Liebert® PEX+Chilled Water Series

Precision Air Conditioning

User Manual

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Purpose of the Document

This document applies to the series of precision air conditioners and cooling solutions which maintain optimal environmental control of technological ecosystems at minimal operating costs. This document gives an overview of the specifications, installation, commissioning, and maintenance procedures with troubleshooting from the user perspective. The figures used in this document are for reference only.

Please read this manual carefully before installing, maintaining, and troubleshooting.

Liebert PEX+ Chilled Water precision CRAC is a professional device, only professionals are permitted to access the unit and is kept in a place where access is restricted to common people.

Styling used in this Guide

The styles used in the manual will be defined as mentioned in the following table:

Situation	Description
Warning/Danger/Caution 	• *The Warning/Danger/Caution note indicates a hazardous or potentially harmful situation that can result in death or injury. It also indicates instructions that need to be adhered to, failing which may result in danger and safety issues thereby having an adverse effect on the reliability of the device and security. Even for practices not related to physical injury, to avoid equipment damage, performance degradation, or interruption in service, follow the warning instruction.*
Note 	• *The Note section indicates additional and useful information. It also calls attention to best practices and industry-best protocols that are standardized and help make maximum utilization of the resources at hand. Helpful information related to the product also comes under the Note heading, helping the users with the definitions, concepts, and terminologies used in the manual.*

Version History

Version	Revision Date	Issue	Changes
31013260	05.05.2020		---

Safety Precautions and Measures

The important safety precautions and measures that should be followed during the installation and maintenance are described in the following sections.

Read the manual prior to installation and operation of the unit. Only qualified personnel should move, install, or service this equipment.

Before working on the equipment, the user reads and considers all precautions, compliance and safety measures. The unit control must be used exclusively for the purpose which it is intended for; the manufacturer takes no liability for incorrect use or a modification to the unit control.

Adhere to all the Warnings and Cautionary measures included in the manual.

Please read this manual carefully before installing, maintaining and troubleshooting; especially the Warning/Danger/Caution information in the User Guide. Apart from the User Guide, also pay attention to the warning labels on the unit and its components.

This manual is retained for the entire service life of the unit. The user must read all the precautions, danger, warnings, and cautionary measures mentioned in the manual prior to carrying out any operations on the unit. Each unit is equipped with an electric insulation which allows the users to work in safe conditions. The main switch is positioned on the electrical panel cover; to access it, open the right door. Before any maintenance operation, switch off the unit with this electrical insulation device to eliminate risks such as electrical shocks, burns, automatic restarting, moving parts, and remote control. The panel key, supplied along with the unit, must be kept by the personnel responsible for the maintenance. The protective covers can be removed after the electric power has been cut off by opening the main switch.

In the following sections, notice the various cautionary measures and warnings that need to be read carefully prior to installing or operating the system.

Disconnect the local and remote power supplies prior to working with the unit.

Prior to the installation process, read all the instructions, verify if all the parts are in place, and check the nameplate to ensure the voltage matches the available utility power for the unit.

The controller doesn't isolate power from the unit even in the Off mode, and some internal components still require and receive power during the Off mode.

If the unit door is open while the fans are operating, the airflow may result in abrupt slamming of the door resulting in injury. Another aspect is the presence of small objects in the fans bay that can result in object ejection during the fan start-up and there is a probable risk of being hit by these objects resulting in grievous injury and causing equipment damage.

The unit contains fluids and gases under high pressure. Therefore, the pressure should be relieved before working with the piping.

Various components such as electrical heater, infrared humidifiers or electrode humidifier are extremely hot during the unit operation. Therefore, allow sufficient time for the unit to cool down before working with the unit cabinet. Handle the unit with extreme caution and wear safety equipment such as protective gloves, safety shoes, and arm protection while working with the hot compressors, discharge lines, and reheats.

There is a risk of water leaking that can damage both the equipment and the building. Effective water drain connection and facilities should be available. Installation should be precise. Implementation of the application and service practices should be appropriate and fault-free. Failure to comply with these norms will result in water leakage from the unit. Water leakage can lead to massive damage and loss of critical equipment in the hosting ecosystem. Therefore, care should be taken to ensure that the unit is not located directly above any equipment that could sustain damage due to water and excessive moisture. Use of a leak detection system for the unit and system supply lines are recommended by Vertiv Co.

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Chapter 1: Product Overview

1.1. Product Introduction

The Liebert® PEX+Chilled Water units (hereafter Liebert PEX+CW) are the next generation series of Precision Air Conditioners (PAC) that provide precise environmental control. The Liebert PEX+ chilled water models consist of wide range of cooling capacity from 30 kW to 200 kW for large, medium and small data centers. Incorporating the high standards associated with the Liebert name, the PEX+CW series utilizes the latest technology, system components, and streamlined manufacturing process.

Liebert PEX+CW air conditioners are products that are specifically designed for the special requirements of data centers, computer rooms, and similar ecosystems wherein optimum cooling is required along with a high degree of reliability and variability. It addresses the needs and challenges associated with such critical applications and setups. It caters to sensitive applications which need a suitable environment for optimal performance. Therefore, care should be taken while testing these sensitive products or maintaining a favorable environment for mission critical equipment, as even a slight deviation may lead to inaccurate results. Precision Air Conditioning must not only keep room conditions within a specific range but also be able to react quickly to a drastic change in heat load and prevent wide temperature fluctuations.

The PEX+CW PAC unit comes with the features such as high reliability, high sensible heat ratio, and large airflow. It is an excellent system that adheres to the standards of Precision Air Cooling in terms of energy-efficiency, space requirements, and reliability.

1.2. Model Description

This chapter introduces the model, appearance, components, optional configuration and refrigerant requirements of Liebert® PEX+. The appearance of 'Liebert PEX+ Chilled Water Series Precision Air Conditioner' ("PEX+ CW" for short hereafter) is shown in Figure 1-1.

Figure 1-1 Liebert PEX+ Series Model

1.3. Model Nomenclature

The Liebert® PEX+CW series model is fully-defined by 25 digits, as represented in Table 1-1.

Table 1-1 Liebert PEX+CW Model Nomenclature

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
P	2	0	9	0	D	C	1	N	2	H	S	1	2	L	1	D	0	0	0	C	E	0	0	0

Digit 1 Product Model	
P	***PEX+***
Digit 2 Product Modulus	
1-3	***Number of Modules/ Bays***
Digit 3 Net Cooling Capacity kW	
0-9	***Nominal Net Cooling Capacity- kW***
Digit 4 Net Cooling Capacity kW	
0-9	***Nominal Net Cooling Capacity- kW***
Digit 5 Net Cooling Capacity kW	
0-9	***Nominal Net Cooling Capacity- kW***
Digit 6 Air Discharge	
U	***Upflow***
D	***Downflow***
Digit 7 System Type	
C	***Chilled Water***
Digit 8 Airflow	
1	***EC Plug Fan***
Digit 9 Power Supply	
C	208 V/ 3 Ph/ 60 Hz
D	230 V/ 3 Ph/ 60 Hz
A	460 V/ 3 Ph/ 60 Hz
M	380-415 V / 3 Ph/ 50 Hz
N	380-415 V / 3 Ph/ 50/ 60 Hz+N
Digit 10 Cooling System	
2	***CW Two way Valves***
3	CW Three way Valves
Digit 11 Humidification	
0	None
H	***Infrared Humidifier***
S	Electrode Humidifier
Digit 12 Display	
9	9-inch HMI Display
S	***Small Display***
L	Large Display
Digit 13 Re-heating	
0	None
1	***Electrical Heating Std. 1 Stage***
2	Electrical heating Opt. 2 Stage

Digit 16 Enclosure Option	
1	***Standard Color Black, Orange Peel Grain Coating (ZP7021)***
2	White Orange Peel Grain Coating (G101)
6	Color Charcoal Grey w/ Double Skin (ZP0420)
Digit 17 Mains Switch High Voltage Option	
D	***Main non-Locking Disconnect***
P	Dual Power Supply Parallel
A	Dual Power Supply Interlocking Contactor
T	Dual Power Supply Auto Transfer Switch
Digit 18 Installation Option	
0	None, Standard Pipe, No Low Ambient Kit
H	Re-heat & Humidity Lockout
Digit 19 Monitoring	
0	***None***
7	Unity Card
8	Unity Card*2
Digit 20 Sensors	
0	***None***
A	Supply Air Pressure Sensor
S	Smoke Sensor
H	High Temperature
F	Smoke & High Temp
N	Supply Air Temperature Sensor
R	Remote Sensor
W	Water Temperature Sensor IN/OUT
L	Water Flow Sensor
X	Other Sensor
Digit 21 Packaging	
P	Package- Standard Cardboard and Wooden Pallet
C	***Packaging– Wooden Crate***
Digit 22 Special Requirements	
E	***For Export***
Digit 23 Order Identifier	
0	***Standard Static***
1	High ESP 100 Pa
2	High ESP 200 Pa
3	Other High ESP
X	SFA Included

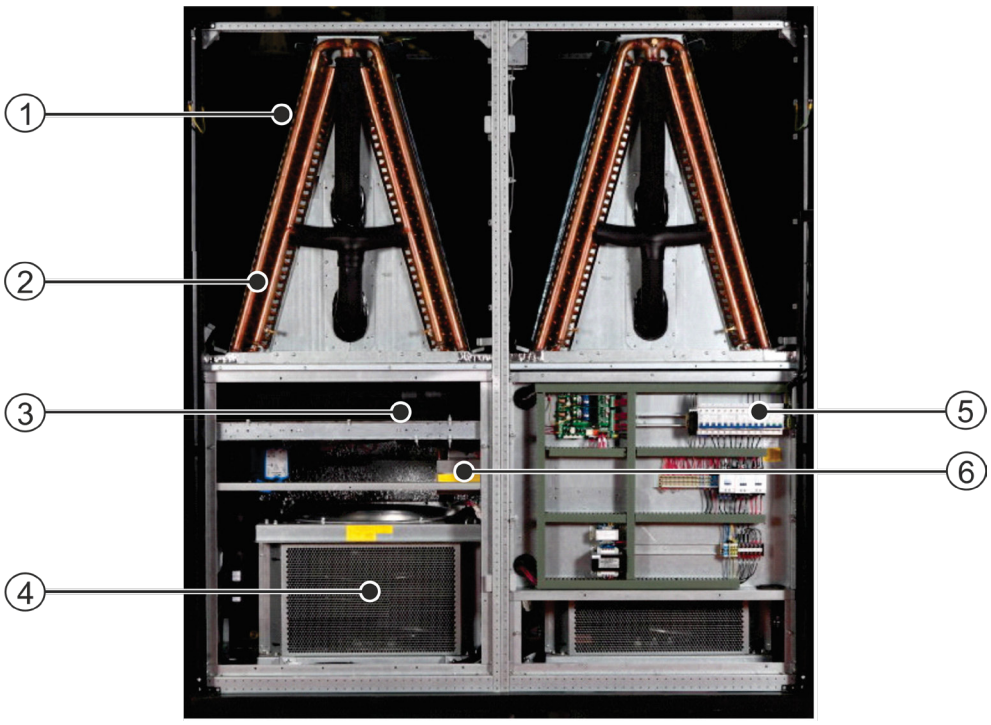
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
P	2	0	9	0	D	C	1	N	2	H	S	1	2	L	1	D	0	0	0	C	E	0	0	0

Digit 14 Filtration		Digit 24 Order Identifier	
2	***G4***	***0***	***None***
3	F5	1	SFA Included
Digit 15 Coil and Valves		**Digit 25 Order Identifier**	
L	***CW Coil, Standard Pressure MBV (≤ 1.6 Mpa)***	***0***	***None***
		1	SFA Included
H	CW Coil, High Pressure MBV		

The standard components are represented in ***'Bold Italic'*** font in Table 1-1.

1.4. Components of PEX+CW Model

An overview of the main components, optional components and features of the Liebert® PEX+CW is mentioned in this section. Liebert PEX+CW components include indoor unit, outdoor unit, and remote monitoring software. Figure 1-2 shows main components of PEX+ model.



No.	Description	No.	Description
1	Filter	4	Fan
2	Cooling Coil	5	Control Board
3	Heater	6	Infrared Humidifier

Figure 1-2 Main Components of PEX+CW Model

The indoor unit includes Compressor, Evaporator, Electronic Expansion Valve (EEV), Infrared Humidifier, EC Fan, Electrical Heating, Sight Glass, Filter Dryer, and iCOM Controller.

1.4.1. Cabinet

The cabinet frame is constructed from 2.5 mm, 2.0 mm and 1.2 mm folded galvanized steel. The exterior panels are constructed from 1.2mm zinc coated sheet of steel and insulated with foam insulation. The cabinet is powder coated in Charcoal Grey color and has a textured finish. The hinged front doors can be removed, and includes captive 1/4 turn fasteners.

1.4.2. EC Fans

The EC Fans used in the Liebert® PEX+CW models are energy-efficient and innovative with integrated electronics and a maintenance-free design.

- Ability to regulate the airflow and reduce the fan input power leading to high energy-efficiency.
- Easy-to-connect facility with minimum wiring leading to a high performance with a great variety of possible airflow rates.

Figure 1-3 EC Fan

1.4.3. Infrared Humidifier

The infrared humidifier consists of infrared humidifier lamp, water injection valve, humidifier water dish, temperature alarm protection devices and water level alarm device.
The infrared humidifier in the Liebert PEX+CW series provides quicker and more responsive operation which is quite important for mission-critical applications. The humidifiers reduce the dependency of water quality and simultaneously achieve full capacity in quick time using almost any water quality.

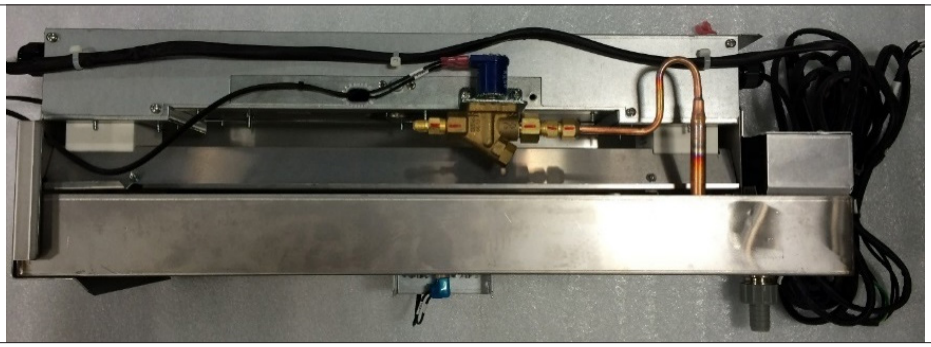


Figure 1-4 Infrared Humidifier

1.4.4. Electrical Heater

Liebert® PEX+ CW models equipped with PTC electrical heater, which features faster heating rate, uniform heating, safety and reliability. The material used in PTC electrical heating for heating purpose are ceramic element and aluminum pipe.

These electrical heaters features lower running temperatures, less susceptible to overheating and long lasting due to less wear thereby ensuring operational safety and lower maintenance and smooth operation

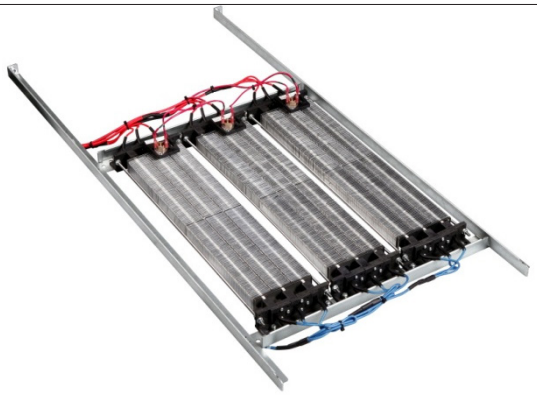


Figure 1-5 Electrical Heater

1.4.5. Water Flow Regulating Valve

The water flow regulating valve (as shown in Figure 1-6) can regulate the chilled water flow according to the cooling requirement of the unit by controlling the water flow passing through the cooling coil thus enables the unit to operate stably within the temperature and humidity setpoint range. User can select two-way or three-way water flow regulating valve according to different applications.

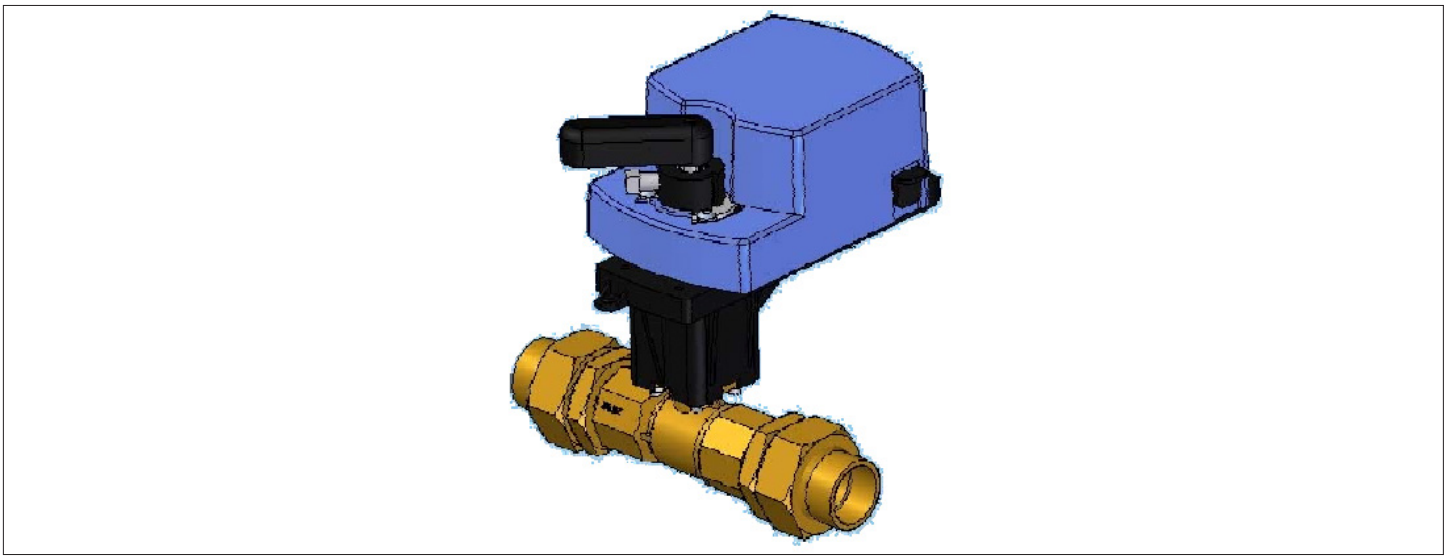


Figure 1-6 Water Flow Regulating Valve

1.4.6. Safety Controlling Device

The electrical reheat is equipped with automatic and manual reset temperature controller which can promptly disconnect and protect the electrical heater when the temperature of the heater is too high.
The infrared humidifier is equipped with manual reset dry burning prevention temperature controller, manual reset safe switch and high water level alarm switch. When there is dry burning and the temperature is too high, the power of the humidifier can be automatically disconnected to protect the humidifier from the damage.

1.4.7. Cooling Coil

Liebert PEX+ CW series is equipped with a fin-tube copper cooling coil which provides high efficiency, high Sensible Heat Ratio (SHR), and low air-side pressure drop. The coil is a construction of enhanced surface aluminum fins mechanically bonded to the surface of copper tubes; the coil frame is fabricated from hot dipped galvanized sheet metal. The water circuits are specifically designed for even water distribution to improve heat transfer rate whilst maintaining pressure drop. The coil fins have a hydrophilic coating as standard and the condensate pan is made from stainless steel.

1.4.8. Filter

The unit uses a standard filter that complies with US ASHRAE52-76 and Eurovent 4/5 standards, and the dust resistance value is 90% (EU4 standard). It is easy to replace. To ensure efficient operation, the dust filter must be checked once a month, and be replaced as required.

Figure 1-7 Filter

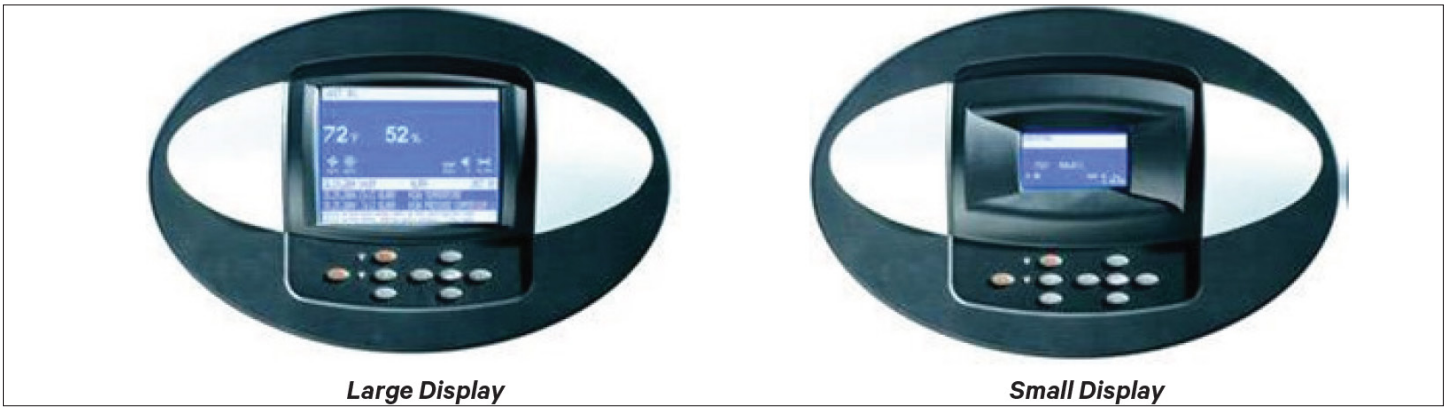
1.4.9. Water Leak Detecting System

The advanced water leak detecting system can signal the alarm information to the controller of PAC unit or a stand-alone monitoring system. The number of the sensors in parallel connection is not limited, but each unit has only one water leakage alarm.

1.4.10. iCOM Controller

The iCOM controller is designed for the special requirements of the data center, equipment or computer room. It features good stability, high controlling precision and intelligence.

The front door of the chilled water PAC unit is facilitated with a display and operating panel. This interface enables the operators to easily monitor, observe and deal with issues triggered during operation in time. The iCOM controlling system also supports the multi-units and teamwork mode. There are two types of display options: Large display with 480x480 pixels and standard Small display with 128x64 pixels, as shown in Figure 1-8.



Large Display *Small Display*

Figure 1-8 iCOM Controller

Liebert PEX+CW PAC adopts Small display with 128 × 64 dot matrix, blue backlight LCD screen as a standard to display the present temperature, humidity, temperature, and humidity setting values, unit output percentage graph (fan, valve, heating, dehumidification, and humidification) and alarm information.

1.5. Optional Components

- **Two-stage Electric Heater**

The two-stage electrical heater can be selected based on the heating requirement. The electrical heater can be divided into two stages by configuring the controller. The heater starts step-wise according to the heating requirement. It not only maintains the room temperature but also reduces the energy consumption.

- **Up Flow Plenum**

All plenums have grills at the outlet to streamline the airflow movement across the room. The plenum grills can be manually regulated by changing the direction of airflow as per the site requirement. In the case of customized design requirement of the Plenum, contact Vertiv local representative.

- **Belt Leak Detector**

Belt leak detector can provide a signal to the controller to trigger an alarm of air conditioner unit. The controller performs several different conditions according to the setpoints:

1. Water Alarm Shuts Unit Down
2. Water Alarm Shuts Hum Down

- **Smoke Detectors**

Smoke detection system facilitates the data center to detect smoke in the unique air-flow environment. The equipment room is outfitted with hot and cold aisles, underfloor and overhead spaces, each separated to contain airflow within the space. The active smoke detection technique triggers an alarm with the first sign of smoke.

- **Fire Detectors**

The fire detector can check the field return air temperature. It triggers fire alarm when the smoke level continues to rise along with elevated room temperature, or the temperature is too high and reaches the fire alarm threshold. The primary purpose of the sensor is to examine the air temperature and to initialize the anti-fire measures installed in the facility.

- **Supply Air Temperature Sensor**

Supply Air Temperature Sensor is used to modulate the heating and cooling effect of the unit by controlling the supply air temperature through plenum. Temperature limits are field adjustable via display interface. The heating or cooling warning activates when the temperature exceeds the thresholds.

- **Water Temperature Sensor IN/OUT**

The 2t temperature sensor can be used to measure the CW temperature status combined with the water flow data which further used to calculate the cooling capacity of the Liebert® PEX+CW unit.

- **High Efficiency Filter**

The unit is also available with the option of high efficiency filter for the environment requiring higher air cleanliness.

- **Electrode Humidifier**

The electrode humidifier uses the electrodes to boil the water in humidifier bottle to produce steam for humidification purpose. It has a specific (soft water) requirements in terms of water quality and sizes of inlet/outlet pipes as compared to the standard infrared humidifier.

- **Three-way Motorized Ball Valve (MBV)**

Three-way MBV can better regulate water flow in the system and also adapts as per more environmental requirements.

- **Supply Air Pressure Sensor**

Supply Air Pressure Sensor is only used for downflow units. It detects the static pressure under the floor of equipment room. The controller can read the values of static pressure.

- **Dual Power Supply Parallel**

In dual power supply parallel, there are two power sources (main and backup) that can be manually switched to backup source in case of power supply failure of main power source to operation of the unit continually.

- **Dual Power Supply Auto Alternate (Interlocking contactor/Automatic Transfer Switch)**

It consists of dual power supply (interlocking contractor 4P). It uses an automatic power switching circuit between the common power supply and backup power supply that is activated if an emergency power supply is required.

- **IS - Unity Card**

IS-UNITY Card can provide two kinds communication protocol: SNMP, Modbus and BACnet that supports standards and norms of the industrial communication protocol.

1.6. Storage & Operating Environment Requirements

Refer Table 1-2 & Table 1-3 for storage environment and operating environment requirement.

Table 1-2 Storage Environment Requirements

Item	Requirement
General requirements	Clean room (no dust)
Environment humidity	5% RH to 85% RH (non-condensing)
Ambient temperature	-20 °C to + 54 °C
Storage time	Total transportation and storage time should not exceed six months, otherwise the performance of the system needs to be re-calibrated.

Table 1-3 Operating Environment Requirements

Item	Requirement
Ambient temperature	Indoor temperature: 18 °C to 40 °C, Outdoor (Chilled Water): Chilled water supply temperature: min 5°C; max 20 °C, Chilled water pressure: max. 16bar
Protection level (cooling unit)	IP20
Altitude	<1000 m, derating is required when located altitude is above 1000 m
Operation voltage range	380 V (-10%) to 415 V (+6%), 3 Ph + N~50/60 Hz

Please contact Vertiv local representative when operating in the following conditions.

1. *The voltage of the air conditioning unit is beyond the range of the operating voltage.*
2. *The altitude is higher than 1000 m.*
3. *If the operating condition is not as per Table 1-3.*

1.7. Noise Level Limits

Under the airflow free return circumstance, the sound pressure level is less than 70 dB for all models. Figure 1-9 and Figure 1-10 provide the noise level measuring points of the unit

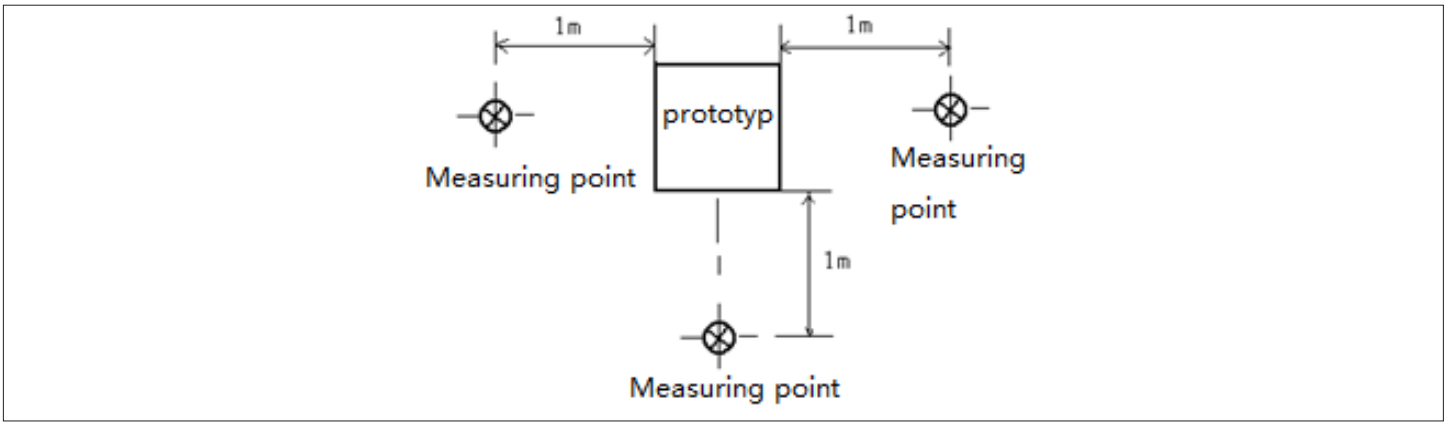


Figure 1-9 Noise Level Measurement (Top View)

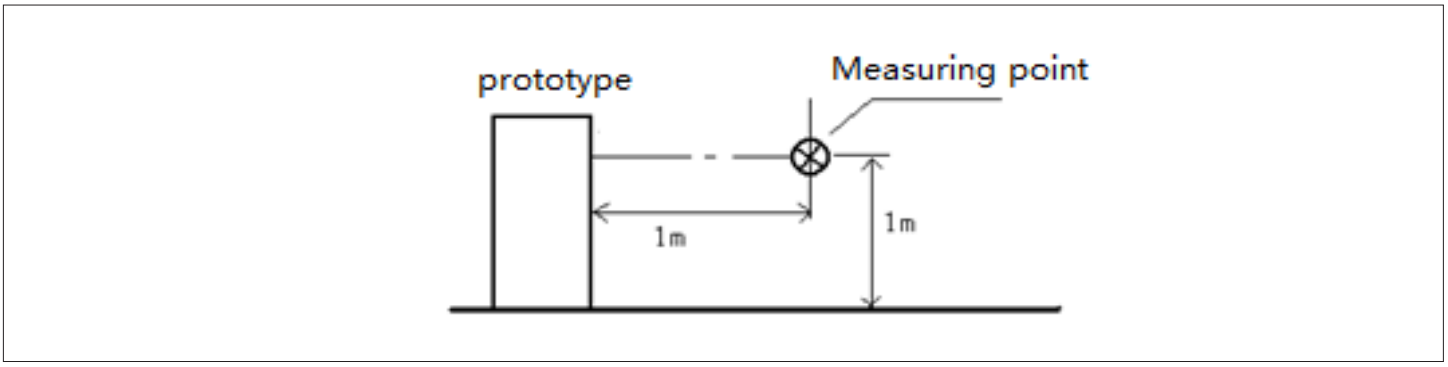


Figure 1-10 Noise Level Measurement (Side View)

Chapter 2: Installation

The Installation process consists of the following procedures, namely:

- Pre-installation
- Installation Preparation
- Mechanical Installation
- Electrical Installation

2.1. Pre-installation

2.1.1. Transportation & Movement

Railways and shipping are the preferable transport options for the CRAC. If transport by rail or by ship is unavailable, transport by road is recommended. When selecting road transport, roads without too many bumps are highly recommended.

- Liebert PEX+ unit is heavy, it is recommended to use the mechanical equipment like electrical forklift to move the unit.
- Move the equipment to the location near the installation site.
- If an electric forklift is used, insert the tines of the forklift below the pallet as illustrated in Figure 2-1.
- Figure 2-1 shows how the forklift tines are inserted underneath the pallet and shows in the same picture the illustration to the right that the tines should be aligned with the center of gravity to prevent the equipment from falling over.

Figure 2-1 Moving an Equipment Using a Forklift Truck

While moving the indoor unit, keep the obliquity within the range of 75° to 105°, as shown in Figure 2-2.

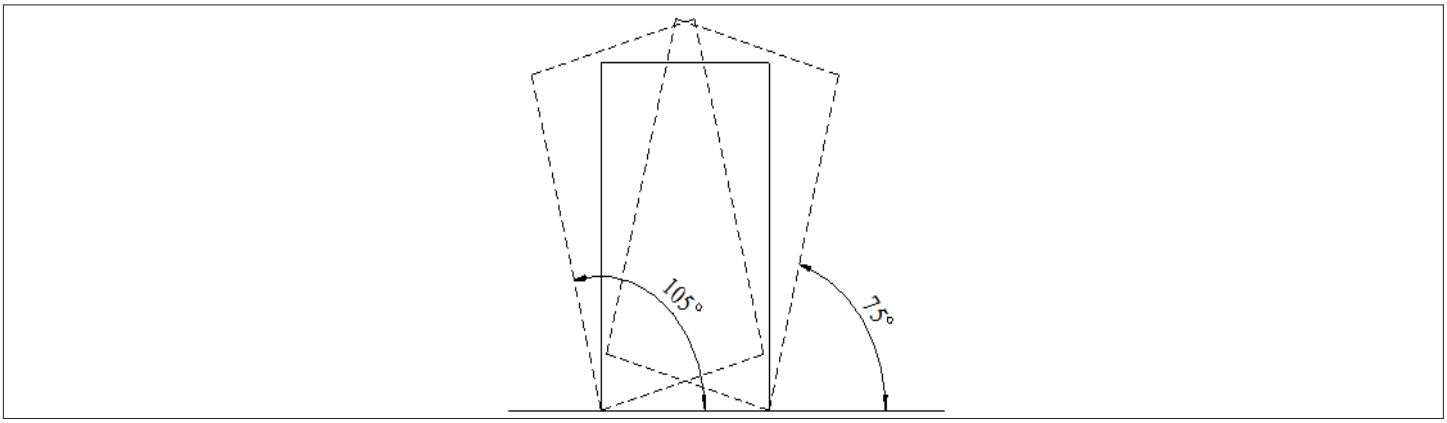


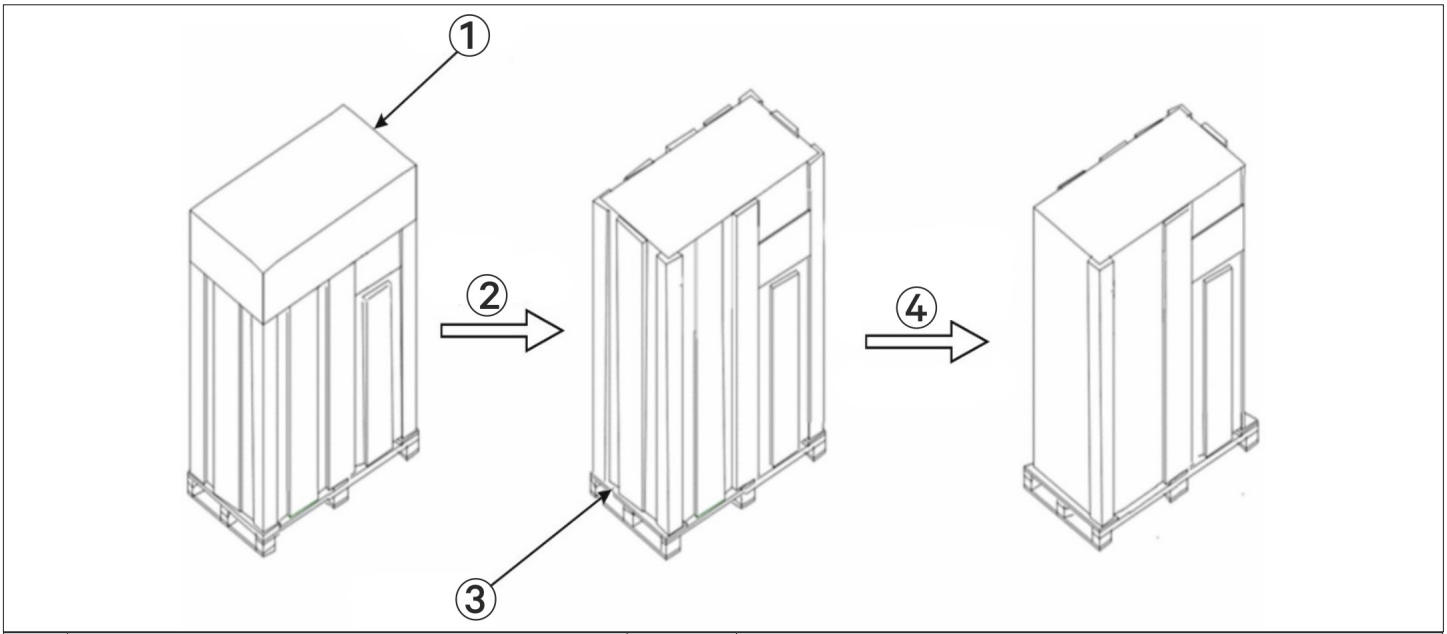
Figure 2-2 Obliquity of the System

2.1.2. Unpacking

Move the unit to the location nearest to the final installation site and unpack it. Follow the procedures below for unpacking.

