



# Liebert<sup>®</sup> PDX and Liebert<sup>®</sup> PCW Thermal Management Systems

## **Installer/User Guide**

**3 to 8 Ton (11 to 29 kW) Capacity, Upflow and Downflow, 60 Hz**

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Vertiv recommends installing a monitored fluid detection system that is wired to activate the automatic closure of field installed coolant fluid supply and return shut off valves, where applicable, to reduce the amount of coolant fluid leakage and consequential equipment and building damage. Refer to local regulations and building codes relating to the application, installation, and operation of this product. The consulting engineer, installer and/or end user is responsible for compliance with all applicable laws and regulations relating to the application, installation, and operation of this product.

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### **Technical Support Site**

If you encounter any installation or operational issues with your product, check the pertinent section of this manual to see if the issue can be resolved by following outlined procedures.

Visit <https://www.vertiv.com/en-us/support/> for additional assistance.

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# 1 Important Safety Instructions

## SAVE THESE INSTRUCTIONS

This manual contains important safety instructions that should be followed during the installation and maintenance of the Vertiv™ Liebert® PDX and Vertiv™ Liebert® PCW. Read this manual thoroughly before attempting to install or operate this unit.

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

Adhere to all warnings, cautions, notices and installation, operating, and safety instructions on the unit and in this manual. Follow all installation, operation, and maintenance instructions and all applicable national and local building, electrical, and plumbing codes.



**WARNING! Arc flash and electric shock hazard. Can cause serious injury or death. Building and equipment damage may also result. Disconnect all local and remote electric power supplies and wear appropriate, OSHA-approved personal protective equipment (PPE) per NFPA 70E before working within the electric control enclosure. Customer must provide earth ground to unit, per NEC, CEC, and local codes, as applicable.**

**Verify with a voltmeter that power is Off. The Vertiv™ Liebert® iCOM™ controller does not isolate power from the unit, even in the “Unit Off” mode. Some internal components still require and receive power even during the “Unit Off” mode of the Liebert® iCOM™ controller. The factory-supplied, optional disconnect switch is inside the unit. The line side of this switch contains live high voltage. The only way to ensure that there is NO voltage inside the unit is to install and open a remote disconnect switch. Refer to unit electrical schematic.**

**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. Follow all local codes.**



**WARNING! Risk of electric shock. Can cause serious injury or death. Building and equipment damage may also result. Open all local and remote electric power supply disconnect switches and verify that power is off with a voltmeter before working within any electric connection enclosures. The Liebert® iCOM™ controller 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™ controller.**

**Installation, service, and maintenance work must be performed only by properly trained and qualified personnel and in accordance with applicable regulations and manufacturers' specifications. Opening or removing the covers to any equipment may expose personnel to lethal voltages within the unit even when it is apparently not operating and the input wiring is disconnected from the electrical source.**



**WARNING! Risk of short circuits and electric shock. Can cause serious injury or death. Building and equipment damage can result from cut insulation or damaged wires. Can cause overheated wiring, smoke, fire, activation of fire suppression systems and EMS personnel, and loss of power to fans. Verify that all wiring connections are tight and that all wiring is contained within the junction box prior to closing and securing the cover.**

**Insert CSA certified or UL listed bushings into holes and/or knockouts used to route wiring through metal panels to protect the wire insulation from contact with sheet metal edges.**



**WARNING!** Risk of improper wire sizing/rating and loose electrical connections causing overheated wire and electrical connection terminals resulting in smoke or fire. Can cause serious injury or death. Building and equipment damage may also result. Use correctly sized copper wire only and verify that all electrical connections are tight before turning power On. Check all electrical connections periodically and tighten as necessary.



**WARNING!** Risk of contact with high speed rotating fan blades. Can cause serious injury or death. Open all local and remote electric power supply disconnect switches, verify with a voltmeter that power is off, and verify that all fan blades have stopped rotating before working in the unit cabinet or on the fan assembly. If control voltage is applied, the fan motor can restart without warning after a power failure. Do not operate the unit with any or all cabinet panels removed. Do not operate upflow units without installing a plenum, duct work or guard over the blower opening(s) on the top surface of the unit cabinet. Ductwork must be connected to the blower(s), or a plenum must be installed on the blower deck for protection from rotating blower wheel(s) on upflow units.



**WARNING!** Risk of over pressurization of the refrigeration system. Can cause serious injury or death. Building and equipment damage may also result. Can cause explosive discharge of high pressure refrigerant, loss of refrigerant, or environmental pollution. This unit contains fluids and gases under high pressure. Use extreme caution when charging the refrigerant system. Do not pressurize the system higher than the design pressure marked on the unit's nameplate.



**WARNING!** Risk of explosive discharge of high pressure refrigerant. Can cause serious injury or death. Building and equipment damage may also result. Neutral and service ports on the compressor service valves do not have a valve core. Front-seat the service valves and relieve pressure from the compressor before loosening a part or a component attached to the service valve. Follow local codes to properly reclaim refrigerant.



**WARNING!** Risk of improper wiring, piping, moving, lifting and handling. Can cause serious injury or death. Building and equipment damage may also result. Installation and service of this equipment should be done only by qualified personnel who have been specially-trained in the installation of air-conditioning equipment and who are wearing appropriate, OSHA-approved PPE.



**WARNING!** Risk of top heavy unit falling over when improperly lifted or moved. Can cause serious injury or death. Building and equipment damage may also result. Read all of the following instructions and verify that all lifting and moving equipment is rated for the weight of the unit before attempting to move, lift, remove packaging from or prepare the unit for installation. Unit weights are specified in **Table 3.3** on page 18 .



**WARNING!** Risk of extremely heavy fan modules dropping downward suddenly. Can cause serious injury or death. Building and equipment damage may also result. Fan modules weigh in excess of 125 lb (56.7 kg) each. Support fan modules before removing mounting hardware. Use caution to keep all body parts out of the fan module pathway of movement during removal or repositioning. Only properly trained and qualified personnel should work on this equipment.

More than one person may be required to complete the assembly and installation. Installer(s) must be properly trained and qualified to lift, move, and manipulate very heavy equipment from floor level to the top of the unit. Wear appropriate, OSHA-approved PPE when moving, lifting, installing, and removing the fan(s) and plenum. Read and follow the lifting equipment and/or ladder manufacturer's operating instructions and safety requirements.



**WARNING!** Risk of improper humidifier canister maintenance. Can cause serious injury or death. Building and equipment damage may also result. Can cause fire suppression and alarm system activation, resulting in building evacuation and mobilization of emergency fire and rescue services. Using a humidifier canister that has reached the end of its service life can be extremely hazardous. If the canister cannot be replaced immediately at the end of life condition, turn off the power and water supply to the humidifier and remove the canister until a replacement canister can be installed. Do not ignore humidifier problem alarms. Resetting the humidifier without addressing cause may result in fire or damage from leaking water. See **Table 9.5** on **page 85** for alarm corrective actions.



**CAUTION:** Risk of excessive refrigerant line pressure. Can cause equipment damage or injury resulting from tubing and component rupture. Do not close off the refrigerant-line isolation valve for repairs unless a pressure-relief valve is field installed in the line between the isolation valve and the check valve. The pressure-relief valve must be rated 5% to 10% higher than the system-design pressure. An increase in ambient temperature can cause the pressure of the isolated refrigerant to rise and exceed the system design pressure rating (marked on the unit nameplate).



**CAUTION:** Risk of contact with sharp edges, splinters, and exposed fasteners. Can cause injury. Only properly trained and qualified personnel wearing appropriate, OSHA-approved PPE should attempt to move, lift, remove packaging from or prepare the unit for installation.



**CAUTION:** Risk of improper handling, heavy and lengthy parts. Can cause injury. Building and Equipment damage may also result. Cabinet panels can exceed 5 feet (1.5 m) in length and weigh more than 35 lb. (15.9 kg). Follow relevant OSHA lifting recommendations and consider using a two-person lift for safe and comfortable removal and installation of cabinet panels. Only properly trained and qualified personnel wearing appropriate, OSHA-approved PPE should attempt to remove or install cabinet panels.



**CAUTION:** Risk of improper moving, lifting and handling. Can cause injury. Building and equipment damage may also result. Only properly trained and qualified personnel should work on this equipment. Evaporator fan modules weigh in excess of 125 lb (56.7 kg). Use proper lifting techniques and wear appropriate OSHA-approved PPE to avoid injury and dropping the fan module during removal. Equipment used in handling/lifting, and/or installing the fan assembly must meet OSHA requirements. Use handling/lifting equipment rated for the weight of the fan assembly. Use ladders rated for the weight of the fan assembly and technicians if used during installation. Refer to handling/lifting, and/or installation equipment operating manual for manufacturer's safety requirements and operating procedures.



**CAUTION:** Risk of heavy unit falling into defective raised floor. Can cause injury and equipment damage. Prior to installation, all floor tiles immediately around floor stand are to be removed and inspected. Make sure tiles are not cracked, and ribs have not been cut. If free from defects, re-install. Replace with new tiles if defects are found.



**CAUTION:** Risk of contact with hot surfaces. Can cause injury. Personal burn injury can be the result of touching an electronics housing, fan motor, and some electrical components that are extremely hot during unit operation. Allow sufficient time for them to cool to a touch safe temperature before working within the unit cabinet. Use extreme caution and wear appropriate, OSHA-approved PPE when working on or near hot components, including when replacing or performing maintenance on the fans.



**CAUTION:** Risk of humidifier canister meltdown, smoke, and fire. Can cause fire suppression system activation, fire and smoke alarm activation, building evacuation, dispatching of fire and rescue equipment and personnel, and water leaks resulting in expensive equipment or building damage, injury or death. Check steam generating humidifier electrode plugs to ensure that they are pressed firmly onto pins. Loose connections will cause overheating of cylinder and plugs.



**CAUTION:** Risk of contact with hot surfaces. Can cause burn injury. The humidifier canister and steam discharge lines are extremely hot during operation. Allow sufficient time for them to cool to a touch-safe temperature before handling. Use extreme caution and wear appropriate, OSHA-approved PPE when performing maintenance on the humidifier.



**CAUTION:** Risk of contact with hot surfaces. Can cause injury. Personal burn injury can be the result of touching a humidifier reservoir pan and/or water contained within the pan, and some electrical components that are extremely hot during unit operation. Allow sufficient time for them to cool to a touch-safe temperature before working within the unit cabinet.

Use extreme caution and wear appropriate, OSHA-approved PPE when working on or near hot components, including when replacing or performing maintenance on the infrared humidifier parts inclusive of its bulbs, metal enclosure, humidifier reservoir pan and/or water contained within the pan, and drain tubing. All infrared humidifier parts are very hot during and remain very hot shortly after operation.



**CAUTION:** Risk of improper handling of boiling water. Can cause leaks, equipment and building damage, or burn injury. The unit requires a drain line that may contain boiling water. Only properly trained and qualified personnel wearing appropriate, OSHA-approved PPE should service the drain line or work on parts near or connected to the drain line.



**CAUTION:** Risk of improper piping installation, leak checking, fluid chemistry and fluid maintenance. Can cause injury. Building and equipment damage may also result. Installation and service of this equipment should be done only by qualified personnel who have been specially-trained in the installation of air-conditioning equipment and who are wearing appropriate, OSHA-approved PPE.



**CAUTION:** Risk of smoke generation. Can cause injury. Can cause fire suppression and alarm system activation, resulting in building evacuation and mobilization of emergency fire and rescue services. Start-up operation of optional electric reheat elements can create smoke or fumes that can activate the facility alarm and fire suppression system. Prepare and take appropriate steps to manage this possibility. Activating reheat during initial start-up may burn off particulates from electric reheat elements. Before beginning initial start-up checks, make certain that unit was installed according to the instructions in this manual. All exterior panels must be in place.



**CAUTION:** Risk of exposure to harmful noise levels. Can cause hearing injury or loss. Depending on the installation and operating conditions, a sound pressure level greater than 70 dB(A) may arise. Take appropriate technical safety measures. Operating personnel must wear appropriate, OSHA-approved PPE and observe all appropriate hearing protection safety requirements.

## NOTICE

Risk of improper power supply connection. Can cause equipment damage and loss of warranty coverage.

Prior to connecting any equipment to a main or alternate power source (for example: backup generator systems) for start-up, commissioning, testing or normal operation, ensure that these sources are correctly adjusted to the nameplate voltage and frequency of all equipment to be connected. In general, power source voltages should be stabilized and regulated to within  $\pm 10\%$  of the load nameplate nominal voltage. Also, ensure that no three phase sources are single phased at any time.

## NOTICE

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

Vertiv™ Liebert® PDX systems require the use of POE (polyolester) 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.

## NOTICE

Risk of improper refrigerant charging. Can cause equipment damage.

Refrigerant charge must be weighed into air cooled compressorized systems before they are started. Starting scroll and digital scroll compressors without proper refrigerant charging can cause the compressors to operate at less than 5°F (–15°C) evaporator temperature and at less than 20 psig (138 kPa). Operation for extended periods at less than 20 psig (138 kPa) can cause premature compressor failure.

## NOTICE

Risk of piping system corrosion and freezing fluids. Can cause leaks resulting in equipment and expensive building damage. Cooling coils, heat exchangers, and piping systems are at high risk of freezing and premature corrosion. Fluids in these systems must contain an inhibitor to prevent premature corrosion.

The system coolant fluid must be analyzed by a competent fluid treatment specialist before start-up to establish the inhibitor level and evaluated at regularly scheduled intervals throughout the life of the system to determine the pattern of inhibitor depletion. The fluid complexity and variations of required treatment programs make it extremely important to obtain the advice of a competent and experienced fluid treatment specialist and follow a regularly scheduled coolant fluid system maintenance program.

Fluid chemistry varies greatly 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 coolant fluid used must be considered, because 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 coolant fluid must be treated and circulating through the system continuously to prevent the buildup of deposits and/or growth of bacteria. Proper inhibitor maintenance must be performed to prevent corrosion of the system.

Consult fluid manufacturer for testing and maintenance of inhibitors.

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

Vertiv recommends installing a monitored fluid detection system that is wired to activate the automatic closure of field installed coolant fluid supply and return shutoff valves to reduce the amount of coolant fluid leakage and consequential equipment and building damage. The shutoff valves must be sized to close off against the maximum coolant fluid system pressure in case of a catastrophic fluid leak.



**NOTICE**

Risk of no flow condition. Can cause equipment damage. Do not leave the water/coolant fluid supply circuit 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 water/coolant fluid supply circuit system operating continuously.

**NOTICE**

Risk of clogged or leaking drain lines and leaking water supply lines. Can cause equipment and building damage.

This unit requires a water drain connection. Drain lines must be inspected at start-up and periodically, and maintenance must be performed to ensure that drain water runs freely through the drain system and that lines are clear and free of obstructions and in good condition with no visible sign of damage or leaks. This unit may also require an external water supply to operate.

Improper installation, application, and service practices can result in water leakage from the unit. Water leakage can result in catastrophic and expensive building and equipment damage and loss of critical data center equipment.

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

We recommend installing a monitored fluid detection system to immediately discover and report coolant fluid system and condensate drain line leaks.

**NOTICE**

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

Lines and joints must be inspected regularly. Improper installation, application and service practices can result in water leakage from the unit. Water leakage can result in severe property damage and loss of critical data center equipment. Do not locate unit directly above any equipment that could sustain water damage.

Vertiv recommends installing monitored leak detection equipment for the unit and supply and return lines.

**NOTICE**

Risk of a catastrophic water circuit rupture. Can cause expensive building and equipment damage.

Install an overflow drain pan under the unit with a monitored leak detection system in the pan and shutoff valves in the supply and return water lines that automatically close if water is detected by the leak detection system. The shutoff valves should be spring return and must be rated for a close off pressure that is the same as or higher than the supply water pressure. If it is not possible to install an overflow drain pan, then a monitored leak detection system should be installed in the base of the unit or under the unit to actuate the shutoff valves immediately on a leak detection signal.

The overflow drain pan should have a drain line connected to it that flows to a floor drain or maintenance sink in case of a shutoff valve or leak detection system malfunction.

**NOTICE**

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

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

**NOTICE**

Risk of water backing up in the drain line. Leaking and overflowing water can cause equipment and building damage.

Do not install an external trap in the drain line. This line already has a factory installed trap inside the cabinet. Installation of a second trap will prevent drain water flow and will cause the water to overflow the drain pan.

Sagging condensate drain lines may inadvertently create an external trap.

**NOTICE**

Risk of passageway interference. Can cause unit and/or structure damage. The unit may be too large to fit through a passageway while on or off the skid. Measure the unit and passageway dimensions, and refer to the installation plans prior to moving the unit to verify clearances.

**NOTICE**

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

**NOTICE**

Risk of improper storage. Can cause unit damage.

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

**NOTICE**

Risk of equipment snagging cables and wiring. Can damage the unit wiring and components.

Carefully monitor the position of the EC-fan wire harnesses and other parts while lowering the fan to be sure that they are not caught or pinched.

**NOTICE**

Risk of improper control circuits. Can cause equipment damage.

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

**NOTICE**

Risk of improper filter installation. Can cause filter collapse and airflow reduction.

**NOTE: The Liebert indoor cooling unit has a factory installed high pressure safety switch in the high side refrigerant circuit. Consult local building codes to determine whether the Vertiv™ Liebert® MC units without receivers will require field provided pressure-relief devices such as a fusible plug. A pressure relief valve is provided with Vertiv™ Liebert® Lee-Temp receivers and an integral, fusible plug is provided on PDX-EEV unheated receivers.**

## Agency Listed

Standard 60Hz units are CSA Certified to the harmonized U.S. and Canadian product safety standard CSA C22.2 No 236/UL 1995 for “Heating and Cooling Equipment” and are marked with the CSA c-us logo.



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## 2 Nomenclature and Components

This section describes the model number for Vertiv™ Liebert® PDX and Vertiv™ Liebert® PCW units and components.

**Figure 2.1 Liebert® PDX and Liebert® PCW Views**



Item	Description
1	Top discharge, front return unit
2	Raised floor discharge unit
3	Three-way floor level discharge unit

## 2.1 Vertiv™ Liebert® PDX Model Number Nomenclature

The tables below describe each digit of the 25 digit configuration number. The 14 digit model number consists of the first 10 digits and last 4 digits of the configuration number.

For the full description of configuration and model number refer to [Vertiv™ Liebert® PDX Model Number Detail](#) on page 111.

**Table 2.1 Liebert® PDX 25 Digit Configuration Number**

Model Number Digits 1 to 10										Model Details											Model Number Digits 11 to 14			
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
P	X	0	2	9	D	A	1	A	D	H	2	2	8	0	1	P	L	B	F	P	A	#	#	#

**Table 2.2 Liebert® PDX Model Number Digit Summary**

Digits 1 and 2 = Unit Family	Digit 15 = Coil, Valve Type, and Pressure Rating
Digit 3, 4, 5 = Nominal Cooling Capacity, kW	Digit 16 = Enclosure Options
Digit 6 = Air Direction and Discharge	Digit 17 = High Voltage Options
Digit 7 = System Type	Digit 18 = Low Voltage Option Packages
Digit 8 = Fan Type	Digit 19 = Monitoring
Digit 9 = Power Supply	Digit 20 = Sensors
Digit 10 = Compressor and Valve (R-410A)	Digit 21 = Packaging
Digit 11 = Humidifier	Digit 22 = Factory Configuration Code
Digit 12 = Display	Digit 23-25 = Factory Configuration Number
Digit 13 = Reheat	N/A
Digit 14 = Air Filter	N/A

## 2.2 Vertiv™ Liebert® PCW Model Number Nomenclature

The tables below describe each digit of the 25 digit configuration number. The 14 digit model number consists of the first 10 digits and last 4 digits of the configuration number.

For the full description of configuration and model number refer to [Vertiv™ Liebert® PCW Model Number Detail](#) on page 115.

**Table 2.3 Liebert® PCW 25 Digit Configuration Number**

Model Number Digits 1 to 10										Model Details											Model Number Digits 11 to 14			
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
P	W	0	2	9	D	C	1	A	D	H	2	2	8	H	1	P	L	B	F	P	A	#	#	#

**Table 2.4 Liebert® PCW Model Number Digit Summary**

Digits 1 and 2 = Unit Family	Digit 15 = Coil
Digit 3, 4, 5 = Nominal Cooling Capacity, kW	Digit 16 = Enclosure Options
Digit 6 = Air Discharge	Digit 17 = High Voltage Options
Digit 7 = System Type	Digit 18 = Low Voltage Option Packages
Digit 8 = Fan Type	Digit 19 = Monitoring
Digit 9 = Power Supply	Digit 20 = Sensors
Digit 10 = Chilled Water Valve and Pressure	Digit 21 = Packaging
Digit 11 = Humidifier	Digit 22 = Factory Configuration Code
Digit 12 = Display	Digit 23-25 = Factory Configuration Number
Digit 13 = Reheat	N/A
Digit 14 = Air Filter	N/A

## 2.3 Component Location

The unit component locations are described in the submittal documents included in the [Submittal Drawings](#) on page 119.

The following table lists the relevant documents by number and title.

**Table 2.5 Component Location Drawings**

Document Number	Title
DPN003004	Liebert® PDX Component Location Diagram, Downflow Models
DPN003005	Liebert® PDX Component Location Diagram, Upflow Models
DPN003020	Liebert® PCW Component Location Diagram, Downflow Models
DPN003021	Liebert® PCW Component Location Diagram, Upflow Models

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## 3 Pre-installation Preparation and Guidelines

**NOTE:** Before installing unit, determine whether any building alterations are required to run piping, wiring, and duct work. Follow all unit dimensional drawings and refer to the submittal engineering dimensional drawings of individual units for proper clearances.

Refer to **Table B.2** on page 111, or **Table C.2** on page 115, and submittal drawings to determine the type of system being installed and anticipate building alterations, piping, and duct work needed.

The unit dimensions, pipe connection locations, and piping schematics are described in the submittal documents included in the [Submittal Drawings](#) on page 119.

- Verify that the floor is level, solid, and sufficient to support the unit. See **Table 3.3** on page 18 for unit weights.
- Confirm that the room is properly insulated and has a sealed vapor barrier.
- For proper humidity control, keep outside or fresh air to an absolute minimum (less than 5% of total air circulated in the room).
- Do not install a Vertiv™ Liebert® PDX or Vertiv™ Liebert® PCW in an alcove or at the end of a long, narrow room.
- Install the units as close as possible to the largest heat load.
- Allow at least the minimum recommended clearances for maintenance and service. See the appropriate submittal drawings for dimensions.
- We recommend installing an under floor water detection system. Contact your Vertiv representative for information.

### 3.1 Planning Dimensions

The unit, floor stand, and plenum dimensions are described in the submittal documents included in the [Submittal Drawings](#) on page 119.

The following table lists the relevant documents by number and title.

**Table 3.1 Dimension Planning Drawings**

Document Number	Title
<b>Downflow Units</b>	
DPN002936	Liebert® PDX/PCW Cabinet Dimensional Data, Downflow Models
DPN002944	Liebert® PDX/PCW Cabinet Dimensional Data, Downflow Floor Level Discharge Models
<b>Upflow Units</b>	
DPN002937	Liebert® PDX/PCW Cabinet Dimensional Data, Upflow Models
DPN002971, pg. 1	Liebert® PDX/PCW Cabinet Dimensional Data, Upflow Rear Return Models
<b>Floor Stands</b>	
DPN002970	Liebert® PDX/PCW Floor Stand and Floor Planning Dimensional Data
DPN002971, pg. 2	Liebert® PDX/PCW Dimensional Data, Upflow Rear Return Floor Stand
<b>Plenums</b>	
DPN002981	Liebert® PDX/PCW Plenum Dimensional Data, Upflow Discharge Grille
DPN003697	Liebert® PDX/PCW Plenum Dimensional Data, Upflow Discharge with Duct Collar

**Table 3.1 Dimension Planning Drawings (continued)**

Document Number	Title
DPN003447	Liebert® PDX/PCW Plenum Dimensional Data, Top Discharge Upflow Units
DPN003610	Liebert® PDX/PCS Downflow Plenum Dimensional Data Downflow Return with Duct Collar
DPN003757	Liebert® PDX/PCW Downflow Unit with Field Duct Connection

## 3.2 Considerations for Air Distribution

Depending on the intake/discharge configuration of the unit, consider the following when preparing for installation:

### When installing a downflow unit with raised floor discharge:

- Verify that the raised floor is properly sized for the unit's airflow and the room is free of airflow restrictions.
- Perforated floor tiles in the raised floor should ensure minimal pressure loss.
- The raised floor must provide a minimum of 7-1/2 inches (191 mm) of clearance.
- Ensure that there is adequate clearance above the unit for return air.
- Provide clearance for service access, see DPN002936 in the [Submittal Drawings](#) on page 119 .

### When installing a downflow unit with floor level discharge:

- Provide several feet of clearance for air discharge of the unit.
- Ensure that there is adequate clearance above the unit for return air.
- Provide clearance for service access, see DPN002944 in the [Submittal Drawings](#) on page 119 .

### When installing upflow units

- Provide several feet of clearance for intake and discharge of the unit or for supply and return ducting.
- Provide clearance for service access. See DPN002937 in the [Submittal Drawings](#) on page 119 .

## 3.3 Connections and System Setup

- The unit requires a drain, which must comply with all applicable codes. This drain line may contain boiling water. See [Field Installed, Gravity Fed Drain Line Requirements](#) on page 30 , for details.
- Three phase electrical service is required for all models. Electrical service must conform to national and local electrical codes. See equipment nameplate for details.
- Plan the routing of wiring, piping, and duct work to the unit. Refer to the appropriate piping connection location drawings, piping schematics, and electrical connection drawings for your system in [Submittal Drawings](#) on page 119 .
- Water/glycol and Vertiv™ Liebert® GLYCOOL units utilizing a Vertiv™ Liebert® Drycooler may require an optional aquastat setting. See **Table 9.8** on page 100 and **Table 9.9** on page 100 for Liebert® Drycooler aquastat setting guidelines. Applications with the optional stat setting require field piping to be insulated to prevent condensation.

**NOTE: Seal openings around piping and electrical connections to prevent air leakage. Failure to do so could reduce the unit's cooling performance.**

## 3.4 Operating Conditions

The Vertiv™ Liebert® PDX and Vertiv™ Liebert® PCW must be operated in a conditioned space within the operating envelope that ASHRAE recommends for data centers. Operating the Liebert® PDX or Liebert® PCW outside of this envelope can decrease equipment reliability. Refer to ASHRAE's publication, "Thermal Guidelines for Data Processing Environments."

### 3.4.1 Cooling, Humidification, and Dehumidification

For operation in the cooling, humidification or dehumidification modes, the unit return air requirements for Vertiv™ Liebert® PDX and Vertiv™ Liebert® PCW proper operation are:

- Maximum dew point of 59°F (15°C).
- Minimum 68°F (20°C) DB.
- Maximum 85° (29.4°C) DB for humidification mode and maximum 100°F (37.7°C) DB for cooling and dehumidification modes.

**NOTE: Operating some Liebert® PDX units equipped with thermal expansion valves (TXVs) above 80° to 85°F (27° to 29.4°C) return air can cause the TXV to run out of stroke and result in an increase in superheat (above 20°F) thus limiting the unit's capacity.**

### 3.4.2 Heating

For operation in the heating mode, the Vertiv™ Liebert® PDX or Vertiv™ Liebert® PCW unit return air requirements for proper unit operation are:

- Maximum dew point of 59°F (15°C).
- Maximum dry bulb of 80°F (27°C).

**NOTE: Heating operation is not available when unit Vertiv™ Liebert® iCOM™ is set for Supply Air Control.**

## 3.5 Shipping Dimensions and Unit Weights

**Table 3.2 Shipping Dimensions for Vertiv™ Liebert® PDX and Vertiv™ Liebert® PCW**

Model Number	L x W x H, in. (mm)	
	Domestic	Export
PX011, PX018	44 x 60 x 85.5	45 x 60 x 86
PX023, PX029	(1118 x 1524 x 2172)	(1143 x 1524 x 2184)
PW011, PW017, PW029		

**Table 3.3 Unit Weights—Approximate**

Model #	Cooling Type	Dry Unit Weight, lb (kg)	Shipping Weight Domestic, lb (kg)	Shipping Weight Export, lb (kg)
PX011	Air	600 (272)	750 (340)	885 (401)
	Air with Liebert® Econ-o-Coil	700 (318)	850 (386)	985 (447)
	Water/Glycol	620 (281)	770 (349)	905 (410)
	Water/Glycol with Liebert® Econ-o-Coil	720 (327)	870 (395)	1005 (456)
	Liebert® GLYCOOL			
PX018 PX023	Air	670 (304)	820 (372)	955 (433)
	Air with Liebert® Econ-o-Coil	750 (340)	900 (408)	1035 (469)
	Water/Glycol	690 (313)	840 (381)	975 (442)
	Water/Glycol with Liebert® Econ-o-Coil	770 (349)	920 (417)	1055 (478)
	Liebert® GLYCOOL			
PX029	Air	700 (317)	850 (385)	985 (446)
	Air with Liebert® Econ-o-Coil	790 (358)	940 (426)	1075 (487)
	Water/Glycol	720 (327)	870 (395)	1005 (456)
	Water/Glycol with Liebert® Econ-o-Coil	810 (367)	960 (435)	1095 (496)
	Liebert® GLYCOOL			
PW011	Chilled Water	575 (261)	725 (379)	860 (390)
PW017		600 (272)	750 (340)	885 (401)
PW029		650 (294)	800 (362)	935 (423)

**NOTE:** See capacity tables for unit liquid volume. Consult your factory sales representative for additional component weight information.

## 4 Equipment Inspection and Handling



**WARNING!** Risk of improper wiring, piping, moving, lifting and handling. Can cause serious injury or death. Building and equipment damage may also result. Installation and service of this equipment should be done only by qualified personnel who have been specially-trained in the installation of air-conditioning equipment and who are wearing appropriate, OSHA-approved PPE.



**WARNING!** Risk of top-heavy unit falling over when improperly lifted or moved. Can cause serious injury or death. Building and equipment damage may also result. Read all of the following instructions and verify that all lifting and moving equipment is rated for the weight of the unit before attempting to move, lift, remove packaging from or prepare the unit for installation. Unit weights are specified in **Table 3.3** on page 18 .



**CAUTION:** Risk of contact with sharp edges, splinters, and exposed fasteners. Can cause injury. Only properly trained and qualified personnel wearing appropriate, OSHA-approved PPE should attempt to move, lift, remove packaging from or prepare the unit for installation.

### NOTICE

Risk of passageway interference. Can cause unit and/or structure damage. The unit may be too large to fit through a passageway while on or off the skid. Measure the unit and passageway dimensions, and refer to the installation plans prior to moving the unit to verify clearances.

### NOTICE

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

### NOTICE

Risk of improper storage. Keep the unit upright, indoors and protected from dampness, freezing temperatures, and contact damage.

Upon arrival of the unit and before unpacking:

- Verify that the labeled equipment matches the bill of lading.
- Carefully inspect all items for visible or concealed damage.
- Report damage immediately to the carrier and file a damage claim with a copy sent to Vertiv or to your sales representative.

### Equipment Recommended for Handling the Unit:

- Forklift
- Pallet jack
- Piano jacks
- Slings
- Spreader bars

## 4.1 Packaging Material



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

## 4.2 Handling the Unit While Packaged

### NOTICE

Risk of passageway interference. Can cause unit and/or structure damage. The unit may be too large to fit through a passageway while on or off the skid. Measure the unit and passageway dimensions, and refer to the installation plans prior to moving the unit to verify clearances.

### NOTICE

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

If possible, transport the unit with a forklift or pallet jack. If that is not possible, use a crane with slings and spreader bars that are rated for the weight of the unit.

When using a forklift or pallet jack:

- Ensure that the fork length is suitable for the unit length and, if adjustable, spread to the widest allowable distance that will fit under the skid.
- When moving the packaged unit, do not lift the unit any higher than 3 inches (76 mm). All personnel except those moving the unit must be kept 20 feet (5 m) or more from the unit while it is being moved.
- If the unit must be lifted higher than 3 inches (76 mm), all personnel not directly involved in moving the unit must be 20 feet (5 m) or farther from the unit.
- Always refer to the location of the center of gravity indicators when lifting the unit from any other side, see **Figure 4.1** below.

**Figure 4.1 Center of Gravity Indicator**



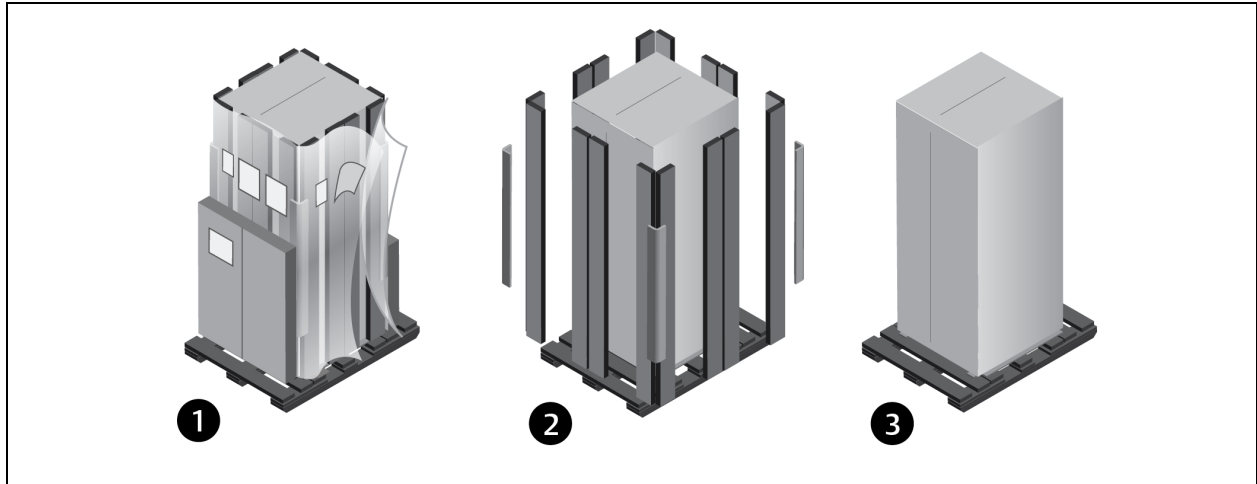
## 4.3 Unpacking the Unit

1. Shipped loose items, if ordered, are secured to the unit package with stretch wrap. Remove the stretch wrap and place the shipped loose box(es) to the side.
2. Remove the exterior stretch wrap packaging from around the unit and protective corner and side packaging, as shown in **Figure 4.2** on the facing page.
3. Remove the protective top and side package pads from the unit, exposing the bag over the unit, see **Figure 4.2** on the facing page.

**NOTE:** The bag may remain in place to protect from dust and to protect the unit panels, or it may be removed for immediate installation.

4. Remove the bag from the unit when ready to remove the skid and install the unit.

**Figure 4.2 Unpacking the Unit**

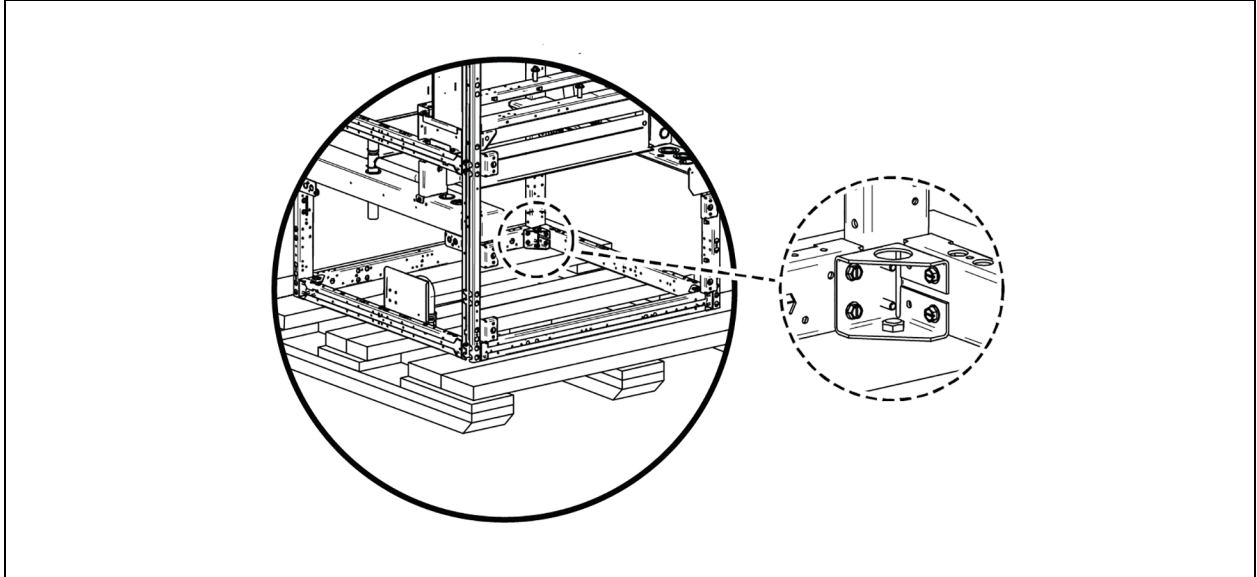


Item	Description
1	Shipped loose items location, and removing exterior wrap from unit.
2	Remove corner and side packaging planks.
3	Leave the bag on the unit until ready to install.

### 4.3.1 Removing the Unit from the Skid with a Forklift

1. Remove the panels from the unit, and remove the four bolts attaching the unit to the skid. They are inside the unit base as shown in **Figure 4.3** below .

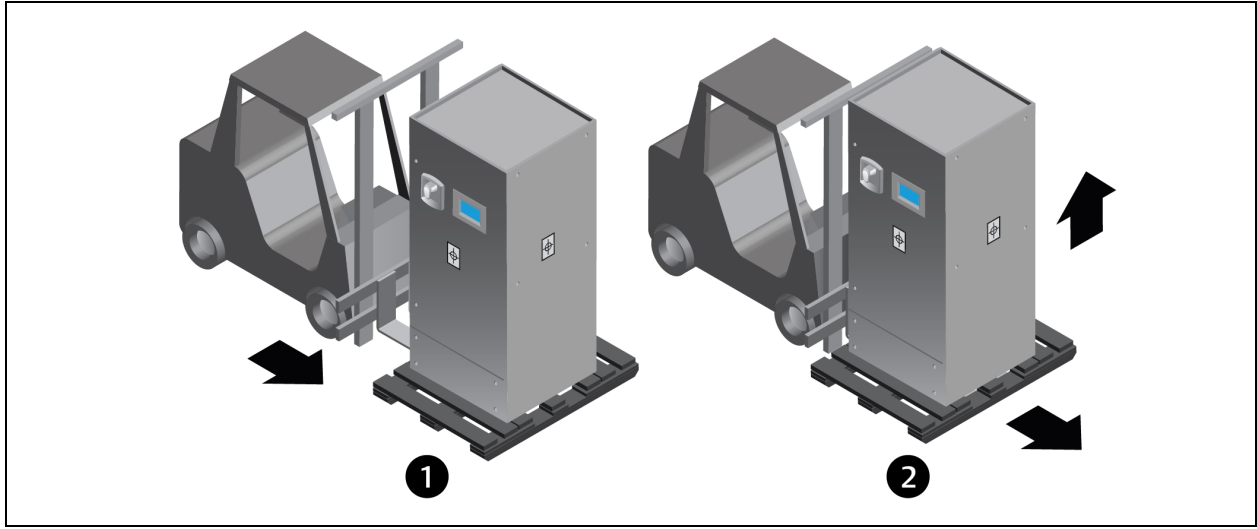
**Figure 4.3** Remove Unit Panels and Bolts to Skid



2. Align a forklift so the tines can be inserted under the unit.
3. Referring to **Figure 4.4** on the facing page :
  - Insert the tines of the forklift completely under the base and beyond the opposite side of the unit making sure they are level, not angled upward.
  - Lift the unit off the skid to where the skid is not supporting the weight of the unit, and remove the skid.
4. To move the unit with piano jacks, keep the unit elevated, and refer to [Moving the Unit with Piano Jacks](#) on page 26 .



Figure 4.4 Remove the Unit from the Skid with a Forklift



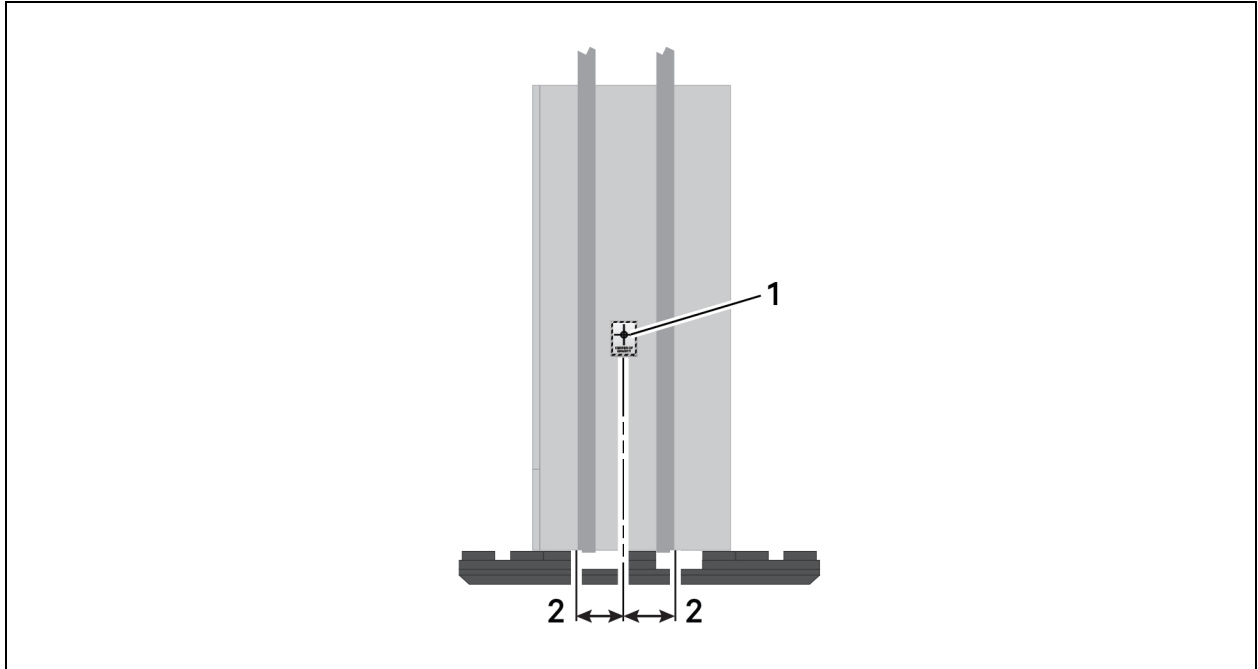
Item	Description
1	Insert tines completely under base of unit.
2	Lift unit and remove skid.

### 4.3.2 Removing the Unit from the Skid Using Rigging

1. Remove the panels from the unit, and remove the four bolts attaching the unit to the skid. They are inside the unit base as shown in **Figure 4.3** on the previous page .
2. Place slings under the unit using the spaces provided between the skid deck boards. Use the center of gravity indicators on the unit to determine the position of the slings as shown in **Figure 4.5** on the next page .

**NOTE:** The unit is shown without packaging. You may refer to these steps to move the unit with rigging while the outer packaging is in place.

Figure 4.5 Center of Gravity Indicator and Example Sling Placement



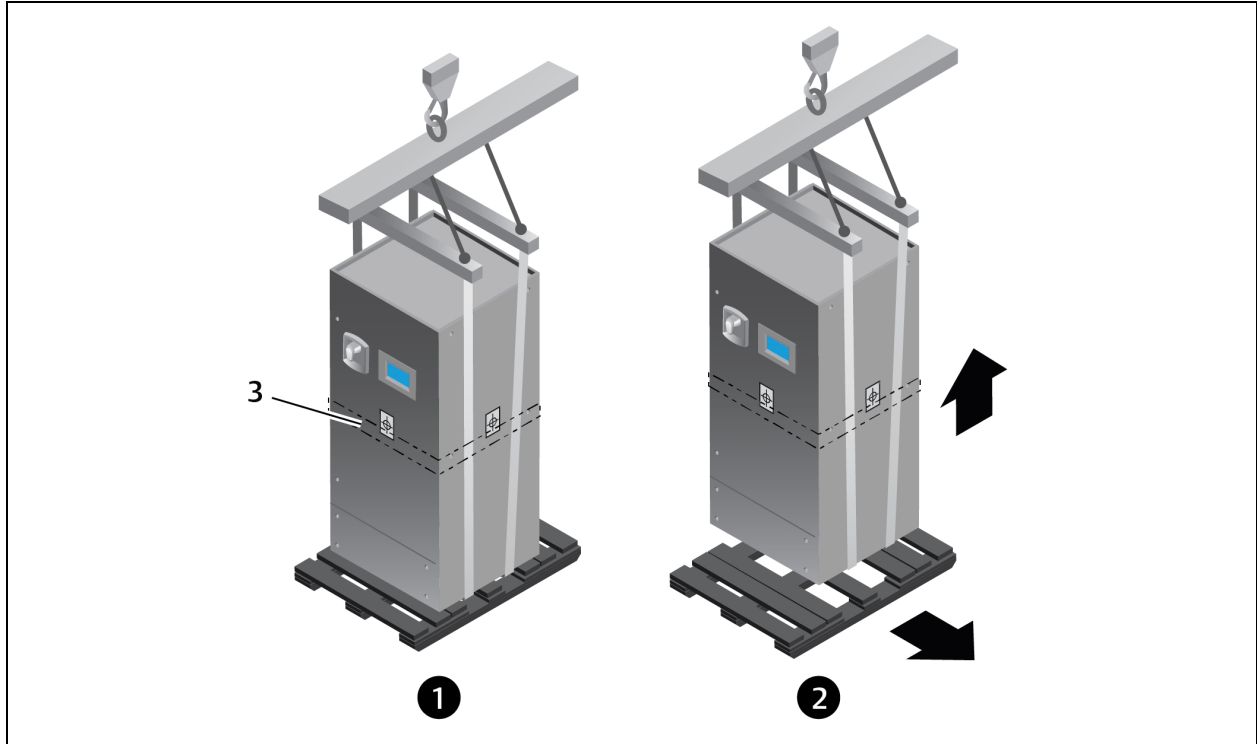
Item	Description
1	Center of gravity marker.
2	Equal distance between sling and marker.

3. Referring to **Figure 4.6** on the facing page :
  - Use spreader bars or an equivalent device to protect the unit from crushing when it is lifted with the slings. Ensure that the unit's panels, if the bag is removed, are protected from the slings.

**NOTE: If rigging will be used to move the unit closer to the site for installation, place one or two horizontal straps around the unit at mid-height.**

- Lift the unit off the skid to a point where the weight of the unit is not resting on the skid, and remove the skid from under the unit.
4. To move the unit with piano jacks, keep the unit elevated, and refer to [Moving the Unit with Piano Jacks](#) on page 26.

Figure 4.6 Remove the Unit from the Skid with Rigging

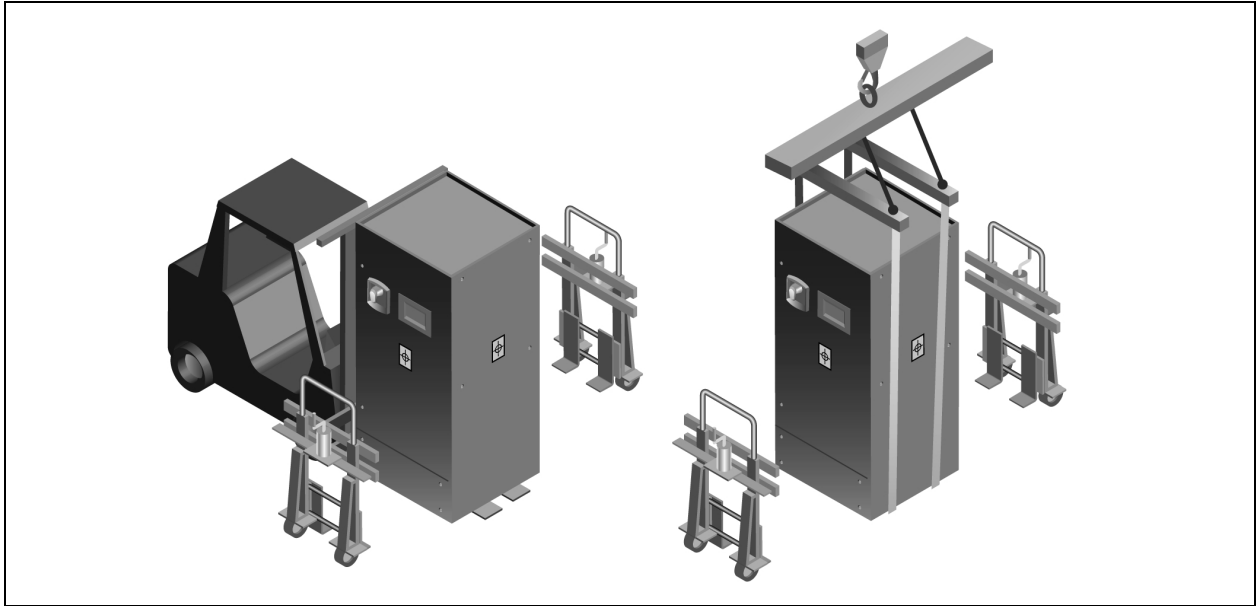


Item	Description
1	Use spreader bars and protect unit from slings.
2	Lift unit so that weight is not on skid, and remove the skid.
3	Horizontal strap location, at mid-height of unit.

### 4.3.3 Moving the Unit with Piano Jacks

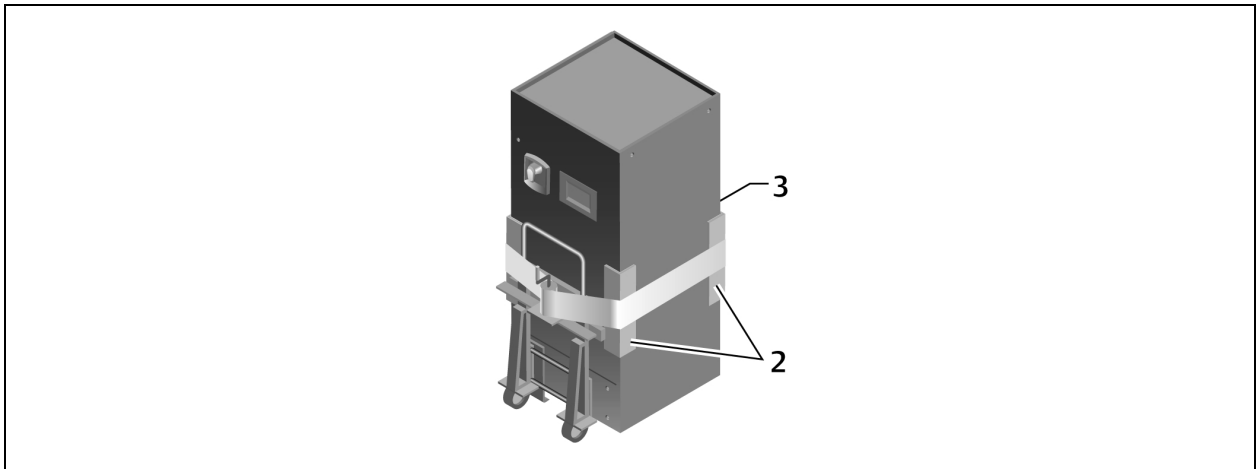
1. With the unit raised by a forklift, pallet jack or rigging according to the previous instructions, position a piano jack on either side of the elevated unit, see **Figure 4.7** below , then lower the unit to a height suitable for the piano jacks.

**Figure 4.7 Lower Unit to Piano Jacks**



2. Place protective padding between the unit and the piano jacks and straps, then secure the unit to the piano jacks with the straps as shown in **Figure 4.8** below .

**Figure 4.8 Unit Strapped to Piano Jacks**



Item	Description
2	Protective padding between piano jacks and straps.
3	Second piano jack on opposite side.

3. Depending on the method used, lower the forklift tines and move the forklift away or remove the straps and move the rigging away.
4. Use the piano jacks to move the unit to the installation site.
  - At least two properly trained and qualified personnel are required to move the unit with piano jacks.
5. Once the unit is in the installation location, remove the unit from the piano jacks:
  - Lower the unit as far as the piano jacks will allow.
  - Undo all straps holding the unit to the piano jacks.
  - Use a pry bar or similar device to lift one end of the unit enough to remove one piano jack.
  - Repeat the previous step to remove the piano jack on the opposite end.
  - Remove the padding used to protect the unit from the piano jacks and strapping.

## 4.4 Placing the Unit on a Floor Stand



**CAUTION: Risk of heavy unit falling into defective raised floor. Can cause injury and equipment damage. Prior to installation, all floor tiles immediately around floor stand are to be removed and inspected. Make sure tiles are not cracked, and ribs have not been cut. If free from defects, re-install. Replace with new tiles if defects are found.**

Refer to the floor stand installation sheet shipped inside the floor stand package. Unit to be placed onto floor stand using process that will provide safest method based on site layout. Professional installers to be used when placing unit. Unit may require lift onto a floor stand if elevated flooring has not been installed. If flooring is installed, unit will be placed over floor opening containing floor stand.

**NOTE: The floor stand for the Vertiv™ Liebert® PDX and Vertiv™ Liebert® PCW is not symmetrical. Its orientation to the unit is critical for installation of the unit.**

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## 5 Piping and Refrigerant Requirements

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 located so that it offers the least resistance to air flow. Careful planning of the piping layout under the raised floor is required to prevent the air flow from being blocked. When installing piping on the subfloor, we recommend that the pipes be mounted in a horizontal plane rather than stacked one above the other. Whenever possible, the pipes should be run parallel to the air flow.

The pipe connection locations, piping general arrangement, and schematics are described in the submittal documents included in the [Submittal Drawings](#) on page 119 .

The following tables list the relevant documents by number and title.

**Table 5.1 Piping General Arrangement Drawings**

Document Number	Title
<b>PDX Piping Schematics</b>	
DPN002929	Liebert® PDX Piping Schematic Air Cooled Models with TXV
DPN003954	Liebert® MC Air Cooled Piping Schematic Condenser above Indoor Unit
DPN003843	Liebert® PDX Piping Schematic Air Cooled Models with EEV
DPN003993	Liebert® PDX with EEV Air Cooled Piping Schematic Liebert® MC with Receiver above Unit
DPN002931	Liebert® PDX Piping Schematics Water/Glycol Models
DPN002932	Liebert® PDX Piping Schematics Liebert® GLYCOOL Models
DPN002972	Liebert® PDX Optional Piping Schematics Econ-o-Coil Models
<b>PCW Piping Schematics</b>	
DPN002930	Liebert® PCW Piping Schematic Chilled Water Models
DPN003737	Liebert® PCW Optional Piping Schematic Hot Water Reheat

**Table 5.2 Piping Connection Drawings**

Document Number	Title
<b>Downflow Model Primary Connection Locations</b>	
DPN002938	Liebert® PCW Primary Connection Locations Downflow Air Cooled Models
DPN002945	Liebert® PDX Primary Connection Locations Downflow Front Discharge Air Cooled Models
DPN002942	Liebert® PDX Primary Connection Locations Downflow Water/Glycol Models
DPN002947	Liebert® PDX Primary Connection Locations Downflow Front Discharge Water/Glycol Models
DPN003520	Liebert® PDX Primary Connection Locations Downflow Liebert® GLYCOOL Models
DPN003522	Liebert® PDX Primary Connection Locations Downflow Front Discharge Liebert® GLYCOOL Models

**Table 5.2 Piping Connection Drawings (continued)**

Document Number	Title
DPN002940	Liebert® PCW Primary Connection Locations Downflow Chilled Water Units
DPN002946	Liebert® PCW Primary Connection Locations Downflow Front Discharge Models
<b>Upflow Model Primary Connection Locations</b>	
DPN002939	Liebert® PDX Primary Connection Locations Upflow Air Cooled Models
DPN002943	Liebert® PDX Primary Connection Locations Upflow/Water Glycol Models
DPN003521	Liebert® PDX Primary Connection Locations Upflow Liebert® GLYCOOL Models
DPN002941	Liebert® PCW Primary Connection Locations Upflow Chilled Water Models

## 5.1 Fluid Piping for Air Cooled, Water/Glycol Cooled, and Chilled Water Piping Applications

The following pipe connections are required:

- A drain line from the evaporator coil drain pan.
- A drain line from the secondary drain pan (if applicable).
- A water supply line to the optional humidifier (if applicable).
- On air cooled systems: refrigerant piping connections between the Vertiv™ Liebert® PDX and the condenser. See [Refrigerant Piping and Charging](#) on page 33 .
- On chilled water systems: connections to the building chilled water source.
- On water glycol systems: connections to a water or glycol loop.

### 5.1.1 Field Installed, Gravity Fed Drain Line Requirements

Observe the following requirements and refer to **Figure 5.1** on the facing page , when installing and routing the drain line:

- The drain line must be sized for 2 gpm (7.6 l/m) flow.
- The drain line must be located so it will not be exposed to freezing temperatures.
- The drain should be the full size of the drain connection.
- The drain line must slope continuously away from the unit. Pitch drain line toward drain a minimum of 1/8 inch (3 mm) per 1 foot (305 mm) of length.
- Drain is trapped internally. Do not externally trap the drain line.
- The drain line must be rigid enough that it does not sag between supports, which unintentionally creates traps.
- Use copper or other material suitable for draining water that can reach temperatures up to 212°F (100°C).
- The drain line must comply with all applicable codes.
- When the evaporator is installed below the level of the gravity-fed drain line, the optional condensate pump kit is required. See the appropriate section, depending on the configuration of your unit:
  - [Factory Installed Condensate Pump in Upflow Units](#) on page 32
  - [Field Installed Condensate Pump for Downflow Units](#) on page 32



Figure 5.1 Correct and Incorrect Gravity Drains for Downflow and Upflow Units

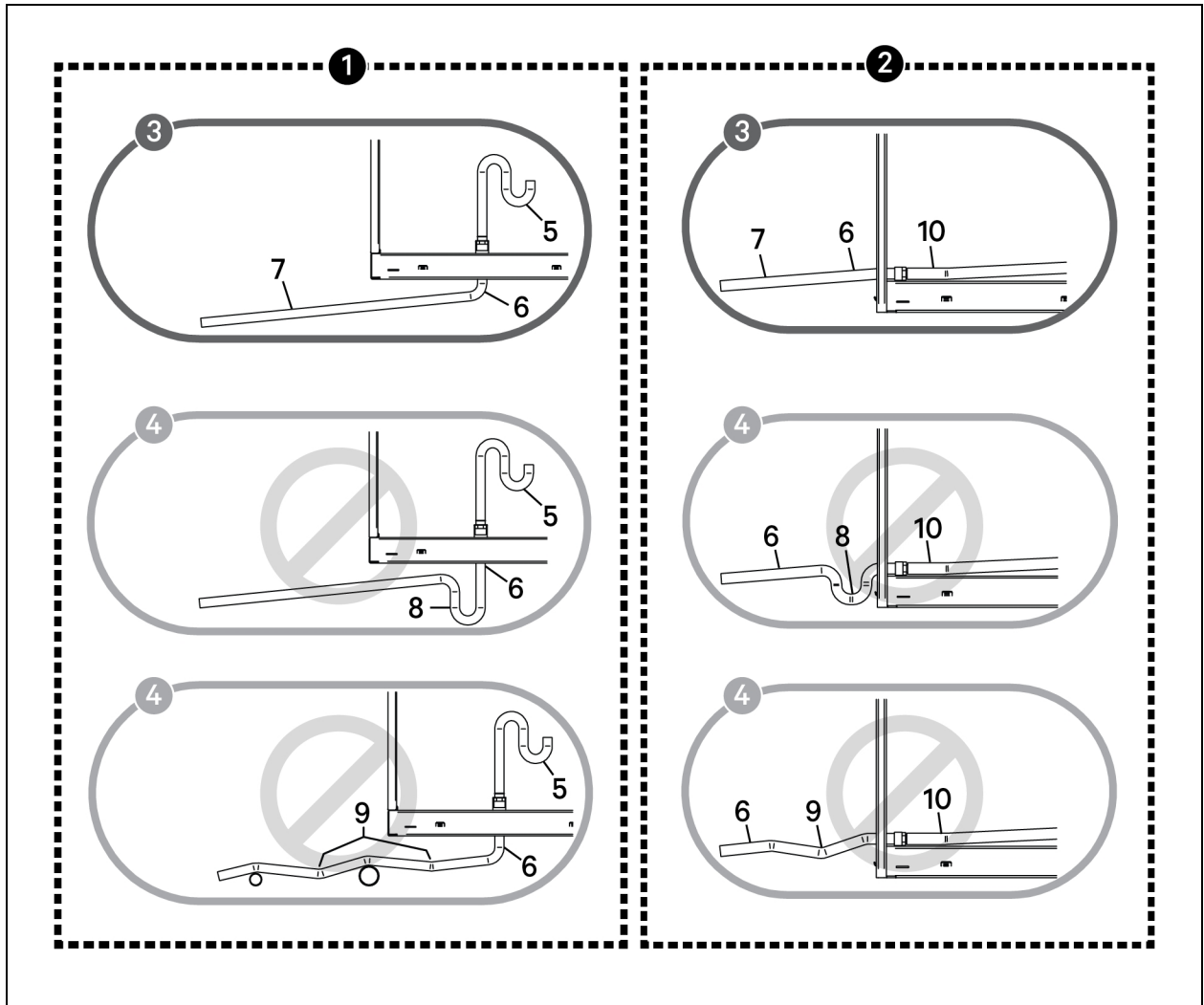


Table 5.3 Gravity Fed Drain Line Figure Descriptions

Item	Description
1	For downflow units with discharge into a raised floor.
2	For upflow and for downflow units with discharge to the front or side.
3	Correct drain installation.
4	Incorrect drain installation.
5	Internal drain and trap. <b>NOTE: Units equipped with a condensate pump do not have an internal trap.</b>
6	External drain.
7	Continuous downward slope.

