VRC Split System

VRC2 Series Rack Cooler

VRC3 Series Condensing Unit

User Manual

VRC Split System

User Manual

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Purpose of the Document

This document applies to the VRC2 series and VRC3 series of cooling solutions which maintain an optimal environmental control mainly for technological ecosystems at minimal operating costs. This document gives an overview of the technical specification. The figures used in this document are for reference only. Please read this manual carefully.

Important Safety Instructions

The important safety instructions that should be followed during the installation and maintenance of the VRC Split System are described in the following sections.

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

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

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

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

WARNING! 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.

Preface

The Vertiv VRC2 series is a split-type cooling unit which should be installed at the bottom of the rack. It is designed to be installed inside any 480 mm (19 in.) 2 or 4-post rack, including those developed by Vertiv. The Vertiv VRC3 series is the split-type condensing unit designed for outdoor installation and must be installed with the Vertiv VRC2 series to form a complete system.

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

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

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PART I

GENERAL INFORMATION

1 Product Overview

The Vertiv™ VRC2 series and VRC3 series are split-type cooling units for utilization in the rack which does not permit any access to any unauthorized and unqualified personnel. If the rack is placed in shopping malls, light industry, or any business environment, it must be used only by professionally trained personnel. This chapter introduces the product description, model description, product appearance, and main components of the cooling unit.

1.1 Product Introduction

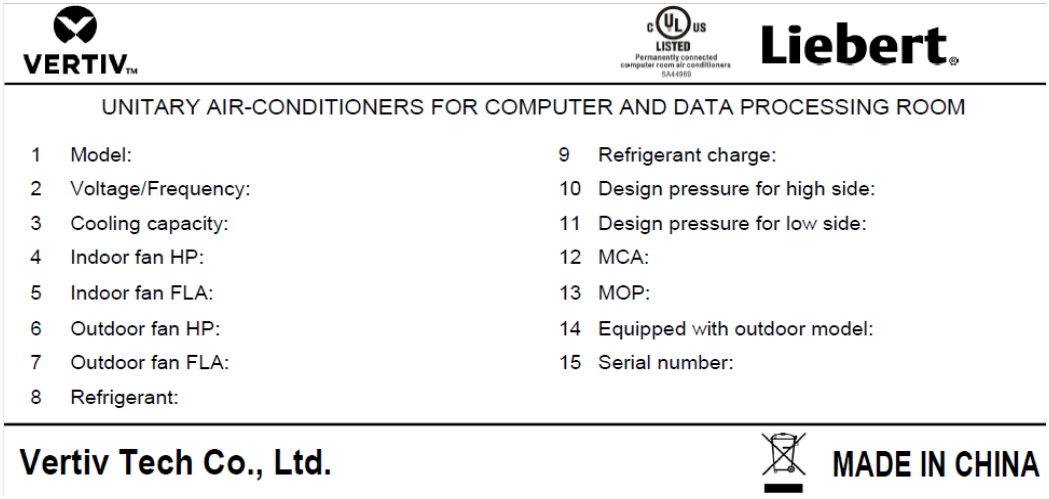
The unit is a split-type conditioner which is designed to be installed inside the rack and includes a separate indoor unit and outdoor condensing unit. The indoor unit is installed in the rack unit, which contains EC fan, evaporator coil and the electronic expansion valve. The condensing unit should be mostly installed external to the room in which the rack is placed as the unit includes compressor, condenser coil and condenser fan.

Primary technical details of the unit shown in ***Figure 1-1*** are mentioned below:

Figure 1-1 Mounting Location of the Indoor Unit

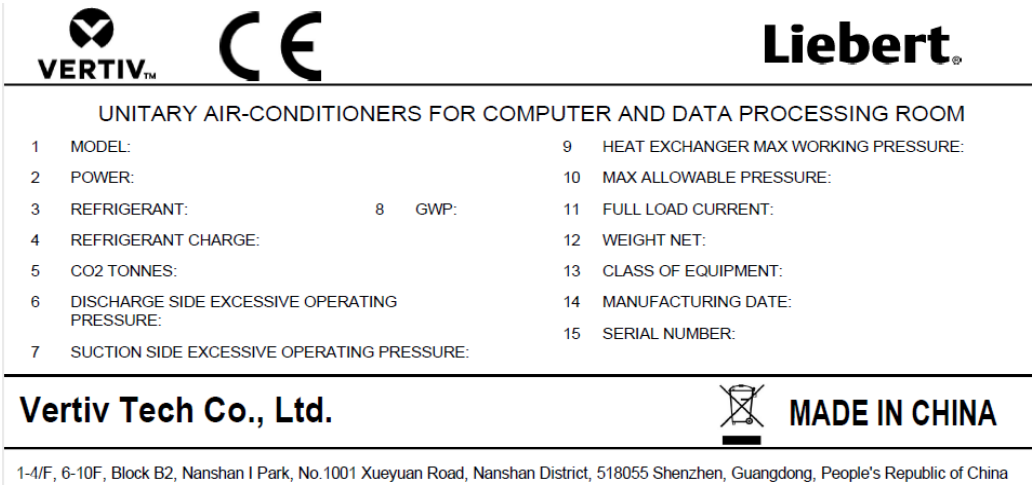
- The unit can be installed inside the rack
- The airflow rate can be modulated based on site conditions
- The output cooling capacity modulates as per the cooling load demands at site
- Operates on R410A refrigerant
- Quick installation and deployment being of a modular construction
- Less work and cost for installation compared to other air conditioners
- White space-saving owing to a relatively small-footprint and mounted inside the rack utilizing lesser rack unit space
- With the unit installed inside the rack, the hot air from the rear side of the rack is drawn inside the unit and cold conditioned air is discharged from the front-side of the unit delivering it right in front of the server's intake side.
- The unit can be installed on both the top and bottom of the rack inside the rack.
- The unit also can be installed at the ceiling outside the rack.
- The direction of supply air discharged from the front side of the unit can be changed by adjusting the grilles, up or down.
- The cooling capacity is modulated automatically by the built-in control system and can range from 25% to 100%, about 0.9 kW to 3.5 kW. This makes the unit best-suited for part-loads or dynamic cooling loads.
- The unit is built-in with high efficiency and reliable components which include the compressor, electronic expansion valve, EC-fan and an advanced controller specifically designed by Vertiv for this unit.
- Utilizes EC-fan technology for the evaporator fan which saves energy by varying the airflow rate exactly as per the requirement.
- The condensing unit is equipped with a variable speed condenser fan with a speed variation ranging from 30% to 100% of the entire operating range.
- Refer to ***Figure 1-2*** for the nameplate description of the VRC2 Series Rack Cooler model:

UL Model:



Position	Description	Position	Description
1	Unit defined by 6 digits	9	Refrigerant charge of the indoor unit
2	Supply Power	10	Discharge Side Excessive Operating Pressure
3	Cooling capacity	11	Suction Side Excessive Operating Pressure
4	Indoor fan power in total	12	Minimum Circuit Amps
5	Indoor fan full load current	13	Maximum Overcurrent Protection
6	Outdoor fan power	14	Equipped with outdoor model
7	Outdoor fan full load current	15	Serial Number
8	Refrigerant Category		

CE Model:



Position	Description	Position	Description
1	Unit defined by 6 digits	9	Heat Exchange Max Working Pressure
2	Supply Power	10	Max Allowable Pressure of the Unit
3	Refrigerant Category	11	Full load Current
4	Refrigerant charge of the unit	12	Net weight
5	CO2 Tonnes	13	Class of Equipment
6	Discharge Side Excessive Operating Pressure	14	Manufacturing Date
7	Suction Side Excessive Operating Pressure	15	Serial Number
8	Global Warming Potential		

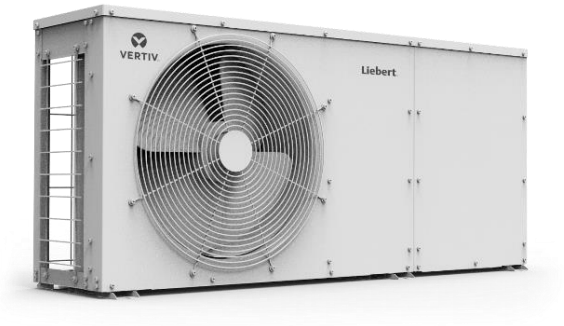
Figure 1-2 Product Nameplate and Model Description

1.2 Model Description

The physical appearance of air conditioner is shown in ***Figure 1-3***.

Indoor unit

Standard condensing unit



Low ambient condensing unit

Figure 1-3 Appearance of the Air Conditioner Units

The indoor unit is installed in the rack or at the ceiling. The condensing unit is mounted external to the rack, preferably outside in an exposed environment.

1.3 Model Nomenclature

The nomenclature of the units is shown in ***Figure 1-4***.

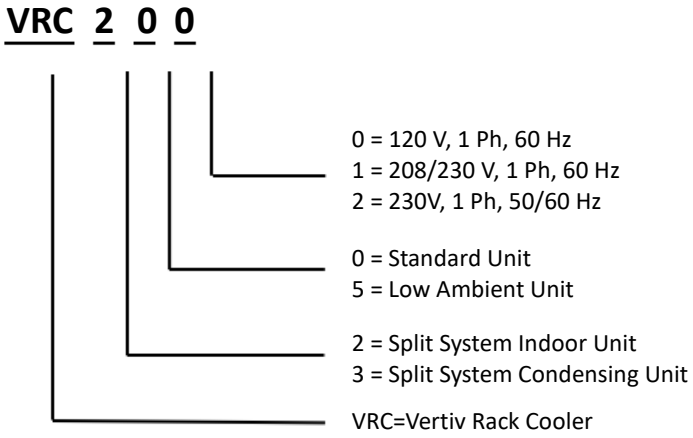


Figure 1-4 Nomenclature

Table 1-1 mentions the description of the indoor and condensing units as per the nomenclature.

Table 1-1 Model Coding Description

Model	Power Supply	Part Code	Description
VRC200	120 V, 60 Hz	01304032	Indoor unit, 3.5 kW, 120 V
VRC300	208/230 V, 60 Hz	01304036	Condensing unit, 3.5 kW, 208/230 V for compressor and 120 V for condensing fan
VRC350	208/230 V, 60 Hz	01304536	Low ambient condensing unit, 3.5 kW, 208/230 V for compressor and 120 V for condensing fan
VRC201	208/230 V, 60 Hz	01304034	Indoor unit, 3.5 kW, 208/230 V
VRC301	208/230 V, 60Hz	01304035	Condensing unit, 3.5 kW, 208/230 V for compressor 208/230 V for condensing fan
VRC351	208/230 V, 60 Hz	01304537	Low ambient condensing unit, 3.5 kW, 208/230 V for compressor 208/230 V for condensing fan
VRC202	230 V, 50/60 Hz	01304534	Indoor unit, 3.5 kW, 230 V
VRC302	230 V, 50/60 Hz	01304535	Condensing unit, 3.5 kW, 230 V for compressor 230 V for condensing fan
VRC352	230 V, 50/60 Hz	01304538	Low ambient condensing unit, 3.5 kW, 230 V for compressor 230 V for condensing fan

1.4 Components

The major components of the unit include the evaporator coil, condensate drain tray, evaporator EC fan, electronic expansion valve (EEV), inverter rotary compressor, condenser coil and condenser fan.

1.4.1 Indoor Unit

The components of the indoor unit are depicted in ***Figure 1-5***.

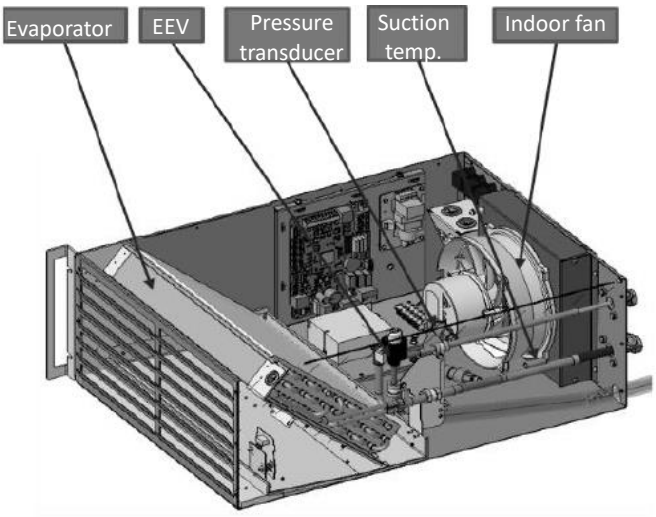


Figure 1-5 Indoor Unit

Evaporator Coil

The slant evaporator coil provides maximum surface area for heat transfer which ensures the delivered SHR > 0.9 always. The coil is constructed from copper pipes with aluminum fins in a slit type configuration. With low air pressure difference across the coil even at higher air flow rates, the coil section is light and compact and has an easy access for removal and repair/replacement.

- **Condensate Drain Tray**

With a metallic condensate drain tray placed under the coil assembly, the entire condensate drain has easy disposal/removal from the unit with a precise condensate outlet connection.

- **Evaporator EC Fan**

The indoor unit is equipped with a high-efficiency EC fan made of aluminum that delivers high airflow rates to ensure the airflow demands are met during the entire operational time. The EC fan has a smooth speed variation across its operating speeds, working in synchronization with the entire system components to deliver the precise output capacity.

- **Electronic Expansion Valve**

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

- **Sensors**

Sensors provide important support for the precise control and reliable operation of indoor and outdoor units. ***Figure 1-6*** shows the position of the sensors in the indoor unit.

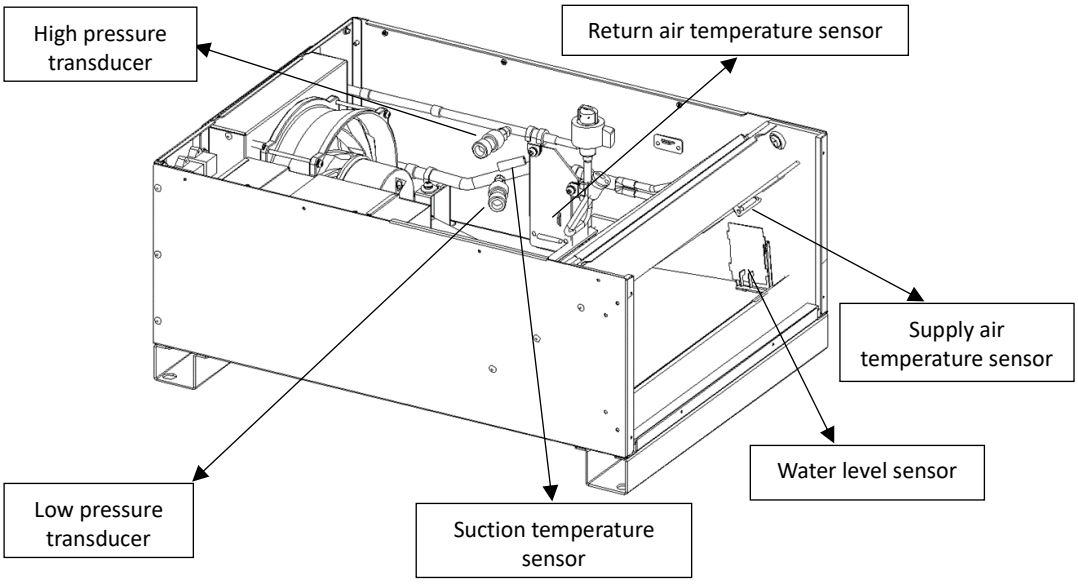


Figure 1-6 Indoor Unit Sensor Location

1.4.2 Condensing Unit

The components of the condensing unit are depicted in ***Figure 1-7*** and ***Figure 1-8***.

