



VRC Self-Contained Rack Cooler

Installer/User Guide

VRC1 Series

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Technical Support Site

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

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

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1 Important Safety Instructions

The important safety instructions that should be followed during the installation and maintenance of the VRC-Self-contained rack cooler 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.

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

This manual is retained for the entire service life of the machine. The user must read all of the precautions, danger, warnings, and cautionary measures mentioned in the manual prior to carrying out any operations on the machine. Before performing any maintenance operation, switch off the machine to eliminate risks such as electrical shocks, burns, automatic restarting, moving parts, and remote control.

Adhere to all the Warnings and Cautionary measures included in this manual. In the following sections, look at the various cautionary measures and warnings that need to be read carefully prior to installing or operating the system.



WARNING! Only trained and qualified personnel must be allowed to install, maintain, and operate the unit.



WARNING! The sharp edges, sharp angles of the object, and bare buckle can result in severe injury. Only properly trained and qualified personnel wearing appropriate, OSHA-approved PPE should attempt to move, lift, remove packaging from or prepare the unit for installation.



WARNING! Risk of unit falling over. Improper handling can cause equipment damage, injury or death. Read all the guidelines pertaining to the system before unpacking, moving, lifting or installing the components. Read the labels on the unit carefully to understand the safety measures prior to handling the containment.



WARNING! Risk of electric shock. Can cause injury or death. Open all local and remote electric power-supply disconnect switches and verify that power is Off with a voltmeter before working within the condensate pump electrical connection enclosure. The Liebert® controller does not isolate power from the unit, even in the “Unit Off” mode. Some internal components require and receive power even during the “Unit Off” mode of the Liebert® controller.



WARNING! Arc flash and electric shock hazard. Open all local and remote electric power-supply disconnect switches, verify with a voltmeter that power is Off and wear appropriate, OSHA- approved personal protective equipment (PPE) per NFPA 70E before working within the electric control enclosure. Failure to comply can cause serious injury or death. Customer must provide earth ground to unit, per NEC, CEC and local codes, as applicable. Before proceeding with installation, read all instructions, verify that all the parts are included and check the nameplate to be sure the voltage matches available utility power. The Liebert® controller does not isolate power from the unit, even in the “Unit Off” mode. Some internal components require and receive power even during the “Unit Off” mode of the controller. The only way to ensure that there is NO voltage inside the unit is to install and open a remote disconnect switch. Refer to unit electrical schematic. Follow all local codes.



WARNING! Risk of electric shock. Can cause equipment damage, injury or death. Open all local and remote electric power supply disconnect switches and verify with a voltmeter that power is off before working within any electric connection enclosures. Service and maintenance work must be performed only by properly trained and qualified personnel and in accordance with applicable regulations and manufacturers' specifications. Opening or removing the covers to any equipment may expose personnel to lethal voltages within the unit even when it is apparently not operating and the input wiring is disconnected from the electrical source.



WARNING! Do not power on the unit until authorized technical personnel have confirmed that the unit connections are correct.



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



WARNING! During the operation of the precision air conditioner, very high voltage may be present in the equipment. Adhere to all of the notes and warnings marked on the equipment or contained in this manual, which may otherwise lead to an injury or fatality.



WARNING! Only qualified maintenance personnel can operate and handle the equipment. All maintenance and operation must follow the local laws, especially the regulations about the electric power, refrigeration, and production.



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



WARNING! Risk of hair, clothing and jewelry entanglement with high speed rotating fan blades. Can cause equipment damage, serious injury or death. Keep hair, jewelry and loose clothing secured and away from rotating fan blades during unit operation.



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



WARNING! Risk of contact with extremely hot and/or cold surfaces. Can cause injury. Verify that all components have reached a temperature that is safe for human contact or wear appropriate, OSHA-approved PPE before working within the electric connection enclosures or unit cabinet. Perform maintenance only when the system is de-energized and component temperatures have become safe for human contact.



WARNING! Certain circuits carry lethal voltages. Only professional technicians are allowed to maintain the unit. Extra precautions should be taken when troubleshooting a live unit. Be particularly careful troubleshooting with the unit's power switched on.



WARNING! If jumpers are used for troubleshooting, make sure to remove the jumpers after troubleshooting. If the connected jumpers are not removed, they may bypass certain control functions causing damage to the equipment.



CAUTION: The center of gravity of the unit is inclined, therefore, when moving the unit adjust the bearing position of the forklift or hand pallet truck.



CAUTION: Comply with the manufacturer's instructions before and during maintenance. Failure to observe this will result in the warranty becoming void. Adherence to the safety instructions is mandatory to ensure personnel safety and prevent any environmental impact apart from equipment damage. Unsuitable components will impede equipment performance and may cause equipment shutdown. Therefore, Vertiv™ recommends the use of VertivOEM or Vertiv-approved components.



CAUTION: Switch off the VRC1 unit and then switch off the power input during equipment maintenance. Switch off the equipment power unless the testing devices need power.



CAUTION: Avoid touching or having skin contact with the residual gas and oils in the compressor. Wear long rubber gloves to handle contaminated parts. The air conditioning system contains refrigerant. The release of refrigerant is harmful to the environment.

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2 Introduction

The VRC Self-Contained Rack Cooler series is a compact, integrated, rack mounted precision cooling unit that has the evaporator and the condenser unit installed in one enclosure. It is designed specifically to be installed inside a 19" EIA server rack and is developed based on the Global R&D Platform of Vertiv Group Corp.

This manual focuses on the user instructions, including overview, instructions for installation preparations, mechanical installation, electrical installation, system startup and commissioning, controller operation, system operation and maintenance, and troubleshooting, etc.

Please read this manual especially the warning information carefully before installing, maintaining and troubleshooting the equipment.

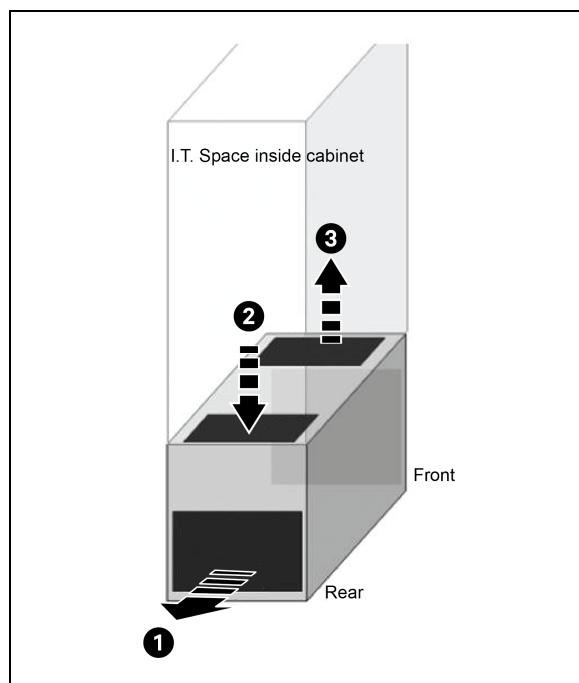
2.1 Product Overview

The VRC Self-Contained Rack Cooler\ (VRC100, VRC101 or VRC102) is a compact, integrated, rack mounted cooling unit (hereinafter referred to as "VRC1 Series") is engineered for utilization in a 19" EIA server rack. The unit should be used after reading the manual or consulting Vertiv. This chapter introduces the product description, model description, product appearance, and main components of the cooling unit.

2.2 Product Introduction

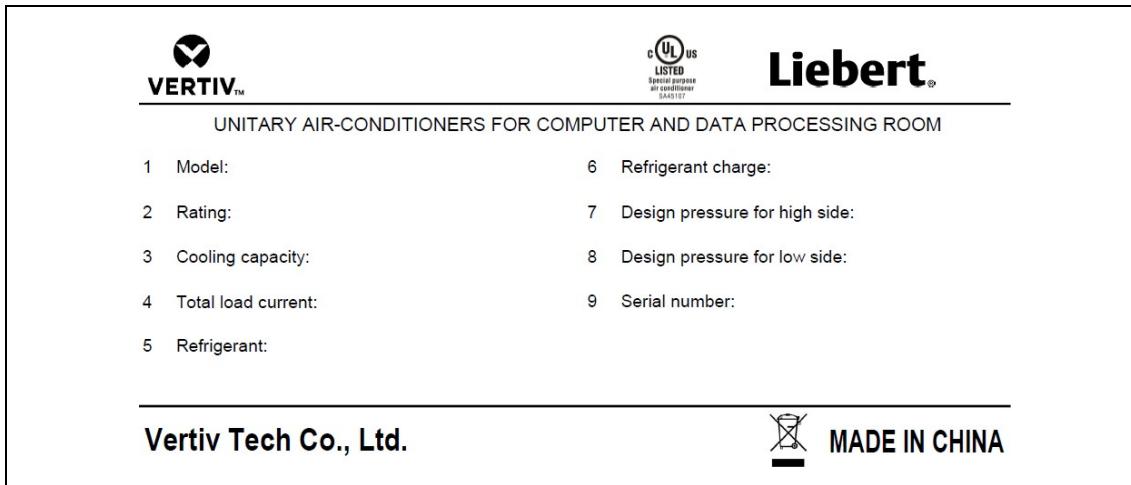
The cooling unit is an integrated precision cooling unit that is a pre-engineered and pre-fabricated cooling solution for server racks. It is specifically designed for the cooling demands of the equipment mounted inside the rack, is precisely controlled and has a conducive and safe operating environment. The precision air conditioner features high reliability, high sensible heat ratio and high airflow. The unit has the following attributes:

- The cooling unit is installed at the bottom of the cabinet. The airflow path is depicted in **Figure 2.1** on the next page . The hot return air enters the unit from the rear side of the cabinet and the conditioned cold air is supplied from the front of the unit directly in front of the servers.

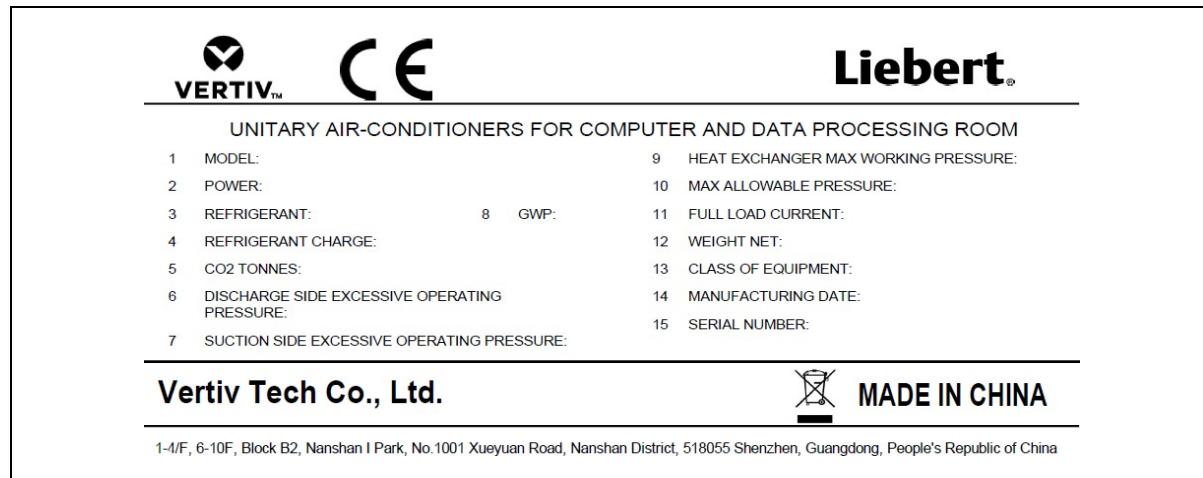
Figure 2.1 VRC Unit in Cabinet

Item	Description
1	Condenser Air Outlet
2	Evaporator Air Inlet
3	Evaporator Air Outlet

- The evaporator and heat rejection unit are placed in one enclosure. It's easy to install being a plug-and-play unit, eliminating the installation work such as electrical wiring, vacuuming and refrigerant charge on-site and refrigerant piping.
- The cooling capacity varies from 25% to 100%, about 0.9 kW to 3.5 kW. It's designed to efficiently cater to part-load or variable cooling loads.
- The unit is designed by Vertiv™ for high efficiency and reliability, and includes the variable capacity inverter compressor, electronic expansion valve, variable speed EC-fan, and controller.
- The evaporator EC fan provides energy savings by smoothly varying the fan speed to deliver the airflow required to match the cooling load.
- The condenser fan speed ranges from 30% to 100% in sync with the variation in the compressor cooling capacity.
- Refer to **Figure 2.2** on the facing page for the nameplate description of the VRC1 Series model:

Figure 2.2 UL Model

POS.	DESCRIPTION	POS.	DESCRIPTION
1	Unit defined by 6 digits	6	Refrigerant charge of the unit
2	Supply Power	7	Discharge Side Excessive Operating Pressure
3	Cooling capacity	8	Suction Side Excessive Operating Pressure
4	Unit full load current in total	9	Serial Number
5	Refrigerant Category		

Figure 2.3 Product Nameplate and Model Description

POS.	DESCRIPTION	POS.	DESCRIPTION
1	Unit defined by 6 digits	9	Heat Exchange Max Working Pressure
2	Supply Power	10	Max Allowable Pressure of the Unit
3	Refrigerant Category	11	Full load Current
4	Refrigerant charge of the unit	12	Net weight

POS.	DESCRIPTION	POS.	DESCRIPTION
5	CO2 Tonnes	13	Class of Equipment
6	Discharge Side Excessive Operating Pressure	14	Manufacturing Date
7	Suction Side Excessive Operating Pressure	15	Serial Number
8	Global Warming Potential		

2.3 Model Description

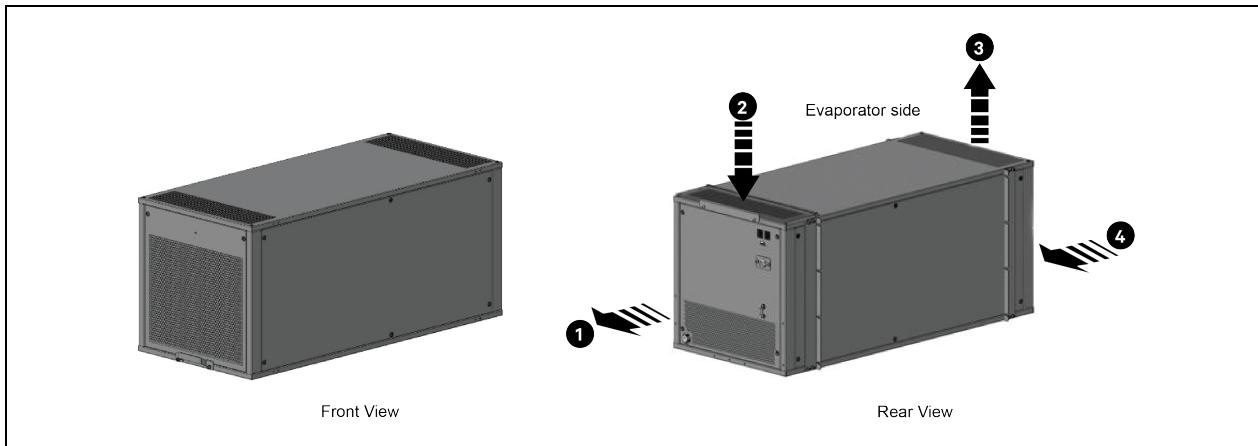
The physical appearance of the cooling module is shown in [Figure 2.4](#) below

Figure 2.4 Appearance of the VRC Precision Air Conditioner



The rear view and front view of cooling module are shown in [Figure 2.5](#) below .

Figure 2.5 Front View and Rear View of the Cooling Unit

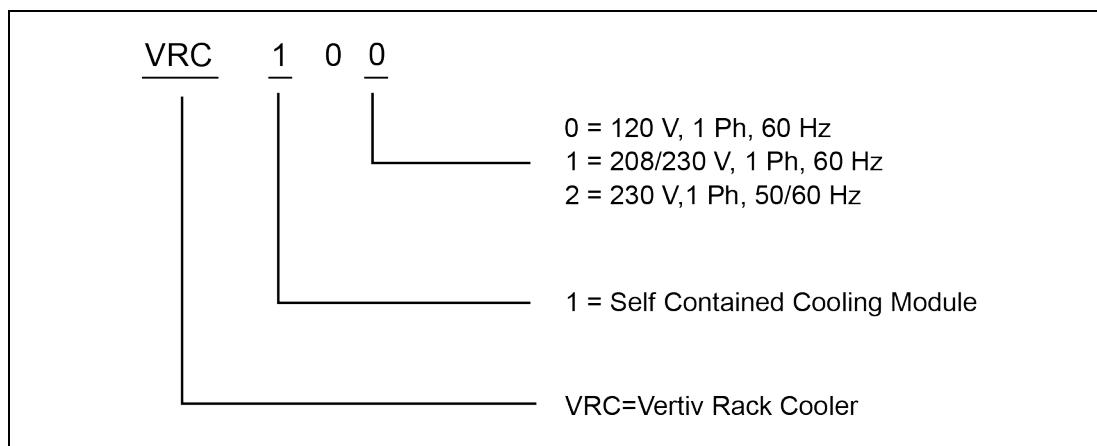


Item	Description
1	Condenser Out
2	Return Air
3	Supply Air
4	Condenser In

2.4 Model Nomenclature

The nomenclature of the VRC units is shown in **Figure 2.6** below

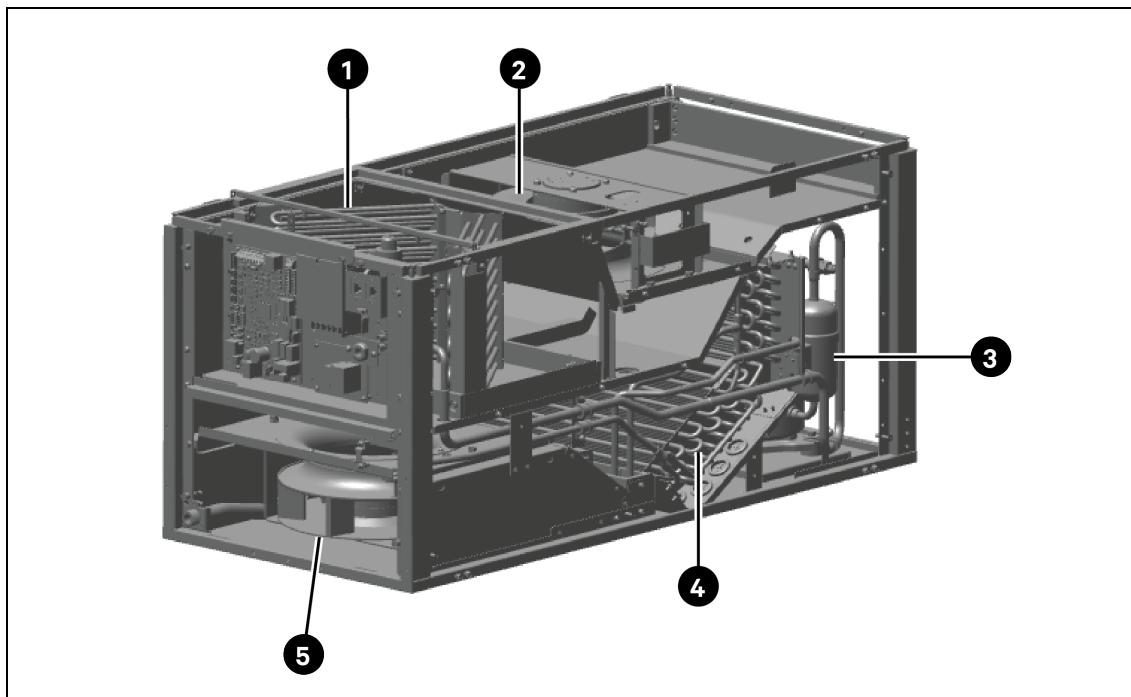
Figure 2.6 Nomenclature



2.5 Components

The major components of the cooling module include the evaporator coil, evaporator EC fan, electronic expansion valve, compressor, condenser coil, and condenser AC fan which are placed in the VRC unit as shown in [Figure 2.7](#) below.

Figure 2.7 Schematic Diagram of Internal Parts of Cooling Section



Item	Description
1	Evaporator
2	Evaporator EC Fan
3	Compressor
4	Condenser
5	Condenser AC Fan

2.5.1 Evaporator Coil

The design of the V shaped evaporator coil provides maximum surface area for heat transfer which provides a high sensible heat ratio (SHR) of > 0.9. The coil is constructed from copper tubes with aluminum fins. Low air pressure difference across the coil reduces fan energy even at higher air flow rates, and the coil section is light and compact.

2.5.2 Condensate Drain Tray

With a metal condensate drain tray placed under the coil assembly, condensation drains to a condensate outlet connection.

2.5.3 Variable Speed Evaporator EC Fan

The cooling module is equipped with a high-efficiency EC fan made of aluminum that delivers high airflow rates to meet the airflow demands during the entire time of operation. The EC fan has a smooth speed variation across its operating speeds that work in synchronization with the entire system components to deliver precise output capacity.



2.5.4 Electronic Expansion Valve

The system is incorporated with an electronic expansion valve that monitors temperature and pressure signals simultaneously to maintain precise adjustment of the refrigerant flow. The electronic expansion valve ensures even flow distribution from each end.



2.5.5 Compressor

The cooling module is equipped with a variable speed inverter rotary compressor that works on R410A refrigerant and which varies its cooling output capacity as per the cooling demands.



2.5.6 Condenser Coil

The L-shaped condenser coil is designed for a maximum contact area. It is made of copper tubes with an aluminum fin configuration.

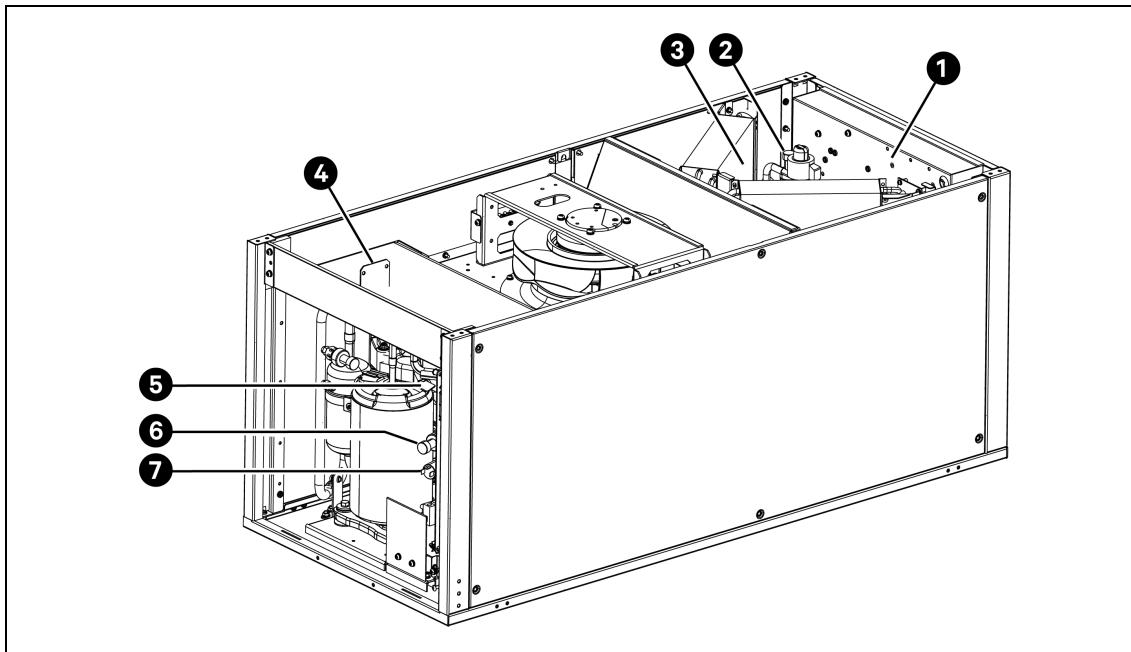
2.5.7 Condenser Fan

The condenser unit is equipped with an AC fan which varies the operating speed with the cooling variations of the compressor to maintain a suitable condensing pressure. The condenser fans are made of metallic material for prolonged life and durability.



