Liebert® PEX3™ DX 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 PEX3 DX series 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
1.0	25.08.2019		---

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 compressors, refrigerant discharge lines, and humidifiers 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.

Table of Contents

Chapter 1: Product Overview

1.1. Product Introduction

The ‘Liebert PEX3 series’ is the next generation series of air conditioners that provide precise environmental control. The Liebert PEX3 models are the latest enterprise-grade products from the Liebert family. Incorporating the high standards associated with the Liebert name, the PEX3 series utilizes the latest technology, system components, and streamlined manufacturing process.

Liebert PEX3 air conditioner are specifically created and designed for data centers, equipment room, computer rooms, and similar ecosystems that require high control accuracy in terms of inside environment condition. It caters to sensitive applications that require 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 PEX3 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.

Air-cooled series

The Liebert PEX air-cooled series air conditioner comprises indoor and outdoor units with the standard configuration of Liebert PEX condenser unit, it can reduce noise pollution to the minimum while meeting system cooling requirements through the pressure regulating the fan speed.

Water-cooled series

The Liebert PEX water-cooled series air conditioner uses integrated structure and highly effective brazed-plate heat exchanger (BPHE), thus it is a compact, efficient and quiet in the operating conditions (only P1030 unit).

1.2. Model Description

This chapter introduces the model, appearance, components, optional configuration and refrigerant requirements of Liebert PEX3. The 'Liebert PEX3 Series Precision Air Conditioner' ("PEX3" for short hereafter) is a cooling equipment, a medium-large sized precision environment control system, adapted to the environment control of the equipment room or computer room, featuring high reliability, high sensible heat ratio and large airflow. The appearance of Liebert PEX3 models are shown in Figure 1-1.

Upflow Model

Downflow Model

Figure 1-1 Liebert PEX3 Models

1.3. Model Nomenclature

The Liebert PEX3 series model is fully-defined by 25 digits, as represented in Table 1-1.

Table 1-1 Liebert PEX3 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	1	0	3	0	D	A	1	0	6	H	9	1	2	E	1	D	L	0	0	C	E	0	3	2

Digit 1,2 Product Model	
P	***PEX3***
1-2	***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	
A	***Air Cooled***
W*	Water Cooled
Digit 8 Airflow	
1	***EC Plug Fan***
Digit 9 Power Supply	
0	***400 V/ 3 Ph/ 50 Hz+N***
7	380 / 3 Ph/ 60 Hz+N
C	208 V/ 3 Ph/ 60 Hz
D	230 V/ 3 Ph/ 60 Hz
A	460 V/ 3 Ph/ 60 Hz
8	400 V/ 3 Ph/ 50 Hz
Digit 10 Cooling System	
4	Compliant Scroll Dual Circuit, R410A
6	***Compliant Scroll Single Circuit, R410A***
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 17 Mains Switch High Voltage Option	
0	None
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
L	***Air-cooled, Long pipe> 30 m***
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
1	A+S
2	A+H
3	A+F
4	N+S
5	H+N
6	A+N
7	H+N+S
8	A+N+S
9	A+H+N
B	A+F+N
Digit 21 Packaging	
P	Package- Standard Cardboard and Wooden Pallet
C	***Packaging– Wooden Crate***

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	1	0	3	0	D	A	1	0	6	H	9	1	2	E	1	D	L	0	0	C	E	0	3	2

Digit 13 Re-heating	
0	None
1	***Electrical Heating Std. 1 Stage***
2	Electrical heating Opt. 2 Stage

Digit 14 Filtration	
2	***G4***
3	F5

Digit 15 Coil and Valves	
E	***Standard DX Air Cooled Coil, EEV***
6	Water-cooled, 2-way valve

Digit 16 Enclosure Option	
1	***Standard Color Black Orange Peel Grain Coating***
2	White orange peel grain coating
6	Color charcoal grey w/ double skin

Digit 22 Special Requirements	
A	SFA- None
P	For Export with Condensate Pump
E	***For Export***

Digit 23 Order Identifier	
0	***Standard ESP***
1	50 Pa ESP
2	100 Pa ESP
3	150 Pa ESP
4	200 Pa ESP

Digit 24 Order Identifier	
3	***Factory Code***

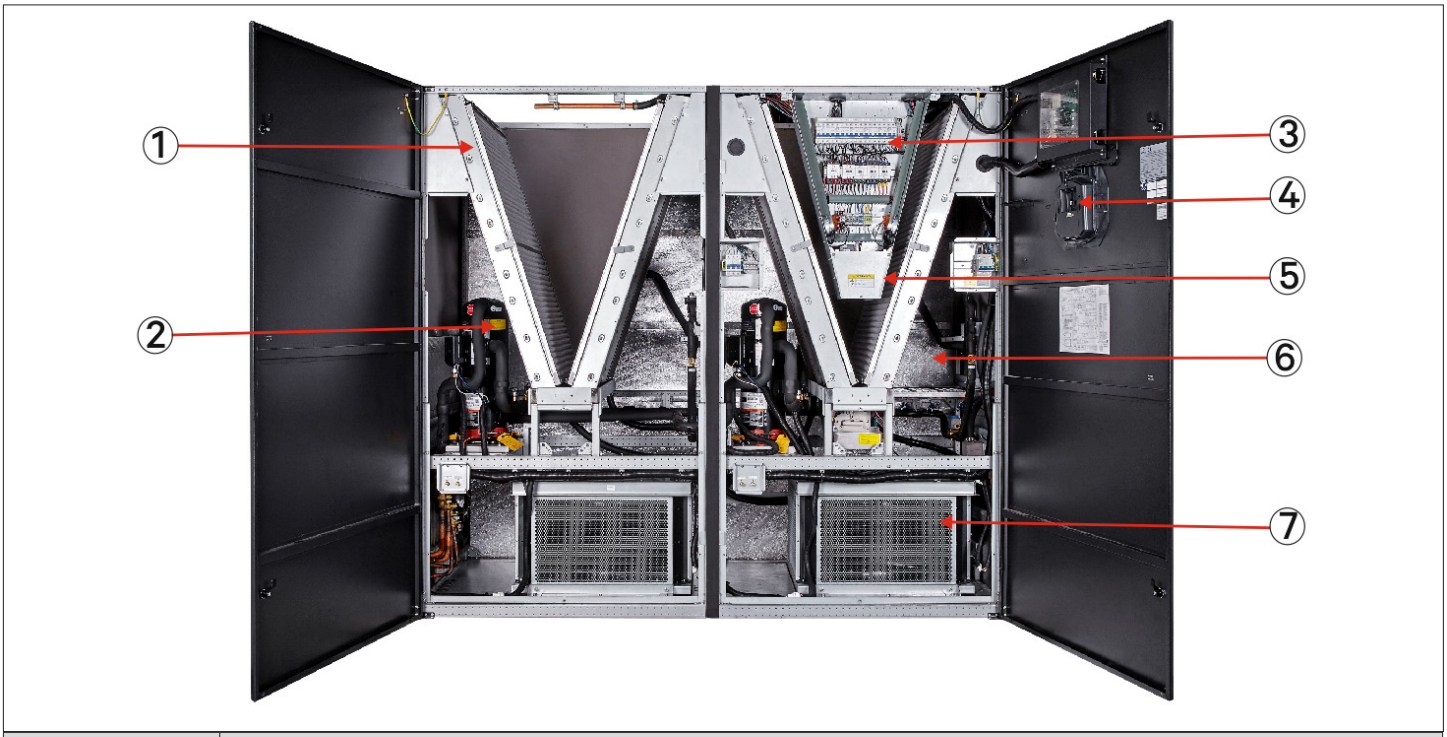
Digit 25 Order Identifier	
2	***Factory Code***

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

**DX Water-cooled version is applicable for 30 kW.*

1.4. Components of PEX3 Model

An overview of the main components, optional components and features of the Liebert PEX3 is mentioned in this section. Liebert PEX3 components include indoor unit, outdoor unit, and remote monitoring software. Figure 1-2 shows main components of PEX3 model.



No.	Description
1	Evaporator Coil
2	Compressor
3	Electrical Panel
4	HMI Display
5	Filter
6	Electronic Expansion Valve (EEV)
7	EC Fan

Figure 1-2 Main Components of PEX3 Model

1.4.1. Indoor Unit Parts

The PEX3 Air-cooled indoor unit includes Compressor, Evaporator, Electronic Expansion Valve, Infrared Humidifier, EC Fan, Electrical Heating, Sight Glass, Filter Dryer and iCOM Controller. The description of the main components is tabulated in the Table 1-2. In case of the water-cooled series indoor unit also includes BPHE and MBV (2-way).

Table 1-2 List of Indoor Unit Components

Component	Description
Cabinet	The cabinet frame is constructed from 2.5mm, 2.0mm and 1.2mm 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.
Compressor	Equipped with compliant scroll compressor, it withstands high vibration, and features low noise and high reliability.
Evaporator	• Uses parallel flow micro-channel evaporator with higher heat transfer efficiency. The material used for evaporator is Aluminum. • Detailed design and verification for internal distributor of the evaporator to ensure uniformity of distribution of the refrigerant, the utilization of the evaporator is considerably improved.
Electronic Expansion Valve (EEV)	• The EEV is designed for precision modulating control of the refrigerant mass flow. • The EEV simultaneously collects temperature and pressure signals to accurately regulate the refrigerant flow. The EEV's wide operating envelope also reduces the condensing pressure, thereby resulting in significant energy savings.
Infrared Humidifier	• Infrared humidifier structure is simple, easy to disassemble, clean and maintain. • The infrared humidifier application reduces the dependence on water quality, it takes a very short time to start up and reach the humidification requirement, it has the performances like high humidifying capacity and high efficiency.
EC Fan	• Uses EC fans with PP plastic blade material that enable high efficiency, space-saving, low noise characteristics. • The structure of EC fan unit is carefully designed, downflow unit adopts a "in-floor" design, this design can lower the EC fan below the floor to supply air, to further improve the efficiency of air supply.
Electrical Heating	Electrical heating features faster heating rate, uniform heating, safety and reliability. The material used for electrical heating is PTC ceramic heating element and aluminum pipe.
Sight Glass	The windows of the system loop observe the state of the refrigerant, detects the system's moisture content. The background color of sight glass changes once the moisture of the system exceeds permissible limits.
Filter Dryer	It can effectively remove moisture present in the system, while the system is operating for long-term. To ensure the normal operation of the system removal of impurities is vital.
BPHE (Water Cooled)	The brazed plate auto-cleansing BPHE is used, where plates are constructed by 316 stainless steel and brazing material is copper. It features compact structure and high heat exchanging efficiency. The maximum working pressure for BPHE is 46 bar. Rotalock connections are provided for water and refrigerant sides.
MBV (Water Cooled)	The 2-way motorized ball valve is used. The water flow in the BPHE can be regulated through the intelligent valve position control of the control board, so as to ensure stable system operation, and the maximum working pressure for MBV is 40 bar.

Component	Description
Long Pipe Kit	The long pipe kit can prevent the refrigerant from returning and concentrating after the compressor is turned off, ensuring normal start of the compressor and making the system safer. The solenoid valve is installed internally, and the check valve is supplied loose for installation on site.
iCOM Controller and HMI Display	• The standard features available in PEX3 unlike legacy PEX series are the highest capability for unit control, communication, and monitoring of CRAC units. • Offers the highest capability for unit control, communication, monitoring of CRAC units. • Speeds setup and installation and simplifies control of CRAC units, putting cooling-system monitoring and management at customers fingertips. • Uses a firm touch, or consider a stylus when interacting with the touchscreen. • User and service menus are password-protected to prevent unauthorized changes to cooling unit operation. • The touchscreen is back-lit and auto-dims after a period of non-use, the turns off and touch the screen to re-illuminate the main screen. • iCOM ships with default settings for efficient and effective operation of most cooling-units and is easily configured to meet any requirements. • iCOM menus and displays are based on the options installed on the cooling units that it monitors and manages. • LCD screens with dark-gray backlight and 800x480 pixels. • Display the real-time values of the CRAC's status, active and history alarms. • Self-recovery after power failure. • It can store up to 400 history event records.

1.4.2. 9-Inch Color Display

PEX3 unit is available with 9-inch touch screen as a standard display, using multi-color 800×480 dot-matrix liquid crystal touch screen with white backlight as shown in Figure 1-3. The operation of the unit becomes simpler and more convenient, and the status view of the unit is more visualized.

Figure 1-3 iCOM Controller Display

1.4.3. Condenser

Two types of condensers are available, for details, refer to “Liebert PEX Condenser User Manual” and “LVC Series Condenser User Manual”.

1.4.4. Remote Monitoring Software

Liebert PEX3 units interface with the BMS system through Modbus/ SNMP/ BACnet communication protocol by unity card, which enables Liebert PEX3 to communicate with the host computer and receive the control instructions from the host software. By default one unity card is configured in the unit, but on the request two unity cards can be configured.

1.5. Optional Components

1.5.1. 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.

1.5.2. 2-stage Electrical Heating

The 2-stage electrical heating can be selected based on the heating requirement. The electrical heating 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.

1.5.3. Dual Power Supply- ATS

The dual power ATS can automatically detect both the power sources (source 1 & source 2). In case of break-down of the preferred power source, ATS is equipped to automatically switch to the source 2. It can also provide an output signal associated with power alarm.

1.5.4. Dual Power Supply- Parallel

In dual power supply parallel, there are two sources of power- one is connected through UPS to the fan and the control board. While, the components such as electrical heating and humidifier are connected to other power source which is directly coupled with the main supply. Hence, the fan and the control board can still be operated when the main connection fails without affecting the room ventilation.

1.5.5. Plenum Configuration

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

1.5.6. Dual Power (Interlocked Contactors)

It consists of dual power supply (interlocking contractor 3P). 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.

1.5.7. Large & Small Display

According to the requirement, Large & Small display are optional, using 480x480 pixel for large display and 128x64 pixels for small display. Both displays have 9 buttons on front board and use the multi-level password to prevent unauthorized operation. Configure the setpoints of CRAC unit, displays the real-time values of the CRAC's status, active and history alarms.

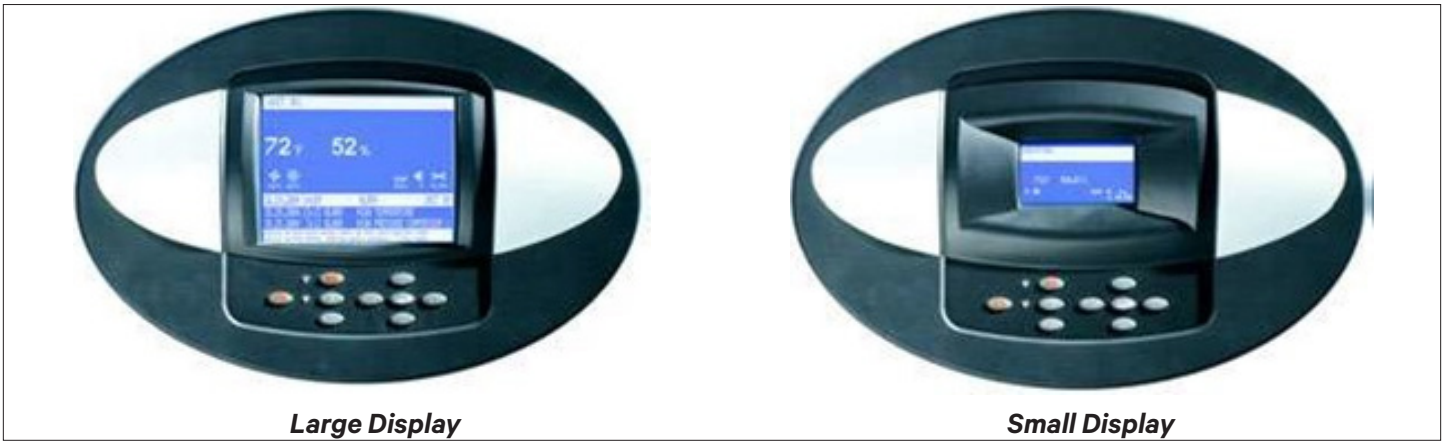


Figure 1-4 Large & Small Display

1.5.8. IS-UNITY-DP Card Assembly

By default, each card supports the Vertiv Protocol, Remote Service Delivery Protocol and HTTP Web. Control and configuration capabilities are protected by an administrator's user-name and password combination. Optionally, status information can be password-protected. The default user-name for the administrator is 'Liebert' and the default password is also 'Liebert'.

1.5.9. 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.

1.5.10. 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.

1.5.11. 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.

1.5.12. 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.

According to the requirements, Liebert PEX3 series can be provided without heating and humidification options.

1.6. Refrigerant Requirement

The unit has a specifically designed air conditioning system that requires a desired per-specified quality of refrigerant (R410A) to perform continuously at the most optimum efficiency. For the details on the quantity of refrigerant to be charged inside the system refer “Section 1.6.1”.

- *Do not use inferior quality refrigerant.*
- *For any consequences resulting from inferior quality refrigerant, Vertiv does not assume warranty responsibility.*

1.6.1. Charging Refrigerant

Air-cooled series

The Liebert PEX3 air-cooled series air conditioner is charged in the factory with 2 bar nitrogen for shipping. Table 1-3 and Table 1-4 show the standard refrigerant charge for indoor and outdoor unit respectively.

Table 1-3 Indoor Refrigerant Charge (Unit: kg)

Indoor Model	P1030	P1040	P1050	P1050	P2060	P2070	P2080	P2090	P2100
	Single Circuit	Single Circuit	Single Circuit	Double Circuit	Double Circuit	Double Circuit	Double Circuit	Double Circuit	Double Circuit
Standard Charge	3.03	3.32	3.32	2x1.66	2x3.03	2x3.03	2x3.32	2x3.32	2x3.32

Table 1-4 Outdoor Refrigerant Charge (Unit : kg)

Outdoor Model	LSF38	LSF42	LSF52	LSF62	LSF70	LSF76	LSF85
Standard Charge	2.99	4.65	6.19	5.64	5.64	7.30	9.73
Outdoor Model	**LDF76**	**LDF85**	**LVC088SE4**	**LVC106SE4**		**LVC140SE4**	**LVC152SE4**
Standard Charge	2x3.65	2x4.87	2x4.79	2x6.39		2x6.10	2x7.19

Refrigerant Charge = Charge of Indoor Unit + Charge of Outdoor Unit + (Refrigerant Charge per Unit Length of Liquid Pipe x Length of Extended Pipe)

Table 1-5 Amount of Refrigerant per Unit Length of Liquid Pipe (Unit: kg/m)

Liquid Pipe OD (mm)	Refrigerant Charge per Unit Length of Liquid Pipe (kg/m)
16	0.17
19	0.24
22	0.32
25	0.42

Water-cooled series

The Liebert PEX3 Water-cooled series air conditioner is charged in the factory with 1 bar to 2 bar nitrogen for shipping. Table 1-6 show the standard refrigerant charge for the unit on-site.

Table 1-6 Indoor Refrigerant Charge Water-cooled (Unit: kg)

Indoor Model	P1030
	Single Circuit
Standard Charge	4.0

1.7. Storage & Operating Environment Requirements

Refer Table 1-7 & Table 1-8 for storage environment and operating environment requirement.

Table 1-7 Storage Environment Requirements

Item	Requirement
General requirements	Clean room (no dust)
Environment humidity	Less than 95% RH (30 °C)
Ambient temperature	-25 °C to +55 °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 1-8 Operating Environment Requirements

Item	Requirement
Ambient temperature	Indoor temperature: 18 °C to 35 °C, Outdoor (air cooling): -15 °C *to* +45 °C, the minimum operating of outdoor is -35 °C, when equipped with low temp kit. Cooling water inlet temperature: 10 °C to 34 °C
Protection level (cooling unit)	IP20
Altitude	<1000 m, derating is required when located altitude is above 1000 m
Operation voltage range	400 V, 3 Ph + N~50 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 1-8.*

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 PEX3 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 displayed 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.

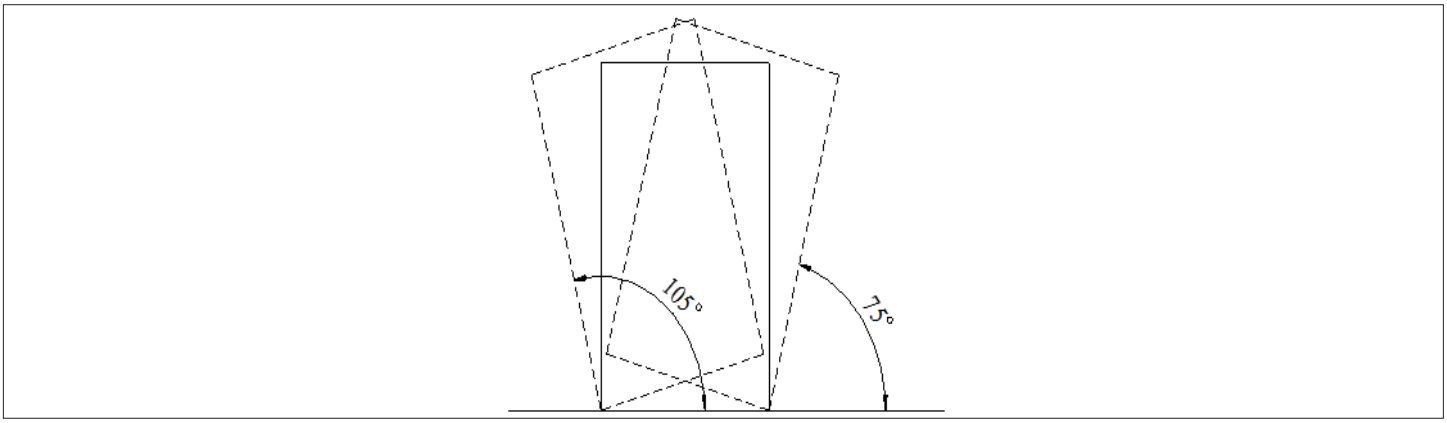


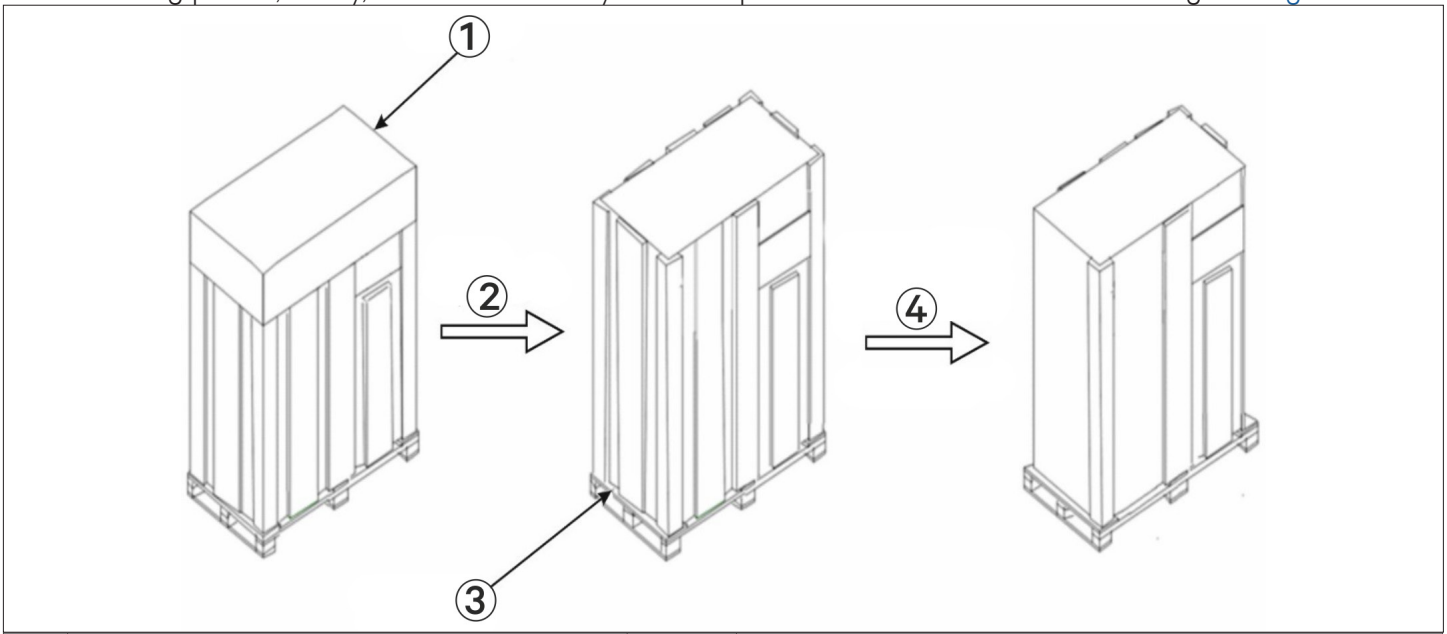
Figure 2-2 Obliquity of the System

2.1.2. Unpacking

Move the equipment 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.

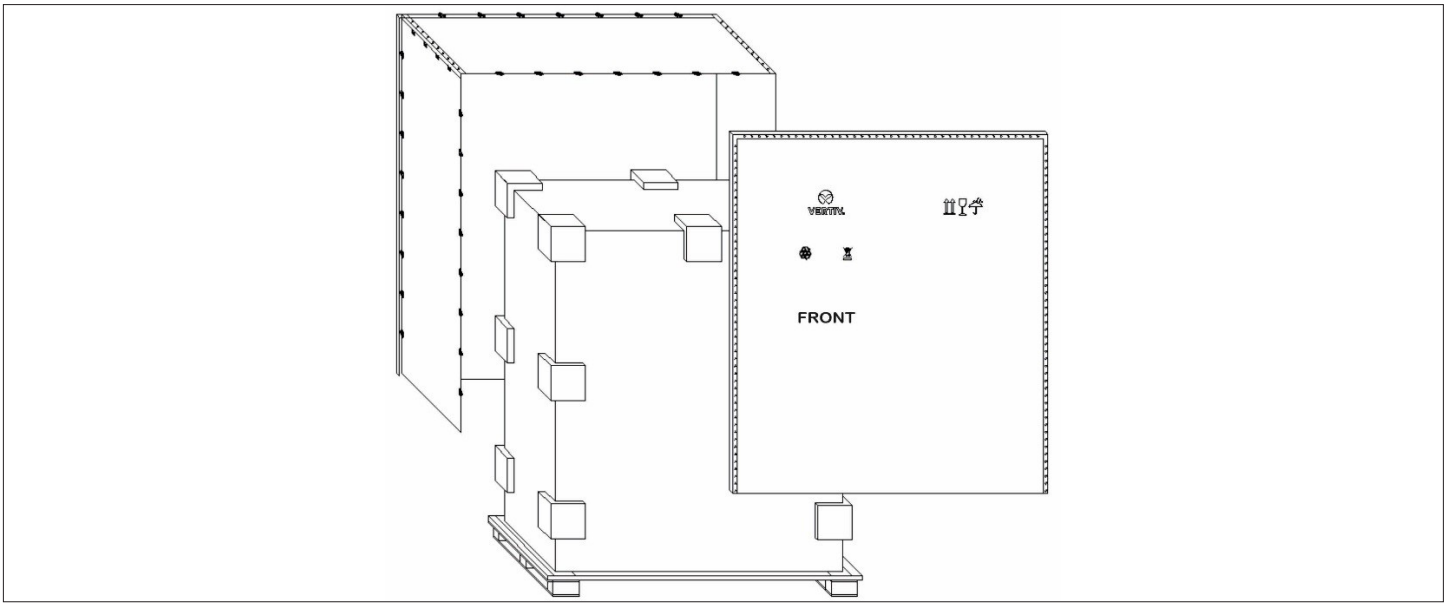
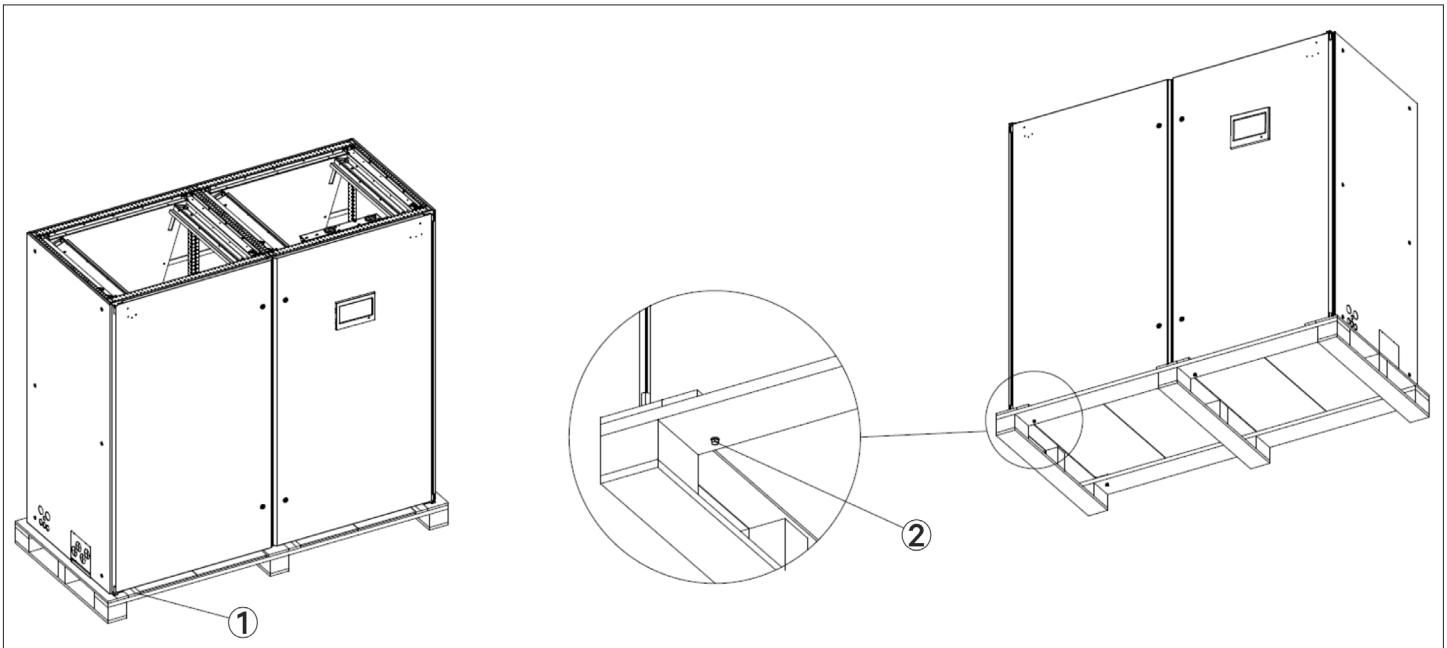


Figure 2-5 Removing Side Panel and Top Cover

- **Remove the Base Pallet**

The unit is fixed onto the base pallet with M8×65 bolts or M8×90 screw, as shown in Figure 2-6 for air-cooled, it will be same for water-cooled model (single bay) as well. Use a 17 mm open-end spanner, ratchet spanner or sleeve to remove the fixing bolts.



No.	Description	No.	Description
1	Pallet Screw Position Marking	2	Pallet Screw

Figure 2-6 Pallet Screws Fixing Position for Air Cooled

2.1.3. Inspection

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

2.2. Installation Preparation (Site Preparation)

PEX3 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 PEX3 DX 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 1100 mm must be reserved in-front of the air conditioning unit. The required maintenance space for air-cooled unit is shown in Figure 2-7 and for water-cooled unit see Figure 2-8. Refer Table 2-1 for maintenance spaces of both types of unit models.