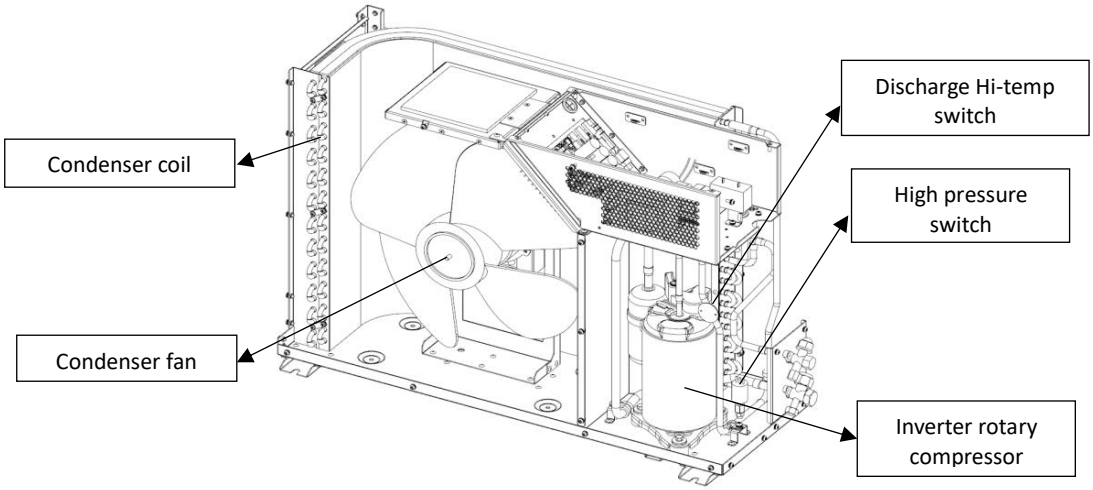


Figure 1-7 Standard Condensing Unit Internal Parts

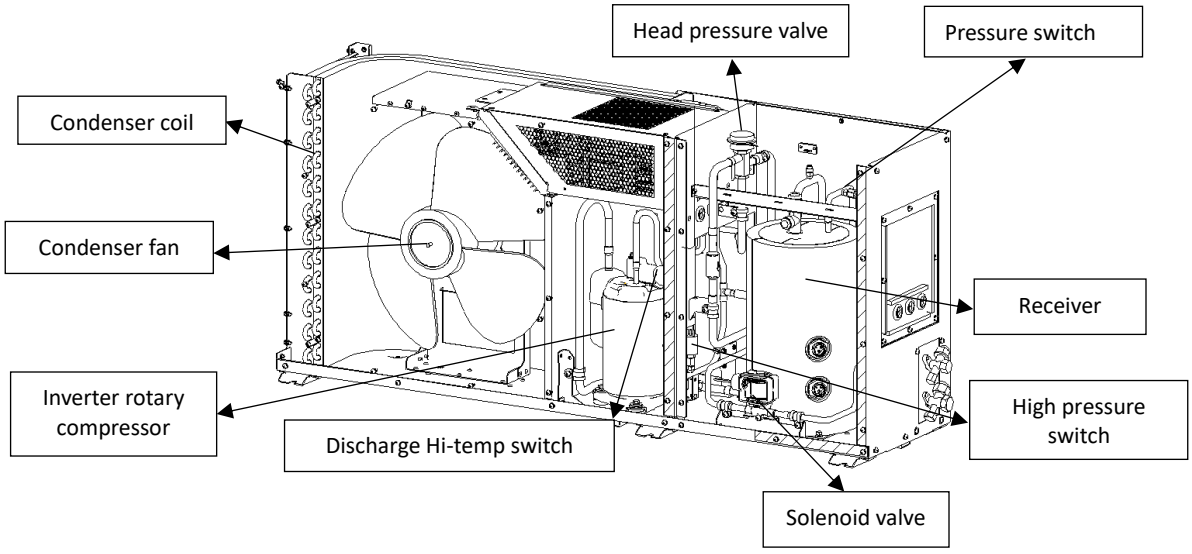


Figure 1-8 Low Ambient Condensing Unit Internal Parts

- **Compressor**

The condensing unit is equipped with an inverter rotary compressor that works on R410A refrigerant and which varies its cooling output capacity as per the cooling demands. It ensures that the cooling capacity of the unit precisely matches the cooling demand under all circumstances.

- **Condenser Coil**

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

- **Condenser Fan**

The condensing unit is equipped with an AC fan which varies the operating speed as per the cooling variations of the compressor to always maintain a suitable condensing pressure.

- **Low Ambient Module**

The low ambient module is equipped with 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).

1.5 Technical Specifications

The detailed technical specifications which include the mechanical and the electrical details are listed in ***Table 1-2***.

Table 1-2 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)		
Net Weight, kg (lbs.)	23 (50)			44 (97)			68 (150)		
Gross Weight, kg (lbs.)	51 (112)			70 (154)			85 (187)		
Noise Level (tested within the rack)	<60 dB(A)			<55 dB(A)			<55 dB(A)		
Operation Temperature range, °C (°F)	18 (64.4) to 40 (104)			-15 (5) to 45 (113)			-34 (-29.2) to 45 (113)		

NOTE:

- **The capacity value is measured under the conditions of indoor temperature dry bulb/wet bulb 35 °C (95 °F), 20.6 °C (69 °F) and outdoor temperature 35 °C (95 °F).**
- **At the same working conditions, the low-temperature outdoor unit has a reduced capacity compared with the standard outdoor unit.**
- **There are two control methods, supply control and return control. The return control mode is suggested to be set in an open environment, while the supply control mode is suggested to be set in an enclosed rack.**

- **Supply air temperature set point varies between 12.8 °C (64.4 °F) and 23 °C (73.4 °F). The recommended supply air temperature set point is 21 °C (69.8 °F).**
- **When the VRC unit is used in a closed rack, the heat load should be evenly placed in rack and unused rack position should be covered with blanking plates.**

The maximum capacities vary with temperatures, as shown below.

Standard Condensing Unit Maximum Capacity, kW		Condenser Air Temperature		
		29.4 °C (85 °F)	35 °C (95 °F)	40 °C (104 °F)
Evaporator Air Temperature to IT Devices	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		Condenser Air Temperature		
		29.4 °C (85 °F)	35 °C (95 °F)	40 °C (104 °F)
Evaporator Air Temperature to Cooling Module	29.4 °C (85 °F)	3.4	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		Condenser Air Temperature		
		29.4 °C (85 °F)	35 °C (95 °F)	40 °C (104 °F)
Evaporator Air Temperature to IT Devices	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		Condenser Air Temperature		
		29.4 °C (85 °F)	35 °C (95 °F)	40 °C (104 °F)
Evaporator Air Temperature to Cooling Module	29.4 °C (85 °F)	3.1	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		Condenser Air Temperature		
		29.4 °C (85 °F)	35 °C (95 °F)	40 °C (104 °F)
Evaporator Air Temperature to IT Devices	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		Condenser Air Temperature		
		29.4 °C (85 °F)	35 °C (95 °F)	40 °C (104 °F)
Evaporator Air Temperature to Cooling Module	29.4 °C (85 °F)	0.92	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		Condenser Air Temperature		
		29.4 °C (85 °F)	35 °C (95 °F)	40 °C (104 °F)
Evaporator Air Temperature to IT Devices	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		Condenser Air Temperature		
		29.4 °C (85 °F)	35 °C (95 °F)	40 °C (104 °F)
Evaporator Air Temperature to Cooling Module	29.4 °C (85 °F)	0.91	0.89	0.87
	35 °C (95 °F)	0.93	0.91	0.89
	40 °C (104 °F)	0.95	0.93	0.91

PART II

INSTALLATION

2 Pre-Installation

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

WARNING! 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.

2.1 Fittings

The fittings are shown in ***Figure 2-1***.

M6 Cage Nut M6 Pan-head Screw M5 Center Screw

Figure 2-1 Fittings

The usage of fittings is shown in ***Table 2-1***. They are included in the package.

Table 2-1 Fittings Instruction

Fitting Utility	Usage	Quantity
M6 cage nut	Used with M6 pan-head screws for tightening pillars	6
M6 Pan-head screw	Used to install the VRC 20X unit	6
M5 center screw	Used to fasten the L-shape mounting rails	10

2.2 Self-Prepared Materials

The cables routed from the room to the unit and the circuit breakers must be prepared at the customer site or are to be obtained by the customer; the specifications for the same are given in the ***Table 2-2***.

Table 2-2 Self-Prepared Materials

Parts	Specifications
External circuit breaker 1	Please refer to FLA (Full Load Amperage) of indoor unit in ***Table 1-2***
External circuit breaker 2	Please refer to FLA of condensing unit in ***Table 1-2***
Input power supply cables for indoor unit	Please refer to FLA of indoor unit in ***Table 1-2***
Input power supply cables for condensing unit	Please refer to FLA of condensing unit in ***Table 1-2***
Cables for condenser fan	Please refer to FLA of condenser fan in ***Table 1-2***
Cables for liquid line solenoid valve (only used in VRC350, VRC351 and VRC352)	Please refer to FLA of liquid line solenoid valve in ***Table 1-2***
Liquid copper pipe	Please refer to pipe connection of unit
Gas copper pipe	Please refer to pipe connection of unit
Communication line between indoor and condensing unit	Communication line with RJ45 ports

2.3 Transportation and Movement

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.

The unit consists of an indoor unit and an outdoor unit. Both of them are comparatively heavy equipment and need to be moved by hand pallet truck or electrical forklift to the vicinity of the pre-decided location to be installed. ***Table 2-3***, ***Figure 2-2*** and ***Figure 2-3*** show the dimensions of the unit's component with the package.

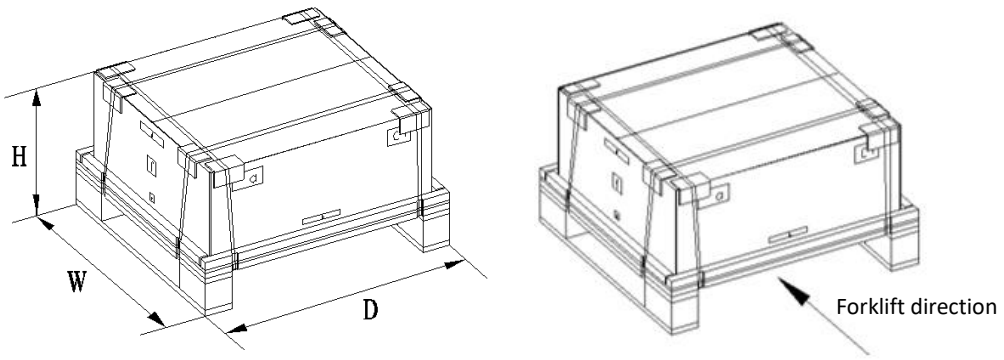


Figure 2-2 Package Dimensions – Indoor Unit

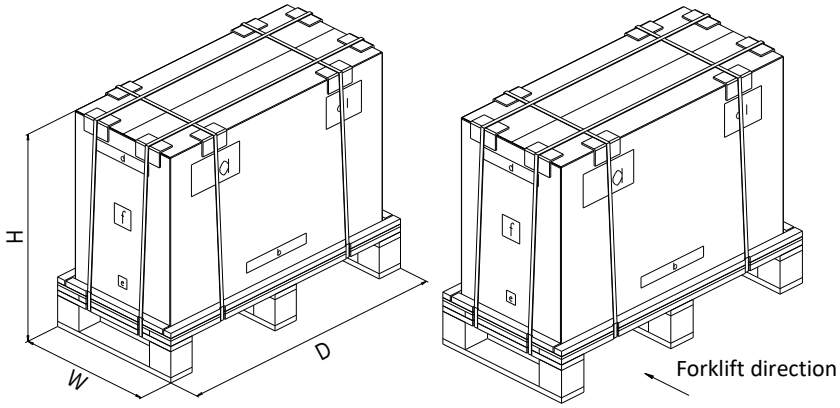


Figure 2-3 Package Dimensions – Condensing Unit

The unit with packing dimensions and weights are listed in ***Table 2-3***:

Table 2-3 Packaging Dimensions

Component		Packaging	Range of Dimensions (Unit: mm (in.))			Weight with Package (Unit: kg (lbs.))
			H	W	D	
Unit with package	VRC200 VRC201 VRC202	Wooden pallet with cardboard box	460 (18.11)	760 (29.92)	830 (32.68)	51 (112)
	VRC300 VRC301 VRC302		750 (29.53)	480 (18.90)	970 (38.19)	70 (154)
	VRC350 VRC351 VRC352		755 (29.72)	480 (18.90)	1350 (53.20)	85 (187)

Figure 2-4 depicts the schematic diagram of a hand pallet truck and an electric forklift.

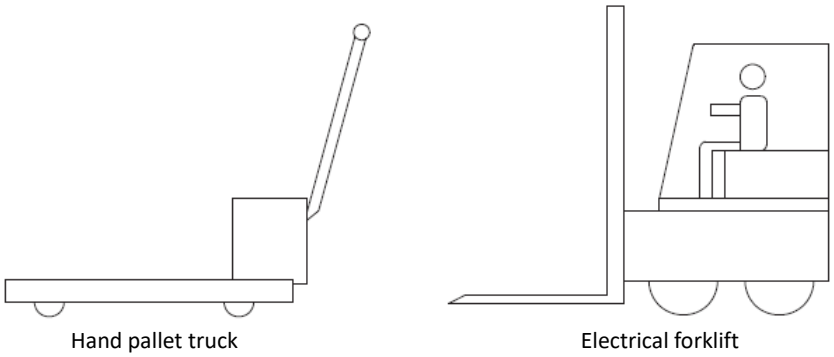


Figure 2-4 Hand Pallet Truck and Electric Forklift

If a hand pallet truck or an electric forklift truck is used, the tines of the hand pallet or electric forklift must be aligned with the center of gravity to prevent the package from toppling or falling over as depicted in ***Figure 2-5***.

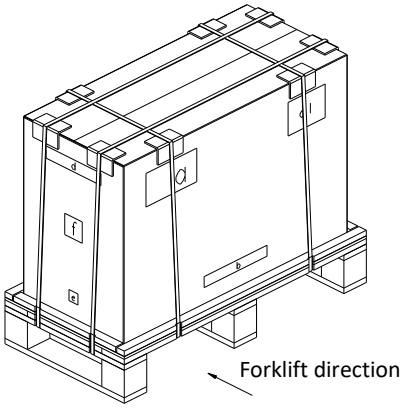


Figure 2-5 Forklift Direction

While moving the package, the obliquity must be maintained at an angle of 90° ± 10°. As shown in ***Figure 2-6***, the 90° ± 10° obliquity is suitable to move the rack to the vicinity of the desired location.

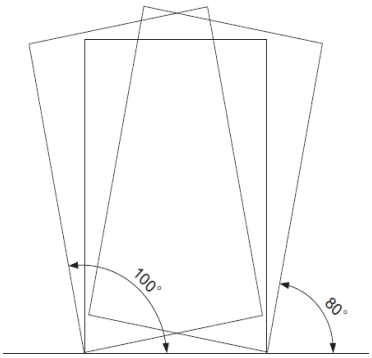


Figure 2-6 Carrying Obliquity

NOTE:

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

2.4 Unpacking

Following are the steps and procedures that are to be observed during the unpacking process:

2.4.1 Unpacking of Indoor Unit

- The unpacking of the indoor unit from the packing materials is shown in ***Figure 2-7***. Move the equipment of the assembled package to an open, firm leveled ground in the vicinity of the predetermined installation site.
- Cut off the packing strip on the package paper box using a utility knife followed by removing the package paper box of the unit.
- Remove the packing materials, including paper cover, support cardboard, paper box, cushion and paper corner in a specific order as mentioned from the top side of the unit.
- Remove the unit from the wooden pallet.

The accessory list of the indoor unit is shown in ***Table 2-4***.

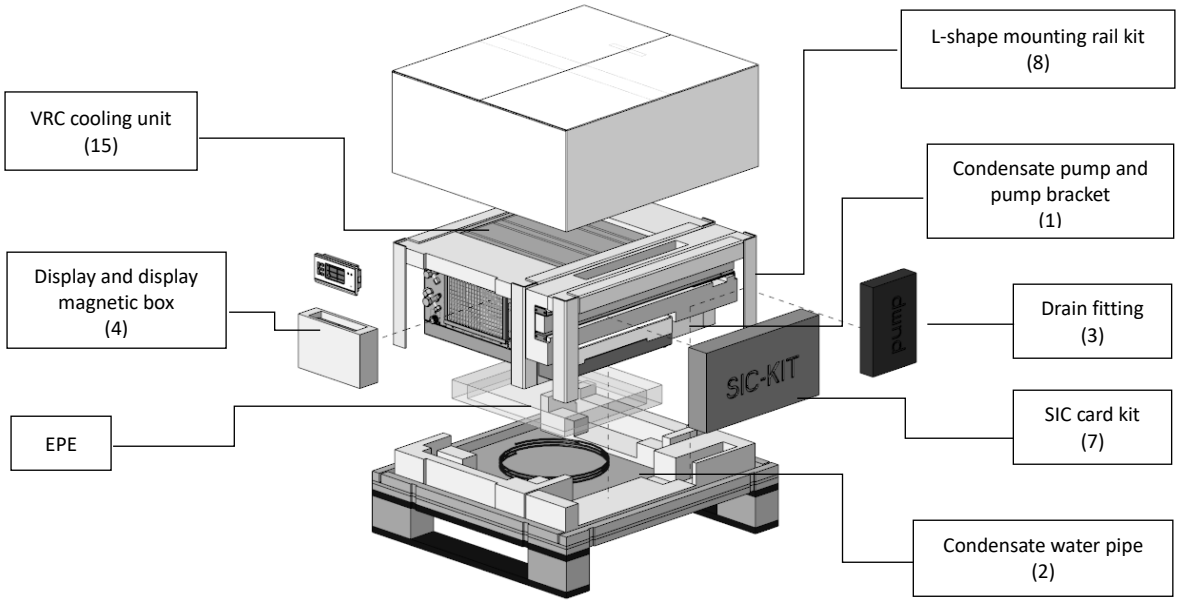


Figure 2-7 Unpacking Indoor Unit

Table 2-4 VRC2 Series Accessories

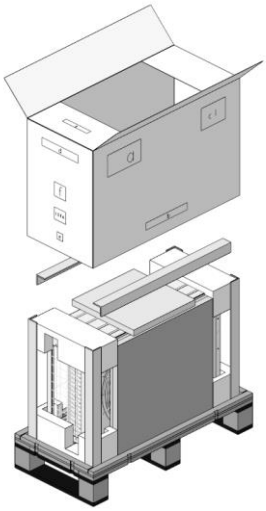
No.	Item		Quantity
1	Drainage Kit	Condensate Pump and Pump Bracket	1
2		Condensate Water Pipe (7.5 m /24.6 ft.)	1
3		Drain fitting	1
4	Display kit	Display and Display Magnetic Box	1
5		10 m (32.8 ft.) Cable of Display	1
6		0.5 m (1.6 ft.) Cable of Display	1
7	SIC Card Kit		1
8	L-shape Mounting Rail Kit		2
9	Cage Nuts (M6)		6
10	Pan-Head Screws M6x12 (Torx T30)		6
11	Center Screws M5x12 (Torx T20)		10
12	USB Converter Cable		1
13	Cable Ties 100x2,5		10
14	User Manual		1
15	VRC Cooling Unit		1

2.4.2 Unpacking of Condensing Unit

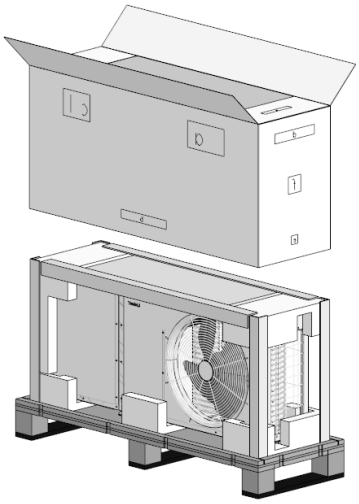
- The unpacking of the condensing unit from the packing materials is shown in ***Figure 2-8***.
- Move the equipment of the assembled package to an open, firm leveled ground in the vicinity of the installation site.
- Cut off the packing strip on the package paper box using a utility knife followed by removing the package paper box of the unit.
- Remove the packing materials, including paper cover, support cardboard, paper box, cushion and

paper corner in a specific order as mentioned from the top side of the unit.