- **Removal of Paper Packaging**

Remove the packaging tape and carton at first, then remove the top cover followed by dismantling the unit on the sealing plastic, finally, remove the Honey Comb Paper Board. For better understanding see Figure 2-3.



No.	Description	No.	Description
1	Top Cover	3	Honey Comb Paper Board
2	Remove Top Cover	4	Remove sealing plastic film and Honey Comb Paper Board

Figure 2-3 Removal of Honey Comb Paper Board

- **Removal of Wood Packaging**

Use a claw hammer or straight screwdriver to straighten the connection hook that holds the side panels to the top cover, as shown in Figure 2-4.

Figure 2-4 Straightening the Hook

Firstly, straighten all the hooks that hold side panel-I and remove side panel-I. Then straighten all the hooks that hold side panel-II and remove side panel-II. At last remove top cover-III, as shown in Figure 2-5.

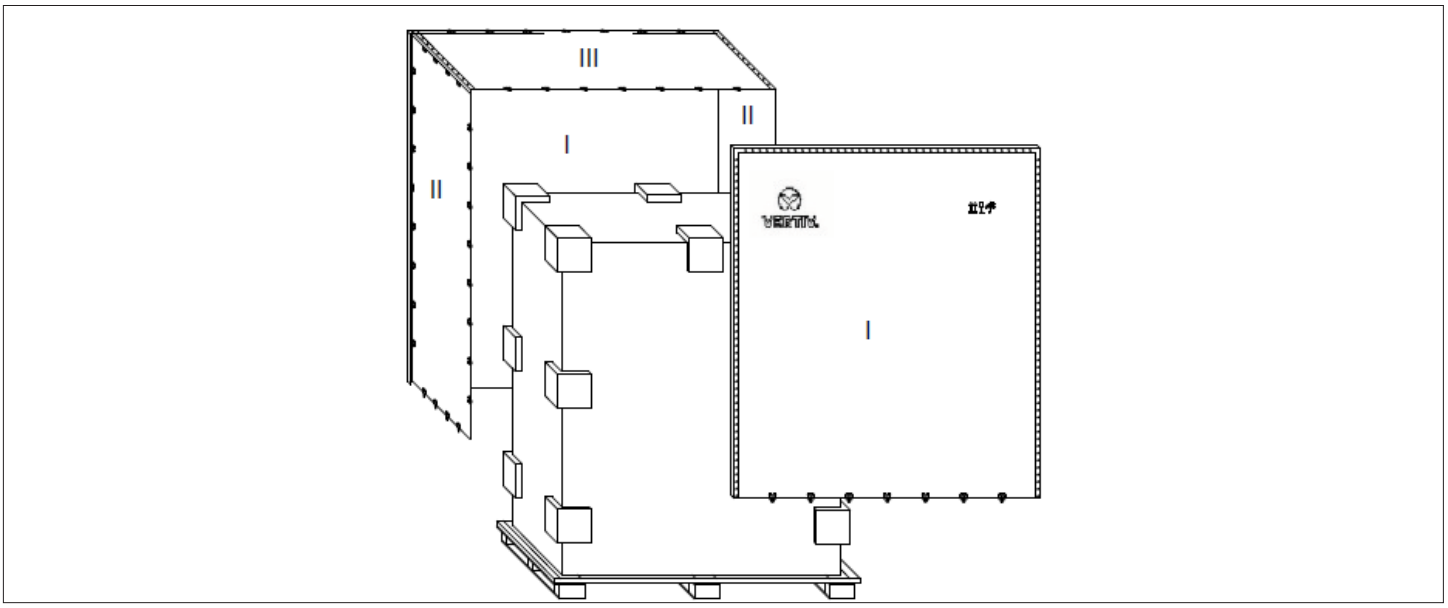
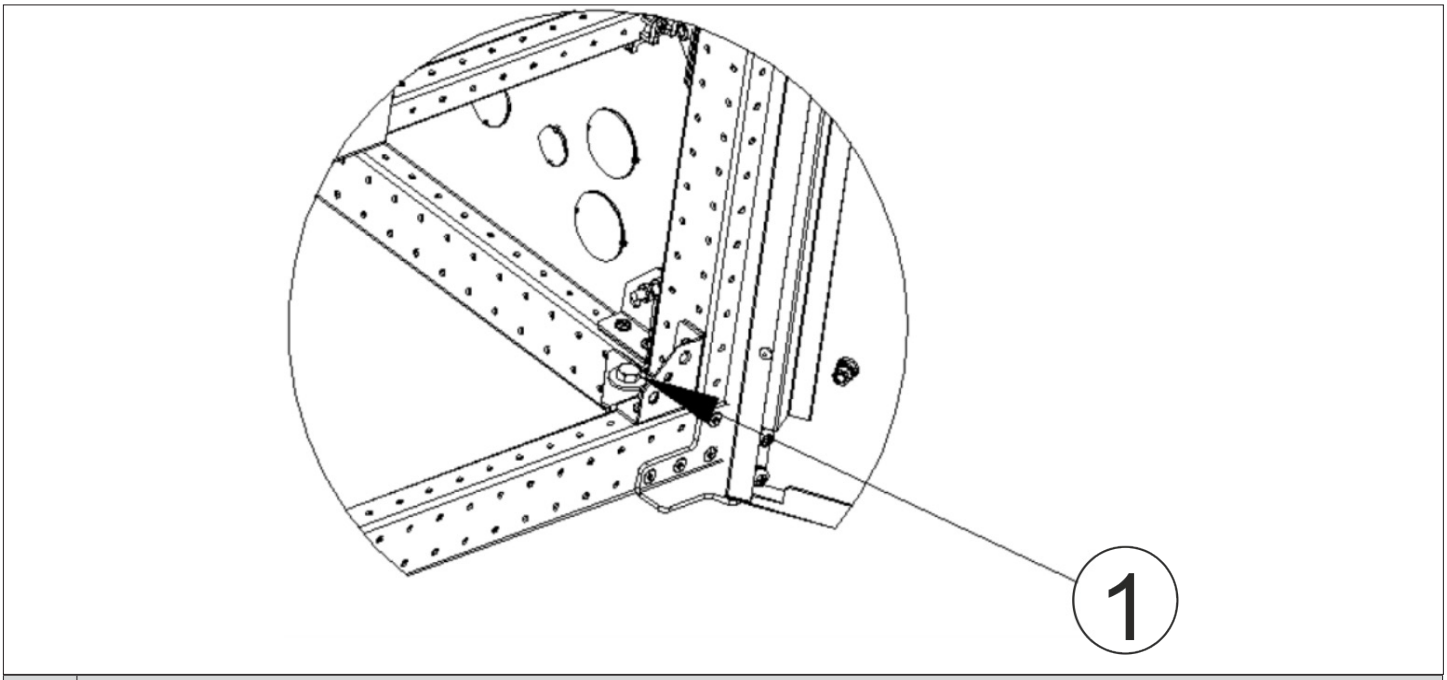


Figure 2-5 Removing Side Panel and Top Cover

- **Remove the Base Pallet**

The unit is fixed onto the base pallet with M8×70 screw, as shown in Figure 2-6. Use a 17 mm open-end spanner, ratchet spanner or sleeve to remove the fixing bolts.



No.	Description
1	Pallet Screw M8X70

Figure 2-6 Pallet Screws Fixing Position

2.1.3. Inspection

Check that the fittings are complete and the components are intact against the packing list. If any part is missing or damage, please report immediately to the local offices of the carrier and Vertiv.

2.2. Installation Preparation (Site Preparation)

Liebert® PEX+ series is streamlined for maintaining a favorable environment for equipment rooms, computer rooms, and similar ecosystems. Strict adherence to the installation procedures is mandatory to ensure that the air conditioner is installed properly.

2.2.1. Equipment Room Requirements

Before installation, the equipment room must be prepared to ensure a smooth operating flow and to achieve the expected results. The equipment room must meet the standards, to get proper ventilation and heating. The design specifications for the air conditioners must be ideal and should match the energy-efficient design standards.

Following are the requirements to maintain a favorable room environment prior to the installation.

- The equipment room should have suitable and effective heat insulation.
- The equipment room should have a sealed and damp-proof layer. Polyethylene film should be used for the damp proof layer of the ceiling and walls. Alternatively, moisture-proof paint can be used to simulate the same effect akin to Polyethylene. It is important to ensure that the coating on the concrete wall and floor is damp-proof.
- Outdoor air significantly increases the load of heating, cooling, humidification, and dehumidification. Therefore, all the doors and windows must be closed. Gaps and seams must be very narrow to prevent the outdoor air from entering the equipment room. It is an industry best practice to keep the infiltration of the outdoor air below 5% of the total indoor airflow. Apply appropriate thermal insulation and antifreeze measures for outdoor water pipes to avoid poor drainage and insufficient water supply caused by freezing.

- *Vertiv recommends that the site preparation is defined as per the requirements. However, if these requirements are not met, Vertiv suggests that rectifications to be made on the site in order to comply with the specified requirements and conditions.*
- *However, if the rectifications or modifications are not implemented, then Vertiv does not guarantee the accuracy and precision of the temperature and humidity provided by the unit.*

2.2.2. Installation Space Requirements

Adequate installation space for the indoor unit must be provided. The indoor unit of the air-cooled product must be installed on the floor of equipment room or computer room and the outdoor unit must be installed outside data center, open to the external ambient.

- *Do not use the indoor unit in the open and severe outdoor environment.*
- *Avoid locating the indoor unit in concave or narrow areas, which can obstruct the airflow, shorten the cooling cycle and result in air return short cycle and air noise.*
- *Avoid locating multiple indoor units close to each other. This can result in short cycle of air and create load imbalance.*
- *Do not install the unit within the vicinity of any other precision cooling equipment to prevent the leakage of condensed water produced due to imbalance load condition.*
- *Do not install other devices (such as smoke detector) over the indoor cabinet*

2.2.3. Maintenance Space Requirement

When installing the unit, a minimum maintenance space of 900 mm must be reserved in-front of the air conditioning unit. The requirement for maintenance space is shown in Figure 2-7.

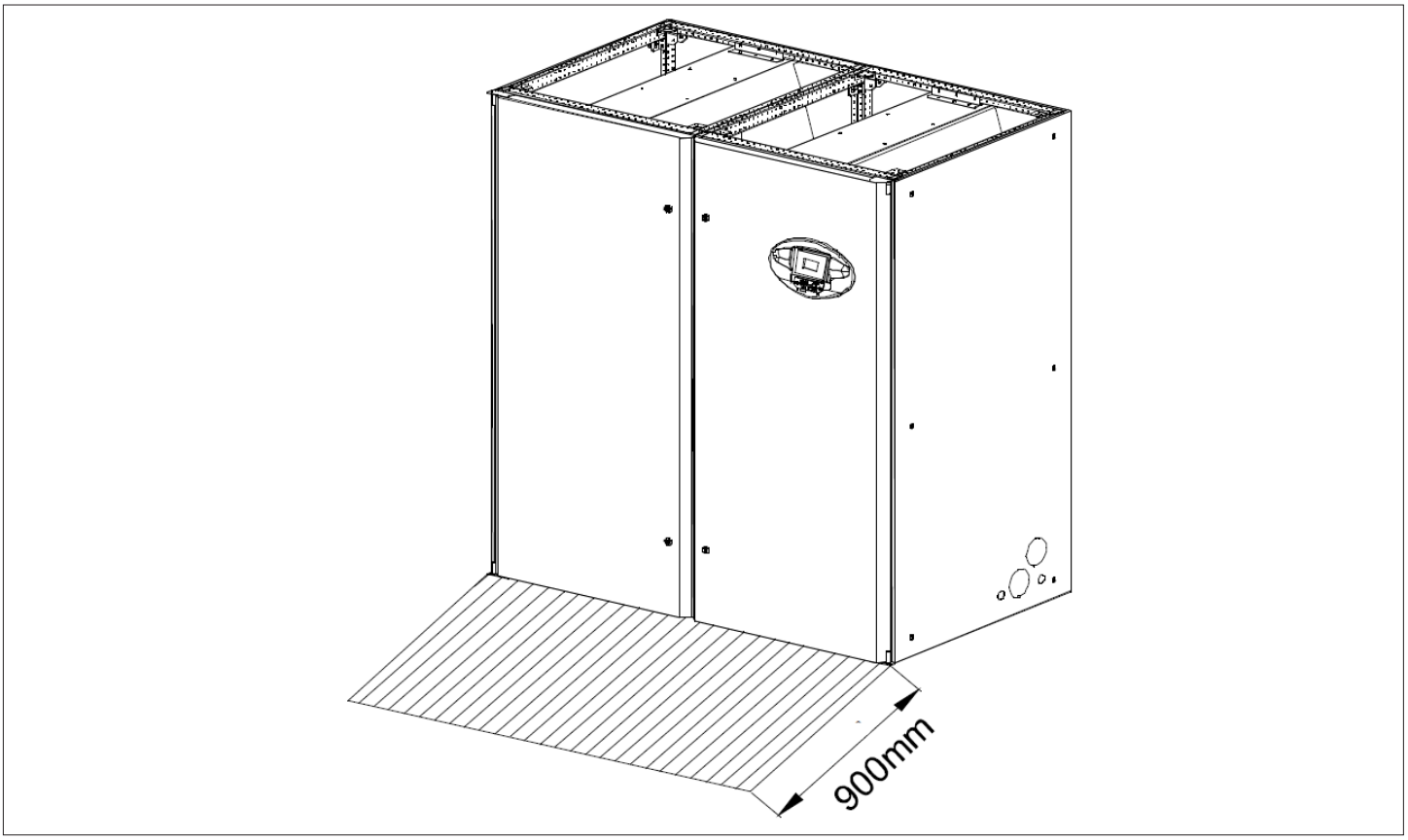


Figure 2-7 Maintenance Space of Unit

2.2.4. Installation Tools

The following Table 2-1 shows the generic tool sets and utilities used in the installation and maintenance process.

Table 2-1 List of Generic Tools

Name	Drawing	Name	Drawing
Electric hand drill		Adjustable wrench	
Slotted screwdriver		Cross head screwdriver	
Stepladder		Forklift	
Drill		Wire cutting pliers	
Claw hammer		Diagonal cutting pliers	
Insulating shoes		Anti-static gloves	
Electrician knife		Cable ties	
Insulating tape		Insulating gloves	
Crimping pliers		Heat shrinkable tube	
Insulated torque wrench		Torque screwdriver	
Multi-meter		Clip-on ammeter	

The tools mentioned in Table 2-1 are generic and commonplace; however, depending on various factors such as site environment, local rules and regulations, cables, installation equipment, and on-site electrical connections these tools may vary in a real- time scenario.

Ensure that the tools used in the installation, operation, and maintenance processes are well insulated.

2.2.5. System Arrangement during Installation

Figure 2-8 shows the piping connection of indoor and outdoor units of the chilled water series PAC.

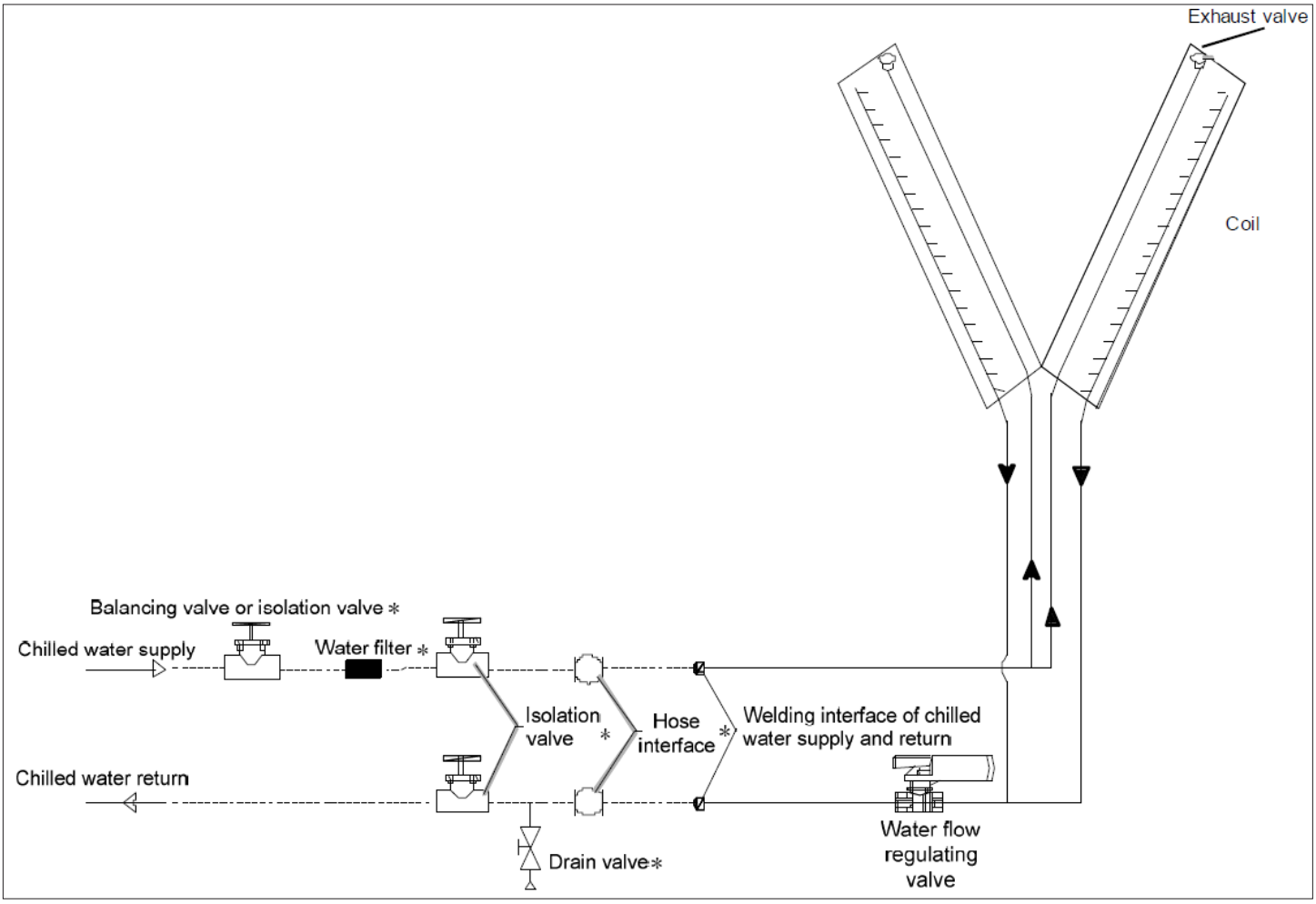


Figure 2-8 System Arrangement

The following points should be considered before checking out the overall layout diagram of an entire system as an example of single system.

- ————————: *Factory piping*
- ----------: Field piping *(by technical personnel)*
- *Components (marked with *) are not supplied by Vertiv Co. but are recommended for proper circuit operation and maintenance.*
- *After the installation, exhaust the PAC unit before filling water to ensure the efficiency of the coil.*
- *In winter, the PAC unit does not operate for a long term; empty the water in PAC unit to protect the heat exchanger from frost cracking.*

2.3. Mechanical Installation

2.3.1. Indoor Unit Size and Weight (Product Dimension)

The dimensions and operational weight of the indoor units are depicted in Figure 2-9 & Figure 2-10 and Table 2-2 respectively.

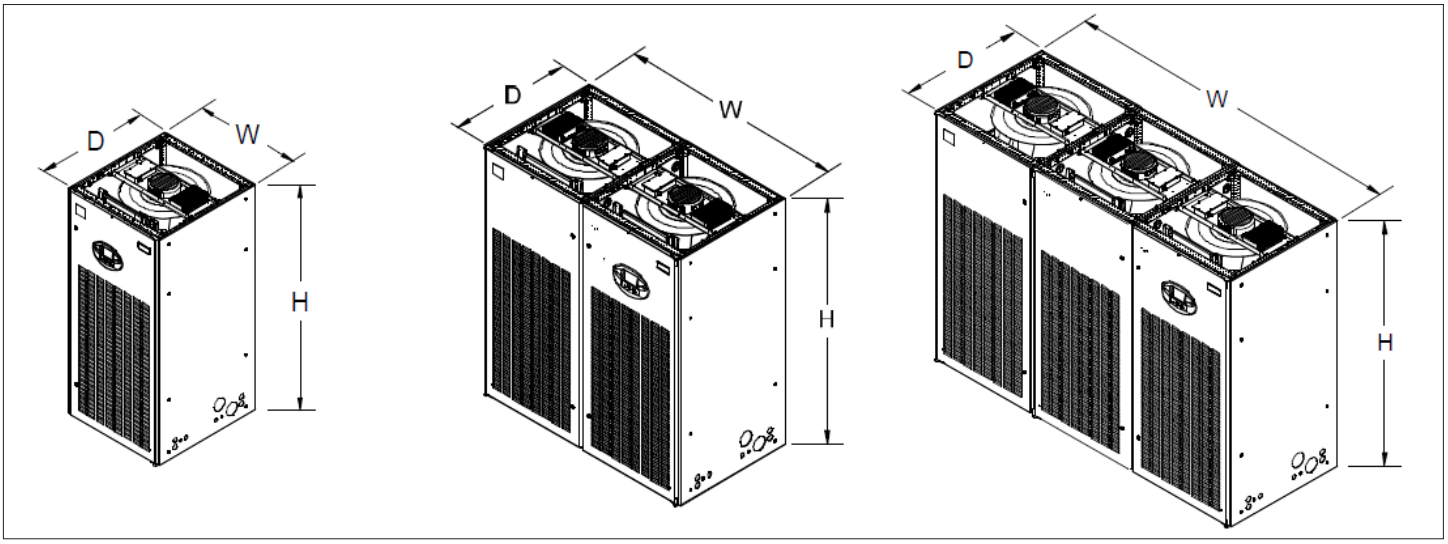


Figure 2-9 Upflow Indoor Unit

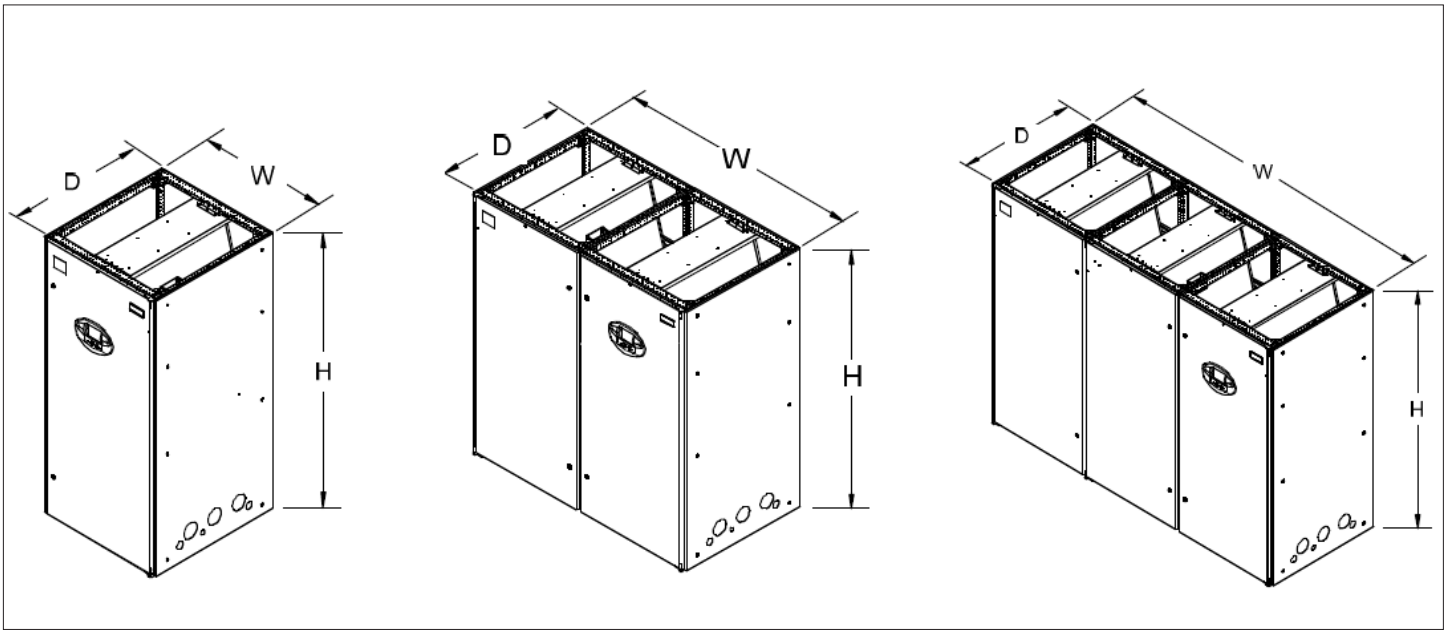


Figure 2-10 Downflow Indoor Unit

Table 2-2 Indoor Unit Size and Weight

Product Number	Dimensions (W×D×H)		Net Weight (kg)
	mm	inch	
P1030	930 × 995 × 1975	36.6”×39.2”×77.7”	300
P1040	930 × 995 × 1975	36.6”×39.2”×77.7”	310
P1050	930 × 995 × 1975	36.6”×39.2”×77.7”	330
P1060	930 × 995 × 1975	36.6”×39.2”×77.7”	350
P2070	1680 × 995 × 1975	66.1”×39.2”×77.7”	490
P2080	1680 × 995 × 1975	66.1”×39.2”×77.7”	500
P2090	1680 × 995 × 1975	66.1”×39.2”×77.7”	510
P2100	1680 × 995 × 1975	66.1”×39.2”×77.7”	520
P2110	1830 × 995 × 1975	72.0”×39.2”×77.7”	540
P2120	1830 × 995 × 1975	72.0”×39.2”×77.7”	550
P2130	1830 × 995 × 1975	72.0”×39.2”×77.7”	560
P2140	1830 × 995 × 1975	72.0”×39.2”×77.7”	580
P3150	2505 × 995 × 1975	98.6”×39.2”×77.7”	770
P3160	2730 × 995 × 1975	107.5”×39.2”×77.7”	790
P3170	2730 × 995 × 1975	107.5”×39.2”×77.7”	810
P3180	2730 × 995 × 1975	107.5”×39.2”×77.7”	820
P3190	2730 × 995 × 1975	107.5”×39.2”×77.7”	840
P3200	2730 × 995 × 1975	107.5”×39.2”×77.7”	850

2.4. Position and Dimension of Air Outlet on Top Cover

The position and dimensions of cut-out of the all models of PEX+CW upflow units are shown in Figure 2-11 and in Table 2-4 respectively.

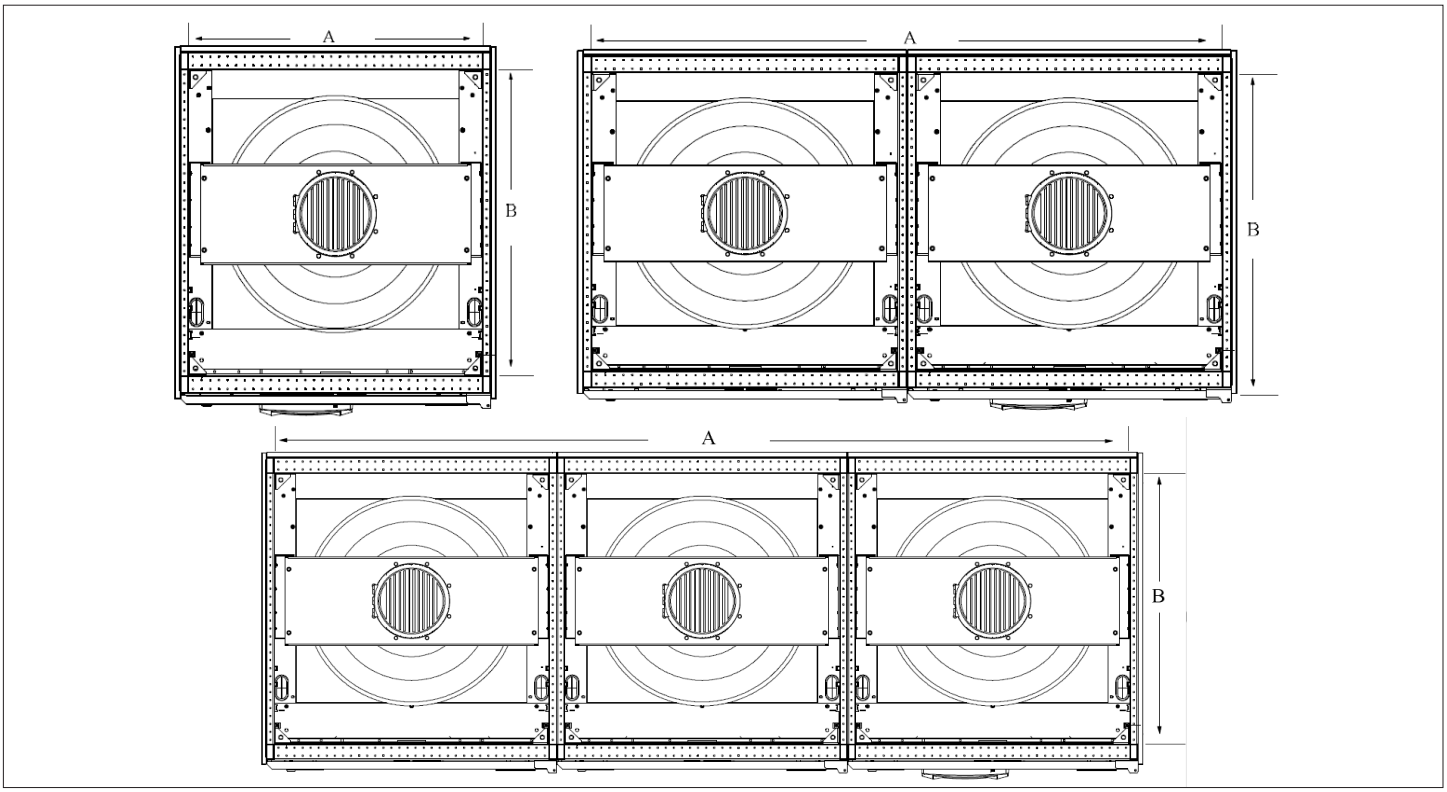


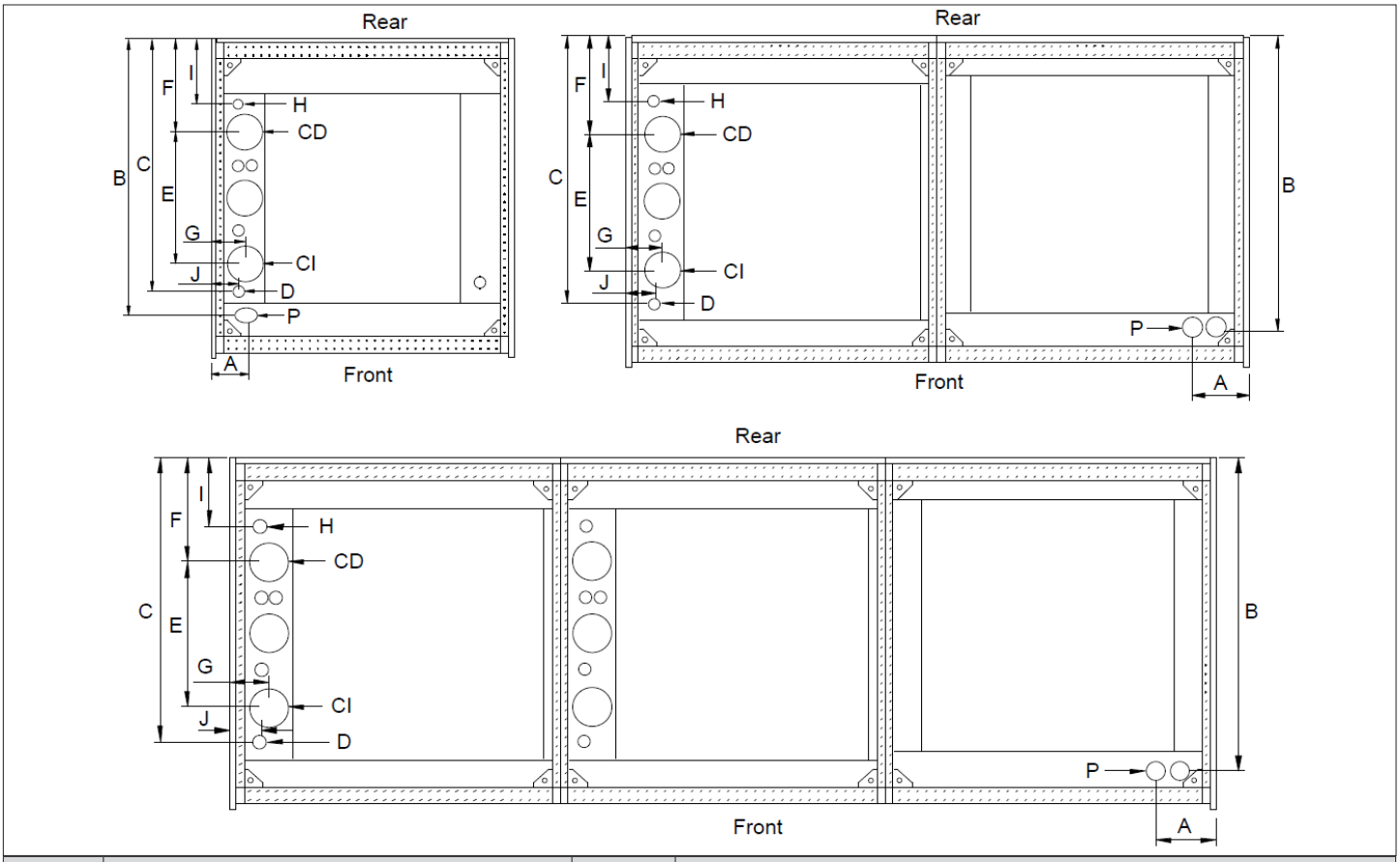
Figure 2-11 The Position of Cut-out Upflow Unit

Table 2-3 Dimensions of Air Outlet on Top Cover of Upflow Unit(inch/mm)

Types of Model	A	B
	mm	mm
P1030-P1060	850	850
P2070-P2100	1600	850
P2110-P2140	1750	850
P3150	2425	850
P3160-P3200	2650	850

2.4.1. Base Pallet Cut-out Location Dimension

The position and dimensions of air outlet on the top cover of downflow unit are shown in Figure 2-12 and in Table 2-5 respectively.