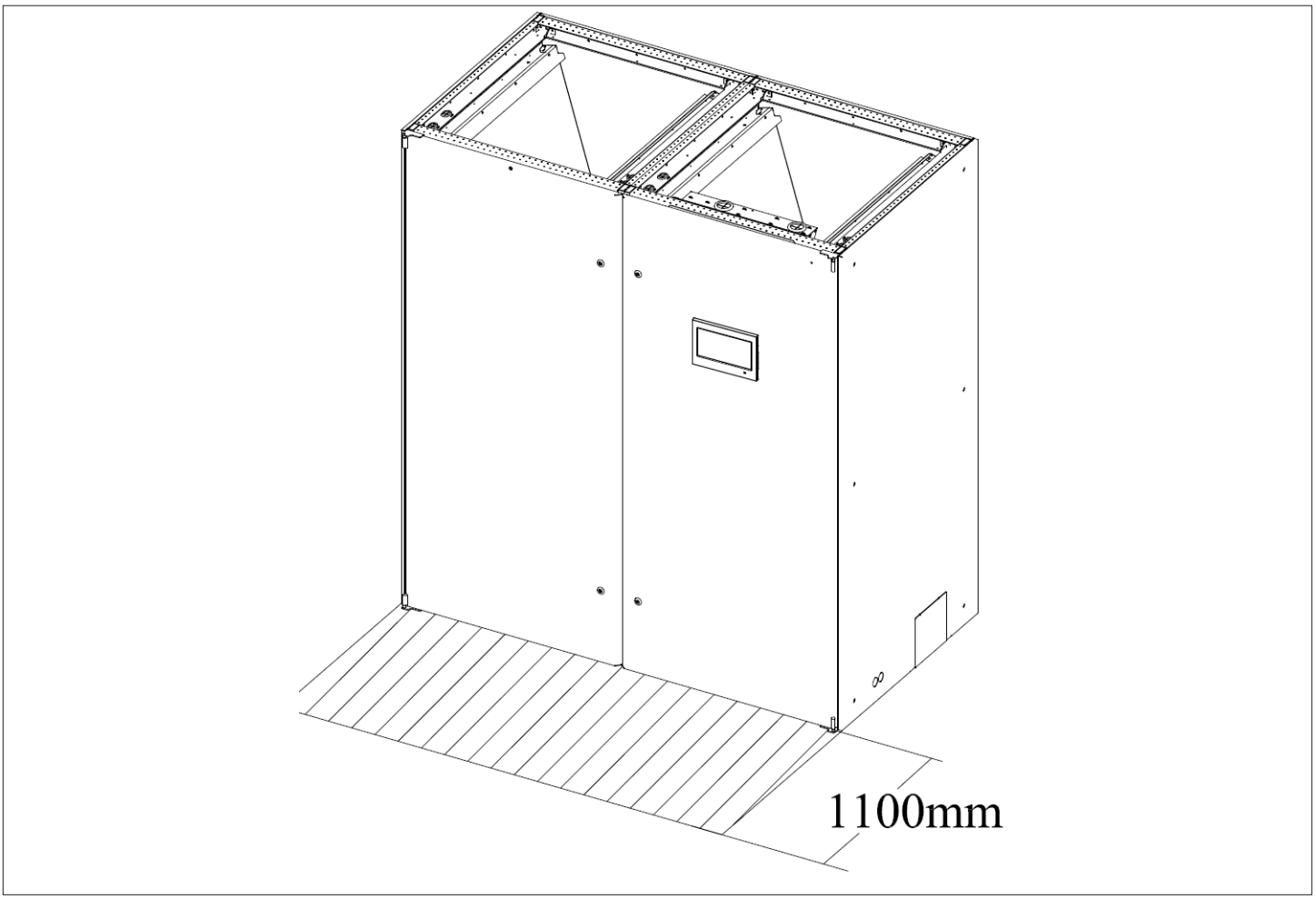


Figure 2-7 Maintenance Space of Unit for Air-cooled Unit

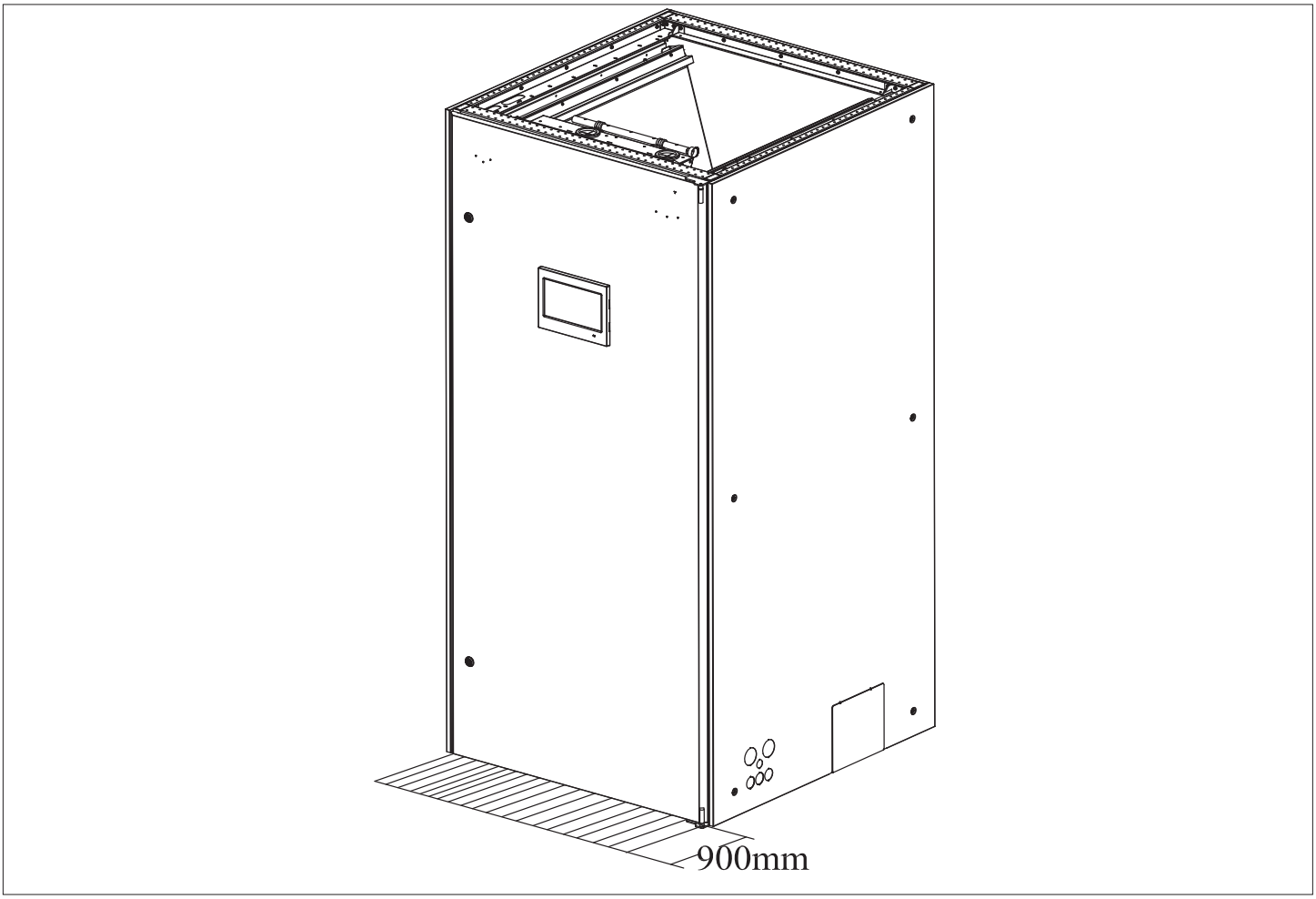


Figure 2-8 Maintenance Space of Unit for Water-cooled Unit

Table 2-1 Normal Maintenance Space (unit: inch/mm)

Product Type	Front	
	mm	inch
P1030	900	35.4”
P1030 (For Water-cooled)	900	35.4”
P1040~P1050	1100	43.3”
P2060~P2070	900	35.4”
P2080~P2100	1100	43.3”

2.2.4. Installation Tools

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

Table 2-2 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 2-2 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

The piping for the refrigerant is needed for the indoor and outdoor unit of the air-cooled system. The system arrangement diagram of the refrigeration system is shown in Figure 2-9.

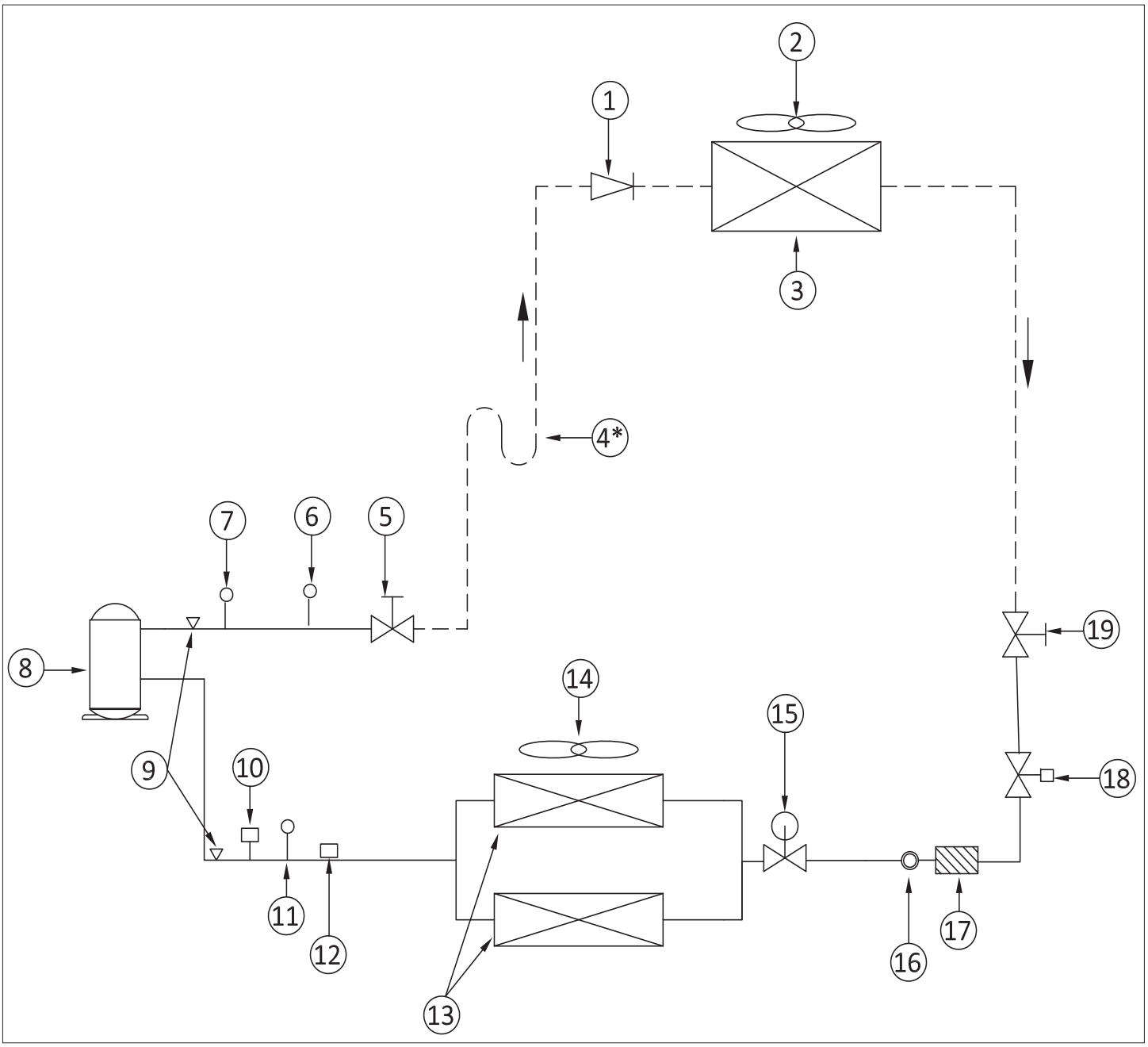


Figure 2-9 Air-cooled System Arrangement Diagram

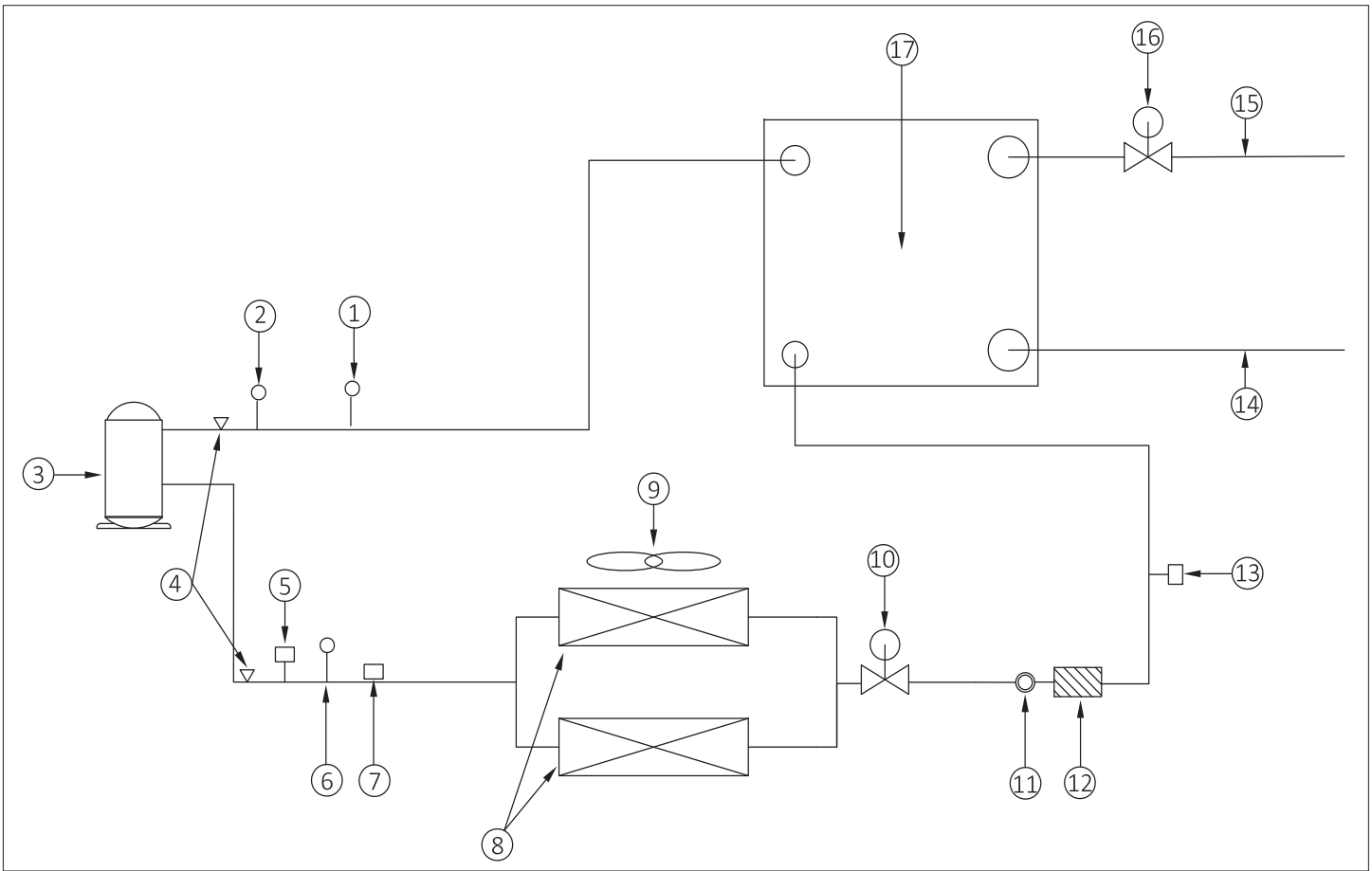
List of the components of system arrangement diagram (Figure 2-9) is given in the below table.

No.	Description	No.	Description
1	Check valve	11	LP switch
2	EC/ AC fan	12	Suction temperature sensor
3	Condenser Coil	13	Evaporator coil
4*	Oil trap (mounted one at every rise of 7.5 m)	14	EC fan
5	Shutoff valve	15	Electronic Expansion Valve
6	Discharge temperature switch	16	Sight glass
7	HP Switch	17	Filter dryer
8	Scroll Compressor	18	Solenoid valve
9	Schradar Valve	19	Shutoff valve
10	LP transducer		

The following points should be considered before checking out the overall layout diagram

- ═══════: *Factory piping*
- ----------: Field piping *(by technical personnel)*
- *The single system is used as an example.*
- *Components (marked with *) are not supplied by Vertiv but are recommended for proper circuit operation and maintenance.*

The system arrangement diagram of the refrigeration system for water-cooled is shown in Figure 2-10

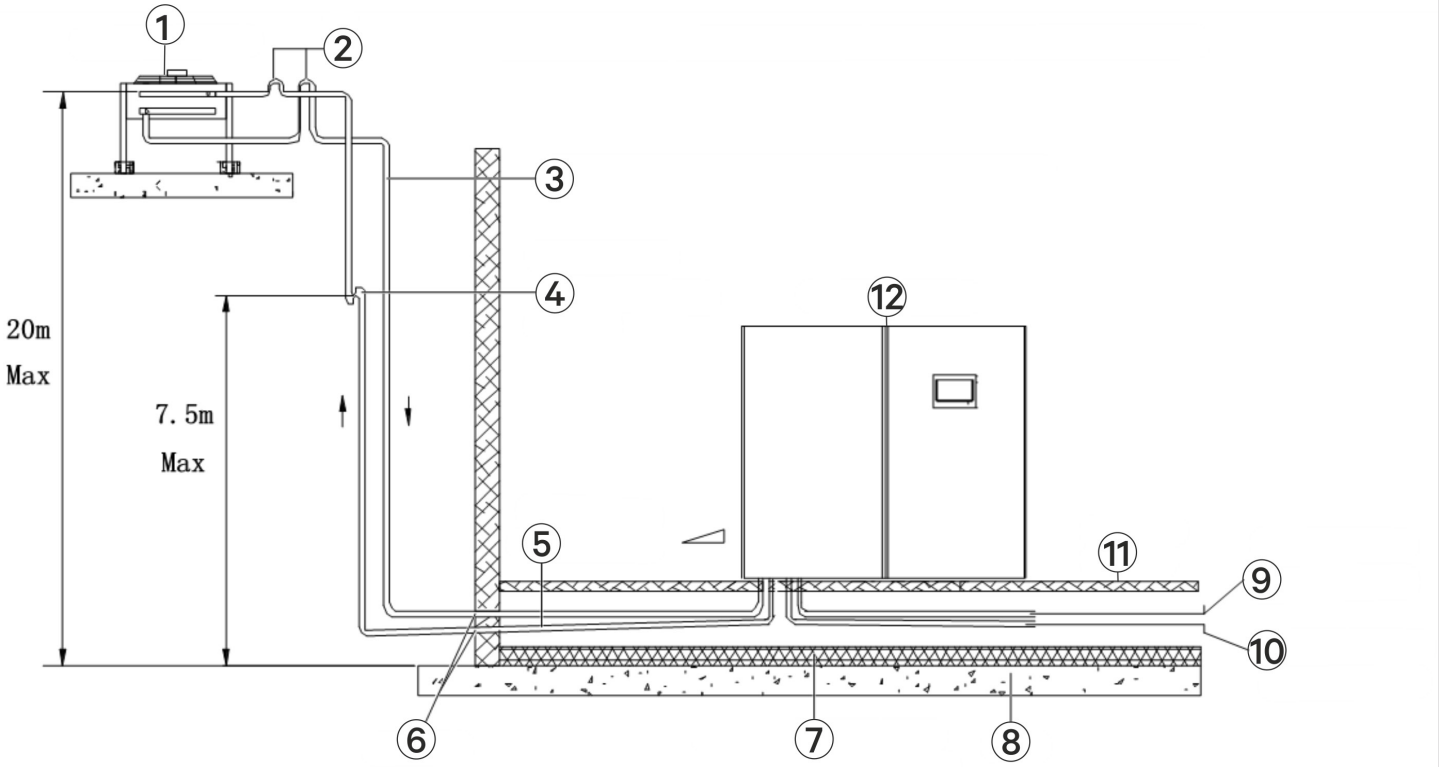


No.	Description	No.	Description
1	Discharge temperature switch	10	Electronic expansion valve
2	HP switch	11	Sight glass
3	Scroll compressor	12	Filter dryer
4	Schrader valve	13	HP transducer
5	LP transducer	14	Welding port of water inlet
6	LP switch	15	Welding port of water outlet
7	Suction temperature sensor	16	Motorized ball valves (MBV)
8	Evaporator coil	17	BPHE
9	EC fan		

Figure 2-10 Water-cooled System Arrangement Diagram

2.2.6. System Installation Mode

The system installation schematic diagram explains the process of installation for the outdoor unit.

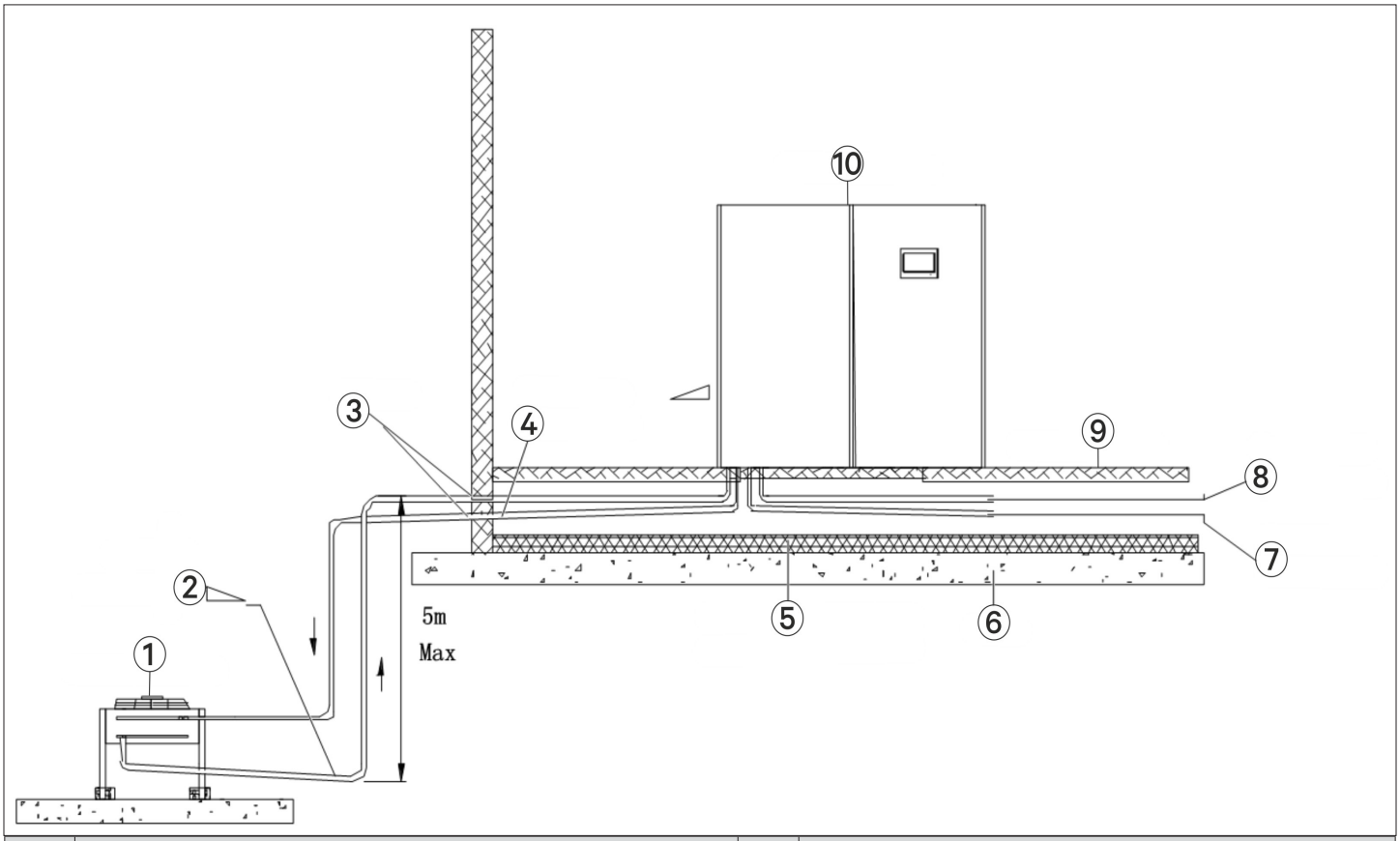


No.	Description	No.	Description
1	Outdoor unit	7	Thermal isolated layer under floor
2	Inverted traps (higher than the top copper pipe of condenser)	8	Slob
3	Liquid pipe (avoid direct sunshine)	9	Humidifier supply pipe
4	Oil trap (oil storage bend)	10	Condensate drain pipe
5	Discharge pipe slope	11	Raised floor
6	Sealed	12	Indoor unit

Figure 2-11 The Outdoor Unit is Placed Higher than the Compressors during Installation

The outdoor unit should be installed at higher position than the compressor, therefore, an inverted backbend is connected to the discharge line and the liquid line of the condenser. The modification is essential as it prevents the liquid refrigerant from flowing back once the compressor stops. The top end of the inverted backbend should be installed higher than the ultimate level of the copper pipe of the outdoor unit. However, if the outdoor unit is installed lower than the compressor, then no modification is required.

The illustration in Figure 2-11 depicts the schematic diagram of system installation when the outdoor unit is installed at a higher level than the compressor and Figure 2-12 when the outdoor unit is installed at a lower level than the compressor.



No.	Description	No.	Description
1	Outdoor unit	6	Slob
2	Liquid pipe slope	7	Condensate drain pipe
3	Sealed	8	Humidifier supply pipe
4	Discharge Pipe slope	9	Raised floor
5	Thermal isolation layer under floor	10	Indoor unit

Figure 2-12 The Outdoor Unit is Placed Lower than the Compressor during Installation

Figure 2-13 shows the arrangement of cooling water system, which requires the water hotter than 10 °C. Use heaters if the water source in site cannot meet this requirement. The cooling tower should be a cooled loop system.

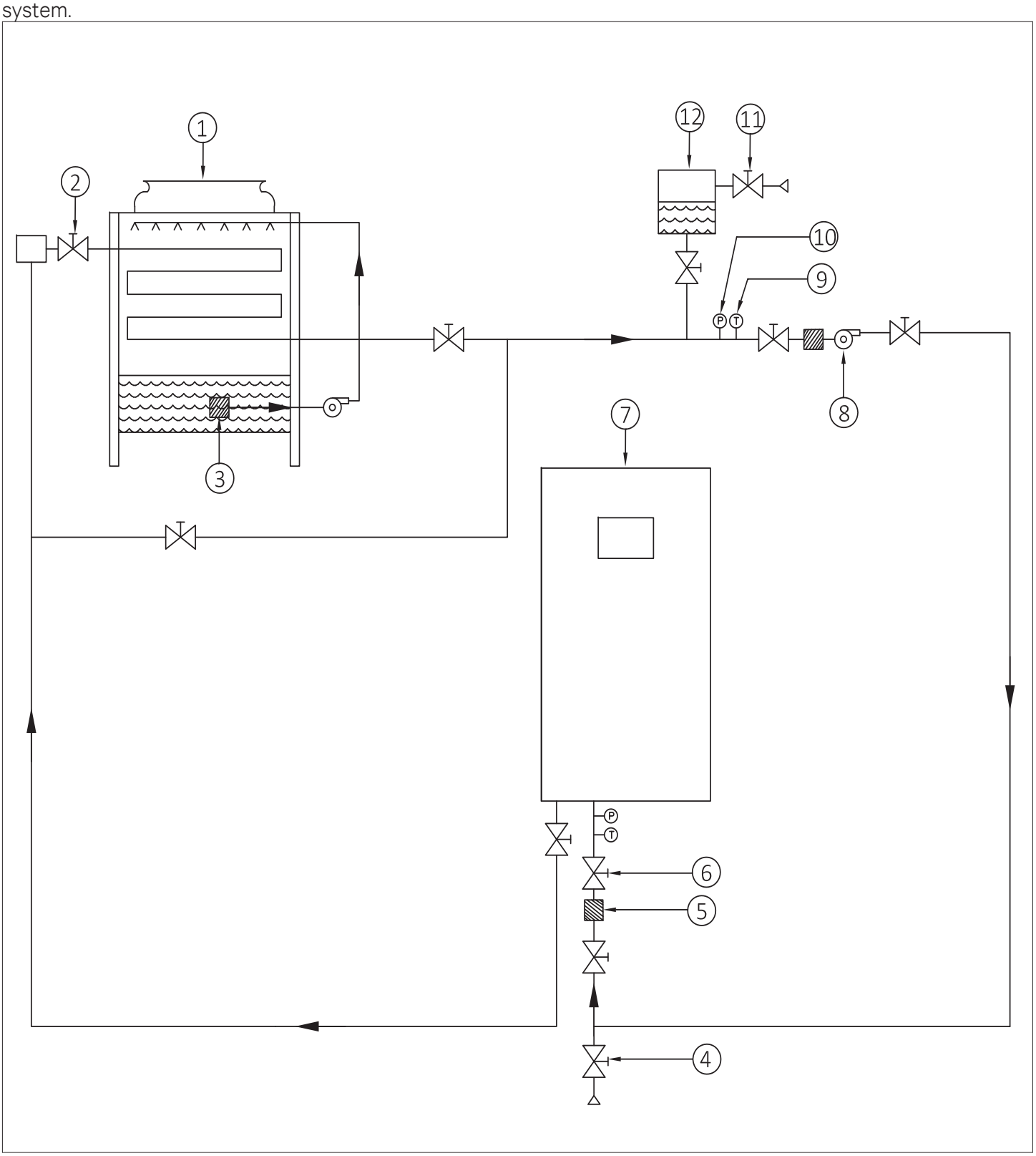


Figure 2-13 Arrangement of Water-cooled System

List of the components of system arrangement diagram (Figure 2-13) is given in the below table.

No.	Description	No.	Description
1	Closed cooling tower	7	Liebert PEX3 unit
2	Exhaust water valve	8	Pump
3	Strainer	9	Temperature gauge
4	Drain valve	10	Manometer
5	Filter	11	Supplementary valve
6	Ball valve	12	Expansion water tank

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 2-14 & Figure 2-15 and Table 2-3 respectively.