- Remove the unit from the wooden pallet.



Standard condensing unit



Low ambient condensing unit

Figure 2-8 Unpacking 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.

The accessory list of the condensing unit is shown in ***Table 2-5***.

Table 2-5 VRC3 Series Accessories

Sr No.	Item	Quantity	Model
1	Side Panel	2	VRC300 VRC301 VRC302
2	Front Panel	1	
3	Screws (M4x10)	10	

2.5 Equipment Installation Room Requirements

The requirements are as follows:

- To ensure the normal operation of environmental control system, the rack should be free from air leakages that de-stabilize the temperature gradient and also could lead into moisture occurrence.
- The rack should have appropriate thermal separation.
- The condensing air entering the equipment room should be reduced to a minimum as the entry of condensing air may increase the load of the system. It is recommended that the leakage rate of condensing air be kept below 5% of the total internal airflow.
- All the doors and windows should be closed properly to avoid any air infiltration from outside into the room.

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

2.6 Environment

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

- **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.**

2.6.1 Operating Environment

The operation environment requirements are mentioned in ***Table 2-6***.

Table 2-6 Operating Environment

Item	Requirements
Installation position	The maximal equivalent length of piping between the indoor unit 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 ***Table 3-7*** [2] The value is positive if the condensing unit is installed above the indoor unit; negative if the indoor unit is installed above the condensing unit	

2.6.2 Storage Environment

The storage environment requirements are mentioned in ***Table 2-7***.

Table 2-7 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

2.7 Installation Space Requirements

The indoor unit is a specifically engineered air conditioning unit. It is recommended to install the indoor unit inside the rack at the lowest rack unit space, as shown in the installation section.

2.8 Clearance Space

2.8.1 Indoor Unit

To facilitate ease of installation and maintenance, enough space must be provisioned at site. When the indoor unit is installed in room, the distance from the front and other sides of the unit to the wall or other obstacles must be greater than 1000 mm (30.00 in.) and 600 mm (18.00 in.) respectively, as shown in ***Figure 2-9***. When the indoor unit is installed in the rack, the distance from the front and rear sides of the rack to the wall or other obstacles must be greater than 1000 mm (30.00 in.) and 600 mm (18.00 in.) respectively.

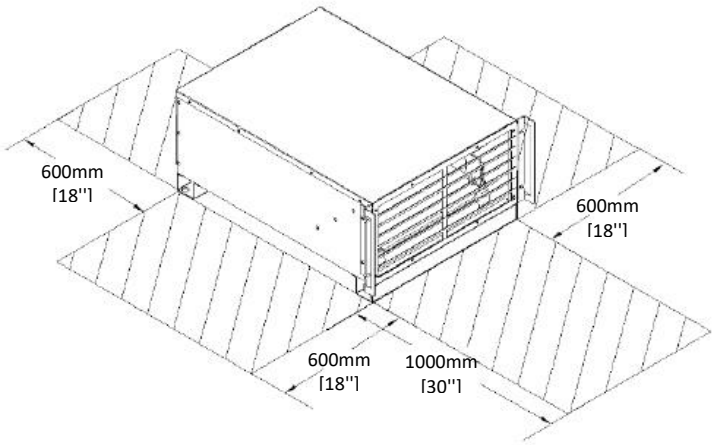


Figure 2-9 Minimum Distance for Pull-out during Maintenance (Top View)

2.8.2 Condensing Unit

For standard condensing unit, it is not necessary to install air deflector when used in indoor environment or in outdoor environment that are always greater than 0°C (32°F), see ***Figure 2-10***. For units without air deflector, the recommended clearance space is shown in ***Figure 2-11.*** Otherwise, it is necessary to install air deflector when used in outdoor environment below 0°C (32°F), and the necessary clearance space is shown in ***Figure 2-12.*** If there is no wall to meet the installation clearance, it is recommended to use the low ambient condensing unit. Besides, it is necessary to use the low ambient condensing unit when outdoor temperature is below -15°C (5°F).

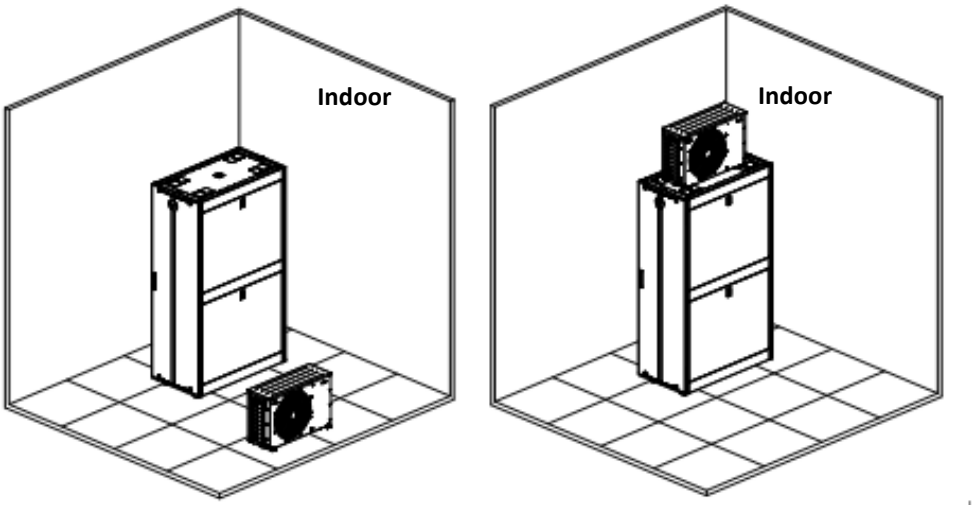


Figure 2-10 Standard Condensing Unit Without Air Deflector for Indoor Use

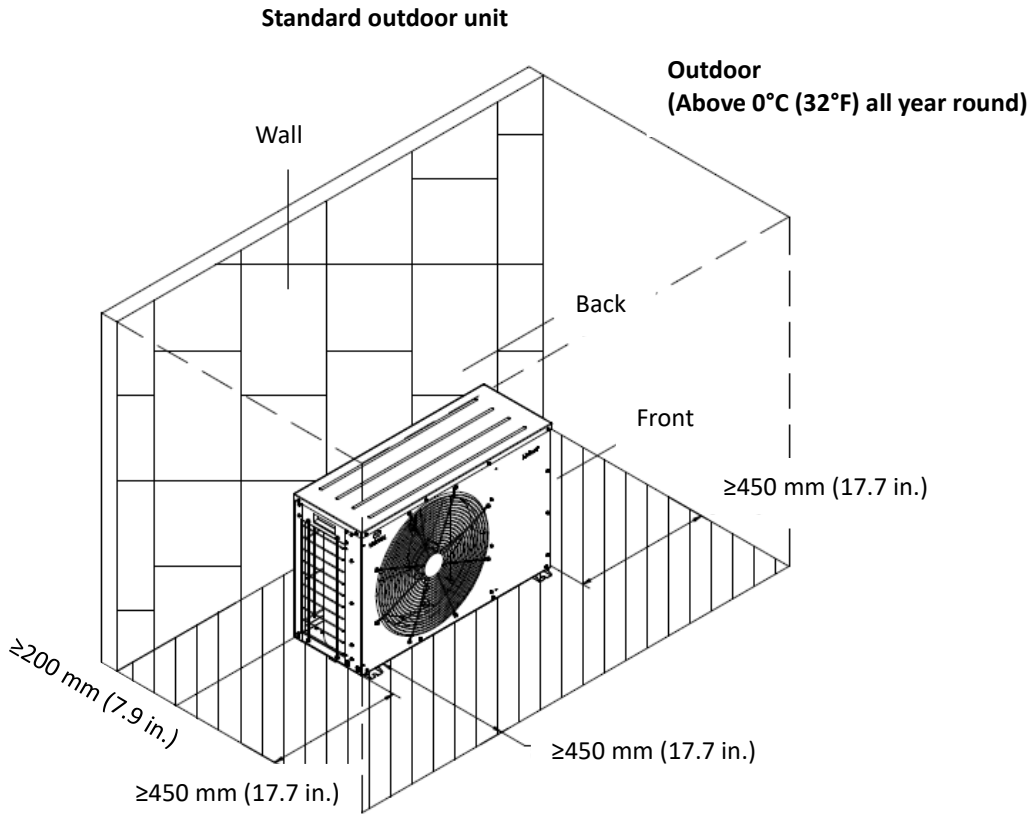
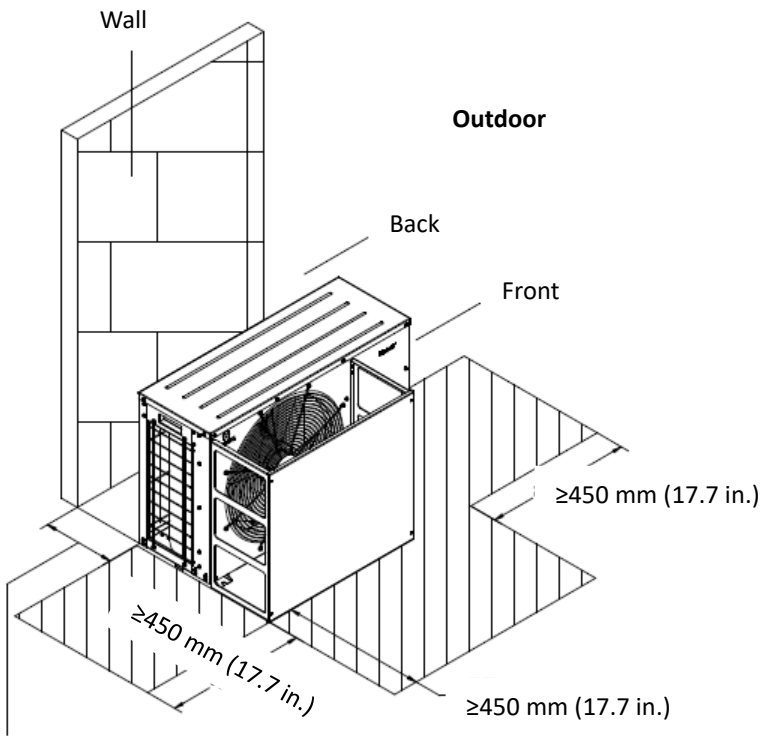


Figure 2-11 Clearance space required for standard condensing unit without air deflector for outdoor use



Necessary clearance when installing air deflector = 200 mm (7.9 in.)

Figure 2-12 Clearance Space Required for Standard Condensing Unit With Air Deflector

For low ambient condensing unit, the air deflector does not need to be installed. The distance from the wall should be large enough to be maintained and the minimum distance from the front side (supply air side) of the condensing unit should be 450 mm (17.72 in.) from any wall, obstacles or adjacent devices. It is a must to provide these clearance distances as shown in ***Figure 2-13*** to ensure appropriate airflow across the condensing unit.

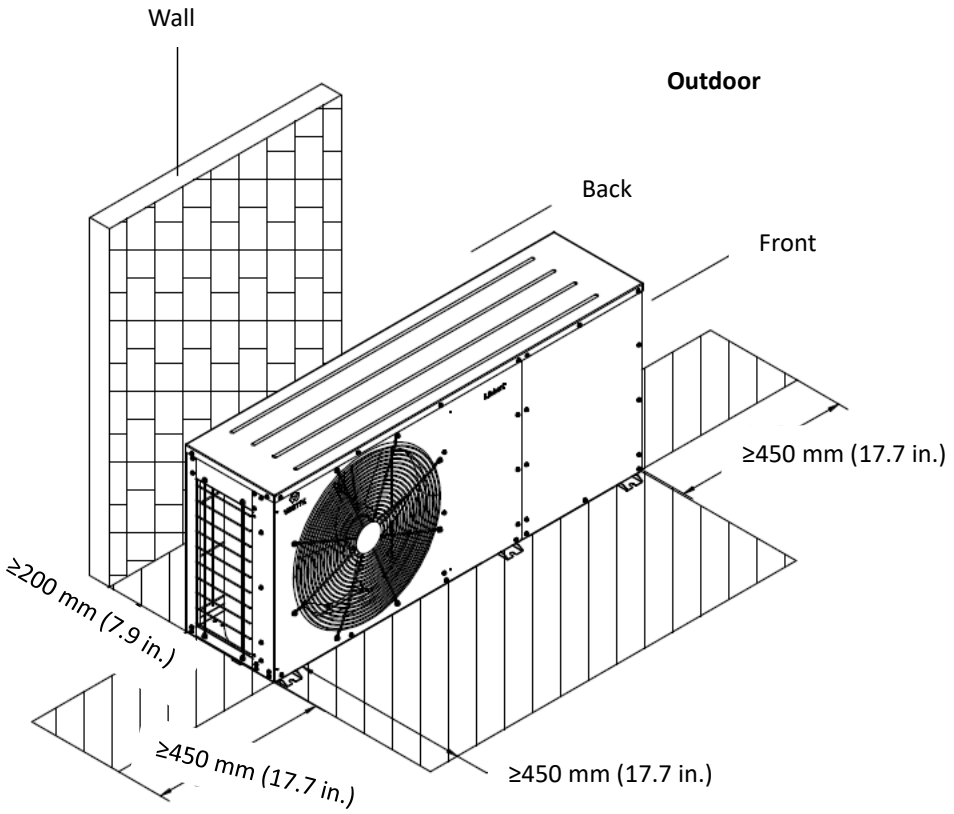


Figure 2-13 Recommended Clearance Space Required for Low Ambient Condensing Unit

2.9 Weight Bearing Capacity

The cooling unit will be installed inside the rack because the concentrated floor loading of the rack will increase. Therefore, the weight bearing capacity of the floor of the computer room must be taken into consideration.

2.10 Inspection

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

3 Mechanical Installation

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

3.1 Installation Notes

NOTE:

- **The indoor unit needs to be installed inside the rack or in room.**
- **Before installation, make sure that the installation environment meets the requirements and there must be sufficient provision for connecting the condensate drain line to the drain point.**
- **Follow the design drawings strictly when installing the equipment and reserve the space for maintenance. The manufacturer's engineering dimensions drawings can serve as a reference.**
- **Two persons are required for installation.**
- **Torx bits T20 and T30 are needed during installation, as shown in *Figure 3-1*.**

Figure 3-1 Torx Bits

3.2 System Installation Layout

The overall layout of the unit which comprises both the indoor unit and the condensing unit is depicted in ***Figure 3-2***, ***Figure 3-3*** and ***Figure 3-4***.