2.5.8 Sensors and Switch

Sensors and Switch provide important support for the precise control and reliable operation of unit. As shown in **Figure 2.8** on the facing page , it indicates the position of the Sensor and Switch in the unit.

Figure 2.8 Unit Sensor and Switch Position

Item	Description
1	Return Air Temperature Sensor
2	Low Pressure Transducer
3	Suction Temperature Sensor
4	Supply Air Temperature Sensor
5	Discharge Temperature Sensor
6	High Pressure Switch
7	High Pressure Transducer

2.6 Technical Specifications

The detailed technical specifications which include the mechanical and the electrical details are mentioned in the table below:

Table 2.1 Technical Specifications

Parameters	Specification		
Model	VRC100	VRC101	VRC102
Certification	UL484	UL484	CE (EN 60335-1; EN 60335-2-40; EN 55014-1; EN 55014-2; EN 61000-3- 2; EN 61000-3-3; EN 50581)
Cooling Capacity, kW	3.3	3.3	3.3

Table 2.1 Technical Specifications (continued)

Parameters	Specification				
Air Volume, m ³ /h (CFM)	750 (441)	750 (441)	750 (441)		
Max Power Input, kW	1.63	1.86	1.86		
Full Load Amperage, A	16.5	13	11.5		
Dimensions (Without Package) W x D x H mm (Inches)	442x978x439 (17.4" x 38.5" x 17.28")				
Input Type	Power Cord (3.2m) with NEMA 5-20P	Power Cord (3.2m) with NEMA L6-20P	IEC 60320 C20 Inlet + Interconnection Cable (3.0m) IEC 60320 C19 to C20		
Voltage (Vac)	L+N+G, 120 Vac	L1+L2+G, 208 Vac/230 Vac	L+N+PE, 230 Vac		
Frequency, Hz	60	50/60			
Color	EG7021 (Black)				
System Protection Grade	IP20 (IEC 60529)				
Net Weight, kg (lbs)	72 (158.7)	74 (163.1)			
Gross Weight, kg (lbs)	134 (295.4)				
Noise Level, dB(A)	<66				

NOTE: The capacity value is measured under the conditions of indoor temperature dry bulb/wet bulb 35°C (95°F), 20.6°C (69°F) and outdoor temperature 35°C (95°F).

In the case that VRC is installed on the bottom of the rack, the maximum capacities at various evaporator and condenser air inlet temperatures are mentioned below:

Maximum Capacity, kW	Condenser Air Temperature			
	29.4 °C (85 °F)	35 °C (95 °F)	40 °C (104 °F)	
Evaporator Air Temperature to Cooling Module	29.4 °C (85 °F)	3.1	2.6	2.2
	35 °C (95 °F)	3.4	3.3	2.8
	40 °C (104 °F)	3.6	3.5	3.1

Maximum Capacity, kW	Condenser Air Temperature			
	25 °C (77 °F)	30 °C (86 °F)	35 °C (95 °F)	
Evaporator Air Temperature to IT Devices	19 °C (66 °F)	3.3	3.2	3.1
	21 °C (70 °F)	3.5	3.4	3.3
	23 °C (73 °F)	3.6	3.5	3.4

In the case that VRC is installed on the bottom of the rack, the minimal cooling capacity are mentioned below:

Minimum Capacity, kW	Condenser Air Temperature			
	29.4 °C (85 °F)	35 °C (95 °F)	40 °C (104 °F)	
Evaporator Air Temperature to Cooling Module	29.4 °C (85 °F)	0.90	0.88	0.86
	35 °C (95 °F)	0.92	0.90	0.88
	40 °C (104 °F)	0.94	0.92	0.90

Minimum Capacity, kW	Condenser Air Temperature			
	25 °C (77 °F)	30 °C (86 °F)	35 °C (95 °F)	
Evaporator Air Temperature to IT Devices	19 °C (66 °F)	0.89	0.88	0.87
	21 °C (70 °F)	0.90	0.89	0.88
	23 °C (73 °F)	0.91	0.90	0.89

NOTE: Capacity may be reduced with addition of heat rejection ductwork.

- There are two control methods, supply control and return control. The return control mode is suggested to be set in an open environment, while the supply control mode is suggested to be set in an enclosed cabinet.
- Supply air temperature set point variable from 18 °C (64.4 °F) to 23 °C (73.4 °F). The recommended supply air temperature set point is 21 °C (69.8 °F).
- When the VRC unit is used in an enclosed cabinet, the heat load should be evenly placed in the cabinet. And unused rack position should be covered with blanking plates.

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3 Pre-Installation

The air conditioner is engineered equipment and requires precise installation procedures for which the preliminary preparation is very important. This chapter details the installation preparation, including how to prepare the installation environment and space and reserve the maintenance space, the air conditioner running and storage environment requirement, and how to unpack and inspect. Please read this chapter carefully before installation.



WARNING! Only trained and qualified personnel must be allowed to install, maintain, and operate the unit.



WARNING! The sharp edges, sharp angles of the object, and bare buckle can result in severe injury. Only properly trained and qualified personnel wearing appropriate, OSHA-approved PPE should attempt to move, lift, remove packaging from or prepare the unit for installation.



WARNING! Risk of unit falling over. Improper handling can cause equipment damage, injury or death. Read all the guidelines pertaining to the system before unpacking, moving, lifting or installing the components. Read the labels on the unit carefully to understand the safety measures prior to handling the containment.

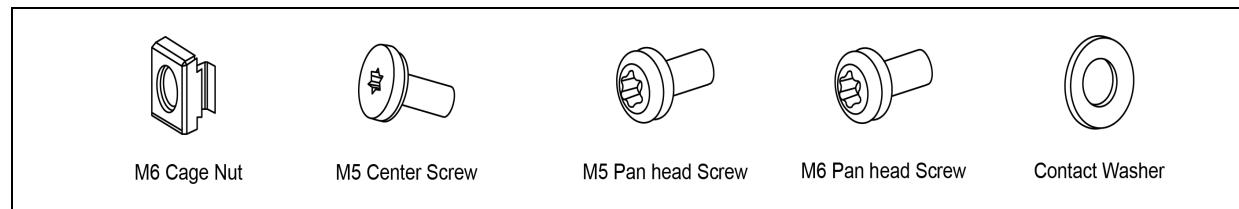


CAUTION: The center of gravity of the unit is inclined, therefore, when moving the unit adjust the bearing position of the forklift or hand pallet truck.

3.1 Fittings

The hardware used for fittings are shown 3.1 above .

Figure 3.1 Fittings



The fitting nuts and their usage are shown in **Table 3.1** below . They are included in the package.

Table 3.1 – Fitting Utilities

Fitting Utility	Usage	Quantity
M6 cage nut	Used with M6 pan-head screws for tightening pillars	20
M5 center screw	Used to fasten the L-shape rails	10
M5 pan-head screw	Used to fasten the transition part	10
M6 Pan-head screw	Used to install the VRC10X unit	20
Contact washer	Used together with the M5 pan-head screw	10

3.2 Self-Prepared Material

The circuit breakers must be prepared at the customer site or are to be obtained by the customer; the specifications for the self-prepared materials are given in **Table 3.2** below.

Table 3.2 Self-prepared Materials

Parts	Specifications
External circuit breaker	Please refer to FLA of Unit

3.3 Transportation and Movement

The VRC1 needs to be moved to the vicinity of the installation site. The cooling unit with heavy components, needs to be transported using equipment such as a hand pallet truck or electric forklift. **Table 3.3** below and **Figure 3.2** below show the dimensions of the unit with packaging.

Figure 3.2 Package Dimensions

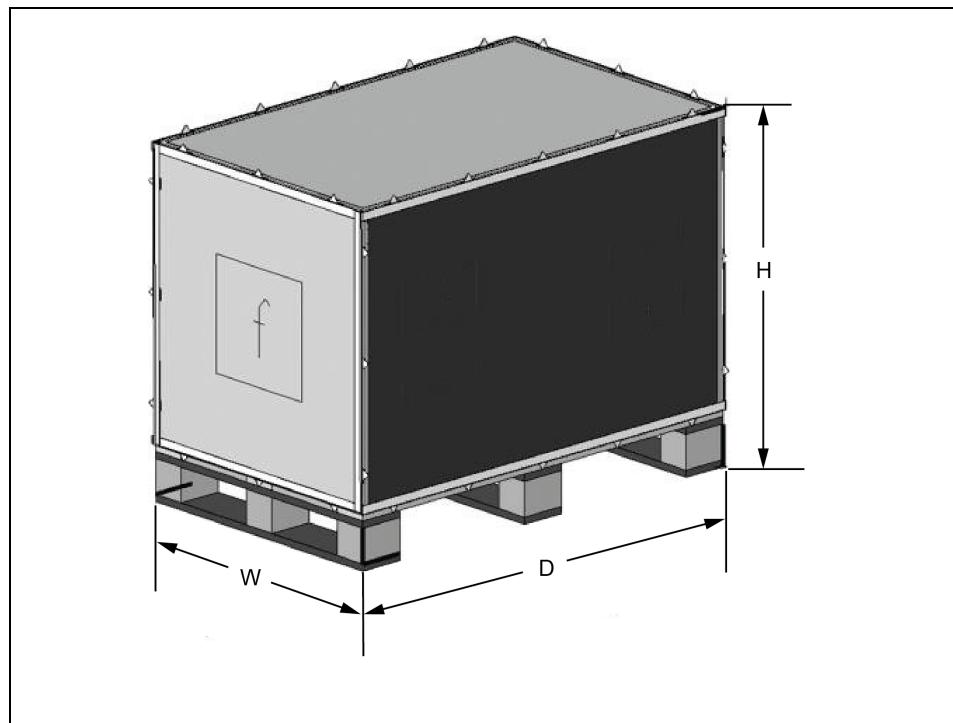
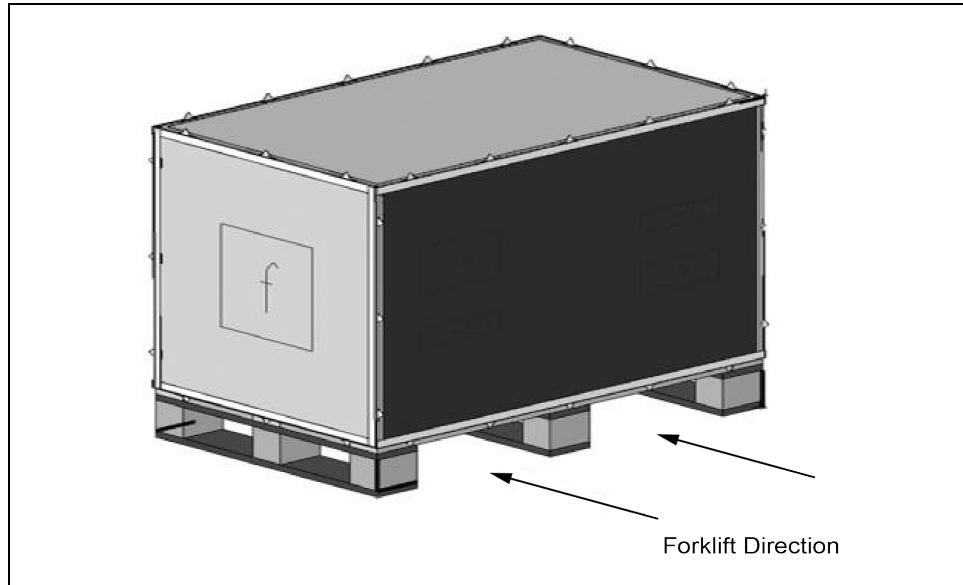


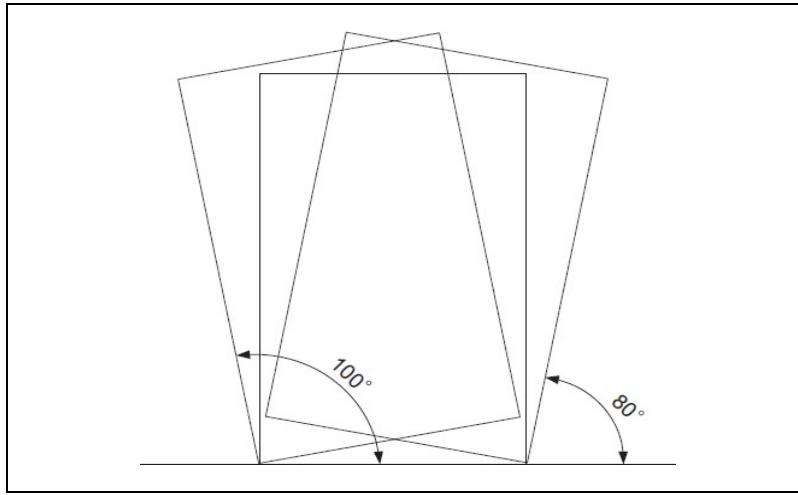
Table 3.3 Overall Dimensions and Weight of the Unit with Packaging

Component	Packaging Material	Dimensions			Weight with Packaging	
		H	W	D		
The VRC1 (With Packaging)	VRC100	Wood case	900 mm (35.4")	730 mm (28.7")	1170 mm (46.1")	134 kg (295.4 lbs)
	VRC101					
	VRC102					

If a hand pallet truck or an electric forklift truck is used, the tines of the hand pallet or electric forklift must be aligned with the center of gravity to prevent the package from toppling or falling over as depicted in **Figure 3.3** on the facing page.

Figure 3.3 Forklift Direction

While moving the package, the obliquity has to be maintained at an angle of $90 \pm 10^\circ$. **Figure 3.4** below depicts the $90 \pm 10^\circ$ obliquity that is suitable to move the unit to the vicinity of the desired location.

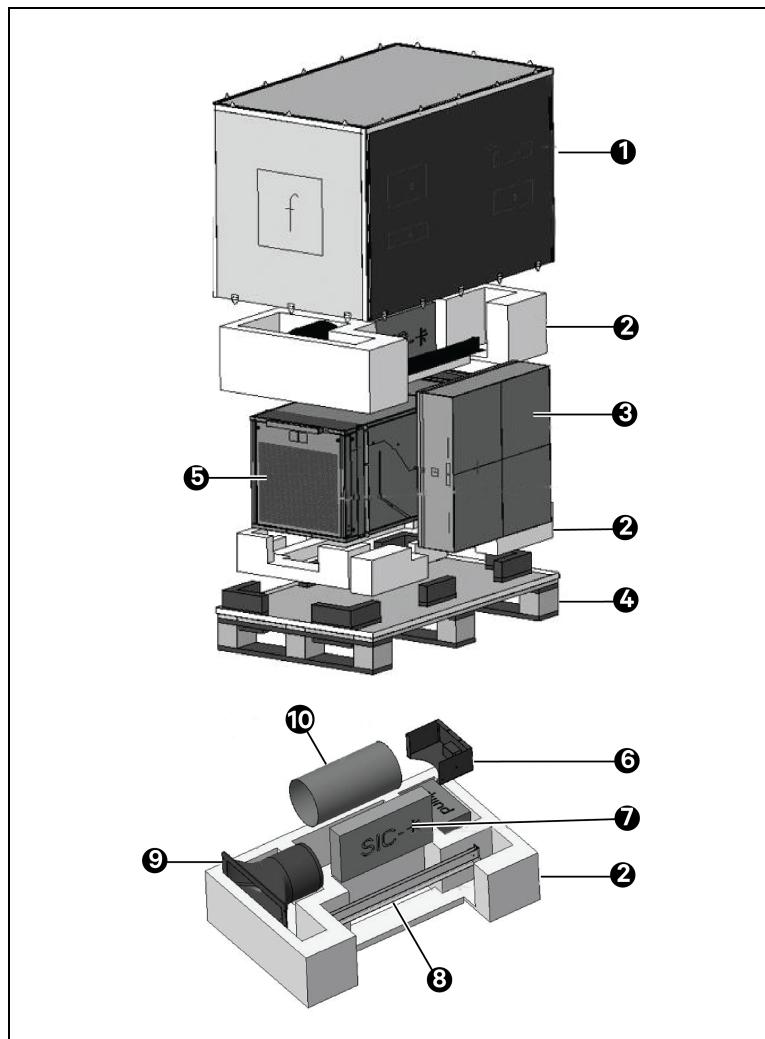
Figure 3.4 Carrying Obliquity

NOTE: Ensure that the equipment stands upright. Do not place the equipment outdoors.

- While using the forklift or the hand pallet truck, ensure that the fork arms (if adjustable and flexible) open to the greatest extent. This is done so that the fork arms can be placed under the pallet of the equipment in a precise manner.
- Ensure that the length of the fork arms match with that of the equipment.

3.4 Unpacking

Unpacking the unit is shown in 3.4 above .

Figure 3.5 Unpacking

Item	Description
1	Wooden Case
2	EPE
3	Ceiling Tile Kit (4)
4	Wooden Pallet
5	Cooling Unit
6	Pump Bracket (Pump is preinstalled) (5)
7	SIC Card (7)
8	L-shape Mounting Rail (6)
9	Transition Part (1)
10	Duct (2)

NOTE: Packing materials of the unit are recyclable. Retain the packing materials for further use or dispose them appropriately as per the protocols and local regulations.

The accessory list is shown in **Table 3.4** below .

Table 3.4 Accessory List

No.	Item		Quantity
1	Transition Part		1
2	Flex Duct (3.8 m / 12.5 ft.)		1
3	Duct Clamp		2
	Ceiling Tile Kit	Ceiling Tile for Air Outtake	1
4		Ceiling Tile for Filter Pad	1
	Drainage Kit	Condensate Pump Kit	1
5		Condensate Pump Brackets	1
		Condensate Water Pipe (7.5 m / 24.6 ft.)	1
6	L-shape Mounting Rail Kit		2
7	SIC Card Kit		1
8	Pan-Head Screws M6x12 (Torx T30)		20
9	Cage Nuts (M6)		20
10	Pan-Head Screws M5x12 (Torx T25)		10
11	Contact Washers for Pan-Head Screw M5x12		10
12	Center Screws M5x12 (Torx T20)		10
13	Display kit	Display	1
		10 m (32.8 ft.) Cable of Display	1
		0.5 m (1.6 ft.) Cable of Display	1
14	Evaporator Filter		1
15	User Manual		1
16	Cable Ties 100x2.5		5
17	USB Converter Cable		1
18	Lifting Straps		2
19	VRC Cooling Unit		1
20	VRC102 Power Cable (Only for VRC102)		1

Follow the steps below during the unpacking process. For installation, please refer to [Mechanical Installation \(Site Preparation\)](#) on page 27 .

- Move the equipment to level ground.
- Unlock the wooden case from the wooden pallet.
- Pull up the wooden case.
- Put the EPE and the ceiling tile kit aside.
- Remove the VRC 10X unit from the wooden pallet that is beneath the VRC 10X unit.

3.5 Equipment Installation Room Requirements

For best performance install the unit in thermally separated racks and install blanking panels in unoccupied U spaces to avoid hot air recirculation. Hot Air recirculation could de-stabilize the temperature gradient in front of the IT equipment.

NOTE: Avoid locating the indoor unit in concave or narrow areas which can affect the airflow. It is prohibited to use the cooling system in an outdoor environment.

3.6 Environment

Following are the requirements that need to be observed from the environment point of view for site preparation of the unit:

- Keep the unit in a place far away from flame or any heat source.
- Direct sunshine is detrimental to the system and therefore, the system needs to be placed at a location where it is not directly affected by sunlight.
- Emission of erosive gases and organic solvents should not be near the unit.

3.6.1 Operating Environment

The operating environment requirements for the unit are specified in **Table 3.5** below :

Table 3.5 Operating Environment

Item	Requirements
Ambient temperature	Indoor: 18 °C to 40 °C (64.4 °F to 104 °F) Heat rejection Air: 0 °C to 40°C (32 °F to 104 °F)
Ambient humidity	17% to 60%
Altitude	<1000 m (3,280 ft.). For every 1000 m (3,280 ft.) increase in elevation, the evaporation temperature drops by 0.5 °C (0.9 °F), and the net cooling capacity drops by 7%

3.6.2 Storage Environment

The storage environment requirements for the unit are specified in **Table 3.6** below.

Table 3.6 Storage Environment

Item	Requirements
Storage environment	Clean (without dust)
Ambient humidity	< 95% RH @40 °C (104 °F)
Ambient temperature	-40 °C to 70 °C (-40 °F to 158 °F)
Storage time	The total shipment and storage time should not exceed 6 months. Otherwise, the performance needs to be re-calibrated

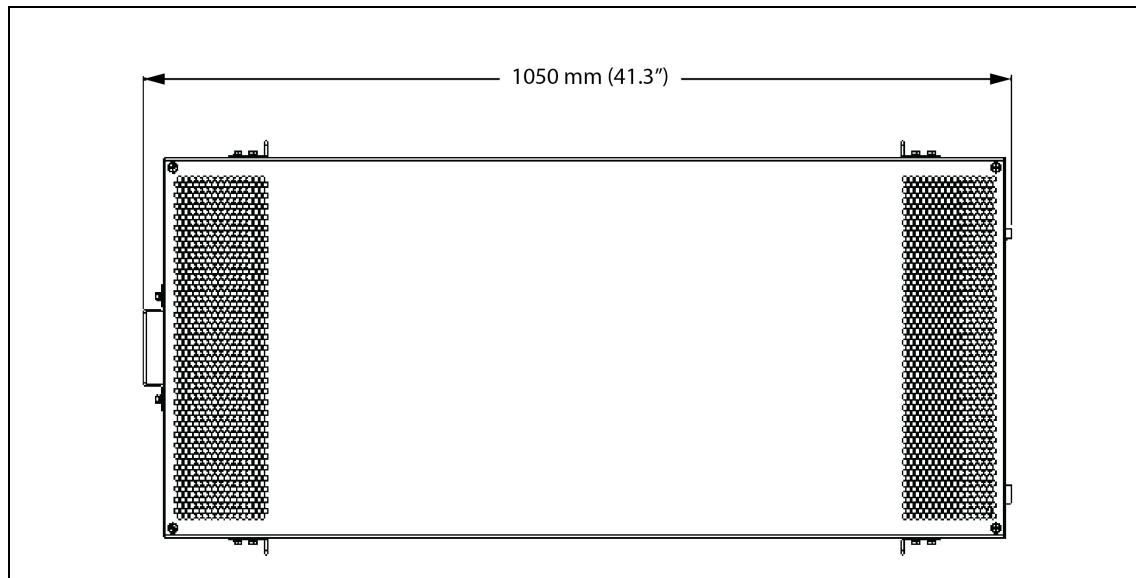
3.7 Installation Space Requirements

The cooling unit is a specifically engineered air conditioning unit. It is recommended to install the unit inside the cabinet at the lowest section, as shown in the installation [Installing the VRC Unit into the Rack](#) on page 30.

To facilitate ease of installation and maintenance, sufficient space needs to be provisioned as per **Figure 3.6** below

The distance from the front door to the wall or other obstacles must be greater than 1050 mm, to ensure the pull-out of the unit entirely for maintenance.