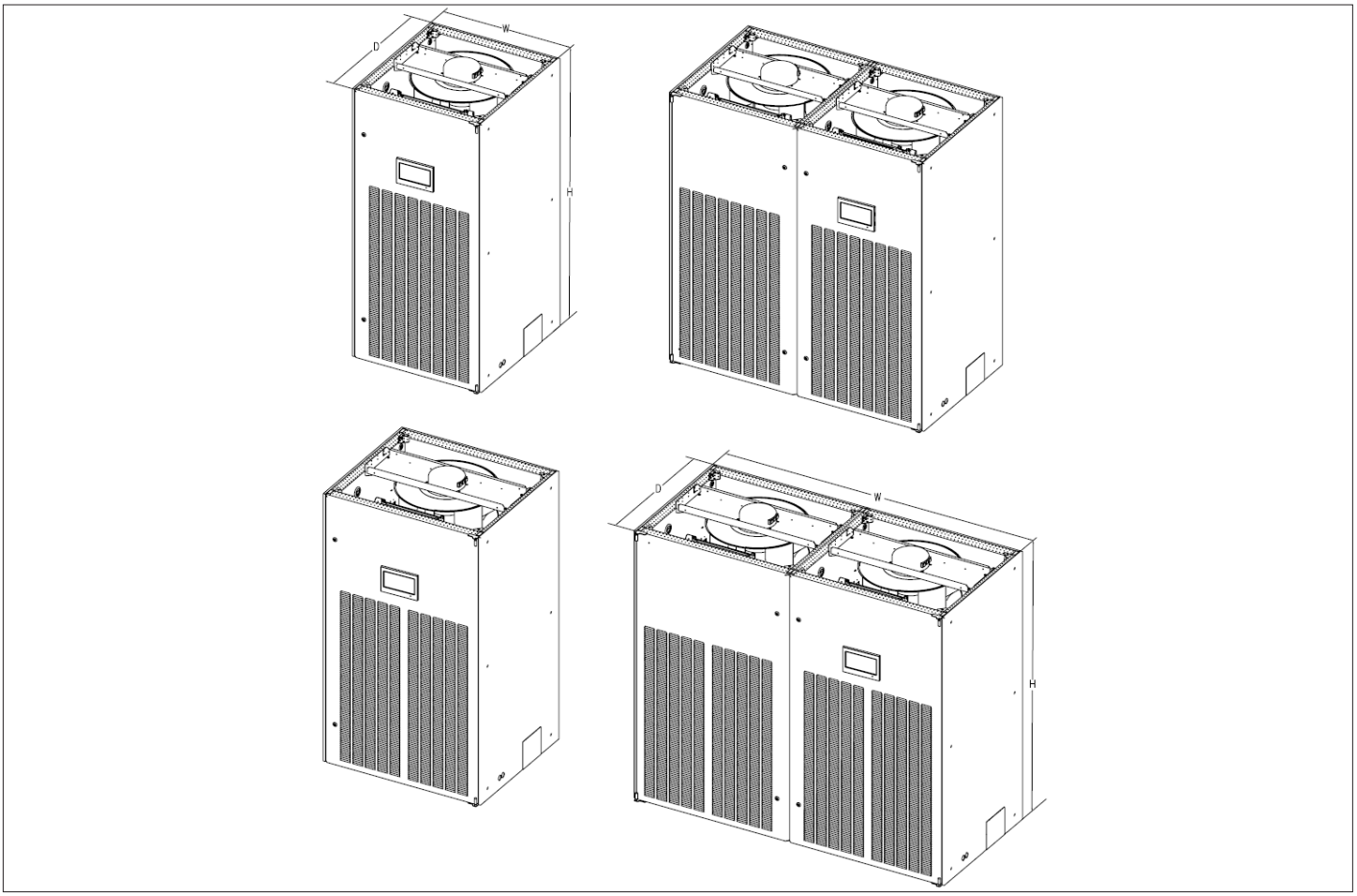


Figure 2-14 Upflow Indoor Unit

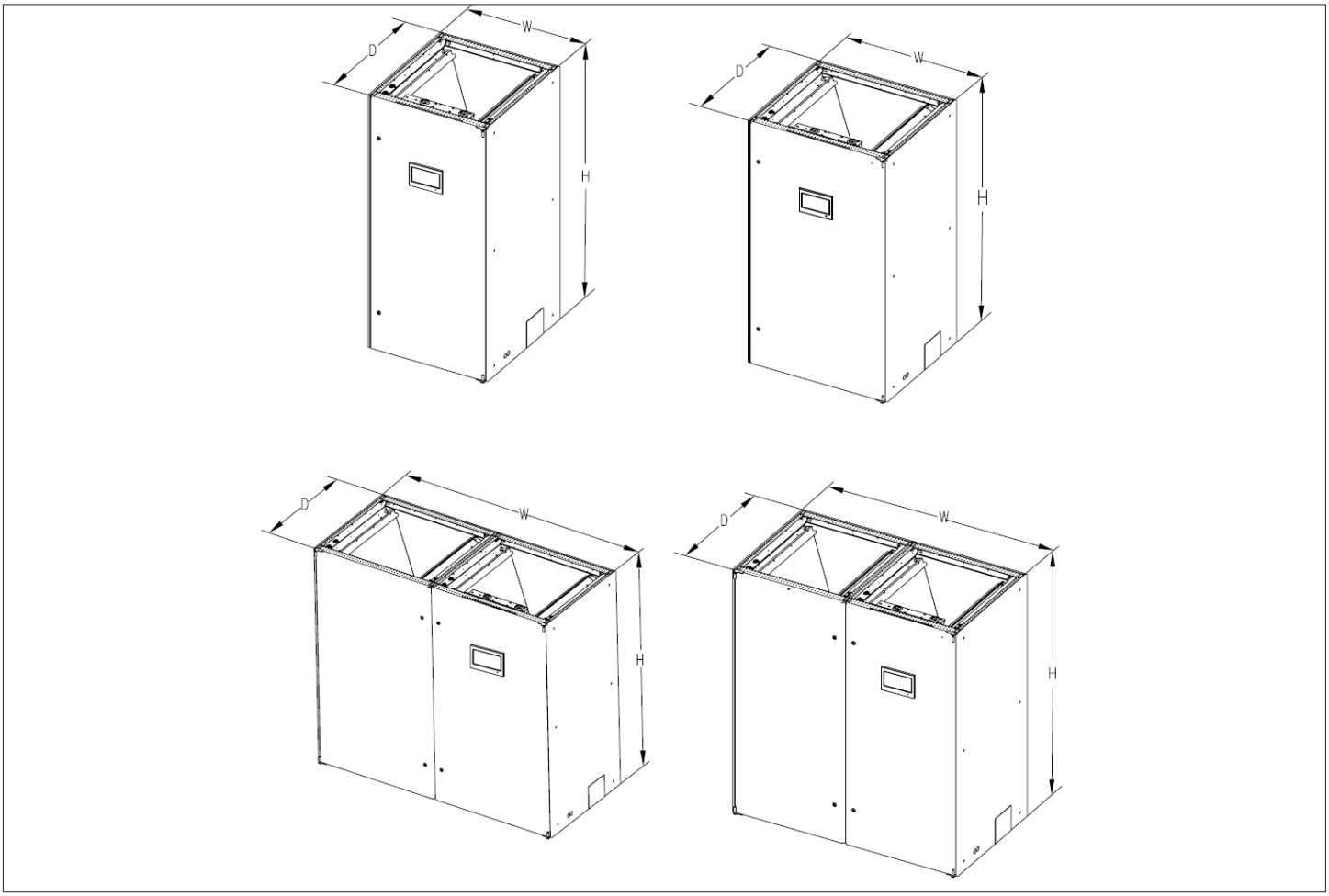


Figure 2-15 Downflow Indoor Unit

Table 2-3 Indoor Unit Size and Weight

Product Number	Dimensions (W×D×H)		Operational Weight (kg)
	mm	inch	
P1030U/ DA	930 × 995 × 1975	36.6”×39.2”×77.7”	360
P1030U/ DW	930 × 995 × 1975	36.6”×39.2”×77.7”	390
P1040	1130 × 995 × 1975	44.5”×39.2”×77.7”	420
P1050 (S)	1130 × 995 × 1975	44.5”×39.2”×77.7”	440
P1050 (D)	1130 × 995 × 1975	44.5”×39.2”×77.7”	470
P2060	1830 × 995 × 1975	72.0”×39.2”×77.7”	660
P2070	1830 × 995 × 1975	72.0”×39.2”×77.7”	670
P2080	2230 × 995 × 1975	87.8”×39.2”×77.7”	740
P2090	2230 × 995 × 1975	87.8”×39.2”×77.7”	770
P2100	2230 × 995 × 1975	87.8”×39.2”×77.7”	780

2.3.2. Plenum Dimensions (for Upflow Unit)

The dimensions of the Plenum as follows, refer Table 2-4.

Table 2-4 Plenum Dimensions

Types	D (depth)		W (width)		H (height)	
	mm	inch	mm	inch	mm	inch
P1030	995	39.2”	930	36.6”	400, 600 (optional)	15.8”, 23.6” (optional)
P1040~P1050	995	39.2”	1130	44.5”	400, 600 (optional)	15.8”, 23.6” (optional)
P2060 ~ P2070	995	39.2”	1830	72.1”	400, 600 (optional	15.8”, 23.6” (optional)
P2080 ~ P2100	995	39.2”	2230	87.8”	400, 600 (optional	15.8”, 23.6” (optional)

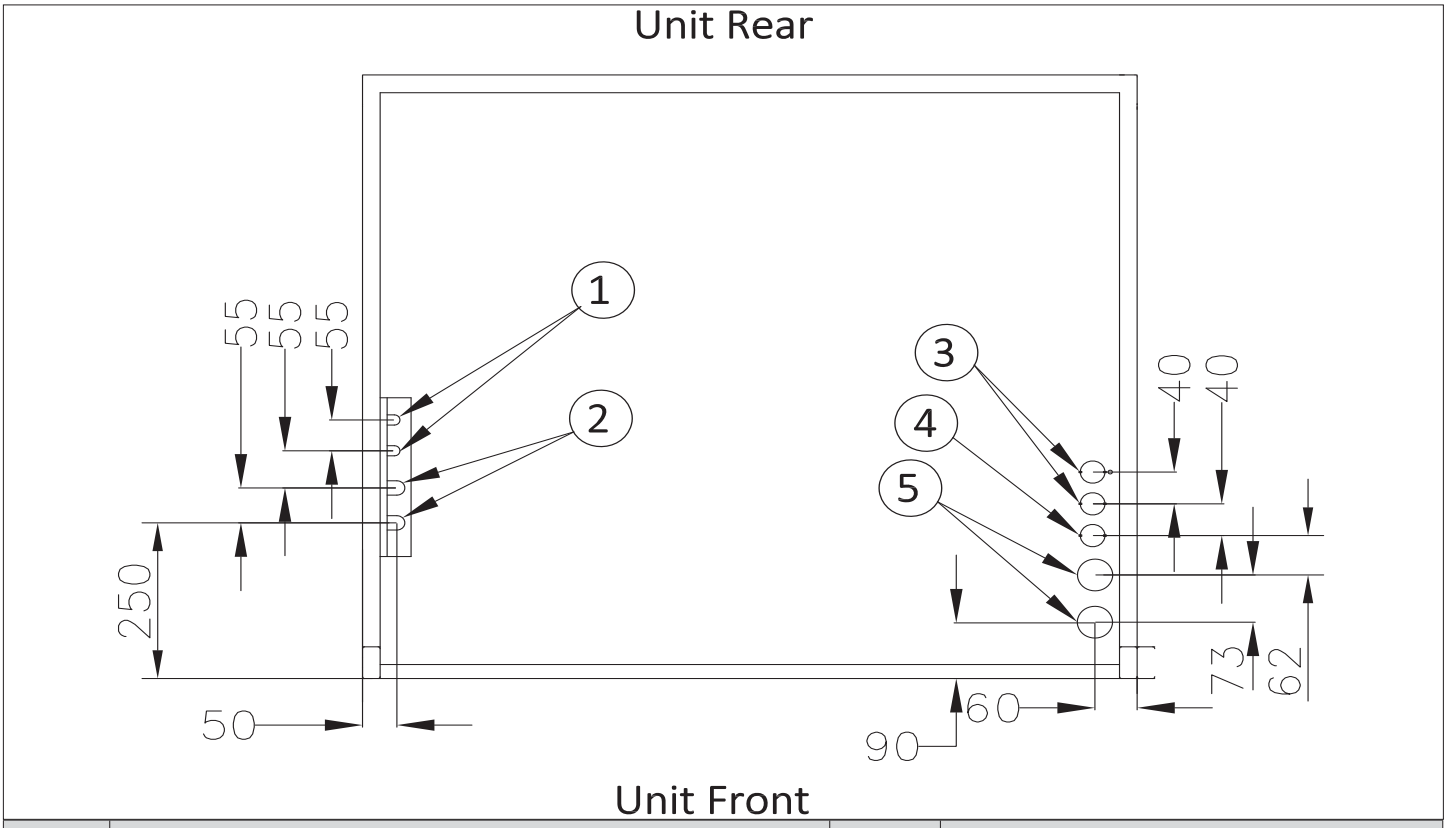
If the height of the plenum selected for air conditioner unit exceeds 23.6”/ 600 mm, consult Vertiv local representative for non-standard requirement.

2.3.3. Dimension and Weight of Condenser

Refer to the “Liebert PEX Condenser User Manual” and “LVC Series Condenser User Manual”.

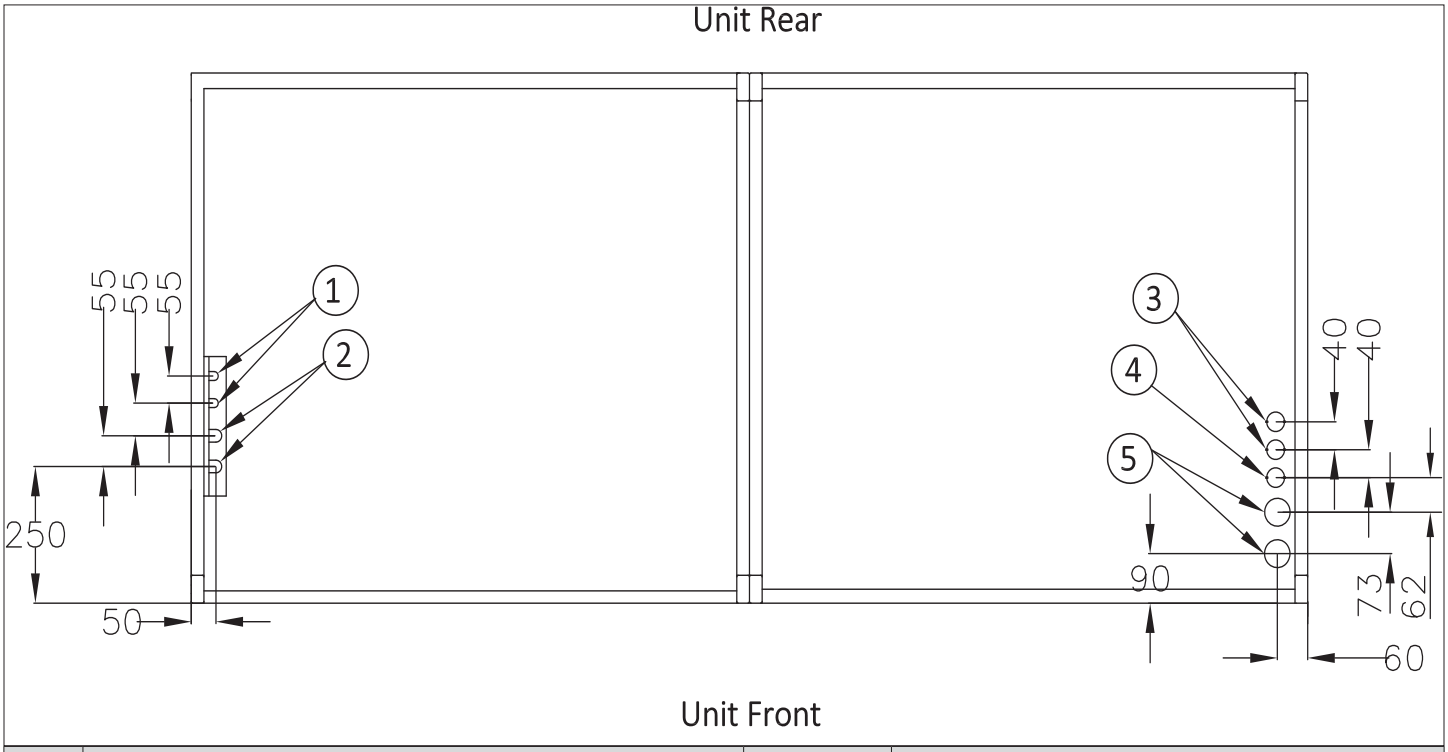
2.3.4. Base Plate Cut-out Position and Dimension

The cut-out position and dimensions are shown in Figure 2-16, Figure 2-17 and Figure 2-18.



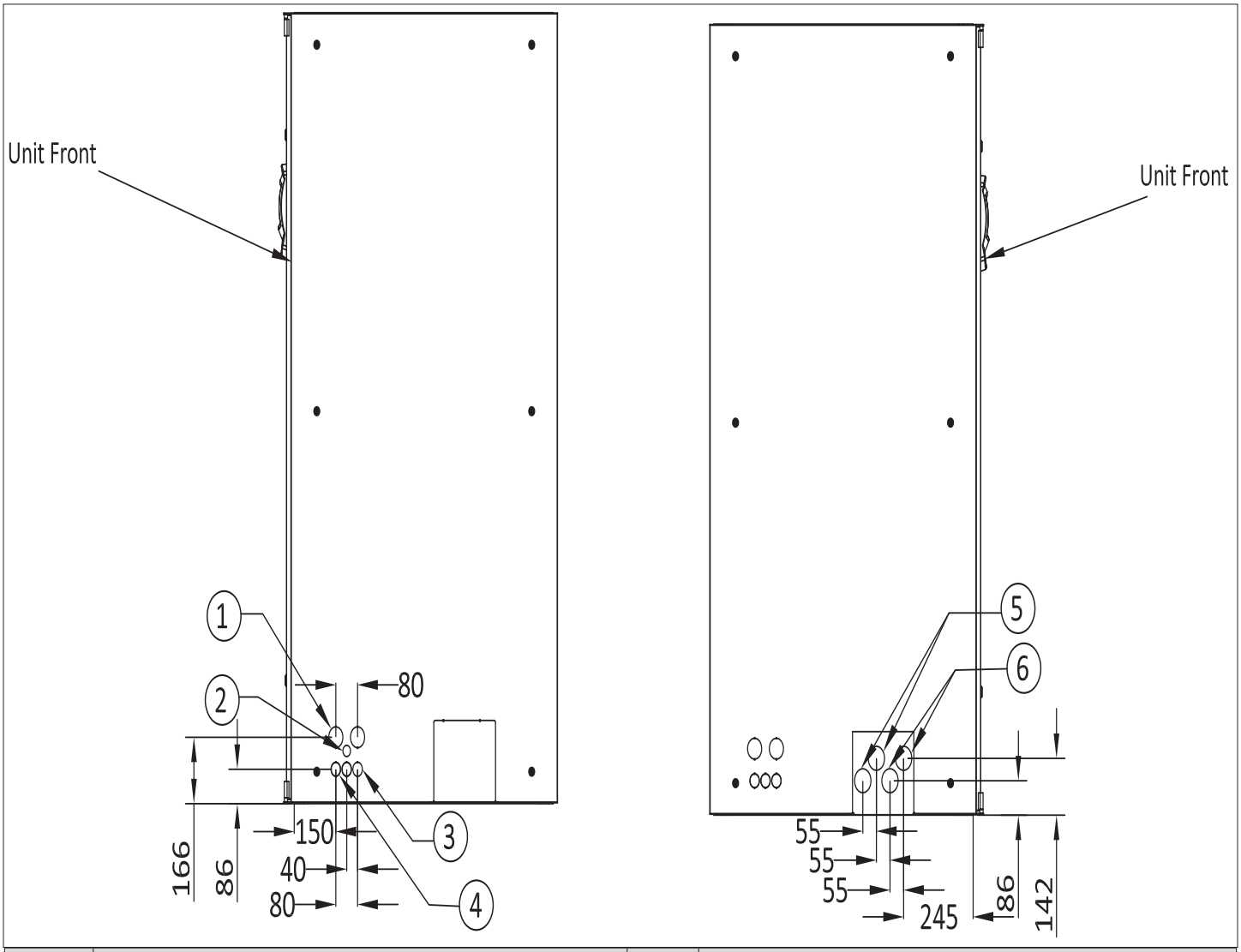
No.	Description	No.	Description
1	Liquid pipe inlet	4	Inlet of humidification inlet pipe Ø35
2	Discharge outlet	5	Cable inlet Ø50
3	Condensate drain outlet Ø35		

Figure 2-16 The Position of Pipe Bottom Outlet of Single Cabinet Unit (unit: mm)



No.	Description	No.	Description
1	Liquid pipe inlet	4	Inlet of humidification inlet pipe Ø35
2	Discharge outlet	5	Cable inlet Ø50
3	Condensate drain outlet Ø35		

Figure 2-17 The Position of Pipe Bottom Outlet of Dual Cabinet Unit (unit: mm)

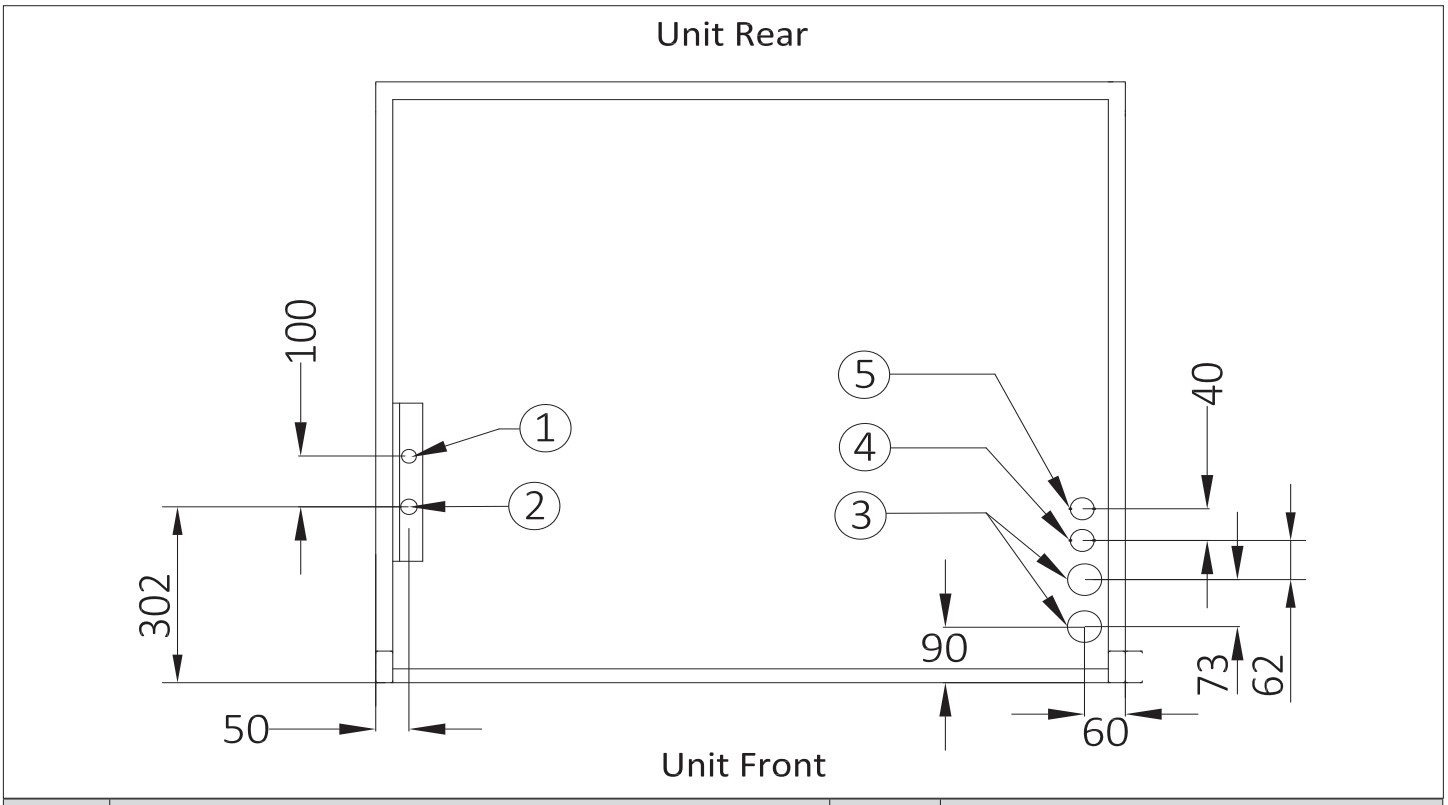


No.	Description	No.	Description
1	Cable Entry Ø52	4	Humidifier inlet nozzle Ø35
2	Single cable inlet Ø25	5	Liquid pipe inlet Ø60
3	Condenser drain pipe Ø35	6	Discharge inlet

Figure 2-18 Left and Right Panel with Nozzle Position of Cut-out Location Dimensions (unit: mm)

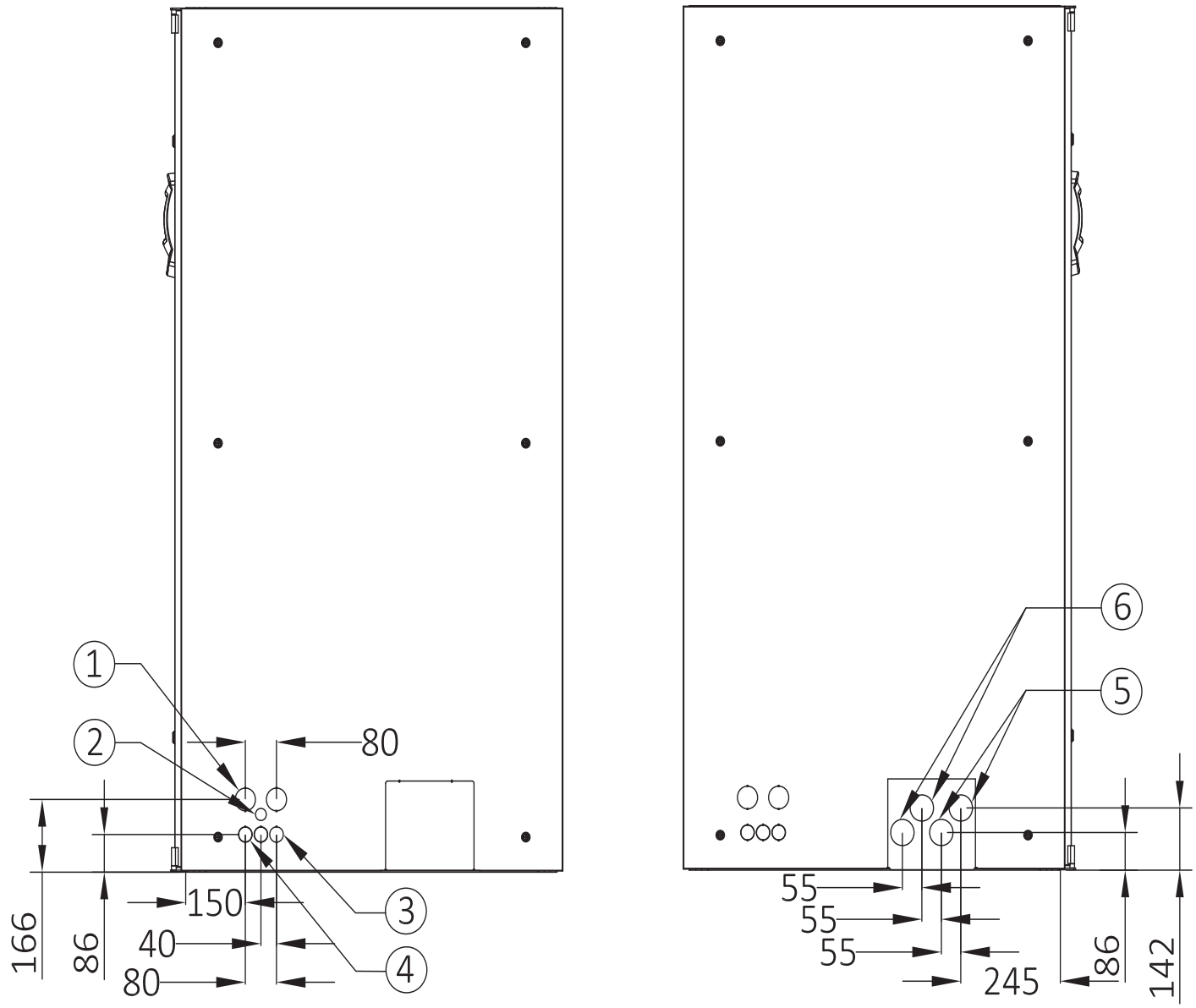
The equipment has knock-outs, ensure to mount sleeve to the cable holes to avoid cutting of the cables.

Figure 2-19 and Figure 2-20 show the cut-out position and dimensions of water-cooled unit.



No.	Description	No.	Description
1	Water pipe inlet Ø50	4	Inlet of humidification inlet pipe Ø35
2	Water pipe outlet Ø50	5	Condensate drain outlet Ø35
3	Cable inlet Ø50		

Figure 2-19 The Position of Pipe Bottom Outlet of Single Cabinet Unit (unit: mm)

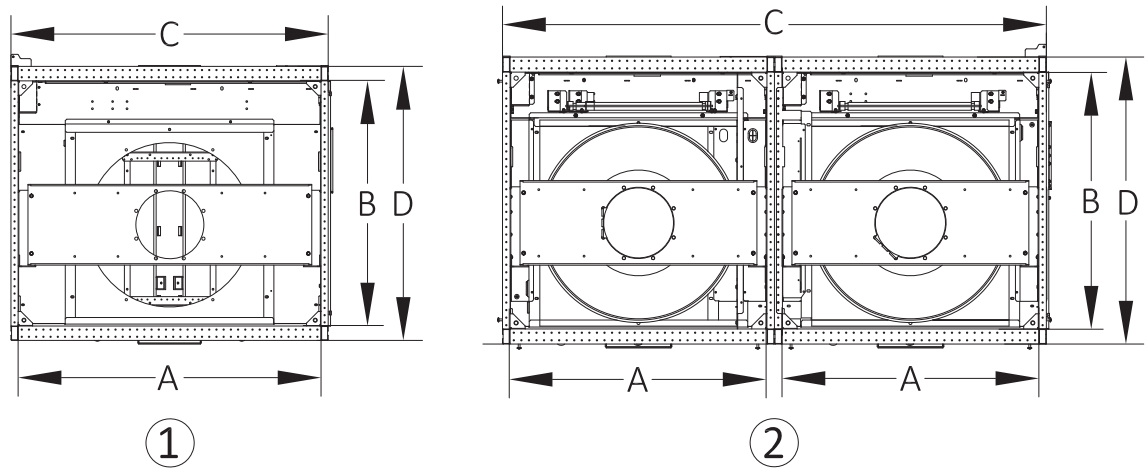


No.	Description	No.	Description
1	Cable entry Ø35	4	Humidification inlet nozzle Ø35
2	Single cable inlet Ø25	5	Water pipe outlet Ø60
3	Condensate drain pipe Ø35	6	Water pipe inlet Ø60

Figure 2-20 Left and Right Panel with Nozzle Position of Cut-out Location Dimensions (unit: mm)

2.3.5. Position and Dimension of Air Outlet on Top Cover

The position and dimensions of air outlet on the top cover of upflow for single bay (air-cooled/ water-cooled) and two bay units are shown in Figure 2-21 and in Table 2-5 respectively.