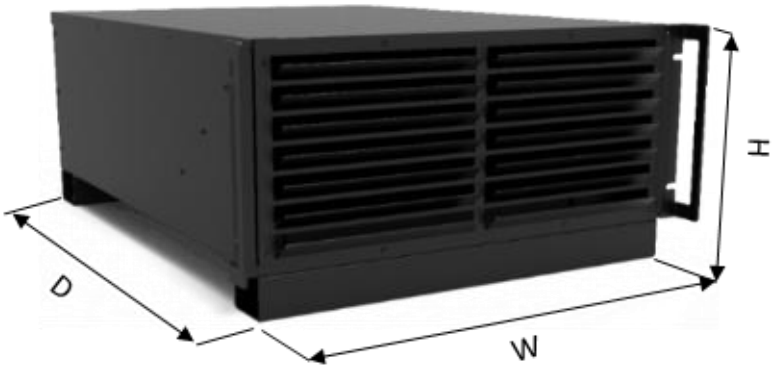


Figure 3-2 Indoor Unit

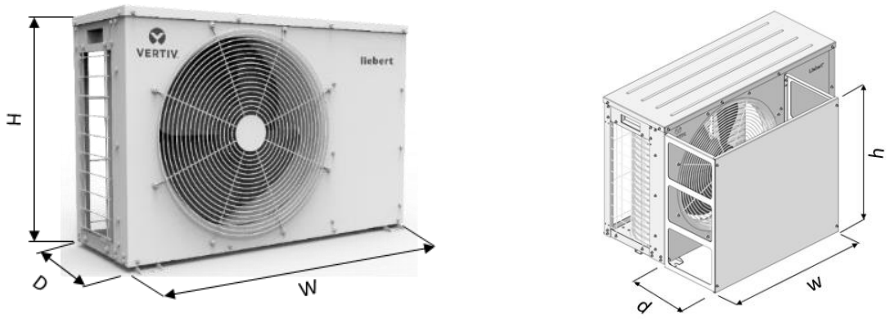


Figure 3-3 Standard Condensing Unit

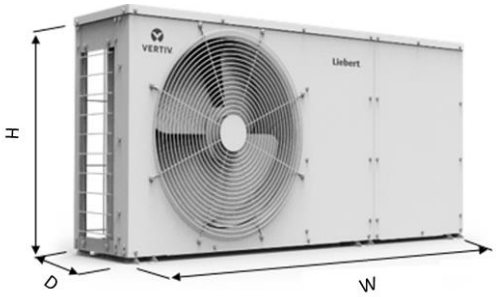


Figure 3-4 Low Ambient Condensing Unit

The dimensions of indoor unit and condensing unit are listed in ***Table 3-1***:

Table 3-1 Dimensions of Indoor and Condensing Unit

Component		**Range of Dimensions (Unit: mm (in.))**		
		H	**W**	**D**
Indoor Unit	VRC200 VRC201 VRC202	264 (10.39)	442 (17.40)	602 (23.70)
Condensing Unit	VRC300 VRC301 VRC302	527 (20.75)	786 (30.94)	282 (11.10)
	VRC350 VRC351 VRC352	527 (20.75)	1158 (45.60)	282 (11.10)

Each standard condensing unit (VRC300, VRC301, VRC302) has a set of air deflector. The dimension of the air deflector is shown in the ***Table 3-2***.

Table 3-2 Dimension of Air Deflector

Component		**Range of Dimensions (Unit: mm (in.))**		
		h	**w**	**d**
Standard Condensing Unit	VRC300 VRC301 VRC302	500 (19.68)	563 (22.17)	233 (9.17)

3.3 Installing the Unit

3.3.1 Installing the Indoor Unit Inside the Rack

A front view with dimensions is shown in ***Figure 3-5*** and ***Figure 3-6,*** which would help mount the unit inside the rack.

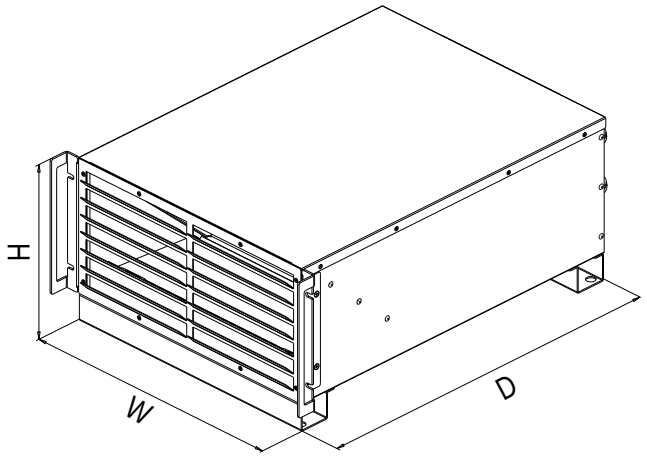


Figure 3-5 Indoor Unit Dimensions

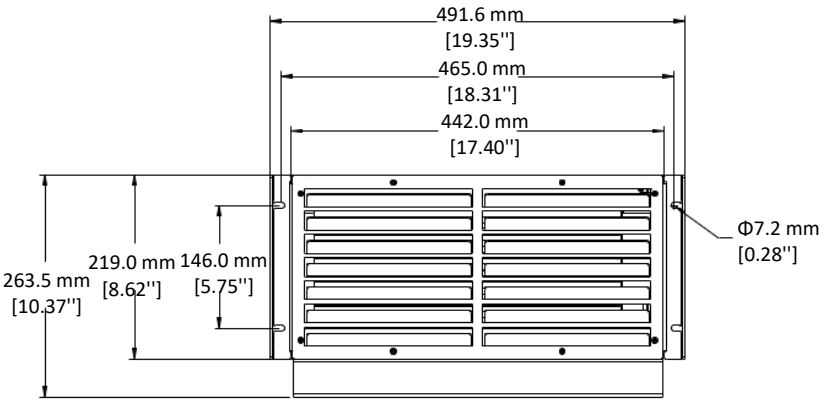


Figure 3-6 Front View of Indoor Unit

The detailed dimensions of the indoor unit with their weights are mentioned in ***Table 3-3***.

Table 3-3 Dimensions of Cooling Unit

Model	Dimensions (W × D × H, mm (inch))	Net Weight (kg. (lbs))
Cooling unit	442 × 602 × 264 (17.40×23.70×10.39)	23.0 (50.7)

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 3-7***. 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.).

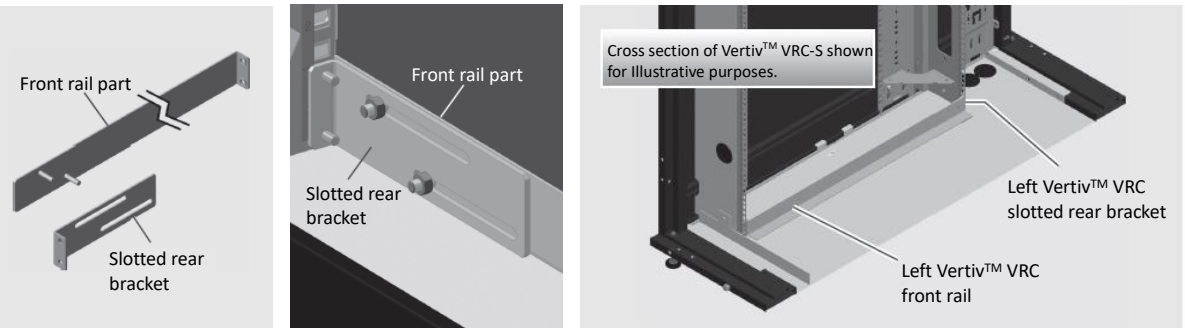


Figure 3-7 L-Shape Rails Installation

2. Inserting the indoor unit into the rack

Insert the indoor unit into the front of the rack until its front brackets are against the rack's uprights.

3. Fastening the indoor unit

Fasten the indoor unit 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 3-8***.

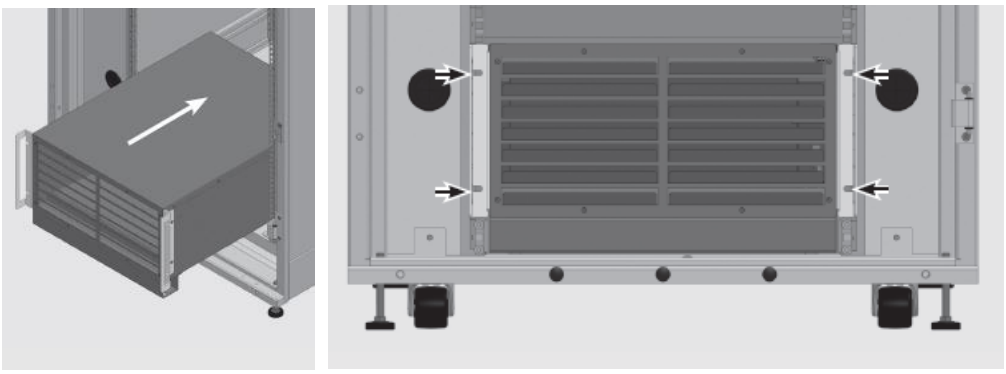


Figure 3-8 Indoor Unit Installation

NOTE:

- **Make sure the indoor unit is installed horizontally, otherwise high-water level alarms may be triggered incorrectly.**
- **For installation in a 2-post rack, please purchase accessory 2POSTRMKITVRC. Installation instructions are included with this rail kit.**

3.3.2 Installing the Condensing Unit

The physical appearance of the condensing unit is shown in ***Figure 3-3*** and ***Figure 3-4.*** The top view of the standard condensing unit is shown in ***Figure 3-9*** and the low ambient condensing unit is shown in ***Figure 3-10***.

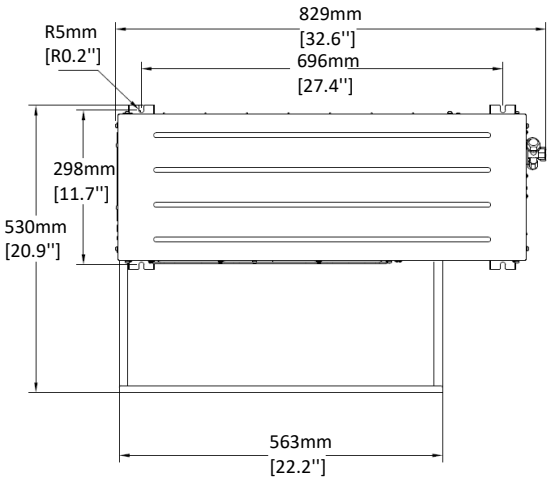


Figure 3-9 Standard Condensing Unit Top View

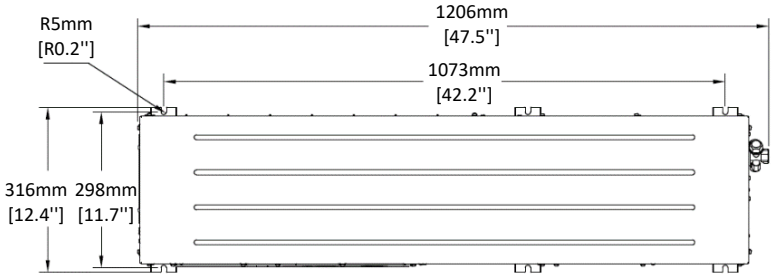


Figure 3-10 Low Ambient Condensing Unit Top View

Table 3-4 Condensing Unit Dimensions

Model	Dimensions (W × D × H, mm (in.))	Net Weight (kg (lbs.))
VRC300 VRC301 VRC302	786×282×527 (30.94×11.10×20.75)	44.0 (97.0)
VRC350 VRC351 VRC352	1158×282×527 (45.60×11.10×20.75)	68.0 (149.9)

The condensing unit must be installed vertically. The condensing unit can either be installed higher than the indoor unit or lower than the indoor unit. ***Figure 3-11*** shows the scenario where the condensing unit is installed higher than the indoor unit. When installing the condensing unit 7.5m higher than the indoor unit, 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.

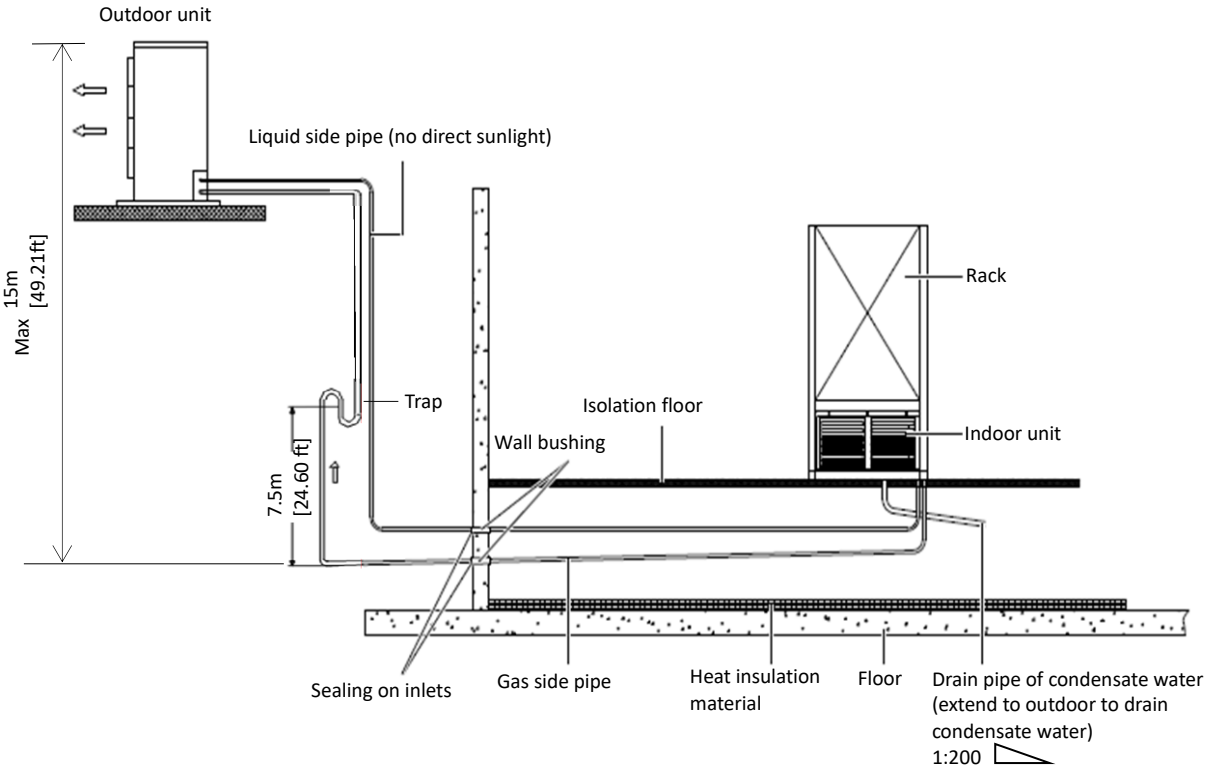


Figure 3-11 Condensing Unit Installed Higher Than the Indoor Unit

Figure 3-12 shows the scenario where the condensing unit is installed lower than the indoor unit.

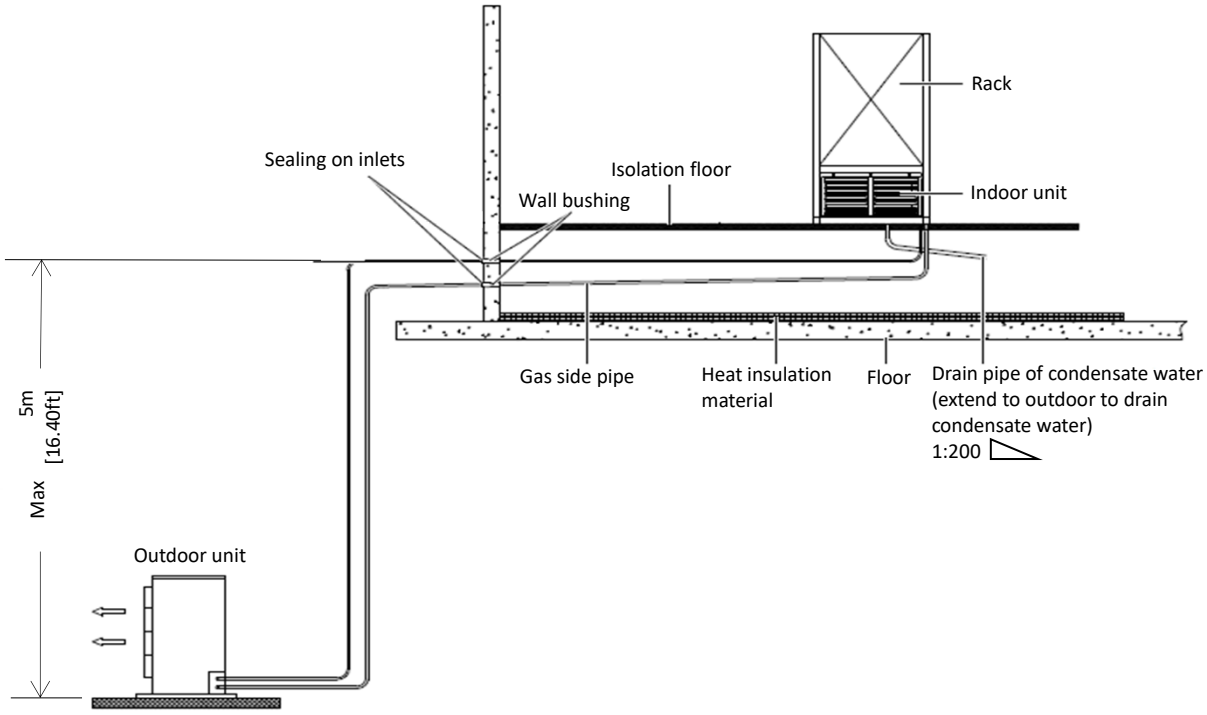


Figure 3-12 Condensing Unit Installed Lower Than the Indoor Unit

Table 3-5 shows the vertical distance between the indoor and the condensing unit.

