CoolPhase Perimeter (DS035-DS105) Thermal Management System Low GWP

Installer/User Guide

35 to 105 kW (10 to 30 ton) Capacity, Upflow and Downflow, 60 Hz, Air Cooled, Water/Glycol Cooled, Dual Cooled, and Vertiv™ Liebert® Econo-o-Coil GLYCOOL Cooled

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

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Technical Support Site

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

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

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1 Important Safety Instructions

SAVE THESE INSTRUCTIONS

This manual contains important safety instructions that should be followed during the installation and maintenance of the Vertiv™ Thermal Management System Low GWP. 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 manufacturers' 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 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 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. 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.

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 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 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 moving. Can cause serious injury or death. Building and equipment damage may also result. Use only lifting equipment that is rated for the unit weight by an OSHA-certified rating organization. The center of gravity varies depending on the unit size and selected options. The slings must be equally spaced on either side of the center of gravity indicator. Shipping weights and unit weights are listed in Table 3.3 on page 20 and Table 3.4 on page 21. Use the center of gravity indicators on the unit to determine the position of the slings.

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 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 20 and Table 3.4 on page 21.

WARNING! Risk of contact with sharp edges, exposed fasteners, and improper handling of very heavy parts. Can cause serious injury or death. Building and equipment damage may also result. Use extreme caution, wear appropriate, OSHA-approved PPE, and install the EC fan(s) and plenum to the unit only as described in these instructions.

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 and installing the fan(s) and plenum.

Equipment used in moving, lifting and installing the fan(s) and plenum must meet OSHA requirements and be rated for the weight of the fan(s) and the plenum. If ladders are used, verify that they are rated for the combined weight of the fan(s), plenum and installer(s) as loaded. EC Fan and plenum weights are specified in **Table 7.1** on page 65 and **Table 7.2** on page 66.

Read and follow the lifting equipment and/or ladder manufacturer's operating instructions and safety requirements.

WARNING! Risk of improper drive-belt removal. Can cause serious injury or death. If improperly handled, the spring-loaded motor base can slam down suddenly causing serious injury to hands and fingers from crushing and pinching. Read the directions in this manual and on the unit instruction labels. Keep hands and fingers away from pinch points. Wear appropriate, OSHA-approved PPE when performing maintenance on the belts, motors or pulleys. Follow all directions when servicing the unit.

WARNING! Risk of improper humidifier canister maintenance. Can cause serious injury or death. Building and equipment damage may also result. Can cause fire suppression and alarm system activation, resulting in building evacuation and mobilization of emergency fire and rescue services. Using a humidifier canister that has reached the end of its service life can be extremely hazardous. If the canister cannot be replaced immediately at the end of life condition, turn off the power and water supply to the humidifier and remove the canister until a replacement canister can be installed. Do not ignore humidifier problem alarms. Resetting the humidifier without addressing cause may result in fire or damage from leaking water. See Table 10.6 on page 122.

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 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 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 contact with hot surfaces. Can cause injury. Personal burn injury can be the result of touching a compressor, refrigerant discharge lines, 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.

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 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 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.

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

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

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: back-up 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 digital scroll compressors without proper refrigerant charging can cause the compressors to operate at less than 15°F (–9.4°C) evaporator temperature and at less than 70 psig (483 kPa). Operation for extended periods at less than 70 psig (483 kPa) can cause premature compressor failure.

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 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 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.

NOTICE

Risk of frozen pipes and corrosion from improper coolant mixture. Can cause water leaks resulting in equipment and building damage.

When the cooling unit or piping may be exposed to freezing temperatures, charge the system with the proper percentage of glycol and water for the coldest design ambient temperature. Automotive antifreeze is unacceptable and must NOT be used in any glycol fluid system. Use only HVAC glycol solution that meets the requirements of recommended industry practices. Do not use galvanized pipe.

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 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 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 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 1.06.042 & later include settings to operate condenser fans if they have been inactive for more than 30 days.

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 reinstalled in their original location.

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™ CoolPhase Perimeter indoor cooling unit has a factory-installed, high-pressure safety switch in the high-side refrigerant circuit. Each refrigerant receiver contains a fusible plug for fire-safety purposes. Consult your local building code to determine whether the refrigerant piping will require additional, field-provided pressure-relief devices.

2 Nomenclature and Components

This section describes the model number for Vertiv™ CoolPhase Perimeter units and components.

2.1 Vertiv™ CoolPhase Perimeter Model Number Nomenclature

Table 2.2 below describes each digit of the model number.

Table 2.1 Vertiv™ CoolPhase Perimeter Model Number Example

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
D	S	0	3	5	A	Z	A	1	E	I	*	*	*	*

Table 2.2 Vertiv™ CoolPhase Perimeter Model Number Digit Definitions

Digit	Description
Digits 1 and 2 = Airflow Distribution	DS = Downflow standard VS = Upflow standard
Digit 3, 4, 5 = Nominal Cooling Capacity, kW	035 = 35 kW, 10 ton 042 = 42 kW, 12 ton 053 = 53 kW, 15 ton 070 = 70 kW, 20 ton 077 = 77 kW, 22 ton 105 = 105 kW, 30 ton
Digit 6 = Cooling Type	A = Air-cooled D = Dual-cool, air cooled H = Dual-cool, water cooled K = Vertiv™ Liebert® Econ-o-Coil GLYCOOL cooled W = Water/Glycol cooled
Digit 7 = Compressor Type	B = Digital Scroll, R-454B with Brazed Plate Z = Digital Scroll, R-454B
Digit 8 = Voltage	A = 460 V - 3 ph - 60 Hz B = 575 V - 3 ph - 60 Hz C = 208 V - 3 ph - 60 Hz D = 230 V - 3 ph - 60 Hz 2 = 380 V - 3 ph - 60 Hz

Table 2.2 Vertiv™ CoolPhase Perimeter Model Number Digit Definitions (continued)

Digit	Description
Digit 9 = Fan Type	
	0 = Forward-curved blowers
	1 = Electronically-commutated (EC) fans
Digit 10 = Reheat Type	
	0 = None
	E = 3-stage electric
	R = Reduced, 3-stage electric
Digit 11 = Humidifier	
	0 = No humidifier
	S = Steam Gen Humidifier
Digit 12-15 = Factory Configuration Number	

2.2 Component Location

The unit component locations are described in the submittal documents included in the Submittal Drawings on page 161.

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

Table 2.3 Component-location Drawings

Document Number	Title
20000407	Vertiv™ CoolPhase Perimeter DS035-DS105 Downflow Component Location Diagram
20000408	Vertiv™ CoolPhase Perimeter DS035-DS105 Upflow Component Location Diagram

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3 Pre-installation Preparation and Guidelines

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

Refer to Vertiv™ CoolPhase Perimeter Model Number Digit Definitions on page 11, 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 161.

- Verify that the floor is level, solid and sufficient to support the unit. See Table 3.3 on page 20 and Table 3.4 on page 21 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 22. 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 22, 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 Submittal Drawings on page 161.

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

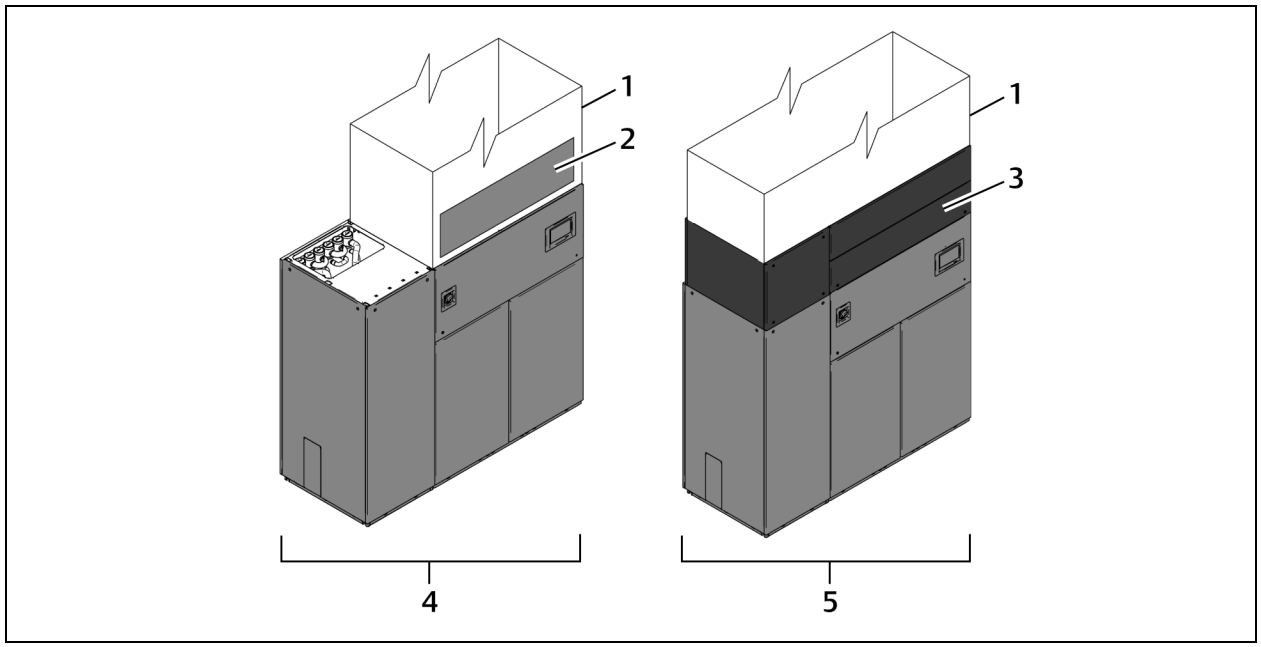
Table 3.1 Dimension Planning Drawings

Document Number	Title
Downflow Units	
20000409	Vertiv™ CoolPhase Perimeter DS035-DS105 Cabinet Dimensional Data
Upflow Units	
20000410	Vertiv™ CoolPhase Perimeter DSDS035-DS105 Upflow Cabinet Dimensional Data with EC Fans
20000411	Vertiv™ CoolPhase Perimeter DS035-DS105 Upflow Cabinet Dimensional Data with Forward Curved Blowers
Floor Stands	
20000412	Vertiv™ CoolPhase Perimeter DS035-DS042 Floor Stand Dimensional Data with EC Fans
20000413	Vertiv™ CoolPhase Perimeter DS053-DS077 Floor Stand Dimensional Data with EC Fans
20000414	Vertiv™ CoolPhase Perimeter DS105 Floor Stand Dimensional Data with EC Fans
20000415	Vertiv™ CoolPhase Perimeter DS035-DS042 Upflow Floor Stand and Floor Planning Dimensional Data with Forward Curved Blowers
20000416	Vertiv™ CoolPhase Perimeter DS053-DS077 Upflow Floor Stand and Floor Planning Dimensional Data with Forward Curved Blowers
20000417	Vertiv™ CoolPhase Perimeter DS105 Upflow Floor Stand and Floor Planning Dimensional Data with Forward Curved Blowers
Blower Outlet, Deck and Filter Box	
20000418	Vertiv™ CoolPhase Perimeter DS035-DS042 Upflow Blower Outlet and Deck Dimensional Data with Forward Curved Blowers
20000419	Vertiv™ CoolPhase Perimeter DS053-DS077 Blower Outlet and Deck Dimensional Data Upflow with Forward Curved Blowers
20000420	Vertiv™ CoolPhase Perimeter DS105 Upflow Blower Outlet and Deck Dimensional Data with Forward Curved Blowers
20000421	Vertiv™ CoolPhase Perimeter DS035-DS105 Upflow Rear Return Filter Box Dimensional Data with Forward Curved Blowers
20000422	Vertiv™ CoolPhase Perimeter DS035-DS105 Upflow Rear Return Filter Box Dimensional Data with EC Fans
Plenums	
20000423	Vertiv™ CoolPhase Perimeter DS035-DS105 Upflow Plenum Dimensional Data with Forward Curved Blowers
20000424	Vertiv™ CoolPhase Perimeter DS035-DS042 Upflow Plenum Dimensional Data with EC Fans
20000425	Vertiv™ CoolPhase Perimeter DS053-DS077 Upflow Plenum Dimensional Data with EC Fans
20000426	Vertiv™ CoolPhase Perimeter DS105 Upflow Plenum Dimensional Data with EC Fans

3.2 Air Distribution Considerations for Downflow Units

- Verify that the raised floor has been 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 7-1/2 in. (191 mm) of clearance.
- A minimum of 24 in. (610 mm) is required to operate the fans when they are lowered with the factory-provided jacking mechanism.
- Ensure that there is adequate clearance above the unit for service, such as replacing filters.
- Optional plenums are available for downflow unit ducting.

Figure 3.1 Downflow Unit Ducting and Plenum Ducting



Item	Description
1	Field-fabricated duct work
2	Field service access for filter replacement Minimum height = 12 in. (305 mm) Minimum distance from unit = 2 in. (51 mm)
3	Optional plenum with service-access door for filter replacement
4	Direct-to-unit ducting
5	Plenum ducting

3.3 Air Distribution Considerations for Upflow Units

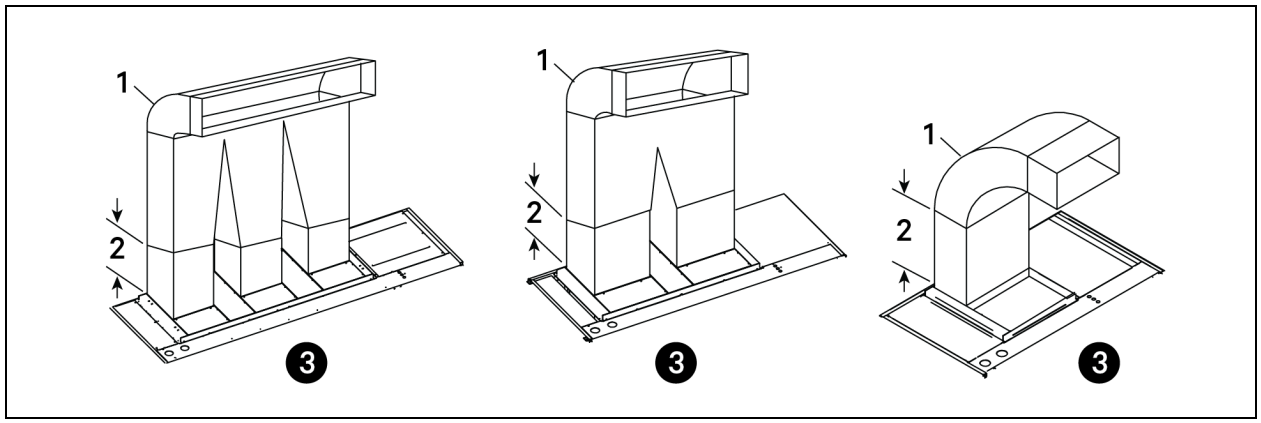
Various configurations are available:

- Front return
- Rear return
- Top-front supply (forward-curved blowers)
- Top-rear supply (forward-curved blowers)
- Top, rear, and front supply with plenum (EC fans)

For in-room applications with supply and return grilles, several feet of clearance must be maintained at the intake and discharge of the unit.

Upflow rear-return configurations use a filter box attached to the back of the unit. Allow 25 in. (635 mm) on one side of the unit for access to the rear-return filter box. Refer to the rear-return installation sheet, inside the rear-return filter box package.

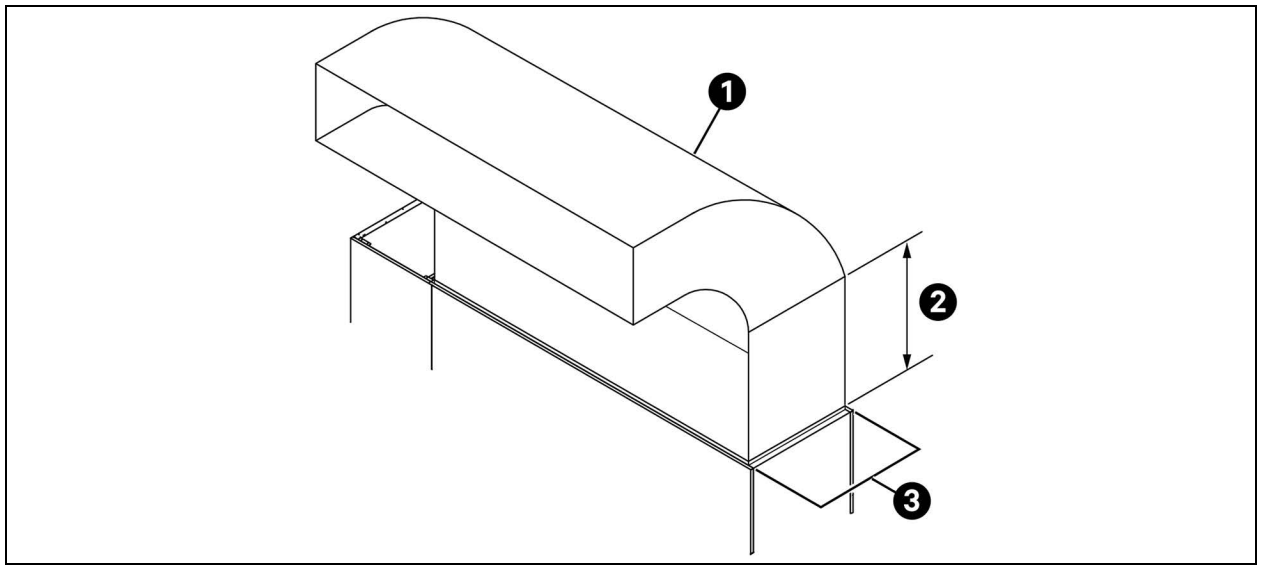
Figure 3.2 Upflow Ducting Configurations (Forward Curved Blowers)



Item	Description
1	Typical ducting
2	Straight sections must be 1.5 to 2.5 times the longest blower dimension.
3	Front of unit

NOTE: Drain traps are qualified to a return duct static of negative 1.5 i.w.g. (-1.5 i.w.g).

Figure 3.3 Upflow Ducting Configurations for EC Fans



Item	Description
1	Typical ducting. May run to either side.
2	Straight section must be 2.5 times the depth of blower.
3	Ducting only attached to flanges on provided plenum.

NOTE: Follow standard practices in all duct work.

3.4 Connections and System Setup

- Three-phase electrical service is required for all models. Electrical service must conform to national and local electrical codes. See equipment nameplate for details.
- The unit requires a drain, which must comply with all applicable codes. See Field-installed, Gravity Fed Drain Line Requirements on page 38, 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 161.
- Water/glycol and Vertiv™ Liebert® GLYCOOL units utilizing a Vertiv™ Liebert® Drycooler may require an optional aquastat setting. See Table 10.9 on page 133, and Table 10.10 on page 133, through Table 10.12 on page 134, for Liebert® Drycooler aquastat setting guidelines. Applications with the optional stat setting require field piping to be insulated to prevent condensation.
- If seismic requirements apply, consult your Vertiv representative for information about a seismic-rated floor stand.

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

3.5 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."

3.5.1 Cooling, Humidification and Dehumidification

Return air to the unit must be no cooler than the ASHRAE recommendation of 68°F (20°C) DB and 40% RH or minimum WB of 54°F (12.2°C) for proper unit operation. Operating below this can decrease equipment reliability. Operate only in return air control mode for units containing humidifiers.

3.5.2 Heating

The CoolPhase Perimeter (DS035-DS105) Thermal Management System Low GWP is qualified for heating-only operation at temperatures not exceeding 80°F (27°C).

3.6 Shipping Dimensions and Unit Weights

Table 3.2 Vertiv™ CoolPhase Perimeter Shipping Dimensions—Domestic and Export

Cooling Type	035/042	053/070/077	105
	LxWxH, in. (mm)	LxWxH, in. (mm)	LxWxH, in. (mm)
Air, Dual-Cool Air	90x42x82 (2286x1067x2083)	102x42x82 (2591x1067x2083	136x42x82 (3454x1067x2083)
Water/Glycol, Vertiv™ Liebert® GLYCOOL/Dual-Cool Water	90x42x82 (2286x1067x2083)	114x42x82 (2896x1067x2083)	—
Source: DPN003085, Rev. B			

Table 3.3 Vertiv™ CoolPhase Perimeter Downflow Unit Weights and Shipping Weights—Approximate

		Downflow	Downflow Shipping Weights, lb (kg)	
Model Number	Cooling Type	EC Fan Unit Weight, lb (kg)	Domestic, lb (kg)	Export, lb (kg)
DS035-042	Air-cooled	1470 (668)	1608 (730)	1778 (807)
	Dual Cool Air	1620 (736)	1758 (798)	1928 (875)
	Water/Glycol	1780 (809)	1918 (870)	2088 (948)
	Vertiv™ Liebert® GLYCOOL/Dual Cool Water	1930 (877)	2068 (939)	2238 (1016)
DS053	Air-cooled	1920 (871)	2070 (939)	2260 (1026)
	Dual Cool Air	2100 (953)	2250 (1021)	2440 (1107)
	Water/Glycol	2220 (1010)	2382 (1081)	2582 (1172)
	Vertiv™ Liebert® GLYCOOL/Dual Cool Water	2400 (1091)	2562 (1163)	2762 (1253)

Table 3.3 Vertiv™ CoolPhase Perimeter Downflow Unit Weights and Shipping Weights—Approximate (continued)

		Downflow	Downflow Shipping Weights, lb (kg)	
Model Number	Cooling Type	EC Fan Unit Weight, lb (kg)	Domestic, lb (kg)	Export, lb (kg)
DS070	Air-cooled	1970 (894)	2120 (962)	2310 (1048)
	Dual Cool Air	2150 (975)	2300 (1044)	2490 (1130)
	Water/Glycol	2270 (1032)	2432 (1104)	2632 (1194)
	Vertiv™ Liebert® GLYCOOL/Dual Cool Water	2450 (1114)	2612 (1185)	2812 (1276)
DS077	Air-cooled	2450 (1114)	2612 (1185)	2812 (1276)
	Dual Cool Air	2630 (1196)	2792 (1267)	2992 (1358)
	Water/Glycol	2750 (1250)	2912 (1321)	3112 (1412)
	Vertiv™ Liebert® GLYCOOL/Dual Cool Water	2930 (1332)	3092 (1403)	3292 (1494)
DS105	Air-cooled	2780 (1261)	3223 (1462)	3443 (1562)
	Dual Cool Air	3135 (1422)	3583 (1626)	3803 (1726)
	Water/Glycol	3150 (1429)	3593 (1630)	3813 (1730)
	Vertiv™ Liebert® GLYCOOL/Dual Cool Water	3505 (1590)	3953 (1794)	4173 (1893)

Source: DPN003085, Rev. B

Table 3.4 Vertiv™ CoolPhase Perimeter Upflow Unit Weights and Shipping Weights—Approximate

		Upflow		Upflow Shipping Weights, lb (kg) w/Forward-curved Blowers	
Model Number	Cooling Type	EC Fan Unit Weight, lb (kg)	Forward-Curved Unit Weight, lb (kg)	Domestic, lb (kg)	Export, lb (kg)
VS035-042	Air-cooled	1370 (621)	1520 (689)	1658 (753)	1828 (830)
	Dual Cool Air	1520 (689)	1670 (758)	1808 (821)	1978 (898)
	Water/Glycol	1680 (762)	1830 (830)	1968 (893)	2138 (970)
	Vertiv™ Liebert® GLYCOOL/Dual Cool Water	1830 (830)	1980 (898)	2118 (961)	2288 (1038)
VS053	Air-cooled	1900 (862)	2070 (939)	2220 (1007)	2410 (1094)
	Dual Cool Air	2080 (943)	2250 (1021)	2400 (1089)	2590 (1175)
	Water/Glycol	2200 (998)	2370 (1075)	2532 (1149)	2732 (1240)
	Vertiv™ Liebert® GLYCOOL/Dual Cool Water	2380 (1080)	2550 (1157)	2712 (1231)	2912 (1321)
VS070	Air-cooled	1900 (862)	2070 (939)	2220 (1007)	2410(1094)
	Dual Cool Air	2080 (943)	2250 (1021)	2400 (1089)	2590 (1175)
	Water/Glycol	2200 (998)	2370 (1075)	2532 (1149)	2732 (1240)
	Vertiv™ Liebert® GLYCOOL/Dual Cool Water	2380 (1080)	2550 (1157)	2712 (1231)	2912 (1321)

Table 3.4 Vertiv™ CoolPhase Perimeter Upflow Unit Weights and Shipping Weights—Approximate (continued)

		Upflow		Upflow Shipping Weights, lb (kg) w/Forward-curved Blowers	
Model Number	Cooling Type	EC Fan Unit Weight, lb (kg)	Forward-Curved Unit Weight, lb (kg)	Domestic, lb (kg)	Export, lb (kg)
VS077	Air-cooled	2330 (1057)	2500 (1134)	2662 (1208)	2862 (1299)
	Dual Cool Air	2510 (1139)	2680 (1216)	2842 (1290)	3042 (1380)
	Water/Glycol	2630 (1193)	2800 (1270)	2962 (1344)	3162 (1435)
	Vertiv™ Liebert® GLYCOOL/Dual Cool Water	2810 (1275)	2980 (1352)	3142 (1426)	3342 (1516)
VS105	Air-cooled	2760 (1252)	3000 (1361)	3183 (1444)	3403 (1544)
	Dual Cool Air	3090 (1402)	3330 (1510)	3513 (1594)	3733 (1694)
	Water/Glycol	3130 (1420)	3370 (1529)	3553 (1612)	3773 (1712)
	Vertiv™ Liebert® GLYCOOL/Dual Cool Water	3460 (1569)	3700 (1678)	3883 (1762)	4103 (1862)

Source: DPN003085, Rev. B

3.7 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 3.4 Change Size vs Effective Dispersal Volume

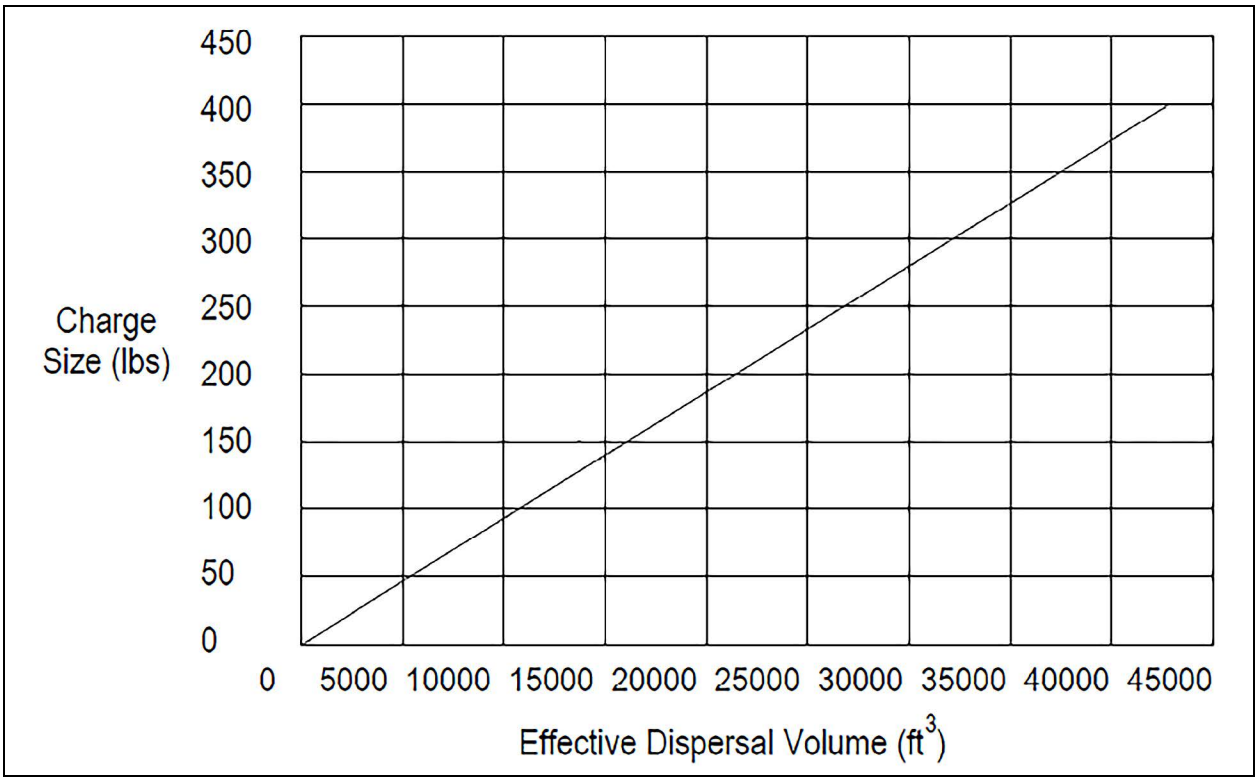
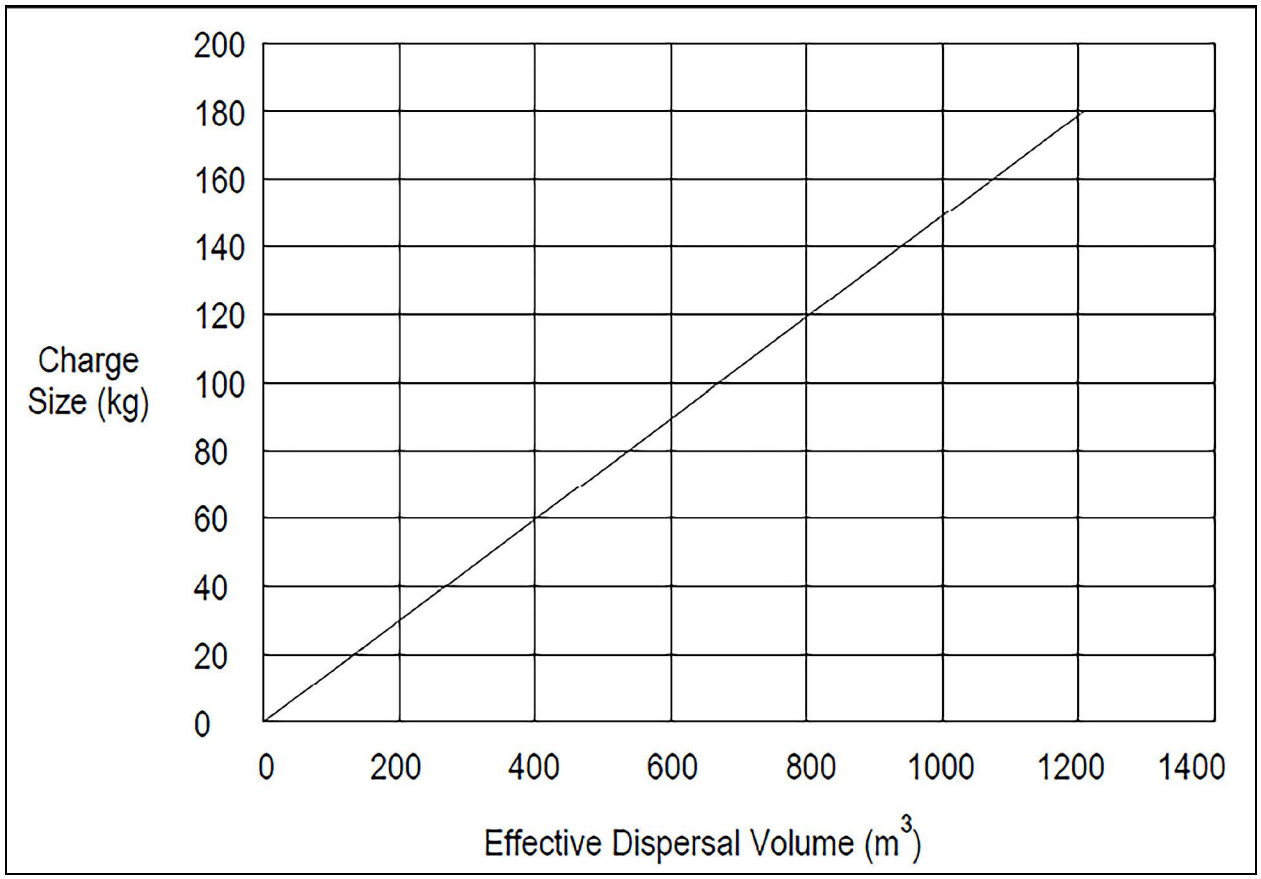


Figure 3.5 Charge Size vs Effective Dispersal Volume



3.7.1 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.

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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 improper moving. Can cause serious injury or death. Building and equipment damage may also result. Use only lifting equipment that is rated for the unit weight by an OSHA-certified rating organization. The center of gravity varies depending on the unit size and selected options. The slings must be equally spaced on either side of the center of gravity indicator. Shipping weights and unit weights are listed in the tables in Table 3.3 on page 20. Use the center of gravity indicators on the unit to determine the position of the slings.

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 20.

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
- Lift beam
- 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

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, lift the unit from the "HEAVY SIDE" of the unit, and do not lift the unit any higher than 6 in. (152 mm). All personnel except those moving the unit must be kept 12 ft (3.7 m) or more from the unit while it is being moved.
- If the unit must be lifted higher than 6 in. (152 mm), all personnel not directly involved in moving the unit must be 20 ft (5 m) or farther from the unit.
- Always refer to the location of the center-of-gravity indicators when lifting the unit, see Figure 4.1 below.

Figure 4.1 Center of Gravity Indicator

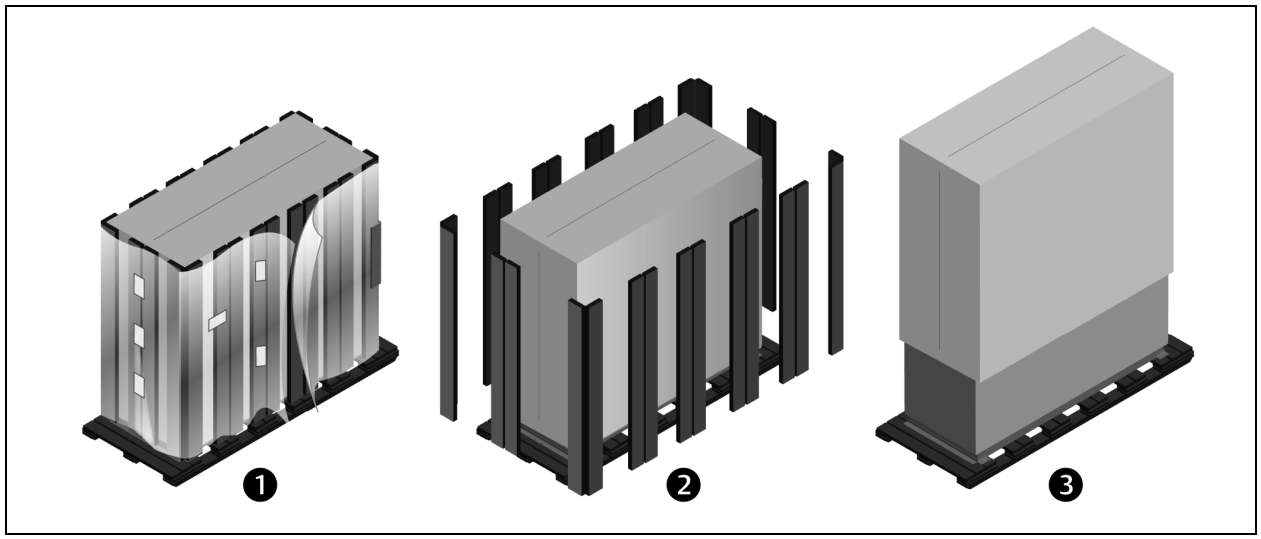
4.3 Unpacking the Unit

1. Remove the exterior stretch wrap packaging and two V-shaped boards from around the unit, as shown in Figure 4.2 below.
2. Remove the corner and side packaging planks, exposing the bag over the unit.

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.

3. 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	Remove 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

Refer to Figure 4.3 on the next page.

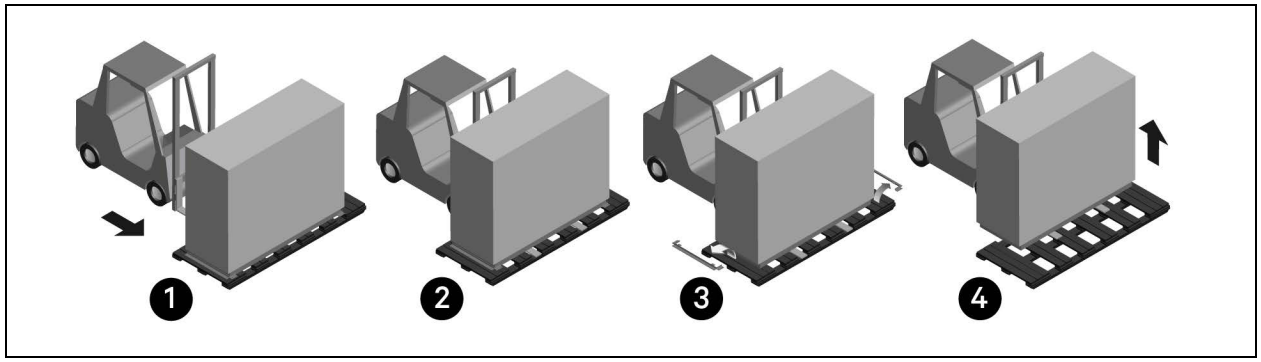
1. Align a forklift with either the front or rear side of the unit.
   - Ensure that the tines of the fork lift are locked to the widest location.
   - Use the center of gravity indicators on the unit panels when determining the entry points for the tines. Center of gravity varies per unit size and selected options.
   - The tines shall be equally spaced on either side of the center of gravity indicator.

2. Insert the tines of the forklift completely under the base of the unit.
    - Ensure that the tines are level, not angled in an upward direction.
    - The tines are to be at a height that will allow proper clearance under the unit.
    - Ensure that the tines extend beyond the opposite side of the unit.

NOTE: If these steps are not followed, damage may occur to the panels and/or base of the unit.

3. Remove the lag bolts from each bracket located around the base, and remove the brackets.
4. Lift the unit off the skid to an elevation point where the skid is not supporting the weight of the unit and remove the skid from under the unit.

Figure 4.3 Removing From Skid with a Forklift



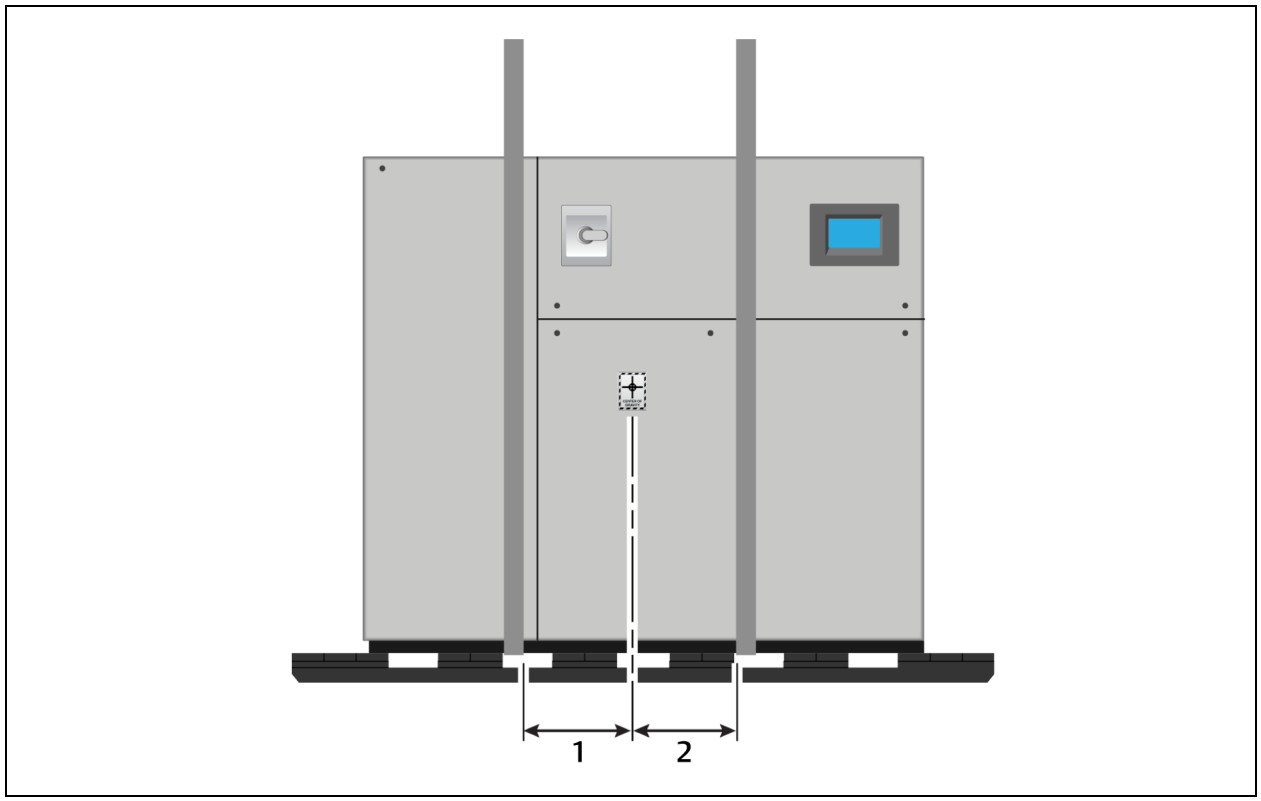
Item	Description
1	Align forklift with front or rear of unit.
2	Insert tines completely under base of unit.
3	Remove lag bolts and brackets
4	Lift unit and remove skid.

4.3.2 Removing the Unit from the Skid Using Rigging

1. Use the center-of-gravity indicators on the unit panels to determine the position of the slings.
    - The slings shall be equally-spaced on either side of the center-of-gravity indicator
2. Place the slings and between the bottom rails of the unit and the skid as shown in Figure 4.4 on the facing page.

NOTE: Unit is shown without packaging. These instructions may be followed with or without the outer packaging in place.

Figure 4.4 Example Sling Placement



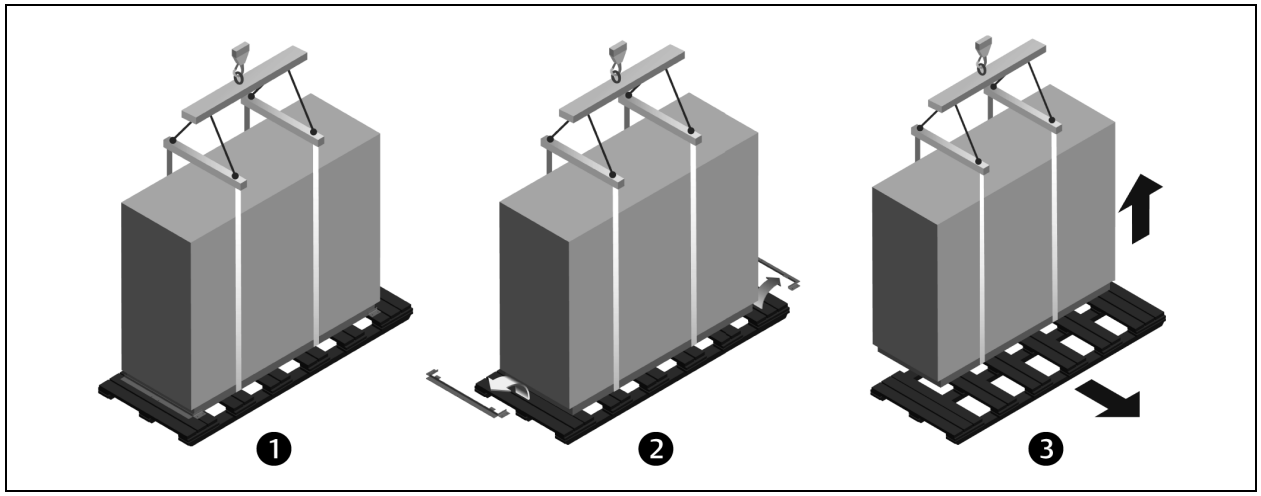
Item	Description
1	Distance between sling and center-of-gravity marker equal to item 2.
2	Distance between sling and center-of-gravity marker equal to item 1.

3. Referring to Figure 4.5 below:
    - Align the slings as described previously.
    - Use spreader bars or equivalent device to ensure proper protection of the unit (Item 1).
    - Remove the lag bolts from each bracket located around the base, and remove the brackets (Item 2).

NOTE: Depending on final installation location, the skid may need to remain under the unit. Therefore, the lag bolts and brackets would not yet be removed.

- Lift the unit off the skid to an elevation point where the skid is not supporting the weight of the unit and remove the skid from under the unit (Item 3).

Figure 4.5 Moving Unit with Rigging



Item	Description
1	Spreader bars and rigging on unit.
2	Remove lag bolts and brackets.
3	Lift the unit and remove the skid.

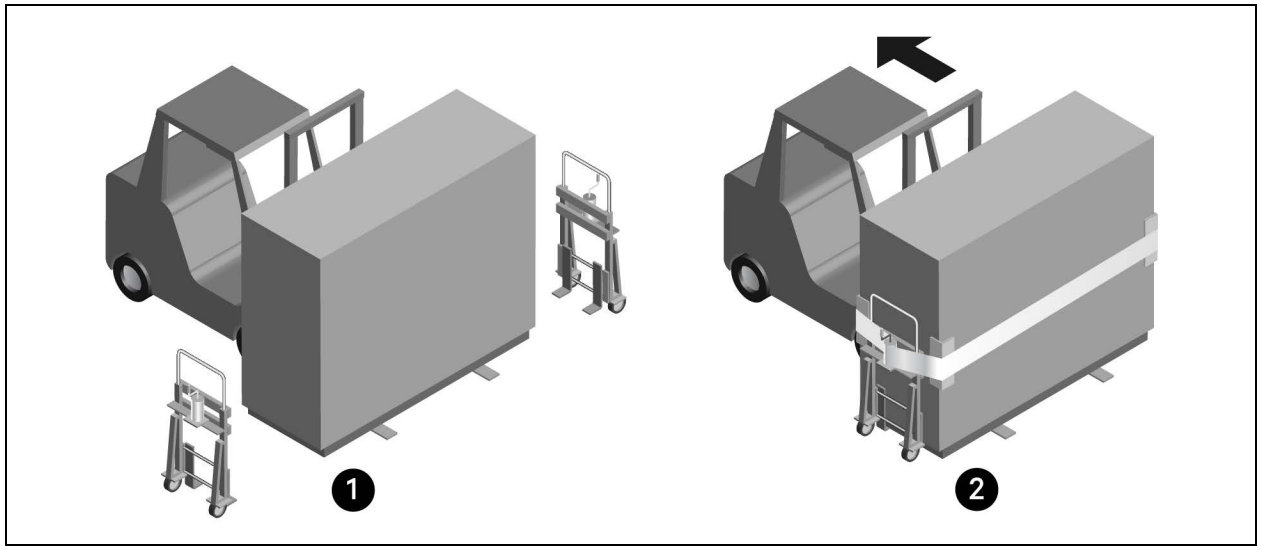
4.3.3 Moving the Unit to the Installation Location Using Piano Jacks

Refer to Figure 4.6 on the facing page.

1. With the unit elevated, position piano jacks at each end of the unit.
2. Lower the unit to a height suitable for the piano jacks, place protective material between the unit and the piano jacks and straps.

3. With the unit secured to the piano jacks, move the forklift away from the unit.
4. Using the piano jacks, at least two trained personnel can move the unit to the site for installation.
    - For location considerations, refer to Pre-installation Preparation and Guidelines on page 15.

Figure 4.6 Moving Unit with Piano Jacks



Item	Description
1	Place piano jacks on each end of the unit.
2	Use padding between unit and straps and, with the unit secured to the piano jacks, move the forklift away from the unit.

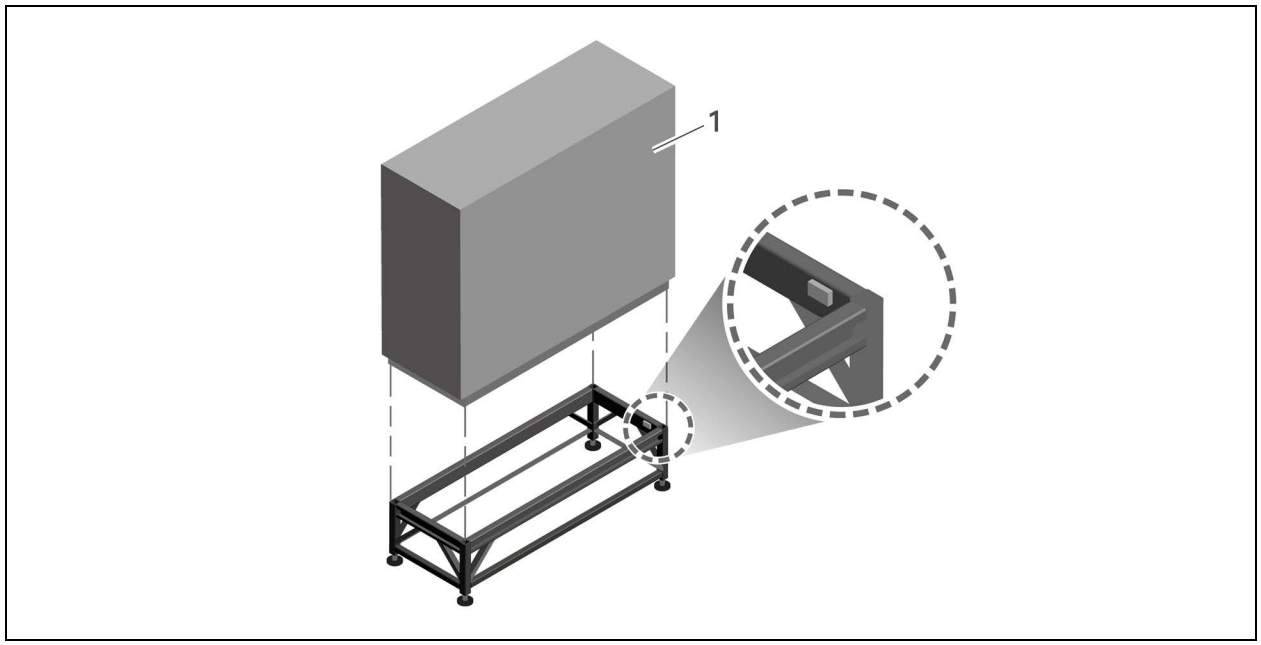
4.4 Placing the Unit on a Floor Stand

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, located 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. Refer to Figure 4.7 below. Be sure to align the welded tabs on top of the floor stand with the inside of the unit frame base.

NOTE: The floor stand for the units equipped with EC fans is not symmetrical. Its orientation to the unit is critical for lowering the EC fans. Unless the floor stand is installed in the correct position, the fans will not lower into the floor stand.

Figure 4.7 Welded Tabs on Floor Stand



Item	Description
1	Front of unit

5 Piping and Refrigerant Requirements

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

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

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

The following pipe connections are required:

- A drain line from the unit.
- A water-supply line to the optional humidifier (if applicable).
- On air, water, or glycol systems: refrigerant piping connections between the evaporator unit and the condensing unit. See Refrigerant Piping and Charging on page 41.
- On water-glycol systems: connections to a water or glycol loop.

The pipe connection locations, piping general arrangement and schematics are described in the submittal documents included in the Submittal Drawings on page 161.

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

Table 5.1 Piping General Arrangement Drawings

Document Number	Title
Air Cooled Units	
20000380	Vertiv™ CoolPhase Condenser Air Cooled Piping Schematic with EEV
20000427	Vertiv™ CoolPhase Perimeter Air Cooled Piping Schematic with Vertiv™ CoolPhase Condenser
Water/Glycol Cooled Units **NOTE: For systems with Vertiv™ Liebert® Drycoolers, see Vertiv™ Liebert® Drycooler Aquastat Settings on page 133.**	
20000428	Vertiv™ CoolPhase Perimeter Water Cooled Piping Schematic
Vertiv™ Liebert® GLYCOOL Units **NOTE: For systems with Vertiv™ Liebert® Drycoolers, see Vertiv™ Liebert® Drycooler Aquastat Settings on page 133.**	
20000429	Vertiv™ CoolPhase Perimeter Liebert® GLYCOOL Cooled Piping Schematic
Vertiv™ Liebert® Econ-o-Coil Option	
20000430	Vertiv™ CoolPhase Econ-o-Coil Optional Piping Schematic

Table 5.2 Piping Connection Drawings

Document Number	Title
Downflow, Air Cooled Models with EC Fans	
20000431	Vertiv™ CoolPhase Perimeter DS035-DS042 Downflow Air Cooled Primary Connection Locations
20000432	Vertiv™ CoolPhase Perimeter DS053-DS077 Downflow Air Cooled Primary Connection Locations with EC Fans
20000433	Vertiv™ CoolPhase Perimeter DS105 Downflow Air Cooled Primary Connection Locations
Downflow, Water/Glycol/Vertiv™ Liebert® GLYCOOL Models with EC Fans	
20000434	Vertiv™ CoolPhase Perimeter DS035-DS042 Downflow Water/Glycol Cooled Primary Connection Locations
20000435	Vertiv™ CoolPhase Perimeter DS053-DS077 Downflow Water/Glycol Cooled Primary Connection Locations
20000436	Vertiv™ CoolPhase Perimeter -DS105 Downflow Water/Glycol Cooled Primary Connection Locations
Upflow, Air Cooled Models with EC Fans	
20000437	Vertiv™ CoolPhase Perimeter DS035-DS042 Upflow Air Cooled Primary Connection Locations with EC Fans
20000438	Vertiv™ CoolPhase Perimeter DS053-DS077 Upflow Air Cooled Primary Connection Locations
20000439	Vertiv™ CoolPhase Perimeter DS105 Upflow Air Cooled Primary Connection Locations
Upflow, Water/Glycol/Vertiv™ Liebert® GLYCOOL Models with EC Fans	
20000440	Vertiv™ CoolPhase Perimeter DS035-DS042 Upflow Water/Glycol Cooled Primary Connection Locations with EC Fans
20000441	Vertiv™ CoolPhase Perimeter DS053-DS077 Upflow Water/Glycol Cooled Primary Connection Locations with EC Fans
20000442	Vertiv™ CoolPhase Perimeter DS105 Upflow Water/Glycol Cooled Primary Connection Locations
Upflow, Air Cooled Models with Forward Curved Blowers	
20000443	Vertiv™ CoolPhase Perimeter DS035-DS042 Upflow Air Cooled Primary Connection Locations with Forward Curved Blowers
20000444	Vertiv™ CoolPhase Perimeter DS053-DS077 Upflow Air Cooled Primary Connection Locations
20000445	Vertiv™ CoolPhase Perimeter DS105 Upflow Air Cooled Primary Connection Locations
Upflow, Water/Glycol/Vertiv™ Liebert® GLYCOOL Models with Forward Curved Blowers	
20000446	Vertiv™ CoolPhase Perimeter DS035-DS042 Upflow Water/Glycol Cooled Primary Connection Locations with Forward Curved Blower
20000447	Vertiv™ CoolPhase Perimeter DS053-DS077 Upflow Water/Glycol Cooled Primary Connection Locations with Forward Curved Blowers
20000448	Vertiv™ CoolPhase Perimeter DS105 Upflow Water/Glycol Cooled Primary Connection Locations

5.1 Drain and Humidifier Fluid Piping

NOTICE

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

The Vertiv™ CoolPhase Perimeter requires a water drain connection. Improper installation, application and service practices can result in water leakage from the unit.

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

We recommend installing monitored leak detection equipment for the water supply lines and the internal unit water lines.

5.1.1 Field-installed, Gravity Fed Drain Line Requirements

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 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.

A 3/4-in. NPT-Female drain connection is provided on units without an optional condensate pump.

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 ft (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.
- The drain line must comply with all applicable codes.
- On units with the optional, factory-installed condensate pump, see Factory Installed Condensate Pump on page 40 and Condensate Pump Drain Line Requirements on page 40.

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

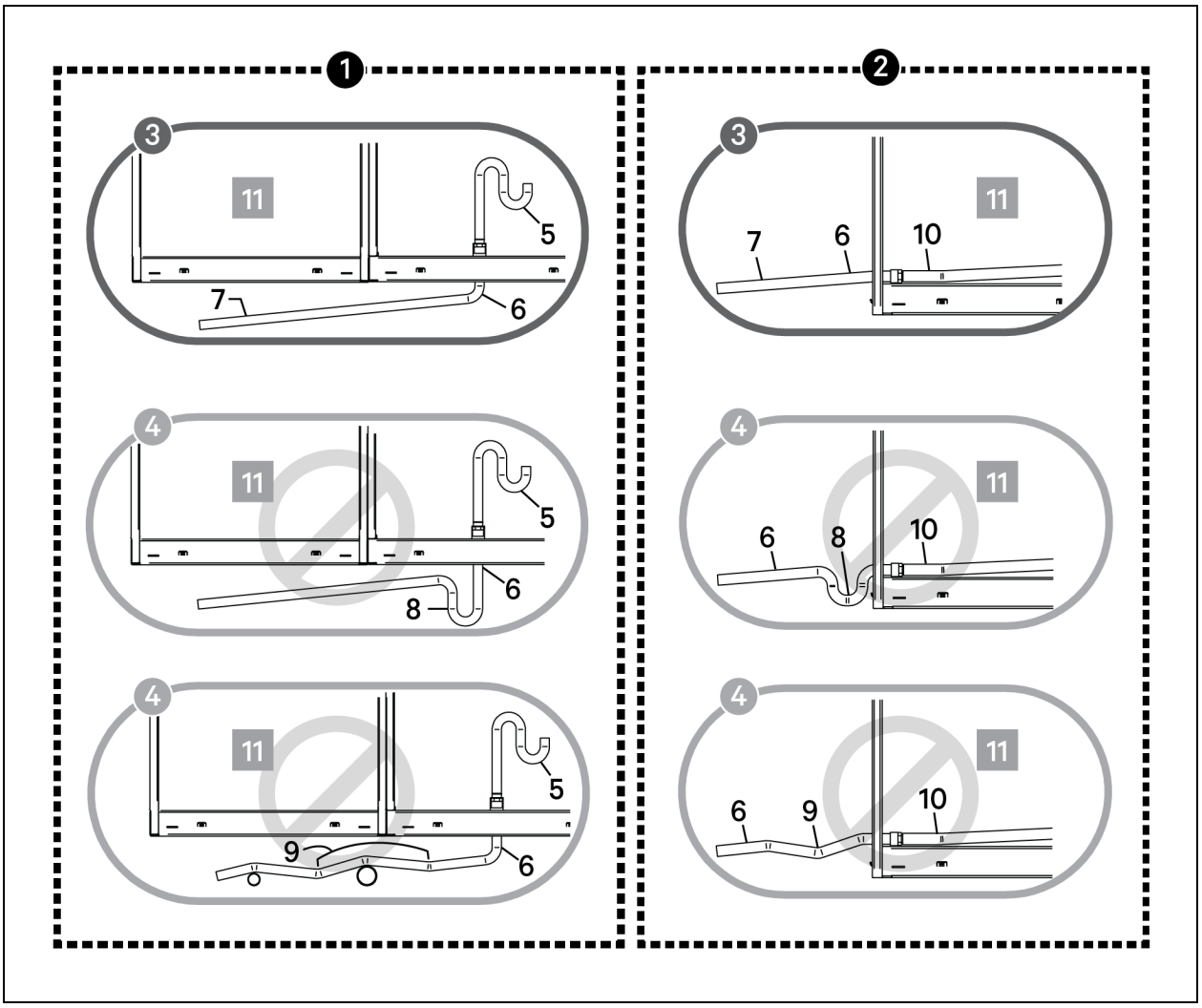


Table 5.3 Gravity Fed Drain Line Figure Descriptions

Item	Description
1	For downflow units
2	For upflow units
3	Correct drain installation
4	Incorrect drain installation
5	Internal drain
6	External drain
7	Continuous downward slope
8	External trap. Do not trap externally.

Table 5.3 Gravity Fed Drain Line Figure Descriptions (continued)

Item	Description
9	External traps, although unintentional. Lines must be rigid enough not to bow over top of other objects.
10	Internal drain
11	CoolPhase Perimeter (DS035-DS105) Thermal Management System Low GWP unit

5.1.2 Condensate Pump Drain Line Requirements

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.

Observe the following requirements when installing and routing the drain line:

- The drain line must be located so it will not be exposed to freezing temperatures.
- Size the piping based on the available condensate head.
- 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.
- We recommend installing monitored, under-floor leak-detection equipment.

Factory Installed Condensate Pump

If your unit includes an optional condensate pump, the pump is factory-installed inside the unit and a 1/2 in. copper sweat connection is provided on the unit.

5.1.3 Water Supply Line Requirements for the Optional Humidifier

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.

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

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 explosive discharge of high-pressure refrigerant, loss of refrigerant, environmental pollution, equipment damage, injury, or death. 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.

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. 23			

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

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

- Field installed interconnecting piping should be properly selected based on local codes and unit labeling.
- 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 1350°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 ft^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.
  - The bottom of the receiver on the outdoor, Vertiv™ CoolPhase condenser must be higher than the elevation of the thermal expansion valve (TXV) inside the indoor unit.
  - The vertical height of the bottom of the receiver must not exceed 60 ft. (18.3 m) above the TXV.
  - Consult factory before installing units, condensers, and receivers outside these parameters.
  - Refer to 20000380 and 20000382 included in the Submittal Drawings on page 161.
- Condenser without receiver:
  - The bottom of the condenser coil must be less than 15 ft below the location of the TXV inside the indoor unit.
  - The vertical height of the bottom of the condenser coil must not exceed 60 ft. (18.3 m) above the TXV inside of the indoor unit.
  - Consult factory before installing units and condensers outside of these parameters.
  - Refer to 20000380 included in the Submittal Drawings on page 161.
- Consult factory if piping run exceeds 150 ft (46 m) equivalent length.
- Install traps on hot-gas (discharge) lines at the base of vertical risers over 5 ft (1.5 m) and then for vertical rises over 25 ft (7.6 m), install a trap in 20 ft (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 ft (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 Compressor Oil on page 127).

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

- Refer to **Table 5.5** on the facing page, for recommended refrigerant piping sizes based on equivalent pipe lengths.
- Refer to Refrigerant Charge Requirements for Air Cooled Systems on the facing page, for the refrigerant-charge requirements of the system.
- Refer to Charging Air Cooled Systems with Vertiv™ Liebert® Lee-Temp Receiver on page 54, for charging information.

5.2.2 Refrigerant Line Sizes and Equivalent Lengths

Table 5.5 Recommended Refrigerant Line Sizes - OD Copper (Inches)

Model:	035		042		053		070		077[2]		105[2]	
Equivalent Length	Hot Gas Line	Liquid Line	Hot Gas Line	Liquid Line	Hot Gas Line	Liquid Line	Hot Gas Line	Liquid Line	Hot Gas Line	Liquid Line	Hot Gas Line	Liquid Line
50 ft (15 m)	3/4[2]	5/8	7/8[2]	5/8	7/8	3/4	7/8	3/4	7/8	3/4	1-1/8	7/8
100 ft (30 m)	3/4[2]	5/8	7/8[2]	5/8	7/8	3/4	7/8	3/4	1-1/8[2]	7/8	1-1/8	7/8
150 ft (45 m)	3/4[2]	5/8	7/8[2]	5/8	7/8	3/4	1-1/8[2]	7/8	1-1/8[2]	7/8	1-1/8	7/8

1. Field installed interconnecting piping must be properly selected and installed based on local and national codes and the unit serial tag.
2. Must downsize vertical riser one trade size (1-1/8" to 7/8" or 7/8" to 3/4" or 3/4" to 5/8" or 5/8" to 1/2").

Source: DPN000788, Rev. 23

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

System Type	Model	Charge per Circuit, lb (kg)
Air-cooled	035, 042	4.7 (2.1)
	053, 070, 077	6.8 (3.1)
	105	8.1 (3.7)

Source: DPN003086, Rev. C

Table 5.7 Interconnecting Piping Refrigerant Charge for R454B, lb per 100 ft (kg per 30 m)

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

Source: DPN003099, Rev. 2

Table 5.8 Approximate R-454B Refrigerant Required per Circuit for Vertiv™ CoolPhase Condenser

Condenser Models	Single Circuit						Dual Circuit					
	Condensers without Receivers without Vertiv™ Liebert® Lee-Temp		Condensers without Receivers with Vertiv™ Liebert® Lee-Temp		Condensers with Small/Large Receivers with Vertiv™ Liebert® Lee-Temp		Condensers without Receivers without Vertiv™ Liebert® Lee-Temp		Condensers without Receivers with Vertiv™ Liebert® Lee-Temp		Condensers with Small/Large Receiver with Vertiv™ Liebert® Lee-Temp	
	lb	(kg)	lb	(kg)	lb	(kg)	lb	(kg)	lb	(kg)	lb	(kg)
MC056	--	--	--	--	--	--	2.3	(1.1)	19.5	(8.8)	--	--
MC 080	7.7	(3.4)	35.8	(16.3)	15.3	(6.9)	3.2	(1.4)	20.4	(9.3)	--	--
MCL110	9.6	(4.4)	44-2	(20.1)	17.6	(7.9)	4.7	(2.2)	22.0	(10.0)	12.6	(5.8)
MCM160	--	--	--	--	--	--	7.7	(3.4)	35.8	(16.3)	15.3/21.6	(6.9)/ (9.8)
MCL220	24.3	(11.1)	92.6	(42.0)	38.3	(17.4)	11.1	(5.0)	45.6	(20.7)	18.9/25.2	(8.6)/ (11.4)

Source: DPN002411, Rev. 12

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.

- 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.

System charges may require additional oil charge to be added. See Additional Oil Requirements for Digital Scroll Compressors above, 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 Standard Formed Tube Trap Versus Straight Tubes and Fittings Trap on page 47 and Volume of Oil in Standard Form Trap by Pipe Diameter on page 47, 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 47 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.

On the tag marked “Oil Added Field Service Record,” attached to each compressor, record the date the oil was added and the amount of oil added by field service, including oil added for traps and for system charge per Additional Oil Requirements for Digital Scroll Compressors on the previous page.

Table 5.9 Additional Oil Required per Circuit by System Refrigerant Charge per Circuit

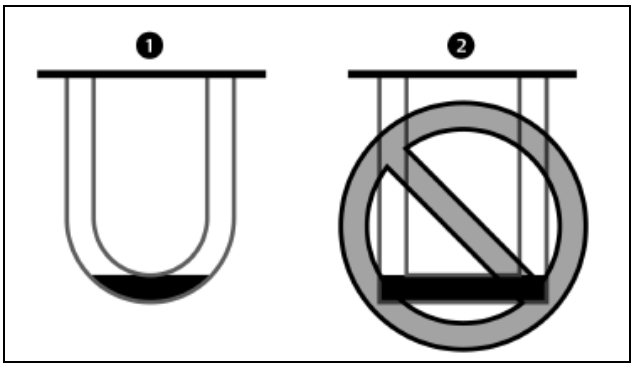
Refrigerant System Charge Per Circuit, lb (kg) *	DS035	DS042	DS053	DS070	DS077	DS105
	Additional Oil Required Per Circuit, oz (ml)					
<40 (18.1)	0	0	0	0	0	0
40 (18.1)	0	0	8 (240)	5 (150)	5 (150)	5 (150)
50 (22.7)	2 (60)	2 (60)	12 (350)	9 (270)	9 (270)	9 (270)
60 (27.2)	4 (120)	4 (120)	16 (470)	13 (380)	13 (380)	13 (380)
70 (31.8)	5.5 (160)	5.5 (160)	20 (590)	17 (500)	17 (500)	17 (500)
80 (36.3)	7 (210)	7 (210)	24 (710)	21 (620)	21 (620)	21 (620)
90 (40.8)	8,5 (250)	8,5 (250)	28 (830)	25 (740)	25 (740)	25 (740)
100 (45.4)	10 (300)	10 (300)	32 (950)	29 (860)	29 (860)	29 (860)
110 (49,9)	11.5 (340)	11.5 (340)	36 (1060)	33 (980)	33 (980)	33 (980)
120 (54.4)	13 (380)	13 (380)	40 (1180)	37 (1090)	37 (1090)	37 (1090)
130 (59.0)	14.5 (430)	14.5 (430)	44 (1300)	41 (1210)	41 (1210)	41 (1210)
140 (63.5)	16 (470)	16 (470)	48 (1420)	45 (1330)	45 (1330)	45 (1330)
150 (68.0)	18 (530)	18 (530)	52 (1540)	49 (1450)	49 (1450)	49 (1450)
160 (72.6)	20 (590)	20 (590)	56 (1660)	53 (1570)	53 (1570)	53 (1570)
170 (77.1)	21.5 (640)	21.5 (640)	60 (1770)	57 (1690)	57 (1690)	57 (1690)
180 (81.6)	23 (680)	23 (680)	64 (1890)	61 (1800)	61 (1800)	61 (1800)
190 (86.2)	24.5 (720)	24.5 (720)	68 (2010)	65 (1920)	65 (1920)	65 (1920)
200 (90.7)	26 (770)	26 (770)	72 (2130)	69 (2040)	69 (2040)	69 (2040)

*System Charge = indoor unit + condenser + refrigerant receiver + refrigerant lines.
For system charges over 200 lb. (91.7 kg), consult your Vertiv representative.

