoints and any active alarm conditions.

If the cooling unit has a large display and is not on a network, whether it is networked or stand-alone, the Status menu will display only that cooling unit's information. Any large display that is connected to a network can be used to view any cooling unit on the network or show an average view of the entire system of cooling units.

The Liebert iCOM control has three main menus: User, Service and Advanced.

The User menu contains the most frequently used features, settings and status information. The Service menu contains settings and features used to set up unit communications and for unit maintenance. The Advanced menu contains settings used to set up the unit at the factory.

NOTE
Menu settings may be viewed without a password, but changing settings requires a password. If a password is required, Liebert iCOM shows a prompt to enter the password. The password for the User menu is 1490. The password for Service menu is 5010. For details on entering a password, see ***Entering a Password on page 53***

10.1.2 Accessing Submenus

To access the User, Service or Advanced menu, press the Enter or down arrow key while viewing the Status menu of the unit you wish to access. The User menu will be displayed first. To view the Service or Advanced menus, press the right arrow key.

Accessing Submenus on Large Displays

While viewing the menu you wish to access (User, Service or Advanced), press the enter key to highlight the first icon. Use the arrow keys to navigate through the icons. With the desired icon highlighted, press the enter key to enter that submenu. Once in a Submenu, a list of parameters will be displayed.

The up and down arrow keys may be used to scroll through the parameters page-by-page if the submenu has multiple pages. To scroll item-by-item, press the Enter key and then use the up and down arrow keys. Using the right or left arrow keys on large displays attached to a network will

change the unit being viewed. Pressing the ESC key will go back a level. **Figures 44** and **45** show the Liebert iCOM® control menus for a stand-alone large display and for a networked large display, respectively.

NOTE

Settings are readable without a password, but changing settings requires a password.

10.1.3 Entering a Password

To change the value of a parameter in a menu, you must first enter the password for that menu. Each menu—User, Service and Advanced—has a unique password to prevent unauthorized changes.

The User menu password is 1490; the Service menu password is 5010.

NOTE

Entering the Service menu password permits access to both the User and Service menus; changes can then be made to parameters in either level.

To enter a password:

1. Navigate to the menu that contains the parameter to be changed.
2. Select *Password* in the submenu by pressing the Enter key
3. Press the Enter key to move your cursor to the right side of the screen to select the question marks.
4. Use the arrow keys to enter the numeral for the password's first digit (the up arrow key moves from 1 to the next digit).
5. Use the right arrow key to move to the next question mark and repeat **Step 4** to enter all digits in the password.
6. After entering the password, press enter.

If the password is correct, the *Actual Level* shown to the right of *Password* will change from 0 to 1 or 2. The menu will remain locked if the password was incorrect.

NOTE

Returning to the Status menu will require re-entering a password to make changes.

Figure 43 Entering a password

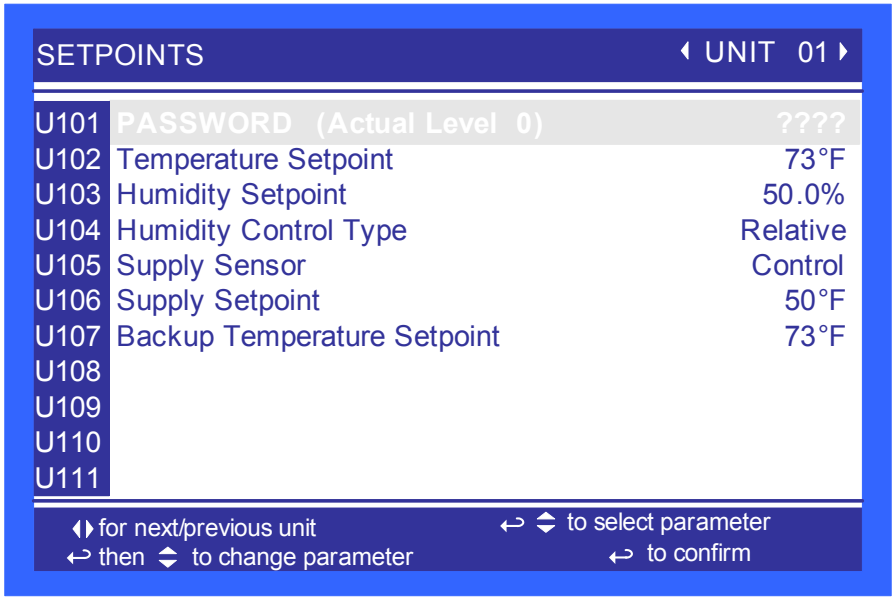
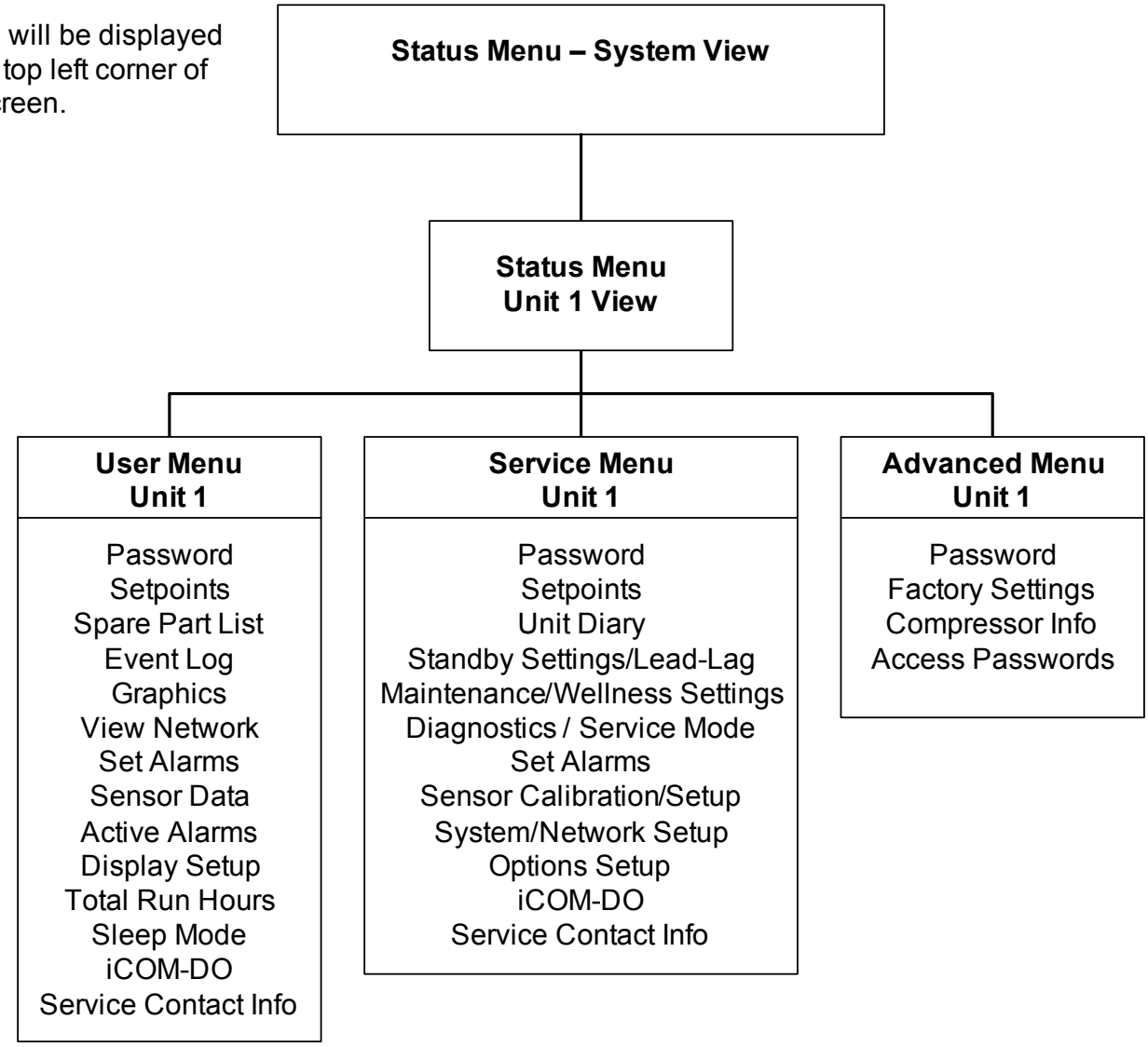


Figure 44 Menu tree—Large display, stand-alone

Unit 1 will be displayed in the top left corner of the screen.



10.1.4 Viewing Multiple Units with a Networked Large Display

When you first wake up the control, press the ESC key to return to the System view Status menu. This view shows an average of all the units on the network and any alarms present. To view a specific unit on the network, press either the enter key or down arrow key. When you do this, you will see the word *System* in the top left of the screen change to a unit number. Using the left and right arrow keys you can toggle through the various units on the network. To go back to the System view, or back one level from any menu in the control, press the ESC key.

Figure 45 Menu tree—Large display, networked

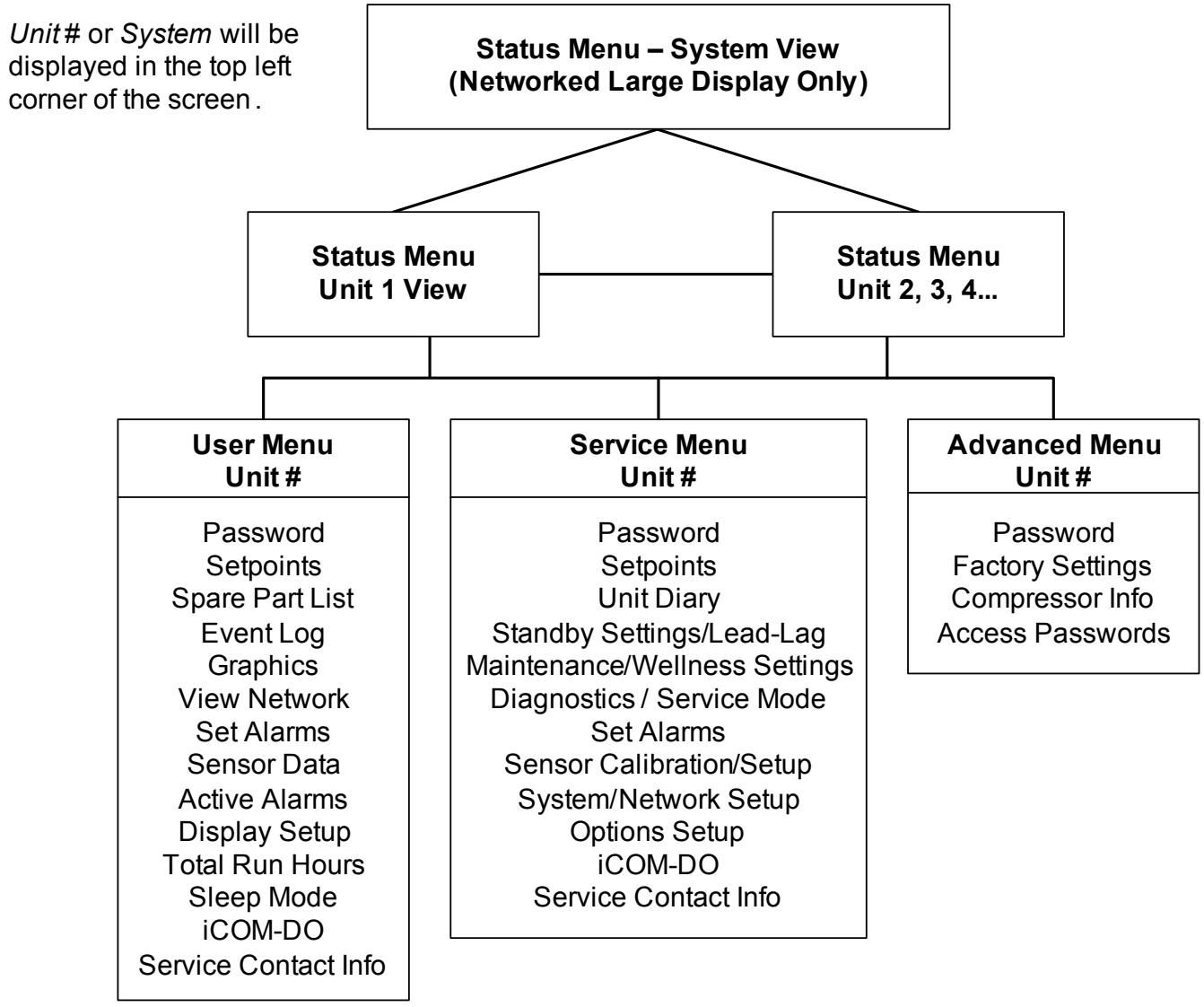
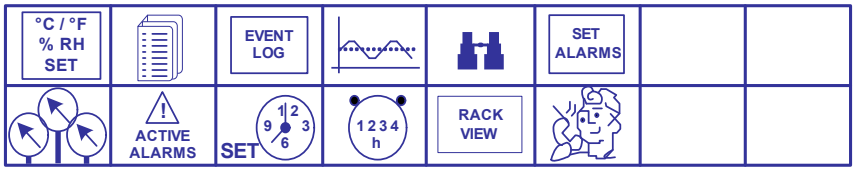


Figure 46 User menu icons



User Menu password: 1490

Table 23 User menu icons

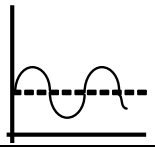
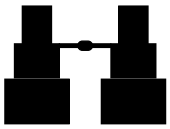
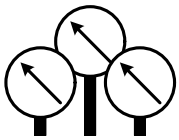
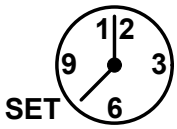
Icon	Name	Description
°C / °F % RH SET	Setpoints	View and change temperature and humidity setpoints
	Spare Part List	Displays the various part numbers of the components/parts in the cooling unit
EVENT LOG	Event Log	Contains last 400 events
	Graphics	Displays temperature and humidity graphs
	View Network	Shows status of all connected units
SET ALARMS	Set Alarms	Allows enable, disable and settings for alarms
	Sensor Data	Shows readings of standard and optional sensors
 ACTIVE ALARMS	Active Alarms	Allows the user to view all current active alarms
 SET	Display Setup	Change settings for display: language, time, simple or graphic view
1234h	Total Run Hours	Records the run time of all components and allows setting of limits on run time

Table 23 User menu icons (continued)

Icon	Name	Description
RACK VIEW	Rack View	Allows viewing data, collected by sensors, about rack status
	Service Contact Info	Contains key contact information for local service, including names and phone numbers
DO	iCOM-DO	Change settings for Liebert iCOM® Discrete Output card

Figure 47 Service menu icons

Service Menu password: 5010

Table 24 Service menu icons

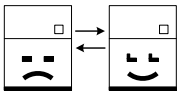
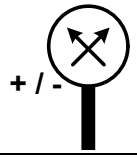
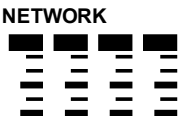
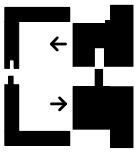
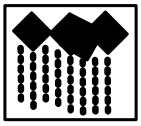
Icon	Name	Description
°C / °F % RH SET	Setpoints	To view and change temperature and humidity setpoints
	Unit Diary	Shows all entered program changes and maintenance performed on the unit
	Standby Settings/ Lead-Lag	Allows lead/lag setup when multiple units are connected
 WELLNESS	Maintenance/ Wellness Settings	Allows setting maintenance interval reminder, maintenance message, number of unit starts and stops and time since last maintenance
 SERVICE	Diagnostics/ Service Mode	Allows troubleshooting, manual mode, read analog and digital inputs
SET ALARMS	Set Alarms	Allows enable, disable and settings for alarms

Table 24 Service menu icons (continued)

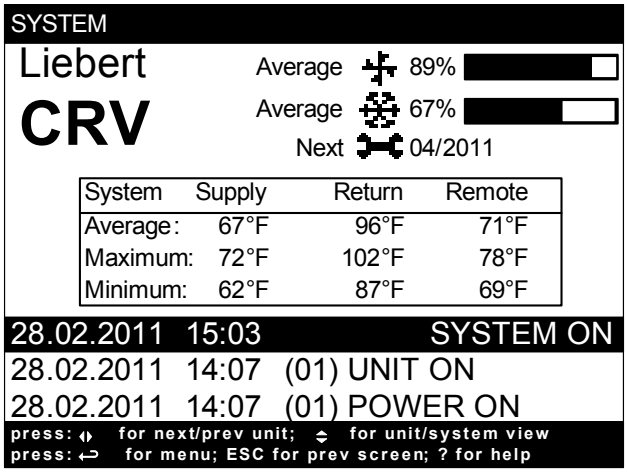
Icon	Name	Description
	Sensor Calibration/Setup	Allows calibration of sensors
	System/Network Setup	Allows setup and U2U communication for multiple units
	Options Setup	Allows setup of component operation
	Rack Setup	Label racks, establish settings for sensors
	Service Contact Info	Contains key contact information for local service, including names and phone numbers
	Humidifier Settings	Change Humidifier settings

10.2 Liebert iCOM® Display Readout

The Liebert iCOM controller for the Liebert CRV supports multiple main screen layouts. The screens are a graphical representation of the Liebert CRV, selectable to show unit operation with or without rack sensors, unit operation with a rack sensor summary, historical temperature and humidity trending or trending the screens used on other Liebert products. Unlike other Liebert cooling products, the Liebert CRV display will always revert to the Unit Screen instead of the System Screen.

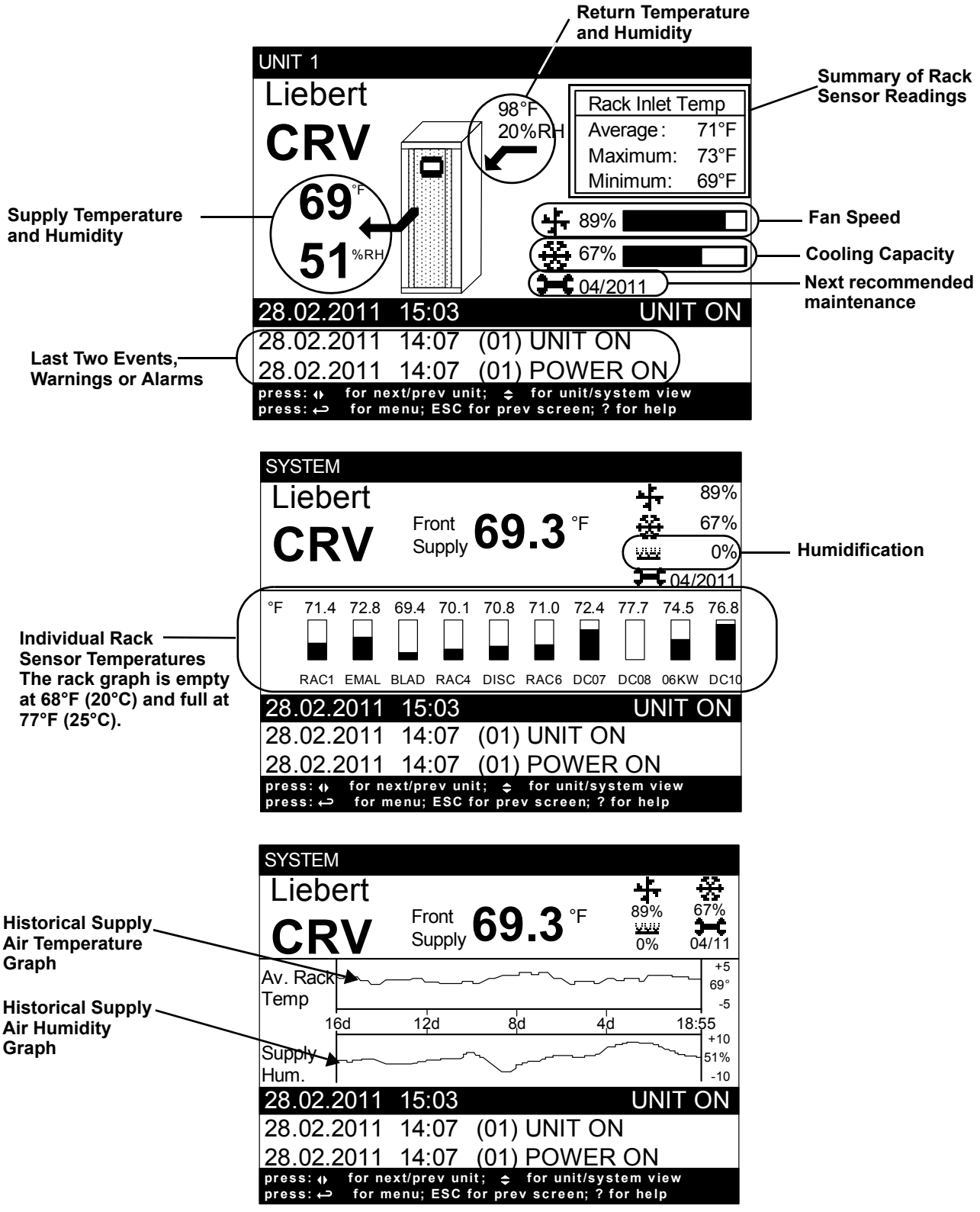
The following screens are user preference. The remote rack sensor screens should be used only when remote rack sensors are connected.

Figure 48 Liebert CRV system screen



The System screen can be accessed by pressing the Up arrow key when the Unit screen is displayed. The System screen shows the fan speed and cooling capacity averages of all connected units. The Supply, Return and Remote Rack sensors of all connected units are also displayed showing the average, maximum and minimum of all connected sensors.

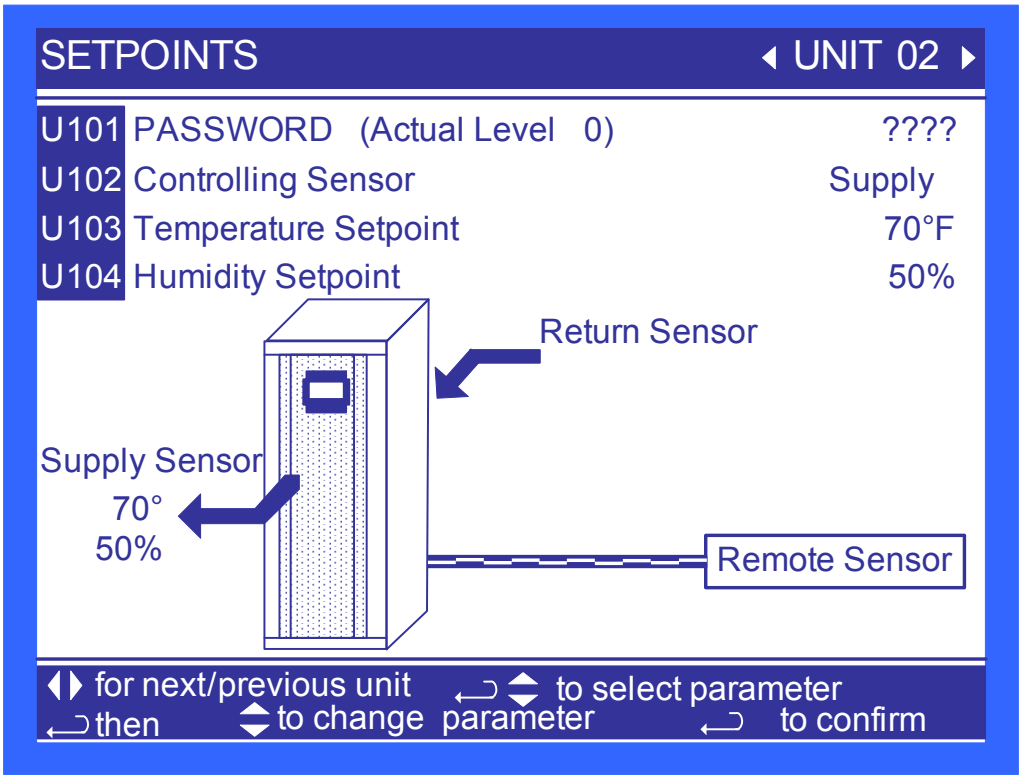
Figure 49 Liebert iCOM® menu components for Liebert CRV



10.3 Liebert iCOM® Control Setup

The Liebert iCOM on the Liebert CRV leaves the factory with the fan speed and cooling capacity controlled by the supply air sensor. This control mode is extremely robust and will ensure that you are delivering precise cooling to the cold aisle. To unlock the full capability of the Liebert CRV, the remote rack sensors should be installed, which will allow the fan speed and the cooling capacity to be "de-coupled." This means that the fan speed can now be controlled independently of the cooling capacity. In this advanced configuration, the Liebert CRV can control the discharge temperature of the unit by modulating cooling capacity based on the supply sensor and use the remote rack sensors to ensure that the cool air is being delivered to the inlet of the racks. Using the supply and remote rack sensors in this de-coupled mode is the preferred method for controlling the Liebert CRV in a hot / cold aisle configuration. In addition to this configuration Emerson has provided additional flexibility for other applications shown in **Table 25**.

Figure 50 Setpoint screen



In **Figure 50**, the controlling temperature sensor can be set to either Supply, Return or Remote. As the selection is changed from one sensor to another, the setpoint is displayed next to the corresponding sensor on the illustration, giving a visual indication of the sensor placement in relationship to the Liebert CRV.

A password must be entered to change the setting; see **10.1.3 Entering a Password** for assistance on entering the password.

Temperature sensor settings are based on user preference. Use the settings below as a guideline.

1. Set the remote temperature setpoint to the desired server inlet temperature
2. Set the humidity setpoint to 45% with a 10 to 20% deadband.
   This will control the moisture content well inside the AHSRAE standard.
3. Set the supply setpoint 5°F below the setting for the remote rack sensor.
   This will serve as a starting point.

If 75°F (24°C) server entering air temperature is desired, the supply air must be colder to account for any thermal pickup of the air as it flows to the cold aisle. If this does not achieve the cold aisle temperature Setpoint, then set the supply sensor setpoint lower. Continue to do this until the cold aisle temperature setpoint is achieved.

The supply temperature Setpoint may require adjusting since it will be dependent on the distance of the CRV to the server racks being cooled. This temperature will also be dependant on rack blanking panels, server population and if containment is being used.

Table 25 Controlling sensor settings

		Cooling Control		
	S103Cool / S125 Fan	**Supply**	**Remote Sensor**	**Return**
Fan Control	Supply	Factory Default (Coupled)	N/A	N/A
	Remote Sensor	Recommended (Decoupled)	X (Coupled)	N/A
	Return	X (Decoupled)	X (Decoupled)	X (Coupled)

Table 25 shows the flexibility of the Liebert CRV and how the different sensor configurations can be used to control the Liebert CRV fan speed and cooling capacity. The table shows the different coupled and decoupled modes available for the Liebert CRV.

10.4 Event Log

The event log displays all events and actions that have been generated by the unit. When multiple units are networked you will see the event log of the whole system. Each event shows the unit that generated the alarm, time and date stamp, a description and the event type.

10.5 Spare Part List

The spare parts lists contains a detailed description and part number that can be used to order parts for the unit. These part numbers are specific to each model and option installed on the unit.

10.6 Wellness—Next Maintenance Calculation

The next maintenance calculation, as well as the included diagnostics feature, will help keep the cooling unit running at peak performance to ensure minimum component stress and maximum reliability. The diagnostics will help the service engineer evaluate the unit's operation since the last maintenance.

10.6.1 Calculation of Next Maintenance and Diagnostics

If the unit includes any of the following components, they are included in the calculation:

- Fan(s)
- Compressor 1
- Compressor 2
- Electric Heaters
- Humidifier

For each component, the next maintenance will be calculated from the following parameters:

- Standard service interval (1, 2 or 4 times a year) (to be set)
- Working hours (counted)
- Number of starts (counted)
- Average running time (calculated)
- Optimum number of starts per hour (to be set)
- Maximum number of starts per hour (to be set)
- Maximum bonus to enlarge time to next maintenance (to be set)
- Maximum penalty to reduce time to next maintenance (to be set)

Calculating Unit Wellness

Liebert iCOM® keeps tabs on the condition of a cooling unit, determining its wellness and projecting when service will be needed, for the entire unit as well as for individual components. This assists in scheduling maintenance calls and helps pinpoint components likely to require service.

Liebert iCOM displays a graphic for needed maintenance. It begins with the standard maintenance interval—12 months, six months or three months—and adjusts that based on its calculation of components' wellness.