Table 3-5 Vertical Distance Between Indoor Unit and Condensing Unit

Relative Position	Value
Condensing unit installed higher than indoor unit	Maximum: 15 m (49.21 ft.)
Condensing unit installed lower than indoor unit	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 3-13*** 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 lbs.) for standard condensing unit or 68 kg (150 lbs.) 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.**

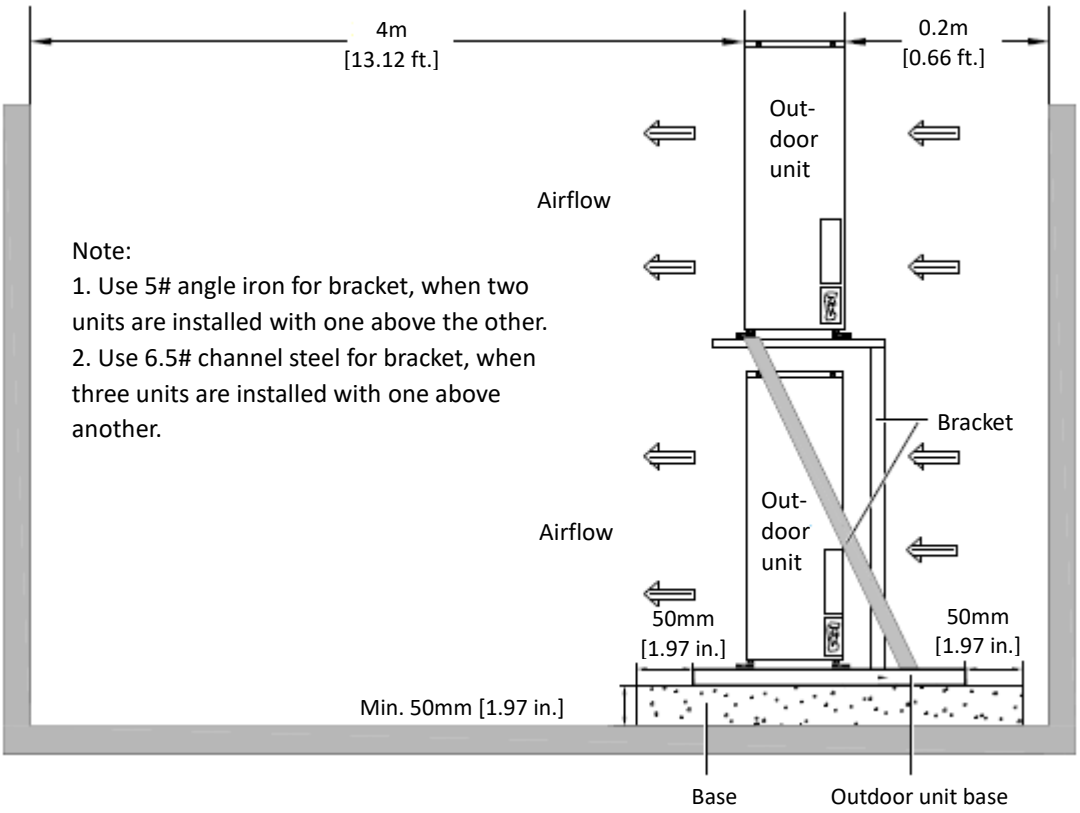


Figure 3-13 Installing Multiple Condensing Units with One Above the Other

3.3.3 Installing the drain fitting to the indoor unit

Fasten the drain fitting to the drain port of the indoor unit, as shown in ***Figure 3-14***. 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.

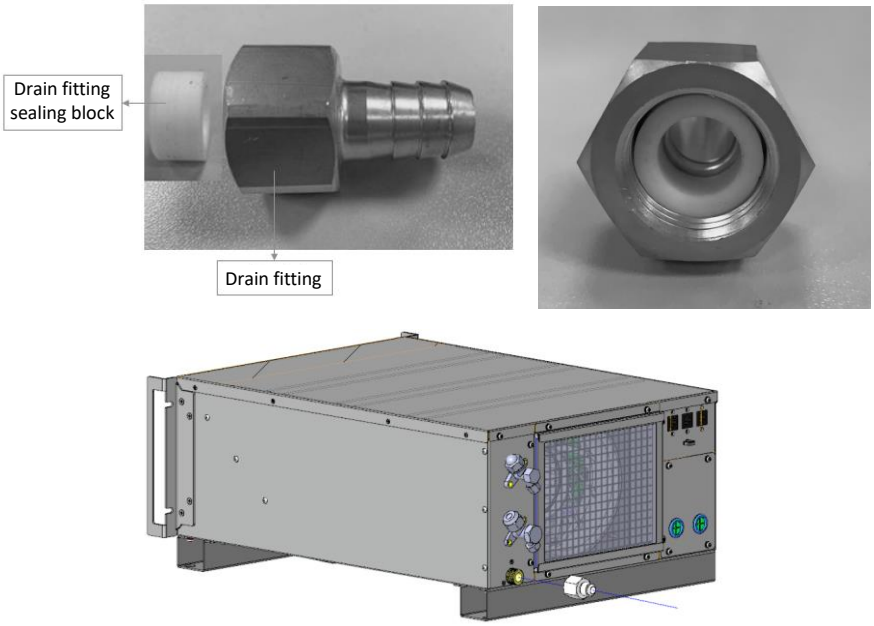


Figure 3-14 Installing the Drain Fitting

3.3.4 Installing the Condensate Pump

NOTE: Please finish the cable connection in chapter 4 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 3-15*** and ***Figure 3-16***.

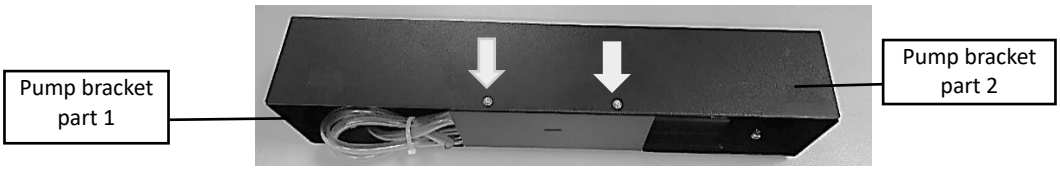


Figure 3-15 Appearance of Pump Bracket

Figure 3-16 Internal Structure of Water Pump Bracket

2. Install the power cord and the L-shape pipe, as shown in ***Figure 3-17***.

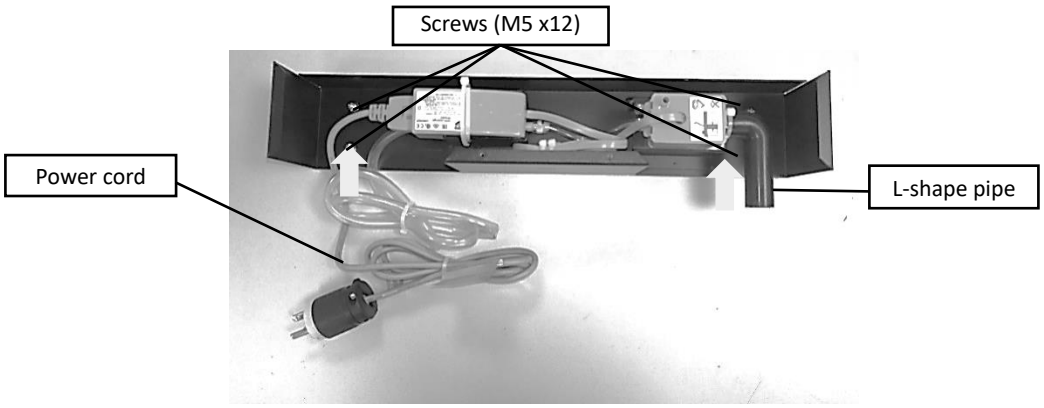


Figure 3-17 Internal Structure of Water Pump Bracket

3. Loosen the four screws in ***Figure 3-17*** for about four turns.

4. Slide the pump bracket part 1 on L-shape mounting rail, as shown in ***Figure 3-18***.

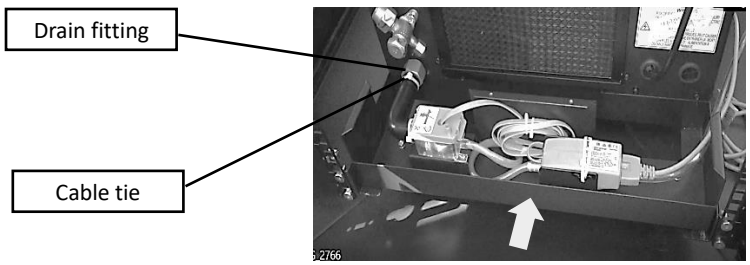


Figure 3-18 Installation of The Pump Kit

5. Install L-shape pipe to drain fitting, and fix it with a cable tie, as shown in ***Figure 3-18***.

6. Tighten the four screws to fix the pump bracket part 1, as shown in ***Figure 3-17***.

7. Tighten the two screws to install pump bracket part 2 to pump bracket part 1, as shown in ***Figure 3-19***.

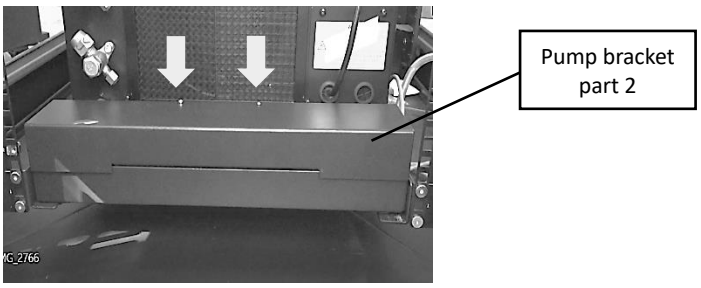


Figure 3-19 Installation of The Pump Bracket Part 2

There are one anti-Siphoning device and a condensate water pipe in indoor unit package. 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.

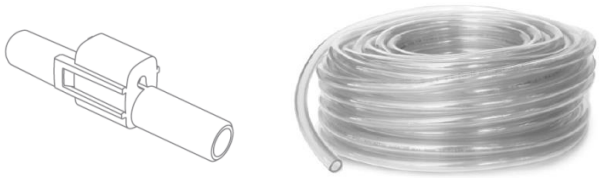


Figure 3-20 Anti-Siphoning Device and Condensate Water Pipe

3.4 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 3-21***. Otherwise, you can ignore the air deflector installation steps.

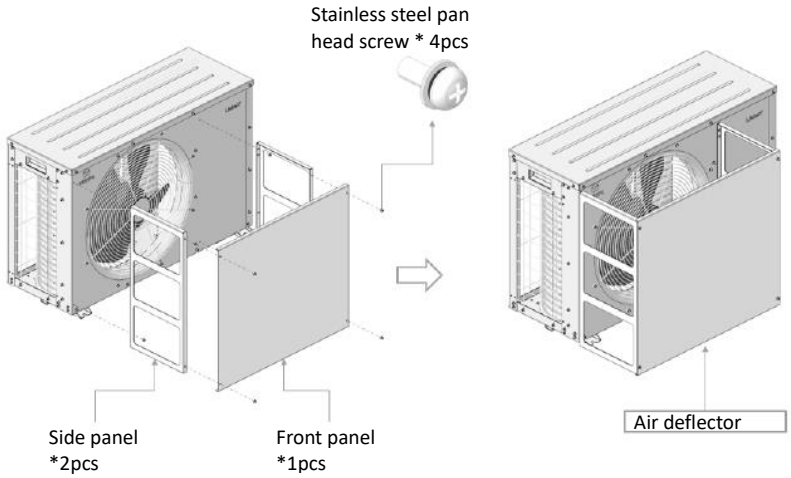


Figure 3-21 Air Deflector Installation for Standard Condensing Unit

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 3-22***, ***Figure 3-23*** and ***Figure 3-24*** show connectors on both the indoor and the condensing unit.

General Principles

- Copper pipes with quick thread connectors must be used to connect the indoor and 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 4.0kg (8.82 lbs), while the amount with standard condensing unit is 1.3 kg (2.87 lbs).
- Avoid oil leakage and clogging in the system. Utmost care while considering these factors minimizes the noise and vibration significantly.

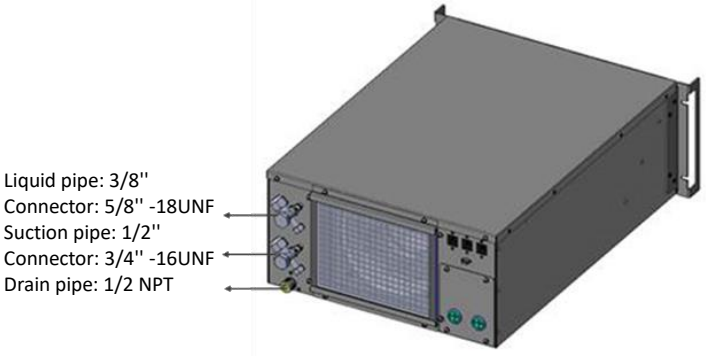


Figure 3-22 Connectors of Indoor Unit

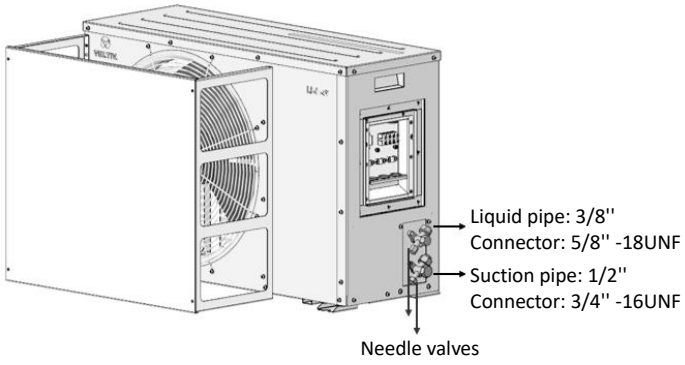


Figure 3-23 Connectors of Standard Condensing Unit

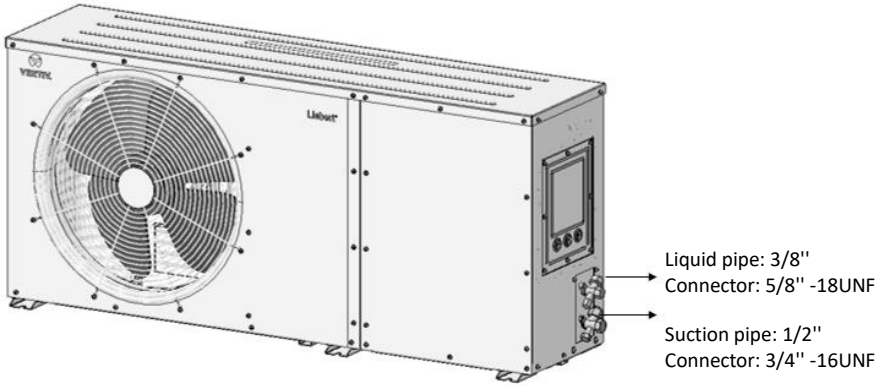


Figure 3-24 Connectors of Low Ambient Condensing Unit

- Use thermal insulation material to cover quick thread connectors of both indoor and condensing

units, after completing the installation and commission, as shown in ***Figure 3-25***.

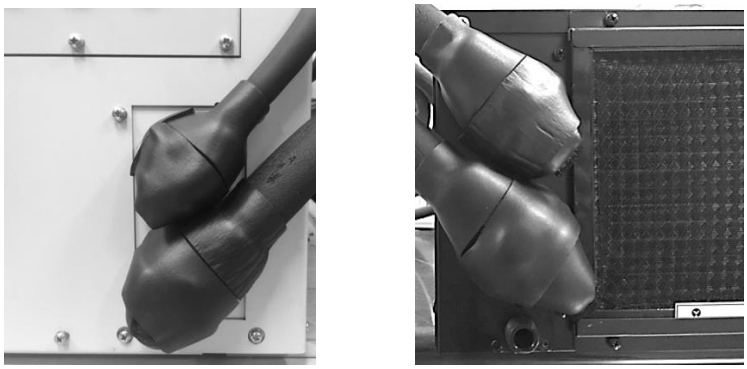


Figure 3-25 Keeping Copper Piping and Quick Thread Connector Insulated

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 indoor unit and 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 indoor unit and condensing unit is 30 m (98.43 ft.).

