CoolPhase Perimeter (PX011-PX029) Thermal Management Systems

Installer/User Guide

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

The information contained in this document is subject to change without notice and may not be suitable for all applications. While every precaution has been taken to ensure the accuracy and completeness of this document, Vertiv assumes no responsibility and disclaims all liability for damages resulting from use of this information or for any errors or omissions.

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.

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™ CoolPhase Perimeter. Read this manual thoroughly before attempting to install or operate this unit.

This equipment is required to be installed only in locations not accessible to the general public. Installation, service, and maintenance work must be performed only by properly trained, certified, and qualified personnel and in accordance with applicable regulations and manufacturer's specifications.

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 16 .

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 Steam Generating Humidifier Status Lights: Causes and Corrective Actions 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 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.

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 ±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™ CoolPhase Perimeter 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.

NOTICE

Condenser fans should be operated manually if they have not run for an extended time in an outdoor environment. Before enabling the condenser for normal cooling operation fans should be run at full speed for at least three hours once a month to move the bearings and allow any condensate that may have ingressed to evaporate. Condenser firmware release 1.06.045 & later include settings to operate condenser fans if they have been inactive for more than 30 days.

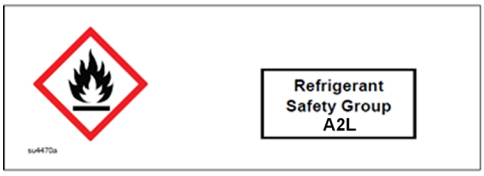
NOTICE

This unit is suitable for ITE (Information Technology Equipment) applications, such as data centers, computer rooms, or other ITE areas only.

NOTE: The Vertiv™ 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™ CoolPhase Condenser units without receivers will require field provided pressure-relief devices such as a fusible plug. A pressure relief valve is provided with Vertiv™ Lee-Temp receivers and an integral, fusible plug is provided on PDX-EEV receivers.

Agency Listed

Standard 60 Hz units are CSA Certified to the harmonized U.S. and Canadian product safety standard UL/CSA 60335-2-40 4th Edition 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™ CoolPhase Perimeter units and components.

Figure 2.1 Vertiv™ CoolPhase Perimeter Views

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

2.1 Vertiv™ CoolPhase Perimeter 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 107.

Table 2.1 Vertiv™ CoolPhase Perimeter 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	Z	H	2	2	8	0	1	P	L	B	F	P	A	#	#	#

Table 2.2 Vertiv™ CoolPhase Perimeter 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-454B)	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 Component Location

The unit component locations are described in the submittal documents included in the 111.

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

Table 2.3 Component Location Drawings

Document Number	Title
20000365	Vertiv™ CoolPhase Perimeter Downflow Component Location Diagram
20000366	Vertiv™ CoolPhase Perimeter Upflow Component Location Diagram

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 107 , or PCW Model Number Digit Definitions, 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 111 .

- Verify that the floor is level, solid, and sufficient to support the unit. See Table 3.3 on page 16 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™ CoolPhase Perimeter 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.

Engineer of record must ensure the room has the required minimum Effective Dispersal Volume for the refrigerant charge amount of the largest refrigerant circuit. See A2L Refrigerant Effective Dispersal Volume Calculation on page 17 . Allow for additional charge due to appropriate subcooling or receiver site glass charging. If installing the unit in an ITE area with less than the required VED (Effective Dispersal Volume), it is required to have a mechanical ventilation system(s) in accordance with ASHRAE 15.

We recommend installing an under floor water detection system. Contact your Vertiv representative for information.

NOTICE

If the unit is not installed in a conditioned space, the location must be constructed such that should any refrigerant leak occur, it will not stagnate and create a fire or explosion hazard.

WARNING! Auxiliary devices which may be a POTENTIAL IGNITION SOURCE shall not be installed in the duct work. Examples of such POTENTIAL IGNITION SOURCES are hot surfaces with a temperature exceeding 700°C and electric switching devices. Only auxiliary devices approved by Vertiv or declared suitable with the refrigerant shall be installed in connecting ductwork.

WARNING! When appliances connected via an air duct system to one or more rooms with A2L REFRIGERANTS are installed in a room with an EFFECTIVE DISPERSAL VOLUME VED less than the minimum as determined by A2L Refrigerant Effective Dispersal Volume Calculation on page 17 , that room shall be without continuously operating open flames (e.g. an operating gas appliance) or other POTENTIAL IGNITION SOURCES (for e.g., an operating electric heater, hot surfaces).

3.1 Planning Dimensions

The unit, floor stand, and plenum dimensions are described in the submittal documents included in the 111.

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

Table 3.1 Dimension Planning Drawings

Document Number	Title
Downflow Units	
20000369	Vertiv™ CoolPhase Perimeter Downflow Cabinet Dimensional Data
20000370	Vertiv™ CoolPhase Perimeter Downflow Cabinet Dimensional Data Floor Level Discharge Models
Upflow Units	
20000371	Vertiv™ CoolPhase Perimeter Upflow Cabinet Dimensional Data
20000372, pg. 1	Vertiv™ CoolPhase Perimeter Upflow Cabinet Dimensional Data Rear Return Models
Floor Stands	
20000373	Vertiv™ CoolPhase Perimeter Floor Stand and Floor Planning Dimensional Data
20000372, pg. 2	Vertiv™ CoolPhase Perimeter Upflow Floor Stand and Floor Planning Dimensional Data Rear Return Models
Plenums	
20000374	Vertiv™ CoolPhase Perimeter Upflow Plenum Dimensional Data Discharge Grille
20000375	Vertiv™ CoolPhase Perimeter Upflow Plenum Dimensional Data with Duct Collar
20000376	Vertiv™ CoolPhase Perimeter Upflow Plenum Dimensional Data Top Discharge
20000377	Vertiv™ CoolPhase Perimeter Downflow Plenum Dimensional Data with Duct Collar
20000378	Vertiv™ CoolPhase Perimeter 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 in. (191 mm) of clearance.
- Ensure that there is adequate clearance above the unit for return air.
- Provide clearance for service access, see 20000369 in the Submittal Drawings on page 111 .

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 20000370 in the Submittal Drawings on page 111 .

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 20000371 in the Submittal Drawings on page 111 .

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 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 111 .
- Water/glycol and Vertiv™ GLYCOOL units utilizing a Vertiv™ Drycooler may require an optional aquastat setting. See Table 9.5 on page 92 and Table 9.6 on page 92 for Vertiv™ 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™ CoolPhase Perimeter must be operated in a conditioned space within the operating envelope that ASHRAE recommends for data centers. Operating the Vertiv™ CoolPhase Perimeter 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™ CoolPhase Perimeter 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 Vertiv™ CoolPhase Perimeter 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™ CoolPhase Perimeter 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™ CoolPhase Perimeter

Model Number	L x W x H, in. (mm)	
	Domestic	Export
PX011, PX018 PX023, PX029	44 x 60 x 85.5 (1118 x 1524 x 2172)	45 x 60 x 86 (1143 x 1524 x 2184)
Source: DPN003087, Rev. C		

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 Vertiv™ Econ-o-Coil	700 (318)	850 (386)	985 (447)
	Water/Glycol	620 (281)	770 (349)	905 (410)
	Water/Glycol with Vertiv™ Econ-o-Coil	720 (327)	870 (395)	1005 (456)
	Vertiv™ GLYCOOL			
PX018 PX023	Air	670 (304)	820 (372)	955 (433)
	Air with Vertiv™ Econ-o-Coil	750 (340)	900 (408)	1035 (469)
	Water/Glycol	690 (313)	840 (381)	975 (442)
	Water/Glycol with Vertiv™ Econ-o-Coil	770 (349)	920 (417)	1055 (478)
	Vertiv™ GLYCOOL			
PX029	Air	700 (317)	850 (385)	985 (446)
	Air with Vertiv™ Econ-o-Coil	790 (358)	940 (426)	1075 (487)
	Water/Glycol	720 (327)	870 (395)	1005 (456)
	Water/Glycol with Vertiv™ Econ-o-Coil	810 (367)	960 (435)	1095 (496)
	Vertiv™ GLYCOOL			
Source: DPN003087, Rev. C				

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

3.6 A2L Refrigerant Effective Dispersal Volume Calculation

Engineer of record to determine the Refrigerant Charge m_c and required minimum Effective Dispersal Volume V_{ED} of the space to which the appliance can be utilized for the cooling of ITE areas.

The required minimum Effective Dispersal Volume V_{ED} is a function of the refrigerant charge, m_c and is represented by the following equation:

$V_{ED} = m_c / 0.5 \times LFL$

V_{ED} = the minimum Effective Dispersal Volume in ft^3 (m^3)

m_c = the refrigerant charge of the largest single circuit of a unit in lbs (kg)

0.5 = the concentration factor

LFL = the Lower Flammability Limit in lbs/1000 ft^3 (kg/m^3)

NOTE: The LFL of R-454B is 18.5 lbs/1000 ft^3 (296.8 g/m^3) according to ASHRAE 34-2024.

Minimum Effective Dispersal Volume V_{ED} of the space shall be based on altitude of the installation location. For locations above sea level, the engineer of record will need to adjust the value of LFL in accordance with ANSI/ASHRAE 34 before applying it to the equation for determining the required minimum Effective Dispersal Volume V_{ED}.

Figure 3.1 Change Size vs Effective Dispersal Volume

Figure 3.2 Charge Size vs Effective Dispersal Volume

3.6.1 How to Determine the Effective Dispersal Volume of an ITE Area

Volume Calculations shall be based on the overall volume of space available to which the refrigerant disperses within the Circulation Airflow in the event of a refrigerant leak. This overall volume shall be modified with the appropriate deductions. For the purposes of determining the Effective Dispersal Volume of an ITE area the following shall apply:

a. The Effective Dispersal Volume shall only include the circulated airflow of the system.
b. The Effective Dispersal Volume shall initially include the ITE area enclosed by the floor, walls, and ceiling of that space.
c. When the Circulation Airflow includes underfloor spaces, suspended ceiling spaces, or other partitioned spaces, such as equipment galleries, the volume of those spaces may be included.

In general, the volume of equipment, piping, wiring, or other apparatus that consume space within and are isolated from the Circulation Airflow shall be deducted from the Effective Dispersal Volume. The following deductions shall be applied:

a. When the Circulation Airflow has been fully contained on both hot and cold sides of the aisle, via ducts or other apparatus, any room volume outside of that containment shall not be included when calculating the Effective Dispersal Volume.

b. When the overall volume of space available, or a partitioned portion of that volume includes ducted openings from partially ducted systems, some volume of that space may require a deduction. No volume greater than four feet away in height from the upper most supply or return duct opening in the space may be included when calculating the Effective Dispersal Volume, unless an analysis of the airflow has been conducted to show that the volume of air has effective movement for the mixing of a leaked refrigerant.
c. Obstructions of tubing, piping, wiring, etc., consuming more than 0.0071 m^3 (0.25 ft^3) of space shall be included in the deductions from the overall volume.
d. The ITE within the circulated airflow shall be evaluated for their deduction from the Effective Dispersal Volume. The deducted volume of the ITE shall be based on the designed maximum capacity or fill of the servers.
e. As a maximum value, no more than 75 % of the ITE's volume shall be included as circulating air space in the Effective Dispersal Volume. The total volume of the ITE shall be defined by the overall dimensions of its ITE enclosure. Small gaps in between individual server racks shall not be included in the Effective Dispersal Volume.
f. Any other volume within the circulation airflow that is otherwise enclosed or partitioned off from the airflow shall be deducted in the calculation of the Effective Dispersal Volume.

Source: 20000249, Rev. A

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 16 .

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 in. (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 in. (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

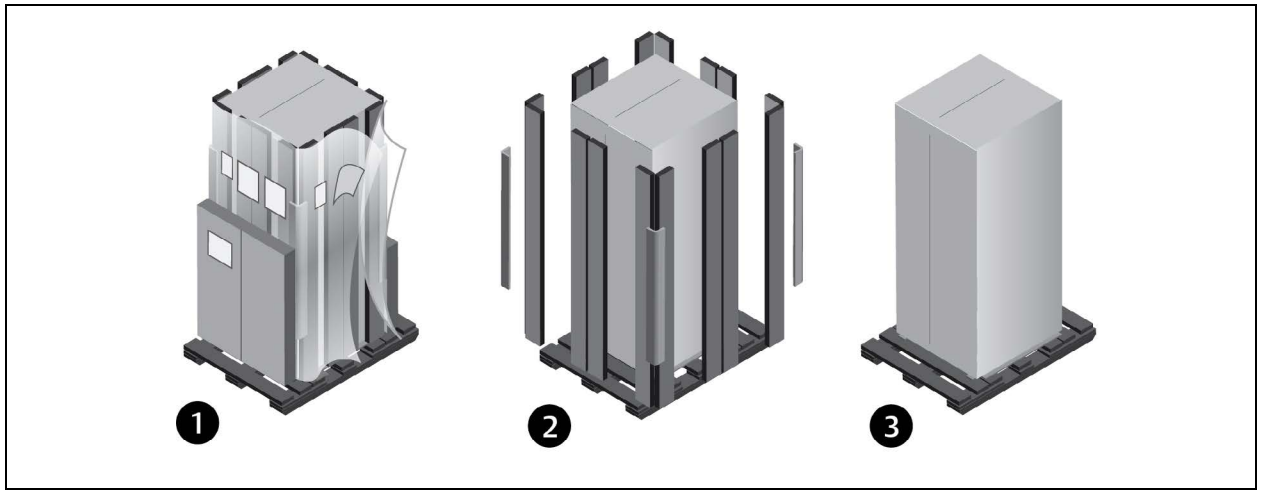
4.3 Unpacking the Unit

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

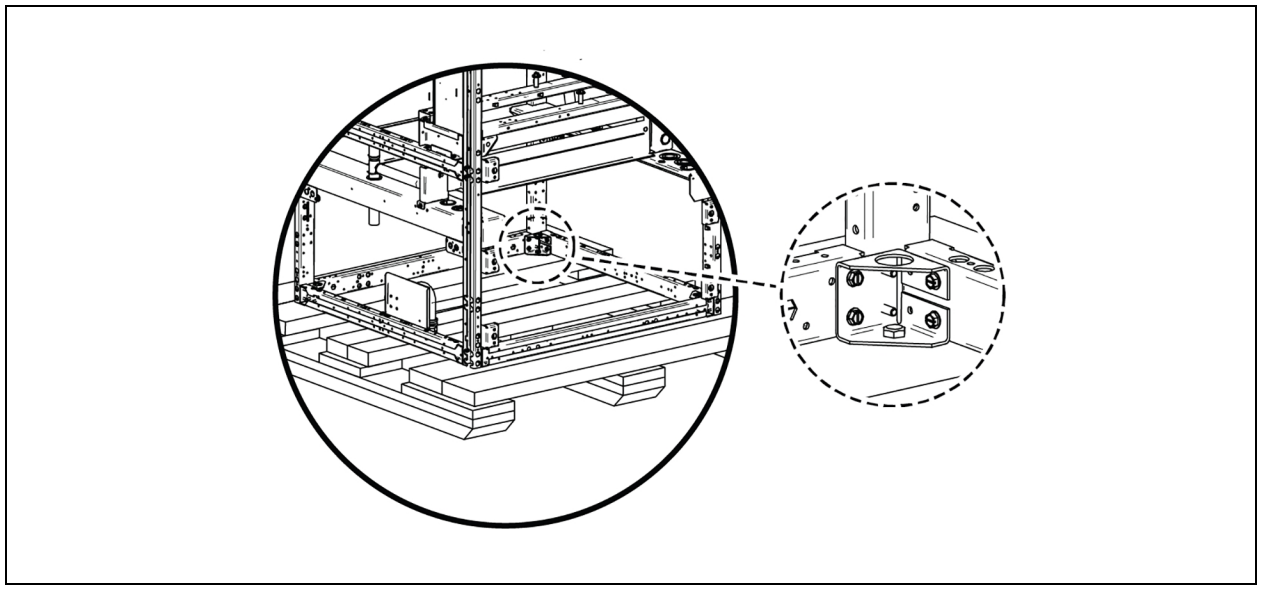


Item	Description
1	Shipped loose items location, and removing exterior wrap from unit.
2	Remove corner and side packaging planks.
3	Leave the bag on the unit until ready to install.

4.3.1 Removing the Unit from the Skid with a Forklift

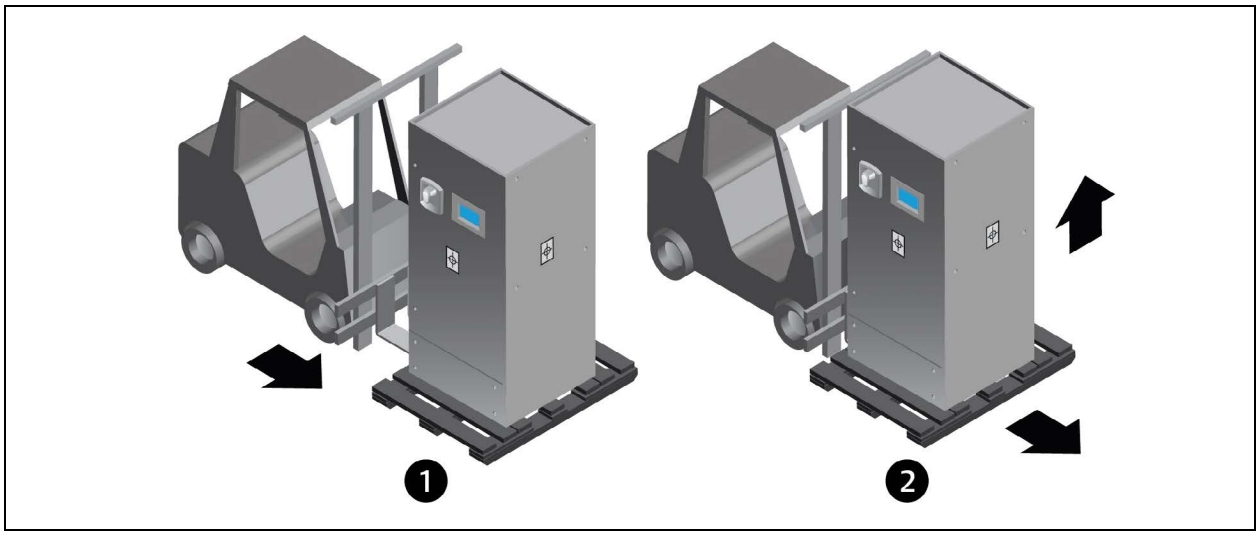
1. Remove the panels from the unit, and remove the four bolts attaching the unit to the skid. They are inside the unit base as shown in Figure 4.3 below .

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



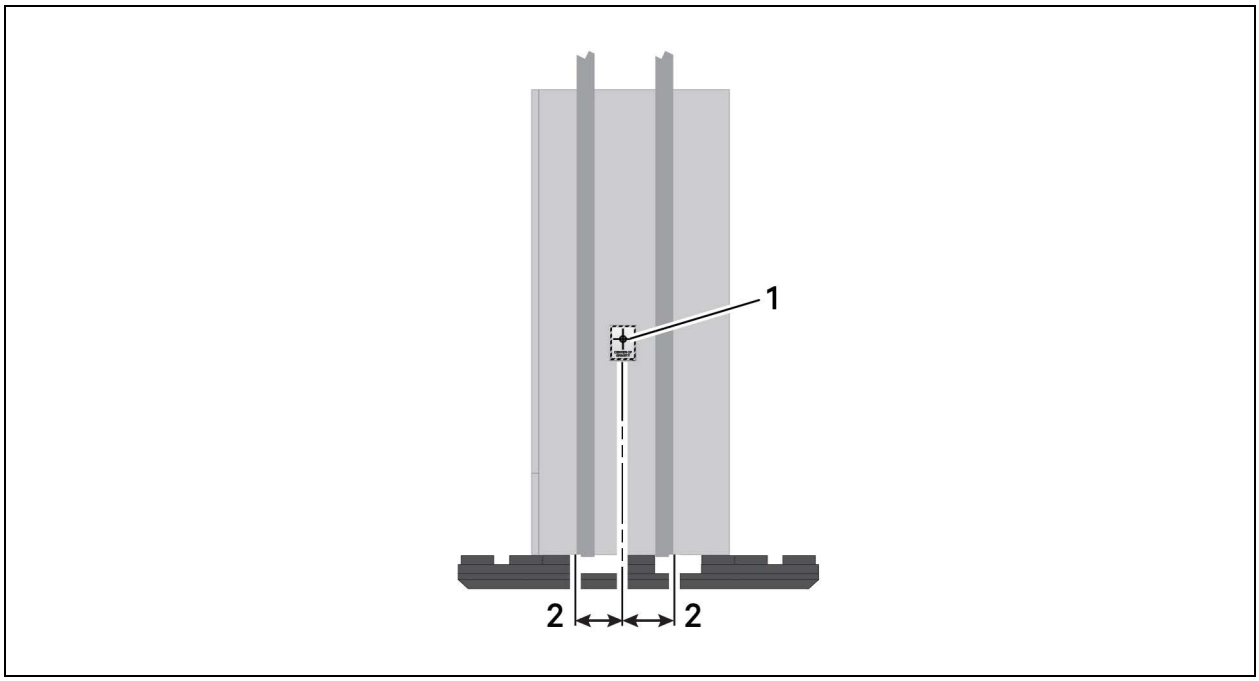
Item	Description
1	Insert tines completely under base of unit.
2	Lift unit and remove skid.

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



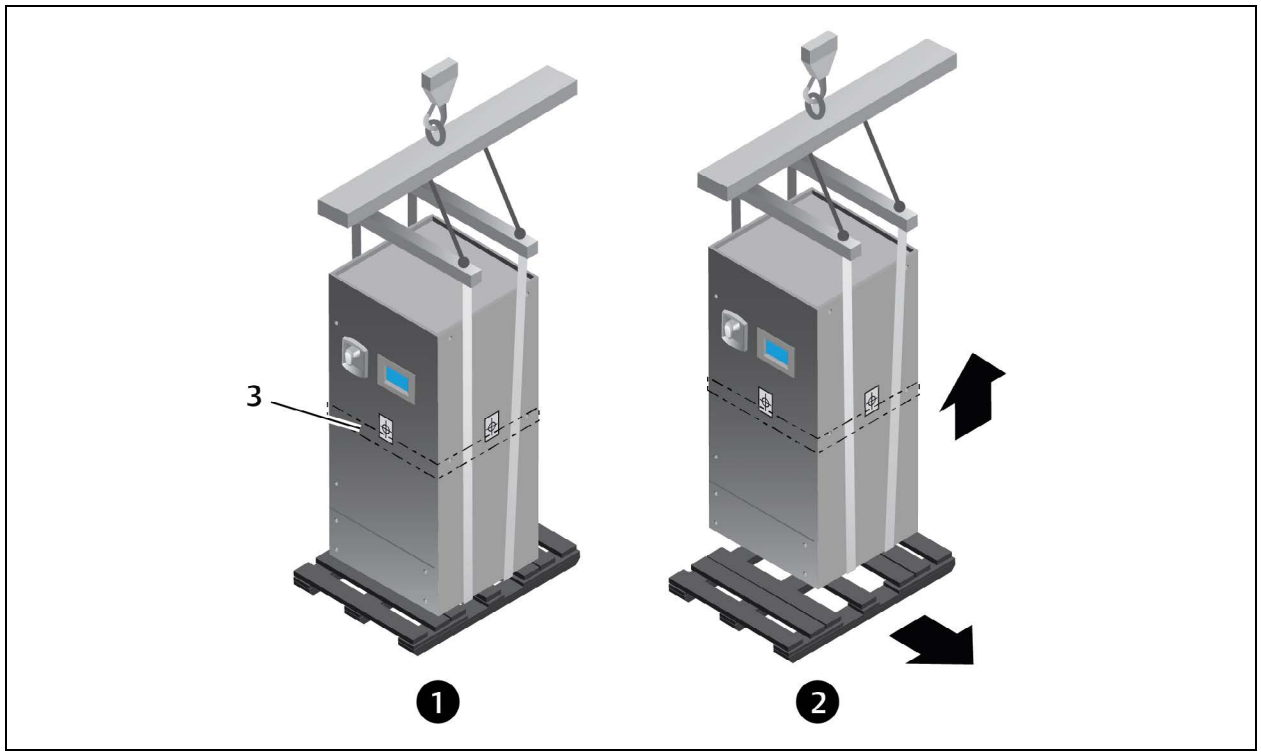
Item	Description
1	Center of gravity marker
2	Equal distance between sling and marker

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

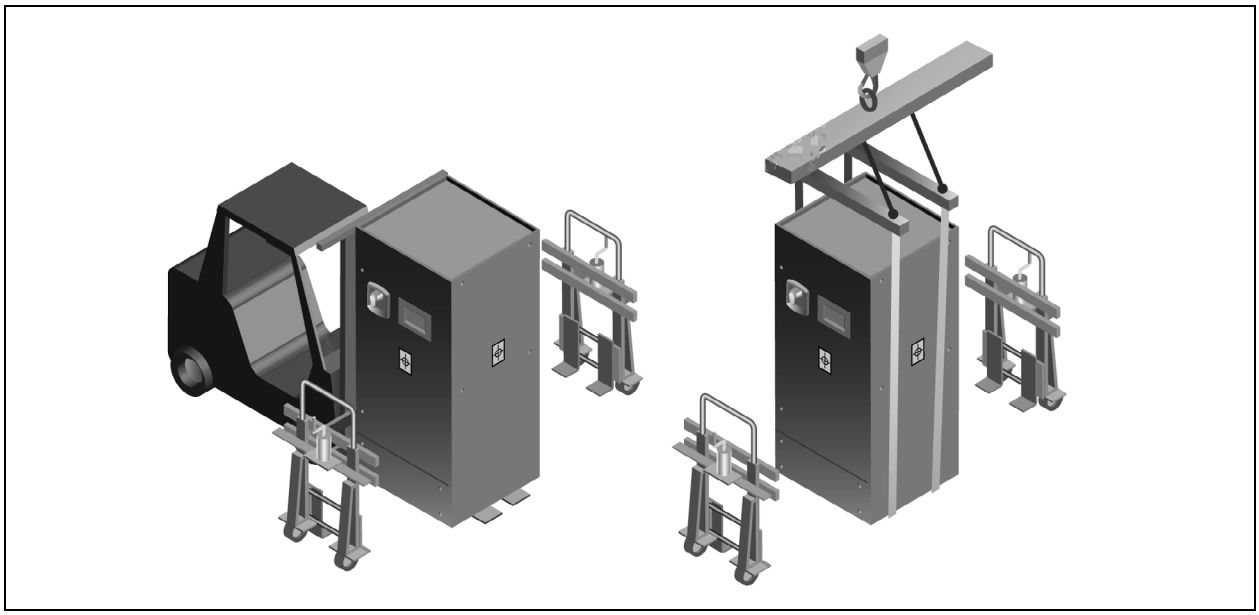


Item	Description
1	Use spreader bars and protect unit from slings.
2	Lift unit so that weight is not on skid, and remove the skid.
3	Horizontal strap location, at mid-height of unit.

4.3.3 Moving the Unit with Piano Jacks

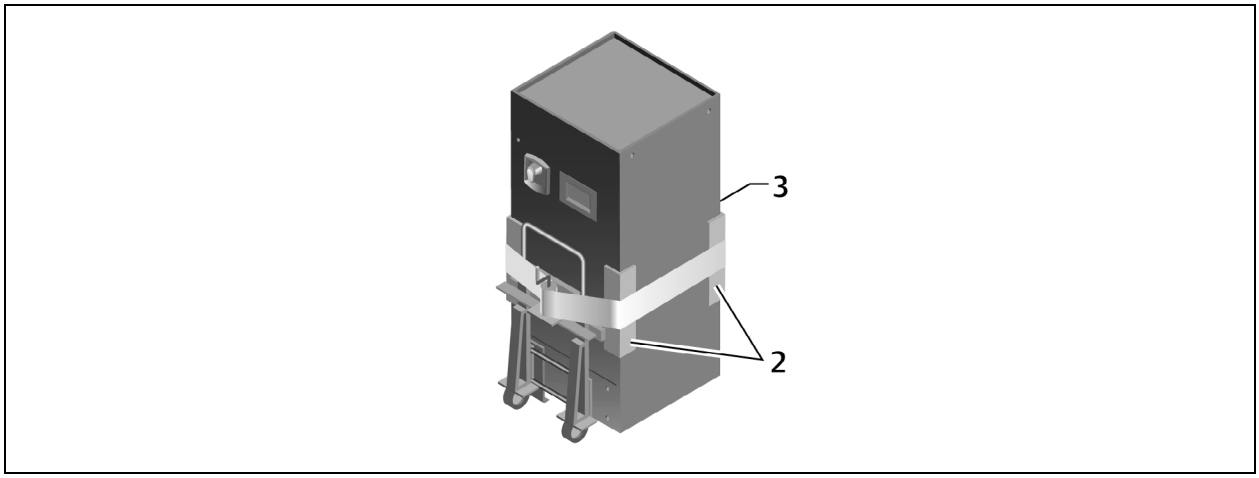
1. With the unit raised by a forklift, pallet jack or rigging according to the previous instructions, position a piano jack on either side of the elevated unit, see Figure 4.7 below , then lower the unit to a height suitable for the piano jacks.

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™ CoolPhase Perimeter is not symmetrical. Its orientation to the unit is critical for installation of the unit.

5 Piping and Refrigerant Requirements

NOTICE

Field installed piping, including piping material, pipe routing, and installation shall include protection from physical damage in operation and service, and be in compliance with national and local codes and standards, such as ASHRAE 15, IAPMO Uniform Mechanical Code, ICC International Mechanical Code, or CSA B52. All field joints shall be accessible for inspection prior to being covered or enclosed.

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 111.

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

Table 5.1 Piping General Arrangement Drawings

Document Number	Title
Vertiv™ CoolPhase Perimeter Piping Schematics	
20000379	Vertiv™ CoolPhase Perimeter Air Cooled Piping Schematic Models with TXV
20000380	Vertiv™ CoolPhase Condenser Air Cooled Piping Schematic with EEV
20000381	Vertiv™ CoolPhase Perimeter Air Cooled Piping Schematic with EEV
20000382	Vertiv™ CoolPhase Perimeter Air Cooled Piping Schematic with EEV and Vertiv™ CoolPhase Condenser with Receiver above Unit
20000383	Vertiv™ CoolPhase Perimeter Water/Glycol Cooled Piping Schematics
20000384	Vertiv™ CoolPhase Perimeter Glycol Cooled Piping Schematics
20000385	Vertiv™ CoolPhase Perimeter Optional Piping Schematics Vertiv™ Econ-o-Coil

Table 5.2 Piping Connection Drawings

Document Number	Title
Downflow Model Primary Connection Locations	
20000388	Vertiv™ CoolPhase Perimeter Downflow Air Cooled Primary Connection Locations
20000389	Vertiv™ CoolPhase Perimeter Downflow Air Cooled Primary Connection Locations
20000390	Vertiv™ CoolPhase Perimeter Downflow Water/Glycol Cooled Primary Connection Locations

Table 5.2 Piping Connection Drawings (continued)

Document Number	Title
20000391	Vertiv™ CoolPhase Perimeter Downflow Water/Glycol Cooled Primary Connection Locations Front Discharge Models
20000392	Vertiv™ CoolPhase Perimeter Downflow Water/Glycol Cooled Primary Connection Locations
20000393	Vertiv™ CoolPhase Perimeter Downflow Water/Glycol Cooled Primary Connection Locations Front Discharge Models
Upflow Model Primary Connection Locations	
20000396	Vertiv™ CoolPhase Perimeter Upflow Air Cooled Primary Connection Locations
20000397	Vertiv™ CoolPhase Perimeter Upflow Water/Glycol Cooled Primary Connection Locations
20000398	Vertiv™ CoolPhase Perimeter Upflow Glycol Cooled Primary Connection Locations

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™ CoolPhase Perimeter and the condenser. See 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 in. (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

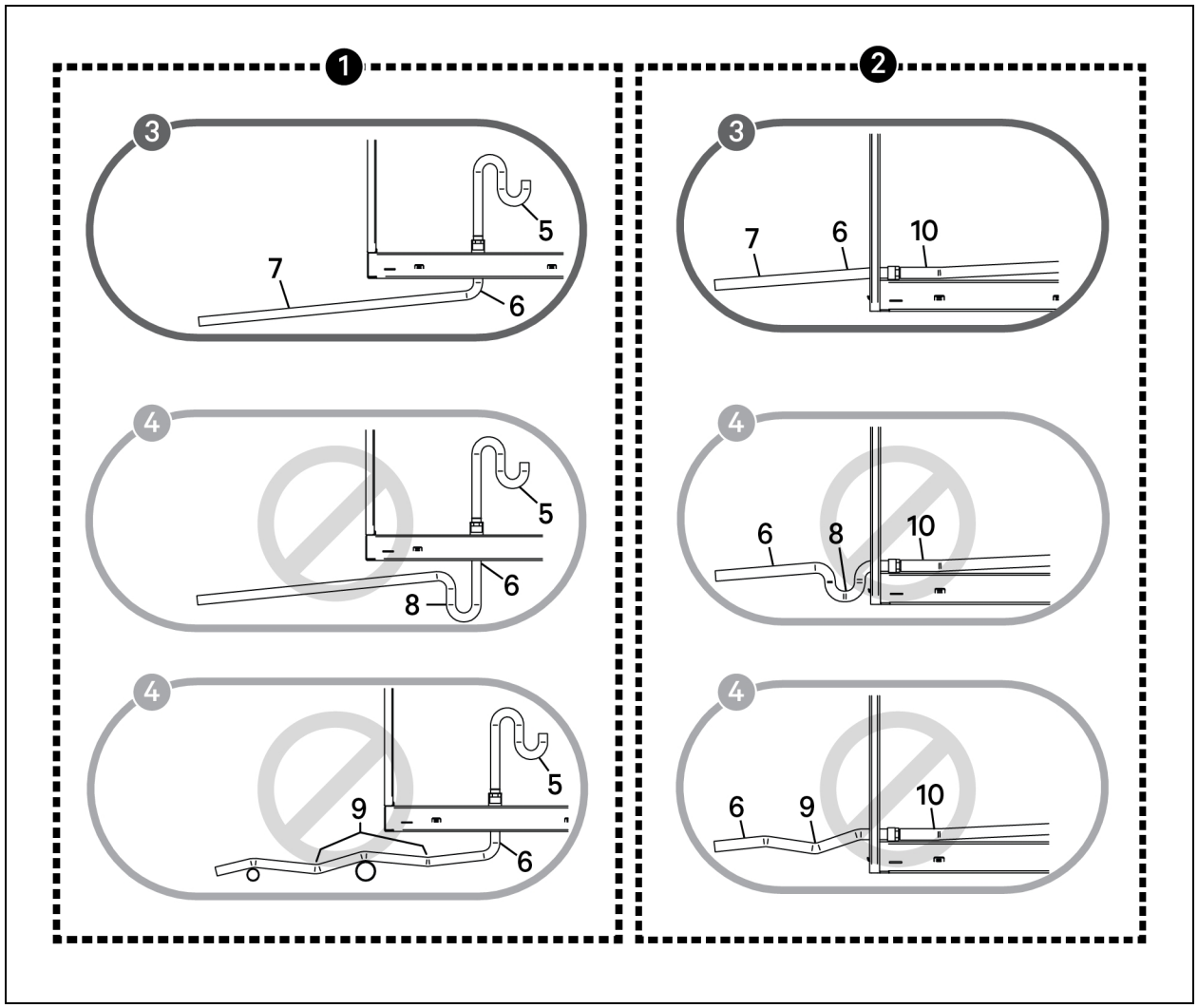


Table 5.3 Gravity Fed Drain Line Figure Descriptions

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 **NOTE: Units equipped with a condensate pump do not have an internal trap.**
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 in. 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 in. (280 mm) floor height is required.

A 3/4 in. 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 in. 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 in. 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 on 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 20000379 and 20000381 in 111.