Figure 3.6 Minimum Distance to Pull out the Unit for Maintenance

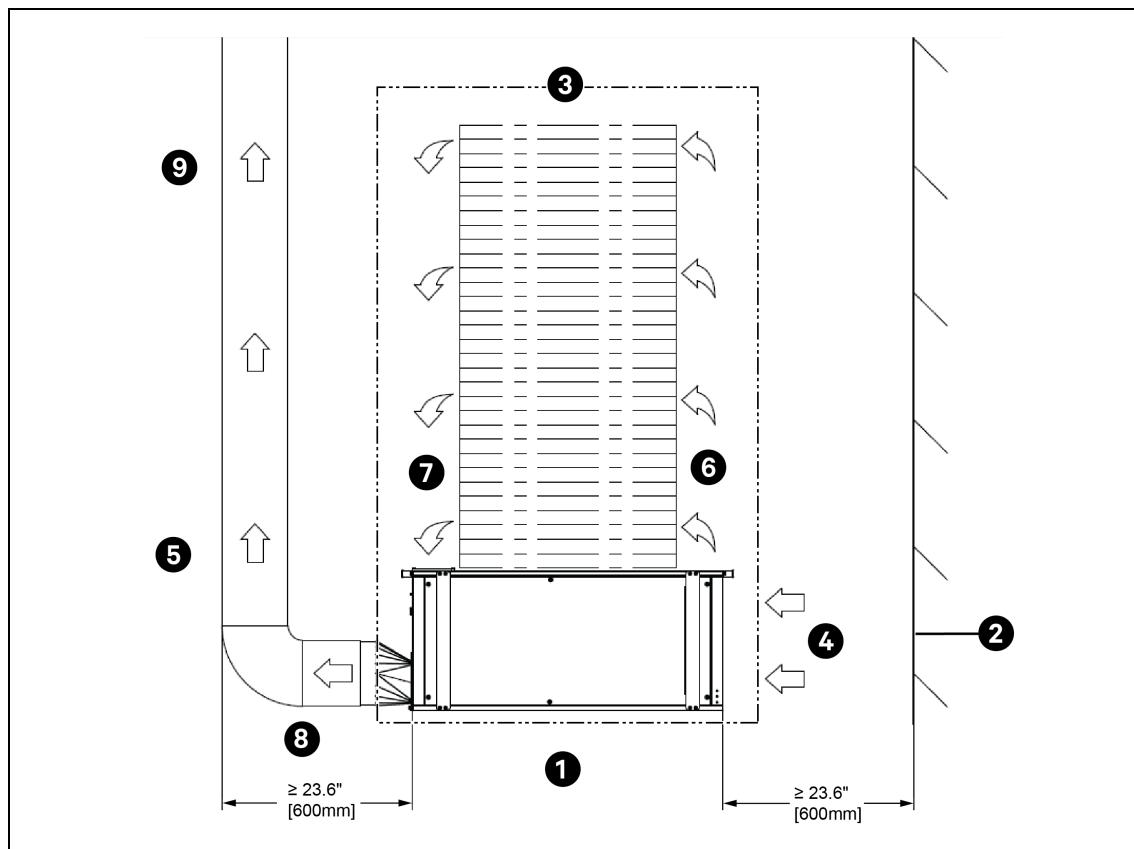


3.8 Condenser Airflow Clearance Requirement

To have sufficient space for condenser air inlet or outlet, the clearance in front and behind the VRC1 unit should not be less than 600 mm (23.6").

NOTE: In the case that the air conditioner is installed in a rack, please refer to the rack instruction to check the clearance in front and behind the rack for installation or maintenance.

Figure 3.7 Required Airflow Clearance



Item	Description
1	VRC Unit
2	Wall
3	Rack Server
4	Heat Rejection Air Inlet
5	Heat Rejection Air Outlet
6	Cold Air Outlet to Servers
7	Hot Air from Servers
8	Transition Parts
9	Flexible Duct

3.9 Weight Bearing Capacity

The unit will be installed inside the cabinet which will increase the cabinet concentrated floor loading. Therefore, the weight bearing capacity of the floor of the room must be taken into consideration.

3.10 Inspection

- The unit is pre-charged. Check that there are no refrigerant or oil leaks.
- Check the system fittings and its components against the packing list to ensure that everything is in its designated position and the entire product assembly is intact.
- Immediately report any missing or damaged parts or components to the carrier. If hidden damages are observed, then contact the local service offices as soon as possible.

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4 Mechanical Installation (Site Preparation)

Proper installation is essential to achieve the intended design performance of the equipment and to maximize its service life. This chapter describes the mechanical installation of the precision air conditioner, including installation notes, system installation layout, end installation, unit piping installation, installation finishing work and installation inspection. This section should be used in conjunction with current mechanical and electrical installation regulations.

4.1 Installation Notes

NOTE: The air conditioner needs to be installed inside the cabinet with the mounting rails as per the procedure mentioned in [Installing the VRC Unit into the Rack](#) on page 30 .

- Before installation, make sure that the installation environment meets the requirements ([Table 3.5](#) on page 22) and there must be sufficient provision for connecting the condensate drain line to the drain point.
- Follow the design drawings strictly while installing the equipment and reserving the space for maintenance.
- Two persons are required for installation.
- Torx bits T20, T25 and T30 are needed during installation.

Figure 4.1 Torx Bits

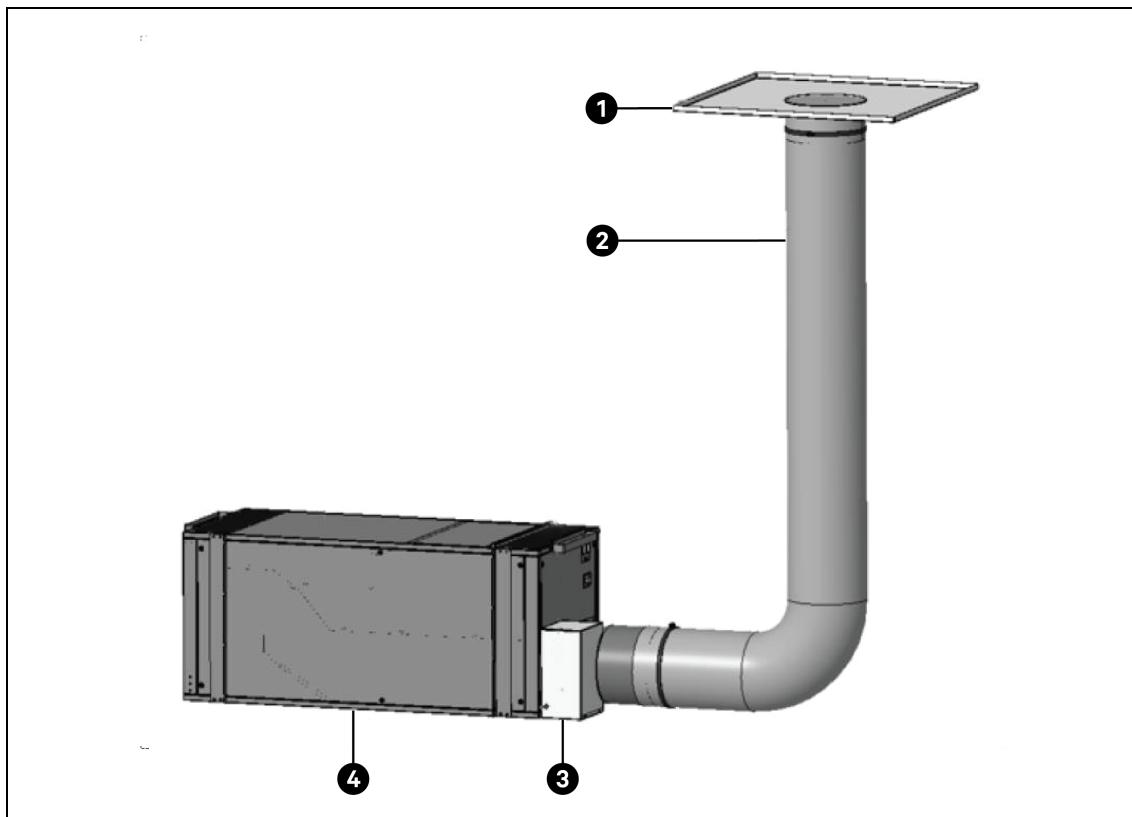


4.2 System Installation Layout

4.2.1 Overall layout of the System

The overall layout of the unit is depicted in the [Figure 4.2](#) on the next page . Hot air generated by the condenser is discharged through transition part and ducted to the ceiling. Condensate water is drained out by the pump.

Figure 4.2 Overall Layout of the System

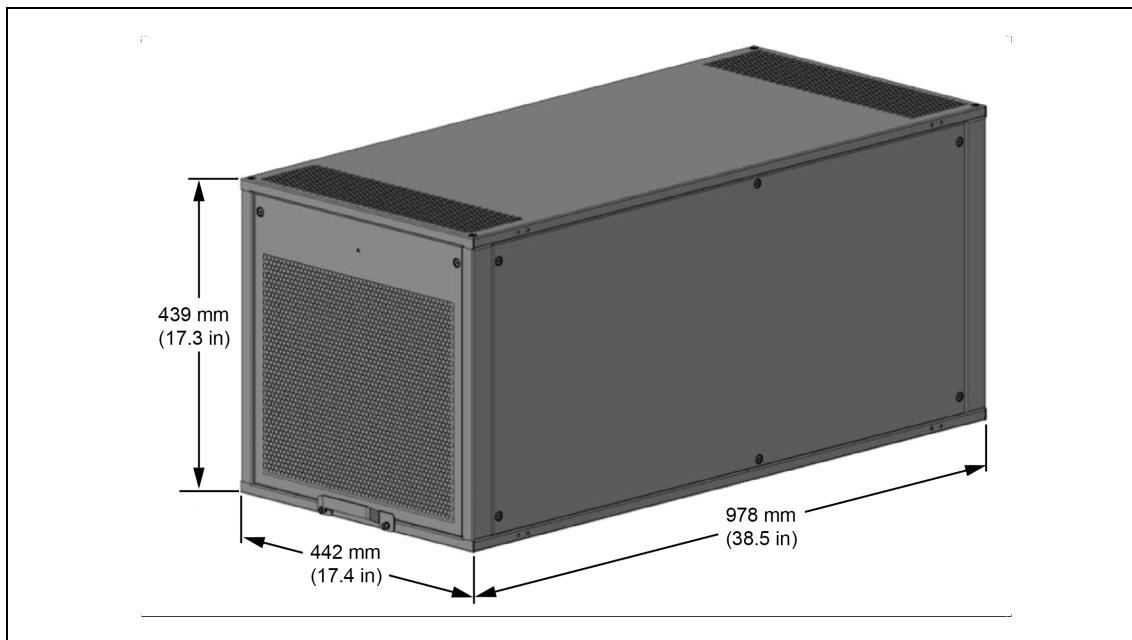


Item	Description
1	Ceiling Tile Unit
2	Flex Duct Max length= 3.8m/12.5 ft
3	Condensate Pump Unit
4	VRC1 Unit

4.2.2 Overall Layout of the VRC Unit

The overall layout of the unit is depicted in **Figure 4.3** below .

Figure 4.3 Overall Layout of the Unit



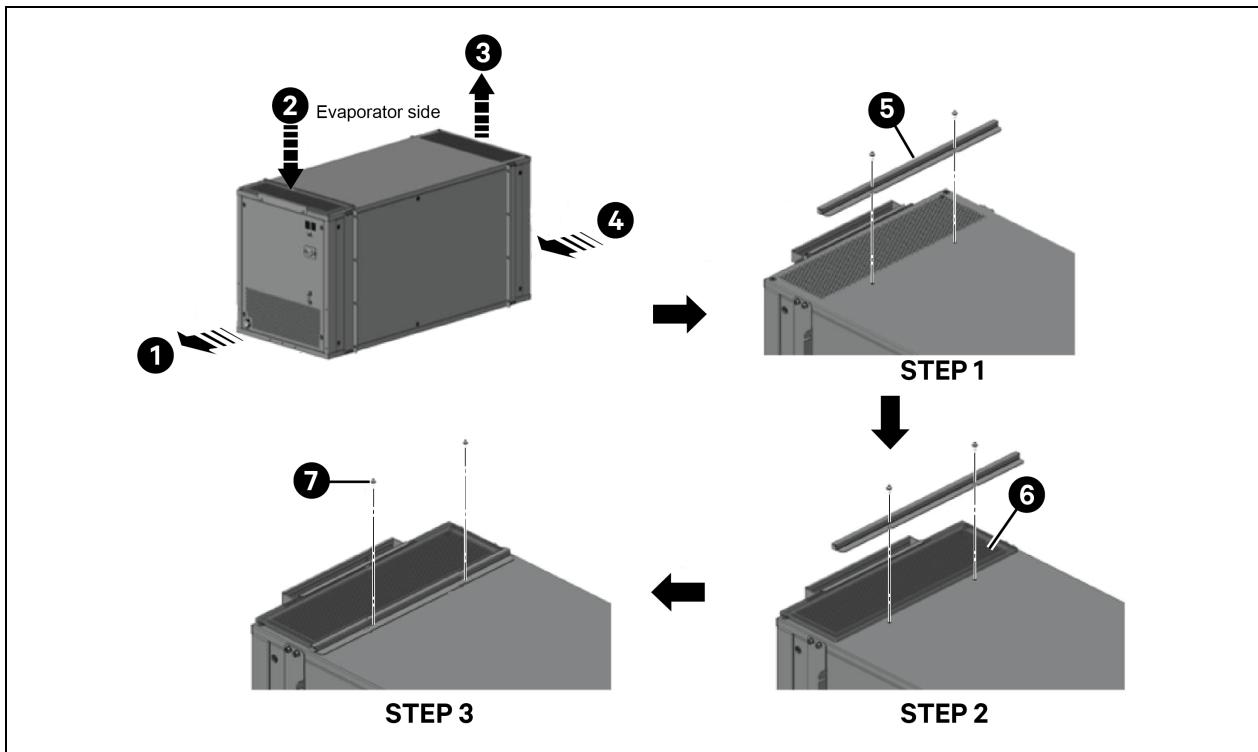
4.3 Installing the VRC Unit into the Rack

The installation process for the cooling unit consists of mounting the unit inside the rack and connecting the condenser duct and the drain piping.

4.3.1 Evaporator Filter Installation

The filter is installed on the air return side of the evaporation side.

Figure 4.4 Install the Evaporator Filter



Item	Description
1	Condenser Out
2	Return Air
3	Supply Air
4	Condenser In
5	Loosen the screws and remove this bracket
6	Filter
7	Screws

Notes to Figures:

Step 1. Loosen the screws and remove this bracket.

Step 2. Place the filter on the air return position.

Step 3. Tighten the screws to screw the filter.

4.3.2 Installing the Unit Inside the 4-Post Rack

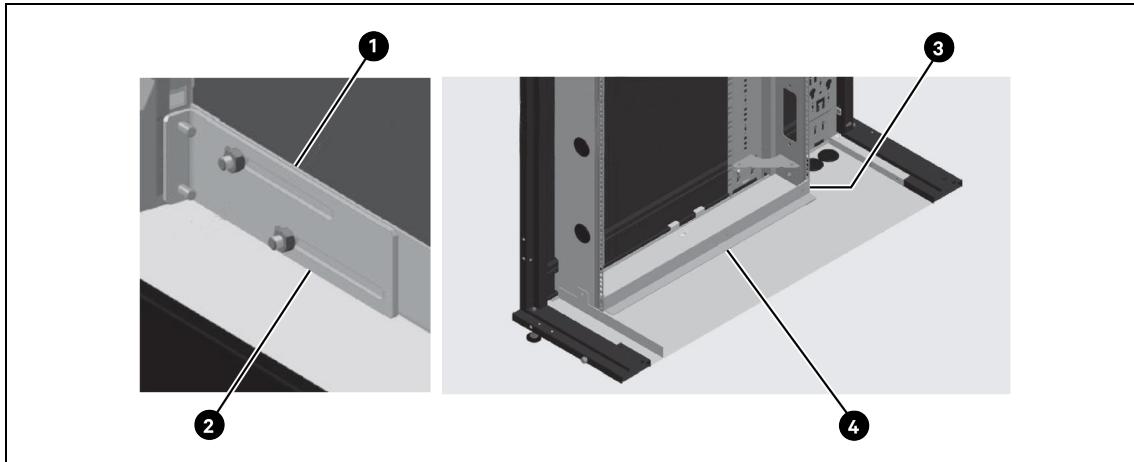
For installation in a 4-post rack, please refer to the procedure below.

NOTE: For installation in a 2-post rack, please purchase accessory 2POSTRMKITVRC. Installation instructions are included with this rail kit.

1. Mount the L-shaped rails in the rack.

Each of the two L-shape rails are comprised of two parts, a long front rail and a slotted rear bracket. There are left and right VRC rails. The flanges of each of the front rails should be on the bottom and pointing toward the center of the rack. Slip the slots in the rear rail bracket over the pressed studs in the front rail part. Loosely fasten with nuts. Fasten the ends of the front rails and rear brackets to the uprights using center screws M5x12 T20. Torque = 4.0 Nm (2.95 lb-ft). Once in place, tighten the nuts on the front rail part studs. Torque = 5.6 Nm (4.13 lb-ft).

Figure 4.5 L-shape Rails Installation

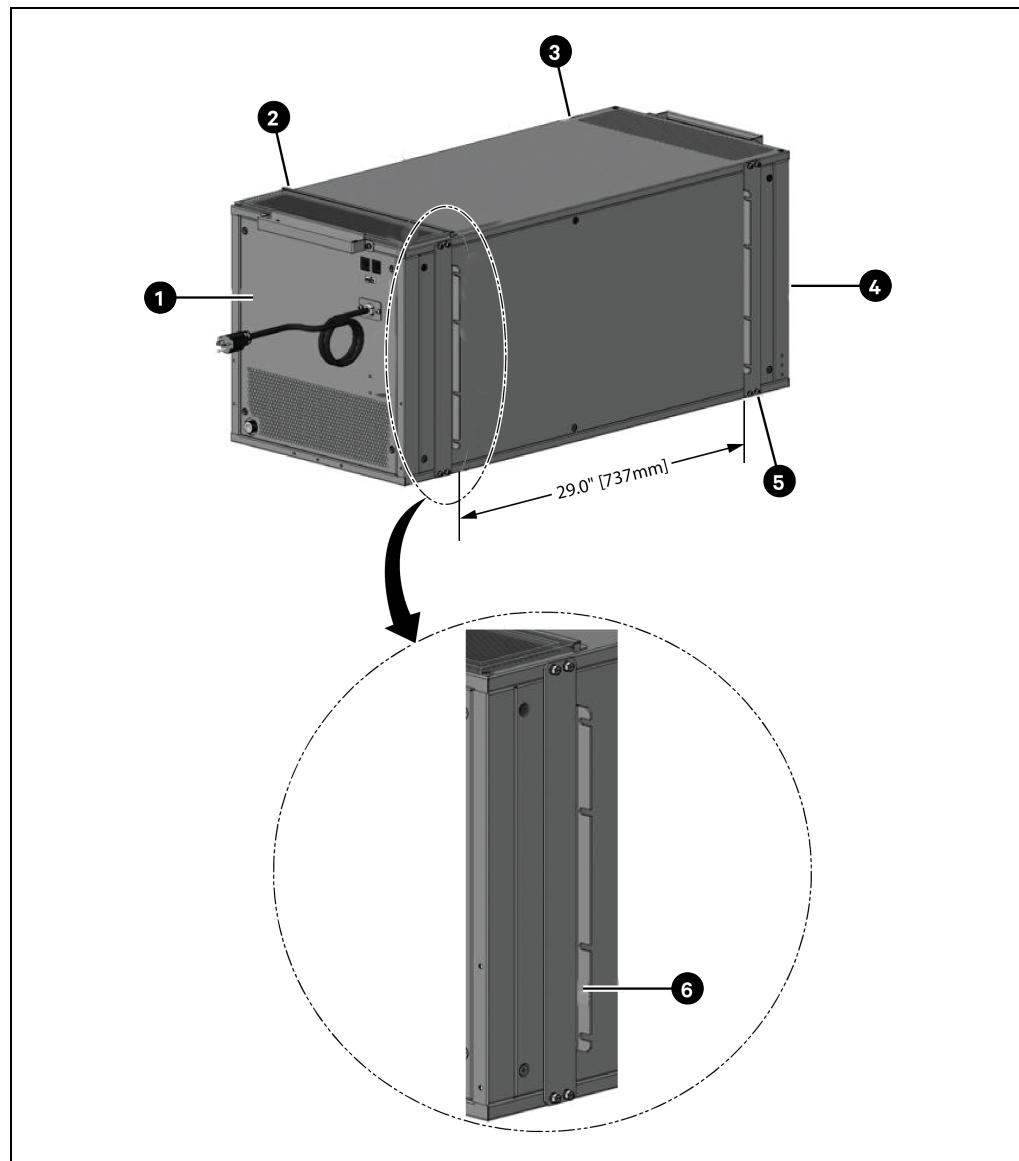


Item	Description
1	Front Rail Part
2	Slotted Rear Bracket
3	VRC Rear Left Bracket
4	VRC Front Left Rail
Cross section of vRack shown for illustrative purposes.	

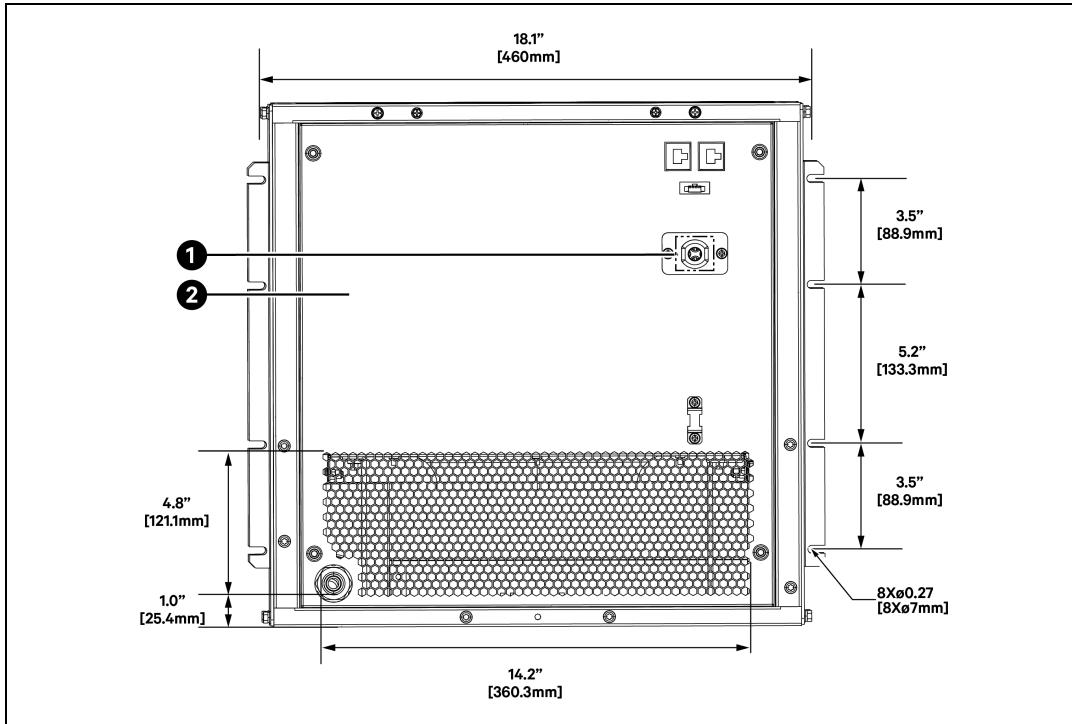
2. Dismantle the C-pillar and D-pillar from the rear side.

NOTE: The direction of the pillar is correct as Right-side View on the next page depicts.

- The distance between A-pillar and C-pillar (or between B-pillar and D-pillar) is 737 mm (29").
- The distance between C-pillar and D-pillar is 460 mm (18.1").

Figure 4.6 Right-side View

Item	Description
1	Back
2	D-pillar
3	B-pillar
4	Front
5	A-pillar
6	C-pillar

Figure 4.7 Back View

Item	Description
1	Strain Relief Bushing
2	Electrical Access Panel

3. Use 2 lifting straps and VRC handles to slide in the unit inside the cabinet from the front side till the B-pillar and the A-pillar are completely flushed against the cabinet 19" profiles. The distance from front rails to front door is 121 mm (4.76").