**Table 5.3 Gravity Fed Drain Line Figure Descriptions (continued)**

Item	Description
8	External trap. Do not trap externally.
9	External traps, although unintentional. Lines must be rigid enough not to bow.
10	Internal drain and trap location. Drain and trap not shown in this view.

### Factory Installed Condensate Pump in Upflow Units

**NOTE: Condensate pumps are factory installed on upflow units. They are shipped separately to be field installed on downflow units.**

If your upflow unit requires a condensate pump, the pump is factory installed inside the unit and a 1/2 inch copper condensate discharge connection is provided on the unit. Size discharge piping based on available condensate head.

### Field Installed Condensate Pump for Downflow Units

**NOTE: Condensate pumps are factory installed on upflow units. They are shipped separately to be field installed on downflow units.**

If your downflow unit requires a condensate pump, the pump is shipped separately to be field installed alongside the unit or beneath the raised floor. If installing beneath a raised floor, a minimum of 11 inches (280 mm) floor height is required.

A 3/4 inch NPT female drain connection is provided on the unit.

- Drain is trapped internally. Do not trap external to unit.
- Size the discharge piping based on available condensate head.

## 5.1.2 Water Supply Line Requirements for the Optional Humidifier

The unit may have an optional humidifier. Refer to the appropriate supply line piping requirements if a humidifier is included on your unit:

#### Infrared Humidifier:

- 1/4 inch supply line, maximum water pressure is 150 psi (1,034 kPa).
- Size supply line for 1 gpm (3.8 l/m), with a minimum water pressure of 20 psi (138 kPa).
- Do not supply de-ionized water to the humidifier.

#### Steam Heating Generator

- 1/4 inch supply line. Maximum water pressure is 145 psi (1,000 kPa).
- Fill valve is sized for pressure range of 30 to 120 psi (207-827 kPa).
- Do not supply steam generating humidifier with softened water.
- Do not use hot water source.
- Water conductivity must be in the range of 330-750 micro-siemens.

## 5.2 Refrigerant Piping and Charging



**WARNING!** Risk of over pressurization of the refrigeration system. Can cause serious injury or death. Building and equipment damage may also result. Can cause explosive discharge of high pressure refrigerant, loss of refrigerant, or environmental pollution. This unit contains fluids and gases under high pressure. Use extreme caution when charging the refrigerant system. Do not pressurize the system higher than the design pressure marked on the unit's nameplate.



**WARNING!** Risk of explosive discharge of high pressure refrigerant. Can cause serious injury or death. Building and equipment damage may also result. Neutral and service ports on the compressor service valves do not have a valve core. Front set the service valves and relieve pressure from the compressor before loosening a part or a component attached to the service valve. Follow local codes to properly reclaim refrigerant.



**CAUTION:** Risk of excessive refrigerant line pressure. Can cause tubing and component rupture resulting in equipment damage and personal injury. Do not close off any field installed refrigerant line isolation valve for repairs unless a pressure relief valve is field installed in the line between the isolation valve and the check valve. The pressure relief valve must be rated 5% to 10% higher than the system design pressure. An increase in ambient temperature can cause the pressure of the isolated refrigerant to rise and exceed the system design pressure rating (marked on the unit nameplate). Do not isolate any circuits from over pressurization protection. Consult DPN002929 and DPN003843 in [Submittal Drawings](#) on page 119 .

Consult local building and plumbing codes for installation requirements of additional pressure relief devices when isolation valves are field installed. Do not isolate any refrigerant circuits from over pressurization protection.

**Table 5.4 System Refrigerant Pressures**

Maximum Design Operating Pressure (High Side)	530 psig	3655 kPa	Noted on the unit serial tag
High Pressure Cut Out Safety Switch	580 psig	3999 kPa	Nominal
Source: DPN000788, Rev 16			

**NOTE:** The Liebert® indoor cooling unit has a factory installed high pressure safety switch in the high side refrigerant circuit. Consult local building codes to determine whether the Vertiv™ Liebert® MC units without receivers will require field provided pressure relief devices such as a fusible plug. A pressure relief valve is provided with Vertiv™ Liebert® Lee-Temp receivers and an integral, fusible plug is provided on PDX-EEV unheated receivers.

### NOTICE

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

Vertiv™ Liebert® PDX systems require the use of POE (polyolester) 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.

**NOTICE**

Risk of improper refrigerant charging. Can cause equipment damage.

Refrigerant charge must be weighed into air cooled compressorized systems before they are started. Starting scroll and digital scroll compressors without proper refrigerant charging can cause the compressors to operate at least 5°F (-15°C) evaporator temperature and less than 20 psig (138 kPa). Operation for extended periods less than 20 psig (138 kPa) can cause premature compressor failure.

**5.2.1 Refrigerant Piping Guidelines for Air Cooled Systems**

- Air cooled units ship with a nitrogen holding charge. Do not vent the charge until all refrigerant piping is in place, ready for connection to the unit and condenser.
- Use copper piping with a brazing alloy with a minimum temperature of 1,350°F (732°C), such as Sil-Fos. Avoid soft solders, such as 50/50 or 95/5.
- Use a flow of dry nitrogen through the piping during brazing to prevent formation of copper oxide scale inside the piping. When copper is heated in the presence of air, copper oxide forms. POE oils will dissolve these oxides from inside the copper pipes and deposit them throughout the system, clogging filter driers and affecting other system components.
- A pure dry nitrogen flow of 1-3 feet<sup>3</sup>/min (0.5-1.5 l/s) inside the pipe during brazing is sufficient to displace the air. Control the flow using a suitable measuring device.
- Ensure that the tubing surfaces to be brazed are clean and that all burrs have been removed from the ends of the tubes.
- Ensure that all loose material has been cleaned from inside the tubing before brazing.
- Protect all refrigerant line components within 18 inches (460 mm) of the brazing site by wrapping them with a wet cloth or with a suitable heat sink compound.
- Isolate piping from building using vibration isolating supports.
- Condenser with receiver:
  - Cannot be installed below the evaporator.
  - EEV units: The outlet of the receiver on the outdoor Vertiv™ Liebert® MC must be higher than the elevation of the electronic expansion valves (EEV) inside the indoor unit. The vertical height of the receiver outlet must not exceed 60 feet (18.3 m) above the EEV.
  - TXV units: The bottom of the receiver on the outdoor Liebert® MC must be higher than the elevation of the thermal expansion valves (TXV) inside the indoor unit. The vertical height of the bottom of the receiver must not exceed 60 feet (18.3 m) above the TXV.
  - Consult factory before installing units, condensers, and receivers outside these parameters.
  - Refer to DPN003954 and DPN003993 included in [Submittal Drawings](#) on page 119 .
- Condenser without receiver:
  - The bottom of the condenser coil must be less than 15 feet below the location of the TXV unit.
  - The vertical height of the bottom of the condenser coil must not exceed 60 feet (18.3 m) above the TXV inside the indoor unit.
  - Consult factory before installing units and condensers outside these parameters.
  - Refer to DPN003954 included in [Submittal Drawings](#) on page 119
- Consult factory if piping run exceeds 300 feet (91 m) equivalent length.
- Install traps on hot gas (discharge) lines at the base of vertical risers over 5 feet (1.5 m) and then for vertical rises over 25 feet (7.6 m), install a trap in 20 feet (6 m) increments or evenly divided over the vertical rise.

- Pitch horizontal hot gas piping down at a minimum rate of 1/2 inch per 10 feet (42 mm per 10 m) so that gravity will aid in moving oil in the direction of refrigerant/oil flow.
- 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 discharge air stream.
- Refrigerant oil: do not mix oil types (see [Compressor Maintenance](#) on page 91).

Refer to ASHRAE Refrigeration Handbook for general, good practice refrigeration piping. The indoor cooling unit has a factory installed high pressure safety switch in the high side refrigerant circuit. Consult building codes to determine whether condensers without receivers require field provided pressure relief devices. A fusible plug kit is available for field installation on condensers without receivers.

- Refer to [Refrigerant Line Sizes and Equivalent Lengths](#) below, for recommended refrigerant piping sizes based on equivalent pipe lengths.
- Refer to [Charging Air Cooled Systems with Vertiv™ Liebert® Lee-Temp Receiver](#) on page 43, for charging information.

## 5.2.2 Refrigerant Line Sizes and Equivalent Lengths

Table 5.5 below lists requirements for field installed refrigerant piping for the system.

**Table 5.5 Recommended Refrigerant Line Sizes for Standard and Digital Scroll Models, OD Copper (Inches)**

Model	PX011		PX018		PX023		PX029	
Equivalent Length	Hot Gas Line	Liquid Line	Hot Gas Line	Liquid Line	Hot Gas Line	Liquid Line	Hot Gas Line	Liquid Line
50 ft. (15 m)	1/2	3/8	5/8	1/2	3/4	5/8	7/8	5/8
100 ft. (30 m)	5/8 <sup>2</sup>	1/2	5/8	1/2	3/4	5/8	7/8	5/8
150 ft. (45 m)	5/8 <sup>2</sup>	1/2	5/8	1/2	3/4	5/8	7/8	5/8
300 ft. (91 m)	5/8 <sup>2</sup>	1/2	3/4 <sup>2</sup>	5/8	7/8 <sup>2</sup>	5/8	1-1/8 <sup>2</sup>	3/4

1. Contact your Vertiv representative for line sizing for runs longer than maximum equivalent length shown in the table.

2. Must down size vertical riser one trade size (1-1/8" to 7/8", 7/8" to 3/4", 3/4" to 5/8", or 5/8" to 1/2").

Source: DPN000788, Rev. 16

## 5.2.3 Refrigerant Charge Requirements for Air Cooled Systems

The following tables provide the refrigerant charge requirements for the Vertiv™ Liebert® PDX, connected piping, and condenser options.

**Table 5.6 Approximate R-410A Refrigerant Charge for Air Cooled Liebert® PDX**

Model	Downflow, lb (kg)	Upflow, lb (kg)
PX011	4.6 (2.1)	5.1 (2.3)
PX018	5.0 (2.3)	7.1 (3.2)
PX023	5.0 (2.3)	7.1 (3.2)
PX029	6.6 (3.0)	7.4 (3.4)

**Table 5.7 Interconnecting Piping Refrigerant Charge for R-410A, lb per 100 ft (kg per 30 m)**

Line Size, O.D., in.	Liquid Line	Hot Gas Line
3/8	3.2 (1.4)	—
1/2	5.9 (2.7)	0.7 (0.3)
5/8	9.6 (4.3)	1.1 (0.5)
3/4	14.3 (6.4)	1.6 (0.7)
7/8	19.8 (8.8)	2.3 (1.0)
1-1/8	33.8 (15.1)	3.9 (1.7)
1-3/8	51.5 (23.0)	5.9 (2.6)
1-5/8	—	8.4 (3.7)

Source: DPN003099, Rev. 1

**Table 5.8 Condenser Refrigerant Charge Approximate R-410A per Circuit Including Receiver**

Condenser Model	Condensers without Receivers, lb (kg)	Condensers with Liebert® Lee-Temp Receiver <sup>1</sup> , lb (kg)	Condensers with PDX-EEV Unheated Receiver <sup>1</sup> , lb (kg)
MCS028	2.5 (1.2)	21.7 (9.8)	11.0 (5.0)
MCM040	3.5 (1.6)	22.7 (10.3)	12.0 (5.4)
MCL055	5.0 (2.3)	24.2 (11.0)	13.5 (6.1)
MCM080	8.5 (3.8)	39.8 (18.1)	17.0 (7.7)
MCL110	10.7 (4.9)	49.1 (22.3)	19.5 (8.8)

1. Condenser charge includes receiver.

Source: DPN002411, Rev. 8

## 5.2.4 Additional Oil Requirements for Scroll and Digital Scroll Compressors

### NOTICE

Risk of improper compressor lubrication. Can cause compressor and refrigerant system damage. Failure to use oil types, viscosities and quantities recommended by the compressor manufacturer may reduce compressor life and void the compressor warranty. See **Table 9.7** on page 92 for the recommended oil for the system.

- Do not mix polyolester (POE) and mineral-based oils.
- Do not mix oils of different viscosities.
- Consult your Vertiv sales representative, visit <https://www.Vertiv.com/en-us/support/>, or contact the compressor manufacturer if questions arise.

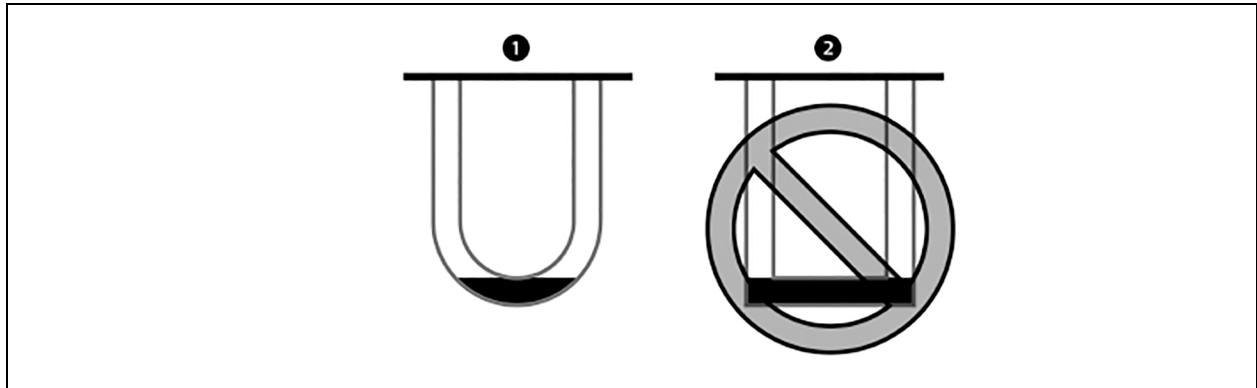
See **Table 5.9** on the facing page, for the amount required for various system charge levels.

In addition to oil added based on system charge, additional oil is required for discharge line field installed traps. Standard formed tube traps are required, see **Figure 5.2** on the facing page, and **Table 5.10** on page 38, because straight tubes and fittings used as traps require much more oil and the length of the straight tube can vary.

After the system has been fully charged with refrigerant, use a hand pump to add the additional oil at the suction side of the system while the system is running.

The amount of oil added by field service and the date of oil addition must be recorded on the tag marked “Oil Added Field Service Record,” attached to each compressor.

**Figure 5.2 Standard Formed Tube Trap Versus Straight Tubes and Fittings Trap**



Item	Description
1	Standard formed tube trap
2	Straight tubes and fittings trap

**Table 5.9 Additional Oil Required per Refrigerant Charge**

Refrigerant System Charge Per Circuit, lb (kg) *	Model			
	PX011	PX018	PX023	PX029
	Additional Oil Required Per Circuit, oz (mL)			
<40 (18.1)	0	0	0	0
40 (18.1)	4 (120)	6 (180)	6 (180)	6 (180)
50 (22.7)	6 (180)	9 (270)	9 (270)	9 (270)
60 (27.2)	8 (240)	12 (350)	12 (350)	12 (350)
70 (31.8)	10 (300)	15 (440)	15 (440)	15 (440)
80 (36.3)	12 (350)	18 (530)	18 (530)	18 (530)
90 (40.8)	14 (410)	21 (620)	21 (620)	21 (620)
100 (45.4)	16 (470)	24 (710)	24 (710)	24 (710)
110 (49.9)	18 (530)	27 (800)	27 (800)	27 (800)

\*System Charge = indoor unit + condenser + refrigerant receiver + refrigerant lines.  
For system charges over 110 lb. (49.9 kg), consult your Vertiv representative.

See **9.10** on page 91, for the recommended oil for the system.

Source: DPN003950, Rev. 6

**Table 5.10 Volume of Oil in Standard Form Trap by Pipe Diameter**

Pipe diameter, in.	Oil volume, oz (mL)
1/2	0.2 (5.9)
5/8	0.4 (11.8)
3/4	0.6 (17.7)
7/8	0.9 (26.6)
1-1/8	1.8 (53.2)
1-3/8	3.3 (97.6)
1-5/8	5.5 (162.7)

Source: DPN003950, Rev. 6

## 5.2.5 Evacuation, Leak Testing, and Charging Air Cooled Systems with TXV and without Receivers

A discharge line and liquid line must be field installed between the indoor unit and the outdoor condenser. See the appropriate piping schematic, listed in **Table 5.1** on page 29.

### Evacuation and Leak Testing Air Cooled Systems without Receivers

For proper leak check and evacuation, you must open all system valves and account for all check valves.

**NOTE:** The system includes 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 the appropriate piping schematic for your system in the submittal drawings appendix.

1. If unit power is available, open the unit liquid line solenoid valve using the evacuation function for System #1 in the diagnostic section of the Vertiv™ Liebert® iCOM™ controller.  
– or –  
If unit power is not available, connect a field supplied 24 VAC/75 VA power source directly 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 (1,034 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, (observe local code) and pull an initial deep vacuum of 500 microns 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 500 microns or less. Re-check the pressure after two hours.  
When the three checks are complete, proceed to [Charging Air Cooled Systems without Receivers](#) on the facing page.



## Charging Air Cooled Systems without Receivers

### NOTICE

Risk of improper refrigerant charging. Can cause equipment damage.

R-410A is a blended refrigerant 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. We recommend connecting a sight glass between the charging hose and the compressor suction service valve. This will permit adjustment of the cylinder hand valve so that liquid can leave the cylinder while allowing vapor to enter the compressor.

### NOTICE

Risk of refrigerant overcharge. Can cause equipment damage.

Do not use the unit sight glass as an indicator when charging Liebert® condenser systems.

**NOTE: A digital scroll compressor can have a clear unit sight glass on the liquid line only when operating at 100% capacity. When operating below 100%, the unit sight glass may show bubbles with each 15 second unloading cycle.**

The system must be fully piped and evacuated before it can be charged. See [Evacuation and Leak Testing Air Cooled Systems without Receivers](#) on the previous page .

Vertiv™ Liebert® MC units are charge sensitive and require accurate calculation of the system charge to avoid overcharging. To avoid overcharge, the following additional guidelines are recommended to ensure trouble free operation.

- When charging system in an outdoor ambient below 50°F (10°C), recheck the subcooling against **Table 5.11** on the next page , when the ambient is above 60°F (15.6°C)
- The indoor space should be maintained at 70 to 80°F (21 to 26.7°C) return air before final charge adjustments are made.
- Charging unit at greater than 80°F (26.7°C) return air and low outdoor ambient temperature may result in the unit being overcharged.
- Charge by subcooling measurement at the indoor unit. See **Table 5.11** on the next page , for target subcooling temperatures.
- Pressure and temperature measuring instruments should be capable of measuring to ±10 psig (68.9 kPa) and ± 2°F (1.1°C) for best subcooling measurement.

### To charge the system:

1. Check the nameplate on the indoor unit for refrigerant type to be used. Unit control configurations differ depending on refrigerant type.
2. The unit must be operating. Refer to the following if necessary:
  - [Checklist for Completed Installation](#) on page 57 to operate the system.
  - The operating manual for the Liebert® MC.

Manuals are available at <https://www.Vertiv.com/en-us/support/>.

3. Calculate the amount of charge for the system. See [Refrigerant Charge Requirements for Air Cooled Systems](#) on page 35 .
4. Accurately weigh in as much of the system charge as possible before starting the unit. Do not exceed the calculated charge by more than 0.5 lb (0.23 kg).
5. Close the Liebert® MC disconnect switch.

6. Close the Vertiv™ Liebert® PDX or Vertiv™ Liebert® PCW disconnect switch.
7. In the Service menu of the Vertiv™ Liebert® iCOM™ controller, select *Diagnostics/Service > Diagnostics*:
  - a. *Enable Manual Mode*.

**NOTE: Manual mode will time out after 30 minutes.**

- b. In Evaporator Fan options set *Motors* to *On* to operate the fan during Manual Mode.
- c. In Compressor Circuit 1 options, set *Compressor Mode* to *Charge* to operate the compressor at full capacity, energize the liquid line solenoid valve, and disable reheat and humidifier.
- d. Reset the charge function as many times as needed to complete unit charging.

**NOTE: You must establish and maintain a minimum 20 psig (138 kPa) for the compressor to operate.**

8. Attach pressure and temperature instruments to the liquid line of the indoor unit, measure the initial subcooling, and continue to add charge until the recommended subcooling for the current outdoor ambient temperature is reached. See **Table 5.11** below. Read the outdoor ambient temperature from the Vertiv™ Liebert® MC control menu ID F02.

**NOTE: To determine subcooling measurement, you must measure the liquid line pressure reading (at the factory installed Schrader tap) and obtain a temperature reading on the liquid line. Convert the liquid line pressure reading into a liquid temperature using a Pressure Temperature Guide or **Table 5.12** on the facing page. Subtract the measured temperature from the saturated liquid temperature. The difference is subcooling. Make sure to use the saturated liquid temperature to calculate subcooling.**

9. 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.

**Table 5.11 Target Subcooling for Ambient Outdoor Temperature**

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

DPN002411, Rev. 8

**Table 5.12 Liquid Pressure and Temperature Chart—R-410A**

Pressure		Temperature*	
PSIG	BarG	°F	°C
170	11.7	59.8	15.4
180	12.4	63.1	17.3
190	13.1	66.3	19.1
200	13.8	69.5	20.8
210	14.5	72.5	22.5
220	15.2	75.4	24.1
230	15.9	78.2	25.7
240	16.6	80.9	27.2
250	17.2	83.6	28.7
260	17.9	86.2	30.1
270	18.6	88.7	31.5
280	19.3	91.1	32.8
290	20.0	93.5	34.2
300	20.7	95.8	35.5
310	21.4	98.1	36.7
320	22.1	100.3	38.0
330	22.8	102.5	39.2
340	23.4	104.6	40.3
350	24.1	106.7	41.5
360	24.8	108.7	42.6
370	25.5	110.7	43.7
380	26.2	112.7	44.8
390	26.9	114.5	45.9
400	27.6	116.4	46.9
500	34.5	133.5	56.4
600	41.4	148.1	64.5

\* Values are for saturated liquid  
Source: DPN002411, Rev. 8

## 5.2.6 Evacuation, Leak Testing, and Charging Air Cooled Systems with Vertiv™ Liebert® Lee-Temp Flooded Condenser Head Pressure Control System

The Liebert® Lee-Temp system consists of a modulating type head pressure control valve and insulated receiver with heater pad to ensure operation at ambient temperatures as low as -30°F (-34.4°C). The Liebert® Lee-Temp system can be used with any Vertiv™ Liebert® PDX compressor or expansion valve choice.

A discharge line and liquid line must be field installed between the indoor unit and the outdoor condenser. See the appropriate piping schematic, listed in [Piping General Arrangement Drawings](#) on page 29 .

### Liebert® Lee-Temp Controlled Materials Supplied

- Built-in, pre-wired condenser control box
- Air cooled condenser
- Piping access cover
- Bolts—four per leg (3/8 inch x 5/8 inch)
- Terminal block for two wire, 24 V interlock connection between unit and condenser
- Terminal blocks for shielded CANbus cable connection between unit and condenser
- Condenser legs—four with 1 fan units and five with 2 fan units
- Bolts—Six per receiver (3/8 inch x 1 inch)
- Liebert® Lee-Temp system:
  - Insulated storage receiver with two liquid level sight glasses—one per circuit
  - Head pressure control valve piping assembly with two integral check valves—one per circuit
  - Service valve—one per receiver
  - Pressure relief valve—one per receiver

**NOTE: The Liebert® Lee-Temp heater pad requires a separate, continuous electrical source. See nameplate on receiver for proper voltage.**

### Evacuation and Leak Testing Air Cooled Systems with Vertiv™ Liebert® Lee-Temp Receiver

For proper leak check and evacuation, you must open all system valves and account for all check valves.

**NOTE: The system includes 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 the appropriate piping schematic for your system in [Submittal Drawings](#) on page 119 .**

1. If unit power is available, open the unit liquid line solenoid valve or electronic expansion valve (EEV) using the evacuation function in the diagnostic section of the Vertiv™ Liebert® iCOM™.
  - or –
  - If unit power is not available, connect a field supplied 24 VAC/75 VA power source directly to the unit solenoid valve.

**NOTE: Unit power is required for Liebert® PDX with EEV.**

2. Connect a jumper hose from the service valve fitting on the outlet of the receiver and the Schrader fitting on the discharge header of the condenser. Seat the service valve approximately two turns from the fully back seated position.
3. At the compressor, connect refrigerant gauges to the suction rotalock valves and discharge line Schrader valves.

4. Open the service valves and place a 150 psig (1,034 kPa) charge of dry nitrogen with a tracer of refrigerant. Check system for leaks with a suitable leak detector.
5. After completion of leak testing, release the test pressure, (observe local code) and pull an initial deep vacuum of 500 microns on the system with a suitable pump.
6. 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 500 microns or less. Re-check the pressure after two hours. When the three checks are complete, remove the jumper hose from the service valve fitting and the condenser, and proceed to [Charging Air Cooled Systems with Vertiv™ Liebert® Lee-Temp Receiver](#) below .

## Charging Air Cooled Systems with Vertiv™ Liebert® Lee-Temp Receiver

### NOTICE

Risk of improper refrigerant charging. Can cause equipment damage.

R-410A is a blended refrigerant 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. We recommend connecting a sight glass between the charging hose and the compressor suction service valve. This will permit adjustment of the cylinder hand valve so that liquid can leave the cylinder while allowing vapor to enter the compressor.

### NOTICE

Risk of improper operation. Can cause compressor failure.

Operating the unit with the EEV closed can cause compressor failure. The reheat and humidifier are disabled. A minimum of 20 psig (138 kPa) must be established and maintained for the compressor to operate. The charging function can be reset as many times as required to complete.

### To charge the system:

1. Check the nameplate on the indoor unit for refrigerant type to be used. Unit control configurations differ depending on refrigerant type.
2. The unit must be operating during charging, refer to [Checklist for Completed Installation](#) on page 57 .
3. Calculate the amount of charge for the system. See [Refrigerant Charge Requirements for Air Cooled Systems](#) on page 35 .
4. Accurately weigh in as much of the system charge as possible before starting the unit.
5. Close the Vertiv™ Liebert® MC disconnect switch.
6. Close the Vertiv™ Liebert® PCW or Vertiv™ Liebert® PDX disconnect switch.
7. In the Service menu of the Vertiv™ Liebert® iCOM™ controller, select *Diagnostics/Service > Diagnostics*:
  - a. *Enable Manual Mode*.

### NOTE: Manual mode will time out after 30 minutes.

- b. In Evaporator Fan options, set *Motors* to *On* to operate the fan during Manual Mode.
- c. In Compressor Circuit 1 options, set *Compressor Mode* to *Charge* to operate the compressor at full capacity, energize the liquid line solenoid valve, and disable reheat and humidifier.
- d. Reset the charge function as many times as needed to complete unit charging.

### NOTE: You must establish and maintain a minimum 20 psig (138 kPa) for the compressor to operate.

8. Check the refrigerant level in the refrigerant level sight glass on the Liebert® Lee-Temp receiver after the unit has been operating for at least 15 minutes.

**NOTE: The receiver at the condenser has two sight glasses and the refrigerant level varies with outside temperature.**

9. Adjust the refrigerant level to meet the level shown in [Target Refrigerant Level in Sight Glasses at Outdoor Temperatures](#) below .
10. After adjusting the refrigerant, allow the system to operate an additional 15 minutes before checking for the need of further adjustment.

**NOTE: A digital scroll compressor can have a clear unit sight glass on the liquid line only when operating at 100% capacity. When operating with a receiver, the unit sight glass might not become clear even when operating at 100% capacity. When operating below 100%, the unit sight glass may show bubbles with each 15 second unloading cycle.**

### Target Refrigerant Level in Sight Glasses at Outdoor Temperatures

- 40°F (4.5°C) and lower—bottom sight glass is 3/4 full.
- 40 to 60°F (4.5 to 15.5°C)—bottom sight glass is full.
- 60°F (15.5°C) and higher—top sight glass is 3/4 full.

## 5.2.7 Evacuation, Leak Testing, and Charging Air Cooled Systems with EEV and Unheated Receivers

The Vertiv™ Liebert® PDX with EEV uses an unheated receiver to balance refrigerant requirements of the evaporator coil and Vertiv™ Liebert® MC coil(s).

A discharge line and liquid line must be field installed between the indoor unit and the outdoor condenser. See the appropriate piping schematic, listed in **Table 5.1** on page 29 .

### Evacuation and Leak Testing Air Cooled Systems with Unheated Receivers

For proper leak check and evacuation, you must open all system valves and account for all check valves.

**NOTE: The system includes 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 the appropriate piping schematic for your system in the submittal drawings appendix.**

1. Open the electronic expansion valves for evacuation.
2. Connect refrigerant gauges to the suction rotalock valve and discharge line Schrader valve.
3. Open the service valves and place a 150 psig (1,034 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, (observe local code) and pull an initial deep vacuum of 500 microns 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 500 microns or less. Re-check the pressure after two hours. When the three checks are complete, proceed to [Charging Air Cooled Systems with Unheated Receivers](#) on the facing page .

## Charging Air Cooled Systems with Unheated Receivers

### NOTICE

Risk of improper refrigerant charging. Can cause equipment damage.

R-410A is a blended refrigerant 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. We recommend connecting a sight glass between the charging hose and the compressor suction service valve. This will permit adjustment of the cylinder hand valve so that liquid can leave the cylinder while allowing vapor to enter the compressor.

### NOTICE

Risk of refrigerant overcharge. Can cause equipment damage.

Do not use the unit sight glass as an indicator when charging Liebert® condenser systems.

### To charge the system:

1. Check the unit's nameplate for refrigerant type to be used. Unit control configurations differ depending on refrigerant type.
2. The unit must be operating, refer to [Checklist for Completed Installation](#) on page 57 .
3. Calculate the amount of charge for the system. See [Refrigerant Charge Requirements for Air Cooled Systems](#) on page 35 .
4. Accurately weigh in as much of the system charge as possible before starting the unit. Do not exceed the calculated charge by more than 0.5 lb (.23 kg).
5. Close the Vertiv™ Liebert® MC disconnect switch.

**NOTE:** We recommend charging the unit with the return-air setpoint between 75°F to 85°F (24 to 29°C). The return air temperature to the charged unit must be stable and must be maintained greater than 65°F (18°C). If this is not possible from lack of heat load, then use load banks to offset the cooling load during start-up. See [Target Refrigerant Level Sight Glasses at Outdoor Temperatures](#) on the next page for the proper charge level in the receiver based on return air temperature and outdoor temperature at time of charging.

6. In the Service menu of the Vertiv™ Liebert® iCOM™ controller, select *Diagnostics/Service > Diagnostics*:
  - a. *Enable* Manual Mode.

**NOTE: Manual mode will time out after 30 minutes.**

- b. In Evaporator Fan options, set *Motors* to *On* to operate the fan during Manual Mode.
- c. In Compressor Circuit 1 options, set *Compressor Mode* to *Charge* to operate the compressor at full capacity, energize the liquid line solenoid valve, and disable reheat and humidifier.
- d. Reset the charge function as many times as needed to complete unit charging.

**NOTE: You must establish and maintain a minimum 20 psig (138 kPa) for the compressor to operate.**

7. Adjust the refrigerant level in the unit to meet the level shown in [Target Refrigerant Level Sight Glasses at Outdoor Temperatures](#) below .
8. After adjusting the refrigerant, allow the system to operate an additional 15 minutes before checking for the need of further adjustment.

#### NOTICE

Risk of improper operation. Can cause compressor failure. Operating the unit with the EEV closed can cause compressor failure.

**NOTE: A digital scroll compressor can have a clear unit sight glass on the liquid line only when operating at 100% capacity. When operating with a receiver, the unit sight glass might not become clear even when operating at 100% capacity. When operating below 100%, the unit sight glass may show bubbles with each 15 second unloading cycle.**

### Target Refrigerant Level Sight Glasses at Outdoor Temperatures

- 40°F (4.5°C) and lower bottom sight glass is 3/4 full.
- 40°F (4.5°C) and higher bottom sight glass is full.

If the return air temperature cannot be maintained between 75°F to 85°F (24 to 29°C) (due to lack of load), then the liquid level in the receiver must be adjusted to the following if return air is between 65°F to 75°F (18 to 29°C):

- 40°F (4.5°C) and lower: charge to the bottom of the top sight glass.
- 40°F (4.5°C) and higher: top sight glass is 1/4 full.

## 5.2.8 Superheat and Refrigerant Charge Optimization

### Superheat on All Vertiv™ Liebert® PDX Units

Compressor suction superheat for all unit types should be in range of 8 to 15°F (4.4 to 8.3°C). See [Determining Suction Superheat](#) on page 89 and [Adjusting Superheat Setting with the TXV](#) on page 89 for superheat measurement and adjustment methods.

### Optimizing Refrigerant Charge on Water/Glycol Units

Vertiv™ Liebert® PDX and Vertiv™ Liebert® PCW water/glycol systems are factory charged with R-410A refrigerant and will operate without refrigerant charge adjustment at a wide range of return air temperatures and water/glycol entering temperatures. Adjusting the factory refrigerant charge while operating the unit at full load room conditions and at typical water/glycol temperatures can maximize the cooling capacity and unit efficiency.

**Table 5.13** on the facing page, describes the factory charge for the unit.



**Table 5.13 Approximate R-410A Refrigerant Factory Charge for Water/Glycol Cooled Liebert® PDX**

Model	Downflow, lb (kg)	Upflow, lb (kg)
PX011	5.7 (2.6)	6.3 (2.9)
PX018	6.2 (2.8)	8.4 (3.8)
PX023	6.2 (2.8)	8.4 (3.8)
PX029	8.5 (3.9)	9.5 (4.3)

**To optimize the refrigerant charge:**

- Operate the unit at full heat load, normal room conditions and normal water/glycol fluid temperatures for a minimum of 30 minutes before measuring stable unit superheat and subcooling temperatures and adjusting charge levels.
  - Condensing temperatures should be in range of 100 to 130°F (38 to 54°C) depending on fluid type and fluid temperature.
  - Full heat load is required to stabilize the system and prevent digital scroll compressors from modulating.
- Attach pressure and temperature instruments to the liquid line of the indoor unit. Use the factory installed Schrader valve located in the liquid line downstream of the condenser. Measure the initial subcooling.

**NOTE: To determine subcooling measurement, a liquid line pressure reading (at the factory installed Schrader tap) must be measured along with the temperature reading on the liquid line. Convert the liquid line pressure reading into a liquid temperature by utilizing a pressure temperature guide or Table 5.12 on page 41. Subtract the measured temperature from the liquid saturation temperature. The difference is subcooling.**

- Adjust refrigerant charge levels as needed to achieve subcooling range of 12 to 14°F (6.7 to 7.8°C) while maintaining full load conditions.

## 5.3 Water/Glycol and Chilled Water Loop Piping Guidelines

### NOTICE

Risk of piping system corrosion and freezing fluids. Can cause leaks resulting in equipment and expensive building damage. Cooling coils, heat exchangers, and piping systems are at high risk of freezing and premature corrosion. Fluids in these systems must contain an inhibitor to prevent premature corrosion.

The system coolant fluid must be analyzed by a competent fluid treatment specialist before start-up to establish the inhibitor level and evaluated at regularly scheduled intervals throughout the life of the system to determine the pattern of inhibitor depletion. The fluid complexity and variations of required treatment programs make it extremely important to obtain the advice of a competent and experienced fluid treatment specialist and follow a regularly scheduled coolant fluid system maintenance program.

Fluid chemistry varies greatly 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 coolant fluid used must be considered, because 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 coolant fluid must be treated and circulating through the system continuously to prevent the buildup of deposits and/or growth of bacteria. Proper inhibitor maintenance must be performed to prevent corrosion of the system.

Consult fluid manufacturer for testing and maintenance of inhibitors.

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

Vertiv recommends installing a monitored fluid detection system that is wired to activate the automatic closure of field installed coolant fluid supply and return shutoff valves to reduce the amount of coolant fluid leakage and consequential equipment and building damage. The shutoff valves must be sized to close off against the maximum coolant fluid system pressure in case of a catastrophic fluid leak.

### NOTICE

Risk of no flow condition. Can cause equipment damage.

Do not leave the water/coolant fluid supply circuit 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 water/coolant fluid supply circuit system operating continuously.

**NOTICE**

Risk of clogged or leaking drain lines and leaking water supply lines. Can cause equipment and building damage.

This unit requires a water drain connection. Drain lines must be inspected at start-up and periodically, and maintenance must be performed to ensure that drain water runs freely through the drain system and that lines are clear and free of obstructions and in good condition with no visible sign of damage or leaks. This unit may also require an external water supply to operate.

Improper installation, application, and service practices can result in water leakage from the unit. Water leakage can result in catastrophic and expensive building and equipment damage and loss of critical data center equipment.

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

We recommend installing a monitored fluid detection system to immediately discover and report coolant fluid system and condensate drain line leaks.

**NOTICE**

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

Lines and joints must be inspected regularly. Improper installation, application and service practices can result in water leakage from the unit. Water leakage can result in severe property damage and loss of critical data center equipment. Do not locate unit directly above any equipment that could sustain water damage.

Vertiv recommends installing monitored leak detection equipment for the unit and supply and return lines.

**NOTICE**

Risk of a catastrophic water circuit rupture. Can cause expensive building and equipment damage.

Install an overflow drain pan under the unit with a monitored leak detection system in the pan and shutoff valves in the supply and return water lines that automatically close if water is detected by the leak detection system. The shutoff valves should be spring return and must be rated for a close off pressure that is the same as or higher than the supply water pressure. If it is not possible to install an overflow drain pan, then a monitored leak detection system should be installed in the base of the unit or under the unit to actuate the shutoff valves immediately on a leak detection signal.

The overflow drain pan should have a drain line connected to it that flows to a floor drain or maintenance sink in case of a shutoff valve or leak detection system malfunction.

**NOTICE**

Risk of water backing up in the drain line. Leaking and overflowing water can cause equipment and building damage.

Do not install an external trap in the drain line. This line already has a factory installed trap inside the cabinet. Installation of a second trap will prevent drain water flow and will cause the water to overflow the drain pan.

Sagging condensate drain lines may inadvertently create an external trap.

These guidelines apply to field leak checking and fluid requirements for field piping systems, including chilled water, hot water, condenser (water or glycol), Vertiv™ Liebert® GLYCOOL and Vertiv™ Liebert® Drycooler circuits.

Refer to the appropriate piping general arrangement schematics for your system for the recommended, field installed hardware such as shutoff valves. See [Piping and Refrigerant Requirements](#) on page 29 .

- Equipment damage and personal injury can result from improper piping installation, leak checking, fluid chemistry and fluid maintenance.
- Follow local piping codes and 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 Vertiv™ Liebert® Drycooler to permit routine service and emergency isolation of the unit.
- Install a monitored fluid detection system that is wired to activate the automatic closure of field installed coolant fluid supply and return shut off valves to reduce the amount of coolant fluid leakage and consequential equipment and building damage. The shut off valves must be sized to close off against the maximum coolant fluid system pressure in case of a catastrophic fluid leak.
- Install the factory provided Y-strainer on the water/glycol supply to water/glycol or Vertiv™ Liebert® GLYCOOL units. The strainer is needed to prevent particles in the water from entering the unit's heat exchanger.

### 5.3.1 Leak Checking for Unit and Field Installed Piping

The fluid systems in the Vertiv™ Liebert® PDX and Vertiv™ Liebert® PCW are factory checked for leaks and may be shipped with a nitrogen holding charge. At installation, check all fluid circuits for leaks.

**NOTE: We recommend isolating the unit with field installed shutoff valves during leak checking of field installed piping. When the units are included in a leak test, use of fluid for pressure testing is recommended. When pressurized gas is used for leak testing the unit, the maximum recommended pressure is 30 psig (207 kPa) and tightness of the unit should be verified by pressure decay over time, (<2 psig/hour [13.8 kPa/hour]) or sensing a tracer gas with suitable instrumentation. Dry seals in fluid valves and pumps may not hold a high gas pressure.**

## 6 Electrical Connections

Three phase electrical service is required for all models. Electrical service must conform to national and local electrical codes. Refer to equipment nameplate regarding wire size and circuit protection requirements. Refer to electrical schematic when making connections. Refer the appropriate submittal drawing, listed in **Table 6.1** on the next page, for electrical service entrances into unit.

A manual electrical disconnect switch should be installed in accordance with local codes and distribution system. Consult local codes for external disconnect requirements.



**WARNING! Arc flash and electric shock hazard. Can cause serious injury or death. Building and equipment damage may also result. Disconnect all local and remote electric power supplies and wear appropriate, OSHA-approved personal protective equipment (PPE) per NFPA 70E before working within the electric control enclosure. Customer must provide earth ground to unit, per NEC, CEC, and local codes, as applicable.**

Verify with a voltmeter that power is Off. The Vertiv™ Liebert® iCOM™ controller does not isolate power from the unit, even in the “Unit Off” mode. Some internal components still require and receive power even during the “Unit Off” mode of the Liebert® iCOM™ controller. The factory-supplied, optional disconnect switch is inside the unit. The line side of this switch contains live high voltage. The only way to ensure that there is NO voltage inside the unit is to install and open a remote disconnect switch. Refer to unit electrical schematic.

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. Follow all local codes.



**WARNING! Risk of electric shock. Can cause serious injury or death. Building and equipment damage may also result. Open all local and remote electric power supply disconnect switches and verify that power is off with a voltmeter before working within any electric connection enclosures. The Liebert® iCOM™ controller 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™ controller .**

Installation, service, and maintenance work must be performed only by properly trained and qualified personnel and in accordance with applicable regulations and manufacturers' specifications. Opening or removing the covers to any equipment may expose personnel to lethal voltages within the unit even when it is apparently not operating and the input wiring is disconnected from the electrical source.



**WARNING! Risk of improper wire sizing/rating and loose electrical connections causing overheated wire and electrical connection terminals resulting in smoke or fire. Can cause serious injury or death. Building and equipment damage may also result. Use correctly sized copper wire only and verify that all electrical connections are tight before turning power On. Check all electrical connections periodically and tighten as necessary.**



**WARNING! Risk of short circuits and electric shock. Can cause serious injury or death. Building and equipment damage can result from cut insulation or damaged wires. Can cause overheated wiring, smoke, fire, activation of fire suppression systems and EMS personnel, and loss of power to fans. Verify that all wiring connections are tight and that all wiring is contained within the junction box prior to closing and securing the cover.**

**Insert CSA certified or UL listed bushings into holes and/or knockouts used to route wiring through metal panels to protect the wire insulation from contact with sheet metal edges.**

**NOTE: Seal openings around piping and electrical connection to prevent air leakage. Failure to do so could reduce the unit’s cooling performance.**

**NOTICE**

Risk of improper electrical connection of three phase input power. Can cause backward compressor rotation and unit damage. Service technicians should use a gauge set on the system during the initial start-up to verify that the three phase power is connected properly. The EC fans are not a reliable indicator of proper connection. The blowers will rotate the same direction, regardless of the three phase power input. Three phase power must be connected to the unit line voltage terminals in the proper sequence so that the compressors rotate in the proper direction. Incoming power must be properly phased to prevent compressors from running backward. We recommend checking the unit’s phasing with proper instrumentation to ensure that power connections were made correctly. We also recommend verifying discharge and suction pressures during start-up to ensure that the compressors are running in the correct direction.

**NOTICE**

Risk of improper power supply connection. Can cause equipment damage and loss of warranty coverage.

Prior to connecting any equipment to a main or alternate power source (for example: backup generator systems) for start-up, commissioning, testing or normal operation, ensure that these sources are correctly adjusted to the nameplate voltage and frequency of all equipment to be connected. In general, power source voltages should be stabilized and regulated to within ±10% of the load nameplate nominal voltage. Also, ensure that no three phase sources are single phased at any time.

See transformer label for primary tap connections. Installer will need to change transformer primary taps if applied unit voltage is other than pre-wired tap voltage.

**NOTE: Unit Input Power Requirements: For three phase units, only three power wires and an earth ground are required. A neutral is not required at the unit input connections. See [Wye and Delta Connected Power Supply for Vertiv™ Liebert® PDX and Vertiv™ Liebert® PCW](#) on the facing page , for detailed information.**

The electrical connections are described in the submittal documents included in the [Submittal Drawings](#) on page 119 .

The following table lists the relevant documents by number and title.

**Table 6.1 Electrical Field Connection Drawings**

Document Number	Title
DPN004594	Liebert® PDX/PCW Electrical Field Connections, Upflow and Downflow Models
DPN004595	Liebert® PDX/PCW Electrical Field Connections, Downflow Models
DPN004596	
DPN003266	Liebert® PDX CANbus & Interlock Connections between Liebert® PDX Unit & Liebert® MC

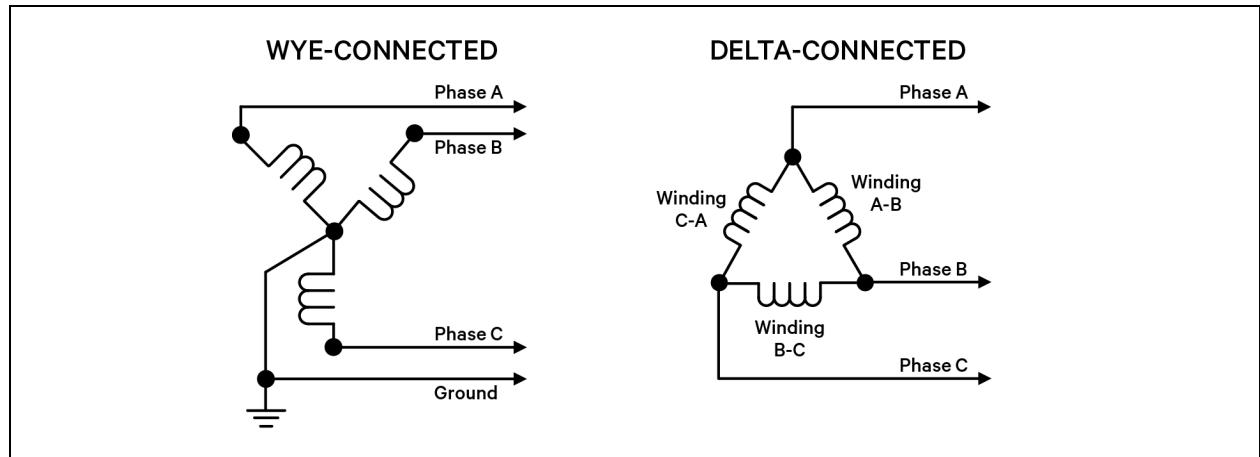
**Table 6.1 Electrical Field Connection Drawings (continued)**

Document Number	Title
DPN002169	Liebert® MC Electrical Field Connections Premium Efficiency Control
DPN002374	Liebert® MC Electrical Field Connections Premium Efficiency Control with Liebert® Lee-Temp
DPN003507	Liebert® iCOM™ Remote Temperature/Humidity Sensor
DPN004351	Liebert® iCOM™ Unit to Unit Network Connections Liebert® CW, Liebert® CWA, Liebert® DS, Liebert® DSE, Liebert® PDX, Liebert® PCW

## 6.1 Wye and Delta Connected Power Supply for Vertiv™ Liebert® PDX and Vertiv™ Liebert® PCW

Table 6.2 below shows the acceptable and unacceptable power supplies by model number for 208-V to 575-V nominal units. See Table 6.1 on the previous page, for the electrical connection locations on the units.

**Figure 6.1 Wye and Delta Connected Power Supply Connection Diagram**



**Table 6.2 Acceptable Power Supplies by Nominal Voltage and Model**

	208V to 230V Nominal	380V to 575V Nominal	208V to 575V Nominal			
	PX011 PW011	PX011 PW011	PX018	PW017	PX023	PX029 PW029
<b>Wye with solidly-grounded neutral:</b>						
208 V Wye, 120 V line to ground	Yes	Yes	Yes	Yes	Yes	Yes
230 V Wye, 133 V line to ground	Yes	Yes	Yes	Yes	Yes	Yes
380 V Wye, 220 V line to ground	Yes	Yes	Yes	Yes	Yes	Yes
480 V Wye, 277 V line to ground	Yes	Yes	Yes	Yes	Yes	Yes
575 V Wye, 332 V line to ground (uses step transformers)	Yes	Yes	Yes	Yes	Yes	Yes
<b>Wye with high resistance (impedance) ground:</b>	Yes	No	Yes	Yes	Yes	Yes
<b>Delta:</b>						

**Table 6.2 Acceptable Power Supplies by Nominal Voltage and Model (continued)**

	208V to 230V Nominal	380V to 575V Nominal	208V to 575V Nominal			
	PX011 PW011	PX011 PW011	PX018	PW017	PX023	PX029 PW029
Without ground or floating ground	No	No	No	No	No	No
With corner ground	Yes	No	Yes	Yes	Yes	Yes
With grounded center tap	No	No	No	No	No	No

**NOTE:** A three phase, wye connected system consists of three hot lines or phases (commonly referred to as X, Y, Z,) and a ground wire, for a total of four wires in a power distribution cable. The lower voltage in each case is the country's standard utilization voltage and is measured line to neutral, while the higher voltage is measured line to line. The line to line voltage is always 1.732 times higher than the line to neutral voltage in a wye configured three phase system.

A three phase Delta connected system consists of three hot lines (commonly referred to as phase A, phase B, phase C,) and a ground wire for a total of four wires in a power distribution cable. These phase voltages are measured line to line and are typically the country's standard utilization voltage. Because there is no neutral line in a Delta connected system, there is no line to neutral voltage. However, the line current in a Delta connected system is 1.732 times the phase current supplied to the load(s).

## 6.2 Supply Temperature Sensor

The Vertiv™ Liebert® iCOM™ is equipped with a supply (discharge) air temperature sensor. The sensor can be used to provide a consistent supply air temperature by adjusting the compressor capacity or chilled water valve position, or it can be for monitoring purposes only.

The supply sensor must be installed 5 to 15 ft. (1.5 to 4.5 m) from the unit, in the discharge air, to provide an accurate reading when Liebert® iCOM™ is set up for supply air temperature monitoring, supply control or supply limit.

A 50 ft (15 m) extension cable is available if the sensor must be farther than 15 ft (4.5 m) from the Liebert® iCOM™ controller.

See the Liebert® iCOM™ User Manual, SL-31075, for more information on supply air temperature monitoring, control or limit setup. The manuals are supplied with the unit and available at <https://www.Vertiv.com/en-us/support/>.

## 6.3 Return Air Sensor

### 6.3.1 Internal Temperature/Humidity Sensor

The unit is supplied with a return air sensor to measure return air temperature and humidity conditions. Vertiv™ Liebert® iCOM™ uses this information for many critical unit control and system monitoring functions. The sensor is factory installed internal to the unit in the return air stream.

### 6.3.2 Remote Temperature/Humidity Sensor

The unit can be configured for a remote temperature/humidity sensor, which is shipped loose for field mounting. Sensor wire must be plugged into P66 on the Vertiv™ Liebert® iCOM™ control board, which is mounted inside the unit control and monitoring section. Wire length options are 30 feet (9 m), 60 feet (18 m), 90 feet (27 m), 120 feet (36 m), or 150 feet (45 m). The internal return air temperature/humidity sensor is omitted from the unit.



## 6.4 2T Wired Remote Sensors

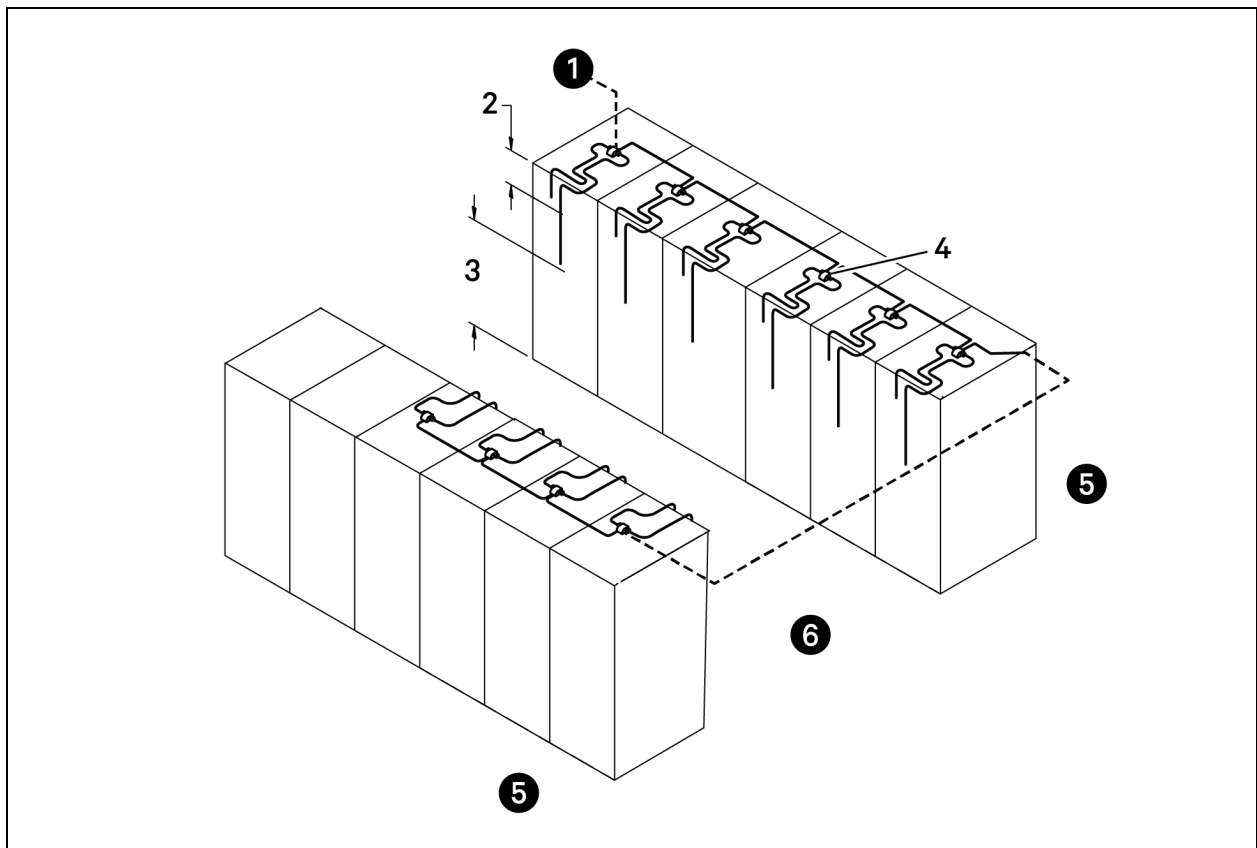
Up to 10 remote sensor modules, installed in the monitored racks and connected to the cooling unit, provide control and reference input to Vertiv™ Liebert® iCOM™ and building management systems. Using remote rack sensors combats cooling problems related to recirculation air, uneven rack loading, and air distribution.

The sensor array consists of 2T sensors that each have two temperature probes on a 6 foot (1.8 m) probe connection cable.

Refer to the installation instructions included with the sensors or the hardware installation section of the Liebert® iCOM™ user's manual, SL-31075, included with the system, for detailed installation and operating configuration of the 2T rack temperature sensors.

**Figure 6.2** below shows the a typical sensor installation on racks that share a common cold aisle and a single CRAC unit.

**Figure 6.2 Rack Sensor Placement**



**Table 6.3 Sensor Descriptions**

Item	Description
1	To cable entry in cooling unit
2	First probe, 12 in. (305 mm) from top
3	Second probe, in approximate center of rack and in front of the equipment
4	2T sensor with label visible
5	Hot aisle
6	Cold aisle

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## 7 Checklist for Completed Installation

### 7.1 Moving and Placing Equipment

1. Unpack and check received material.
2. Proper clearance for service access has been maintained around the equipment.
3. Equipment is level and mounting fasteners are tight.

### 7.2 Electrical Installation Checks

1. Supply voltage and phase matches equipment nameplate.
2. Power wiring connections completed to the disconnect switch, evaporator unit, and heat rejection equipment.
3. Power line circuit breakers or fuses have proper ratings for equipment installed.
4. Control wiring connections completed between indoor evaporator and heat rejection equipment.
5. All internal and external high and low voltage wiring connections are tight.
6. Confirm that unit is properly grounded to an earth ground.
7. Control transformer setting matches incoming power.
8. Electrical service conforms to national and local codes.
9. Check blowers and compressors for proper rotation.
10. Check for loose electrical connections on steam generating humidifier. Confirm that electrode plugs are pressed firmly onto the electrode pins.

### 7.3 Piping Installation Checks

1. Piping completed to coolant loop (if required).
2. Piping has been leak checked, evacuated, and charged (if required).
3. Additional oil has been added for system charges over 40 pounds (18.1 kg) per circuit. See [Additional Oil Requirements for Scroll and Digital Scroll Compressors](#) on page 36.
4. Piping is properly sized, sloped, and trapped as shown in the piping schematics.
5. Check piping inside and outside of equipment for proper support and adequate spacing to prevent rub through.
6. Ensure TXV equalizer lines and sensing bulb lines have sufficient clearance and do not rub against other refrigerant lines.
7. Ensure units with EEV have a receiver installed/piped on the Vertiv™ Liebert® MC and receiver is mounted at or above the relative height of the EEV in the Vertiv™ Liebert® PDX unit.
8. Ensure that factory clamps have been reinstalled.
9. Drain line connected, not obstructed, and pitched per local code.
10. Water supply line connected to humidifier and not leaking.
11. Condensate drain line piping has no leaks or visible damage.

### 7.4 Other Installation Checks

1. Ducting complete (if required), maintain access to filters.
2. Filters installed.
3. Check fasteners that secure reheats, humidifier, and motors. Some may have become loose during shipment.

4. Verify water detection is properly installed around all units (recommended).
5. Humidifier control panel DIP switches are set based on user requirements.
6. Blower drive system rotates freely.
7. All fans are free of debris.
8. Remove rubber band from float in optional infrared humidifier.
9. Seal openings around piping and electrical connections.
10. Installation materials and tools have been removed from equipment (literature, shipping materials, construction materials, tools, etc.).

## 8 Initial Start-up Checks and Commissioning Procedure for Warranty Inspection



**WARNING!** Arc flash and electric shock hazard. Can cause serious injury or death. Building and equipment damage may also result. Disconnect all local and remote electric power supplies and wear appropriate, OSHA-approved personal protective equipment (PPE) per NFPA 70E before working within the electric control enclosure. Customer must provide earth ground to unit, per NEC, CEC, and local codes, as applicable.

Verify with a voltmeter that power is Off. The Vertiv™ Liebert® iCOM™ controller does not isolate power from the unit, even in the “Unit Off” mode. Some internal components still require and receive power even during the “Unit Off” mode of the Liebert® iCOM™ controller. The factory-supplied, optional disconnect switch is inside the unit. The line side of this switch contains live high voltage. The only way to ensure that there is NO voltage inside the unit is to install and open a remote disconnect switch. Refer to unit electrical schematic.

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. Follow all local codes.



**WARNING!** Risk of electric shock. Can cause serious injury or death. Building and equipment damage may also result. Open all local and remote electric power supply disconnect switches and verify that power is off with a voltmeter before working within any electric connection enclosures. The Liebert® controller 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® controller.

Installation, service, and maintenance work must be performed only by properly trained and qualified personnel and in accordance with applicable regulations and manufacturers' specifications. Opening or removing the covers to any equipment may expose personnel to lethal voltages within the unit even when it is apparently not operating and the input wiring is disconnected from the electrical source.



**WARNING!** Risk of improper wiring, piping, moving, lifting and handling. Can cause serious injury or death. Building and equipment damage may also result. Installation and service of this equipment should be done only by qualified personnel who have been specially-trained in the installation of air-conditioning equipment and who are wearing appropriate, OSHA-approved PPE.



**CAUTION:** Risk of smoke generation. Can cause injury. Can cause fire suppression and alarm system activation, resulting in building evacuation and mobilization of emergency fire and rescue services. Start-up operation of optional electric reheat elements can create smoke or fumes that can activate the facility alarm and fire suppression system. Prepare and take appropriate steps to manage this possibility. Activating reheat during initial start-up may burn off particulates from electric reheat elements. Before beginning initial start-up checks, make certain that unit was installed according to the instructions in this manual. All exterior panels must be in place.

## NOTICE

Risk of improper electrical connection of three phase input power. Can cause backward compressor rotation and unit damage. Service technicians should use a gauge set on the system during the initial start-up to verify that the three phase power is connected properly. The EC fans are not a reliable indicator of proper connection. The blowers will rotate the same direction, regardless of the three phase power input. Three phase power must be connected to the unit line voltage terminals in the proper sequence so that the compressors rotate in the proper direction. Incoming power must be properly phased to prevent compressors from running backward. We recommend checking the unit's phasing with proper instrumentation to ensure that power connections were made correctly. We also recommend verifying discharge and suction pressures during start-up to ensure that the compressors are running in the correct direction.

- Confirm that all items on [Checklist for Completed Installation](#) on page 57 have been done.
- Locate Liebert® PDX and Liebert® PCW Warranty Inspection Check Sheet in the unit's electric panel. (PSWI-8542-425-CO).
- Complete Liebert® PDX and Liebert® PCW Warranty Inspection Check Sheet during start-up. (PSWI-8542-425-CO).
- Forward the completed Liebert® PDX and Liebert® PCW Warranty Inspection Check Sheet to your local sales office. **This information must be completed and forwarded to validate warranty.**
- Contact your local sales representative or technical support if you have any questions or problems during unit start-up and commissioning. Visit <https://www.Vertiv.com/en-us/support/> or call 1-800-543-2778 for contacts.

Local sales offices and product support contacts can be found at <https://www.Vertiv.com/en-us/support/> or 1-800-543-2778.

## 9 Maintenance



**WARNING!** Arc flash and electric shock hazard. Can cause serious injury or death. Building and equipment damage may also result. Disconnect all local and remote electric power supplies and wear appropriate, OSHA-approved personal protective equipment (PPE) per NFPA 70E before working within the electric control enclosure. Customer must provide earth ground to unit, per NEC, CEC, and local codes, as applicable.

Verify with a voltmeter that power is Off. The Vertiv™ Liebert® iCOM™ controller does not isolate power from the unit, even in the “Unit Off” mode. Some internal components still require and receive power even during the “Unit Off” mode of the Liebert® iCOM™ controller. The factory-supplied, optional disconnect switch is inside the unit. The line side of this switch contains live high voltage. The only way to ensure that there is NO voltage inside the unit is to install and open a remote disconnect switch. Refer to unit electrical schematic.