To calculate wellness, Liebert iCOM keeps a running total of component working hours and the number of times it has been started. Liebert iCOM relates that data to the optimum/maximum starts per hour. Accordingly, Liebert iCOM will increase or decrease the time before the next service call will be needed.

The more frequently a component starts, the sooner it is likely to need maintenance. If, for example, a unit's fan runs continuously, but it's compressor starts and stops often, Liebert iCOM records that and calls for maintenance based on the compressor's wellness factor.

Alarms and warnings, such as clogged filters or high or low pressure, reduce the time till the next maintenance to zero. If the alarm is cleared and reset, Liebert iCOM recalculates wellness. It begins with the pre-alarm maintenance time and factors in the alarm.

Parameters for Next Maintenance Calculation

General Maintenance Settings

- **Maintenance Frequency**—can be set as one to 12 months or to zero, which disables maintenance calculation
- **Max. Bonus**—increases the time to next maintenance with the set value, if all components run optimally (number of starts, average running time)
- **Max. Penalty value**—decreases the time to next maintenance with the set value, if some components run in non-optimum way (number of starts, average running time)
- **Last Maintenance**—date can be set from service-engineer; informational
- **Service-Engineer**—name of the service engineer; editable
- **Reset**—puts all counters of all components, such as (motor, compressors, heaters and humidifier), at zero and starts a new maintenance calculation (reset to be done after maintenance)

Fans / Heaters / Humidifier Settings and Diagnostics

- Number of starts and Working hours are counted separately since the last maintenance. Total working hours can be read in the standard working hours window (customer window).
- Average Working Hours is the calculation, resulting from starts and working hours.
- Starts per Day Optimum is the number of starts considered as optimum.
- Starts per Day Worst is the number of starts considered as hunting (worst case).
- Number of Alarms counts the alarms, happened between two service intervals.
- Actual Bonus is calculated from number of starts and average working time. Can be positive (bonus) or negative (penalty). This value influences the time remaining to the next maintenance.

Compressor 1 / 2 Settings and Diagnostics

- Number of starts and Working hours are individually counted since the last maintenance. Total working hours can be read in the standard working hours window (customer window).
- Average Working Hours is the calculation, resulting from starts and working hours.
- Starts per Day Optimum is the number of starts considered as optimum.
- Starts per Day Worst is the number of starts considered as hunting (worst case).
- Number of HP Alarms counts the high-pressure alarms, happened between 2 service intervals.
- Number of LP Alarms counts the low-pressure alarms, happened between 2 service intervals.
- Number of TH Alarms counts the thermal protection alarms, happened between 2 service intervals.
- Actual Bonus is calculated from number of starts and average working time. Can be positive (bonus) or negative (penalty). This value influences the time remaining to the next maintenance.

10.7 Liebert CRV Operation—Liebert iCOM® Control

10.7.1 Cooling

The cooling control of the Liebert CRV can be managed from any of the temperature sensors. Emerson recommends using the supply temperature sensor to control the cooling capacity of the Liebert CRV. The supply temperature is an accurate representation of the actual heat rejection the Liebert CRV needs to perform at an optimal level. A chilled water version of the Liebert CRV will modulate the cooling capacity from 0% - 100% and the DX version of the Liebert CRV will modulate the cooling capacity of the unit from 20% -100% compressor capacity.

To avoid short-cycling the compressor during room heat load changes, the Liebert CRV will not deactivate the compressor until the air temperature is below 150% of temperature setpoint when in Remote or Supply Air Control or below 200% of temperature setpoint when operating in Return Air control.

10.7.2 Heating

The heating control is active only when the unit is in dehumidification mode. The reheats will begin activation when the control temperature has dropped to -66% of the controls proportional band and will deactivate when the temperature setpoint has been reached.

10.7.3 Air Flow

The Liebert CRV's airflow can be controlled manually or dynamically by temperature sensors. Emerson recommends controlling the fan speed using the remote rack temperature sensors. The remote rack sensors are an accurate representation of the delivery of the Liebert CRV's discharge air. When using the remote rack temperature sensors, the fan speed will modulate from 50% to 100% based on the remote rack temperature setpoint and the sensitivity of the proportional and integral settings. Manually controlling the Liebert CRV's fan speed is also possible by setting a fixed fan speed either from the front display or through a monitoring system. The manual control will be overridden for freeze protection, humidification and reheat operation. In the event of a single fan failure the Liebert CRV will ramp the remaining operating fan to 110% of its rated output to compensate for the loss of airflow. In addition, an alarm will be triggered to report which fan failed.

10.7.4 Humidification

The Liebert CRV's humidification is activated when the measured temperature and humidity sensor has been calculated to exceed the corresponding dew point setpoint. The dew point setpoint is calculated based on the temperature and humidity of the sensor set to control the control setpoint and relative humidity.

Example: Temperature Setpoint 72°F / Humidity Setpoint 50% = 52°F Dew Point

NOTE

The Liebert iCOM control monitors the condition of the air discharging from the unit to protect neighboring electronic equipment. Liebert iCOM will prevent the humidifier from activating if the discharge air is near its saturation point. This protects against discharging fog from the unit or condensation forming on the unit's supply air baffles. This protection mode is activated when the supply sensor reading is below 53°F (11.7°C) or above 55% relative humidity. When this condition is met a message will display showing "humidifier" suspended.

The status of the humidifier lockout can be viewed in the Service/Diagnostics menu.

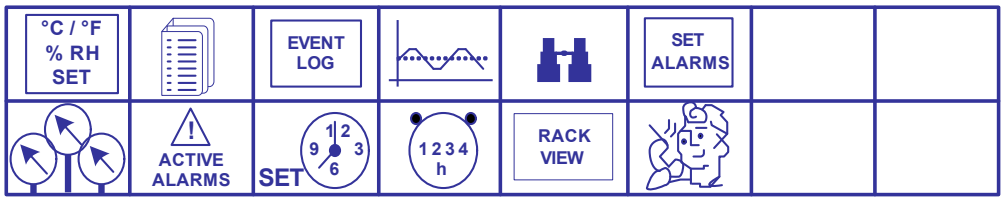
These protections do not apply to the external humidifier output.

10.8 Liebert iCOM® User Menu Screens

User menus report general cooling unit operations and status. The user menu password is **1490**.

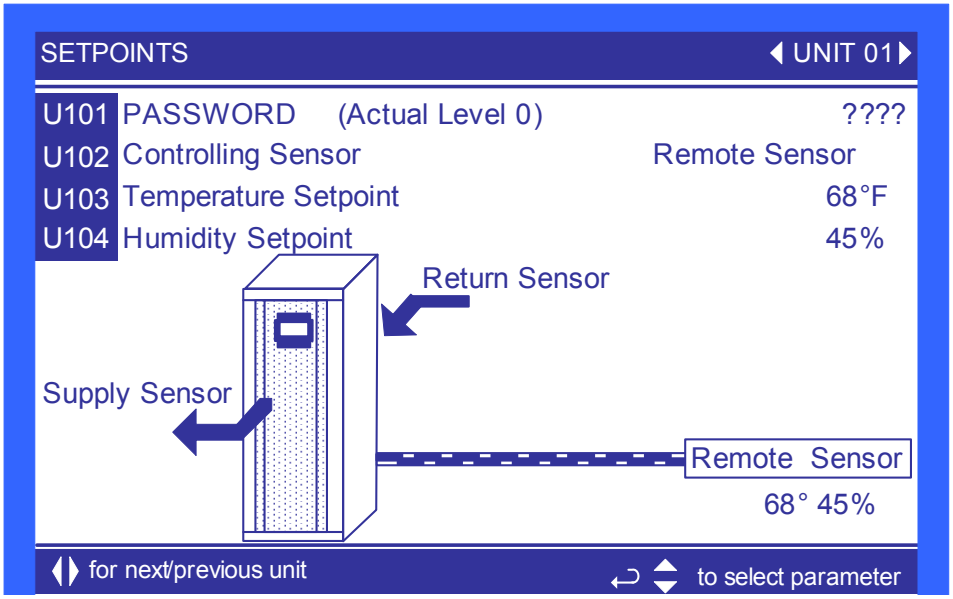
The User menu parameter tables in this manual may differ from the display on your cooling unit. The Liebert iCOM functions with several Liebert Precision Cooling units, each with its own set of control commands. In addition, the Liebert iCOM control firmware is being updated constantly. As a result, the User menu parameter tables in this manual may differ from the display on your cooling unit. Check **www.liebert.com** for the latest Liebert iCOM user manual updates.

Figure 51 User menu icons



User Menu password: 1490

Figure 52 Setpoints parameters screen



Controlling Sensor—This parameter allows the user to select which sensor will be used to determine the amount of cooling needed. This parameter can select only a single sensor for both the temperature and fan speed control. Use the Service / Setpoints menu to decouple the operation of fan speed to the remote sensors and the cooling capacity to the supply sensor.

Temperature Setpoint—This parameter allows the user to select a temperature that the cooling unit will maintain by applying cooling and or reheats.

Humidity Setpoint—This parameter allows the user to select a humidity that the cooling unit will maintain by removing or adding moisture to the air.

Spare Part List

Spare Parts—The spare parts lists contains a detailed description and part number that can be used to order parts for the unit. These part numbers are specific to each model and option installed on the unit.

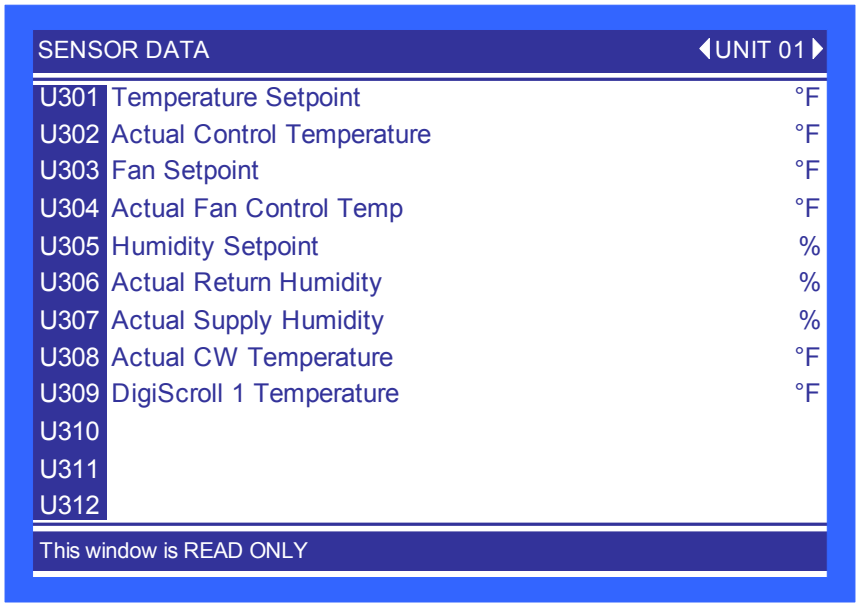
Event Log

Event Log—The event log displays all events and actions that have been generated by the unit. When multiple units are networked you will see the event log of the whole system. Each event shows the unit that generated the alarm, time and date stamp, a description and the event type

View Network

View Network—The view network screen provides an overview of the Liebert iCOM® network and a status of each unit. This screen will provide the unique unit name given to the unit. If no name is given, then only the unit number will be displayed.

Figure 53 Sensor data parameters screen



Temperature Setpoint—This parameter shows the cooling setpoint, which is the setpoint used to drive the compressor capacity. This parameter will automatically change based on which sensor is used for control (Return, Supply or Remote sensor).

Actual Control Temperature—This parameter is the temperature reading of the actual sensor that is referenced to U301. This parameter automatically changes based on the control sensor setting.

Fan Setpoint—This parameter defines the fan speed setpoint. This value is not shown when a single sensor (Coupled Mode) is used to control cooling capacity and fan speed. This parameter is calculated by adding the temperature setpoint and the fan speed delta in the Service / Setpoints menu.

Actual Fan Control Temp—This parameter is the temperature reading of the actual sensor that is referenced to U303. This parameter automatically changes based on the control sensor settings.

Humidity Setpoint—This parameter allows the user to select a humidity that the cooling unit will maintain by removing or adding moisture to the air. This parameter is adjustable from 20-80%. The factory default setting from the factory is 50%.

Actual Return Humidity—This parameter is the return relative humidity reading of the sensor.

Actual Supply Humidity—This parameter is the calculated relative humidity of the supply sensor based on the actual return humidity reading. This value is calculated by using a reverse look up algorithm based on dew point.

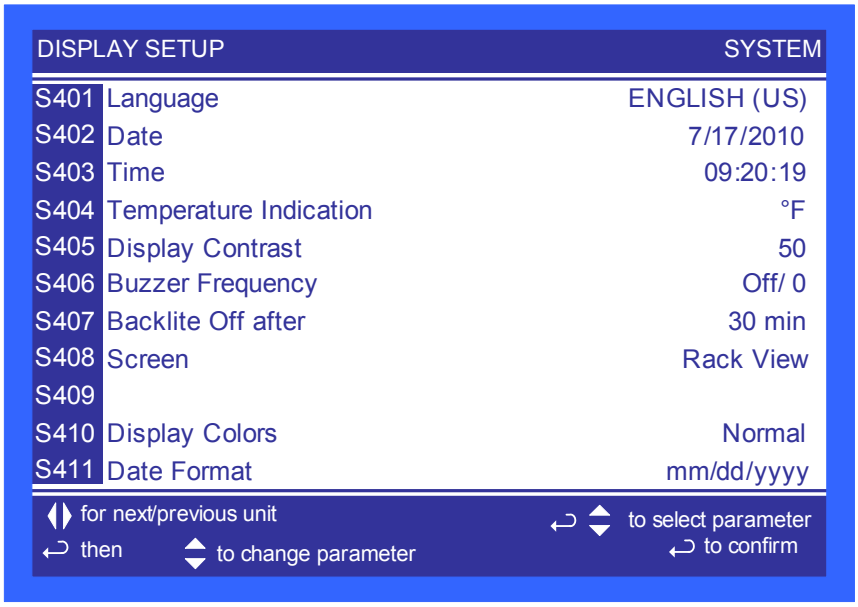
Actual CW Temperature—This parameter displays the actual chilled water supply temperature being delivered to the unit.

DigiScroll 1 Temperature—When digital scroll compressors are installed in the unit then the actual digital scroll number 1 head temperature will be shown.

Active Alarms

Active Alarms—Permits viewing all current, active alarms.

Figure 54 Display setup parameters screen



Language—This parameter sets the language on the display. When this parameter is changed all menu parameters will be converted to the selected language.

Date—This parameter sets the internal date of the unit. If this unit is connected to other units with the unit to unit network connection. All units will reflect the last date set.

Time—This parameter sets the internal time of the unit. If this unit is connected to other units with the unit to unit network connection. All units will reflect the last time set.

Temperature Indication—This parameter selects the actual and set point temperature indication. Selecting C will set the unit to display in Celsius and F will set the unit to display in Fahrenheit.

Display Contrast—This parameter changes the contrast of the display to adjust for different viewing angles, low light and bright light conditions. As the display ages the contrast may need to be adjusted for better viewing clarity.

Buzzer Frequency—This parameter changes the audible noise frequency of the built in buzzer. When adjusting the buzzer frequency the buzzer will sound allowing you to select a frequency that is easily detected when an alarm occurs.

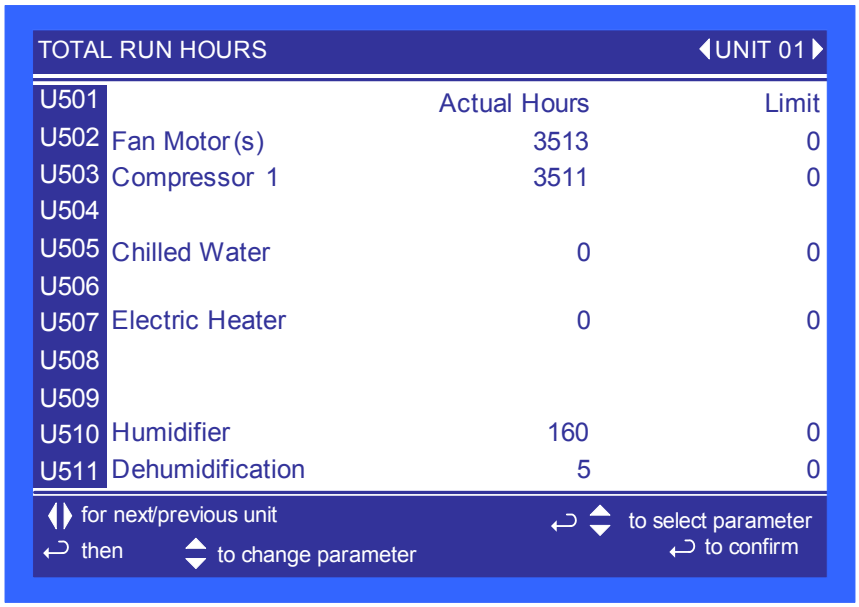
Backlite Off After—This parameter controls the length of time that the backlite remains active when the display is unused. When the buttons on the front display have not been pressed for the time selected in this parameter the backlite will turn off, extending the life of the display and saving energy.

Screen—Multiple screen layouts exist for the CRV, Including Rack View and Trends to be monitoring on the main display. Views include a Unit View with or without sensors, Rack View and Graphical Data Record View. See **Figure 49** for screen layouts.

Display Colors—This parameter selects the background color. Inverted sets the display to show white font with blue background and Normal sets a white background with blue font.

Date Format—Date format changes the month, day and year arrangement shown on the front display and on event time stamps.

Figure 55 Total run hours parameters screen



Each parameter shows the actual hours the component has operated and the maximum time the component can operate before the next maintenance.

10.9 Liebert iCOM® Service Menu Screens

Service menus allow customized settings for site operations. The password for service menu parameters is **5010.**

The Liebert iCOM control firmware is being updated constantly. As a result, the Service menu parameter tables shown in this manual may be slightly different than what is shown on your cooling unit's display. Please check **www.liebert.com** for the latest Liebert iCOM User manual updates.

Figure 56 Service Menu Main Screen

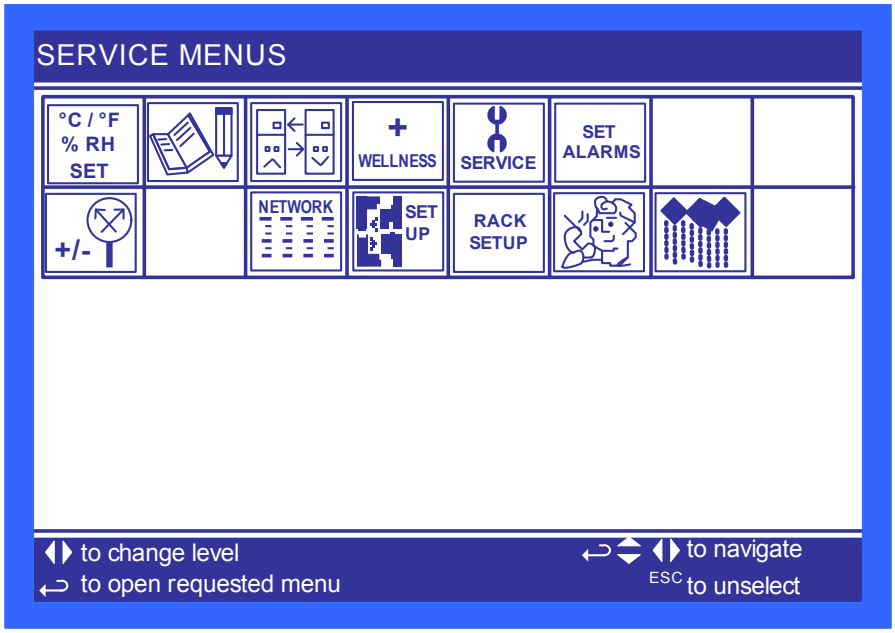
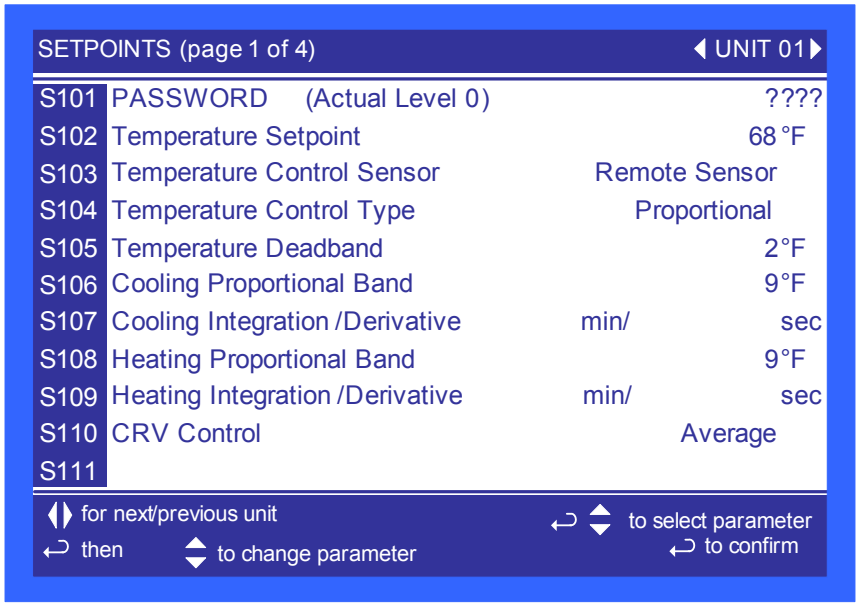


Figure 57 Setpoints parameters screen - Page 1



Temperature Setpoint—This parameter selects a temperature that the cooling unit will maintain by applying cooling and or reheats. This parameter is adjustable from 41-104°F (5-40°C), the factory default setting is 73°F (22.7°C).

Temperature Control Sensor—This sensor controls the cooling capacity of the Liebert CRV. If the unit is chilled water model, then this sensor controls the chilled water valve opening. If the unit is a DX (direct expansion) model then this sensor will control the amount of digital scroll capacity.

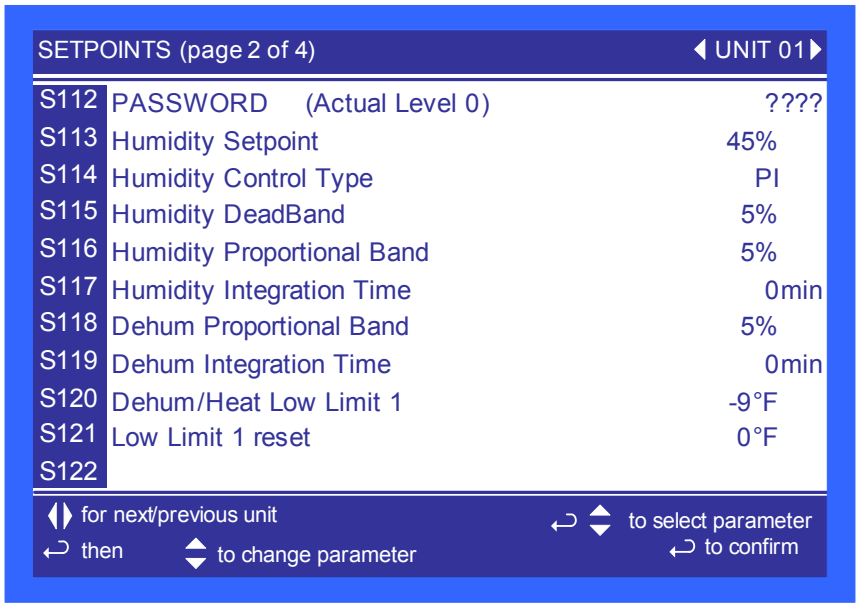
Temperature Control Type—This parameter selects the type of control the system will use to activate cooling, heating, humidification and dehumidification. A detailed description of each control type can be found in **3.7 - Supply Control**.

Temperature Deadband—This parameter can be set to avoid overshooting of the setpoint and cycling between the reheats and cooling. The value entered into this field will be split in half by the temperature setpoint. Example—If the temperature setpoint is 70°F (21.1°C) and a 4°F (2.2°C) deadband is set, then no cooling will be activated until 72°F (22.2°C) and no heating will be activated until 68°F (20°C) is reached.

Cooling Proportional Band—This parameter adjusts the activation points of compressors or rate of change based on the actual sensor values deviation from setpoint. The smaller this number the faster the compressors and valve(s) will increase capacity. Too small of a number may cause the unit to short cycle the compressors or excessively reposition the valve.

Cooling Integration/Derivative—Cooling integration takes into consideration the amount of time the actual temperature has deviated from the setpoint. The longer this deviation exists the more corrective action the unit will use to achieve the setpoint. The derivative term monitors the rate of change and will reduce or increase the amount of corrective action based on the actual temperature increasing or decreasing toward the temperature setpoint.

Figure 58 Setpoints parameters screen - Page 2



Humidity Setpoint—This parameter allows the user to select a humidity that the cooling unit will maintain by removing or adding moisture to the air. This parameter is adjustable from 20-80%. The factory default setting from the factory is 50%.

Humidity Control Type—This parameter selects the humidity control calculation. Setting this parameter to "Relative" will control the humidity without considering any temperature deviations. "Predictive" and "Absolute" control consider the temperature deviation from temperature setpoint so that a constant level of moisture is kept in the area based on the humidity sensor reading and the temperature deviation from setpoint. The factory default setting is "Predictive."

Humidity Deadband—This parameter can be set to avoid overshooting of the setpoint and cycling between humidification and dehumidification. The value entered into this field will be split in half by the temperature setpoint. Example: If the humidity setpoint is 50% and a 4% deadband is set then no humidity control will be activated between 48% and 52%.

Humidity Proportional Band—This parameter adjusts the activation points of the humidifier and compressors based on the actual sensor values deviation from setpoint. The smaller this number the faster the compressors and humidifier will increase capacity, too small of a number may cause the unit to short cycle or overshoot setpoint.

Humidity Integration Time—This parameter adjusts the capacity of the unit based on time away from setpoint so that accurate humidity control can be maintained. This parameter is only active when Control Type is set to "PI."

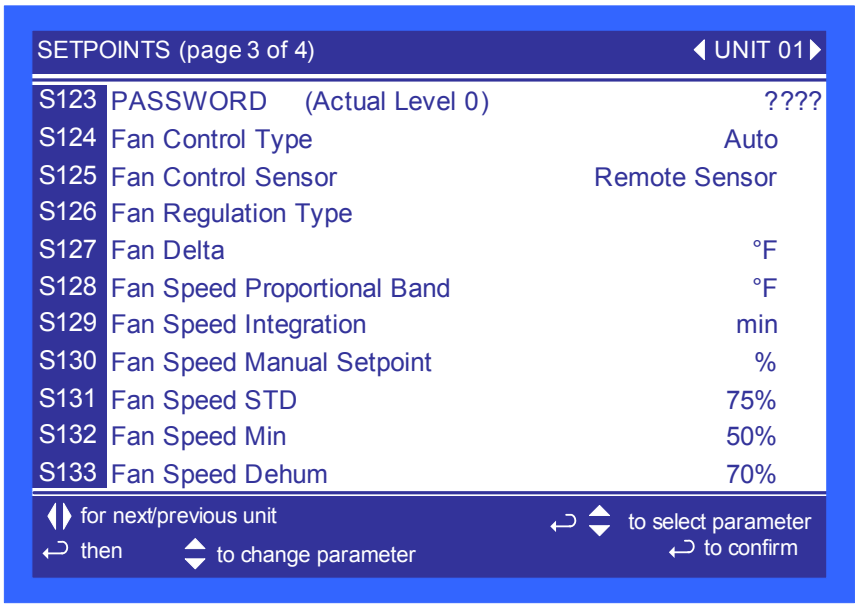
Dehum Proportional Band—The parameter adjusts the activation points of dehumidification based on the actual sensor values deviation from setpoint. The smaller this number the faster the compressors and humidifier will increase capacity, too small of a number may cause the unit to short cycle or overshoot setpoint.

Dehum Integration Time—This parameter adjusts the capacity of the unit based on time away from setpoint so that accurate humidity control can be maintained. This parameter is only active when control type is set to "PI".

Dehum/Heat Low Limit 1—This parameter sets the temperature at which the compressor will be deactivated for dehumidification control. Example—If Low Limit 1 is set to 4°F (2.2°C) and the temperature setpoint is 70°F (21.1°C), then dehumidification will turn off at 66°F (18.8°C).