Use Copeland POE Oil ULTRA 32-3MAF or other Copeland-approved oils,

Source: 20000354, Rev. A

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 5.10 Volume of Oil in Standard Form Trap by Pipe Diameter

Pipe Diameter, in.	Oil Volume, oz
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 without Vertiv™ Liebert® Lee-Temp Receivers

Two discharge lines and two liquid lines must be field-installed between the indoor unit and the outdoor condenser. See the appropriate piping schematic, listed in Piping General Arrangement Drawings on page 35.

NOTE: Keep the evaporator unit and condenser closed with their factory charge of dry nitrogen while all field piping is installed. Keep the field piping clean and dry during installation. Do not allow it to stand open to the atmosphere. When all the field interconnecting piping is in place, vent each outdoor unit's dry nitrogen charge and connect to the field piping. Finally, vent the evaporator unit's dry nitrogen charge and make its piping connection last. Follow all proper brazing practices, including a dry nitrogen purge to maintain system cleanliness. The condenser connection pipes must be wrapped with a wet cloth to keep the pressure and temperature sensors cool during any brazing.

Evacuation and Leak Testing Air Cooled Systems without Vertiv™ Liebert® Lee-Temp

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 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 valves using the evacuation function for System #1 and System #2 in the diagnostic section of the Vertiv™ Liebert® iCOM™ controller.
   – or –
   If unit power is not available, connect a field supplied 24-VAC/75-VA power source directly to the unit solenoid valve.
2. Connect refrigerant gauges to the suction rotalock valves and discharge-line Schrader valves on both compressors.
3. Starting with Circuit #1, open the service valves and place a 150 psig (1034 kPa) of dry nitrogen with a tracer of refrigerant. Check system for leaks with a suitable leak detector.
4. With pressure still in Circuit #1, open the compressor service valves in Circuit #2.
   - If pressure increases in Circuit #2, the system is cross-circuited and must be re-checked for proper piping.
   - If there is no pressure increase, repeat step 3 on Circuit #2.
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 4 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 2 hours.
7. When the 3 checks are complete, proceed to Charging Air Cooled Systems without Vertiv™ Liebert® Lee-Temp on the facing page.

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.

Charging Air Cooled Systems without Vertiv™ Liebert® Lee-Temp

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 sight glass as an indicator when charging condenser systems.

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

The system must be fully piped and evacuated before it can be charged. See Evacuation and Leak Testing Air Cooled Systems without Vertiv™ Liebert® Lee-Temp on the previous page.

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

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

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 91 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 43.

4. Add additional compressor and trap oil. See Additional Oil Requirements for Digital Scroll Compressors on page 45.
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.

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 32 psig (221 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** below. 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 on the facing page. Subtract the measured temperature from the saturated-liquid temperature. The difference is subcooling. Make sure to use the saturated liquid temperature to calculate subcooling.

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)

Table 5.11 Target Subcooling for Ambient Outdoor Temperature (continued)

Ambient Temp, °F (°C)	Subcooling, °F (°C)
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
Source: DPN002411, Rev. 12	

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.

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

Pressure		Temperature*	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
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

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

Pressure		Temperature*	Temperature*
PSIG	BarG	°F	°C
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. 12

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

The Liebert® Lee-Temp system consists of a modulating-type head-pressure control valve and insulated receiver with heater pad to ensure operation at ambient temperatures as low as -30°F (-34.4°C).

Two discharge lines and two liquid lines must be field-installed between the indoor unit and the outdoor condenser. See the appropriate piping schematic, listed in Piping General Arrangement Drawings on page 35.

NOTE: Keep the evaporator unit, receiver, and condenser closed with their factory charge of dry nitrogen while all field piping is installed. Keep the field piping clean and dry during installation. Do not allow it to stand open to the atmosphere. When all the field interconnecting piping is in place, vent each outdoor unit's dry nitrogen charge and connect to the field piping. Finally, vent the evaporator unit's dry nitrogen charge and make its piping connection last. Follow all proper brazing practices, including a dry nitrogen purge to maintain system cleanliness. The condenser connection pipes must be wrapped with a wet cloth to keep the pressure and temperature sensors cool during any brazing.

Vertiv™ Liebert® Lee-Temp Controlled Materials Supplied

- Built-in, pre-wired condenser control box
- Air-cooled condenser
- Piping access cover
- Bolts—4 per leg (3/8 in. x 5/8 in.)
- Terminal block for 2 wire, 24V interlock connection between unit and condenser
- Terminal blocks for shielded, CANbus-cable connection between unit and condenser
- Condenser legs—6 with 2 fan units, 8 with 2 , 3, and 4 fan units
- Bolts—6 per receiver (3/8 in. x 1 in.)
- Liebert® Lee-Temp system:
  - Insulated storage receiver with (2) liquid-level sight glasses—1 per circuit
  - Head-pressure control-valve piping assembly with (2) integral check valves—1 per circuit
  - Service valve—1 per receiver
  - Pressure-relief valve—1 per receiver

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

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

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

NOTE: The system includes a factory-installed additional downstream Schrader valve with core in the compressor discharge line. Proper evacuation of the condenser side of the compressor can be accomplished only using the downstream Schrader valve. See the appropriate piping schematic for your system in Submittal Drawings on page 161.

1. If unit power is available, open the unit liquid-line solenoid valve using the evacuation function in the diagnostic section of the Vertiv™ Liebert® iCOM™ control.
   – 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 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. On both compressors, connect refrigerant gauges to the suction rotalock valves and discharge-line Schrader valves.
4. Starting with Circuit #1, open the service valves and place a 150 psig (1034 kPa) of dry nitrogen with a tracer of refrigerant. Check system for leaks with a suitable leak detector.
5. With pressure still in Circuit #1, open the compressor service valves in Circuit #2.
   - If pressure increases in Circuit #2, the system is cross-circuited and must be re-checked for proper piping.
   - If there is no pressure increase, repeat step 4 on Circuit #2.
6. 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.
7. After 4 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 2 hours.
   When the 3 checks are complete, remove the jumper hose from the service-valve fitting and the condenser, and proceed to Charging Air Cooled Systems with Vertiv™ Liebert® Lee-Temp Receiver below.

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.

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

NOTICE

Risk of improper refrigerant charging. Can cause equipment damage.

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 for the liquid line Schraeder port.

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 Checklist for Completed Installation on page 91.
3. Calculate the amount of charge for the system. See Refrigerant Charge Requirements for Air Cooled Systems on page 43.

4. Add additional compressor and trap oil. See Additional Oil Requirements for Digital Scroll Compressors on page 45.
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.

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 32 psig (221 kPa) for the compressor to operate.

   e. Repeat step 8 for Compressor Circuit 2.
9. Check the refrigerant level in the refrigerant-level sight glass on each Vertiv™ Liebert® Lee-Temp receiver after the unit has been operating for at least 15 minutes.

NOTE: Each receiver at the condenser has 2 sight glasses and the refrigerant level varies with outside temperature.

10. Adjust the refrigerant level in each circuit to meet the level shown in Target Refrigerant Level in Sight Glasses at Outdoor Temperatures below.
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.

5.3 Refrigerant Charge for Water/Glycol Cooled Systems

The water/glycol cooled system is factory-charged and includes control valves and a Vertiv™ Liebert® Paradenser Condenser or Vertiv™ Brazed Plate Heat Exchanger. The unit 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 Approximate R-454B Refrigerant Factory Charge for Water/Glycol Cooled Vertiv™ CoolPhase Perimeter

System Type	Model	Circuit 1 lb (kg)	Circuit 2 lb (kg)
Water, Glycol/Vertiv™ Liebert® GLYCOOL with Vertiv™ Liebert® Paradenser	035, 042	14.2 (6.4)	15.5 (7.0)
	053, 070, 077	17.4 (7.9)	17.4 (7.9)
	105	22.0 (10.0)	22.4 (10.2)
Water, Glycol/Vertiv™ Liebert® GLYCOOL with Brazed Plate	035, 042	7.8 (3.5)	7.4 (3.4)
	053, 070, 077	10.3 (4.7)	12.8 (5.8)
	105	14.6 (6.6)	12.8 (5.8)

Source: DPN003086, Rev. D

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 51. 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 12 to 14°F (6.7 to 7.8°C) while maintaining full load conditions.

Table 5.14 Water/Glycol Cooled and Vertiv™ Liebert® GLYCOOL Suction Pressure Transducer Settings

Function	R-454B	
	Gauge (Sea Level) PSIG (kPa)	Absolute psiA (kPa)
Minimum to Start-Cooling	49 (338)	64 (441)
Freeze Protection (DX w/Vertiv™ Liebert® Econ-o-Coil)	92 (634)	107 (738)

5.4 Water/Glycol Loop Piping Guidelines

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.

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 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.

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.

Refer to the appropriate piping general-arrangement schematics for your system for the recommended, field-installed hardware such as shut-off valves. See Table 5.1 on page 35.

- Use copper piping with a brazing alloy with a minimum temperature of 1350°F (732°C), such as Sil-Fos. Avoid soft solders, such as 50/50 or 95/5.
- Follow local piping codes and safety codes.
- Qualified personnel must install and inspect system piping.
- The water/glycol-cooled system will operate in conjunction with a cooling tower, city water or Vertiv™ Liebert® Drycooler.
- Contact a local water consultant regarding water quality, corrosion protection and freeze-protection requirements.
- Install manual shut-off valves at the supply and return line to each indoor unit and Liebert® Drycooler to permit routine service and emergency isolation of the unit.
- Install a monitored, fluid-detection system that is wired to activate the automatic closure of field installed coolant-fluid supply and return shut-off valves to reduce the amount of coolant fluid leakage and consequential equipment and building damage. The shut-off valves must be sized to close-off against the maximum coolant-fluid system pressure in case of a catastrophic fluid leak.

5.4.1 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 an inert-gas holding charge. At installation, check all fluid circuits for leaks.

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

6 Electrical Connections

Three-phase electrical service is required for all models. Electrical service must conform to national and local electrical codes. Refer to equipment nameplate regarding wire size and circuit protection requirements. Refer to electrical schematic when making connections. Refer the appropriate submittal drawing, listed in Electrical Field Connection Drawings 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.

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

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.

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: back-up 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.

The electrical connections are described in the submittal documents included in the Submittal Drawings on page 161.

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

Table 6.1 Electrical Field Connection Drawings

Document Number	Title
20000449	Vertiv™ CoolPhase Perimeter Electrical Field Connection Description
20000450	CANbus and Interlock Connections between Vertiv™ CoolPhase Perimeter and Vertiv™ CoolPhase Condenser (Premium)

7 EC Fans and Plenums

Depending on the air-distribution options of your unit, you may have EC fans and/or plenums to install.

7.1 Downflow Units with EC Fans

Vertiv™ CoolPhase Perimeter (DS035-DS105) Thermal Management System Low GWP downflow models are equipped with EC fans that may operate in the fully-raised position or lowered into the floor stand for increased efficiency from reduced air resistance.

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 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.

NOTE: Use fans either in their original raised position or with the fans in their fully-lowered position. Suspension of fans in an intermediate position will directly affect product performance and is not recommended.

7.1.1 Lowering the EC Fans into the Floor Stand on Downflow Models

NOTE: If your floor-stand height is between 9 in. (228.6 mm) and 21 in. (533.5 mm), please contact the factory before attempting to lower the fans into the floor stand. If the floor-stand height is 24 in. (609.6 mm) up to 48 in. (1219.2 mm), the fans can be installed and lowered into the floor stand.

Tools Needed

- 1/2 in. hex socket and wrench
- Factory-supplied jack, crank and jack support
- Cable tie cutter

To lower the fans:

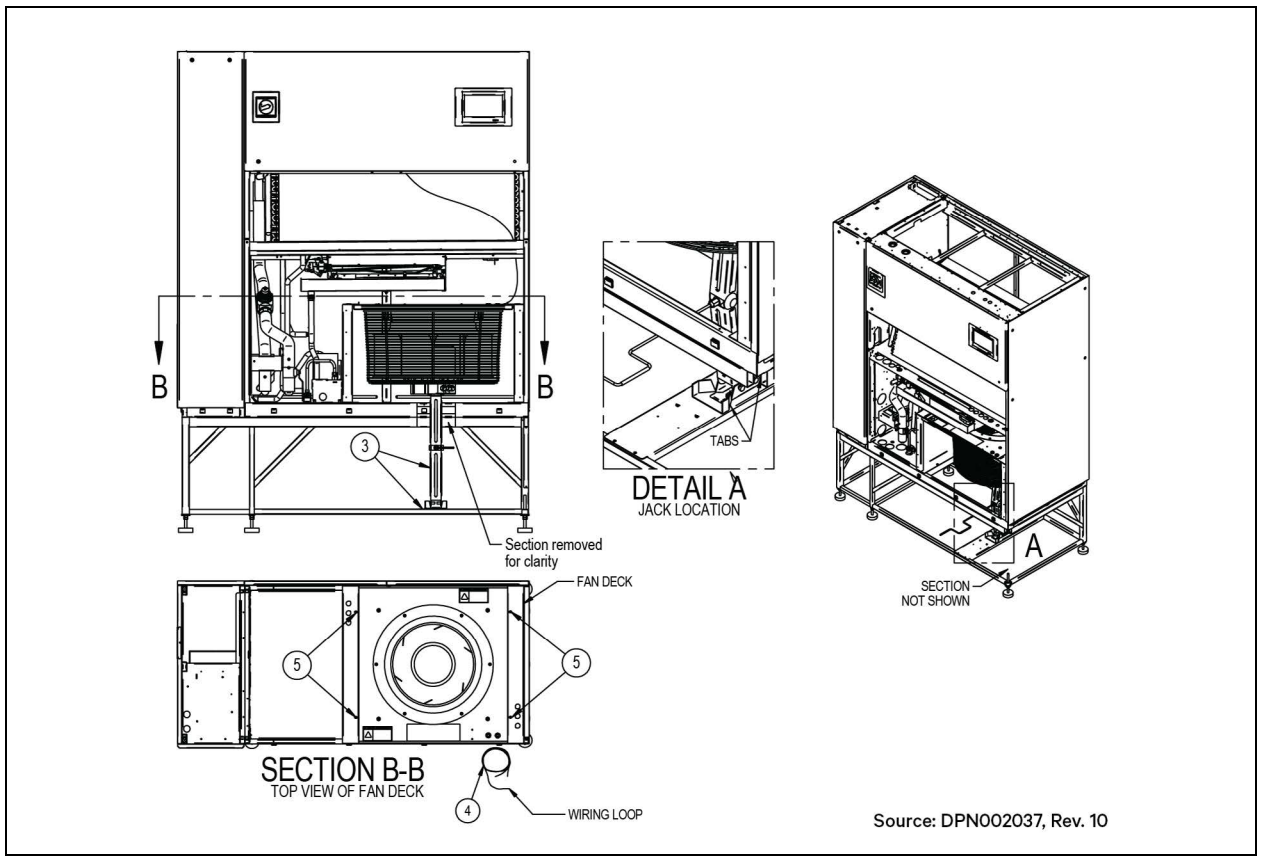
1. Remove the middle and bottom panels from the front of the unit.
2. For ease of fan lowering, We recommend removing the humidifier.
3. Position the factory-supplied jack and jack support under the fan to be lowered.

4. Raise the jack to safely support the fan before removing any hardware.

NOTE: The jack should be centered between the first and second set of tabs on the jack support (see Detail A in Figure 7.1 below).

5. Cut and remove the cable tie that holds the wiring loop to the blower mounting plate. All other cable ties that route the fan wiring should remain intact.
6. Remove the six 1/2 in. hex head screws. Retain the hardware for later use.

Figure 7.1 Lowering EC Fans into Floor Stand, Steps 1 through 6



7. Using the jack, lower the fan module slowly until it rests on the frame of the unit.

NOTICE

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

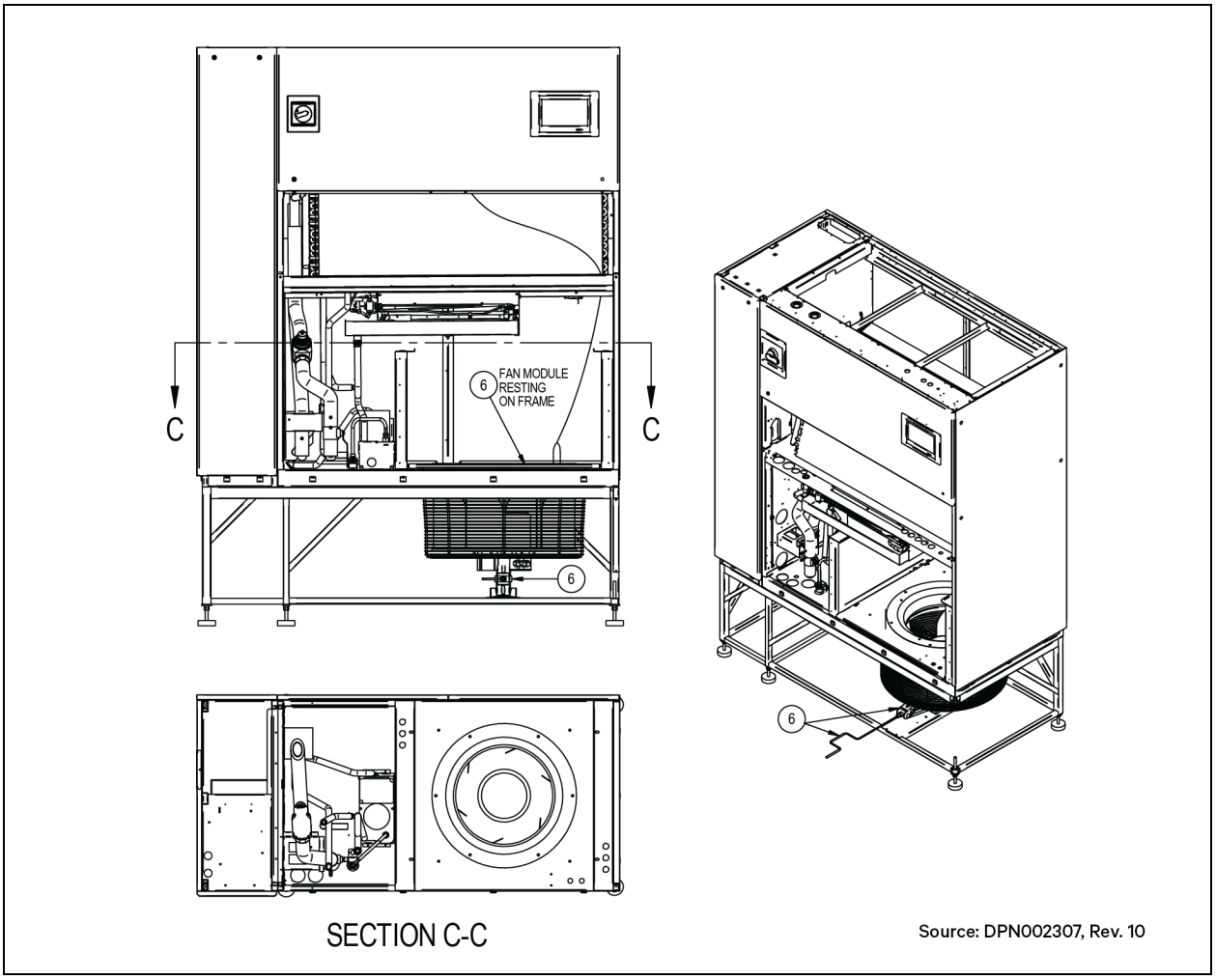
Carefully monitor the position of the EC-fan wire harnesses and other parts while lowering the fan to be sure that they are not caught or pinched.

8. Secure the fan module in the fully lowered position by reinstalling the hex head screws directly to the frame. Screw clearance holes are provided in the fan module.

NOTE: Not all hardware retained will be used to secure the fans in the lowered positioned.

9. Repeat steps 3 through 8 to lower remaining fan modules.

Figure 7.2 Lowering EC Fans into Floor, Steps 7 through 8



7.2 Upflow Unit Plenums with EC Fans

EC fans on upflow units are mounted external to the unit in a factory-provided plenum. The plenum distributes air to the conditioned space through adjustable, double-deflection grilles, or connects with field-supplied duct work.

Read all instructions before installing plenums and 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.

WARNING! Risk of contact with sharp edges, exposed fasteners, and improper handling of very heavy parts. Can cause serious injury or death. Building and equipment damage may also result. Use extreme caution, wear appropriate, OSHA-approved PPE, and install the EC fan(s) and plenum to the unit only as described in these instructions.

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 and installing the fan(s) and plenum.

Equipment used in moving, lifting and installing the fan(s) and plenum must meet OSHA requirements and be rated for the weight of the fan(s) and the plenum. If ladders are used, verify that they are rated for the combined weight of the fan(s), plenum and installer(s) as loaded. EC Fan and plenum weights are specified in Table 7.1 on the facing page and Table 7.2 on page 66.

Read and follow the lifting equipment and/or ladder manufacturer's operating instructions and safety requirements.

NOTE: Grilled plenums are intended for use in upflow configurations only. Non-grilled plenums provide service access on upflow units with duct work.

NOTE: We recommend using a duct lift or scissors lift when installing the EC-fan assemblies on top of the unit.

Equipment recommended to install the upflow plenum and EC fans

- Ladders
- Over-head winch or crane
- Duct lift
- Lift chains with hooks
- Scissor lift

7.2.1 Assembly Inspection

1. Inspect all items for visible or concealed damage. Immediately report any damage to the carrier and file a damage claim, sending a copy of the claim to your local sales representative.
2. Move to the installation location, remove items from packaging and verify that the assembly number is correct:
   - Refer to Table 7.1 below to verify plenum number by unit length, plenum height, quantity, and grille size.
   - If a compressor-section plenum is included, refer to Table 7.4 on page 69 to verify plenum number by size.
   - Refer to Table 7.2 on the next page to verify EC fan number by unit voltage.
   - Verify that the fan-motor voltage rating is appropriate for the marked voltage rating of the cooling unit.
3. Verify that all assembly contents are present:
   - Refer to Figure 7.3 on page 67 and Table 7.3 on page 68 to verify plenum parts.
   - If a compressor-section plenum is included, refer to Figure 7.4 on page 69 and Table 7.4 on page 69 to verify plenum parts.
   - Refer to on page 70 to verify EC-fan parts.

Table 7.1 Plenum Assembly Numbers, Plenum Heights, Plenum Weights and Unit Lengths

Plenum Height:	24 in. (610 mm)	30 in. (762 mm)	36 in. (917 mm)
Unit Description	Assembly Number and Weight		
VS105, Unit Length 132 in. (3353 mm)			
Non-grilled plenum, length 105 in. (2673 mm)	311666G1 - 131 lb (59 kg)	311666G2 - 162 lb (74 kg)	311666G3 - 188 lb (85 kg)
Front discharge, length 105 in. (2673 mm)	311776G1 - 206 lb (93 kg)	—	—
Rear discharge, length 105 in. (2673 mm)	31230G1 - 220 lb (100 kg)	—	—
VS053–077, Unit Length 109 in. (2769 mm)/98 in. (2489 mm)			
Non-grilled plenum, length 82 in. (2089 mm)	312208G1 - 112 lb (51 kg)	312208G2 - 136 lb (62 kg)	312208G3 - 156 lb (71 kg)
Front discharge, length 82 in. (2089 mm)	31298G1 - 160 lb (73 kg)	—	—
Rear discharge, length 82 in. (2089 mm)	312411G1 - 173 lb (79 kg)	—	—
VS028–042, Unit Length 73 in. (1854 mm)/86 in. (2184 mm)			

Table 7.1 Plenum Assembly Numbers, Plenum Heights, Plenum Weights and Unit Lengths (continued)

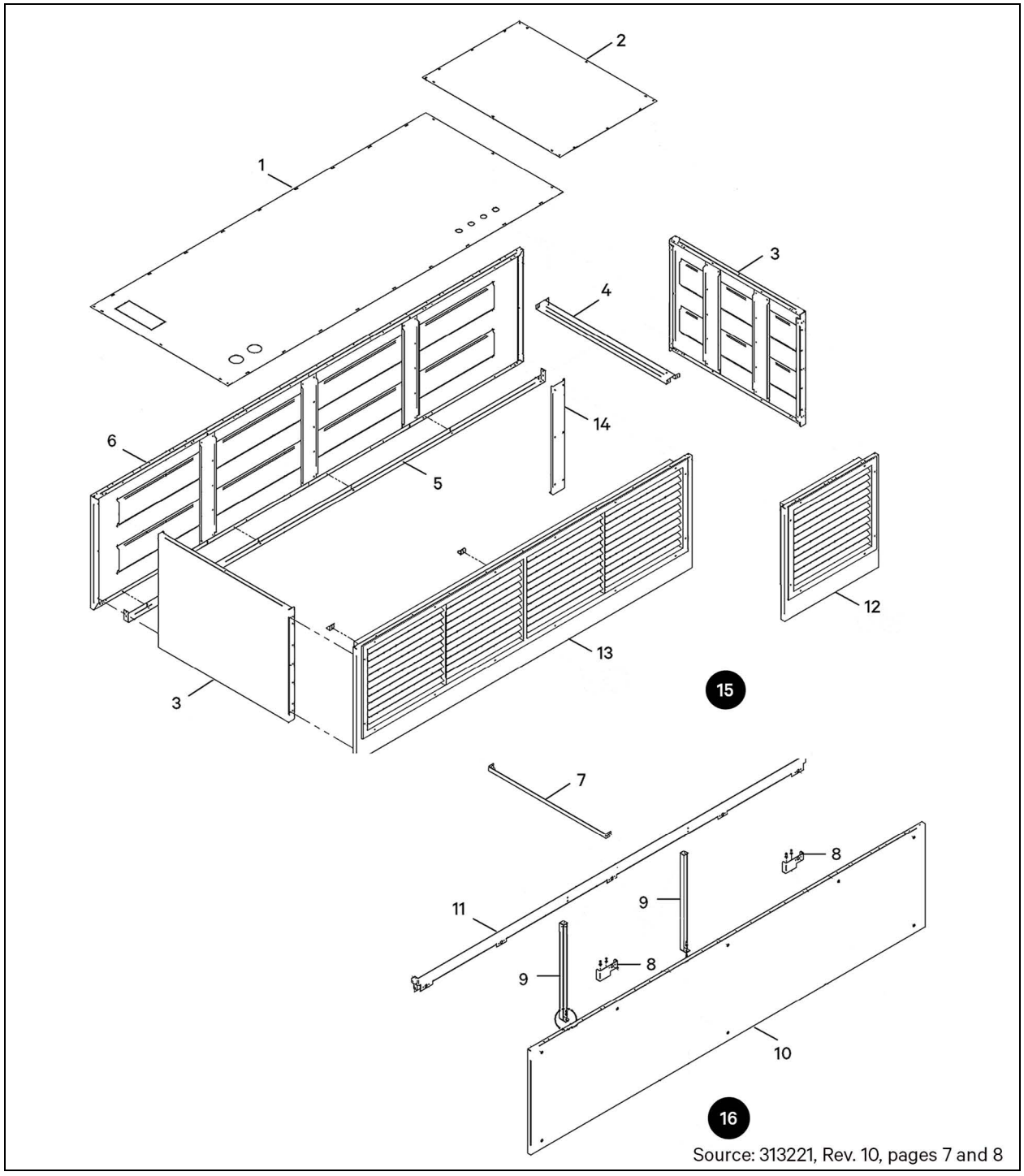
Plenum Height:	24 in. (610 mm)	30 in. (762 mm)	36 in. (917 mm)
Unit Description	Assembly Number and Weight		
Non-grilled plenum, length 59 in. (1505 mm)	313077G1 - 85 lb (39 kg)	313077G2 - 105 lb (48 kg)	313077G3 - 123 lb (56 kg)
Front discharge, length 59 in. (1505 mm)	312980G1 - 126 lb (57 kg)	—	—
Rear discharge, length 59 in. (1505 mm)	313025G1 - 129 lb (59 kg)	—	—

Table 7.2 EC-fan Assembly Numbers, Weights and Voltage

Assembly no. and weight	Fan size (Nominal)	Voltage / kW	Unit Size
312583G1 - 93 lb (42 kg)	20 in. (500 mm)	460 V / 2.5 kW	VS105
312583G2 - 93 lb (42 kg)		208 V / 2.7 kW	VS105
312583G3 - 102 lb (46 kg)	22 in. (560 mm)	460 V / 3.1 kW	VS053 / 070/ 077
312583G4 - 102 lb (46 kg)		208 V / 2.9 kW	
312583G5 - 119 lb (54 kg)	25 in. (630 mm)	460 V / 2.8 kW	VS028 / 035
312583G6 - 119 lb (54 kg)		208 V / 2.9 kW	
312583G7 - 141 lb (64 kg)		460 V / 4.0 kW	VS042

Plenum Parts Identification

Figure 7.3 Plenum Parts Identification



Source: 313221, Rev. 10, pages 7 and 8

NOTE: Not all parts are used in all models:

- **Units shorter than 132 in. (3353 mm) do not include short front and rear grilled panels or channel panels.**
- **Only non-grilled plenums on 132 in. (3353 mm) units include a plenum brace.**
- **Units shorter than 132 in. (3353 mm) have only 1 top panel (with holes).**
- **Front-discharge units do not include a top frame or channel frames. 86 in. (2184 mm) and 73 in. (1854 mm) units do not include channel frames or panel-mounting brackets.**

Table 7.3 Plenum Parts and Quantities

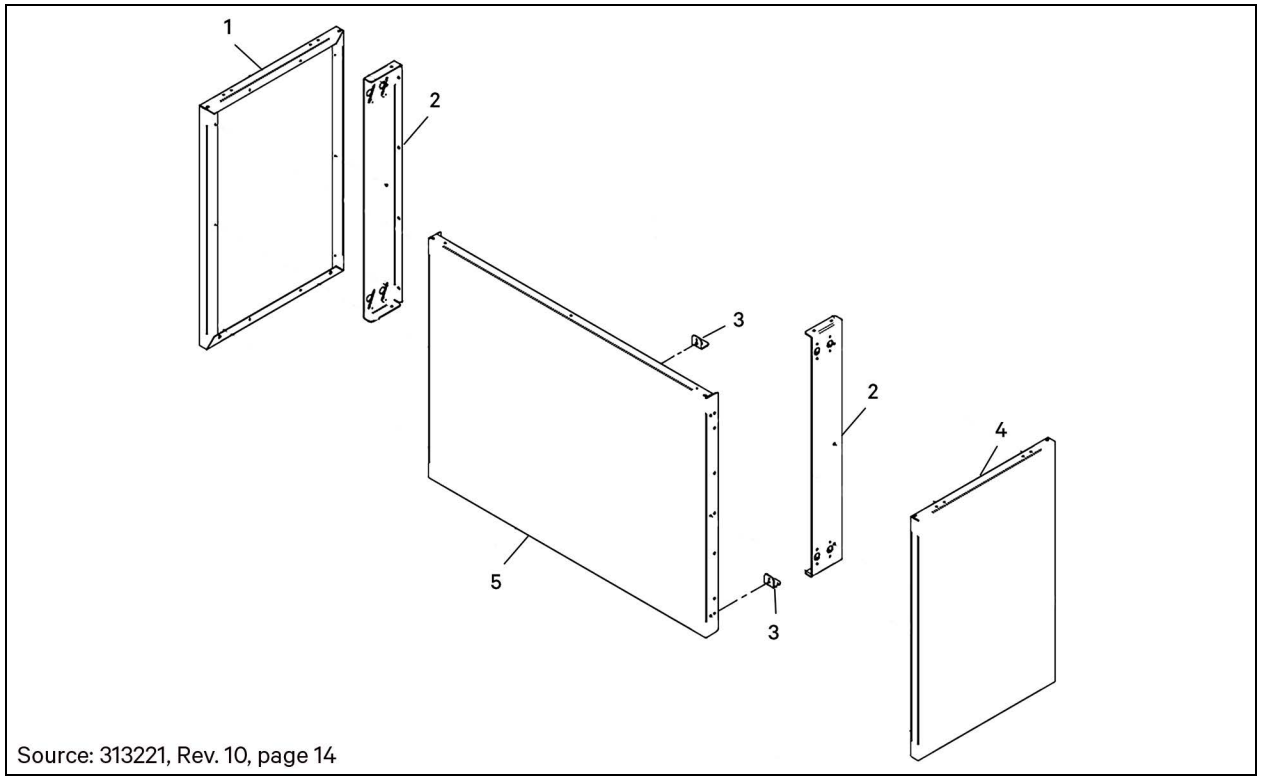
Item	Description	Quantity
1	Top panel (with holes)	1
2	Top panel (plain)	1
3	Side panel	2
4	Top-panel brace (Non-grilled plenum)	1
5	Angle bracket, 59 in. - 105 in.	1
6	Front/Rear solid panel	1
7	Top-panel brace (Rear-discharge plenum)	1
8	Panel mounting bracket	1 or 2
9	Channel frame	varies
10	Front solid panel	1
11	Top frame	1
12	Short front grilled panel	1
13	Front grilled panel	1
14	Channel panel	1 or 2
15	Assembly view of long and short front/rear grilled panels	N/A
16	Assembly view of front solid panel.	N/A
Not shown	Angle bracket	varies
Not shown	Washer 1/4	varies
Not shown	Bolt 1/4-20 x 1	varies
Not shown	Sheet-metal screw #8-18 x 1/2	varies
Not shown	Insulation tape	varies

Compressor Plenum Parts Identification

Table 7.4 Compressor Plenum Assembly Numbers, Weights and Size

Assembly No. and Weight	Plenum Size, in. (mm)
313202G1 - 33 lb (15 kg)	26 x 24 (660 x 610)
313202G2 - 37 lb (17 kg)	26 x 30 (660 x 762)
313202G3 - 42 lb (19 kg)	26 x 36 (660 x 914)
313202G4 - 26 lb (12 kg)	15 x 24 (381 x 610)
313202G5 - 29 lb (13 kg)	15 x 30 (381 x 762)
313202G6 - 31 lb (14 kg)	15 x 36 (381 x 914)
313202G7 - 24 lb (11 kg)	13 x 24 (330 x 610)
313202G8 - 26 lb (12 kg)	13 x 30 (330 x 762)
313202G9 - 29 lb (13 kg)	13 x 36 (330 x 914)
313202G10 - 27 lb (11 kg)	17 x 24 (432 x 610)
313202G11 - 30 lb (14 kg)	17 x 30 (432 x 762)
313202G12 - 33 lb (15 kg)	17 x 36 (432 x 914)

Figure 7.4 Compressor Plenum Parts Identification



Source: 313221, Rev. 10, page 14

NOTE: Not all parts are used in all plenum sizes: 26 in. (660 mm) wide compressor plenums include 3 angle-mounting brackets and a front panel with quarter-turn fasteners.

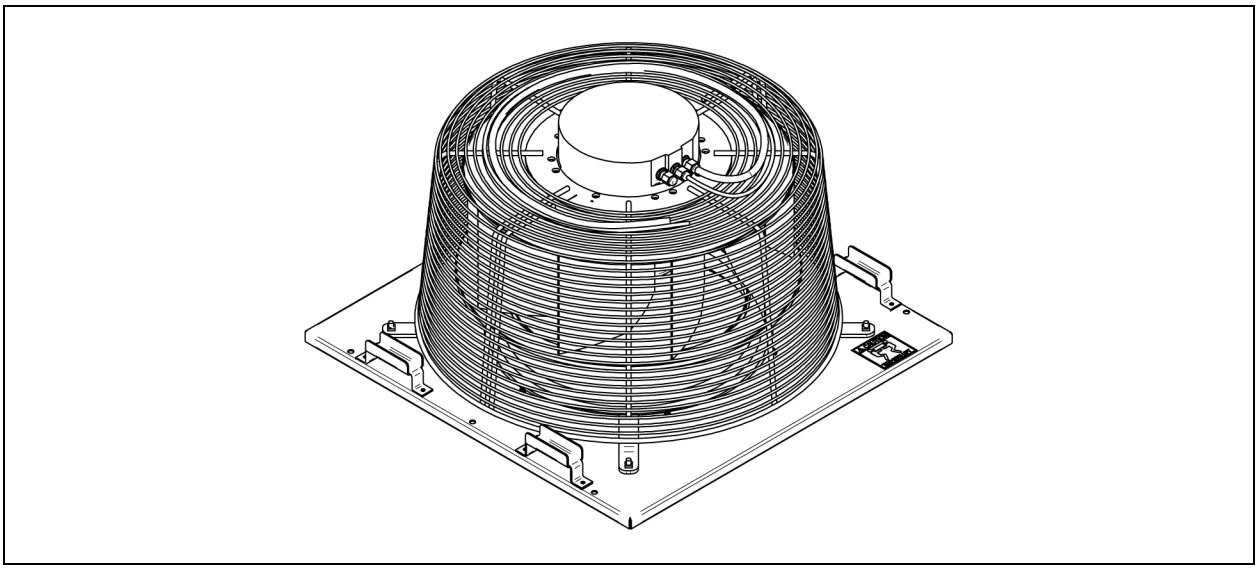
NOTE: Compressor plenums shorter than 26 in. (660 mm) include 2 angle mounting brackets and do not include a front panel with quarter-turn fasteners.

Table 7.5 Compressor plenum parts and quantities

Item	Description	Quantity
1	Front/Rear panel	1 or 2
2	Angle-mounting channel	2 or 3
3	Angle-mounting bracket	2
4	Front panel with quarter-turn fasteners	1
5	Side panel	1
Not shown	Sheet-metal screw	varies

EC Fan Parts Identification

Figure 7.5 EC Fan Assembly



Item	Description	Quantity
Not shown	Washer	6
Not shown	Bolt	6
Not shown	Spacer	6

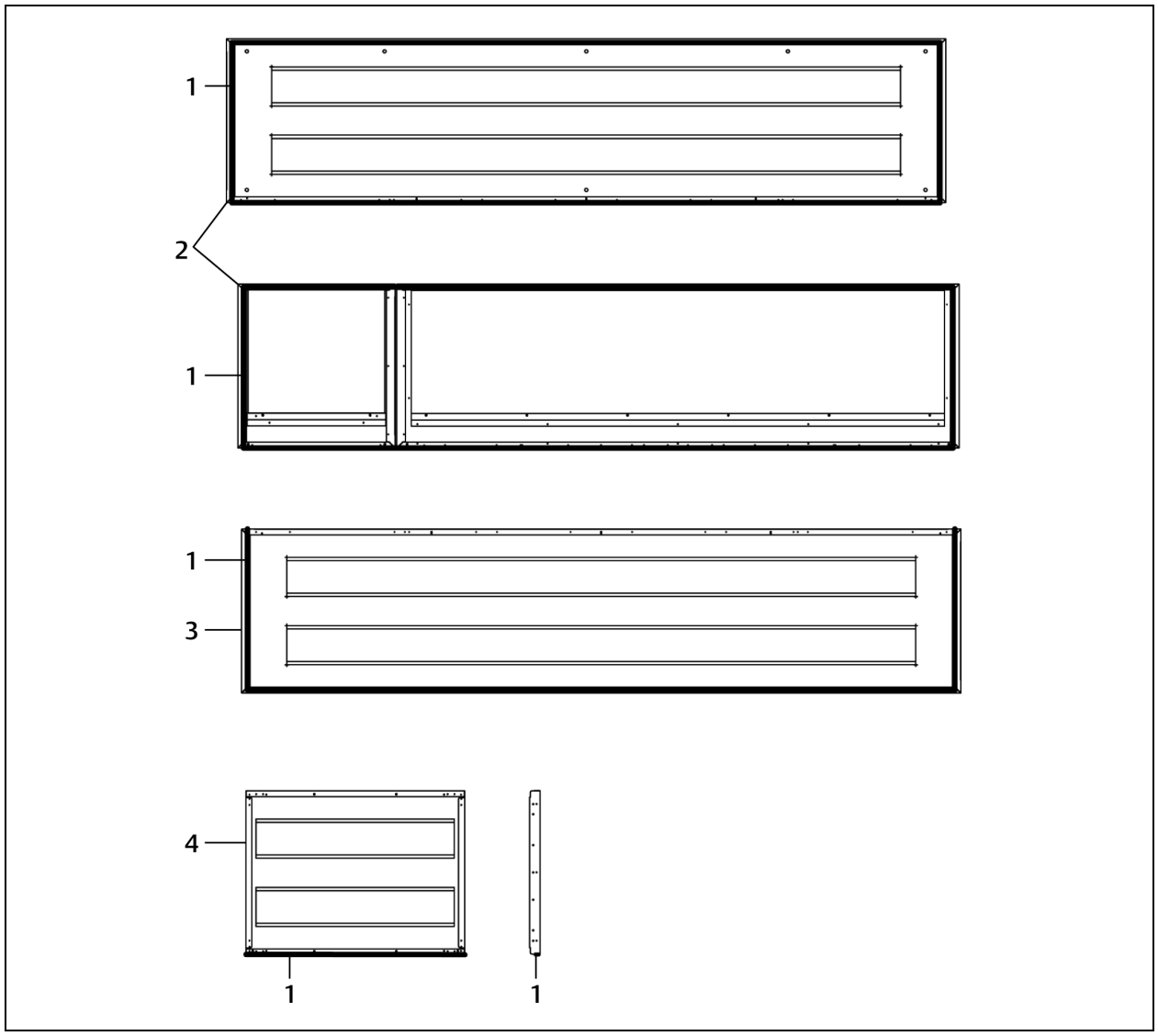
7.2.2 Assemble Plenum Rear and Side Panels

NOTE: Grilles can be installed on different sides of the plenum depending on discharge configuration. Verify grill location and install according to facility-layout plans.

NOTE: Electrical connections and some piping connections are made through the plenum. Plan accordingly.

1. Apply factory-supplied gasket/insulation tape to plenum panels, see Figure 7.6 on the next page:
   - On front solid panels install the gasketing on the inner edge of the sides, and along the top and bottom edges.
   - On front and rear grilled panels, install the gasketing on the inner edge of the sides, and along the top and bottom edges, except on 105 in. (2673 mm) plenums, do not install gasketing along the edges where the short and long panel connect.
   - On rear solid panels, install the gasketing on the inner edge of the sides and along the bottom edge only.
   - On side panels, install the gasketing along the bottom edge.

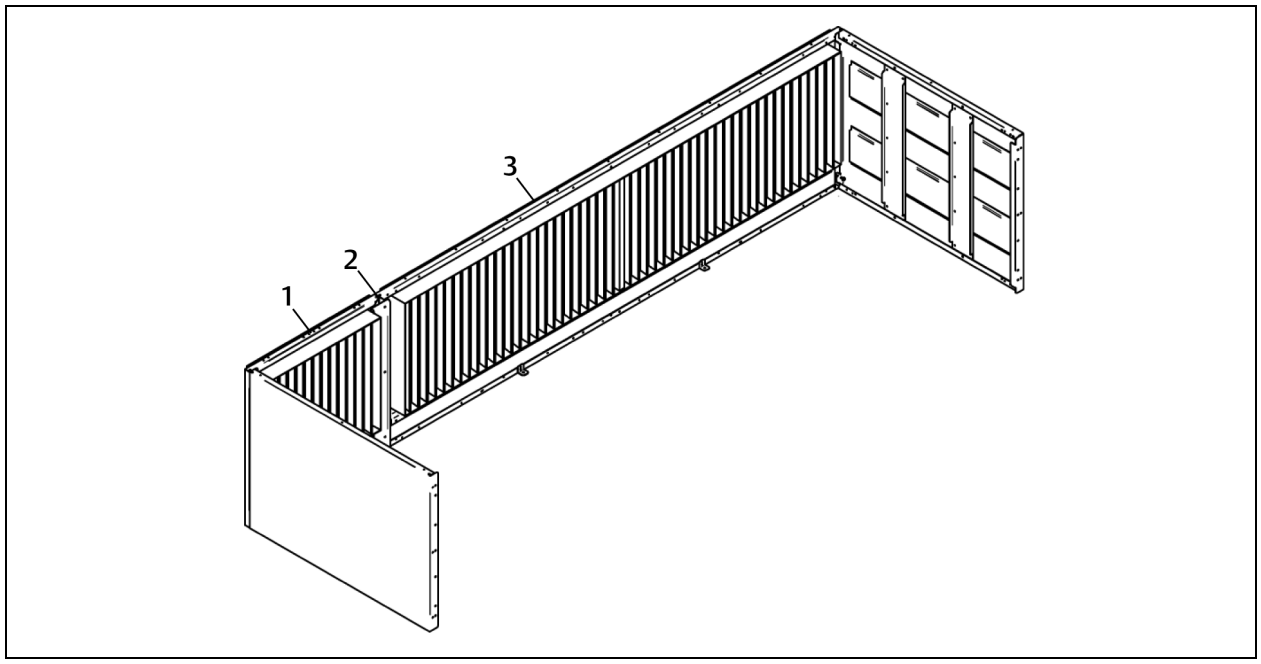
Figure 7.6 Apply Gasket/Insulation Tape



Item	Description
1	Gasketing/Insulation tape
2	Front solid panel, Front and Rear grilled panels
3	Rear solid panel
4	Side panel

2. If assembling a solid rear plenum or a grilled rear plenum shorter than 105 in. (2673 mm), skip to step 3 .
   – or –
   If assembling a 105 in. (2676 mm) grilled, rear plenum, attach the long and short panel together using the channel panel and sheet-metal screws as shown in Figure 7.7 below.

Figure 7.7 105-in. Grilled Rear Panel Assembly

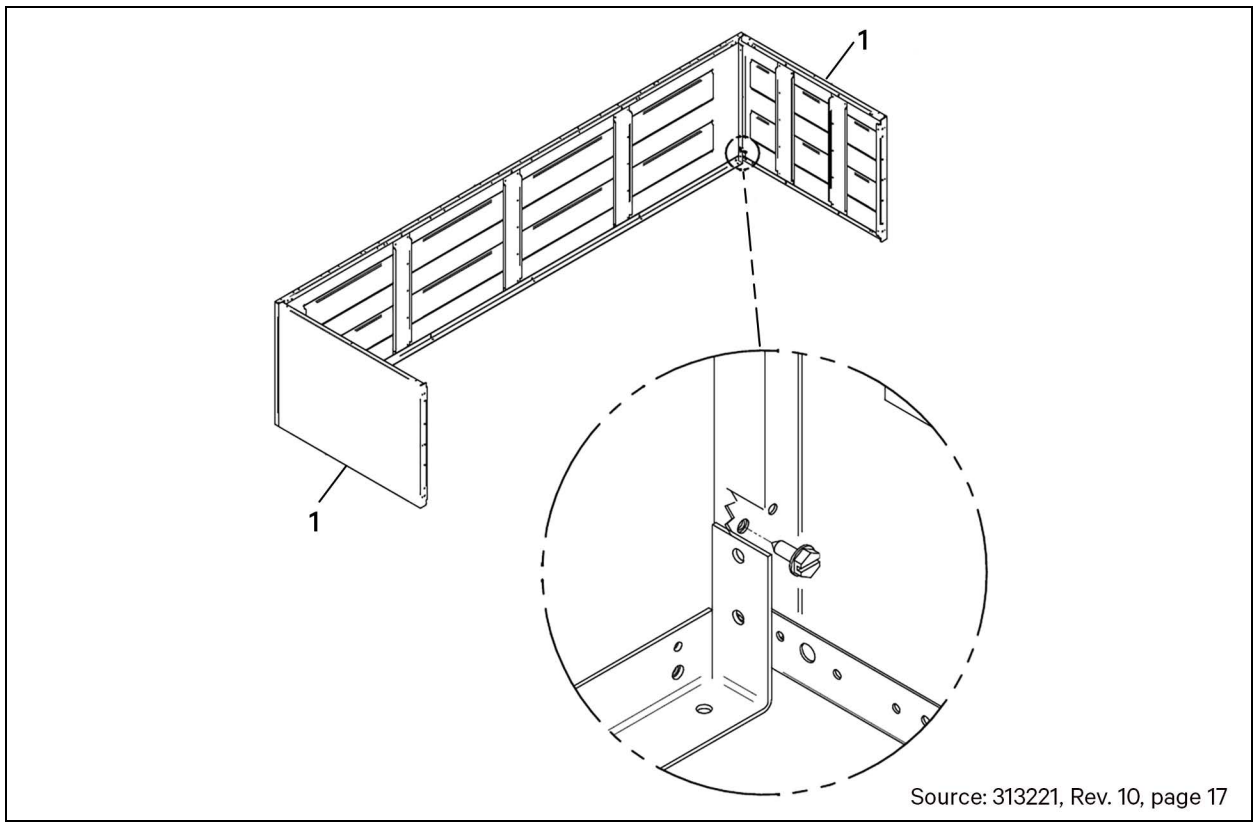


Item	Description
1	Short rear panel
2	Channel panel
3	Long rear panel

3. Attach the 2 side panels to each end of the rear-panel assembly using 10 sheet-metal screws as shown in **Figure 7.8** below.

NOTE: Figure 7.8 below, shows a non-grilled rear plenum as an example. If your unit is rear-discharge, the rear plenum panels have grilles.

Figure 7.8 Attach Side Panels to Rear Panel



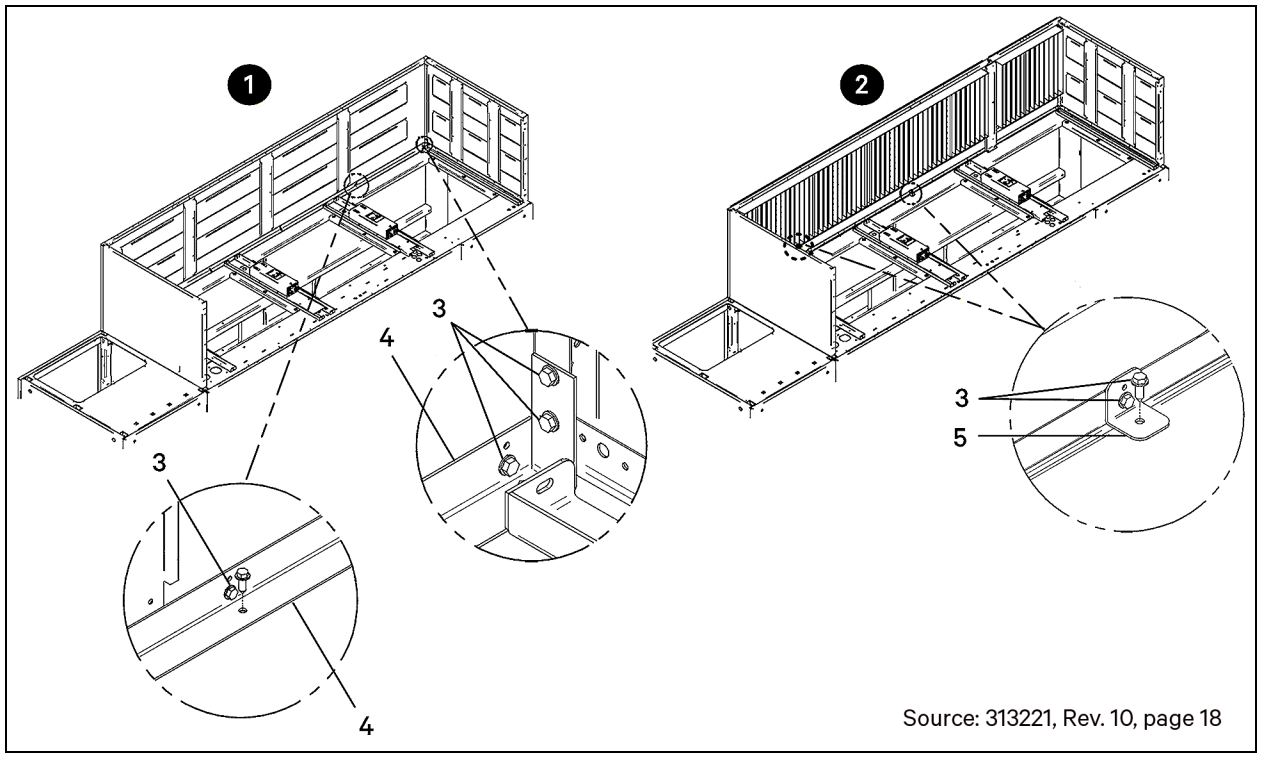
Source: 313221, Rev. 10, page 17

Item	Description
1	Side panel

7.2.3 Place Assembled Panels and EC Fans on Top of Unit

1. Lift the assembled plenum panels and place on top of the unit, Figure 7.9 below.
2. If assembling a solid rear plenum or a grilled rear plenum shorter than 105 in. (2673 mm), attach the rear-panel assembly using the angle bracket as shown in Figure 7.9 below.
   – or –
   If assembling a 105 in. (2676 mm) grilled, attach the rear-panel assembly using two angle brackets and sheet-metal screws as shown in Figure 7.9 below.

Figure 7.9 Rear Panel Assembly Attached to Top of Unit

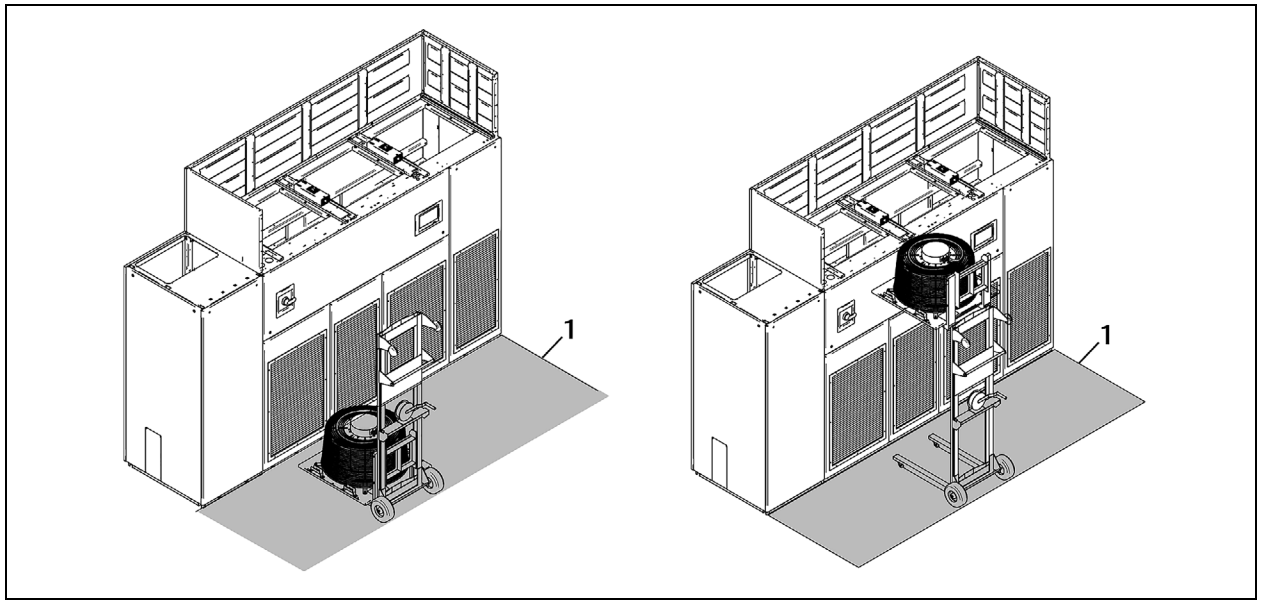


Source: 313221, Rev. 10, page 18

Item	Description
1	Solid rear-panel attachment
2	Grilled rear-panel attachment
3	Sheet-metal screw
4	Angle bracket, 59-in. – 105-in.
5	Angle bracket

3. Refer to Figure 7.10 below, for the recommended clearance from bottom of the unit to the top of the plenum for access to install the fan(s).
    - Place an EC-fan assembly on the lifting device.
      (Figure 7.10 below, shows a duct lift as one option to lift the EC-fan assembly.)
    - Position the lifting device so that it lines-up with the installation location of the EC-fan assembly.
    - Use the device to lift the EC-fan assembly just above the top of the unit.

Figure 7.10 EC Fan Assembly Positioned for Lifting

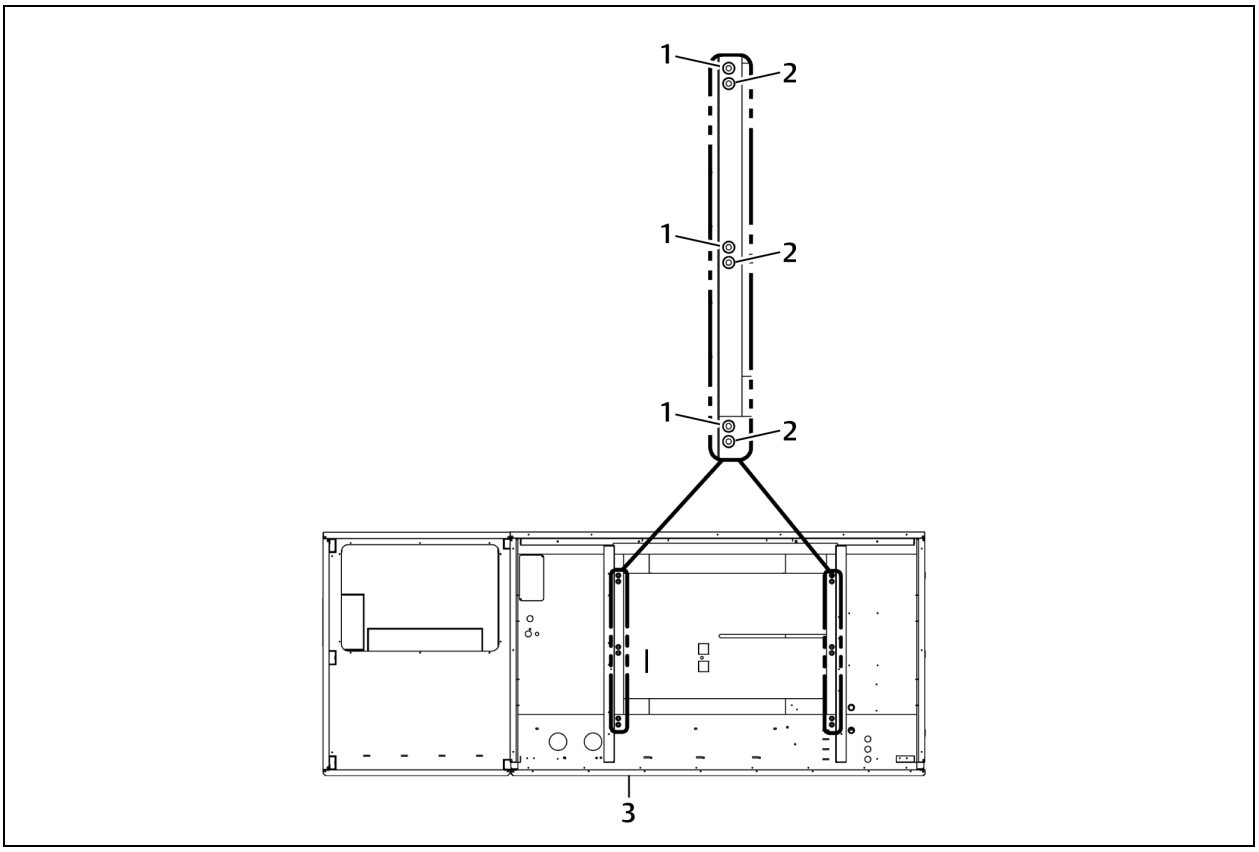


Item	Description
1	Access clearance area of 36 in. (914 mm) from top to bottom of unit

4. Using the handles on the EC-fan assembly, carefully lift the assembly over the hinge along the top of the unit, and slide the assembly onto the top of the unit.
5. Align the mounting holes on the base of the assembly with the threaded holes on top of the unit depending on the size of the unit:
    - For all unit sizes except for 73 in. and 85 in. single-fan units, skip to step 7 .
    - For 73 in. and 85 in. single-fan units, continue with step 6 .

6. Refer to Figure 7.11 below. The single-fan 73-in. and 85-in. units have 2 sets of mounting holes depending on discharge direction:
   - On rear-discharge plenums, align the mounting holes on the EC-fan assembly with threaded holes on the unit labeled 2 in Figure 7.11 below.
   - On top-discharge and front-discharge plenums, align the mounting holes with the threaded holes on the unit labeled 1 in Figure 7.11 below.

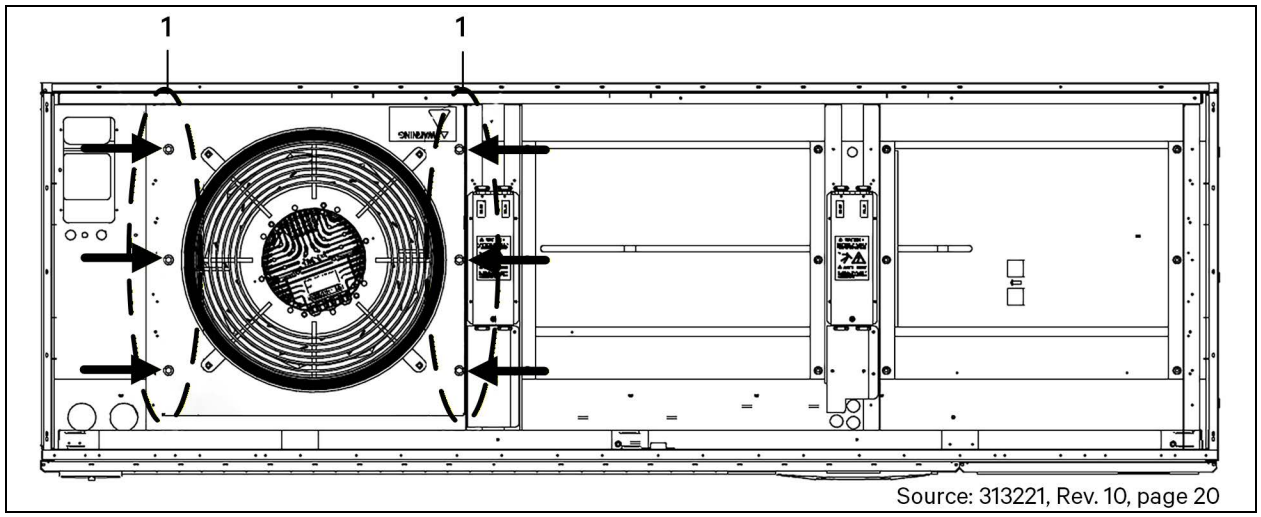
Figure 7.11 EC Fan mounting Hole Alignment for 73 in. and 85 in. Units



Item	Description
1	Threaded mounting holes for top-discharge and front-discharge plenums.
2	Threaded mounting holes for rear-discharge plenums.
3	Front of the unit.

7. Align the mounting holes on the base of the assembly with the threaded holes on top of the unit, Figure 7.12 below.

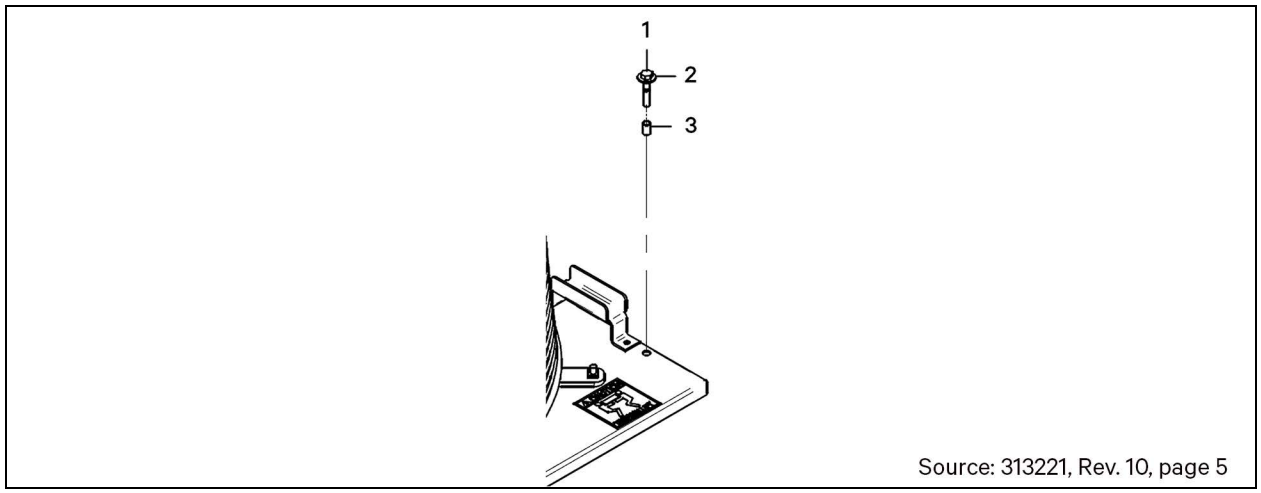
Figure 7.12 Assembly in Place on the Unit



Item	Description
1	Mounting holes

8. Use the bolts, washers and spacers, Figure 7.13 below, to attach the assembly to the unit.
9. Repeat steps 3 to 8 for each EC-fan assembly.

Figure 7.13 Attach EC Fan Assembly to Top of Unit (6 Places)



Item	Description
1	Bolt
2	Washer
3	Spacer

7.2.4 Wire the EC Fans

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.

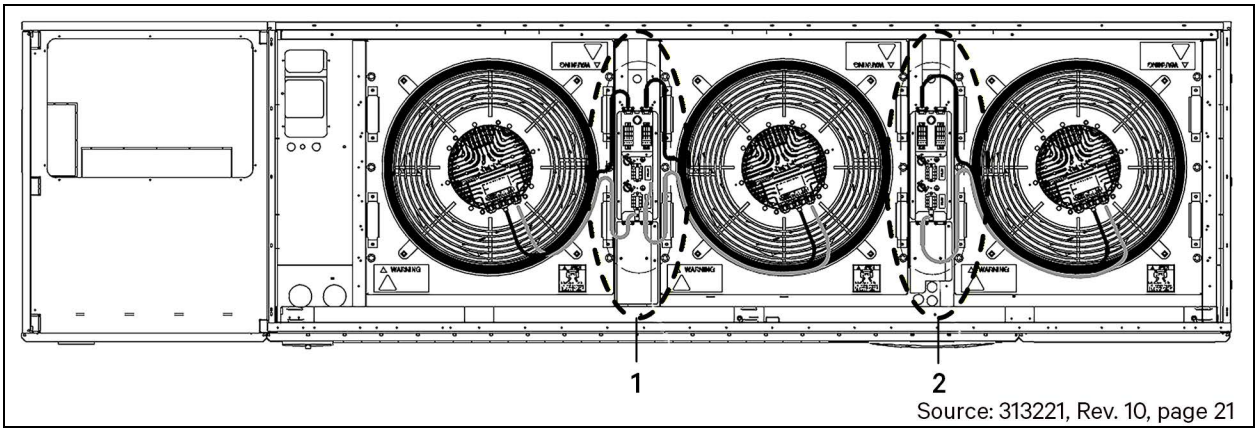
Black-sleeved harness contains fan-control wires. Grey-sleeved harness contains motor high-volt connection.

1. Refer to Figure 7.14 below, Figure 7.15 on the next page, and Figure 7.16 on page 81, to route the wire harnesses and insert them into the indicated openings on the junction boxes.
   - You may need to remove existing wire ties that hold the harness to the fan cage.

NOTE: Do not route the wiring over the handles on the EC-fan assembly.

2. Connect the wires inside the junction box:
   - Between fan 1 and 2 on 2- and 3-fan units, refer to Figure 7.15 on the next page.
   - On single-fan or fan 3 of 3-fan units, refer to Figure 7.16 on page 81.
3. Use provided wire ties to secure the wire harnesses to the fan cage to prevent harness movement when fans are running.

