



Liebert[®] PCW Chilled Water Thermal Management Systems

Installer/User Guide

10 to 48 Ton (35 to 170 kW) Capacity, Upflow and Downflow, 60 Hz

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

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Technical Support Site

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

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

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1 Important Safety Instructions

1.1 Conventions



WARNING! Indicates a hazardous situation which, if not avoided, could result in death or serious injury.



CAUTION: Indicates a hazardous situation which, if not avoided, may result in minor or moderate injury.

NOTICE

Indicates a property damage message.

ENVIRONMENT

Indicates an environment damage message.

Lockout-Tagout (LOTO)

The power must be disconnected and proper LOTO safety procedures must be followed.

Safeguards Raised Floor

When you finish the operations on the unit, always remember the following:

- Remount and fix with screws all the safeguards (panels, grids).
- If present, close and lock all the doors.
- Install all the floor panels around and under the unit.
- Never operate the unit without the above mentioned safeguards.

SAVE THESE INSTRUCTIONS

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

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

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



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

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

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



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

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



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

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



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



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



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



WARNING! Risk of top heavy unit falling over when improperly lifted or moved. Can cause serious injury or death. Building and equipment damage may also result. Read all of the following instructions and verify that all lifting and moving equipment is rated for the weight of the unit before attempting to move, lift, remove packaging from or prepare the unit for installation. Unit weights are specified in **Table 7.6** on page 54 .



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 7.6** on page 54 . Use the center of gravity indicators on the unit to determine the position of the slings.



WARNING! Risk of improper piping installation, leak checking, fluid chemistry, and fluid maintenance can cause equipment damage and personal injury. Installation and service of this equipment should be done only by qualified personnel who have been specifically-trained in the installation of air-conditioning equipment and who are wearing appropriate, OSHA-approved PPE.



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



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



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



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



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

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



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



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



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



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

NOTICE

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

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

NOTICE

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

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

Fluid chemistry varies greatly as do the required additives, called inhibitors, that reduce the corrosive effect of the fluids on the piping systems and components.

The chemistry of the coolant fluid used must be considered, because some sources may contain corrosive elements that reduce the effectiveness of the inhibited formulation. Sediment deposits prevent the formation of a protective oxide layer on the inside of the coolant system components and piping. The coolant fluid must be treated and circulating through the system continuously to prevent the buildup of deposits and/or growth of bacteria. Proper inhibitor maintenance must be performed to prevent corrosion of the system.

Consult fluid manufacturer for testing and maintenance of inhibitors.

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

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

NOTICE

Risk of no flow condition. Can cause equipment damage. Do not leave the water/coolant fluid supply circuit in a no flow condition. Idle fluid allows the collection of sediment that prevents the formation of a protective oxide layer on the inside of tubes. Keep unit switched on and water/coolant fluid supply circuit system operating continuously.

NOTICE

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

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

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

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

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

NOTICE

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

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

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

NOTICE

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

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

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

NOTICE

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

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

NOTICE

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

Downflow unit internal drain lines contain a factory installed trap. Do not externally trap the unit.

Upflow unit internal drain lines do not contain a factory installed trap. Trap the unit externally.

Sagging condensate drain lines may inadvertently create an external trap.

Drain line may contain boiling water. Select appropriate drain system materials. The drain line must comply with local codes.

NOTICE

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

NOTICE

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

NOTICE

Risk of improper storage. Can cause unit damage.

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

NOTICE

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

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

NOTICE

Risk of improper control circuits. Can cause equipment damage.

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

NOTICE

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

1.2 Agency Listed

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



1.3 Residual Risks

1.3.1 Electric and Control System

The unit contains potentially lethal voltage in some circuits.

The electric and control panel can retain a stored high-voltage electrical charge for up to 10 minutes.

Risk of arc flash and electric shock.

Can cause injury or death.

General safety measures:

- Only properly trained and qualified personnel may perform repair, maintenance and cleaning.
- The key of the electric panel must be kept by the person responsible for maintenance.
- Always wear the protective equipment prescribed by the local regulations.
- It is forbidden to operate on the electrical components without using insulating platforms, or in the presence of water and humidity.

Before working inside the electrical and control panels proceed as follows:

1. Open all of the local and remote disconnecting switches of the unit.
2. Wait at least 10 minutes.
3. Verify with a voltmeter that the power is OFF.

1.3.2 Components at High Temperature

The following components are at high temperature:

- Electrical heaters
- Humidifiers

General safety measures:

- Always wear temperature resistant gloves when unit panels are open or removed.

1.3.3 Sharp Elements

Evaporators and condensers are made of plates and fins, which may have sharp edges and burrs.

Also other elements inside the unit may have sharp edges, burrs, splinters, and exposed fasteners.

General safety measures:

- Always wear cut resistant gloves.

1.3.4 Automatic Start-up and Rotating Elements

This unit operates and restarts automatically.

The fan blades can automatically start rotating without warning at any time during a cooling cycle or after the power is restored after a power failure.

Risk of contact with high-speed rotating fan blades.

Can cause serious personal injury or death.

Before working inside the unit, removing the fan guards or servicing the fans (speed control, blades, motors) proceed as follows:

- Turn all the disconnecting switches to OFF and follow the local LOTO safety procedure.

1.3.5 Automatic Start-up and Strong Air Flow

This unit operates and restarts automatically.

The fans may suddenly start blowing out a strong air flow, which may carry particles and small objects from inside the unit.

If the door is opened, the air flow may slam the door closed.

Can cause serious personal injury.

General safety measures:

- Wear eyes protection when you need to get close to the unit while it is operating.
- Pay attention to the warning labels on the unit.

Before working on the unit proceed as follows:

- Turn all of the disconnecting switches to OFF and follow the local LOTO safety procedure.

1.3.6 Lifting and Moving

- Make sure to use transport and lifting equipment rated for the unit dimensions and weight.
- Pay attention to the gravity center and warning labels placed on the unit.
- Make sure that the lifting point is aligned with the gravity center.
- Refer to [Planning Dimensions](#) on page 52 for dimensions, weight, and gravity center position.

1.3.7 Handling Area

- Never walk or stay below a suspended load.
- The area for handling and moving must be free from obstacles and persons.
- Unauthorized personnel must keep at safe distance from the handling area.
- The floor of the handling area must be suitable to bear the weight of the unit and of the moving equipment.

2 Nomenclature and Components

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

2.1 Vertiv™ Liebert® PCW Model Number Nomenclature

Table 2.3 below describes each digit of the model number.

Table 2.1 Liebert® PCW Model Number Digits 1-20 Example

Model Number Digits 1-20																			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
P	W	0	4	5	U	L	E	A	2	0	7	0	8	H	1	D	0	1	0

Table 2.2 Liebert® PCW Model Number Digits 21-40 Example

Model Number Digits 21-40																			
21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	A	*	*	*

Table 2.3 Liebert® PCW Model Number Digit Definitions

Digit	Description
Digits 1-2 = Unit Family	
Digits 3, 4, 5 = Nominal Capacity, kW	
Digit 6 = Cabinet Configuration	U = Upflow (not available on PW145 or PW170) H = Downflow Front Discharge (not available on PW145 or PW170) D = Downflow, fans in unit E = Downflow, fans in raised floor
Digit 7 = Coil Configuration	L = Standard Coil
Digit 8 = Fan Type	E – Motorized impeller for systems without reheat P - Motorized impeller for systems with reheat
Digit 9 = Power Supply	A = 460/3/60 B = 575/3/60

Table 2.3 Liebert® PCW Model Number Digit Definitions (continued)

Digit	Description
Digit 10 = Valve	<p>2 = 2-Way Valve High Pressure</p> <p>3 = 3-Way Valve High Pressure</p>
Digit 11 = Humidification	<p>0 = None</p> <p>H = Infrared w/Auto-Flush</p>
Digit 12 = Display	<p>7 = Liebert® iCOM™ (7" High Definition)</p>
Digit 13 = Reheat	<p>0 = None</p> <p>1 = Electric, Single Stage (Models 035-045)</p> <p>2 = Electric, Two Stage (Models 060-170)</p>
Digit 14 = Filters	<p>8 = 2" MERV 8 + Filter Clog Switch</p> <p>9 = 2" MERV 11 + Filter Clog Switch</p>
Digit 15 = Piping Options	<p>H = Piping out the bottom of cabinet (downflow only)</p> <p>T = Piping out the top of cabinet (upflow only up to PW080)</p> <p>S = Piping out the left side of cabinet (upflow only)</p>
Digit 16 = Enclosure	<p>1 = Standard Color, RAL7021</p>
Digit 17 = Power Input Options	<p>D = Standard Power Supply</p> <p>U = Standard Power Supply with Capacitive Buffer</p> <p>A = Dual Power Supply, with ATS (PW045-PW170, Not Available on 575V)</p> <p>G = Dual Power Supply with ATS and Capacitive Buffer (PW045-PW170, Not Available on 575V)</p>
Digit 18 = Static Pressure Control	<p>0 = None</p> <p>P = Static Pressure Control</p>
Digit 19 = Monitoring	<p>1 = Standard (SNMP, BACnet IP, Modbus TCP, SMTP, HTTP, HTTPS)</p> <p>2 = Standard plus Modbus RTU</p> <p>3 = Standard plus BACnet MSTP</p>

Table 2.3 Liebert® PCW Model Number Digit Definitions (continued)

Digit	Description
Digit 20 = Low Voltage Options	<p>0 = None</p> <p>L = Low Voltage Terminal Package</p> <p>D = Low Voltage Terminal Package and Remote Humidity Contact</p>
Digit 21 = Packaging	<p>N = Domestic Packaging</p> <p>E = Export Packaging</p>
Digit 22 = Sensors	<p>0 = None</p> <p>F = Smoke and High Temperature</p>
Digit 23 = Power Meter	<p>0 = None</p> <p>1 = Power Meter</p>
Digit 24 = Factory Condensate Pump	<p>0 = None</p> <p>C = Condensate Pump</p>
Digit 25 - Ethernet Switch	<p>0 = None</p> <p>S = Ethernet Switch</p>
Digit 26 = Harmonic Filters	<p>0 = None</p> <p>H = Harmonic Filters</p>
Digit 27 = Water Temp Sensors (Future)	<p>0 = None</p>
Digit 28 = Placeholder	<p>0 = Placeholder</p>
Digit 29 = Placeholder	<p>0 = Placeholder</p>
Digit 30 = Placeholder	<p>0 = Placeholder</p>
Digit 31 = Placeholder	<p>0 = Placeholder</p>
Digit 32 = Placeholder	<p>0 = Placeholder</p>
Digit 33 = Placeholder	<p>0 = Placeholder</p>

Table 2.3 Liebert® PCW Model Number Digit Definitions (continued)

Digit	Description
Digit 34 = Placeholder 0 = Placeholder	
Digit 35 = Placeholder 0 = Placeholder	
Digit 36 = Placeholder 0 = Placeholder	
Digit 37 - Special Requirements A-Z = No SFA S = SFA Included	
Digit 38 = Factory configuration number	
Digit 39 = Factory configuration number	
Digit 40 = Factory configuration number	

3 Acronyms

Item	Definition
ATS	Automatic Transfer Switch
EC	Electronically Commutated (fans)
STO	Safe Torque Off
Ultracap	Ultra Capacitor
UPS	Uninterruptible Power Supply

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4 Intended Use

4.1 Purpose of the Unit

The Vertiv™ Liebert® PCW units have been designed and manufactured for the following purpose:

- Precision air conditioning for indoor use (for data centers, network closets, technology rooms).

4.2 Assembly

The Liebert® PCW units are factory assembled, including all of the internal wiring.

The only operations to be made at the installation site are the following:

- Electrical connections for power supply, low volt signals, and communication
- Water piping connections to the chilled water supply system
- Other optional piping connections (condensate drain and condensate pump kit)

See [Component Location and Internal Configuration](#) on page 19 for details about the unit structure, versions, and optional components.

NOTE: Do not assemble or connect the unit with systems or machines that are different from what is specified in this manual for your unit. Contact Vertiv Technical Support with any questions.

4.3 Heat Transfer Fluid

The heat transfer fluid is chilled water or a mixture of water and glycol supplied by an external system.

In this document we will use the word “water” in the case of water and glycol mixture when not otherwise specified.

4.4 Functional Limits

See [Technical Data](#) on page 37.

NOTE: Risk of component failure or breakage. Do not use fluids and voltage that are different from what is specified in this manual for your unit. Contact Vertiv Technical Support with any questions.

4.5 Space Limits

Overall Unit Dimensions

See [Planning Dimensions](#) on page 52.

Clearance

Keep free space around the unit as explained in [Space Requirements](#) on page 54.

4.6 Environment

NOTE: Do not use in explosive, acidic or any aggressive atmosphere.

4.6.1 Operating Conditions

Table 4.1 Application Ambient Conditions During Operation

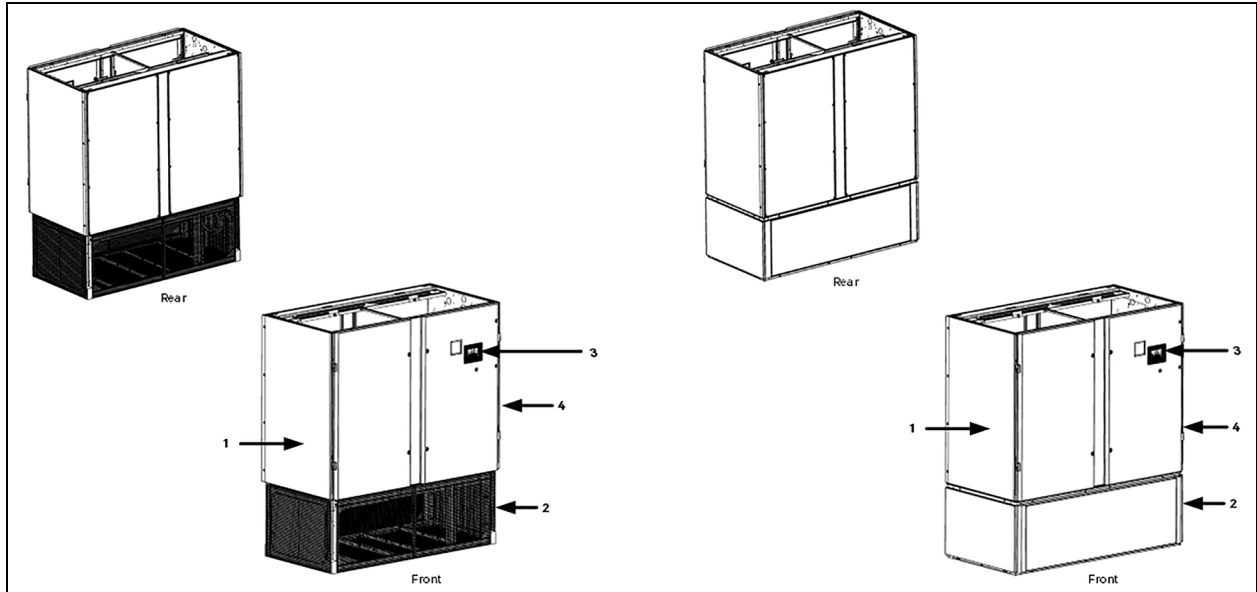
Operating Environment	The unit is designed for indoor installation, protected from weather agents, with the following ambient conditions.
Air returning to the unit inlet (indoors conditions)	Temperature 64°F - 105°F (+18°C - +41°C)
	Relative humidity 20 - 60 %
	The allowed thermal load must be higher than 20% of the unit nominal cooling capacity. A lower thermal load will cause inaccurate temperature and humidity control.
Chilled Water System	Minimum water inlet temperature 41°F (5°C)
	Maximum water pressure 400 psig (27.6 bar)

5 Component Location and Internal Configuration

NOTE: The images in this manual refer to sample units. Some components may be different for other units but the function remains the same.

5.1 Component Location

Figure 5.1 External Structure

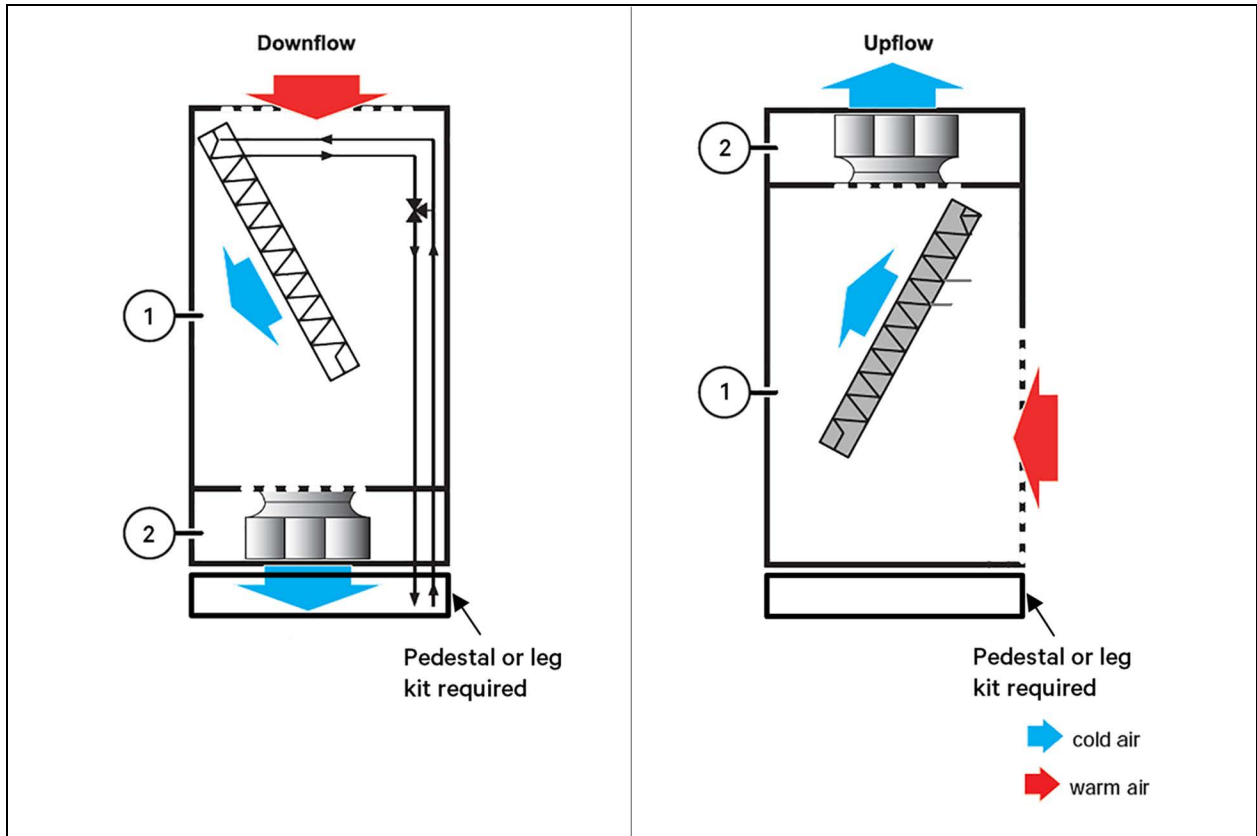


Item	Description	Remarks
1	Coil section	The coil section is completely closed by panels and by the door for protection against any contact with electric parts and hot or cold surfaces.
2	Fan section	The fan section is completely closed by panels and grids for protection against any contact with moving parts.
3	Control panel	The control panel is placed on the front door.
4	Doors	The doors can be opened only by the proper tool.

5.1.1 Air Distribution

The unit frame is made by the coil section and the fan section. See **Figure 5.2** below . The coil section contains the cooling system of the unit, the electric panel, and the control system. The fan takes the warm air from the room into the unit. The air flows through the heat exchanger, cools down, and blows out again in the room.

Figure 5.2 Unit Frame Coil and Fan Sections

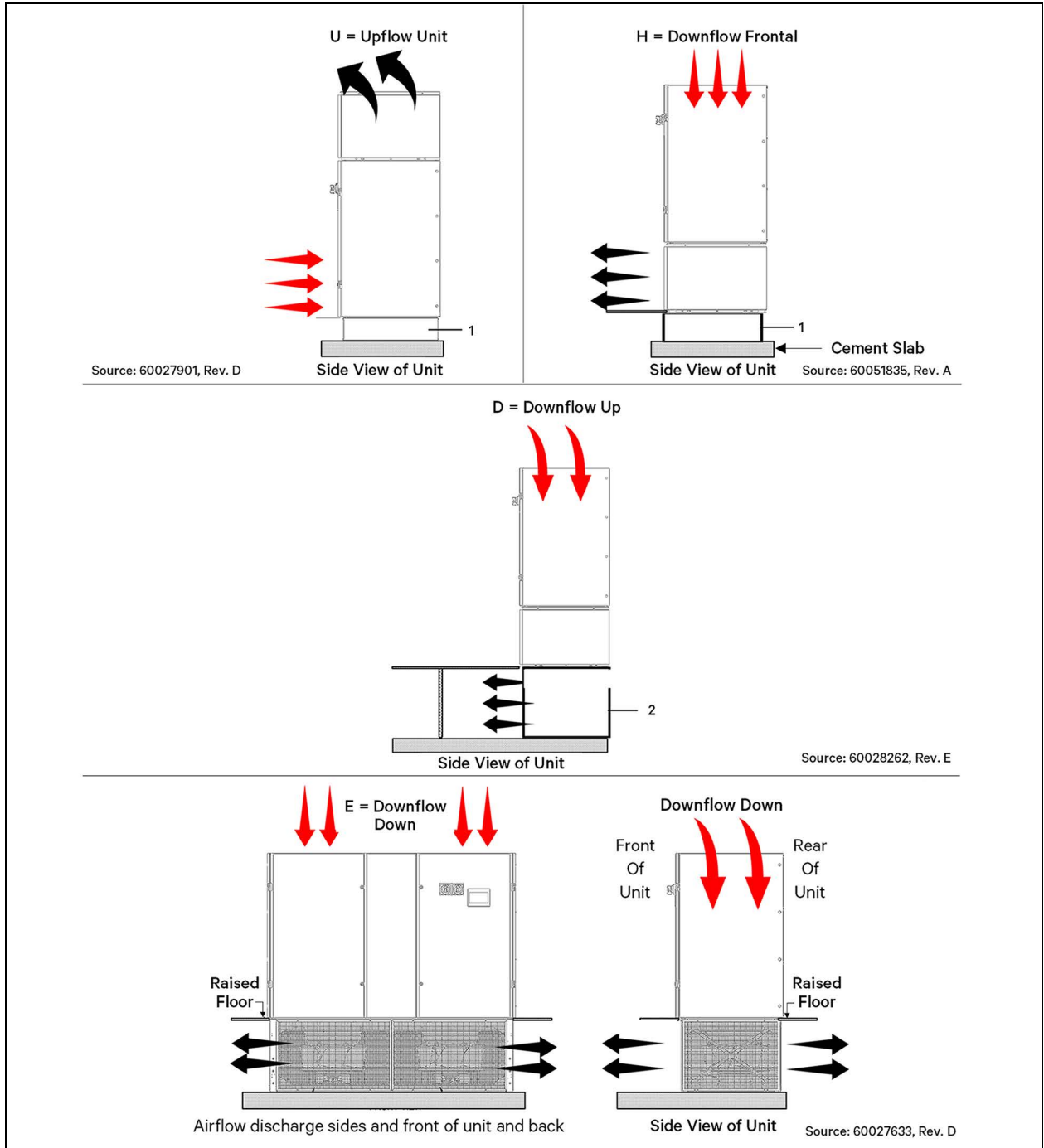


Item	Description
1	Coil section
2	Fan section

The air flow direction can be either upflow (fan section on top) or downflow (fan section at the bottom). Upflow units require pedestal or optional floorstand, downflow units can be supported by floorstand or leg kit.

The following combinations are available:

Figure 5.3 Air Distribution Combinations



Item	Description
1	Pedestal
2	Leg kit

Floorstand

For Upflow units installed with a raised floor. The floorstand legs are fixed with the unit frame and support the unit at different heights. The height of the legs can be modified by cutting them in the field and can be adjusted from 4.7 to 31.5 inches.

Legs Kit

For Downflow units only, the legs kit is field attached to the unit frame and allows support of the unit at different raised floor heights.

For raised floor heights from 31.5 to 48.0 inches in a factory, an extended leg kit is required.

Pedestal

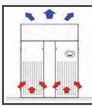
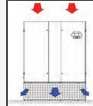
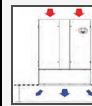
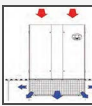
For Upflow units where a floorstand is not required, the unit must be placed on a pedestal stand. The height of the pedestal is fixed at 7.9 inches.

5.1.2 Accessories

Several accessories are available for the following purposes:

- Support and adjustment of the unit height: floorstand, leg kits and pedestals
- Plenums

Table 5.1 Accessories

Accessory	Purpose	Position	U - Upflow	H - Downflow Frontal	D - Downflow Up	E - Downflow Down
						
Legs Kit**	Support	Bottom	No	No	Yes	Yes
Floorstand**	Support	Bottom	No	No	Yes	Yes
Pedestal*	Support and piping lay-down	Bottom	Yes	Yes	No	No
Extension Plenum	Air Flow	Top	Yes	Yes	Yes	Yes
Plenum with grilles	Air Flow	Top	Yes	No	No	No
Leak Detectors	Water leak detection	Bottom	Yes	Yes	Yes	Yes
Leak detectors (i.e. 480160, LT410, LT460)	Water leak detection	Under the unit	Yes	Yes	Yes	Yes
*The pedestal is required for upflow and downflow frontal. Required only if floorstand or leg kit not ordered.						
**Either the floorstand or leg kit is required for downflow up or downflow down.						

5.2 Internal Components

5.2.1 EC Fan

The unit is fitted with variable speed, high efficiency, single inlet, backward curved, centrifugal plug type innovating EC fan(s). The fan(s) have an impeller with curved blades corrosion resistant. The fan motors are Electronically Commutated, IP54, with internal protections, continuous speed regulation via controller signal.

The motor is three-phase with IP54 protection; provided with internal thermal protection. The fan wheel is statically and dynamically balanced of degree G6.3 according to ISO 21940-11:2016; the bearings are self-lubricating.

A separator shall be installed between the fans to eliminate turbulence effects of one fan to the others; it shall also be designed to increase efficiency compared to simple plate separators.

5.2.2 Water Valve Types

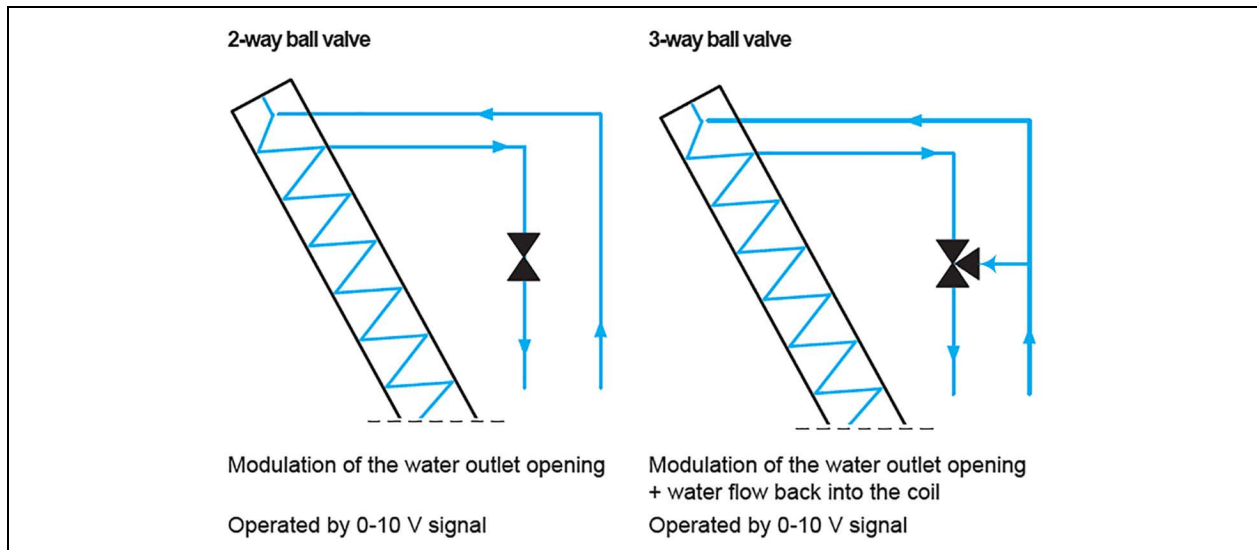
NOTICE

Do not exceed the nominal operating pressure of the circuit components.

All valves are internally threaded.

To get precise pressure drop data, please use selection software.

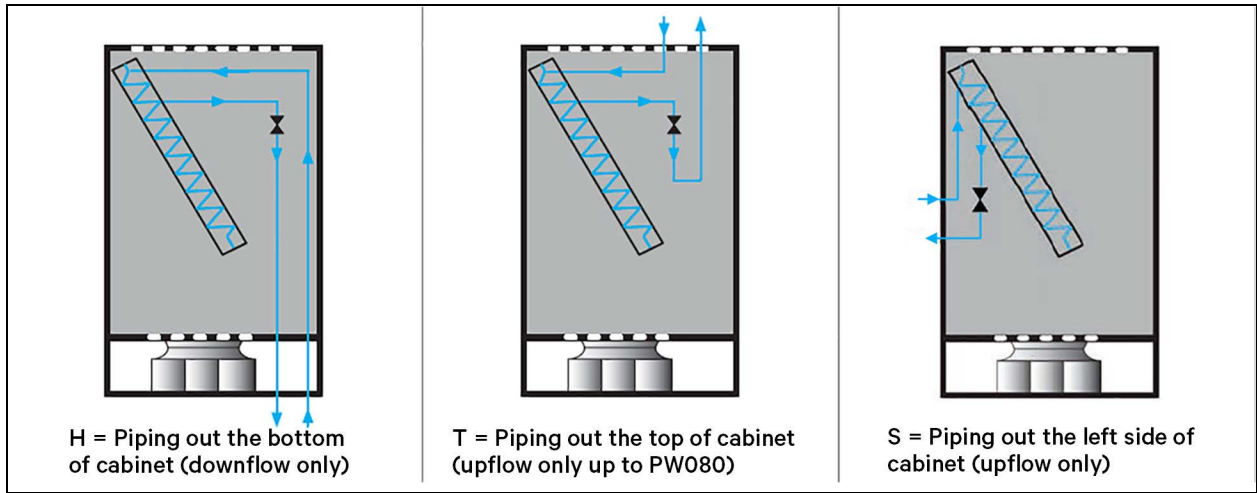
Figure 5.4 Water Valves



NOTE: Recommended glycol mixture is less than 40%.

5.2.3 Chilled Water Connection Configurations

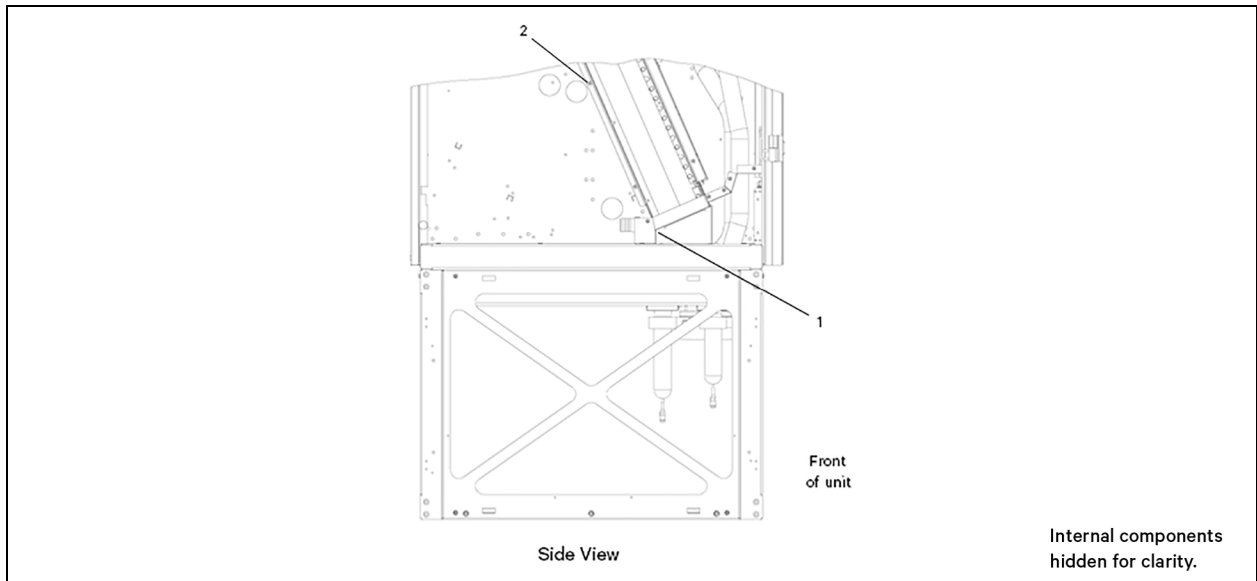
Figure 5.5 Chilled Water Connection Configurations (Digit 15)



5.2.4 Condensate Pan

The tray collects the condensate from the evaporator. See Figure 5.6 below .

Figure 5.6 Condensate Pan (Downflow Unit)



Item	Description
1	Condensate drain pan
2	Coil

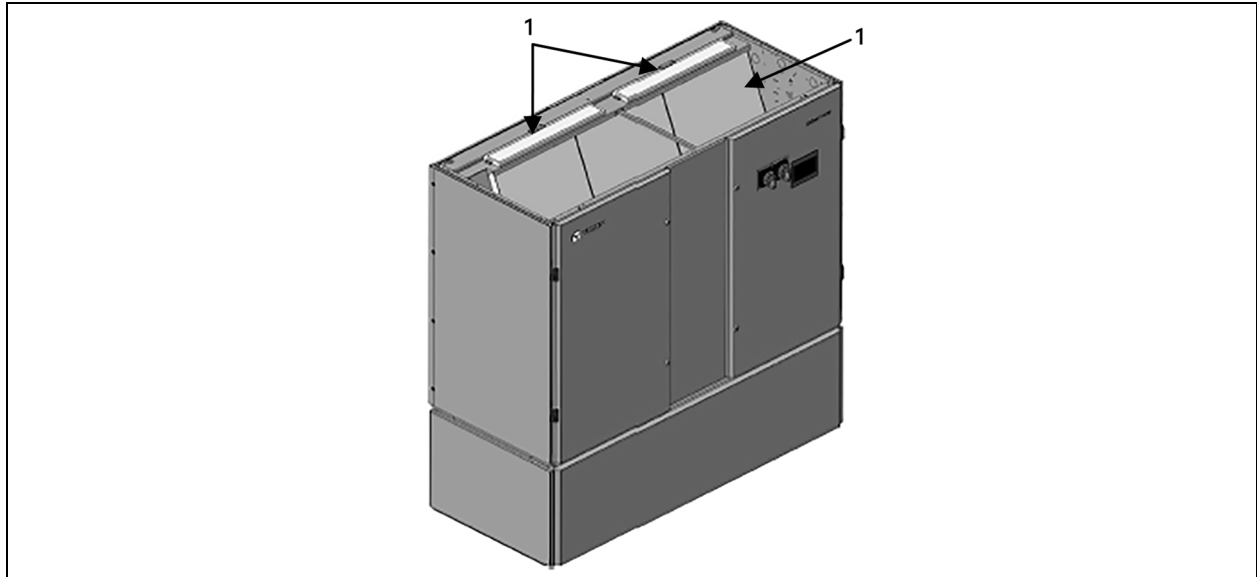
5.2.5 Condensate Pump (Optional)

An optional condensate pump is available. The pump discharges condensate water from the coil and humidifier. Condensate pump is shipped separate from the unit.

Condensate pump is field installed external to the unit.

5.2.6 Filters and Clog Sensor

Figure 5.7 Filter Locations (Downflow Unit)



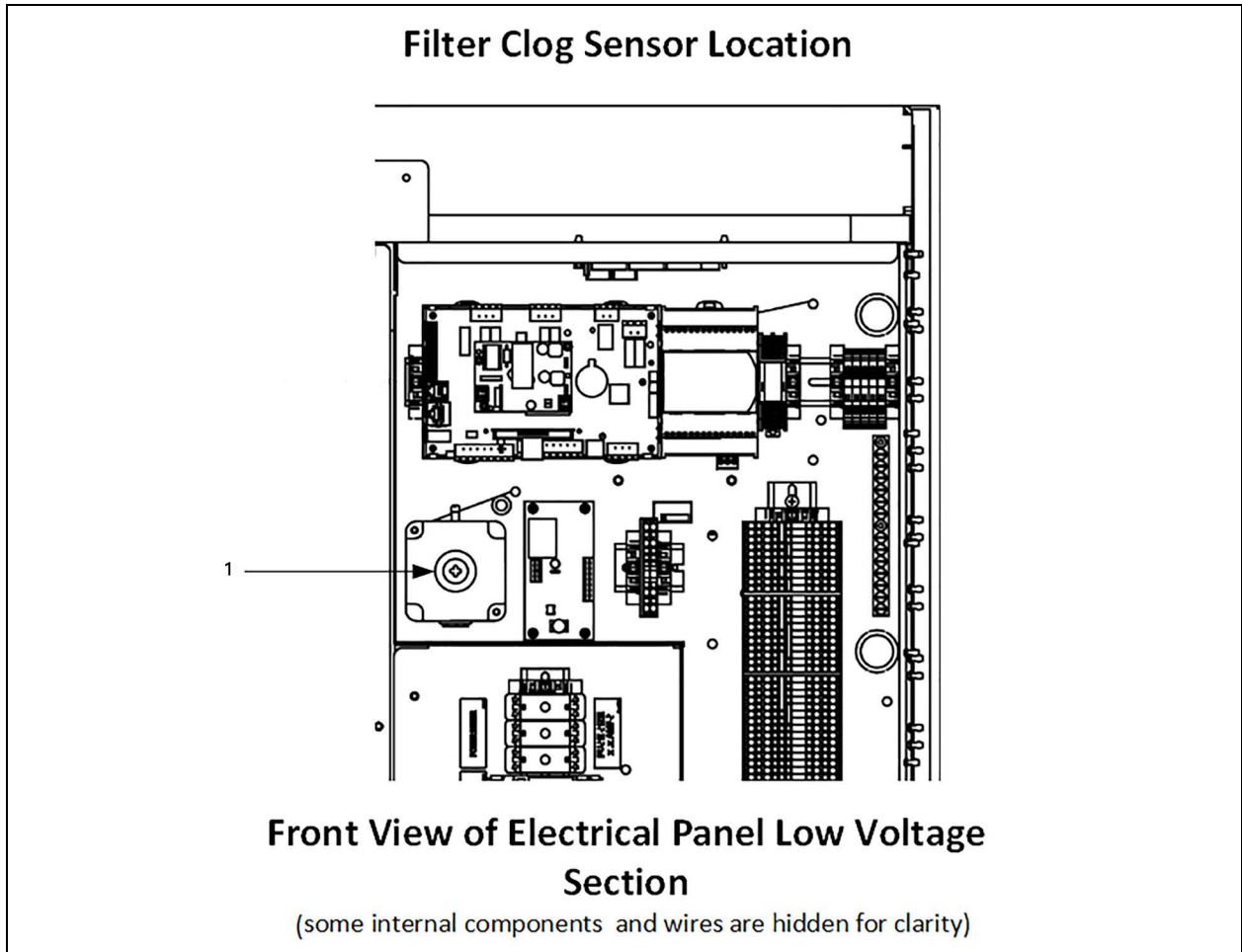
Item	Description
1	Filter locations

Figure 5.7 above shows standard filter locations.

Filter Clog Sensor

A sensor sends an alarm to the control system if the pressure difference through the filter is higher than a threshold setting, meaning that the filter is clogged. Measured by filter differential pressure switch located in the control panel.

Figure 5.8 Filter Clog Sensor Location (low voltage section of electrical panel).



Item	Description
1	Filter Clog Switch

5.2.7 Electrical Heater

Heater Temperature Switch

The temperature switch is installed on the heater. It switches off the heater if its temperature is higher than the alarm value. See **Figure 13.8** on page 104 . The unit will continue to operate without heat.

The auto reset temperature switch opens at 185°F and closes at 178°F. The manual reset temperature switch opens at 248°F.

Reset Button Function

NOTE: Investigate and solve why this manual reset occurred before resetting the switch.

In case of activation of the temperature switch, a manual reset is required.

- Press the button to manually reset of the heater. See **Figure 5.9** on the facing page .
- Reset the temperature alarm on the control panel.

Figure 5.9 Reheat Location Above the Unit Fans

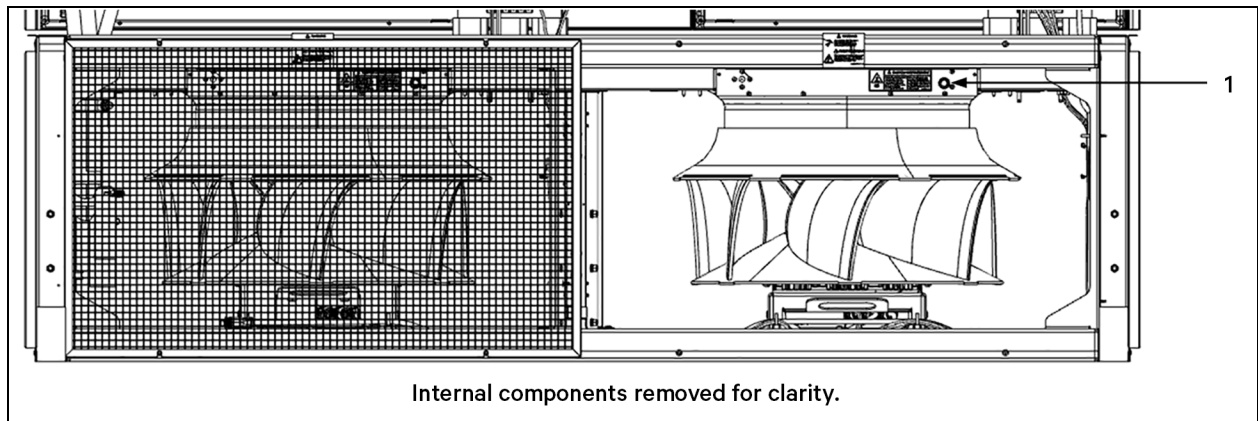
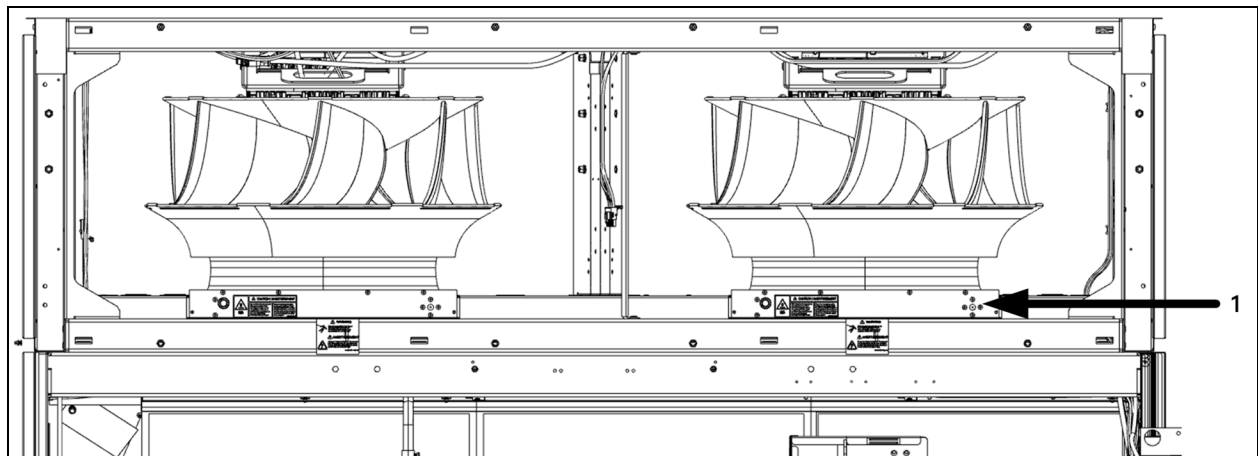


Figure 5.10 Reheat Location Upflow



Item	Description
1	Manual resettable safety thermostat

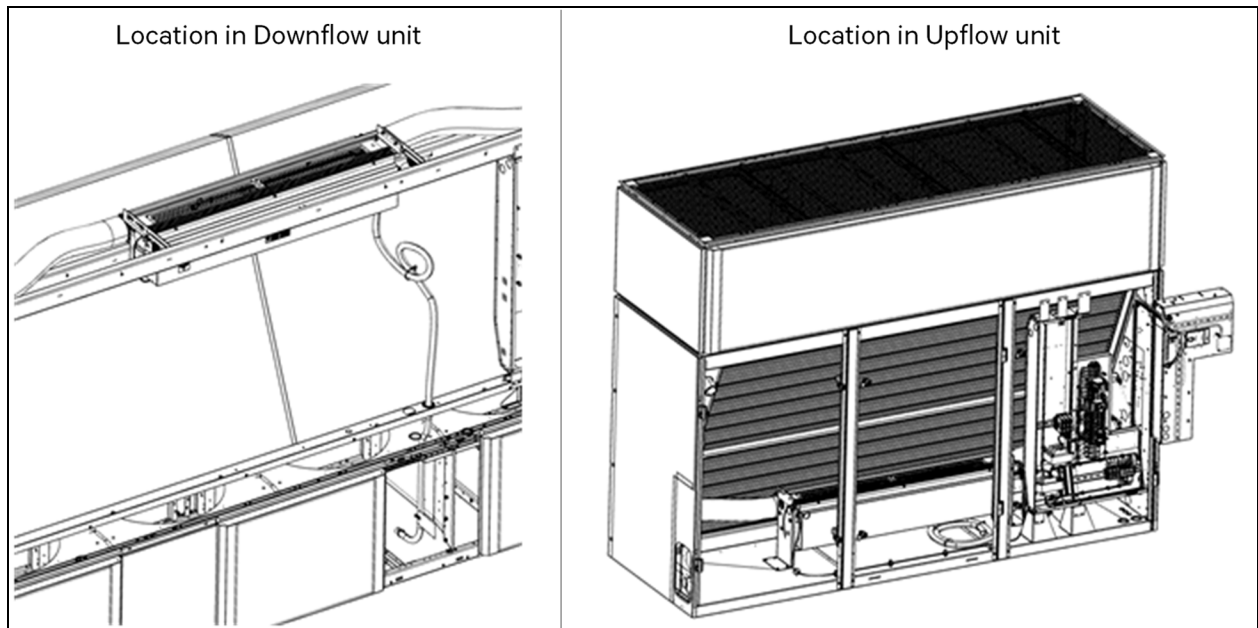
Safety Air High Temperature Sensor

This sensor measures the air temperature at the unit outlet and switches off the heater if the air temperature is higher than the alarm threshold. The unit will continue to operate without heat.

This sensor is a thermistor in the fan module. The control has a setting of 104°F for when it alarms.

5.2.8 Humidifier (Optional)

Figure 5.11 Infrared Humidifier (some internal components removed for clarity)



Installed inside the unit. See [Replacing Infrared Humidifier](#) on page 112.

5.2.9 Electric and Control System

The unit may be delivered with standard power supply or optional dual power supply in order to have the units up and running if the main power supply fails. **Table 5.2** below explains the main options.

Refer to the Electric Diagrams for details about your unit power supply system.

See [Technical Data](#) on page 37 for the power supply relevant data and limits (voltage, frequency, etc).

Table 5.2 Options

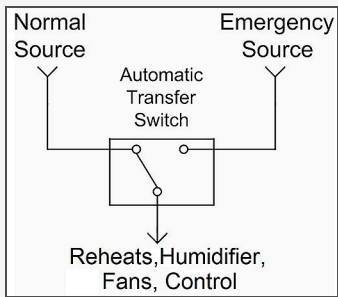
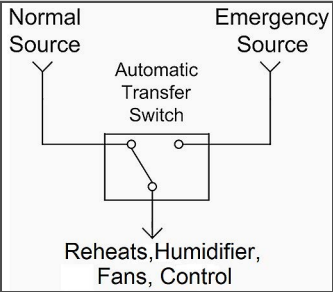
Option	Description	What happens in case of power failure	What happens when power is restored
Standard Power Supply Digit 17 = D	Single supply line	Without power supply (and ultracap) the control board dies. The controls inside the fan will be powered a few seconds while it's capacitor bank discharges, but the fan's motor is not powered. The impeller's momentum will cause it to continue to spin as it decelerates.	After the control board rebooting time, the unit restarts automatically.
Standard Power Supply with capacitive buffer Digit 17 - U	Single supply line	An Ultracap device supplies power to the control for about 60 seconds. The controls inside the fan will be powered a few seconds while it's capacitor bank discharges, but the fan's motor is not powered. The impeller's momentum will cause it to continue to spin as it decelerates.	The unit restarts automatically. The control system reboots if the down time is more than 60 seconds.
Dual Power Supply with ATS (PW045-PW170, Not Available on 575V) Digit 17 = A	<p>Double power supply to the ATS electric panel, which is connected to the main electrical panel. Each power supply can completely supply the unit.</p> 	During the ATS switching, the control board dies (Power supply is missing and the Ultracap is not present). The controls inside the fan will be powered a few seconds while it's capacitor bank discharges, but the fan's motor is not powered. The impeller's momentum will cause it to continue to spin as it decelerates.	After the control board rebooting time, the unit restarts automatically.

Table 5.2 Options (continued)

Option	Description	What happens in case of power failure	What happens when power is restored
<p>Dual Power Supply with ATS and Capacitive Buffer (PW045-PW170, Not Available on 575V)</p> <p>Digit 17 = G</p>	<p>Double power supply to the ATS electric panel, which is connected to the main electrical panel. Each power supply can completely supply the unit.</p> 	<p>In case of failure of the main supply, the ATS (Automatic Transfer Switch) automatically switches to the second power supply. The ultracapacitor keeps the main control board alive during the ATS switching time.</p> <p>NOTE: The Ultracap supplies power to the control for about 60 seconds.</p> <p>NOTE: Depending on the electric system configuration, the unit may be set to remain switched off for a certain time.</p>	<p>The unit restarts automatically as soon as the power supply is available.</p>

5.2.10 Disconnecting Switches

NOTE: Due to the presence of optional Ultracaps for the control and other devices, the electric and control panels can retain a stored high voltage electrical charge for a certain time.

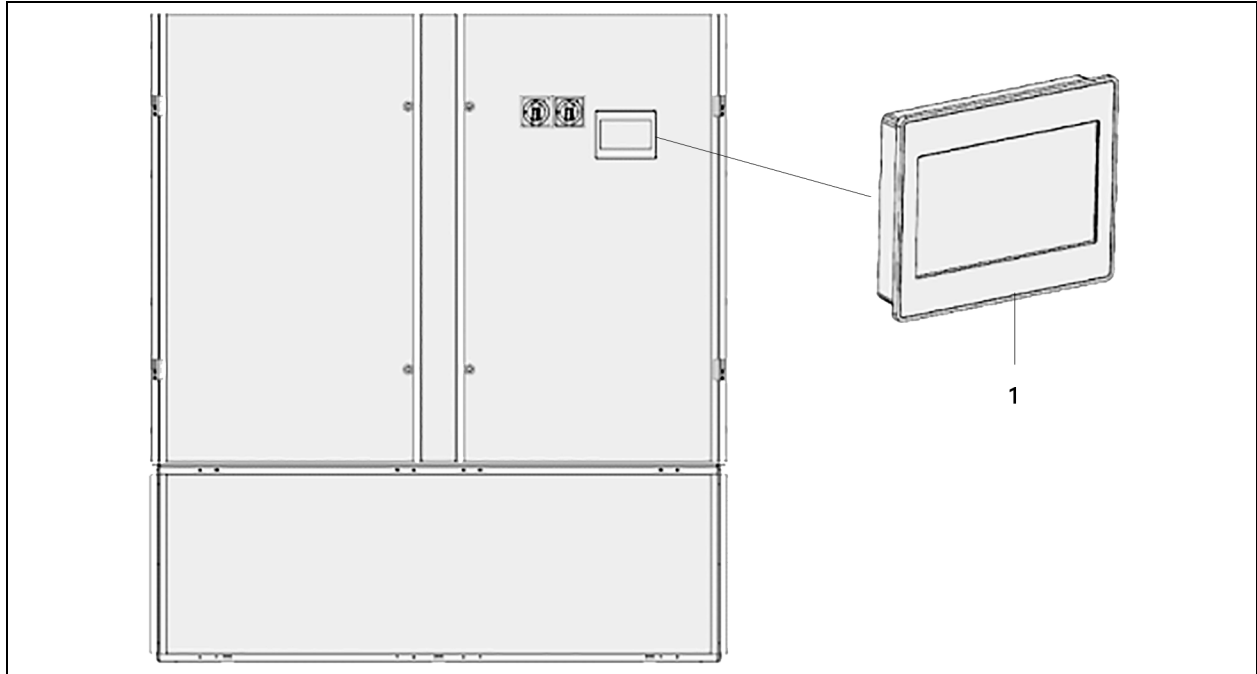
Before removing the panels and working inside the electric and control panels, proceed as follows:

- Open all the local and remote disconnecting switches of the unit.
- Wait at least 10 minutes.
- Verify with a voltmeter that the power is OFF.

5.2.11 Control Panel

The unit has a control panel in the front door. See the Liebert® PCW Control Application User Manual for details.

Figure 5.12 Control Panel



Item	Description
1	Control panel

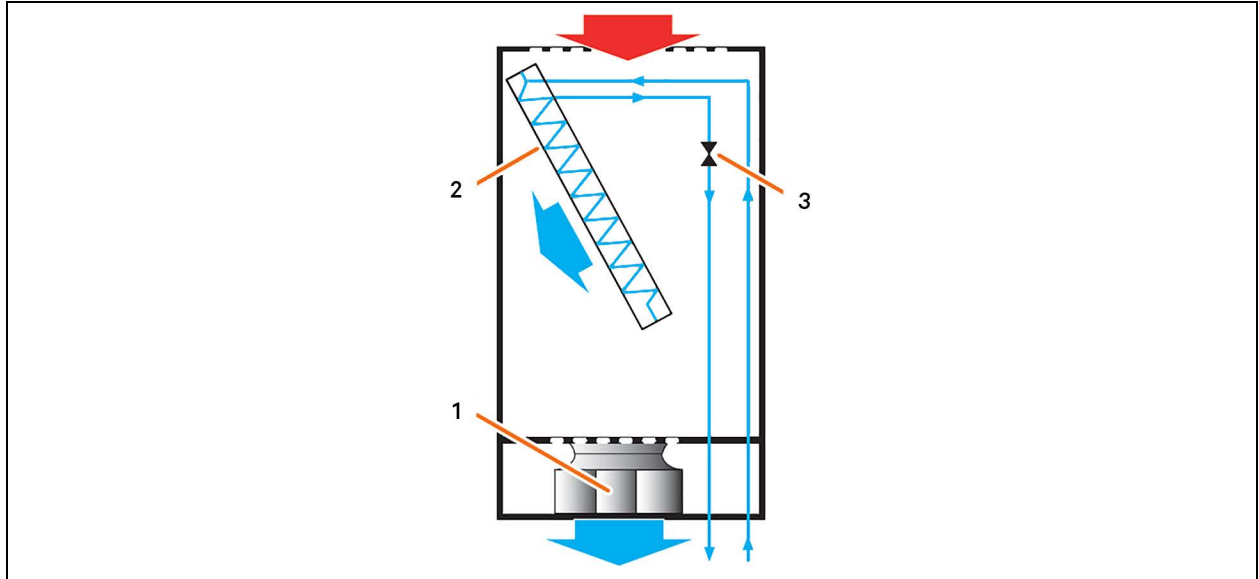
5.2.12 Protective Functions

The control system manages all the safety and operating devices needed for reliable automatic operation. The main alarms are briefly explained below. Refer to the *Liebert® PCW Control Application Manual* for details.

5.3 Cooling System

5.3.1 Circuit Versions and Operating Principle

Figure 5.13 Single Circuits



Item	Description
1	Fan
2	Water coil
3	Water valve

Operating Principle

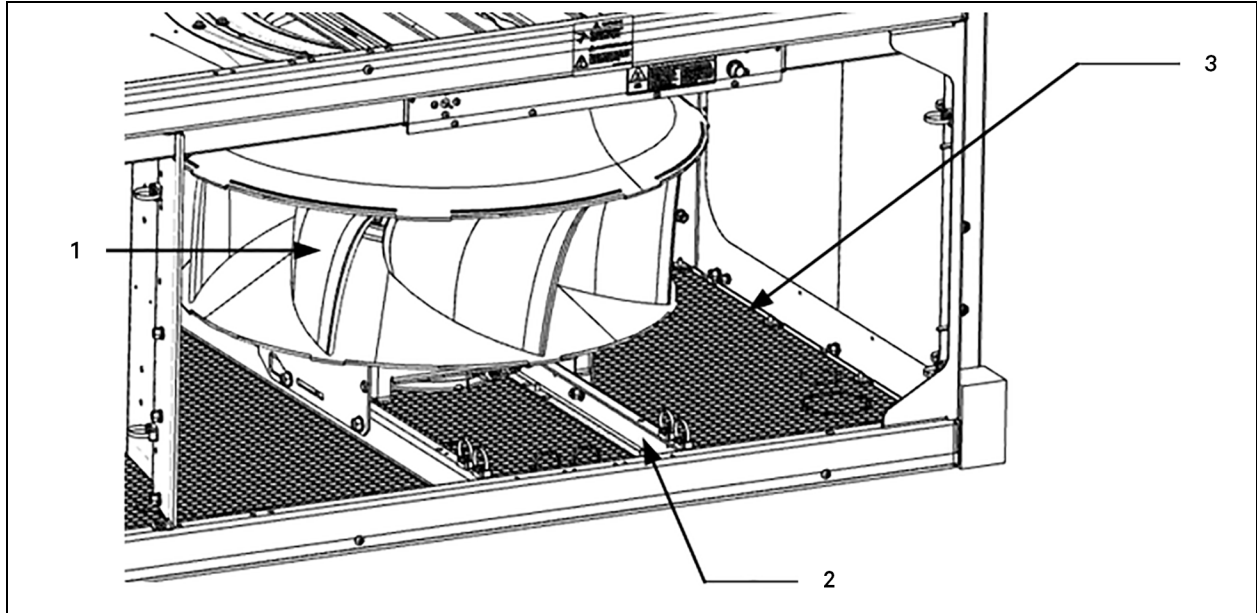
Figure 5.13 above shows a simplified scheme for a downflow unit with single circuit. Refer to [Chilled Water Circuit](#) for details.

The operating principle is the same for all of the models (also including upflow air distribution and double circuits). The fan allows the warm air coming from the room to flow through the water coil. See Figure 5.13 above. The water cools down the air, which flows again into the room. The control system operates the opening and closing of the water valve at the water outlet in order to control the water flow rate to maintain the desired operating conditions.

5.4 Air System

5.4.1 Fans

Figure 5.14 Fans



Item	Description
1	Fan
2	Fan supporting frame
3	Protective grid The grids protect against contact from the top (for the upflow versions) or from below the floor, if the floor is opened for any reason near the machine (for the downflow versions).

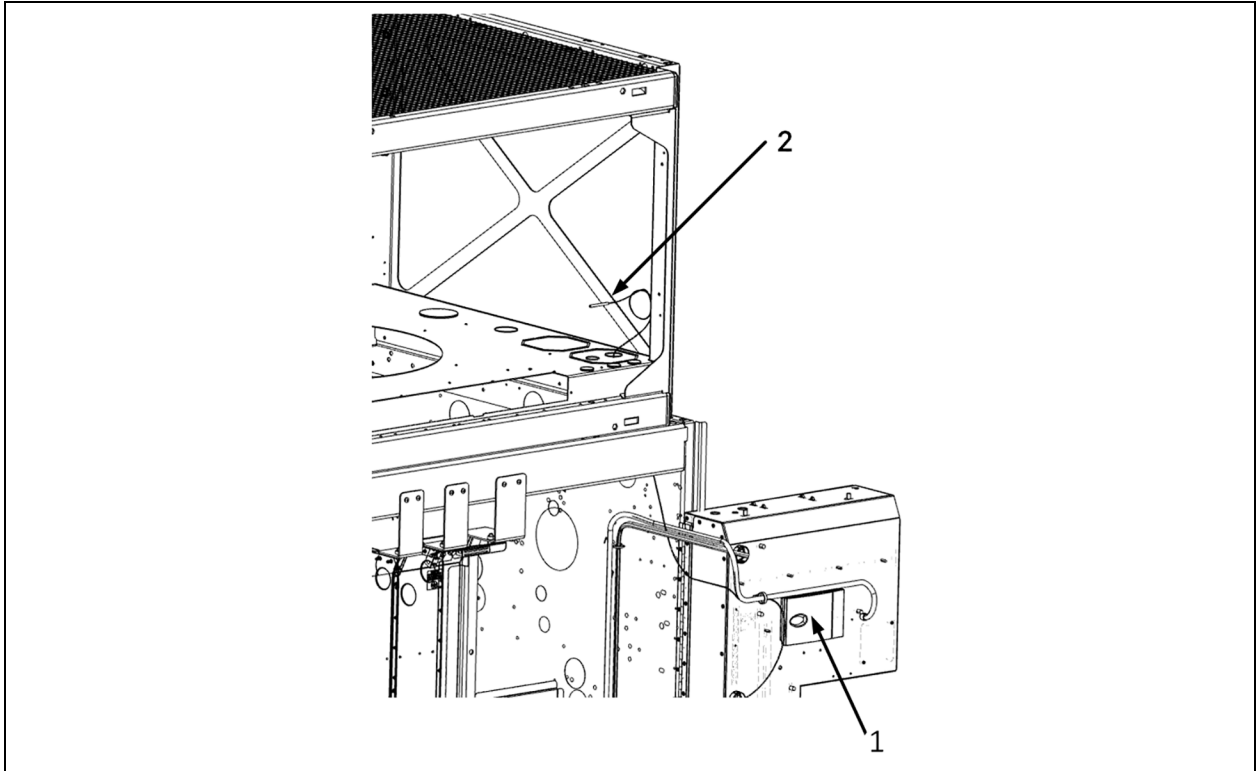
The fan motors are protected by time delayed fuses. See [Electric and Control System](#) on page 29 for details.

5.4.2 Sensors and Instruments

- Humidity and temperature sensor for the air returning from the room into the unit
- Temperature sensor (NTC type) for the air at the unit outlet

NOTE: Other optional remote temperature sensors may be connected to the unit by the end user. Only Modbus type are allowed. See [Modbus Connections](#) for details.

Figure 5.15 Location of Sensors



Item	Description
1	TH/ sensor
2	Air temperature Sensor

5.4.3 Fans

All the units have EC fans. The unit control system adjusts the fan rotation speed depending on the operating conditions.

Connection to the unit through Modbus protocol. If the Modbus connection is interrupted, then the fans continue to run at a preset speed. Speed adjustment between 30% and 100% of the maximum speed. See [Modbus Connections and Settings](#) on page 110 .

NOTE: It is possible to set a limit to the maximum speed at the factory in order to reduce the noise of the emission. The ability to change the maximum speed depends on unit configuration.

Protective Functions

- Electronics overheating protection
- Motor overheating protection
- Locked rotor protection
- Short circuit at the motor output

5.4.4 Vertiv™ Liebert® SmartAisle™

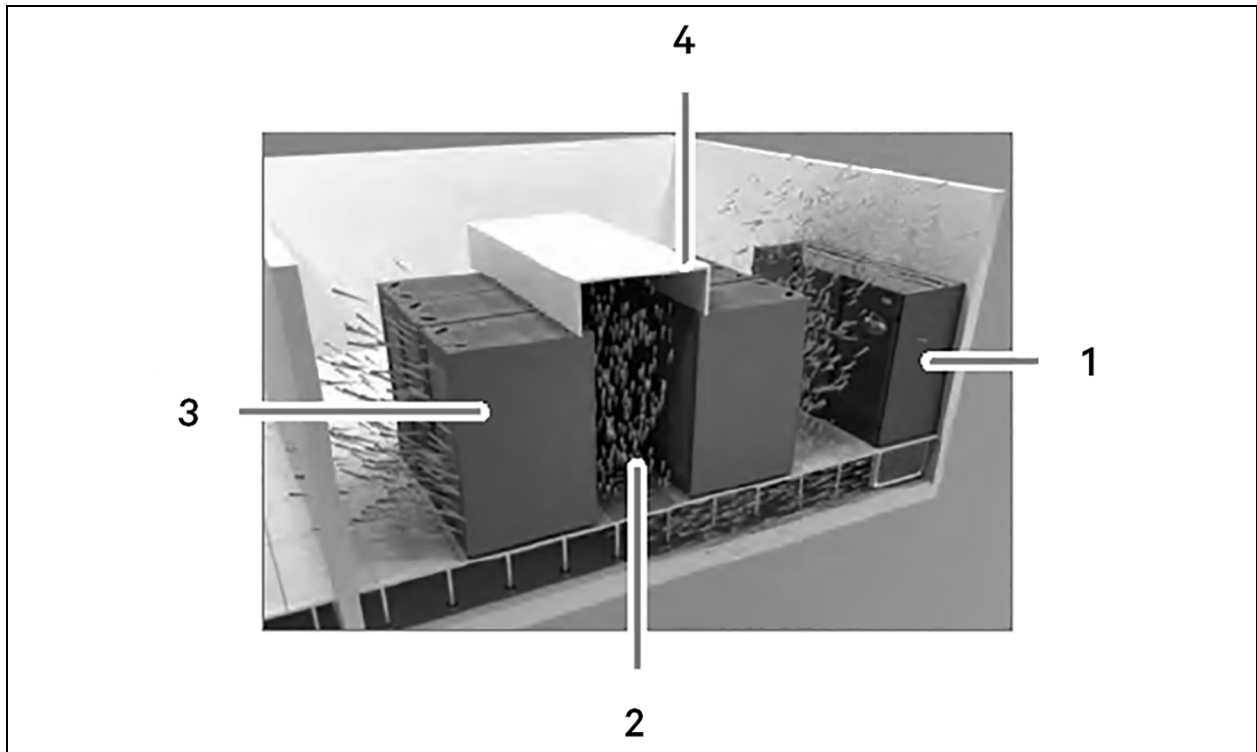
The Vertiv™ Liebert® PCW units can be used in a Vertiv™ Liebert® SmartAisle™ system. The SmartAisle™ is a Liebert patented system for the control of the units in a room with cold aisle arrangement. See **Figure 5.16** below .

The unit blows the air into the cold aisle through the raised floor. The hot air coming from the active equipment returns to the unit.

The unit airflow is managed by the fan speed modulation according to the readings from remote temperature sensors installed on the border of cold/hot aisle area.

The temperature setpoint is based on supply air.

Figure 5.16 Liebert® SmartAisle™



Item	Description
1	Unit
2	Cold aisle
3	Heat load cabinets
4	Temperature sensors

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6 Technical Data

6.1 System Data

Table 6.1 Capacity and Physical Data, PW035-PW070

Model		PW035	PW040	PW045	PW060	PW070
Net Capacity Data Based on 45°F (7.2°C) Entering Water, 10°F (5.5°C) Water Rise						
75°F DB, 61°F WB, 52°F DP 44% RH (23.9°C, DB 16.1°C WB)	Total Capacity kW (BTUH)	39.7 (135.5)	46.4 (158.4)	52.3 (178.5)	74.0 (252.6)	82.6 (281.9)
	Sensible Capacity kW (BTUH)	39.1 (133.4)	44.3 (151.2)	50.0 (170.7)	72.5 (247.4)	80.4 (274.4)
	Flow Rate, GPM (lps)	28.7 (1.8)	33.3 (2.1)	37.5 (2.4)	53.6 (3.4)	59.6 (3.8)
	Pressure drop, ft. of water (kPa)	18.7 (55.7)	28.0 (83.5)	21.4 (63.8)	40.9 (121.9)	27.0 (80.5)
80°F DB, 62.8°F WB, 52°F DP WB 38% RH (26.7°C DB, 17.1°C WB)	Total Capacity kW (BTUH)	49.0 (167.2)	56.5 (192.8)	63.7 (217.4)	90.6 (309.2)	100.8 (344.0)
	Sensible Capacity kW (BTUH)	48.3 (164.8)	54.2 (185.0)	61.2 (208.9)	89.1 (304.1)	98.7 (336.9)
	Flow Rate, GPM (lps)	35.0 (2.2)	40.2 (2.6)	45.2 (2.9)	64.8 (4.2)	71.9 (4.6)
	Pressure drop, ft. of water (kPa)	26.9 (80.2)	39.3 (117.2)	29.9 (89.1)	57.8 (172.3)	37.9 (113.0)
85°F DB, 64.4°F WB, 52°F DP 32% RH (29.4°C, DB 18°C WB)	Total Capacity kW (BTUH)	58.2 (198.6)	66.1 (225.6)	74.8 (255.3)	106.8 (364.5)	118.6 (404.8)
	Sensible Capacity kW (BTUH)	57.5 (196.2)	63.8 (217.7)	72.2 (246.4)	105.4 (359.7)	116.5 (397.6)
	Flow Rate, GPM (lps)	41.2 (2.6)	46.7 (3.0)	52.7 (3.4)	75.8 (4.9)	83.8 (5.4)
	Pressure drop, ft. of water (kPa)	36.4 (108.5)	51.8 (154.4)	39.6 (118.1)	76.9 (229.2)	50.1 (149.4)
Net Capacity Data Based on 50°F (10°C) Entering Water, 12°F (6.7°C) Water Rise						
75°F DB, 61°F WB, 52°F DP 44% RH (23.9°C, DB 16.1°C WB)	Total Capacity kW (BTUH)	26.7 (91.1)	32.0 (109.2)	35.9 (122.5)	50.7 (173.0)	56.8 (193.9)
	Sensible Capacity kW (BTUH)	26.7 (91.1)	32.0 (109.2)	35.9 (122.5)	50.7 (173.0)	56.8 (193.9)
	Flow Rate, GPM (lps)	16.5 (1.1)	19.6 (1.3)	22.0 (1.4)	31.5 (2.0)	35.0 (2.2)
	Pressure drop, ft. of water (kPa)	6.7 (20.0)	10.5 (31.3)	8.0 (23.8)	15.3 (45.6)	10.2 (30.4)
NOTE: The net capacity data has fan motor heat factored in for all ratings. Capacity data is factory certified to be within 5% tolerance. Data rated with standard filter.						

Table 6.1 Capacity and Physical Data, PW035-PW070 (continued)

Model		PW035	PW040	PW045	PW060	PW070
80°F DB, 62.8°F WB 38% RH (26.7°C DB, 17.1°C WB)	Total Capacity kW (BTUH)	36.5 (124.6)	42.4 (144.7)	47.7 (162.8)	68.2 (232.8)	76.0 (259.4)
	Sensible Capacity kW (BTUH)	36.5 (124.6)	42.4 (144.7)	47.7 (162.8)	68.2 (232.8)	76.0 (259.4)
	Flow Rate, GPM (lps)	22.0 (1.4)	25.5 (1.6)	28.6 (1.8)	41.4 (2.7)	45.8 (2.9)
	Pressure drop, ft. of water (kPa)	11.3 (33.7)	16.8 (50.1)	12.9 (38.5)	25.0 (74.5)	16.5 (49.2)
85°F DB, 64.4°F WB, 52°F DP 32% RH (29.4°C, DB 18°C WB)	Total Capacity kW (BTUH)	45.9 (156.7)	52.4 (178.8)	59.0 (201.4)	85.2 (290.8)	94.6 (322.9)
	Sensible Capacity kW (BTUH)	45.9 (156.7)	52.4 (178.8)	59.0 (201.4)	85.2 (290.8)	94.6 (322.9)
	Flow Rate, GPM (lps)	27.3 (1.8)	31.1 (2.0)	35.0 (2.2)	51.0 (3.3)	56.3 (3.6)
	Pressure drop, ft. of water (kPa)	16.8 (50.1)	24.1 (71.8)	18.5 (55.2)	36.5 (108.8)	23.9 (71.2)
Net Capacity Data Based on 50°F (10°C) Entering Water, 14°F (7.8°C) Water Rise						
75°F DB, 61°F WB, 52°F DP 44% RH (23.9°C, DB 16.1°C WB)	Total Capacity kW (BTUH)	23.0 (78.5)	28.6 (97.6)	31.8 (108.5)	44.5 (151.9)	50.1 (171.0)
	Sensible Capacity kW (BTUH)	23.0 (78.5)	28.6 (97.6)	31.8 (108.5)	44.5 (151.9)	50.1 (171.0)
	Flow Rate, GPM (lps)	12.4 (0.8)	15.2 (1.0)	16.9 (1.1)	24.0 (1.5)	26.8 (1.7)
	Pressure drop, ft. of water (kPa)	4.0 (11.9)	6.6 (19.7)	5.0 (14.9)	9.4 (28.0)	6.4 (19.1)
80°F DB, 62.8°F WB 38% RH (26.7°C DB, 17.1°C WB)	Total Capacity kW (BTUH)	33.1 (113.0)	39.4 (134.5)	44.2 (150.9)	62.7 (214.0)	70.1 (239.3)
	Sensible Capacity kW (BTUH)	33.1 (113.0)	39.4 (134.5)	44.2 (150.9)	62.7 (214.0)	70.1 (239.3)
	Flow Rate, GPM (lps)	17.3 (1.1)	20.4 (1.3)	22.8 (1.5)	32.8 (2.1)	36.4 (2.3)
	Pressure drop, ft. of water (kPa)	7.2 (21.5)	11.2 (33.4)	8.6 (25.6)	16.4 (48.9)	11.0 (32.8)
85°F DB, 64.4°F WB, 52°F DP 32% RH (29.4°C, DB 18°C WB)	Total Capacity kW (BTUH)	42.7 (145.7)	49.7 (169.6)	55.8 (190.4)	80.0 (273.0)	89.1 (304.1)
	Sensible Capacity kW (BTUH)	42.7 (145.7)	49.7 (169.6)	55.8 (190.4)	80.0 (273.0)	89.1 (304.1)
	Flow Rate, GPM (lps)	21.9 (1.4)	25.3 (1.6)	28.4 (1.8)	41.2 (2.6)	45.6 (2.9)
	Pressure drop, ft. of water (kPa)	11.2 (33.4)	16.6 (49.5)	12.7 (37.9)	24.7 (73.6)	16.4 (48.9)

Table 6.1 Capacity and Physical Data, PW035-PW070 (continued)

Model		PW035	PW040	PW045	PW060	PW070
NOTE: The net capacity data has fan motor heat factored in for all ratings. Capacity data is factory certified to be within 5% tolerance. Data rated with standard filter.						
Net Capacity Data Based on 50°F (10°C) Entering Water, 16°F (8.9°C) Water Rise						
75°F DB, 61°F WB, 52°F DP 44% RH (23.9°C, DB 16.1°C WB)	Total Capacity kW (BTUH)	18.9 (64.5)	24.7 (84.3)	27.3 (93.2)	37.7 (128.7)	42.7 (145.7)
	Sensible Capacity kW (BTUH)	18.9 (64.5)	24.7 (84.3)	27.3 (93.2)	37.7 (128.7)	42.7 (145.7)
	Flow Rate, GPM (lps)	9.1 (0.6)	11.6 (0.7)	12.9 (0.8)	18.1 (1.2)	20.3 (1.3)
	Pressure drop, ft. of water (kPa)	2.0 (6.0)	4.0 (11.9)	2.9 (8.6)	5.6 (16.7)	3.9 (11.6)
80°F DB, 62.8°F WB, 52°F DP WB 38% RH (26.7°C DB, 17.1°C WB)	Total Capacity kW (BTUH)	29.5 (100.7)	36.1 (123.2)	40.3 (137.5)	56.7 (193.5)	63.6 (217.1)
	Sensible Capacity kW (BTUH)	29.5 (100.7)	36.1 (123.2)	40.3 (137.5)	56.7 (193.5)	63.6 (217.1)
	Flow Rate, GPM (lps)	13.6 (0.9)	16.4 (1.1)	18.3 (1.2)	26.2 (1.7)	29.1 (1.9)
	Pressure drop, ft. of water (kPa)	4.7 (14.0)	7.6 (22.7)	5.8 (17.3)	10.9 (32.5)	7.4 (22.1)
85°F DB, 64.4°F WB, 52°F DP 32% RH (29.4°C, DB 18°C WB)	Total Capacity kW (BTUH)	39.4 (134.5)	46.7 (159.4)	52.3 (178.5)	74.6 (254.6)	83.2 (284.0)
	Sensible Capacity kW (BTUH)	39.4 (134.5)	46.7 (159.4)	52.3 (178.5)	74.6 (254.6)	83.2 (284.0)
	Flow Rate, GPM (lps)	17.8 (1.1)	20.9 (1.3)	23.4 (1.5)	33.7 (2.2)	37.4 (2.4)
	Pressure drop, ft. of water (kPa)	7.6 (22.7)	11.7 (34.9)	8.9 (26.5)	17.2 (51.3)	11.5 (34.3)
Fan Data						
CFM (CMH)	Air Volume at 0.2" ESP	6,900 (11,723)	6,900 (11,723)	7,900 (13,422)	13,000 (22,087)	13,900 (23,616)
Fan Motor hp (kW), Operating	hp @ 85F	2.4 hp (1.8 kW)	2.6 hp (1.9 kW)	2.8 hp (2.1 kW)	4.8 hp (3.6 kW)	5.0 hp (3.7 kW)
NOTE: The net capacity data has fan motor heat factored in for all ratings. Capacity data is factory certified to be within 5% tolerance. Data rated with standard filter.						