Sym.	Description	Sym.	Description
P	Power cable entry	D	Drain pipe hole
H	Water inlet for humidifier	CI/CO	Chilled water inlet and outlet

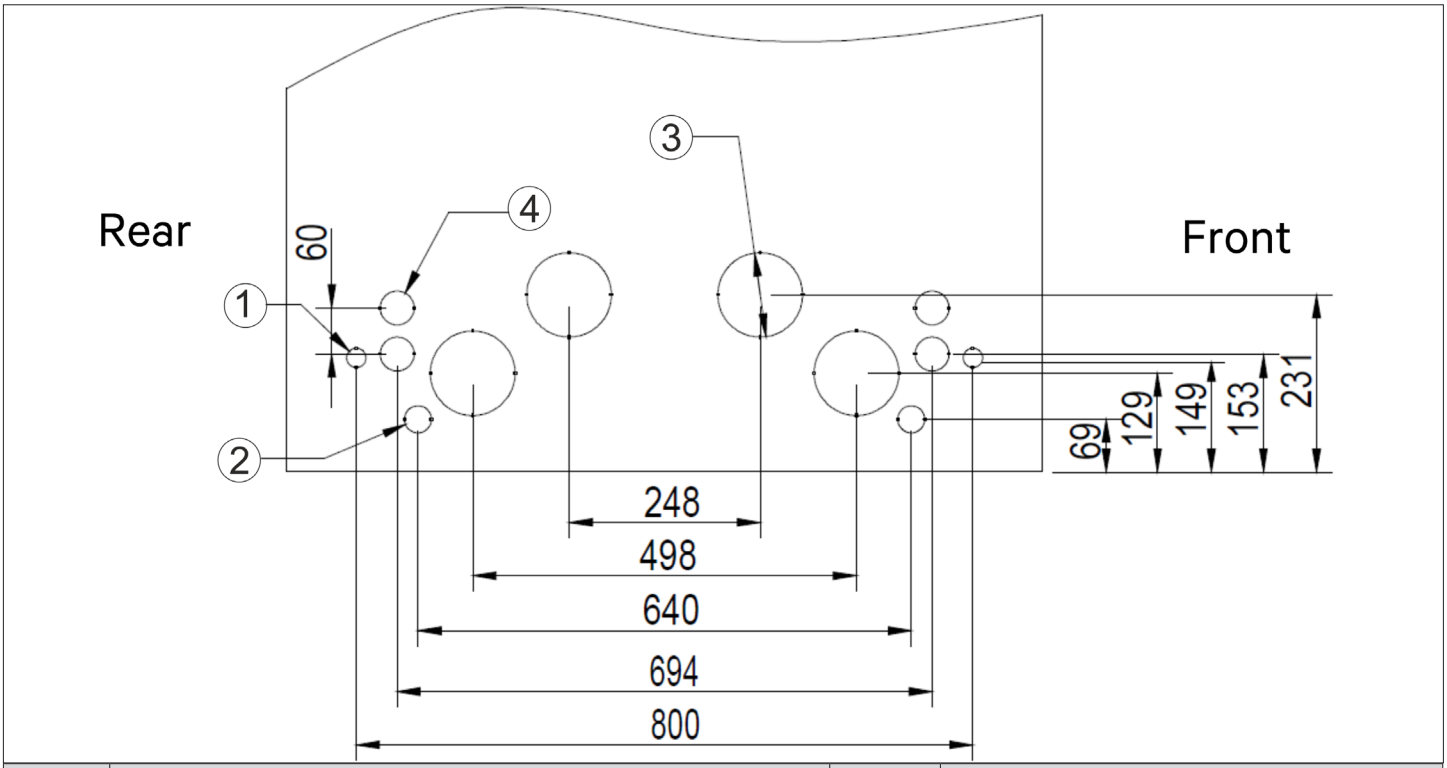
Figure 2-12 The Position of Air Outlet on Top Cover Upflow Unit

Table 2-4 Dimensions of Air Outlet on Top Cover of Downflow Unit (inch/mm)

Types of Model	A	B	C	E	F	G	I	J	D	H	P	CI	CO
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
P1030~P1050	117	852	779	404	290	105	205	85	35	35	51x76	110	110
P1060	141	797	797	404	290	108	187	66	35	35	51x76	110	110
P2070-P2100	180	887	779	404	290	105	205	85	35	35	56	110	110
P2110-P2140	167	874	792	404	290	108	192	88	35	35	56	110	110
P3150	180	887	779	404	290	105	205	85	35	35	56	110	110
P3160	182	887	779	404	290	105	205	85	35	35	56	110	110
P3170-P3200	167	874	792	404	290	108	192	88	35	35	56	110	110

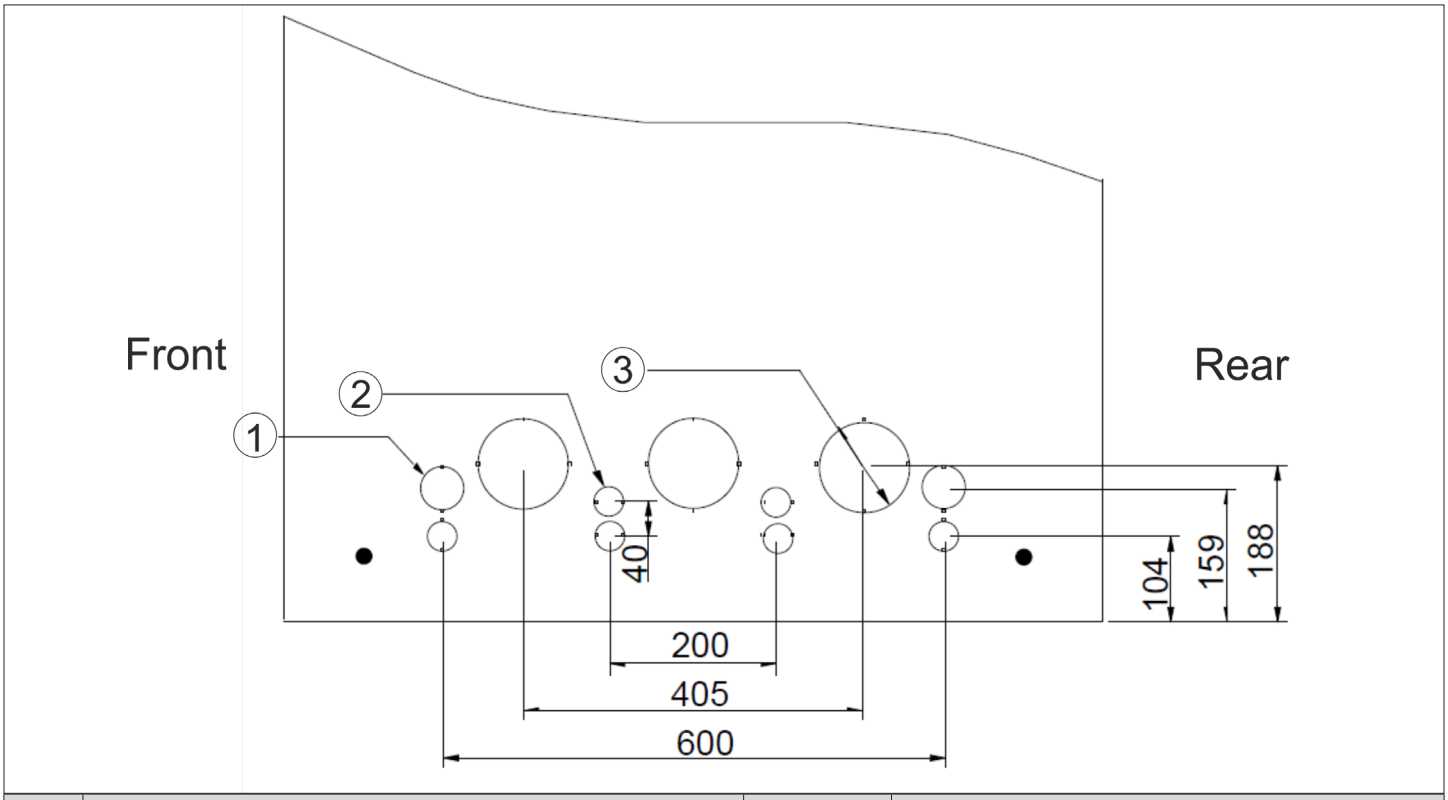
2.4.2. Side Panel Knock-out Location

If it is difficult to route piping and cabling from the base then route the connection from side panel. The locations and dimensions of knock-out holes are shown in Figure 2-13 and Figure 2-14. Select the inlet and outlet holes according to the requirements. Ensure only one service is used per opening.



No.	Description	No.	Description
1	2-Ø25 Knock-out hole	3	4-Ø110 Knock-out hole
2	2-Ø35 Knock-out hole	4	4-Ø44 Knock-out hole

Figure 2-13 Knock-out Holes on Side Panel of the Upflow Unit (unit: mm)



No.	Description	No.	Description
1	2-Ø52 Knock-out hole	3	3-Ø110 Knock-out hole
2	6-Ø35 Knock-out hole		

Figure 2-14 Knock-out Holes on Side Panel of the Downflow Unit (unit: mm)

The unit has knock-outs on the panels, ensure to mount sleeve to the cable holes to avoid cutting of the cables.

2.4.3. Plenum Dimension (for Upflow)

Following are the plenum dimension for Liebert® PEX+CW series upflow units as per one, two and three bays as shown in Figure 2-15, Figure 2-16, Figure 2-17 and in Table 2-6 respectively.

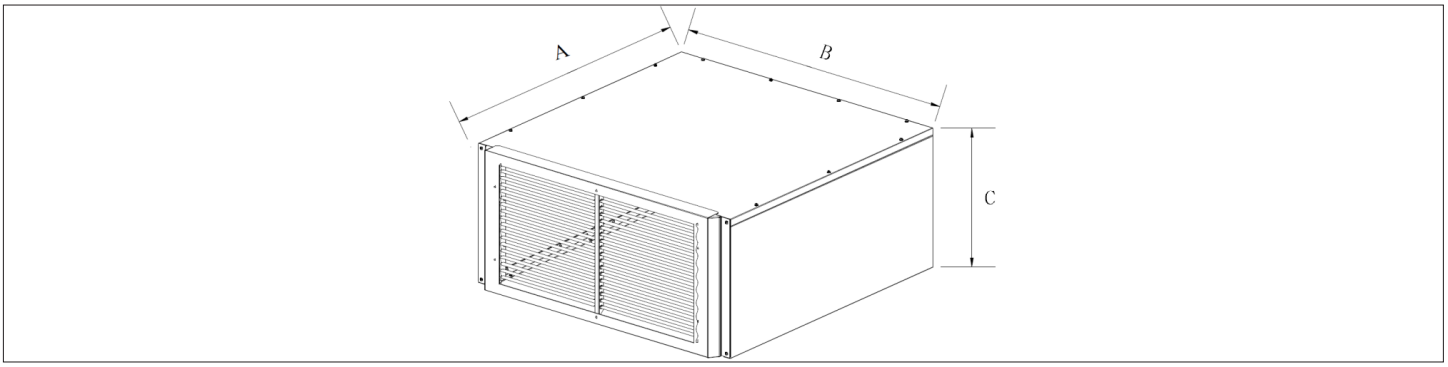


Figure 2-15 Plenum Dimensions of P1030 and P1060 Upflow Unit

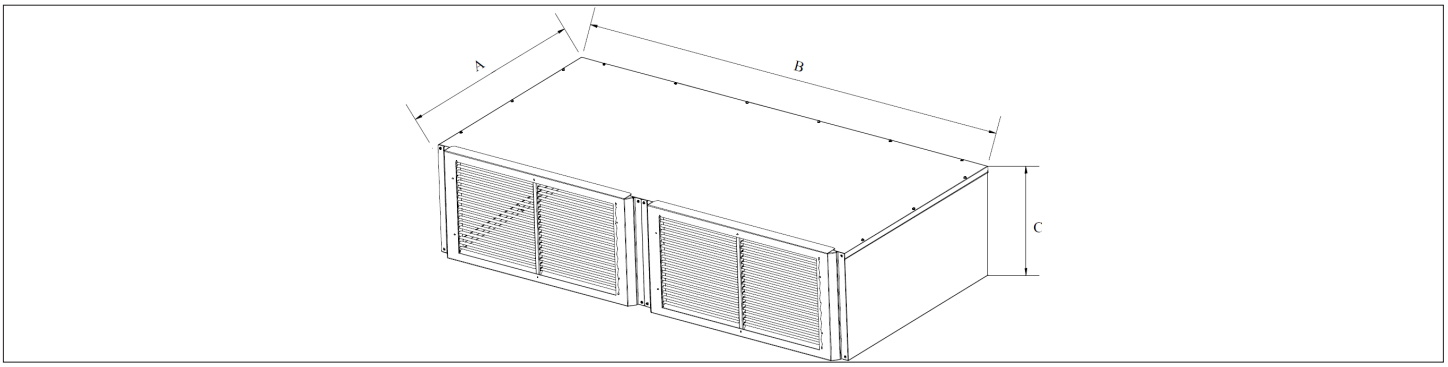


Figure 2-16 Plenum Dimensions of P2070 toP2140 Upflow Unit

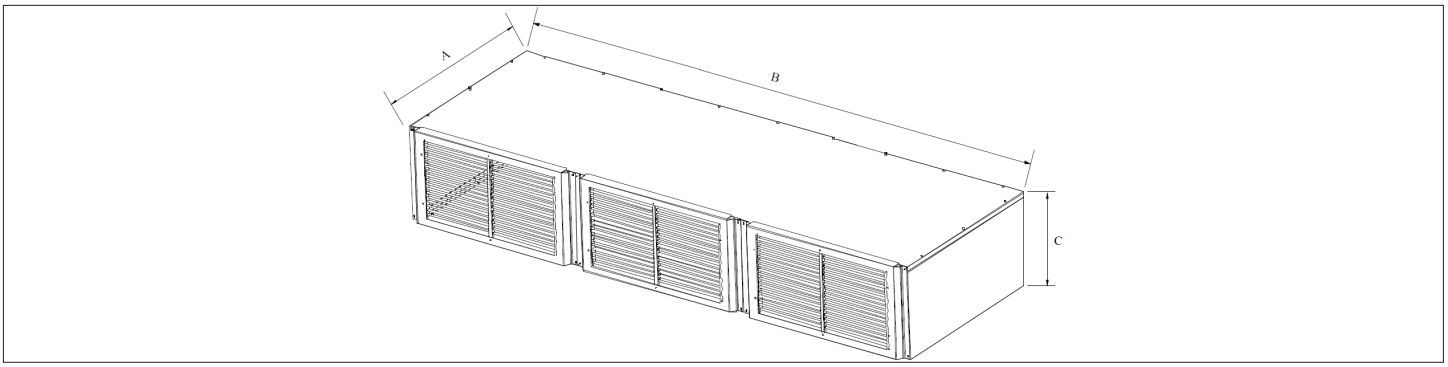


Figure 2-17 Plenum Dimensions of P3160 to P3200 Upflow Unit

Table 2-5 Dimensions of Air Outlet on Top Cover of Upflow Unit(inch/mm)

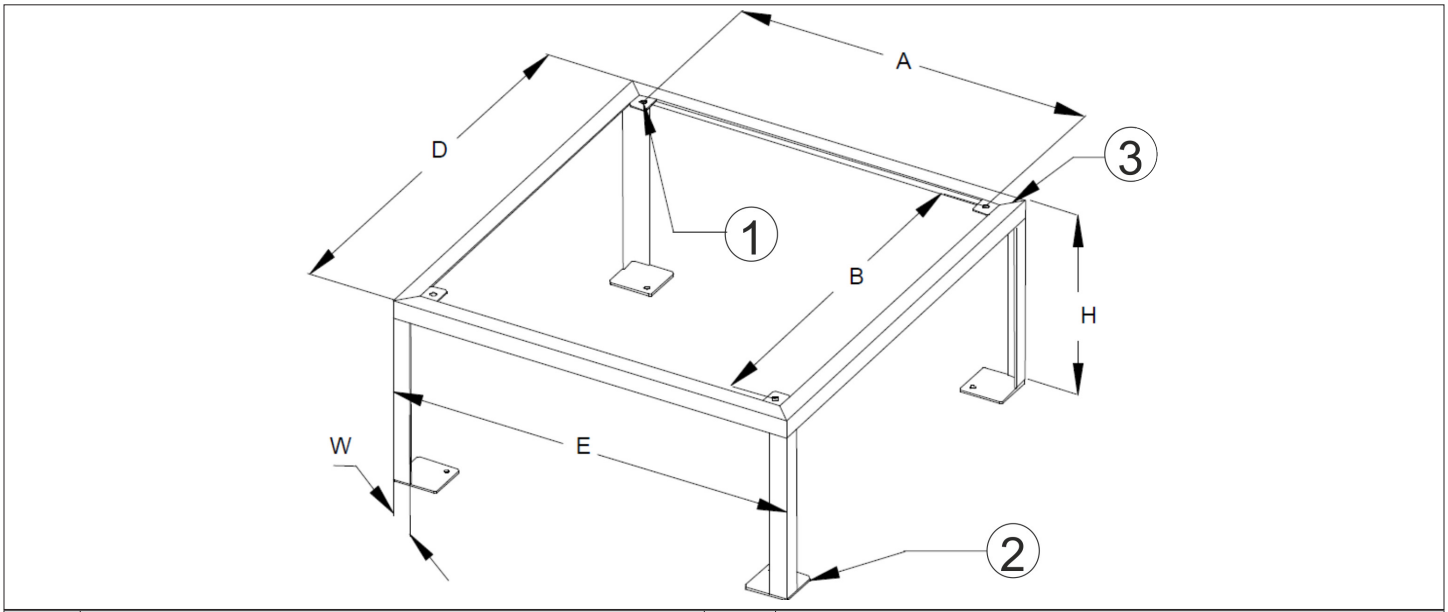
Types of Model	A (Depth)	B (Width)	C (Height)
	mm	mm	mm
P1040 - P1060	995	930	400 (600, optional)
P2070 - P2100	995	1680	400 (600, optional)
P2110 - P2140	995	1830	400 (600, optional)
P3150	995	2505	400 (600, optional)
P3160 - P3200	995	2730	400 (600, optional)

If the plenum height requirement is more than 600 mm then consult Vertiv local representative for more details on non-standard production.

2.4.4. Indoor Installation

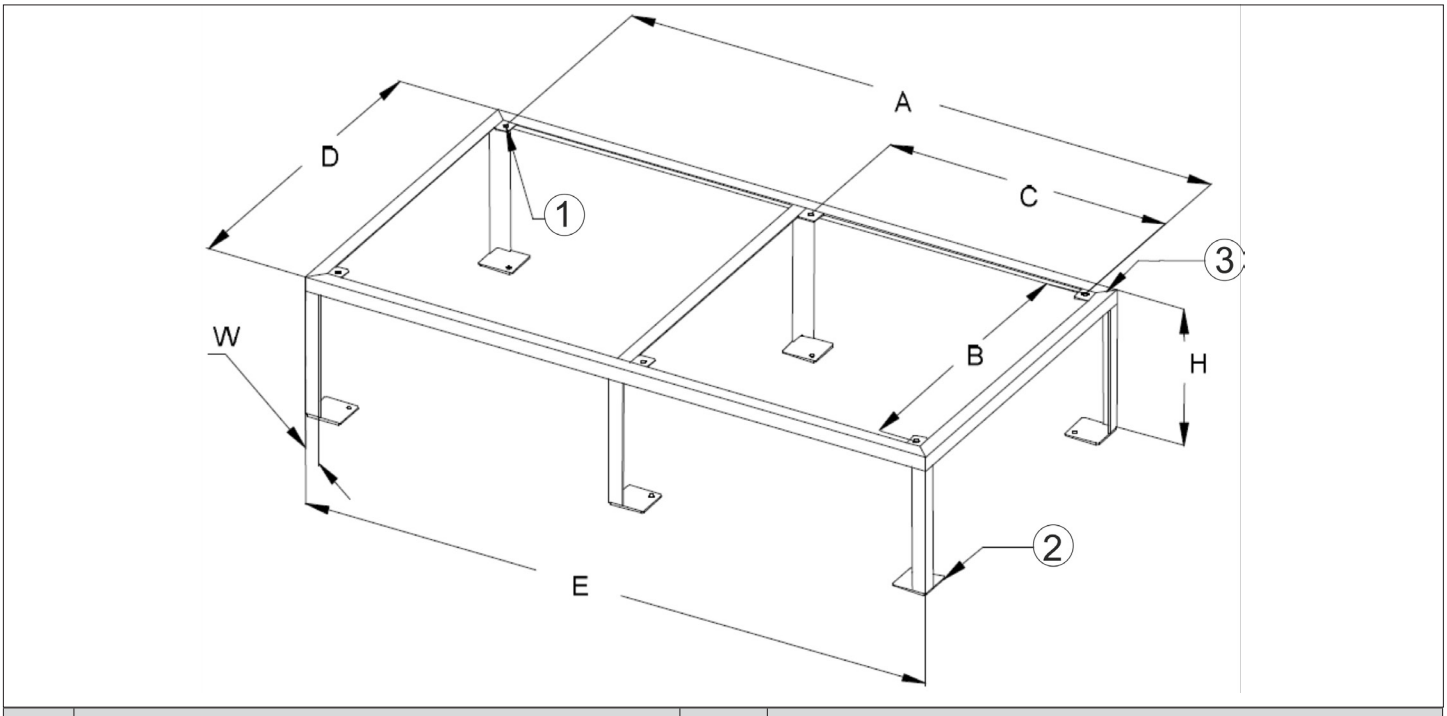
- **Mounting Floor Stand**

The mounting floor stand is to be prepared by the installation team according to the dimensions, weight, and height of the unit to ensure that the structure is rigid, the floor stand should be sized according to the number of bays in the unit model as shown in Figure 2-18, Figure 2-19, Figure 2-20 and Table 2-7 respectively.



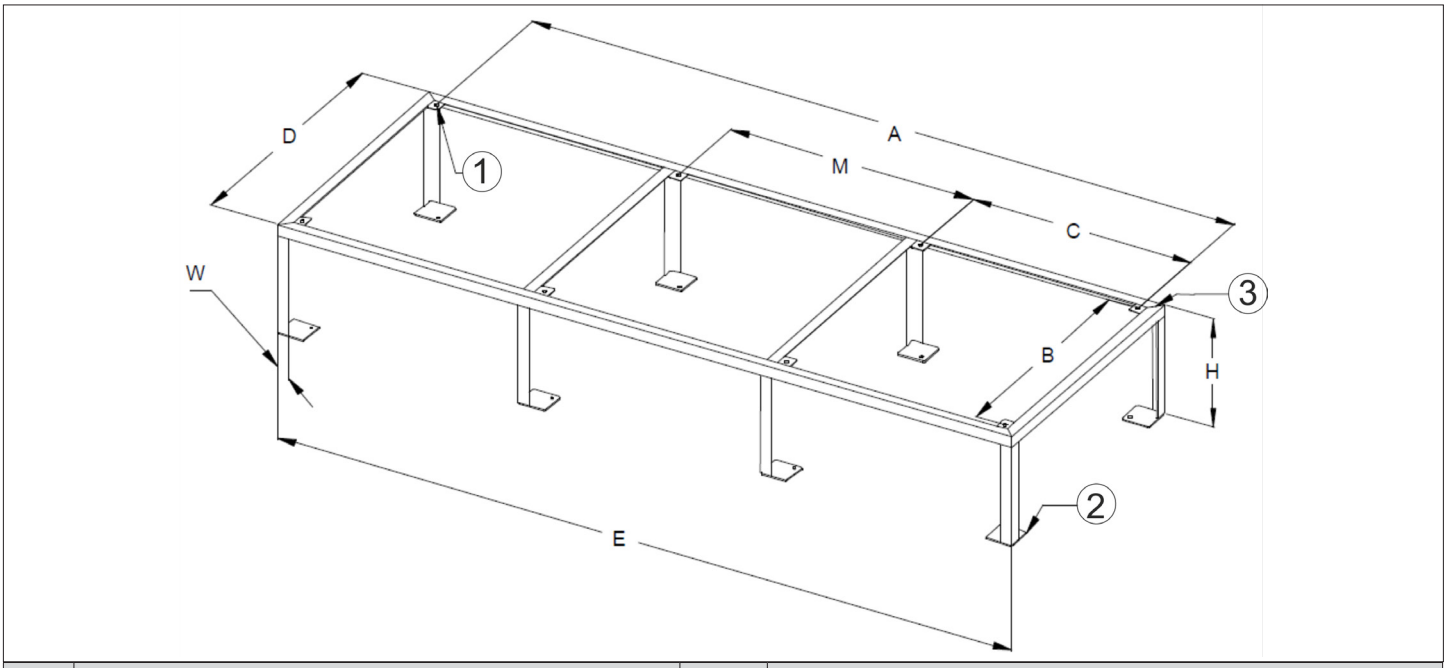
No.	Description	No.	Description
1	4-Ø14 hole	3	Bottom rubber cushion
2	Bottom rubber cushion, 4PCS		

Figure 2-18 Mounting Floor Stand of One Bay Series



No.	Description	No.	Description
1	6-Ø14 hole	3	Bottom rubber cushion
2	Bottom rubber cushion, 6PCS		

Figure 2-19 Mounting Floor Stand of Two Bay Series



No.	Description	No.	Description
1	8-Ø14 hole	3	Bottom rubber cushion
2	Bottom rubber cushion, 4PCS		

Figure 2-20 Mounting Floor Stand of Three Bay Series

Table 2-6 Mounting Floor Stand Dimensions (inch/mm)

Model	A	B	C	D	E	M	F	H	W
P1030 - P1060	810	860	/	980	930	/	/	400 <H≤550	40
							F≤240	550 <H≤1100	50
P2070 - P2100	1560	860	735	980	1680	/	/	400 <H≤550	40
							F≤240	550 <H≤1100	50
P2110 ~ P2140	1710	860	810	980	1830	/	/	400 <H≤550	40
							F≤240	550 <H≤1100	50
P3150	2385	860	735	980	2505	825	/	400 <H≤550	40
							F≤240	550 <H≤1100	50
P2090 ~ P2100	2610	860	810	980	2730	900	/	400 <H≤550	40
							F≤240	550 <H≤1100	50

- *Refer to Table 2-7 A/B/C/M as the center of the base from the mounting hole D/ E is the size of the base frame and front door will 15 mm above the mounting base.*
- *H is the height of the base, F is the distance between the joint angle steel and the floor.*
- *W is the width of the angle iron, it is recommended to use size of the angles 40 mm x 40 mm x 3 mm or 50 mm x 50 mm x 4 mm specification.*
- *For the downflow unit, the base must be greater than the height of 400 mm.*
- *For the upflow unit, the base height must be about 200 mm.*
- *The side panels are suspended to the frame of the unit, ensure that floor stand should bear the weight of the panels.*
- *The distance between the obstacles that may obstruct the air supply around the upper edge of the base and the outer edge of the EC fan shall be greater than 160 mm.*

- **Installing Floor Stand**

Procedure to install floor stand for Liebert PEX+CW:

1. Determine the installation position according to the space requirements of the unit, and fix the floor stand onto the selected mounting position.
2. Rigidly fix the floor stand to the ground using expansion bolts or spot welding, and ensure the alignment of the floor stand is calibrated by a horizontal ruler before it is fixed.
3. Ensure that the top surface of floor stand is at uniform level.

While designing and installing the downflow unit which requires lowering of EC fan, installation team must consider the proper gap distance and the base strength of the floor stand.

- **Vibration Absorption Treatment**

Place a layer of rubber cushion on the top, side of the base and on the bottom of the steel plate respectively to prevent transmission of vibration during operation of the unit. Refer Table 2-8 for more details.

Table 2-7 Dimensions of Rubber Cushion for Vibration Absorbing

Item		Specification
Rubber cushion (NBR)	Top	Thickness: 3 mm to 5 mm
	Lateral	Thickness: 2 mm to 3 mm
	Bottom	Thickness: 10 mm to 12 mm

2.4.5. Installation of Indoor Unit

Liebert® PEX+CW indoor unit should be installed on the horizontal surface of mounting floor stand and ensure that all indoor units are at the same level.

2.4.6. Pipe Installation Unit

There are three kinds of pipe to be joint as follows:

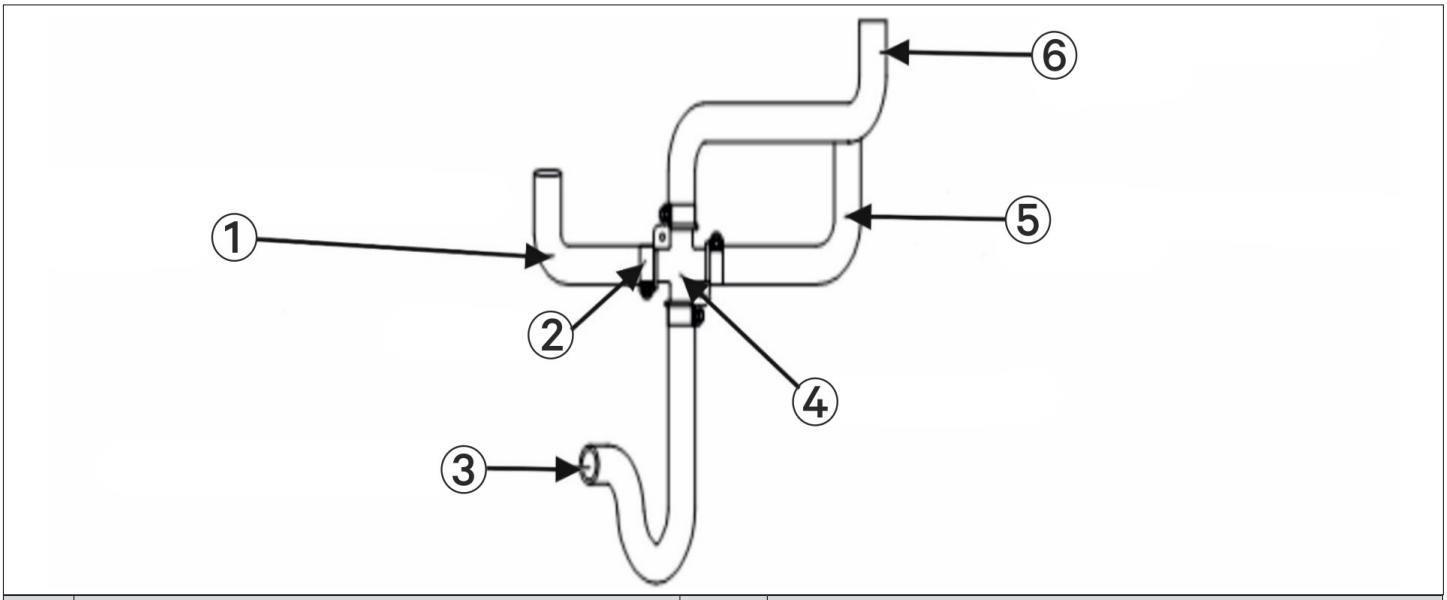
- Condensed drain piping connection of the indoor unit
- Water inlet pipe of humidifier connection
- Chilled Water inlet and outlet piping connection

2.4.7. Condensed Drain Piping Connection of Indoor Unit

The condensate of Infrared humidifier and evaporator coil are connected by a cross connector and drained through the drain pipe, as shown in Figure 2-21; the material used for the drain pipe is 'triple ethyl propylene rubber (EPDM) rubber. The pipe outer diameter is 25 mm. If the drain pipe is used by three or more units, the minimal pipe outer diameter should be 40 mm. For the unit with electrode humidifier the inner diameter of the drain pipe is 40 mm.

When connecting the drain pipe, ensure that the U-bend is installed vertically and the 'U' shape is not distorted, so that the condensate can be drained immediately and effectively.

Because the Infrared humidifier contains hot flowing water, the water pipe must be resistant to heat higher than 90 °C.



No.	Description	No.	Description
1	From evaporated condensed water pan	4	Cross connector
2	Hose clamp	5	From evaporated condensed water pan
3	To condensate drain pipe	6	From infrared humidifier water pan

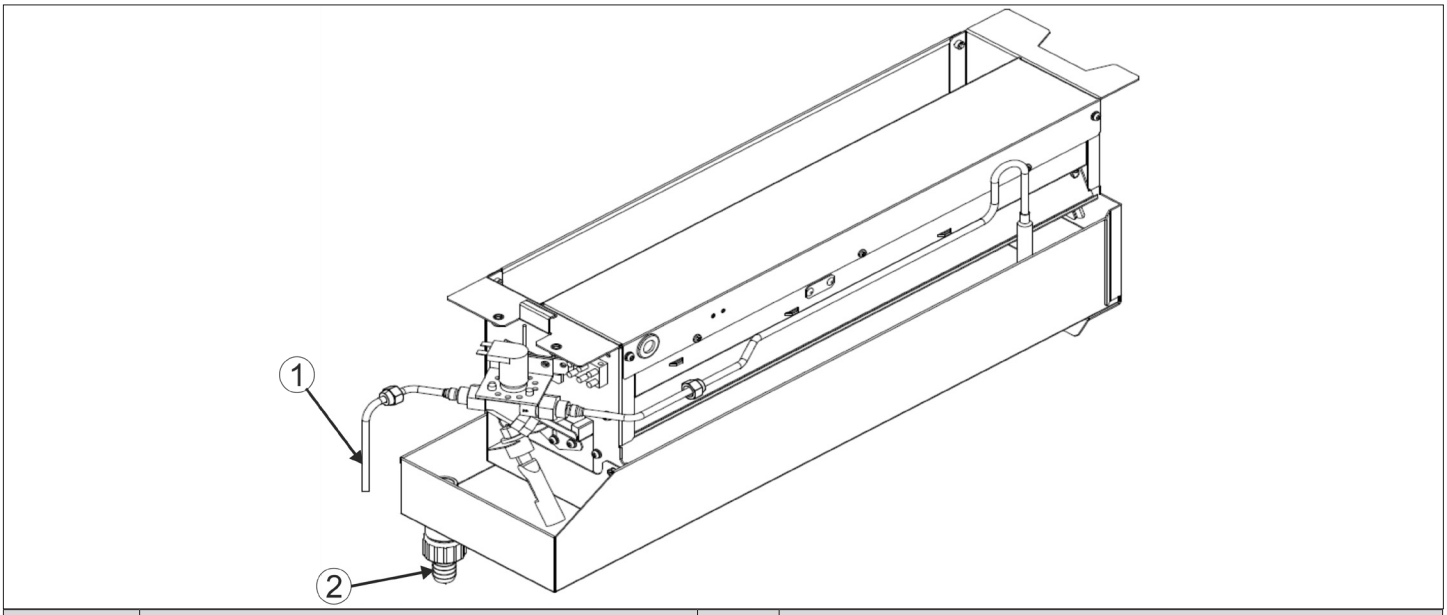
Figure 2-21 Connection of the Drain Pipe of Condensate Water

2.4.8. Water Inlet Pipe Humidifier Connection

Requirements for connecting the water inlet pipe of infrared humidifier:

- To facilitate maintenance, an isolation valve should be fitted to the water inlet pipe.
- Ensure that the water inlet pipe is sealed properly to prevent leakage. The Infrared humidifier reserved a copper pipe (OD: 6.35 mm). There is a 1/4" copper nut at the end of copper pipe and the 1/4" × 1/2" conversion copper thread connector to avoid loose connection as shown in Figure 2-22.

- *Where the main pipe pressure may exceed 700* kPa *(the main pipe pressure range should be 100 kPa to 700 kPa), a pressure reducer should be installed.*
- *Where the pressure of the main pipe is lower than 100 kPa, there should be a water collecting tank and a water pump system.*
- *Some unit installation may required components from local end.*

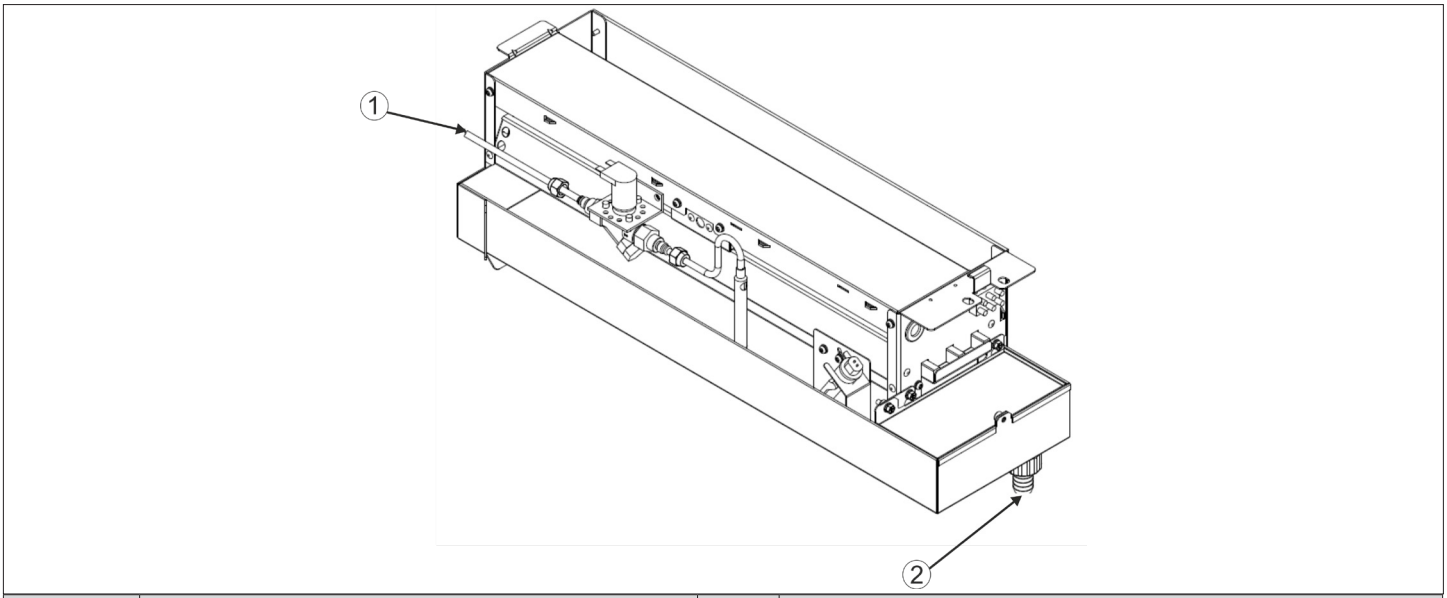


No.	Description	No.	Description
1	Water inlet pipe (OD:6.35 mm)	2	Water outlet joint

Figure 2-22 Water Inlet Pipe of Infrared Humidifier for Upflow Units

Requirements for connecting the water inlet pipe of electrode humidifier:

- Water inlet pipe uses 3/4" G screw-threaded connection pipe
- Water filter and water quality detection are recommended to prevent the water quality from affecting the normal operation of the humidifier, refer Figure 2-23 for better understanding.