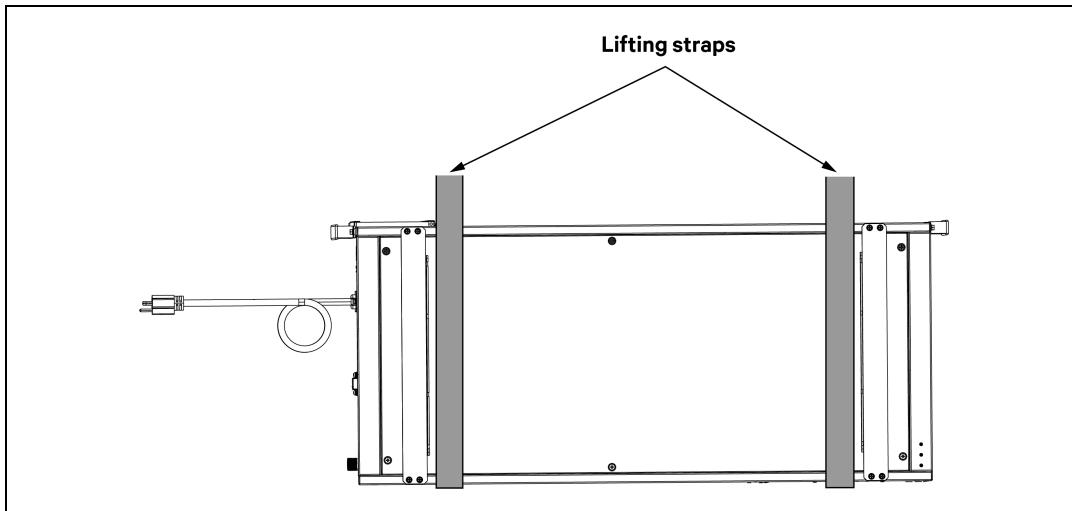
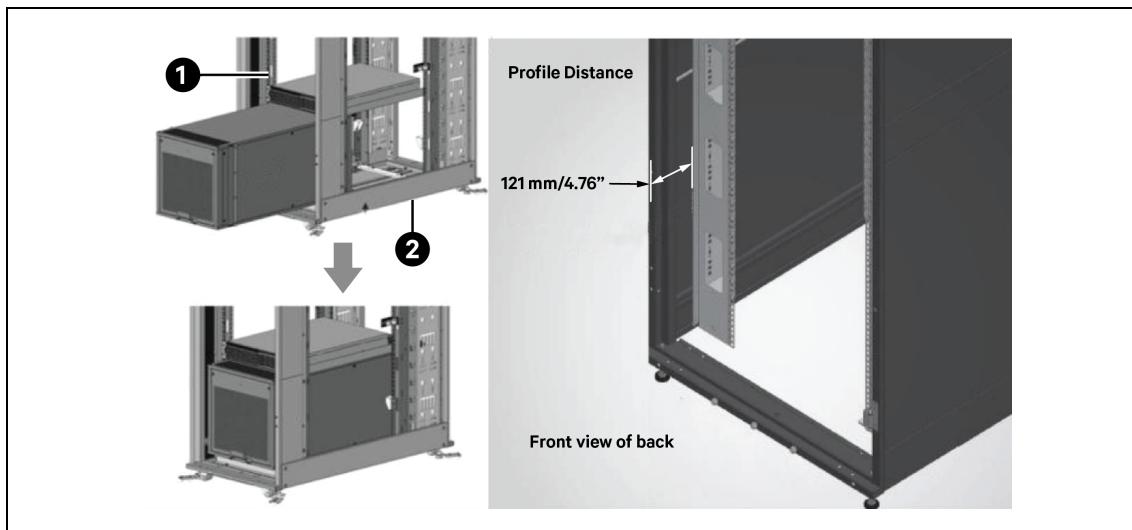
Figure 4.8 Lifting Straps

Figure 4.9 Mounting the VRC into the Rack

Item	Description
1	Other Device
2	Rack

4. The distance between A-pillar and C-pillar (or between B-pillar and D-pillar) is 737 mm (29"). If the cabinet space is suitable, then install the C-pillar and D-pillar back again onto the unit body casing. If not, then only installing A-pillar and B-pillar.
5. Firmly secure A-pillar, B-pillar, C-pillar and D-pillar on the cabinet column with 2 M6x12 screws (fastened with cage nuts) per pillar. Torque = 5.6 Nm (4.13 lb-ft).

NOTE: Ensure that the installation direction of pillars is correct. And ensure the VRC unit is installed horizontally, otherwise high-water level alarms may be triggered incorrectly.

4.4 Connecting the Accessories

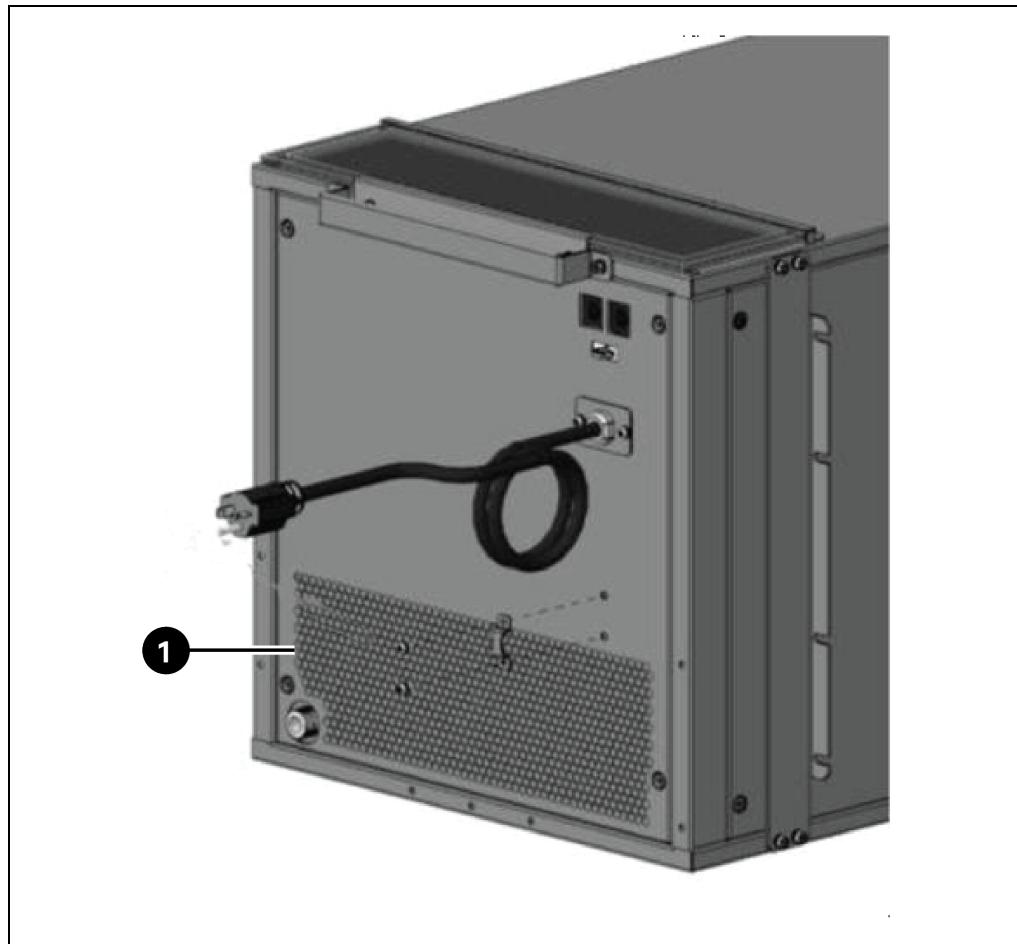
If the unit must be placed in an environment where the hot air from the condenser duct needs to be extracted from the room and discharged at a suitable pre-determined location, an air duct is provided as a part of the accessories shipped with the unit and can be connected to the condenser discharge side.

If a gravity drain is not possible, a condensate pump kit is provided as a part of the accessory shipped with the unit and can be installed in the field.

4.4.1 Remove the Power Cable Clamp from the VRC1 Unit

The power cable clamp is used to secure the power cable during transportation. Remove the power cable clamp before installing the accessories.

Figure 4.10 Remove the Power Cable Bracket

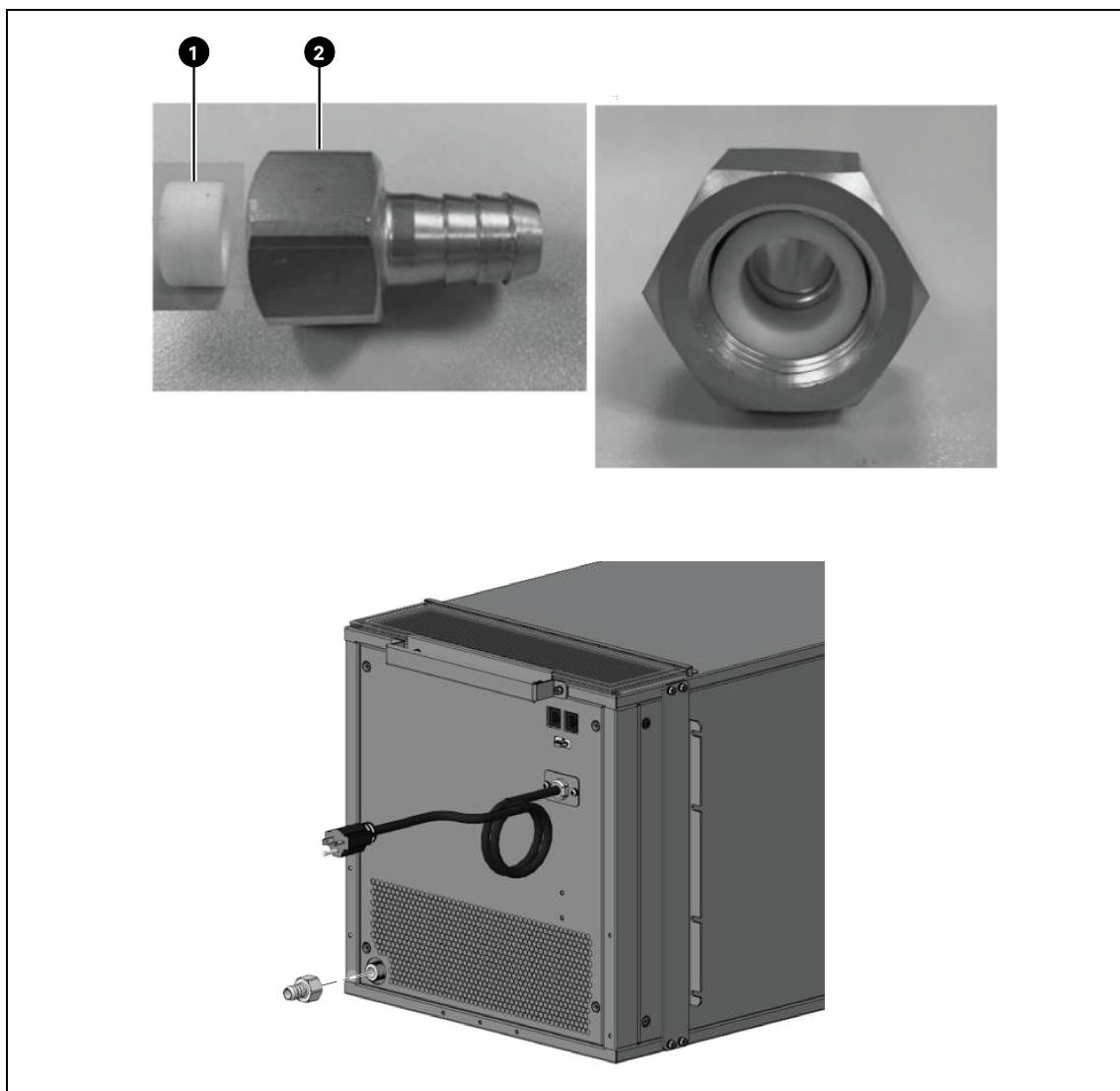


Item	Description
1	Remove the power cable bracket

4.4.2 Installing the Drain Fitting to the VRC1 Unit

Fasten the drain fitting to the drain port of the VRC1 unit. The drain fitting contains a sealing block, which is used for preventing the water leaking from the drain fitting port. Make sure the sealing block is installed tightly.

Figure 4.11 Install the Drain Fitting

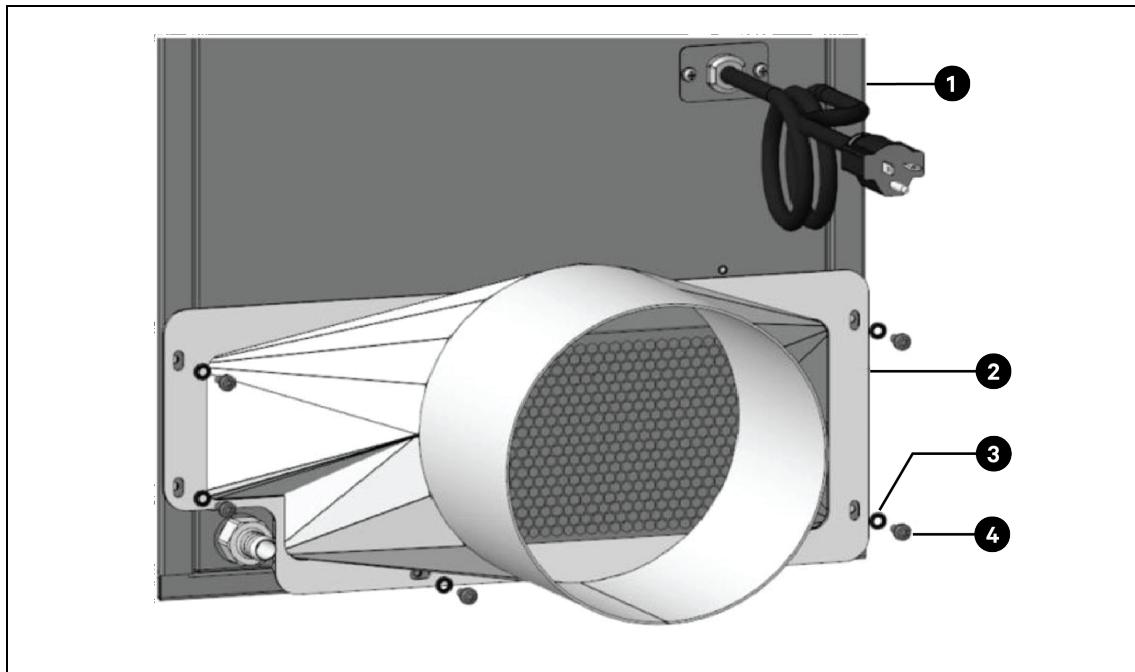


Item	Description
1	Drain fitting sealing block
2	Drain fitting

4.4.3 Installing the Transition Part on VRC1 Unit

The transition part is installed on the condensing air discharge side. On this step, it can be installed with 6 M5x12 pan-head screws and 6 M5 contact washers. Torque=4.0 Nm (2.95 lb-ft)

Figure 4.12 Transition Part Installation



Item	Description
1	VRC 10X
2	Transition part
3	Contact washer 5 (x6)
4	Pan-head screw M5x12 (x6)

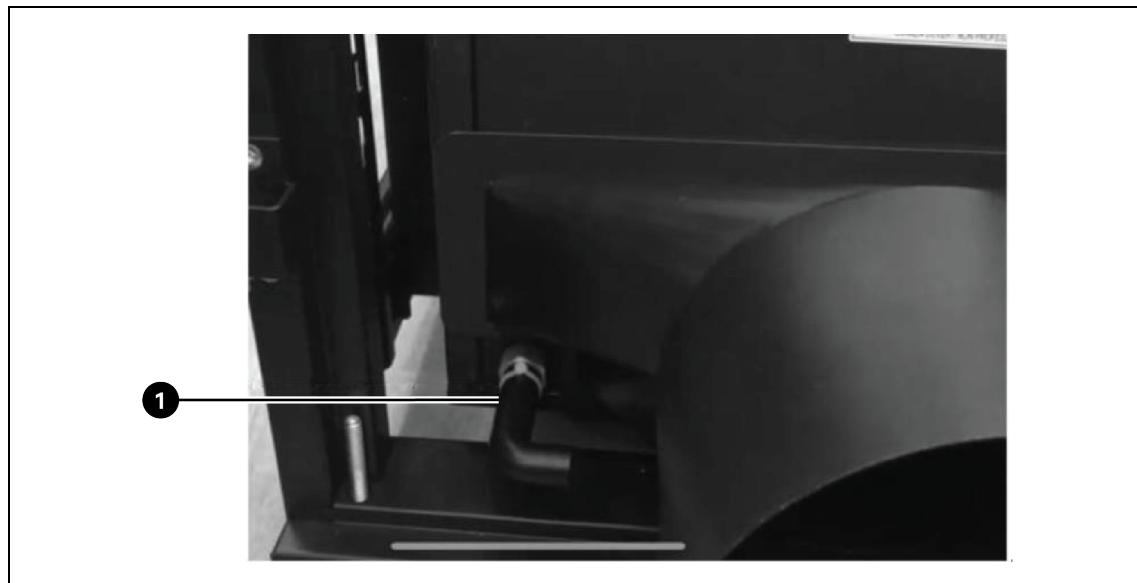
4.4.4 Connect the L-Shape Pipe to the Drain Fitting

Figure 4.13 L-shape Pipe



Connect the L-shape pipe to the drain fitting. Use a cable tie to fasten it.

Figure 4.14 Connect the Pipe 4 to the Drain Fitting

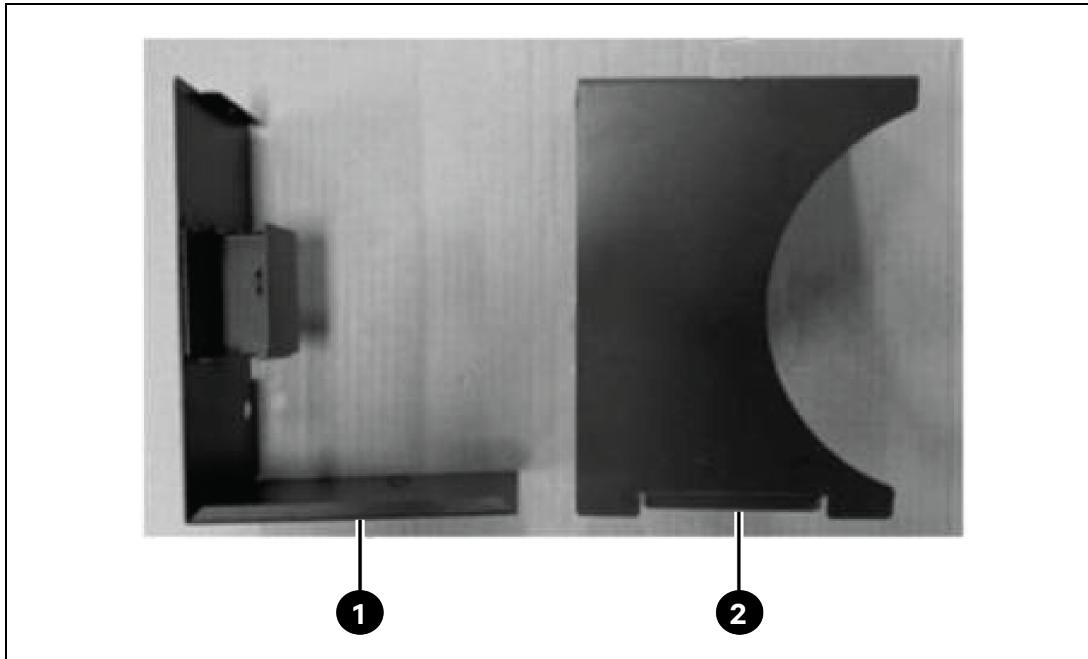


Item	Description
1	Connect the L- shape pipe, ID=16 mm (5/8"), to the drain fitting and use a cable tie to

4.4.5 Installing the pump

1. The pump bracket is comprised of two parts, pump bracket 1 and pump bracket 2.

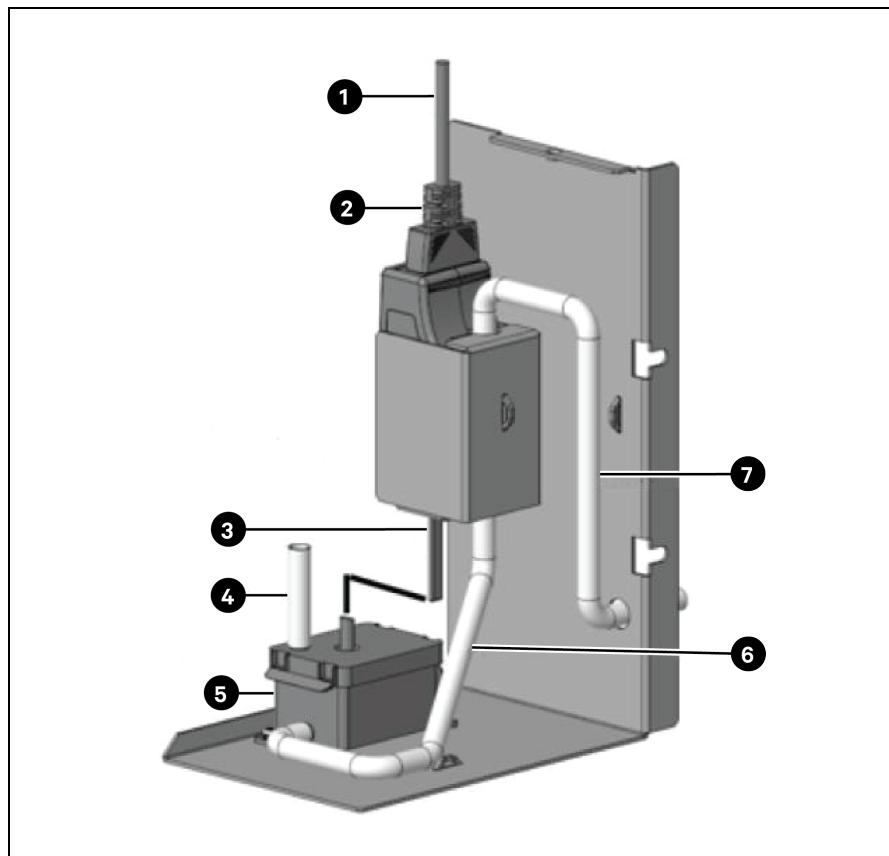
Figure 4.15 Pump Bracket



Item	Description
1	Condensate pump bracket part 1
2	Condensate pump bracket part 2

2. Loose the screw and remove the pump bracket part 2 from the pump bracket part 1. The pump is pre-installed on the pump bracket part 1 in factory.

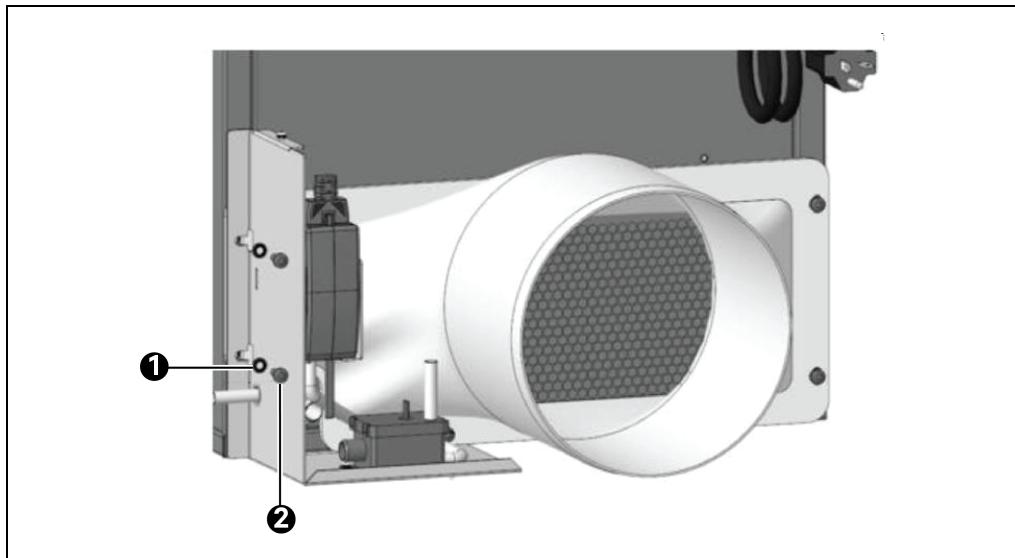
Figure 4.16 Pump is Pre-installed on the Bracket 1



Item	Description
1	Pump power cable
2	Pump
3	Pump communication cable
4	Pipe 1 ID=6mm (1/4") L=60mm (2.4")
5	Reservoir
6	Pipe 2 ID=6mm (1/4") L=300mm (11.8")
7	Pipe 3 ID=6mm (1/4")

3. Install the pump bracket part 1 on the condensing air discharge side of the VRC1, tightened by two pan-head screws with contact washer (M5 x 12). Torque = 4.0 Nm (2.95 lb-ft).