Low Limit 1 reset—This parameter controls when the temperature has increased enough to re-enable dehumidification.

Figure 59 Setpoints parameters screen - Page 3



Fan Control Type—This parameter sets how the fan speed will be controlled. This parameter can be set to Auto mode, which will allow the Liebert CRV to drive the fan based on the temperature sensor selected for sensor control type. This parameter can also be set to Manual mode, which allows the Liebert CRV to be set to a fixed fan speed either through the local display or through a building management system.

Fan Control Sensor—This parameter sets which sensor will drive the Liebert CRV fans when set to Auto mode for the fan control type.

Fan Regulation Type—This parameter is the fans' control type. It can be set to Proportional control, which will modulate the fans linearly based on the deviation from the setpoint. PI control is also available and works in the same manner as the temperature control integral term.

Fan Delta—This parameter sets the fan speed setpoint. The delta accounts for the temperature rise from the Supply Air Sensor and the Remote Rack sensors by adding the Fan Delta to the Temperature Setpoint (S102). This eliminates the possibility of setting the remote rack temperature setpoint lower than the supply temperature setpoint.

Fan Speed Proportional Band—This parameter adjusts the fans rate of change based on the actual sensor values deviation from setpoint or the delta. The smaller this number the faster the fan will increase its speed. Too small of a number may cause the fans to excessively reposition.

Fan Speed Integration—This parameter adjusts the fanspeed of the unit based on time away from setpoint. This parameter is only active when Control Type is set to "PI."

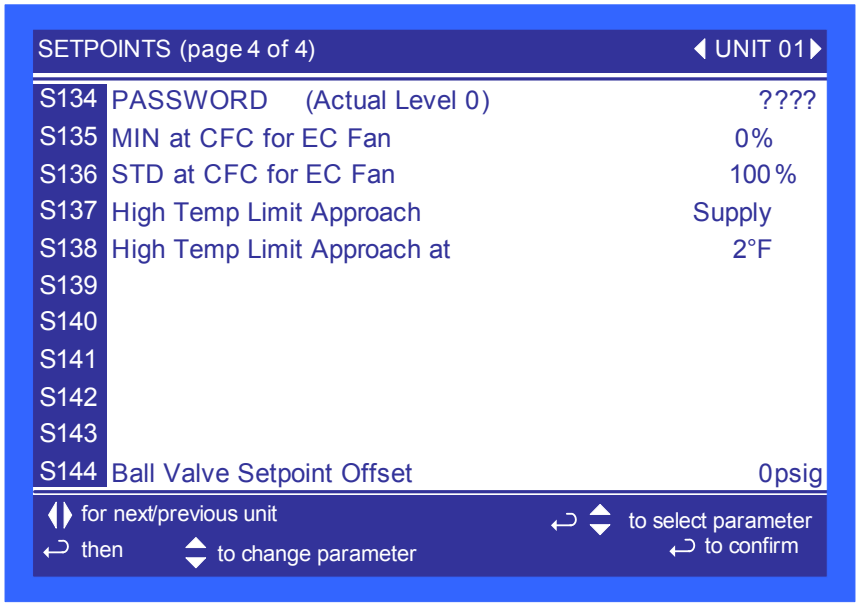
Fan Speed Manual Setpoint—This parameter sets the speed of the fans when the unit is placed into Manual Fan Speed Control mode.

Fan Speed STD—This parameter sets the maximum fan speed of the unit under normal operating circumstances.

Fan Speed Min—This parameter sets the lowest fan speed operation of the unit.

Fan Speed Dehum—This parameter sets the fan speed the unit will operate at during a call for dehumidification. The fan speed will position to the highest requirement. If the call for fan speed from the remote rack sensor is requesting more CFM than the Dehum fan speed, then the fans will run at the remote sensor fan speed request.

Figure 60 Setpoints parameters screen - Page 4



MIN at CFC for EC Fan—This parameter can provide an offset to the minimum fan speed at the minimum call for cooling. When set to 0 / 100 the MIN speed is reached when the call for fan is at 0%; and the STD speed is reached when the call for fan reaches 100%.

For example, if the minimum is set to 20 and the standard is set to 90, the fan speed MIN is reached earlier (the fan operates on lower speed compared to the calculated call for fan), and the STD speed is reached faster when compared to the calculated call for fan.

STD at CFC for EC Fan—This parameter can provide an offset to the minimum fan speed at the minimum call for cooling. When set to 0 / 100 the MIN speed is reached when the call for fan is at 0%; and the STD speed is reached when the call for fan reaches 100%.

High Temp Limit Approach—This parameter sets the sensor that controls the fan speed maximum override. This can be set to Disable, Supply or Return.

NOTE
The Liebert CRV fans are oversized and can be used to help protect equipment in emergency situations, such as high temperature and a single fan failure.

High Temp Limit Approach at— This parameter sets the temperature when the units fan speed can operate above the maximum speed. The maximum override speed during this mode is set in parameter A157 (Advanced menus).

Ball Valve Setpoint Offset—This parameter adjusts the operating compressor discharge pressure by changing the targeted range of control. Available only on water-cooled units.

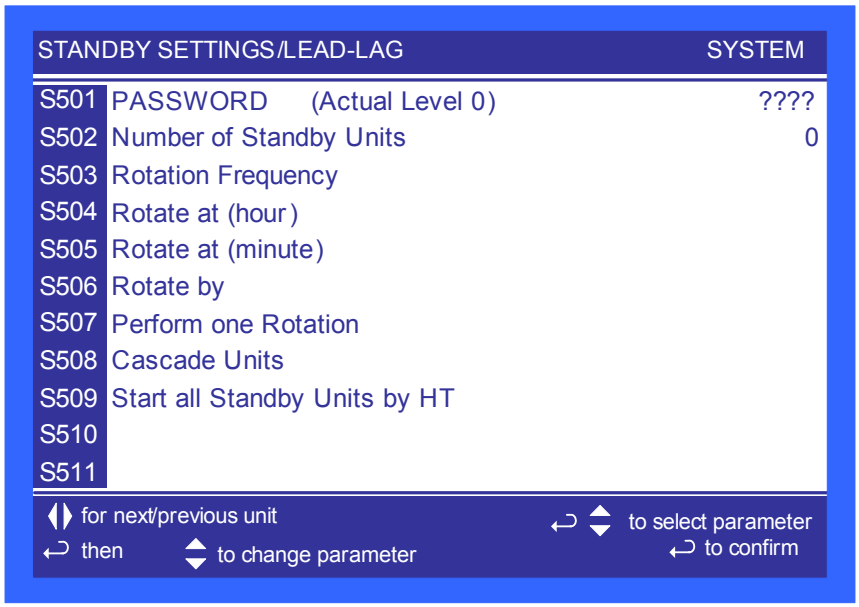
Unit Diary—Large Display Only

Shows all entered program changes and maintenance performed on the unit.

Table 26 Unit diary parameters

Function		Range Imperial (metric)
Large Display	Small Display	
Page 1 of 1		
Text entered with iST (Liebert iCOM® Service Tool)	N/A	-

Figure 61 Standby settings / lead-lag parameters screen



Number of Standby Units—This parameter selects the number of units that will be in Standby mode. When a unit is in standby mode the fan will be off and no cooling will be provided.

Rotation Frequency—This parameter controls when a rotation will occur between the standby units and the operating units within a network.

Rotate at (hour)—This parameter sets the hour of the rotation

Rotate at (minute)—This parameter sets the minute of the rotation

Rotate by—This parameter determines the number of positions to rotate by. Example: If there are 6 units in a unit to unit network and units 1, 3 & 5 are in standby and this parameter is set to "1" then at the next rotation units 2, 4,& 6 will be placed into standby and 1, 3 & 5 will become operational.

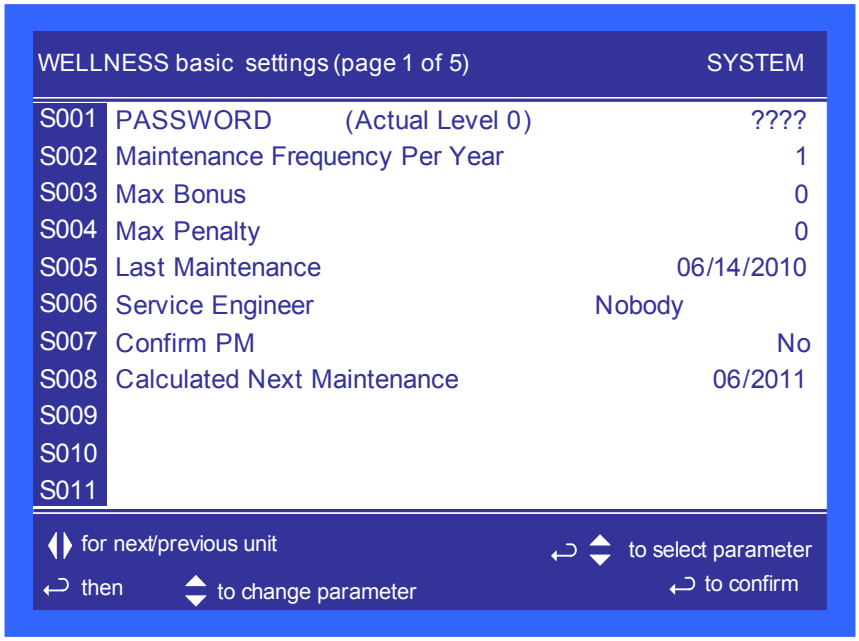
Perform one Rotation—This parameter will manually force a single rotation between units.

Cascade Units—This parameter when set allows units to activate from Standby mode if the room temperature is unable to be maintained by the non-standby units. If yes is selected then the cascade units can perform all functions when activated from standby. This parameter can also be set for Cooling Only or Cool / Heat only.

Start all Standby Units by HT—This parameter activates all units to cool when a High Temperature alarm occurs.

See **3.9.1 - Calculation of Next Maintenance and Diagnostics** for details on these menus.

Figure 62 Wellness basic settings screen- Page 1



Maintenance Frequency Per Year—This parameter sets the number of expected maintenance visits in a one year time span.

Max Bonus—This parameter will increase the time to the next maintenance cycle. A bonus should be assigned when a service visit finds that all components are working optimally.

Max Penalty—This parameter will decrease the time to the next maintenance cycle. A penalty should be used when a service visit finds excessive wear on components.

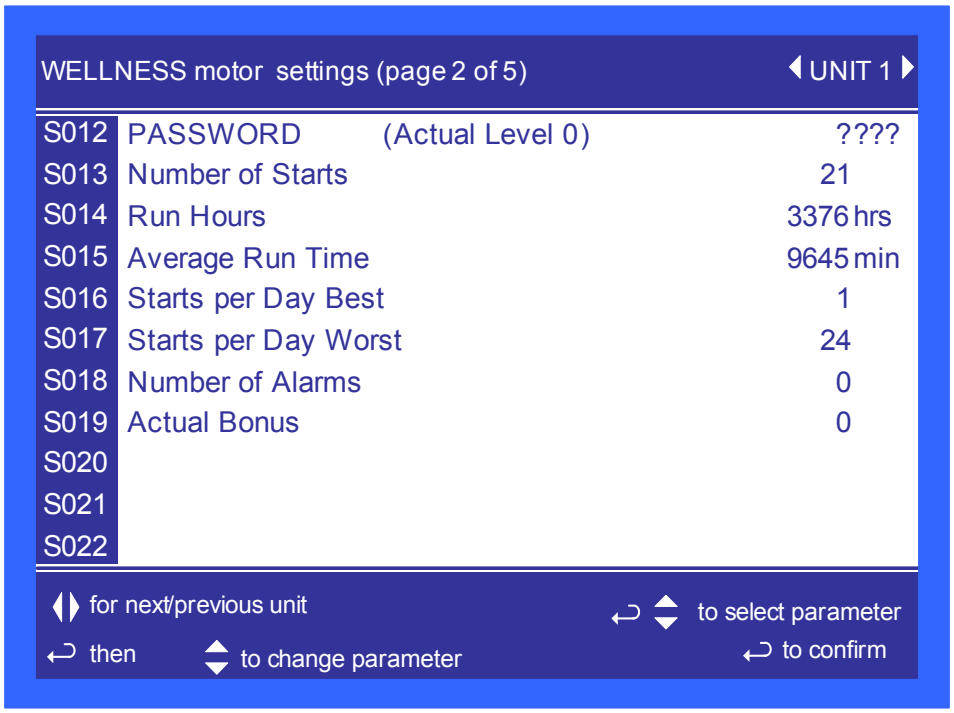
Last Maintenance—This parameter is set during the service call. It also indicates to other service personnel the date of the last visit.

Service Engineer—This parameter provides a label for the service representative to list either the company name or representative's name.

Confirm PM—This parameter confirms that the service representative has completed the preventive maintenance and resets the next maintenance date.

Calculated Next Maintenance—This parameter provides a date to when the next expected maintenance should take place based on the last confirmed PM, component starts, run hours and the penalty / bonus currently set in the Liebert iCOM® control.

Figure 63 Wellness motor settings parameters screen - Page 2



Number of Starts—This parameter shows the number of starts for the unit's fans.

Run Hours—This parameter shows the number of run hours for the unit's fan.

Average Run Time—This parameter displays the average run time of the unit's fan.

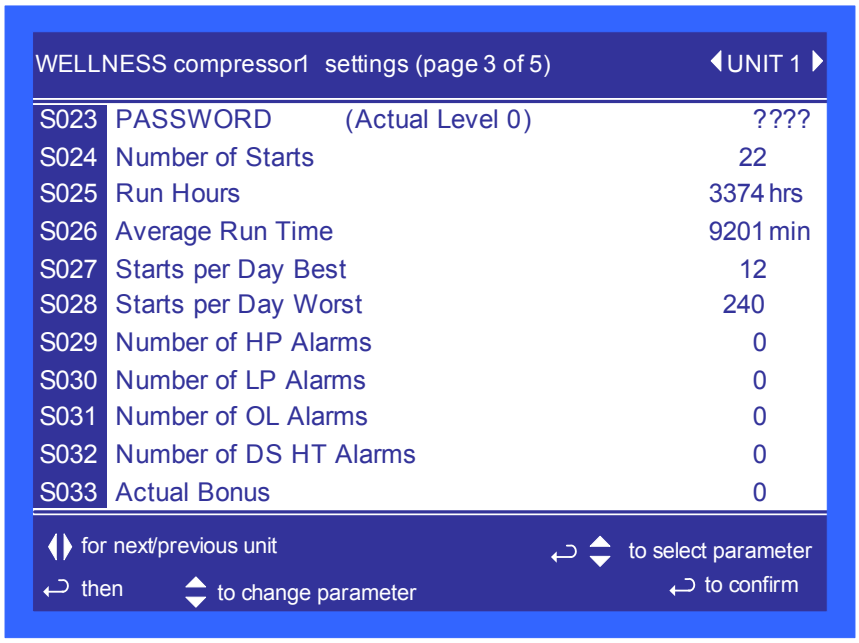
Starts per Day Best—This parameter displays the lowest number of starts in a rolling 24 hour period.

Starts per Day Worst—This parameter displays the highest number of starts in a rolling 24 hour period.

Number of Alarms—This parameter displays the number of alarms that have occurred with the unit's fans.

Actual Bonus—This parameter displays the actual calculation of wellness for the unit's fans. The unit will always take the value from the worst component for the next maintenance indication.

Figure 64 Wellness compressor 1 settings parameters screen - Page 3



Number of Starts—This parameter shows the number of starts for the unit's compressor.

Run Hours—This parameter shows the number of run hours for the unit's compressor.

Average Run Time—This parameter displays the average run time of the unit's compressor.

Starts per Day Best—This parameter displays the lowest number of starts in a rolling 24 hour period.

Starts per Day Worst—This parameter displays the highest number of starts in a rolling 24 hour period.

Number of HP Alarms—This parameter displays the number of high pressure alarms that have occurred with the unit's compressor.

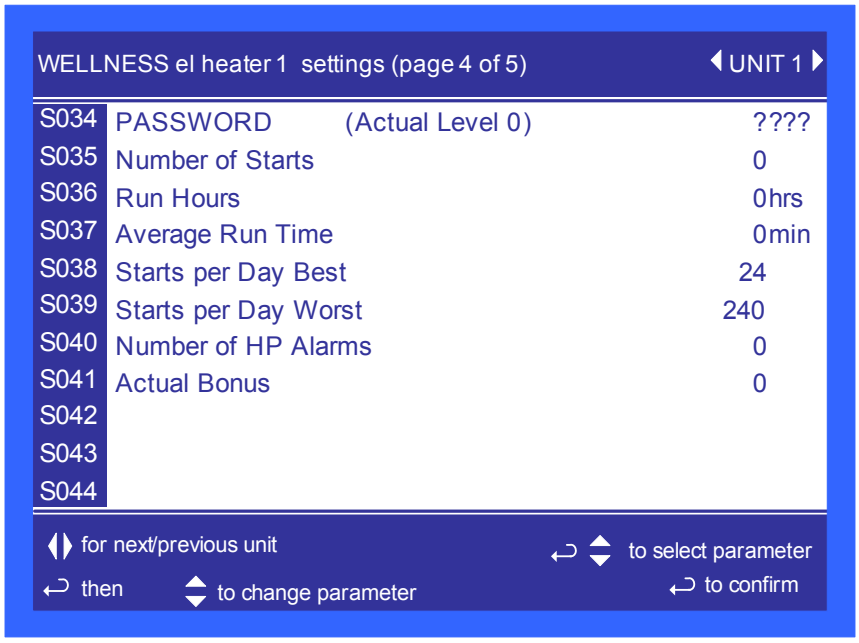
Number of LP Alarms—This parameter displays the number of low pressure alarms that have occurred with the unit's compressor.

Number of OL Alarms—This parameter displays the number of overload alarms that have occurred with the unit's compressor.

Number of DS HT Alarms—This parameter displays the number of Digital Scroll High Temperature alarms that have occurred with the unit's compressor.

Actual Bonus—This parameter displays the actual calculation of wellness for the unit's compressor. The unit will always take the value from the worst component for the next maintenance indication.

Figure 65 Wellness electric heater 1 settings parameters screen - Page 4



Screen displayed only if unit is equipped with electric heater

Number of Starts—This parameter shows the number of starts for the unit's reheats.

Run Hours—This parameter shows the number of run hours for the unit's reheats.

Average Run Time—This parameter displays the average run time of the unit's reheats.

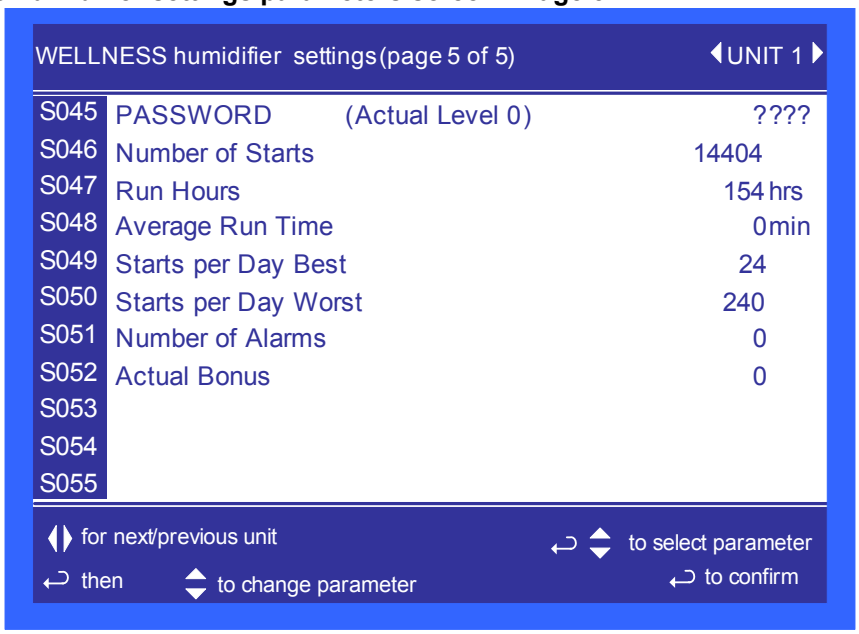
Starts per Day Best—This parameter displays the lowest number of starts in a rolling 24 hour period.

Starts per Day Worst—This parameter displays the highest number of starts in a rolling 24 hour period.

Number of HP Alarms—This parameter displays the number of high pressure alarms that have occurred with the unit's reheats.

Actual Bonus—This parameter displays the actual calculation of wellness for the unit's reheats. The unit will always take the value from the worst component for the next maintenance indication.

Figure 66 Wellness humidifier settings parameters screen - Page 5



Screen displayed only if unit is equipped with humidifier

Number of Starts—This parameter shows the number of starts for the unit's humidifier.

Run Hours—This parameter shows the number of run hours for the unit's humidifier.

Average Run Time—This parameter displays the average run time of the unit's humidifier.

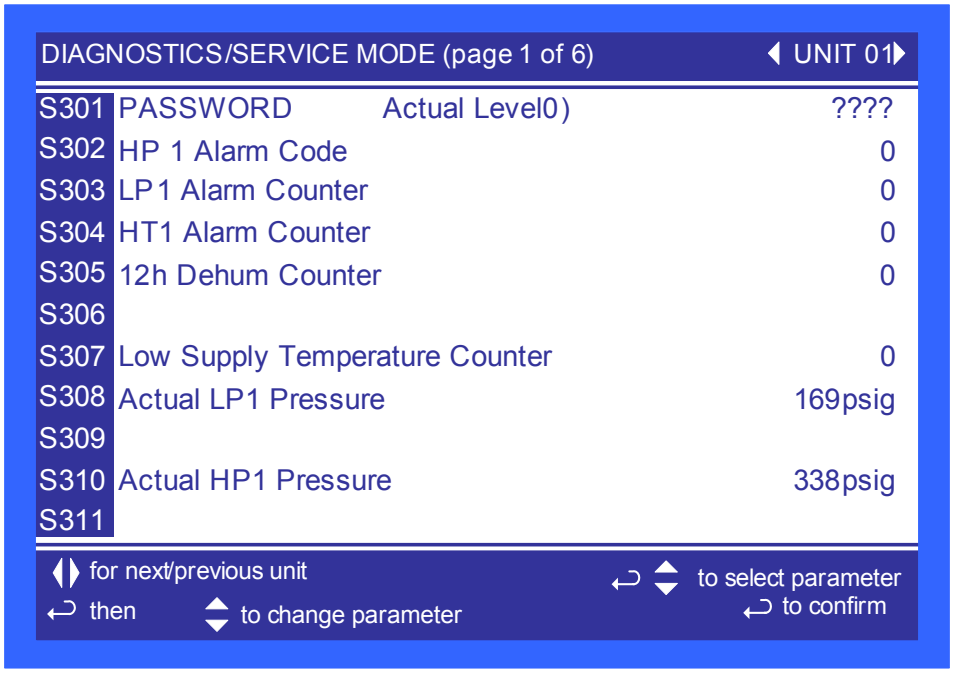
Starts per Day Best—This parameter displays the lowest number of starts in a rolling 24 hour period.

Starts per Day Worst—This parameter displays the highest number of starts in a rolling 24 hour period.

Number of Alarms—This parameter displays the number of high pressure alarms that have occurred with the unit's humidifier.

Actual Bonus—This parameter displays the actual calculation of wellness for the unit's humidifier. The unit will always take the value from the worst component for the next maintenance indication.

Figure 67 Diagnostics / service mode parameters screen - Page 1



HP 1 Alarm Code—Compressor 1 high pressure alarm code.

LP 1 Alarm Code—Indicates which phase compressor 1 is operating in. For more information on this refer to the Liebert iCOM® Training and Service manual's low pressure transducer flow chart.

HT 1 Alarm Counter—Compressor 1 high temperature event alarm counter. If more than five events in a rolling 4 hour period occur then the compressor will be locked out.

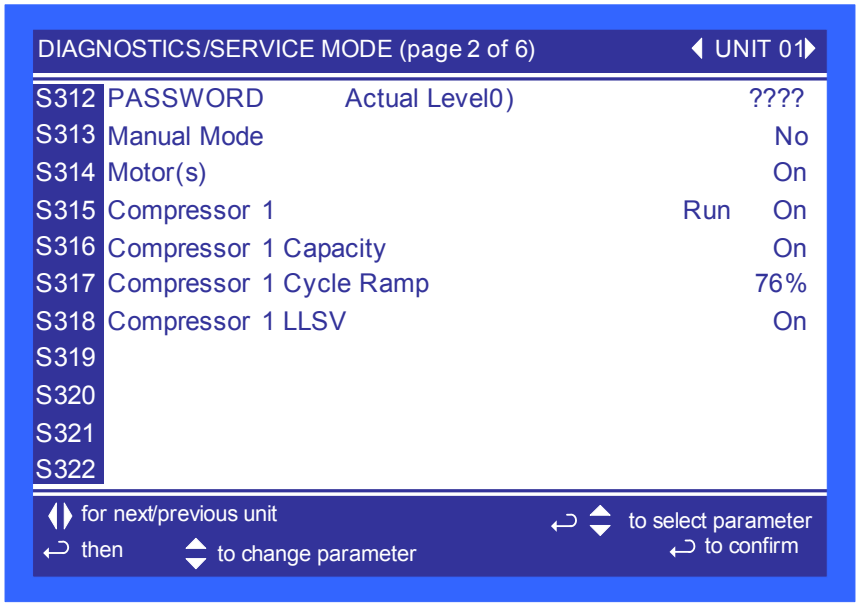
12h Dehum Counter—

Low Supply Temperature Counter—

Actual LP1 Pressure—Current refrigerant low pressure side reading in atmosphere for Compressor 1.

Actual HP1 Pressure—Current refrigerant high pressure side liquid reading in atmosphere for Compressor 1. (This is available only on water cooled units equipped with motorized ball valves.)

Figure 68 Diagnostics / service mode parameters screen - Page 2



Manual Mode—Use this setting to place the Liebert iCOM® control in manual mode. This is the initial setting necessary to activate any of the following items.

Motor(s)—Setting this option to ON will start the main fan of the unit. Note that the main fan must be On in order to activate any of the following overrides.

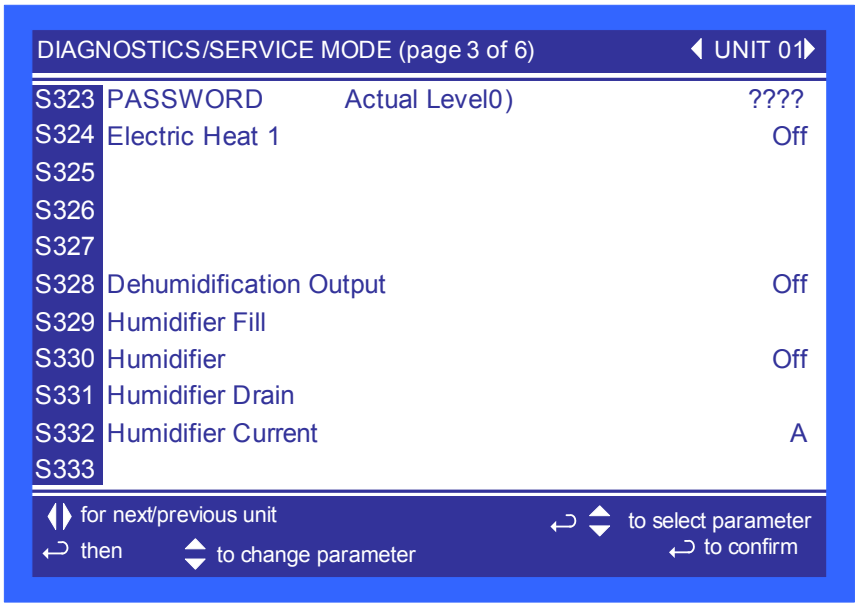
Compressor 1—Use this setting to turn on compressor 1 and select the mode of compressor operation. The operation selections are RUN, EVACUATE and CHARGE.

Compressor 1 Capacity—Use this setting to enable Compressor 1 Cycle Ramp.

Compressor 1 Cycle Ramp—This setting allows the user to select the capacity the compressor should run at. Range on this is 0 – 100%.

Compressor 1 LLSV—This option will control the liquid line solenoid valve for compressor 1.

