VRC Split System

User Manual

VRC2 and VRC3 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/ or https://www.vertiv.com/en-emea/support/ for additional assistance.

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1 Important Safety Instructions

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

Only qualified personnel should move, install or service this equipment. Any operation that requires opening doors or equipment panels must be carried out only by properly trained and qualified personnel.

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

To identify the unit model and serial number for assistance or spare parts, locate the identification label on the unit. A warning label on the front and back panels reminds users that:

- the unit restarts automatically.
- the main switch must be opened before opening the internal compartments for any 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! The components of the unit are comparatively large and heavy. Therefore, there may be a risk when the containment collapses. The collapse may result in physical injury, fatality and damage to the equipment.

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.

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.

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

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: 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.

CAUTION: 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.

CAUTION: 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.

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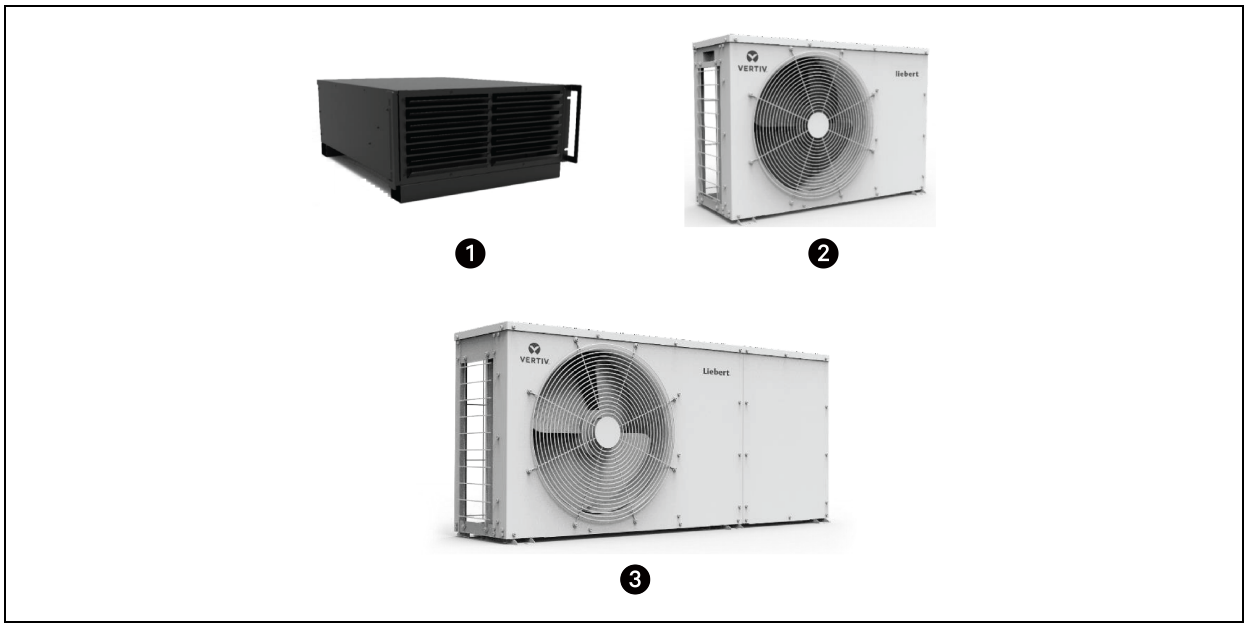
2 Product Overview

Vertiv™ VRC split system contains the VRC2 evaporator and the VRC3 condensing unit. It is designed for 480 mm (19 in.) 2-post and 4-post racks. The VRC2 evaporator is installed at the bottom of the rack or on the ceiling. The VRC3 condensing unit is installed in the outdoor environment.

Figure 2.1 Appearance of the VRC Split System



Item	Description	Item	Description
1	Evaporator	3	Low ambient condensing unit
2	Standard condensing unit		

2.1 Model Nomenclature

Table 2.1 VRC Split System Model Number Digit Definitions

Digit	Variable	Description of Variable
1	VRC	Vertiv™ Rack Cooler
2		
3		
4	2, 3	2 = Split System Evaporator 3 = Split System Condensing Unit
5	0, 5	0 = Standard Unit 5 = Low Ambient Unit
6	0, 1, 2	0 = 120 V, 1 Ph, 60 Hz 1 = 208/230 V, 1 Ph, 60 Hz 2 = 230 V, 1Ph, 50/60 Hz

Table 2.2 Model Description

Model	Power Supply	Description
VRC200	120 V, 60 Hz	Evaporator, 3.5 kW, 120 V
VRC300	208/230 V, 60 Hz	Condensing unit, 3.5 kW, 208/230 V for compressor and 120 V for condenser fan
VRC350	208/230 V, 60 Hz	Low ambient condensing unit, 3.5 kW, 208/230 V for compressor and 120 V for condenser fan
VRC201	208/230 V, 60 Hz	Evaporator, 3.5 kW, 208/230 V
VRC301	208/230 V, 60Hz	Condensing unit, 3.5 kW, 208/230 V for compressor and 208/230 V for condenser fan
VRC351	208/230 V, 60 Hz	Low ambient condensing unit, 3.5 kW, 208/230 V for compressor and 208/230 V for condenser fan
VRC202	230 V, 50/60 Hz	Evaporator, 3.5 kW, 230 V
VRC302	230 V, 50/60 Hz	Condensing unit, 3.5 kW, 230 V for compressor and 230 V for condenser fan
VRC352	230 V, 50/60 Hz	Low ambient condensing unit, 3.5 kW, 230 V for compressor and 230 V for condenser fan

2.2 Name Plate

Figure 2.2 Name Plate of UL Model

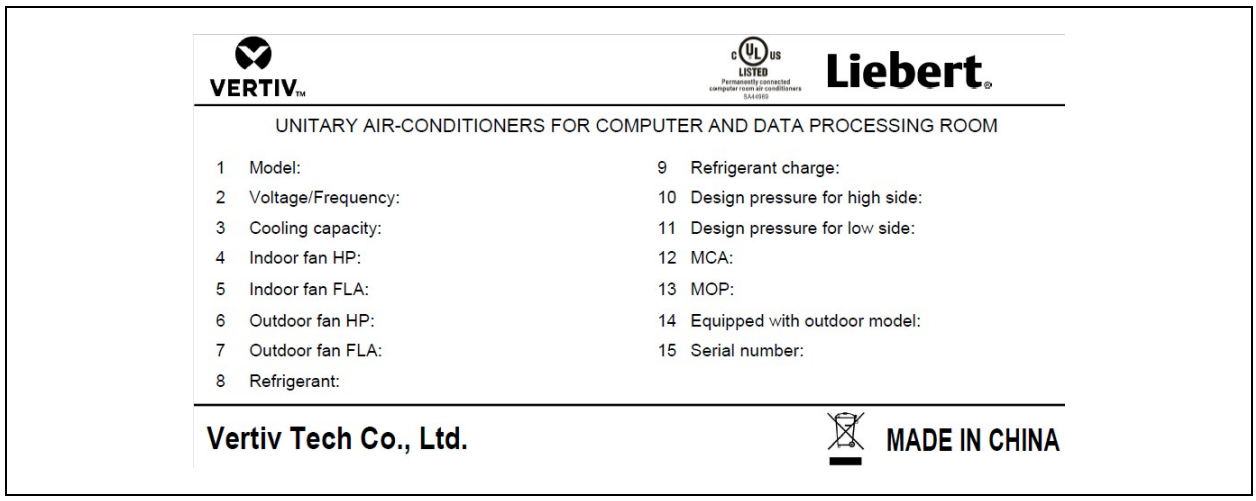
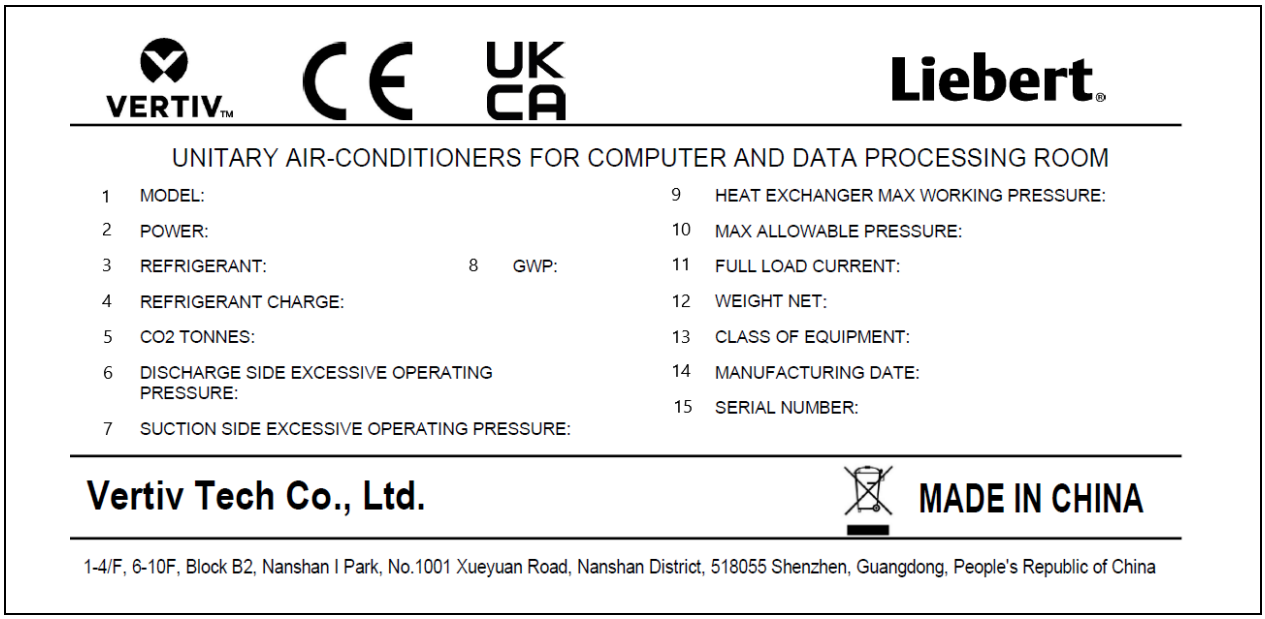


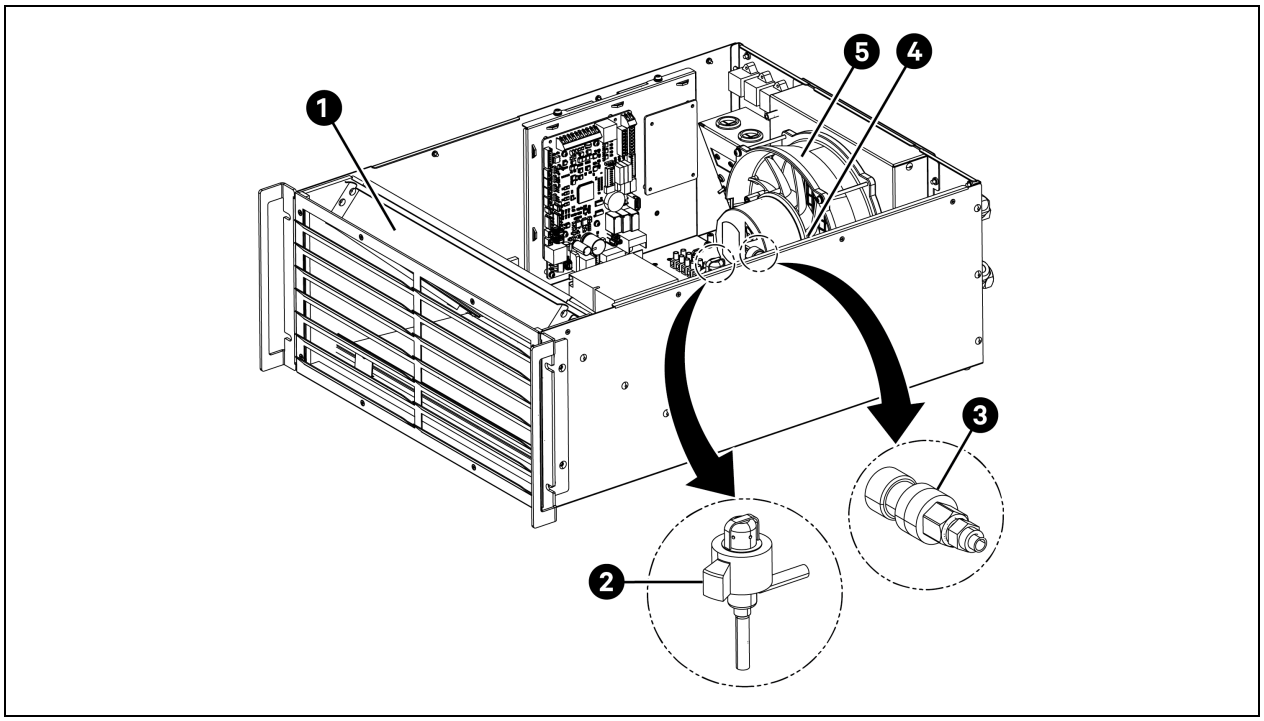
Figure 2.3 Name Plate of CE Model



2.3 Components

2.3.1 VRC2 Evaporator Components

Figure 2.4 VRC2 Evaporator



Item	Description	Item	Description
1	Evaporator	4	Suction temperature sensor
2	EEV	5	Evaporator fan
3	Pressure transducer		

Evaporator Coil

The evaporator coil provides maximum surface area for heat transfer. The sensible heat ratio (SHR) is higher than 0.9. The coil is made of copper tubes with aluminum fins.

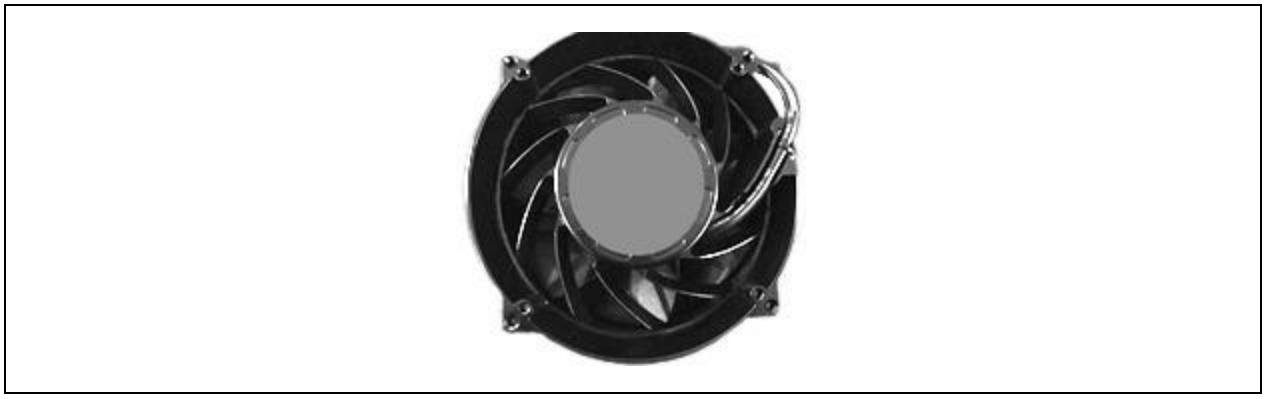
Condensate Drain Tray

The metal condensate drain tray is placed under the coil assembly. It collects the condensate water from the coil surface.

Evaporator EC Fan

The evaporator EC fan delivers high airflow rates and has a smooth speed variation. It works in synchronization with all the system components to deliver precise output capacity.

Figure 2.5 Evaporator EC Fan



Electronic Expansion Valve

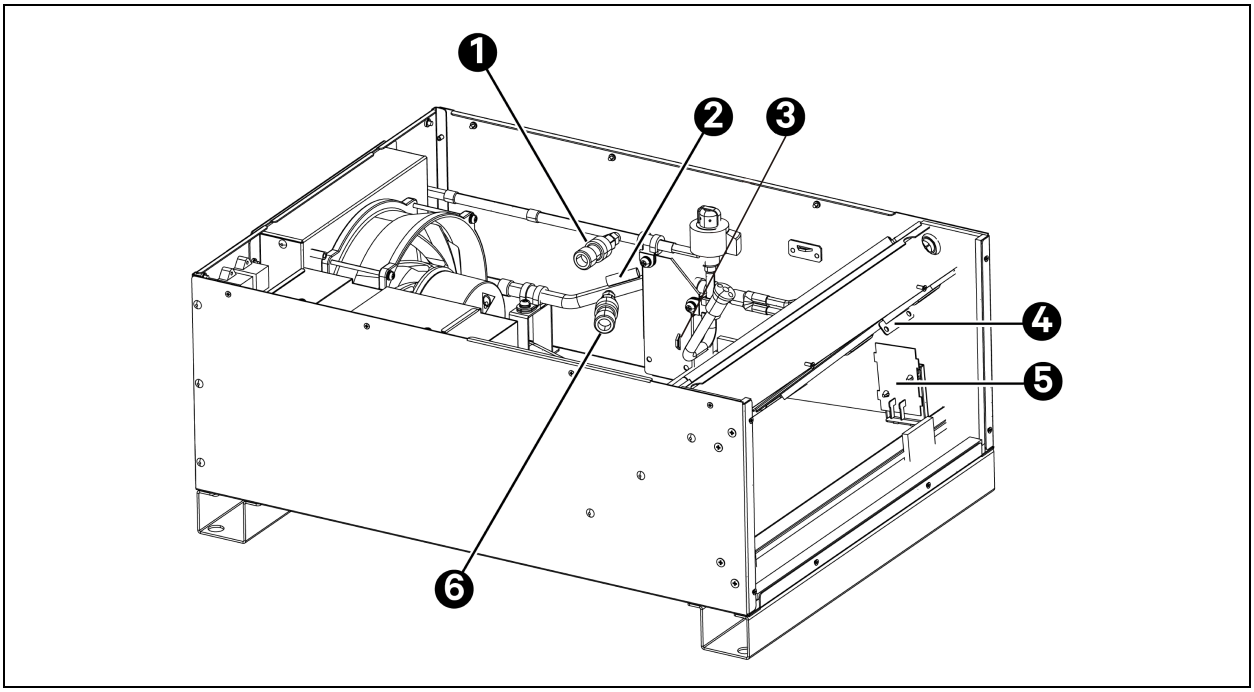
The electronic expansion valve monitors temperature and pressure signals to maintain precise adjustment of the refrigerant flow.

Figure 2.6 Electronic Expansion Valve

Sensors

Sensors provide important support for precise control and reliable operation. Their location in the evaporator is depicted in the following figure.

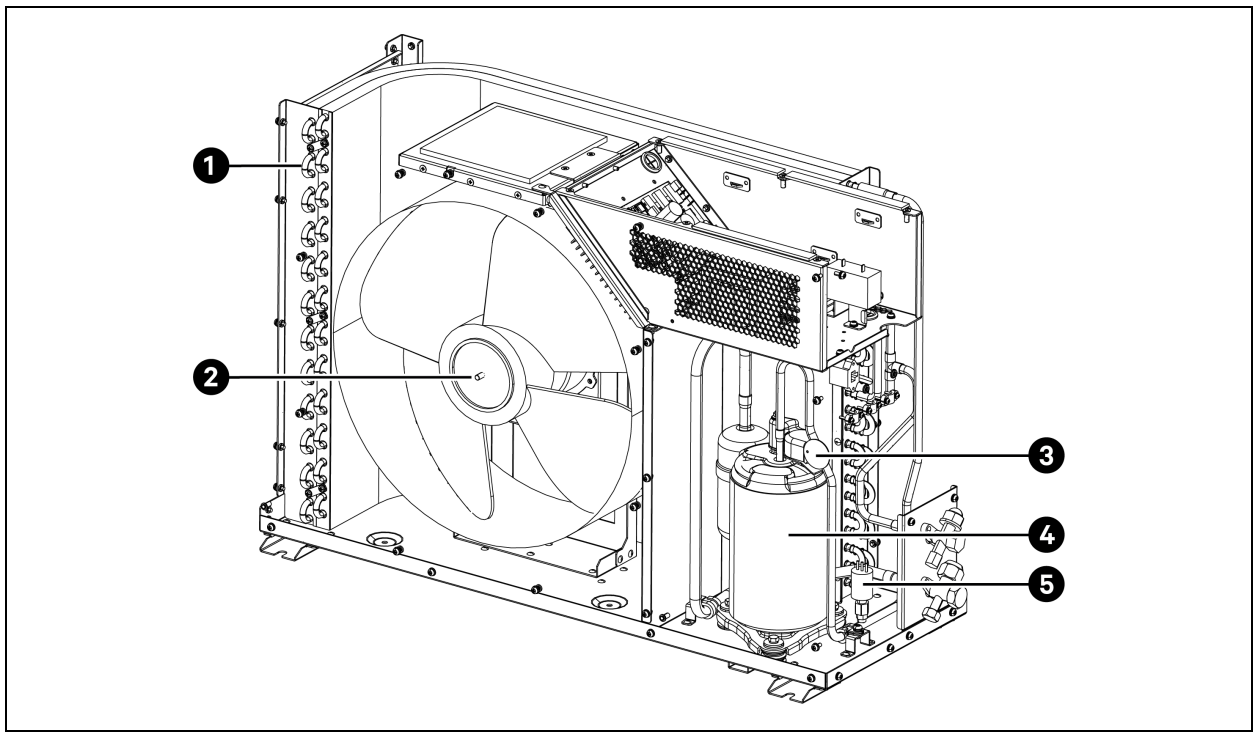
Figure 2.7 Sensors in the Evaporator



Item	Description	Item	Description
1	High pressure transducer	4	Supply air temperature sensor
2	Suction temperature sensor	5	Water level sensor
3	Return air temperature sensor	6	Low pressure transducer

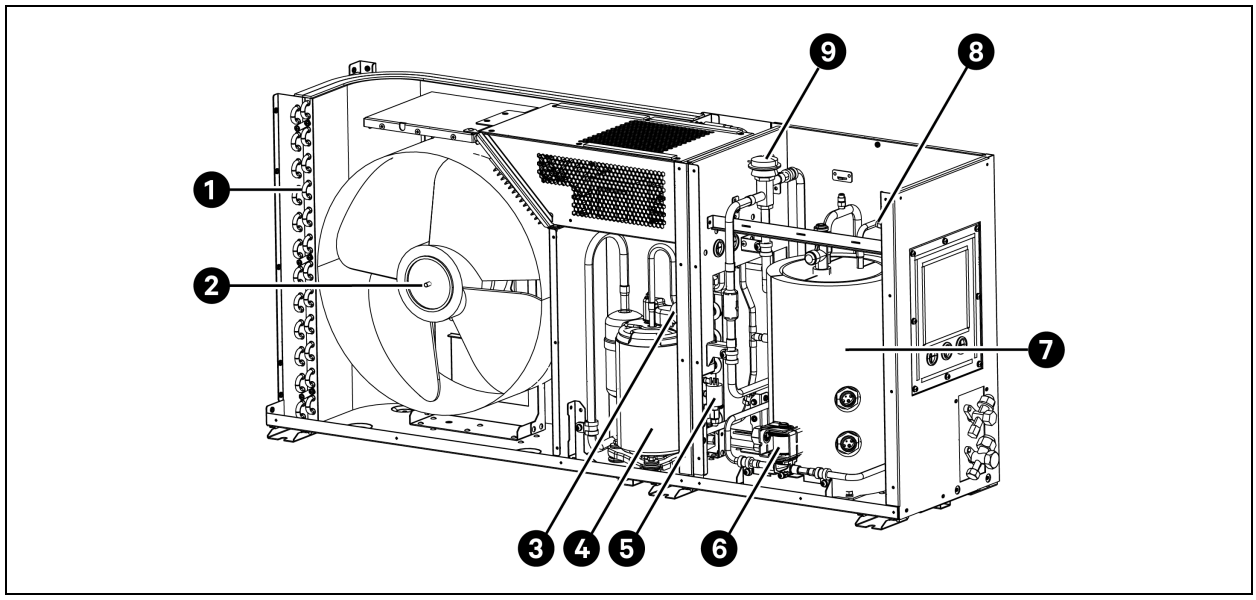
2.3.2 VRC3 Condensing Unit Components

Figure 2.8 VRC3 Standard Condensing Unit Components



Item	Description	Item	Description
1	Condenser coil	4	Inverter rotary compressor
2	Condenser fan	5	High pressure switch
3	Discharge high temperature switch		

Figure 2.9 VRC3 Low Ambient Condensing Unit Components



Item	Description	Item	Description
1	Condenser coil	6	Solenoid valve
2	Condenser fan	7	Receiver
3	Discharge high temperature switch	8	Pressure switch
4	Inverter rotary compressor	9	Head pressure valve
5	High pressure switch		

Compressor

The inverter rotary compressor works with R410A refrigerant. It varies the cooling output capacity based on cooling demands.

Figure 2.10 Compressor

Condenser Coil

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

Condenser Fan

The condenser fan varies its speed with the condensing pressure.

Figure 2.11 Condenser Fan

Low Ambient Module

The low ambient module contains a receiver, a solenoid valve, and a head pressure control valve. This module ensures that the air conditioner system can work at -34 °C (-29.2 °F).

2.4 Technical Specifications

Table 2.3 Technical Specifications

Parameters	Specification								
Model	VRC200	VRC201	VRC202	VRC300	VRC301	VRC302	VRC350	VRC351	VRC352
Certification	UL 1995 (CSA C22.2 NO.236-11)		CE (EN 60335-1; EN 60335-2-40; EN 55014-1; EN 55014-2; EN 61000-3-2; EN 61000-3-3; EN 50581)	UL 1995 (CSA C22.2 NO.236-11)		CE (EN 60335-1; EN 60335-2-40; EN 55014-1; EN 55014-2; EN 61000-3-2; EN 61000-3-3; EN 50581)	UL 1995 (CSA C22.2 NO.236-11)		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	3.5			-					
Air Volume, m3/h (CFM)	750 (441)			-					
Max Power Input, kW	0.21			1.12			1.12		
Input Voltage, Vac	L1+L2+G, 120 Vac	L1+L2+G, 208/230 Vac	L+N+PE, 230 Vac	L1+L2+G, 208/230 Vac		L+N+PE, 230 Vac	L1+L2+L3+G, 208/230 Vac		L+N+PE, 230 Vac
Full Load Amperage, A	2.1	1.7	1.5	7.2	7.2	6.5	7.2	7.2	6.5
Condenser Fan- Full Load Amperage, A	/			0.87	0.37	0.37	0.87	0.37	0.37
Liquid Line Solenoid Valve - Full Load Amperage, A	/						0.13	0.08	0.08
Dimensions (W×D×H, mm (in.))	442×602×264 (17.40×23.70×10.39)			786×282×527 (30.94×11.10×20.75)			1158×282×527 (45.60×11.10×20.75)		
Frequency, Hz	60	60	50/60	60	60	50/60	60	60	50/60
Color	EG7021 (Black)			G103 (White)					
IP Code	/			IPX4 (IEC 60529)			IPX4 (IEC 60529)		

Table 2.3 Technical Specifications (continued)

Parameters	Specification		
Net Weight, kg (lb)	23 (50)	44 (97)	68 (150)
Gross Weight, kg (lb)	51 (112)	70 (154)	85 (187)
Noise Level (tested within the rack)	<60 dB(A)	<55 dB(A)	<55 dB(A)
Outdoor Temperature range, °C (°F)	/	-15 (5) to 45 (113)	-34 (-29.2) to 45 (113)

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

NOTE: At the same working conditions, the low temperature condensing unit has a reduced capacity compared with the standard condensing unit.

NOTE: The system has two control modes: supply air control mode and return air control mode. It is recommended to use return air control mode when the VRC2 evaporator works in an open environment, and use supply air control mode when the VRC2 evaporator works in an enclosed cabinet.

NOTE: The supply air temperature setpoint ranges from 18 °C (64.4 °F) to 23 °C (73.4 °F). The recommended setpoint is 21 °C (69.8 °F).

NOTE: When the unit is used in an enclosed cabinet, the heat load should be evenly placed in the cabinet and the unused rack position should be covered with blank plates.

The maximum capacities vary with temperatures, as shown below.

Standard Condensing Unit Maximum Capacity, kW		Temperature of Condenser Inlet Air		
		29.4 °C (85 °F)	35 °C (95 °F)	40 °C (104 °F)
Temperature of evaporator supply air	19 °C (66 °F)	3.7	3.6	3.6
	21 °C (70 °F)	3.9	3.8	3.8
	23 °C (73 °F)	3.9	3.8	3.8

Standard Condensing Unit Maximum Capacity, kW		Temperature of Condenser Inlet Air		
		29.4 °C (85 °F)	35 °C (95 °F)	40 °C (104 °F)
Temperature of evaporator return air	29.4 °C (85 °F)	3.4	3.3	2.8
	35 °C (95 °F)	3.8	3.7	3.2
	40 °C (104 °F)	4.0	3.9	3.4

Low Ambient Condensing Unit Maximum Capacity, kW		Temperature of Condenser Inlet Air		
		29.4 °C (85 °F)	35 °C (95 °F)	40 °C (104 °F)
Temperature of evaporator supply air	19 °C (66 °F)	3.2	3.1	3.1
	21 °C (70 °F)	3.4	3.4	3.4
	23 °C (73 °F)	3.5	3.4	3.4

Low Ambient Condensing Unit Maximum Capacity, kW		Temperature of Condenser Inlet Air		
		29.4 °C (85 °F)	35 °C (95 °F)	40 °C (104 °F)
Temperature of evaporator return air	29.4 °C (85 °F)	3.1	3.0	2.5
	35 °C (95 °F)	3.5	3.4	2.9
	40 °C (104 °F)	3.6	3.5	3.0

The minimum capacities vary with temperatures, as shown below.