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. Follow all local codes.



**WARNING!** Risk of electric shock. Can cause serious injury or death. Building and equipment damage may also result. Open all local and remote electric power supply disconnect switches and verify that power is off with a voltmeter before working within any electric connection enclosures. The Liebert® iCOM™ controller 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™ controller.

Installation, service, and maintenance work must be performed only by properly trained and qualified personnel and in accordance with applicable regulations and manufacturers' specifications. Opening or removing the covers to any equipment may expose personnel to lethal voltages within the unit even when it is apparently not operating and the input wiring is disconnected from the electrical source.



**WARNING!** Risk of improper wiring, piping, moving, lifting and handling. Can cause serious injury or death. Building and equipment damage may also result. Installation and service of this equipment should be done only by qualified personnel who have been specially-trained in the installation of air-conditioning equipment and who are wearing appropriate, OSHA-approved PPE.



**CAUTION:** Risk of improper handling heavy and lengthy parts. Can cause injury. Building and equipment damage may also result. Cabinet panels can exceed 5 ft. (1.5 m) in length and weigh more than 35 lb (15.9 kg). Follow relevant OSHA lifting recommendations and consider using a two-person lift for safe and comfortable removal and installation of cabinet panels. Only properly trained and qualified personnel wearing appropriate, OSHA-approved PPE should attempt to remove or install cabinet panels.



**CAUTION: Risk of contact with hot surfaces. Can cause injury. Personal burn injury can be the result of touching an electronics housing, fan motor, and some electrical components that are extremely hot during unit operation. Allow sufficient time for them to cool to a touch safe temperature before working within the unit cabinet. Use extreme caution and wear appropriate, OSHA-approved PPE when working on or near hot components, including when replacing or performing maintenance on the fans.**

**NOTICE**

Risk of improper control circuits. Can cause equipment damage.

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

The Vertiv™ Liebert® PDX or the Vertiv™ Liebert® PCW are a single component in the facility heat-removal system. The system includes air distribution (raised floors, duct systems), outdoor heat rejection (condensers, pumps, Vertiv™ Liebert® Drycoolers) and indoor cooling and humidity loads (equipment load, location, outside air infiltration). Proper application and maintenance of the entire system is critical to the life and reliability of the thermal management units.

- Good maintenance practices are essential to minimizing operation costs and maximizing product life.
- Read and follow monthly and semi-annual maintenance schedules included in this manual. These **minimum** maintenance intervals may need to be more frequent based on site-specific conditions.
- See the Vertiv™ Liebert® iCOM™ user manual, SL-31075, available at [www.Vertiv.com](http://www.Vertiv.com), for instructions on using the controller to predict some service maintenance intervals.
- We recommend the use of trained and authorized service personnel, extended service contracts, and factory specified replacement parts. Contact your Vertiv sales representative.

## 9.1 Filters

**NOTICE**

Risk of improper filter installation. Can cause filter collapse and airflow reduction.

To maximize the performance and reliability of the equipment, use only Vertiv filters. Contact your Vertiv representative to order replacement filters.

Verify that filters are installed and positioned so the air flow direction marked on the filter is the same direction as unit air flow.

**Table 9.1 Filters, Number and Size**

011, 017, 018, 023, 029	
<b>Downflow Models</b>	
Quantity	1
Nominal Size, inches	29.5 x 28.5 x 2
<b>Upflow Models</b>	
Quantity	1
Nominal Size, inches	34 x 28 x 2
Disposable Type - Nominal sizes and number required, Standard MERV 8 or Optional MERV 11	



### 9.1.1 Filter Replacement for Downflow Units

1. Disconnect power from the unit.
2. Open the front access panel, locate the filter above the electric panel, and slide the filter out the front of the unit.
3. Replace with new filter. Install the filter in the proper direction of the airflow.
4. Test the operation of the filter clog switch.  
The unit panels must be in place and closed to find this point.
5. Start the blower and turn the switch counterclockwise until the alarm is energized.
6. Turn the adjusting knob one turn clockwise or to the desired filter change point.

### 9.1.2 Filter Replacement for Upflow Units

1. Disconnect power from the unit.
2. Open the front access panel and remove the filter.
3. Replace with new filter. Install the filters in the proper direction of the airflow. The proper direction is marked on the filter.
4. Test the operation of the filter clog switch.  
The unit panels must be in place and closed to find this point.
5. Start the blower and turn the switch counterclockwise until the alarm is energized.
6. Turn the adjusting knob one turn clockwise or to the desired filter change point.

### 9.1.3 Filter Replacement for Upflow Units with Rear Return

1. Disconnect power from the unit.
2. Open the front access panel from the floor stand, locate the filter, and slide the filter out the front of the floor stand.
3. Replace with new filter. Install the filter in the proper direction of the airflow.
4. Test the operation of the filter clog switch.  
The unit panels must be in place and closed to find this point.
5. Start the blower and turn the switch counterclockwise until the alarm is energized.
6. Turn the adjusting knob one turn clockwise or to the desired filter change point.

## 9.2 Blower Drive System—EC Fans



**WARNING! Risk of electric shock. Can cause serious injury or death. Open all local and remote electric power supply disconnect switches and verify that power is off with a voltmeter before working within any electric connection enclosures. The Vertiv™ Liebert® iCOM™ controller does not isolate power from the unit, even in the "Unit Off" mode. Fan-motor controls can maintain an electric charge for 10 minutes after power is disconnected. Wait 10 minutes after power is verified as off before working within the electric control/connection enclosures.**

**Installation, service, and maintenance work must be performed only by properly trained and qualified personnel and in accordance with applicable regulations and manufacturers' specifications. Opening or removing the covers to any equipment may expose personnel to lethal voltages within the unit even when it is apparently not operating and the input wiring is disconnected from the electrical source.**



**WARNING!** Risk of contact with high speed rotating fan blades. Can cause serious injury or death. Open all local and remote electric power supply disconnect switches, verify with a voltmeter that power is off, and verify that all fan blades have stopped rotating before working in the unit cabinet or on the fan assembly. If control voltage is applied, the fan motor can restart without warning after a power failure. Do not operate the unit with any or all cabinet panels removed. Do not operate upflow units without installing a plenum, ductwork or guard over the blower opening(s) on the top surface of the unit cabinet. Ductwork must be connected to the blower(s), or a plenum must be installed on the blower deck for protection from rotating blower wheel(s) on upflow units.



**CAUTION:** Risk of improper moving, lifting and handling. Can cause injury. Building and equipment damage may also result. Only properly trained and qualified personnel should work on this equipment. Evaporator fan modules weigh in excess of 125 lb (56.7 kg). Use proper lifting techniques and wear appropriate OSHA-approved PPE to avoid injury and dropping the fan module during removal. Equipment used in handling/lifting, and/or installing the fan assembly must meet OSHA requirements. Use handling/lifting equipment rated for the weight of the fan assembly. Use ladders rated for the weight of the fan assembly and technicians if used during installation. Refer to handling/lifting, and/or installation equipment operating manual for manufacturer's safety requirements and operating procedures.



**CAUTION:** Risk of contact with hot surfaces. Can cause injury. Personal burn injury can be the result of touching an electronics housing, fan motor, and some electrical components that are extremely hot during unit operation. Allow sufficient time for them to cool to a touch safe temperature before working within the unit cabinet. Use extreme caution and wear appropriate, OSHA-approved PPE when working on or near hot components, including when replacing or performing maintenance on the fans.

## NOTICE

Risk of improper power supply connection. Can cause equipment damage and loss of warranty coverage.

Prior to connecting any equipment to a main or alternate power source (for example: backup generator systems) for start-up, commissioning, testing or normal operation, ensure that these sources are correctly adjusted to the nameplate voltage and frequency of all equipment to be connected. In general, power source voltages should be stabilized and regulated to within  $\pm 10\%$  of the load nameplate nominal voltage. Also, ensure that no three phase sources are single phased at any time. See transformer label for primary tap connections. Installer will need to change transform primary taps is applied unit voltage is other than pre-wired tap voltage.

## NOTICE

Risk of improper installation. Can cause equipment damage.

Only a properly trained and qualified technician should install or open this motor.

Use 60/75°C Class 1 copper wire only.

## 9.2.1 Fan Impellers and Bearings Maintenance

Fan impellers should be periodically inspected and any debris removed. Check to ensure that the impellers can rotate freely and that the fan guards are still properly mounted for sufficient protection against accidentally contacting the impeller. Bearings used on the units are maintenance free. Consult the factory for more information.

## 9.2.2 Protective Features

Monitoring functions protect the motor against over temperature of electronics, over temperature of motor, and in correct rotor position detection. With any of these failures, an alarm will display through the Vertiv™ Liebert® iCOM™ controller and the motor stops electronically. There is no automatic restart. The power must be switched off for a minimum of 20 seconds once the motor is at a standstill.

The motor also provides locked rotor protection, under voltage/phase failure detection and motor current limitation. These conditions will display an alarm through the Liebert® iCOM™.

## 9.2.3 Fan Assembly Troubleshooting

Any safety hazards stemming from the device must be re-evaluated once it is installed in the end device.

Do not make any modifications, additions or conversions to the fan assembly without the approval of Vertiv.



**WARNING!** Risk of electric shock. Can cause serious injury or death. Open all local and remote electric power supply disconnect switches and verify that power is off with a voltmeter before working within any electric connection enclosures. The Vertiv™ Liebert® iCOM™ controller does not isolate power from the unit, even in the "Unit Off" mode. Fan-motor controls can maintain an electric charge for 10 minutes after power is disconnected. Wait 10 minutes after power is verified as off before working within the electric control/connection enclosures.

Installation, service, and maintenance work must be performed only by properly trained and qualified personnel and in accordance with applicable regulations and manufacturers' specifications. Opening or removing the covers to any equipment may expose personnel to lethal voltages within the unit even when it is apparently not operating and the input wiring is disconnected from the electrical source.



**WARNING!** Risk of contact with high speed rotating fan blades. Can cause serious injury or death. Open all local and remote electric power supply disconnect switches, verify with a voltmeter that power is off, and verify that all fan blades have stopped rotating before working in the unit cabinet or on the fan assembly. If control voltage is applied, the fan motor can restart without warning after a power failure. Do not operate the unit with any or all cabinet panels removed. Do not operate upflow units without installing a plenum, ductwork or guard over the blower opening(s) on the top surface of the unit cabinet. Ductwork must be connected to the blower(s), or a plenum must be installed on the blower deck for protection from rotating blower wheel(s) on upflow units.



**CAUTION:** Risk of contact with hot surfaces. Can cause injury. Personal burn injury can be the result of touching an electronics housing, fan motor, and some electrical components that are extremely hot during unit operation. Allow sufficient time for them to cool to a touch-safe temperature before working within the unit cabinet. Use extreme caution and wear appropriate, OSHA-approved PPE when working on or near hot components, including when replacing or performing maintenance on the fans.



**CAUTION:** Risk of exposure to harmful noise levels. Can cause hearing injury or loss. Depending on the installation and operating conditions, a sound pressure level greater than 70 dB(A) may arise. Take appropriate technical safety measures. Operating personnel must wear appropriate, OSHA-approved PPE and observe all appropriate hearing protection safety requirements.

**NOTICE**

Risk of equipment snagging cables and wiring. Can damage the unit wiring and components.

Carefully monitor the position of the EC-fan wire harnesses and other parts while lowering the fan to be sure that they are not caught or pinched.

**NOTICE**

Risk of improper control circuits. Can cause equipment damage.

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

**NOTICE**

Risk of improper power supply connection. Can cause equipment damage and loss of warranty coverage.

Prior to connecting any equipment to a main or alternate power source (for example: backup generator systems) for start-up, commissioning, testing or normal operation, ensure that these sources are correctly adjusted to the nameplate voltage and frequency of all equipment to be connected. In general, power source voltages should be stabilized and regulated to within ±10% of the load nameplate nominal voltage. Also, ensure that no three phase sources are single phased at any time.

**NOTE: Do not assume that the fan blades will not start to spin. If the motor is in a fault condition, it will safely shut down. Once the fault condition is cleared, there are certain conditions in which the motor will automatically resume operation.**

**EC Fan Fault Conditions**

**Table 9.2 EC Fan Fault Conditions**

Fault Condition	Reset Trigger	Description
Phase Failure	Automatic	One phase is missing. In this case the motor will come to a stop and then automatically restart when all phases are present.
Locked/Blocked Rotor	Automatic	The rotor is blocked. Once the locking mechanism has been removed, the motor will automatically restart.
Hall Effect Sensor Error	Manual (Mains/Software)	The Hall Effect Sensor is used to monitor fan speed. If there is a hall sensor communication failure with the electronics, the motor will stop. In this case there has to be a manual restart (either with the mains power or software).
Motor Over Temperature	Manual (Mains/Software)	The motor will stop in the event there is a motor over temperature condition. In this case there has to be a manual restart (either with the mains power or software).
Electronics Over Temperature	Manual (Mains/Software)	The motor will stop in the event there is an electronics over temperature condition. In this case there has to be a manual restart (either with the mains power or software).
Line Under Voltage	Automatic	Once the line voltage returns within permitted operating range, the fan will automatically restart.

## EC Fan High Voltage Tests

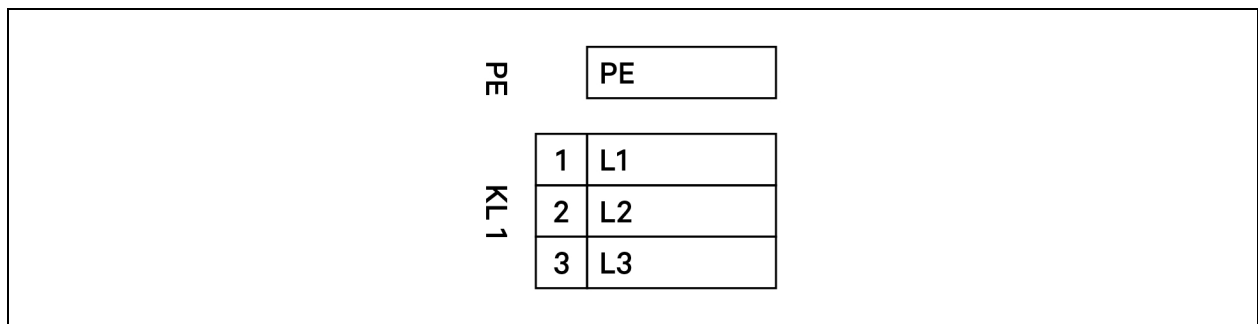
1. Check fuses. If fuses are okay, perform the following:
  - Check all connections.
  - Make sure connections are on the wire strand and not on the wire insulation.
  - Cycle power. Disconnect mains voltage to power down the motor and then re-apply power.
  - Check mains voltage at each phase (phase to ground) at the KL1 connector. Confirm phase failure not present.
  - Check that the voltage is within the acceptable voltage range at the KL1 connector. Confirm line under voltage is not present.
2. Check fuses. If fuses are blown, perform the following:
  - Check resistances across the phases at the KL1 connector and note them in the following table.

**NOTE: Power wires must be removed from the motor for resistance test.**

L1 - L2	Ohm
L2 - L3	Ohm
L1 - L3	Ohm

- Resistance should be similar for all three readings.
- Resistance readings should be greater than 2 Ohm.
  - Check all connections. Make sure connections are on the wire strand and not on the wire insulation.
  - Replace fuses.
  - Check mains voltage at each phase (phase to ground) at the KL1 connector. Confirm phase failure not present.

**Figure 9.1 KL1 Connector**



- Check that the voltage is within the acceptable voltage range at the KL1 connector. Confirm line under voltage is not present.

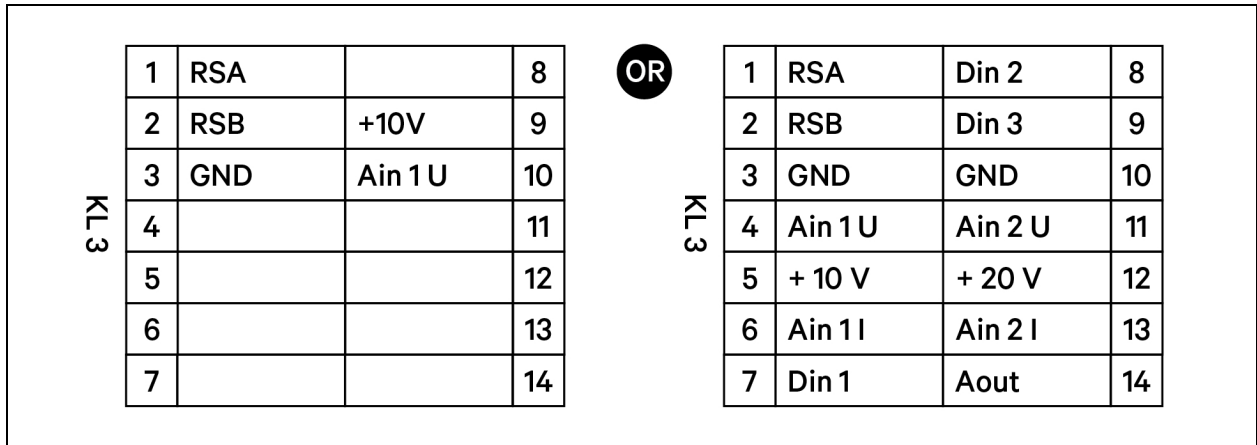
### EC Fan Low Voltage Tests

- Check control input at the KL3 connector (Ain1U to GND). Confirm that there is a control voltage present at the KL3 connector.

**NOTE: Use the GND in the KL3 connector. Do not connect the control ground to the PE in KL1!**

- Check +10 V output on KL3 connector (between +10 V and GND).

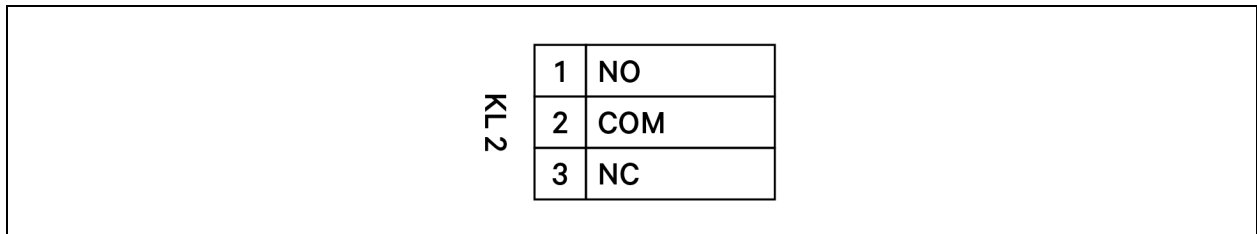
Figure 9.2 KL3 Connector



### EC Fan Alarm Contact Tests

Check the alarm contact at KL2 to determine if there are any fault conditions present.

Figure 9.3 KL2 Connector



**Table 9.3 No Fault/Fault Conditions While Motor Actively Energized**

Condition	No Fault Condition	Fault Condition
NO - COM	Open	Closed
NC - COM	Closed	Open

**NOTE: The table refers to conditions while the motor is actively energized. When the motor is de-energized, it will be in a fault condition.**

- Check EC Control to determine the fault condition.

## 9.2.4 Replacing EC Fans in Downflow Models

The EC fan modules are removable for easier maintenance and replacement.



**WARNING!** Arc flash and electric shock hazard. Can cause serious injury or death. Building and equipment damage may also result. Disconnect all local and remote electric power supplies and wear appropriate, OSHA-approved personal protective equipment (PPE) per NFPA 70E before working within the electric control enclosure. Customer must provide earth ground to unit, per NEC, CEC, and local codes, as applicable.

Verify with a voltmeter that power is Off. The Vertiv™ Liebert® iCOM™ controller does not isolate power from the unit, even in the “Unit Off” mode. Some internal components still require and receive power even during the “Unit Off” mode of the Liebert® iCOM™ controller. The factory-supplied, optional disconnect switch is inside the unit. The line side of this switch contains live high voltage. The only way to ensure that there is NO voltage inside the unit is to install and open a remote disconnect switch. Refer to unit electrical schematic.

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. Follow all local codes.



**WARNING!** Risk of electric shock. Can cause serious injury or death. Open all local and remote electric power supply disconnect switches and verify that power is off with a voltmeter before working within any electric connection enclosures. The Liebert® iCOM™ controller does not isolate power from the unit, even in the "Unit Off" mode. Fan-motor controls can maintain an electric charge for 10 minutes after power is disconnected. Wait 10 minutes after power is verified as off before working within the electric control/connection enclosures.

Installation, service, and maintenance work must be performed only by properly trained and qualified personnel and in accordance with applicable regulations and manufacturers' specifications. Opening or removing the covers to any equipment may expose personnel to lethal voltages within the unit even when it is apparently not operating and the input wiring is disconnected from the electrical source.



**WARNING!** Risk of contact with high speed rotating fan blades. Can cause serious injury or death. Open all local and remote electric power supply disconnect switches, verify with a voltmeter that power is off, and verify that all fan blades have stopped rotating before working in the unit cabinet or on the fan assembly. If control voltage is applied, the fan motor can restart without warning after a power failure. Do not operate the unit with any or all cabinet panels removed. Do not operate upflow units without installing a plenum, duct work or guard over the blower opening(s) on the top surface of the unit cabinet. Ductwork must be connected to the blower(s), or a plenum must be installed on the blower deck for protection from rotating blower wheel(s) on upflow units.



**WARNING!** Risk of extremely heavy fan modules dropping downward suddenly. Can cause serious injury or death. Building and equipment damage may also result. Fan modules weigh in excess of 125 lb (56.7 kg) each. Support fan modules before removing mounting hardware. Use caution to keep all body parts out of the fan module pathway of movement during removal or repositioning. Only properly trained and qualified personnel should work on this equipment.

More than one person may be required to complete the assembly and installation. Installer(s) must be properly trained and qualified to lift, move, and manipulate very heavy equipment from floor level to the top of the unit. Wear appropriate, OSHA-approved PPE when moving, lifting, installing, and removing the fan(s) and plenum. Read and follow the lifting equipment and/or ladder manufacturer's operating instructions and safety requirements.



**CAUTION:** Risk of improper moving, lifting and handling. Can cause injury. Building and equipment damage may also result. Only properly trained and qualified personnel should work on this equipment. Evaporator fan modules weigh in excess of 125 lb (56.7 kg). Use proper lifting techniques and wear appropriate OSHA-approved PPE to avoid injury and dropping the fan module during removal. Equipment used in handling/lifting, and/or installing the fan assembly must meet OSHA requirements. Use handling/lifting equipment rated for the weight of the fan assembly. Use ladders rated for the weight of the fan assembly and technicians if used during installation. Refer to handling/lifting, and/or installation equipment operating manual for manufacturer's safety requirements and operating procedures.



**CAUTION:** Risk of contact with hot surfaces. Can cause injury. Personal burn injury can be the result of touching an electronics housing, fan motor, and some electrical components that are extremely hot during unit operation. Allow sufficient time for them to cool to a touch-safe temperature before working within the unit cabinet. Use extreme caution and wear appropriate, OSHA-approved PPE when working on or near hot components, including when replacing or performing maintenance on the fans.



**CAUTION:** Risk of improper handling of boiling water. Can cause leaks, equipment and building damage, or burn injury. The unit requires a drain line that may contain boiling water. Only properly trained and qualified personnel wearing appropriate, OSHA-approved PPE should service the drain line or work on parts near or connected to the drain line.

## NOTICE

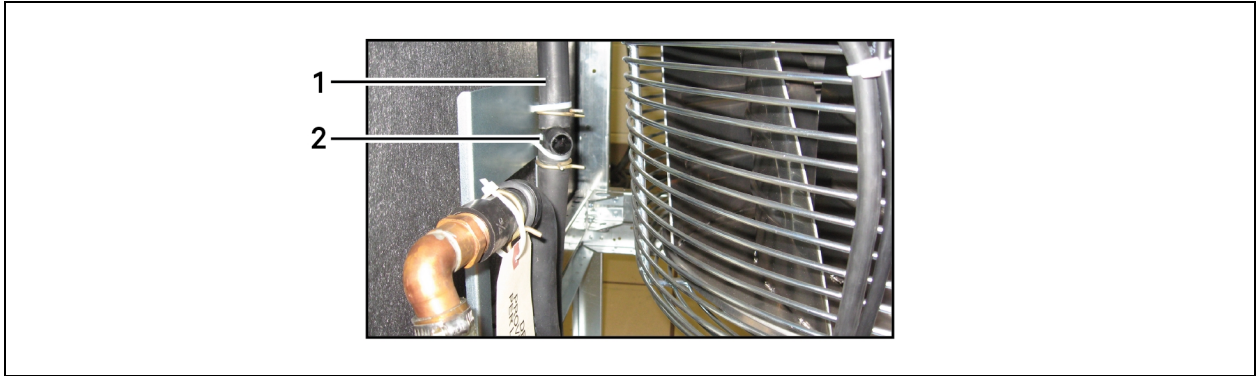
Risk of improper motor installation. Can cause equipment damage. Only a properly trained and qualified technician should install or open this motor. Use 60/70° Class 1 copper wire only.

### To replace the fan(s):

1. Turn off the unit by touching Turn Unit Off in the Vertiv™ Liebert® iCOM™ menu and confirm in next screen by touching Turn Unit Off.
2. Allow the unit shut down. Once shutdown is complete, turn the disconnect switch to the Off position.
3. Open the front of the unit.
4. Remove the humidifier drain line by removing it from the T-connection on the left side of the unit and disconnecting it from the humidifier pan. Then pull it up through the humidifier air blocking panel it passes through. See **Figure 9.5** on the facing page .

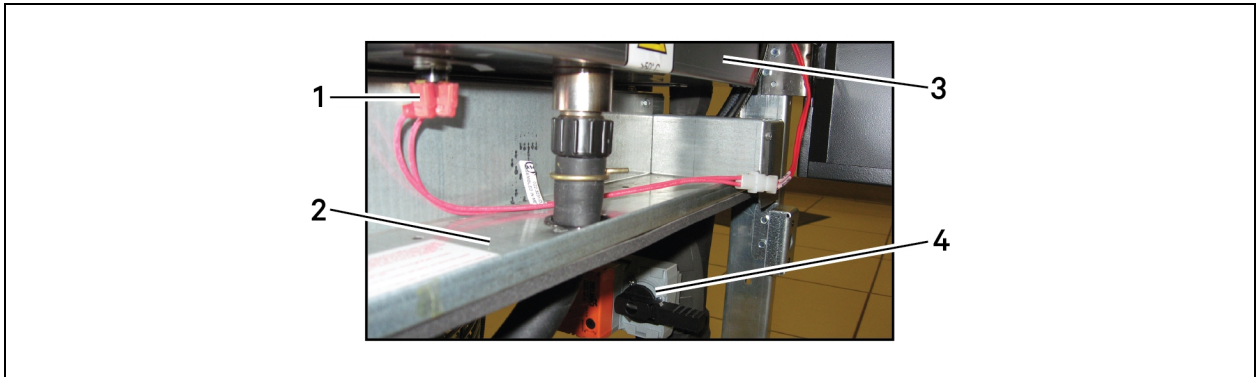


**Figure 9.4 Remove the Humidifier Drain Line**



Item	Description
1	Humidifier drain
2	T-connection

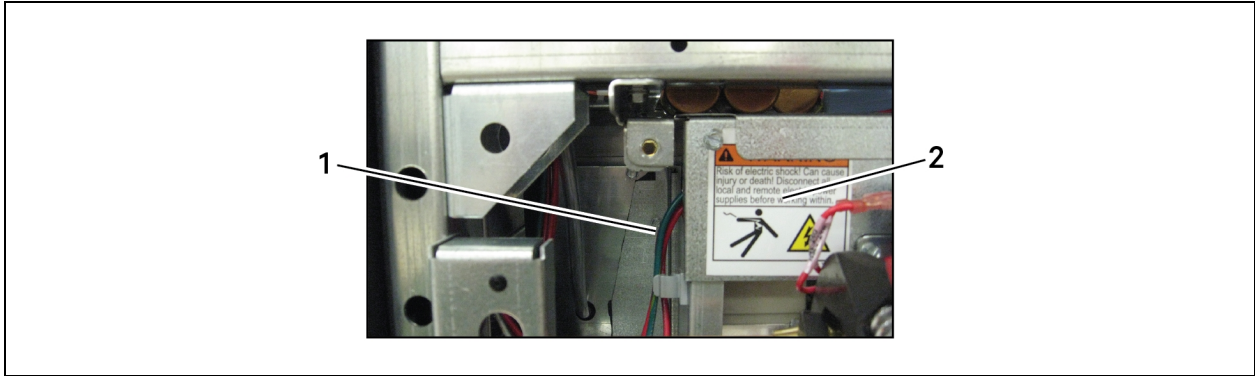
**Figure 9.5 Remove Humidifier High Limit Wires**



Item	Description
1	Humidifier high limit wires
2	Air blocking panel
3	Humidifier pan
4	Actuator

5. Disconnect the actuator from the pipe beneath the right side of the humidifier (if present). See **Figure 9.5** above .
6. Remove the humidifier air block-off panel. See **Figure 9.5** above .
7. Locate the humidifier assembly and remove the cover to the electrical compartment. Disconnect the wires entering the humidifier electric box from the left side. See **Figure 9.6** on the next page .

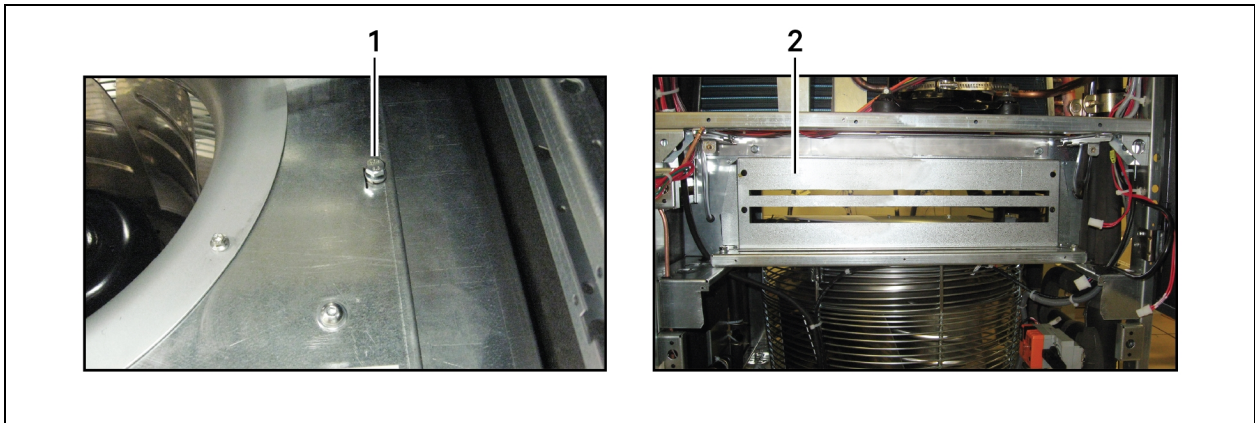
**Figure 9.6 Humidifier Electric Box Location**



Item	Description
1	Humidifier wiring harness
2	Humidifier electric compartment cover

8. Remove the four hex bolts securing the humidifier assembly to the unit, see **Figure 9.7** below , then remove the humidifier from the unit.
9. Remove the panel located behind the humidifier’s previous location. This will reveal the panel and make it accessible. See **Figure 9.7** below .

**Figure 9.7 Bolt and Panel Removal**



Item	Description
1	Hex bolt (4 places)
2	Panel behind humidifier

10. Remove the smoke detector tubing from the right side; remove the air sail tubing from the left side.
11. Remove the high and low voltage wiring supplying the fan.
12. Remove the four hex bolts securing the mounting panel to the unit. Remove only the bolts indicated in **Figure 9.7** above .

13. Slide the EC fan assembly forward and out of the unit.
14. Place the new EC fan assembly in the unit on the mounting rails that supported the old assembly.
15. Connect all high voltage and low voltage wiring.
16. Secure the new assembly using the same hardware removed in step 12.
17. Re-attach smoke detector and air sail tubing removed in step 10.
18. Reinstall the panel removed in step 9.
19. Reinstall the humidifier air blocking panel removed in step 6.
20. Reinstall the humidifier assembly and reconnect the wire harness removed in step 8.
21. Run the drain humidifier drain that was removed in step 4 through the humidifier air-blocking panel. Connect to the T-connection on the left side of the unit; reconnect the humidifier's high limit wires to the bottom of the humidifier pan that were removed in step 5.
22. Reconnect the actuator (if present) that was removed in step 5.
23. Replace the front panel of the unit. Turn main disconnect to On. Turn unit On at display and verify the new fan starts.

## 9.2.5 Replacing EC Fans in Upflow Models

The EC fan modules are removable for easier maintenance and replacement.



**WARNING! Arc flash and electric shock hazard. Can cause serious injury or death. Building and equipment damage may also result. Disconnect all local and remote electric power supplies and wear appropriate, OSHA-approved personal protective equipment (PPE) per NFPA 70E before working within the electric control enclosure. Customer must provide earth ground to unit, per NEC, CEC, and local codes, as applicable.**

**Verify with a voltmeter that power is Off. The Vertiv™ Liebert® iCOM™ controller does not isolate power from the unit, even in the “Unit Off” mode. Some internal components still require and receive power even during the “Unit Off” mode of the Liebert® iCOM™ controller. The factory-supplied, optional disconnect switch is inside the unit. The line side of this switch contains live high voltage. The only way to ensure that there is NO voltage inside the unit is to install and open a remote disconnect switch. Refer to unit electrical schematic.**

**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. Follow all local codes.**



**WARNING! Risk of electric shock. Can cause serious injury or death. Open all local and remote electric power supply disconnect switches and verify that power is off with a voltmeter before working within any electric connection enclosures. The Liebert® iCOM™ controller does not isolate power from the unit, even in the "Unit Off" mode. Fan-motor controls can maintain an electric charge for 10 minutes after power is disconnected. Wait 10 minutes after power is verified as off before working within the electric control/connection enclosures.**

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**WARNING!** Risk of contact with high speed rotating fan blades. Can cause serious injury or death. Open all local and remote electric power supply disconnect switches, verify with a voltmeter that power is off, and verify that all fan blades have stopped rotating before working in the unit cabinet or on the fan assembly. If control voltage is applied, the fan motor can restart without warning after a power failure. Do not operate the unit with any or all cabinet panels removed. Do not operate upflow units without installing a plenum, duct work or guard over the blower opening(s) on the top surface of the unit cabinet. Ductwork must be connected to the blower(s), or a plenum must be installed on the blower deck for protection from rotating blower wheel(s) on upflow units.



**WARNING!** Risk of extremely heavy fan modules dropping downward suddenly. Can cause serious injury or death. Building and equipment damage may also result. Fan modules weigh in excess of 125 lb (56.7 kg) each. Support fan modules before removing mounting hardware. Use caution to keep all body parts out of the fan module pathway of movement during removal or repositioning. Only properly trained and qualified personnel should work on this equipment.

More than one person may be required to complete the assembly and installation. Installer(s) must be properly trained and qualified to lift, move, and manipulate very heavy equipment from floor level to the top of the unit. Wear appropriate, OSHA-approved PPE when moving, lifting, installing, and removing the fan(s) and plenum. Read and follow the lifting equipment and/or ladder manufacturer's operating instructions and safety requirements.



**CAUTION:** Risk of improper moving, lifting and handling. Can cause injury. Building and equipment damage may also result. Only properly trained and qualified personnel should work on this equipment. Evaporator fan modules weigh in excess of 125 lb (56.7 kg). Use proper lifting techniques and wear appropriate OSHA-approved PPE to avoid injury and dropping the fan module during removal. Equipment used in handling/lifting, and/or installing the fan assembly must meet OSHA requirements. Use handling/lifting equipment rated for the weight of the fan assembly. Use ladders rated for the weight of the fan assembly and technicians if used during installation. Refer to handling/lifting, and/or installation equipment operating manual for manufacturer's safety requirements and operating procedures.



**CAUTION:** Risk of contact with hot surfaces. Can cause injury. Personal burn injury can be the result of touching an electronics housing, fan motor, and some electrical components that are extremely hot during unit operation. Allow sufficient time for them to cool to a touch-safe temperature before working within the unit cabinet. Use extreme caution and wear appropriate, OSHA-approved PPE when working on or near hot components, including when replacing or performing maintenance on the fans.

## NOTICE

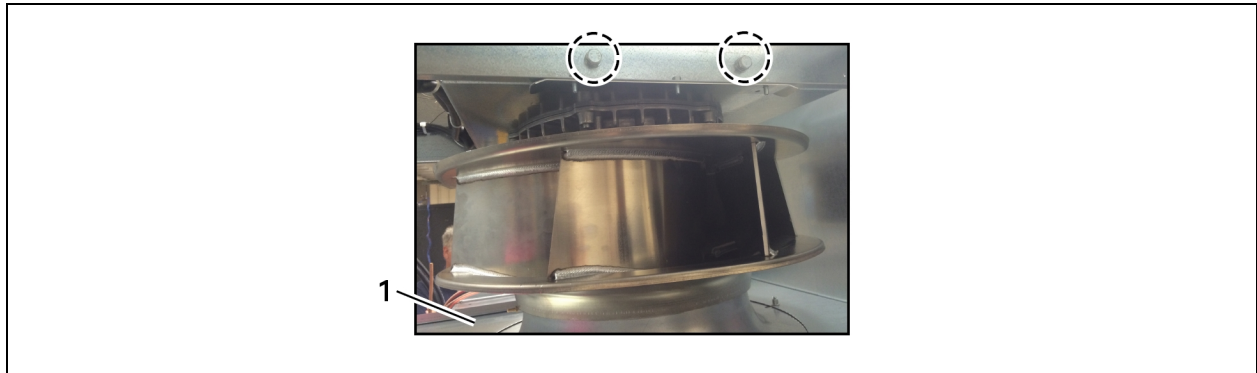
Risk of improper motor installation. Can cause equipment damage. Only a properly trained and qualified technician should install or open this motor. Use 60/70° Class 1 copper wire only.

### To replace the fan(s):

1. Turn off the unit by touching Turn Unit Off in the Vertiv™ Liebert® iCOM™ menu and confirm in the next screen by touching Turn Unit Off.
2. Allow the unit to shut down. Once shutdown is complete, turn the main electrical disconnect switch to the Off position.

3. Open the front of the unit.  
Removing the side panels will assist in replacing the fan, but it is not necessary.
4. Remove the high and low voltage wiring connections to the fan.
5. Remove the four bolts that secure the fan assembly to the unit. These bolts are front accessible, with two on the left side and two on the right side. The bolts on one side are shown in **Figure 9.8** below .

**Figure 9.8 Mounting Plate Bolt Location**



Item	Description
1	Orifice mounting plate

6. Locate the four bolts on the intake orifice mounting plate, an example is shown in **Figure 9.9** below . These bolts are front-accessible with two on the left side and two on the right side of the plate.
7. Loosen these 4 bolts and lower the orifice mounting plate so that it rests on the brackets, one of the brackets is shown in **Figure 9.9** below .

**Figure 9.9 Bolts to Loosen and Brackets on Which the Plate Will Rest**



Item	Description
1	Bolt on mounting plate to loosen
2	Bracket on which mounting plate will rest

8. With the mounting plate lowered, remove the fan from the unit by sliding it forward on the rails as shown in **Figure 9.10** on the next page . Take note of how the fan slid from the unit.

9. A service loop has been added to the wire harness, cut the wire ties to loosen.

**Figure 9.10 Slide the Fan Assembly Out of the Front of the Unit**



10. Slide the new fan assembly into place along the guide rails until it is in the correct position.
11. Re-install the bolts that were removed in step 5 to secure the fan assembly to the unit.
12. Tight the bolts that were loosened in step 7 to raise the mounting plate back into position.
13. Close the unit and re-install any panels that were removed.
14. Turn main electrical disconnect to On, turn the unit On at the Vertiv™ Liebert® iCOM™ display.
15. Place the unit into a call for cooling and verify that the new fan starts.

### 9.3 Infrared Humidifier Maintenance

During normal humidifier operation, deposits of mineral solids will collect in humidifier pan and on the float switch. These must be cleaned periodically to ensure proper operation. Frequency of cleaning must be locally established since it is dependent on humidifier usage and local water quality. A spare pan is recommended to reduce maintenance time at unit. The auto flush system can greatly increase the time between cleanings, but does not eliminate the need for periodic checks and maintenance (see Liebert® iCOM™ user manual SL-31075 for auto flush setup). To help reduce excessive scaling in locations with difficult water quality, the use of Vapure is recommended (contact your local sales representative).



**WARNING! Arc flash and electric shock hazard. Can cause serious injury or death. Building and equipment damage may also result. Disconnect all local and remote electric power supplies and wear appropriate, OSHA-approved personal protective equipment (PPE) per NFPA 70E before working within the electric control enclosure. Customer must provide earth ground to unit, per NEC, CEC, and local codes, as applicable.**

**Verify with a voltmeter that power is Off. The Vertiv™ Liebert® iCOM™ controller does not isolate power from the unit, even in the “Unit Off” mode. Some internal components still require and receive power even during the “Unit Off” mode of the Liebert® iCOM™ controller. The factory-supplied, optional disconnect switch is inside the unit. The line side of this switch contains live high voltage. The only way to ensure that there is NO voltage inside the unit is to install and open a remote disconnect switch. Refer to unit electrical schematic.**

**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. Follow all local codes.**





**WARNING!** Risk of electric shock. Can cause serious injury or death. Building and equipment damage may also result. Open all local and remote electric power supply disconnect switches and verify that power is off with a voltmeter before working within any electric connection enclosures. The Liebert® iCOM™ controller 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™ controller.

Installation, service, and maintenance work must be performed only by properly trained and qualified personnel and in accordance with applicable regulations and manufacturers' specifications. Opening or removing the covers to any equipment may expose personnel to lethal voltages within the unit even when it is apparently not operating and the input wiring is disconnected from the electrical source.



**CAUTION:** Risk of contact with hot surfaces. Can cause injury. Personal burn injury can be the result of touching a humidifier reservoir pan and/or water contained within the pan, and some electrical components that are extremely hot during unit operation. Allow sufficient time for them to cool to a touch-safe temperature before working within the unit cabinet.

Use extreme caution and wear appropriate, OSHA-approved PPE when working on or near hot components, including when replacing or performing maintenance on the infrared humidifier parts inclusive of its bulbs, metal enclosure, humidifier reservoir pan and/or water contained within the pan, and drain tubing. All infrared humidifier parts are very hot during and remain very hot shortly after operation.



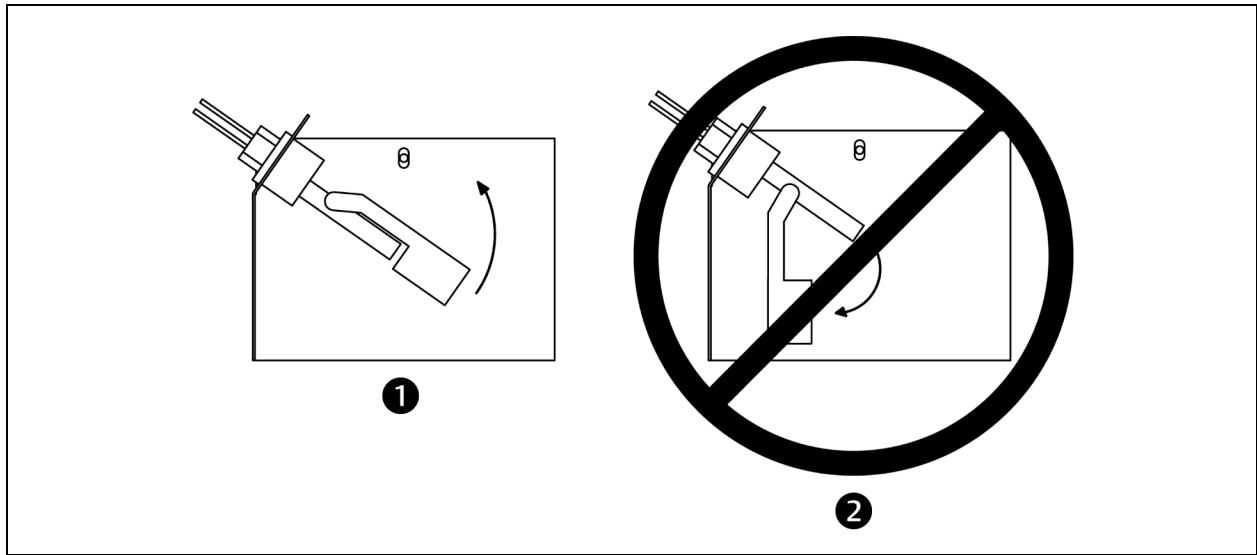
**CAUTION:** Risk of improper handling of boiling water. Can cause leaks, equipment and building damage, or burn injury. The unit requires a drain line that may contain boiling water. Only properly trained and qualified personnel wearing appropriate, OSHA-approved PPE should service the drain line or work on parts near or connected to the drain line.

### 9.3.1 Cleaning Humidifier Pan and Float Switch

**Before turning the unit off:**

1. With unit operating, remove call for humidification at the Vertiv™ Liebert® iCOM™ control.
2. Let the blower operate five minutes to allow the humidifier and water to cool.
3. If unit has a condensate pump, turn unit Off at Liebert® iCOM™ control.
4. Pull out the humidifier standpipe in pan.
5. Inspect the O-ring (replace if necessary).
6. Let the pan drain and condensate pump operate (if applicable).
7. Disconnect power from the unit.
8. Disconnect the drain coupling from the bottom of the pan.
9. Remove the thermostat from the bottom of the pan and the retaining screws from the sides of the pan.
10. Slide the pan out.
11. Loosen scale on side and bottom of pan with a stiff nylon brush or plastic scraper.
12. Flush with water.
13. Carefully clean scale off float switch (make sure to reinstall correctly (see **Figure 9.11** on the next page ).
14. Reinstall the pan, thermostat, standpipe, drain coupling, and screws into the humidifier.
15. Operate the humidifier and check for leaks.

Figure 9.11 Correct Float Switch Orientation



Item	Description
1	Correct switch orientation
2	Incorrect switch orientation

### 9.3.2 Changing Humidifier Lamps



**WARNING!** Risk of electric shock. Can cause serious injury or death. Building and equipment damage may also result. Open all local and remote electric power supply disconnect switches and verify that power is off with a voltmeter before working within any electric connection enclosures. The Vertiv™ Liebert® iCOM™ controller 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™ controller.

Installation, service, and maintenance work must be performed only by properly trained and qualified personnel and in accordance with applicable regulations and manufacturers' specifications. Opening or removing the covers to any equipment may expose personnel to lethal voltages within the unit even when it is apparently not operating and the input wiring is disconnected from the electrical source.



**CAUTION:** Risk of contact with hot surfaces. Can cause injury. Personal burn injury can be the result of touching a humidifier reservoir pan and/or water contained within the pan, and some electrical components that are extremely hot during unit operation. Allow sufficient time for them to cool to a touch-safe temperature before working within the unit cabinet.

Use extreme caution and wear appropriate, OSHA-approved PPE when working on or near hot components, including when replacing or performing maintenance on the infrared humidifier parts inclusive of its bulbs, metal enclosure, humidifier reservoir pan and/or water contained within the pan, and drain tubing. All infrared humidifier parts are very hot during and remain very hot shortly after operation.

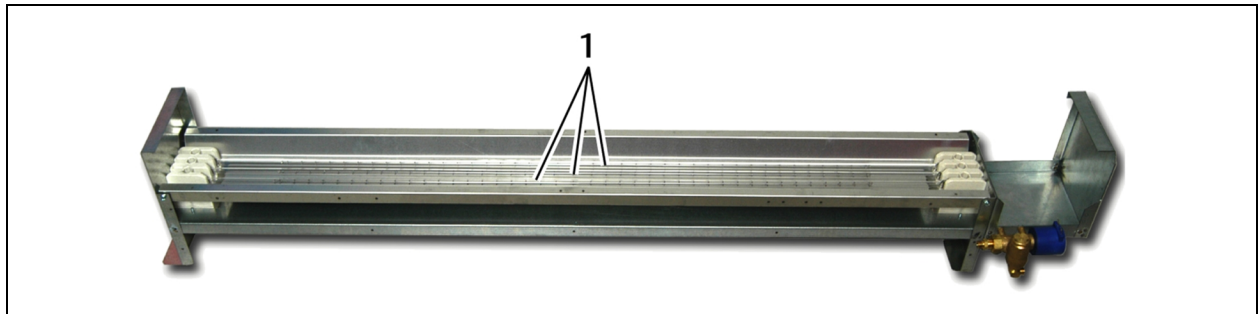
**NOTE:** Touching quartz lamps with bare hands will severely shorten bulb life. Skin oils create hot spots on lamp surface. Wear clean cotton gloves when handling lamps.



The lamps are shown in **Figure 9.12** below .

1. Remove humidifier pan (see [Cleaning Humidifier Pan and Float Switch](#) on page 77 , steps 1 through 10 ).
2. Disconnect power from unit.
3. At humidifier, remove screws and cover from high voltage compartment.
4. Disconnect one end of purple jumper wires.
5. Using a continuity meter, locate burned out lamp.
6. Remove lamp brackets under lamps.
7. Loosen two screws securing lamp lead wires to junction block.
8. Pull bulb straight down and discard.
9. Wrap lead wires once around new lamp's metal ends. This will support lamp and allow for thermal expansion. Insert lead wires into junction block and torque screws to 30 in-lb.
10. Reassemble by reversing steps 1 through 9 .

**Figure 9.12 Infrared Humidifier Lamps**



Item	Description
1	Infrared bulbs

## 9.4 Steam Generating Humidifier Maintenance

The humidifier drains and refills to maintain a current setpoint and alert the operator when the humidifier canister needs to be replaced.



**WARNING!** Arc flash and electric shock hazard. Can cause serious injury or death. Building and equipment damage may also result. Disconnect all local and remote electric power supplies and wear appropriate, OSHA-approved personal protective equipment (PPE) per NFPA 70E before working within the electric control enclosure. Customer must provide earth ground to unit, per NEC, CEC, and local codes, as applicable.

Verify with a voltmeter that power is Off. The Vertiv™ Liebert® iCOM™ controller does not isolate power from the unit, even in the “Unit Off” mode. Some internal components still require and receive power even during the “Unit Off” mode of the Liebert® iCOM™ controller. The factory-supplied, optional disconnect switch is inside the unit. The line side of this switch contains live high voltage. The only way to ensure that there is NO voltage inside the unit is to install and open a remote disconnect switch. Refer to unit electrical schematic.

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. Follow all local codes.



**WARNING!** Risk of electric shock. Can cause serious injury or death. Building and equipment damage may also result. Open all local and remote electric power supply disconnect switches and verify that power is off with a voltmeter before working within any electric connection enclosures. The Liebert® iCOM™ controller 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™ controller.

Installation, service, and maintenance work must be performed only by properly trained and qualified personnel and in accordance with applicable regulations and manufacturers' specifications. Opening or removing the covers to any equipment may expose personnel to lethal voltages within the unit even when it is apparently not operating and the input wiring is disconnected from the electrical source.



**WARNING!** Risk of improper wiring, piping, moving, lifting, and handling. Can cause equipment damage, serious injury or death. Installation and service of this equipment should be done only by qualified personnel who have been specially trained in the installation of air conditioning equipment and who are wearing appropriate, OSHA-approved PPE.



**WARNING!** Risk of improper humidifier canister maintenance. Can cause serious injury or death. Building and equipment damage may also result. Can cause fire suppression and alarm system activation, resulting in building evacuation and mobilization of emergency fire and rescue services. Using a humidifier canister that has reached the end of its service life can be extremely hazardous. If the canister cannot be replaced immediately at the end of life condition, turn off the power and water supply to the humidifier and remove the canister until a replacement canister can be installed. Do not ignore humidifier problem alarms. Resetting the humidifier without addressing cause may result in fire or damage from leaking water. See **Table 9.5** on **page 85** for alarm corrective actions.



**CAUTION:** Risk of humidifier canister meltdown, smoke, and fire. Can cause injury. Can cause fire suppression and alarm system activation, resulting in building evacuation and mobilization of emergency fire and rescue services. Check steam generating humidifier electrode plugs to ensure that they are pressed firmly onto pins. Loose connections will cause overheating of cylinder and plugs.



**CAUTION:** Risk of contact with hot surfaces. Can cause injury. The humidifier canister and steam suppression and alarm system activation allow sufficient time for them to cool to a touch safe temperature before working within the unit cabinet. Use extreme caution and wear appropriate, OSHA-approved PPE when working on or near hot components, including when replacing or performing maintenance on the fans.



**CAUTION:** Risk of improper handling of boiling water. Can cause leaks, equipment and building damage, or burn injury. The unit requires a drain line that may contain boiling water. Only properly trained and qualified personnel wearing appropriate, OSHA-approved PPE should service the drain line or work on parts near or connected to the drain line.

After an extended period of operation, in accordance with life expectancy information, the cylinder is completely used as indicated by the amber high water sensor light illuminated on the cabinet. When this condition is reached, a new replacement cylinder must be installed.

**NOTE:** The amber high water sensor light may come on during initial start-up, but this instance does not indicate that the cylinder should be replaced.

The steam cylinder is disposable and must be replaced at the end of the cylinder's life. Cylinder life will vary according to water supply conditions and humidifier use.

**Table 9.4 Humidifier Canister Part Numbers**

Unit Model	200V, 208V, 230V	380/415V, 460V	Humidifier Model
PX011, 018, 023, 029	317911p1	317911p2	MES 2
PW017, 029			MES 2

**Figure 9.13 Steam Generating Humidifier Canister**



### 9.4.1 Removing the Old Canister

To replace a used up humidifier cylinder:

1. Turn off the water supply to 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 completely drained, push the auto On/Off/Drain switch to the Off position.
4. Open the main electrical disconnect 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 up to remove the plugs from the pins.
6. Use slotted screwdriver to loosen the steam hose clamp(s).
7. Disconnect the steam hose by pulling it straight up.
8. Loosen the reversible cylinder zip tie. The cylinder is now ready to be lifted out of the unit.

### 9.4.2 Mandatory Cleaning of the Drain Valve

Always clean the drain valve before installing a new cylinder. **Figure 9.14** on the facing page, shows an exploded view of the drain valve for reference to clean it.

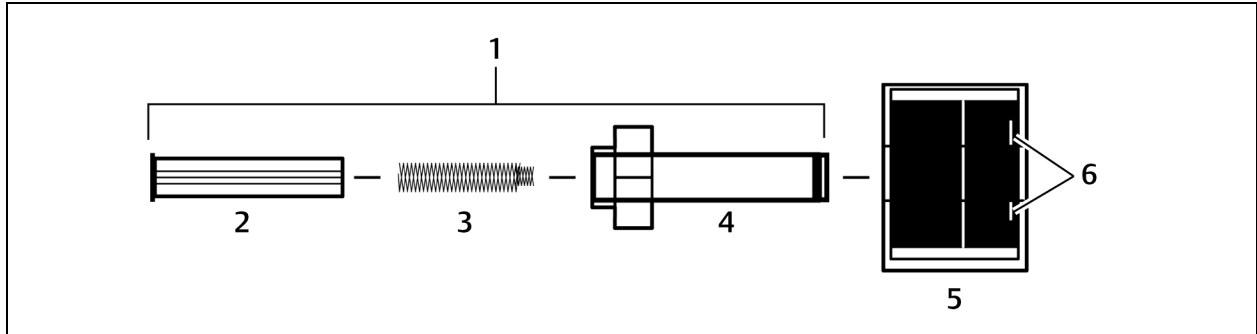
1. Remove old cylinder as described in [Removing the Old Canister](#) above.
2. Note that the ring terminal for the drain valve green ground wire is sandwiched between the drain valve and the drain pan.
3. Remove the two screws securing the drain valve body to the drain pan.
4. Remove the hose clip and hose connection from the drain valve body.
5. The drain valve assembly is now free for disassembly and cleaning.
6. At a sink, remove the snap fit red cap from the coil assembly and slide the coil off the actuator.
7. Loosen actuator using a wrench and unscrew from the plastic body.
8. Clean the exposed core, spring, and plastic drain valve pot

- Reinstall in the reverse order.

**NOTE: Be cautious when putting the spring back into the plunger, the taper end of the spring must be installed toward the solenoid.**

- Hand tighten the actuator back into place, then secure it using a wrench to turn it a quarter of a turn.
- Clean out the end of the hose, then reconnect it to the drain valve body with the clamp.
- Fit mounting screws back through the drain valve body, one through ring terminal on the green wire.

**Figure 9.14 Drain Valve Assembly**



Item	Description	Item	Description
1	Actuator	4	Sleeve
2	Plunger	5	Holding coil
3	Spring	6	Male, slip on connection tabs

### 9.4.3 Installing the New Canister

- The reverse procedure should be followed to install a new cylinder. The main electrical disconnect is to be left open until the cylinder is completely installed and reconnected.
- The blue sensor plug on all units is for the high water sensor pin, which always goes on the single pin with collar offset from the others. See **Figure 9.15** on the next page.
- Ensure that cylinder plugs are snug on the pins. Replace any loose fitting plugs as these may result in hazardous operation.

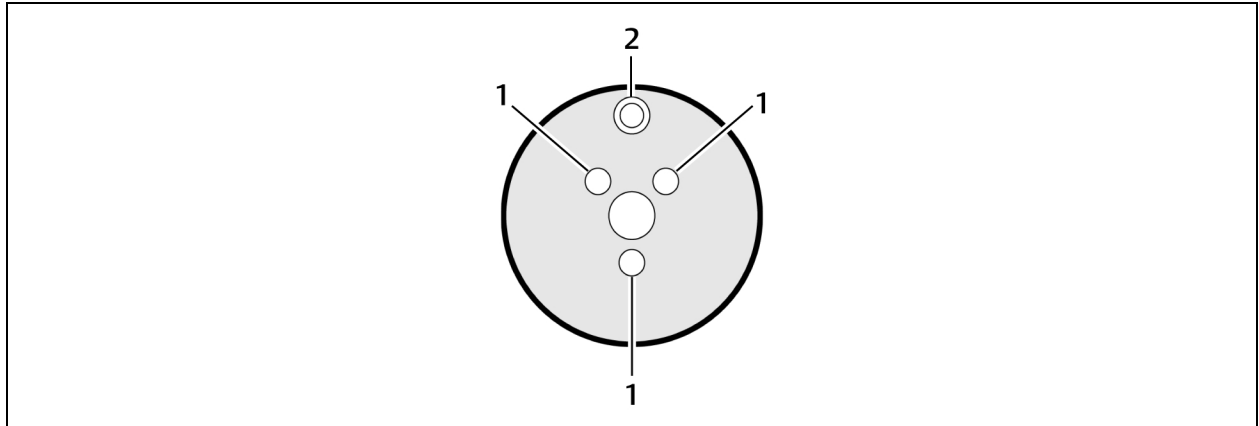


**WARNING! Risk of improper humidifier canister maintenance. Can cause serious injury or death. Building and equipment damage may also result. Can cause fire suppression and alarm system activation, resulting in building evacuation and mobilization of emergency fire and rescue services. Using a humidifier canister that has reached the end of its service life can be extremely hazardous. If the canister cannot be replaced immediately at the end of life condition, turn off the power and water supply to the humidifier and remove the canister until a replacement canister can be installed. Do not ignore humidifier problem alarms. Resetting the humidifier without addressing cause may result in fire or damage from leaking water. See **Table 9.5** on page 85 for alarm corrective actions.**



**CAUTION:** Risk of humidifier canister meltdown, smoke, and fire. Can cause injury. Can cause fire suppression and alarm system activation, resulting in building evacuation and mobilization of emergency fire and rescue services. Check steam generating humidifier electrode plugs to ensure that they are pressed firmly onto pins. Loose connections will cause overheating of cylinder and plugs.

Figure 9.15 Canister Plugs



Item	Description
1	3Ø power pin
2	High water sensor pin

### 9.4.4 Humidifier Troubleshooting



**CAUTION:** Risk of contact with hot surfaces. Can cause burn injury. The humidifier canister and steam discharge lines are extremely hot during operation. Allow sufficient time for them to cool to a touch-safe temperature before handling. Use extreme caution and wear appropriate, OSHA-approved PPE when performing maintenance on the humidifier.



**CAUTION:** Risk of improper handling of boiling water. Can cause leaks, equipment and building damage, or burn injury. The unit requires a drain line that may contain boiling water. Only properly trained and qualified personnel wearing appropriate, OSHA-approved PPE should service the drain line or work on parts near or connected to the drain line.

#### NOTICE

Risk of improper control circuits. Can cause equipment damage.

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

Terms used in humidifier troubleshooting:

- **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.

**Table 9.5 Steam Generating Humidifier Status Lights: Causes and Corrective Actions**

Unit Status light		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. Check for short cycling. Water conductivity too high.