No.	Description	No.	Description
1	Top view of the single bay unit	2	Top view of the double bay unit

Figure 2-21 The Position of Air Outlet on Top Cover Upflow Unit

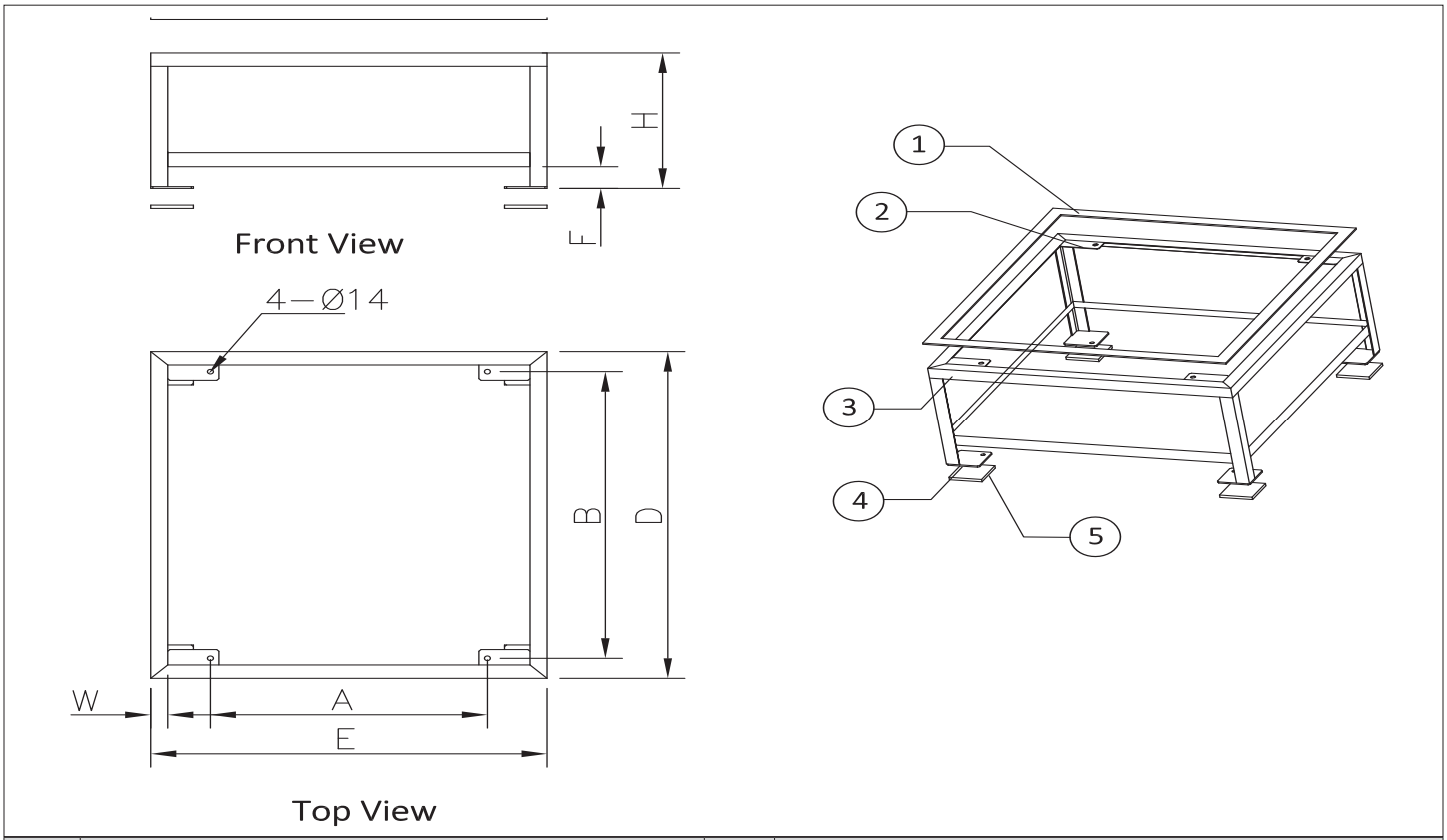
Table 2-5 Dimensions of Air Outlet on Top Cover of Upflow Unit

Types of Model	A		B		C		D	
	mm	inch	mm	inch	mm	inch	mm	inch
P1030	850	33.5”	850	33.5”	900	35.4”	950	37.4”
P1040~P1050	1050	41.3”	850	33.5”	1100	43.3”	950	37.4”
P2060~P2070	850	33.5”	850	33.5”	1800	70.9”	950	37.4”
P2080~P2100	1050	41.3”	850	33.5”	2200	86.6”	950	37.4”

2.3.6. Indoor Installation

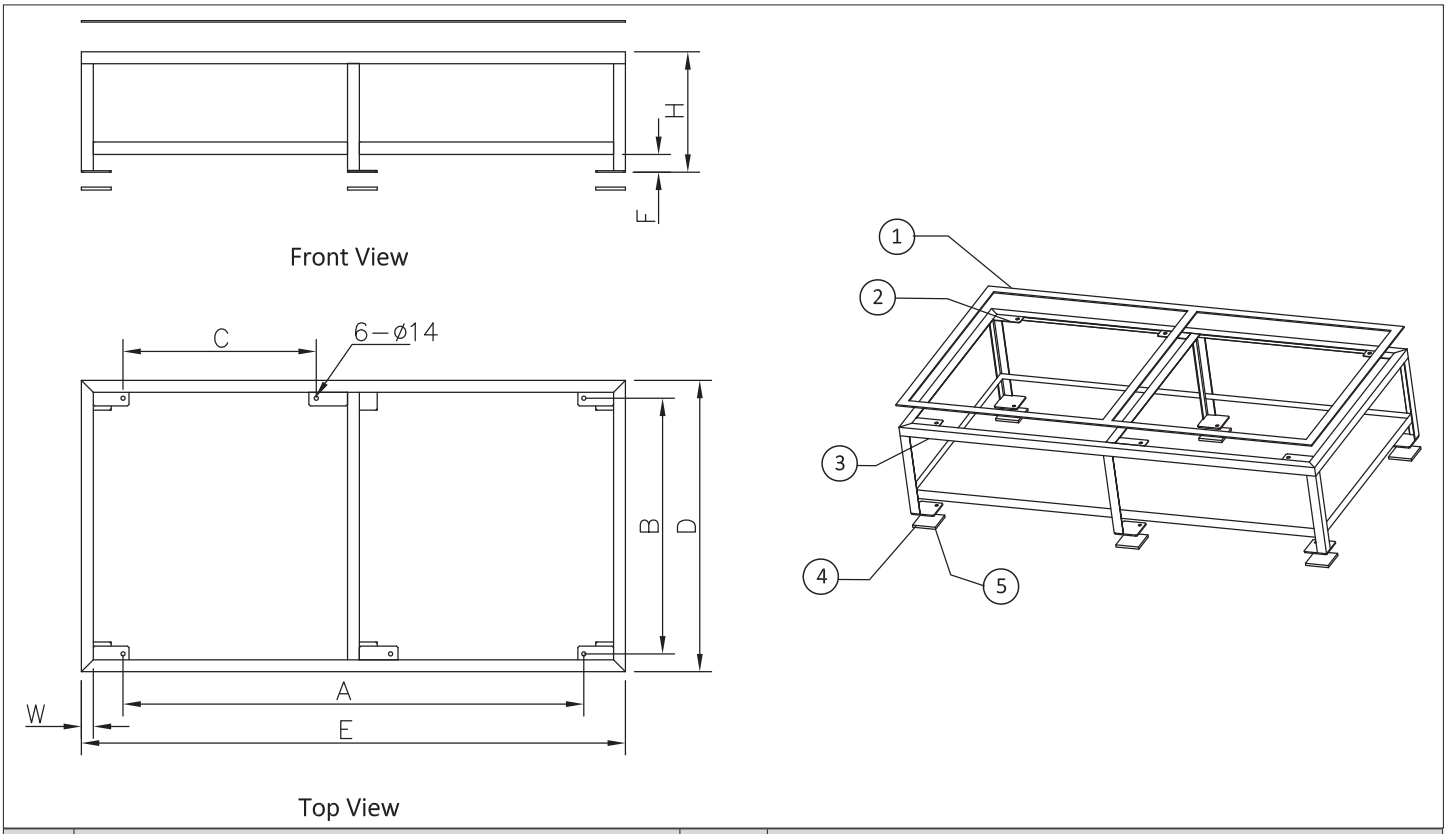
- **Floor Stand**

The 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 Figure 2-22 for single bay unit (Air/ Water-cooled Unit) and Figure 2-23 for two bay unit and Table 2-6.



No.	Description	No.	Description
1	Upper rubber damping pad (5 mm thick)	4	Bottom plate (100 mm x 100 mm x 5 mm, 4PCS)
2	Fixed steel plate (3 mm thick 4PCS)	5	Bottom rubber cushion (10 mm thick, 4PCS)
3	Incline tie joint (angle steel 3 mm thick)		

Figure 2-22 Floor Stand of the Single Unit



No.	Description	No.	Description
1	Upper rubber damping pad (5 mm thick)	4	Bottom plate (100 mm x 100 mm x 5 mm, 6PCS)
2	Fixed steel plate (3 mm thick 6PCS)	5	Bottom rubber cushion (10 mm thick, 6PCS)
3	Angle steel (3 mm thick)		

Figure 2-23 Floor Stand of the Double Unit

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

Model	A	B	C	D	E	F	H	W
P1030 ~ P1040	25.6"/ 650	33.9"/ 860	/	38.6"/ 980	36.6"/ 930	/	15.7"/400 <H≤21.6"/550	1.6"/40
						F≤9.4"/240	21.7"/550 <H≤43.3"/1100	2.0"/50
P1050	33.5"/ 850		/		44.5"/ 1130	/	15.7"/400 <H≤21.6"/550	1.6"/40
						F≤9.4"/240	21.7"/550 <H≤43.3"/1100	2.0"/50
P2060 ~ P2080	61.0"/ 1550		25.6"/ 650		72.0"/ 1830	/	15.7"/400 <H≤21.6"/550	1.6"/40
						F≤9.4"/240	21.7"/550 <H≤43.3"/1100	2.0"/50
P2090 ~ P2100	76.8"/ 1950		33.5"/ 850		87.8"/ 2230	/	15.7"/400 <H≤21.6"/550	1.6"/40
						F≤9.4"/240	21.7"/550 <H≤43.3"/1100	2.0"/50

2.3.7. Installing Floor Stand

Determine the installation position according to the space requirements of the unit, and fix the floor stand onto the selected mounting position. The floor stand is fixed to the ground using expansion bolts or spot welding, and the alignment of the floor stand is calibrated by a horizontal ruler before it is fixed. 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, we must consider the proper gap distance and the base strength of the floor stand.

- *Refer to Table 2-6 A/B/C as the center of the base from the mounting hole D/ E is the size of the base frame.*
- *H is the height of the base, F is the height of the welding beam.*
- *W is the width of the angle, height ≤ 550 mm recommended use size 40 mm x 40 mm x 3 mm, the height of > 550 mm quadrangular column is recommended to use 50 mm x 50 mm x 4 mm specification. The bottom plate is recommended to use 100 mm x 100 mm x 5 mm.*
- *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.*

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 2-7 for more details.

Table 2-7 Dimensions of Rubber Cushion for Vibration Absorbing

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

2.3.8. Installation of Indoor Unit

The indoor unit should be installed on the horizontal base plate, and ensure that all indoor units are at the same level. The indoor unit and the horizontal base do not require any welding or other fixed rigid connections.

2.3.9. Pipe Installation Unit (Air-cooled Units)

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

- Condensed drain piping connection of the indoor unit
- Humidifier inlet pipe connection
- Connection of the copper pipe (discharge and liquid pipe) between the indoor and outdoor unit.
- Long piping kit.

The following points need to be taken into consideration during the piping process:

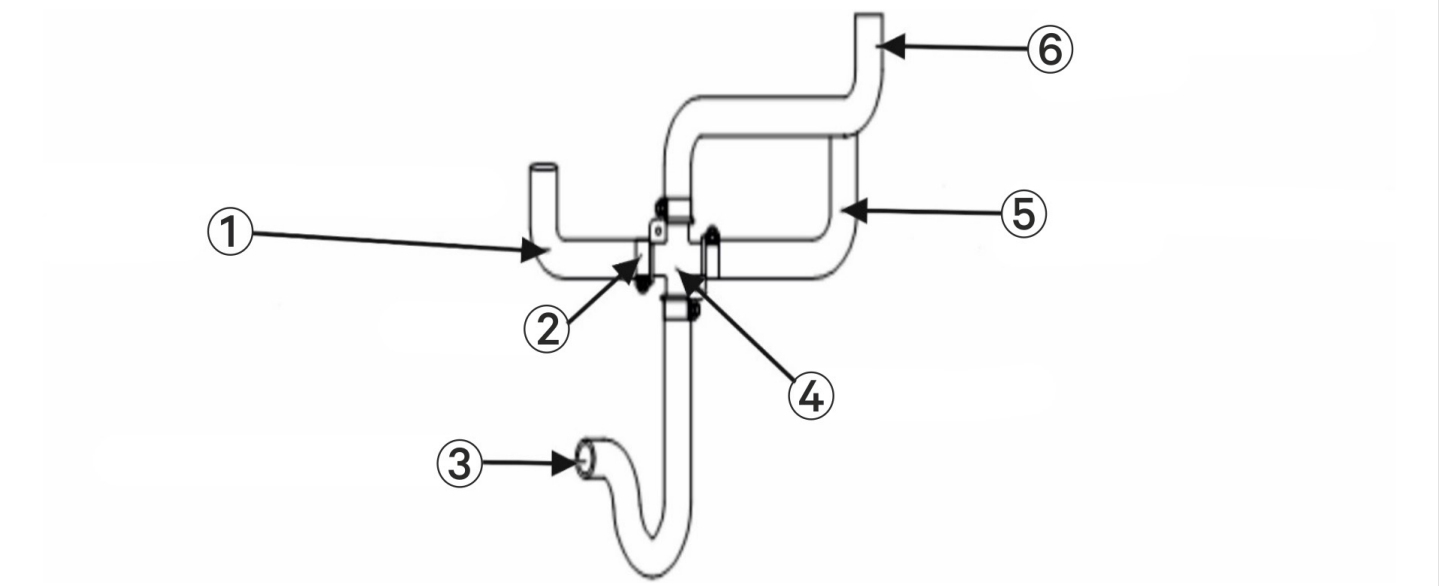
- *All the joints of the refrigerating pipes must be silver-brazed.*
- *The selection, layout, and fixing of the pipes should comply to the industry standards and norms.*
- *Vacuum pumping and refrigerant charging operations, and procedures must comply with the industry standards.*
- *Pressure drop, compressor oil return, noise, and vibration must be considered during the designing and installation process.*

Condensed Drain Piping Connection of Indoor Unit

The condensate of Infrared humidifier and evaporator are connected by a cross connector and drained through the drain pipe, as shown in Figure 2-24 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.

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

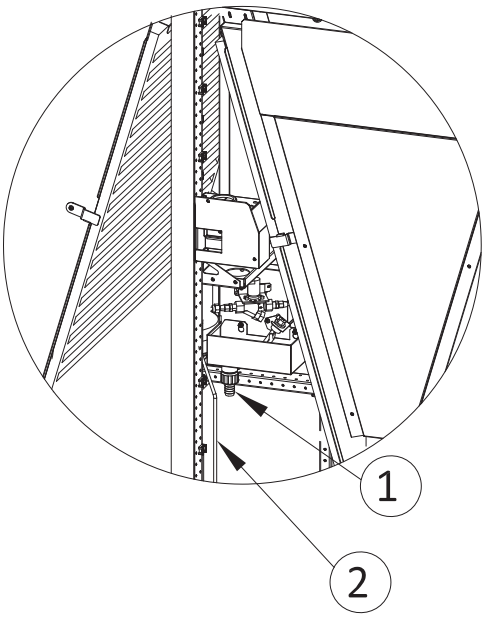
Figure 2-24 Connection of the Drain Pipe of Condensate Water

2.3.10. Infrared Humidification Inlet Pipe 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 1/4" copper nut and the 1/4" × 1/2" conversion copper thread connector to avoid loose connection as shown in Figure 2-25 for air-cooled and water-cooled units.

- *Where the main line pressure may exceed 700* kPa *(the main line 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.*



No.	Description	No.	Description
1	Outlet joints	2	Inlet pipe

Figure 2-25 Water Inlet Pipe of Infrared Humidifier

2.3.11. Connection of Copper Pipe (Discharge and Liquid pipe) between Indoor and Outdoor Unit

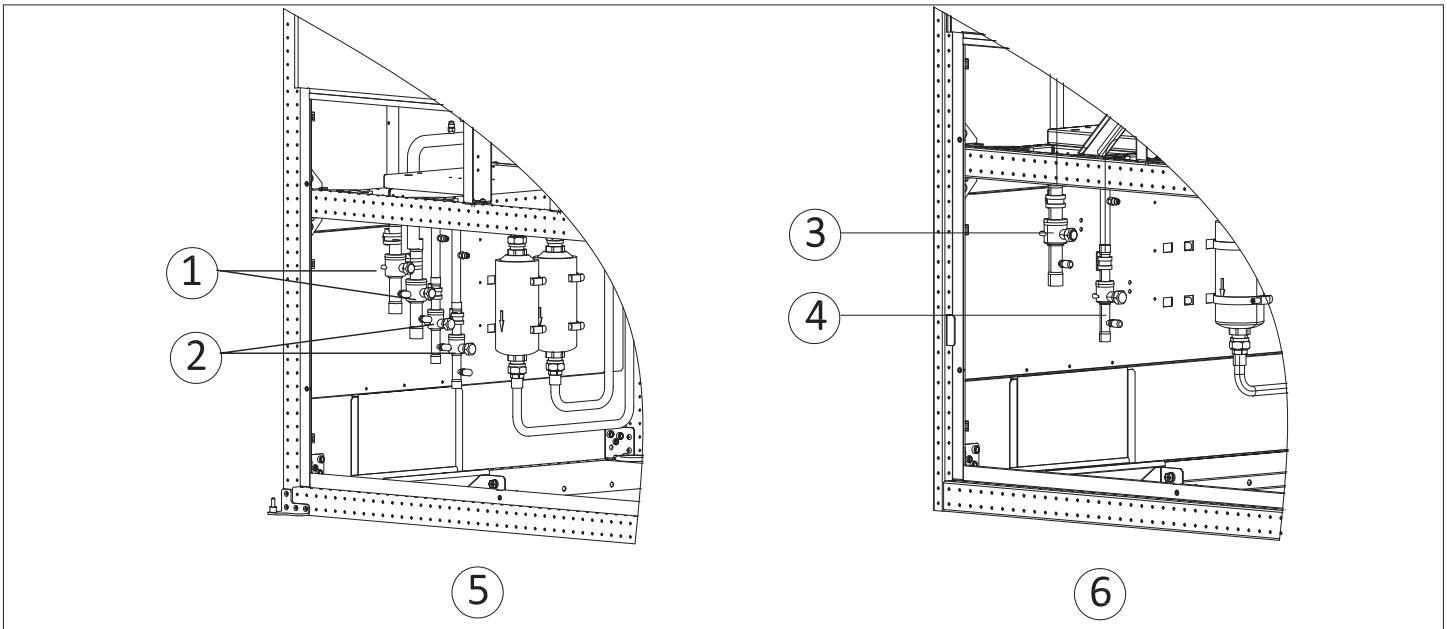
- Select the appropriate dimension (Pipe diameter & Wall thickness) of pipes connecting the indoor and the outdoor unit. Considering the effect of the diameter and wall thickness of copper piping on the pressure drop of the system, the pipe dimensions of the indoor and outdoor unit should be determined according to the specifications in Table 2-9 or consult Vertiv local representative. The recommended dimensions of piping is given in Table 2-8.

- Connect the copper pipes in brazing mode. The connection ball valves of the discharge pipe and liquid pipe of the indoor unit are shown in Figure 2-26. Notes and instruction labels are pasted onto the base and the side panel close to the ball valve. Ensure that the ball valve must be wrapped with a wet cloth before brazing to protect the label from burning.

- Connect the discharge pipe and liquid pipe of the indoor unit according to the instructions on the labels.

- Horizontal sections of the discharge pipe should be sloped down from the compressor with a slope of at least 1:200 (5 mm down for each 1 m run). The discharge pipes should be insulated where they are routed in the conditioned space (including under a raised floor).

The exposure time of system pipes must not exceed 15min. Longer exposure will lead to the compressor refrigeration oil being affected by moisture, which can affect the life of the key components and the system operation stability.



No.	Description	No.	Description
1	Discharge ball valve	4	Liquid pipe ball valve
2	Liquid pipe ball valve	5	Double circuit
3	Discharge ball valve	6	Single circuit

Figure 2-26 Locations of Discharge Pipe and Ball Valve and Liquid Pipe Ball Valve

Table 2-8 Recommended Pipe Size

Model	P1030 (single system) P2060 (dual system)		P1040 (single system) P2080 (dual system)		P1050 (single system) P2100 (dual system)		P1050 (dual system)		P2070 (dual system)		P2090 (dual system)	
Pipe Length	D	L	D	L	D	L	D	L	D	L	D	L
10m	16/16	16/16	19/19	16/16	19/19	19/19	16/16	16/16	19/19	16/16	19/19	19/19
20m	19/19	16/16	22/22	16/16	22/22	19/19	16/16	16/16	19/19	16/16	22/22	19/19
30m	19/19	16/16	22/22	16/16	25/22	19/19	19/16	16/16	22/19	16/16	22/22	19/19
40m	22/19	16/16	25/22	16/16	25/25	19/19	22/16	16/16	25/19	16/16	25/22	19/19
50m	22/19	16/16	25/22	16/16	25/25	19/19	25/16	16/16	25/19	16/16	25/22	19/19
60m	25/19	16/16	25/22	16/16	25/25	19/19	25/16	16/16	28/19	16/16	28/22	19/19

- *D: Discharge line, L: Liquid line*
- *22/ 19: horizontal pipe diameter is 22 mm, vertical pipe diameter is 19 mm*
- *If the pipe length exceeds 60 m or drops over 20 m, please consult Vertiv local representative for details.*
- *If the outdoor temperature is below -20 °C, use the low temperature kit and consult Vertiv local representative for details.*

Table 2-9 Pipe Wall Thickness Requirements

Pipe Dimensions Outer Diameter		Wall Thickness (mm)	
mm	inch	mm	inch
16	5/8	≥1	0.04”
19	>3/4	≥1.2	0.05”
22	7/8	≥1.2	0.05”
25	1	≥1.5	0.06”
28	1-1/8	≥1.5	0.06”
32	>1-1/4	≥1.5	0.06”
35	1-3/8	≥1.5	0.06”

2.3.12. Height Difference Requirements and Equivalent Length Calculation

The long piping kit is the standard component for Liebert PEX3. Height difference between the indoor and outdoor unit is shown in Table 2-10. The equivalent length can be calculated by selecting appropriate dimensions in accordance with the respective diameter, refer Table 2-11 for the equivalent length of the sub-assembly.

Table 2-10 Height Distance between Indoor and Outdoor Unit

Relative Position	Distance
Condenser above the indoor unit	+ 20 m
Condenser below the indoor unit	-5 m

- *If the vertical distance between indoor and outdoor unit exceeds the values in Table 2-10, consult Vertiv local representative.*
- *‘U’ trap should be installed for every 7.5 m of vertical distance consult Vertiv local representative for details.*

Table 2-11 Equivalent Length of Each Sub-Assembly

Fluid Pipe Diameter (inch)	Equivalent length (m)		
	Elbow 90°	Elbow 45°	T-piece
3/8	0.21	0.10	0.76
1/2	0.24	0.12	0.76
5/8	0.27	0.15	0.76
3/4	0.3	0.18	0.76
7/8	0.44	0.24	1.1
1-1/8	0.56	0.3	1.4

2.3.13. Pipe Installation Unit (Water-cooled unit)

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

1. Condensed drain piping connection of the indoor unit (the same as the Air-cooled unit).
2. Humidifier inlet pipe connection (the same as the Air-cooled unit).
3. Water inlet and outlet pipe of cooling water.

The following points need to be taken into consideration during the piping process:

- *The selection, layout, and fixing of the pipes should comply to the industry standards and norms*
- *Vacuum pumping and refrigerant charging operations, and procedures must comply with the industry standards.*

2.3.14. Connection between Water inlet and Outlet Pipe of Cooling Water

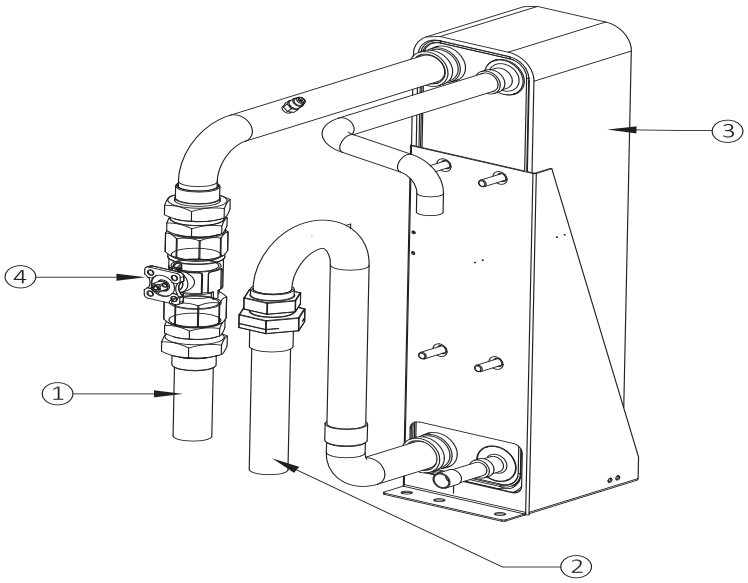
Each water cooled cooling system uses a BPHE and an MBV. The water supply (inlet) pipe and water return (outlet) pipe of the cooling water should be connected to the system. A filter (Filter mesh: 1mm) and motorized isolation valves should be mounted on the water supply (inlet) pipe of the cooling water, and this motorized isolation valve acts as a balancing valve. The cooling water system with a balancing valve can control the water distribution more accurately and it also enhances the efficiency of pump.

On the other hand, the motorized valve can keep the optimal condensing temperature by regulating the internal water flow. The actuator of the regulating valve also features a manual override to allow water side balancing by the installer. It is recommended to arrange the cooling water piping separately for different systems, so that repairing one pipe will not affect the operation of the other piping.

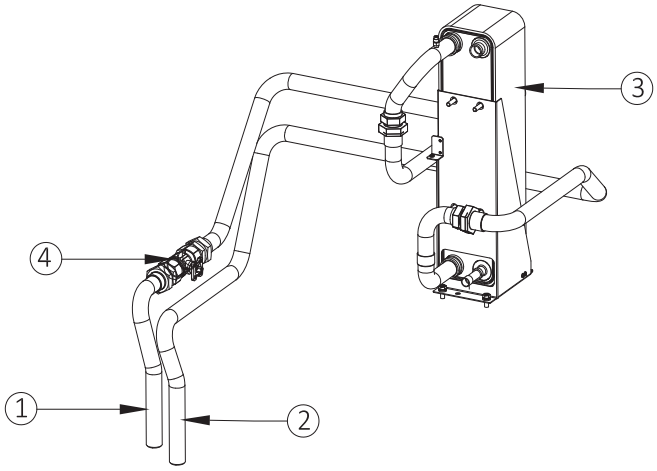
The water pressure should be high enough to overcome the pressure drops created by all the components of the water system. In addition, because of the sediments and impurities more pressure drop can occur after long term operation, user should arrange a redundancy of 20% to 25% when selecting the pump. Inlet water pressure of 0.1 MPa to 0.3 MPa is recommended, but the water flow of the system should be guaranteed.

Refer Figure 2-10 for the system arrangement of the water-cooled unit. The material used for the cooling water inlet and outlet piping of the indoor unit is copper with outer diameter of 32 mm.

As shown in Figure 2-27 connect the pipes through direct brazing at the site and ensure that the junction is well-sealed.



Upflow Unit



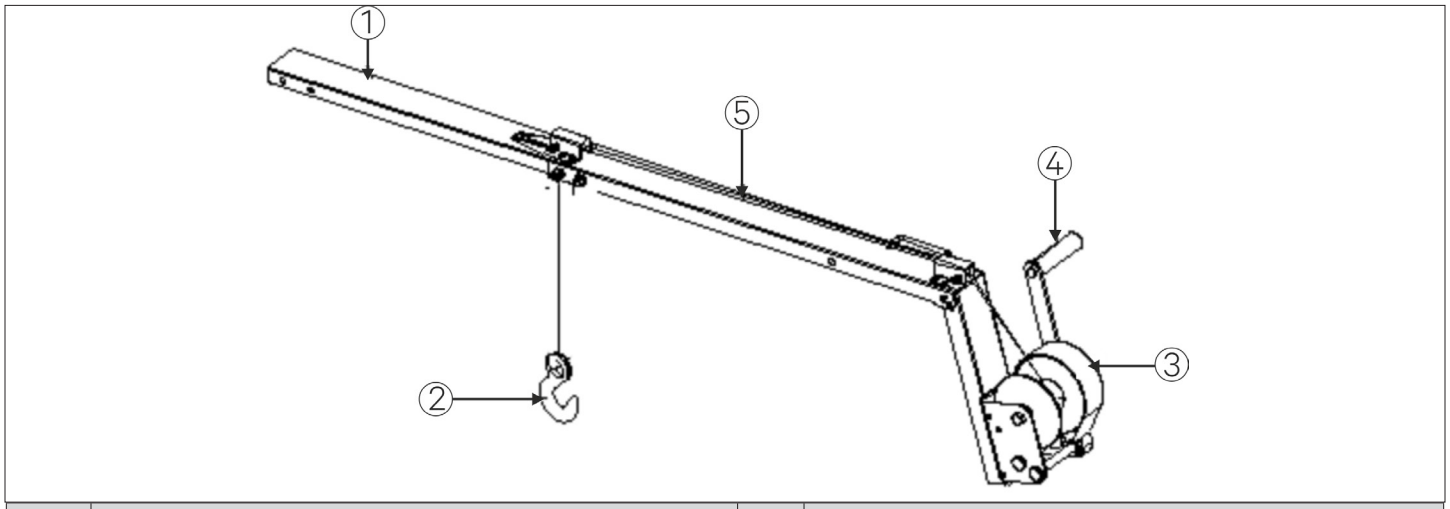
Downflow Unit

No.	Description	No.	Description
1	Water outlet	3	BPHE
2	Water inlet	4	A filter with motorized ball valve

Figure 2-27 Unit Connection (Water-cooled)

2.3.15. 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 2-28 for air-cooled and water-cooled unit. It mainly includes, winch bracket, hook, sling, hand winch, handle, and a L-shaped lifting component.

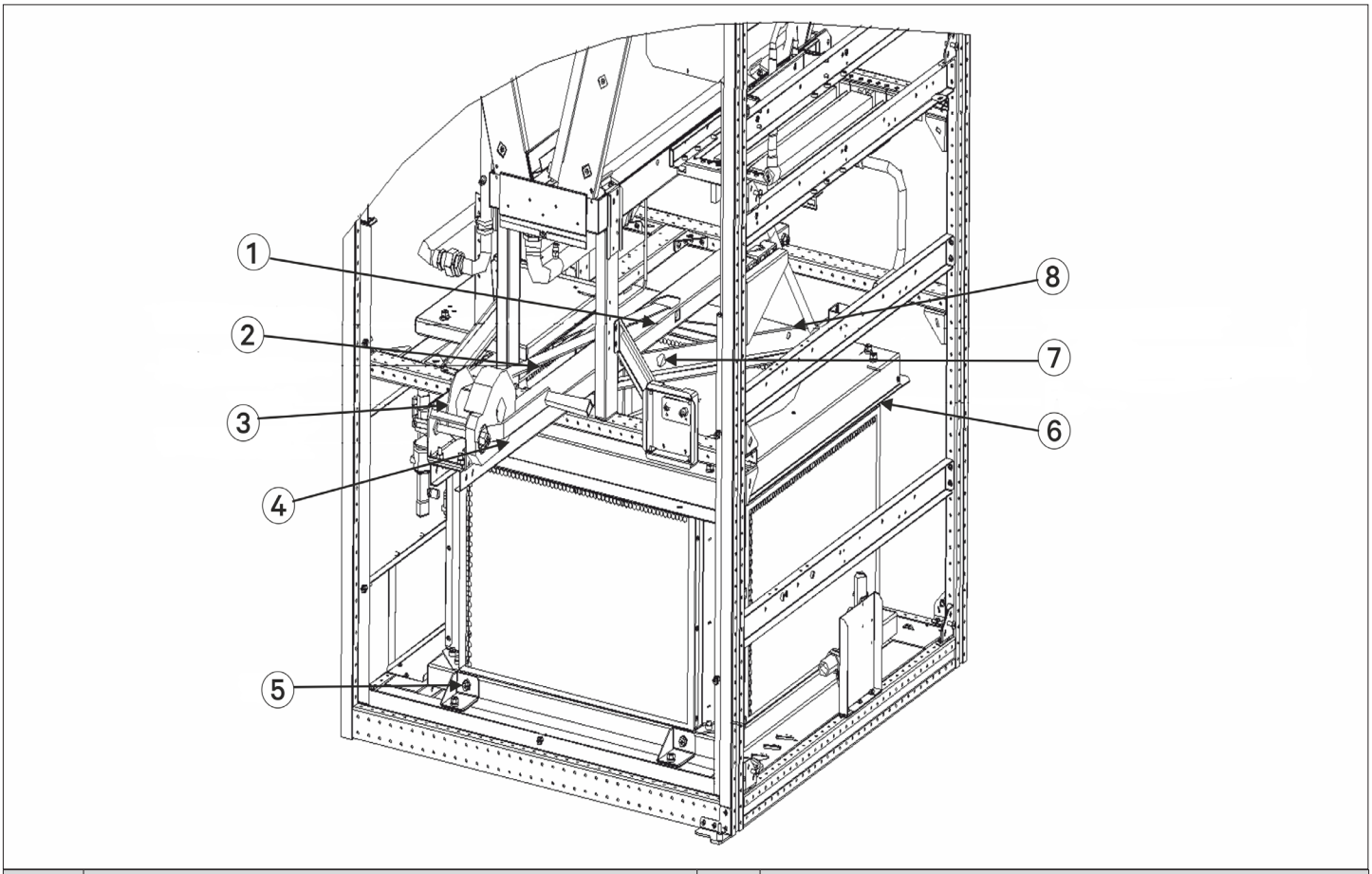


No.	Description	No.	Description
1	Winch bracket	4	Handle
2	Hook	5	Sling
3	Winch		

Figure 2-28 Fan Elevator Assembly (Winch mode)

- **Lowering Procedure**

1. Installing lift and lowering kit for 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 2-29.



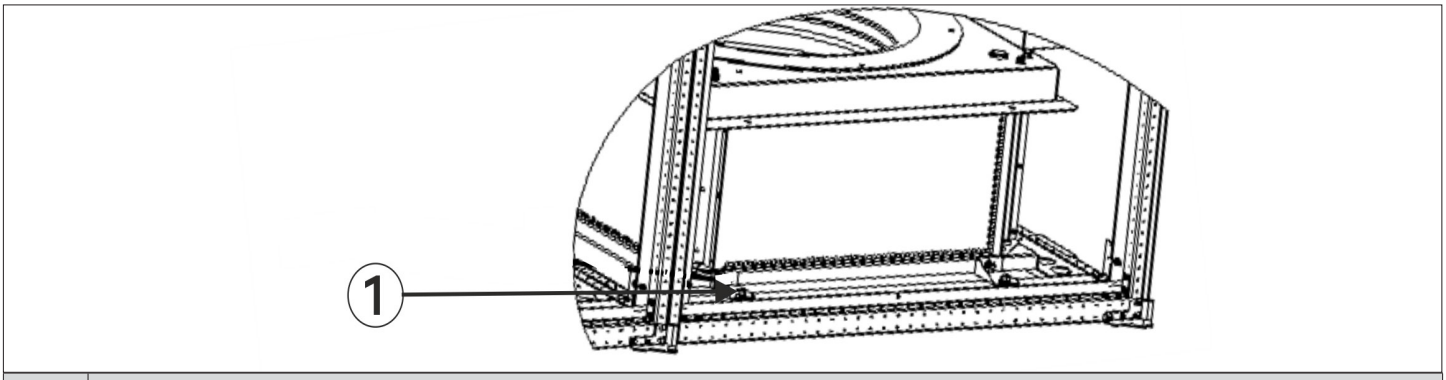
No.	Description	No.	Description
1	Winch bracket	5	Bolt
2	Lifting rope	6	Fan
3	Winch	7	Hoist hanging hole
4	Winch handle	8	Lifting fastener

Figure 2-29 Installed Winch Bracket

2. Turn the handle and use the winch hook to hook the L-shaped lifting component to the middle round hole (refer Figure 2-30). 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 (refer Figure 2-30, total four PCS) for fan lowering.