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

High Pressure Cut Out Safety Switch	540 psig	3723 kPa	Noted on the unit serial tag
Source: DPN000788, Rev. 22			

NOTE: The Vertiv™ 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™ CoolPhase Condenser units without receivers will require field provided pressure relief devices such as a fusible plug. A pressure relief valve is provided with Vertiv™ Lee-Temp receivers and an integral, fusible plug is provided on PDX-EEV unheated receivers.

NOTICE

LEAK DETECTION SYSTEM INSTALLED. This unit is equipped with electrically powered safety measures. To be effective, the unit must be electrically powered at all times after installation, other than when servicing.

NOTICE

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

Vertiv™ CoolPhase Perimeter 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.

NOTICE

Units should never be operated with no refrigerant charge, a holding charge, a proper load or without additional oil as required added. Tag out system to prevent unauthorized personnel from accidentally starting equipment and damaging compressors if any of these conditions exist.

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^3/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 in. (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™ CoolPhase Condenser 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 Vertiv™ CoolPhase Condenser 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 20000380 and 20000382 included in Submittal Drawings on page 111 .
- 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 20000380 included in 111
- 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 in. 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-454B 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 84).

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 on the next page , for recommended refrigerant piping sizes based on equivalent pipe lengths.
- Refer to Charging Air Cooled Systems with Vertiv™ Lee-Temp Receiver on page 45 , 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 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[2]	1/2	3/42	5/8	3/4	5/8	7/8	5/8
150 ft. (45 m)	5/8[2]	1/2	3/42	5/8	7/82	5/8	1-1/82	3/4
300 ft. (91 m)	5/8[2]	1/2	3/4[2]	5/8	7/8[2]	5/8	1-1/8[2]	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. 22

5.2.3 Refrigerant Charge Requirements for Air Cooled Systems

The following tables provide the refrigerant charge requirements for the Vertiv™ CoolPhase Perimeter, connected piping, and condenser options.

Table 5.6 Approximate R-454B Refrigerant Charge for Air Cooled Vertiv™ CoolPhase Perimeter

Model	Downflow, lb (kg)	Upflow, lb (kg)
PX011	4.1 (1.9)	4.6 (2.1)
PX018	4.5 (2.1)	6.4 (2.9)
PX023	4.5 (2.1)	6.4 (2.9)
PX029	5.9 (2.7)	6.7 (3.1)

Source: DPN003088, Rev. C

Table 5.7 Interconnecting Piping Refrigerant Charge for R-454B, lb per 100 ft (kg per 30 m)

Line Size, O.D., in.	Liquid Line	Hot Gas Line
3/8	3.0 (1.3)	—
1/2	5.8 (2.7)	0.5 (0.2)
5/8	9.5 (4.3)	0.9 (0.4)
3/4	14.2 (6.4)	1.3 (0.6)
7/8	19.0 (8.6)	1.7 (0.8)

Table 5.7 Interconnecting Piping Refrigerant Charge for R-454B, lb per 100 ft (kg per 30 m) (continued)

Line Size, O.D., in.	Liquid Line	Hot Gas Line
1-1/8	33.2 (15.1)	2.9 (1.3)
1-3/8	49.2 (22.3)	4.5 (2.0)
1-5/8	—	6.4 (2.9)

Source: DPN003099, Rev. 2

Table 5.8 Condenser Refrigerant Charge Approximate R-454B per Circuit Including Receiver

Condenser Model	Condensers without Receivers, lb (kg)	Condensers with Vertiv™ Lee-Temp Receiver[1], lb (kg)	Condensers with PDX-EEV Unheated Receiver[1], lb (kg)
MCS028	2.3 (1.1)	19.5 (8.8)	9.9 (4.5)
MCM040	3.2 (1.4)	20.4 (9.3)	10.8 (4.9)
MCL055	4.5 (2.1)	21.8 (9.9)	12.2 (5.5)
MCM080	7.7 (3.4)	35.8 (16.3)	15.3 (6.9)
MCL110	9.6 (4.4)	44.2 (20.1)	17.6 (7.9)

1. Condenser charge includes receiver.

Source: DPN002411, Rev. 10 and DPN003088, Rev. C

5.2.4 Additional Oil Requirements for 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 9.4 on page 85 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 next 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 next page , and Table 5.10 on page 39 , because straight tubes and fittings used as traps require much more oil and the length of the straight tube can vary.

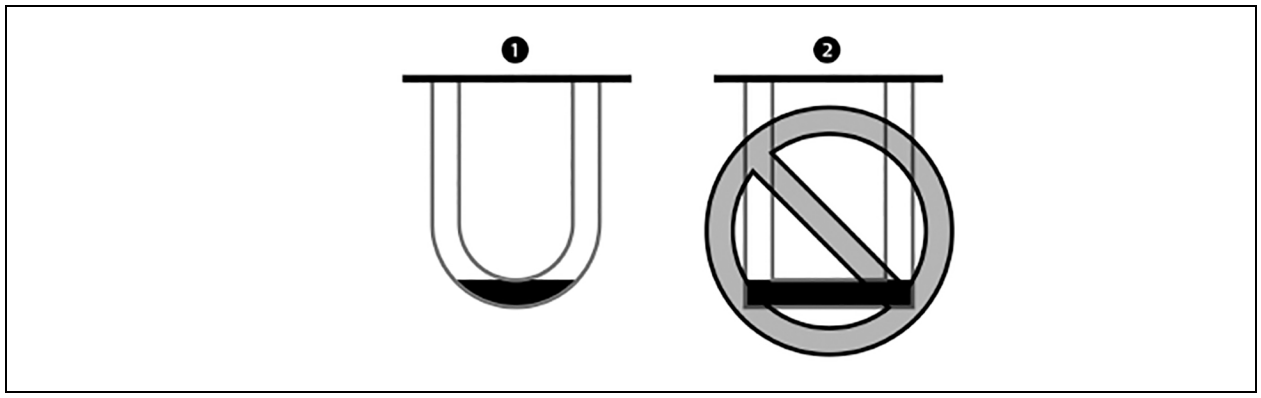
With the total calculated refrigerant charge for each circuit, see Table 5.9 on the next page for the refrigerant charge amount that was calculated and follow that line to the right to see how much additional compressor oil is required for each circuit.

Count the numbers of traps in each circuit. See Table 5.10 on page 39 for the discharge line pipe diameter. Follow the line to the right to see how much oil is needed per trap. Multiply the number of traps per circuit by the Oil volume.

Add the additional compressor oil amount and the trap oil volume together. This will be the total amount of oil that will need to be added before the refrigerant is added to each circuit.

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 9.8 on page 84 , for the recommended oil for the system.

Source: 20000354, Rev. A

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: 20000354 , Rev. A	

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 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 40.

Break Vacuum

Using a manifold charging hose equipped with a ball valve, properly connect to a tank of refrigerant, and purge the hose with refrigerant to ensure non-condensables do not enter the system. Connect the hose assembly to the liquid line Schrader port and break circuit vacuum with a portion of the calculated refrigerant pre-charge. Add enough refrigerant to bring pressure slightly above positive. Close ball valve and remove refrigerant tank.

NOTE: After completion of field piping, it shall be pressure tested with an inert gas and then vacuum tested prior to refrigerant charging, according to the following requirements:

The minimum test pressure for the low side of the system shall be the low side design pressure and the minimum test pressure for the high side of the system shall be the high side design pressure, unless the high side of the system cannot be isolated from the low side of the system in which case the entire system shall be pressure tested to the low side design pressure.

Charging Air Cooled Systems without Receivers

NOTICE

Risk of improper refrigerant charging. Can cause equipment damage.

R-454B is a blended refrigerant and must be introduced and charged from the cylinder only as a liquid.

Care must be exercised to avoid damage to the compressor. We recommend connecting a manifold charging hose equipped with a ball valve to the liquid line Schraeder port.

NOTICE

Risk of refrigerant overcharge. Can cause equipment damage.

Do not use the unit sight glass as an indicator when charging Vertiv™ 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 39.

Vertiv™ CoolPhase Condenser 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 page 42 , 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 page 42 , 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.

NOTICE

Units should never be operated with no refrigerant charge, holding charge, proper load, or without additional oil as required. Tag out system to prevent unauthorized personnel from accidentally starting equipment and damaging compressors if any of these conditions exist.

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. Refer to the following if necessary:
   - Checklist for Completed Installation on page 61 to operate the system.
   - The operating manual for the Vertiv™ CoolPhase Condenser.

   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 36 .
4. Add additional compressor and trap oil. See Additional Oil Requirements for Digital Scroll Compressors on page 37 .
5. 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).
6. Close the Vertiv™ CoolPhase Condenser disconnect switch.
7. Close the Vertiv™ CoolPhase Perimeter disconnect switch.

NOTICE

The unit must have line voltage applied to the unit at least 12 hours before compressor start-up to allow the compressor crankcase heaters time to warm the compressors and boil off any liquid refrigerant in the compressors after pre-charge.

Apply manifold gauges to suction and discharge service valves on circuit 1. Open service valves on compressor.

8. 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 60 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.

9. 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 on the next page . Read the outdoor ambient temperature from the Vertiv™ CoolPhase Condenser 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 below . Subtract the measured temperature from the saturated liquid temperature. The difference is subcooling. Make sure to use the saturated liquid temperature to calculate subcooling.

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

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. 10

Table 5.12 Liquid Pressure and Temperature Chart—R-454B

Pressure		Temperature*	
PSIG	BarG	°F	°C
170	11.7	63.0	17.2
180	12.4	66.4	19.1
190	13.1	69.6	20.9
200	13.8	72.8	22.7
210	14.5	75.9	24.4
220	15.2	78.8	26.0

Table 5.12 Liquid Pressure and Temperature Chart—R-454B (continued)

Pressure		Temperature*	
PSIG	BarG	°F	°C
230	15.9	81.9	27.7
240	16.6	84.5	29.2
250	17.2	87.4	30.8
260	17.9	89.9	32.2
270	18.6	92.3	33.5
280	19.3	94.8	34.9
290	20.0	97.2	36.2
300	20.7	99.6	37.6
310	21.4	101.9	38.8
320	22.1	104.2	40.1
330	22.8	106.4	41.3
340	23.4	108.5	42.5
350	24.1	110.6	43.7
360	24.8	112.7	44.8
370	25.5	114.7	45.9
380	26.2	116.7	47.1
390	26.9	118.7	48.2
400	27.6	120.6	49.2
500	34.5	138.0	58.9
600	41.4	153.3	67.4

* Values are for saturated liquid

Source: DPN002411, Rev. 10

Additional Compressor Oil

Once the circuits are topped off with refrigerant, more compressor oil may need to be added to each circuit if the final charge is over 10 pounds of the calculated refrigerant charge. Record this additional oil amount on the manilla tag hanging on the compressor service valve.

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

The Vertiv™ 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 Vertiv™ Lee-Temp system can be used with any Vertiv™ CoolPhase Perimeter 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 29.

Vertiv™ Lee-Temp Controlled Materials Supplied

- Built-in, pre-wired condenser control box
- Air cooled condenser
- Piping access cover
- Bolts—four per leg (3/8 in. x 5/8 in.)
- 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 in. x 1 in.)
- Vertiv™ 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 Vertiv™ 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™ 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 111.

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 Vertiv™ CoolPhase Perimeter 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 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 45.

Break Vacuum

Using a manifold charging hose equipped with a ball valve, properly connect to a tank of refrigerant, and purge the hose with refrigerant to ensure non-condensables do not enter the system. Connect the hose assembly to the liquid line Schrader port and break circuit vacuum with a portion of the calculated refrigerant pre-charge. Add enough refrigerant to bring pressure slightly above positive. Close ball valve and remove refrigerant tank.

NOTE: After completion of field piping, it shall be pressure tested with an inert gas and then vacuum tested prior to refrigerant charging, according to the following requirements:

The minimum test pressure for the low side of the system shall be the low side design pressure and the minimum test pressure for the high side of the system shall be the high side design pressure, unless the high side of the system cannot be isolated from the low side of the system in which case the entire system shall be pressure tested to the low side design pressure.

Charging Air Cooled Systems with Vertiv™ Lee-Temp Receiver

NOTICE

Risk of improper refrigerant charging. Can cause equipment damage.

R-454B is a blended refrigerant and must be introduced and charged from the cylinder only as a liquid.

Care must be exercised to avoid damage to the compressor. We recommend connecting a manifold charging hose equipped with a ball valve to the liquid line Schraeder port.

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.

NOTICE

Units should never be operated with no refrigerant charge, holding charge, proper load, or without additional oil as required. Tag out system to prevent unauthorized personnel from accidentally starting equipment and damaging compressors if any of these conditions exist.

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. Refer to 61.
3. Calculate the amount of charge for the system. See 36.

4. Add additional compressor and trap oil. See Additional Oil Requirements for Digital Scroll Compressors on page 37 .
5. Accurately weigh in as much of the system charge as possible before starting the unit.
6. Close the Vertiv™ CoolPhase Condenser disconnect switch.
7. Close the Vertiv™ CoolPhase Perimeter disconnect switch.

NOTICE

The unit must have line voltage applied to the unit at least 12 hours before compressor start-up to allow the compressor crankcase heaters time to warm the compressors and boil off any liquid refrigerant in the compressors after pre-charge.

Apply manifold gauges to suction and discharge service valves on circuit 1. Open service valves on compressor.

8. 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 60 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.

9. Check the refrigerant level in the refrigerant level sight glass on the Vertiv™ 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.

10. Adjust the refrigerant level to meet the level shown in 46.
11. 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.

Additional Compressor Oil

Once the circuits are topped off with refrigerant, more compressor oil may need to be added to each circuit if the final charge is over 10 pounds of the calculated refrigerant charge. Record this additional oil amount on the manilla tag hanging on the compressor service valve.

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

The Vertiv™ CoolPhase Perimeter with EEV uses an unheated receiver to balance refrigerant requirements of the evaporator coil and Vertiv™ CoolPhase Condenser 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 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 48.

Break Vacuum

Using a manifold charging hose equipped with a ball valve, properly connect to a tank of refrigerant, and purge the hose with refrigerant to ensure non-condensables do not enter the system. Connect the hose assembly to the liquid line Schrader port and break circuit vacuum with a portion of the calculated refrigerant pre-charge. Add enough refrigerant to bring pressure slightly above positive. Close ball valve and remove refrigerant tank.

NOTE: After completion of field piping, it shall be pressure tested with an inert gas and then vacuum tested prior to refrigerant charging, according to the following requirements:

The minimum test pressure for the low side of the system shall be the low side design pressure and the minimum test pressure for the high side of the system shall be the high side design pressure, unless the high side of the system cannot be isolated from the low side of the system in which case the entire system shall be pressure tested to the low side design pressure.

Charging Air Cooled Systems with Unheated Receivers

NOTICE

Risk of improper refrigerant charging. Can cause equipment damage.

R-454B is a blended refrigerant and must be introduced and charged from the cylinder only as a liquid.

Care must be exercised to avoid damage to the compressor. We recommend connecting a manifold charging hose equipped with a ball valve to the liquid line Schraeder port.

NOTICE

Risk of refrigerant overcharge. Can cause equipment damage.

Do not use the unit sight glass as an indicator when charging Vertiv™ condenser systems.

NOTICE

Units should never be operated with no refrigerant charge, holding charge, proper load, or without additional oil as required. Tag out system to prevent unauthorized personnel from accidentally starting equipment and damaging compressors if any of these conditions exist.

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. Refer to 61.
3. Calculate the amount of charge for the system. See 36.
4. Add additional compressor and trap oil. See Additional Oil Requirements for Digital Scroll Compressors on page 37 .
5. 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).
6. Close the Vertiv™ CoolPhase Condenser disconnect switch.

NOTICE

The unit must have line voltage applied to the unit at least 12 hours before compressor start-up to allow the compressor crankcase heaters time to warm the compressors and boil off any liquid refrigerant in the compressors after pre-charge.

Apply manifold gauges to suction and discharge service valves on circuit 1. Open service valves on compressor.

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 49 for the proper charge level in the receiver based on return air temperature and outdoor temperature at time of charging.

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 60 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. Adjust the refrigerant level in the unit to meet the level shown in 49.
9. 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.

Additional Compressor Oil

Once the circuits are topped off with refrigerant, more compressor oil may need to be added to each circuit if the final charge is over 10 pounds of the calculated refrigerant charge. Record this additional oil amount on the manilla tag hanging on the compressor service valve.

5.2.8 Superheat and Refrigerant Charge Optimization

Superheat on All Vertiv™ CoolPhase Perimeter Units

Compressor suction superheat for all unit types should be in range of 8 to 15°F (-4.4 to -8.3°C). See 82 and 82 for superheat measurement and adjustment methods.

Optimizing Refrigerant Charge on Water/Glycol Units

Vertiv™ CoolPhase Perimeter water/glycol systems are factory charged with R-454B 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 below , describes the factory charge for the unit.

Table 5.13 Approximate R-454B Refrigerant Factory Charge for Water/Glycol Cooled Vertiv™ CoolPhase Perimeter

Model	Downflow, lb (kg)	Upflow, lb (kg)
PX011	5.1 (2.3)	5.4 (2.5)
PX018	7.4 (3.3)	7.3 (3.3)
PX023	7.4 (3.3)	7.3 (3.3)
PX029	7.5 (3.4)	7.3 (3.3)

Source: DPN003088, Rev. C

To optimize the refrigerant charge:

1. 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.
2. 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 42 . Subtract the measured temperature from the liquid saturation temperature. The difference is subcooling.

3. Adjust refrigerant charge levels as needed to achieve subcooling range of 10 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™ GLYCOOL and Vertiv™ Drycooler circuits.

Refer to the appropriate piping general arrangement schematics for your system for the recommended, field installed hardware such as shutoff valves. See 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™ 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™ GLYCOOL units. The strainer is needed to prevent particles in the water from entering the unit's heat exchanger.
- Minimum Operating Fluid Temperature: 7°C (45°F)
- Maximum Operating Fluid Temperature: 43°C (110°F)
- Minimum Operating Fluid Pressure: 1 bar (14.5 psig)
- Maximum Operating Fluid Pressure: 27.6 bar (400 psig)

5.3.1 Leak Checking for Unit and Field Installed Piping

The fluid systems in the Vertiv™ CoolPhase Perimeter 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.

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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 57, for detailed information.

The electrical connections are described in the submittal documents included in the 111.

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

Table 6.1 Electrical Field Connection Drawings

Document Number	Title
20000400	Vertiv™ CoolPhase Perimeter Electrical Field Connections
20000401	Vertiv™ CoolPhase Perimeter Downflow Electrical Field Connections
20000402	Vertiv™ CoolPhase Perimeter Upflow Electrical Field Connections

Table 6.1 Electrical Field Connection Drawings (continued)

Document Number	Title
20000403	Vertiv™ CoolPhase Perimeter CANbus & Interlock Connections between Vertiv™ CoolPhase Perimeter PDX Unit and Vertiv™ CoolPhase Condenser
20000404	Vertiv™ CoolPhase Condenser Electrical Field Connections Premium Efficiency Control
20000405	Vertiv™ CoolPhase Condenser Electrical Field Connections Premium Efficiency Control with Vertiv™ Lee-Temp
20000406	Liebert® iCOM™ Remote Temperature/Humidity Sensor
20000347	Liebert® iCOM™ Unit to Unit Network Connections (Liebert® CW, Liebert® CWA, Vertiv™ CoolPhase Perimeter)

6.1 Wye and Delta Connected Power Supply for Vertiv™ CoolPhase Perimeter

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

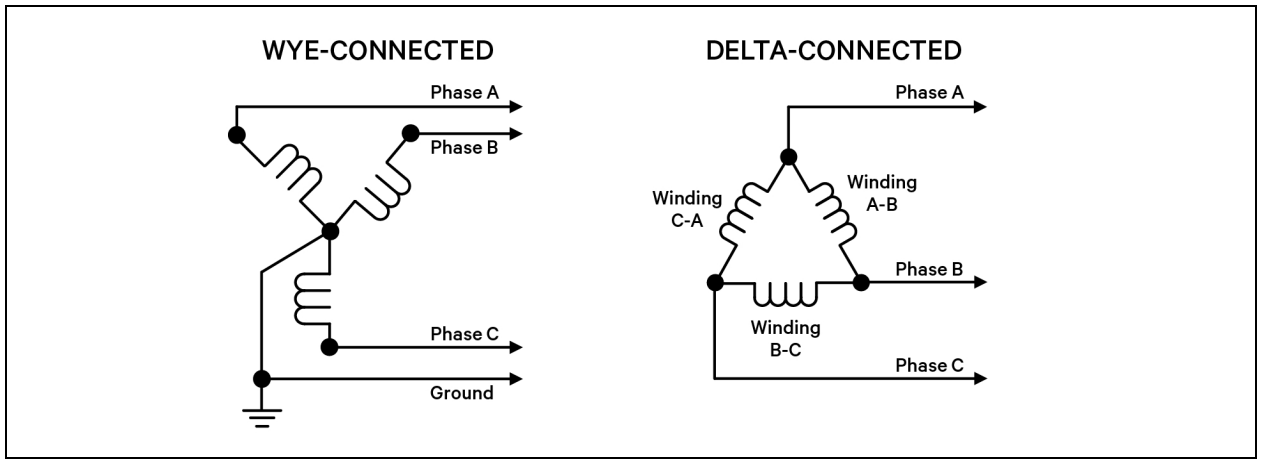


Table 6.2 Acceptable Power Supplies by Nominal Voltage and Model

	208V to 230V Nominal	380V to 575V Nominal	208V to 575V Nominal		
	PX011	PX011	PX018	PX023	PX029
Wye with solidly-grounded neutral:					
208 V Wye, 120 V line to ground	Yes	Yes	Yes	Yes	Yes
230 V Wye, 133 V line to ground	Yes	Yes	Yes	Yes	Yes
380 V Wye, 220 V line to ground	Yes	Yes	Yes	Yes	Yes
480 V Wye, 277 V line to ground	Yes	Yes	Yes	Yes	Yes
575 V Wye, 332 V line to ground (uses step transformers)	Yes	Yes	Yes	Yes	Yes

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	PX011	PX018	PX023	PX029
Wye with high resistance (impedance) ground:	Yes	No	Yes	Yes	Yes
Delta:					
Without ground or floating ground	No	No	No	No	No
With corner ground	Yes	No	Yes	Yes	Yes
With grounded center tap	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-80185, 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-80185, 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

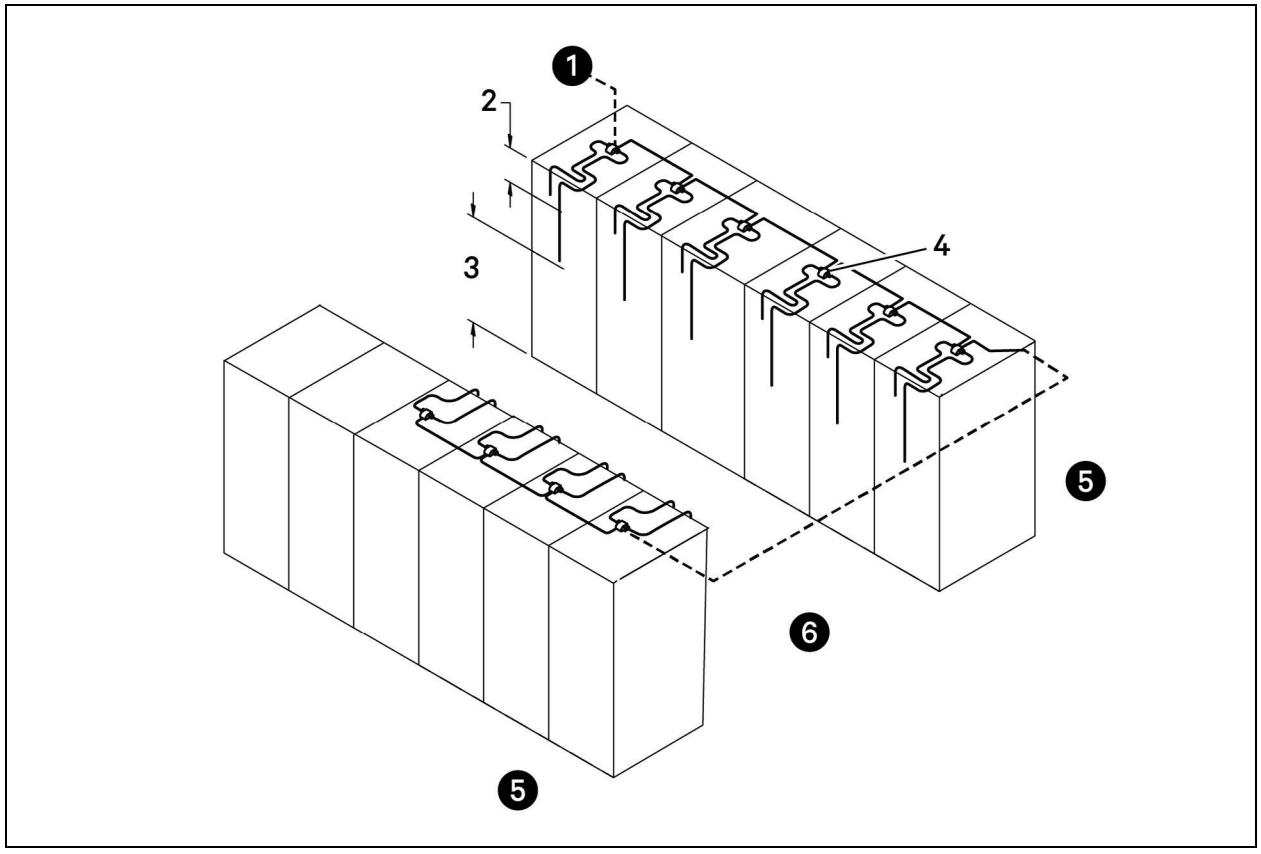


Table 6.3 Sensor Descriptions

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

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 lb (18.1 kg) per circuit. See 37.
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™ CoolPhase Condenser and receiver is mounted at or above the relative height of the EEV in the Vertiv™ CoolPhase Perimeter 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. Seal openings around piping and electrical connections.
9. Installation materials and tools have been removed from equipment (literature, shipping materials, construction materials, tools, etc.).

7.5 Refrigerant Leak Mitigation

For information regarding the Refrigerant Leak Detection system, Mitigation Mode, and testing procedures, refer to the Diagnosing Water Leak Detection Issues section of the Vertiv™ Liebert® iCOM™ Installer/User Guide SL-80185.

Table 7.1 Fan Speed Settings for Refrigerant Leak Mitigation

Unit	Cooling Type	Mitigation Setting (cfm)[1]	Equivalent % Fan Speed
PX011	Air	1350	75%
PX018	Air	2925	75%
PX023	Air	2925	75%
PX029	Air	2925	75%
PX011	Water	1350	75%
PX018	Water	2925	75%
PX023	Water	2925	75%
PX029	Water	2925	75%

Source: 20000578, Rev. A

[1]Mitigation airflow is an approximation based on lowest airflow condition for Vertiv™ Thermal Management unit.

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® 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 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 61 have been done.
- Locate Vertiv™ CoolPhase Perimeter Warranty Inspection Check Sheet in the unit's electric panel. (PSWI-8542-425-CO).
- Complete Vertiv™ CoolPhase Perimeter Warranty Inspection Check Sheet during start-up. (PSWI-8542-425-CO).
- Forward the completed Vertiv™ CoolPhase Perimeter 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™ CoolPhase Perimeter is a single component in the facility heat-removal system. The system includes air distribution (raised floors, duct systems), outdoor heat rejection (condensers, pumps, Vertiv™ CoolPhase 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-80185, available at 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

	PX011, PX018, PX023, PX023, PX029
Downflow Models	
Quantity	1
Nominal Size, inches	29.5 x 28.5 x 2
Upflow Models	
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 ±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

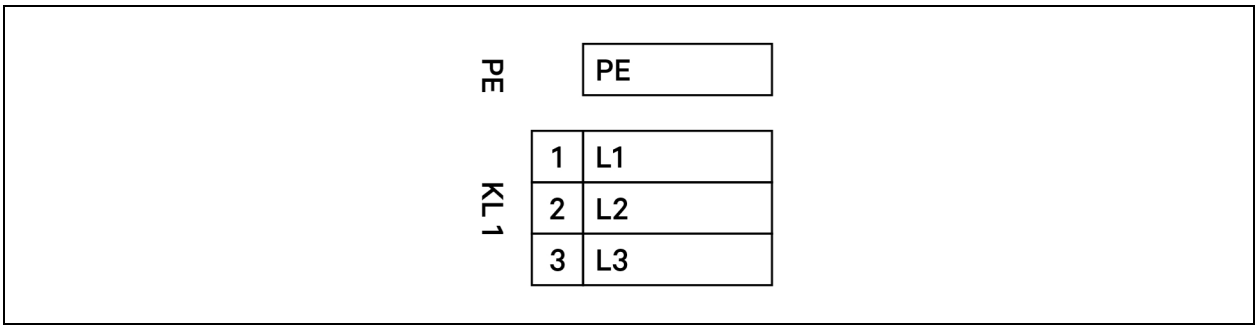
1. Check fuses. If fuses are okay, perform the following:
    - Check all connections.
    - Make sure connections are on the wire strand and not on the wire insulation.
    - Cycle power. Disconnect mains voltage to power down the motor and then re-apply power.
    - Check mains voltage at each phase (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.

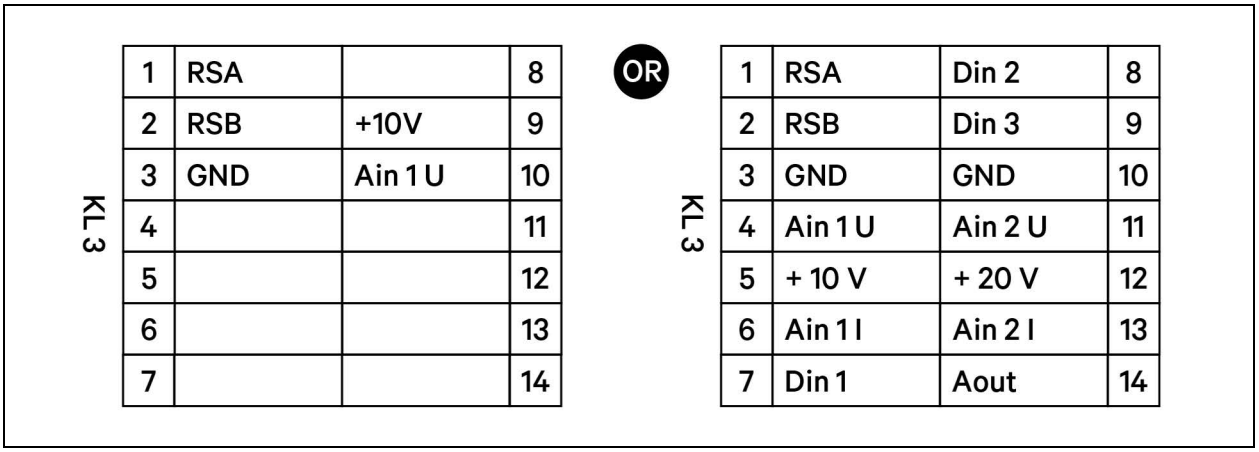
EC Fan Low Voltage Tests

- 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

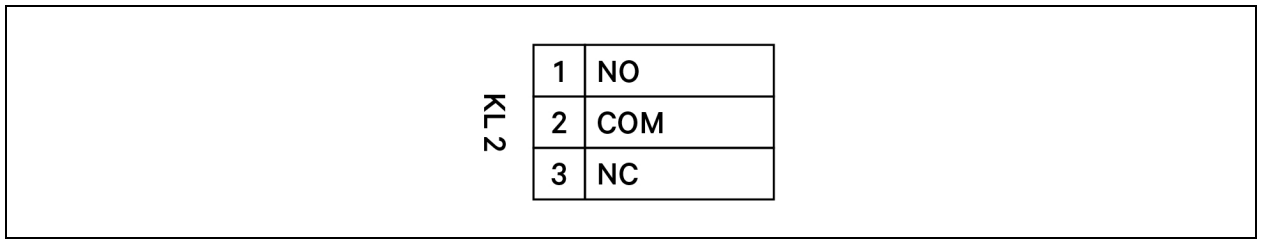


Table 9.3 No Fault/Fault Conditions While Motor Actively Energized

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.

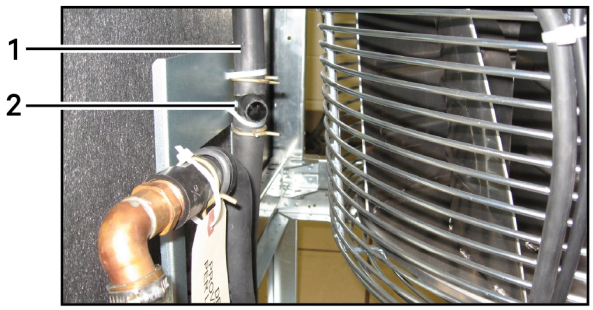
NOTICE

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):

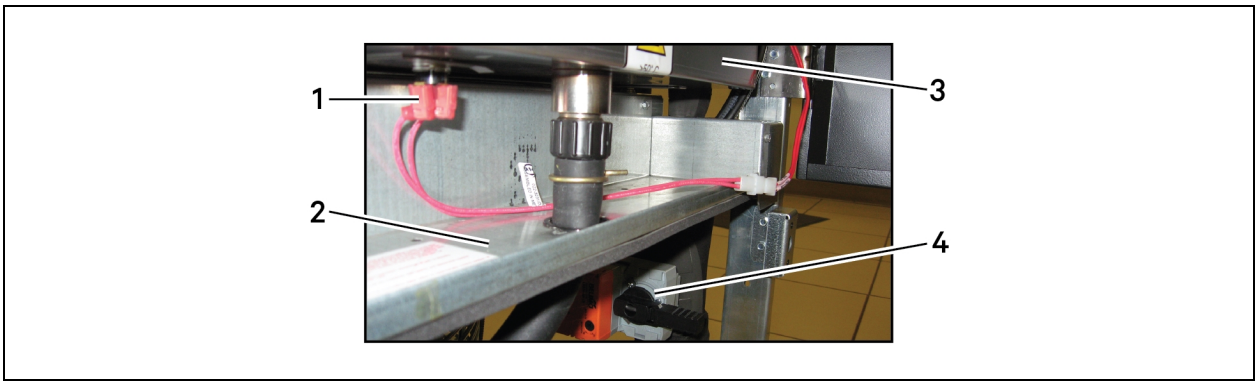
1. Turn off the unit by touching Turn Unit Off in the Vertiv™ Liebert® iCOM™ menu and confirm in next screen by touching Turn Unit Off.
2. Allow the unit shut down. Once shutdown is complete, turn the disconnect switch to the Off position.
3. Open the front of the unit.
4. Remove the humidifier drain 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 next page .

Figure 9.4 Remove the Humidifier Drain Line



Item	Description
1	Humidifier drain
2	T-connection

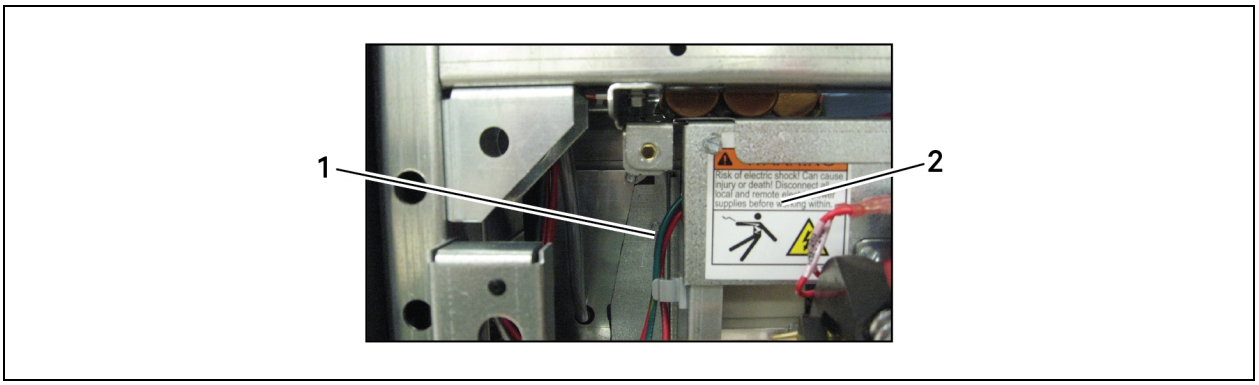
Figure 9.5 Remove Humidifier High Limit Wires



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 below .