Standard Condensing Unit Minimum Capacity, kW		Temperature of Condenser Inlet Air		
		29.4 °C (85 °F)	35 °C (95 °F)	40 °C (104 °F)
Temperature of evaporator supply air	19 °C (66 °F)	0.92	0.90	0.88
	21 °C (70 °F	0.94	0.92	0.90
	23 °C (73 °F)	0.96	0.94	0.92

Standard Condensing Unit Minimum Capacity, kW		Temperature of Condenser Inlet Air		
		29.4 °C (85 °F)	35 °C (95 °F)	40 °C (104 °F)
Temperature of evaporator return air	29.4 °C (85 °F)	0.92	0.90	0.88
	35 °C (95 °F)	0.94	0.92	0.90
	40 °C (104 °F)	0.96	0.94	0.92

Low Ambient Condensing Unit Minimum Capacity, kW		Temperature of Condenser Inlet Air		
		29.4 °C (85 °F)	35 °C (95 °F)	40 °C (104 °F)
Temperature of evaporator supply air	19 °C (66 °F)	0.91	0.89	0.87
	21° C (70 °F)	0.93	0.91	0.89
	23 °C (73°F)	0.95	0.93	0.91

Low Ambient Condensing Unit Minimum Capacity, kW		Temperature of Condenser Inlet Air		
		29.4 °C (85 °F)	35 °C (95 °F)	40 °C (104 °F)
Temperature of evaporator return air	29.4 °C (85 °F)	0.91	0.89	0.87
	35 °C (95 °F)	0.93	0.91	0.89
	40 °C (104 °F)	0.95	0.93	0.91

3 Pre-Installation

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.

3.1 Customer-Prepared Materials

The cables routed from the room to the unit and the circuit breakers must be prepared by customers.

Table 3.1 Customer-Prepared Materials

Material	Specification
External circuit breaker 1	See the full load amperage of the evaporator in Technical Specifications on page 13
External circuit breaker 2	See the full load amperage of the condensing unit in Technical Specifications on page 13
Liquid copper pipe	Please refer to pipe connection of unit
Gas copper pipe	Please refer to pipe connection of unit
Communications cable between evaporator and condensing unit	Communications cable with RJ45 ports

Table 3.2 Customer-Prepared Cables

	VRC200	VRC201	VRC202	VRC300	VRC301	VRC302	VRC350	VRC351	VRC352
Power supply cables for the evaporator	UL1015 18 AWG	UL1015 18 AWG	1.0 mm^2	-	-	-	-	-	-
Power supply cables for the condensing unit	-	-	-	UL1015 16 AWG	UL1015 16 AWG	1.5 mm^2	UL1015 16 AWG	UL1015 16 AWG	1.5 mm^2
Cables for the condenser fan	-	-	-	UL1015 18 AWG	UL1015 18 AWG	1.0 mm^2	UL1015 18 AWG	UL1015 18 AWG	1.0 mm^2
Cables for the liquid line solenoid valve	-	-	-	UL1015 20 AWG	UL1015 20 AWG	0.75 mm^2	UL1015 20 AWG	UL1015 20 AWG	0.75 mm^2

3.2 Moving the Packaged Unit

WARNING! The components of the unit are comparatively large and heavy. Therefore, there may be a risk when the containment collapses. The collapse may result in physical injury, fatality and damage to the equipment.

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

Keep the packaged unit upright and do not place it outdoors. Transport the packaged unit with a forklift or pallet jack. When using a forklift or pallet jack, make sure that the forks (if adjustable) are spread to the widest allowable distance that is suitable for the pallet length and can fit under the pallet.

Figure 3.1 Package Dimensions of Evaporator and Condensing Unit

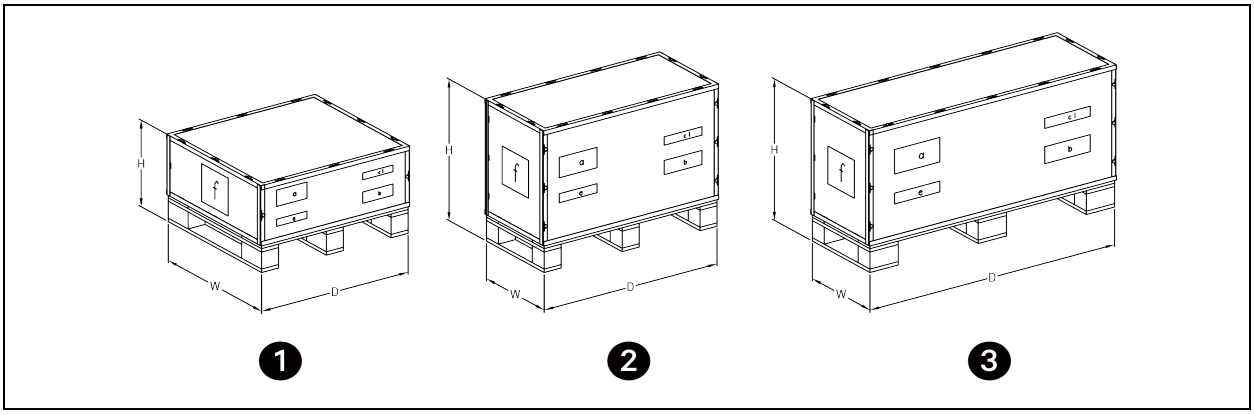
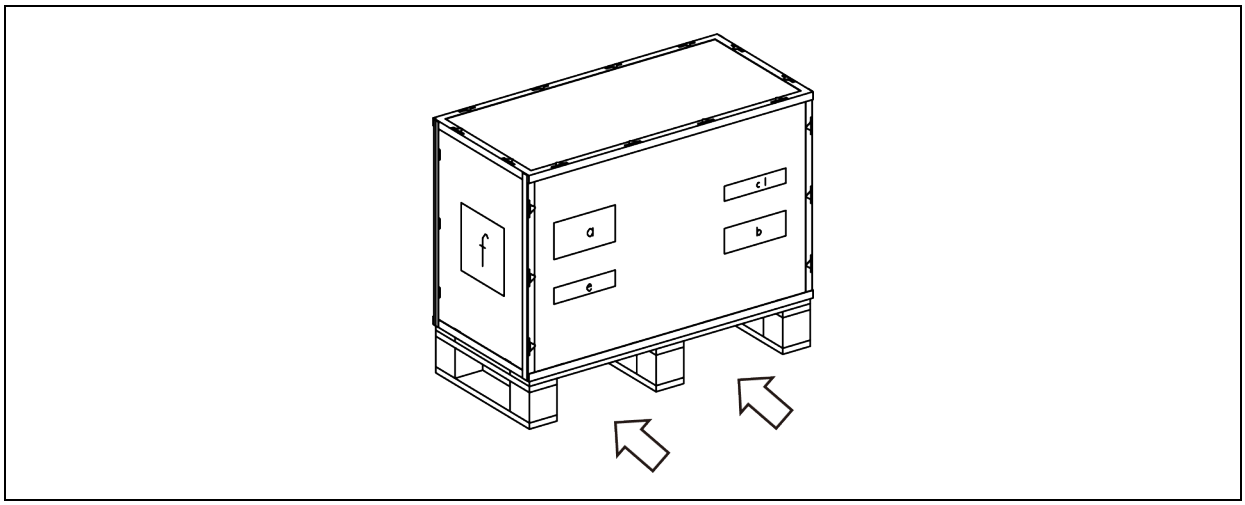


Table 3.3 Dimensions and Weight of the Packaged Evaporator and Condensing Unit

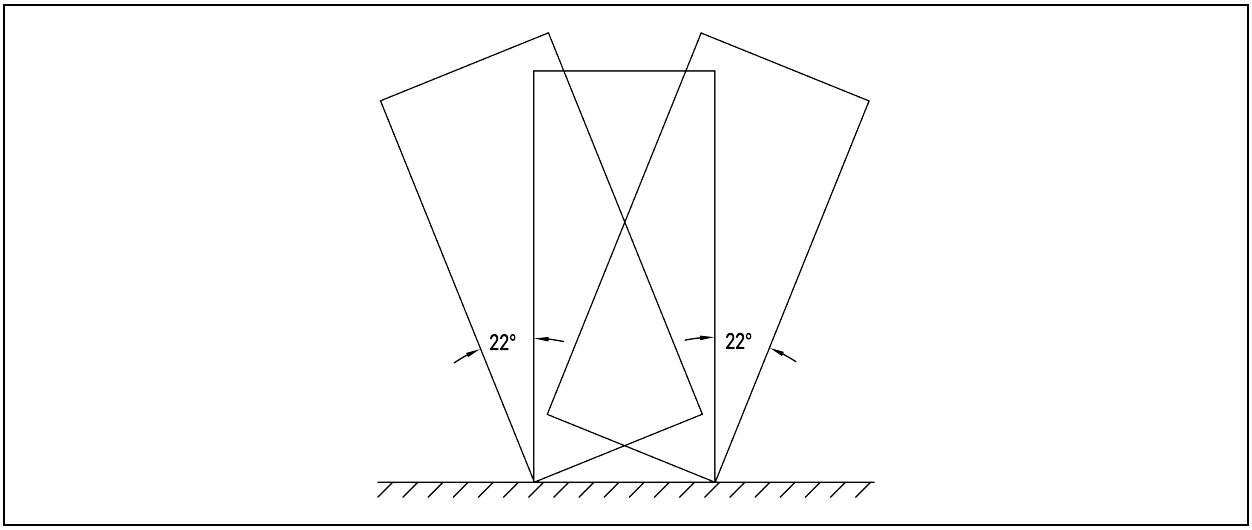
Item	Unit	Model	Package	Dimensions mm (in.)			Weight with Package kg (lb)
				H	W	D	
1	Evaporator	VRC200 VRC201 VRC202	Wooden box with wooden pallet	462 (18.2)	706 (27.8)	776 (30.6)	61 (134.5)
2	Standard condensing unit	VRC300 VRC301 VRC302		752 (29.6)	436 (17.2)	916 (36.1)	80 (176.4)
3	Low ambient condensing unit	VRC350 VRC351 VRC352		752 (29.6)	436 (17.2)	1296 (51.0)	95 (209.4)

Figure 3.2 Inserting Forks in This Direction



When moving the packaged unit, align the fork arms with the center of gravity and do not tilt the unit more than 22 degrees any direction to prevent it from falling over.

Figure 3.3 Not Tilting the Unit More Than 22 Degrees



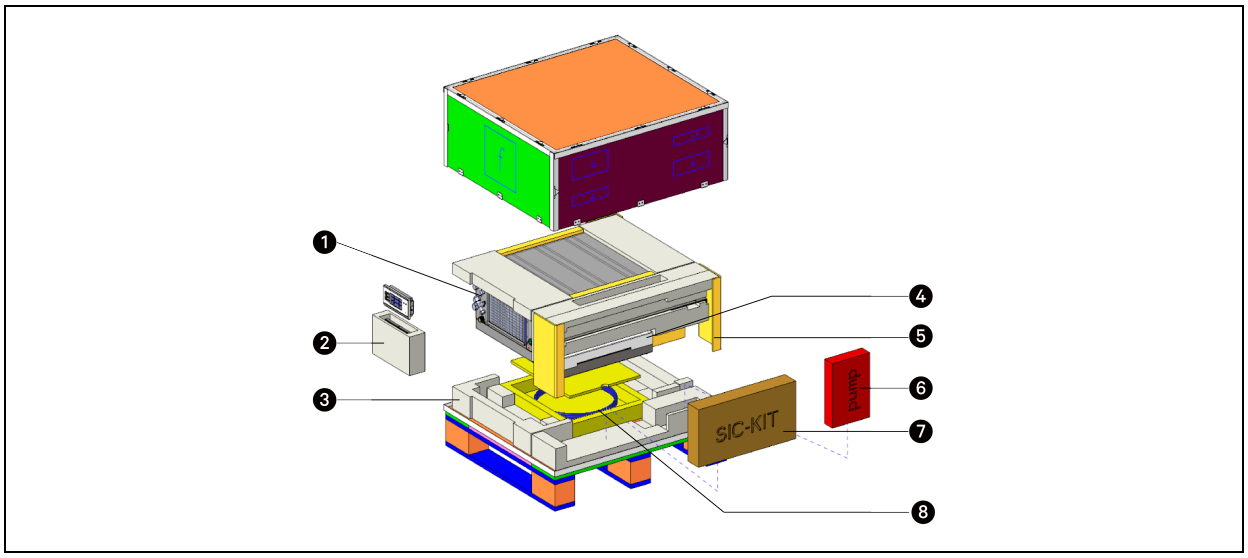
3.3 Unpacking the Unit

3.3.1 Unpacking the Evaporator

To unpack the evaporator:

1. Pull straight the latches on the wooden box using a claw hammer.
2. Remove the wooden case.
3. Put the EPE and the ceiling tile kit aside.
4. Remove the unit from the wooden pallet and place it to its installation site.

Figure 3.4 Unpacking the Evaporator

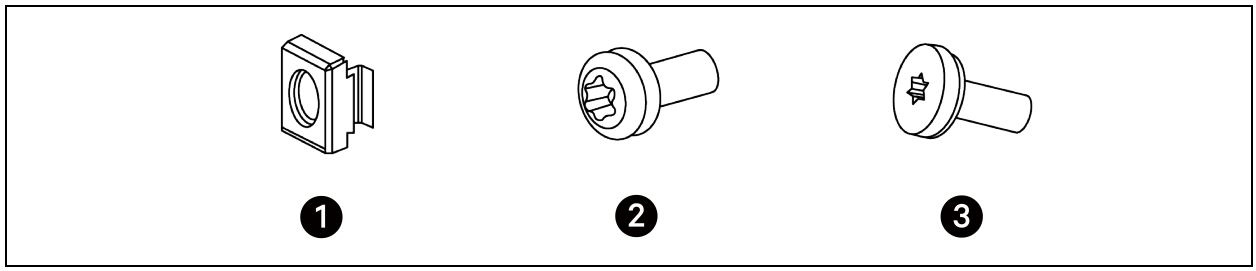


Item	Description	Item	Description
1	VRC2 evaporator	5	L-shaped mounting rail kit
2	Display and display magnetic box	6	Drain fitting
3	EPE	7	SIC card kit
4	Condensate pump and pump bracket	8	Condensate water pipe

Table 3.4 Accessories of the Evaporator

Item		Quantity
Drainage kit	Condensate pump and pump bracket	1
	Condensate water pipe (7.5 m (24.6 ft))	1
	Drain fitting	1
Display kit	Display and display magnetic box	1
	Cable of display (10 m (32.8 ft))	1
	Cable of display (0.5 m (1.6 ft))	1
SIC card kit		1
L-shaped mounting rail kit		2
M6 cage nut		6
M6 x 12 Torx pan head screw		6
M5 x 12 Torx center screw		10
USB converter cable		1
Cable tie		10
User manual		1

Figure 3.5 Fittings



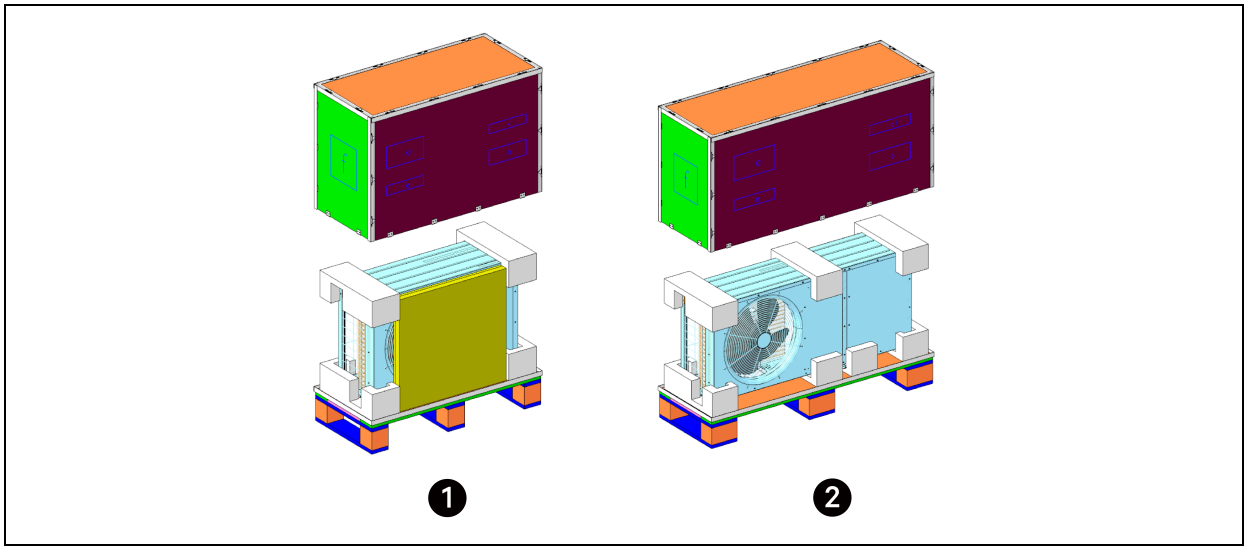
Item	Description	Usage	Quantity
1	M6 cage nut	Used with M6 pan head screws for tightening pillars	6
2	M6 pan head screw	Used to install the VRC2 evaporator	6
3	M5 center screw	Used to fasten the L-shaped mounting rails	10

3.3.2 Unpacking the Condensing Unit

To unpack the condensing unit:

1. Pull straight the latches on the wooden box using a claw hammer.
2. Remove the wooden case.
3. Put the EPE and the ceiling tile kit aside.
4. Remove the unit from the wooden pallet and place it to its installation site.

Figure 3.6 Unpacking the Condensing Unit



Item	Description
1	Standard condensing unit
2	Low ambient condensing unit

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.

Table 3.5 Accessories of the Condensing Unit

Sr No.	Item	Quantity	Model
1	Side panel	2	VRC300
2	Front panel	1	VRC301
3	M4 x 10 screws	10	VRC302

3.4 Environment Requirements

CAUTION: Keep the unit in a place far away from sparks or any heat source.

CAUTION: Emission of erosive gases and organic solvents should not be near the unit.

Note the following when placing the unit:

- It is recommended to install the evaporator inside the rack at the lowest rack unit space. The rack has appropriate thermal separation.
- The condensing air entering the room is below 5% of the total internal airflow.
- All the doors and windows are closed to avoid any air infiltration from outside into the room.
- Avoid locating the evaporator in concave or narrow areas which can affect the airflow.

3.4.1 Storage Environment

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

3.4.2 Operating Environment

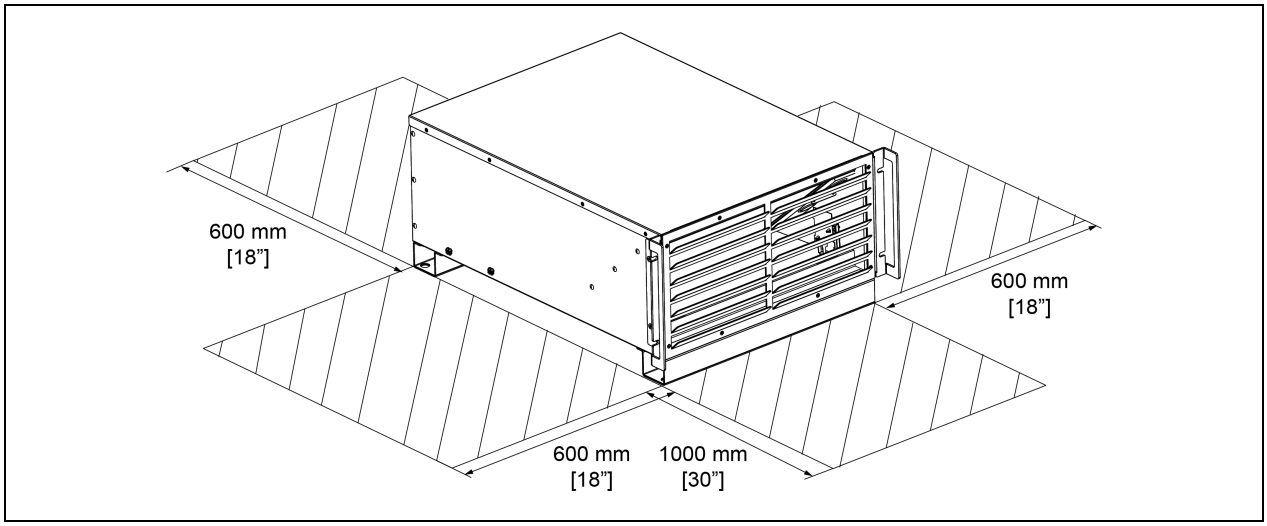
Table 3.7 Operating Environment

Item	Requirements
Installation position	The maximal equivalent length of piping between the evaporator and condensing unit [1]: 30 m (98.43 ft) Vertical distance ΔH [2]: -5 m (-16.40 ft) ≤ ΔH ≤15 m (49.21 ft)
Ambient temperature	Indoor: 18 °C to 40 °C (64.4 °F to 104 °F) Standard condensing: -15 °C to 45 °C (5 °F to 113 °F) Low ambient condensing unit: -34 °C to 45 °C (-29.2 °F to 113 °F)
Ambient humidity	17% to 60%
Protection level	Condensing unit: IPX4 (IEC 60529)
Altitude	< 1000 m (3280.84 ft). For every 1000m increase in elevation, the evaporation temperature drops by 0.5 °C (0.9 °F) the net cooling capacity drops by 7%
NOTE: [1] For the equivalent length of parts, refer to **4.4** on page 37 . [2] The value is positive if the condensing unit is installed above the evaporator. The value is negative if the condensing unit is installed below the evaporator	

3.4.3 Clearance Space

Evaporator

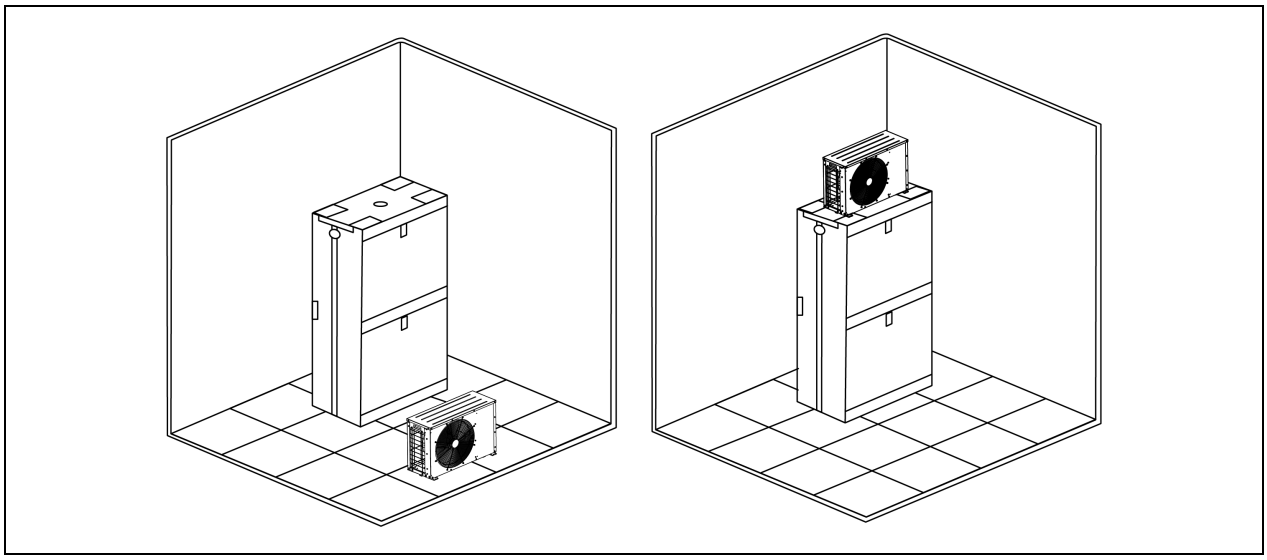
Figure 3.7 Minimum Distance for Pulling out the Evaporator during Maintenance (Top View)



Condensing Unit in Indoor Environment

When the standard condensing unit is installed in an indoor environment (on the top of a cabinet or on the room floor), it is not necessary to install the air deflector.

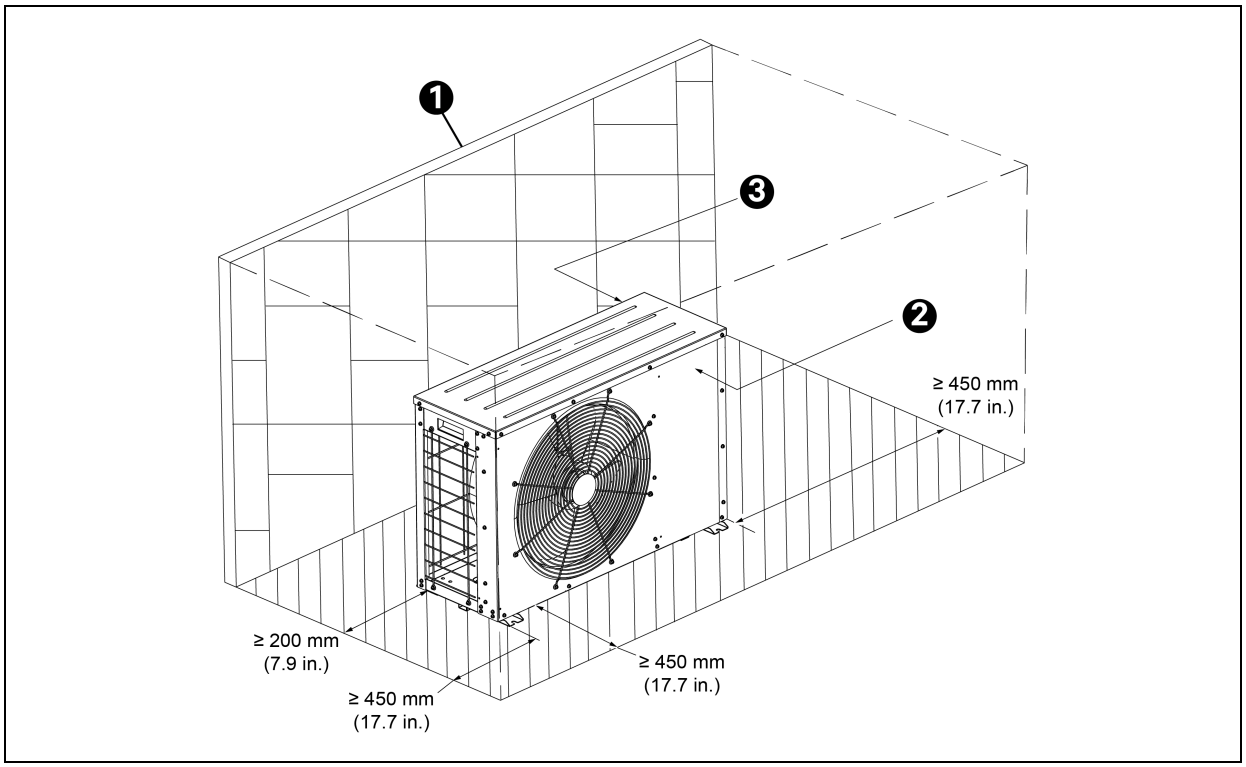
Figure 3.8 Standard Condensing Unit without Air Deflector for Indoor Use



Condensing Unit in Outdoor Environment

When the standard condensing unit is installed in an outdoor environment and the temperature is always above 0°C (32°F), it is not necessary to install the air deflector. For the standard condensing unit without air deflector, the recommended clearance space is shown in the figure below.

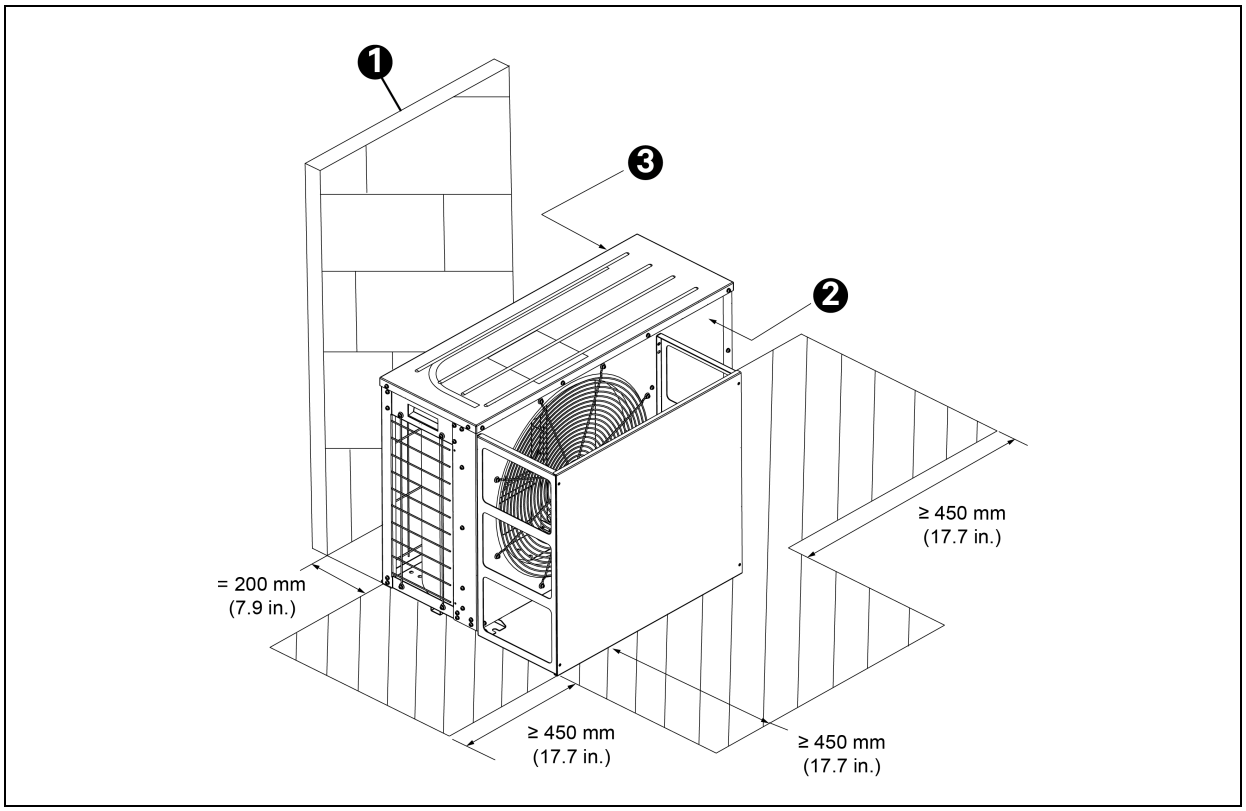
Figure 3.9 Clearance Space Required for Standard Condensing Unit without Air Deflector



Item	Description	Item	Description
1	Wall	3	Rear side
2	Front side		

When the standard condensing unit is installed in an outdoor environment and the temperature can be down to 0°C (32°F) or below, you need to install the air deflector. For the standard condensing unit with air deflector, the recommended clearance space is shown in the figure below.