Table 6.2 Capacity and Physical Data, PW080-PW170

Model		PW080	PW095	PW110	PW145	PW170
Net Capacity Data Based on 45°F (7.2°C) Entering Water, 10°F (5.5°C) Water Rise						
75°F DB, 61°F WB, 52°F DP 44% RH (23.9°C, DB 16.1°C WB)	Total Capacity kW (BTUH)	90.3 (308.2)	102.0 (348.1)	124.2 (423.9)	149.6 (510.6)	177.9 (607.2)
	Sensible Capacity kW (BTUH)	87.0 (296.9)	98.6 (336.5)	119.9 (409.2)	140.7 (480.2)	169.8 (579.5)
	Flow Rate, GPM (lps)	65.0 (4.2)	72.2 (4.6)	89.6 (5.7)	107.2 (6.9)	127.9 (8.2)
	Pressure drop, ft. of water (kPa)	23.6 (70.4)	29.4 (87.6)	30.9 (92.1)	36.7 (109.4)	42.1 (125.5)
80°F DB, 62.8°F WB, 52°F DP WB 38% RH (26.7°C DB, 17.1°C WB)	Total Capacity kW (BTUH)	110.4 (376.8)	123.6 (421.8)	151.5 (517.1)	181.0 (617.8)	216.9 (740.3)
	Sensible Capacity kW (BTUH)	106.8 (364.5)	120.2 (410.2)	146.9 (501.4)	171.4 (585.0)	207.9 (709.6)
	Flow Rate, GPM (lps)	78.6 (5.0)	86.9 (5.6)	108.0 (6.9)	128.5 (8.2)	154.3 (9.9)
	Pressure drop, ft. of water (kPa)	33.3 (99.3)	41.1 (122.5)	43.6 (130.0)	51.3 (152.9)	59.8 (178.3)
85°F DB, 64.4°F WB, 52°F DP 32% RH (29.4°C, DB 18°C WB)	Total Capacity kW (BTUH)	129.6 (442.3)	144.7 (493.9)	177.7 (606.5)	210.9 (719.8)	254.0 (866.9)
	Sensible Capacity kW (BTUH)	125.8 (429.4)	141.4 (482.6)	173.2 (591.1)	201.0 (686.0)	244.6 (834.8)
	Flow Rate, GPM (lps)	91.5 (5.9)	101.1 (6.5)	125.7 (8.1)	148.7 (9.5)	179.3 (11.5)
	Pressure drop, ft. of water (kPa)	44.0 (131.2)	54.2 (161.6)	57.7 (172.0)	67.4 (200.9)	79.4 (236.7)
Net Capacity Data Based on 50°F (10°C) Entering Water, 12°F (6.7°C) Water Rise						
75°F DB, 61°F WB, 52°F DP 44% RH (23.9°C, DB 16.1°C WB)	Total Capacity kW (BTUH)	62.0 (211.6)	71.0 (242.3)	85.7 (292.5)	103.7 (353.9)	122.5 (418.1)
	Sensible Capacity kW (BTUH)	62.0 (211.6)	71.0 (242.3)	85.7 (292.5)	103.7 (353.9)	122.5 (418.1)
	Flow Rate, GPM (lps)	38.1 (2.4)	42.6 (2.7)	52.7 (3.4)	63.2 (4.1)	75.0 (4.8)
	Pressure drop, ft. of water (kPa)	8.8 (26.2)	11.2 (33.4)	11.5 (34.3)	13.6 (40.5)	15.2 (45.3)
80°F DB, 62.8°F WB 38% RH (26.7°C DB, 17.1°C WB)	Total Capacity kW (BTUH)	82.8 (282.6)	93.8 (320.1)	114.2 (389.8)	136.1 (464.5)	162.8 (555.6)
	Sensible Capacity kW (BTUH)	82.8 (282.6)	93.8 (320.1)	114.2 (389.8)	136.1 (464.5)	162.8 (555.6)
	Flow Rate, GPM (lps)	49.8 (3.2)	55.5 (3.6)	68.8 (4.4)	81.5 (5.2)	97.7 (6.3)

Table 6.2 Capacity and Physical Data, PW080-PW170 (continued)

Model		PW080	PW095	PW110	PW145	PW170
	Pressure drop, ft. of water (kPa)	14.3 (42.6)	17.9 (53.4)	18.7 (55.7)	21.7 (64.7)	24.9 (74.2)
NOTE: The net capacity data has fan motor heat factored in for all ratings. Capacity data is factory certified to be within 5% tolerance. Data rated with standard filter.						
85°F DB, 64.4°F WB, 52°F DP 32% RH (29.4°C, DB 18°C WB)	Total Capacity kW (BTUH)	102.7 (350.5)	115.8 (395.2)	141.7 (483.6)	167.0 (570.0)	201.2 (686.7)
	Sensible Capacity kW (BTUH)	102.7 (350.5)	115.8 (395.2)	141.7 (483.6)	167.0 (570.0)	201.2 (686.7)
	Flow Rate, GPM (lps)	61.1 (3.9)	67.9 (4.4)	84.3 (5.4)	98.9 (6.3)	119.4 (7.7)
	Pressure drop, ft. of water (kPa)	20.6 (61.4)	25.8 (76.9)	27.1 (80.8)	31.0 (92.4)	36.2 (107.9)
Net Capacity Data Based on 50°F (10°C) Entering Water, 14°F (7.8°C) Water Rise						
75°F DB, 61°F WB, 52°F DP 44% RH (23.9°C, DB 16.1°C WB)	Total Capacity kW (BTUH)	54.7 (186.7)	63.4 (216.4)	75.9 (259.0)	93.4 (318.8)	108.6 (370.7)
	Sensible Capacity kW (BTUH)	54.7 (186.7)	63.4 (216.4)	75.9 (259.0)	93.4 (318.8)	108.6 (370.7)
	Flow Rate, GPM (lps)	29.2 (1.9)	32.9 (2.1)	40.5 (2.6)	49.2 (3.2)	57.5 (3.7)
	Pressure drop, ft. of water (kPa)	5.5 (16.4)	7.0 (20.9)	7.2 (21.5)	8.6 (25.6)	9.3 (27.7)
80°F DB, 62.8°F WB 38% RH (26.7°C DB, 17.1°C WB)	Total Capacity kW (BTUH)	76.4 (260.8)	87.1 (297.3)	105.6 (360.4)	127.3 (434.5)	150.8 (514.7)
	Sensible Capacity kW (BTUH)	76.4 (260.8)	87.1 (297.3)	105.6 (360.4)	127.3 (434.5)	150.8 (514.7)
	Flow Rate, GPM (lps)	39.6 (2.5)	44.3 (2.8)	54.8 (3.5)	65.6 (4.2)	77.9 (5.0)
	Pressure drop, ft. of water (kPa)	9.5 (28.3)	12.0 (35.8)	12.4 (37.0)	14.5 (43.2)	16.3 (48.6)
85°F DB, 64.4°F WB, 52°F DP 32% RH (29.4°C, DB 18°C WB)	Total Capacity kW (BTUH)	96.9 (330.7)	109.6 (374.1)	133.7 (456.3)	145 (43.2)	190.4 (649.8)
	Sensible Capacity kW (BTUH)	96.9 (330.7)	109.6 (374.1)	133.7 (456.3)	159.2 (543.3)	190.4 (649.8)
	Flow Rate, GPM (lps)	49.5 (3.2)	55.2 (3.5)	68.4 (4.4)	81.0 (5.2)	97.1 (6.2)
	Pressure drop, ft. of water (kPa)	14.1 (42.0)	17.7 (52.8)	18.5 (55.2)	21.4 (63.8)	24.6 (73.3)
Net Capacity Data Based on 50°F (10°C) Entering Water, 16°F (8.9°C) Water Rise						

Table 6.2 Capacity and Physical Data, PW080-PW170 (continued)

Model		PW080	PW095	PW110	PW145	PW170
75°F DB, 61°F WB, 52°F DP 44% RH (23.9°C, DB 16.1°C WB)	Total Capacity kW (BTUH)	46.6 (159.0)	54.9 (187.4)	64.9 (221.5)	81.5 (278.2)	92.6 (316.0)
	Sensible Capacity kW (BTUH)	46.6 (159.0)	54.9 (187.4)	64.9 (221.5)	81.5 (278.2)	92.6 (316.0)
	Flow Rate, GPM (lps)	22.1 (1.4)	25.1 (1.6)	30.7 (2.0)	38.0 (2.4)	43.6 (2.8)
	Pressure drop, ft. of water (kPa)	3.3 (9.8)	4.4 (13.1)	4.4 (13.1)	5.4 (16.1)	5.5 (16.4)
NOTE: The net capacity data has fan motor heat factored in for all ratings. Capacity data is factory certified to be within 5% tolerance. Data rated with standard filter.						
80°F DB, 62.8°F WB, 52°F DP WB 38% RH (26.7°C DB, 17.1°C WB)	Total Capacity kW (BTUH)	69.4 (236.9)	79.7 (272.0)	96.2 (328.3)	117.4 (400.7)	137.4 (468.9)
	Sensible Capacity kW (BTUH)	69.4 (236.9)	79.7 (272.0)	96.2 (328.3)	117.4 (400.7)	137.4 (468.9)
	Flow Rate, GPM (lps)	31.7 (2.0)	35.7 (2.3)	44.0 (2.8)	53.2 (3.4)	62.5 (4.0)
	Pressure drop, ft. of water (kPa)	6.3 (18.8)	8.1 (24.1)	8.3 (24.7)	9.9 (29.5)	10.8 (32.2)
85°F DB, 64.4°F WB, 52°F DP 32% RH (29.4°C, DB 18°C WB)	Total Capacity kW (BTUH)	90.7 (309.6)	102.9 (351.2)	125.3 (427.6)	150.5 (513.7)	178.6 (609.6)
	Sensible Capacity kW (BTUH)	90.7 (309.6)	102.9 (351.2)	125.3 (427.6)	150.5 (513.7)	178.6 (609.6)
	Flow Rate, GPM (lps)	40.7 (2.6)	45.5 (2.9)	56.3 (3.6)	67.2 (4.3)	80.0 (5.1)
	Pressure drop, ft. of water (kPa)	9.9 (29.5)	12.5 (37.3)	13.0 (38.8)	15.2 (45.3)	17.1 (51.0)
Fan Data						
CFM (CMH)	Air Volume at 0.2" ESP	13,900 (23,616)	16,300 (27,694)	19,500 (33,131)	20,800 (35,339)	26,000 (44,174)
Fan Motor hp (kW), Operating	hp @ 85F	5.3 hp (3.9 kW)	4.1 hp (3.0 kW)	7.2 hp (5.3 kW)	7.7 hp (5.7 kW)	9.6 hp (7.1 kW)
NOTE: The net capacity data has fan motor heat factored in for all ratings. Capacity data is factory certified to be within 5% tolerance. Data rated with standard filter.						

6.2 Physical Data

Table 6.3 Physical Data, PW035-PW070

Model Number	PW035	PW040	PW045	PW060	PW070
Frame Type. See Component Location and Internal Configuration on page 19 for more info.	2		3		4
Quantity of Fans	1	1	1	2	2
Fan Data - EC Fans					
Air Volume CFM (CMH) @ 0.2" (50 Pa) ESP with MERV8 filters	6,900 (11,723)	6,900 (11,723)	7,900 (13,422)	13,000 (22,087)	13,900 (23,616)
Face Velocity FPM (m/s)	539 (916)	539 (916)	391 (664)	644 (1093)	572 (972)
Fan Motor, Maximum kW, each	3.50				
Chilled Water Coil					
Coil Rows	4	5	4	4	4
Coil Face Area ft ² (m ²)	12.80	12.80	20.20	20.20	24.30
Valve Actuator, Sensors, and Body	Modulating Valve Actuator with Proportional Sensors and either 2-Way or 3-Way Valve Body				
Valve Quantity	1				
2-way Valve Size, in. (mm)	1-5/8" (41 mm)				2-1/8" (54 mm)
Valve, Cv	Different Cv for 2 and 3 way. See Table 6.5 on page 45 .				
Valve Close-off pressure rating psi (kPa)	200 psi (1379 kPa)				
Valve rating psi (kPa)	400 psi (2758 kPa)				
System Design pressure rating psi (kPa)	400 psi (2758 kPa)				
Performance data available upon request					
Filter Section					
Disposable Type - Nominal Size and Quantities, MERV8 and MERV11 (Optional) See Table 6.6 on page 45 .					
Reheat Section					
Electric Reheat Stages	1			2	
Capacity, kW	7.50	7.50	7.50	15	15
Humidifier Section					
Type	Infrared				
Capacity, lb/hr (kg/h)	11			22	
Kw input, Nominal	4.80			9.60	

Table 6.3 Physical Data, PW035-PW070 (continued)

Model Number	PW035	PW040	PW045	PW060	PW070
Piping Connection Sizes					
Customer Supply & Return Chilled Water Connection, O.D. Copper	1-5/8"				2"
Condensate Drain Connection	5/8" x 1 ea				
Humidifier Supply Connection	1/4 in (6 mm). O.D.				
Unit Drain Connection	3/4 in. (19 mm) I.D. Hose				

Table 6.4 Physical Data, PW080-PW170

Model Number	PW080	PW095	PW110	PW145	PW170
Frame Type. See Component Location and Internal Configuration on page 19 for more info	4	5		6	7
Quantity of Fans	2	3	3	3	4
Fan Data - EC Fans					
Air Volume CFM (CMH) @ 0.2" (50 Pa) ESP with MERV8 filters	13,900 (23,616)	16,300 (27,694)	19,500 (33,131)	20,800 (35,339)	26,000 (44,174)
Face Velocity FPM (m/s)	572 (972)	528 (896)	631 (1,072)	570 (968)	619 (1,052)
Fan Motor, Maximum kW, each	3.5				
Chilled Water Coil					
Coil Rows	5	4	5	6	6
Coil Face Area ft2 (m2)	24.30	30.90	30.90	36.50	42
Valve Actuator, Sensors, and Body	Modulating Valve Actuator with Proportional Sensors and either 2-Way or 3-Way Valve Body				
Valve Quantity	1				
2-way Valve Size, in. (mm)	2-1/8" (54 mm)	2-5/8" (67 mm)			
Valve, Cv	Different Cv for 2 and 3 way. See Table 6.5 on the facing page				
Valve Close-off pressure rating psi (kPa)	200 psi (1379 kPa)				
Valve rating psi (kPa)	400 psi (2758 kPa)				
System Design pressure rating psi (kPa)	400 psi (2758 kPa)				
Performance data available upon request					
Filter Section					
Disposable Type - Nominal Size and Quantities, MERV8 and MERV11 (Optional) See Table 6.6 on the facing page .					

Table 6.4 Physical Data, PW080-PW170 (continued)

Model Number	PW080	PW095	PW110	PW145	PW170
Reheat Section					
Electric Reheat Stages	2				
Capacity, kW	15	25.50	22.50	22.50	22.50
Humidifier Section					
Type	Infrared				
Capacity, lb/hr (kg/h)	22				
Kw input, Nominal	9.6				
Piping Connection Sizes					
Customer Supply & Return Chilled Water Connection, O.D. Copper	2"	2-5/8"			
Condensate Drain Connection	5/8" x 1 ea	5/8" x 2 ea			
Humidifier Supply Connection	Cu 1/4/ in. (6 mm) O.D.				
Unit Drain Connection	3/4 in. (19 mm) I.D. Hose				

6.3 Chilled Water Cv and Filter

Table 6.5 PCW Chilled Water Valve Cv

MODELDIGITS_3_5 (Nominal Capacity kw)	035, 040	045, 060	070, 080	095, 110	145	170
2-way Valve Cv	25	29	46	46	46	46
3-way Valve Cv	25	29	46	73.7	73.7	73.7

Table 6.6 PCW Chilled Filter Match-up

MODELDIGITS_3_5 (Nominal Capacity kw)	035, 040	045, 060	070, 080	095, 110	145	170	035, 040	045, 060	070, 080	095, 110
FILTER 12.375 x 25 x 2	6	2	4	-	-	-	-	-	-	-
FILTER 29.5 X 4.25 X 1	1	2	2	3	3	4	-	-	-	-
FILTER 22.5 x 25 x 2	-	4	2	-	4	8	-	-	-	-
FIL TER 29.375 x 25 x 2	-	-	-	6	4	2	-	-	-	-
FIL TER 12.375 X 25 X 2	-	-	-	-	-	-	6	2	-	-
FIL TER 22.5 x 25 x 2	-	-	-	-	-	-	-	4	2	-
FIL TER 23.625 X 25 X 2	-	-	-	-	-	-	-	-	4	-
FIL TER 29.375 X 25 X 2	-	-	-	-	-	-	-	-	-	6

6.4 Water System

6.4.1 Water Valves Differential Pressure

Table 6.7 Water Valves Differential Pressure (for all models)

2-Way and 3-Way Valve	
Max Differential Pressure psi (kPa)	Close-off Pressure psi (kPa)
50 (345)	200 (1379)

6.5 Electrical Requirements

6.5.1 Unit Electrical Data

General Remarks

- The cables have to be sized in compliance with local standards and according to the type and characteristics (for example amperes) of installation.
- The data in the tables does not consider other options not explicitly described.

The Modbus wiring is field supplied and must be:

- Shielded
- 22-18 AWG (0.20-0.82 mm²) stranded tinned copper until 351 ft. (107 m) , 18-16 AWG (0.82-1.31 mm²) stranded tinned copper until 656.2 ft. (200 m)
- 120 ohm nominal impedance
- Low capacitance (17pF/ft or less)
- Plenum rated (NEC type CMP) if required by local codes
- UV and moisture resistant or run within conduit once in an outdoor environment, and must be temperature and voltage rated for conditions present

NOTE: Do not run the Modbus cable in the same conduit, raceway or chase used for high voltage wiring. Mandatory shield connection to ground close Master (indoor unit control board). For Modbus network lengths greater than 656.2 ft (200 m), contact Vertiv for assistance.

Units with Power Supply 460 V/3 ph/60 Hz + Earth Ground

Table 6.8 Electrical Data for Cooling Only - 460 V/3 ph/60 Hz + Earth Ground

460V		Without Condensate Pump				With Condensate Pump			
		Reheat and Humidifier	Reheat Only	Humidifier Only	Fans Only	Reheat and Humidifier	Reheat Only	Humidifier Only	Fans Only
PW035, PW040	FLA	19.7	13.9	10.3	4.5	20.9	15.1	11.5	5.7
	WSA	24.6	17.4	12.9	5.6	26.1	18.9	14.4	6.8
	OPD	25	20	15	15	30	20	15	15
PW045	FLA	25.5	13.9	16.1	4.5	26.7	15.1	17.3	5.7
	WSA	31.9	17.4	20.1	5.6	33.4	18.9	21.6	6.8
	OPD	35	20	25	15	35	20	25	15
PW060- PW080	FLA	39.4	27.8	20.6	9	40.6	29	21.8	10.2
	WSA	49.3	34.8	25.8	10.1	50.8	36.3	27.3	11.3
	OPD	50	35	30	15	60	40	30	15
PW095- PW145	FLA	53.3	41.7	25.1	13.5	54.5	42.9	26.3	14.7
	WSA	66.6	52.1	31.4	14.6	68.1	53.6	32.9	15.8
	OPD	70	60	35	15	70	60	35	20
PW170	FLA	57.8	46.2	29.6	18	59	47.4	30.8	19.2
	WSA	72.3	57.8	37	19.1	73.8	59.3	38.5	20.3
	OPD	80	60	40	20	80	60	40	25

Source: DPN005243, Rev. A

See [Power Supply Requirements for the Unit](#) on page 69.

Units with Power Supply 575 V/3 ph/60 Hz + Earth Ground

Table 6.9 Electrical Data - 575 V/3 ph/60 Hz + Earth Ground

575V		Without Condensate Pump				With Condensate Pump			
		Reheat and Humidifier	Reheat Only	Humidifier Only	Fans Only	Reheat and Humidifier	Reheat Only	Humidifier Only	Fans Only
PW035 PW040	FLA	18.5	11.1	11.0	3.6	19.4	12.0	11.9	4.5
	WSA	23.1	13.9	13.8	4.5	24.3	15.0	14.9	5.4
	OPD	25	15	15	15	25	20	15	15
PW045	FLA	22.7	11.1	15.2	3.6	23.6	12.0	16.1	4.5
	WSA	28.4	13.9	19.0	4.5	29.5	15.0	20.2	5.4
	OPD	30	15	20	15	30	20	25	15
PW060 PW080	FLA	33.8	22.2	18.8	7.2	34.7	23.1	19.7	8.1
	WSA	42.3	27.8	23.5	8.1	43.4	28.9	24.7	9.0
	OPD	45	30	25	15	45	30	25	15
PW095 PW145	FLA	44.9	33.3	22.4	10.8	45.8	34.2	23.3	11.7
	WSA	56.1	41.6	28.0	11.7	57.3	42.8	29.2	12.6
	OPD	60	45	30	15	60	45	30	15
PW170	FLA	48.5	36.9	26.0	14.4	49.4	37.8	26.9	15.3
	WSA	60.6	46.1	32.5	15.3	61.8	47.3	33.7	16.2
	OPD	70	50	35	20	70	50	35	20

Source: DPN005243, Rev. A

7 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.

Carefully read [Important Safety Instructions](#) on page 1.

Pay attention to the safety labels on the unit and to the safety warnings in this chapter.

- Verify that the floor is level, solid, and sufficient to support the unit. See Table 7.3 on the facing page 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 Liebert® PCW in an alcove or at the end of a long, narrow room.
- Install the units as close as possible to the largest heat load.
- Allow at least the minimum recommended clearances for maintenance and service. See the appropriate submittal drawings for dimensions.
- We recommend installing an under-floor water detection system. Contact your Vertiv representative for information.

NOTE: Vertiv takes no responsibility for systems not compliant with the specifications given in this manual. Lack of compliance to the specifications given by Vertiv voids the warranty.

The customer is responsible for the following operations.

Table 7.1 Operations

Operation	See
Prepare the area.	See Location on page 54 and Space Requirements on page 54 .
Prepare the piping for the connection of the unit to the facility systems (chilled water, drainage).	See Condensate Piping Requirements on page 89 .
Make sure that the water supply is suitable.	See Water Supply Requirements on page 82 .
Prepare the electric system.	See Electrical System Requirements on page 75 .

Table 7.2 Application Checklist

Operation	See
Identify the model and air distribution of your unit.	See Nomenclature and Components on page 11 .
Identify the type of frame of your unit.	See Chilled Water Cv and Filter on page 45 .
Find the overall dimensions for the unit frame, without accessories.	
Check which accessories are mounted on the unit.	Accessories on page 135 .
Find the dimensions of the accessories. Calculate the total height of the unit.	

Table 7.2 Application Checklist (continued)

Operation	See
Check if there is enough free space at top and bottom of the unit.	
If you are going to install a downflow unit, find the dimensions of the hole in the raised floor.	
Check if there is enough free space for service in front of the unit.	See Space Requirements on page 54 .

The following operations must be done on the unit at the installation site:

Table 7.3 Operations on the Unit

Operation	See
1. Assemble any optional accessory.	See Accessories on page 135 .
2. Position the unit at the final location and fix it on the floor or the supporting structure.	
3. Connect the unit to the chilled water system.	
4. Connect the unit to the drain system.	
5. Connect the water supply and the water drain piping of the humidifier.	See Replacing Infrared Humidifier on page 112 .
6. Connect the electric power supply.	See Power Supply Cable on page 77 .
7. Connect the electric equipment to the electric panel.	See Contacts for the Unit Status Signals on page 77 .
8. Check or adjust the Modbus settings.	See Modbus Connections and Settings on page 110 .
9. Fill the chilled water system.	
10. Check the whole system.	See Checklist for Completed Installation on page 91 .
11. Start the unit.	

7.1 Planning Dimensions

The unit, floor mount options, and plenum dimensions are described in the submittal documents included in the [Submittal Drawings](#) on page 127 .

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

NOTE: Leave a free space of at least 39.3 in. (1,000 mm) on the front to allow safe installation and maintenance operations.

Table 7.4 Dimension Planning Drawings

Document Number	Title
Planning Dimensions - Downflow Units	
60028268	Cabinet Dimensions PW035-040D
60028266	Cabinet Dimensions PW035-040E
60051993	Cabinet Dimensions PW035-040H
60027882	Cabinet Dimensions PW045-060D
60027545	Cabinet Dimensions PW045-060E

Table 7.4 Dimension Planning Drawings (continued)

Document Number	Title
60050460	Cabinet Dimensions PW045-060H
60027815	Cabinet Dimensions PW070-080D
60027633	Cabinet Dimensions PW070-080E
60051835	Cabinet Dimensions PW070-080H
60028262	Cabinet Dimensions PW095-110D
60027712	Cabinet Dimensions PW095-110E
60051939	Cabinet Dimensions PW095-110H
60028240	Cabinet Dimensions PW145D
60027730	Cabinet Dimensions PW145E
60028289	Cabinet Dimensions PW0170D
60028288	Cabinet Dimensions PW0170E
Planning Dimensions - Upflow Units	
60028269	Cabinet Dimensions PW035-040U
60027883	Cabinet Dimensions PW045-060U
60027901	Cabinet Dimensions PW070-080U
60028263	Cabinet Dimensions PW095-110U
Planning Dimensions - Floor Mount Options	
60051900	Floorstand Dimensions
60051898	Leg Kit Dimensions
60051899	Leg Kit over 32 in. Dimensions
60061863	Pedestal Dimensions
Planning Dimensions - Plenums	
60028435	Plenum Upflow and Downflow

7.2 Shipping Dimensions and Unit Weights

Table 7.5 Shipping Dimensions

Model	Domestic Packed, in (mm)	Export Packed, in (mm)
PW035-040E	45 x 64 x 85 (1143 x 1626 x 2159)	45 x 64.5 x 85.5 (1143 x 1638 x 2172)
PW045-060D	45 x 97 x 85 (1143 x 2464 x 2159)	45 x 97.5 x 85.5 (1143 x 2477 x 2172)
PW070-080	45 x 97 x 85 (1143 x 2464 x 2159)	45 x 97.5 x 85.5 (1143 x 2477 x 2172)
PW095-110	45 x 120 x 85 (1143 x 3048 x 2159)	45 x 120.5 x 85.5 (1143 x 3061 x 2172)
PW145E	45 x 143 x 85 (1143 x 3632 x 2159)	45 x 143.5 x 85.5 (1143 x 3645 x 2172)
PW0170D	45 x 143 x 85 (1143 x 3632 x 2159)	45 x 143.5 x 85.5 (1143 x 3645 x 2172)

Table 7.6 Unit Weight

Model	Unit (dry weight) (lbs/kg)	Domestic Shipping Weight (lbs/kg)
PW035	785 lbs (356 kg)	945 (429 kg)
PW040	822 lbs (373 kg)	982 (445 kg)
PW045	1,060 lbs (481 kg)	1,290 (585 kg)
PW060	1,127 lbs (511 kg)	1,357 (616 kg)
PW070	1,283 lbs (582 kg)	1,513 (686 kg)
PW080	1,319 lbs (598 kg)	1,548 (702 kg)
PW095	1,499 lbs (680 kg)	1,769 (802 kg)
PW110	1,631 lbs (740 kg)	1,901 (862 kg)
PW145	1,881 lbs (853 kg)	2,192 (994 kg)
PW170	2,105 lbs (955 kg)	2,416 (1096 kg)

7.2.1 Location

- Verify that the floor is level, solid, and sufficient to support the unit. See **Table 7.6** above 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 Liebert® CW 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.

7.2.2 Space Requirements

See dimensions included in [Submittal Drawings](#) on page 127 .

Keep free space between the unit and any obstacle.

NOTE: Leave a free space of at least 39.3 in. (1,000 mm) on the front to allow safe installation and maintenance operations.

8 Equipment Inspection and Handling



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



WARNING! Risk of top-heavy unit falling over when improperly lifted or moved. Can cause serious injury or death. Building and equipment damage may also result. Read all of the following instructions and verify that all lifting and moving equipment is rated for the weight of the unit before attempting to move, lift, remove packaging from or prepare the unit for installation. Unit weights are specified in **Table 7.6** on page 54 .



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. Wear appropriate OSHA approved personal protective equipment (PPE) when attempting to move, lift, remove packaging from or prepare for installation.

NOTICE

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

NOTICE

Risk of improper storage. Can cause unit damage.

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

Keep the unit in storage with the ambient conditions given in [Storage Conditions](#).

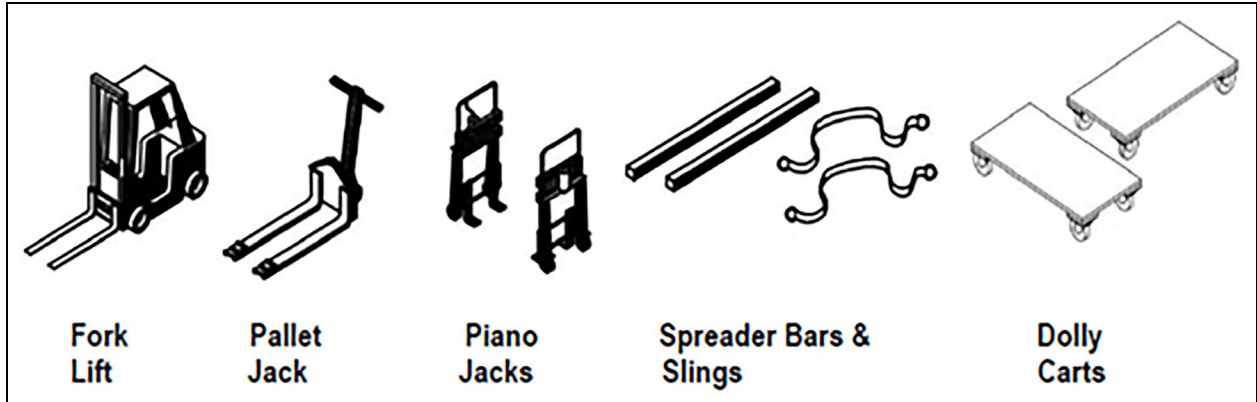
Inspection

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.
- After receiving the product, check the accessories against the packing list.
- If any parts are found missing or damaged, please report it to the carrier immediately.

- If you find any damage, please report it to the carrier and to the local distributor.
- Report damage immediately to the carrier and file a damage claim with a copy sent to Vertiv or to your sales representative.

Figure 8.1 Recommended Unit Handling Equipment:



8.1 Handling the Modules While Packaged

NOTE: The following instructions are valid for both the standard units and the modules of the units (coil module and fan module).

- Transport packaged unit using a fork lift.
- When using a forklift, make sure the forks (if adjustable) are spread to the widest allowable distance to still fit under the skid. Also, ensure the fork length is suitable for unit length.
 - Skid length for PW035-040 = 64 in. (1,626 mm)
 - Skid length for PW045-060 = 97 in. (2,464 mm)
 - Skid length for PW070-080 = 97 in. (2,464 mm)
 - Skid length for 095-110 = 120 in. (3,048 mm)
 - Skid length for PW145 = 143 in. (3,632 mm)
 - Skid length for PW170 = 143 in. (3,632 mm)
- When using a forklift, unit shall not be lifted any higher than 2-4 in. (51-102 mm) off the ground when handled. All by-standing personnel shall be no closer than 13 ft. (3.7 m) to handled packaged unit.
- If circumstances require unit to be lifted higher than 4 in. (102 mm) great care shall be exercised, and all by-standing personnel shall be no closer than 20 ft. (5 m) to lift point of unit.

8.2 Unpacking the Unit



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.

NOTE: The following instructions are valid both for standard units and the modules of the units (coil module and fan module).

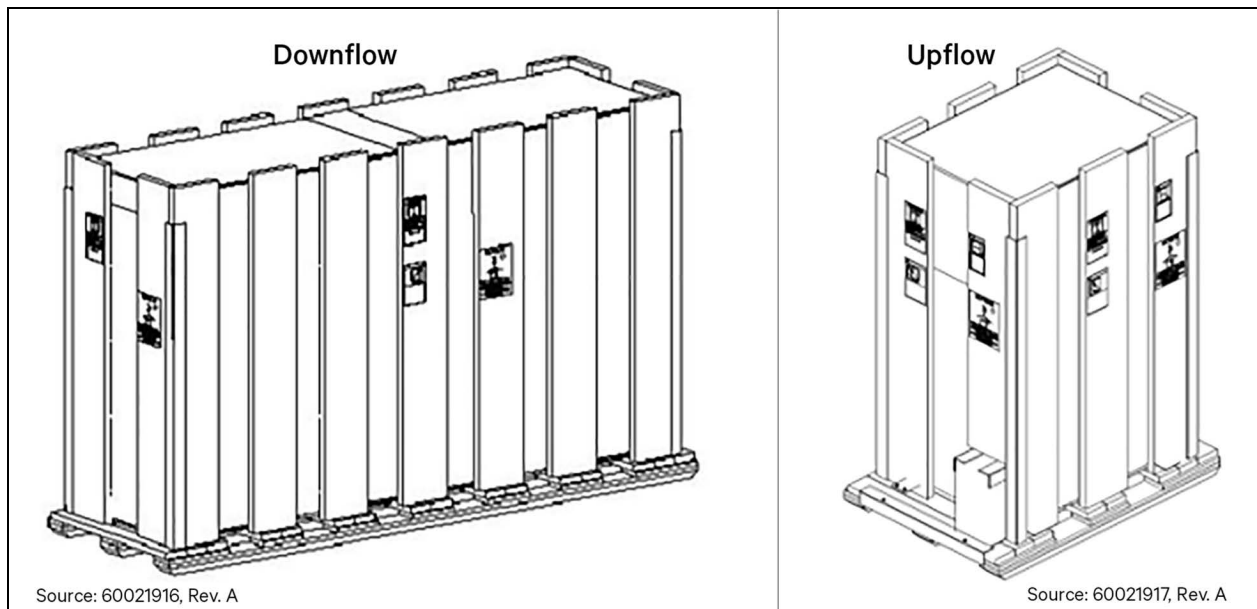
Domestic Packaging:

1. Remove the exterior packaging material from around the unit. See **Figure 8.2** below .

NOTE: All material used to package this unit is recyclable. Please save for future use, or dispose the package materials according to the local regulations about waste disposal.

2. Unit bag may remain in place for dust and panel protection. Or remove for immediate unit installation.

Figure 8.2 Unpacking the Unit



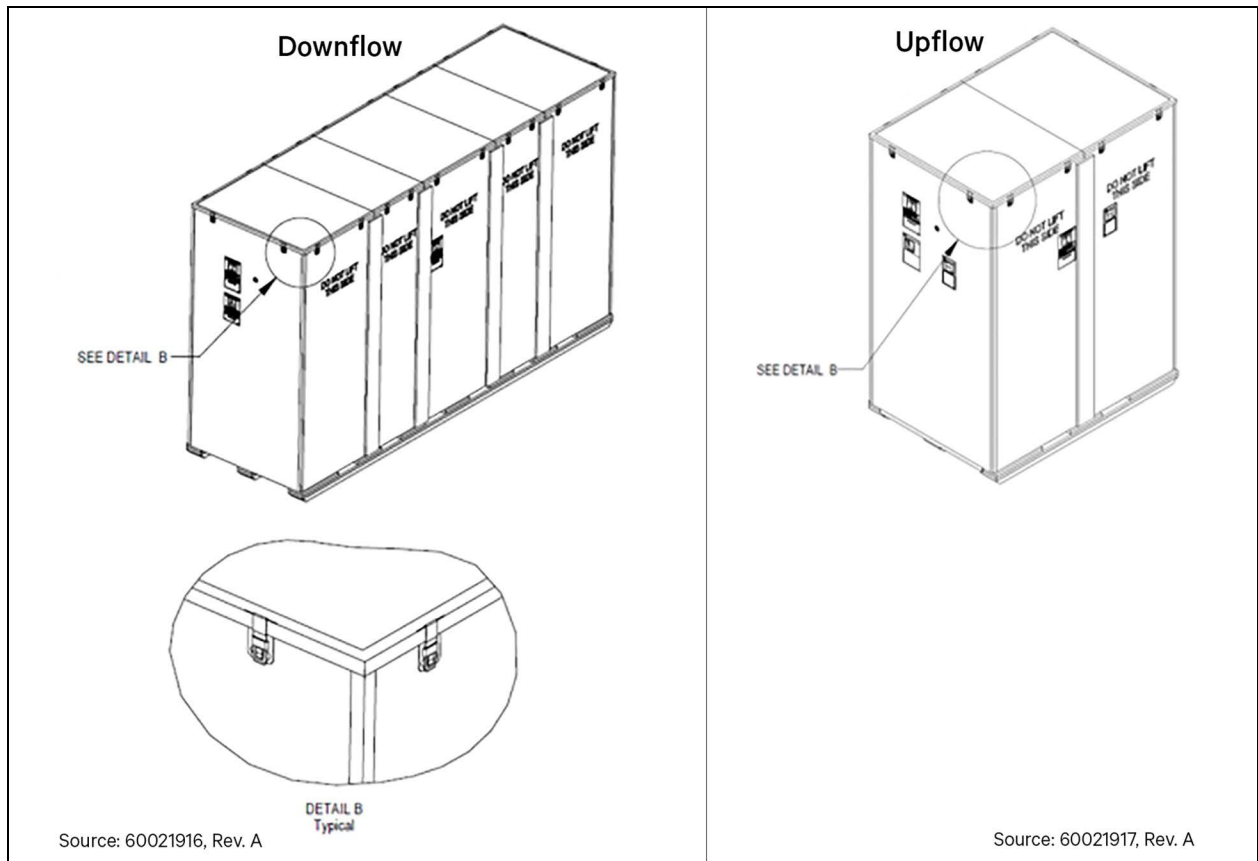
Export Crating:

1. Remove metal spring clip securing top panels of crate. Refer to detail B.
2. Remove all fasteners securing crate side panels to shipping skid.

NOTE: All material used to package this unit is recyclable. Please save for future use or dispose of the package materials according to the local regulations about waste disposal.

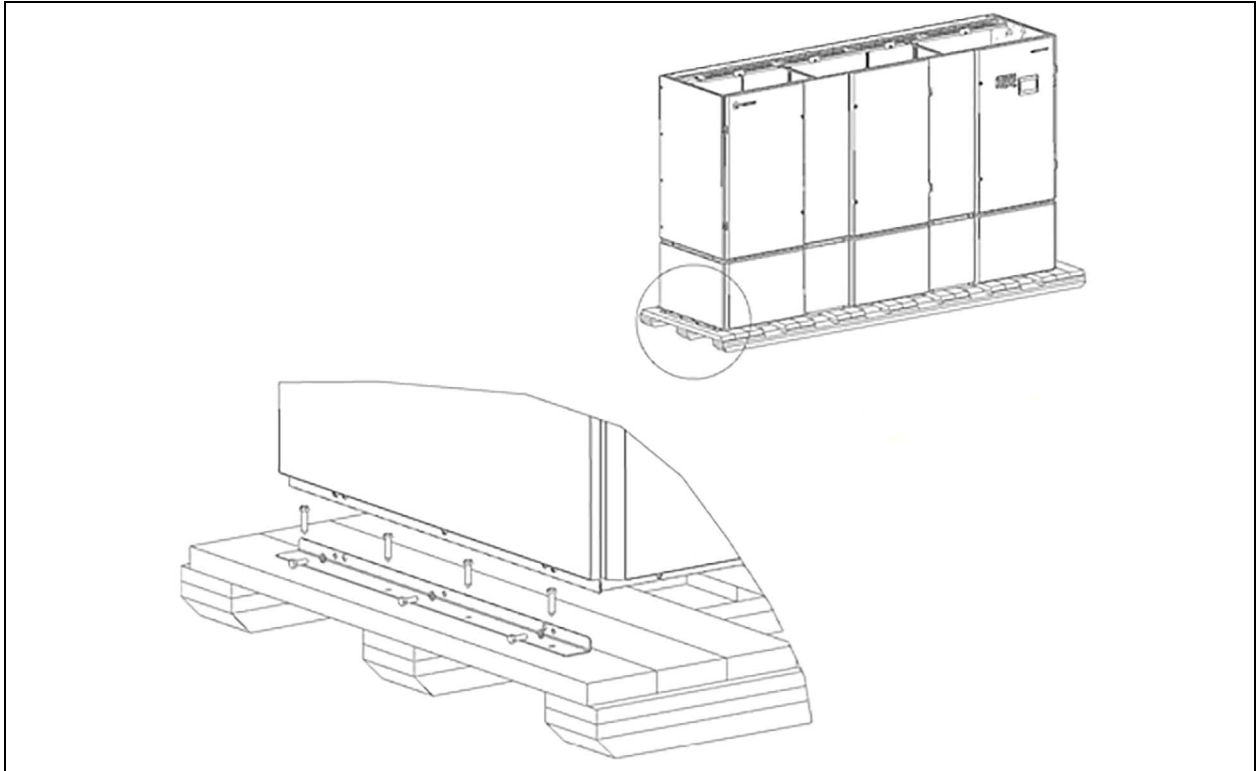
3. With crate removed, follow previous steps for removing domestic package material.

Figure 8.3 Uncrating the Unit



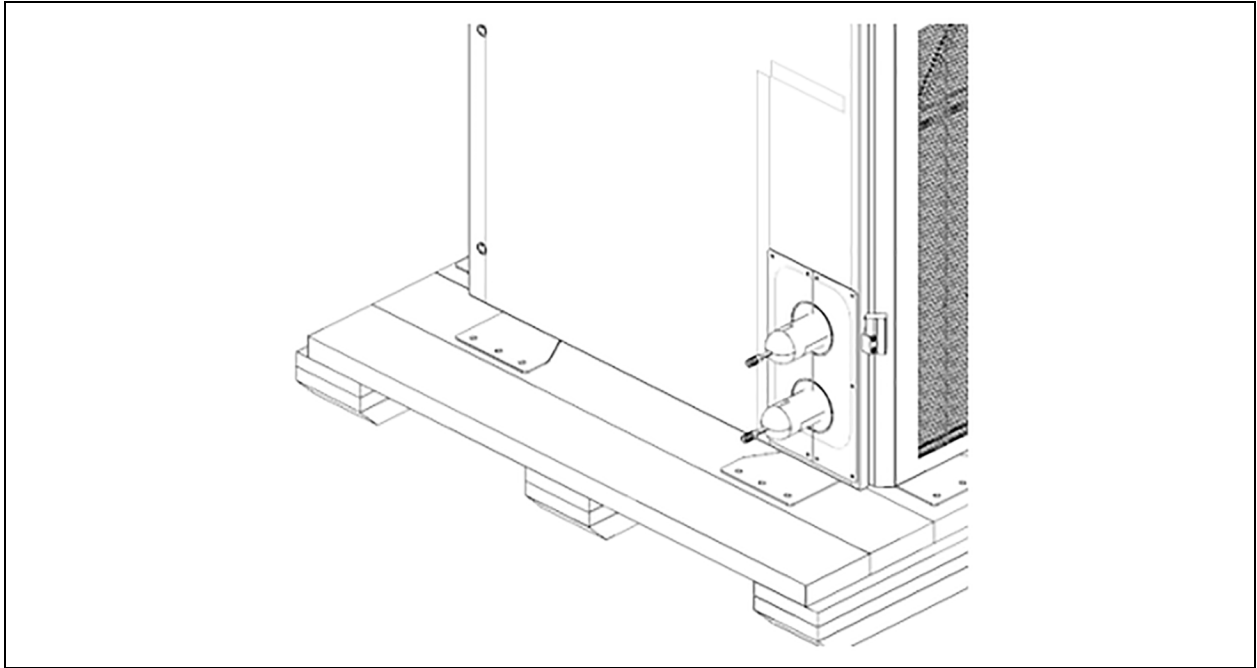
Downflow Shipping Bracket Removal:

- Use 9/16 in. socket drive to remove eight lag screws from two shipping brackets.
- Remove six M8 screws securing shipping brackets to unit.
- Remove shipping brackets. Unit is no longer attached to shipping skid.

Figure 8.4 Downflow Shipping Bracket**Upflow Shipping Bracket Removal:**

- Use 9/16 in. socket drive to remove 16 lag screws from four shipping brackets.
- Unit is no longer attached to skid.
- Brackets can only be removed from unit after unit is lifted off shipping skid.

Figure 8.5 Upflow Shipping Bracket



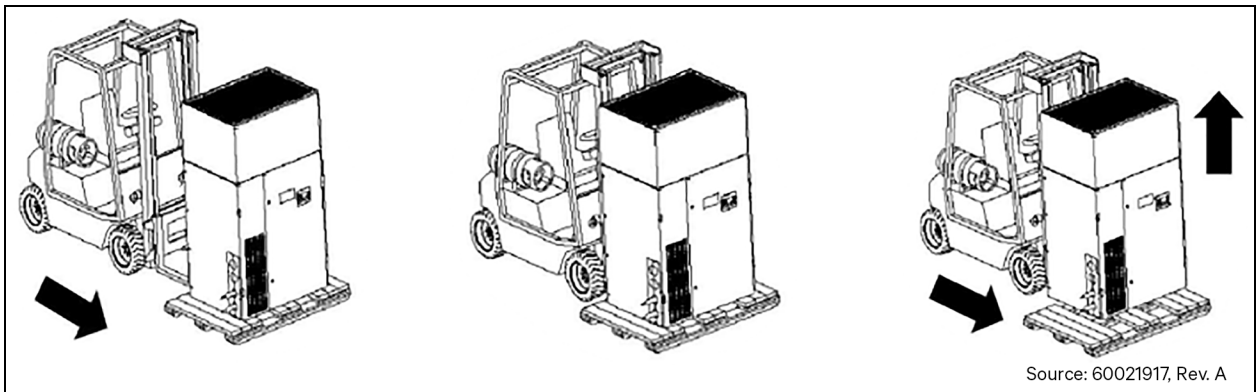
8.2.1 Removing the Unit from the Skid Using a Forklift

NOTICE

Unit panel and/or base damage may occur if the below steps are not followed.

1. Align a forklift centered with either the front or rear side of unit. Make sure tines of forklift are locked to widest position.
2. Insert tines of forklift under base of the unit. Make sure tines are level, not angled in an upward direction. Tines are to be at a height that will allow proper clearance under unit. Make sure tines extend beyond opposite side of unit.
3. Lift the unit off shipping skid to an elevation point where the shipping skid no longer supports the unit weight. Remove the shipping skid from under the unit.

Figure 8.6 Forklift



8.3 Removing the Unit from the Shipping Skid Using Rigging



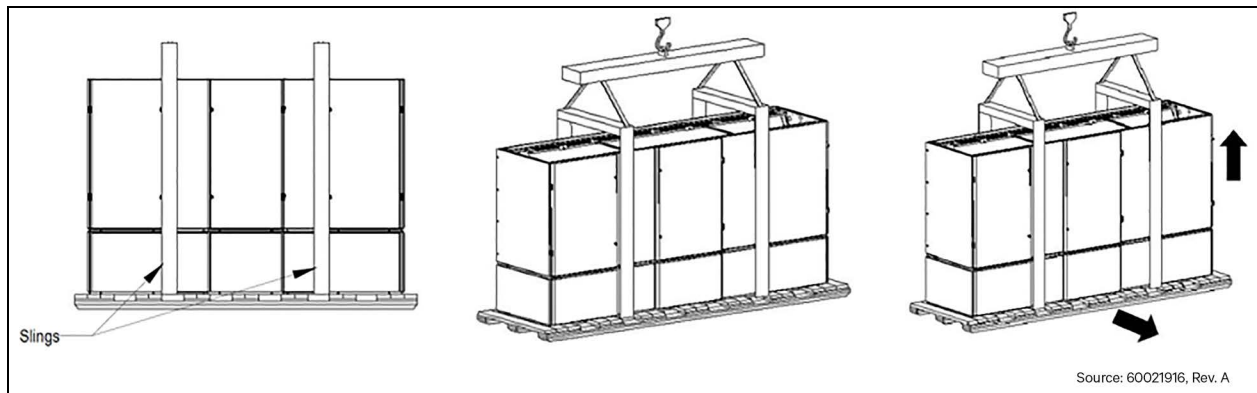
WARNING! Risk of improper moving. Can cause serious injury or death. Building and equipment damage may also result. Use only lifting equipment that is rated for the unit weight by an OSHA-certified rating organization. The center of gravity varies depending on the unit size and selected options. The slings must be equally spaced on either side of the center of gravity indicator. Shipping weights and unit weights are listed in [Shipping Dimensions and Unit Weights](#) on page 53. Use center of gravity indicators on the unit to determine the position of the slings.

NOTICE

Lift the unit with a speed suitable for the load to be moved, so as not to damage the structure.

1. Place slings as close as possible to side panels of unit to prevent over-balancing to one side. Slings shall be equally spaced on either side of center of gravity labels. Place slings between unit bottom rails and shipping skid.
2. Use spreader bars or equivalent device to ensure proper protection of unit. Make sure panels, if attached, are well protected from slings.
3. Lift the unit off shipping skid to an elevation point where the shipping skid no longer supports the unit weight. Remove the shipping skid from under the unit.

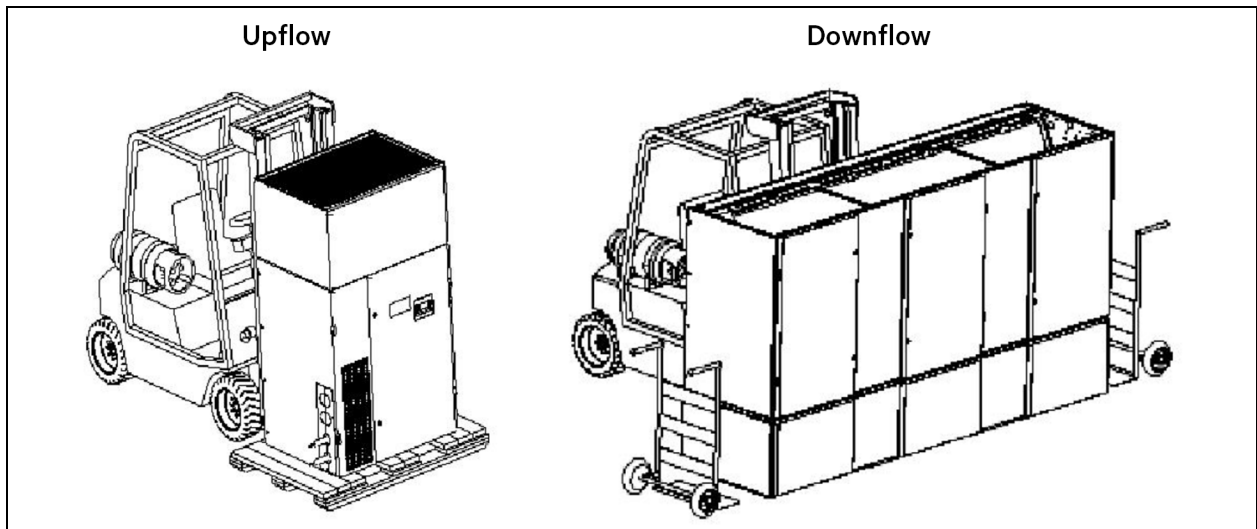
Figure 8.7 Slings



8.3.1 Moving the Unit to the Installation Location Using Piano Jacks

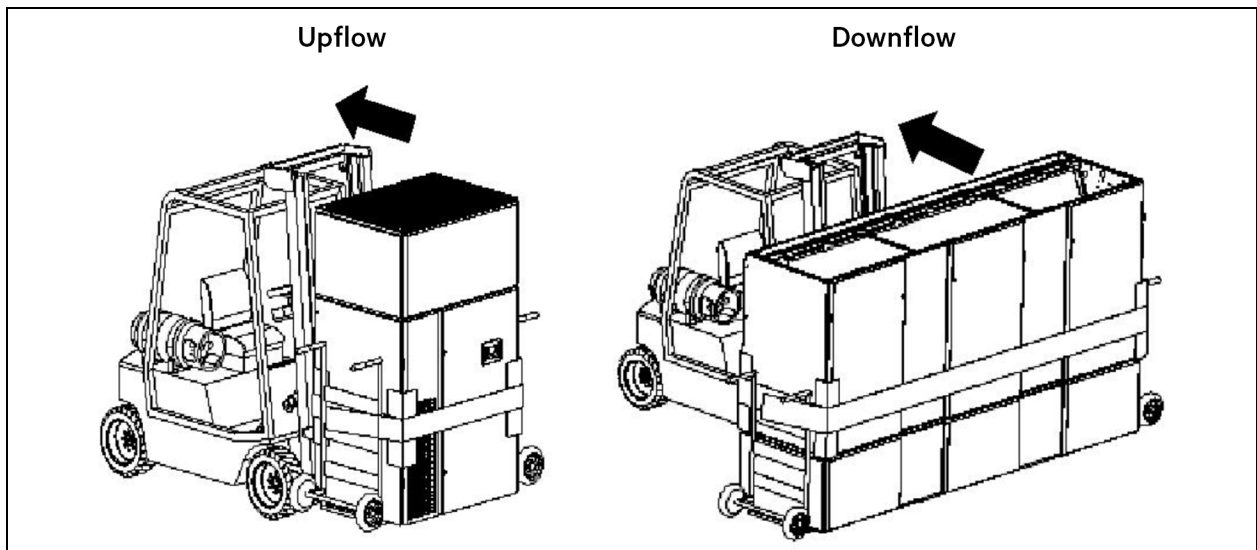
1. If path of unit installation is across an elevated floor, make sure the floor can support the unit when moved with piano jacks. If necessary, cover the floor with metal plates or other support material that can distribute the weight across flooring.
2. Acquire piano jacks, and with unit elevated, place piano jacks into position where one is at each end of the unit. See [Figure 8.8](#) on the next page.

Figure 8.8 Module and Piano Jacks



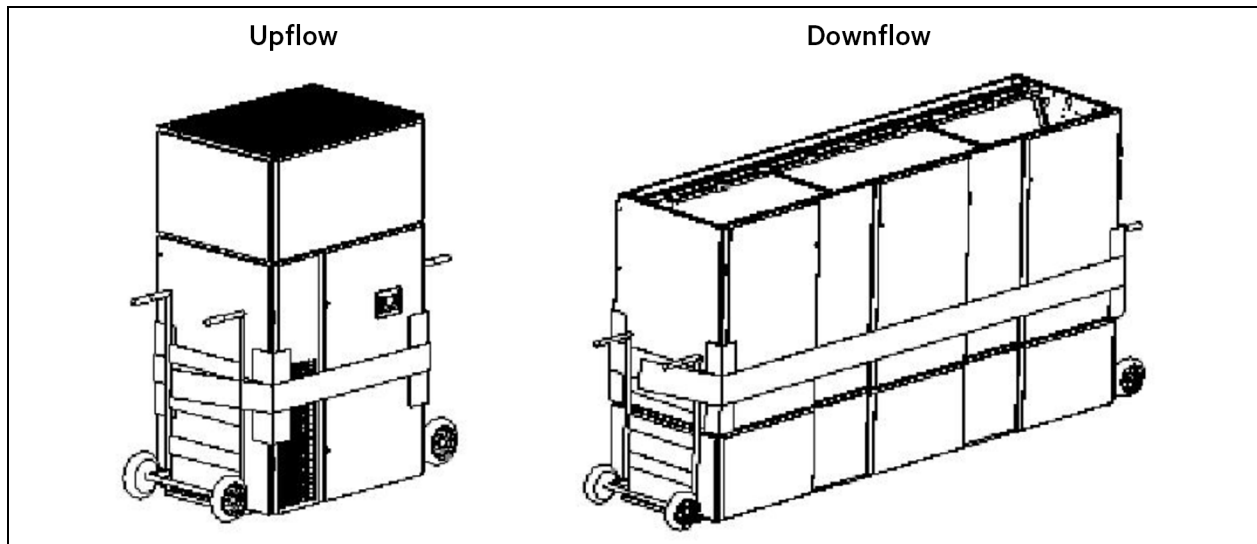
3. Lower unit to a height suitable for piano jacks. Place protective material between the unit, piano jacks, and strapping. With unit secured to the piano jacks, remove either the forklift or rigging away from the unit. See **Figure 8.9** below.

Figure 8.9 Moving Forklift Away from Unit



4. Using piano jacks, a minimum of two trained personnel can move unit to site for installation. See **Figure 8.10** on the facing page.

Figure 8.10 Moving Unit

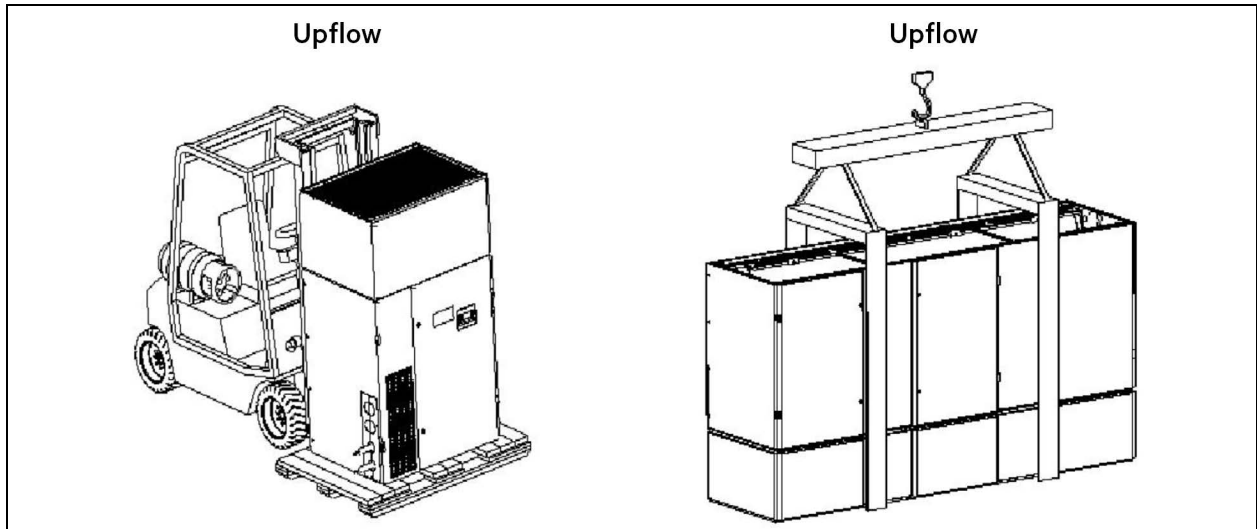


NOTE: Condensate pump is shipped separately from the main unit before installation and is field installed.

8.4 Moving the Unit to the Installation Location Using Dolly Cart

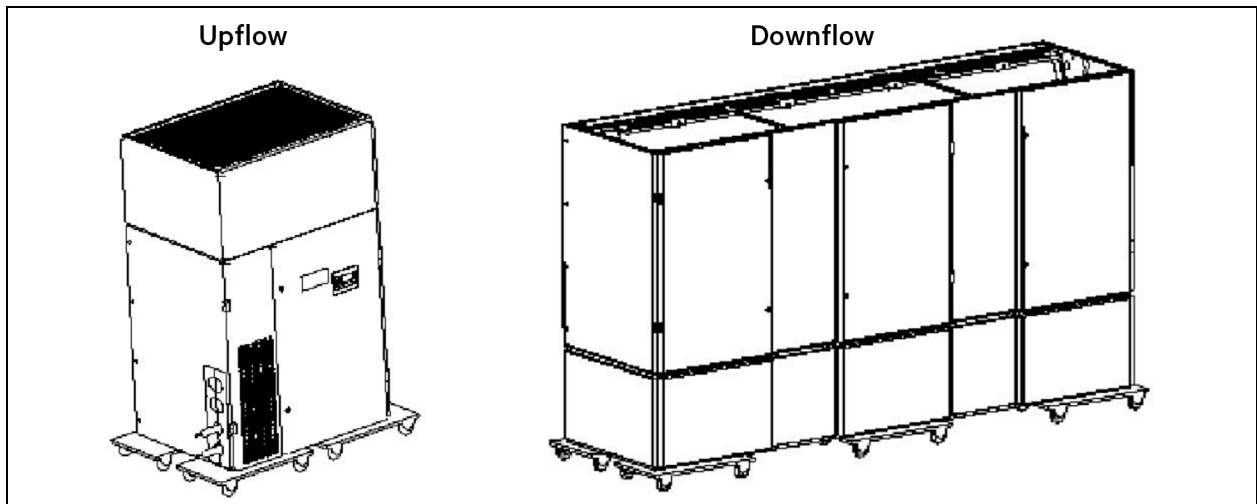
1. Quantity of dolly carts to use per unit model type:
 - PW035-040: four dolly carts, place one per corner
 - PW045-060: four dolly carts, place one per corner
 - PW070-080: four dolly carts, place one per corner
 - PW095-110: six dolly carts, place one per corner, one in middle of each side
 - PW145: six dolly carts, place one per corner, one in middle of each side
 - PW170: six dolly carts, place one per corner, one in middle of each side
2. If path of unit installation is across an elevated floor, make sure the floor can support the unit when moved with dolly carts. If necessary, cover the floor with metal plates or other support material that can distribute the weight across flooring.
3. Lower the unit onto dolly carts for movement to designated installation location. See **Figure 8.11** on the next page.

Figure 8.11 Unit on Dolly Cart



4. Using dolly carts, a minimum of two trained personnel can move unit to site for installation.

Figure 8.12 Moving to Installation Site



8.4.1 Removing the Unit from the Skid Using a Crane

! **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 7.6** on page 54 . Use the center of gravity indicators on the unit to determine the position of the slings.

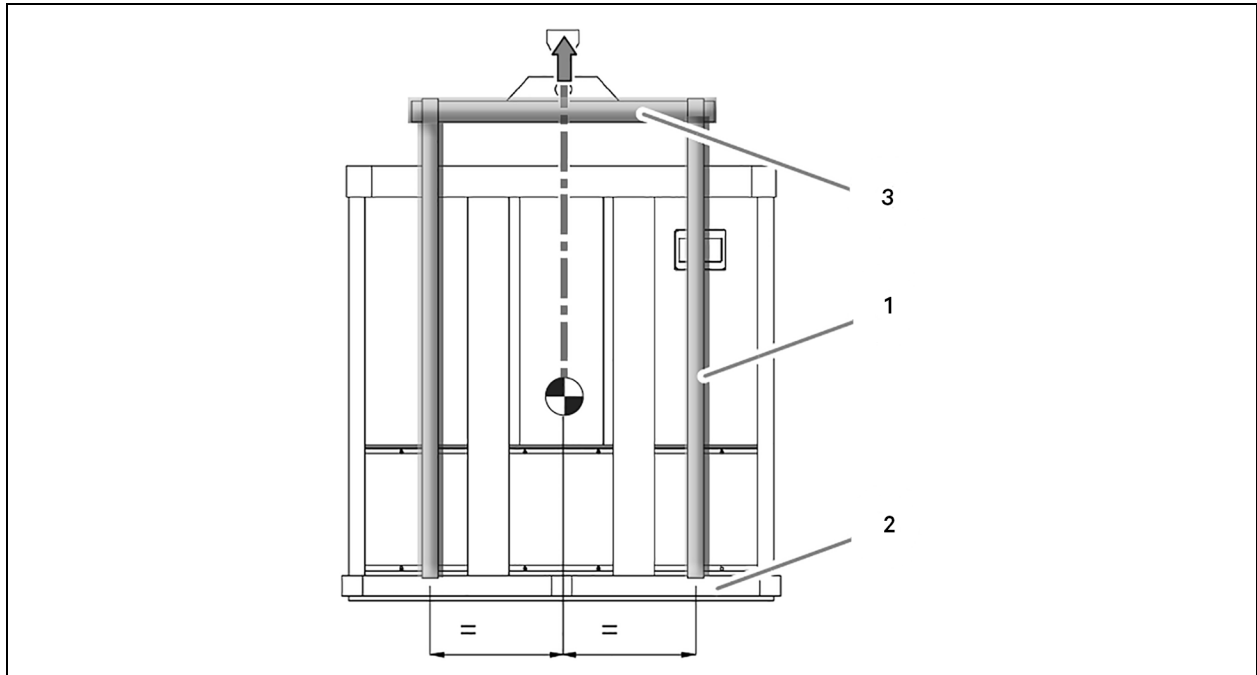
1. Place the slings between the unit bottom rails and the skid, at the widest allowable distance. See **Figure 8.13** on the facing page .

2. Be sure that the distance between slings guarantees the unit stability.
3. Fix the slings to the spreader bar.

NOTICE

Lift the unit with a speed suitable for the load to be moved, so as not to damage the structure.

Figure 8.13 Lifting the Unit with a Crane



Item	Description
1	Slings
2	Skid
3	Spreader bar

8.5 Preparing for Assembly

NOTE: The following instructions are valid for both standard units except upflow with left customer connections.

8.6 Placing the Unit on a Floorstand



CAUTION: Risk of heavy unit falling into defective raised floor. Can cause injury and equipment damage. Prior to installation, all floor tiles immediately around floorstand 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.

Review the **Leg kit, Extend Leg Kit, Floorstand and Pedestal installation sheet**, located inside the package before installing the unit.

Units being placed onto a Floorstand or Pedestal must use a process that will provide safest method based on site layout. Professional installers to be used when placing unit. Unit may require lift onto a floorstand or pedestal if the elevated flooring has not been installed.

Unit will need to be lifted up to attach Leg kit and Extend Leg Kit to the main unit, Professional installers to be used. If the floorstand or Pedestal is installed, unit will be placed over floor opening containing floor stand. Be sure to align the floorstand or Pedestal with the inside of the unit frame base.

Table 8.1 Accessories

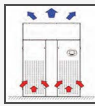
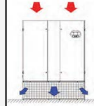
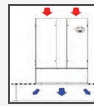
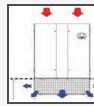
Accessory	Purpose	U - Upflow	H - Downflow Frontal	D - Downflow Up	E - Downflow Down
					
Legs Kit**	Support and Condensate drain/pump	N/A	N/A	R**	R**
Extended leg kit	Support and Condensate drain/pump	N/A	N/A	O**	O**
Floorstand**	Support and Condensate drain/pump	O*	O*	O**	O**
Pedestal*	Support and piping chase and Condensate drain/pump	R*	R*	N/A	N/A
<p>*The pedestal is required for upflow and downflow frontal. Required only if floorstand or leg kit not ordered.</p> <p>**Either the floorstand or leg kit is required for downflow up or downflow down.</p> <p>(R = required, O = optional, N/A)</p>					

Table 8.2 Floor Mount Options

Planning Dimesions - Floor Mount Options	
60051900	Floorstand Dimensions
60051898	Leg Kit Dimensions
60051899	Leg Kit Dimensions Leg Kit over 32 in. Dimensions
60061863	Pedestal Dimensions
Refer to Submittal Drawings for technical detail.	

9 Electrical Connections



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 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.

NOTICE

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

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

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

9.1 Local Codes

- 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 the appropriate submittal drawing, listed in **Table 9.1** on page 71, for electrical service entrances into unit. Electrical service must conform to national and local electrical codes.
- All wiring must be done in accordance with all applicable local, state, and national electrical codes.

9.2 Power Supply Requirements for the Unit

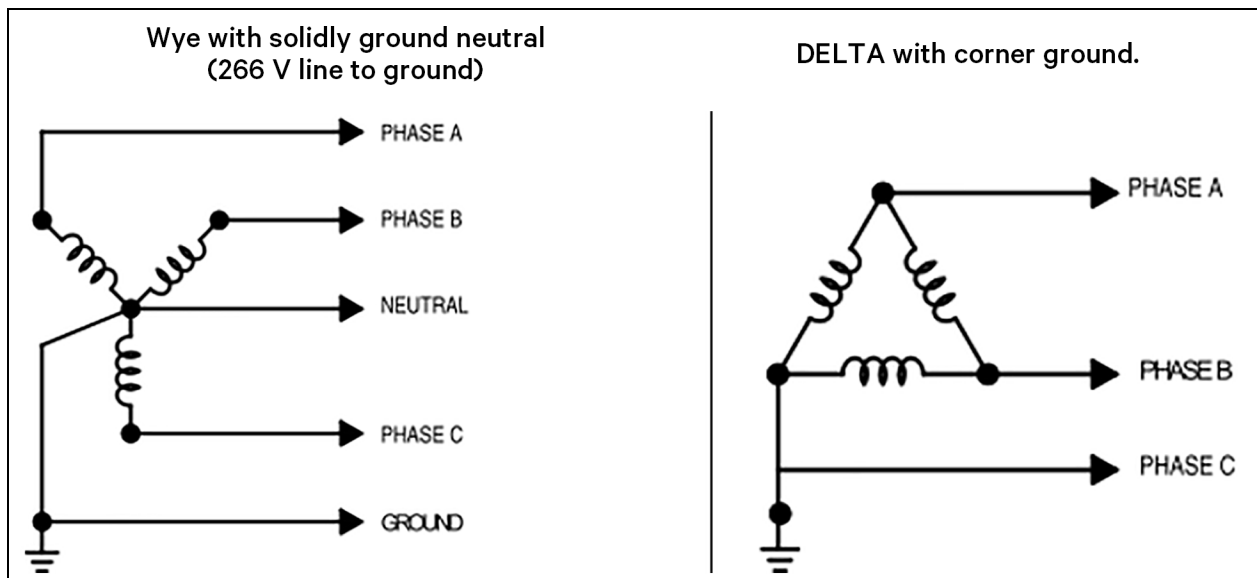
Vertiv™ Liebert® PCW voltage should be verified with available power supply before installation. Refer to the unit's electrical schematic and serial tag for specific electrical requirements.

Before proceeding with the electrical connections, ensure that:

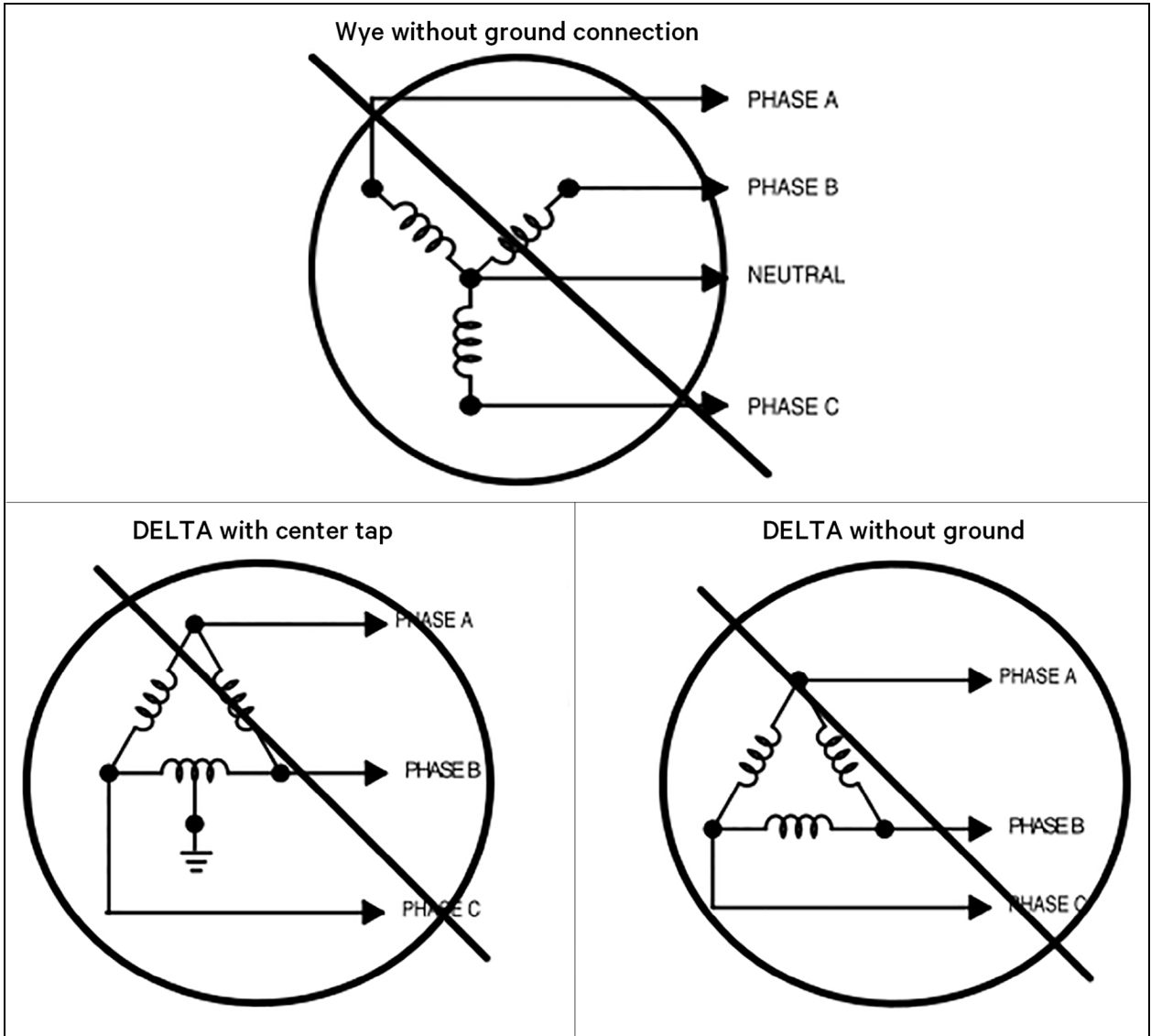
- All electrical components are undamaged.
- All terminal screws are tight.
- The supply voltage and frequency match up to the unit name plate located above the Electrical box.

9.2.1 Acceptable and Unacceptable Power Supply Type

Acceptable:



Unacceptable:



A manual electrical disconnect switch should be installed in accordance with local codes and distribution system. Consult local codes for external disconnect requirements. The electrical and unit-to-unit connections are described in the submittal documents included in the [Submittal Drawings](#) on page 127 .

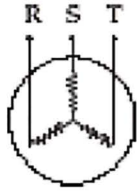
Table 9.1 on the facing page contains the relevant documents by number and title.

9.2.2 Power Supply Variability - Sizing THD Transformer

- Check that the maximum unbalance between the phases does not exceed the value given in [Technical Data](#) on page 37.
- Make sure to comply with the following data:
 - Electrical voltage between 0.9 and 1.1 nominal voltage
 - For units with the THD filter, electrical voltage between 0.9 and 1.05 nominal voltage.
 - Frequency between 0.95 and 1.05 the nominal frequency
 - Voltage unbalance of supply voltage less than 5%

See **Figure 9.1** below for variability evaluation.

Figure 9.1 Example of Calculating Phase to Phase Variability

<p>1. The 460 V supply has the following variability: $RS = 458 \text{ V}$ $ST = 461 \text{ V}$ $RT = 462 \text{ V}$</p> <p>2. The average voltage is: $\frac{458 + 461 + 462}{3}$</p> <p>3. The maximum deviation from the average is: $462 - 460 = 2 \text{ V}$</p> <p>4. The phase to phase variability is: $\frac{2}{460} \times 100 = 0.43 \text{ (acceptable)}$</p>	
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The following table lists the relevant documents by number and title.

Table 9.1 Electrical Field Connection Drawings

Document Number	Title
DPN005242	Electrical Field Connections PW035-170
Downflow Units	
60051954	Electrical Field Connections PW035-040
60051995	Electrical Field Connections PW170
60051895	Electrical Field Connections PW095-110
60051884	Electrical Field Connections PW145
60051836	Electrical Field Connections PW070-080
60050461	Electrical Field Connections PW045-060 PIP
Upflow Units	
60052106	Electrical Field Connections PW070-080U
60052091	Electrical Field Connections PW045-060U
60052088	Electrical Field Connections PW035-040U

Table 9.1 Electrical Field Connection Drawings (continued)

Document Number	Title
60052087	Electrical Field Connections PW095-110U PIP
Unit-to-Unit Networking	
10030066	iCOM3 Unit-to-Unit Network Connections
Misc. Electrical Options	
DPN005245	Remote T&H Sensors
DPN005212	THD Mitigation

9.2.3 High and Low Voltage Cable Connections

Downflow High and low Voltage Cable Pathway

The High and Low Voltage cables must not touch hot surfaces. If necessary, wrap the electrical cables with a thermal insulating sheath.

Do not fit the supply cable in the raceways inside the electric panel. The electrical cables must pass through the unit shoulder: the power cable on left and sensor/alarms cable on the right.

- The connection for remote ON-OFF must be done by the installer.
- The general alarm terminals allow remote alarm signaling.

Standard Power Supply or Dual Power Supply

1. Open the front door to access the electrical panel and the internal safety panels.
2. Open the electrical panel dead-front door.
3. Remove the frontal panels or frontal grids from the fan module.
4. Run the power cable from the bottom through the precut in the fan module.
5. Use appropriate cable ties to fix the cable to the frame on the left shoulder.
6. Connect the power cable to the inlet terminals.
7. Replace all the panels removed for the cable connection:
 - The electrical panel cover
 - The fan electrical connection cover inside the fan module
 - The panels or grids removed from the fan module
8. Make sure not to damage the electrical cable between the panels and the unit.

9.2.4 Check Integrity

- Make sure that all electrical connections are tightened to the correct torque.
- Make sure that all electrical components are undamaged.

If the unit is provided with ATS, then the procedure is the same as for a standard power supply, but there are two power cables (4 + 4 cords) to be connected to the inlet terminals of the ATS panel.

9.2.5 Low Voltage Wiring

1. Run the signal cable through the precut on the right shoulder of the frame.
2. For details about the cable entrance holes see **Table 9.1** on page 71.
3. Use appropriate cable ties to fix the cable to the frame on the left shoulder.
4. Restore the original protection degree with suitable accessories for the wiring and junction boxes.
5. Be sure to allow enough slack to allow the EP section to swing out.

Refer the electrical connections described in the submittal documents included in the [Submittal Drawings](#) on page 127.

9.2.6 Supply Air Temperature Sensor

The supply temperature sensors should be installed in an area that is influenced only by the unit it is connected to. The supply sensor should be 5 -15 ft (1.5-4.5 m) from the cooling unit to provide an accurate reading for the control.

The sensor has already been installed in the unit and it is fixed in the fan module with at least 16 ft (5 m) of cable length available. Remove the stripe and place it according the drawing.

NOTE: To grant a proper unit regulation, install the sensor according the drawing. Vertiv is not responsible in case of improper installation.

Figure 9.2 Supply Air Temperature Sensor Downflow Unit

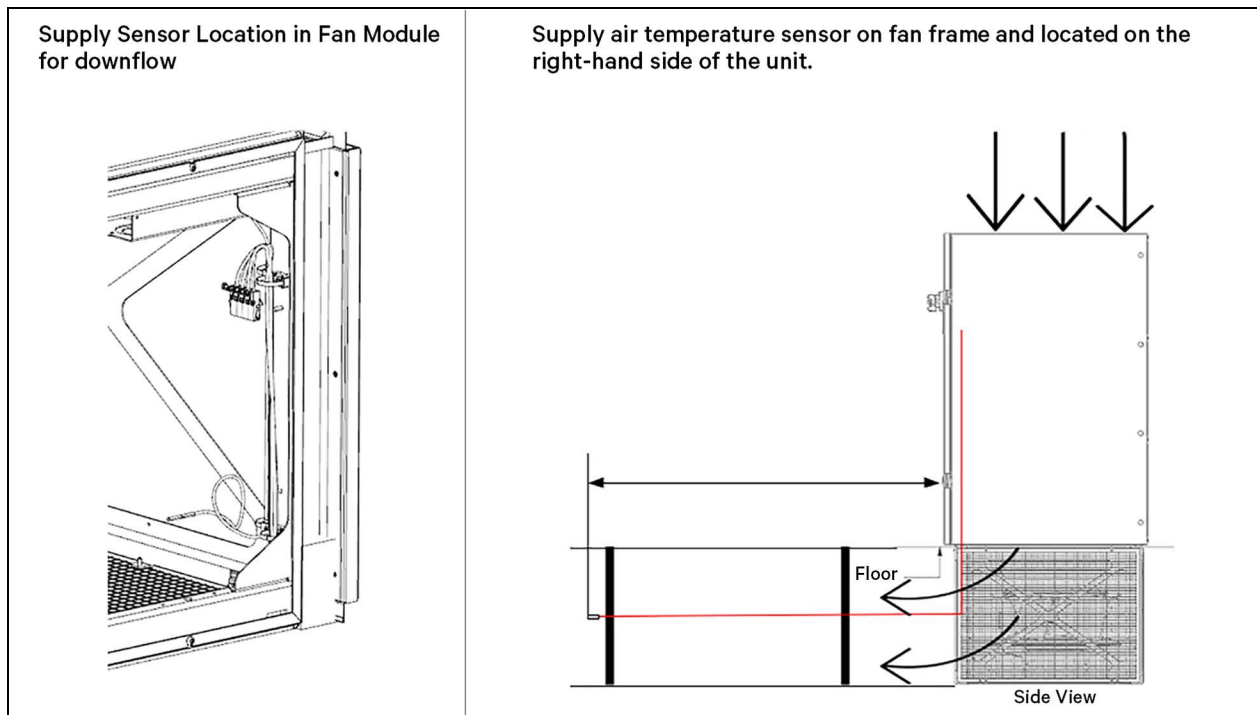
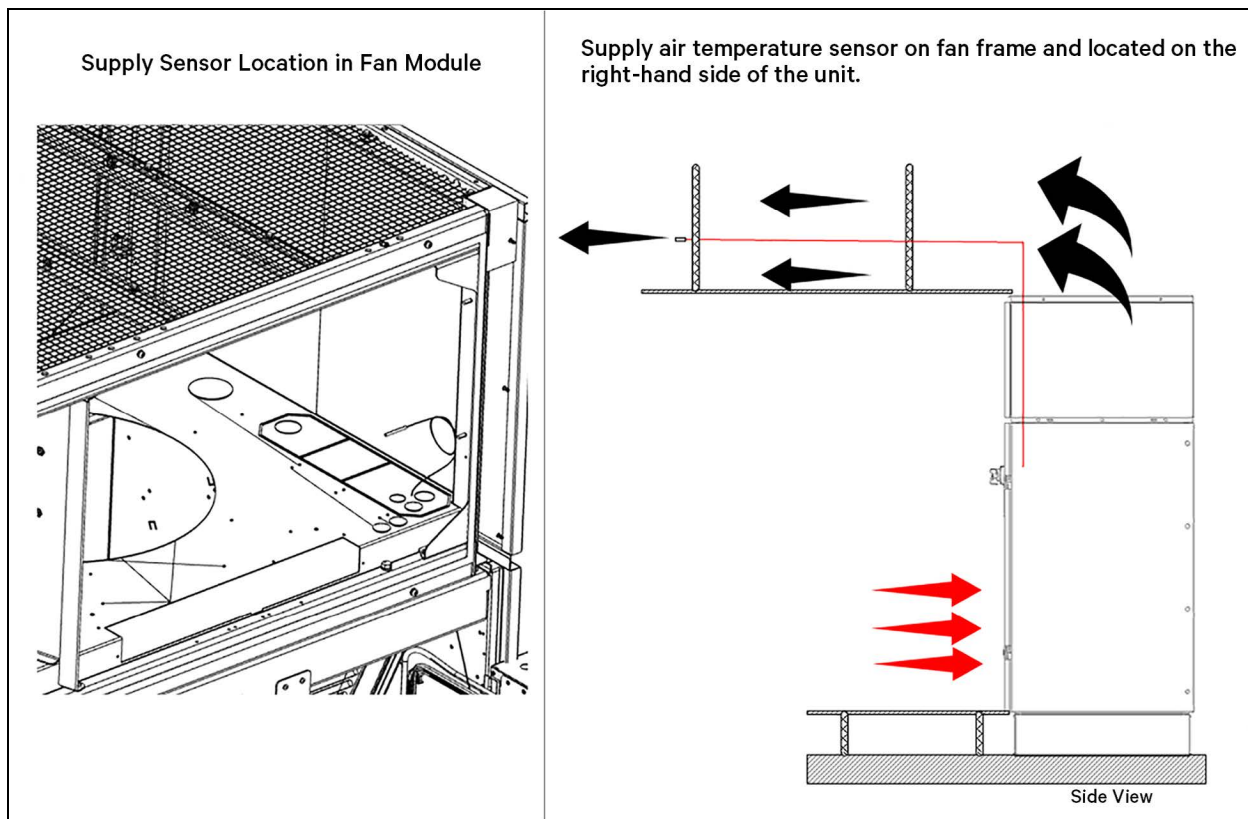


Figure 9.3 Supply Air Temperature Sensor Upflow Unit



9.3 Electrical System Requirements

9.3.1 Power Supply Requirements for the Unit

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: Units with the THD filter option must have the voltage stabilized and regulated to +5%, -10% of the nameplate nominal voltage.