Figure 9.6 Humidifier Electric Box Location

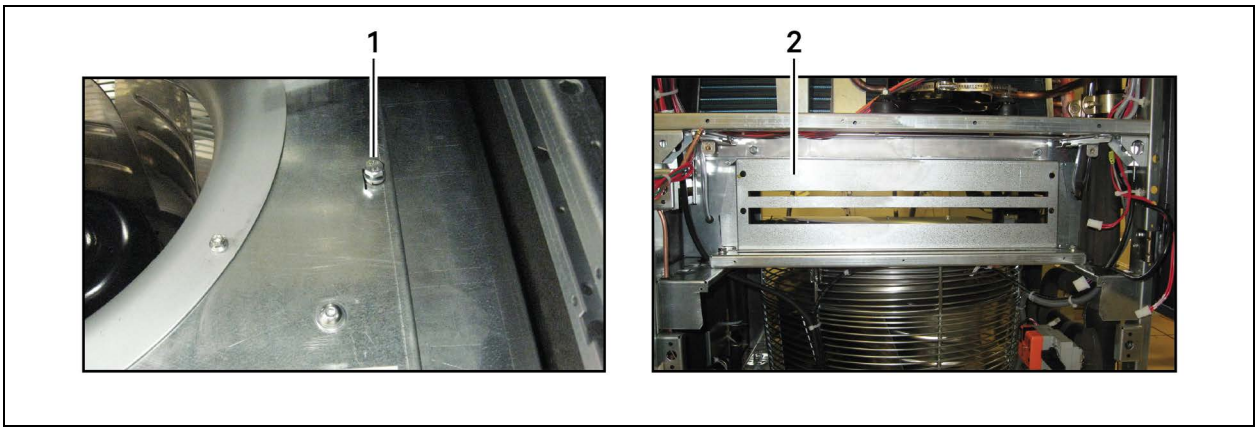


Item	Description
1	Humidifier wiring harness
2	Humidifier electric compartment cover

8. Remove the four hex bolts securing the humidifier assembly to the unit, see Figure 9.7 on the facing page , 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.

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.

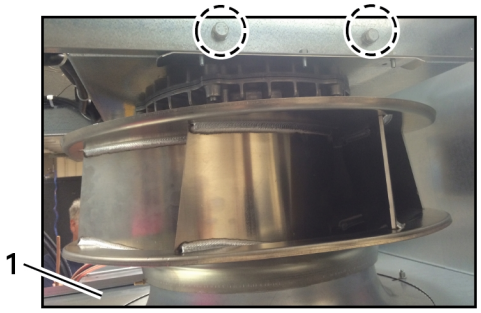
NOTICE

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 on the next page .

Figure 9.8 Mounting Plate Bolt Location



Item	Description
1	Orifice mounting plate

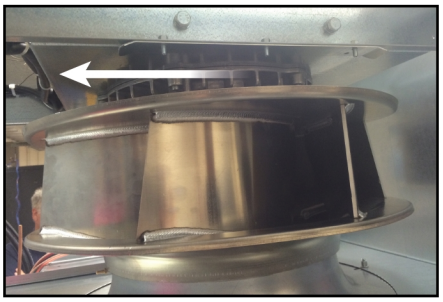
6. Locate the four bolts on the intake orifice mounting plate, an example is shown in Figure 9.9 below . These bolts are front-accessible with two on the left side and two on the right side of the plate.
7. Loosen these 4 bolts and lower the orifice mounting plate so that it rests on the brackets, one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

9.3.1 Condensate Drain

Check for and clear obstructions in tubing during routine maintenance.

9.3.2 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.

9.4 Air Cooled Condenser and Vertiv™ 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.

9.5 Electric Reheat Maintenance

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

9.6 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.

9.6.1 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.

9.6.2 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.

9.7 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 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 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).

9.8 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™ CoolPhase Perimeter 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.

9.8.1 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 9.4 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 9.4 Compressor Oil Types for R-454B Refrigerant

Compressor Type	Oil Type
Copeland Scroll and Digital Scroll	POE Oil - ISO 32 Centistoke Viscosity[1]
1. Use Copeland POE Oil ULTRA 32-3MAF or other Copeland-approved oils.	
Source: 20000354, Rev. A	

NOTE: See 37, for additional oil based on the system's refrigerant charge.

9.8.2 Digital Scroll Compressor Maintenance

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

NOTE: Refer to 37 for approved oil types and additional oil required based on the system's refrigerant charge.

9.8.3 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.

9.8.4 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.

9.8.5 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.

9.8.6 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:
   - 39
   - 44.
   - Evacuation and Leak Testing Air Cooled Systems with Unheated Receivers on page 47
   - 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-454B 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.

9.8.7 Compressor Mechanical Failure

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

9.8.8 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.

9.9 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.

9.10 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.

9.11 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.

9.11.1 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.

9.11.2 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.

9.11.3 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.

9.11.4 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™ Drycooler aquastats should be set to prevent continuous fluid temperature swings greater than ±10°F (5.6°C). See Vertiv™ Drycooler Aquastat Settings on the next page .

9.11.5 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.

9.11.6 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.

9.12 Vertiv™ Drycooler Aquastat Settings

Applications with the Optional Stat Setting require field piping to be insulated to prevent condensation. Table 9.5 below , shows acceptable applications where stats must be adjusted to Optional Setting.

Aquastats must be field adjusted to Optional Setting for:

- Vertiv™ GLYCOOL/Dual Cool applications

Table 9.5 Water/Glycol System Conditions Requiring Optional Settings for Aquastats

Flow Control:	MBV			
Cooling Type:	Glycol		GLYCOOL	
Vertiv™ Drycooler in Loop	1	Multiple	1	Multiple
Stat Setting*	Optional	Factory	Optional	Optional
Insulate Field Piping	Yes	No	Yes	Yes
* See Table 9.6 below MBV = Motorized ball valve				
Source: 20000355, Rev. A				

Table 9.6 Aquastat Settings—2 Fan through 4 Fan Vertiv™ 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)
1. All Vertiv™ Drycoolers are shipped at Factory Setting. 2. Factory setting is used for all glycol applications, except single Vertiv™ Drycooler loops with motor ball valve controls. 3. Stats must be field adjusted to Optional Setting for Vertiv™ GLYCOOL/Dual Cool applications and all single Vertiv™ Drycooler loops using motorized ball valve flow controls.			
Source: 20000355, Rev. A			

Table 9.7 Aquastat Settings—6 Fan Vertiv™ CoolPhase 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)

1. All Vertiv™ CoolPhase Drycoolers are shipped at factory setting.
2. Factory setting is used for all glycol applications, except single Vertiv™ Drycooler loops with motor ball valve controls.
3. Stats must be field adjusted to Optional Setting for Vertiv™ GLYCOOL/Dual Cool applications and all single Vertiv™ Drycooler loops using motor ball valve flow controls.

Source: 20000355 , Rev. A

9.13 Units with a Refrigeration Detection System

For units with a Refrigerant Detection System:

REFRIGERANT DETECTION SYSTEMS shall only be replaced with sensors specified by Vertiv.

A service schedule shall be made to verify the safety systems of the appliance are working as intended, at a minimum interval of once per year.

A design failure mode and effects analysis of the circulation airflow path must be conducted, in the ITE (Information Technology Equipment) AREA, to ensure the airflow velocity is at least 1 m/s for all operating conditions expected for the life of the ITE AREA.

Vertiv models with A2L refrigerants provide an output signal for use in notifying the user that a REFRIGERANT DETECTION SYSTEM has been activated. The user shall provide a notification means of receiving the output signal. If this signal is used for an alarm, the alarm shall comply with all national and local codes.

9.14 Qualification of Workers

The manual shall contain specific information about the required qualification of the working personnel for maintenance, service and repair operations. Every working procedure that affects safety means shall only be carried out by competent persons.

Examples for such working procedures are:

- Breaking into the refrigerating circuit
- Opening of sealed components
- Opening of ventilated enclosures

Information of procedures additional to usual information for refrigerating appliance installation, repair, maintenance and decommission procedures is required when an appliance with FLAMMABLE REFRIGERANTS is affected.

The training of these procedures is carried out by national training organizations or manufacturers that are accredited to teach the relevant national competency standards that may be set in legislation.

The achieved competence should be documented by a certificate.

9.15 Information on Servicing

The manual shall contain specific information for service personnel according to the following:

Checks to the Area

Prior to beginning work on systems containing FLAMMABLE REFRIGERANTS, safety checks are necessary to ensure that the risk of ignition is minimized. For repair to the REFRIGERATING SYSTEM, the following checks to the area shall be completed prior to conducting work on the system.

Work Procedure

Work shall be undertaken under a controlled procedure so as to minimize the risk of a flammable gas or vapor being present while the work is being performed.

General Work Area

All maintenance staff and others working in the local area shall be instructed on the nature of work being carried out. Work in confined spaces shall be avoided.

Checking for Presence of Refrigerant

The area shall be checked with an appropriate refrigerant detector prior to and during work, to ensure the technician is aware of potentially toxic or flammable atmospheres. Ensure that the leak detection equipment being used is suitable for use with all applicable refrigerants, i.e. non-sparking, adequately sealed or intrinsically safe.

Presence of Fire Extinguisher

If any hot work is to be conducted on the refrigerating equipment or any associated parts, appropriate fire extinguishing equipment shall be available to hand. Have a dry powder or CO2 fire extinguisher adjacent to the charging area.

No Ignition Sources

No person carrying out work in relation to a REFRIGERATING SYSTEM which involves exposing any pipe work shall use any sources of ignition in such a manner that it may lead to the risk of fire or explosion. All possible ignition sources, including cigarette smoking, should be kept sufficiently far away from the site of installation, repairing, removing and disposal, during which refrigerant can possibly be released to the surrounding space. Prior to work taking place, the area around the equipment is to be surveyed to make sure that there are no flammable hazards or ignition risks. “No Smoking” signs shall be displayed.

Ventilated Area

Ensure that the area is in the open or that it is adequately ventilated before breaking into the system or conducting any hot work. A degree of ventilation shall continue during the period that the work is carried out. The ventilation should safely disperse any released refrigerant and preferably expel it externally into the atmosphere.

Checks to the Refrigerating Equipment

Where electrical components are being changed, they shall be fit for the purpose and to the correct specification. At all times the manufacturer’s maintenance and service guidelines shall be followed. If in doubt, consult the manufacturer’s technical department for assistance.

The following checks shall be applied to installations using FLAMMABLE REFRIGERANTS:

- The actual REFRIGERANT CHARGE is in accordance with the room size within which the refrigerant containing parts are installed.
- The ventilation machinery and outlets are operating adequately and are not obstructed.

- Marking to the equipment continues to be visible and legible. Markings and signs that are illegible shall be corrected.
- Refrigerating pipe or components are installed in a position where they are unlikely to be exposed to any substance which may corrode refrigerant containing components, unless the components are constructed of materials which are inherently resistant to being corroded or are suitably protected against being so corroded.

Checks to Electrical Devices

Repair and maintenance to electrical components shall include initial safety checks and component inspection procedures. If a fault exists that could compromise safety, then no electrical supply shall be connected to the circuit until it is satisfactorily dealt with. If the fault cannot be corrected immediately but it is necessary to continue operation, an adequate temporary solution shall be used. This shall be reported to the owner of the equipment so all parties are advised.

Initial safety checks shall include:

- That capacitors are discharged: this shall be done in a safe manner to avoid possibility of sparking.
- That no live electrical components and wiring are exposed while charging, recovering or purging the system.
- That there is continuity of earth bonding.

Cabling

Check that cabling will not be subject to wear, corrosion, excessive pressure, vibration, sharp edges or any other adverse environmental effects. The check shall also take into account the effects of aging or continual vibration from sources such as compressors or fans.

Detection of Flammable Refrigerants

Under no circumstances shall potential sources of ignition be used in the searching for or detection of refrigerant leaks. A halide torch (or any other detector using a naked flame) shall not be used.

The following leak detection methods are deemed acceptable for all refrigerant systems.

Electronic leak detectors may be used to detect refrigerant leaks but, in the case of FLAMMABLE REFRIGERANTS, the sensitivity may not be adequate, or may need re-calibration. (Detection equipment shall be calibrated in a refrigerant-free area.) Ensure that the detector is not a potential source of ignition and is suitable for the refrigerant used. Leak detection equipment shall be set at a percentage of the LFL of the refrigerant and shall be calibrated to the refrigerant employed, and the appropriate percentage of gas (25% maximum) is confirmed.

Leak detection fluids are also suitable for use with most refrigerants but the use of detergents containing chlorine shall be avoided as the chlorine may react with the refrigerant and corrode the copper pipe-work.

Examples of leak detection fluids are:

- Bubble method
- Fluorescent method agents

If a leak is suspected, all naked flames shall be removed/extinguished.

If a leakage of refrigerant is found which requires brazing, all of the refrigerant shall be recovered from the system, or isolated (by means of shut off valves) in a part of the system remote from the leak. Removal of refrigerant shall be according to Clause DD.9.

Removal and Evacuation

When breaking into the refrigerant circuit to make repairs – or for any other purpose – conventional procedures shall be used. However, for flammable refrigerants it is important that best practice be followed, since flammability is a consideration.

The following procedure shall be adhered to:

- Safely remove refrigerant following local and national regulations.
- Evacuate (optional for A2L); continuously flush or purge with inert gas when using flame to open circuit; and open the circuit.

The refrigerant charge shall be recovered into the correct recovery cylinders if venting is not allowed by local and national codes. For appliances containing flammable refrigerants, the system shall be purged with oxygen-free nitrogen to render the appliance safe for flammable refrigerants. This process might need to be repeated several times. Compressed air or oxygen shall not be used for purging refrigerant systems.

For appliances containing flammable refrigerants, refrigerants purging shall be achieved by breaking the vacuum in the system with oxygen-free nitrogen and continuing to fill until the working pressure is achieved, then venting to atmosphere, and finally pulling down to a vacuum (optional for A2L). This process shall be repeated until no refrigerant is within the system (optional for A2L). When the final oxygen-free nitrogen charge is used, the system shall be vented down to atmospheric pressure to enable work to take place.

The outlet for the vacuum pump shall not be close to any potential ignition sources, and ventilation shall be available.

Charging Procedures

In addition to conventional charging procedures, the following requirements shall be followed:

- Ensure that contamination of different refrigerants does not occur when using charging equipment. Hoses or lines shall be as short as possible to minimize the amount of refrigerant contained in them.
- Cylinders shall be kept in an appropriate position according to the instructions.
- Ensure that the REFRIGERATING SYSTEM is earthed prior to charging the system with refrigerant.
- Label the system when charging is complete (if not already).
- Extreme care shall be taken not to overfill the REFRIGERATING SYSTEM.

Prior to recharging the system, it shall be pressure-tested with the appropriate purging gas. The system shall be leak-tested on completion of charging but prior to commissioning. A follow up leak test shall be carried out prior to leaving the site.

Decommissioning

Before carrying out this procedure, it is essential that the technician is completely familiar with the equipment and all its detail. It is recommended good practice that all refrigerants are recovered safely. Prior to the task being carried out, an oil and refrigerant sample shall be taken in case analysis is required prior to re-use of recovered refrigerant. It is essential that electrical power is available before the task is commenced.

1. Become familiar with the equipment and its operation.
2. Isolate system electrically.
3. Before attempting the procedure, ensure that:
    a. Mechanical handling equipment is available, if required, for handling refrigerant cylinders.
    b. All personal protective equipment is available and being used correctly.
    c. The recovery process is supervised at all times by a competent person.
    d. Recovery equipment and cylinders conform to the appropriate standards.
4. Pump down refrigerant system, if possible.
5. If a vacuum is not possible, make a manifold so that refrigerant can be removed from various parts of the system.
6. Make sure that cylinder is situated on the scales before recovery takes place.
7. Start the recovery machine and operate in accordance with instructions.

8. Do not overfill cylinders (no more than 80 % volume liquid charge).
9. Do not exceed the maximum working pressure of the cylinder, even temporarily.
10. When the cylinders have been filled correctly and the process completed, make sure that the cylinders and the equipment are removed from site promptly and all isolation valves on the equipment are closed off.
11. Recovered refrigerant shall not be charged into another REFRIGERATING SYSTEM unless it has been cleaned and checked.

Labeling

Equipment shall be labeled stating that it has been de-commissioned and emptied of refrigerant. The label shall be dated and signed. For appliances containing FLAMMABLE REFRIGERANTS, ensure that there are labels on the equipment stating the equipment contains FLAMMABLE REFRIGERANT.

Recovery

When removing refrigerant from a system, either for servicing or decommissioning, it is recommended good practice that all refrigerants are removed safely.

When transferring refrigerant into cylinders, ensure that only appropriate refrigerant recovery cylinders are employed. Ensure that the correct number of cylinders for holding the total system charge is available. All cylinders to be used are designated for the recovered refrigerant and labeled for that refrigerant (i.e. special cylinders for the recovery of refrigerant). Cylinders shall be complete with pressure-relief valve and associated shut-off valves in good working order. Empty recovery cylinders are evacuated and, if possible, cooled before recovery occurs.

The recovery equipment shall be in good working order with a set of instructions concerning the equipment that is at hand and shall be suitable for the recovery of the flammable refrigerant. If in doubt, the manufacturer should be consulted. In addition, a set of calibrated weighing scales shall be available and in good working order. Hoses shall be complete with leak-free disconnect couplings and in good condition.

The recovered refrigerant shall be processed according to local legislation in the correct recovery cylinder, and the relevant waste transfer note arranged. Do not mix refrigerants in recovery units and especially not in cylinders.

If compressors or compressor oils are to be removed, ensure that they have been evacuated to an acceptable level to make certain that flammable refrigerant does not remain within the lubricant. The compressor body shall not be heated by an open flame or other ignition sources to accelerate this process. When oil is drained from a system, it shall be carried out safely.

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10 Preventive Maintenance Checklist

Source: 20000356, Rev. A

Inspection Date			Job Name
Indoor Unit Model #			Indoor Unit Serial Number #
Vertiv™ Fin/Tube Condenser or Vertiv™ 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 99 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

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.

☐ Suction pressure	Circuit #1	_____	Circuit #2	_____
☐ Discharge pressure	Circuit #1	_____	Circuit #2	_____
☐ Superheat	Circuit #1	_____	Circuit #2	_____
☐ Low pressure switch cut out	Circuit #1	_____	Circuit #2	_____
☐ Low pressure cut in	Circuit #1	_____	Circuit #2	_____
☐ High pressure cut out	Circuit #1	_____	Circuit #2	_____
☐ Amp draw				

Circuit #1A	L1	L2	L3
Circuit #1B	L1	L2	L3
Circuit #2A	L1	L2	L3
Circuit #2B	L1	L2	L3

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™ 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™ CoolPhase Condenser 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 Vertiv™ Lee-Temp or pumped refrigerant) _____
12. Motor amp draw

#1	L1	L2	L3
#2	L1	L2	L3

Vertiv™ 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 (Vertiv™ 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).

MAINTENANCE NOTES

Name

Signature

Company

Make photocopies for your records. Compare readings/information to previous maintenance worksheet.

To locate your local Vertiv representative for Vertiv engineered parts, check https://www.Vertiv.com/en-us/support/ or call 1-800-543-2778.

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

Vertiv™ Thermal Management Products

1-800-543-2378

Vertiv™ Channel Products

1-800-222-5877

Vertiv™ AC and DC Power Products

1-800-543-2378

A.2 Locations

United States

Vertiv Headquarters

505 N. Cleveland Ave.

Westerville, OH 43082, 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™ CoolPhase Perimeter 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 Vertiv™ CoolPhase Perimeter 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	Z	0	2	2	8	0	1	P	L	B	F	P	A	#	#	#

Table B.2 Vertiv™ CoolPhase Perimeter Model Number Digit Definitions

Digit	Description
Digits 1 and 2 = Unit Family	
	PX = Vertiv™ CoolPhase Perimeter (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 = Vertiv™ GLYCOOL
	D = Dual Cool (Air Cooled + Vertiv™ Econ-o-Coil w/3-way MBV)
	H = Dual Cool (Water/Glycol Cooled + Vertiv™ Econ-o-Coil w/3-way MBV)
	2 = Dual Cool (Air Cooled + Vertiv™ Econ-o-Coil w/2-way MBV)
	3 = Dual Cool (Water/Glycol Cooled + Vertiv™ Econ-o-Coil w/2-way MBV)
Digit 8 = Fan Type	
	1 = EC Plug Fans (variable speed)

Table B.2 Vertiv™ CoolPhase Perimeter Model Number Digit Definitions (continued)

Digit	Description
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
Digit 10 = Compressor and Valve (R-454B)	
	Z = R-454B
Digit 11 = Humidifier	
	0 = No Humidifier
	S = Steam Gen Canister Humidifier
Digit 12 = Display	
	2 = Liebert® iCOM™ (high definition)
Digit 13 = Reheat	
	0 = No Reheat
	2 = Electric Reheat (2-Stage)
	5 = SCR Reheat (PX011 and System Type A or W only)
Digit 14 = Air filter	
	8 = MERV 8, 2-in. Pleated
	9 = MERV 11, 2-in. Pleated
Digit 15 Coil, Valve Type and Pressure Rating[1]	
	0 = Air Cooled Only
	B = Dual Cool/Air Cooled, 150 PSIG CW MBV
	E = Dual Cool/Air Cooled, 400 PSIG CW MBV
	1 = W/G, 2-way 150 PSIG Condenser MBV
	2 = W/G, 2-way 400 PSIG Condenser MBV
	7 = W/G, 3-way 150 PSIG Condenser MBV
	8 = W/G, 3-way 400 PSIG Condenser MBV
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

Table B.2 Vertiv™ CoolPhase Perimeter Model Number Digit Definitions (continued)

Digit	Description
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
Digit 20 = Sensors	
	0 = 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 Vertiv™ Econ-o-Coil valve.	

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Appendix C: Submittal Drawings

Table C.1 Submittal Drawings Contents

Document Number	Title
Component Location Drawings	
20000365	Vertiv™ CoolPhase Perimeter Downflow Component Location Diagram
20000366	Vertiv™ CoolPhase Perimeter Upflow Component Location Diagram
Dimension Planning Drawings--Downflow Units	
20000369	Vertiv™ CoolPhase Perimeter Downflow Cabinet Dimensional Data
20000370	Vertiv™ CoolPhase Perimeter Downflow Cabinet Dimensional Data Floor Level Discharge Models
Dimension Planning Drawings--Upflow Units	
20000371	Vertiv™ CoolPhase Perimeter Upflow Cabinet Dimensional Data
20000372, pg. 1	Vertiv™ CoolPhase Perimeter Upflow Cabinet Dimensional Data Rear Return Models
Dimension Planning Drawings--Floor Stands	
20000373	Vertiv™ CoolPhase Perimeter Floor Stand and Floor Planning Dimensional Data
20000372, pg. 2	Vertiv™ CoolPhase Perimeter Upflow Floor Stand and Floor Planning Dimensional Data Rear Return Models
Dimension Planning Drawings--Plenums	
20000374	Vertiv™ CoolPhase Perimeter Upflow Plenum Dimensional Data Discharge Grille
20000375	Vertiv™ CoolPhase Perimeter Upflow Plenum Dimensional Data with Duct Collar
20000376	Vertiv™ CoolPhase Perimeter Upflow Plenum Dimensional Data Top Discharge
20000377	Vertiv™ CoolPhase Perimeter Downflow Plenum Dimensional Data with Duct Collar
20000378	Vertiv™ CoolPhase Perimeter Downflow Unit with Field Duct Connection
PDX Piping Schematics	
20000379	Vertiv™ CoolPhase Perimeter Air Cooled Piping Schematic Models with TXV
20000380	Vertiv™ CoolPhase Condenser Air Cooled Piping Schematic with EEV
20000381	Vertiv™ CoolPhase Perimeter Air Cooled Piping Schematic with EEV
20000382	Vertiv™ CoolPhase Perimeter Air Cooled Piping Schematic with EEV and Vertiv™ CoolPhase Condenser with Receiver above Unit
20000383	Vertiv™ CoolPhase Perimeter Water/Glycol Cooled Piping Schematics
20000384	Vertiv™ CoolPhase Perimeter Glycol Cooled Piping Schematics
20000385	Vertiv™ CoolPhase Perimeter Optional Piping Schematics Vertiv™ Econ-o-Coil
Downflow Model Primary Connection Locations	
20000388	Vertiv™ CoolPhase Perimeter Downflow Air Cooled Primary Connection Locations
20000389	Vertiv™ CoolPhase Perimeter Downflow Air Cooled Primary Connection Locations
20000390	Vertiv™ CoolPhase Perimeter Downflow Water/Glycol Cooled Primary Connection Locations

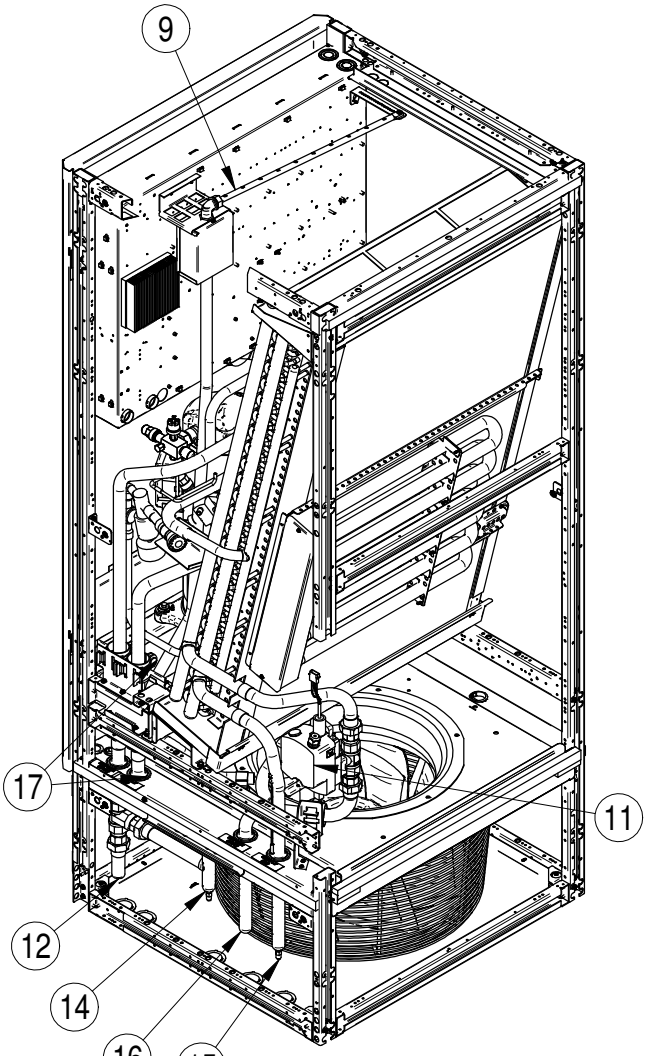
Table C.1 Submittal Drawings Contents (continued)

Document Number	Title
20000391	Vertiv™ CoolPhase Perimeter Downflow Water/Glycol Cooled Primary Connection Locations Front Discharge Models
20000392	Vertiv™ CoolPhase Perimeter Downflow Water/Glycol Cooled Primary Connection Locations
20000393	Vertiv™ CoolPhase Perimeter Downflow Water/Glycol Cooled Primary Connection Locations Front Discharge Models
Upflow Model Primary Connection Locations	
20000396	Vertiv™ CoolPhase Perimeter Upflow Air Cooled Primary Connection Locations
20000397	Vertiv™ CoolPhase Perimeter Upflow Water/Glycol Cooled Primary Connection Locations
20000398	Vertiv™ CoolPhase Perimeter Upflow Glycol Cooled Primary Connection Locations
Electrical Field Connection Drawings	
20000400	Vertiv™ CoolPhase Perimeter Electrical Field Connections
20000401	Vertiv™ CoolPhase Perimeter Downflow Electrical Field Connections
20000402	Vertiv™ CoolPhase Perimeter Upflow Electrical Field Connections
20000403	Vertiv™ CoolPhase Perimeter CANbus & Interlock Connections between Vertiv™ CoolPhase Perimeter Unit and Vertiv™ CoolPhase Condenser
20000404	Vertiv™ CoolPhase Condenser Electrical Field Connections Premium Efficiency Control
20000405	Vertiv™ CoolPhase Condenser Electrical Field Connections Premium Efficiency Control with Vertiv™ Lee-Temp
20000406	Vertiv™ iCOM™ Remote Temperature/Humidity Sensor
20000347	Vertiv™ iCOM™ Unit to Unit Network Connections (Liebert® CW, Liebert® CWA, Vertiv™ CoolPhase Perimeter)

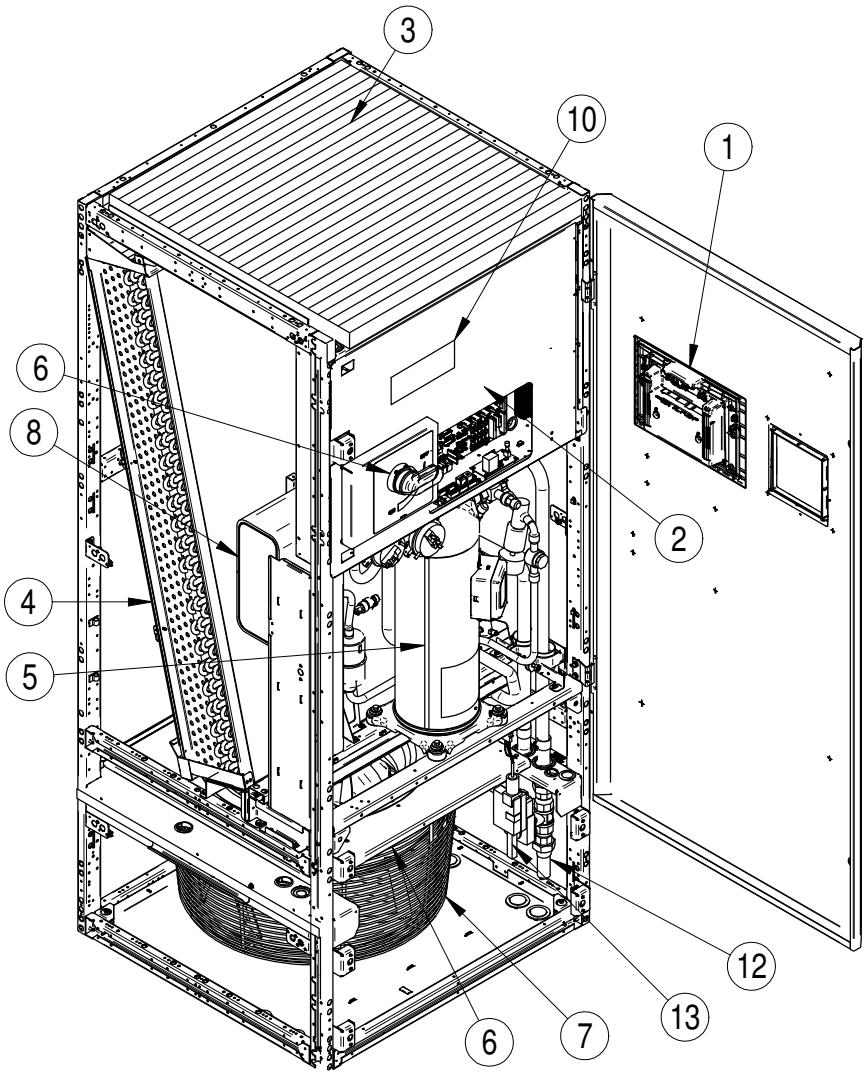
COOLPHASE PERIMETER

COMPONENT LOCATION DIAGRAM

PX011 - PX029 DOWNFLOW MODELS



REAR VIEW



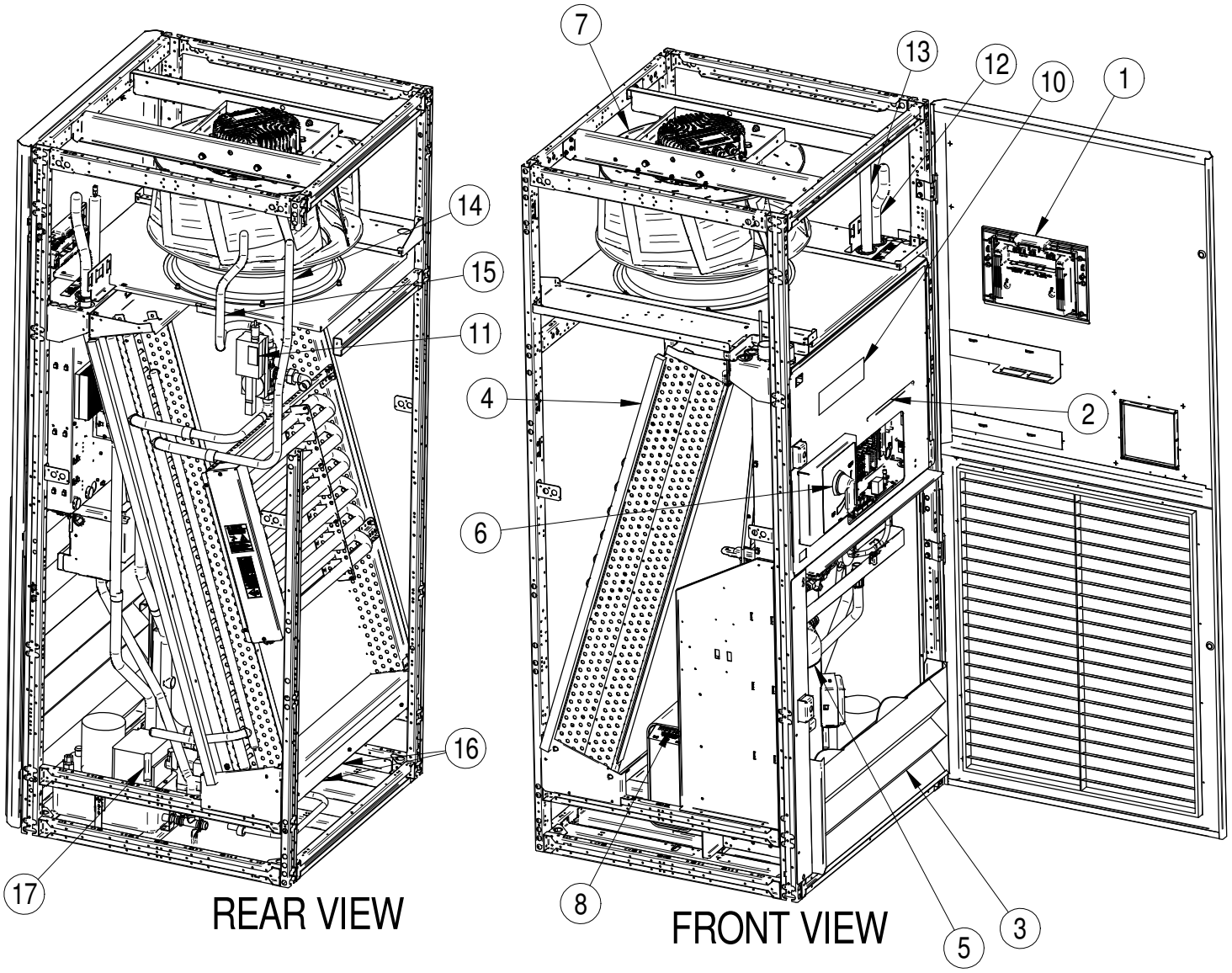
FRONT VIEW

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

COOLPHASE PERIMETER

COMPONENT LOCATION DIAGRAM

PX011 - PX029 UPFLOW MODELS

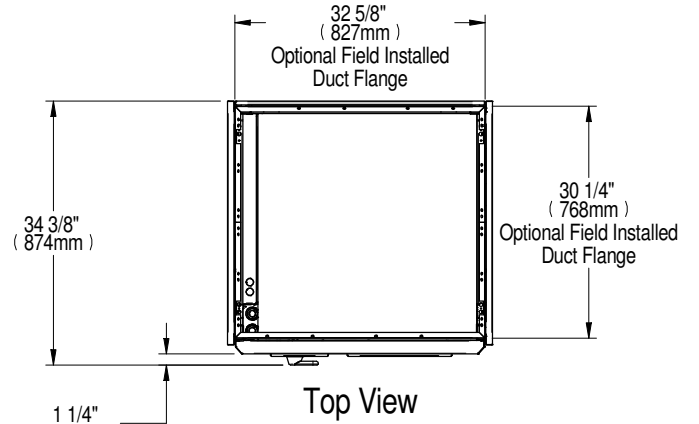


1. Vertiv™ iCOM™ Control Display
2. Electric Box
3. Filter
4. Evaporator Coil
5. Compressor
6. Disconnect
7. EC Fan
8. Plate Condenser (optional)
9. Smoke Detector (optional, not shown)
10. Serial Tag
11. Econ-o-Coil Valve - GLYCOOL/Dual Cooling (optional)
12. Hot Gas Line (Air-Cooled) or Return Connection (Water/Glycol/GLYCOOL)
13. Liquid Line Connection (Air-Cooled) or Return Connection (Water/Glycol)
14. Supply Connection (GLYCOOL/Econ-o-Coil)
15. Return Connection (Econ-o-Coil)
16. Refrigerant Leak Detector
17. Condensate Pump (optional, not shown)
18. Steam Gen Humidifier (option not shown, located above condensate pump)