Table 3-6 lists the equivalent length of the piping to be considered in the liquid line piping for the bends and the elbows connector devices.

Table 3-6 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 3-26***. The same can be replicated for fitting the connectors of the indoor unit.

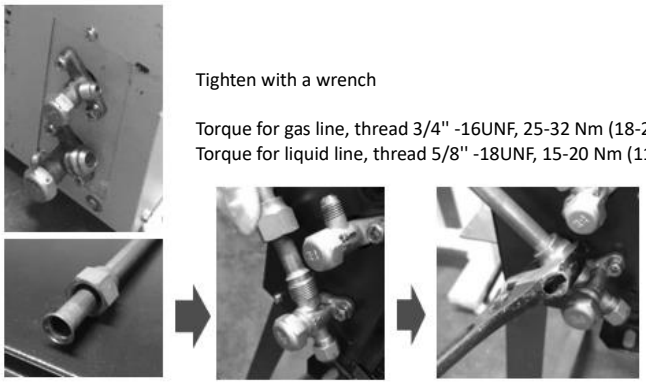


Figure 3-26 Tightening the Connectors of The Condensing Unit

The recommended torque values are listed in *Table 3-7***.**

Table 3-7 Torque Value for Tightening the Piping Connections

Coupling Size	Torque Value (Nm (ft.-lb.))
3/4” - 16UNF	25 – 32 (18-24)
5/8” - 18UNF	15 – 20 (11-15)

Required pipe connections

Following steps must be implemented during connection of the refrigerant pipe between the indoor unit 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.
- Use a thermal insulation material to cover the connecting copper piping and the quick thread connectors of the indoor unit and condensing unit to ensure good performance of the unit.
- Connect pipes of the indoor and condensing units based on the labels. The unit adheres to the quick connection mode.
- The unit has been charged with appropriate refrigerant and refrigerant oil (FV50S) before delivery. However, if the connecting pipe between the condensing unit and indoor unit is longer than 10m (32.8 ft.), add the refrigerant and refrigerant oil (FV50S) to the system to ensure normal system operation.

- When installing the condensing unit 7.5m higher than the indoor unit, 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.

Refrigerant and refrigerant oil must be added in accordance with the following formula:

Refrigerant and refrigerant oil amount to be added (kg (lbs.)) = Adding refrigerant and refrigerant oil amount per meter of the liquid pipe (kg/m (lbs./ft.)) × [Total length of the liquid pipe (m (ft.)) – 10.0 m (32.8 ft.)]

Table 3-8 shows the refrigerant and refrigerant oil amount to be added per meter of the liquid pipe.

Table 3-8 Additional Refrigerant and Refrigerant Oil

Adding refrigerant amount per meter kg/m (lbs./ft.)	Adding refrigerant oil (FV50S) amount per meter ml/m (ml/ft.)
0.050 (0.034)	13.0 (4.0)

NOTE:

- **Risk of oil contamination with moisture. Can cause equipment damage. VRC systems require the use of PVE (FV50S) 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.**
- **Risk of improper refrigerant charging can cause equipment damage.**

3.5 Refrigerant Charge

The unit is usually pre-charged with the rated amount of refrigerant in factory, and the connectors of the liquid and the suction lines are closed. Fill the suction and liquid pipe with 2.7 MPa(g) nitrogen at the needle valves on suction and liquid pipe connectors, wait for at least 3 hours, and then check for any leakage in the piping and connections. If no leakage is observed, vacuum the liquid and suction lines at the needle valves. The absolute pressure after vacuuming should be below 20 Pa(a). Open the connectors of the liquid and the suction lines after evacuation.

If the unit is not pre-charged, it is necessary to add refrigerant, as shown in ***Table 3-9***. Open the connectors of suction and liquid pipe, fill the suction and liquid pipe with 2.7 MPa(g) nitrogen at the needle valves on suction and liquid pipe connectors, wait for at least 3 hours, and then check for any leakage in the piping and connections. If there is no leakage observed, vacuum the unit at the needle valves. The absolute pressure after vacuuming should be below 20 Pa(a). Add refrigerant to air conditioner after evacuation.

For standard unit, the position of needle valves for vacuuming and charging the refrigerant is shown in ***Figure 3-27***.

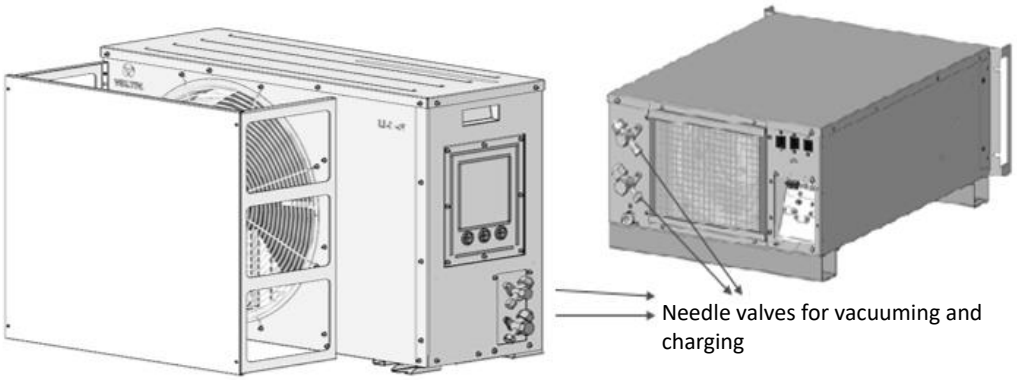


Figure 3-27 Charging the Refrigerant Gas

For low ambient condensing unit, position of needle valves for vacuuming and charging the refrigerant is shown ***Figure 3-28***. There is a receiver in the low ambient condensing unit. Point 1 and 2 represent the needle valves, point 3 represents a needle valve at the inlet of the receiver depicted in ***Figure 3-28***. Vacuuming or charging the refrigerant from the three points simultaneously. If the vacuuming operation is not carried out through point 3, the operation will fail.

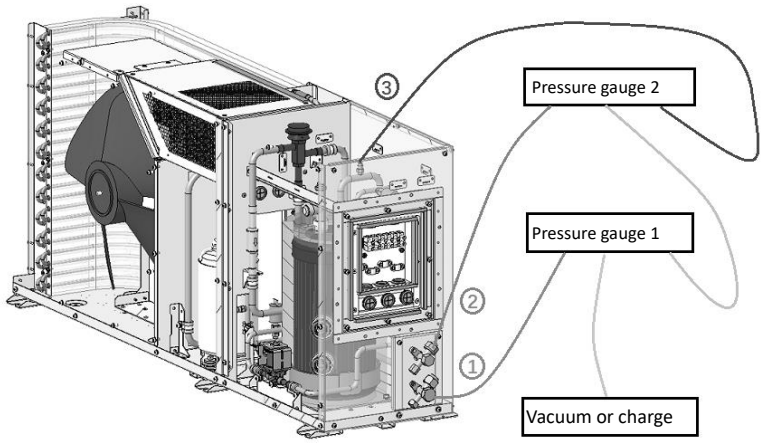


Figure 3-28 Vacuuming and Charging for Low Ambient Condensing Unit

If it is necessary to add more refrigerant and refrigerant oil, please contact Vertiv for technical assistance. For the exact amount of refrigerant and refrigerant oil to be charged in the system, refer to ***Table 3-8*** and ***Table 3-9***.

Table 3-9 Amount of refrigerant to be charged in the system

Unit Type	Refrigerant Type	Refrigerant Charge (kg (lbs.))
VRC200/VRC300	R410A	1.30 (2.87)
VRC201/VRC301		
VRC202/VRC302		
VRC200/VRC350		4.00 (8.82)
VRC201/VRC351		
VRC202/VRC352		

3.6 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 3-10***.

Table 3-10 Mechanical Installation Checklist

Items	Results
Sufficient space for maintenance activities at site	
All the fittings are connected firmly	
The placement direction of the indoor unit 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	

4 Electrical Installation

This chapter describes the electrical installation of the unit, including installation notes, cable connection, communication cable connection and installation inspection.

4.1 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.

4.2 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 FLA of unit that is mentioned in ***Table 4-1***.

The cable connections for the indoor unit are operated through the cover panel at the back-side of the unit as shown in ***Figure 4-1***.

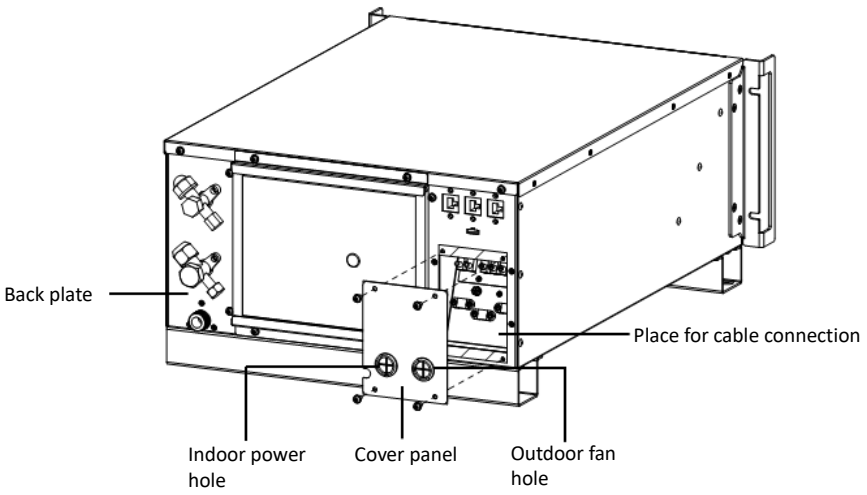


Figure 4-1 Cover Panel for Cabling Connections

The power cables can be selected based on the amperage ratings for each component listed in ***Table 4-1***.

Table 4-1 Current Ratings of Components

Unit Type	Input Voltage	Frequency	FLA of Compressor (A)	FLA of Liquid Line Solenoid Valve (A)	FLA of Outdoor 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
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 indoor and the condensing units are depicted in ***Figure 4-2*** and ***Figure 4-3***.

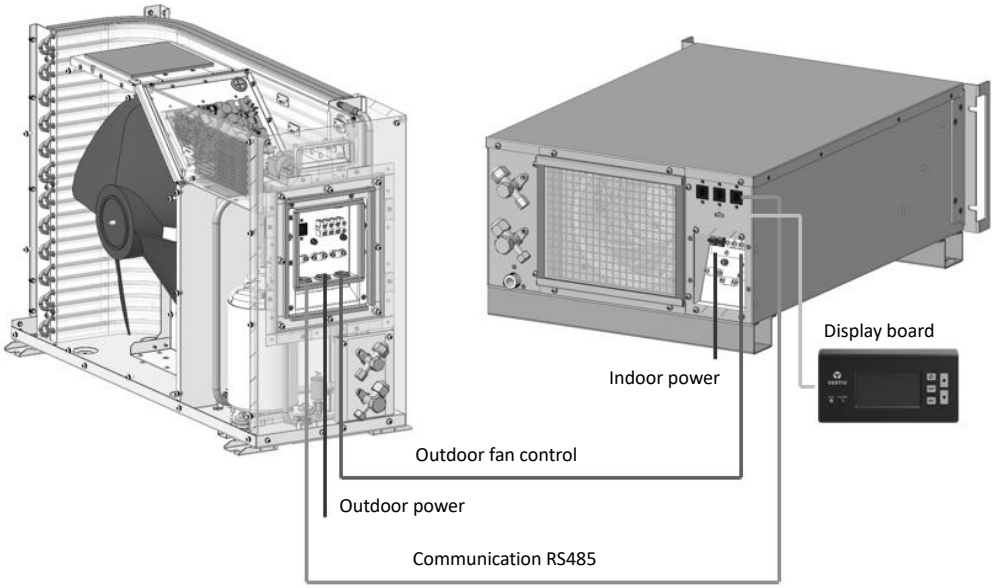


Figure 4-2 Overview of the Cabling Connections (Standard Condensing Unit)

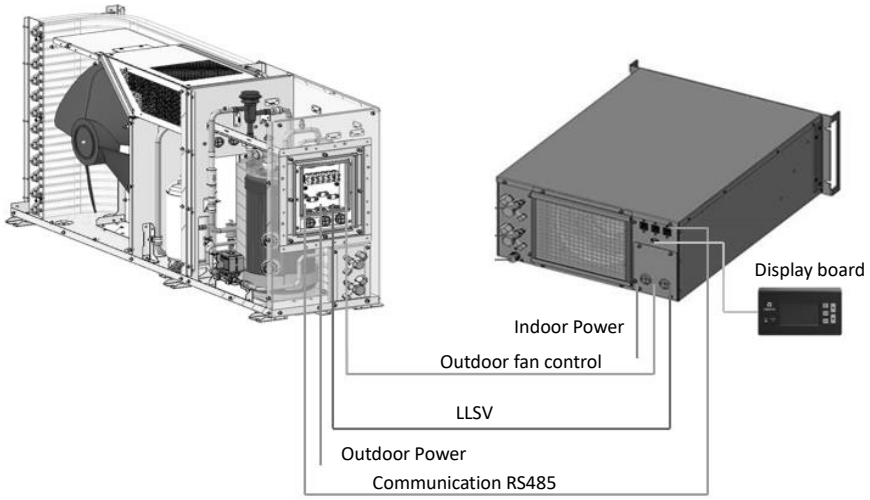


Figure 4-3 Overview of the Cabling Connections (Low Ambient Condensing)

Detailed input cabling connections of the indoor unit power terminal are shown in ***Figure 4-4***.

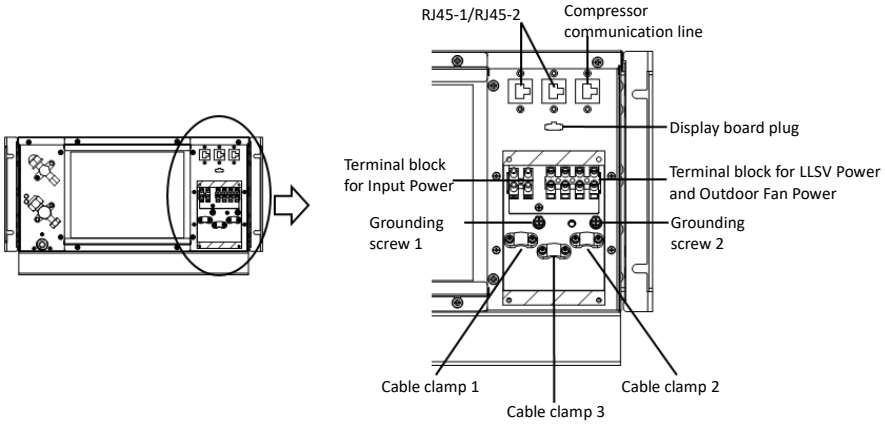


Figure 4-4 Input Cabling Connections – Indoor Power Terminal

Input cabling connections of the condensing unit power terminal block are shown in ***Figure 4-5***.

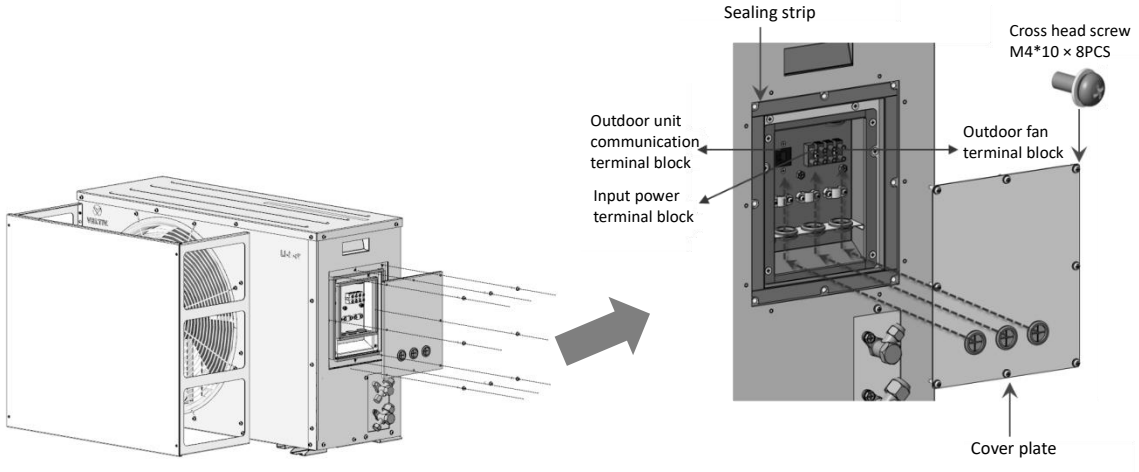


Figure 4-5 Input Cabling Connections – Condensing Power Terminal

Detailed input cabling connections of the condensing unit electric box are shown in ***Figure 4-6*** and ***Figure 4-7***.