Figure 69 Diagnostics / service mode parameters screen - Page 3



Electric Heat 1 (or HG/HW)—This will activate stage 1 of the unit's reheat system.

Dehumidification Output—This activates the dehumidification cycle.

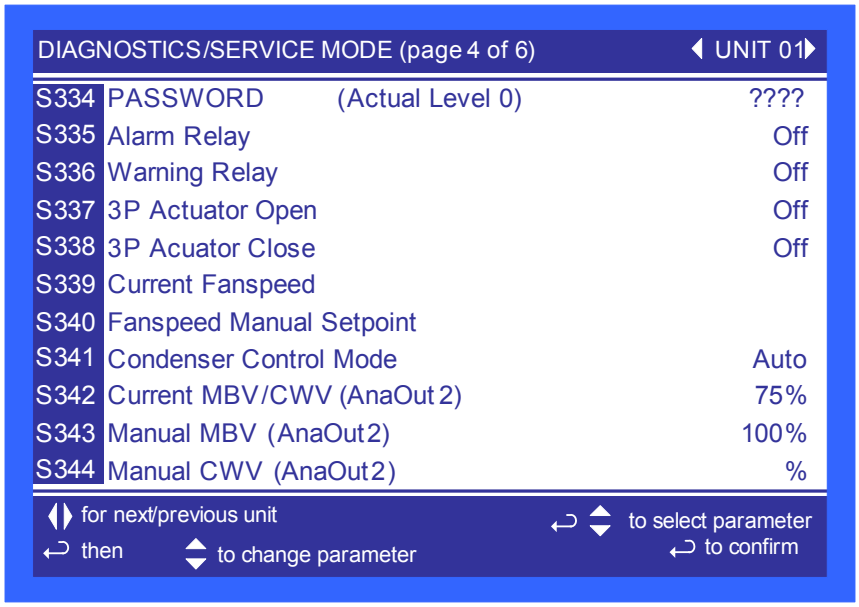
Humidifier Fill—This activates just the humidifier water source solenoid valve which fills the humidifier pan or canister with water.

Humidifier—This activates the humidifier system in its entirety.

Humidifier Drain—This activates just the humidifier drain solenoid in the case of the steam generating humidifier, allowing water to drain from the canister.

Humidifier Current—In the case of the steam generating humidifier option this setting shows the amount of AC amperes the system is consuming.

Figure 70 Diagnostics / service mode parameters screen - Page 4



Alarm Relay—This allows the user to activate the Liebert iCOM® control's common alarm relay output.

Warning Relay—This allows the user to activate the Liebert iCOM control's free-cooling relay output.

3P Actuator Open—This setting will energize the open circuit of the 3P type chilled or freecooling control valve thus journeying it to the open state.

3P Actuator Close—This setting will energize the close circuit of the 3P type chilled or freecooling control valve thus journeying it to the closed state.

Current Fanspeed (Read only)—Shows the analog output for the fan in automatic mode.

Fanspeed Manual Setpoint (Read only)—Drives the analog output for the fan in manual mode.

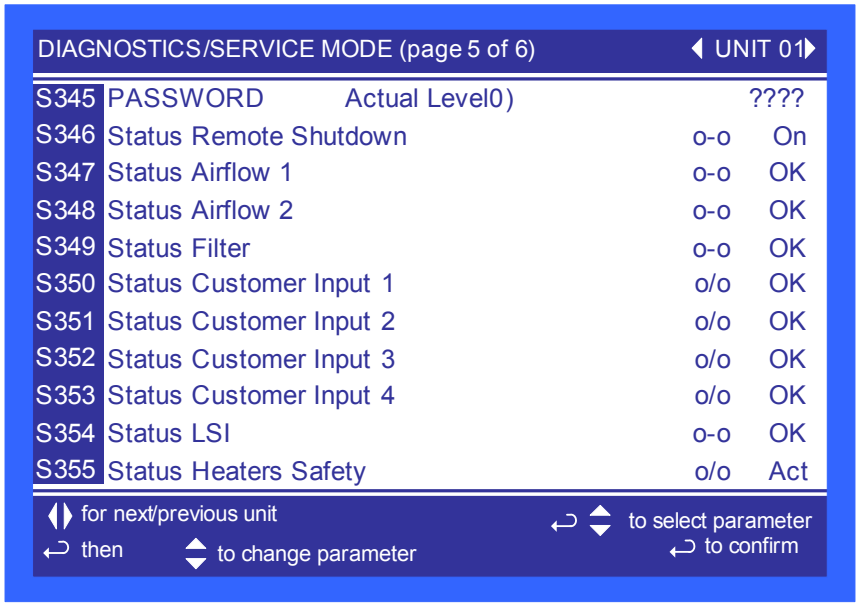
Condenser Control Mode—Defines the condenser control mode in manual or auto mode during compressor manual mode.

Current MBV / CWV (AnaOut2) (Read only)—Shows the analog output for the MBV (motorized ball valve) or analog CWV (chilled water valve) in automatic mode.

Manual MBV (AnaOut2)—Drives the analog output for the condenser valve (MBV) in manual mode.

Manual CWV (AnaOut2)—Drives the analog output for the analog CWV (chilled water valve) in manual mode.

Figure 71 Diagnostics / service mode parameters screen - Page 5



Status Remote Shutdown—This show the status of the unit's remote shut down input.

Status Airflow 1 & 2—This show the status of the unit's air proof switches.

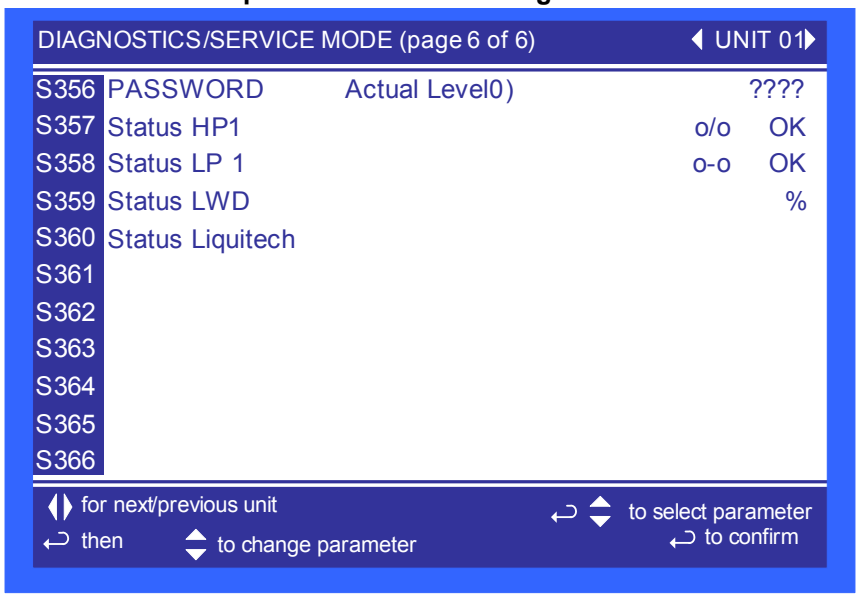
Status Filter—This shows the status of the unit's filter clog switch input.

Status Customer Input 1, 2, 3 & 4—This shows the status of the unit's customer inputs.

Status LSI—

Status Heaters Safety—(HPM and PEX only) This parameter shows the status of the unit's reheat safety switch.

Figure 72 Diagnostics / service mode parameters screen - Page 6



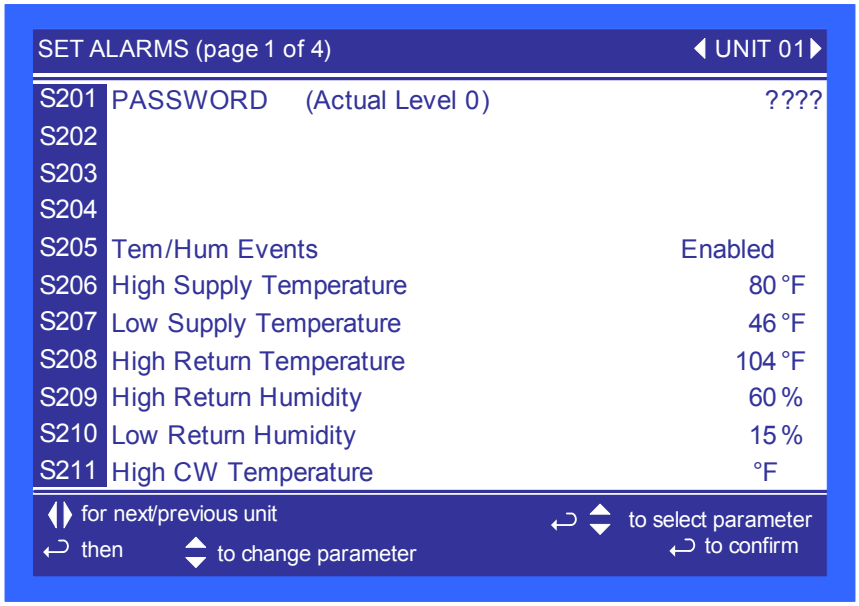
Status HP1—This shows the status of the unit's compressor 1 high pressure switch input.

Status LP1—This shows the status of the unit's compressor 1 low pressure switch input.

Status LWD—This shows the status of the unit's Leakage Water Detector.

Status Liquitech—This shows the status of the unit's Liebert Liqui-tect® liquid detection setup.

Figure 73 Set alarms parameters screen - Page 1



Temp/Hum Events—This parameter enables or disables all of the temperature and humidity events.

High Supply Temperature—This parameter sets the high temperature threshold that will trigger an alarm on the Liebert iCOM® local display and any monitoring system that may be connected.

Low Supply Temperature—This parameter sets the low temperature threshold that will trigger an alarm on the Liebert iCOM local display and any monitoring system that may be connected.

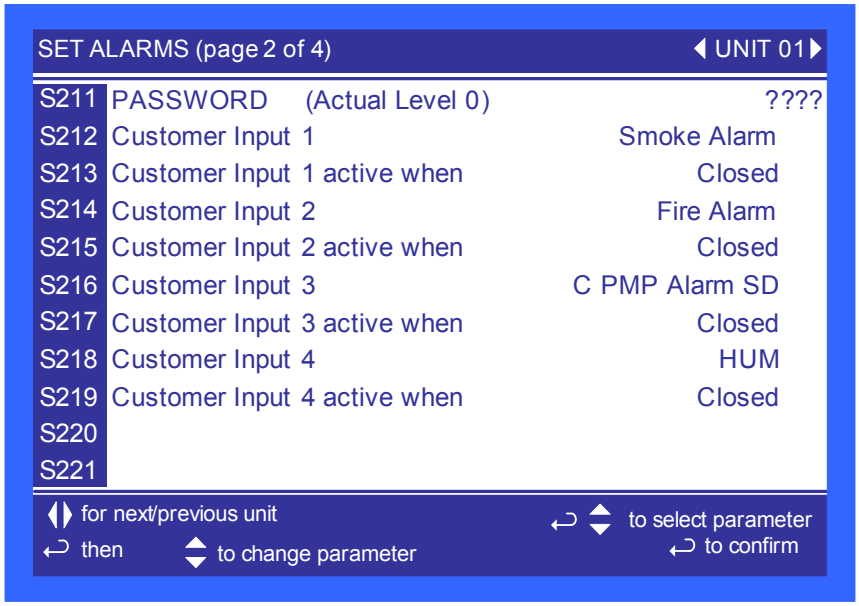
High Return Temperature—This parameter sets the threshold temperature when a return high temperature alarm will occur.

High Return Humidity—This parameter sets the threshold humidity when a return high humidity alarm will occur.

Low Return Humidity—This parameter sets the threshold humidity when a return low humidity alarm will occur.

High CW Temperature—This parameter sets the threshold chilled water when a return high chilled water temperature alarm will occur.

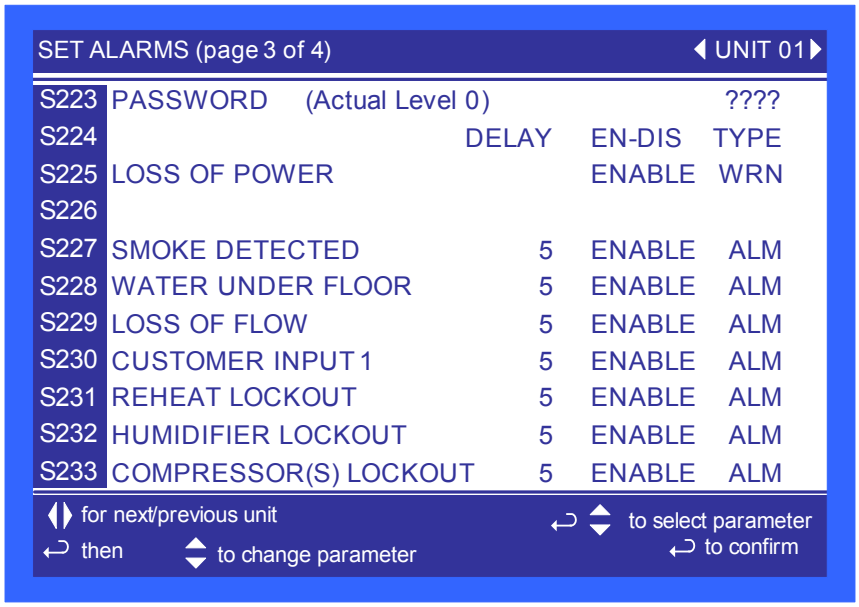
Figure 74 Set alarms parameters screen - Page 2



Customer Input 1, 2, 3 & 4—These parameters select the device and operation of the customer inputs. Each event reflects a different alarm and possible action to the unit. Refer to table 7 for a description of selectable options.

Customer Input 1, 2, 3 & 4 active when—These parameters select whether the input is a normally closed or normally closed input.

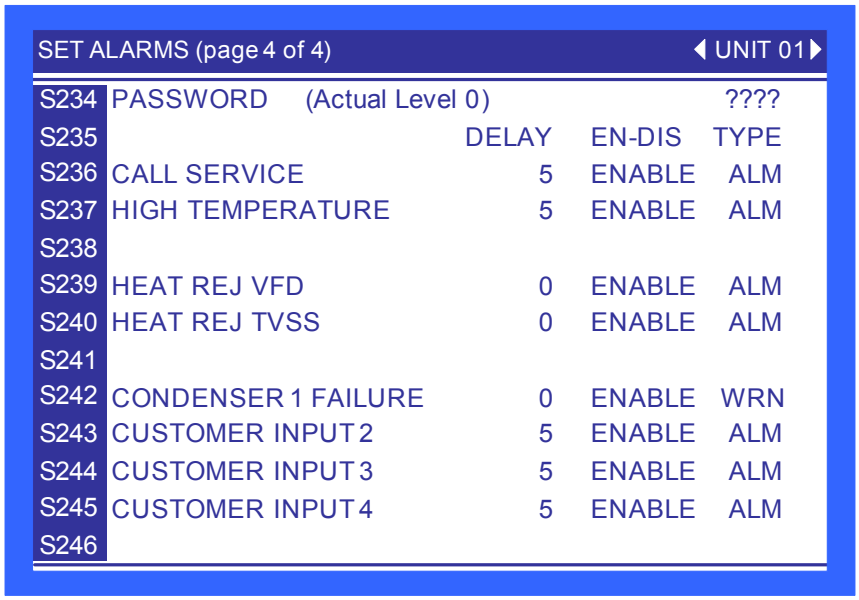
Figure 75 Set alarms parameters screen - Page 3



This screen selects the operation of an active alarm. Each event can be enabled or disabled and can be set to operate as an alarm, warning or message. The delay is the time the control waits before reporting the event.

- Alarm: Annunciates the buzzer, triggers a monitoring event, triggers the alarm relay and flashes the red LED on the display
- Warning / Alarm: Annunciates the buzzer, triggers a monitoring event, shows the event in the event viewer / front display and flashes the red LED on the display.
- Message: Shows the event in the event viewer and on the front display.

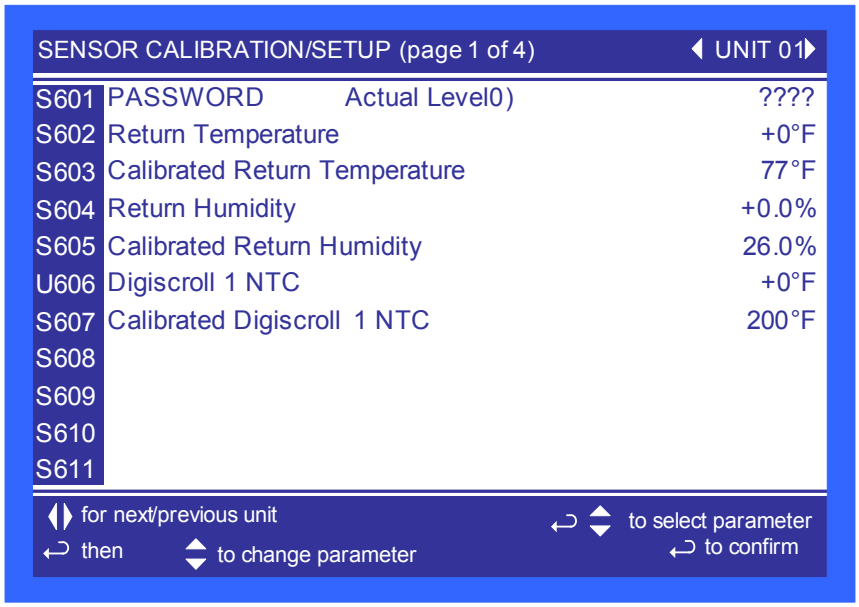
Figure 76 Set alarms parameters screen - Page 4



This screen selects the operation of an active alarm. Each event can be enabled or disabled and can be set to operate as an alarm, warning or message. The delay is the time the control waits before reporting the event.

- Alarm: Annunciates the buzzer, triggers a monitoring event, triggers the alarm relay and flashes the red LED on the display
- Warning / Alarm: Annunciates the buzzer, triggers a monitoring event, shows the event in the event viewer / front display and flashes the red LED on the display.
- Message: Shows the event in the event viewer and on the front display.

Figure 77 Sensor calibration / setup parameters - Page 1



Return Temperature—This parameter adjusts the return temperature reading from the actual sensor to compensate for any error of the sensor or to match other sensors in the room.

Calibrated Return Temperature—This parameter shows the adjusted temperature value of the return sensor. This value is the actual sensor reading (+ or -) the offset "Return Temperature".

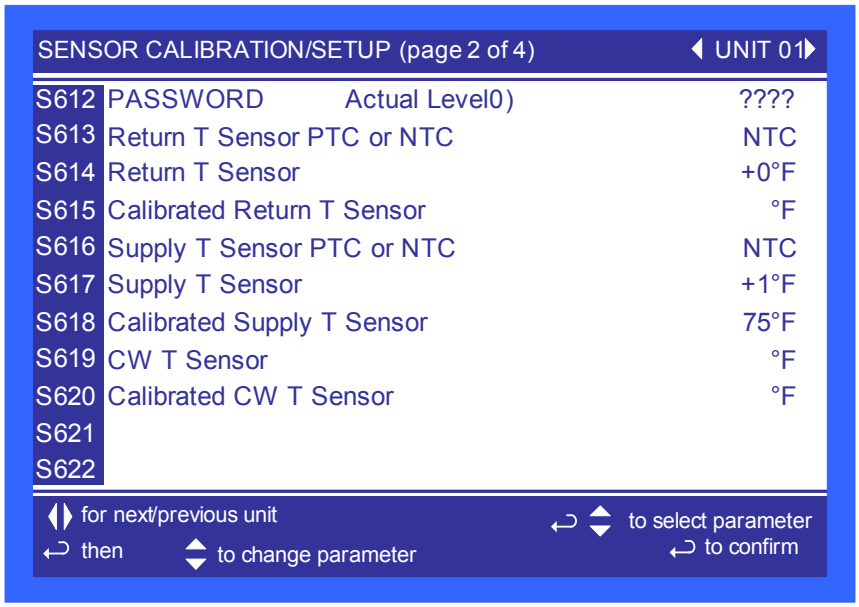
Return Humidity—This parameter adjusts the return humidity reading from the actual sensor to compensate for any error of the sensor or to match other sensors in the room.

Calibrated Return Humidity—This parameter shows the adjusted humidity value of the return sensor. This value is the actual sensor reading (+ or -) the offset "Return Humidity".

Digiscroll 1 NTC—This parameter adjusts the digital scroll 1 NTC reading from the actual sensor to compensate for any error or drift of the sensor.

Calibrated Digiscroll 1 NTC—This parameter shows the adjusted Digital Scroll 1 NTC sensor value. This value is the actual sensor reading (+ or -) the offset "Digital Scroll 1 NTC".

Figure 78 Sensor calibration / setup parameters - Page 2



Return T Sensor PTC or NTC—This parameter selects the type of sensor being used for the return air sensor.

Return T Sensor—This parameter can provide an offset to the actual sensor reading to calibrate the units sensor to other sensors.

Calibrated Return T Sensor—This parameter is the reading after the offset has been added to or subtracted from the actual sensor reading.

Supply T Sensor PTC or NTC—This parameter sets the type of sensor that is connected to the unit. It is set at the factory as NTC and should be changed only by a certified Emerson technician.

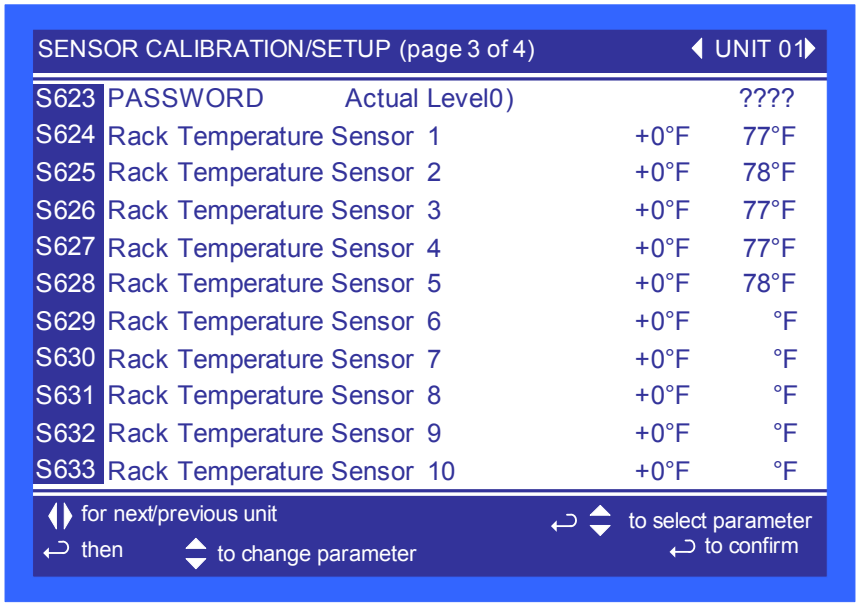
Supply T Sensor—This parameter can provide an offset to the actual sensor reading to calibrate the unit's sensor to other sensors.

Calibrated Supply T Sensor—This parameter is the reading after the offset has been added to or subtracted from the actual sensor reading.

CW T Sensor—This parameter can provide an offset to the actual sensor reading to calibrate the unit's sensor to other sensors.

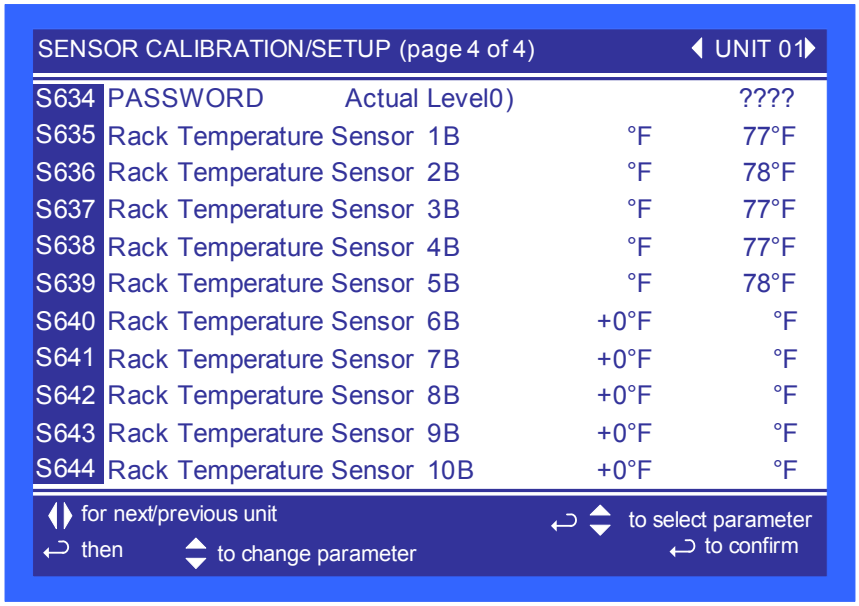
Calibrated CW T Sensor—This parameter is the reading after the offset has been added to or subtracted from the actual sensor reading.

Figure 79 Sensor calibration / setup parameters - Page 3



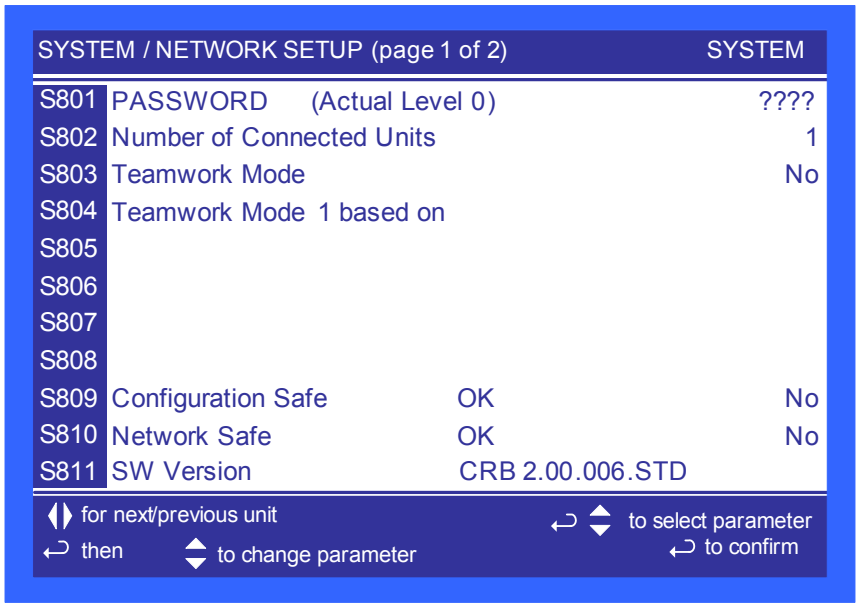
This unit can be equipped with a total of 20 rack sensor readings or 10 2T temperature sensor modules. This menu provides the ability to calibrated by entering a negative or positive offset. The calibrated reading is displayed in the far right column. If a value is not shown in the far right column, then the sensor is either not setup correctly or is not connected.

Figure 80 Sensor calibration / setup parameters - Page 4



This unit can be equipped with a total of 20 rack sensor readings or 10 2T temperature sensor modules. This menu provides the ability to calibrated by entering a negative or positive offset. The calibrated reading is displayed in the far right column. If a value is not shown in the far right column, then the sensor is either not setup correctly or is not connected.

Figure 81 System / network setup parameters—System - Page 1



Number of Connected Units—This parameter sets the number of units that will be viewable from the large display and will participate on the unit to unit network.

Teamwork Mode—This parameter selects which teamwork mode to use within a selected group. Teamwork modes are described in section 4.0 of this manual.