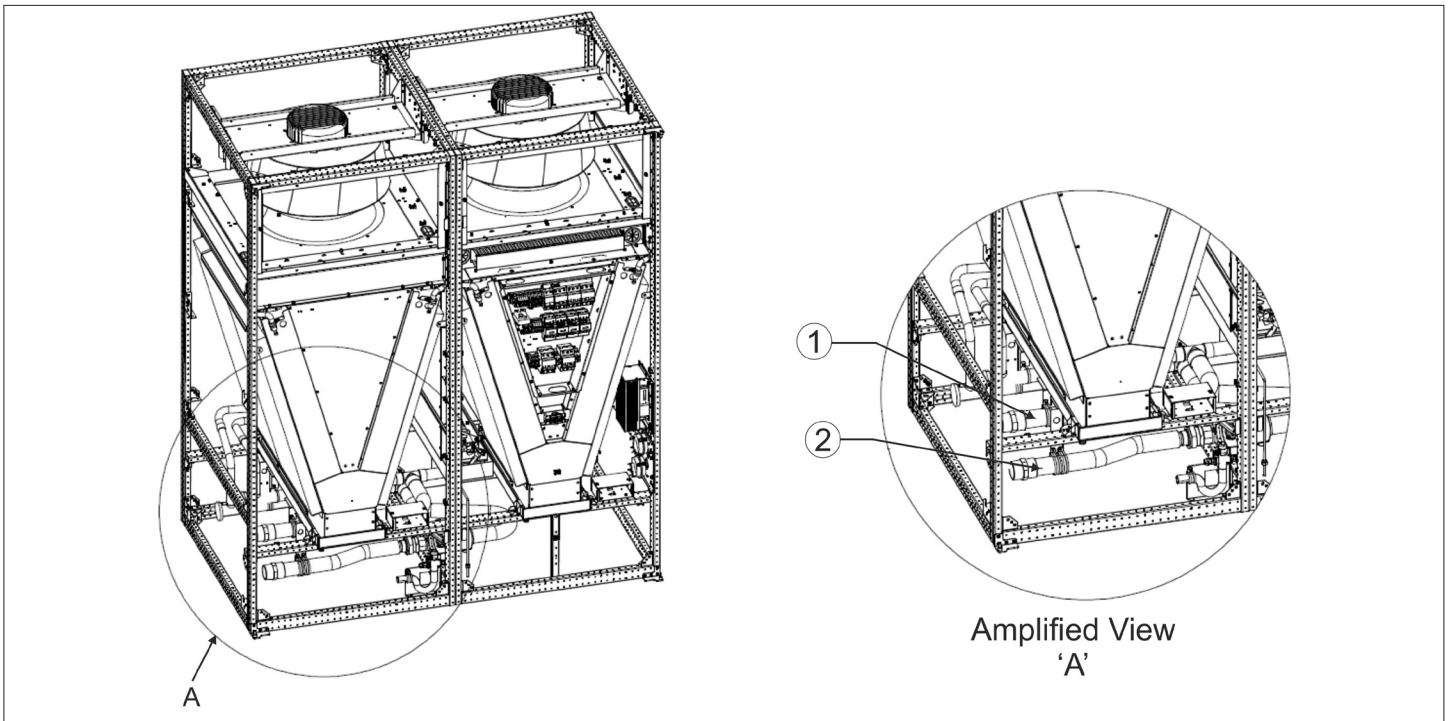


No.	Description	No.	Description
1	Water inlet pipe (OD:6.35 mm)	2	Water outlet joint

Figure 2-23 Water Inlet Pipe of Infrared Humidifier for Downflow Units

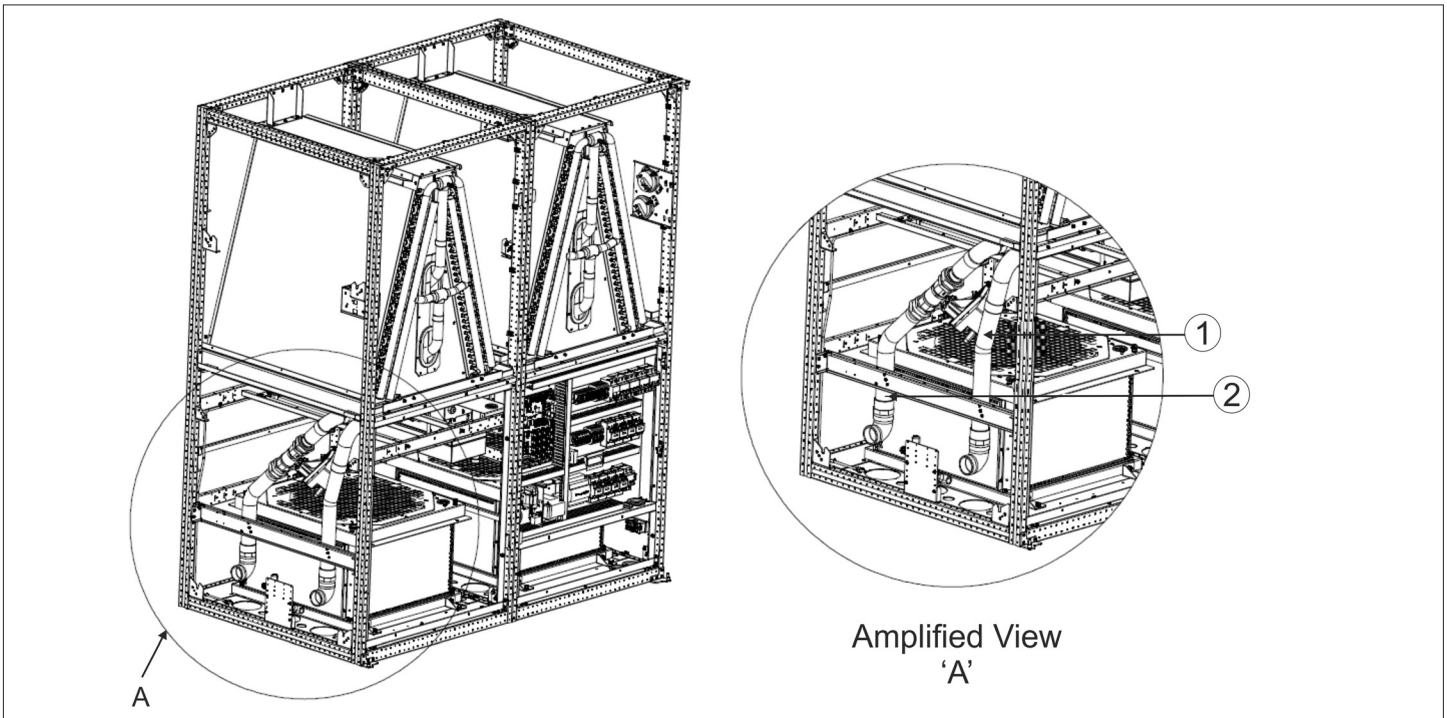
2.4.9. Chilled Water Inlet and Outlet Piping Connection

- The chilled water supply and return pipes are connected with the Air Handling Unit (AHU) by threaded connector (optional flanges or copper brazing mode), as shown in Figure 2-24 and Figure 2-25. The supply and return pipes should be brazed according to the labels on the unit. Do not reverse the connection. Chilled water supply and return pipes can be connected through the base pallet or the side panel. The chilled water supply pipes should be equipped with the water filter with over 60 meshes to facilitate the clearance of impurities in the pipes.
- The chilled water supply and return pipes need to be equipped with several isolation valves, which can cut off water sources during maintenance. One of the isolation valves can be a balancing valve. Chilled water system with a balancing valve would be more efficient and more accurate in controlling water distribution.
- Water pressure should be sufficient to overcome the water pressure drop caused by all the components of the water system. Considering the possibility that water pressure drop would increase due to deposition or impurities resulted from long-time running of the system. Therefore, when choosing the fluid recirculating component (e.g. pump), we should consider making 20% to 25% redundancy. The weight of the water pipes connected with the unit should not be assumed by the unit. The chilled water supply and return pipes must be kept warm. Table 2-9 shows the connecting dimensions of chilled water supply and return pipes of Liebert® PEX+ CW units.



No.	Description	No.	Description
1	Water supply pipe	2	Water return pipe

Figure 2-24 Connection of Chilled Water Supply and Return Pipes (upflow units)



No.	Description	No.	Description
1	Water supply pipe	2	Water return pipe

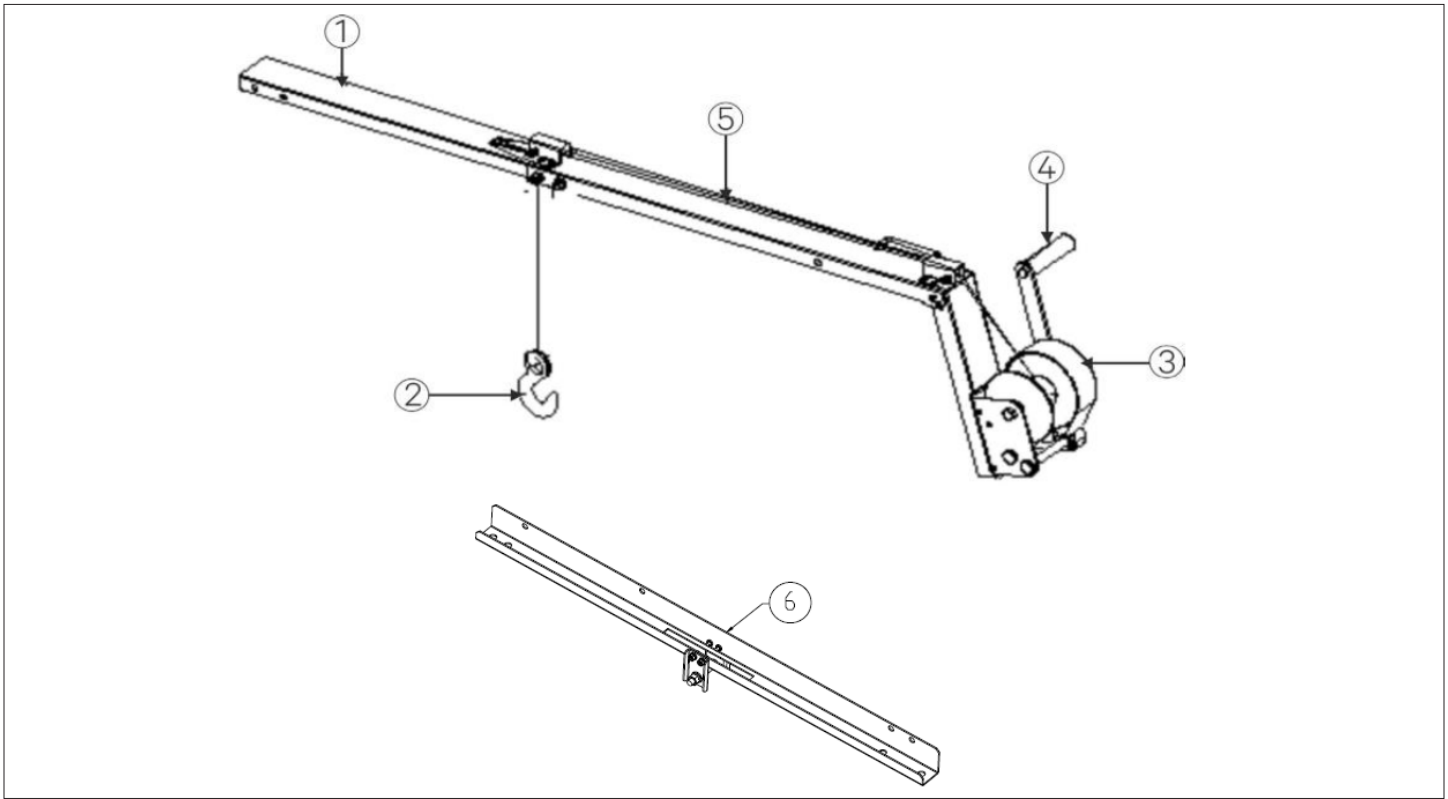
Figure 2-25 Connection of Chilled Water Supply and Return Pipes (downflow units)

Table 2-8 Male Screw of Chilled Water In and Out Pipes

Model	Male Screw of Chilled Water In & Out Pipes (inch)
P1030~P1050	R1 1/4"
P1060~P2080	R1 1/2"
P2090~P2140	R2
P3150~P3200	R2 1/2"

2.5. Lowering the Fan

Before commissioning, the EC fans of the downflow unit must be lowered. The downflow unit is equipped with a lowering tool when it is shipped. The lowering tool that uses winch is shown in Figure 2-26. It mainly includes, winch bracket, hook, sling, hand winch, handle, and a L-shaped lifting component.

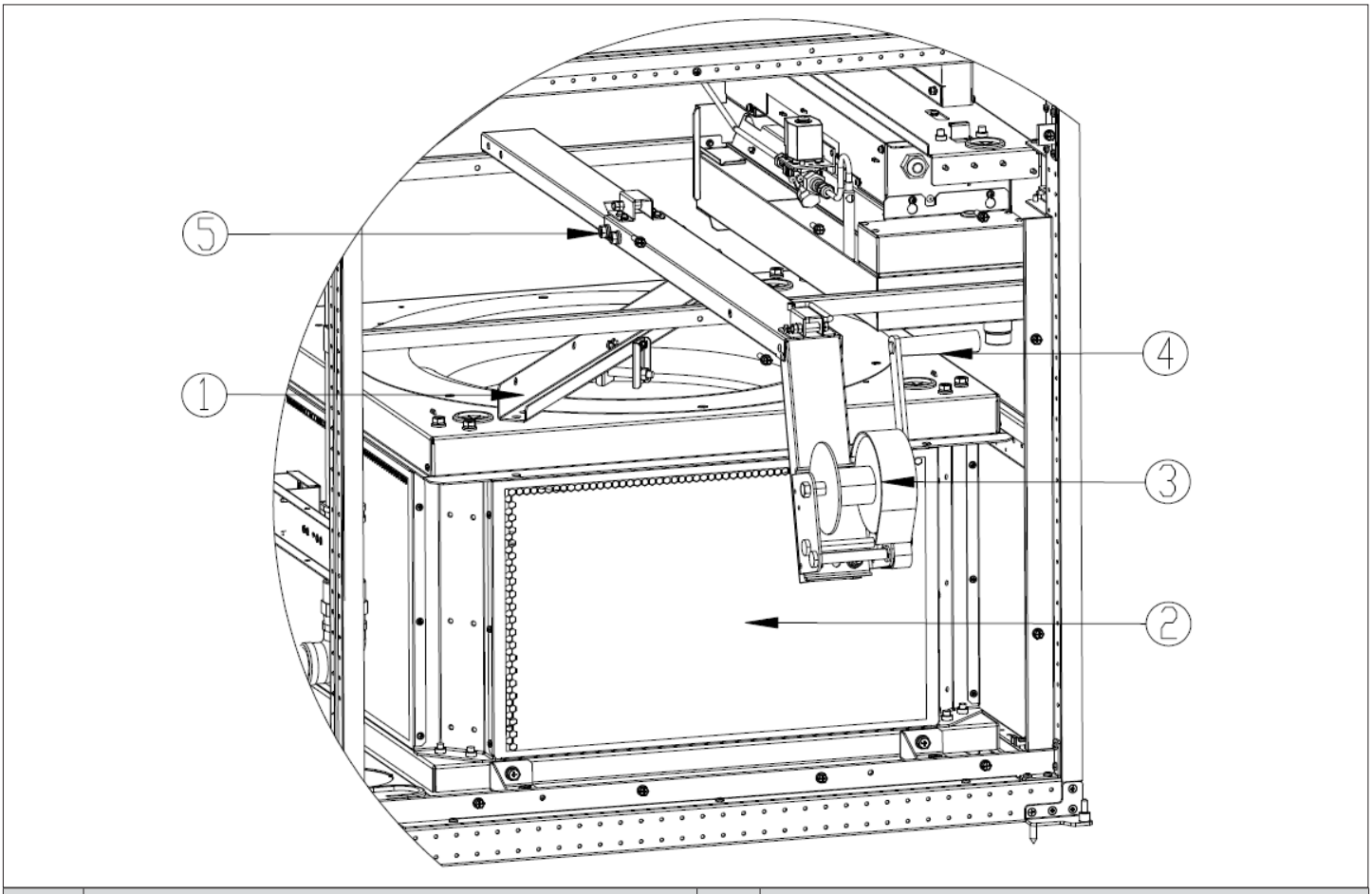


No.	Description	No.	Description
1	Winch bracket	4	Handle
2	Hook	5	Sling
3	Winch	6	L-shaped beam

Figure 2-26 Fan Elevator Assembly (Winch mode)

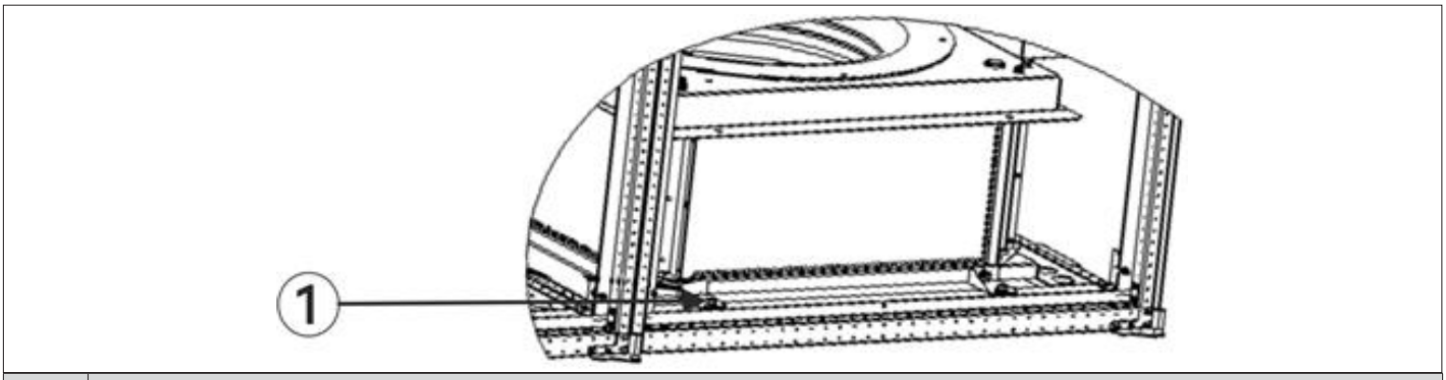
- **Lowering Procedure**

1. Installing lift and lowering kit for lowering the fan: Open the unit maintenance cover, check the fixing bolts (refer, total two PCS) of the L-shaped lifting component to ensure that it is fixed properly, and then install the fixing bolts (total four PCS) of the winch bracket, as shown in Figure 2-27.
2. Turn the winch handle and use the winch hook to hook the L-shaped lifting component to the middle round hole (refer Figure 2-28). Adjust the handle until the sling is completely tight.
3. Cut the cable tie that binds the fan cables to ensure that the cable length meets the fan lowering requirements, and then remove the fixing bolts and washers (refer Figure 2-28, total four PCS) for fan lowering.
4. Hold the winch handle firmly, and then turn the handle counterclockwise to lower the fan. The status after the fan has been lowered is shown in Figure 2-29.



No.	Description	No.	Description
1	L-shaped beam	4	Winch handle
2	Fan	5	Fixing bolt
3	Winch		

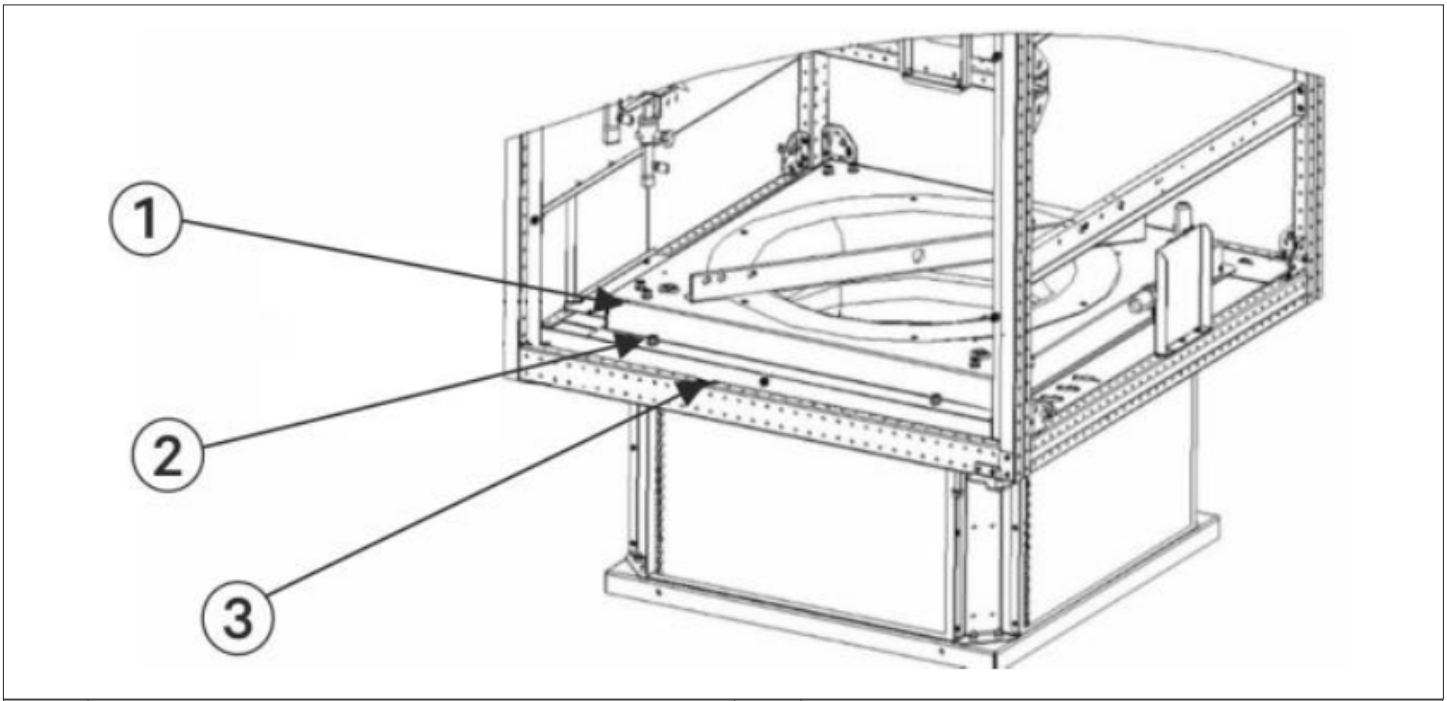
Figure 2-27 Installed Winch Bracket



No.	Description
1	Bolt

Figure 2-28 Position of Fixing Bolt

5. Install the fixing bolts, as shown in Figure 2-28 and hold the arrangement tight during operation with total four PCS of bolts.



No.	Description	No.	Description
1	Fan mount roof	3	The unit bottom
2	Bolt		

Figure 2-29 Lowered Fan

6. Remove the hook from the L-shaped lifting component, turn the handle clockwise, arranged the sling in order and remove the fixing bolts (refer Figure 2-28: Position of Fixing Bolt, totally two PCS) of the winch bracket, and take out the winch and the bracket assembly.
7. Remove the fixing bolts of the L-shaped lifting component and take out the L-shaped lifting component. At this point, the operation of lowering the fan of the one-bay unit is complete. For the unit with two fans, lower the other fan too, using the fan elevator assembly. The requirements are as follows:
8. Repeat steps 1-7 of the one-bay unit to lower the other fan.
9. After lowering all fans, arrange the fan cables in the correct order and fix them using a cable tie.
10. Confirm whether the EC fan has been lowered and installed and ensure that the blade does not touch the fan housing when the fan rotates.

In case of two bays and three bays units, electrical control boxes blocking the fan and infrared humidifier must be removed from the left side before lowering the fan.

2.5.1. Removing Fastener and Vibration Absorber

To protect components from damaging and distorting due to bumping, impact, and resonance in transportation, fasteners, and vibration absorbers are mounted at certain locations before delivery. Remove the fasteners and vibration absorbers before installation and commissioning.

2.5.2. Removing of Fasteners of Infrared Humidifier

The floating pole of the humidifier high water-level switch is tightly bound together with a rubber string before delivery, as shown in Figure 2-30. Remove the rubber string before the unit operation. Otherwise, the unit will not be able to detect the high water-level alarm.

The sheet metal cover of the high water-level switch should be reinstalled in the original position after removing the rubber string. Otherwise, it will produce condensate water when the unit is operating

Do not touch the lamps with the bare hands.

No.	Description	No.	Description
1	Plug terminal to water level switch	2	HWA plug terminal

Figure 2-30 High Water Level Detection Float Switch Lever and Terminal HWA

2.6. Installation Inspection

Table 2-9 Installation Inspection Checklist

Check Items	Results
Leave enough space around the unit for maintenance	
The equipment is installed vertically, and the installation fasteners have been fixed	
The chilled water pipes between the indoor and outdoor unit have been connected, and the ball valves of the indoor and outdoor unit have been fully opened	
Condensate pump has been installed (if required)	
The drain pipe has been connected	
The water supply pipe for the Infrared humidifier has been connected	
All pipe joints are tightened	
Fasteners for transportation have been removed	
Irrelevant things (such as transportation material, structure material, and tools) inside or around the equipment have been cleared after the equipment is installed	
The airflow distribution system has been installed in each room (e.g. raised floor/grill, duct, etc.)	
The upflow unit must have plenum or air duct connection, and after installation the fan and heater shall not be accessible	

After confirming the above checklist, follow the electrical installation.

Chapter 3: Electrical Installation

In this chapter, the electrical installation of the Liebert® PEX+ CW series is explained in-depth to help with the various tasks such as the installation notes, cable connections of the indoor unit and the inspection checklist.

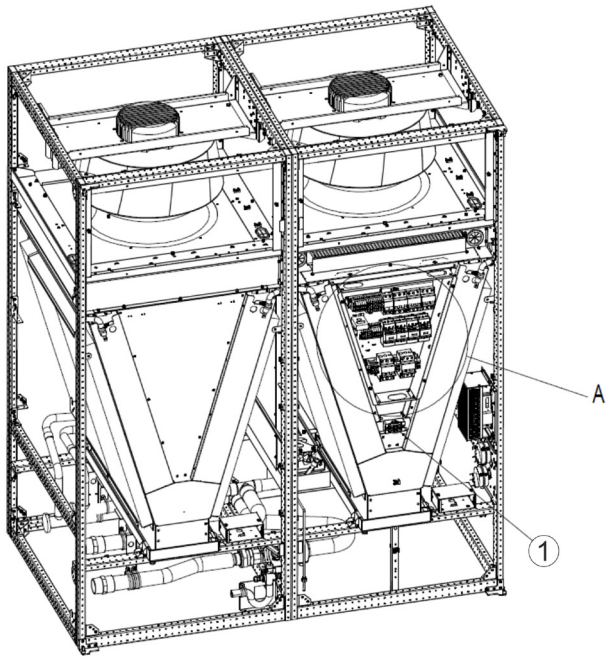
3.1. Installation Notes

- The connection of all power cables, control cables, and ground cables should comply with the local and national electrical regulations.
- The electrical installation and maintenance must be performed only by authorized trained professional or personnel.
- Refer the unit's nameplate for the full load current. The cable sizes should meet the local cabling norms and rules.
- Mains supply requirement: 380 Vac (-10% to +15%), 50 Hz, 3N
- If the soft power cable uses Y-connection, and if the cable is damaged, it must be replaced only by professional service personnel.
- Before the wiring, use a voltmeter to measure the power supply voltage and ensure that the power supply is switched off.
- The applicable grid for this air conditioner: TN, TT star connection power system; consult Vertiv local representative for other connections details.
- A breaker device must be provided to disconnect the unit from power supply. The recommended breaking type is EN60947; the recommended power cable type is EN60227.
- A breaker of 30 mA leakage current device should be provided.

3.2. Cabling of Indoor Unit

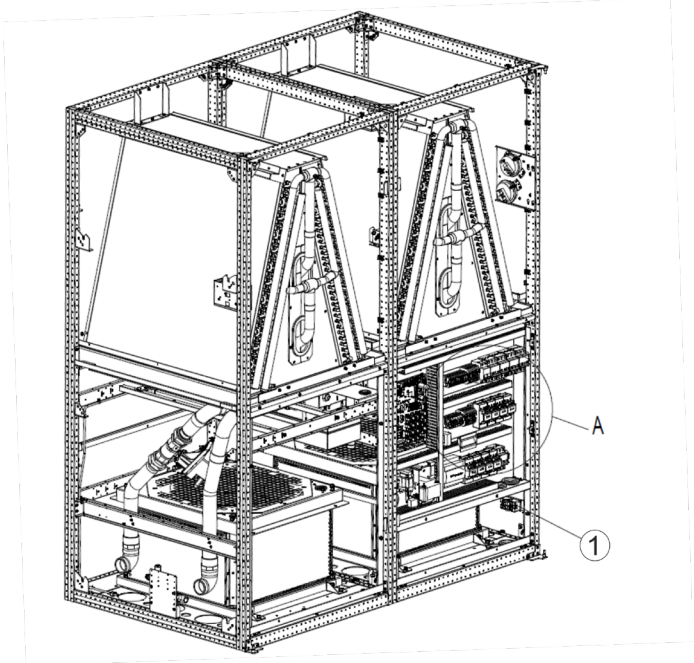
- Locating Electrical Ports of Indoor Unit

The locations of the low voltage devices are visible after opening the front door of the electrical control box of the indoor unit, as shown in Figure 3-1.and Figure 3-2 for upflow and downflow units respectively. The detailed distribution information of the low voltage components are differentiated according to the labels.
Refer Figure 3-3 for the amplified view of electrical box



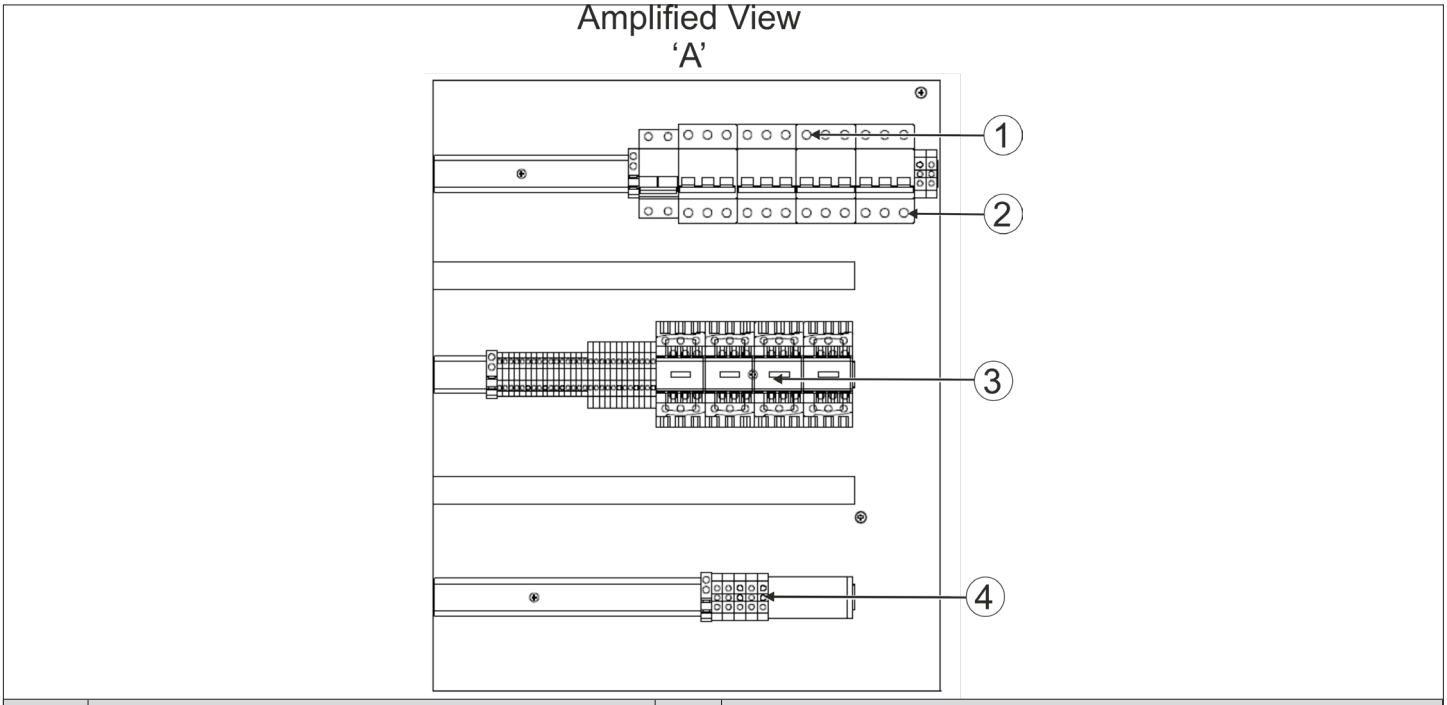
No.	Description
1	Cable clamp

Figure 3-1 Location of Electrical Control Box (Upflow unit)



No.	Description
1	Cable clamp

Figure 3-2 Location of Electrical Control Box (Downflow unit)



No.	Description	No.	Description
1	MCB	3	Connector and terminal block
2	Cable connector	4	Terminal block

Figure 3-3 Electrical Control Box of P2070DC

- Connecting Power Cable of Indoor Unit

Figure 3-4 shows the details of power connectors in electrical control box, connects terminals L1 ~ L3, N, and PE respectively to 3-phase external power supply. Reserve some redundancy of the incoming cable and fix the cable to the cable clamp located on the inner side panel of the unit, refer Figure 3-3. For cable specification and the rated Full Load Ampere (FLA) in the Table 3-1.

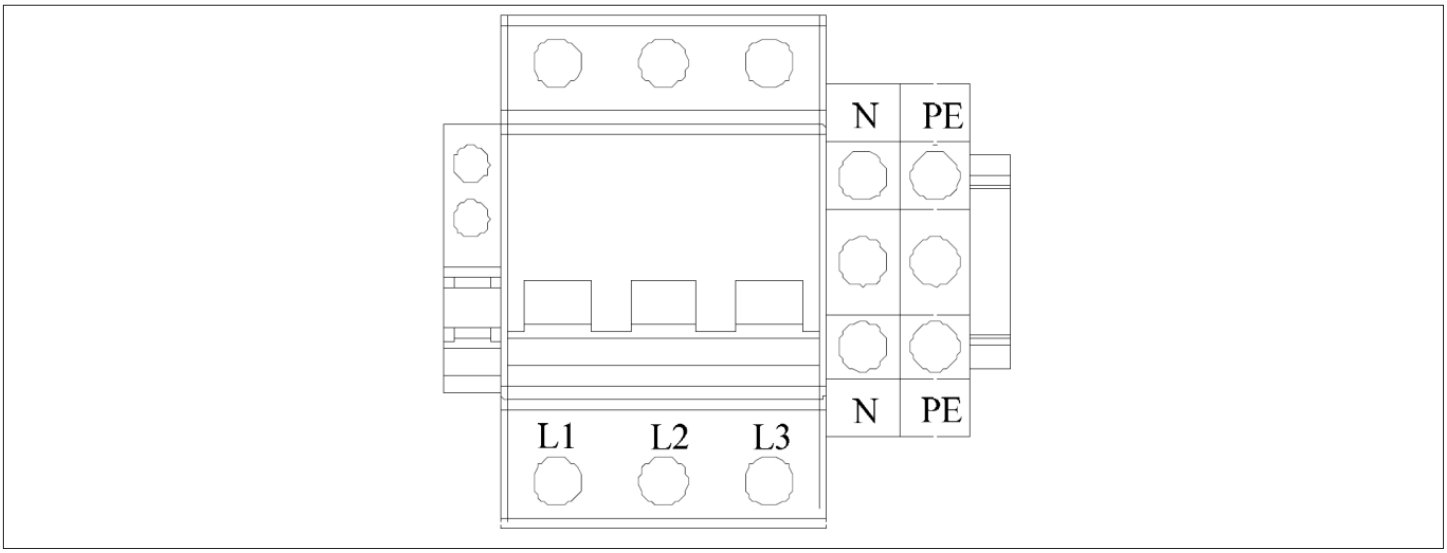


Figure 3-4 Enlarge View of Power Connector

The cable sizes should meet the local wiring regulations.