- Check the electrical data on the label applied on the unit.
- Check that the available power supply is consistent with the unit power requirements given in [Technical Data](#) on page 37.
- Refer to the electrical schematic supplied with the unit when making line voltage supply, low voltage main unit interlock, and any low voltage alarm connections.

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

9.3.2 Protection

- Select and install the line side electrical supply wire and over current protection device(s) according to the specifications on the unit nameplate(s), per the instructions in this manual, and according to the applicable national, state, and local code requirements.
- The customer is responsible for the system protection.

Acceptable:

- Wye with solidly grounded neutral (266 V line to ground)
- DELTA with corner ground.

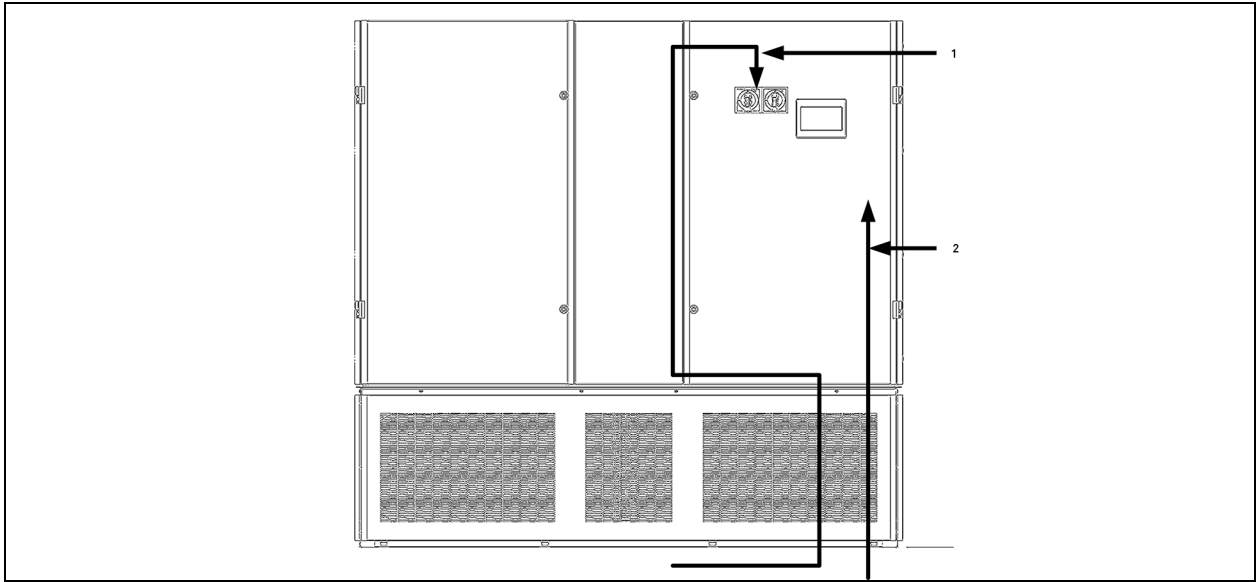
Unacceptable:

- Wye without ground connection
- DELTA without ground
- DELTA with center tap

For more detailed information look at electrical connection submittal drawings, **Appendix B:** on page 127.

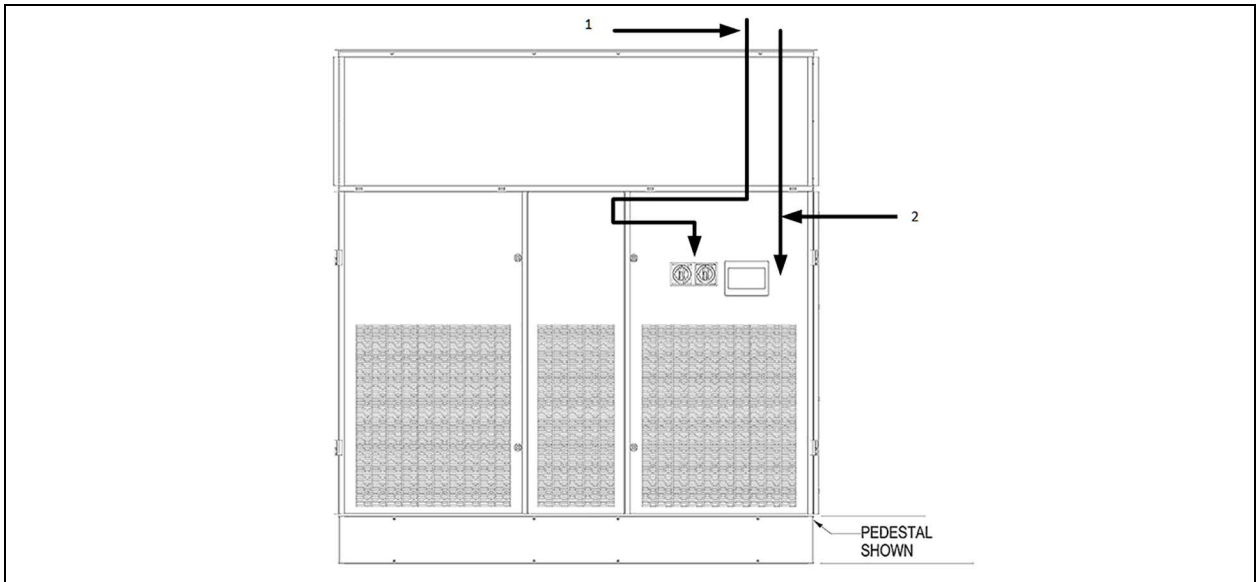
9.3.3 Cable Connections

Figure 9.4 Downflow Cable Connections



Item	Description
1	Power cable
2	Sensor/alarms cable

Figure 9.5 Upflow Cable Connections



Item	Description
1	Power cable
2	Sensor/alarms cable

- Do not fit the supply cable in the raceways inside the electric panel. The electrical cables must pass through the unit shoulder; the power cable on the left and sensor/alarms cable on the right. See **Figure 9.5** on the previous page
- The connection for remote ON-OFF must be done by the installer.
- The general alarm terminals allow remote alarm signaling.

9.3.4 Check Integrity

- Make sure that all electrical connections are tightened to the correct torque.
- Make sure that all electrical components are undamaged.

9.3.5 Hot Surfaces

- The cables must not touch hot surfaces. If necessary, wrap the electrical cables with a thermal insulating sheath.

9.4 Power Supply Cable

9.4.1 General instructions

1. After opening the passage in the structural works (precut) for the supply line inlet, restore the original protection degree with suitable accessories for the wiring and junction boxes.
2. Install the cable, carefully avoid touching hot surfaces.
3. After connecting the cable, restore the protections against direct contacts.
4. The system/line cable protection is to be arranged by the customer.
5. For details about the cable entrance holes see **Figure 9.5** on the previous page.

9.4.2 Contacts for the Unit Status Signals

1. Run the signal cable through the precut on the right shoulder of the frame.
2. For details about the cable entrance holes.
3. Use appropriate cable ties to fix the cable to the frame on the left shoulder.
4. Restore the original protection degree with suitable accessories for the wiring and junction boxes.
5. Be sure to allow enough slack to allow the EP section to swing out.

The dry contacts can be used only with Class 2 sources.

For more detailed information look at electrical connection submittal drawings, [Submittal Drawings](#) on page 127.

9.4.3 Sensors Connections

Any remote or additional sensor must be connected to the unit via [Modbus Connections and Settings](#) on page 110.

9.4.4 Fan Management

Speed Control

The fan speed can be managed in one of the following ways:

Table 9.2 Fan Speed Management

Return Sensor	The fan speed is modulated from minimum value to maximum value following the return temperature deviation.
Supply Sensor	The fan speed is modulated from minimum value to maximum value following the supply temperature deviation.
Remote Sensor	The fan speed is modulated from minimum value to maximum value following the remote temperature deviation.
Delta (temperature difference)	<p>The control tries to achieve a fixed temperature difference between return temperature and supply temperature.</p> <p>When the temperature difference is inside the deadband the fan speed will not change.</p> <p>When the temperature difference is outside the deadband the control will change (increasing or decreasing) the speed of the fan to try to put the temperature difference inside the deadband.</p> <ul style="list-style-type: none"> • If the temperature difference Return-Supply is lower than the difference setpoint, then the fan will decrease the speed. • If the temperature difference Return-Supply is higher than the difference setpoint, then the fan will increase the speed.
Static Pressure	<p>The speed of the fans are modulated in order to keep fixed the static pressure in the raised floor.</p> <p>When the pressure is inside the deadband the fan speed does not change; when the pressure is outside the deadband the control increases or decreases the speed of the fan trying to put the pressure inside the deadband.</p>
Return CW Priority	The CW valve modulates from 0% and 50% of the call for cooling based on return temperature. The fan speed modulates from 50% and 100% of the call for cooling based on return temperature. This means the fan starts to modulate only when the CW valve is fully open.
Fixed Speed	During normal operation the fan will operate at the fixed speed set.

Fan Speed Override

The fan speed can be limited or overwritten in the following cases:

Table 9.3 Fan Speed Override

High Temperature Alarm	The fan will run at defined speed. This feature can be enabled or disabled.
No Power	The fan will run at defined speed.
Modbus High Speed Operation	If enabled, in the case of single fan failure or single fan communication failure, (or up to N-1), the remaining fans will be forced to maximum speed.
Fan and cooling forcing by user (cool/fan 100%)	The fan will run at 100%.
Heating ON Humidification ON Dehumidification ON	The fan will run at defined speed. If a higher call for fans speed occurs, the fan will operate at the higher call.
Control Sensor Failure	<p>Teamwork Mode:</p> <ul style="list-style-type: none"> • Return, Return CW Priority, Remote or Static Pressure Control: The fan will work using the system value. • Supply or Delta: The fan will run at defined speed. If a higher call for fan speed occurs, the fan will operate at the higher call. <p>No Teamwork Mode:</p> <ul style="list-style-type: none"> • The fan will run at defined speed. If a higher call for fan speed occurs, the fan will operate at the higher call.

10 Piping Requirements



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 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 the tubes. Keep unit switched On and water/ coolant fluid-supply circuit system operating continuously. In multiple unit teams, allow standby units to enter the rotation automatically or schedule regular manual rotations.

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 obstruction 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 services practices can result in water leakage from the unit. Water leakage can result in catastrophic and expensive building and equipment damage and loss of critical data center equipment.

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

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

NOTICE

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

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

Install a monitored, fluid-detection system that is wired to activate the automatic closer 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 catastrophic fluid leak.

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

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

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

The pipe connection locations, piping general arrangement and schematics are described in the submittal documents included in the [Submittal Drawings](#) on page 127.

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

Document Number	Title
60029159	Piping Schematic PCW035-170
Downflow Units	
60051954	Connection Locations PW035-040
60051995	Connection Locations PW170
60051895	Connection Locations PW095-110
60051884	Connection Locations PW145
60051836	Connection Locations PW070-080
60050461	Connection Locations PW045-060
Upflow Units	
60052106	Connection Locations PW070-080U
60052091	Connection Locations PW045-060U
60052088	Connection Locations PW035-040U
60052087	Connection Locations PW095-110U
Condensate Pump	
60029157	Downflow Condensate Drain
60029158	Upflow Condensate Drain

10.1 Chilled Water Requirements

10.1.1 Analyze the Water

It is the user's responsibility to establish the quality of the water and make sure that this is compatible with the materials used in the exchangers.

The quality of water may significantly affect the operation and the life of the exchangers.

The first step in planning the treatment water is chemical analysis, which must be performed by qualified personnel from specialist organizations.

Prepare the piping for connecting the main unit according to the specifications.

Material - Use copper tubing.

Relieve pressure through the access valve before working on, cutting into, disconnecting joints or removing components of the coil or piping system.

Connections - Cut the tube ends and braze to on-site chilled water piping.

10.1.2 Thermal insulation

Wrap the piping by using thermal insulating material such as Armaflex.

10.1.3 Piping Layout

Prepare the external piping as following:

- 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 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 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.
- It is advisable to install a thermometer and a manometer on the unit inlet and outlet.
- Install a drain valve at the lowest point in the circuit.
- Place the piping on supporting brackets.
- Insulate both pipes using Armaflex insulation.

10.1.4 Water Supply Requirements



WARNING! Risk of improper piping installation, leak checking, fluid chemistry, and fluid maintenance can cause equipment damage and personal injury. Installation and service of this equipment should be done only by qualified personnel who have been specifically-trained in the installation of air-conditioning equipment and who are wearing appropriate, OSHA-approved PPE.

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

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

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

Fluid chemistry varies greatly as do the required additives, called inhibitors, that reduce the corrosive effect of the fluids on the piping systems and components.

The chemistry of the coolant fluid used must be considered, because some sources may contain corrosive elements that reduce the effectiveness of the inhibited formulation. Sediment deposits prevent the formation of a protective oxide layer on the inside of the coolant system components and piping. The coolant fluid must be treated and circulating through the system continuously to prevent the buildup of deposits and/or growth of sulfate reducing bacteria. Proper inhibitor maintenance must be performed to prevent corrosion of the system.

Consult fluid manufacturer for testing and maintenance of inhibitors.

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

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

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.

NOTE: The following instructions refer to both chilled water and hot water.

10.2 Piping Layout

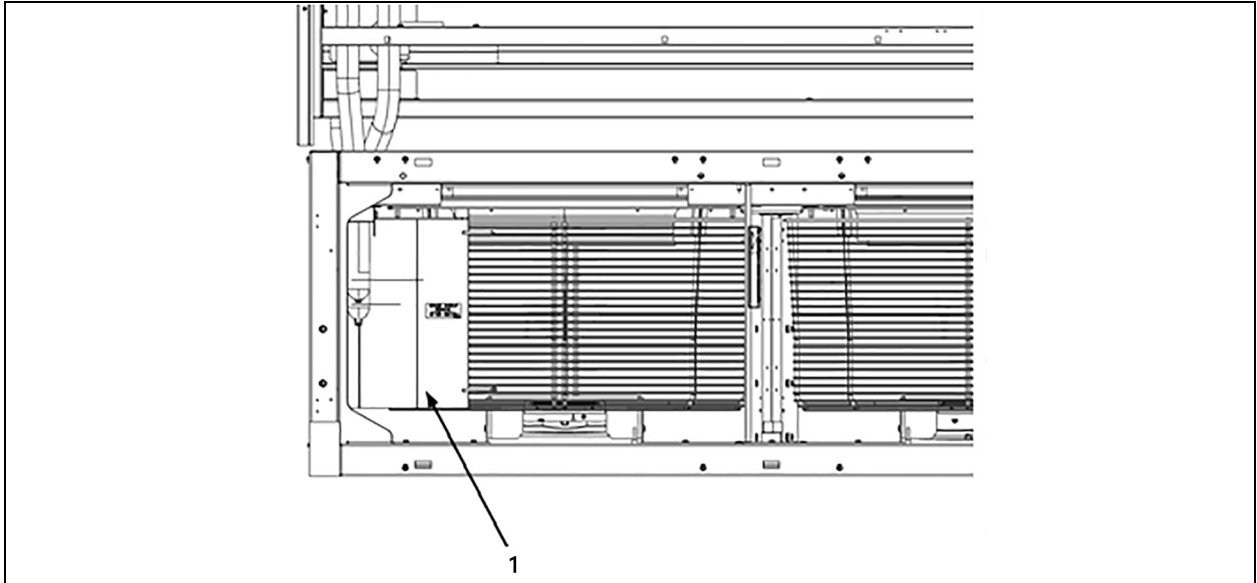
Prepare the External Piping as follows:

10.2.1 General Installation Instructions

Connections	The inlet and outlet directions are clearly marked with labels and arrows on the respective pipings. Pay attention to follow the directions.
Keep clean	<ul style="list-style-type: none"> Keep the piping clean and dry. Make sure that the surfaces to be brazed are clean and that the ends of the tubes have been carefully reamed to remove any burrs. Ensure that all loose material has been cleaned from inside the tubing before brazing.
Brazing	<p>NOTE: When copper is heated in the presence of air, copper oxide forms.</p> <ul style="list-style-type: none"> Connect the chilled water inlet and outlet piping per unit piping submittal drawing. Use copper piping with a brazing alloy with a minimum temperature of 1,350°F (732°C), such as Sil-Fos. Avoid soft solders such as 50/50 or 95/5. 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 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 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.
Piping layout	<ul style="list-style-type: none"> Keep the piping as short as possible. This helps to minimize the pressure drops. Avoid bends as much as possible. Make bends with large radius (bending radius at least equal to the pipe diameter). For hard copper piping use preformed curves. You may bend soft copper piping by hand or by using a bending tool. Support both the horizontal and the vertical piping by vibration dampening clamps that include rubber gaskets. Place the clamps every .06-.08 in. (1.5-2 mm).

Insulate both pipes using Armaflex insulation.

Figure 10.1 General Connection Location on Chilled Water Unit (Downflow)



Item	Description
1	Installation brazed shield

10.3 Leak Checking for Unit and Field Installed Piping

The fluid systems in the Vertiv™ Liebert® CW are factory-checked for leaks and may be shipped with an inert-gas holding charge. At installation, check all fluid circuits for leaks.

10.3.1 Gravity Drain Connection

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.

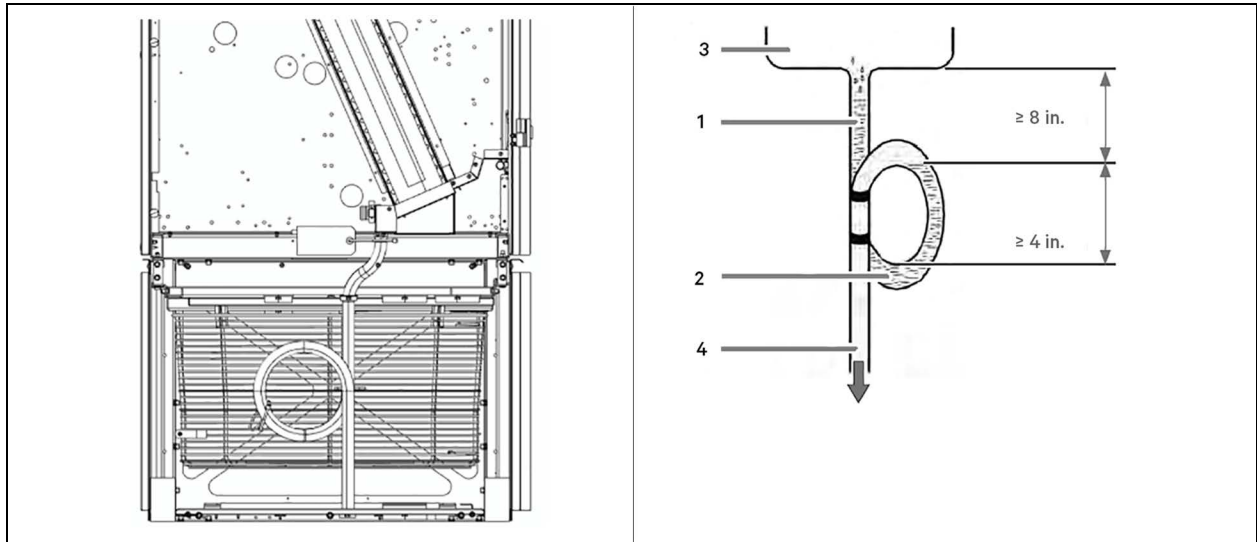
Sagging condensate drain lines may inadvertently create an external trap.

1. Take the flexible pipe coming out of the drain pan. See appendix.
2. Make a drain trap on the hose, placed at least 7.9 in. (200 mm) below the drain tray and with a minimum height of 4 in. (100 mm) as shown in the **Figure 10.2** on the facing page .
3. Connect the hose outlet to the on-site drainage system.
4. In the upflow configuration units, the drain trap must placed under the unit, in the raised floor.
5. To avoid spraying the condensate, fill the drain trap with water before start-up.

NOTE: If the drain trap is done inside the fan module in the downflow units, attach the hose and the drain trap properly to the fan module frame using cable ties/brackets, to avoid the risk of contact with fans.

NOTE: Downflow units contain a factory installed condensate trap. Do not trap external to the unit. Upflow units do not contain a factory installed condensate trap. Trap external to the unit.

Figure 10.2 Condensate Drain



Item	Description
1	Flexible pipe
2	Drain trap
3	Drain tray
4	Hose outlet

10.3.2 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:

- Do not reduce drain lines.
- 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

10.3.3 Field Installed 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.



CAUTION: Risk of contact with sharp edges and exposed fasteners. Can cause injury. Use only qualified HVAC installation personnel to install block-off kit. Wear appropriate OSHA approved personal protection equipment (PPE) while installing this EC fan front block off kit to prevent injury.

Contact your local sales representative or technical support if you have any questions or problems during installation. Visit <https://www.Vertiv.com/en-us/support/> or call 1-800-543-2778 for contacts.

The condensate pump package ships external to the main unit and must be field installed before the unit is set in place. See **Figure 10.3** below for the Condensate pump curve.

Figure 10.3 Condensate Pump Curve

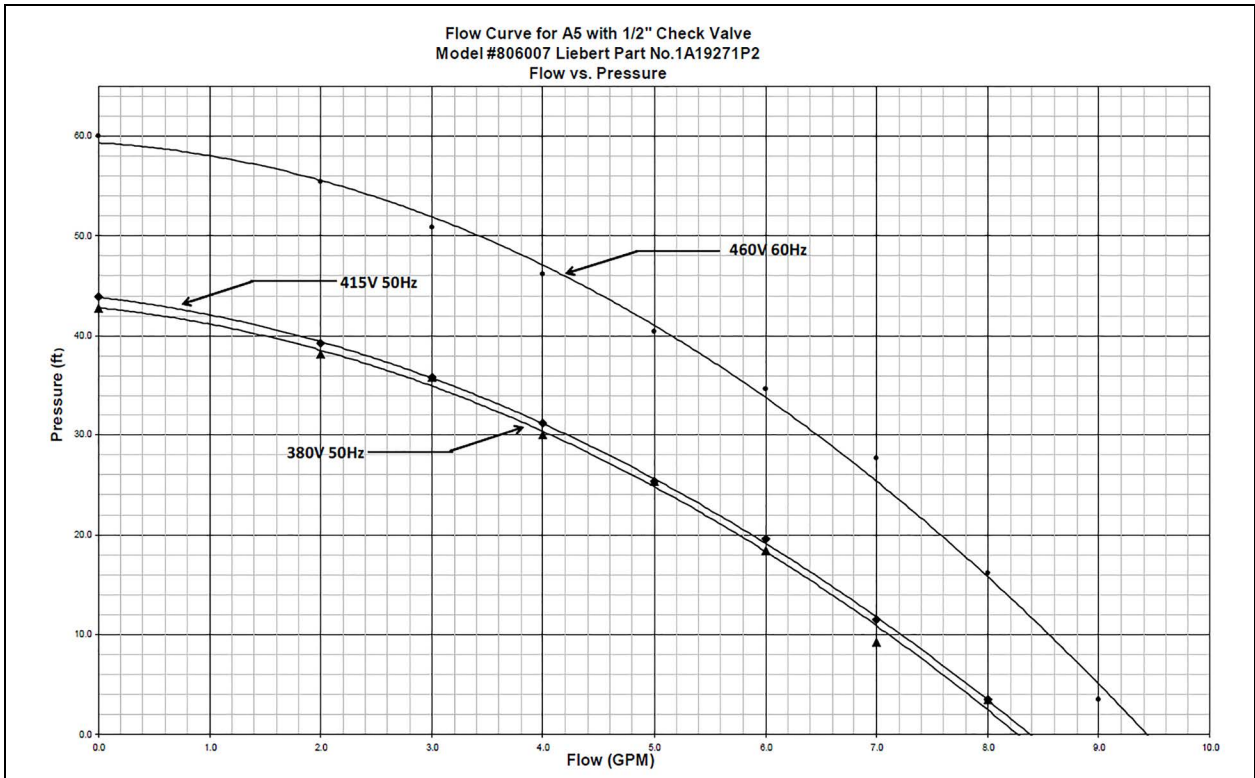


Table 10.1 Condensate Pump and Gravity Drain Line Position

Document Number	Description
60029157	Downflow Condensate Drain
60029158	Upflow Condensate Drain

10.4 Condensate Pump Installation

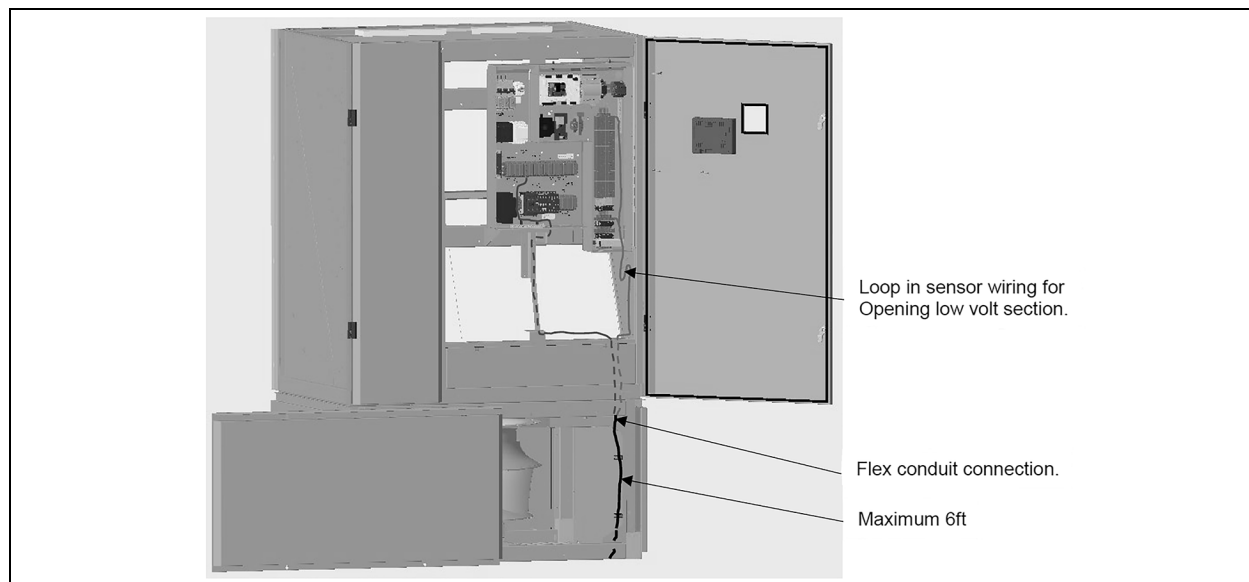
1. The condensate pump package will include the pump with wires and a length of 3/8 in. flex with conduit fittings. The pump location should be positioned to limit the length of the flex conduit at 6 ft. or less. See **Figure 10.4** below.
2. Feed the pump wires through the flex and connect the flex to the pump using the compression fitting on the pump.
3. Connect the other end of the conduit to the knockout provided in the sheet metal of the unit using the provided conduit fitting. A knockout reducer may be needed.
4. Route the power (brown) and ground (green) wires to the high voltage section.
5. Route the float sensor wires (purple) to the low volt section.

NOTE: Provide a loop in the sensor wires to allow the low volt section to swing out.

See **Figure 10.4** below.

Reference **Table 9.1** on page 71.

Figure 10.4 Wiring



6. Wire the brown power wires to the fuse holders labeled Condensate Pump. The fuses will need to be removed to tighten the wires to the torque value of 20 lb-in.
7. Remove the terminal ring on the green ground wire and strip to a 3/8 in. length. Connect the wire to the ground bar in the high voltage section. Tighten to the torque of 35 lb-in.
8. Connect one of the condensate sensor purple wires to terminal labeled 24B. It is located at the top of the terminal assembly.

9. Connect the other purple wire to the terminal labeled 197 located at the bottom of the terminal assembly beside the CPAR relay.

10.5 Condensate Drain Line Connection Recommendations

NOTICE

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

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

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

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 on downflow units. 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.

1. Units will contain multiple drain lines. All drain lines must be sloped toward the condensate pump with a minimum of 1/8 in. per 1 ft. length.
2. Verify there are no kinks or collapsed sections in the hose. Do not bend the hose more than a 50° angle.

Document Number	Description
60029157	Downflow Condensate Drain
60029158	Upflow Condensate Drain

3. Connect the drain hose from the unit to the 3/4 in. barb located at the top of the pump.
4. The condensate pump discharge is provided with a 1/2 in. copper sweat connection for connecting to the building drain.
5. Observe the following requirements when installing and routing the drain line.
 - a. The drain line must be located so it will not be exposed to freezing temperatures.
 - b. Size the piping based on the available condensate head.
 - c. On **downflow and upflow units**, the drain is trapped internally. Do not externally-trap the drain line on **downflow** units.
 - d. The drain line must be rigid enough that it does not sag between supports, which unintentionally creates traps.
 - e. We recommend installing monitored, under-floor leak-detection equipment.

Technical information about pump will be shipped with the unit.

Figure 10.5 Condensate Pump Curve



10.5.1 Condensate Piping Requirements

Follow local code.

The condensate pump is field installed.

Prepare the piping for connecting the unit to the condensate drain system according to the following specifications.

Table 10.2 Piping Connection Requirements

	Without Condensate Pump	With Condensate Pump (optional for upflow units)
Material	PVC or flexible polythene tubing	½ in. copper sweat connection
Connections	Hose barb	The units are provided with smooth pipe stubs, ready for the connection by brazing.
Piping Layout	The drain pipe must have at least a 2% gradient from the unit outlet to the connection to the site drainage system.	Maximum discharge total head allowed 9.84 ft. (head and hydraulic connection loss). The final drain must be able to receive .264 gpm water at high temperature (max water temperature 100 °C).

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11 Checklist for Completed Installation

NOTE: Follow these instructions at first start-up and also in case of restart after a long stop.

NOTE: Record the functional data on the Start-Up certificate.

11.1 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.

11.2 Piping Installation Checks

1. Piping completed to coolant loop.
2. Piping has been leak-checked.
3. Piping has been flushed to clear debris, pipe dope, and contaminants.
4. Check piping inside and outside of equipment for proper support and adequate spacing to prevent rub through.
5. Ensure that factory clamps have been reinstalled.
6. Drain line connected, not obstructed, and pitched per local code.
7. Water supply line connected to humidifier and not leaking.
8. Condensate drain connected.
9. Condensate pump, if applicable, is operational.

11.3 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. All fans are free of debris.
6. Remove rubber band from float in optional infrared humidifier.
7. Seal openings around piping and electrical connections.
8. Installation materials and tools have been removed from equipment (literature, shipping materials, construction materials, tools, etc.).
9. Locate blank start-up sheet, ready for completion by installer or start-up technician.

11.4 Electrical System

1. Supply voltage and phase matches equipment nameplate.
2. Power wiring connections completed to the disconnect switch and unit.
3. Power line circuit breakers or fuses have proper ratings for equipment installed.
4. All internal and external high- and low-voltage wiring connections are tight.
5. Confirm that unit is properly grounded to an earth ground.
6. Control transformer setting matches incoming power.
7. Electrical service conforms to national and local codes.
8. Check blowers and compressors for proper rotation.

11.5 Cooling System

1. Make sure that the condensate drain line is connected and not obstructed.
2. Make sure that all the factory clamps that secure the piping to the structure have been reinstalled (if removed during the installation).

11.6 Air System

1. Check that the unit fans are operating properly.
2. Check that all of the unit options that involve the air flow management.
3. Check that all of the temperature and humidity probes read a correct value.
4. Make sure that the humidifier supply and drain water connections are connected properly.
5. Check that the humidifier works properly.
6. Check that electrical heaters operate when required.

11.7 Safeguards

1. Make sure that all the safeguards (panels, grids) have been remounted.
2. Close and lock all the doors.
3. Place all the floor panels around and under the unit.

12 Troubleshooting

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.

Symptom	Possible Cause	Check or Remedy
The unit does not start.	No power supply to the unit.	Check voltage at the input terminal block.
	The circuit breaker or fuse for the low voltage transformer in unit is tripped.	Locate the problem in the unit electrical panel and repair.
	Remote On/Off	Check the remote switch.
	The local control switch is opened.	Check the local switch (green=On).
High vibration on the unit	The piping is not properly fixed.	Check the piping.
	Fans have debris on blades	Check fans.
A Modbus component is not read.	Wrong Modbus cabling.	Check the cabling.
	The address name is not correct.	Check the address.
The fans do not run.	The power cables are not connected.	Connect the cables.
	There is no signal.	Check the Modbus chain.
	The fuses are open.	Check fuses.
The unit is noisy.	The fan is noisy.	Check the fan mounting.
No humidification	Humidifier pan not filling.	Check the water supply.
		Check fill valve operation.
		Check drain stand pipe adjustment.
		Check for clogged water supply piping.
	Control not calling for humidity.	Check status on control.
Control calling but humidifier not starting.	Check visually.	
	If contact is made, check line voltage after contactor, fuses, and circuit breakers.	
Quartz lamp burned out.	Replace the quartz lamp.	
Loosened lead on old quartz lamp.	Trim excess lead length on new quartz lamp to avoid shorts.	

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13 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 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 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.

For downflow units installed on a raised floor:



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.

NOTE: Rotating elements, hot surface elements. If you need to remove the floor tiles within a distance of 33.4 in. (850 mm) from the unit, first disconnect the unit from the power supply.

13.1 Spare Parts

The use of original spare parts is recommended. Using third-party material can invalidate the warranty. When placing an order, refer to the Component List enclosed with the unit and quote the unit model and serial number.

NOTE: If you need to replace a component, carefully follow the manufacturer's instructions that come with the component.

NOTICE

If you need to weld a component, be careful not to damage other components (like gaskets, seals, and O-rings).

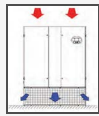
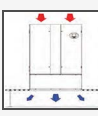
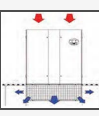
For downflow units installed on a raised floor:



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.

NOTE: Rotating elements, hot surface elements. If you need to remove the floor tiles within a distance of 33.4 in. (850 mm) from the unit, first disconnect the unit from the power supply.

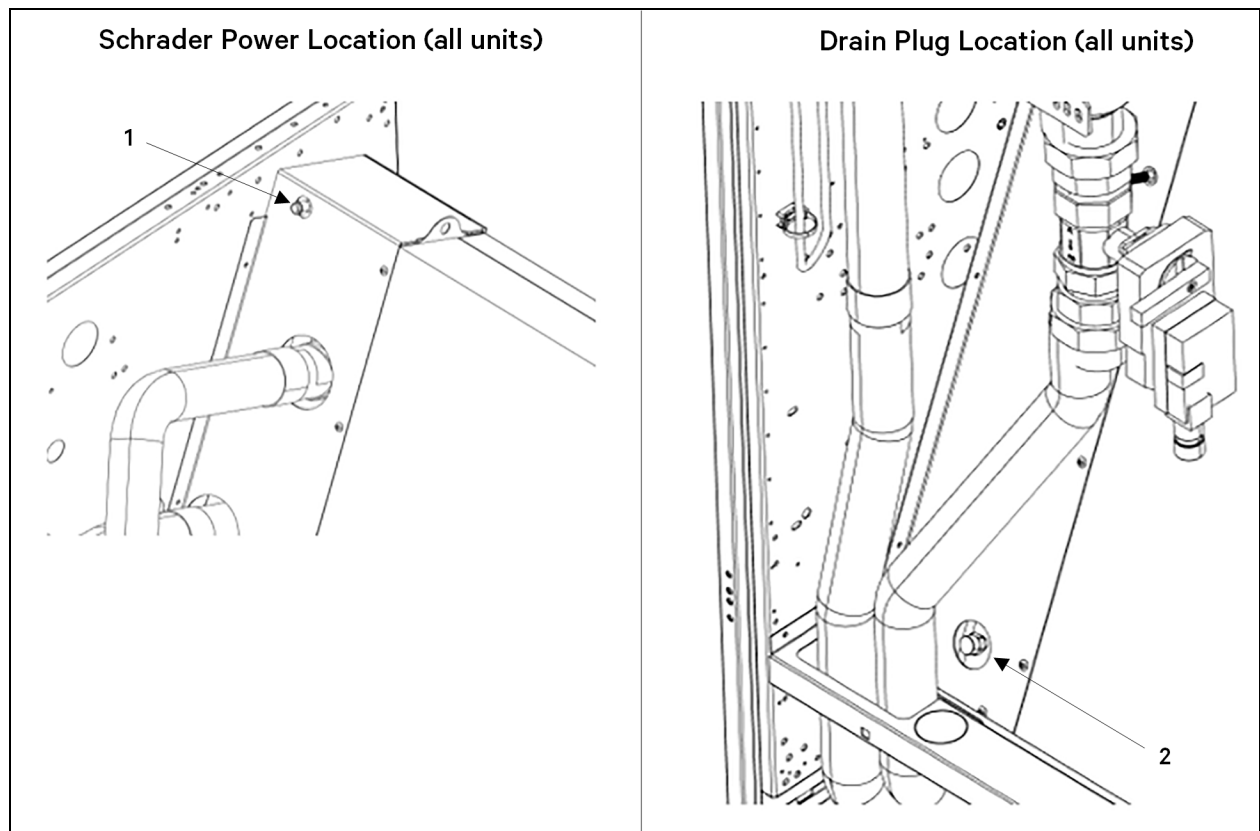
Table 13.1 Downflow Unit Configurations

Accessory	Purpose	H - Downflow Frontal	D - Downflow Up	E - Downflow Down
				
Legs Kit**	Support and Condensate drain/pump	N/A	R**	R**
Extended leg kit	Support and Condensate drain/pump	N/A	O**	O**
Floorstand	Support and Condensate drain/pump	O*	O**	O**
Pedestal	Support and piping chase and Condensate drain/pump	R*	N/A	N/A

13.2 Coil Drainage Port Location

13.2.1 Downflow and Upflow Unit

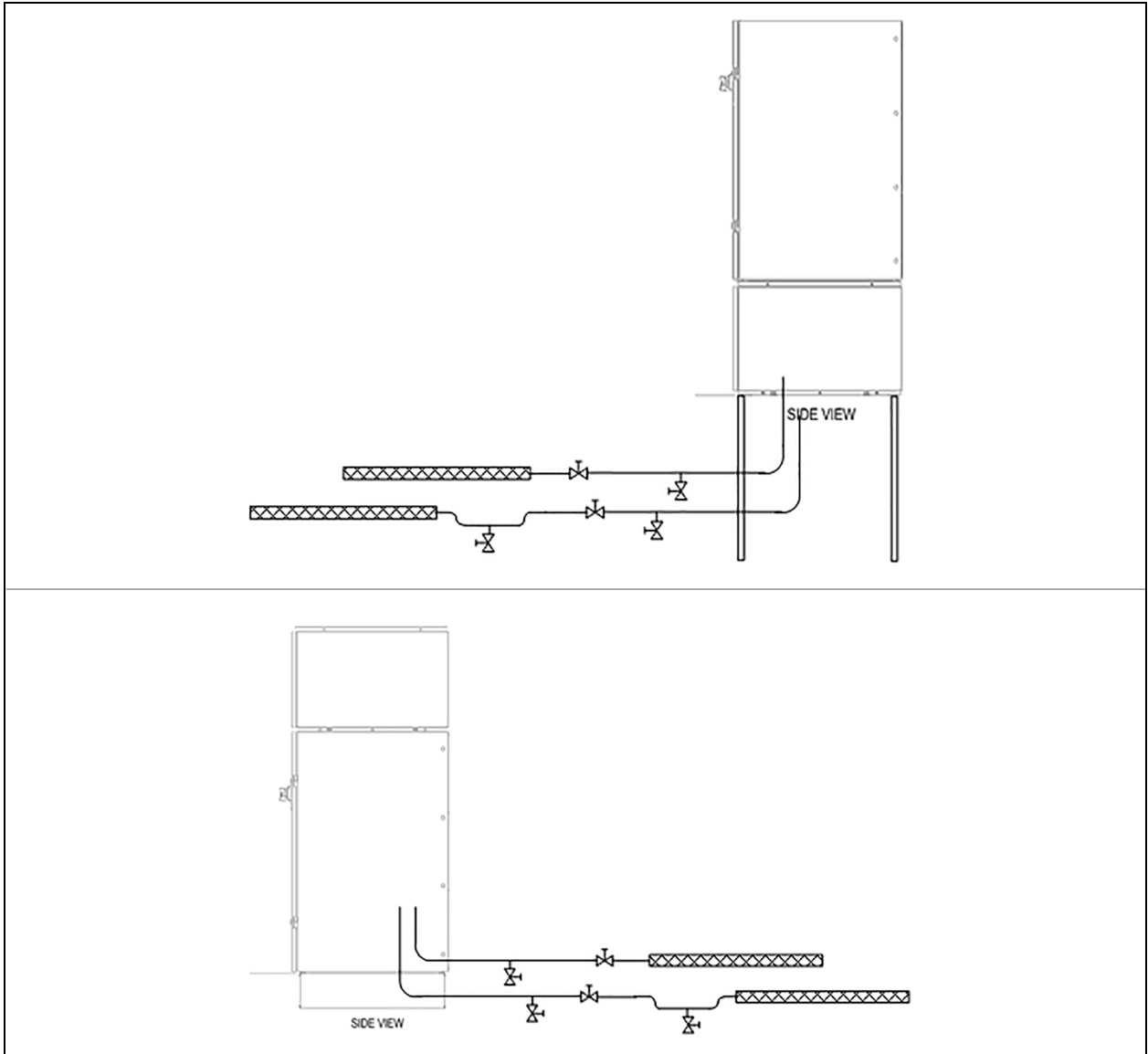
Figure 13.1 Schrader Port Location (all units) and Drain Plug Location (all units)



Item	Description
1	Vent valve on chilled water coil
2	Drain plug on coil

1. Close the shut-off valves on the water supply system upstream of the unit (building facility). See **Figure 13.2** below .
2. Open the drain plug. See **Figure 13.1** on the previous page .
3. Open the vent valves. See **Figure 13.1** on the previous page .
4. Keep the drain plug open until no more water flows out.

Figure 13.2 Shut-off Valves



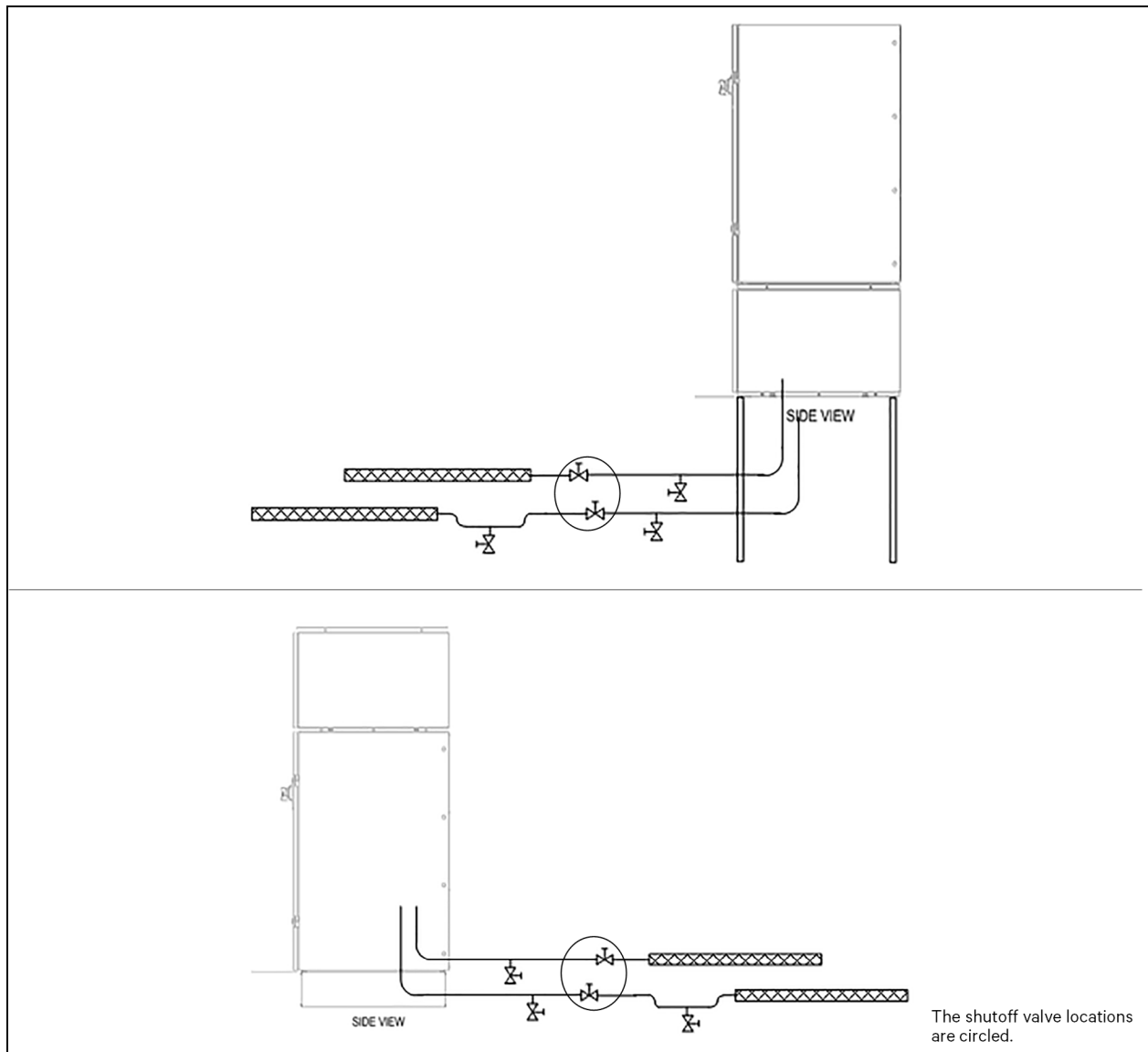
Item	Description
1	Shut-off valve

13.3 How to Drain a Unit

13.3.1 How to Drain a Unit Coil

1. Close the shut-off valves on the water supply system upstream of the unit (building facility). See **Figure 13.1** on page 97.
2. Connect to field supplied Hose Bib connection in the water supply and return line.
3. Open the vent valve. Reference Unit Piping Schematic submittal drawing in [Submittal Drawings](#) on page 127.
4. Keep the drain plug open until no more water flows out.

Figure 13.3 External Shut-off Valve Location and Drain Port



13.3.2 Replacing the Valve Actuator - 2/3 Way Valves

1. Close the external field supplied shutoff value on the supply of unit before working on the unit. Use the Coil drain port to drain unit if needed.
2. Turn off the unit by setting the disconnection switch of the unit to position "0".
3. Disconnect the 4 pin connector from the actuator.
4. Press the clutch button down and hold it in position by pressing the latch.
5. Manually turn the valve using the actuator handle until you reach the end stop.
6. To remove the actuator follow instructions included with the replacement.
7. To install new actuator it is necessary to set ring to end stop. Then proceed with steps 6 through 2 in this order.

13.3.3 Replacing the Air Filter

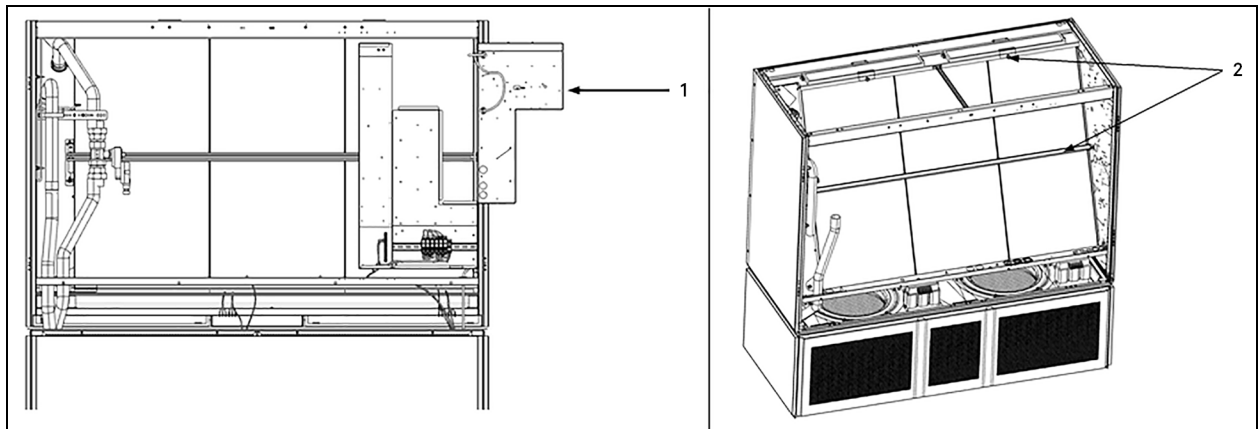
NOTICE

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

NOTE: Upflow filters require plastic frame to prevent moisture damage.

1. Turn off the unit by setting the disconnection switch of the unit to position "0".
2. Hinge low voltage open.
3. Uninstall filter tie down brackets.
4. Remove filter and then install new part into unit.
5. Reattach brackets and restore Low voltage EP oriental position.

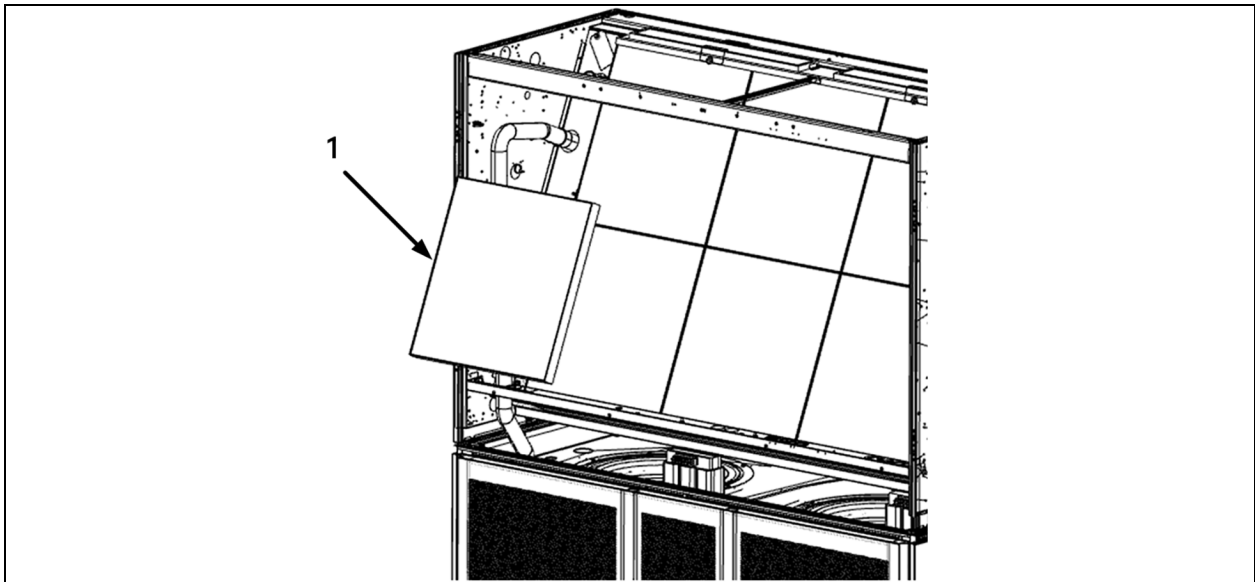
Figure 13.4 Air Filter Replacement Downflow Units (panels and internal components hidden)



See **Table 6.5** on page 45 for air filter sizes.

Item	Description
1	Flow Voltage Electrical panel
2	Filter tie down brackets

Figure 13.5 Filter



Item	Description
1	Filter

See **Table 6.3** on page 43 and **Table 6.4** on page 44 for air filter sizes.

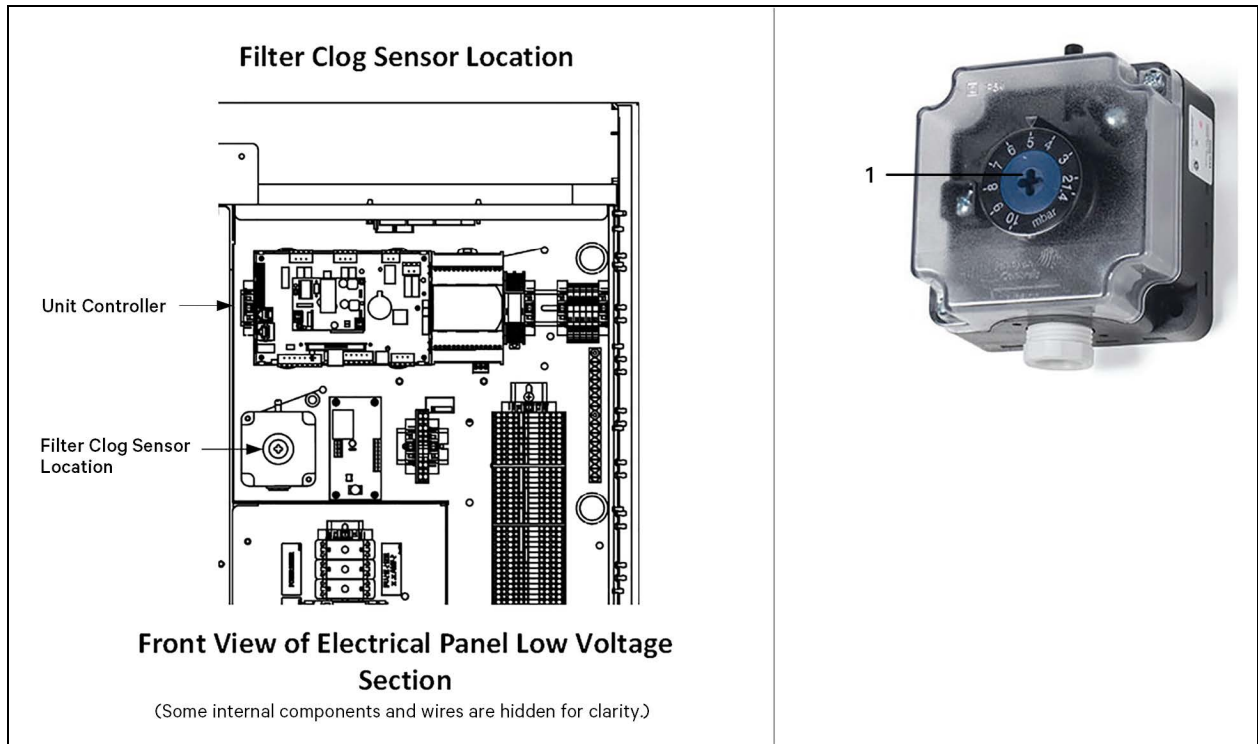
13.4 Clogged Filter Pressure Switch

Adjustment range: 0.5 – 4 mbar

Setting: 3 mbar (300 Pa)

To replace the clogged filter differential pressure switch, turn the screw to adjust the setting. See **Figure 13.6** below .

Figure 13.6 Clogged Filter Differential Pressure Switch

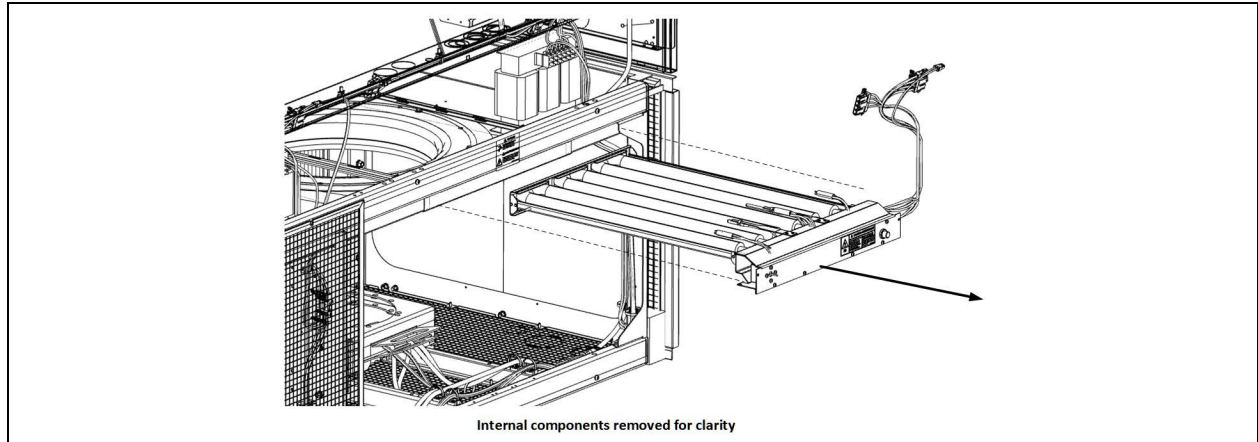


Item	Description
1	Adjustment screw

13.5 Replace Reheat

The device is located above each fan regardless of unit type. See **Figure 13.7** below for device location.

Figure 13.7 Reheat Compartment (Downflow unit shown below.)



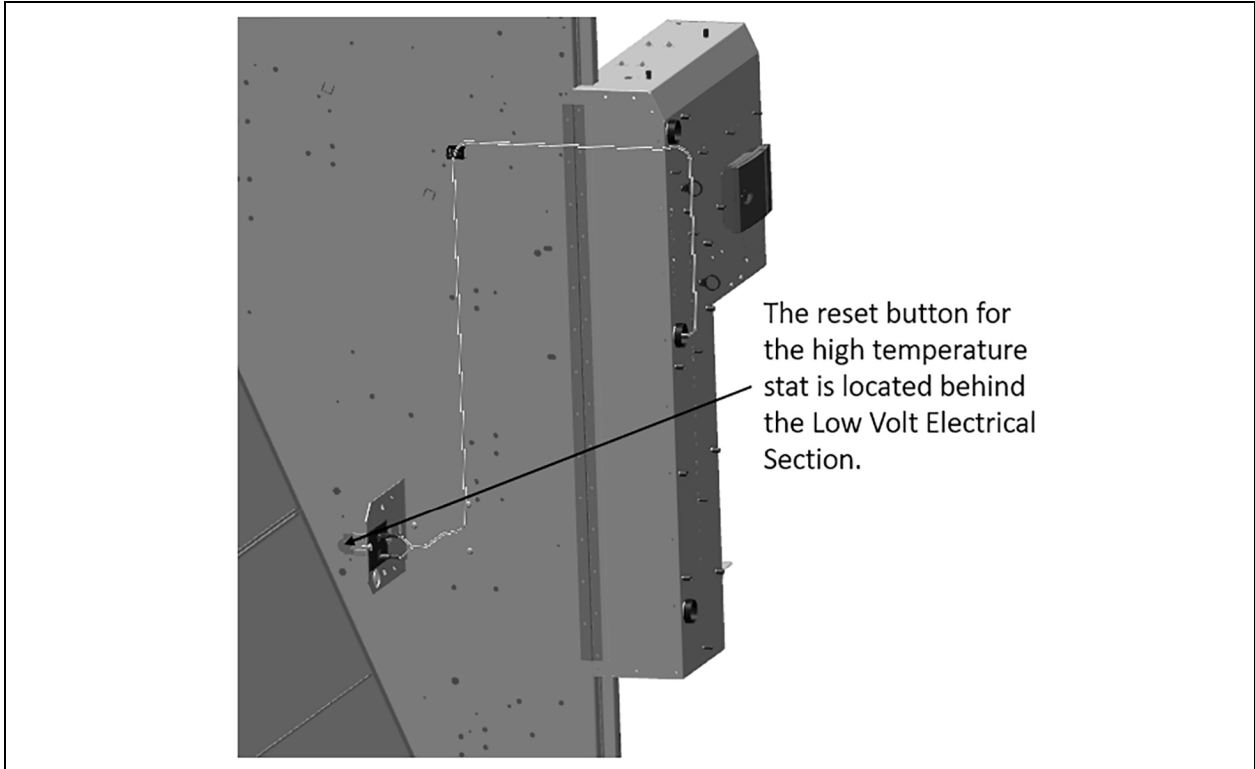
13.6 Temperature Safety Switch (if reheat option is present)

The device is manual reset and located behind the low voltage Electrical panel. See **Figure 13.8** on the next page for device location.

Setting: 125°F +/- 6°F

Manual reset

Figure 13.8 High Temperature Stat Reset Switch



13.6.1 Replacing a Fan



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

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

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



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

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



WARNING! Risk of contact with high-speed rotating fan blades. Can cause serious injury or death. Open all local and remote electric power-supply disconnect switches, verify with a voltmeter that power is off, and verify that all fan blades have stopped rotating before working in the unit cabinet or on the fan assembly. If control voltage is applied, the fan motor can restart without warning after a power failure. Do not operate the unit with any or all cabinet panels removed.

Do not operate upflow units without installing a plenum, 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 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 extremely heavy fan modules dropping downward suddenly. Can cause serious injury or death. Building and equipment damage may also result. Fan modules weigh in excess of 125-lb (56.7-kg) each. Support fan modules before removing mounting hardware. Use caution to keep all body parts out of the fan module pathway of movement during removal or repositioning. Only properly trained and qualified personnel should work on this equipment.

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



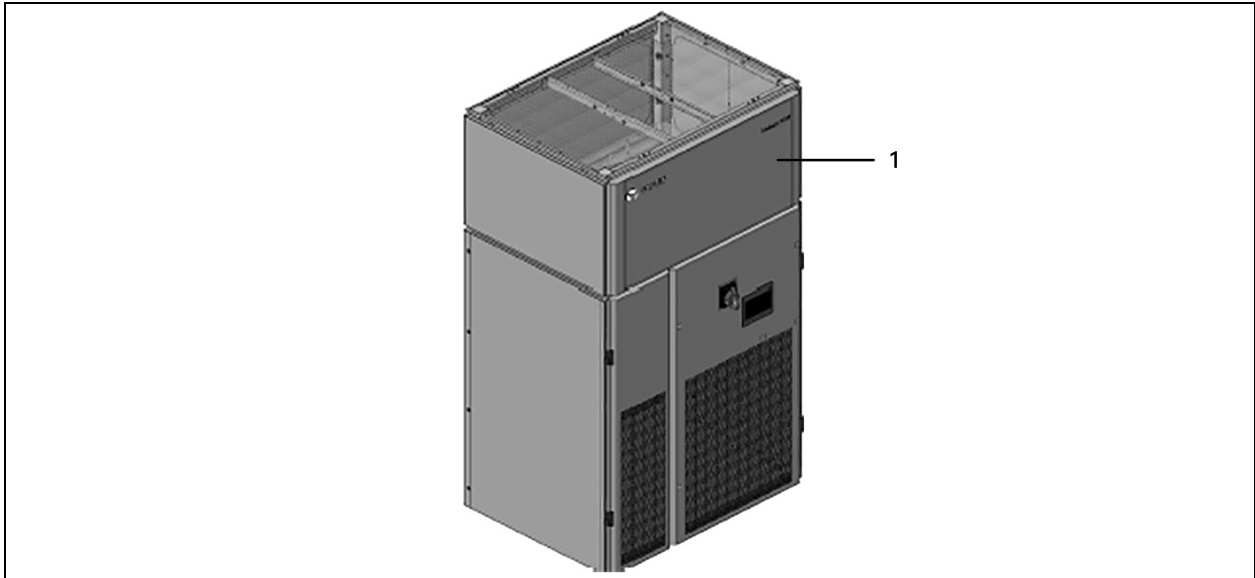
CAUTION: Risk of improper moving, lifting and handling. Can cause injury. Building and equipment damage may also result. Only properly trained and qualified personnel should work on this equipment. Evaporator fan modules weigh in excess of 125-lb (56.7-kg). Use proper lifting techniques and wear appropriate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

Refer to the fan manufacturer's instructions for transporting, handling, and mounting the fans. After reassembling, connect the fan to a laptop and use the configuration software provided by the manufacturer to set the fan Modbus address. (See [Setting Modbus Devices](#) on page 111 and the Liebert® PCW Control Application for details.)

13.6.2 Replacing a Fan - Upflow Units

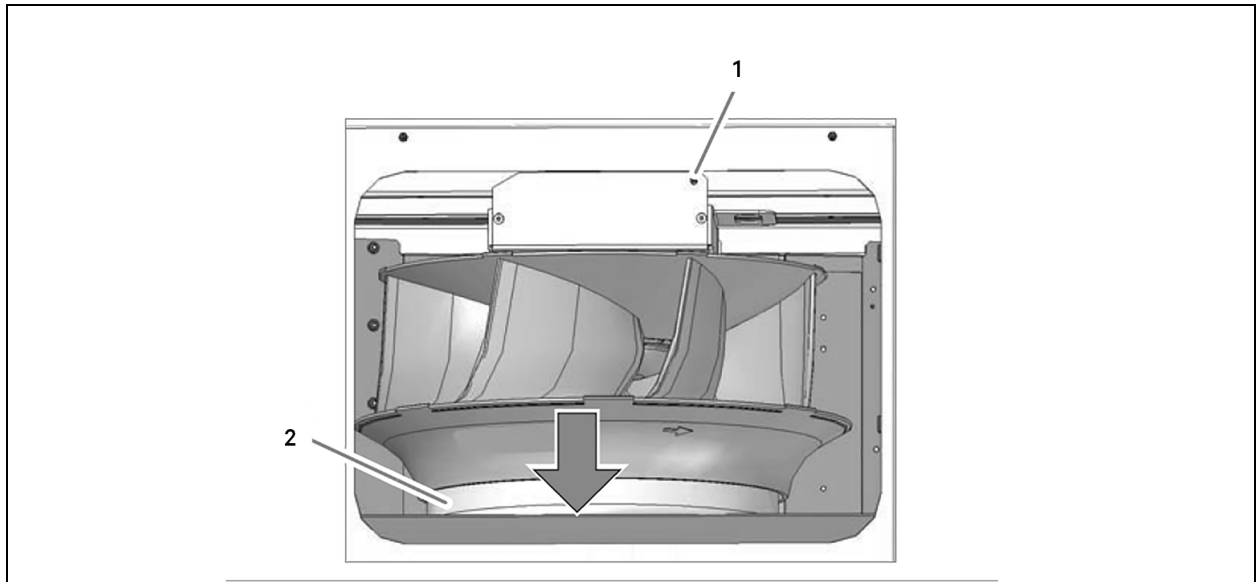
1. Remove the panel. See **Figure 13.9** below .
2. Disconnect the fan electrical cable from the connector.
3. Remove the screw and slowly put down the fan on its inlet collar. See **Figure 13.10** on the facing page .
4. Remove the screw. See **Figure 13.11** on the facing page .
5. Lift the fan higher than its inlet collar.
6. Pull the handle to slide the fan out of the bay.
7. Proceed in reverse order to reassemble the fan.

Figure 13.9 Removing Panel - Upflow Unit



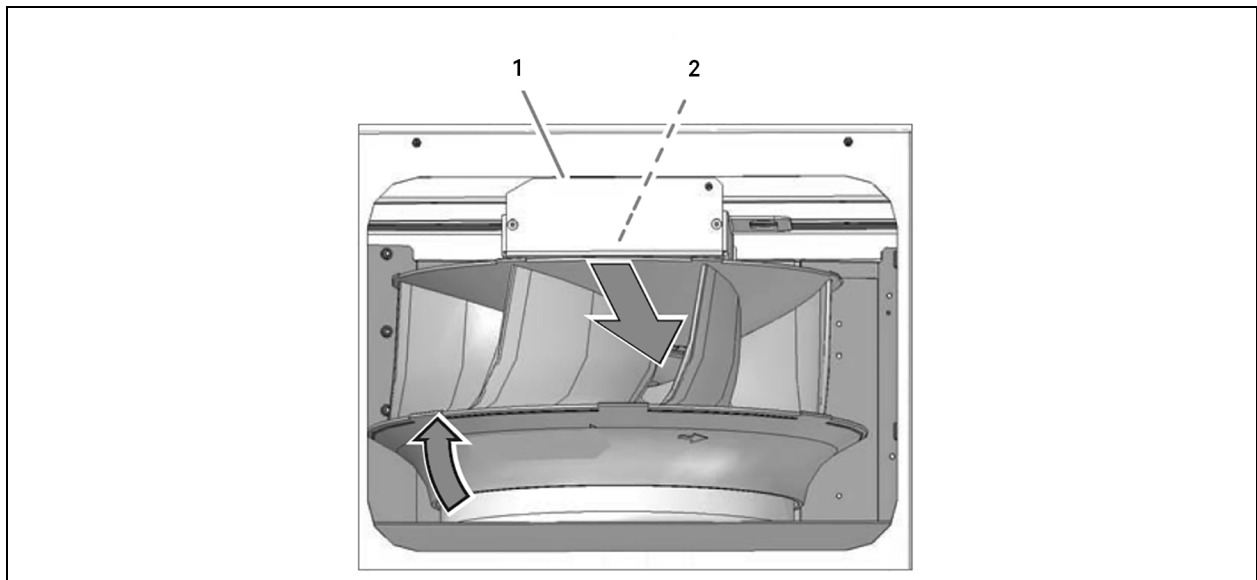
Item	Description
1	Panel

Figure 13.10 Fan with Inlet Collar



Item	Description
1	Screw
2	Inlet collar

Figure 13.11 Fan with Handle

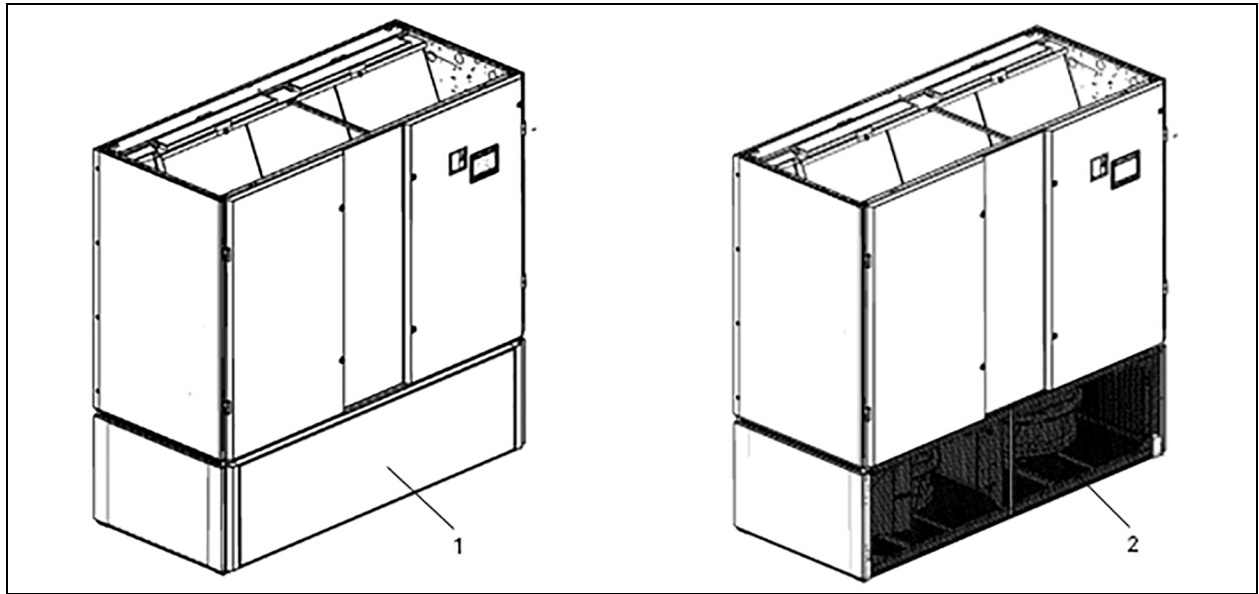


Item	Description
1	Screw
2	Handle

13.6.3 Replacing a Fan - Downflow Units

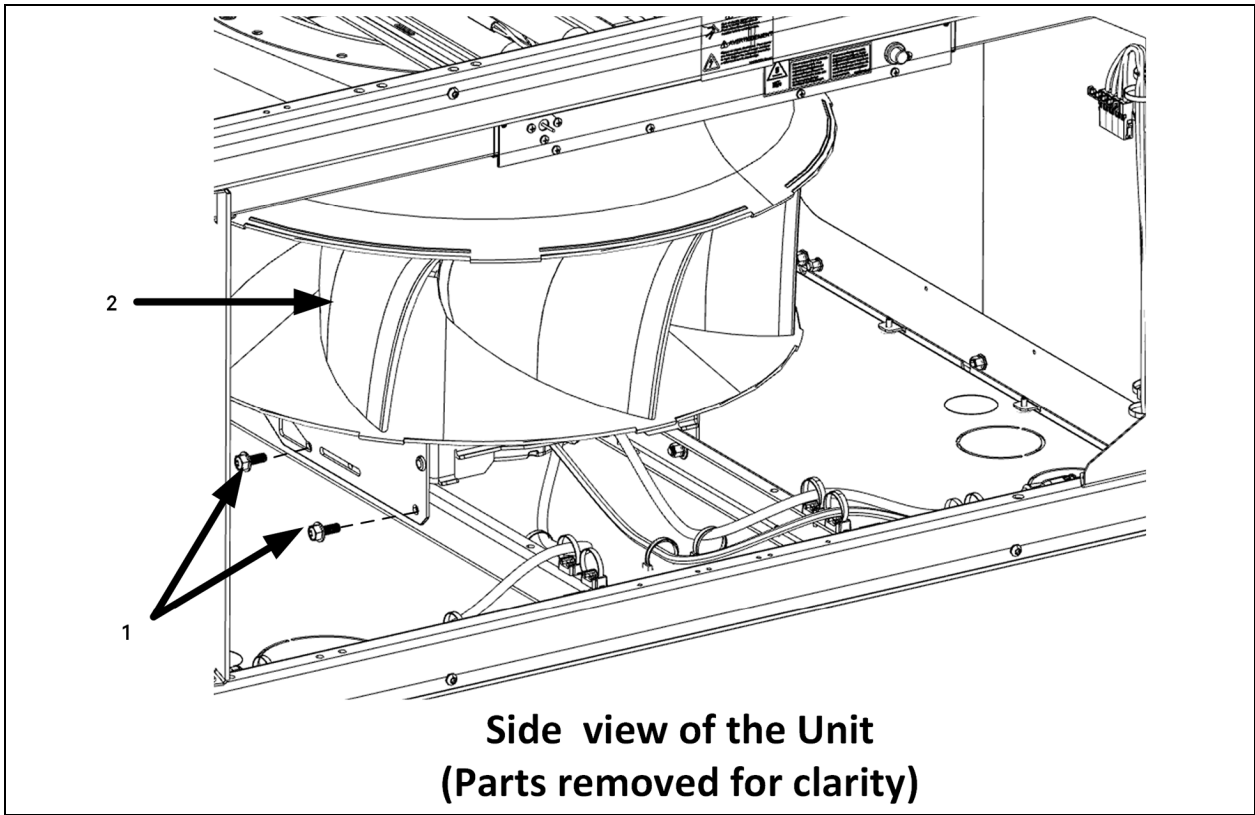
1. Remove a few floor tiles in front of the fan section.
2. Remove any obstacle in front of the fans to allow the fan extraction (raised floor structure, piping, etc.).
3. Remove the panel or the grid. See **Figure 13.12** below .
4. Disconnect the fan electrical cable from the connector.
5. Remove the two front screws that attach the fan support to the sliding bars. See **Figure 13.13** on the facing page .
6. Loosen the two back screws that attach the fan support to the sliding bars. **Figure 13.13** on the facing page .
7. Slide down the fan by pulling the handle. See **Figure 13.14** on page 110 .
8. Completely remove the two screws on the back of the fan. See **Figure 13.13** on the facing page .
9. Pull the handle to slide the fan out of the bay.