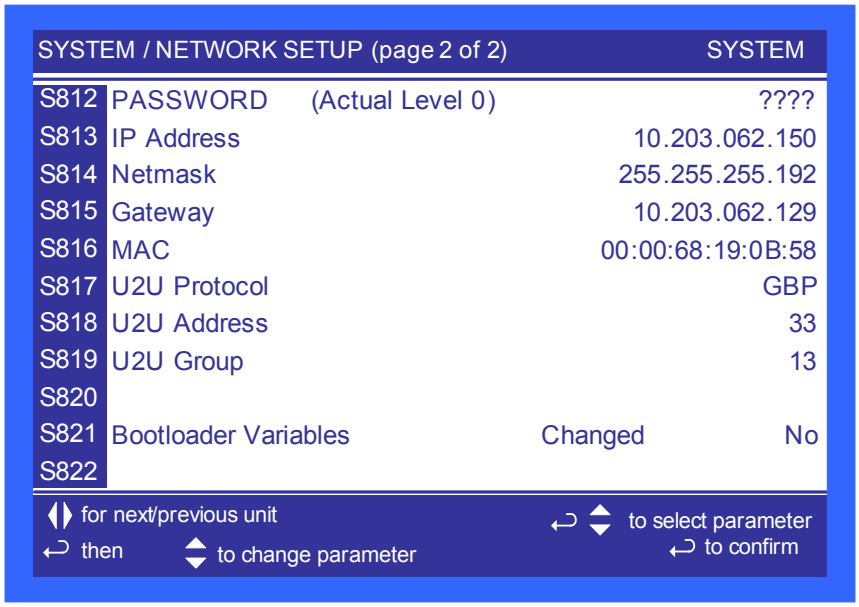
Teamwork Mode 1 based on—

Configuration Safe—This parameter saves or loads configuration settings for the display that have been modified from the factory defaults to an internal file that can be downloaded / uploaded using the Liebert iCOM® Service Tool. Selecting "Save" will write the settings to the internal storage file and selecting "Load" will write the settings from the internal storage file to the application software. The internal file is updated every 12 hours automatically.

Network Safe—This parameter saves or loads network settings for the display that have been modified from the factory defaults to an internal file that can be downloaded / uploaded using the Liebert iCOM® Service Tool. Selecting "Save" will write the settings to the internal storage file and selecting "Load" will write the settings from the internal storage file to the application software.

SW Version—This parameter contains the application software version loaded into the Liebert iCOM display.

Figure 82 System / network setup parameters—large display only System - Page 2



IP Address—This parameter contains the network address of the display. This address must be unique to every other device on the network.

Netmask—Not currently used.

Gateway—Not currently used.

MAC—The MAC address is a unique hardware identifier of the Ethernet device.

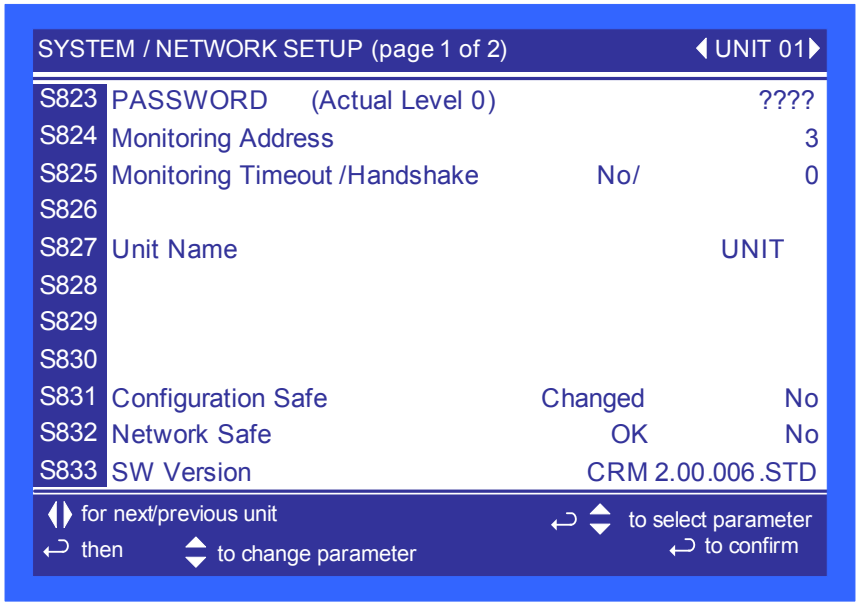
U2U Protocol—This parameter is always set to GBP.

U2U Address—This parameter is a unique identifier for each unit on the network. Display addresses range from 33 to 64. Each display on the U2U network must have a different U2U address.

U2U Group—This parameter is used to create zones or groups within a U2U network. Once a group number is selected the display will only see other devices with the same group number. The group number can be changed to view other devices in different groups.

Bootloader Variables—This parameter indicates if there has been a change to the bootloader since it was last loaded. This parameter should only be activated by an authorized service person.

Figure 83 System/Network setup parameters Unit- Page 1



Monitoring Address—This parameter sets the address used by the Liebert IntelliSlot® cards. This is set to 3 from the factory and should not be changed.

Monitoring Timeout/Handshake—This parameter can be used with a building management system to verify communications has not been lost between the Liebert iCOM® control and the BMS. If the amount of time specified in this parameter elapses before the BMS writes a new value then an alarm will occur "BMS TIMEOUT" and the temperature setpoint will revert to the backup setpoint and the fan speed "if equipped" will change to 100%. To disable this feature write a zero to this parameter when it is active.

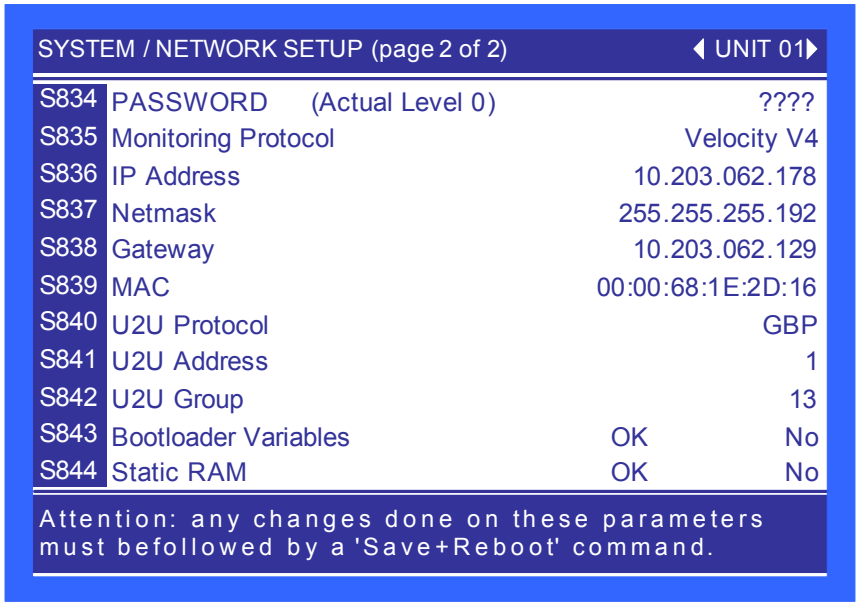
Unit Name—This parameter is a label to identify the unit from the local or remote display. This label will show at the top right of every screen that has monitoring or configuration of that unit.

Configuration Safe—This parameter saves or loads configuration settings for the control board that have been modified from the factory defaults to an internal file that can be downloaded / uploaded using the Liebert iCOM Service Tool. Selecting "Save" will write the settings to the internal storage file and selecting "Load" will write the settings from the internal storage file to the application software. The internal file is updated every 12 hours automatically.

Network Safe—This parameter saves or loads network settings for the control board that have been modified from the factory defaults to an internal file that can be downloaded / uploaded using the Liebert iCOM Service Tool. Selecting "Save" will write the settings to the internal storage file and selecting "Load" will write the settings from the internal storage file to the application software.

SW Version—This parameter contains the application software version loaded onto the Liebert iCOM control board.

Figure 84 System/Network setup parameters Unit - Page 2



Monitoring Protocol—This parameter selects the monitoring protocol. Velocity V3 is the factory default which will provide communications to the Liebert IntelliSlot® housing. iGMNet will activate the 77/78 terminals for communications to the Liebert SiteLink® (-E). Hironet is used only on HPM units.

IP Address—This parameter contains the network address of the display. This address must be unique to every other device on the network.

Netmask—Not currently used.

Gateway—Not currently used.

MAC—The MAC address is a unique hardware identifier of the Ethernet device.

U2U Protocol—This parameter is always set to GBP.

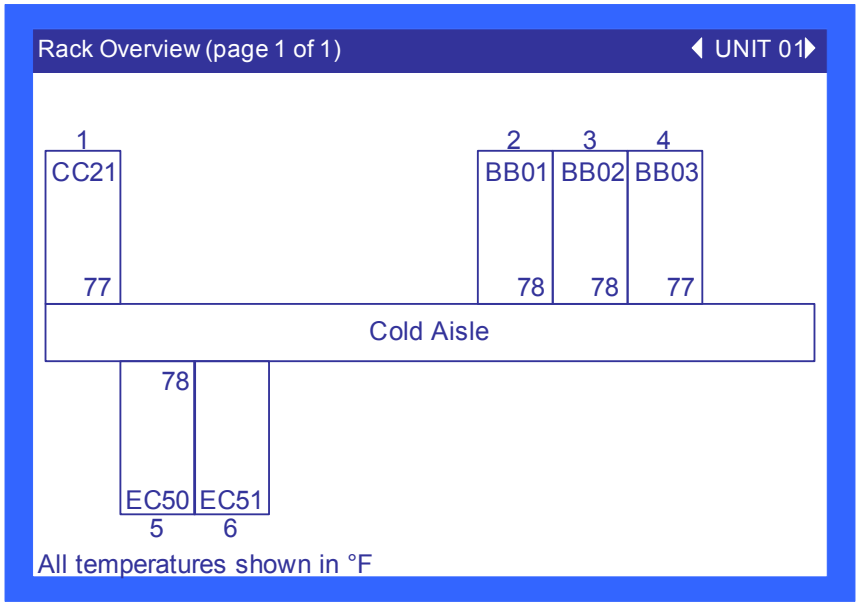
U2U Address—This parameter is a unique identifier for each unit on the network. Display addresses range from 33 to 64. Each display on the U2U network must have a different U2U address.

U2U Group—This parameter is used to create zones or groups within a U2U network. Once a group number is selected the display will only see other devices with the same group number. The group number can be changed to view other devices in different groups.

Bootloader Variables—This parameter indicates if there has been a change to the boot loader since it was last loaded. This parameter should only be activated by an authorized service person.

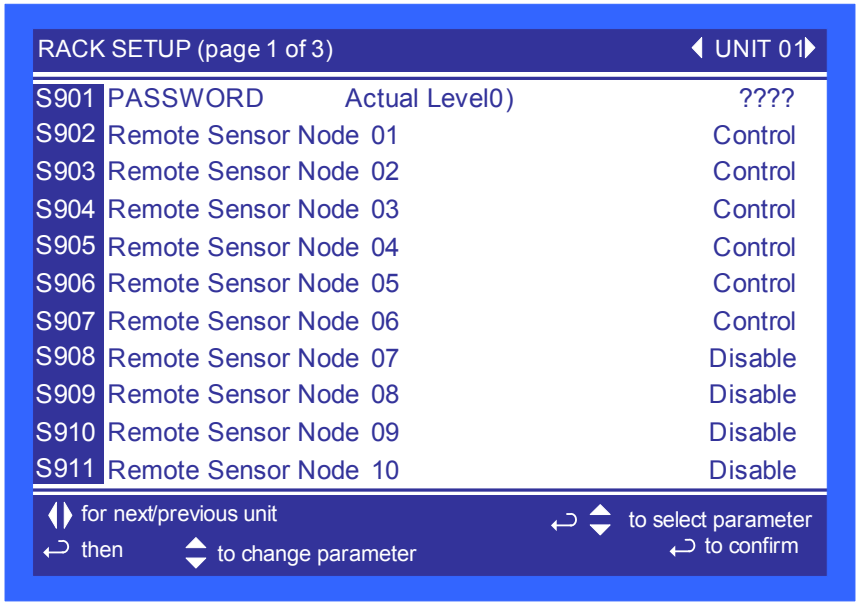
Static RAM—

Figure 85 Rack Overview, Page 1



This screen shows the rack label assigned to each rack and the temperature associated with the rack sensor. This screen shows the relative distance between the Liebert CRV and each rack sensor.

Figure 86 Rack Setup, Page 1



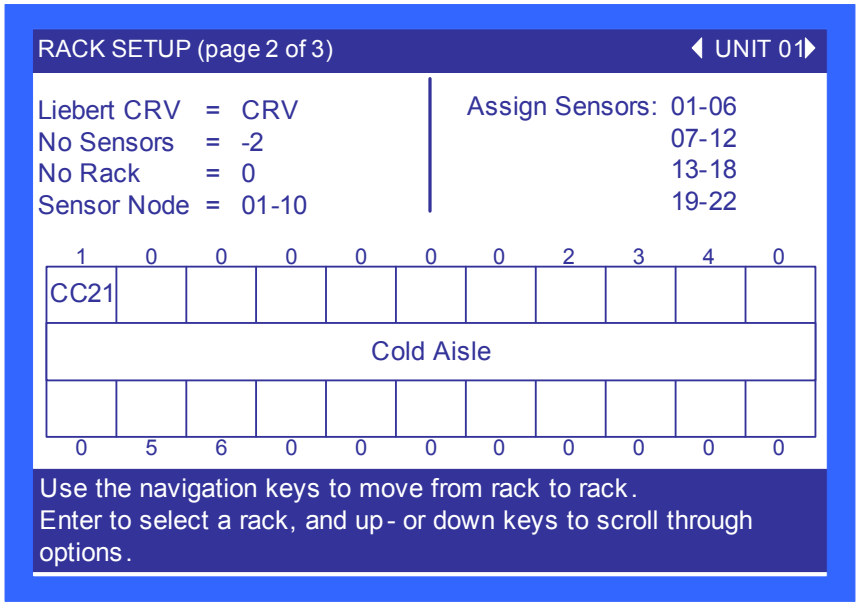
Rack Sensors are automatically detected when connected and set to "Control." A maximum of 10 2T sensors can be connected; the control automatically detects the type.

Control—The Liebert CRV is using the sensor for temperature control.

Reference—The sensor value is shown, but not used for temperature control.

Disable—No sensor connected.

Figure 87 Rack Setup, Page 2



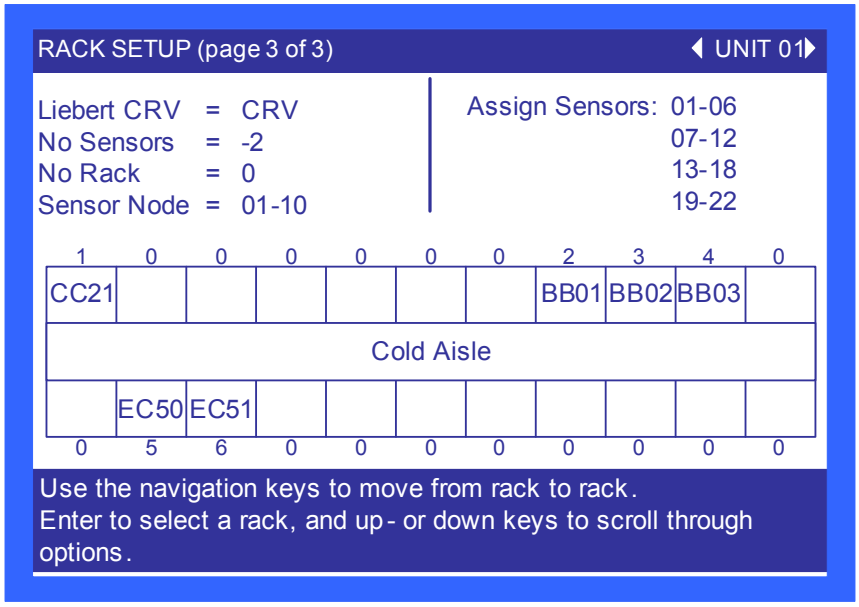
The Rack Setup display allows creating a graphical map of the remote rack sensors.

When the Assigned Sensors 1-6 are selected, it will drop the user down to assign the sensor node address to the first group of six "boxes." Setting "CRV" instead of a number (CRV is located below 0) will give the hard-coded name "CRV" to the selected box.

A sensor address (#1- #10) or "CRV" can be assigned only once per screen.

The names for each rack can be assigned on the next page. Once names have been assigned, they will also show up on this page (read only).

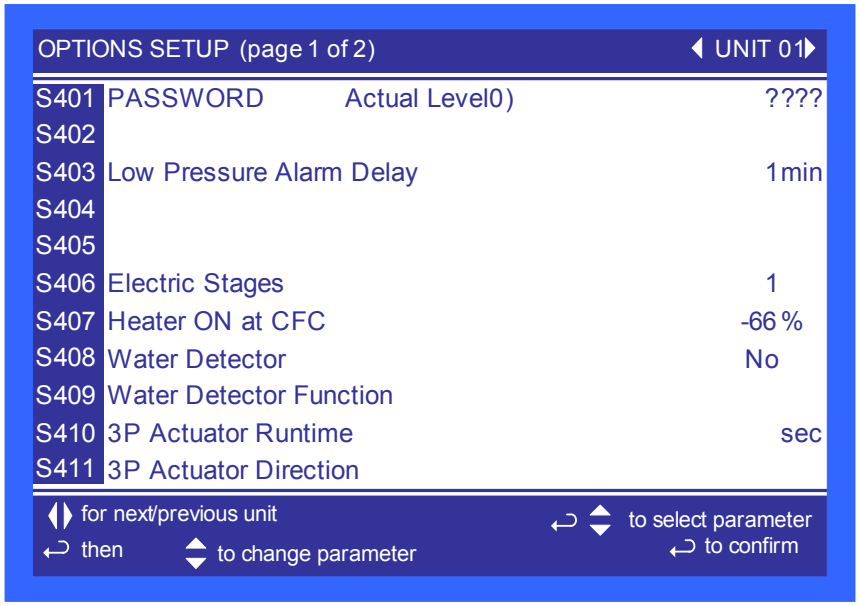
Figure 88 Rack Setup, Page 3



The Rack Setup display allows naming each rack with up to four characters, either letters or digits (A-Z or 0-9). Names can be assigned to each rack except those that have no sensor (#0-#10), no "CRV" or "Rack w/o sensor (-2)" assigned on the previous Rack Setup page.

When the Assigned Names 1-6 are selected, it will drop the user down to assign the rack name to the first group of six "boxes."

Figure 89 Options setup parameters - Page 1



Low Pressure Alarm Delay—This parameter sets the amount of time that the unit will ignore a low pressure condition. In the past this parameter has also been referred to as a Winter Start Time. This parameter can be set between 0 to 5 minutes.

Electric Stages—This parameter shows the number of electric stages that can be activated during a call for reheat. This parameter is setup from the factory based on the model number of the unit.

3P Actuator Runtime—If Valve Control is selected for "Time" then this parameter sets the travel time of the valve to determine the full open and closed position of the valve. This setting is set from the factory based on the valves manufacturer specifications.

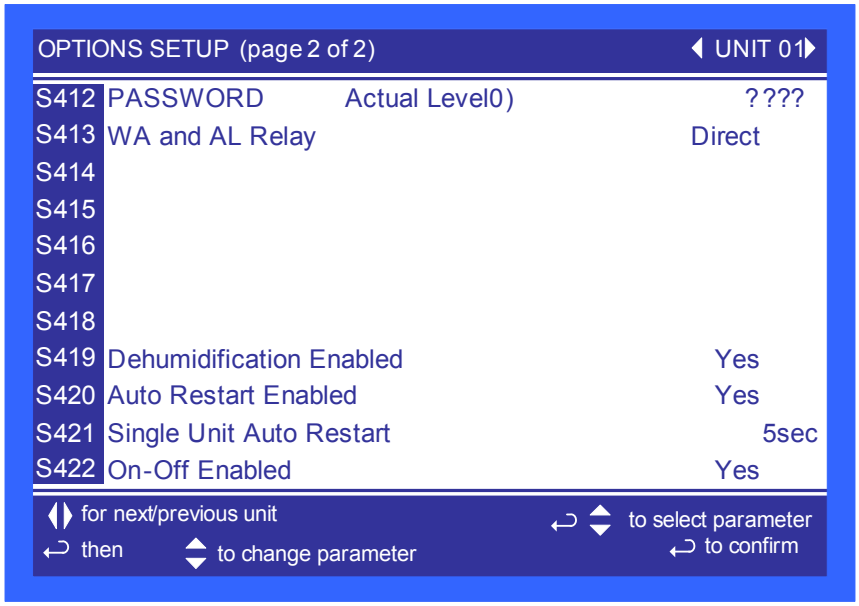
3P Actuator Direction—This parameter selects if the valve is a "Direct" or "Reverse" acting valve.

NOTE

When attaching the optional leak detection sensors (Liebert Liqui-tect®) the following parameters must be adjusted:

- *S408 – Set to LQTECH*
- *S409 – Set to alarm*

Figure 90 Options setup parameters - Page 2



WA and AL Relay—

Dehumidification Enabled—This parameters selects if the compressor and / or valve will be used to dehumidify when the humidity is above setpoint.

Auto Restart Enabled—This parameter when set to "Yes" restarts the unit after a power cycle. When this parameter is set to "No" then the unit will not restart (Turn On) after a power cycle.

Single Unit Auto Restart—This parameter sets a time delay for the unit to restart when the Auto Restart Enabled is set to "Yes". The delay begins once the boot process has completed. This parameter allows units to be staggered On to reduce the amount of simultaneous power consumption after a loss of power.

On-Off Enabled—This parameter disables the power button on the front of the display. The default configuration is "On".

Table 27 Service contact info parameters

Function		Range Imperial (metric)
Large Display	**Small Display**	
Page 1 of 1		
Password	PASSWORD	-
Country	Country	None Austria Switzerland D Switzerland F Benelux D Benelux FL Germany France UK Hungary Italy Poland Spain United States Australia New Zealand Indonesia Malaysia Singapore
Address line 1	Address line 1	text-string
Address line 2	Address line 2	text-string
Address line 3	Address line 3	text-string
Address line 4	Address line 4	text-string

11.0 OPERATION IN TEAMWORK MODE

11.1 Unit-to-Unit Network Wiring

Liebert CRV's can be connected in a unit-to-unit, or U2U, configuration, which allows multiple units to communicate with each other, sharing of local unit status and sensor readings. The U2U network will allow up to 32 units to be connected within a single group and up to 99 different groups to exists on the same physical network. Groups can be used to create zones of influence so that only the Liebert CRV's serving a common area will work together and back each other up.

The U2U setup unlocks the use of Lead-Lag/Rotation, Cascade and Teamwork Modes 1 and 2.

Lead-lag/rotation allows a standby Liebert CRV to activate based on an alarm or on a rotation based on time.

Cascade provides staging of the Liebert CRV's based on the actual temperature and its relation to the temperature setpoint.

Teamwork Modes 1 and 2 use the collective temperature information from all Liebert CRV's on the U2U network within the same group to determine how the group of Liebert CRV's should operate. To help manage the large amount of sensor information Liebert iCOM® allows the sensor data to be used as an average or a maximum value of all temperature sensor readings at both the local and system level.

Different groups can be configured to operation in different teamwork modes. If one Liebert CRV group serves a nonbalanced load, Teamwork Mode 2 will share all sensor data, prevent conflicting modes of operation between units but still allow each Liebert CRV to modulate based on the unit's local sensor readings. Another group of Liebert CRV's can be configured to operate in Teamwork Mode 1 that will share all sensor data, prevent conflicting modes of operation between units but will modulate all Liebert CRV's at the same capacity based on the U2U sensor readings.

11.2 Liebert iCOM U2U Ethernet Network

The Liebert iCOM U2U network must be isolated from other network traffic. The network switch(es) that connect Liebert iCOM controls must be dedicated to supporting only Liebert iCOM communication. The U2U network cannot be connected to the building or IT network. If network communication is ever lost, all Liebert iCOM-controlled cooling units will continue to operate as independent units.

The Liebert iCOM control can support up to 64 nodes on one network. An input/output board, large display and large wall-mount display are each considered one node. Of the 64 nodes that may be connected, no more than 32 may be input/output boards (32 cooling units).

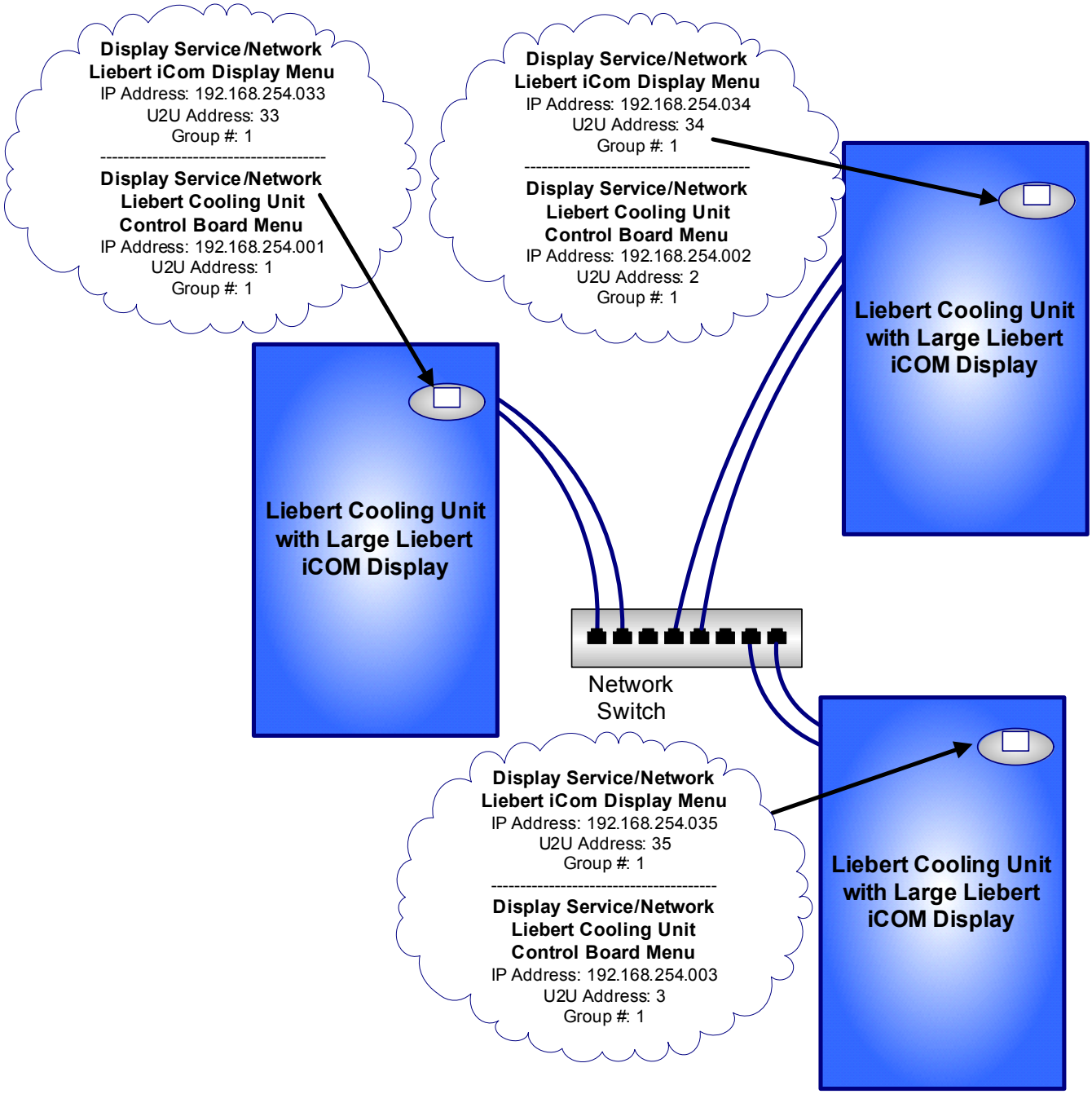
Network communication can be configured during system startup by a Liebert-trained technician. For technical issues contact:

Liebert Technical Service
1050 Dearborn Drive
Columbus, Ohio 43235
Telephone: 1-800-LIEBSRV (1-800-543-2778)
E-Mail: **technicalservice@emersonnetworkpower.com**

11.3 Wiring a Liebert iCOM® U2U Network

A network switch is required to enable Ethernet unit-to-unit communication on one or more Liebert CRV's. Each Liebert CRV requires two straight-through Ethernet cables from a network switch. One cable connects to port P64 on the Liebert iCOM input/output board and the other straight-through cable connects to the P64 port on the back of the large display (see **Figure 92**).