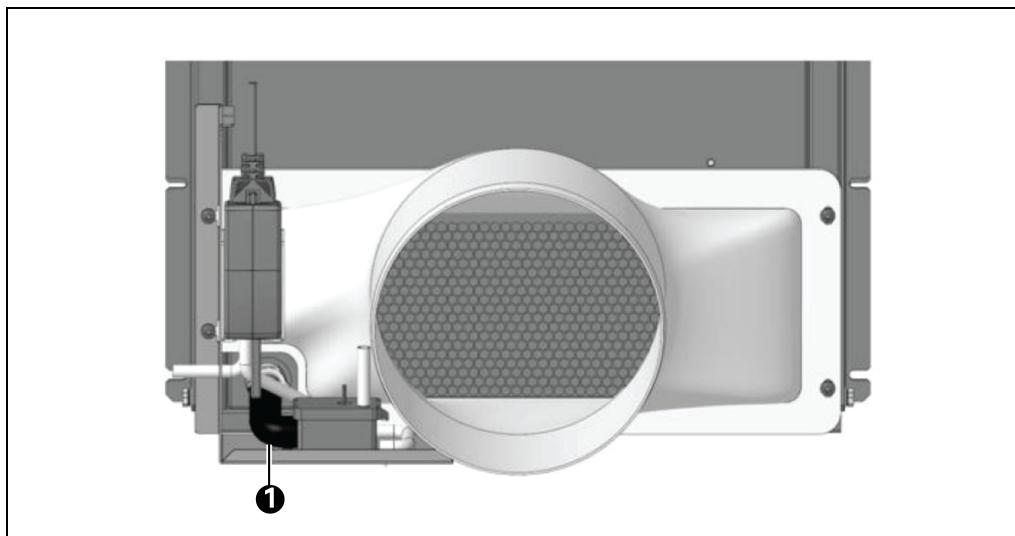
Figure 4.17 Install the Pump Bracket Part 1 on the unit



Item	Description
1	Contact washer 5 (x2)
2	Pan-head screw M5x12 (x2)

4. Then connect the L-shape pipe and the reservoir. Use a cable tie to fix it.

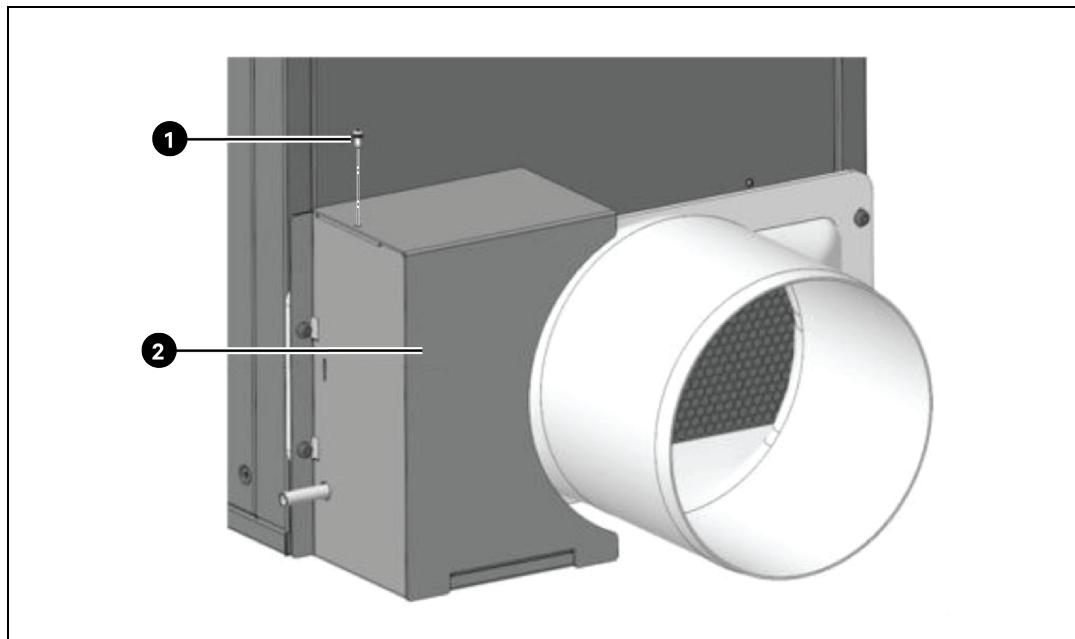
Figure 4.18 Connect the Pipe 4 and the Reservoir



Item	Description
1	Use a cable tie to fix it

- After that, condensate pump bracket part 2 should be tightened by a M5 screw. Torque = 4.0 Nm (2.95 lb·ft).

Figure 4.19 Pump Bracket Part 2 Installation



Item	Description
1	Using a screw to install it
2	Condensate pump bracket part 2

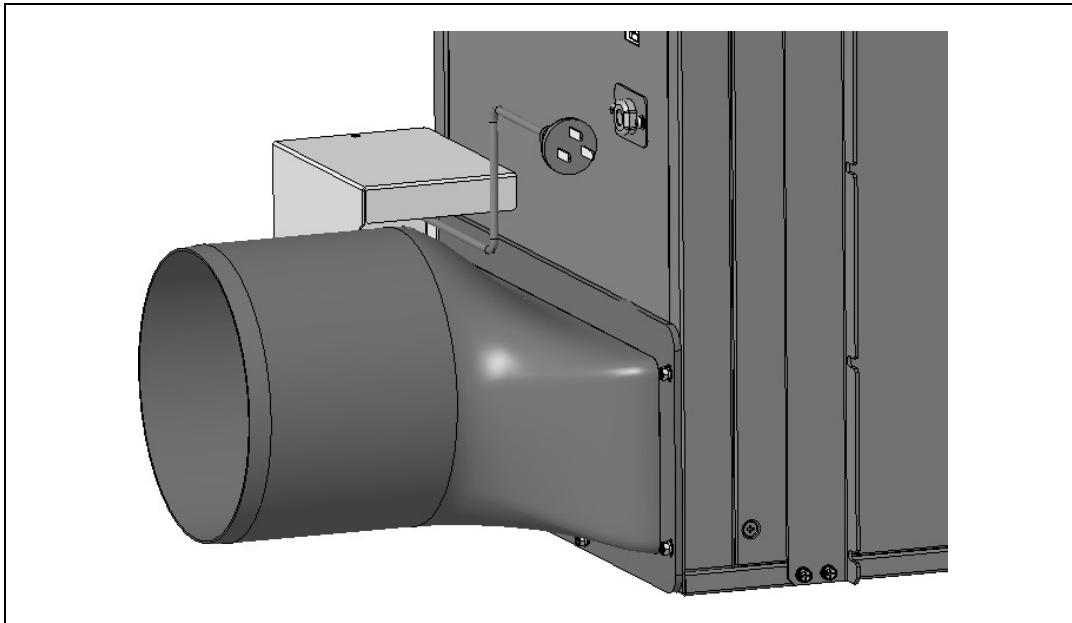
- There is a condensate water pipe (7.5 m / 24.6 ft) in the package, which can be used to extend drainage lines.

Figure 4.20 Anti-siphoning Device and Condensate Water Pipe



The pump power plug can be pulled out from the gap between the pump bracket and the transition part. If the condensate pump is not powered through rPDU in vRack, the pump must be protected by a 1 A inline fuse upstream.

Figure 4.21 Pull Out the Pump Power Plug



The pump power plug for different versions of VRC1 units is depicted in the **Table 4.1** below .

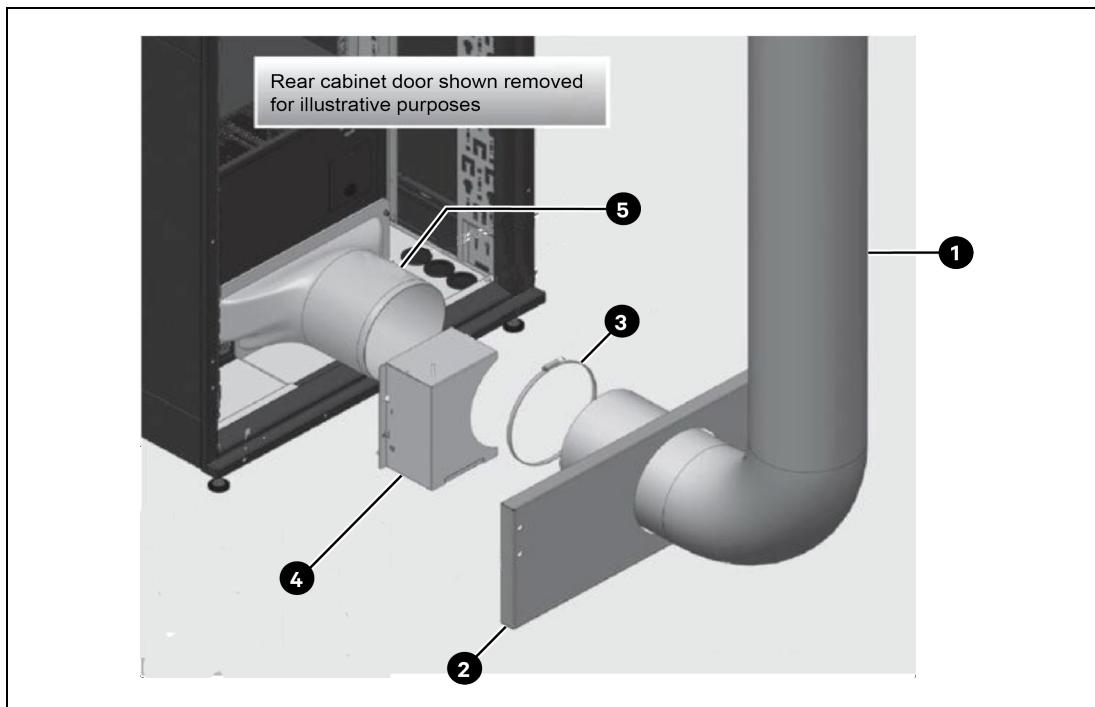
Table 4.1 Pump Power Plug

Unit	Plug	Rating
VRC100	NEMA 5-20	20 A, 125 Vac
VRC101	IEC60320 C14	10 A, 250 Vac
VRC102	IEC60320 C14	10 A, 250 Vac

4.4.6 Connect the Duct to the Transition Part

The total length of the cylindrical part of the transition part is 100 mm (3.94"). To ensure the connection reliability, the minimal overlapping of duct and transition part should not be less than 90 mm (3.54"), and make sure the clamping force is sufficient.

Figure 4.22 Connect the Duct and Transition Part



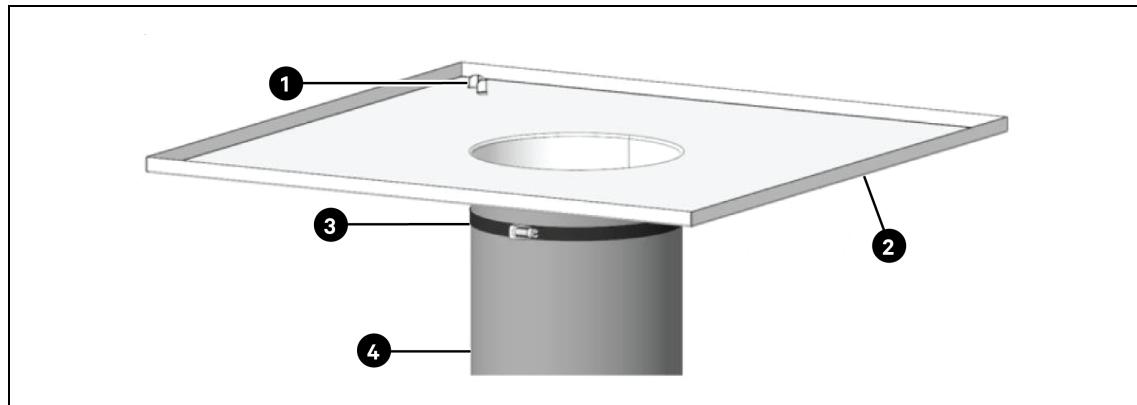
Item	Description
1	Air duct PN: 27140303
2	Plinth
3	Pipe clamp PN: 63128710
4	Condensate pump PN: 02092419
5	Transition PN: 21121507

NOTE: Before connecting the duct, the air duct needs to pass through the rear cabinet plinth firstly.

4.4.7 Connect the Duct to the Ceiling Tile for Air Outtake

Connect the duct to the ceiling tile for air outtake which will be mounted on the ceiling and secure it with a clamp. Also, the minimal overlapping of duct and transition part should not be less than 90 mm (3.54"), and make sure the clamping force is sufficient to ensure the connection reliability.

Figure 4.23 Connect the Duct and Ceiling Tile for Air Outtake



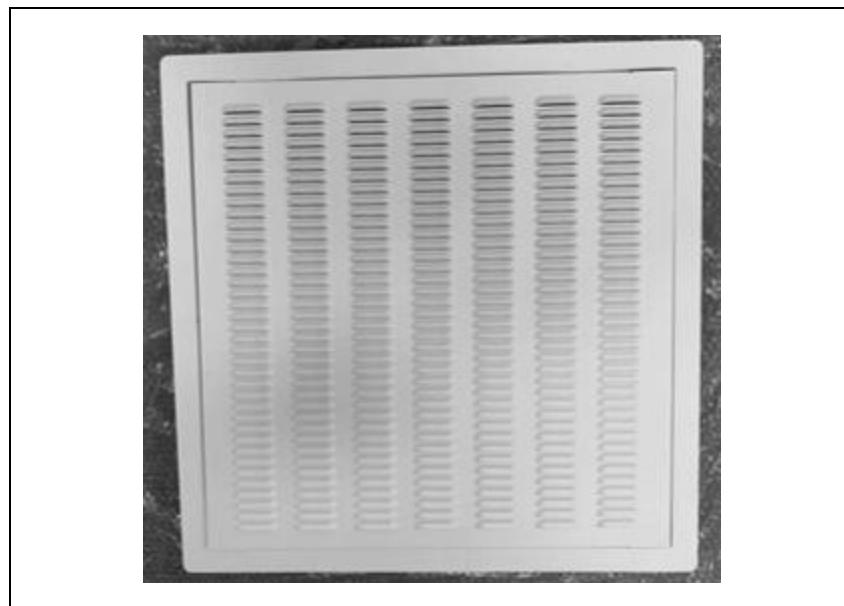
Item	Description
1	A hook for construction
2	Ceiling tile for air outtake PN:21243048
3	Clamp PN: 63128710
4	Flex Air Duct PN: 27140303

NOTE: There is a hook on the ceiling tile for air outtake for safety reason when connecting the ceiling tile to the ceiling construction.

4.4.8 Install the Ceiling Tile for Filter Pad

The ceiling tile for filter pad is installed in a 2'x2' ceiling tile at the air inlet. The fresh air enters the condenser for heat exchange through the ceiling tile filter. The ceiling tile for filter pad is used to clean the fresh air.

Figure 4.24 The Ceiling Tile for Filter Pad



4.4.9 Installation/Pre- commissioning Check List

After the unit is installed with all of the necessary mechanical connections, check the installation per **Table 4.2** below .

Table 4.2 Mechanical Installation Checklist

Items	Results
Sufficient space for maintenance activities at site.	
All the fittings are tightly connected	
The unit is placed correctly. Verify that the supply air is sent to the cold aisle at the front of the unit and that the hot air is drawn to the return air inlet in the back of the unit.	
Foreign materials in and around the equipment are removed (such as shipping materials, removed structural materials, tools, and so on).	
The condensate drain pipe is connected properly.	

After all these items are checked and confirmed, continue with the electrical installation procedure for the unit.

5 Electrical Installation

This chapter describes the electrical installation of the air-conditioning unit, including task introduction, installation precautions, end cable connection and electrical inspection.



WARNING! Arc flash and electric shock hazard. Open all local and remote electric power-supply disconnect switches, verify with a voltmeter that power is Off and wear appropriate, OSHA- approved personal protective equipment (PPE) per NFPA 70E before working within the electric control enclosure. Failure to comply can cause serious injury or death. Customer must provide earth ground to unit, per NEC, CEC and local codes, as applicable. Before proceeding with installation, read all instructions, verify that all the parts are included and check the nameplate to be sure the voltage matches available utility power. The Liebert® controller does not isolate power from the unit, even in the “Unit Off” mode. Some internal components require and receive power even during the “Unit Off” mode of the controller. The only way to ensure that there is NO voltage inside the unit is to install and open a remote disconnect switch. Refer to unit electrical schematic. Follow all local codes.



WARNING! Risk of electric shock. Can cause equipment damage, injury or death. Open all local and remote electric power supply disconnect switches and verify with a voltmeter that power is off before working within any electric connection enclosures. Service and maintenance work must be performed only by properly trained and qualified personnel and in accordance with applicable regulations and manufacturers' specifications. Opening or removing the covers to any equipment may expose personnel to lethal voltages within the unit even when it is apparently not operating and the input wiring is disconnected from the electrical source.



WARNING! Risk of electric shock. Can cause injury or death. Open all local and remote electric power-supply disconnect switches and verify that power is Off with a voltmeter before working within the condensate pump electrical connection enclosure. The Liebert® controller does not isolate power from the unit, even in the “Unit Off” mode. Some internal components require and receive power even during the “Unit Off” mode of the Liebert® controller.



WARNING! Do not power on the unit until authorized technical personnel have confirmed that the unit connections are correct.



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

5.1 Installation Notes

NOTE: All power and control wiring and ground connections must be in accordance with the National Electrical Code and local codes.

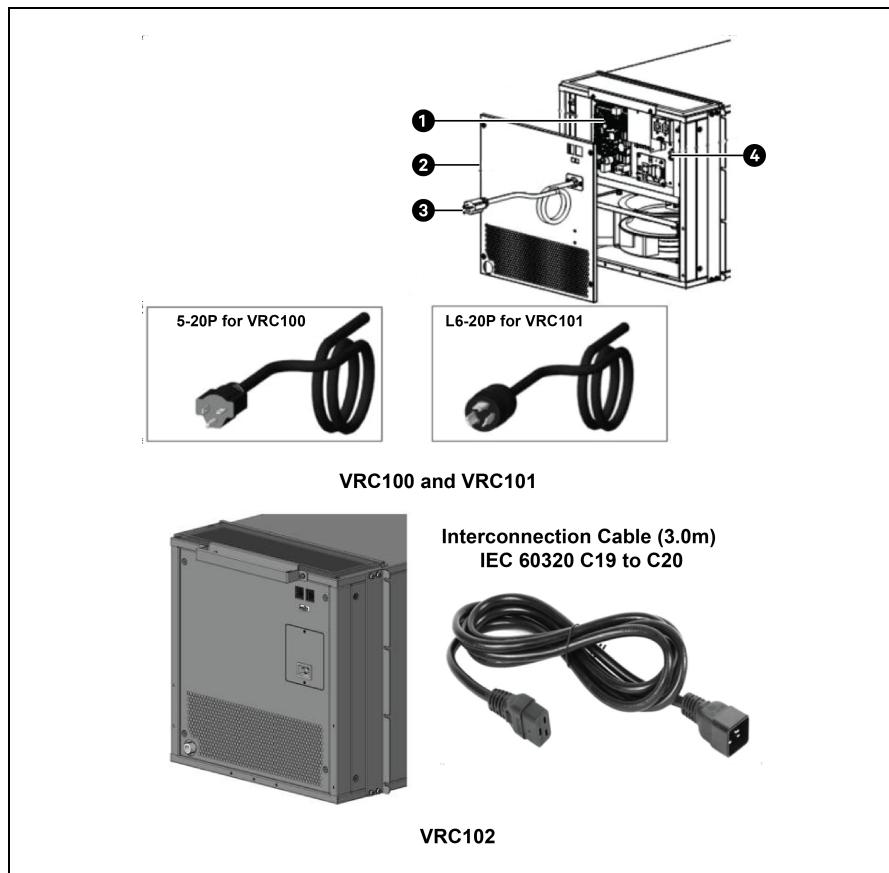
- Refer to the equipment nameplate for full load current and electrical requirements. The wire sizes should meet the local wiring standards and regulations.
- Requirements for the main power supply 120 Vac ± 10%, 1 Ph, 60 Hz or 208 Vac ± 10%, 1 Ph, 60 Hz or 230 Vac ± 10%, 1 ph, 50/60 Hz must be consistent with the unit nameplate power supply.
- Power cord is a Y-type connection. If the power cord is damaged, it must be replaced by a professional maintenance person.
- Before performing any electrical works, use a voltmeter to measure the power supply voltage and make sure that the power supply has been switched off.
- The equipment needs to be installed with screws, rails and other methods to avoid shaking during startup or operation process.
- Disconnect the rated circuit breaker from the power supply.

5.2 Cable from the Power Supply Connection

5.2.1 Electrical Box Placement

The electric box is located at the back of the unit as shown in **Figure 5.1** below. For VRC100 and VRC101, the power cord with plug comes pre-attached from the factory.

Figure 5.1 Electric box of VRC100, VRC101 and VRC102



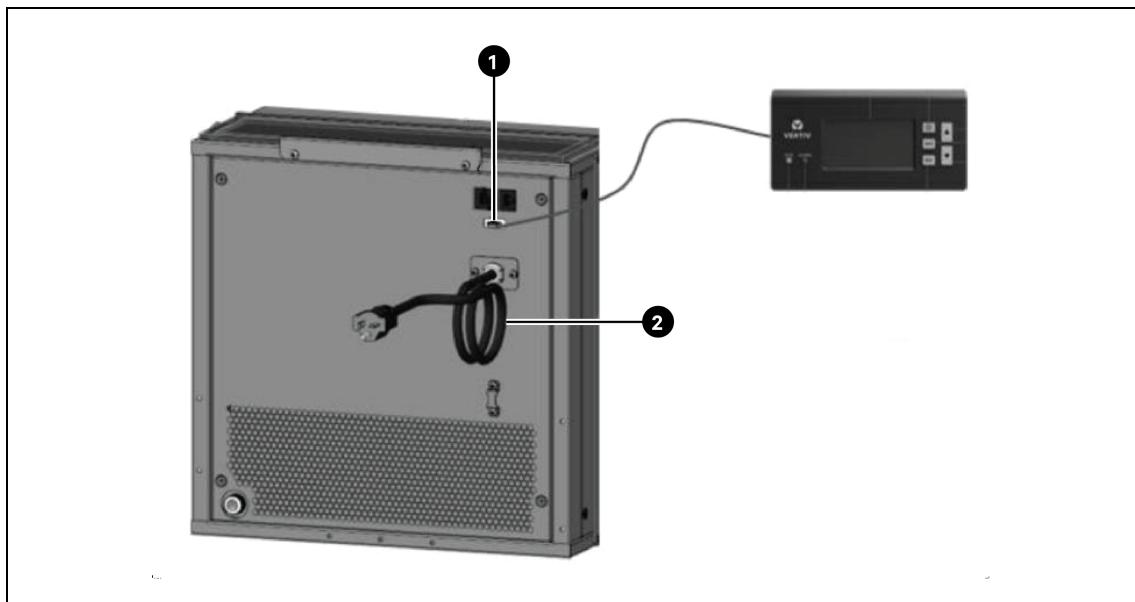
Item	Description
1	Electric Box
2	Back Plate
3	Power Plug
4	3PIN Terminal

For the VRC102, the interconnection cable IEC 320 C19 to C20 is provided in the package. Connecting the power cables between the VRC102 and the power supply onsite.