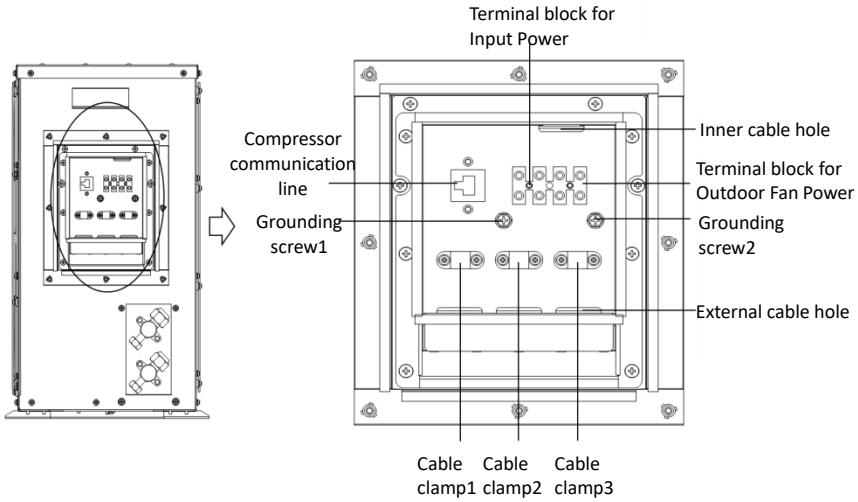


Figure 4-6 Standard Condensing Unit Electric Connection Illustration

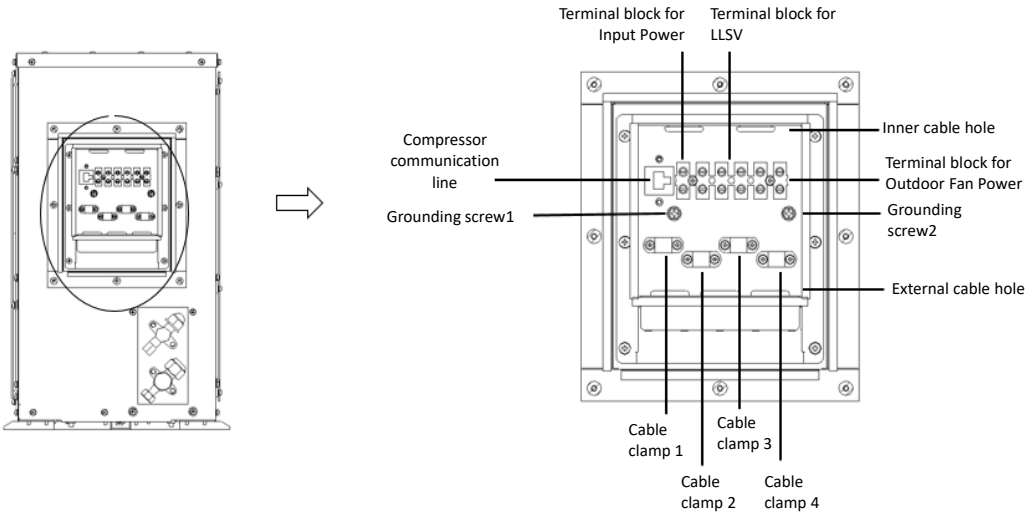


Figure 4-7 Low Ambient Condensing Unit Electric Connection Illustration

4.3 Communication Cable Connecting

4.3.1 Display cable connection

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.

4.3.2 Communication connection

The RJ-45 cable (RS485-3) for connecting indoor and 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 4-6*** and ***Table 4-2***.

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 in ***Figure 4-8*** and ***Table 4-2***.

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

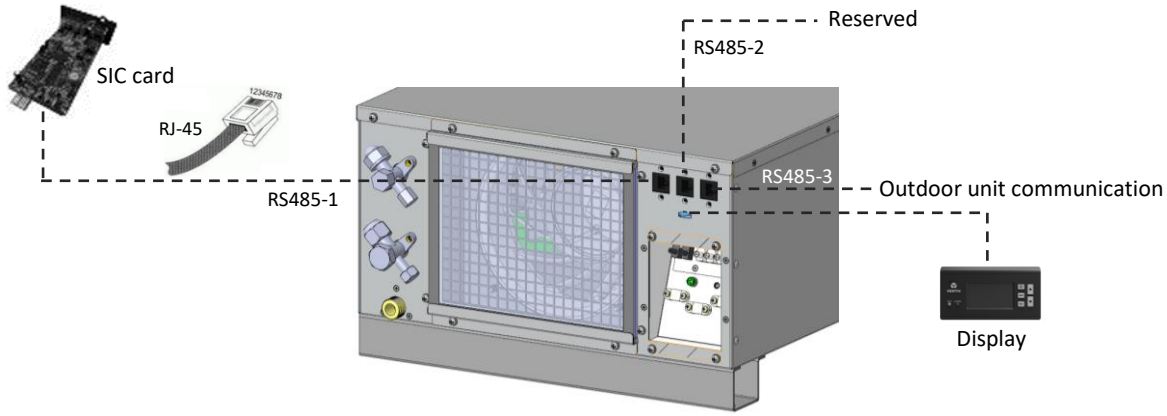


Figure 4-8 Communication and Monitoring Cable Connections in the Indoor Unit

Table 4-2 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-

4.4 Installation Inspection

After completing the electrical installation, inspect the installation according to ***Table 4-3***.

Table 4-3 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.

5 Controller Operation Instructions

This chapter gives a detailed description on feature, appearance, LCD screen, control buttons, control interface and menu structure of the air conditioner.

5.1 LCD Screen

The LCD screen displays English menus with white backlight. ***Figure 5-1*** depicts the image of the controller display.

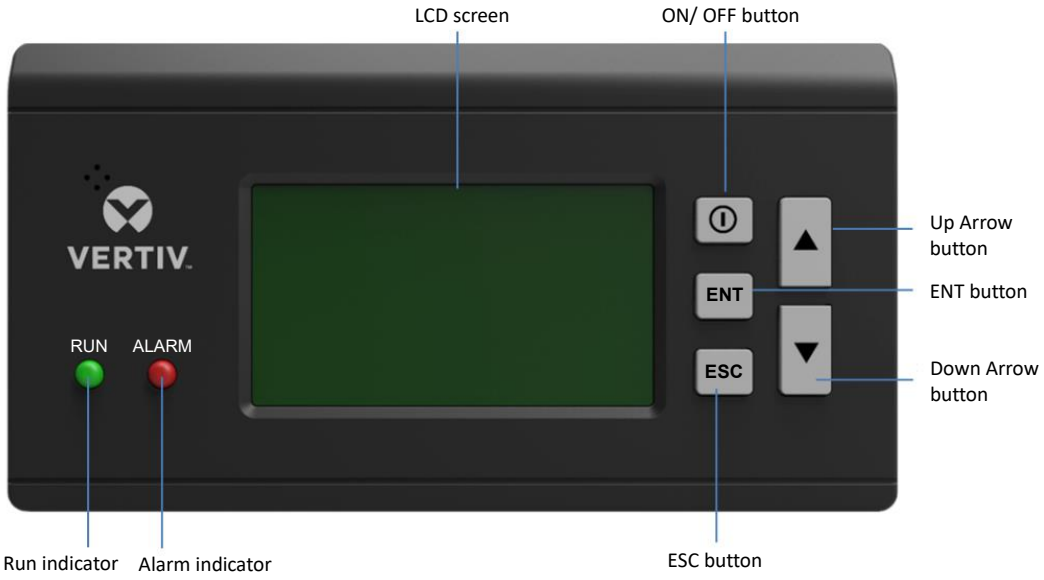


Figure 5-1 Controller Display

5.2 Control Buttons

The micro-processing controller provides five control buttons, as shown in ***Figure 5-2***.

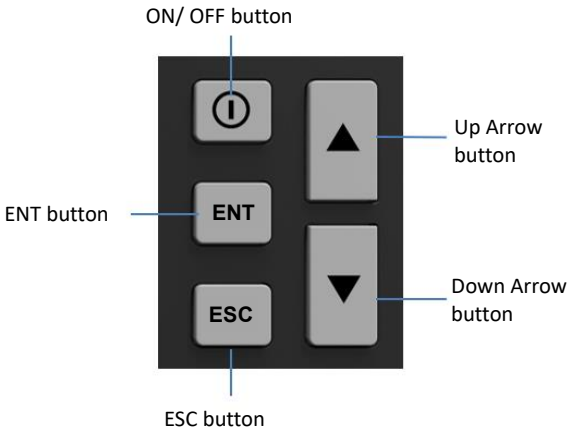


Figure 5-2 Control Buttons

The functions of the control buttons are described in ***Table 5-1***.

Table 5-1 Functional Description of the Controller Buttons

Key	Function Description
ON/OFF	Switch on/off the controller by pressing and holding the key for 3s
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 the previous menu screen. Abort parameter change. Make the audible alarm silent
Up 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 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

5.3 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.

5.4 Normal Screen

After the unit is powered on, the Normal screen will be displayed after 10 seconds, as shown in ***Figure 5-3***. The temperature units of VRC200, VRC201 and VRC202 are Fahrenheit, Fahrenheit and Celsius, respectively. The VRC200 is used as an example.

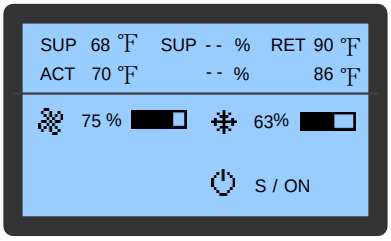


Figure 5-3 Normal Screen

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 5-2***.

Table 5-2 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

5.5 Unit Working Icons

The icons and their definitions are listed in ***Table 5-3***.

Table 5-3 Description of Icons

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

5.6 Menu

Alarm Menu

Select Alarm Menu on Main Menu screen to enter the screen as shown in ***Figure 5-4***. Press the Up or Down button to scroll up or down the menu items.

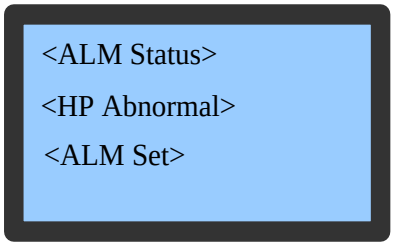


Figure 5-4 Alarm Menu

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 5-5***. XX indicates the alarm serial number (SN), and YY indicates the total number of reported alarms.

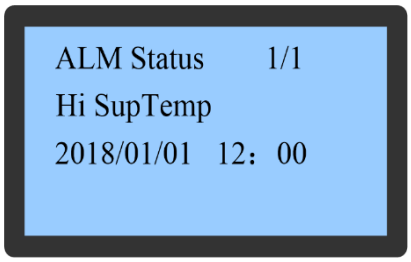


Figure 5-5 Current Alarm Menu

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.**
- **The current alarms are automatically cleared upon system power failure.**

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 5-6***, ***Figure 5-7*** and ***Figure 5-8***. Parameter settings can be saved permanently.

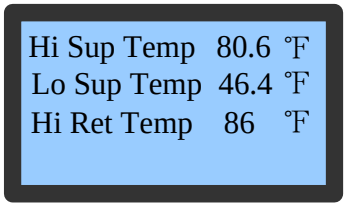


Figure 5-6 Items of the Alarm Value Setup Menu

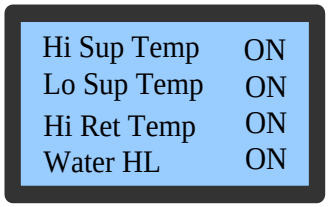


Figure 5-7 Items of the System Alarm Attribute Setup Menu

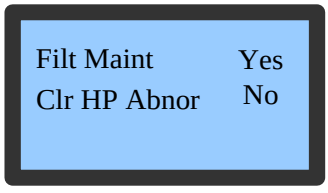


Figure 5-8 Items of Alarm Handle Attribute Menu

Temp Set

Select **Main Menu** > **Temp Set** to enter the screen as shown in ***Figure 5-9***. The Temperature Setting values will be permanently saved.

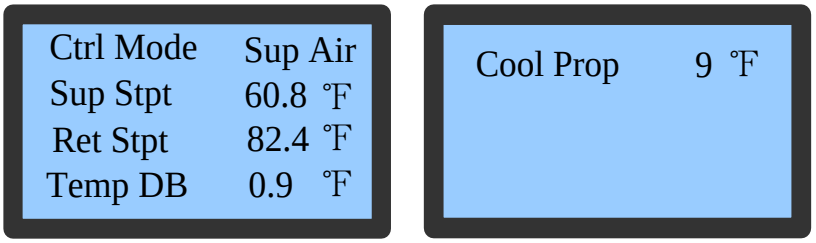


Figure 5-9 Temp & Hum Set Menu

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 indoor unit is used in the open rack, it is recommended to use return air control mode.**
- **If the indoor unit is used in the closed rack, it is recommended to use supply air control mode.**

System Status

Select **Main Menu** > **System State** to enter the System State menu, as shown in ***Figure 5-10***.

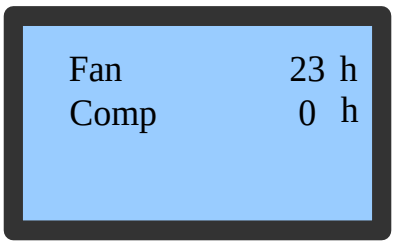


Figure 5-10 System Status

Run Time

You can query the operation time of the device on this menu, as shown in ***Figure 5-11***.

Figure 5-11 Run Time Menu

Help Menu

The menu includes Date &Time information. You can view the relevant information, as shown in ***Figure 5-12***.

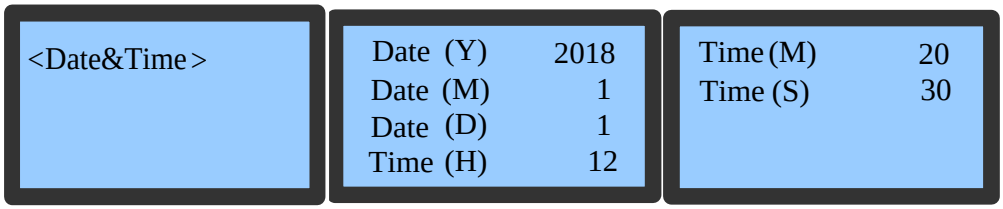


Figure 5-12 Date & Time Menu

PART III

SYSTEM OPERATION & GENERAL MAINTENANCE

6 Startup Commissioning

This chapter describes the startup commissioning, including specific operations.

6.1 Preparations Before Commissioning

6.1.1 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.

6.1.2 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.

6.2 Start-up Inspection Checklist

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

Table 6-1 Start-Up Inspection Checklist

Inspection	Items	Remarks
Mechanical inspection	The indoor unit and 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	

6.3 System Commissioning

The indoor and condensing units have been charged with the rated amount of refrigerant in factory, when the indoor unit and condensing unit have been connected as an entire system at sites. 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.

6.4 Commissioning Complete Inspection

Check according to ***Table 6-2*** after commissioning.

Table 6-2 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	

7 System Operation and Maintenance

Periodic system maintenance is crucial to ensure product reliability and validity. This chapter expounds the system maintenance of the air conditioner, including safety instructions, electric inspection, indoor unit maintenance, outdoor unit maintenance, electrical connection maintenance, cooling system maintenance, system diagnosis testing and maintenance inspection checklist.

7.1 Safety Instructions

Following are the safety instructions that need to be observed during the maintenance process:

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.

7.2 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.

7.3 Indoor Unit Maintenance

7.3.1 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.

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.

7.3.2 Return Air Filter

The return air filter is mounted on the back side of the indoor unit, as shown in ***Figure 7-1***. 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.

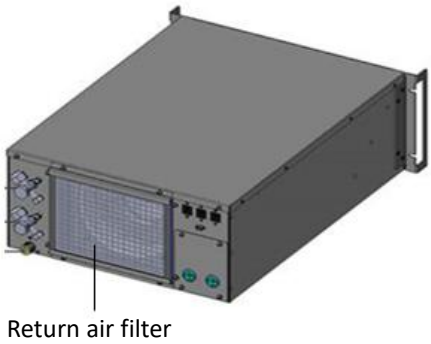


Figure 7-1 Return Air Filter

7.3.3 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.

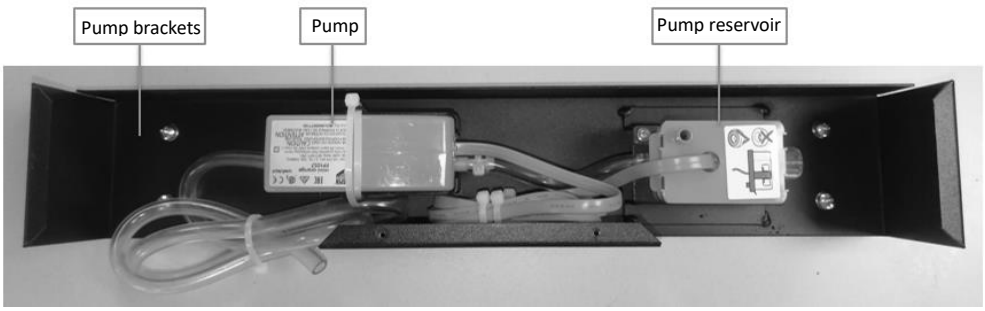


Figure7-2 Condensate Pump Kit

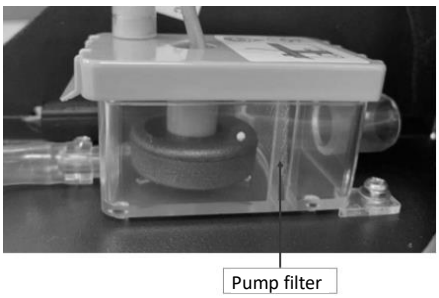


Figure 7-3 Pump Filter

7.4 Condensing Unit Maintenance

7.4.1 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.