**Table 9.5 Steam Generating Humidifier Status Lights: Causes and Corrective Actions (continued)**

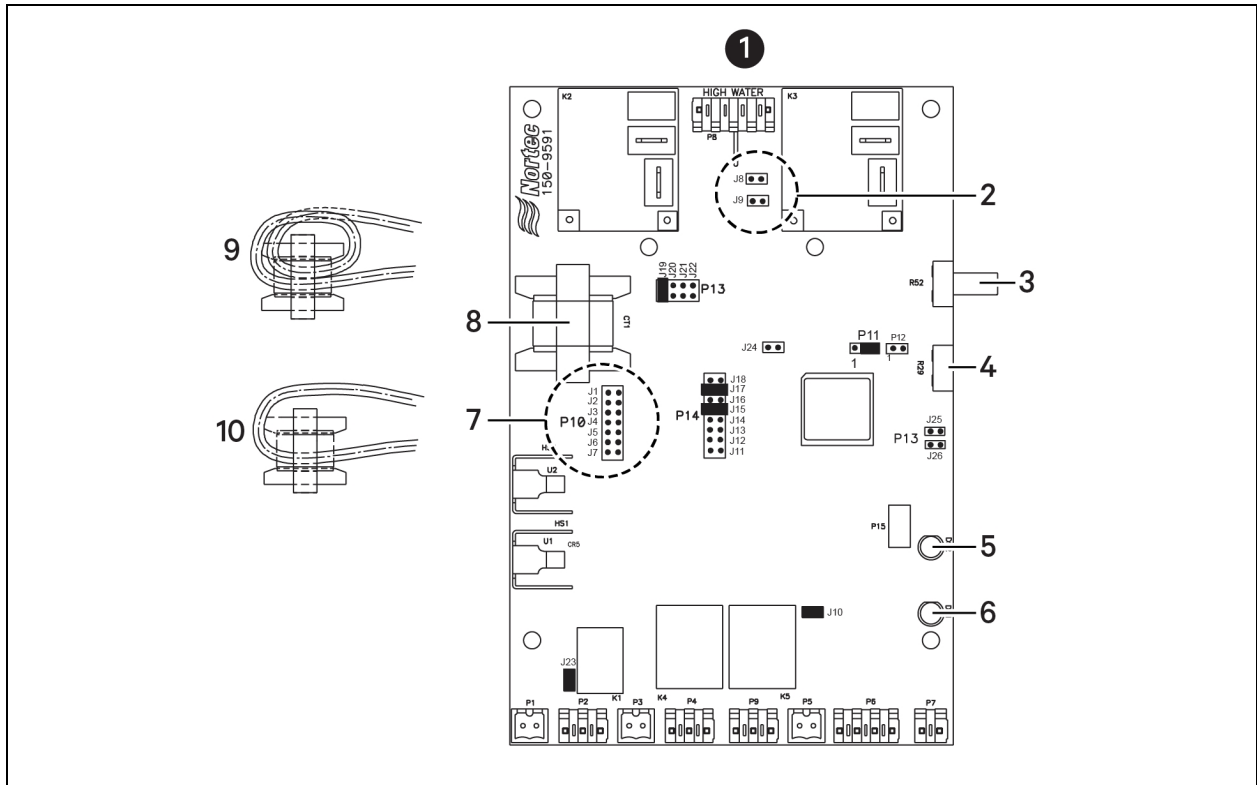
Unit Status light		Symptom	Corrective Actions
Yellow	Green		
2 flashes in sequence	Off	No current detection for 30 minutes with continuous call for humidity.	<p>Check water level in the cylinder - should be more than 1/4 full. If not, check fill rate, 24 VAC on fill valve terminals (unit must be on with 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).</p> <p>If cylinder is more than 1/4 full, check primary power, connections to the cylinder, continuity of wires to cylinder.</p> <p>Are power wires connected to proper terminals on the cylinder? (Color coding.) Possibly wrong cylinder type.</p> <p>Low water conductivity.</p>
4 flashes in sequence	Off	End of cylinder life - change cylinder.	<p>Check water level in the cylinder; should be about 3/4 full.</p> <p>Check for foaming if water level is lower or cylinder life shorter than expected.</p> <p>Change cylinder, clean drain valve.</p>

**Table 9.6 Steam Generating Humidifier Troubleshooting Guide**

Symptom	Possible Cause	Check or Remedy
Unit in call for humidification, humidifier will not operate	Humidifier not receiving power	Verify ON/OFF/DRAIN switch is in ON position.
		Check fuses or CBs and replace or reset if necessary.
Humidifier Contactor pulled in, but no water enters canister	No water available to unit	Check external water shut off valves.
	Clogged fill line strainer	Clean or replaced fill line strainer
Excessive arcing in canister	Drain valve clogged or defective	Verify that drain valve operates freely when activated. Clean valve and replace if defective. Flush canister several times and replace if arcing persists.
	Improper water supply	If water is commercially softened, reconnect humidifier to raw water supply, drain canister and restart. If connected to hot water supply, reconnect to cold water.
	Insufficient drain rate	Verify that drain valve operates freely when activated. Clean valve and replace if defective. Flush canister several times and replace if arcing persists.
	Excessive mineral content in water	Analyze mineral content of water. If mineral content is excessive contact Vertiv Technical Support.



Figure 9.16 Steam Generating Humidifier Circuit Board Diagram



Item	Description	Item	Description
1	PCB is configured for: MES-L	6	Yellow LED
2	HW Sensor Jumpers <ul style="list-style-type: none"> <li>J9: Low Voltage 200-240 V</li> <li>J8: High Voltage 380-600 V</li> </ul>	7	Mains Voltage Select Jumpers <ul style="list-style-type: none"> <li>J6: 200-208</li> <li>J5: 230 V</li> <li>J3: 380-415</li> <li>J2: 460 V</li> <li>J1: 575 V</li> </ul>
3	Capacity adjust (Default at 100%)	8	Current transformer
4	Sealed, do not adjust	9	Current Transformer for MES-L 10, loop current sensing wire twice through current sensing coil.
5	Green LED	10	Current transformer for MES-L 20, loop current sensing wire once through current sensing coil.

To configure the correct PCB voltage, set the jumpers as follows:

**NOTE:** The asterisk (\*) indicates a factory setting. Do not adjust.

- 208 V: J6, J9, J15\*, J17\*, J19\*, J10\*, J23\*, P11 (2-3)\*
- 230 V: J5, J9, J15\*, J17\*, J19\*, J10\*, J23\*, P11 (2-3)\*
- 380 V: J3, J8, J15\*, J17\*, J19\*, J10\*, J23\*, P11 (2-3)\*
- 460 V: J2, J8, J15\*, J17\*, J19\*, J10\*, J23\*, P11 (2-3)\*
- 575 V: J1, J8, J15\*, J17\*, J19\*, J10\*, J23\*, P11 (2-3)\*

## 9.5 Condensate Drain and Condensate Pump System Maintenance

### 9.5.1 Condensate Drain

Check for and clear obstructions in tubing during routine maintenance.

### 9.5.2 Condensate Pump



**WARNING! Risk of electric shock. Can cause serious injury or death. Open all local and remote electric power supply disconnect switches and verify that power is off with a voltmeter before working within any electric connection enclosures. The Vertiv™ Liebert® iCOM™ controller does not isolate power from the unit, even in the "Unit Off" mode. Condensate pump will stay energized and has the potential to operate even in the "Unit Off" mode.**

**Installation, service, and maintenance work must be performed only by properly trained and qualified personnel and in accordance with applicable regulations and manufacturers' specifications. Opening or removing the covers to any equipment may expose personnel to lethal voltages within the unit even when it is apparently not operating and the input wiring is disconnected from the electrical source.**

**To maintain the 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. Re-assemble and check for leaks.

## 9.6 Air Cooled Condenser and Vertiv™ Liebert® Drycooler Maintenance

Restricted airflow will reduce operating efficiency and could result in high compressor head pressure and loss of cooling.

- Clear coil surface of all debris that will inhibit airflow.
- Check for bent or damaged coil fins and correct.
- Do not permit snow to accumulate around or under outdoor unit.
- Periodically consider commercial cleaning of coil surface
- Inspect fans, motors, and controls for proper operation.
- Check all piping and capillaries for proper support.
- Inspect for leaks.
- Check contactors for pitting. Replace if pitted.

## 9.7 Electric Reheat Maintenance

- Inspect and clean reheat elements.
- Inspect and tighten support hardware.

## 9.8 Thermostatic Expansion Valve (TXV) Maintenance

The TXV performs one function: it keeps the evaporator supplied with enough refrigerant to satisfy load conditions. It does not affect compressor operation.

Proper valve operation can be determined by measuring superheat. The correct superheat setting is between 10 and 20°F (5.5 and 11°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.

### 9.8.1 Determining Suction Superheat

To determine superheat:

1. Measure the temperature of the suction line at the point the TXV 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.

### 9.8.2 Adjusting Superheat Setting with the TXV

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. Allow up to 15 minutes of fully loaded compressor operation before checking superheat or making additional stem adjustments.**

## 9.9 Electronic Expansion Valve (EEV) Maintenance

The EEV controls superheat through the Vertiv™ Liebert® iCOM™ controls by actively measuring suction pressure via a transducer attached to the suction line rotalock and suction temperature via a thermister strapped to the suction line. The EEV actively adjusts the orifice size and resulting mass flow of refrigerant to maintain the superheat setpoint (set in Liebert® iCOM™). The EEV is used in place of the standard thermal expansion valve (TXV).



**WARNING! Risk of electric shock. Can cause serious injury or death. Building and equipment damage may also result. Open all local and remote electric power supply disconnect switches and verify that power is off with a voltmeter before working within any electric connection enclosures. The Liebert® iCOM™ controller 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™ controller.**

**Installation, service, and maintenance work must be performed only by properly trained and qualified personnel and in accordance with applicable regulations and manufacturers' specifications. Opening or removing the covers to any equipment may expose personnel to lethal voltages within the unit even when it is apparently not operating and the input wiring is disconnected from the electrical source.**

**NOTE: Intermittent loss of subcooling may result in EEV/superheat instability. If superheat instability is observed, check for proper refrigerant level in receiver (see [Refrigerant Piping Guidelines for Air Cooled Systems](#) on page 34 for the proper charge level). If proper charge is observed in receiver, and superheat remains unstable, then increase superheat setting in the Liebert® iCOM™ to 15°F (8.49°C).**

## 9.10 Compressor Maintenance



**WARNING!** Risk of electric shock. Can cause serious injury or death. Building and equipment damage may also result. Open all local and remote electric power supply disconnect switches and verify that power is off with a voltmeter before working within any electric connection enclosures. The Vertiv™ Liebert® iCOM™ controller 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™ controller.

Installation, service, and maintenance work must be performed only by properly trained and qualified personnel and in accordance with applicable regulations and manufacturers' specifications. Opening or removing the covers to any equipment may expose personnel to lethal voltages within the unit even when it is apparently not operating and the input wiring is disconnected from the electrical source.



**WARNING!** Risk of over pressurization of the refrigeration system. Can cause serious injury or death. Building and equipment damage may also result. Can cause explosive discharge of high pressure refrigerant, loss of refrigerant, or environmental pollution. This unit contains fluids and gases under high pressure. Use extreme caution when charging the refrigerant system. Do not pressurize the system higher than the design pressure marked on the unit's nameplate.



**WARNING!** Risk of explosive discharge of high pressure refrigerant. Can cause serious injury or death. Building and equipment damage may also result. Neutral and service ports on the compressor service valves do not have a valve core. Front-seat the service valves and relieve pressure from the compressor before loosening a part or a component attached to the service valve. Follow local codes to properly reclaim refrigerant.

### NOTICE

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

Vertiv™ Liebert® PDX systems require the use of POE (polyolester) 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.

## 9.10.1 Compressor Oil

### NOTICE

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

Failure to use oil types, viscosities, and quantities recommended by the compressor manufacturer may reduce compressor life and void the compressor warranty.

See oil types specified in **Table 9.7** below .

- Do not mix polyolester (POE) and mineral-based oils.
- Do not mix oils of different viscosities.
- Consult Vertiv technical support or the compressor manufacturer if questions arise.

**Table 9.7 Compressor Oil Types for R-410A Refrigerant**

Compressor Type	Oil Type
Copeland Scroll and Digital Scroll	POE Oil - ISO 32 Centistoke Viscosity <sup>1</sup>
1. Use Copeland POE Oil ULTRA 32-3MAF or other Copeland-approved oils.	
Source: DPN003950, Rev. 6	

**NOTE:** See [Additional Oil Requirements for Scroll and Digital Scroll Compressors](#) on page 36 , for additional oil based on the system's refrigerant charge.

## 9.10.2 Scroll and Digital Scroll Compressor Maintenance

Hermetic scroll and digital scroll compressors do not have an oil sight glass.

**NOTE:** Refer to [Additional Oil Requirements for Scroll and Digital Scroll Compressors](#) on page 36 for approved oil types and additional oil required based on the system's refrigerant charge.

## 9.10.3 Replacement Compressors

Replacement compressors are available through your Vertiv sales office. If the unit is under warranty, the replacement compressor must be obtained from and the original compressor returned to your local Vertiv sales office. Compressors are shipped in reusable packaging, and the original compressor should be returned in the same packaging.

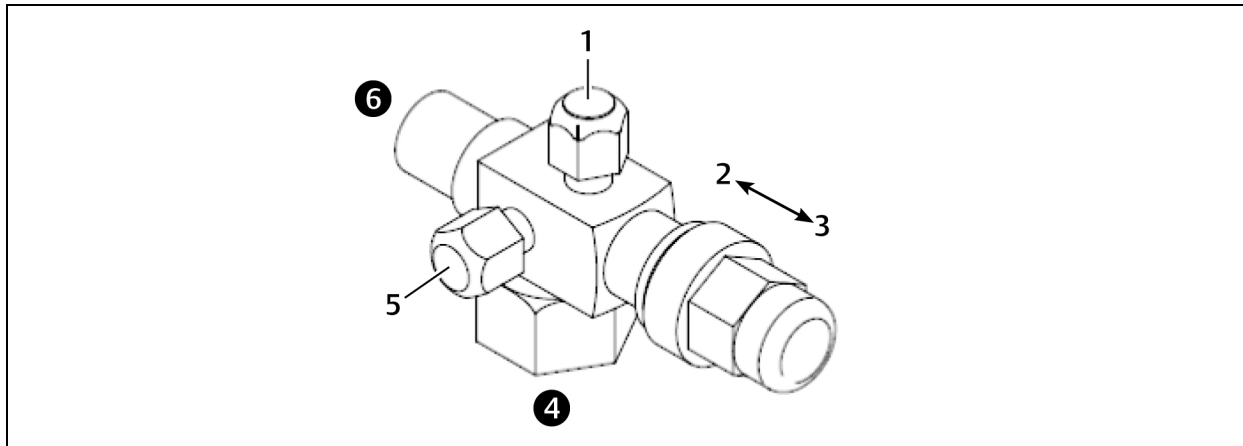
### 9.10.4 Rotalock Valve on Scroll and Digital Scroll Compressors



**WARNING! Risk of explosive discharge of high pressure refrigerant. Can cause serious injury or death. Building and equipment damage may also result. Neutral and service ports on the compressor service valves do not have a valve core. Front-seat the service valves and relieve pressure from the compressor before loosening a part or a component attached to the service valve. Follow local codes to properly reclaim refrigerant.**

- The neutral port remains open to the compressor side in all positions of the valve stem, see **Figure 9.17** below . A high pressure cut out switch or low pressure switch/transducer will be connected to this port.
- The service port is closed to the system when valve stem is back seated, see **Figure 9.17** below . It is open to the system as soon as the valve is adjusted away from the back seated position.

Figure 9.17 Rotalock Valve



Item	Description
1	Service port (gauge)
2	Front seat
3	Back seat
4	Compressor side of valve
5	Neutral port
6	System side of valve

### 9.10.5 Unloading Solenoid(s) on a Digital Scroll Compressor

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

### 9.10.6 Compressor Electrical Failure (Motor Burnout)

If a burnout has occurred, a full system clean out is required. If not cleaned, compressor and system problems will continue.

Consult the factory for compressor maintenance. Do not attempt to remove the compressor without first contacting Vertiv support at 1-800-543-2778.

### 9.10.7 Replacing a Compressor with Electrical Failure (Motor Burnout)



**WARNING!** Risk of electric shock. Can cause serious injury or death. Building and equipment damage may also result. Open all local and remote electric power supply disconnect switches and verify that power is off with a voltmeter before working within any electric connection enclosures. The Vertiv™ Liebert® iCOM™ controller 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™ controller.

Installation, service, and maintenance work must be performed only by properly trained and qualified personnel and in accordance with applicable regulations and manufacturers' specifications. Opening or removing the covers to any equipment may expose personnel to lethal voltages within the unit even when it is apparently not operating and the input wiring is disconnected from the electrical source.



**WARNING!** Risk of over pressurization of the refrigeration system. Can cause serious injury or death. Building and equipment damage may also result. Can cause explosive discharge of high pressure refrigerant, loss of refrigerant, or environmental pollution. This unit contains fluids and gases under high pressure. Use extreme caution when charging the refrigerant system. Do not pressurize the system higher than the design pressure marked on the unit's nameplate.



**WARNING!** Risk of explosive discharge of high pressure refrigerant. Can cause serious injury or death. Building and equipment damage may also result. Neutral and service ports on the compressor service valves do not have a valve core. Front-seat the service valves and relieve pressure from the compressor before loosening a part or a component attached to the service valve. Follow local codes to properly reclaim refrigerant.

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

1. Attach suction and discharge gauges to access fittings.
2. Front seat service valves to isolate the compressor. Recover refrigerant using an approved recovery procedure and equipment. Use a filter drier when charging the system with recovered refrigerant.
3. Remove marked pressure transducer and discharge pressure switch. Disconnect all electrical connections.
4. Detach service valves from compressor.
5. Remove failed compressor.
6. Follow compressor manufacturer's suggested clean-out procedures.



7. Install replacement compressor and make all connections. Replace gaskets or seals on service valves. Replace unloading solenoid.
8. Evacuate, charge, and operate per the appropriate procedure per local codes:
  - [Evacuation, Leak Testing, and Charging Air Cooled Systems with TXV and without Receivers](#) on page 38
  - [Evacuation, Leak Testing, and Charging Air Cooled Systems with Vertiv™ Liebert® Lee-Temp Flooded Condenser Head Pressure Control System](#) on page 42.
  - [Evacuation and Leak Testing Air Cooled Systems with Unheated Receivers](#) on page 44
  - Water/Glycol cooled units should be charged with refrigerant amount as shown on the serial tag, using standard industry charging procedures for self-contained R-410A units.

#### NOTICE

Risk of improper component re-installation. Can cause equipment damage.

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

### 9.10.8 Compressor Mechanical Failure

If mechanical failure of the compressor has occurred, only the compressor needs replaced. A full system clean out is not required.

### 9.10.9 Replacing a Compressor with Mechanical Failure



**WARNING! Risk of electric shock. Can cause serious injury or death. Building and equipment damage may also result. Open all local and remote electric power supply disconnect switches and verify that power is off with a voltmeter before working within any electric connection enclosures. The Vertiv™ Liebert® iCOM™ controller 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™ controller.**

Installation, service, and maintenance work must be performed only by properly trained and qualified personnel and in accordance with applicable regulations and manufacturers' specifications. Opening or removing the covers to any equipment may expose personnel to lethal voltages within the unit even when it is apparently not operating and the input wiring is disconnected from the electrical source.



**WARNING! Risk of over pressurization of the refrigeration system. Can cause serious injury or death. Building and equipment damage may also result. Can cause explosive discharge of high pressure refrigerant, loss of refrigerant, or environmental pollution. This unit contains fluids and gases under high pressure. Use extreme caution when charging the refrigerant system. Do not pressurize the system higher than the design pressure marked on the unit's nameplate.**



**WARNING! Risk of explosive discharge of high pressure refrigerant. Can cause serious injury or death. Building and equipment damage may also result. Neutral and service ports on the compressor service valves do not have a valve core. Front-seat the service valves and relieve pressure from the compressor before loosening a part or a component attached to the service valve. Follow local codes to properly reclaim refrigerant.**

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

1. Front seat service valves to isolate the compressor. Recover refrigerant using an approved recovery procedure and equipment.
2. Remove failed compressor.
3. Keep the replacement compressor sealed until installation is complete to the point that the system isolation valves are ready to be engaged. Keep exposure of the POE oil in compressor to atmosphere to a minimum.
4. Install replacement compressor, replace gaskets or seals on service valves, and make all connections. Replace unloading solenoid, if equipped.
5. Once the compressor is completely installed, keep isolation valves closed to the system and open to compressor. Add dry nitrogen to compressor and check all connections for leaks. With no leaks confirmed, evacuate the isolated compressor prior to introducing to the rest of the system.
6. When evacuating the isolated compressor volume, pull a vacuum of 500 microns with no decay above 1000 microns within 20 minutes.  
Once evacuation requirements of compressor are met, open the valves to open the compressor to the system.
7. Check compressor and system operation. Make any necessary adjustments for proper equipment operation.

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

### NOTICE

Risk of piping system corrosion and freezing fluids. Can cause leaks resulting in equipment and very expensive building damage. Heat exchangers and piping systems are at high risk of freezing and premature corrosion. Fluids in these systems must contain the proper antifreeze and inhibitors to prevent freezing and premature coil and piping corrosion. When the cooling unit or piping may be exposed to freezing temperatures, charge the system with coolant fluid based on the coldest ambient design temperature. Automotive antifreeze is unacceptable and must NOT be used in any fluid system. Use only coolant fluid solution that meets the requirements of recommended industry practices. Do not use galvanized pipe.

The system coolant fluid must be analyzed by a competent fluid treatment specialist before start up to establish the inhibitor and antifreeze solution requirement and evaluated at regularly scheduled intervals throughout the life of the system to determine the pattern of inhibitor depletion.

The fluid complexity and variants of required treatment programs make it extremely important to obtain the advice of a competent and experienced fluid-treatment specialist and follow a regularly scheduled coolant fluid system-maintenance program.

Fluid chemistry varies greatly 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 coolant fluid used must be considered, because 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 coolant fluid must be treated and circulating through the system continuously to prevent the buildup of deposits and/or growth of sulfate reducing bacteria. Proper inhibitor maintenance must be performed to prevent corrosion of the system.

Consult fluid manufacturer for testing and maintenance of inhibitors.

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

Vertiv recommends installing a monitored fluid-detection system that is wired to activate the automatic closure of field installed coolant fluid supply and return shut-off valves to reduce the amount of coolant fluid leakage and consequential equipment and building damage. The shut-off valves must be sized to close off against the maximum coolant fluid system pressure in case of a catastrophic fluid leak.

Maintaining the system fluid quality is required throughout the life of the system. Fluid and piping system maintenance schedules must be established and performed. A coolant fluid maintenance program must be established that will evaluate fluid chemistry and apply necessary treatment. The complexity of water/glycol solution condition problems and the variations of required treatment programs make it extremely important to obtain the advice of a competent and experienced water treatment specialist and follow a regularly scheduled coolant fluid system maintenance program.

Perform periodic inspections of the facility and the unit coil and/or heat exchanger and coolant fluid piping system for leaks and visible damage.

## 9.12 Glycol Solution Maintenance

### NOTICE

Risk of piping system corrosion and freezing fluids. Can cause leaks resulting in equipment and very expensive building damage. Heat exchangers and piping systems are at high risk of freezing and premature corrosion. Fluids in these systems must contain the proper antifreeze and inhibitors to prevent freezing and premature coil and piping corrosion. When the cooling unit or piping may be exposed to freezing temperatures, charge the system with coolant fluid based on the coldest ambient design temperature. Automotive antifreeze is unacceptable and must NOT be used in any fluid system. Use only coolant fluid solution that meets the requirements of recommended industry practices. Do not use galvanized pipe.

The system coolant fluid must be analyzed by a competent fluid treatment specialist before start up to establish the inhibitor and antifreeze solution requirement and evaluated at regularly scheduled intervals throughout the life of the system to determine the pattern of inhibitor depletion.

The fluid complexity and variants of required treatment programs make it extremely important to obtain the advice of a competent and experienced fluid-treatment specialist and follow a regularly scheduled coolant fluid system maintenance program.

Fluid chemistry varies greatly 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 coolant fluid used must be considered, because 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 coolant fluid must be treated and circulating through the system continuously to prevent the buildup of deposits and/or growth of sulfate reducing bacteria. Proper inhibitor maintenance must be performed to prevent corrosion of the system.

Consult fluid manufacturer for testing and maintenance of inhibitors.

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

Vertiv recommends installing a monitored fluid-detection system that is wired to activate the automatic closure of field installed coolant fluid supply and return shut-off valves to reduce the amount of coolant fluid leakage and consequential equipment and building damage. The shutoff valves must be sized to close off against the maximum coolant fluid system pressure in case of a catastrophic fluid leak.

It is difficult to establish a specific schedule of inhibitor maintenance because the rate of inhibitor depletion depends upon local water conditions. Analysis of water samples at the time of installation and through a maintenance program should help to establish a pattern of depletion. A visual inspection of the solution and filter residue is often helpful in judging whether active corrosion is occurring.

The complexity of water/glycol solution condition problems and the variations of required treatment programs make it extremely important to obtain the advice of a competent and experienced water treatment specialist and follow a regularly scheduled coolant fluid system maintenance program. It is important to note that improper use of water treatment chemicals can cause problems more serious than using none. Proper inhibitor maintenance must be performed in order to prevent corrosion of the glycol system. Consult the glycol manufacturer for testing and maintenance of inhibitors. Do not mix products from different manufacturers.

## 9.13 Motorized Ball Valve (MBV) Maintenance (Digital Scroll Compressors)

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

### 9.13.1 MBV Control

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

### 9.13.2 MBV Control Method

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

### 9.13.3 MBV Adjustment

Both pressure thresholds can be shifted simultaneously over a 50 psi (35 kPa) range (the 35 psi [241 kPa] differential remains constant). The ball valve setpoint offset parameter in the Service menu can be adjusted from 0 to 50 psi (345 kPa) to raise or lower the control band similar to the pressure adjustment on a water regulating valve. Changing the setpoint offset will adjust the pressure thresholds for both circuits. Units are factory set at a 30 psi (207 kPa) setpoint offset (30 psi [207 kPa] above minimum). This results in a 220 psiA (1,517 kPa) lower threshold and a 255 psiA (1,758 kPa) upper threshold pressure.

### 9.13.4 MBV Start Up

The setpoint offset is adjusted to the minimum value during start-up, then transitions to the set value once the compressor reaches normal operating pressures. Due to the control dead band it is possible for each circuit to stabilize at different pressures within the dead band. Additionally, changes in fluid temperature could cause pressure changes that do not result in valve movement within the dead band. Vertiv™ Liebert® Drycooler aquastats should be set to prevent continuous fluid temperature swings greater than 10°F (5.6°C). See [Vertiv™ Liebert® Drycooler Aquastat Settings](#) on the next page.

### 9.13.5 MBV Location

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

### 9.13.6 MBV Manual Control

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

## 9.14 Vertiv™ Liebert® Drycooler Aquastat Settings

Applications with the Optional Stat Setting require field piping to be insulated to prevent condensation. **Table 9.8** below, shows acceptable applications where stats must be adjusted to Optional Setting.

Aquastats must be field adjusted to Optional Setting for:

- Liebert® GLYCOOL/Dual Cool applications

**Table 9.8 Water/Glycol System Conditions Requiring Optional Settings for Aquastats**

Flow Control:	MBV			
Cooling Type:	Glycol		GLYCOOL	
Liebert® Drycooler in Loop	1	Multiple	1	Multiple
Stat Setting*	Optional	Factory	Optional	Optional
Insulate Field Piping	Yes	No	Yes	Yes
* See <b>Table 9.9</b> below				
MBV = Motorized ball valve				

**Table 9.9 Aquastat Settings—2 Fan through 4 Fan Liebert® Drycoolers**

Dial Setting (Stat Open Temp) Set for Mid Differential 8°F (4.4°C) Rise to Close			
Aquastat #	Fans	Factory Setting (Glycol) (see Notes 1 and 2)	Optional Setting (GLYCOOL) (see Note 3)
AQ1	F1	65°F (18.3°C)	35°F (1.7°C)
AQ2	F2 & F3	75°F (23.9°C)	45°F (7.2°C)
AQ3	F44	70°F (21.1°C)	40°F (4.4°C)
<ol style="list-style-type: none"> <li>1. All Liebert® Drycoolers are shipped at Factory Setting.</li> <li>2. Factory setting is used for all glycol applications, except single Liebert® Drycooler loops with motor ball valve controls.</li> <li>3. Stats must be field adjusted to Optional Setting for Liebert® GLYCOOL/Dual Cool applications and all single Liebert® Drycooler loops using motorized ball valve flow controls.</li> </ol>			
Source: DPN0001602, Rev. 5			

**Table 9.10 Aquastat Settings—6 Fan Liebert® Drycoolers**

Dial Setting (Stat Open Temp) Set for Mid Differential 8°F (4.4°C) Rise to Close				
Aquastat #	Fans	Stat Location Cabinet	Factory Setting (Glycol) (see Notes 1 and 2)	Optional Setting (GLYCOOL) (see Note 3)
AQ1	F1	Main	65°F (18.3°C)	35°F (1.7°C)
AQ2	F2	Main	70°F (21.1°C)	40°F (4.4°C)
AQ3	F3 & F4	Auxiliary	73°F (22.8°C)	43°F (6.1°C)
AQ4	F5 & F6	Auxiliary	75°F (23.9°C)	45°F (7.2°C)
<ol style="list-style-type: none"> <li>1. All Liebert® Drycoolers are shipped at factory setting.</li> <li>2. Factory setting is used for all glycol applications, except single Liebert® Drycooler loops with motor ball valve controls.</li> <li>3. Stats must be field adjusted to Optional Setting for Liebert® GLYCOOL/Dual Cool applications and all single Liebert® Drycooler loops using motor ball valve flow controls.</li> </ol>				
Source: DPN0001602, Rev. 5				

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# 10 Preventive Maintenance Checklist

Source: DPN002952, Rev. 4

Inspection Date	Job Name
Indoor Unit Model #	Indoor Unit Serial Number #
Liebert® Fin/Tube Condenser or Liebert® Drycooler Model #	Condenser/Drycooler Serial #
Room Temperature/Humidity      °      %	Ambient Temperature      °

Not all units will have all components. To determine your unit's configuration, compare the [Indoor Unit Model #](#) above and the information in the [Nomenclature and Components](#) on page 11 section.

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

## **Check all that apply:**

### **Evaporator/Filters**

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

### **Blower Section (EC fan)**

1. Mounting bolts tight.
2. Fan guard bolts tight.
3. Impeller spins freely.
4. Check/test air sail switch (if equipped).
5. Motor amp draw.
  - Compare to nameplate amps.

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

6. Check belt tension and condition. (Replace if needed.)
7. Check sheave/pulley. (Replace if worn.)

### Reheat

1. Inspect elements.
2. Check wire connections. (Inside reheat box.)
3. Reheat amp draw.

L1

L2

L3

---

### Steam Generating Humidifier (if equipped)

1. Check drain valve/drain lines/trap for damage/clogs/leaks.
2. Check water fill valve and all supply lines/connection for leaks.
3. Check condition of steam hose.
4. Clean strainer.
5. Replace humidifier bottle, if necessary.
6. Check operation of humidifier.
7. Humidifier amp draw.

L1

L2

L3

---

### Infrared Humidifier (if equipped)

1. Check drain lines and trap for damage/clogs/leaks.
2. Check/clean pan for mineral deposits.
3. Clean reflector.
4. Check water make up valve/supply lines/connections for leaks.
5. Check humidifier lamps (replace if burnt out).
6. Check/re-torque wire connections (inside humidifier box).
7. Check humidifier high water alarm operation.
8. Humidifier amp draw.

L1

L2

L3

---

### Condensate Pump (if equipped)

1. Check for debris in sump.
2. Check operation of float(s) (free movement).
3. Check/clean discharge check valve.

**Electrical Panel**

- 1. Check fuses.
- 2. Check contactors for pitting. (Replace if pitted.)
- 3. Check/re-torque wire connections.

**Controls**

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

**Refrigeration Piping**

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

**Compressor Section (if equipped)**

- 1. Check oil level.
- 2. Check for oil leaks.
- 3. Check compressor mounts (springs/bushings).
- 4. Cap tubes (not rubbing).
- 5. Check/Re-torque wire connections (inside compressor box).
- 6. Compressor operation (vibration/noise).
- 7. Check crank case heater fuses/operation.
- 8. Check for refrigerant leaks.
- 9. Suction pressure.

Circuit #1 \_\_\_\_\_

- 10. Discharge pressure

Circuit #1 \_\_\_\_\_

- 11. Superheat

Circuit #1 \_\_\_\_\_

- 12. Low pressure switch cut out

Circuit #1 \_\_\_\_\_

- 13. Low pressure cut in

Circuit #1 \_\_\_\_\_

- 14. High pressure cut out

Circuit #1 \_\_\_\_\_

15. Amp draw

Circuit #1	L1	L2	L3
<hr/>			

**Water Cooled Condensers (if equipped)**

1. Verify proper water maintenance/treatment is being performed.
2. Check water regulating valve (motorized ball valve) operation.
3. Verify water flow.
4. Clean screen on Y strainer (if equipped).
5. Cap tubes (not rubbing).
6. Check condenser and supply/return lines/connections for water/glycol leaks.
7. Entering water temperature \_\_\_\_\_°.
8. Leaving water temperature \_\_\_\_\_°.

**Chilled Water/Vertiv™ Liebert® Econ-o-Coil (if equipped)**

1. Verify proper water maintenance is being performed.
2. Check coil and supply/return lines/connections for water/glycol leaks.
3. Stroke free cooling valve open and closed.

**Vertiv™ Liebert® MC if equipped)**

1. Coil clean of debris. (Clean coil if required).
2. Fans free of debris.
3. Fans securely mounted.
4. Motor bearings in good condition.
5. Check all refrigerant lines for vibration isolation. Support as necessary.
6. Check for refrigerant leaks.
7. Check surge protection device (if installed) status indicator lights.
8. Check/re-torque wire connections.
9. Check contactors for pitting (replace if pitted).
10. Verify operation sequence/setpoints.
11. Charge verification:
  - a. Outdoor ambient temperature: \_\_\_\_\_
  - b. Subcooling: \_\_\_\_\_
  - c. Indoor unit return air temperature: \_\_\_\_\_
  - d. Sight glass level (if Liebert® Lee-Temp or pumped refrigerant) \_\_\_\_\_

## 12. Motor amp draw

#1	L1	L2	L3
#2	L1	L2	L3

**Vertiv™ Liebert® Drycooler (if equipped)**

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

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

**Glycol Pump (if equipped)**

1. Check pump rotation.
2. Check pump and supply/return lines/connections for leaks.
3. Pump pressures.

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

## 4. Amp draw

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

5. Verify pump changeover (if multiple pumps).



# Appendices

## Appendix A: Technical Support and Contacts

### A.1 Technical Support/Service in the United States

Vertiv Group Corporation

24x7 dispatch of technicians for all products.

1-800-543-2378

Liebert® Thermal Management Products

1-800-543-2778

Liebert® Channel Products

1-800-222-5877

Liebert® AC and DC Power Products

1-800-543-2378

### A.2 Locations

#### United States

Vertiv Headquarters

1050 Dearborn Drive

Columbus, OH, 43085, USA

#### Europe

Via Leonardo Da Vinci 8 Zona Industriale Tognana

35028 Piove Di Sacco (PD) Italy

#### Asia

7/F, Dah Sing Financial Centre

3108 Gloucester Road

Wanchai, Hong Kong

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## Appendix B: Vertiv™ Liebert® PDX Model Number Detail

**Table B.1** below, describes each digit of the 25 digit configuration number. The 14 digit model number consists of the first 10 digits and last 4 digits of the configuration number.

**Table B.1 Liebert® PDX 25 Digit Configuration Number**

Model Number Digits 1 to 10										Model Details											Model Number Digits 11 to 14			
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
P	X	0	2	9	D	A	1	A	D	H	2	2	8	0	1	P	L	B	F	P	A	#	#	#

**Table B.2 Liebert® PDX Model Number Digit Definitions**

Digit	Description
Digits 1 and 2 = Unit Family PX = Liebert® PDX (DX)	
Digit 3, 4, 5 = Nominal Cooling Capacity, kW 011 018 023 029	
Digit 6 = Air Direction and Discharge D = Downflow for raised floor H = Downflow for solid floor - front 1 = Downflow for solid floor - front + right side 2 = Downflow for solid floor - front + left + right side 3 = Downflow for solid floor - front + left side U = Upflow w/Front Air Return C = Upflow w/Bottom Air Return	
Digit 7 = System Type A = Air Cooled W = Water/Glycol Cooled G = Liebert® GLYCOOL D = Dual Cool (Air Cooled + Liebert® Econ-o-Coil w/3-way MBV) H = Dual Cool (Water/Glycol Cooled + Liebert® Econ-o-Coil w/3-way MBV) 2 = Dual Cool (Air Cooled + Liebert® Econ-o-Coil w/2-way MBV) 3 = Dual Cool (Water/Glycol Cooled + Liebert® Econ-o-Coil w/2-way MBV)	
Digit 8 = Fan Type 1 = EC Plug Fans (variable speed)	

**Table B.2 Liebert® PDX Model Number Digit Definitions (continued)**

Digit	Description
Digit 9 = Power Supply	<p>A = 460 V - 3 ph - 60 Hz</p> <p>B = 575 V - 3 ph - 60 Hz</p> <p>C = 208 V - 3 ph - 60 Hz</p> <p>D = 230 V - 3 ph - 60 Hz</p> <p>2 = 380 V - 3 ph - 60 Hz</p>
Digit 10 = Compressor and Valve (R-410A)	<p>D = Digital Scroll w/TXV</p> <p>8 = Digital Scroll w/ Sound Jacket and TXV</p> <p>P = Digital Scroll w/ EEV</p> <p>9 = Digital Scroll w/ Sound Jacket and EEV</p> <p>S = Scroll w/TXV</p>
Digit 11 = Humidifier	<p>0 = No Humidifier</p> <p>H = Infrared Humidifier</p> <p>S = Steam Gen Canister Humidifier</p>
Digit 12 = Display	<p>2 = Liebert® iCOM™ (high definition)</p>
Digit 13 = Reheat	<p>0 = No Reheat</p> <p>2 = Electric Reheat (2-Stage)</p> <p>5 = SCR Reheat (PX011 w/digital scroll and System Type A or W only)</p>
Digit 14 = Air filter	<p>8 = MERV 8, 2-in. Pleated</p> <p>9 = MERV 11, 2-in. Pleated</p>
Digit 15 Coil, Valve Type and Pressure Rating <sup>1</sup>	<p>0 = Air Cooled Only</p> <p>B = Dual Cool/Air Cooled, 150 PSIG CW MBV</p> <p>E = Dual Cool/Air Cooled, 400 PSIG CW MBV</p> <p>1 = W/G, 2-way 150 PSIG Condenser MBV</p> <p>2 = W/G, 2-way 400 PSIG Condenser MBV</p> <p>7 = W/G, 3-way 150 PSIG Condenser MBV</p> <p>8 = W/G, 3-way 400 PSIG Condenser MBV</p>
Digit 16 = Enclosure Options	<p>1 = Standard Enclosure</p> <p>C = Double Skin Panels</p>

**Table B.2 Liebert® PDX Model Number Digit Definitions (continued)**

Digit	Description
Digit 17 = High voltage Options	M = Locking Disconnect P = Locking Disconnect with Condensate Pump
Digit 18 = Low Voltage Option Packages	O = None L = Low Voltage Terminal Package (LVTP) H = Reheat and Humidifier (R/H) Lockout D = LVTP and Remote Humidifier Contact (RHC) E = LVTP and R/H Lockout and RHC
Digit 19 = Monitoring	B = Base Comms and Connectivity
Digit 20 = Sensors	O = None S = Smoke Sensor H = High Temperature Sensor C = Compressor Overload Sensor F = Smoke and High Temperature Sensors A = Smoke and Compressor Overload Sensors K = Smoke, High Temperature and Compressor Overload Sensors
Digit 21 = Packaging	P = Domestic C = Wood Crate Export
Digit 22 = Factory Configuration Code	A = No SFA's (any alpha letter except S) S = SFA
Digit 23-25 = Factory Configuration Number	
1. High pressure MBV also results in high pressure Liebert® Econ-o-Coil valve.	

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## Appendix C: Vertiv™ Liebert® PCW Model Number Detail

**Table C.1** below, describes each digit of the 25 digit configuration number. The 14 digit model number consists of the first 10 digits and last 4 digits of the configuration number.

**Table C.1 Liebert® PCW 25 Digit Configuration Number**

Model Number Digits 1 to 10										Model Details										Model Number Digits 11 to 14				
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
P	W	0	2	9	D	C	1	A	D	H	2	2	8	H	1	P	L	B	F	P	A	#	#	#

**Table C.2 Liebert® PCW Model Number Digit Definitions**

Digit	Description
Digits 1 and 2 = Unit Family PW = Liebert® PCW (chilled water system)	
Digit 3, 4, 5 = Nominal Cooling Capacity, kW 011 017 029	
Digit 6 = Air Discharge D = Downflow for raised floor H = Downflow for solid floor - front 1 = Downflow for solid floor - front + right side 2 = Downflow for solid floor - front + left + right side 3 = Downflow for solid floor - front + left side U = Upflow w/ Front Air Return (Future) C = Upflow w/ Bottom Air Return (Future)	
Digit 7 = System Type C = Chilled Water	
Digit 8 = Fan Type 1 = EC plug Fan (variable speed)	
Digit 9 = Power Supply A = 460 V - 3 ph - 60 Hz B = 575 V - 3 ph - 60 Hz C = 208 V - 3 ph - 60 Hz D = 230 V - 3 ph - 60 Hz 2 = 380 V - 3 ph - 60 Hz	

**Table C.2 Liebert® PCW Model Number Digit Definitions (continued)**

Digit	Description
Digit 10 = Chilled Water Valve and Pressure	2 = 2-Way 150 PSIG Chilled Water Motorized Ball Valve 3 = 3-Way 150 PSIG Chilled Water Motorized Ball Valve 1 = 2-Way 400 PSIG Chilled Water Motorized Ball Valve T = 3-Way 400 PSIG Chilled Water Motorized Ball Valve
Digit 11 = Humidifier	0 = No humidifier H = Infrared Humidifier S = Steam Gen Canister Humidifier
Digit 12 = Display	2 = iCOM™ (high definition)
Digit 13 = Reheat	0 = No Reheat 2 = Electric Reheat (2-Stage) 4 = Hot Water Reheat (CW only)
Digit 14 = Air filter	8 = MERV 8, 2-in. Pleated 9 = MERV 11, 2-in. Pleated
Digit 15 = Coil	H = Chilled Water Unit
Digit 16 = Enclosure Options	1 = Standard Enclosure C = Double Skin Panels
Digit 17 = High voltage Options	M = Locking Disconnect P = Locking Disconnect with Condensate Pump
Digit 18 = Low Voltage Option Packages	0 = None L = Low Voltage Terminal Package (LVTP) H = Reheat and Humidifier (R/H) Lockout D = LVTP and Remote Humidifier Contact (RHC) E = LVTP and R/H Lockout and RHC
Digit 19 = Monitoring	B = Base Comms and Connectivity

**Table C.2 Liebert® PCW Model Number Digit Definitions (continued)**

Digit	Description
Digit 20 = Sensors	<ul style="list-style-type: none"> <li data-bbox="337 331 412 359">0 = None</li> <li data-bbox="337 373 480 401">S = Smoke Sensor</li> <li data-bbox="337 415 574 443">H = High Temperature Sensor</li> <li data-bbox="337 457 675 485">F = Smoke and High Temperature Sensors</li> </ul>
Digit 21 = Packaging	<ul style="list-style-type: none"> <li data-bbox="337 546 444 573">P = Domestic</li> <li data-bbox="337 588 521 615">C = Wood Crate Export</li> </ul>
Digit 22 = Factory Configuration code	<ul style="list-style-type: none"> <li data-bbox="337 680 651 707">A = No SFAs (any alpha letter except S)</li> <li data-bbox="337 722 402 749">S = SFA</li> </ul>
Digit 23-25 = Factory Configuration Number	

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## Appendix D: Submittal Drawings

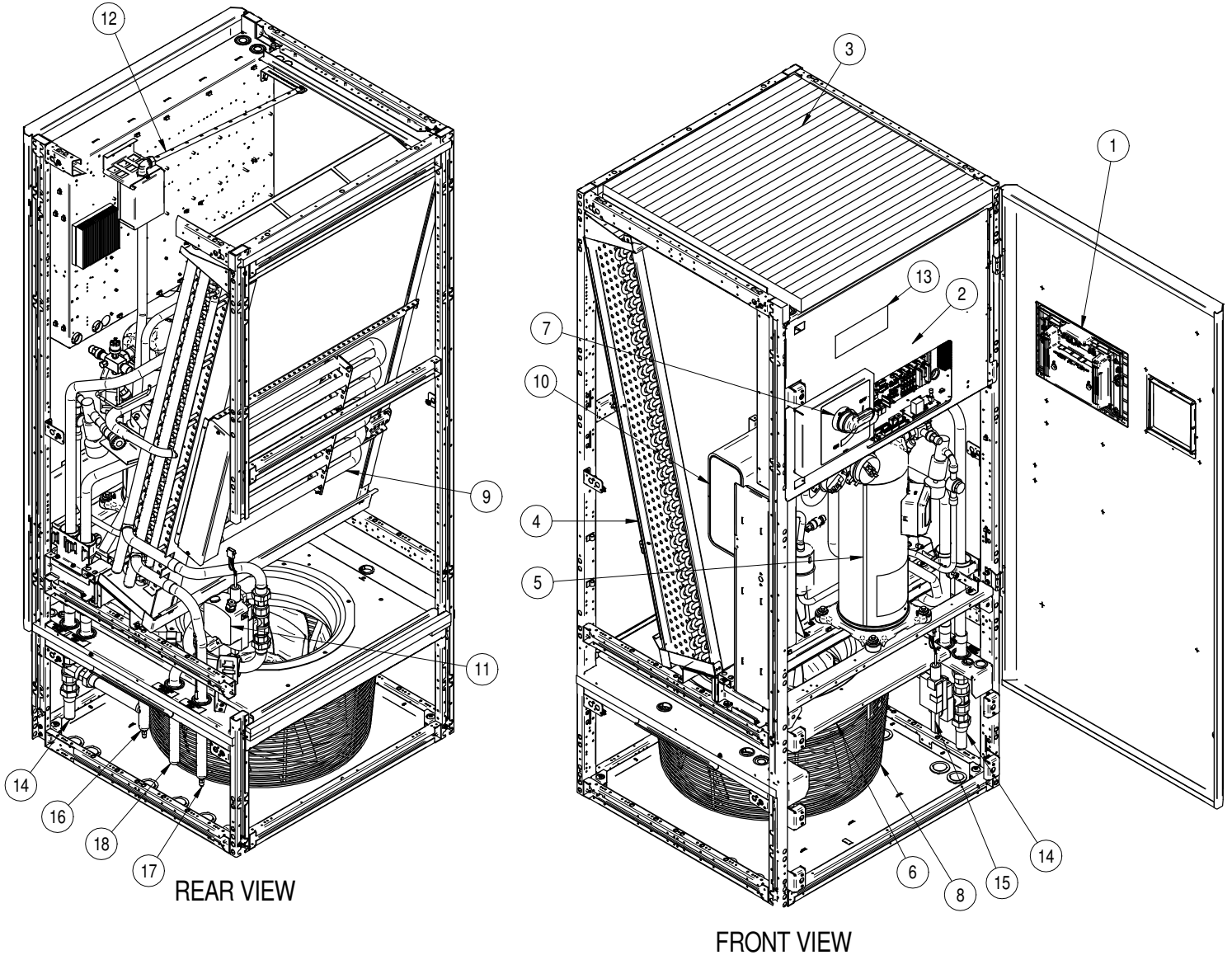
**Table D.1 Submittal Drawings Contents**

Document Number	Title
<b>Component Location Drawings</b>	
DPN003004	Liebert® PDX Component Location Diagram Downward Flow Models
DPN003005	Liebert® PDX Component Location Diagram, Upflow Models
DPN003020	Liebert® PCW Component Location Diagram, Downflow Models
DPN003021	Liebert® PCW Component Location Diagram, Upflow Models
<b>Dimension Planning Drawings--Downflow Units</b>	
DPN002936	Liebert® PDX/PCW Cabinet Dimensional Data, Downflow Models
DPN002944	Liebert® PDX/PCW Cabinet Dimensional Data, Downflow Floor Level Discharge Models
<b>Dimension Planning Drawings--Upflow Units</b>	
DPN002937	Liebert® PDX/PCW Cabinet Dimensional Data, Upflow Models
DPN002971, pg. 1	Liebert® PDX/PCW Cabinet Dimensional Data, Upflow Rear Return Models
<b>Dimension Planning Drawings--Floor Stands</b>	
DPN002970	Liebert® PDX/PCW Floor Stand and Floor Planning Dimensional Data
DPN002971, pg. 2	Liebert® PDX/PCW Dimensional Data, Upflow Rear Return Floor Stand
<b>Dimension Planning Drawings--Plenums</b>	
DPN002981	Liebert® PDX/PCW Plenum Dimensional Data, Upflow Discharge Grille
DPN003697	Liebert® PDX/PCW Plenum Dimensional Data, Upflow Discharge with Duct Collar
DPN003447	Liebert® PDX/PCW Plenum Dimensional Data, Top Discharge Upflow Units
DPN003610	Liebert® PDX/PCW Downflow Plenum Dimensional Data Downflow Return with Duct Collar
DPN003757	Liebert® PDX/PCW Downflow Unit with Field Duct Connection
<b>PDX Piping Schematics</b>	
DPN002929	Liebert® PDX Piping Schematic Air Cooled Models with TXV
DPN003954	Liebert® PDX Piping Schematic Air Cooled Models with EEV
DPN003843	Liebert® Piping Schematic Air Cooled Models with EEV
DPN003993	Liebert® PDX with EEV Air Cooled Piping Schematic Liebert® MC with Receiver above Unit
DPN002931	Liebert® PDX Piping Schematics Water/Glycol Models
DPN002932	Liebert® PDX Piping Schematics Liebert® GLYCOOL Models
DPN002972	Liebert® PDX Optional Piping Schematics Liebert® Econ-o-Coil Models
<b>PCW Piping Schematics</b>	
DPN002930	Liebert® PCW Piping Schematic Chilled Water Models
DPN003737	Liebert® PCW Optional Piping Schematic Hot Water Reheat

**Table D.1 Submittal Drawings Contents (continued)**

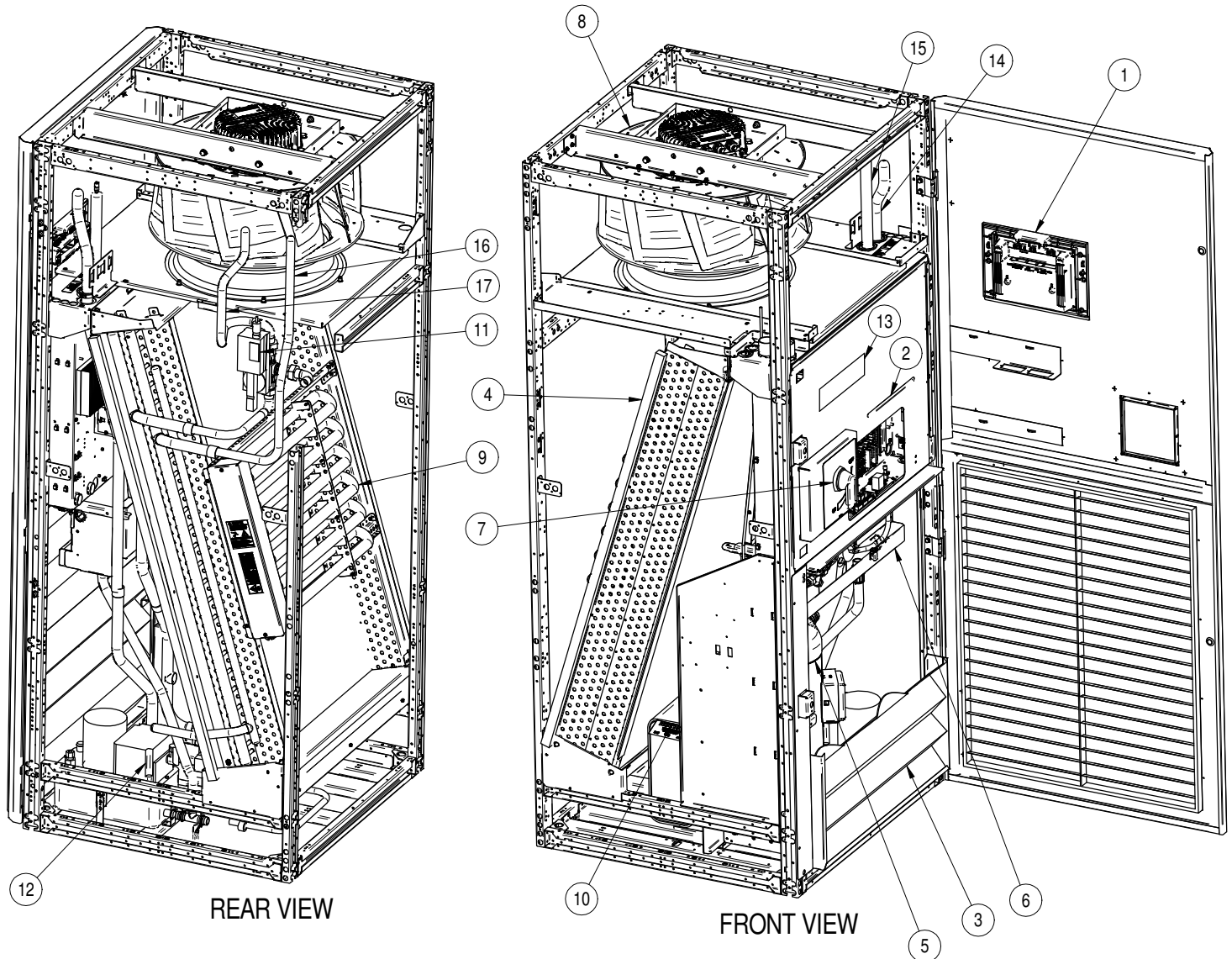
Document Number	Title
<b>Downflow Model Primary Connection Locations</b>	
DPN002938	Liebert® PCW Primary Connection Locations Downflow Air Cooled Models
DPN002945	Liebert® PDX Primary Connection Locations Downflow Front Discharge Air Cooled Models
DPN002942	Liebert® PDX Primary Connection Locations Downflow Water/Glycol Models
DPN002947	Liebert® PDX Primary Connection Locations Downflow Front Discharge Water/Glycol Models
DPN003520	Liebert® PDX Primary Connection Locations Downflow Liebert® GLYCOOL Models
DPN003522	Liebert® PDX Primary Connection Locations Downflow Front Discharge Liebert® GLYCOOL Models
DPN002940	Liebert® PCW Primary Connection Locations Downflow Chilled Water Units
DPN002946	Liebert® PCW Primary Connection Locations Downflow Front Discharge Models
<b>Upflow Model Primary Connection Locations</b>	
DPN002939	Liebert® PDX Primary Connection Locations Upflow Air Cooled Models
DPN002943	Liebert® PDX Primary Connection Locations Upflow/Water Glycol Models
DPN003521	Liebert® PDX Primary Connection Locations Upflow GLYCOOL Models
DPN002941	Liebert® PCW Primary Connection Locations Upflow Chilled Water Models
<b>Electrical Field Connection Drawings</b>	
DPN004594	Liebert® PDX/PCW Electrical Field Connections, Upflow and Downflow Models
DPN004595	Liebert® PDX/PCW Electrical Field Connections, Downflow Models
DPN004596	Liebert® PDX/PCW Electrical Field Connections, Upflow Models
DPN003266	Liebert® PDX CANbus & Interlock Connections between Liebert® PDX Unit and Liebert® MC
DPN002169	Liebert® MC Electrical Field Connections Premium Efficiency Control
DPN002374	Liebert® MC Electrical Field Connections Premium Efficiency Control with Lee-Temp
DPN003507	Liebert® iCOM™ Remote Temperature/Humidity Sensor
DPN004351	Liebert® iCOM™ Unit to Unit Network Connections Liebert® CW, Liebert® CWA, Liebert® DS, Liebert® DSE, Liebert® PDX, Liebert® PCW

**COMPONENT LOCATION DIAGRAM  
DOWNFLOW MODELS**



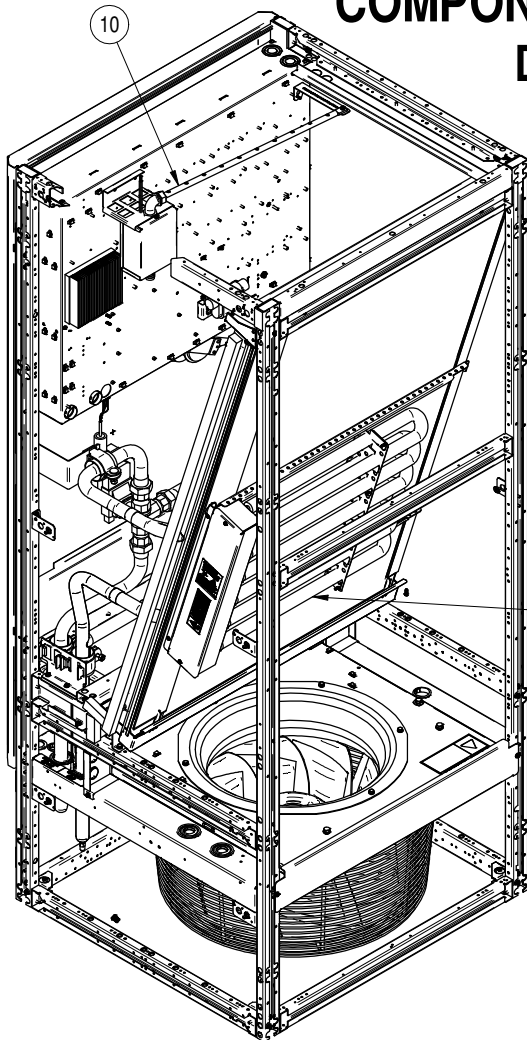
- |                                   |  |
|-----------------------------------|--|
| 1. Liebert® iCOM™ Control Display | 11. Econ-O-Coil Valve - GLYCOOL/Dual Cooling (optional)                                      |
| 2. Electric Box                   | 12. Smoke Detector (optional)  |
| 3. Filter                         | 13. Serial Tag   |
| 4. Evaporator Coil                | 14. Hot Gas Line (Air-Cooled) or Return Connection (Water/Glycol/GLYCOOL)                    |
| 5. Compressor                     | 15. Liquid Line Connection (Air-Cooled)  |
| 6. Infrared Humidifier (optional) | 16. Supply Connection (Water/Glycol)   |
| 7. Disconnect                     | 17. Supply Connection (GLYCOOL/Econ-O-Coil)  |
| 8. EC Fan                         | 18. Return Connection (Econ-O-Coil)  |
| 9. Electric Reheat (optional)     | 19. Steam Gen Humidifier (option not shown, located to the left hand side of the Compressor) |
| 10. Plate Condenser (optional)    |  |

**COMPONENT LOCATION DIAGRAM  
UPFLOW MODELS**

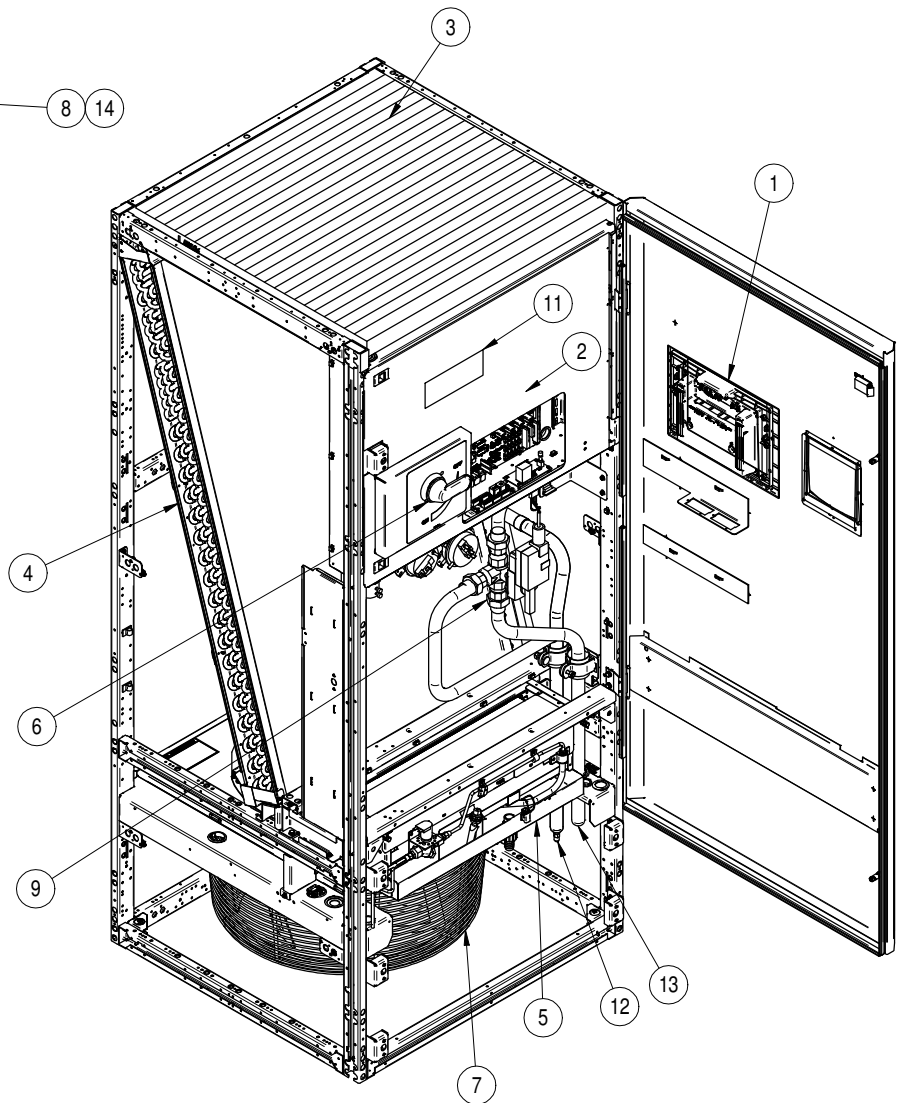


- |   |   |
|---|---|
| 1 Liebert® iCOM™ Control Display            | 30 Plate Condenser (optional)   |
| 2 Electric Box                              | 31 Econ-O-Coil Valve - GLYCOOL/Dual Cooling (optional)                    |
| 3 Filter (partial filter shown for clarity) | 32 Condensate Pump (optional)   |
| 4 Evaporator Coil                           | 33 Serial Tag   |
| 5 Compressor                                | 34 Hot Gas Line (Air-cooled) or Return Connection (Water/Glycol/GLYCOOL)  |
| 6 Infrared Humidifier (optional)            | 35 Liquid Line (Air-Cooled) or Return Connection (Water/Glycol)           |
| 7 Disconnect                                | 36 Supply Connection (GLYCOOL / Econ-O-coil)                              |
| 8 EC Fan                                    | 37 Return Connection (Econ-O-Coil)  |
| 9 Electric Reheat (optional)                | 38 Steam Gen Humidifier (option not shown, located above Condensate Pump) |