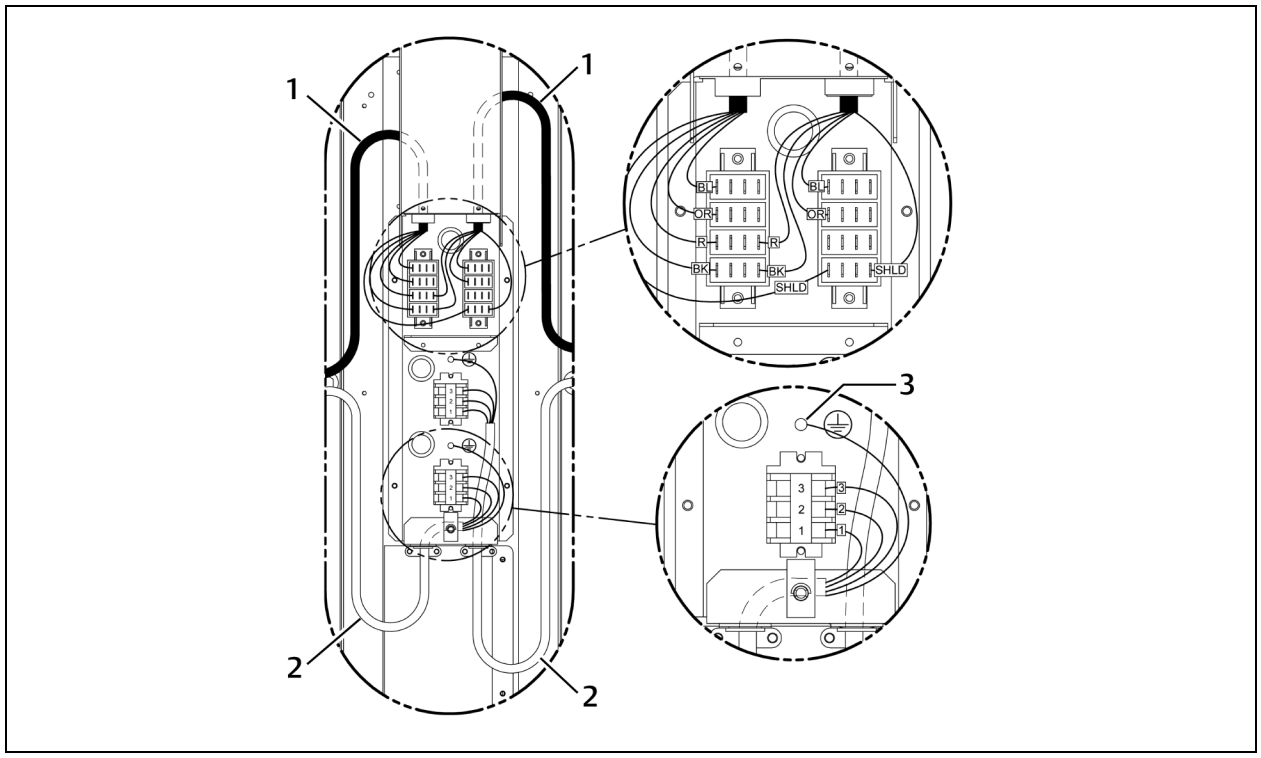
Figure 7.14 EC Fan Junction Boxes



Source: 313221, Rev. 10, page 21

Item	Description
1	Junction box between fans 1 and 2 on 2- and 3-fan unit
2	Junction box for 1- or 3-fan unit

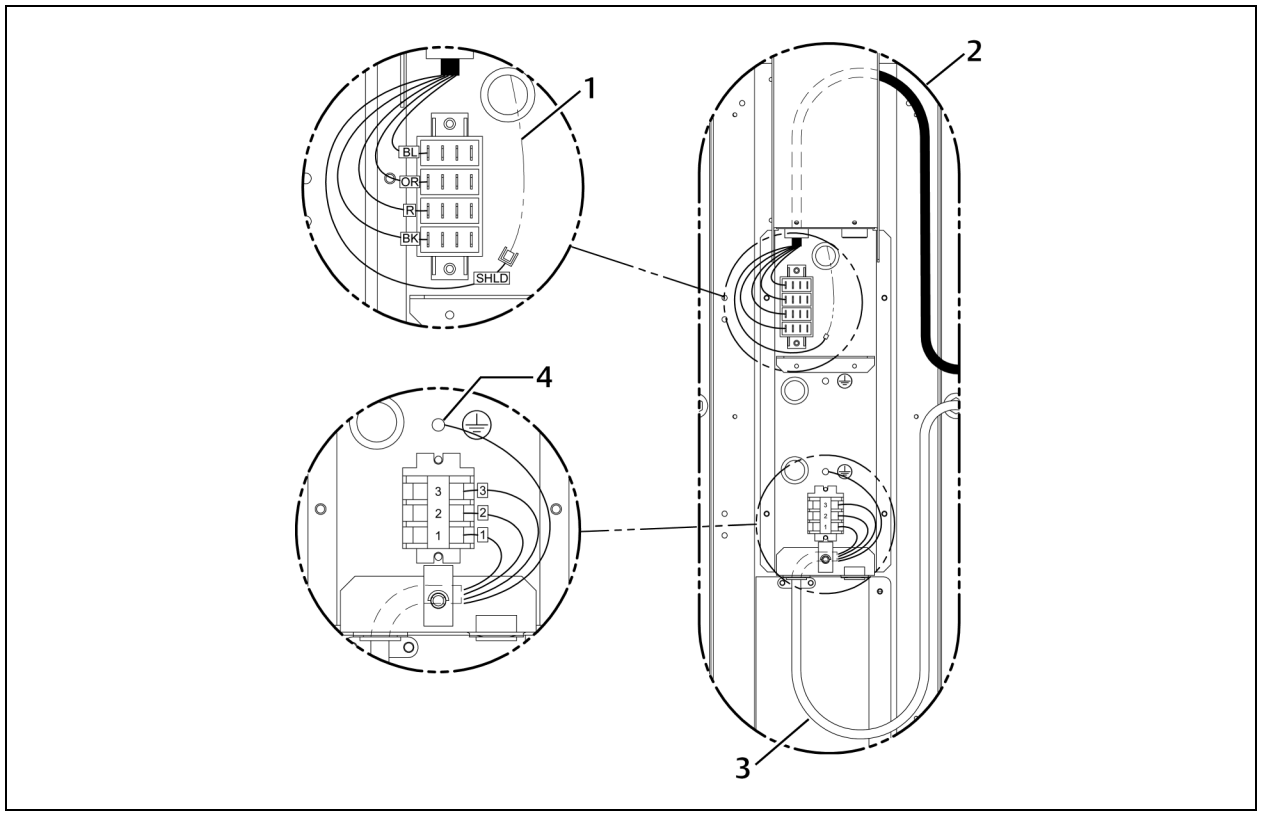
Figure 7.15 Junction Box between Fans 1 and 2



NOTE: For the high-volt terminal blocks, the wire-termination torque is 16-20 in-lbs.

Item	Description
1	Fan (low-volt) wiring
2	Motor (high-volt) wiring
3	Green/Yellow ground wire

Figure 7.16 Junction Box for Single Fan or Fan 3



NOTE: For the high-volt terminal blocks, the wire-termination torque is 16-20 in lbs.

Item	Description
1	SHLD wire from unit harness
2	Fan (low-volt) wiring
3	Motor (high-volt) wiring
4	Green/Yellow ground wire

7.2.5 Install Front Panels on Plenum

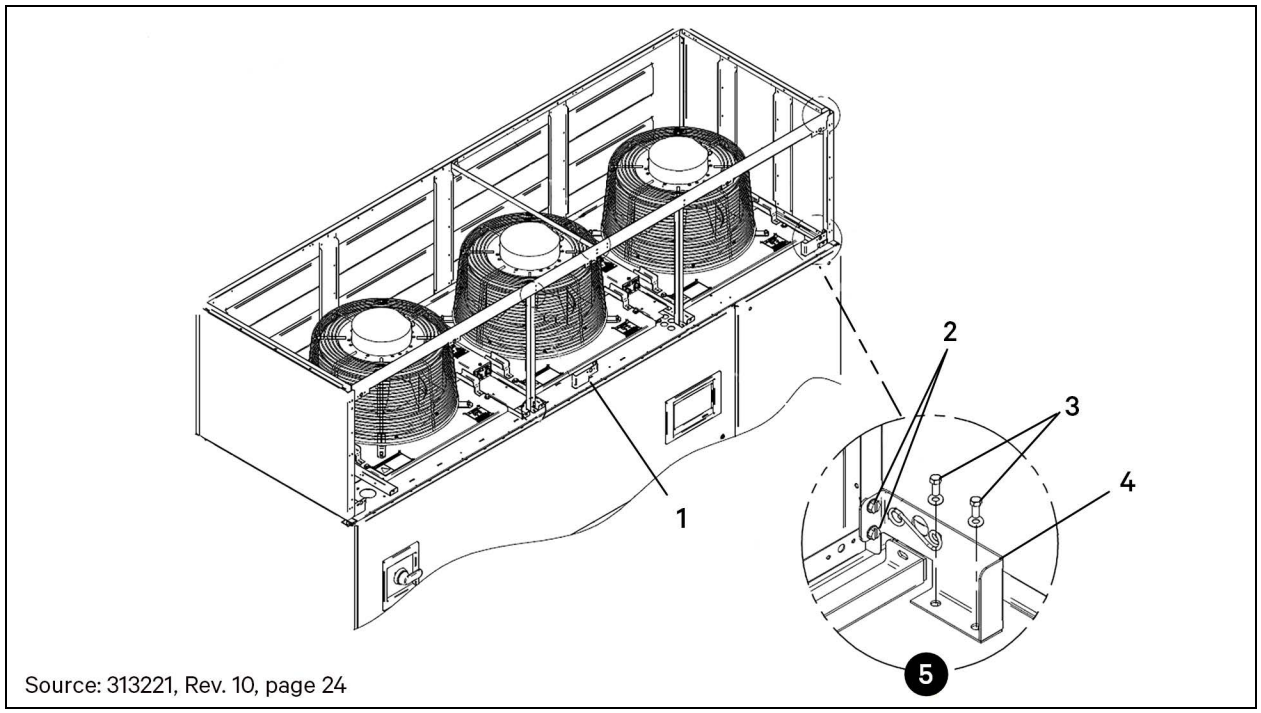
Non-grilled plenum front panels require assembly and attachment before mounting the panels, see Non-Grilled and Rear Discharge Front Panel Assembly on the next page.

Grilled plenums do not require a frame assembly, see Front Discharge Front Panel Assembly on page 89.

Non-Grilled and Rear Discharge Front Panel Assembly

1. Attach the panel-mounting bracket(s), Figure 7.17 below:
   - Attach the right-side panel-mounting bracket to the top of the unit using 2 bolts and 2 washers and to the side panel using 2 sheet-metal screws as shown in the detail view in Figure 7.17 below.
   - If a second panel-mounting bracket is included, attach in the center location using 2 bolts and 2 washers.

Figure 7.17 Panel Mounting Bracket Attachment



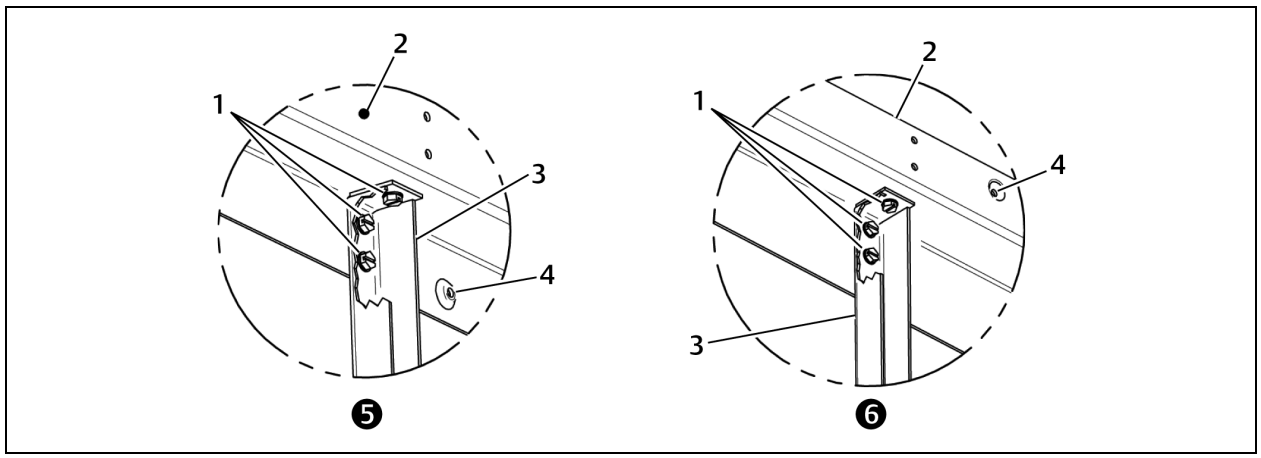
Source: 313221, Rev. 10, page 24

Item	Description
1	Panel mounting bracket
2	Sheet-metal screws
3	Bolt and Washer
4	Panel mounting bracket
5	Detail view of right-side bracket installation. Shown from inside the plenum.

2. Attach the channel frame(s) to the top frame using 3 sheet-metal screws:
   - For non-grilled plenums, make sure the dimple shown in Figure 7.18 below, is on the bottom flange of the top frame.
   - For rear-discharge plenums, make sure the dimple shown in Figure 7.18 below, is on the top flange of the top frame.

NOTE: The number of channel frames varies depending on the size of plenum.

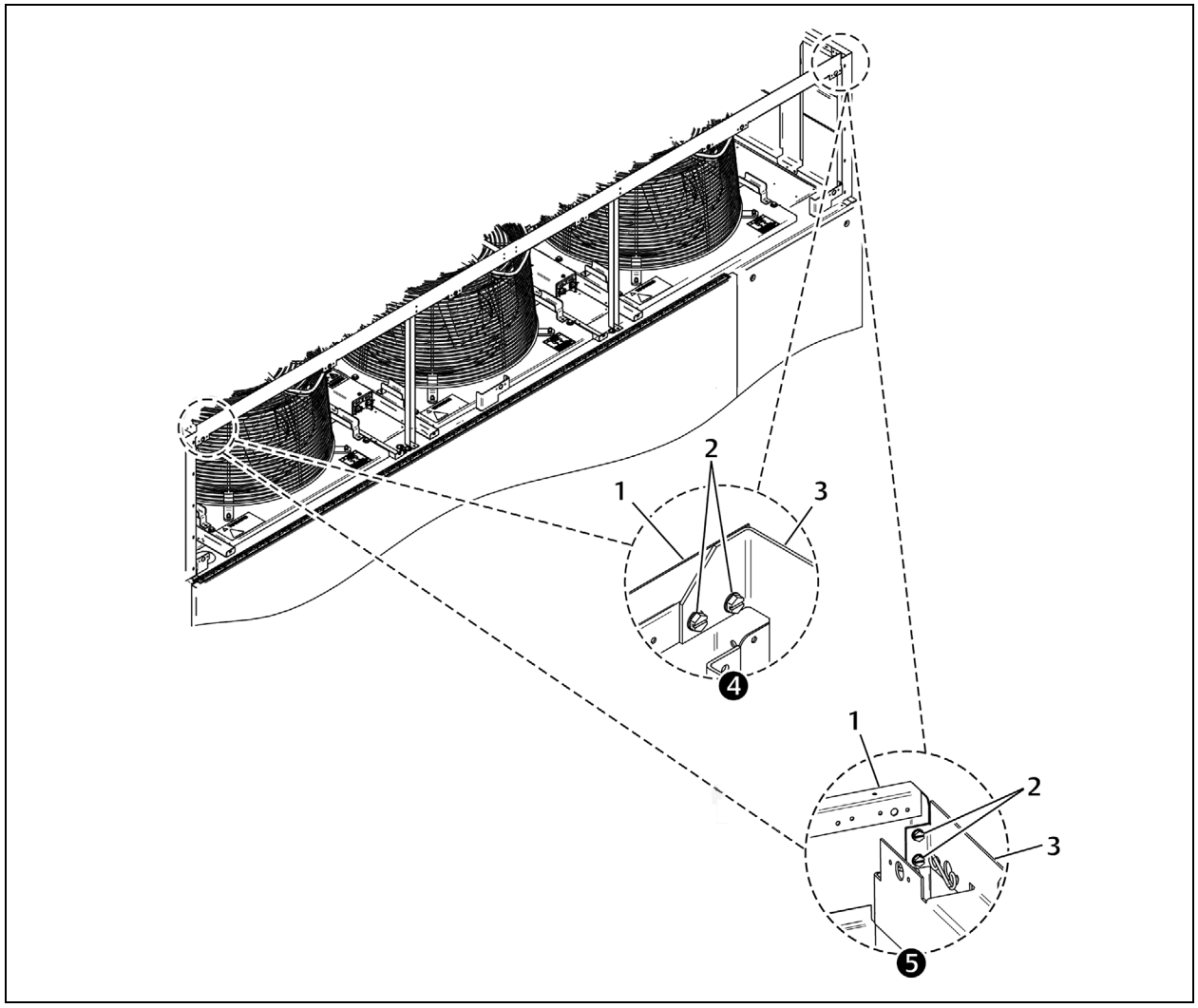
Figure 7.18 Channel Frame Top Attachment



Item	Description
1	Sheet-metal screws
2	Top frame
3	Channel frame
4	Dimple
5	Attachment on non-grilled plenum. Shown from bottom.
6	Attachment on rear-discharge plenum. Shown from bottom.

3. Attach the assembled top/channel frame to the side panels on top of the unit:
   - For non-grilled plenums, refer to Figure 7.19 below. and use 2 sheet-metal screws on each end.
   - For rear-discharge, refer to Figure 7.19 below, and attach the smaller flange to the side panel using 2 sheet-metal screws on each end.

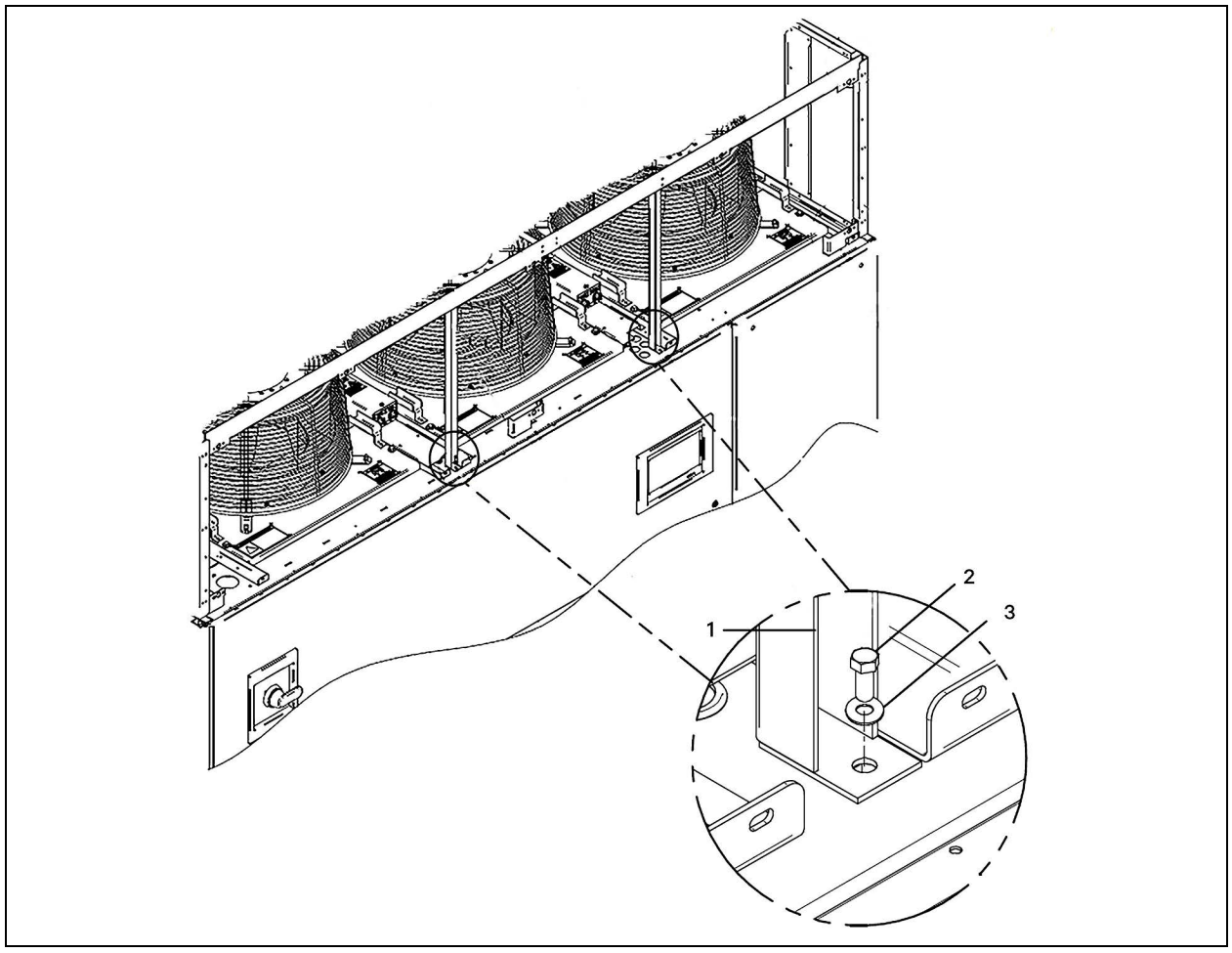
Figure 7.19 Top Frame Attachment to Sides



Item	Description
1	Side panel
2	Sheet-metal screws
3	Top frame
4	Attachment for non-grilled plenums. Shown from inside the plenum.
5	Attachment for rear-discharge plenum. Shown from inside the plenum.

4. Attach the bottom of the channel frame(s) to the top of the unit using 1 washer and 1 bolt for each, Figure 7.20 below.

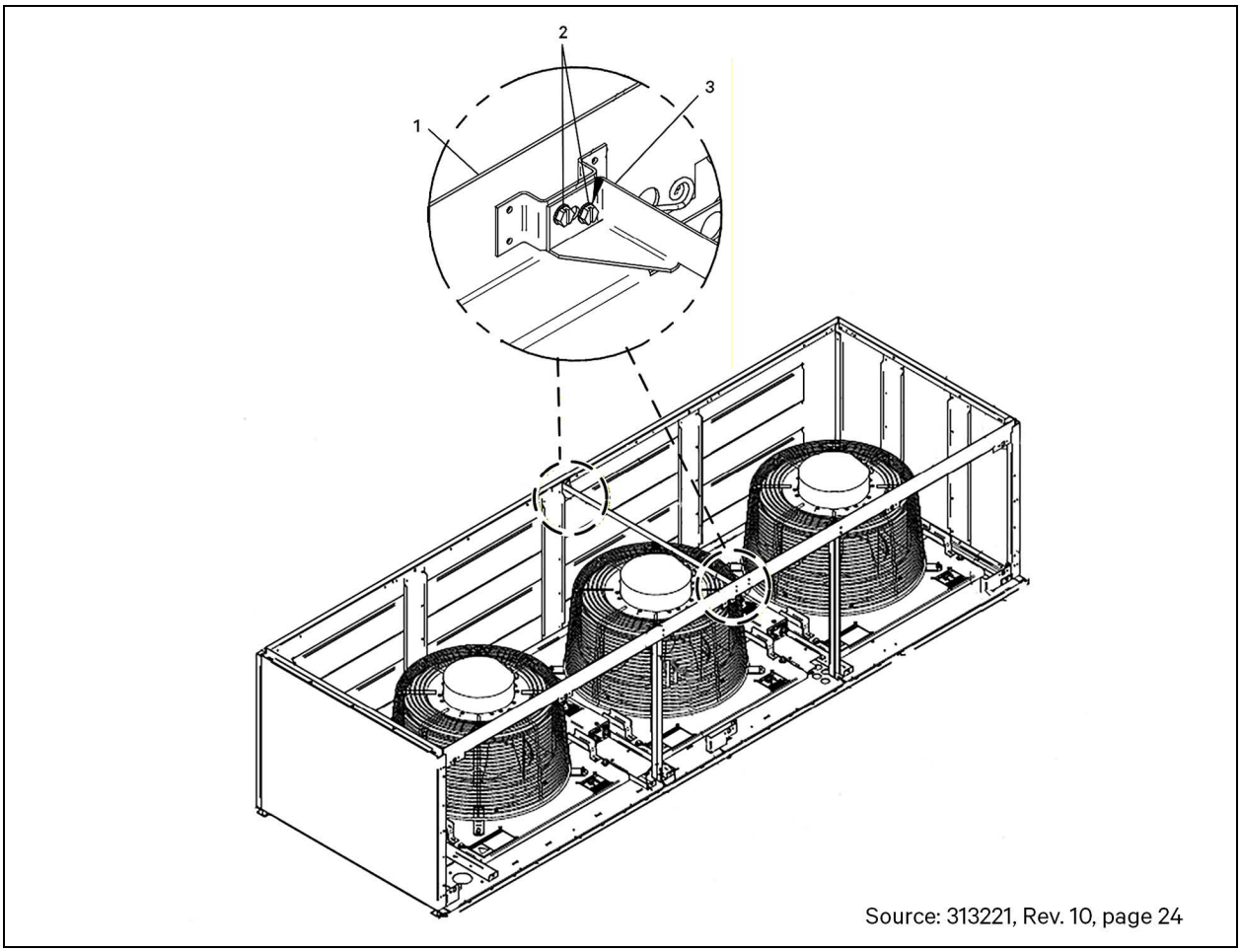
Figure 7.20 Channel Frame Bottom Attachment



Item	Description
1	Channel frame
2	Bolt
3	Washer

5. For non-grilled plenums, refer to Figure 7.21 below, and attach the plenum brace to the top frame and the rear panel using 2 sheet-metal screws on each end.

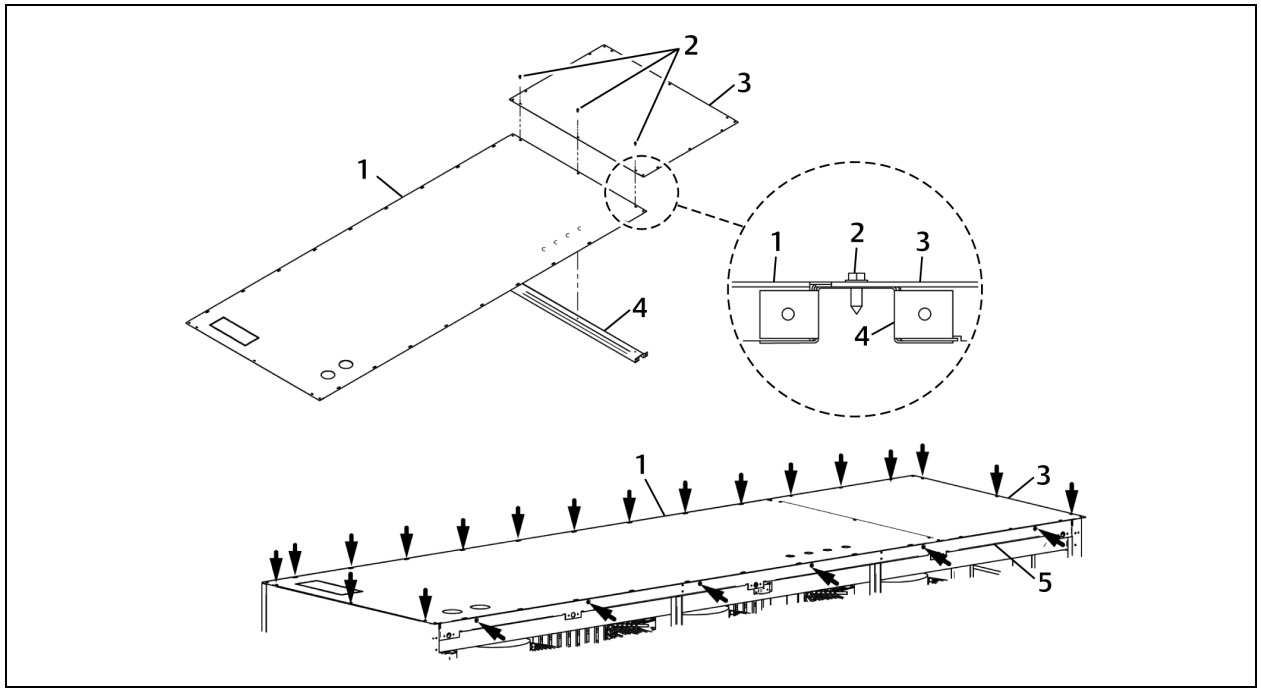
Figure 7.21 Non-Grilled Plenum Plenum-Brace Attachment



Item	Description
1	Top frame on front of plenum. Shown from inside.
2	Sheet-metal screws
3	Plenum brace

6. For non-grilled plenums, skip to step 7 .
   – or –
   For rear-discharge plenums, assemble and attach the top panels:
   - If a top-panel brace and plain top panel is included, attach them to the top panel with holes using 3 sheet-metal screws as shown in Figure 7.22 below.
   - Attach the top panel to the side and rear panels using 18 sheet-metal screws, Figure 7.22 below.
   - Attach the top panel to the top frame using 6 sheet-metal screws, Figure 7.22 below.

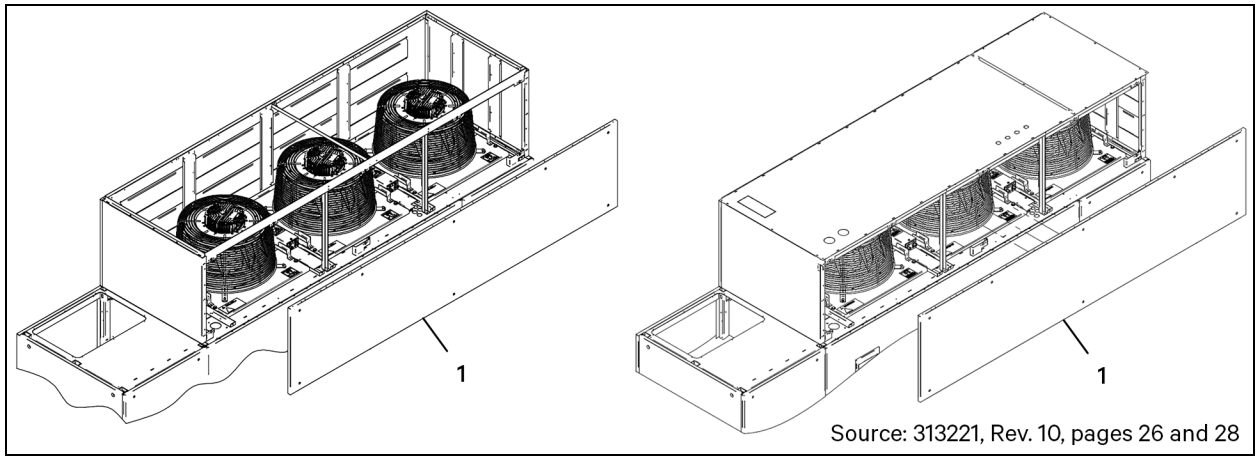
Figure 7.22 Rear Discharge Top Panel Assembly and Attachment



Item	Description
1	Top panel (with holes)
2	Sheet-metal screws
3	Top panel (plain)
4	Top-panel brace
5	Top frame

7. Attach the solid front panel using the quarter-turn fasteners in the panels, Figure 7.23 below.

Figure 7.23 Front Panel Attachment

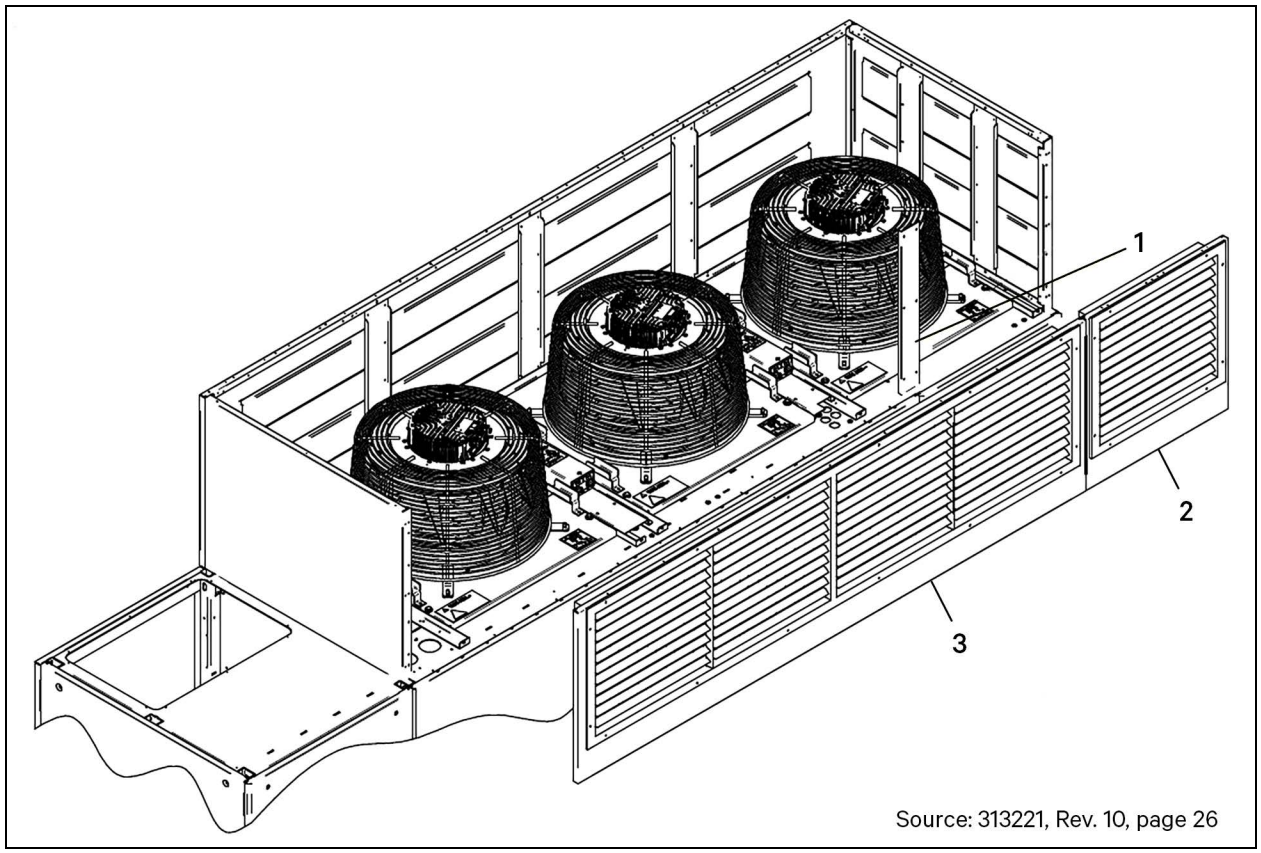


Item	Description
1	Front panel

Front Discharge Front Panel Assembly

1. Using the channel panel and 10 sheet-metal screws, attach the grilled front panel and the short, grilled front panel, Figure 7.24 below.
2. Attach the assembled front panels to the plenum sides using 10 sheet-metal screws, 5 on each end.

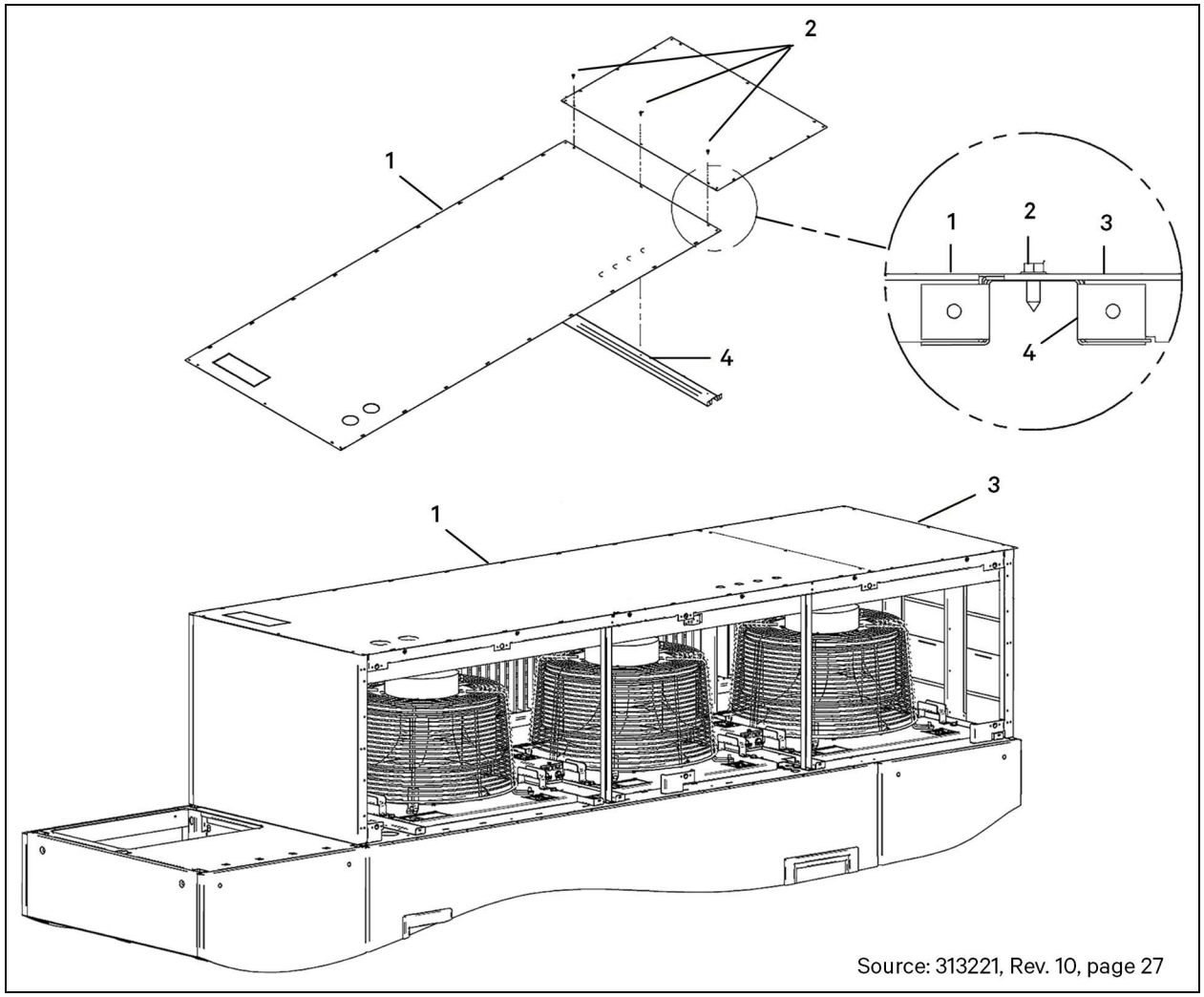
Figure 7.24 Front Discharge Front Panel Attachment



Item	Description
1	Channel panel
2	Short front panel
3	Front panel

3. Assemble and attach the top panels:
    - If a top-panel brace and plain top panel is included, attach them to the top panel with holes using 3 sheet-metal screws as shown in Figure 7.24 on the previous page.
    - Attach the top panel and to top of the plenum assembly using 39 sheet-metal screws, Figure 7.25 below.

Figure 7.25 Front Discharge Top Panel Assembly and Attachment



Item	Description
1	Top panel (with holes)
2	Sheet-metal screws
3	Top panel (plain)
4	Top-panel brace

8 Checklist for Completed Installation

8.1 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.
4. If equipment has been disassembled for installation, unit must be reassembled per instructions.

8.2 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. For upflow units only: Field installed low-voltage wiring routed with loop to allow electric box to swing.
11. Check for loose electrical connections on steam generating humidifier. Confirm that electrode plugs are pressed firmly onto the electrode pins.

8.3 Piping Installation Checks

1. Piping completed to refrigerant or 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 Additional Oil Requirements for Digital Scroll Compressors on page 45.
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 that factory clamps have been reinstalled.
7. Drain line connected, not obstructed, and pitched per local code.
8. Water supply line connected to humidifier and not leaking.
9. Condensate drain line piping has no leaks or visible damage.

8.4 Other Installation Checks

1. Ducting or plenum assembly 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. Compressor shipping blocks removed and springs adjusted.
7. Blower drive system rotates freely and belts are properly aligned and tensioned.
8. All fans are free of debris.
9. Remove rubber band from float in optional humidifier.
10. Seal openings around piping and electrical connections.
11. Installation materials and tools have been removed from equipment (literature, shipping materials, construction materials, tools, etc.).
12. Review and complete installation checklists for heat-rejection units (condensers/drycoolers), if included.
13. Locate blank start-up sheet, ready for completion by installer or start-up technician.

8.5 Refrigerant Leak Mitigation

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

Table 8.1 Fan Speed Setting for Refrigerant Leak Mitigation

Unit	Cooling Type	Qmin Mitigation Setting (cfm)	Equivalent % Fan Speed for Qmin Mitigation Setting
DS035/VS035	Air	1895	40%
DS042/VS042	Air	1895	40%
DS053/VS053	Air	2665	40%
DS070/VS070	Air	2665	40%
DS077/VS077	Air	2665	40%
DS105/VS105	Air	3425	40%
DS035/VS035	Water	1895	40%
DS042/VS042	Water	1895	40%
DS053/VS053	Water	2665	40%
DS070/VS070	Water	2665	40%
DS077/VS077	Water	2665	40%
DS105/VS105	Water	3425	40%
Source: 20000578, Rev. D			

9 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 Checklist for Completed Installation on page 91 have been done.
- Locate "Vertiv™ CoolPhase Perimeter Warranty Inspection Check Sheet" in the unit's electric panel. (PSWI-8542-405-CO).
- Complete "Vertiv™ CoolPhase Perimeter Warranty Inspection Check Sheet" during start-up. (PSWI-8542-405-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 1-800-222-5877 for contacts.

10 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.

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, 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.

10.1 Filters

NOTICE

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

Pleat direction is non-standard. Use only short-pleat filters (see Figure 10.2 on page 98). Long-pleat filters are subject to collapse at high airflows.

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 10.1 Filter Quantities

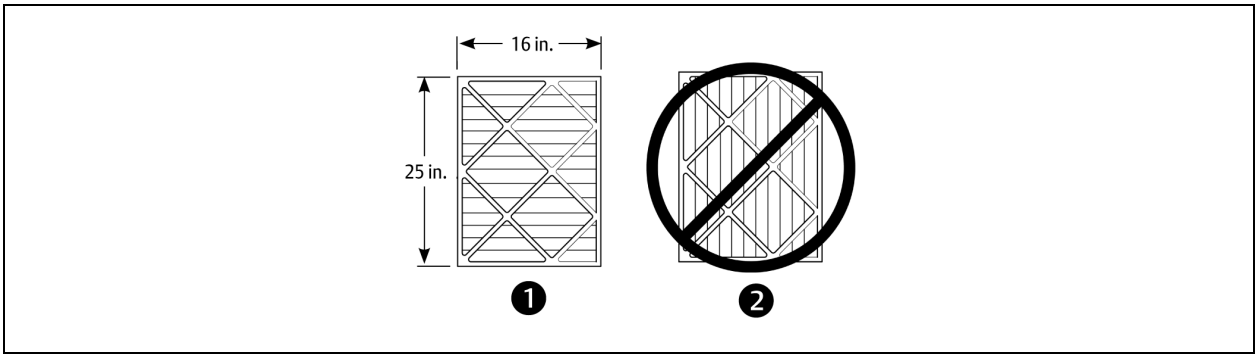
	035	042	053	070	077	105
Downflow Models						
Quantity	3	3	4	4	4	4
Nominal Size, inches	2 @ 25x20 1 @ 25x16	2 @ 25x20 1 @ 25x16	4 @ 25x20	4 @ 25x20	4 @ 25x20	2 @ 25x20 4 @ 25x16
Upflow Models (Front & Rear return) Filters located in separate filter box on rear return, located on lower unit panel						
Quantity	4	4	6	6	6	8
Nominal Size, inches	25x20	25x20	25x20	25x20	25x20	25x20
Disposable Type - Nominal Sizes and Quantities, Standard MERV 8 or Optional MERV 11; (filter types cannot be mixed, must be all MERV 8 or all MERV 11)						

10.1.1 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.

Figure 10.1 Proper Filter Pleat Direction



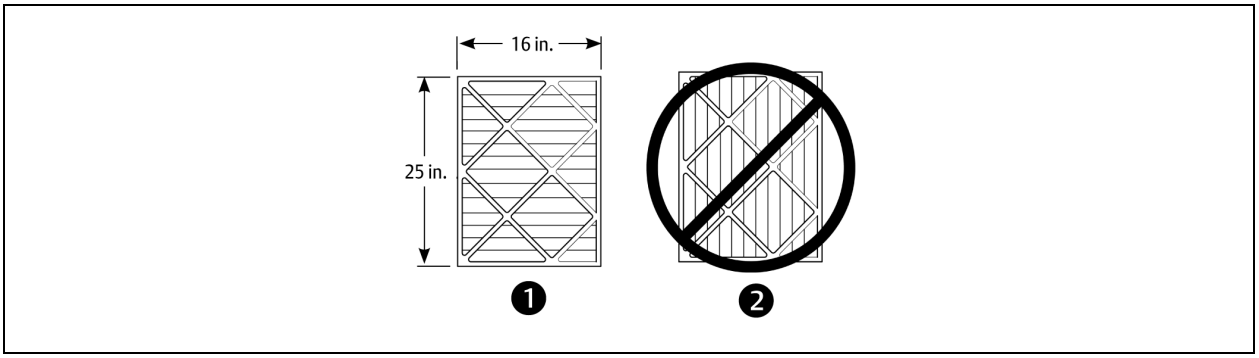
Item	Description
1	Short pleat construction
2	Long pleat construction

10.1.2 Filter Replacement for Upflow Units

1. Disconnect power from the unit.
2. Open the front access panel and remove the filter(s).
   - For upflow front return units, remove the lower front access panels, lift filters to the top of the filter rack and tilt forward for removal.
   - For upflow rear return units, remove filters using filter access door in rear return filter box.
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.

Figure 10.2 Proper Filter Pleat Direction



Item	Description
1	Short pleat construction
2	Long pleat construction

10.2 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 with a voltmeter that power is off before working within the fan-motor electric-connection enclosures. 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. Use only fully-trained and qualified HVAC technicians to perform maintenance on the fans.

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.

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 contact with sharp edges, exposed fasteners, and improper handling of very heavy parts. Can cause serious injury or death. Building and equipment damage may also result. Use extreme caution, wear appropriate, OSHA-approved PPE, and install the EC fan(s) and plenum to the unit only as described in these instructions.

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 and installing the fan(s) and plenum.

Equipment used in moving, lifting and installing the fan(s) and plenum must meet OSHA requirements and be rated for the weight of the fan(s) and the plenum. If ladders are used, verify that they are rated for the combined weight of the fan(s), plenum and installer(s) as loaded. EC Fan and plenum weights are specified in **Table 7.1** on page 65 and **Table 7.2** on page 66.

Read and follow the lifting equipment and/or ladder manufacturer's operating instructions and safety requirements.

WARNING! Risk of improper drive-belt removal. Can cause serious injury or death. If improperly handled, the spring-loaded motor base can slam down suddenly causing serious injury to hands and fingers from crushing and pinching. Read the directions in this manual and on the unit instruction labels. Keep hands and fingers away from pinch points. Wear appropriate, OSHA-approved PPE when performing maintenance on the belts, motors or pulleys. Follow all directions when servicing the unit.

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.

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: back-up 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.

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.

10.2.1 Protective Features

Monitoring functions protect the motor against overtemperature of electronics, overtemperature of motor and incorrect 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, undervoltage/phase failure detection and motor current limitation. These conditions will display an alarm through the Liebert® iCOM™.

10.2.2 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.

10.2.3 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 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.

CAUTION: Risk of contact with hot surfaces. Can cause injury. The fan motor, and some electrical components 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.

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: back-up 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: 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 10.2 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.

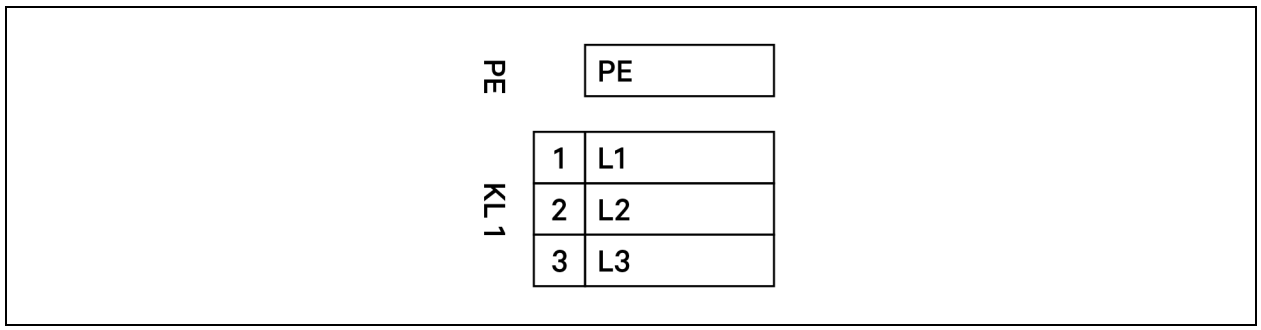
NOTE: Power wires must be removed from the motor for resistance test.

Table 10.3 Resistances at KL1 Connector

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

- Resistances should be similar for all 3 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. Confirms phase failure not present.

Figure 10.3 KL1 Connector



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

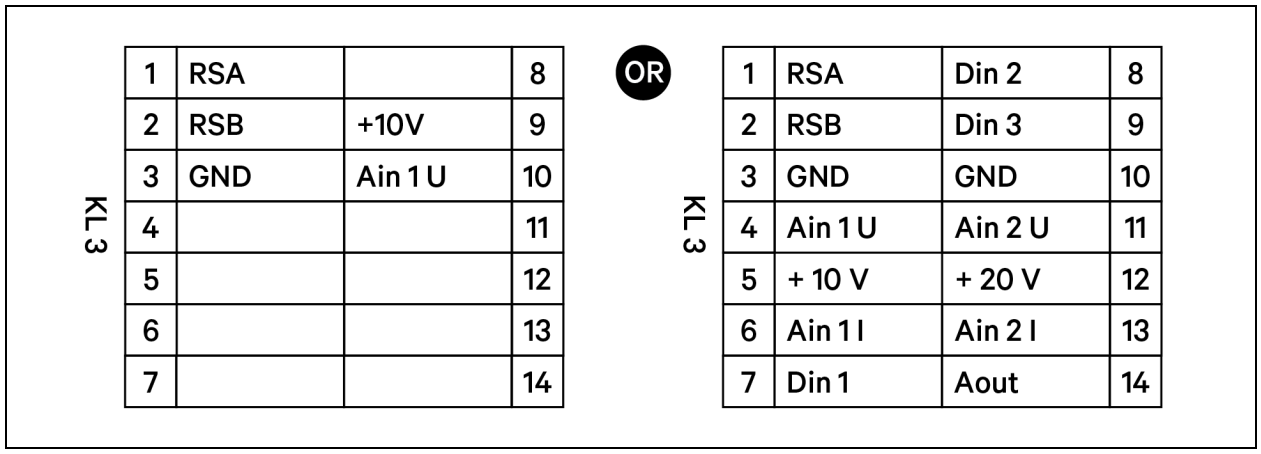
EC Fan Low Voltage Tests

- 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 10.4 KL3 Connector



EC Fan Alarm Contact Tests

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

Figure 10.5 KL2 Connector

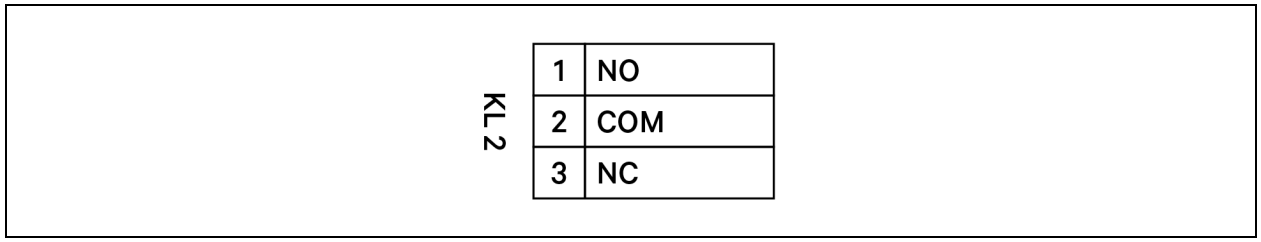


Table 10.4 No Fault/Fault Conditions while Motor Actively Energized

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.

10.2.4 Removing EC Fans from Downflow Units

The EC fans in Vertiv™ CoolPhase Perimeter units can be removed for easier maintenance or for replacement.

WARNING! Risk of electric shock. Can cause serious injury or death. Open all local and remote electric power supply disconnect switches and verify with a voltmeter that power is off before working within the fan-motor electric-connection enclosures. 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. Use only fully-trained and qualified HVAC technicians to perform maintenance on the fans.

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.

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

Read these instructions and unit labeling before removing fan modules. The instructions show a CoolPhase Perimeter (DS035-DS105) Thermal Management System Low GWP with a 24 in. floorstand. Your unit may look slightly different.

Hardware and Tools Required

- 1/2 in. hex socket and wrench
- Factory-supplied jack, crank and jack support
- Cable tie cutter
- Field-supplied fan removal device capable of supporting fan assembly weight

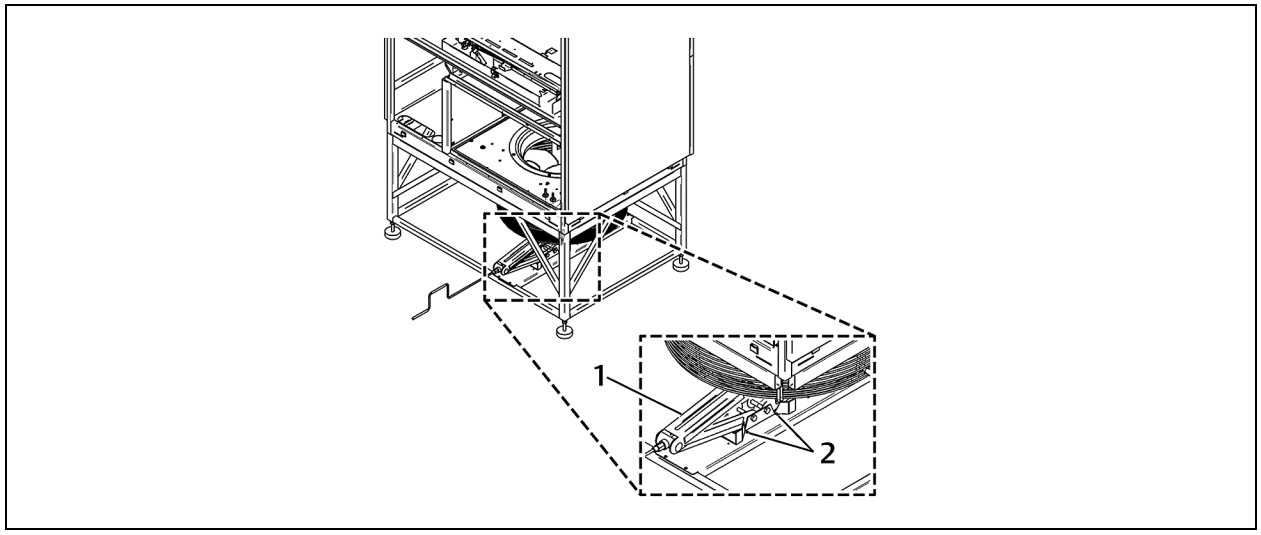
To remove an EC fan module:

1. Remove panels from the front of the unit.

2. If the fan module is raised and in the unit, proceed to step 5 .
   – or –

   If the fan module is lowered into the floor stand, refer to Figure 10.6 below and before removing any hardware, center the factory-supplied jack between the tabs on the jack support.

Figure 10.6 Jack Placement to Support EC Fan Module

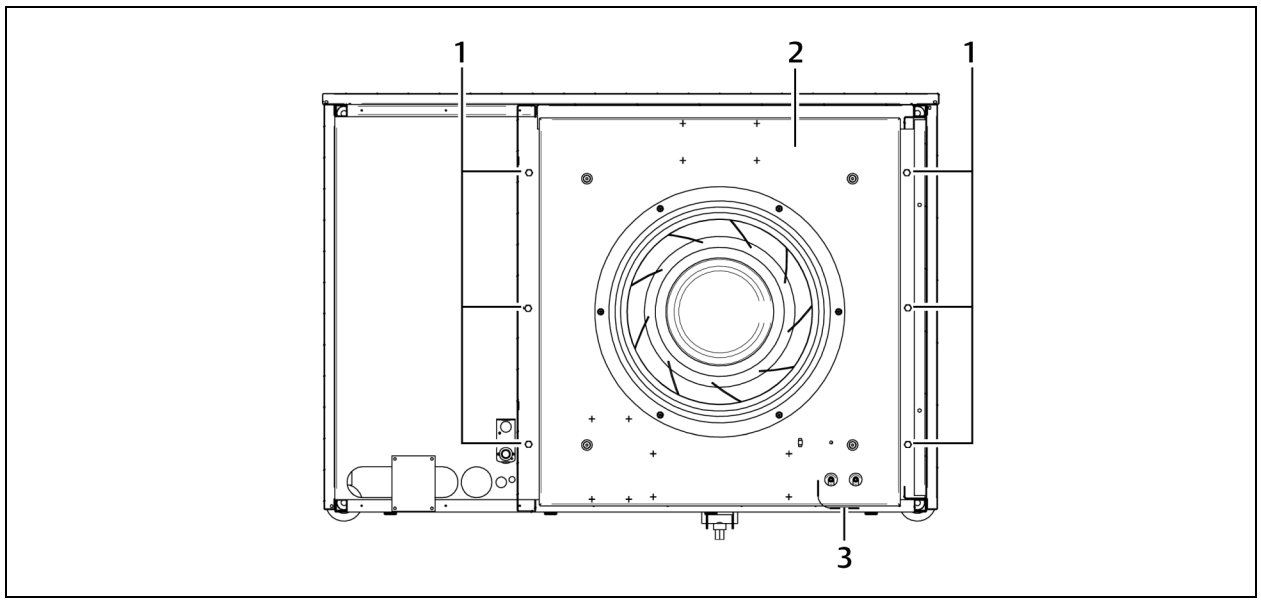


Item	Description
1	Position jack to support fan
2	Tabs

3. Remove hardware, Figure 10.7 below, that retains the fan in the lowered position, and save it for re-installation.

NOTE: Hardware quantity and location varies depending on the type of unit.

Figure 10.7 Hardware Removal



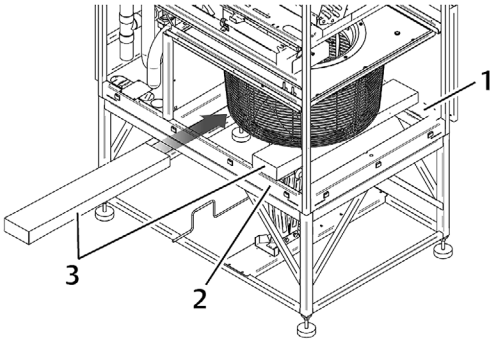
Item	Description
1	1/2 in. (13 mm) Hex-head bolts (typical both sides)
2	Fan deck
3	Wiring loop

4. Use the jack to raise the fan module slowly until the fan motor clears the front frame channel.
5. Insert a field-supplied fan-removal device securely on the front and rear frame channels under the fan module as shown in Figure 10.8 on the next page.
    - A suitable fan-removal device is two lengths of rigid material that is 4 in. (100 mm) wide and strong enough to support the weight of the fan module.

6. Disconnect high-voltage and low-voltage fan-motor wiring from the fan-motor electric component inside the electric panel. Cut cable ties as needed.
7. Using the removal device shown inserted in Figure 10.8 below, slide the fan module out through the front of the unit.
8. To reinstall the fan module, reverse these steps. Remove the field-supplied fan-removal device before resuming operation.

NOTE: Refer to the unit's electrical schematic for specific wire-attachment points.

Figure 10.8 Slide EC Fan out of the Unit



Item	Description
1	Rear frame channel (right-side panel not shown)
2	Front channel
3	Fan-removal devices

10.2.5 Removing EC Fans from Upflow Units

WARNING! Risk of electric shock. Can cause serious injury or death. Open all local and remote electric power supply disconnect switches and verify with a voltmeter that power is off before working within the fan-motor electric-connection enclosures. 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. Use only fully-trained and qualified HVAC technicians to perform maintenance on the fans.

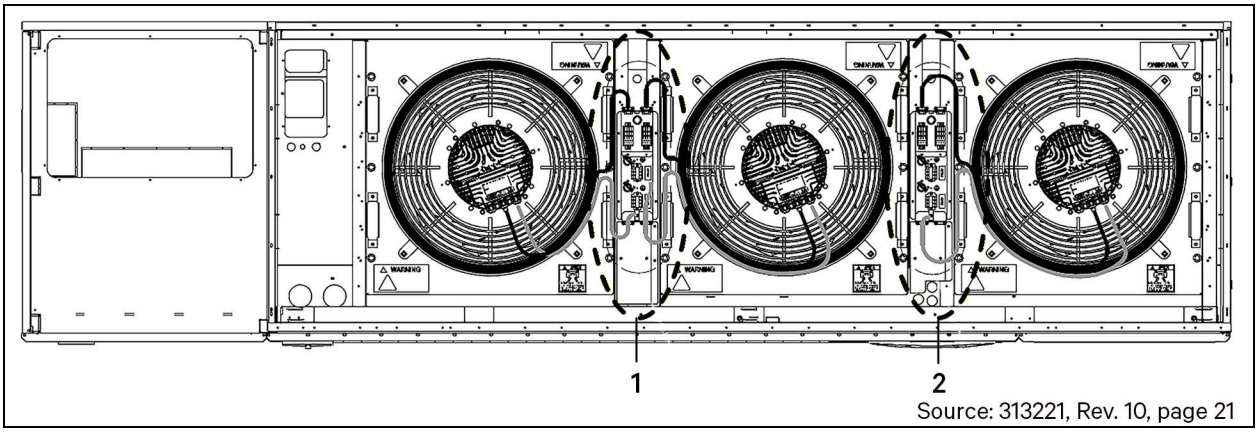
WARNING! Risk of contact with high-speed rotating fan blades. Can cause serious injury or death. Open all local and remote electric power-supply disconnect switches, verify with a voltmeter that power is off, and verify that all fan blades have stopped rotating before working in the unit cabinet or on 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.

WARNING! Risk of extremely heavy fan modules dropping downward suddenly. Can cause injury or death. Fan modules weigh in excess of 125 lb (56.7 kg) each. Support fan modules before removing mounting hardware. Use caution to keep body parts out of fan module pathway of movement during removal. 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.

NOTE: We recommend using a duct lift or scissors lift when installing or removing the EC-fan assemblies on top of the unit.

1. Disconnect the black-sleeved low-voltage harness and the green-sleeved high-voltage harness from the junction box, Figure 10.9 below.

Figure 10.9 EC Fan Junction Boxes

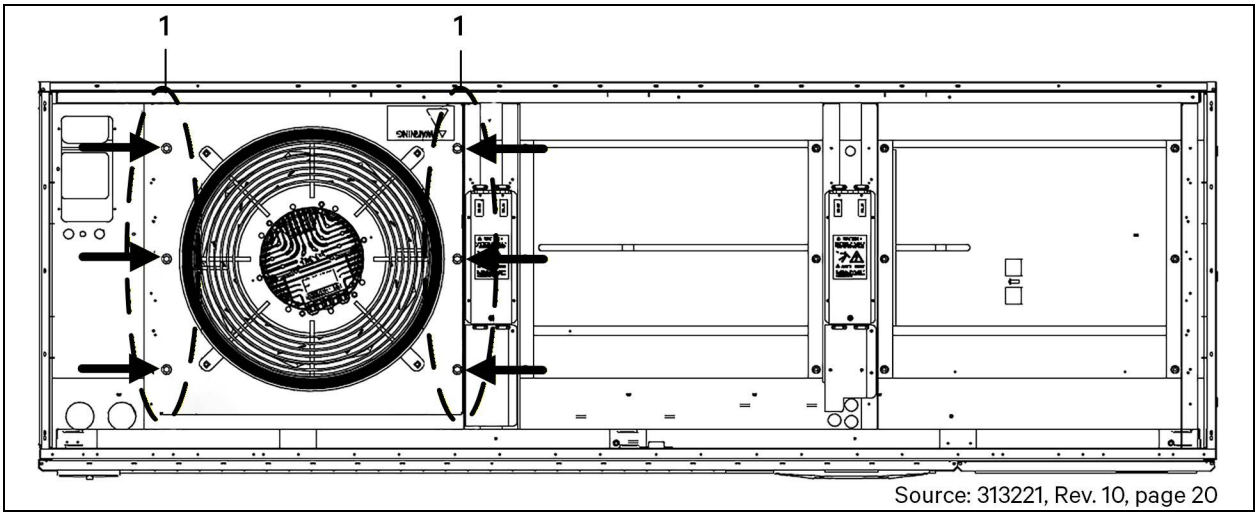


Source: 313221, Rev. 10, page 21

Item	Description
1	Junction box between fans 1 and 2 on 2- and 3-fan unit
2	Junction box for 1- or 3-fan unit

2. Locate the 6 places where the EC-fan assembly attaches to the unit, Figure 10.10 below, and remove the bolts, washers and spacers, Figure 10.11 on the facing page.

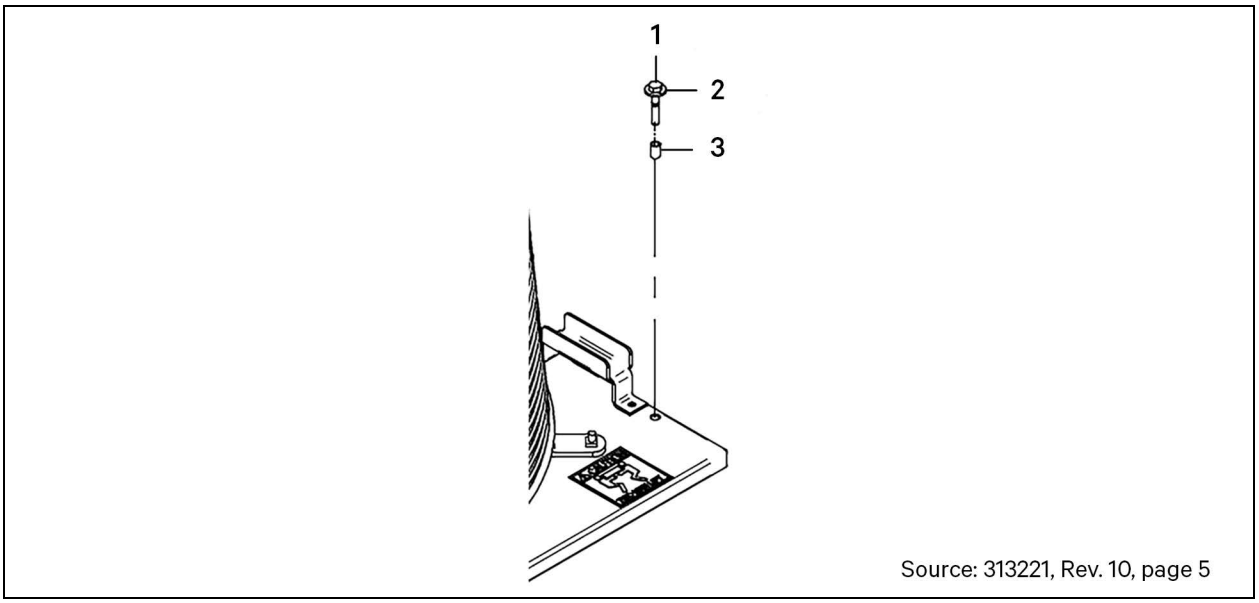
Figure 10.10 Assembly in Place on the Unit



Source: 313221, Rev. 10, page 20

Item	Description
1	Mounting holes

Figure 10.11 Bolts, Washers, and Spacers on EC Fan Assembly (6 Places)



Source: 313221, Rev. 10, page 5

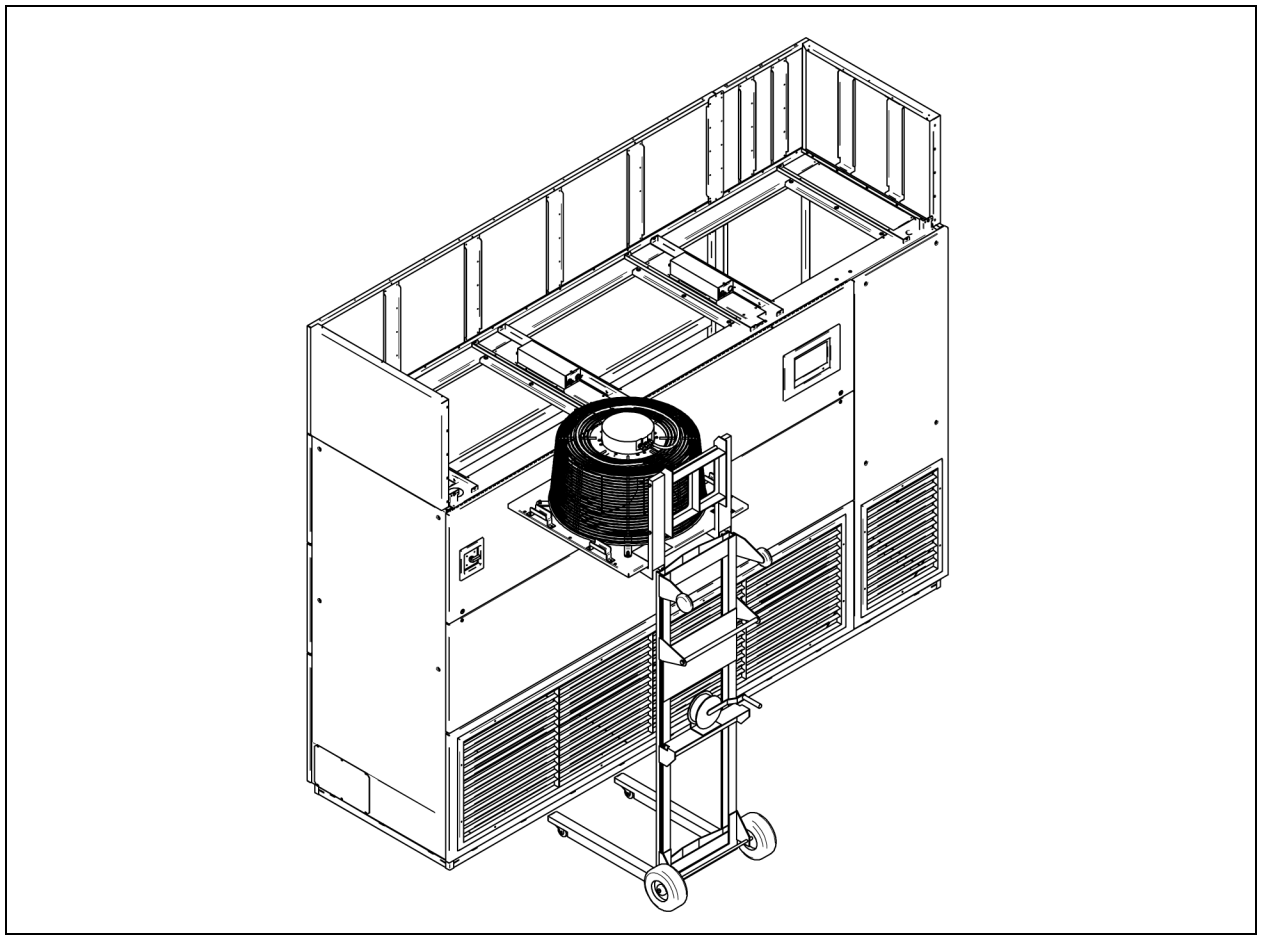
Item	Description
1	Bolt
2	Washer
3	Spacer

3. Position the lifting device so that it lines-up with the EC-fan assembly.

NOTE: A minimum clearance of 36 in. (914 mm) from the bottom of the unit to the top of the plenum is required for component access.