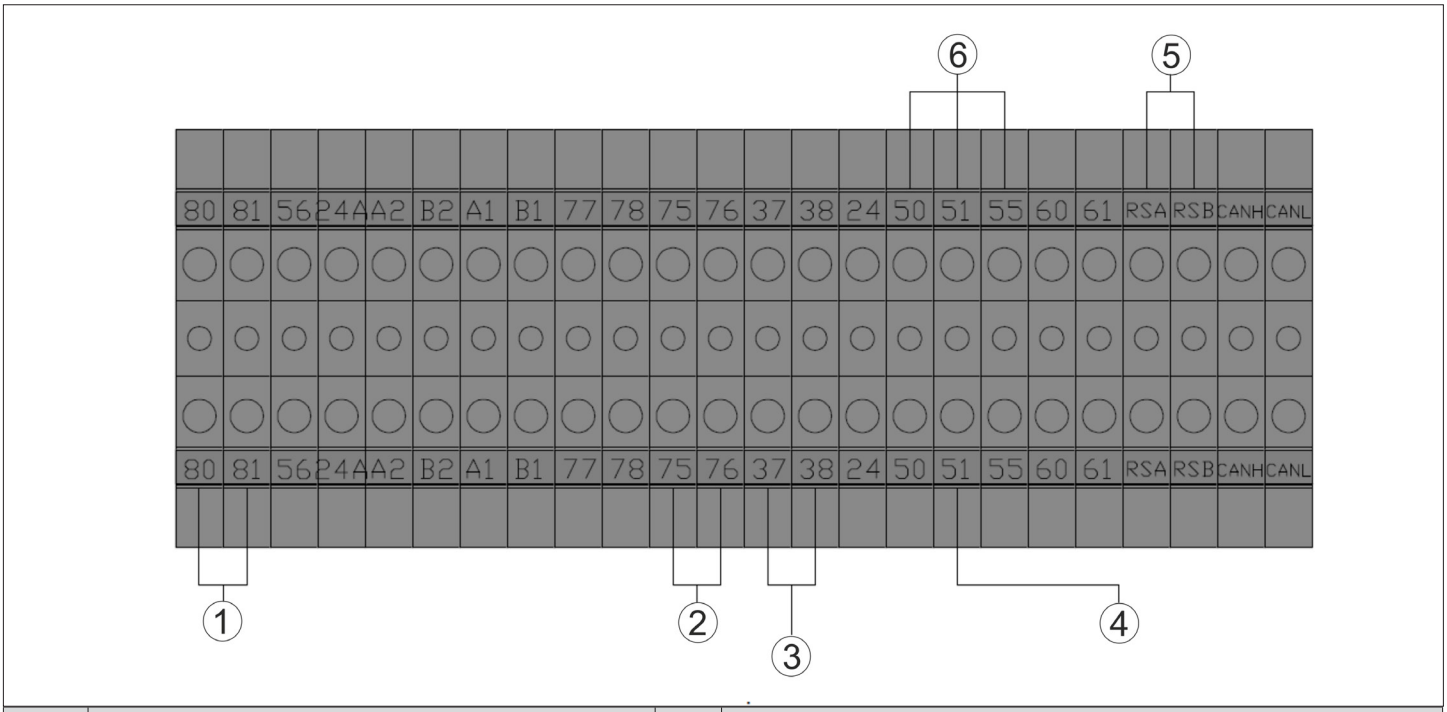
Table 3-1 Rated Full Load Ampere (FLA) (unit: A)

Model	Full Load Amps (Fans only – no heating and no humidification	Unit with 1 Stage Heating (No humidification)	Unit with 2 Stage Heating (No humidification)	Unit with Electrode Humidifier (No heating)	Unit with Infrared Humidifier (No heating)
	(A)	(B)	(C)	(D)	(E)
P1030	5.4	15.4	25.4	10.8	11.5
P1040	5.4	15.4	25.4	10.8	11.5
P1050	5.4	15.4	25.4	10.8	11.5
P1060	5.5	15.5	25.5	10.9	11.6
P2070	10.8	25.9	40.9	21.6	23.0
P2080	10.8	25.9	40.9	21.6	23.0
P2090	10.8	25.9	40.9	21.6	23.0
P2100	10.8	25.9	40.9	21.6	23.0
P2110	11.0	26.1	41.1	21.8	23.2
P2120	11.0	26.1	41.1	21.8	23.2
P2130	11.0	26.1	41.1	21.8	23.2
P2140	11.0	26.1	41.1	21.8	23.2
P3150	16.2	36.2	56.2	27.0	28.4
P3160	16.2	36.2	56.2	27.0	28.4
P3170	16.5	36.5	56.5	27.3	28.7
P3180	16.5	36.5	56.5	27.3	28.7
P3190	16.5	36.5	56.5	27.3	28.7
P3200	16.5	36.5	56.5	27.3	28.7

- *The standard model is configured with humidifier and 1-stage electrical heater.*
- *The FLA of the standard unit is the same as the unit fitted with 1-stage heater (no humidifier).*
- *MCB and cable sizes are selected as per the local electrical standards.*

- Connecting Control Cables

The position of field connection terminals is shown in Figure 3-1.and Figure 3-2 for upflow and downflow units respectively, and the amplified view is shown in Figure 3-5. The upper part of the terminal block is connected to the unit, while the lower part serves as user control signal interfaces.



No.	Description	No.	Description
1	External alarm output of the smoke sensor	4	Water leakage alarm terminal
2	Connecting common alarm terminal	5	R485 port
3	37/38 shorted remove upon remote shutdown	6	Customized alarm terminal 24 is the common terminal

Figure 3-5 Enlarged View of Terminal Block

Anti-static measures should be taken before connecting the control cables.

- Connecting Water Under Floor Sensor

Each unit is equipped with a water under floor sensor. Connect one end of the sensor to Terminal 51# and the other end to the common Terminal 24#.

The number of the sensors in parallel connection can be connected, but each unit has only one water under floor alarm.

- Remote Shutdown

As shown in Figure 3-5, 37# and 38# terminals can connect to remote shutdown switch, which has been shorted in the factory and the shorting cable should be removed if the terminals are to be connected to the remote shutdown switch.

When Terminal 37# and Terminal 38# are opened, the unit will be shut down.

- Smoke Detector

Terminals 80# and Terminal 81# are used to connect output external alarms for the smoke sensor.

- Customized Alarm Terminal

Terminal 50#, Terminal 51# and Terminal 55# can be connected to three kinds of sensors such as smoke sensor and water-under-floor sensor, and Terminal 24# is their common terminal. After the customer terminals are connected with external alarm signals, set the corresponding customized alarm through the iCOM controller, for more information refer to the Section 4.6.5 Set Alarms.

When the contact is open and no external alarm is generated, the input state of the customer terminal is open. But when the contact is closed and the external alarm is generated, the input state of the customer terminal will be shorted.

At this point, the air conditioner system will generate an audible alarm, and the iCOM controller LCD will display the alarm information.

Terminal 50# and Terminal 24#: Remote alarm (optional).

Terminals 51# and Terminal 24#: Water sensor (by default).

Terminals 55# and Terminal 24#: Setting safe switch for condensation water pump (optional).

- CPSS

When the CPSS is configured in the unit then connect one end of the CPSS to Terminals 55#, and the other end to the common Terminals 24#.

- External General Alarm

Terminals 75# and Terminal 76# can be connected to the external general alarms. These terminals are controlled by the common alarm relay K3 on the circuit board. The terminals output signal to external alarm devices, such as alarm indicator. When a critical alarm occurs, the contactor will be closed to trigger remote alarms, send signals to the Building Management System (BMS) or dials the paging system automatically. The power supply of the external general alarm system is user-prepared.

For the detailed definition of other terminals, refer to Appendix 1 Circuit Diagram.

3.3. Electrical Installation Checklist

After the electrical installation is completed, confirm the following points as given in the following Table 3-2.

Table 3-2 Electrical Installation Checklist

Items	Results
The power supply voltage meets the rated voltage on the unit nameplate	
The system electric loop has no open circuit or short circuit	
Power cables and ground cables to the MCBs and indoor unit are well connected	
The ratings of the MCBs and fuses are correct	
The control cables are well connected	
All the cables connections are fastened, with no loose screws	
Control transformer setting matches the incoming power.	

Do not power On the unit until the Installation team has checked and confirmed all the electrical installation parameters of the unit.

Chapter 4: iCOM Controller Operation

This chapter explains name, definitions, working and features of Liebert® iCOM controller, this includes LCD, Button, Structure Chart of Control Menu, Start-Up Interface, Main Interface and Event features. The iCOM controller adopts various menu operation, display board monitors. It also enables user easy browsing or settings values; to access event records, graph data, sensor data and alarm setting through various menu options on the screen.

It features a LCD backlight screen designed for saving energy. If no button is pressed within a certain period of time (default: 5min), the backlight will be Off, until one of the buttons is pressed.

The advanced microprocessor makes the Liebert PEX+ chilled water AC control the temperature and humidity of the equipment room accurately, Its features are as follows:

- Easy operation interface, multiple password protection to prevent unauthorized operation.
- Liebert iCOM has the restoration on a power-down and high, low voltage protection functions.
- Displays the operating time of important components through menu operation screen.
- Expert class malfunction diagnosis system can automatically display the present malfunction information to facilitate easy maintenance.
- It can store 400 historical records, including MESSAGE, WARNING and ALARM.
- It has RS485 interface, adopting the industrial communication protocol.
- Temperature setting value: the range is 5 °C to 40 °C.
- Humidity setting value: the range is 20% RH to 80% RH.
- Humidity control mode: the control modes contains Pred, Comp, Rel.
- Supply Air Temperature limit: Enable and Disable can be selected.
- Supply Air Temperature limit setting value: the range is 5 °C to 25 °C.

The microprocessor is capable of generating following audible and visual alarms.

1. High temperature alarm
2. Low temperature alarm
3. High humidity alarm
4. Low humidity alarm
5. Loss of airflow alarm
6. Some self-defined alarms

4.1. LCD Screen

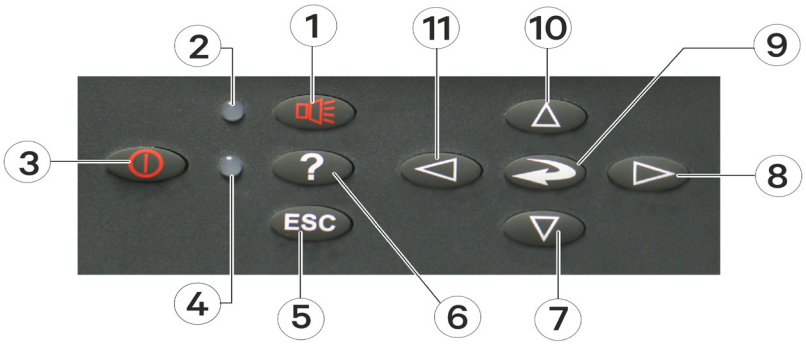
LCD Screen is located on the front panel of the Liebert PEX+CW series. The LCD displays the current state of the equipment room such as temperature, humidity and so on. You can also read and modify the equipment configuration through the LCD. The LCD uses white back-light, if no button is pressed within a certain period of time (settable; default: 5min), the back-light turns off until any one button of the panel is pressed.

4.2. Button and Indicator Panel

Nine buttons and two indicators are located on the button & indicator panel as shown in Figure 4-1, Including:

- Indicators: alarm indicator and operation indicator

Buttons: ON/ OFF button, Enter button, ESC button, Up button, Down button, Left button, Right button, Alarm silence button, and Help button.



No.	Description	No.	Description
1	Alarm silence button	7	Down button
2	Alarm indicator	8	Right button
3	ON/OFF button	9	Enter button
4	Operation indicator	10	Up button
5	ESC button	11	Left button
6	Help button		

Figure 4-1 Button and Indicator Panel

The indicators are described in Figure 4-2. The functions of the buttons are described in Table 4-2.

Table 4-1 Indicator Description

Indicator	Description
Alarm indicator	The alarm indicator turns on red upon alarms triggered. It is off after the alarm has been cleared
Operation indicator	The operation indicator turns on green when the unit is operating. When the unit is shut down, the indicator is yellow

Table 4-2 Button Description

Button	Function Description
ON/OFF button	• Switch on/ off the system. Press the ON/ OFF button to shut down the unit, or to start an idle system. • Test the display state of the back-light of the LCD and operation indicator. • After powering-on, when the system is stand-by (defined as test state in this manual), press the ON/ OFF button to turn on the unit, the indicator turns to green, and the LCD back-light turns on. This is for testing whether the LCD back-light and operation indicator are normal.
Enter button	• Enter the selected menu or save the setting after parameters are changed. Select the menu or parameter by pressing the direction button, the menu and the parameter is high-lighted. • Test the display of characters. • When the system is in the test state, press the Enter button that will display the ASCII code. This function is used to test whether the characters are displayed normally on the LCD.
ESC button	• Quit the current menu. • Cancel the current change of parameters. • Test the LCD high light. • Press the ESC button to switch the LCD between light and high light when the system is in the test state. This function can test whether the LCD high light is normal.
Up button	• Increase the value of the displayed parameters during parameter setting. • Scroll a row or a screen up in the query state. • Test the buzzer. • Press the Up button when the system is in the test state to increase the buzzing frequency (initial value: 0%). Meanwhile the buzzer will sound at the set frequency. This function is used to test whether the buzzer is normal.
Down button	• Decrease the value of the displayed parameters during parameter setting. • Scroll a row or a screen down in the query state. • Test the buzzer. • If the buzzer frequency is not 0%, press the down button to decrease the buzzing frequency when the system is in the test state. Meanwhile the buzzer will sound at the set frequency. This function is used to test whether the buzzer is normal.

Button	Function Description
Left button	• Select the left bit during the parameter setting operation. • Test the LCD contrast. • Press the Left button when the system is in the test state to decrease the LCD contrast (by default: 100%) This function is used to test whether the LCD contrast is normal.
Right button	• Select the right bit during the parameter setting operation. • Test the LCD contrast. • If the LCD contrast is not 100%, press the right button when the system is in the test state to increase the LCD contrast. This function is used to test whether the LCD contrast is normal.
Alarm silence button	• The system will issue an alarm sound upon alarms. If you press the Alarm Silence button, the alarm sound will be eliminated. • Clear the current alarm after the alarm sound is silenced. • Test the alarm indicator and rest the LCD contrast and buzzer frequency. • Press the alarm silence button when the system is in the test state to switch the alarm indicator between on and off. It can test whether the alarm indicator is normal. Meanwhile, reset the LCD contrast to 100% and buzzer frequency to 0%.
Help button	• Display the online help. • Test the yellow display of the LCD operation indicator. • When the system is in the test state, press the Help button to switch on and off the LCD operation indicator. This function is used to test whether the yellow display of the LCD operation indicator is normal.

- *After the system is power-on, the system will resume the operation state before power-off. For example, if the system is in the work state when its power-off, it goes to the work state automatically after power-on. You do not need to start it manually.*
- *When the system is in the test state, the setpoints will not be written into the iCOM controller.*

4.3. Start-Up Interface

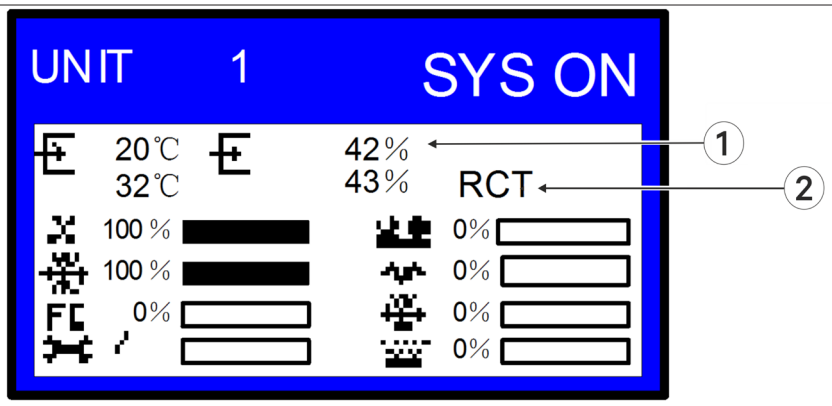
After the system is powered on, it is in the dwelling state. The LCD will display the interface shown in Figure 4-2.

Figure 4-2 Startup Interface

4.4. Main Interface

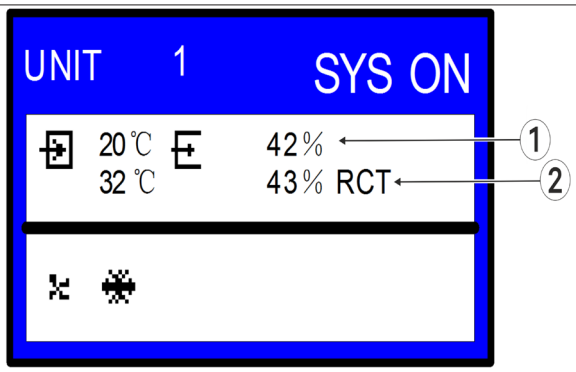
After power-on, the LCD will enter the main interface after about 60s. The main interface provides the general information about relative equipment status, including current temperature and humidity; temperature and humidity setpoints; equipment output status (fan, water valve, cooling, heating, dehumidifying, humidifying); alarm and maintenance status.

The main interface has two display modes: Graphical and Simple. The difference between these two display modes is that the graphical interface (see Figure 4-3) displays the percentage output chart of the function components, while the simple interface (see Figure 4-4) displays only the icons of current operation mode only. The switching of two modes can be realized by operating the menu. For details, refer to DISPLAY SETUP.
The upper left corner of the main interface displays the current unit number; the upper right corner displays the current system status If there is no button operation for 255sec on other menu display screen, the LCD screen returns to the main interface.



No.	Description	No.	Description
1	Setpoint	2	Present value

Figure 4-3 Graphical Mode of Main Interface



No.	Description	No.	Description
1	Setpoint	2	Present value

Figure 4-4 Simple Mode of Main Interface

The icons of the graphical and simple modes on the main interface are defined in Table 4-3.

Table 4-3 Definition of Icons

Icon	Definition	Icon	Definition
	Fan running	FC	Free cooling
	Cooling		Maintenance
	Hot water heating		Dehumidifying
	Electrical heating		Humidifying

4.5. User Menus

Press the enter or down button on the main interface to enter the User Menus, as shown in Figure 4-5. The User Menus are displayed in six pages, each displaying one or two submenus. Press the Enter button to highlight the submenu, the Up or Down button to browse the submenus, and the Enter button to enter the selected one.

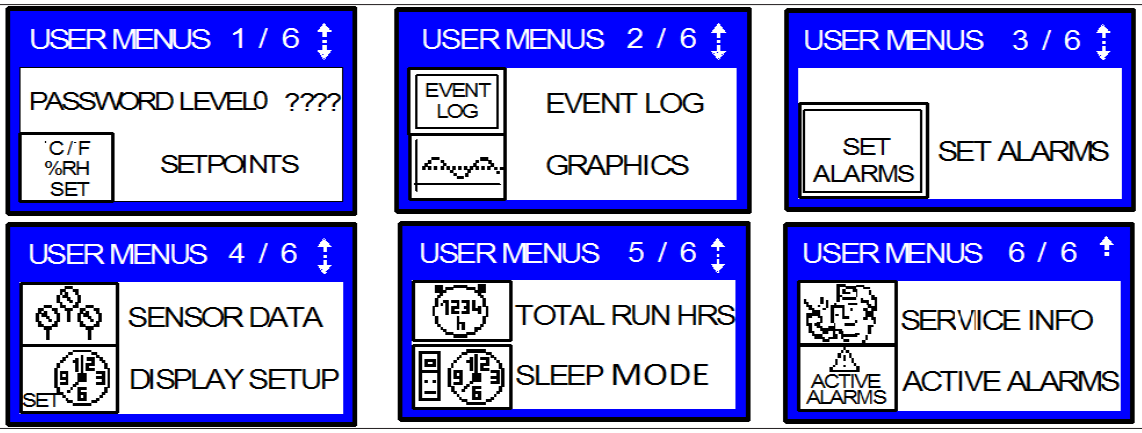


Figure 4-5 User Menus

Refer Appendix II, the structure chart of iCOM controller (User Menu)

4.5.1. Password

The password is necessary for different level menus. After entering the password (user password: 149), use the up and down navigation buttons to browse/ change all the options/parameters in User Menu, and then press the enter button to enter the selected option.

4.5.2. Setpoints

The setpoints disappear when the power is lost. Use the User Menus to browse and set parameters in the SETPOINTS submenu. The left row displays the parameter codes; the middle row; the parameter name; the right row and the setpoints, as shown in Table 4-4.

Table 4-4 Descriptions of Setpoint Parameters

Parameters		Default	Setting range	Description
U102	TEMP SET	23 °C	5 °C to 40 °C	Temperature Setpoint
	TEMP ACT	23 °C	0 °C to 45 °C	Temperature Setpoint Act
U103	TEMP SENS	2 (Return Sensor)	0 = SUP 1 = REM 2 = RET	Temperature Control Sensor
U104	HUM SET	50%	20% to 80%	Humidity Setpoint
		8.9 °C	5.0 °C to18.3 °C	Dew Point Setpoint
U105	HUM SENS	2 (Return Sensor)	1 = REM 2 = RET	Humidity Control Sensor
U106	HUM CTRL	2 (Predictive)	0 = Rel 1 = Comp 2 = Pred 3 = DewP	Humidity Control Type
U107	FAN SET	22.8 °C	5.0 °C to 40.0 °C	Fan Setpoint
U108	FAN SENS	2 (Return Sensor)	0 = SUP 1 = REM 2 = RET 3 = MAN	Fan Control Sensor
U110	SMART AI	0 (Disabled)	0 = No 1 = Yes	Smart Aisle Enabled
U113	2ND SETP	23 °C	5 °C to 40 °C	2nd Temperature Setpoint
U114	SUP TEMP	5 °C	5 °C to 27 °C	Supply Temp Limit Setpoint
U116	BACK TSP	23 °C	5 °C to 40 °C	BMS Backup Temp Setpoint
U117	BACK FAN	23 °C	5 °C to 40 °C	BMS Backup Fan Setpoint
	BACK SPD	100%	0% to 100%	BMS Backup Fan Speed
U119	RCOMP SP	23 °C	5 °C to 40 °C	Return Compensation Setpoint

If you want to modify the preceding setpoints, enter the password before entering the SETPOINTS menu. Then press the Enter button to enter the submenu and use the Up and Down button to scroll the options. Press the Enter button to select one parameter, use the Up or Down button to set the value, and press the Enter button to save the change.

4.5.3. Event Log

You can enter the EVENT LOG menu without a password, as shown in the Figure 4-6.

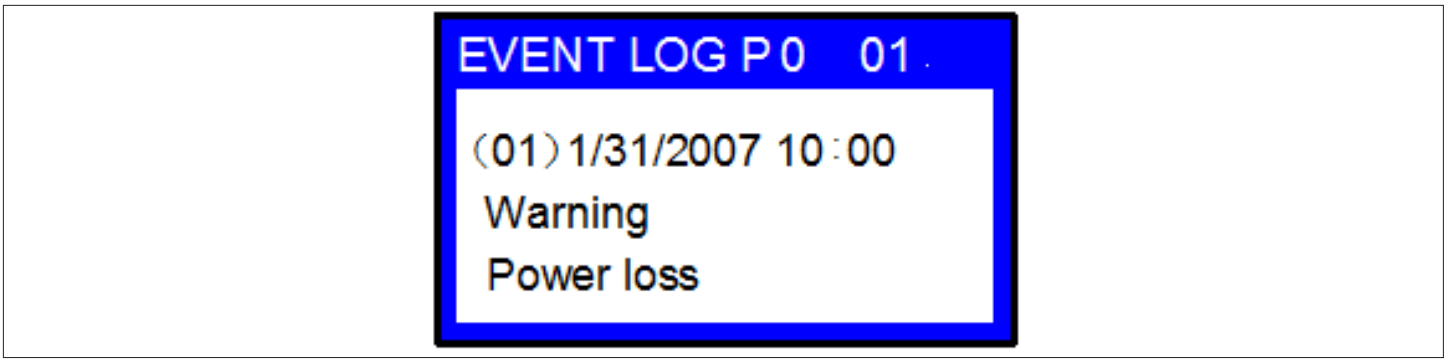


Figure 4-6 Event Log Menu

The EVENT LOG menu saves the last 400 system records. The event types include message, warning and alarm

- When the event type shows 'Message', the LCD will display the event name only.
- When the event type shows 'Warning', the LCD will display the event name and the alarm indicator turns red.
- When the event type shows 'Alarm', the LCD will display the event name, the alarm indicator will turn red, and an audible alarm will be raised.

4.5.4. Graphics

The GRAPHICS menu provides two types of graphs: COOLING CONTROL TEMPERATURE, CONTROL HUMIDITY, FAN CONTROL, TEMPERATURE and CONTROL DEW POINT. Whether it shows humidity or dew point depends on Humidity Control Type selection. These graphs reflect the temperature and humidity (or dew point) changes over a period of time in the past.
In the graphs, the current temperature or humidity (or dew point) is the origin, the time is the horizontal axis, and the temperature or humidity (or dew point) is the vertical axis, as shown in the Figure 4-7.

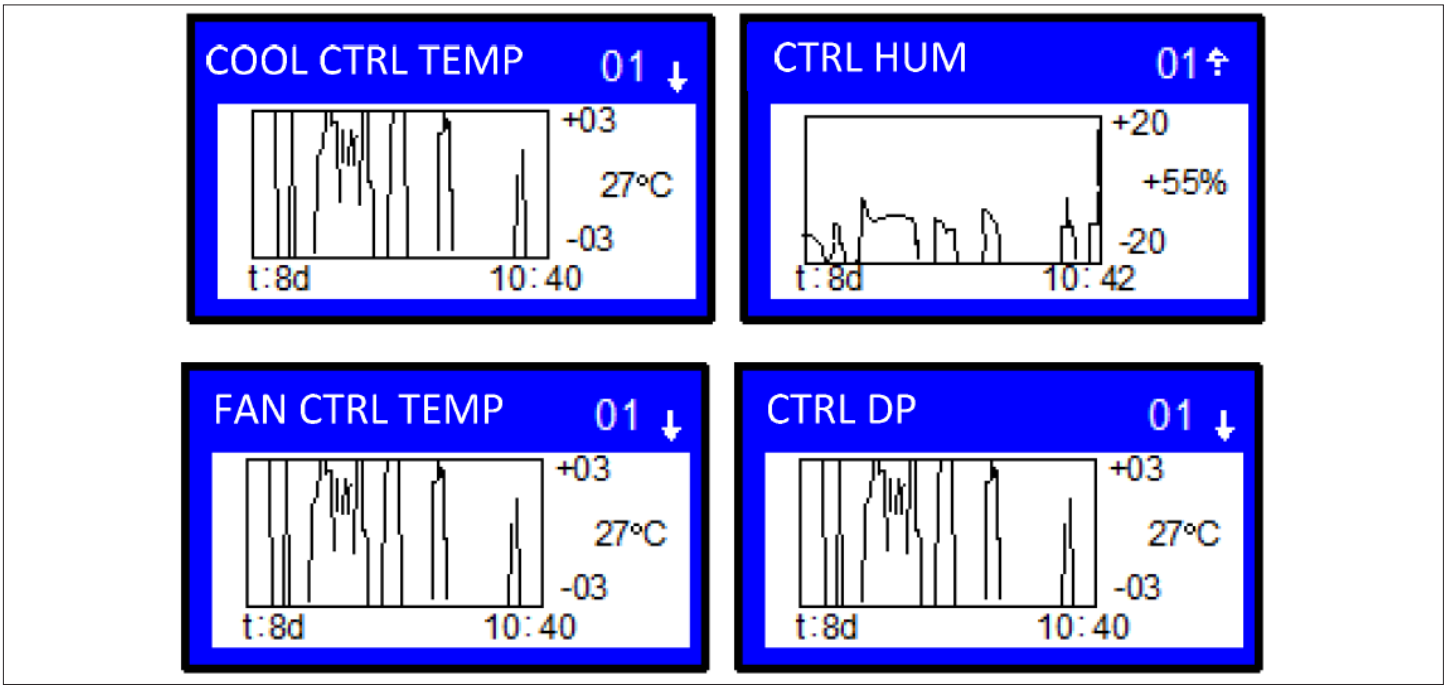


Figure 4-7 The Graph of Return Temperature and Return Humidity

As the horizontal axis, the time range can be set into nine types. Each pixel indicates different time in different time ranges. See Table 4-5 for the detailed time range. The height of the graph scale can be set between 2 °C and 20 °C (4°F and 36°F) / 2% RH and 20% RH. The greater the scaling range is, the greater the value each pixel indicates, and the graph will be more centered.

The Parameters can be set without entering the password. Press the enter button to highlight the parameters, use the up or down button to select a parameter. Then press 'Enter button' again to enter the parameter and use the up or down button to set the value. Press the Enter button to finally save the change.

Table 4-5 Time Range

Time Range	Time Indicated by Each Pixel	Time Range	Time Indicated by Each Pixel
8min	6s	2d	36min
32min	24s	4d	72min
1hr	45s	8d	144min
12hr	9min	16d	288min
24hr	18min		

4.5.5. Set Alarms

The SET ALARMS menu is used to set the upper and lower limits of temperature and humidity alarms. The settings will not be lost when the power supply fails. User can select the 'SET ALARMS' submenu to browse and set the parameters through the USER MENUS. The parameters are described in Table 4-6.

It is not recommended to change the system defaults. If user consider it necessary to change the defaults, consult Vertiv personnel.

Table 4-6 Descriptions of SET ALARMS Parameters

Parameters		Default	Setting Range	Description
U202	RTN SNSR	1 (Enabled)	0 = No 1 = Yes	Std. Sensor Alarms Enable
U203	HI TEMP	37.8 °C	1 °C to 99 °C	Std. Sensor High Temperature Alarm
U204	LO TEMP	18.3 °C	1 °C to 99.°C	Std. Sensor Low Temperature Alarm
U205	HI HUM	65%	1% to 99%	Std. Sensor High Humidity Alarm
U206	LO HUM	35%	1% to 99%	Std. Sensor Low Humidity Alarm
U207	SENSOR A	0 (Disabled)	0 = No 1 = Yes	Sensor alarm enable
U208	HI TEMPA	32.3 °C	1.0 - 99.0 °C	Sensor A High Temperature Alarm
U209	LO TEMPA	12.8 °C	1.0 - 99.0 °C	Sensor A Low Temperature Alarm
U210	HI HUM A	70.0%	1.0 - 99.0 %	Sensor A High Humidity Alarm
U211	LO HUM A	30.0%	1.0 - 99.0 %	Sensor A Low Humidity Alarm
U213	SUP SNSR	0 (Disabled)	0 = No 1 = Yes	Internal Temperature Sensor Alarms Enable
U214	HI SUP T	23.9 °C	1.0 - 99.0 °C	Internal Sensor High Temperature Alarm
U215	LO SUP T	10.0 °C	1.0 - 99.0 °C	Internal Sensor Low Temperature Alarm
U219	REM SNSR	0 (Disabled)	0 = No 1 = Com 2 = Sep	Remote Sensor Alarms
U220	HI REM	32.3 °C	1.0 - 99.0 °C	High Remote Temperature
U220	LO REM	12.8 °C	1.0 - 99.0 °C	Low Remote Temperature
U224	HIREM 01	32.3 °C	1.0 - 99.0 °C	High Remote Temperature 01
U224	LOREM 01	12.8 °C	1.0 - 99.0 °C	Low Remote Temperature 01
U225	HIREM 02	32.3 °C	1.0 - 99.0 °C	High Remote Temperature 02
U225	LOREM 02	12.8 °C	1.0 - 99.0 °C	Low Remote Temperature 02
U226	HIREM 03	32.3 °C	1.0 - 99.0 °C	High Remote Temperature 03
U226	LOREM 03	12.8 °C	1.0 - 99.0 °C	Low Remote Temperature 03
U227	HIREM 04	32.3 °C	1.0 - 99.0 °C	High Remote Temperature 04
U227	LOREM 04	12.8 °C	1.0 - 99.0 °C	Low Remote Temperature 04
U228	HIREM 05	32.3 °C	1.0 - 99.0 °C	High Remote Temperature 05
U228	LOREM 05	12.8 °C	1.0 - 99.0 °C	Low Remote Temperature 05
U229	HIREM 06	32.3 °C	1.0 - 99.0 °C	High Remote Temperature 06
U229	LOREM 06	12.8 °C	1.0 - 99.0 °C	Low Remote Temperature 06
U230	HIREM 07	32.3 °C	1.0 - 99.0 °C	High Remote Temperature 07
U230	LOREM 07	12.8 °C	1.0 - 99.0 °C	Low Remote Temperature 07
U231	HIREM 08	32.3 °C	1.0 - 99.0 °C	High Remote Temperature 08
U231	LOREM 08	12.8 °C	1.0 - 99.0 °C	Low Remote Temperature 08

Parameters		Default	Setting Range	Description
U232	HIREM 09	32.3 °C	1.0 - 99.0 °C	High Remote Temperature 09
U232	LOREM 09	12.8 °C	1.0 - 99.0 °C	Low Remote Temperature 09
U233	HIREM 10	32.3 °C	1.0 - 99.0 °C	High Remote Temperature 10
U233	LOREM 10	12.8 °C	1.0 - 99.0 °C	Low Remote Temperature 10
U235	STPR MSG	0 (Disabled)	0 = No 1 = Yes	Static Pressure Message Enable
U236	HI STAT	320 Pa	2 - 350 Pa	High Static Pressure Alarm Border Pa
U237	LO STAT	0 Pa	0 - 348 Pa	Low Static Pressure Alarm Border Pa
U238	STAT OFF	0 (No)	0 = No 1 = Yes	Stat Pres Msg Disable for Unit Off
U239	STAT FAN	0 (No)	0 = No 1 = Yes	Stat Pres Msg Disable for Fan Events
U240	HI RANG	320 Pa	0 - 350 Pa	SP Transducer High Range Pa
U241	LO RANG	0 Pa	0 - 348 Pa	SP Transducer Low Range Pa

To browse through the menu, press the enter button to highlight the option, and use the up or down button to scroll. Password is required for changing the setpoints. Then, enter the SET ALARMS menu, press the enter button to highlight the option, use the up or down button to browse the submenu. Press the enter button to enter the selected parameter. Use the up or down button to change the setpoints, and press the enter button to save the change, or press the ESC button to quit the change.

4.5.6. Sensor Data

The data acquired can be monitored by the sensors through the SENSOR DATA menu. The values are read only; no setting or change is allowed.

4.5.7. Display Setup

The DISPLAY SETUP menu is used to set the LCD display attributes. Password is not required for changing the setpoints. The parameters are described in the Table 4-7.

Table 4-7 Descriptions of DISPLAY SETUP Parameters

Parameters		Default	Setting range	Description
U401	LANGUAGE	EN	0 = EN 1 = DEU 2 = ITA 3 = FRE 4 = ESP 5 = POR 6 = CZE 7 = RUS 8 = CHI 9 = GRE 10 = SWE 11 = TUR 12 = HUN 13 = POL 14 = JAP 15 = THA 16 = Lan17 17 = Lan18 18 = Lan19 19 = Lan20 20 = Lan21	Language options
U402	YEAR			Current year
U402	MONTH			Current month
U402	DAY			Current day
U403	HOUR		h	Current hour
U403	MINUTE		min	Current minute
U403	SECOND		s	Current second
U404	TEMP F/C	0 (°C)	0 =°F, 1 = °C	Temperature indication
U405	CONTRAST	50%	From 0% to 100%	Display contract
U406	BUZ FREQ	50%	From 0% to 100%	Buzzer frequency. 0% means buzzer silenced
U406	BUZ TEST	0 = Off	0 = Off, 1 = On	Buzzer frequency test switch. It determines whether or not there will be sound accompanying the adjustment of BUZ FREQ through the setting
U407	BACKLITE	1 (5min)	1 = 5 m 2 = 10 m 3 = 30 m 4 = 1 h 5 = 12 h	Backlight time, or the backlight time when there is no button operation
U408	SCREEN	2 (Simple)	1 = Graph 2 = Simpl 3 = Graph 4 = Simpl	Main interface display mode
U410	DISPLAY	0 (Norma)l	0 = Norm, 1 = Inv	Display color
U412	DATE	0 (mm/dd/yyyy)	0 = mm/dd/yyyy 1 = dd.mm.yyyy 2 = yyyy-mm-dd	Date display format
U415	SHOW SUP	1 (Yes)	0 = No, 1 = Yes	Show Supply Temp at Unit Off

4.5.8. Total Run Hrs

The TOTAL RUN HRS menu records the total run time (unit: hr) of the system components. You can also set the run time limits of the system components through this menu. If the actual component run time exceeds the set limit, alarms is triggered.