Figure 13.12 Downflow Unit with Leg Kit



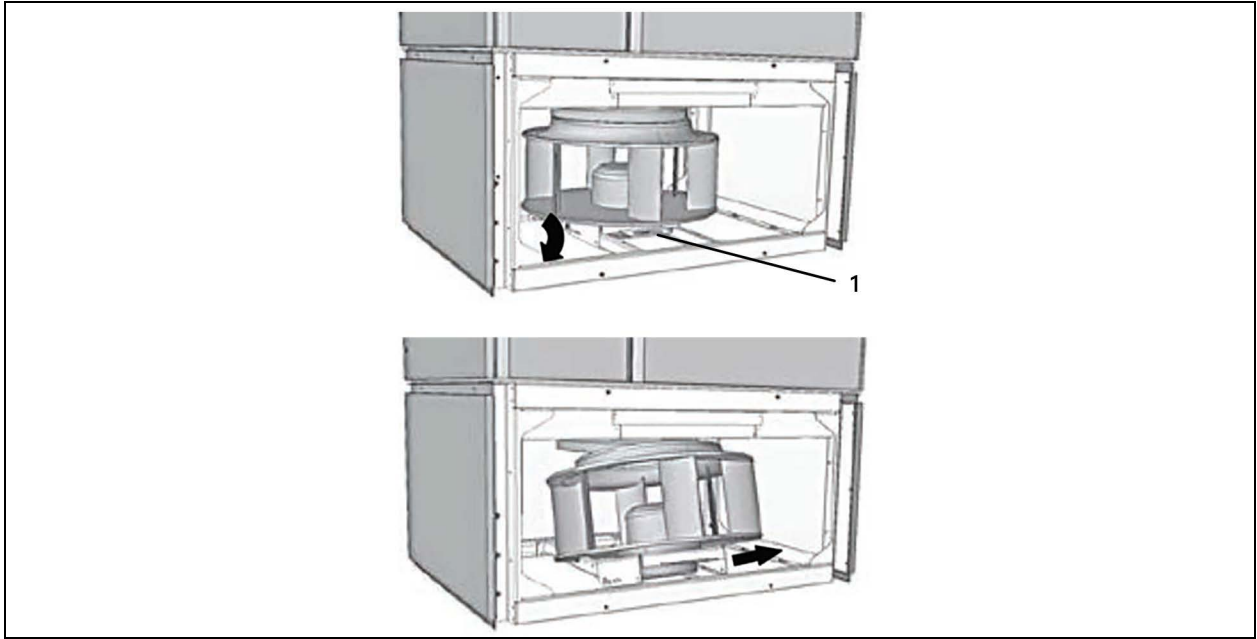
Item	Description
1	Panel
2	Grid

Figure 13.13 Disconnect Fan Electric Cable



Item	Description
1	Front screws
2	Back screws

Figure 13.14 Removing Fan from the Bay



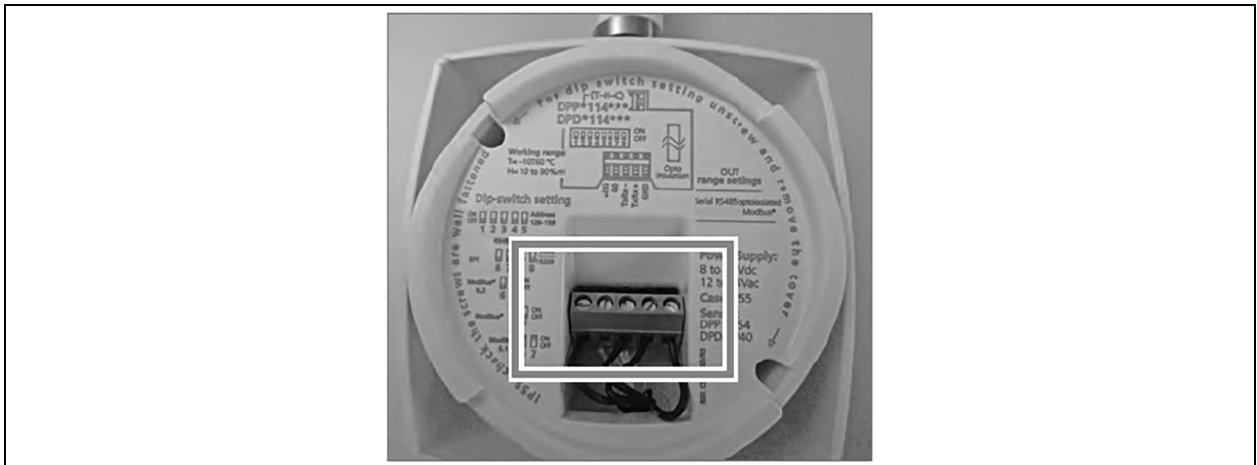
Item	Description
1	Handle

13.7 Modbus Connections and Settings

13.7.1 Connecting a Device to the Modbus Cable

1. Use a Modbus (RS485) cable, which is made of four shielded cables inside the sheath. See **Figure 13.15** below .
2. Connect a positive and a negative wire to the inlet terminal.
3. Connect a positive and a negative wire to the outlet terminal.

Figure 13.15 Modbus Connections

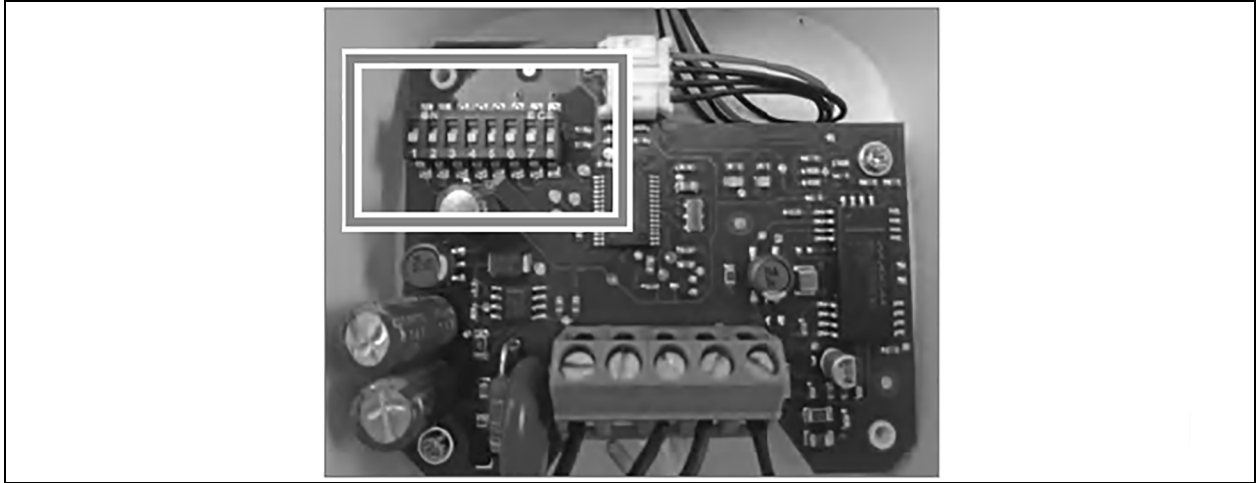


13.7.2 Setting Modbus Devices

Setting a Modbus device requires setting the following parameters:

1. Dip Switched address:

Figure 13.16 Setting Modbus Parameters



2. Confirm that the address of the device is unique.
3. For the Temperature and Humidity sensor set the pins on the board.
4. For Fans (inside the unit) the setting is factory made. If the fan is replaced the Mod bus address must be set up at the time of install.
5. Refer to the Vertiv™ Liebert® iCOM™ control for the programing tool.
6. Set the Baud Rate to 19200, Parity set to Even, and Stop bits set to 1.

Table 13.2 below and **Figure 13.16** above provide the details and the addresses for the settings. Also review the unit electrical schematic.

Table 13.2 Modbus Options and Addresses

MD ID = 1	MC
MD ID = 11	Power meter
MD ID = 12	ATS controller
MB ID = 21	Fan 1
MD ID = 22	Fan 2
MD ID = 23	Fan 3
MD ID = 24	Fan 4
MB ID = 128	TH/HU censor
MB ID = 141-150	Remote sensors T or T+H (1-10)

13.8 Replacing Infrared Humidifier

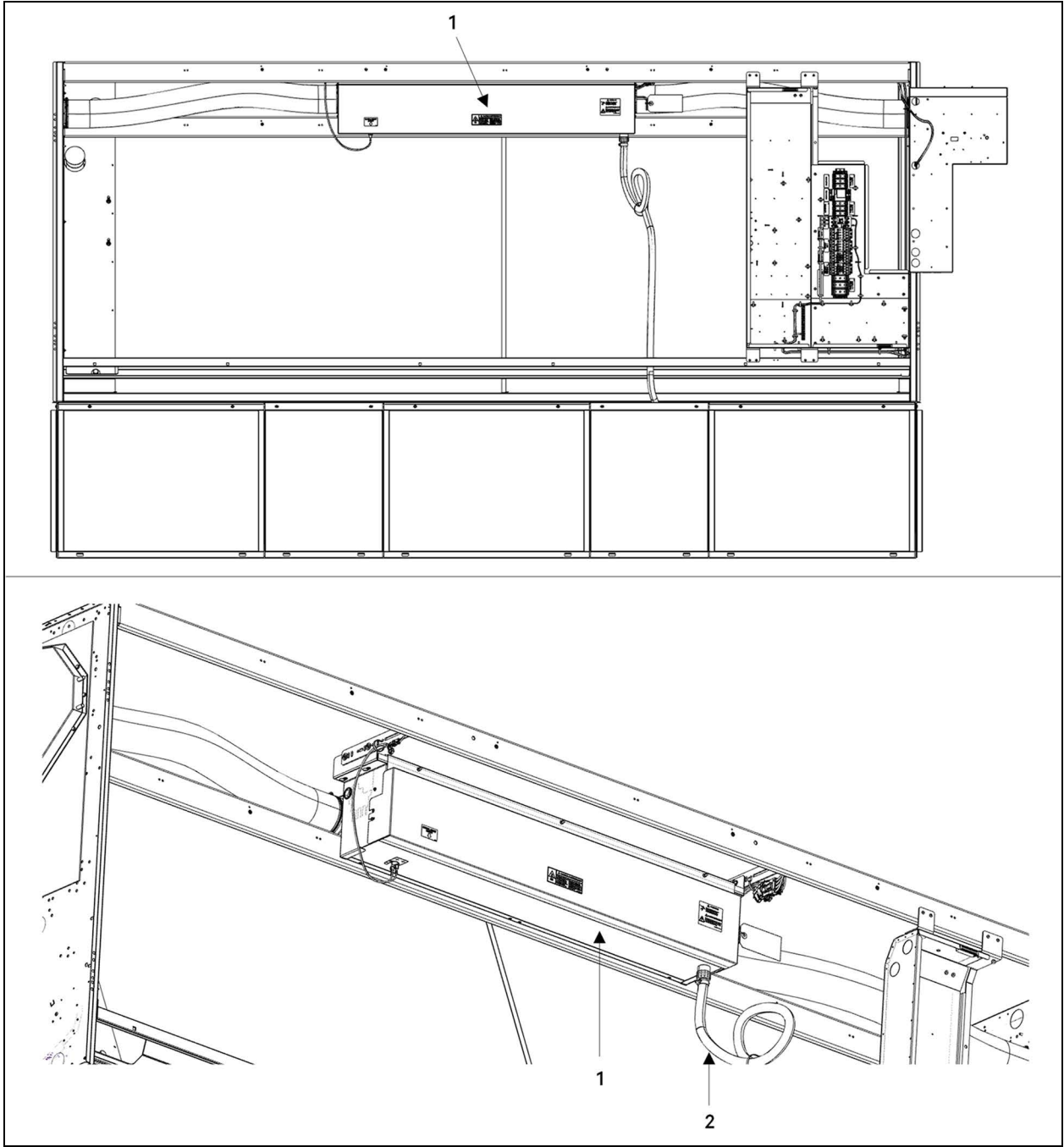
13.8.1 Operating Principal

The quartz lamps are mounted above the stainless steel pan, which is filled with water through the supply inlet. See **Figure 13.17** on the facing page .

The float switch detects if the water level is too high. When humidification is required, the lamps are switched on and infrared rays generate steam within seconds (without impurities or odor).

The lamps never come in contact with water.

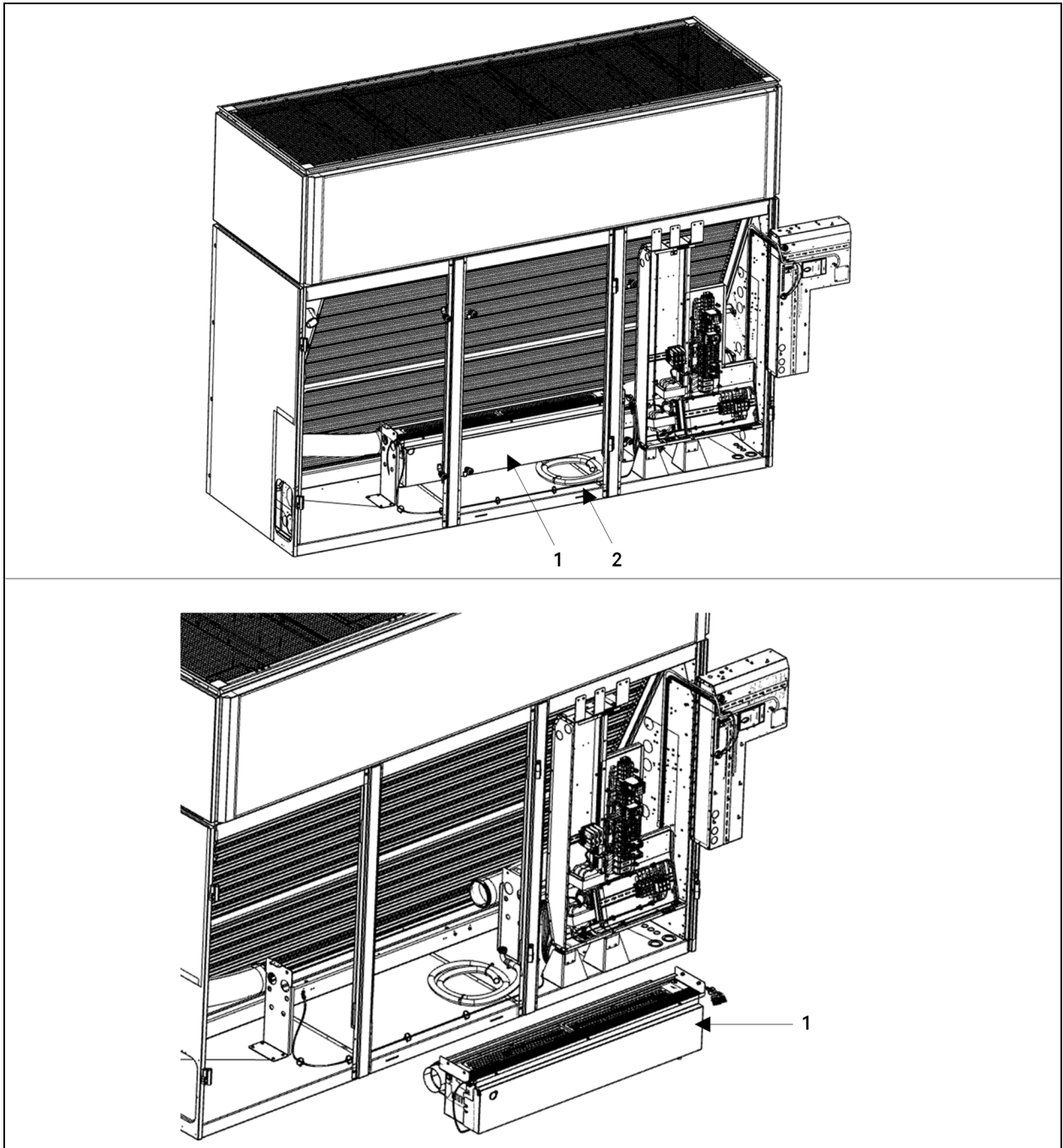
Figure 13.17 Downflow Unit - Humidifier Location (some internal components hidden)



Item	Description
1	Humidifier Location
2	Drain coupling and hose

Refer to the Piping Connection submittal drawing for Supply Water and Drain connection sizes in [Submittal Drawings](#) on page 127.

Figure 13.18 Upflow Unit - Humidifier Location



Item	Description
1	Humidifier Location
2	Drain coupling and hose

Refer to Piping Connection submittal drawing for Supply Water and Drain connection sizes.

13.8.2 Humidifier Specifications

Table 13.3 Infrared Humidifier Technical Data

Unit Frame Size	Volts	Pan Material	Capacity lb/h (kg/h)	Current (Amps)	Power (kW)
Small	460	Stainless Steel	11.0 lb/h (5.0 kg/h)	5.8	4.8
	575			7.4	4.8
Large	460	Stainless Steel	22.0 lb/h (10.0 kg/h)	11.6	9.6
	575			11.6	9.6

Supply Water

- Pressure between 20 Psi (138 kPa) and 145 Psi (1,000 kPa)
- Flow rate 1.0 GPM (3.8 l/min)

NOTE: Do not add disinfectants or anti-corrosive compounds to the water, as they are potential irritants. The use of well water, industrial water or water from cooling circuits and, in general, any potentially chemically or bacteriologically contaminated water is not recommended.

Drain Water

The drain water contains the same substances dissolved in the supply water, however, in larger quantities. It may reach a temperature of 212°F (100°C). It is not toxic and can be drained into the sewerage system.

Connect the drain hose to an ordinary drainage network with the following specifications:

- install a siphon that must be able to withstand temperatures up to 212°F (100°C).

13.8.3 Humidifier Maintenance



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

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



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

NOTICE

Maintenance operations must be carried out only by authorized and trained technicians. We recommend Vertiv Customer Service.

For any operation that is not specifically mentioned in this manual, you must contact Vertiv Technical Support.

NOTE: Optical radiation from the quartz lamps. Before opening the door, always switch off the Vertiv™ Liebert® PCW unit.

Maintenance Checklist

- Check drain piping and trap for clogs.
- Check the pan. Clean mineral deposits.
- Clean the reflector.
- Check the water supply valve for leaks.
- Check the quartz lamps (replace if burnt out).
- Check the wiring connections (inside the humidifier electric panel).

NOTE: Deposits of mineral solids will collect in the humidifier pan and on the float switch. These must be cleaned periodically to ensure proper operation. The frequency of cleaning must be locally established because it depends on humidifier usage and local water quality. A spare pan is recommended to reduce the maintenance time. The Liebert® auto flush system can greatly increase the time between cleaning but does not eliminate the need for periodic checks and maintenance.

13.9 Humidifier Installation

The humidifier is supplied already mounted within the Vertiv™ Liebert® PCW unit. The only necessary operations are the connections to the supply water and drain water.

- Supply water connection: external diameter .23 in. (6 mm)
- Drain water connection: internal diameter .86 in. (22 mm), male thread

13.10 Humidifier Startup and Operation

Initial checks	Before using the humidifier, check the following conditions: <ul style="list-style-type: none"> • The water supply and drain piping are properly connected. • All the wirings are properly connected.
Start-up	The humidifier starts up automatically as soon as the Liebert® PCW unit is switched on.
Operation	The adjustable parameters which determine the humidifier operation have already been factory-preset.

13.11 Removing the Pan

NOTICE

Maintenance operations must be carried out only by authorized and trained technicians. We recommend Vertiv Customer Service.

For any operation that is not specifically mentioned in this manual, you must contact Vertiv Technical Support.

<p>Before switching off Liebert® PCW unit</p>	<ul style="list-style-type: none"> • With the Liebert® PCW unit operating, remove the call for humidification at the control. • Let the fans operate five minutes to allow the humidifier and water to cool. • Let the pan drain and the condensate pump operate (if applicable) until the pan is dry. • If applicable, let the condensate pump operate until the drain tank is dry. • Switch off the Liebert® PCW unit.
<p>With the Liebert® PCW unit disconnected from the power supply</p>	<ul style="list-style-type: none"> • Remove safety panels, if installed. • Pull out the humidifier standpipe from the pan. • Inspect the O-ring (replace if necessary). • Disconnect the drain coupling from the bottom of the pan. • Remove the thermostat from the bottom of the pan. • Remove the fixing screws from the sides of the pan and slide the pan out.

13.12 Cleaning the Pan and Float Switch

NOTICE

Maintenance operations must be carried out only by authorized and trained technicians. We recommend Vertiv Customer Service.

For any operation that is not specifically mentioned in this manual, you must contact Vertiv Technical Support.

<p>With the Liebert® PCW unit disconnected from the power supply</p>	<ul style="list-style-type: none"> Loosen the scale on the side and bottom of the pan with a stiff nylon brush or plastic scraper. Flush with water. Carefully clean the scale from the float switch. Make sure to reassemble it correctly.
<p>With the Liebert® PCW unit connected again to the power supply</p>	<div> </div> <ul style="list-style-type: none"> Reassemble pan, thermostat, standpipe, drain coupling, cover, and screws into the humidifier. Operate the humidifier and check for leaks.

13.13 Changing the Lamps

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

NOTICE

Maintenance operations must be carried out only by authorized and trained technicians. We recommend Vertiv Customer Service.

For any operation that is not specifically mentioned in this manual, you must contact Vertiv Technical Support.

13.14 Humidifier Troubleshooting

Symptom	Possible Cause	Check or Remedy
No humidification	Humidifier pan not filling.	Check the water supply. Check fill valve operation. Check drain stand pipe adjustment. Check for clogged water supply piping.
	Control not calling for humidity.	Check status on control.
	Control calling but humidifier not starting.	Check visually. If contact is made, check line voltage after contactor, fuses, and circuit breakers.
		Check for open humidifier safety stat.
	Quartz lamp burned out.	Replace the quartz lamp.
Loosened lead on old quartz lamp.	Trim excess lead length on new quartz lamp to avoid shorts.	

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14 Preventive Maintenance Checklist

Source: DPN002952, Rev. 4

Inspection Date	Job Name		
Indoor Unit Model #	Indoor Unit Serial Number #		
Room Temperature/Humidity	°	%	Ambient Temperature °

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

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

Check all that apply:

Evaporator/Filters

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

Blower Section (EC fan)

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

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

Reheat (if equipped)

1. Inspect elements.
2. Check/re-torque wire connections (inside reheat box).
3. Reheat amp draw.

#1	#2	#3
----	----	----

Infrared Humidifier (if equipped)

1. Check drain lines and trap for clogs/leaks.
2. Check/clean pan for mineral deposits.
3. Clean reflector.
4. Check water make-up valve for leaks.
5. Check humidifier lamps (replace if burnt out).
6. Check/re-torque wire connections (inside humidifier box). Torque is: Ceramic terminals - 35 lb-in., thermostat - 18 lb-in.
7. Check humidifier high water alarm operation.
8. Humidifier Amp draw.

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

Condensate Pump (if equipped)

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

Electrical Panel

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

Disconnects

-5 to 60A

4-6AWG wire - 35 lb-in

6-8AWG wire - 30 lb-in

8-18AWG wire - 20 lb-in

-65 to 100A

12-18AWG wire - 20 lb-in

10AWG wire - 25 lb-in

8AWG - 40 lb-in

4-6AWG - 45 lb-in

1-3AWG - 55 lb-in

Main power GND Lug - 75 lb-in

ATS Terminals - 5 lb-in

ATS contactors

Rated at 40A

Power - 35 lb-in

Coil and auxiliary switches - 11 lb-in

Rated at 80A & 96A

Power - 53 lb-in

Coil and auxiliary switches - 11 lb-in Power distribution block

Line side - 2/0 - 1/0AWG wire - 120 lb-in

1-6AWG wire - 120 lb-in

8AWG wire - 40 lb-in

10AWG wire - 35 lb-in

Load side - 4-14AWG wire - 35 lb-in

ATS Transformer Fuse Holders - 30 lb-in

PS Relay - 10 lb-in

GND bar - 35 lb-in

Power Meter - 4.5 lb-in

Low Volt Relays - 8 lb-in

Low Volt Fuses - 6 lb-in

Controller - 6 lb-in

Power din rail terminals - 15 lb-in

Cube Fuse Holders

30A 18-12AWG wire - 20 lb-in

10-8AWG wire - 25 lb-in

60A 18-10AWG wire - 20 lb-in

8-4AWG wire - 35 lb-in

Option Contactors

Power - 22 lb-in

Coil and auxiliary switches - 11 lb-in

Harmonic Filter Contactor

Power - 35 lb-in

Coil and auxiliary switches - 11 lb-in

Controls

1. Check/verify control operation (sequence).
2. Check/test changeover device(s) (if equipped).
3. Check/test water detection device(s) (if equipped).

Chilled Water

1. Verify proper water maintenance is being performed.
2. Check coil and supply/return lines/connections for water/glycol leaks.

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: Submittal Drawings

Appendix B: above groups the drawings by topic/application.

Table B.1 Submittal Drawings Contents

Document Number	Title
Planning Dimensions - Downflow Units	
60028268	Cabinet Dimensions PW035-040D
60028266	Cabinet Dimensions PW035-040E
60051993	Cabinet Dimensions PW035-040H
60027882	Cabinet Dimensions PW045-060D
60027545	Cabinet Dimensions PW045-060E
60050460	Cabinet Dimensions PW045-060H
60027815	Cabinet Dimensions PW070-080D
60027633	Cabinet Dimensions PW070-080E
60051835	Cabinet Dimensions PW070-080H
60028262	Cabinet Dimensions PW095-110D
60027712	Cabinet Dimensions PW095-110E
60051939	Cabinet Dimensions PW095-110H
60028240	Cabinet Dimensions PW145D
60027730	Cabinet Dimensions PW145E
60028289	Cabinet Dimensions PW0170D
60028288	Cabinet Dimensions PW0170E
Planning Dimensions - Upflow Units	
60028269	Cabinet Dimensions PW035-040U
60027883	Cabinet Dimensions PW045-060U
60027901	Cabinet Dimensions PW070-080U
60028263	Cabinet Dimensions PW095-110U
Planning Dimensions - Floor Mount Options	
60051900	Floorstand Dimensions
60051898	Leg Kit Dimensions
60051899	Leg Kit over 32 in. Dimensions
60061863	Pedestal Dimensions
Planning Dimensions - Plenums	
60028435	Plenum Upflow and Downflow

Table B.1 Submittal Drawings Contents (continued)

Document Number	Title
Electrical Connections	
DPN005242	Electrical Field Connections PW035-170
Electrical Connections - Downflow Units	
60051954	Electrical Field Connections PW035-040
60051995	Electrical Field Connections PW170
60051895	Electrical Field Connections PW095-110
60051884	Electrical Field Connections PW145
60051836	Electrical Field Connections PW070-080
60050461	Electrical Field Connections PW045-060 PIP
Electrical Connections - Upflow Units	
60052106	Electrical Field Connections PW070-080U
60052091	Electrical Field Connections PW045-060U
60052088	Electrical Field Connections PW035-040U
60052087	Electrical Field Connections PW095-110U PIP
Unit-to-Unit Networking	
10030066	iCOM3 Unit-to-Unit Network Connections
Misc. Electrical Options	
DPN005245	Remote T&H Sensors
DPN005212	THD Mitigation
Piping Schematic	
60029159	Piping Schematic PCW035-170
Piping Connections - Downflow Units	
60051954	Connection Locations PW035-040
60051995	Connection Locations PW170
60051895	Connection Locations PW095-110
60051884	Connection Locations PW145
60051836	Connection Locations PW070-080
60050461	Connection Locations PW045-060
Piping Connections - Upflow Units	
60052106	Connection Locations PW070-080U
60052091	Connection Locations PW045-060U
60052088	Connection Locations PW035-040U
60052087	Connection Locations PW095-110U

Table B.1 Submittal Drawings Contents (continued)

Document Number	Title
Condensate Pump	
60029157	Downflow Condensate Drain
60029158	Upflow Condensate Drain

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VERTIV™**LIEBERT® PCW****CABINET DIMENSIONAL DATA - PW035-040****DOWNFLOW**

The drawing shows two views of the cabinet: a front view and a side view. The front view shows a cabinet with a width of 1206 mm [47.5] and a total height of 1970 mm [77.6]. The height from the top of the cabinet to the top of the fan grille is 1604 mm [63.1]. The side view shows a cabinet with a depth of 890 mm [35.0] and a total height of 1776 mm [69.9].

FRONT VIEW

SIDE VIEW

1. All dimensions have a tolerance of ± 13 mm (1/2").

2. Floor mount option required:
 - Leg kit, extended leg kit, or floorstand for Fixed Fan Option.
 - Floorstand for Translatable Fan Option.

3. A recommended clearance of 39.3 in. (1,000 mm) must be provided in front of the unit to allow access to all internal components.

Dry weight of Unit	lb(kg)
PW035	785(356)
PW040	822(373)

60028268

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REV: E

REV DATE: 10/2022

VERTIV™**LIEBERT® PCW****CABINET DIMENSIONAL DATA- PW035-040
DOWNFLOW, FANS IN RAISED FLOOR**

Dry weight of Unit	lb(kg)
PW035	785(356)
PW040	822(373)

1. All dimensions measured from front left corner of unit including panels and have a tolerance of ± 13 mm (1/2").

2. Floor mount option required (leg kit, extended leg kit, or floor stand).

3. A recommended clearance of 39.3 in. (1,000 mm) must be provided in front of the unit to allow access to all internal components.

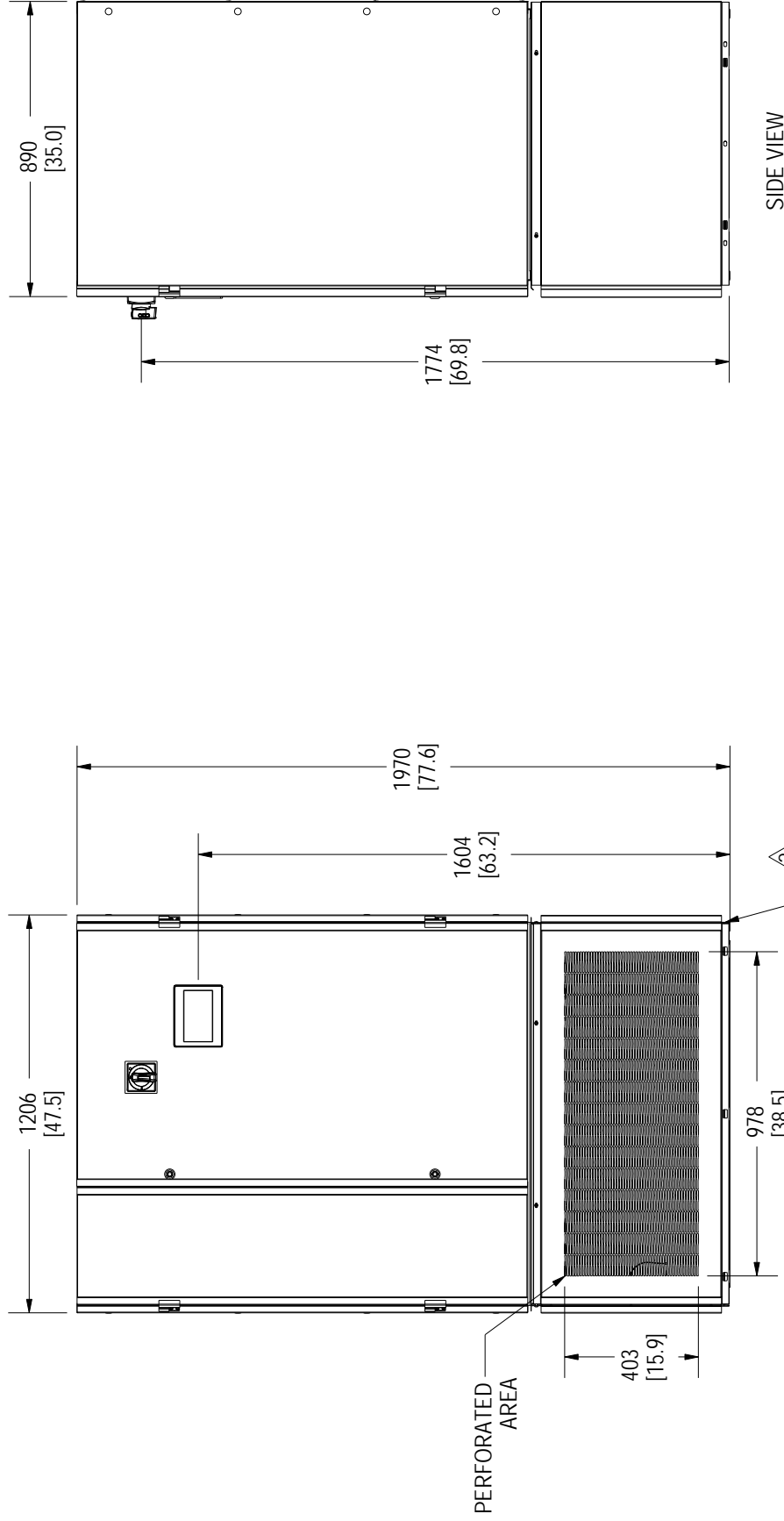
60028266

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REV: D

REV DATE: 11/2021

CABINET DIMENSIONAL DATA - PW035-040 DOWNFLOW FRONT DISCHARGE



SIDE VIEW

FRONT VIEW

Dry weight of Unit	lb(kg)
PW035	785(356)
PW040	822(373)

1. All dimensions have a tolerance of ± 13 mm (1/2").

2. Floor mount option required (leg kit, extended leg kit, floorstand or Pedestal).

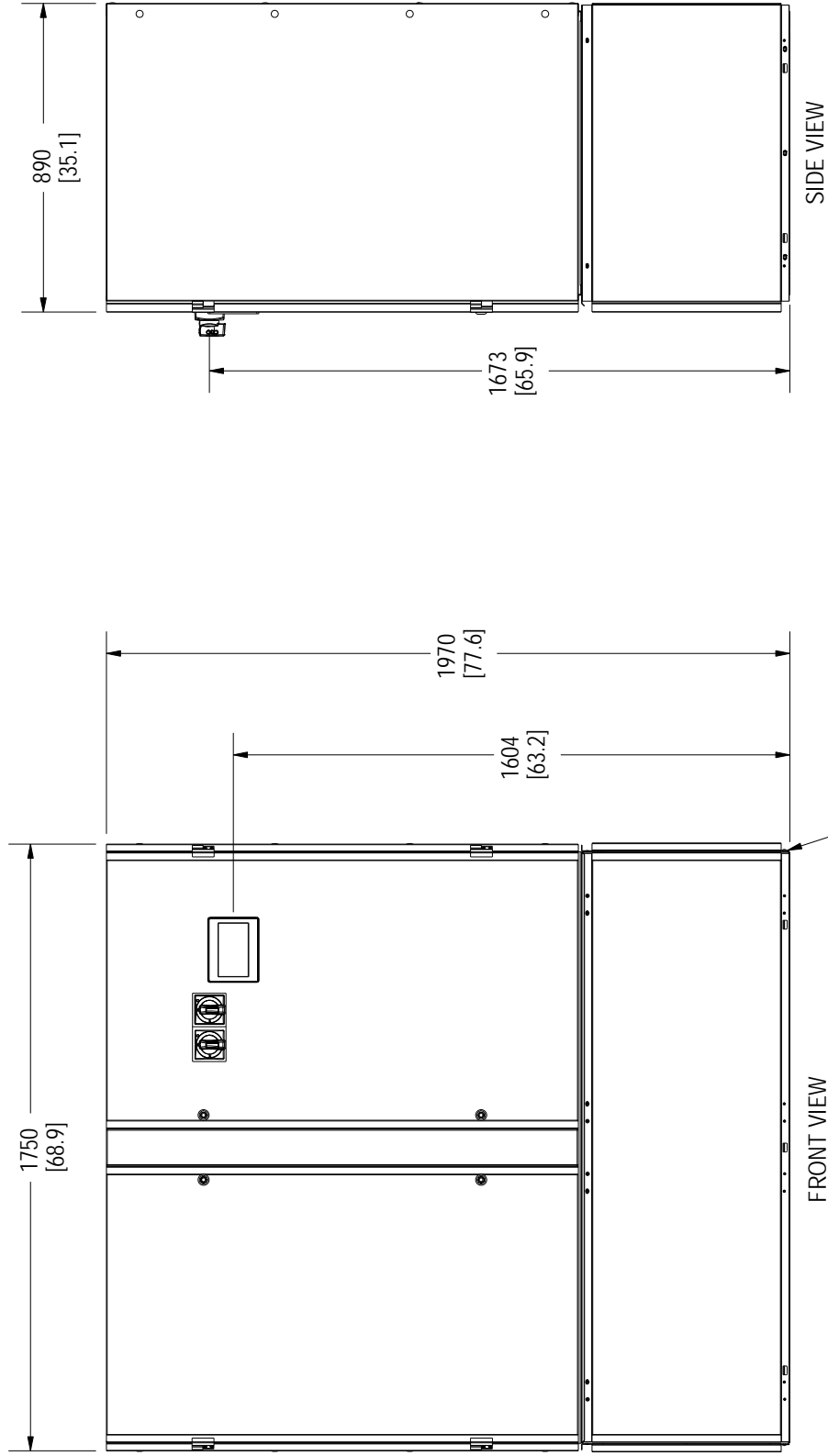
3. A recommended clearance of 39.3 in. (1,000 mm) must be provided in front of the unit to allow access to all internal components.



VERTIV™

LIEBERT® PCW

**CABINET DIMENSIONAL DATA- PW045-060
DOWNFLOW**



Dry weight of Unit	lb(kg)
PW045	1060(481)
PW060	1127(511)

1. All dimensions have a tolerance of ± 13 mm (1/2").

2. Floor mount option required:
 - Leg kit, extended leg kit, or floorstand for Fixed Fan Option
 - Floorstand for Translatable Fan Option.

3. A recommended clearance of 39.3 in. (1,000 mm) must be provided in front of the unit to allow access to all internal components.

VERTIV™**LIEBERT® PCW****CABINET DIMENSIONAL DATA- PW045-060
DOWNFLOW, FANS IN RAISED FLOOR**

The drawing shows two views of the cabinet: a front view and a side view. The front view shows a cabinet with a height of 1750 mm [68.9] and a depth of 600 mm [23.6]. The distance from the floor to the top of the cabinet is 1970 mm [77.6]. The distance from the floor to the top of the fan grille is 1004 mm [39.5]. The side view shows a cabinet with a width of 890 mm [35.1] and a height of 1073 mm [42.2]. Labels include 'FLOOR', 'GRILLE', and 'FRONT VIEW'.

1. All dimensions measured from front left corner of unit including panels and have a tolerance of ± 13 mm (1/2").

2. Floor mount option required (leg kit, extended leg kit, or floorstand).

3. A recommended clearance of 39.3 in. (1,000 mm) must be provided in front of the unit to allow access to all internal components.

Dry weight of Unit	lb(kg)
PW045	1060(481)
PW060	1127(511)

60027545

PAGE: 1 OF 1

REV: D

REV DATE: 11/2021

VERTIV™**LIEBERT® PCW****CABINET DIMENSIONAL DATA - PW045-060
DOWNFLOW FRONT DISCHARGE**

The drawing includes the following dimensions:

- Overall width: 1750 [68.9]
- Overall height: 1970 [77.6]
- Height to top of door: 1604 [63.2]
- Height to top of perforated area: 1673 [65.9]
- Perforated area height: 651 [25.6] (TYP.)
- Perforated area depth: 403 [15.9]
- Overall depth: 890 [35.1]

Labels in the drawing include: FRONT VIEW, SIDE VIEW, and PERFORATED AREA.

Dry weight of Unit	lb (kg)
PW045	1060(481)
PW060	1127(511)

1. All dimensions have a tolerance of ± 13 mm (1/2").

2. Floor mount option required (leg kit, extended leg kit, floorstand, or pedestal)

3. A recommended clearance of 39.3 in. (1,000 mm) must be provided in front of the unit to allow access to all internal components.

60050460

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REV: A

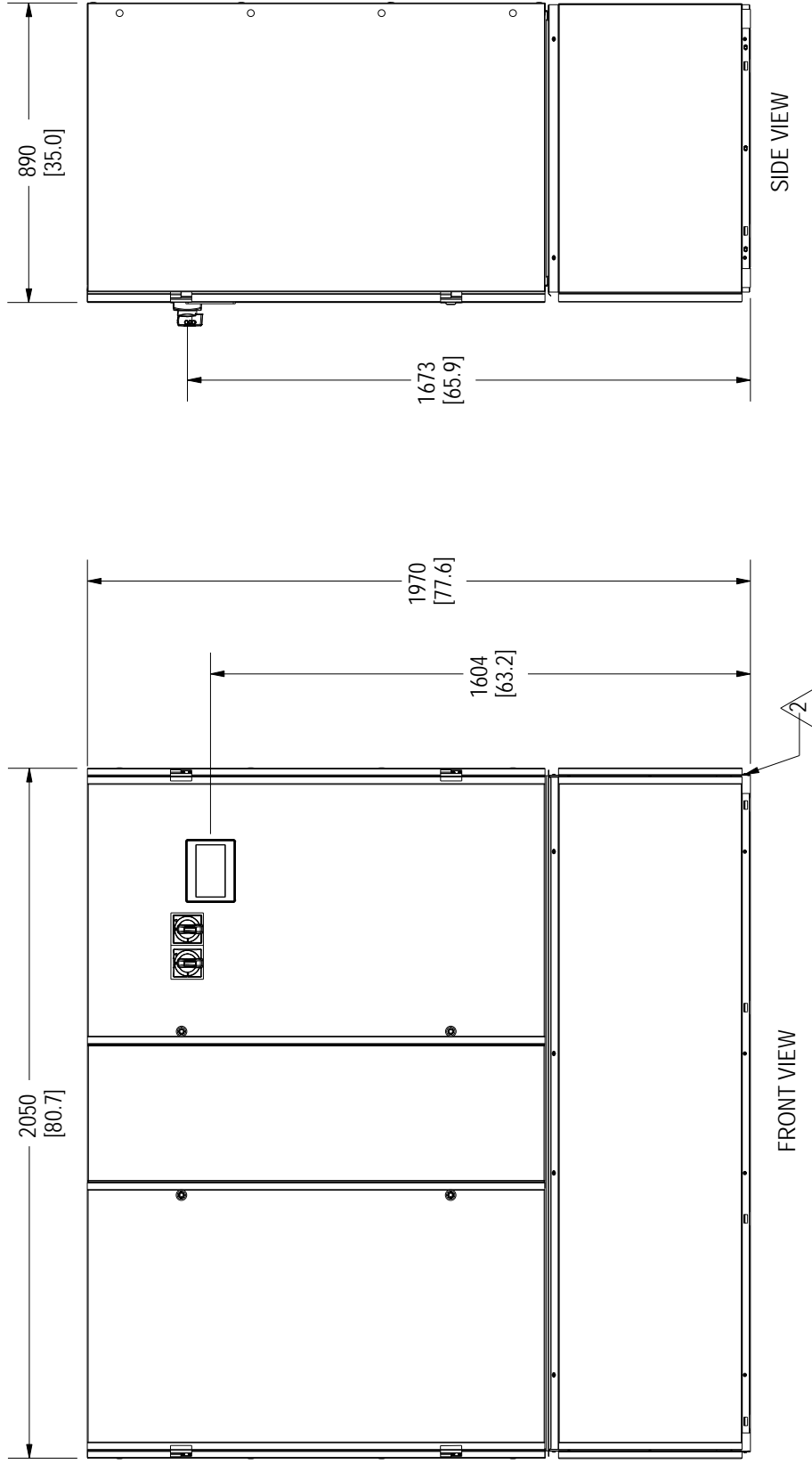
REV DATE: 03/2022



VERTIV™

LIEBERT® PCW

**CABINET DIMENSIONAL DATA - PW070-080
DOWNFLOW**



Dry weight of Unit	lb(kg)
PW070	1283(582)
PW080	1319(598)

1. All dimensions have a tolerance of ± 13 mm (1/2").

2. Floor mount option required:
 - Leg kit, extended leg kit, or floorstand for Fixed Fan Option
 - Floorstand for Translatable Fan Option

3. A recommended clearance of 39.3 in. (1,000 mm) must be provided in front of the unit to allow access to all internal components.

VERTIV™**LIEBERT® PCW****CABINET DIMENSIONAL DATA- PW070-080
DOWNFLOW, FANS IN RAISED FLOOR**

The drawing consists of two views: a front view and a side view. The front view shows a cabinet with a total height of 2050 [80.7] and a depth of 600 [23.6]. The distance from the floor to the top of the fan grilles is 1004 [39.5], and the distance from the floor to the top of the main cabinet door is 1970 [77.6]. The side view shows a cabinet with a total width of 890 [35.0] and a depth of 1073 [42.2]. Labels include 'FLOOR' at the base, 'GRILLE' for the front and side panels, and 'SIDE VIEW' and 'FRONT VIEW' for the respective views.

Dry weight of Unit	lb(kg)
PW070	1283(582)
PW080	1319(598)

1. All dimensions have a tolerance of ± 13 mm (1/2").
2. Floor mount option required (leg kit, extended leg kit, or floorstand).
3. A recommended clearance of 39.3 in. (1,000 mm) must be provided in front of the unit to allow access to all internal components.

60027633
 PAGE: 1 OF 1
 REV: D
 REV DATE: 11/2021

VERTIV™**LIEBERT® PCW****CABINET DIMENSIONAL DATA - PW070-080
DOWNFLOW FRONT DISCHARGE**

FRONT VIEW

PERFORATED AREA

2050 [80.7]

1970 [77.6]

1604 [63.2]

405 [15.9]

651 [25.6]

324 [12.8]

651 [25.6]

651 [25.6]

SIDE VIEW

890 [35.0]

1673 [65.9]

1. All dimensions have a tolerance of ± 13 mm (1/2").

2. Floor mount option required (leg kit, extended leg kit, floorstand, or pedestal).

3. A recommended clearance of 39.3 in. (1,000 mm) must be provided in front of the unit to allow access to all internal components.

Dry weight of Unit	lb(kg)
PW070	1283(582)
PW080	1319(598)

60051835

PAGE: 1 OF 1

REV: A

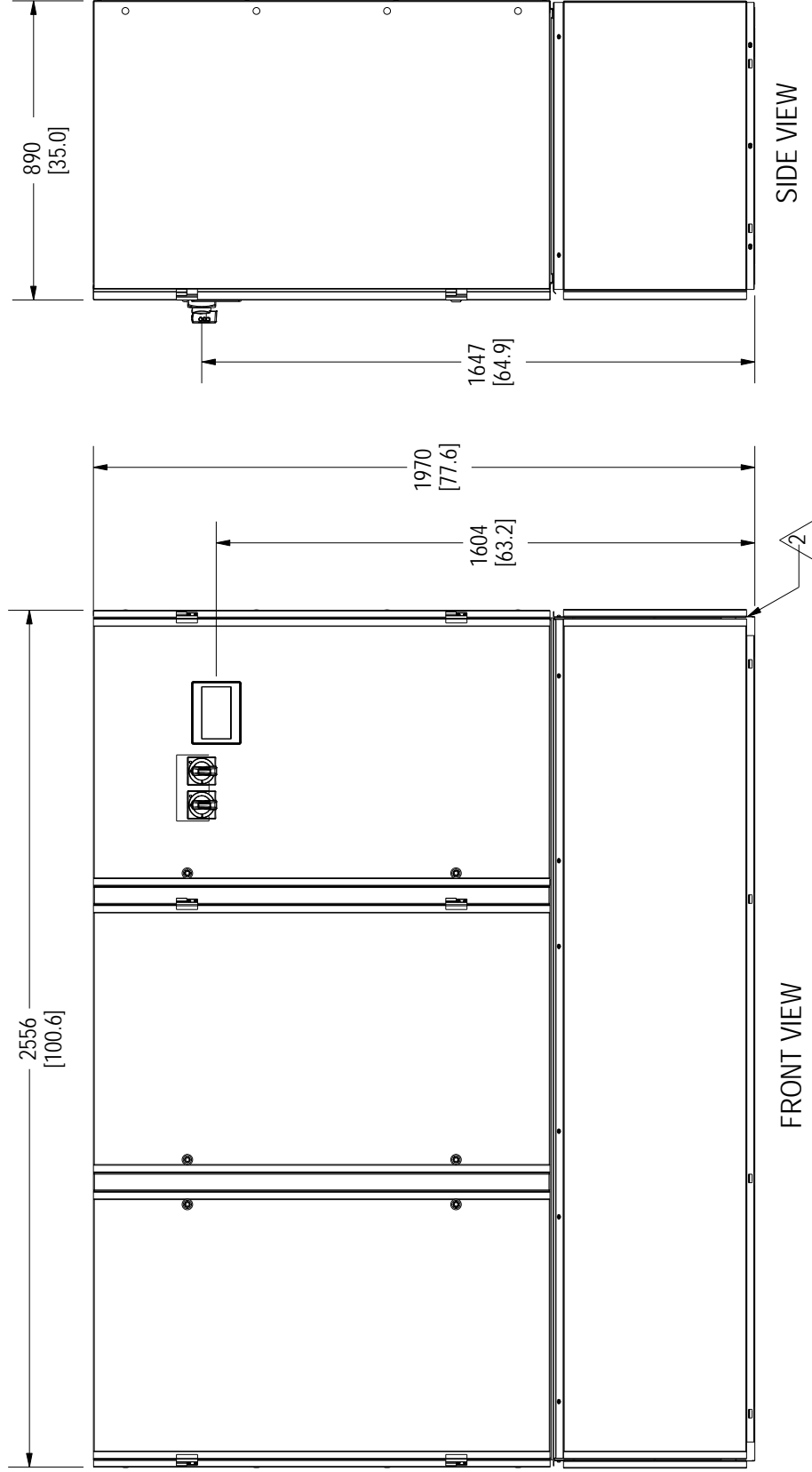
REV DATE: 03/2022



VERTIV™

LIEBERT® PCW

**CABINET DIMENSIONAL DATA - PW095-110
DOWNFLOW**



FRONT VIEW

SIDE VIEW

1. All dimensions have a tolerance of ± 13 mm (1/2").

△ Floor mount option required:

- Leg kit, extended leg kit, or floorstand for Fixed Fan Option.
- Floorstand for Translatable Fan Option.

3. A recommended clearance of 39.3 in. (1,000 mm) must be provided in front of the unit to allow access to all internal components.

Dry weight of Unit	lb(kg)
PW095	1499(680)
PW110	1631(740)

VERTIV™**LIEBERT® PCW****CABINET DIMENSIONAL DATA - PW095-110
DOWNFLOW, FANS IN RAISED FLOOR**

The drawing shows two views of the cabinet: a front view and a side view. The front view shows a cabinet with three doors and three grilles. Dimensions include a total width of 2556 mm [100.6], a door width of 1004 mm [39.5], a total height of 1970 mm [77.6], and a grille height of 600 mm [23.6]. A floor line is indicated at the bottom. The side view shows a depth of 890 mm [35.0] and a height of 1047 mm [41.2]. A floor line is also indicated at the bottom. A callout '2' points to the top edge of the cabinet.

Dry weight of Unit	lb(kg)
PW095	1499(680)
PW110	1631(740)

1. All dimensions have a tolerance of ± 13 mm (1/2").

2. Floor mount option required (leg kit, extended leg kit, or floorstand).

3. A recommended clearance of 39.3 in. (1,000 mm) must be provided in front of the unit to allow access to all internal components.

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VERTIV™**LIEBERT® PCW****CABINET DIMENSIONAL DATA - PW095-110
DOWNFLOW FRONTAL DISCHARGE**

The drawing includes the following dimensions:

- Overall width: 2556 [100.6]
- Overall height: 1970 [77.6]
- Height to top of control panel: 1615 [63.6]
- Height to top of main cabinet: 1673 [65.9]
- Depth: 890 [35.0]
- Perforated area height: 651 [25.6] (TYP.)
- Control panel height: 405 [15.9] (TYP.)

Labels include: FRONT VIEW, SIDE VIEW, PERFORATED AREA, and a note: (TYP.)

Dry weight of Unit	lb(kg)
PW095	1499(680)
PW110	1631(740)

1. All dimensions have a tolerance of ± 13 mm (1/2").

2. Floor mount option required (leg kit, extended leg kit, floorstand, or pedestal).

3. A recommended clearance of 39.3 in. (1,000 mm) must be provided in front of the unit to allow access to all internal components.

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REV: A

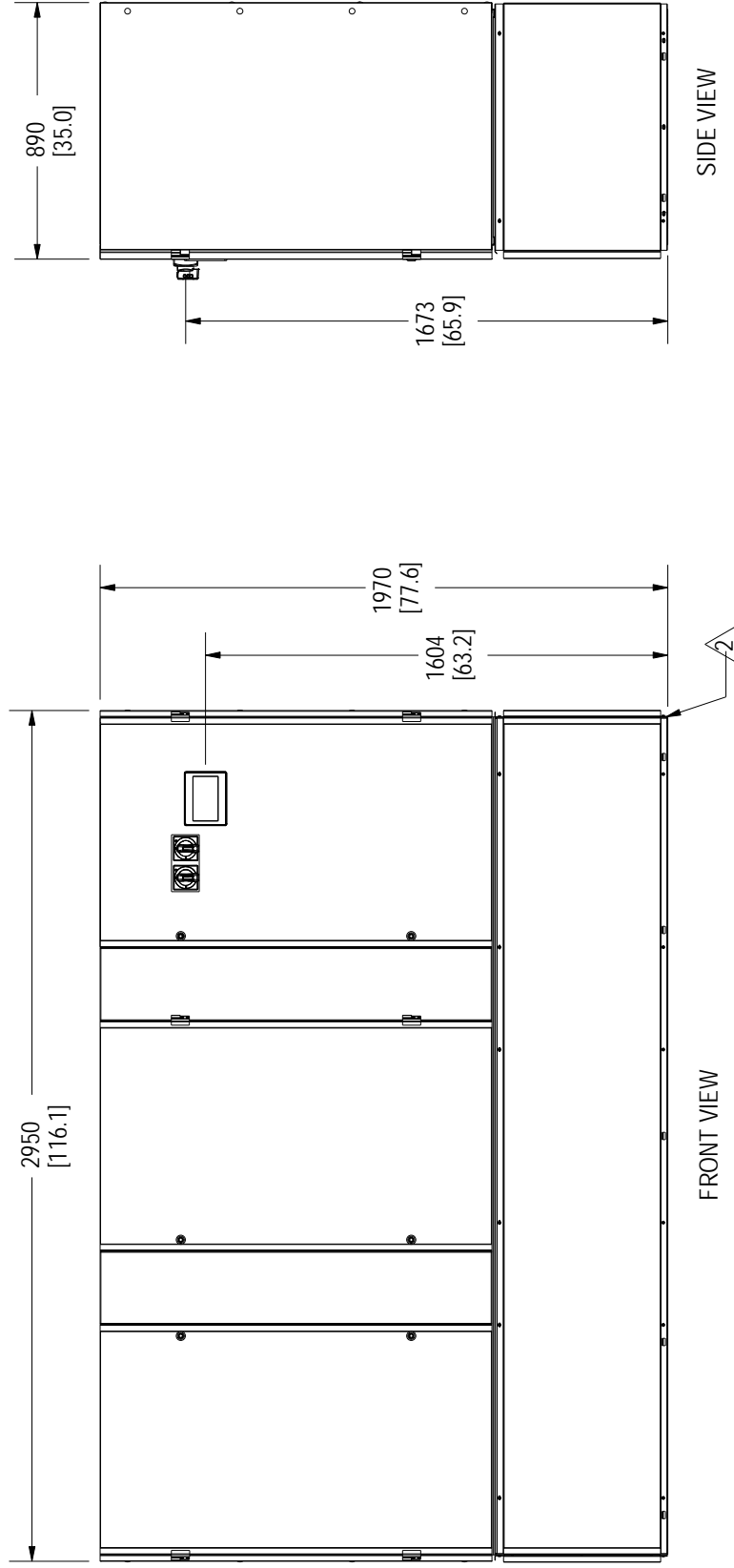
REV DATE: 03/2022



VERTIV™

LIEBERT® PCW

**CABINET DIMENSIONAL DATA- PW145
DOWNFLOW**



Dry weight of Unit	lb(kg)
PW145	1881(853)

1. All dimensions have a tolerance of ± 13 mm (1/2").

2. Floor mount option required:

- Leg kit, extended leg kit, or floorstand for Fixed Fan Option.
- Floorstand for Translatable Fan Option.

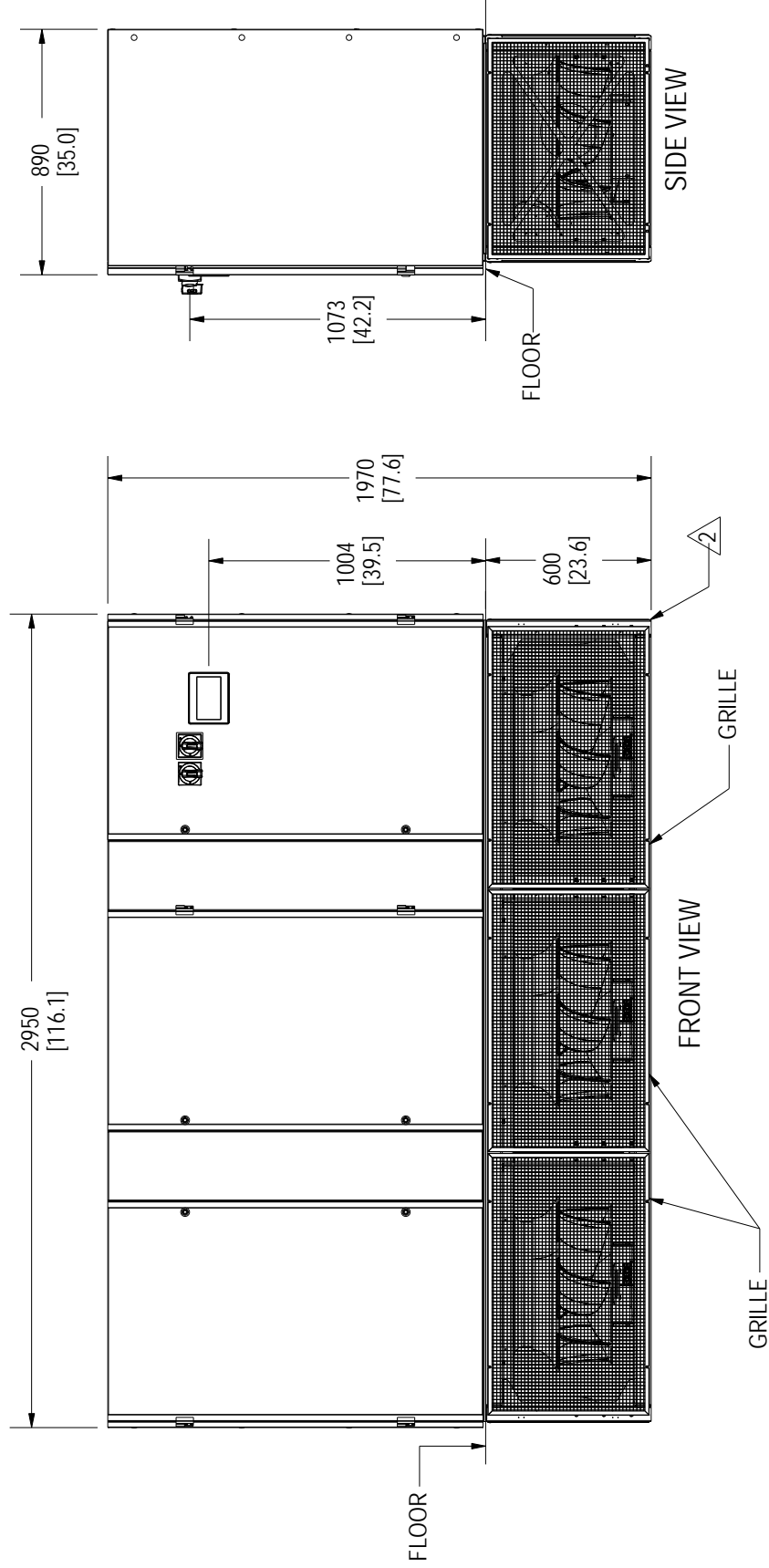
3. A recommended clearance of 39.3 in. (1,000 mm) must be provided in front of the unit to allow access to all internal components.



VERTIV™

LIEBERT® PCW

**CABINET DIMENSIONAL DATA - PW145
DOWNFLOW, FANS IN RAISED FLOOR**



Dry weight of Unit	lb(kg)
PW145	1881(853)

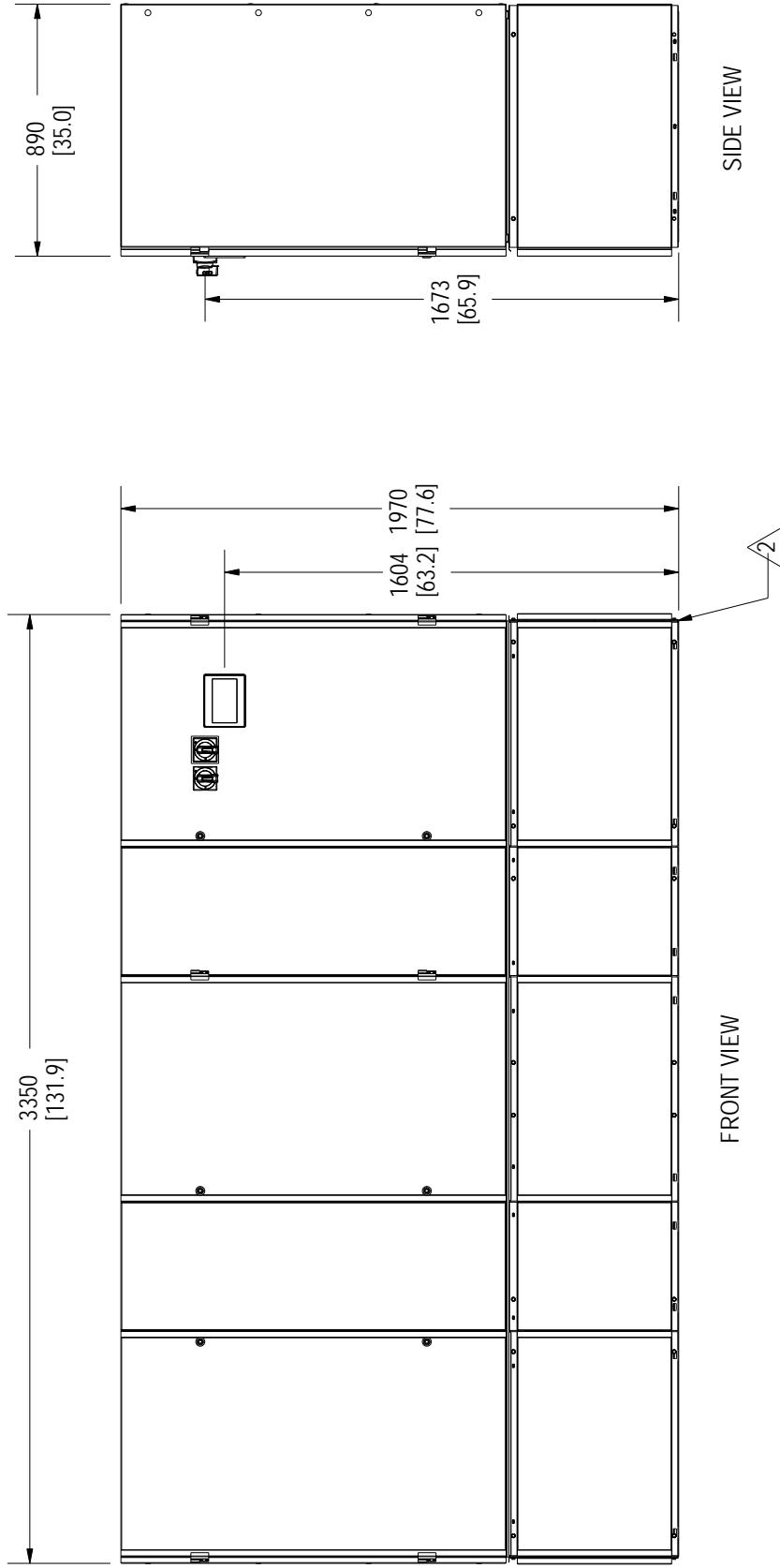
1. All dimensions have a tolerance of ± 13 mm (1/2").
2. Floor mount option required (leg kit, extended leg kit, or floorstand).
3. A recommended clearance of 39.3 in. (1,000 mm) must be provided in front of the unit to allow access to all internal components.



VERTIV™

LIEBERT® PCW

CABINET DIMENSIONAL DATA PW170 DOWNFLOW



Dry weight of Unit	lb(kg)
PW170	2105(955)

1. All dimensions measured have a tolerance of ± 13 mm (1/2").

2. Floor mount option required:

- Leg kit, extended leg kit, or floorstand for Fixed Fan Option.
- Floorstand for Translatable Fan Option.

3. A recommended clearance of 39.3 in. (1,000 mm) must be provided in front of the unit to allow access to all internal components.

VERTIV™**LIEBERT® PCW****CABINET DIMENSIONAL DATA PW170
DOWNFLOW, FANS IN RAISED FLOOR**

The drawing shows two views of the Liebert PCW cabinet:

- FRONT VIEW:** Shows a cabinet with a total width of 3350 [131.9]. The height is 1970 [77.6]. The distance from the top edge to the top of the fan grilles is 1004 [39.5]. The distance from the top edge to the bottom of the fan grilles is 600 [23.6]. The front panel features four grilles, each labeled "GRILLE".
- SIDE VIEW:** Shows the cabinet's depth of 890 [35.0]. The height from the floor to the top edge is 1073 [42.2]. The floor is labeled "FLOOR".

1. All dimensions have a tolerance of ± 13 mm (1/2").

△ Floor mount option required (leg kit, extended leg kit, or floorstand).

3. A recommended clearance of 39.3 in. (1,000 mm) must be provided in front of the unit to allow access to all internal components.

Dry weight of Unit PW170	lb(kg) 2105(955)
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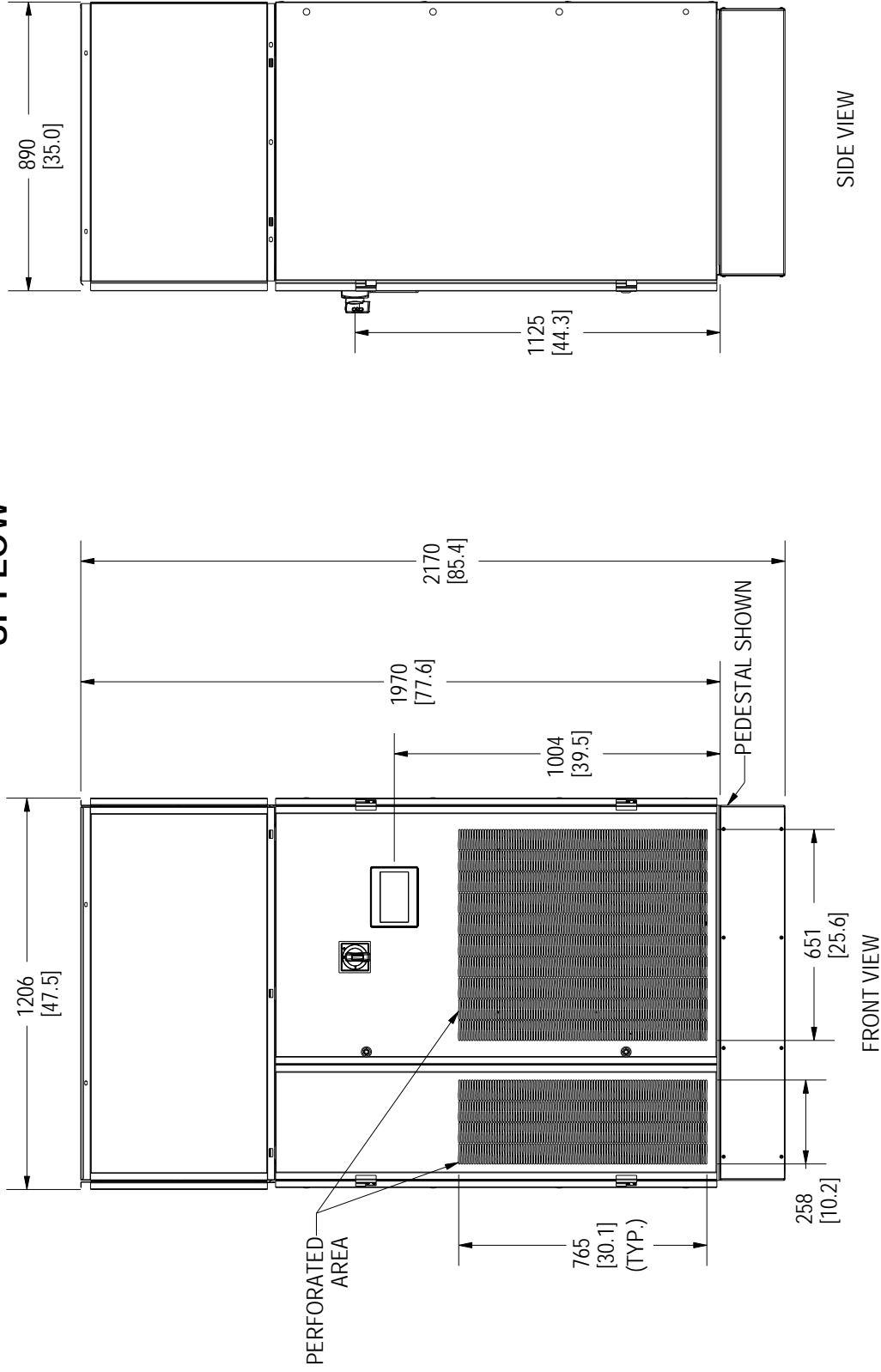
REV DATE: 11/2021



VERTIV™

LIEBERT® PCW

CABINET DIMENSIONAL DATA- PW035-040 UPFLOW



Dry weight of Unit	lb(kg)
PW035	785(356)
PW040	822(373)

1. All dimensions have a tolerance of ± 13 mm (1/2").
2. Pedestal required on Upflow units.
3. A recommended clearance of 39.3 in. (1,000 mm) must be provided in front of the unit to allow access to all internal components.

VERTIV™**LIEBERT® PCW****CABINET DIMENSIONAL DATA - PW045-060
UPFLOW**

The drawing includes the following dimensions:

- Overall width: 1750 [68.9]
- Overall height: 2170 [85.4]
- Distance from top to main panel: 1970 [77.6]
- Distance from top to bottom panel: 1004 [39.5]
- Distance from top to bottom panel (typical): 765 [30.1] (TYP.)
- Distance from bottom panel to base: 651 [25.6] (TYP.)
- Distance from front panel to back panel: 1022 [40.2]
- Distance from front panel to side panel: 890 [35.1]

Labels include: PERFORATED AREA, PEDESTAL SHOWN, FRONT VIEW, and SIDE VIEW.

Dry weight of Unit	lb(kg)
PW045	1060(481)
PW060	1127(511)

1. All dimensions have a tolerance of ± 13 mm (1/2").
2. Pedestal required on Upflow units.
3. A recommended clearance of 39.3 in. (1,000 mm) must be provided in front of the unit to allow access to all internal components.

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VERTIV™**LIEBERT® PCW****CABINET DIMENSIONAL DATA- PW070-080
UPFLOW**

The drawing consists of two views: a front view and a side view. The front view shows a cabinet with three vertical sections. The left section is labeled 'PERFORATED AREA'. The middle section contains a control panel with a display and buttons. The right section contains a large filter. Dimensions for the front view include: total width 2050 [80.7], three filter sections each 651 [25.6] wide, a gap of 324 [12.8] between the first two filter sections, a gap of 651 [25.6] between the second and third filter sections, a total height of 2170 [85.4], a height of 1970 [77.6] to the top of the control panel, and a height of 1004 [39.5] to the top of the filter sections. A typical height of 765 [30.1] is noted for the filter sections. The side view shows a depth of 887 [34.9] and a height of 1022 [40.2] to the top of the filter sections. A 'PEDESTAL SHOWN' is indicated at the bottom right of the front view.

1. All dimensions have a tolerance of ± 13 mm (1/2").

2. Pedestal required on Upflow units.

3. A recommended clearance of 39.3 in. (1,000 mm) must be provided in front of the unit to allow access to all internal components.

Dry weight of Unit	lb(kg)
PW070	1283(582)
PW080	1319(598)

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VERTIV™**LIEBERT® PCW****CABINET DIMENSIONAL DATA - PW095-110
UPFLOW**

The drawing includes the following dimensions:

- Overall width: 2556 [100.6]
- Overall height: 890 [35.0]
- Front view depth: 765 [30.1] (TYP.)
- Front view depth: 651 [25.6] (TYP.)
- Front view depth: 1004 [39.5]
- Front view depth: 1970 [77.6]
- Front view depth: 2170 [85.4]
- Side view depth: 1022 [40.3]

Labels in the drawing include: FRONT VIEW, SIDE VIEW, PERFORATED AREA, and PEDESTAL SHOWN.

Dry weight of Unit	lb(kg)
PW095	1499(680)
PW110	1631(740)

1. All dimensions have a tolerance of ± 13 mm (1/2").
2. Pedestal required on upflow units.
3. A recommended clearance of 39.3 in. (1,000 mm) must be provided in front of the unit to allow access to all internal components.

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VERTIV™

LIEBERT® PCW

FLOORSTAND DIMENSIONAL DATA

ISO VIEW
FLOORSTAND PCW95-110 SHOWN

Unit	A mm[inch]	B mm[inch]	C mm[inch]	D mm[inch]	E mm[inch]	F mm[inch]	Number of Legs
PW035-040	1186 [46.7]	1156 [45.5]	1084 [42.7]	NA	NA	36 [1.4]	4
PW045-060	1750 [68.9]	1706 [67.2]	1648 [64.9]	824 [32.4]	NA	29 [1.1]	6
PW070-080	1934 [76.1]	2006 [79.0]	1934 [76.1]	967 [38.1]	NA	36 [1.4]	6
PW095-110	2536 [99.8]	2506 [98.7]	2434 [95.8]	832 [32.8]	832 [32.8]	36 [1.4]	8
PW145	2936 [115.6]	2906 [114.4]	2834 [111.6]	832 [32.8]	832 [32.8]	51 [2.0]	8
PW170	3350 [131.9]	3306 [130.2]	3248 [127.9]	838 [33.0]	864 [34.0]	29 [1.1]	8

1. The legs are cut to length and support the unit at different heights 200 - 800 mm [7.9 - 31.5 in].
 - Minimum Floorstand height of 559 mm [22.0 in] is required for Translatable Fan Option.