4. Using the handles on the EC-fan assembly, carefully lift the assembly over the hinge along the top of the unit, and slide the assembly onto the lifting device, Figure 10.12 below.
5. Use the lifting device to lower the EC-fan assembly for transport to service or maintenance area.

Figure 10.12 EC Fan Assembly Moved onto Lifting Device



10.3 Blower Drive System—Forward Curved Blowers

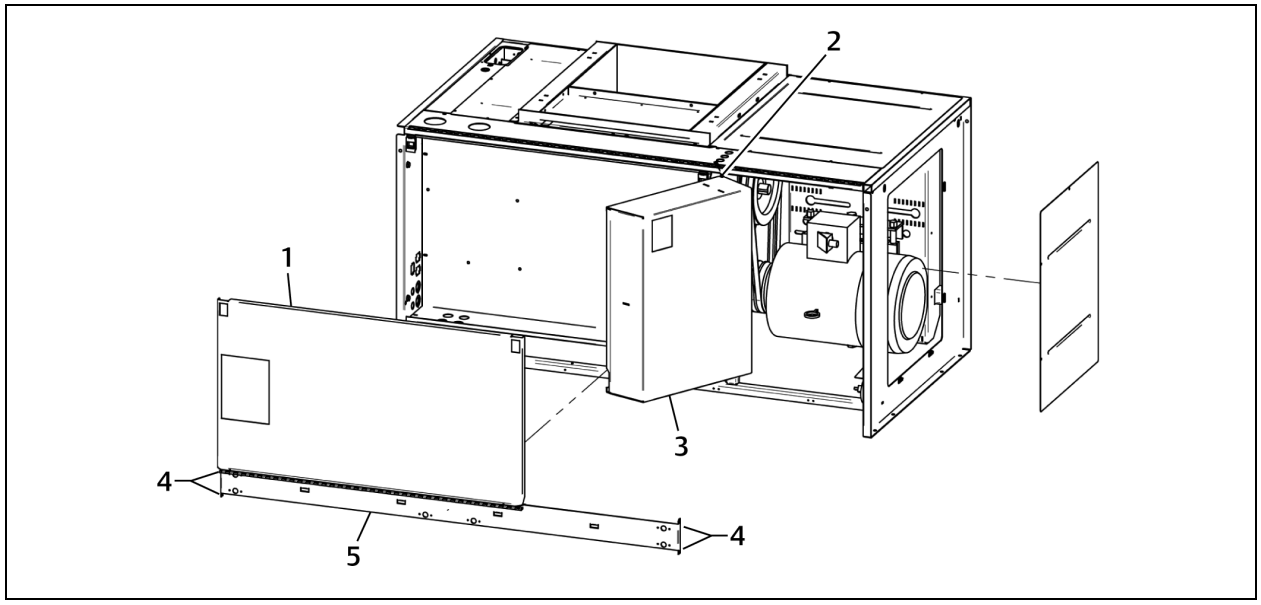
Blower drive system components that are part of the maintenance schedule include the blower wheels drive shaft, bearings, pulley, belts, sheave, motor auto-tension base and motor.

WARNING! Risk of improper drive-belt removal. Can cause serious injury or death. If improperly handled, the spring-loaded motor base can slam down suddenly causing serious injury to hands and fingers from crushing and pinching. Read the directions in this manual and on the unit instruction labels. Keep hands and fingers away from pinch points. Wear appropriate, OSHA-approved PPE when performing maintenance on the belts, motors or pulleys. Follow all directions when servicing the unit.

10.3.1 Upflow Motor Access

1. Remove the lateral support (sheet metal channel) under electric box by removing two screws at each end.
2. Removed the hinged dead-front panel (30-ton units have open access to the motor).
3. Remove two screws on the right side of the low-voltage electric box that secure the low volt electric box to the sheet metal shoulder.
4. Swing open low-voltage electric box to gain access to the motor.

Figure 10.13 Upflow Motor Access



Item	Description	Item	Description
1	Dead front	4	Screws
2	Hinge	5	Lateral support
3	Low-voltage electric box		

10.3.2 Belt Removal

1. Disconnect power to unit.

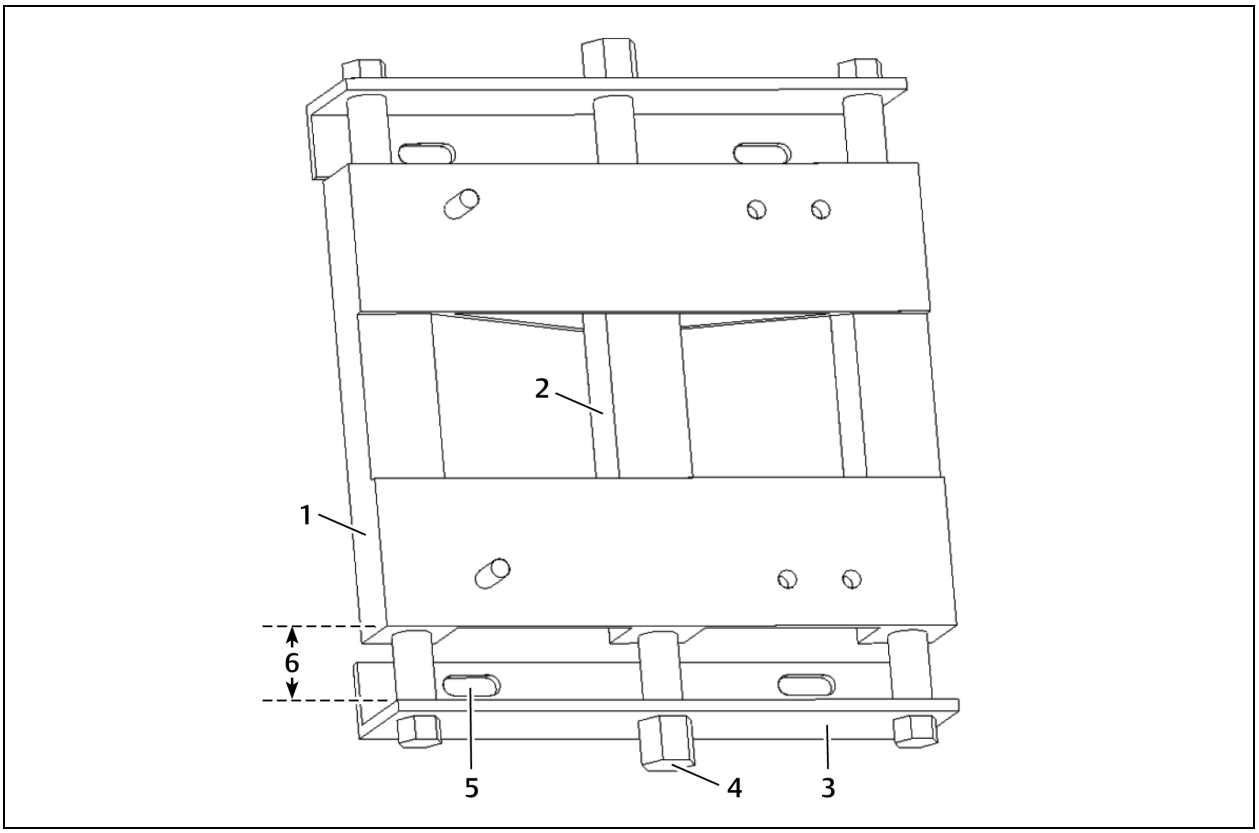
NOTE: Do not pry the belts off sheave or pulley.

2. Refer to instruction labels on unit near motor base.
3. Turn adjustment nut (see Auto Belt Tensioning Motor Base on the facing page) counterclockwise (left) to loosen belts and bring motor base internal spring out of compression.
4. Remove belts.

10.3.3 Belt Installation and Tensioning

1. Select the appropriate replacement of belts (matched set) and position on drive package.
   To maximize performance and reliability of Vertiv™ CoolPhase Perimeter (DS035-DS105) Thermal Management System Low GWP equipment, use only belts supplied by Vertiv. Contact your Vertiv sales representative for replacement belts.
2. Ensure pulley grooves are properly aligned. If adjustment is required, loosen (do not remove) four nuts in adjustment slots (see Auto Belt Tensioning Motor Base on the facing page) holding motor base to unit frame and slide motor base assembly into alignment.
3. Tension belts by turning adjustment nut clockwise (right) until motor base carriage stops moving downward.
4. Ensure minimum 1/2 in. (13 mm) clearance exists from motor-base carriage to base front flange (see Auto Belt Tensioning Motor Base on the facing page). If the clearance is less than 1/2 in. (13 mm), select shorter belts.
5. Mark the adjustment nut and rotate clockwise (right) 5 additional full turns. This sets internal spring for proper belt tension, no readjustments necessary.

Figure 10.14 Auto Belt Tensioning Motor Base



Item	Description	Item	Description
1	Motor base carriage	4	Adjustment nut
2	Spring housing	5	Motor-plate adjustment slot
3	Motor plate	6	Minimum gap = 1/2 in. (13 mm)

10.3.4 Blower Bearing Maintenance

- Field lubrication is NOT required for the life of the bearing.
- Bearings are permanently sealed and self-lubricating and cannot be greased.

10.3.5 Blower Bearing Inspection

1. Disconnect power to unit.
2. Remove drive belts (see Belt Removal on the previous page).
3. Inspect bearing for tightness of set screws and mounting bolts.
4. Rotate fan wheel by hand.
5. Listen for *unusual* noise and look for signs of *unusual* play.

10.3.6 Blower Bearing Replacement

1. To maximize performance and reliability of Vertiv™ CoolPhase Perimeter equipment, use only SealMaster® Reduced Maintenance pillow block bearing with tapered lands race and double lock set screws. Contact your local sales representative to order replacement bearings.
2. Properly mount and align bearings on shaft. Tighten set-screws in proper sequence and to proper torque using a torque wrench in accordance with the manufacturer's instructions.

10.3.7 Blower Motor

Inspect motor at regular intervals. Keep motor clean and ventilation openings clear of dust, dirt and other debris.

10.3.8 Blower Motor Lubrication

- Motor is lubricated at the factory and does not require initial lubrication.
- Contact the motor manufacturer for the lubrication interval for motor bearings that have grease fittings.
- Contact the motor manufacturer to determine what type of grease to use for lubrication. Greases of different bases may not be compatible when mixed.

10.3.9 Blower Wheel

Check to see if wheels are tightly mounted on fan shaft. Rotate wheels and make sure they do not rub against fan housing. The wheels should be periodically cleaned of dirt and debris.

10.4 Steam Generating Humidifier Maintenance

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

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

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

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

WARNING! Risk of electric shock. Can cause serious injury or death. Building and equipment damage may also result. Open all local and remote electric power supply disconnect switches and verify that power is off with a voltmeter before working within any electric connection enclosures. The Liebert® iCOM™ controller does not isolate power from the unit, even in the "Unit Off" mode. Some internal components require and receive power even during the "unit off" mode of the Liebert® iCOM™ controller.

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

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

WARNING! Risk of improper humidifier canister maintenance. Can cause serious injury or death. Building and equipment damage may also result. Can cause fire suppression and alarm system activation, resulting in building evacuation and mobilization of emergency fire and rescue services. Using a humidifier canister that has reached the end of its service life can be extremely hazardous. If the canister cannot be replaced immediately at the end of life condition, turn off the power and water supply to the humidifier and remove the canister until a replacement canister can be installed. Do not ignore humidifier problem alarms. Resetting the humidifier without addressing cause may result in fire or damage from leaking water. See Table 10.6 on page 122.

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

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

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

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

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

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

Table 10.5 Humidifier Canister Part Numbers

Unit Model	200V, 208V, 230V	380/415V, 460V	Humidifier Model
DS032, DS042	163812P1	163812P4	MES 2
DS053, DS070, DS077, DS105	163814P1	163814P2	MES 2

Figure 10.15 Steam Generating Humidifier Canister

10.4.1 Removing the Old Canister

To replace a used up humidifier cylinder:

1. Turn off the water supply to unit.
2. The old cylinder must be drained completely before removing. This is done by pushing the auto On/Off/Drain switch to the Drain position.
3. When completely drained, push the auto On/Off/Drain switch to the Off position.
4. Open the main electrical disconnect during the entire cylinder change operation.
5. The power wires to the cylinder are attached by cylinder plugs to the electrode pins on top of the cylinder. Pull up to remove the plugs from the pins.
6. Use slotted screwdriver to loosen the steam hose clamp(s).
7. Disconnect the steam hose by pulling it straight up.
8. Loosen the reversible cylinder zip tie. The cylinder is now ready to be lifted out of the unit.

10.4.2 Mandatory Cleaning of the Drain Valve

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

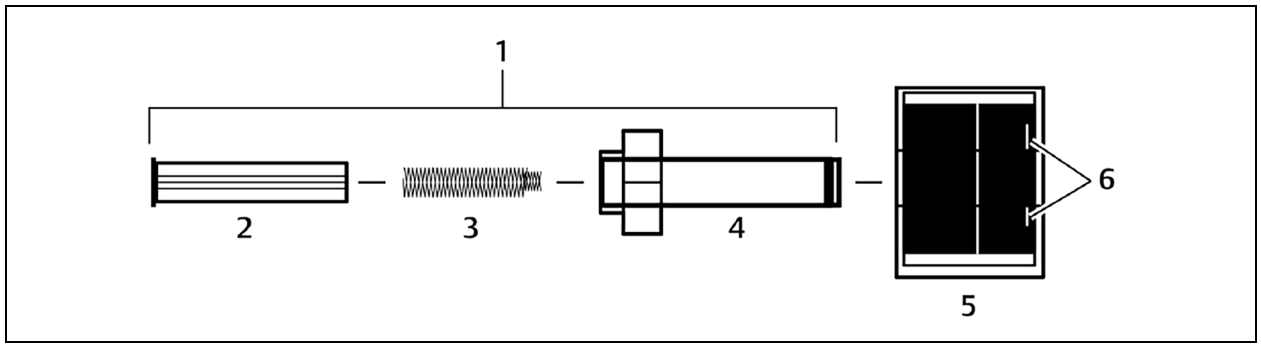
1. Remove old cylinder as described in Removing the Old Canister above .
2. Note that the ring terminal for the drain valve green ground wire is sandwiched between the drain valve and the drain pan.
3. Remove the two screws securing the drain valve body to the drain pan.

4. Remove the hose clip and hose connection from the drain valve body.
5. The drain valve assembly is now free for disassembly and cleaning.
6. At a sink, remove the snap fit red cap from the coil assembly and slide the coil off the actuator.
7. Loosen actuator using a wrench and unscrew from the plastic body.
8. Clean the exposed core, spring, and plastic drain valve pot.
9. Reinstall in the reverse order.

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

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

Figure 10.16 Drain Valve Assembly



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

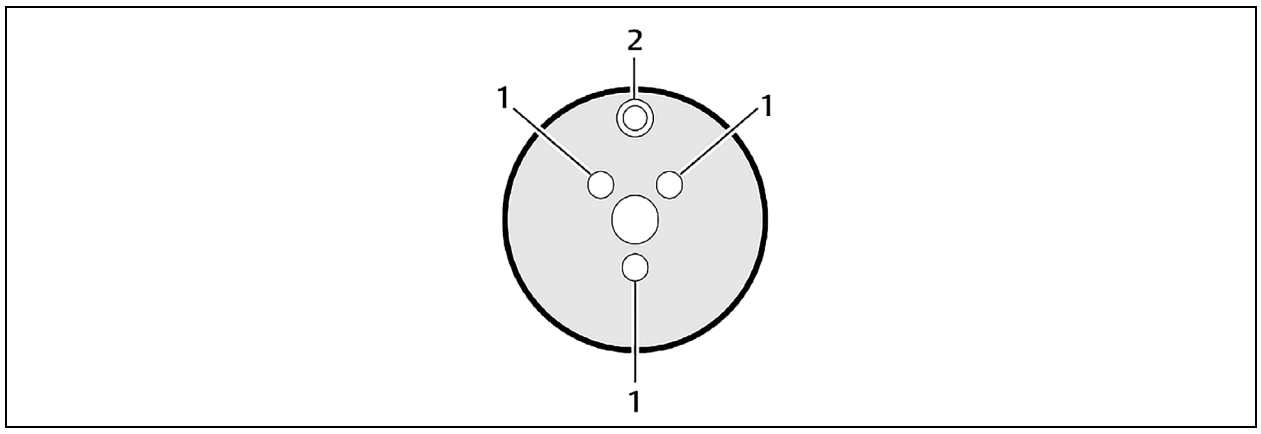
10.4.3 Installing the New Canister

1. The reverse procedure should be followed to install a new cylinder. The main electrical disconnect is to be left open until the cylinder is completely installed and reconnected.
2. The blue sensor plug on all units is for the high water sensor pin, which always goes on the single pin with collar offset from the others. See Figure 10.17 on the next page.
3. Ensure that cylinder plugs are snug on the pins. Replace any loose fitting plugs as these may result in hazardous operation.

WARNING! Risk of improper humidifier canister maintenance. Can cause serious injury or death. Building and equipment damage may also result. Can cause fire suppression and alarm system activation, resulting in building evacuation and mobilization of emergency fire and rescue services. Using a humidifier canister that has reached the end of its service life can be extremely hazardous. If the canister cannot be replaced immediately at the end of life condition, turn off the power and water supply to the humidifier and remove the canister until a replacement canister can be installed. Do not ignore humidifier problem alarms. Resetting the humidifier without addressing cause may result in fire or damage from leaking water. See Table 10.6 on page 122.

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

Figure 10.17 Canister Plugs



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

10.4.4 Humidifier Troubleshooting

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

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

NOTICE

Risk of improper control circuits. Can cause equipment damage.

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

Terms used in humidifier troubleshooting:

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

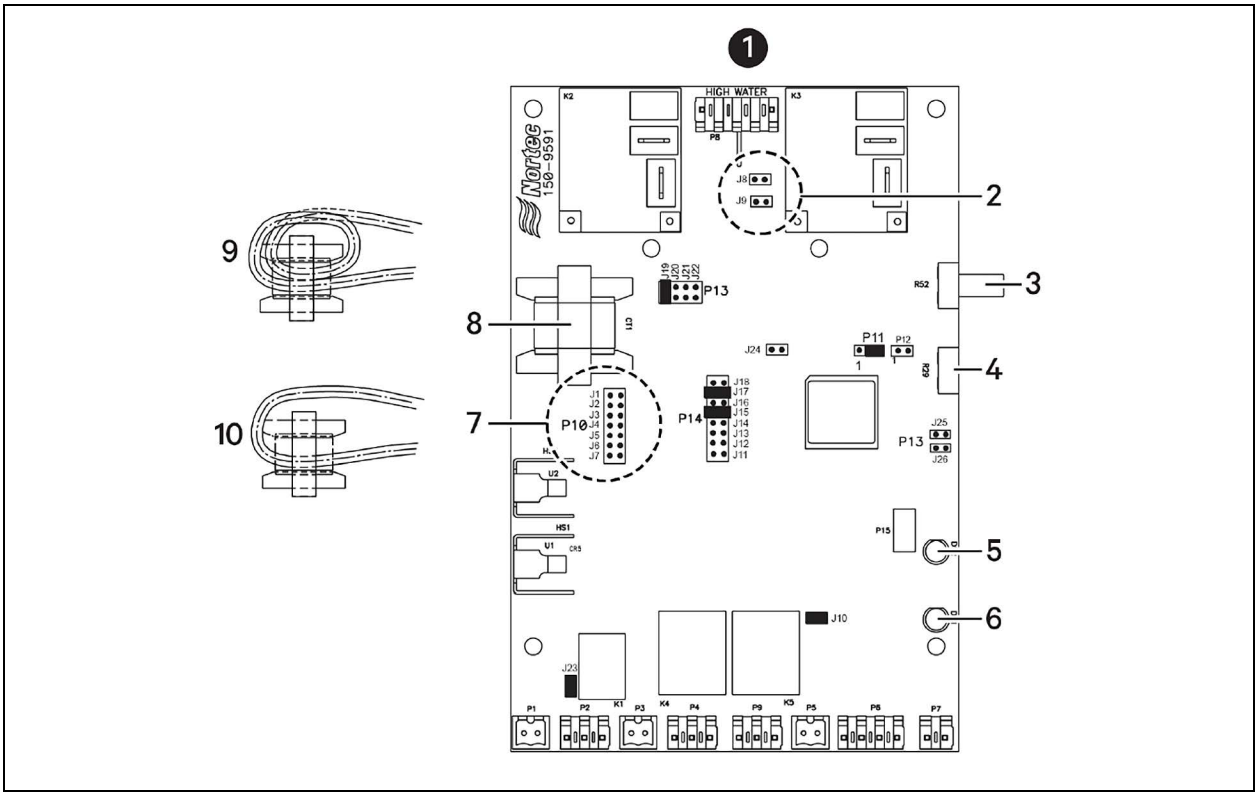
Table 10.6 Steam Generating Humidifier Status Lights: Causes and Corrective Actions

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

Table 10.7 Steam Generating Humidifier Troubleshooting Guide

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

Figure 10.18 Steam Generating Humidifier Circuit Board Diagram



Item	Description	Item	Description
1	PCB is configured for: MES-L	6	Yellow LED
2	HW Sensor Jumpers • J9: Low Voltage 200-240 V • J8: High Voltage 380-600 V	7	Mains Voltage Select Jumpers • J6: 200-208 • J5: 230 V • J3: 380-415 • J2: 460 V • J1: 575 V
3	Capacity adjust (Default at 100%)	8	Current transformer
4	Sealed, do not adjust	9	Current Transformer for MES-L 10, loop current sensing wire twice through current sensing coil.
5	Green LED	10	Current transformer for MES-L 20, loop current sensing wire once through current sensing coil.

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

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

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

10.5 Condensate Drain and Condensate Pump System Maintenance

10.5.1 Condensate Drain

Check for and clear obstructions in tubing during routine maintenance.

10.5.2 Condensate Pump

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

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

To maintain the condensate pump:

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

10.6 Air Cooled Condenser and Vertiv™ Liebert® Drycooler Maintenance

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

- Clear coil surface of all debris that will inhibit airflow.
- Check for bent or damaged coil fins and correct.
- Do not permit snow to accumulate around or under outdoor unit.
- Periodically consider commercial cleaning of coil surface.
- For condensers and drycoolers with coil coating, see the heat rejection manual for specific instructions on cleaning and maintenance requirements.
- 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.

10.7 Electric Reheat Maintenance

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

10.8 Thermostatic Expansion Valve (TXV) Maintenance

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

Proper valve operation can be determined by measuring superheat. The correct superheat setting is . 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.

10.8.1 Determining Suction Superheat

To determine superheat:

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

10.8.2 Adjusting Superheat Setting with the TXV

To adjust the superheat setting:

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

NOTE: Make no more than one turn of the stem at a time. Allow up to 15 minutes of fully loaded compressor operation before checking superheat or making additional stem adjustments.

10.9 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.

10.9.1 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 10.8 on the next page.

- 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 10.8 Compressor Oil types for R-454B Refrigerant

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

NOTE: See Additional Oil Requirements for Digital Scroll Compressors on page 45, for additional oil based on the system's refrigerant charge.

10.9.2 Digital Scroll Compressor Maintenance

Digital scroll compressors do not have an oil sight glass.

NOTE: Refer to Additional Oil Requirements for Digital Scroll Compressors on page 45, for approved oil types and additional oil required based on the system's refrigerant charge.

10.9.3 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.

10.9.4 Unloading Solenoids on a Digital Scroll Compressor

On Models 035 and 042:

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.

On Models 053 and 070:

When replacing a digital-scroll compressor, digital solenoid coil must be replaced. Compressor and coil kit are shipped separately.

10.9.5 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 1-800-222-5877.

10.9.6 Replacing a Compressor with Electrical Failure (Motor Burnout)

WARNING! Risk of electric shock. Can cause serious injury or death. The Vertiv™ Liebert® iCOM™ microprocessor does not isolate power from the unit, even in the "Unit Off" mode. Some internal components require and receive power even during the "unit off" mode of the Liebert® iCOM™ control. Open all local and remote electric power disconnect switches and verify with a voltmeter that power is Off before working on any component of the system.

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.

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

1. Attach suction and discharge gauges to access fittings.
2. Front-seat service valves to isolate the compressor. Recover refrigerant using an approved recovery procedure and equipment. Use a filter drier when charging the system with recovered refrigerant.
3. Remove marked pressure transducer and discharge pressure switch. Disconnect all electrical connections.
4. Detach service valves from compressor.
5. Remove failed compressor.
6. Follow compressor manufacturer's suggested clean-out procedures.
7. Install replacement compressor and make all connections. Replace gaskets or seals on service valves. Replace unloading solenoid.
8. Evacuate, charge and operate per the appropriate procedure per local codes:
   - Evacuation, Leak Testing, and Charging Air Cooled Systems without Vertiv™ Liebert® Lee-Temp Receivers on page 48.
   - Evacuation, Leak Testing, and Charging Air Cooled Systems with Vertiv™ Liebert® Lee-Temp "Flooded Condenser" Head Pressure Control System on page 53.
   - 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 reinstalled in their original location.

10.9.7 Compressor Mechanical Failure

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

10.9.8 Replacing a Compressor with Mechanical Failure

WARNING! Risk of electric shock. Can cause serious injury or death. The Vertiv™ Liebert® iCOM™ microprocessor does not isolate power from the unit, even in the "Unit Off" mode. Some internal components require and receive power even during the "unit off" mode of the Liebert® iCOM™ control. Open all local and remote electric power disconnect switches and verify with a voltmeter that power is Off before working on any component of the system.

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.

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.

10.10 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.

10.10.1 MBV Control

The valve actuator operates on 24 VAC power and is controlled by a 2 to 10 VDC proportional control signal. The valve full-open to full-close time 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.

10.10.2 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.

10.10.3 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 (1517 kPa) lower threshold and a 255 psiA (1758 kPa) upper threshold pressure.

10.10.4 MBV Start-up

The setpoint offset is adjusted to the minimum value during start up, then transitions to the set value once the compressor reaches normal operating pressures. Due to the control dead band it is possible for each circuit to stabilize at different pressures within the dead band. Additionally changes in fluid temperature could cause pressure changes that do not result in valve movement within the dead band. Vertiv™ Liebert® Drycooler aquastats should be set to prevent continuous fluid temperature swings greater than 10°F (5.6°C) (see Vertiv™ Liebert® Drycooler Aquastat Settings on page 133).

10.10.5 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.

10.10.6 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.

10.11 Facility Fluid and Piping Maintenance for Water and Glycol Systems

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.

10.12 Glycol Solution Maintenance

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.

10.13 Vertiv™ Liebert® Paradenser—Water Cooled Condenser Maintenance

During normal Liebert® Paradenser operation, deposits will collect on the inside wall of condenser tubes. It must be cleaned periodically to ensure proper operation. Frequency of cleaning must be locally established because it varies according to Liebert® Paradenser usage and local fluid quality. See Facility Fluid and Piping Maintenance for Water and Glycol Systems on the previous page.

10.13.1 Cleaning the Vertiv™ Liebert® Paradenser

1. Disconnect power to unit.
2. Close field-installed isolation valves to isolate this unit's condenser system from facility water or glycol circuit.
3. Remove access panel from front of compressor section.
4. Locate the 1/2 in. NPT drain plugs located at lower front of compressor section and provide means to collect fluid drained from system
5. Remove the 1/2 in. drain plugs using two wrenches to prevent damage to drain lines.
6. Locate and remove the 3 in. diameter clean out plugs on top of shell assemblies (use 1-3/16 in. drag link socket or similar).
7. Brush and flush each of the nominal 5/8 in. inner diameter, rifled copper tubes. Recommend using John R. Robinson, Inc. or similar:
   - Motorized Tube Cleaner, Model JR3800-1200
   - Nylon brush 9/16 in. diameter, Model JRRB211N-916
   - Flexible shaft, Model JRRFS702-25
8. Reinstall 1/2 in. drain plugs 6 to 7 turns using Loctite 567 PST Thread Sealant as instructed by the manufacturer.
9. Wipe clean the machine threads and sealing surfaces of 3 in. diameter clean out plugs.
10. Remove and install new O-rings (Vertiv™ part number 180750P1) on the 3 in. diameter clean out plugs. (Do not use thread sealant).
11. Hand tighten 3 in. diameter clean out plugs and torque using drag link socket to 25 ft-lb. (33.9 Nm).
12. Leak check fluid system (refer to Leak Checking for Unit and Field Installed Piping on page 58).
13. Bleed system using Schrader ports near the top of the Vertiv™ Liebert® Paradenser.
14. Ensure that condensing fluid isolation valves are fully open.
15. Unit is ready to be put on-line.

10.14 Vertiv™ Liebert® Drycooler Aquastat Settings

Applications with the Optional Stat Setting require field piping to be insulated to prevent condensation. Table 10.9 below, shows acceptable applications where stats must be adjusted to Optional Setting.

Aquastats must be field-adjusted to Optional Setting for:

- Vertiv™ Liebert® GLYCOOL/Dual Cool applications

Table 10.9 Water/Glycol System Conditions Requiring Optional Settings for Aquastats

Flow Control:	MBV				WRV			
Cooling Type:	Glycol		Vertiv™ Liebert® GLYCOOL		Glycol		Vertiv™ Liebert® GLYCOOL	
Vertiv™ Liebert® Drycoolers in Loop	1	Multiple	1	Multiple	1	Multiple	1	Multiple
Stat Setting*	Optional	Factory	Optional	Optional	Factory	Factory	Optional	Optional
Insulate Field Piping	Yes	No	Yes	Yes	No	No	Yes	Yes
* See Table 10.10 below through Table 10.12 on the next page MBV = motorized ball valve, WRV = water regulating valve								

Table 10.10 Aquastat Settings—2 Fan through 4 Fan Vertiv™ Liebert® Drycoolers

Dial Setting (Stat Open Temp) Set for Mid Differential 8°F (4.4°C) Rise to Close			
Aquastat #	Fans	Factory Setting (Glycol) (See Notes 1 and 2.)	Optional Setting (Vertiv™ Liebert® 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 Liebert® Drycoolers are shipped at Factory Setting.
2. Factory Setting is used for all glycol applications, except single Liebert® Drycooler loops with motor ball valve controls.
3. Stats must be field-adjusted to Optional Setting for Vertiv™ Liebert® GLYCOOL/Dual Cool applications and all single Liebert® Drycooler loops using motorized-ball-valve flow controls.

Source: 20000355, Rev. B

Table 10.11 Aquastat Settings—6 Fan Vertiv™ Liebert® Drycooler

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

Source: 20000355, Rev. B

Table 10.12 Aquastat Settings—8 Fan Vertiv™ Liebert® Drycooler

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 (Vertiv™ Liebert® 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)
AQ5	F7 & F8	Main	78°F (25.6°C)	48°F (8.9°C)

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

Source: 20000355, Rev. A

10.15 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.

10.16 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.

10.17 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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11 Preventive Maintenance Checklist

Source: 20000356, Rev. B

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

Not all units will have all components. To determine your unit's configuration, compare the Indoor Unit Model # above and the information in the Components and Nomenclature 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. Coil clean.
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

Blower Section (Forward Curved)

1. Blower wheels free of debris.
2. Check belt tension and condition (replace if needed).
3. Check/lube bearings (Vertiv™ CoolPhase Perimeter bearings are sealed and do not require lubrication even though grease fittings are present.)
4. Check/lube motor (if supplied with grease ports). Check motor manufacturer's web site for procedure, amount and type of grease required.
5. Check sheave/pulley. (Replace if worn.)
6. Check motor mount.
7. Check/Test air sail switch.
8. Motor amp draw.
    - Compare to nameplate amps.

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

Reheat

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

L1	L2	L3
L1	L2	L3
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.

Condensate Pump (if Equipped)

1. Check for debris in sump.
2. Check operation of floats for 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 devices, if equipped.
3. Check/test water-detection devices, if equipped.
4. Check/test CAN connection between indoor and outdoor units, if equipped.

Refrigeration Piping

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

Compressor Section

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

9. Suction pressure	Circuit #1	_____	Circuit #2	_____
10. Discharge Pressure	Circuit #1	_____	Circuit #2	_____
11. Superheat	Circuit #1	_____	Circuit #2	_____
12. Low-pressure switch cut out	Circuit #1	_____	Circuit #2	_____
13. Low pressure cut in	Circuit #1	_____	Circuit #2	_____
14. High pressure cut out	Circuit #1	_____	Circuit #2	_____

15. Amp draw

Circuit #1A	L1	L2	L3
Circuit #1B (if tandem)	L1	L2	L3
Circuit #2A	L1	L2	L3
Circuit #2B (if tandem)	L1	L2	L3

Water Cooled Condensers (if Equipped)

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

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

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

Vertiv™ CoolPhase Condenser

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 status-indicator lights, if installed.
8. Check/re-torque wire connections.
9. Check contactors for pitting and replace if pitted.
10. Verify operation sequence/set points.
11. Charge verification:
    a. Outdoor ambient temperature _____
    b. Subcooling _____
    c. Indoor unit Return air temperature _____
    d. Sight glass level (if Vertiv™ Liebert® Lee-Temp or pumped refrigerant) _____
12. Motor amp draw

#1	L1	L2	L3
#2	L1	L2	L3
#3	L1	L2	L3
#4	L1	L2	L3
#5	L1	L2	L3
#6	L1	L2	L3
#7	L1	L2	L3
#8	L1	L2	L3
#9	L1	L2	L3
#10	L1	L2	L3
#11	L1	L2	L3
#12	L1	L2	L3
#13	L1	L2	L3
#14	L1	L2	L3
#15	L1	L2	L3
#16	L1	L2	L3

Vertiv™ Liebert® Drycooler (if Equipped)

1. Coil clean free of debris.
2. Motor mounts tight.
3. Motor bearings in good condition.
4. Piping support/clamps secure.
5. Check/re-torque wire connections.
6. Check contactors for pitting and 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™ Liebert® Lee-Temp)
12. Glycol level.
13. Glycol solution ----_____%
14. Water/glycol solution flowing continuously/clean and free of debris
15. Water treatment plan established and followed for open cooling-tower application
16. Check refrigerant/glycol lines for signs of leaks and 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 1-800-222-5877.

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Appendices

Appendix A: Technical Support and Contacts

A.1 Technical Support/Service in the United States

Vertiv Group Corporation

24x7 dispatch of technicians for all products.

1-800-543-2378

Liebert® Thermal Management Products

1-800-543-2378

Liebert® Channel Products

1-800-222-5877

Liebert® 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: Disassembling the Vertiv™ CoolPhase Perimeter for Transport

The CoolPhase Perimeter (DS035-DS105) Thermal Management System Low GWP has a modular frame construction that allows separating the unit into three sections. Each of these sections is more easily maneuvered through tight spaces or placed in small elevators.

A qualified service technician with the required tools and recommended assistance can disassemble an air-cooled unit in about four hours, assuming refrigerant evacuation is not required.

This procedure requires four or more people for lifting the filter and electric box assembly on downflow units and for lifting the blower and electric box assembly 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 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 20.

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. 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.

NOTICE

Risk of improper disassembly. Can cause equipment damage.

Disassembling this unit requires substantial work, including reclaiming refrigerant and charging the unit, cutting and brazing refrigerant lines, cutting and brazing water lines, disconnecting and reconnecting electrical lines and moving heavy, bulky equipment. One member of the crew disassembling the unit must be qualified in wiring, brazing and refrigeration.

Improperly disassembling or reassembling the CoolPhase Perimeter (DS035-DS105) Thermal Management System Low GWP may affect warranty.

The disassembly dimensions and details are described in the submittal documents included in the Submittal Drawings on page 161.

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

Table B.1 Disassembly Dimension Drawings

Document Number	Title
Downflow Units	
20000451	Vertiv™ CoolPhase Perimeter DS035-DS042 Downflow Disassembly Dimensional Data
20000452	Vertiv™ CoolPhase Perimeter DS053-DS077 Downflow Disassembly Dimensional Data
20000453	Vertiv™ CoolPhase Perimeter DS105 Downflow Disassembly Dimensional Data
Upflow Units	
20000454	Vertiv™ CoolPhase Perimeter DS035-DS042 Upflow Disassembly Dimensional Data
20000455	Vertiv™ CoolPhase Perimeter DS053-DS077 Upflow Disassembly Dimensional Data
20000456	Vertiv™ CoolPhase Perimeter DS105 Upflow Disassembly Dimensional Data

B.1 Required Equipment

- Piano jacks
- Stepladder
- Refrigeration tools

B.2 Disassembly—Downflow Units

1. Remove the unit from its shipping skid before beginning. Refer to Unpacking the Unit on page 29.
2. Remove all panels except the top front accent.
3. Remove all filters. This allows access to the screws for metal plate blocking off the top coil and removal of the filter plate.
4. All wires are hot-stamped and all circuit board connectors are lettered to ease connection. Some cable ties must be cut and replaced. Refer to the unit's wiring schematic on the unit's dead-front panel for details.

NOTICE

Risk of oil loss or displacement. Can cause compressor damage.

Do not lay the compressor section on its side. It must remain upright. The coil section also must remain upright.

5. Label the three quick-connect plugs from the compressor compartment and disconnect them.

6. Disconnect the compressor wire harness, including the crankcase heater wires, if present, from the contactor in the electric box.
7. Pull the conduit and wires into the compressor compartment.
8. Disconnect the fan motor wire harness from the bottom of the contactor in the electric box.
9. Pull the conduit and wires into the bottom section of the unit.
10. Reheat—Optional Component
    a. Disconnect the reheat wire harness from the bottom of the contactor in the electric box.
    b. Unplug the low-voltage quick connect for the reheat safety wires.
    c. Pull the conduit and wires into the unit's blower and coil assembly section.
11. Humidifier—Optional Component
    a. Disconnect the humidifier wire harness from the bottom of the contactor in the electric box.
    b. Disconnect 35-3 and 35-4 from the control board.
    c. Pull the conduit and wires into the unit's blower and coil assembly section.
12. Condensate Pump—Optional Component
    a. Disconnect the condensate pump's high-voltage wiring harness.
    b. Remove the low-volt wires from terminal strips #24 and #55.
    c. Pull the conduit and wires into the unit's blower and coil assembly section.
13. Vertiv™ Liebert® GLYCOOL/Dual-Cool—Optional Component
    a. On units with an actuator, unplug the valve actuator harness at the actuator and pull the wire harness into the electric box.
    b. Disconnect the glycol sensor from the control board and pull it into the unit's blower and coil assembly section.
14. Disconnect the air sail switch wires and pull them into the electric box.
15. Smoke Detector—Optional Component
    a. Remove the smoke detector cover.
    b. Remove the plug connector from the smoke detector and pull it into electric box.
    c. Remove the wires from terminal strips #91, 92, 93 and route them into the smoke detector box.
    d. Remove the sensing tube from top of the smoke detector.

NOTE: The wand and tube will remain attached to filter and electric box assembly.

16. Close the electric box cover and the accent panel.
17. Remove the pull bar that supports the accent panel from the left end of unit, otherwise it will fall out when the compressor section is removed.

18. Evacuate and recover all refrigerant from the unit.

    Air-cooled units are shipped with an inert-gas holding charge. Water, glycol and Vertiv™ Liebert® GLYCOOL units are factory-charged with refrigerant. Refer to Piping and Refrigerant Requirements on page 35, for piping guidelines and to the ASHRAE Refrigeration Handbook for general, good-practice refrigeration piping.

NOTICE

Risk of compressor oil contamination with moisture. Can cause equipment damage.

We recommend front-seating the compressor service valves. Front-seating the valves keeps the inert gas or refrigerant charge in the compressor and prevents moisture from contaminating the compressor oil. This is particularly important with units using R-454B refrigerant.

19. Cut the insulation and pull it back from the piping.
20. Cut the refrigerant piping with a tubing cutter; if there is no Schrader fitting, let the inert gas bleed out before cutting all the way through the pipe.

NOTE: We do not recommend unsweating refrigerant connections.

21. Un-sweat or cut all copper water pipes that interconnect unit sections.
22. Immediately cap and seal all piping that has been cut, including the suction and liquid lines, as well as the fluid piping on Liebert® GLYCOOL and dual-cool units.

B.3 Remove the Compressor Assembly

1. Secure the compressor wire harness to the compressor assembly.
2. Remove the 10 thread-cutting bolts holding the compressor section assembly to the filter and electric box assembly and the blower and coil assembly.

   There are five bolts in the front, four in the back and one on the top at the middle of the unit.

   a. Begin removing bolts at the bottom of the unit and progress toward the top. Use this method for the front and back bolts.
   b. Stabilize the compressor section before removing the top, middle bolt.

NOTICE

Risk of oil loss or displacement. Can cause compressor damage.

The compressor section is top-heavy and has a small base. It must remain upright. Do not lay the compressor section on its side during or after removing it from the unit. Do not remove shipping blocks from compressors until the unit is fully reassembled and ready for installation.

NOTE: We recommend using piano jacks when moving this section.

B.4 Remove the Filter and Electric Box Assembly

1. Using a stepladder to reach the top of the unit, remove the filter support plate; it is attached to the filter and electric box assembly with two screws, one on each end.
2. Remove tags from the Schrader fittings on top of the coil headers. Retain the tags for replacement during reassembly.
3. Remove 16 screws, (8) on each side, from the evaporator top cover plate to coil assembly. Coil top blocker will remain with top section for rigidity.

4. Remove coil access plates from the left side of the unit.
5. Remove the four thread-cutting bolts securing the filter and electric box assembly to the blower and coil assembly. There are two on the left and two on the right.
6. Separate the unit sections with caution.

NOTICE

Risk of improper handling.

- The filter and electric box section should be moved forward and set on the floor.
- Make sure to lift the coil plate over the Schrader fittings on the headers. We recommend using four people to remove this section. Special care is required when moving this section because the legs are not designed to withstand strong shocks.
- The blower and coil assembly must remain upright. The coil is not secured to the blower and coil assembly.
- Secure the coil to the bottom section with straps or a similar method before moving the section.

7. Move each section of the unit to the installation location.

B.5 Reassembly—Downflow Units

1. Replace the top section.
   Make sure to clear the Schrader valves on the coil header.
2. Reconnect the filter and electric box assembly to the blower and coil assembly using thread-cutting bolts.
   Torque the bolts to 225 in-lb. (25 Nm)
3. Reattach the evaporator top cover plate; there are eight screws on each side.
4. Reattach the filter support plate to the filter and electric box assembly; there is one screw on each side.
5. Reattach the tags to the Schrader fittings on top of the coil headers.
6. Replace the compressor section.
   Insert all compressor thread-cutting bolts before tightening any of the bolts.
7. Reinstall the pull bar to support the accent panel.
8. Reattach the low-voltage plugs in the compressor section.
9. Reconnect the wiring for the compressor, fan motor, reheat, humidifier, condensate pump, smoke detector and air sail switch.
10. Reattach the sensing tube to the top of the smoke detector.
11. On Vertiv™ Liebert® GLYCOOL and dual-cool units, reattach the plug connection at the actuator and reroute the sensor wire back through the electric box and onto the control board.

Reconnecting Piping, Charging and Replacing Panels

1. Piping must be reassembled in accordance with local codes.
2. Move insulation and plastic bushings away from the brazing area.
3. Wrap piping with wet cloths. Use copper fittings where required.
4. Refer to Piping and Refrigerant Requirements on page 35, for piping guidelines and to the ASHRAE Refrigeration Handbook for general, good-practice refrigeration piping.
5. Open the service valves on the compressor.
6. Reinsert the plastic bushings.
7. Charge the unit with refrigerant; see the unit's nameplate for the proper charge.
8. Reinstall the galvanized panels on the left side of the coil.

9. Replace the filters.
10. Replace the panels.

B.6 Reassembly Checklist

1. Thread-cutting bolts reconnected and torqued to 225 in-lb. (25 Nm)
2. Top cover plate attached to coil
3. Filter plate attached
4. High-voltage wires connected to proper contactors:
    a. Compressor
    b. Fan motor
    c. Reheat, if applicable
    d. Humidifier, if applicable
    e. Condensate pump, if applicable
5. Low-voltage wires connected
    a. Actuator
    b. Terminal strip
    c. Plug connections
    d. Smoke detector, if applicable
6. Coil access plates on right and left replaced
7. Water lines brazed
8. Suction and liquid refrigerant lines brazed
9. Vacuum pulled and unit checked for leaks
10. Unit recharged
11. Filters replaced
12. Panels replaced
13. Piping systems pressure-checked for leaks

B.7 Disassembly—Upflow Units

1. Remove the unit from its skid.
2. Remove all panels except top front accent.
3. Remove all filters on front return units. This allows easier access to items located in the filter and coil assembly.
4. All wires are hot stamped and all circuit board connectors are lettered for easy replacement. Cable ties will need to be cut and replaced as necessary. Reference unit wiring schematic on dead-front panel for details.
5. Label the three quick connect plugs from the compressor compartment, and disconnect them.
6. Disconnect compressor wire harness, including crankcase heater wires, if applicable, from contactor in electric box. Pull conduit and wires into compressor compartment.
7. Reheat (optional component): Disconnect reheat wire harness from bottom of contactor in electric box. Unplug low-voltage quick connect for reheat safety wires. Pull conduit and wires into filter and coil assembly section of unit.

8. Humidifier (optional component):
    a. Disconnect the humidifier wire harness from the bottom of the contactor in the electric box.
    b. Disconnect 35-3 and 35-4 from the control board.
    c. Pull the conduit and wires into the unit's filter and coil assembly section.
9. Condensate pump (optional component): Disconnect condensate pump high-voltage wire harness. Remove low volt wires from terminal strip #24 and #55. Pull conduit and wires into filter and coil assembly section of unit.
10. **Vertiv™ Liebert® GLYCOOL/Dual-Cool (optional component):** On units with actuator, unplug valve actuator harness at actuator and pull wire harness into electric box. Disconnect glycol sensor from control board and pull into filter and coil assembly section of unit.
11. Smoke detector (optional component): For units with smoke detector, remove cover on smoke detector. Remove plug connector from smoke detector and pull into electric box. Remove wires from terminal strip #91, 92, 93 and route the wires to the smoke detector box. Remove the sensing tube from the bottom of the plastic elbow.
12. Filter Clog Switch: Disconnect both tubes from the filter clog switch. Pull both of the tubes into the electric box.
13. Close the electric box cover and the accent panel.
14. Remove the pull bar that supports the accent panel from left end of unit, otherwise it will fall out when the compressor section is removed.
15. Evacuate and recover all refrigerant from the unit.
    Air-cooled units contain an inert-gas holding charge. Water, glycol and Liebert® GLYCOOL units are factory charged with refrigerant. Refer to Piping and Refrigerant Requirements on page 35, for piping guidelines and to the ASHRAE Refrigeration Handbook for general good practice refrigeration piping.

NOTICE

Risk of compressor oil contamination with moisture. Can cause equipment damage.

We recommend front-seating the compressor service valves. Front-seating the valves keeps the inert gas or refrigerant charge in the compressor and prevents moisture from contaminating the compressor oil. This is particularly important with units using R-454B refrigerant.

16. Cut and pull back insulation from piping.
17. Cut the refrigerant piping with a tubing cutter; if there is no Schrader fitting, let the inert gas bleed out before cutting all the way through the pipe.

NOTE: We do not recommend unsweating refrigerant connections.

18. Un-sweat or cut all copper water pipes that interconnect unit sections.
19. Immediately cap off and seal all piping that has been cut, including the suction and liquid lines, the humidifier supply line and the condensate discharge line (if applicable), as well as fluid piping on Liebert® GLYCOOL and dual-cool units.

B.8 Remove the Compressor Assembly

1. Secure the compressor wire harness to the compressor assembly.
2. Remove the 10 thread-cutting bolts holding the compressor section assembly to the filter and electric box assembly and the blower and coil assembly.

   There are five bolts in the front, four in the back and one on the top at the middle of the unit.

   a. Begin removing bolts at the bottom of the unit and progress toward the top. Use this method for the front and back bolts.
   b. Stabilize the compressor section before removing the top, middle bolt.

NOTICE

Risk of oil loss or displacement. Can cause compressor damage.

The compressor section is top-heavy and has a small base. It must remain upright. Do not lay the compressor section on its side during or after removing it from the unit.

NOTE: We recommend using piano jacks when moving this section.

B.9 Remove Blower and Electric Box Assembly

1. Remove the motor access plate from right end of unit.
   This will provide a place to grasp the blower and electric box assembly and move it.
   Remove the coil access plates on the left side of the unit for clearance when brazing the suction and discharge lines.
2. Remove the thread-cutting bolts holding the unit sections together; there are four on the left and four on the right.
3. Separate the unit sections with caution.

NOTICE

Risk of improper handling. Can cause damage to the unit.

- The blower and electric box assembly should be moved forward and set on the floor.
- We recommend using four people to remove this section.
- The motor end will be significantly heavier than the other end.
- The filter and coil assembly must remain upright. The coil is not secured to the filter and coil assembly.
- Secure the coil to the bottom section with straps or a similar means before moving the section.

4. Move each section of the unit to the installation location.

B.10 Reassembly—Upflow Unit

1. Reattach the top section using thread-cutting bolts; there are four on each side.
   Torque the bolts to 225 in-lb. (25 Nm).
2. Reinstall the motor access plate.
   Do not replace the left end coil access plates until brazing is finished.
3. Reattach the compressor section. Insert all compressor thread-cutting bolts before tightening them all down.
4. Reinstall the pull bar to support the accent panel.
5. Reinstall the low-voltage plugs in the compressor section.

6. Rewire the compressor, reheat, humidifier, condensate pump and smoke detector, if applicable.
7. Reattach the sensing tube to the blower inlet.
8. Reattach the plug connection at the actuator and reroute the sensor back through electric box and onto control board, on Vertiv™ Liebert® GLYCOOL and dual-cool units.
9. Piping must be reassembled in accordance with local codes.
10. Move the insulation and plastic bushings away from the brazing area.
11. Wrap the piping with wet cloths. Use copper fittings where required.
12. Refer to Piping and Refrigerant Requirements on page 35, for piping guidelines and to the ASHRAE Refrigeration Handbook for general, good-practice refrigeration piping.
13. Open service valves on compressor.
14. Reinsert plastic bushings.
15. Charge the unit with refrigerant; see the unit's nameplate for the proper charge.
16. Replace the galvanized panels on the left side of the coil.
17. Replace the filters.
18. Replace the panels.

B.11 Reassembly Checklist—Upflow Unit

1. Thread-cutting bolts reconnected at a torque specification of 225 in-lb. (25 Nm).
2. High-voltage wires connected to proper contactors:
    a. compressor
    b. reheat, if applicable
    c. humidifier, if applicable
    d. condensate pump, if applicable
3. Low-voltage wires connected:
    a. actuator
    b. terminal strip
    c. plug connections
    d. smoke detector, if applicable
4. Coil access plates on left side replaced
5. Motor access plate on right side replaced
6. Water lines brazed
7. Suction and liquid refrigerant lines brazed
8. Unit recharged
9. Filters replaced
10. Panels replaced
11. Piping systems pressure-checked for leaks

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Appendix C: Submittal Drawings

Table C.1 below, groups the drawings by topic/application.

Table C.1 Submittal Drawings Contents

Document Number	Title
Component Locations	
20000407	Vertiv™ CoolPhase Perimeter DS035-DS105 Downflow Component Location Diagram
20000408	Vertiv™ CoolPhase Perimeter DS035-DS105 Upflow Component Location
Dimension Planning Drawings	
20000409	Vertiv™ CoolPhase Perimeter DS035-DS105 Cabinet Dimensional Data
20000410	Vertiv™ CoolPhase Perimeter DSDS035-DS105 Upflow Cabinet Dimensional Data with EC Fans
20000411	Vertiv™ CoolPhase Perimeter DS035-DS105 Upflow Cabinet Dimensional Data with Forward Curved Blowers
20000412	Vertiv™ CoolPhase Perimeter DS035-DS042 Floor Stand Dimensional Data with EC Fans
20000413	Vertiv™ CoolPhase Perimeter DS053-DS077 Floor Stand Dimensional Data with EC Fans
20000414	Vertiv™ CoolPhase Perimeter DS105 Floor Stand Dimensional Data with EC Fans
20000415	Vertiv™ CoolPhase Perimeter DS035-DS042 Upflow Floor Stand and Floor Planning Dimensional Data with Forward Curved Blowers
20000416	Vertiv™ CoolPhase Perimeter DS053-DS077 Upflow Floor Stand and Floor Planning Dimensional Data with Forward Curved Blowers
20000417	Vertiv™ CoolPhase Perimeter DS105 Upflow Floor Stand and Floor Planning Dimensional Data with Forward Curved Blowers
20000418	Vertiv™ CoolPhase Perimeter DS035-DS042 Upflow Blower Outlet and Deck Dimensional Data with Forward Curved Blowers
20000419	Vertiv™ CoolPhase Perimeter DS053-DS077 Blower Outlet and Deck Dimensional Data Upflow with Forward Curved Blowers
20000420	Vertiv™ CoolPhase Perimeter DS105 Upflow Blower Outlet and Deck Dimensional Data with Forward Curved Blowers
20000421	Vertiv™ CoolPhase Perimeter DS035-DS105 Upflow Rear Return Filter Box Dimensional Data with Forward Curved Blowers
20000422	Vertiv™ CoolPhase Perimeter DS035-DS105 Upflow Rear Return Filter Box Dimensional Data with EC Fans
20000423	Vertiv™ CoolPhase Perimeter DS035-DS105 Upflow Plenum Dimensional Data with Forward Curved Blowers
20000424	Vertiv™ CoolPhase Perimeter DS035-DS042 Upflow Plenum Dimensional Data with EC Fans
20000425	Vertiv™ CoolPhase Perimeter DS053-DS077 Upflow Plenum Dimensional Data with EC Fans
20000426	Vertiv™ CoolPhase Perimeter DS105 Upflow Plenum Dimensional Data with EC Fans
Piping General Arrangement	
20000380	Vertiv™ CoolPhase Condenser Air Cooled Piping Schematic with EEV

Table C.1 Submittal Drawings Contents (continued)

Document Number	Title
20000427	Vertiv™ CoolPhase Perimeter Air Cooled Piping Schematic Piping Schematic with Vertiv™ CoolPhase Condenser
20000428	Vertiv™ CoolPhase Perimeter Water Cooled Piping Schematic
20000429	Vertiv™ CoolPhase Perimeter Glycol Cooled Piping Schematic
20000430	Vertiv™ Liebert® Econ-o-Coil Optional Piping Schematic
Piping Connection Drawings	
20000431	Vertiv™ CoolPhase Perimeter DS035-DS042 Downflow Air Cooled Primary Connection Locations
20000432	Vertiv™ CoolPhase Perimeter DS053-DS077 Downflow Air Cooled Primary Connection Locations with EC Fans
20000433	Vertiv™ CoolPhase Perimeter DS105 Downflow Air Cooled Primary Connection Locations
20000434	Vertiv™ CoolPhase Perimeter DS035-DS042 Downflow Water/Glycol Cooled Primary Connection Locations
20000435	Vertiv™ CoolPhase Perimeter DS053-DS077 Downflow Water/Glycol Cooled Primary Connection Locations
20000436	Vertiv™ CoolPhase Perimeter -DS105 Downflow Water/Glycol Cooled Primary Connection Locations
20000437	Vertiv™ CoolPhase Perimeter DS035-DS042 Upflow Air Cooled Primary Connection Locations with EC Fans
20000438	Vertiv™ CoolPhase Perimeter DS053-DS077 Upflow Air Cooled Primary Connection Locations
20000439	Vertiv™ CoolPhase Perimeter DS105 Upflow Air Cooled Primary Connection Locations
20000440	Vertiv™ CoolPhase Perimeter DS035-DS042 Upflow Water/Glycol Cooled Primary Connection Locations with EC Fans
20000441	Vertiv™ CoolPhase Perimeter DS053-DS077 Upflow Water/Glycol Cooled Primary Connection Locations with EC Fans
20000442	Vertiv™ CoolPhase Perimeter DS105 Upflow Water/Glycol Cooled Primary Connection Locations
20000443	Vertiv™ CoolPhase Perimeter DS035-DS042 Upflow Air Cooled Primary Connection Locations with Forward Curved Blowers
20000444	Vertiv™ CoolPhase Perimeter DS053-DS077 Upflow Air Cooled Primary Connection Locations
20000445	Vertiv™ CoolPhase Perimeter DS105 Upflow Air Cooled Primary Connection Locations
20000446	Vertiv™ CoolPhase Perimeter DS035-DS042 Upflow Water/Glycol Cooled Primary Connection Locations with Forward Curved Blower
20000447	Vertiv™ CoolPhase Perimeter DS053-DS077 Upflow Water/Glycol Cooled Primary Connection Locations with Forward Curved Blowers

Table C.1 Submittal Drawings Contents (continued)

Document Number	Title
20000448	Vertiv™ CoolPhase Perimeter DS105 Upflow Water/Glycol Cooled Primary Connection Locations
Electrical Field Connection Drawings	
20000449	Vertiv™ CoolPhase Perimeter Electrical Field Connection Description
20000450	CANbus and Interlock Connections between Vertiv™ CoolPhase Perimeter and Vertiv™ CoolPhase Condenser (Premium)
Disassembly Dimension Drawings	
20000451	Vertiv™ CoolPhase Perimeter DS035-DS042 Downflow Disassembly Dimensional Data
20000452	Vertiv™ CoolPhase Perimeter DS053-DS077 Downflow Disassembly Dimensional Data
20000453	Vertiv™ CoolPhase Perimeter DS105 Downflow Disassembly Dimensional Data
20000454	Vertiv™ CoolPhase Perimeter DS035-DS042 Upflow Disassembly Dimensional Data
20000455	Vertiv™ CoolPhase Perimeter DS053-DS077 Upflow Disassembly Dimensional Data
20000456	Vertiv™ CoolPhase Perimeter DS105 Upflow Disassembly Dimensional Data

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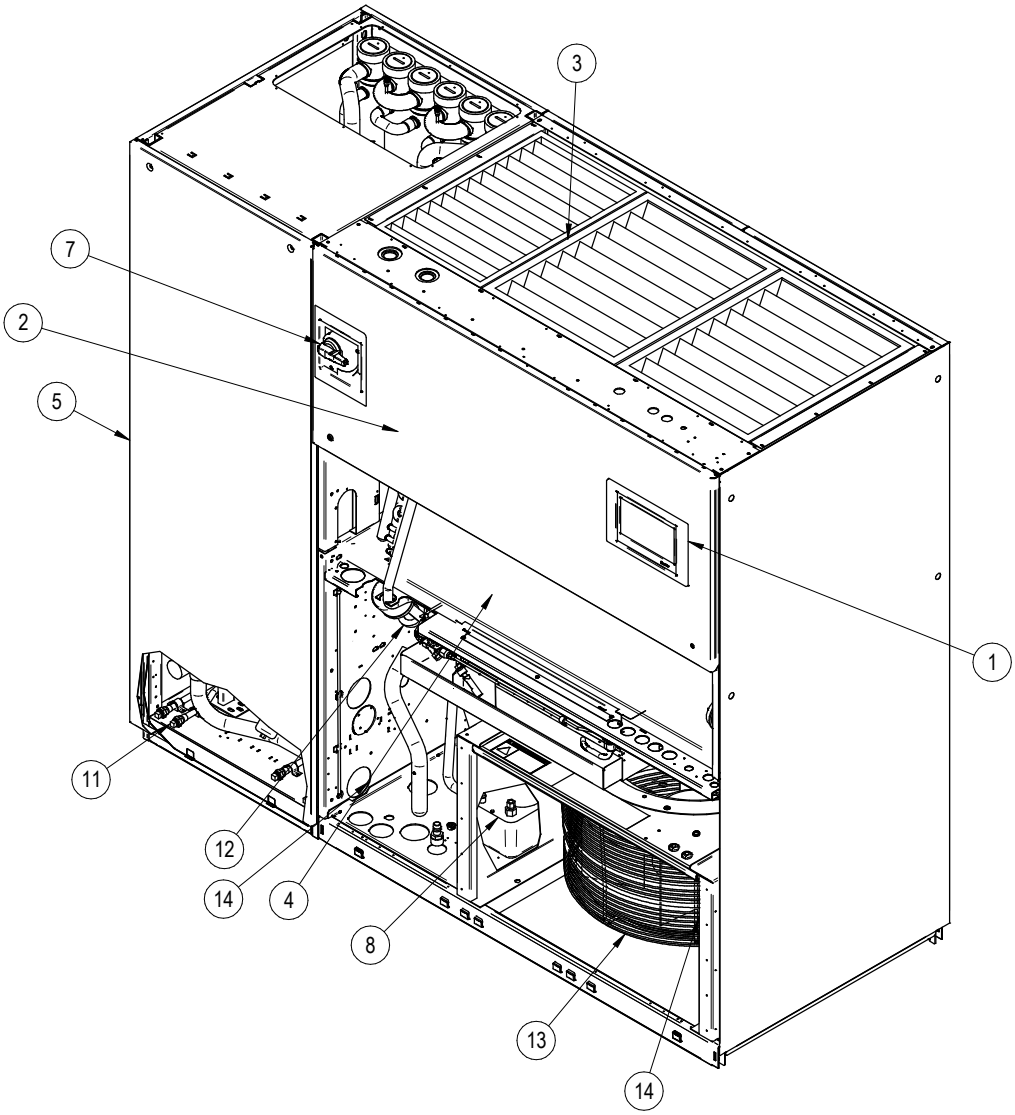
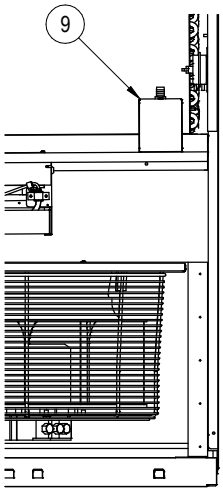
COOLPHASE PERIMETER

COMPONENT LOCATION

DS035 - DS105 DOWNFLOW MODELS



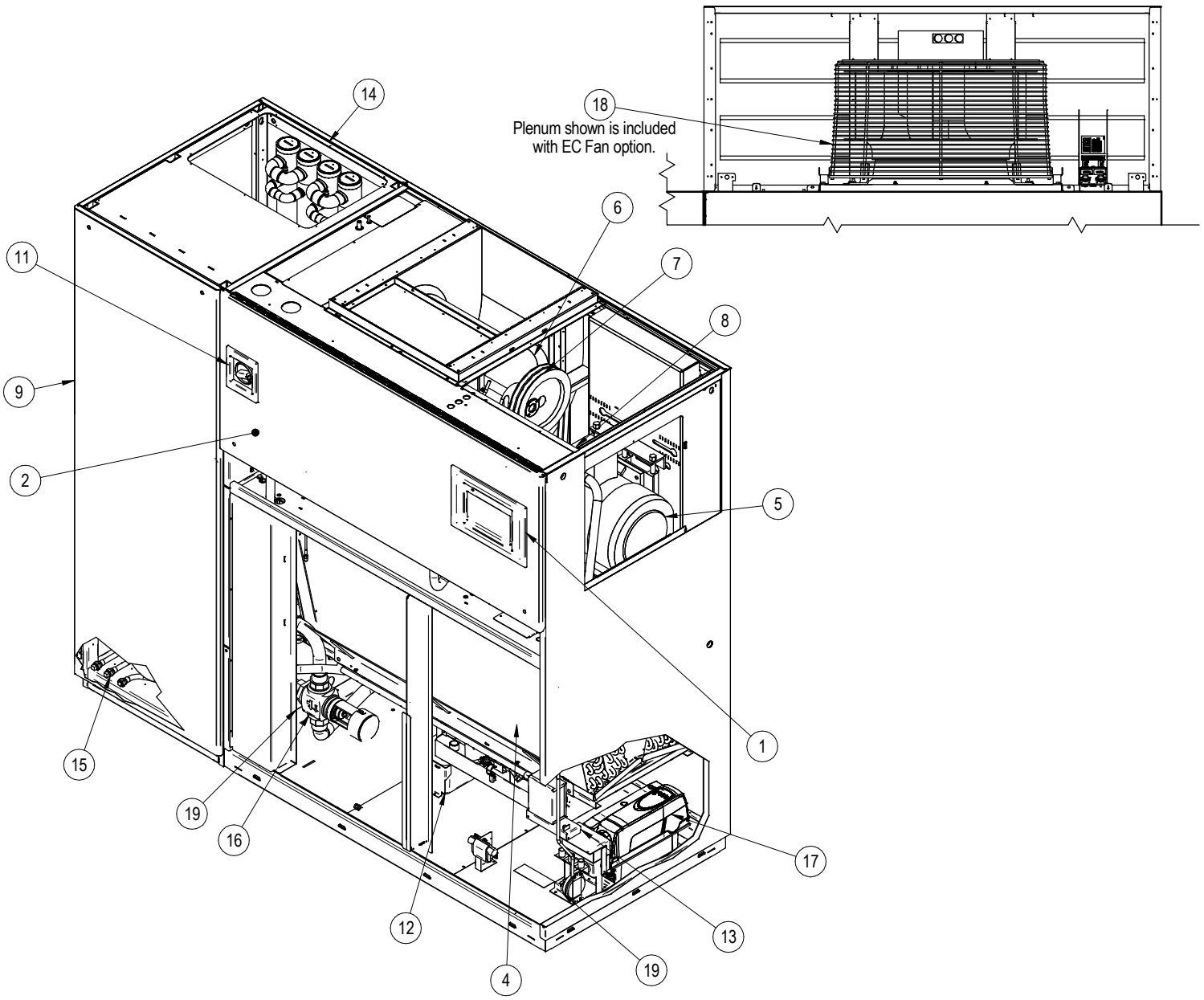


1. iCOM™ Control Display
2. Electric Box
3. Filters
4. Evaporator Coil
5 Compressor Section
6. Humidifier (not shown for clarity)
7. Disconnect (optional)
8. Condensate Pump (optional)
9. Smoke Sensor (optional)
10. Condenser Clean Out Plugs (fluid cooled units only)
11. Condenser Drain Plugs (fluid cooled units only)
12. Vertiv™ EconoPhase Valve (Glycool/Dual Cooling)
13. EC Fans (optional)
14. Refrigerant Leak Detector

COOLPHASE PERIMETER

COMPONENT LOCATION

DS035 - DS105 UPFLOW MODELS

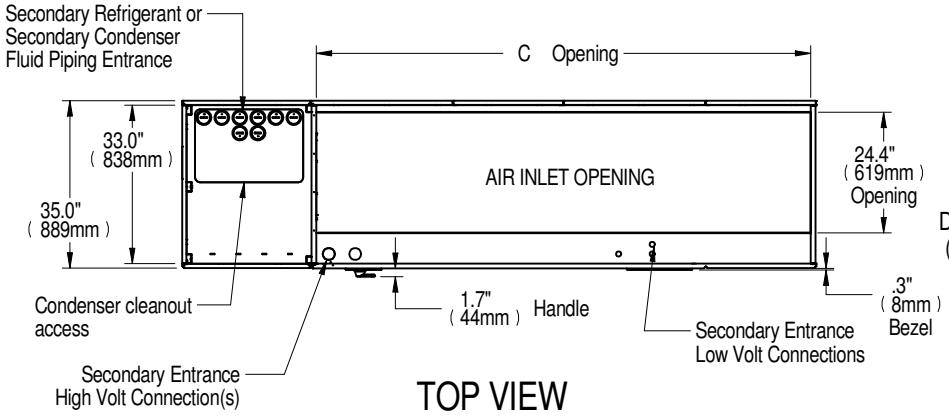


1. iCOM™ Control Display
2. Electric Box
3. Filters (not shown for clarity)
4. Evaporator Coil
5. Motor
6. Blower
7. Fan Pulley
8. Motor Sheave and Belts
9. Compressor Section
10. Humidifier (not shown for clarity)
11. Disconnect (optional)
12. Condensate Pump (optional)
13. Smoke Sensor (optional)
14. Condenser Clean Out Plugs (fluid cooled units only)
15. Condenser Drain Plugs (fluid cooled units only)
16. Vertiv™ EconoPhase Valve (Glycool/Dual Cooling)
17. Variable Frequency Drive (optional)
18. EC Fans (optional)
19. Refrigerant Leak Detector

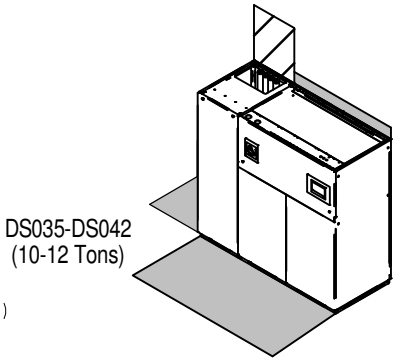
COOLPHASE PERIMETER

CABINET DIMENSIONAL DATA

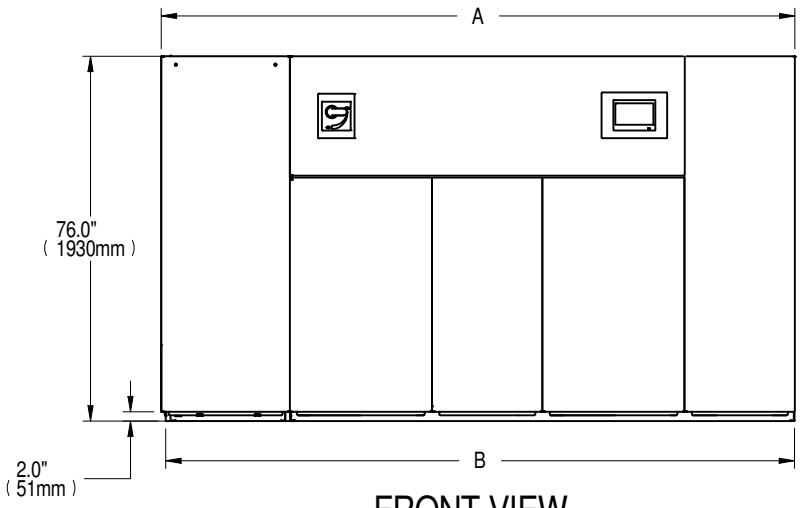
DOWNFLOW DS035-DS105 (10-30 TONS) MODELS



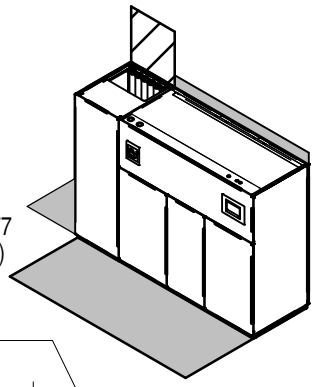
TOP VIEW



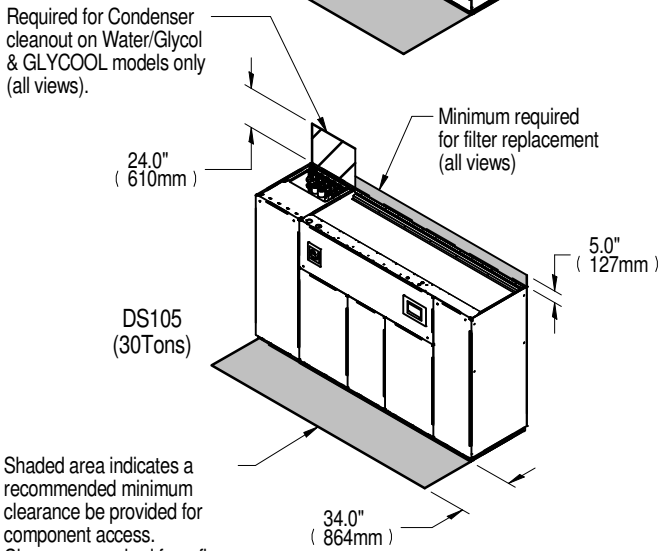
DS035-DS042
(10-12 Tons)



FRONT VIEW



DS053-DS077
(15-22 Tons)



DS105
(30Tons)

Shaded area indicates a recommended minimum clearance be provided for component access. Clearance required from floor to top of unit and plenum (all views).