This menu requires password. You can reset the total run time to zero to restart timing. The parameters on this menu are described in the Table 4-8. Each component has a LIMIT option to set the run time limit of the corresponding component.

Table 4-8 Descriptions of TOTAL RUN HRS Parameters

Parameters		Default	Setting Range	Description
U502	MOTOR(S)	-	6 digits	Total Run Hours Fan Motor DINT
U502	LIMIT	32000	0 - 32001	Run Hours Threshold Fan Motor
U505	CW	-	6 digits	Total Run Hours Chilled Water DINT
U505	LIMIT	32000	0 - 32001	Run Hours Threshold Chilled Water
U508	EL HEAT1	-	6 digits	Total Run Hours El. Heater 1 DINT
U508	LIMIT	32000	0 - 32001	Run Hours Threshold El. Heater 1
U509	EL HEAT2	-	6 digits	Total Run Hours El. Heater 2 DINT
U509	LIMIT	32000	0 - 32001	Run Hours Threshold El. Heater 2
U510	EL HEAT3	-	6 digits	Total Run Hours El. Heater 3 DINT
U510	LIMIT	32000	0 - 32001	Run Hours Threshold El. Heater 3
U511	HUM	-	6 digits	Total Run Hours Humidifier DINT
U511	LIMIT	32000	0 - 32001	Run Hours Threshold Humidifier
U512	DEHUM	-	6 digits	Total Run Hours Dehum DINT
U512	LIMIT	32000	0 - 32001	Run Hours Threshold Dehum
U517	UNIT ON	-	0 - 999999 h	Total Run Hours Unit

Timers resetting is not needed unless the components are replaced.

4.5.9. Sleep Mode

In the sleep mode, the air conditioner unit can realize auto-On/ Off. Through the SLEEP MODE menu, you can set two-time zones of the sleep mode, and select the sleep timing mode. The parameters on this menu are described in Table 4-9.

Table 4-9 Descriptions of SLEEP MODE Parameters

Parameters		Default	Setting Range	Description
U602	SLEEP EN	0 (No)	0 = No 1 = Yes	Sleep Mode Enable
U604	MON	0 (No)	0 = No 1 = Yes	Sleep on Monday
U604	TUE	0 (No)	0 = No 1 = Yes	Sleep on Tuesday
U604	WED	0 (No)	0 = No 1 = Yes	Sleep on Wednesday
U604	THU	0 (No)	0 = No 1 = Yes	Sleep on Thursday
U604	FRI	0 (No)	0 = No 1 = Yes	Sleep on Friday
U604	SAT	0 (No)	0 = No 1 = Yes	Sleep on Saturday
U604	SUN	0 (No)	0 = No 1 = Yes	Sleep on Sunday
U606	START 1	0	Time (hh)	Sleep 1 from (hour)
		0	Time (mm)	Sleep 1 from (minute)
	STOP 1	0	Time (hh)	Sleep 1 to (hour)
		0	Time (mm)	Sleep 1 to (minute)
U608	START 2	0	Time (hh)	Sleep 2 from (hour)
		0	Time (mm)	Sleep 2 from (minute)
	STOP 2	0	Time (hh)	Sleep 2 to (hour)
		0	Time (mm)	Sleep 2 to (minute)
U609	TIME MOD	0 (No)	0 = No 1 = Yes 2 = Auto	Timer Mode
U610	TIME TYP	0 (Sys Off)	0 = S.OFF 1 = DEADB	Timer Mode Type
U611	DEADBAND	2.3 K	2 to 15 K	Deadband for Timer Mode

4.6. Service Info

The SERVICE INFO menu provides the contact information of customer service personnel. This information is read only.

4.7. Active Alarms

The ACTIVE ALARMS menu displays the active alarms of the system. No password is required to access this menu.

4.8. Event Name and Definition

Table 4-15 shows events name and its definition

Table 4-10 Event Name and Definition

Event	Definition
General Alarm	General Alarm
HIGH CW TEMP	Chilled water high temperature
LOSS OF CW FLOW	Loss of chilled water
EL HEAT HIGH TEMP	Electric heater high temperature
LOSS OF AIRFLOW	Loss of air flow
CLOGGED FILTERS	Clogged filters
CUSTOMER INPUT n (n = 1 ~ 4)	Customer input n (n = 1 ~ 4)
CALL SERVICE	Call for service
HIGH TEMPERATURE	High temperature alarm
LOSS OF AIR BLOWER 1	Loss of air blower 1
HIGH ROOM TEMP	High room temperature
LOW ROOM TEMP	Low room temperature
HIGH ROOM HUM	High room humidity
LOW ROOM HUM	Low room humidity
HIGH TEMP SENSOR A	High temperature of sensor A
LOW TEMP SENSOR A	Low temperature of sensor A
HIGH HUM SENSOR A	High humidity of sensor A
LOW HUM SENSOR A	Low humidity of sensor A
UNIT HRS EXCEEDED	Unit has exceeded operating time
HUM HRS EXCEEDED	Humidifier has exceeded operating time limit
SUPPLY SENSOR FAILURE	Supply sensor failure
ROOM SENSOR FAILURE	Room sensor failure
SENSOR A FAILURE	Sensor A failure
NETWORK FAILURE	Network failure
UNIT ON	Unit on
UNIT OFF	Unit off
SLEEP MODE	Sleep mode
STANDBY MODE	Standby mode
POWER ON	Power on
POWER OFF	Power off
Unit n disconnected (n = 1 ~ 32)	Unit n disconnected (n = 1 ~ 32)

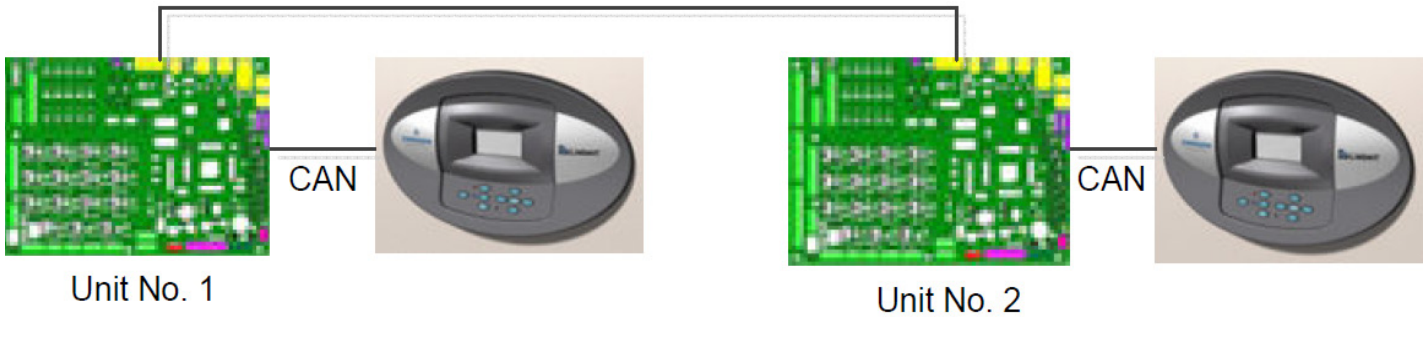
Event	Definition
ON-OFF KEY DISABLED	ON-OFF key disabled
VALVE HRS EXCEEDED	Valve has exceeded operating time limit
HIGH SUPPLY TEMPERATURE	High supply temperature
LOW SUPPLY TEMPERATURE	Low supply temperature
HIGH RETURN HUMIDITY	High return humidity
LOW RETURN HUMIDITY	Low return humidity
NOISE RED MODE STARTED	Noise reduced mode started
NOISE RED MODE STOPPED	Noise reduced mode stopped
REM SENSOR 1~10 FAILURE	Remote Sensor # 1~ #10 is disconnected.
HIGH RETURN TEMPERATURE	High return temperature
ROOM HUMIDITY PROBLEM	Room humidity problem
iCOM-DO #0 ~ #2 DISCONNECTED	iCOM-do #0 ~ #2 disconnected
FEEDBACK SIGNAL 2 FAILURE	Feedback signal 2 failure
BOTTOM FAN FAILURE	Bottom fan failure
EC FAN FAULT	EC fan fault
REM SENSOR n LO TEMP (n=1~10)	The Remote Sensor # 1 ~ #10 Temperature is below the thresh-old.
REM SENSOR n HI TEMP (n=1~10)	The Remote Sensor # 1 ~ #10 Temperature is above the thresh-old.
REM SENS AVG LO TEMP	The Local Unit Remote Sensor Average Temperature is below the threshold.
REM SENS AVG HI TEMP	The Local Unit Remote Sensor Average Temperature is above the threshold.
REM SENS SYS LO TEMP	The System Remote Sensor Average Temperature is below the threshold.
REM SENS SYS HI TEMP	The System Remote Sensor Average Temperature is above the threshold.
DISPLAY OFF DISABLED	The display off button was set disabled but somebody pressed it.
HUM CTRL SENSOR FAIL	The unit has hum / dehum enabled but no valid reading from the humidity sensor.
MM CYCLE LOCK OUT	Control has entered Mixed Mode too many times in rolling time period. Mixed Mode is locked out.
TEMP CTRL SENSOR FAIL	The value of the selected temperature control sensor is invalid.
DAMPER FAILURE	Damper feedback not in sync: actual feedback vs. position re-quest.
STAT PRES SENSOR FAIL	Static Pressure Sensor is disconnected or signal is invalid.
LOW STATIC PRESSURE	Current Static Pressure is below the threshold.
HIGH STATIC PRESSURE	Current Static Pressure is above the threshold.
CW FLUSH STARTED	Chilled Water Coil Flush has started.
CW FLUSH FINISHED	Chilled Water Coil Flush has finished.
STATPRES OUT OF RANGE	Static Pressure Sensor reading is out of defined range.

Event	Definition
FLOW SENSOR FAIL C1	Flow Sensor 1 Signal is out of range.
FLOW SENSOR FAIL C2	Flow Sensor 2 Signal is out of range.
CW TEMP SENS FAIL C1	Chilled Water Circuit 1 2T Sensor is not connected or reports in-valid on at least one lead.
CW TEMP SENS FAIL C2	Chilled Water Circuit 2 2T Sensor is not connected or reports in-valid on at least one lead.
OFF BY REMOTE SWITCH	The Unit was shut down by means of the Remote On-Off digital input.
MANUAL MODE ON	The Unit was started in Manual Mode.
OFF BY LOCAL SWITCH	The Unit was shut down by means of the external switch connected to the HCS12 or 3Digits Display.
OFF BY DISPLAY	The Unit was shut down by means of the Display On-Off button.
OFF BY BMS	The Unit was shut down by BMS.
MANUAL MODE OFF	Manual Mode has stopped, the unit operates in auto-mode(which can be Unit On or Unit Off, depending on the state before Manual Mode was started).

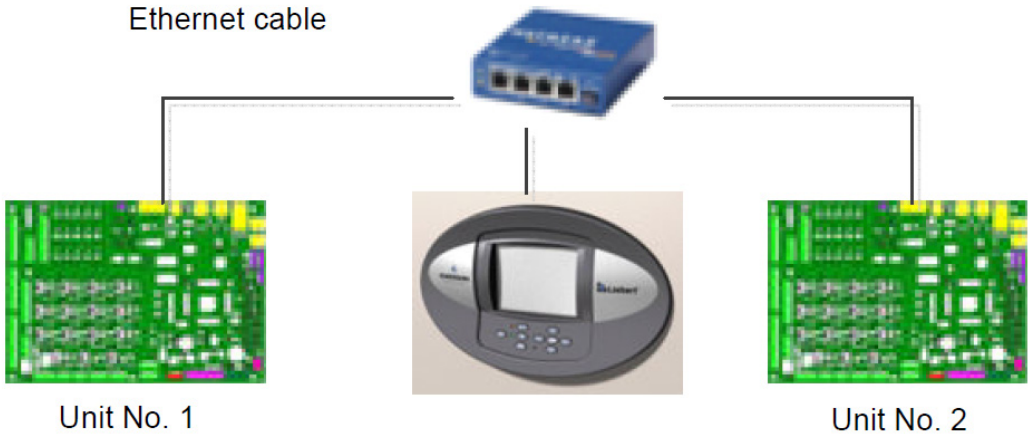
4.9. Multi-units and Teamwork Modes

Liebert® iCOM controller enables PEX+ chilled water unit to connect multiple units in single network through the teamwork mode. This teamwork mode facilitates corresponding network connection and network setting.

The control board and graphic display can be connected to an Ethernet network through a CAT5 cable, as shown in Figure 4-8. Up to 32 units (control boards) and up to 32 graphic displays can be connected together by using the Global Bus Protocol. The two units (two control boards or one control board and one large graphic display) can be directly connected through a crossed Ethernet cable, and multiple units can be interconnected in a networking with the help of a hub or a switch, as shown in Figure 4-9.



Control Board Connection with Small Display Screen



Control Board Connection with Large Display Screen

Figure 4-8 Networking of the Two Units

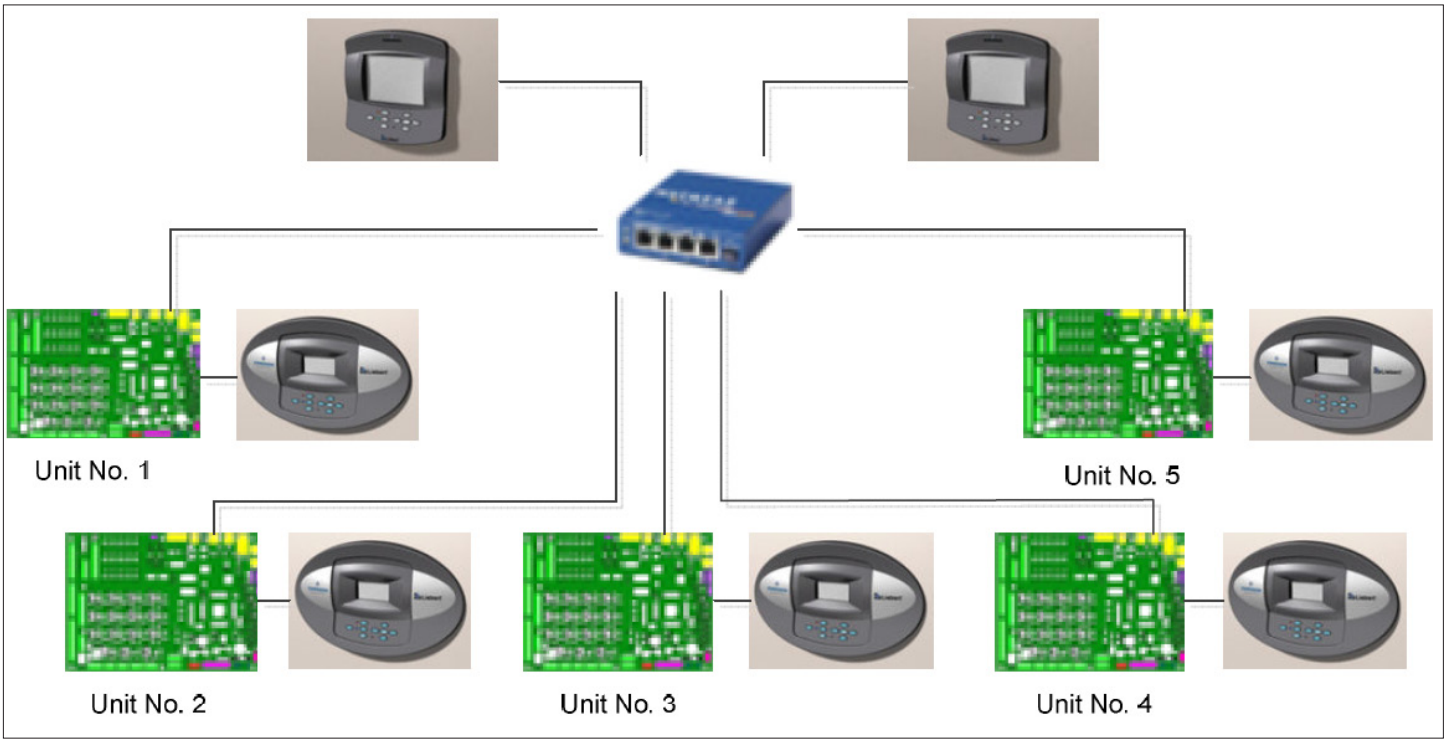


Figure 4-9 Networking of the Multiple Units

4.10. Teamwork Modes

Following are the teamwork modes to group Liebert PEX+CW units in a network

- No Teamwork
- Teamwork Mode 1
- Teamwork Mode 2
- Teamwork Mode 3

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

4.10.1. Application of Teamwork Modes

- **No Teamwork: Multiple zones in one room**

All cooling units work independently, responding to their own sensors. Standby function and unit rotation are possible, but cascading is not possible (refer Section 4.10.3 Standby and Cascade). Auto set will not adjust the proportional band in this mode.

- Teamwork Mode 1: Balanced load (small groups of units inside the same environment)

Teamwork Mode 1 works best in small rooms with balanced heat loads. The master unit computes the average of all cooling units return temperature and humidity sensors' reading in the operation (fan on) and use it for controlling. The master unit will send the operating requirements to all operating units according to unit numbers, rotated by each unit in every 24 hours. In this teamwork mode, most of the parameters are shared; if set in any one of the units, all other units will follow with the same settings. Auto set will adjust the proportional band in Teamwork Mode 1.

The master unit evenly divides the system proportional band among the number of available units. Each unit will receive instruction on how to operate from the master unit depending upon - how far the system deviates from the setpoints. The number of available units is calculated like:

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

Figure 4-10 shows how two cooling units work together in Teamwork Mode 1. Since Unit 1 and Unit 2 are available to operate, the master unit, Unit 1, averages the temperature and humidity sensor readings from each unit. The master unit determines that a 60% call for cooling is required for the system. Since there are two available cooling units, each unit makes up half of the system proportional band; Unit 1 handles 0-50% system call for cooling and Unit 2 handles 51-100%. For every 1% system call for cooling, each unit provides 2% of its total cooling capacity. The 60% system call for cooling exceeds the 50% Unit 1 can provide, so Unit 1 operates at full capacity. The remaining 10% system call for cooling (60% - 50% = 10%) is handled by Unit 2. Unit 2 responds by operating at 20% cooling capacity (10% ÷ 50% = 20%).

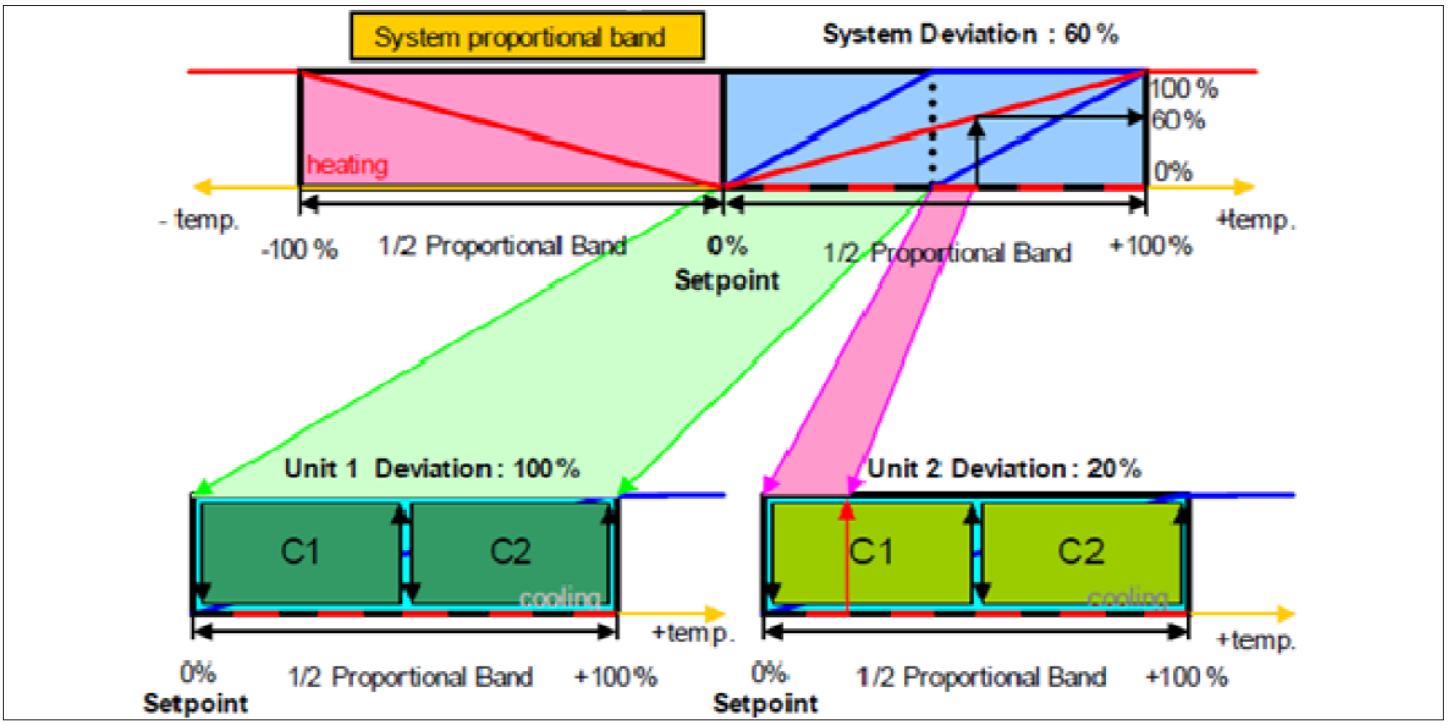


Figure 4-10 System Proportional Band

- Teamwork Mode 2: Unbalanced load (large rooms, not all units will have the same load) (work well for most applications)

Teamwork Mode 2 is designed to prevent units within a group from working against each other or “fighting”. It is best applied in large rooms with unbalanced heat loads. In Teamwork Mode 2, all parameters are shared equal to Mode 1, and Unit #1 averages all of the available unit sensor readings on the network to define whether there is a cooling, heating, dehumidification or humidification request. If there is a cooling request, all units are released to start cooling resources according to their own temperature readings; heating is disabled for all units and vice versa. Same for humidity control.

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

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

- Teamwork Mode 3 (Smart Team):

Teamwork Mode 3 can be selected when the units are set to operate in Smart Aisle Control mode and have been connected in a unit-to-unit network. Teamwork provides coordination between the units to prevent the “fighting” among th units in the network by not allowing units to operate in conflicting modes at the same time. This conflict may arise due to mode selection based on the average of the collective unit sensors (Cooling vs. Heating and Humidifying vs. Dehumidifying).

Teamwork Mode 3 allows the cooling capacity (Supply Sensor) to operate as a local control by removing only the amount of load required to maintain the discharge air temperature at each unit. This allows for an unbalanced room load while maintaining a consistent discharge air temperature. The fan speed is controlled by the remote rack sensors of all units, providing a controlled delivery method of the air to the cold aisle. In raised floor applications, all units will share sensor information to achieve even underfloor air distribution. This distribution is achieved by operating all fans in parallel that will also provide the highest energy efficiency.

Figure 4-11 shows the difference in both underfloor air distribution and energy consumption when Variable Fan speed and Teamwork Mode 3 are applied to the Liebert Precision Cooling units. The example on the left is using the standard standby configuration; the example on the right is utilizing Teamwork Mode 3. The units below are assuming that the fan power consumed at each unit is 8.1 kW when operating at 100%.

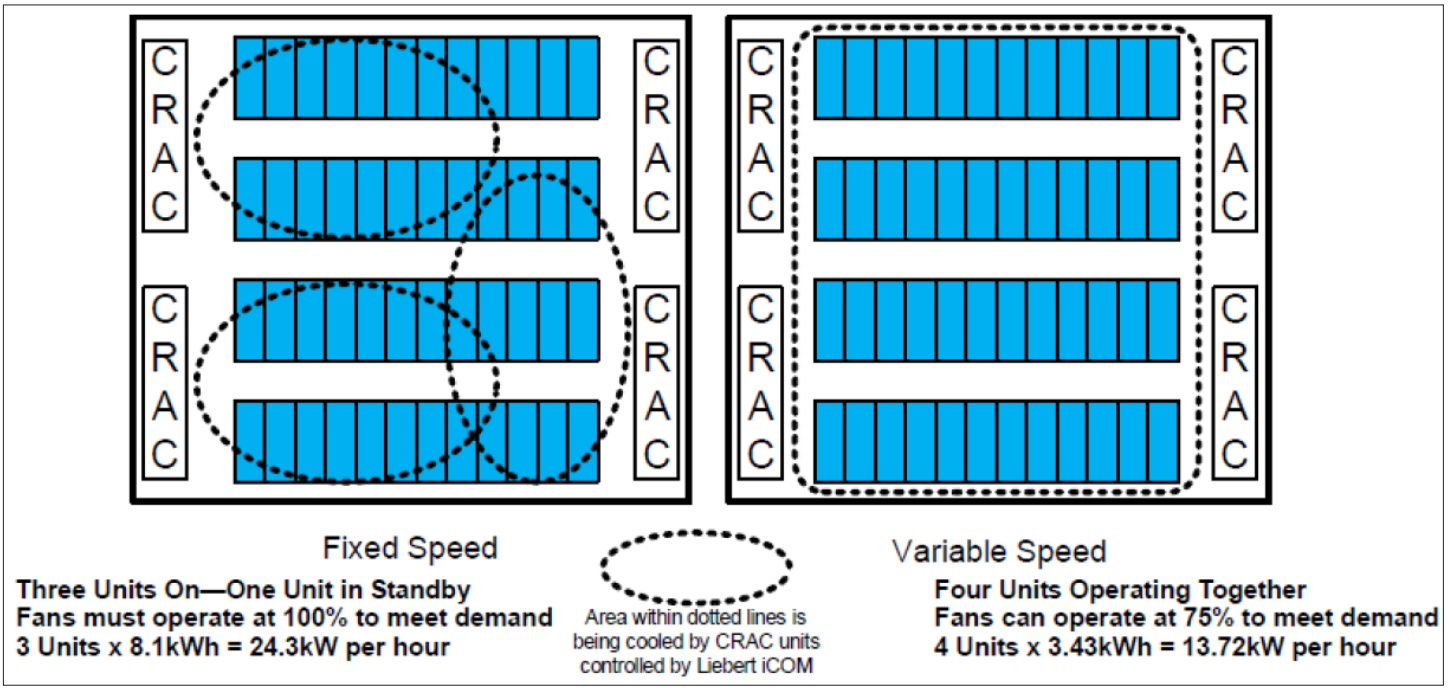


Figure 4-11 Teamwork Mode 3

4.10.2. Standby – Rotation

This function can be performed in any teamwork mode, including NO Teamwork. One or more units can be defined to be Standby; the normal status of standby units is Standby Off (fan Off).

In case one regular unit has an alarm that is defined (to be defined in the alarm configuration), to switch On a standby unit, the faulty unit will switch Off and the standby unit will switch On. If the next unit has an alarm, the next standby unit will be started. If no more standby units are available, the unit with a non-critical alarm that permits unit operation will be switched On again (water detection, fan alarm, fire alarm etc. will not permit unit restarting). The standby function can be rotated daily (setting the time), weekly (setting the day of the week and time) or monthly (setting the first weekday of the month and time).

The rotation can be performed with a selectable number of units: if rotation parameter is set to '1' then standby rotation is from 1-2 to 2-3 in a 4 units configuration; with two standby units, if rotation parameter is set to '2' then rotation is from 1-2 to 3-4 in the same configuration.

4.10.3. Standby and Cascade

- Cascade is possible in Teamwork Mode 1 and 3 only.
- Line S508 Cascade Units has the options of Yes, Cool / Heat, Cooling, Fan
- Yes -Based on a call for heating, cooling, humidification or dehumidification. Teamwork Mode 1
- Cool / Heat- Based on a call for heating or cooling. Teamwork Mode 1
- Cooling - Based on a call for cooling. Teamwork Mode 1
- Fan - The only selection available for Teamwork Mode 3; not available in Teamwork Mode 1. This uses fan control deviation to stage on standby unit fans/cooling. Fans stage serially according to the system fan control band and temperature control is based on the local supply deviation (Fan proportional band/number of connected units). The standby unit will remain On for the time set in the parameter. The default is 30 minutes; the range is from 2 to 360 minutes.

Standby units will start if an alarm occurs in one of the operational units. If the standby units are cascaded or in Teamwork Mode 3, they will also start and work with the regular operational units. If the temperature or humidity cannot be controlled by the operational units, Cascaded units are switched Off again as soon as the temperature/humidity returns back to normal before a high or low temperature/humidity condition occurs. .

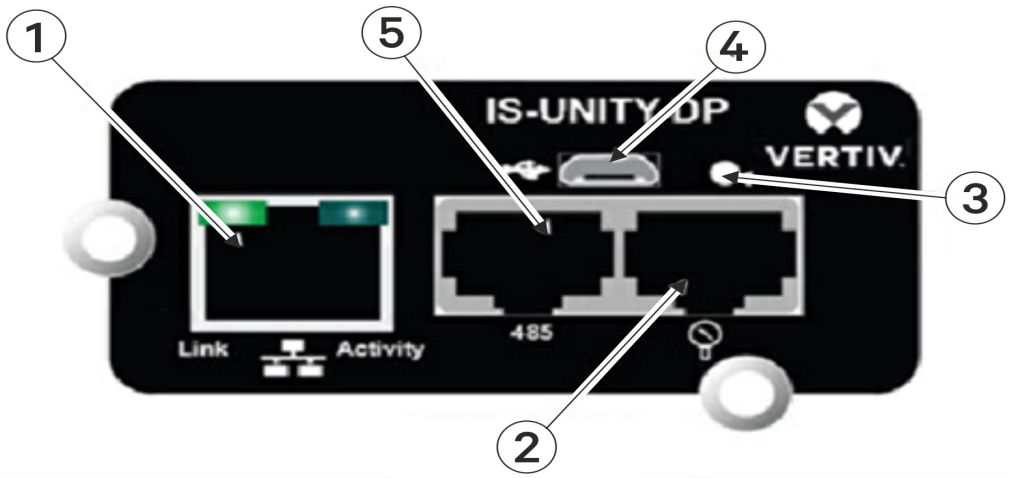
The master unit defines its proportional band according to the number of available units. When a standby unit receives a request for full heating or cooling from the master unit, it will respond to the request after its control delay.

Chapter 5: Application of INTELLI SLOT

This chapter introduces the application of the host communication components INTELLI SLOT, including installation and commissioning of the host communication card.

5.1. Introduction of Host Communication Card

Liebert® PEX+CW has a IS-UNITY card, which supports two kinds communication protocol: IS-485 and IS-WEB shown in the Figure 5-1.



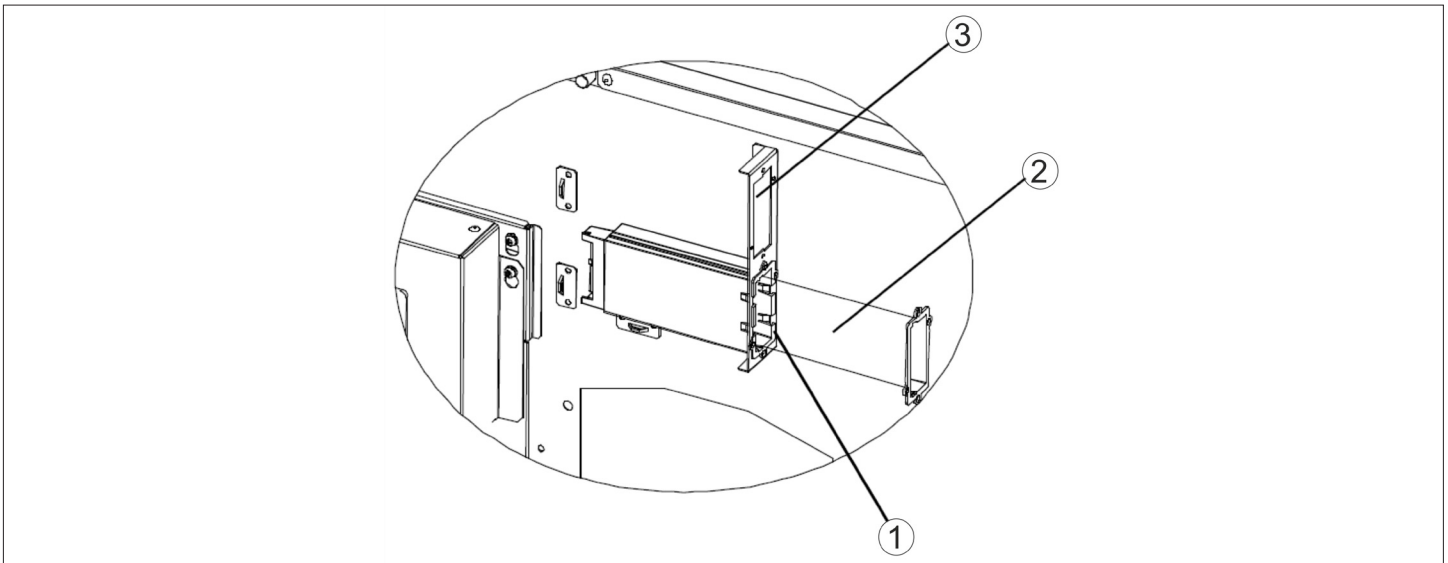
No.	Description	No.	Description
1	RJ-45-Ethernet:- HTTP; Modbus TCP; BACnet IP; SNMPv1,v2e,v3; Vertiv protocol	4	Micro- USB AB (Future release)
2	Liebert sensor network (Future release)	5	BACnet; MSTP; Modbus RTU YDN23
3	Reset button (Reboot or reset to factory defaults)		

Figure 5-1 IS-UNITY-DP Card

5.2. Installing Host Communication Card

5.2.1. Installing communication card

Liebert PEX+ chilled water AC units are equipped with installation boxes 1 and 2. To install the host communication configuration, insert the communication card into the installation box 1 and fixed the screws as shown in Figure 5-2.

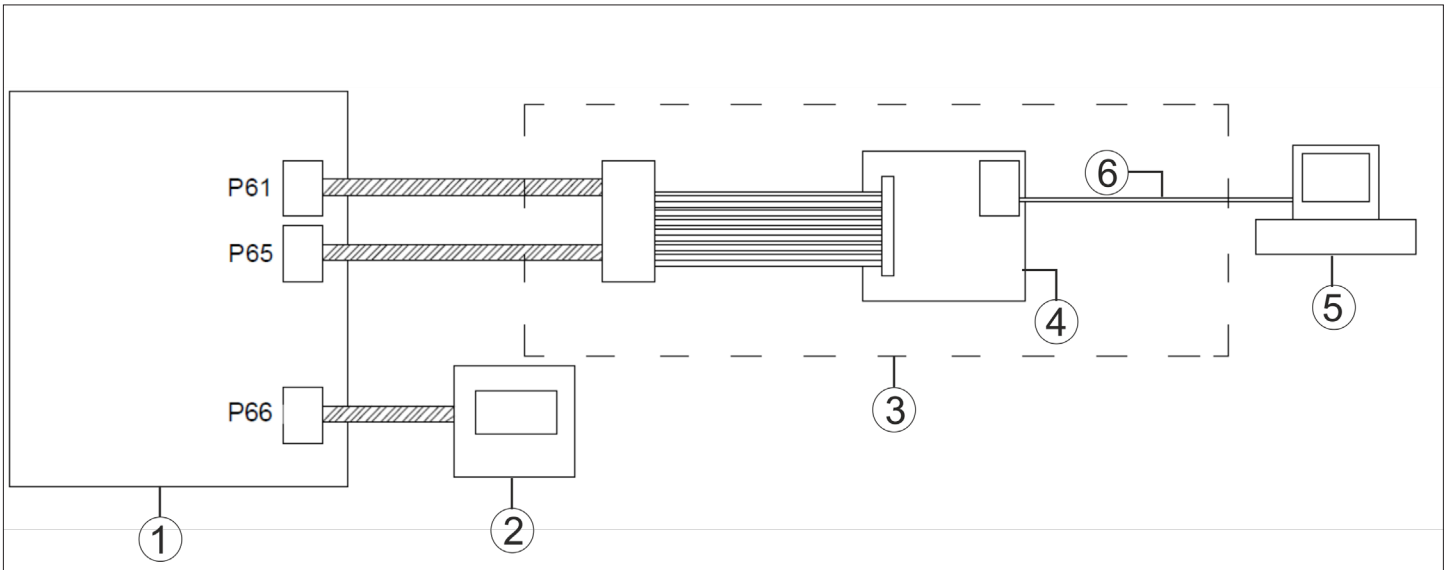


No.	Description	No.	Description
1	Intelli Slot 1	3	Intelli Slot 2
2	Communication card		

Figure 5-2 IS-UNITY Card Location

5.2.2. Connection

The electrical schematic figure of the host communication configuration is shown in Figure 4-3. P61, P65 and P66 cables are connected in the factory. Therefore, only the communication card is to be connected the monitoring center.