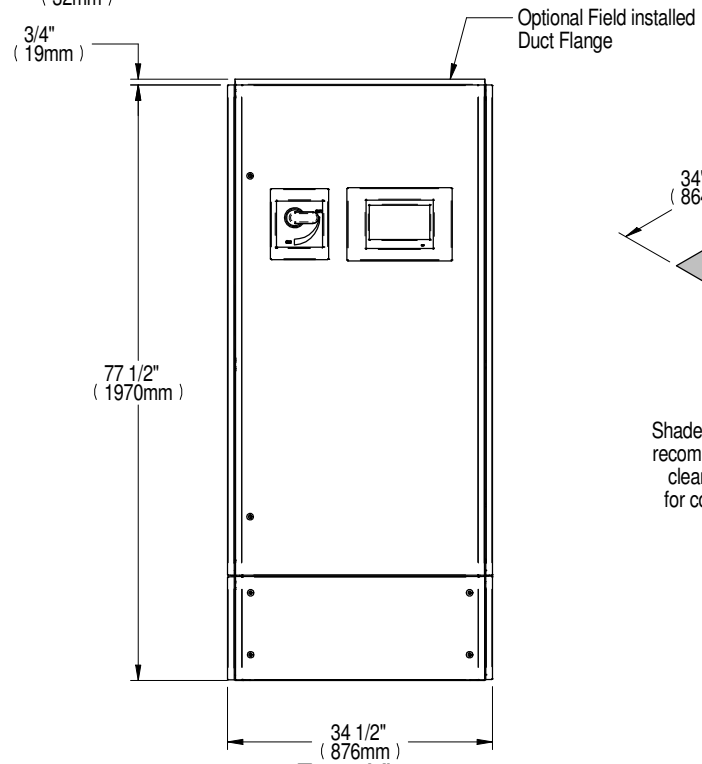
COOLPHASE PERIMETER

CABINET DIMENSIONAL DATA

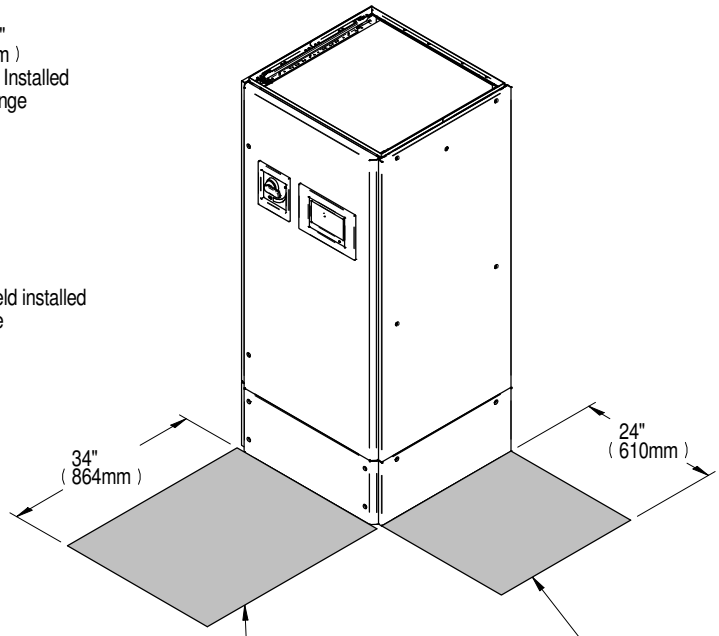
PX011-PX029 DOWNFLOW MODELS



Top View



Front View



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

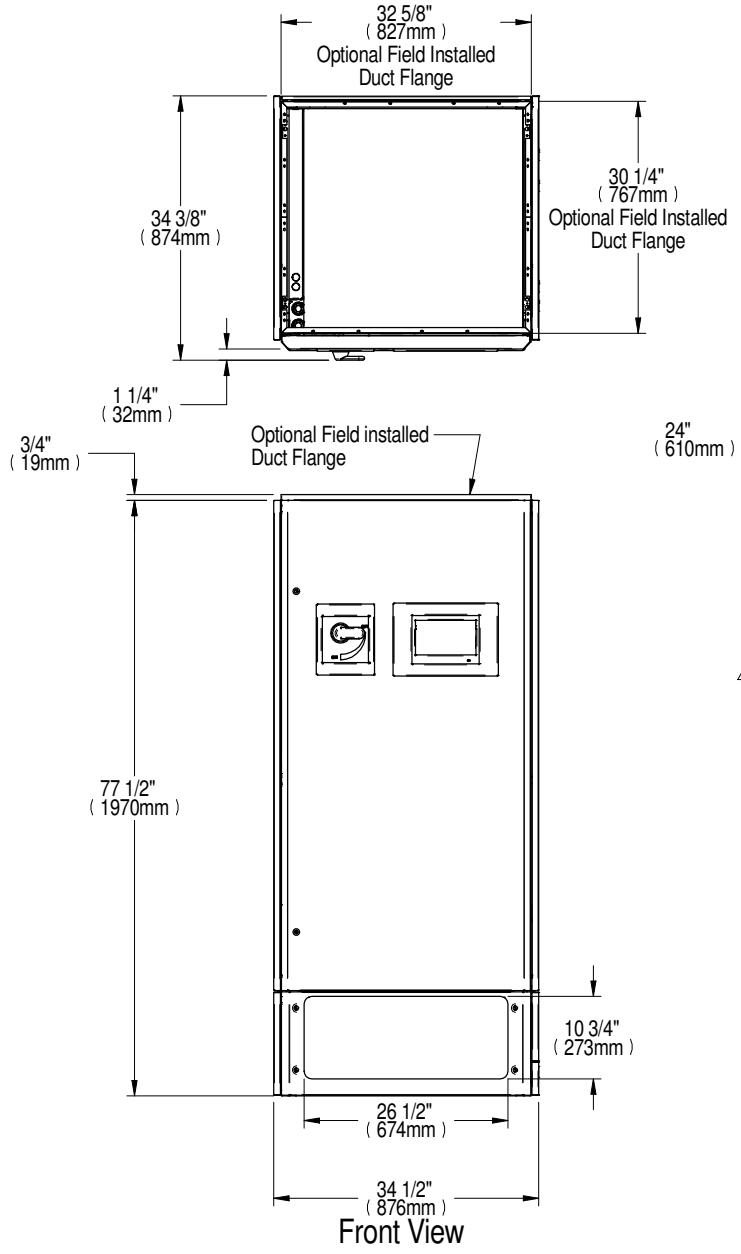
Recommended clearance for unit installation and for servicing these components if equipped: Reheat, Filter Clog Switch, Water/Glycol Reg Valve, Econ-o-Coil Valve, and Smoke Detector.

DRY WEIGHT lb (kg) APPROXIMATE			
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)

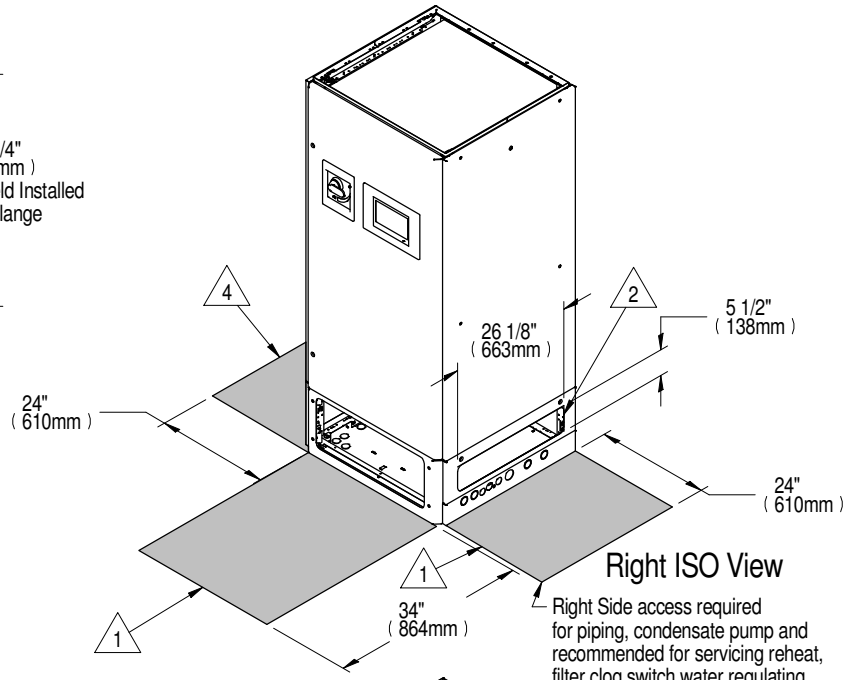
COOLPHASE PERIMETER

CABINET DIMENSIONAL DATA

PX011-PX029 DOWNFLOW FLOOR LEVEL DISCHARGE MODELS

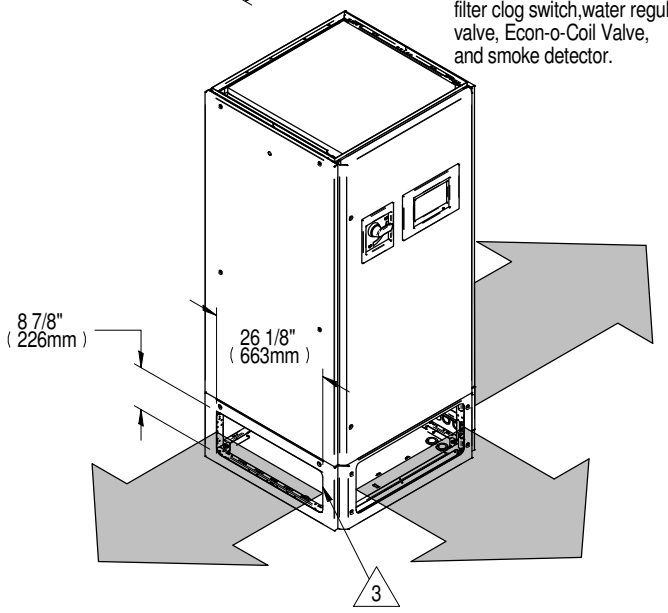


Front View



Right ISO View

Right Side access required for piping, condensate pump and recommended for servicing reheat, filter clog switch,water regulating valve, Econ-o-Coil Valve, and smoke detector.



Left ISO View

DRY WEIGHT lb (kg) APPROXIMATE			
CoolPhase Perimeter 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)

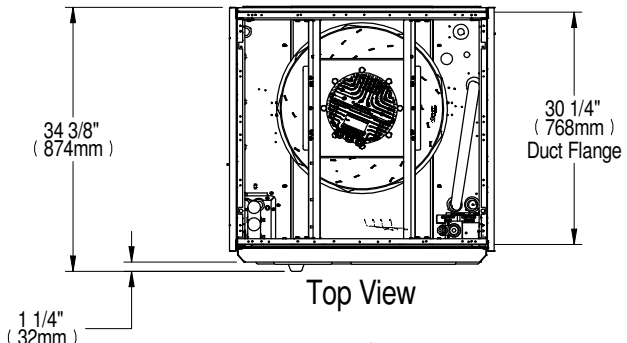
Notes:

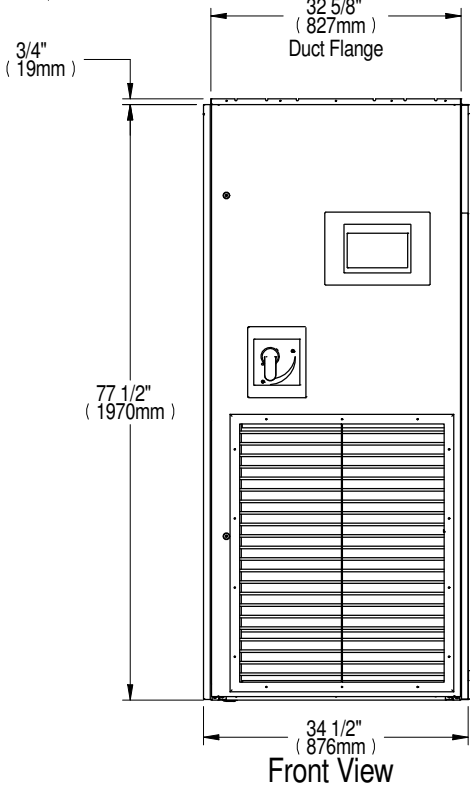
1. Shaded area indicates a recommended minimum clearance be provided for component access and air discharge.
2. Optional opening for units with right side discharge or right and left side discharge.
3. Optional opening for units with left side discharge or right and left side discharge.
4. Shaded area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

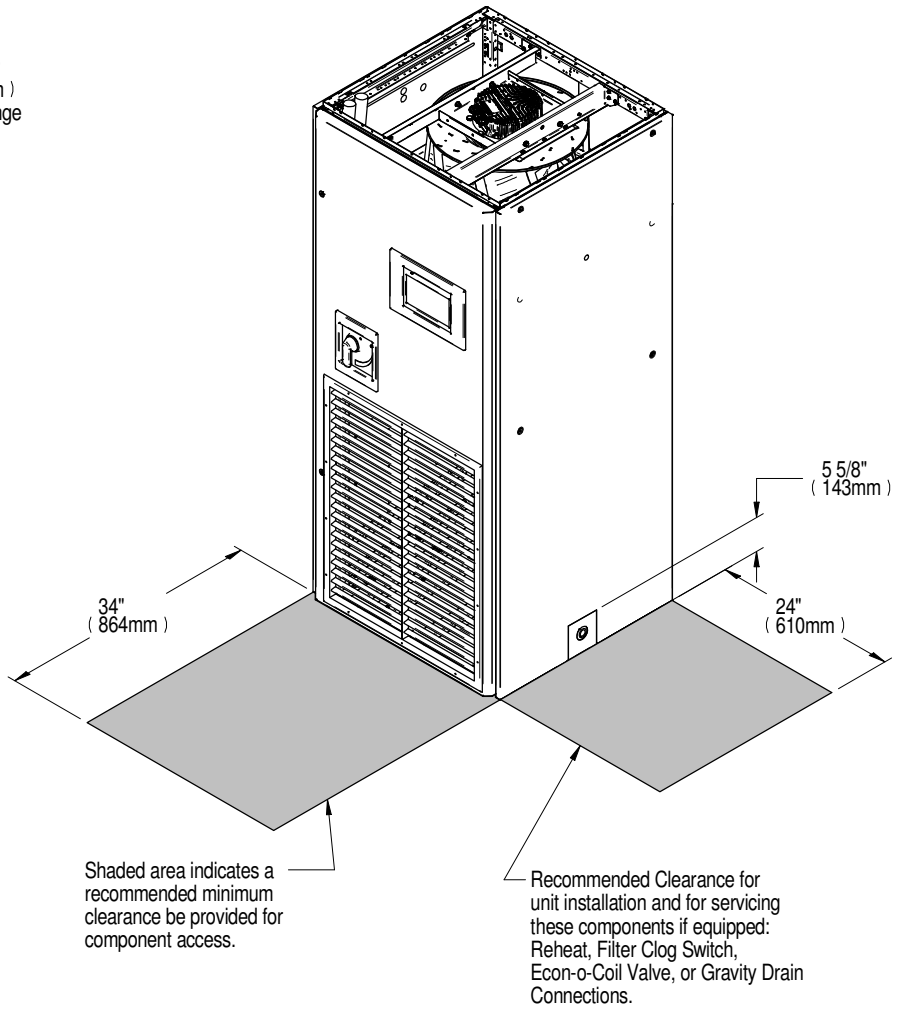
COOLPHASE PERIMETER

CABINET DIMENSIONAL DATA

PX011-PX029 UPFLOW MODELS







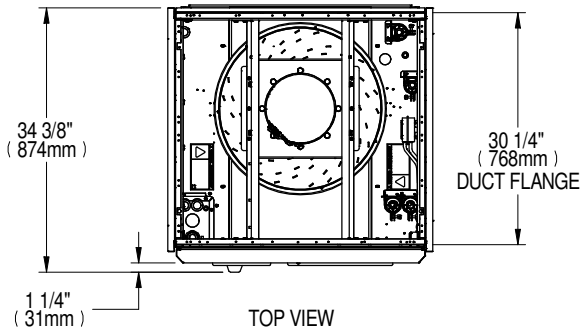
DRY WEIGHT lb (kg) APPROXIMATE			
COOLPHASE PERIMETER Model No.	**PX011**	**PX018-023**	**PX029**
Air Cooled	600 (272)	670 (304)	700 (317)
Air Cooled w/dual cool	700 (317)	750 (340)	790 (358)
Water/Glycol	620 (281)	690 (313)	720 (327)
GLYCOOL or Water/Glycol w/dual cool	720 (327)	770 (349)	810 (367)

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).

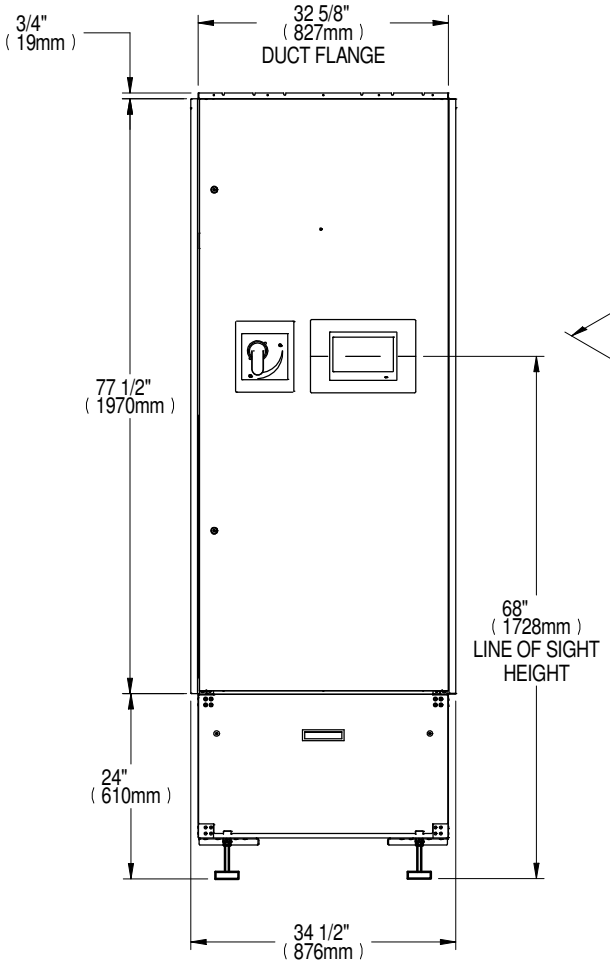
COOLPHASE PERIMETER

CABINET DIMENSIONAL DATA

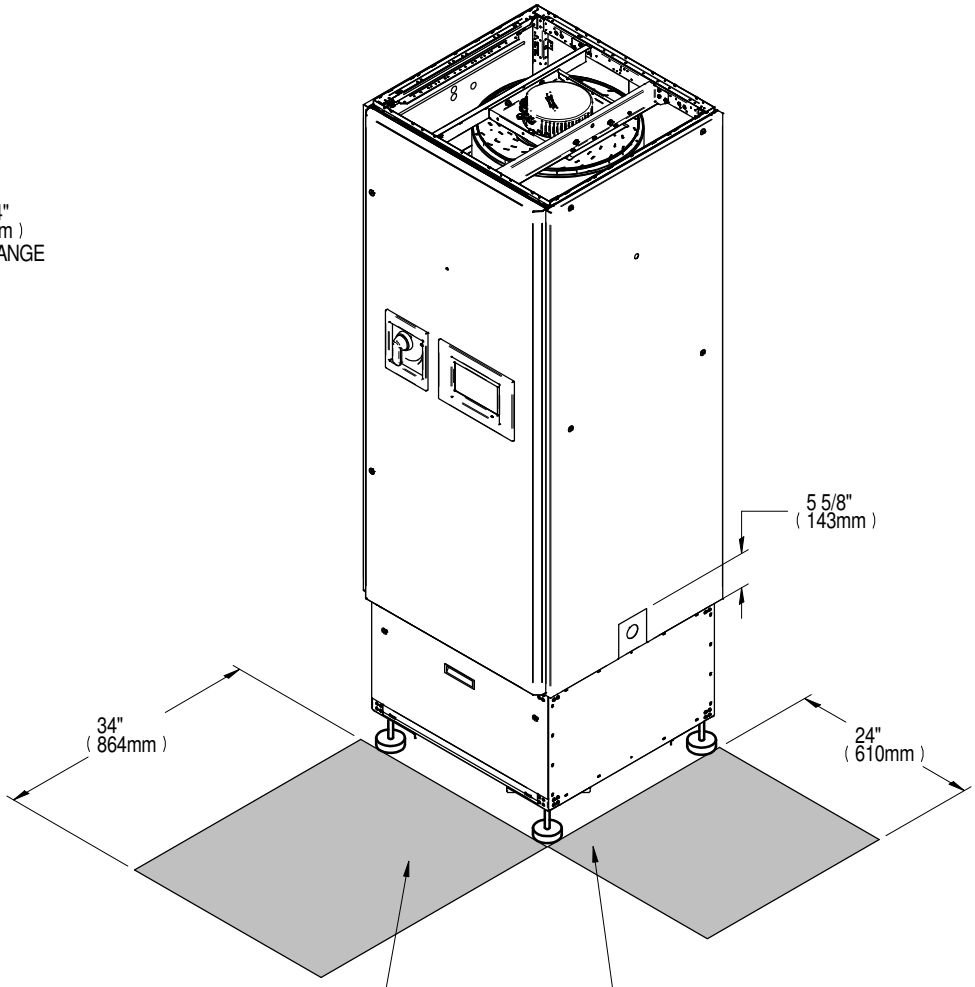
PX011-PX029 UPFLOW REAR RETURN MODELS



TOP VIEW



FRONT VIEW



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

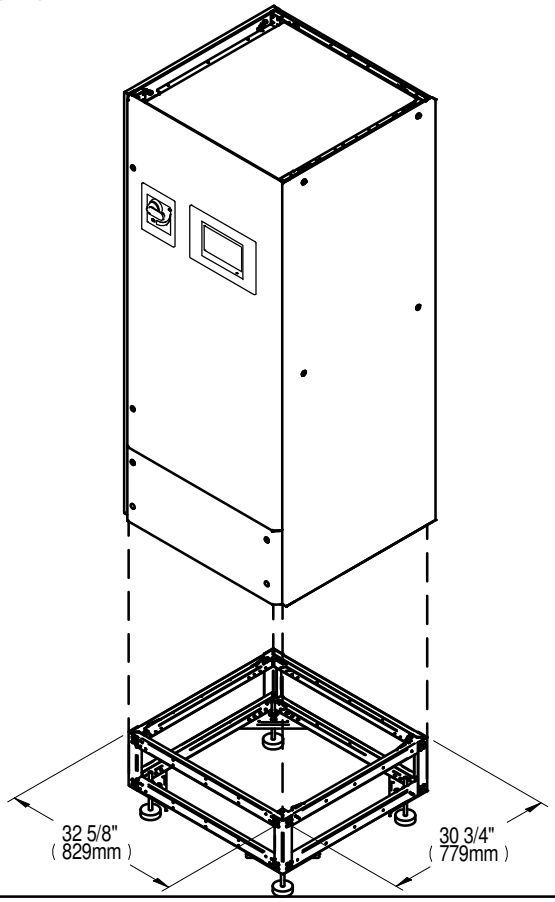
Recommended Clearance for unit installation and for servicing these components if equipped: Reheat, Filter Clog Switch, Econ-o-Coil Valve, or Gravity Drain Connections.

DRY WEIGHT lb (kg) APPROXIMATE			
CoolPhase Perimeter 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)

COOLPHASE PERIMETER

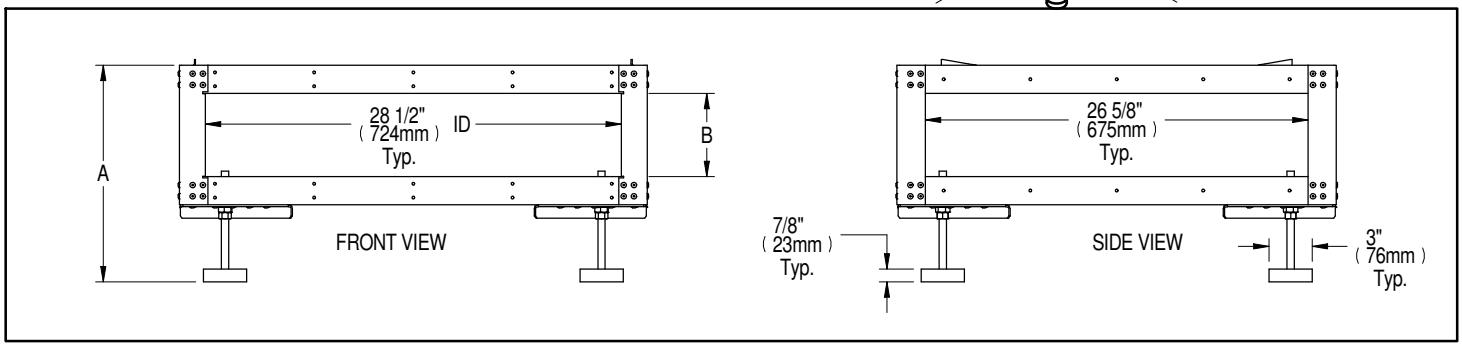
FLOORSTAND & FLOOR PLANNING

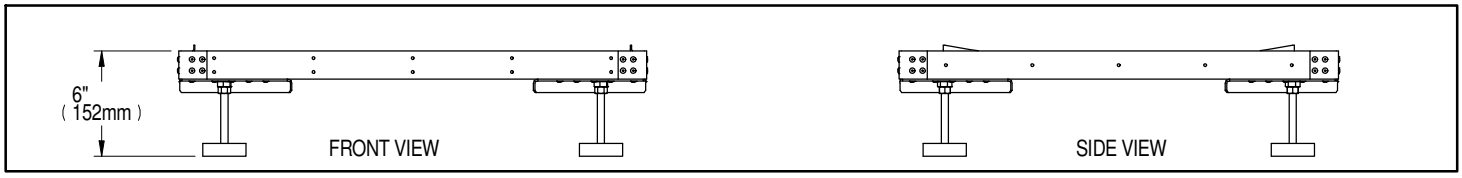
PX011-PX029 DIMENSIONAL DATA

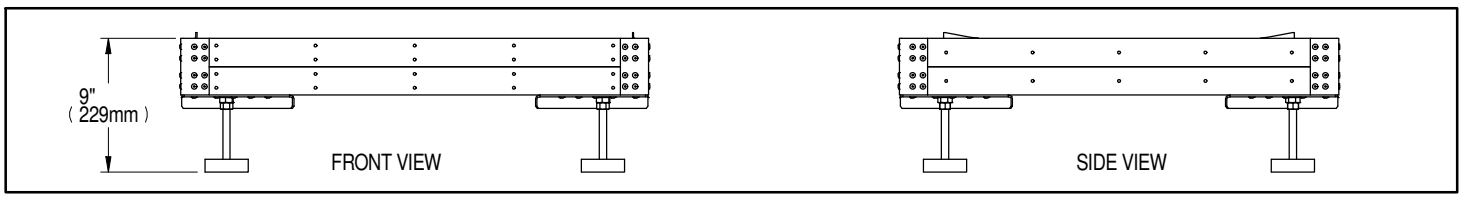


Height in. (mm)	
A	B
12 (305)	2-3/4 (70)
15 (381)	5-3/4 (146)
18 (457)	8-3/4 (223)
21 (533)	11-3/4 (299)
24 (610)	14-3/4 (375)

NOTES:
1. Leveling feet are provided with ±1-1/2" (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.



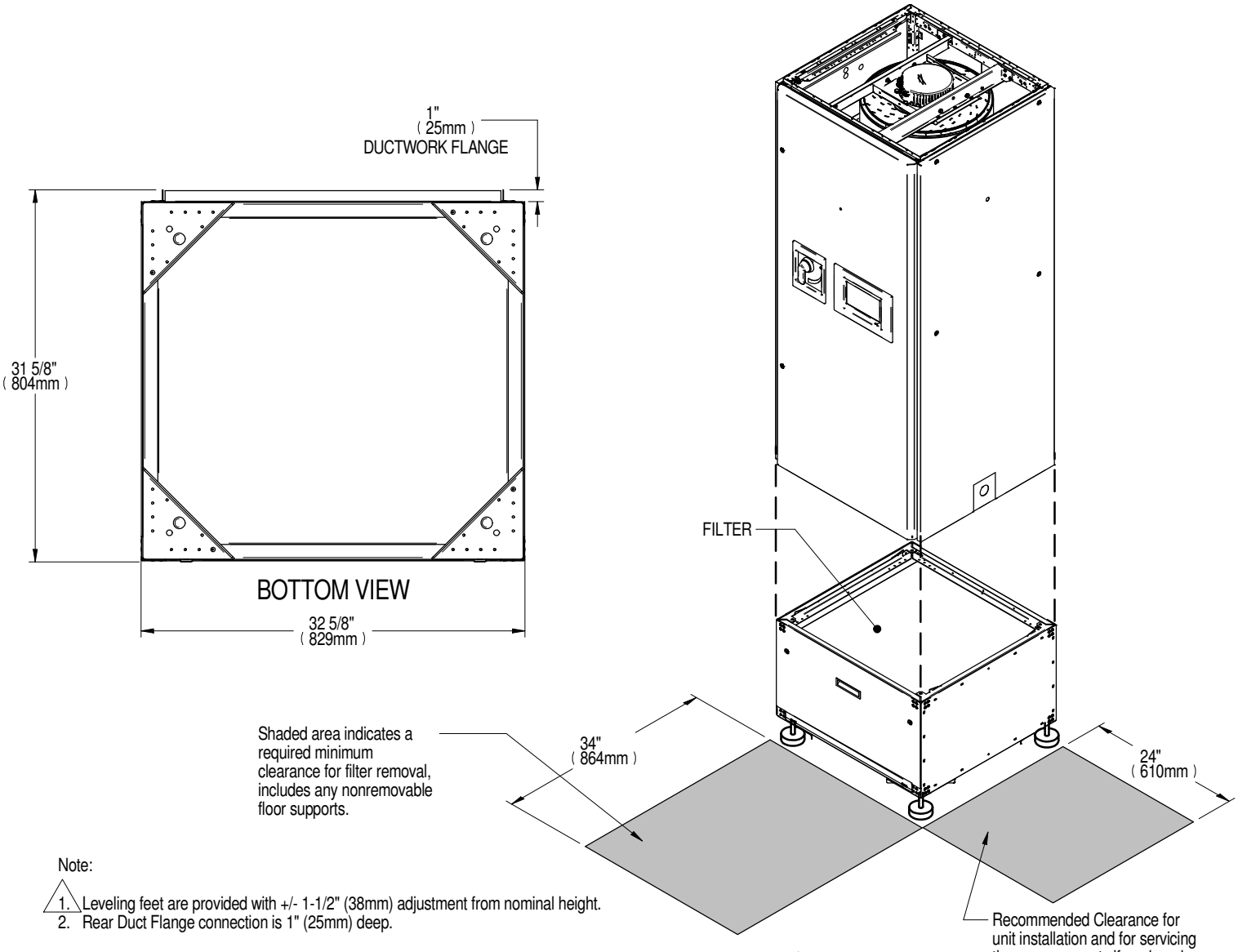




COOLPHASE PERIMETER

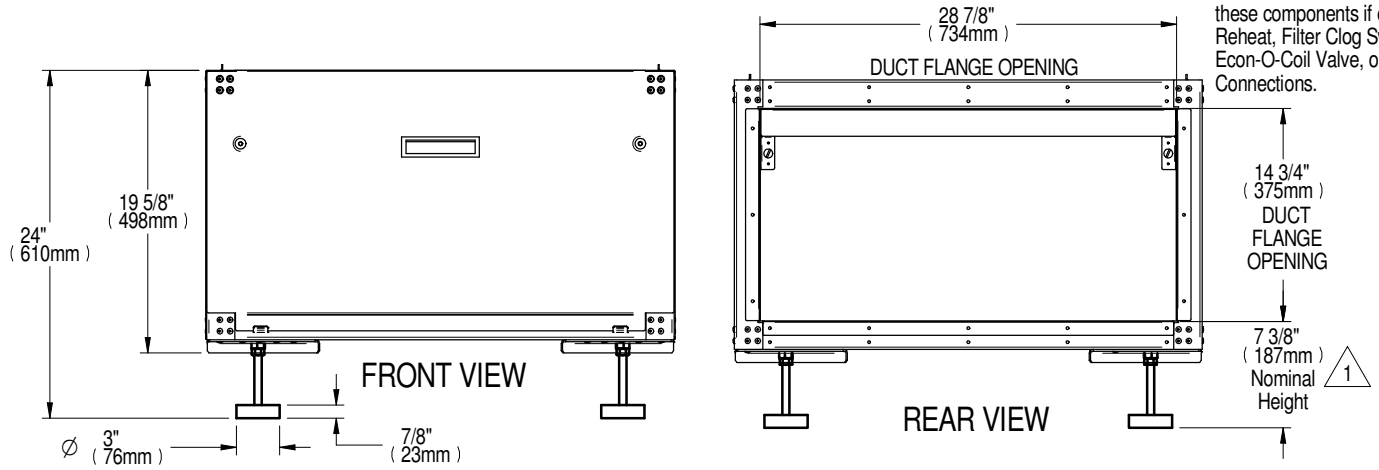
DIMENSIONAL DATA

PX011-PX029 UPFLOW REAR FLOORSTAND



Note:

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



COOLPHASE PERIMETER

PLENUM DIMENSIONAL DATA

PX011-PX029 UPFLOW DISCHARGE GRILLE

FRONT VIEWS - CHECK ONE (1):

☐ WITH GRILLE

☐ WITHOUT GRILLE

REAR VIEWS - CHECK ONE (1):

☐ WITH GRILLE

☐ WITHOUT GRILLE

LEFT SIDE VIEWS - CHECK ONE (1):

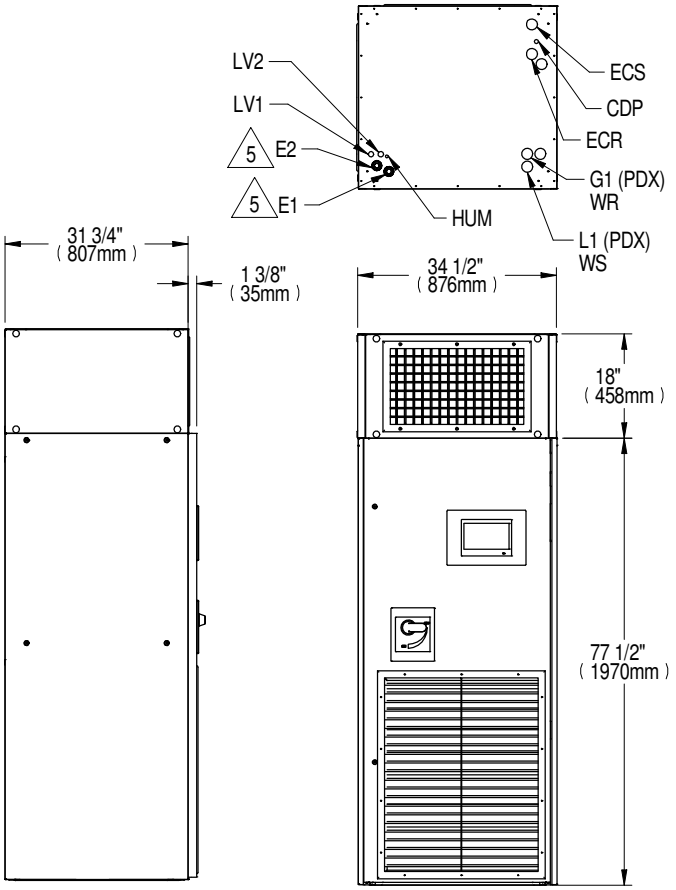
☐ WITH GRILLE

☐ WITHOUT GRILLE

RIGHT SIDE VIEWS - CHECK ONE (1):

☐ WITH GRILLE

☐ WITHOUT GRILLE



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	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 4 / GLYCOOL SUPPLY	4-1/4 (109)	3-1/8 (80)	
ECR	ECON-O-COIL RETURN 4		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) 5
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:
1. Two grilles minimum per plenum required.
   The nominal grille size is 24" (609mm) x 14" (355mm).
2. All Plenums are shipped flat (non-assembled) and must be assembled on site.
3. Upflow bottom return units are available with required rear return floorstand with filter.