34.0"
(864mm)

Notes:
1. Filters are accessible through top of unit only.
2. Downflow electrical connections can be made from top or bottom of unit
3. All notes, references, and dimensions not in table are typical for all downflow models.

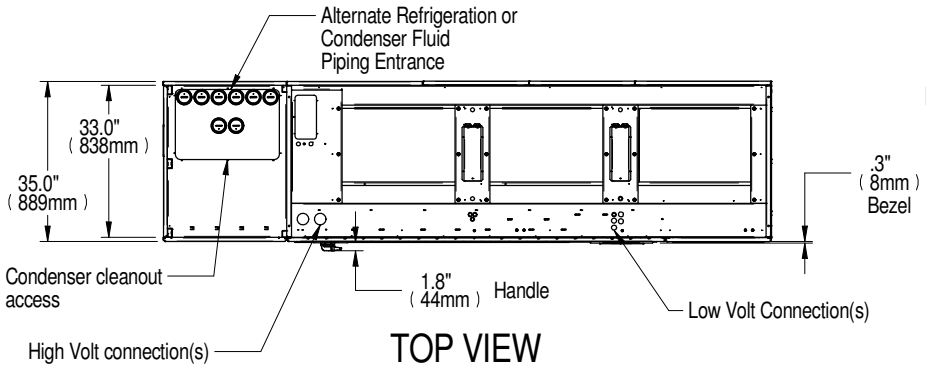
4. Unit power must be off when performing transformer and THD filter maintenance.

Model Number	Cooling Type	A in. (mm)	B in. (mm)	C in. (mm)
DS035 - DS042	Air Cooled & AirCooled w/ Dual Cool	73 (1854)	72 (1854)	56-7/8 (1445)
	Water/Glycol/GLYCOOL/Dual Cool	86 (2184)	85 (2184)	
DS053 - DS070	Air Cooled & AirCooled w/ Dual Cool	98 (2489)	97 (2489)	80 (2032)
	Water/Glycol/GLYCOOL/Dual Cool	109 (2769)	108 (2743)	
DS077	Air Cooled & AirCooled w/ Dual Cool	98 (2489)	97 (2489)	
	Water/Glycol/GLYCOOL/Dual Cool	109 (2769)	108 (2743)	
DS105	Air Cooled & AirCooled w/ Dual Cool	132 (3353)	131 (3327)	102-13/16 (2611)
	Water/Glycol/GLYCOOL/Dual Cool			

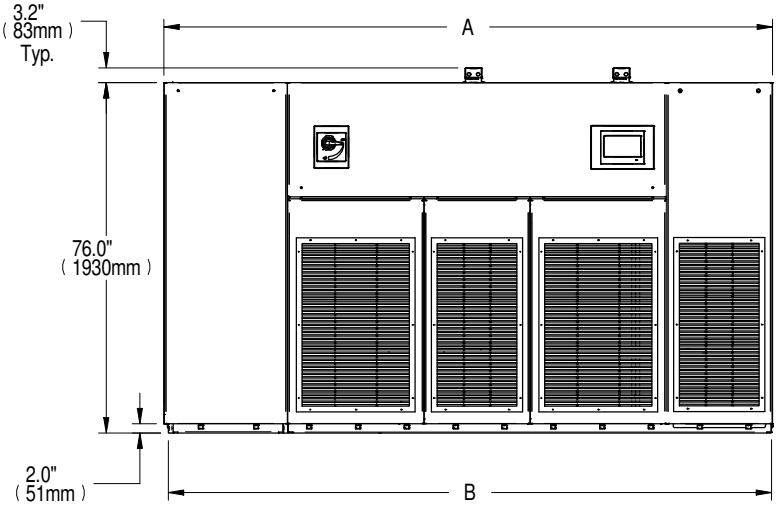
COOLPHASE PERIMETER

CABINET DIMENSIONAL DATA

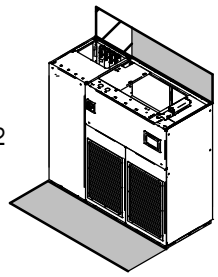
UPFLOW DS035-DS105 (10-30 TONS) MODELS W/ EC FANS



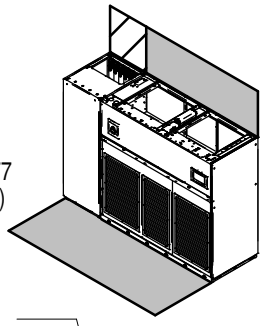
TOP VIEW



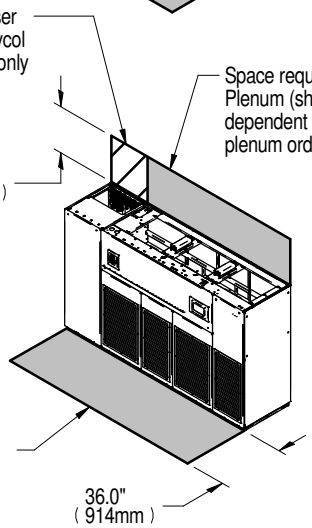
FRONT VIEW



DS035-DS042
(10-12 Tons)



DS053-DS077
(15-22 Tons)



DS105
(30Tons)

Shaded area indicates a recommended minimum clearance be provided for component access. Clearance required from floor to top of unit and plenum (all views).

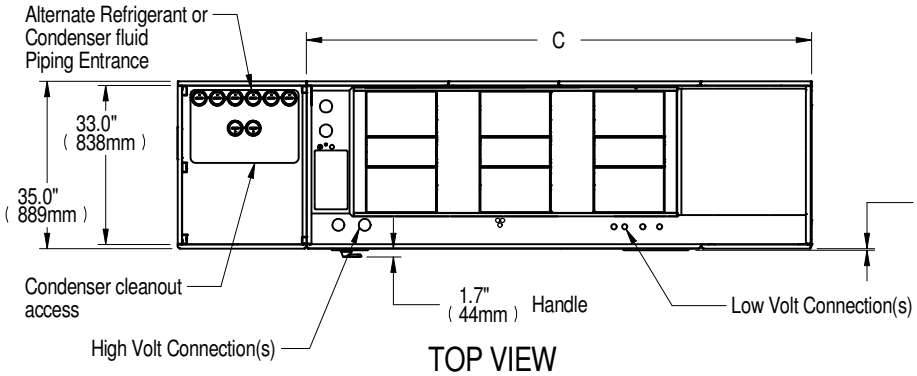
Note:
1. Front air return unit shown. For rear return unit, in addition to front service area shown, also include 25" (635mm) on one side of unit for access to rear return filter box. See 20000422.
2. EC fans plenum is not shown. EC fans and plenum shipped separately. See 20000424, 20000425, & 20000426 for unit dimensions with EC fans plenum mounted.
3. All notes, references, and dimensions not included in table are typical on all Upflow EC Fan units.

Model Number	Cooling Type	A in. (mm)	B in. (mm)
DS035 - DS042	AirCooled/Air Cooled w/Dual Cool	73 (1854)	72 (1829)
	Water/Glycol/GLYCOOL/Dual Cool	86 (2184)	85 (2159)
DS053 - DS070	AirCooled/Air Cooled w/Dual Cool	98 (2489)	97 (2464)
	Water/Glycol/GLYCOOL/Dual Cool	109 (2769)	108 (2743)
DS077	AirCooled	98 (2489)	97 (2464)
	Water/Glycol/GLYCOOL/Dual Cool	109 (2769)	108 (2743)
DS105	AirCooled	132 (3353)	131 (3327)
	Water/Glycol/GLYCOOL/Dual Cool		

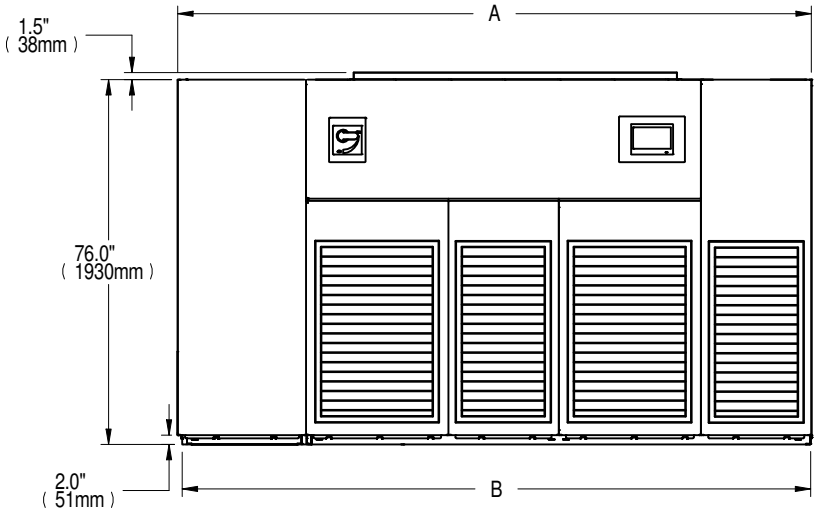
COOLPHASE PERIMETER

CABINET DIMENSIONAL DATA

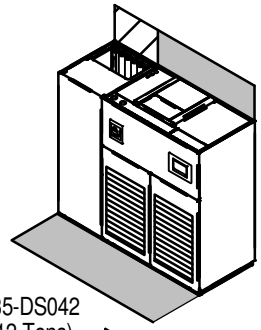
UPFLOW DS035-DS105 (10-30 TONS) W/ FORWARD CURVED BLOWERS



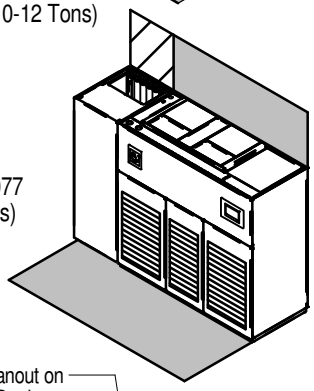
TOP VIEW



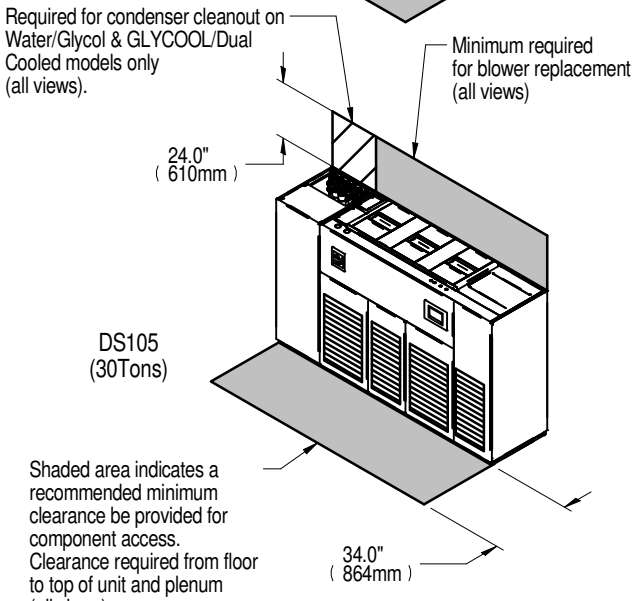
FRONT VIEW



DS035-DS042
(10-12 Tons)



DS053-DS077
(15-22 Tons)



DS105
(30Tons)

Notes:
1. Front air return unit shown. For rear return unit, in addition to front service area shown, also include 25" (635mm) on one side of unit for access to rear return filter box. See 20000421.
2. All dimensions, references, and notes not in table are typical to all Upflow units with Forward Curved Fans.

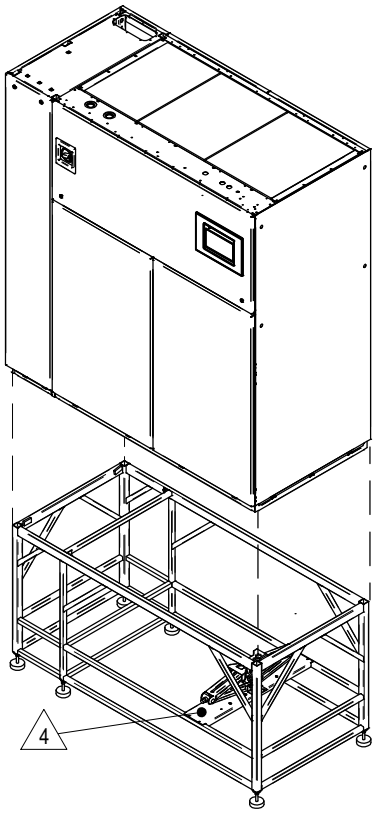
Model Number	Cooling Type	A in. (mm)	B in. (mm)	C in. (mm)
DS035 - DS042	AirCooled/Air Cooled w/Dual Cool	73 (1854)	72 (1829)	59-1/4 (1504)
	Water/Glycol/GLYCOOL/Dual Cool	86 (2184)	85 (2159)	
DS053 - DS070	AirCooled/Air Cooled w/Dual Cool	98 (2489)	97 (2464)	82-1/8 (2086)
	Water/Glycol/GLYCOOL/Dual Cool	109 (2769)	108 (2743)	
DS077	AirCooled	98 (2489)	97 (2464)	
	Water/Glycol/GLYCOOL/Dual Cool	109 (2769)	108 (2743)	
DS105	AirCooled	132 (3353)	131 (3327)	105-1/4 (2673)
	Water/Glycol/GLYCOOL/Dual Cool			

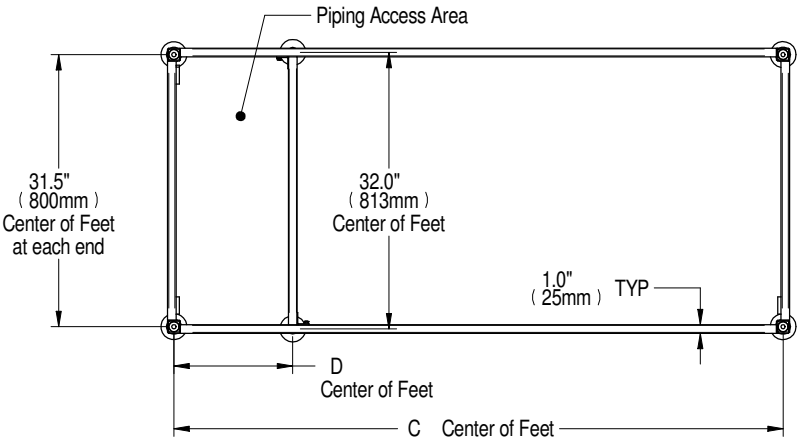
COOLPHASE PERIMETER

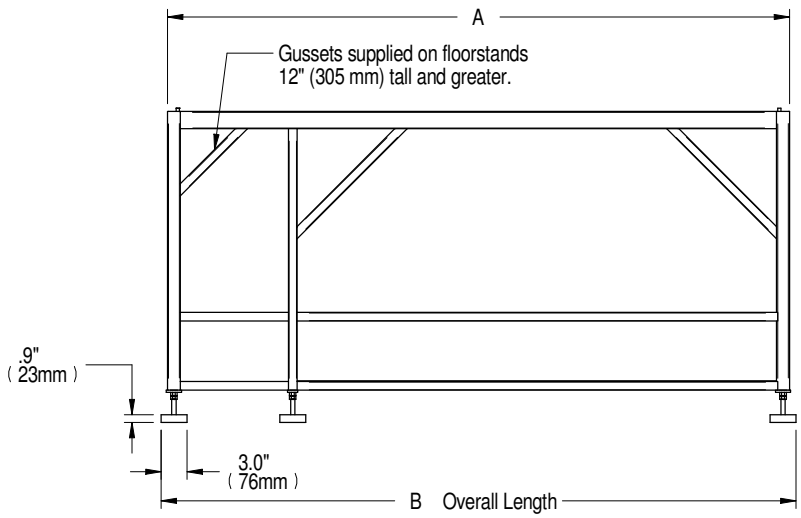
FLOORSTAND DIMENSIONAL DATA

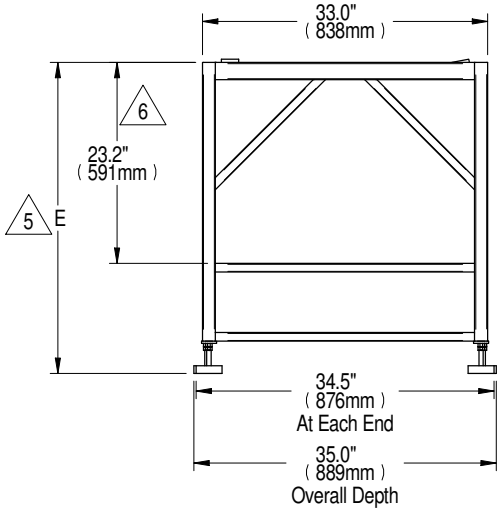
DS035-DS042 (10-12 TONS) W/ EC FANS

Notes:
1. This floorstand should be used when EC fans are intended to be lowered under a raised floor. 24-48" floorstands allow fan to be lowered under the raised floor.
2. Right side of paneled unit is flush with right side of floorstand. All other paneled sides overhang floorstand 1" (25mm).
3. The floorstand used with EC units is not symmetrical and its orientation to the Coolphase Perimeter is critical for lowering the EC fans. Unless the floorstand is installed in the correct position, the blowers will not lower into the floor stand.
4. Jack and jack support are shipped loose and are intended to be placed into position under each fan and utilized to lower or raise that fan as needed for Downflow units.
5. Leveling feet are provided with ± 1-1/2" (38mm) adjustment from nominal height "E".
6. Applies to 36", 42", & 48" Floorstands.









MODEL	DIMENSIONAL DATA IN. (mm)			
	A	B	C	D
Water/Glycol/GLYCOOL Digital Scroll Models	85 (2159)	86-1/2 (2197)	83-1/2 (2121)	26-3/4 (679)
Air-Cooled Digital Scroll Models	72 (1829)	73-1/2 (1867)	70-1/2 (1791)	13-3/4 (349)

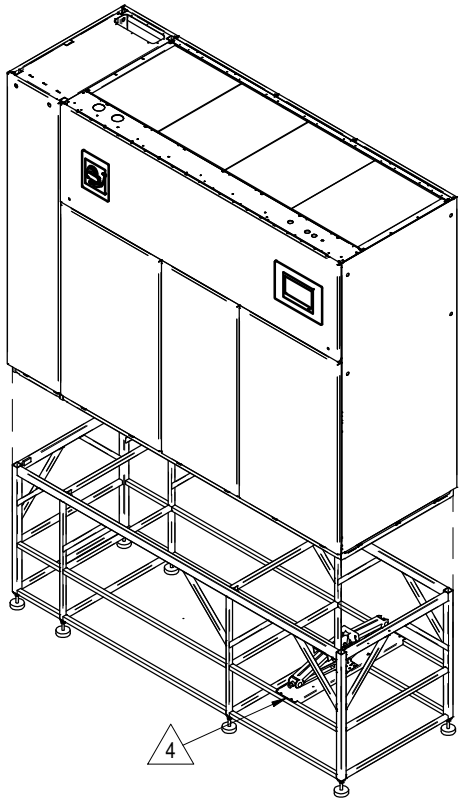
HEIGHT IN. (mm) E 5
24 (610)
30 (762)
36 (914)
42 (1069)
48 (1219)

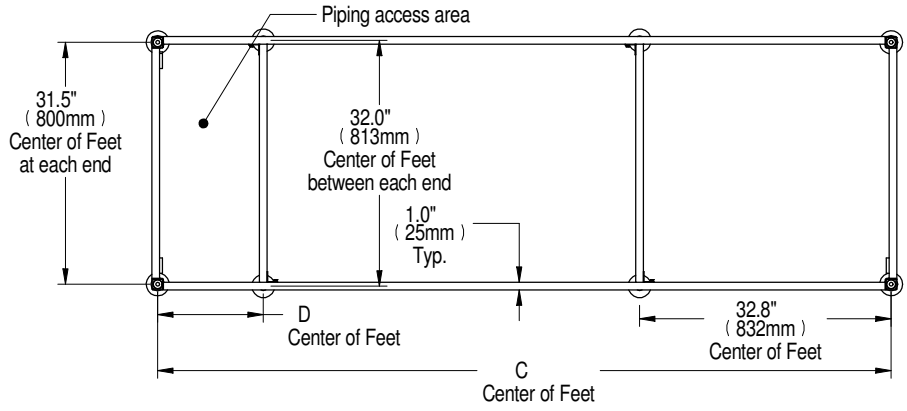
COOLPHASE PERIMETER

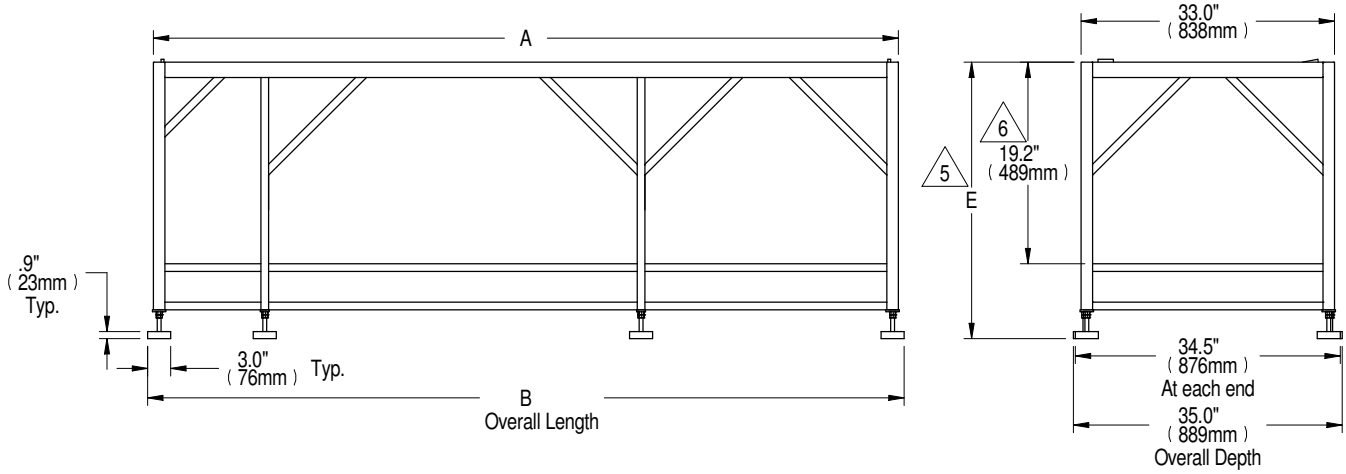
FLOORSTAND DIMENSIONAL DATA

DS053-DS077 (15-22 TONS) W/ EC FANS

Notes:
1. This floorstand should be used when EC fans are intended to be lowered under a raised floor. 24-48" floorstands allow fan to be lowered under raised floor.
2. Right side of paneled unit is flush with right side of floorstand. All other paneled sides overhang floorstand 1" (25mm).
3. The floorstand used with EC units is not symmetrical and its orientation to the CoolPhase Perimeter is critical for lowering the EC fans. Unless the floorstand is installed in the correct position, the blowers will not lower into the floor stand.
4. Jack and jack support are shipped loose and are intended to be placed into position under each fan and utilized to lower or raise that fan as needed for Downflow units.
5. Leveling feet are provided with ± 1-1/2" (38mm) adjustment from nominal height "E".
6. Applies to 36", 42" & 48" Floorstand.





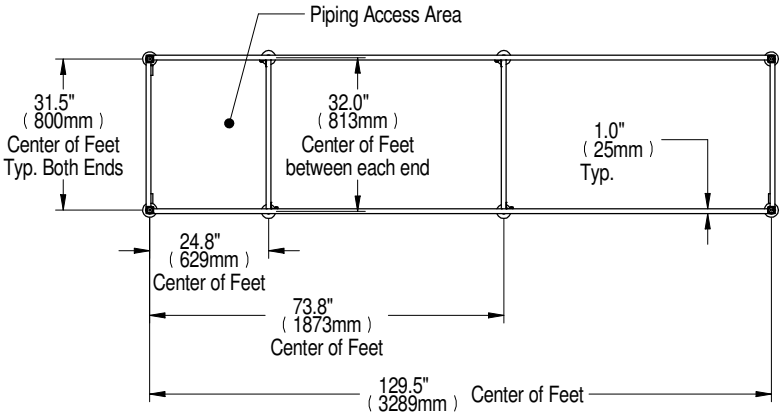


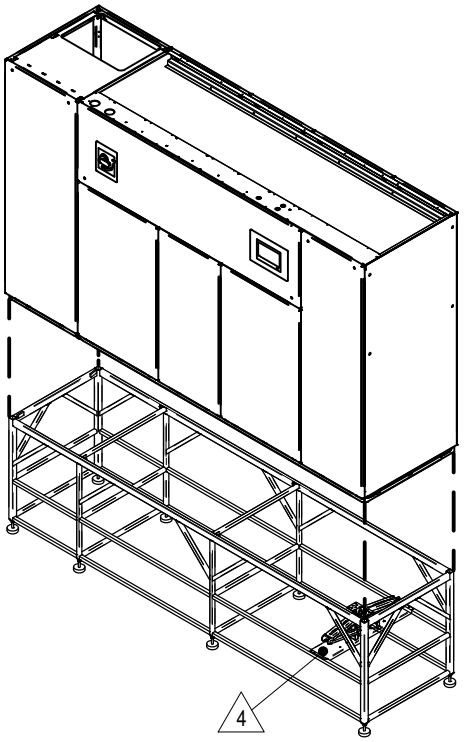
Model		DIMENSIONAL DATA IN. (mm)			
		A	B	C	D
DS053 - DS070	Water/Glycol/GLYCOOL Digital Scroll Models	108 (2743)	109-1/2 (2781)	106-1/2 (2705)	24-3/4 (629)
	Air-Cooled Digital Scroll Models	97 (2464)	98-1/2 (2502)	95-1/2 (2426)	13-3/4 (349)
DS077	Water/Glycol/GLYCOOL Digital Scroll Models	108 (2743)	109-1/2 (2781)	106-1/2 (2705)	24-3/4 (629)
	Air-Cooled Digital Scroll Models	97 (2464)	98-1/2 (2502)	95-1/2 (2426)	13-3/4 (349

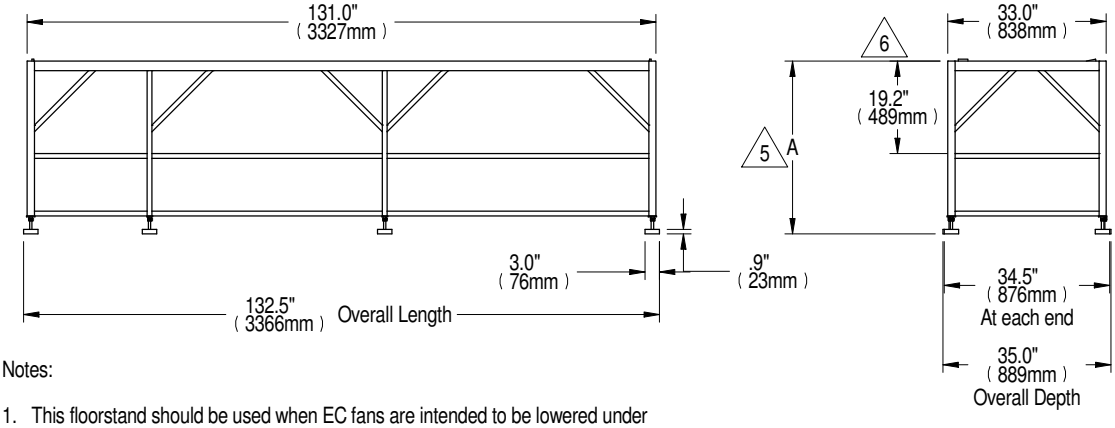
HEIGHT IN. (mm) E 5
24 (610)
30 (762)
36 (914)
42 (1067)
48 (1219)

COOLPHASE PERIMETER

FLOORSTAND DIMENSIONAL DATA
DS105 (30 TONS) MODELS W/ EC FANS







Notes:

1. This floorstand should be used when EC fans are intended to be lowered under a raised floor.
2. Right side of paneled unit is flush with right side of floorstand. All other paneled sides overhang floorstand 1" (25mm).
3. The floorstand used with EC units is not symmetrical and its orientation to the CoolPhase Perimeter is critical for lowering the EC fans. Unless the floorstand is installed in the correct position, the blowers will not lower into the floorstand.

4. Jack and jack support are shipped loose and are intended to be placed into position under each fan and utilized to lower or raise that fan as needed for Downflow units.

5. Leveling feet are provided with ± 1-1/2" (38mm) adjustment from nominal height "A".

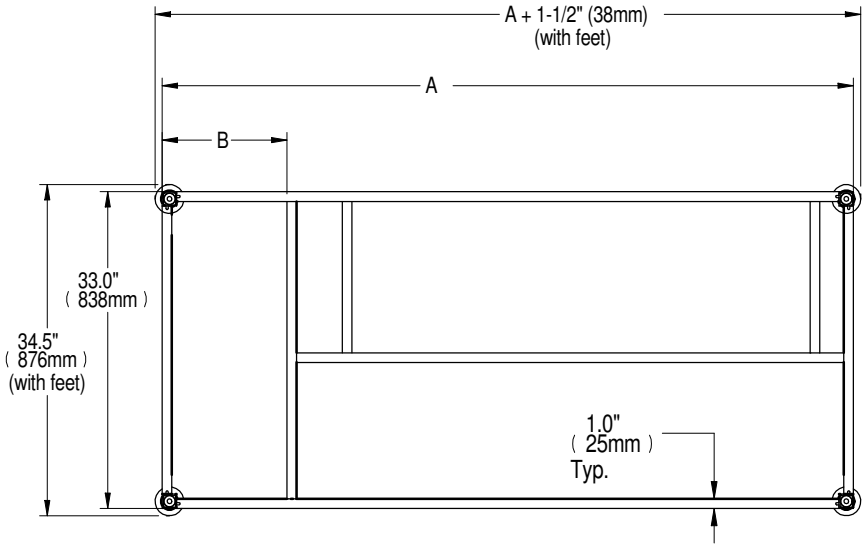
6. Applies to 36", 42", & 48" Floorstands.

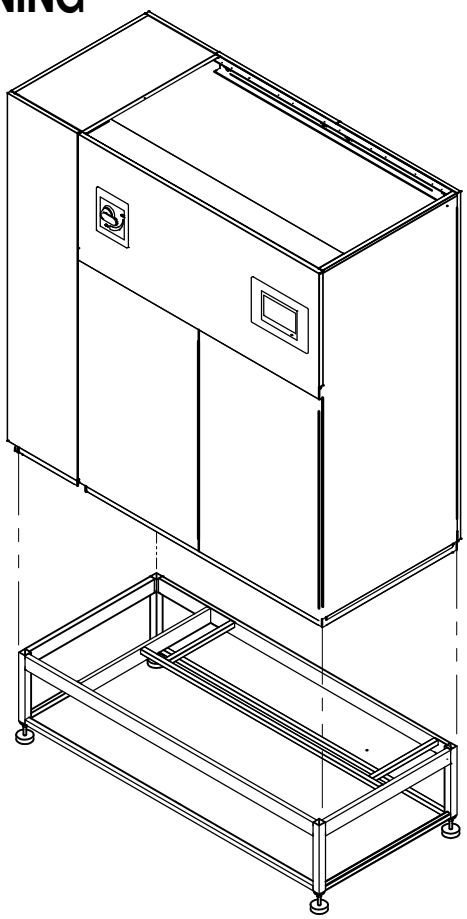
HEIGHT IN. (mm) A 5
24 (610)
30 (762)
36 (914)
42 (1067)
48 (1219)

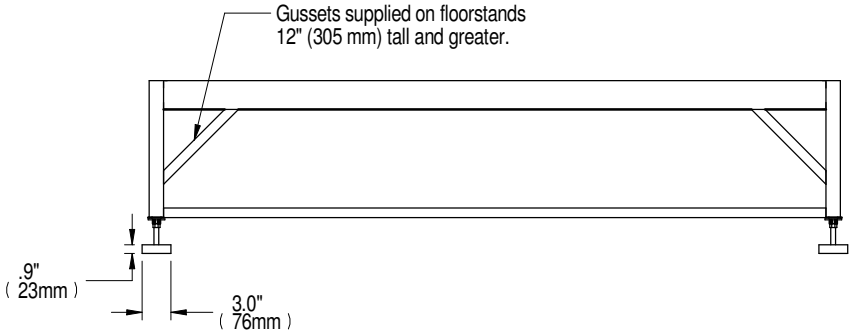
COOLPHASE PERIMETER

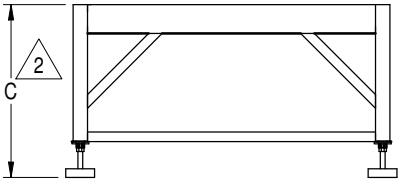
FLOORSTAND DIMENSIONAL DATA

UPFLOW DS035-DS042 (10-12 TONS) MODELS W/ FORWARD CURVED BLOWERS FLOOR PLANNING









DIMENSIONAL DATA IN. (mm)		
MODEL	A	B
Water/Glycol/GLYCOOL Cooled Digital Scroll	85 (2159)	26 (660)
Air-Cooled Digital Scroll	72 (1829)	13 (330)

HEIGHT IN. (mm) C △2
9 (229)
12 (305)
15 (381)
18 (457)
21 (533)
24 (610)

Notes:

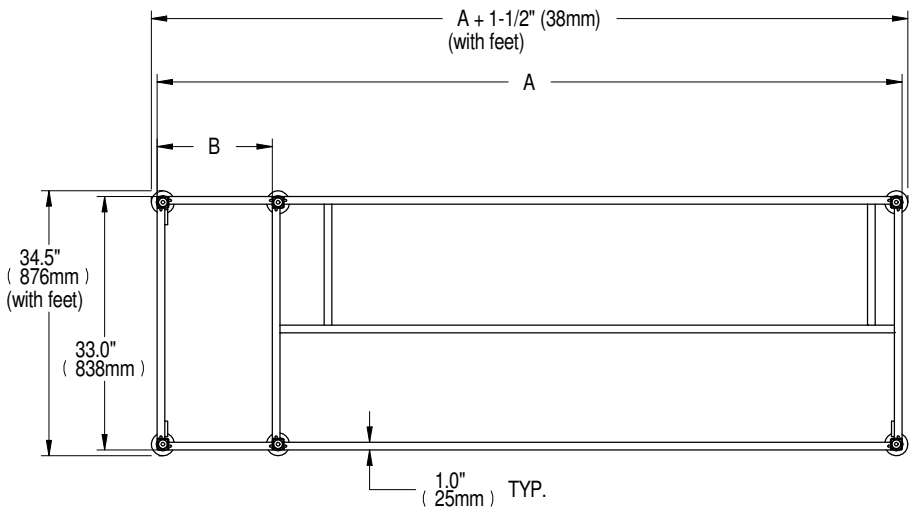
1. Right side of paneled unit is flush with right side of floorstand. All other paneled sides overhang floorstand 1" (25mm).

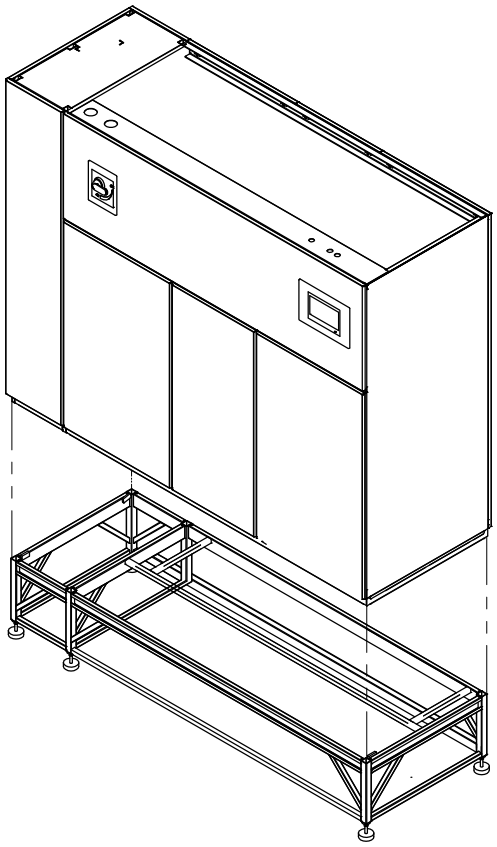
△2. Leveling feet are provided with ± 1-1/2" (38mm) adjustment from nominal height C.

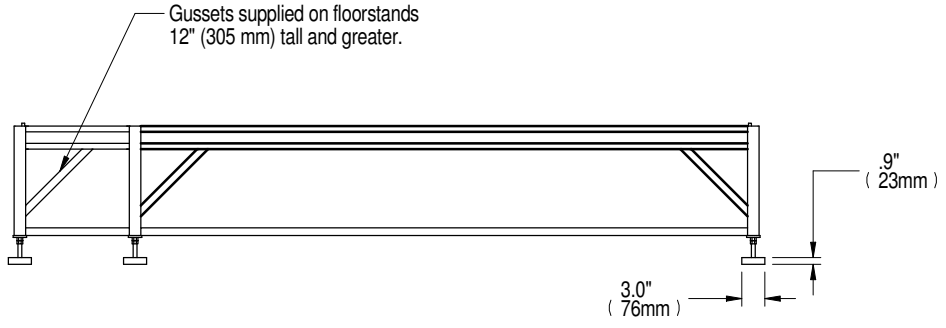
COOLPHASE PERIMETER

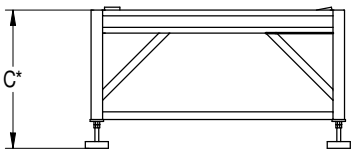
FLOORSTAND DIMENSIONAL DATA

UPFLOW DS053-DS077 (15-22 TONS) MODELS W/ FORWARD CURVED BLOWERS FLOOR PLANNING









DIMENSIONAL DATA IN. (mm)		
MODEL	**A**	**B**
Water/Glycol/GLYCOOL	108 (2743)	26 (660)
Air-Cooled Digital Scroll	97 (2464)	15 (381)

HEIGHT IN. (mm) C △2
9 (229)
12 (305)
15 (381)
18 (457)
21 (533)
24 (610)

Notes:
1. Right side of paneled unit is flush with right side of floorstand. All other paneled sides overhang floorstand 1" (25mm).

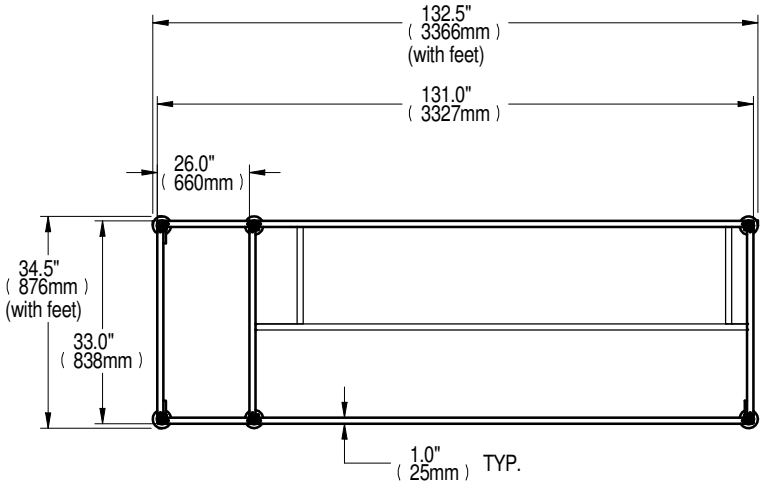
△2. Leveling feet are provided with ± 1-1/2" (38mm) adjustment from nominal height C.

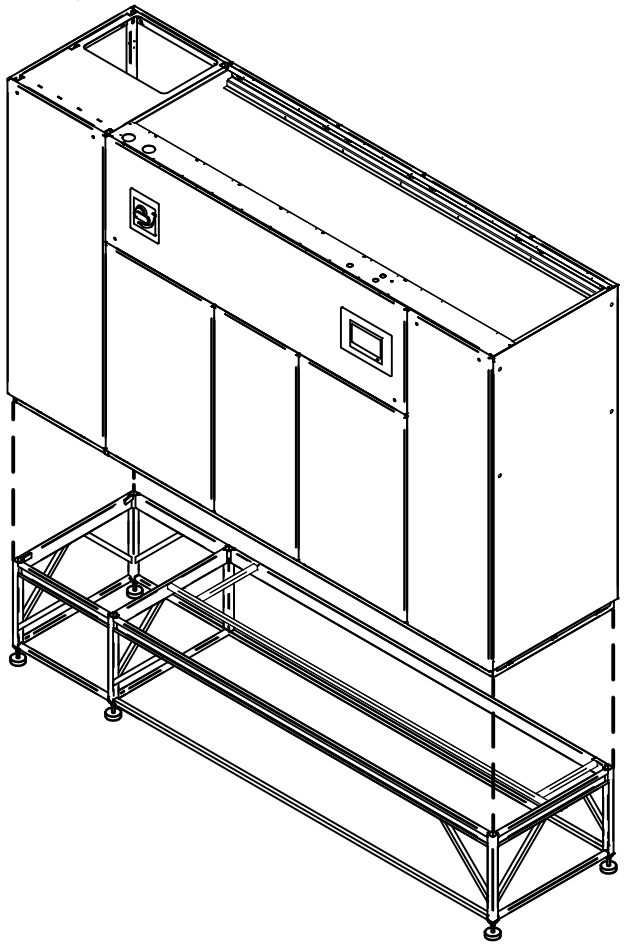
COOLPHASE PERIMETER

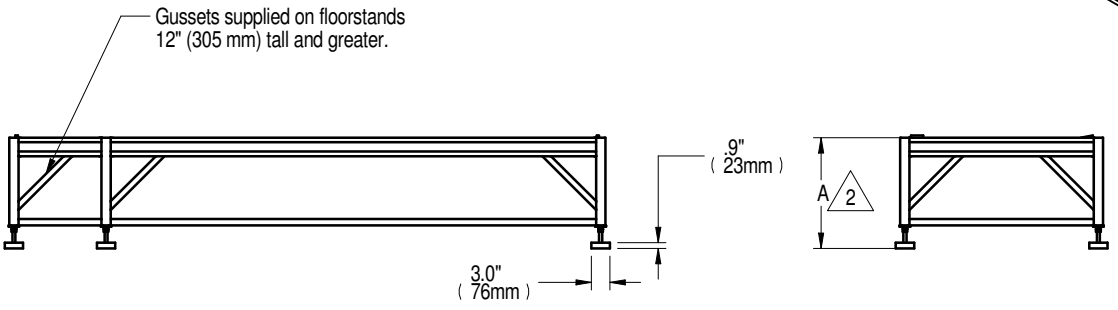
FLOORSTAND DIMENSIONAL DATA

UPFLOW DS105 (30 TONS) MODELS W/ FORWARD CURVED BLOWERS

FLOOR PLANNING







HEIGHT IN. (mm) A 2
9 (229)
12 (305)
15 (381)
18 (457)
21 (533)
24 (610)

Notes:

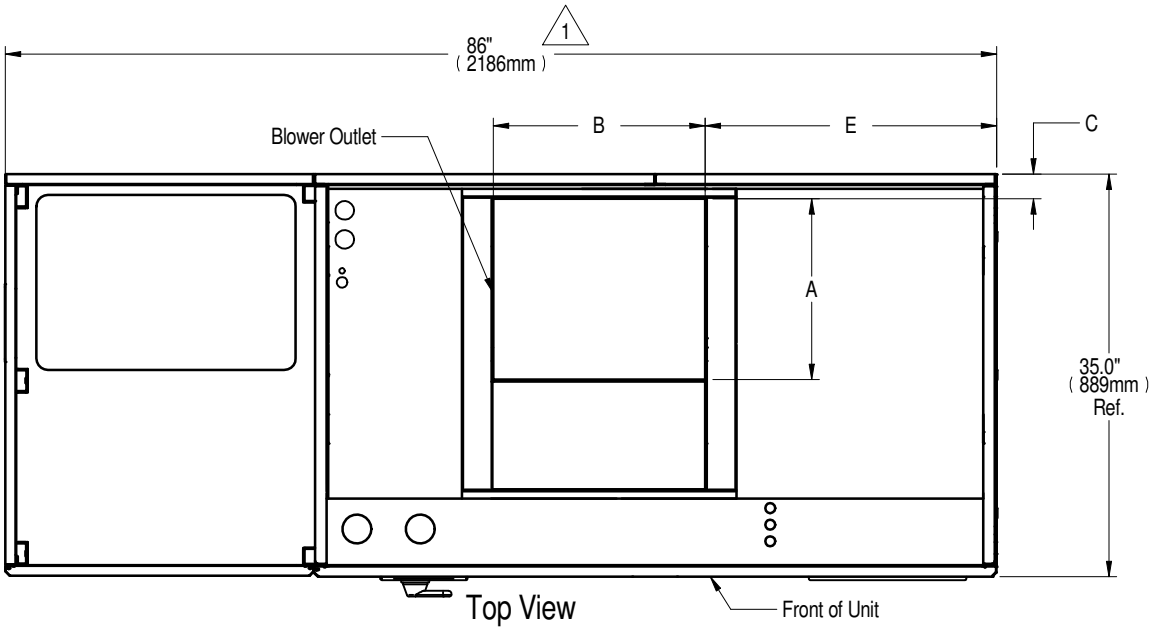
1. Right side of paneled unit is flush with right side of floorstand. All other paneled sides overhang floorstand 1" (25mm).

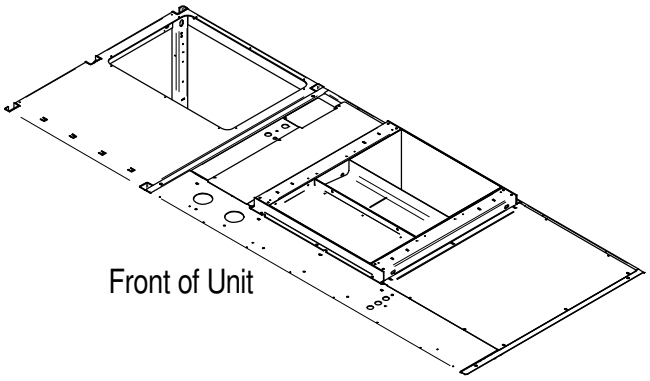
2. Leveling feet are provided with ± 1-1/2" (38mm) adjustment from nominal height A.

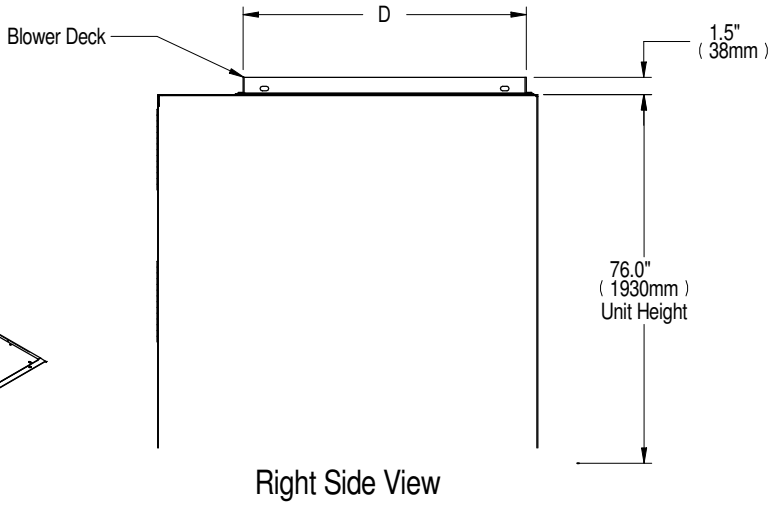
COOLPHASE PERIMETER

BLOWER OUTLET & DECK DIMENSIONAL DATA

UPFLOW DS035-DS042 (10-12 TONS) W/ FORWARD CURVED BLOWERS







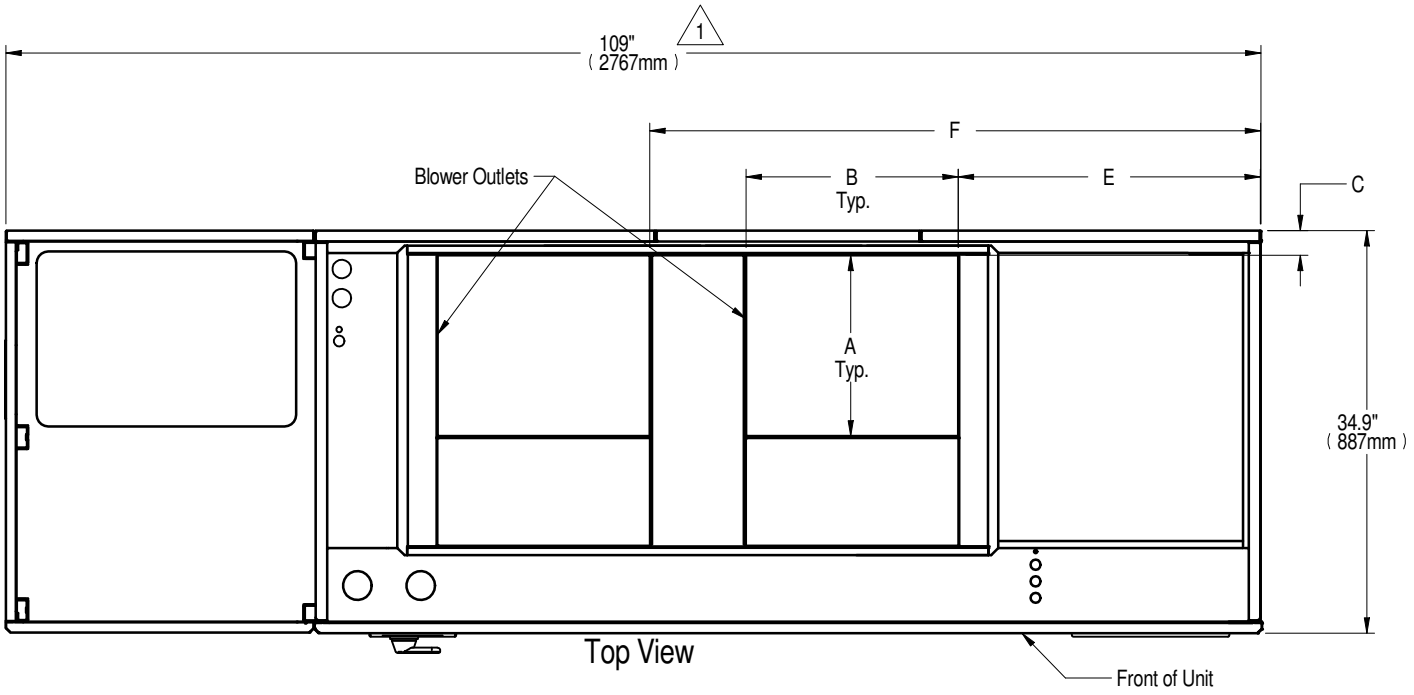
Notes:

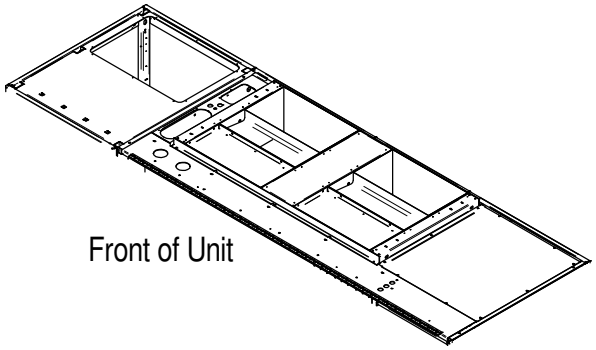
1. Applies to units with water-cooled compressor section.
   Dimension for air-cooled units compressor section is 73" (1854mm).

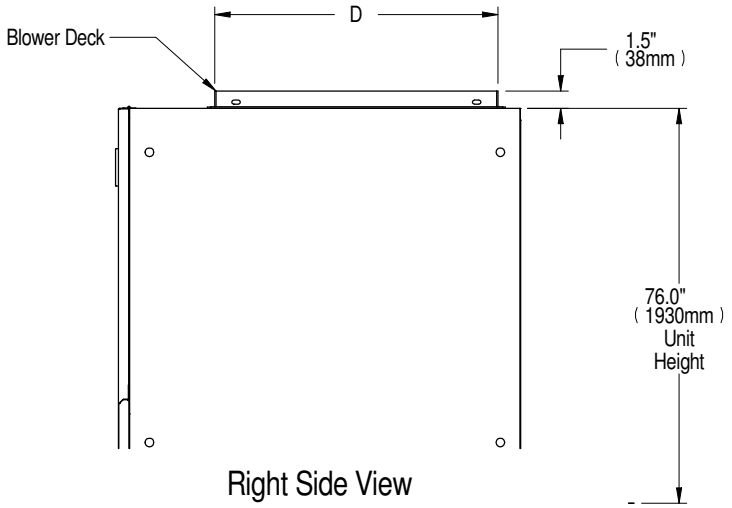
BLOWER	SUPPLY	DIMENSIONAL DATA IN. (mm)				
		A	B	C	D	E
15 x 15	FRONT THROW	15-7/8 (404)	18-5/8 (472)	2-1/8 (54)	24-5/8 (625)	25-1/4 (641)
	REAR THROW			11-5/8 (295)		
15 x 11	FRONT THROW		14-3/4 (375)	2-1/8 (54)		
	REAR THROW			11-5/8 (295)		

COOLPHASE PERIMETER

BLOWER OUTLET & DECK DIMENSIONAL DATA
UPFLOW DS053-DS077 (15-22 TONS) W/ FORWARD CURVED BLOWERS







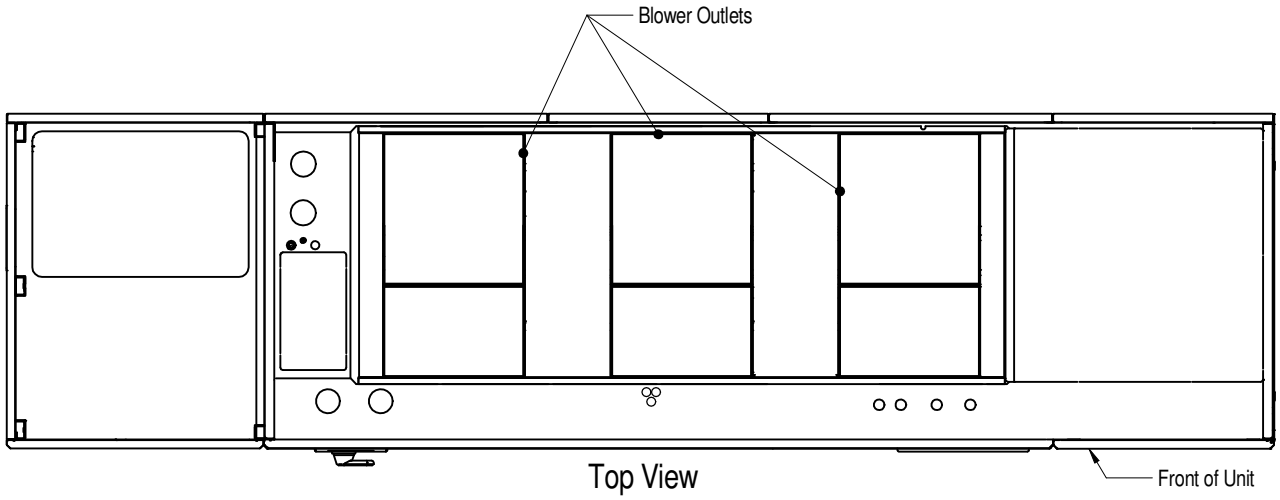
Notes:

1. Applies to units with water-cooled compressor section.
Dimension for air-cooled units compressor section is 98" (2489mm).

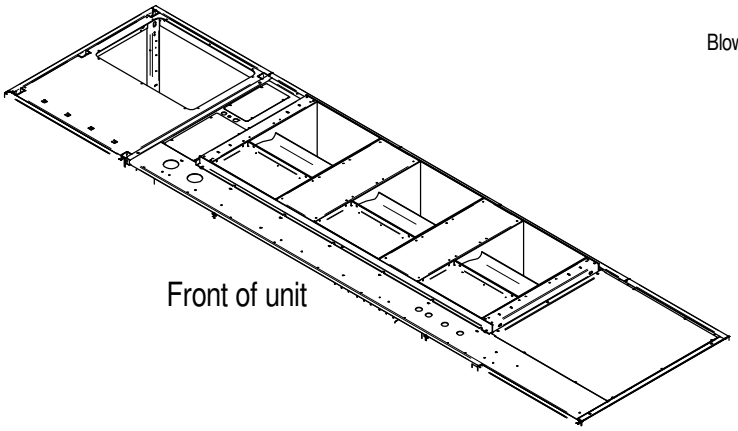
BLOWER	SUPPLY	DIMENSIONAL DATA IN. (mm)					
		A	B	C	D	E	F
15 x 15	FRONT THROW	15-7/8 (404)	18-5/8 (472)	2-1/8 (54)	24-5/8 (625)	27-7/8 (708)	54-1/2 (1384)
	REAR THROW			11-5/8 (295)			
15 x 11	FRONT THROW		14-3/4 (375)	2-1/8 (54)		31-3/8 (797)	58-1/2 (1486)
	REAR THROW			11-5/8 (295)			

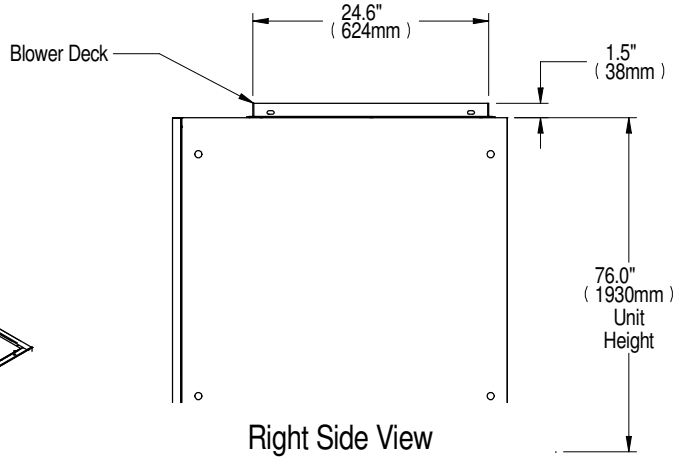
COOLPHASE PERIMETER

BLOWER OUTLET & DECK DIMENSIONAL DATA
UPFLOW DS105 (30 TONS) W/ FORWARD CURVED BLOWERS



Top View





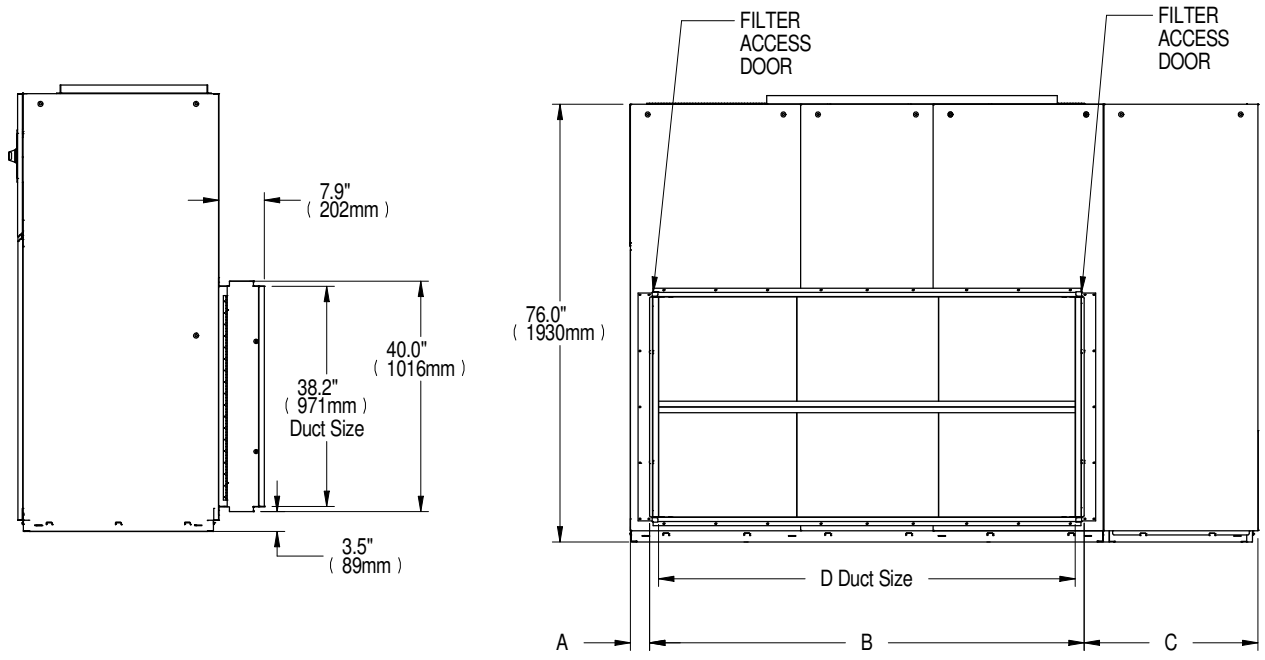
Right Side View

BLOWER	SUPPLY	DIMENSIONAL DATA IN. (mm)						
		A	B	C	D	E	F	G
15 x 11	FRONT THROW	15-7/8 (404)	14-3/4 (375)	2-1/8 (54)	24-5/8 (625)	30-3/4 (781)	54-1/2 (1384)	78-1/4 (1988)
	REAR THROW			11-5/8 (295)				

COOLPHASE PERIMETER

FILTER BOX DIMENSIONAL DATA

UPFLOW DS035-DS105 (10-30 TONS) ALL COMPRESSOR MODELS W/ FORWARD CURVED BLOWERS REAR RETURN FILTER



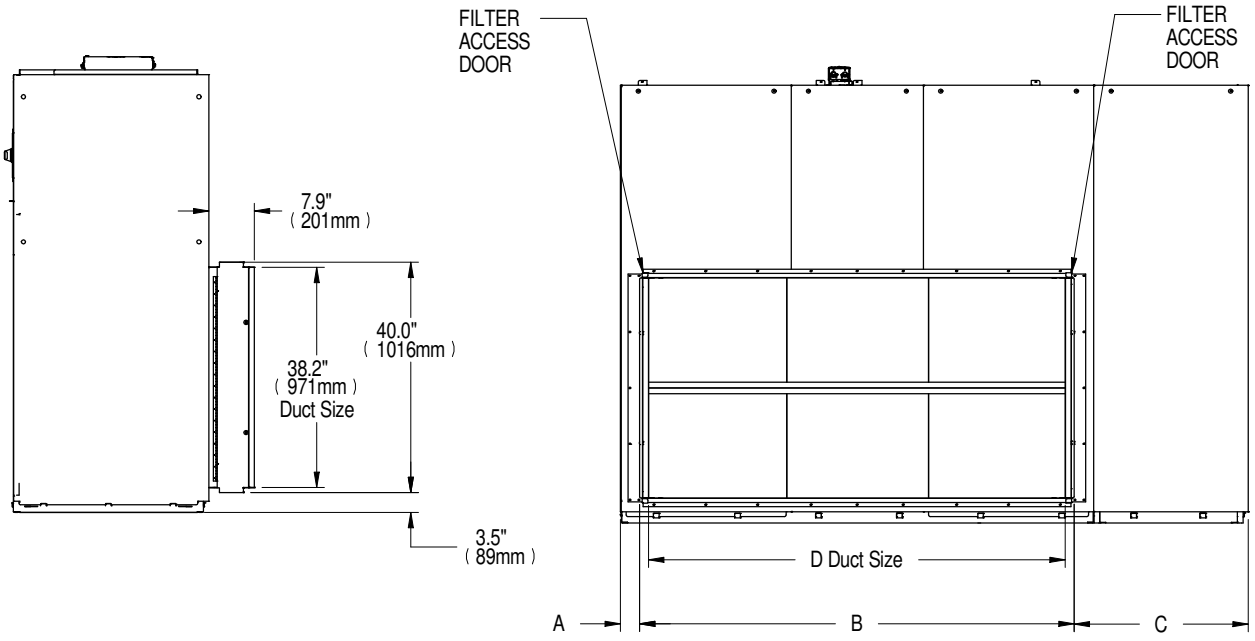
Notes:
1. Filters can be accessed from either side.
2. 25" (635mm) minimum clearance provided on one side for filter access.
3. Filter boxes are shipped flat and must be field assembled.