No.	Description	No.	Description
1	iCom Control board	4	IS-UNITY-DP Communication Card
2	Standard display Screen	5	Monitoring Center
3	Intellislot	6	Communication Cable

Figure 5-3 Electrical Schematic of Host Communication Configuration

Commissioning Host Communication Component

Before commissioning user must access the SERVICE Menus' of the iCOM control board to set S824 MON ADD as '3' S835 MON PORT as Vertiv and S843 BL CTRL as S+R in the "Network Setup."

5.2.3. Assigning the Card's IP Address

DHCP

- Liebert IntelliSlot Unity card is factory-configured for DHCP. If user requires a Static or Boot network configuration, ensure to change the Boot Mode as described in Static IP.
- Connect a RJ-45 cable to the card and it will receive an IP address from the DHCP server. Contact the DHCP administrator to obtain the IP address using Liebert IntelliSlot Unity card's MAC address. The MAC address is printed on the card faceplate.
- If the DHCP administrator is not available or there is no way of determining the IP address assigned by the DHCP server, use a computer with a direct Ethernet connection to Liebert IntelliSlot Unity card, and follow the instructions to auto configuration IPv4 Address, conventions are described in Section 5.2.4- Connect an Ethernet Cable - Connect an Ethernet Cable to access the card's Web page and configure the card.

- To see the card's last DHCP- assigned IP address, click on the Unity Tab, then on the left side menu select Support > Active Networking. The table of information shows the last IP address assigned by the DHCP server. The card may retain that IP address when it reconnects to the DHCP network because most DHCP systems reuse the same IP address for the same device.

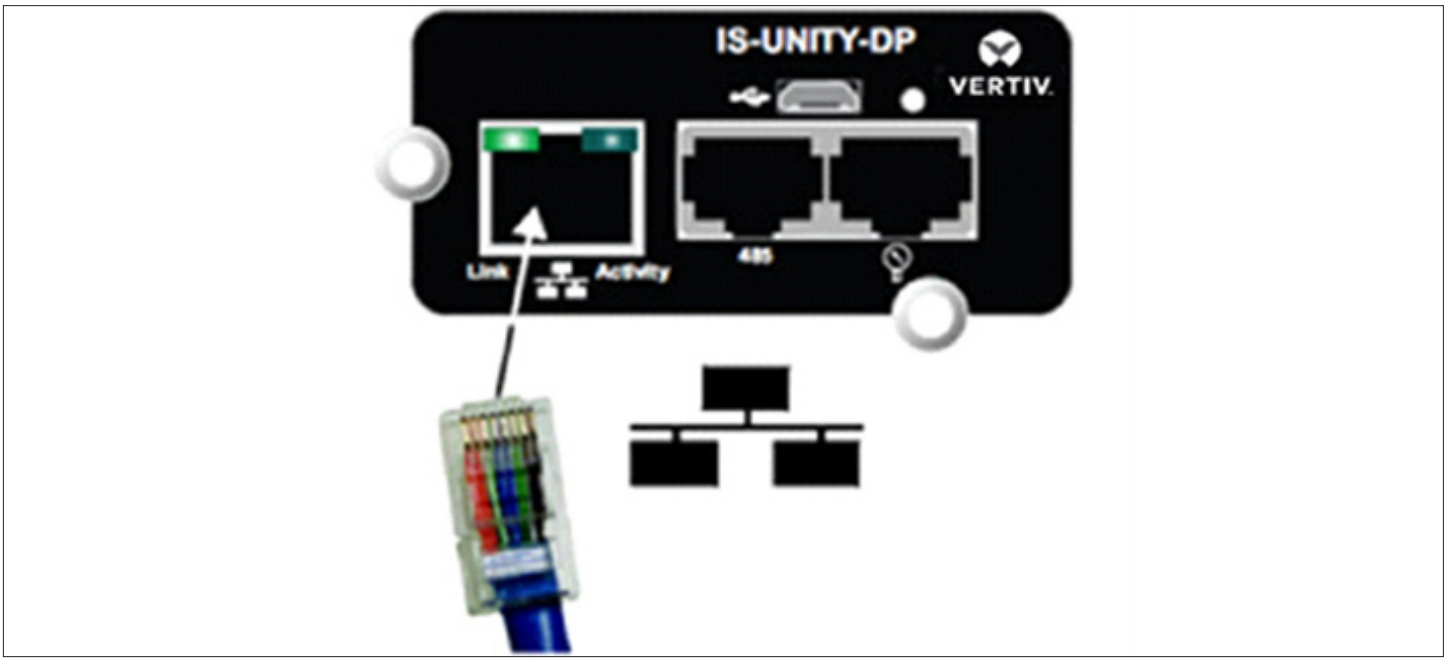
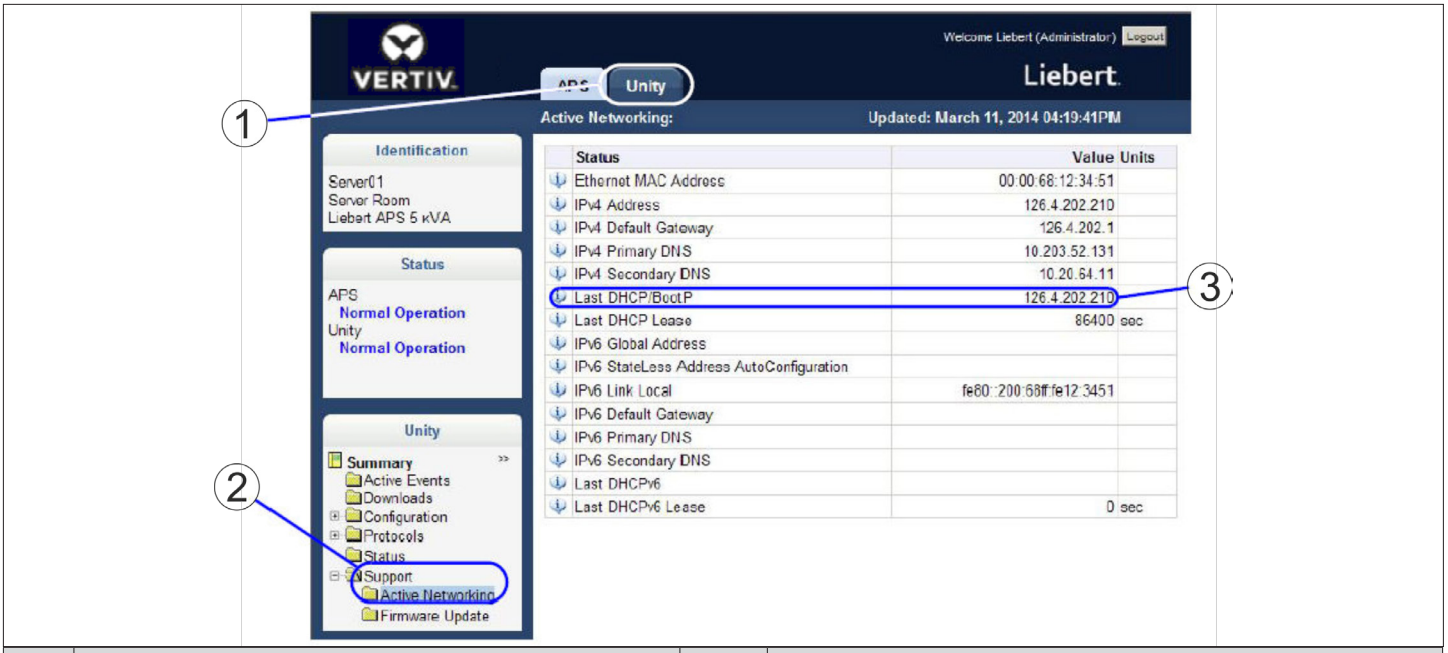


Figure 5-4 IS-UNITY-DP Card Connection Port



No.	Description	No.	Description
1	Unity Tab	3	Last DHCP
2	Support > Active networking		

Figure 5-5 Example of IS-UNITY-DP Card Web Page

Static IP

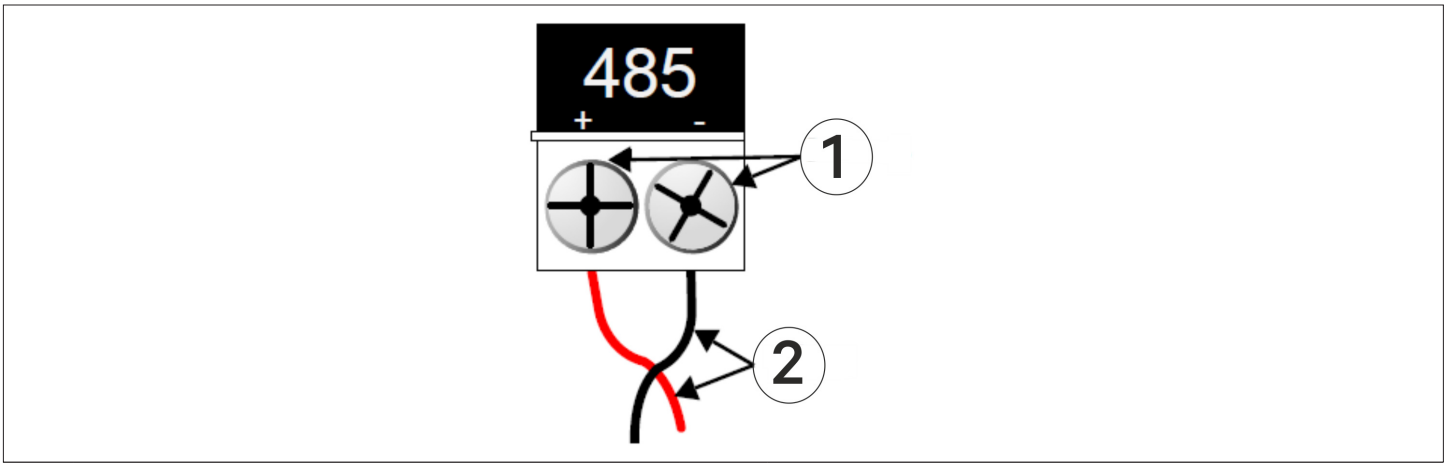
To assign a static IP address, use the Ethernet connection to configure the card. Proceed to Section 5.2.4. Connect an Ethernet Cable.

5.2.4. Connect an Ethernet Cable

1. Connect the computer running on Microsoft Windows operating system (Microsoft Windows® XP with SP2 [64-bit] or SP3 [32-bit] or later) to the card by plugging a network cable into the RJ-45 port on the computer and Liebert IntelliSlot Unity card.
2. Auto-configuration, which is normally enabled on the computer running with Microsoft Windows operating system will automatically negotiate the communication settings. This takes about one minute.
3. If the Ethernet adapter is used to attach the card and it does not show an auto-configuration IPv4 address, then open a new Command Prompt and type ipconfig/ renew and press 'Enter'. This forces the computer to acquire the auto-configuration IPv4 address.
4. When the computer has the auto-configuration IPv4 address, then open a browser window on the computer and type 169.254.24.7 (the card's default 'Auto-configuration IPv4 Address') in the URL address field. The card's Web page appears.

5.2.5. Connect a RS-485 Serial Cable

Liebert IntelliSlot Unity cards come with an Adapter RJ-45-2POS Terminal Block. The adapter has two screw terminals to attach the ends of a RS-485 cable for communicating to a building management system.



No.	Description	No.	Description
1	Screws	2	Cables

Figure 5-6 Adapter RJ-45-2POS Terminal Block

1. Find the serial cable from the building management system. If it already has the RJ-45 connector at the end, determine whether it uses the same pinout as the Liebert IntelliSlot Unity card's connector. If the pinout is same as that of Liebert IntelliSlot Unity card connector's pinout, then proceed to Step 6.

2. Strip the ends of the positive (typically red) and negative (typically black) leads on the RS-485 cable so that enough bare wire is exposed for connection, about 1/4" (6 mm).

3. Position the adapter so that the side with positive and negative marks is faced up. The small markings are on the same side as the screw heads, as shown in Figure 5-6.

4. Loosen the screw to the positive terminal and insert the red wire far enough to insert the bare wires into the terminal block under the screw, then tighten the screw (Be careful not to break the wires).

5. Repeat Step 4 for the negative terminal and the black wire.

6. Plug the cable into the 485 RJ-45 port on the Liebert IntelliSlot Unity card.

5.3. Configure the Card

The Liebert IntelliSlot Unity card requires minor configuration, such as choosing the IP/Web communication interface, serial RS-485 communication interface, or both. The default for IP/Web communication is IPv4, which can be changed to IPv6 for greater security; contact the nearest network administrator to determine whether it is compatible with the network. To choose the communication interface refer to Figure 4-7:

1. Select Unity Tab > Configuration > Network Settings.

2. Enable the protocol, either IPv4 or IPv6 that will be used to communicate with the Liebert IntelliSlot Unity card and with the Liebert equipment.

- Click on either IPv4 Settings or IPv6 Settings.
- Click the Edit button.
- When prompted with a login display, enter the user name and password (the defaults are Liebert and Liebert).
- Put a check mark (✓) in the enabled box.
- Insert the desired or assigned IP address along with the rest of the required networking information; contact the system administrator if necessary.

3. Click on Save to confirm the changes or click on Cancel to discard them. The changes will take effect after the card is restarted, refer Figure 5-7 for better understanding.

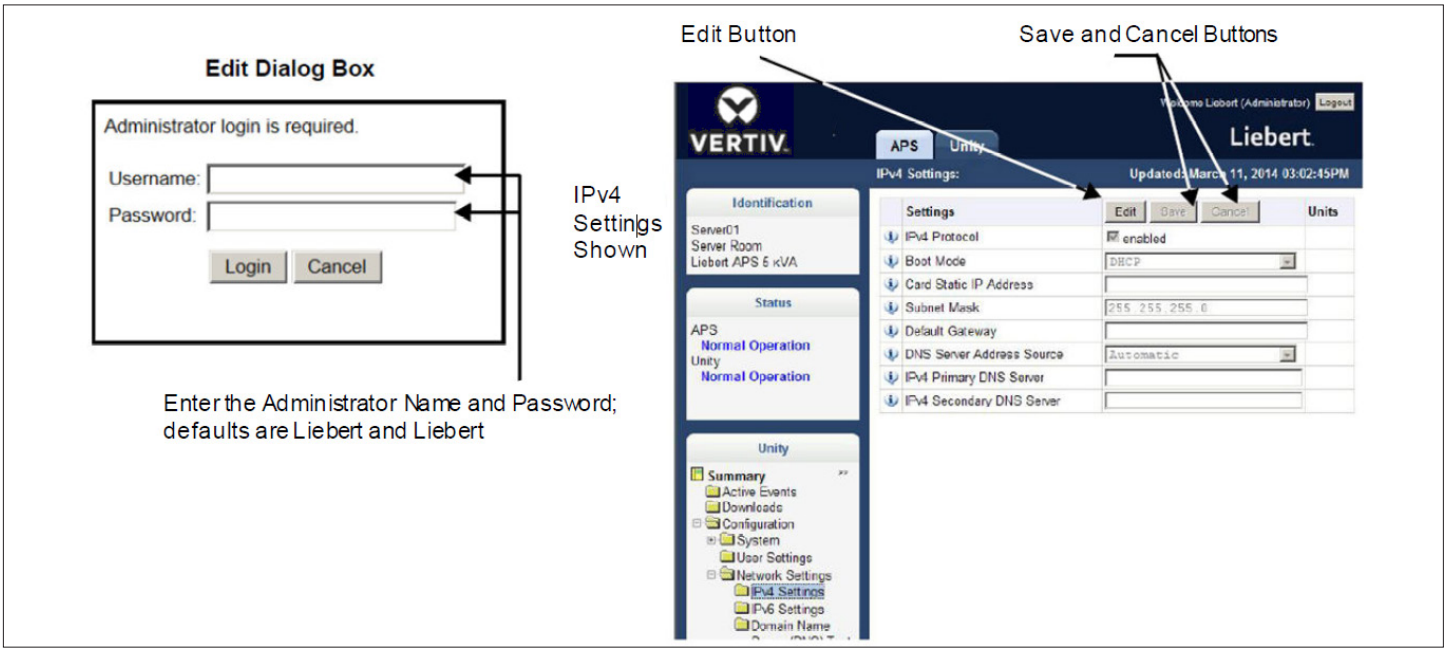


Figure 5-7 Enabling the Communication Protocol—IPv4 or IPv6

The Liebert IntelliSlot Unity card will communicate with equipment and third-party systems over the following protocols:

- BACnet IP
- BACnet MSTP
- Modbus TCP
- Modbus RTU
- SNMP
- YDN23

- *Any two of the protocols can be enabled on one card.*
- *Only one version of BACnet can be selected, either BACnet IP or BACnet MSTP.*
- *Only one version of Modbus can be selected, either Modbus TCP or Modbus RTU.*
- *Only one of the protocols can use the 485 port; choosing two 485 protocols will cause conflicts.*

5.3.1. Enable Protocols

Protocols may be enabled after a card has been installed and configured. After a protocol is enabled, it must be configured, which requires opening that protocol's folder (Unity>Protocols> (desired protocol).

To enable two communication protocols:

1. Select Unity Tab > Protocols.
2. Click on Edit and enter the administrator user name and password.
3. Put a check mark (✓) in the desired protocols—Only two may be enabled; Only one of the two can use the 485 port.
4. Click Save to confirm the changes or click on Cancel to discard them.
5. Configure the protocols selected.
6. Restart the card.

- Select Unity Tab > Support.
- Enable the commands.
- Click on Restart.

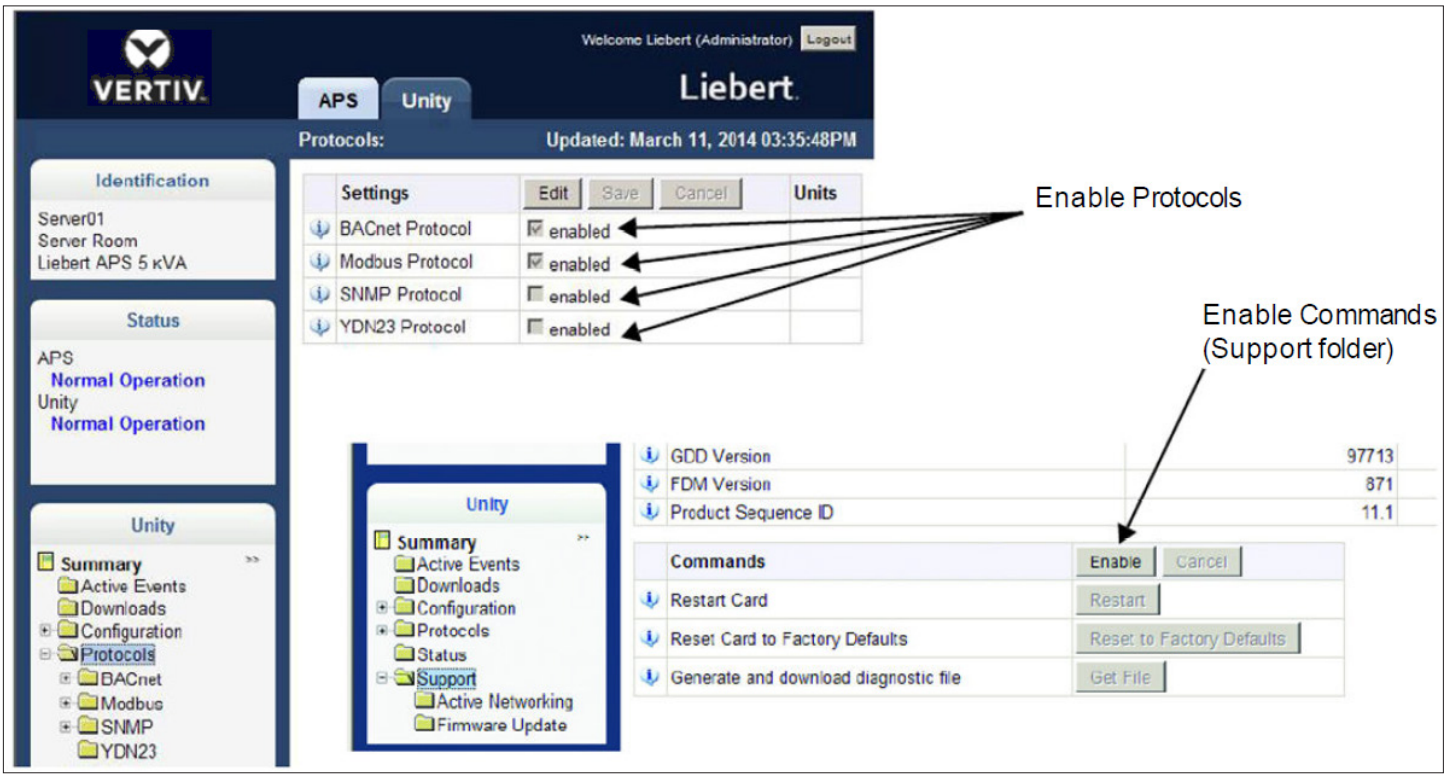


Figure 5-8 Enabling Protocol, Enable Commands

5.3.2. Enable Modbus Protocol

1. Protocols may be enabled after a card has been installed and configured. To enable Modbus protocol:
2. Select Unity Tab > Protocols > Modbus.
3. Click on Edit and enter a User name and password.
4. Select the access level (Read Only or Read/Write).
5. Select the Modbus interface, (Modbus TCP or Modbus RTU).
6. Click Save to confirm the changes or click on Cancel to discard the changes.
7. Configure the Modbus interface chosen; refer to Configure Modbus TCP or Configure Modbus RTU.

5.3.3. Configure Modbus TCP

1. Select the Unity Tab > Protocols > Modbus TCP.
2. Click on Edit and enter a User name and password if required.
3. Set the Limit Network Access Type by choosing from the drop-down list (Open/Same Subnet/Trusted IP List).
4. Enter the port to be used by the Modbus Server to listen for and respond to Modbus protocol requests based on limit Network Access Type setting.
5. Enter the Maximum Client Connection Count.
6. Click Save to confirm the changes or click on Cancel to discard them.
7. Restart the card to confirm the changes.

- Select Unity Tab > Support.
- Enable the commands.
- Click on Restart.

5.3.4. Configure Modbus RTU

1. Select the Unity Tab > Protocols > Modbus RTU.
2. Click on Edit and enter a user name and password if required.
3. Set the Node ID and the Baud Rate.

4. The Node ID defaults to 1, but must have a value from 1 to 255 that is unique among devices connected through the RS-485 interface.
5. The default baud rate is 9600; 19200 and 38400 also available.
6. Contact the system administrator if there are any uncertainties regarding the settings.
7. Click Save to confirm the changes or click on Cancel to discard them.
8. Restart the card to confirm the changes.
9. Select Unity Tab > Support.
10. Enable the commands.
11. Click on Restart.

5.3.5. Enable BACnet Protocol

Contact the system administrator or building management system administrator if any ambiguity is faced about the settings.

1. Select Unity Tab > Protocols > BACnet.
2. Click on Edit and enter a user name and password if required.
3. Enter the Managed Device Write Access level (Read Only or Read/Write). This determines a user's ability to change settings in the Liebert IntelliSlot Unity card.
4. Choose the BACnet interface, either BACnet IP or BACnet MSTP
5. Set the Device Object Instance Number.
6. Set the Device Object Name.
7. Set the APDU Timeout.
8. Set the APDU Retries.
9. Click Save to confirm the changes or click on Cancel to discard them.
10. Configure the BACnet interface chosen; refer to Configure BACnet IP Protocol or Configure BACnet MSTP Protocol.

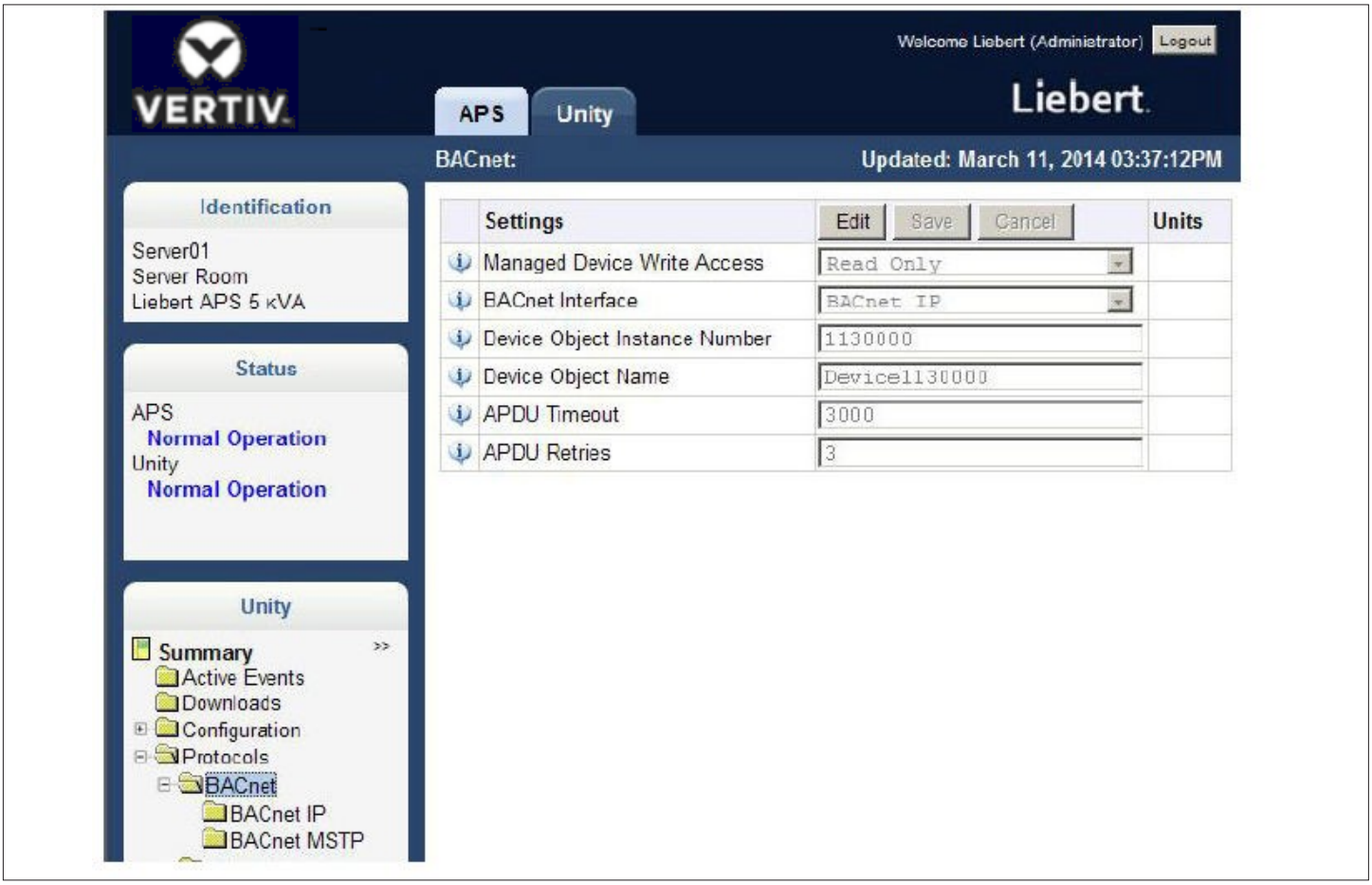


Figure 5-9 BACnet Protocol Settings

5.3.6. Configure BACnet IP Protocol

Contact the system administrator or building management system administrator if any ambiguity is faced about the settings.

1. Select Unity Tab > Protocols > BACnet IP.
2. Click on Edit and enter a User name and password if required.
3. Set the BACnetIP/Port Number
4. If the Liebert IntelliSlot Unity card is on a different subnet, a possibility when the monitored units are part of a Liebert SiteScan network or other third-party monitoring service:

- Choose whether to enable Register as Foreign Device.
- Enter the IP address of the BBMD (BACnet Broadcast Management Device).
- Enter a time in seconds for Foreign Device Time-to-Live.

5. Click Save to confirm the changes or click on Cancel to discard them.
6. Restart the card to activate the changes.

- Select the Unity Tab > Support.
- Enable the commands.
- Click on Restart

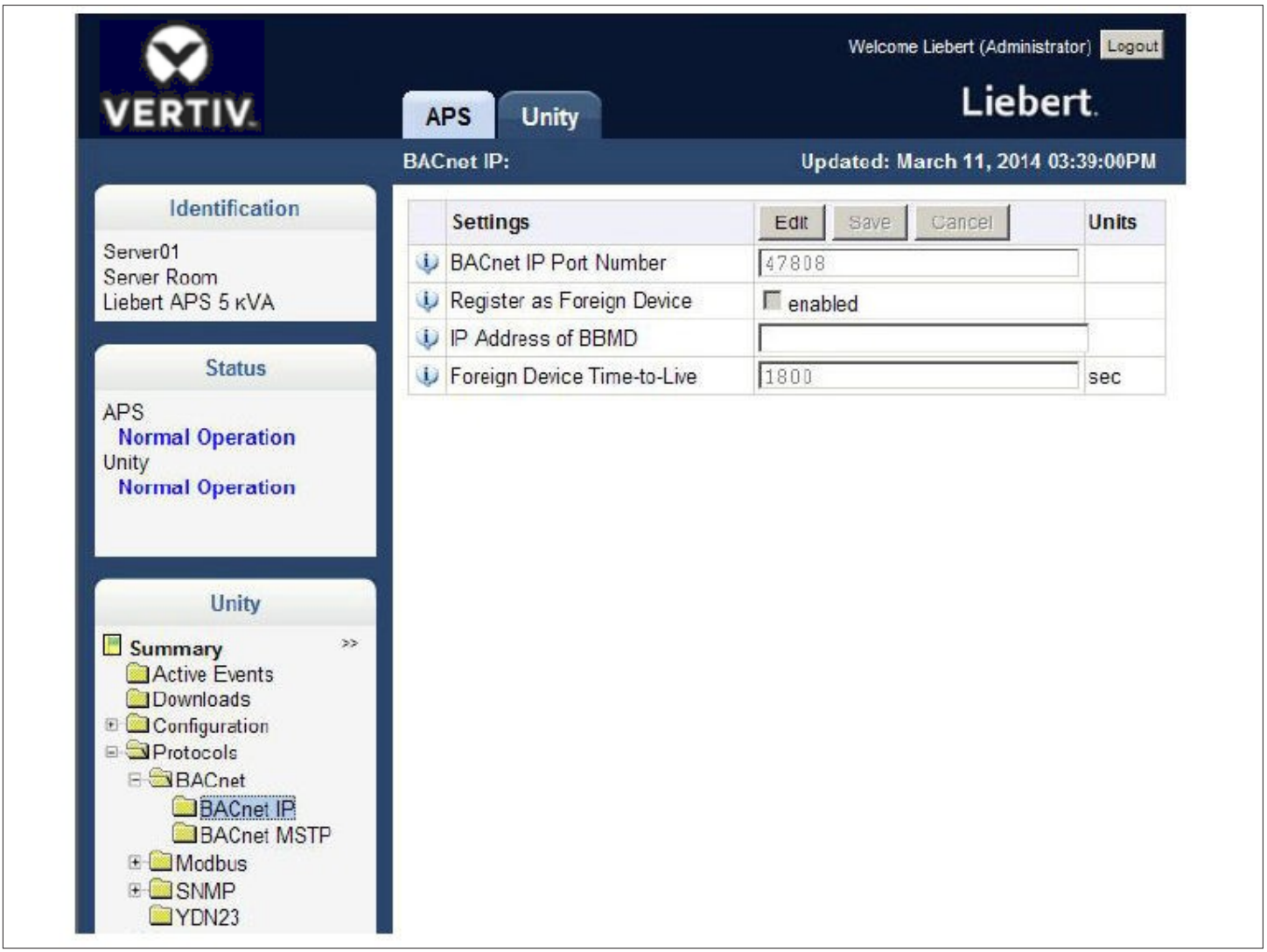


Figure 5-10 BACnet IP settings

5.3.7. Configure BACnet MSTP Setting

Contact the system administrator or building management system administrator if any ambiguity is faced about the settings.

1. Select Unity Tab > Protocols > BACnet MSTP.
2. Click on Edit and enter a user name and password if required.
3. Set the BACnet MSTP Node ID. The ID default is 1.
4. Set the BACnet MSTP Data Rate.
5. Set the BACnet MSTP Max Master Address.
6. Set the BACnet MSTP Max Info Frames. The default is 8.
7. Click Save to confirm the changes or click on Cancel to discard them.
8. Restart the card to activate the changes.

- Select Unity Tab > Support.
- Enable the commands.
- Click on Restart

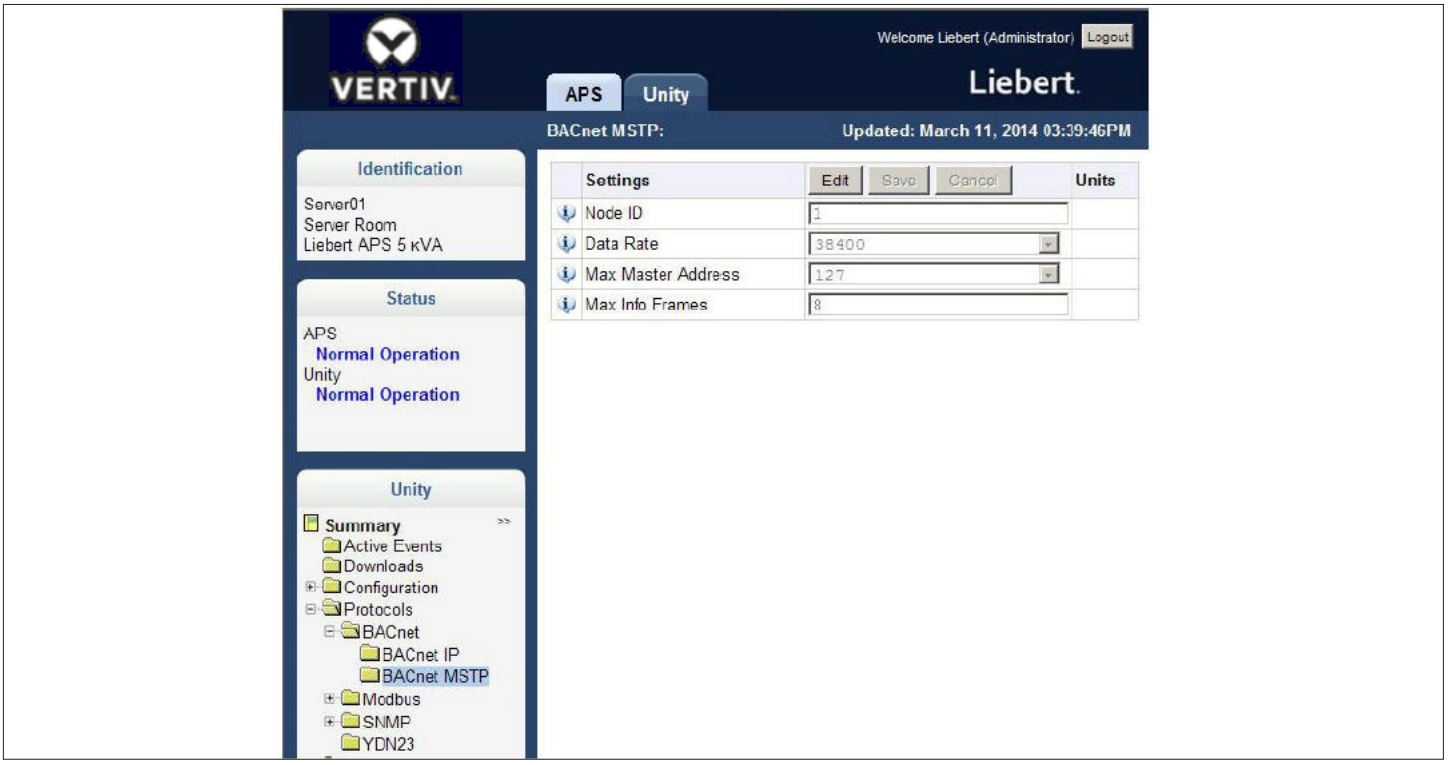


Figure 5-11 BACnet MSTP Settings

5.3.8. Enable SNMP

SNMPv1/v2c and SNMPv3 are enabled by default. The protocols may be configured or their default values may be accepted. Authentication Traps are not enabled by default. The default Heartbeat Trap interval is 24 hours; this can be disabled or the interval may be changed.