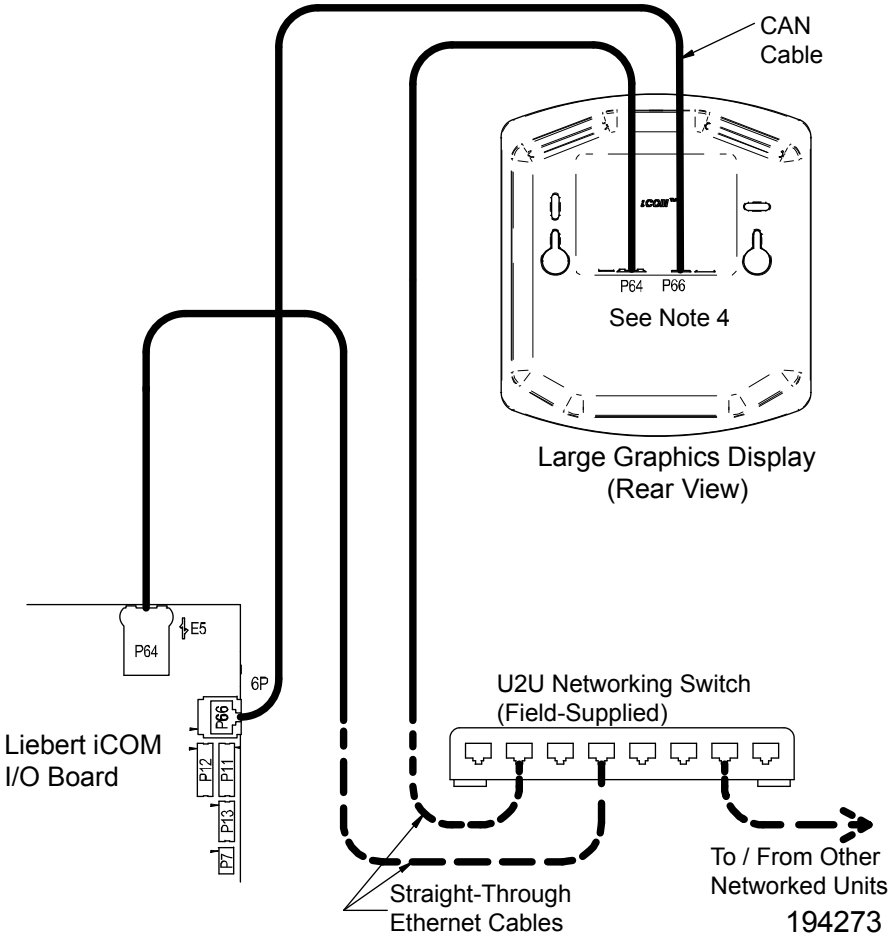
Figure 91 U2U network setup diagram



Wall-Mount Large Display

The Liebert CRV has a large display as standard equipment. Only large displays can be used for remotely monitoring and controlling cooling units connected on the same network. Each wall-mount large display requires 120V input power; Liebert provides an AC adapter wall plug. A straight-through Ethernet cable must be connected between the network switch and the P64 port on the back of the display. This will enable control and monitoring capabilities to any cooling unit connected to the network.

Figure 92 Wiring a large display for U2U network operation



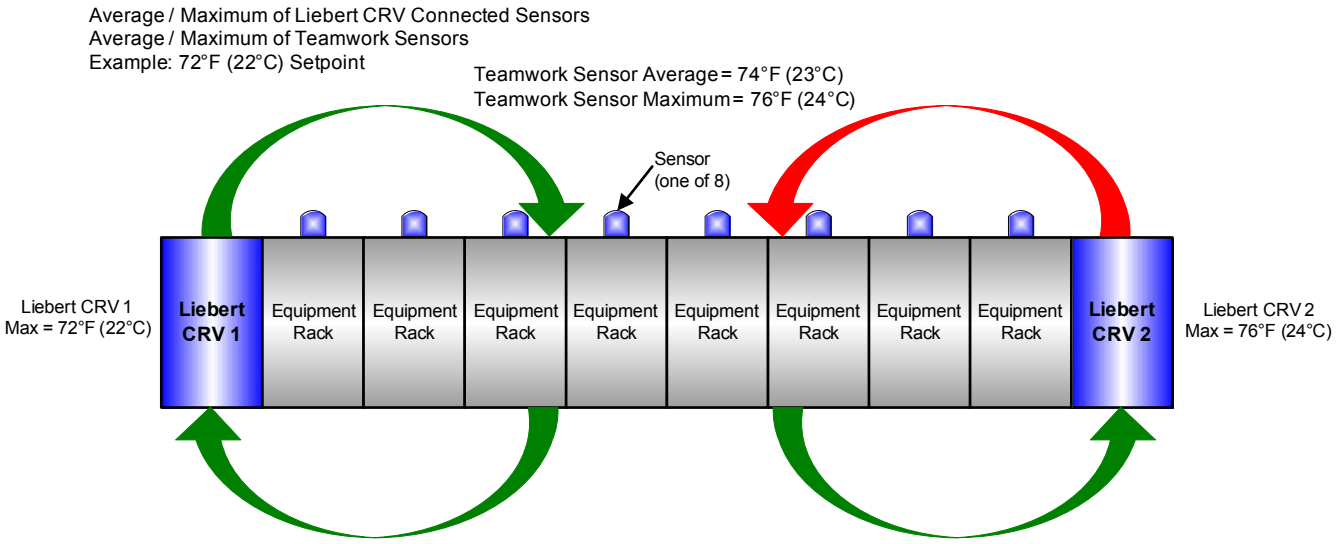
11.4 Teamwork Modes

Groups of cooling units connected to a network can be set up to work together in any of three teamwork modes:

- No Teamwork
- Teamwork Mode 1
- Teamwork Mode 2

All Liebert iCOM-controlled cooling units on a network must be set to run in the same teamwork mode.

Figure 93 Teamwork modes and sensor management



11.4.1 Application of Teamwork Modes

- **No Teamwork**: Multiple zones in one room
- **Teamwork Mode 1**: Balanced load (small groups of units inside the same environment)
- **Teamwork Mode 2**: Unbalanced load (large rooms, not all units will have the same load) (work well for most applications)

All units in a network will run in the same Teamwork Mode.

11.4.2 No Teamwork

All cooling units work independently, responding to their own sensors.

Standby function and unit rotation are possible, but cascading is not (see **Standby and Cascade on page 102**). AutoSet will not adjust the proportional band in this mode.

11.4.3 Teamwork Mode 1

Teamwork Mode 1 works best in small rooms with balanced heat loads. The return temperature and humidity sensor readings of all units in operation (fan on) are averaged by the master unit, Unit #1, and used for control. The master unit will send the operating requirements to all operating units according to unit numbers, rotated by one unit every 24 hours.

In this teamwork mode, most of the parameters are shared; if set in any one of the units, all other units will follow with the same settings. AutoSet will adjust the proportional band in Teamwork Mode 1.

The master unit evenly divides the system proportional band among the number of available units. Each unit will receive instruction on how to operate from the master unit based on how far the system deviates from the setpoints.

The number of available units is calculated like:

- In non-standby configuration: all units with fan on
- In typical standby function (no cascade): all units with fan on
- In cascade mode: all units that could operate (no alarm, which forces the unit to switch off, unit not switched off, etc.)

NOTE

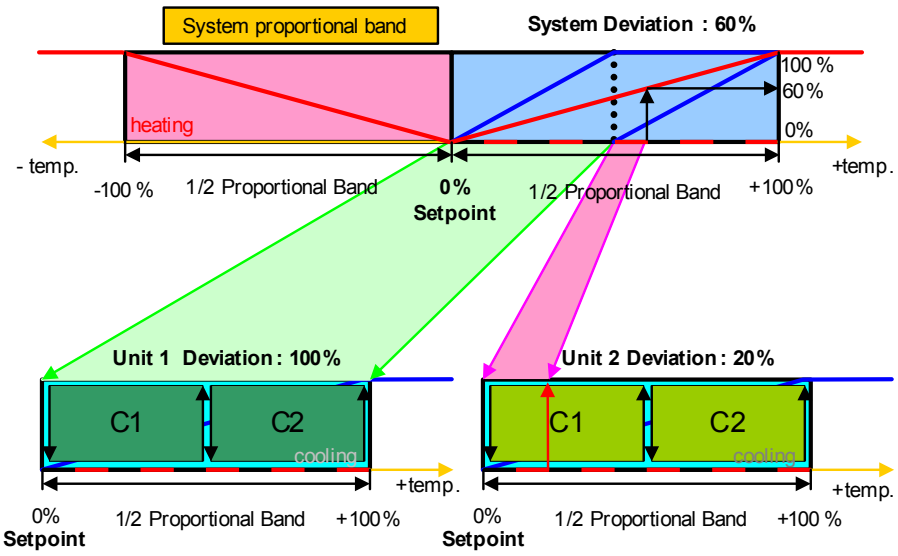
1. *Proportional actuators (chilled water valve, free-cooling actuator) are driven in parallel in all units.*
2. *Changeover to second cooling source, low limit during dehumidification and low supply limit control air local functions, managed from each unit independently.*

Figure 94 shows how two cooling units work together in Teamwork Mode 1. Since Unit 1 and Unit 2 are available to operate, the master unit, Unit 1, averages the temperature and humidity sensor readings from each unit.

The master unit determines that a 60% call for cooling is required for the system. Since there are two available cooling units, each unit makes up half of the system proportional band; Unit 1 handles 0-50% system call for cooling and Unit 2 handles 51-100%. For every 1% system call for cooling, each unit provides 2% of its total cooling capacity.

The 60% system call for cooling exceeds the 50% Unit 1 can provide, so Unit 1 operates at full capacity. The remaining 10% system call for cooling (60% - 50% = 10%) is handled by Unit 2. Unit 2 responds by operating at 20% cooling capacity (50% ÷ 10% = 20%).

Figure 94 Teamwork Mode 1 with two cooling units



11.4.4 Teamwork Mode 2

Teamwork Mode 2 is designed to prevent units within a group from working against each other or "fighting." It is best applied in large rooms with unbalanced heat loads. In Teamwork Mode 2, all parameters are shared equal to Mode 1, and Unit #1 averages all of the available unit sensor readings on the network to define whether there is a cooling, heating, dehumidification or humidification request.

If there is a cooling request, all units are released to start cooling resources according to their own temperature readings; heating is disabled for all units and vice versa. Same for humidity control.

If the network average would ask for 0% proportional band, the most demanding request (highest or lowest temperature of all units, highest or lowest humidity of all units) would be used to define the operation to be performed.

Teamwork Mode 2 does not rotate; unevenly distributed working hours to be expected. AutoSet will not adjust the proportional band in this mode.

NOTE

In Teamwork Mode 2, all units must have the same setpoints. The units' proportional band, deadband and related settings may differ.

11.4.5 Standby—Rotation

Typical Standby (Lead/Lag) Function

This function can be performed in any teamwork mode, including NO Teamwork.

One or more units can be defined to be Standby; the normal status of standby units is Standby Off (fan off).

In case one regular unit has an alarm that is defined (to be defined in the alarm configuration), to switch on a standby unit, the faulty unit will switch off and the standby unit will switch on.

If the next unit has an alarm, the next standby unit will be started. If no more standby units are available, the unit with a non-critical alarm that permits unit operation will be switched on again (water detection, fan alarm, fire alarm etc. will not permit unit restarting).

The standby function can be rotated daily (setting the time), weekly (setting the day of the week and time) or monthly (setting the first weekday of the month and time).

The rotation is performed with a selectable number of units: if 1 is selected, to standby rotates from 1-2 to 2-3 in a 4 units configuration with two standby units, and rotates from 1-2 to 3-4 in the same configuration, when the rotation parameter is set to 2.

NOTE

Before entering standby mode, units will operate the fan only for 3 minutes to cool the electrical heaters, remove steam from the unit, etc.

Standby and Cascade

Cascade is possible in Teamwork Mode 1 only.

Standby units will start if an alarm occurs in one of the operational units. If the standby units are cascaded, they will also start and work with the regular operational units if the temperature or humidity cannot be controlled by the operational units; before a high or low temperature / humidity condition occurs. Cascaded units are switched off again as soon as the temperature / humidity returns back to normal.

The master unit defines its proportional band according to the number of available units (see **11.4.3 Teamwork Mode 1**).

When a standby unit receives a request for full heating or cooling from the master unit, it will respond to the request after its control delay.

NOTE

Cascaded units are not included in the calculation of the average temperature / humidity.

12.0 OPERATION

Figure 95 Return air temperature and humidity sensor viewed from the rear of the unit

The control system compares the relayed information with the programmed setpoint and proportional band values and performs one of the following operations:

- **Cooling**—Direct expansion mode (DX): The compressor is started and the cold refrigerant flows through the evaporator, thus cooling the air passing through it. For compressor operation see Liebert iCOM® user manual, SL-18835. Liebert recommends using the supply temperature sensor to control the cooling capacity of the Liebert CRV, but cooling can be managed from any of the temperature sensors. The supply temperature is an accurate representation of the actual heat rejection the Liebert CRV needs to perform. Chilled water Liebert CRV models will modulate the cooling capacity from 0% - 100% and DX models will modulate the cooling capacity from 20% - 100% compressor capacity. To avoid short-cycling the compressor during room heat load changes, the CRV will not deactivate the compressor until the air temperature is below 150% of temperature setpoint when in Remote or Supply Air Control or below 200% of temperature setpoint when operating in Return Air Control.
- **Chilled water mode (CW)**—The three-way valve is opened and the chilled water flows through the coil, thus cooling the air passing through it. For valve operation, see the Liebert iCOM user manual, SL-18835.
- **Reheating—**Electrical heating (optional): The heating elements heat the air passing over them during dehumidifcation. The heating control is active only when the unit is in dehumidification mode. The reheats will only activate when the unit is dehumidifying. The reheats will begin activation when the control temperature has dropped to -66% of the control's proportional band and will deactivate when temperature setpoint has been reached.
- **Dehumidification (DX mode)**— The temperature of the cooling coil is reduced to remove moisture from the air (refer to **Figures 58**, **59**, **69** and **90**).

NOTE

If dehumidification cannot reach its setpoint within a set amount of time, the unit will delay dehumidification to allow the room temperature to stabilize.

In dehumidification mode, the air after passing over the coil is reheated (if needed) by electrical heaters to stabilize the initial temperature.

- **Humidification** (optional)—The humidifier creates steam, which is distributed into the air stream via the steam distribution pipe. (See also **Appendix A - Humidifier**). The Liebert CRV's humidification is activated when the measured temperature and humidity sensor has been calculated to exceed the corresponding dew point setpoint. The dew point setpoint is calculated based on the temperature and humidity of the sensor set to control the control setpoint and relative humidity.

  Example: Temperature Setpoint 72°F / Humidity Setpoint 50% = 52°F Dew Point

NOTE

The Liebert iCOM® control monitors the condition of the air discharging from the unit to protect neighboring electronic equipment. Liebert iCOM will prevent the humidifier from activating if the discharge air is near its saturation point. This protects against discharging fog from the unit or condensation forming on the unit's supply air baffles. This protection mode is activated when the supply sensor reading is below 53°F (11.7°C) or above 55% relative humidity. When this condition is met a message will display showing "humidifier" suspended.

The status of the humidifier lockout can be viewed in the Service/Diagnostics menu.

These protections do not apply to the external humidifier output.

12.1 Alarms/Events

The following alarms and events are supported by the Liebert iCOM® control on the Liebert CRV.

When an alarm is triggered the alarm sounds, the LED will flash red, an event will be written to the Event Log and the BMS will be notified. If the alarm is acknowledged, the alarm will silence and the LED will turn solid red. When the alarm condition is resolved, the LED lights green and the BMS alarm notification is reset.

General Alarm	Unit 07 Disconnected	Dig Scroll1 High Temp	Unit 31 Disconnected
Comp 1 High Pressure	Unit 08 Disconnected	Smoke Detected	Unit 32 Disconnected
Comp 1 Low Pressure	Unit 09 Disconnected	Water Under Floor	System Off Requested
High CW Temp	Unit 10 Disconnected	Cond Pump-High Water	System Off Confirmed
Loss of CW Flow	Unit 11 Disconnected	Loss of Flow	Fire Alarm
Loss of Airflow	Unit 12 Disconnected	El Heat1 Hrs Exceeded	Heaters Overheated
Clogged Filters	Unit 13 Disconnected	Unit Code Missing	Condenser 1 Failure
Customer Input 1	Unit 14 Disconnected	Loss of Power	Humidifier Cylinder Worn
Customer Input 2	Unit 15 Disconnected	Reheat Lockout	Maintenance Done
Customer Input 3	Unit 16 Disconnected	Heat Rej VFD	Maintenance to be Done!
Customer Input 4	Dscroll 1 Sensor Fail	Humidifier Lockout	Top Fan Failure
LP Transducer 1 Fail	On-Off Key Disabled	Heat Rej TVSS	Control Valve Failure
Call Service	Lwd Sensor Fail	Compressor(S) Lockout	Fluid Sensor Failure
High Temperature	Hum Disabled	Humidifier Low Amps	High Supply Temperature
Unit Hrs Exceeded	Hum Enabled	Comp 1 Short Cycle	Low Supply Temperature
Comp 1 Hrs Exceeded	RAM / Battery Fail	Humidifier High Amps	High Return Humidity
Hum Hrs Exceeded	Low Memory 1	Humidifier Low Water	Low Return Humidity
Supply Sensor Failure	No Connection w/Unit1	Unit 17 Disconnected	Rack Sensor 1 Failure
Room Sensor Failure	Hp Transducer 1 Fail	Unit 18 Disconnected	Rack Sensor 2 Failure
Network Failure	Comp Power Reduction	Unit 19 Disconnected	Rack Sensor 3 Failure
Unit On	No Power	Unit 20 Disconnected	Rack Sensor 4 Failure
Unit Off	Unit Disabled	Unit 21 Disconnected	Rack Sensor 5 Failure
Standby Mode	Unit Shut Down	Unit 22 Disconnected	Rack Sensor 6 Failure
Power On	Dehum Disabled	Unit 23 Disconnected	Rack Sensor 7 Failure
Power Off	Dehum Disabled 12hrs	Unit 24 Disconnected	Rack Sensor 8 Failure
Unit 01 Disconnected	Dehum Enabled	Unit 25 Disconnected	Rack Sensor 9 Failure
Unit 02 Disconnected	Humidifier Problem	Unit 26 Disconnected	Rack Sensor 10 Failure
Unit 03 Disconnected	Dehum Hrs Exceeded	Unit 27 Disconnected	High Return Temperature
Unit 04 Disconnected	Comp 1 Pumpdown Fail	Unit 28 Disconnected	Room Humidity Problem
Unit 05 Disconnected	HCB Not Connected	Unit 29 Disconnected	Bottom Fan Failure
Unit 06 Disconnected	BMS Disconnected	Unit 30 Disconnected	

13.0 CALIBRATION AND REGULATION AFTER STARTUP

The Liebert CRV has been factory-tested and calibrated, but it is very important to check, at startup, the superheating of the thermostatic valve (A/W versions).

- For calibrations of instruments installed on the external condensers/drycoolers, refer to the manual for the equipment.
- For control system calibrations, refer to the Liebert iCOM® manual, SL-18835. (To prevent erratic operation, do not use temperature and relative humidity setpoints/proportional bands that differ excessively from the default settings.)

13.1 Thermostatic Expansion Valve

The Thermostatic Expansion Valve (TEV) 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. The correct superheat setting is between 10 and 20°F (-12 and -6°C). 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.

13.1.1 Determine Suction Superheat

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 the bulb's location and the 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.

13.1.2 Adjust Superheat Setting with the TEV

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 thirty minutes may be required for the new balance to take place.

13.2 Environmental Protection

Misuse or incorrect calibration of the unit leads to increased energy consumption, resulting in economic and environmental damage.

14.0 MAINTENANCE

14.1 Safety Instructions

All maintenance operations must strictly observe national, state and local accident prevention regulations, especially the regulations concerning electrical systems, refrigerators and manufacturing resources.

Air conditioning equipment maintenance may be performed only by authorized properly trained and qualified personnel.

To keep all warranties valid, the maintenance must adhere to the manufacturer's regulations.

WARNING

Arc flash and electric shock hazard. Can cause injury and death.

Disconnect local and remote power supplies and wear appropriate personal protective equipment per NFPA 70E before working within.

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 control.

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

Install and open a remote disconnect switch and verify with a voltmeter that live hazardous voltage potential is not present inside the unit cabinet before working within. Refer to the unit electrical schematic.

Follow all national and local codes.

WARNING

Risk of contact with rotating fan blades and extremely hot and/or cold surfaces. Can cause equipment damage, injury and death.

Disconnect all local and remote electric power supplies before working within. Perform maintenance only when the system is de-energized, all fan blades have stopped rotating and component temperatures have become safe for human contact.

- Turn Off the system by switching it Off at the controller and the main disconnect switch.
- Post a warning sign saying "Do not switch on."
- Electrical components of the unit must be switched Off and checked using a voltmeter to ensure they are not receiving electrical input power.

WARNING

Risk of hair, clothing and jewelry entanglement with high speed rotating fan blades. Can cause equipment damage, serious injury or death.

Keep hair, jewelry and loose clothing secured and away from rotating fan blades during operation.

NOTICE

Risk of improper maintenance. Can cause equipment damage.

All maintenance must be performed only by authorized properly trained and qualified personnel.

Ignoring safety instructions can be dangerous to persons as well as to the environment. Soiled parts always cause a loss of performance and, for switch or control devices, can lead to the breakdown of a plant.

14.2 Spare Parts

Only original spare parts made by Emerson Network Power may be used. Using third-party material can invalidate the warranty. When making seeking technical assistance, always refer to the component list supplied with the equipment, and specify the model number, serial number and, if available, the part number.

NOTE

1. *When replacing a faulty component, follow the relevant manufacturer instructions.*
2. *When the spare parts must be brazed, be careful not to damage the internal parts (gaskets, seals, O-rings, etc.).*

14.3 Maintenance Schedule

Conduct monthly, quarterly, biannual and annual checks according to the following guidelines.

All tasks and time periods listed here are the manufacturers' regulations and must be documented in an inspection report.

Table 28 Maintenance schedule

Component		Maintenance Period			
		Monthly By User	Every 3 Months	Every 6 Months	Annually
General	Check unit display for clogged-filter warning	X			
	Check for irregular noise from unit fans	X			
	Check for irregular noise from compressor (if applicable)	X			
	Check for irregular noise from remote condenser fan(s) (if applicable)	X			
Filters	Check state of filters		X		
	Replace air filter if necessary		X		
	Check filter switch functionality			X	
Blowers	Verify impellers move freely		X		
	Check bearings			X	
	Check motor mounts for tightness			X	
	Check fan safety switch				X
Electrical/Electronics	Check condition of contacts			X	
	Check electrical connections				X
	Check operation of controller			X	
	Check unit operation sequence			X	
Steam-Generating Humidifier	Check cylinder and pan		X		
	Check condition of steam hoses			X	
	Verify filling solenoid valve is operating properly			X	
Cooling Water Circuit (Water/Glycol and Chilled Water Units)	Check circuit for leakage/general condition		X		
	Check water (glycol) inlet temperature			X	
	Check water regulating valve operation			X	
	Check in/out water (glycol) Δt			X	
	Check mixture glycol level (if applicable)				X

Table 28 Maintenance schedule

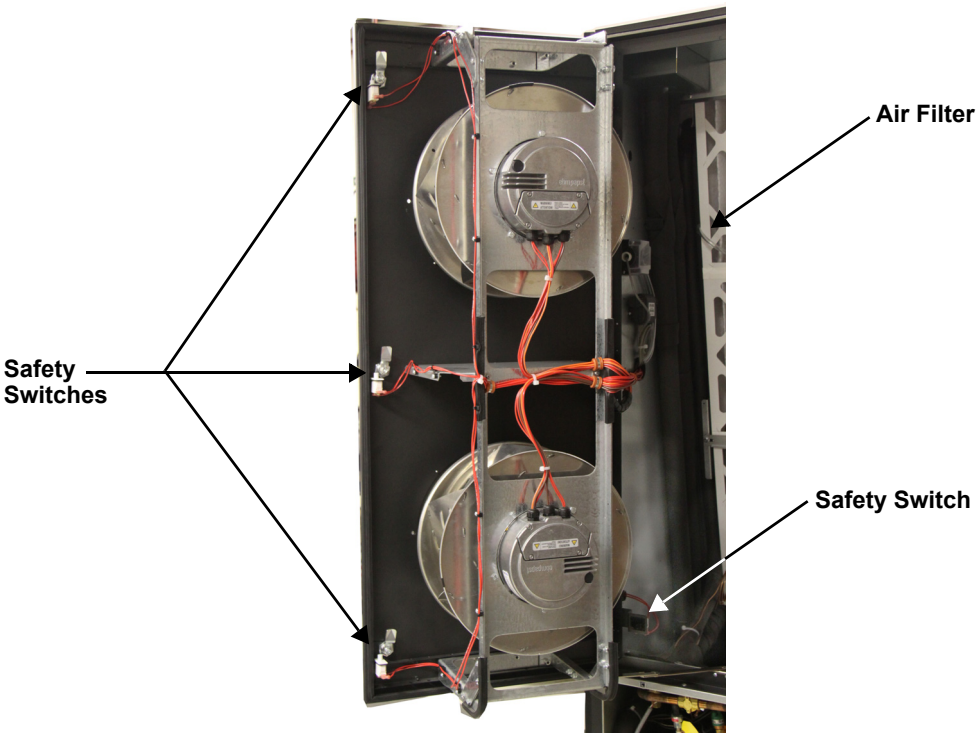
Component		Maintenance Period			
		Monthly By User	Every 3 Months	Every 6 Months	Annually
Refrigerating Circuit	Check compressor noise/vibrations		X		
	Check oil level through compressor sight glass			X	
	Adjust/tighten compressor/functional elements			X	
	Check sight glass for problem detection			X	
	Check starting/running amps			X	
	Check refrigerating circuit main pressures			X	
	Check compressor suction superheat			X	
	Check discharge temperature			X	
	Check subcooling				X
Air-Cooled Condenser/Drycooler (if applicable)	Check fan bearings		X		
	Check fan motor mounts for tightness			X	
	Check coil condition			X	
	Check pipeline supports			X	
	Check fan speed controller operation				X
Water/Glycol Pump	See manual for the pump				

14.4 Inspect and Replace the Air Filter

Check the air filter monthly to maintain efficient air distribution through the evaporator coil.

1. Switch Off the CRV.
2. Open the rear panel by rotating the three locks with a screwdriver.
3. Wait until the fans stop rotating. When you open the first lock, you also open a safety switch that cuts the input power; see **Figure 96** below.