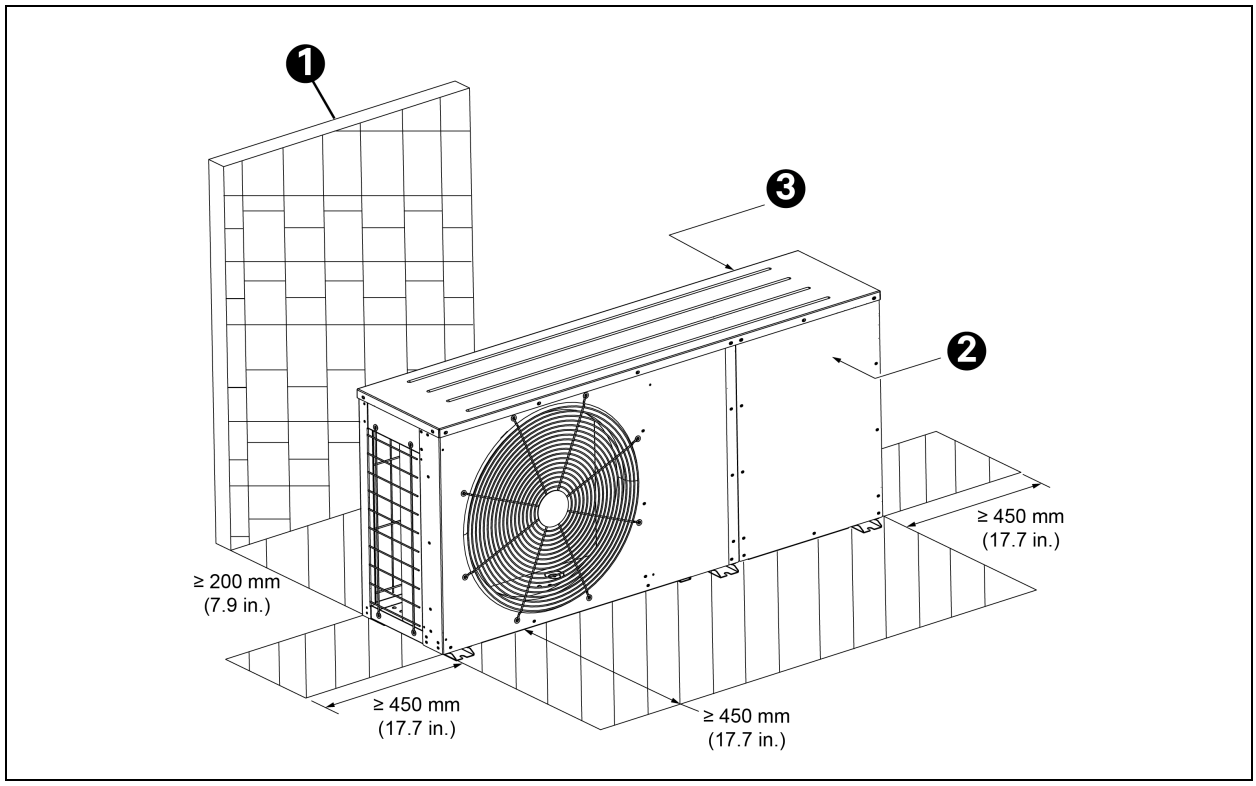
Figure 3.10 Clearance Space Required for Standard Condensing Unit with Air Deflector



Item	Description	Item	Description
1	Wall	3	Rear side
2	Front side		

When the temperature is down to -15°C (5°F) or below, you must use the low ambient condensing unit. The low ambient condensing unit is not shipped with an air deflector. For the low ambient condensing unit without air deflector, the recommended clearance space is shown in the figure below.

Figure 3.11 Recommended Clearance Space Required for Low Ambient Condensing Unit



Item	Description	Item	Description
1	Wall	3	Rear side
2	Front side		

3.5 Inspection

Inspect the unit before installation.

- The unit is pre-charged with refrigerant and lubricating oil. Check that there is no refrigerant leak or oil leak.
- Check against the packing list. Immediately report any missing or damaged parts to the carrier.

4 Mechanical Installation

4.1 Installation Notes

NOTE: The evaporator needs to be installed inside the rack or on the room floor.

- Before installation, make sure that the environment meets the requirements and there is sufficient space for connecting the condensate drain line.
- Follow the design drawings strictly for installing the evaporator and reserve enough space for maintaining the unit.
- Two persons are required for installation.

4.2 Unit Dimensions and Overall View

Figure 4.1 Evaporator

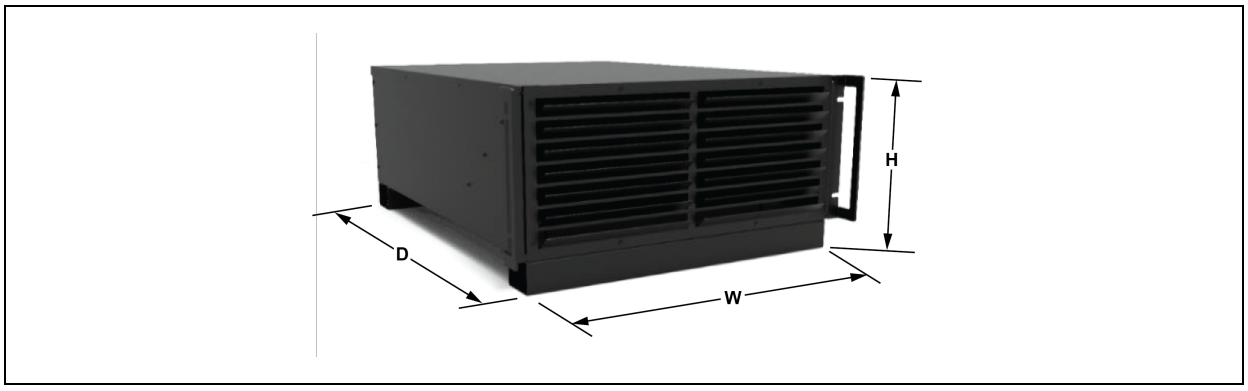


Figure 4.2 Standard Condensing Unit

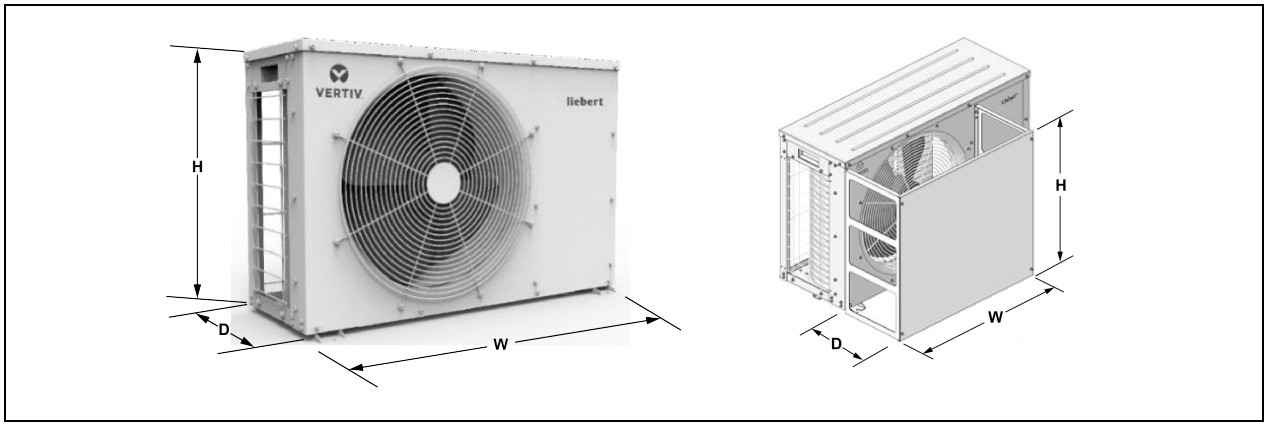


Figure 4.3 Low Ambient Condensing Unit

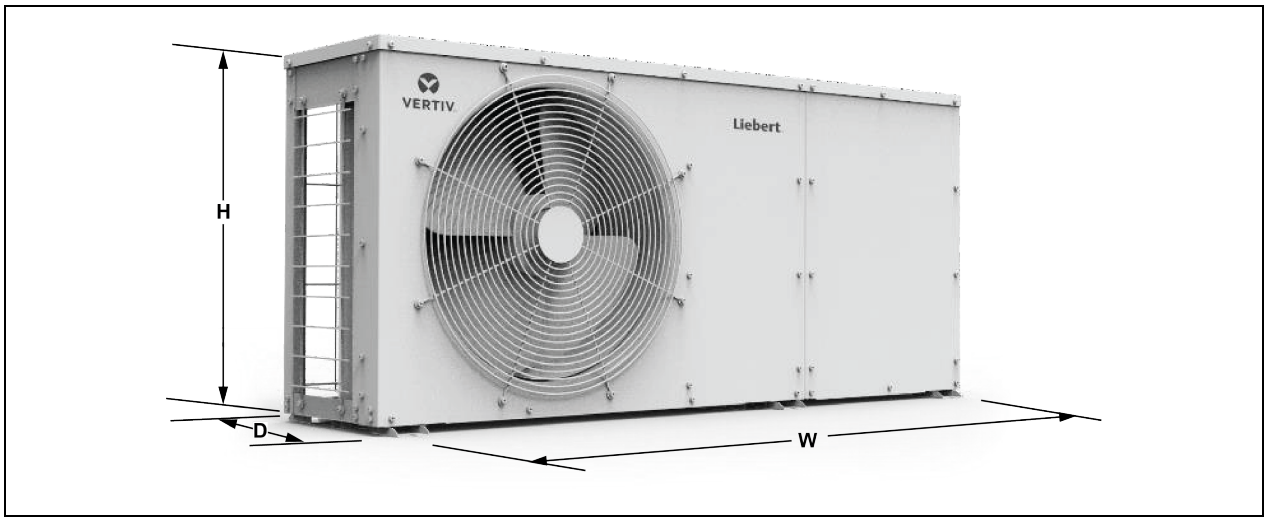


Table 4.1 Dimensions and Weight of Evaporator and Condensing Unit

Unit	Dimensions mm (in.)			Unit Weight kg (lb)
	H	W	D	
Evaporator (VRC200, VRC201, VRC202)	264 (10.39)	442 (17.40)	602 (23.70)	23.0 (50.7)
Standard condensing unit (VRC300, VRC301, VRC302)	527 (20.75)	786 (30.94)	282 (11.10)	44.0 (97.0)
Low ambient condensing unit (VRC350, VRC351, VRC352)	527 (20.75)	1158 (45.60)	282 (11.10)	68.0 (149.9)

Each standard condensing unit (VRC300, VRC301, VRC302) is shipped with an air deflector. The dimensions of the air deflector is shown in the table below.

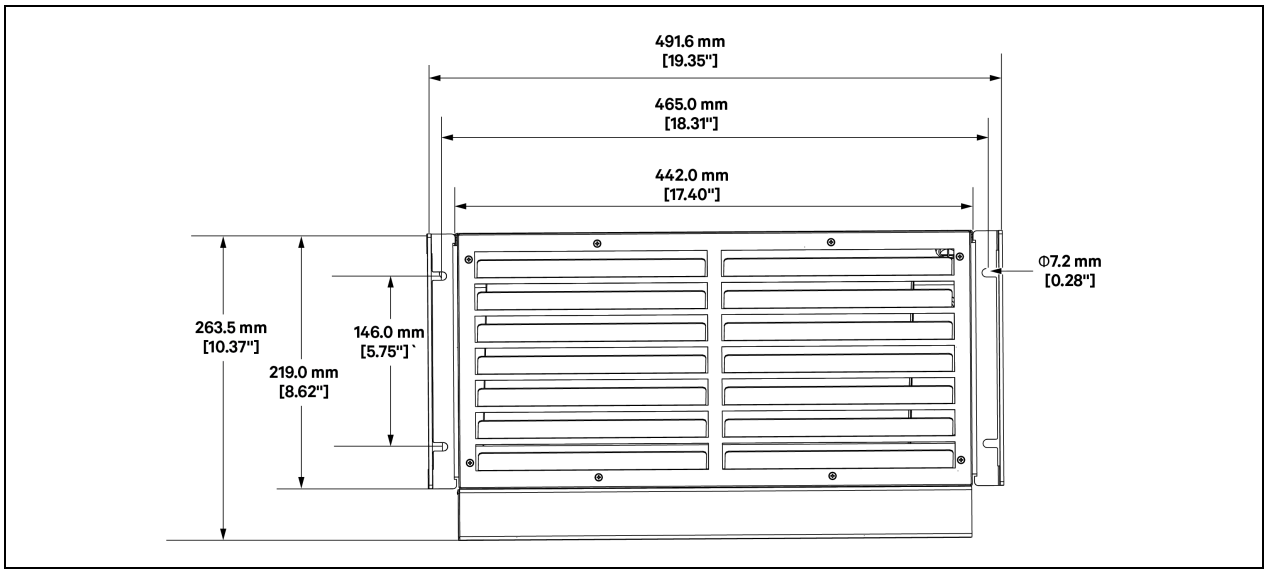
Table 4.2 Dimensions of Air Deflector

Component	Dimensions mm (in.)		
	H	W	D
Air deflector for standard condensing unit (VRC300, VRC301, VRC302)	500 (19.68)	563 (22.17)	233 (9.17)

4.3 Installing the Unit

4.3.1 Installing the Evaporator in the Rack

Figure 4.4 Top View of Evaporator

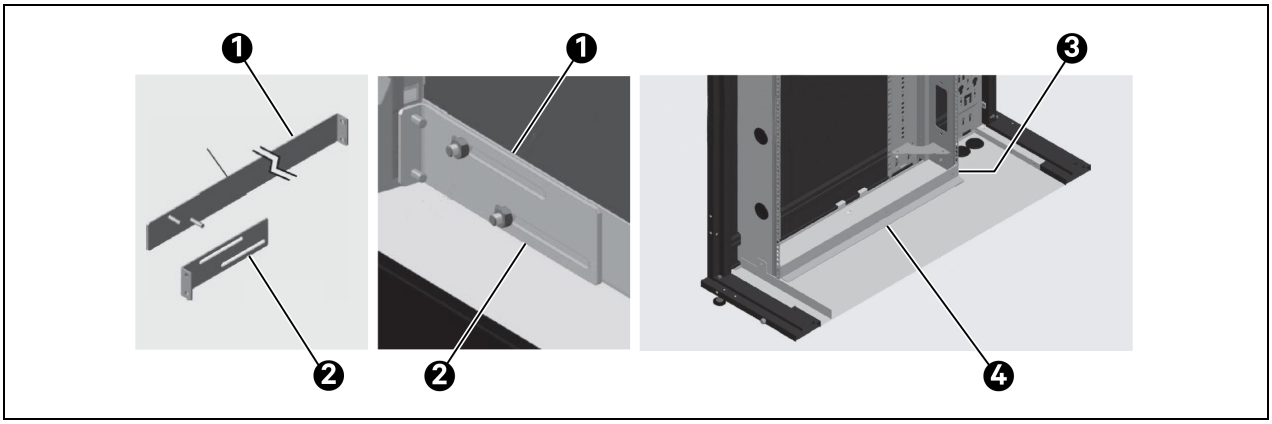


To install the evaporator in the rack:

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

   Each of the two L-shape rails is comprised of two parts, a long front rail and a slotted rear bracket, as shown in Figure 4.5 below . 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 ft-lb). Once in place, tighten the nuts on the front rail part studs. Torque = 5.6 Nm (4.13 ft-lb).

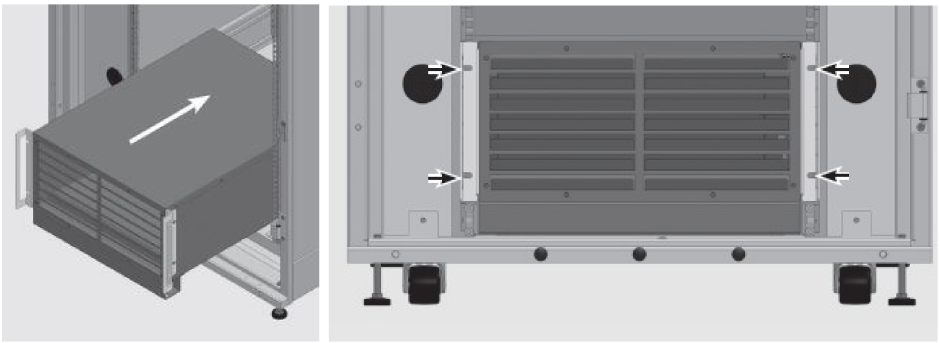
Figure 4.5 Installing L-shape Rails



Item	Description	Item	Description
1	Front rail part	3	Left VRC slotted rear bracket
2	Slotted rear bracket	4	Left VRC front rail
Cross section of Vertiv TM VRC S shown for Illustrative purposes.			

2. Insert the evaporator into the front of the rack until its front brackets are against the rack's uprights.
3. Fasten the evaporator front brackets to both front uprights using four M6 cage nuts and M6x12 T30 screws (5.6 Nm/4.13 ft-lb torque), as shown in Figure 4.6 below .

Figure 4.6 Installing Evaporator



NOTE: Make sure the evaporator is installed horizontally. Otherwise high-water level alarms may be triggered incorrectly.

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

4.3.2 Installing the Condensing Unit

Figure 4.7 Top View of Standard Condensing Unit

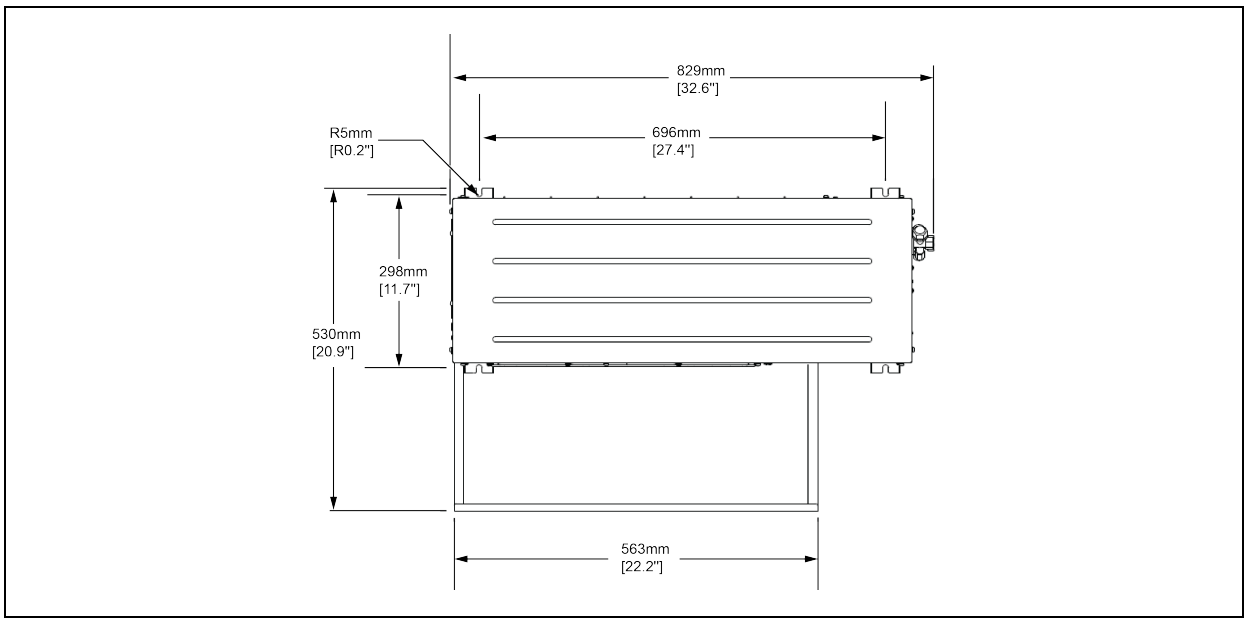
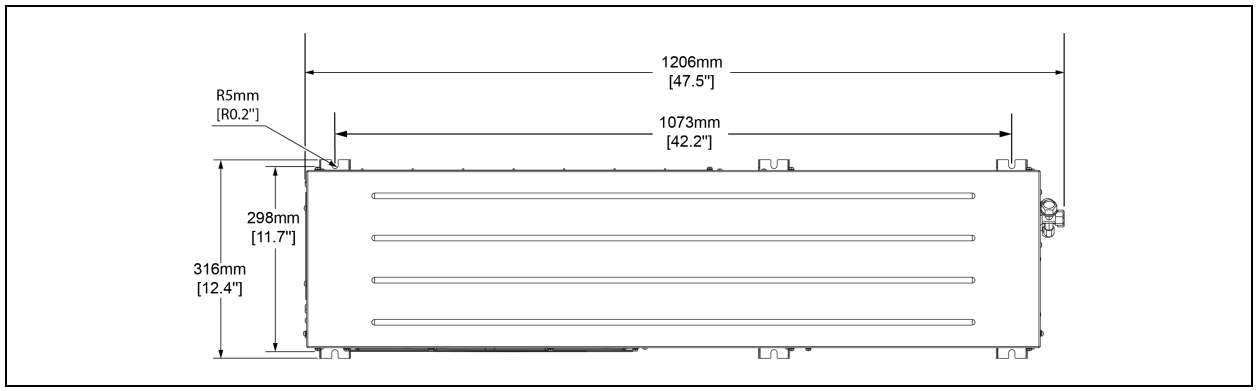
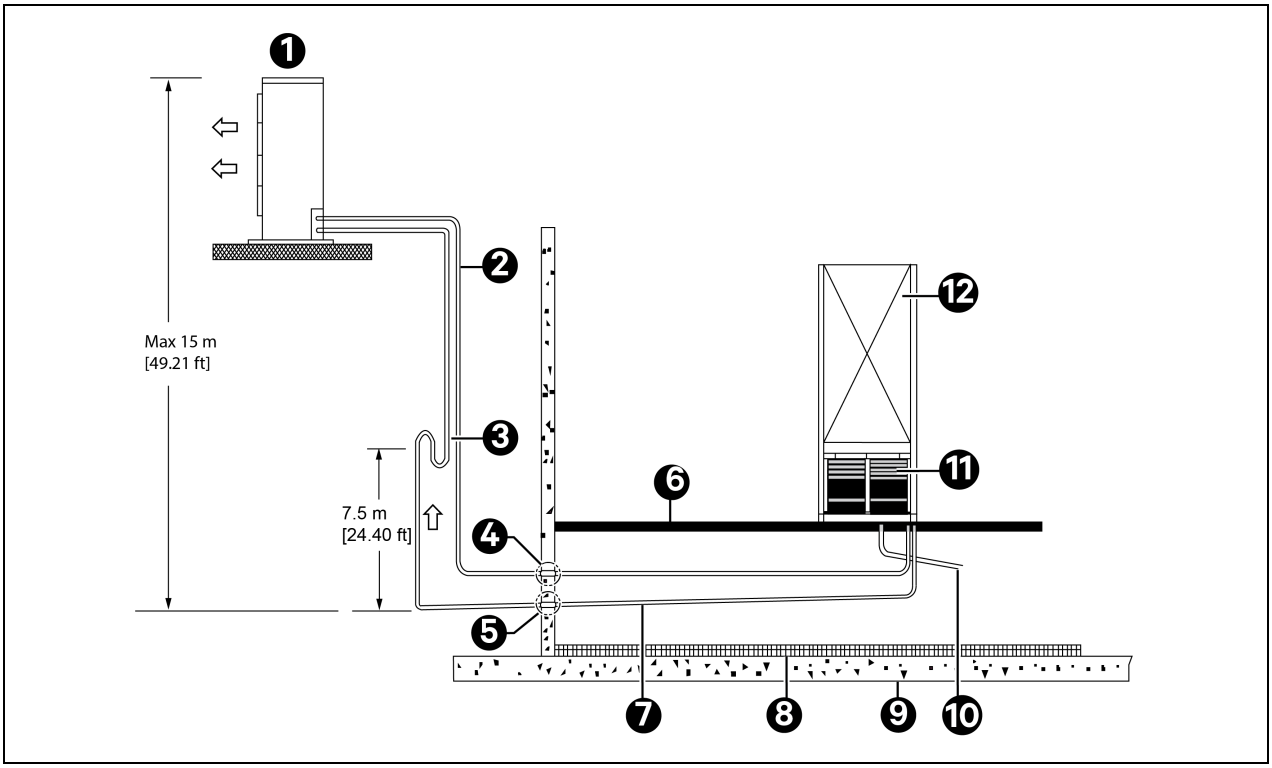


Figure 4.8 Top View of Low Ambient Condensing Unit



The condensing unit must be installed vertically. The condensing unit can either be installed higher than the evaporator or lower than the evaporator. When the condensing unit is 7.5m higher than the evaporator, a trap should be installed on the discharge pipe. This trap will retain refrigerant oil in the off cycle of the compressor. When the compressor starts, oil in the trap will be carried up and return to the compressor immediately.

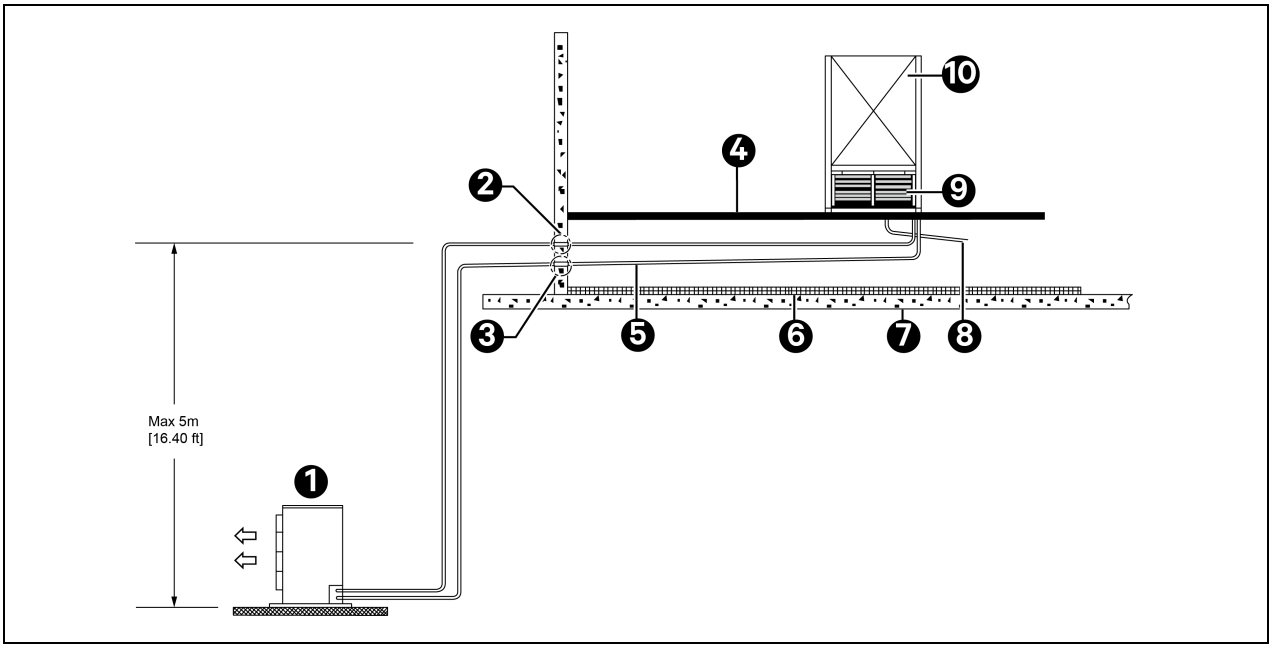
Figure 4.9 Condensing Unit Installed Higher than the Evaporator



Item	Description	Item	Description
1	Condensing unit	7	Gas side pipe
2	Liquid side pipe (no direct sunlight)	8	Heat insulation material
3	Trap	9	Floor

Item	Description	Item	Description
4	Wall bushing	10	Drain pipe of condensate water (extend to outdoor to drain condensate water) 1:200
5	Sealing on inlets	11	Evaporator
6	Isolation floor	12	Rack

Figure 4.10 Condensing Unit Installed Lower than the Evaporator



Item	Description	Item	Description
1	Condensing unit	6	Heat insulation material
2	Wall bushing	7	Floor
3	Sealing on inlets	8	Drain pipe of condensate water (extend to outdoor to drain condensate water) 1:200
4	Isolation floor	9	Evaporator
5	Gas side pipe	10	Rack

Table 4.3 Vertical Distance Between Evaporator and Condensing Unit

Relative Position	Vertical Distance
Condensing unit installed higher than evaporator	Maximum: 15 m (49.21 ft)
Condensing unit installed lower than evaporator	Maximum: 5 m (16.40 ft)

Following are the steps that need to be observed for the regular installation of the condensing unit:

1. Place the condensing unit on the base.
2. Use expansion bolts to fix the condensing unit on the base.

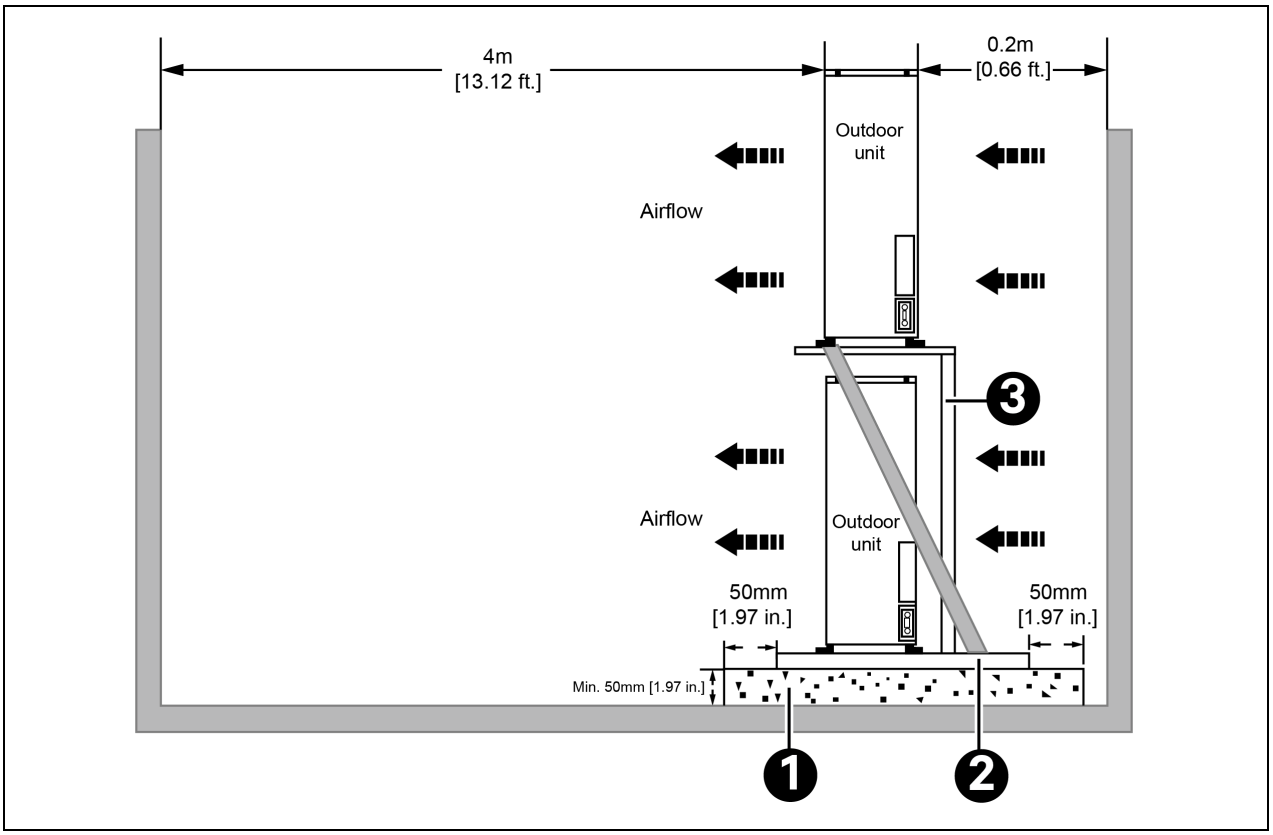
   If there are multiple condensing units, they need to be placed on top of the other. Figure 4.11 on the facing page shows how to place the condensing units.