5.2.2 Display Connection

The display board is connected to the unit with a power cable (available in two lengths of cables, one is 10 m and the other is 0.5 m) as show in **Figure 5.2** below .

Figure 5.2 Display, Power and Monitoring Cable Connections



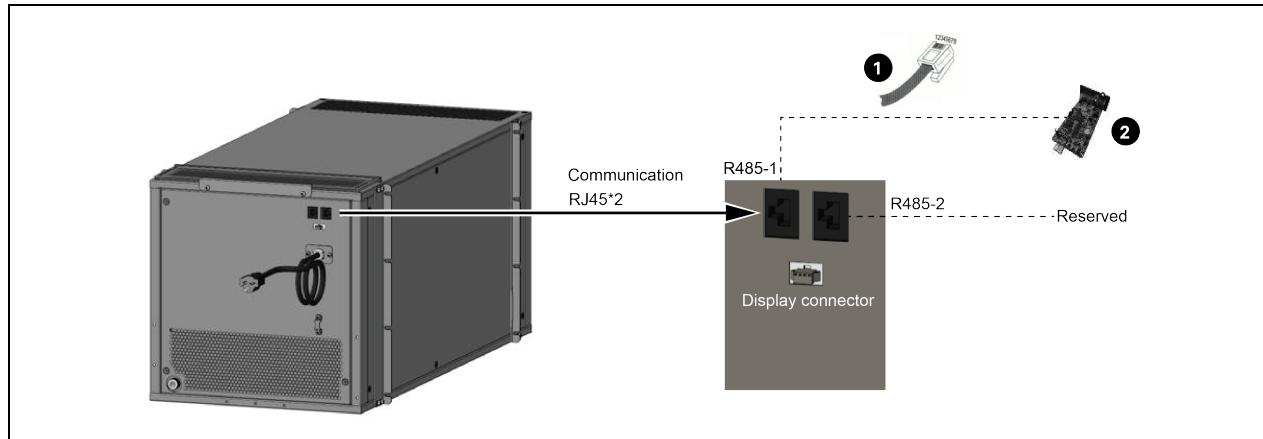
Item	Description
1	Display board plug
2	Power cable (with plug)

5.2.3 Communication

There are two RJ-45 ports present on the unit for communication with third party monitoring systems to enable remote monitoring of the unit. The RS485-1 (with 12 V power supply) can be connected with the SIC card monitoring kit. For detailed installation, please refer to SIC Field Instructions. The RS485-2 is reserved, it can be used for communication with Vertiv rPDU. The aforementioned connections are shown in **Figure 5.3** below and **Table 5.1** below.

NOTE: The VRC has only one standby port and it cannot support two active Modbus RTUs simultaneously.

Figure 5.3 Communication Cable Connections



Item	Description
1	RJ-45
2	SIC Card

Table 5.1 Communication Port Description

Port Type	RS485-1	RS485-2
1		
2	12 V	NC
3	NC	NC
4		
5	GND	GND
6	NC	NC
7	D+	D+
8	D-	D-

5.3 Installation Inspection

- After the electrical installation is completed, perform the installation inspection listed in **Table 5.2** below.
- After confirming the above items, you can start the commissioning of the VRC unit.

Table 5.2 Installation Inspection

Items	Results
The power supply voltage meets the rated voltage on the unit nameplate.	
The system electric loop has no open circuit or short circuit.	
There must be no open-circuit or short-circuit in the electrical connections.	
The power cable and grounding cable to the air-break switch are connected.	
The ratings of the Miniature Circuit Breaker and fuses are correct (refer to unit nameplate to select suitable Miniature Circuit Breaker or fuses).	
The control cables are tightly connected.	
All the cables connections are fastened appropriately, with no loose screws at the connections.	

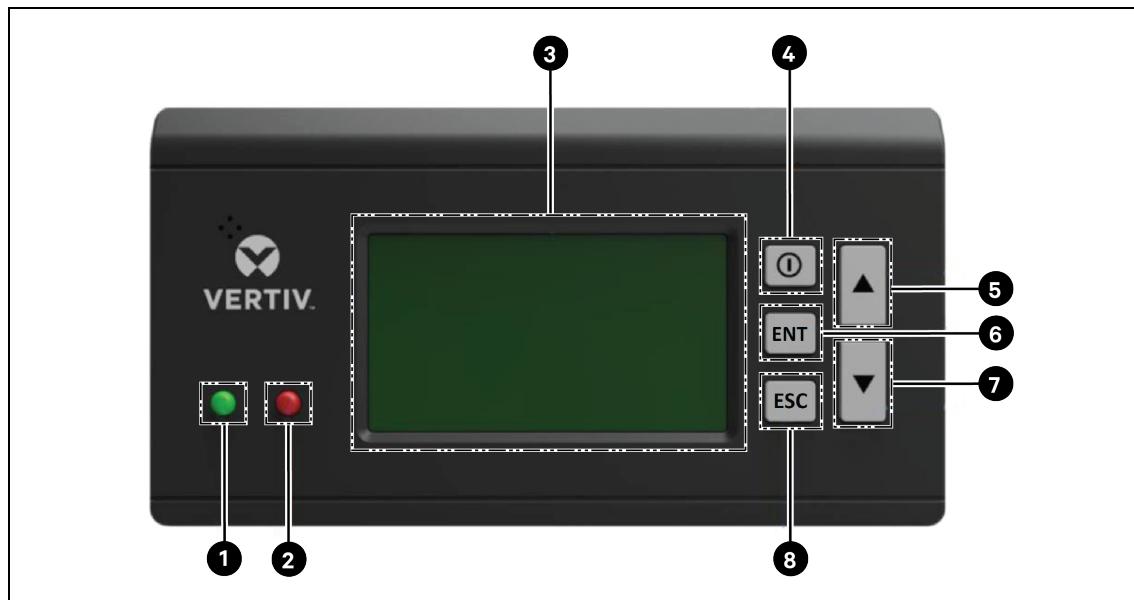
6 Controller Operation Instructions

This chapter gives a detailed description of the features, appearance, LCD screen, control buttons, control interface and menu structure of the VRC1 unit.

6.1 LCD Screen

The backlit LCD screen displays English menus. **Figure 6.1** below depicts the image of the controller display.

Figure 6.1 Controller Display

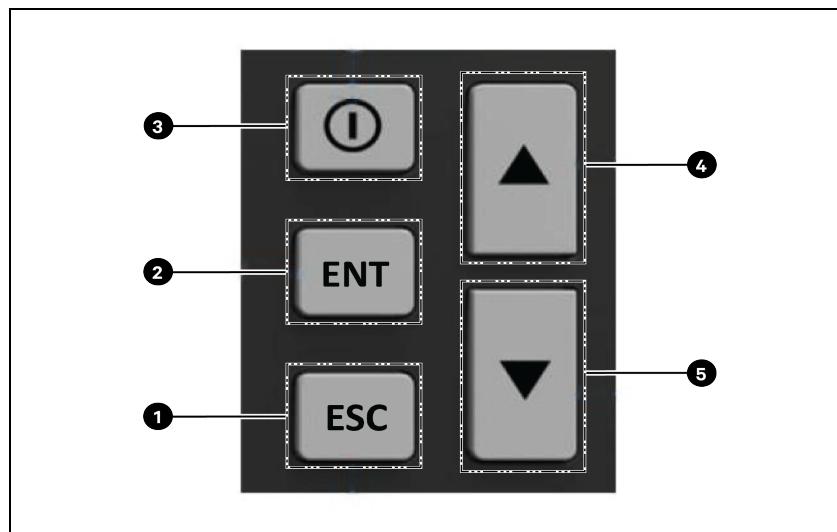


Item	Description
1	Run Indicator
2	Alarm Indicator
3	LCD Screen
4	ON/OFF Button
5	Up Arrow
6	Enter Button
7	Down Arrow
8	Escape Button

6.2 Control Buttons

The micro-processing controller provides five control buttons, as shown in **Figure 6.2** below .

Figure 6.2 Control Buttons



Item	Description
1	Escape Button
2	ENT Button
3	ON/ OFF button
4	Up Arrow
5	Down Arrow

The functions of the control buttons are described in **Table 6.1** below

Table 6.1 Functional Description of the Controller Buttons

Key	Function Description
ON/OFF	Switch on/off the controller by pressing for 3 seconds.
ENT (Enter button)	Enter the selected menu screen. Validate the parameter setting value.
ESC	Exit the current menu and return to the Normal screen or previous menu screen. Abort parameter change; make the audible alarm silent.
Up arrow button	Move the cursor up or increase the parameter value. For a toggle selection: scroll through the options. For a multi-screen menu: scroll up the screen
Down arrow button	Move the cursor down or decrease the parameter value. For a toggle selection: scroll through the options. For a multi-screen menu: scroll down the screen

6.3 ON Screen

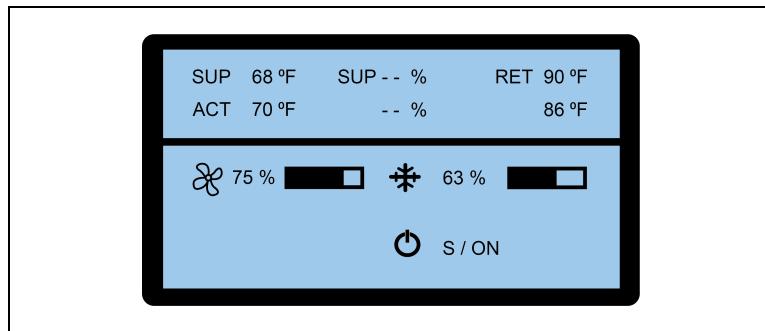
After the unit is powered on, the LCD screen will display the ON screen. You can choose the display board language.

6.4 Normal Screen

After the unit is powered on, the Normal screen will be displayed after 10 seconds, as shown in **Figure 6.3** below .

NOTE: The temperature units of VRC100 and VRC101 are Fahrenheit. And the temperature units of VRC102 is Celsius. The VRC100 is used as an example.

Figure 6.3 Normal Screen



The setting and actual values are displayed in the upper half of the screen related to the settings, actual air supply temperature in the first column, humidity in the second column, and air return temperature in the third column.

The unit output status (fan and cooling) and unit operation status (off, running, standby, and locked) are displayed in the lower part of the screen.

The icons on the main screen indicate the unit output status, unit property, and unit operating status.

6.5 Password Interface

Press the Enter button on the Normal screen to display the Password screen. See **Figure 6.4** below

Figure 6.4 Password Interface



Do not enter password. Press the Enter key four times instead to enter the next interface.

6.6 Unit Working Icons

The icons and their definitions are listed in**Table 6.2** below .

Table 6.2 Description of Icons

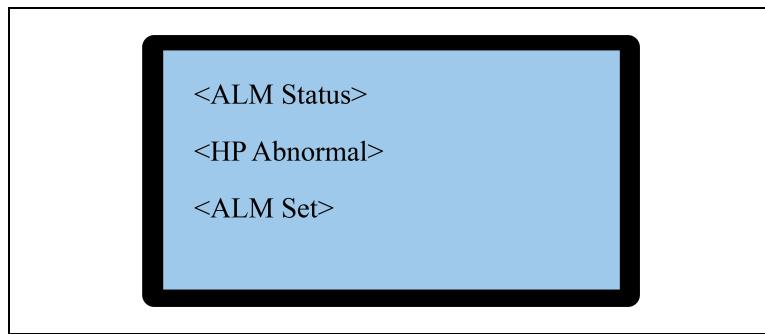
Icon	Description
SUP	Supply air temperature setpoint
ACT	Actual air temperature
RET	Specified return temperature
❄	Cooling, the output of compressor. Displays the percentage of actual compressor capacity
❀	Rotating speed rate of the fan, ranging from 40% to 95%. Displays the percentage of actual fan rotating speed
⟳	Unit attribute/running state. S: standalone; RUN: running; OFF: shutdown. Unit property/operation status. S: single; ON: running; R-OFF: remote shutdown; L-OFF: local shutdown; M-OFF: monitoring shutdown; MANU: manual mode; BKUP: backup; Lock: Alarm lock

6.7 Menu

6.7.1 Alarm Menu

Select Alarm Menu on the Main Menu screen to enter the screen shown in [Figure 6.5](#) below. Press the UP or Down button to scroll up or down the menu items.

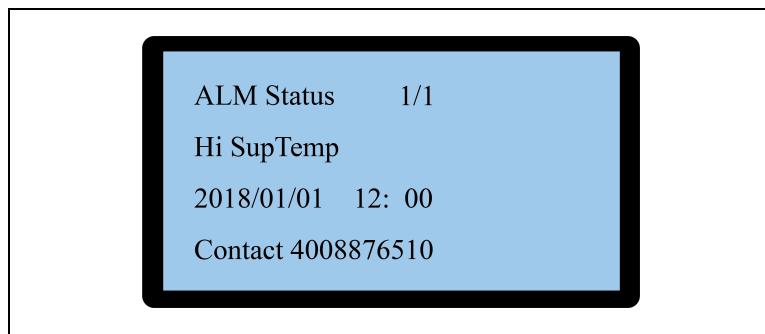
[Figure 6.5 Alarm Menu Screen](#)



6.7.2 Alarm Status

Alarm status menu is used to monitor the current alarm status of the air conditioner unit. It displays no alarm or specific alarm information. The specific alarm information includes XX/YY, alarm type, and alarm generation time, as shown in [Figure 6.6](#) below. XX indicates the alarm serial number (SN), and YY indicates the total number of reported alarms.

[Figure 6.6 Current Alarm Menu](#)



NOTE: The latest alarm SN is the biggest number. Press the Up or Down button to scroll through the alarm status records if more than one alarm is activated. The current alarms are automatically cleared upon system power failure.

6.7.3 Alarm Setup

Enter the alarm setup screen on the Alarm Setup menu. Use the Up or Down key to query menu items. The alarm setup menu includes Alarm Setpoint, System Alarms, and Alarm Handle, as shown in **Figure 6.7** below , **Figure 6.8** below and **Figure 6.9** below . Parameter settings can be saved permanently.

Figure 6.7 Items of the Alarm Value Setup Menu

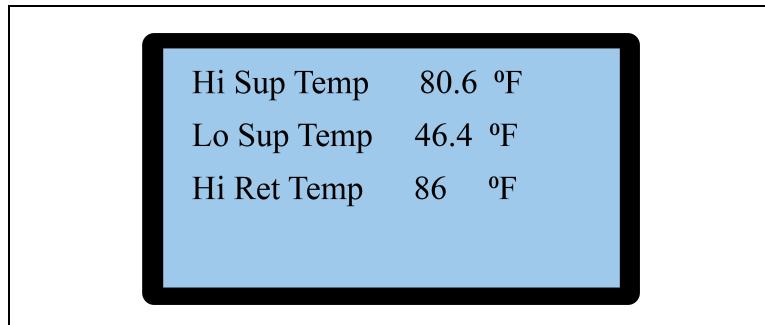


Figure 6.8 System Alarm Setup Menu

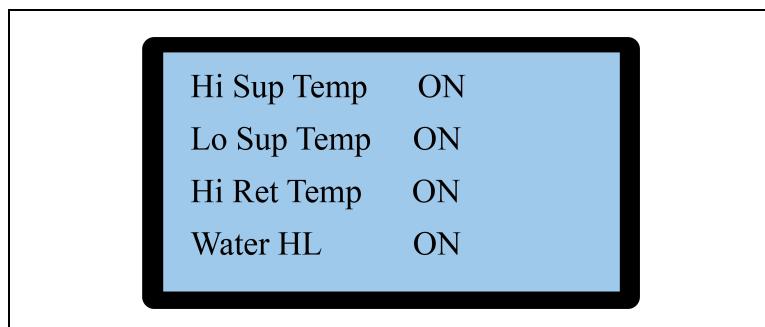
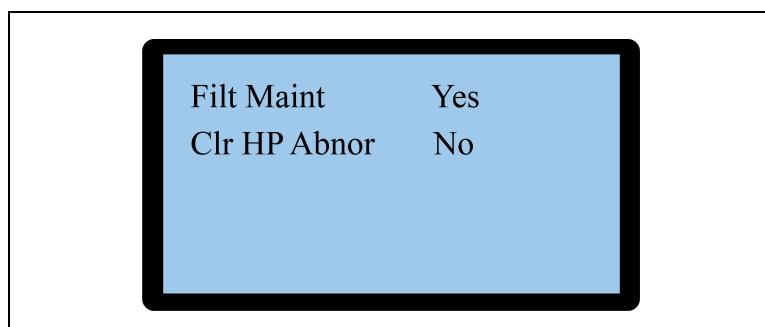


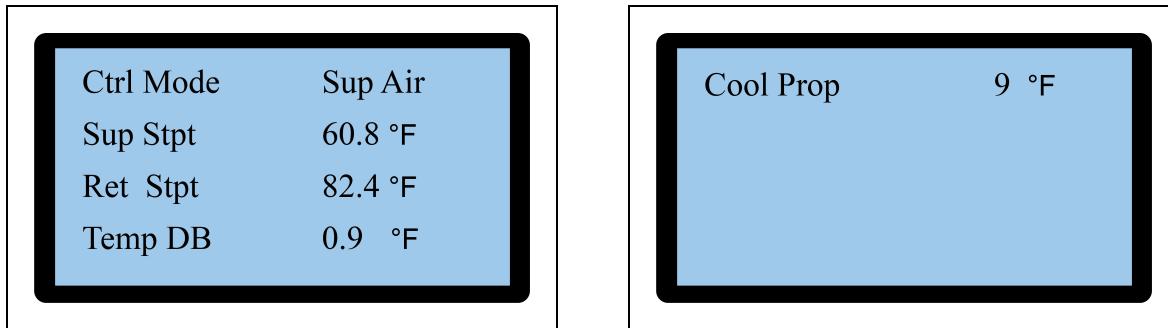
Figure 6.9 Alarm Handle Menu



6.7.4 Temp Set

Select Main Menu > Temp Set and press Enter as shown in **Figure 6.10** below , and the Temperature Setting values will be permanently saved.

Figure 6.10 Temperature and Humidity Set Menu



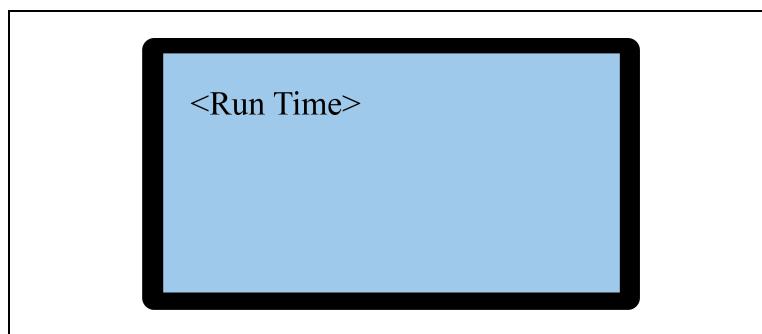
NOTE: The specified temperature value is the target temperature to ensure that the system is running normally.
When the control mode is set to return or supply air, the specified temperature is the temperature of the return air or supply air.

- The default control mode of the unit is supply air control mode.
- If the AC is used in the open rack, use the return air control mode.

6.7.5 System Status

Select Main Menu > System State to enter the System State menu, as shown in **Figure 6.11** below .

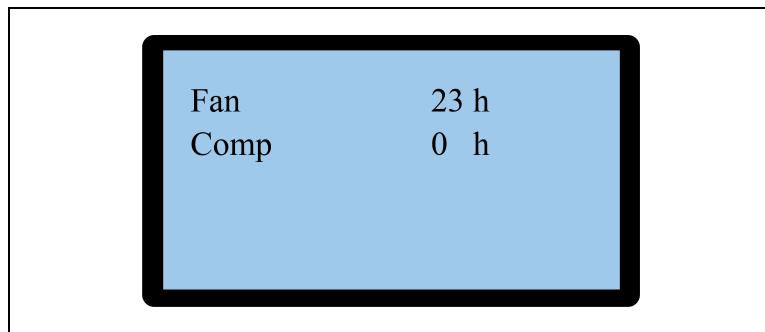
Figure 6.11 System State



6.7.6 Run Time

You can query the operation time of the device on this menu, as shown in **Figure 6.12** below

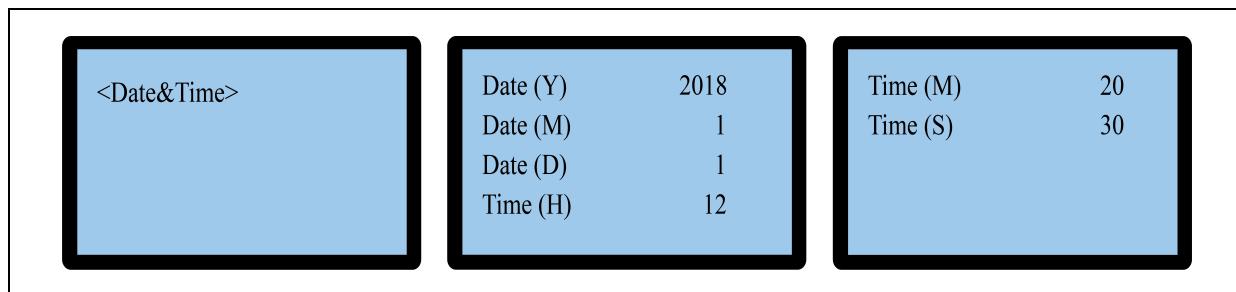
Figure 6.12 Run Time Menu



6.7.7 Help Menu

The menu includes Date and Time information. You can view the relevant information, as shown in **Figure 6.13** below.

Figure 6.13 Date and Time Menu



7 Startup Commissioning

This chapter describes the startup commissioning, including specific operations.

7.1 Preparations Before Commissioning

Mechanical part

- Connect the condensate water drain system piping and inspect for any leakage in the connections.
- Ensure that the unit has at least 30% of the designated head load. If not, use other heating devices that compensate for the heat load to ensure the necessary amount of heat load for commissioning.

Electronic part

- Ensure that the input voltage of the main power supply is within $\pm 10\%$ of the rated voltage and that the power disconnector is closed.
- Ensure that the power cord and the communication cable are segregated from each other.

7.2 Start-up Inspection Checklist

Before powering up the unit, ensure the mechanical and electrical inspections below are properly checked as **Table 7.1** below .

Table 7.1 Start-up Inspection Checklist

Inspection	Items	Remarks
Mechanical Inspection	Verify that the drainage pipe is tightly connected and there are no kinks or blockages in the hose	
Electrical Inspection	Verify that the AC main voltage and frequency are normal. Make sure that the main connection is correct and does not short circuit	
	Make sure that the electrical and control connections are tight	

7.3 System Commissioning

Start up the unit

- Switch on the circuit breaker and connect to utility power.
- Press and hold the 'ON' button on the display board for 3 seconds to power up the unit.
- Pay attention to the controller display to ensure that no alarms and warnings are displayed.
- There will be short vibration when starting or switching off. After running for more than half an hour, ensure the operating status of the compressor, evaporator fan and condenser fan is smooth and that there are no vibrations or any kind of noise from any of these components.
- Observe and monitor whether the system parameters are within the normal range, such as return air temperature and supply air temperature, etc. as per the set operational functionality.