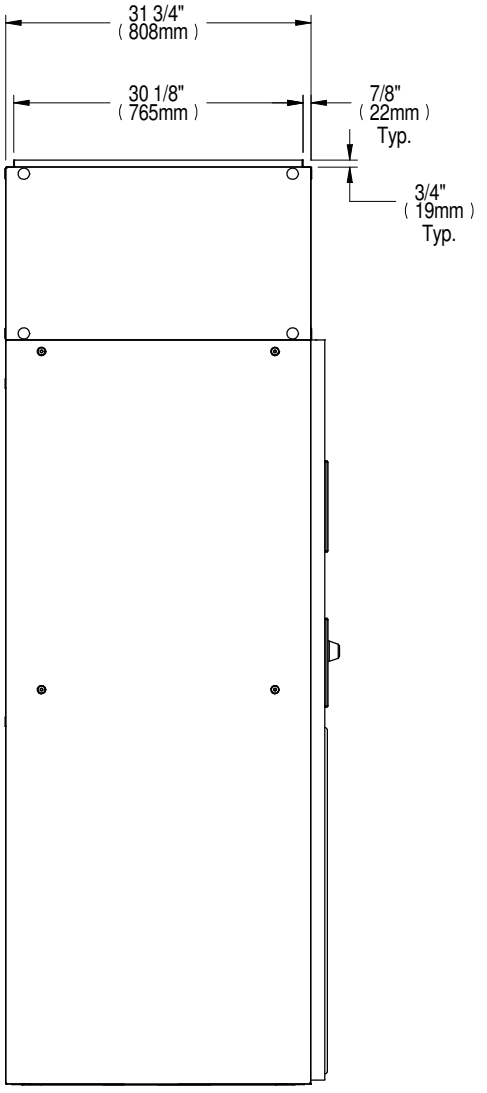
4. Units supplied with Dual Cooling systems only (4 pipe system).

5. Concentric knockouts to be used based on field supplied conduit diameter.

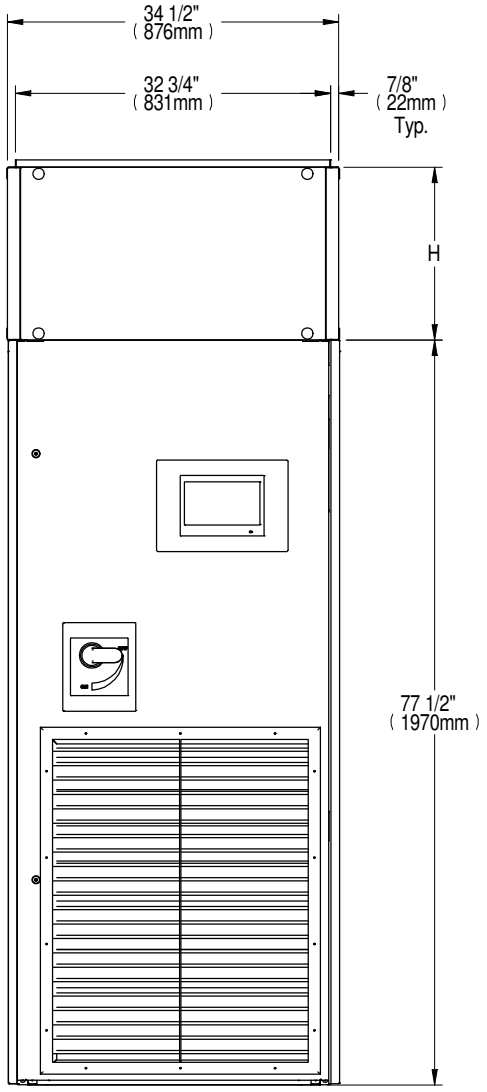
COOLPHASE PERIMETER

PLENUM DIMENSIONAL DATA

PX011-PX029 UPFLOW DISCHARGE W/ DUCT COLLAR



SIDE VIEW - UNIT WITH PLENUM



FRONT VIEW - UNIT WITH PLENUM

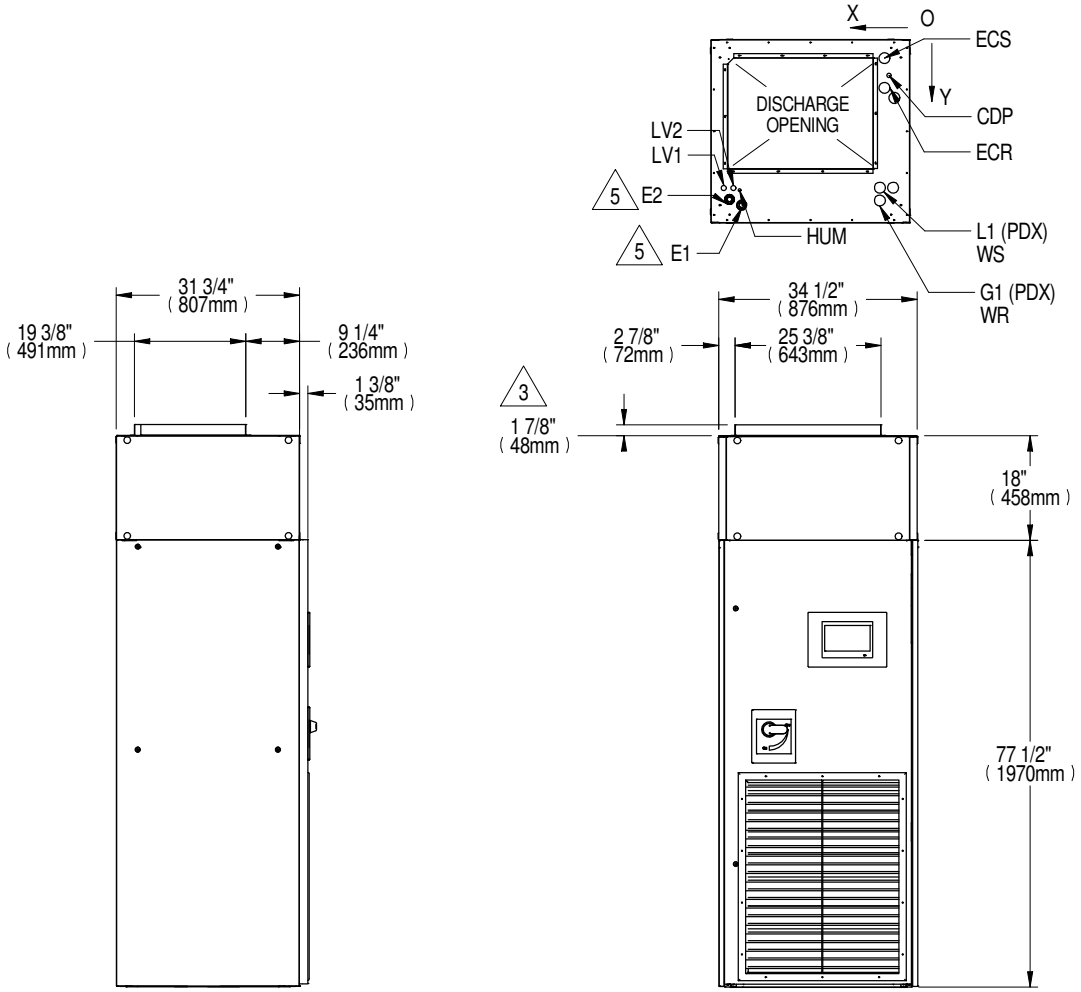
	Height H in (mm)
☐	18 (457)
☐	24 (609)
☐	30 (762)
☐	36 (914)
☐	42 (1066)
☐	48 (1219)

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.

COOLPHASE PERIMETER

PLENUM DIMENSIONAL DATA

PX011-PX029 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	5-1/8 (130)	25-5/8 (651)	2 (51)
G1	HOT GAS DISCHARGE 1		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	5-1/8 (130)	25-5/8 (651)	2 (51)
WR	RETURN-CW/WATER/GLYCOL/GLYCOOL			
ECS	ECON-O-COIL SUPPLY 4 / GLYCOOL SUPPLY	4-1/4 (109)	3-1/8 (80)	
ECR	ECON-O-COIL RETURN 4		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) 5
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:

1. Plenums are shipped flat (non-assembled) and must be assembled on site.
2. Unit with front return shown. Upflow unit with bottom return are available, but requires a rear return floorstand with filter.

3. Plenums with inner liners the duct flange measures 1" (25mm).

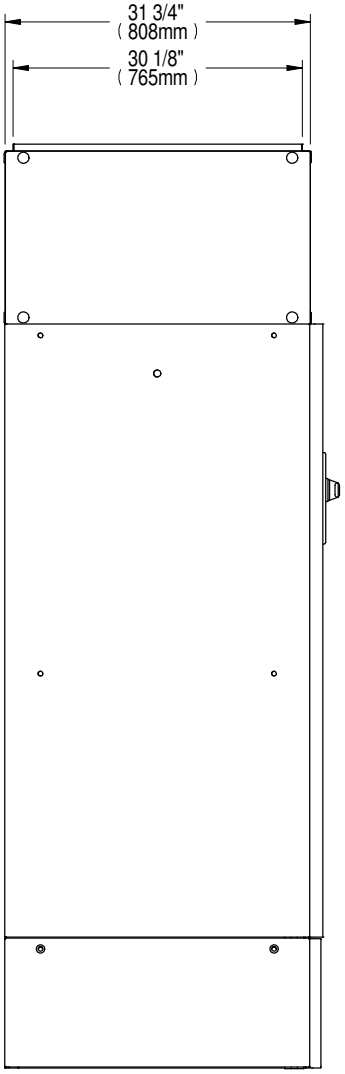
4. Units supplied with Dual Cooling systems only (4 pipe system).

5. Concentric knockouts to be used based on field supplied conduit diameter.

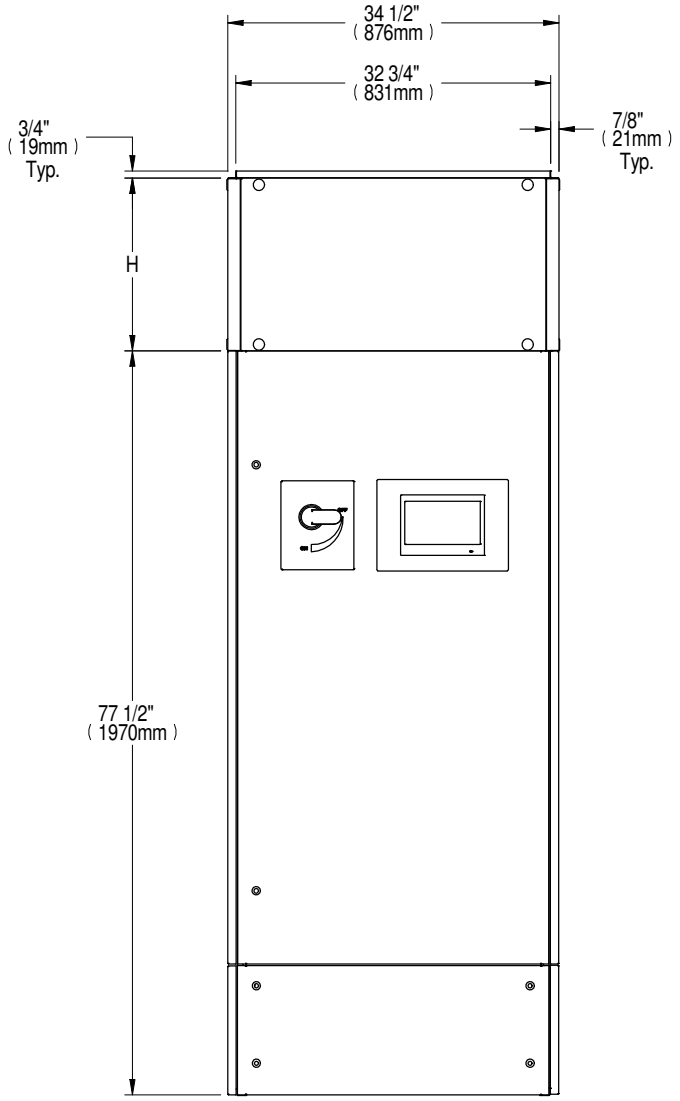
COOLPHASE PERIMETER

PLENUM DIMENSIONAL DATA

PX011-PX029 DOWNFLOW RETURN W/ DUCT COLLAR



LEFT SIDE VIEW - WITH PLENUM



FRONT VIEW - UNIT WITH PLENUM

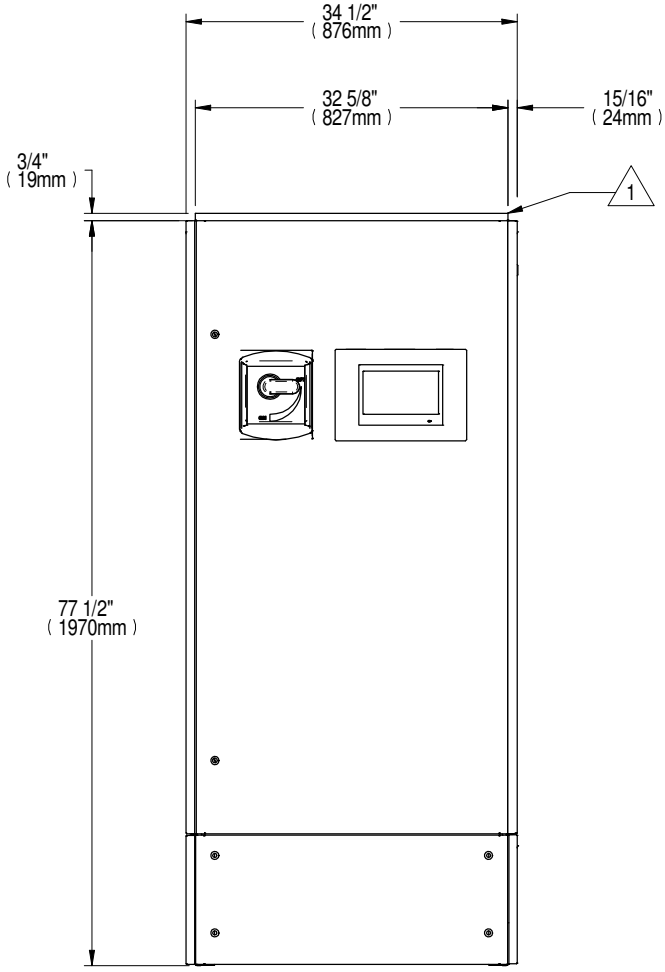
	Height H in (mm)
☐	18 (457)
☐	24 (609)
☐	30 (762)
☐	36 (914)
☐	42 (1066)
☐	48 (1219)

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

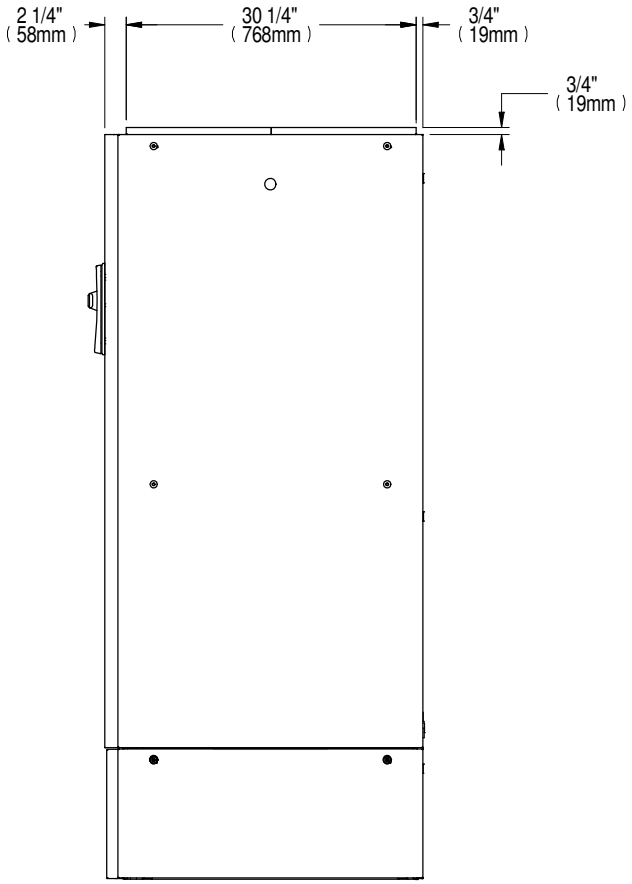
COOLPHASE PERIMETER

DOWNFLOW UNIT WITH FIELD DUCT CONNECTION

PX011 - PX029 MODELS



Front



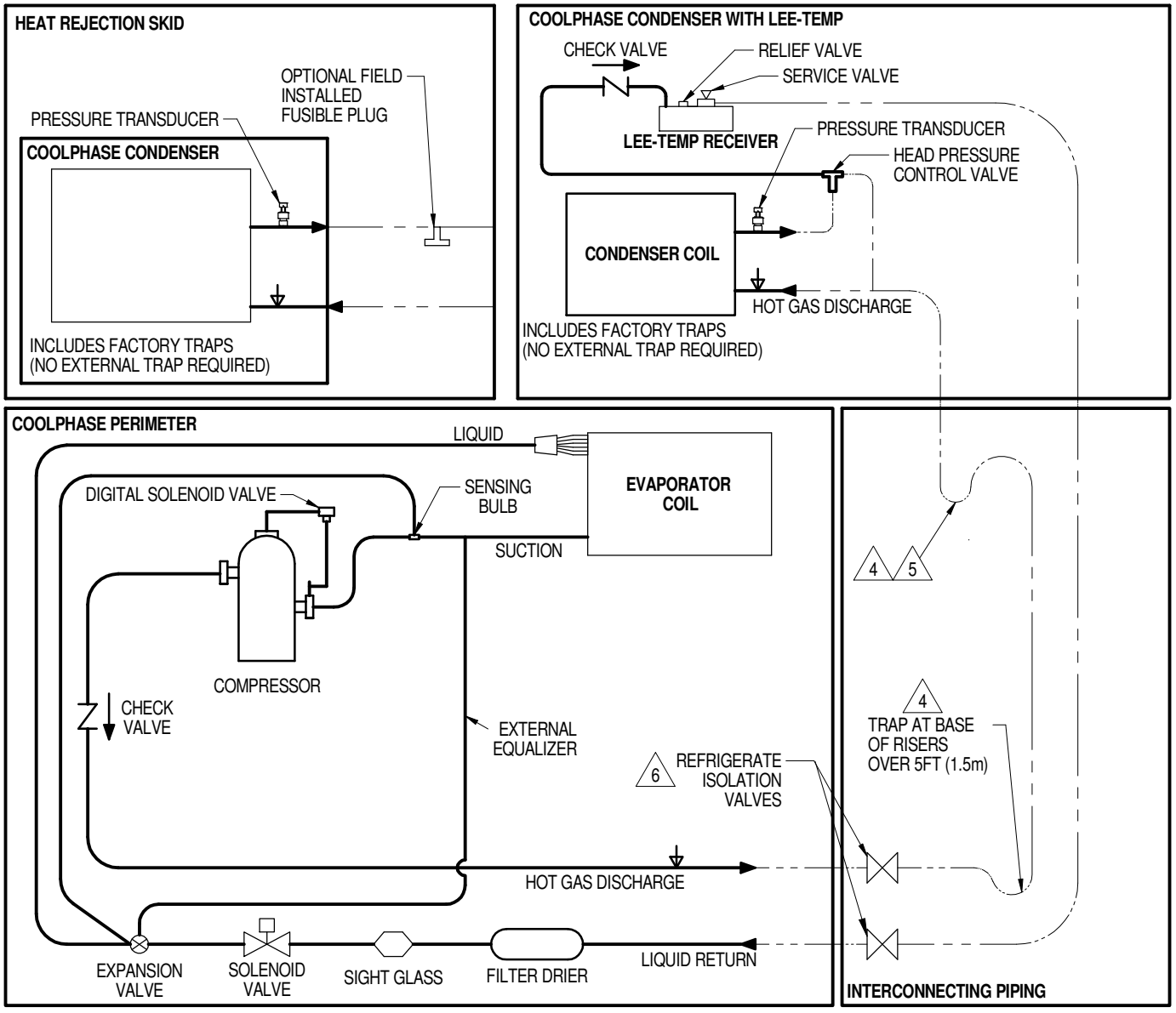
Right Side

Notes:

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

COOLPHASE PERIMETER

PIPING SCHEMATIC
PX011-PX029 AIR COOLED MODELS



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. 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.
3. Do not isolate any refrigerant circuits from over pressurization protection.

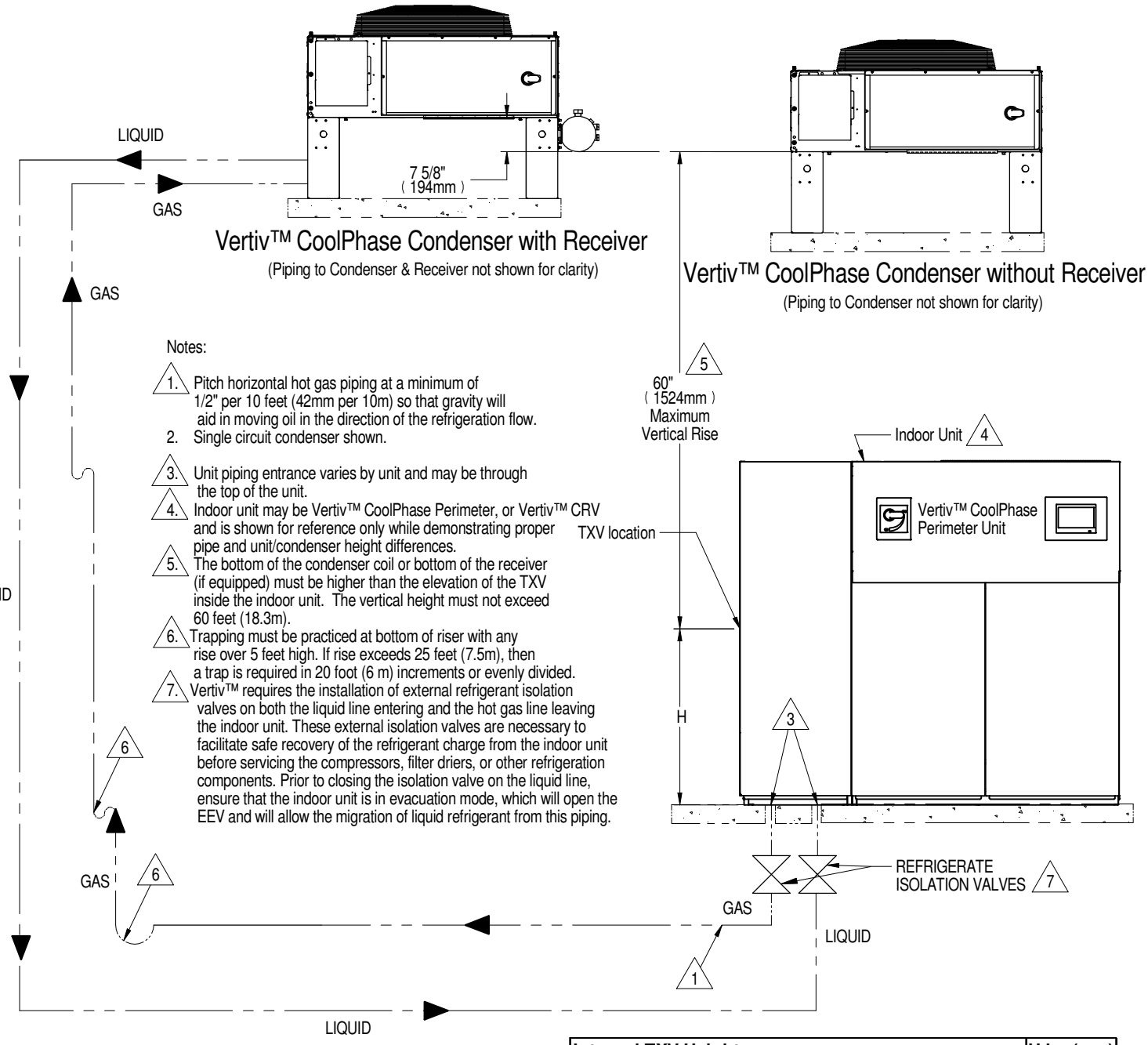
4. Components are not supplied by Vertiv™ but are required for proper circuit operation and maintenance.

5. For rises over 25 ft (7.6 m), trap every 20 ft (6 m) or evenly divided.

6. Vertiv™ requires the installation of external refrigerant isolation valves on both the liquid line entering and the hot gas line leaving the indoor unit. These external isolation valves are necessary to facilitate safe recovery of the refrigerant charge from the indoor unit before servicing the compressors, filter driers, or other refrigeration components. Prior to closing the isolation valve on the liquid line, ensure that the indoor unit solenoid valve is open (may be done in evacuation mode).

COOLPHASE CONDENSER

AIR COOLED PIPING SCHEMATIC
CONDENSER ABOVE INDOOR UNIT



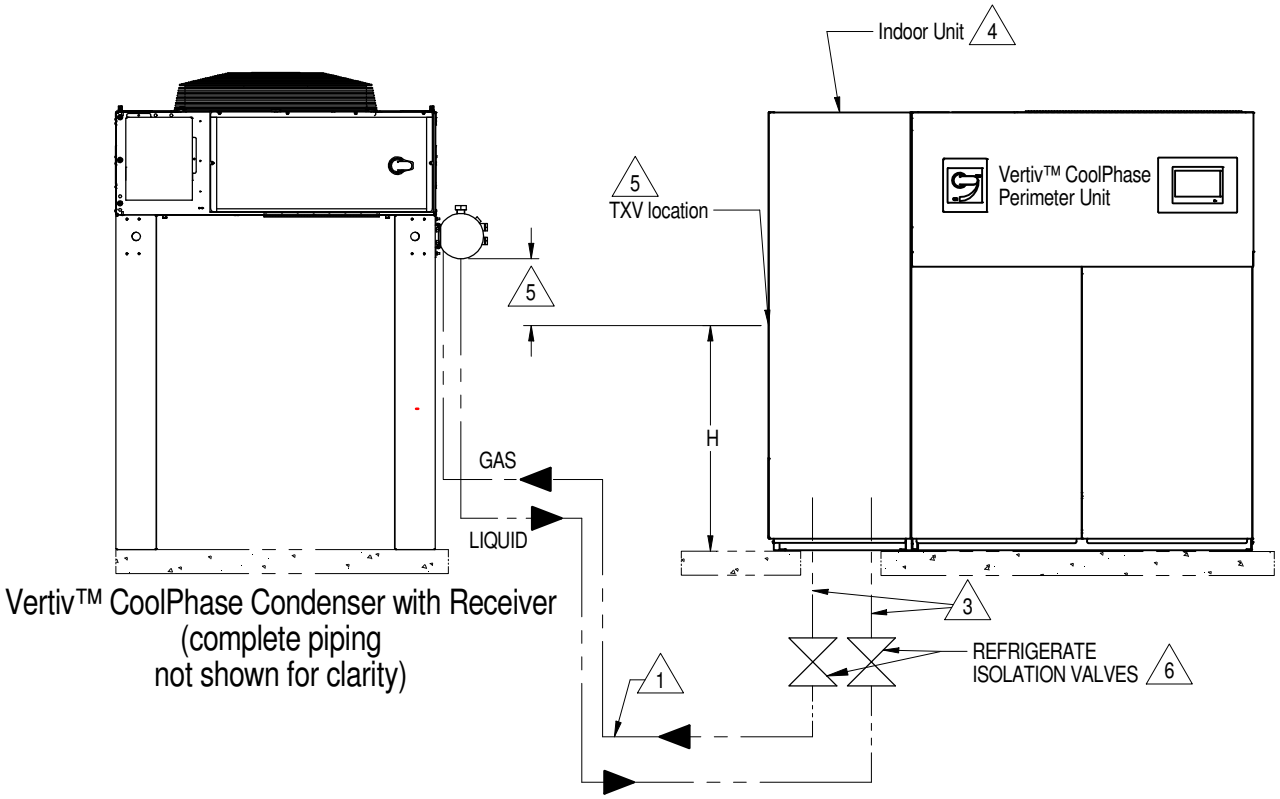
Notes:

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 Vertiv™ CoolPhase Perimeter, or Vertiv™ CRV and is shown for reference only while demonstrating proper pipe and unit/condenser height differences.
5. The bottom of the condenser coil or bottom of the receiver (if equipped) must be higher than the elevation of the TXV inside the indoor unit. The vertical height must not exceed 60 feet (18.3m).
6. Trapping must be practiced at bottom of riser with any rise over 5 feet high. If rise exceeds 25 feet (7.5m), then a trap is required in 20 foot (6 m) increments or evenly divided.
7. Vertiv™ requires the installation of external refrigerant isolation valves on both the liquid line entering and the hot gas line leaving the indoor unit. These external isolation valves are necessary to facilitate safe recovery of the refrigerant charge from the indoor unit before servicing the compressors, filter driers, or other refrigeration components. Prior to closing the isolation valve on the liquid line, ensure that the indoor unit is in evacuation mode, which will open the EEV and will allow the migration of liquid refrigerant from this piping.