Rear Return Filter Box Dimensional Data in (mm)					
MODEL	**A**	**B**	**C**	**D**	**# Filters**
DS035 - DS042 Air-Cooled Digital Scroll	4-1/4 (108)	50-3/4 (1289)	18 (457)	47-5/8 (1210)	4
DS035 - DS042 Water/Glycol/GLYCOOL			31 (787)		
DS053-DS070 Air-Cooled Digital Scroll	3-1/4 (83)	75-1/2 (1918)	19-1/4 (489)	72-3/8 (1838)	6
DS053-DS070 Water/Glycol/GLYCOOL			30-1/4 (768)		
DS077 Air Cooled Scroll			19-1/4 (489)		
DS077 Water/Glycol/GLYCOOL			30-1/4 (768)		
DS105 All Models	2-1/4 (57)	100-1/4 (2546)	29-1/2 (749)	97-1/8 (2467)	8

COOLPHASE PERIMETER

FILTER BOX DIMENSIONAL DATA

UPFLOW DS035-DS105 (10-30 TONS) W/ EC FANS ALL COMPRESSOR MODELS REAR RETURN FILTER



Notes:
1. Filters can be accessed from either side.
2. 25" (635mm) minimum clearance provided on one side for filter access.
3. Filter boxes are shipped flat and must be field assembled.

Rear Return Filter Box Dimensional Data in. (mm)					
MODEL	**A**	**B**	**C**	**D**	**# Filters**
DS035 - DS042 Air-Cooled Scroll Digital Scroll	4-1/4 (108)	50-3/4 (1289)	18 (457)	47-5/8 (1210)	4
DS035 - DS042 Water/Glycol/GLYCOOL			31 (787)		
DS053-DS070 Air-Cooled Digital Scroll	3-1/4 (83)	75-1/2 (1918)	19-1/4 (489)	72-3/8 (1838)	6
DS053-DS070 Water/Glycol/GLYCOOL			30-1/4 (768)		
DS077 Air Cooled Scroll			19-1/4 (489)		
DS077 Water/Glycol/GLYCOOL			30-1/4 (768)		
DS105 All Models	2-1/4 (57)	100-1/4 (2546)	29-1/2 (749)	97-1/8 (2467)	8

COOLPHASE PERIMETER

PLENUM DIMENSIONAL DATA

UPFLOW DS035-DS105 (10-30 TONS) MODELS W/ FORWARD CURVED BLOWERS

FRONT VIEWS - CHECK ONE (1):

☐ WITH FRONT GRILLE

☐ WITHOUT GRILLE

REAR VIEWS - CHECK ONE (1):

☐ WITH REAR GRILLE

☐ WITHOUT GRILLE

LEFT SIDE VIEWS - CHECK ONE (1):

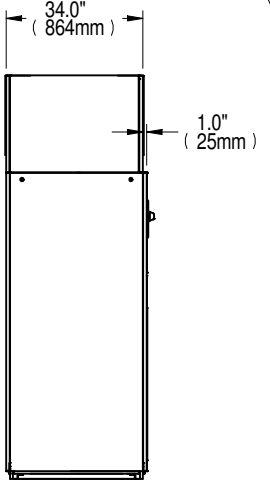
☐ WITH GRILLE

☐ WITHOUT GRILLE

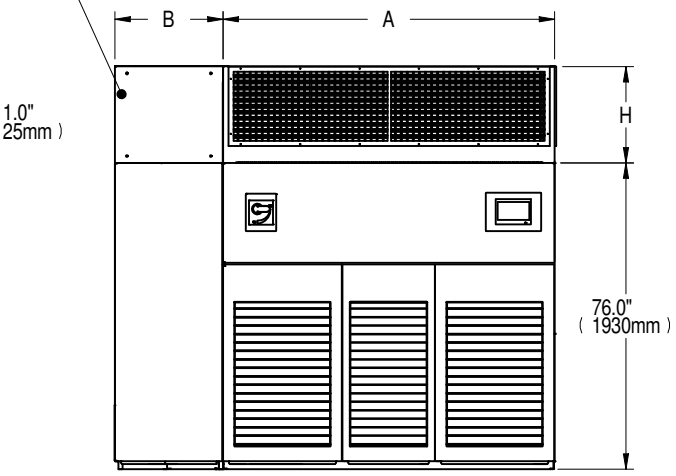
RIGHT SIDE VIEWS - CHECK ONE (1):

☐ WITH GRILLE

☐ WITHOUT GRILLE



SIDE VIEW - UNIT WITH PLENUM



FRONT VIEW - UNIT WITH PLENUM

Model		Plenum Dimensional Data in. (mm)		Grille Size in. (mm) - Nominal	
		A	B	Front/Rear Grilles	Side Grille
DS035 - DS042	Air-Cooled Models	59-1/4 (1505)	13-3/4 (349)	18 (457) X 55 (1397)	18 (457) X 20 (508)
	Water/Glycol/GLYCOOL Models		26-3/4 (679)		
DS053-DS070	Air-Cooled Models	82-1/4 (2089)	15-3/4 (400)	18 (457) X 78 (1981)	
	Water/Glycol/GLYCOOL Models		26-3/4 (679)		
DS077	Air-Cooled Models		15-3/4 (400)		
	Water/Glycol/GLYCOOL Models		26-3/4 (679)		
DS105	All Models	105-1/4 (2673)		(1) 18 (457) X 20 (508)	
				(1) 18 (457) X 78 (1981)	

HEIGHT IN. (mm) H	PLENUM CONFIGURATION
20 (508)	NON GRILLED
24 (610)	NON-GRILLED, FRONT DISCHARGE OR REAR DISCHARGE
36 (914)	NON-GRILLED

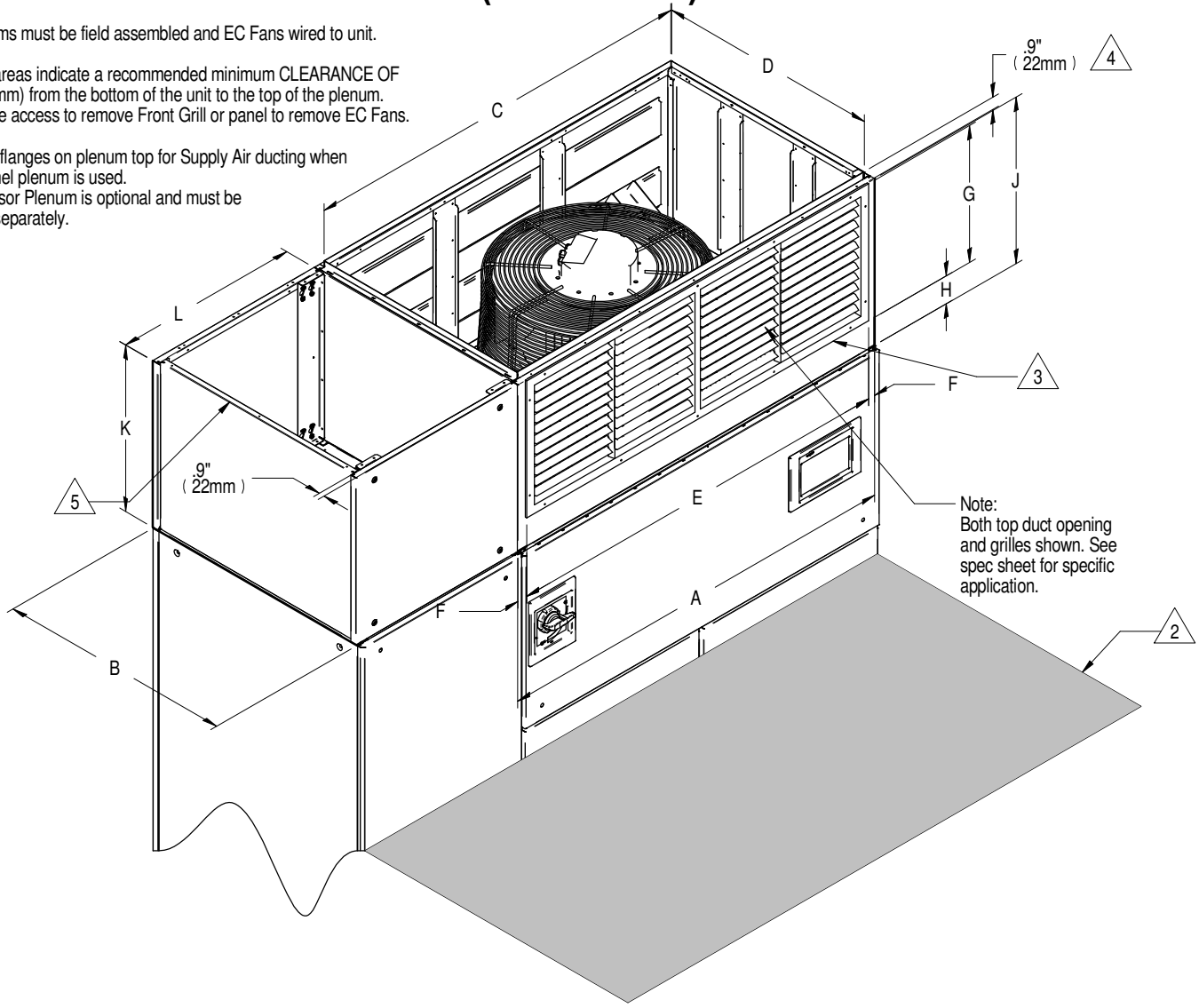
Notes:
1. Typical DS053-DS077 (15-22 Tons) unit orientation shown with grille Plenum. View varies by unit size and Plenum selection.
2. Optional grille Plenum kits must include front or rear grille.
3. Non-grille Plenums are open on the top and not designed with duct flange.
4. All Plenums are shipped flat and must be field assembled.

COOLPHASE PERIMETER

PLENUM DIMENSIONAL DATA

UPFLOW DS035-DS042 (10-12 TONS) MODELS W/ EC FANS

Notes:
1. All Plenums must be field assembled and EC Fans wired to unit.
2. Shaded areas indicate a recommended minimum CLEARANCE OF 36" (914mm) from the bottom of the unit to the top of the plenum.
3. Must have access to remove Front Grill or panel to remove EC Fans.
4. Top duct flanges on plenum top for Supply Air ducting when solid panel plenum is used.
5. Compressor Plenum is optional and must be ordered separately.



MAIN UNIT PLENUM HEIGHT IN. (mm) J	MAIN UNIT PLENUM WEIGHT lb. (kg)		
	NON-GRILLED PLENUM	FRONT DISCHARGE	REAR DISCHARGE
24 (610)	85 (39)	126 (57)	129 (59)
30 (762)	105 (48)	N/A	
36 (914)	123 (56)		

COMPRESSOR PLENUM			
MODEL	WIDTH IN. (mm) L	HEIGHT IN. (mm) K	WEIGHT lb. (kg)
Air-Cooled	13 (330)	24 (610)	24 (11)
		30 (762)	26 (12)
		36 (914)	29 (13)
Water-Cooled	26 (660)	24 (610)	33 (15)
		30 (762)	37 (17)
		36 (914)	42 (19)

PLENUM DIMENSIONAL DATA IN. (mm)							
A	B	C	D	E	F	G	H
59-1/4 (1505)	33-3/4 (857)	57-9/16 (1463)	32-1/16 (815)	56-11/16 (1440)	1-5/16 (33)	19-11/16 (500)	4-5/16 (109)

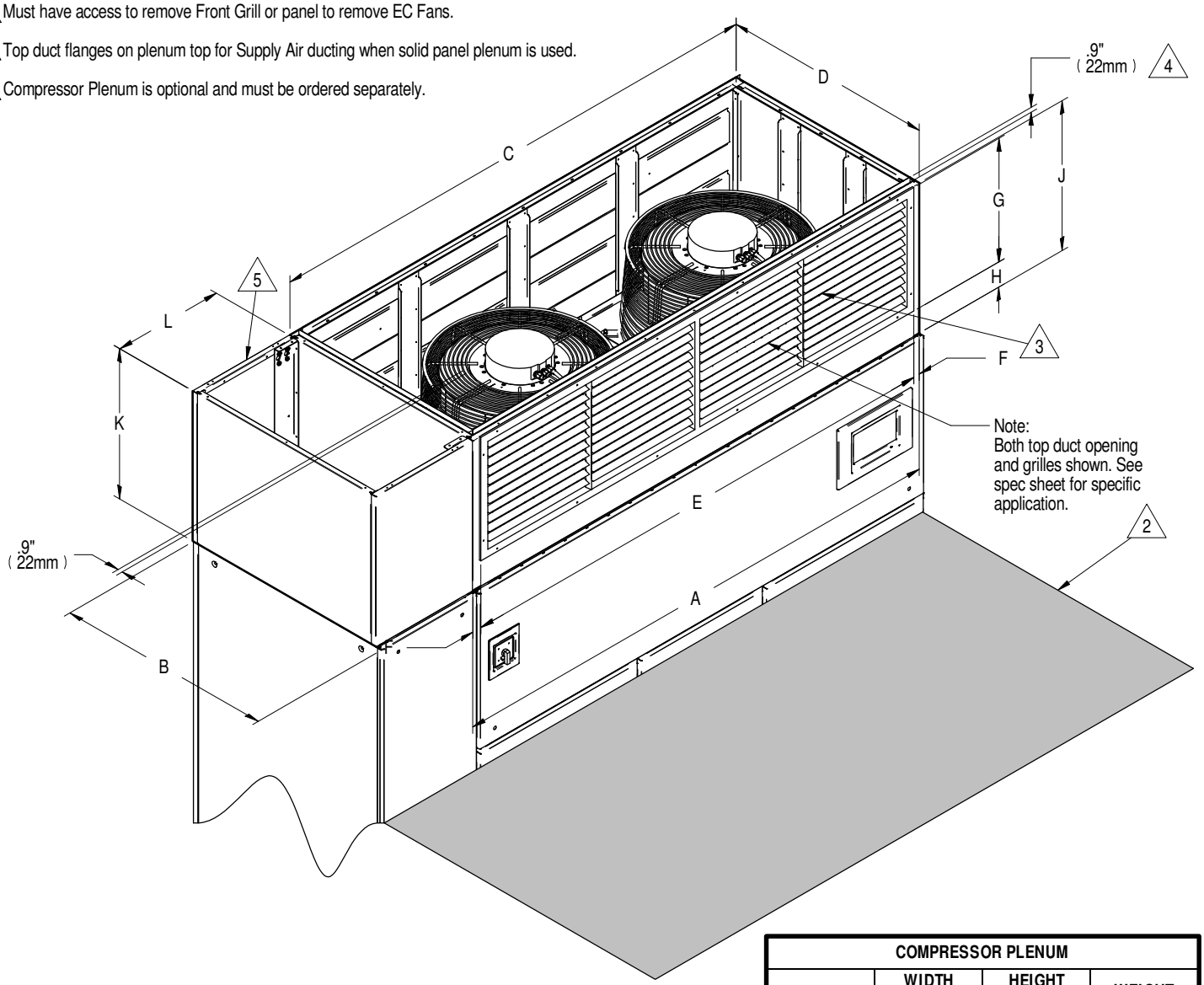
NO. OF FANS/UNIT	EC FAN ASSEMBLY WEIGHT lb. (kg)	
	VS028-VS035	VS042
1	119 (54)	141 (64)

COOLPHASE PERIMETER

PLENUM DIMENSIONAL DATA

UPFLOW DS053-DS077 (15-22 TONS) W/ EC FANS

Notes:
1. All Plenums must be field assembled and fans wired to unit.
2. Shaded areas indicate a recommended minimum clearance of 36" (914mm) from the bottom of the unit to the top of the plenum.
3. Must have access to remove Front Grill or panel to remove EC Fans.
4. Top duct flanges on plenum top for Supply Air ducting when solid panel plenum is used.
5. Compressor Plenum is optional and must be ordered separately.



MAIN UNIT PLENUM HEIGHT IN. (mm) J	MAIN UNIT PLENUM WEIGHT lb. (kg)		
	NON-GRILLED PLENUM	FRONT DISCHARGE	REAR DISCHARGE
24 (610)	112 (51)	160 (73)	173 (79)
30 (762)	136 (62)	N/A	
36 (914)	156 (71)		

COMPRESSOR PLENUM			
MODEL	WIDTH IN. (mm) L	HEIGHT IN. (mm) K	WEIGHT lb. (kg)
Air-Cooled	15 (381)	24 (610)	26 (12)
		30 (762)	29 (13)
		36 (914)	31 (14)
Water-Cooled	26 (660)	24 (610)	33 (15)
		30 (762)	37 (17)
		36 (914)	42 (19)

PLENUM DIMENSIONAL DATA IN. (mm)							
A	B	C	D	E	F	G	H
82 (2083)	34 (864)	81 (2057)	32 (813)	80 (2032)	1 (25)	20 (508)	4 (102)

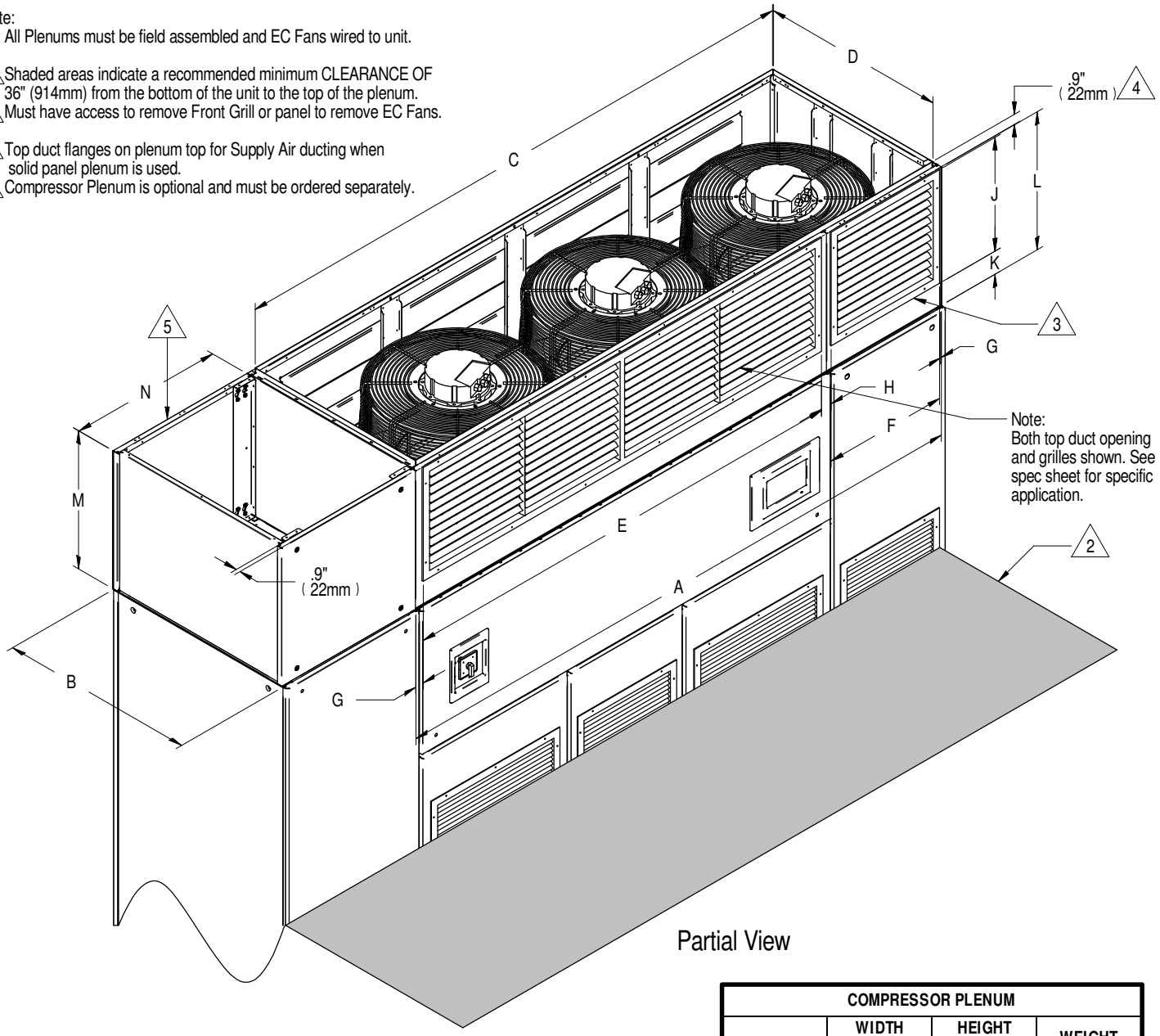
NO. OF FANS/UNIT	EC FAN ASSEMBLY WEIGHT lb. (kg)
2	102 (46)

COOLPHASE PERIMETER

PLENUM DIMENSIONAL DATA

UPFLOW DS105 (30 TONS) MODELS W/ EC FANS

Note:
1. All Plenums must be field assembled and EC Fans wired to unit.
2. Shaded areas indicate a recommended minimum CLEARANCE OF 36" (914mm) from the bottom of the unit to the top of the plenum.
3. Must have access to remove Front Grill or panel to remove EC Fans.
4. Top duct flanges on plenum top for Supply Air ducting when solid panel plenum is used.
5. Compressor Plenum is optional and must be ordered separately.



Partial View

MAIN UNIT PLENUM HEIGHT IN. (mm) L	MAIN UNIT PLENUM WEIGHT lb. (kg)		
	NON-GRILLED PLENUM	FRONT DISCHARGE	REAR DISCHARGE
24 (610)	131 (59)	206 (93)	220 (100)
30 (762)	162 (74)	N/A	
36 (914)	188 (85)		

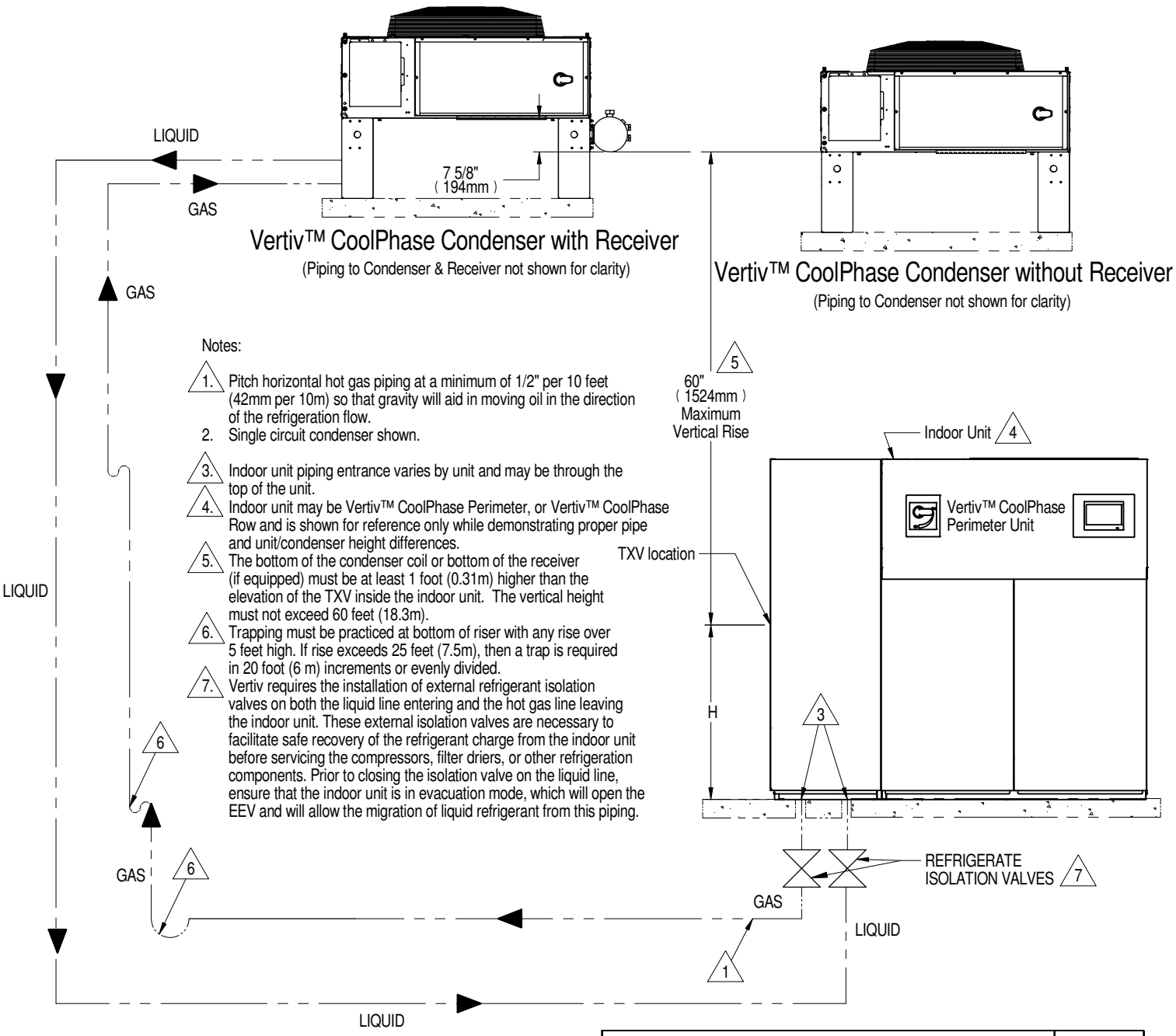
COMPRESSOR PLENUM			
MODEL	WIDTH IN. (mm) N	HEIGHT IN. (mm) M	WEIGHT lb. (kg)
Air-Cooled	15 (381)	24 (610)	26 (12)
		30 (762)	29 (13)
		36 (914)	31 (14)
Water-Cooled	26 (660)	24 (610)	33 (15)
		30 (762)	37 (17)
		36 (914)	42 (19)

PLENUM DIMENSIONAL DATA IN. (mm)									
A	B	C	D	E	F	G	H	J	K
105 (2673)	34 (864)	104 (2641)	32 (813)	80 (2032)	22 (559)	1 (25)	2 (51)	20 (508)	4 (102)

NO. OF FANS/UNIT	EC FAN ASSEMBLY WEIGHT lb. (kg)
3	93 (42)

COOLPHASE CONDENSER

AIR COOLED PIPING SCHEMATIC
CONDENSER ABOVE INDOOR UNIT



Notes:

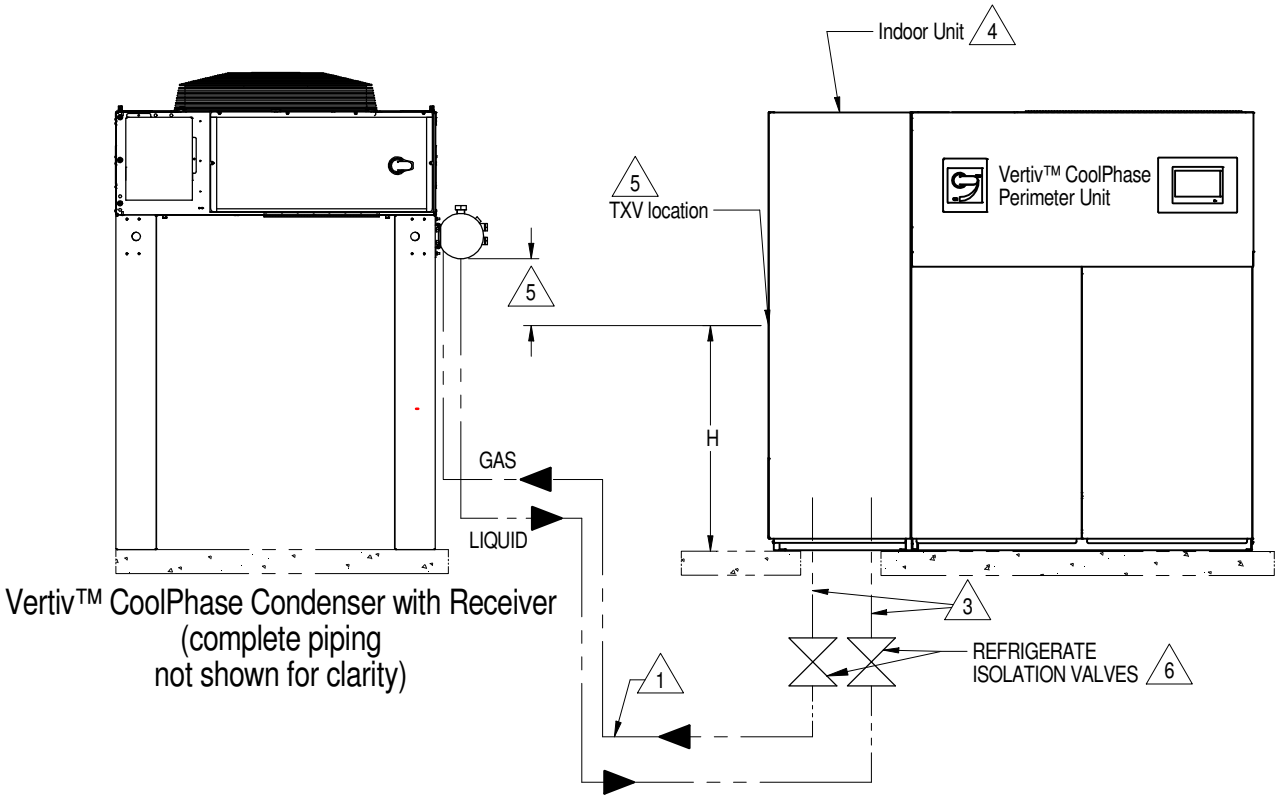
1. Pitch horizontal hot gas piping at a minimum of 1/2" per 10 feet (42mm per 10m) so that gravity will aid in moving oil in the direction of the refrigeration flow.
2. Single circuit condenser shown.
3. Indoor unit piping entrance varies by unit and may be through the top of the unit.
4. Indoor unit may be Vertiv™ CoolPhase Perimeter, or Vertiv™ CoolPhase Row 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 at least 1 foot (0.31m) 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™ CoolPhase Row (CR019)	45 (1143)
Vertiv™ CoolPhase Row (CR020-CR035)	27 (686)

——— Field piping

COOLPHASE CONDENSER

AIR COOLED PIPING SCHEMATIC
CONDENSER AND INDOOR UNIT AT SAME LEVEL



—— - - - —— Field piping

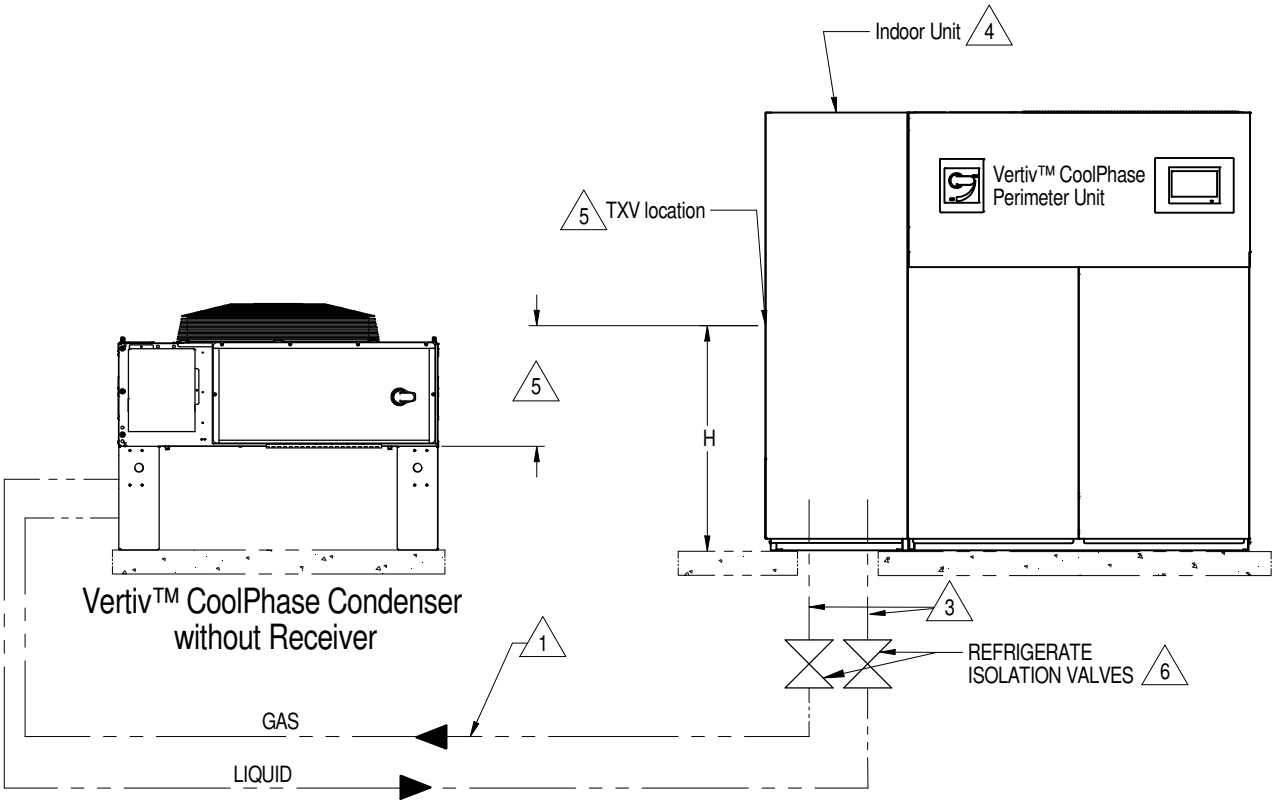
Internal TXV Height	H in. (mm)
Vertiv™ CoolPhase Perimeter (PX011-PX029) Downflow	44 (1118)
Vertiv™ CoolPhase Perimeter (PX011-PX029) Upflow	20 (508)
Vertiv™ CoolPhase Perimeter (DS035-DS105)	43 (1092)
Vertiv™ CoolPhase Row (CR019)	45 (1143)
Vertiv™ CoolPhase Row (CR020-CR035)	27 (686)

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. Indoor 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™ CoolPhase Row and is shown for reference only.
5. The bottom of the receiver must be at least 1 foot (0.31m) higher than the elevation of the TXV inside the indoor unit, otherwise extended legs or a field piped subcooler needs to be utilized.
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 CONDENSER

AIR COOLED PIPING SCHEMATIC
CONDENSER AND INDOOR UNIT AT SAME LEVEL



—— – – – —— Field piping

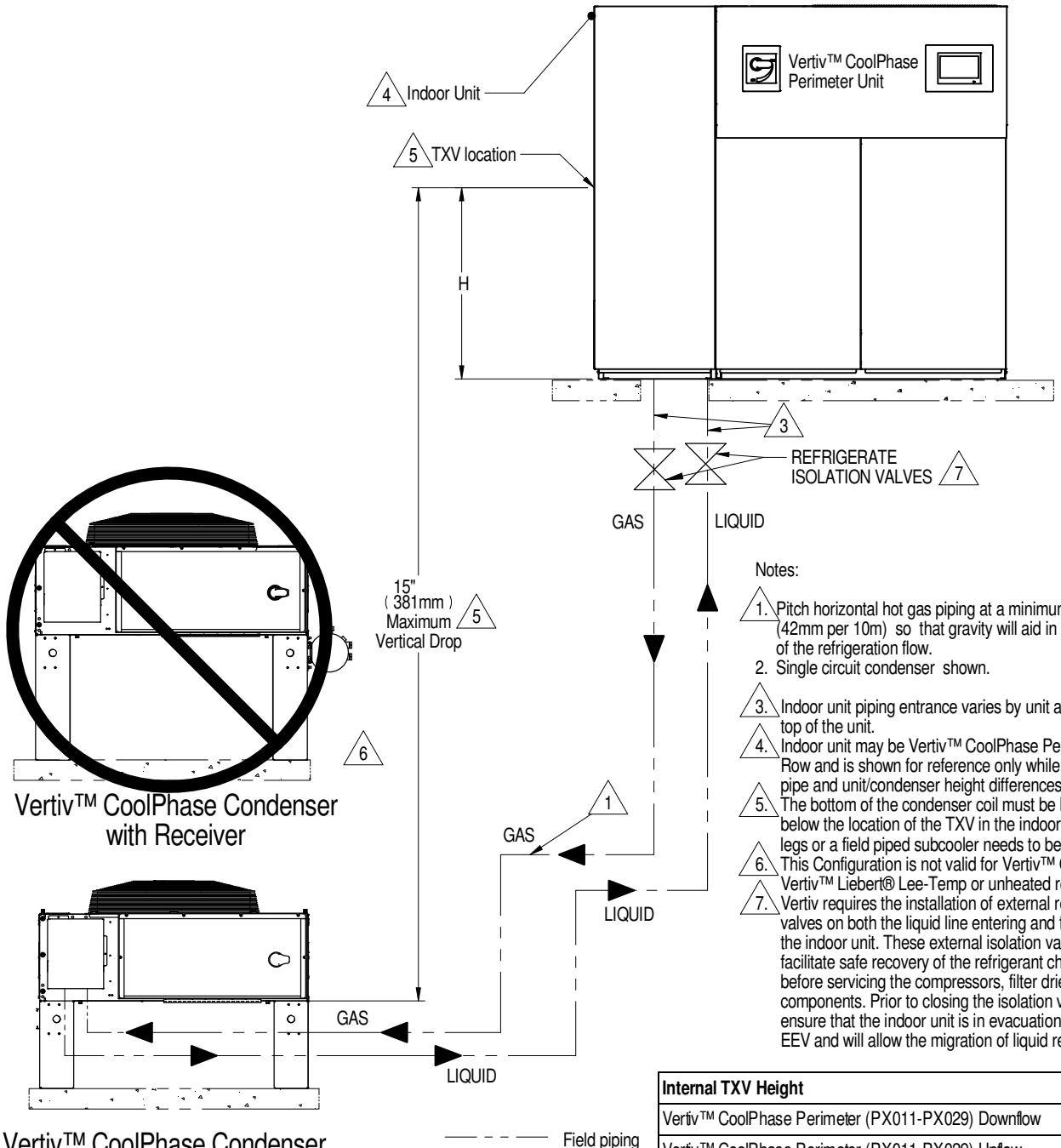
Internal TXV Height	H in. (mm)
Vertiv™ CoolPhase Perimeter (PX011-PX029) Downflow	44 (1118)
Vertiv™ CoolPhase Perimeter (PX011-PX029) Upflow	20 (508)
Vertiv™ CoolPhase Perimeter (DS035-DS105)	43 (1092)
Vertiv™ CoolPhase Row (CR019)	45 (1143)
Vertiv™ CoolPhase Row (CR020-CR035)	27 (686)

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. Indoor 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™ CoolPhase Row 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.
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 CONDENSER

AIR COOLED PIPING SCHEMATIC
CONDENSER BELOW INDOOR UNIT



Notes:

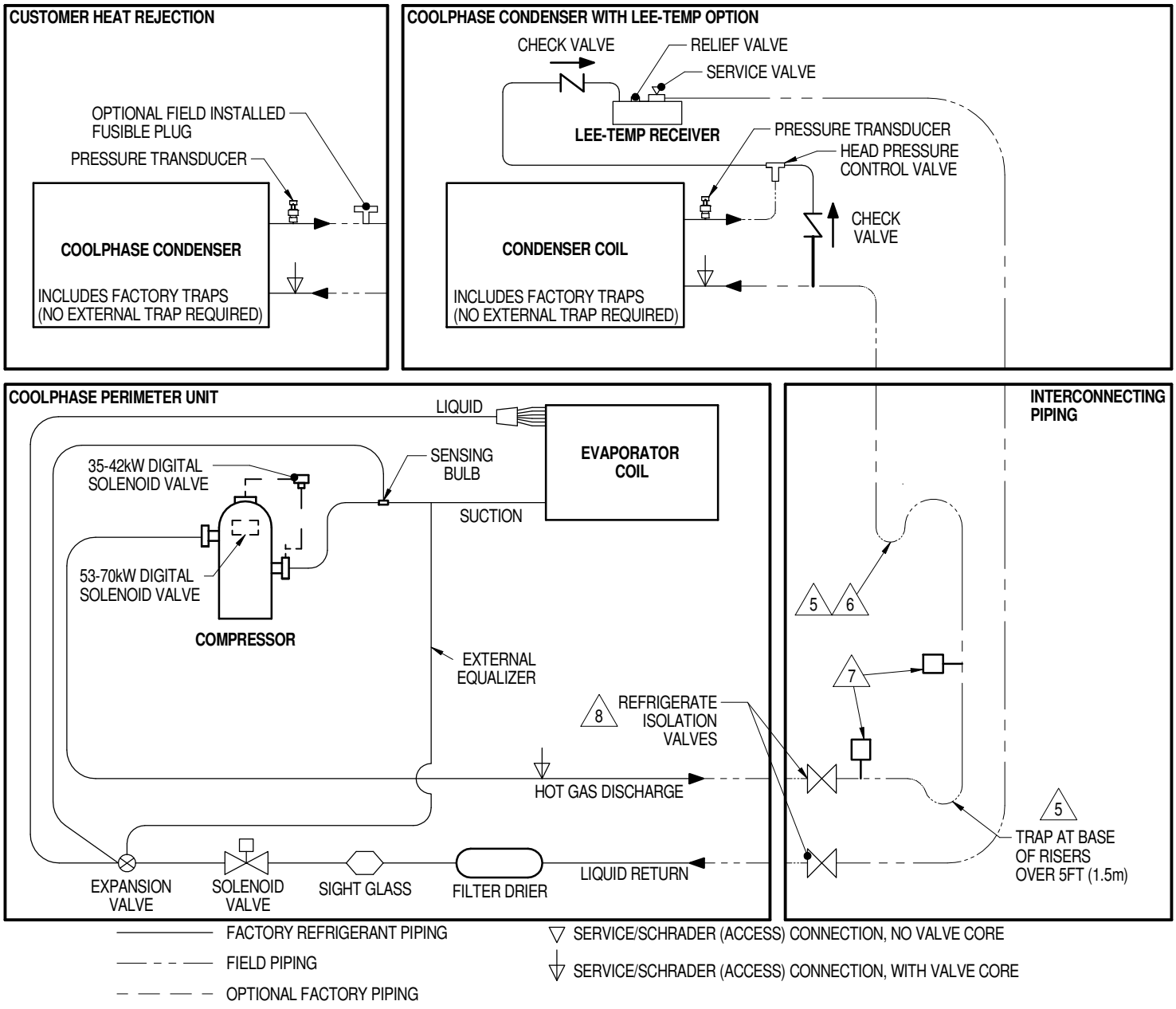
1. Pitch horizontal hot gas piping at a minimum of 1/2" per 10 feet (42mm per 10m) so that gravity will aid in moving oil in the direction of the refrigeration flow.
2. Single circuit condenser shown.
3. Indoor unit piping entrance varies by unit and may be through the top of the unit.
4. Indoor unit may be Vertiv™ CoolPhase Perimeter, or Vertiv™ CoolPhase Row 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.
6. This Configuration is not valid for Vertiv™ CoolPhase Condenser with Vertiv™ Liebert® 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 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™ CoolPhase Row (CR019)	45 (1143)
Vertiv™ CoolPhase Row (CR020-CR035)	27 (686)

COOLPHASE PERIMETER

PIPING SCHEMATIC

DS035-DS105 AIR COOLED MODELS W/ COOLPHASE CONDENSER



NOTES:

1. Single refirigeration circuit shown for clarity.
2. Schematic representation shown. Do not use for specific connection locations.
3. Do not isolate any refrigerant circuits from over pressurization protection.
4. 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.

△5. Components are not supplied by Vertiv™, but are required for proper operation and maintenance.

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

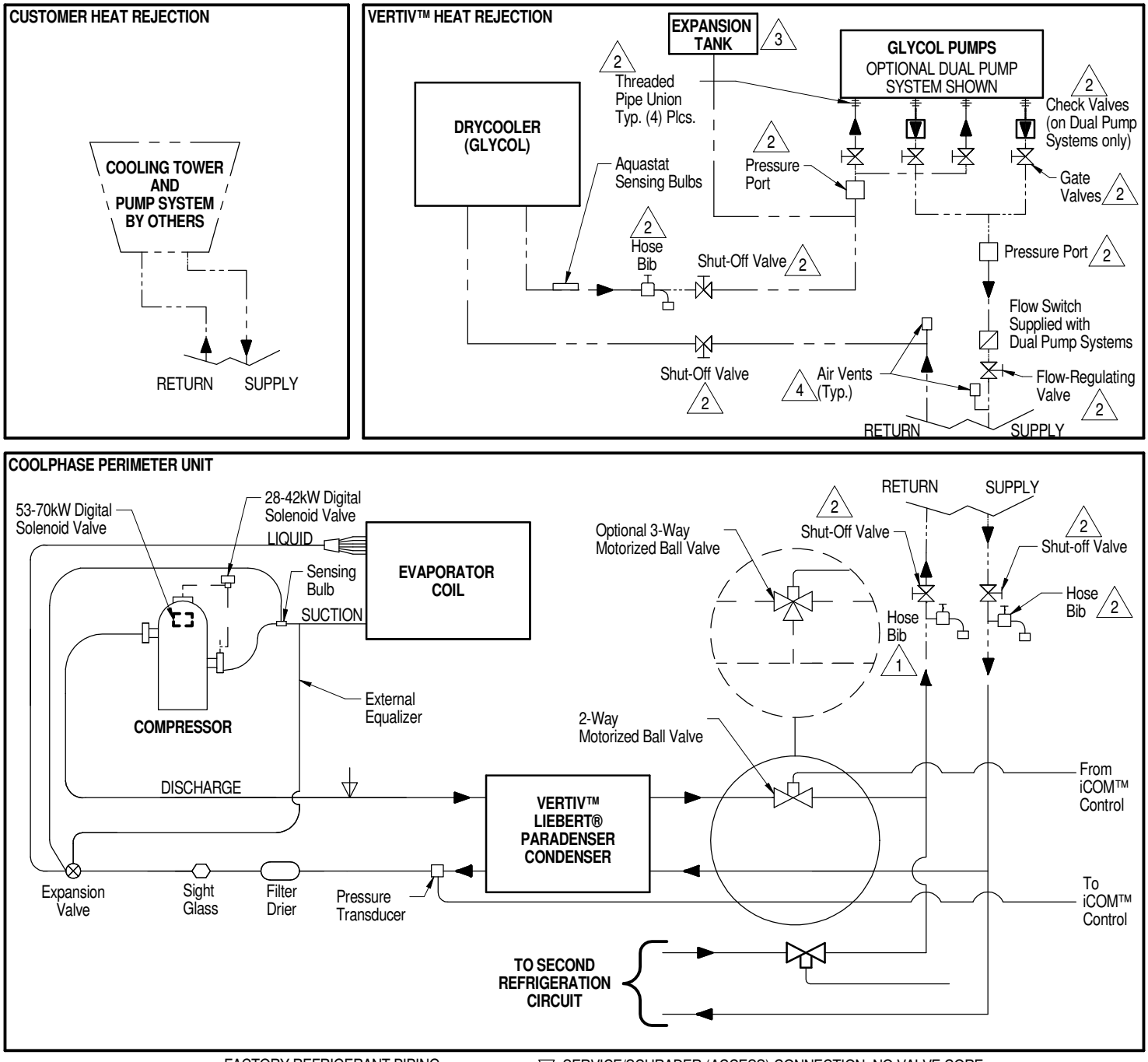
△7. Unit rated maximum 650 psig (45 bar) (see local requirement for relief valve installation).

△8. 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

PIPING SCHEMATIC

DS035-DS105 WATER/GLYCOL MODELS



FACTORY REFRIGERANT PIPING

FIELD PIPING

OPTIONAL FACTORY PIPING

SERVICE/SCHRADER (ACCESS) CONNECTION, NO VALVE CORE

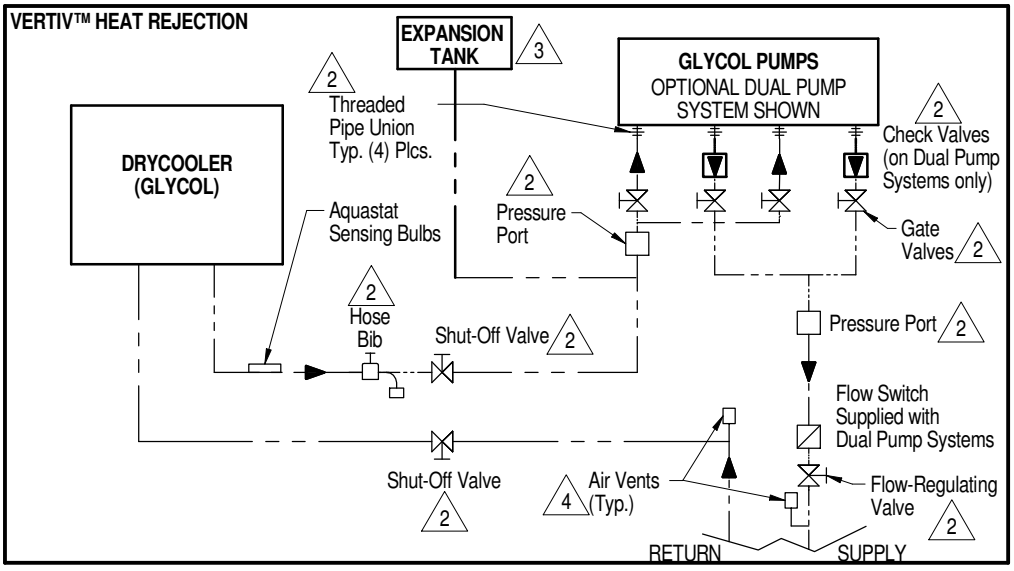
SERVICE/SCHRADER (ACCESS) CONNECTION, WITH VALVE CORE

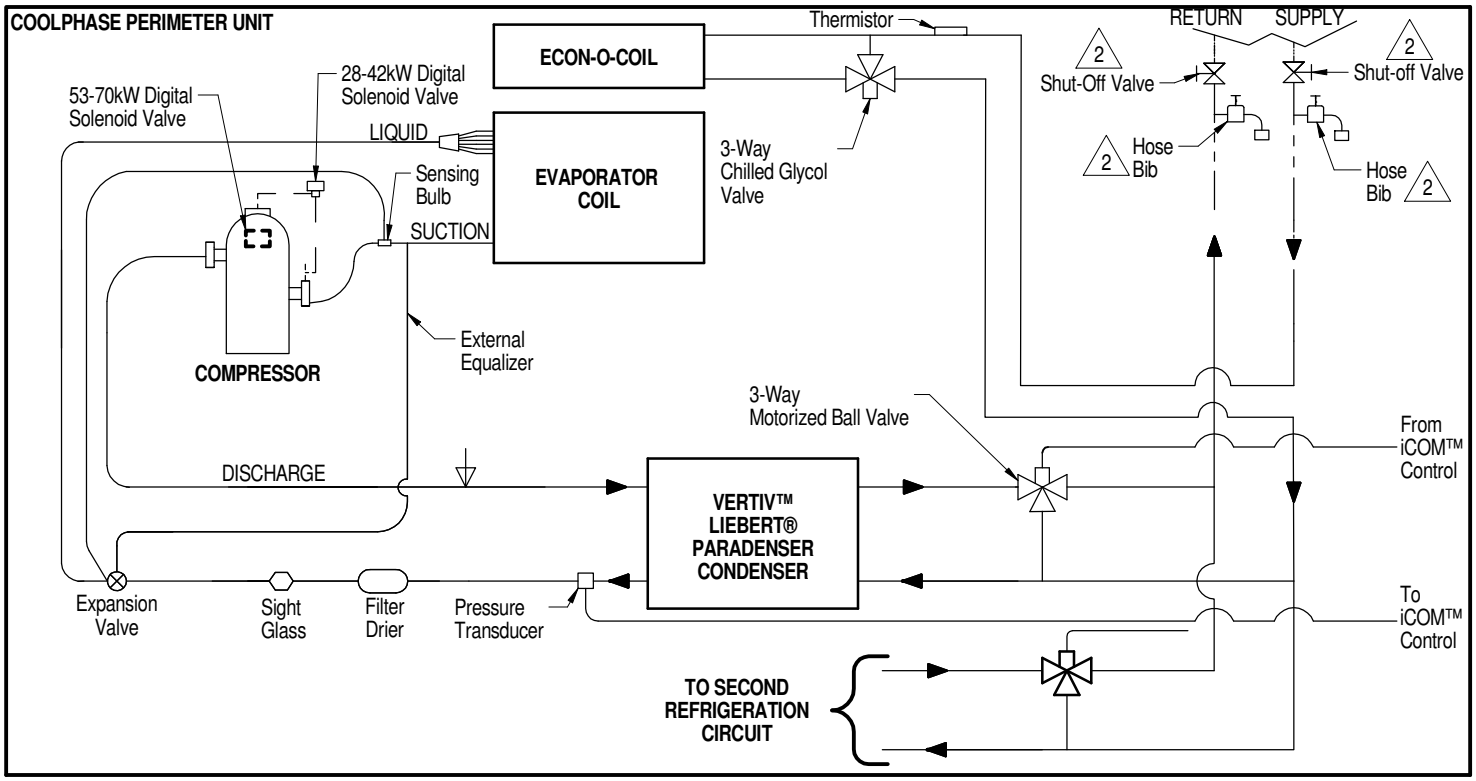
NOTES:

1. Schematic representation shown. Do not use for specific connection locations.
2. Components are not Vertiv™ supplied. Components are field installed and are required for proper circuit operation and maintenance.
3. Field installed at highest point in system on return line to pumps.
4. Locate at tops of all risers and any intermediate system high points.

COOLPHASE PERIMETER

PIPING SCHEMATIC
DS035-DS105 GLYCOOL MODELS





FACTORY REFRIGERANT PIPING

FIELD PIPING

SERVICE/SCHRADER (ACCESS) CONNECTION, NO VALVE CORE

SERVICE/SCHRADER (ACCESS) CONNECTION, WITH VALVE CORE

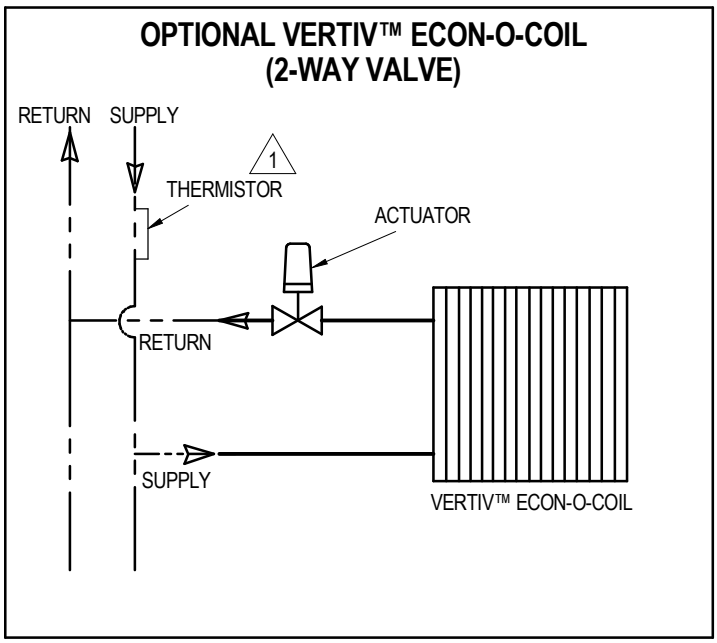
NOTES:

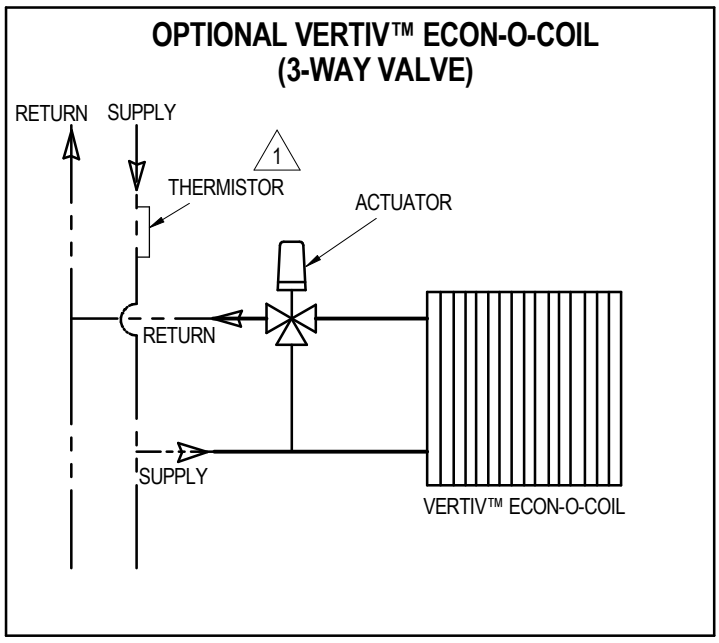
1. Schematic representation shown. Do not use for specific connection locations.
2. Components are not Vertiv™ supplied. Components are field installed and are required for proper circuit operation and maintenance.
3. Field installed at highest point in system on return line to pumps.
4. Locate at tops of all risers and any intermediate system high points.

COOLPHASE PERIMETER

OPTIONAL PIPING SCHEMATIC

VERTIV™ LIEBERT® ECON-O-COIL FOR DS035-DS105 MODELS





FACTORY PIPING

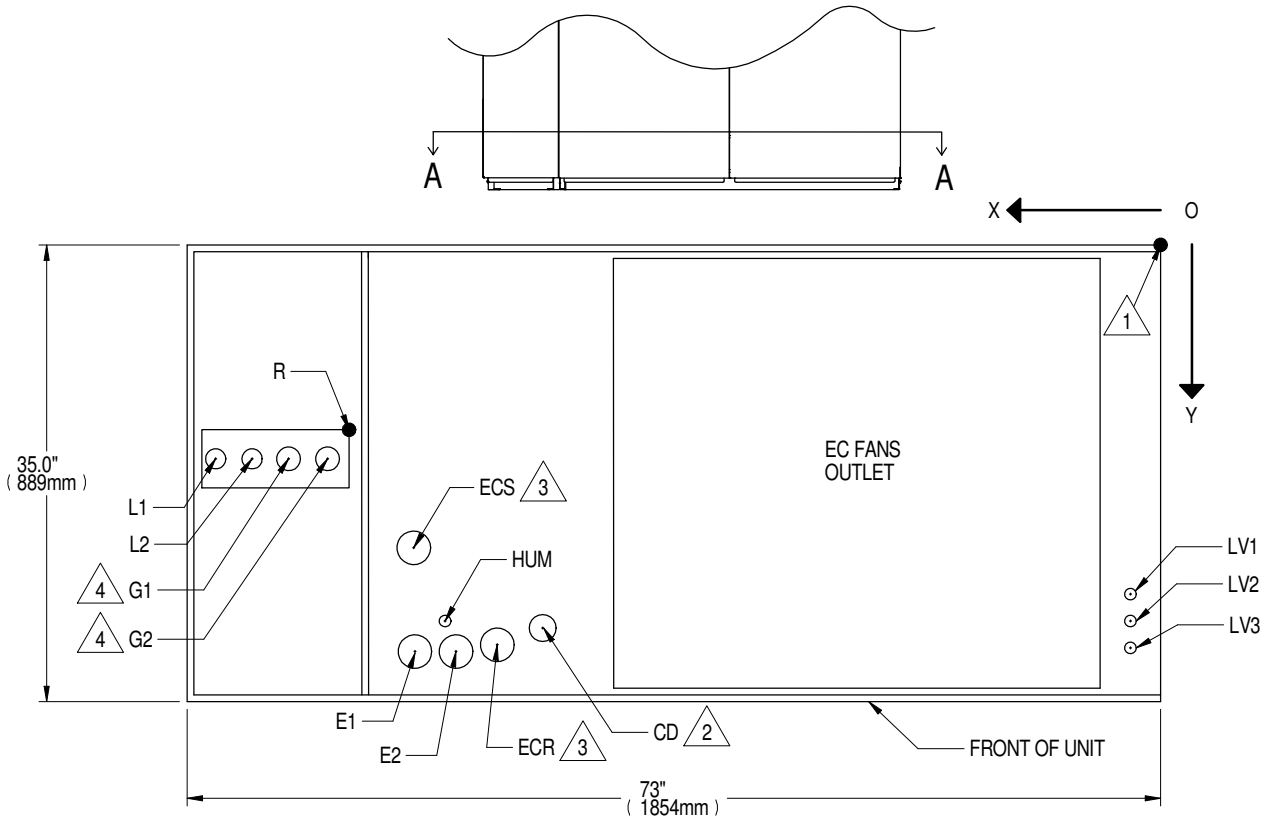
FIELD PIPING

NOTES:

1. SUPPLIED WITH 10 FEET EXTRA THERMISTOR WIRE FOR INSTALLATION ON FIELD SUPPLY LINE.
2. PLACE THERMISTOR IN LOCATION WHERE FLOW IS ALWAYS PRESENT.
3. THERMISTOR MUST BE LOCATED OUT OF THE SUPPLY AIR STREAM.

COOLPHASE PERIMETER

PRIMARY CONNECTION LOCATIONS
DOWNFLOW AIR COOLED DS035-DS042 (10-12 TONS)



SECTION A-A

Notes:

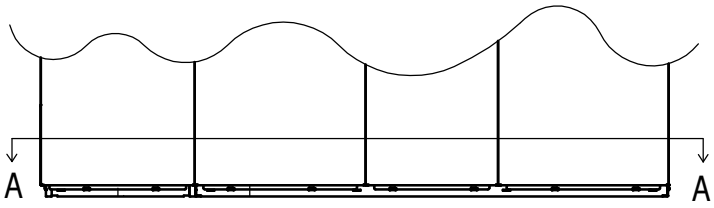
1. Drawing not to scale. All dimensions from rear corner of unit including panels, and have a tolerance of ± 1/2" (13mm).
2. Field pitch Condensate Drain line a minimum of 1/8" (3.2 mm) per foot (305 mm). All units contain a factory installed condensate trap. Do not trap external to the unit. Select appropriate drain system materials. The drain line must comply with all local codes.
3. Supplied on Dual Cooling systems only.
4. When piping out the top of the unit, field must install traps in the discharge lines in the bottom of the unit before running lines to the top.

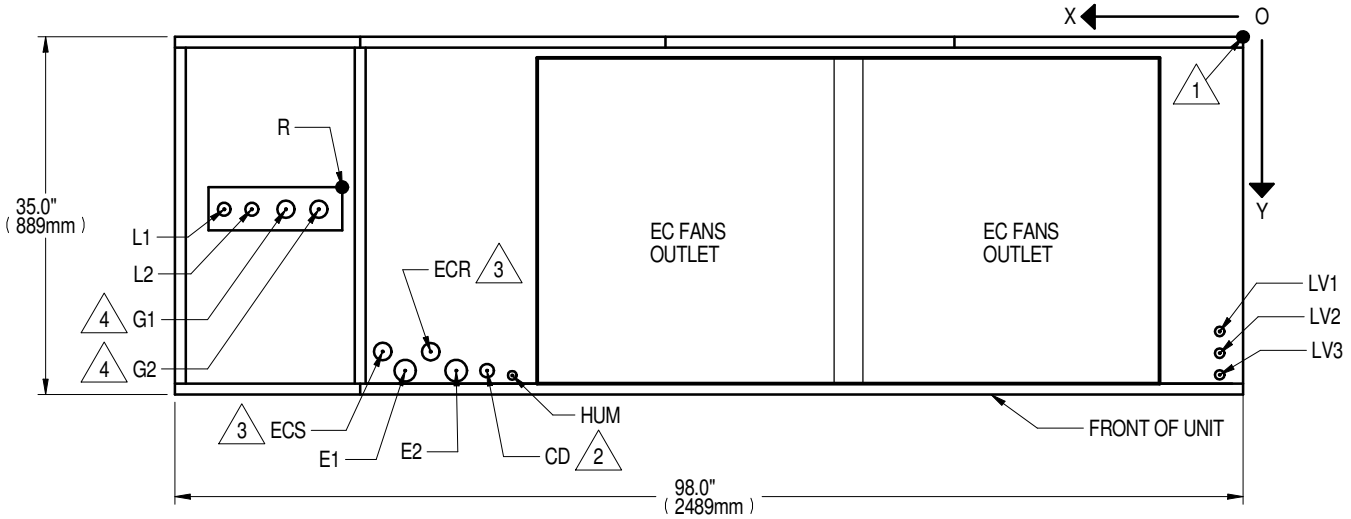
POINT	DESCRIPTION	X in. (mm)	Y in. (mm)	CONNECTION SIZE / OPENING
R	REFRIGERANT ACCESS	59-5/16 (1507)	14-3/4 (375)	11-3/16" (284mm) X 4" (102mm)
L1	LIQUID LINE SYSTEM 1	69-15/16 (1776)	16-13/16 (427)	1/2" O.D. Cu
L2	LIQUID LINE SYSTEM 2	67-5/8 (1718)		
G1 4	HOT GAS DISCHARGE 1	65-1/2 (1664)		5/8" O.D. Cu
G2 4	HOT GAS DISCHARGE 2	62-7/16 (1586)		
CD 2	CONDENSATE DRAIN (infrared humidifier or no humidifier)	46 (1168)	29-1/2 (749)	3/4" NPT FEMALE
	W/ OPTIONAL PUMP			1/2" O.D. Cu
HUM	HUMIDIFIER SUPPLY LINE	53-1/2 (1359)	29 (737)	1/4" O.D. Cu
ECS 3	ECON-O-COIL SUPPLY	54-7/8 (1394)	22-9/16 (573)	1-5/8" O.D. Cu
ECR 3	ECON-O-COIL RETURN	49-3/8 (1254)	30-3/4 (781)	
E1	ELECTRICAL CONN. (HIGH VOLT)	55-1/2 (1410)	31-1/4 (794)	2-1/2"
E2	ELECTRICAL CONN. (HIGH VOLT)	52-7/16 (1332)		
LV1	ELECTRICAL CONN. (LOW VOLT)	2-1/4 (57)	27 (686)	7/8"
LV2	ELECTRICAL CONN. (LOW VOLT)		29 (737)	
LV3	ELECTRICAL CONN. (LOW VOLT)		31 (787)	

COOLPHASE PERIMETER

PRIMARY CONNECTION LOCATIONS

DOWNFLOW AIR COOLED DS053-DS077 (15-22 TONS) W/ EC FANS





SECTION A-A

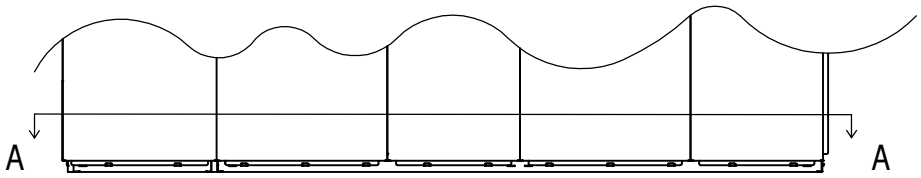
Notes:

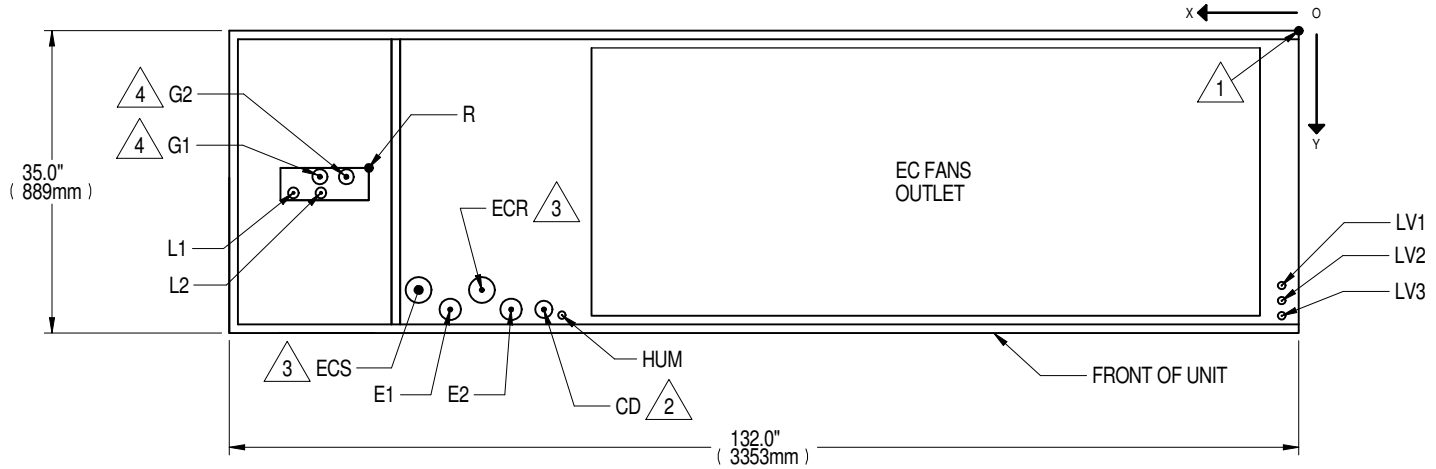
1. Drawing not to scale. All dimensions from rear corner of unit including panels, and have a tolerance of ± 1/2" (13mm).
2. Field pitch Condensate Drain line a minimum of 1/8" (3.2 mm) per foot (305 mm). All units contain a factory installed condensate trap. Do not trap external to the unit. Select appropriate drain system materials. The drain line must comply with all local codes.
3. Supplied on Dual Cooling systems only.
4. When piping out the top of the unit, field must install traps in the discharge lines in the bottom of the unit before running lines to the top.