## COMPONENT LOCATION DIAGRAM DOWNFLOW MODELS



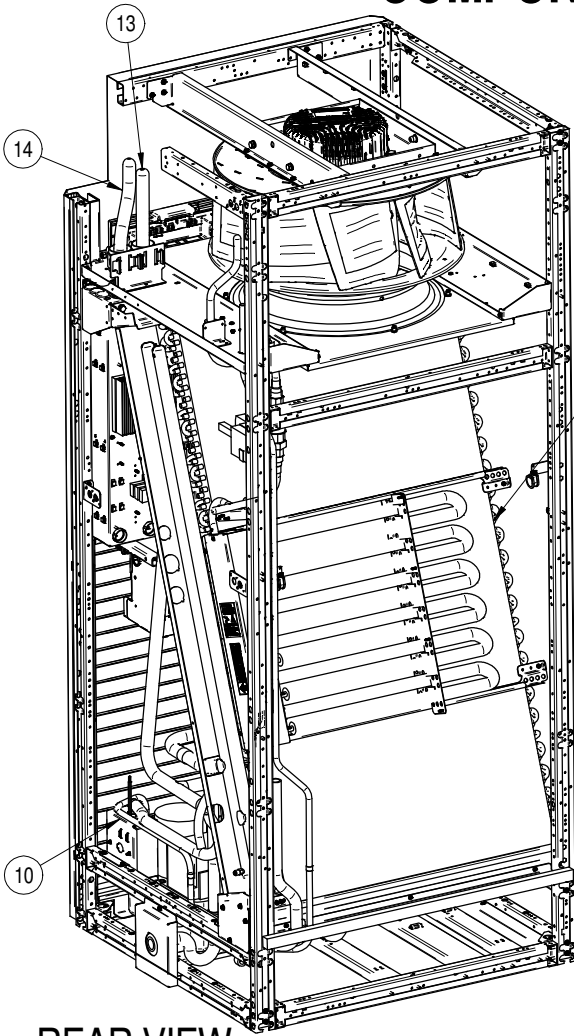
REAR VIEW



FRONT VIEW

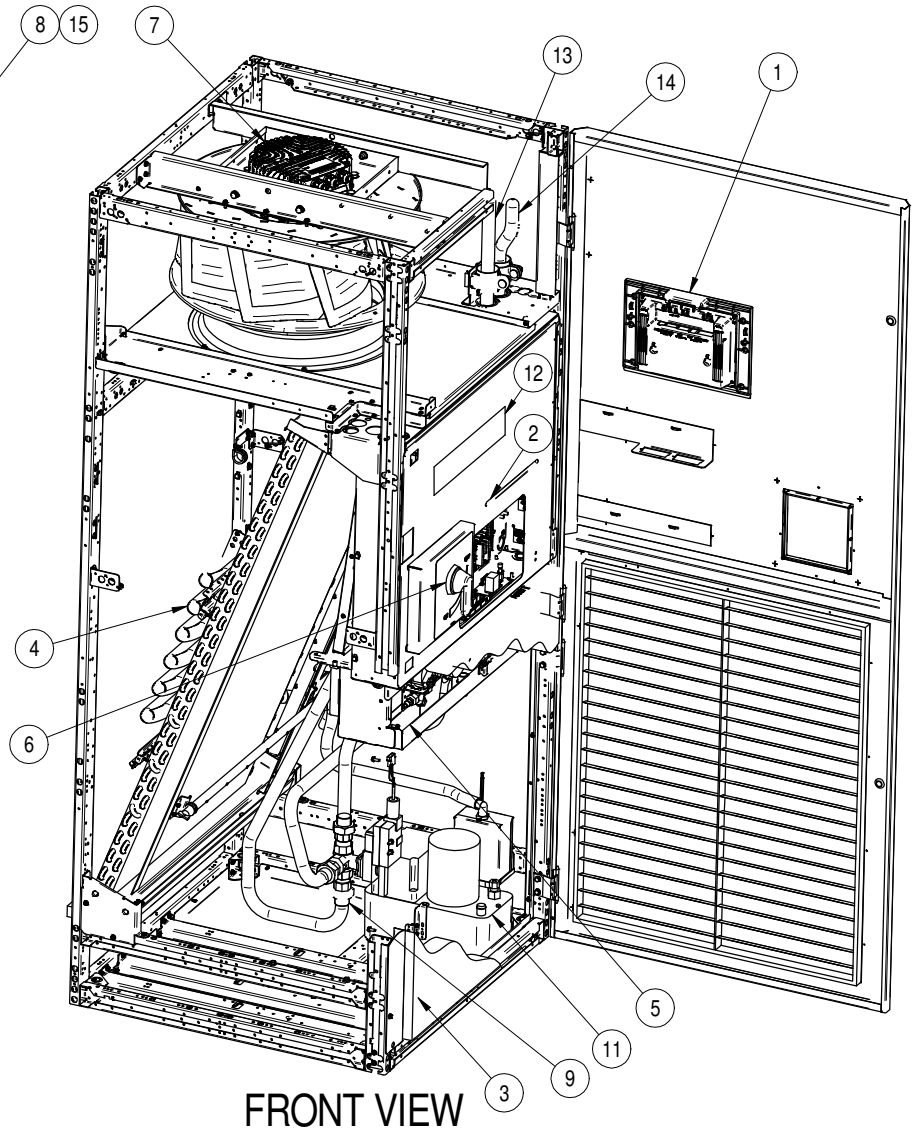
1. Liebert® iCOM™ Control Display
2. Electric Box
3. Filter
4. Chilled Water Coil
5. Infrared Humidifier (optional)
6. Disconnect
7. EC Fan
8. Electric Reheat (optional)
9. Chilled Water Valve
10. Smoke Detector (optional)
11. Serial Tag
12. Supply Connection - Chilled Water
13. Return Connection - Chilled Water
14. Hot Water Reheat Coil (option not shown, located in place of Electric Reheat)
15. Steam Gen Humidifier (option not shown, located to the left of the Chilled Water Valve)

## COMPONENT LOCATION DIAGRAM UPFLOW MODELS



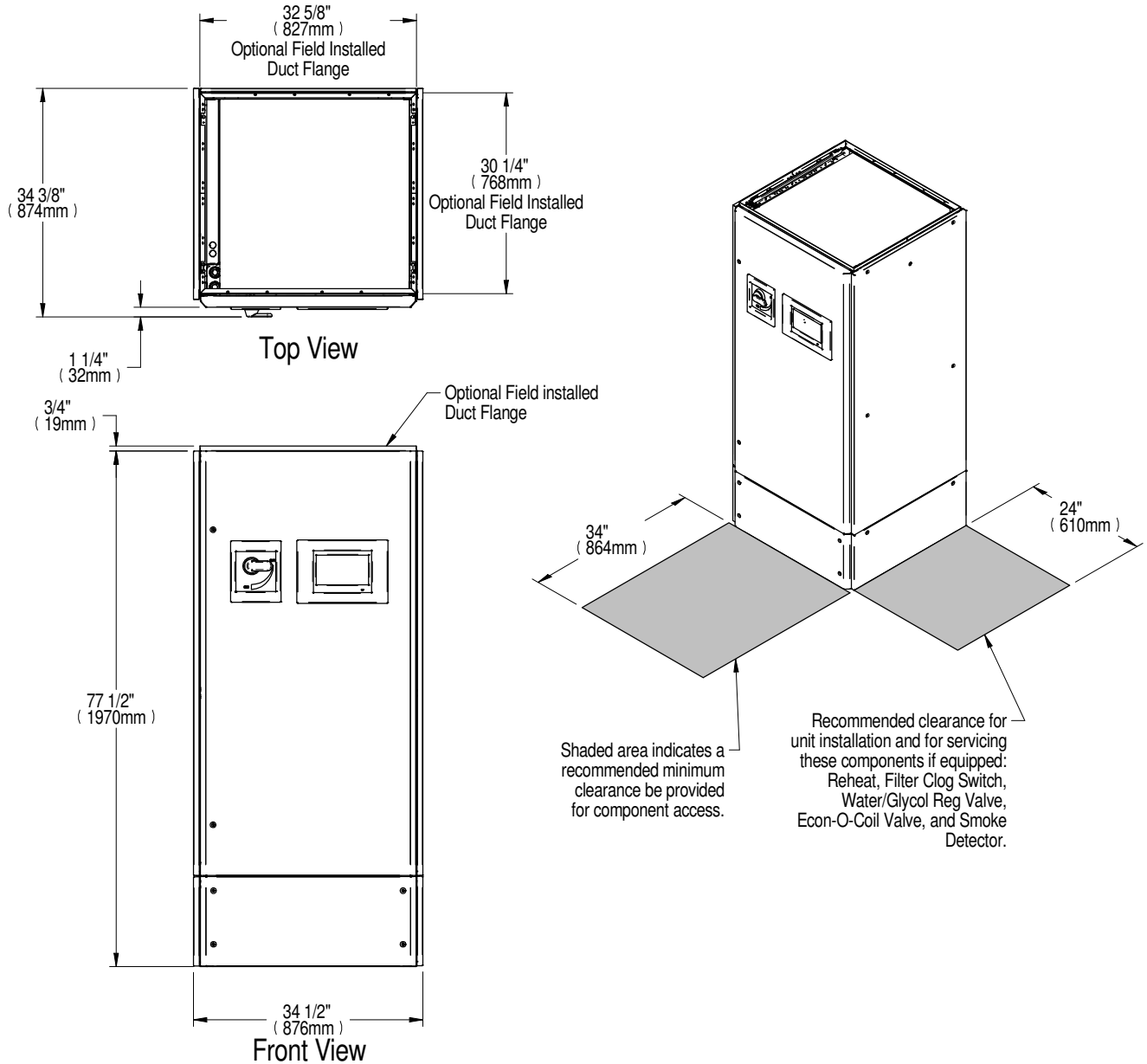
### REAR VIEW

1. Liebert® iCOM™ Control Display
2. Electric Box
3. Filter (partial filter shown for clarity)
4. Chilled Water Coil
5. Infrared Humidifier (optional)
6. Disconnect
7. EC Fan
8. Electric Reheat (optional)
9. Chilled Water Valve
10. Smoke Detector (optional)
11. Condensate Pump (optional)
12. Serial Tag
13. Supply Connection - Chilled Water
14. Return Connection - Chilled Water
15. Hot Water Reheat Coil  
(option not shown, located in place of Electric Reheat)
16. Steam Gen Humidifier  
(option not shown, located above Condensate Pump)



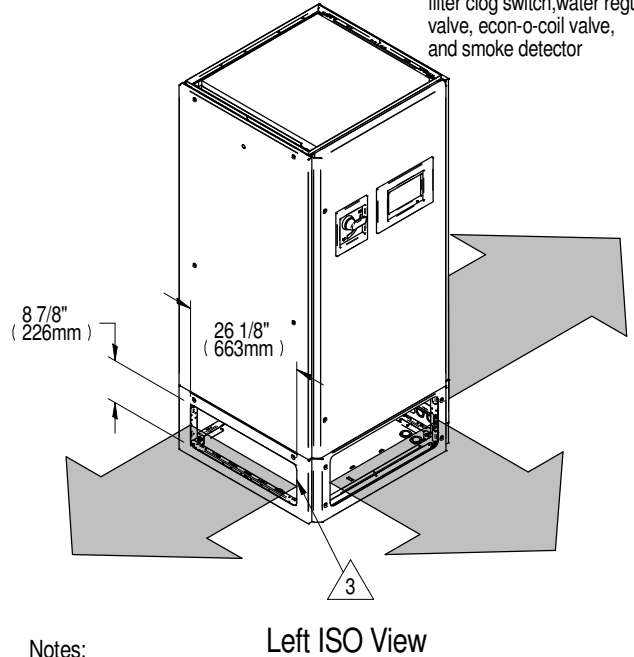
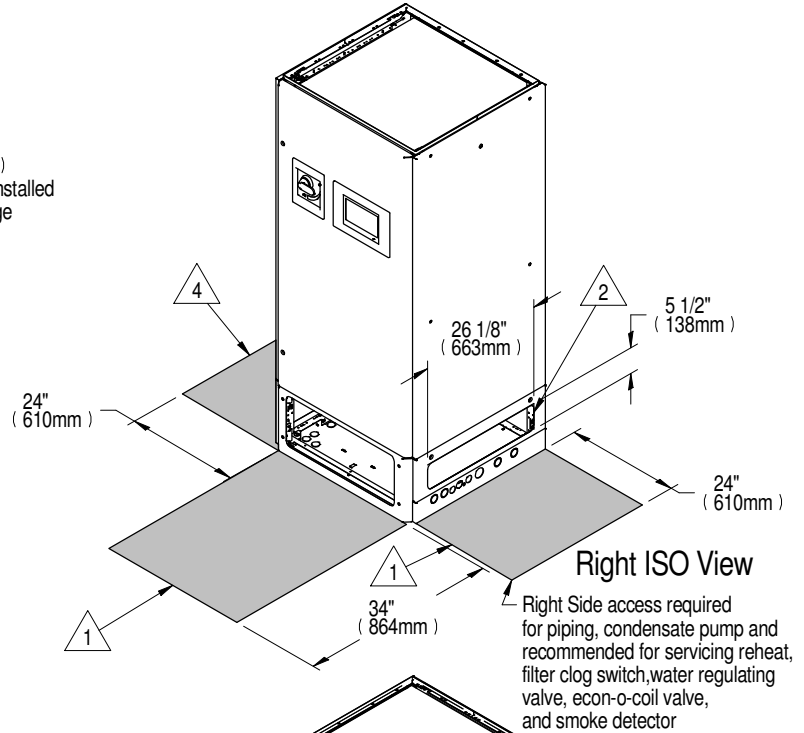
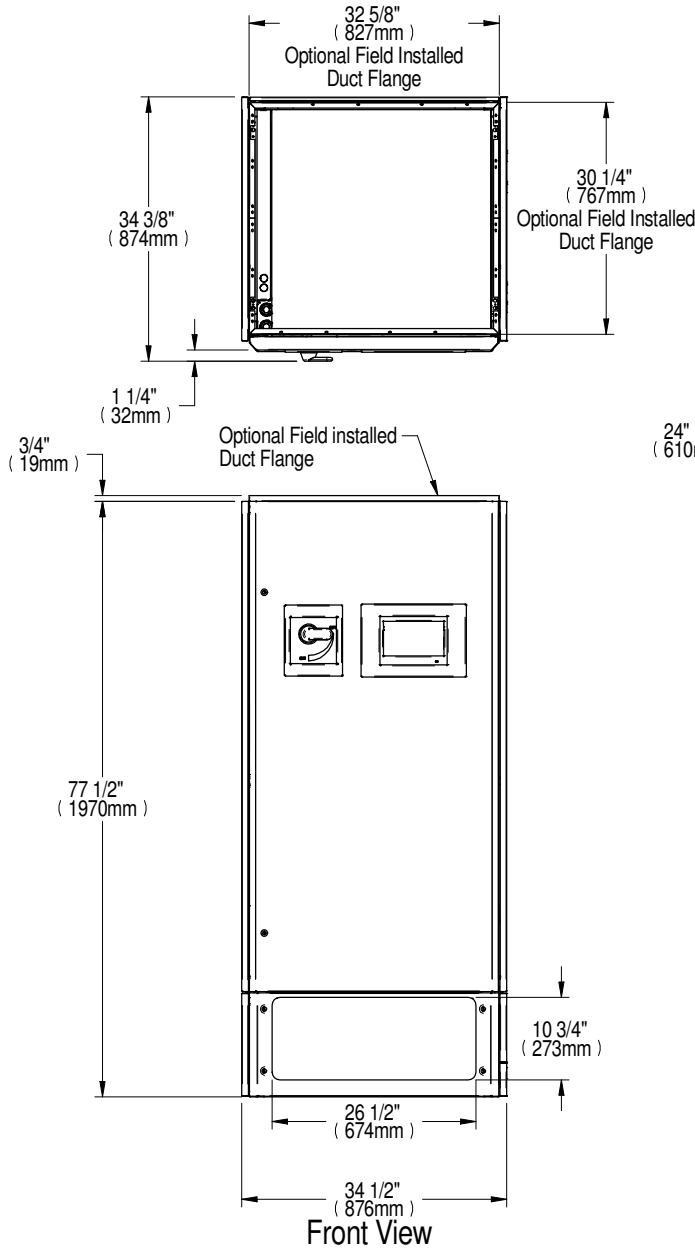
### FRONT VIEW

## CABINET DIMENSIONAL DATA DOWNFLOW MODELS



DRY WEIGHT lb (kg) APPROXIMATE			
Liebert® PDX Model No.	PX011	PX018-023	PX029
Air Cooled	600 (272)	670 (304)	700 (317)
Air Cooled w/dual cool	700 (317)	750 (340)	790 (358)
Water/Glycol	620 (281)	690 (313)	720 (327)
GLYCOOL or Water/Glycol w/Dual Cool	720 (327)	770 (349)	810 (367)
Liebert® PCW Model No.	PW011	PW017	PW029
Chilled Water	575 (260)	600 (272)	650 (294)

## CABINET DIMENSIONAL DATA DOWNFLOW FLOOR LEVEL DISCHARGE MODELS



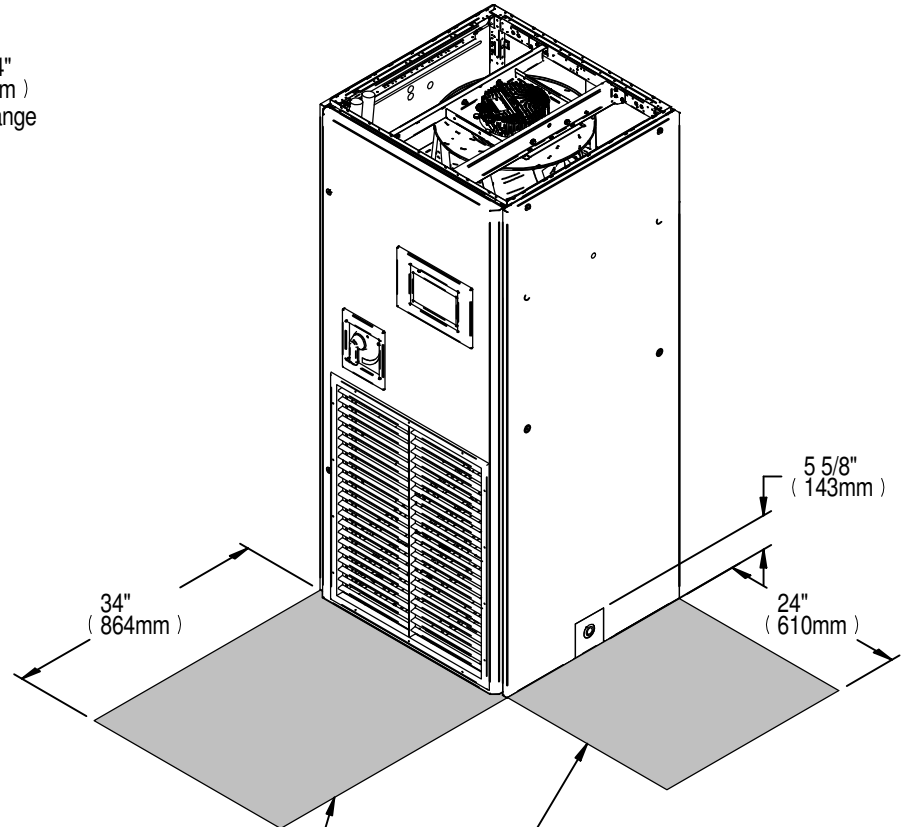
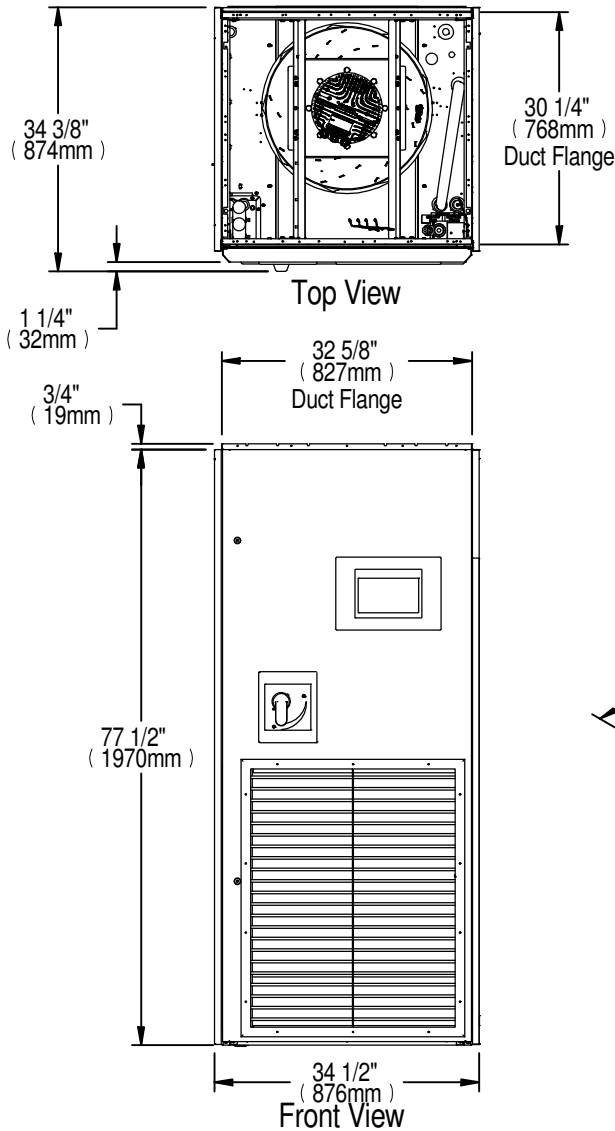
Notes:

1. Shaded area indicates a recommended minimum clearance be provided for component access and air discharge.
2. Optional opening for units with right side discharge or right and left side discharge.
3. Optional opening for units with left side discharge or right and left side discharge.
4. Shaded area indicates recommended clearance for air discharge.

DRY WEIGHT lb (kg) APPROXIMATE			
Liebert® PDX Model No.	PX011	PX018-023	PX029
Air Cooled	600 (272)	670 (304)	700 (317)
Air Cooled w/dual cool	700 (317)	750 (340)	790 (358)
Water/Glycol	620 (281)	690 (313)	720 (327)
GLYCOOL or Water/Glycol w/dual cool	720 (326)	770 (349)	810 (367)
Liebert® PCW Model No.	PW011	PW017	PW029
Chilled Water	575 (260)	600 (272)	650 (294)



## CABINET DIMENSIONAL DATA UPFLOW MODELS



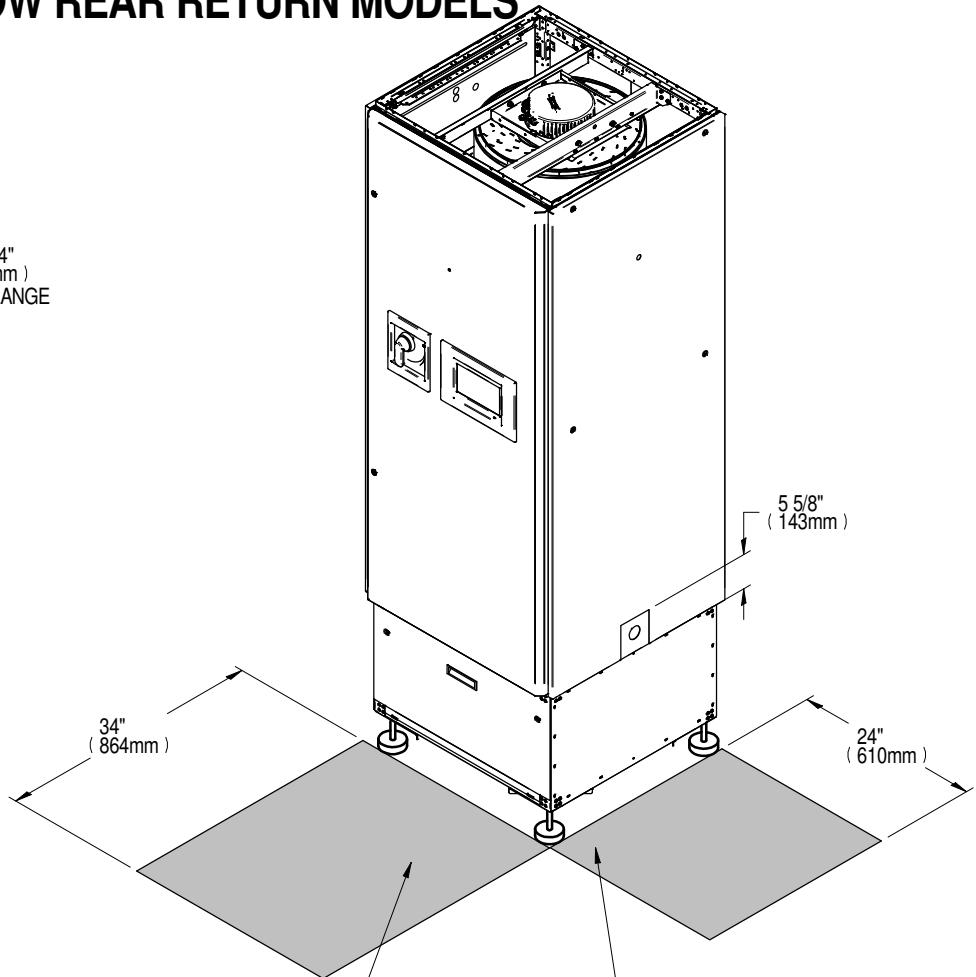
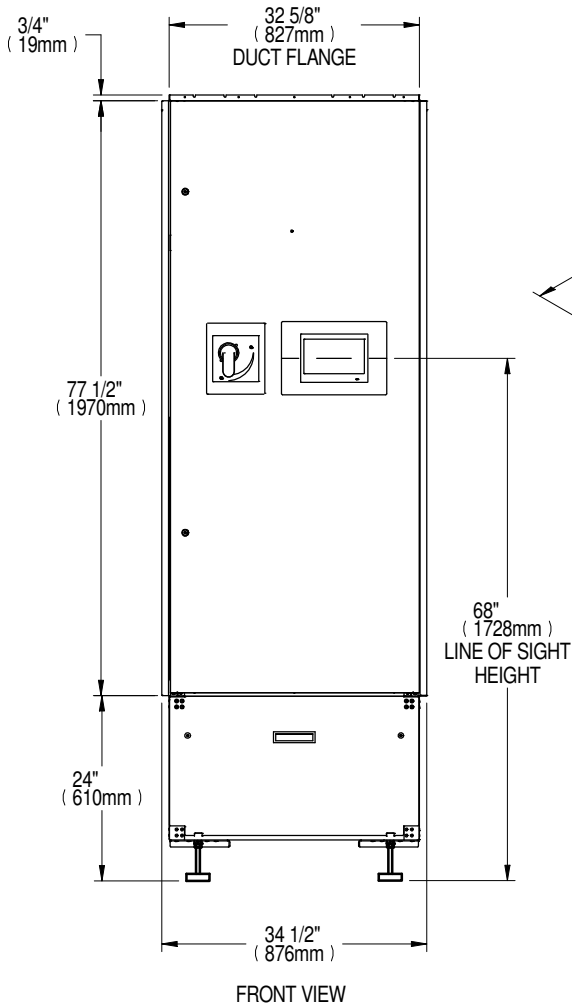
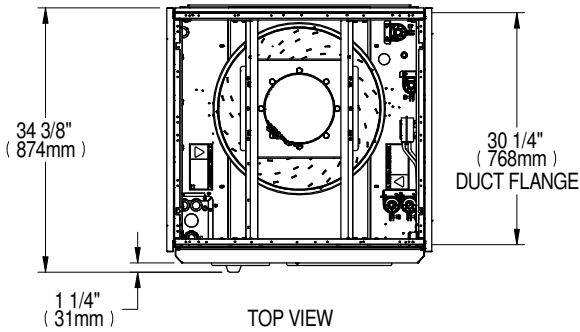
Shaded area indicates a recommended minimum clearance be provided for component access.

Recommended Clearance for unit installation and for servicing these components if equipped: Reheat, Filter Clog Switch, Econ-O-Coil Valve, or Gravity Drain Connections.

DRY WEIGHT lb (kg) APPROXIMATE			
Liebert® PDX Model No.	PX011	PX018-023	PX029
Air Cooled	600 (272)	670 (304)	700 (317)
Air Cooled w/dual cool	700 (317)	750 (340)	790 (358)
Water/Glycol	620 (281)	690 (313)	720 (327)
GLYCOOL or Water/Glycol w/dual cool	720 (327)	770 (349)	810 (367)
Liebert® PCW Model No.	PW011	PW017	PW029
Chilled Water	575 (260)	600 (272)	650 (294)

Note: Unit with front return shown. Bottom return with rear return floorstand is also available (24" height rear return floorstand is required for use with bottom return unit).

## CABINET DIMENSIONAL DATA UPFLOW REAR RETURN MODELS



Shaded area indicates a required minimum clearance for filter removal, includes any nonremovable floor supports.

Recommended Clearance for unit installation and for servicing these components if equipped: Reheat, Filter Clog Switch, Econ-O-Coil Valve, or Gravity Drain Connections.

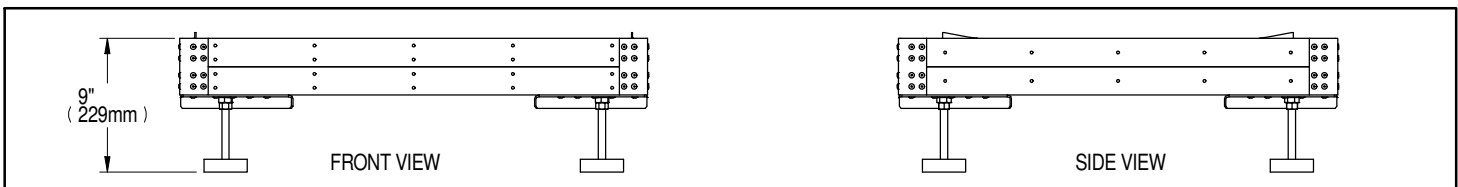
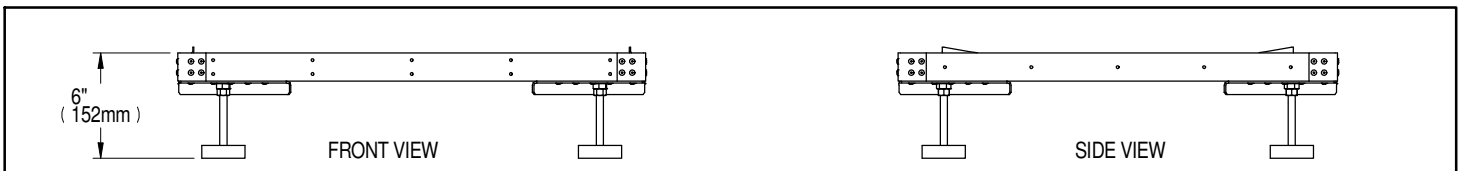
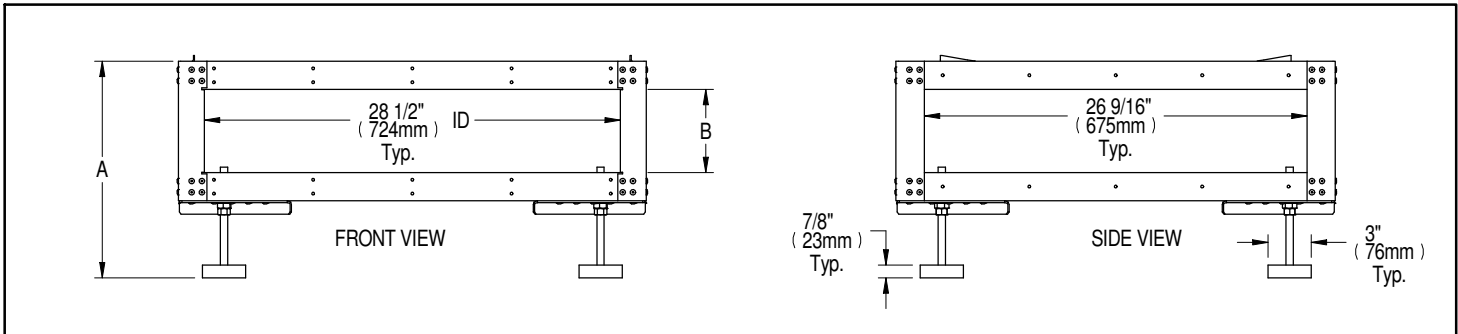
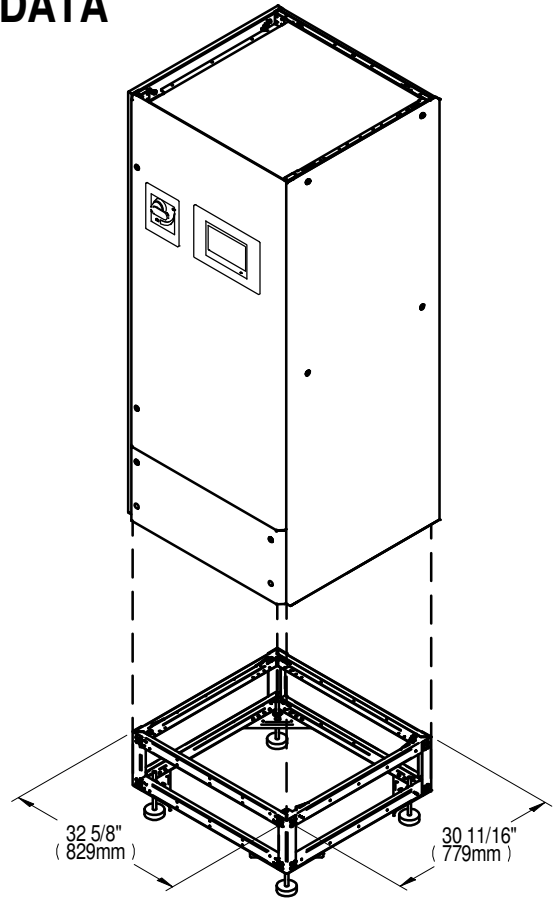
### DRY WEIGHT lb (kg) APPROXIMATE

Liebert® PDX Model No.	PX011	PX018-023	PX029
Air Cooled	700 (318)	770 (349)	800 (317)
Air Cooled w/dual cool	800 (363)	850 (386)	890 (358)
Water/Glycol	720 (327)	790 (358)	820 (327)
GLYCOOL or Water/Glycol w/dual cool	820 (372)	870 (395)	910 (367)
Liebert® PCW Model No.	PW011	PW017	PW029
Chilled Water	675 (306)	700 (318)	750 (340)

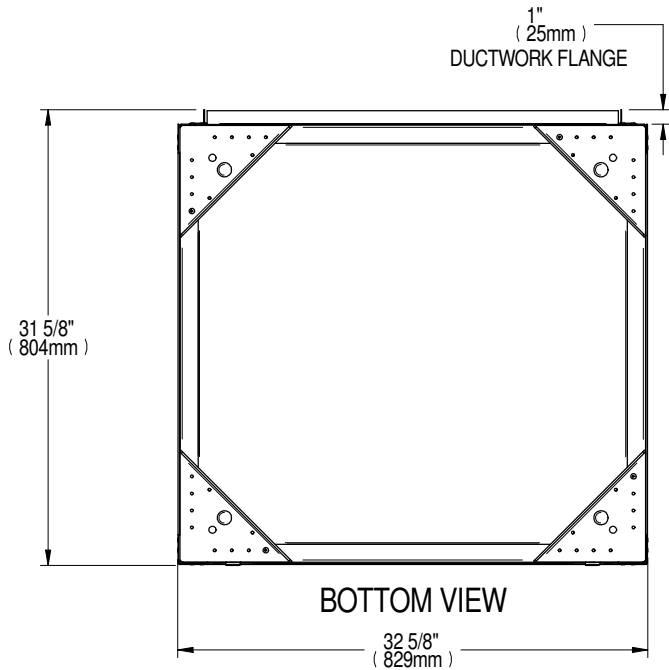
## FLOORSTAND & FLOOR PLANNING DIMENSIONAL DATA

Height in. (mm)	
A	B
12 (305)	2-3/4 (70)
15 (381)	5-3/4 (146)
18 (457)	8-3/4 (223)
21 (533)	11-3/4 (299)
24 (610)	14-3/4 (375)

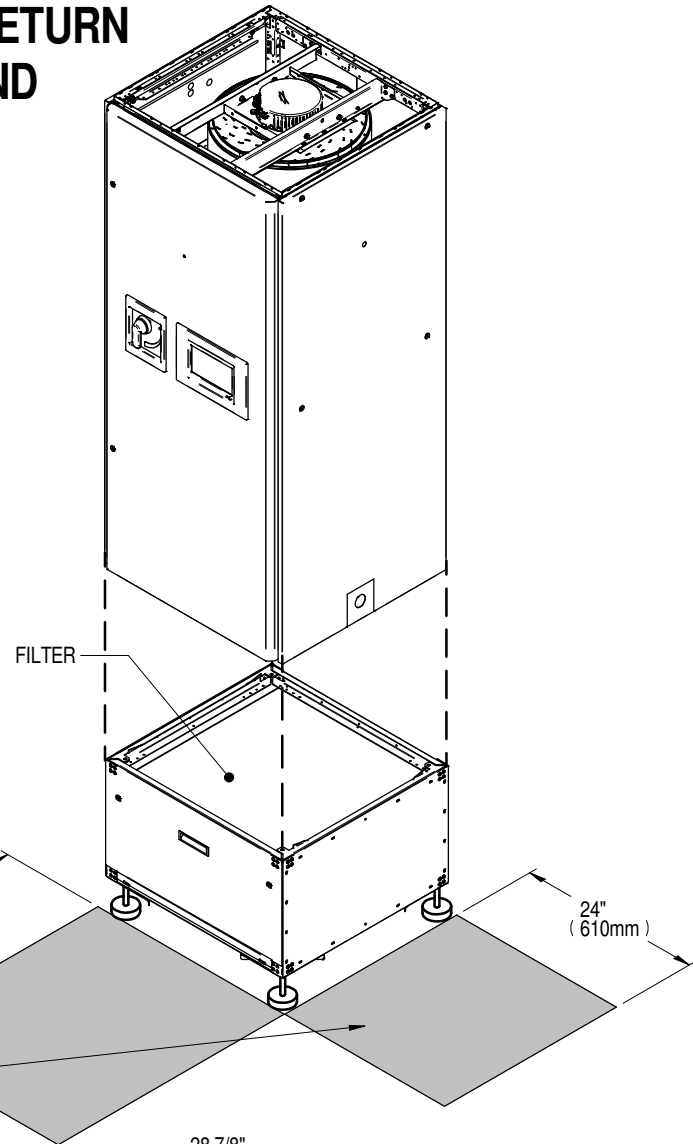
- NOTES:
1. Leveling feet are provided with  $\pm 1\text{-}1/2"$  (38mm) adjustment for all floorstands.
  2. Using the table above and the boxes to the left of the floorstand views select one floorstand size. If you have any difficulty please contact your Vertiv™ Sales Representative for assistance.



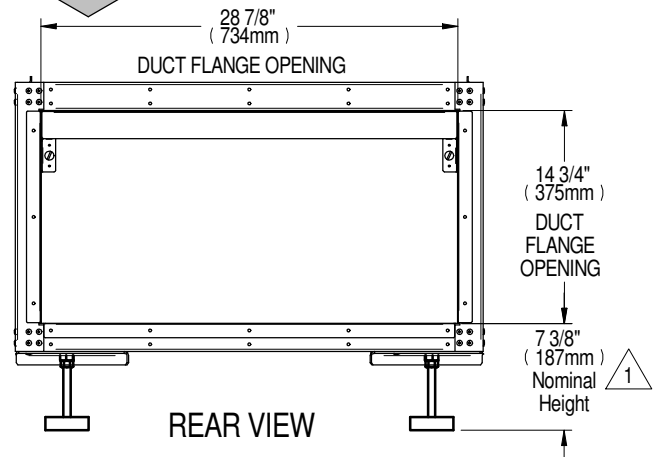
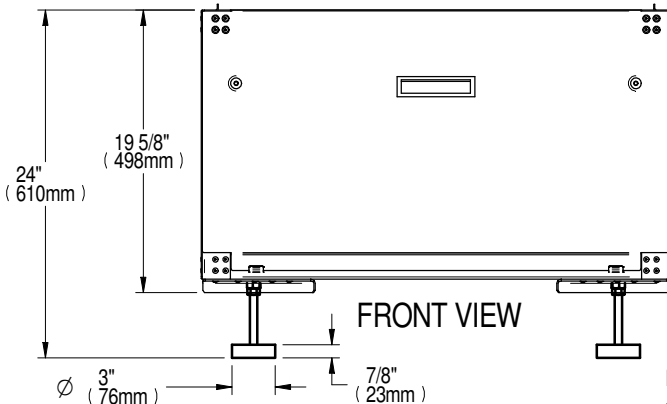
## DIMENSIONAL DATA UPFLOW REAR RETURN FLOORSTAND



Shaded area indicates a required minimum clearance for filter removal, includes any nonremovable floor supports.



Recommended Clearance for unit installation and for servicing these components if equipped:  
Reheat, Filter Clog Switch, Econ-O-Coil Valve, or Gravity Drain Connections.

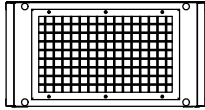


Note:

1. Leveling feet are provided with +/- 1-1/2" (38mm) adjustment from nominal height.
2. Rear Duct Flange connection is 1" (25mm) deep.

## PLENUM DIMENSIONAL DATA UPFLOW DISCHARGE GRILLE

FRONT VIEWS - CHECK ONE (1):

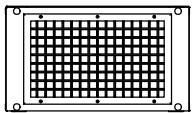


WITH GRILLE

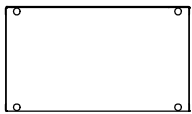


WITHOUT GRILLE

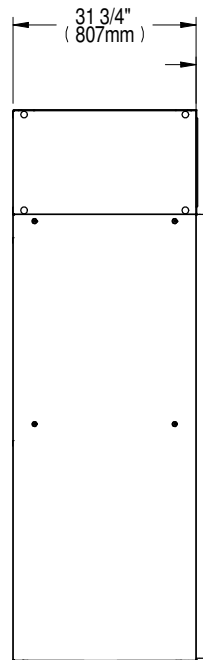
LEFT SIDE VIEWS -  
CHECK ONE (1):



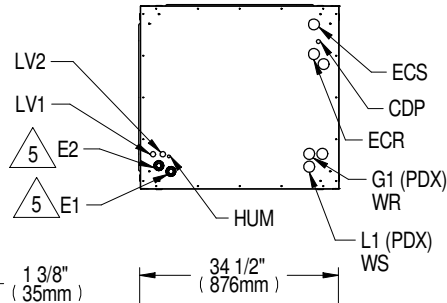
WITH GRILLE



WITHOUT GRILLE

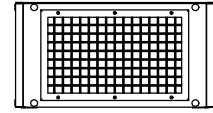


SIDE VIEW - UNIT WITH PLENUM

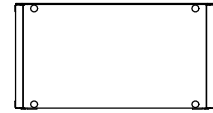


FRONT VIEW - UNIT WITH PLENUM

REAR VIEWS - CHECK ONE (1):

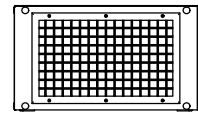


WITH GRILLE

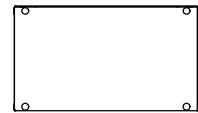


WITHOUT GRILLE



RIGHT SIDE VIEWS -  
CHECK ONE (1):



WITH GRILLE





WITHOUT GRILLE

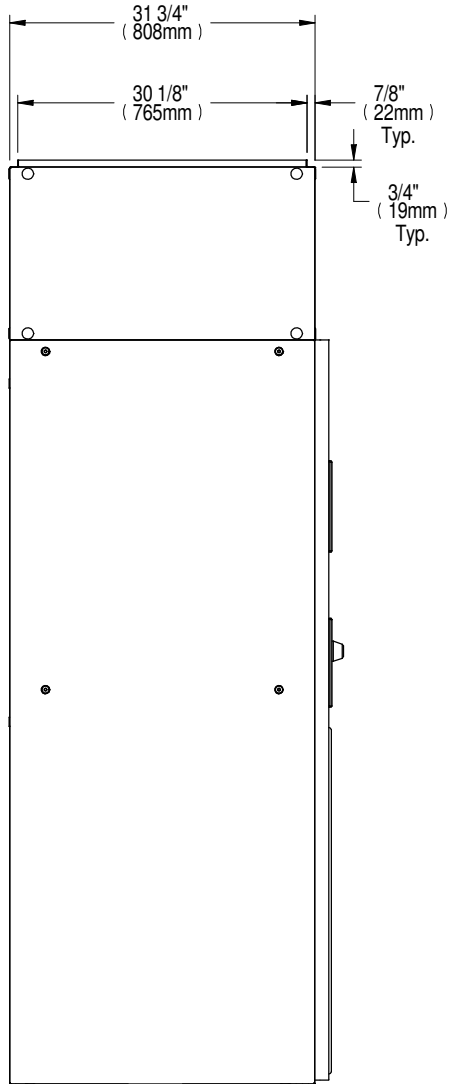
POINT	DESCRIPTION	X in. (mm)	Y in. (mm)	KNOCKOUT SIZE, in. (mm)
L1	LIQUID LINE SYSTEM 1	5-1/8 (130)	25-5/8 (651)	2 (51)
G1	HOT GAS DISCHARGE 1			
CDP	CONDENSATE DRAIN WITH PUMP	3-1/2 (89)	6-1/8 (155)	3/4 (19)
HUM	HUMIDIFIER SUPPLY LINE	29-1/2 (748)	26 (662)	1/2 (13)
WS	SUPPLY-CW/WATER/GLYCOL	5-1/8 (130)	25-5/8 (651)	2 (51)
WR	RETURN-CW/WATER/GLYCOL/GLYCOOL			
ECS	ECON-O-COIL SUPPLY  / GLYCOOL SUPPLY	4-1/4 (109)	3-1/8 (80)	
ECR	ECON-O-COIL RETURN 		8-1/4 (210)	
E1	ELECTRICAL CONN. (HIGH VOLT)	29-1/8 (739)	28-5/8 (728)	7/8 (23), 1-3/8 (35), 1-3/4 (44)
E2	ELECTRICAL CONN. (HIGH VOLT)	31-1/4 (793)	27-5/8 (702)	
LV1	ELECTRICAL CONN. (LOW VOLT)	32-1/4 (818)	25-5/8 (652)	1 (25)
LV2	ELECTRICAL CONN. (LOW VOLT)	30-1/2 (775)		

Notes:

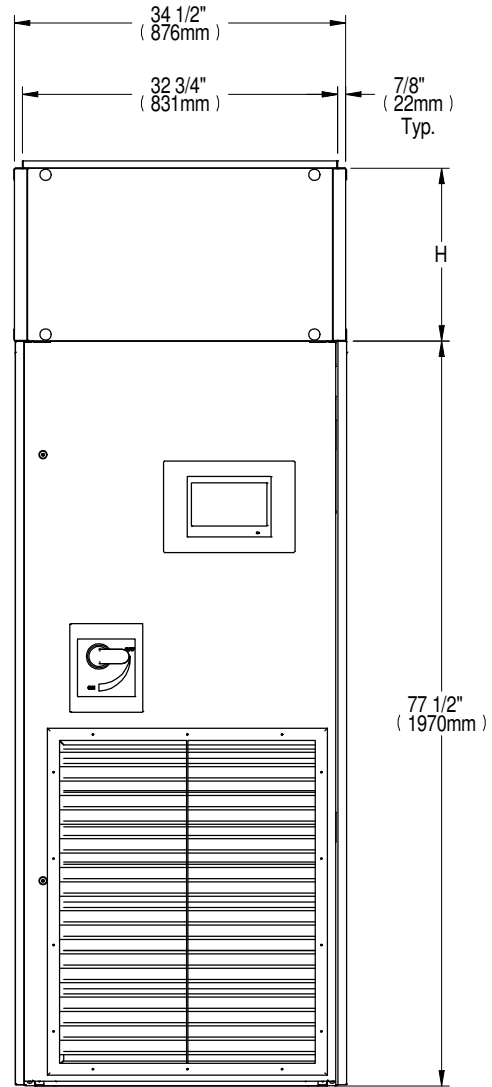
- Two grilles minimum per plenum required.  
The nominal grille size is 24" (609mm) x 14" (355mm).
- All Plenums are shipped flat (non-assembled) and must be assembled on site.
- Upflow bottom return units are available with required rear return floorstand with filter.

-  Units supplied with Dual Cooling systems only (4 pipe system).
-  Concentric knockouts to be used based on field supplied conduit diameter.

## PLENUM DIMENSIONAL DATA UPFLOW DISCHARGE W/ DUCT COLLAR



SIDE VIEW - UNIT WITH PLENUM



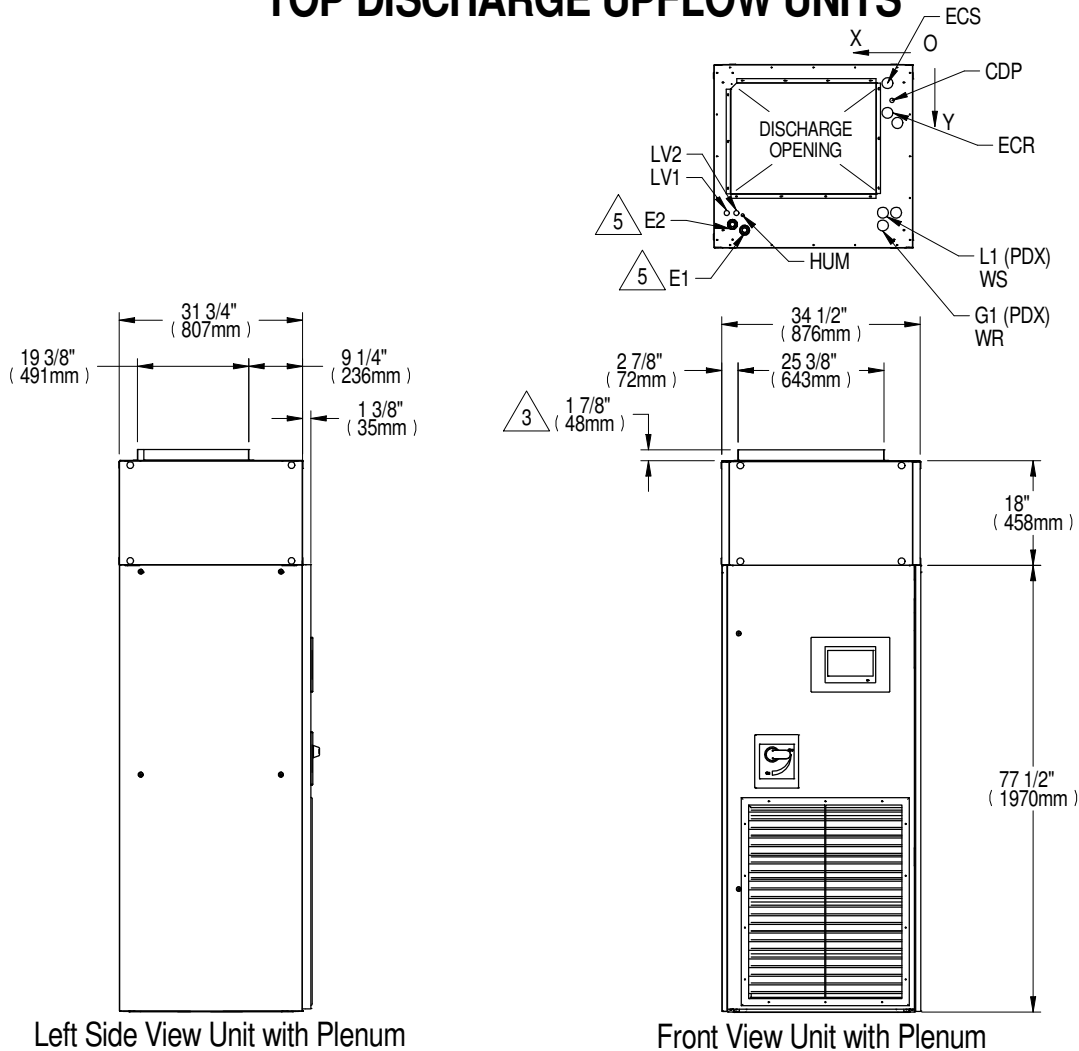
FRONT VIEW - UNIT WITH PLENUM

**Notes:**

1. Upflow unit shown with top discharge Plenum with duct collar.
2. All Plenums are shipped flat (non-assembled) and must be assembled on site.
3. Unit with front return shown. Upflow bottom return units are available with required rear return floorstand with filter.



	Height H in (mm)
<input type="checkbox"/>	18 (457)
<input type="checkbox"/>	24 (609)
<input type="checkbox"/>	30 (762)
<input type="checkbox"/>	36 (914)
<input type="checkbox"/>	42 (1066)
<input type="checkbox"/>	48 (1219)

## PLENUM DIMENSIONAL DATA TOP DISCHARGE UPFLOW UNITS






Left Side View Unit with Plenum

Front View Unit with Plenum

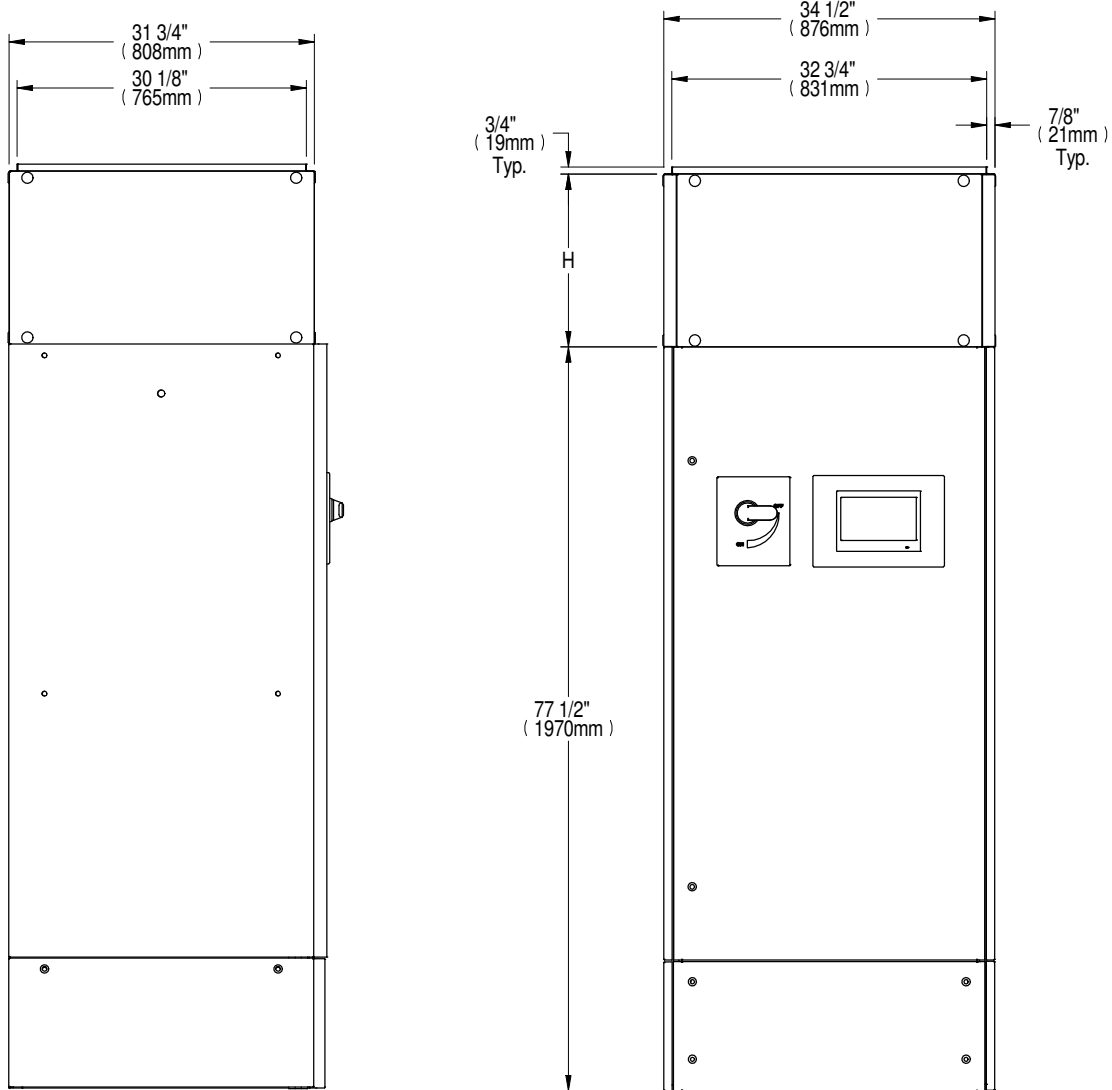
POINT	DESCRIPTION	X in. (mm)	Y in. (mm)	KNOCKOUT SIZE, in. (mm)
L1	LIQUID LINE SYSTEM 1		25-5/8 (651)	2 (51)
G1	HOT GAS DISCHARGE 1	5-1/8 (130)	27-7/8 (708)	
CDP	CONDENSATE DRAIN WITH PUMP	3-1/2 (89)	6-1/8 (155)	3/4 (19)
HUM	HUMIDIFIER SUPPLY LINE	29-1/2 (748)	26 (662)	1/2 (13)
WS	SUPPLY-CW/WATER/GLYCOL			2 (51)
WR	RETURN-CW/WATER/GLYCOL/GLYCOOL	5-1/8 (130)	25-5/8 (651)	
ECS	ECON-O-COIL SUPPLY  / GLYCOOL SUPPLY		3-1/8 (80)	2 (51)
ECR	ECON-O-COIL RETURN 	4-1/4 (109)	8-1/4 (210)	
E1	ELECTRICAL CONN. (HIGH VOLT)	29-1/8 (739)	28-5/8 (728)	7/8 (23), 1-3/8 (35), 1-3/4 (44)
E2	ELECTRICAL CONN. (HIGH VOLT)	31-1/4 (793)	27-5/8 (702)	
LV1	ELECTRICAL CONN. (LOW VOLT)	32-1/4 (818)		1 (25)
LV2	ELECTRICAL CONN. (LOW VOLT)	30-1/2 (775)	25-5/8 (652)	

Notes:

- Plenums are shipped flat (non-assembled) and must be assembled on site.
- Unit with front return shown. Upflow unit with bottom return are available, but requires a rear return floorstand with filter.
-  Plenums with inner liners the duct flange measures 1" (25mm).

-  Units supplied with Dual Cooling systems only (4 pipe system).
-  Concentric knockouts to be used based on field supplied conduit diameter.