Internal TXV Height	H in. (mm)
Vertiv™ CoolPhase Perimeter (PX011-PX029) Downflow	44 (1118)
Vertiv™ CoolPhase Perimeter (PX011-PX029) Upflow	20 (508)
Vertiv™ CoolPhase Perimeter (DS035-DS105)	43 (1092)
Vertiv™ CRV (CR019)	45 (1143)
Vertiv™ CRV (CR020-CR035)	27 (686)

Field piping

AIR COOLED PIPING SCHEMATIC
CONDENSER AND INDOOR UNIT AT SAME LEVEL



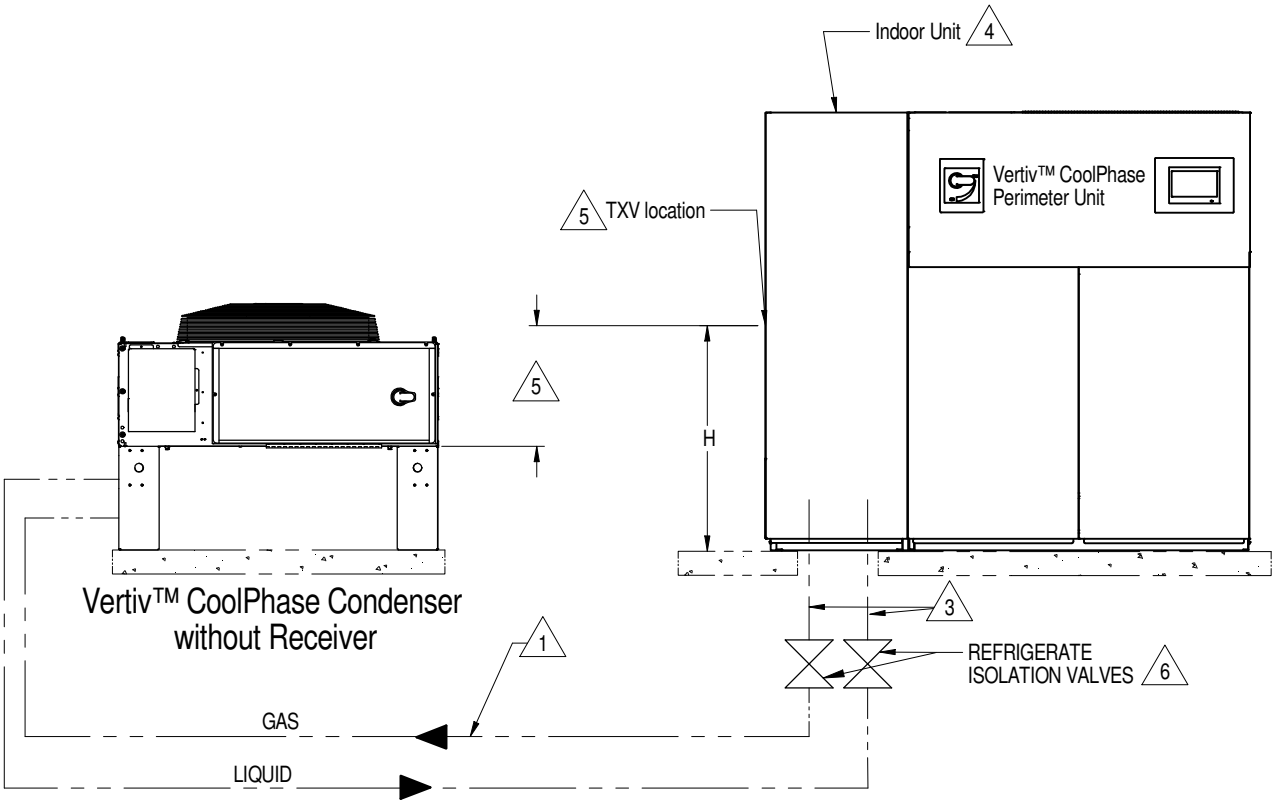
Internal TXV Height	H in. (mm)
Vertiv™ CoolPhase Perimeter (PX011-PX029) Downflow	44 (1118)
Vertiv™ CoolPhase Perimeter (PX011-PX029) Upflow	20 (508)
Vertiv™ CoolPhase Perimeter (DS035-DS105)	43 (1092)
Vertiv™ CRV (CR019)	45 (1143)
Vertiv™ CRV (CR020-CR035)	27 (686)

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 Vertiv™ CoolPhase Perimeter, or Vertiv™ 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.
6. Vertiv™ requires the installation of external refrigerant isolation valves on both the liquid line entering and the hot gas line leaving the indoor unit. These external isolation valves are necessary to facilitate safe recovery of the refrigerant charge from the indoor unit before servicing the compressors, filter driers, or other refrigeration components. Prior to closing the isolation valve on the liquid line, ensure that the indoor unit is in evacuation mode, which will open the

COOLPHASE CONDENSER

AIR COOLED PIPING SCHEMATIC
CONDENSER AND INDOOR UNIT AT SAME LEVEL



—— – – – —— Field piping

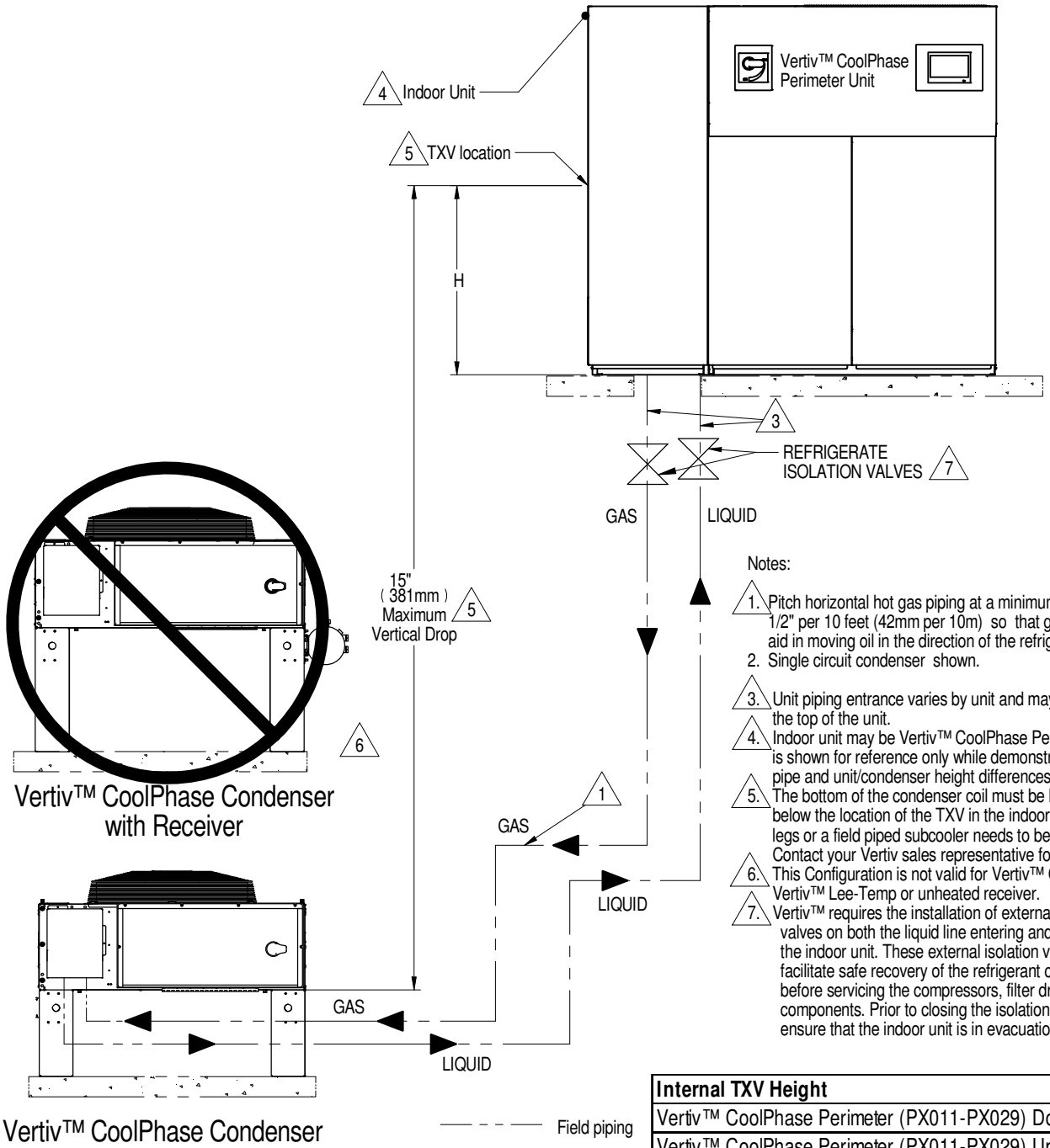
Internal TXV Height	H in. (mm)
Vertiv™ CoolPhase Perimeter (PX011-PX029) Downflow	44 (1118)
Vertiv™ CoolPhase Perimeter (PX011-PX029) Upflow	20 (508)
Vertiv™ CoolPhase Perimeter (DS035-DS105)	43 (1092)
Vertiv™ CRV (CR019)	45 (1143)
Vertiv™ CRV (CR020-CR035)	27 (686)

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 Vertiv™ CoolPhase Perimeter, or Vertiv™ 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.
6. Vertiv™ requires the installation of external refrigerant isolation valves on both the liquid line entering and the hot gas line leaving the indoor unit. These external isolation valves are necessary to facilitate safe recovery of the refrigerant charge from the indoor unit before servicing the compressors, filter driers, or other refrigeration components. Prior to closing the isolation valve on the liquid line, ensure that the indoor unit is in evacuation mode, which will open the

COOLPHASE CONDENSER

AIR COOLED PIPING SCHEMATIC
CONDENSER BELOW INDOOR UNIT



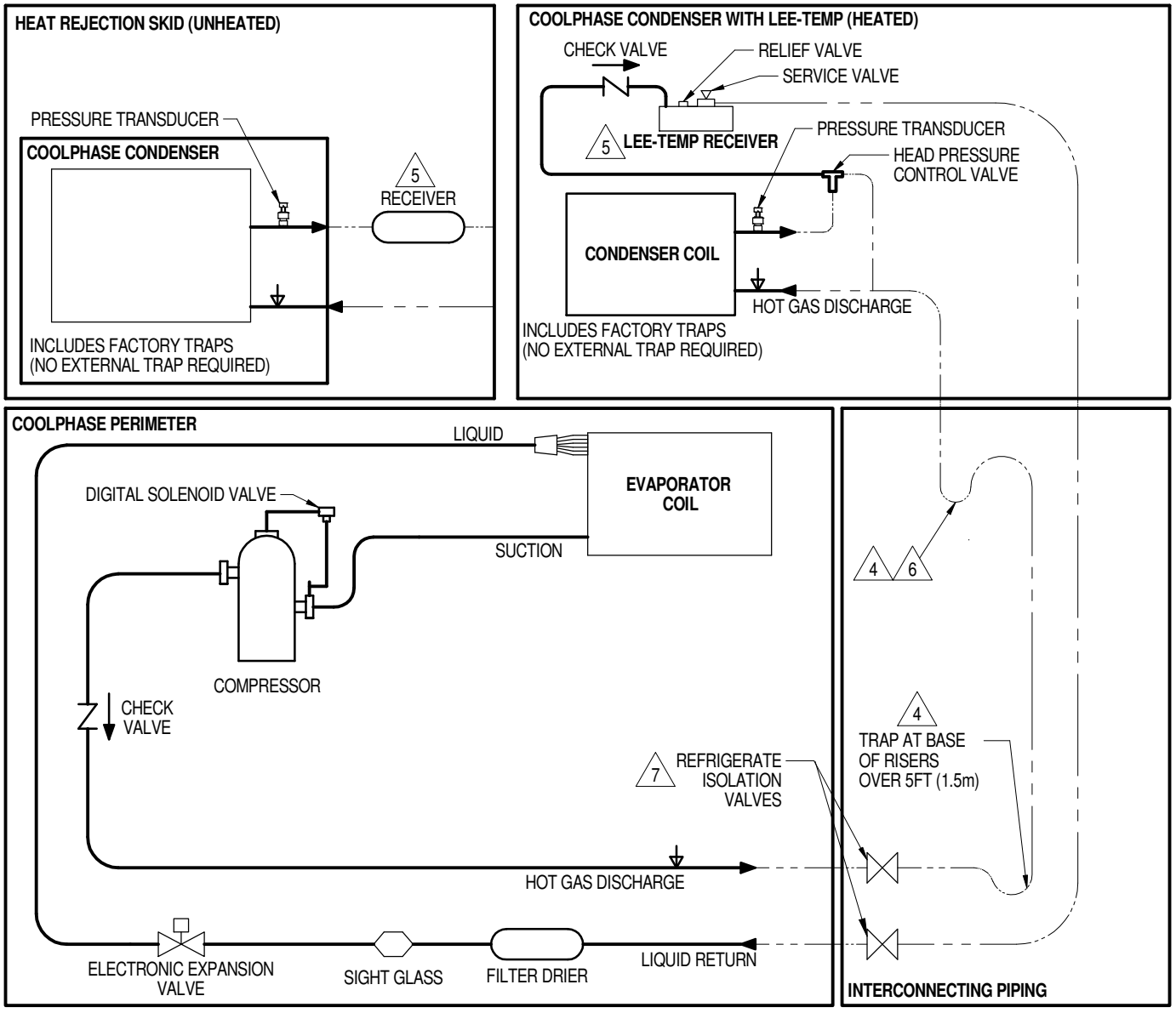
Notes:

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 Vertiv™ CoolPhase Perimeter, or Vertiv™ CRV and is shown for reference only while demonstrating proper pipe and unit/condenser height differences.
5. The bottom of the condenser coil must be less than 15 feet (4.6m) below the location of the TXV in the indoor unit, otherwise extended legs or a field piped subcooler needs to be utilized. Contact your Vertiv sales representative for additional information.
6. This Configuration is not valid for Vertiv™ CoolPhase Condenser with Vertiv™ Lee-Temp or unheated receiver.
7. Vertiv™ requires the installation of external refrigerant isolation valves on both the liquid line entering and the hot gas line leaving the indoor unit. These external isolation valves are necessary to facilitate safe recovery of the refrigerant charge from the indoor unit before servicing the compressors, filter driers, or other refrigeration components. Prior to closing the isolation valve on the liquid line, ensure that the indoor unit is in evacuation mode, which will open the

Internal TXV Height	H in. (mm)
Vertiv™ CoolPhase Perimeter (PX011-PX029) Downflow	44 (1118)
Vertiv™ CoolPhase Perimeter (PX011-PX029) Upflow	20 (508)
Vertiv™ CoolPhase Perimeter (DS035-DS105)	43 (1092)
Vertiv™ CRV (CR019)	45 (1143)
Vertiv™ CRV (CR020-CR035)	27 (686)

COOLPHASE PERIMETER

PIPING SCHEMATIC
PX011-PX029 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:

1. Schematic representation shown. Do not use for specific connection locations.
2. 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.
3. Do not isolate any refrigerant circuits from over pressurization protection.

4. Components are not supplied by Vertiv™ but are required for proper circuit operation and maintenance.

5. Refrigerant receiver or Lee-temp receiver required with Vertiv™ CoolPhase Perimeter 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).

6. For rises over 25 ft (7.6 m), trap every 20 ft (6 m) or evenly divided.

7. Vertiv™ requires the installation of external refrigerant isolation valves on both the liquid line entering and the hot gas line leaving the indoor unit. These external isolation valves are necessary to facilitate safe recovery of the refrigerant charge from the indoor unit before servicing the compressors, filter driers, or other refrigeration components. Prior to closing the isolation valve on the liquid line, ensure that the indoor unit solenoid valve is open (may be done in evacuation mode).

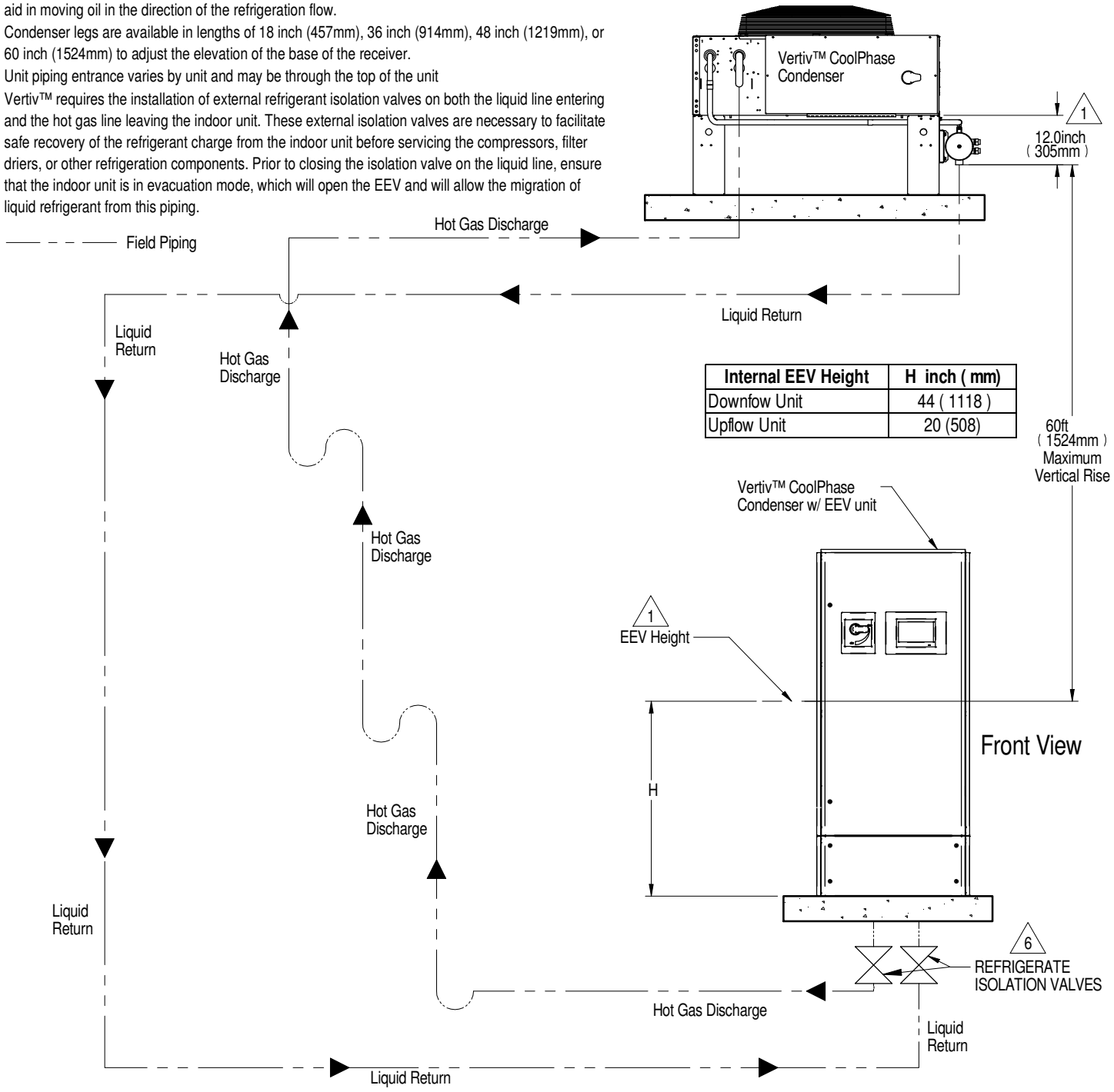
COOLPHASE PERIMETER w/EEV

AIR COOLED PIPING SCHEMATIC

PX011-PX029 VERTIV™ COOLPHASE CONDENSER WITH RECEIVER ABOVE UNIT

Notes:

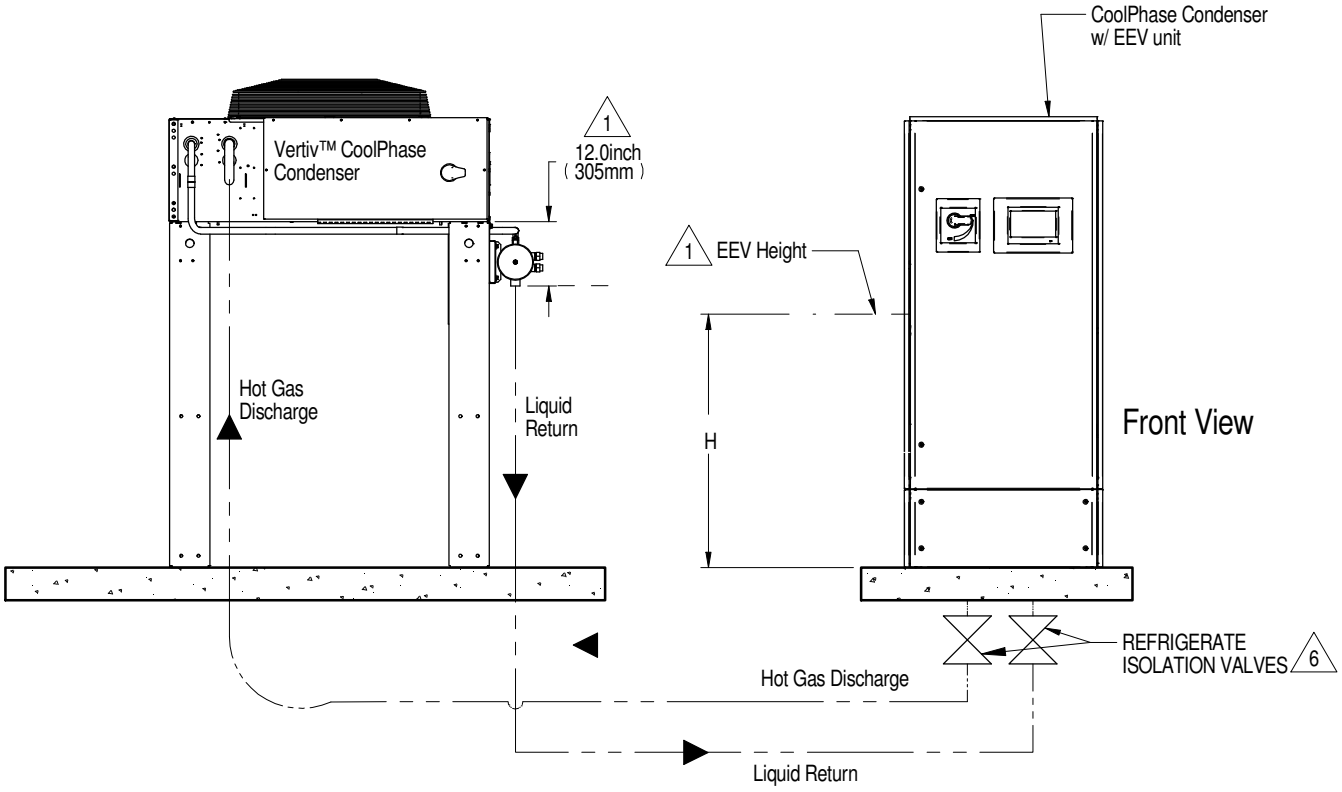
1. The outlet of the required receiver must be higher than the elevation of the EEV inside the indoor unit.
2. Unit must be trapped at bottom of riser with any rise over 5 feet (1.5m) high. If rise exceeds 25 feet (7.5m), then a trap is required in 20 foot (6.1m) increments or evenly divided.
3. Pitch horizontal hot gas piping at a minimum of ½ 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
6. Vertiv™ requires the installation of external refrigerant isolation valves on both the liquid line entering and the hot gas line leaving the indoor unit. These external isolation valves are necessary to facilitate safe recovery of the refrigerant charge from the indoor unit before servicing the compressors, filter driers, or other refrigeration components. Prior to closing the isolation valve on the liquid line, ensure that the indoor unit is in evacuation mode, which will open the EEV and will allow the migration of liquid refrigerant from this piping.



COOLPHASE PERIMETER w/EEV

AIR COOLED PIPING SCHEMATIC

PX011-PX029 VERTIV™ COOLPHASE CONDENSER WITH RECEIVER MOUNTED AND UNIT AT SIMILIAR LEVEL



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

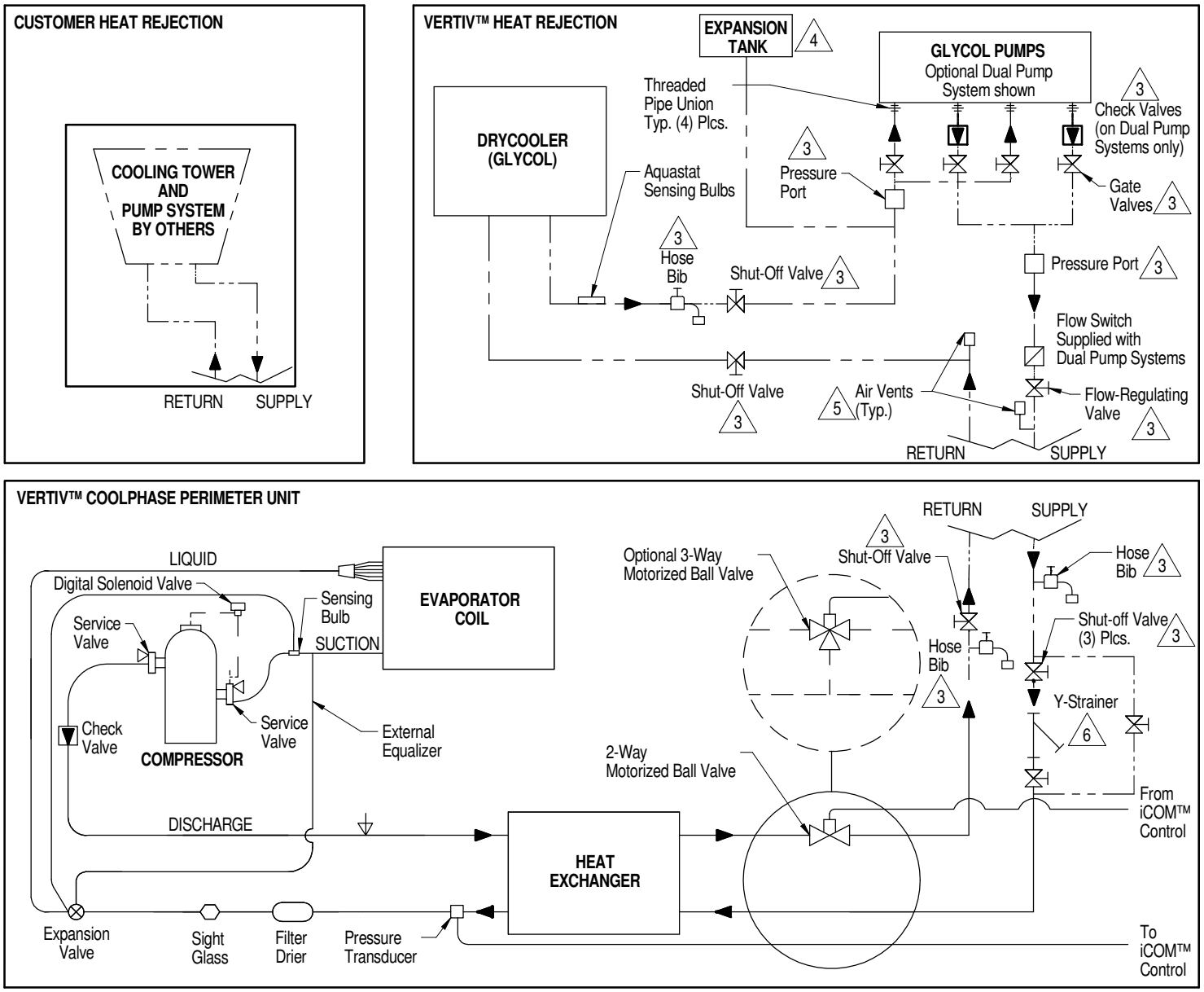
Notes:

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 ½ 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

6. Vertiv™ requires the installation of external refrigerant isolation valves on both the liquid line entering and the hot gas line leaving the indoor unit. These external isolation valves are necessary to facilitate safe recovery of the refrigerant charge from the indoor unit before servicing the compressors, filter driers, or other refrigeration components. Prior to closing the isolation valve on the liquid line, ensure that the indoor unit is in evacuation mode, which will open the EEV and will allow the migration of liquid refrigerant from this piping.

COOLPHASE PERIMETER

PIPING SCHEMATIC
PX011-PX029 WATER/GLYCOL MODELS



FACTORY PIPING

FIELD PIPING

OPTIONAL FACTORY PIPING

SERVICE / SCHRADER (ACCESS) CONNECTION NO VALVE CORE

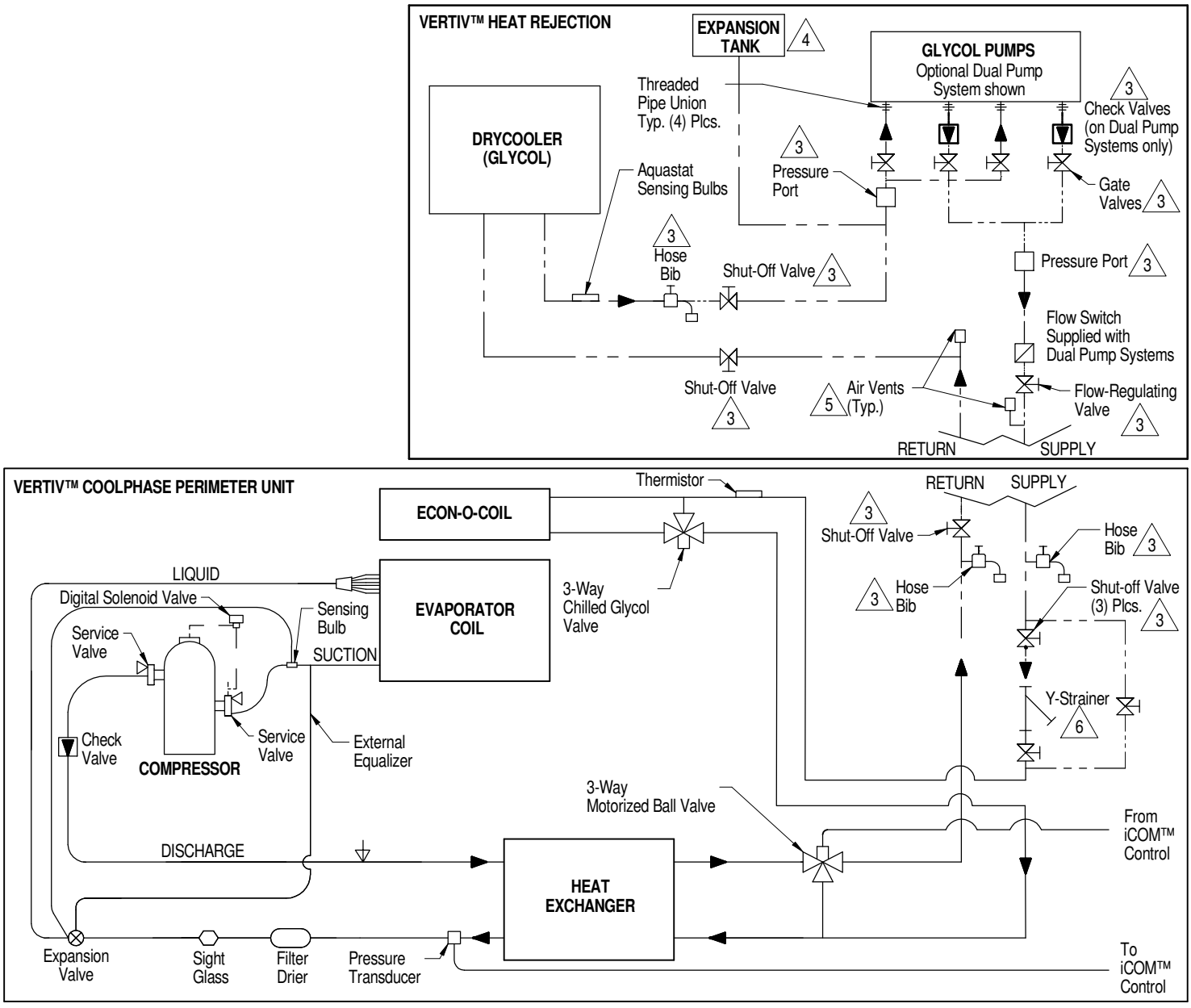
SERVICE / SCHRADER (ACCESS) CONNECTION WITH VALVE CORE

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 maintaing flow to the cooling unit.
3. Components are not supplied by Vertiv™.
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 Vertiv™ supplied and field installed, and are required for proper circuit operation and maintenance.

COOLPHASE PERIMETER

PIPING SCHEMATIC
PX011-PX029 GLYCOOL MODELS



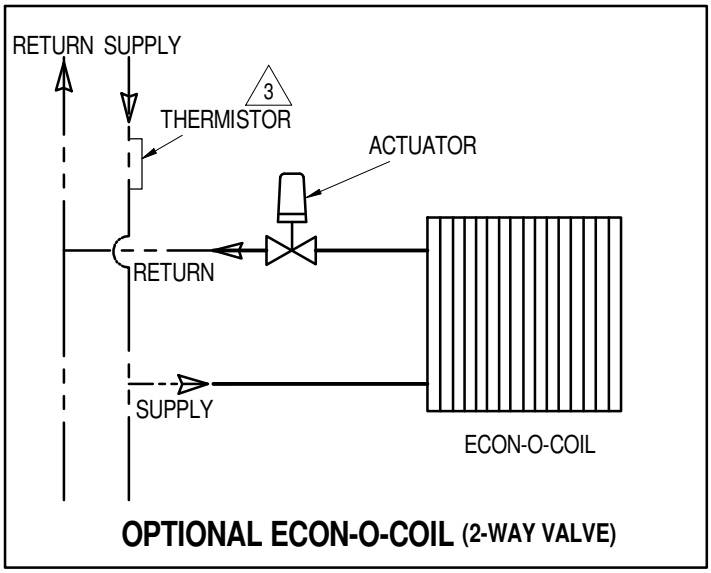
FACTORY PIPING
FIELD PIPING

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

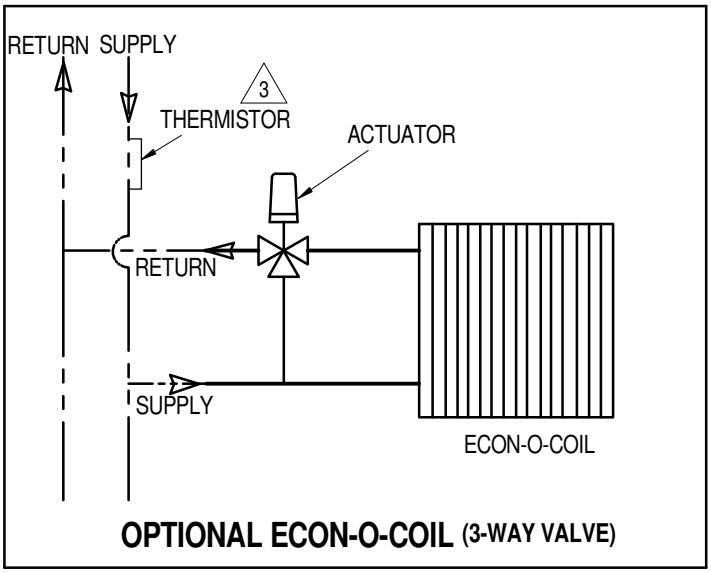
Notes:
1. Schematic representation shown. Do not use for specific connection locations.
2. Install a 20 mesh strainer, in an easily accessible location, on the water/glycol supply to prevent particles from entering the heat exchanger. Strainer bypass valves are recommended to allow the strainer to be cleaned while maintaing flow to the cooling unit.
3. Components are not supplied by Vertiv™.
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 Vertiv™ supplied and field installed, and are required for proper circuit operation and maintenance.

COOLPHASE PERIMETER

OPTIONAL PIPING SCHEMATICS
PX011-PX029 ECON-O-COIL MODELS



OPTIONAL ECON-O-COIL (2-WAY VALVE)



OPTIONAL ECON-O-COIL (3-WAY VALVE)

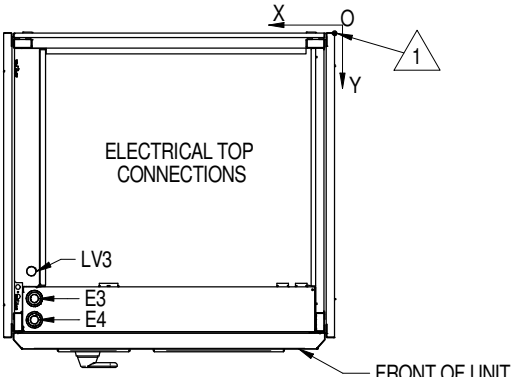
FACTORY PIPING
FIELD PIPING

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

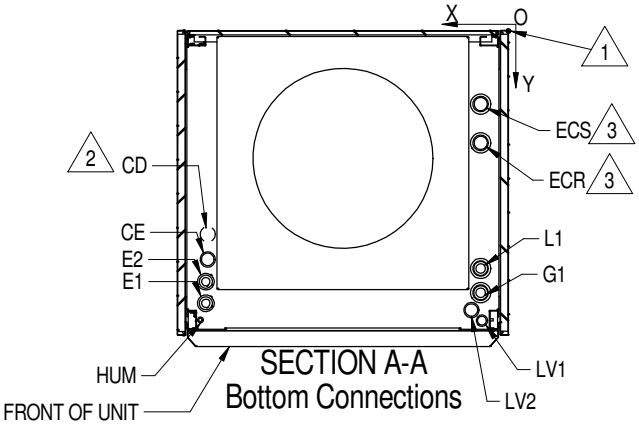
△3. Supplied with 10 feet extra thermistor wire for installation on Field Supply line.

COOLPHASE PERIMETER

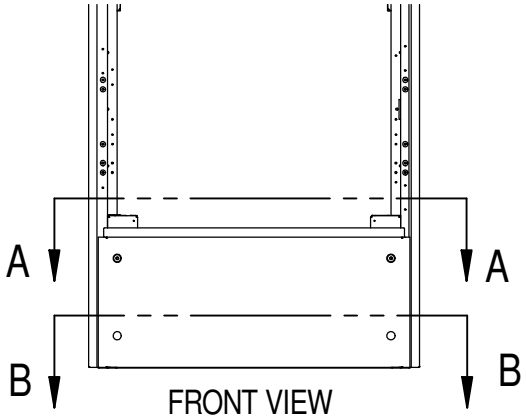
PRIMARY CONNECTION LOCATIONS
PX011-PX029 DOWNFLOW AIR COOLED MODELS



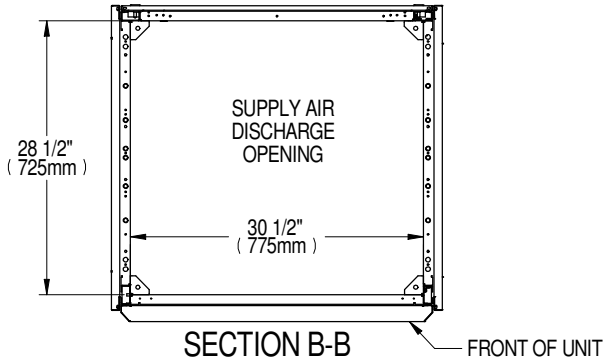
TOP VIEW



SECTION A-A
Bottom Connections



FRONT VIEW



SECTION B-B

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 △2	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 △3	ECON-O-COIL SUPPLY	2-7/8 (73)	7-5/8 (194)	7/8"	1-1/8"	
ECR △3	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:

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

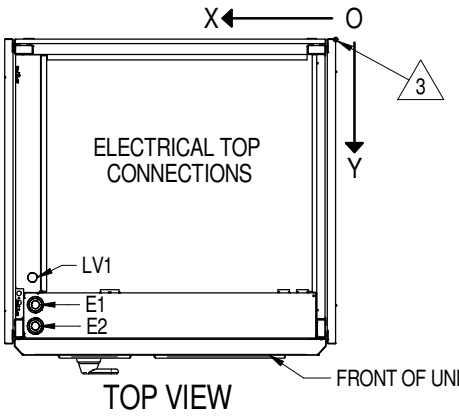
△2. Field pitch Condensate drain line a minimum of 1/8" (3mm) per 12" (305mm). All units contain a factory installed condensate trap. Do not trap external to the unit. Drain line may contain boiling water. Select appropriate drain system materials. The drain line must comply with local codes.

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

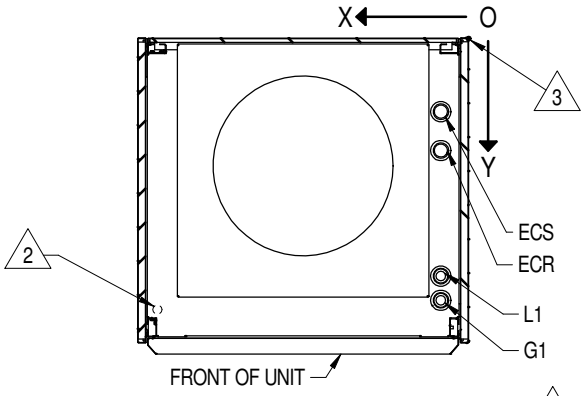
4. All refrigerant & water piping connections are O.D. Copper except as noted.