POINT	DESCRIPTION	X in. (mm)	Y in. (mm)	CONNECTION SIZE / OPENING	
R	REFRIGERANT ACCESS	81-3/4 (2076)	14-3/4 (375)	12-3/16" (310mm) X 4" (102mm)	
				53kW (15 TONS)	70 & 77kW (20 & 22 TONS)
L1	LIQUID LINE SYSTEM 1	94-11/16 (2405)	16-3/4 (425)	5/8" O.D. Cu	5/8" O.D. Cu
L2	LIQUID LINE SYSTEM 2	91-7/8 (2334)			
G1 (4)	HOT GAS DISCHARGE 1	88-3/4 (2254)	16-3/8 (416)	7/8" O.D. Cu	7/8" O.D. Cu
G2 (4)	HOT GAS DISCHARGE 2	85-9/16 (2173)			
CD (2)	CONDENSATE DRAIN (infrared humidifier or no humidifier)	68-3/8 (1737)	31-3/8 (797)	3/4" NPT FEMALE	
	W/ OPTIONAL PUMP			1/2" O.D. Cu	
HUM	HUMIDIFIER SUPPLY LINE	76-1/2 (1943)	29 (737)	1/4" O.D. Cu	
ECS (3)	ECON-O-COIL SUPPLY	78-5/8 (1997)	22-1/4 (565)	2-1/8" O.D. Cu	
ECR (3)	ECON-O-COIL RETURN	73-15/16 (1878)	26-9/16 (675)		
E1	ELECTRICAL CONN. (HIGH VOLT)	78-1/2 (1994)	31-1/8 (791)	2-1/2"	
E2		75-3/8 (1915)			
LV1	ELECTRICAL CONN. (LOW VOLT)	2 (51)	29 (737)	7/8"	
LV2			30-7/8 (784)		
LV3			32 (813)		

COOLPHASE PERIMETER

PRIMARY CONNECTION LOCATIONS
DOWNFLOW AIR COOLED DS105 (30 TONS)





SECTION A-A

Notes:

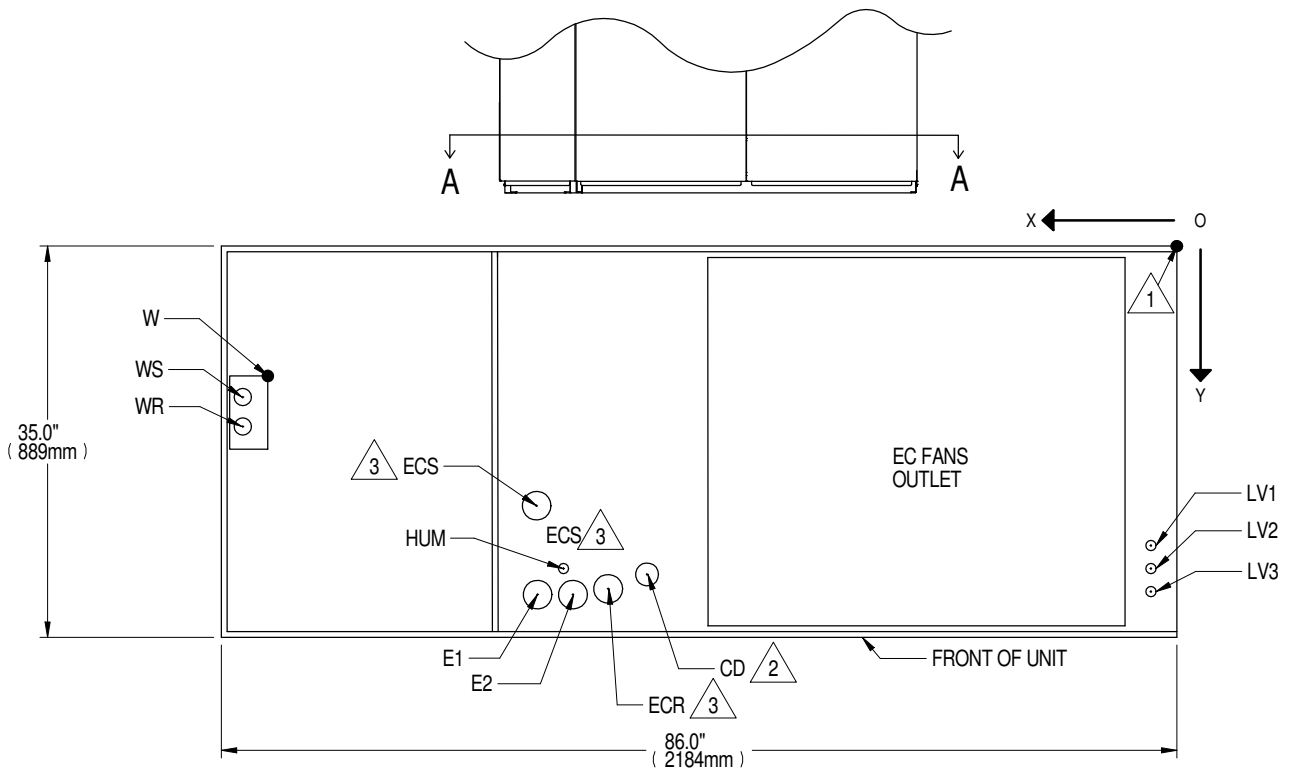
1. Drawing not to scale. All dimensions from rear corner of unit including panels, and have a tolerance of ± 1/2" (13mm).
2. Field pitch Condensate Drain line a minimum of 1/8" (3.2 mm) per foot (305 mm). All units contain a factory installed condensate trap. Do not trap external to the unit Select appropriate drain system materials. The drain line must comply with all local codes.
3. Supplied on Dual Cooling systems only.
4. When piping out the top of the unit, field must install traps in the discharge lines in the bottom of the unit before running lines to the top.

POINT	DESCRIPTION	X in. (mm)	Y in. (mm)	CONNECTION SIZE / OPENING
R	REFRIGERANT ACCESS	109 (2769)	15-3/4 (400)	16-7/16" (418mm) X 4" (102mm)
L1	LIQUID LINE SYSTEM 1	121-3/4 (3092)	16-3/4 (425)	5/8" O.D. Cu
L2	LIQUID LINE SYSTEM 2	118-1/8 (3000)		
G1 4	HOT GAS DISCHARGE 1	118-1/4 (3004)	14-1/4 (362)	1-1/8" O.D. Cu
G2 4	HOT GAS DISCHARGE 2	115-5/8 (2937)		
CD 2	CONDENSATE DRAIN (infrared humidifier or no humidifier)	87-3/8 (2219)	31 (787)	3/4" NPT FEMALE
	W/ OPTIONAL PUMP	83-13/16 (2129)	30 (762)	1/2" O.D. Cu
HUM	HUMIDIFIER SUPPLY LINE	85-5/16 (2167)	32-1/2 (826)	1/4" O.D. Cu
ECS 3	ECON-O-COIL SUPPLY	101-7/8 (2588)	29 (737)	2-5/8" O.D. Cu
ECR 3	ECON-O-COIL RETURN	94-9/16 (2402)		
E1	ELECTRICAL CONN. (HIGH VOLT)	98-1/8 (2492)	31 (787)	2-1/2"
E2	ELECTRICAL CONN. (HIGH VOLT)	91 (2311)		
LV1	ELECTRICAL CONN. (LOW VOLT)	2 (51)	29 (737)	7/8"
LV2	ELECTRICAL CONN. (LOW VOLT)		30-7/8 (784)	
LV3	ELECTRICAL CONN. (LOW VOLT)		32 (813)	

COOLPHASE PERIMETER

PRIMARY CONNECTION LOCATIONS

DOWNFLOW WATER/GLYCOL/GLYCOOL DS035-DS042 (10-12 TONS)



SECTION A-A

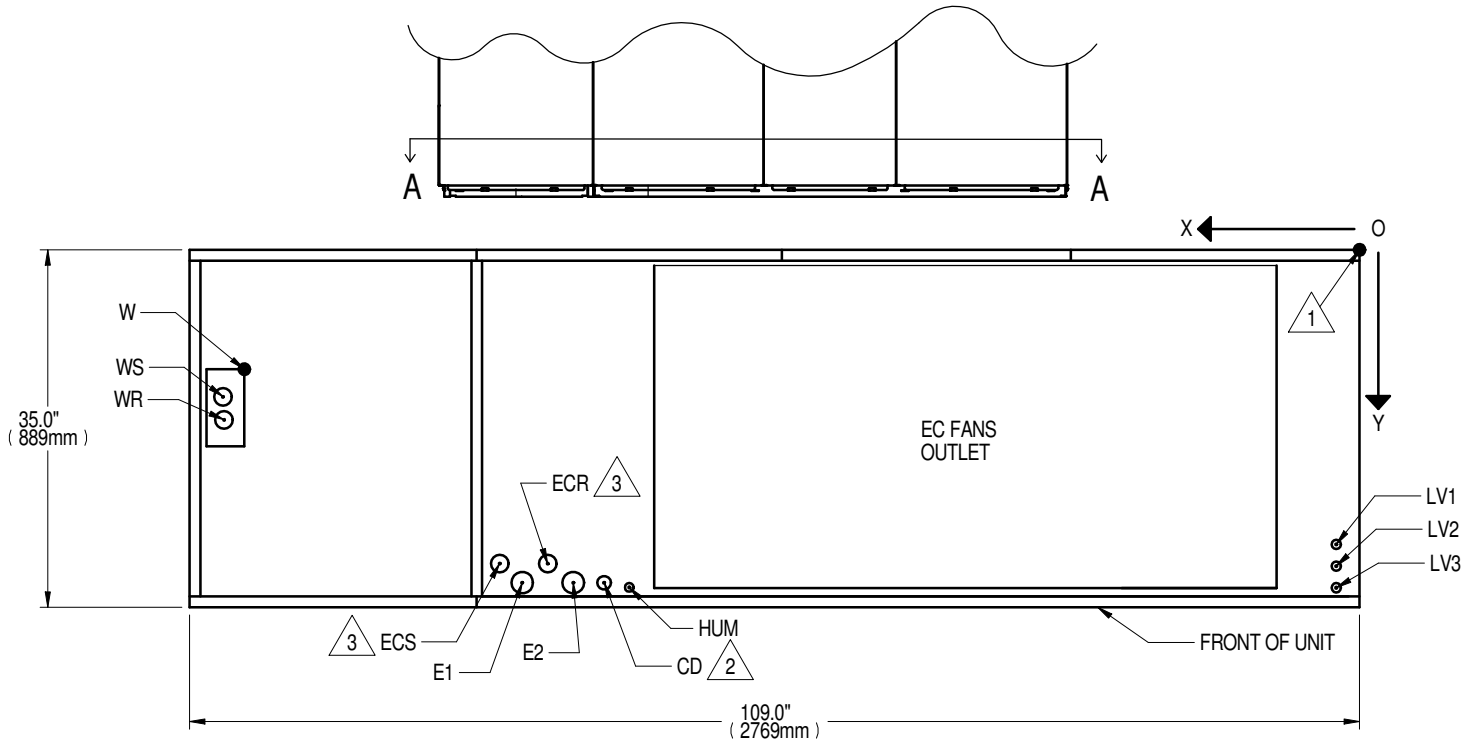
Notes:

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" (3.2 mm) per foot (305 mm). All units contain a factory installed condensate trap. Do not trap external to the unit. Select appropriate drain system materials. The drain line must comply with all local codes.
3. Supplied on Dual Cooling systems only (four-pipe system).

POINT	DESCRIPTION	X in. (mm)	Y in. (mm)	CONNECTION SIZE / OPENING	
				35kW (10 TONS)	42kW (12 TONS)
W	WATER/GLYCOL/GLYCOOL ACCESS	79-15/16 (2030)	9-1/16 (230)	3-1/2" (89mm) X 8" (203mm)	
WS	WATER/GLYCOL/GLYCOOL SUPPLY	82-15/16 (2107)	10-15/16 (278)	1-5/8" O.D. CU	2-1/8" O.D. CU
WR	WATER/GLYCOL/GLYCOOL RETURN		14-1/16 (357)		
ECS 3	ECON-O-COIL SUPPLY	54-7/8 (1394)	22-9/16 (573)		
ECR 3	ECON-O-COIL RETURN	49-13/16 (1265)	28-1/2 (724)		
CD 2	CONDENSATE DRAIN (infrared humidifier or no humidifier)	46 (1168)	29-1/2 (749)	3/4" NPT FEMALE	
	W/ OPTIONAL PUMP			1/2" O.D. Cu	
HUM	HUMIDIFIER SUPPLY LINE	53-1/2 (1359)	29 (737)	1/4" O.D. Cu	
E1	ELECTRICAL CONN. (HIGH VOLT)	55-1/2 (1410)	31-1/4 (794)	2-1/2"	
E2	ELECTRICAL CONN. (HIGH VOLT)	52-7/16 (1332)			
LV1	ELECTRICAL CONN. (LOW VOLT)	2-1/4 (57)	27 (686)	7/8"	
LV2	ELECTRICAL CONN. (LOW VOLT)		29 (737)		
LV3	ELECTRICAL CONN. (LOW VOLT)		31 (787)		

COOLPHASE PERIMETER

PRIMARY CONNECTION LOCATIONS
DOWNFLOW WATER/GLYCOL/GLYCOOL DS053-DS077 (15-22 TONS)



SECTION A-A

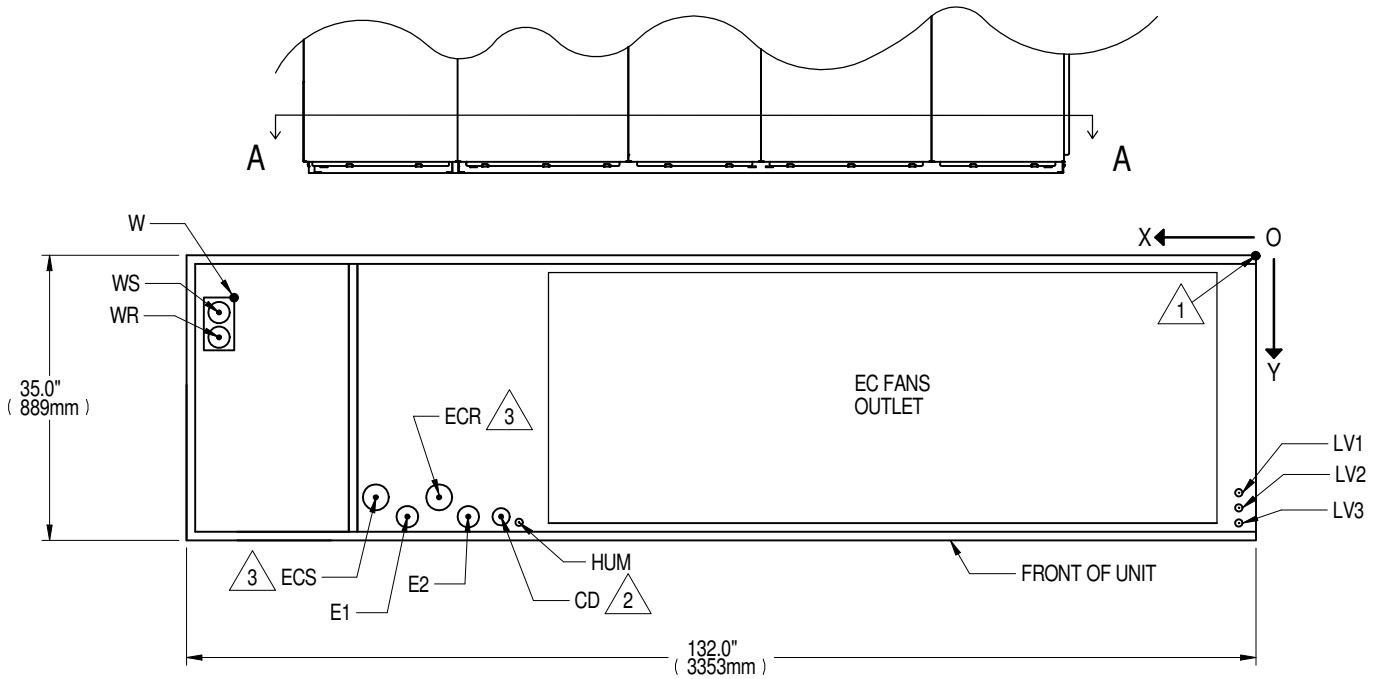
Notes:

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" (3.2 mm) per foot (305 mm). All units contain a factory installed condensate trap. Do not trap external to the unit. Select appropriate drain system materials. The drain line must comply with all local codes.
3. Supplied on Dual Cooling systems only (four-pipe system).

POINT	DESCRIPTION	X in. (mm)	Y in. (mm)	CONNECTION SIZE / OPENING
W	WATER/GLYCOL/GLYCOOL ACCESS	103 (2616)	9 (229)	3-1/2" (89mm) X 8 (203mm)
WS	WATER/GLYCOL/GLYCOOL SUPPLY	104-3/4 (2661)	11 (279)	2-1/8" O.D. Cu
WR	WATER/GLYCOL/GLYCOOL RETURN		15 (381)	
CD 2	CONDENSATE DRAIN (infrared humidifier or no humidifier)	68-3/8 (1737)	31-3/8 (797)	3/4" NPT FEMALE
	W/ OPTIONAL PUMP			1/2" O.D. Cu
HUM	HUMIDIFIER SUPPLY LINE	76-1/2 (1943)	29 (737)	1/4" O.D. Cu
ECS 3	ECON-O-COIL SUPPLY	78-5/8 (1997)	22-1/4 (565)	2-1/8" O.D. Cu
ECR 3	ECON-O-COIL RETURN	73-15/16 (1878)	26-9/16 (675)	
E1	ELECTRICAL CONN. (HIGH VOLT)	78-1/2 (1994)	31-1/8 (791)	2-1/2"
E2		75-3/8 (1915)		
LV1	ELECTRICAL CONN. (LOW VOLT)	2 (51)	29 (737)	7/8"
LV2			30-7/8 (784)	
LV3			32 (813)	

COOLPHASE PERIMETER

PRIMARY CONNECTION LOCATIONS
DOWNFLOW WATER/GLYCOL/GLYCOOL DS105 (30 TONS)



SECTION A-A

Notes:

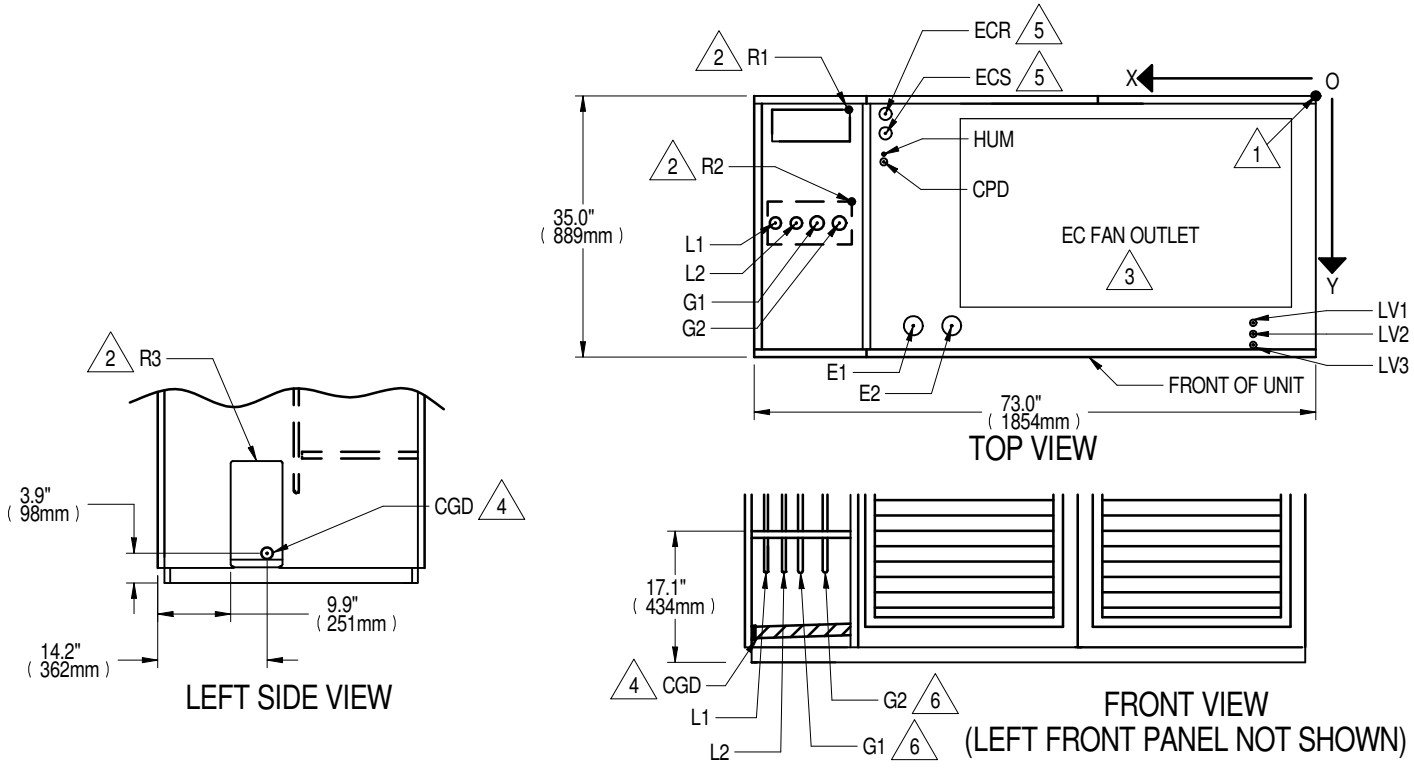
1. Drawing not to scale. All dimensions from rear corner of unit including panels, and have a tolerance of ± 1/2" (13mm).
2. Field pitch Condensate Drain line a minimum of 1/8" (3.2 mm) per foot (305 mm). All units contain a factory installed condensate trap. Do not trap external to the unit. Select appropriate drain system materials. The drain line must comply with all local codes.
3. Supplied on Dual Cooling systems only (four-pipe system).

POINT	DESCRIPTION	X in. (mm)	Y in. (mm)	CONNECTION SIZE / OPENING
W	WATER/GLYCOL/GLYCOOL ACCESS	125-15/16 (3199)	9 (229)	3-1/2" (89mm) X 8" (203mm)
WS	WATER/GLYCOL/GLYCOOL SUPPLY	127-7/8 (3248)	10-1/16 (256)	2-1/8" O.D. Cu
WR	WATER/GLYCOL/GLYCOOL RETURN		13-1/4 (337)	
CD 2	CONDENSATE DRAIN (infrared humidifier or no humidifier)	87-3/8 (2219)	31 (787)	3/4" NPT FEMALE
	W/ OPTIONAL PUMP	83-13/16 (2129)	30 (762)	1/2" O.D. Cu
HUM	HUMIDIFIER SUPPLY LINE	85-5/16 (2167)	32-1/2 (826)	1/4" O.D. Cu
ECS 3	ECON-O-COIL SUPPLY	101-7/8 (2588)	29 (737)	2-5/8" O.D. Cu
ECR 3	ECON-O-COIL RETURN	94-9/16 (2402)		
E1	ELECTRICAL CONN. (HIGH VOLT)	98-1/8 (2492)	31 (787)	2-1/2"
E2	ELECTRICAL CONN. (HIGH VOLT)	91 (2311)		
LV1	ELECTRICAL CONN. (LOW VOLT)	2 (51)	29 (737)	7/8"
LV2	ELECTRICAL CONN. (LOW VOLT)		30-7/8 (784)	
LV3	ELECTRICAL CONN. (LOW VOLT)		32 (813)	

COOLPHASE PERIMETER

PRIMARY CONNECTION LOCATIONS

UPFLOW AIR COOLED DS035-DS042 (10-12 TONS) W/ EC FANS



Notes:

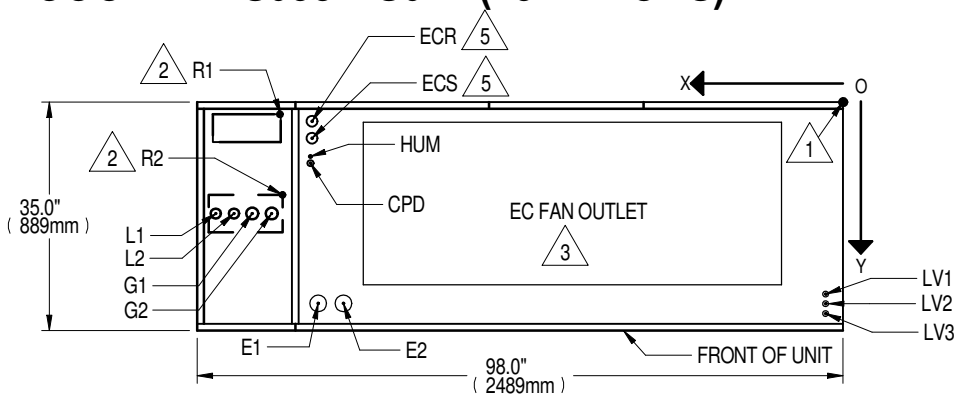
1. Drawing not to scale. All dimensions from rear corner of unit including panels, and have a tolerance of ± 1/2" (13mm).
2. Field routed alternatives for refrigerant gas & liquid line connection points.
3. EC fan shown. See submittal page 20000424 for EC fan outlet & plenum dimensional data.
4. Field 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. Select appropriate drain system materials. The drain line must comply with all local codes.
5. Supplied on Dual Cooling Systems only.
6. When piping out the top of the unit, field must install traps in the discharge lines in the bottom of the unit before running lines to the top.

POINT	DESCRIPTION	X in. (mm)	Y in. (mm)	CONNECTION SIZE / OPENING
R1 2	REFRIGERANT ACCESS (TOP)	60-5/8 (1540)	2-13/16 (71)	10-1/8" (257mm) X 4-1/8" (105mm)
R2 2	REFRIGERANT ACCESS (BOTTOM)	59-5/16 (1507)	14-3/4 (375)	11-3/16" (284mm) X 4" (102mm)
R3 2	REFRIGERANT ACCESS (SIDE)	N/A	N/A	6" (152mm) X 17-3/16" (437mm)
L1	LIQUID LINE SYSTEM 1	69-15/16 (1776)	16-3/4 (425)	1/2" O.D. Cu
L2	LIQUID LINE SYSTEM 2	67-5/8 (1718)		
G1 6	HOT GAS DISCHARGE 1	65-1/2 (1664)	16-5/8 (422)	5/8" O.D. Cu
G2 6	HOT GAS DISCHARGE 2	62-7/16 (1586)		
CGD 4	CONDENSATE GRAVITY DRAIN	N/A	N/A	3/4" NPT FEMALE
CPD	CONDENSATE PUMP DISCHARGE (OPT)	56-1/4 (1429)	11-1/8 (283)	1/2" O.D. Cu
HUM	HUMIDIFIER SUPPLY LINE		9-1/8 (232)	1/4" O.D. Cu
ECS 5	ECON-O-COIL SUPPLY	56 (1422)	7-5/16 (186)	1-5/8" O.D. Cu
ECR 5	ECON-O-COIL RETURN		4-1/2 (114)	
E1	ELECTRICAL CONN. (HIGH VOLT)	52-3/8 (1330)	29-15/16 (760)	2-1/2"
E2		47-3/8 (1203)		
LV1	ELECTRICAL CONN. (LOW VOLT)	8-1/8 (206)	29-9/16 (751)	7/8"
LV2			31 (787)	
LV3			32-7/16 (824)	

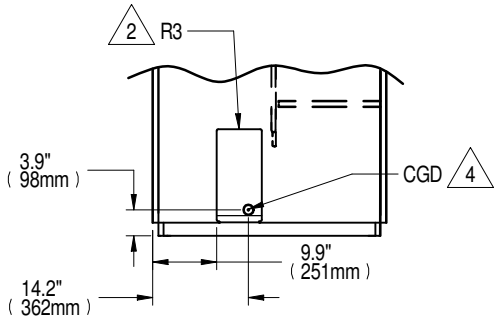
COOLPHASE PERIMETER

PRIMARY CONNECTION LOCATIONS

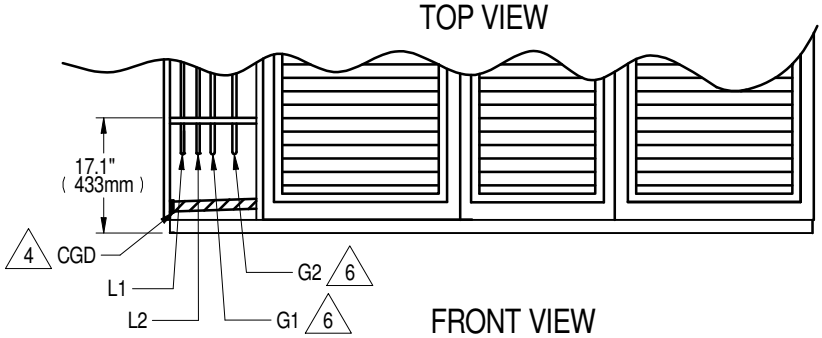
UPFLOW AIR COOLED DS053-DS077 (15-22 TONS)



TOP VIEW



LEFT SIDE VIEW



FRONT VIEW
(LEFT FRONT PANEL NOT SHOWN)

Notes:

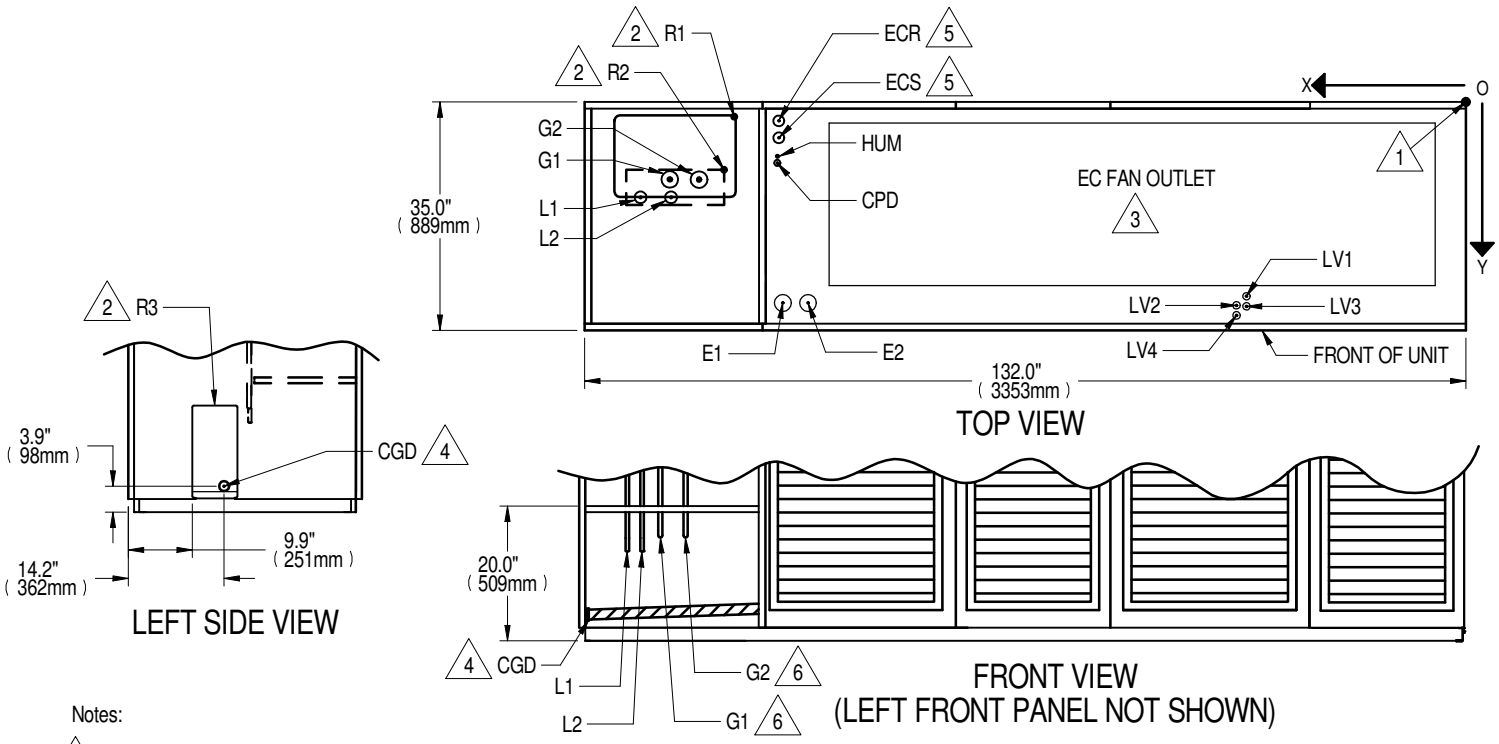
1. Drawing not to scale. All dimensions from rear corner of unit including panels, and have a tolerance of ± 1/2" (13mm).
2. Field routed alternatives for refrigerant gas and liquid line connection points.
3. EC fans shown. See submittal page 20000425 for EC fan outlet and plenum dimensional data.
4. 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. Select appropriate drain system materials. The drain line must comply with all local codes.
5. Supplied on Dual Cooling Systems only.
6. When piping out the top of the unit, field must install traps in the discharge lines in the bottom of the unit before running lines to the top.

POINT	DESCRIPTION	X in. (mm)	Y in. (mm)	CONNECTION SIZE / OPENING	
R1 2	REFRIGERANT ACCESS (TOP)	83-5/8 (2124)	2 (51)	12"(305mm) X 4" (102mm)	
R2 2	REFRIGERANT ACCESS (BOTTOM)	82-3/4 (2102)	14-3/4 (375)	12-3/16" (310mm) X 4" (102mm)	
R3 2	REFRIGERANT ACCESS (SIDE)	N/A	N/A	6" (152mm) X 17-3/16" (437mm)	
				53kW (15TONS)	70 & 77kW (20 & 22TONS)
L1	LIQUID LINE SYSTEM 1	94-11/16 (2405)	16-3/4 (425)	5/8" O.D. Cu	5/8" O.D. Cu
L2	LIQUID LINE SYSTEM 2	91-7/8 (2334)			
G1 6	HOT GAS DISCHARGE 1	88-3/4 (2254)	16-3/8 (416)	7/8" O.D. Cu	7/8" O.D. Cu
G2 6	HOT GAS DISCHARGE 2	85-9/16 (2173)			
CGD 4	CONDENSATE GRAVITY DRAIN	N/A	N/A	3/4" NPT FEMALE	
CPD	CONDENSATE PUMP DISCHARGE (OPT)	79-5/16 (2015)	11-7/8 (302)	1/2" O.D. Cu	
HUM	HUMIDIFIER SUPPLY LINE		9-7/8 (251)	1/4" O.D. Cu	
ECS 5	ECON-O-COIL SUPPLY	78-5/8 (1997)	7-7/8 (200)	2-1/8" O.D. Cu	
ECR 5	ECON-O-COIL RETURN		4-5/8 (117)		
E1	ELECTRICAL CONN. (HIGH VOLT)	78-1/8 (1984)	30 (762)	2-1/2"	
E2	ELECTRICAL CONN. (HIGH VOLT)	74-3/8 (1889)			
LV1	ELECTRICAL CONN. (LOW VOLT)	2-5/8 (67)	28-9/16 (725)	7/8"	
LV2	ELECTRICAL CONN. (LOW VOLT)		30 (762)		
LV3	ELECTRICAL CONN. (LOW VOLT)		31-7/16 (799)		

COOLPHASE PERIMETER

PRIMARY CONNECTION LOCATIONS

UPFLOW AIR COOLED DS105 (30 TONS)



Notes:

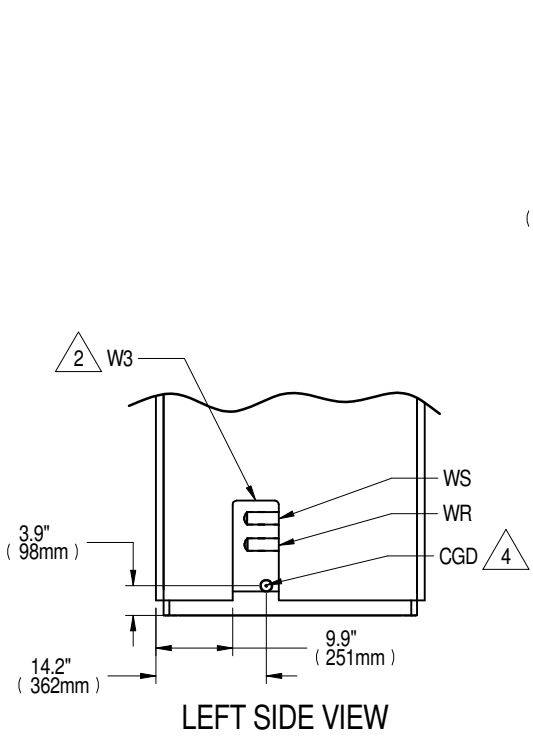
1. Drawing not to scale. All dimensions from rear corner of unit including panels, and have a tolerance of ± 1/2" (13mm).
2. Field routed alternatives for refrigerant gas and liquid line connection points.
3. EC fans shown. See submittal page 20000426 for EC fan outlet and plenum dimensional data.
4. 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. Select appropriate drain system materials. The drain line must comply with all local codes.
5. Supplied on Dual Cooling Systems only.
6. When piping out the top of the unit, field must install traps in the discharge lines in the bottom of the unit before running lines to the top.

POINT	DESCRIPTION	X in. (mm)	Y in. (mm)	CONNECTION SIZE / OPENING
R1 2	REFRIGERANT ACCESS (TOP)	106-7/8 (2715)	1-7/8 (48)	22-1/2"(572mm) X 15-3/16" (386mm)
R2 2	REFRIGERANT ACCESS (BOTTOM)	109-1/8 (2772)	13-7/8 (352)	16-7/16" (418mm) X 4" (102mm)
R3 2	REFRIGERANT ACCESS (SIDE)	N/A	N/A	6" (152mm) X 17-3/16" (437mm)
L1	LIQUID LINE SYSTEM 1	122-3/4 (3119)	14-1/4 (360)	5/8" O.D. Cu
L2	LIQUID LINE SYSTEM 2	118-1/4 (3004)		
G1 6	HOT GAS DISCHARGE 1	118-1/2 (3009)	11-1/2 (293)	1-1/8" O.D. Cu
G2 6	HOT GAS DISCHARGE 2	114-1/8 (2898)		
CGD 4	CONDENSATE GRAVITY DRAIN	N/A	N/A	3/4" NPT FEMALE
CPD	CONDENSATE PUMP DISCHARGE (OPT)	102-3/8 (2600)	13-5/8 (346)	1/2" O.D. Cu
HUM	HUMIDIFIER SUPPLY LINE	101-1/8 (2569)	13-1/8 (333)	1/4" O.D. Cu
ECS 5	ECON-O-COIL SUPPLY		10-1/4 (260)	2-5/8" O.D. Cu
ECR 5	ECON-O-COIL RETURN		5-1/4 (133)	
E1	ELECTRICAL CONN. (HIGH VOLT)		30 (762)	2-1/2"
E2		97-7/8 (2486)		
LV1	ELECTRICAL CONN. (LOW VOLT)	34-1/8 (867)	30-1/4 (768)	7/8"
LV2			31-3/4 (806)	
LV3		32-5/8 (829)	28-15/16 (735)	
LV4			30-7/16 (773)	

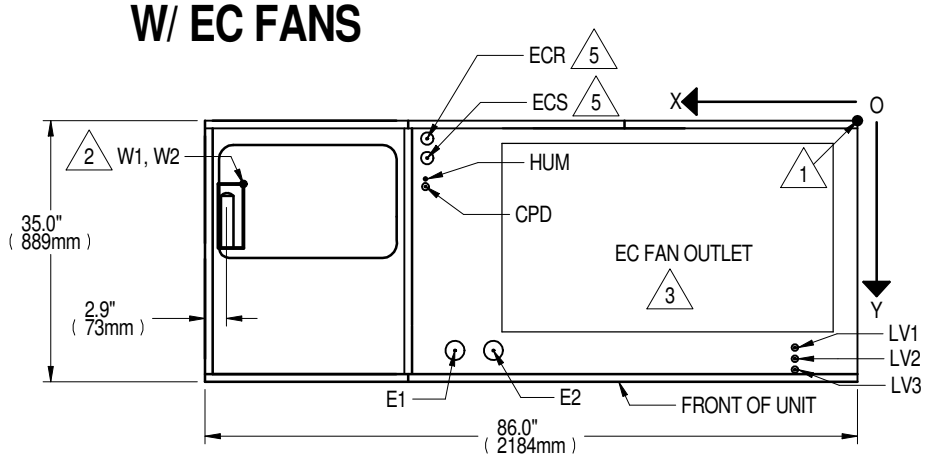
COOLPHASE PERIMETER

PRIMARY CONNECTION LOCATIONS

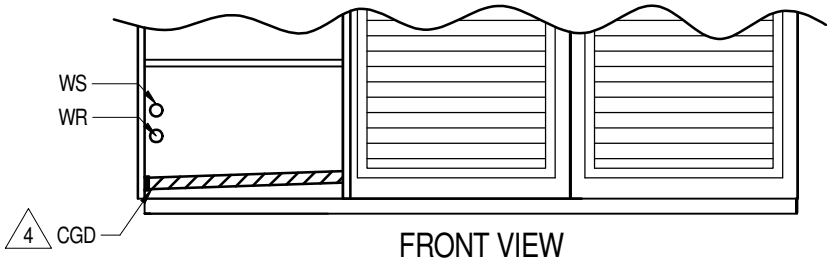
UPFLOW WATER/GLYCOL/GLYCOOL DS035-DS042 (10-12 TONS) W/ EC FANS



LEFT SIDE VIEW



TOP VIEW



FRONT VIEW
(LEFT FRONT PANEL NOT SHOWN)

Notes:

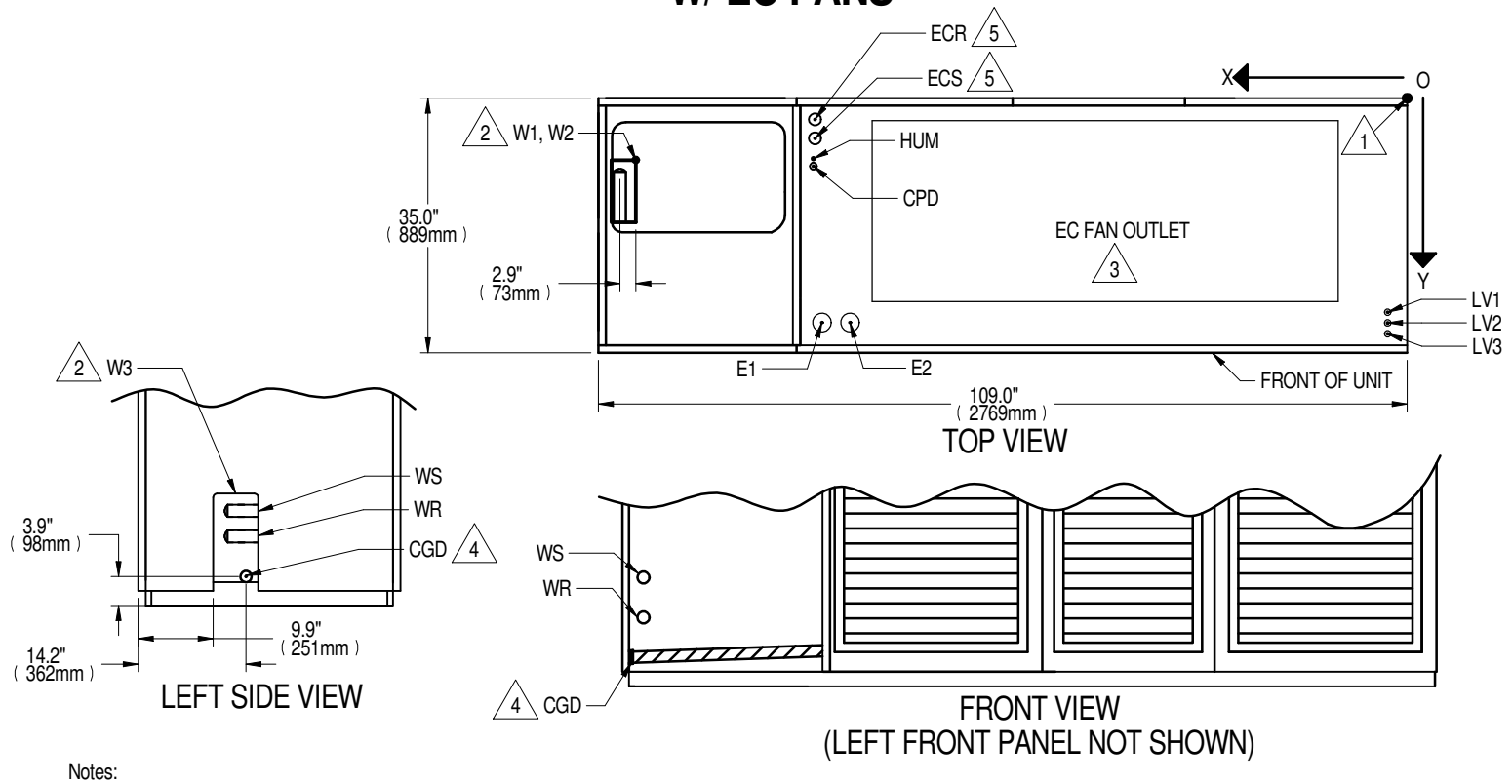
1. Drawing not to scale. All dimensions from rear corner of unit including panels, and have a tolerance of ±1/2" (13mm).
2. Field routed alternatives for water/glycol connections.
3. EC fan shown. See submittal page 20000424 for EC fan outlet and plenum dimensional data.
4. Field pitch Condensate Drain 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. Select appropriate drain system materials. The drain line must comply with all local codes.
5. Supplied on Dual Cooling Systems only (four-pipe systems).

POINT	DESCRIPTION	X in. (mm)	Y in. (mm)	CONNECTION SIZE / OPENING	
				35kW (10 TONS)	42kW (12 TONS)
W1 2	WATER/GLYCOL/GLYCOOL ACCESS (BOTTOM)	79-15/16 (2030)	9 (229)	3-1/2" (89mm) X 8" (203mm)	
W2 2	WATER/GLYCOL/GLYCOOL ACCESS (TOP)				
W3 2	WATER/GLYCOL/GLYCOOL ACCESS (SIDE)	N/A	N/A	6" (152mm) x 17-3/16" (437mm)	
WS	WATER/GLYCOL/GLYCOOL SUPPLY			1-5/8" O.D. Cu	2-1/8" O.D. Cu
WR	WATER/GLYCOL/GLYCOOL RETURN				
ECS 5	ECON-O-COIL SUPPLY	56 (1422)	7-5/16 (186)		
ECR 5	ECON-O-COIL RETURN		4-1/2 (114)		
CGD 4	CONDENSATE GRAVITY DRAIN	N/A	N/A	3/4" NPT FEMALE	
CPD	CONDENSATE PUMP DISCHARGE (OPT)	56-1/4 (1429)	11-1/8 (283)	1/2" O.D. Cu	
HUM	HUMIDIFIER SUPPLY LINE		9-1/8 (232)	1/4" O.D. Cu	
E1	ELECTRICAL CONN. (HIGH VOLT)	52-3/8 (1330)	29-15/16 (760)	2-1/2"	
E2		47-3/8 (1203)			
LV1	ELECTRICAL CONN. (LOW VOLT)	8-1/8 (206)	29-9/16 (751)	7/8"	
LV2			31 (787)		
LV3			32-7/16 (824)		

COOLPHASE PERIMETER

PRIMARY CONNECTION LOCATIONS

UPFLOW WATER/GLYCOL/GLYCOOL DS053-DS077 (15-22 TONS) W/ EC FANS



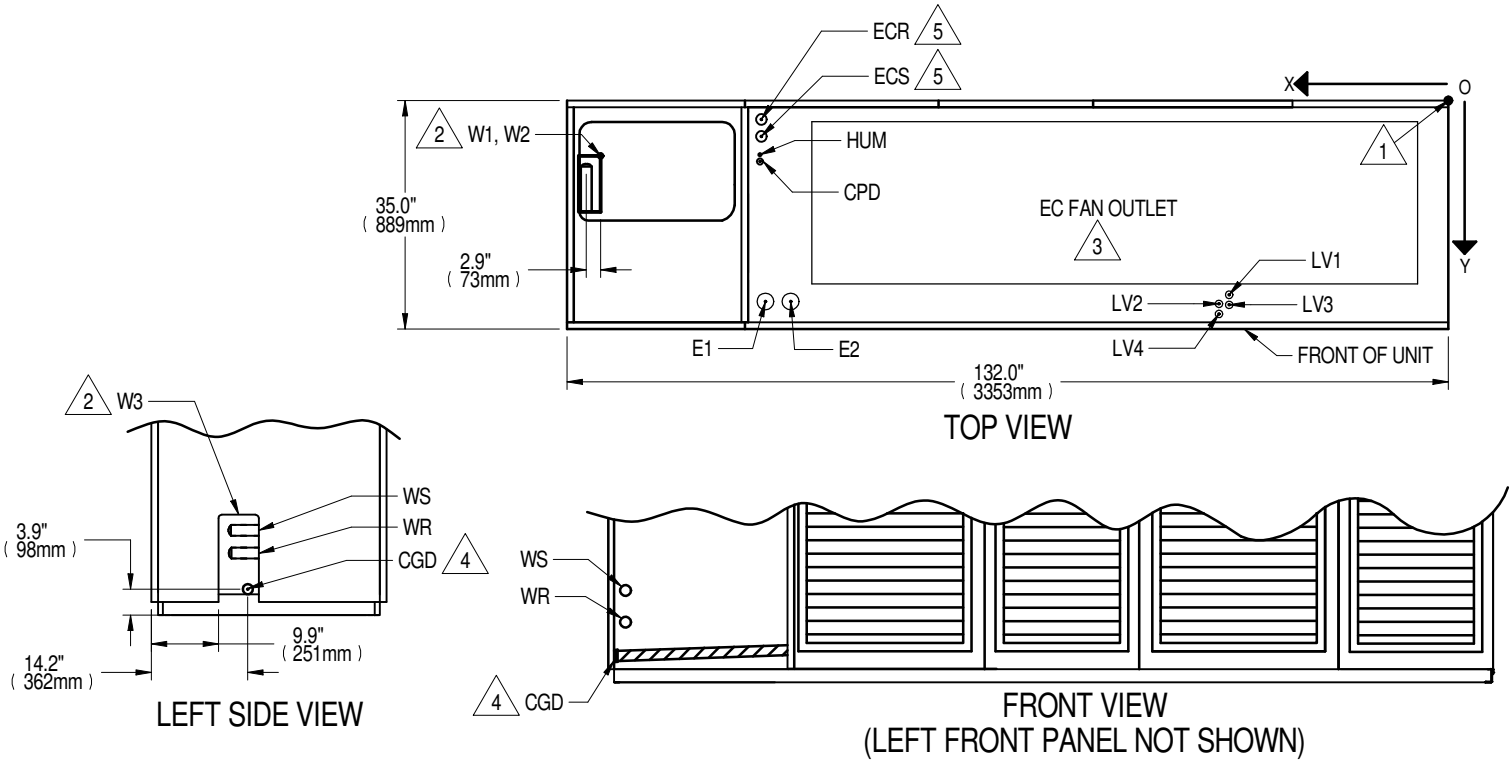
Notes:

1. Drawing not to scale. All dimensions from rear corner of unit including panels, and have a tolerance of ± 1/2" (13mm).
2. Field routed alternatives for water/glycol connections.
3. EC fan shown. See submittal 20000425 for EC fan outlet & plenum dimensional data.
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. Select appropriate drain system materials. The drain line must comply with all local codes.
5. Supplied on Dual Cooling Systems only (four-pipe system).

POINT	DESCRIPTION	X in. (mm)	Y in. (mm)	CONNECTION SIZE / OPENING
W1 2	WATER/GLYCOL/GLYCOOL ACCESS (BOTTOM)	102-15/16 (2615)	9 (229)	3-1/2" (89mm) X 8" (203mm)
W2 2	WATER/GLYCOL/GLYCOOL ACCESS (TOP)			3-1/2" (89mm) X 8" (203mm)
W3 2	WATER/GLYCOL/GLYCOOL ACCESS (SIDE)	N/A	N/A	6" (152mm) x 17-3/16" (437mm)
WS	WATER/GLYCOL/GLYCOOL SUPPLY			2-1/8" O.D. Cu
WR	WATER/GLYCOL/GLYCOOL RETURN			
CGD 4	CONDENSATE GRAVITY DRAIN			3/4" NPT FEMALE
CPD	CONDENSATE PUMP DISCHARGE (OPT)	79-5/16 (2015)	11-7/8 (302)	1/2" O.D. Cu
HUM	HUMIDIFIER SUPPLY LINE		9-7/8 (251)	1/4" O.D. Cu
ECS 5	ECON-O-COIL SUPPLY	78-5/8 (1998)	7-7/8 (200)	2-1/8" O.D. Cu
ECR 5	ECON-O-COIL RETURN		4-5/8 (117)	
E1	ELECTRICAL CONN. (HIGH VOLT)	78-1/8 (1984)	30 (762)	2-1/2"
E2	ELECTRICAL CONN. (HIGH VOLT)	74-3/8 (1889)		
LV1	ELECTRICAL CONN. (LOW VOLT)	2-5/8 (66)	28-9/16 (726)	7/8"
LV2	ELECTRICAL CONN. (LOW VOLT)		30 (762)	
LV3	ELECTRICAL CONN. (LOW VOLT)		31-7/16 (799)	

COOLPHASE PERIMETER

PRIMARY CONNECTION LOCATIONS
UPFLOW WATER/GLYCOL/GLYCOOL DS105 (30 TONS)



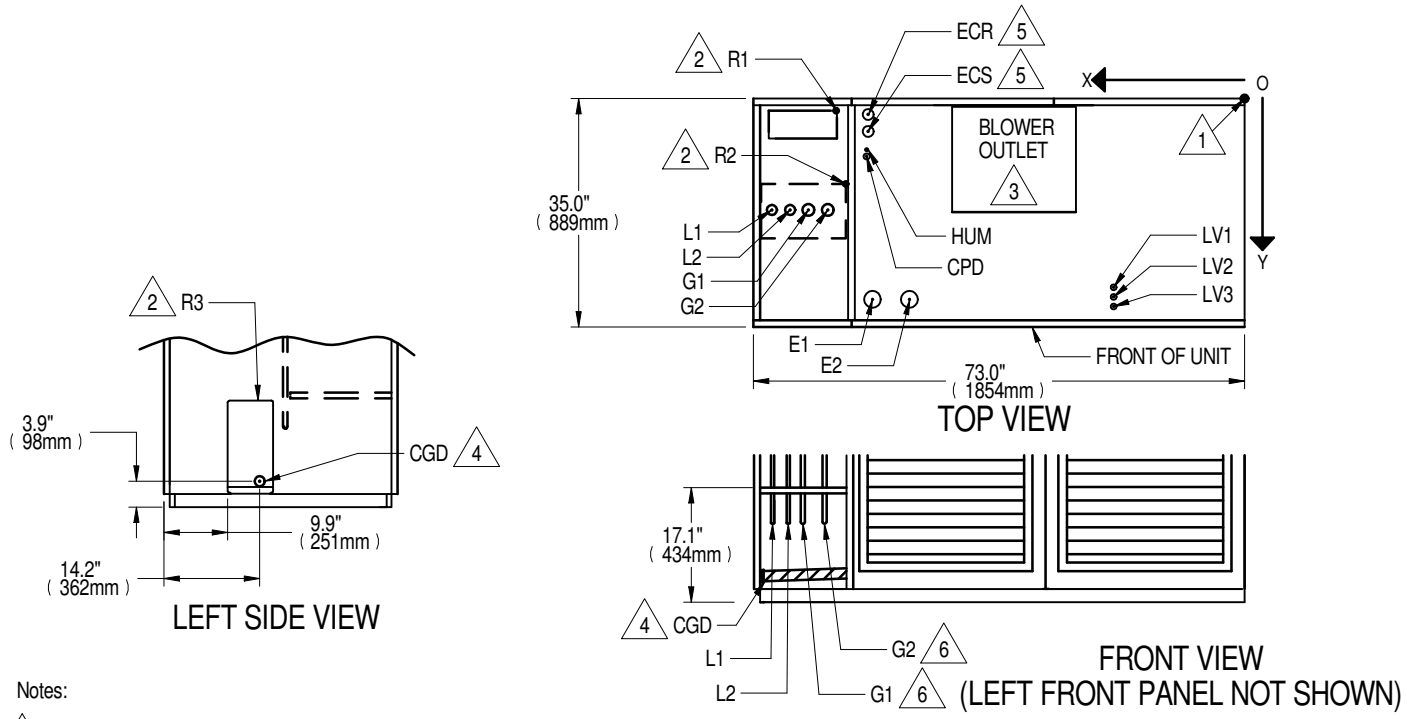
Notes:

1. Drawing not to scale. All dimensions from rear corner of unit including panels, and have a tolerance of ± 1/2" (13mm).
2. Field routed alternatives for water/glycol connections.
3. EC fans shown. See submittal 20000426 for EC fan outlet & plenum dimensional data.
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. Select appropriate drain system materials. The drain line must comply with all local codes.
5. Supplied on Dual Cooling Systems only (four-pipe system).

POINT	DESCRIPTION	X in. (mm)	Y in. (mm)	CONNECTION SIZE / OPENING
W1 2	WATER/GLYCOL/GLYCOOL ACCESS (BOTTOM)	126-1/8 (3204)	9 (229)	3-1/2" (89mm) X 8" (203mm)
W2 2	WATER/GLYCOL/GLYCOOL ACCESS (TOP)			3-1/2" (89mm) X 8" (203mm)
W3 2	WATER/GLYCOL/GLYCOOL ACCESS (SIDE)	N/A	N/A	6" (152mm) x 17-3/16" (437mm)
WS	WATER/GLYCOL/GLYCOOL SUPPLY			2-1/8" O.D. Cu
WR	WATER/GLYCOL/GLYCOOL RETURN			
CGD 4	CONDENSATE GRAVITY DRAIN			3/4" NPT FEMALE
CPD	CONDENSATE PUMP DISCHARGE (OPT)	102-3/8 (2600)	13-5/8 (346)	1/2" O.D. Cu
HUM	HUMIDIFIER SUPPLY LINE	101-1/8 (2569)	13-1/8 (333)	1/4" O.D. Cu
ECS 5	ECON-O-COIL SUPPLY		10-1/4 (260)	2-5/8" O.D. Cu
ECR 5	ECON-O-COIL RETURN		5-1/4 (133)	
E1	ELECTRICAL CONN. (HIGH VOLT)	101-5/8 (2581)	30 (762)	2-1/2"
E2		97-7/8 (2486)		
LV1	ELECTRICAL CONN. (LOW VOLT)	34-1/8 (867)	30-1/4 (768)	7/8"
LV2			31-3/4 (806)	
LV3		32-5/8 (829)	28-15/16 (735)	
LV4			30-7/16 (773)	

COOLPHASE PERIMETER

PRIMARY CONNECTION LOCATIONS
UPFLOW AIR COOLED DS035-DS042 (10-12 TONS)
W/ FORWARD CURVED BLOWERS



Notes:

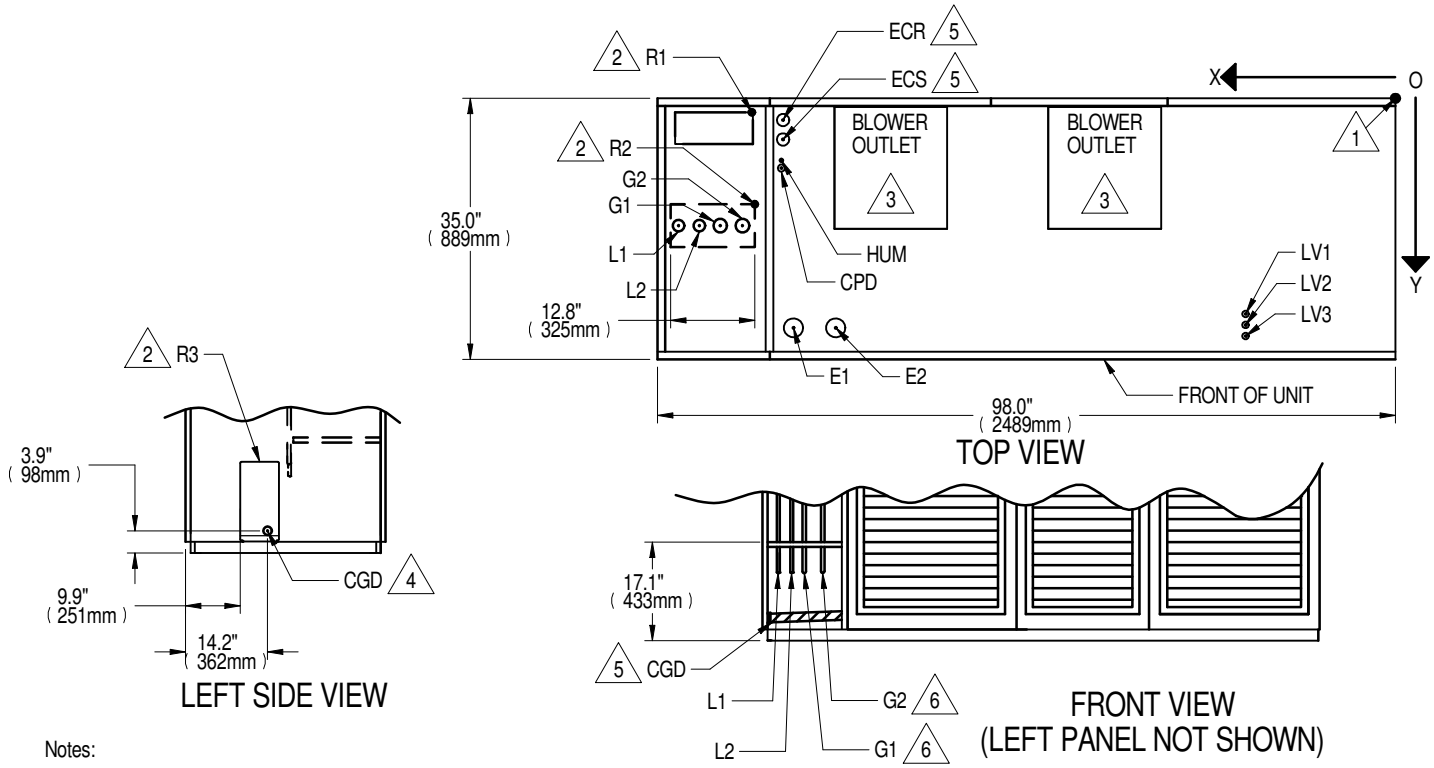
1. Drawing not to scale. All dimensions from rear corner of unit including panels, and have a tolerance of ± 1/2" (13mm).
2. Field routed alternatives for refrigerant gas & liquid line connection points.
3. Forward Curved Blower Shown. See submittal page 20000418 for blower outlet and deck dimensional data.
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. Select appropriate drain system materials. The drain line must comply with all local codes.
5. Supplied on Dual Cooling Systems only.
6. When piping out of the top of the unit, field must install traps in the discharge lines in the bottom of the unit before running lines to the top.

POINT	DESCRIPTION	X in. (mm)	Y in. (mm)	CONNECTION SIZE / OPENING
R1 2	REFRIGERANT ACCESS (TOP)	60-5/8 (1540)	2-13/16 (71)	10-1/8" (257mm) X 4-1/8" (105mm)
R2 2	REFRIGERANT ACCESS (BOTTOM)	59-5/16 (1507)	14-3/4 (375)	11-3/16" (284mm) X 4" (102mm)
R3 2	REFRIGERANT ACCESS (SIDE)	N/A	N/A	6" (152mm) X 17-3/16" (437mm)
L1	LIQUID LINE SYSTEM 1	69-15/16 (1776)	16-3/4 (425)	1/2" O.D. Cu
L2	LIQUID LINE SYSTEM 2	67-5/8 (1718)		
G1 6	HOT GAS DISCHARGE 1	65-1/2 (1664)	16-5/8 (422)	5/8" O.D. Cu
G2 6	HOT GAS DISCHARGE 2	62-7/16 (1586)		
CGD 4	CONDENSATE GRAVITY DRAIN	N/A	N/A	3/4" NPT FEMALE
CPD	CONDENSATE PUMP DISCHARGE (OPT)	56-1/4 (1429)	11-1/8 (283)	1/2" O.D. Cu
HUM	HUMIDIFIER SUPPLY LINE		9-1/8 (232)	1/4" O.D. Cu
ECS 5	ECON-O-COIL SUPPLY	56 (1422)	7-5/16 (186)	1-5/8" O.D. Cu
ECR 5	ECON-O-COIL RETURN		4-1/2 (114)	
E1	ELECTRICAL CONN. (HIGH VOLT)	52-3/8 (1330)	30 (762)	2-1/2"
E2	ELECTRICAL CONN. (HIGH VOLT)	46-7/8 (1191)		
LV1	ELECTRICAL CONN. (LOW VOLT)	19-1/2 (495)	29-1/16 (738)	7/8"
LV2	ELECTRICAL CONN. (LOW VOLT)		30-1/2 (775)	
LV3	ELECTRICAL CONN. (LOW VOLT)		31-15/16 (811)	

COOLPHASE PERIMETER

PRIMARY CONNECTION LOCATIONS

UPFLOW AIR COOLED DS053-DS077 15-22 TONS



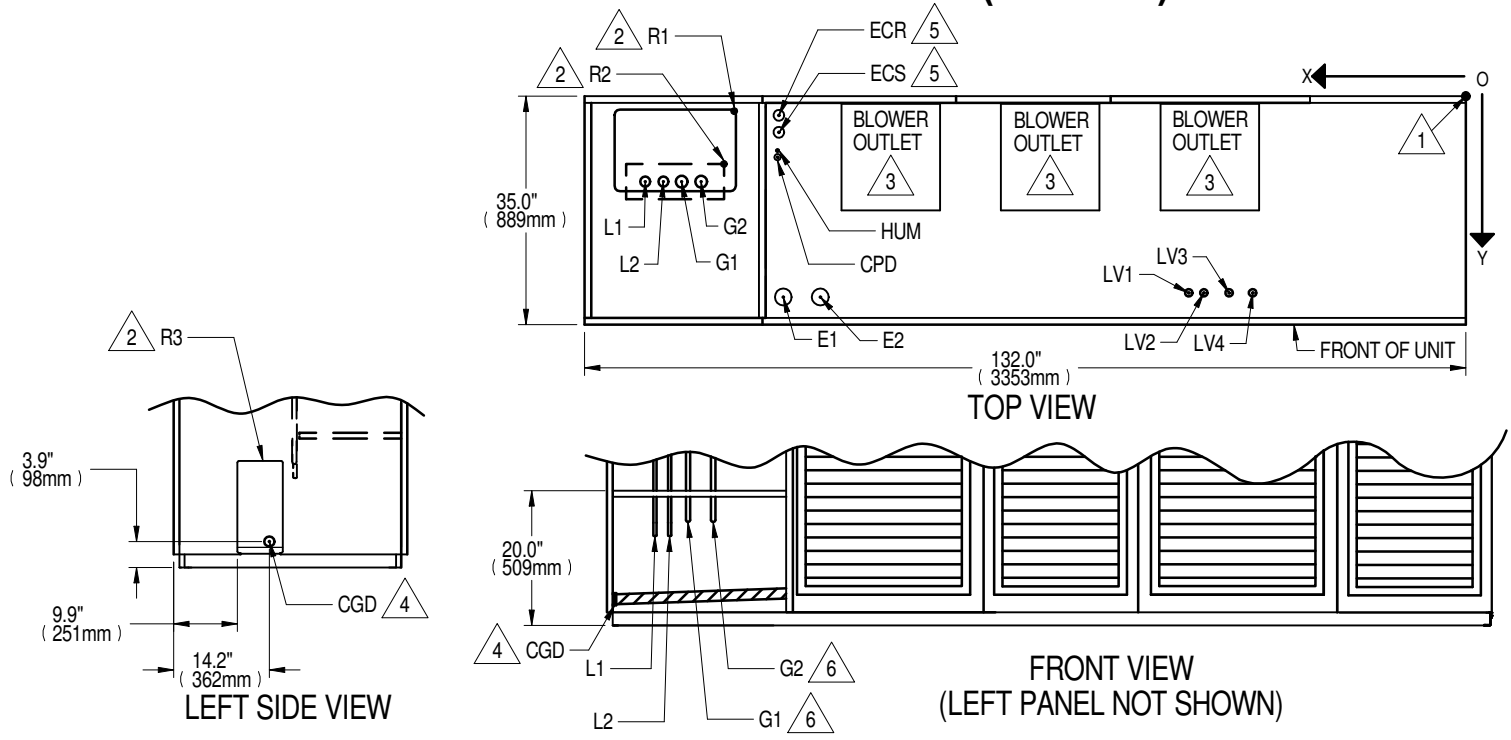
Notes:

1. Drawing not to scale. All dimensions from rear corner of unit including panels, and have a tolerance of ± 1/2" (13mm).
2. Field routed alternatives for refrigerant gas and liquid line connection points.
3. Forward Curved Blowers shown. See submittal page 20000419 for blower outlet and deck dimensional data.
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. Select appropriate drain system materials. The drain line must comply with all local codes.
5. Supplied on Dual Cooling Systems only.
6. When piping out the top of the unit, field must install traps in the discharge lines in the bottom of the unit before running the lines to the top.