1. Select the Unity Tab > Protocols > SNMP.
2. Click on Edit and enter a User name and password if required.
3. To enable Authentication Traps, put a check mark (✓) in the box.
4. To change the Heartbeat Trap Interval, choose a time from the drop-down list or choose Disabled to prevent any heartbeat traps from being sent.
5. The interval times offered are 5 minutes, 30 minutes, or 1, 4, 8, 12 or 24 hours.
6. Choose whether to disable the traps or to set the interval to one of the periods on the menu.
7. Click Save to confirm the changes or click on Cancel to discard them.
8. Restart the card to activate the changes.

- Select the Unity Tab > Support
- Enable the commands
- Click on Restart

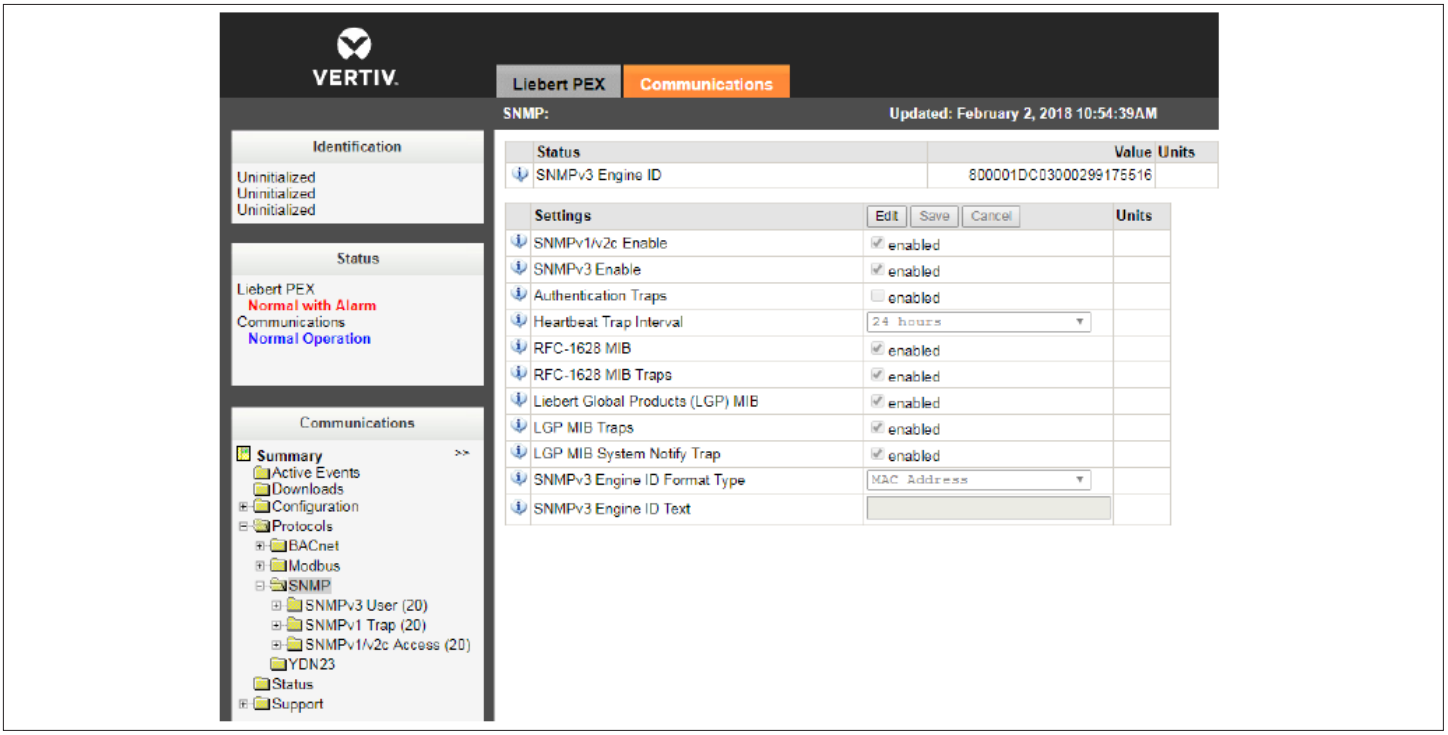


Figure 5-12 SNMP Settings

Chapter 6: System Start-up Commissioning

This chapter introduces the start-up commissioning of the Liebert® PEX+Chilled Water AC, including preparation before commissioning, procedures of commissioning and inspection after commissioning.

6.1. Start-up Commissioning

6.1.1. Preparation Before Commissioning

- Mechanical and system part

1. Check that the protection materials during transportation have been removed.
2. The pressure-leak detection of the chilled water system has been done and the chilled water system is installed according to Vertiv recommendation and local regulations.
3. The cleaning and emptying of the chilled water system have been done (air vent valve is located at the top of the heat exchanger coil).
4. The chilled water system has been confirmed ready for operation by the Vertiv professionals.
5. The water supply/drainage piping of the humidification system has been reliably connected according to the material requirements and has been checked for any sign of leakage.
6. Ensure that the equipment room temperature is above 20 °C with sufficient heat load. If the heat load is insufficient, heat the equipment room with other heating devices, or by forcibly running the heater of the unit or adjacent other equipment (in this case, go through the following procedures till the third step of 6.2 Commissioning Procedures) to ensure the heat load is sufficient for the commissioning of the unit.

- Electrical part

1. Check that the input voltage of the main power is 380 V (-10%) to 415 V (+6%).
2. Check that all electrical or control cables are correctly connected. Fasten all the connecting terminals.
3. The power supply cables and the low voltage control cables are separated.

6.2. Commissioning Procedures

1. Turn off the MCBs of various parts. Turn on the main MCB and control MCB and check the control voltage. Switch on the unit using the iCOM display.
2. Switch on the fan MCB and click on the contactor of the fan to confirm the rotation direction of the fan. Start the unit and measure the current of the fan.
3. Switch on the electrical reheat MCB and change the temperature setting to start the electrical reheat, or start the reheat manually. Measure all the phase current of the electrical reheat. To trigger the electrical reheat:

4. Change the temperature setting to 5 °C higher than the equipment room temperature. The system should then trigger the call for heating and the electrical reheating starts to work. Then set the temperature setting to 5°C lower than the equipment room temperature. If the electrical heater stops working, it means the heating function is normal.
   Continue the following commissioning steps.

- Switch on the humidification MCB and change the humidity setting to start the humidifier, or start the humidifier manually. Measure all the phase current of the humidifier. Manually charge water into the cooling system to check that the charge/drainage piping do not leak and the drainage pipes are clear.
- To trigger the humidifier:
  Adjust the humidity setting to 10% higher than the relative humidity of the equipment room. The control system should then trigger the call for humidification, and the humidifier starts to work. If the humidifier stops working when the humidity setting is lower than the relative humidity of the equipment room, it means the humidifying function is normal.

After commissioning, restore the temperature and humidity setting to the default or the original setting.

5. Change the temperature setting and start cooling or start the cooling manually. Record the water flow quantity of the system and water resistance. To start cooling (open the water flow control valve), then change the temperature setting to 5 °C lower than the equipment room temperature. The control system should then trigger the call for cooling, and the water flow control valve opens. After at least three minutes of cooling, change the temperature setting to 5 °C higher than the equipment room temperature. The water flow control valve should close.

6. Change the humidity setting and the unit will enter a dehumidifying status. Record the water flow quantity of the system and water resistance.
   To trigger dehumidification:
   Change the humidity setting to 10% lower than the relative humidity of the equipment room. The control system should then trigger the call for dehumidification; the water flow control valve opens. Note that during the commissioning process, if the equipment room temperature is 3 °C higher than the temperature setting, the system may enter the forced cooling mode, and the dehumidification demand will not be responded. After commissioning, restore the humidity setting to the default or the original setting.

6.3. Inspection after Commissioning

1. Check that all output functions are working well.
2. Check that all temperature and humidity settings have been set correctly according to customer requirement.
3. Ensure that all the other setting functions are correct.

Chapter 7: System Operation and Maintenance

Regular system maintenance is critical to ensure the reliability and the effectiveness of the product. This chapter describes Liebert® PEX+CW system maintenance, including information related to routine maintenance and inspection, electrical connections inspection, cabling, system diagnosis, visual appearance checks, and drainage maintenance.

- *During the running of Liebert PEX+CW, there may be lethal voltage within the device. The system must therefore comply with all cautions and warnings mentioned in this manual or which may cause casualties.*
- *Only qualified service and maintenance personnel can perform system operation and maintenance.*

7.1. Routine Maintenance Inspection Items (Monthly)

Components of the monthly inspection system, focusing on whether the system function is normal and whether the components show any signs of wear and tear, refer Table 7-1 the monthly routine maintenance inspection items.

Table 7-1 Monthly Routine Checklist of Items

Part	Check Item	Remark
Air Filter	Check for clogging or damage	
	Check the filter clog switch	
	Clean the filter	
Fan	Check fan blades are not distorted	
Chilled Water System	Check chilled water pipes	
	Check chilled water inlet/outlet temperature	
	Check if the condensed water pan is clogged	
Electrical heating system	Check the re-heater operation	
	Check the erosion situation of the components	
Infrared humidifier	Check clogging of the drain pipes	
	Check the lamps of the infrared humidifier	
	Check the mineral sediments on the water pan	

7.2. Routine Maintenance Inspection Items (Semi-Annual)

Refer Table 7-2 for routine maintenance inspection items semi-annually.

Table 7-2 Semi-Annual Routine Checklist of Items

Part	Check Item	Remark
Air Filter	Check for clogging or damage	
	Check the filter clog switch	
	Clean the filter	
Fan	Check fan blades are not distorted	
	Check whether there is bearing wear	
	Check and fasten the circuit connector	
Chilled Water System	Clean pipe system	
	Check the function of the ball valve	
	Check if the water system leaks	
Electrical heating system	Check the re-heater operation	
	Check the erosion situation of the components	
	Check and fasten the circuit connections	
Infrared humidifier	Check clogging of the drain pipes	
	Check the lamps of the infrared humidifier	
	Check the mineral sediments on the water pan	
	Check and fasten the circuit connections	
Electrical control part	Check and fasten the circuit connections	

7.3. Self-Diagnostic System

The iCOM controller provides the diagnostic function of manually opening and closing of components, which is used to self-test the state of the functional components of the system.

7.4. Check the Electrical Connections and Maintenance

Following are the electrical connections to make visual inspection and treatment:

1. Conduct overall electrical insulation test: find out the unqualified contacts and handle them carefully. Note to disconnect the fuses or MCBs of the control part during the test before the high voltage should damage the control components.

2. Check the contactors before power-on and ensure the contactors can act freely without obstruction.

3. Clean the electric and control elements of dust with brush or dry compressed air.

4. Check the closing of contactors for arcs or signs of burning. Replace the contactor if necessary.

5. Fasten all the electrical connection terminals.

6. Check whether the sockets and plugs are in good conditions. Replace those damaged ones.

7. If the power cables are damaged, to avoid further damage, the cables must be replaced by professional personnel.

7.5. Appearance Inspection and Maintenance of Controller Components

A control section to make visual inspection of the following entries, and a simple function test process:

1. Visually inspect the power transformers and isolation transformers and test the output voltage of the indoor unit and outdoor unit.

2. Check whether there are no signs of aging on the control interface board, control board, temperature and humidity sensor board.

3. Clean the electrical control elements and control board of dust and dirt with brush and electronic dust removing agent.

4. Check and fasten the I/O ports at the control interface board, including the connection between control board and control interface board, as well as between the temperature/humidity sensor board and the interface board. Check the connection between the user terminals (37# and 38#) and the control interface board.

5. Check the output connection between the control interface board and various contactors and the input connection between control interface board and heating over-temperature protection switch, humidifier protection switches, filter clogging switch, and airflow loss switch. In particular, check the connection parts such as high-pressure switches and solenoid valves, and replace tIn particular, check the connection parts such as water flow control valves, and replace the component if in poor connection or faulty.

6. Check and replace electrical components that are faulty, such as control fuses (or MCBs) and control boards.

7. Use temperature and humidity measuring meters with higher precision to measure and calibrate the temperature and humidity sensors.

8. Adjust the setpoints. Check the action of the functional parts and the auto-flush control logic of water pan of the infrared humidifier according to control logic.

9. Simulate and check the operation of the protection devices including high and low-pressure alarm, high and low temperature alarm, high water level alarm and over-temperature protection.

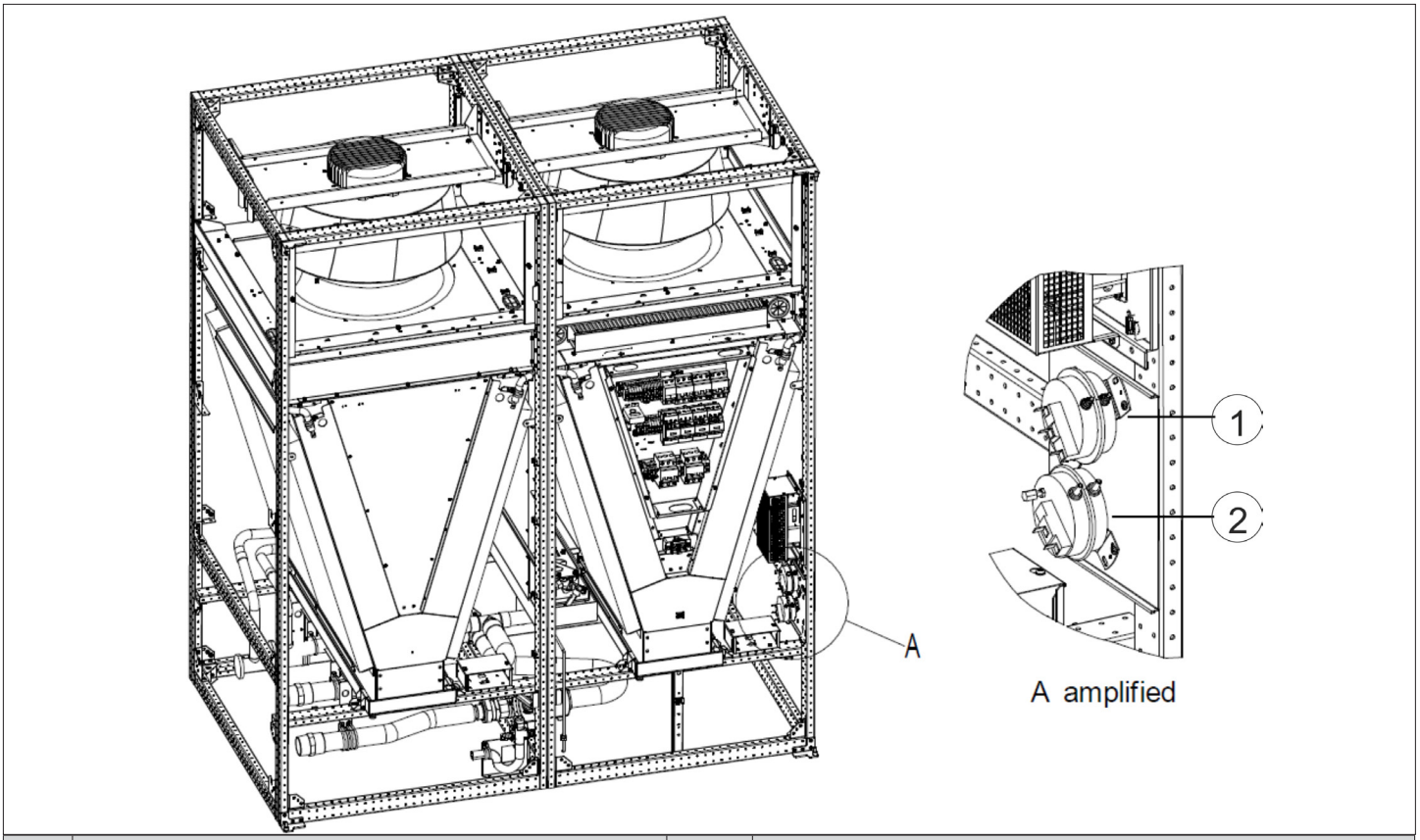
10. Check the water detection sensor. Connect the water detection sensor probes and confirm the alarm through the controller. The sensor should be placed in low-lying areas near the unit.

Set the humidity control mode to 'relative humidity control during calibration process.

- *Before fastening the connection of any mechanical parts or cables, ensure that the power supply of the control unit has been disconnected.*
- *Do not use the water detection sensor adjacent to flammable liquid or use it to detect flammable liquid.*

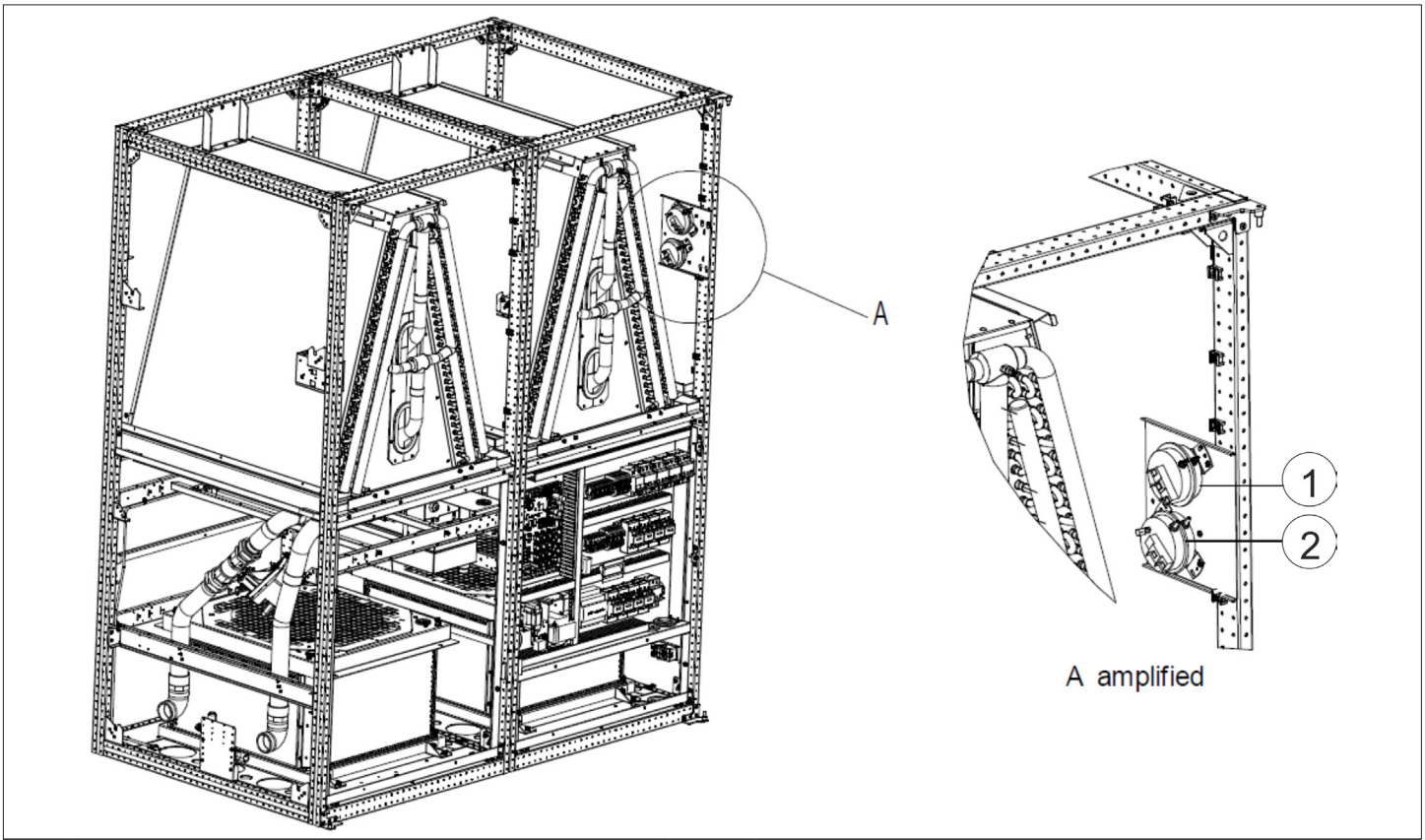
7.6. Filter Maintenance Guide

The efficiency of the filter in the unit is 30%, which complies with US ASHRAE52-76 and Eurovent 4/5 standards, and the dust resistance value is 90% (EU4 standards). To ensure efficient operation, the dust filter must be checked once a month, and replaced as required. The filter clogging switch and pressure difference switch are located as shown in Figure 7-1 and Figure 7-2.



No.	Description	No.	Description
1	Airflow loss switch	2	Filter clogging switch

Figure 7-1 Filter Clogging Switch and Airflow Loss Switch (Upflow Unit)



No.	Description	No.	Description
1	Airflow loss switch	2	Filter clogging switch

Figure 7-2 Filter Clogging Switch and Alrflow Loss Switch (Downflow Unit)

User needs to adjust the setting point of the filter clogging switch if the new filter is of a different model. It samples the air pressures from front and behind the filter through a black hose and decides the output after comparing the two values.

To adjust the setting point of the filter clogging switch, you should:

1. After replacing the filter, restore and seal all the panels, so that the alarm point can be found precisely.

2. Keep the fan running and rotate the rotary switch of the filter clogging switch counter-clockwise until the filter alarm is triggered.

3. Rotate the rotary switch clockwise for two and half rounds or rotate it to the point where the filter should be replaced.

- *Cut off the power supply before replacing the filter.*
- *It is recommended to set airflow switch according to the manual instructions, otherwise there will be an air filter alarm or in the opposite case, the alarm could not be triggered by the dust accumulation on the filter, endangering the system operation due to deteriorated ventilation.*
- *If you are unsure about the setting point, consult with Vertiv before using a filter of a different model to replace the old one.*

7.7. Fan

Regular check items of the fan include motor working status, fan blade status, fan assembly fixation, and the clearance between the fan and the inlet ring.

Specially note that the fan components and the inlet ring are fixed firmly. Rotate the blades to ensure that they do not scratch the adjacent metal plate. Any abnormal airflow obstruction should be immediately disposed, for protecting the refrigeration system and other system components from airflow reduction.

7.8. Infrared Humidifier Maintenance Guide

During the normal operation of the infrared humidifier, sediment such as mineral particles will accumulate on its water pan. To ensure efficient operation of the infrared humidifier, you need to clean the sediment regularly. However, the cleansing cycle varies because the water quality is different in different regions. It is recommended to check, and cleanse (when necessary) the water pan, once a month. The auto-flush function of the infrared humidifier can prolong the cleansing cycle. However, regular checks and maintenance are necessary.

Cleaning Steps:

1. Remove the water level standpipe to drain the water pan.
2. Disconnect the drainage pipe.
3. Remove the safety switch of the water pan.
4. Remove the fixing screws at the two ends of the pan and pull out the water pan. Cleanse the water pan with water and hard brush.
5. Restore the water pan by reversing the preceding procedures.

Before exercising the corresponding operation, ensure that the power supply has been switched off; also, ensure that the water in the water pan is close to the room temperature before draining the water from the infrared humidifier water pan to avoid the personal injury.

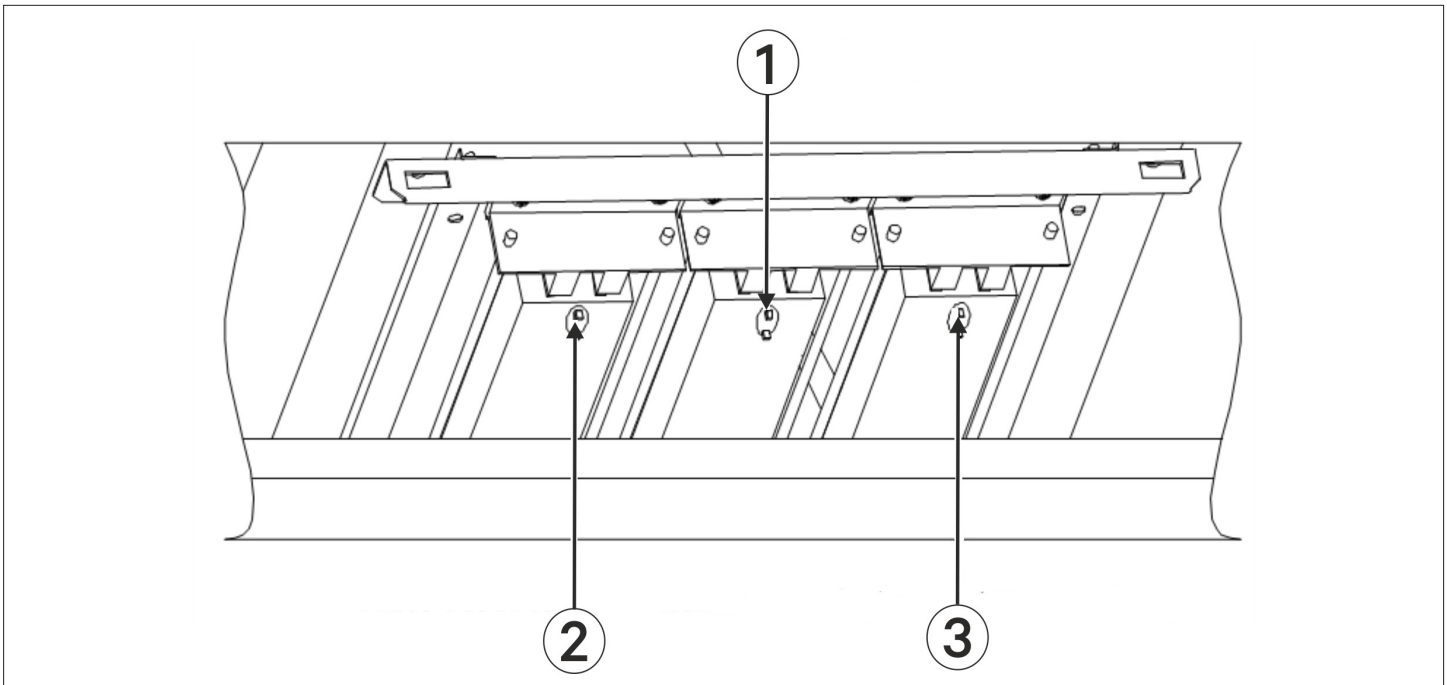
7.9. Electric Heater Maintenance Guide

The electric reheating shown in Figure 7-3, three temperature switches are serially connected to the control loop inside the electric heater, including two automatic reset switches and one manual reset switch. Check the electrical heating for rust. Use an iron brush to get rid of or replace the rust, if possible, if the rustiness is immense or if some damage occurs.

1. Check the rustiness condition of the electric heater; use the iron brush to get rid of the rust or replace it according to actual conditions.

2. When heating is required, but heating is not effective, or no heating effect is observed, a multimeter should be used to check whether the cable connected to the temperature switch is functioning correctly to ensure that the three temperature switches are normal.

3. If the cable is not functioning properly, remove the electrical heater and check if the manual reset switch is disconnected. Next, check the automatic reset switches or the electric heater pipe for damage or faulty condition.

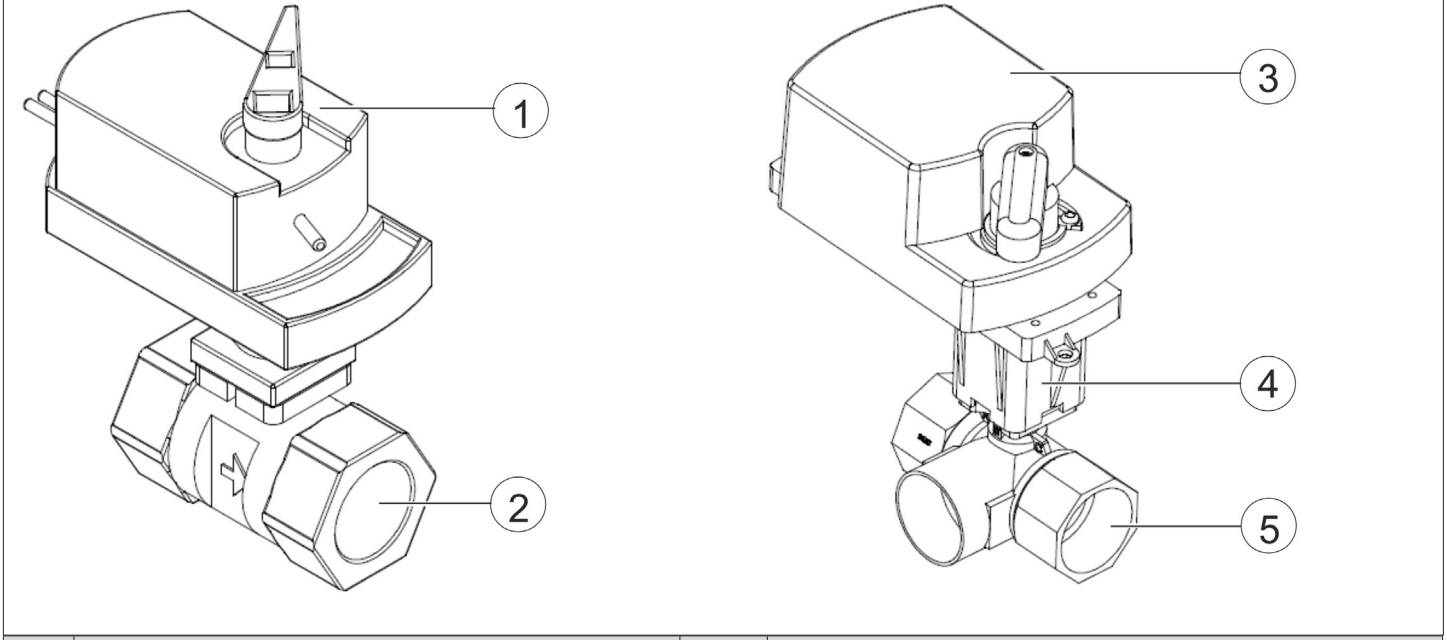


No.	Description	No.	Description
1	Manual reset temp switch	3	Auto reset temp switch
2	Auto reset temp switch		

Figure 7-3 PTC Electrical Heating

7.10. Water Flow Control Valve

The water flow control valve adjusts the valve position by collecting the cooling requirement, to control the water flow through the heat exchanger coil. The higher the load is, the more water flow is required to flow through the evaporator coil. The water flow control valve is composed of a regulator body, connector (some of the units may not have a connector, please pay attention to the actual instance) and actuator. User should select the two way valve or the three way valve depending on the application situation, as shown in Figure 7-4



No.	Description	No.	Description
1	Actuator	4	Connector
2	Regulator body	5	Regulator body
3	Actuator		

Figure 7-4 Water Flow Control Valve

Chapter 8: Diagnosis and Troubleshooting

This chapter introduces the troubleshooting of Liebert® PEX+Chilled Water AC, including the troubleshooting and fault handling of fan, infrared humidifier and cooling system, and heating system.

For the diagnosis and treatment of complex fault please contact Vertiv local representative.

Prior to operation and maintenance, the lethal voltage may be present in the equipment which can be fatal. All notes, warnings, and cautions marked on the equipment as well as the ones mentioned in the manual must be considered, otherwise, it may lead to injury and fatality.

Qualified and professional maintenance personnel are the one supposed to operate and handle the equipment.

8.1. Fault Diagnosis and Treatment of Fans

Refer Table 8-1 for fan fault diagnosis and treatment.

Table 8-1 Fault Diagnosis and Treatment of Fans

Symptom	Potential Causes	Items to be Examined or Handled
EC fan cannot be started	Power Supply Disconnected	Check the MCB of main fan, check if the fans L1, L2 and L3 are power-off, or have phase failure or under voltage
	Control panel failure	Check whether there is 24 Vac voltage between P36-3 and E1. if no, check the control panel. Check whether the green LED beside silicon control Q5 on the control panel is on or not
		Check whether there is less than 10 Vdc voltage between P53-2 and P53-3. if no, check the control panel
Air loss alarm is displayed	Air filter is clogged	Check if the filter is clogged that causes low airflow, if so, replace the filter

8.2. Fault Diagnosis and Treatment of Infrared Humidifier

8.2.1. Infrared Humidifier Troubleshooting

Refer Table 8-2 for diagnosis and treatment of the infrared humidifier.

Table 8-2 Diagnosis and Treatment of Infrared Humidifier

Symptom	Potential Causes	Items to be Examined or Handled
Humidification ineffective	No water in water pan	Check the water supply is normal
		Check whether the water supply solenoid valve is working
		Check the state of the high water-level switch and the water level regulator
		Check whether the water supply pipe is not clogged
	The humidification contactor does not close	Check the contactor, and check the circuit voltage of the contactor
		Check the opened safety devices of the infrared humidifier: Water pan over-temperature protection switch and lamp over-temperature protection switch.
	Humidifier main power failure	Check whether the humidifier MCB is closed. In humidifier contactor closed state, check whether L1, L2 and L3 voltages are normal.
	Infrared humidifier lamp burned	Replace the lamp.

8.3. Refrigeration System - Fault Diagnosis and Treatment

Refer Table 8-3 for fault diagnosis and refrigeration system.

Table 8-3 Refrigeration System Fault Diagnosis and Treatment

Symptom	Potential Causes	Items to be Examined or Handled
No cooling or dehumidification	Control panel failure	Check if there is 24 Vac voltage between P51-1 and E1, P52-1 and E1. If there is not, then the control panel has failures
	Failure to turn on the water valve	Check if there is 10 Vdc voltage between water valve Vdc/mA and E5 terminal. If there is, then the water valve has failures. Please replace the water valve.
Contactor closed, no heating effect	Power supply failure of electrical heater	Check if the electrical heater MCB is turned-on. When the heating contactor is closed, check if the L1, L2 and L3 voltages of contactor are normal
	Electrical heater burnout	Turn-off the power supply and check the condition of the electrical heater

8.4. Heating System - Fault Diagnosis and Treatment

Refer Table 8-4 for fault diagnosis and treatment of heating system.

Table 8-4 Diagnosis and Treatment of Heating System

Symptom	Potential Causes	Items to be Examined or Handled
The heating system is not running, the contactor does not pull	No heating required	Check the state of the controller, to confirm whether there is a heating requirement.
	Heating auxiliary relay fault	Check if the LED besides the relay is on and if the circuit is correct
	Heating system safety device is disconnected	Check if manual reset switch is turned off and check the automatic reset for damage.

Appendix I: Content of Harmful Substances in Products

Harmful Substances in Products

Part Name	Harmful Substance					
	Lead (Pb)	Mercury (Hg)	Cadmium (Cd)	Hexavalent chromium (Cr (VI))	Polybrominated biphenyls (PBB)	Polybrominated diphenyl ethers (PBDE)
Cabinet	×	○	○	○	○	○
Cooling part	×	○	○	○	○	○
Fan unit	×	○	×	○	○	○
Heater unit	×	○	○	○	○	○
Electric control unit	×	○	×	○	○	○
LCD	×	×	○	○	○	○
PCBA	×	○	○	○	○	○
Heat exchanger	×	○	○	○	○	○
Copper bus	×	○	○	○	○	○
Cables	×	○	○	○	○	○

This form is prepared in accordance with the provisions of SJ/T 11363-2006.
O: Means the content of the hazardous substances in all the average quality materials of the part is within the limits specified in SJ/T-11363-2006;
×: Means the content of the hazardous substances in at least one of the average quality materials of the part is outside the limits specified in SJ/T11363-2006

Vertiv has been committed to the design and manufacture of environmentally friendly products, we will reduce and eliminate toxic and hazardous substances in products through ongoing research. The following application components, or toxic and hazardous substances is not limited to the current level of technology or no reliable alternative mature solution:
1. Parts of the above reasons lead: Copper alloy member containing lead; high temperature solder of lead; high temperature solder of lead diodes; uranium glass resistor lead (exempt); electronic ceramics containing lead (exempt);
2. The backlight lamp contains Mercury;
3. Distribution of the switch contact portion containing Cadmium and Cadmium compounds

Notes on environmental protection use period: Environmental protection use period of the product (identified in the body of the product), means that under normal conditions of use and compliance with safety precautions from the date of production of this product (excluding battery) Term toxic and hazardous substances or elements contained no serious impact on the environment, persons and property.

Scope: Liebert® PEX+ Chilled Water series of Precision Air Conditioning