2. Floorstand can be used with upflow or downflow units. Downflow unit shown

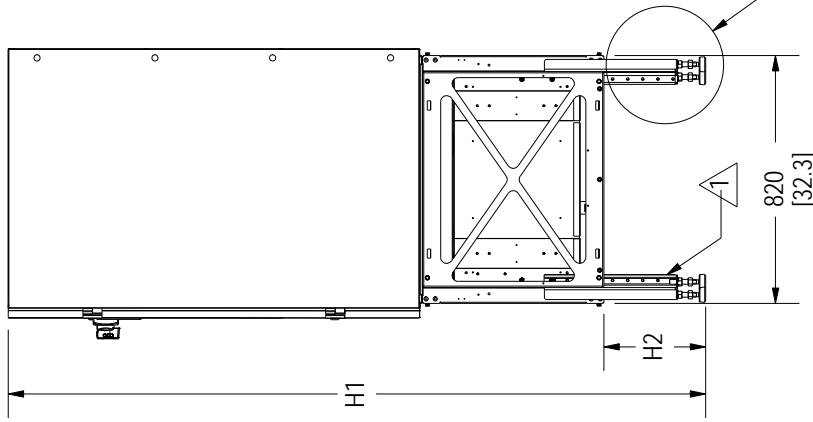
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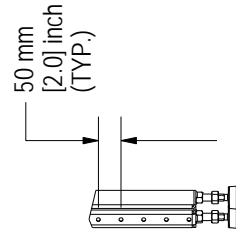
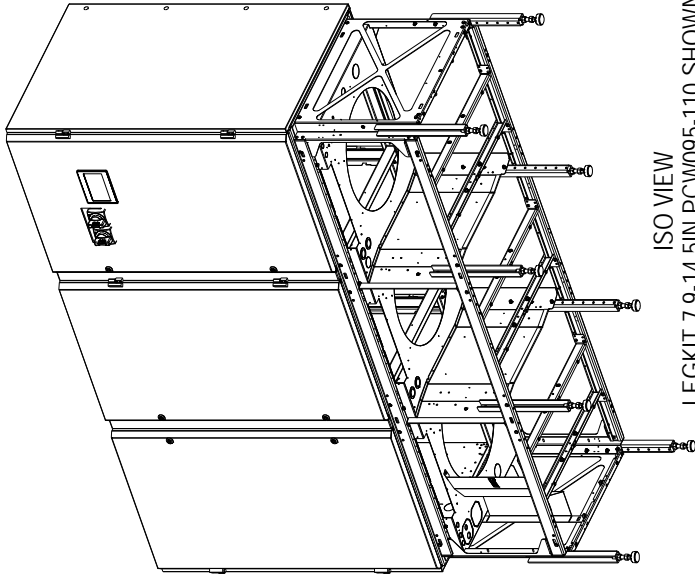
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REV DATE: 11/2022

LEG KIT DIMENSIONAL DATA DOWNFLOW



Unit	Number of Legs
PW035-040	4
PW045-060	6
PW070-080	6
PW095-110	8
PW145	8
PW170	8

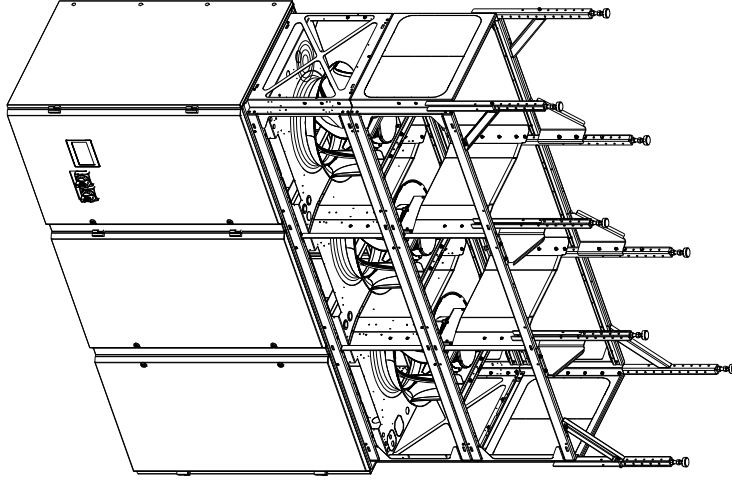
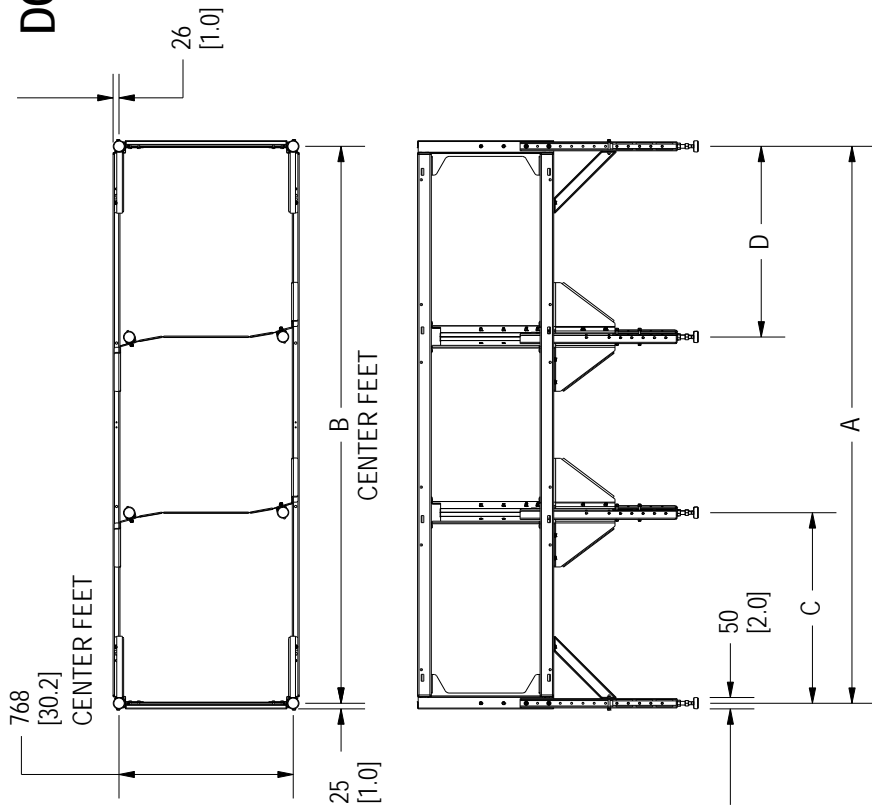


DETAIL A

Total Height mm [in]	Height mm [in]
H1	H2
2000 - 2338 [78.7 - 92.0]	200 - 368 [7.9 - 14.5]
2338 - 2539 [92.0 - 100.0]	368 - 569 [14.5 - 22.4]
2539 - 2770 [100.0 - 109.1]	569 - 800 [22.4 - 31.5]

△ Leg kit height is fully adjustable through the height range listed with leveling feet adjustment +/- 20mm (.75")

EXTENDED LEG KIT DIMENSIONAL DATA DOWNFLOW



ISO VIEW
LEGKIT 31.5-48.0" PCW95-110 SHOWN

Unit	A	B	C	D	# Legs
PW035-040	1156 [45.5]	1106 [43.5]	NA	NA	4
PW045-060	1706 [67.2]	1656 [65.2]	428 [16.9] front leg only	428 [16.9] rear leg only	6
PW070-080	2006 [79.0]	1956 [77.0]	990 [39.0]	NA	6
PW095-110	2456 [96.7]	2456 [96.7]	840 [33.1]	841 [33.1]	8
PW145	2906 [114.4]	2856 [112.4]	952 [37.5]	952 [37.5]	8
PW170	3306 [130.2]	3256 [128.2]	1078 [42.4]	1078 [42.4]	8

Height mm [in]	Height mm [in]
H1	H2
800 - 1219 [31.5 - 48.0]	200 - 619 [7.9 - 24.4]

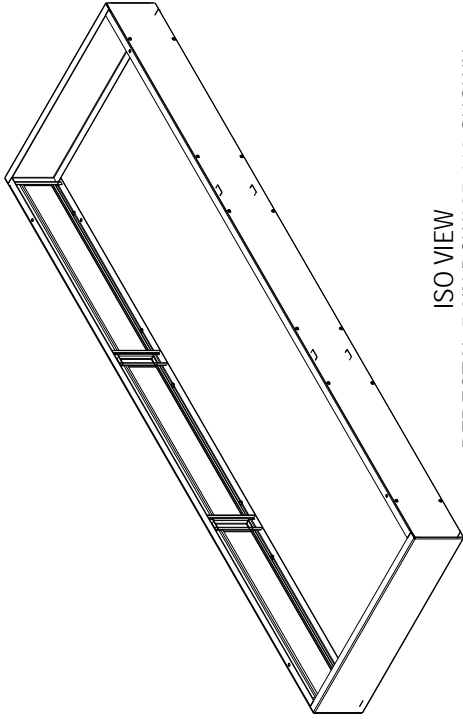
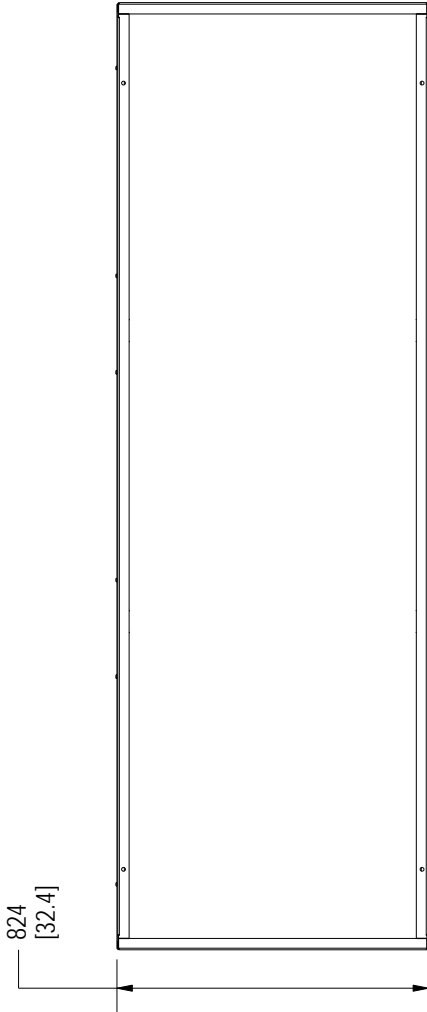
1. Extended leg kit heights are fully adjustable through the height range "H1" listed. Hole spacing is 50mm(2.0 in) with leveling feet adjustment +/- 20mm (0.8 in)



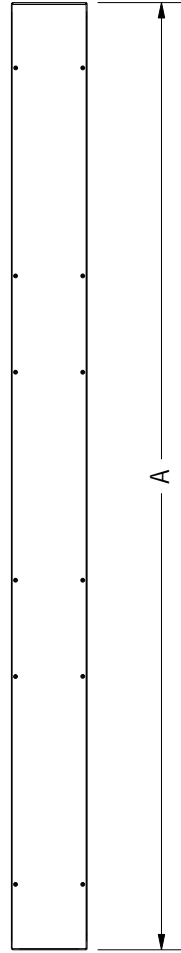
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LIEBERT® PCW

PEDESTAL DIMENSIONAL DATA



ISO VIEW
PEDESTAL 7.9IN PCW095-110 SHOWN

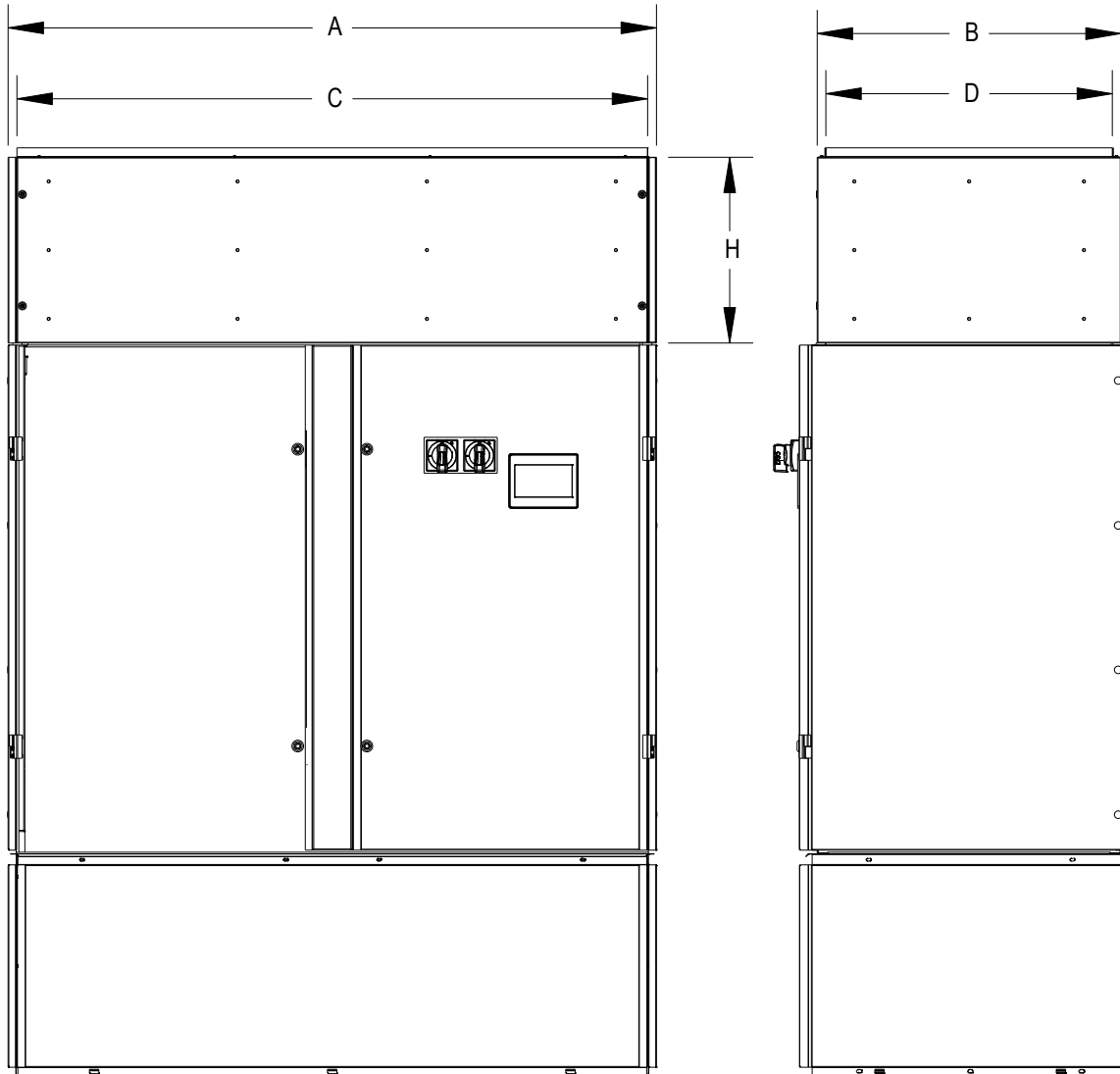


Unit	A
PW035-040	1156 [45.5]
PW045-060	1706 [67.2]
PW070-080	2006 [79.0]
PW095-110	2506 [98.7]

1. Pedestal must be used with upflow units. It can be used as floor mount option for downflow front discharge units.

DIMENSIONAL DATA

VERTICAL FLOW EXT. PLENUM DOWNFLOW PCW035-170



Plenum Dimensional Data mm (in)				
Model	A	B	C	D
PCW035-040	1200 (47.2)	820 (32.3)	1152 (45.4)	773 (30.4)
PCW045-060	1750 (68.9)	820 (32.3)	1702 (67.0)	773 (30.4)
PCW070-080	2050 (80.7)	820 (32.3)	2002 (78.8)	773 (30.4)
PCW095-110	2550 (100.4)	820 (32.3)	2502 (98.5)	773 (30.4)
PCW145	2950 (116.1)	820 (32.3)	2902 (114.3)	773 (30.4)
PCW170	3350 (131.9)	820 (32.3)	3302 (130.0)	773 (30.4)

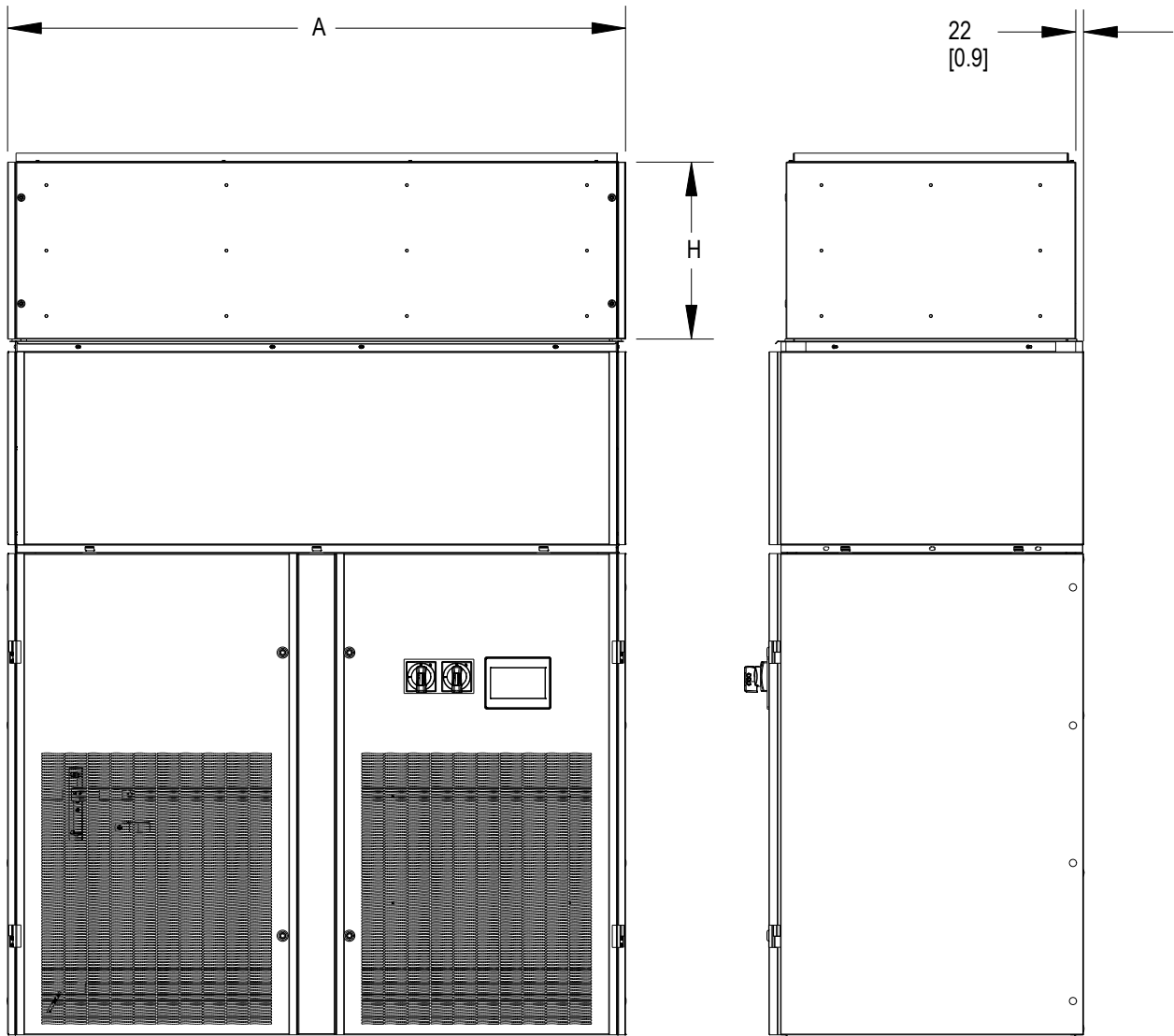
Plenum Height mm (in)
H
500 (19.7)
600 (23.6)
800 (31.5)
900 (35.4)

Notes:

1. Plenums require duct flanges to be field installed on the unit. These flanges are included with plenum kit.

DIMENSIONAL DATA

VERTICAL FLOW EXTENSION PLENUM UPFLOW PCW035-110



Plenum Dimensional Data mm (in)				
Model	A	B	C	D
PCW035-040	1200 (47.2)	820 (32.3)	1152 (45.4)	773 (30.4)
PCW045-060	1750 (68.9)	820 (32.3)	1702 (67.0)	773 (30.4)
PCW070-080	2050 (80.7)	820 (32.3)	2002 (78.8)	773 (30.4)
PCW095-110	2550 (100.4)	820 (32.3)	2502 (98.5)	773 (30.4)

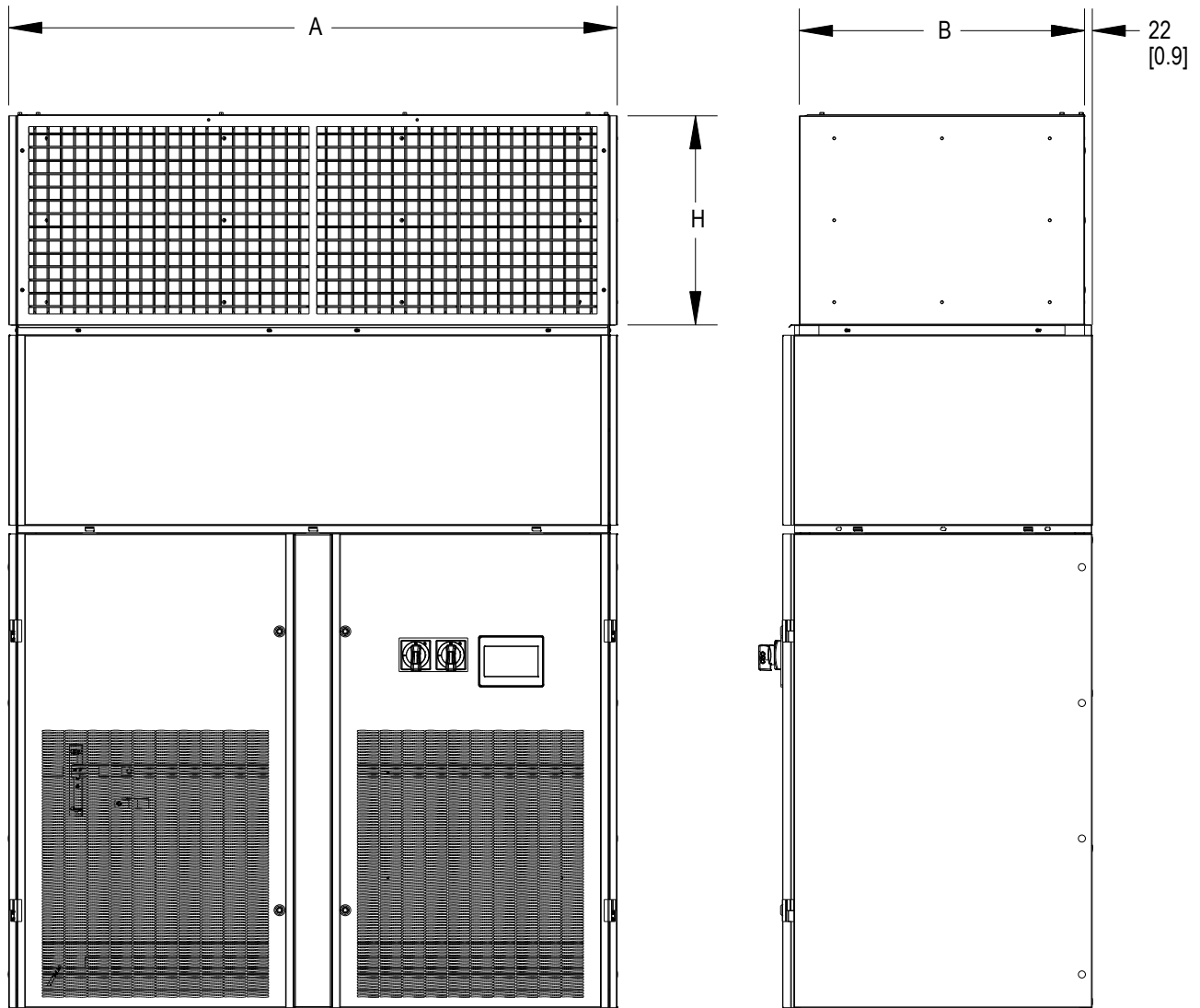
Plenum Height mm (in)
H
500 (19.7)
600 (23.6)
800 (31.5)
900 (35.4)

Notes:

1. Plenums require duct flanges to be field installed on the unit. These flanges are included with plenum kit.

DIMENSIONAL DATA

HORIZONTAL PLENUM W/ GRID UPFLOW PCW035-110



Plenum Dimensional Data mm (in)		
Model	A	B
PCW035-040	1200 (47.2)	820 (32.3)
PCW045-060	1750 (68.9)	820 (32.3)
PCW070-080	2050 (80.7)	820 (32.3)
PCW095-110	2550 (100.4)	820 (32.3)

Plenum Height mm (in)
H
600 (23.6)

Notes:

1. Plenums require duct flanges to be field installed on the unit. These flanges are included with plenum kit.

ELECTRICAL FIELD CONNECTIONS

PW035-PW040

STANDARD HIGH VOLTAGE ELECTRICAL CONNECTIONS

- 1) High voltage entrance - Located on left side wall (quantity 1)
- 2) Low voltage entrance - Located in LV section (quantity 3)
- 3) Source 1 three phase electrical service - Terminals are on top of disconnect switch. Three phase service not provided by Vertiv. (Switch size will vary based on unit options.)

Copper wire

30A & 60A -	4 - 18AWG	torque - 3.39Nm(30lb-in)
100A -	12 - 18AWG	torque - 2.26Nm(20lb-in)
	10AWG	torque - 3.95Nm(35lb-in)
	1 - 8AWG	torque - 4.52Nm(40lb-in)

- 4) Earth ground - Terminal for field supplied earth grounding wire. Earth grounding required for Vertiv units.

Copper wire

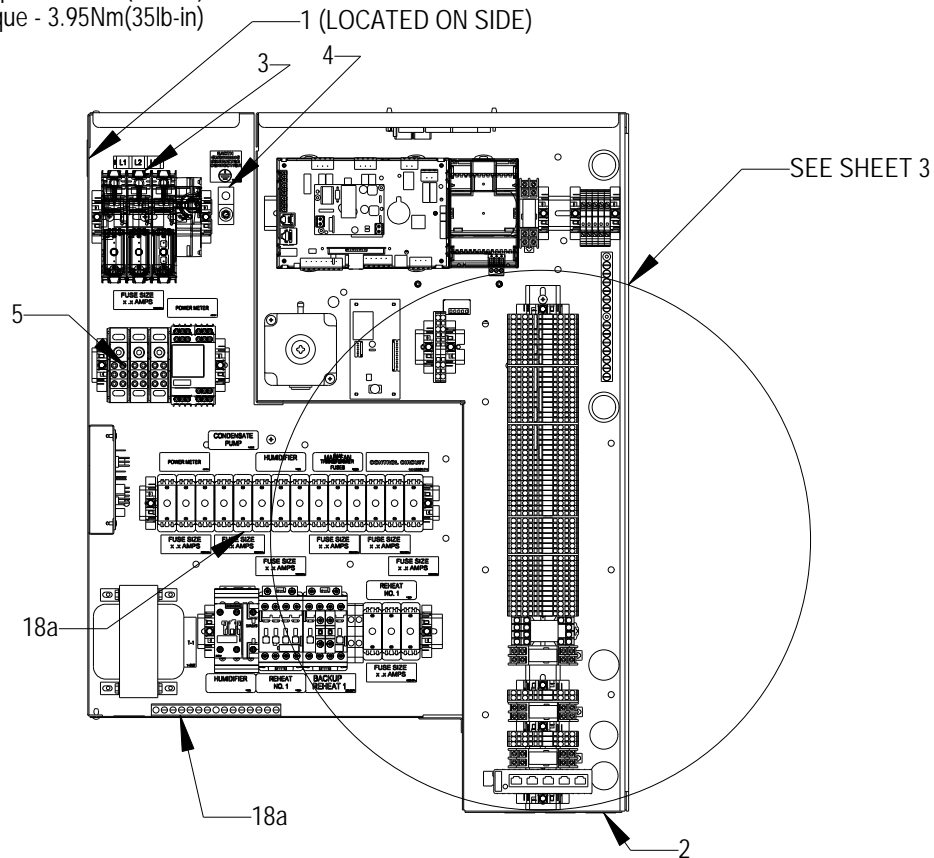
14 - 10AWG	torque - 3.95Nm(35lb-in)
8AWG	torque - 4.52Nm(40lb-in)
6 - 4AWG	torque - 5.08Nm(45lb-in)
2AWG	torque - 5.65Nm(50lb-in)

- 5) Unit factory installed disconnect switch and main fuses - Access to the high voltage electric panel compartment can be obtained only with the switch in the off position. Fused disconnects are provided with a defeater button that allows access to the electrical panel when power is on.

OPTIONAL HIGH VOLTAGE ELECTRICAL CONNECTIONS

- 18a) Field installed condensate pump power - Condensate pump power connections are connected to the condensate pump fuses. Green GND wire will connect to ground bar in high volt section of the electric panel.

Power wire	torque - 2.26Nm(20lb-in)
GND wire	torque - 3.95Nm(35lb-in)





LIEBERT® PCW

ELECTRICAL FIELD CONNECTIONS

PW045-PW170

STANDARD HIGH VOLTAGE ELECTRICAL CONNECTIONS

- 1) High voltage entrance - Located on left side wall (quantity 2)
- 2) Low voltage entrance - Located in LV section (quantity 3)
- 3a) Source 1 three phase electrical service - Terminals are on top of disconnect switch. Three phase service not provided by Vertiv. (Switch size will vary based on unit options.)

Copper wire

30A & 60A -	4 - 18AWG	torque - 3.39Nm(30lb-in)
100A -	2 - 18AWG	torque - 2.26Nm(20lb-in)
	10AWG	torque - 3.95Nm(35lb-in)
	1 - 8AWG	torque - 4.52Nm(40lb-in)

- 3b) Source 2 three phase electrical service - Terminals are on top of disconnect switch. Three phase service not provided by Vertiv. (Switch size will vary based on unit options. See #3a for wire range and torque.)

- 4) Earth ground - Terminal for field supplied earth grounding wire. Earth grounding required for Vertiv units.

Copper wire

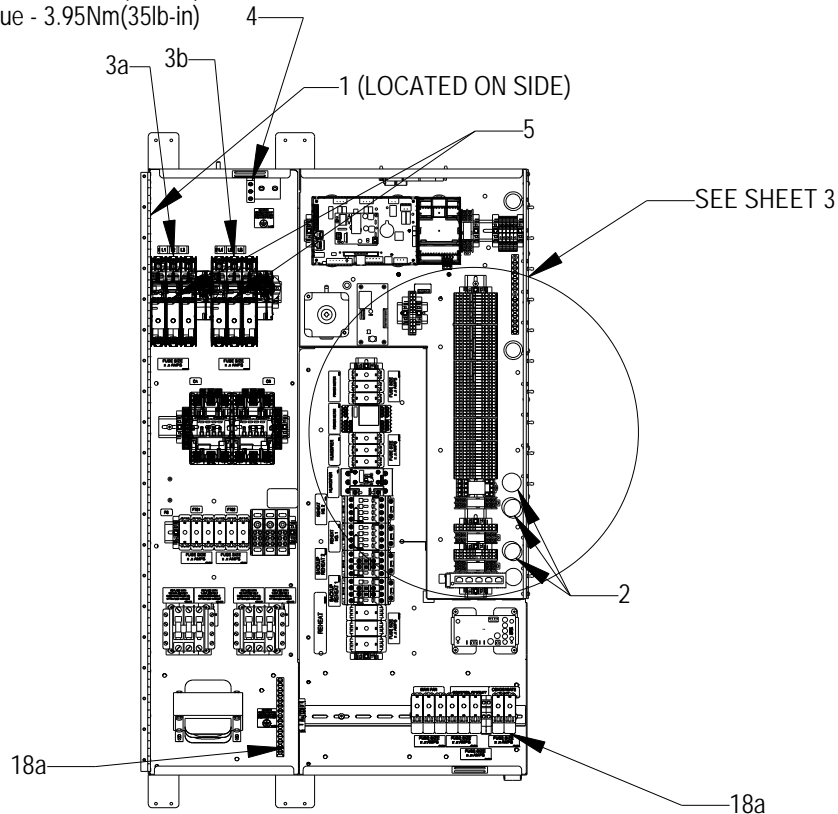
14 -	10AWG	torque - 3.95Nm(35lb-in)
	8AWG	torque - 4.52Nm(40lb-in)
6 -	4AWG	torque - 5.08Nm(45lb-in)
	2AWG	torque - 5.65Nm(50lb-in)

- 5) Unit factory installed disconnect switch and main fuses - Access to the high voltage electric panel compartment can be obtained only with the switch in the off position. Fused disconnects are provided with a defeater button that allows access to the electrical panel when power is on.

OPTIONAL HIGH VOLTAGE ELECTRICAL CONNECTIONS

- 18a) Field installed condensate pump power - Condensate pump power connections are connected to the condensate pump fuses. Green GND wire will connect to ground bar in high volt section of the electric panel.

Power wire	torque - 2.26Nm(20lb-in)
GND wire	torque - 3.95Nm(35lb-in)



ELECTRICAL FIELD CONNECTIONS

PW045-PW170

STANDARD LOW VOLTAGE ELECTRICAL CONNECTIONS

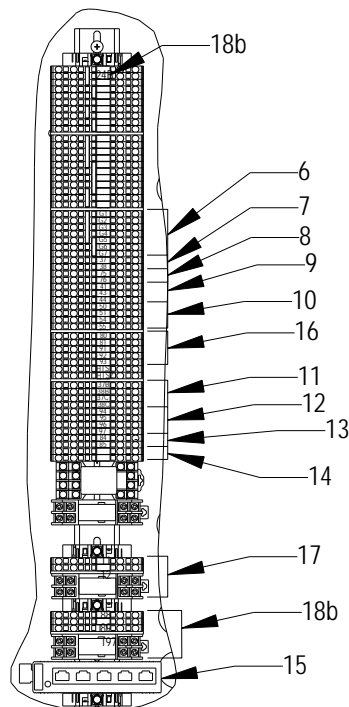
- 6) Customer connections to Common, terminals G1-G7.
- 7) Remote unit shutdown - Replace existing jumper between terminals 37 & 38 with field supplied normally closed switch having a minimum 75VA, 24VAC rating. Use field supplied Class 1 wiring.
- 8) Common alarm - On any alarm, normally open contact is closed across terminals 75 & 76 for remote indication. 1 Amp, 24VAC max load. Use Class 1 field supplied wiring.
- 9) Analog inputs- Terminals 41, 43, and 44 are user configurable for 0-10V, 0-5V, or 4-20mA.
- 10) Customer digital inputs - Terminals for field supplied, normally open contacts, having a minimum 75VA, 24VAC rating, between terminals G1-G7 and 50, 51, 55, and 56. Use Class 1 supply wiring.

OPTIONAL LOW VOLTAGE TERMINAL PACKAGE CONNECTIONS

- 11) 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.
- 12) Extra 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.
- 13) Main fan enabled contact - On VFD enable, normally open dry contact is closed across terminals 84 & 85 for remote indication. 1 AMP, 24VAC max load. Use Class 1 field supplied wiring.
- 14) Spare terminals

OPTIONAL ELECTRICAL CONNECTIONS

- 15) Unit-to-Unit and BMS communication - Five port Ethernet hub (Four ports usable)
- 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) Remote humidifier - On any call for humidification, normally open dry contact is closed across terminals 11 and 12 to signal field supplied remote humidifier. 1 AMP, 24VAC max load. Use Class 1 field supplied wiring.
- 18b) Field installed condensate pump alarm and signal - Condensate pump LV signal connections connect to terminal 24B & 197. Condensate alarm - 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.





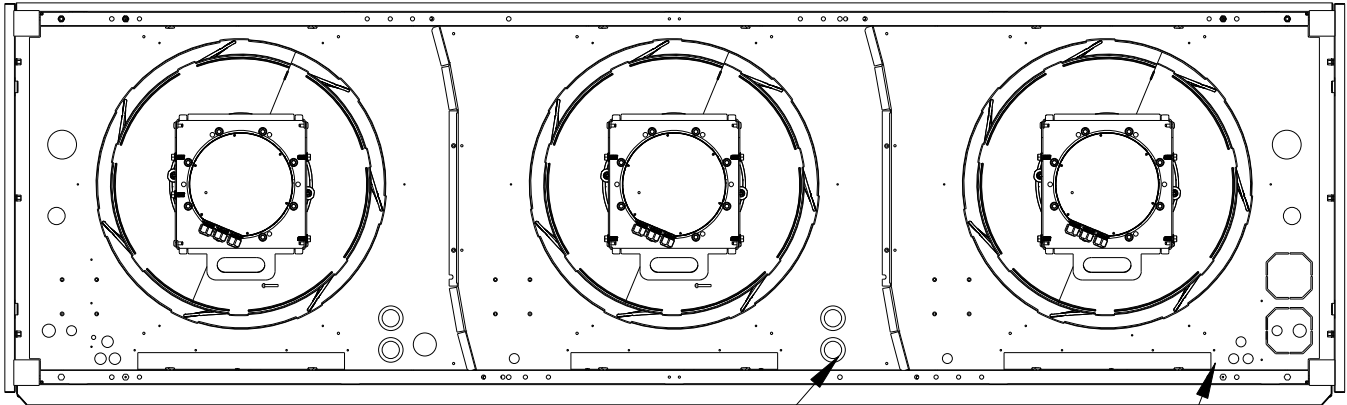
LIEBERT® PCW

ELECTRICAL FIELD CONNECTIONS

PW035-PW170

UPFLOW UNITS
(AS SEEN FROM TOP)

BACK



FRONT

2" / 1 3/8" Double knockouts provided for field wiring to high volt connections.
PW035 - PW040 - Quantity 1
PW045 - PW110 - Quantity 2

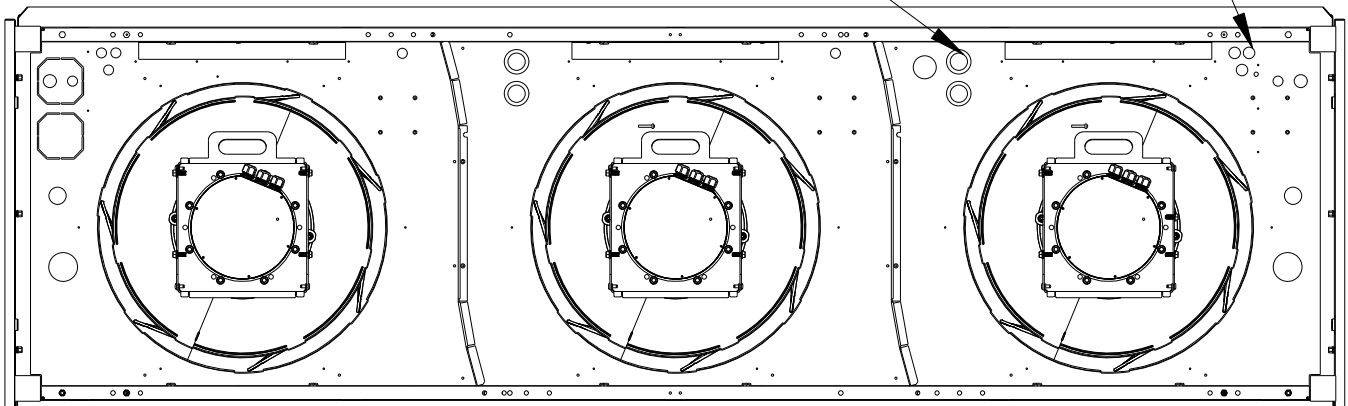
7/8" Knockouts provided for field wiring to low volt connections.
PW035 - PW040 - Quantity 2
PW045 - PW110 - Quantity 3

2" / 1 3/8" Double knockouts provided for field wiring to high volt connections.
PW035 - PW040 - Quantity 1
PW045 - PW170 - Quantity 2

7/8" Knockouts provided for field wiring to low volt connections.
PW035 - PW040 - Quantity 2
PW045 - PW170 - Quantity 3

DOWNFLOW UNITS
(AS SEEN FROM BOTTOM)

FRONT

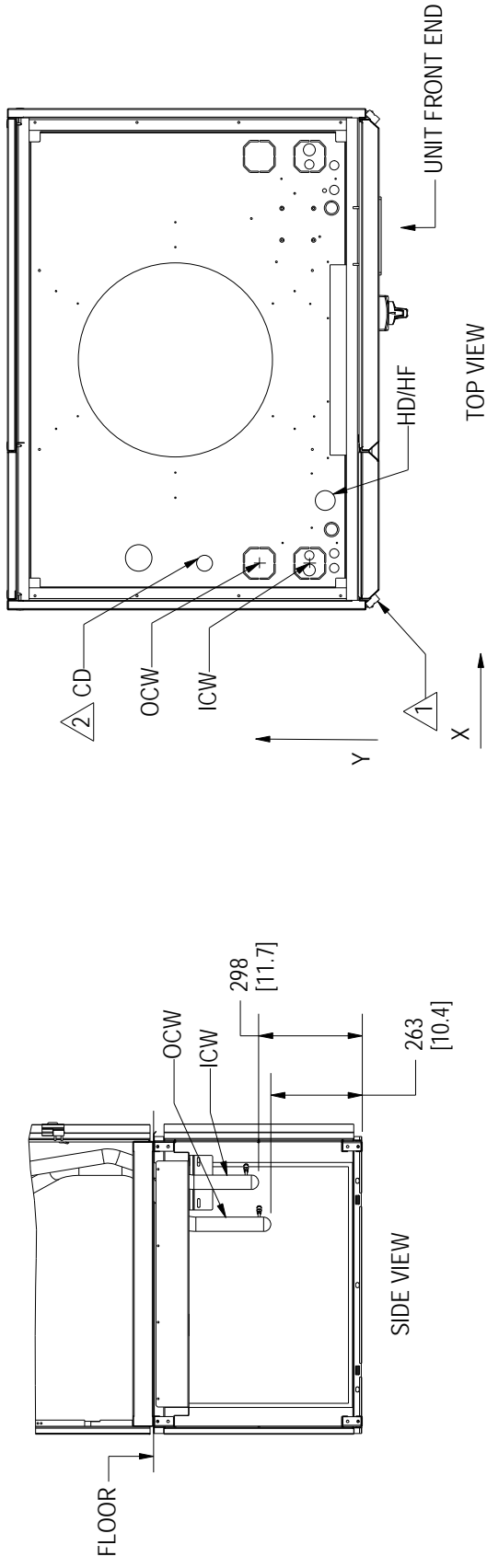


BACK

NOTES:

1. Protective mesh (not shown) must be cut to allow customer wiring. Care must be taken to prevent cutting into factory wiring (not shown).
2. Customer wiring must enter and be secured properly to prevent contact with fan impeller.

PIPING CONNECTION LOCATIONS- PW035-040 DOWNFLOW



- 1 All dimensions measured from front left corner of unit including panels and have a tolerance of ± 13 mm (1/2").
- 2 Downflow units contain a factory installed condensate trap. Do not trap external to the unit. Drain line may contain boiling water. Select appropriate drain system materials. Field pitch Condensate Drain line a minimum of 1/8" (3.2 mm) per foot (305 mm). The drain line must comply with local codes.
3. End grilles, panels, EP, Coil, Piping and EC Fan not shown for clarity.
4. Condensate pump is field installed.

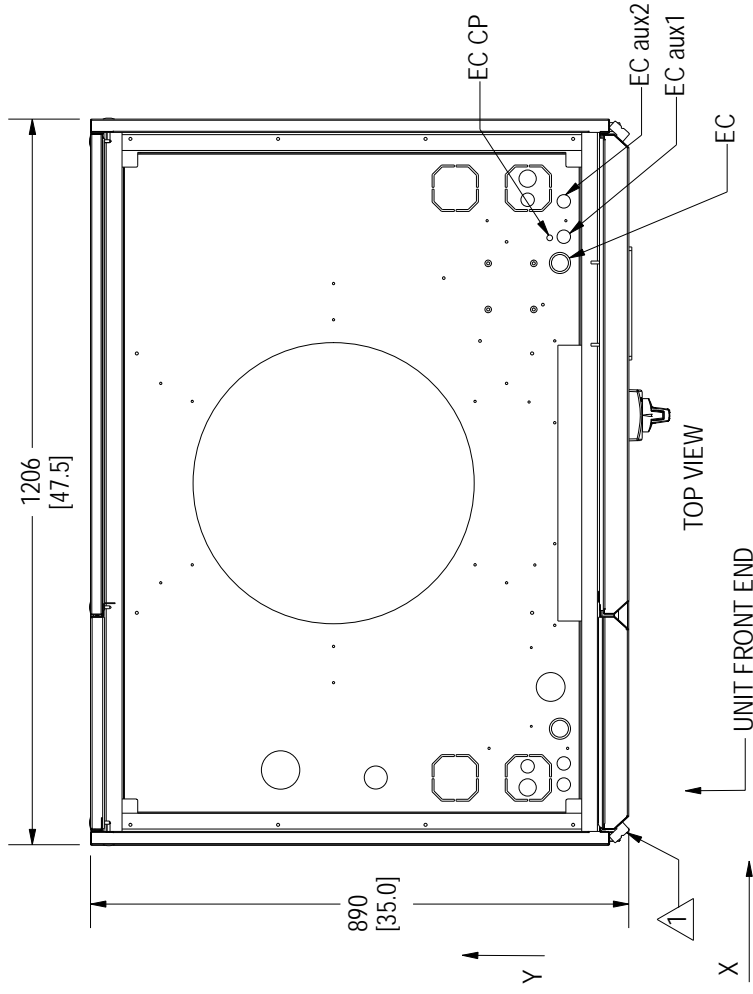
POINT	DESCRIPTION	X mm (in)	Y mm (in)	CONNECTION SIZE mm (in)	
				PW035	PW040
ICW	Chilled water inlet (single chilled water circuit)	113 (4.5)	166 (6.5)	O.D. Cu \varnothing 41 (1-5/8)	
OCW	Chilled water outlet (single chilled water circuit)	113 (4.5)	287 (11.3)	O.D. Cu \varnothing 41 (1-5/8)	
CD	Condensate drain	111 (4.4)	418 (16.5)	I.D. Hose \varnothing 19 (3/4)	
HD/HF	Humidifier drain / Humidifier supply	261 (10.3)	129 (5.1)	I.D. Hose \varnothing 19 (3/4) / O.D. Cu \varnothing 6 (1/4)	



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ELECTRICAL CONNECTION LOCATIONS- PW035-040 DOWNFLOW



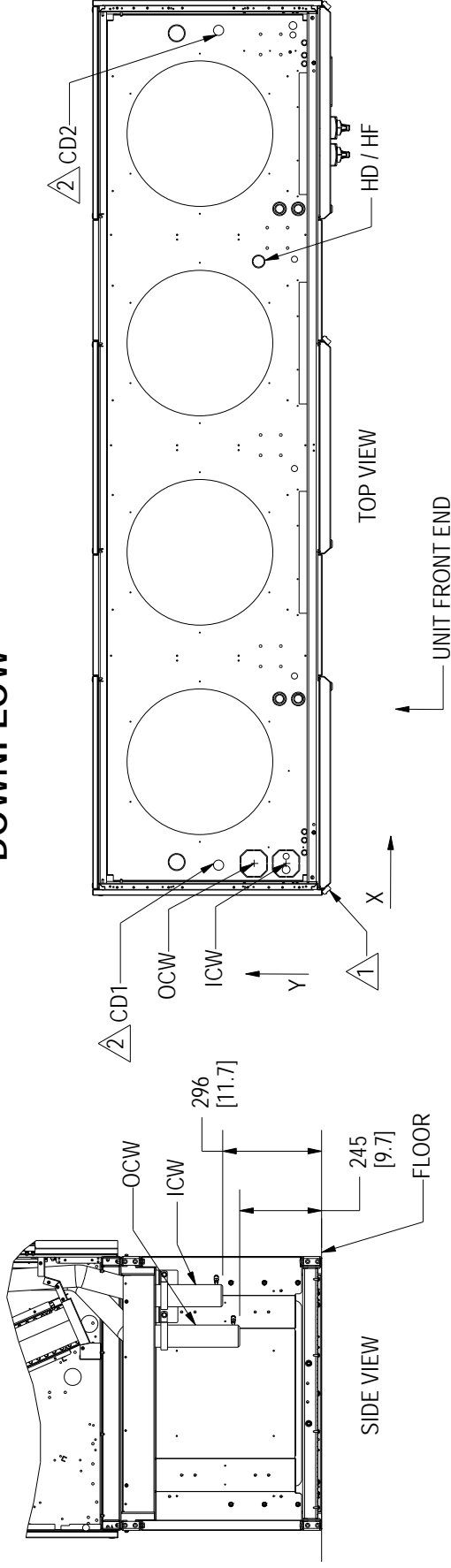
△1. All dimensions measured from front left corner of unit including panels and have a tolerance of ± 13 mm (1/2").

2. End grilles, panels, EP, Coil, Piping and EC Fan not shown for clarity.

3. Condensate pump is field installed.

POINT	DESCRIPTION	X mm (in)	Y mm (in)	CONNECTION SIZE mm (in)	
				PW035	PW040
EC	Electrical power supply	963 (37.9)	114 (4.5)	\varnothing 35(1-3/8)X28(1.1) Double KO	
EC aux1	Low voltage cables	1007 (39.6)	107 (4.2)	\varnothing 22 (7/8)	
EC aux2	Low voltage cables	1065 (41.9)	107 (4.2)	\varnothing 22 (7/8)	
EC CP	Electrical power supply, Condensate pump	1004 (39.5)	126 (5.0)	\varnothing 9.5 (3/8)	

PIPING CONNECTION LOCATIONS PW170 DOWNFLOW



1. All dimensions measured from front left corner of unit including panels and have a tolerance of ± 13 mm (1/2").

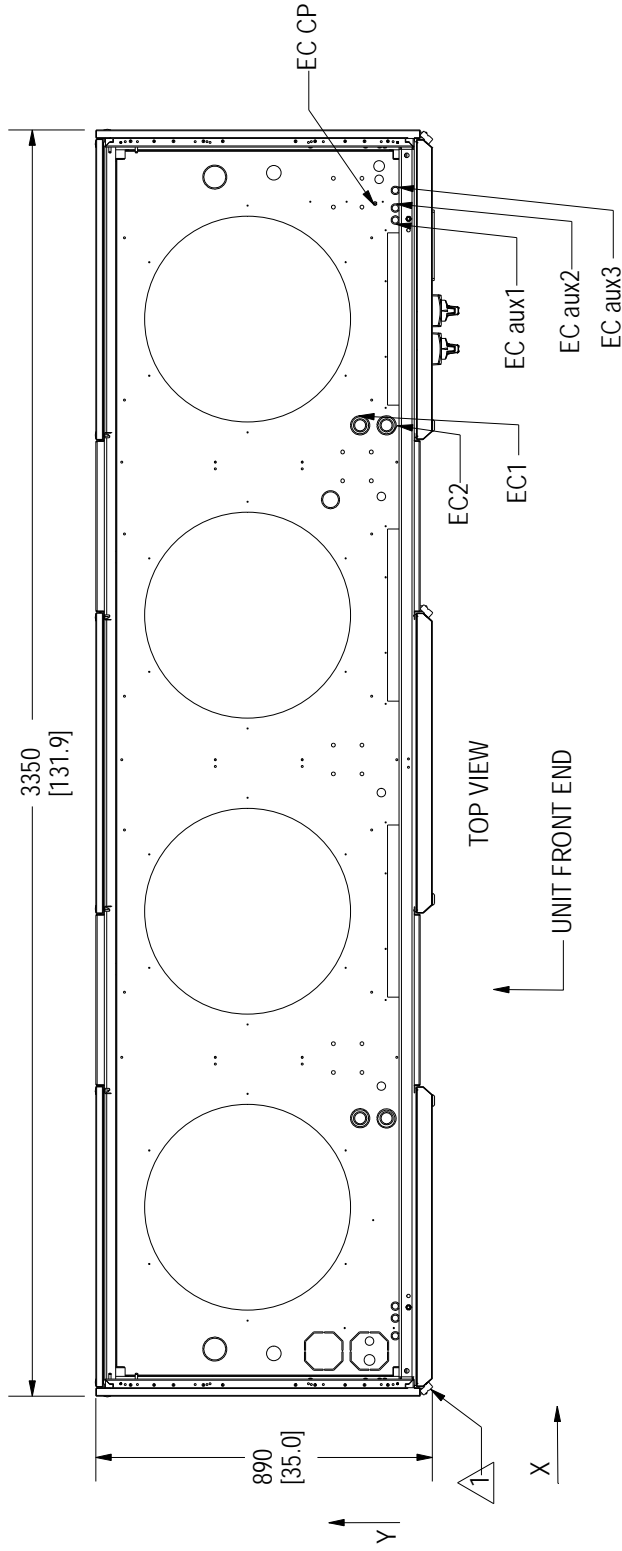
2. Downflow units contain a factory installed condensate trap. Do not trap external to the unit. Drain line may contain boiling water. Select appropriate drain system materials. Field pitch Condensate Drain line a minimum of 1/8" (3.2 mm) per foot (305 mm). The drain line must comply with local codes.

3. End grilles, panels, EP, Coil, Piping and EC Fan not shown for clarity.

POINT	DESCRIPTION	X mm (in)	Y mm (in)	CONNECTION SIZE mm (in)	
				PW170	
ICW	Chilled water inlet (single chilled water circuit)	113 (4.4)	166 (6.5)	O.D. Cu \varnothing 67 (2-5/8)	
OCW	Chilled water outlet (single chilled water circuit)	113 (4.4)	287 (11.3)	O.D. Cu \varnothing 67 (2-5/8)	
CD1	Condensate drain	113 (4.4)	419 (16.5)	I.D. Hose \varnothing 19 (3/4)	
CD2	Condensate drain	3237 (127.4)	419 (16.5)	I.D. Hose \varnothing 19 (3/4)	
HD/HF	Humidifier drain/Humidifier supply	2372 (93.4)	269 (10.6)	I.D. Hose \varnothing 19 (3/4) / O.D. Cu \varnothing 6 (1/4)	



**ELECTRICAL CONNECTION LOCATIONS PW170
DOWNFLOW**

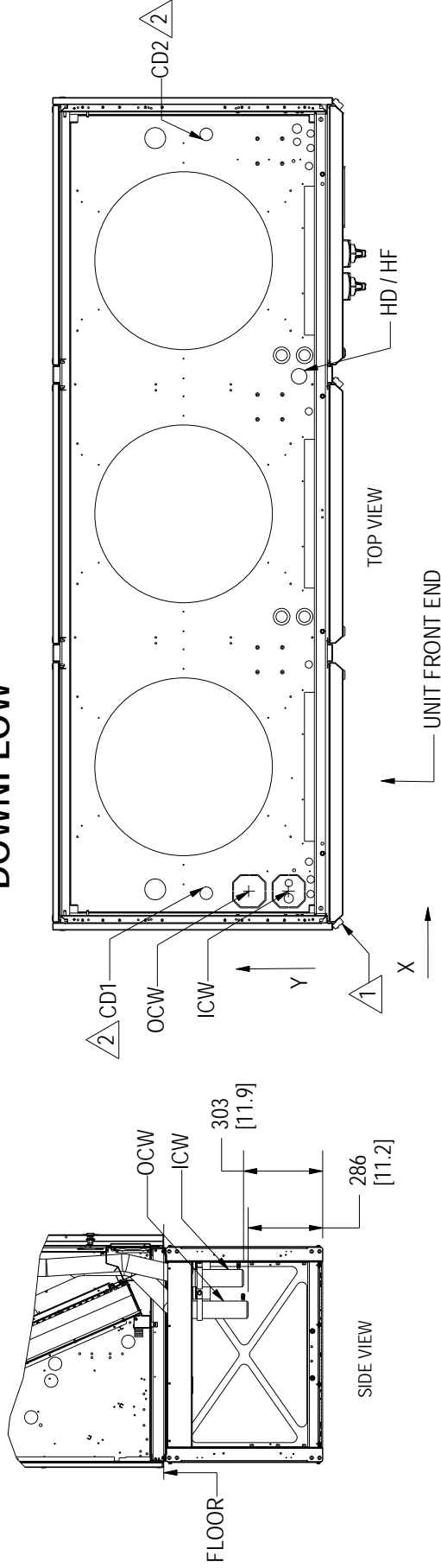


1. All dimensions measured from front left corner of unit including panels and have a tolerance of ± 13 mm (1/2").
2. End grilles, panels, EP, Coil, Piping and EC Fan not shown for clarity.
3. Condensate pump is field installed.

POINT	DESCRIPTION	X mm (in)	Y mm (in)	CONNECTION SIZE mm (in)
EC1	Electrical power supply	2569 (101.1)	191(7.5)	PW170
EC2	Electrical power supply	2569 (101.1)	121(4.8)	\varnothing 51(2)X35(1-3/8) Double KO
EC aux1	Low voltage cables	3112 (122.5)	98(3.9)	\varnothing 51(2)X35(1-3/8) Double KO
EC aux2	Low voltage cables	3144 (123.8)	98(3.9)	\varnothing 22 (7/8) KO
EC aux3	Low voltage cables	3190 (125.6)	98(3.9)	\varnothing 22 (7/8) KO
EC CP	Electrical power supply. Condensate pump	3156 (124.2)	112 (4.4)	\varnothing 9.5 (3/8)



PIPING CONNECTION LOCATIONS-PW095-110 DOWNFLOW



1. All dimensions measured from front left corner of unit including panels and have a tolerance of ± 13 mm (1/2").

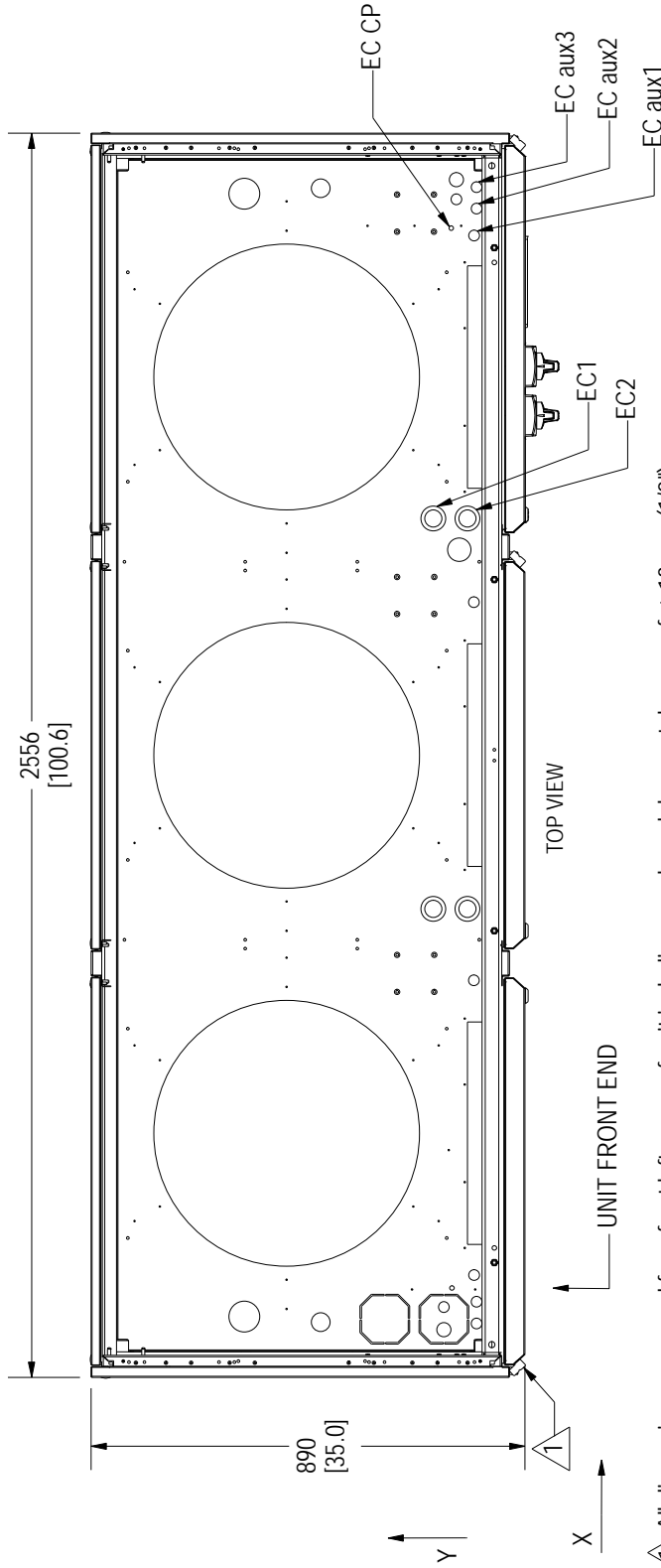
2. Downflow units contain a factory installed condensate trap. Do not trap external to the unit. Drain line may contain boiling water. Select appropriate drain system materials. Field pitch Condensate Drain line a minimum of 1/8" (3.2 mm) per foot (305 mm). The drain line must comply with local codes.

3. End grilles, panels, EP, Coil, Piping and EC Fan not shown for clarity.

POINT	DESCRIPTION	X mm (in)	Y mm (in)	CONNECTION SIZE mm (in)	
				PW095	PW0110
ICW	Chilled water inlet (single chilled water circuit)	113 (4.5)	166 (6.5)	O.D. Cu \varnothing 67 (2-5/8)	
OCW	Chilled water outlet (single chilled water circuit)	113 (4.5)	286 (11.2)	O.D. Cu \varnothing 67 (2-5/8)	
CD1	Condensate drain	113 (4.5)	419 (16.5)	I.D. Hose \varnothing 19 (3/4)	
CD2	Condensate drain	2437 (95.9)	419 (16.5)	I.D. Hose \varnothing 19 (3/4)	
HD/HF	Humidifier drain / Humidifier supply	1696 (66.8)	135 (5.3)	I.D. Hose \varnothing 19 (3/4) / O.D. Cu \varnothing 6 (1/4)	



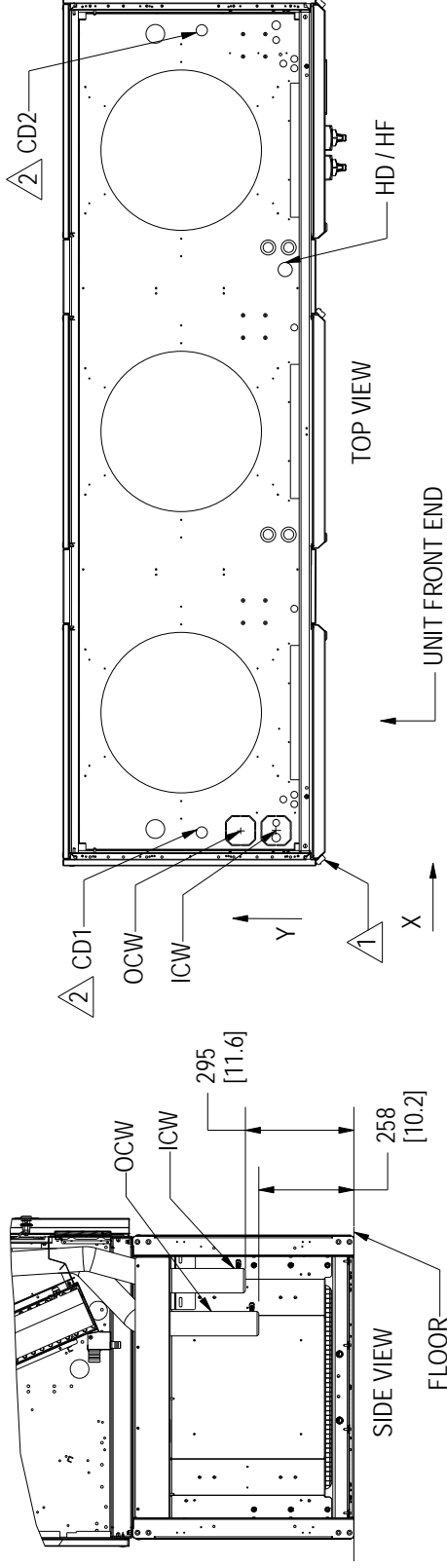
ELECTRICAL CONNECTION LOCATIONS-PW095-110 DOWNFLOW



1. All dimensions measured from front left corner of unit including panels and have a tolerance of $\pm 13 \text{ mm } (1/2\text{'})$.
2. End grilles, panels, EP, Coil, Piping and EC Fan not shown for clarity.
3. Condensate pump is field installed.

POINT	DESCRIPTION	X mm (in)	Y mm (in)	CONNECTION SIZE mm (in)	
				PW095	PW0110
EC1	Electrical power supply	1760 (69.3)	188 (7.4)	$\varnothing 51(2) \times 35(1-3/8)$	Double KO
EC2	Electrical power supply	1760 (69.3)	118(4.7)	$\varnothing 51(2) \times 35(1-3/8)$	Double KO
EC aux1	Low voltage cables	2340 (92.1)	105 (4.1)	$\varnothing 22$	(7/8)
EC aux2	Low voltage cables	2395 (94.3)	100 (3.9)	$\varnothing 22$	(7/8)
EC aux3	Low voltage cables	2440 (96.0)	100 (3.9)	$\varnothing 22$	(7/8)
EC CP	Electrical power supply, Condensate pump	2356 (93.0)	152 (6.0)	$\varnothing 9.5$	(3/8)

PIPING CONNECTION LOCATIONS- PW145 DOWNFLOW



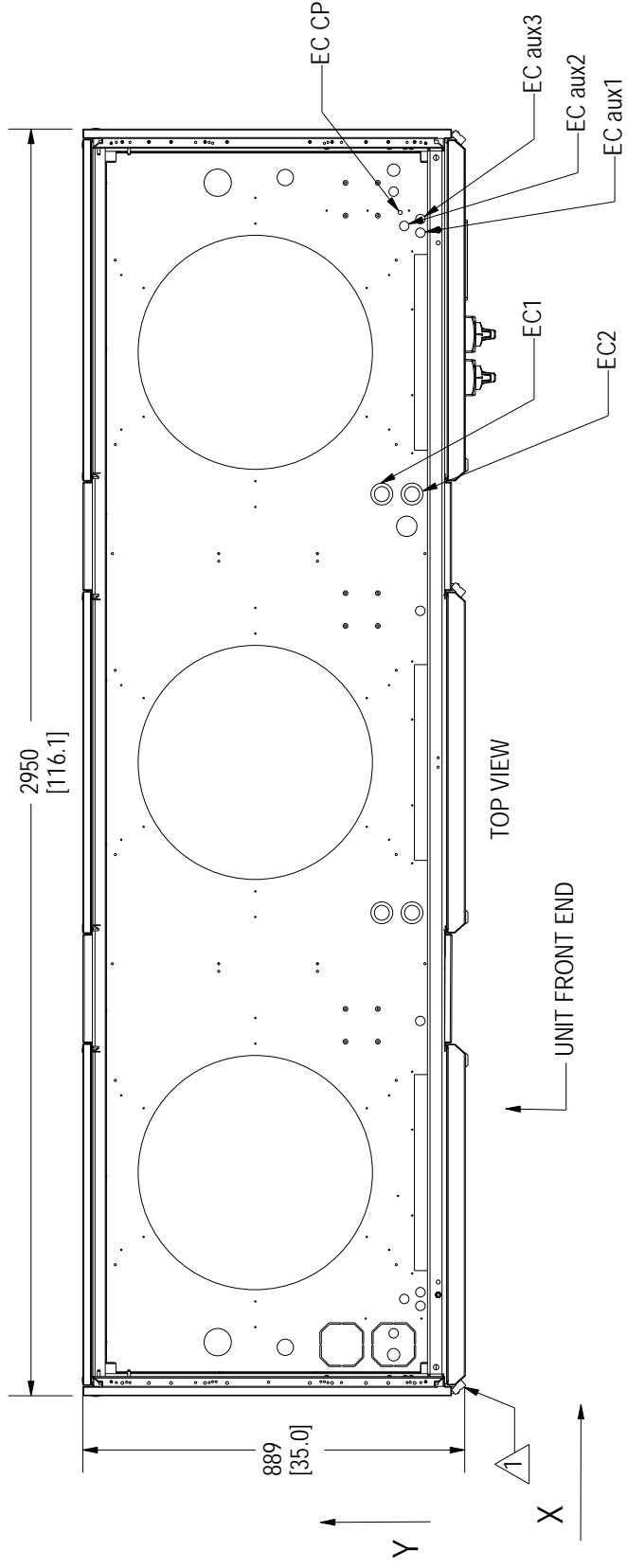
1. All dimensions measured from front left corner of unit including panels and have a tolerance of ± 13 mm ($1/2$ ").

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

3. End grilles, panels, EP, Piping, Coil and EC Fan not shown for clarity.

POINT	DESCRIPTION	X mm (in)	Y mm (in)	CONNECTION SIZE mm (in)	
				PW145	
ICW	Chilled water inlet (single chilled water circuit)	113 (4.4)	169 (6.7)	O.D. Cu \varnothing 67 (2-5/8)	
OCW	Chilled water outlet (single chilled water circuit)	113 (4.4)	285 (11.2)	O.D. Cu \varnothing 67 (2-5/8)	
CD1	Condensate drain	113 (4.4)	419 (16.5)	I.D. Hose \varnothing 19 (3/4)	
CD2	Condensate drain	2856 (112.4)	419 (16.5)	I.D. Hose \varnothing 19 (3/4)	
HD/HF	Humidifier drain/Humidifier supply	2025 (79.7)	136 (5.4)	I.D. Hose \varnothing 19 (3/4) / O.D. Cu \varnothing 6 (1/4)	

ELECTRICAL CONNECTION LOCATIONS- PW145 DOWNFLOW



1. All dimensions measured from front left corner of unit including panels and have a tolerance of ± 13 mm (1/2").

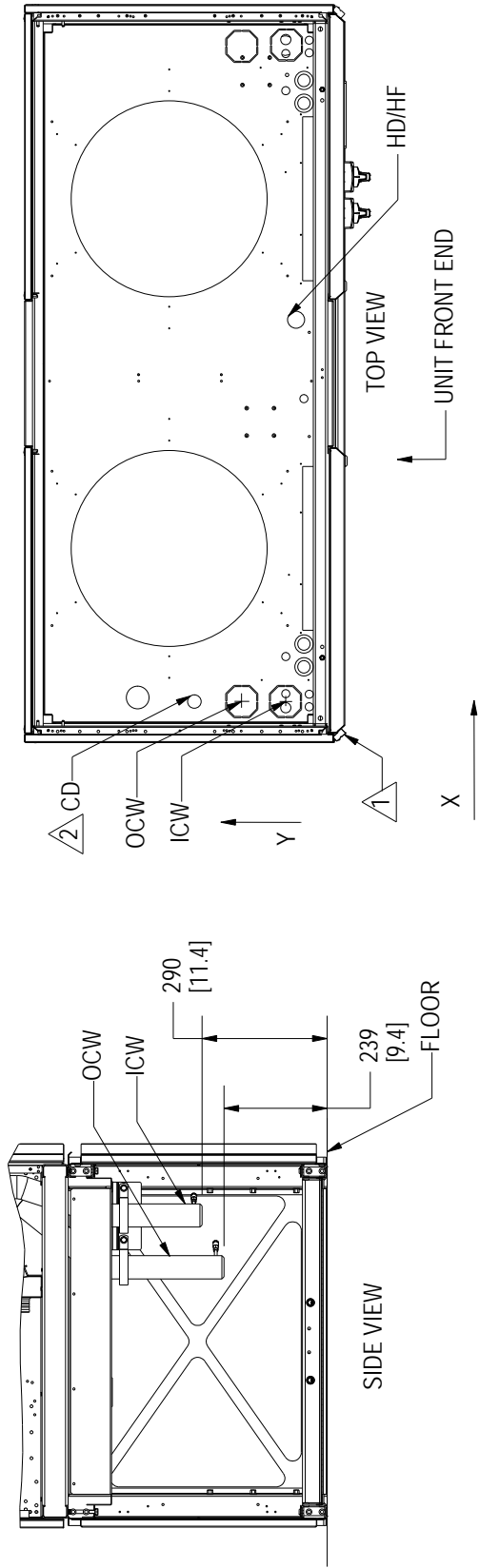
2. End grilles, panels, EP, Piping, Coil and EC Fan not shown for clarity.

3. Condensate pump is field installed.

POINT	DESCRIPTION	X mm (in)	Y mm (in)	CONNECTION SIZE mm (in)
EC1	Electrical power supply	2100 (82.7)	194 (7.6)	PW145
EC2	Electrical power supply	2100 (82.7)	124(4.9)	\varnothing 51(2)X35(1-3/8) Double KO
EC aux1	Low voltage cables	2709 (106.6)	104 (4.1)	\varnothing 51(2)X35(1-3/8) Double KO
EC aux2	Low voltage cables	2724(107.3)	142 (5.6)	\varnothing 22 (7/8)
EC aux3	Low voltage cables	2740(107.9)	104 (4.1)	\varnothing 22 (7/8)
EC CP	Electrical power supply, Condensate pump	2756 (108.5)	151 (6.0)	\varnothing 9.5 (3/8)



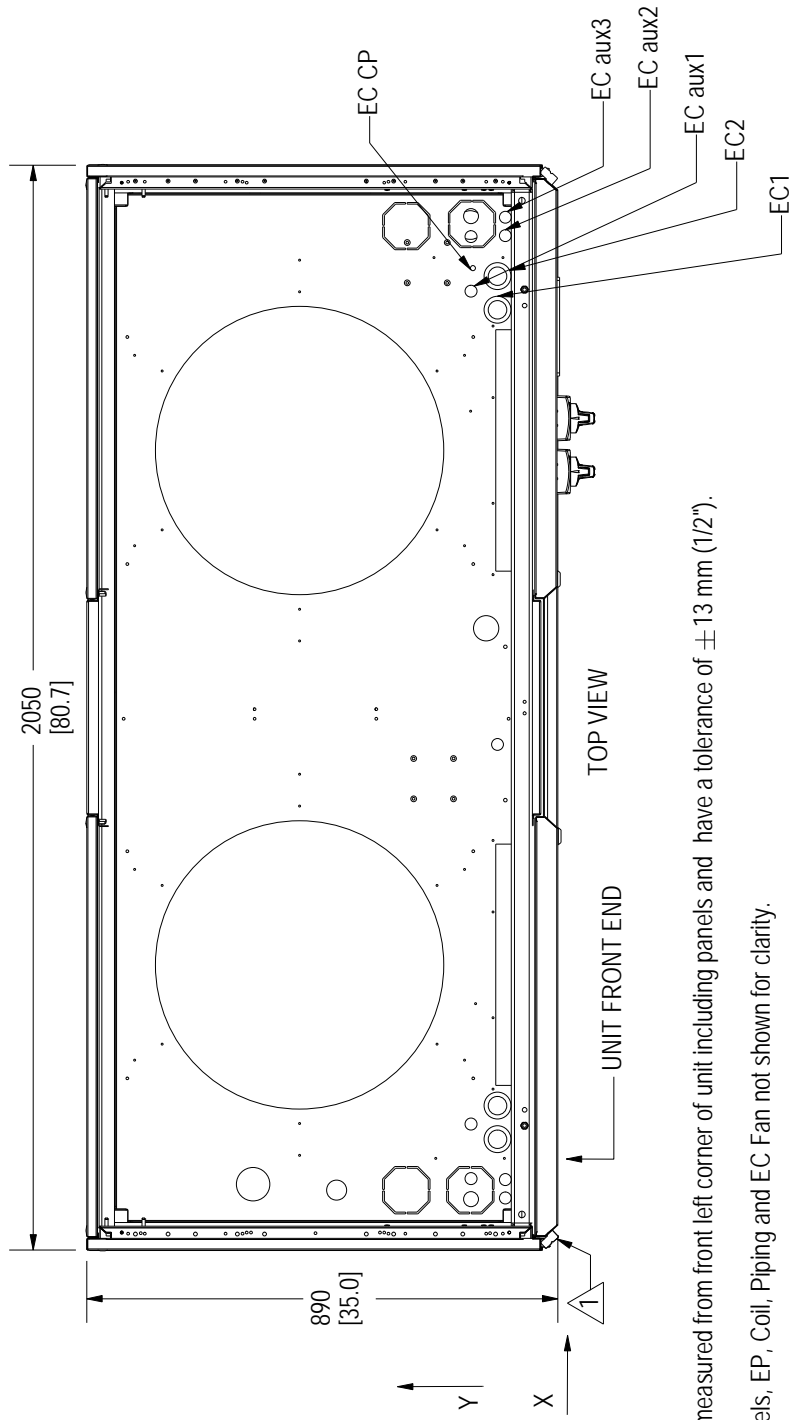
**PIPING CONNECTION LOCATIONS - PW070-080
DOWNFLOW**



- 1. All dimensions measured from front left corner of unit including panels and have a tolerance of ± 13 mm (1/2").
- 2. Downflow units contain a factory installed condensate trap. Do not trap external to the unit. Drain line may contain boiling water. Select appropriate drain system materials. Field pitch Condensate Drain line a minimum of 1/8" (3.2 mm) per foot (305 mm). The drain line must comply with local codes
- 3. End grilles, panels, EP, Piping, Coil and EC Fan not shown for clarity.

POINT	DESCRIPTION	X mm (in)	Y mm (in)	CONNECTION SIZE mm (in)	
				PW070	PW080
ICW	Chilled water inlet (single chilled water circuit)	113 (4.5)	165 (6.5)	O.D. Cu \varnothing 54 (2-1/8)	
OCW	Chilled water outlet (single chilled water circuit)	113 (4.5)	287 (11.3)	O.D. Cu \varnothing 54 (2-1/8)	
CD	Condensate drain	113 (4.5)	418 (16.5)	I.D. Hose \varnothing 19 (3/4)	
HD/HF	Humidifier drain / Humidifier supply	1175 (46.3)	135 (5.3)	I.D. Hose \varnothing 19 (3/4) / O.D. Cu \varnothing 6 (1/4)	

ELECTRICAL CONNECTION LOCATIONS - PW070-080 DOWNFLOW



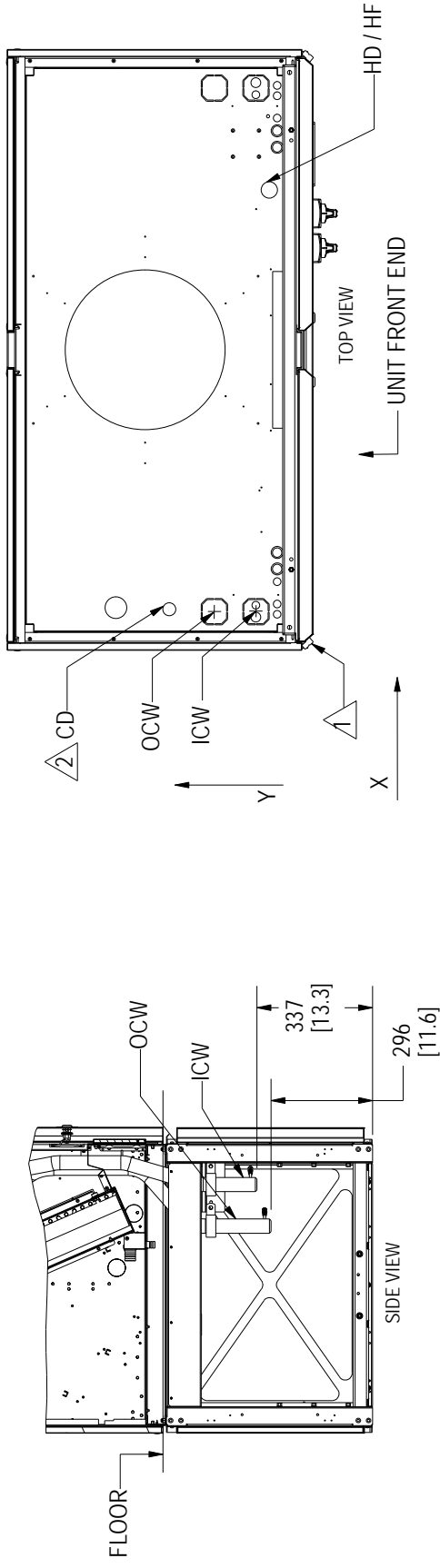
1. All dimensions measured from front left corner of unit including panels and have a tolerance of ± 13 mm (1/2").

2. End grilles, panels, EP, Coil, Piping and EC Fan not shown for clarity.

3. Condensate pump is field installed.

POINT	DESCRIPTION	X mm (in)	Y mm (in)	CONNECTION SIZE mm (in)	
				PW070	PW080
EC1	Electrical power supply	1777 (70.0)	114 (4.5)	\varnothing 51(2)X35(1-3/8)	Double KO
EC2	Electrical power supply	1841(72.5)	114 (4.5)	\varnothing 51(2)X35(1-3/8)	Double KO
EC aux1	Low voltage cables	1813 (71.4)	164 (6.5)	\varnothing 22 (7/8)	
EC aux2	Low voltage cables	1918(75.5)	99(3.9)	\varnothing 22 (7/8)	
EC aux3	Low voltage cables	1953(76.9)	99(3.9)	\varnothing 22 (7/8)	
EC CP	Electrical power supply, Condensate pump	1856 (73.1)	161 (6.3)	\varnothing 9.5 (3/8)	

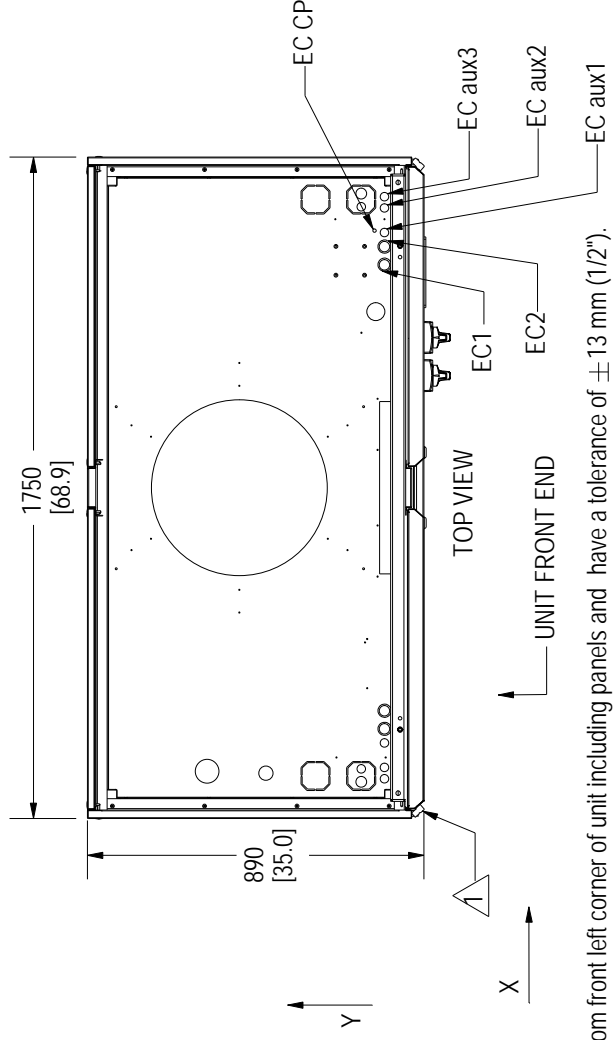
PIPING CONNECTION LOCATIONS- PW045-060 DOWNFLOW



1. All dimensions measured from front left corner of unit including panels and have a tolerance of $\pm 13 \text{ mm}$ (1/2").
2. Downflow units contain a factory installed condensate trap. Do not trap external to the unit. Drain line may contain boiling water. Select appropriate drain system materials. Field pitch Condensate Drain line a minimum of 1/8" (3.2 mm) per foot (305 mm). The drain line must comply with local codes.
3. End grilles, panels, EP, Coil, Piping and EC Fan not shown for clarity.
4. The PW045 unit frame is displayed. The PW060 unit frame is configured to contain two fans and not displayed.

POINT	DESCRIPTION	X mm (in)	Y mm (in)	CONNECTION SIZE mm (in)	
				PW045	PW060
ICW	Chilled water inlet (single chilled water circuit)	113 (4.4)	166 (6.5)	O.D. Cu $\varnothing 41$ (1-5/8)	
OCW	Chilled water outlet (single chilled water circuit)	113 (4.4)	287 (11.3)	O.D. Cu $\varnothing 41$ (1-5/8)	
CD	Condensate drain	113 (4.4)	418 (16.5)	I.D.Hose $\varnothing 19$ (3/4)	
HD/HF	Humidifier drain/Humidifier supply	1341 (52.8)	127 (5.0)	I.D. Hose $\varnothing 19$ (3/4) / O.D. Cu $\varnothing 6$ (1/4)	

ELECTRICAL CONNECTION LOCATIONS- PW045-060 DOWNFLOW



1. All dimensions measured from front left corner of unit including panels and have a tolerance of ± 13 mm (1/2").
2. End grilles, panels, EP, Coil, Piping and EC Fan not shown for clarity.
3. The PW045 unit frame is displayed. The PW060 unit frame is configured to contain two fans and not displayed.
4. Condensate pump is field installed.