## PLENUM DIMENSIONAL DATA DOWNFLOW RETURN W/ DUCT COLLAR



LEFT SIDE VIEW - WITH PLENUM

FRONT VIEW - UNIT WITH PLENUM

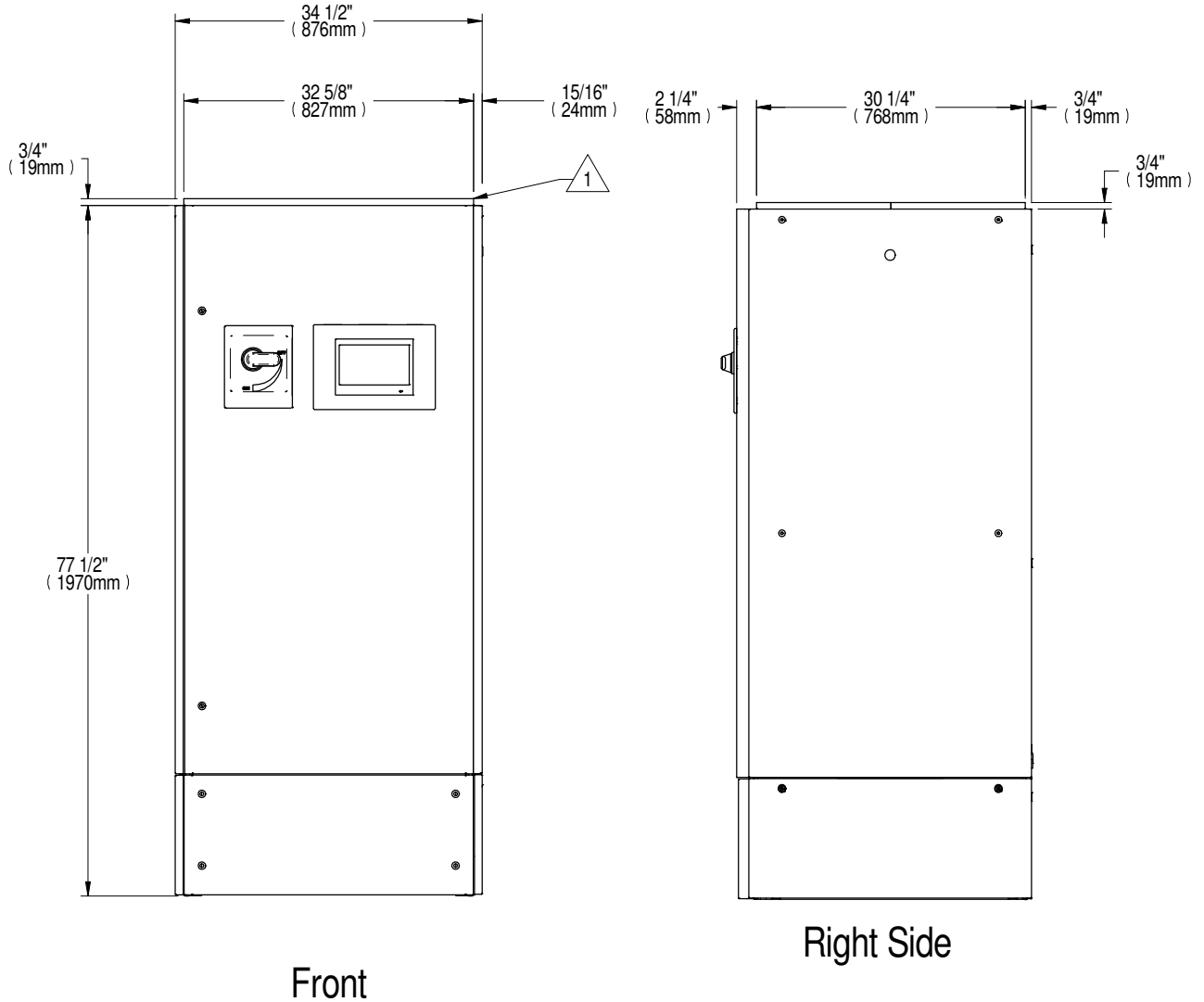
**Notes:**

1. All Plenums are shipped flat (non-assembled) and must be assembled on site.

	Height H in (mm)
<input type="checkbox"/>	18 (457)
<input type="checkbox"/>	24 (609)
<input type="checkbox"/>	30 (762)
<input type="checkbox"/>	36 (914)
<input type="checkbox"/>	42 (1066)
<input type="checkbox"/>	48 (1219)



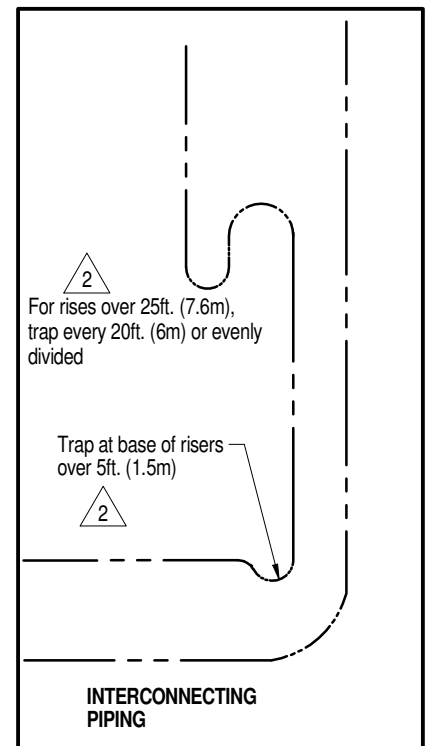
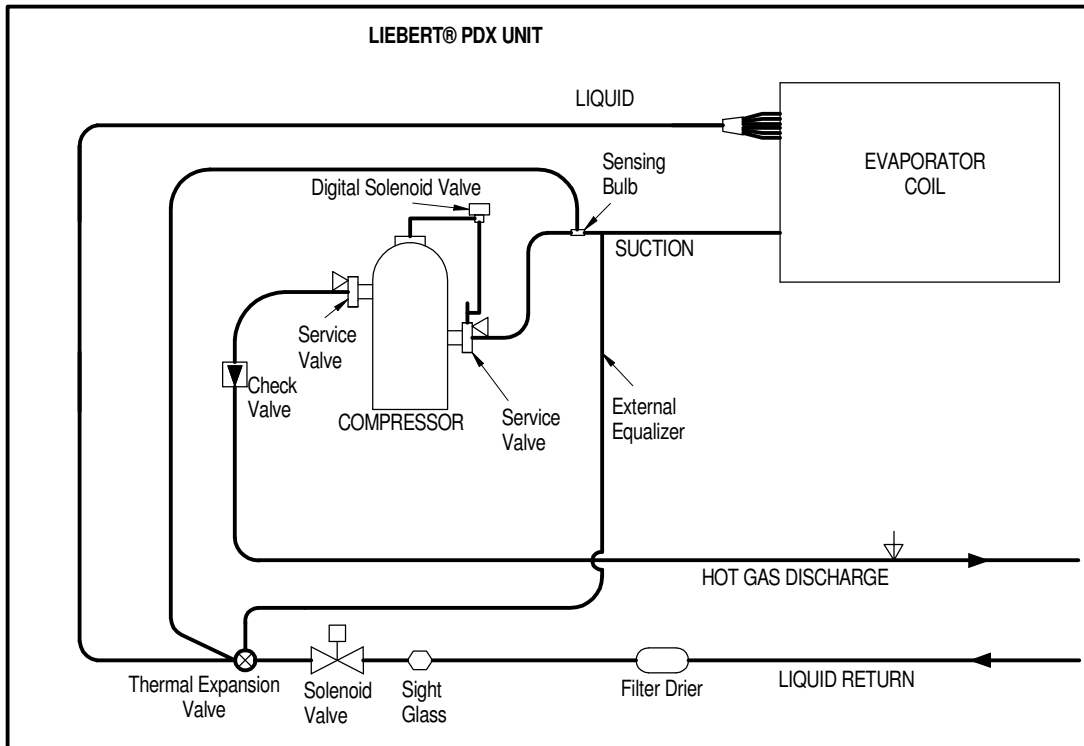
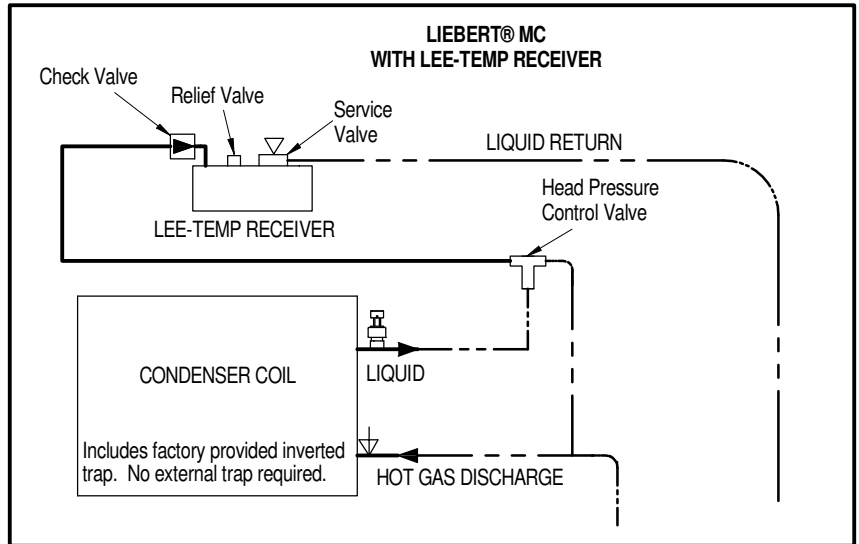
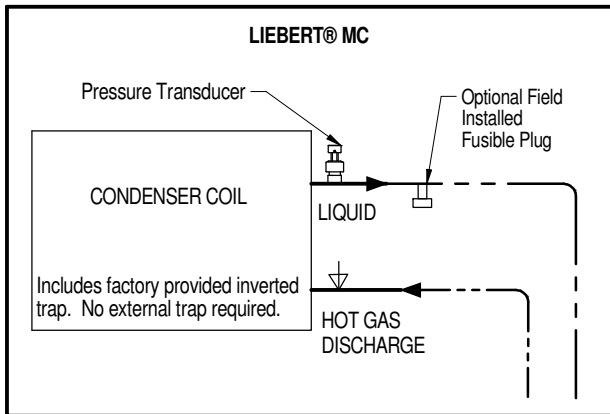
## DOWNFLOW UNIT WITH FIELD DUCT CONNECTION



Notes:

- 1. Duct collar kit is shipped loose and is field assembled.

## PIPING SCHEMATIC AIR COOLED MODELS WITH TXV

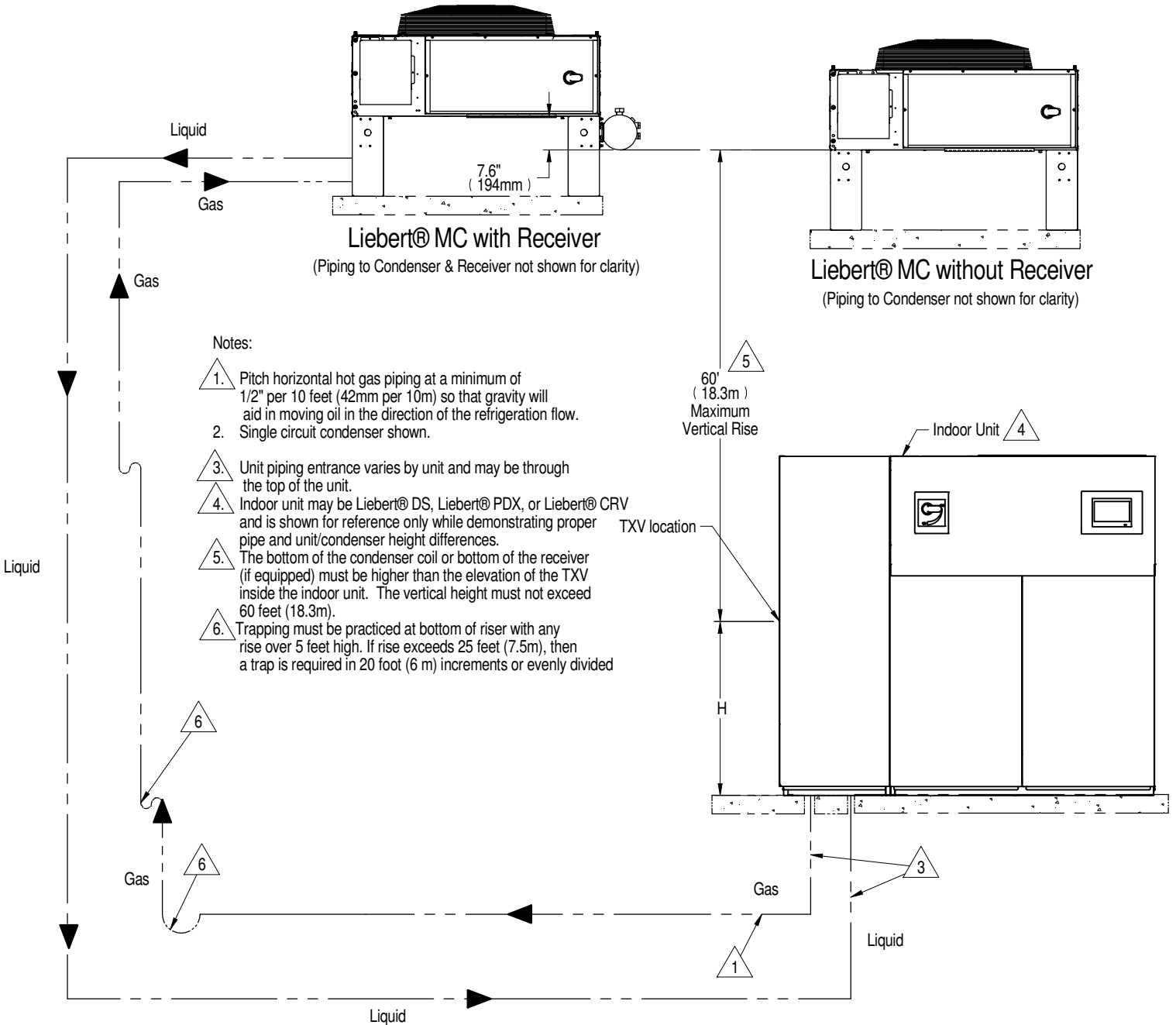


- FACTORY REFRIGERANT PIPING
- - - FIELD PIPING
- ▽ SERVICE / SCHRADER (ACCESS) CONNECTION NO VALVE CORE
- ▽ SERVICE / SCHRADER (ACCESS) CONNECTION WITH VALVE CORE

**Notes:**

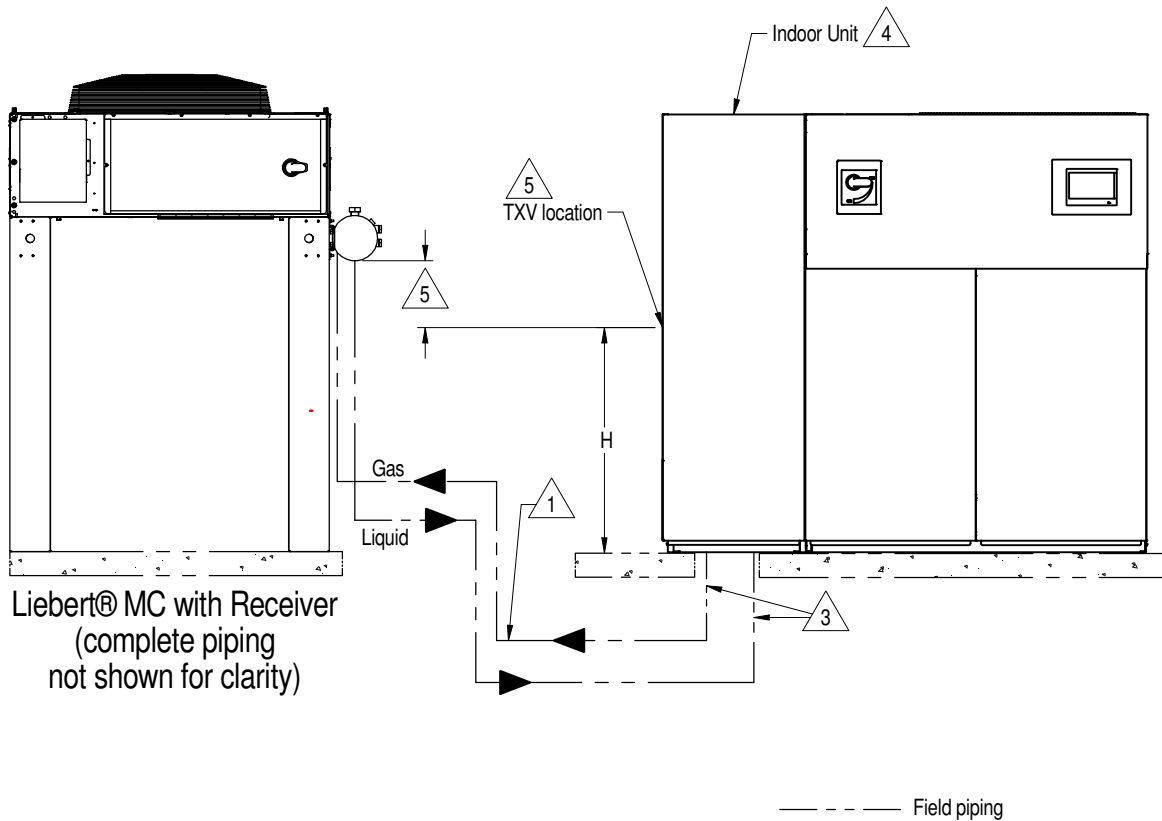
1. Schematic representation shown. Do not use for specific connection locations.
2. Components are not supplied by Liebert® but are required for proper circuit operation and maintenance.
3. Traps must be installed and horizontal lines pitched to ensure proper oil return and to reduce liquid floodback to compressor. Pitch horizontal hot gas piping at a minimum of 1/2" per 10 feet (42mm per 10m) so that gravity will aid in moving oil in the direction of the refrigeration flow.
4. Do not isolate any refrigerant circuits from over pressurization protection.

## AIR COOLED PIPING SCHEMATIC CONDENSER ABOVE INDOOR UNIT



Internal TXV Height	H in. (mm)
Liebert® PDX Downflow	44 (1118)
Liebert® PDX Upflow	20 (508)
Liebert® DS	43 (1092)
Liebert® CRV - CR019	45 (1143)
Liebert® CRV - CR020/CR035	27 (686)

## AIR COOLED PIPING SCHEMATIC CONDENSER AND INDOOR UNIT AT SAME LEVEL



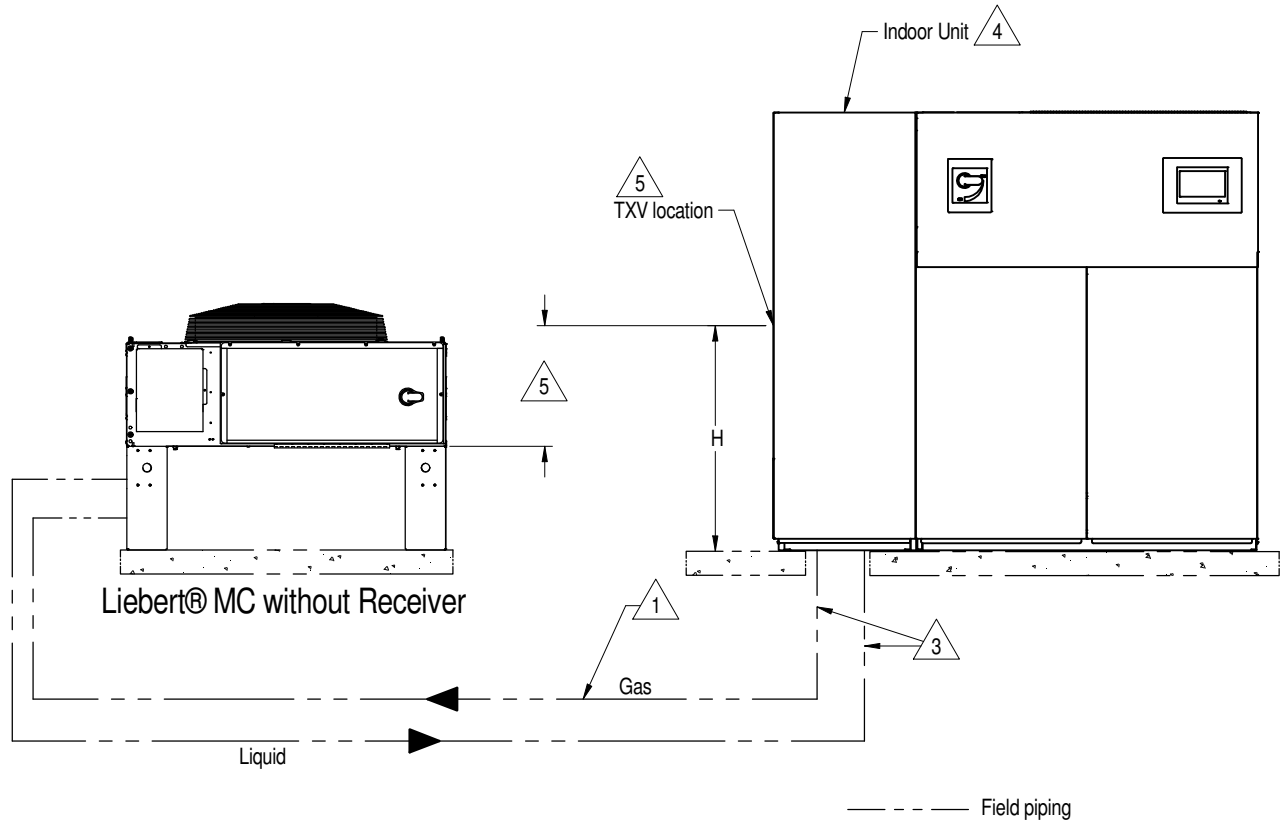
Liebert® MC with Receiver  
(complete piping  
not shown for clarity)

Notes:

1. Pitch horizontal hot gas piping at a minimum of 1/2" per 10 feet (42mm per 10m) so that gravity will aid in moving oil in the direction of the refrigeration flow.
2. Single circuit condenser shown.
3. Unit piping entrance varies by unit and may be through the top of the unit.
4. Indoor unit may be Liebert® DS, Liebert® PDX, or Liebert® CRV and is shown for reference only.
5. The bottom of the receiver must be higher than the elevation of the TXV inside the indoor unit, otherwise extended legs or a field piped subcooler needs to be utilized. Contact your Vertiv sales representative for additional information.

Internal TXV Height	H in. (mm)
Liebert® PDX Downflow	44 (1118)
Liebert® PDX Upflow	20 (508)
Liebert® DS	43 (1092)
Liebert® CRV - CR019	45 (1143)
Liebert® CRV - CR020/CR035	27 (686)

## AIR COOLED PIPING SCHEMATIC CONDENSER AND INDOOR UNIT AT SAME LEVEL

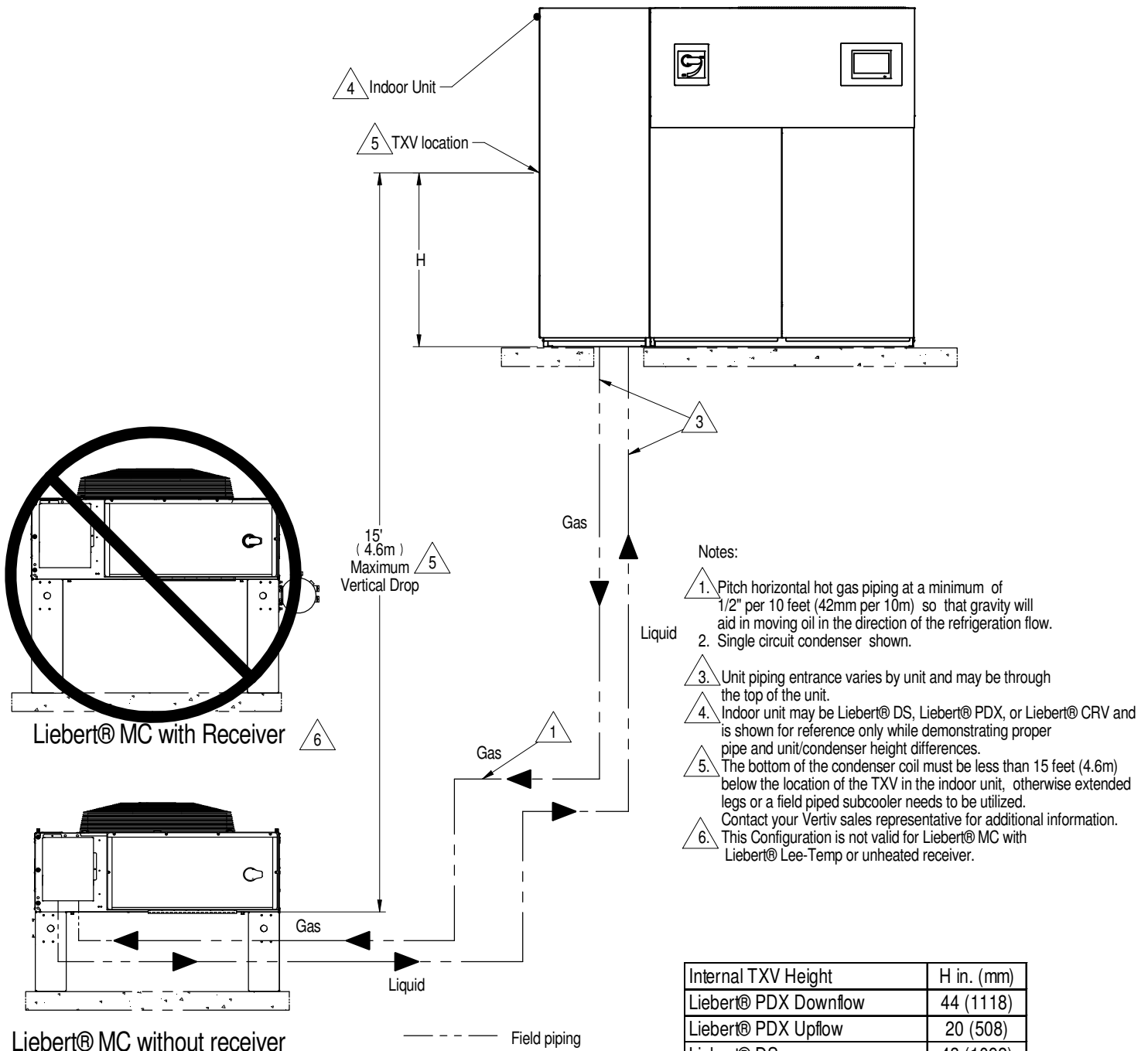


**Notes:**

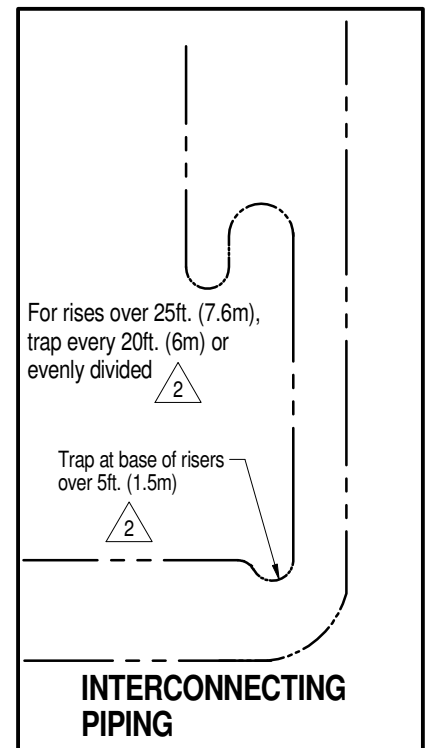
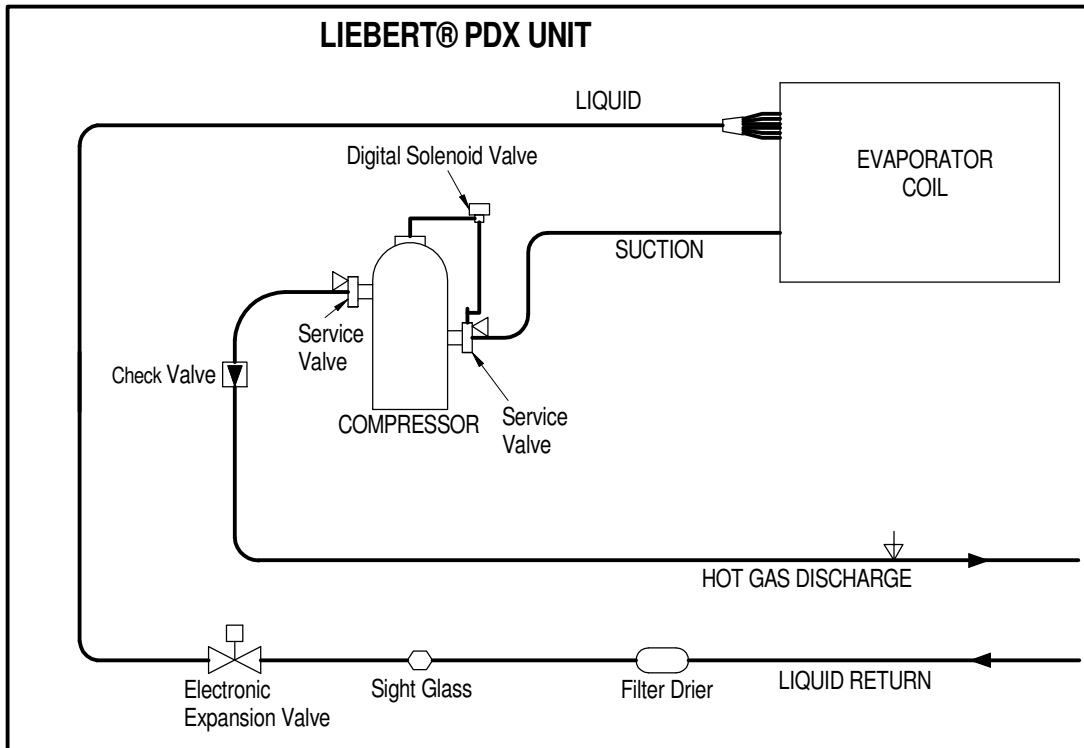
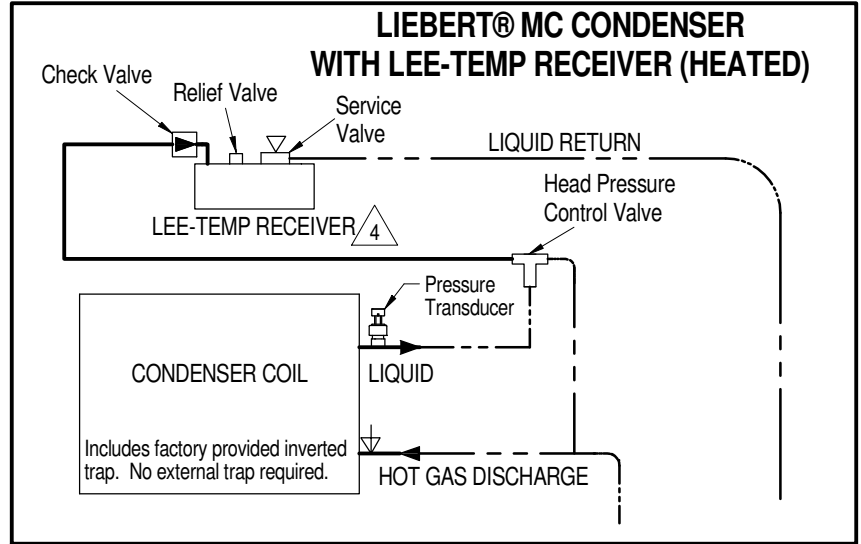
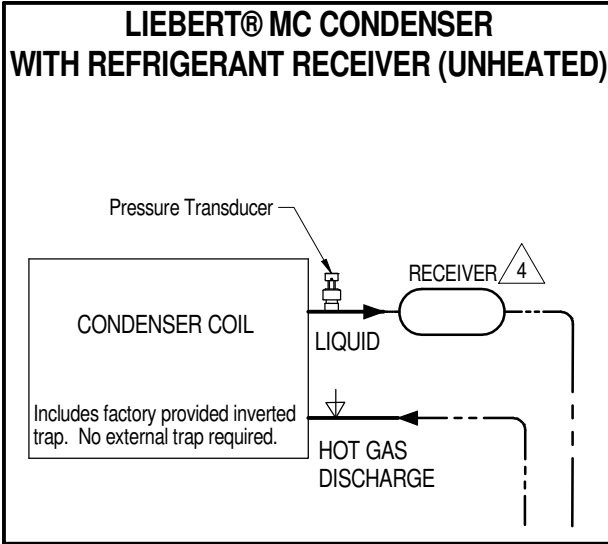
1. Pitch horizontal hot gas piping at a minimum of 1/2" per 10 feet (42mm per 10m) so that gravity will aid in moving oil in the direction of the refrigeration flow.
2. Single circuit condenser shown.
3. Unit piping entrance varies by unit and may be through the top of the unit.
4. Indoor unit may be Liebert® DS, Liebert® PDX, or Liebert® CRV and is shown for reference only.
5. The bottom of the coil must be less than 15' (4.6m) below the elevation of the TXV inside the indoor unit.  
Contact your Vertiv sales representative for additional information.

Internal TXV Height	H in. (mm)
Liebert® PDX Downflow	44 (1118)
Liebert® PDX Upflow	20 (508)
Liebert® DS	43 (1092)
Liebert® CRV - CR019	45 (1143)
Liebert® CRV - CR020/CR035	27 (686)

## AIR COOLED PIPING SCHEMATIC CONDENSER BELOW INDOOR UNIT



## PIPING SCHEMATIC AIR COOLED MODELS WITH EEV



————— FACTORY REFRIGERANT PIPING  
- - - - - FIELD PIPING

▽ SERVICE/SCHRADER (ACCESS) CONNECTION, NO VALVE CORE.  
▽ SERVICE/SCHRADER (ACCESS) CONNECTION, WITH VALVE CORE.

**Notes:**

- Schematic representation shown. Do not use for specific connection locations.
- Components are not supplied by Liebert but are required for proper circuit operation and maintenance.
- Traps must be installed and horizontal lines pitched to ensure proper oil return and to reduce liquid floodback to compressor. Pitch horizontal hot gas piping at a minimum of 1/2" per 10 feet (42mm per 10m) so that gravity will aid in moving oil in the direction of the refrigeration flow.
- Refrigerant receiver or Lee-temp receiver required with Liebert® PDX unit with EEV option. The outlet of the receiver must be higher than the elevation of the EEV inside the indoor unit. This vertical height must not exceed 60ft. (18.3m).
- Do not isolate any refrigerant circuits from over pressurization protection.

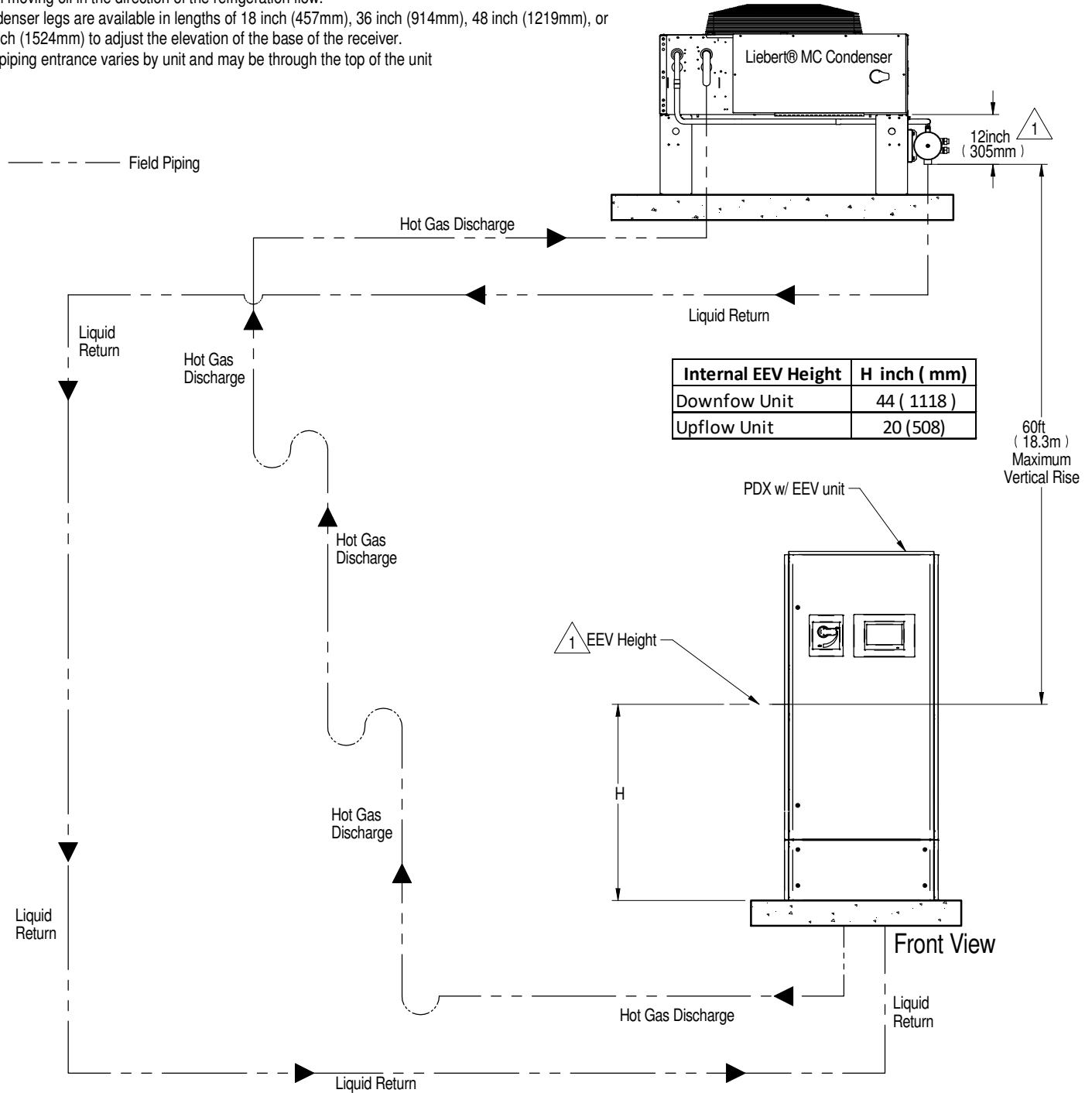


# LIEBERT® PDX w/EEV

## AIR COOLED PIPING SCHEMATIC LIEBERT® MC WITH RECEIVER ABOVE UNIT

Notes:

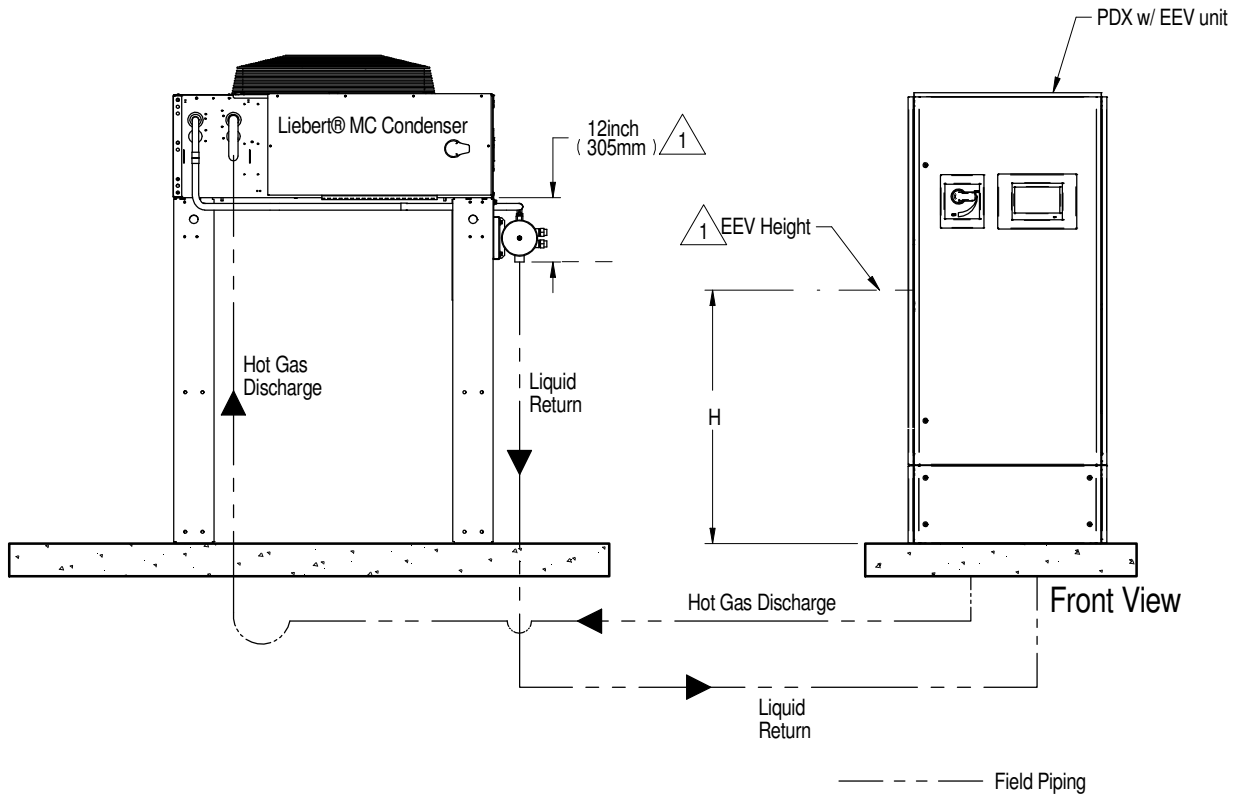
1. The outlet of the required receiver must be higher than the elevation of the EEV inside the indoor unit.
2. Unit must be trapped at bottom of riser with any rise over 5 feet (1.5m) high. If rise exceeds 25 feet (7.5m), then a trap is required in 20 foot (6.1m) increments or evenly divided.
3. Pitch horizontal hot gas piping at a minimum of 1/2 inch per 10 feet (42 mm per 10m) so that gravity will aid in moving oil in the direction of the refrigeration flow.
4. Condenser legs are available in lengths of 18 inch (457mm), 36 inch (914mm), 48 inch (1219mm), or 60 inch (1524mm) to adjust the elevation of the base of the receiver.
5. Unit piping entrance varies by unit and may be through the top of the unit





## AIR COOLED PIPING SCHEMATIC

### LIEBERT® MC WITH RECEIVER MOUNTED AND UNIT AT SIMILAR LEVEL

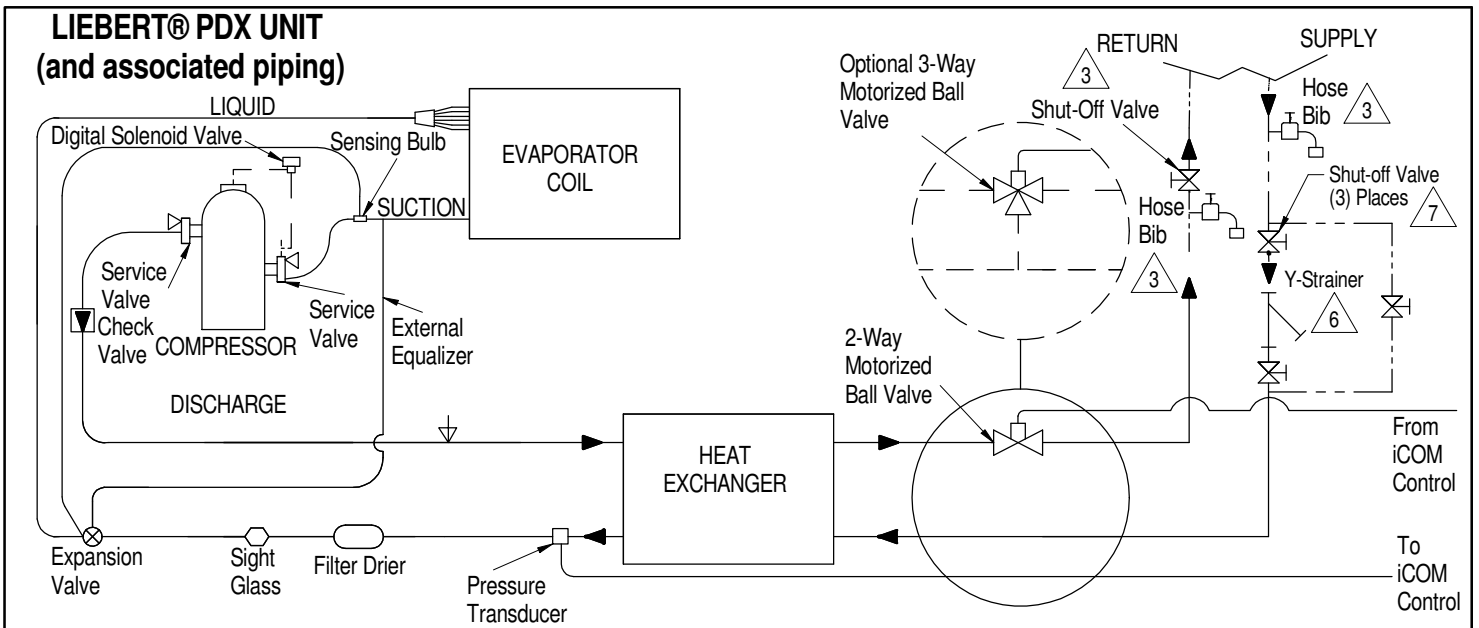
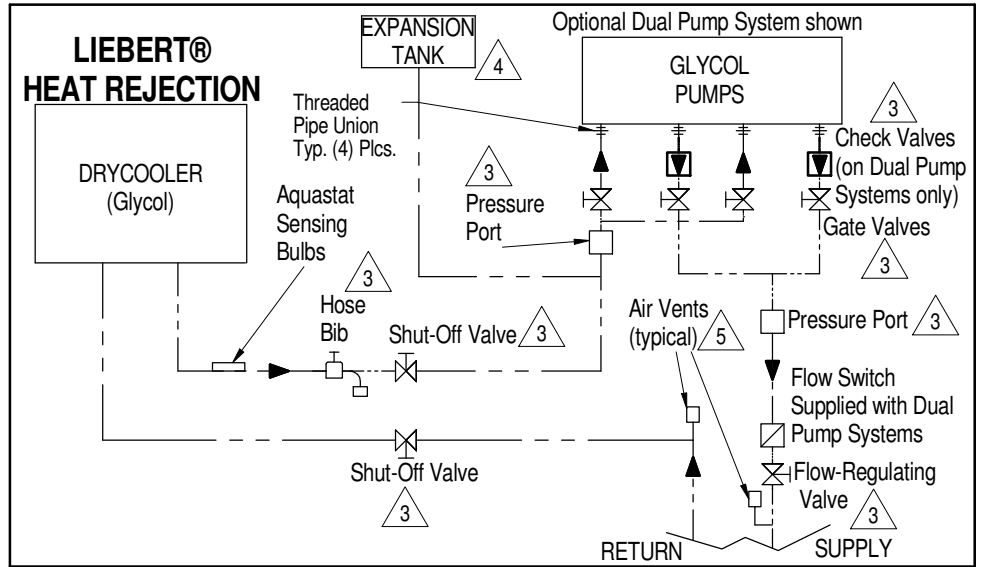
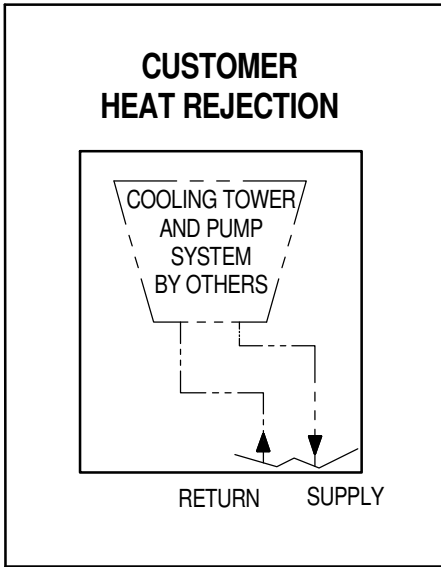


Internal EEV Height	H inch ( mm)
Downfow Unit	44 ( 1118 )
Upfow Unit	20 ( 508)

Notes:

1. The outlet of the required receiver must be higher than the elevation of the EEV inside the indoor unit.
2. Unit must be trapped at bottom of riser with any rise over 5 feet (1.5m) high. If rise exceeds 25 feet (7.5m), then a trap is required in 20 foot (6.1m) increments or evenly divided.
3. Pitch horizontal hot gas piping at a minimum of 1/2 inch per 10 feet (42mm per 10m) so that gravity will aid in moving oil in the direction of the refrigeration flow.
4. Condenser legs are available in lengths of 18 inch (457mm), 36 inch (914mm), 48 inch (1219mm), or 60 inch (1524mm) to adjust the elevation of the base of the receiver.
5. Unit piping entrance varies by unit and may be through the top of the unit

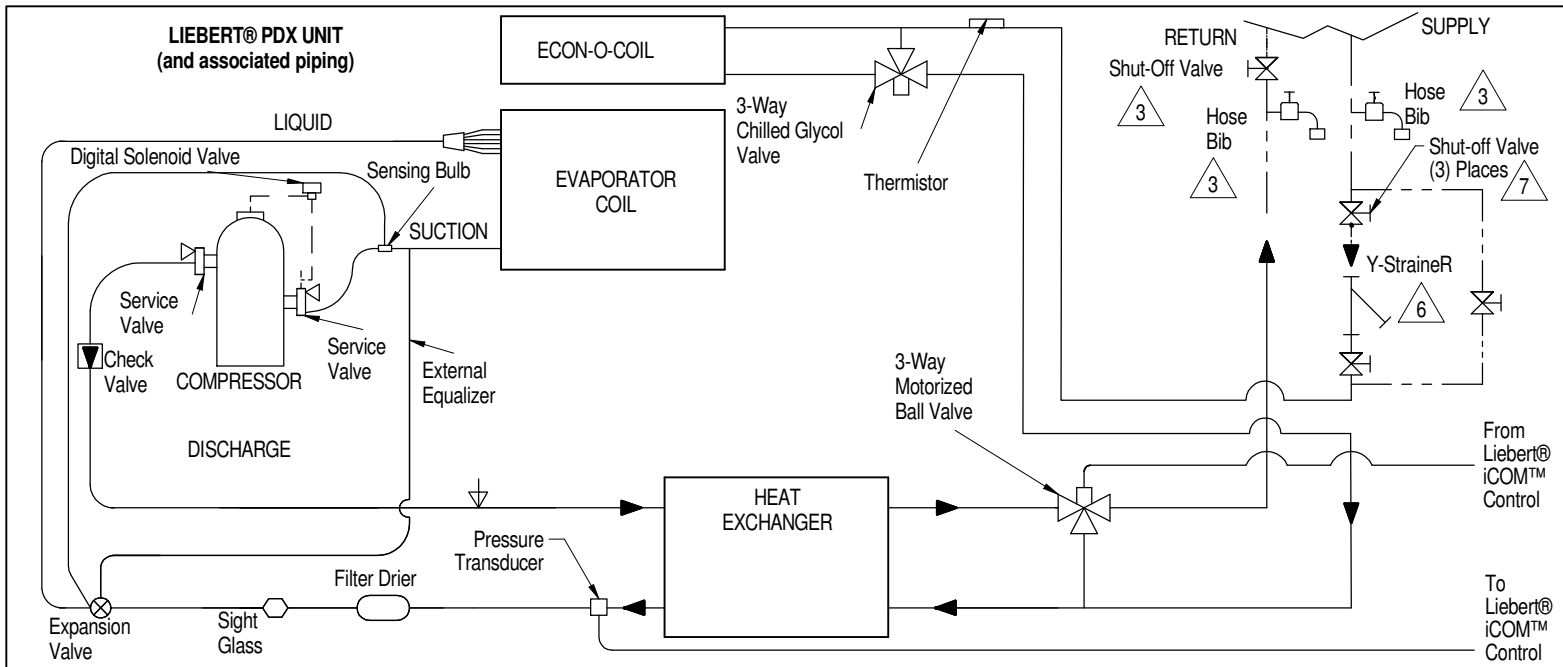
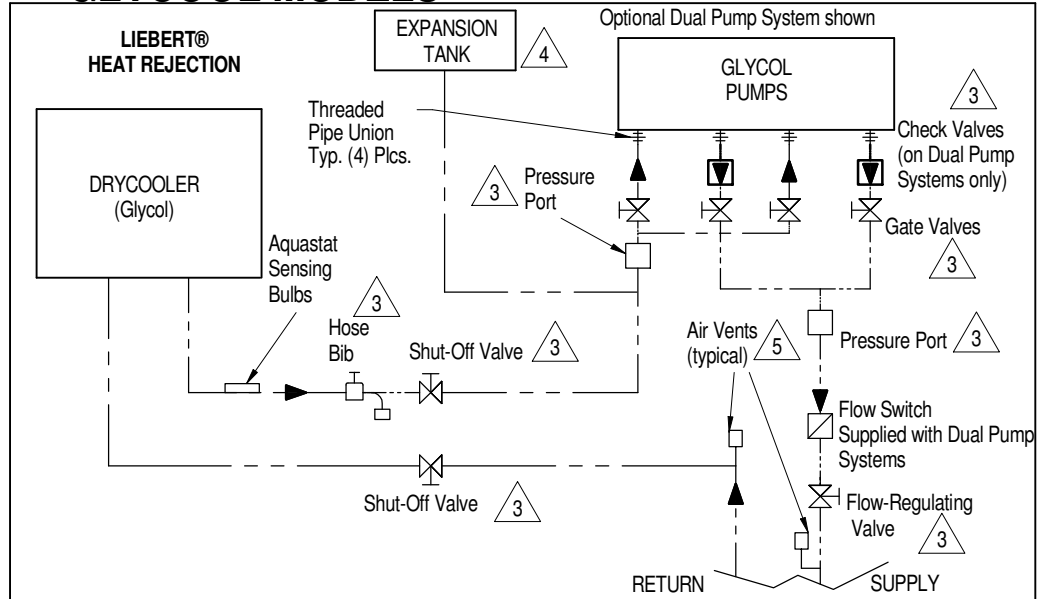
## PIPING SCHEMATIC WATER/GLYCOL MODELS



- FACTORY PIPING
- - - - - FIELD PIPING
- - - - - OPTIONAL FACTORY PIPING
- ▽ SERVICE / SCHRADER (ACCESS) CONNECTION NO VALVE CORE
- ▽ SERVICE / SCHRADER (ACCESS) CONNECTION WITH VALVE CORE

- Notes:
1. Schematic representation shown. Do not use for specific connection locations.
  2. Install a 20 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.
  3. Components are not supplied by Liebert®.
  4. Field installed at highest point in system on return line to pumps.
  5. Locate at tops of all risers and any intermediate system high points.
  6. Components are Liebert® supplied and field installed, and are required for proper circuit operation and maintenance.
  7. Component are not supplied by Liebert® but are recommended for proper circuit operation and maintenance.

## PIPING SCHEMATIC GLYCOL MODELS



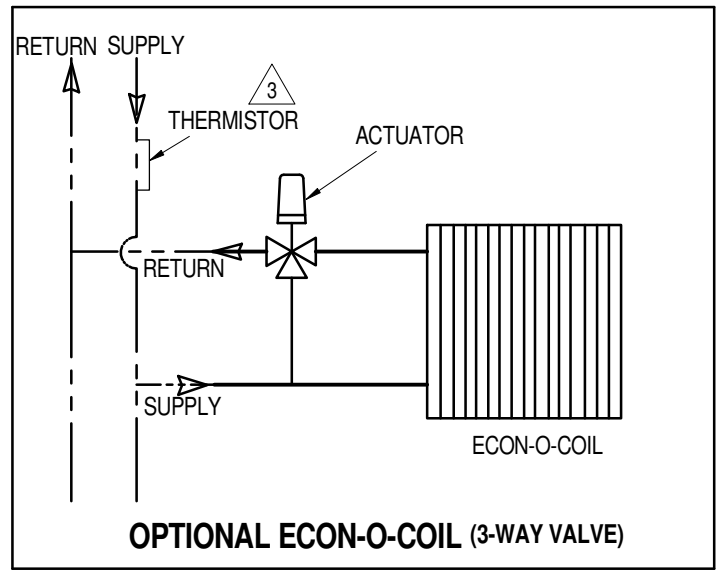
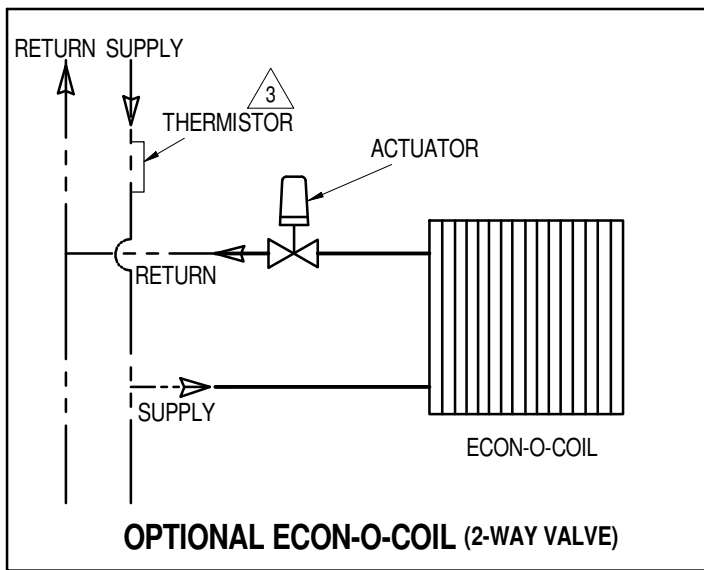
— FACTORY PIPING  
- - - FIELD PIPING

▽ SERVICE / SCHRADER (ACCESS) CONNECTION NO VALVE CORE  
▽ SERVICE / SCHRADER (ACCESS) CONNECTION WITH VALVE CORE

Notes:

1. Schematic representation shown. Do not use for specific connection locations.
2. Install a 20 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.
3. Components are not supplied by Liebert®.
4. Field installed at highest point in system on return line to pumps.
5. Locate at tops of all risers and any intermediate system high points.
6. Components are Liebert® supplied and field installed, and are required for proper circuit operation and maintenance.
7. Component are not supplied by Liebert® but are recommended for proper circuit operation and maintenance.

**OPTIONAL PIPING SCHEMATICS  
ECON-O-COIL MODELS**



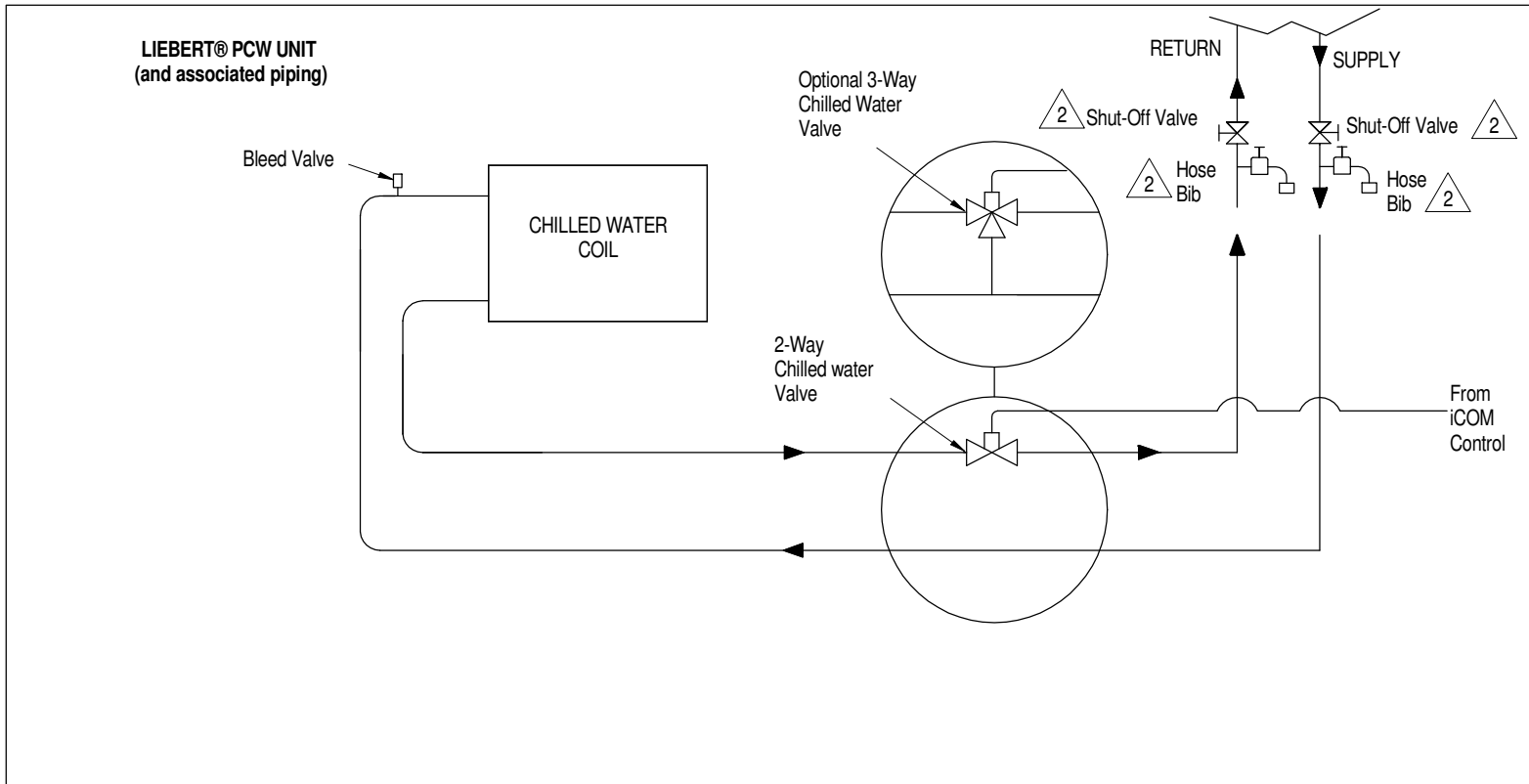
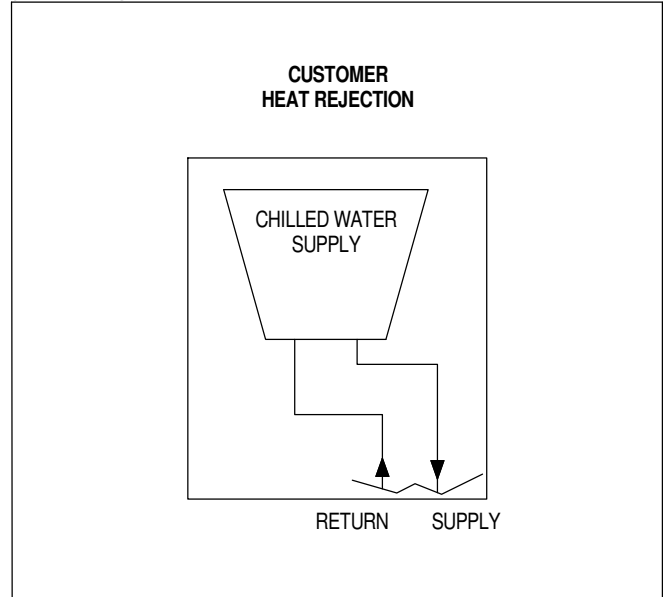
————— FACTORY PIPING  
- - - - - FIELD PIPING

Notes:

1. Place thermistor in location where flow is always present.
2. Thermistor must be located out of the Supply air stream.

△ 3. Supplied with 10 feet extra thermistor wire for installation on Field Supply line.