Following points need to be taken into consideration during the installation of the condensing unit.

NOTE: The condensing unit must be placed appropriately in a safe place for maintenance. It should not be installed on the bottom floor of the public site or kept in a residential area.

- **It should not be kept in an environment where noise levels are considered crucial.**
- **Keep the condensing unit in a clean environment, free of debris, dust, and foreign matter. This is done to avoid blocking of the heat exchanger and ensure an efficient cooling effect.**
- **There should be no steam, hot gas, or exhaust gas near the condensing unit.**
- **Preferably, keep 450 mm between the condensing unit and the wall, obstacles, or adjacent devices. For standard condensing unit, if the condensing unit will be installed in an outdoor environment, the recommended distance of the back side (return air side) from the wall should be 200 mm (7.87 in.). It is a must to provide these clearance distances to ensure appropriate airflow across the condensing unit.**
- **Avoid keeping the condensing unit in places where snow may accumulate in the air intake side and air outlet side.**
- **Preparing a base to bear the weight of the condensing unit is important where the base should be at least 50 mm (1.97 in.) higher than the ground and 50 mm (1.97 in.) wider than the condensing unit base.**
- **The weight is around 44 kg (97 lb) for standard condensing unit or 68 kg (150 lb) for low ambient condensing unit. Therefore, utmost care must be taken while removing it. Any mishandling will result in severe injury and damage to the equipment.**

Figure 4.11 Installing Multiple Condensing Units with One Above the Other



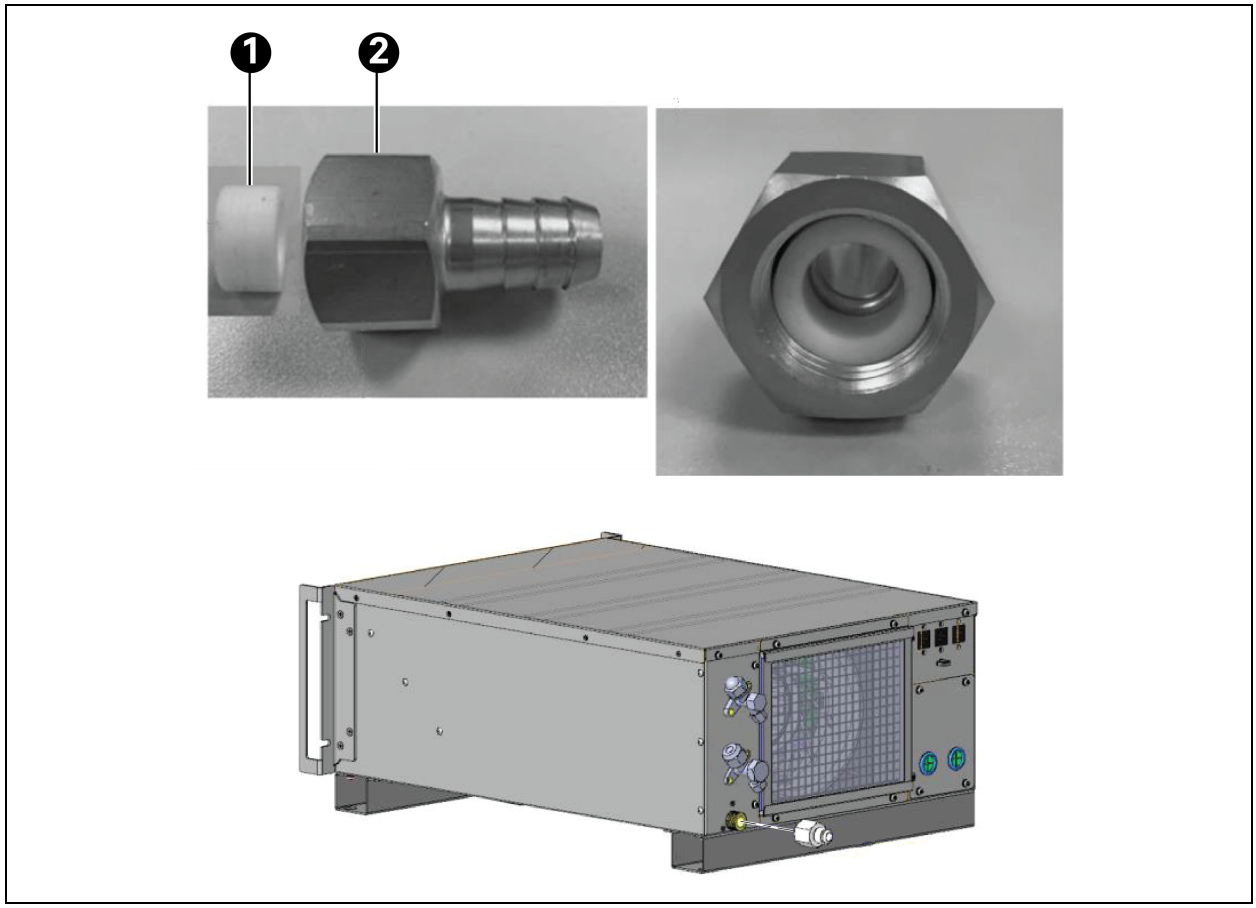
Item	Description	Item	Description
1	Base	3	Bracket
2	Condensing unit base		

NOTE: Use number 5 angle iron bracket when two units are installed with one above the other. Use number 6.5 channel steel bracket when three units are installed with one above another.

4.3.3 Installing the Drain Fitting to the Evaporator

Fasten the drain fitting to the drain port of the evaporator, as shown in Figure 4.12 below . 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 4.12 Installing the Drain Fitting



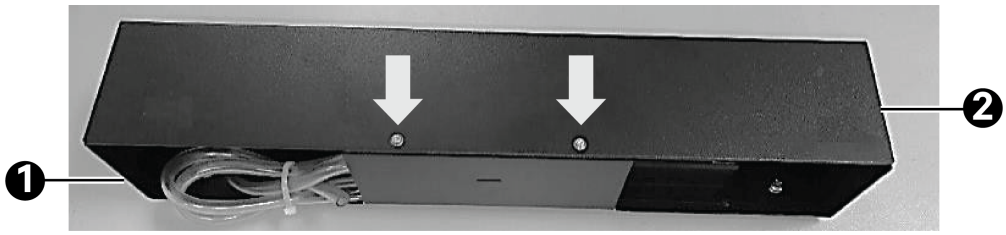
Item	Description
1	Drain fitting sealing block
2	Drain fitting

4.3.4 Installing the Condensate Pump

NOTE: Please finish the Cable Connection on page 47 first, otherwise it will be difficult to connect the cables.

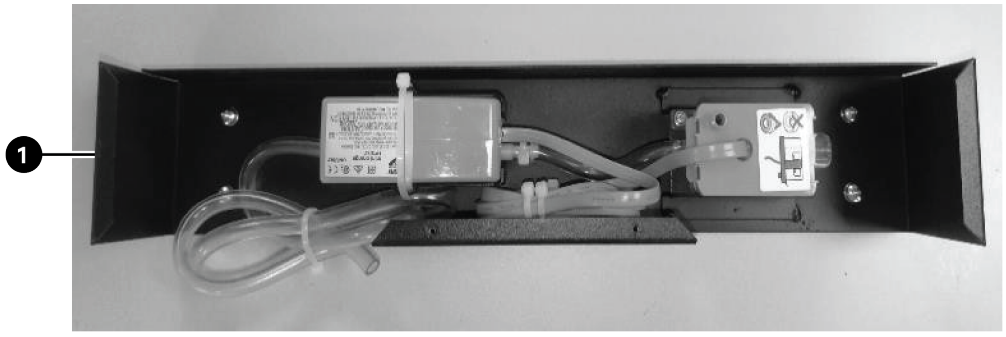
1. Divide the pump bracket into part 1 and part 2, as shown in Figure 4.13 on the facing page and Figure 4.14 on the facing page .

Figure 4.13 Appearance of Pump Bracket



Item	Description
1	Pump bracket part 1
2	Pump bracket part 2

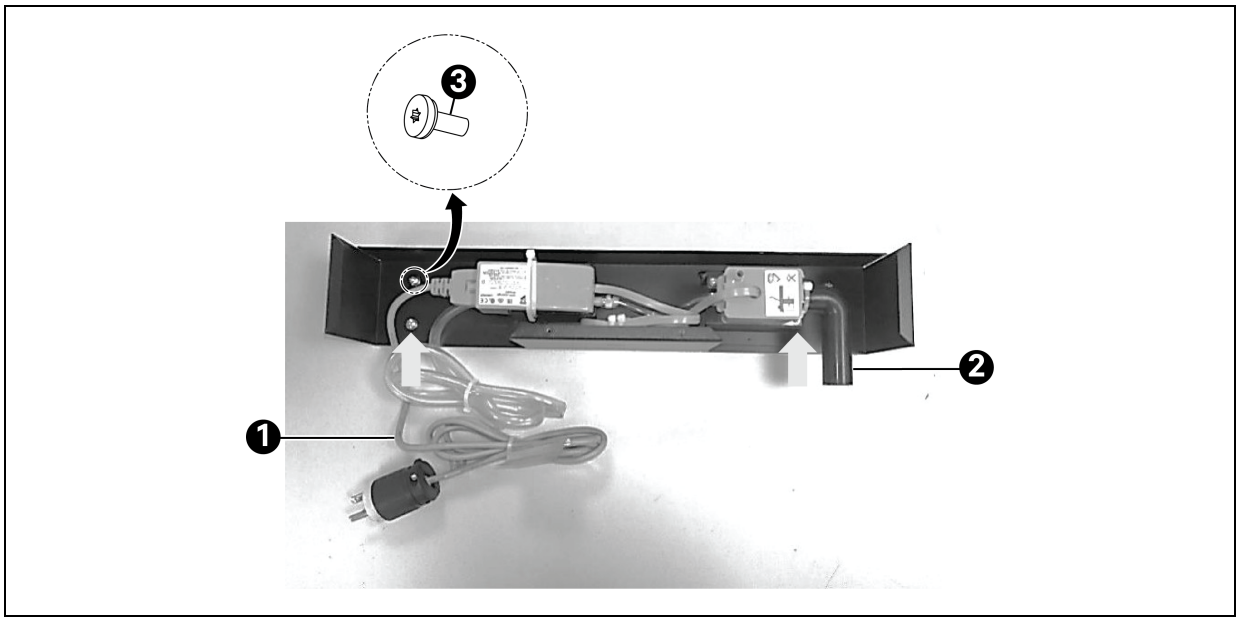
Figure 4.14 Internal Structure of Water Pump Bracket



Item	Description
1	Pump bracket part 1

2. Install the power cord and the L-shape pipe, as shown in Figure 4.15 on the next page .

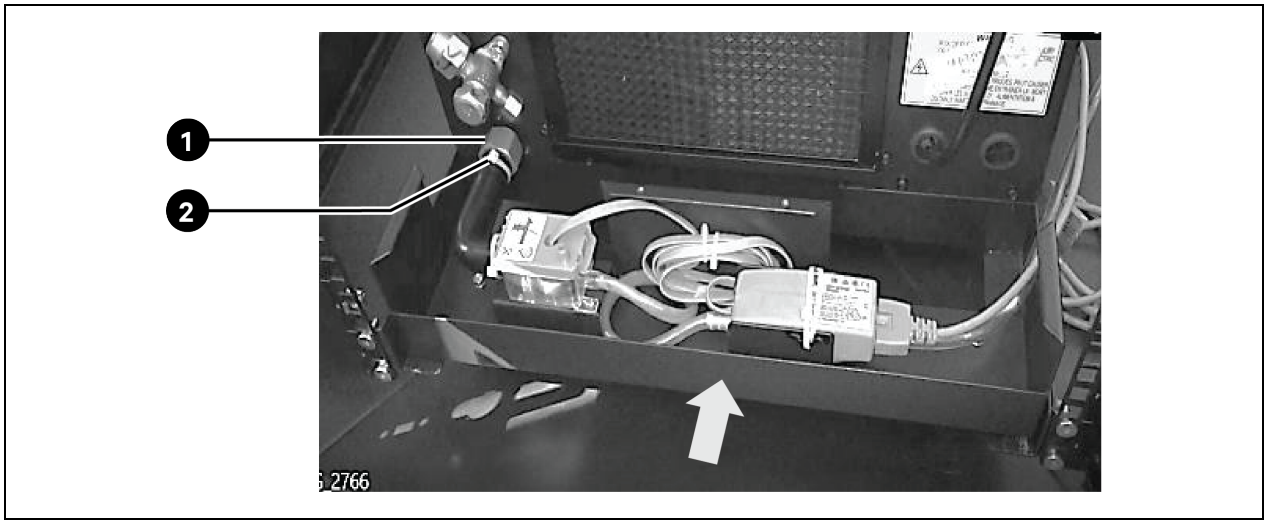
Figure 4.15 Internal Structure of Water Pump Bracket



Item	Description	Item	Description
1	Power cord	3	Screws (M5 x12)
2	L-shape pipe		

3. Loosen the four screws in Figure 4.15 above for about four turns.
4. Slide the pump bracket part 1 on L-shape mounting rail, as shown in Figure 4.16 below .

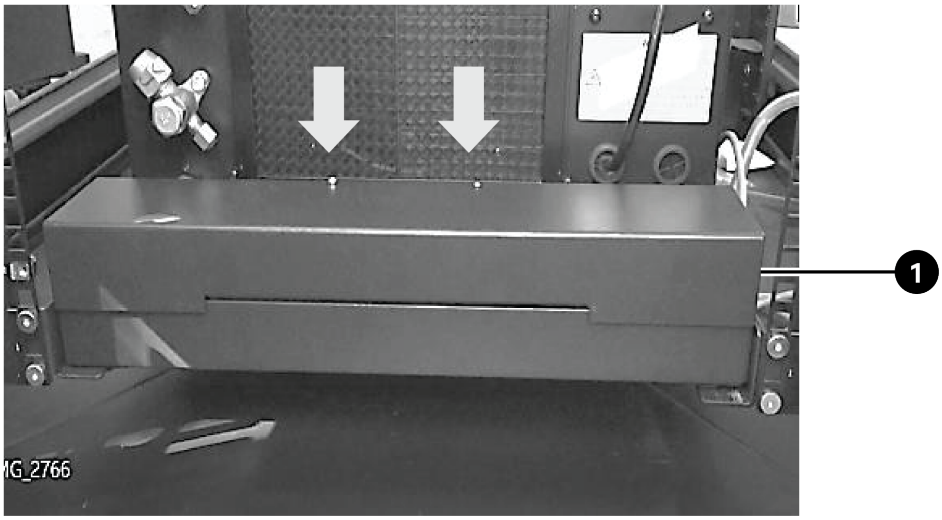
Figure 4.16 Installation of the Pump Kit



Item	Description
1	Drain fitting
2	Cable tie

5. Install L-shape pipe to drain fitting, and fix it with a cable tie, as shown in Figure 4.16 on the previous page .
6. Tighten the four screws to fix the pump bracket part 1, as shown in Figure 4.15 on the previous page .
7. Tighten the two screws to install pump bracket part 2 to pump bracket part 1, as shown in Figure 4.17 below .

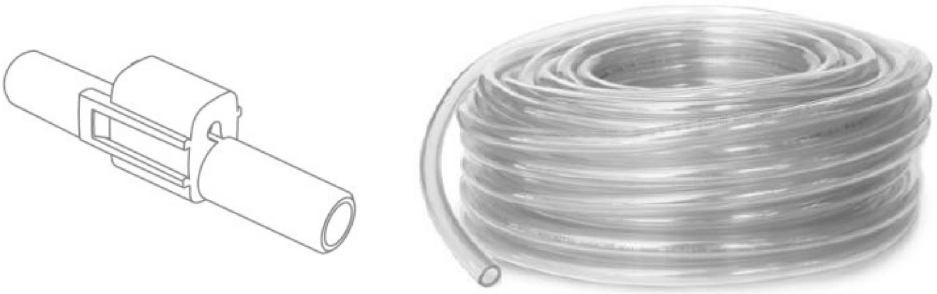
Figure 4.17 Installation of the Pump Bracket Part 2



Item	Description
1	Pump bracket part 2

One anti-Siphoning device and one condensate water pipe are shipped with the evaporator. The anti- Siphoning device is used to prevent siphonage and should be installed vertically on the pipe. The condensate water pipe can be used to extend drainage lines.

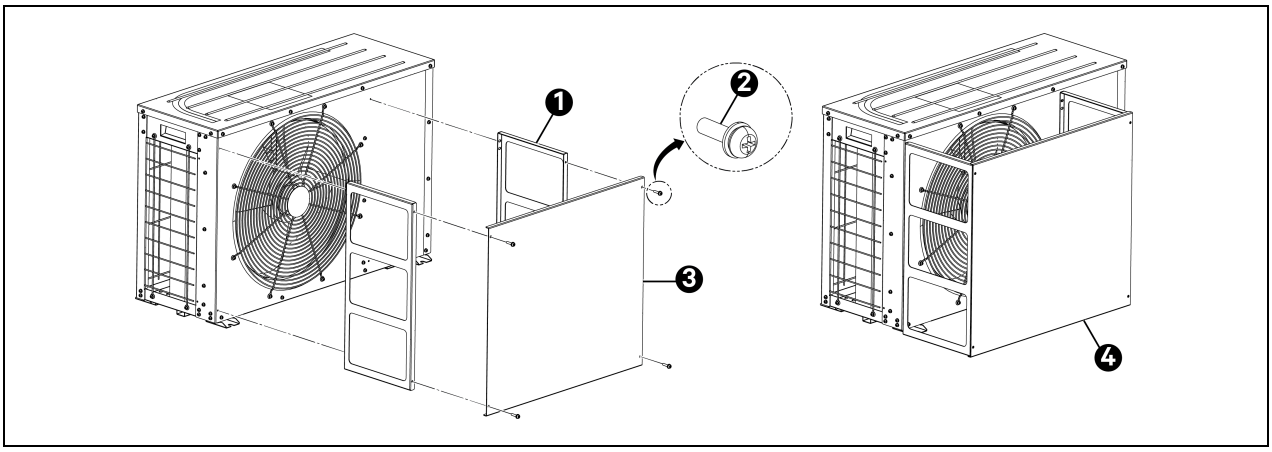
Figure 4.18 Anti-Siphoning Device and Condensate Water Pipe



4.4 Connecting the Copper Pipes to the Unit

For standard condensing unit, if a deflector must be installed, install the air deflector first before connecting the copper pipes, as shown in Figure 4.19 on the next page . Otherwise, you can ignore the air deflector installation steps.

Figure 4.19 Air Deflector Installation for Standard Condensing Unit



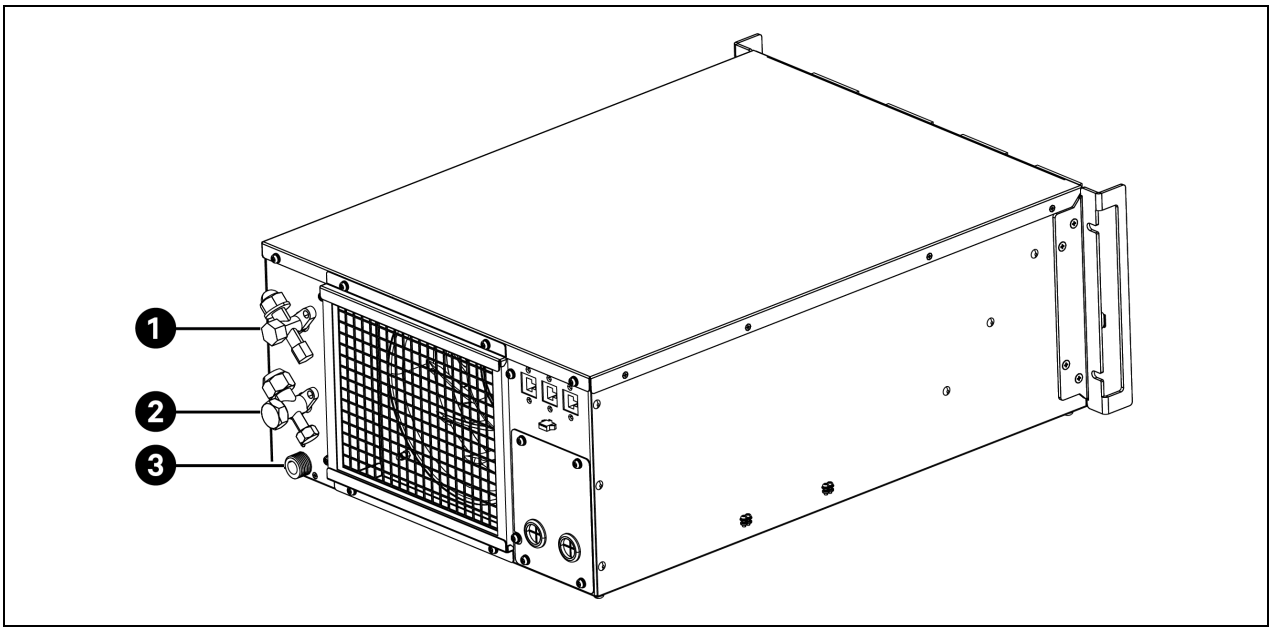
Item	Description	Item	Description
1	Side Panel* 2 pcs	3	Front Panel* 1 pcs
2	Stainless steel pan head screw * 4 pcs	4	Air deflector

In this section, the general principles of connecting copper pipes, installation information about the connectors and the required pipe connections will be explained in detail. Figure 4.20 on the facing page , Figure 4.21 on the facing page and Figure 3-24 show connectors on both the evaporator and the condensing unit.

General Principles

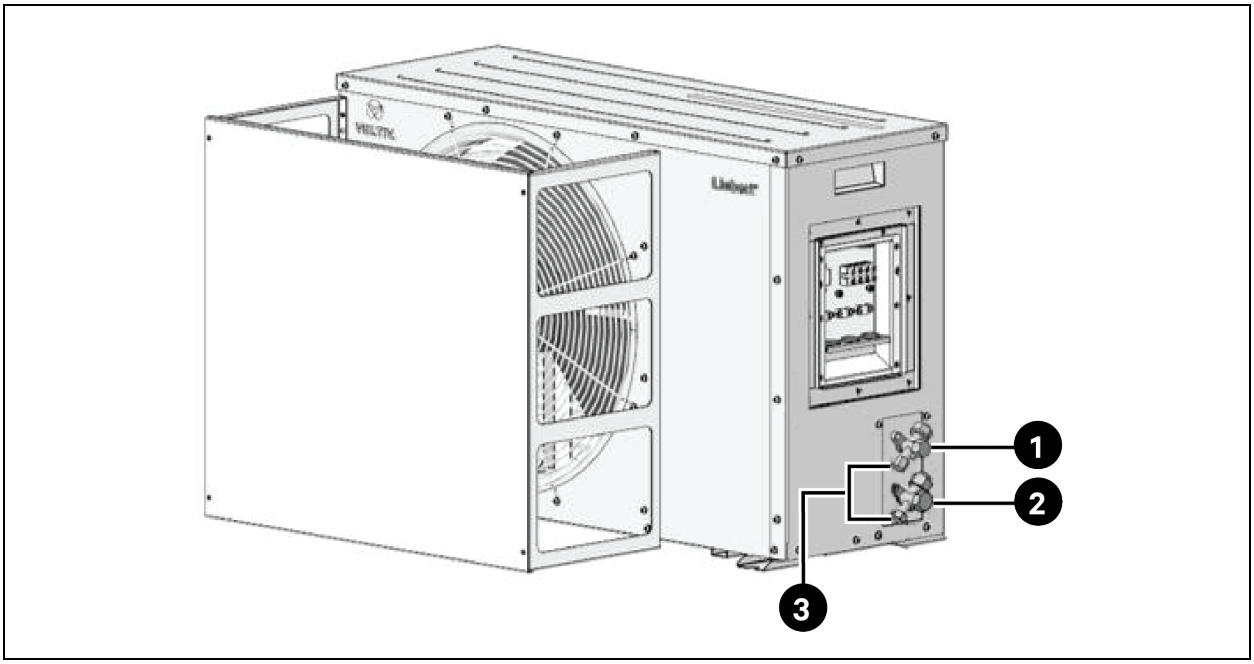
- Copper pipes with quick thread connectors must be used to connect the evaporator and the condensing unit. If the pipe length exceeds the standard pipe length and a straight copper pipe is used, piping joints must be brazed.
- Follow standard industry practices in selecting and placing pipes, evacuating the system, and charging the system with refrigerant. The standard refrigerant of the unit is R410A. The charging amount with low ambient condensing unit is 4.0 kg (8.82 lb), while the amount with standard condensing unit is 1.3 kg (2.87 lb).
- Avoid oil leakage and clogging in the system. Utmost care while considering these factors minimizes the noise and vibration significantly.

Figure 4.20 Connectors of Evaporator



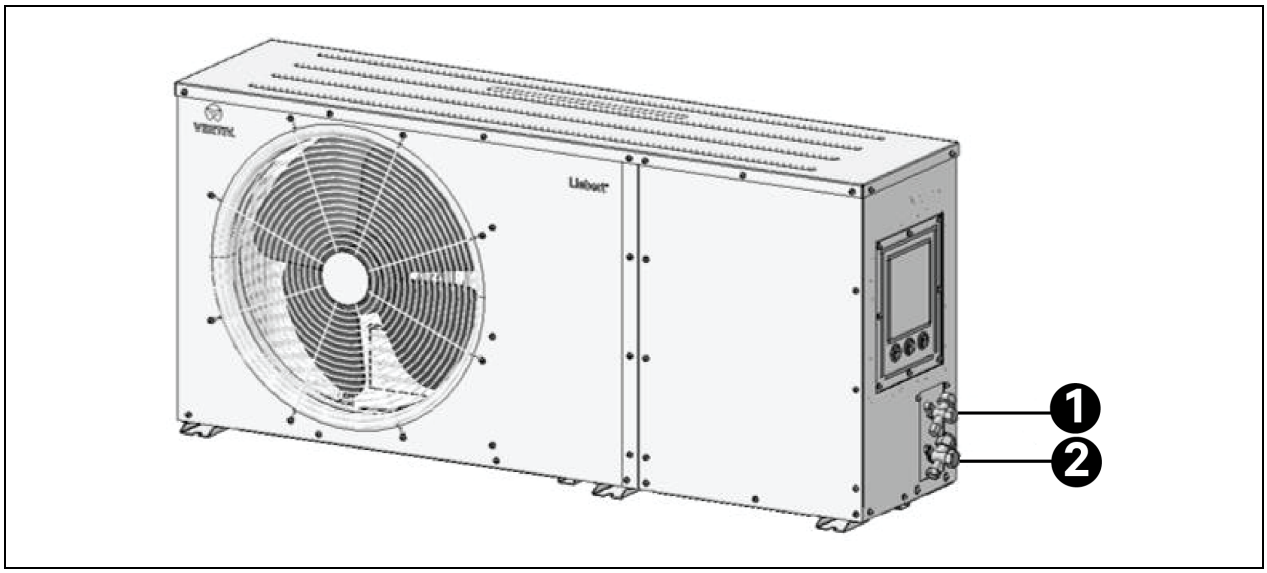
Item	Description	Item	Description
1	Liquid pipe: 3/8" Connector: 5/8" -18 UNF	3	Drain pipe: 1/2 NPT
2	Suction pipe: 1/2" Connector: 3/4" -16 UNF		

Figure 4.21 Connectors of Standard Condensing Unit



Item	Description	Item	Description
1	Liquid pipe: 3/8" Connector: 5/8" -18 UNF	3	Schrader valves
2	Suction pipe: 1/2" Connector: 3/4" -16 UNF		

Figure 4.22 Connectors of Low Ambient Condensing Unit



Item	Description
1	Liquid pipe: 3/8" Connector: 5/8" -18 UNF
2	Suction pipe: 1/2" Connector: 3/4" -16 UNF

Installation Notes of the Connector

Both top and bottom piping methods are compatible with the unit. The connectors of the unit are located on the evaporator and the condensing unit. Utmost care must be taken while connecting the quick thread connector.

Read the following steps thoroughly before making the connection:

- Remove the dust-proof caps.
- Wipe the coupling seats and threaded surface with a clean cloth carefully.
- Lubricate the male thread with refrigerant oil.
- Thread the coupling halves together manually (by hand) to ensure that the threads mate properly.
- Tighten the coupling body's hexagon nut and union valve until a definite resistance is felt.
- Use a marker to draw a line lengthwise from the coupling unit to the bulkhead. Tighten the nuts by an additional quarter turn with a wrench (22 mm for liquid pipe, 24 mm for suction pipe). The misalignment of the lines shows how much the coupling has been tightened. The final quarter turn is essential to ensuring that the joint doesn't leak.