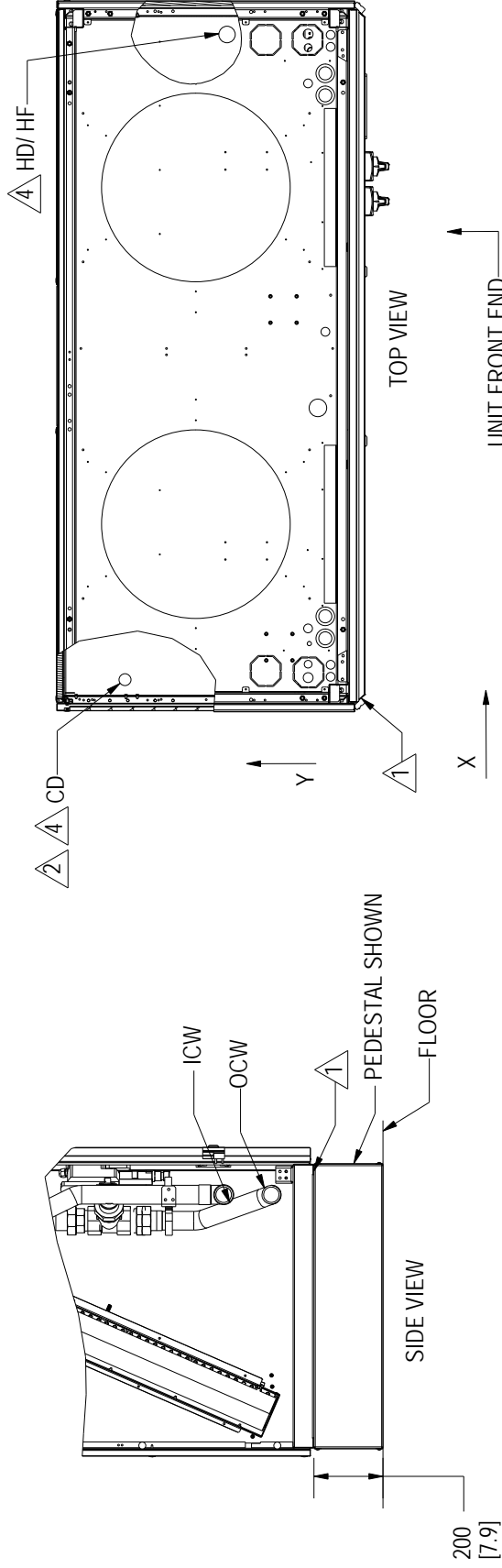
POINT	DESCRIPTION	X mm (in)	Y mm (in)	CONNECTION SIZE mm (in)	
				PW045	PW060
EC1	Electrical power supply	1465 (57.7)	104 (4.1)	\varnothing 35(1-3/8)X28(1.1)	Double KO
EC2	Electrical power supply	1513 (59.6)	104 (4.1)	\varnothing 35(1-3/8)X28(1.1)	Double KO
EC aux1	Low voltage cables	1550 (61.0)	104 (4.1)	\varnothing 22 (7/8)	
EC aux2	Low voltage cables	1615 (63.6)	104 (4.1)	\varnothing 22 (7/8)	
EC aux3	Low voltage cables	1645 (64.8)	104 (4.1)	\varnothing 22 (7/8)	
EC CP	Electrical power supply, Condensate pump	1556 (61.2)	131 (5.2)	\varnothing 9.5 (3/8)	



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PIPING CONNECTION LOCATIONS-PW070-080 UPFLOW - LEFT CONNECTION



1. X, Y dimensions are measured from front left corner of unit including panels. Z dimension is measured from bottom of unit frame. Tolerance is ± 13 mm (1/2").
2. Upflow units do not contain a factory installed condensate trap. Trap external to the unit. Drain line may contain boiling water. Select appropriate drain system materials. Field pitch Condensate Drain line a minimum of 1/8" (3.2 mm) per foot (305 mm). The drain line must comply with local codes.
3. Panels and EC Fan not shown for clarity.
4. CD and HD/HF are located on Base plate.
5. Pedestal required on upflow units.

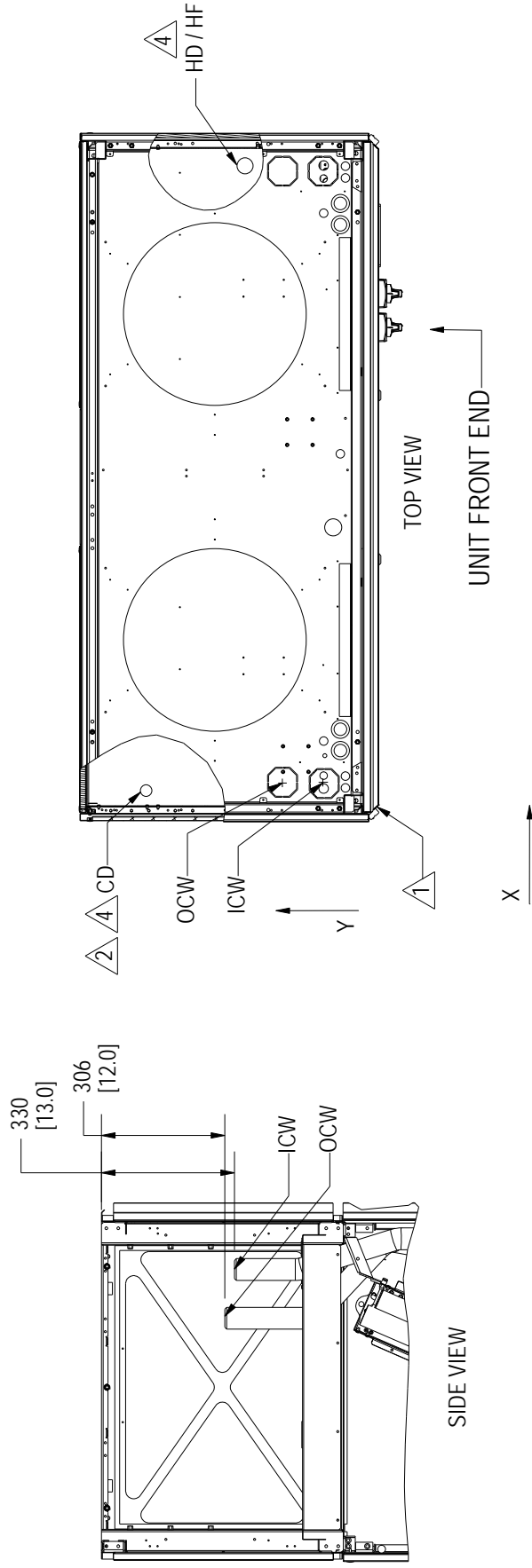
POINT	DESCRIPTION	X mm (in)	Y mm (in)	Z mm (in)	CONNECTION SIZE mm (in)	
					PW070	PW080
ICW	Chilled water inlet (single chilled water circuit)	-	126 (5.0)	260 (10.2)	O.D. Cu \varnothing 54 (2-1/8)	
OCW	Chilled water outlet (single chilled water circuit)	-	136 (5.4)	121 (4.8)	O.D. Cu \varnothing 54 (2-1/8)	
CD	Condensate drain	93 (3.7)	693 (27.3)	-	I.D. Hose \varnothing 19 (3/4)	
HD/HF	Humidifier drain / Humidifier supply	1956 (77.0)	398 (15.7)	-	O.D. Hose \varnothing 19 (3/4) / O.D. Cu \varnothing 6 (1/4)	



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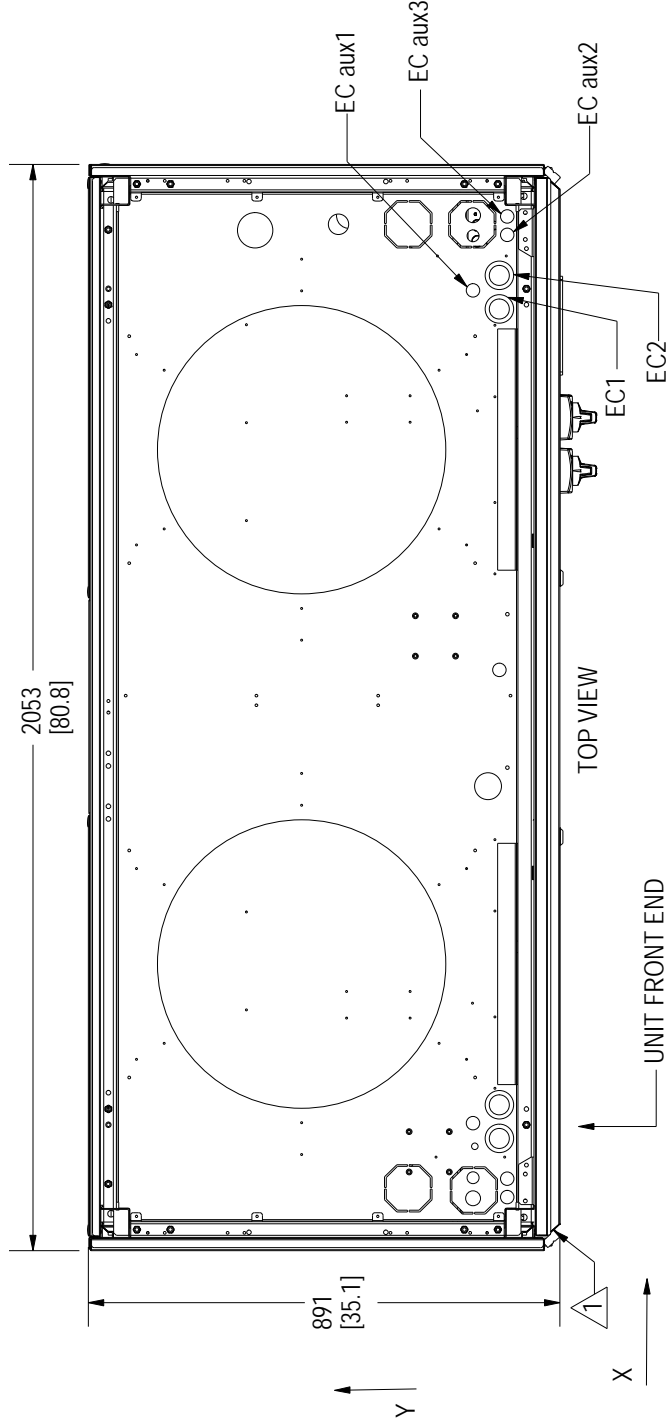
PIPING CONNECTION LOCATIONS- PW070-080 UPFLOW - TOP CONNECTION



1. All dimensions measured from front left corner of unit including panels and have a tolerance of ± 13 mm (1/2").
2. Upflow units do not contain a factory installed condensate trap. Trap external to the unit. Drain line may contain boiling water. Select appropriate drain system materials. Field pitch Condensate Drain line a minimum of 1/8" (3.2 mm) per foot (305 mm). The drain line must comply with local codes.
3. Panels and EC Fan not shown for clarity.
4. CD and HD/HF are located on Base plate.
5. Pedestal required on upflow units.

POINT	DESCRIPTION	X mm (in)	Y mm (in)	CONNECTION SIZE mm (in)	
				PW070	PW080
ICW	Chilled water inlet (single chilled water circuit)	113 (4.5)	126 (5.0)	O.D. Cu \varnothing 54 (2-1/8)	
OCW	Chilled water outlet (single chilled water circuit)	113 (4.5)	136 (5.4)	O.D. Cu \varnothing 54 (2-1/8)	
CD	Condensate drain	93 (3.7)	693 (27.3)	I.D. Hose \varnothing 19 (3/4)	
HD/HF	Humidifier drain / Humidifier supply	1956 (77.0)	398 (15.7)	O.D. Hose \varnothing 19 (3/4) / O.D. Cu \varnothing 6 (1/4)	

ELECTRICAL CONNECTION LOCATIONS-PW070-080 UPFLOW

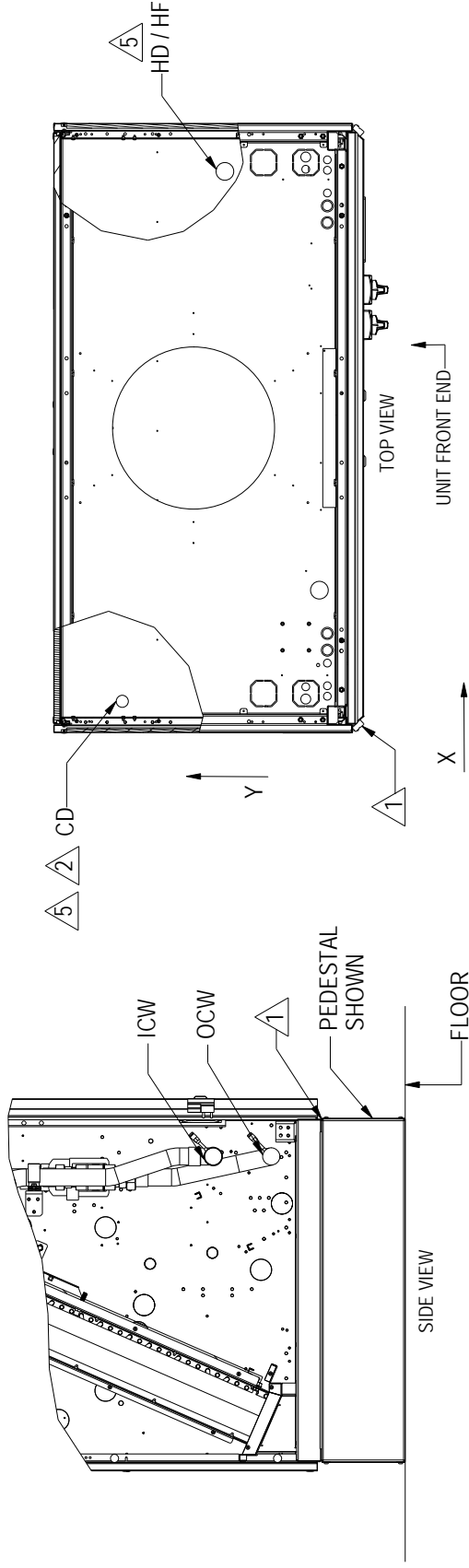


1. X, Y dimensions are measured from front left corner of unit including panels. Z dimension is measured from bottom of unit frame. Tolerance is ± 13 mm (1/2").

2. Panels and EC Fan not shown for clarity.
3. Pedestal required on upflow units.

POINT	DESCRIPTION	X mm (in)	Y mm (in)	CONNECTION SIZE mm (in)	
				PW070	PW080
EC1	Electrical power supply	1780 (70.1)	114 (4.5)	$\varnothing 51(2) \times 35(1-3/8)$	Double KO
EC2	Electrical power supply	1844 (72.6)	114 (4.5)	$\varnothing 51(2) \times 35(1-3/8)$	Double KO
EC aux1	Low voltage cables	1815 (71.5)	164 (6.5)	$\varnothing 22$	(7/8)
EC aux2	Low voltage cables	1920 (75.6)	99(3.9)	$\varnothing 22$	(7/8)
EC aux3	Low voltage cables	1955 (77.0)	99(3.9)	$\varnothing 22$	(7/8)

PIPING CONNECTION LOCATIONS- PW045-060 UPFLOW - LEFT CONNECTION

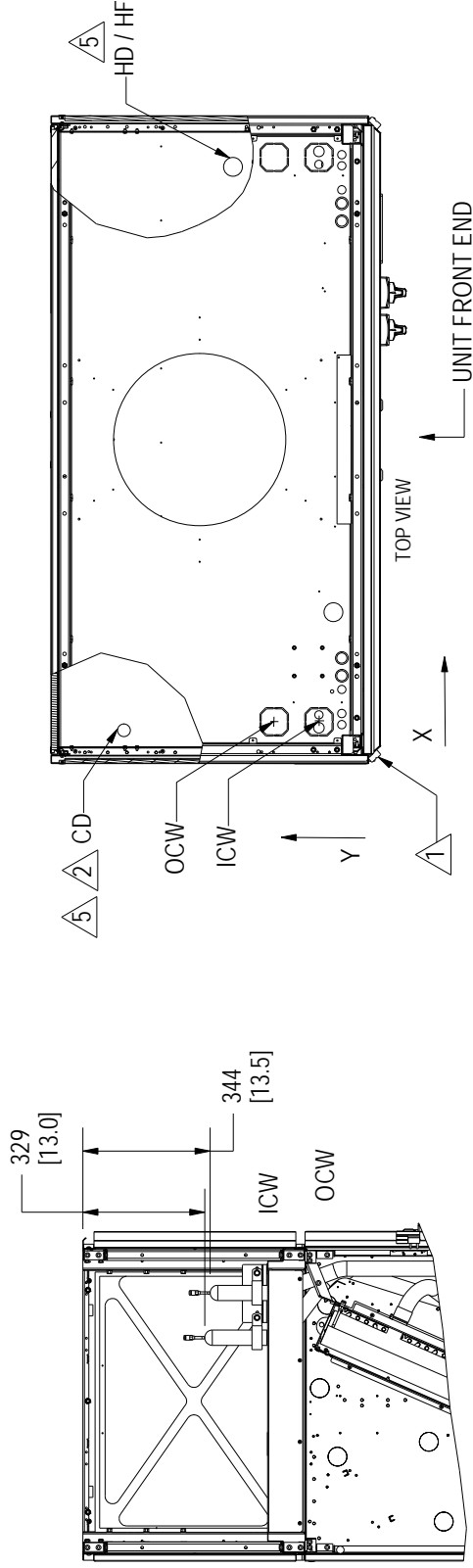


1. X, Y dimensions are measured from front left corner of unit including panels. Z dimension is measured from bottom of unit frame. Tolerance is ± 13 mm (1/2").
2. Upflow units do not contain a factory installed condensate trap. Trap external to the unit. Drain line may contain boiling water. Select appropriate drain system materials. Field pitch Condensate Drain line a minimum of 1/8" (3.2 mm) per foot (305 mm). The drain line must comply with local codes.
3. Panels and EC Fan not shown for clarity.
4. The PW045 unit frame is displayed. The PW060 unit frame is configured to contain two fans and not displayed.
5. CD and HD/HF are located on Base Plate.
6. Pedestal required on upflow units.

POINT	DESCRIPTION	X mm (in)	Y mm (in)	Z mm (in)	CONNECTION SIZE mm (in)	
					PW045	PW060
ICW	Chilled water inlet (single chilled water circuit)	-	138 (5.4)	260 (10.2)	O.D. Cu \varnothing 41.28 (1-5/8)	
OCW	Chilled water outlet (single chilled water circuit)	-	138 (5.4)	121 (4.8)	O.D. Cu \varnothing 41.28 (1-5/8)	
CD	Condensate drain	90 (3.5)	693 (27.3)	-	I.D. Hose \varnothing 19 (3/4)	
HD/HF	Humidifier drain / Humidifier supply	1612 (63.5)	398 (15.7)	-	I.D. Hose \varnothing 19 (3/4) / O.D. Cu \varnothing 6 (1/4)	



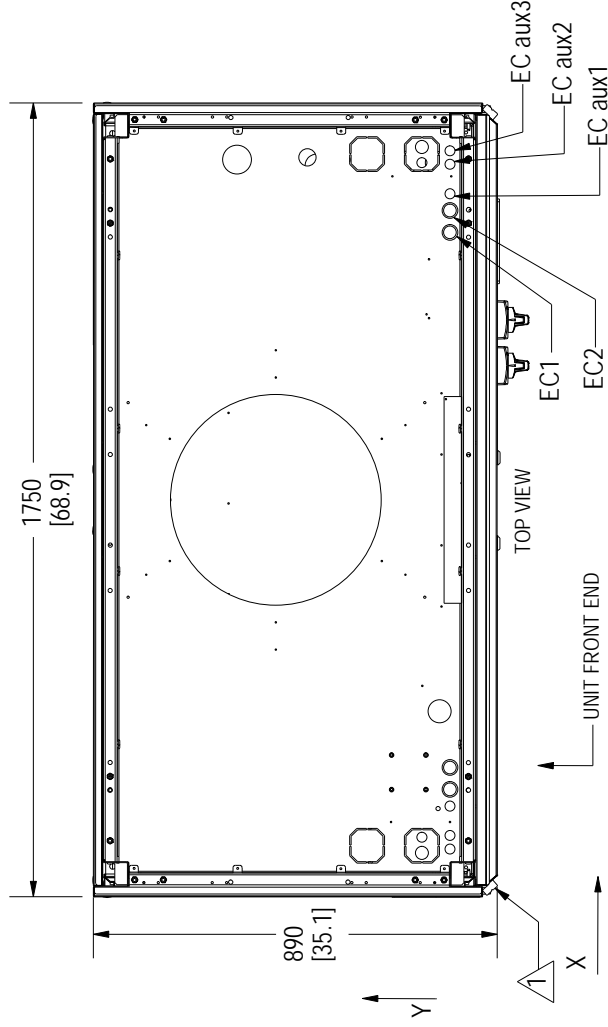
PIPING CONNECTION LOCATIONS- PW045-060 UPFLOW - TOP CONNECTION



- 1. All dimensions measured from front left corner of unit including panels and have a tolerance of ± 13 mm (1/2").
- 2. Upflow units do not contain a factory installed condensate trap. Trap external to the unit. Drain line may contain boiling water. Select appropriate drain system materials. Field pitch Condensate Drain line a minimum of 1/8" (3.2 mm) per foot (305 mm). The drain line must comply with local codes.
- 3. Panels and EC Fan not shown for clarity.
- 4. The PW045 unit frame is displayed. The PW060 unit frame is configured to contain two fans and not displayed.
- 5. CD and HD/HF are located on Base Plate.
- 6. Pedestal required on upflow units.

POINT	DESCRIPTION	X mm (in)	Y mm (in)	CONNECTION SIZE mm (in)	
				PW045	PW060
ICW	Chilled water inlet (single chilled water circuit)	113 (4.4)	166 (6.5)	O.D. Cu \varnothing 41.28 (1-5/8)	
OCW	Chilled water outlet (single chilled water circuit)	113 (4.4)	287 (11.3)	O.D. Cu \varnothing 41.28 (1-5/8)	
CD	Condensate drain	90 (3.5)	693 (27.3)	I.D. Hose \varnothing 19 (3/4)	
HD/HF	Humidifier drain / Humidifier supply	1612 (63.5)	398 (15.7)	I.D. Hose \varnothing 19 (3/4) / O.D. Cu \varnothing 6 (1/4)	

ELECTRICAL CONNECTION LOCATIONS- PW045-060 UPFLOW



▲ All dimensions are measured from front left corner of unit including panels. Z dimension is measured from bottom of unit frame. Tolerance is ± 13 mm (1/2").

2. Panels and EC Fan not shown for clarity.
3. The PW045 unit frame is displayed. The PW060 unit frame is configured to contain two fans and not displayed.
4. Pedestal required on upflow units.

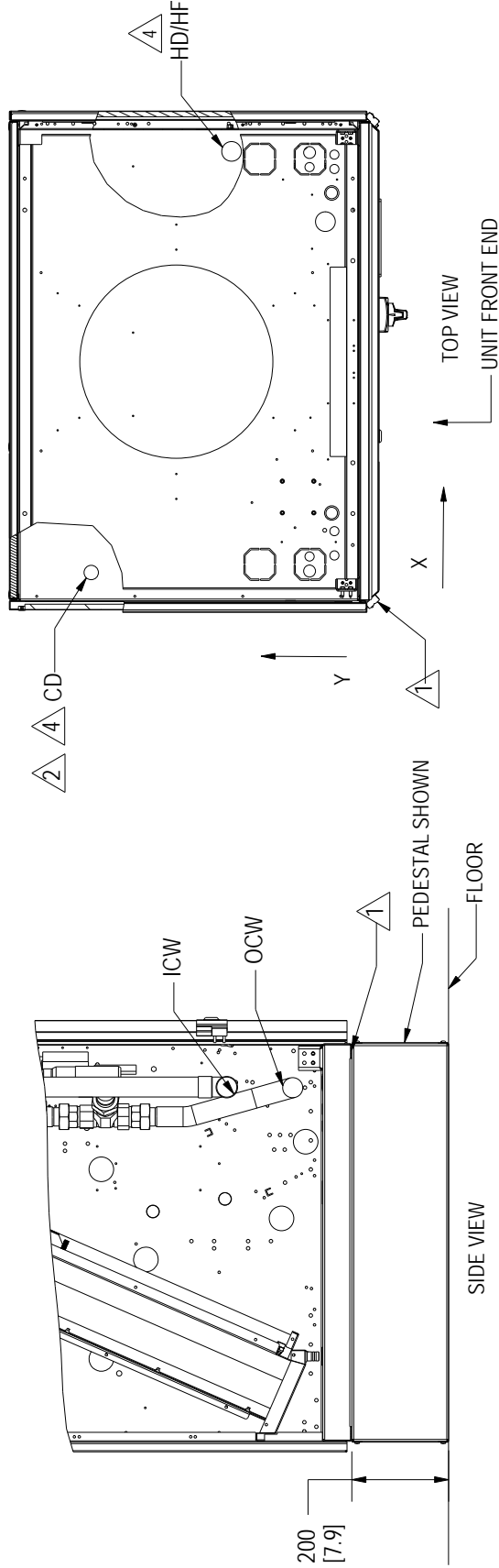
POINT	DESCRIPTION	X mm (in)	Y mm (in)	CONNECTION SIZE mm (in)	
				PW045	PW060
EC1	Electrical power supply	1465(57.7)	104 (4.1)	\varnothing 35(1-3/8)X28(1.1)	Double KO
EC2	Electrical power supply	1513(59.6)	104 (4.1)	\varnothing 35(1-3/8)X28(1.1)	Double KO
EC aux1	Low voltage cables	1550 (61.0)	104 (4.1)	\varnothing 22 (7/8)	
EC aux2	Low voltage cables	1615 (63.6)	104 (4.1)	\varnothing 22 (7/8)	
EC aux3	Low voltage cables	1645(64.8)	104 (4.1)	\varnothing 22 (7/8)	



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PIPING CONNECTION LOCATIONS- PW035-040 UPFLOW - LEFT CONNECTION

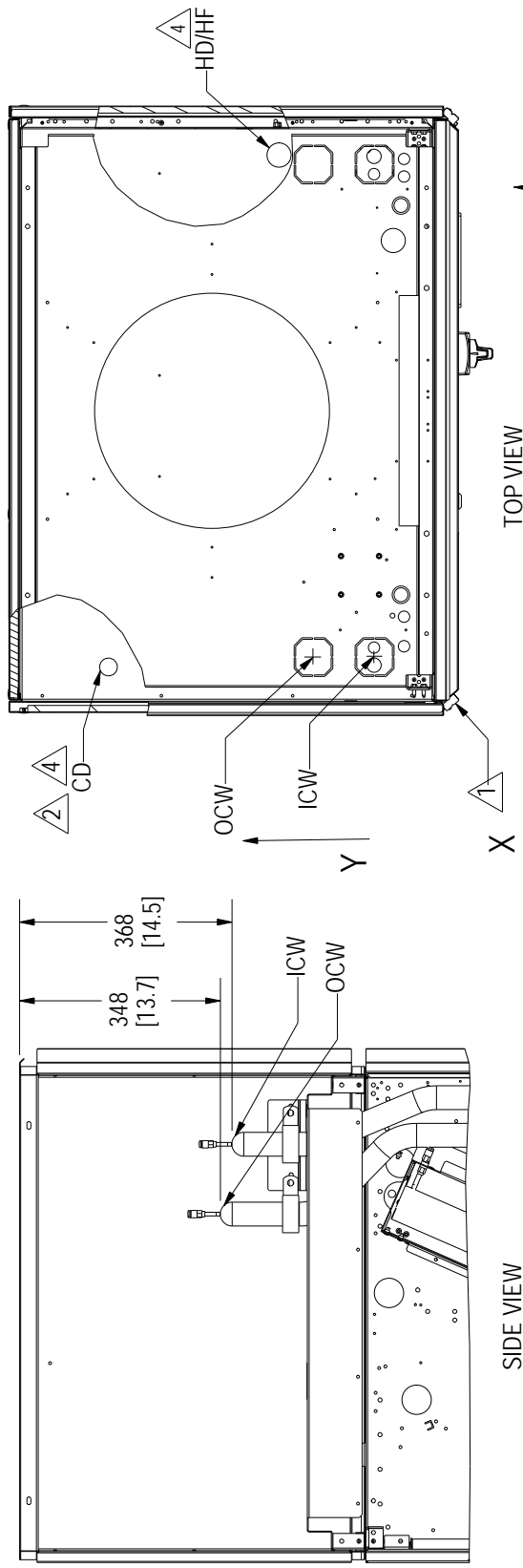


1. X, Y dimensions are measured from front left corner of unit including panels. Z dimension is measured from bottom of unit frame. Tolerance is ± 13 mm (1/2").
 2. Upflow units do not contain a factory installed condensate trap. Trap external to the unit. Drain line may contain boiling water. Select appropriate drain system materials. Field pitch Condensate Drain line a minimum of 1/8" (3.2 mm) per foot (305 mm). The drain line must comply with local codes..
 3. Panels and EC Fan not shown for clarity.
 4. CD and HD/HF are located on Base plate.
5. Pedestal required on Upflow units.

POINT	DESCRIPTION	X mm (in)	Y mm (in)	Z mm (in)	CONNECTION SIZE mm (in)	
					PW035	PW040
ICW	Chilled water inlet (single chilled water circuit)	-	165 (6.5)	258 (10.2)	O.D. Cu \varnothing 41 (1-5/8)	
OCW	Chilled water outlet (single chilled water circuit)	-	286 (11.3)	122 (4.8)	O.D. Cu \varnothing 41 (1-5/8)	
CD	Condensate drain	96 (3.8)	693 (27.3)	-	I.D. Hose \varnothing 19 (3/4)	
HD/HF	Humidifier drain / Humidifier supply	1109 (43.7)	355 (14.0)	-	I.D. Hose \varnothing 19 (3/4) / O.D. Cu \varnothing 6 (1/4)	



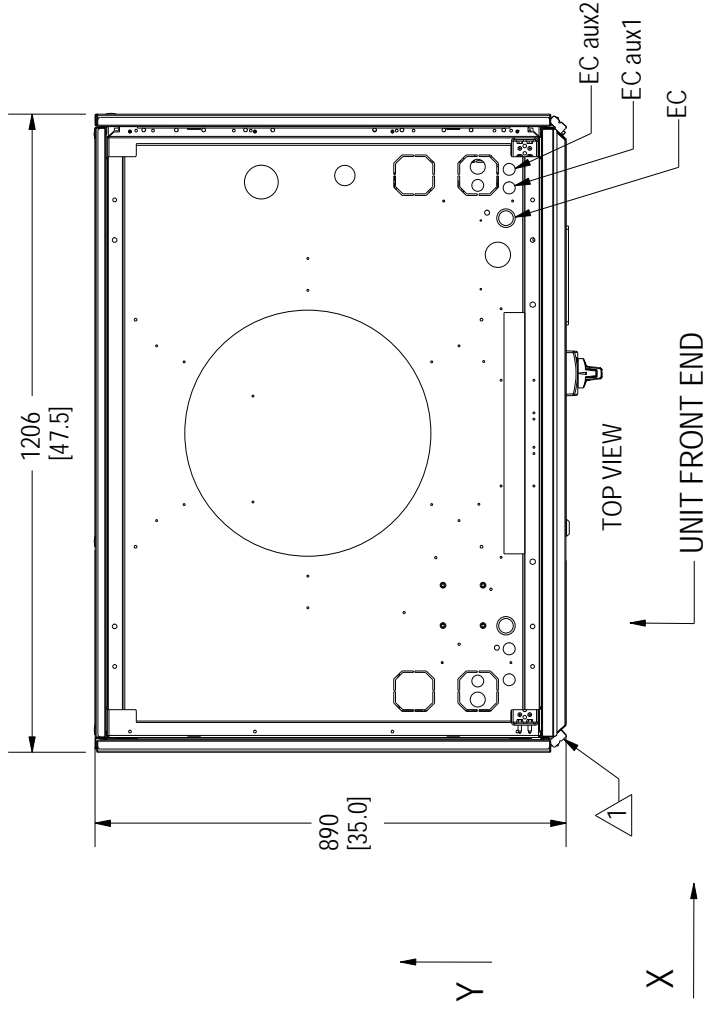
**PIPING CONNECTION LOCATIONS- PW035-040
UPFLOW - TOP CONNECTION**



- 1. All dimensions measured from front left corner of unit including panels and have a tolerance of ± 13 mm (1/2").
- 2. Upflow units do not contain a factory installed condensate trap. Trap external to the unit. Drain line may contain boiling water. Select appropriate drain system materials. Field pitch Condensate Drain line a minimum of 1/8" (3.2 mm) per foot (305 mm). The drain line must comply with local codes.
- 3. Panels and EC Fan not shown for clarity.
- 4. CD and HD/HF are located on Base plate.
- 5. Pedestal required on upflow units.

POINT	DESCRIPTION	X mm (in)	Y mm (in)	CONNECTION SIZE mm (in)	
				PW035	PW040
ICW	Chilled water inlet (single chilled water circuit)	112 (4.4)	165 (6.5)	O.D. Cu \varnothing 41 (1-5/8)	
OCW	Chilled water outlet (single chilled water circuit)	112 (4.4)	286 (11.3)	O.D. Cu \varnothing 41 (1-5/8)	
CD	Condensate drain	96 (3.8)	693 (27.3)	I.D. Hose \varnothing 19 (3/4)	
HD/HF	Humidifier drain / Humidifier supply	1109 (43.7)	355 (14.0)	I.D. Hose \varnothing 19 (3/4) / O.D. Cu \varnothing 6 (1/4)	

ELECTRICAL CONNECTION LOCATIONS- PW035-040 UPFLOW



△. All dimensions measured from front left corner of unit including panels and have a tolerance of ± 13 mm (1/2").

2. Panels and EC Fan not shown for clarity
3. Pedestal required on upflow units.

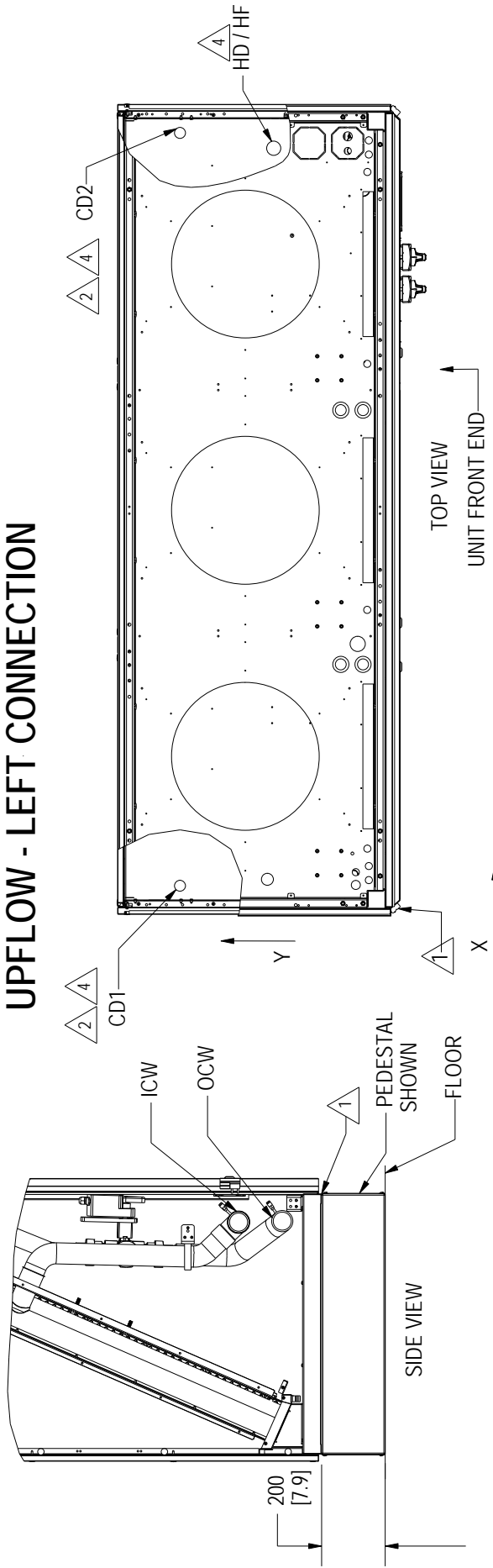
POINT	DESCRIPTION	X mm (in)	Y mm (in)	CONNECTION SIZE mm (in)	
				PW035	PW040
EC	Electrical power supply	1009 (39.7)	114 (4.5)	\varnothing 35(1-3/8)X28(1.1) Double KO	
EC aux1	Low voltage cables	1067 (42.0)	107 (4.2)	\varnothing 22 (7/8)	
EC aux2	Low voltage cables	1101 (43.4)	107 (4.2)	\varnothing 22 (7/8)	



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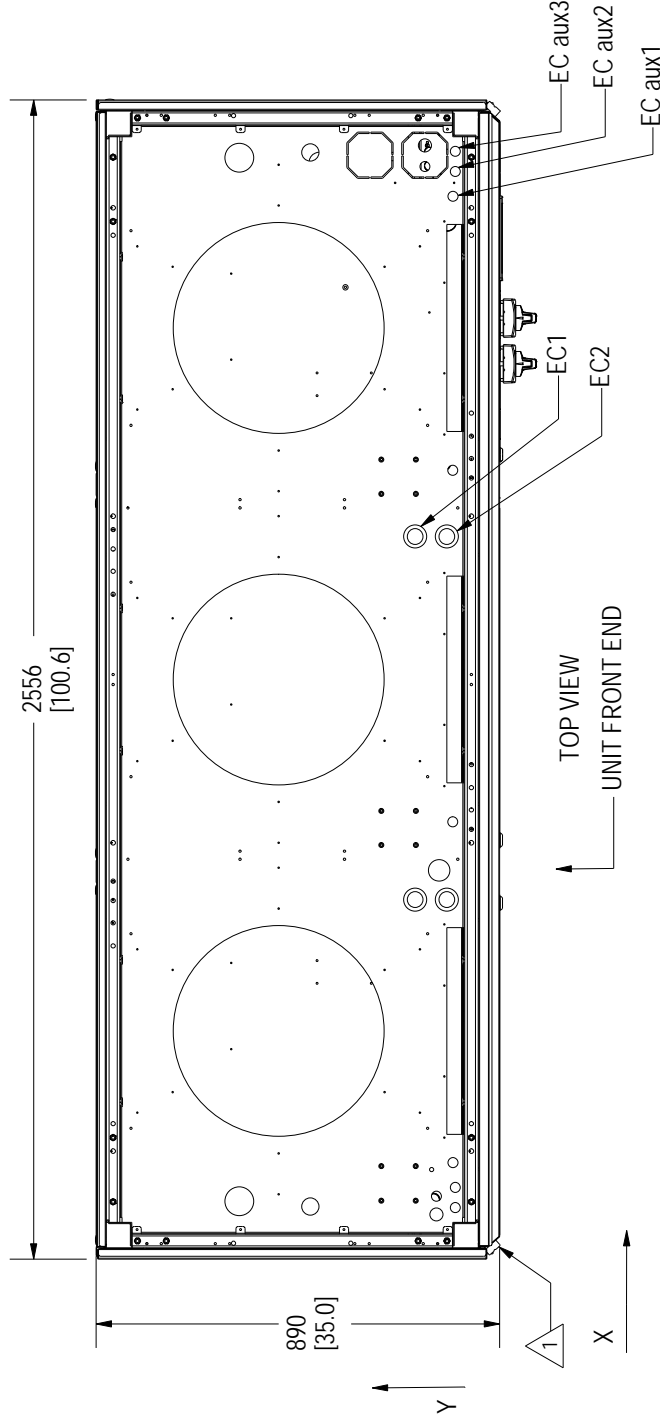
PIPING CONNECTION LOCATIONS - PW095-110 UPFLOW - LEFT CONNECTION



1. X, Y dimensions are measured from front left corner of unit including panels. Z dimension is measured from bottom of unit frame. Tolerance is ± 13 mm (1/2").
2. Upflow units do not contain a factory installed condensate trap. Trap external to the unit. Drain line may contain boiling water. Select appropriate drain system materials. Field pitch Condensate Drain line a minimum of 1/8" (3.2 mm) per foot (305 mm). The drain line must comply with local codes.
3. End grilles, panels and EC Fan not shown for clarity.
4. CD and HD/HF are located on Base Plate.
5. Pedestal required on upflow units.

POINT	DESCRIPTION	X mm (in)	Y mm (in)	Z mm (in)	CONNECTION SIZE mm (in)	
					PW95	PW110
ICW	Chilled water inlet (single chilled water circuit)	-	138 (5.4)	262 (10.3)	O.D. Cu \varnothing 67 (2-5/8)	
OCW	Chilled water outlet (single chilled water circuit)	-	138 (5.4)	124 (4.9)	O.D. Cu \varnothing 67 (2-5/8)	
CD1	Condensate drain	96 (3.8)	693 (27.3)	-	I.D. Hose \varnothing 19 (3/4)	
CD2	Condensate drain	2466 (97.1)	693 (27.3)	-	I.D. Hose \varnothing 19 (3/4)	
HD/HF	Humidifier drain/Humidifier supply	2418 (95.2)	398 (15.7)	-	I.D. Hose \varnothing 19 (3/4) / O.D. Cu \varnothing 6 (1/4)	

ELECTRICAL CONNECTION LOCATIONS - PW095-110 UPFLOW



1. X, Y dimensions are measured from front left corner of unit including panels. Tolerance is ± 13 mm (1/2").

2. End grilles, panels and EC Fan not shown for clarity.

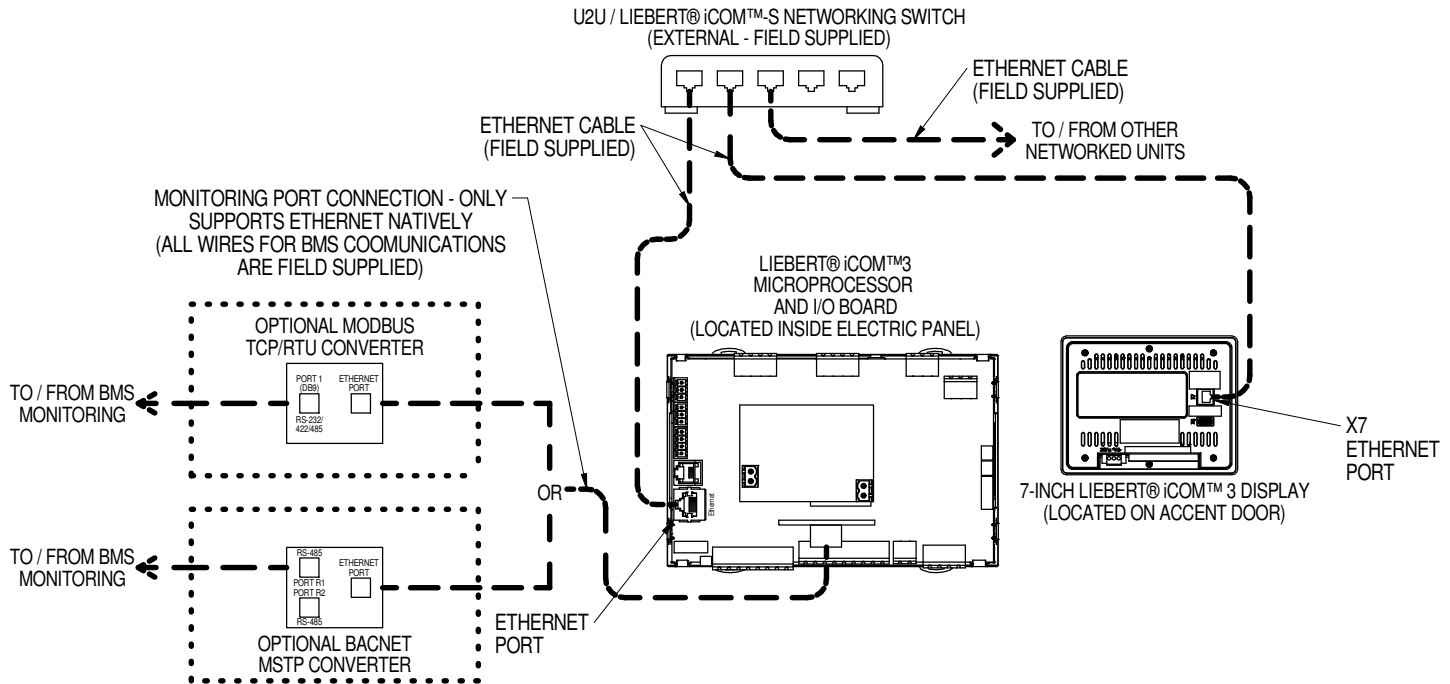
3. Pedestal required on upflow units.

POINT	DESCRIPTION	X mm (in)	Y mm (in)	CONNECTION SIZE mm (in)	
				PW95	PW110
EC1	Electrical power supply	1593 (62.7)	187 (7.3)	\varnothing 51(2)X35(1-3/8)	Double KO
EC2	Electrical power supply	1593 (62.7)	117 (4.6)	\varnothing 51(2)X35(1-3/8)	Double KO
EC aux1	Low voltage cables	2343 (92.3)	103 (4.1)	\varnothing 22 (7/8)	
EC aux2	Low voltage cables	2398 (94.4)	98 (3.9)	\varnothing 22 (7/8)	
EC aux3	Low voltage cables	2422(95.4)	98 (3.9)	\varnothing 22 (7/8)	

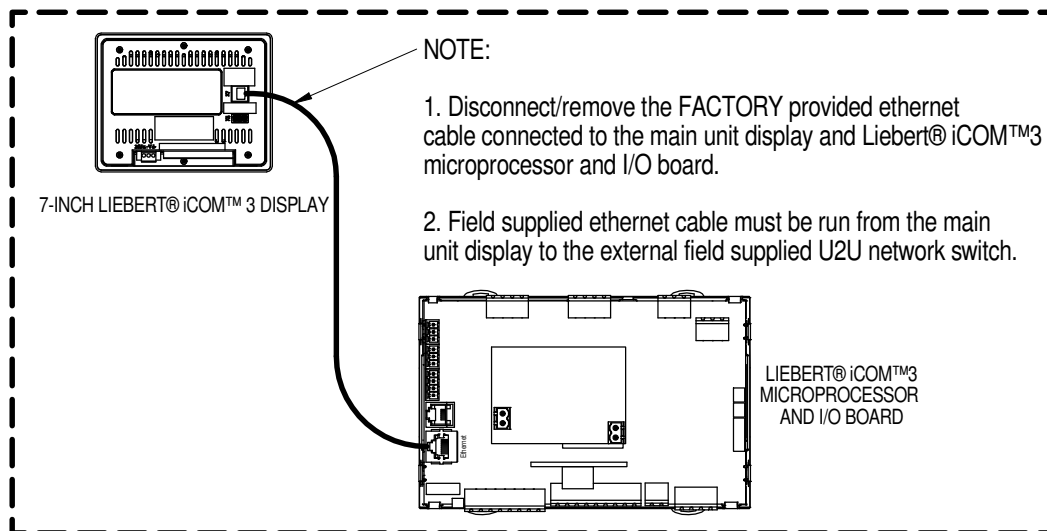
UNIT TO UNIT NETWORK CONNECTIONS

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UNIT CONFIGURATION - STANDARD W/O ETHERNET SWITCH OPTION SELECTED



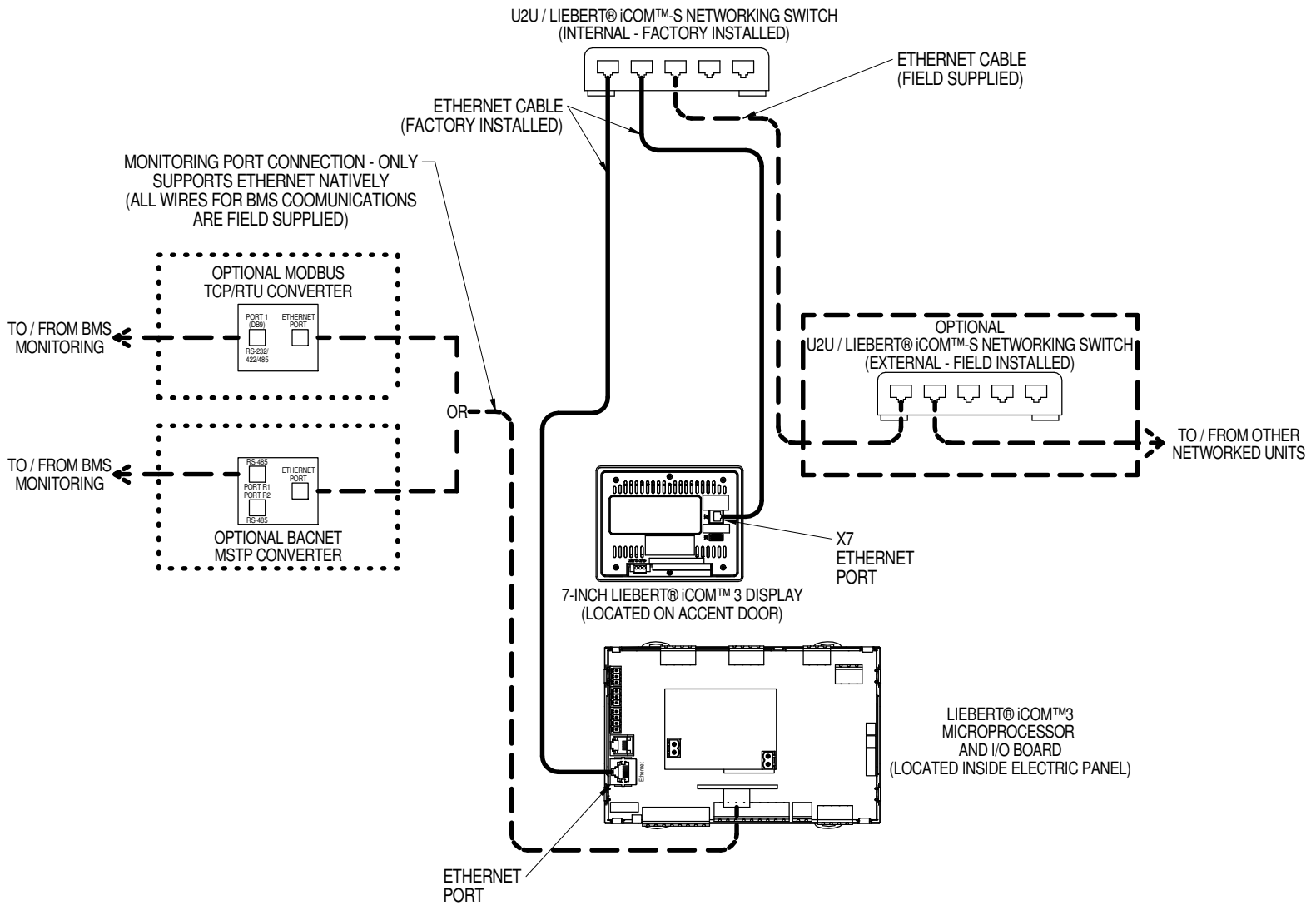
EXISTING FACTORY CABLE MUST BE REMOVED FOR UNIT TO UNIT COMMUNICATIONS.



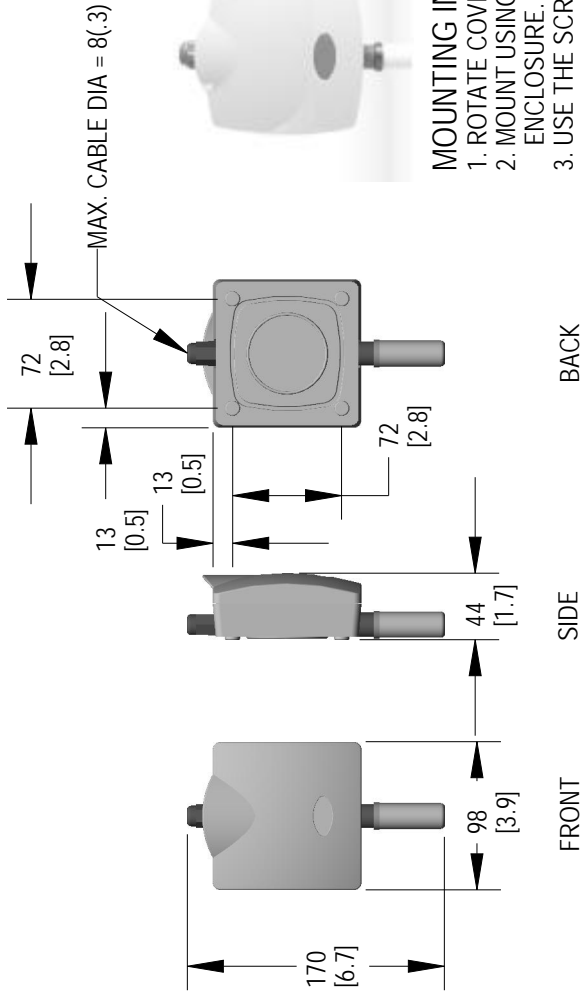
UNIT TO UNIT NETWORK CONNECTIONS

LIEBERT® PCW

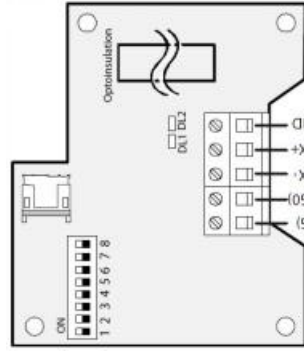
UNIT CONFIGURATION - INTERNAL ETHERNET SWITCH OPTION SELECTED



Remote Temperature and Humidity Sensor

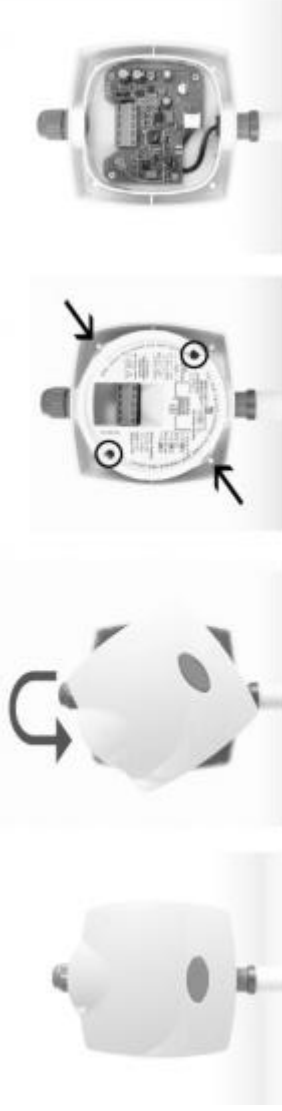


DIMENSIONS mm[inches]



PCB LOCATED INSIDE ENCLOSURE

SENSOR OPERATING CHARACTERISTICS
 POWER: 24VAC +/- 10%, 13mA
 TEMPERATURE: -20°C TO +70°C +/- 1.0°C
 HUMIDITY: 00 TO 100%RH +/- 5%RH



MOUNTING INSTRUCTIONS

1. ROTATE COVER COUNTERCLOCKWISE AND REMOVE.
2. MOUNT USING THE HOLES IN THE CORNERS OF THE ENCLOSURE. MOUNTING DIMENSION IS TO THE LEFT.
3. USE THE SCREWS PROVIDED WITH THE SENSOR.
4. RE-ATTACH THE SENSOR COVER.

CONFIGURING SENSOR

1. ROTATE COVER COUNTERCLOCKWISE AND REMOVE.
2. REMOVE THE PROTECTIVE COVER BY REMOVING THE SCREWS CIRCLED ABOVE.
3. USE SWITCHES 1 - 5 TO SET THE MODBUS ADDRESS.
 THE SELECTION FOLLOWS THE RULES OF 5-BIT BINARY CODING.
 EXAMPLE: OFF-OFF-OFF-OFF-OFF=128
 ON-OFF-ON-OFF-OFF=133
 SWITCHES 6-7-8 MUST BE SET TO ON-ON-OFF TO COMMUNICATE PROPERLY TO ICOM3. IT SET THE MODBUS SETTINGS TO 8-E-1 WITH A BAUD RATE OF 19200.

WIRING SENSOR

1. WIRE SENSOR USING CABLE SUPPLIED WITH KIT. FOLLOW CONDUCTOR LABELS AND UNIT SCHEMATIC FOR CORRECT WIRING POSITIONS.
2. SENSOR REQUIRES 24VAC +/-10% FOR POWER PROVIDED BY THE UNIT THROUGH THE COMMUNICATION CABLE.
3. IF THIS IS THE LAST SENSOR CONNECTED IN THE SERIES, WIRE 120OHM RESISTOR (PROVIDED IN KIT) IN PARALLEL WITH THE COMMUNICATION CABLE ON TERMINALS TRX- AND TRX+.

THD MITIGATION PCW

IEEE Std 519-2014 defines the maximum voltage distortion limits allowed to be reflected onto the utility distribution system at the point of common coupling (PCC). It is a guideline meant to minimize the effects of electrical pollution created by one utility customer from affecting a different customer.

The guideline requires total voltage harmonic distortion (THD) conform to the limits shown in Table 1.

Table 1 - Voltage distortion limits

Bus voltage V at PCC	Individual Harmonic (%)	Total harmonic distortion THD (%)
$V \leq 1.0 \text{ kV}^b$	5.0	8.0
$1 \text{ kV} < V \leq 69 \text{ kV}$	3.0	5.0
$69 \text{ kV} < V \leq 161 \text{ kV}$	1.5	2.5
$161 \text{ kV} < V$	1.0	1.5 ^a

^aHigh-voltage systems can have up to 2.0% THD where the cause is an HVDC terminal whose effects will have attenuated at points in the network where future users may be connected.

^bLiebert® PCW units fall under the limits for $V \leq 1.0 \text{ kV}$

The individual harmonic current distortion and total current demand distortion (TDD) conform to the limits shown in Table 2.

Table 2 - Current distortion limits for systems rated 120 V through 69 kV

Maximum harmonic current distortion in percent of I_L						
Individual harmonic order (odd harmonics) ^{a,b}						
I_{sc} / I_L	$3 \leq h < 11$	$11 \leq h < 17$	$17 \leq h < 23$	$23 \leq h < 135$	$35 \leq h < 50$	TDD
$< 20^c$	4.0	2.0	1.5	0.6	0.3	5.0
$20 < 50$	7.0	3.5	2.5	1.0	0.5	8.0
$50 < 100$	10.0	4.5	4.0	1.5	0.7	12.0
$100 < 1000^d$	12.0	5.5	5.0	2.0	1.0	15.0
> 1000	15.0	7.0	6.0	2.5	1.4	20.0

^aEven harmonics are limited to 25% of the odd harmonic limits above.

^bCurrent distortions that result in a dc offset, e.g., half-wave converters, are not allowed.

^cAll power generation equipment is limited to these values of current distortion, regardless of actual I_{sc} / I_L , where

I_{sc} = maximum short-circuit current at PCC (determined by building short circuit analysis)

I_L = maximum demand load current (fundamental frequency component)
at the PCC under normal load operating conditions

^dLiebert® PCW units typically fall under the limits for $100 < 1000$, assuming $I_{sc} \geq 3,500$ amps

It is **NOT** a guideline for individual connected loads, but a guideline for a total building or plant. Many apply the voltage distortion criteria to all substations, and apply the current distortion criteria exclusively to the utility metering point.

Typically, if the variable speed fan load is less than 10% of the current capacity at the point of common coupling (PCC), your installation will meet IEEE-519 guidelines. In this case you should have no interference issues with other electrical equipment. Typically, the worst case PCC is the emergency backup generator plant but could be the transformer which powers the cooling load. If the PCC is a UPS unit, consult your UPS supplier for recommendations. For customers who have variable speed loads that exceed this rule of thumb, it may be necessary to minimize the harmonic impact these variable speed loads have on the system voltage. In these instances, an undesirable effect is a difficulty in switching from generator supply back to utility supply. The purpose of the Liebert® PCW THD mitigation device is to cancel current harmonics generated by the variable frequency drive. This device will not improve harmonics caused by other systems on the power network.



LIEBERT® PCW

THD MITIGATION PW035 TO PW045

Below are the Total Voltage Distortion levels as measured on a single PW040 unit. This data is typical of what can be expected in the field for PW035 through PW045 units. Values may vary depending on operating conditions.

WARNING: A passive harmonic filter raises the voltage to the fan by 20-30V. This difference requires that the input voltage be limited to +5%, -10% on 460V and 575V units. If the input voltage is above +5% of the rated voltage, disconnect the capacitor contactor coil from the circuit.

Typical Total Voltage Distortion for PW040 Fan Only at 480 Volts:
Voltage Harmonic List — 100% Fan Speed

Without Mitigation Device						
Order	L1		L2		L3	
	Volts	% Distortion	Volts	% Distortion	Volts	% Distortion
1	487.21		483.06		484.89	
3	0.42	0.09%	0.56	0.12%	0.43	0.09%
5	2.19	0.45%	2.41	0.50%	2.73	0.56%
7	6.54	1.34%	5.16	1.07%	6.28	1.30%
9	0.50	0.10%	0.29	0.06%	0.19	0.04%
11	1.68	0.34%	1.58	0.33%	1.46	0.30%
13	0.60	0.12%	0.63	0.13%	0.67	0.14%
15	0.14	0.03%	0.09	0.02%	0.23	0.05%
17	0.47	0.10%	0.49	0.10%	0.43	0.09%
19	0.75	0.15%	0.40	0.13%	0.63	0.13%
21	0.15	0.03%	0.01	0.02%	0.08	0.02%
23	0.16	0.03%	0.02	0.03%	0.12	0.03%
25	0.58	0.12%	0.21	0.09%	0.74	0.15%
Total THD (%)	1.52%		1.29%		1.50%	
With Mitigation Device, Capacitor Disconnected						
Order	L1		L2		L3	
	Volts	% Distortion	Volts	% Distortion	Volts	% Distortion
1	468.43		463.96		467.67	
3	0.42	0.09%	0.57	0.12%	0.25	0.05%
5	3.08	0.66%	2.51	0.54%	3.2	0.68%
7	5.77	1.23%	4.33	0.93%	5.08	1.09%
9	0.66	0.14%	0.61	0.13%	0.48	0.10%
11	0.79	0.17%	0.84	0.18%	0.85	0.18%
13	0.62	0.13%	0.56	0.12%	0.59	0.13%
15	0.12	0.02%	0.12	0.03%	0.21	0.05%
17	0.35	0.07%	0.37	0.08%	0.21	0.04%
19	0.63	0.13%	0.43	0.09%	0.48	0.10%
21	0.09	0.02%	0.19	0.04%	0.1	0.02%
23	0.13	0.04%	0.15	0.03%	0.09	0.02%
25	0.14	0.03%	0.12	0.03%	0.21	0.05%
Total THD (%)	1.46%		1.16%		1.35%	
With Mitigation Device						
Order	L1		L2		L3	
	Volts	% Distortion	Volts	% Distortion	Volts	% Distortion
1	468.43		463.26		467.12	
3	0.38	0.08%	0.64	0.14%	0.18	0.04%
5	3.12	0.67%	2.62	0.57%	3.43	0.73%
7	5.63	1.20%	4.49	0.97%	4.96	1.06%
9	0.44	0.09%	0.58	0.13%	0.52	0.11%
11	0.76	0.16%	0.92	0.20%	0.70	0.15%
13	0.58	0.12%	0.69	0.15%	0.57	0.12%
15	0.16	0.03%	0.27	0.06%	0.26	0.06%
17	0.37	0.08%	0.51	0.11%	0.23	0.05%
19	0.66	0.14%	0.5	0.11%	0.44	0.09%
21	0.13	0.03%	0.33	0.07%	0.16	0.04%
23	0.23	0.05%	0.22	0.05%	0.19	0.04%
25	0.17	0.04%	0.21	0.05%	0.31	0.07%
Total THD(%)	1.43%		1.22%		1.34%	



LIEBERT® PCW

THD MITIGATION PW035 TO PW045

Below are the Total Current Distortion levels as measured on a single PW040 unit at full cooling without reheat or humidifier. This data is typical of what can be expected in the field for PW035 through PW045 units. Values may vary depending on operating conditions.

Typical Total Current Distortion for PW040 Fan Only at 480 Volts:

Current Harmonic List — 100% Fan Speed						
Without Mitigation Device						
Order	L1		L2		L3	
	Amps	% Distortion	Amps	% Distortion	Amps	% Distortion
1	3.21		3.13		3.11	
3	0.02	0.60%	0.06	1.77%	0.05	1.70%
5	0.80	24.76%	0.83	26.62%	0.82	26.24%
7	0.34	10.59%	0.38	12.21%	0.36	11.42%
9	0.01	0.40%	0.03	0.81%	0.03	0.89%
11	0.47	14.69%	0.48	16.39%	0.49	15.64%
13	0.26	8.18%	0.29	9.15%	0.28	8.83%
15	0.02	0.58%	0.04	1.16%	0.04	1.26%
17	0.32	10.06%	0.32	10.36%	0.33	10.66%
19	0.28	8.68%	0.27	8.60%	0.29	9.31%
21	0.01	0.27%	0.04	1.26%	0.04	1.19%
23	0.23	7.06%	0.19	6.21%	0.22	7.10%
25	0.28	8.65%	0.26	8.18%	0.31	9.92%
Total THD (%)	41.50%		44.01%		44.12%	
With Mitigation Device, Capacitor Disconnected						
Order	L1		L2		L3	
	Amps	% Distortion	Amps	% Distortion	Amps	% Distortion
1	3.11		2.99		3.02	
3	0.04	1.42%	0.04	1.28%	0.04	1.34%
5	0.65	20.83%	0.65	21.87%	0.68	22.66%
7	0.25	8.15%	0.23	7.66%	0.22	7.46%
9	0.01	0.20%	0.01	0.34%	0.01	0.28%
11	0.09	2.91%	0.09	3.17%	0.09	3.11%
13	0.06	1.88%	0.05	1.75%	0.05	1.80%
15	0.001	0.03%	0.004	0.15%	0.003	0.10%
17	0.02	0.70%	0.02	0.82%	0.02	0.82%
19	0.02	0.59%	0.02	0.53%	0.02	0.53%
21	0.001	0.03%	0.001	0.03%	0.001	0.05%
23	0.005	0.16%	0.01	0.20%	0.01	0.21%
25	0.01	0.17%	0.004	0.14%	0.004	0.14%
Total THD (%)	22.71%		23.52%		24.19%	
With Mitigation Device						
Order	L1		L2		L3	
	Amps	% Distortion	Amps	% Distortion	Amps	% Distortion
1	3.1		3.04		3.02	
3	0.03	0.96%	0.02	0.67%	0.04	1.21%
5	0.13	4.04%	0.11	3.61%	0.17	5.56%
7	0.14	4.54%	0.13	4.33%	0.14	4.55%
9	0.003	0.11%	0.01	0.27%	0.01	0.24%
11	0.10	3.22%	0.10	3.44%	0.11	3.52%
13	0.07	2.19%	0.06	2.04%	0.06	1.97%
15	0.002	0.06%	0.003	0.09%	0.003	0.09%
17	0.01	0.23%	0.01	0.22%	0.01	0.29%
19	0.01	0.21%	0.01	0.22%	0.01	0.18%
21	0.001	0.02%	0.001	0.04%	0.001	0.03%
23	0.004	0.12%	0.01	0.17%	0.005	0.16%
25	0.003	0.08%	0.002	0.07%	0.002	0.06%
Total THD(%)	7.31%		6.99%		8.35%	



LIEBERT® PCW

THD MITIGATION PW060 TO PW080

Below are the Total Voltage Distortion levels on a single PW060 unit. This data is typical of what can be expected in the field for PW060 through PW080 units. Values may vary depending on operating conditions.

WARNING: A passive harmonic filter raises the voltage to the fan by 20-30V. This difference requires that the input voltage be limited to +5%, -10% on 460V and 575V units. If the input voltage is above +5% of the rated voltage, disconnect the capacitor contactor coil from the circuit.

Typical Total Voltage Distortion for PW060 Fan Only at 480 Volts:
Voltage Harmonic List — 100% Fan Speed

Without Mitigation Device						
Order	L1		L2		L3	
	Volts	% Distortion	Volts	% Distortion	Volts	% Distortion
1	479.17		480.13		479.40	
3	0.33	0.07%	0.46	0.10%	0.13	0.03%
5	3.20	0.67%	3.04	0.63%	3.01	0.63%
7	7.10	1.48%	6.50	1.35%	6.50	1.36%
9	0.38	0.08%	0.40	0.08%	0.76	0.16%
11	2.30	0.48%	1.50	0.31%	4.87	1.02%
13	0.99	0.21%	0.69	0.14%	1.84	0.38%
15	0.14	0.03%	0.08	0.02%	1.61	0.34%
17	0.58	0.12%	0.47	0.10%	1.0	0.21%
19	1.00	0.21%	0.42	0.09%	1.48	0.31%
21	0.17	0.03%	0.01	0.002%	0.64	0.13%
23	0.20	0.04%	0.02	0.01%	0.23	0.05%
25	0.76	0.16%	0.22	0.05%	1.09	0.23%
Total THD (%)		1.74%		1.55%		1.94%
With Mitigation Device, Capacitor Disconnected						
Order	L1		L2		L3	
	Volts	% Distortion	Volts	% Distortion	Volts	% Distortion
1	480.0		481.31		480.35	
3	0.55	0.12%	2.59	0.54%	0.53	0.11%
5	3.70	0.77%	3.02	0.63%	3.40	0.71%
7	6.20	1.29%	5.80	1.21%	6.05	1.26%
9	0.99	0.21%	0.54	0.11%	0.58	0.12%
11	0.47	0.10%	0.41	0.09%	0.43	0.09%
13	0.16	0.03%	0.14	0.03%	0.12	0.03%
15	0.13	0.03%	0.11	0.02%	0.23	0.05%
17	0.15	0.03%	0.35	0.07%	0.09	0.02%
19	0.10	0.02%	0.08	0.02%	0.09	0.02%
21	0.04	0.01%	0.11	0.02%	0.04	0.01%
23	0.02	0.004%	0.03	0.01%	0.01	0.003%
25	0.01	0.003%	0.01	0.002%	0.02	0.004%
Total THD (%)		1.53%		1.47%		1.46%
With Mitigation Device						
Order	L1		L2		L3	
	Volts	% Distortion	Volts	% Distortion	Volts	% Distortion
1	480.59		481.07		480.26	
3	0.93	0.19%	3.74	0.78%	0.70	0.15%
5	2.90	0.60%	3.10	0.64%	2.85	0.59%
7	6.00	1.25%	5.75	1.20%	5.85	1.22%
9	0.66	0.14%	0.87	0.18%	0.40	0.08%
11	0.25	0.05%	0.34	0.07%	0.26	0.05%
13	0.29	0.06%	0.43	0.09%	0.29	0.06%
15	0.16	0.03%	1.89	0.39%	0.24	0.05%
17	0.07	0.01%	0.21	0.04%	0.05	0.01%
19	0.13	0.03%	0.12	0.03%	0.10	0.02%
21	0.04	0.01%	0.15	0.03%	0.06	0.01%
23	0.02	0.005%	0.03	0.01%	0.02	0.003%
25	0.02	0.004%	0.02	0.004%	0.02	0.004%
Total THD(%)		1.41%		1.63%		1.37%



LIEBERT® PCW

THD MITIGATION PW060 TO PW080

Below are the Total Current Distortion levels on a single PW060 unit at full cooling without reheat or humidifier. This data is typical of what can be expected in the field for PW060 through PW080 units. Values may vary depending on operating conditions.

Typical Total Current Distortion for PW060 Fan Only at 480 Volts:

Current Harmonic List — 100% Fan Speed

Without Mitigation Device						
Order	L1		L2		L3	
	Amps	% Distortion	Amps	% Distortion	Amps	% Distortion
1	4.58		4.46		4.45	
3	0.02	0.52%	0.06	1.27%	0.05	1.04%
5	1.12	24.38%	1.18	26.46%	1.16	26.00%
7	0.49	10.67%	0.53	11.94%	0.51	11.47%
9	0.01	0.22%	0.03	0.76%	0.03	0.72%
11	0.66	14.33%	0.69	15.45%	0.69	15.58%
13	0.37	8.18%	0.41	9.12%	0.40	8.89%
15	0.03	0.66%	0.05	1.12%	0.04	0.96%
17	0.44	9.58%	0.46	10.27%	0.47	10.48%
19	0.41	8.91%	0.38	8.49%	0.41	9.25%
21	0.01	0.27%	0.05	1.18%	0.05	1.04%
23	0.32	7.02%	0.29	6.39%	0.32	7.22%
25	0.39	8.52%	0.35	7.80%	0.43	9.73%
Total THD (%)	35.69%		38.07%		38.41%	
With Mitigation Device, Capacitor Disconnected						
Order	L1		L2		L3	
	Amps	% Distortion	Amps	% Distortion	Amps	% Distortion
1	4.43		4.27		4.28	
3	0.12	2.71%	0.12	2.90%	0.06	1.40%
5	0.81	18.33%	0.83	19.36%	0.86	20.12%
7	0.32	7.21%	0.31	7.18%	0.29	6.85%
9	0.01	0.23%	0.01	0.23%	0.01	0.23%
11	0.11	2.59%	0.12	2.72%	0.12	2.72%
13	0.08	1.76%	0.07	1.54%	0.07	1.56%
15	0.001	0.02%	0.004	0.09%	0.003	0.07%
17	0.03	0.60%	0.03	0.62%	0.03	0.61%
19	0.03	0.58%	0.03	0.60%	0.03	0.61%
21	0.001	0.02%	0.001	0.02%	0.001	0.02%
23	0.001	0.02%	0.01	0.31%	0.02	0.39%
25	0.02	0.34%	0.01	0.14%	0.01	0.14%
Total THD (%)	20.15%		21.10%		21.55%	
With Mitigation Device						
Order	L1		L2		L3	
	Amps	% Distortion	Amps	% Distortion	Amps	% Distortion
1	4.25		4.11		4.09	
3	0.05	1.07%	0.01	0.32%	0.12	2.84%
5	0.10	2.29%	0.05	1.22%	0.26	6.24%
7	0.21	4.89%	0.18	4.38%	0.18	4.42%
9	0.002	0.05%	0.02	0.49%	0.003	0.07%
11	0.13	2.95%	0.15	3.76%	0.14	3.47%
13	0.10	2.37%	0.08	1.89%	0.08	1.91%
15	0.002	0.05%	0.01	0.29%	0.0003	0.01%
17	0.02	0.35%	0.02	0.39%	0.02	0.38%
19	0.02	0.47%	0.01	0.24%	0.01	0.24%
21	0.001	0.02%	0.01	0.12%	0.0001	0.002%
23	0.004	0.09%	0.02	0.36%	0.01	0.18%
25	0.003	0.07%	0.002	0.05%	0.002	0.05%
Total THD(%)	6.71%		6.25%		9.08%	



LIEBERT® PCW

THD MITIGATION PW095 TO PW145

Below are the Total Voltage Distortion levels as measured on a single PW110 unit. This data is typical of what can be expected in the field for PW095 through PW145 units. Values may vary depending on operating conditions.

WARNING: A passive harmonic filter raises the voltage to the fan by 20-30V. This difference requires that the input voltage be limited to +5%, -10% on 460V and 575V units. If the input voltage is above +5% of the rated voltage, disconnect the capacitor contactor coil from the circuit.

Typical Total Voltage Distortion for PW110 Fan Only at 480 Volts:
Voltage Harmonic List — 100% Fan Speed

Without Mitigation Device						
Order	L1		L2		L3	
	Volts	% Distortion	Volts	% Distortion	Volts	% Distortion
1	479.17		480.13		479.40	
3	2.02	0.42%	6.46	1.34%	5.01	0.47%
5	1.47	0.31%	2.38	0.49%	1.76	0.28%
7	0.10	0.02%	0.31	0.06%	0.15	0.08%
9	0.13	0.03%	0.08	0.02%	0.03	0.04%
11	0.30	0.06%	0.21	0.04%	0.09	0.06%
13	0.34	0.07%	0.43	0.09%	0.16	0.08%
15	0.13	0.03%	0.12	0.03%	0.02	0.03%
17	0.48	0.10%	0.42	0.09%	0.19	0.09%
19	0.39	0.08%	0.41	0.09%	0.23	0.10%
21	0.10	0.02%	0.12	0.02%	0.02	0.03%
23	0.84	0.17%	0.61	0.13%	0.38	0.13%
25	0.57	0.12%	0.78	0.16%	0.66	0.17%
Total THD (%)		1.11%	1.57%		1.17%	
With Mitigation Device, Capacitor Disconnected						
Order	L1		L2		L3	
	Volts	% Distortion	Volts	% Distortion	Volts	% Distortion
1	480.00		481.31		480.35	
3	1.17	0.24%	1.13	0.24%	0.71	0.15%
5	0.54	0.11%	0.46	0.10%	0.51	0.11%
7	0.14	0.03%	0.22	0.05%	0.11	0.02%
9	0.06	0.01%	0.09	0.02%	0.10	0.02%
11	0.65	0.13%	0.67	0.14%	0.84	0.18%
13	0.43	0.09%	0.37	0.08%	0.34	0.07%
15	0.12	0.02%	0.08	0.02%	0.12	0.03%
17	0.28	0.06%	0.15	0.03%	0.29	0.06%
19	0.52	0.11%	0.42	0.09%	0.46	0.10%
21	0.18	0.04%	0.15	0.03%	0.18	0.04%
23	0.87	0.18%	0.67	0.14%	0.80	0.17%
25	0.70	0.15%	0.73	0.15%	0.81	0.17%
Total THD (%)		0.85%	0.72%		0.85%	
With Mitigation Device						
Order	L1		L2		L3	
	Volts	% Distortion	Volts	% Distortion	Volts	% Distortion
1	480.59		481.07		480.26	
3	0.60	0.12%	0.87	0.18%	0.44	0.09%
5	0.11	0.02%	0.12	0.02%	0.13	0.03%
7	0.21	0.04%	0.14	0.03%	0.23	0.05%
9	0.08	0.02%	0.08	0.02%	0.13	0.03%
11	0.46	0.10%	0.52	0.11%	0.62	0.13%
13	0.32	0.07%	0.29	0.06%	0.29	0.06%
15	0.13	0.03%	0.01	0.02%	0.14	0.03%
17	0.31	0.06%	0.19	0.04%	0.34	0.07%
19	0.51	0.11%	0.45	0.09%	0.45	0.09%
21	0.20	0.04%	0.18	0.04%	0.21	0.04%
23	0.85	0.18%	0.69	0.14%	0.76	0.16%
25	0.66	0.14%	0.70	0.15%	0.80	0.17%
Total THD(%)		0.80%	0.68%		0.79%	



LIEBERT® PCW

THD MITIGATION PW095 TO PW145

Below are the Total Current Distortion levels as measured on a single PW110 unit at full cooling without reheat or humidifier. This data is typical of what can be expected in the field for PW095 through PW145 units. Values may vary depending on operating conditions.

Typical Total Current Distortion for PW110 Fan Only at 480 Volts:

Current Harmonic List — 100% Fan Speed

Without Mitigation Device						
Order	L1		L2		L3	
	Amps	% Distortion	Amps	% Distortion	Amps	% Distortion
1	12.16		12.35		12.10	
3	0.05	0.42%	0.17	1.35%	0.14	1.14%
5	2.81	23.14%	2.61	21.16%	2.68	22.15%
7	1.72	14.16%	1.87	15.14%	1.82	15.06%
9	0.03	0.15%	0.15	1.19%	0.15	1.27%
11	1.24	10.24%	1.08	8.78%	1.11	9.18%
13	1.00	8.19%	1.12	9.08%	1.09	8.98%
15	0.02	0.14%	0.16	1.31%	0.16	1.30%
17	0.89	7.30%	0.72	5.86%	0.75	6.21%
19	0.68	5.59%	0.82	6.65%	0.81	6.68%
21	0.04	0.31%	0.16	1.28%	0.19	1.57%
23	0.83	6.83%	0.64	5.16%	0.63	5.17%
25	0.51	4.18%	0.68	5.53%	0.68	5.62%
Total THD (%)	33.92%		32.74%		33.73%	
With Mitigation Device, Capacitor Disconnected						
Order	L1		L2		L3	
	Amps	% Distortion	Amps	% Distortion	Amps	% Distortion
1	12.06		12.34		12.15	
3	0.07	0.58%	0.10	0.83%	0.12	0.96%
5	2.09	17.36%	1.99	16.13%	2.14	17.59%
7	0.76	6.33%	0.72	5.83%	0.69	5.69%
9	0.04	0.30%	0.03	0.21%	0.01	0.10%
11	0.33	2.70%	0.31	2.50%	0.34	2.82%
13	0.20	1.69%	0.19	1.53%	0.18	1.49%
15	0.02	0.13%	0.01	0.12%	0.003	0.03%
17	0.09	0.78%	0.09	0.72%	0.10	0.85%
19	0.07	0.59%	0.07	0.53%	0.06	0.49%
21	0.01	0.06%	0.01	0.04%	0.001	0.01%
23	0.03	0.22%	0.03	0.21%	0.03	0.26%
25	0.02	0.18%	0.02	0.17%	0.02	0.14%
Total THD (%)	18.87%		17.52%		18.95%	
With Mitigation Device						
Order	L1		L2		L3	
	Amps	% Distortion	Amps	% Distortion	Amps	% Distortion
1	12.22		12.51		12.20	
3	0.29	2.39%	0.33	2.61%	0.10	0.82%
5	0.36	2.98%	0.35	2.83%	0.14	1.18%
7	0.39	3.20%	0.39	3.11%	0.38	3.14%
9	0.10	0.80%	0.04	0.30%	0.07	0.61%
11	0.39	3.21%	0.33	2.65%	0.45	3.72%
13	0.25	2.03%	0.27	2.12%	0.23	1.90%
15	0.04	0.35%	0.01	0.11%	0.03	0.24%
17	0.06	0.51%	0.05	0.38%	0.07	0.58%
19	0.01	0.10%	0.02	0.13%	0.01	0.06%
21	0.01	0.05%	0.002	0.02%	0.01	0.05%
23	0.02	0.17%	0.02	0.12%	0.02	0.20%
25	0.02	0.13%	0.02	0.17%	0.02	0.13%
Total THD (%)	6.59%		6.22%		5.65%	



LIEBERT® PCW

THD MITIGATION PW170

Below are the Total Voltage Distortion levels as measured on a single PW170 unit. This data is typical of what can be expected in the field. Values may vary depending on operating conditions.