Table 7.2 System Parameters Normal Range

Item	Range
Suction Pressure (Gauge)	700 kPa to 1500 kPa (116.0 psig to 217.6 psig)
Discharge Pressure (Gauge)	2000 kPa to 3600 kPa (290.1 psig to 522.1 psig)
Discharge Temperature	40 °C to 115 °C (104°F to 239°F)
Supply air Temperature	13 °C to 28 °C (55 °F to 82 °F)

- If any abnormal operation is noticed, stop the unit by pressing the 'ON/OFF' button on the display board for 3 seconds, and disconnect all air circuit breakers.

7.4 Commissioning Complete Inspection

Inspect the items in **Table 7.3** below , Checklist after Commissioning.

Table 7.3 Checklist After Commissioning

Inspection Items	Inspection Results
Check that all outputs are functional	
Check that the temperature settings are correct and are controlled within range	
Check that there are no abnormal alarms or warnings displayed on the controller	
Make sure all the other functions are set correctly	

8 System Operation and Maintenance

Periodic system maintenance is crucial to ensuring product reliability and validity. This chapter describes the operation and maintenance of the precision air conditioner, including routine maintenance, system diagnostic testing, and maintenance of filters, fan components, refrigeration systems and drainage systems.

8.1 Safety Instructions



WARNING! During the operation of the precision air conditioner, very high voltage may be present in the equipment. Adhere to all of the notes and warnings marked on the equipment or contained in this manual, which may otherwise lead to an injury or fatality.



WARNING! Only qualified maintenance personnel can operate and handle the equipment. All maintenance and operation must follow the local laws, especially the regulations about the electric power, refrigeration, and production.



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



WARNING! Risk of hair, clothing and jewelry entanglement with high speed rotating fan blades. Can cause equipment damage, serious injury or death. Keep hair, jewelry and loose clothing secured and away from rotating fan blades during unit operation.



WARNING! Risk of contact with extremely hot and/or cold surfaces. Can cause injury. Verify that all components have reached a temperature that is safe for human contact or wear appropriate, OSHA-approved PPE before working within the electric connection enclosures or unit cabinet. Perform maintenance only when the system is de-energized and component temperatures have become safe for human contact.



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



CAUTION: Comply with the manufacturer's instructions before and during maintenance. Failure to observe this will result in the warranty becoming void. Adherence to the safety instructions is mandatory to ensure personnel safety and prevent any environmental impact apart from equipment damage. Unsuitable components will impede equipment performance and may cause equipment shutdown. Therefore, Vertiv recommends the use of Vertiv OEM or Vertiv-approved components.



CAUTION: Switch off the VRC1 unit and then switch off the power input during equipment maintenance.
Switch off the equipment power unless the testing devices need power.

8.2 Electrical Inspection

Inspect the control board and temperature sensor every 6 months for loose electrical connections and circuit corrosion.

The steps to inspect the boards are as follows:

- Firmly tighten all the electrical contacts.
- Clean the electrical and control components with a brush or by using compressed dry air.

8.3 Main Components Maintenance

8.3.1 Evaporator Fan

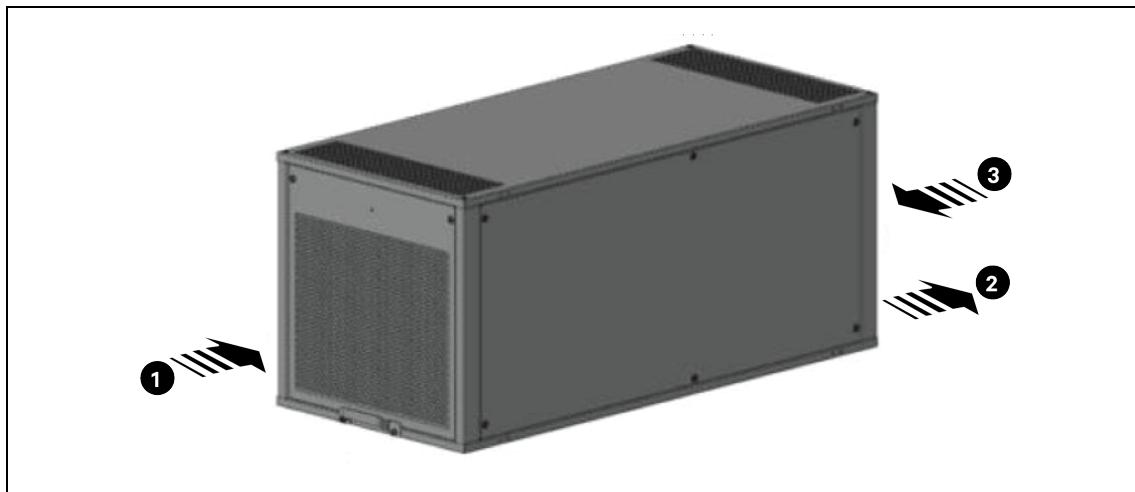
Since the fan operates 24/7 throughout the year, any unusual airflow obstruction must be cleared in time to avoid damage to the cooling system and other system components caused by reduced air volume.

8.3.2 Air Cooled Condenser

There are times when the airflow through heat rejection unit is restricted. In such a scenario, use compressed air to clean the dust and debris that inhibits airflow off the condenser. The compressed air should be blown in the reverse airflow direction.

8.3.3 Compressor

Figure 8.1 Condenser Airflow Direction



Item	Description
1	Condenser Air In
2	Condenser Air Out
3	Reverse Air Flow Direction



CAUTION: Avoid touching or having skin contact with the residual gas and oils in the compressor. Wear long rubber gloves to handle contaminated parts. The air conditioning system contains refrigerant. The release of refrigerant is harmful to the environment.

The compressor faults can be categorized into two types:

- Motor faults (such as winding burnout, insulation failure, short circuit between coils, etc.)
- Mechanical faults (such as compressor failure, relief valve faults, etc.)

If the operating pressure is not established, it means that the compressor has failed. Confirm that the suction pressure and discharge pressure are balanced and verify that the motor does not rotate in reverse. The controller is streamlined with capabilities like powerful alarm and protection functions to ensure safe operation of the compressor. Periodic checks of high pressure and low pressure along with alarm protection for such pressure-related issues should be carried out by maintenance personnel on a regular basis to rule out discrepancies.

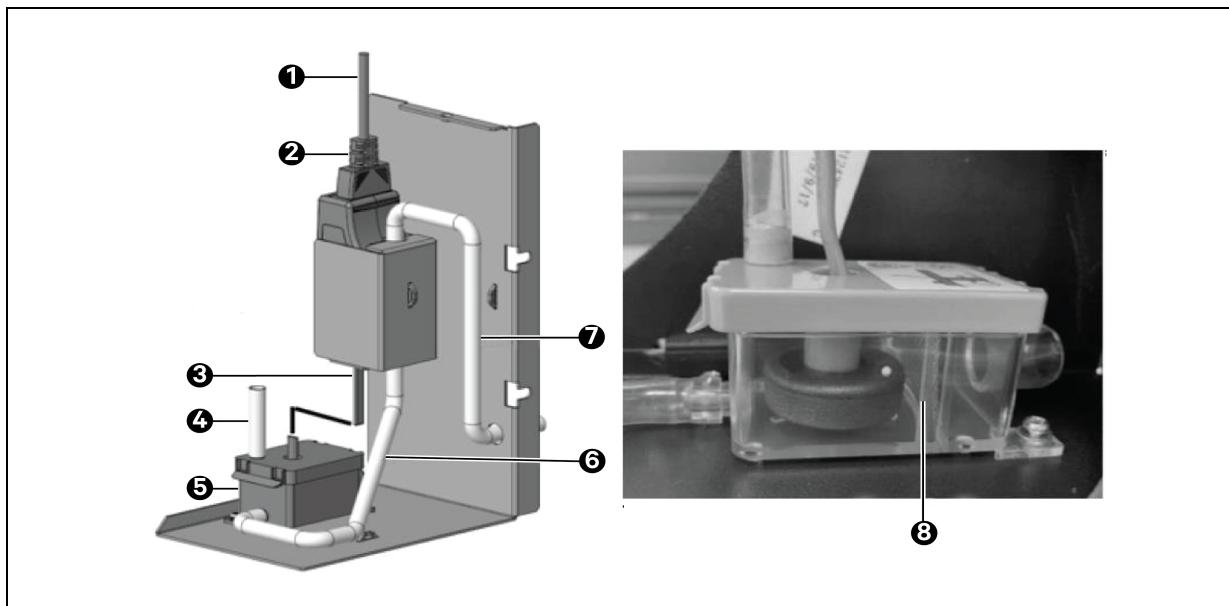
Table 8.1 VRC1 Series

VRC1 Series		
Date		Prepared by
Model		Serial number
Type	Maintenance Components:	Item Result
Monthly	Filters	Check for restricted air flow
		Check the filter cleanliness
		Clean the filter
	Evaporator fan and condenser fan	Check if fan blades are distorted
		Check if the fan generates noise during operation
	Compressor	Signs of oil leakage
		Check if the compressor vibrates or makes noise during operation
		Suction pressure
	Refrigerant system	Discharge pressure
		Superheat
Semi- annually:	EEV electric board	Check if the wiring and coil of the electronic expansion valve control board are loose
		Check electrical connections
		Check the surface for signs of corrosion

8.3.4 Drain Pipe

Inspect the drain pipe for normal operation every 6 months.

Ensure no pipe buckling is present. If the pipe buckling happens, the new pipe should be used. Ensure that reservoir, pump filter and inlet tube are free of sludge and debris. If not, please clean it.

Figure 8.2 Condensate Pump Kit

Component	Inspection Items	Remarks
Pump Filter	Check if filter is clogged or damaged	
	Clean the filter	
Pump Pipes	Check if the pipes are loose	
Drainage Pump	Check if there are impurities and debris in the water tray	
	Check the drain pump connection line for clogging	
	Check if the cable of the drain pump is loose	

8.4 Maintenance Inspection Checklist

Periodic system maintenance is crucial to ensuring product reliability and validity. This chapter describes operation and maintenance of the precision air conditioner, including routine maintenance, system diagnostic testing, and maintenance of filters, fan components, refrigeration systems and drainage systems.

Component	Inspection Items	Remarks
(2 VRC filters; 1 pump filter; 1 ceiling tile filter)	Check if filter is clogged or damaged	
	Check if the unit prompts for filter maintenance	
	Clean the filter	
Fans	Check if fan blades are distorted	
	Check if the fan generates any noise during operation	
	Check if the fan stopped rotating	
	Check and fasten the circuit connector	
Electronic Expansion Valve	Check if the wiring and coil of the electronic expansion valve control board are loose	

Component	Inspection Items	Remarks
Cooling Circulation System	Check the cleanliness of the evaporator surface	
	Check if the refrigeration pipe has leakage and proper support	
	Check if refrigerant is filled into the system	
Electrical Control Part	Check and fasten the circuit connector	
	Check if the cables and meter reading of each sensor are within prescribed range	

8.5 Monthly Routine Inspection Items

Check the system components monthly especially the system function and component wearing symptoms, and the inspection items shown in **Table 8.2** below

Table 8.2 Monthly Routine Inspection Items

Component	Inspection Items	Remarks
Filters (2 VRC filters; 1 ceiling tile filter)	Check if filter is clogged and damaged	
	Clean the filter	
Fans	Check if the fan generates any noise during operation	
	Check if the fan has stopped rotating	
Drainage	Check that the drain pipe is unblocked, no pipe buckling is present, and the pump works normally	

8.6 Routine Inspection Items (Semi-annually)

See **Table 8.3** below for the routine semi-annual maintenance items.

Table 8.3 Routine Maintenance Items Every Half a Year

Components	Item	Remark
Pump Filter	Check for clogging or damage	
	Clean the filter	
Fans	The Fan blades are not distorted Check if the fan generates any noise during operation Check and fasten the circuit connections	
Compressor	Check for leakage	
	Check if the compressor vibrates or makes noise during operation	
	Check and fasten the circuit connections	
Condenser	Check the cleanliness of the fins The fan base should be firm The fan vibration absorber is not deteriorated or damaged The temperature switch is set at the required position The refrigerant pipes are properly supported Check and fasten the circuit connections	
Refrigeration System	Check the suction pressure	
	Check the discharge pressure	
	Check the superheat	
	Check the refrigerant pipes	
Electric Control Part	Check the fuse and the MCB Check and fasten the circuit connections Check the control program	

8.7 System Diagnosis Testing

The microprocessor controller supports the manual mode and provides diagnostic functions such as manually enabling and disabling parts. Such functions can be used to detect the states of the system functional parts.

8.8 Electrical Maintenance

Check the appearance of the electrical connections and follow the steps below.

- Switch off the VRC1 unit and then switch off the power input during the equipment maintenance. Switch off the equipment power unless the testing devices need power.
- Conduct overall electrical insulation test: find out the non-insulated contacts and rectify them with proper insulation covering.
- Check that the power cord has been unplugged before the test because high voltage may damage the control components.
- Clean the dust from the electrical panel and control panel boards by using a brush or blowing low pressure dry compressed air.
- Properly fasten all the electric connection terminals.
- Check that the sockets and plugs are in good condition. Replace the loose ones with new sockets and plugs.
- If the power cables are damaged, the cables must be replaced by professional personnel to avoid any non-standard installation practices.

8.9 Controller Connections Maintenance

Check the appearance of the controller and follow the steps below.

- Check the appearance of the power module and measure the output voltage.
- Check if the surface of the control interface board, control board, temperature NTC and electronic expansion valve control board show any signs of aging or wear and tear.
- Clean up dust and dirt from the electrical control components and control board with a brush using an electronic dust cleaning agent.
- Check and fasten the input and output connectors of the control interface boards, including the control board, interface board, temperature NTC, and electronic expansion valve control board.
- Check if the contact and connection of the fan power cable, signal cable, and rotating speed feedback signal cable are firmly fixed.
- Check if the interconnection terminals between the control interface board and the temperature or pressure sensor are firmly connected. If they are loose, faulty or have a bad connection immediately replace the interconnection terminal.
- Replace the faulty electrical components such as the control fuse (or air breaker) and control board.
- Use a high-precision temperature measurement meter to measure and calibrate the reading of the temperature sensor.
- Adjust the set points. Check the motion of each functional component according to the control logic.

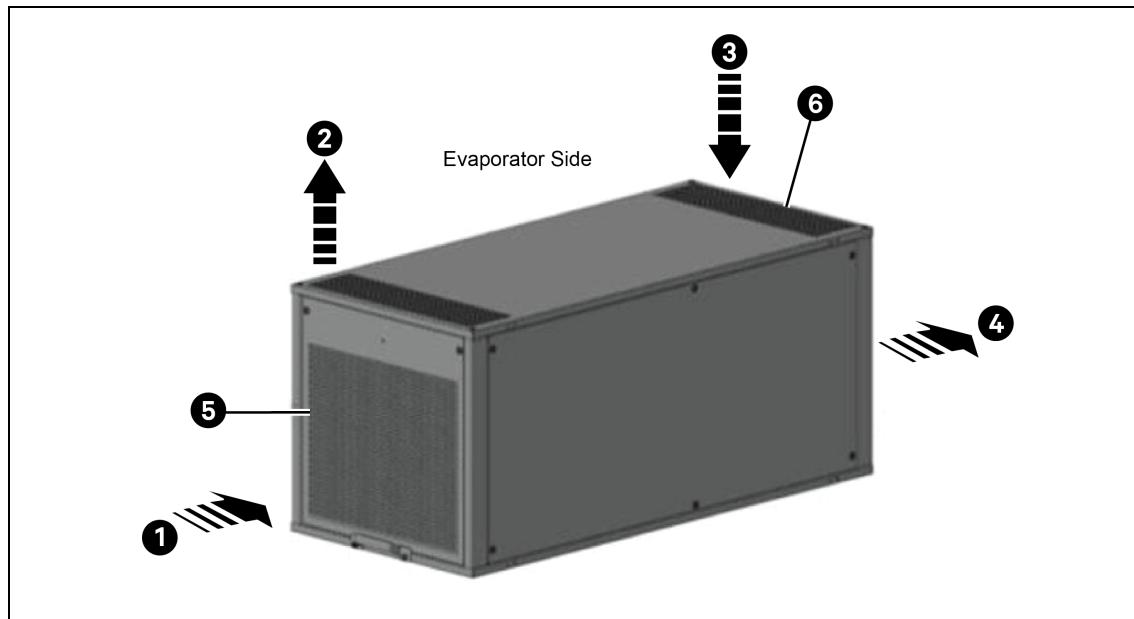
8.10 Filters Maintenance Guidance

8.10.1 VRC filters

There are two filters for each unit. A filter net is mounted on the condenser air inlet side (PN: 02560118). And another is mounted on the return air side (PN: 02560155). To ensure the normal operation of the filter, the filter service alarm logic is provided by the controller. The default fan running time is 2000 hours (settable according to the local running environment), when the time is exceeded, the filter service alarm is triggered. The filter needs to be replaced based on its clogged condition. The filter must be checked once a month and be replaced as required during operation. If the VRC unit is used in a dirty environment, please check the filter once a week.

8.10.2 Pump filter

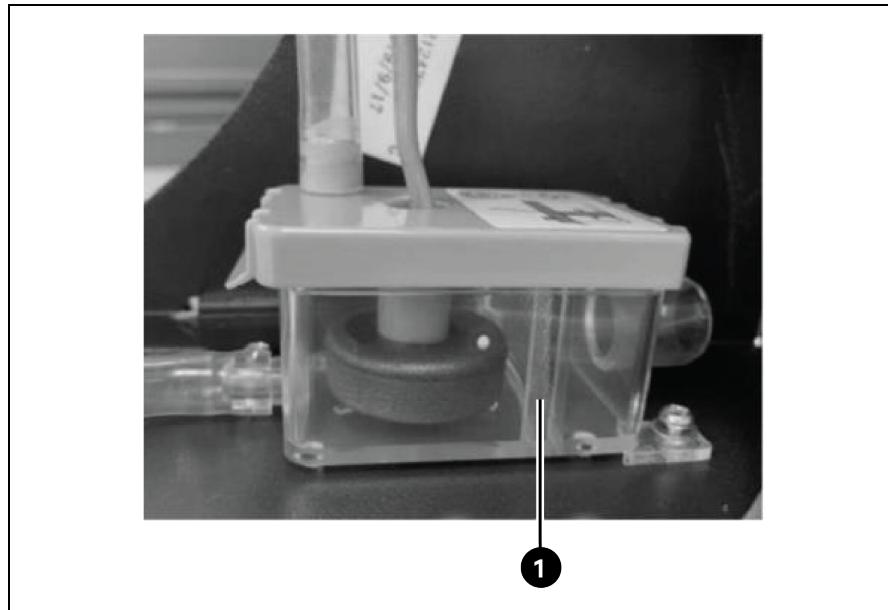
Figure 8.3 VRC Filters



Item	Description
1	Condenser Air In
2	Supply Air
3	Return Air
4	Condenser Air Out
5	Filter 1
6	Filter 2

There is a filter in the pump reservoir. Inspect it every 6 months.

Figure 8.4 Pump Filter

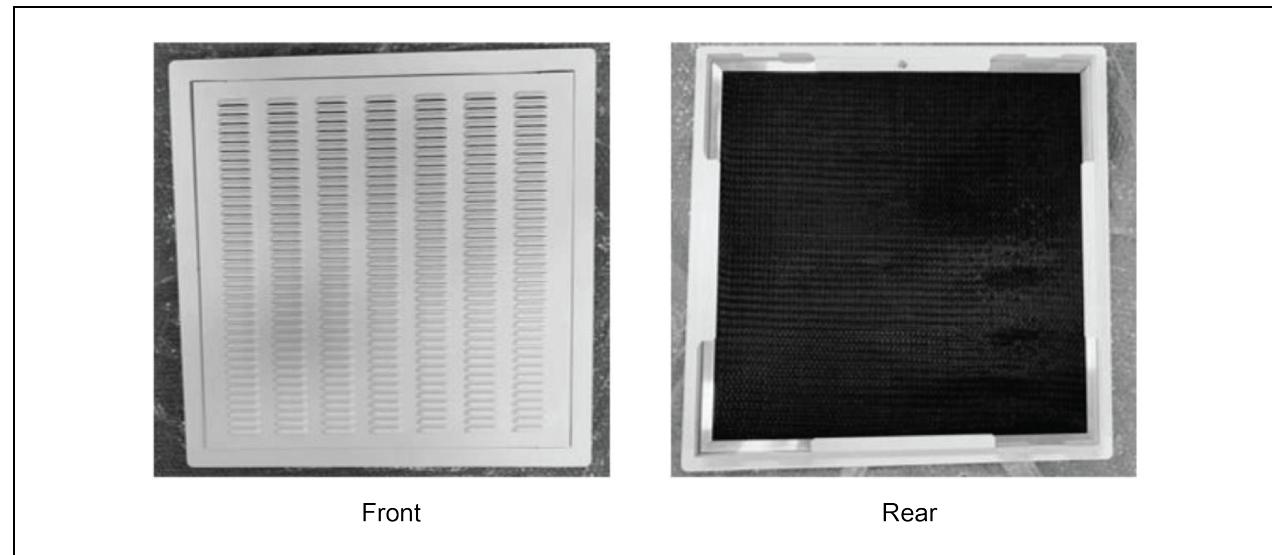


Item	Description
1	Pump Filter

8.10.3 Ceiling Tile Filter

The ceiling tile filter is installed in the ceiling tile for filter pad. It needs to be checked once a month.