## PIPING SCHEMATIC CHILLED WATER MODELS



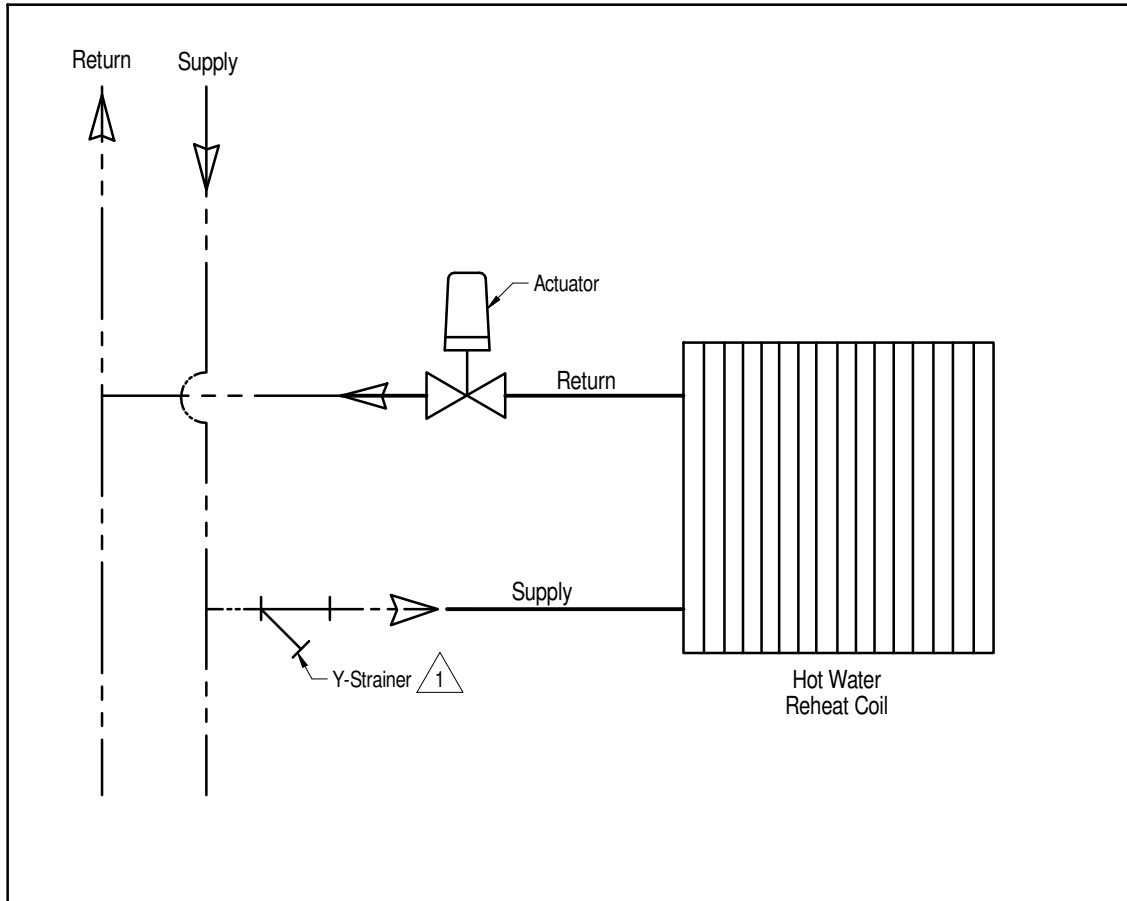
- FACTORY PIPING
- - - - - FIELD PIPING
- · - · - · OPTIONAL FACTORY PIPING

**Notes:**

1. Schematic representation shown. This schematic does not imply or define elevations and component location, unless specifically noted.

2. Components are not supplied by Liebert® but are required for proper circuit operation and maintenance.

**OPTIONAL PIPING SCHEMATIC  
HOT WATER REHEAT**



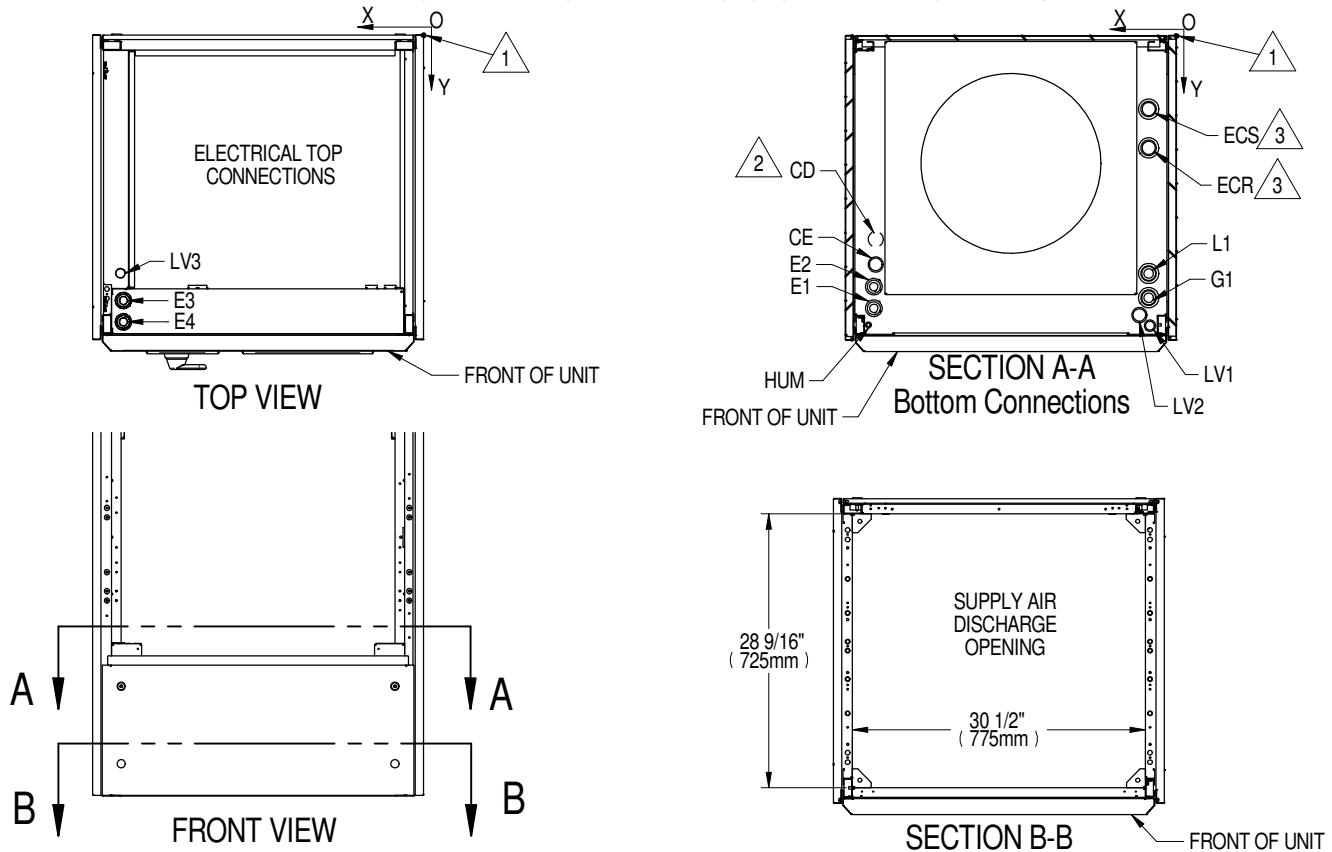
Optional Hot Water Reheat (2-way valve)

————— FACTORY PIPING  
 - - - - - FIELD PIPING

Note:

1. Components are not supplied by Liebert®, but are required for proper circuit operation and maintenance.

**PRIMARY CONNECTION LOCATIONS  
DOWNFLOW AIR COOLED MODELS**

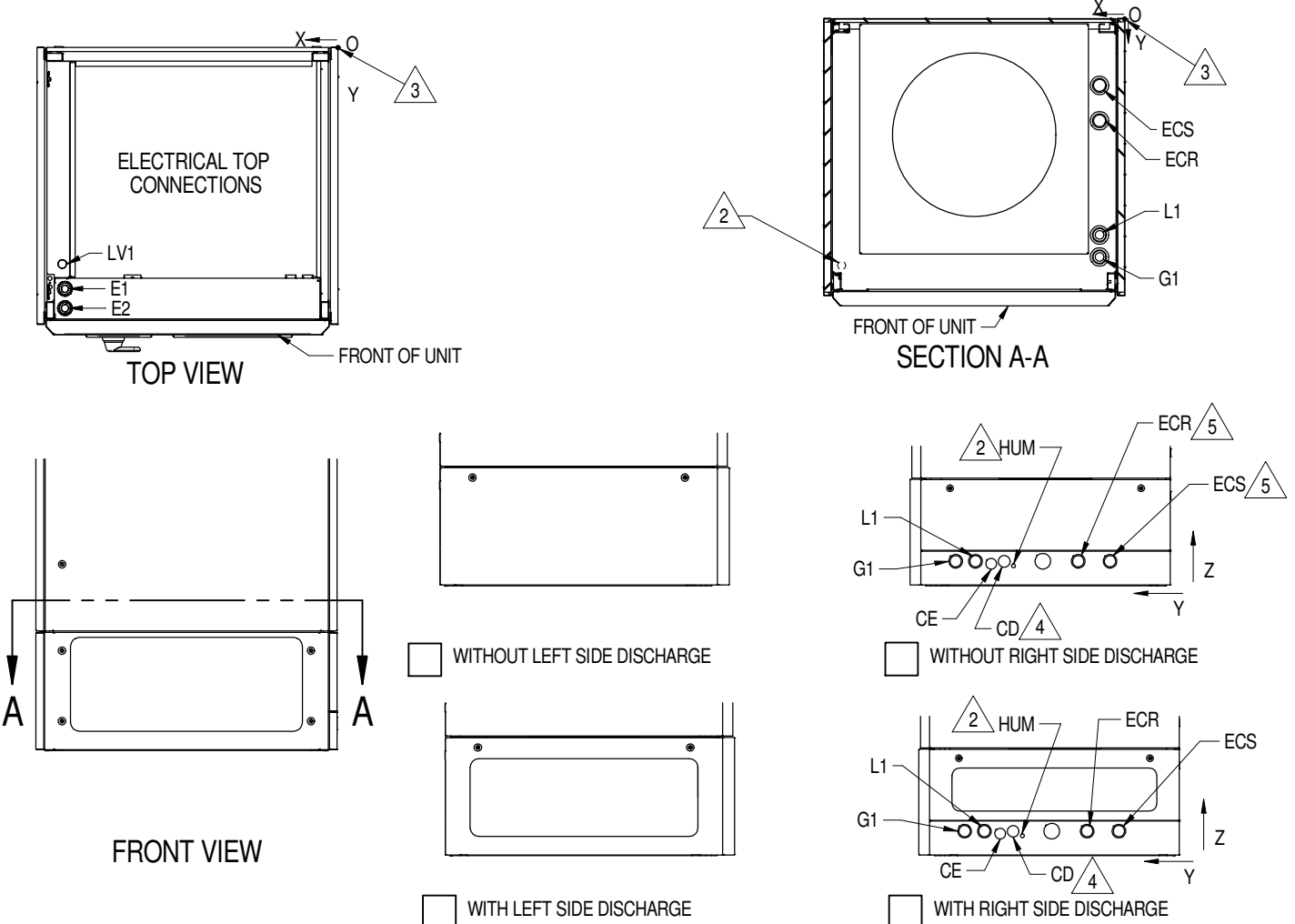


POINT	DESCRIPTION	X in. (mm)	Y in. (mm)	CONNECTION SIZE / OPENING		
				PX011	PX018, PX023	PX029
L1	LIQUID LINE SYSTEM	2-7/8 (73)	24-3/4 (629)	3/8"	1/2"	5/8"
G1	HOT GAS DISCHARGE		27-3/8 (695)	1/2"	5/8"	7/8"
CD <sup>2</sup>	CONDENSATE DRAIN	31-1/2 (800)	21-1/4 (540)	3/4" NPT FEMALE		
CE	CONDENSATE ELECTRICAL		24 (610)	1-1/2"		
HUM	HUMIDIFIER SUPPLY LINE	32 (813)	30-1/8 (765)	1/4"		
ECS <sup>3</sup>	ECON-O-COIL SUPPLY	2-7/8 (73)	7-5/8 (194)	7/8"	1-1/8"	
ECR <sup>3</sup>	ECON-O-COIL RETURN		11-3/4 (298)			
E1	ELECTRICAL CONN. (HIGH VOLT) BOTTOM	31-1/2 (800)	28-3/8 (721)	7/8", 1-3/8", 1-3/4"		
E2	ELECTRICAL CONN. (HIGH VOLT) BOTTOM		26-1/8 (664)			
E3	ELECTRICAL CONN. (HIGH VOLT) TOP		27-5/8 (701)			
E4	ELECTRICAL CONN. (HIGH VOLT) TOP		29-7/8 (758)			
LV1	ELECTRICAL CONN. (LOW VOLT) BOTTOM	2-3/4 (70)	30-1/8 (765)	1-1/8"		
LV2	ELECTRICAL CONN. (LOW VOLT) BOTTOM	3-1/2 (89)	29 (737)	1-1/2"		
LV3	ELECTRICAL CONN. (LOW VOLT) TOP	31-5/8 (803)	24-7/8 (632)	1"		

Notes:

- <sup>1</sup> Drawing not to scale. All dimensions from rear corner of unit including panels, and have a tolerance of  $\pm 1/2"$  (13mm).
- <sup>2</sup> Field pitch Condensate drain line a minimum of 1/8" (3mm) per 12" (305mm). All units contain a factory installed condensate trap. Do not trap external to the unit. Drain line may contain boiling water. Select appropriate drain system materials. The drain line must comply with local codes.
- <sup>3</sup> Supplied on Dual Cooling Systems only (4 pipe system).
4. All refrigerant & water piping connections are O.D. Copper except as noted.

## PRIMARY CONNECTION LOCATIONS DOWNFLOW FRONT DISCHARGE AIR COOLED MODELS



POINT	DESCRIPTION	X in. (mm)	Y in. (mm)	Z in. (mm)	CONNECTION SIZE / OPENING		
					PX011	PX018, PX023	PX029
L1	LIQUID LINE SYSTEM	2-7/8 (73)	24-3/4 (629)	3 (76)	3/8"	1/2"	5/8"
G1	HOT GAS DISCHARGE		27-3/8 (695)		1/2"	5/8"	7/8"
CD	CONDENSATE DRAIN	N/A	21-1/8 (537)	2-3/4 (70)	3/4" NPT FEMALE		
CE	CONDENSATE ELECTRICAL		22-3/4 (578)		2-3/4 (70)	1-3/8"	
HUM	HUMIDIFIER SUPPLY LINE	N/A	20 (508)	2-1/2 (64)	1/4"		
ECS	ECON-O-COIL SUPPLY		7-5/8 (194)		3 (76)	7/8"	1-1/8"
ECR	ECON-O-COIL RETURN	11-3/4 (298)					
E1	ELECTRICAL CONN. (HIGH VOLT) TOP	31-1/4 (793)	27-5/8 (701)	N/A	7/8", 1-3/8", 1-3/4"		
E2	ELECTRICAL CONN. (HIGH VOLT) TOP		29-7/8 (758)				
LV1	ELECTRICAL CONN. (LOW VOLT) TOP	31-5/8 (803)	24-7/8 (632)		1"		

**Notes:**

1. Pipes at various heights to allow for tube cutter to be used. Will require stub tubes and elbows for connection at all tube locations.

2. Humidifier supply line will need to be routed through this opening to the connection at the left hand side of the unit.

3. Drawing not to scale. All dimensions from rear corner of unit including panels, and have a tolerance of  $\pm 1/2"$  (13mm).

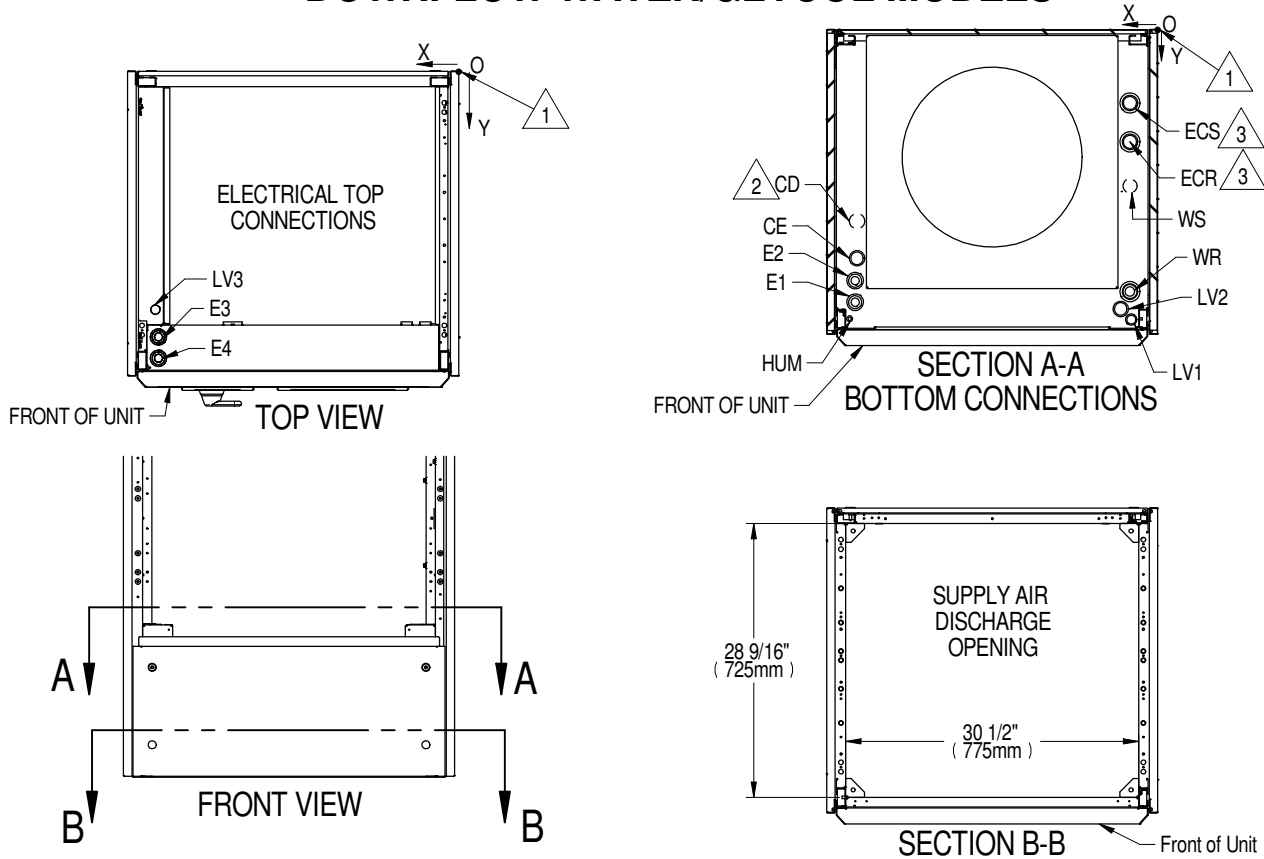
4. Field pitch Condensate Drain line a minimum of 1/8" (3.2 mm) per foot (305 mm). All units contain a factory installed condensate trap. Do not trap external to the unit. Drain line may contain boiling water. Select appropriate drain system materials. The drain line must comply with all local codes.

5. Supplied on Dual Cooling Systems only (4 pipe system).

6. All refrigerant & water piping connections are O.D. Copper except as noted.



**PRIMARY CONNECTION LOCATIONS  
DOWNFLOW WATER/GLYCOL MODELS**

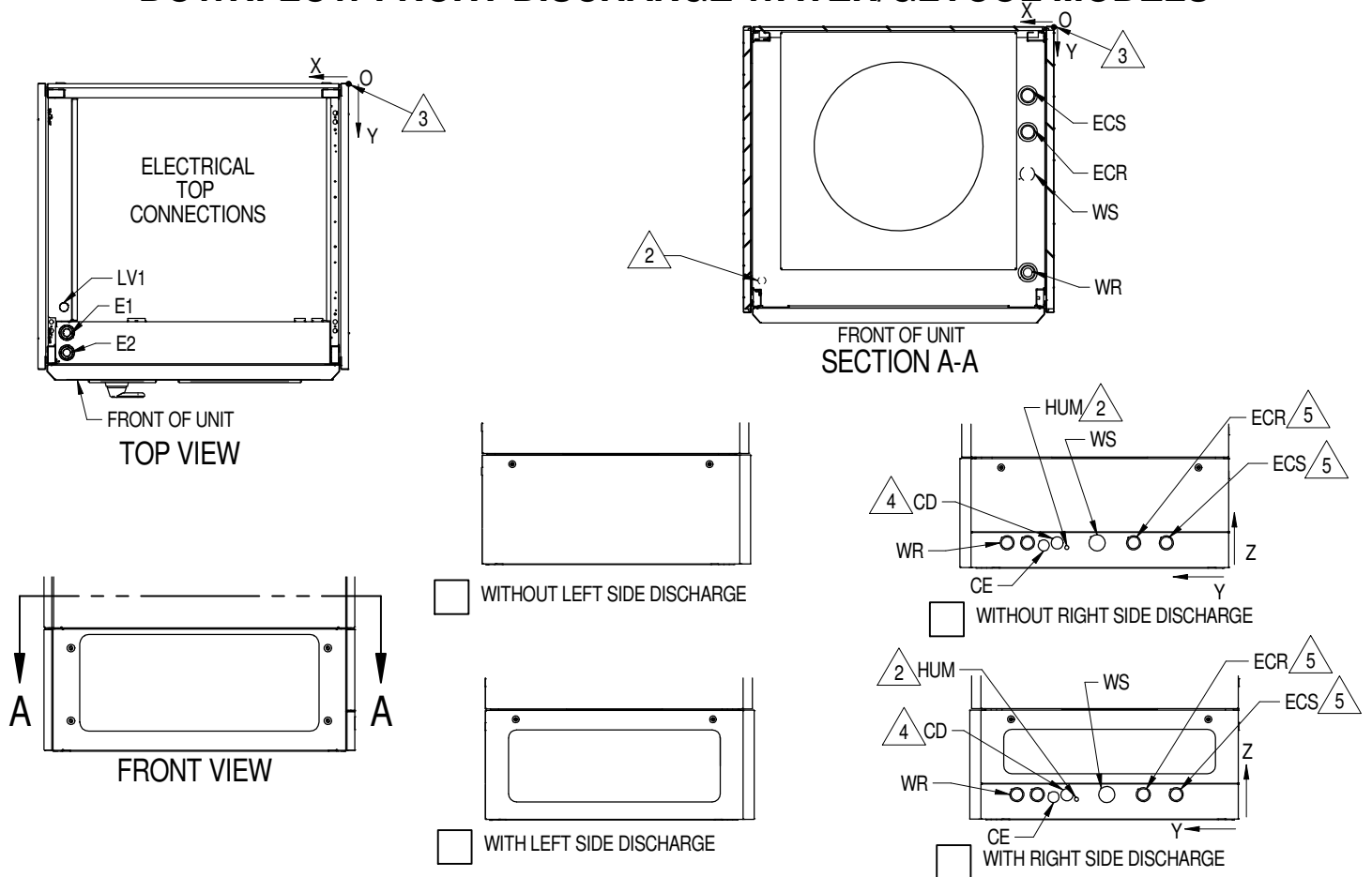


POINT	DESCRIPTION	X in. (mm)	Y in. (mm)	CONNECTION SIZE / OPENING	
				PX011	PX018-PX029
WS	WATER/GLYCOL SUPPLY	2-7/8 (73)	16-1/4 (413)	7/8"	1-1/8"
WR	WATER/GLYCOL RETURN		27-3/8 (695)		
CD <sup>2</sup>	CONDENSATE DRAIN	31-1/2 (800)	21-1/4 (540)	3/4" NPT FEMALE	
CE	CONDENSATE ELECTRICAL		24 (610)	1-1/2"	
HUM	HUMIDIFIER SUPPLY LINE	32 (813)	30-1/8 (765)	1/4"	
ECS <sup>3</sup>	ECON-O-COIL SUPPLY	2-7/8 (73)	7-5/8 (194)	7/8"	1-1/8"
ECR <sup>3</sup>	ECON-O-COIL RETURN		11-3/4 (298)		
E1	ELECTRICAL CONN. (HIGH VOLT) BOTTOM	31-1/2 (800)	28-3/8 (721)	7/8", 1-3/8", 1-3/4"	
E2	ELECTRICAL CONN. (HIGH VOLT) BOTTOM		26-1/8 (664)		
E3	ELECTRICAL CONN. (HIGH VOLT) TOP	31-1/4 (793)	27-5/8 (701)		
E4	ELECTRICAL CONN. (HIGH VOLT) TOP		29-7/8 (758)		
LV1	ELECTRICAL CONN. (LOW VOLT) BOTTOM	2-3/4 (70)	30-1/8 (765)	1-1/8"	
LV2	ELECTRICAL CONN. (LOW VOLT) BOTTOM	3-1/2 (89)	29 (737)	1-1/2"	
LV3	ELECTRICAL CONN. (LOW VOLT) TOP	31-5/8 (803)	24-7/8 (632)	1"	

Notes:

- <sup>1</sup> Drawing not to scale. All dimensions from rear corner of unit including panels, and have a tolerance of  $\pm 1/2"$  (13mm).
- <sup>2</sup> Field pitch Condensate drain line a minimum of 1/8" (3mm) per 12" (305mm). All units contain a factory installed condensate trap. Do not trap external to the unit. Drain line may contain boiling water. Select appropriate drain system materials. The drain line must comply with local codes.
- <sup>3</sup> Supplied on Dual Cooling Systems only (4 pipe system).
- <sup>4</sup> All water piping is O.D. Copper except as noted.

# PRIMARY CONNECTION LOCATIONS DOWNFLOW FRONT DISCHARGE WATER/GLYCOL MODELS



POINT	DESCRIPTION	X in. (mm)	Y in. (mm)	Z in. (mm)	CONNECTION SIZE / OPENING	
					PX011	PX018-PX029
WS	WATER/GLYCOL SUPPLY	2-7/8 (73)	16-1/4 (413)	3 (76)	7/8"	1-1/8"
WR	WATER/GLYCOL RETURN		27-3/8 (695)			
CD <sup>4</sup>	CONDENSATE DRAIN	N/A	21-1/8 (537)	2-3/4 (70)	3/4" NPT FEMALE	
CE	CONDENSATE ELECTRICAL		22-3/4 (578)		1-3/8"	
HUM <sup>2</sup>	HUMIDIFIER SUPPLY LINE		20 (508)		1/4"	
ECS <sup>5</sup>	ECON-O-COIL SUPPLY	2-7/8 (73)	7-5/8 (194)	3 (76)	7/8"	1-1/8"
ECR <sup>5</sup>	ECON-O-COIL RETURN		11-3/4 (298)			
E1	ELECTRICAL CONN. (HIGH VOLT) TOP	31-1/4 (793)	27-5/8 (701)	N/A	7/8", 1-3/8", 1-3/4"	
E2	ELECTRICAL CONN. (HIGH VOLT) TOP		29-7/8 (758)			
LV1	ELECTRICAL CONN. (LOW VOLT) TOP	31-5/8 (803)	24-7/8 (632)		1-1/8"	

**Notes:**

1. Pipes at various heights to allow for tube cutter to be used. Will require stub tubes and elbows for connection at all tube locations.

<sup>2</sup> Humidifier supply line will need to be routed through this opening to the connection at the left hand side of the unit.

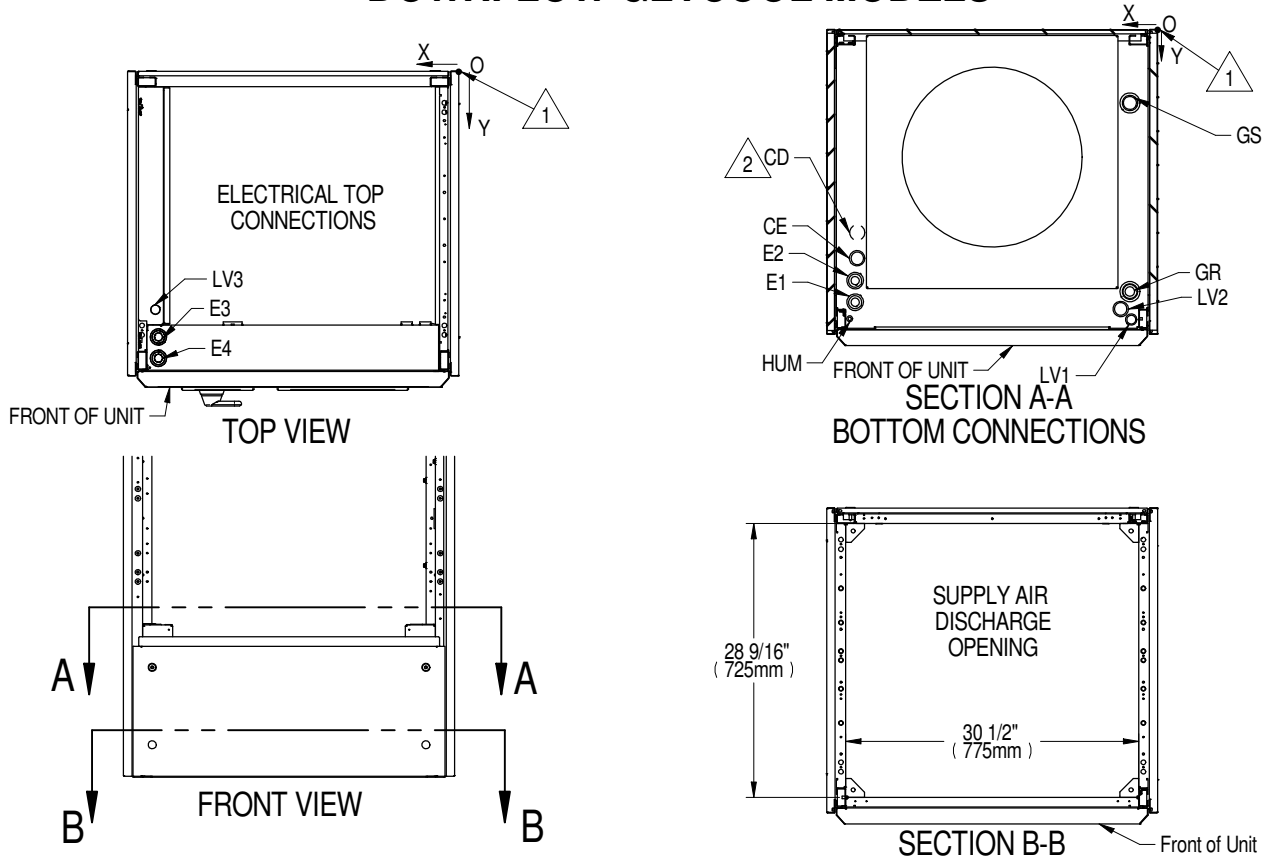
<sup>3</sup> Drawing not to scale. All dimensions from rear corner of unit including panels, and have a tolerance of  $\pm 1/2"$  (13mm).


<sup>4</sup> Field pitch Condensate Drain line a minimum of 1/8" (3.2 mm) per foot (305 mm). All units contain a factory installed condensate trap. Do not trap external to the unit. Drain line may contain boiling water. Select appropriate drain system materials. The drain line must comply with all local codes.

<sup>5</sup> Supplied on Dual Cooling Systems only (4 pipe system).



<sup>6</sup> All water piping is O.D. Copper except as noted.

**PRIMARY CONNECTION LOCATIONS  
DOWNFLOW GLYCOOL MODELS**

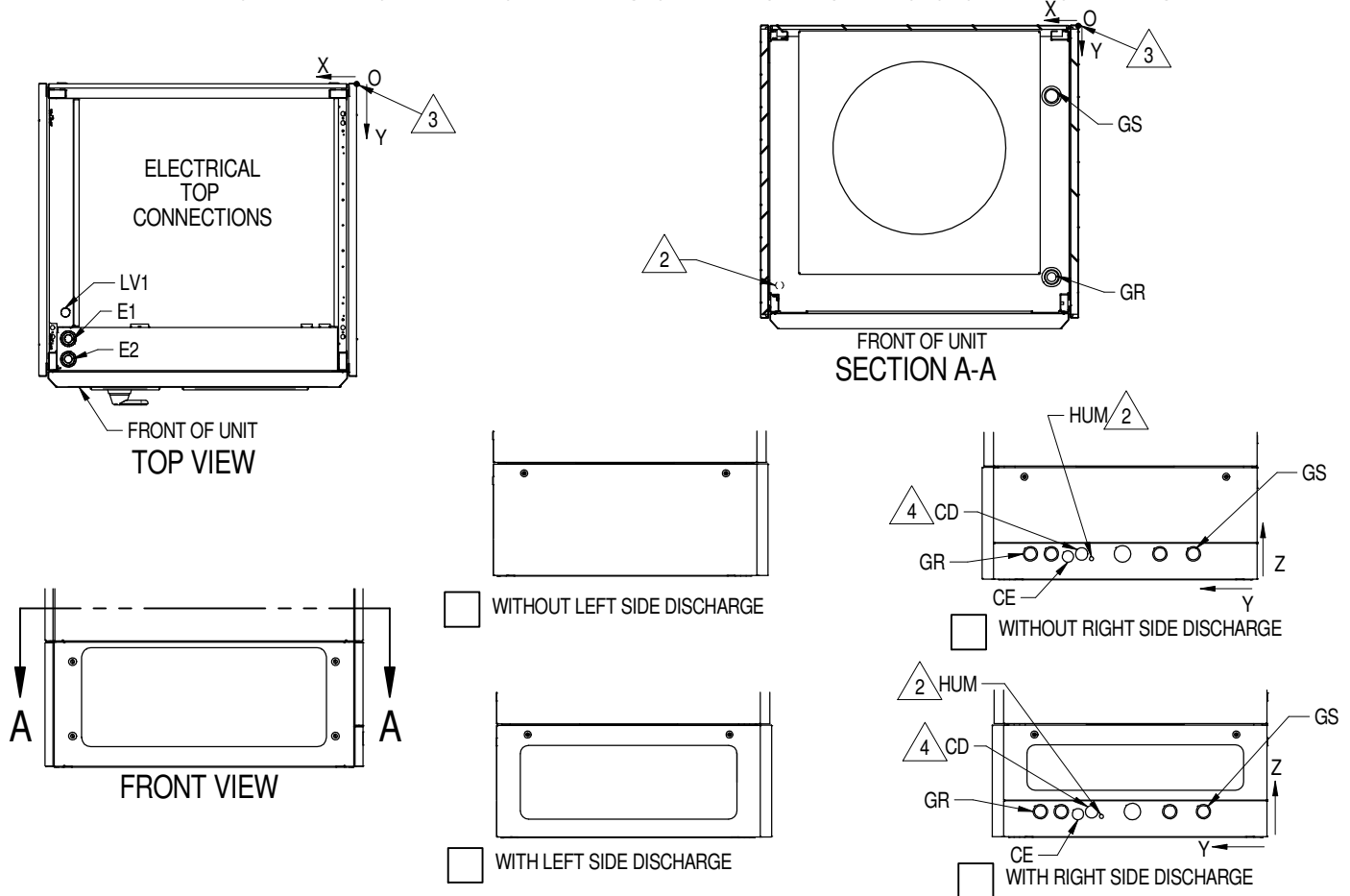


POINT	DESCRIPTION	X in. (mm)	Y in. (mm)	CONNECTION SIZE / OPENING	
				PX011	PX018-PX029
GS	GLYCOOL SUPPLY	2-7/8 (73)	7-5/8 (194)	7/8"	1-1/8"
GR	GLYCOOL RETURN		27-3/8 (695)		
CD 	CONDENSATE DRAIN	31-1/2 (800)	21-1/4 (540)	3/4" NPT FEMALE	
CE	CONDENSATE ELECTRICAL		24 (610)	1-1/2"	
HUM	HUMIDIFIER SUPPLY LINE	32 (813)	30-1/8 (765)	1/4"	
E1	ELECTRICAL CONN. (HIGH VOLT) BOTTOM	31-1/2 (800)	28-3/8 (721)	7/8", 1-3/8", 1-3/4"	
E2	ELECTRICAL CONN. (HIGH VOLT) BOTTOM		26-1/8 (664)		
E3	ELECTRICAL CONN. (HIGH VOLT) TOP	31-1/4 (793)	27-5/8 (701)		
E4	ELECTRICAL CONN. (HIGH VOLT) TOP		29-7/8 (758)		
LV1	ELECTRICAL CONN. (LOW VOLT) BOTTOM	2-3/4 (70)	30-1/8 (765)	1-1/8"	
LV2	ELECTRICAL CONN. (LOW VOLT) BOTTOM	3-1/2 (89)	29 (737)	1-1/2"	
LV3	ELECTRICAL CONN. (LOW VOLT) TOP	31-5/8 (803)	24-7/8 (632)	1"	

Notes:

-  1. Drawing not to scale. All dimensions from rear corner of unit including panels, and have a tolerance of  $\pm 1/2"$  (13mm).
-  2. Field pitch Condensate drain line a minimum of 1/8" (3mm) per 12" (305mm). All units contain a factory installed condensate trap. Do not trap external to the unit. Drain line may contain boiling water. Select appropriate drain system materials. The drain line must comply with local codes.
3. All water piping is O.D. Copper except as noted.

**PRIMARY CONNECTION LOCATIONS  
DOWNFLOW FRONT DISCHARGE GLYCOOL MODELS**

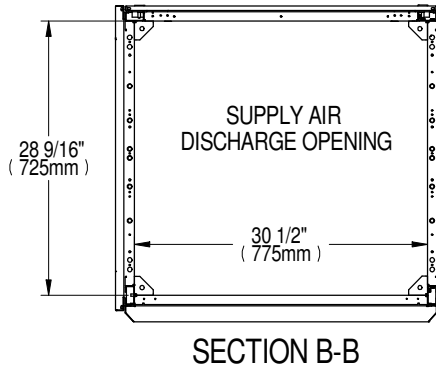
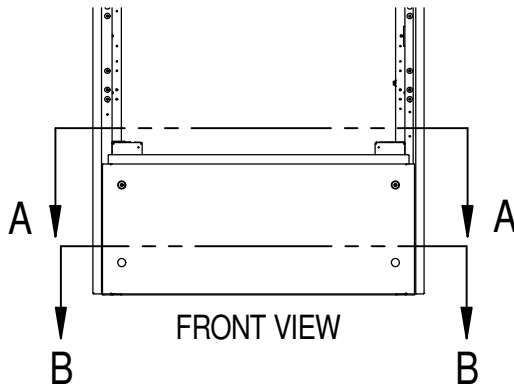
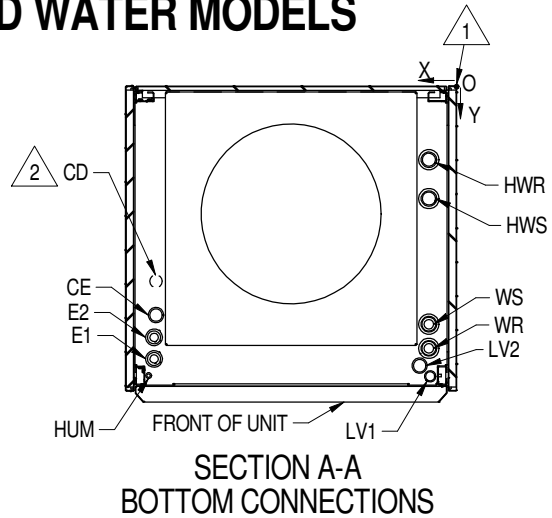
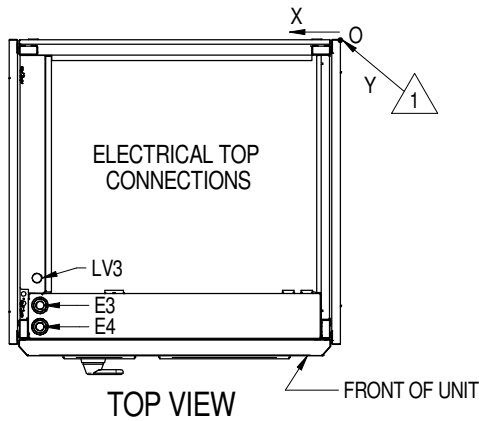



POINT	DESCRIPTION	X in. (mm)	Y in. (mm)	Z in. (mm)	CONNECTION SIZE / OPENING	
					PX011	PX018-PX029
GS	GLYCOOL SUPPLY	2-7/8 (73)	7-5/8 (194)	3 (76)	7/8"	1-1/8"
GR	GLYCOOL RETURN		27-3/8 (695)			
CD <sup>4</sup>	CONDENSATE DRAIN	N/A	21-1/8 (537)	2-3/4 (70)	3/4" NPT FEMALE	
CE	CONDENSATE ELECTRICAL		22-3/4 (578)		1-3/8"	
HUM <sup>2</sup>	HUMIDIFIER SUPPLY LINE		20 (508)		2-1/2 (64)	1/4"
E1	ELECTRICAL CONN. (HIGH VOLT) TOP	31-1/4 (793)	27-5/8 (701)	N/A	7/8", 1-3/8", 1-3/4"	
E2	ELECTRICAL CONN. (HIGH VOLT) TOP		29-7/8 (758)			
LV1	ELECTRICAL CONN. (LOW VOLT) TOP	31-5/8 (803)	24-7/8 (632)		1-1/8"	

Notes:

- Pipes at various heights to allow for tube cutter to be used. Will require stub tubes and elbows for connection at all tube locations.
- <sup>2</sup> Humidifier supply line will need to be routed through this opening to the connection at the left hand side of the unit.
- <sup>3</sup> Drawing not to scale. All dimensions from rear corner of unit including panels, and have a tolerance of  $\pm 1/2"$  (13mm).
- <sup>4</sup> Field pitch Condensate Drain line a minimum of 1/8" (3.2 mm) per foot (305 mm). All units contain a factory installed condensate trap. Do not trap external to the unit. Drain line may contain boiling water. Select appropriate drain system materials. The drain line must comply with all local codes.
- All water piping is O.D. Copper except as noted.

## PRIMARY CONNECTION LOCATIONS DOWNFLOW CHILLED WATER MODELS

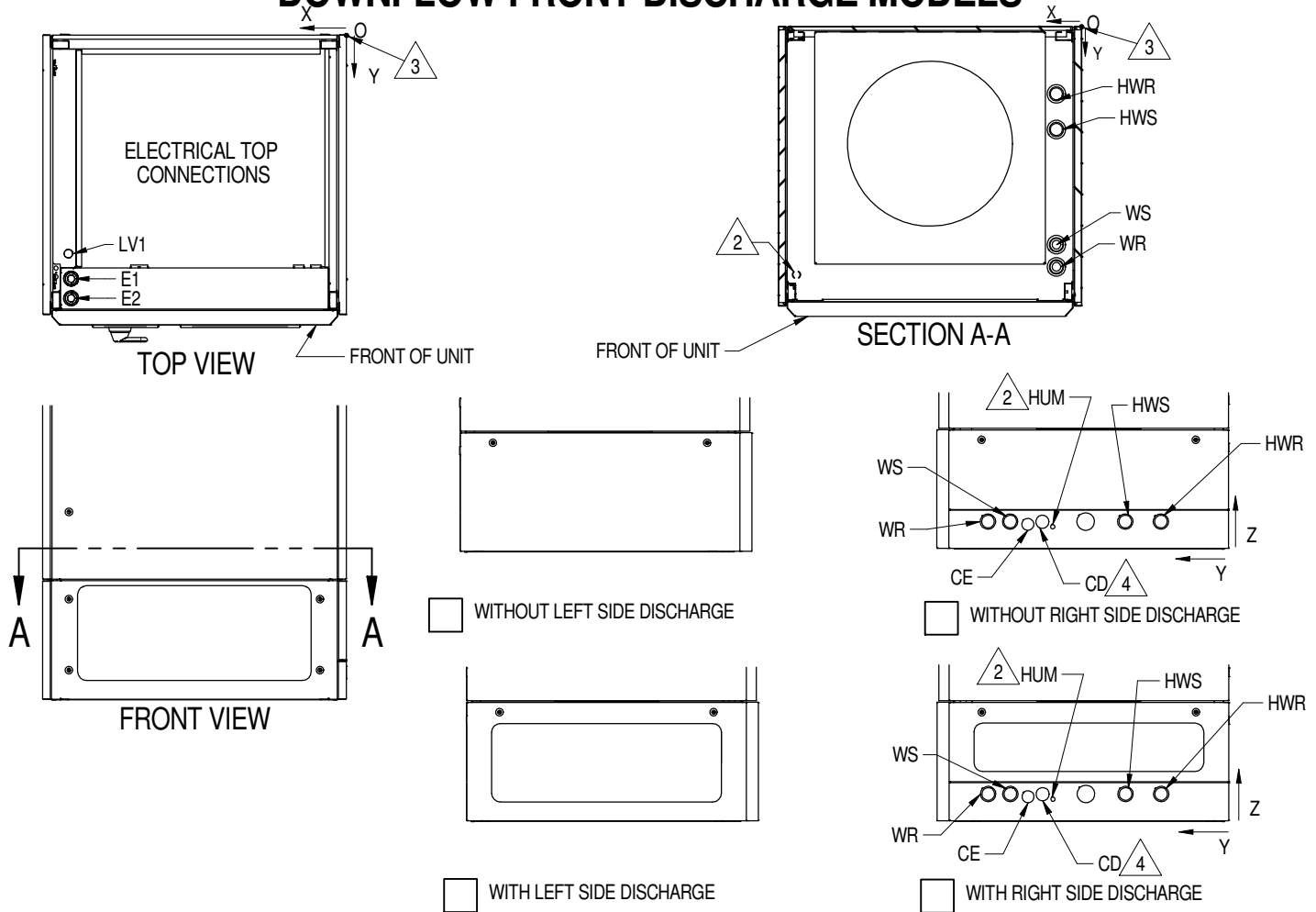


POINT	DESCRIPTION	X in. (mm)	Y in. (mm)	CONNECTION SIZE / OPENING
HWR	HOT WATER REHEAT RETURN (OPTIONAL)	2-7/8 (73)	7-5/8 (194)	5/8"
HWS	HOT WATER REHEAT SUPPLY (OPTIONAL)		11-3/4 (298)	
WS	WATER SUPPLY		24-3/4 (629)	1-1/8"
WR	WATER RETURN	27-3/8 (695)		
CD 	CONDENSATE DRAIN	31-1/2 (800)	21-1/4 (540)	3/4" NPT FEMALE
CE	CONDENSATE ELECTRICAL		24 (610)	1-1/2"
HUM	HUMIDIFIER SUPPLY LINE	32 (813)	30-1/8 (765)	1/4"
E1	ELECTRICAL CONN. (HIGH VOLT) BOTTOM	31-1/2 (800)	28-3/8 (721)	7/8", 1-3/8", 1-3/4"
E2	ELECTRICAL CONN. (HIGH VOLT) BOTTOM		26-1/8 (664)	
E3	ELECTRICAL CONN. (HIGH VOLT) TOP	31-1/4 (793)	27-5/8 (701)	
E4	ELECTRICAL CONN. (HIGH VOLT) TOP		29-7/8 (758)	
LV1	ELECTRICAL CONN. (LOW VOLT) BOTTOM	2-3/4 (70)	30-1/8 (765)	1-1/8"
LV2	ELECTRICAL CONN. (LOW VOLT) BOTTOM	3-1/2 (89)	29 (737)	1-1/2"
LV3	ELECTRICAL CONN. (LOW VOLT) TOP	31-5/8 (803)	24-7/8 (632)	1"

Note:

1. Drawing not to scale. All dimensions from rear corner of unit including panels, and have a tolerance of  $\pm 1/2"$  (13mm).
2. Field pitch Condensate drain line a minimum of 1/8" (3mm) per 12" (305mm). All units contain a factory installed condensate trap. Do not trap external to the unit. Drain line may contain boiling water. Select appropriate drain system materials. The drain line must comply with local codes.
3. All water piping is O.D. Copper except as noted.

## PRIMARY CONNECTION LOCATIONS DOWNFLOW FRONT DISCHARGE MODELS



POINT	DESCRIPTION	X in. (mm)	Y in. (mm)	Z in. (mm)	CONNECTION SIZE / OPENING
					PW011-PW029
HWR	HOT WATER REHEAT RETURN (OPTIONAL)	2-7/8 (73)	7-5/8 (194)	3 (76)	5/8"
HWS	HOT WATER REHEAT SUPPLY (OPTIONAL)		11-3/4 (298)		
WS	WATER SUPPLY		24-3/4 (629)		
WR	WATER RETURN	27-3/8 (695)			
CD <sup>4</sup>	CONDENSATE DRAIN	N/A	21-1/8 (537)	2-3/4 (70)	3/4" NPT FEMALE
CE	CONDENSATE ELECTRICAL		22-3/4 (578)		1-1/2"
HUM <sup>2</sup>	HUMIDIFIER SUPPLY LINE		20 (508)	2-1/2 (64)	1/4"
E1	ELECTRICAL CONN. (HIGH VOLT) TOP	31-1/4 (793)	27-5/8 (701)	N/A	7/8", 1-3/8", 1-3/4"
E2	ELECTRICAL CONN. (HIGH VOLT) TOP		29-7/8 (758)		
LV1	ELECTRICAL CONN. (LOW VOLT) TOP	31-5/8 (803)	24-7/8 (632)		1"

**Notes:**

1. Pipes at various heights to allow for tube cutter to be used. Will require stub tubes and elbows for connection at all tube locations.

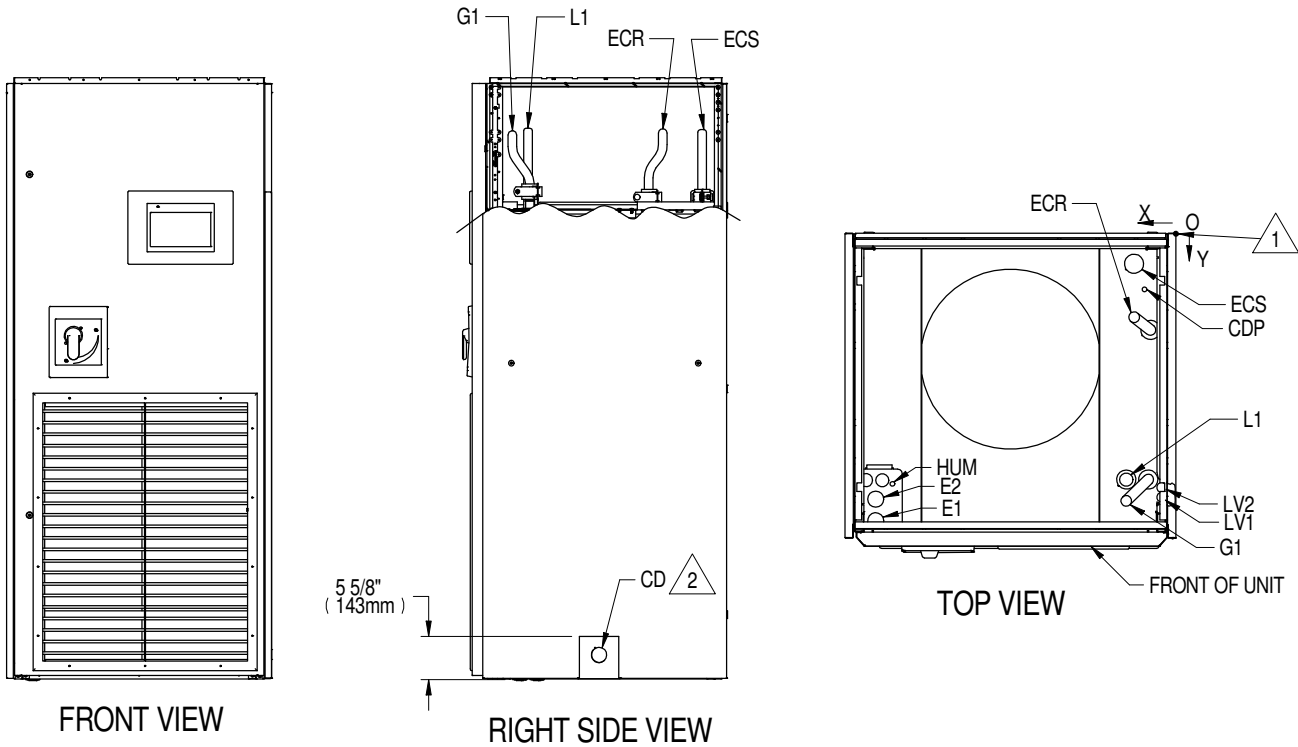
<sup>2</sup> Humidifier supply line will need to be routed through this opening to the connection at the left hand side of the unit.

<sup>3</sup> Drawing not to scale. All dimensions from rear corner of unit including panels, and have a tolerance of ± 1/2" (13mm).

<sup>4</sup> Field pitch Condensate Drain line a minimum of 1/8" (3.2 mm) per foot (305 mm). All units contain a factory installed condensate trap. Do not trap external to the unit. Drain line may contain boiling water. Select appropriate drain system materials. The drain line must comply with all local codes.

5. All water piping is O.D. Copper except as noted.

**PRIMARY CONNECTION LOCATIONS  
UPFLOW AIR COOLED MODELS**



POINT	DESCRIPTION	X in. (mm)	Y in. (mm)	Z in. (mm)	CONNECTION SIZE in.		
					PX011	PX018, PX023	PX029
L1	LIQUID LINE SYSTEM	5-1/8 (130)	25-5/8 (651)	N/A	3/8	1/2	5/8
G1	HOT GAS DISCHARGE		27-7/8 (708)		1/2	5/8	7/8
CD	CONDENSATE DRAIN <sup>2</sup>	N/A	16-5/8 (422)	3-1/8 (89)	3/4 NPT FEMALE		
CDP	CONDENSATE DRAIN WITH PUMP	3-1/4 (83)	5-7/8 (149)	N/A	1/2		
HUM	HUMIDIFIER SUPPLY LINE	29-1/2 (749)	26 (660)		1/4		
ECS	ECON-O-COIL SUPPLY <sup>3</sup>	4-1/4 (108)	3-1/4 (83)		7/8	1-1/8	
ECR	ECON-O-COIL RETURN <sup>3</sup>		8-1/4(210)				
E1	ELECTRICAL CONN. (HIGH VOLT)	31-1/4 (794)	30 (762)		7/8, 1-3/8, 1-3/4 <sup>6</sup>		
E2	ELECTRICAL CONN. (HIGH VOLT)		27-3/4 (705)				
LV1	ELECTRICAL CONN. (LOW VOLT)	1-1/2 (38)	27-1/2 (699)		1		
LV2	ELECTRICAL CONN. (LOW VOLT)		26-1/2 (673)				

Notes:

<sup>1</sup> Drawing not to scale. All dimensions from rear corner of unit including panels and have a tolerance of ± 1/2" (13mm).

<sup>2</sup> Field pitch Condensate drain line a minimum of 1/8" (3mm) per 12" (305mm). All units contain a factory installed condensate trap. Do not trap external to the unit. Drain line may contain boiling water. Select appropriate drain system materials. The drain line must comply with local codes.

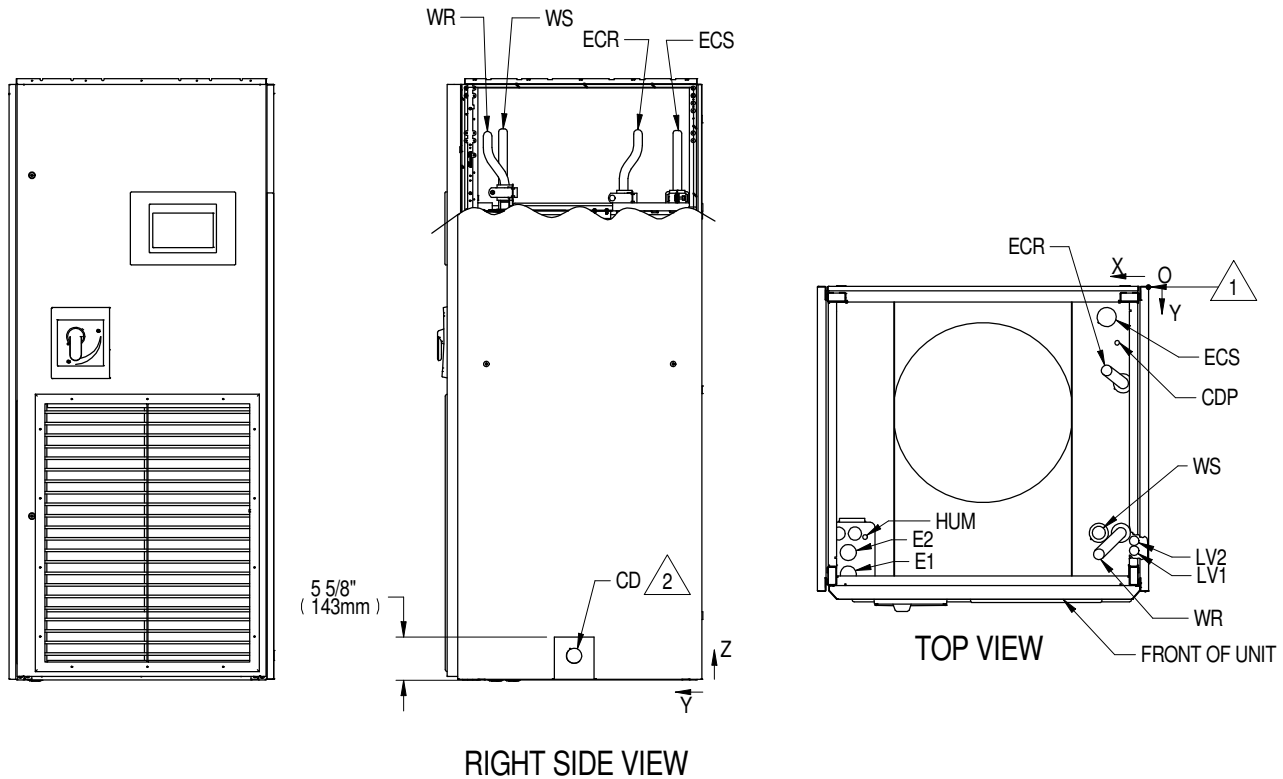
<sup>3</sup> Supplied on Dual Cooling Systems only.

<sup>4</sup> Unit with front return shown. Bottom return with rear return floorstand also available.

<sup>5</sup> All refrigerant & water piping connections are O.D. Copper except as noted.

<sup>6</sup> Concentric knockouts to be used based on field supplied conduit diameter.

## PRIMARY CONNECTION LOCATIONS UPFLOW WATER/GLYCOL MODELS



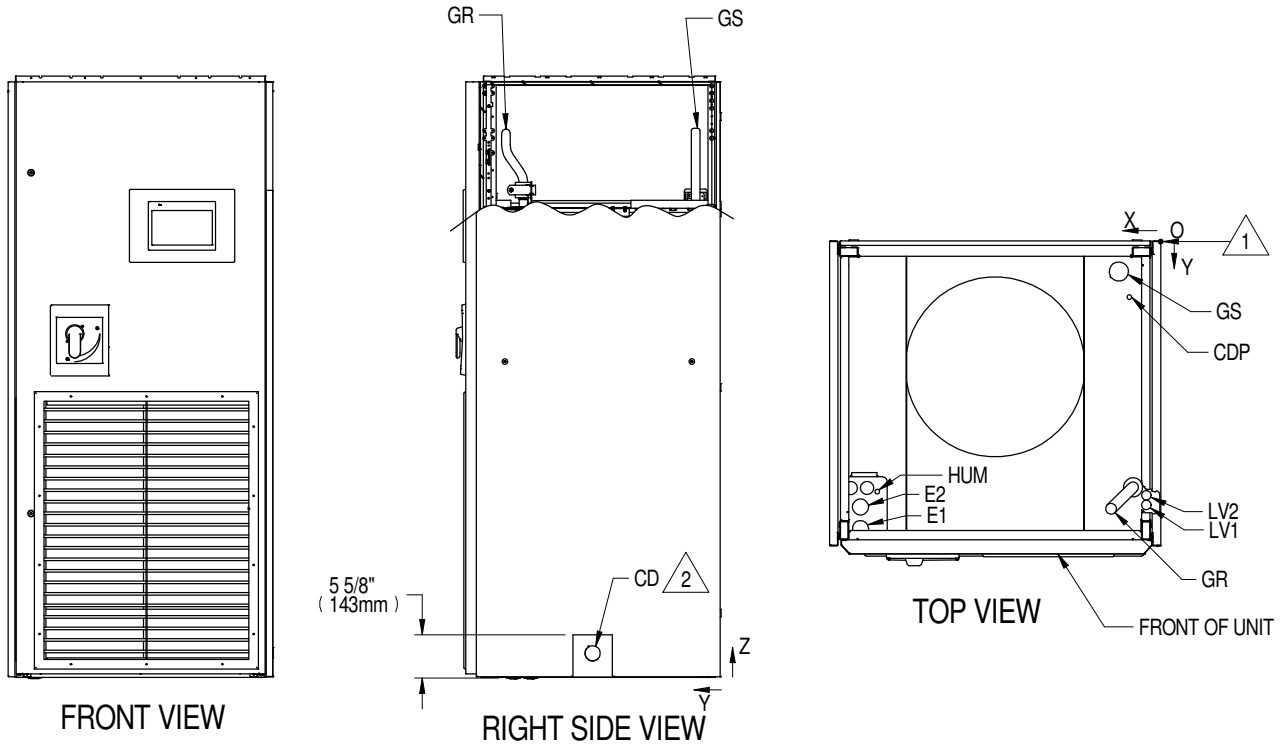
POINT	DESCRIPTION	X in. (mm)	Y in. (mm)	Z in. (mm)	CONNECTION SIZE in.	
					PX011	PX018-PX029
WS	WATER/GLYCOL SUPPLY	5-1/8 (130)	25-5/8 (651)	N/A	7/8	1-1/8
WR	WATER/GLYCOL RETURN		27-7/8 (708)			
CD	CONDENSATE DRAIN <sup>2</sup>	N/A	16-5/8 (422)	3-1/8 (89)	3/4 NPT FEMALE	
CDP	CONDENSATE DRAIN WITH PUMP	3-1/4 (83)	5-7/8 (149)	N/A	1/2	
HUM	HUMIDIFIER SUPPLY LINE	29-1/2 (749)	26 (660)		1/4	
ECS	ECON-O-COIL SUPPLY <sup>3</sup>	4-1/4 (108)	3-1/4 (83)		7/8	1-1/8
ECR	ECON-O-COIL RETURN <sup>3</sup>		8-1/4(210)			
E1	ELECTRICAL CONN. (HIGH VOLT)	31-1/4 (794)	30 (762)		7/8, 1-3/8, 1-3/4 <sup>6</sup>	
E2	ELECTRICAL CONN. (HIGH VOLT)		27-3/4 (705)			
LV1	ELECTRICAL CONN. (LOW VOLT)	1-1/2 (38)	27-1/2 (699)		1	
LV2	ELECTRICAL CONN. (LOW VOLT)		26-1/2 (673)			

Notes:

- <sup>1</sup> Drawing not to scale. All dimensions from rear corner of unit including panels, and have a tolerance of  $\pm 1/2"$  (13mm).
- <sup>2</sup> Field pitch Condensate drain line a minimum of 1/8" (3mm) per 12" (305mm). All units contain a factory installed condensate trap. Do not trap external to the unit. Drain line may contain boiling water. Select appropriate drain system materials. The drain line must comply with local codes.
- <sup>3</sup> Supplied on Dual Cooling Systems only (4 pipe system)
- <sup>4</sup> Unit with front return shown. Bottom return with rear return floorstand also available.
- <sup>5</sup> All water piping is O.D. Copper except as noted.
- <sup>6</sup> Concentric knockouts to be used based on field supplied conduit diameter.