COOLPHASE PERIMETER

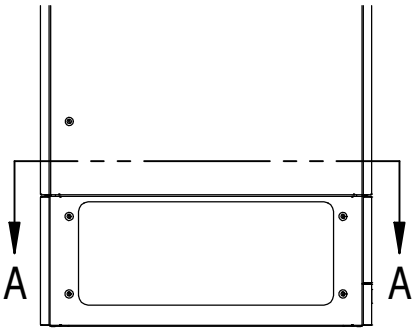
PRIMARY CONNECTION LOCATIONS
PX011-PX029 DOWNFLOW FRONT DISCHARGE AIR COOLED MODELS



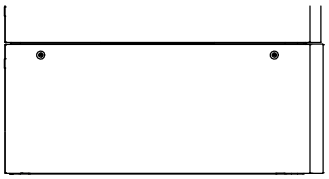
TOP VIEW

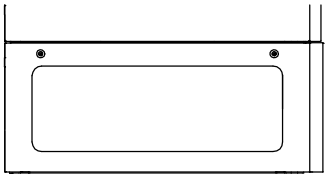


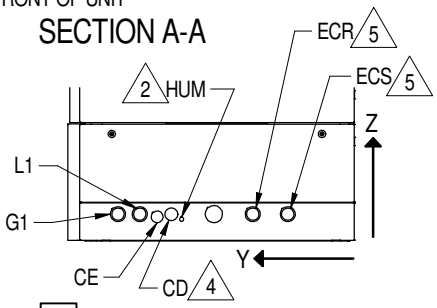
SECTION A-A



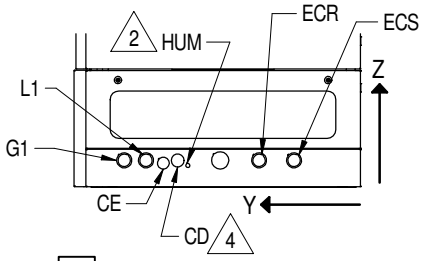
FRONT VIEW


WITHOUT LEFT SIDE DISCHARGE


WITH LEFT SIDE DISCHARGE



WITHOUT RIGHT SIDE DISCHARGE



WITH RIGHT SIDE DISCHARGE

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 4	CONDENSATE DRAIN	N/A	21-1/8 (537)		3/4" NPT FEMALE		
CE	CONDENSATE ELECTRICAL		22-3/4 (578)	2-3/4 (70)	1-3/8"		
HUM 2	HUMIDIFIER SUPPLY LINE		20 (508)	2-1/2 (64)	1/4"		
ECS 5	ECON-O-COIL SUPPLY	2-7/8 (73)	7-5/8 (194)	3 (76)	7/8"	1-1/8"	
ECR 5	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 ± 1/2" (13mm).

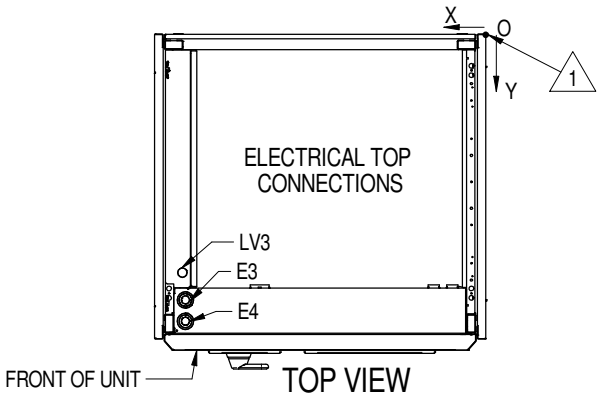
4. Field pitch Condensate Drain line a minimum of 1/8" (3.2 mm) per foot (305 mm). All units contain a factory installed condensate trap. Do not trap external to the unit Drain line may contain boiling water. Select appropriate drain system materials. The drain line must comply with all local codes.

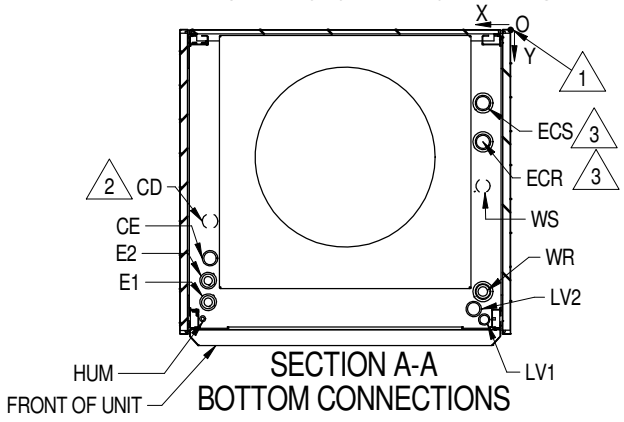
5. Supplied on Dual Cooling Systems only (4 pipe system).

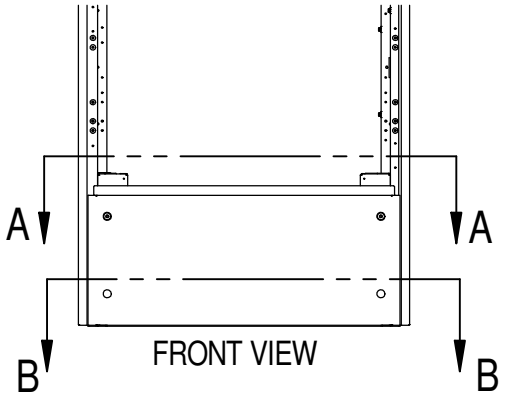
6. All refrigerant & water piping connections are O.D. Copper except as noted.

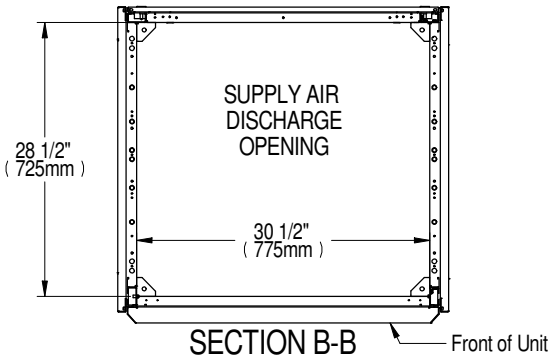
COOLPHASE PERIMETER

PRIMARY CONNECTION LOCATIONS
PX011-PX029 DOWNFLOW WATER/GLYCOL MODELS









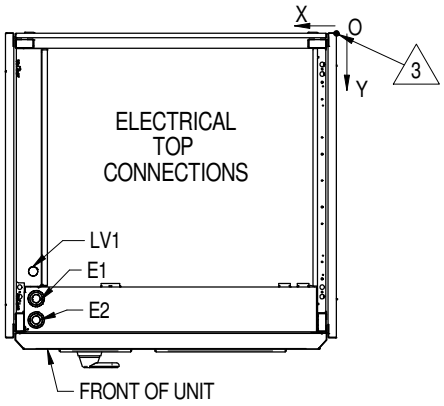
POINT	DESCRIPTION	X in. (mm)	Y in. (mm)	CONNECTION SIZE / OPENING	
				PX011	PX018-PX029
WS	WATER/GLYCOL SUPPLY	2-7/8 (73)	16-1/4 (413)	7/8"	1-1/8"
WR	WATER/GLYCOL RETURN		27-3/8 (695)		
CD 2	CONDENSATE DRAIN	31-1/2 (800)	21-1/4 (540)	3/4" NPT FEMALE	
CE	CONDENSATE ELECTRICAL		24 (610)	1-1/2"	
HUM	HUMIDIFIER SUPPLY LINE	32 (813)	30-1/8 (765)	1/4"	
ECS 3	ECON-O-COIL SUPPLY	2-7/8 (73)	7-5/8 (194)	7/8"	1-1/8"
ECR 3	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:

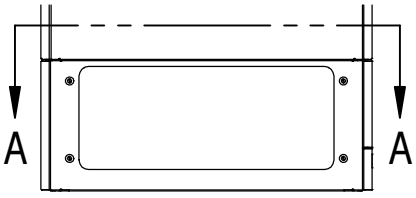
1. Drawing not to scale. All dimensions from rear corner of unit including panels, and have a tolerance of ± 1/2" (13mm).
2. Field pitch Condensate drain line a minimum of 1/8" (3mm) per 12" (305mm). All units contain a factory installed condensate trap. Do not trap external to the unit. Drain line may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

COOLPHASE PERIMETER

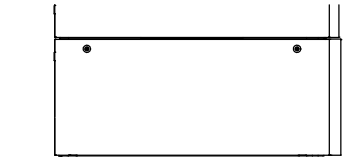
PRIMARY CONNECTION LOCATIONS
PX011-PX029 DOWNFLOW FRONT DISCHARGE WATER/GLYCOL MODELS

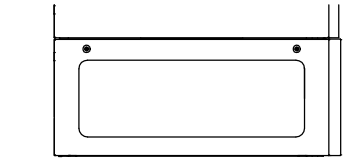


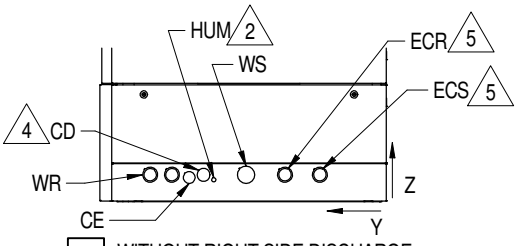
TOP VIEW



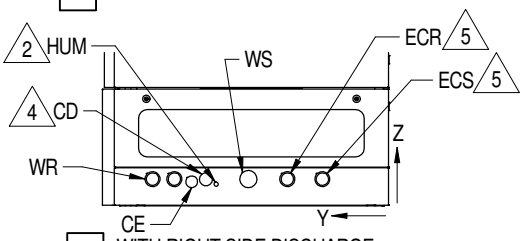
FRONT VIEW


WITHOUT LEFT SIDE DISCHARGE


WITH LEFT SIDE DISCHARGE



WITHOUT RIGHT SIDE DISCHARGE



WITH RIGHT SIDE DISCHARGE

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 4	CONDENSATE DRAIN	N/A	21-1/8 (537)		3/4" NPT FEMALE	
CE	CONDENSATE ELECTRICAL		22-3/4 (578)	2-3/4 (70)	1-3/8"	
HUM 2	HUMIDIFIER SUPPLY LINE		20 (508)	2-1/2 (64)	1/4"	
ECS 5	ECON-O-COIL SUPPLY	2-7/8 (73)	7-5/8 (194)	3 (76)	7/8"	1-1/8"
ECR 5	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.

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 ± 1/2" (13mm).

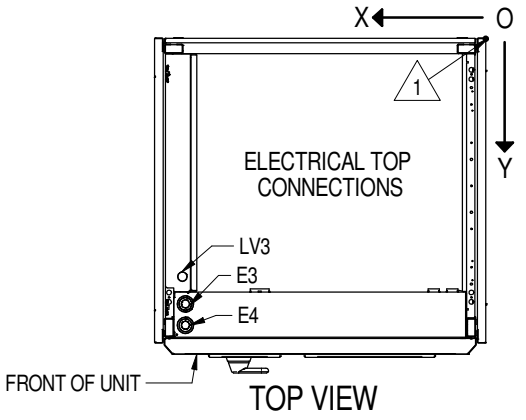
4. Field pitch Condensate Drain line a minimum of 1/8" (3.2 mm) per foot (305 mm). All units contain a factory installed condensate trap. Do not trap external to the unit Drain line may contain boiling water. Select appropriate drain system materials. The drain line must comply with all local codes.

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

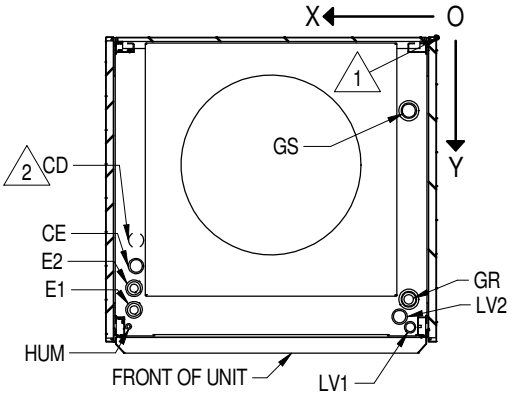
6. All water piping is O.D. Copper except as noted.

COOLPHASE PERIMETER

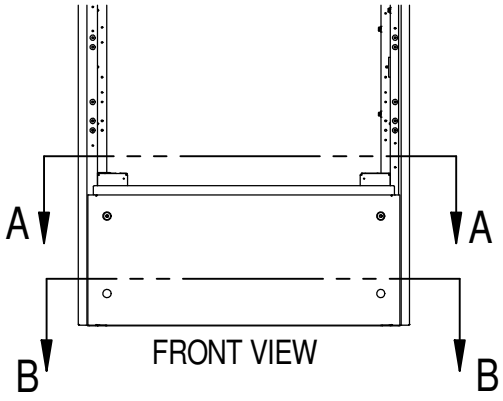
PRIMARY CONNECTION LOCATIONS
PX011-PX029 DOWNFLOW GLYCOOL MODELS

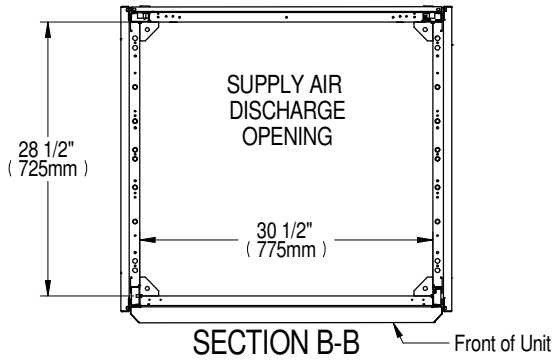


TOP VIEW



SECTION A-A
BOTTOM CONNECTIONS





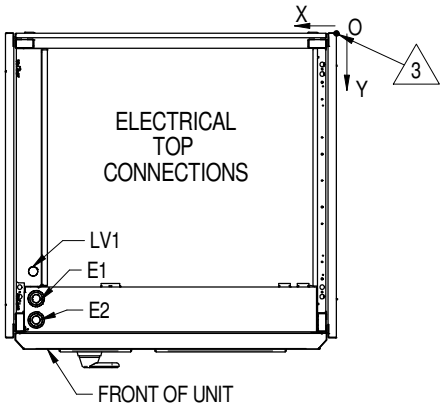
POINT	DESCRIPTION	X in. (mm)	Y in. (mm)	CONNECTION SIZE / OPENING	
				PX011	PX018-PX029
GS	GLYCOOL SUPPLY	2-7/8 (73)	7-5/8 (194)	7/8"	1-1/8"
GR	GLYCOOL RETURN		27-3/8 (695)		
CD 2	CONDENSATE DRAIN	31-1/2 (800)	21-1/4 (540)	3/4" NPT FEMALE	
CE	CONDENSATE ELECTRICAL		24 (610)	1-1/2"	
HUM	HUMIDIFIER SUPPLY 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:

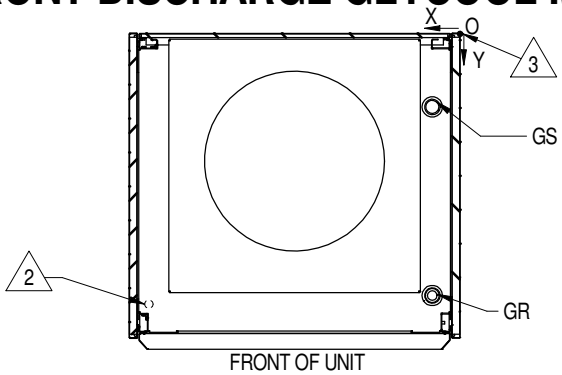
1. Drawing not to scale. All dimensions from rear corner of unit including panels, and have a tolerance of ± 1/2" (13mm).
2. Field pitch Condensate drain line a minimum of 1/8" (3mm) per 12" (305mm). All units contain a factory installed condensate trap. Do not trap external to the unit. Drain line may 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.

COOLPHASE PERIMETER

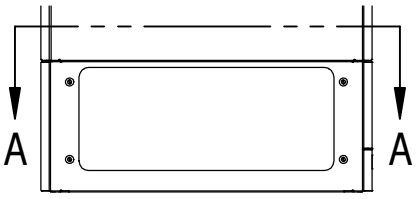
PRIMARY CONNECTION LOCATIONS
PX011-PX029 DOWNFLOW FRONT DISCHARGE GLYCOOL MODELS



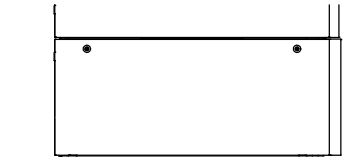
TOP VIEW

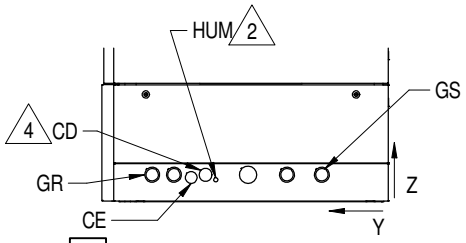


SECTION A-A

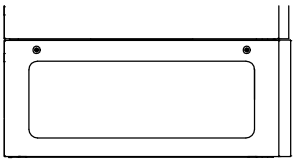


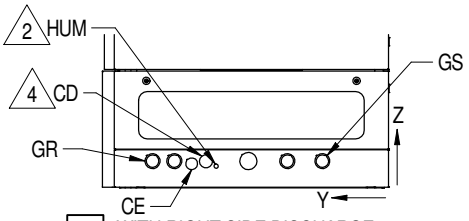
FRONT VIEW


WITHOUT LEFT SIDE DISCHARGE



WITHOUT RIGHT SIDE DISCHARGE


WITH LEFT SIDE DISCHARGE



WITH RIGHT SIDE DISCHARGE

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 ⚠4	CONDENSATE DRAIN	N/A	21-1/8 (537)		3/4" NPT FEMALE	
CE	CONDENSATE ELECTRICAL		22-3/4 (578)	2-3/4 (70)	1-3/8"	
HUM ⚠2	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:
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.

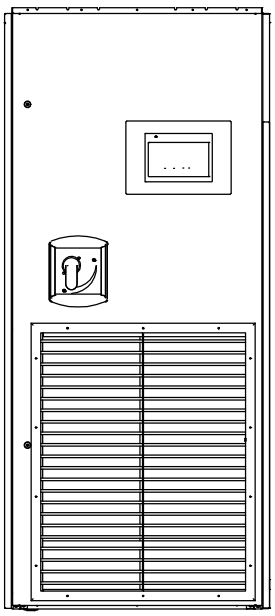
⚠2. Humidifier supply line will need to be routed through this opening to the connection at the left hand side of the unit.

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

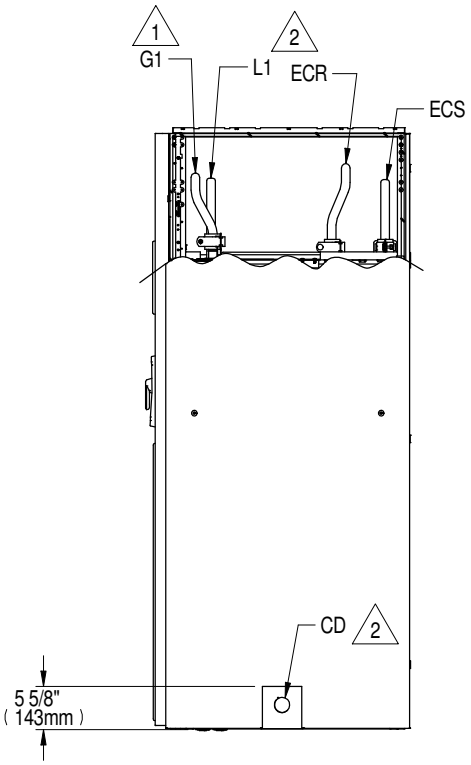
⚠4. Field pitch Condensate Drain line a minimum of 1/8" (3.2 mm) per foot (305 mm). All units contain a factory installed condensate trap. Do not trap external to the unit. Drain line may contain boiling water. Select appropriate drain system materials. The drain line must comply with all local codes.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

COOLPHASE PERIMETER

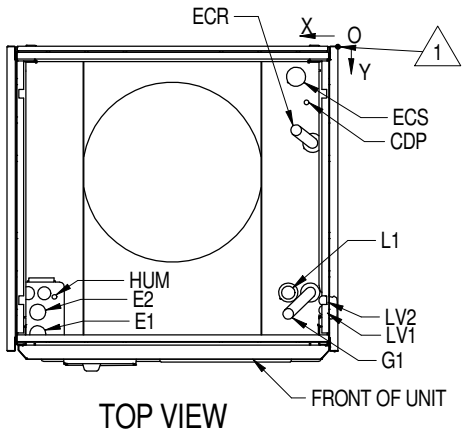
PRIMARY CONNECTION LOCATIONS
PX011-PX029 UPFLOW AIR COOLED MODELS



FRONT VIEW



RIGHT SIDE VIEW



TOP VIEW

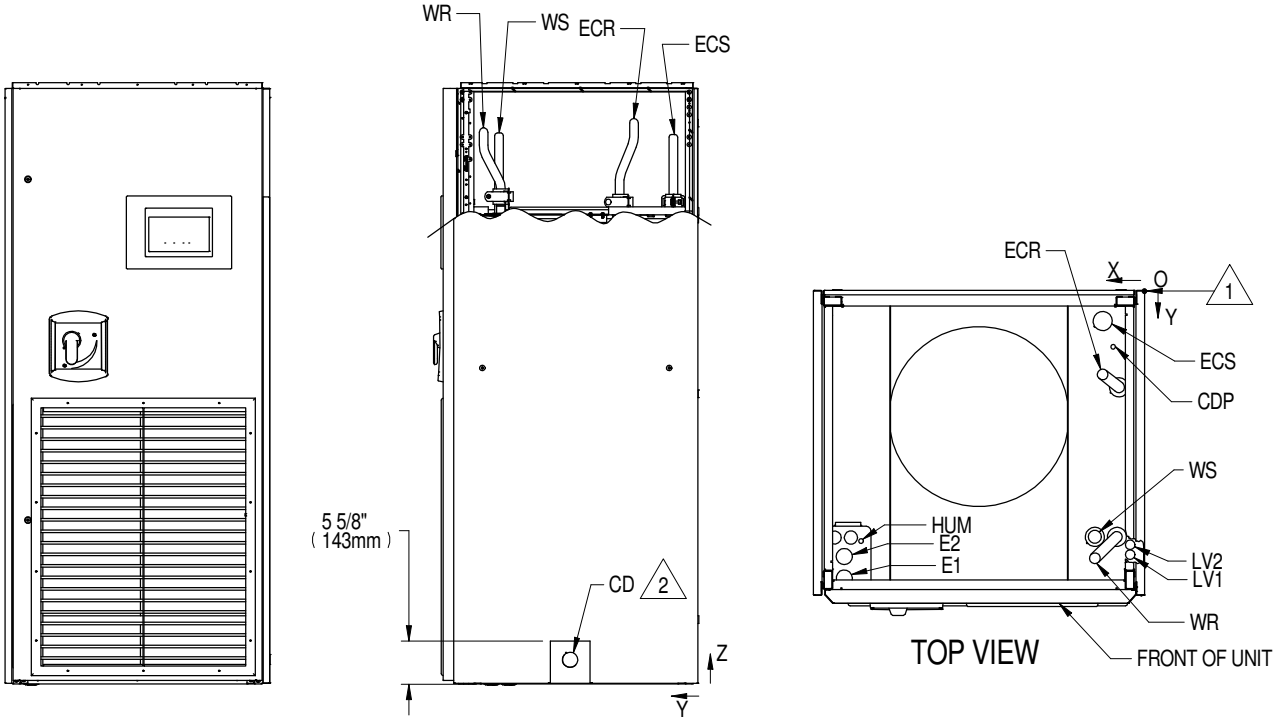
POINT	DESCRIPTION	X in. (mm)	Y in. (mm)	Z in. (mm)	CONNECTION SIZE in.		
					PX011	PX018, PX023	PX029
L1	LIQUID LINE SYSTEM	5-1/8 (130)	25-5/8 (651)	N/A	3/8	1/2	5/8
G1	HOT GAS DISCHARGE		27-7/8 (708)		1/2	5/8	7/8
CD	CONDENSATE DRAIN 2	N/A	16-5/8 (422)	3-1/8 (89)	3/4 NPT FEMALE		
CDP	CONDENSATE DRAIN 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 3	4-1/4 (108)	3-1/4 (83)		7/8	1-1/8	
ECR	ECON-O-COIL RETURN 3		8-1/4(210)				
E1	ELECTRICAL CONN. (HIGH VOLT)	31-1/4 (794)	30 (762)		7/8, 1-3/8, 1-3/4 6		
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:

1. Drawing not to scale. All dimensions from rear corner of unit including panels and have a tolerance of ± 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. Supplied on Dual Cooling Systems only.
4. Unit with front return shown. Bottom return with rear return floorstand also available.
5. All refrigerant & water piping connections are O.D. Copper except as noted.
6. Concentric knockouts to be used based on field supplied conduit diameter.

COOLPHASE PERIMETER

PRIMARY CONNECTION LOCATIONS
PX011-PX029 UPFLOW WATER/GLYCOL MODELS



RIGHT SIDE VIEW

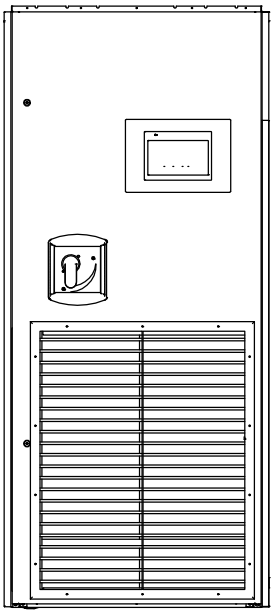
POINT	DESCRIPTION	X in. (mm)	Y in. (mm)	Z in. (mm)	CONNECTION SIZE in.	
					PX011	PX018-PX029
WS	WATER/GLYCOL SUPPLY	5-1/8 (130)	25-5/8 (651)	N/A	7/8	1-1/8
WR	WATER/GLYCOL RETURN		27-7/8 (708)			
CD	CONDENSATE DRAIN 2	N/A	16-5/8 (422)	3-1/8 (89)	3/4 NPT FEMALE	
CDP	CONDENSATE DRAIN WITH PUMP	3-1/4 (83)	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 3	4-1/4 (108)	3-1/4 (83)		7/8	1-1/8
ECR	ECON-O-COIL RETURN 3		8-1/4(210)			
E1	ELECTRICAL CONN. (HIGH VOLT)	31-1/4 (794)	30 (762)		7/8, 1-3/8, 1-3/4 6	
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:

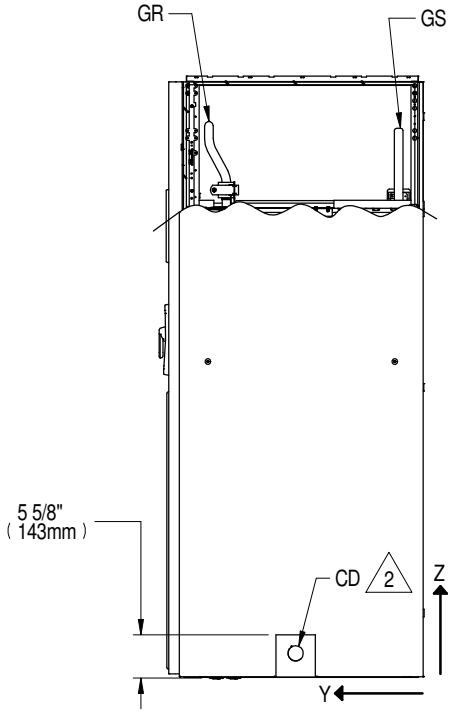
1. Drawing not to scale. All dimensions from rear corner of unit including panels, and have a tolerance of ± 1/2" (13mm).
2. Field pitch Condensate drain line a minimum of 1/8" (3mm) per 12" (305mm). All units contain a factory installed condensate trap. Do not trap external to the unit. Drain line may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

COOLPHASE PERIMETER

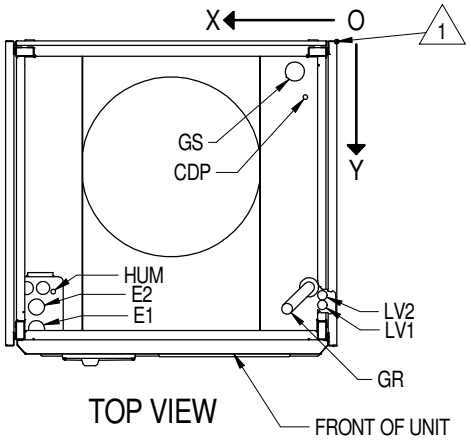
PRIMARY CONNECTION LOCATIONS
PX011-PX029 UPFLOW GLYCOOL MODELS



FRONT VIEW



RIGHT SIDE VIEW



TOP VIEW

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 2	CONDENSATE DRAIN	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 5	
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:

1. Drawing not to scale. All dimensions from rear corner of unit including panels, and have a tolerance of ± 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. Unit with front return shown. Bottom return with rear return floorstand also available.
4. All water piping is O.D. Copper except as noted.
5. Concentric knockouts to be used based on field supplied conduit diameter.

ELECTRICAL FIELD CONNECTIONS
PX011-PX029 UPFLOW & DOWNFLOW MODELS

1. **High Voltage Entrance.** Supplied on top and bottom of electric box. Knockout size Ø1.75in (44.5mm).
2. **Low Voltage Entrance.** Ø1.375 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 Liquitect Indicator.** Optional remote liquitect 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.

ELECTRICAL FIELD CONNECTIONS
PX011-PX029 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 Vertiv™ CoolPhase Condenser.

21. CANbus Cable. CANbus cable provided by others to connect to the outdoor condenser and optional Vertiv™ EconoPhase 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

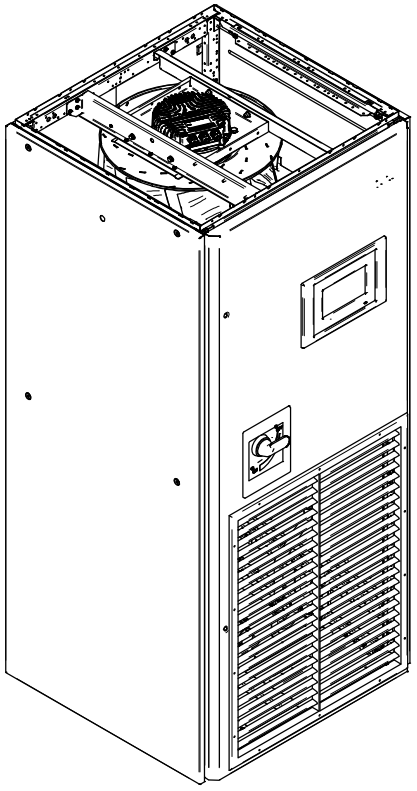
24. Unit-To-Unit – Plug 64 is reserved for U2U communication.

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.

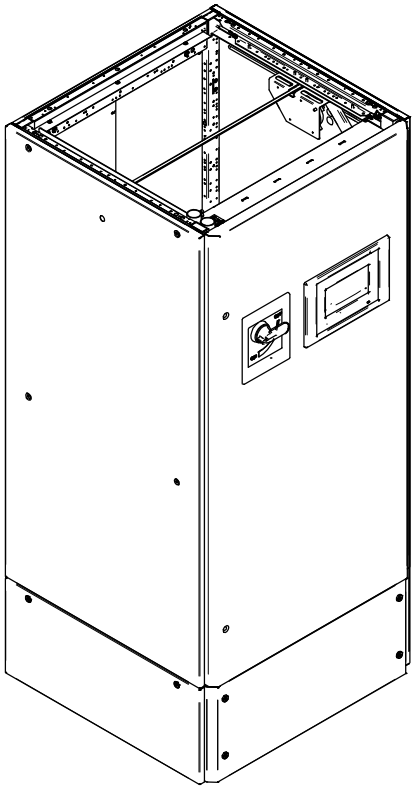
NOTE: Refer to specification sheet for total unit full load amps, wire size amps, and max overcurrent protective device size.