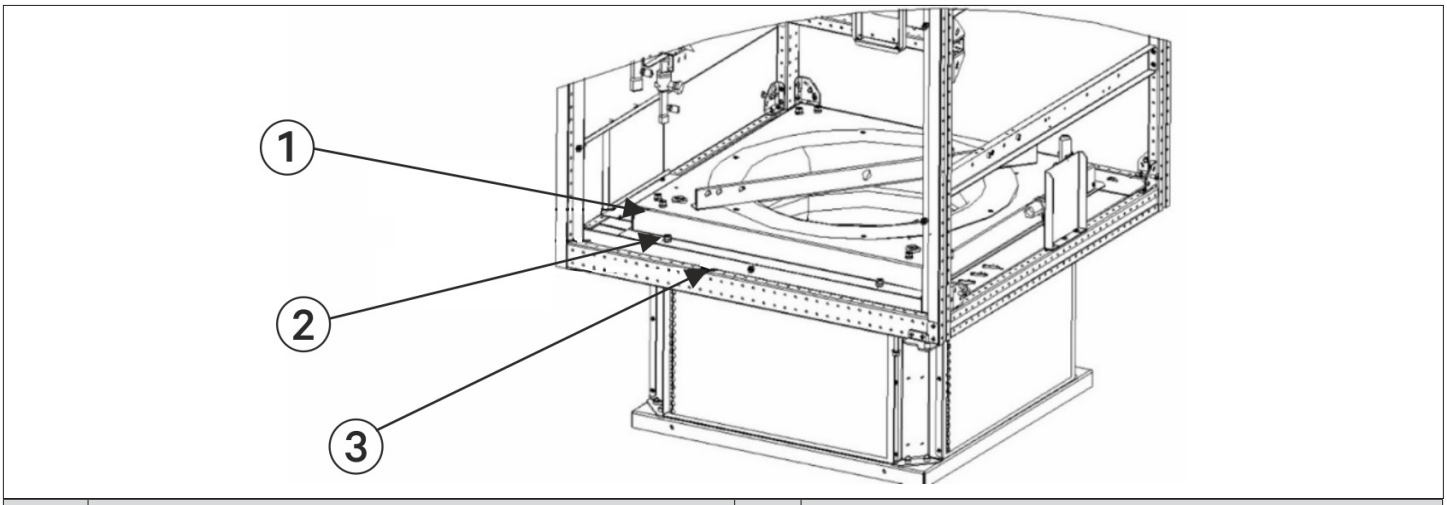
4. Hold the winch handle firmly, and then turn the handle counterclockwise to lower the fan. The status after the fan has been lowered is shown in Figure 2-31.



No.	Description
1	Bolt

Figure 2-30 Position of Fixing Bolt

5. Install the fixing bolts, as shown in Figure 2-30 and hold the arrangement tight during operation with total four PCS of bolts.



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

Figure 2-31 Lowered Fan

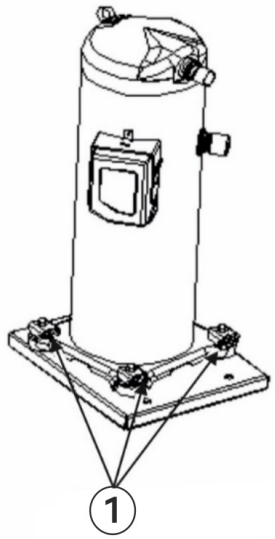
6. Remove the hook from the L-shaped lifting component, turn the handle clockwise, arranged the sling in order and remove the fixing bolts (refer Figure 2-30: Position of Fixing Bolt, totally two PCS) of the winch bracket, and take out the winch and the bracket assembly.
7. Remove the fixing bolts of 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.

2.3.16. Removing Transportation Fixing Plate of the Compressor

Damping cushions are added to the compressor base to reduce the vibration and noise during operation. However, such method cannot best withstand the vibration while transporting the unit and may result in loosening connections and wearing of certain parts. Hence to ensure the rigidity of the compressor during transportation, three L-shaped fixing plates are added to the compressor base.

- *Remove the three L-shaped fixing plates after installation, and then restore the bolts and washers in reverse sequence of the disassembly process.*
- *The fastening torque of the bolts is (12±1) Nm.*



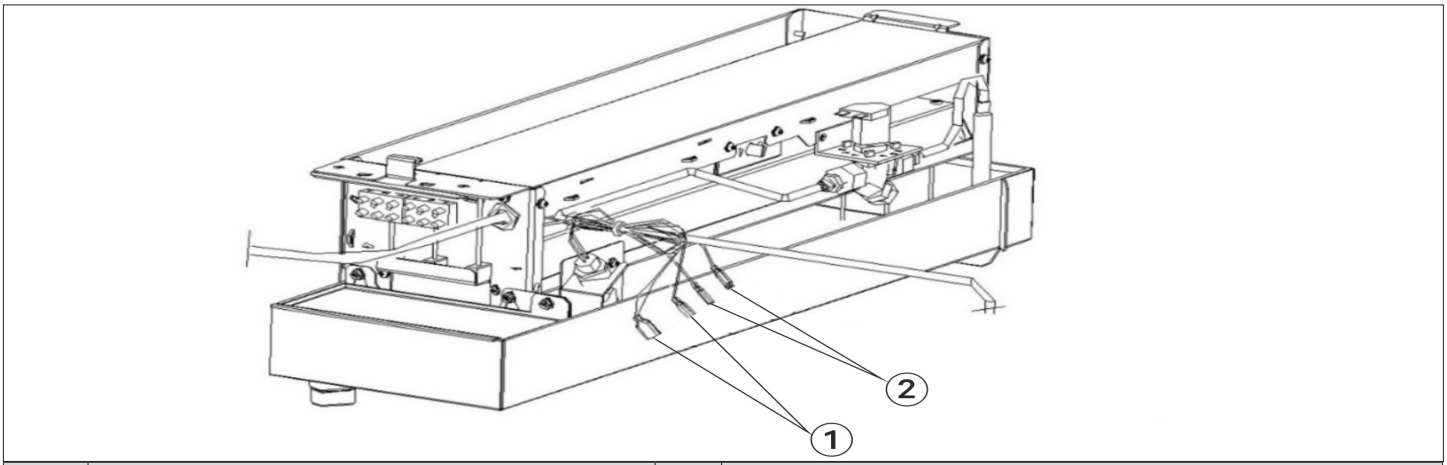
No.	Description
1	Fixed sheet metal (total 3PCS)

Figure 2-32 Position of "L" Shape Fixing Plate

2.3.17. 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 2-33. Remove the rubber string before the unit operation. Otherwise, the unit will not be able to detect the high water-level alarm.

Do not touch the lamps with the bare hands.



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

Figure 2-33 High Water Level Detection Float Switch Lever and Terminal HWA

2.3.18. Removing Pipe Fasteners

To prevent the long copper pipes from scratching the metal plate and being damaged, the pipes are cushioned with foam or bound before delivery. Remove those materials before power-on commissioning.

2.3.19. Installation Inspection

Table 2-12 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 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 is 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	

Everything is checked and verified, follow the electrical installation.

2.4. Electrical Installation

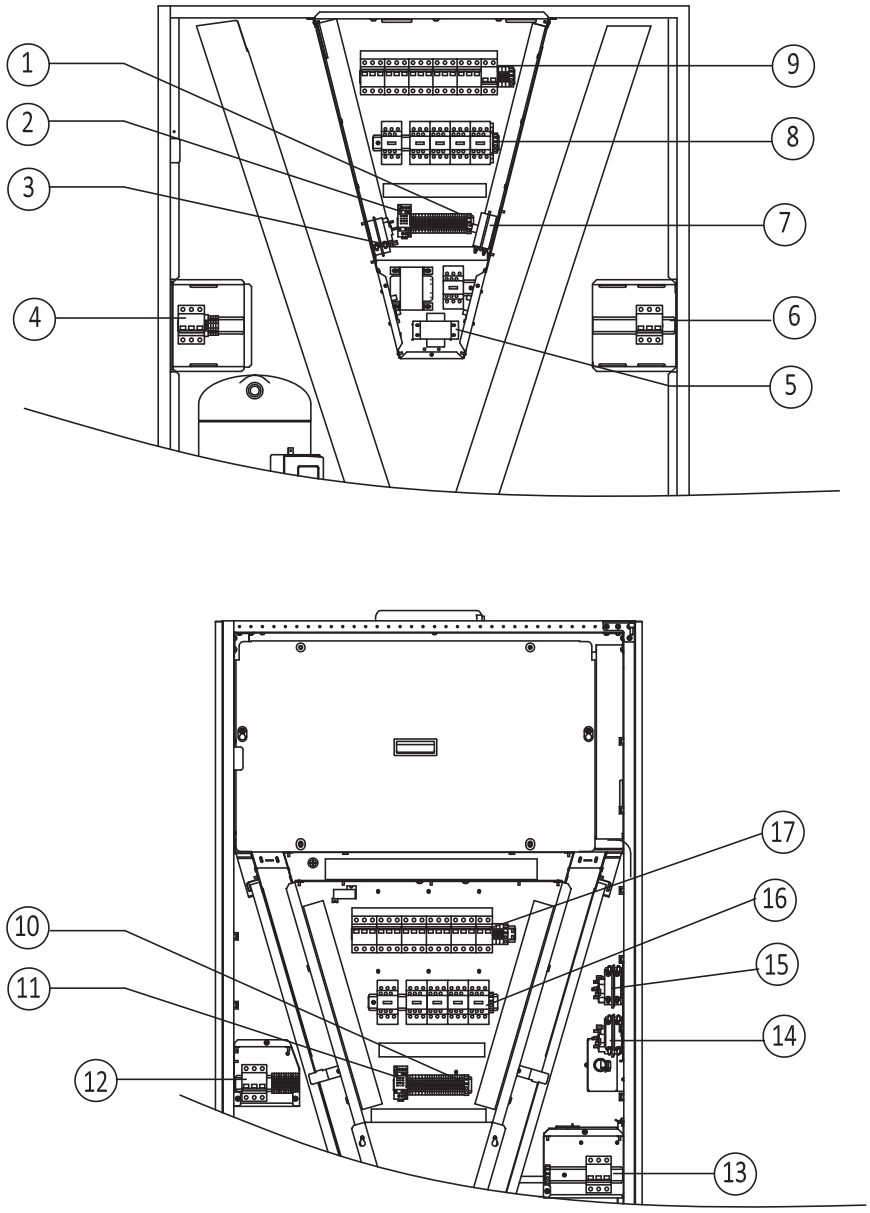
In this section, the electrical installation of the PEX3 unit is explained in-depth to help to get familiar with the various tasks such as the installation considerations, indoor wiring, power lines connection to the condenser, and the checklist.

2.4.1. Installation Precautions

- 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 by authorized professional/installation personnel.
- See the unit name-plate for the full load current. The cable sizes should meet the local wiring rules.
- Mains supply requirement: 400 V, 3 Ph +N~50 Hz.
- If the soft power cable uses Y-connection, and if the cable is damaged, it must be replaced by professional service personnel.
- Before the wiring, use a volt-meter to measure the power supply voltage and ensure that the power supply has been switched off.
- The applicable grid for this air conditioner, TN, TT star connection power system; consult Vertiv local representative for other connections.
- A breaking device must be provided to disconnect the unit from power supply.
- The short circuit breaking current of the unit is 6 kA.
- Install suitable RCD according to actual installation.

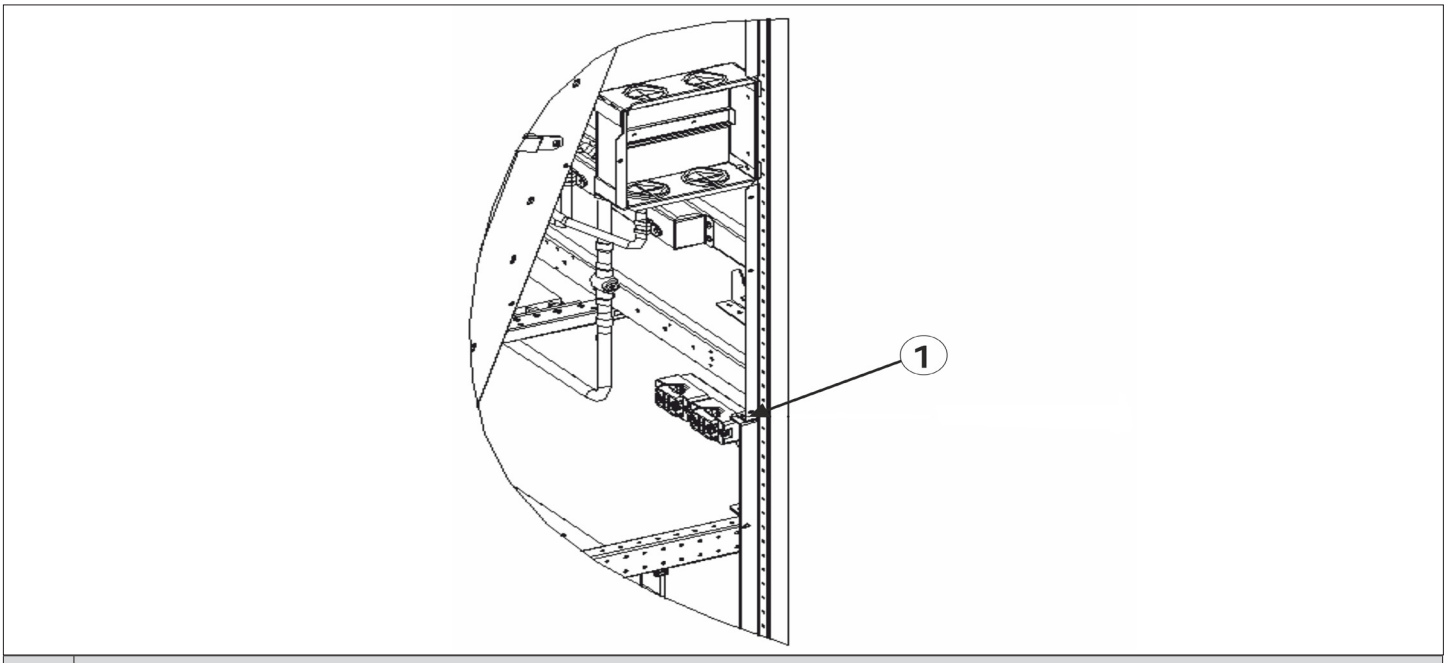
2.4.2. Wiring of Indoor Unit

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 2-34 (for air-cooled/ water-cooled model). The distribution information of the detailed low voltage components are differentiated according to the labels.



No.	Description	No.	Description
1	Terminal row	10	Terminal row
2	Electrical row	11	Electrical relay
3	Differential pressure switch	12	Outdoor machine empty open (Only for Air-cooled)
4	Outdoor machine empty open (Only for Air-cooled)	13	Power connector
5	Transformer	14	Differential pressure switch
6	Power connector	15	Airflow loss switch
7	Airflow loss switch	16	Contact device
8	Contact device	17	Bus/ air open
9	Bus/ air open		

Figure 2-34 Electrical Control Box



No.	Description
1	Cable clamp

Figure 2-35 Cable Clamp Position

Figure 2-34 shows the details of power connectors in electrical control box, connects terminals L1 ~ L3, N, and PE respectively to their counterparts of 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 2-35. The types of wiring cables are of copper conductor, and the cross-section-area requirements of the copper wires can vary with the different models. For the cable specification, refer the rated Full Load Ampere (FLA) in the Table 2-13. Over-current/ Ground fault protection device is recommended to use the air switch with the feature of D-release. Refer Table 2-14 for specific model selection.

An enlarged view of outdoor unit MCB (only for Air-cooled) and field terminal array are shown in Figure 2-37. L1~L3, N and PE are respectively connected with the corresponding end of the outdoor unit power line.

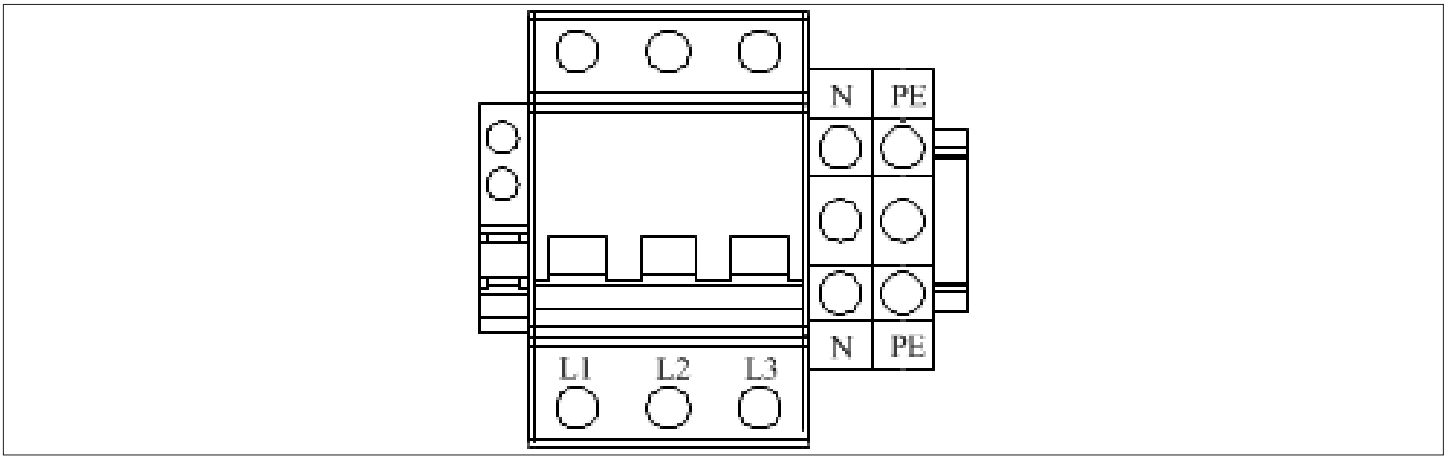


Figure 2-36 Enlarged View of Power Connector

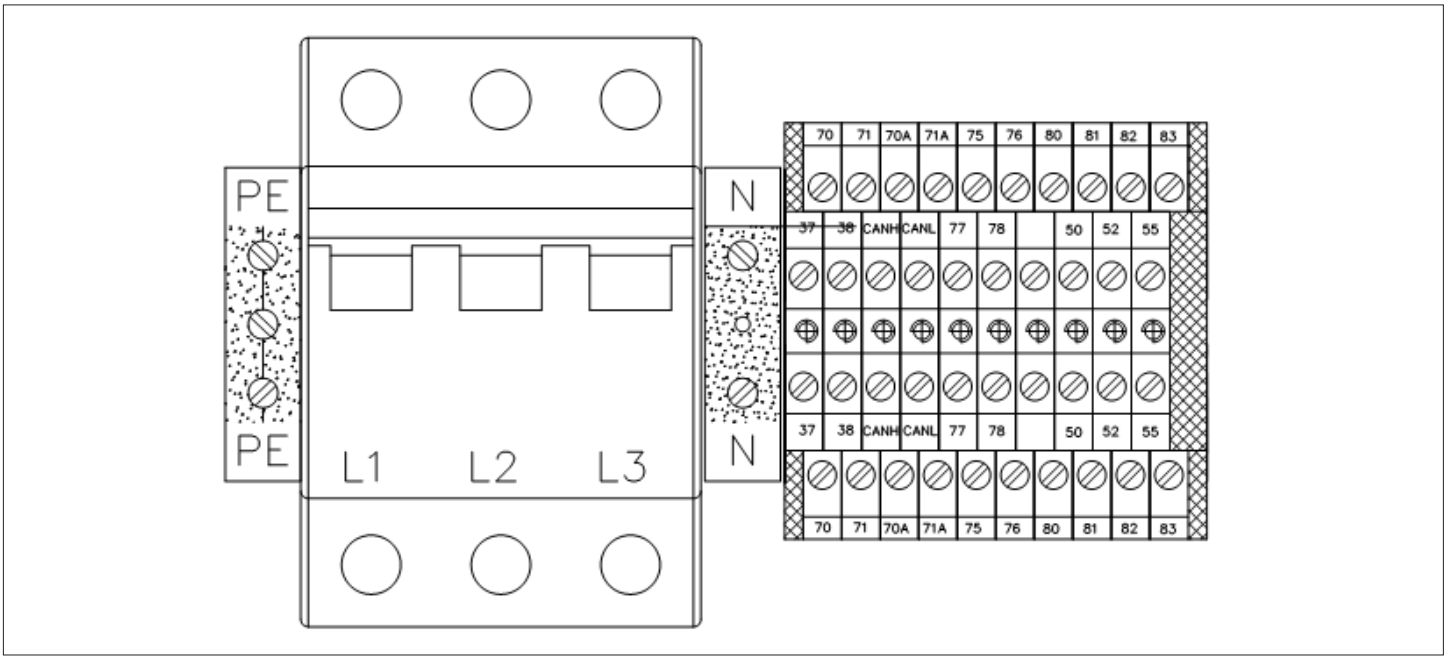


Figure 2-37 Enlarged View of Condenser MCB and Terminal

The cable sizes should meet the local wiring regulations.

Table 2-13 Rated Full Load Ampere (FLA)

Unit Type	Standard Models	Electrical Heating			No Electrical Heating		Cross-Section-Area of Copper Wire mm²
		Standard Model with 2-stage Electrical Heating	1-stage Electrical Heating/ No Humidifier	2-stage Electrical Heating/ No Humidifier	With Humidifier	Without Humidifier	
P1030	29.6	38.7	29.6	38.7	26.6	20.5	7
P1040	37.8	51.5	37.8	51.5	30.2	24.1	10
P1050 (S)	46.4	60.1	46.4	60.1	38.8	32.7	12
P1050 (D)	46.8	60.5	46.8	60.5	39.2	33.1	12
P2060	54.7	68.4	54.7	68.4	52.4	41.0	14
P2070	57.7	71.4	57.7	71.4	55.4	44.0	14
P2080	66.4	84.7	66.4	84.7	59.6	48.2	17
P2090	76.4	94.7	76.4	94.7	69.6	58.2	19
P2100	83.6	101.9	83.6	101.9	76.8	65.4	21

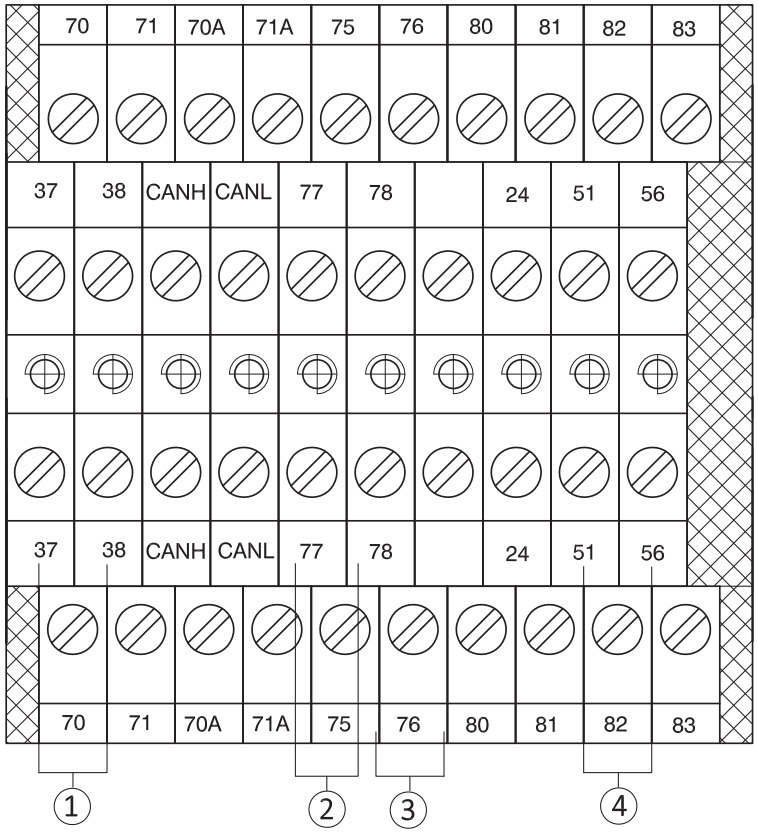
- *The standard model is configured with compressor, EC fan, humidifier and one-stage electrical heating.*
- *Air-cooled unit FLA excludes the outdoor unit current.*

Table 2-14 Rated Current of MCB

Type	Rated Current of MCB (A)
P1030~P2100	125

2.4.3. Connecting Control Cables

The position of field connection terminals is shown in Figure 2-36 and the enlarged view of the terminal row is shown in Figure 2-38. The upper part of the terminal row is connected with the unit, and the lower part is the interface of the user control signal line.



No.	Description	No.	Description
1	37/38 short connection, remove this short wire at remote shutdown	3	Access to public alarm
2	Rs485 interface	4	Custom alarm end for its common end

Figure 2-38 Enlarged View of Terminal Block/Row

Before connecting the control line, it is mandatory to perform the corresponding anti-static measures..

2.4.4. 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 sensors in parallel connection is not limited, but each unit has only one water-under-floor alarm.

2.4.5. Remote Shutdown Control Line Connection

As shown in Figure 2-38, 37# and 38# terminals can connect to remote shutdown switch, and they have 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 37# and 38# are opened, the unit will shut down.

2.4.6. Customized Alarm Terminal

Terminals 51# and 56# can be connected to two types of sensors, and terminal 24# is their common terminal and can be defined as water-under-floor sensor. If there is an optional smoke detector, the alarm can be involved in any between #56 and # 24 terminal. After the customer terminals are connected to external alarm signals, the corresponding customized alarm should be set through the controller.

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 Precision Air Conditioner system will generate an audible alarm, and the controller LCD will display the alarm information.

- LCD displays the corresponding alarm content
- Terminals 37# and 38#: Remote alarm
- Terminals 51# and 24#: Water-under-floor sensor by factory settings

2.4.7. External General Alarm

Terminals 75# and 76# can be connected to the external general alarms. The output signals to external alarm devices, such as alarm indicator. When critical alarm occurs, the contact will be closed to trigger remote alarms, send signals to the building management system or dial the paging system automatically. The power supply of the external general alarm system is user prepared.

2.4.8. Condenser Wiring

- Condenser Control Signal Terminal

70#/ 71# and 70A#/ 71A# are control signal input terminals for two circuits of condensers and their switching status are identical with those of the compressor.

- Control Signal Line Connected to the Condenser

Open the sealed panel of the electric control box of the condenser to reveal the fan speed controller board, according to the cable connection instructions in the “Liebert Condenser User Manual”. The signal cable connection of condenser is as follows.

- Wiring Mode of PEX Condenser of Single System Unit Matches with Indoor Unit of Single System

The digital signal of dry contact J6 on the board (Refer Cable terminals section in “Vertiv PEX+ Condenser User Manual” for the locations) is connected to the control terminals 70#/ 71# of the indoor unit.

- Wiring Mode of two PEX Condensers of Single System Unit Matches with Indoor unit of Dual System

The digital signals of dry contacts J6 on the condenser board corresponding to compressor 1# are connected to the control terminals 70#/ 71# of the indoor unit, and the digital signals of dry contacts J6 on the condenser board corresponding to compressor 2# are connected to the control terminals 70A#/ 71A# of the indoor unit.

- Wiring Mode of PEX Condenser of Dual System Unit Matches with Indoor unit of Dual System

Short-connected the terminals 70# & 70A# and 71# & 71A#. The digital signal of dry contact J6 on the board can be connected to the control terminals 70#/ 71# or 70A#/ 71A#.

- Wiring Mode of LVC Condenser matches with two Indoor units of single system

Compressor single terminal row 70#/ 71# in 1# condenser electrical control box (refer “the LVC Condenser Series User Manual” for external cables) can be introduced from either control interface of indoor unit. Compressor single terminal row 70/ 70A#/ 71/ 71A# in 2# condenser (refer “the LVC Condenser Series User Manual” for external cables) can be introduced from another 70#/ 71# control interface of indoor unit.

- Wiring Mode of LVC Condenser matches with Indoor unit of dual system

The power cables of condenser are connected with the MCBs (Figure 2-37) reserved in the indoor unit.

2.4.9. Check the Installation

After completion of the electrical installation, should check confirmation as per Table 2-15.

Table 2-15 Inspection Checklist

Check items	Results
The power supply voltage meets the rated voltage on the unit name plate	
The system electric loop has no open circuit or short circuit	
Power cables and ground cables to the MCBs, indoor unit and condenser 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	

Do not power-on the unit, unless the unit has been checked and confirmed by Vertiv Personnel/ Vertiv Service Team.

Chapter 3: Touchscreen Operation

The Liebert iCOM offers the highest capability for unit control, communication, and monitoring of Liebert Thermal Management Units. It is available as factory-installed on new units and assemblies.

3.1. Touchscreen Display and User Interface

The Liebert iCOM touchscreen, user interface speed set up, installation, and simplified control of Liebert PEX3 units literally putting cooling-system monitoring and management at your fingertips.

- User and service menus are password-protected to prevent unauthorized changes in the cooling unit operation settings.
- The touchscreen is back-lit and auto-dims after a period of non-use, then turns off. Touch the screen to re-illuminate the main screen.
- iCOM ships with default settings for efficient and effective operation of most cooling-units and it is easily configured to meet any requirement.
- iCOM menus and displays are based on the options installed on the cooling units that it monitors and manages.