NOTE: The maximal equivalent length of piping between the evaporator and the condensing unit is 30 m (98.43 ft).

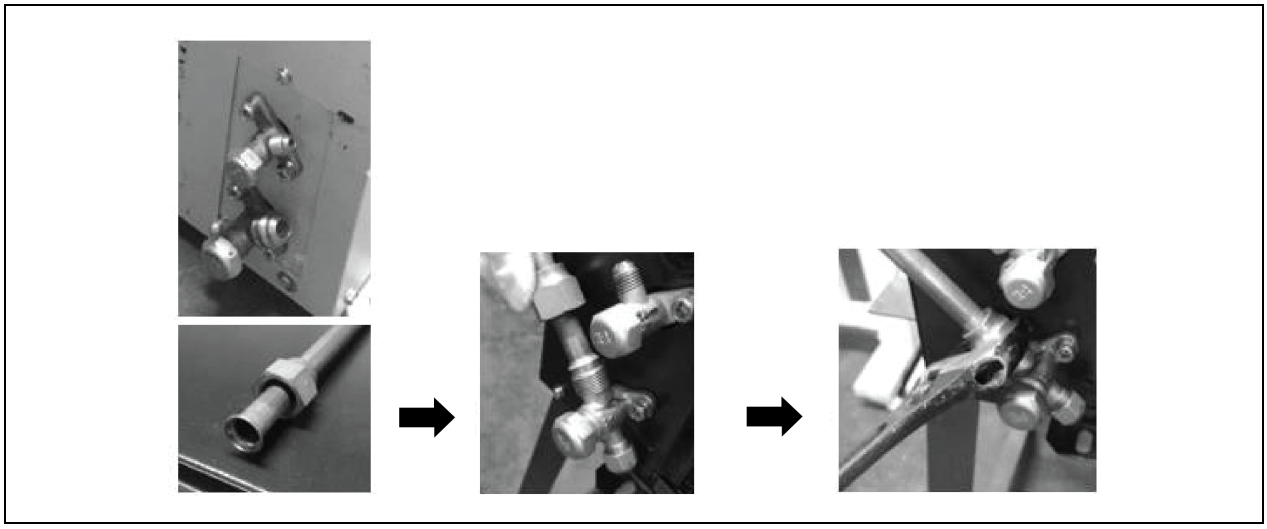
Table 4.4 below lists the equivalent length of the piping to be considered in the liquid line piping for the bends and the elbows connector devices.

Table 4.4 Equivalent Length for Bends and Valves

Liquid pipe OD (mm (inch))	Equivalent Length m (ft)				
	90° bend	45° bend	180° U bend	90° shut-off valve	Check valve
9.52 (3/8)	0.44 (1.44)	0.22 (0.72)	0.65 (2.13)	1.8 (5.91)	1.6 (5.25)
12.7 (1/2)	0.50 (1.64)	0.25 (0.82)	0.75 (2.46)	2.1 (6.90)	1.9 (6.23)

The procedure for fitting the connectors of the condensing unit are mentioned in Figure 4.23 below . The same can be replicated for fitting the connectors of the evaporator.

Figure 4.23 Tightening the Connectors of the Condensing Unit



Liquid pipe connector on condensing unit

- Connecting to ø 9.52 mm (3/8 in.) liquid pipe
- Coupling size: 5/8” - 18 UNF
- Torque value: 30 - 35 Nm (22.1 - 25.8 lb-ft)

Gas pipe connector on condensing unit

- Connecting to ø 12.7 mm (1/2 in.) gas pipe
- Coupling size: 3/4” - 16 UNF
- Torque value: 40 - 45 Nm (29.5 - 33.2 lb-ft)

Required pipe connections

Following steps must be implemented during connection of the refrigerant pipe between the evaporator and the condensing unit.

- The liquid pipe functions as the refrigerant liquid pipe of the condensing unit outlet. Select an appropriate pipe diameter and length for the pipe to ensure that the pressure drop of the refrigerant liquid through the pipe during the unit operation doesn't exceed 40kPa (5psi - 6psi).
- Install and remove the pipe with utmost care to prevent it from getting damaged. Use tube benders and ensure that all the bends are made accurately prior to making connections to either end.
- If the jointing mode is required, ensure all the refrigerant piping connections are made with silver blazed joints.
- Check all the piping supports, test leakage, as well as dehydrate and evacuate the pipes before usage. Use vibration isolation support to isolate the refrigeration pipes from the building.
- Use soft and flexible material for packing around the pipes to protect them from damage caused due to openings in walls and to reduce vibration transmission.
- Connect pipes of the evaporator and the condensing units based on the labels. The unit adheres to the quick connection mode.
- When installing the condensing unit 7.5m higher than the evaporator, a trap should be installed on the discharge pipe. This trap will retain refrigerant oil in the off cycle of the compressor. When the compressor starts, oil in the trap will be carried up and return to the compressor immediately.

4.5 Evacuating Line Set and Charging Extra Refrigerant and Lubricating Oil

4.5.1 Amount of Pre-charged Refrigerant

The system has been pre-charged with R410A refrigerant in factory. The pre-charged volume is shown in the table below.

Table 4.5 Amount of Pre-charged R410A Refrigerant

Unit	Refrigerant Charge kg (lb)
Evaporator (VRC200, VRC201, VRC202)	0.4 (0.9)
Standard condensing unit (VRC300, VRC301, VRC302)	0.9 (2.0)
Low ambient condensing unit (VRC350, VRC351, VRC352)	3.6 (7.9)

4.5.2 Amount of Extra Charge

The extra charge of the refrigerant and lubricating oil is calculated using the following formula:

Extra charge of refrigerant or lubricating oil (kg (lb)) = Refrigerant or lubricating oil per meter of the liquid pipe (kg/m (lb/ft)) × [Total length of the liquid pipe (m (ft)) – 10 m (32.8 ft)]

Table 4.6 Refrigerant or Lubricating Oil Per Meter of the Liquid Pipe

Refrigerant Per Meter of the Liquid Pipe kg/m (lb/ft)	Lubricating Oil Per Meter of the Liquid Pipe ml/m (ml/ft)
0.050 (0.034)	13.0 (4.0)

4.5.3 Evacuating Line Set

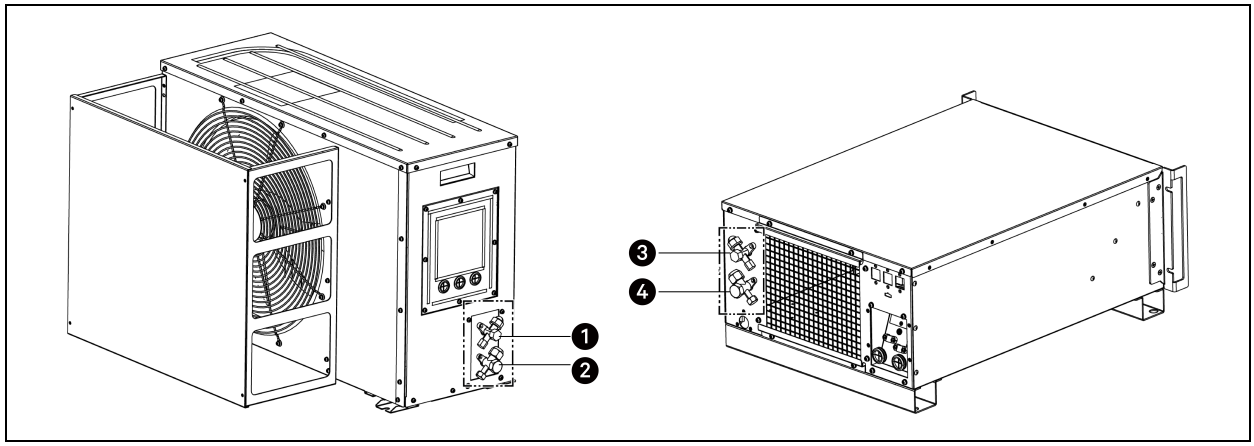
NOTE: The evaporator and the condensing unit have been pre-charged with R410A refrigerant in factory. Here you only need to evacuate the liquid pipe and the gas pipe between the evaporator and the condensing unit.

NOTE: Before evacuating the line set, make sure that the connectors on the condensing unit and the connectors on the evaporator are closed.

To evacuate the line set:

1. On the condensing unit, remove Schrader valve caps from High and Low Schrader valve connections (1 and 2 in Connectors on Condensing Unit and Evaporator below) on the condensing unit to the low and high sides of the manifold gauge. You can also evacuate from the High and Low Schrader valve connections (3 and 4 in Connectors on Condensing Unit and Evaporator below) on the evaporator.
2. Connect a nitrogen tank to the hose in the center of the gauge. Fill the line set with 2.8 MPa(a) (406.1 psig) nitrogen.
3. Wait for at least three hours and check for any leakage in the piping and connections. If there is no leakage, remove the nitrogen tank and connect a vacuum pump to evacuate the line set. The absolute pressure after evacuation should be below 65 Pa(a) or 500 microns.

Figure 4.24 Connectors on Condensing Unit and Evaporator



Item	Description	Item	Description
1	Liquid pipe connector on condensing unit	3	Liquid pipe connector on evaporator
2	Gas pipe connector on condensing unit	4	Gas pipe connector on evaporator

4.5.4 Charging Extra Lubricating Oil

NOTE: The system has been pre-charged with base lubricating oil (FV50S) in factory. When the liquid pipe between the evaporator and the condensing unit is shorter than 10 m (32.8 ft), you do not need to add extra lubricating oil. When the liquid pipe is longer than 10 m (32.8 ft), you need to add extra lubricating oil. It is recommended to charge the FV50S lubricating oil. If this type of oil cannot be obtained, you can use FVC68D which can be mixed with FV50S in any ratio.

NOTE: Risk of oil contamination with moisture. Can cause equipment damage. VRC systems require the use of PVE (FV50S or FVC68D) oil. PVE oil absorbs moisture at a much faster rate when exposed to air than previously used oils. Because moisture is the enemy of a reliable refrigeration system, extreme care must be used when opening systems during installation or service. If moisture is absorbed into the PVE oil, it will not be easily removed and will not be removed through the normal evacuation process. If the oil is too wet, an oil change might be required. PVE oils can act as a solvent in a refrigeration system. Maintaining system cleanliness is extremely important because the oil tends to bring any foreign matter back to the compressor.

After evacuating the unit, remove the vacuum pump and connect the lubricating oil tank to make the oil draw to the line set. Repeat this procedure (evacuating and then adding oil) several time until desired amount of oil is added.

4.5.5 Charging Extra Refrigerant

NOTE: The system has been pre-charged with R410A refrigerant in factory. When the liquid pipe between the evaporator and the condensing unit is shorter than 10 m (32.8 ft), you do not need to add extra refrigerant. When the liquid pipe is longer than 10 m (32.8 ft), you need to add extra refrigerant. The system is to be charged with R410A only.

NOTE: R410A is a mixed refrigerant. When charging the air conditioner with mixed refrigerant, charge only liquid refrigerant.

NOTE: Do not over-charge or under-charge the system. Otherwise the performance of the system will be affected.

NOTE: After charging extra refrigerant, completely open the gas pipe connector and liquid pipe connector on the evaporator and the condensing unit.

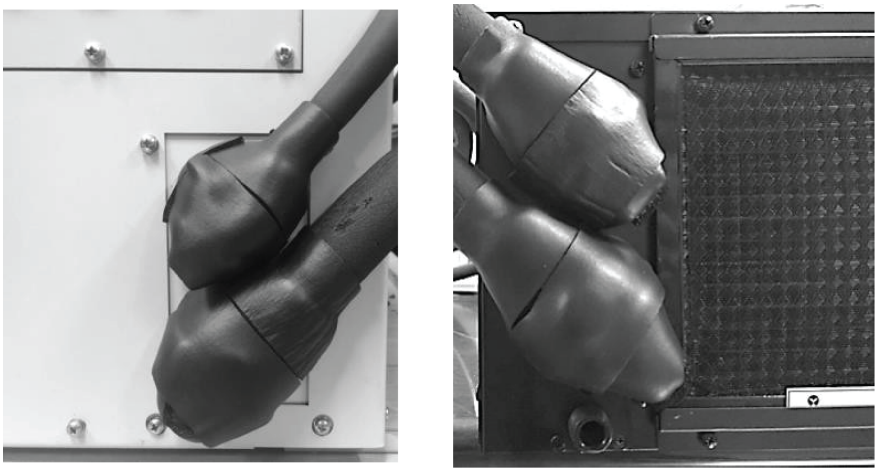
To charge the R410A refrigerant:

1. Remove the vacuum pump and connect the R410A refrigerant tank to the gauge. Purge manifold tank hose to remove air between refrigerant tank and manifold gauges.
2. Keep the refrigerant tank inverted to pull liquid refrigerant from the tank and place on scale. Once tank is on scale open the manifold gauge and start adding liquid refrigerant to both the liquid pipe and gas pipe. Keep tank inverted to insure liquid refrigerant is being drawn from the refrigerant tank.
3. When the desired amount of refrigerant is charged, close the valves on the manifold gauge and the refrigerant tank and remove the tank.

4.5.6 Insulating the Pipes and Connectors

After the above operations, use thermal insulation material to cover the gas and liquid pipes and connectors on both the evaporator and the condensing unit.

Figure 4.25 Insulating the Gas and Liquid Pipes and Connectors



4.6 Installation/Pre-commissioning Check List

After the unit is mounted and all the mechanical connections are completed, it is necessary to re-check the installation as per the pre-commissioning checklist per Table 4.7 on the facing page .

Table 4.7 Mechanical Installation Checklist

Items	Results
Sufficient space for maintenance activities at site	
All the fittings are connected firmly	
The placement direction of the evaporator is correct. The supply air is sent to the cold aisle at the front, and the hot air is drawn back to the return air inlet of the unit at the back	
Foreign materials in and around the equipment are removed (such as shipping materials, removed construction materials, tools, etc.)	
The condensate pump and pipes are connected properly	
All pipe joints are firmly fixed	
All pipe connectors and fasteners are tightly fastened	
Gas and liquid pipe connectors on the evaporator and condensing unit are completely opened	

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5 Electrical Installation

5.1 Installation Notes

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.

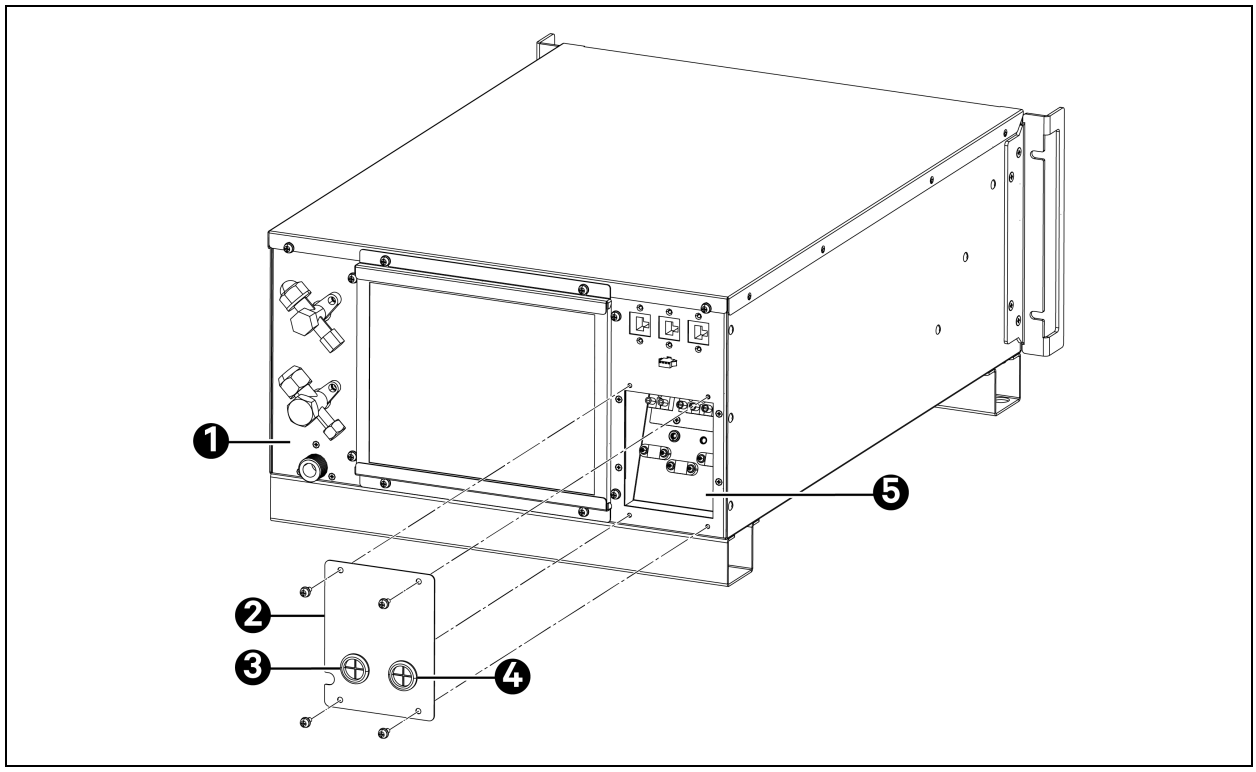
WARNING! Risk of improper wire sizing/rating and loose electrical connections. Can cause overheated wire and electrical connection terminals resulting in smoke, fire, equipment and building damage, injury or death. Use correctly sized copper wire only and verify that all electrical connections are tight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

5.2 Cable Connection

It is required to install circuit breakers between the unit and the power supply. The circuit breakers can be selected based on the full load amperage listed in Technical Specifications on page 13 .

The cable connection for the evaporator is operated through the cover panel at the back-side of the unit as shown in Figure 5.1 below .

Figure 5.1 Cover Panel for Cabling Connections



Item	Description	Item	Description
1	Rear side of the evaporator	4	Grommet for routing the condenser fan power supply cable
2	Cover panel	5	Electrical panel
3	Grommet for routing the evaporator power supply cable		

The power cables can be selected based on the amperage ratings for each component listed in Table 5.1 below

Table 5.1 Current Ratings of Components

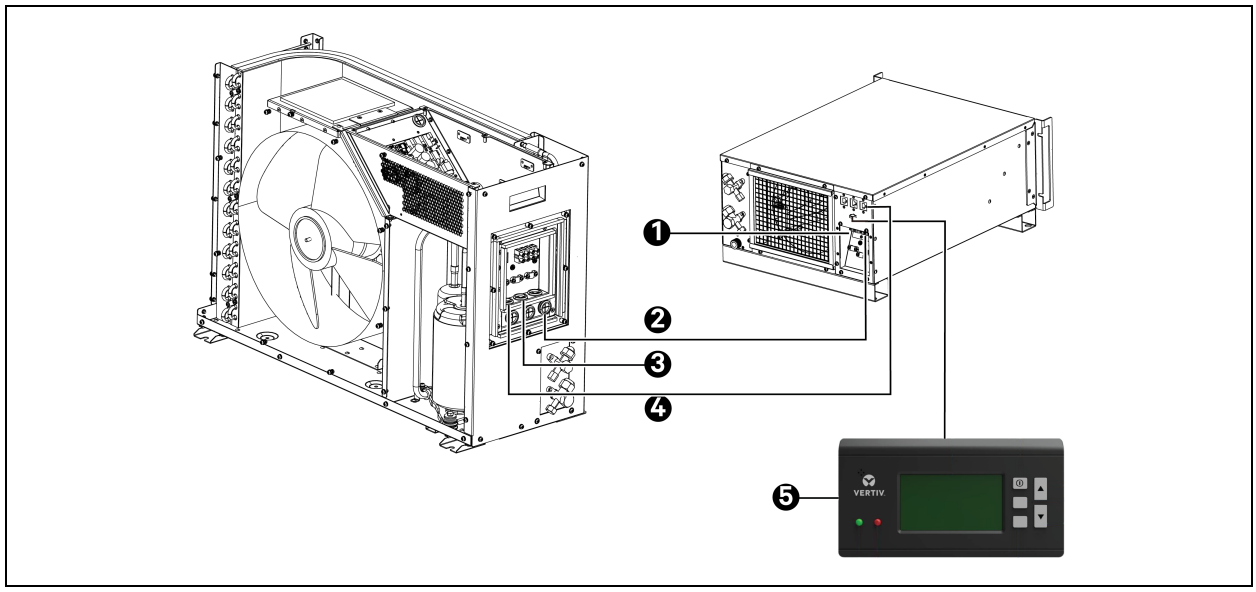
Unit Type	Input Voltage	Frequency	FLA of Compressor (A)	FLA of Liquid Line Solenoid Valve (A)	FLA of Condenser Fan (A)	FLA of Unit (A)
VRC200	120 Vac	60 Hz	-	-	-	2.1
VRC201	208/230 Vac	60 Hz	-	-	-	1.7
VRC300	208/230 Vac	60 Hz	7.2	-	0.87	7.2
VRC301	208/230 Vac	60 Hz	7.2	-	0.37	7.2
VRC202	230 Vac	50/60 Hz	-	-	-	1.5
VRC302	230 Vac	50/60 Hz	6.5	-	0.37	6.5

Table 5.1 Current Ratings of Components (continued)

Unit Type	Input Voltage	Frequency	FLA of Compressor (A)	FLA of Liquid Line Solenoid Valve (A)	FLA of Condenser Fan (A)	FLA of Unit (A)
VRC350	208/230 Vac	60 Hz	7.2	0.13	0.87	7.2
VRC351	208/230 Vac	60 Hz	7.2	0.08	0.37	7.2
VRC352	230 Vac	50/60 Hz	6.5	0.08	0.37	6.5

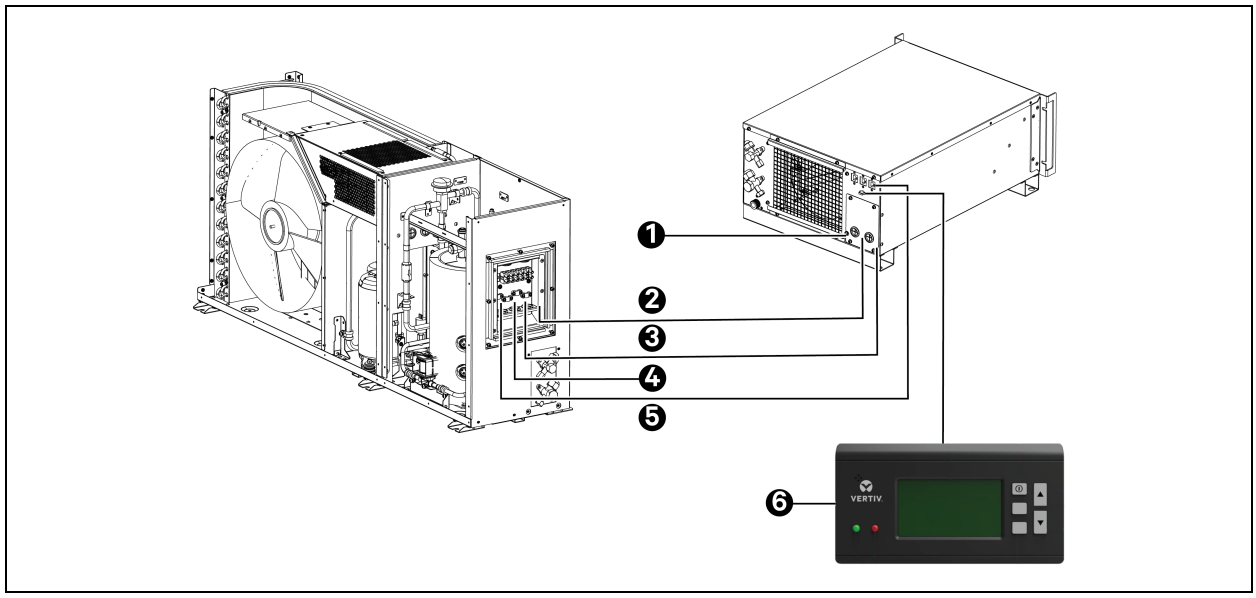
The cables of the evaporator and the condensing units are depicted in Figure 5.2 below and Figure 5.3 on the next page .

Figure 5.2 Overview of the Cabling Connections (Standard Condensing Unit)



Item	Description	Item	Description
1	Terminal for connecting the evaporator power supply cable	4	RS485 port for connecting the compressor communications cable
2	Terminal for connecting the condenser fan power supply cable	5	Display
3	Terminal for connecting the compressor power supply cable		

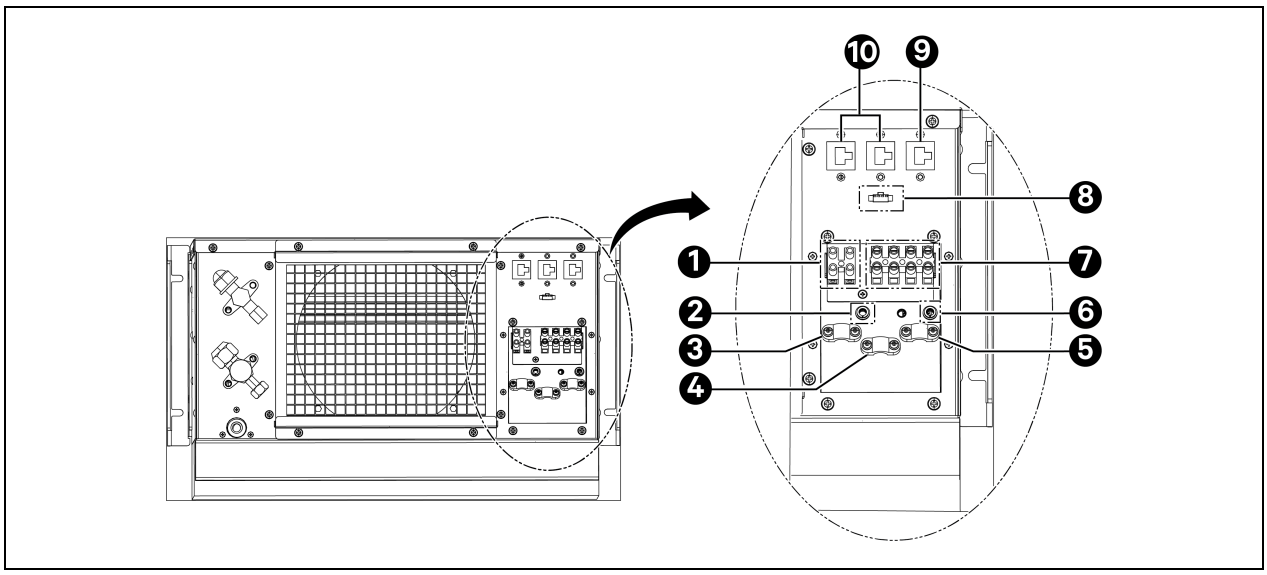
Figure 5.3 Overview of the Cabling Connections (Low Ambient Condensing Unit)



Item	Description	Item	Description
1	Terminal for connecting the evaporator power supply cable	4	Terminal for connecting the compressor power supply cable
2	Terminal for connecting the condenser fan power supply cable	5	RS485 port for connecting the compressor communications cable
3	Terminal for connecting the LLSV power supply cable	6	Display

Detailed input cabling connection of the evaporator power terminal is shown in Figure 5.4 below .

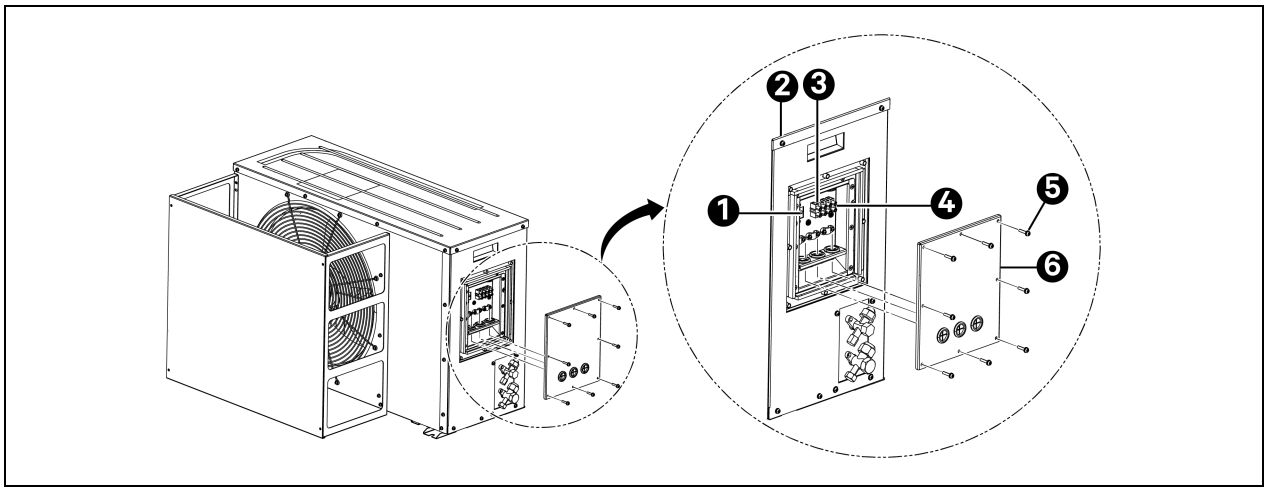
Figure 5.4 Input Cabling Connection – Evaporator Terminal



Item	Description	Item	Description
1	Terminal for connecting the evaporator power supply cable	6	Grounding screw 2
2	Grounding screw 1	7	Terminal for connecting LLSV power supply cable and condenser fan power supply cable
3	Cable clamp 1	8	Terminal for connecting display
4	Cable clamp 3	9	Terminal for connecting compressor communications cable
5	Cable clamp 2	10	RJ45-1/RJ45-2

Input cabling connections of the condensing unit power terminal block are shown in Figure 5.5 below .