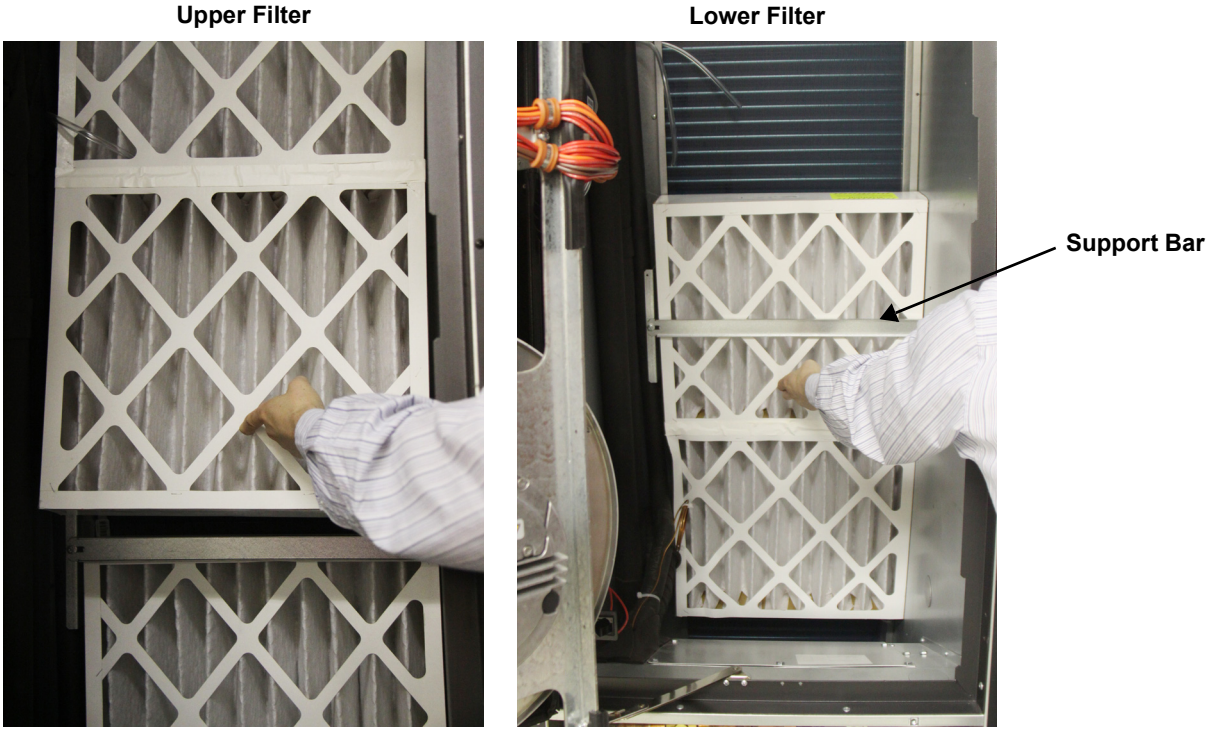
Figure 96 Air filter location and input power safety switch



To extract the filters (refer to **Figure 97**:

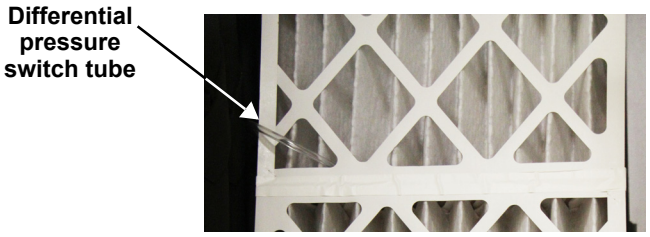
1. Push up the upper filter.
2. Pull the bottom of the filter away from the Liebert CRV.
3. Pull it out of the unit.
4. Lift the lower filter up
5. Pull the bottom of the filter away from the Liebert CRV.
6. Pull it out of the unit.

Figure 97 Remove the air filters



After cleaning or replacing the filter and before reassembling the unit, check that the air differential pressure switch pipes (clogged filter alarm) are in the correct position and order. Check also that the drain trays are clean and the pipe secure.

Figure 98 Differential pressure switch tubes



Before restarting the unit, be sure that the microswitches are properly closed; otherwise, the unit remains in safety status.

14.5 Condensate Drain and Condensate Pump Systems

14.5.1 Condensate drain

Check for and clear obstructions in tubing during routine maintenance.

14.5.2 Condensate Pump, Dual-Float

Figure 99 Condensate pump

1. Disconnect power to the unit using the disconnect switch.
2. Check for and clear obstructions in gravity lines leading to the condensate pump.
3. Remove the sump, clean with a stiff nylon brush and flush with water.
4. Inspect and clear clogs in the discharge check valve and float mechanism.
5. Reassemble and check for leaks.

14.6 Air-Cooled Condenser and Drycoolers

1. Clear the coil surface of all debris that might inhibit airflow.
2. Check for and correct bent or damaged coil fins.
3. Do not permit snow to accumulate around or under an outdoor unit.
4. Consider having the coil surface commercially cleaned periodically.
5. Inspect fans, motors and controls for proper operation.
6. Check all piping and capillaries for proper support.
7. Inspect for leaks.

14.7 Electrical Heaters

1. Inspect and clean reheat elements.
2. Inspect and tighten support hardware.

14.8 Dismantling the Unit

The Liebert CRV has been designed and built to ensure continuous operation.

The working life of some of the main components, such as the fan and the compressor, depends on proper maintenance.

NOTICE

Risk of release of hazardous substances into the environment. Can cause environmental pollution and violation of environmental regulations.

The Liebert CRV contains substances and components hazardous for the environment (electronic components, refrigerating gases and oils). At the end of its useful life, the Liebert CRV must be dismantled by specialized refrigerating technicians. The unit must be delivered to suitable centers specializing in the collection and disposal of equipment containing hazardous substances.

The refrigerating fluid and the lubricating oil inside the circuit must be recovered according to the laws in the relevant country.

To recover the gas, use all the connections described in **6.0 Refrigerant Connections**.

14.9 F-Gas Regulation (EC) No. 842/2006

Stationary air conditioning placed in the European Community market and operating with fluorinated greenhouse gases (F-gas), such as R-134A, R-407C and R-410A, must comply with the F-gas Regulation (applied since July 4, 2007).

Following considerations must be observed when operating with the above-mentioned equipment:

- Fluorinated greenhouse gases are covered by the Kyoto Protocol.
- The fluorinated greenhouse gases in this equipment should not be vented to the atmosphere.
- Referring to the value noted in Annex I of Regulation (EC) No 842/2006, the following list specifies the global warming potential (GWP) of some major F-gases:
  - R-134A: GWP 1300
  - R-407C: GWP 1610
  - R-410A: GWP 1890
- Operators of the above-mentioned applications, which contain fluorinated greenhouse gases, shall, using all measures that are technically feasible and do not entail disproportionate cost:
  a. prevent leakage of these gases and, as soon as possible, repair any detected leakage;
  b. ensure that they are checked for leakage by certified personnel;
  c. ensure arrangements are put in place for the proper recovery by certified personnel.
  d. In case of applications containing 3 kg (6 kg in case of hermetically sealed systems) or more of F-gases, certified personnel and companies (according to Reg. 303/2008) provide regular leak testing (according to Reg. 1516/2007 and Reg. 1497/2007) and maintain records of maintenance activities in a dedicated log book.
  e. Recovery for the purpose of recycling, reclamation or destruction of the fluorinated greenhouse gases, pursuant to Art. 4 (Recovery) of Reg.842/2006, shall take place before the final disposal of that equipment and, when appropriate, during its servicing and maintenance.
- Operator, according to Reg. 842/2006, Article 2, point 6, means the natural or legal person exercising actual power over the technical functioning of the equipment and system covered by the Regulation. The State may, in defined, specific situations, designate the owner as being responsible for the operator's obligations.
- Direct methods of leakage checking approved by the manufacturer (Reg. 1516/2007 and Reg. 1497/2007):
  a. gas detection device adapted to the refrigerant in the system; the sensitivity of portable gas detection devices (as a direct test method) shall be at least five grams per year.
  b. proprietary bubble solutions / soapsuds.

- Additional information located in a dedicated label of the unit (Reg. 1494/2007):
  a. Where fluorinated greenhouse gas is foreseen to be added to the equipment outside of the manufacturing site at the point of installation, a dedicated label accommodates notation of both the quantity (kg) pre-charged in the manufacturing plant and the quantity charged at the installation site, as well as the resulting total quantity of F-gas as a combination of the above-mentioned quantities, in a manner that conforms to legibility and indelibility.

     Our split units are usually not pre-charged at the factory; in this case, the total quantity of refrigerant charged in the unit must be written in the relevant label, during the commissioning operation at the installation site.
  b. Our packaged units (not split) operating with F-gas are usually fully charged at the factory, and the total amount of refrigerant charge is already reported on the label. In this case, the label has no need of further written information.
  c. In general, the above-mentioned information has been located in the main nameplate of the relevant unit.
  d. For equipment with double refrigeration circuits, in regards to different requirements based on the quantity of F-gas contained, the required information about refrigerant charge quantities must be listed separately for each individual circuit.
  e. For equipment with separate indoor and outdoor sections connected by refrigerant piping, the label information will be on that part of the equipment that is initially charged with the refrigerant. In case of a split system (separate indoor and outdoor sections) without a factory precharge of refrigerant, the mandatory label information will be on that part of the product or equipment that contains the most suitable service points for charging or recovering the fluorinated greenhouse gas(es).
- Safety data sheets of F-gases used into the products are available on demand.

15.0 TROUBLESHOOTING

Table 29 Unit diagnostics

Problem	Possible Cause	Corrective Action
Rack temperature is too high	Dirty filters	Replace filters
	Filter clog sensor failure	Call Emerson Network Power
	Incorrect positioning of remote temperature sensor(s)	Verify that remote temperature sensors are correctly positioned
	Remote temperature sensor(s) issue	Contact Emerson
	Condensing pressure (head pressure) is too high	Air-cooled units: Verify that remote condenser fan(s) are running
		Water/glycol units: Check cooling water supply
		Water/glycol units: Check cooling water temp
		Call Emerson Network Power
	Chilled water units: inlet water temperature is too high	Check cooling water temperature
	Refrigerating circuit charge issue	Contact your local Emerson representative
	Cold air short-cycling issues	Verify unit positioning/room configuration
		Verify unit air baffles set-up
		Verify cold aisle containment seals (if applicable)
	Insufficient room-cooling capacity	Reduce rack heat load or add cooling units
	(C unit) water-regulating valve issue	Contact your local Emerson representative
	Unit safety devices intervention	Contact your local Emerson representative
Unit fan fails to start	Fan is faulty	Contact your local Emerson representative
Water drops carried by airflow	Room humidity is over acceptable limit	Check room condition
	Condensate pan drain is clogged	Contact your local Emerson representative
	Problem with humidifier control	Contact your local Emerson representative
Water on the floor around the unit	Unit is not properly levelled	Adjust the levelling feet
	Unit condensate drain pipe is clogged	Remove pipe obstruction
	Chilled water and water/glycol units: leak in the water circuit	Locate and repair the leak
	Piping insulation broken/damaged	Restore insulation integrity
	Leak in the draining circuit	Contact your local Emerson representative
	Condensate pump is faulty	Contact your local Emerson representative
	Leak in the humidifier filling hose	Contact your local Emerson representative
Cooling unit noise level is higher than expected	Incorrect positioning of remote temperature sensor(s)	Verify correct positioning of temperature sensors
	Unbalanced heat load distribution	Redistribute rack heat load
	Remote temperature sensor(s) issue	Contact your local Emerson representative
Unsteady air delivery temperature	Faulty temperature sensor(s)	Contact your local Emerson representative
	Unit controller issue	Contact your local Emerson representative
Local display is not operational but unit operates	Local display cable disconnected	Connect cable
	Local display cable damaged	Replace cable
	Local display configuration lost	Contact your local Emerson representative
Local display is not operational and unit does not operate	Unit electrical supply is Off	Restore electrical supply
	Unit main switch is Off	Switch On the unit
	Control board supply issue	Contact your local Emerson representative
	Control board issue	Contact your local Emerson representative

Table 30 Liebert iCOM® medium control board DIPswitch settings

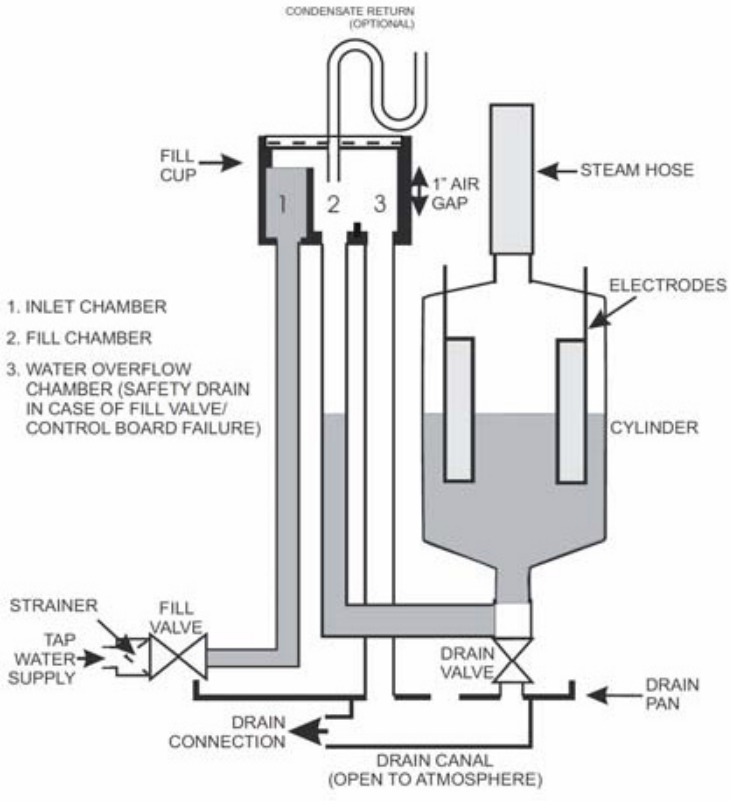
DIPswitch Number	Compressorized CRV models CR020 and CR035	Chilled Water Model-CR040
1	On	Off
2	Off	Off
3	On	Off
4	Off	Off
5	Off	Off
6	Off	Off
7	Off	On
8	On	On

APPENDIX A - HUMIDIFIER

A.1 PRINCIPAL OF OPERATION

When the Liebert iCOM® calls, the cylinder fills to 100% of the Full Load Amperage (FLA) or to the top of the cylinder, whichever comes first. See **Figure 100**. If it reaches 100% FLA, the water heats and boils away to a level giving 80% FLA. An electronic timer uses the rate of amp fall to determine the water level. The objective is to concentrate current carrying minerals in the cylinder so that a smaller volume of water is required to produce the rated steam output. This extends the life of the disposable cylinder by minimizing electrode coverage and reducing energy use because the high concentration allows a minimal drain rate. When 80% FLA is reached, the fill valve will open, refilling the cylinder to 100% FLA. On occasion, the drain valve will also come on if the water level is too low, indicating too high a concentration and the need to dilute the water in the cylinder. If the water reaches the top of the cylinder before 100% FLA, the fill valve shuts Off via the sensor, and the fill-boil-fill-boil cycle continues, cycling Off the red high water sensor light until the concentration becomes high enough to reach 100% FLA. The above-described control process will then take over.

Figure 100 General diagram—humidifier operation



NOTE

The Liebert iCOM control monitors the condition of the air discharging from the unit to protect neighboring electronic equipment. The Liebert iCOM will prevent the humidifier from activating if the discharge air is near its saturation point. This protects against discharging fog from the unit or condensation forming on the unit's supply air baffles. This protection mode is activated when the supply air leaving the unit is below 64°F (17.8°C) or above 55% relative humidity. The Liebert iCOM screen will display "Humidifier Suspended." The screen will display "Humidifier Resumed" when the protection mode resets at 67°F (19.4°C).

A.1.1 Humidifier Water Supply and Plumbing

The fill valve is sized for an extended water pressure range of 30 to 80 psi.

For installations where water pressure is less than 15 psi, add a pressure boost pump and notify the factory; a fill valve with an oversized opening will be supplied.

For installations where water pressure is greater than 80 psi, install a pressure reducing valve in the water feed line to the unit.

With dirty or muddy water sources (e.g., some well sources), ensure proper filtration by adding an external filter to the water line entering the unit. (Consult factory for accessories such as filters.)

NOTICE

Risk of improper water supply. Can reduce humidifier efficiency or obstruct humidifier plumbing.

Do not use completely demineralized water with this unit; it is the minerals that allow the electrode principle to work.

Do not use a hot water source; it will cause deposits that will eventually block the fill valve opening.

A.1.2 Humidifier Water Connection

A copper compression olive type coupling for 1/4" O.D. soft copper tubing is provided with the unit and requires no soldering for the water connection to the unit.

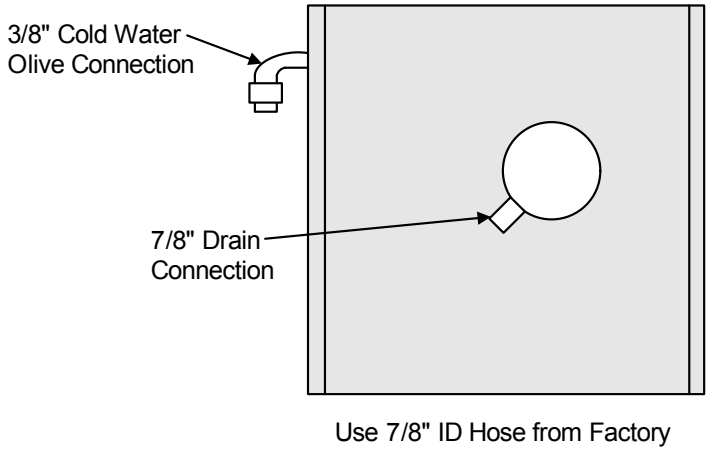
An isolating valve should ALWAYS be placed in the feed water line to allow service of the fill valve.

Each unit is fitted with a fill solenoid valve located on the base drain pan.

Flow openings are designed for water pressure from 30 to 80 psi and are protected by the built-in strainer.

For inlet water pressure outside this range, the factory should be contacted.

Figure 101 Water connection to humidifier



A.1.3 Humidifier Startup and Operation

- Ambient temperature location for humidifier: 41 - 104°F (5 - 40°C).
- Relative humidity location for humidifiers: 5 - 80% RH.

Check to see that the unit is securely mounted on a level surface with the proper drain and water supply. Check for correct voltage with appropriately sized service. Check that the steam distributor, steam supply hose and condensate line are correctly installed and routed back to the unit.

Check all electrical connections for wires that may have become loose in shipping. Components damaged because of loose connections are NOT under warranty.

Check electrode plugs to ensure they are pressed firmly onto the electrode pins. Important: Loose connections will cause overheating of the cylinder plugs, possibly melting the plugs and/or cylinder.

1. Open the isolating valve in the feed water line to the unit.
2. Make sure the Liebert iCOM® is set high enough to call for humidification.
3. Turn on the main disconnect in the primary service feeding the unit and check that unit has power at the primary terminal block.
4. Push the auto On/Off/Drain Switch to “On.”

Water will start to enter the cylinder through its bottom port and rise in the cylinder to a point determined by the solid state control circuitry. It is not unusual upon initial startup for the water to fill the cylinder and cycle on the red high-water sensor light.

The red light simply acts as a safety to shut off the fill valve and prevent overfilling. With the red light on, the water in the cylinder will continue to heat and, after a few minutes, start to boil. After the boiling of the water has lowered the water level below the sensor at the top of the cylinder, the red light will go out and the fill solenoid will again open until the cylinder is again full. This cycling of the red light and fill valve will continue until the unit's full output capacity is reached, after which the water level will automatically lower itself in the cylinder. (The increased concentration allows for lower electrode coverage while maintaining the same output.) When a stabilized condition is reached, the water will be boiling close to the cylinder seam level. The solid state circuitry will maintain the proper concentration in the cylinder by introducing short drains only when necessary. If the cylinder is manually drained, the above process will repeat itself.

A.1.4 Low Water Conductivity

Should normalization of the unit be required immediately after startup, the installer may speed up the process by artificially increasing water conductivity. During a fill cycle, the installer should dissolve half a teaspoon of table salt (no more) in a cup of water and add it to the cylinder by means of the fill cup attached to the plumbing section. Open the plumbing compartment and add salt solution through cylinder outlet. Excessive amounts of salt will result in erratic operation of the unit; however, normalization of the unit will occur automatically through the solid-state control sequence.

A.1.5 Cylinder Replacement

NOTICE

Risk of improper operation. Can cause equipment damage.

The steam cylinder is disposable and must be replaced at the end of cylinder life. Cylinder life depends on water supply conditions and humidifier usage. Failure to replace the cylinder at the end of cylinder life may result in unit damage.

After an extended period of operation, the cylinder will be completely used, as indicated by the red high-water sensor light illuminated on the cabinet. When this condition is reached, a new replacement cylinder must be installed.

NOTE

*The red light may come on during initial startup, but this does not mean the cylinder must be replaced. See **9.0 Startup** and **12.0 Operation**.*

Contact Emerson or your local Emerson representative to obtain a replacement cylinder. To obtain the correct cylinder, supply the cylinder model from the white three-digit label on the cylinder, or supply the model, voltage and serial number from the unit specification label.

Remove the Old Cylinder

1. Turn Off the water supply to the unit.
2. The old cylinder must be drained completely before removing. This is done by pushing the auto On/Off/Drain switch to the “drain” position.
3. When the cylinder is empty, push the auto On/Off/Drain switch to the Off position.
4. Open the main disconnect switch during the entire cylinder change operation.
5. The power wires to the cylinder are attached by cylinder plugs to the electrode pins on top of the cylinder. Pull these plugs off the pins.
6. Using a slotted screwdriver, loosen the steam hose clamp(s) and pull the steam hose off.

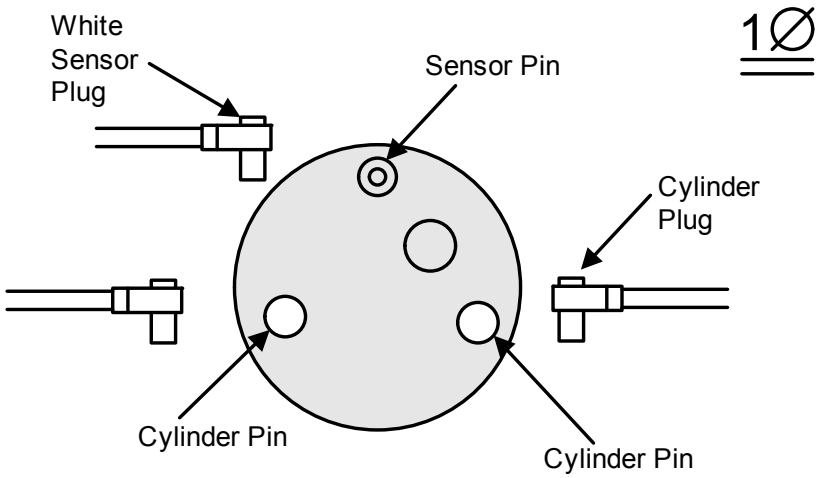
   The cylinder is now ready to be lifted out of the unit.

Installing the New Cylinder

1. Leave the main disconnect open until the cylinder is completely installed and reconnected.
2. Ensure that the cylinder mounting stubs are seated properly in the allotted side mounting slots within the unit.
3. The white sensor plug on all units is for the sensor pin, which always goes on the single pin offset from the others.
4. Ensure that cylinder plugs are snug on the pins.
5. Replace loose-fitting plugs; loose plugs may generate enough heat to melt and destroy the plug, and new cylinder plugs must be ordered.

Reverse the procedure to install a new cylinder.

Figure 102 Sensor pins, cylinder plugs



Humidifier Maintenance

WARNING

Risk of electric shock. Can cause injury or death.

Disconnect all local and remote electric power supplies before working within. The plumbing and electrical compartments contain high-voltage components and wiring. The access cover is attached with screws. Access should be limited to authorized personnel only.

Extended Shutdown

Always drain the cylinder before disconnecting power to the humidifier for a period of extended shutdown. Otherwise, the electrodes are subject to harmful corrosion, which drastically shortens the cylinder life. Do not leave the switch in the DRAIN position indefinitely because the drain coil could burn out. Leave the switch in the Off position and open the main external fused disconnect to stop power to the humidifier. Close the shutoff valve in the water supply line feeding the humidifier.

A.1.6 Humidifier Troubleshooting

Terms Used

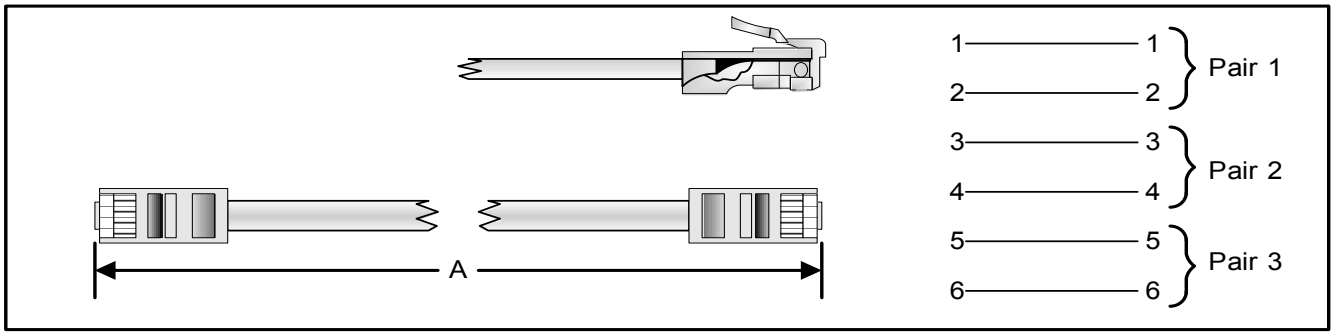
- **FLA (Full Load Amps)** are amps listed on the humidifier specification label.
- **Short cycling** occurs when the humidifier's "On time" is less than 10 minutes upon a call for humidity. To correct short cycling, all humidifiers have a capacity adjustment that allows the output of the humidifier to be reduced to as low as 20% of rated output, thus extending the "on time" required to maintain output.
- **Foaming** can occur when the impurities already in water reach an excess concentration as a result of boiling away water and continued boiling agitates the contained water. The humidifier electronics are designed to prevent foaming, although in extreme cases water will foam with little concentration, making it necessary to increase the drain time of the water contained in the cylinder. Foaming is normally caused by short cycling, a restricted drain or back pressure. The foam generated in these instances is conductive and may lead to false full-cylinder indication if the level of the foam approaches the top of the cylinder.
- **Back pressure** is the restriction of steam flow caused by long steam runs, improperly sloped steam lines, elbows changing the direction of steam flow from horizontal to vertical without a drain leg, any plumbing detail allowing the accumulation of condensate, undersized steam line, improper steam distributor, downward air flow onto the distributor causing excess static pressure at the steam outlets, or high static pressure ducts (not probable). To overcome excess static pressure in the duct, use a fill cup extension kit. In downflow applications, a downflow distributor should be used, but in some cases the fill cup extension will also be required.
- **Reset unit (humidifier)**: To reset the humidifier, switch the auto On/Off/Drain switch at the front of the humidifier to the Off position for at least five seconds, then switch it back to the On position.
- **Monitored leg** is the primary wire to the cylinder that loops through the current sensing device of the main PCB. This wire ends at the red cylinder plug at the cylinder.

A.2 REMOTE RACK SENSOR TROUBLESHOOTING

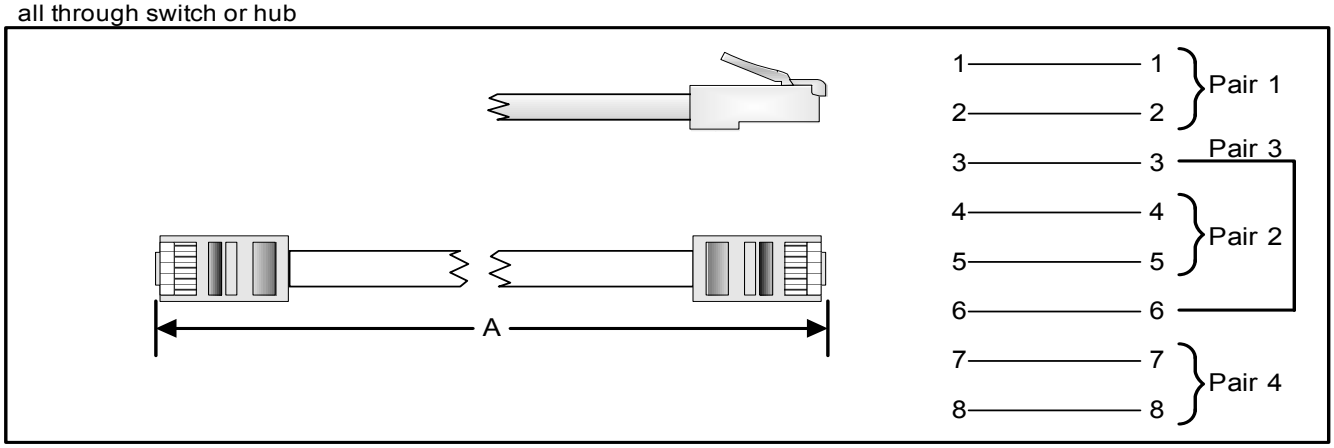
If the sensor has been set up correctly and is communicating to the Liebert CRV, then the status of the LED (DS1) located on the sensor circuit board will be solid green.