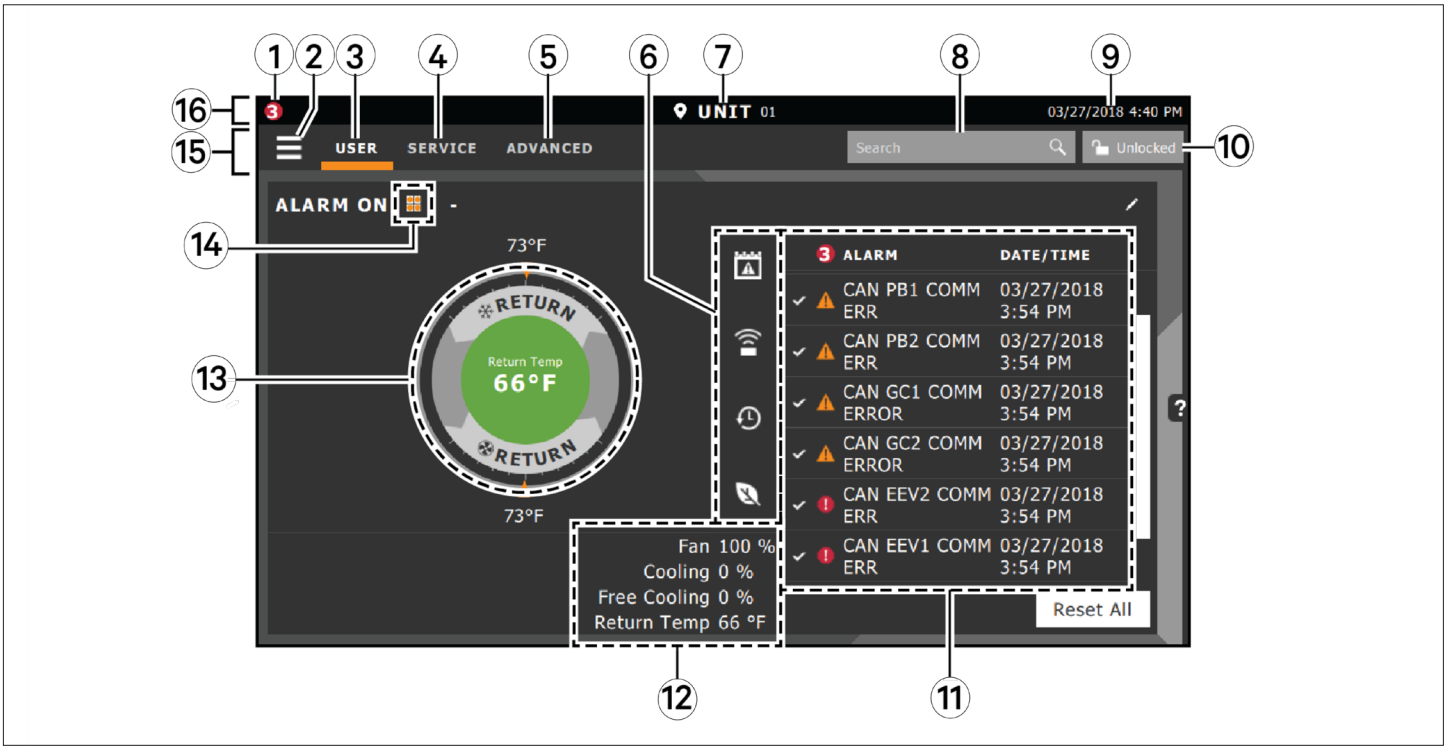


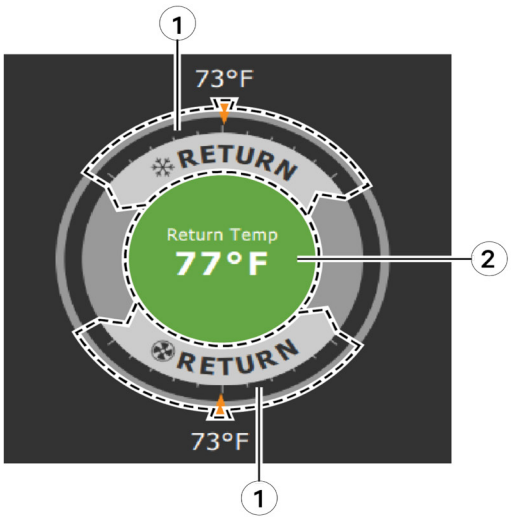
Figure 3-1 iCOM Main Display

Table 3-1 Main Display Controls and Options

No.	Description
1	Alarms present: Displays the number of active alarms.
2	Menu icon: When unlocked, displays a menu for user or service option depending on which icon is selected.
3	User icon: When selected the user options are available on the main display and menu (Note: Unlock the display with the user Password to access the menu and options. See "Powering-On iCOM and Logging-in/ Unlocking Controls").
4	Service icon: When selected the service options are available on the main display and menu (Note: Unlock the display with the user Password to access the menu and options. See "Powering-On iCOM and Logging-in/ Unlocking Controls").
5	Advanced icon: When selected the advanced options are available on the main display and menu (NOTE: Unlock the display with the Service Password to access the menu and read-only options. See "Powering-On iCOM and Logging-in/ Unlocking Controls".
6	Cooling-unit parameters: Status display of selected system parameter settings. See Adding and Adjusting Content.
7	Unit Identification: You can customize the unit name up to 6 characters/ numbers.
8	Search icon: Open the keyboard to search for controls and setting locations. See "Searching".
9	Date/ Time.
10	• Lock/Unlock icon: Indicates whether or not the user and service is logged-in and options are accessible • Locked icon = display is read only • Unlocked icon = User or service is logged-in and option is accessible • See Powering-on iCOM and logging-in/ Unlocking Controls
11	Secondary-content panel: When accessing setting/configuration via the menus, the settings is displayed in the right, 'Secondary' panel
12	Summary of current unit function. You can customize to show fan speed, cooling, percentages from any installed device, and any physical (sensor) values.
13	Status Dial: Circular display of setpoints and environment conditions of the unit. See Touchscreen
14	Teamwork-mode icon: In a panel with status content the Teamwork Mode icon indicates the mode selected
15	Control header: Control to access the user and service menus. See Control Header
16	Status Header. Displays the alarm status, unit identification, and the current date and time.

3.2. Touchscreen Status Dial

The dial in the primary-control panel is divided into four customizable read-only sections that display setpoints and environmental conditions for the unit status at a glance. See Figure 3-2, the center of the dial displays sensor readings and changes color according to the alarm thresholds as the readings rise and fall. When the cooling unit is powered-Off, the center of the dial is grey. The readings display can be selected by touching the center of the dial cycles through a set of sensor settings.

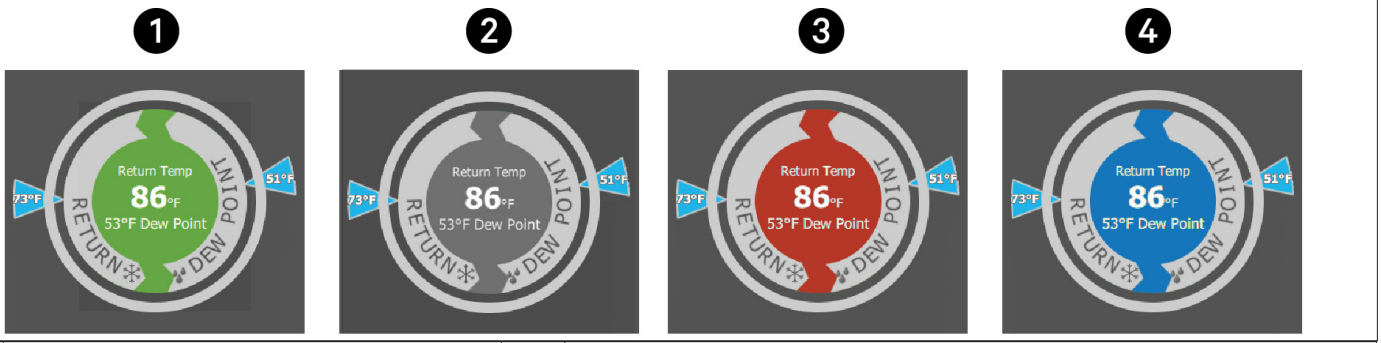


No.	Description
1	• Control sensor and its setpoint: The sensors and setpoints displayed depend on the configuration of the unit. If the sensor selected for temperature-control or humidity-control, the dial displays only temperature control or humidity control setpoints respectively. • If the sensor selected for fan control then the dial displays fan-control sensor and setpoint, as shown in Figure 3-2 above.
2	Single or multiple sensor readings. The setpoints can be scrolled by touching the displayed reading.

Figure 3-2 Dial Sections

3.2.1. Dial Background-Color Status Indication

The background color of the dial indicates whether or not the unit is powered-On or Off and it also responds to threshold settings of the control-sensor reading, see Figure 3-3 and Table 3-2 describes the background color displayed if the selected sensor reading has threshold limits set.



No.	Description	No.	Description
1	Sensor reading is within threshold limits	3	Sensor reading is above threshold limit or the unit is in an alarm condition
2	Unit is powered-off	4	Sensor reading is below threshold limits

Figure 3-3 Dial Background Colors

Table 3-2 Background Color Displayed by Selected Value and Threshold Limit

Sensor/Value Selected	Threshold Limit	Background Color
Return Temp	None	Blue
	High return temperature	Red
Return Humidity	Low return humidity	Blue
	High return humidity	Red
Dew Point	Low dew point	Blue
	High dew point	Red
Supply Temp	Low supply temperature	Blue
	High supply temperature	Red
Average Rack Temp	Low remote temperature	Blue
	High remote temperature	Red
Max Rack Temp	Low remote temperature	Blue
	High remote temperature	Red
Min Rack Temp	Low remote temperature	Blue
	High remote temperature	Red
Static Pressure	Low static pressure	Blue
	High static pressure	Red
Outdoor Temp	None	Green
Outdoor Humidity	None	Green

3.3. Control Header

The control header contains the controls to access the user and service settings. The display is locked when started initially and resumed after a period of inactivity.

3.3.1. Powering-On iCOM and Logging-in/ Unlocking Controls

iCOM is powered-ON when power is switched ON at the cooling unit's disconnect switch and you activate the display by touching it. iCOM is locked when started and also locks after a period of inactivity to prevent unauthorized changes. A four digit password is required to access the user and service menus & options. The advance menu is read-only at service level login.

- *The factory-default inactivity period is a minute*
- *The factory-default password for user and service login are provided. We recommend changing the passwords to prevent unauthorized changes.*
- *Default User Password = 1490*
- *Default Service Password = 5010*

Steps to Unlock the Controls:

1. On the header, press  . The keypad opens.
2. Press the numbers/ characters for your Password, then press  . Depending on the Password entered and your access level, the User and/ or Service options and view-only access to the Advance menu are accessible. The details will be provided by accessing the User and Service Menus.

3.3.2. Powering-on the Thermal Management Unit

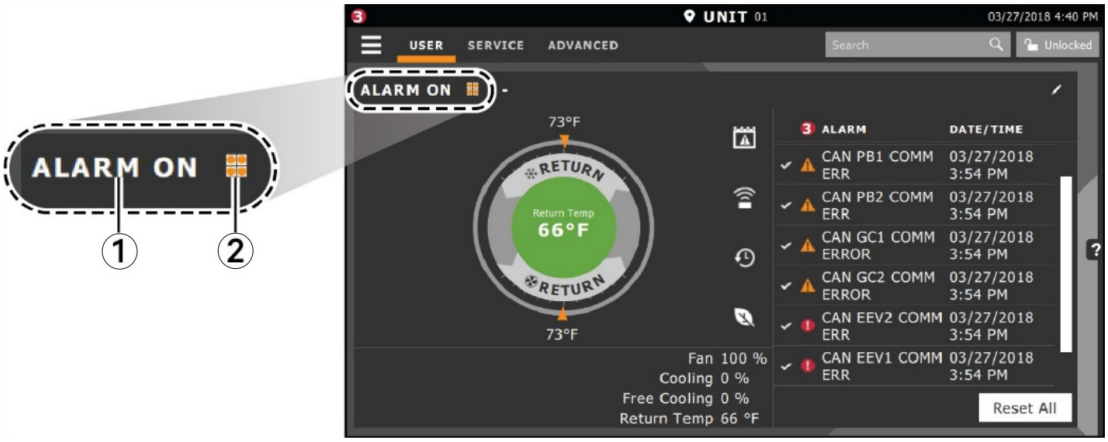
Depending on the operating state, there are start/ stop priority switches that may prevent the cooling unit from operating even though power to the unit is switched on and you have turned it on via iCOM. When all switches are closed, then only the cooling unit operates. For example, even though you have turned-on the unit through iCOM, if the BMS remote-monitoring system is sending a command to turn-off the unit, the cooling unit remains Off.

You must be logged-in to access the menu options See "Powering-On iCOM and Logging-in/ Unlocking Controls".

To Power-On the Unit:

1. Press  then  > Turn Unit On, then Unit On dialog box opens.

2. Press Turn Unit On, then cooling unit starts, and the operating status is displayed as shown in Figure 3-4.



No.	Description
1	Current status of the unit. See Cooling -unit status displayed as follow.
2	Teamwork icon. See Viewing Teamwork, Stand-by, Cascade Status.

Figure 3-4 Unit Status on iCOM Display

Table 3-3 Cooling Unit Status Displayed

Unit Status Text	Description
ALARM OFF	An alarm forced the unit to turn off. See Viewing Unit Alarm.
MANUAL	Controlled by a service technician.
DISPLAY OFF	Unit is turned OFF at the iCOM display. See Powering-on the Thermal Management Unit.
ALARM STANDBY	In stand-by because of an active alarm on the unit see Viewing Unit Alarm.
STANDBY	In stand-by, because of service menu setting.
TIMER OFF	Scheduled on a timer and is in “sleep” mode waiting for the next start interval.
UNIT ON	Operating normally without alarm or warning.
WARNING ON	Active warning but still operating.
ALARM ON	Active alarm but still operating.
TIMER	Scheduled on a timer to operate and is in operating mode.
REMOTE OFF	• Turned-off by remote shutdown terminal. • Occurs when a normally-closed set of 24 V contacts open. • The remote On/ Off and Display On/ Off switches are in series, and the cooling unit will only turn-on if both switches are “On/ Closed” or if one is “Off/ Open”, the unit turns off.

Unit Status Text	Description
MONITORING OFF	• Turned-off by remote monitoring system. • Check the remote monitoring device or call Vertiv technician support for assistance.
BACK-DRAFT	Unit is non-operational, but EC fan is operating as a back-draft damper.
RESTART DELAY	Not yet operational after a power cycle because the restart- delay time is active.

3.3.3. Powering-Off the Thermal Management Unit

1. Press 

then  > Turn Unit Off, then Turn Unit Off panel opens.

2. Press 'Turn Unit Off', the unit begins a power-Off countdown then powers-Off.

You must be logged-in to access the menu options. See Powering-on iCOM and Logging-in/ Unlocking Controls.

3.3.4. Logging Out

Log-out occurs automatically when the display back light turns-Off for inactivity.

1. To log-out manually, press the lock icon. The icon indicates "locked".

The factory-default inactivity period is 1minute.

3.3.5. Setting the Date and Time

The correct date and time are critical for warnings, alarms, and scheduling.

1. Press  then  > Display Options >Display Properties > Date & Time.
2. Press the date field, use the arrow to select the date and press Ok or press the time field, use the arrow to set the time, and press OK.
3. Select the date and time format if necessary.
4. Press Save.

The date selector has a preference switch in the upper-right corner. It helps in selecting between a graphical or list view.

3.3.6. Searching

When logged-in, you can use the display search to find the location of settings options based on a term, service codes or parameter. You can also search by the line ID used in the iCOM before the touchscreen model.

1. In the control header, press the search field. The keyboard opens.
2. Type the term and press  . A list of locations that contain the searched term opens.
3. To go to a listed location, press an item, then press Go. The panel for the selected location opens.
4. Or to view the service codes and parameter entries related to the searched term, press View Parameter Directory Entries (the number of related entries is included in the option). The Parameter Directory opens. You may further refine the search in the directory.

You must be logged-in to access the display search. See Powering-on iCOM and Logging-in/ Unlocking Controls.

3.3.7. Using Context-Sensitive Help

Pressing the Help icon  on the right-hand side of the display opens the Help drawer with information about the panel or dialog currently on the display.

1. You can use search and the topic index to find further information.
2. To close the Help drawer, press the close arrow  .

3.3.8. About iCOM Version

The version, build, and other firmware information for the iCOM display board may be helpful while servicing or troubleshooting.

1. Press  then  >About. The ABOUT panel opens.

3.3.9. Accessing the User and Service Functions

iCOM operating functions that monitor and control a cooling unit are accessed via the User and Service menus.

1. To access a menu, press the icon for the menu you want,  ,  or  . In the control header, see Control Header: The orange bar appears below the menu name when selected indicating the menu content that will be displayed.
2. Press the menu icon  . The menu opens.

You must be logged-in to access the menu options. See Powering-on iCOM and Logging-in/ Unlocking Controls.

3.3.10. User Menu

The user menu lets you view system and unit status and edit some setpoints.

User menu options

1. Setpoints: Opens the SETPOINTS panel. See Viewing and Editing setpoints for the cooling unit.
2. Active Alarms: Opens the ALARMS panel. See Viewing Unit Alarms.
3. Event Log: Opens the EVENT LOG panel. See Viewing the Event Log.

4. Sensor Data: Opens the SENSOR DATA panel. See Viewing Sensor Data.
5. Display Options: Opens the Display Options menu:

- Customize Labels
- Display Properties
- Date & Time

6. Total Run Hours: Opens the RUN HOURS panel. See Managing Run Hours for a Component.
7. About: Opens the ABOUT panel. See About iCOM Version details
8. Turn Unit On/Off: Depending on unit's status, open the TURN UNIT ON or TURN UNIT OFF dialog. See Powering-on the Thermal Management Unit or Powering-off the Thermal Management Unit

3.3.11. Service Menu

The service menu lets you view and edit setpoints and perform many other functions.

Service Menu Options

1. Setpoints: Opens the SETPOINTS panel.
2. Diagnostic/Service: Opens the Diagnostic/Service menu:

- Diagnostics
- Technical Support-contact information for the cooling unit and iCOM display

3. Alarm/Event Setup: Opens the ALARMS & EVENTS panel.
4. Economizer: Opens the panel for the economizer installed on the cooling unit.
5. BMS & Teamwork Setup: Opens the BMS & Teamwork Setup menu:

- U2U Setup
- Teamwork/Standby
- BMS Setup

6. Scheduler: Opens the SCHEDULER panel.
7. Options Setup: Opens the OPTIONS SETUP panel.

8. Auxiliary Device Setup: Opens the Auxiliary Device Setup menu:

- Sensors
- Analog Input
- Modbus Devices
- iCOM-DO
- CapCom

9. Backup & Security: Opens the Backup & Security menu:

- Control Upgrade
- Control Backup/ Replicate
- Control Files
- Display Upgrade
- Display Backup/ Replicate

10. Turn Unit On/ Off: Depending on unit's status, open the TURN UNIT ON or TURN UNIT OFF dialog. See Powering-on the Thermal Management Unit or Powering-off the Thermal Management Unit.

3.3.12. Advanced Menu

The advanced menu provides a read-only view of the advanced set-up and factory-level settings.

1. Advanced Menu Options:
2. Factory Settings: Unit-code and configuration settings.
3. Diagnostic: Details about control and cooling operation.
4. Expert Settings: Parameters and settings for use by trained professionals only.
5. Compressor Info: Details about compressor state and operating mode.
6. Tandem Info: Details about compressor state and operating mode.
7. MBV Settings: Motorized ball valve settings (water-cooled heat rejection).
8. Running Monitoring: Details about component run times.

9. Modbus Devices: Information about connected Modbus devices such as power and flow meters.
10. Control Override: Allows simulating events and override of analog outputs beyond normal limits.
11. EEV Settings: Electronic Expansion Valve settings.
12. MC Condenser: Details about MC condenser (air-cooled heat rejection).
13. Parameter Directory: A searchable list of all parameters in the user interface.

3.4. User Operation

Viewing and Editing setpoints for the cooling unit.

- *User-level access allows viewing and editing of only a limited number of setpoints. To view or adjust all setpoints, you must have service-level access.*
- *Depending on the type of thermal management unit, included components and control settings of your system, the options on your iCOM display may differ.*

3.4.1. Editing Humidity Setpoints

1. Press 

then  > Setpoints > Humidity Control. The Humidity Control secondary panel opens.
2. Adjust the setpoint options, then press Save. The setpoint will be updated.
3. Press Cancel to discard the changes.

3.4.2. Editing Temperature Setpoints

1. Press 

then  > Setpoints > Temperature Control. The Temperature Control secondary panel opens.
2. Adjust the setpoint options, then press Save. The setpoint will be updated.
3. Press Cancel to discard the changes.

3.4.3. Viewing Unit Alarms

The ALARMS panel lists active alarm and warning events. Table 3-4 below describes the type and state of the alarm shown by indicator dots.

Table 3-4 Alarm Status/ Indicator

Indicator	Description
Yellow dot	Warning event
Red dot	Alarm event
Circle	Event condition has cleared, but still must be acknowledge. See the Acknowledge Alarm

To view alarms

1. Press  then  >Alarms. The ALARMS panel opens.

2. Press an alarm to display the ALARM DETAILS panel.

3.4.4. Silencing an Audible Alarm

Touch the screen to silence an audible alarm. If the alarm is non-latching, the alarm silences when the condition clears.

The audible alarm must be enabled in display options to make sound.

3.4.5. Acknowledging Alarms

Depending on the notification settings, alarms and warnings must be acknowledged or reset. An event is active as long as it is unacknowledged, with the exception of the network-failure events described in Table 3-5. Once acknowledged, an event remains active until the situation that triggered the event is resolved, see Table 3-4 for event-status indicators. When the event is acknowledged and cleared, it is removed from the Alarms panel and the LED stops flashing red.

Acknowledging alarm events does not clear them, to clear an issue, it must be corrected, reset automatically by the controller or reset manually.

To acknowledge alarms

1. On the ALARMS panel, press Acknowledge All: A check mark overlays the status indicator of the active alarms and warnings, and these automatically clears when the condition is no longer present.

2. If a critical event must be reset manually, then the acknowledged items are listed with a Reset All button on the ALARMS panel.

3. Touch Reset All to manually reset the condition.

Table 3-5 Events that Clear without Acknowledgment

Network Failure	Description
Unit xx disconnected	• The iCOM I/O board assigned as U2U address number XX (two up to thirty- two) has lost communication with the group • Make sure all units are powered-on at the disconnect • Check cable connections and network setting wherever applicable
No connection W/unit 1	• The iCOM I/O board assigned as U2U address number 1 has lost communication with the group • Make sure all units are powered-on at the disconnect • Check cable connections and network setting wherever applicable
BMS disconnect	• The BMS/ BAS has not completed a handshake within the time defined by the BMS/ BAS • Verify monitoring connection and communication to the BMS/ BAS panel
Unit code missing	The Factory unit code must be confirmed, saved and executed
Unit code mismatch	The Factory unit code must be confirmed, saved and executed
Ambient sensor failure	The outdoor temperature/ humidity sensor used on the air economizer unit has become disconnected or is no longer working properly

3.4.6. Viewing the Event Log

The event log is a list by date/ time of the last 400 events generated by iCOM for the thermal-management unit. On the User menu, press Event Log. The EVENT LOG for the cooling unit opens. Table 3-6 describes the color-coded status for each event.

Depending on the type of thermal management unit, included components and control settings of your system, the options on your iCOM display may differ.

Table 3-6 Events that Clear without Acknowledgment

Indicator	Description
Green Dot	Message
Yellow Dot	Unacknowledged warning event. See acknowledge alarm on the previous page
Red Dot	Unacknowledged alarm event. See acknowledge alarm on the previous page
White Dot with check-mark overlay	Acknowledged event, the cause still exists
White circle	Acknowledged event, the cause is cleared

3.4.7. Viewing Sensor Data

The Sensor Data panel lists the standard and optional sensors monitored by iCOM and the current readings of each sensor.

1. Press 

then  > Sensor Data. The Sensor Data panel opens.

2. A secondary panel displays the DAILY SENSOR READING SUMMARY, which shows temperature, humidity and dew-point readings for the cooling unit.

3.4.8. Managing Run Hours for a Component

You can view the run hours for components on a cooling unit, set the total-run-time limit, and reset total run hours to zero.

1. Press 

then  > Total Run Hours. The RUN HOURS panel opens and the current hours for each component are listed in the Total Run Hours column (to reset the total run hours to zero, refer Section 3.4.9 Setting run hours to zero).

2. Use the slider to set the total-run-time limit for each component, then press *Save* to set the limits.

3.4.9. Setting Run Hours to Zero

1. On the RUN HOURS panel, press to check each box in the *Total Run Hours* column next to the component (s) to reset. The Set to Zero button is enabled.

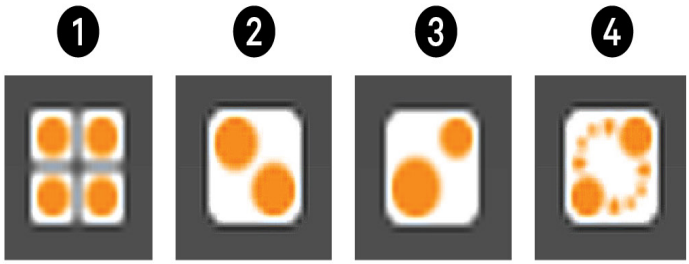
2. Press *Set to Zero*, the total run hours for selected component (s) will set to zero.

3.4.10. Viewing Teamwork, Stand-by, Cascade and Operating Status

In the main User panel, the Teamwork Mode icon indicates the mode selected, see Figure 3-5.

To view the teamwork details

1. Press the Teamwork-mode icon.
2. The teamwork dialog opens display the teamwork mode, number of units in stand-by, and number of operating units.



No.	Description
1	No teamwork
2	Mode 1- Parallel Teamwork
3	Mode 2- Independent Teamwork
4	Mode 3- Optimized Aisle Teamwork

Figure 3-5 Teamwork icons

You must be logged-in with the Service Password to edit teamwork mode. Refer Powering-on iCOM and Logging-in/ Unlocking Controls.

Chapter 4: iCOM Controller Operation

This chapter explains the LCD, Button, Indicator Panel, Structure Chart of Control Menu, Start-Up Interface, Main Interface, User Menus, Service Menus, Advanced Menus and Event Name and Definition of the iCOM Controller. The iCOM controller adopts menu operation. The display board monitors, displays, and the user may operate the parameters on the display board to control the environment within a set range.

4.1. LCD Screen

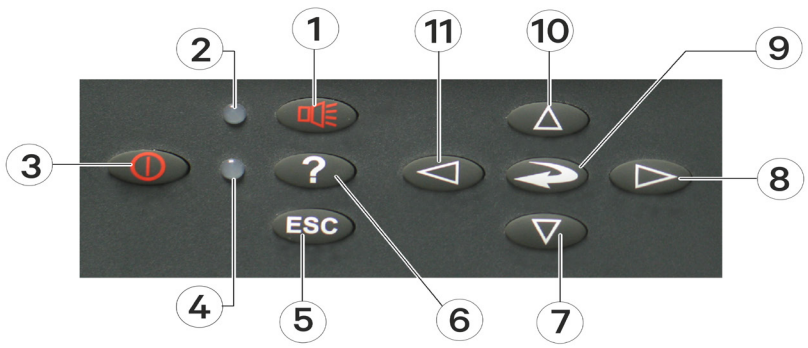
LCD Screen is located on the front panel of the Liebert PEX3 series. The LCD displays the current state of the equipment room such as temperature, humidity and so on. You can also read and modify the equipment configuration through the LCD. The LCD uses white back-light, if no button is pressed within 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

- *After the system is powered on, the system will resume the operation state before power-off. For example, if the system is in the work state when its powered 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.*

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 the 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 the 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. • Abolish 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.

Button	Function Description
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.
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.

4.3. Structure Chart of Control Menu

Please refer to Appendix-III Menu Structure of iCOM Controller.

4.4. Start-Up Interface

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

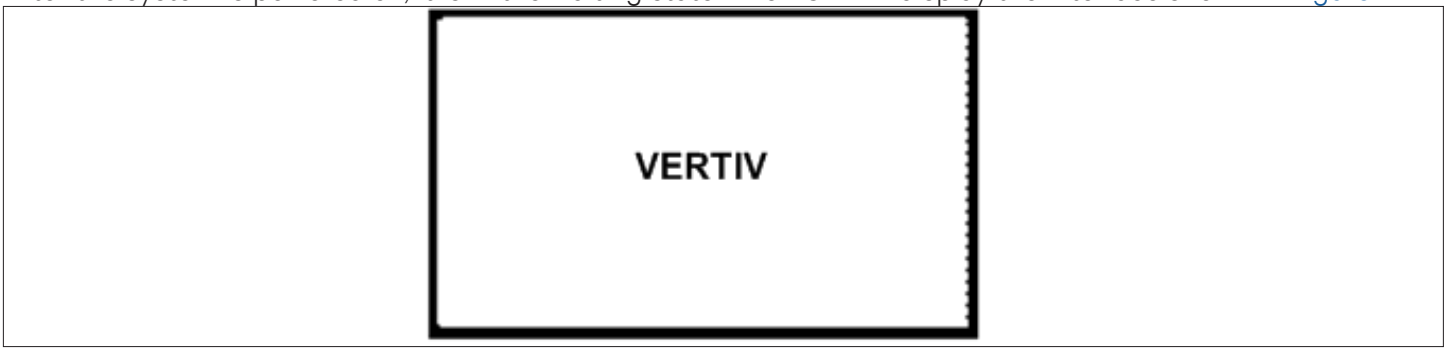
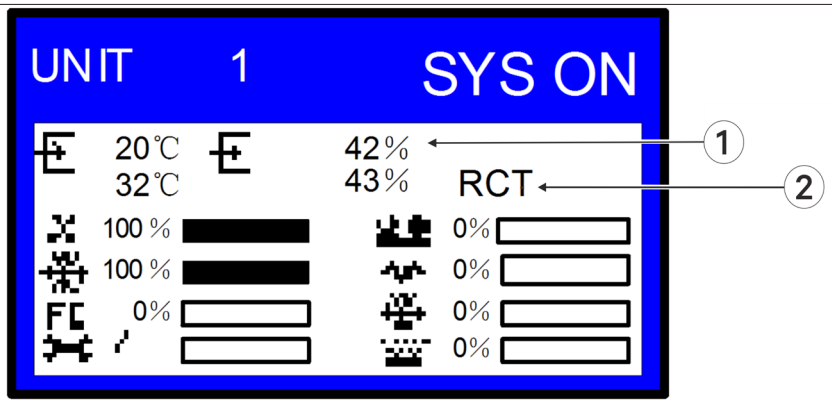


Figure 4-2 Startup Interface

4.5. Main Interface

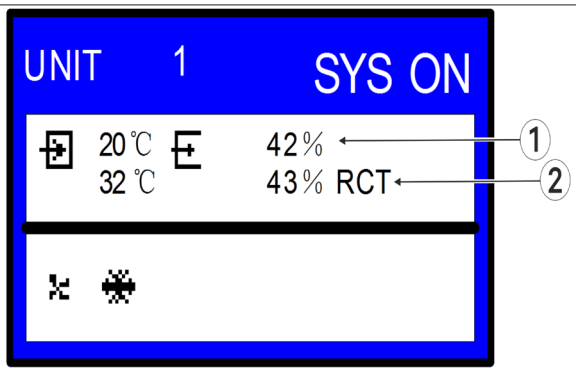
After power-on, the LCD will enter the main interface after about 60s. The main interface provides the general information about relative equipment status, including current temperature and humidity; temperature and humidity setpoints; equipment output status (fan, compressor, cooling, heating, dehumidifying, 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 255s 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

4.6. 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.

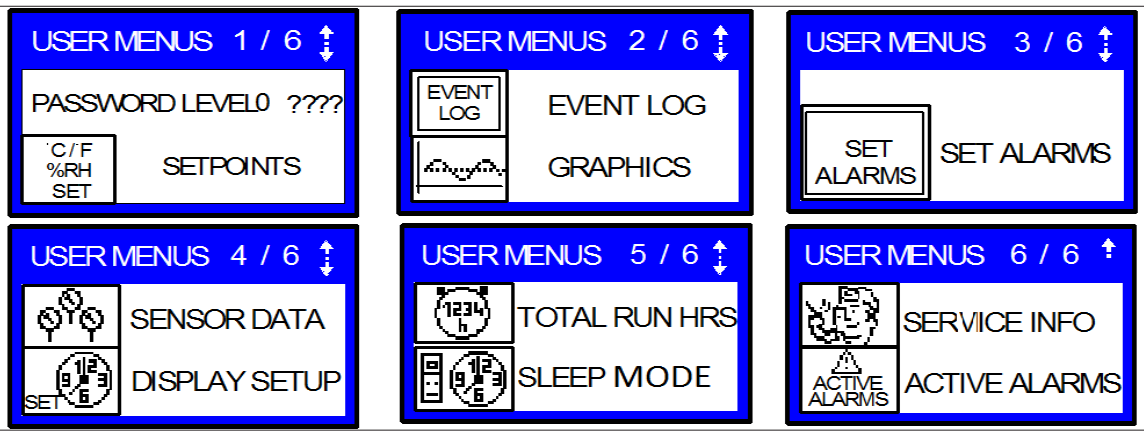


Figure 4-5 User Menus

4.7. 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.