WARNING: A passive harmonic filter raises the voltage to the fan by 20-30V. This difference requires that the input voltage be limited to +5%, -10% on 460V and 575V units. If the input voltage is above +5% of the rated voltage, disconnect the capacitor contactor coil from the circuit.

Typical Total Voltage Distortion for PW170 Fan Only at 480 Volts:
Voltage Harmonic List — 100% Fan Speed

Without Mitigation Device						
Order	L1		L2		L3	
	Volts	% Distortion	Volts	% Distortion	Volts	% Distortion
1	477.51		479.66		479.25	
3	1.60	0.33%	5.35	1.12%	1.48	0.31%
5	2.70	0.57%	3.00	0.62%	1.94	0.41%
7	0.77	0.16%	0.59	0.12%	0.69	0.14%
9	0.10	0.02%	0.11	0.02%	0.12	0.03%
11	0.41	0.09%	0.20	0.04%	0.30	0.06%
13	0.56	0.12%	0.47	0.10%	0.44	0.09%
15	0.13	0.03%	0.11	0.02%	0.14	0.03%
17	0.59	0.12%	0.40	0.08%	0.44	0.09%
19	0.52	0.11%	0.43	0.09%	0.54	0.11%
21	0.11	0.02%	0.12	0.02%	0.16	0.03%
23	1.03	0.22%	0.75	0.16%	0.72	0.15%
25	0.77	0.16%	0.86	0.17%	0.97	0.20%
Total THD (%)	1.20%		1.45%		1.17%	
With Mitigation Device, Capacitor Disconnected						
Order	L1		L2		L3	
	Volts	% Distortion	Volts	% Distortion	Volts	% Distortion
1	477.31		478.92		478.83	
3	1.54	0.32	5.13	1.07	1.50	
5	4.46	0.94	3.01	0.63	3.81	0.80
7	1.45	0.30	1.43	0.30	1.08	0.23
9	0.09	0.02	0.08	0.02	0.12	0.03
11	0.39	0.08	0.33	0.07	0.42	0.09
13	0.11	0.02	0.09	0.02	0.07	0.01
15	0.13	0.03	0.07	0.01	0.13	0.03
17	0.12	0.03	0.14	0.03	0.12	0.03
19	0.08	0.02	0.08	0.02	0.09	0.02
21	0.07	0.02	0.09	0.02	0.08	0.02
23	0.13	0.03	0.14	0.03	0.13	0.03
25	0.06	0.01	0.05	0.01	0.07	0.01
Total THD (%)	1.35		1.36		1.27	
With Mitigation Device						
Order	L1		L2		L3	
	Volts	% Distortion	Volts	% Distortion	Volts	% Distortion
1	477.50		479.04		478.95	
3	1.47	0.31%	5.08	1.06%	1.72	0.36%
5	2.40	0.50%	1.43	0.30%	1.70	0.36%
7	0.48	0.10%	0.61	0.13%	0.38	0.08%
9	0.12	0.02%	0.12	0.03%	0.10	0.02%
11	0.15	0.03%	0.19	0.04%	0.23	0.05%
13	0.16	0.03%	0.18	0.04%	0.15	0.03%
15	0.13	0.03%	0.07	0.01%	0.13	0.03%
17	0.06	0.01%	0.08	0.02%	0.07	0.01%
19	0.10	0.02%	0.11	0.02%	0.10	0.02%
21	0.06	0.01%	0.08	0.02%	0.08	0.01%
23	0.08	0.02%	0.08	0.02%	0.06	0.01%
25	0.08	0.02%	0.07	0.01%	0.05	0.01%
Total THD(%)	1.06%		1.23%		1.08%	



LIEBERT® PCW

THD MITIGATION PW170

Below are the Total Current Distortion levels as measured on a single PW170 unit at full cooling without reheat or humidifier. This data is typical of what can be expected in the field. Values may vary depending on operating conditions.

Typical Total Current Distortion for PW170 Fan Only at 480 Volts:

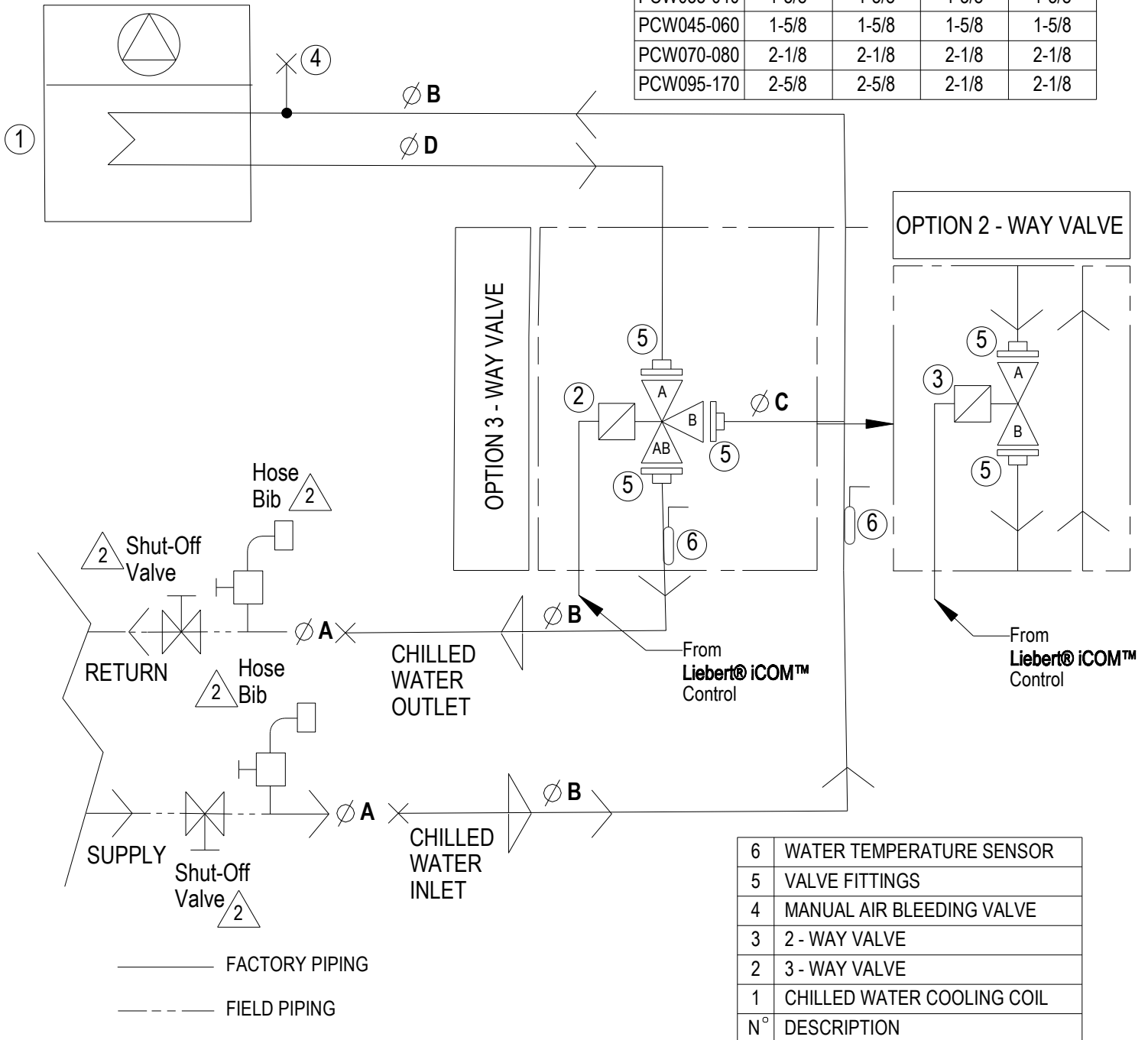
Current Harmonic List — 100% Fan Speed

Without Mitigation 2.62Device						
Order	L1		L2		L3	
	Amps	% Distortion	Amps0.16	% Distortion	Amps	% Distortion
1	17.34		17.59		17.31	
3	0.06	0.32%	0.16	0.935	0.13	0.73%
5	3.92	22.58%	3.71	21.11%	3.78	21.82%
7	2.47	14.27%	2.62	14.92%	2.58	14.90%
9	0.03	0.15%	0.17	0.99%	0.16	0.95%
11	1.73	9.98%	1.55	8.80%	1.57	9.10%
13	1.44	8.29%	1.57	8.91%	1.54	8.90%
15	0.03	0.19%	0.20	1.12%	0.17	0.98%
17	1.22	7.04%	1.03	5.88%	1.06	6.15%
19	0.99	5.71%	1.15	6.52%	1.15	6.65%
21	0.05	0.27%	0.21	1.17%	0.22	1.29%
23	1.16	6.70%	0.96	5.48%	0.92	5.29%
25	0.71	4.09%	0.91	5.20%	0.95	5.51%
Total THD (%)	33.20%		32.20%		33.04%	
With Mitigation Device, Capacitor Disconnected						
Order	L1		L2		L3	
	Amps	% Distortion	Amps	% Distortion	Amps	% Distortion
1	17.17		17.62		17.22	
3	0.21	1.36%	0.31	1.74%	0.18	1.02%
5	2.61	15.20%	2.53	14.37%	2.71	15.74%
7	0.97	5.64%	0.96	5.45%	0.92	5.36%
9	0.04	0.23%	0.03	0.16%	0.01	0.06%
11	0.42	2.42%	0.40	2.28%	0.44	2.55%
13	0.26	1.49%	0.25	1.41%	0.24	1.38%
15	0.02	0.09%	0.01	0.08%	0.003	0.02%
17	0.12	0.71%	0.12	0.67%	0.13	0.77%
19	0.09	0.52%	0.09	0.50%	0.08	0.47%
21	0.01	0.04%	0.01	0.03%	0.001	0.01%
23	0.004	0.23%	0.04	0.23%	0.05	0.27%
25	0.03	0.18%	0.03	0.18%	0.03	0.16%
Total THD (%)	16.70%		15.83%		17.12%	
With Mitigation Device						
Order	L1		L2		L3	
	Amps	% Distortion	Amps	% Distortion	Amps	% Distortion
1	16.77		16.97		16.51	
3	0.44	2.62%	0.22	1.28%	0.29	1.75%
5	0.27	1.63%	0.16	0.92%	0.21	1.26%
7	0.58	3.47%	0.54	3.17%	0.49	2.96%
9	0.07	0.41%	0.08	0.49%	0.02	0.13%
11	0.49	2.93%	0.51	3.01%	0.58	3.51%
13	0.36	2.14%	0.35	2.09%	0.30	1.84%
15	0.04	0.25%	0.04	0.23%	0.003	0.02%
17	0.09	0.51%	0.08	0.49%	0.11	0.64%
19	0.02	0.13%	0.02	0.13%	0.01	0.07%
21	0.01	0.04%	0.01	0.03%	0.001	0.01%
23	0.02	0.15%	0.03	0.15%	0.03	0.20%
25	0.02	0.13%	0.02	0.14%	0.02	0.11%
Total THD(%)	6.26%		5.31%		5.68%	

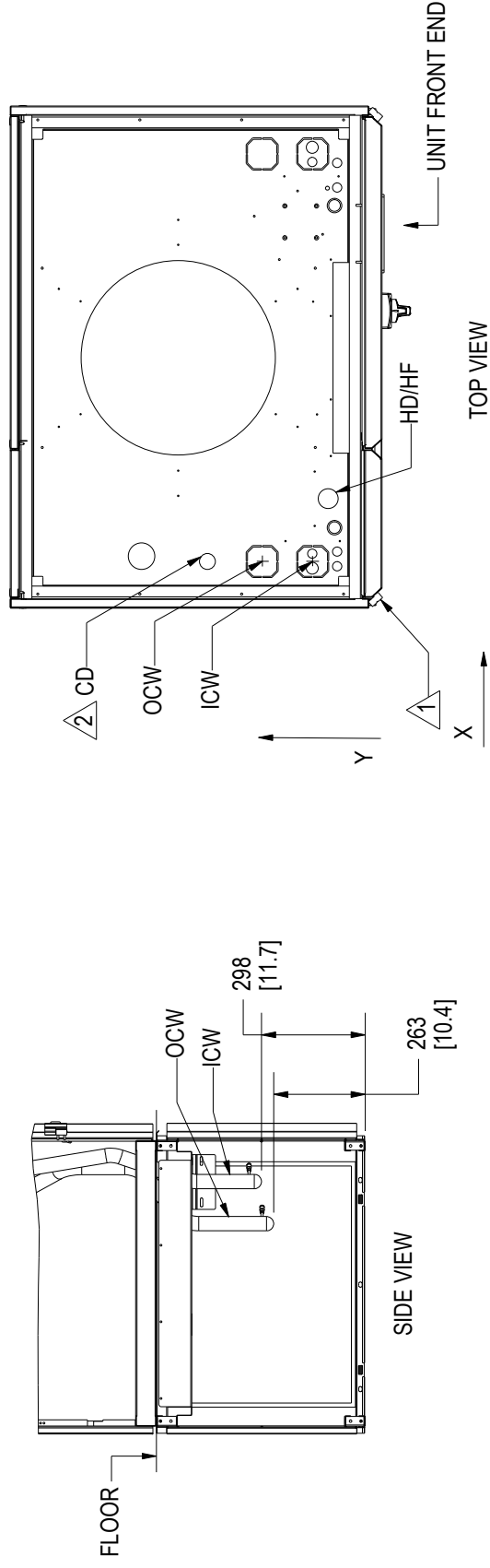
PIPING SCHEMATIC

PCW035-170 UPFLOW & DOWNFLOW UNITS

	∅ A	∅ B	∅ C	∅ D
PCW035-040	1-5/8	1-5/8	1-3/8	1-5/8
PCW045-060	1-5/8	1-5/8	1-5/8	1-5/8
PCW070-080	2-1/8	2-1/8	2-1/8	2-1/8
PCW095-170	2-5/8	2-5/8	2-1/8	2-1/8



PIPING CONNECTION LOCATIONS- PW035-040 DOWNFLOW

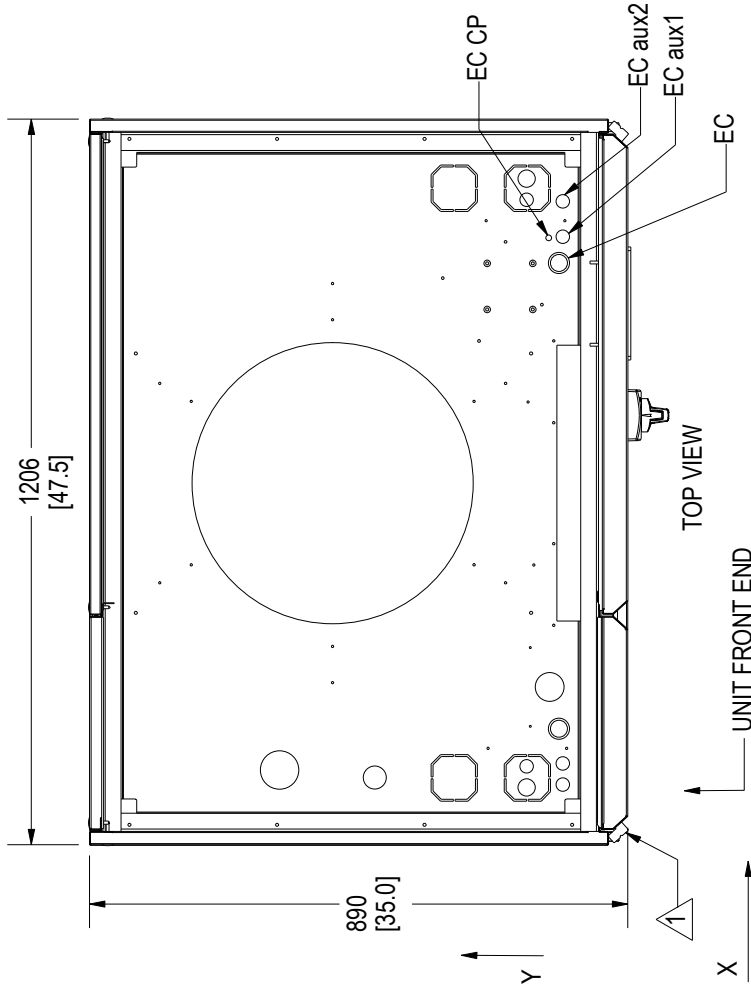


- 1. All dimensions measured from front left corner of unit including panels and have a tolerance of ± 13 mm (1/2").
- 2. Downflow units contain a factory installed condensate trap. Do not trap external to the unit. Drain line may contain boiling water. Select appropriate drain system materials. Field pitch Condensate Drain line a minimum of 1/8" (3.2 mm) per foot (305 mm). The drain line must comply with local codes.
- 3. End grilles, panels, EP, Coil, Piping and EC Fan not shown for clarity.
- 4. Condensate pump is field installed.

POINT	DESCRIPTION	X mm (in)	Y mm (in)	CONNECTION SIZE mm (in)	
				PW035	PW040
ICW	Chilled water inlet (single chilled water circuit)	113 (4.5)	166 (6.5)	O.D. Cu ϕ 41 (1-5/8)	
OCW	Chilled water outlet (single chilled water circuit)	113 (4.5)	287 (11.3)	O.D. Cu ϕ 41 (1-5/8)	
CD	Condensate drain	111 (4.4)	418 (16.5)	I.D. Hose ϕ 19 (3/4)	
HD/HF	Humidifier drain / Humidifier supply	261 (10.3)	129 (5.1)	I.D. Hose ϕ 19 (3/4) / O.D. Cu ϕ 6 (1/4)	



**ELECTRICAL CONNECTION LOCATIONS- PW035-040
DOWNFLOW**



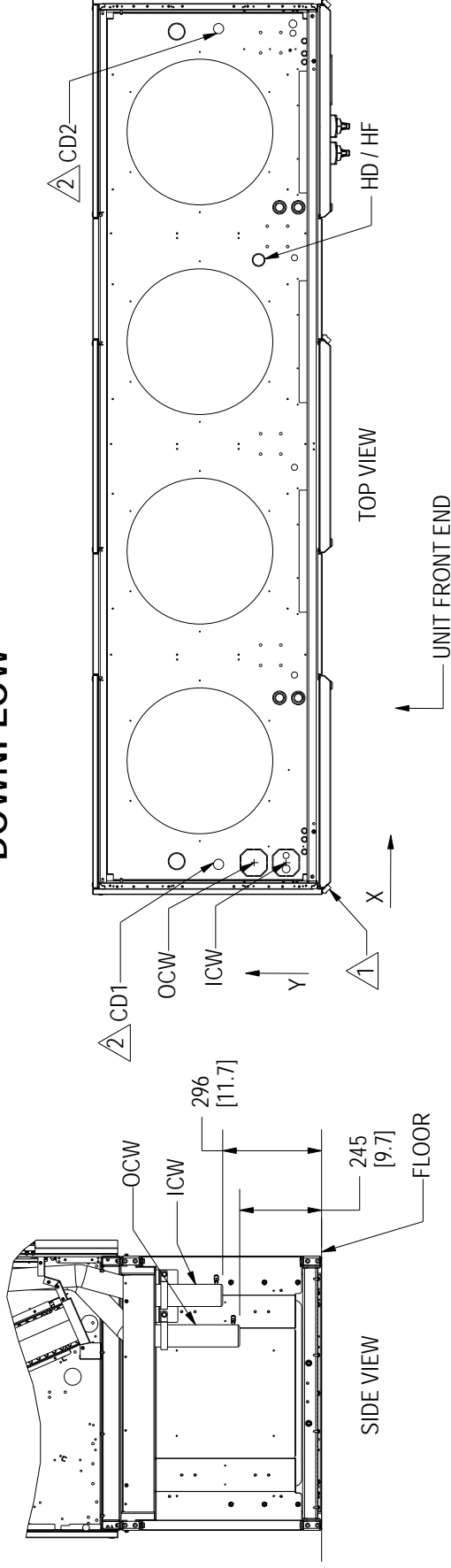
△1. All dimensions measured from front left corner of unit including panels and have a tolerance of ±13 mm (1/2").

2. End grilles, panels, EP, Coil, Piping and EC Fan not shown for clarity.

3. Condensate pump is field installed.

POINT	DESCRIPTION	X mm (in)	Y mm (in)	CONNECTION SIZE mm (in)	
				PW035	PW040
EC	Electrical power supply	963 (37.9)	114 (4.5)	∅ 35(1-3/8)X28(1.1) Double KO	
EC aux1	Low voltage cables	1007 (39.6)	107 (4.2)	∅ 22 (7/8)	
EC aux2	Low voltage cables	1065 (41.9)	107 (4.2)	∅ 22 (7/8)	
EC CP	Electrical power supply, Condensate pump	1004 (39.5)	126 (5.0)	∅ 9.5 (3/8)	

PIPING CONNECTION LOCATIONS PW170 DOWNFLOW



1. All dimensions measured from front left corner of unit including panels and have a tolerance of ± 13 mm (1/2").

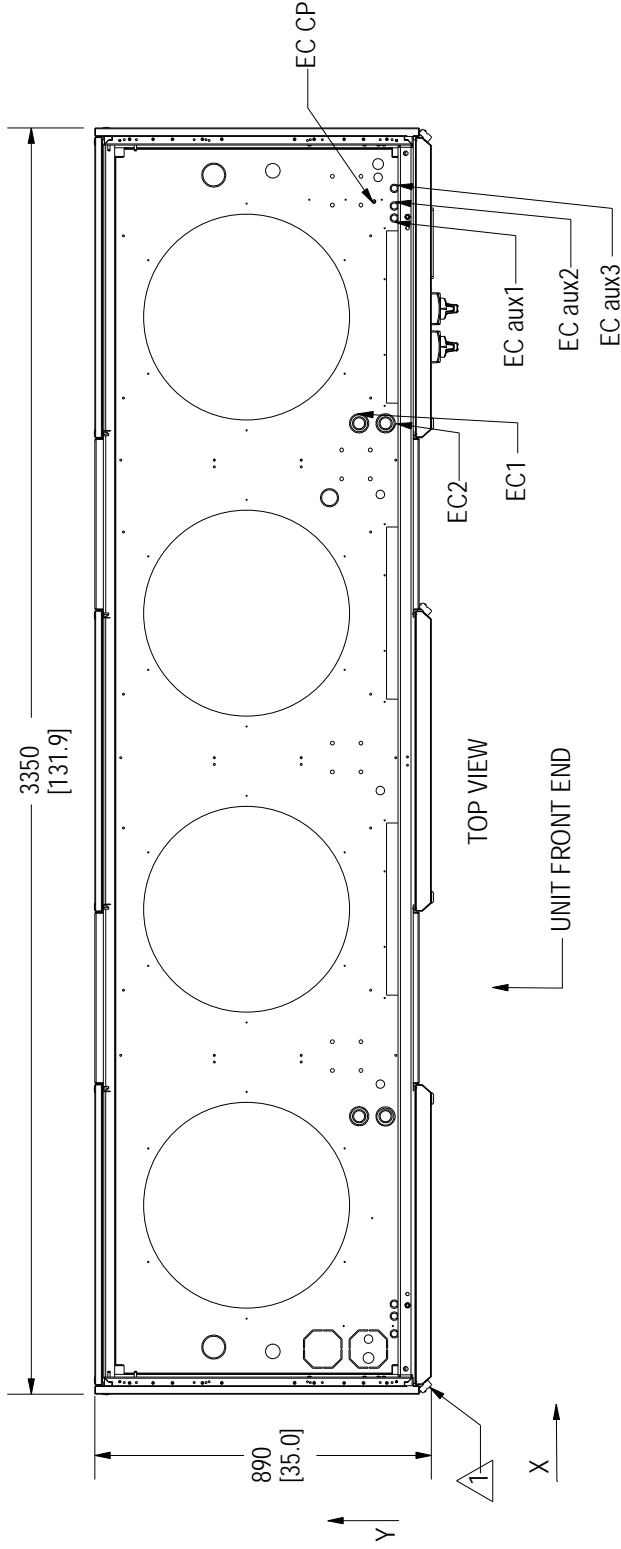
2. Downflow units contain a factory installed condensate trap. Do not trap external to the unit. Drain line may contain boiling water. Select appropriate drain system materials. Field pitch Condensate Drain line a minimum of 1/8" (3.2 mm) per foot (305 mm). The drain line must comply with local codes.

3. End grilles, panels, EP, Coil, Piping and EC Fan not shown for clarity.

POINT	DESCRIPTION	X mm (in)	Y mm (in)	CONNECTION SIZE mm (in)	
				PW170	
ICW	Chilled water inlet (single chilled water circuit)	113 (4.4)	166 (6.5)	O.D. Cu \varnothing 67 (2-5/8)	
OCW	Chilled water outlet (single chilled water circuit)	113 (4.4)	287 (11.3)	O.D. Cu \varnothing 67 (2-5/8)	
CD1	Condensate drain	113 (4.4)	419 (16.5)	I.D. Hose \varnothing 19 (3/4)	
CD2	Condensate drain	3237 (127.4)	419 (16.5)	I.D. Hose \varnothing 19 (3/4)	
HD/HF	Humidifier drain/Humidifier supply	2372 (93.4)	269 (10.6)	I.D. Hose \varnothing 19 (3/4) / O.D. Cu \varnothing 6 (1/4)	



**ELECTRICAL CONNECTION LOCATIONS PW170
DOWNFLOW**



1. All dimensions measured from front left corner of unit including panels and have a tolerance of ± 13 mm (1/2").
2. End grilles, panels, EP, Coil, Piping and EC Fan not shown for clarity.
3. Condensate pump is field installed.

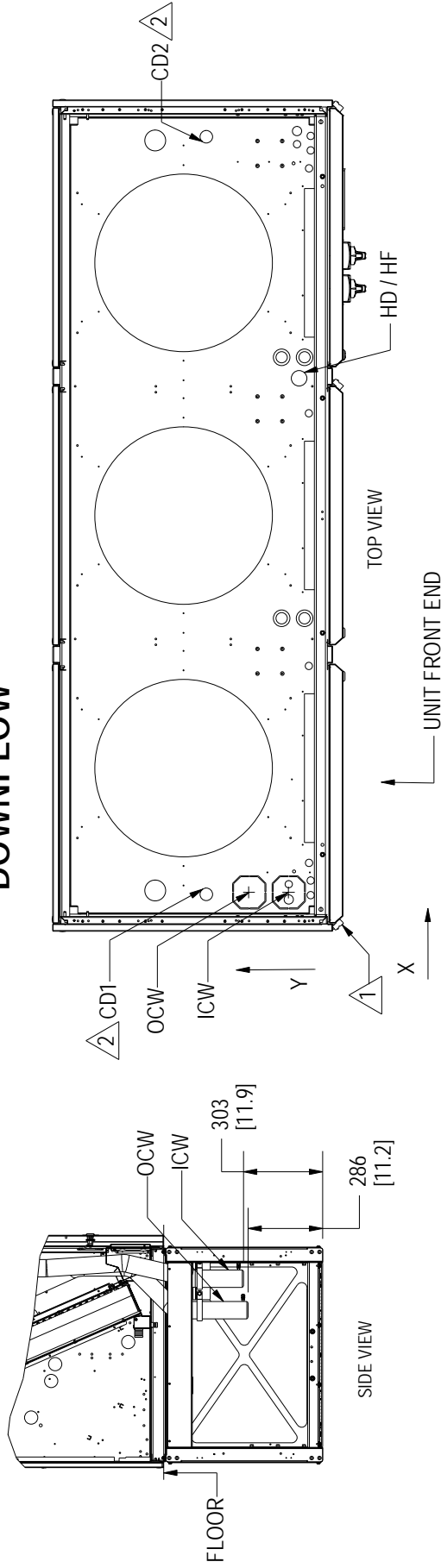
POINT	DESCRIPTION	X mm (in)	Y mm (in)	CONNECTION SIZE mm (in)
EC1	Electrical power supply	2569 (101.1)	191(7.5)	PW170
EC2	Electrical power supply	2569 (101.1)	121(4.8)	\varnothing 51(2)X35(1-3/8) Double KO
EC aux1	Low voltage cables	3112 (122.5)	98(3.9)	\varnothing 51(2)X35(1-3/8) Double KO
EC aux2	Low voltage cables	3144 (123.8)	98(3.9)	\varnothing 22 (7/8) KO
EC aux3	Low voltage cables	3190 (125.6)	98(3.9)	\varnothing 22 (7/8) KO
EC CP	Electrical power supply. Condensate pump	3156 (124.2)	112 (4.4)	\varnothing 9.5 (3/8)



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PIPING CONNECTION LOCATIONS-PW095-110 DOWNFLOW



1. All dimensions measured from front left corner of unit including panels and have a tolerance of ± 13 mm (1/2").

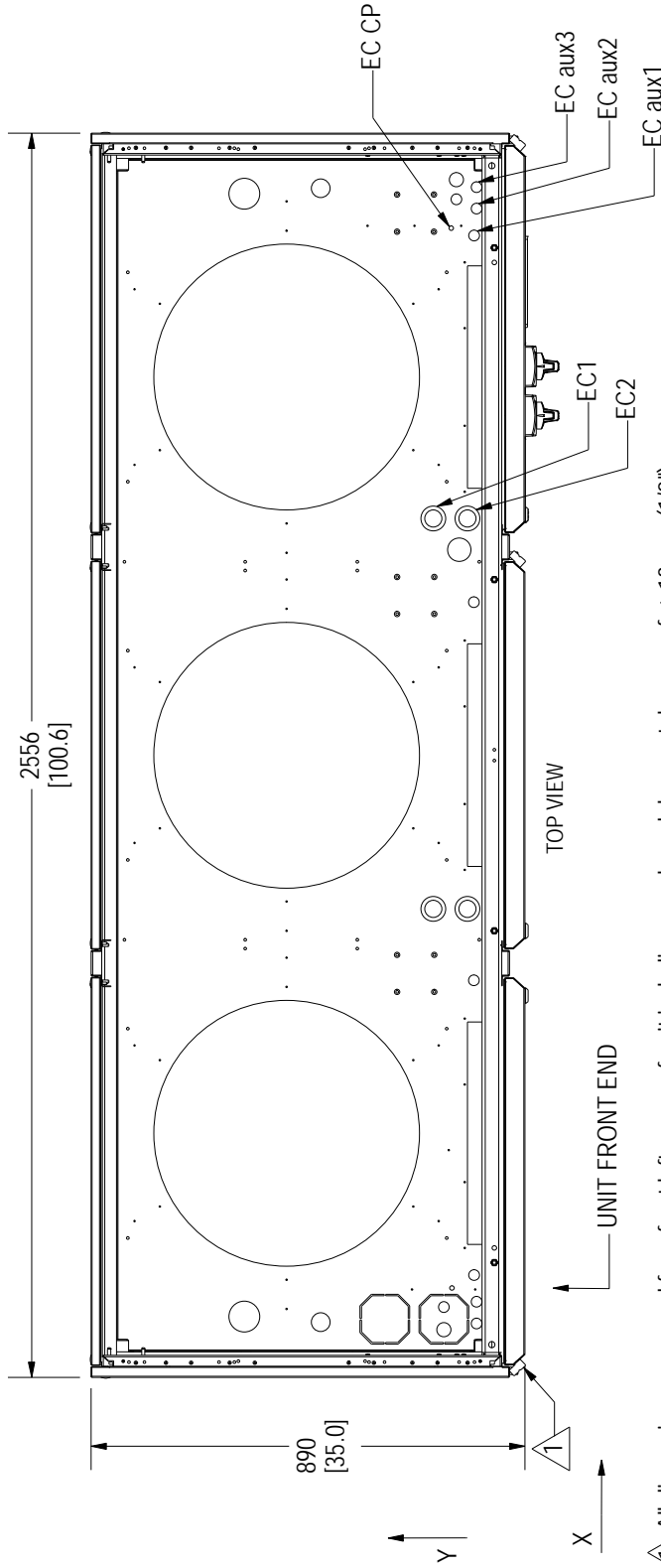
2. Downflow units contain a factory installed condensate trap. Do not trap external to the unit. Drain line may contain boiling water. Select appropriate drain system materials. Field pitch Condensate Drain line a minimum of 1/8" (3.2 mm) per foot (305 mm). The drain line must comply with local codes.

3. End grilles, panels, EP, Coil, Piping and EC Fan not shown for clarity.

POINT	DESCRIPTION	X mm (in)	Y mm (in)	CONNECTION SIZE mm (in)	
				PW095	PW0110
ICW	Chilled water inlet (single chilled water circuit)	113 (4.5)	166 (6.5)	O.D. Cu \varnothing 67 (2-5/8)	
OCW	Chilled water outlet (single chilled water circuit)	113 (4.5)	286 (11.2)	O.D. Cu \varnothing 67 (2-5/8)	
CD1	Condensate drain	113 (4.5)	419 (16.5)	I.D. Hose \varnothing 19 (3/4)	
CD2	Condensate drain	2437 (95.9)	419 (16.5)	I.D. Hose \varnothing 19 (3/4)	
HD/HF	Humidifier drain / Humidifier supply	1696 (66.8)	135 (5.3)	I.D. Hose \varnothing 19 (3/4) / O.D. Cu \varnothing 6 (1/4)	



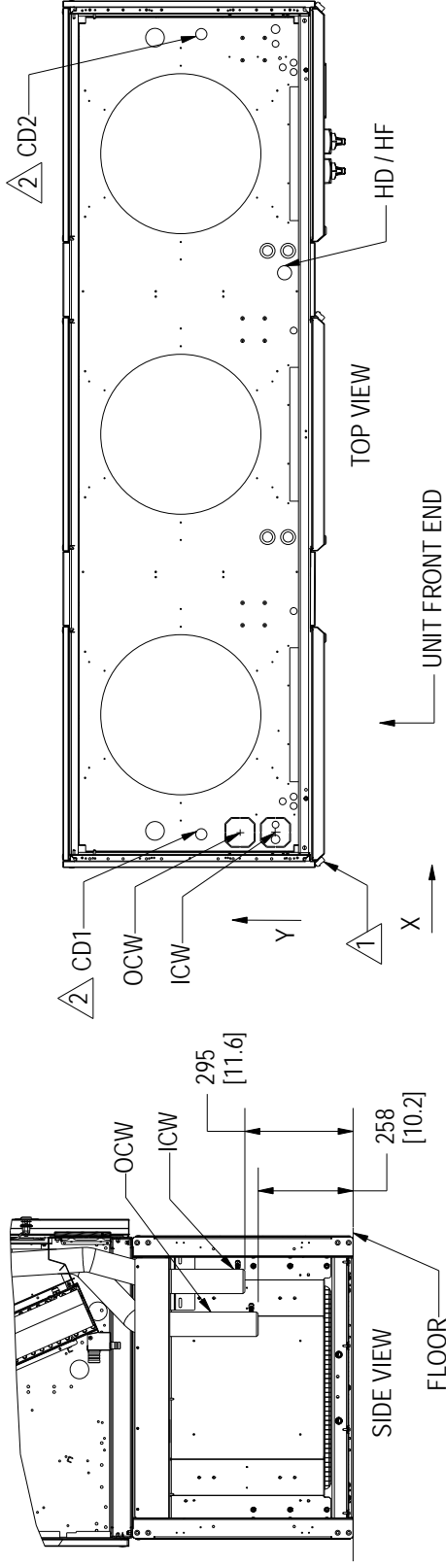
ELECTRICAL CONNECTION LOCATIONS-PW095-110
DOWNFLOW



1. All dimensions measured from front left corner of unit including panels and have a tolerance of ± 13 mm (1/2").
2. End grilles, panels, EP, Coil, Piping and EC Fan not shown for clarity.
3. Condensate pump is field installed.

POINT	DESCRIPTION	X mm (in)	Y mm (in)	CONNECTION SIZE mm (in)	
				PW095	PW0110
EC1	Electrical power supply	1760 (69.3)	188 (7.4)	\varnothing 51(2)X35(1-3/8)	Double KO
EC2	Electrical power supply	1760 (69.3)	118(4.7)	\varnothing 51(2)X35(1-3/8)	Double KO
EC aux1	Low voltage cables	2340 (92.1)	105 (4.1)	\varnothing 22 (7/8)	
EC aux2	Low voltage cables	2395 (94.3)	100 (3.9)	\varnothing 22 (7/8)	
EC aux3	Low voltage cables	2440 (96.0)	100 (3.9)	\varnothing 22 (7/8)	
EC CP	Electrical power supply, Condensate pump	2356 (93.0)	152 (6.0)	\varnothing 9.5 (3/8)	

PIPING CONNECTION LOCATIONS- PW145 DOWNFLOW



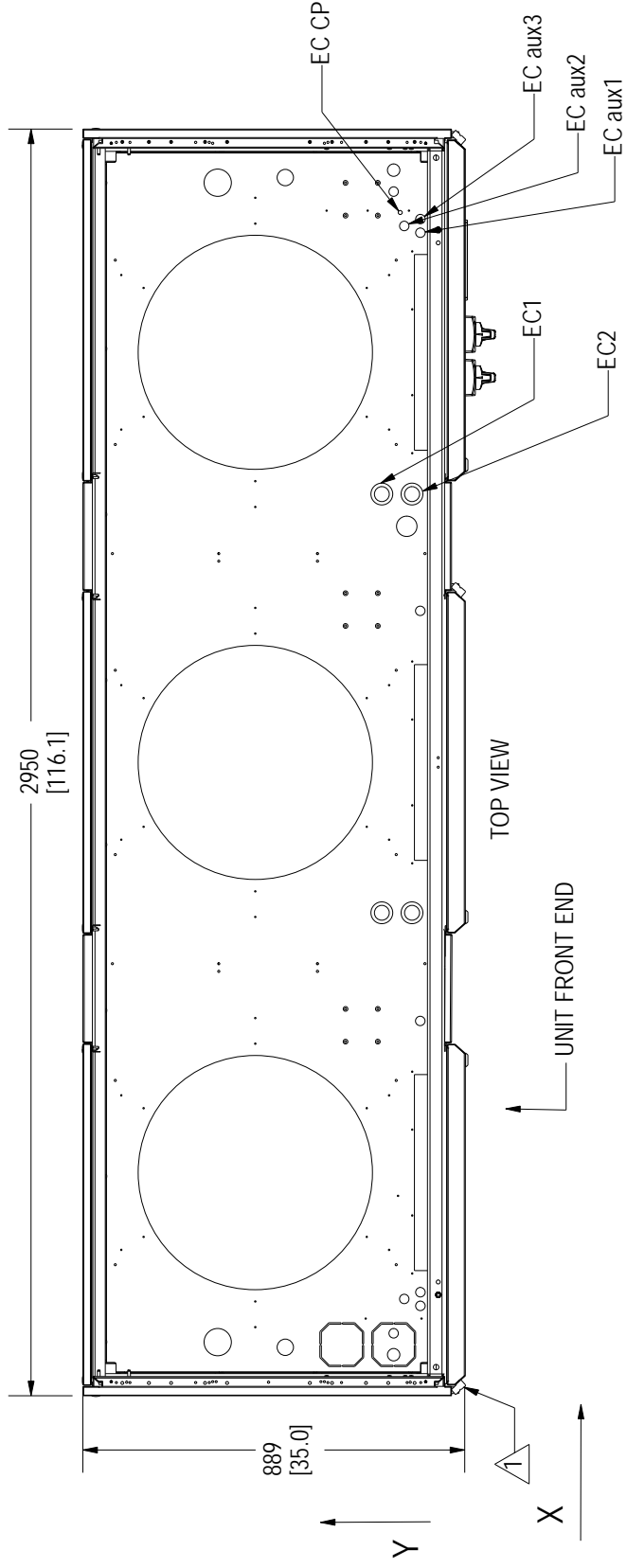
1. All dimensions measured from front left corner of unit including panels and have a tolerance of ± 13 mm ($1/2$ ").

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

3. End grilles, panels, EP, Piping, Coil and EC Fan not shown for clarity.

POINT	DESCRIPTION	X mm (in)	Y mm (in)	CONNECTION SIZE mm (in)	
				PW145	
ICW	Chilled water inlet (single chilled water circuit)	113 (4.4)	169 (6.7)	O.D. Cu \varnothing 67 (2-5/8)	
OCW	Chilled water outlet (single chilled water circuit)	113 (4.4)	285 (11.2)	O.D. Cu \varnothing 67 (2-5/8)	
CD1	Condensate drain	113 (4.4)	419 (16.5)	I.D. Hose \varnothing 19 (3/4)	
CD2	Condensate drain	2856 (112.4)	419 (16.5)	I.D. Hose \varnothing 19 (3/4)	
HD/HF	Humidifier drain/Humidifier supply	2025 (79.7)	136 (5.4)	I.D. Hose \varnothing 19 (3/4) / O.D. Cu \varnothing 6 (1/4)	

ELECTRICAL CONNECTION LOCATIONS- PW145 DOWNFLOW



1. All dimensions measured from front left corner of unit including panels and have a tolerance of ± 13 mm (1/2").

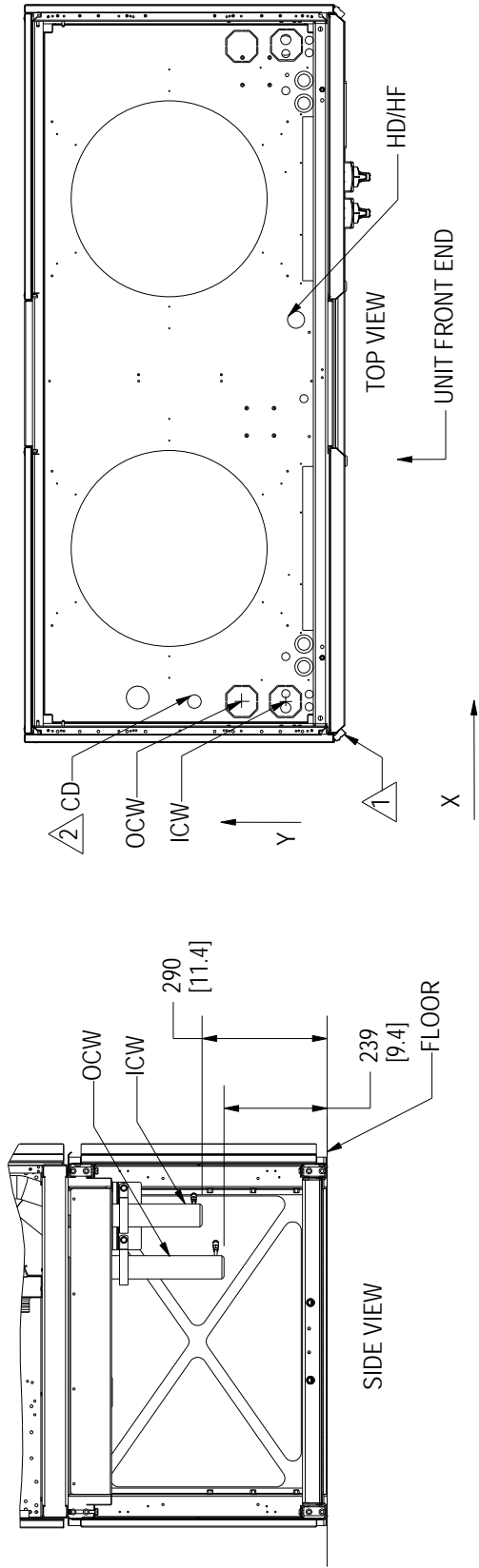
2. End grilles, panels, EP, Piping, Coil and EC Fan not shown for clarity.

3. Condensate pump is field installed.

POINT	DESCRIPTION	X mm (in)	Y mm (in)	CONNECTION SIZE mm (in)
EC1	Electrical power supply	2100 (82.7)	194 (7.6)	PW145
EC2	Electrical power supply	2100 (82.7)	124(4.9)	\varnothing 51(2)X35(1-3/8) Double KO
EC aux1	Low voltage cables	2709 (106.6)	104 (4.1)	\varnothing 51(2)X35(1-3/8) Double KO
EC aux2	Low voltage cables	2724(107.3)	142 (5.6)	\varnothing 22 (7/8)
EC aux3	Low voltage cables	2740(107.9)	104 (4.1)	\varnothing 22 (7/8)
EC CP	Electrical power supply, Condensate pump	2756 (108.5)	151 (6.0)	\varnothing 9.5 (3/8)



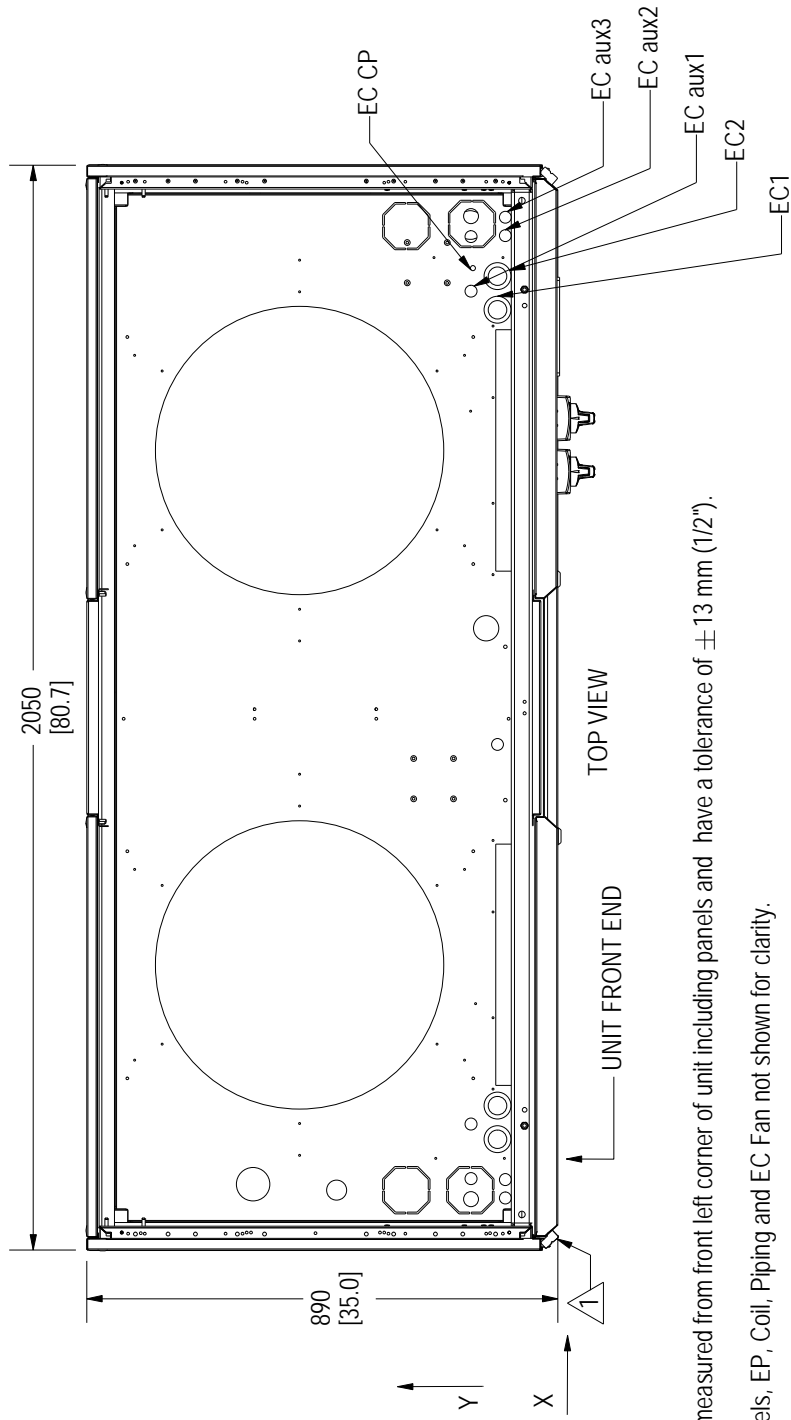
PIPING CONNECTION LOCATIONS - PW070-080 DOWNFLOW



- 1. All dimensions measured from front left corner of unit including panels and have a tolerance of ± 13 mm (1/2").
- 2. Downflow units contain a factory installed condensate trap. Do not trap external to the unit. Drain line may contain boiling water. Select appropriate drain system materials. Field pitch Condensate Drain line a minimum of 1/8" (3.2 mm) per foot (305 mm). The drain line must comply with local codes
- 3. End grilles, panels, EP, Piping, Coil and EC Fan not shown for clarity.

POINT	DESCRIPTION	X mm (in)	Y mm (in)	CONNECTION SIZE mm (in)	
				PW070	PW080
ICW	Chilled water inlet (single chilled water circuit)	113 (4.5)	165 (6.5)	O.D. Cu \varnothing 54 (2-1/8)	
OCW	Chilled water outlet (single chilled water circuit)	113 (4.5)	287 (11.3)	O.D. Cu \varnothing 54 (2-1/8)	
CD	Condensate drain	113 (4.5)	418 (16.5)	I.D. Hose \varnothing 19 (3/4)	
HD/HF	Humidifier drain / Humidifier supply	1175 (46.3)	135 (5.3)	I.D. Hose \varnothing 19 (3/4) / O.D. Cu \varnothing 6 (1/4)	

ELECTRICAL CONNECTION LOCATIONS - PW070-080 DOWNFLOW



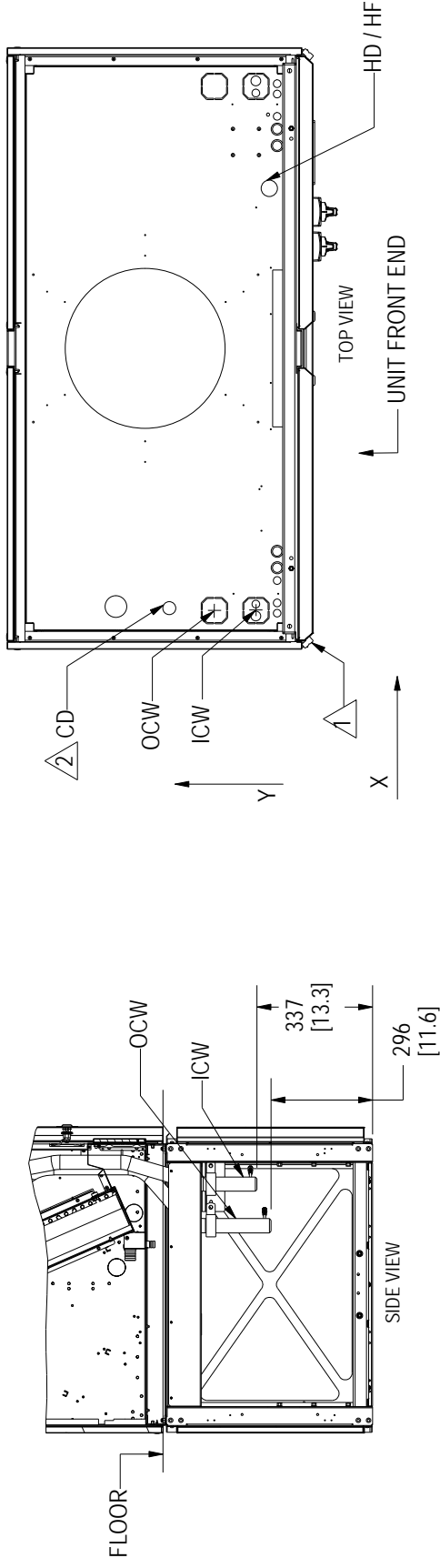
1. All dimensions measured from front left corner of unit including panels and have a tolerance of ± 13 mm (1/2").

2. End grilles, panels, EP, Coil, Piping and EC Fan not shown for clarity.

3. Condensate pump is field installed.

POINT	DESCRIPTION	X mm (in)	Y mm (in)	CONNECTION SIZE mm (in)	
				PW070	PW080
EC1	Electrical power supply	1777 (70.0)	114 (4.5)	\varnothing 51(2)X35(1-3/8)	Double KO
EC2	Electrical power supply	1841(72.5)	114 (4.5)	\varnothing 51(2)X35(1-3/8)	Double KO
EC aux1	Low voltage cables	1813 (71.4)	164 (6.5)	\varnothing 22 (7/8)	
EC aux2	Low voltage cables	1918(75.5)	99(3.9)	\varnothing 22 (7/8)	
EC aux3	Low voltage cables	1953(76.9)	99(3.9)	\varnothing 22 (7/8)	
EC CP	Electrical power supply, Condensate pump	1856 (73.1)	161 (6.3)	\varnothing 9.5 (3/8)	

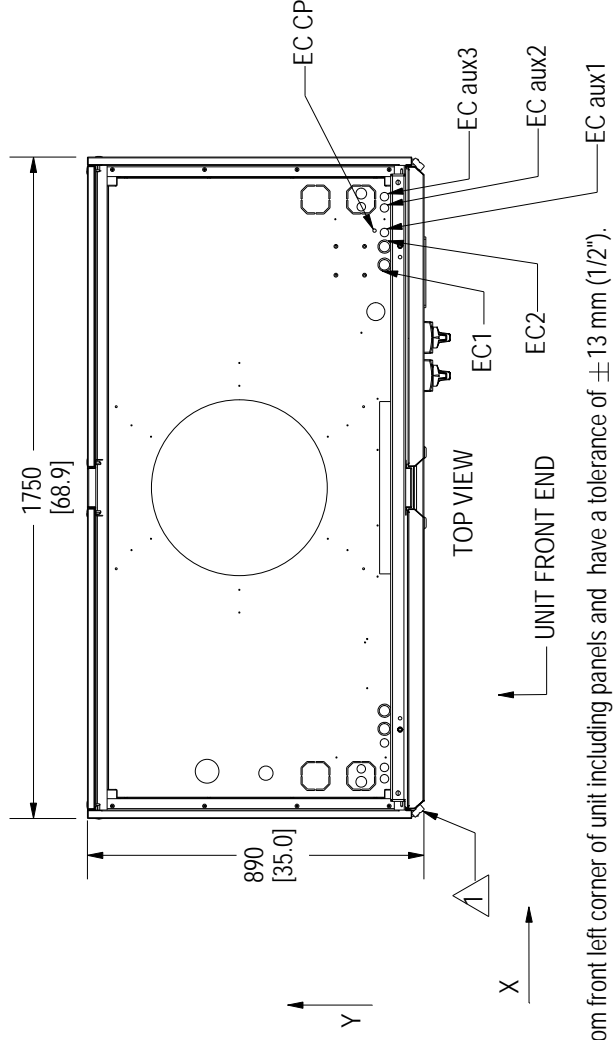
PIPING CONNECTION LOCATIONS- PW045-060 DOWNFLOW



1. All dimensions measured from front left corner of unit including panels and have a tolerance of $\pm 13 \text{ mm}$ (1/2").
2. Downflow units contain a factory installed condensate trap. Do not trap external to the unit. Drain line may contain boiling water. Select appropriate drain system materials. Field pitch Condensate Drain line a minimum of 1/8" (3.2 mm) per foot (305 mm). The drain line must comply with local codes.
3. End grilles, panels, EP, Coil, Piping and EC Fan not shown for clarity.
4. The PW045 unit frame is displayed. The PW060 unit frame is configured to contain two fans and not displayed.

POINT	DESCRIPTION	X mm (in)	Y mm (in)	CONNECTION SIZE mm (in)	
				PW045	PW060
ICW	Chilled water inlet (single chilled water circuit)	113 (4.4)	166 (6.5)	O.D. Cu $\varnothing 41$ (1-5/8)	
OCW	Chilled water outlet (single chilled water circuit)	113 (4.4)	287 (11.3)	O.D. Cu $\varnothing 41$ (1-5/8)	
CD	Condensate drain	113 (4.4)	418 (16.5)	I.D.Hose $\varnothing 19$ (3/4)	
HD/HF	Humidifier drain/Humidifier supply	1341 (52.8)	127 (5.0)	I.D. Hose $\varnothing 19$ (3/4) / O.D. Cu $\varnothing 6$ (1/4)	

ELECTRICAL CONNECTION LOCATIONS- PW045-060 DOWNFLOW



1. All dimensions measured from front left corner of unit including panels and have a tolerance of ± 13 mm (1/2").
2. End grilles, panels, EP, Coil, Piping and EC Fan not shown for clarity.
3. The PW045 unit frame is displayed. The PW060 unit frame is configured to contain two fans and not displayed.
4. Condensate pump is field installed.

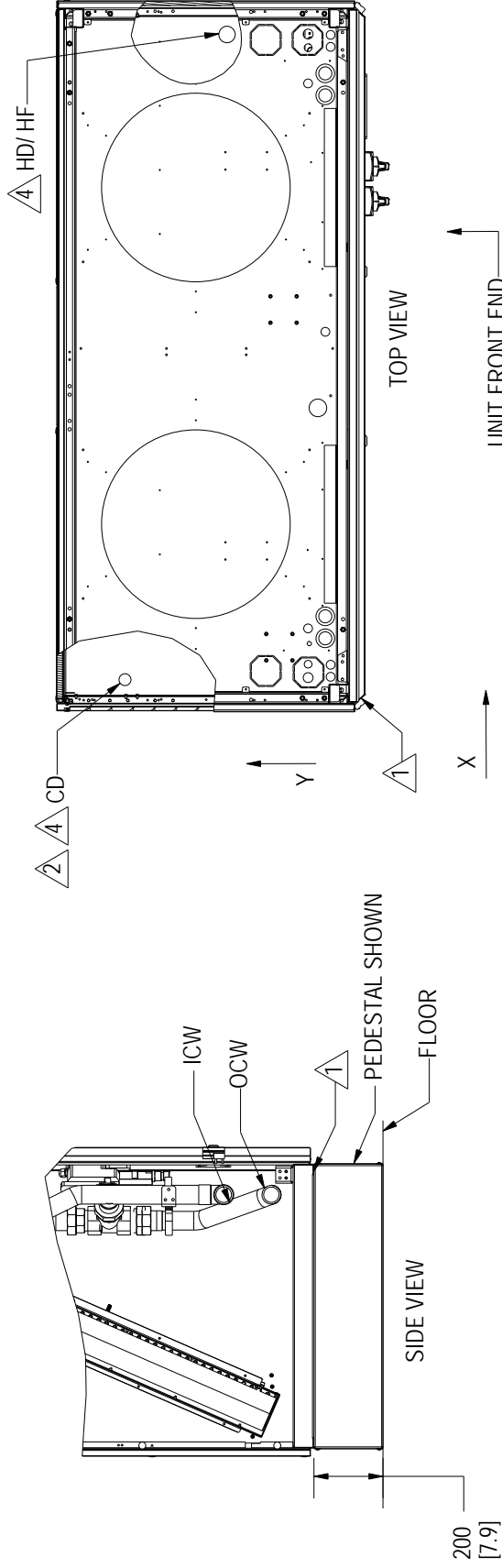
POINT	DESCRIPTION	X mm (in)	Y mm (in)	CONNECTION SIZE mm (in)	
				PW045	PW060
EC1	Electrical power supply	1465 (57.7)	104 (4.1)	\varnothing 35(1-3/8)X28(1.1)	Double KO
EC2	Electrical power supply	1513 (59.6)	104 (4.1)	\varnothing 35(1-3/8)X28(1.1)	Double KO
EC aux1	Low voltage cables	1550 (61.0)	104 (4.1)	\varnothing 22 (7/8)	
EC aux2	Low voltage cables	1615 (63.6)	104 (4.1)	\varnothing 22 (7/8)	
EC aux3	Low voltage cables	1645 (64.8)	104 (4.1)	\varnothing 22 (7/8)	
EC CP	Electrical power supply, Condensate pump	1556 (61.2)	131 (5.2)	\varnothing 9.5 (3/8)	



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PIPING CONNECTION LOCATIONS-PW070-080 UPFLOW - LEFT CONNECTION



1. X, Y dimensions are measured from front left corner of unit including panels. Z dimension is measured from bottom of unit frame. Tolerance is ± 13 mm (1/2").
2. Upflow units do not contain a factory installed condensate trap. Trap external to the unit. Drain line may contain boiling water. Select appropriate drain system materials. Field pitch Condensate Drain line a minimum of 1/8" (3.2 mm) per foot (305 mm). The drain line must comply with local codes.
3. Panels and EC Fan not shown for clarity.
4. CD and HD/HF are located on Base plate.
5. Pedestal required on upflow units.

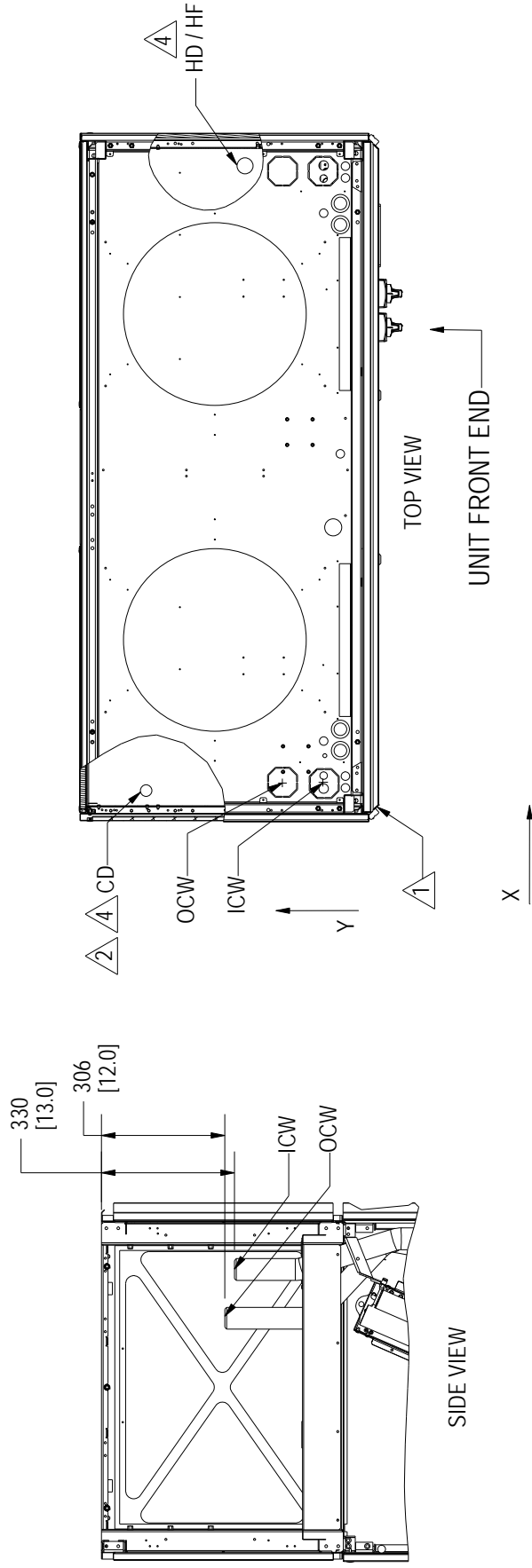
POINT	DESCRIPTION	X mm (in)	Y mm (in)	Z mm (in)	CONNECTION SIZE mm (in)	
					PW070	PW080
ICW	Chilled water inlet (single chilled water circuit)	-	126 (5.0)	260 (10.2)	O.D. Cu \varnothing 54 (2-1/8)	
OCW	Chilled water outlet (single chilled water circuit)	-	136 (5.4)	121 (4.8)	O.D. Cu \varnothing 54 (2-1/8)	
CD	Condensate drain	93 (3.7)	693 (27.3)	-	I.D. Hose \varnothing 19 (3/4)	
HD/HF	Humidifier drain / Humidifier supply	1956 (77.0)	398 (15.7)	-	O.D. Hose \varnothing 19 (3/4) / O.D. Cu \varnothing 6 (1/4)	



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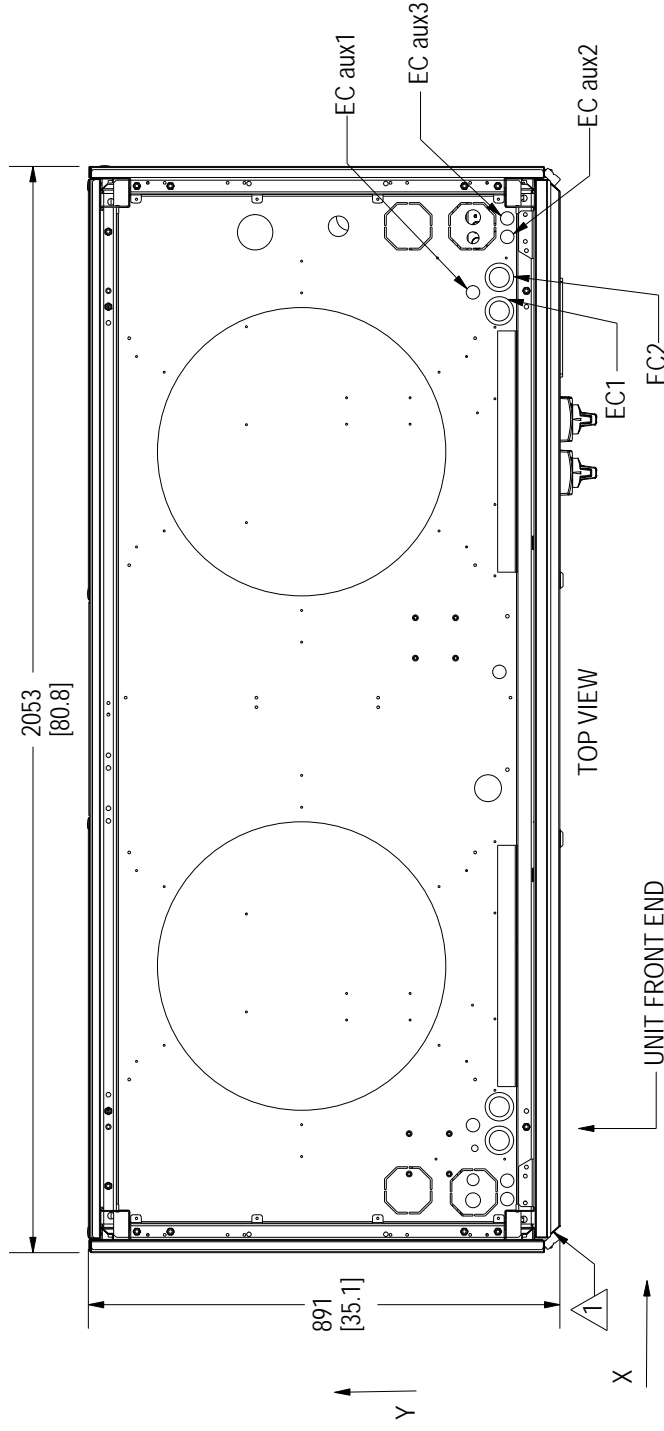
PIPING CONNECTION LOCATIONS- PW070-080 UPFLOW - TOP CONNECTION



1. All dimensions measured from front left corner of unit including panels and have a tolerance of ± 13 mm (1/2").
2. Upflow units do not contain a factory installed condensate trap. Trap external to the unit. Drain line may contain boiling water. Select appropriate drain system materials. Field pitch Condensate Drain line a minimum of 1/8" (3.2 mm) per foot (305 mm). The drain line must comply with local codes.
3. Panels and EC Fan not shown for clarity.
4. CD and HD/HF are located on Base plate.
5. Pedestal required on upflow units.

POINT	DESCRIPTION	X mm (in)	Y mm (in)	CONNECTION SIZE mm (in)	
				PW070	PW080
ICW	Chilled water inlet (single chilled water circuit)	113 (4.5)	126 (5.0)	O.D. Cu \varnothing 54 (2-1/8)	
OCW	Chilled water outlet (single chilled water circuit)	113 (4.5)	136 (5.4)	O.D. Cu \varnothing 54 (2-1/8)	
CD	Condensate drain	93 (3.7)	693 (27.3)	I.D. Hose \varnothing 19 (3/4)	
HD/HF	Humidifier drain / Humidifier supply	1956 (77.0)	398 (15.7)	O.D. Hose \varnothing 19 (3/4) / O.D. Cu \varnothing 6 (1/4)	

ELECTRICAL CONNECTION LOCATIONS-PW070-080 UPFLOW

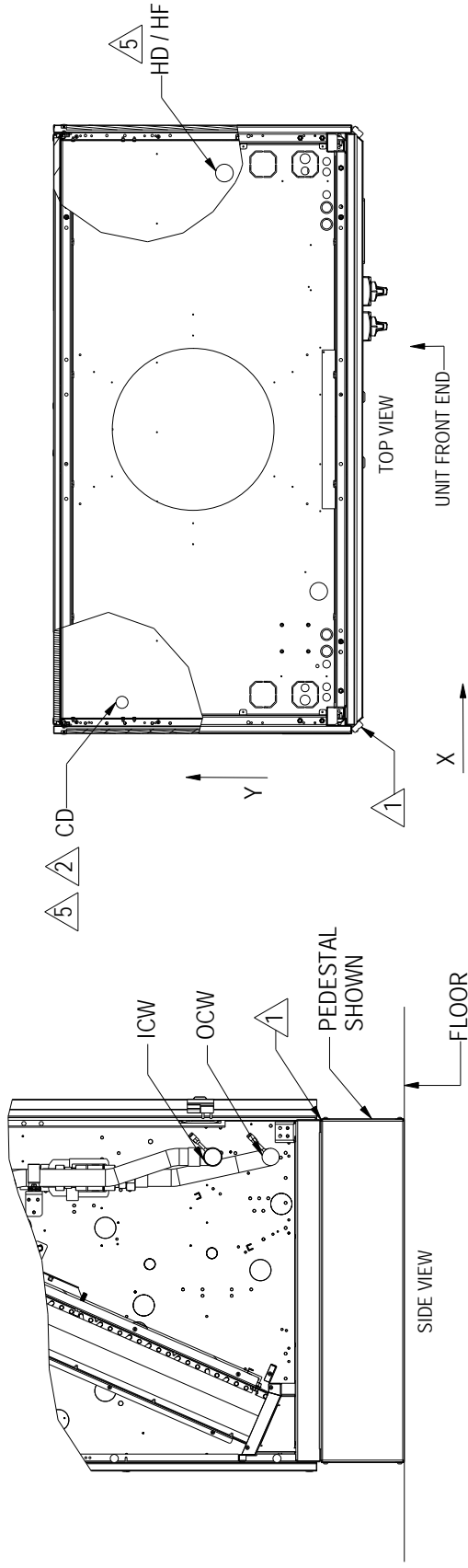


1. X, Y dimensions are measured from front left corner of unit including panels. Z dimension is measured from bottom of unit frame. Tolerance is ± 13 mm (1/2").

2. Panels and EC Fan not shown for clarity.
3. Pedestal required on upflow units.

POINT	DESCRIPTION	X mm (in)	Y mm (in)	CONNECTION SIZE mm (in)	
				PW070	PW080
EC1	Electrical power supply	1780 (70.1)	114 (4.5)	$\varnothing 51(2) \times 35(1-3/8)$	Double KO
EC2	Electrical power supply	1844 (72.6)	114 (4.5)	$\varnothing 51(2) \times 35(1-3/8)$	Double KO
EC aux1	Low voltage cables	1815 (71.5)	164 (6.5)	$\varnothing 22$	(7/8)
EC aux2	Low voltage cables	1920 (75.6)	99(3.9)	$\varnothing 22$	(7/8)
EC aux3	Low voltage cables	1955 (77.0)	99(3.9)	$\varnothing 22$	(7/8)

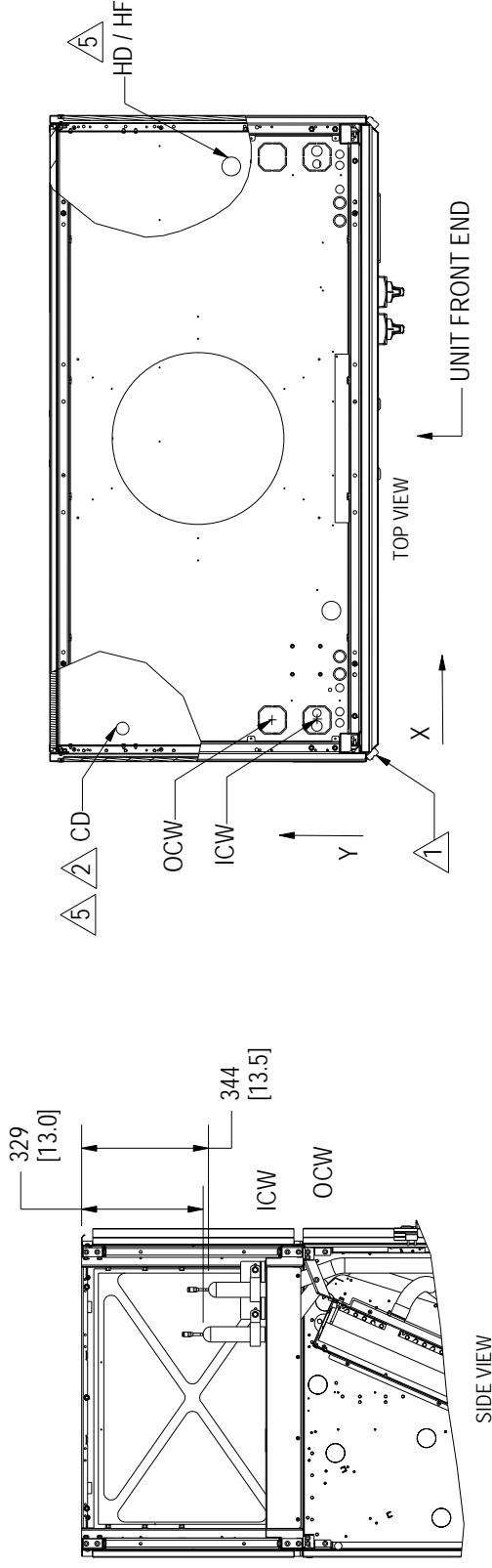
PIPING CONNECTION LOCATIONS- PW045-060 UPFLOW - LEFT CONNECTION



1. X, Y dimensions are measured from front left corner of unit including panels. Z dimension is measured from bottom of unit frame. Tolerance is ± 13 mm (1/2").
2. Upflow units do not contain a factory installed condensate trap. Trap external to the unit. Drain line may contain boiling water. Select appropriate drain system materials. Field pitch Condensate Drain line a minimum of 1/8" (3.2 mm) per foot (305 mm). The drain line must comply with local codes.
3. Panels and EC Fan not shown for clarity.
4. The PW045 unit frame is displayed. The PW060 unit frame is configured to contain two fans and not displayed.
5. CD and HD/HF are located on Base Plate.
6. Pedestal required on upflow units.

POINT	DESCRIPTION	X mm (in)	Y mm (in)	Z mm (in)	CONNECTION SIZE mm (in)	
					PW045	PW060
ICW	Chilled water inlet (single chilled water circuit)	-	138 (5.4)	260 (10.2)	O.D. Cu \varnothing 41.28 (1-5/8)	
OCW	Chilled water outlet (single chilled water circuit)	-	138 (5.4)	121 (4.8)	O.D. Cu \varnothing 41.28 (1-5/8)	
CD	Condensate drain	90 (3.5)	693 (27.3)	-	I.D. Hose \varnothing 19 (3/4)	
HD/HF	Humidifier drain / Humidifier supply	1612 (63.5)	398 (15.7)	-	I.D. Hose \varnothing 19 (3/4) / O.D. Cu \varnothing 6 (1/4)	

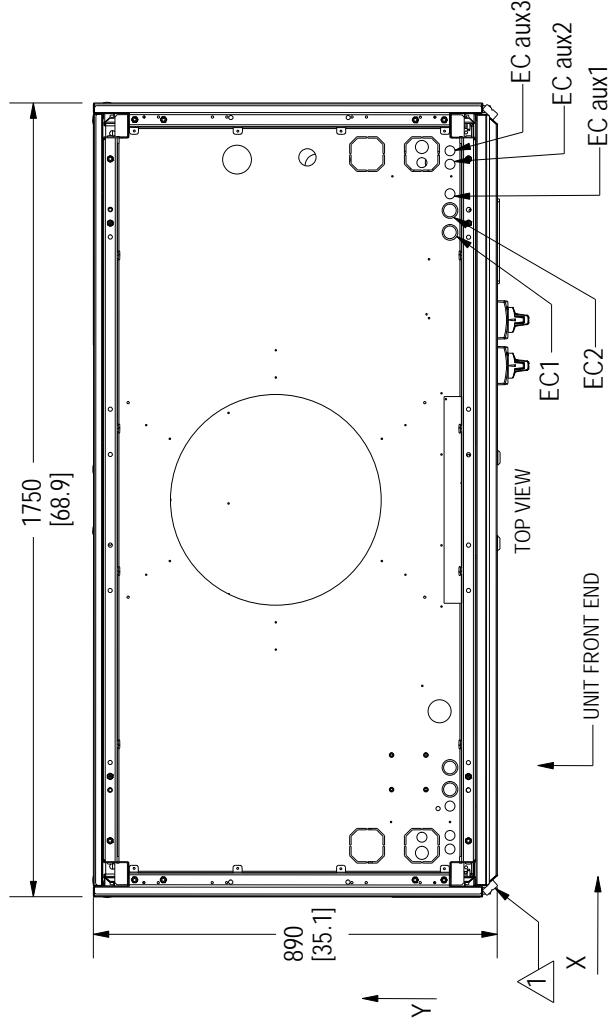
PIPING CONNECTION LOCATIONS- PW045-060 UPFLOW - TOP CONNECTION



1. All dimensions measured from front left corner of unit including panels and have a tolerance of ± 13 mm (1/2").
2. Upflow units do not contain a factory installed condensate trap. Trap external to the unit. Drain line may contain boiling water. Select appropriate drain system materials. Field pitch Condensate Drain line a minimum of 1/8" (3.2 mm) per foot (305 mm). The drain line must comply with local codes.
3. Panels and EC Fan not shown for clarity.
4. The PW045 unit frame is displayed. The PW060 unit frame is configured to contain two fans and not displayed.
5. CD and HD/HF are located on Base Plate.
6. Pedestal required on upflow units.

POINT	DESCRIPTION	X mm (in)	Y mm (in)	CONNECTION SIZE mm (in)	
				PW045	PW060
ICW	Chilled water inlet (single chilled water circuit)	113 (4.4)	166 (6.5)	O.D. Cu \varnothing 41.28 (1-5/8)	
OCW	Chilled water outlet (single chilled water circuit)	113 (4.4)	287 (11.3)	O.D. Cu \varnothing 41.28 (1-5/8)	
CD	Condensate drain	90 (3.5)	693 (27.3)	I.D. Hose \varnothing 19 (3/4)	
HD/HF	Humidifier drain / Humidifier supply	1612 (63.5)	398 (15.7)	I.D. Hose \varnothing 19 (3/4) / O.D. Cu \varnothing 6 (1/4)	

ELECTRICAL CONNECTION LOCATIONS- PW045-060 UPFLOW



△ All dimensions are measured from front left corner of unit including panels. Z dimension is measured from bottom of unit frame. Tolerance is ± 13 mm (1/2").

2. Panels and EC Fan not shown for clarity.
3. The PW045 unit frame is displayed. The PW060 unit frame is configured to contain two fans and not displayed.
4. Pedestal required on upflow units.