Figure 103 CAN bus and Ethernet cable wiring

Six-wire CAN bus cable; suitable for Liebert iCOM board with THB, HCB and Liebert iCOM display connections



Ethernet cable; suitable for U2U connection or for connecton of the Liebert iCOM Large Coldfire Display all through switch or hub



A.3 STARTING POINT

Auto On/Off/Drain switch in On position—unit will not fill:

When the On/Off control circuit is made and the Auto On/Off/Drain switch is pushed to On, the 24V holding coil of the primary contactor should energize. The resulting magnetic pull closes the high voltage contacts with a distinct and audible "clunk." If the contactor will not make the connection, then inspect the following while referring to the wiring diagram:

- Check for 24V across terminals 18 and 26 on the PC board.
- The low-voltage 3A fuse located in the control box may be blown.
- The contactor holding coil may be open or shorted.
- The switch may be defective.

Recheck that the Auto On/Off/Drain switch is still On. If it is, shut off the main disconnect and check fuses or breaker of the main disconnect. If they are serviceable, turn power back on.

To test for a defective Auto On/Off/Drain switch, connect a wire from the fuse directly to Terminal 6 on the external controls strip. If the contactor activates, the On side of the switch is defective. If the contactor does not activate, the PC board could be defective.

If the 3A control fuse blows when the wire from the fuse touches Terminal 6 on the external controls strip, the contactor holding coil may be shorted. Replace contactor if necessary.

After the necessary components have been replaced and the contactor pulls in, there is line voltage to the cylinder and the control sequence can begin.

Approximately 30 seconds after the contactor pulls in, the fill valve coil should energize. There is also a visible fill relay on the printed circuit board. It is the one located farthest from the C.T. core. The points on this relay must be touching in order for the fill valve coil to be energized. If the points do not touch after the built-in time delay, the sensor input may be interfering. To confirm, remove the black and red sensor wires from terminals 6 and 10 on the PC board. Wait 30 seconds and, if the fill relay points do not touch, replace the sensor. If they still do not touch, the basic PC board may be faulty. To confirm, disconnect the red wire from terminal 18 and touch it to terminal 14. If the fill valve coil activates, the basic PC board should be replaced. If it still does not activate, the fill valve coil should be replaced. After the necessary components have been changed, water will start filling the cylinder and begin to submerge the electrodes. Because of the high voltage across the electrodes, the water can now conduct electricity.

Red "Change Cylinder" light on—Water at top of cylinder:

This is a common occurrence on startup. See **9.0 Startup** and **12.0 Operation**.

Water remains at high level and won't concentrate:

This is normal on cold startup and can be accelerated by adding a maximum of 1/2 tsp. of dissolved salt to the cylinder on fill cycle through the plastic fill cup. See **A.1.4 Low Water Conductivity**.

If the unit has been operating extensively, observe for normal fill-boil-fill-boil cycle; no drainage should occur. If drainage occurs, check for leaking drain valve or back pressure.

Unit drains continually:

May be caused by foaming and/or back pressure or by a leaking drain valve.

If cylinder is almost empty, check for magnetic pull on drain solenoid indicating miswiring. If there is no pull, drain actuator is blocked open; remove, disassemble and clean.

If drain is occurring through activated drain valve, valve is miswired or electronics are faulty; consult factory.

If drain is occurring through the overflow on the fill cup, this is due to abnormal restriction on the steam line and back pressure forcing water out of the cylinder so water cannot concentrate and level remains high. Review installation of steam line to ensure there are no blockages or excessive static pressure in the air system.

Table 31 Humidifier troubleshooting

Unit Status Lamp		Symptom	Corrective actions
Yellow	**Green**		
On	On	Maximum water level inside cylinder.	This usually happens on initial start-up after replacing the cylinder (normal). Water is concentrated with minerals inside the cylinder. Let unit run; yellow light will disappear when the unit is at full output. This may take a day or two.
Off	Off	No power to the board.	Check for main power supply fault. Turn power switch to 'Drain' position. If drain valve is activated (sound of solenoid), check connection to the board or board itself. When no sound is present, check fuse (replace with 3.0 A if needed), transformer (voltage should be present between fuse holder and ground screw).
1 flash sequence	Off	Excess current. Operating amperage exceeded 130% of rated amps. Water is drained from the cylinder (drain valve on for 10 minutes).	Check drain valve operation, drain time, possible drain restrictions. Check fill valve for leaks (not holding supply water). Back pressure may also cause very conductive water conditions. Was the humidifier short cycling? Check for short cycling. Water conductivity too high.
2 flashes in sequence	Off	No current detection for 30 minutes with continuous call for humidity.	Check water level in the cylinder - should be more than 1/4 full. If not, check fill rate, 24 VAC voltage on fill valve terminals (unit must be on with call for humidity - green light on steadily). Verify fresh water supply to the humidifier. Leaking drain valve may be at fault (minerals blocking the plunger). If cylinder is more than 1/4 full, check primary power, connections to the cylinder, continuity of wires to cylinder. Are power wires connected to proper terminals on the cylinder? (Color coding.) Possibly wrong cylinder type. Low water conductivity.
4 flashes in sequence	Off	End of cylinder life - change cylinder.	Check water level in the cylinder; should be about 3/4 full. Check for foaming if water level is lower or cylinder life shorter than expected. Change cylinder, clean drain valve.

APPENDIX B - ELECTRICAL DATA

Table 32 Liebert CRV electrical data - 60Hz (Amps)

	Air-Cooled Units				Water/Gylcol-Cooled Units				Chilled Water Units	
	CR035RA		CR020RA		CR035RW		CR020RW		CR040RC	
Voltage	460/3/60	208/3/60	460/3/60	208/3/60	460/3/60	208/3/60	460/3/60	208/3/60	460/3/60	208/3/60
Cooling with Dehumidifying, Condensate Pump, Reheat; with or without Humidifier										
FLA	31.7	62.0	24.3	51.0	31.7	62.0	24.3	51.0	11.7	24.9
WSA	38.6	75.4	29.3	61.6	38.6	75.4	29.3	61.6	14.6	31.1
OPD	50	100	35	80	50	100	35	80	20	35
Cooling with Dehumidifying, Condensate Pump and Humidifier; NO Reheat										
FLA	27.9	53.8	20.5	42.8	27.9	53.8	20.5	42.8	7.9	16.7
WSA	32.9	63.1	23.6	49.3	32.9	63.1	23.6	49.3	9.9	20.9
OPD	50	90	35	70	50	90	35	70	15	25
Cooling with Dehumidifying and Condensate Pump, NO Reheat, NO Humidifier										
FLA	24.2	45.4	16.8	34.4	24.2	45.4	16.8	34.4	4.2	8.3
WSA	29.2	54.7	19.9	40.9	29.2	54.7	19.9	40.9	4.6	9.1
OPD	45	90	30	60	45	90	30	60	15	15
Cooling with Dehumidifying and Reheat; NO Condensate Pump, NO Humidifier										
FLA	30.5	59.7	23.1	48.7	30.5	59.7	23.1	48.7	10.5	22.6
WSA	37.4	73.1	28.1	59.3	37.4	73.1	28.1	59.3	13.1	28.3
OPD	50	100	35	80	50	100	35	80	15	30
Cooling with Dehumidifying, NO Condensate Pump, NO Reheat, NO Humidifier										
FLA	23.0	43.1	15.6	32.1	23.0	43.1	15.6	32.1	3.0	6.0
WSA	28.0	52.4	18.7	38.6	28.0	52.4	18.7	38.6	3.4	6.8
OPD	45	80	30	60	45	80	30	60	15	15

NOTICE

Risk of exceeding line-to-ground limit. Can cause equipment damage.

The electrically commutated (EC) motors included in 480V CR035 and CR040 units are suitable for connection to power supplies with 300V or less line to ground potential. Excess line-to-ground voltage can cause capacitor failure internal to the motors.

- Power supplies such as 480V WYE with solidly grounded neutral have 277V line to ground and are acceptable.
- Power supplies such as 480V WYE with high resistance (or impedance) ground, 480V delta without ground or with floating ground, 480V delta with corner ground or 480V delta with grounded center tap will exceed the 300V line-to-ground limit.

Table 33 Calibration of electrical components

Refrigeration Circuit Item No.	Component	Setting	Notes	Contact
18-19	High Pressure Transducer	Range 045 barg Output 05V	See Liebert iCOM® User Manual, SL-18835	—
14	Low Pressure Transducer	Range 017.3 barg Output 05V		—
3	High Pressure Switch (HP)	STOP 38.7±1 barg START 30.0±1.5 barg (fixed setting manual reset)	Reset	Normally Closed
—	Clogged Filter Differential Pressure Switch (CF)	Setpoint range 0.54 mbar Filter G4 = 2 mbar	Setting Ring	Normally Closed

APPENDIX C - ELECTRICAL FIELD CONNECTIONS DESCRIPTIONS

C.1 STANDARD ELECTRICAL CONNECTIONS

(Source: DPN001884, Rev. 4, Page 1)

1. **High Voltage Connection Through the Bottom of the Electric Panel**—1-3/8" (34.9mm), 1-3/4" (44.5mm) 2-1/2" (64mm) diameter concentric knockout.
2. **Low Voltage Connection Through the Bottom of the Electric Panel**—Quantity (2) 7/8" (22mm) diameter knockouts.
3. **High Voltage Connection Through the Top of the Unit**—1-3/8" (34.9mm), 1-3/4" (44.5mm) and 2-1/2" (64mm) diameter concentric knockout.
4. **Low Voltage Connection Through the Top of the Unit**—Quantity (4) 7/8" (22mm) diameter knockouts.
5. **Three-Phase Electrical Service**—Connect to terminals on disconnect switch. Three-phase service not by Liebert (see **NOTICE on page 125**).
6. **Factory-Installed locking Disconnect Switch**
7. **Earth Ground**—Terminal for field-supplied earth grounding wire.
8. **Remote Unit Shutdown**—Replace existing jumper between Terminals 37 and 38 with field-supplied normally closed switch having a minimum 75VA, 24VAC rating. Use field-supplied Class 1 wiring.
9. **Customer Alarm Inputs**—Terminals for field supplied, normally closed contacts, having a minimum 75VA, 24VAC rating, between Terminals 3 and 50, 2 and 51, 5 and 55 or between 3 and 56. Use Class 1, field-supplied wiring. Terminals 3 and 56 are used for humidifier alarm when a humidifier is installed. The remaining terminals are available for customer alarm inputs, such as smoke sensors and building fire alarms.
10. **Common Alarm**—On any alarm, normally open dry contact is closed across Terminals 75 and 76 for remote indication. 1A, 24VAC maximum load. Use field-supplied Class 1 wiring.
11. **Heat Rejection Interlock**—On any call for compressor operation, normally open dry contact is closed across Terminals 70 and 71 to heat rejection equipment. 1A, 24VAC maximum load. Use field-supplied Class 1 wiring.

C.2 ELECTRICAL CONNECTIONS FOR OPTIONAL FEATURES

12. **Condensate Pump High Water Alarm (available when optional pump is installed)**—On pump high water indication, normally open dry contact is closed across Terminals 88 and 89 for remote indication. 1A, 24VAC maximum load. Use field-supplied Class 1 wiring.
13. **Liebert Liqui-tect® Shutdown and Dry Contact (Available When Optional Liebert Liqui-tect Sensor is Installed)**—On Liebert Liqui-tect activation, normally open dry contact is closed across Terminals 58 and 59 for remote indication. The Liebert Liqui-tect sensor notifies Liebert iCOM of indication through Terminals 60 and 61. 1A, 24VAC maximum load. Use field-supplied Class 1 wiring.
14. **Reheat and humidifier lockout**—Remote 24VAC required at Terminals 82 and 83 for lockout of reheat and humidifier.
15. **Additional Common Alarm**—On any alarm, one additional normally open dry contact is closed across Terminals 94 and 95 for remote indication. 1A, 24VAC maximum load. Use field-supplied Class 1 wiring.

NOTE

Refer to specification sheet for total unit full load amps, wire size amps and maximum overcurrent protective device size.

NOTICE

Risk of improper input power. Can cause equipment damage.

The electronically commutated motors included in the Liebert CRV unit are suitable for connection to an electrical service providing input power to the unit with 300V or less line-to-ground potential only.

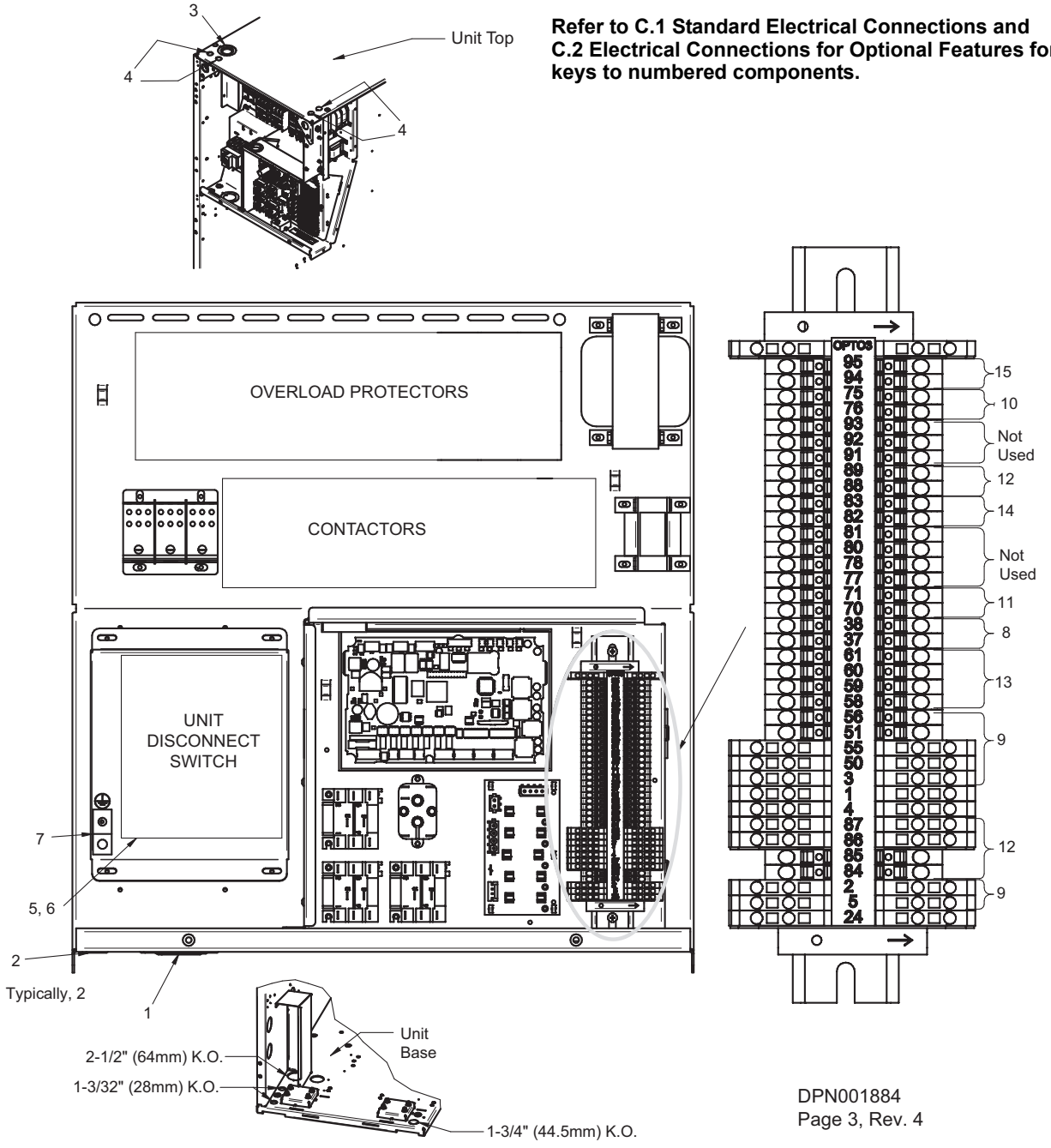
Acceptable unit input electrical service for 460V (480V) nominal units:

- 480V wye with solidly grounded neutral and 277V line-to-ground

Unacceptable unit input electrical service for 460V (480V) nominal units

- Wye with high resistance (or impedance) ground
- Delta without ground or with floating ground
- Delta with corner ground
- Delta with grounded center tap

Figure 104 Electrical field connections



Refer to C.1 Standard Electrical Connections and C.2 Electrical Connections for Optional Features for keys to numbered components.

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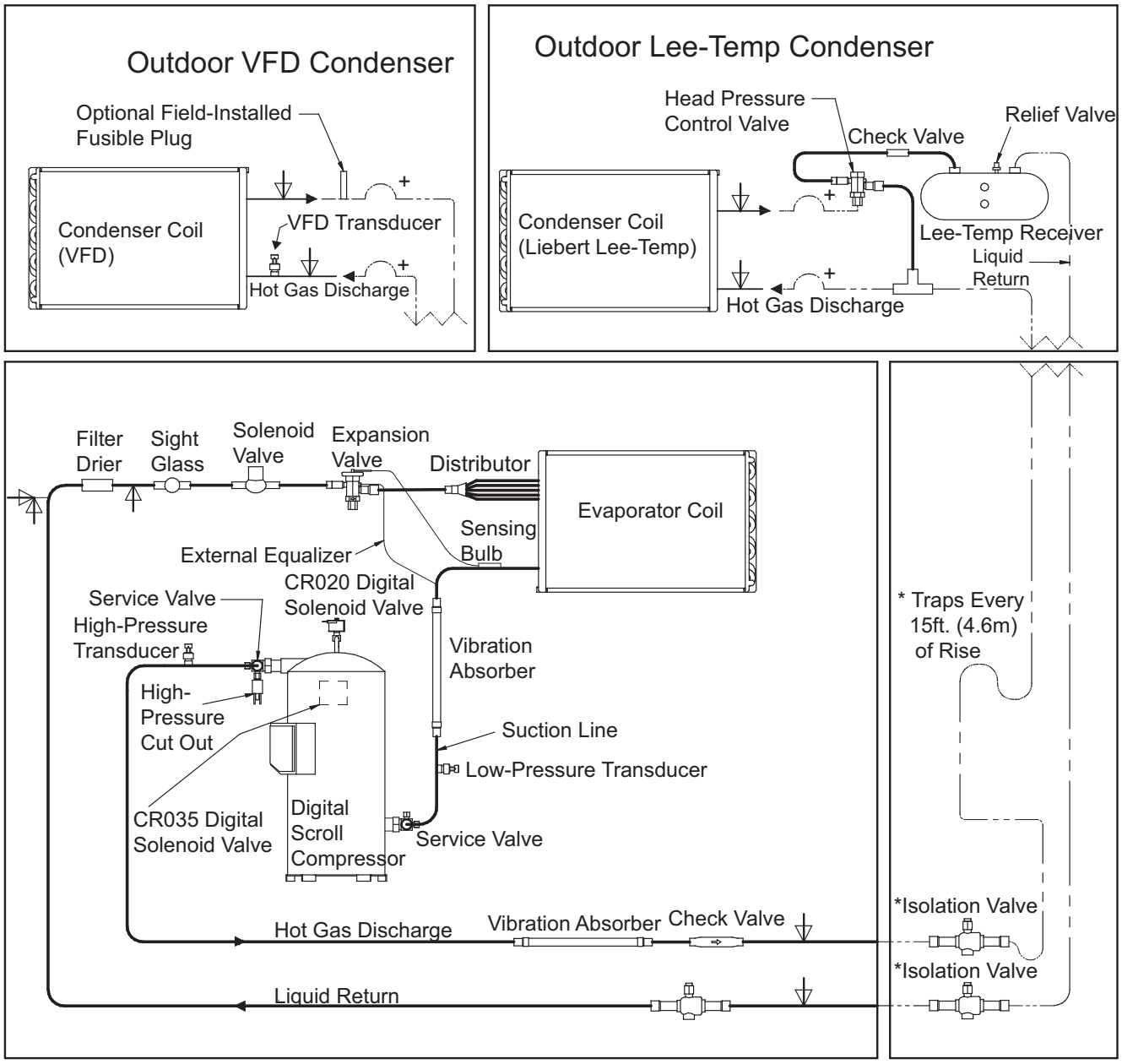
APPENDIX D - REFRIGERATION AND HYDRAULIC CIRCUITS

Figure 105 General arrangement—air-cooled units



Factory Refrigerant Piping

Field Piping

▽ Service / Schrader (Access) Connection No Valve Core

⇩ Service / Schrader (Access) Connection With Valve Core

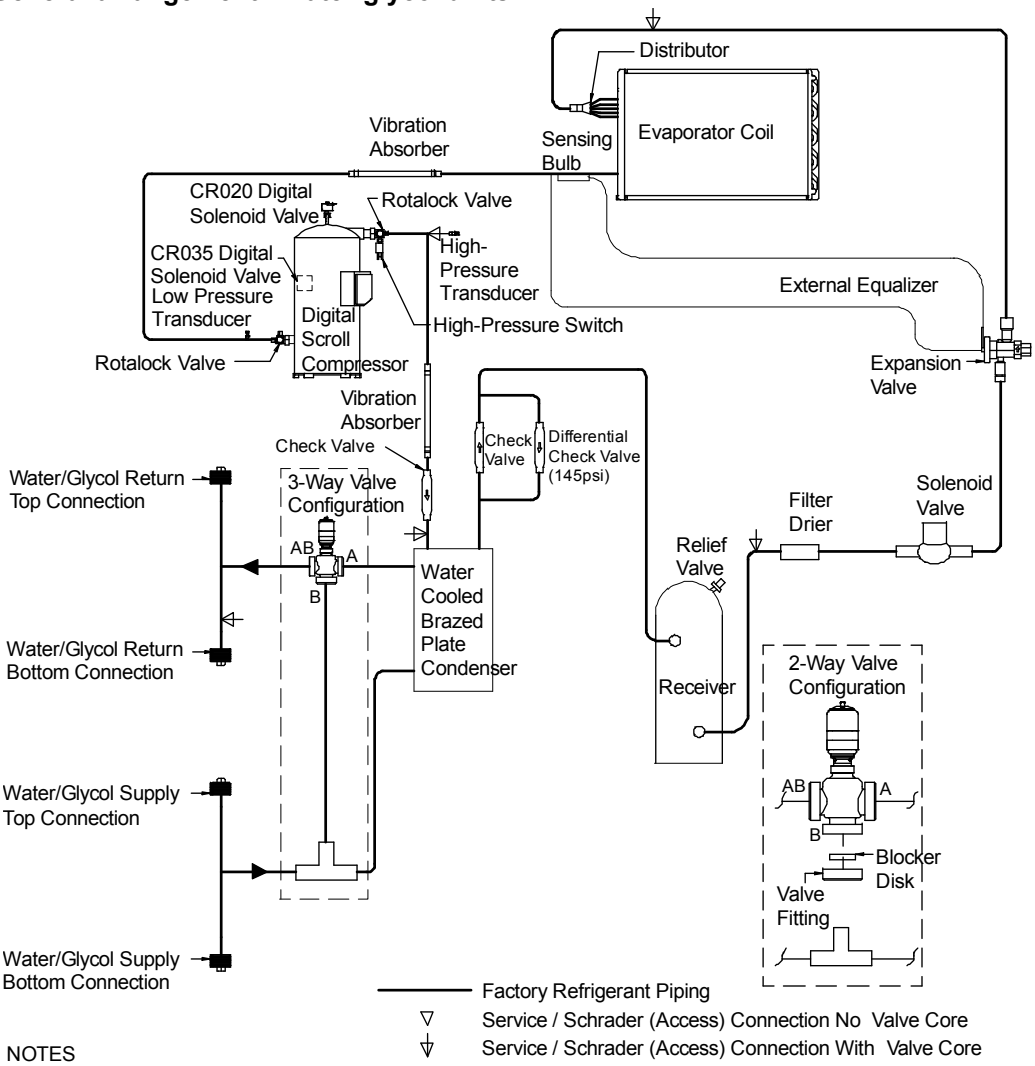
1. Schematic representation shown. Do not use for specific connection locations.
2. One or more additional pressure relief valves are required downstream of any and all field-installed isolation. Do not isolate any refrigerant circuits from overpressurization protection.

* Components are not supplied by Liebert but are recommended for proper circuit operation and maintenance. Should be located near the indoor Liebert CRV unit.

\+ Inverted Trap on Discharge and Liquid Lines to extend above the base of the coil by a minimum of 7-1/2" (190mm).

DPN001984
Rev. 4

Figure 106 General arrangement—water-glycol units

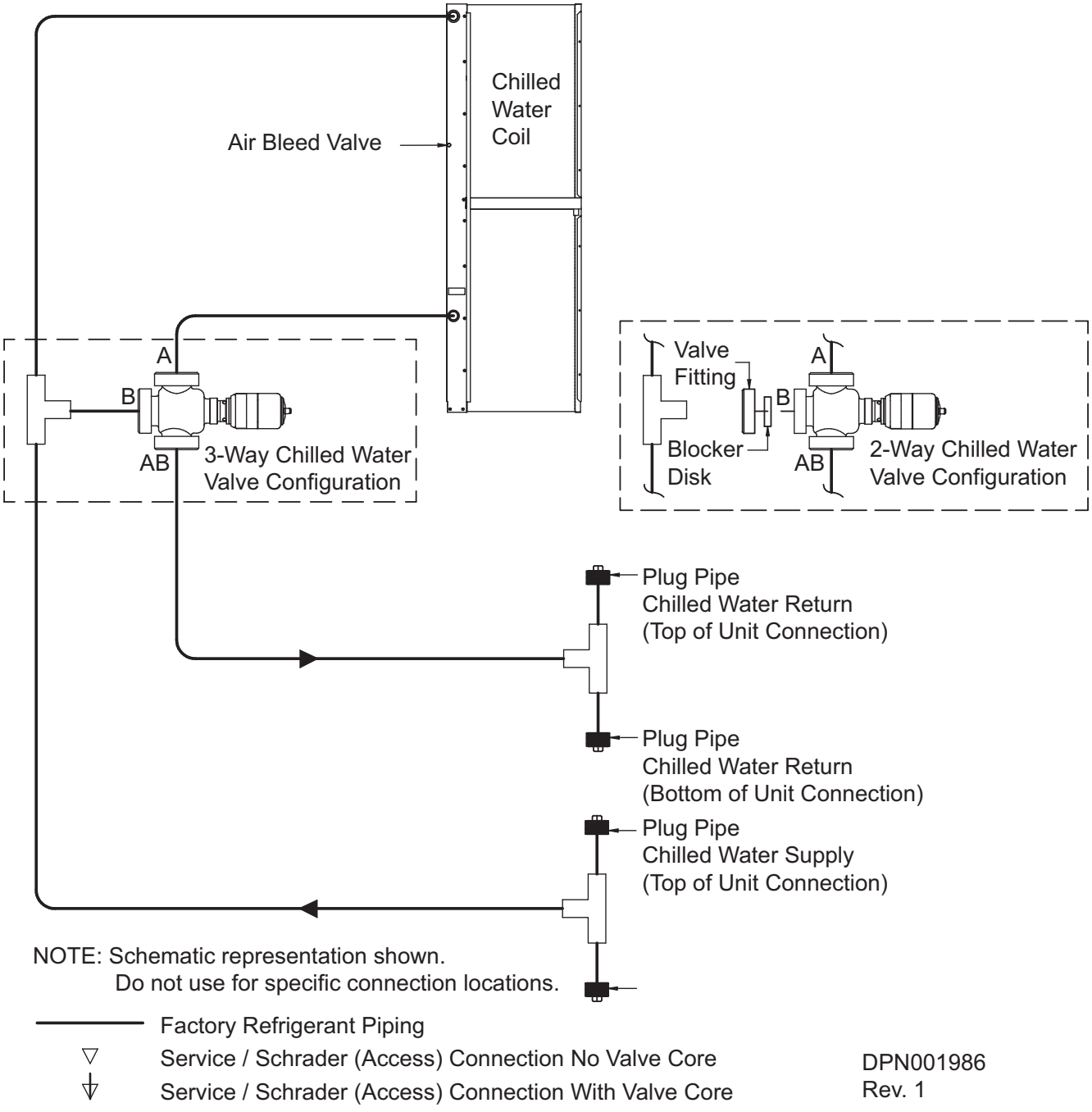


NOTES

1. Schematic representation shown. Do not use for specific connection locations.
2. Install a 35 mesh straine r, in an easily accessible location, on the water/glycol supply to prevent particles from entering the heat exchange r. Strainer bypass valves are reccomended to allow the strainer to be cleaned while maintaining flow to the cooling unit.

DPN001985
Rev. 1

Figure 107 General arrangement—chilled water



NOTES

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