4.8. 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	23.0 °C	5.0 °C to 40.0 °C	Air Temperature Setpoint
U102	TEMP ACT	-	5.0 °C to 40.0 °C	Actual Air Temperature Setpoint
U103	TEMPSENS	Return Sensor	0 = SUP 1 = REM 2 = RET	Temperature Control Sensor
U104	HUM SET	50%	20% to 80%	Humidity Setpoint
		12.0 °C	5.0 °C to 30.0 °C	Dew Point Setpoint
U105	SUP SENS	No	No, Lim, Ctrl, Cool	Supply Air Type
U106	HUM CTRL	Predictive	0 = Rel 1 = Comp 2 = Pred 3 = DewP	Humidity Control Type
U107	FAN SET	23.0 °C	5.0 °C to 40.0 °C	Fan Speed Temperature Setpoint
U108	FAN SENS	Return Sensor	0 = SUP 1 = REM 2 = RET 3 = MAN	Fan Control Sensor
U110	SMART AI	-	0 = No 1 = Yes	Smart Aisle Enabled
U113	2ND SETP	23.0 °C	5.0 °C to 40.0 °C	2nd Temperature Setpoint
U114	SUP TEMP	5.0 °C	5.0 °C to 27.0 °C	Supply Temp Limit Setpoint
U116	BACK TSP	23.0 °C	5.0 °C to 40.0 °C	BMS Backup Temp Setpoint
U117	BACK FAN	23.0 °C	5.0 °C to 40.0 °C	BMS Backup Fan Setpoint
U119	RCOMP SP	23.0 °C	5.0 °C to 40.0 °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.

4.9. Event Log

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

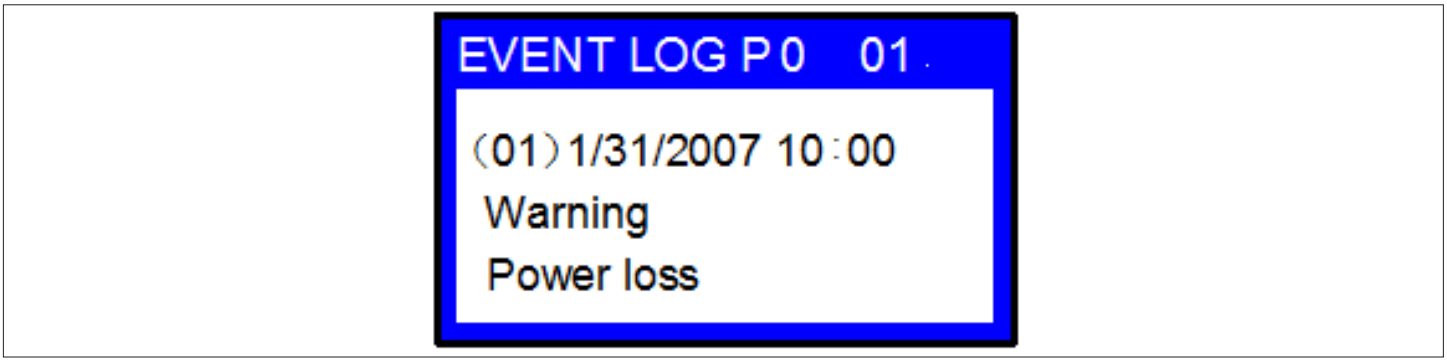


Figure 4-6 Event Log Menu

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.

4.10. Graphics

The GRAPHICS menu provides two types of graphs: RETURN TEMP and RETURN HUMIDITY. These graphs reflect the temperature and humidity changes over a period of time in the past.
In the graphs, the current temperature or humidity is the origin, the time is the horizontal axis, and the temperature or humidity is the vertical axis, as shown in the Figure 4-7.

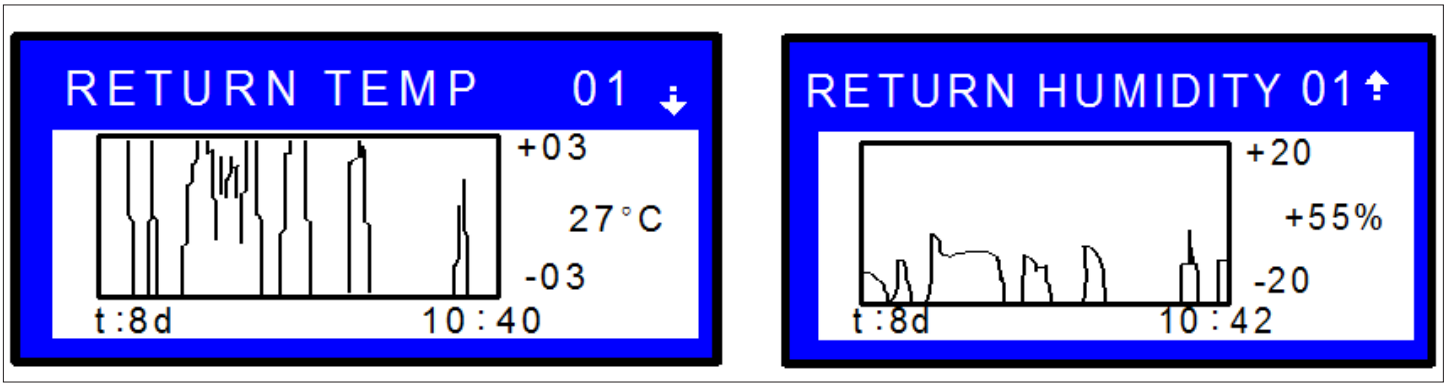


Figure 4-7 The Graph of Return Temperature and Return Humidity

As the horizontal axis, the time range can be set into eight types. Each pixel indicates different time in different time ranges. See Table 4-5 for the detailed time range. The scaling of the vertical axis can also be set for the RETURN TEMP, the scaling range is ± 3 to ± 20: For the RETURN HUMIDITY, the scaling range is ± 10 to ± 30. The greater the scaling range, the greater the value each pixel and the more centered the curves.

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 the 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		

4.11. 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 fails. You 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 recommended not to change the system defaults. If you 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	Yes	Yes, No	Return air sensor alarm enable
U203	HI TEMP	37.8 °C	1.0 °C to 99.0 °C	High return air temperature threshold
U204	LO TEMP	18.3 °C	1.0 °C to 99.0 °C	Low return air temperature threshold
U205	HI HUM	65%	1% to 99%	High return air humidity threshold
U206	LO HUM	35%	1% to 99%	Low return air humidity threshold
U207	SENSOR A	No	Yes, No	Sensor alarm enable
U208	HI TEMPA	32.3 °C	1.0 °C to 99.0 °C	High temperature threshold of sensor A
U209	LO TEMPA	12.8 °C	1.0 °C to 99.0 °C	Low temperature threshold of sensor A
U210	HI HUM A	70%	1% to 99%	High humidity threshold of sensor A
U211	LO HUM A	30%	1% to 99%	Low humidity threshold of sensor A
U213	SUP SNSR	Yes	Yes, No	Supply air alarm enable

Parameters		Default	Setting Range	Description
U214	HI SUP T	23.9 °C	1.0 °C to 99.0 °C	High supply air temperature threshold
U215	LO SUP T	10.0 °C	1.0 °C to 99.0 °C	Low supply air temperature threshold
U219	REM SNSR	Disabled	0 = No 1 = Com 2 = Sep	Remote Sensor Alarms
U220	HI REM	32.3 °C	1.0 °C to 99.0 °C	High Remote Temperature
U220	LO REM	12.8 °C	1.0 °C to 99.0 °C	Low Remote Temperature
U224	HIREM 01	32.3 °C	1.0 °C to 99.0 °C	High Remote Temperature 01
U224	LOREM 01	12.8 °C	1.0 °C to 99.0 °C	Low Remote Temperature 01
U225	HIREM 02	32.3 °C	1.0 °C to 99.0 °C	High Remote Temperature 02
U225	LOREM 02	12.8 °C	1.0 °C to 99.0 °C	Low Remote Temperature 02
U226	HIREM 03	32.3 °C	1.0 °C to 99.0 °C	High Remote Temperature 03
U226	LOREM 03	12.8 °C	1.0 °C to 99.0 °C	Low Remote Temperature 03
U227	HIREM 04	32.3 °C	1.0 °C to 99.0 °C	High Remote Temperature 04
U227	LOREM 04	12.8 °C	1.0 °C to 99.0 °C	Low Remote Temperature 04
U228	HIREM 05	32.3 °C	1.0 °C to 99.0 °C	High Remote Temperature 05
U228	LOREM 05	12.8 °C	1.0 °C to 99.0 °C	Low Remote Temperature 05
U229	HIREM 06	32.3 °C	1.0 °C to 99.0 °C	High Remote Temperature 06
U229	LOREM 06	12.8 °C	1.0 °C to 99.0 °C	Low Remote Temperature 06
U230	HIREM 07	32.3 °C	1.0 °C to 99.0 °C	High Remote Temperature 07
U230	LOREM 07	12.8 °C	1.0 °C to 99.0 °C	Low Remote Temperature 07
U231	HIREM 08	32.3 °C	1.0 °C to 99.0 °C	High Remote Temperature 08
U231	LOREM 08	12.8 °C	1.0 °C to 99.0 °C	Low Remote Temperature 08
U232	HIREM 09	32.3 °C	1.0 °C to 99.0 °C	High Remote Temperature 09
U232	LOREM 09	12.8 °C	1.0 °C to 99.0 °C	Low Remote Temperature 09
U233	HIREM 10	32.3 °C	1.0 °C to 99.0 °C	High Remote Temperature 10
U233	LOREM 10	12.8 °C	1.0 °C to 99.0 °C	Low Remote Temperature 10

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.

4.12. 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	RUS, CZE, CHI, ESP, FRE, ITA, DEU, EN, POR	Language options
U402	YEAR	2005	-	Current year
U402	MONTH	04	01 to 12	Current month
U402	DAY	19	01 to 31	Current day
U403	HOUR	19h	-	Current hour
U403	MINUTE	8min	-	Current minute
U403	SECOND	17s	-	Current second
U404	TEMP F/C	°C	°F, °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	Off	On, Off	Buzzer frequency test switch. It determines whether or not there will be sound accompanying the adjustment of BUZ FREQ through the setting
U407	BACKLITE	5min	5min, 10min, 30min, 1hr, 12hr	Backlight time, or the backlight time when there is no button operation
U408	SCREEN	Graph	Graph, Simple, SimCo, GraCo	Main interface display mode
U409	SHOWS	A + S	SET, ACT, A + S	Main interface display mode of setpoints and actual values Range: SET: only setpoints of the temperature and humidity are displayed. ACT: only actual temperature and humidity are displayed. A + S: both setpoints and actual values of the temperature and humidity are displayed.
U410	DISPLAY	Norm	Norm (normal), Inv	Display color
U411	DATE	m/d/y	m/d/y, dmy, ymd	Date display format

4.13. 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	Related component	Parameters		Default	Related component
U502	MOTOR (S)	1000hr	Fan motor	U507	HG/HW	23hr	Hot gas/ Hot water
U502	LIMIT	32000hr		U508	EL HEAT1	-	Electric reheat 1
U503	COMP1	500hr	Compressor 1	U508	LIMIT	0hr	
U503	LIMIT	32000hr		U509	EL HEAT2	-	Electric reheat 2
U504	COMP2	500hr	Compressor 2	U509	LIMIT	0hr	
U504	LIMIT	32000hr		U510	EL HEAT3	-	Electric reheat 3
U505	CW	-	Chilled Water	U510	LIMIT	0hr	
U505	-	-		U511	HUM	-	Humidifier
U506	LIMIT	3200hr	Free Cooling	U511	LIMIT	0hr	
U506	FC	23hr		U512	DEHUM	-	Dehumidifier
U507	LIMIT	3200hr	Hot gas/ Hot water	U512	LIMIT	0hr	

Timers resetting is not needed unless the components are replaced.

4.14. 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	No	Yes, No	Sleep mode day, including Monday ~ Sunday. Set the value of any day to 'Yes', and the system will enter sleep mode on that day every week. This parameter works together with the following hour and minute settings to designate an exact time
U604	MON	No		
U604	TUE	No		
U604	WED	No		
U604	THU	No		
U604	FRI	No		
U604	SAT	No		
U604	SUN	No		
U606	START 1	0hr	-	Sleep mode start time 1. The first parameter is used to set the hour of time, and the second one is used to set the minute of time
U606	START 1	0m		
U606	STOP 1	0hr		Sleep mode end time 1. The first parameter is used to set the hour of time, and the second one is used to set the minute of time
U606	STOP 1	0min		
U608	START 2	0hr		Sleep mode start time 2. The first parameter is used to set the hour of time, and the second one is used to set the minute of time
U608	START 2	0min		
U608	STOP 2	0hr		Sleep mode end time 2. The first parameter is used to set the hour of time, and the second one is used to set the minute of time
U608	STOP 2	0min		
U609	TIME MOD	Yes	Auto, Yes, No	Timing mode setting range. Auto: during the system sleep time, if high/low temperature occurs, the system will resume operation and mask the alarm for 15min The system will re-enter the sleep mode after the alarm is cleared. Yes: start sleep mode; No: no sleep mode
U610	TIME TYP	S.OFF	S.OFF, DEADB	Timing mode selection
U611	DEADBAND	2.3 K	2 K to 15 K	Used to set the deadband temperature setting range

4.15. Service Info

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

4.16. Active Alarms

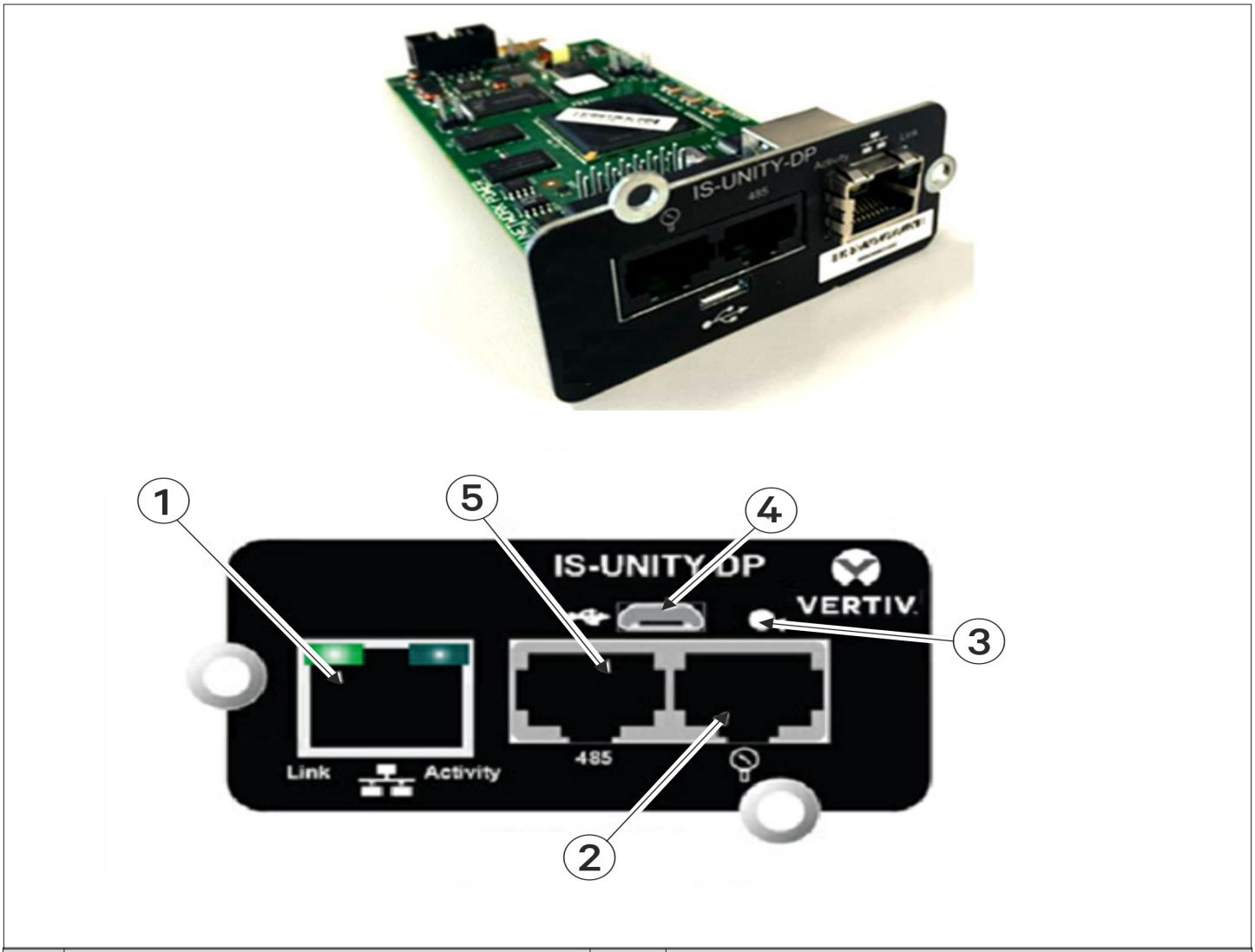
The ACTIVE ALARMS menu displays the active alarms of the system. No password is required to access this menu.

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 PEX3 supports IS-UNITY-DP card, 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. Commissioning Host Communication Component

Before commissioning you 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."

5.2.1. Assigning the Card's IP Address

DHCP

Liebert IntelliSlot Unity card is factory-configured for DHCP. If you require 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 5.2.2- 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.

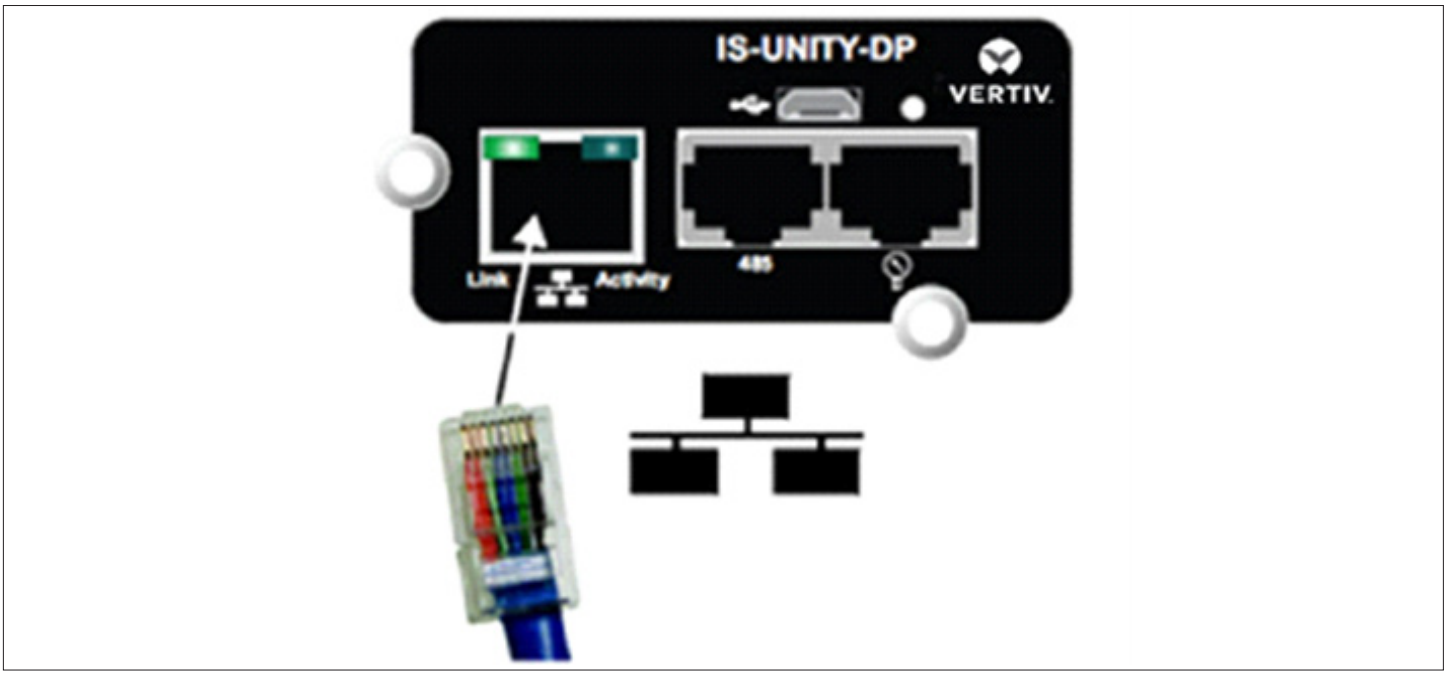
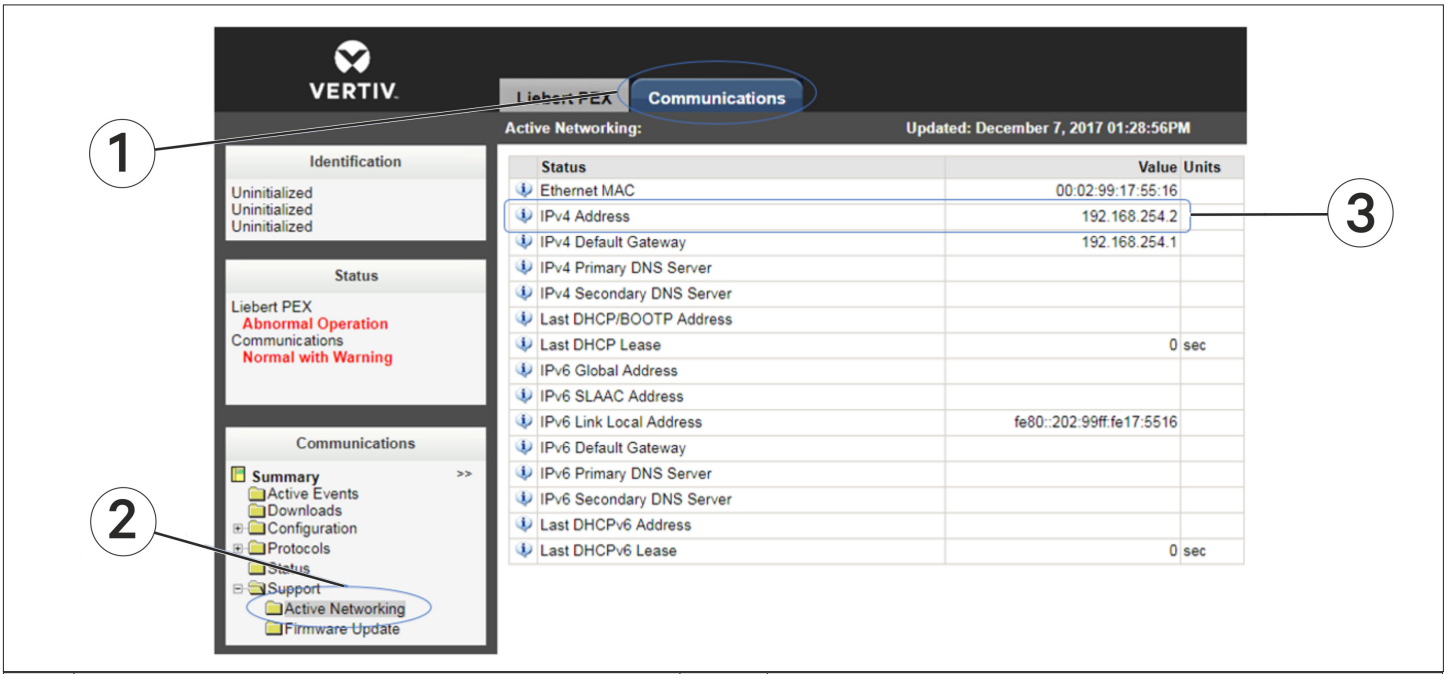


Figure 5-2 IS-UNITY-DP Card Connection Port



No.	Description	No.	Description
1	Communication tab	3	IP address
2	Support > Active networking		

Figure 5-3 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 5.2.2. Connect an Ethernet Cable.

5.2.2. 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.

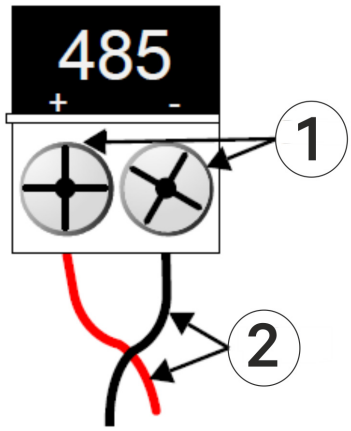
2. Auto-configuration, which is normally enabled on the computer running with Microsoft Windows operating system will automatically negotiate the communication settings. This takes about one minute.

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.

5.2.3. 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	Wires

Figure 5-4 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 5-4.

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.

Chapter 6: System Operation and Maintenance

Regular system maintenance is critical to ensure the reliability and the effectiveness of the product. This chapter describes Liebert PEX3 system maintenance, the content includes routine maintenance inspection items, check the electrical connections, control devices visual inspection, maintenance guide air-cooled condenser, filter maintenance guide, the infrared humidifier dimensional guidance, electric heating maintenance guidance.

- *During the running of Liebert PEX3, 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.*

6.1. 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 6-1 the monthly routine maintenance inspection items.

Table 6-1 Monthly Routine Check List of Items

Part	Check Item	Remark
Filter	Check for clogging or damage	
	Check the filter clog switch	
	Clean the filter	
Fan	Check fan blades are not distorted	
Compressor	Check for leakage	
	Listen to the operation sound, observe the operation vibration	
Air-cooled condenser (air-cooled units)	Check the fins are clean	
	The fan base should be firmed	
	The fan vibration absorber is not deteriorated or damaged	
	The SPD board should be effective (in the storming seasons, the SPD board should be check once a week)	
	The refrigerant pipes are properly supported	

Part	Check Item	Remark
Refrigeration cycle system	Check refrigerant pipes. Refrigerant pipes must be properly supported and must not lean against walls, floors or where the frame vibrates	
	Check the moisture content of the system (through a sight glass)	
	Check electronic expansion valve	
	Check the condenser drain pan for dirt blockage	
	Check the suction pressure and temperature	
	Check the discharge pressure and temperature	
	Check the water-cooled unit water inlet temperature	
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	

6.2. Routine Maintenance Inspection Items (Semi-Annual)

Refer Table 6-2 for routine maintenance inspection items semi-annually.

Table 6-2 Semi-Annual Routine Check List of Items

Part	Check Item	Remark
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	
Compressor	Check for leakage	
	Listen to the operation sound, observe the operation vibration	
	Check and fasten the circuit connections	
Air-cooled condenser (air-cooled units)	Check the fins are clean	
	The fan base should be firmed	
	The fan vibration absorber is not deteriorated or damaged	
	The SPD board should be effective (in the storming seasons, the SPD board should be check once a week)	
	The refrigerant pipes are properly supported	
	Check and fasten the circuit connections	

Part	Check Item	Remark
Water-cooled condenser (water-cooled unit)	Check the water pipe system	
	Check the MBV	
	Check for leakage	
	Check the water pressure and temperature	
Refrigeration cycle system	Check refrigerant pipes. Refrigerant pipes must be properly supported and must not lean against walls, floors or where the frame vibrates	
	Check the moisture content of the system (through a sight glass)	
	Check electronic expansion valve	
	Check whether refrigerant needs to be added (through the sight glass)	
	Check the condenser drain pan for dirt blockage	
	Check the suction pressure and temperature	
	Check the discharge pressure and temperature	
	Check the water-cooled unit water inlet temperature	
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	

6.3. Self-Diagnostic System

The 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.

6.4. 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.

6.5. 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.

5. Check the connection between the user terminals (70#, 71#, 70A#, 71A#, 37#, 38#) and the control interface board.

6. Check the output connection between the control interface board and various contactors and solenoid valves for liquid pipes, and the input connection between control interface board and fan overload protector, high pressure switch, heating over-temperature protection switch, humidifier protection switches, discharge air temperature sensor, and low-pressure sensor. In particular, check the connection parts such as high-pressure switches and solenoid valves, and replace the component if it is in poor condition or is faulty.

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

8. Check the specification and aging condition of the control cable and power cable between the indoor unit and the outdoor unit and replace the cables if necessary.

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

10. 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.

11. 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.

12. Check the water detection sensor. Bridge 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.*

6.6. Air-Cooled Condenser Maintenance Guide

Refer the associated "Liebert PEX condenser User Manual" and "LVC Series Condenser User Manual".

6.7. Water-Cooled Condenser Maintenance Guide

BPHE

The turbulence generated in the ducts of brazed BPHE can clean the ducts. However, in case of serious scaling (when scaling is due to the use of hot hard water), it is necessary to use cyclic rinsing device to clean the BPHE. Add weak acid (like 5% phosphoric acid) into a jar and pump the fluid into the BPHE to clean it, thoroughly. If the BPHE is regularly cleaned, then use 5% oxalic acid.

MBV

The iCOM controller controls the electronic ball valve position by collecting the refrigerant pressure from the pressure sensor at the BPHE outlet, so as to control the water flow through the BPHE for system stable operation. The higher the load, the more water flow is allowed to flow through the BPHE. The lower the load, the less water flow is allowed to flow through the BPHE.

- *Vertiv maintenance service does not cover the cleaning of BPHE, but user can consult Vertiv local representative for more details.*
- *If the electronic ball valve is in abnormal regulation state, consult Vertiv local representative.*

6.8. 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. You need 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.*

6.9. 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:

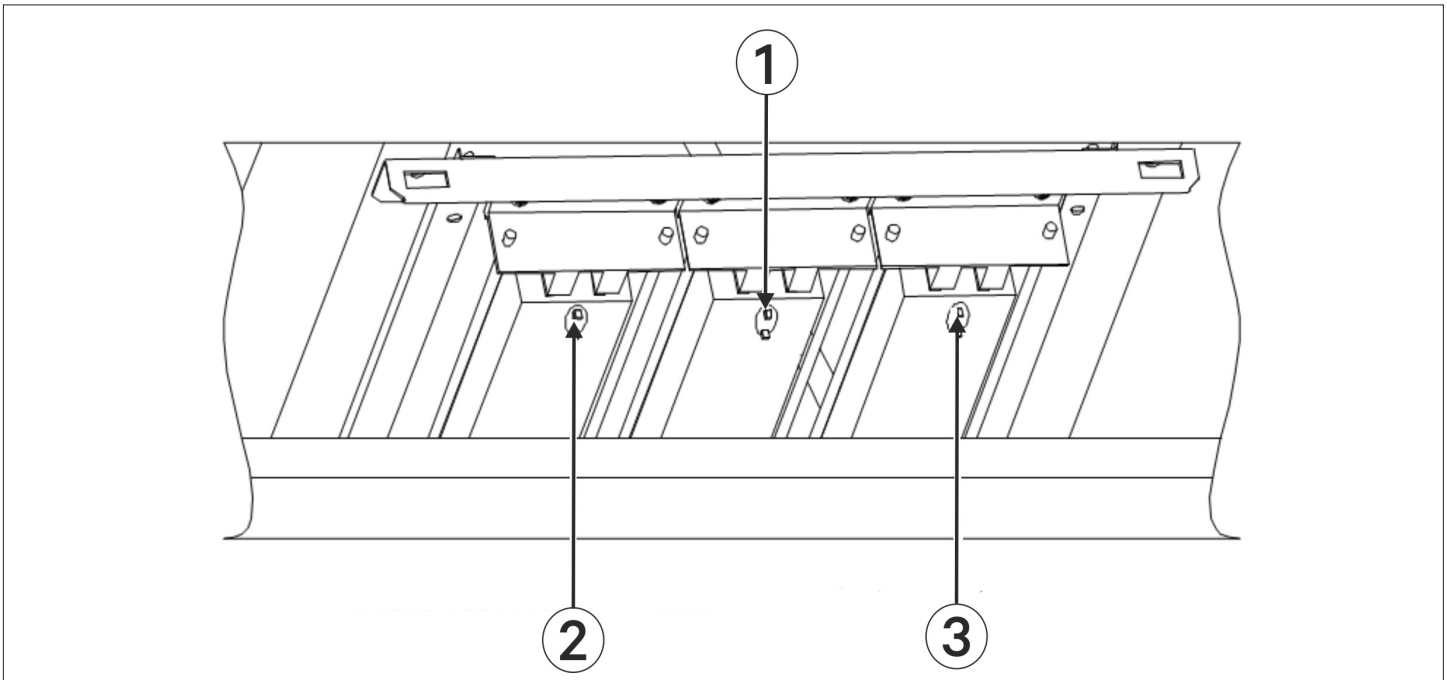
1. Remove the water level standpipe to drain the water pan.
2. Disconnect the drainage pipe.
3. Remove the safety switch of the water pan.
4. Remove the fixing screws at the two ends of the pan and pull out the water pan. Cleanse the water pan with water and hard brush.
5. Restore the water pan by reversing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

6.10. Electric Heater Maintenance Guide

The electric reheating shown in Figure 6-1, 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 6-1 PTC Electrical Heating

Chapter 7: Diagnosis and Maintenance

This chapter describes the system operation and maintenance of the Liebert PEX3 series air conditioner briefly in accordance to the end-user perspective. It includes information related to routine maintenance and inspection, electrical connections inspection, wiring, system diagnosis, visual appearance checks, and drainage maintenance among others; that helps in system fault diagnosis and treatment.