## PRIMARY CONNECTION LOCATIONS UPFLOW GLYCOOL MODELS

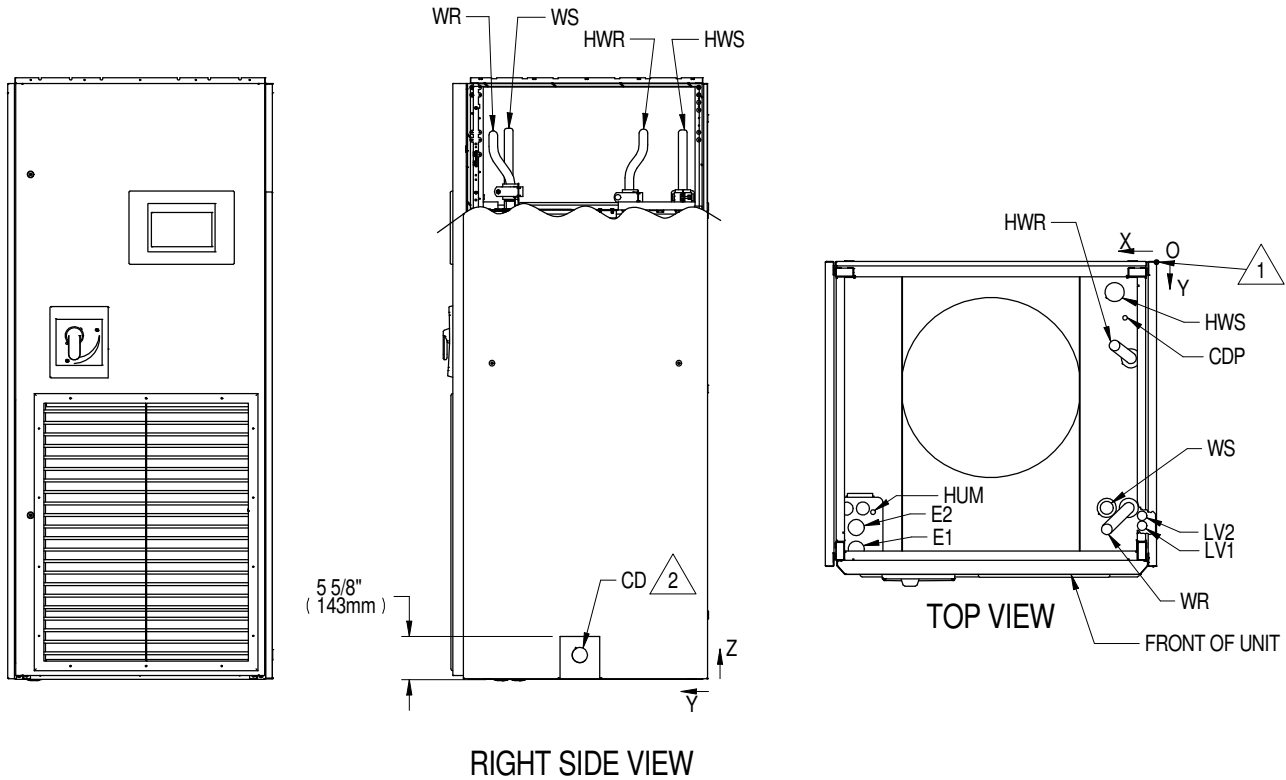


POINT	DESCRIPTION	X in. (mm)	Y in. (mm)	Z in. (mm)	CONNECTION SIZE in.	
					PX011	PX018-PX029
GS	GLYCOOL SUPPLY	4-1/4 (108)	3-1/4 (83)	N/A	7/8	1-1/8
GR	GLYCOOL RETURN	5-1/8 (130)	27-7/8 (708)			
CD	CONDENSATE DRAIN <sup>2</sup>	N/A	16-5/8 (422)	3-1/8(79)	3/4 NPT FEMALE	
CDP	CONDENSATE DRAIN WITH PUMP	3-1/4 (83)	5-7/8 (149)	N/A	1/2	
HUM	HUMIDIFIER SUPPLY LINE	29-1/2 (749)	26 (660)		1/4	
E1	ELECTRICAL CONN. (HIGH VOLT)	31-1/4 (794)	30 (762)		7/8, 1-3/8, 1-3/4 <sup>5</sup>	
E2	ELECTRICAL CONN. (HIGH VOLT)		27-3/4 (705)			
LV1	ELECTRICAL CONN. (LOW VOLT)	1-1/2 (38)	27-1/2 (699)		1	
LV2	ELECTRICAL CONN. (LOW VOLT)		26-1/2 (673)			

Notes:

- <sup>1</sup> Drawing not to scale. All dimensions from rear corner of unit including panels, and have a tolerance of  $\pm 1/2"$  (13mm).
- <sup>2</sup> Field pitch Condensate drain line a minimum of 1/8" (3mm) per 12" (305mm). All units contain a factory installed condensate trap. Do not trap external to the unit. Drain line may contain boiling water. Select appropriate drain system materials. The drain line must comply with local codes.
3. Unit with front return shown. Bottom return with rear return floorstand also available.
4. All water piping is O.D. Copper except as noted.
- <sup>5</sup> Concentric knockouts to be used based on field supplied conduit diameter.

**PRIMARY CONNECTION LOCATIONS  
UPFLOW CHILLED WATER MODELS**



POINT	DESCRIPTION	X in. (mm)	Y in. (mm)	Z in. (mm)	CONNECTION SIZE in.
WS	WATER SUPPLY	5-1/8 (130)	25-5/8 (651)	N/A	1-1/8
WR	WATER RETURN		27-7/8(708)		
HWR	HOT WATER REHEAT RETURN (OPTIONAL)	4-1/4 (108)	8-1/4 (210)		5/8
HWS	HOT WATER REHEAT SUPPLY (OPTIONAL)		3-1/4 (83)		
CD	CONDENSATE DRAIN <sup>2</sup>	N/A	16-5/8 (422)	3-1/8 (89)	3/4 NPT FEMALE
CDP	CONDENSATE DRAIN WITH PUMP	3-1/4 (83)	5-7/8 (149)	N/A	1/2
HUM	HUMIDIFIER SUPPLY LINE	29-1/2 (749)	26 (660)		1/4
E1	ELECTRICAL CONN. (HIGH VOLT)	31-1/4 (794)	30 (762)		7/8, 1-3/8, 1-3/4 <sup>5</sup>
E2	ELECTRICAL CONN. (HIGH VOLT)		27-3/4 (705)		
LV1	ELECTRICAL CONN. (LOW VOLT)	1-1/2 (38)	27-1/2 (699)		
LV2	ELECTRICAL CONN. (LOW VOLT)		26-1/2 (673)		

Notes:

- <sup>1</sup> Drawing not to scale. All dimensions from rear corner of unit including panels, and have a tolerance of  $\pm 1/2"$  (13mm).
- <sup>2</sup> Field pitch Condensate drain line a minimum of 1/8" (3mm) per 12" (305mm). All units contain a factory installed condensate trap. Do not trap external to the unit. Drain line may contain boiling water. Select appropriate drain system materials. The drain line must comply with local codes.
3. Unit with front return shown. Bottom return with rear return floorstand also available.
4. All water piping is O.D. Copper except as noted.
- <sup>5</sup> Concentric knockouts to be used based on field supplied conduit diameter.



# LIEBERT® PDX/PCW

## ELECTRICAL FIELD CONNECTIONS UPFLOW & DOWNFLOW MODELS

1. **High Voltage Entrance.** Supplied on top and bottom of electric box. Knockout size  $\text{Ø}1.75\text{in}$  (44.5mm).
2. **Low Voltage Entrance.**  $\text{Ø}1.375\text{ in.}$  (34.9mm) hole located on bottom of Electric Box.
3. **Three phase Electric Service and earth ground.** Field supplied.
4. **Three phase connection.** Electric service connection terminals on disconnect.
5. **Factory installed disconnect switch.** Fused disconnect switch provided on units.
6. **Earth ground connection.** Connection terminals for field supplied earth grounding wire.
7. **Earth ground bar.** Connection terminals with factory ground from each high voltage component for field supplied earth grounding wire.
8. **Control and monitoring section** of electric box.
9. **Remote unit shutdown.** Replace existing jumper between terminals 37 & 38 with normally closed switch having a minimum 75VA, 24VAC rating. Use field supplied Class 1 wiring. Two additional contact pairs available as an option (labeled as 37B & 38B, 37C & 38C). Replace existing jumper for appropriate pair as done for 37 & 38.
10. **Remote Alarm Device (RAD) Connections.** Alarm connections may be factory wired or field wired. See schematic, RAD1-4, for factory wired alarms. For field wired alarms, use Class 1 wiring to connect normally open contacts between terminals 24 & 50, 24 & 51, 24 & 55, or 24 & 56. Suitable for 24VAC.
11. **Smoke detector alarm connections.** Field supplied Class 1 wiring to 1 Amp, 24VAC maximum remote alarm circuits. Factory wired contacts from optional smoke detector are #91-Common, #92-NO, and #93-NC. Optional smoke detector trouble (SDT) connections #80 & # 81.
12. **Common alarm connection.** Field supplied Class 1 wiring to common alarm terminals 75 & 76 (and optional 94 & 95, and 96 & 97), which are factory connected to normally open contacts, 1 Amp, 24VAC maximum on common alarm relay (R3).
13. **Heat rejection connection.** Field supplied Class 1 wiring to heat rejection interlock terminals 70 & 71 which are factory connected to normally open compressor side switch (self contained units only) or to GLYCOOL relay K11 (GLYCOOL units only). On Dual Cool units only, connect auxilliary cooling source terminals 72 & 73 to relay K11. See indoor and outdoor electric schematic for more information.
14. **Reheat and Humidifier Lockout.** Optional emergency power lockout of reheat and/or humidifier: Connections #82 & #83 are provided for remote 24VAC source and Class 1 wiring by others.
15. **Main Fan Auxiliary Switch.** Optional main fan auxiliary side switch. Terminals located on customer connection terminal block for remote indication that the evaporator fan motor/unit is on. Field to connect 24V maximum, Class 1 wiring to connections #84 & #85.
16. **Optional Condensate Alarm (Dual Float Condensate Pump only).** Relay terminals located on customer connection terminal block for remote indication. Field supplied Class 1 wiring to connections #88 & #89.
17. **Optional Remote Liquefact Indicator.** Optional remote liquefact indicator for unit shutdown. Terminals located on customer connection terminal block. Field to connect 24V maximum, Class 1 wiring to connections #58 & #59.
18. **Optional Analog Inputs #3 & #4.** Customer connection to terminals 41, 42, 43, 44 for analog inputs.
19. **Spare Terminals for Optional Devices.** Customer connection when optional device is supplied. See unit schematic.



# LIEBERT® PDX/PCW

## ELECTRICAL FIELD CONNECTIONS UPFLOW & DOWNFLOW MODELS

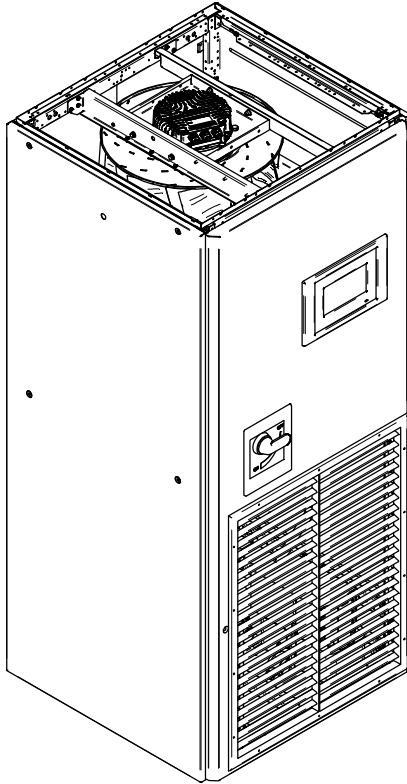
- 20. CANbus Connector.** Terminal block with terminals 49-1 (CAN-H) and 49-3 (CAN-L) + SH (shield connection). The terminals are used to connect the CANbus communication cable (provided by others) from the indoor unit to the Liebert MC Condenser.
- 21. CANbus Cable.** CANbus cable provided by others to connect to the outdoor condenser and optional PRE unit. No special considerations are required when the total external cable connection between the indoor unit and outdoor unit(s) is less than 450FT (137M). For total external cable connections greater than 450FT (137M). For external cable connections greater than 450FT (137M), but less than 800FT (243M) a CANbus isolator is required (Contact Factory). Cable must have the following specifications:
- Braided shield or foil shield with drain wire
  - Shield must be wired to ground at indoor unit
  - 22-18AWG stranded tinned copper
  - Twisted pair (minimum 4 twists per foot)
  - Low Capacitance (15pF/FT or less)
  - Must be rated to meet local codes and conditions
  - EXAMPLES BELDEN 89207 (PLENUM RATED), OR ALPHA WIRE 6454 CATEGORY 5, 5E, OR HIGHER
- 22.** Do not run in same conduit, raceway, or chase as high voltage wiring.
- 23.** For CANbus network lengths greater than 450FT (137M) call Factory.

### OPTIONAL COMMUNICATION CONNECTIONS

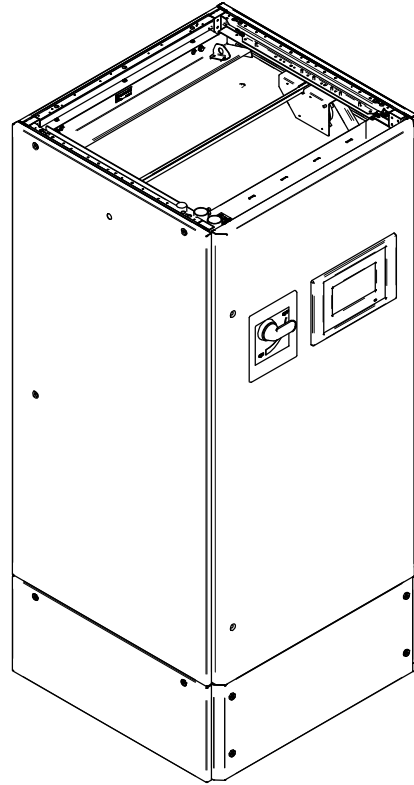
- 24. Unit-To-Unit** – Plug 64 is reserved for U2U communication.
- 25. Site and BMS** – Plug 74 and terminal block 3 are reserved for Site and BMS connections. Plug 74 is an eight pin RJ45 for a Cat 5 cable. Terminal block 3 is a two position screw terminal block for use with twisted pair wires. Only one of these connections can be used at a time.

**NOTE:** Refer to specification sheet for total unit full load amps, wire size amps, and max overcurrent protective device size.

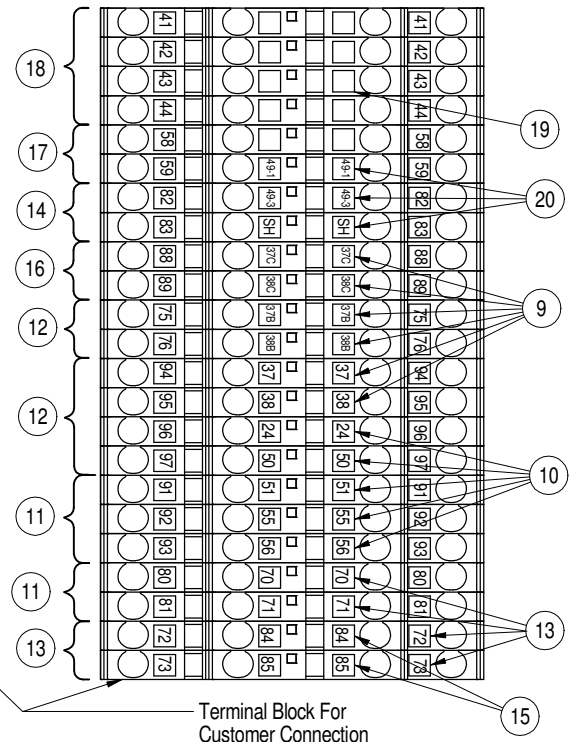
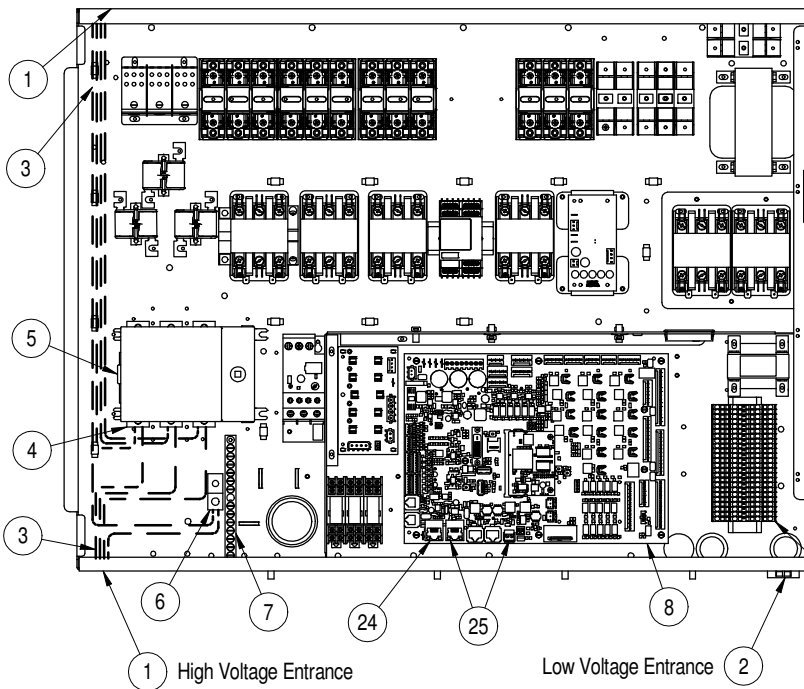
## ELECTRICAL FIELD CONNECTIONS UPFLOW & DOWNFLOW MODELS



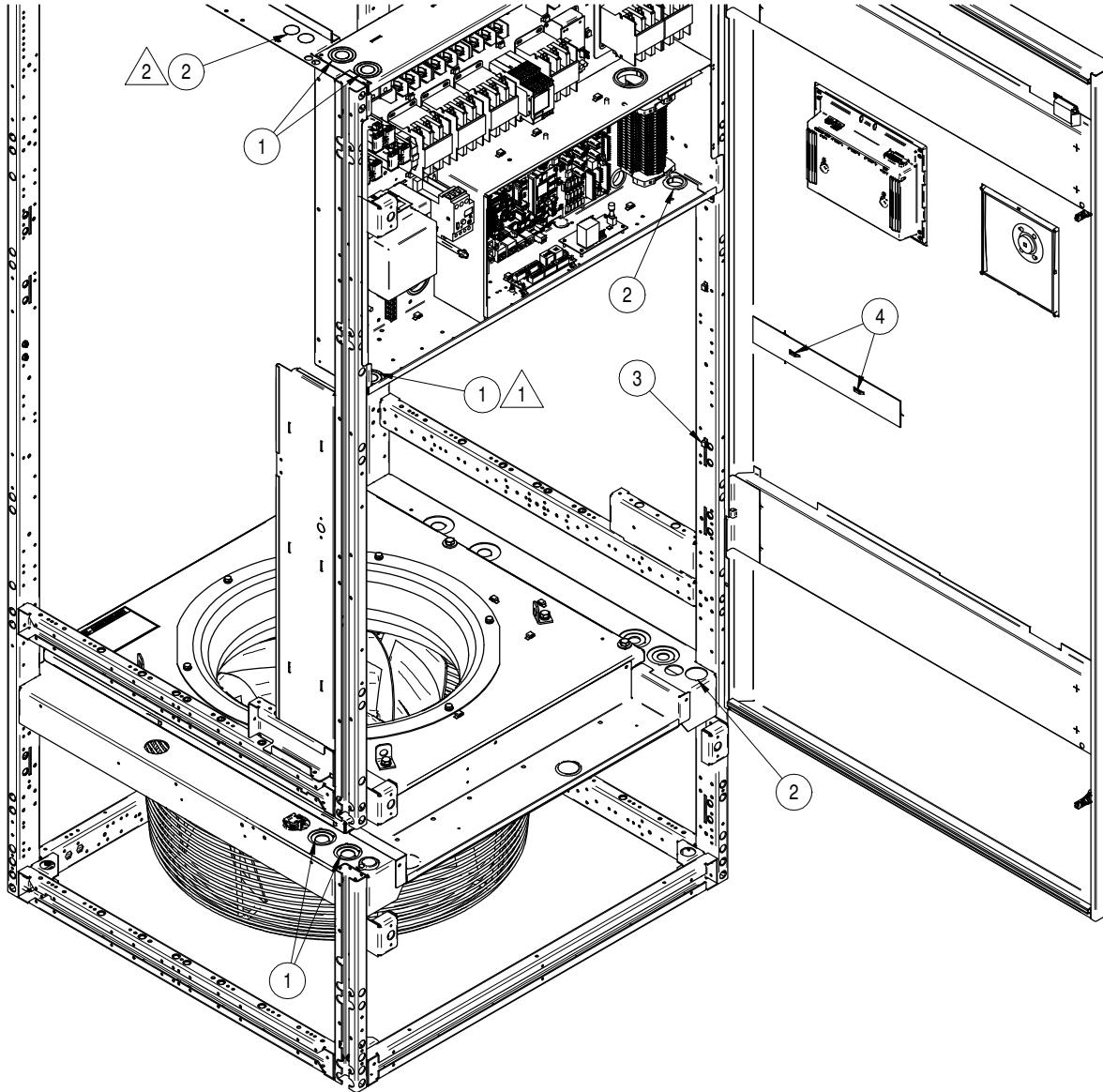
UPFLOW UNIT



DOWNFLOW UNIT



## ELECTRICAL FIELD CONNECTIONS DOWNFLOW MODELS

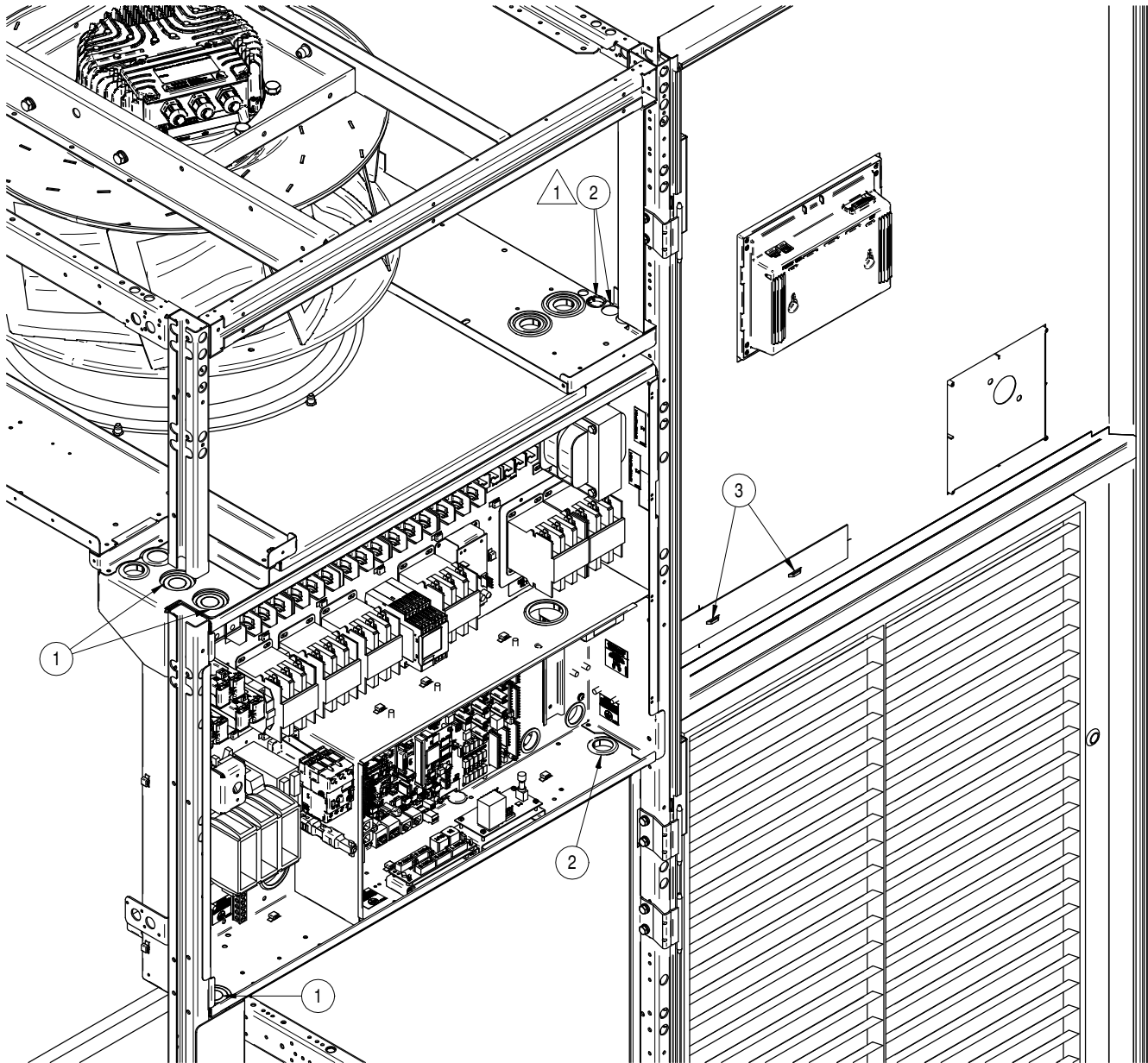


- ① Opening for field wiring. Suggested entry point for HV field wiring to unit.
- ② Opening for field wiring. Suggested entry point for LV field wiring to unit.
- ③ Wire tie anchors. Use to secure customer Ethernet wiring to control board.
- ④ Wire tie anchors. Use to secure customer wiring.

NOTES:

- ① Requires bushing if conduit is terminated below.
- ② Wire needs to be routed behind electric box to Low Voltage entrance on bottom of Electric Box.

## ELECTRICAL FIELD CONNECTIONS UPFLOW MODELS

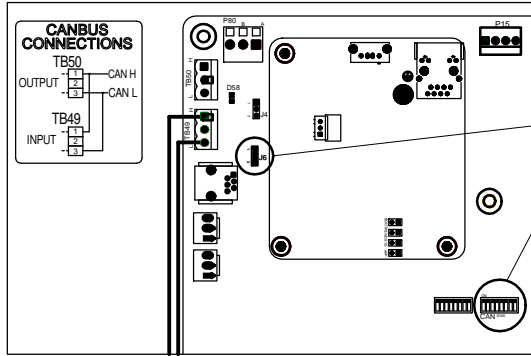


- ① Opening for field wiring. Suggested entry point for HV field wiring to unit.
- ② Opening for field wiring. Suggested entry point for LV field wiring to unit.
- ③ Wire tie anchors. Use to secure customer wiring.

Notes:

- ① Wire needs to be routed outside Electric Box to Low Voltage knockout on bottom of Electric Box.

## CANbus & INTERLOCK CONNECTIONS BETWEEN LIEBERT® PDX UNIT & LIEBERT® MC CONDENSER (PREMIUM)



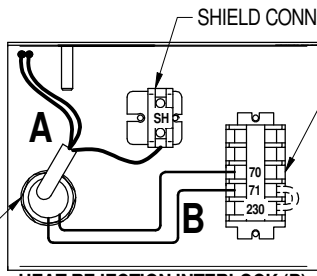
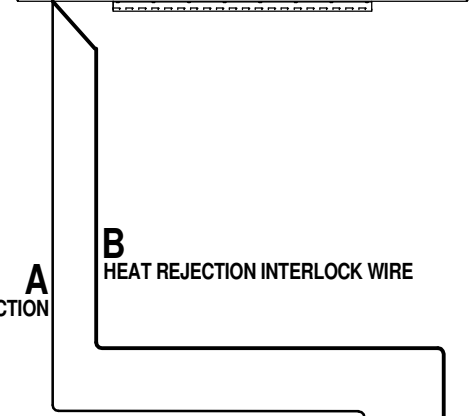
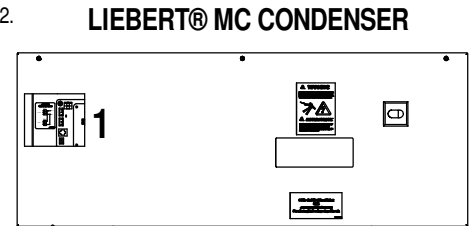
DETAIL 1  
CAN CABLE CONNECTION (A)



J6 TERMINATION JUMPER  
MUST BE SET TO PINS 1 AND 2.



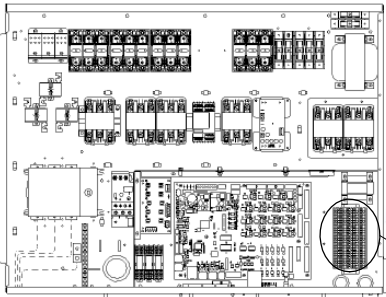
CANbus  
ADDRESSING  
SWITCH



LOW VOLTAGE FIELD ENTRANCE  
LOCATED ON BOTTOM LEFT OF  
CONDENSER ENCLOSURE.

HEAT REJECTION INTERLOCK (B)

CANbus CABLE CONNECTION



INDOOR UNIT

58				58
59	49-1	49-1		59
82	49-3	49-3		82
83	SH	SH		83
88	37-C	37-C		88
89	38-C	38-C		89
75	87-B	87-B		75
76	88-B	88-B		76
94				94
95	38	38		95
96	24	24		96
97	50	50		97
91	51	51		91
92	55	55		92
93	56	56		93
80	70	70		80
81	71	71		81

PARTIAL VIEW SHOWN FOR CLARITY





# LIEBERT® PDX

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## CANbus & INTERLOCK CONNECTIONS BETWEEN LIEBERT® PDX UNIT & LIEBERT® MC CONDENSER (PREMIUM)

### COMPONENT NOTES:

1. COMPONENT APPEARANCE, ORIENTATION AND POSITIONING MAY VARY TERMINAL NAMES AND CALLOUTS REMAIN CONSTANT.
2. ALL CIRCUITS TO THESE CONNECTION POINTS ARE CLASS 2.

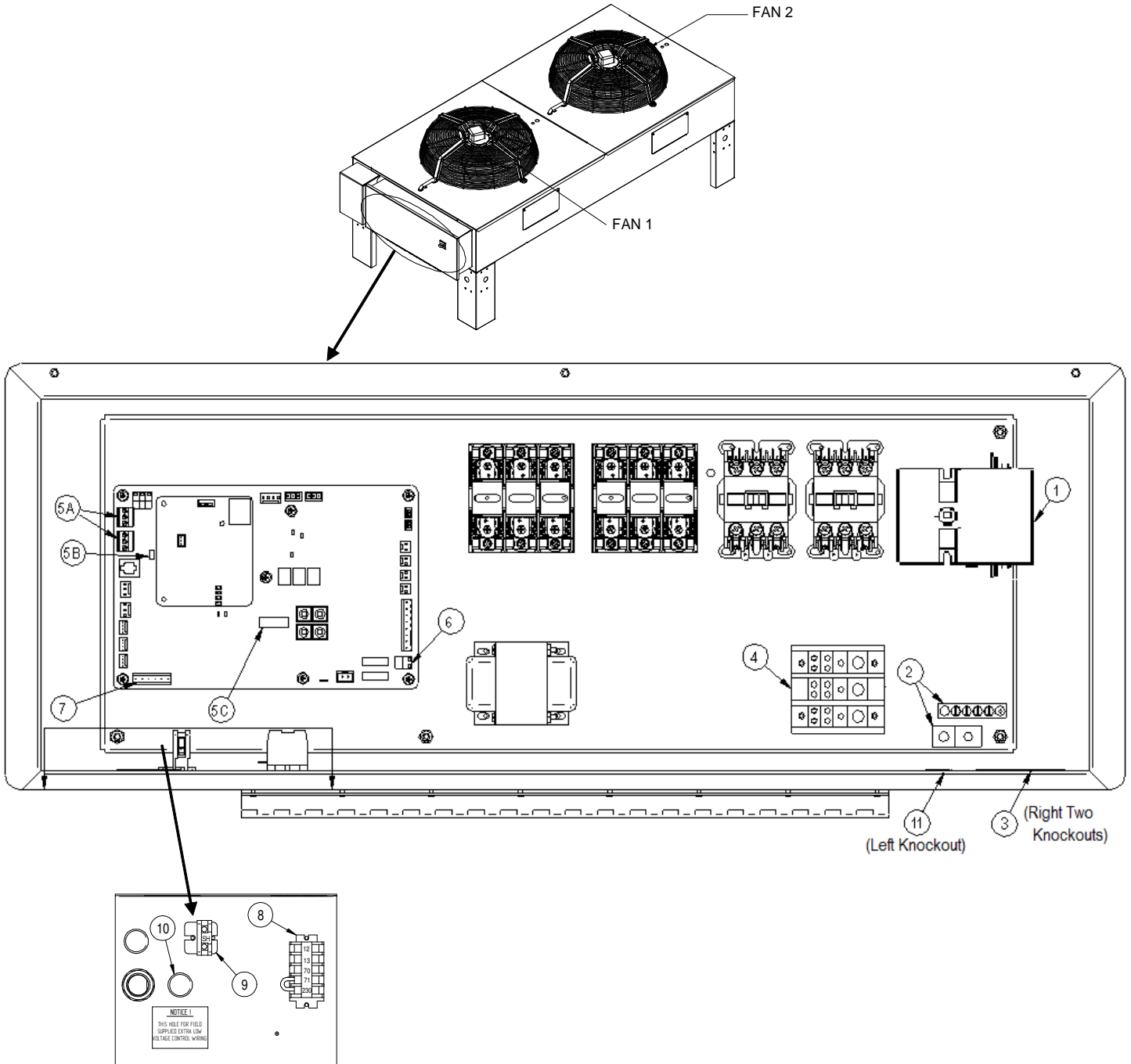
### CAN & CABLE NOTES (A):

1. CABLE MUST HAVE THE FOLLOWING SPECIFICATIONS:
  - BRAIDED SHIELD OR FOIL SHIELD WITH DRAIN WIRE
  - SHIELD MUST BE WIRED TO GROUND AT INDOOR UNIT
  - 22-18AWG STRANDED TINNED COPPER
  - TWISTED PAIR (MINIMUM 4 TWISTS PER FOOT)
  - LOW CAPACITANCE (15pF/FT OR LESS)
  - MUST BE RATED TO MEET LOCAL CODES AND CONDITIONS.
  - EXAMPLES BELDEN 89207 (PLENUM RATED), OR ALPHA WIRE 6454 CATEGORY 5, 5E, OR HIGHER.
2. DO NOT RUN IN SAME CONDUIT, RACEWAY, OR CHASE AS HIGH VOLTAGE WIRING.
3. FOR CANBUS NETWORK LENGTHS GREATER THAN 450FT(137M), CONTACT FACTORY.

### INTERLOCK WIRE NOTES (B):

1. FIELD SUPPLIED WIRE
  - 2 CONDUCTOR 18AWG OR GREATER
  - RATED 600V
2. RUN FIELD SUPPLIED WIRES BETWEEN THE INDOOR UNIT AND THE CONDENSER.

**ELECTRICAL FIELD CONNECTIONS  
PREMIUM EFFICIENCY CONTROL**



**KEY ELECTRICAL DETAILS:**

- 1) **Three phase electrical service** – Terminals are on top of disconnect switch for one and two fan units. Terminals are on bottom of disconnect switch for three and four fan units. Three phase service not by Vertiv. See note 5.
- 2) **Earth ground** – Field lug terminal for earth ground connection. Ground terminal strip for fan motor ground connection.
- 3) **Primary high voltage entrance** – Two 7/8" (22.2mm) diameter knockouts located at the bottom of the enclosure.
- 4) **SPD field connection terminals** – High voltage surge protective device (SPD) terminals. SPD is an optional device.



## ELECTRICAL FIELD CONNECTIONS PREMIUM EFFICIENCY CONTROL

- 5) **CANbus terminal connections** – Field terminals for CANbus cable connection.
- 5A is the CANbus connectors.
    - TB49-1 is the input terminal for CANbus high.
    - TB49-3 is the input terminal for CANbus low.
    - TB50-1 is output terminal for CANbus high.
    - TB50-3 is the output terminal for CANbus low.
    - Each CANbus cable shield is connected to terminal “SH”, item 9.
  - 5B is the “END OF LINE” jumper.
  - 5C is the CANbus “DEVICE ADDRESS DIP SWITCH”. CANbus cable not by Vertiv. See Note 2. (below)
- 6) **Remote unit shutdown** – Replace existing jumper between terminals TB38-1 and TB38-2 with field supplied normally closed switch having a minimum 75VA 24VAC rating. Use field supplied Class 1 wiring. (This is an optional feature that may be owner specified.)
- 7) **Alarm terminal connections** –
- a. Common Alarm Relay indicates when any type of alarm occurs. TB74-1 is common, TB74-2 is normally open, and TB74-3 is normally closed. 1 Amp 24VAC is the maximum load. Use Class 1 field supplied wiring.
  - b. Shutdown Alarm Relay indicates when condenser loses power, or when a critical alarm has occurred that shuts down the condenser unit. TB74-4 is common, TB74-5 is normally open, and TB74-6 is normally closed. 1 Amp 24VAC is the maximum load. Use Class 1 field supplied wiring.
- 8) **Indoor unit interlock and SPD alarm terminals** –
- a. On any call for compressor operation, normally open contact is closed across terminals 70 and 71 for Circuit 1, and normally open contact is closed across terminals 70 and 230 for Circuit 2 from indoor room unit.
  - b. During SPD alarm, normally open contact is closed across terminals 12 & 13. SPD is an optional device.
- 9) **CANbus shield terminal** – Terminal for field shield connection of the CANbus field supplied cables. The shield of CANbus field supplied cables must not be connected to ground at the condenser.
- 10) **Primary low voltage entrance** – One 7/8” (22.2mm) diameter knockout that is free for customer low voltage wiring.
- 11) **SPD entrance** – One 7/8” (22.2mm) diameter knockout hole located at the bottom of the enclosure. High voltage surge protective device (SPD) is optional.

### NOTES:

1. Refer to specification sheet for unit voltage rating, full load amp, and wire size amp ratings.
2. The CANbus wiring is field supplied and must be:
  - Braided shield or foil shield with drain wire
  - Shield must be wired to ground at indoor unit
  - 22-18AWG stranded tinned copper
  - Twisted pair (minimum 4 twists per foot)
  - Low Capacitance (15pF/FT or less)
  - Must be rated to meet local codes and conditions
  - EXAMPLES BELDEN 89207 (PLENUM RATED), OR ALPHA WIRE 6454 CATEGORY 5, 5E, OR HIGHER
3. Do not run in same conduit, raceway, or chase as high voltage wiring.
4. For CANbus network lengths greater than 450FT (137M) call Factory.



# LIEBERT® MC

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## ELECTRICAL FIELD CONNECTIONS PREMIUM EFFICIENCY CONTROL

5. All wiring must be sized and selected for insulation case per NEC and other local codes.
6. Do not bend cables to less than four times the diameter of the cable.
7. Do not deform cables when securing in bundles or when hanging them.
8. Avoid running the cables by devices that may introduce noise, such as machines, fluorescent lights, and electronics.
9. Avoid stretching cables.
10. The electrically commutated (EC) motors included in the Liebert® MC are suitable for connection to power supplies with a solidly grounded neutral or high resistance to ground or corner ground.
  - a. Acceptable power supplies for 208 to 575V nominal units:
    - 208V wye with solidly grounded neutral and 120V line to ground;
    - 380V wye with solidly grounded neutral and 220V line to ground;
    - 480V wye with solidly grounded neutral and 277V line to ground;
    - 575V wye with solidly grounded neutral and 332V line to ground (uses step-down transformer);
    - Wye with high resistance (or impedance) ground;
    - Delta with corner ground
  - b. Unacceptable power supplies for 208V to 575V nominal units:
    - Delta without ground or with floating ground;
    - Delta with grounded center tap.

## ELECTRICAL FIELD CONNECTIONS PREMIUM EFFICIENCY CONTROL WITH LIEBERT® LEE-TEMP

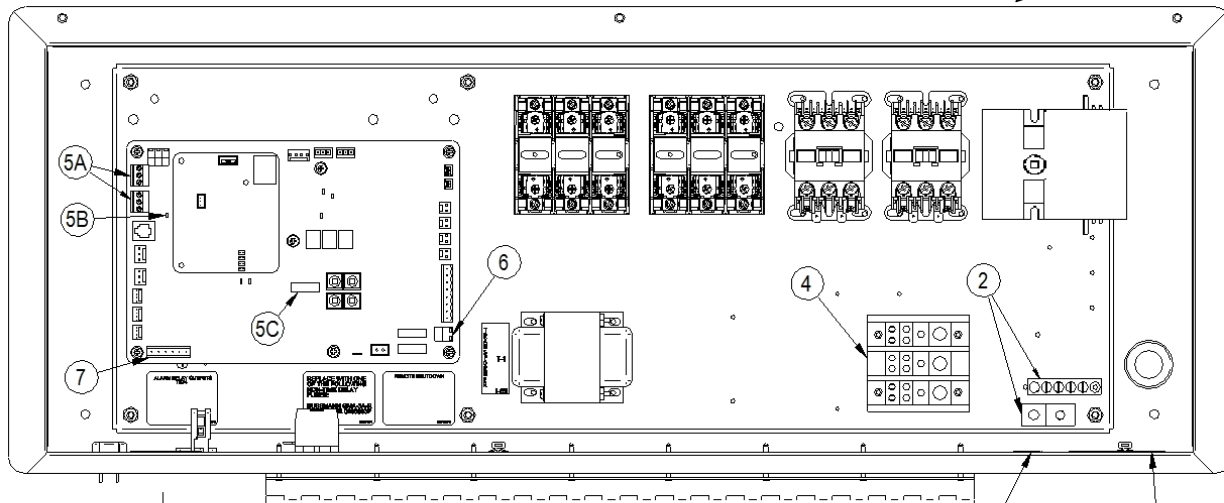
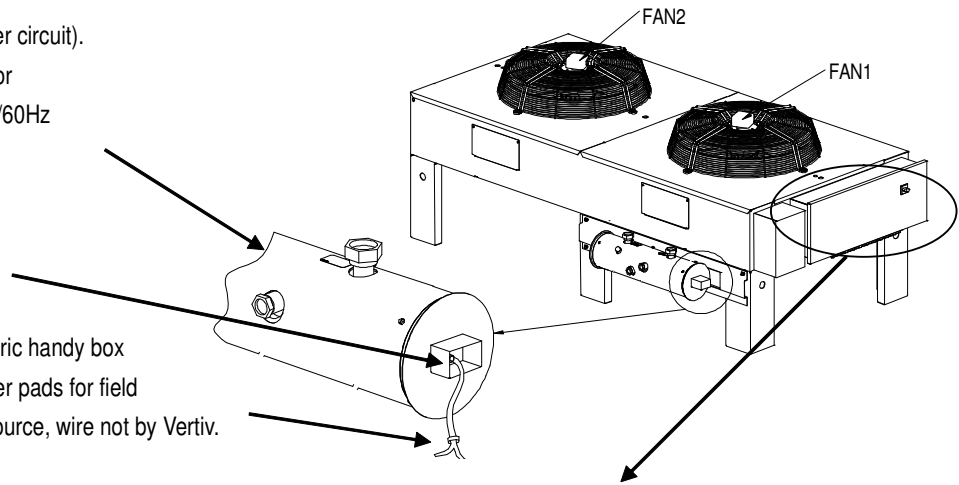
### Electrical Connections for Liebert® Lee-Temp Receiver

Liebert® Lee-Temp receiver tank (1 per circuit).

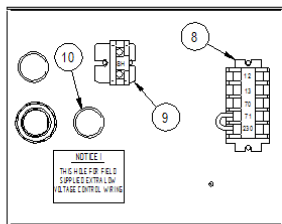
NOTE: Heater pad voltage available for  
120V/1 phase/60 Hz or 230V/1 phase/60Hz  
150 or 300 Watt, varies by condenser.

Electrical connection box with cover.  
(Cover removed for clarity.)

Electrical service connection. Pigtails in electric handy box  
are factory wired to Liebert® Lee-Temp heater pads for field  
connection of separate continuous electric source, wire not by Vertiv.



(LEFT KNOCKOUT) (RIGHT TWO KNOCKOUTS)



### KEY ELECTRICAL DETAILS:

- 1) **Three phase electrical service** – Terminals are on top of disconnect switch for one and two fan units. Terminals are on bottom of disconnect switch for three and four fan units. Three phase service not by Vertiv. See Note 5 (below).
- 2) **Earth ground** – Field lug terminal for earth ground connection. Ground terminal strip for fan motor ground connection.
- 3) **Primary high voltage entrance** – Two 7/8" (22.2mm) diameter knockouts located at the bottom of the enclosure.
- 4) **SPD field connection terminals** – High voltage surge protective device (SPD) terminals. SPD is an optional device.

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## ELECTRICAL FIELD CONNECTIONS

### PREMIUM EFFICIENCY CONTROL WITH LIEBERT® LEE-TEMP

- 5) **CANbus terminal connections** – Field terminals for CANbus cable connection.
- 5A is the CANbus connectors.
    - TB49-1 is the input terminal for CANbus high.
    - TB49-3 is the input terminal for CANbus low.
    - TB50-1 is output terminal for CANbus high.
    - TB50-3 is the output terminal for CANbus low.
    - Each CANbus cable shield is connected to terminal “SH”, item 9.
  - 5B is the “END OF LINE” jumper.
  - 5C is the CANbus “DEVICE ADDRESS DIP SWITCH”. CANbus cable not by Vertiv. See Note 2 (below).
- 6) **Remote unit shutdown** – Replace exiting jumper between terminals TB38-1 and TB38-2 with field supplied normally closed switch having a minimum 75VA 24VAC rating. Use field supplied Class 1 wiring. (This is an optional feature that may be owner specified.)
- 7) **Alarm terminal connections** –
- a. Common Alarm Relay indicates when any type of alarm occurs. TB74-1 is common, TB74-2 is normally open, and TB74-3 is normally closed. 1 Amp 24VAC is the maximum load. Use Class 1 field supplied wiring.
  - b. Shutdown Alarm Relay indicates when condenser loses power, or when a critical alarm has occurred that shuts down the condenser unit. TB74-4 is common, TB74-5 is normally open, and TB74-6 is normally closed. 1 Amp 24VAC is the maximum load. Use Class 1 field supplied wiring.
- 8) **Indoor unit interlock and SPD alarm terminals** –
- a. On any call for compressor operation, normally open contact is closed across terminals 70 & 71 for Circuit 1, and normally open contact is closed across terminals 70 & 230 for Circuit 2 from indoor room unit.
  - b. During SPD alarm, normally open contact is closed across terminals 12 & 13. SPD is an optional device.
- 9) **CANbus shield terminal** – Terminal for field connection of the CANbus field supplied cables. Shield of CANbus field supplied cables must not be connected to ground.
- 10) **Primary low voltage entrance** – One 7/8” (22.2mm) diameter knockout that is free for customer low voltage wiring.
- 11) **SPD entrance** – One 7/8” (22.2mm) diameter knockout hole located at the bottom of the enclosure. High voltage surge protective device (SPD) is optional.

**NOTES:**

1. Refer to specification sheet for unit voltage rating, full load amp, and wire size amp ratings.
2. The CANbus wiring is field supplied and must be:
  - Braided shield or foil shield with drain wire
  - Shield must be wired to ground at indoor unit
  - 22-18AWG stranded tinned copper
  - Twisted pair (minimum 4 twists per foot)
  - Low Capacitance (15pF/FT or less)
  - Must be rated to meet local codes and conditions
  - EXAMPLES BELDEN 89207 (PLENUM RATED), OR ALPHA WIRE 6454 CATEGORY 5, 5E, OR HIGHER
3. Do not run in same conduit, raceway, or chase as high voltage wiring.
4. For CANbus network lengths greater than 450FT (137M) call Factory.



# LIEBERT® MC

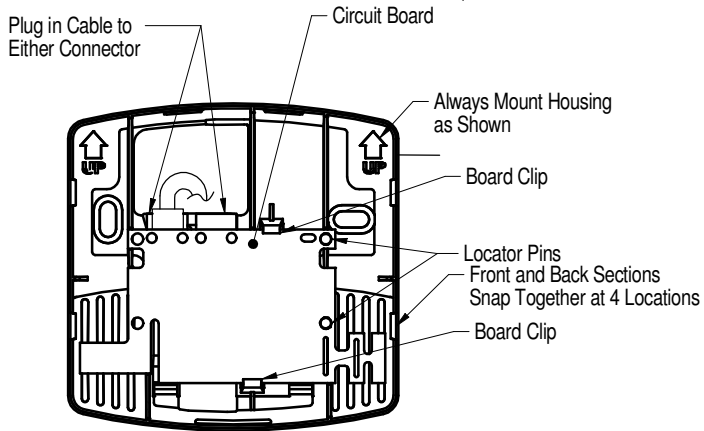
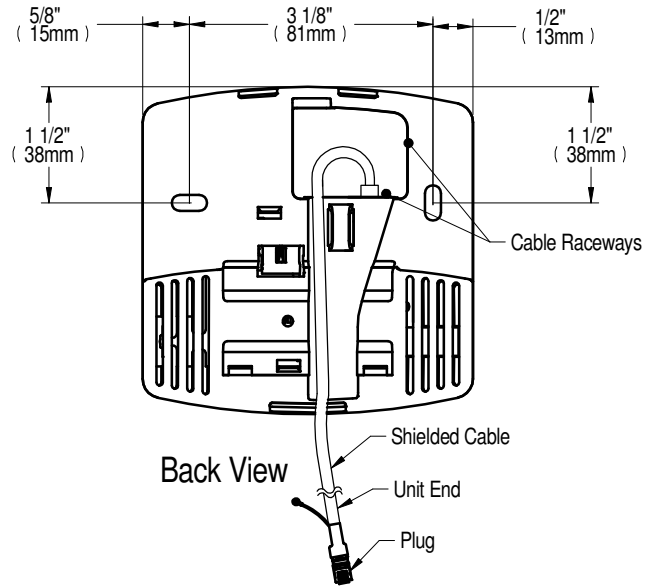
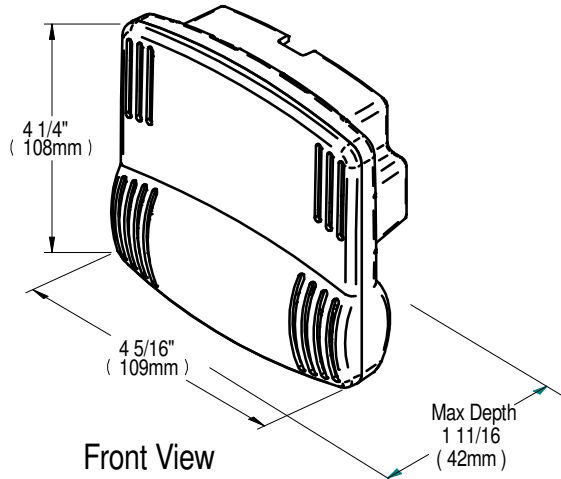
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## ELECTRICAL FIELD CONNECTIONS

### PREMIUM EFFICIENCY CONTROL WITH LIEBERT® LEE-TEMP

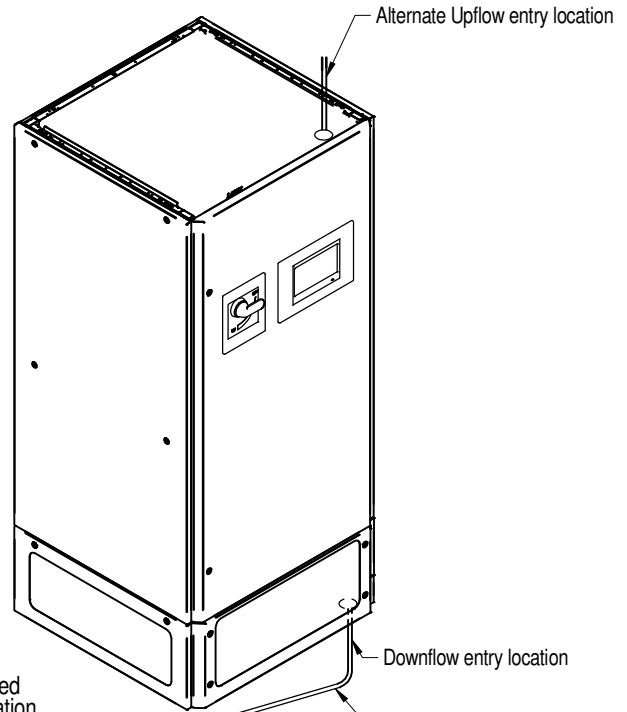
5. All wiring must be sized and selected for insulation case per NEC and other local codes.
6. Do not bend cables to less than four times the diameter of the cable.
7. Do not deform cables when securing in bundles or when hanging them.
8. Avoid running the cables by devices that may introduce noise, such as machines, fluorescent lights, and electronics.
9. Avoid stretching cables.
10. The electrically commutated (EC) motors included in the Liebert® MC are suitable for connection to power supplies with a solidly grounded neutral or high resistance to ground or corner ground.
  - A. Acceptable power supplies for 208 to 575V nominal units:
    - 208V wye with solidly grounded neutral and 120V line to ground;
    - 380V wye with solidly grounded neutral and 220V line to ground;
    - 480V wye with solidly grounded neutral and 277V line to ground;
    - 575V wye with solidly grounded neutral and 332V line to ground (uses step-down transformer);
    - Wye with high resistance (or impedance) ground;
    - Delta with corner ground
  - B. Unacceptable power supplies for 208V to 575V nominal units:
    - Delta without ground or with floating ground;
    - Delta with grounded center tap.

**REMOTE TEMPERATURE & HUMIDITY SENSOR**



**Inside View of Back**

**Remote Temp & Humid Sensor Box**



Factory supplied, field installed shielded cable. See specification sheet for length.

Cable Marked "Unit End" Plugs into P67

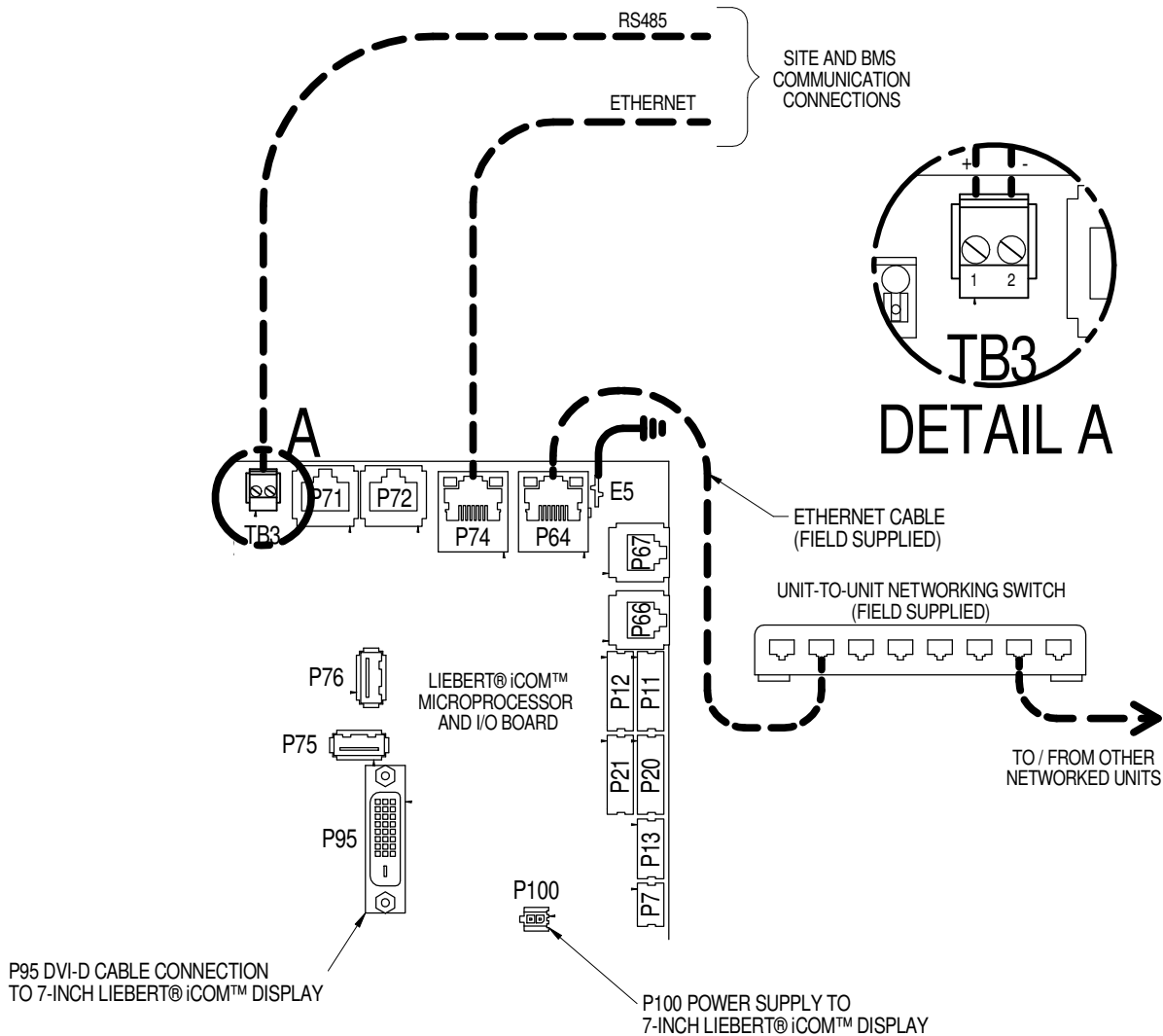
Cable Marked "Sensor End"

**Liebert® Room Unit**  
(unit size varies per product line)



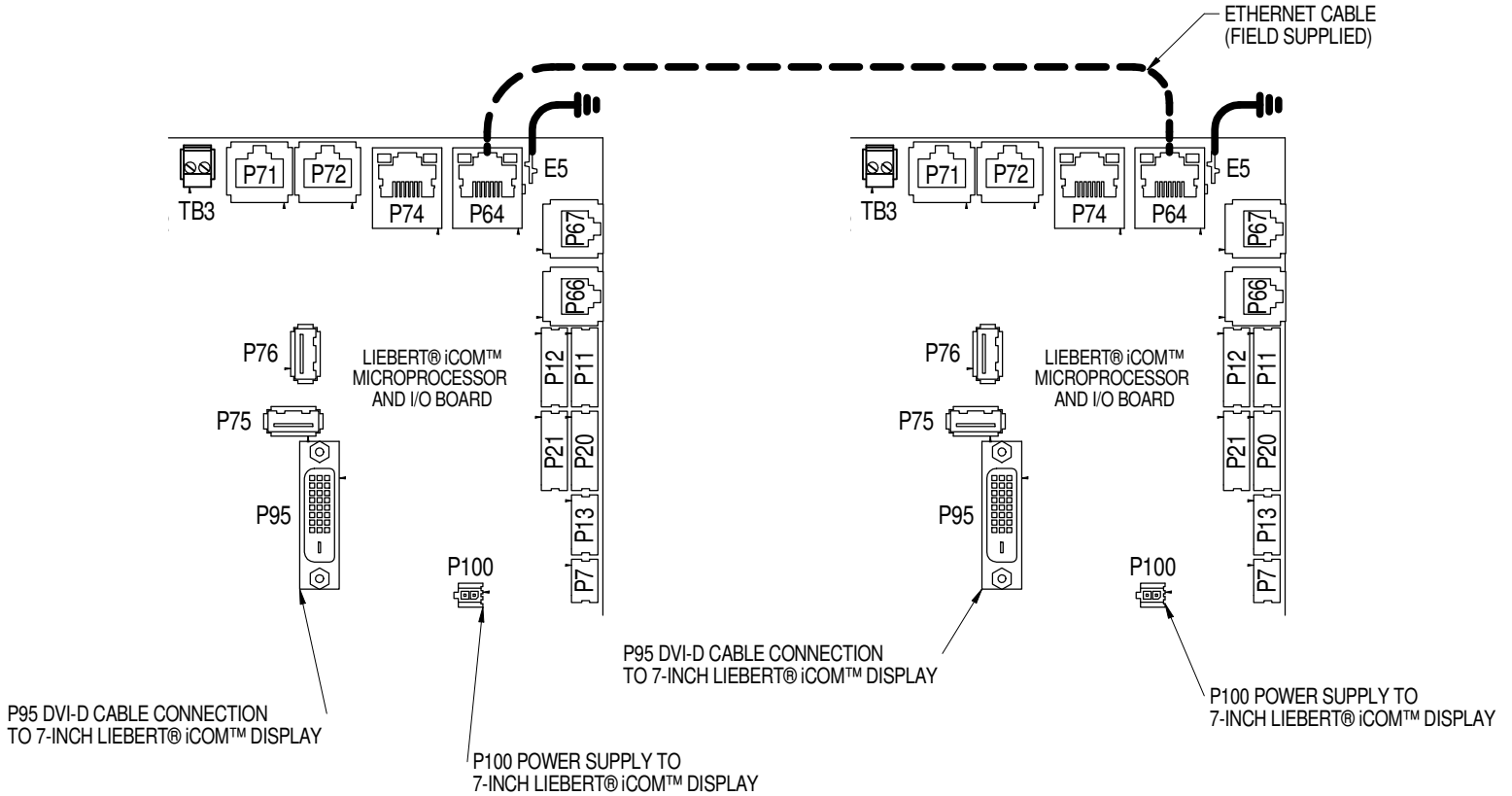
## UNIT TO UNIT NETWORK CONNECTIONS

LIEBERT® CW, LIEBERT® CWA, LIEBERT® DS, LIEBERT® DSE,  
LIEBERT® PDX, LIEBERT® PCW



**UNIT TO UNIT NETWORK CONNECTIONS**

**LIEBERT® CW, LIEBERT® CWA, LIEBERT® DS, LIEBERT® DSE,  
LIEBERT® PDX, LIEBERT® PCW**



**NOTE\*** For dual-unit network configurations only

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