Figure 5.5 Input Cabling Connections – Condensing Power Terminal

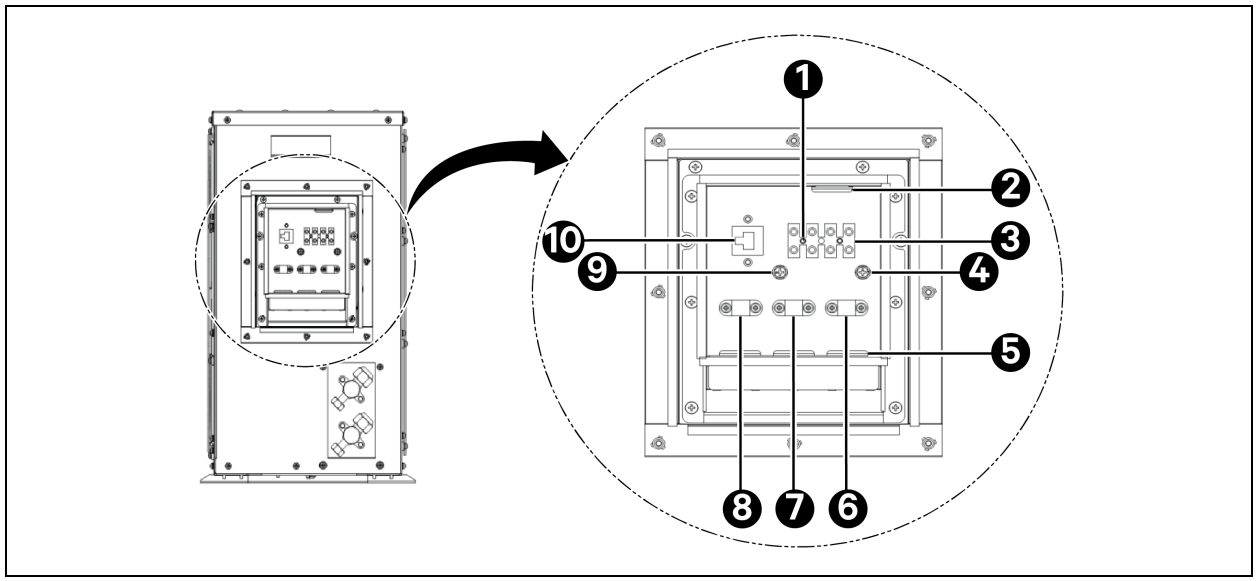


Item	Description	Item	Description
1	Terminal for connecting condensing unit communications cable	4	Terminal for connecting condenser fan power supply cable
2	Sealing strip	5	Cross head screw M4*10 × 8PCS
3	Terminal for connecting compressor power supply cable	6	Cover plate

Detailed input cabling connections of the condensing unit electric box are shown in Figure 5.6 on the next page and

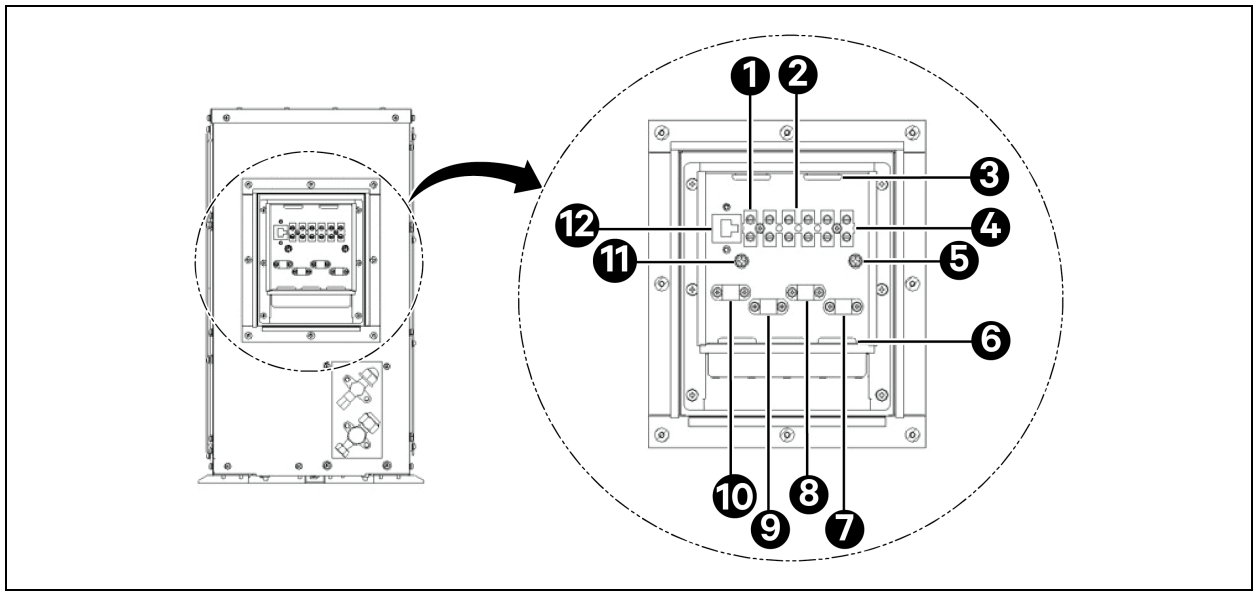
Figure 5.7 on the next page .

Figure 5.6 Standard Condensing Unit Electric Connection Illustration



Item	Description	Item	Description
1	Terminal for connecting compressor power supply cable	6	Cable clamp 3
2	Inner cable hole	7	Cable clamp 2
3	Terminal for connecting condenser fan power supply cable	8	Cable clamp 1
4	Grounding screw 2	9	Grounding screw 1
5	External cable hole	10	RS485 port for connecting compressor communications cable

Figure 5.7 Low Ambient Condensing Unit Electric Connection Illustration



Item	Description	Item	Description
1	Terminal for connecting compressor power supply cable	7	Cable clamp 4
2	Terminal for connecting LLSV power supply cable	8	Cable clamp 3
3	Inner cable hole	9	Cable clamp 2
4	Terminal for connecting condenser fan power supply cable	10	Cable clamp 1
5	Grounding screw 2	11	Grounding screw 1
6	External cable hole	12	RS485 port for connecting compressor communications cable

5.3 Connecting Communications Cable

5.3.1 Display Cable

Two display cables shall be provided in the accessories kit. Insert one end of the cable into the display board plug and connect the other end of the cable to the display board.

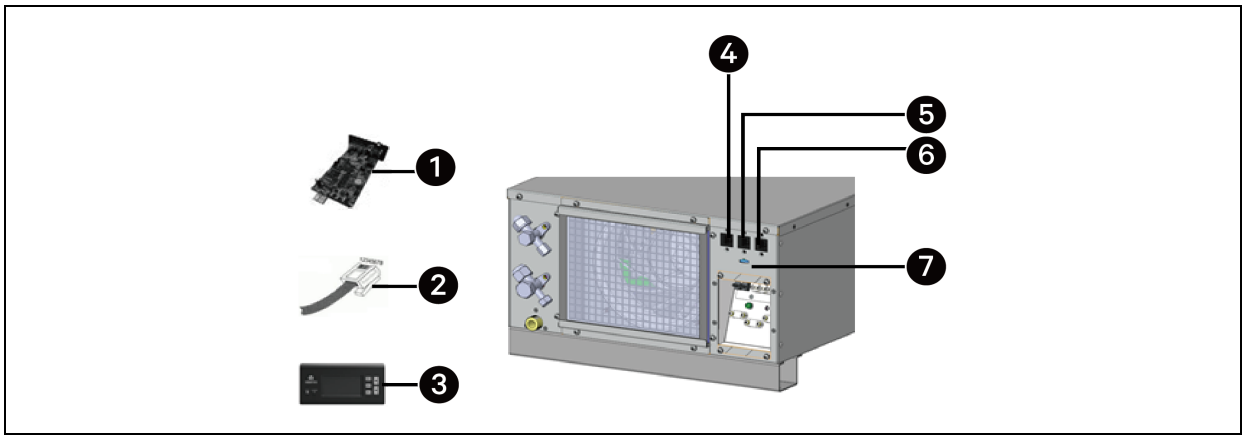
5.3.2 Communications Cable

The RJ-45 cable (RS485-3) for connecting the evaporator and the condensing unit must be provisioned by the customer. The length of the communication line should be prepared according the actual installation distance at site. The position and description of insert plug are shown in Figure 5.6 on the previous page and Table 5.2 on the next page .

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) could connect with the SIC card monitoring kit. For detailed installation, please refer to RDU-SIC G2 Card Field Installation for details. The RS485-2 is reserved, it can be used for communication with Vertiv rPDU. The aforementioned connections are shown inFigure 5.8 below and Table 5.2 on the next page .

NOTE: The VRC has only one subordinate port for master (Modbus RTU subordinate). It cannot support two Modbus RTU masters simultaneously.

Figure 5.8 Communication and Monitoring Cable Connection in the Evaporator



Item	Description	Item	Description
1	SIC card	5	RS485-2 (reserved)
2	RJ-45	6	RS485-3 (connecting compressor communications cable)
3	Display	7	Terminal (connecting display)
4	RS485-1 (connecting SIC card)		

Table 5.2 Communication Port Description

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

5.4 Installation Inspection

After completing the electrical installation, inspect the installation according to Table 5.3 below .

Table 5.3 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 breakers and fuses are correct (refer to the unit nameplates to select suitable miniature circuit breakers or fuses)	
The control cables are connected firmly	
All the cables connections are fastened appropriately, with no loose screws at the connections	

After confirming the above points, you can start the commissioning of the unit.

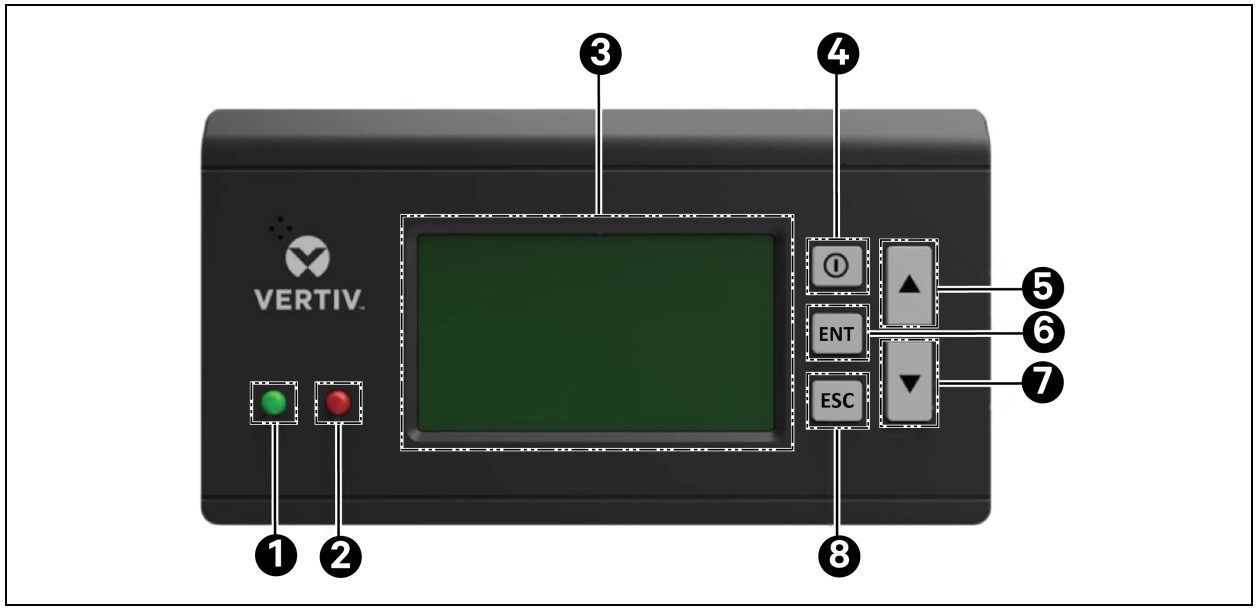
NOTE: Do not power on the unit until any Vertiv authorized technical personnel has checked and confirmed the unit

6 Controller Operation Instructions

6.1 LCD Screen

The LCD screen displays English menus with white backlight. Figure 6.1 below depicts the image of the controller display.

Figure 6.1 Controller Display

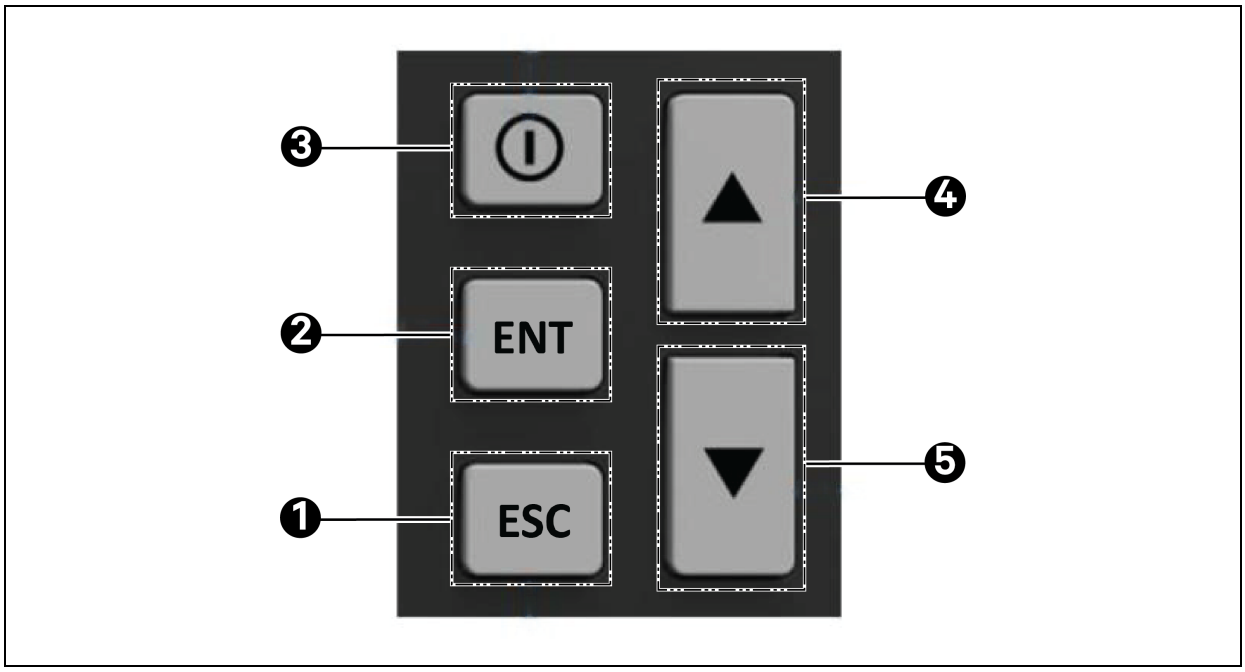


Item	Description	Item	Description
1	Run Indicator	5	Up Arrow
2	Alarm Indicator	6	Enter Button
3	LCD Screen	7	Down Arrow
4	ON/OFF Button	8	Escape Button

6.2 Control Buttons

The micro-processing controller provides five control buttons, as shown in Figure 6.2 on the next page .

Figure 6.2 Control Buttons



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

The functions of the control buttons are described in 6.1 on the previous page

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

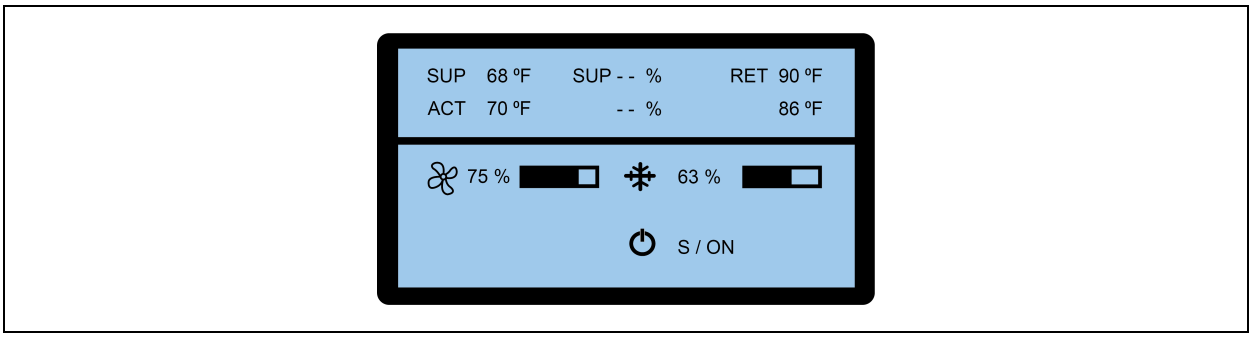
6.3 ON Screen

After the unit is powered on, the LCD screen will display the ON screen, and you can choose English or Chinese on the display board.

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 . The temperature units of VRC200, VRC201 and VRC202 are Fahrenheit, Fahrenheit and Celsius, respectively. The VRC200 is used as an example.

Figure 6.3 Normal Screen



In the upper half of the screen, the settings and the actual supply air temperature are displayed in the first column, humidity in the second column, and return air temperature in the third column.

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

The icons on the main screen indicate the unit output status, unit property, and unit operating status. The icons and their definitions are displayed in Table 6.2 below .

Table 6.2 Controller Display Icon Details

Icons	Definitions
	Fan rotating speed. The percentage of actual fan rotating speed
	Compressor capacity. The percentage of actual compressor capacity
	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

6.5 Unit Working Icons

The icons and their definitions are listed in Table 6.3 below .

Table 6.3 Description of Icons

Icon	Description
SUP	Supply air temperature setpoint
ACT	Actual air temperature
RET	Specified return temperature

Table 6.3 Description of Icons (continued)

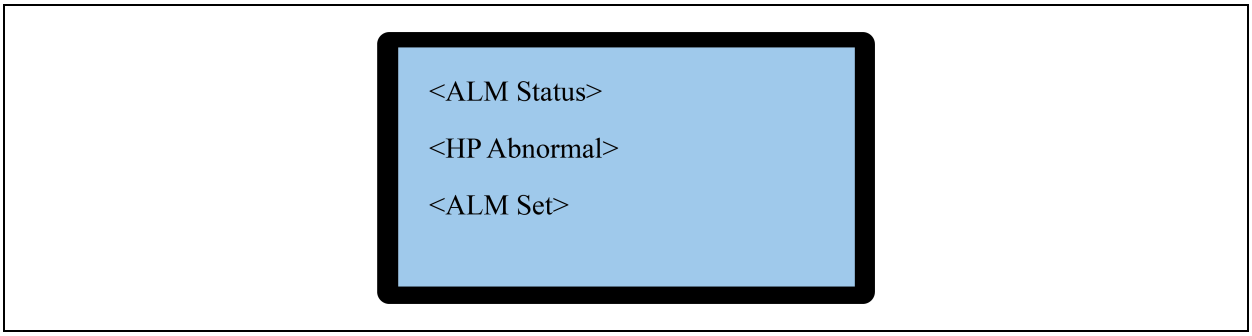
Icon	Description
	The cooling output of compressor
	Rotating speed rate of the fan, ranging from 30% to 100%
	Unit attribute/running state. S: standalone; RUN: running; OFF: shutdown

6.6 Menu

6.6.1 Alarm Menu

Select Alarm Menu on Main Menu screen to enter the screen as shown in Figure 6.4 below . Press the Up or Down button to scroll up or down the menu items.

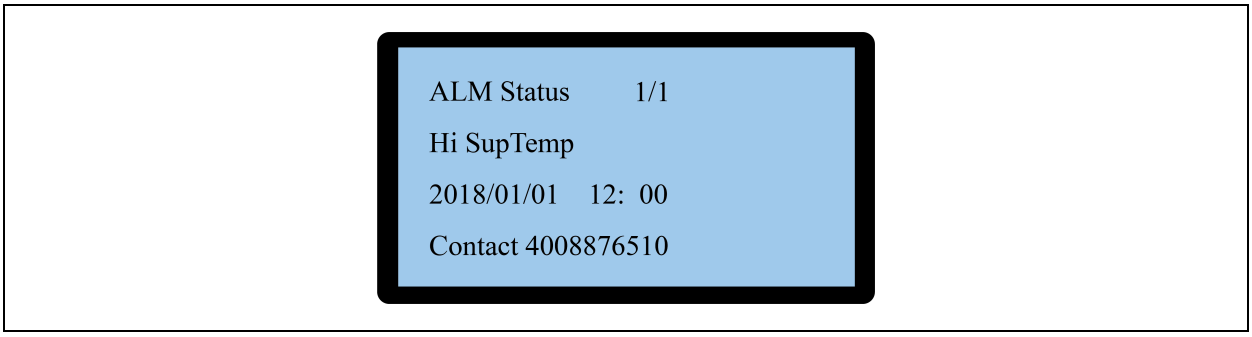
Figure 6.4 Alarm Menu



6.6.2 Alarm Status

The alarm status menu is used to monitor the current alarm status of the air conditioner unit. Alarm or specific alarm information will not be displayed. The specific alarm information includes XX/YY, alarm type, and alarm generation time, as shown in Figure 6.5 below . XX indicates the alarm serial number (SN), and YY indicates the total number of reported alarms.

Figure 6.5 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.

NOTE: The current alarms are automatically cleared upon system power failure.

6.6.3 Alarm Set

On the Alarm Set menu, select to enter the alarm setup screen. 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 6.6 below , Figure 6.7 below and Figure 5-8. Parameter settings can be saved permanently.

Figure 6.6 Items of the Alarm Value Setup Menu

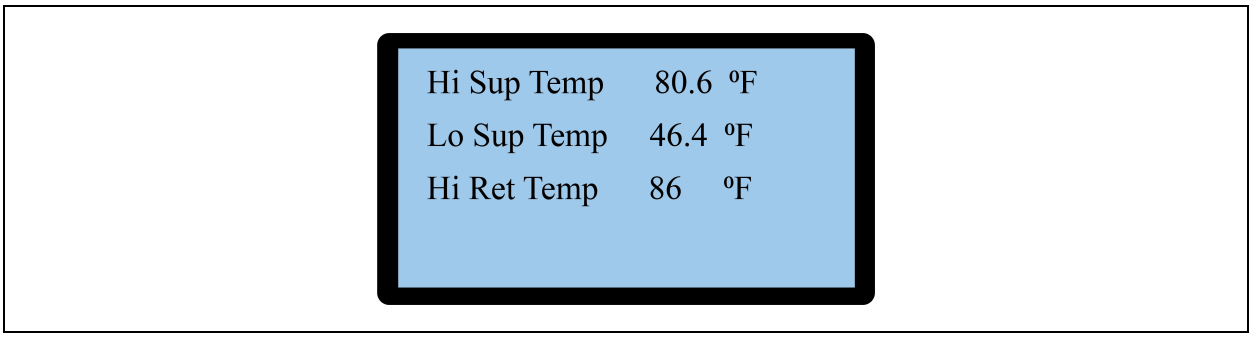


Figure 6.7 Items of the System Alarm Attribute Setup Menu

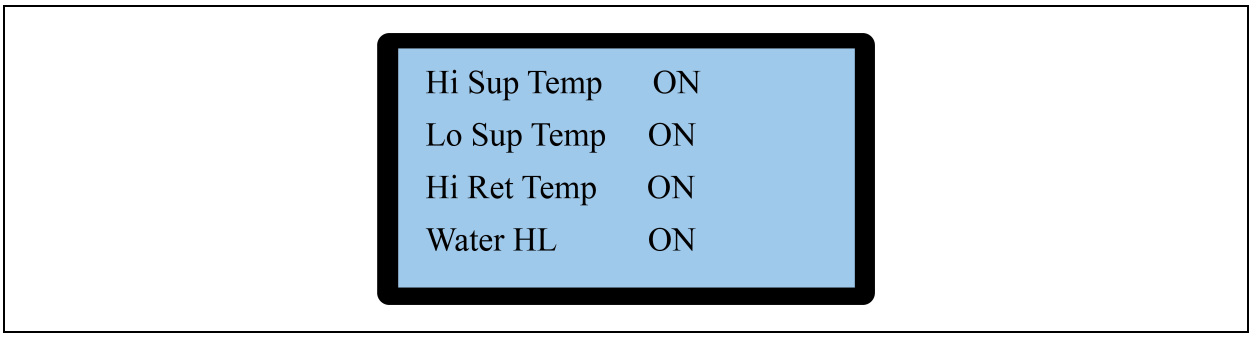
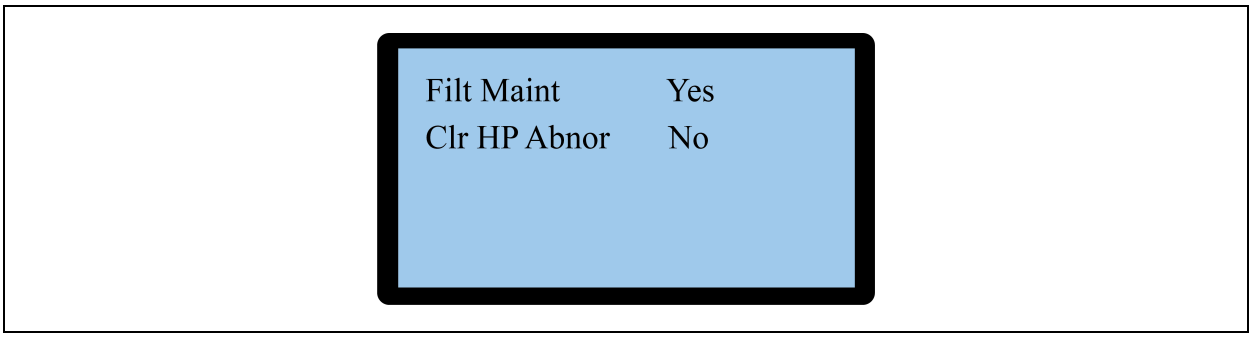


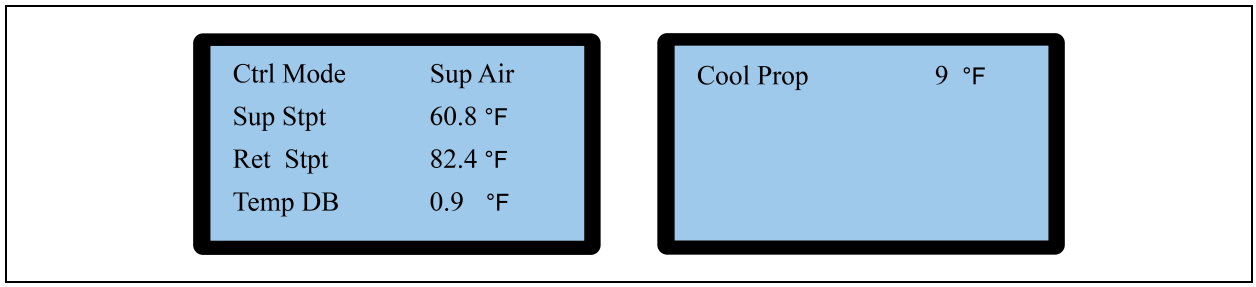
Figure 6.8 Items of Alarm Handle Attribute Menu



6.6.4 Temp Set

Select Main Menu > Temp Set to enter the screen as shown inFigure 6.9 on the next page . The Temperature Setting values will be permanently saved.

Figure 6.9 Temperature and Humidity Set Menu



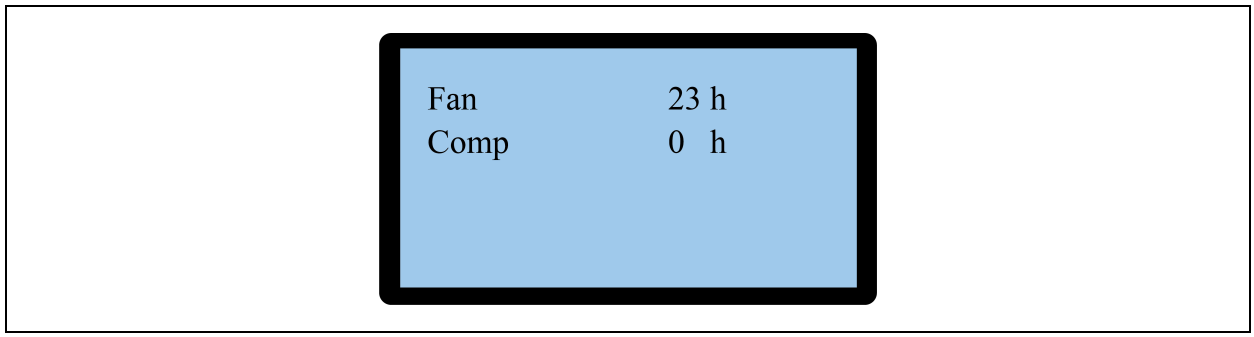
NOTE: The specified temperature value is the target temperature for ensuring normal system running. When the control mode is set to return or supply air, the specified temperature is the temperature of the return air or supply air.

- **The default control mode of the unit is return air control mode, and the setpoint is 25 °C (77 °F).**
- **If the evaporator is used in an open rack, it is recommended to use return air control mode.**
- **If the evaporator is used in an enclosed cabinet, it is recommended to use supply air control mode.**

6.6.5 System Status

Select Main Menu > System State to enter the System State menu, as shown in Figure 6.10 below .

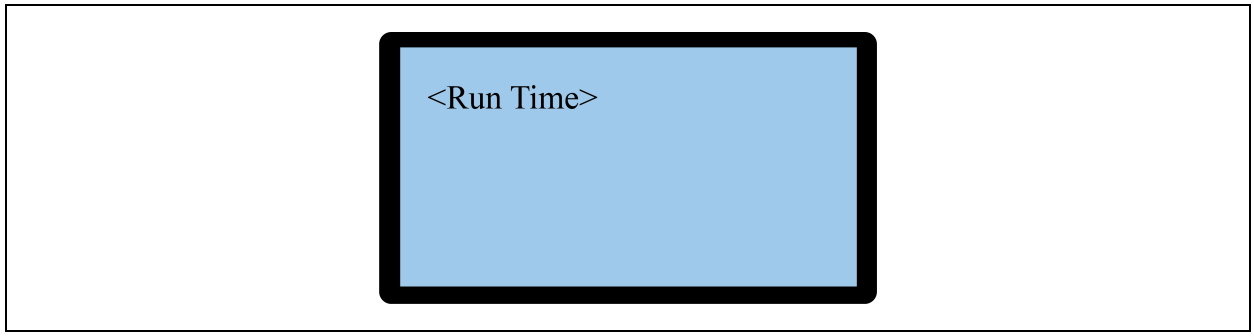
Figure 6.10 System Status



6.6.6 Run Time

You can query the operation time of the device on this menu, as shown inFigure 6.11 below .