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.

7.1. Fault Diagnosis and Treatment of Fans

Refer Table 7-1 for fan fault diagnosis and treatment.

Table 7-1 Fault Diagnosis and Treatment of Fans

Symptom	Potential Causes	You Need to Check Items or Processing Method
EC fan cannot be started	Circuit breaker disconnection	Check the circuit breaker of the main fan.
	Contactor cannot be closed	Check whether there is 24Vac voltage between P36-3 and P36-8. If yes, but the contactor still cannot close, then the contactor is damaged. Replace the contactor.
	Control board failure	Check whether there is 24Vac voltage between P36-3 and P36-8. If yes not, then the control panel is damaged.
		Check whether the green LED beside silicon control Q5 on the control panel is on or off.
	Contactor closed, air flow switch alarm	Check whether there is 0 Vdc to 10 Vdc analog signals output from P51-3, if not, then check the control board carefully.
		Check whether the values of S152 and S153 are set too low, if it is so, then fix it by increasing the setting values properly.
		Check whether the External Static Pressure (ESP) is too high, if it is so, then fix it by optimizing the air channel and increasing the setting values properly.

Symptom	Potential Causes	You Need to Check Items or Processing Method
EC fan cannot be started	EC fan failure	If the EC fan fault alarm triggers and restart automatically then the possible reasons are as follows: • EC fan is blocked • EC fan is out of phase • EC Fan internal communication master slave error • EC fan is under voltage
		If the EC fan is automatically restarted but there is still EC fan fault alarm, then the reasons are as follows: • EC fan is reversed • The bus voltage is high • The power supply harmonic distortion rate is high (THDU>10%). • To determine the specific reasons: Connect to 485 communication port and use the EBM manufacturers software for analysis.

7.2. Fault Diagnosis and Treatment of Infrared Humidifier

7.2.1. Infrared Humidifier Troubleshooting

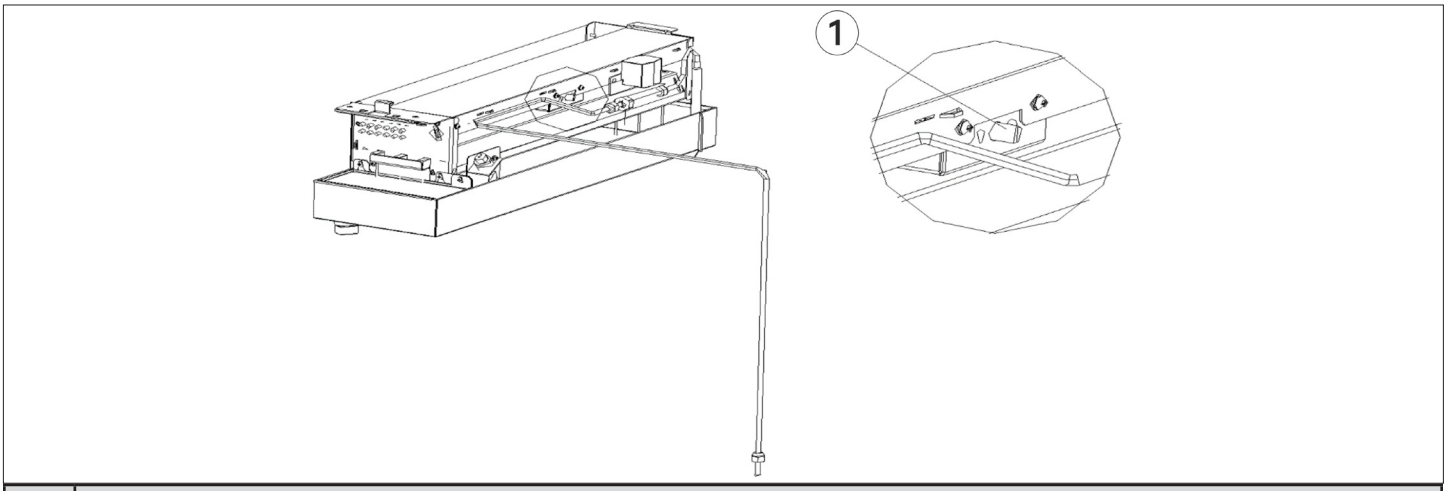
Refer Table 7-2 for diagnosis and treatment of the infrared humidifier.

Table 7-2 Diagnosis and Treatment of Infrared Humidifier

Symptom	Potential Causes	You Need to Check Items or Processing Method
Humidification ineffective	No water in water pan	Check the water supply
		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. If manual reset or adjustment is reached, the contractor does not close. Use a jumper to shot terminals P35-1 and P35-2. If the contactor is closed, replace the series-connected safety device, and remove the jumper.
	Air flow lose switch failure	Check whether the air flow lose switch connection is normal. Examine whether there is 24 Vac voltage between P36-7 and P36-4 after startup, if it is not, then you should check whether the air flow lose switch is damaged.
	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.

7.2.2. High-Temp Switch

The manual-reset high-temp switch is fitted above the lamps. When overheat occur due to abnormal situation, the switch cut-offs the power supply to the lamps.



No.	Description
1	Reset button

Figure 7-1 Infrared Humidifier Reset Button

7.3. Compressor and Refrigeration System - Fault Diagnosis and Treatment

In case of static resistance imbalance, the motor windings may short the circuit. Refer the static resistance of different models of compressor in Table 7-3.

Table 7-3 Static Resistance of Compressors of Each Type

Compressor Model	Resistance Line to Line (25 °C)
ZP91KCE-TFD-522	1.79
ZP104KCE-TFD-522	1.38
ZP122KCE-TFD-522	1.17
ZP143KCE-TFD-522	1.14
ZP154KCE-TFD-522	1.10
ZP182KCE-TFD-522	0.83

If the compressor has been shut down for a long time and cannot be started, check the status of resistance, if it is open, then the compressor motor is damaged. In case of the compressor is stopped during operation, then the temperature at the top of the shell is very high, wait for the compressor to cool down for more than an hour. Try to restart the unit, if it can be turned-on, the built-in protection of the compressor will work; if the situation is not improved, that indicates that the compressor motor is damaged.

Refer Table 7-4 for fault diagnosis and treatment of compressor and refrigeration system.

Table 7-4 Compressor and Refrigeration System Fault Diagnosis and Treatment

Symptom	Potential Causes	You Need to Check Items or Processing Method
Compressor does not start	Power supply off	Check the main power switch or circuit breaker connection is normal.
	Loose circuit connections	Check and fix the circuit connectors.
	Power overloaded and MCB tripped	Check the current average value, and manually reset
	Abnormal supply voltage	Check whether the supply voltage of compressor terminal is normal.
	Static resistance of compressor	If the voltage is normal, check the static resistance of compressor.
	Ground insulation	If the static resistance is normal, check the compressor for ground insulation.
	Motor inspection	If the motor inspection is normal, it is likely to be the moving components such as scroll disks, bearings, etc. are damaged
The compressor stops functioning	No cooling/ dehumidifying demand output	Check the controller status and whether the power demand is greater than 50%.
	High-voltage switch operation	Check if there is high pressure alarm
	Discharge temperature detecting switch	Check if there is the exhaust/ high temperature alarm.
	Low-voltage switch operation	Check if there is low pressure alarm in the history of alarms; investigate ,whether there is refrigerant leakage.
	Contactor fault	Check whether the contactor has a supply input of 24Vac.
	Breaker tripping stopped	Check circuit voltage after checking breaker and contactor.
High discharge temperature	Refrigerant leakage	Check whether the suction pressure and discharge pressure are low, find the leakage point and fix it. Add refrigerant if required
	Discharge pressure is High or pressure ratio is low	If discharge pressure is high and the pressure ratio is high point, check whether the condenser and its fan are functioning normal.
	Compressor current	Check the compressor current. If the current is high and the unit is highly loaded, check whether the condenser and its fan are functioning normal
Operation of the compressor overheating	Compression ratio is too high	Check the setting of the high and low-pressure switch, and whether the condenser is fouled. Check whether the fans of condenser and evaporator are operating normally.
	Suction superheat is too high	Adjust Electronic Expansion Value or add appropriate refrigerant.

Symptom	Potential Causes	You Need to Check Items or Processing Method
Compressor excessive noise	Compressor base is not fixed	Check if the compressor base is fixed properly, and whether the pipeline collides with the shell.
	Pressure difference at start of unit	Check if the high- and low-pressure difference is small while starting the compressor or any similar conditions.
	System charge is large	If the system charge is large, check if the compressor crankcase heating zone is fully preheated.
	Compressor reversal	Check the compressor terminal wirings are in sequence.
	Compressor current is high	If the compressor current is high, it may be the bearing or scroll has been worn.
High compressor current	Supply voltage	Check the supply voltage
	AC contactor	Check the AC contactor
	Discharge pressure	Check the discharge pressure
	Current of compressor	Check current of compressor according to the standard suction and discharge pressure setting, if the current is high, it is likely to be that the compressor components are damaged.
High-pressure protection	Condenser fouling	Clean condenser or plate and confirm whether the ball valve of the exhaust pipe is opening.
	Condensing equipment is not operating	Check air cooling system and the fan of condenser.
		Check water system. Check the operation procedures.
	Excessive amount of refrigerant charge	Check whether the degree of supercooling is too high.
	MBV improperly set (water-cooled)	• Check whether the HP sensor reading and actual pressure meet ±0.6 bar requirement (the HP sensor value can be read from the SERVICE MENUS/DIAGNOSTICS, which displays the absolute pressure) • Check whether the BPHE electric ball valve is normal.
The compressor has no suction and discharge pressure difference	Refrigerant leakage	Detect the leakage point, repair it and add refrigerant.
	Discharge temperature difference	• Check the discharge temperature of compressor. If the temperature is very high, the built-in temperature protection device ASTP may be triggered. • Start the compressor, after cooling for 1 hour and observe whether there is still high or low pressure. • If the pressure difference can be established, it may be caused by too high discharge pressure, and check the reason of high discharge temperature.
	Unloading solenoid valve	If digital compressor, check the unloading solenoid valve, maybe it is in active state.
	The compressor reverse or internal gas stirring	If compressor reverse, check if the any two L lines of the compressor are interchanged, and if the inner string and the gas generator cannot be restored, replace the compressor.

Symptom	Potential Causes	You Need to Check Items or Processing Method
Suction and Discharge Pressure is too low or too high	Refrigerant Leakage	Check for refrigerant leakage, if identified do maintenance accordingly.
	Blockage of Check Valve or Throttle Valve	Check if Check valve or Throttle valve is blocked, resulting in high discharge pressure and low suction pressure.
	Compressor reversal	Check the compressor terminal wirings are in sequence, resulting in low discharge pressure and high suction pressure, and generally low discharge temperature.
	Temperature protection ASTP triggers	The built-in temperature protection ASTP triggers, resulting in low discharge pressure and high suction pressure, generally high discharge temperature.
	Digital compressor unloading	Digital compressor unloading, resulting in low discharge pressure and high suction pressure, generally low discharge pressure.
	Lack of refrigerant in the system	Check for leakage. If identified, repair and add refrigerant
	Dirty air filter	Replace the air filter.
	Filter dryer clogged	Replace the filter dryer.
	Improper setting of Electronic Expansion Valve superheat parameters	Check whether it adheres with the standard design of the unit superheat values.
	Electronic Expansion Valve device failure	Replace the Electronic Expansion Valve.
	Poor airflow distribution	Check the supply air and return air system.
	Condensing pressure is too low	Check the condenser.
	Excessive external residual pressure, causing air volume attenuation	Check air duct and evaluate the residual pressure outside the unit.

- *Voltage and current measurement: The output of the AC contactor of the compressor is used to determine whether the supply voltage and start current of the compressor are within the normal range.*
- *Static resistance: Disconnect the power line on the compressor terminal, and then measure the resistance value between the terminals with the ohmmeter directly on the compressor terminal.*
- *The normal resistance relationship is satisfied: Three-phase compressor, RT1=RT2=RT3, measurement error of three phase does not exceed 15%.*
- *Insulation resistance: The resistance of the compressor's copper pipe terminal to the ground can be measured using 'Ω' position of the multimeter. Under noramal condition the resistance value is greater than 40 MΩ or infinite.*

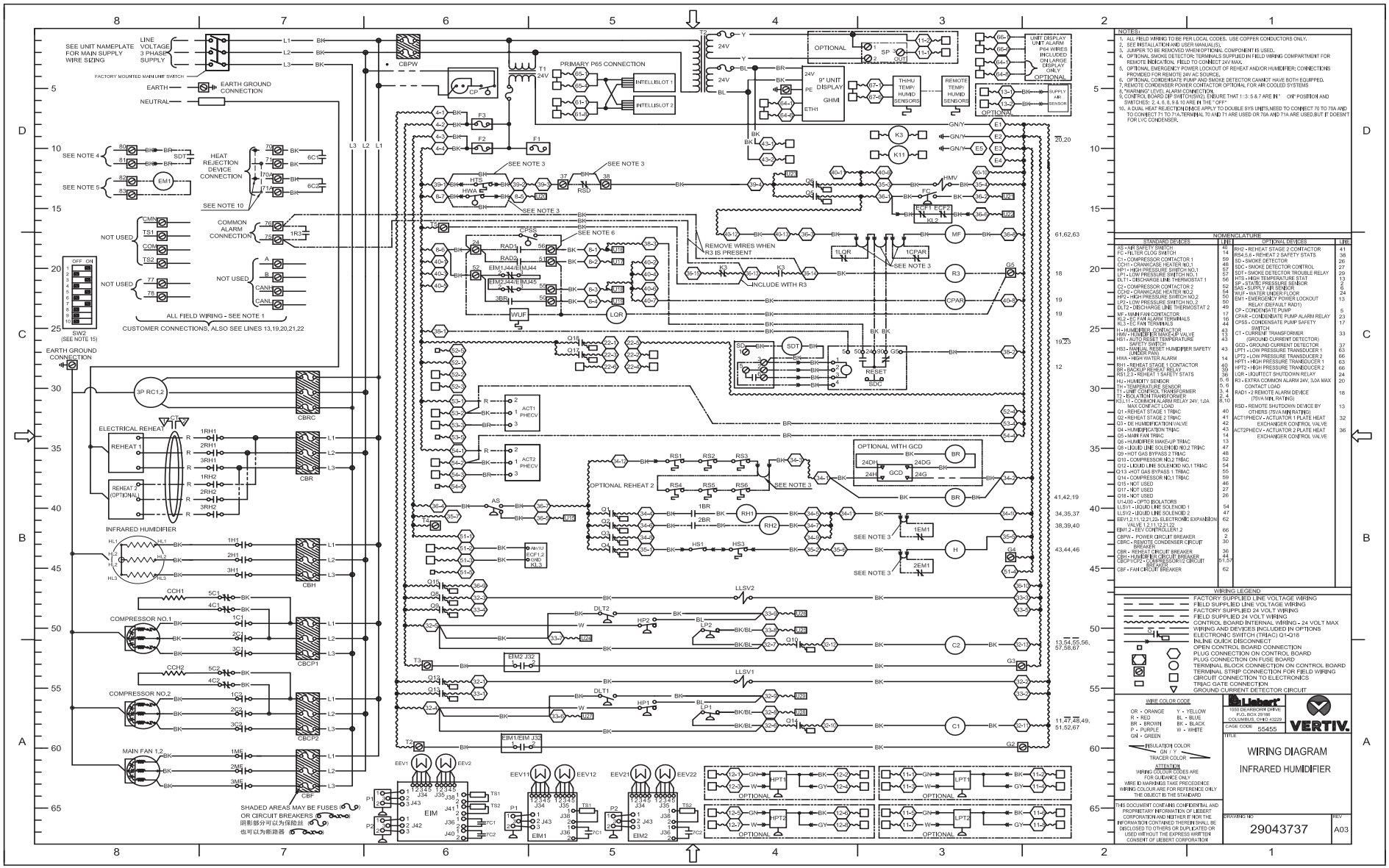
7.4. Heating System - Fault Diagnosis and Treatment

Refer Table 7-5 for fault diagnosis and treatment of heating system.

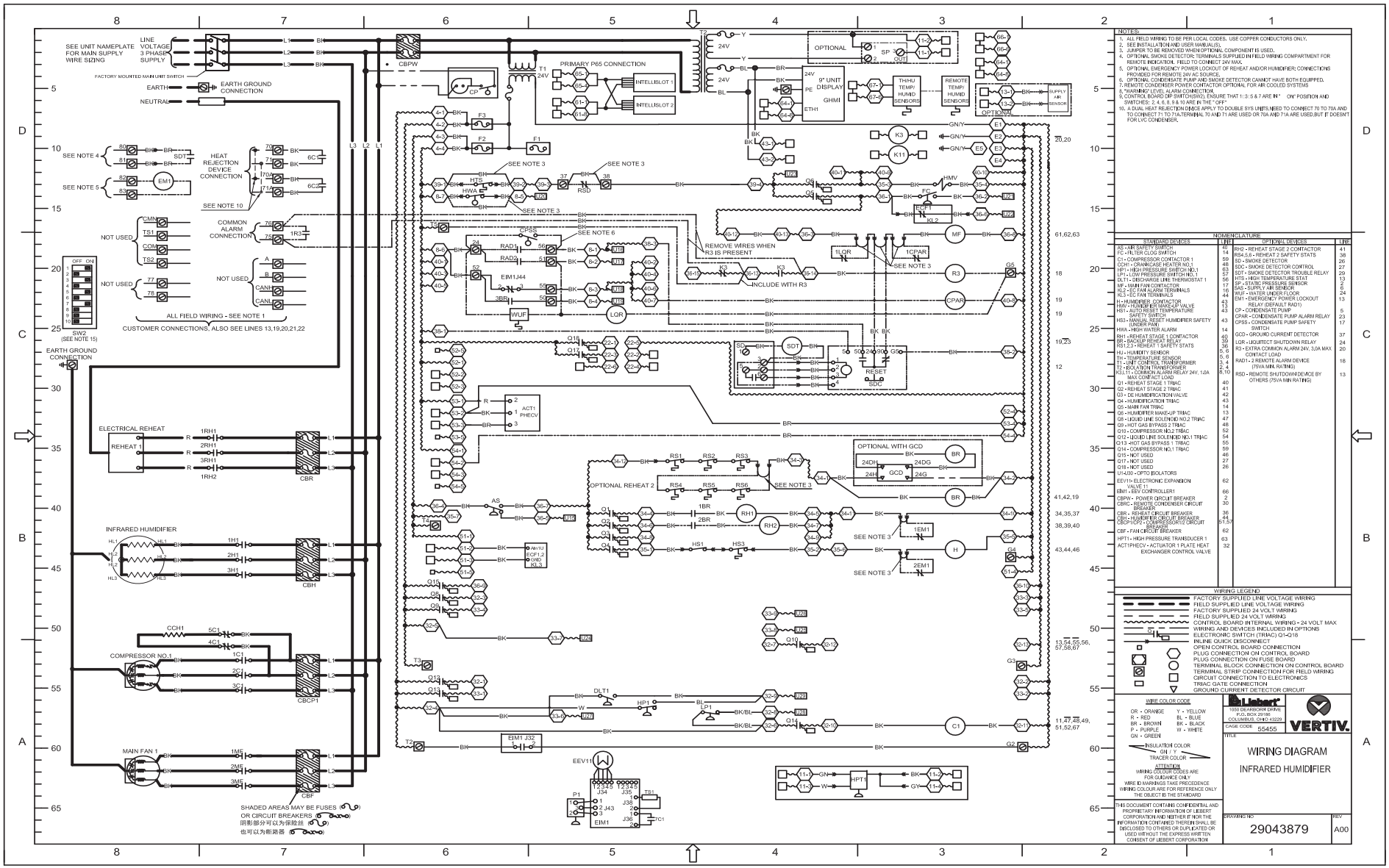
Table 7-5 Diagnosis and Treatment of Heating System

Symptom	Potential Causes	You Need to Check Items or Processing Method
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 whether the light next to the heating auxiliary relay is on and whether the line is correct.
	Heating system safety device is disconnected	Check if manual reset switch is turned off and check the automatic reset for damage.
Contactor is closed	The heater main is powered off	Check whether the heating air switch is closed or not, and check if the contactor L1, L2 and L3 supply voltage is normal when the heating contactor is closed.
	The heater is burned	Cut off the power, detecting the resistance characteristic of heater by ohmmeter to judge whether the electrical heating is damaged.

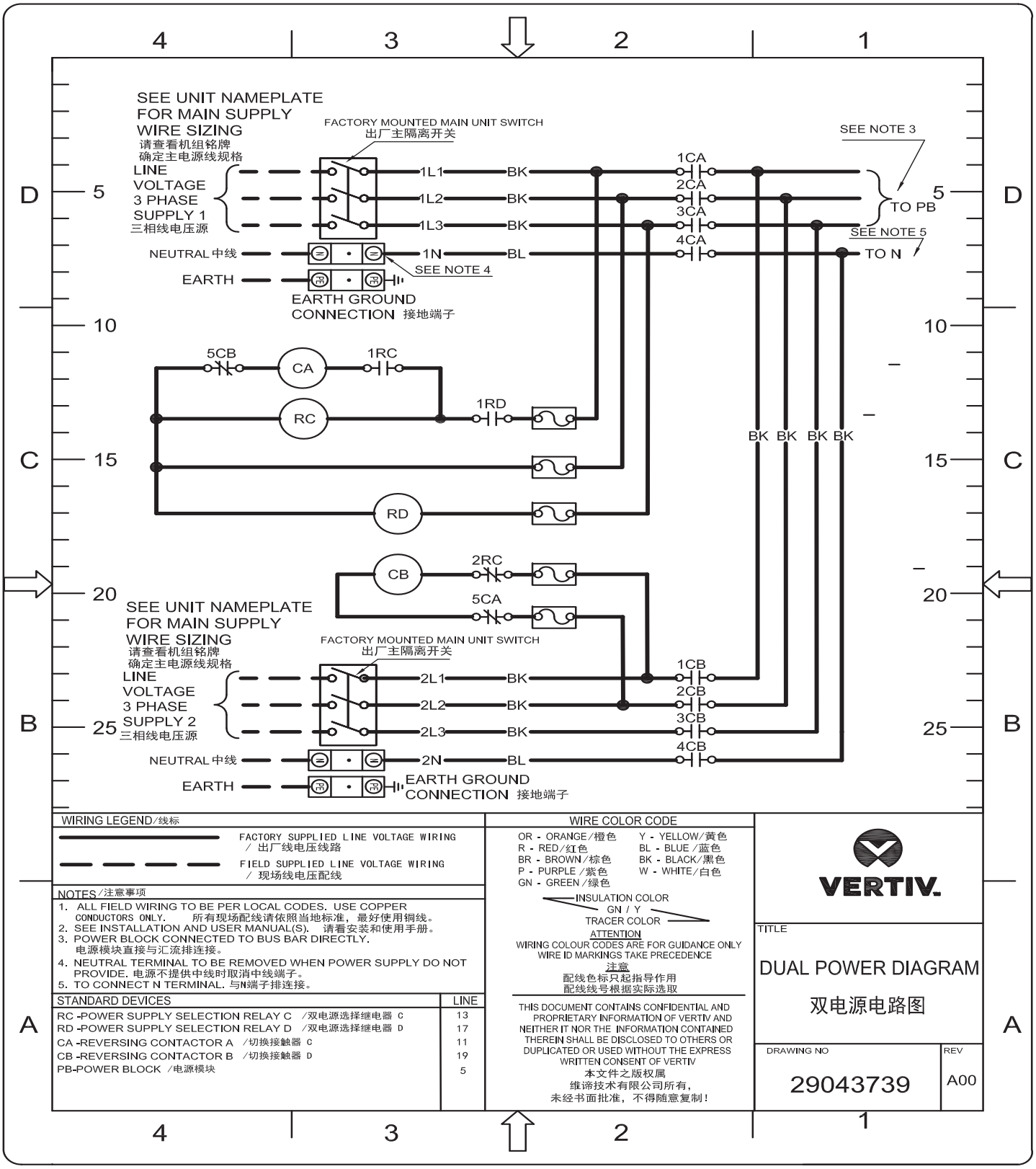
Appendix I: Wiring Diagram Infrared Humidifier (for Air-cooled)



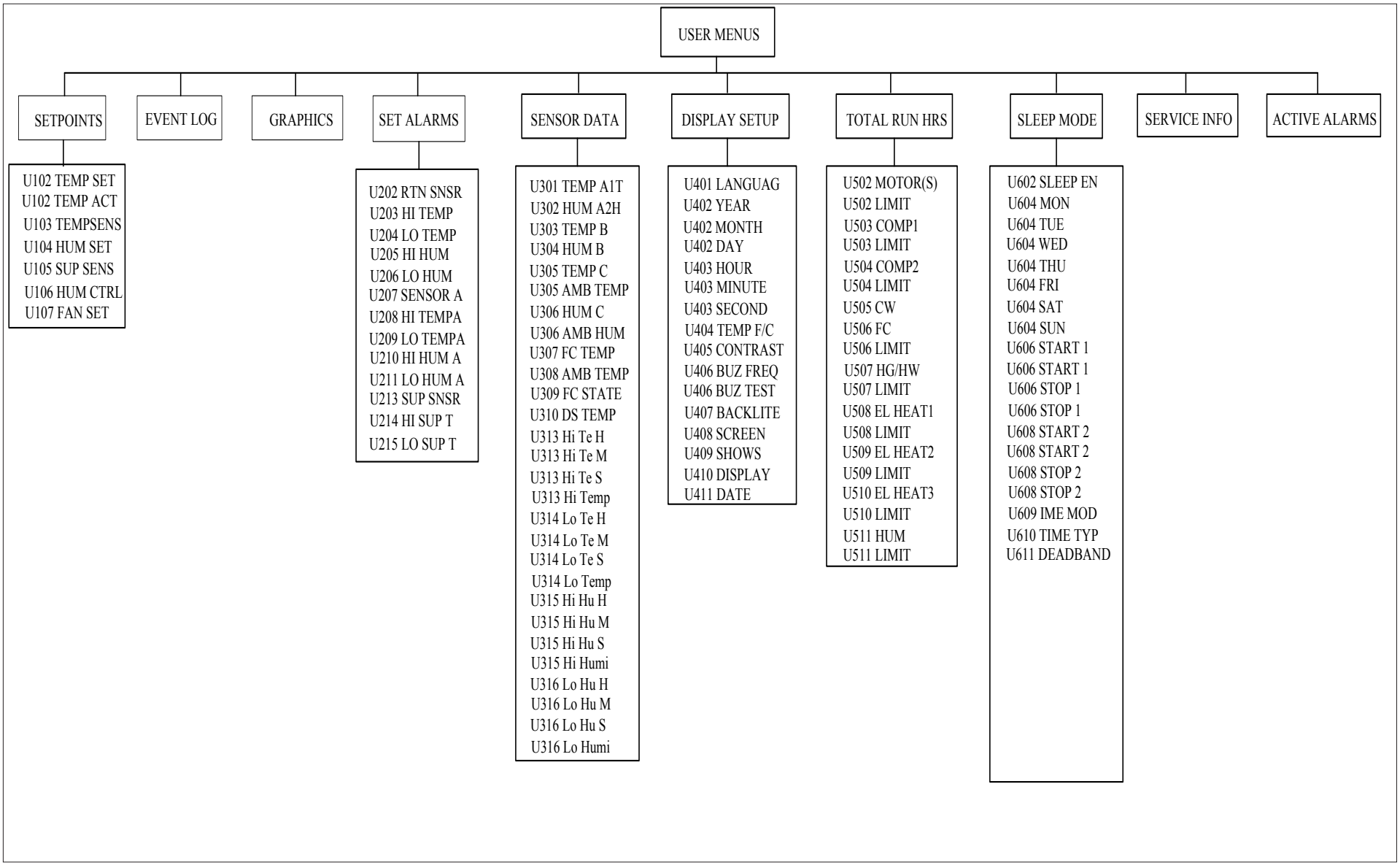
Appendix II: Wiring Diagram Infrared Humidifier (for Water-cooled)



Appendix III: Circuit Diagram Dual Power



Appendix IV: Menu Structure of iCOM Controller (Users Menus)



Appendix V: Table Names and 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)
Cabinets	×	○	○	○	○	○
Refrigeration accessories	×	○	○	○	○	○
Fan unit	×	○	×	○	○	○
Heating unit	×	○	○	○	○	○
ECU	×	○	×	○	○	○
Display	×	×	○	○	○	○
Plate made	×	○	○	○	○	○
Evaporator	×	○	○	○	○	○
Copper tube	×	○	○	○	○	○
Cable	×	○	○	○	○	○

This form is prepared in accordance with the provisions of SJ/T 11364.
O: Indicates claim limit concentration of the hazardous substances in homogeneous materials for all components specified in GB/T 26572 or less;
X: Represents the hazardous substance content of at least one homogeneous material of the member exceeds the limit requirement GB/T 26572 specified.

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 PEX3 DX series of Precision Air Conditioning

Appendix VI: Routine Maintenance Inspection Items (Monthly)

Date: _____ Prepared by: _____

Model: _____ Serial Number: _____

Equipment Maintenance Checklist (Monthly)

Part	Check Item	Remark
Filter	Check for clogging or damage	
	Check the filter clog switch	
	Clean the filter	
Fan	Check for fan blades are not distorted.	
Compressor	Check for leakage	
	Listen to the operation sound, observe the operation vibration	
Air-cooled condenser (air-cooled units)	Check the fins are clean	
	The fan base should be firmed	
	The fan vibration absorber is not deteriorated or damaged	
	The SPD board should be effective (in the storming seasons, the SPD board should be check once a week)	
	The refrigerant pipes are properly supported	
Refrigeration cycle system	Check refrigerant pipes. Refrigerant pipes must be properly supported and must not lean against walls, floors or where the frame vibrates	
	Check the moisture content of the system (through a sight glass)	
	Check electronic expansion valve	
	Check the condenser drain pan for dirt blockage	
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	

Signature_____

Note: Please copy this table as a record keeping purposes.

Appendix VII: Routine Maintenance Inspection Items (Semi-Annual)

Date: _____ Prepared by: _____

Model: _____ Serial Number: _____

Routine Maintenance Inspection Item (Semi-Annual)

Part	Check Item	Remark
Filter	Check for clogging or damage	
	Check the filter clog switch	
	Clean the filter	
Fan	Check for fan blades are not distorted	
	Check, whether there is bearing wear	
	Check and fasten the circuit connector	
Compressor	Check for leakage	
	Listen to the operation sound, observe the operation vibration	
	Check and fasten the circuit connections	
Air-cooled condenser (air-cooled units)	Check the fins are clean	
	The fan base should be firmed	
	The fan vibration absorber is not deteriorated or damaged	
	The SPD board should be effective (in the storming seasons, the SPD board should be check once a week)	
	The refrigerant pipes are properly supported	
	Check and fasten the circuit connections	
Water-cooled condenser (water-cooled unit)	Check the water pipe system	
	Check the MBV	
	Check for leakage	
	Check the water pressure and temperature	
Refrigeration cycle system	Check refrigerant pipes. Refrigerant pipes must be properly supported and must not lean against walls, floors or where the frame vibrates	
	Check the moisture content of the system (through a sight glass)	
	Check electronic expansion valve	
	Check whether refrigerant needs to be added (through the sight glass)	
	Check the condenser drain pan for dirt blockage	

Part	Check Item	Remark
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	

Signature_____

Note: Please copy this table as a record keeping purposes.