COOLPHASE PERIMETER

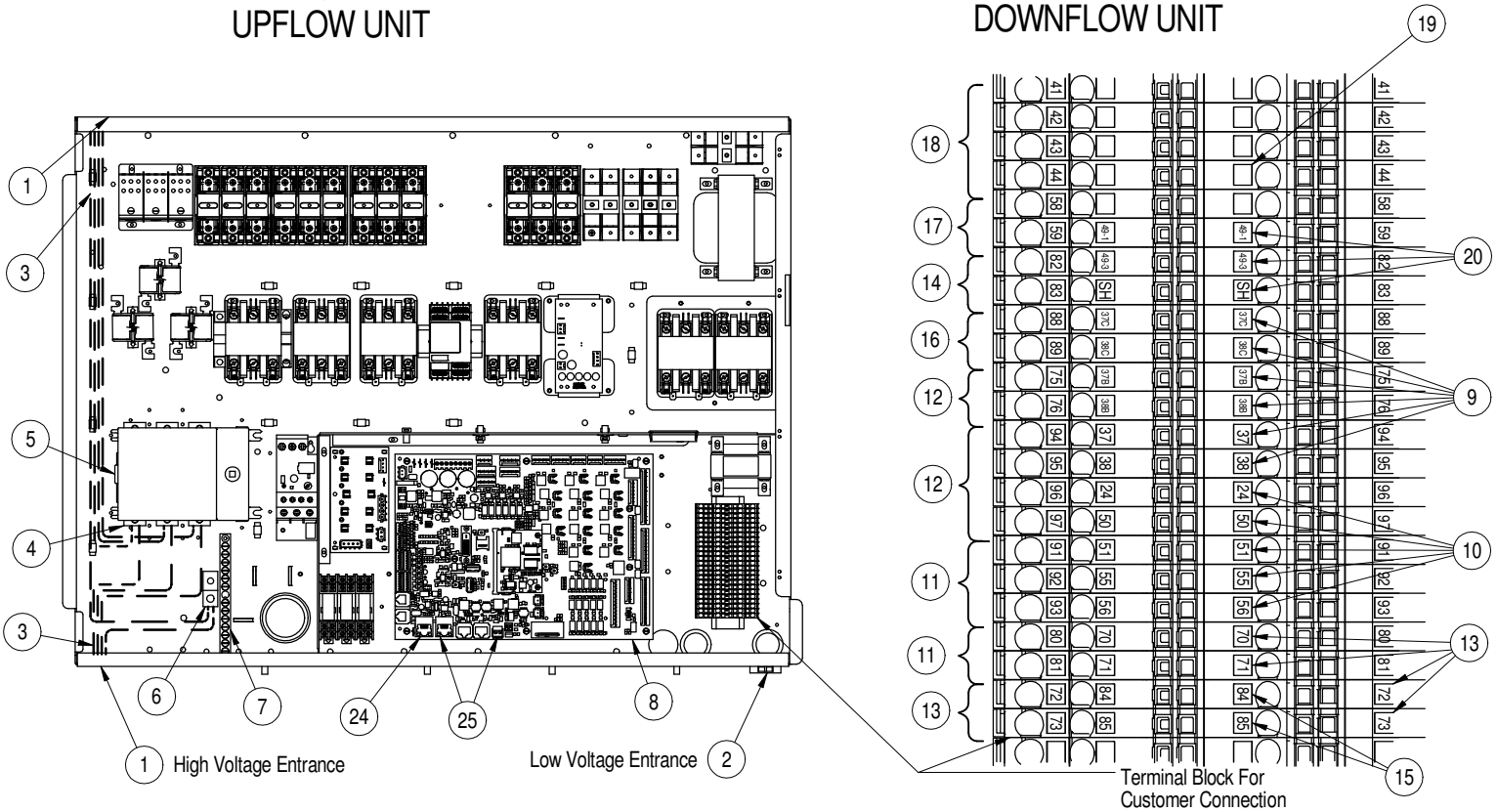
ELECTRICAL FIELD CONNECTIONS
PX011-PX029 UPFLOW & DOWNFLOW MODELS



UPFLOW UNIT

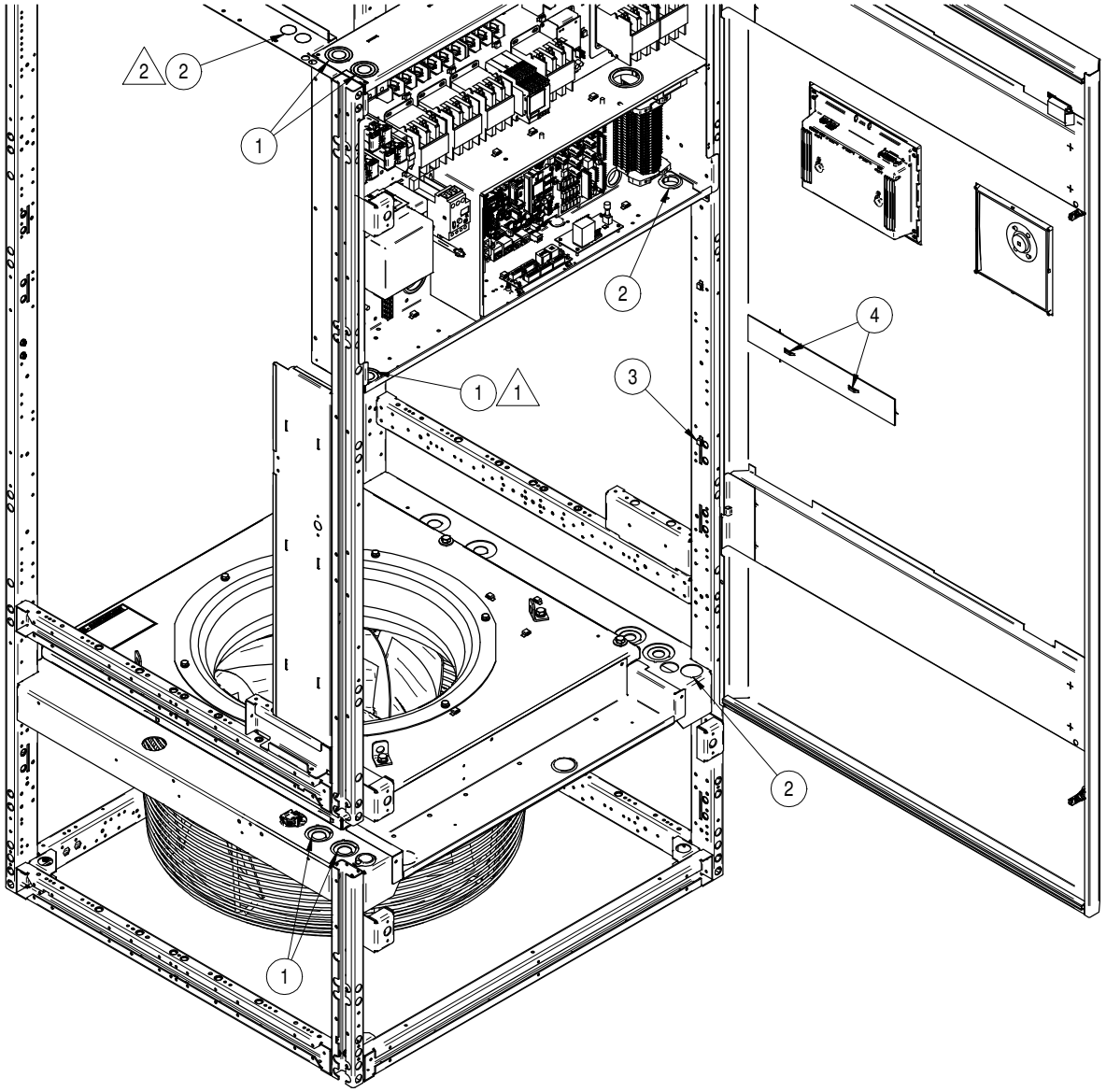


DOWNFLOW UNIT



COOLPHASE PERIMETER

ELECTRICAL FIELD CONNECTIONS
PX011-PX029 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.

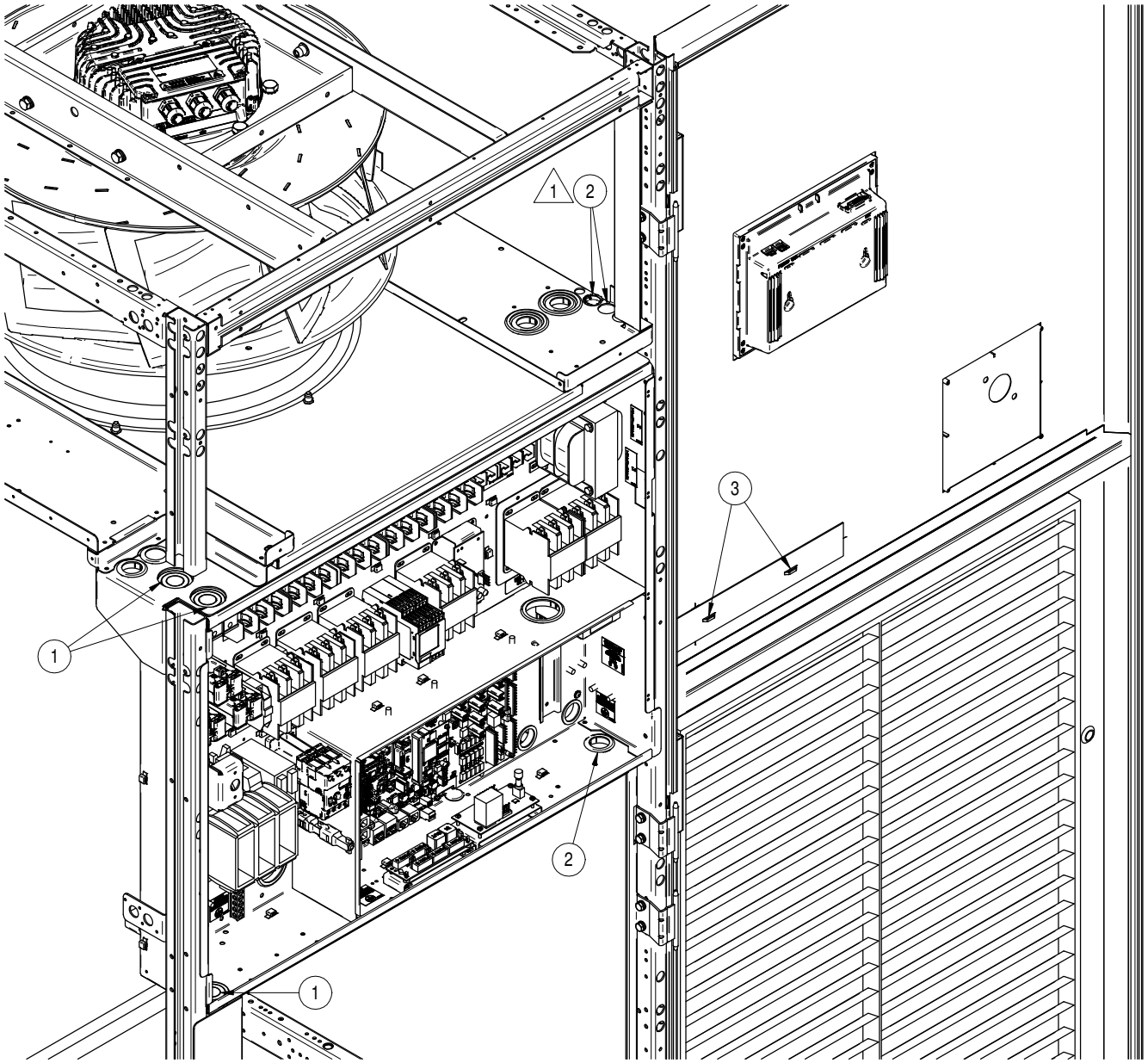
NOTES:

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.

COOLPHASE PERIMETER

ELECTRICAL FIELD CONNECTIONS

PX011-PX029 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.

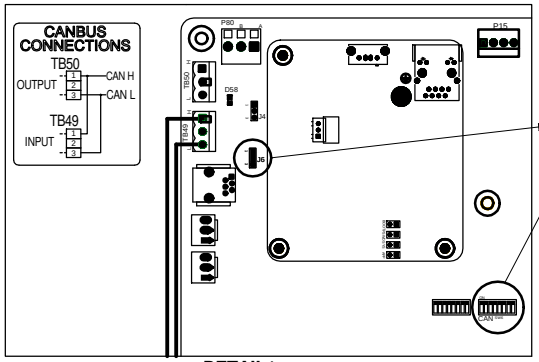
(3.) Wire tie anchors. Use to secure customer wiring.

Notes:

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

COOLPHASE PERIMETER

CANbus & INTERLOCK CONNECTIONS
BETWEEN PX011-PX029 & COOLPHASE CONDENSER (PREMIUM)

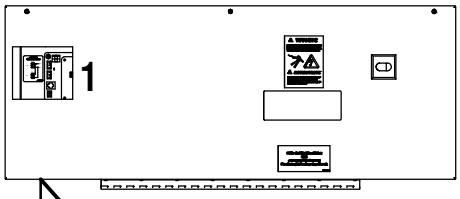


DETAIL1
CAN CABLE CONNECTION (A)

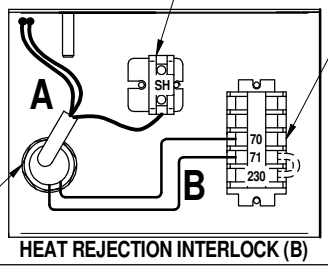
J6 TERMINATION JUMPER MUST BE SET TO PINS 1 AND 2.

CANbus ADDRESSING SWITCH

VERTIV™ COOLPHASE CONDENSER



SHIELD CONNECTION



FACTORY WIRING BETWEEN COOLPHASE CONDENSER CONTROL BOARD AND TERMINAL STRIP.

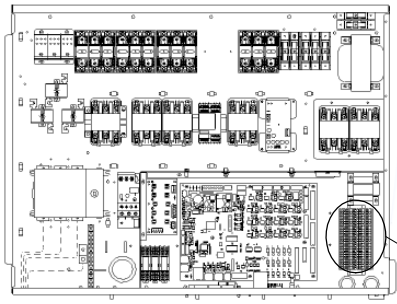
LOW VOLTAGE FIELD ENTRANCE LOCATED ON BOTTOM LEFT OF CONDENSER ENCLOSURE.

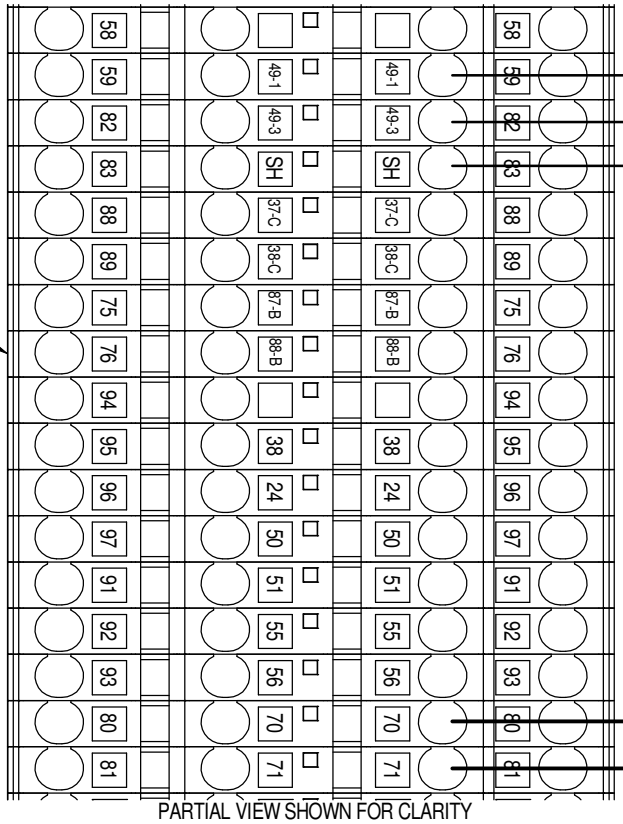
HEAT REJECTION INTERLOCK (B)

A
CANbus CABLE CONNECTION

B
HEAT REJECTION INTERLOCK WIRE

INDOOR UNIT





PARTIAL VIEW SHOWN FOR CLARITY

CANbus & INTERLOCK CONNECTIONS
BETWEEN PX011-PX029 & COOLPHASE 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.

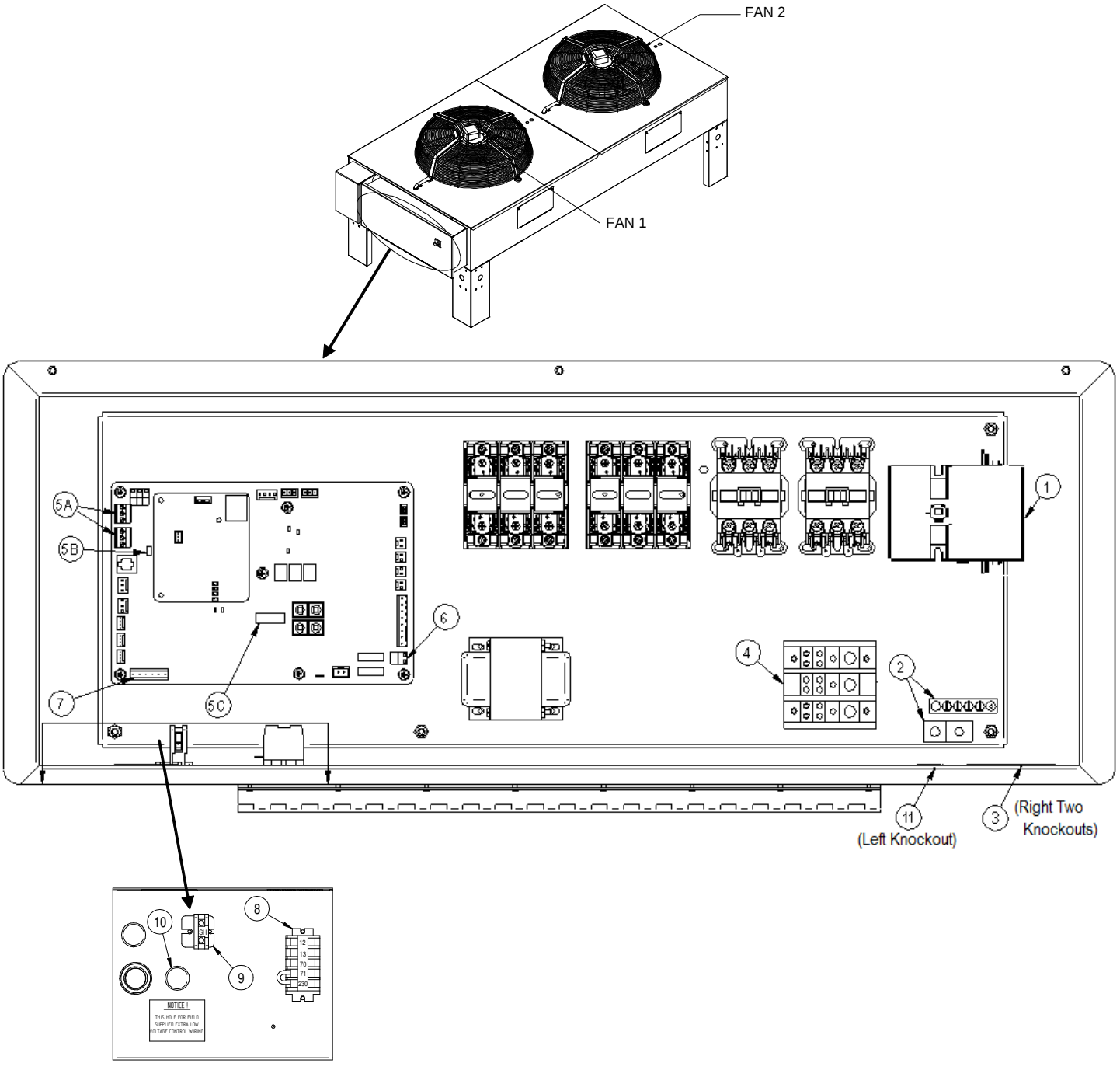
CAN & CABLE NOTES (A):
1. CABLE MUSTHAVE THE FOLLOWING SPECIFICATIONS:
   - BRAIDED SHIELD OR FOIL SHIELD WITH DRAIN WIRE
   - SHIELD MUST BE WIRED TO GROUND AT INDOOR UNIT
   - 22-18AWG STRANDED TINNED COPPER
   - TWISTED PAIR (MINIMUM 4 TWISTS PER FOOT)
   - LOW CAPACITANCE (15pF/FT OR LESS)
   - MUST 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.

COOLPHASE 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.
    - o TB49-1 is the input terminal for CANbus high.
    - o TB49-3 is the input terminal for CANbus low.
    - o TB50-1 is output terminal for CANbus high.
    - o TB50-3 is the output terminal for CANbus low.
    - o 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.

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 Vertiv™ CoolPhase Condenser 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.

COOLPHASE CONDENSER

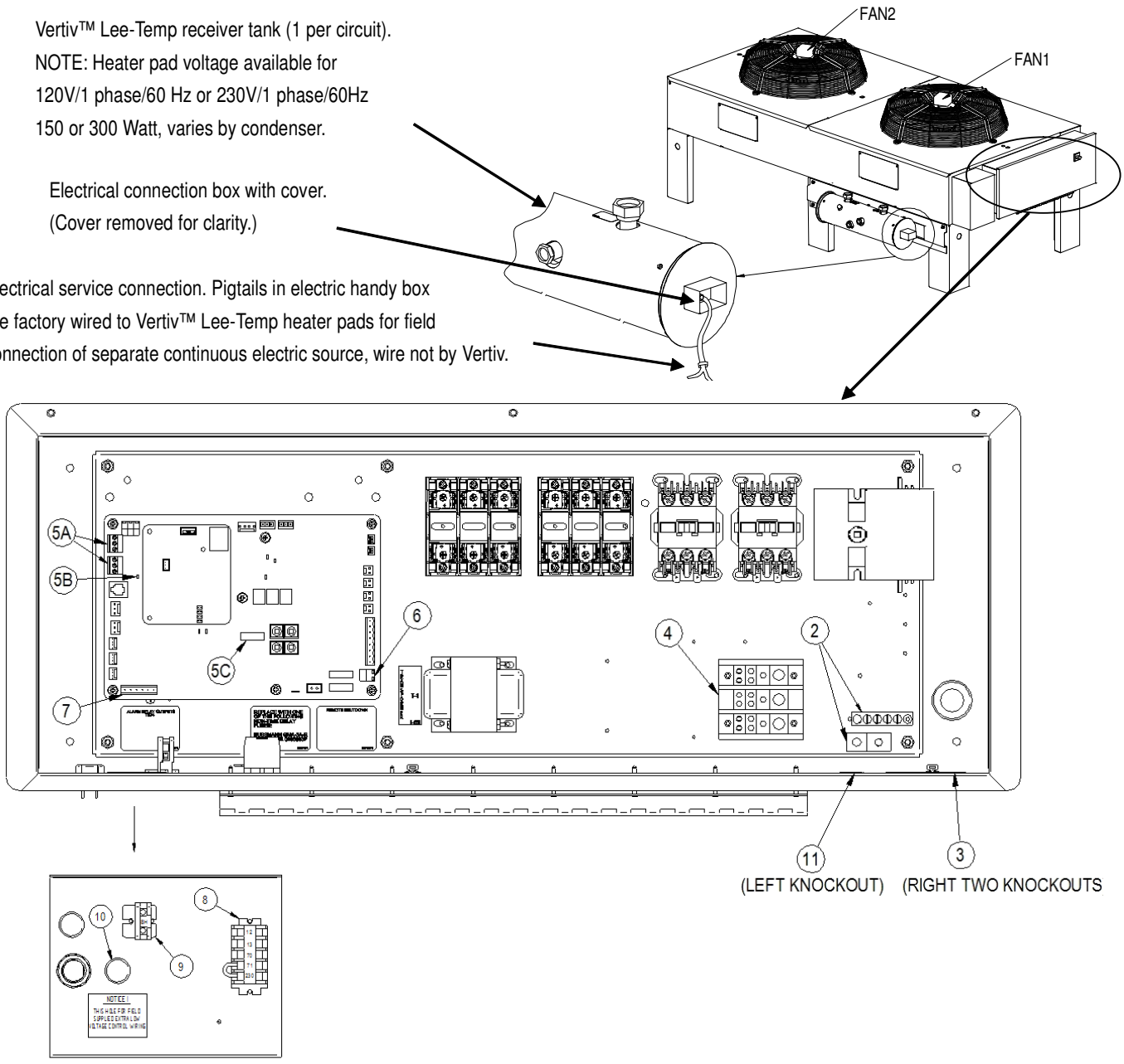
ELECTRICAL FIELD CONNECTIONS
PREMIUM EFFICIENCY CONTROL WITH VERTIV™ LEE-TEMP

Electrical Connections for Vertiv™Lee-Temp Receiver

Vertiv™ 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 Vertiv™ Lee-Temp heater pads for field connection of separate continuous electric source, wire not by Vertiv.



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ELECTRICAL FIELD CONNECTIONS
PREMIUM EFFICIENCY CONTROL WITH VERTIV™ LEE-TEMP

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ELECTRICAL FIELD CONNECTIONS
PREMIUM EFFICIENCY CONTROL WITH VERTIV™ LEE-TEMP

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        - 575V wye with solidly grounded neutral and 332V line to ground (uses step-down transformer);
        - Wye with high resistance (or impedance) ground;
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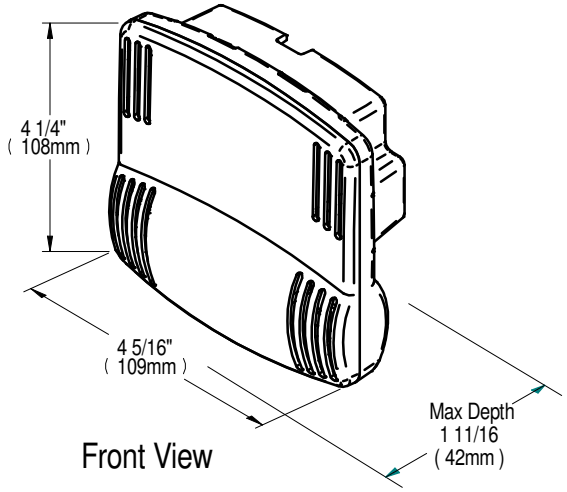
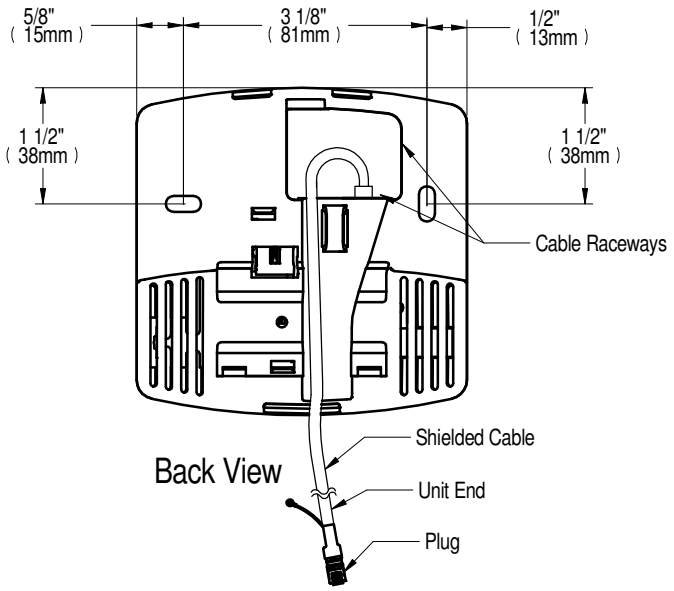
    B. Unacceptable power supplies for 208V to 575V nominal units:
        - Delta without ground or with floating ground;
        - Delta with grounded center tap.

iCOM™

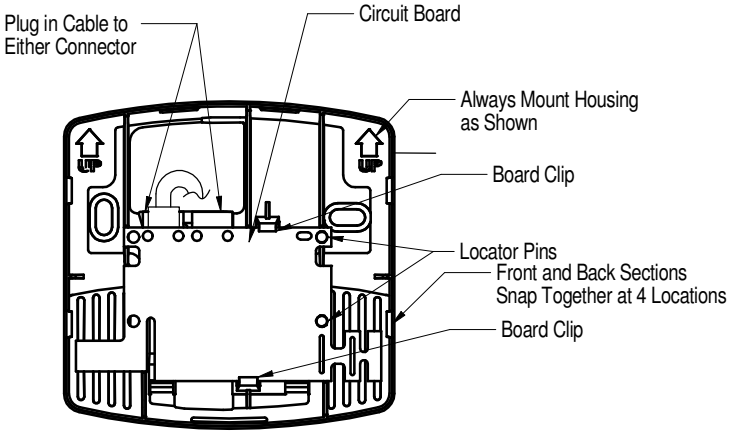
REMOTE TEMPERATURE & HUMIDITY SENSOR



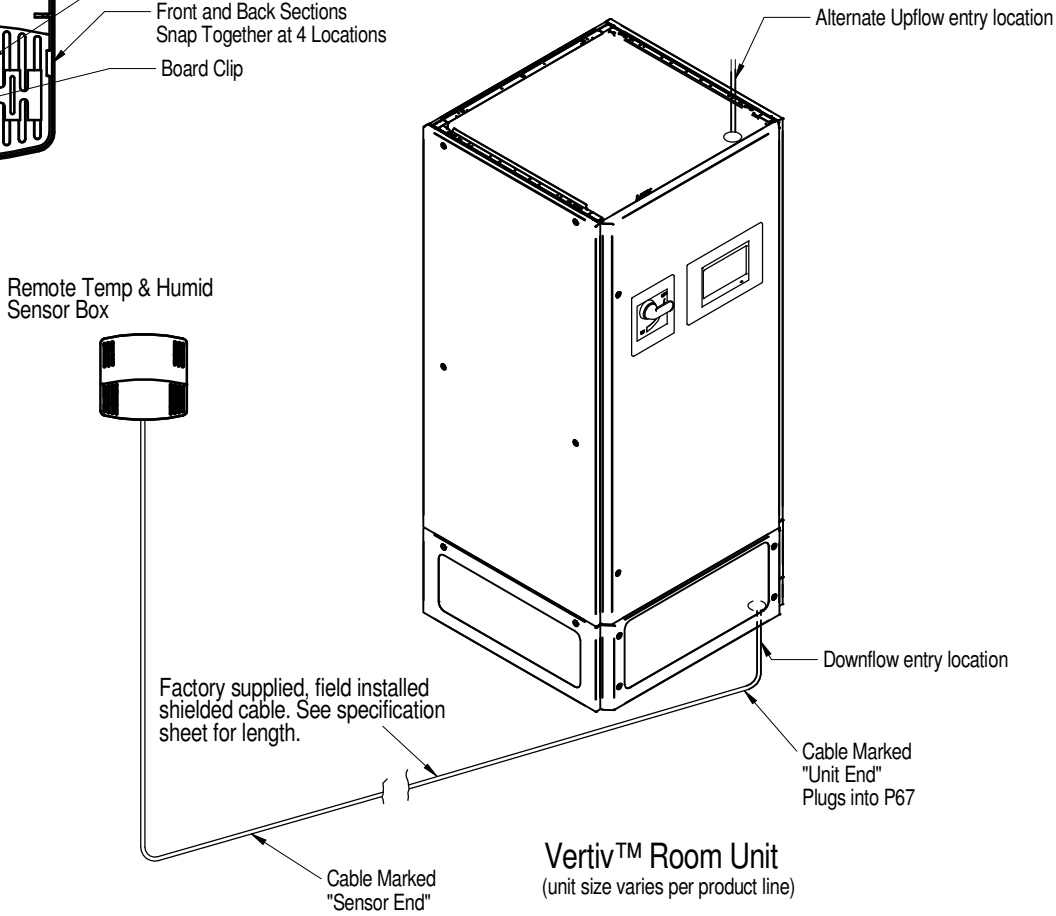
Front View



Back View

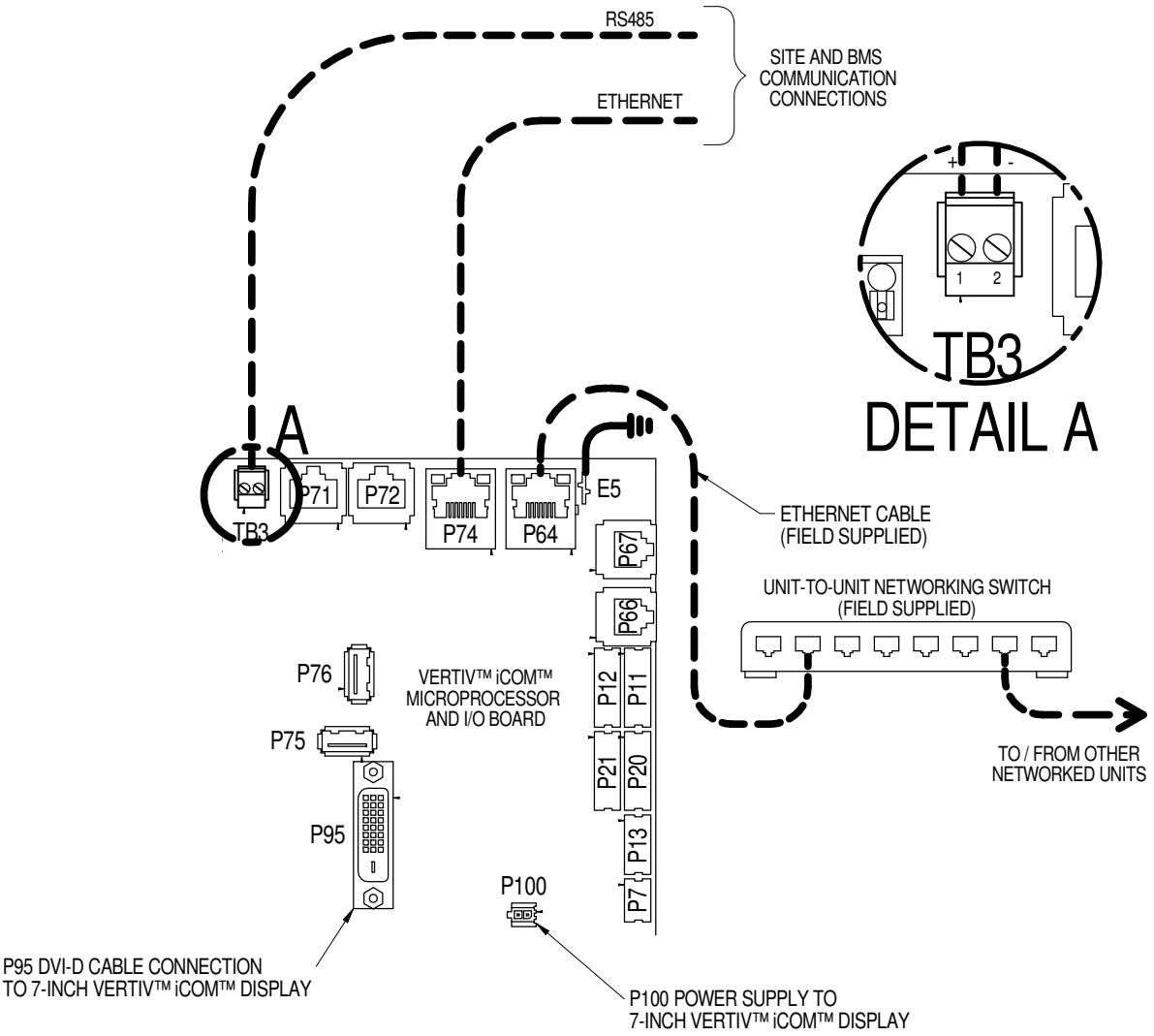


Inside View of Back

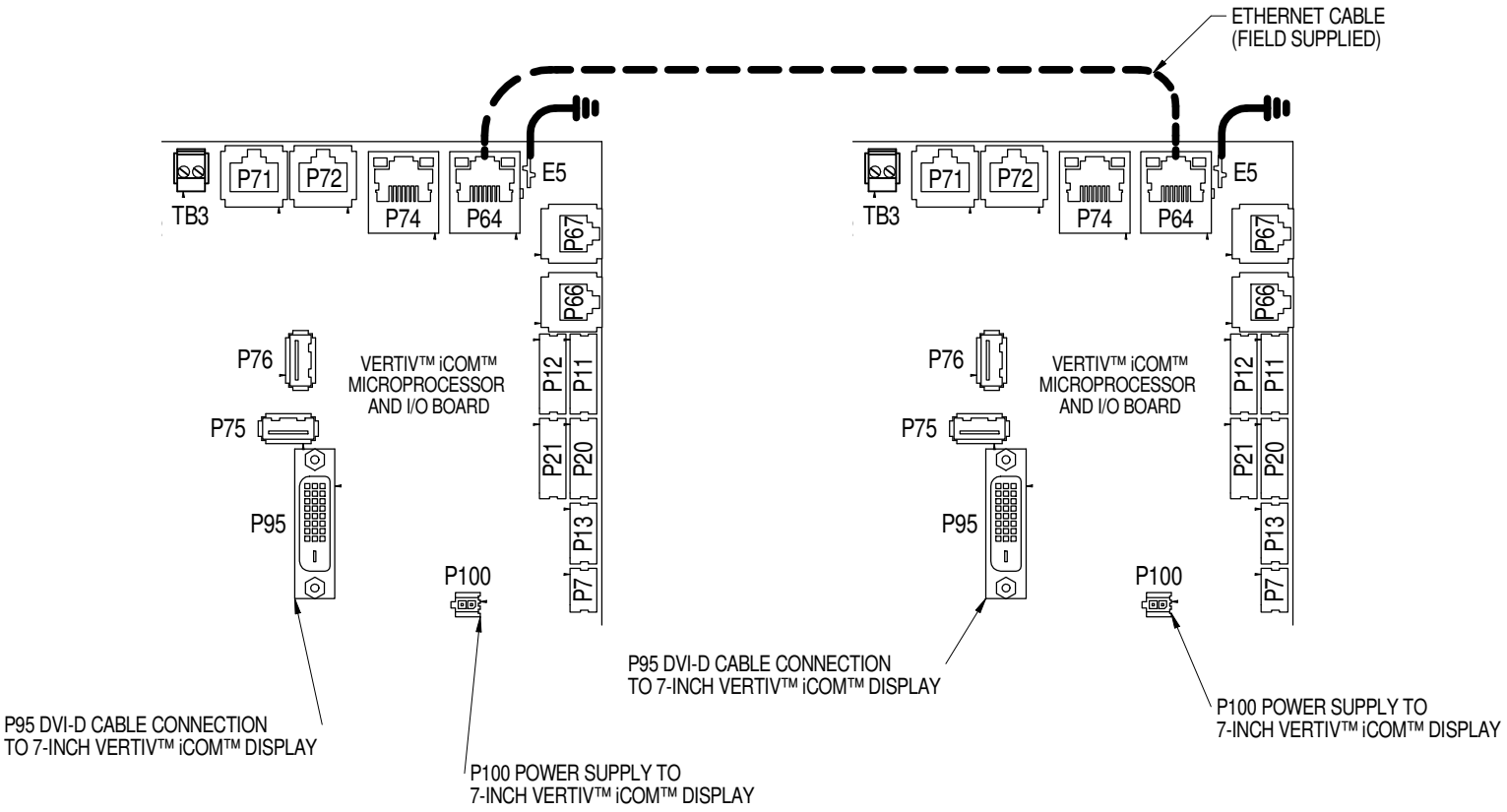


Vertiv™ Room Unit
(unit size varies per product line)

UNIT TO UNIT NETWORK CONNECTIONS
COOLPHASE PERIMETER AND COOLLOOP PERIMETER UNITS



UNIT TO UNIT NETWORK CONNECTIONS
COOLPHASE PERIMETER AND COOLLOOP PERIMETER UNITS



NOTE* For dual-unit network configurations only

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