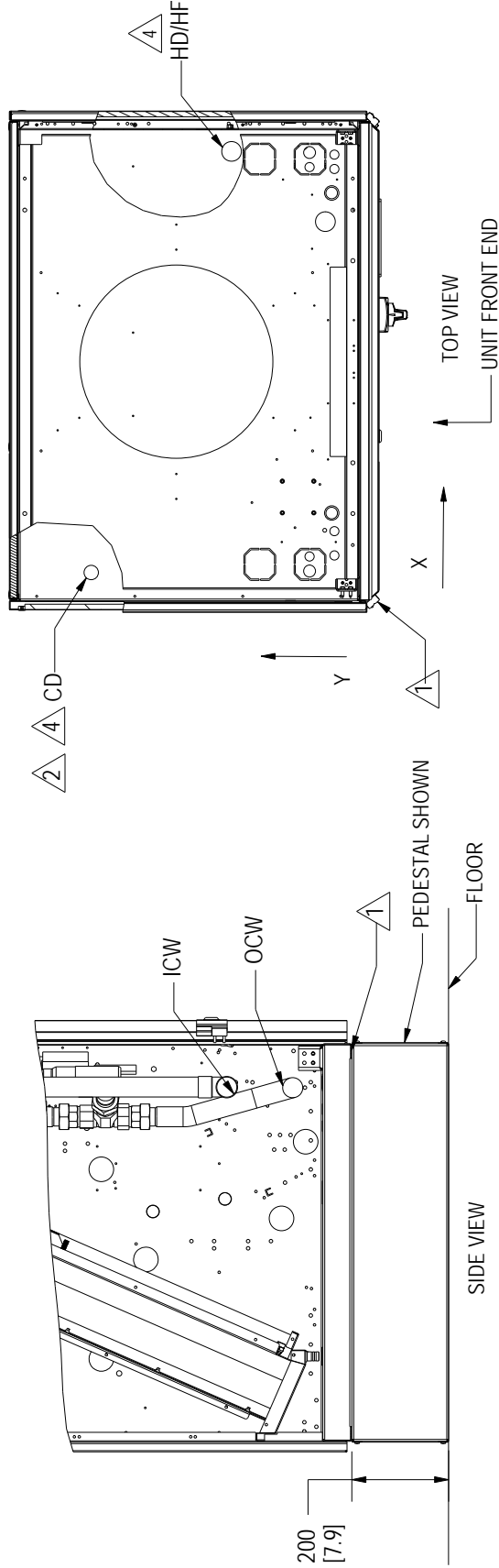
POINT	DESCRIPTION	X mm (in)	Y mm (in)	CONNECTION SIZE mm (in)	
				PW045	PW060
EC1	Electrical power supply	1465(57.7)	104 (4.1)	$\varnothing 35(1-3/8) \times 28(1.1)$	Double KO
EC2	Electrical power supply	1513(59.6)	104 (4.1)	$\varnothing 35(1-3/8) \times 28(1.1)$	Double KO
EC aux1	Low voltage cables	1550 (61.0)	104 (4.1)	$\varnothing 22$	(7/8)
EC aux2	Low voltage cables	1615 (63.6)	104 (4.1)	$\varnothing 22$	(7/8)
EC aux3	Low voltage cables	1645(64.8)	104 (4.1)	$\varnothing 22$	(7/8)



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PIPING CONNECTION LOCATIONS- PW035-040 UPFLOW - LEFT CONNECTION

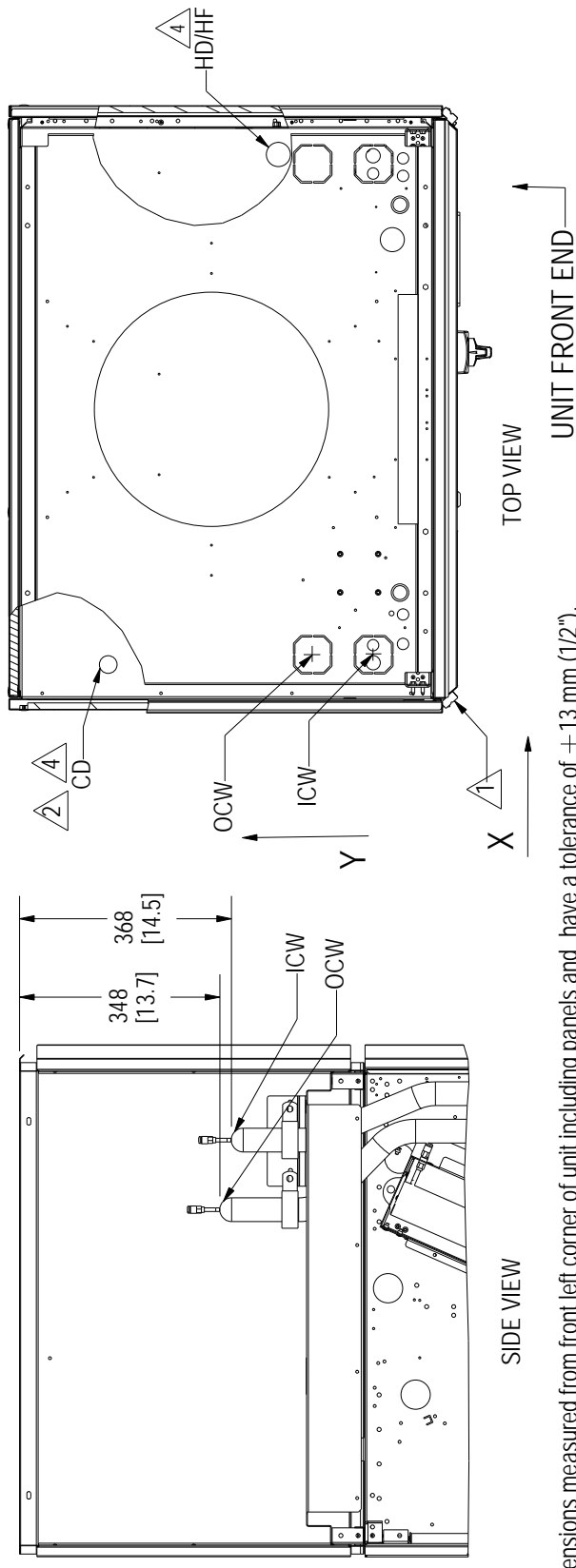


1. X, Y dimensions are measured from front left corner of unit including panels. Z dimension is measured from bottom of unit frame. Tolerance is ± 13 mm (1/2").
2. Upflow units do not contain a factory installed condensate trap. Trap external to the unit. Drain line may contain boiling water. Select appropriate drain system materials. Field pitch Condensate Drain line a minimum of 1/8" (3.2 mm) per foot (305 mm). The drain line must comply with local codes..
3. Panels and EC Fan not shown for clarity.
4. CD and HD/HF are located on Base plate.
5. Pedestal required on Upflow units.

POINT	DESCRIPTION	X mm (in)	Y mm (in)	Z mm (in)	CONNECTION SIZE mm (in)	
					PW035	PW040
ICW	Chilled water inlet (single chilled water circuit)	-	165 (6.5)	258 (10.2)	O.D. Cu \varnothing 41 (1-5/8)	
OCW	Chilled water outlet (single chilled water circuit)	-	286 (11.3)	122 (4.8)	O.D. Cu \varnothing 41 (1-5/8)	
CD	Condensate drain	96 (3.8)	693 (27.3)	-	I.D. Hose \varnothing 19 (3/4)	
HD/HF	Humidifier drain / Humidifier supply	1109 (43.7)	355 (14.0)	-	I.D. Hose \varnothing 19 (3/4) / O.D. Cu \varnothing 6 (1/4)	



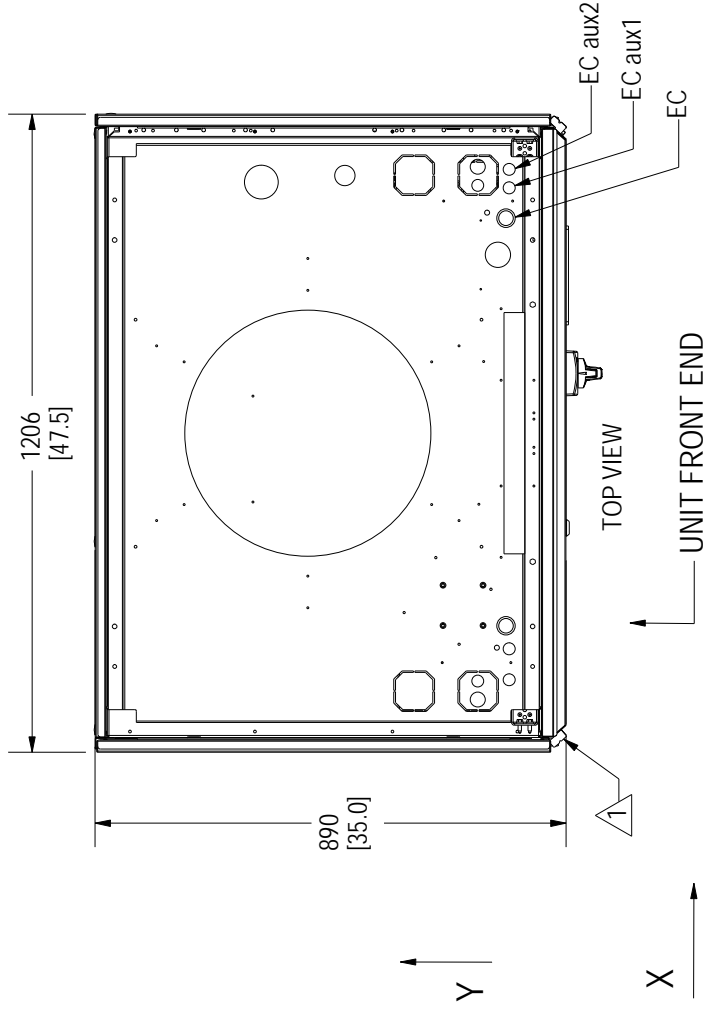
**PIPING CONNECTION LOCATIONS- PW035-040
UPFLOW - TOP CONNECTION**



- 1. All dimensions measured from front left corner of unit including panels and have a tolerance of ± 13 mm (1/2").
- 2. Upflow units do not contain a factory installed condensate trap. Trap external to the unit. Drain line may contain boiling water. Select appropriate drain system materials. Field pitch Condensate Drain line a minimum of 1/8" (3.2 mm) per foot (305 mm). The drain line must comply with local codes.
- 3. Panels and EC Fan not shown for clarity.
- 4. CD and HD/HF are located on Base plate.
- 5. Pedestal required on upflow units.

POINT	DESCRIPTION	X mm (in)	Y mm (in)	CONNECTION SIZE mm (in)	
				PW035	PW040
ICW	Chilled water inlet (single chilled water circuit)	112 (4.4)	165 (6.5)	O.D. Cu \varnothing 41 (1-5/8)	
OCW	Chilled water outlet (single chilled water circuit)	112 (4.4)	286 (11.3)	O.D. Cu \varnothing 41 (1-5/8)	
CD	Condensate drain	96 (3.8)	693 (27.3)	I.D. Hose \varnothing 19 (3/4)	
HD/HF	Humidifier drain / Humidifier supply	1109 (43.7)	355 (14.0)	I.D. Hose \varnothing 19 (3/4) / O.D. Cu \varnothing 6 (1/4)	

ELECTRICAL CONNECTION LOCATIONS- PW035-040 UPFLOW



△ 1. All dimensions measured from front left corner of unit including panels and have a tolerance of ± 13 mm (1/2").

2. Panels and EC Fan not shown for clarity
3. Pedestal required on upflow units.

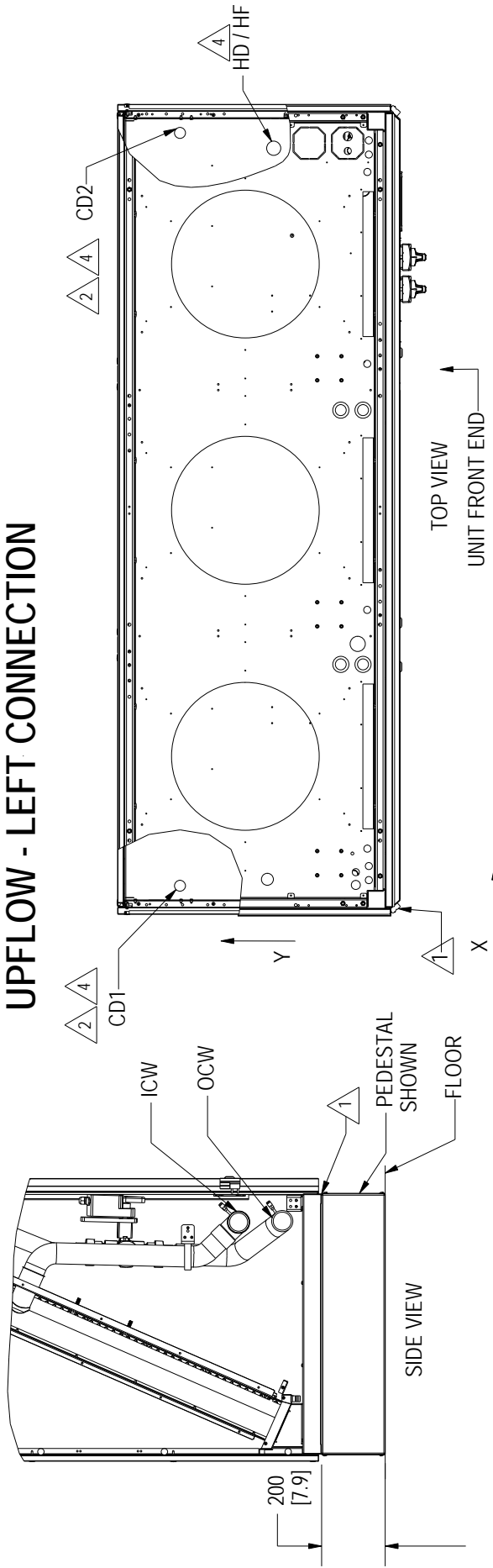
POINT	DESCRIPTION	X mm (in)	Y mm (in)	CONNECTION SIZE mm (in)	
				PW035	PW040
EC	Electrical power supply	1009 (39.7)	114 (4.5)	\varnothing 35(1-3/8)X28(1.1) Double KO	
EC aux1	Low voltage cables	1067 (42.0)	107 (4.2)	\varnothing 22 (7/8)	
EC aux2	Low voltage cables	1101 (43.4)	107 (4.2)	\varnothing 22 (7/8)	



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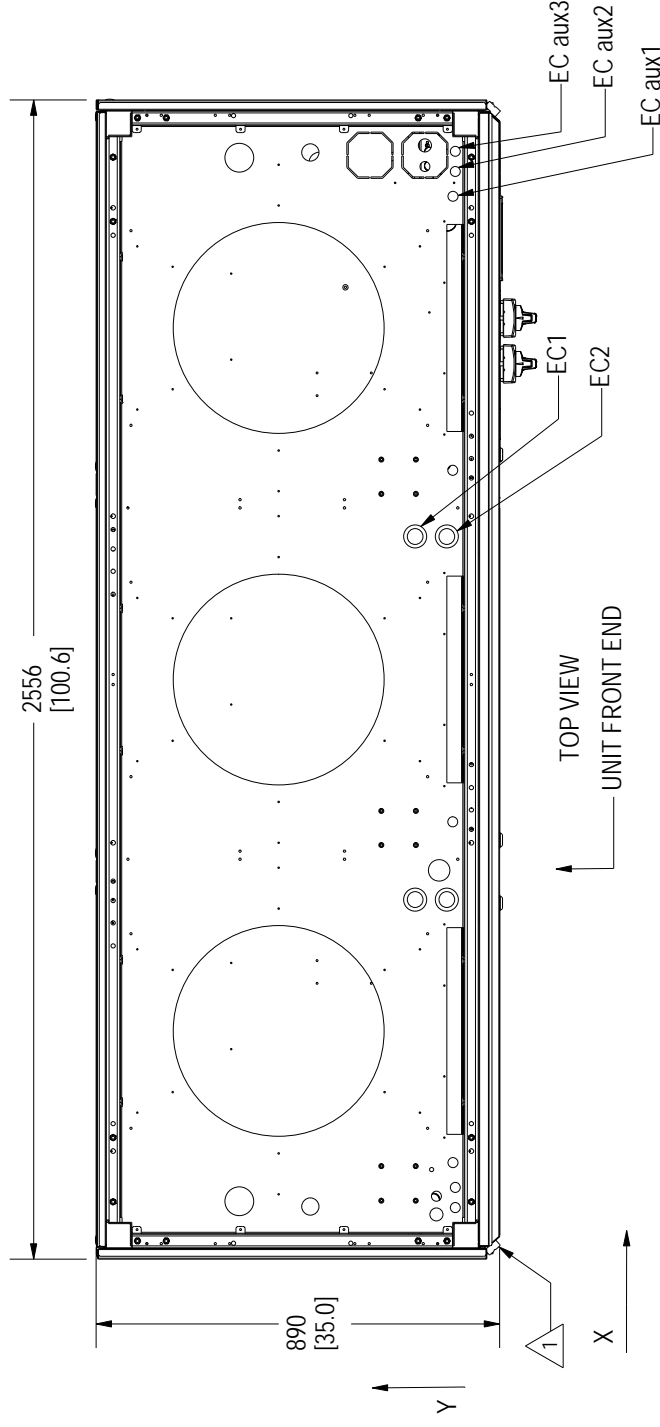
PIPING CONNECTION LOCATIONS - PW095-110 UPFLOW - LEFT CONNECTION



1. X, Y dimensions are measured from front left corner of unit including panels. Z dimension is measured from bottom of unit frame. Tolerance is $\pm 13 \text{ mm } (1/2")$.
2. Upflow units do not contain a factory installed condensate trap. Trap external to the unit. Drain line may contain boiling water. Select appropriate drain system materials. Field pitch Condensate Drain line a minimum of 1/8" (3.2 mm) per foot (305 mm). The drain line must comply with local codes.
3. End grilles, panels and EC Fan not shown for clarity.
4. CD and HD/HF are located on Base Plate.
5. Pedestal required on upflow units.

POINT	DESCRIPTION	X mm (in)	Y mm (in)	Z mm (in)	CONNECTION SIZE mm (in)	
					PW95	PW110
ICW	Chilled water inlet (single chilled water circuit)	-	138 (5.4)	262 (10.3)	O.D. Cu \varnothing 67 (2-5/8)	
OCW	Chilled water outlet (single chilled water circuit)	-	138 (5.4)	124 (4.9)	O.D. Cu \varnothing 67 (2-5/8)	
CD1	Condensate drain	96 (3.8)	693 (27.3)	-	I.D. Hose \varnothing 19 (3/4)	
CD2	Condensate drain	2466 (97.1)	693 (27.3)	-	I.D. Hose \varnothing 19 (3/4)	
HD/HF	Humidifier drain/Humidifier supply	2418 (95.2)	398 (15.7)	-	I.D. Hose \varnothing 19 (3/4) / O.D. Cu \varnothing 6 (1/4)	

ELECTRICAL CONNECTION LOCATIONS - PW095-110 UPFLOW



1. X, Y dimensions are measured from front left corner of unit including panels. Tolerance is ± 13 mm (1/2").

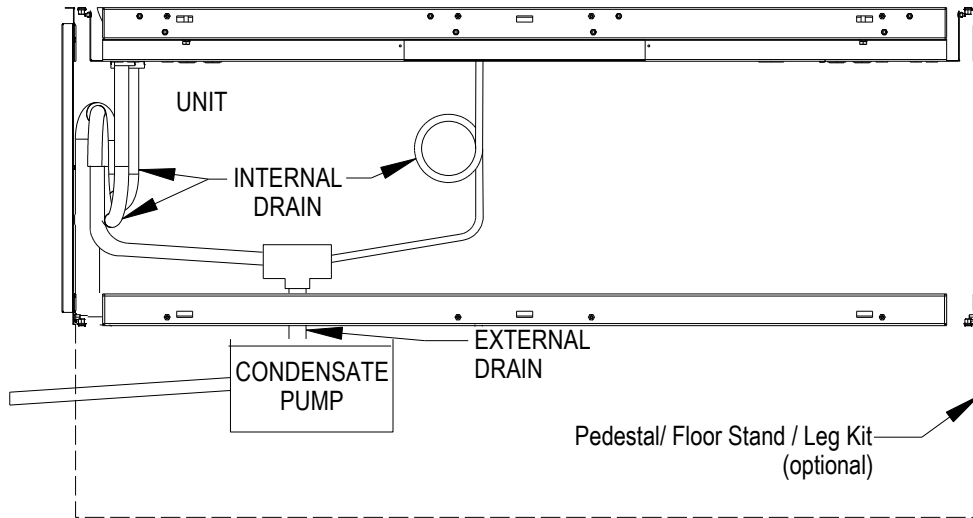
2. End grilles, panels and EC Fan not shown for clarity.

3. Pedestal required on upflow units.

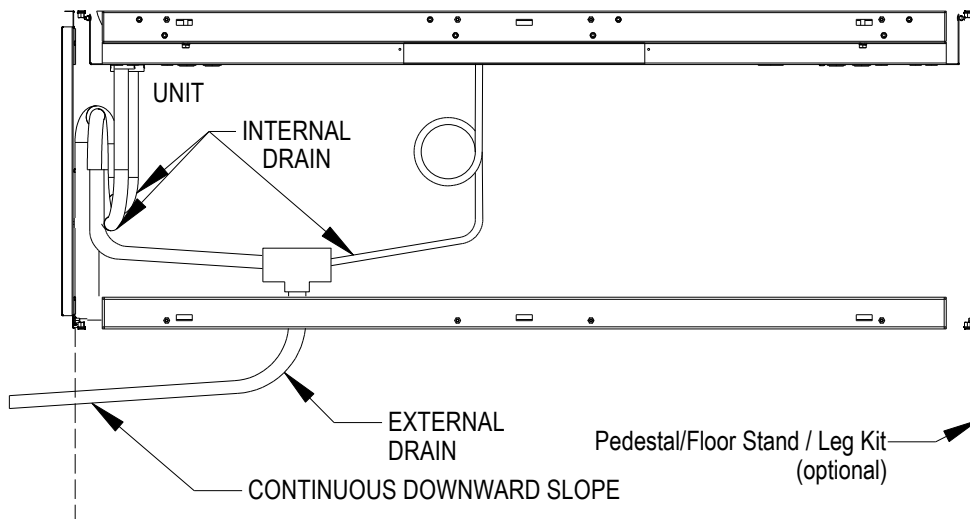
POINT	DESCRIPTION	X mm (in)	Y mm (in)	CONNECTION SIZE mm (in)	
				PW95	PW110
EC1	Electrical power supply	1593 (62.7)	187 (7.3)	\varnothing 51(2)X35(1-3/8)	Double KO
EC2	Electrical power supply	1593 (62.7)	117 (4.6)	\varnothing 51(2)X35(1-3/8)	Double KO
EC aux1	Low voltage cables	2343 (92.3)	103 (4.1)	\varnothing 22 (7/8)	
EC aux2	Low voltage cables	2398 (94.4)	98 (3.9)	\varnothing 22 (7/8)	
EC aux3	Low voltage cables	2422(95.4)	98 (3.9)	\varnothing 22 (7/8)	

DRAIN SYSTEMS DOWNFLOW UNITS

DOWNFLOW PCW035-080 WITH CONDENSATE PUMP



DOWNFLOW PCW035-080 WITHOUT CONDENSATE PUMP

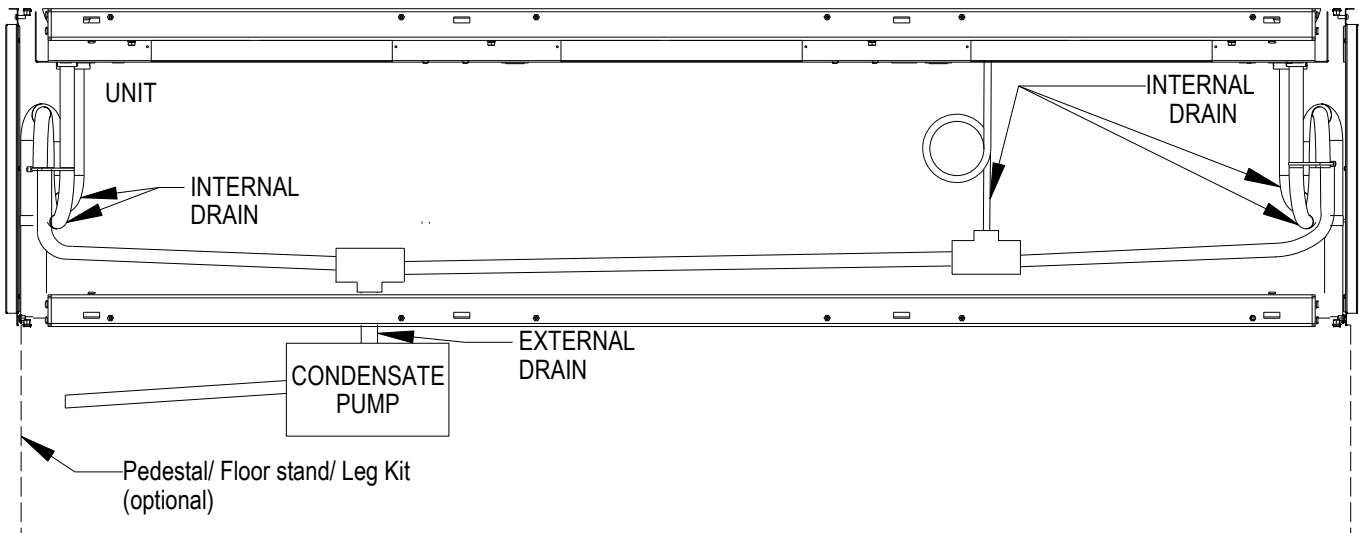


NOTES:

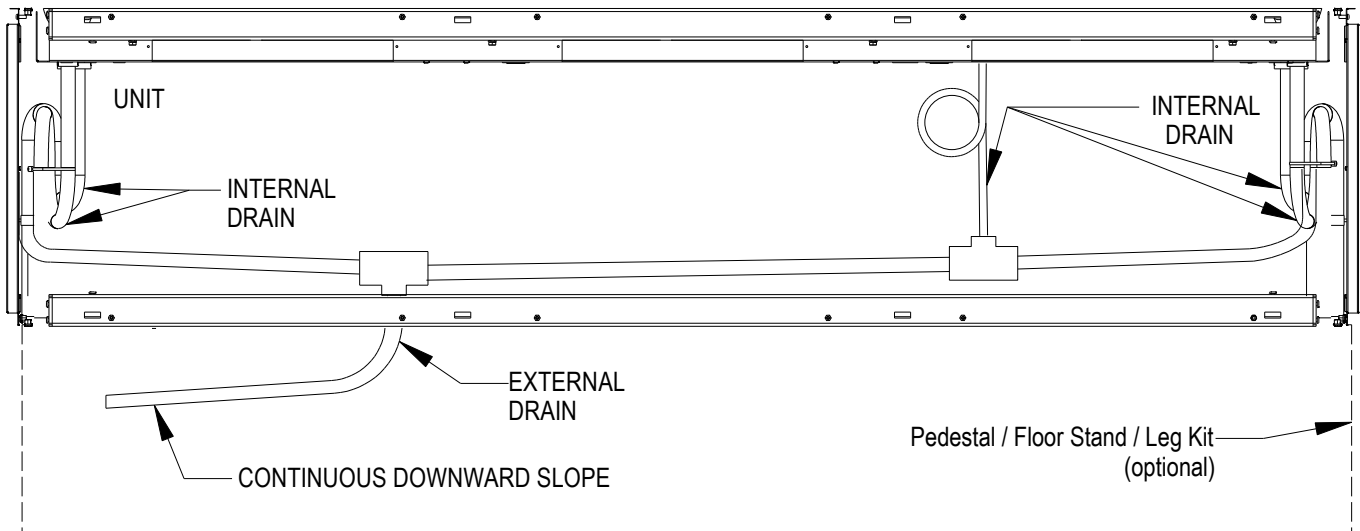
1. INTERNAL DRAIN LINES CONTAIN A FACTORY INSTALLED TRAP. DO NOT EXTERNALLY TRAP THE UNIT.
2. DRAIN LINES MUST BE RIGID ENOUGH NOT TO BOW OVER TOP OF OTHER OBJECTS. SELECT APPROPRIATE DRAIN SYSTEM MATERIALS. COMPLY WITH LOCAL CODES.
3. EXTERNAL DRAIN LINE COMPONENTS ARE NOT PROVIDED WITH THE UNIT.

DRAIN SYSTEMS DOWNFLOW UNITS

DOWNFLOW PCW095-170 WITH CONDENSATE PUMP



DOWNFLOW PCW095-170 WITHOUT CONDENSATE PUMP

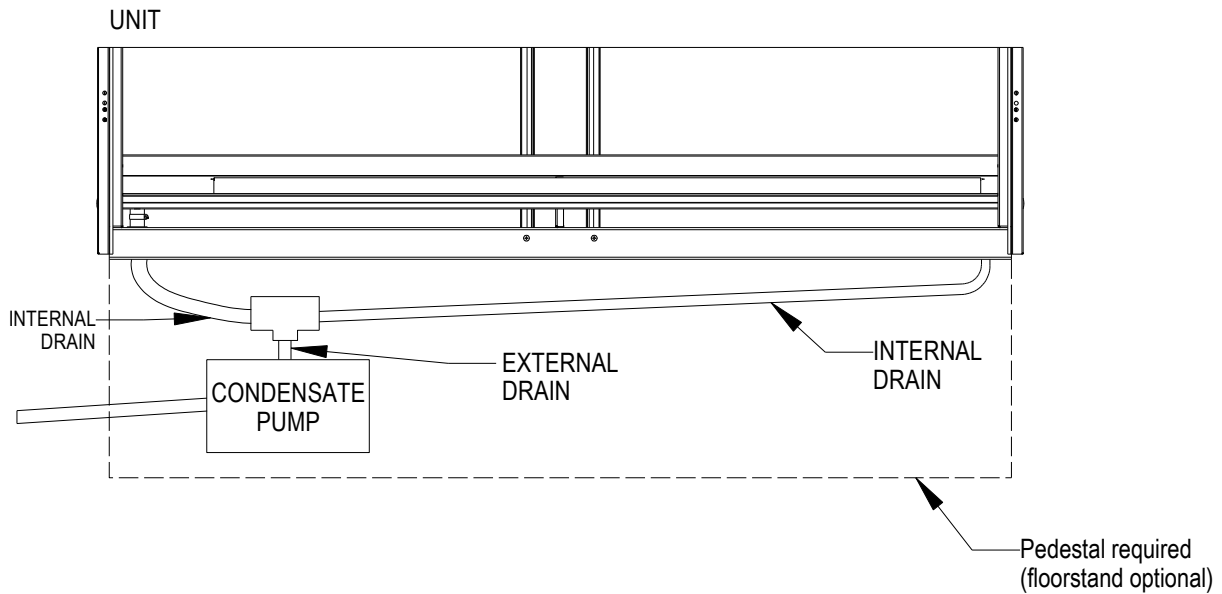


NOTES:

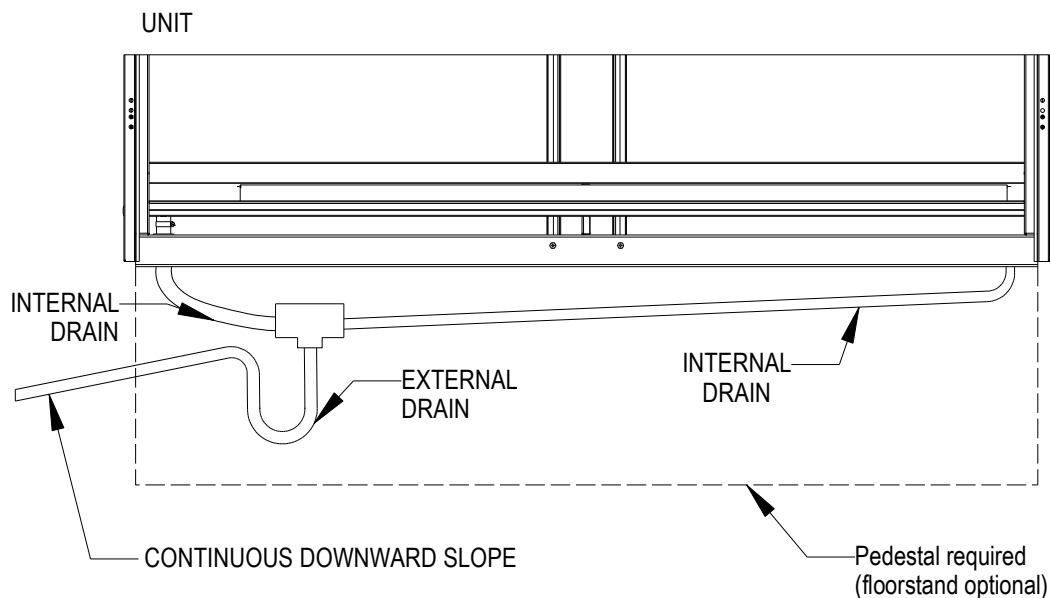
1. INTERNAL DRAIN LINES CONTAIN A FACTORY INSTALLED TRAP. DO NOT EXTERNALLY TRAP THE UNIT.
2. DRAIN LINES MUST BE RIGID ENOUGH NOT TO BOW OVER TOP OF OTHER OBJECTS. SELECT APPROPRIATE DRAIN SYSTEM MATERIALS. COMPLY WITH LOCAL CODES.
3. EXTERNAL DRAIN LINE COMPONENTS ARE NOT PROVIDED WITH THE UNIT.

DRAIN SYSTEM UPFLOW UNITS

UPFLOW PCW035-080 WITH CONDENSATE PUMP



UPFLOW PCW035-080 WITHOUT CONDENSATE PUMP



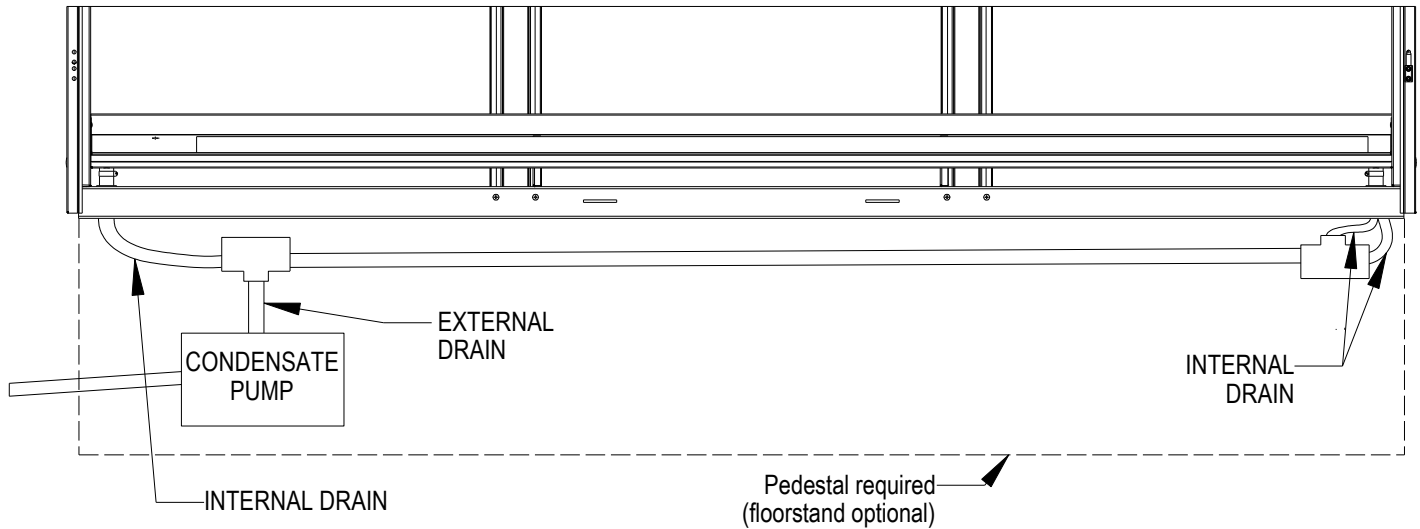
NOTES:

1. INTERNAL DRAIN LINES DO NOT CONTAIN A FACTORY INSTALLED TRAP. TRAP THE UNIT EXTERNALLY.
2. DRAIN LINES MUST BE RIGID ENOUGH NOT TO BOW OVER TOP OF OTHER OBJECTS. SELECT APPROPRIATE DRAIN SYSTEM MATERIALS. COMPLY WITH LOCAL CODES.
3. EXTERNAL DRAIN LINE COMPONENTS ARE NOT PROVIDED WITH THE UNIT.

DRAIN SYSTEM FOR UPFLOW UNITS

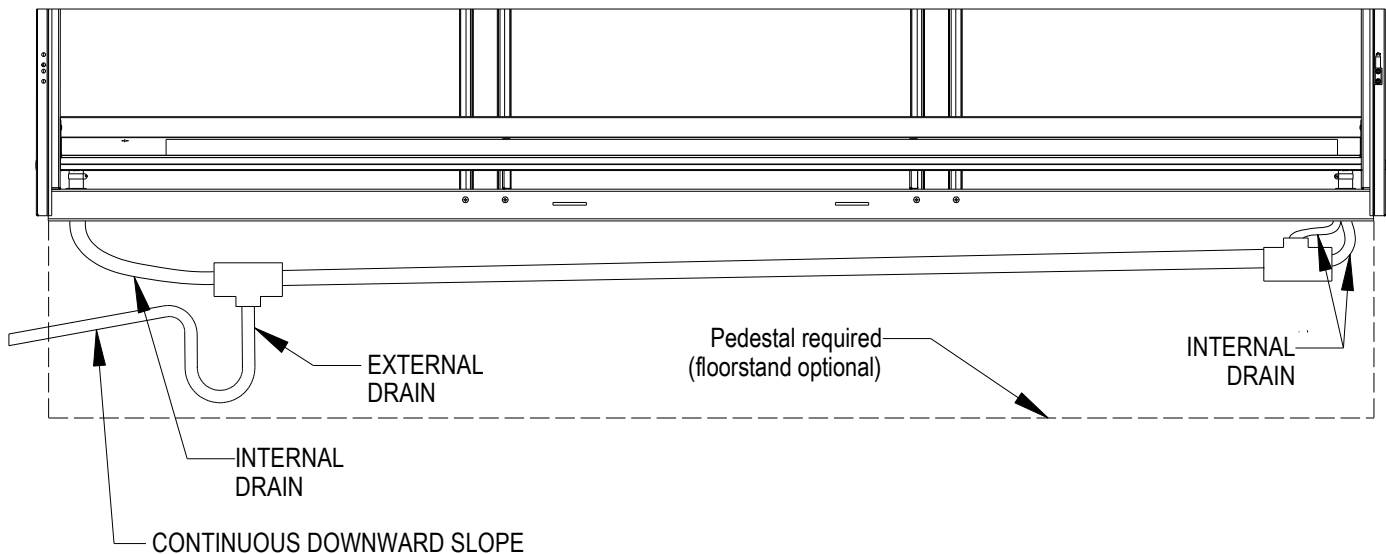
UPFLOW PCW095-110 WITH CONDENSATE PUMP

UNIT



UPFLOW PCW095-110 WITHOUT CONDENSATE PUMP

UNIT



NOTES:

1. INTERNAL DRAIN LINES DO NOT CONTAIN A FACTORY INSTALLED TRAP. TRAP THE UNIT EXTERNALLY.
2. DRAIN LINES MUST BE RIGID ENOUGH NOT TO BOW OVER TOP OF OTHER OBJECTS. SELECT APPROPRIATE DRAIN SYSTEM MATERIALS. COMPLY WITH LOCAL CODES.
3. EXTERNAL DRAIN LINE COMPONENTS ARE NOT PROVIDED WITH THE UNIT.

Appendix C: Sound Level

*Measurement conditions: High Power EC fan mode, max airflow

Table C.1 Sound Power Level (dB) - Downflow Up Configuration, High Efficiency EC Fan Module, Max Airflow

	Unit Model	Level	Octave Band Frequency (Hz)									Sound Level [dB] (A)
			31.5	63	125	250	500	1000	2000	4000	8000	
Downflow Up	PW035	PWL	77.0	77.0	81.7	86.3	90.0	91.2	87.0	92.5	77.1	96.8
		SPL	68.4	68.4	73.7	73.7	66.6	60.2	55.6	47.3	38.8	68.8
	PW040	PWL	76.5	76.5	81.2	85.8	89.5	90.7	86.5	92.0	76.9	96.3
		SPL	67.9	67.9	73.2	73.2	66.1	59.7	55.1	46.8	38.3	68.3
	PW045	PWL	78.1	78.1	82.8	87.4	91.2	92.4	88.1	93.5	78.1	97.9
		SPL	67.9	67.9	73.2	73.2	66.1	59.7	55.1	46.8	38.3	68.3
	PW060	PWL	71.9	71.9	78.1	83.0	86.3	88.1	84.9	83.7	73.3	92.0
		SPL	70.1	70.1	75.4	75.4	68.3	61.9	57.3	49.0	40.5	70.5
	PW070	PWL	73.7	73.7	79.1	84.0	88.0	89.7	85.8	87.1	74.6	93.9
		SPL	70.0	70.9	75.3	75.3	68.2	61.8	57.2	48.9	40.4	70.4
	PW080	PWL	73.2	73.2	79.6	83.5	87.5	89.2	85.3	86.6	74.1	93.4
		SPL	69.5	69.5	74.8	74.8	67.7	61.3	56.7	48.4	39.9	69.9
	PW095	PWL	74.7	74.7	80.6	85.5	89.0	90.8	87.4	86.9	75.9	94.8
		SPL	72.1	72.1	77.4	77.4	70.3	63.9	59.3	51.0	42.5	72.5
	PW110	PWL	74.2	74.2	80.1	85.0	88.5	90.3	86.9	86.4	75.4	94.3
		SPL	71.6	71.6	76.9	76.9	69.8	63.4	58.8	50.5	42.0	72.0
	PW145	PWL	74.6	74.6	80.2	85.2	88.9	90.7	87.0	87.3	75.6	94.7
		SPL	71.0	71.0	76.3	76.3	69.2	62.8	58.2	49.9	41.4	71.4
	PW170	PWL	77.0	77.0	83.4	85.4	86.4	89.0	88.2	82.7	75.4	93.4
		SPL	74.7	74.7	80.0	80.0	72.9	66.5	61.9	53.6	45.1	75.1

The sound levels are global and for each octave band are expressed in dB with a tolerance of (0/+2) dB.

PWL - Sound Power Level calculated according to ISO 3744 procedure method.

SPL - Sound Pressure Level measured in free field conditions and at 6.6 ft. (2 meters) from the front of the unit and 5 ft. (1.5 meters) above the surface according to ISO 3744 average method.

All Liebert® PCW units have very high noise emission at maximum airflow.

LEGEND

The sound levels are global and for each octave band are expressed in dB with a tolerance of (0/+2) dB.

1. Only ventilation (30 Pa available external static pressure), 6.6 ft. (2 m) in front of the unit and 5 ft. (1.5 m) height, in free field conditions.

Table C.2 Sound Power Level (dB) - Downflow Down Configuration, High Efficiency EC Fan Module, Max Airflow

	Unit Model	Level	Octave Band Frequency (Hz)									Sound Level [dB (A)]
			31.5	63	125	250	500	1000	2000	4000	8000	
Downflow Down	PW035	PWL	76.0	76.0	80.7	85.3	89.0	90.2	86.0	91.5	76.1	95.8
		SPL	67.4	67.4	72.7	72.7	65.6	59.2	54.6	46.3	37.8	67.8
	PW040	PWL	75.4	75.4	80.1	84.7	88.4	89.6	85.4	90.9	75.5	95.2
		SPL	66.8	66.8	72.1	72.1	65.0	58.6	54.0	45.7	37.2	67.2
	PW045	PWL	77.1	77.1	81.8	86.4	90.2	91.4	87.1	92.5	77.1	96.9
		SPL	66.9	66.9	72.2	72.2	65.1	58.7	54.1	45.8	37.3	67.3
	PW060	PWL	71.1	71.1	77.3	82.2	85.5	87.3	84.1	82.9	72.5	91.2
		SPL	69.3	69.3	74.6	74.6	67.5	61.1	56.5	48.2	39.7	69.7
	PW070	PWL	73.0	73.0	78.4	83.3	87.3	89.0	85.1	86.4	73.9	93.2
		SPL	69.3	69.3	74.6	74.6	67.5	61.1	56.5	48.2	39.7	69.7
	PW080	PWL	72.4	72.4	77.8	82.7	86.7	88.4	88.5	85.8	73.3	92.6
		SPL	68.7	68.7	74.0	74.0	66.9	60.5	55.9	47.6	39.1	69.1
	PW095	PWL	74.1	74.1	80.0	84.9	88.4	90.2	86.8	86.3	75.3	94.2
		SPL	71.5	71.5	76.8	76.8	69.7	63.3	58.7	50.4	41.9	71.9
	PW110	PWL	73.2	73.2	79.1	84.0	87.5	89.3	85.9	85.4	74.4	93.3
		SPL	70.6	70.6	75.9	75.9	68.8	62.4	57.8	49.5	41.0	71.0
	PW145	PWL	73.5	73.5	79.1	84.1	87.8	89.6	85.9	86.2	74.5	93.6
		SPL	69.9	69.9	75.2	75.2	68.1	61.7	57.1	48.8	40.3	70.3
	PW170	PWL	75.7	75.7	82.1	84.1	85.1	87.7	86.9	81.4	74.1	92.1
		SPL	73.4	73.4	78.7	78.7	71.6	65.2	60.6	52.3	43.8	73.8

The sound levels are global and for each octave band are expressed in dB with a tolerance of (0/+2) dB.
 PWL - Sound Power Level calculated according to ISO 3744 procedure method.
 SPL - Sound Pressure Level measured in free field conditions and at 6.6 ft. (2 meters) from the front of the unit and 5 ft. (1.5 meters) above the surface according to ISO 3744 average method.
 All Liebert® PCW units have very high noise emission at maximum airflow.

Table C.3 Sound Power Level (dB) - Downflow Up Frontal Air Delivery Configuration, High Efficiency EC Fan Module, Max Airflow

	Unit Model	Level	Octave Band Frequency (Hz)								Sound Level (dB) (A)	
			31.5	63	125	250	500	1000	2000	4000		8000
Downflow Frontal	PW035	PWL	80.3	80.3	85.0	89.6	93.3	94.5	90.3	95.8	80.4	100.1
		SPL	71.7	71.7	77.0	77.0	69.9	63.5	58.9	50.6	42.1	72.1
	PW040	PWL	79.8	79.8	84.5	89.1	92.8	94.0	89.8	95.3	79.9	99.6
		SPL	71.2	71.2	76.5	76.5	69.4	63.0	58.4	50.1	41.6	71.6
	PW045	PWL	81.4	81.4	86.1	90.7	94.5	95.7	91.4	96.8	81.4	101.2
		SPL	71.2	71.2	76.5	76.5	69.4	63.0	58.4	50.1	41.6	71.6
	PW060	PWL	75.1	75.1	81.3	86.2	89.5	91.3	88.1	86.9	76.5	95.2
		SPL	73.3	73.3	78.6	78.6	71.5	65.1	60.5	52.2	43.7	73.7
	PW070	PWL	77.0	77.0	82.4	87.3	91.3	93.0	89.1	90.4	77.9	97.2
		SPL	73.3	73.3	78.6	78.6	71.5	65.1	60.5	52.2	43.7	73.7
	PW080	PWL	76.4	76.4	81.8	86.7	90.7	92.4	88.5	89.8	77.3	96.6
		SPL	72.7	72.7	78.0	78.0	70.9	64.5	59.9	51.6	43.1	73.1
	PW095	PWL	77.9	77.9	83.8	88.7	92.2	94.0	90.6	90.1	79.1	98.0
		SPL	75.3	75.3	80.6	80.6	73.5	67.1	62.5	54.2	45.7	75.7
	PW110	PWL	77.4	77.4	83.3	88.2	91.7	93.5	90.1	89.6	78.6	97.5
		SPL	74.8	74.8	80.1	80.1	73.0	66.6	62.0	53.7	45.2	75.2

The sound levels are global and for each octave band are expressed in dB with a tolerance of (0/+2) dB.

PWL - Sound Power Level calculated according to ISO 3744 procedure method.

SPL - Sound Pressure Level measured in free field conditions and at 6.6 ft. (2 meters) from the front of the unit and 5 ft. (1.5 meters) above the surface according to ISO 3744 average method.

All Liebert® PCW units have very high noise emission at maximum airflow.

LEGEND

The sound levels are global and for each octave band are expressed in dB with a tolerance of (0/+2) dB.

1. Only ventilation (30 Pa available external static pressure), 6.6 ft. (2 m) in front of the unit and 5 ft. (1.5 m) height, in free field conditions.

Table C.4 Sound Power Level (dB) - Upflow Frontal Delivery Configuration, High Efficiency EC Fan Module, Max Airflow

	Unit Model	Level	Octave Band Frequency (Hz)									Sound Level [dB (A)]
			31.5	63	125	250	500	1000	2000	4000	8000	
Upflow	PW035	PWL	73.2	73.2	77.9	82.5	86.2	87.4	83.2	88.7	73.3	93.0
		SPL	64.6	64.6	69.9	69.9	62.8	56.4	51.8	43.5	35.0	65.0
	PW040	PWL	72.8	72.8	77.5	82.1	85.8	87.0	82.8	88.3	72.9	92.6
		SPL	64.2	64.2	69.5	69.5	62.4	56.0	51.4	43.1	34.6	64.6
	PW045	PWL	74.5	74.5	79.2	83.8	87.6	88.8	84.5	89.9	74.5	94.3
		SPL	64.3	64.3	69.6	69.6	62.5	56.1	51.5	43.2	34.7	64.7
	PW060	PWL	68.7	68.7	74.9	79.8	83.1	84.9	81.7	80.5	70.1	88.8
		SPL	66.9	66.9	72.2	72.2	65.1	58.7	54.1	45.8	37.3	67.3
	PW070	PWL	74.8	74.8	80.2	85.1	89.1	90.8	86.9	88.2	75.7	95.0
		SPL	71.1	71.1	76.4	76.4	69.3	62.9	58.3	50.0	41.5	71.5
	PW080	PWL	69.6	69.6	75.0	79.9	83.9	85.6	81.7	83.0	70.5	89.8
		SPL	65.9	65.9	71.2	71.2	64.1	57.7	53.1	44.8	36.3	66.3
	PW095	PWL	71.4	71.4	77.3	82.2	85.7	85.7	84.1	83.6	72.6	91.5
		SPL	68.8	68.8	74.1	74.1	67.0	60.6	56.0	47.7	39.2	69.2
	PW110	PWL	71.2	71.2	77.1	82.0	85.5	87.3	83.9	83.4	72.4	91.3
		SPL	68.6	68.6	73.9	73.9	66.8	60.4	55.8	47.5	39.0	69.0

The sound levels are global and for each octave band are expressed in dB with a tolerance of (0/+2) dB.

PWL - Sound Power Level calculated according to ISO 3744 procedure method.

SPL - Sound Pressure Level measured in free field conditions and at 6.6 ft. (2 meters) from the front of the unit and 5 ft. (1.5 meters) above the surface according to ISO 3744 average method.

All Liebert® PCW units have very high noise emission at maximum airflow.

LEGEND

The sound levels are global and for each octave band are expressed in dB with a tolerance of (0/+2) dB.

1. Only ventilation (30 Pa available external static pressure), 6.6 ft. (2 m) in front of the unit and 5 ft. (1.5 m) height, in free field conditions.

Appendix D: Accessories

D.1 Leak Detector - Liebert® Liqui-tect™

Table D.1 Leak Detector Sensor Description

Purpose	The flooding alarm detects the presence of water or any other conductive liquid and activates an alarm.
Description	<p>Liebert® Liqui-tect™: It is made up of a corrosion-proof metal container, with access to the two terminals for connecting the line. The detector connection line must be terminated by a 10 kΩ resistor. Up to five sensors can be connected to the same flooding alarm device to control many points in the room.</p> <p>Leak detector: The flooding alarm detects the presence of water or any other conductive liquid and activates an alarm.</p>
For Airflow Version	<p>U - Upflow</p> <p>H - Downflow Frontal</p> <p>D - Downflow Up</p> <p>E - Downflow Down</p>
Available Version	<p>Liebert® Liqui-tect™</p> <p>LT410 - Point leak-detection sensor</p> <p>LT460 - Zone leak-detection sensor with cable</p>

D.2 Smoke Sensor

Purpose	<p>The field provided smoke detector senses the room air: in case of smoke, the unit activates the event without any actions; instead in case of fire, the unit activates the alarm and shuts the unit down.</p> <p>Dry contacts are available for a remote customer alarm. This smoke detector is not intended to function as or replace any room smoke detection system that may be required by local or national codes.</p>
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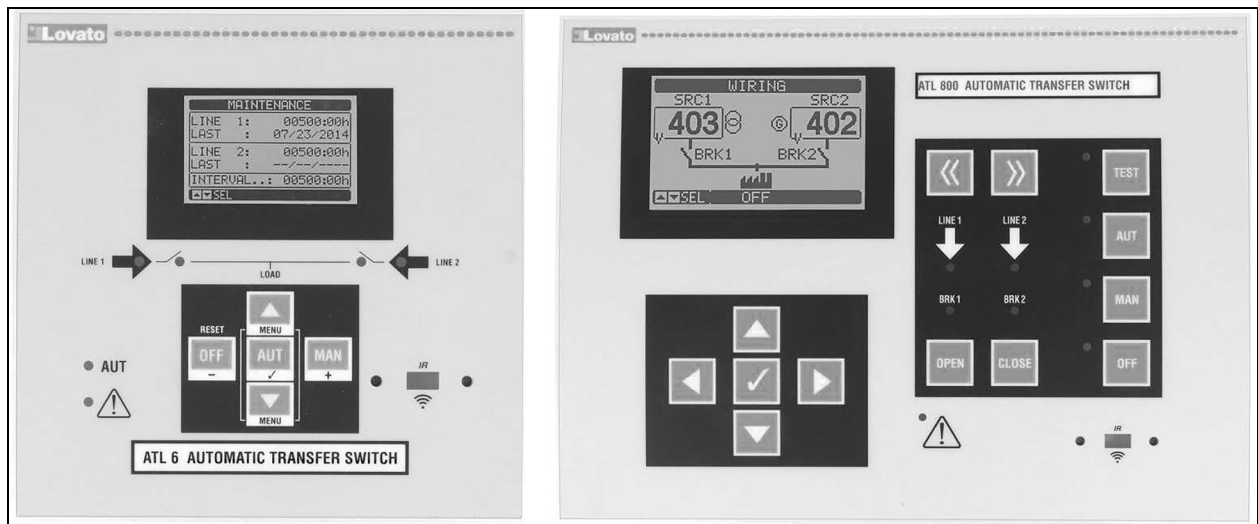
Appendix E: ATS (Automatic Transfer Switch) - Optional

E.1 Overview of Lovato ATS, Models ATL610 and ATL800

Vertiv™ Liebert® Thermal Management units equipped with the optional Lovato ATS (automatic transfer switch) control, will automatically switch over to a secondary power source upon loss of primary power. It will also return to the primary power source when it is determined it is available.

When units are equipped with the optional Capacitive Buffer feature, it will not only keep the Vertiv™ Liebert® iCOM™ control powered (minimum of three minutes) during a loss of power, but will also keep the ATS electronics powered when neither the primary or secondary source are available, allowing for a quick unit response when power is restored.

Figure E.1 ATL610 (Units up to 460V) and ATL800 (575V Units)

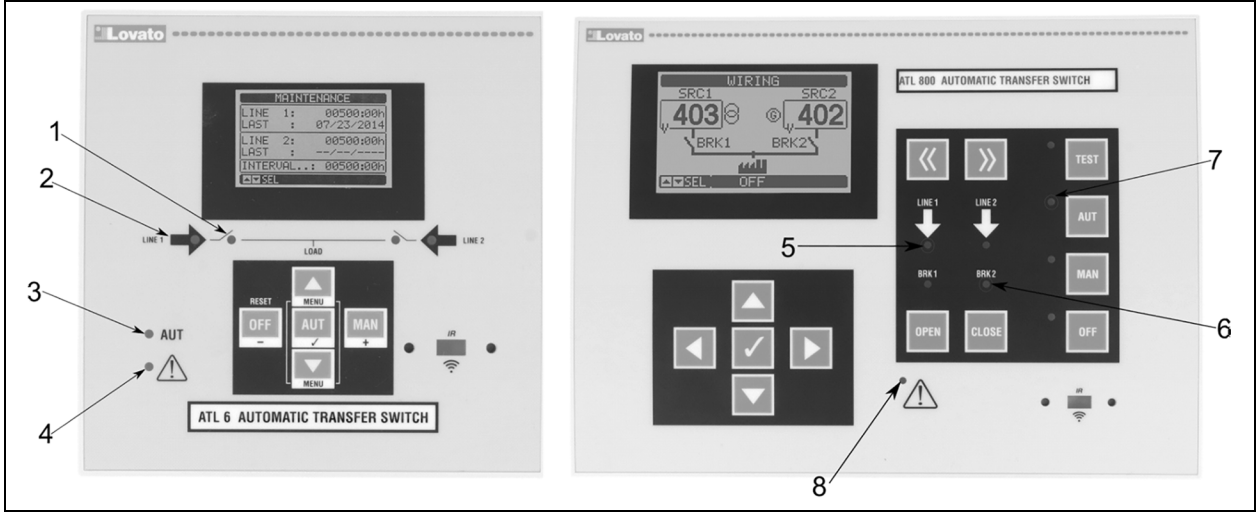


Lovato ATS, model ATL610 (or ATL800) shown in **Figure E.1** above, will be located within the cabinet of the units.

E.2 Key Capabilities of Lovato ATS, Models ATL610 and ATL800

The Lovato ATS, model ATL610 (or ATL800), will be the primary unit level device for switching between power sources. This control will be capable of the following features:

- Determine if power is available in both primary and secondary sources.
- Allow for selection of which source is primary and which is secondary.
- Ability to automatically switch from primary to secondary source, in the event of primary power loss.
- Ability to automatically switch secondary to primary source when primary power returns.
- Visible indication of available power sources.
- Visible indication of power source that is currently active.



ATL610 Display		ATL800 Display	
Item	Description	Item	Description
1	LEDs indicate which source is active.	5	LEDs indicate if a source is available
2	LEDs indicate if a source is available.	6	LEDs indicate which source is active.
3	Controller is in automatic mode.	7	Controller is in automatic mode.
4	Alarm is present.	8	Alarm is present.

E.3 Interaction of Lovato ATS with Vertiv™ Liebert® iCOM™ Control

The Liebert® iCOM™ control will pull key information from the Lovato ATS, allowing for easy interpretation of the current operation without needing to open the unit's front panel, potentially interrupting operation.

Figure E.2 Identification of Current Power Source and Power Source Availability



Available via PA2.06.54.04R or greater.

Power source availability

- GREEN circle w/ check mark = power source available
- RED circle w/ cross = power source not available

Power Source A/B utilization

- ORANGE highlighted and underlined power source title = current power source being utilized.

E.4 Key Parameters of Lovato ATS, Models ATL610 and ATL800

There are multiple key parameters that are factory set by Vertiv to recommended values. Please consult a Vertiv factory technician before making any changes to these parameters.

- Priority power source selection (default = Source 1)
- Switching delay between power sources
 - If secondary power source is present at time of primary failure, delay is up to 11s (default, adjustable via multiple parameters).
 - If secondary power source is NOT present at time of primary failure, delay is 10s (default, adjustable) after secondary power source is available.
- Unit would be removed from active power source in following conditions:
 - Voltage Limit: If voltage is outside of a set limit for a set period (default = 5s)
 - Min Voltage Limit = 85% (default) of nominal
 - Max Voltage Limit = 115% (default) of nominal

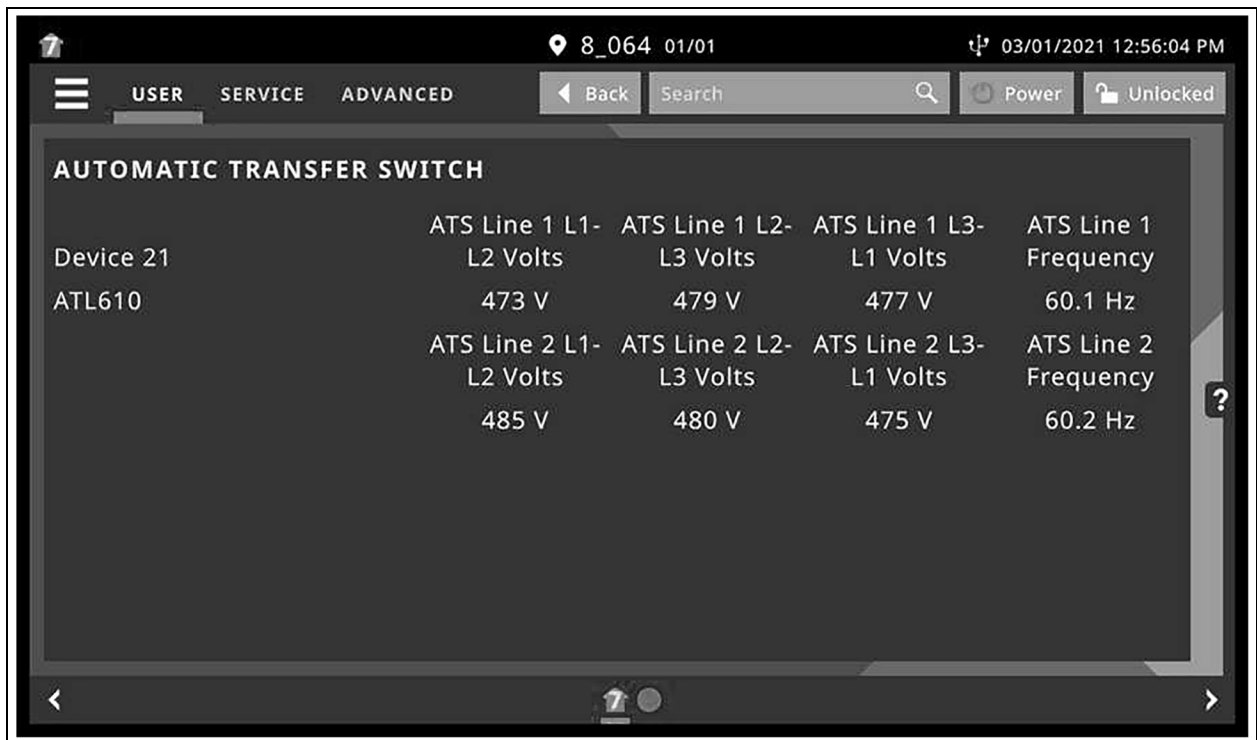
- Voltage Imbalance: If voltage imbalance (asymmetry) is greater than 15% (default) for a set period (default = 5s)
- Phase Loss: If a phase falls below 70% (default) of nominal for a set period (default = 0.1s)
- Frequency Limit: If frequency is outside of a set limit for a set period (default = 3s)
 - Min Freq Limit = 95% (default)
 - Max Frequency Limit = 105% (default)

Please note that not all parameters are applicable to Vertiv equipment operation. Consult a Vertiv factory technician before making any changes to these parameters.

E.5 Monitoring Functions of Lovato ATS, Models ATL610 and ATL800

The voltage and frequency information from the ATS can be displayed on the Vertiv™ Liebert® iCOM™ user interface, as shown in **Figure E.3** below . Further information is available via BMS monitoring through the Liebert® iCOM™ Unity Card/Embedded Unity (BACnet MSTP, BACnet IP, Modbus TCP/IP, Modbus RTU, SNMP v2, v3). The items are outlined in the **Table E.1** on the facing page .

Figure E.3 ATS Voltage and Frequency Summary Page



E.6 Monitoring Points

The below ATS specific points can be monitored through a BMS system. Alarm codes at the ATS panel will not match the BMS alarm but can be cross referenced in this chart. Please note that these points are read only.

Table E.1 ATS Specific Points

Lovato Code (at ATS)	Vertiv Alarm (BMS)	Description
ATS_EvLdTO	ATS Load Not Powered Timeout	Unit has not been powered after preset delay (default = 60s).
ATS1_L1L2	Power Source: L1-L2 voltage	Voltage reading phase L1-L2
ATS1_L2L3	Power Source: L2-L3 voltage	Voltage reading phase L2-L3
ATS1_L3L1	Power Source: L3-L1 voltage	Voltage reading phase L3-L1
ATS1_Freq	Power Source: Line Frequency	Measured frequency, per source.
ATS1_BrkOp	Power Source: Breaker Operation Count	Available to be turned on by customer, would indicate number of operations per source.
ATS1VAlOk	Power Source: All status are okay	All parameters are within limits, per source.
ATS1VLo	Power Source: Voltage Is Too Low	Voltage on active source is below acceptable range.
ATS1VHi	Power Source: Voltage Is Too High	Voltage on active source is above acceptable range.
ATS1VAsymm	Power Source: Voltages Are Asymmetric	Voltages imbalance alarm
ATS1VPhsLs	Power Source: Voltage Phase Loss	Indicates one of the phases voltage has dropped below 70% nominal.
ATS2VPhsSq	Power Source: Phase Sequence Issue	Indicates the incoming power wasn't wired per the phase sequence configured (L1-L2-L3).
ATS1VFrqLo	Power Source: Frequency Is Too Low	Frequency on active source is below acceptable range.
ATS1VFrqHi	Power Source: Frequency Is Too High	Frequency on active source is above acceptable range.
ATS2BClsd	Power Source: Breaker is closed	ATS is receiving feedback that the indicated contactor as closed.
ATS2BCClsd	Power Source: Breaker command status closed	ATS is directing the indicated contactor to close.
ATS1EvBTim	Power Source: Breaker Timeout Issue	The indicated changeover device did not complete the closing operation within the max set time.
ATS1EvHrsS	Power Source: Line Operating Hour Exceeded	Available to be turned on by customer, would indicate number of hours in operation per source

E.7 Change Over Circuit Sequence of Operations

Source 1 is out of range

1. Source 1 exceeds one or more limits of voltage, frequency, phase, or voltage symmetry.
2. A delay timer will begin to count. The amount of time depends on which Source 1 parameter is out of spec, and the value saved in the following parameters. The parameters below are the delays for each condition.

Table E.2 Parameters

Description	Default	Parameter	
		ATL610	ATL800
Voltage below the minimum limit	5s	P06.03	P09.01.03
Voltage above the maximum limit	5s	P06.06	P09.01.06
Phase failure	0.1s	P06.10	P09.01.10
Voltage exceeds the asymmetry limits	5s	P06.12	P09.01.12
Frequency exceeds the maximum limit	3s	P06.14	P09.01.14
Frequency exceeds the minimum limit	5s	P06.16	P09.01.16

3. Once the delay timer is finished, the following events will occur.
 - a. The transfer controller will de-energize Source 1 contactor coil.
 - b. The transfer controller will signal the unit is no longer being powered by Source 1.
 - c. An auxiliary switch NO contact on Source 1’s contactor will open, sending a signal to the transfer controller. This signal verifies that the load is not connected to Source 1.
 - d. The NC contacts of the same auxiliary switch will close to allow the coil of the Source 2 contactor to be energized. The Source 2 contactor coil is not energized at this time.
4. Once the transfer controller output has opened, a delay timer will begin using the value entered under parameter P05.03 (ATL610) or P07.01.02 (ATL800), default = 6s. This value should not be decreased without consent from Vertiv.
5. A presence delay is used to determine if Source 2 is a valid source. This delay will start as soon as Source 2 is available. The presence delay is based on the value entered in parameter P07.07 (ATL610) or P09.02.07 (ATL800), default = 10s. If Source 2 is available before Source 1 fails, it is possible that the delay will already be satisfied at the time Source 1 fails. If this is a manual transfer to Source 2 and Source 1 is still available, the presence delay will refer to the value in parameter P07.08 (ATL610) or P09.02.08 (ATL800), default = 60s.
6. When the timer in both step 4 and 5 are finished,
 - a. The transfer controller will energize the Source 2 contactor.
 - b. An auxiliary switch NO contact on Source 2’s contactor will close, sending a signal to the transfer controller. This signal verifies that the load is connected to Source 2.
 - c. The NC contacts of the same auxiliary switch will open to prevent the coil of Source 1 contactor from energizing.
 - d. The transfer controller will signal the unit is being powered by Source 2.

Transfer back to Source 1 when Source 2 is present.

1. When Source 1 has reached acceptable levels, a presence delay will start. The presence delay is based on the value entered in parameter P06.08 (ATL610) or P09.01.08 (ATL800), default = 60s.
2. Once this timer is finished,

- a. The transfer controller will de-energize Source 2 contactor coil.
 - b. An auxiliary switch NO contact on Source 2's contactor will open, sending a signal to the transfer controller. This signal verifies that the load is not connected to Source 2.
 - c. The NC contacts of the same auxiliary switch will close to allow the coil of the Source 1 contactor to be energized. The Source 1 contactor coil is not energized at this time.
 - d. The transfer controller will signal the unit is no longer being powered by Source 2.
3. A delay timer starts using the value in parameter P05.04 (ATL610) or P07.02.02 (ATL800), default = 6s. This value should not be decreased without consent from Vertiv.
 4. When the timer in step 3 is finished,
 - a. The transfer controller will energize the Source 1 contactor.
 - b. An auxiliary switch NO contact on Source 1's contactor will close, sending a signal the transfer controller. This signal verifies that the load is connected to Source 1.
 - c. The NC contacts of the same auxiliary switch will open to prevent the coil of Source 2 contactor from energizing.
 - d. The transfer controller will signal the unit is being powered by Source 1.

Source 2 is out of range when unit is powered by Source 2

1. Source 2 exceeds one or more limits of voltage, frequency, phase, or voltage symmetry.
2. A delay timer will begin to count. The amount of time depends on which Source 2 parameter is out of spec, and the value saved in the following parameters. The parameters below are the delays for each condition.

Table E.3 Parameters

Description	Default	Parameter	
		ATL610	ATL800
Voltage below the minimum limit	5s	P07.03	P09.02.03
Voltage above the maximum limit	5s	P07.06	P09.02.06
Phase failure	0.1s	P07.10	P09.02.10
Voltage exceeds the asymmetry limits	5s	P07.12	P09.02.12
Frequency exceeds the maximum limit	3s	P07.14	P09.02.14
Frequency exceeds the minimum limit	5s	P07.16	P09.02.16

3. Once the delay timer is finished, the following events will occur.
 - a. The transfer controller will de-energize Source 2 contactor coil.
 - b. The transfer controller will signal the unit is no longer being powered by Source 2.
 - c. An auxiliary switch NO contact on Source 2's contactor will open, sending a signal to the transfer controller. This signal verifies that the load is not connected to Source 2.
 - d. The NC contacts of the same auxiliary switch will close to allow the coil of Source 1 contactor to be energized. The Source 1 contactor coil is not energized at this time.
4. Once the transfer controller output has opened, a delay timer will begin using the value entered under parameter P05.04 (ATL610) or P07.02.02 (ATL800), default = 6s. This value should not be decreased without consent from Vertiv.

5. A presence delay is used to determine if Source 1 is a valid source. This delay will start as soon as Source 1 is available. The presence delay is based on the value entered in parameter P06.07 (ATL610) or P09.01.07 (ATL800), default = 10s. If Source 1 is available before Source 2 fails, it is possible that the delay will already be satisfied at the time Source 2 fails. If this is a manual transfer to Source 1 and Source 2 is still available, the presence delay will refer to the value in parameter P06.08 (ATL610) or P09.01.08 (ATL800), default = 60s.
6. When the timer in both step 4 and 5 are finished,
 - a. The transfer controller will energize the Source 1 contactor.
 - b. An auxiliary switch NO contact on Source 1's contactor will close, sending a signal to the transfer controller. This signal verifies that the load is connected to Source 1.
 - c. The NC contacts of the same auxiliary switch will open to prevent the coil of Source 2 contactor from energizing.
 - d. The transfer controller will signal the unit is being powered by Source 1.

Transfer when Source 1 and Source 2 fails

If both Source 1 and Source 2 fail and are restored, the transfer controller will transfer the load to the preferred Source defined in parameter P05.02 (ATL610) or P06.01.02/P06.02.02 (ATL800), default = 1.

Figure E.4 Transfer Controller Terminal Labels – ATL610

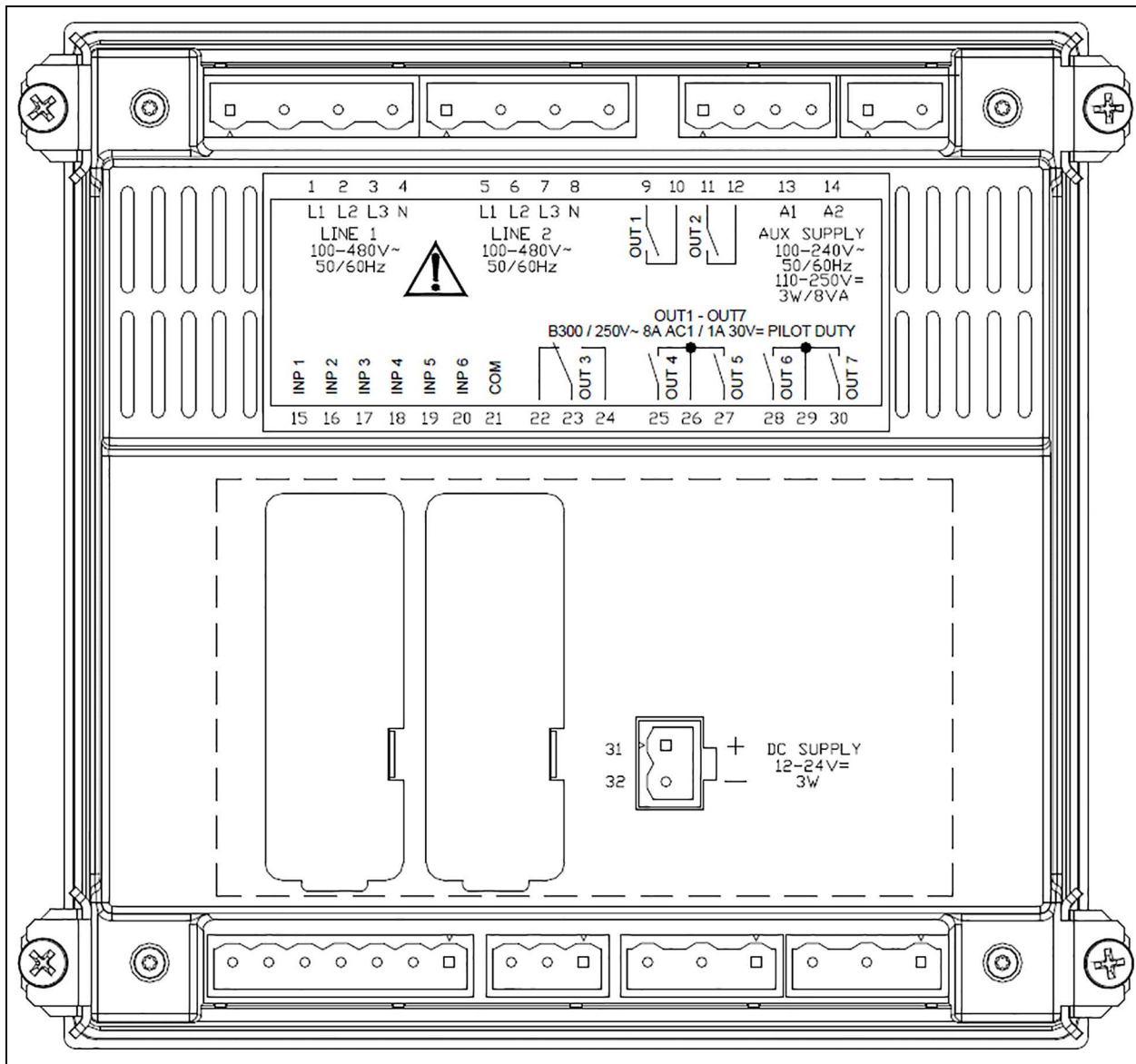
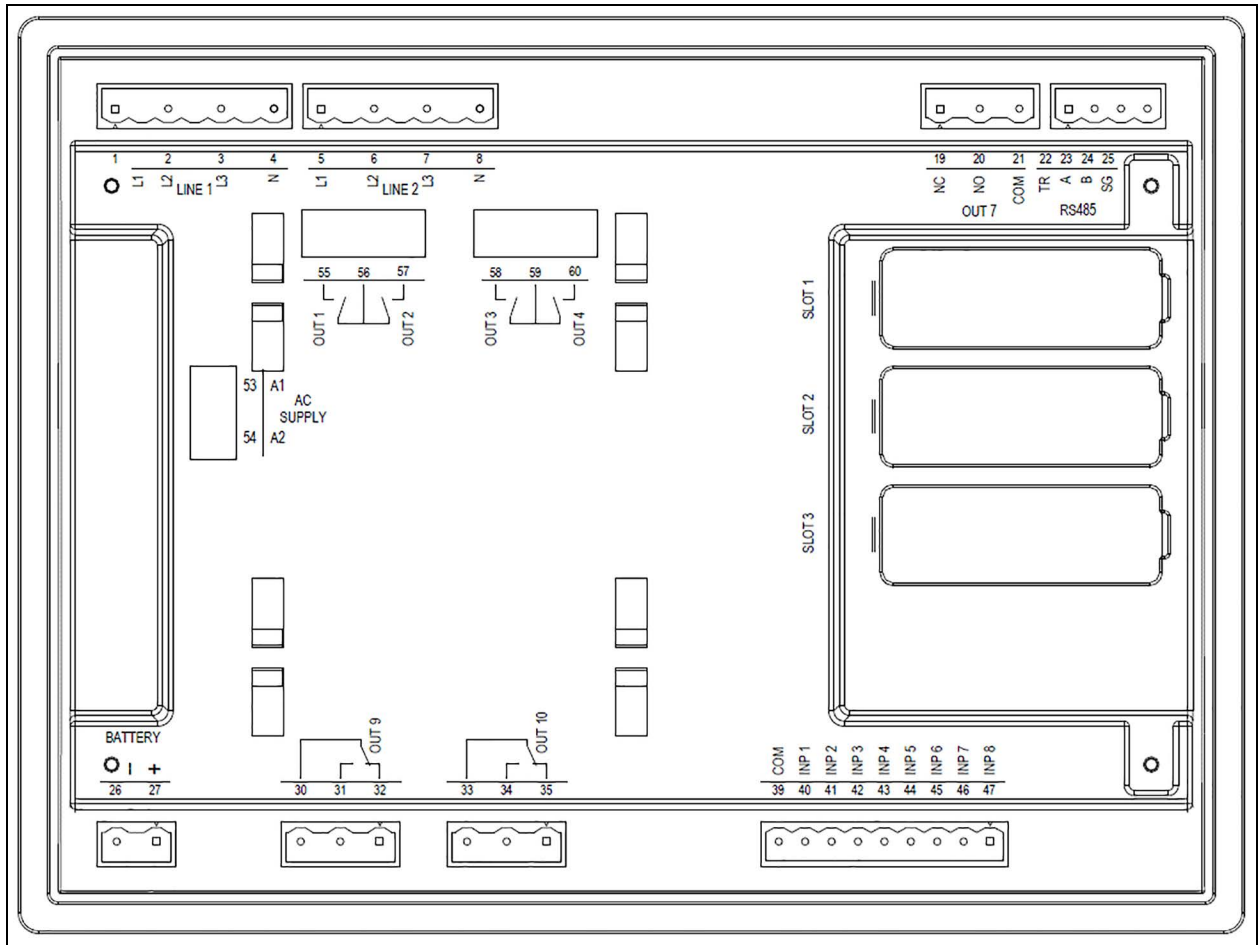


Figure E.5 Transfer Controller Terminal Labels – ATL800



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