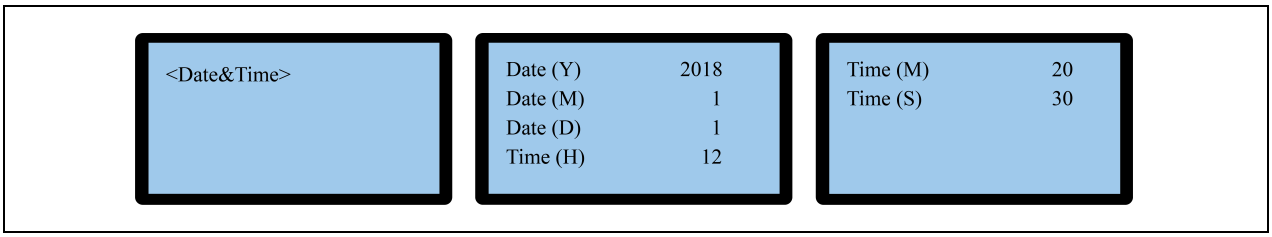
Figure 6.11 Run Time Menu



6.6.7 Help Menu

The menu includes Date &Time information. You can view the relevant information, as shown in Figure 6.12 below .

Figure 6.12 Date and Time Menu



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7 Startup Commissioning

7.1 Preparations Before Commissioning

7.1.1 Mechanical Part

- Ensure all valves are open in the refrigerant lines as per their initial valve opening set-points.
- Ensure that the amount of refrigerant charged inside the system is correct.
- Connect the condensate water drain system piping and inspect for any leakages in the connections.
- Ensure that the unit has a heat load of at least 0.9 KW. If not, use other heating devices that compensate for the heat load to ensure necessary amount of heat load for commissioning.

7.1.2 Electronic Part

- Ensure that the input voltage of the main power supply is within ± 10% of the rated voltage and that the power disconnector is closed.
- Ensure that all electrical or control connections are correct and tighten all electrical and control connectors.
- Ensure that the power cable and low-voltage control cable are separately arranged and far from electromagnetic noise sources.

7.2 Start-up Inspection Checklist

Before powering up the unit, perform the mechanical and electrical inspections according to Table 6- 1.

Table 7.1 Start-Up Inspection Checklist

Inspection	Items	Remarks
Mechanical inspection	The evaporator and the condensing unit have been connected as an entire system	
	All valves in system have been opened fully	
	Refrigerant and oil have been added as instructed	
	Drainage pipe has been connected properly and tightly	
	There is heat load for AC operating, if not, please increase the heat load by some devices, such as heaters	
Electrical inspection	The AC mains voltage and frequency are normal, and the AC mains correction is correct without any short circuit	
	All electrical or control connections are correct and tight	

7.3 System Commissioning

The evaporator and the condensing unit have been charged with the rated amount of refrigerant in factory, when the evaporator and the condensing unit have been connected as an entire system at site. Follow the steps below to ensure the normal operation of the unit:

- Close all the circuit breakers of the unit only after a careful inspection of the entire unit installation.
- 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 or warnings is displayed.

- Ensure that the operating status of 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.
- If any abnormal operation is noticed, stop the unit by pressing the ON/OFF button on the display board for 3 seconds to disconnect all circuit breakers.

7.4 Commissioning Complete Inspection

Check according to Table 7.2 below after commissioning.

Table 7.2 Checklist After Commissioning

Inspection Items	Inspection Results
All outputs are functional	
The temperature settings are correct and are controlled within range	
There is no abnormal alarms or warnings on the controller	
All the other functions are set correctly	

8 System Operation and Maintenance

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.

8.2 Electrical Inspection

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

Following are the steps to inspect the boards:

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

8.3 Evaporator Maintenance

8.3.1 Evaporator Fan

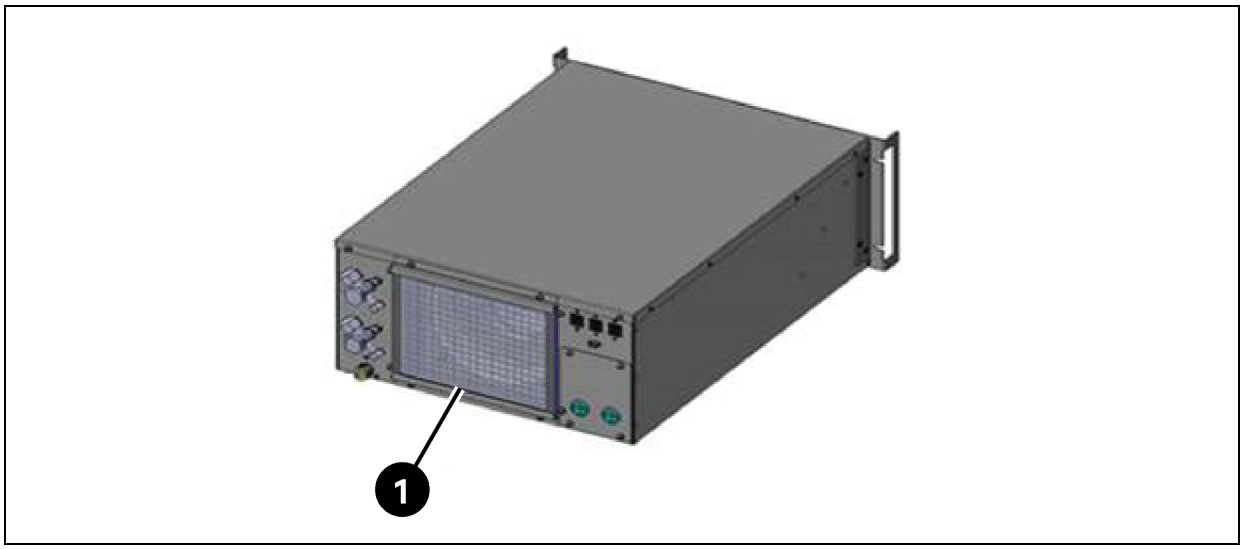
Since the fan operates 24/7 throughout the year, any unusual airflow obstruction must be cleared in time to avoid damage to the cooling system and other system components caused by reduced air volume. Periodic inspection covers the state of the fan impellers, fastening of fan components, abnormal noise of the fan, and cable connection of the fan.

WARNING! Do not operate and maintain the fan in a running condition to avoid any injury to the operator or any damage to the fan blades.

8.3.2 Return Air Filter

The return air filter is mounted on the back side of the evaporator, as shown in Figure 8.1 below . 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 for its condition once a month and be replaced as required.

Figure 8.1 Return Air Filter

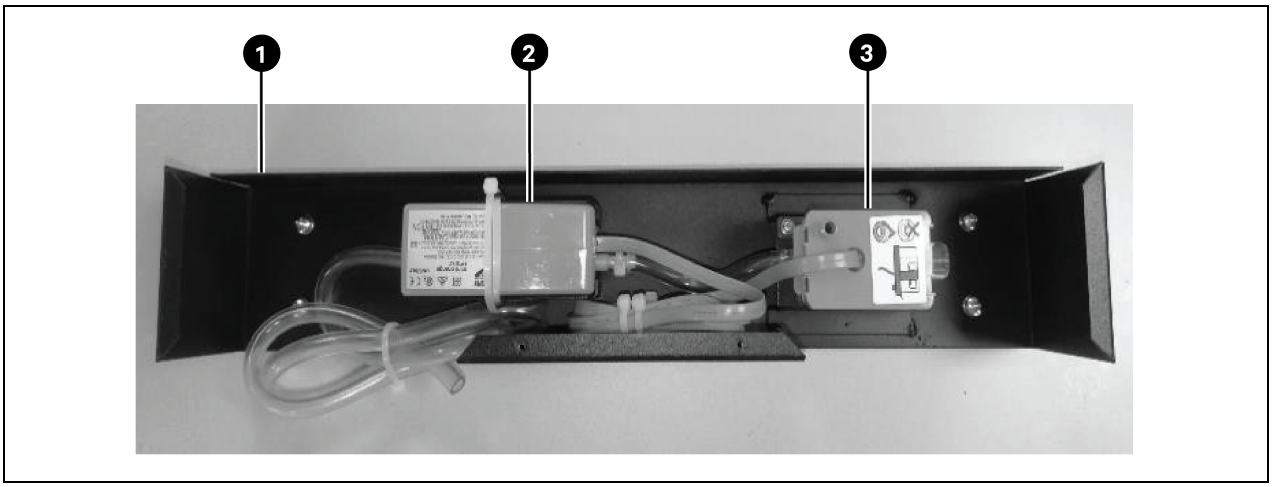


Item	Description
1	Return Air Filter

8.3.3 Drainage Pump

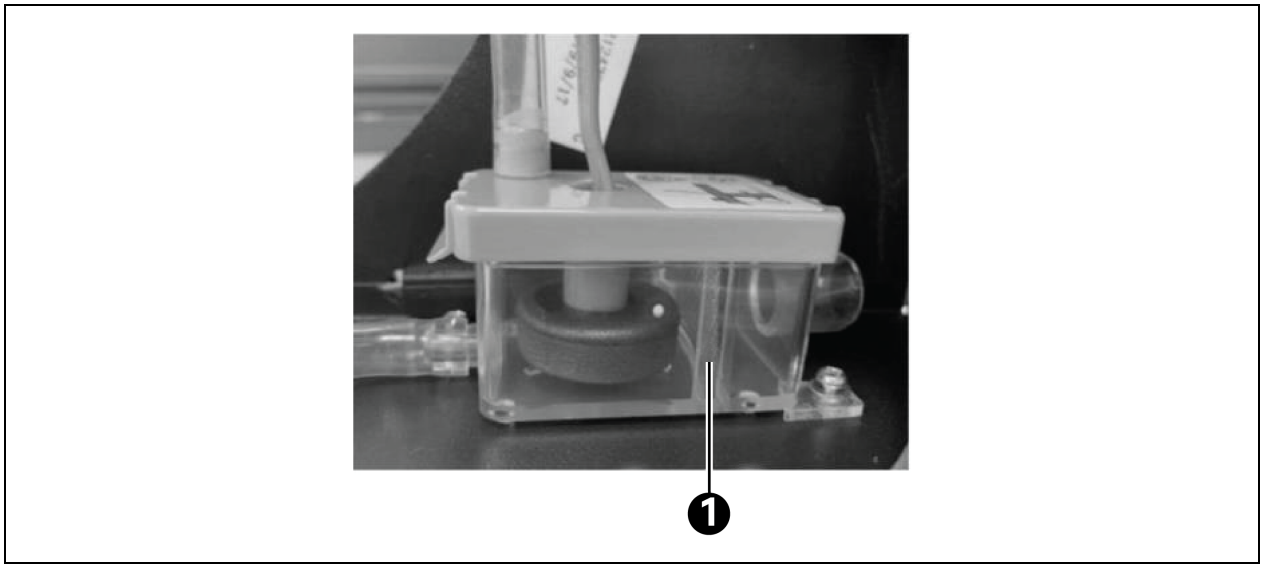
Inspect the drain pipe for normal operation. Ensure no pipe buckling is present. If the pipe buckling happens, the new pipe should be used. Ensure that reservoir, pump filter, and inlet tube are free of sludge and debris. If not, please clean it.

Figure 8.2 Condensate Pump Kit



Item	Description	Item	Description
1	Pump Brackets	3	Pump Reservoir
2	Pump		

Figure 8.3 Pump Filter



Item	Description
1	Pump Filter

8.4 Condensing Unit Maintenance

8.4.1 Condenser

- Sometimes the airflow through the condensing unit is restricted. In such a scenario, use compressed air or a fin cleaner (alkalescency) to clean the dust and debris that inhibit airflow off the condenser. The compressed air should be blown in the reverse airflow direction.
- Check for bent or damaged fins and repair them, if necessary.
- Check the connection refrigerant pipes for signs of oil leakage and rectify it if any leakage is found.

8.4.2 Compressor

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 if the suction pressure and discharge pressure are balanced and verify that the motor does not rotate reversely. 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.

8.4.3 Condenser Fan

The monthly inspection items of the fan include: motor operation status, impeller status, fan fixation and clearance between fan and impeller. Inspect the motor bearing and impeller monthly and replace it if any damaged impeller is found. Check that the impeller is tightly mounted on the rotor of the motor and does not rub against its neighboring metal components during rotation. Since the fan kit operates 24 hours every day continuously, any unusual airflow obstruction must be cleared in time to avoid the damage to the cooling system and other system components caused by reduced air volume.

8.4.4 Receiver and Heating Belt

Periodically check the liquid level of the refrigerant in fluid reservoir to ensure that no refrigerant leakage happens. For detailed operation, refer to 6.3 Check Refrigerant Charge Capacity of Low Ambient Condensing Unit.

Periodically check whether the heating belt works normally. When the system is powered on and standby, and the high pressure is lower than 1.2 MPa, the heating belt preheats the receiver. If the heating does not happen, check whether the heating belt or the pressure switch works normally. After confirming the fault part(s), replace it or them.

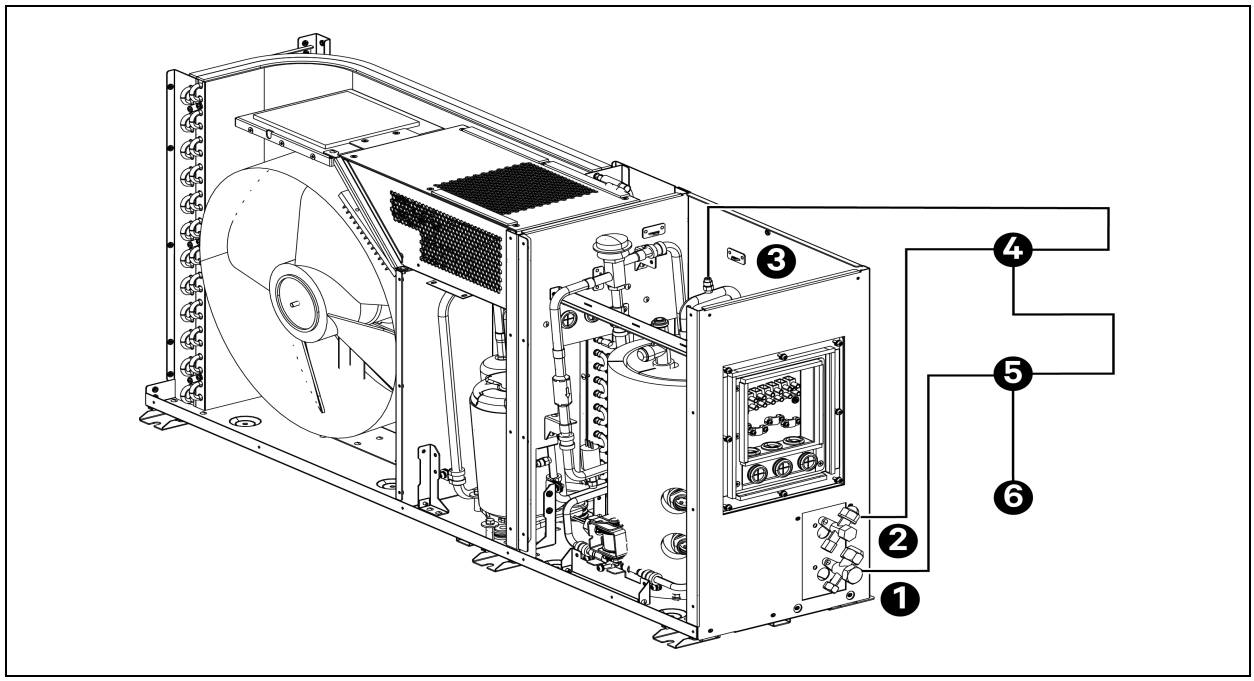
NOTE: Wear long rubber gloves to handle contaminated parts.

- **The air conditioning system contains refrigerant and the release of refrigerant to the atmosphere is harmful to the environment.**

8.4.5 Low Ambient Condensing Unit

If it is required to evacuate the evaporator and the condensing unit during maintenance, for the low ambient condensing unit, you need to evacuate through the connectors on the condensing unit and the reserved Schrader valve near the receiver simultaneously.

Figure 8.4 Evacuating the Low Ambient Condensing Unit



Item	Description	Item	Description
1	Gas pipe connector	4	Manifold gauge
2	Liquid pipe connector	5	Manifold gauge
3	Reserved Schrader valve near receiver	6	Vacuum pump

8.5 Electrical Connection Maintenance

8.5.1 Electrical Maintenance

Check the appearance to the electrical connections and take actions according to the following procedures:

- Conduct overall electrical insulation test: find out the non-insulated contacts and rectify them with proper insulation covering.
- Disconnect all the fuses or MCBs of the control part during the test as the high supply voltage may damage the control components.
- Clean the electrical panel and control panel boards from dust with a brush or by 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.

8.5.2 Controller Connections Maintenance

Check the appearance to the control part and take actions according to the following procedures:

- Check the appearance of the power module and measure the output voltage.
- Check if the surface and interface of power protector board, ICOM edge controller board, EEV controller board, EMI board, and compressor inverter board show any signs of aging or wear & 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 power protector board, ICOM edge controller board, EEV controller board, EMI board, and compressor inverter board.
- Check whether the fan power cable and rotating speed feedback signal cable are firmly fixed.
- Check whether the interconnection terminals between the control interface board and the temperature sensor or pressure transducer are firmly fixed. If there is any loose, poor contact, or fault, immediately replace the interconnection terminal.
- Replace the faulty electrical components such as the control fuse (or air breaker) and control
- board.
- Use the temperature measurement meter with high measurement precision 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.

8.6 Cooling System Maintenance

The components of the cooling system must be inspected for any abnormalities in the operation causing abrasions due to continuous operation. As the failure or damage of components is usually accompanied by corresponding faults, regular checking needs to be carried out to prevent most of the 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 pressure, and temperature sensor failure. The mechanical failure may be the effect of 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.

Refrigerant pipes must be properly fixed and should not vibrate against the wall, floor or the unit frame. Inspect all refrigerant pipes and fixing bracket every six months for signs of wear.

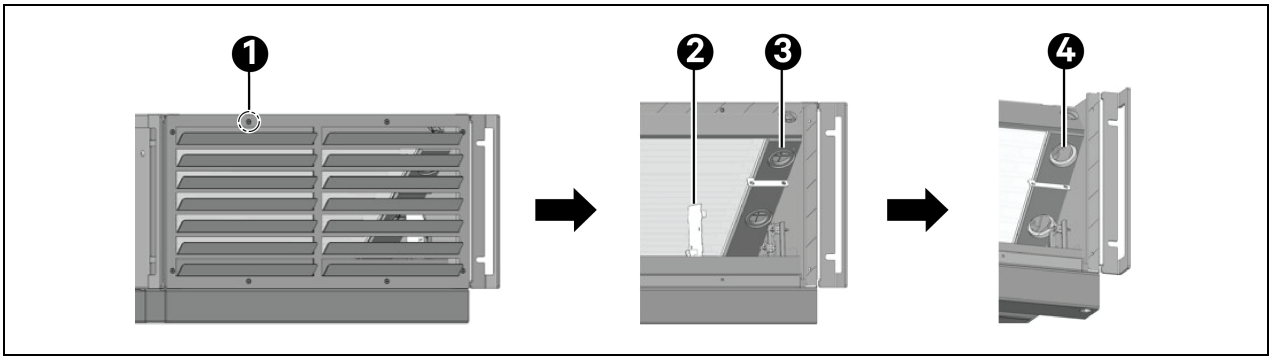
8.7 Leakage Detection (F-gas)

For countries covered by the F-gas regulation, when the low ambient condensing unit (VRC352) is used, both the evaporator (VRC202) and the low ambient condensing unit should be checked for leakages once a year according to mandatory rules. There are three holes in the evaporator for detection, as shown in Figure 8.5 on the facing page and Figure 8.6 on the facing page .

The following section is a step-by-step illustration of the process of leak detection.

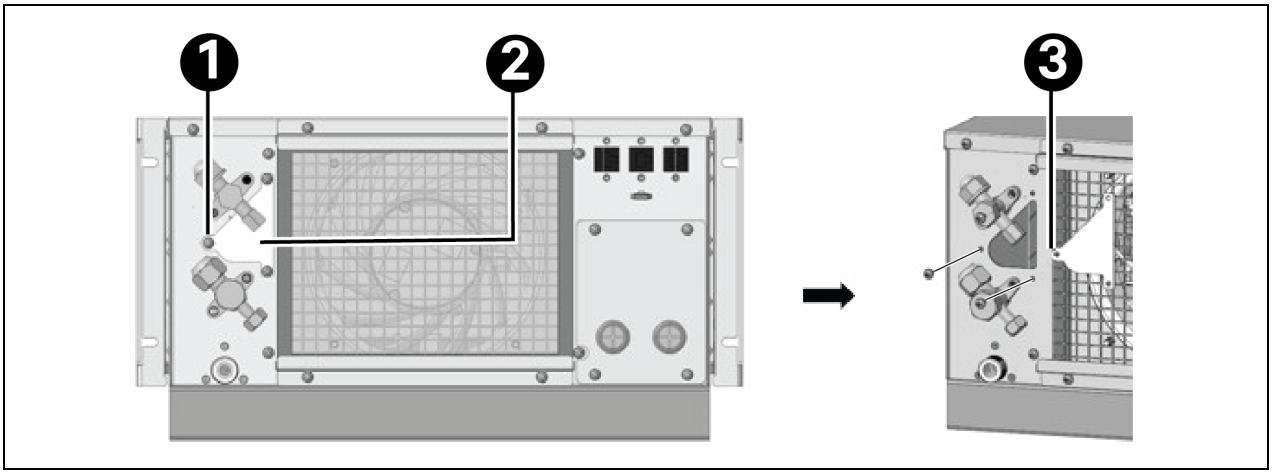
1. Remove the 8 screws, grille, water leakage detection board, and 2 rubber bushing in Figure 8.5 below one by one.
2. Remove the 3 screws and cover plate in Figure 8.6 below .
3. Insert the sniffer into the VRC202 unit to check whether the refrigerant leaks in the areas in Figure 8.7 on the next page . Check detection area (front) and detection area (rear) from the front and rear of the VRC202 unit, respectively.
4. Restore the VRC202 unit to its original state after the check is completed.

Figure 8.5 Detection Holes in VRC202 (Front)



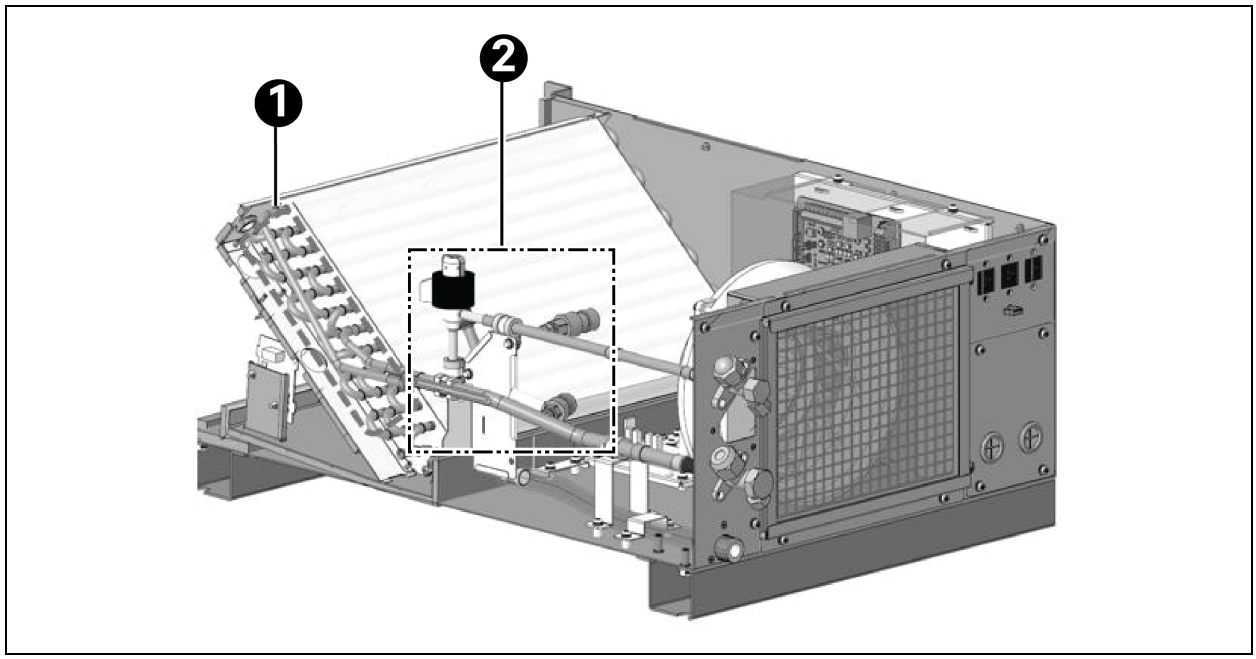
Item	Description	Item	Description
1	Screw M3×8 * 8pcs	3	Rubber bushing 2*pcs
2	Water leakage detection board	4	Detection hole 2*pcs

Figure 8.6 Detection Holes in VRC202 (Rear)



Item	Description	Item	Description
1	Screw M4×10 * 3pcs	3	Detection hole 1*pcs
2	Cover plate 1*pcs		

Figure 8.7 Detection Area in VRC202 (Rear)



Item	Description
1	Detection area (front)
2	Detection area (rear)

8.8 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 states of the system functional parts.

8.9 Maintenance Inspection Checklist

The maintenance checklist of the unit is provided in Table 8.1 on the facing page .

Table 8.1 Maintenance Checklist

Type	Maintenance Component	Item	Result
Monthly:	Return air filter	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 any noise during operation	
		Check if the fan has stopped rotating	
		Check and fasten the circuit connector	
		The fan base should be firm	
	Drainage pump	Check whether filter is clogged or damaged	
		Clean the filter	
		Check whether the pipes are loose	
		Check whether there are impurities and debris in the water tray	
		Check the drain pump connection line for clogging	
		Check whether the cable of the drain pump is loose	
Semi- annually:	Compressor	Check if there is any signs of oil leakage	
		Check if there is abnormal vibration and noise of compressor	
	Condenser	Check the fins cleanness	
	Cooling system	Check if there is leakage	
		Check if heating belt works normally	
		Check if pressure switch works normally	
		Check if the liquid line solenoid valve works normally	
		Check suction pressure	
		Check discharge pressure	
		Check that there is no superheat	
		Check that there is no leakage in connection pipes	
		Charging the capacity of refrigerant	
	Electrical control part	Check if the main circuit breaker and the circuit breaker cable of the power module are tightly connected	
		Check and fasten the circuit connector	
		Check if the cables and the meter reading of each sensor are within prescribed range	
	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	

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9 Troubleshooting

CAUTION: 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.

CAUTION: 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 Troubleshooting

Trouble Shooting for the entire unit is listed in the table below.

Table 9.1 Troubleshooting

Fault Occurrence	Possible Cause	Check or Remedy
High temperature alarm	Unreasonably high temperature alarm setpoint	Check and reset high temperature alarm setpoint
	Overload condition	Check if the max. actual heating load is over the rated value
	Condenser fan does not run normally or is faulty	Check if the fan power cable is disconnected
	Compressor does not run normally	Check if the compressor power cable is disconnected
Low temperature alarm	Unreasonably low temperature alarm setpoint	Check and reset low temperature alarm setpoint
	Evaporator fan does not run normally or is faulty	Check if the fan power cable is disconnected
	Compressor does not run normally	Check if the compressor power cable is disconnected
High pressure alarm	Condenser fan does not run normally or is faulty	Check if the fan power cable is disconnected
	High pressure transducer is abnormal	Check if the high pressure transducer is normal
Low pressure alarm	Insufficient condensing airflow	Remove debris from the coil and air inlet
		Check if the fan speed controller operates normally
	Refrigerant leakage	Check for leaking points and re-charge refrigerant
	Condenser fan runs at full speed when ambient temperature is too low	Check if wire connection of condenser fan is reversed
	EEV adjusts abnormally or is closed	Check if the EEV coil or EEV cable is loose
	Evaporator fan does not run normally or is faulty	Check if the cable of fan is disconnected
	Insufficient airflow across evaporator coil	Remove debris from the coil and air inlet
	The air humidity is too high	Use other dehumidifier to control the air humidity

Table 9.1 Troubleshooting (continued)

Fault Occurrence	Possible Cause	Check or Remedy
Severe condensation or water leakage	EEV adjusts abnormally	Check if the EEV coil or EEV cable is loose
	Compressor runs at high speed	Check if the compressor is out of control Check if drainage pipe is loose or clean the debris in the drainage pan or pipe
	The drainage pan or pipe is loose or blocked	Check if the compressor is out of control Check if drainage pipe is loose or clean the debris in the drainage pan or pipe
Compressor vibration or abnormal noise	The mounting position is not even Check mounting position state	Check mounting position state
	The fixing parts are loose	Check the fixing nuts of compressor and fasten again
	Compressor is faulty	Call the customer service hotline of Vertiv

9.2 Fan Troubleshooting

The fan troubleshooting is listed in Table 9.2 below .

Table 9.2 Fan Fault Diagnosis and Handling

Symptom	Probable Causes	Check Items and Handling Methods
EC fan can't be started	The circuit breaker is open	Check if the circuit breaker is closed
	Fan power module failure	Check the alarm indicator of the fan power module to 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 fixed Check if the cable from the control terminal bar to the plug wire terminal of the fan is firmly fixed

9.3 Fault Diagnosis and Handling of Electronic Expansion Valve

As a key component for refrigerant system and cooling capacity adjustment, the working of the electronic expansion valve is important. Table 9.3 below describes the fault diagnosis and handling methods.

Table 9.3 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 transducer is faulty	Check if the sensor cable is firmly fixed 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 of 24 V power supply
	The cable connection of the control board is faulty	Check if the valve cable connection on the control board of the electronic expansion valve is faulty Check if the communication cable between the electronic expansion valve control board and the main control board is properly connected

9.4 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 9.4 below describes the major faults and troubleshooting.