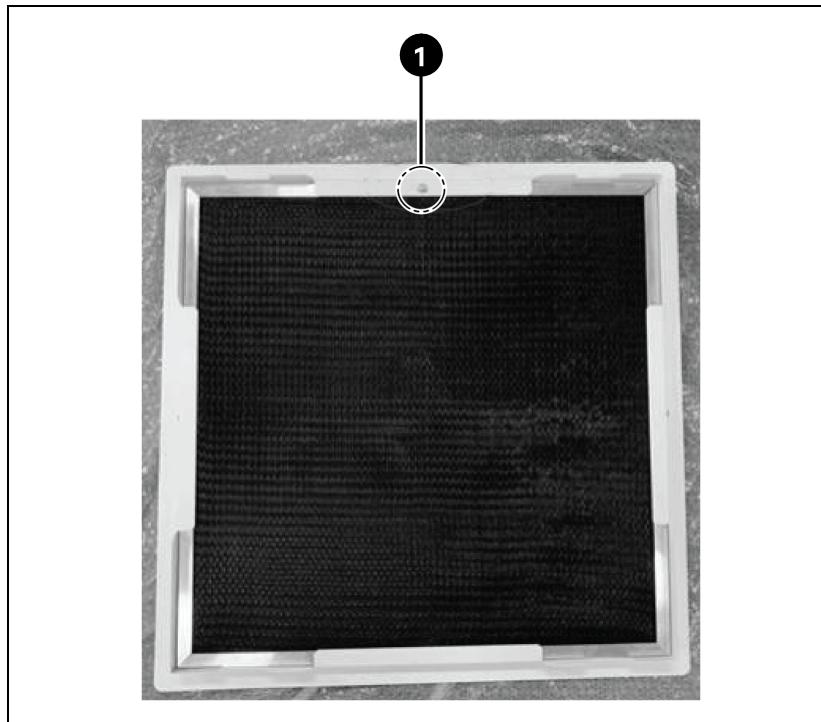
Figure 8.5 Ceiling Tile for Filter Pad



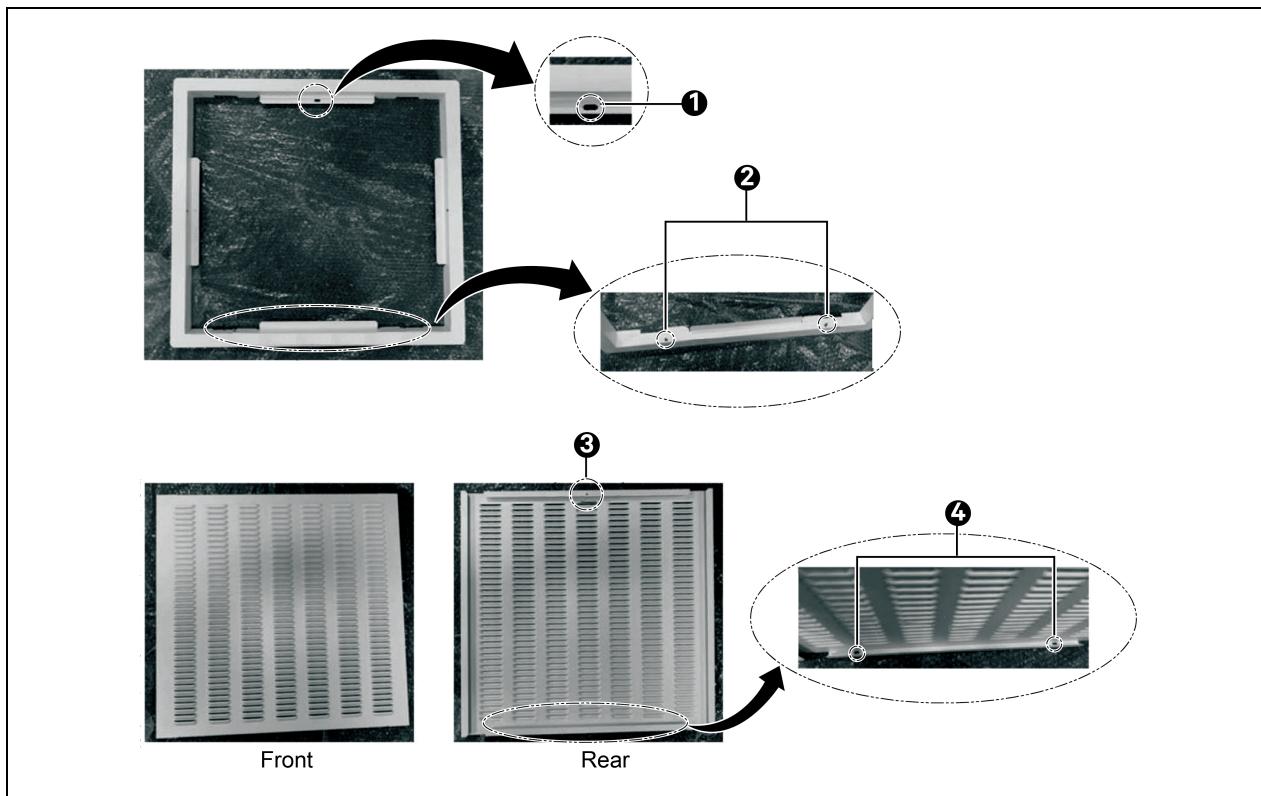
Uninstalling the Ceiling Tile Filter

The ceiling tile filter pad consists of 3 parts, 2 sheet metals and 1 ceiling tile filter. The ceiling tile filter is fixed by 2 sheet metals. Loose the M5 screw and the filter can be uninstalled.

Figure 8.6 Loose the M5 screw



Item	Description
1	M5

Figure 8.7 Sheet Metals of the Ceiling Tile for Filter Pad

Item	Description
1	Through hole for M5 screw
2	Two limit columns
3	M5 screw threaded hole
4	Two limit holes

8.11 Maintenance Guidance for Fan Kit

- Periodic inspection covers the state of the fan impellers, fastening of fan components, abnormal fan noise, and fan cable connection.
- Pay close attention to assess whether the fan kit and impeller are properly fixed, and the rotation of the fan blade does not physically interfere with other components. Ensure that the air discharge path is free from any obstacles to the airflow.
- If the EC fan cannot rotate, check the analog signal cable, rotating speed feedback cable, power module power cable, and the power module.
- Do not operate the fan during maintenance to avoid injury to the operator or damage to the fan blades.
- During the unit operation, do not touch the fan cover as the fan rotation may cause mechanical damage.

8.12 Cooling System Maintenance

The cooling system components must be inspected monthly for abnormalities in the operation which can cause abrasions due to continuous operation. As the failure or damage of components is usually accompanied by corresponding faults, check regularly to prevent system faults.

The surface of the evaporator coil should be kept clean and have no rupture.

The major reasons for electronic expansion valve failure are related to electrical failure and/or mechanical failure. The electrical failure may be attributed to the failure of the power supply of the electronic expansion valve control panel and coil, loosely connected control board wiring, and pressure and temperature sensor failure. The mechanical failure may be caused by blockage in the refrigerant flow in an electronic expansion valve. Therefore, when the electronic expansion valve is faulty, pay close attention to the control panel power supply, control board wiring, pressure and temperature sensor wiring or the valve itself.

NOTE: It is not recommended to adjust the electronic expansion valve without prior permissions.

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9 Troubleshooting

This chapter introduces the failure diagnosis and troubleshooting and can be used together with the alarm section in [Controller Operation Instructions](#) on page 53



WARNING! Certain circuits carry lethal voltages. Only professional technicians are allowed to maintain the unit. Extra precautions should be taken when troubleshooting a live unit. Be particularly careful troubleshooting with the unit's power switched on.



WARNING! If jumpers are used for troubleshooting, make sure to remove the jumpers after troubleshooting. If the connected jumpers are not removed, they may bypass certain control functions causing damage to the equipment.

9.1 Fan Troubleshooting

Fan troubleshooting is listed in **Table 9.1** below.

Table 9.1 Fan Fault Diagnosis and Handling

Symptom	Probable Causes	Check Items and Handling Methods
EC fan cannot be started	The circuit breaker is open	Check if the fan circuit breaker is closed
	Fan power module failure	Check the Fan power module alarm indicator to see if the control board fails
	The cable is faulty	Check if the cable from the main control board, fan fault detection board, or power module to the control terminal bar is firmly connected. Check if the cable from the control terminal bar to the plug wire terminal of the fan is firmly connected

9.2 Fault Diagnosis and Handling of Electronic Expansion Valve

As a key component for refrigerant system and cooling capacity adjustment, the electronic expansion valve is important. **Table 9.2** below describes the fault diagnosis and handling methods.

Table 9.2 Fault Diagnosis and Handling Methods

Symptom	Probable Causes	Check Items and Handling Methods
The adjustment of the electronic expansion valve is faulty.	The temperature sensor or pressure sensor is faulty.	Check if the sensor cable is firmly connected. Check if the sensor cable position on the control board is correct.
	The control board is powered off.	Check if the output fuse of the transformer has tripped/broken. Check if the input power of the control board of the electronic expansion valve is a 24 V power supply.
	The cable connection of the control board is faulty.	Check if the communication cable between the electronic expansion valve control board and the main control board is properly connected. Check if the valve cable connection on the control board of the electronic expansion valve is faulty.

9.3 Fault Diagnosis and Handling of the Air Conditioning System

When the air conditioning system component is faulty, identify the causes and tackle the problem to ensure normal operation of the unit. **Table 9.3** below describes the major faults and troubleshooting methods.

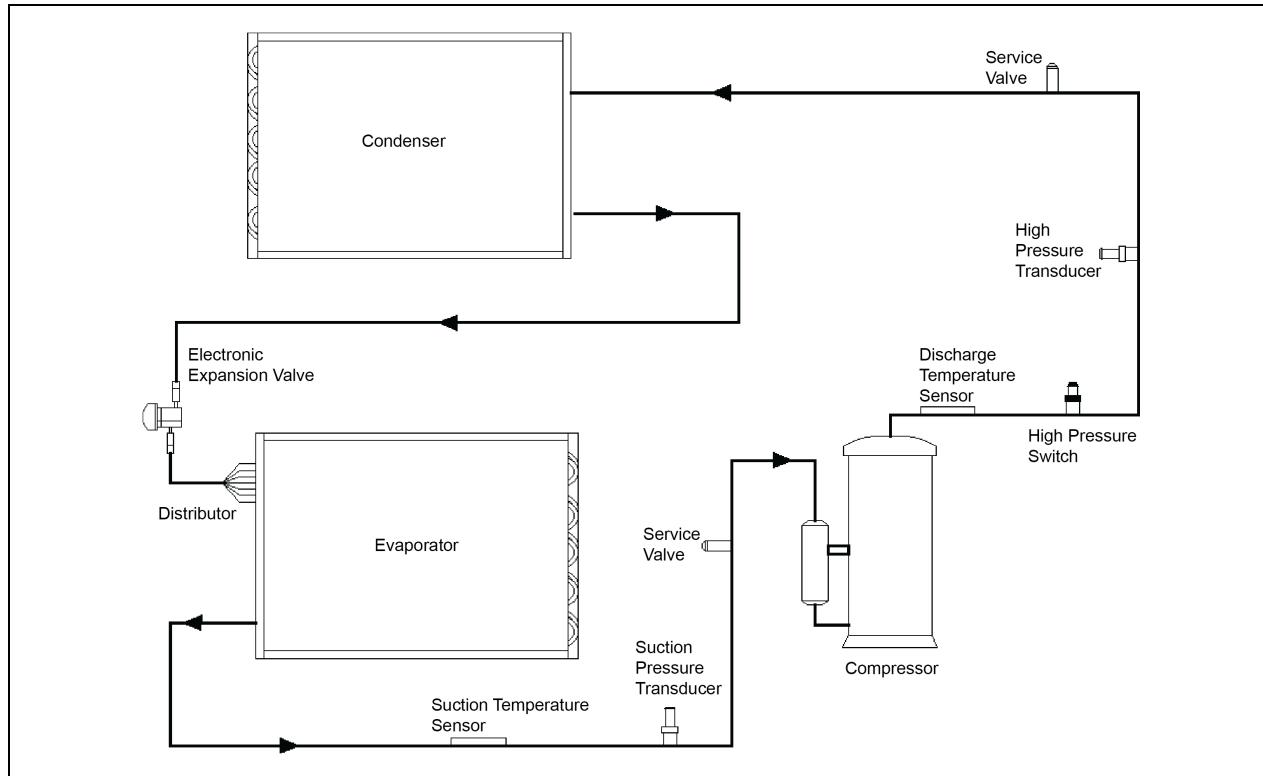
Table 9.3 Refrigeration System Faults and Troubleshooting Methods

Symptom	Probable Causes	Check Items and Handling Methods
The surface of the evaporator has serious condensation	Check if the surface of the evaporator is blocked with debris	Check the surface of the evaporator. Blockage may result in uneven discharge of the condensate water
Air volume decrease	The air filter is blocked The fan is faulty Blockage of the evaporator	Periodically check the filter and replace it in a timely manner to avoid reduction in air volume due to blockage Check if the fan is faulty. Table 9.1 on the previous page describes the diagnosis and handling methods Check the surface of the micro-channel evaporator and periodically handle the blockage problem

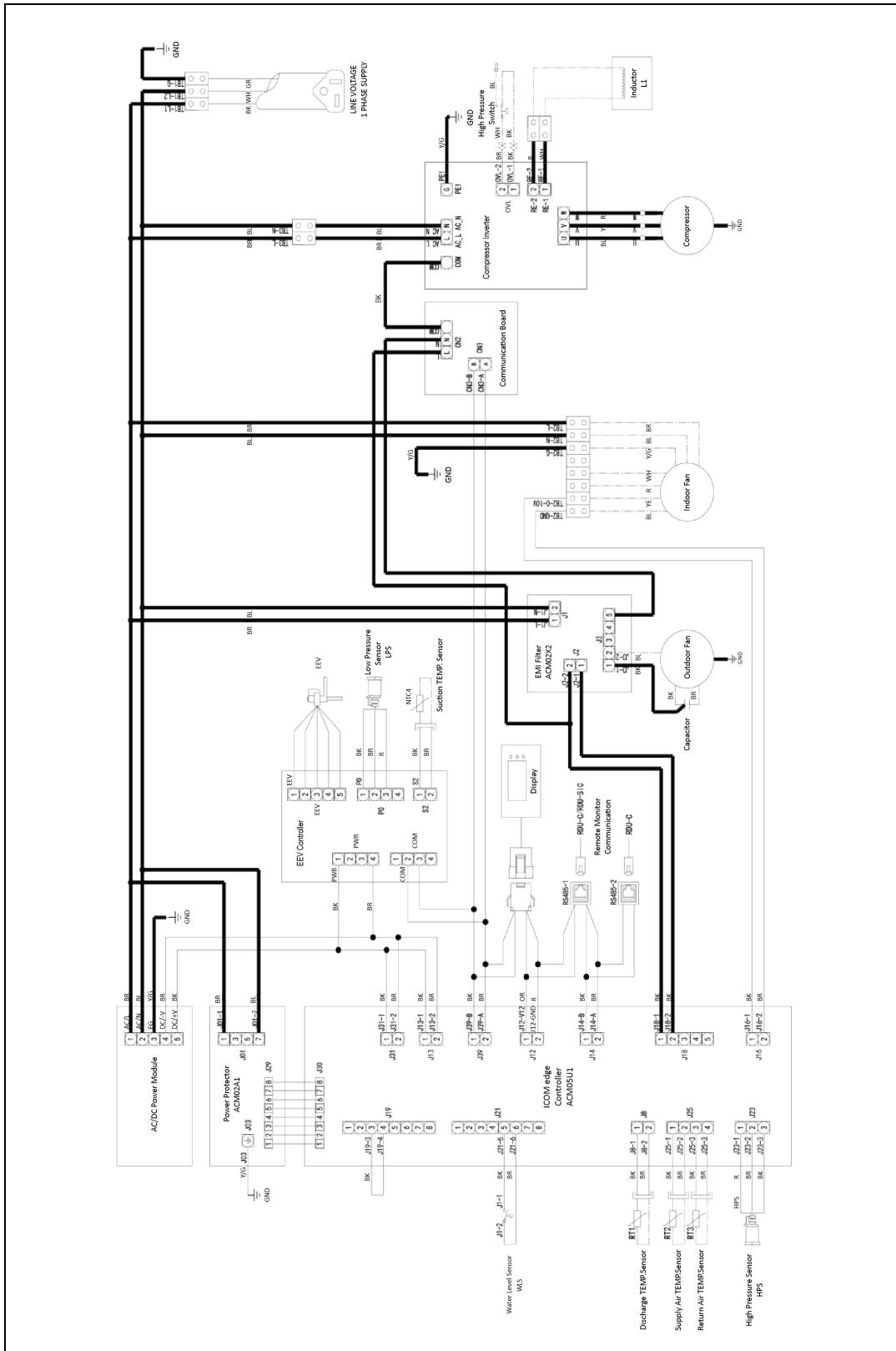
10 Appendices

Appendix A: Diagrams

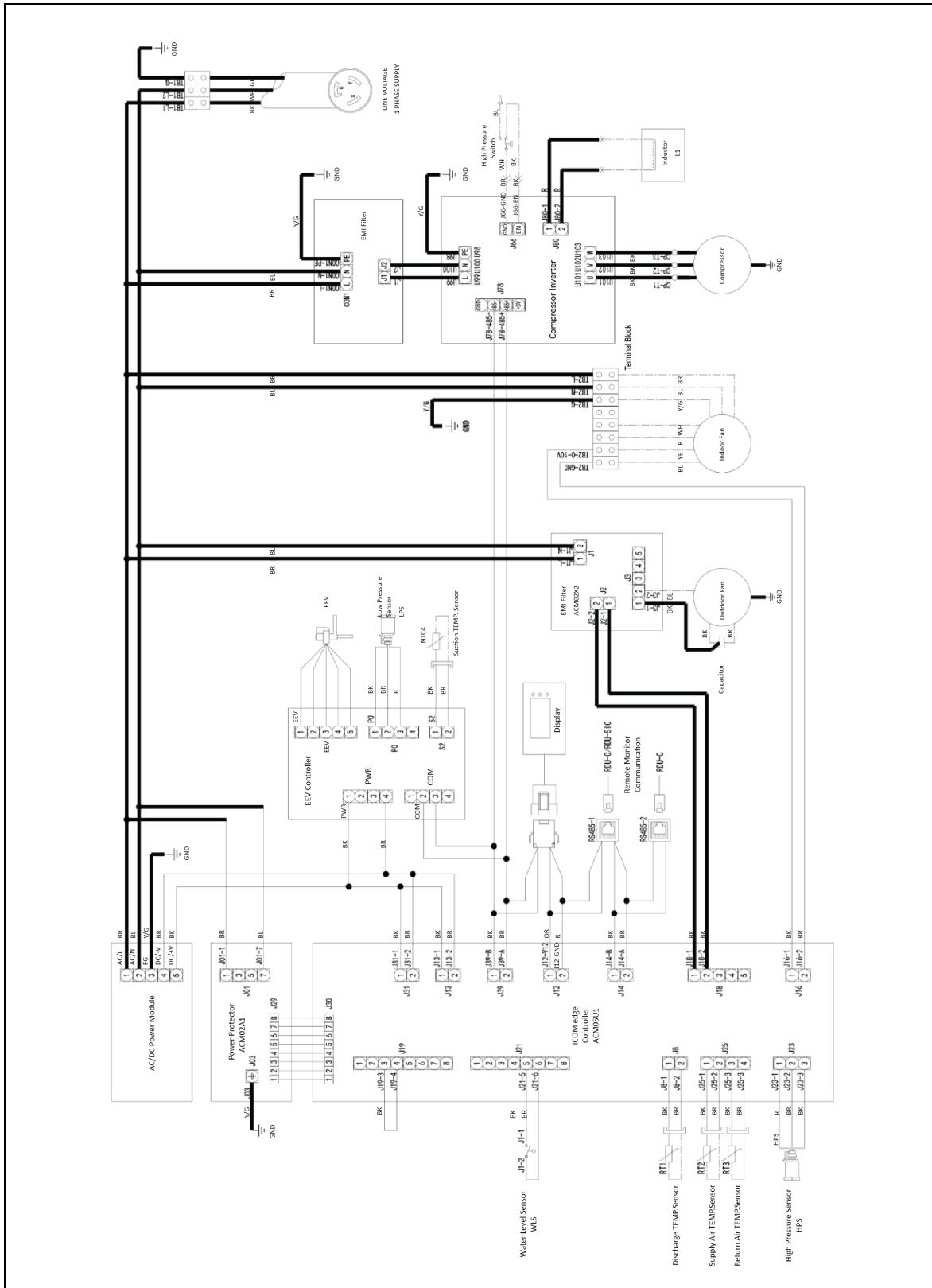
A.1 System Diagram



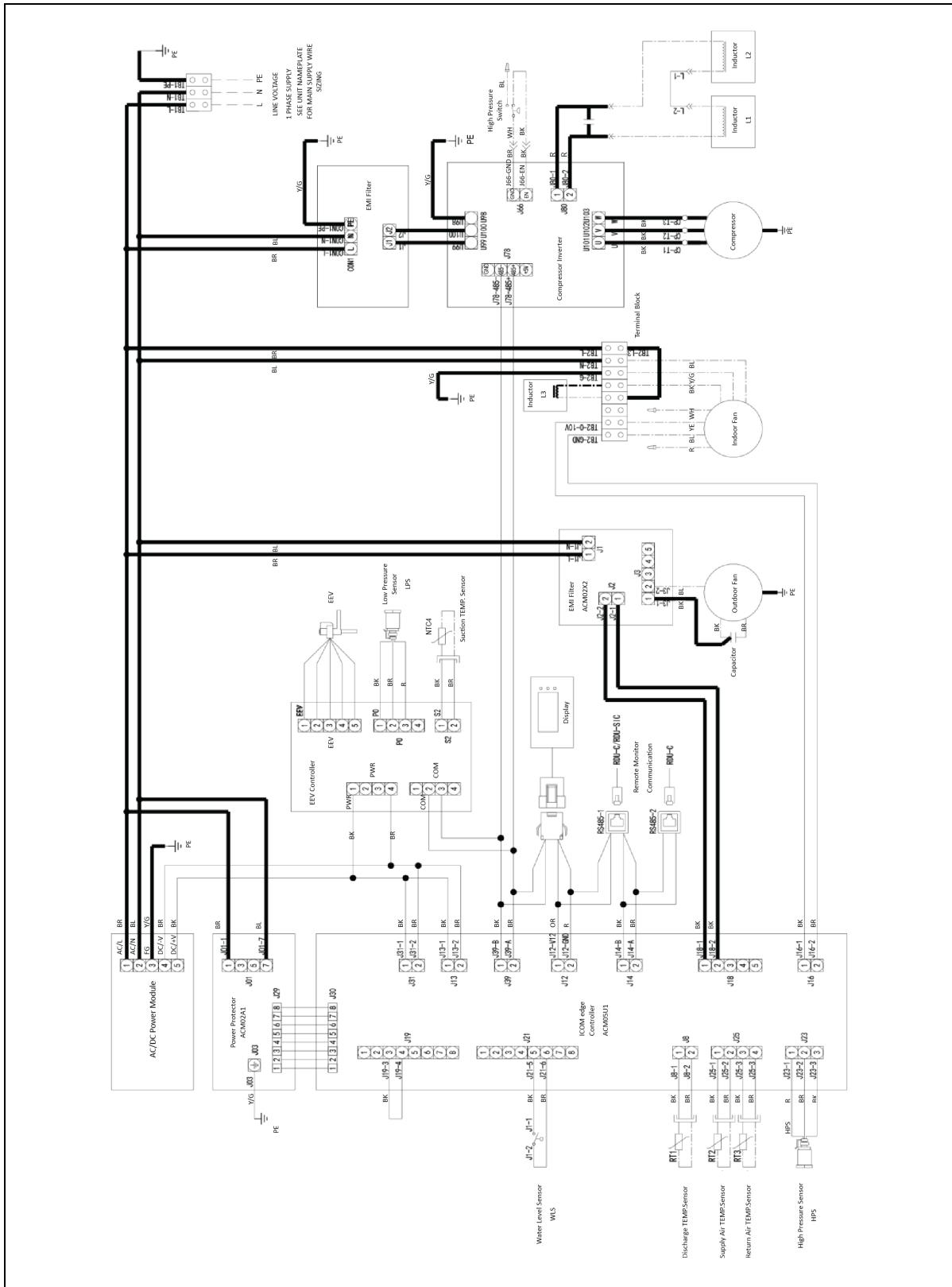
A.2 Wiring Diagram (VRC100 Unit)



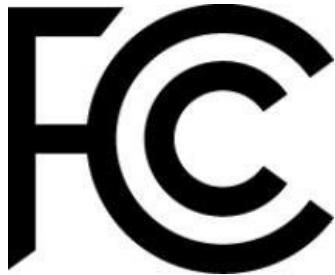
A.3 Wiring Diagram (VRC101 Unit)



A.4 Wiring Diagram (VRC102 Unit)



Appendix B: Suppliers Declaration of Conformity



Unique Identifier: VRC100, VRC101

Party Issuing Supplier's Declaration of Conformity

Vertiv Group Corp. 1050 Dearborn Driver Columbus, OH, US

Customer service hotline: 1-800-LIEBERT (1-800-543-2378)

FCC Compliance Statement (for products subject to Part 15)

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Appendix C: Technical Support Contact

Australia: 1300 367 686; 1800 065 345

Austria, Benelux, Czech Republic, France, Germany, Hungary, Italy, Ireland, Poland, Russia, South Africa, Spain, Sweden, Switzerland, UK : 80011554499

Bahrain: 390499717744

Croatia: 800989019

Egypt 390499717744

Ghana: 242426263

Greece: 80044146622

Indonesia: 0817 988 2288; 021 251 3003

Malaysia: 19 211 1668; 3 7884 5000

New Zealand: 1300 367 686; 1800 065 345

Nigeria: 7080601125

Qatar: 800100439

Romania: 800477000

Saudi Arabia: 8008446628

Singapore: 64674218; 64674218

Turkey: 800448826888

UAE: 800035702985

United States: +1 800 543 2378; +1 800 543 2778; +1 800 222 5877

Other Countries in Europe, the Middle East, and Africa: 49872327750

Website: www.VertivCo.com

For Technical Support, please contact the nearest Vertiv local sales office or service center.

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