POINT	DESCRIPTION	X in. (mm)	Y in. (mm)	CONNECTION SIZE / OPENING	
R1 2	REFRIGERANT ACCESS (TOP)	83-5/8 (2124)	2 (51)	12"(305mm) X 4" (102mm)	
R2 2	REFRIGERANT ACCESS (BOTTOM)	82-3/4 (2102)	14-3/4 (375)	12-3/16" (310mm) X 4" (102mm)	
R3 2	REFRIGERANT ACCESS (SIDE)	N/A	N/A	6" (152mm) X 17-3/16" (437mm)	
				53kW (15TONS) /	70 & 77kW (20 & 22TONS)
L1	LIQUID LINE SYSTEM 1	94-11/16 (2405)	16-3/4 (425)	5/8" O.D. Cu	5/8" O.D. Cu
L2	LIQUID LINE SYSTEM 2	91-7/8 (2334)			
G1 6	HOT GAS DISCHARGE 1	88-3/4 (2254)	16-3/8 (416)	7/8" O.D. Cu	7/8" O.D. Cu
G2 6	HOT GAS DISCHARGE 2	85-9/16"(2173)			
CGD 4	CONDENSATE GRAVITY DRAIN	N/A	N/A	3/4" NPT FEMALE	
CPD	CONDENSATE PUMP DISCHARGE (OPT)	79-5/16 (2015)	11-7/8 (302)	1/2" O.D. Cu	
HUM	HUMIDIFIER SUPPLY LINE		9-7/8 (251)	1/4" O.D. Cu	
ECS 5	ECONO-O-COIL SUPPLY	78-5/8 (1997)	7-7/8 (200)	2-1/8" O.D. Cu	
ECR 5	ECONO-O-COIL RETURN		4-5/8 (117)		
E1	ELECTRICAL CONN. (HIGH VOLT)	75-3/8 (1915)	30 (762)	2-1/2"	
E2		69-7/8 (1775)			
LV1	ELECTRICAL CONN. (LOW VOLT)	19-1/2 (495)	29-1/16 (738)	7/8"	
LV2			30-1/2 (775)		
LV3			31-15/16 (811)		

COOLPHASE PERIMETER

PRIMARY CONNECTION LOCATIONS
UPFLOW AIR COOLED DS105 (30 TONS)



Notes:

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

2. Field routed alternatives for refrigerant gas and liquid line connection points.

3. Forward Curved Blowers shown. See submittal page 20000420 for blower outlet and deck dimensional data.

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. Select appropriate drain system materials. The drain line must comply with all local codes.

5. Supplied on Dual Cooling Systems only.

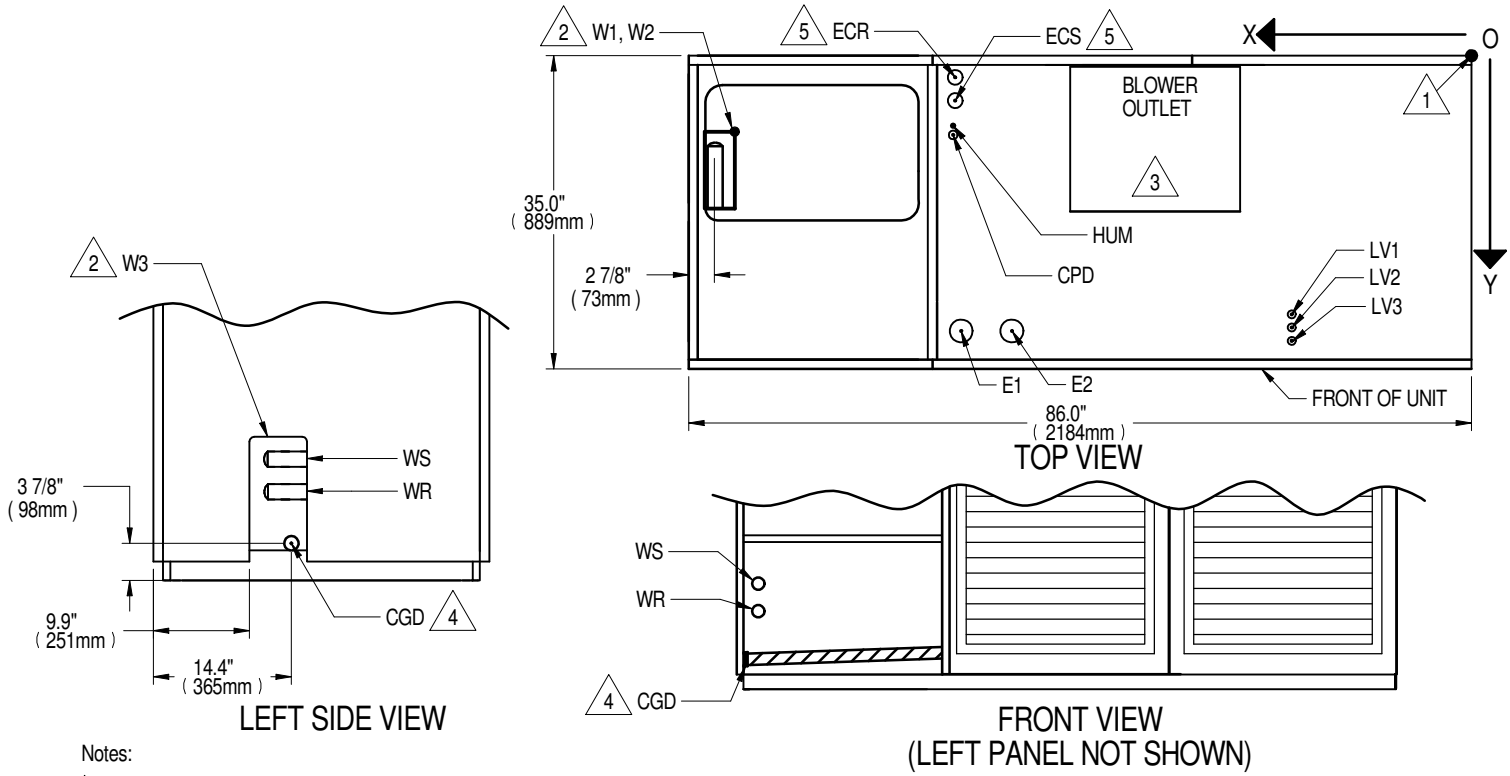
6. When piping out the top of the unit, field must install traps in the discharge lines in the bottom of the unit before running lines to the top.

POINT	DESCRIPTION	X in. (mm)	Y in. (mm)	CONNECTION SIZE / OPENING
R1 2	REFRIGERANT ACCESS (TOP)	106-7/8 (2715)	1-7/8 (48)	22-1/2"(572mm) X 15-3/16" (386mm)
R2 2	REFRIGERANT ACCESS (BOTTOM)	109-1/8 (2772)	13-7/8 (352)	16-7/16" (418mm) X 4" (102mm)
R3 2	REFRIGERANT ACCESS (SIDE)	N/A	N/A	6" (152mm) X 17-3/16" (437mm)
L1	LIQUID LINE SYSTEM 1	121-3/4 (3092)	16-3/4 (425)	5/8" O.D. Cu
L2	LIQUID LINE SYSTEM 2	118-1/8 (3000)		
G1 6	HOT GAS DISCHARGE 1	118-1/4 (3004)	14-1/4 (362)	1-1/8" O.D. Cu
G2 6	HOT GAS DISCHARGE 2	115-5/8 (2937)		
CGD 4	CONDENSATE GRAVITY DRAIN	N/A	N/A	3/4" NPT FEMALE
CPD	CONDENSATE PUMP DISCHARGE (OPT)	102-3/8 (2600)	13-5/8 (346)	1/2" O.D. Cu
HUM	HUMIDIFIER SUPPLY LINE	101-1/8 (2569)	13-1/8 (333)	1/4" O.D. Cu
ECS 5	ECONO-O-COIL SUPPLY		10-1/4 (260)	2-5/8" O.D. Cu
ECR 5	ECONO-O-COIL RETURN		5-1/4 (133)	
E1	ELECTRICAL CONN. (HIGH VOLT)	98-1/2 (2502)	30 (762)	2-1/2"
E2		93 (2362)		
LV1	ELECTRICAL CONN. (LOW VOLT)	41-1/8 (1045)	30-3/8 (772)	7/8"
LV2		38-7/8 (987)		
LV3		35-1/8 (892)		
LV4		31-5/8 (803)		

COOLPHASE PERIMETER

PRIMARY CONNECTION LOCATIONS

UPFLOW WATER/GLYCOL/GLYCOOL DS035-DS042 (10-12 TONS) W/ FORWARD CURVED BLOWER



Notes:

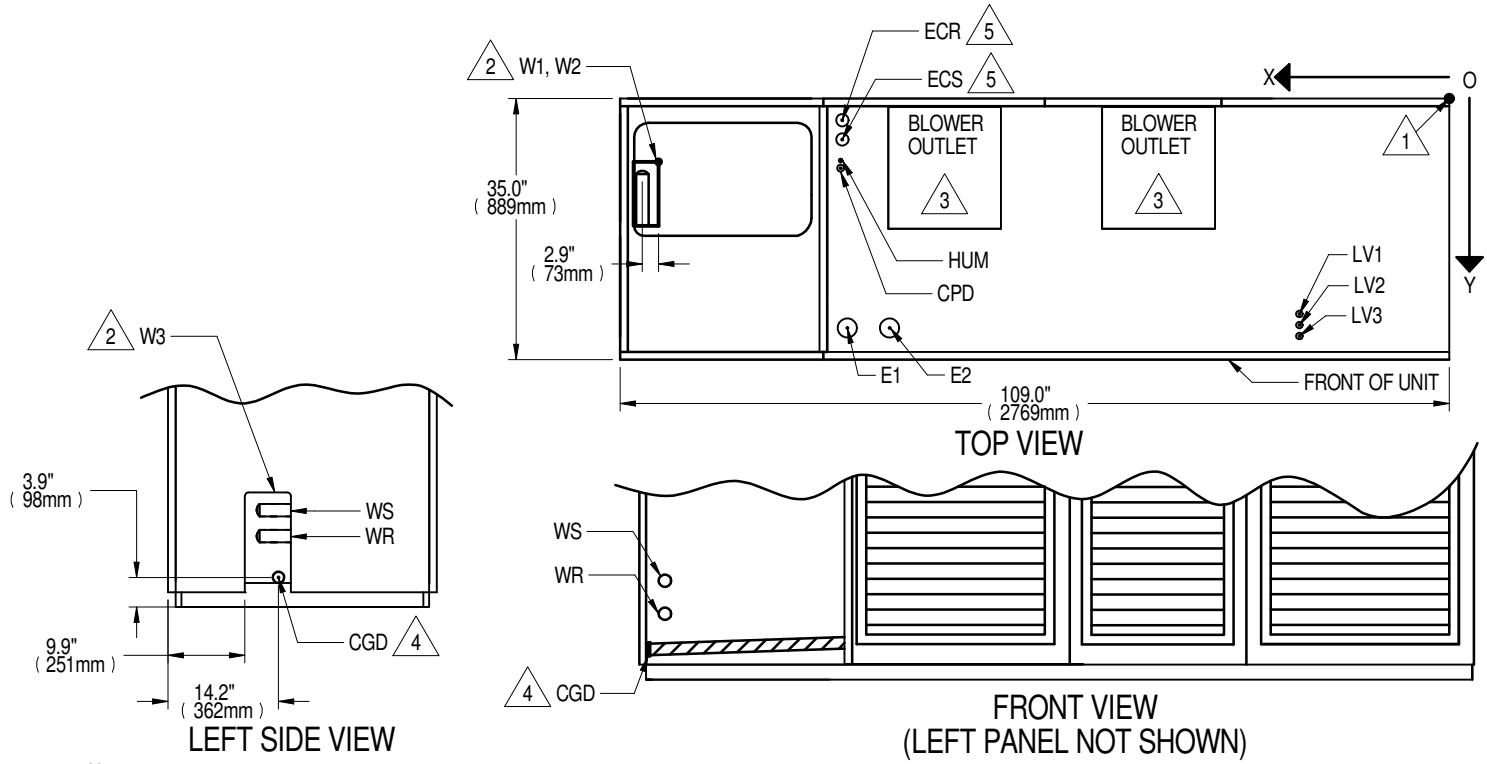
1. Drawing not to scale. All dimensions from rear corner of unit including panels and have a tolerance of ± 1/2" (13mm).
2. Field routed alternatives for water/glycol connections.
3. Forward Curved Blower shown. See submittal page 20000420 for blower outlet and deck dimensional data.
4. Field pitch Condensate 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. Select appropriate drain system materials. The drain line must comply with all local codes.
5. Supplied on Dual Cooling Systems only (four-pipe system).

POINT	DESCRIPTION	X in. (mm)	Y in. (mm)	CONNECTION SIZE / OPENING	
				35kW (10 TON)	42kW (12 TON)
W1 2	WATER/GLYCOL/GLYCOOL ACCESS (BOTTOM)	79-15/16 (2030)	9 (229)	3-1/2" (89mm) X 8" (203mm)	
W2 2	WATER/GLYCOL/GLYCOOL ACCESS (TOP)				
W3 2	WATER/GLYCOL/GLYCOOL ACCESS (SIDE)	N/A	N/A	6" (152mm) x 17-3/16" (437mm)	
WS	WATER/GLYCOL/GLYCOOL SUPPLY			1-5/8" O.D. Cu	2-1/8" O.D. Cu
WR	WATER/GLYCOL/GLYCOOL RETURN				
ECS 5	ECONO-O-COIL SUPPLY	56 (1422)	7-5/16 (186)		
ECR 5	ECONO-O-COIL RETURN		4-1/2 (114)		
CGD 4	CONDENSATE GRAVITY DRAIN	N/A	N/A	3/4" NPT FEMALE	
CPD	CONDENSATE PUMP DISCHARGE (OPT)	56-1/4 (1429)	11-1/8 (283)	1/2" O.D. Cu	
HUM	HUMIDIFIER SUPPLY LINE		9-1/8 (232)	1/4" O.D. Cu	
E1	ELECTRICAL CONN. (HIGH VOLT)	52-3/8 (1330)	30 (762)	2-1/2"	
E2		46-7/8 (1191)			
LV1	ELECTRICAL CONN. (LOW VOLT)	19-1/2 (495)	29-1/16 (738)	7/8"	
LV2			30-1/2 (775)		
LV3			31-15/16 (811)		

COOLPHASE PERIMETER

PRIMARY CONNECTION LOCATIONS

UPFLOW WATER/GLYCOL/GLYCOOL DS053-DS077 (15-22 TONS) W/ FORWARD CURVED BLOWERS



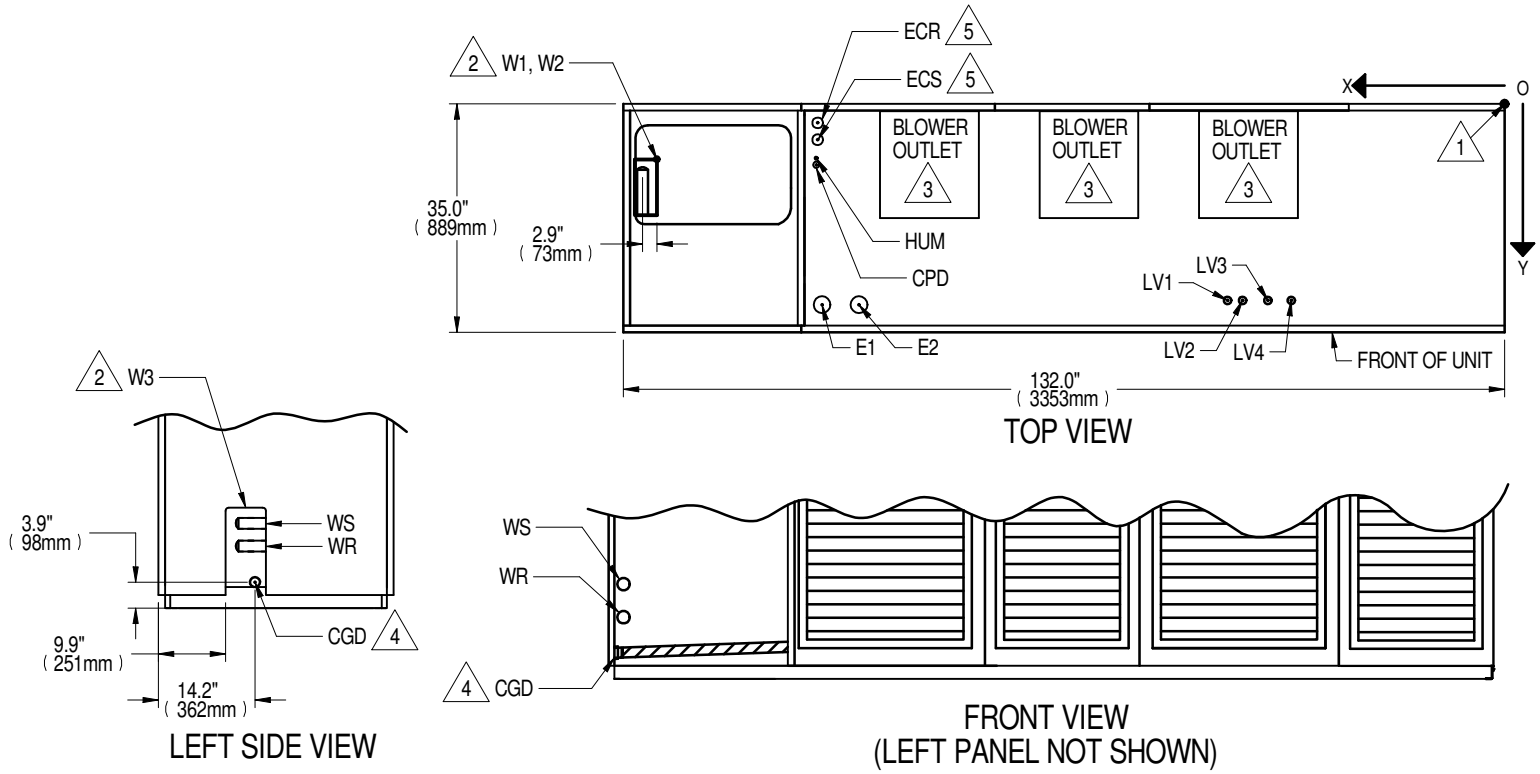
Notes:

1. Drawing not to scale. All dimensions are from rear corner of unit including panels, and have a tolerance of ± 1/2" (13mm).
2. Field routed alternatives for water/glycol connections.
3. Forward Curved Blowers shown. See submittal page 20000419 for blower outlet and deck dimensional data.
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. Select appropriate drain system materials. The drain line must comply with all local codes.
5. Supplied on Dual Cooling Systems only (four-pipe system).

POINT	DESCRIPTION	X in. (mm)	Y in. (mm)	CONNECTION SIZE / OPENING
W1 (2)	WATER/GLYCOL/GLYCOOL ACCESS (BOTTOM)	102-15/16 (2615)	9 (229)	3-1/2" (89mm) X 8" (203mm)
W2 (2)	WATER/GLYCOL/GLYCOOL ACCESS (TOP)			
W3 (2)	WATER/GLYCOL/GLYCOOL ACCESS (SIDE)	N/A	N/A	6" (152mm) x 17-3/16" (437mm)
WS	WATER/GLYCOL/GLYCOOL SUPPLY			2-1/8" O.D. Cu
WR	WATER/GLYCOL/GLYCOOL RETURN			
CGD (4)	CONDENSATE GRAVITY DRAIN			3/4" NPT FEMALE
CPD	CONDENSATE PUMP DISCHARGE (OPT)	79-5/16 (2015)	11-7/8 (302)	1/2" O.D. Cu
HUM	HUMIDIFIER SUPPLY LINE		9-7/8 (251)	1/4" O.D. Cu
ECS (5)	ECONO-O-COIL SUPPLY	78-5/8 (1997)	7-7/8 (200)	2-1/8" O.D. Cu
ECR (5)	ECONO-O-COIL RETURN		4-5/8 (117)	
E1	ELECTRICAL CONN. (HIGH VOLT)	75-3/8 (1915)	30 (762)	2-1/2"
E2	ELECTRICAL CONN. (HIGH VOLT)	69-7/8 (1775)		
LV1	ELECTRICAL CONN. (LOW VOLT)	19-1/2 (495)	29-1/16 (738)	7/8"
LV2	ELECTRICAL CONN. (LOW VOLT)		30-1/2 (775)	
LV3	ELECTRICAL CONN. (LOW VOLT)		31-15/16 (811)	

COOLPHASE PERIMETER

PRIMARY CONNECTION LOCATIONS
UPFLOW WATER/GLYCOL/GLYCOOL DS105 (30 TONS)



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 routed alternatives for water/glycol connections.
3. Forward Curved Blowers shown. See submittal page 20000420 for blower outlet and deck dimensional data.
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. Select appropriate drain system materials. The drain line must comply with all local codes.
5. Supplied on Dual Cooling Systems only (four-pipe systems).

POINT	DESCRIPTION	X in. (mm)	Y in. (mm)	CONNECTION SIZE / OPENING
W1 2	WATER/GLYCOL/GLYCOOL ACCESS (BOTTOM)	126-1/8 (3204)	9 (229)	3-1/2" (89mm) X 8" (203mm)
W2 2	WATER/GLYCOL/GLYCOOL ACCESS (TOP)			
W3 2	WATER/GLYCOL/GLYCOOL ACCESS (SIDE)	N/A	N/A	6" (152mm) x 17-3/16" (437mm)
WS	WATER/GLYCOL/GLYCOOL SUPPLY			2-1/8" O.D. Cu
WR	WATER/GLYCOL/GLYCOOL RETURN			
CGD 4	CONDENSATE GRAVITY DRAIN			3/4" NPT FEMALE
CPD	CONDENSATE PUMP DISCHARGE (OPT)	102-3/8 (2600)	13-5/8 (346)	1/2" O.D. Cu
HUM	HUMIDIFIER SUPPLY LINE	101-1/8 (2569)	13-1/8 (333)	1/4" O.D. Cu
ECS 5	ECONO-O-COIL SUPPLY		10-1/4 (260)	2-5/8" O.D. Cu
ECR 5	ECONO-O-COIL RETURN		5-1/4 (133)	
E1	ELECTRICAL CONN. (HIGH VOLT)	98-1/2 (2502)	30 (762)	2-1/2"
E2	ELECTRICAL CONN. (HIGH VOLT)	93 (2362)		
LV1	ELECTRICAL CONN. (LOW VOLT)	41-1/8 (1045)	30-3/8 (772)	7/8"
LV2	ELECTRICAL CONN. (LOW VOLT)	38-7/8 (987)		
LV3	ELECTRICAL CONN. (LOW VOLT)	35-1/8 (892)		
LV4	ELECTRICAL CONN. (LOW VOLT)	31-5/8 (803)		

COOLPHASE PERIMETER

ELECTRICAL FIELD CONNECTION DESCRIPTION
UPFLOW AND DOWNFLOW MODELS

STANDARD ELECTRICAL CONNECTIONS

1) **Primary high voltage entrance -** 2.50" (64mm); 1.75" (44mm); 1.375" (35mm) diameter concentric knockouts located in bottom of box.
2) **Secondary high voltage entrance -** 2.50" (64mm); 1.75" (44mm); 1.375" (35mm) diameter concentric knockouts located in top of box.
3) **Primary low voltage entrance -** Quantity (3) 1.375" (35mm) diameter knockouts located in bottom of unit.
4) **Secondary low voltage entrance -** Quantity (3) 1. 375" (35mm) diameter knockouts located in top of box.
5) **Three phase electrical service -** Terminals are on main fuse block (disregard if unit has optional disconnect switch). Three phase service not by Vertiv™.
6) **Earth ground -** Terminal for field supplied earth grounding wire. Earth grounding required for Vertiv™ units.
7) **Remote unit shutdown -** Replace existing jumper between terminals 37 & 38 with field supplied normally closed switch having a minimum 75VA, 24VAC rating. Use field supplied Class 1 wiring.
8) **Customer alarm inputs -** Terminals for field supplied, normally open contacts, having a minimum 75VA, 24VAC rating, between terminals 24 & 50, 51, 55, 56. Use field supplied Class 1 wiring. Terminal availability varies by unit options.
9) **Common alarm -** On any alarm, normally open dry contact is closed across terminals 75 & 76 for remote indication. 1 AMP, 24VAC max load. Use Class 1 field supplied wiring.
10) **Heat rejection interlock -** On any call for compressor operation, normally open dry contact is closed across terminals 70 & 71(circuit 1), 230 (circuit 2) to heat rejection equipment. 1 AMP, 24VAC max load. Use Class 1 field supplied wiring. When Vertiv™ CoolPhase Perimeter unit is paired with a Vertiv™ CoolPhase Condenser series condenser, remove jumper between terminal 71 and terminal 230. Three wires must connect terminals 70, 71 and 230 of the indoor unit to terminals 70, 71 and 230 of the Vertiv™ CoolPhase Condenser MC series condenser.
11) **Unit factory installed disconnect switch, Fuse Block and Main Fuses –** "Locking Type" consists of a non-automatic molded case switch operational from the outside of the unit. Access to the high voltage electric panel compartment can be obtained only with the switch in the "off" position. Units with fused disconnects are provided with a defeater button that allows access to the electrical panel when power is on. The molded case switch disconnect models contain separate main fuses.

CANBUS ELECTRICAL CONNECTIONS

12) **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 – Optional Vertiv™ EconoPhase Unit.
13) **CANbus Cable** – CANbus cable provided by others to connect to the outdoor condenser, and optional PRE unit (DA units only). 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) 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

14) Do not run in same conduit, raceway, or chase as high voltage wiring.
15) For CANbus network lengths greater than 450FT (137M) call factory.

ELECTRICAL FIELD CONNECTION DESCRIPTION
UPFLOW AND DOWNFLOW MODELS

OPTIONAL ELECTRICAL CONNECTIONS

16) **Smoke sensor alarm -** Factory wired dry contacts from smoke sensor are 91-common, 92-NO, and 93-NC. Supervised contacts, 80 & 81, open on sensor trouble indication. This smoke sensor is not intended to function as, or replace, any room smoke detection system that may be required by local or national codes. 1 AMP, 24VAC max load. Use Class 1 field supplied wiring.
17) **Reheat and humidifier lockout -** Remote 24VAC required at terminals 82 & 83 for lockout of reheat and humidifier.
18) **Condensate alarm (with condensate pump option) -** On pump high water indication, normally open dry contact is closed across terminals 88 & 89 for remote indication. 1 AMP, 24VAC max load. Use Class 1 field supplied wiring.
19) **Remote humidifier -** On any call for humidification, normally open dry contact is closed across terminals 11 & 12 to signal field supplied remote humidifier. 1 AMP, 24VAC max load. Use Class 1 field supplied wiring.
20) **Auxiliary cool contact -** On any call for Vertiv™ Econophase operation, normally open dry contact is closed across terminals 72 & 73 on dual cool units only. 1 AMP, 24VAC max load. Use Class 1 field supplied wiring.
21) **Analog Inputs -** Terminals 41, 42, 43, 44 are user configurable for 0-10V, 0-5V, or 4-20MA.

OPTIONAL LOW VOLTAGE TERMINAL PACKAGE CONNECTIONS

22) **Remote unit shutdown -** Two additional contact pairs available for unit shutdown (labeled as 37B & 38B, 37C & 38C). Replace jumpers with field supplied normally closed switch having a minimum 75VA, 24VAC rating. Use field supplied Class 1 wiring.
23) **Common alarm -** On any alarm, two additional normally open dry contacts are closed across terminals 94 & 95 and 96 & 97 for remote indication. 1 AMP, 24VAC max load. Use Class 1 field supplied wiring.
24) **Main fan auxiliary switch -** On closure of main fan contactor, normally open dry contact is closed across terminals 84 & 85 for remote indication. 1 AMP, 24VAC max load. Use Class 1 field supplied wiring.
25) **Vertiv™ Liebert® Liqui-Tect™ shutdown and dry contact -** Vertiv™ Liebert® Liqui-Tect™ activation, normally open dry contact is closed across terminals 58 & 59 for remote indication (Vertiv™ Liebert® Liqui-Tect™ sensor ordered separately). 1 AMP, 24VAC max load. Use Class 1 field supplied wiring.

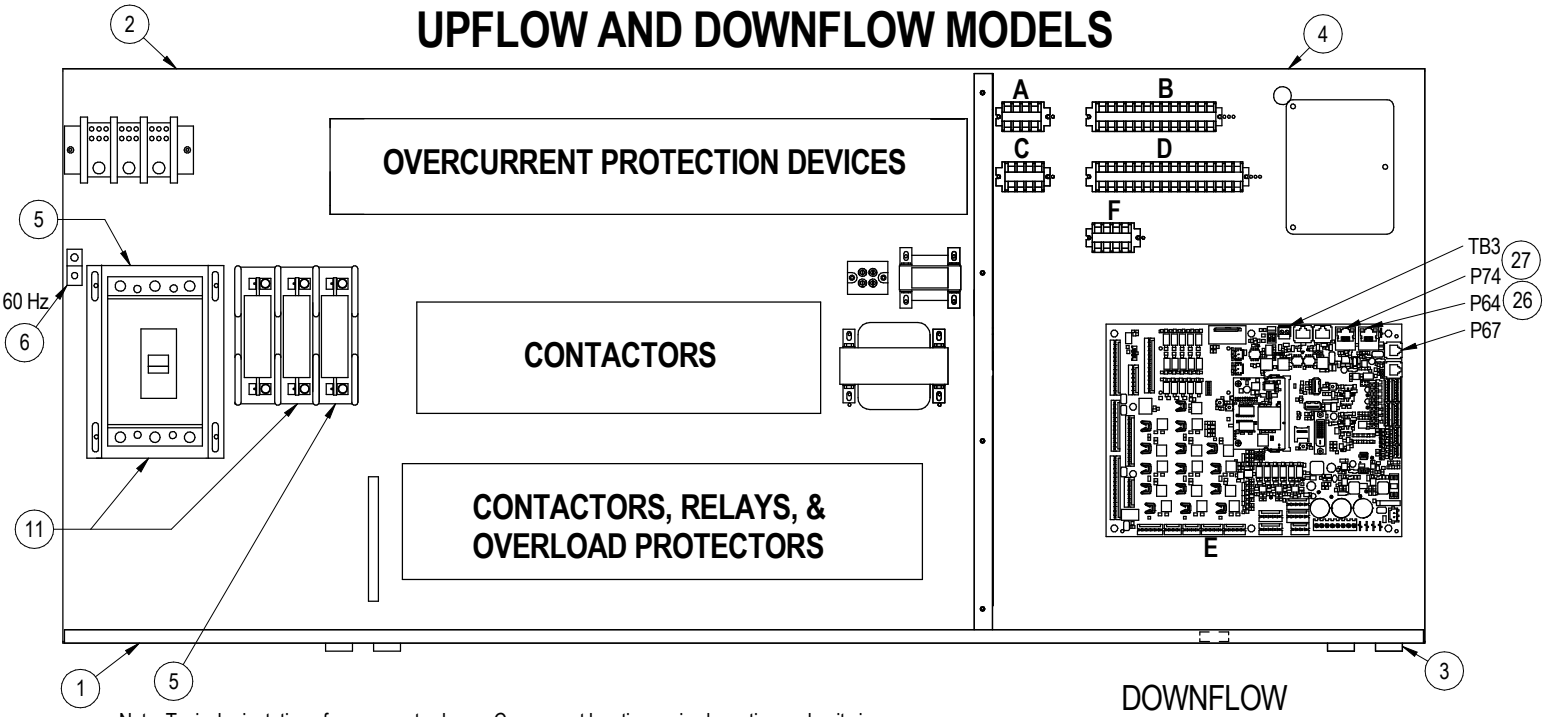
OPTIONAL COMMUNICATION CONNECTIONS

26) **Unit-To-Unit -** Plug 64 is reserved for U2U communication.
27) **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.

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

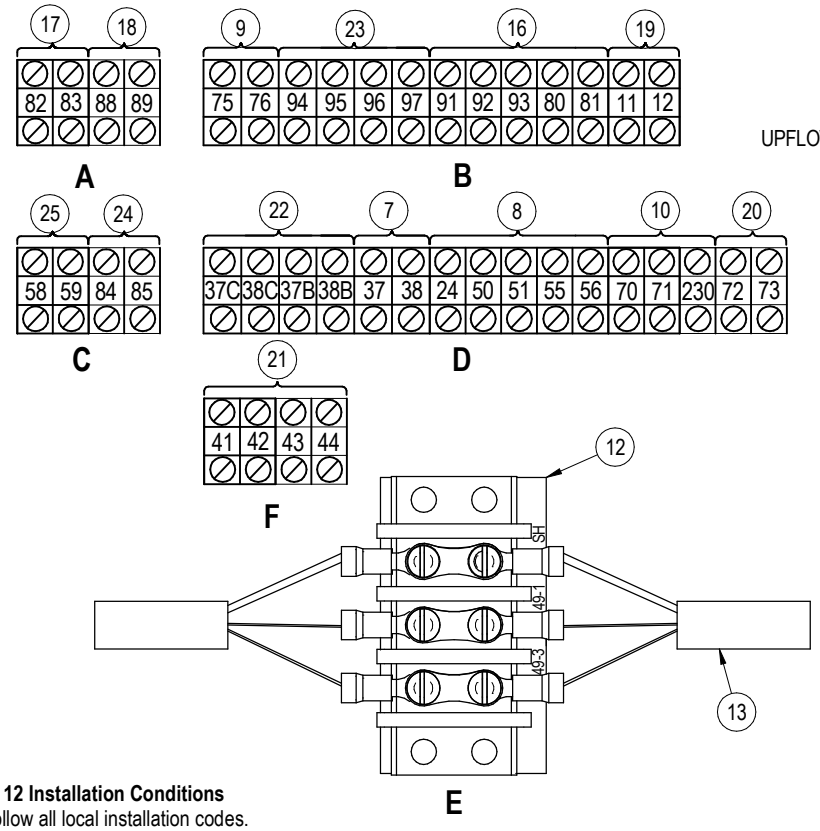
ELECTRICAL FIELD CONNECTION DESCRIPTION

UPFLOW AND DOWNFLOW MODELS



Note: Typical orientation of components shown. Component location varies by option and unit size.

DOWNFLOW
LOW VOLT SECTION

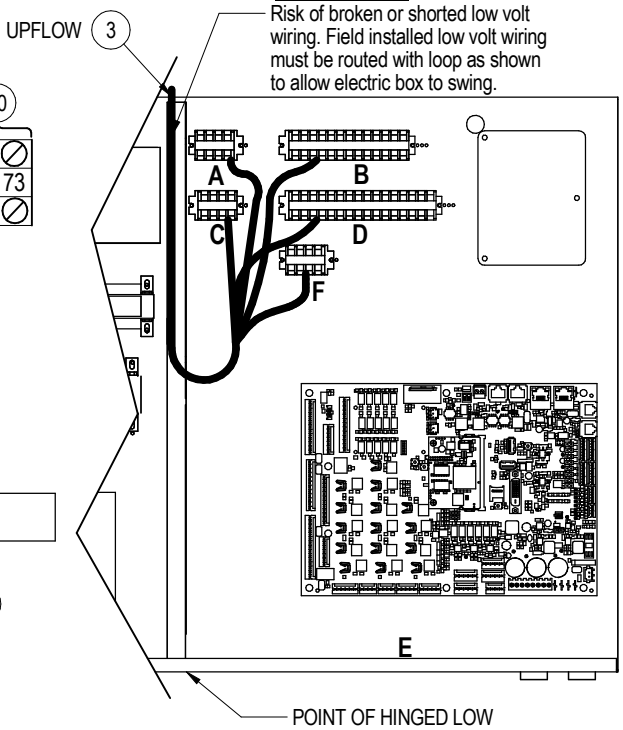


Item 12 Installation Conditions

1. Follow all local installation codes.
2. Do not run CAN cables in same conduit, raceway, or chase as high voltage wires (120-600V).
3. Separate high volt wires from CAN wires by 12 inches.

CAUTION:

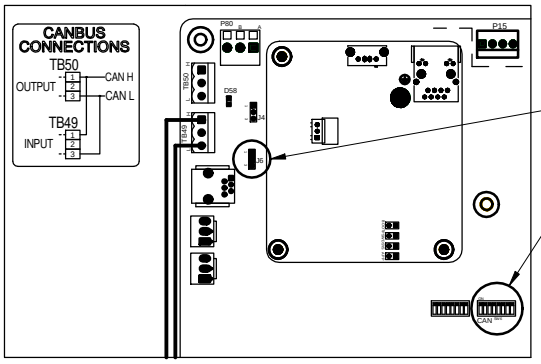
Risk of broken or shorted low volt wiring. Field installed low volt wiring must be routed with loop as shown to allow electric box to swing.



UPFLOW LOW VOLT SECTION

COOLPHASE PERIMETER

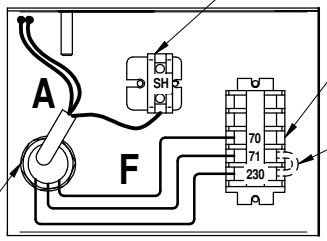
CANbus & INTERLOCK CONNECTIONS
BETWEEN COOLPHASE PERIMETER & COOLPHASE CONDENSER
(PREMIUM)



J6 TERMINATION JUMPER
MUST BE SET TO PINS 1 AND 2

CANbus ADDRESSING SWITCH

DETAIL 3
CAN CABLE CONNECTION (A)



SHIELD CONNECTION

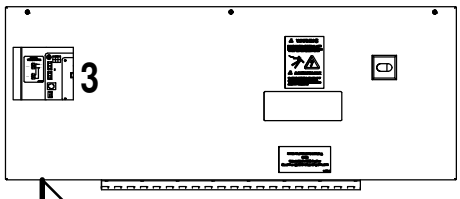
FACTORY WIRING BETWEEN
MC CONTROL BOARD AND
TERMINAL STRIP

REMOVE JUMPER
FOR DUAL CIRCUIT

LOW VOLTAGE FIELD ENTRANCE
LOCATED ON BOTTOM LEFT OF
CONDENSER ENCLOSURE

HEAT REJECTION INTERLOCK (F)

COOLPHASE CONDENSER



F HEAT REJECTION INTERLOCK

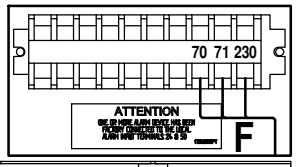
A CANbus CONNECTION

COMPONENT NOTES:
1. COMPONENT APPEARANCE, ORIENTATION , AND POSITION MAY VARY BETWEEN PRODUCT LINES. TERMINAL NAMES AND CALLOUTS REMAIN CONSTANT.
2. ALL CIRCUITS TO THESE CONNECTION POINTS ARE CLASS 2.

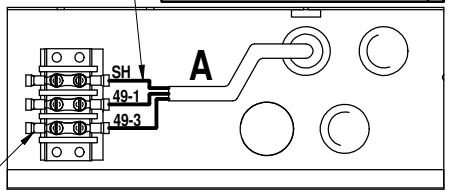
CABLE NOTES (A):
1. CABLE MUSTHAVE THE FOLLOWING SPECIFICATIONS:
   - BRAIDED SHIELD OR FOIL SHIELD WITH DRAIN WIRE
   - SHIELD MUST BE WIRED TO GROUND AT INDOOR UNIT
   - 22-18AWG STRANDED TINNED COPPER
   - TWISTED PAIR (MINIMUM 4 TWISTS PER FOOT)
   - LOW CAPACITANCE (15pF/FT OR LESS)
   - MUST BE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

WIRE NOTES (F):
1. FIELD SUPPLIED WIRE
   - 3 CONDUCTOR 18AWG OR GREATER
   - RATED 600V
2. RUN FIELD SUPPLIED WIRES BETWEEN THE INDOOR COOLPHASE PERIMETER UNIT AND THE COOLPHASE CONDENSER.

DETAIL 2
HEAT REJECTION INTERLOCK (F)

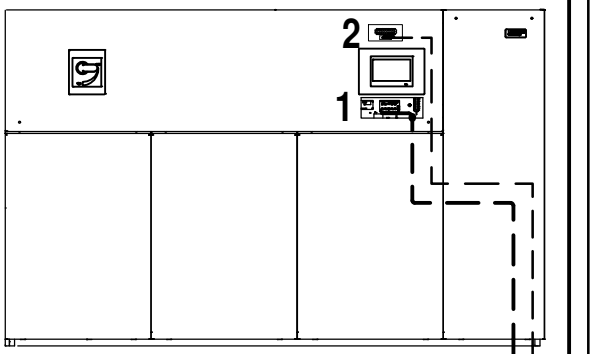


SHIELD CONNECTION



DETAIL 1 CAN CABLE CONNECTION (A)

FACTORY WIRING BETWEEN VERTIV™ iCOM™ AND TERMINAL STRIP

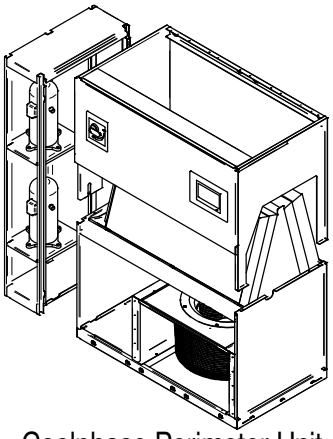


INDOOR COOLPHASE

PERIMETER UNIT

COOLPHASE PERIMETER

DISASSEMBLY DIMENSIONAL DATA
DOWNFLOW DS035-DS042 (10-12 TONS) MODELS



Coolphase Perimeter Unit
Compressor Section

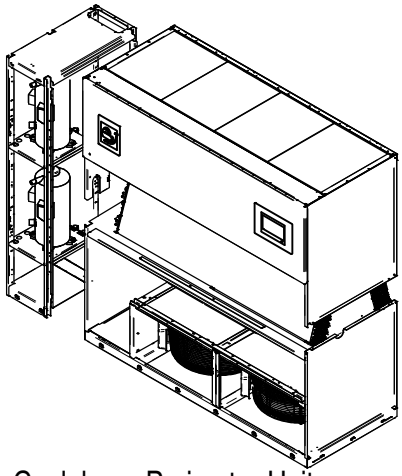
Cooling Type	A in. (mm)	B in. (mm)
Air Cooled	13 (330)	72 (1829)
Air Cooled w/Dual Cool		
Water/Glycol	26 (660)	85 (2159)
GLYCOOL/Dual Cool		

Assembly	APPROXIMATE DRY WEIGHT lb (kg) (Includes Panels)			
	Air Cooled	A/C w/ Dual Cool	Water/Glycol	GLYCOOL/Dual Cool
Compressor Assembly	490 (223)	490 (223)	800 (364)	800 (364)
Filter & Electric Box Assembly	210 (96)	210 (96)	210 (96)	210 (96)
Blower & Coil Assembly	770 (350)	920 (418)	770 (350)	920 (418)

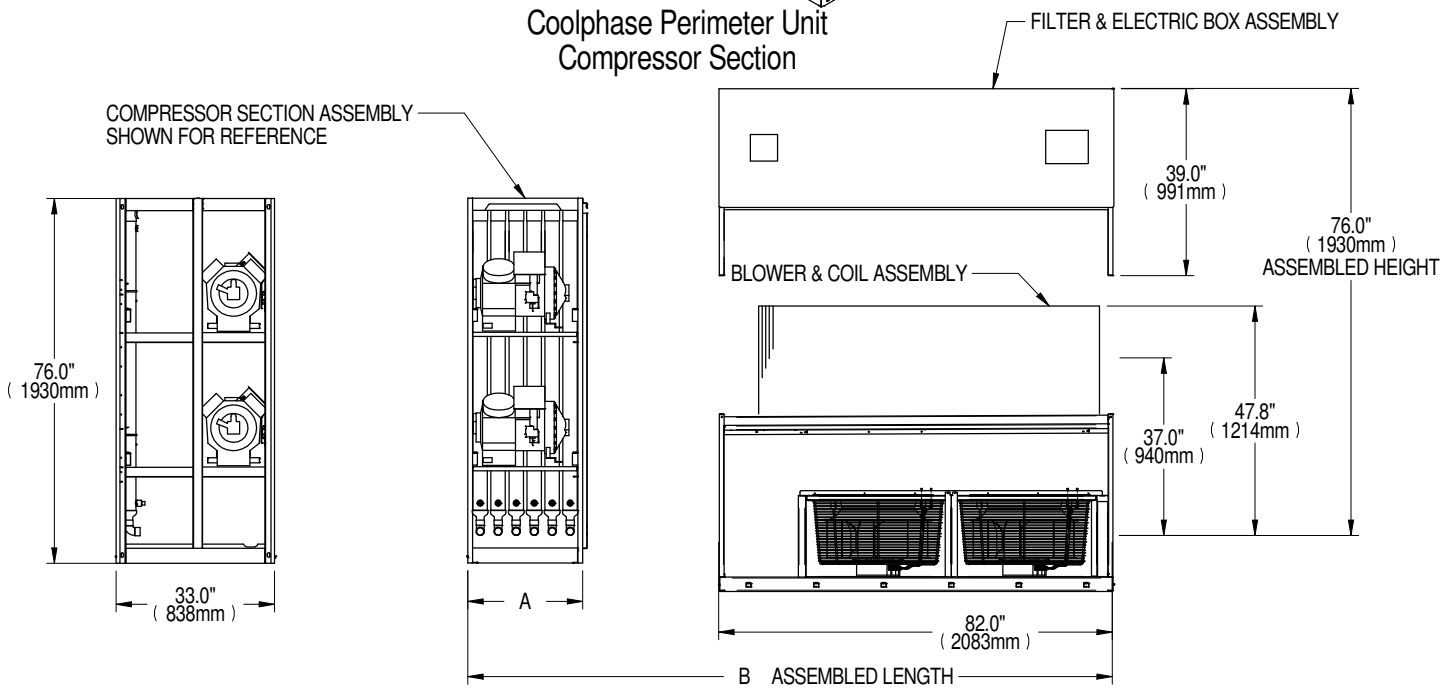
Notes:
1. Drawing Views are simplified with panels removed to show overall dimensions. See disassembly and handling instructions in installation manual.

COOLPHASE PERIMETER

DISASSEMBLY DIMENSIONAL DATA
DOWNFLOW DS053-DS077 (15-22 TONS) MODELS



Coolphase Perimeter Unit
Compressor Section



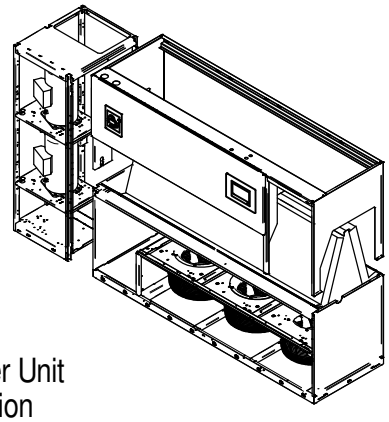
Model Number	Cooling Type	A in. (mm)	B in. (mm)
DS053-DS077	Air Cooled	15 (381)	97 (2464)
	Air Cooled w/ Dual Cool		
	Water/Glycol	26 (660)	108 (2743)
	GLYCOOL/Dual Cool		

Notes:
1. Drawing Views are simplified with panels removed to show overall dimensions. See disassembly and handling instructions in installation manual.

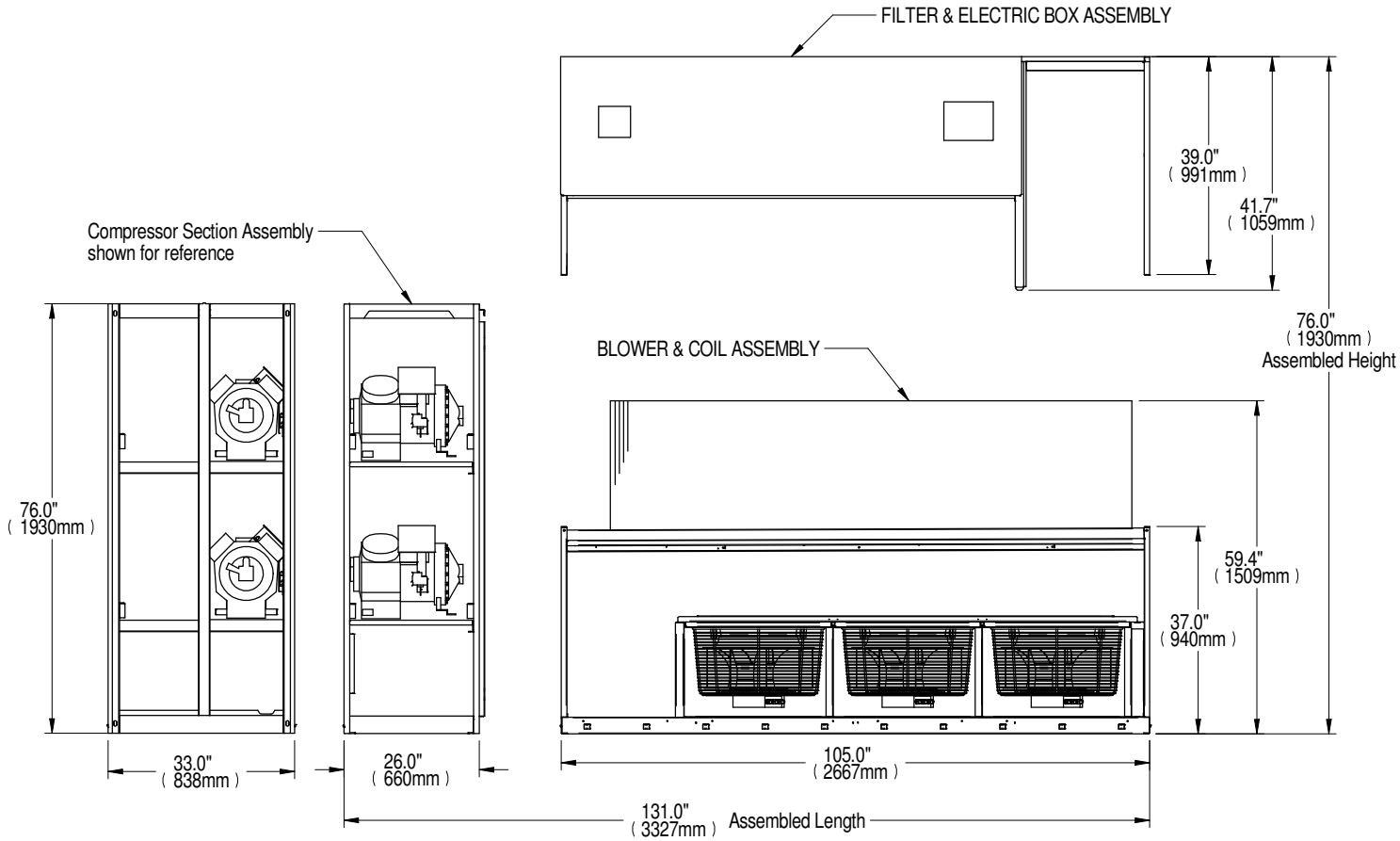
Assembly	APPROXIMATE DRY WEIGHT lb (kg) (Includes Panels)			
	Air Cooled	A/C w/ Dual Cool	Water/Glycol	GLYCOOL/Dual Cool
Compressor Assembly	540 (246)	540 (246)	840 (382)	840 (382)
Filter & Electric Box Assembly	250 (114)	250 (114)	250 (114)	250 (114)
Blower & Coil Assembly	1230 (560)	1410 (641)	1230 (560)	1410 (641)

COOLPHASE PERIMETER

DISASSEMBLY DIMENSIONAL DATA
DOWNFLOW DS105 (30 TONS) MODELS



Coolphase Perimeter Unit
Compressor Section

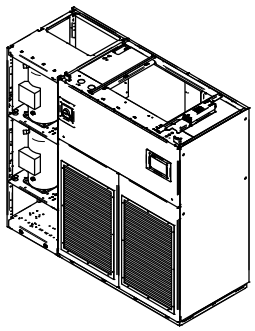


Note: Drawing Views are simplified with panels removed to show overall dimensions. See disassembly and handling instructions in installation manual.

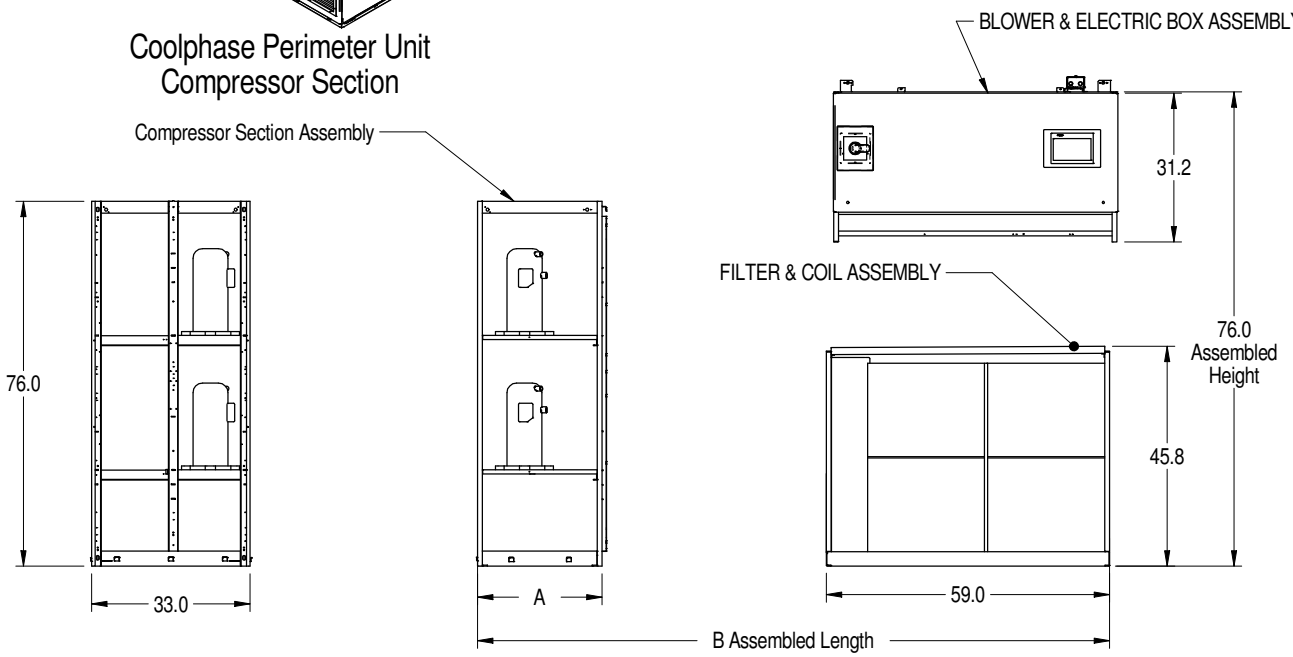
Assembly	APPROXIMATE DRY WEIGHT lb (kg) (Includes Panels)			
	Air Cooled	A/C w/ Dual Cool	Water/Glycol	GLYCOOL/Dual Cool
Compressor Assembly	830 (377)	950 (432)	1320 (600)	1320 (600)
Filter & Electric Box Assembly	270 (123)	270 (123)	270 (123)	270 (123)
Blower & Coil Assembly	1560 (708)	1915 (870)	1560 (708)	1915 (870)

COOLPHASE PERIMETER

DISASSEMBLY DIMENSIONAL DATA
UPFLOW DS035-DS042 (10-12 TONS) MODELS



Coolphase Perimeter Unit
Compressor Section



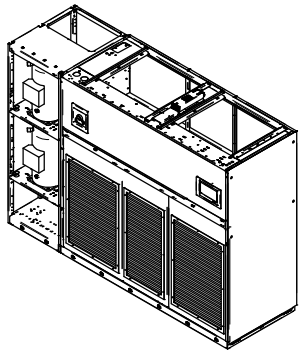
Model Number	Cooling Type	A in. (mm)	B in. (mm)
DS035-042	Air Cooled	13 (330)	72 (1829)
	Air Cooled w/ Dual Cool		
	Water/Glycol	26 (660)	85 (2159)
	GLYCOOL/Dual Cool		

Notes:
1. Drawing Views are simplified with panels removed to show overall dimensions. See disassembly and handling instructions in installation manual. EC Fan unit shown.
2. EC Fan wieght not included in this unit weight. Fan is installed in plenum. See 20000424.

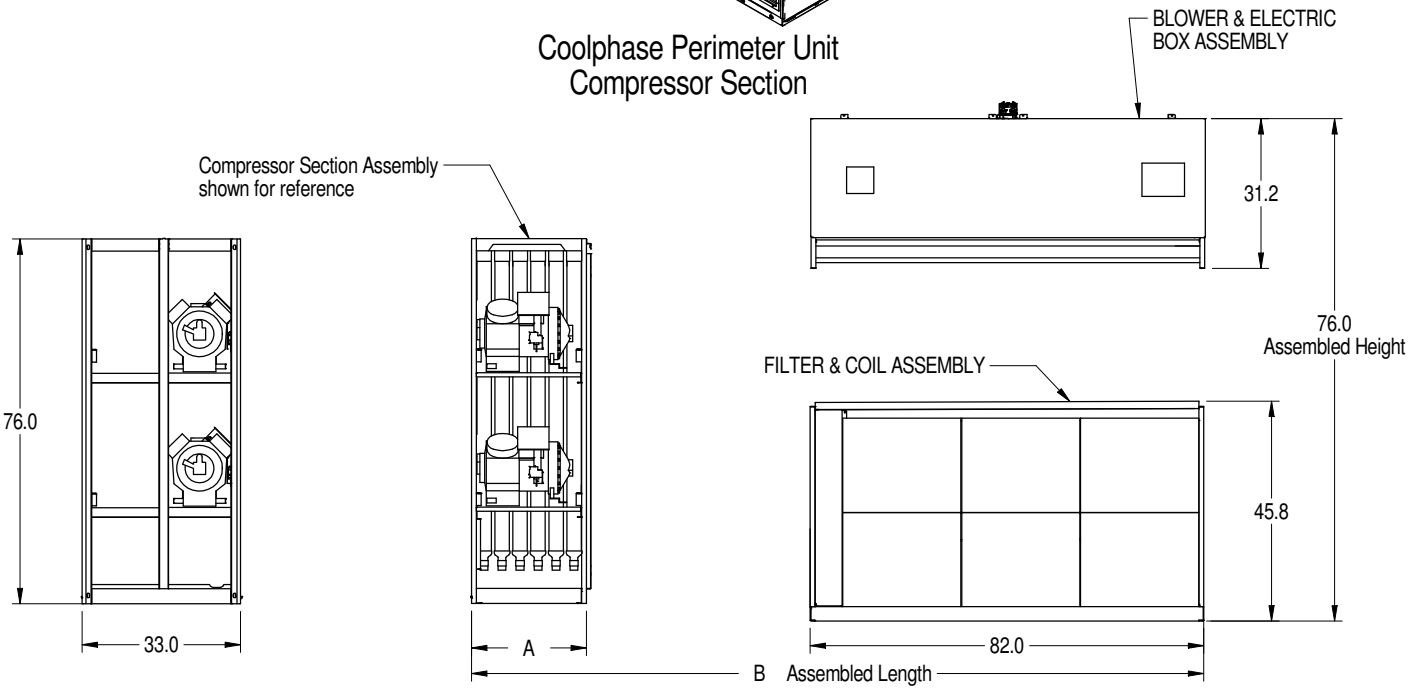
Assembly	APPROXIMATE DRY WEIGHT lb (kg) (Includes Panels)			
	Air Cooled	A/C w/ Dual Cool	Water/Glycol	GLYCOOL/Dual Cool
Compressor Assembly	490 (223)	490 (223)	800 (364)	800 (364)
Forward Curved Blower & Electric Box Assembly	510 (231)	510 (231)	510 (231)	510 (231)
EC Fan & Electric Box Assembly 2	360 (163)	360 (163)	360 (163)	360 (163)
Filter & Coil Assembly	520 (236)	670 (304)	520 (236)	670 (304)

COOLPHASE PERIMETER

DISASSEMBLY DIMENSIONAL DATA
UPFLOW DS053-DS077 (15-22 TONS) MODELS



Coolphase Perimeter Unit
Compressor Section



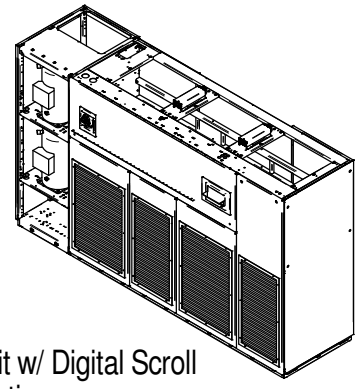
Model Number	Cooling Type	A in. (mm)	B in. (mm)
DS053-DS077	Air Cooled	15 (381)	97 (2464)
	Air Cooled w/ Dual Cool		
	Water/Glycol	26 (660)	108 (2743)
	GLYCOOL/Dual Cool		

Notes:
1. Drawing Views are simplified with panels removed to show overall dimensions. See disassembly and handling instructions in installation manual. EC Fan unit shown.
2. EC Fan weight not included in this unit weight. Fan is installed in plenum. See 20000425.

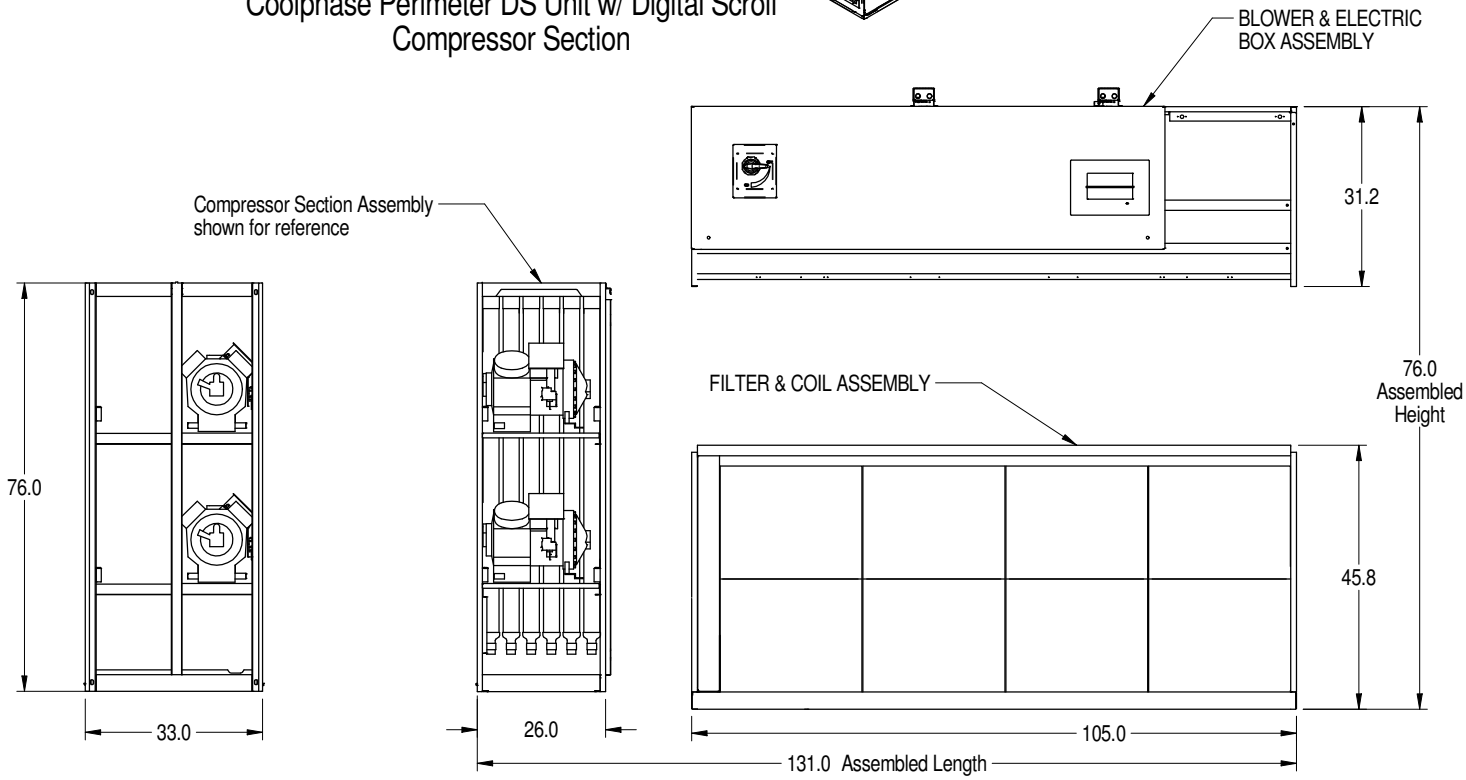
Assembly	APPROXIMATE DRY WEIGHT lb (kg) (Includes Panels)			
	Air Cooled	A/C w/ Dual Cool	Water/Glycol	GLYCOOL/Dual Cool
Compressor Assembly	540 (246)	540 (246)	840 (382)	840 (382)
Forward Curved Blower & Electric Box Assembly	770 (349)	770 (349)	770 (349)	770 (349)
EC Fan & Electric Box Assembly 2	600 (272)	600 (272)	600 (272)	600 (272)
Filter & Coil Assembly	760 (345)	940 (426)	760 (345)	940 (426)

COOLPHASE PERIMETER

DISASSEMBLY DIMENSIONAL DATA
UPFLOW DS105 (30 TONS) MODELS



Coolphase Perimeter DS Unit w/ Digital Scroll Compressor Section



Notes:
1. Drawing Views are simplified with panels removed to show overall dimensions. See disassembly and handling instructions in installation manual. EC Fan unit shown.

△2. EC Fan weight not included in this unit weight. Fan is installed in plenum. See 20000426.

Assembly	APPROXIMATE DRY WEIGHT lb (kg) (Includes Panels)			
	Digital Scroll Compressor		Digital Scroll Compressor	
	Air Cooled	A/C w/ Dual Cool	Water/Glycol	GLYCOOL/Dual Cool
Compressor Assembly	830 (376)		1320 (599)	
Forward Curved Blower & Electric Box Assembly	1080 (490)		1080 (490)	
EC Fan & Electric Box Assembly △2	840 (381)		840 (381)	
Filter & Coil Assembly	970 (440)	1300 (590)	970 (440)	1300 (590)

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