Table 9.4 Refrigeration System Faults and Troubleshooting Methods

Symptom	Probable Causes	Check Items and Handling Methods
The surface of the evaporator has serious condensation	The surface of the evaporator is filth blocked	Check the surface of the evaporator. Blockage may result in non-smooth discharge of the condensate water
Air volume decrease	The air filter is blocked	Periodically check the filter and replace it in a timely manner to avoid air volume attenuation due to filth blockage
	The fan is faulty	Check if the fan is faulty. Table 9.1 on page 75 describes the diagnosis and handling methods
	The evaporator is blocked	Check the surface of the micro-channel evaporator and periodically handle the blockage problem

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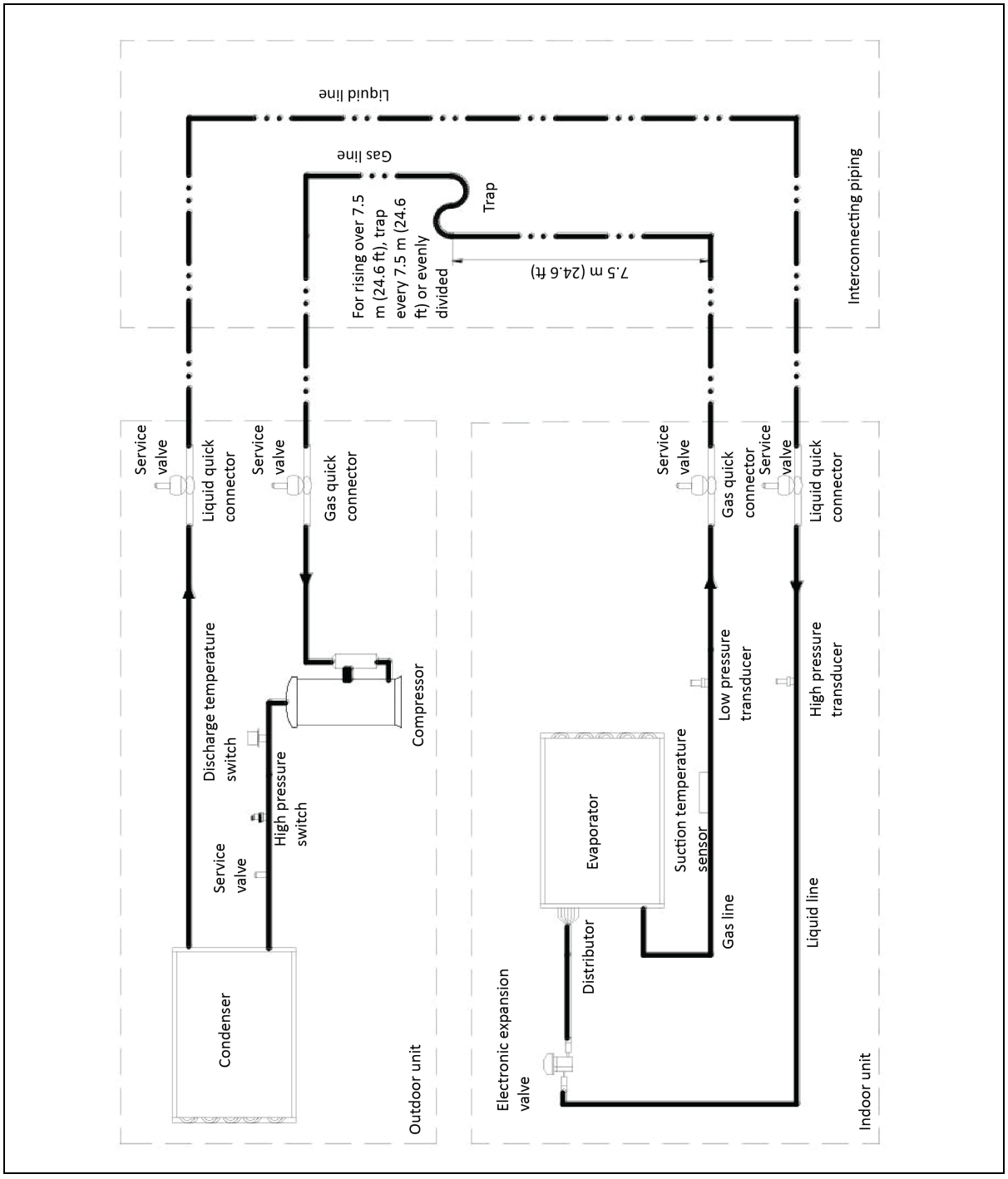
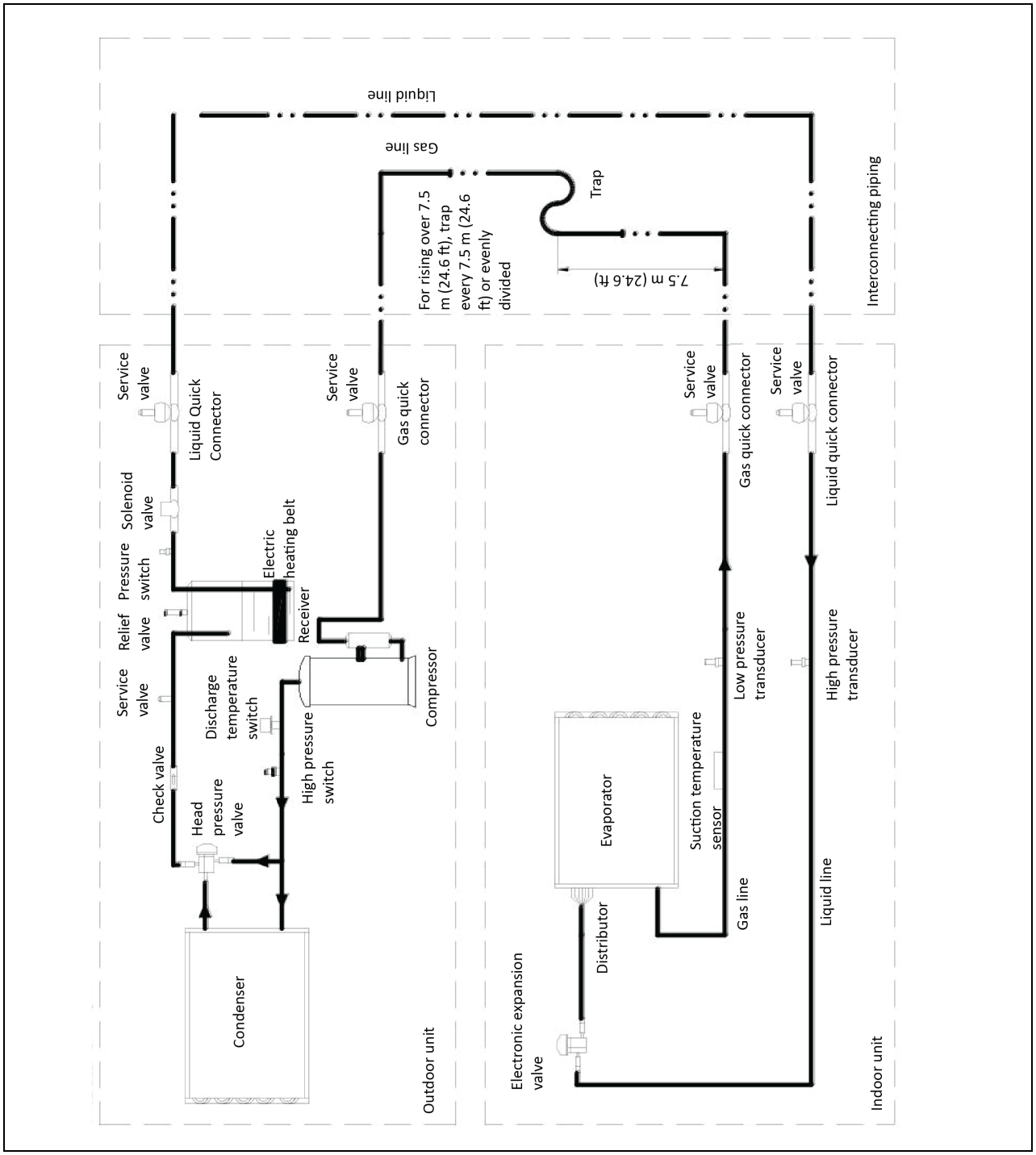
10 Appendices

Appendix A: Diagrams

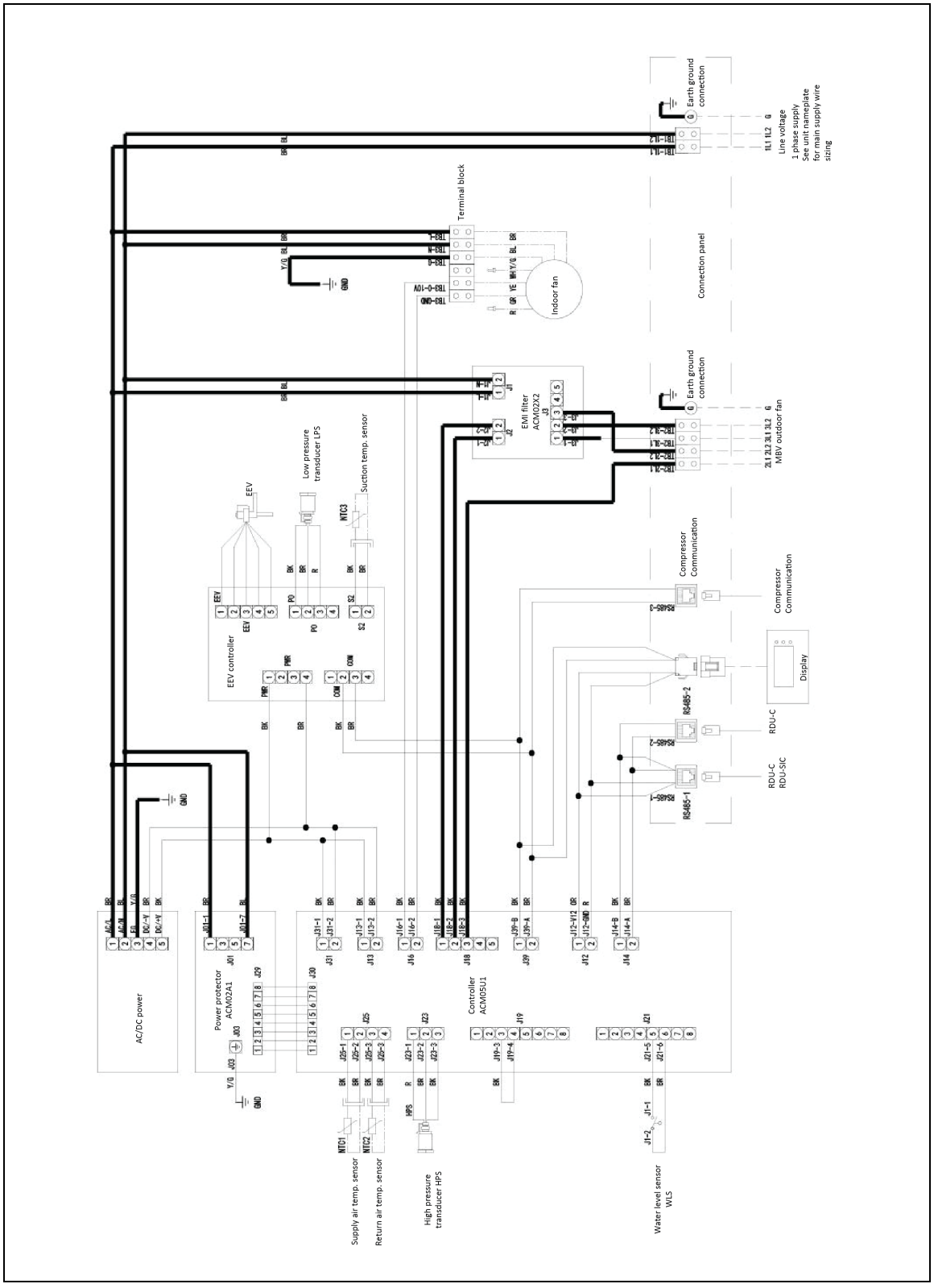
A.1 System Diagram (Standard Unit)



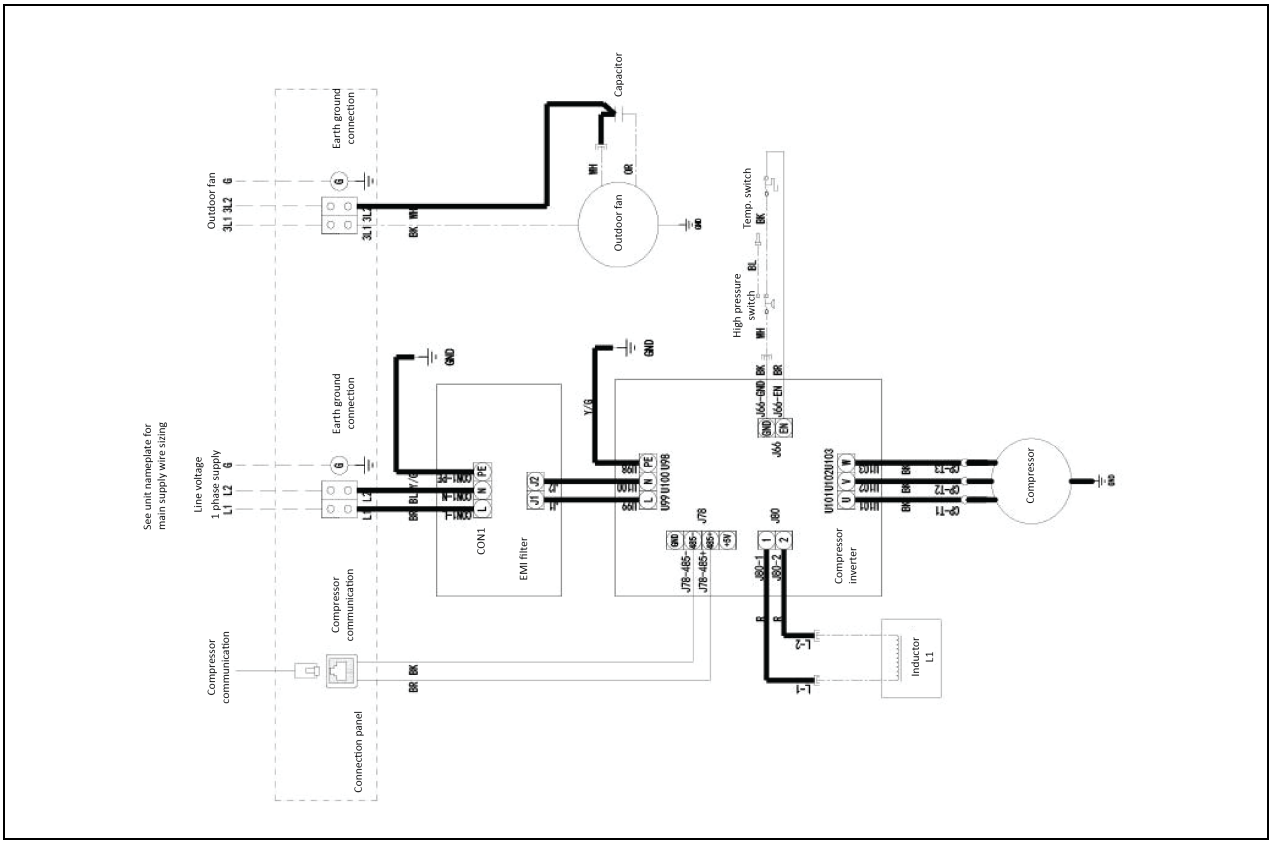
A.2 System Diagram (Low Ambient Unit)



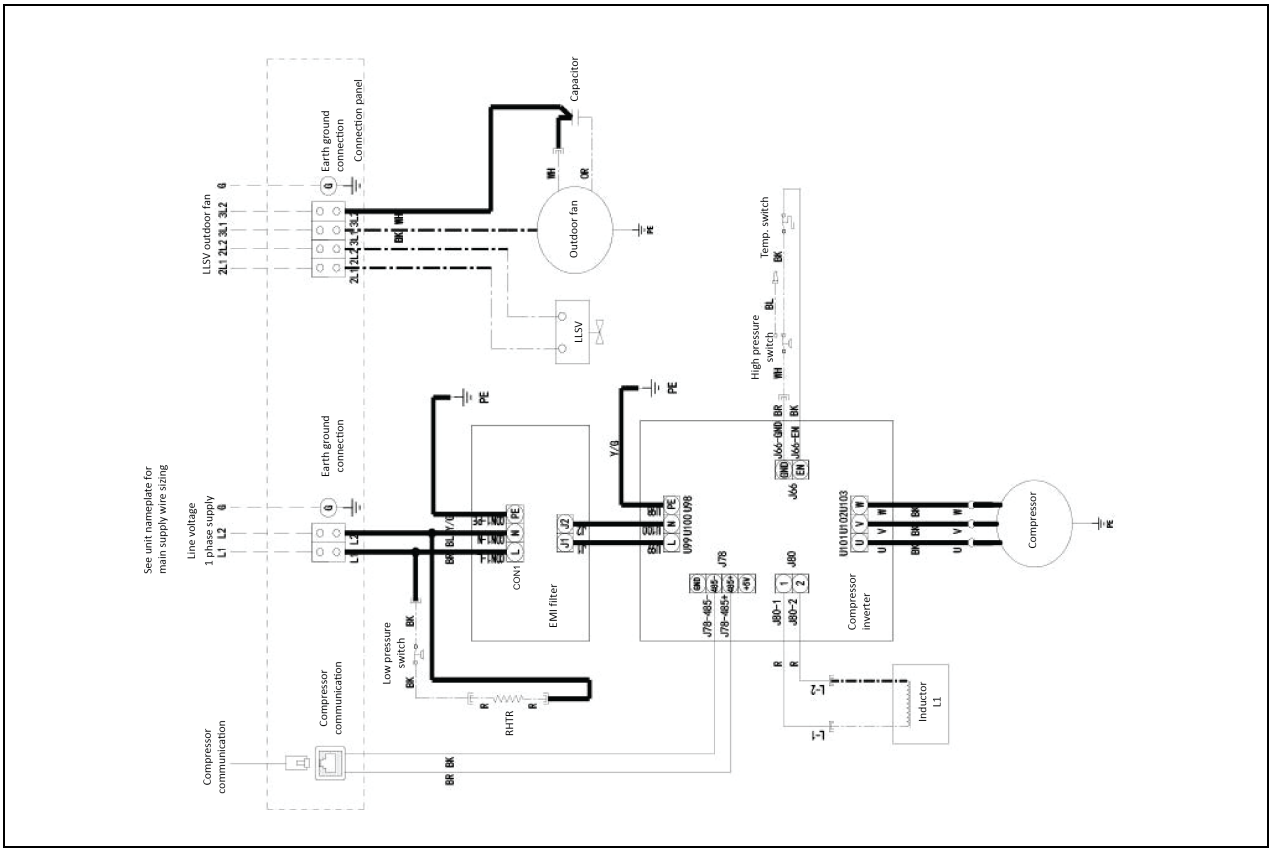
A.3 Wiring Diagram (VRC200/VRC201 Unit)



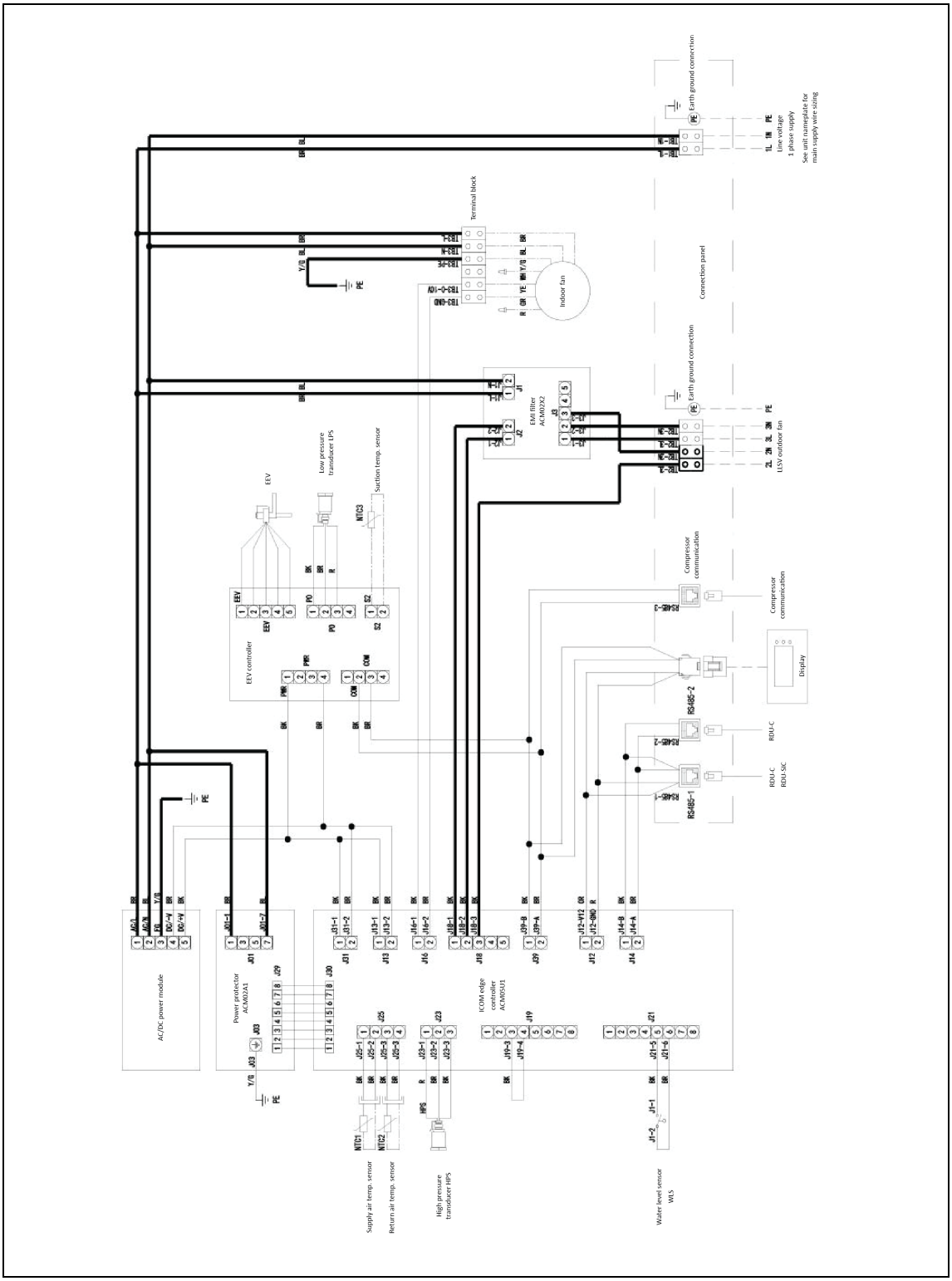
A.4 Wiring Diagram (VRC300/VRC301 Unit)



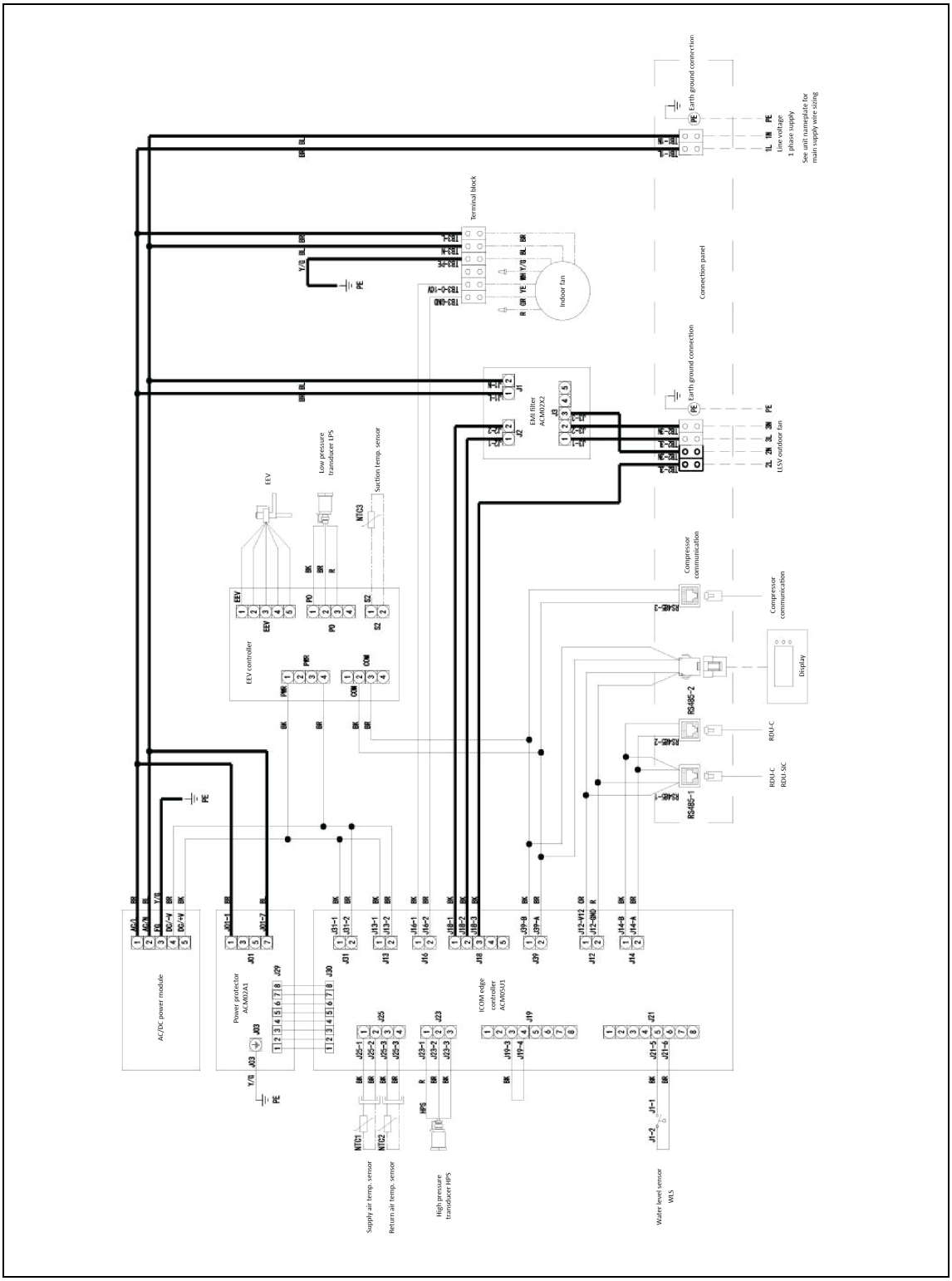
A.5 Wiring Diagram (VRC350/VRC351 Unit)



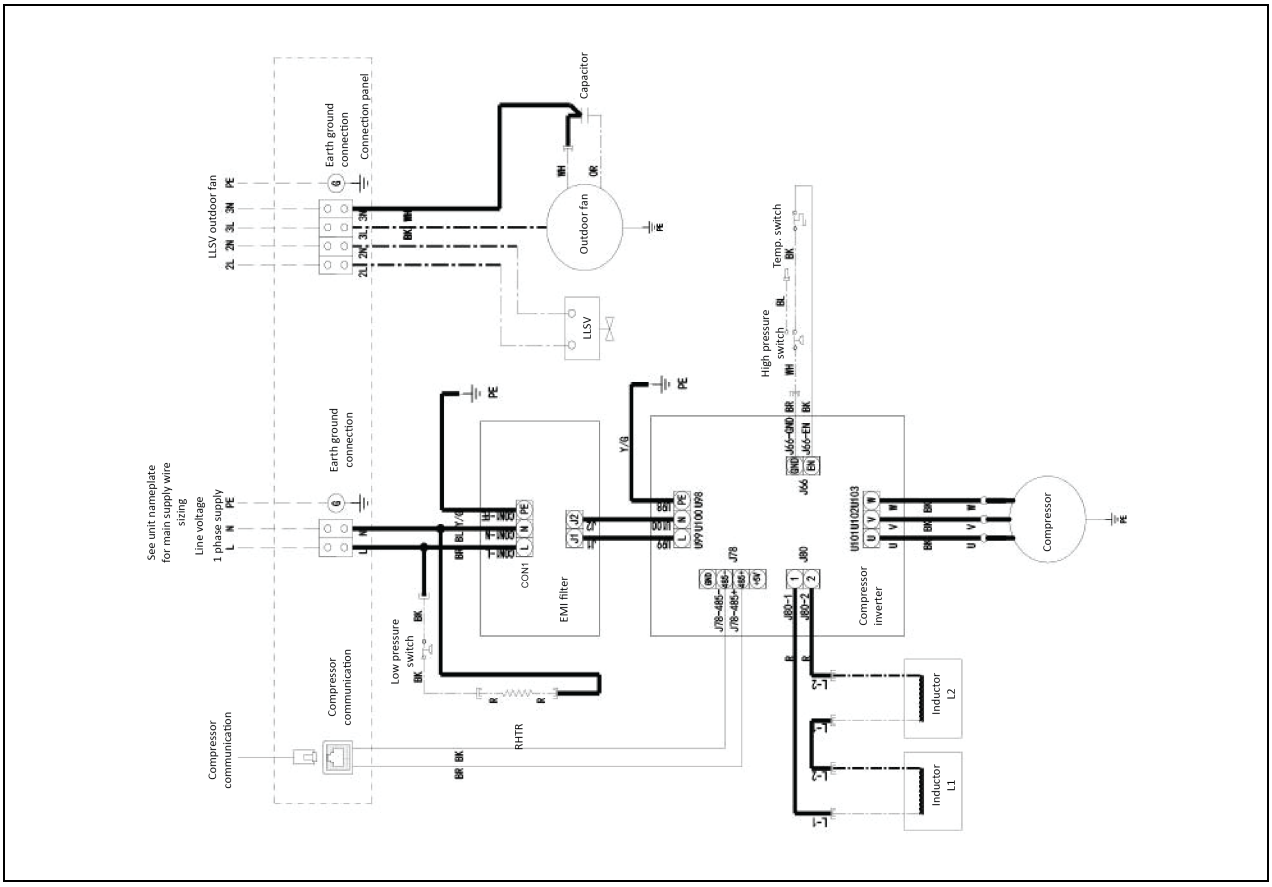
A.6 Wiring Diagram (VRC202 Unit)



A.7 Wiring Diagram (VRC302 Unit)



A.8 Wiring Diagram (VRC352 Unit)



Appendix B: Suppliers Declaration of Conformity

Unique Identifier: VRC200, VRC201, VRC300, VRC301, VRC350, VRC351

Party Issuing Supplier's Declaration of Conformity

Vertiv Group Corp.

1050 Dearborn Drive

Columbus, OH 43085 US

Customer service hotline: 614-888-0246

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 (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 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 and Contacts

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

Europe, the Middle East and Africa: For technical support, please contact your local Vertiv or Partner office. You can also contact us using the contact details on our website: https://www.vertiv.com/en-emea/contacts2

Connect with Vertiv on Social Media

https://www.facebook.com/vertiv/

https://www.instagram.com/vertiv/

https://www.linkedin.com/company/vertiv/

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