7.4.2 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.

7.4.3 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.

7.4.4 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.**

7.5 Electrical Connection Maintenance

7.5.1 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.

7.5.2 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.

7.6 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.

7.7 Leakage Detection (F-gas)

For countries covered by the F-gas regulation, when the low ambient condensing unit (VRC352) is used, both the indoor unit (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 indoor unit for detection, as shown in ***Figure 7-4*** and ***Figure 7-5***.

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 7-4*** one by one.
2. Remove the 3 screws and cover plate in ***Figure 7-5***.
3. Insert the sniffer into the VRC202 unit to check whether the refrigerant leaks in the areas in ***Figure 7-6***. 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.

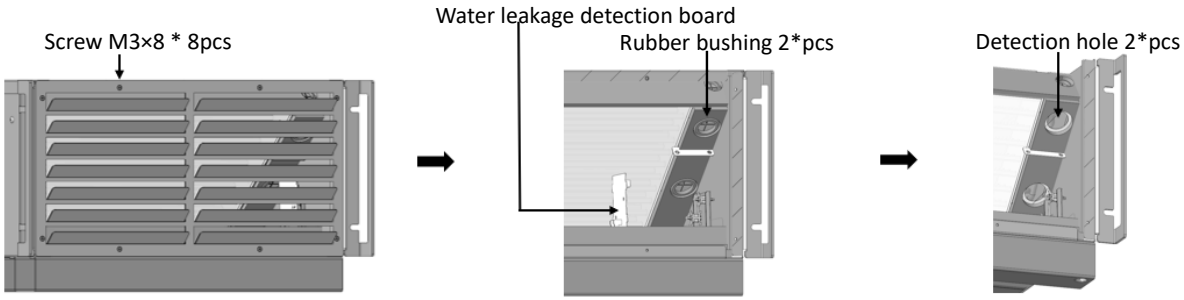


Figure 7-4 Detection Holes in VRC202 (Front)

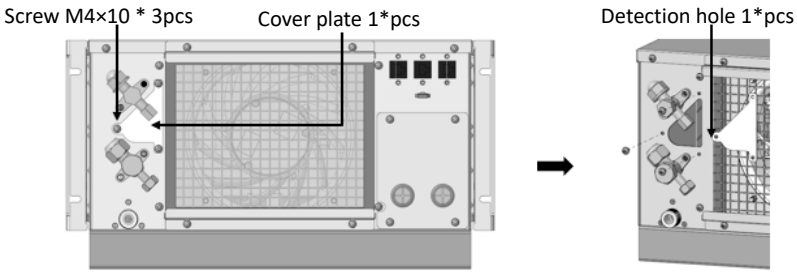


Figure 7-5 Detection Holes in VRC202 (Rear)

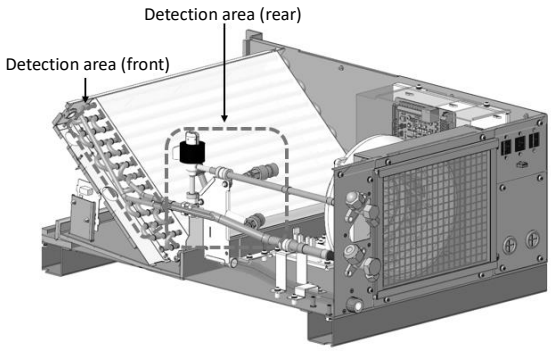


Figure 7-6 Detection Area in VRC202 (Rear)

7.8 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.

7.9 Maintenance Inspection Checklist

The maintenance checklist of the unit is provided in ***Table 7-1***.

Table 7-1 Maintenance Checklist

VRC2/3			
Date		**Prepared by**	
Model		**Serial Number**	
Type	**Maintenance Components:**	**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 stoped 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	
	Low ambient kit	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	
	Cooling system	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	

8 Troubleshooting

This chapter introduces the failure diagnosis and troubleshooting and can be used together with the alarm section in Chapter 5.

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.

8.1 Troubleshooting

Trouble Shooting for the entire unit is listed in ***Table 8-1***.

Table 8-1 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
	Insufficient condensing airflow	Remove debris from the coil and air inlet
		Check if the fan speed controller operates normally
Low pressure alarm	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 outdoor 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

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
	The drainage pan or pipe is loose or blocked	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
	The fixing parts are loose	Check the fixing nuts of compressor and fasten again
	Compressor is faulty	Call the customer service hotline of Vertiv

8.2 Fan Troubleshooting

The fan troubleshooting is listed in **Table 8-2**

Table 8-2 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

8.3 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 8-3*** describes the fault diagnosis and handling methods.

Table 8-3 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

8.4 Fault Diagnosis and Handling of the Air Conditioning System

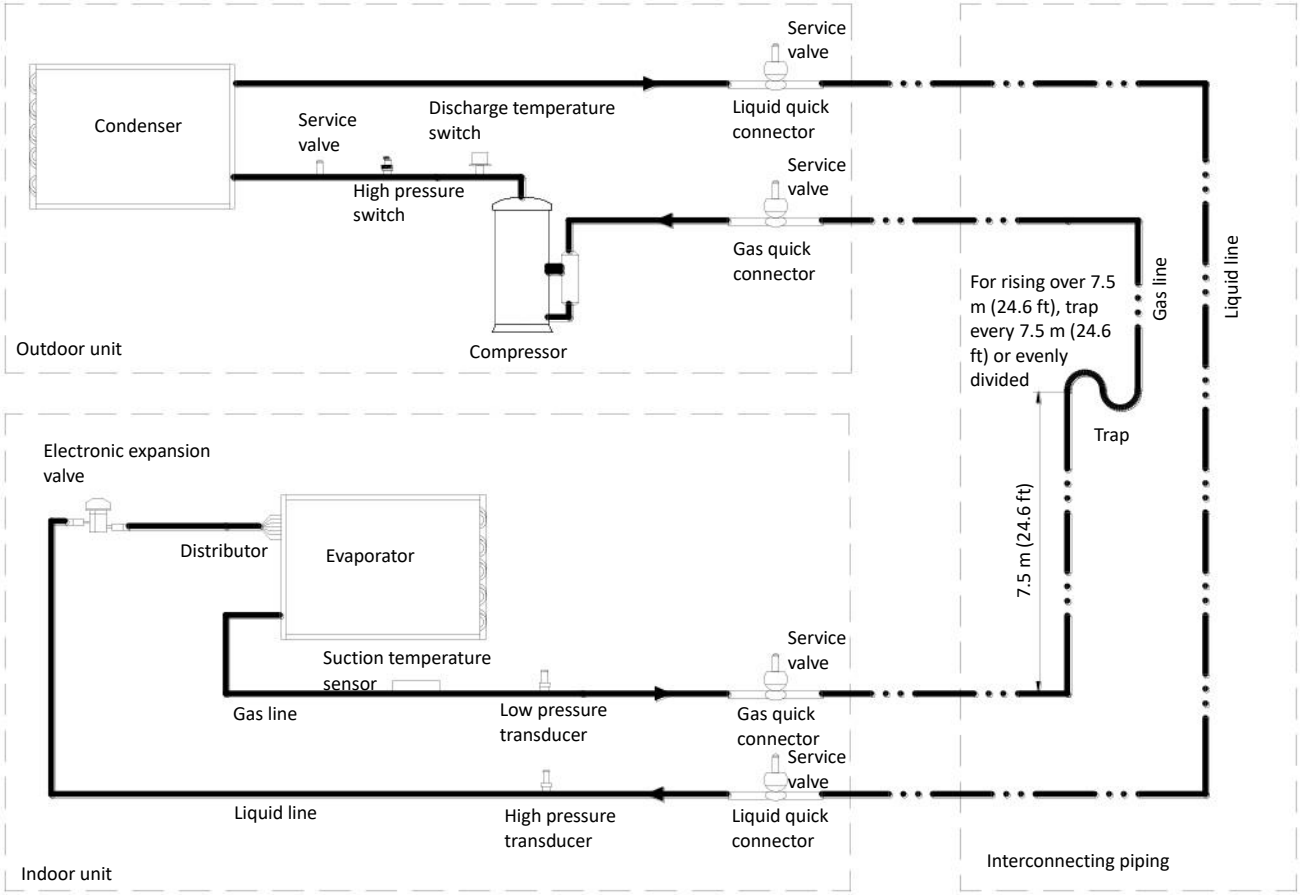
When the air conditioning system component is faulty, identify the causes and tackle the problem to

ensure normal operation of the unit. ***Table 8-4*** describes the major faults and troubleshooting methods.

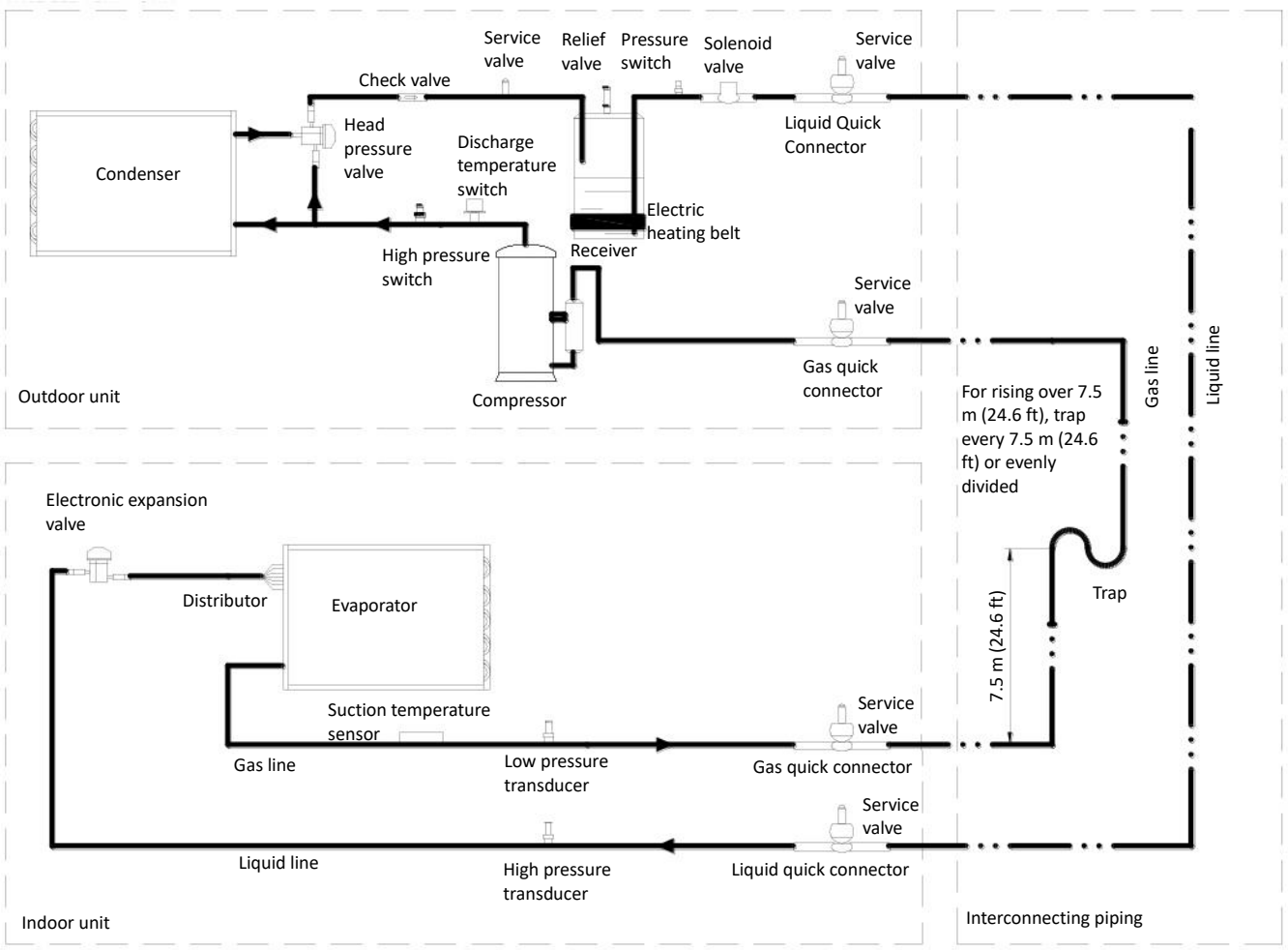
Table 8-4 Refrigeration System Faults and Troubleshooting Methods

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 8-1*** describes the diagnosis and handling methods
	The evaporator is blocked	Check the surface of the micro-channel evaporator and periodically handle the blockage problem

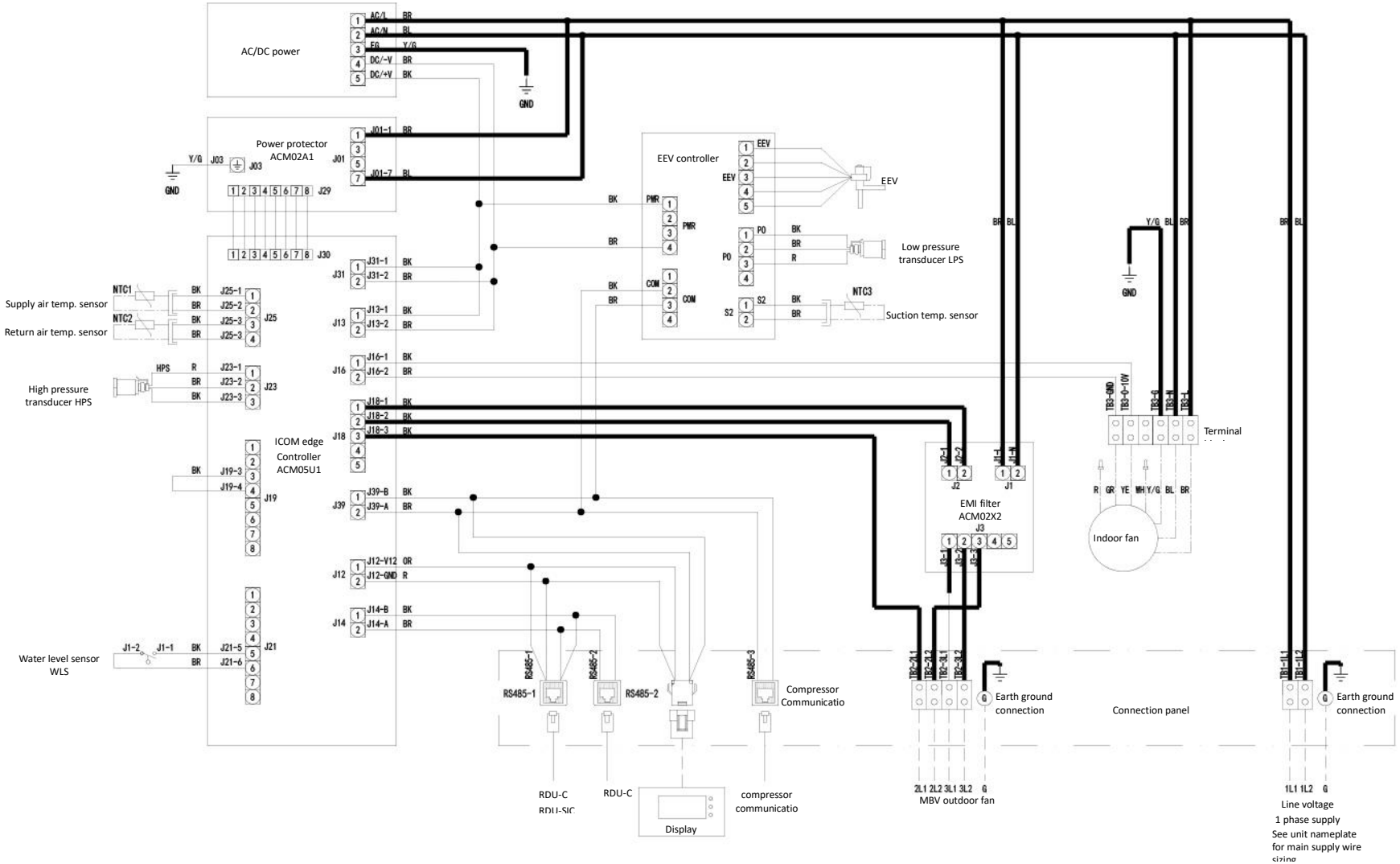
Appendix I: System Diagram (Standard Unit)



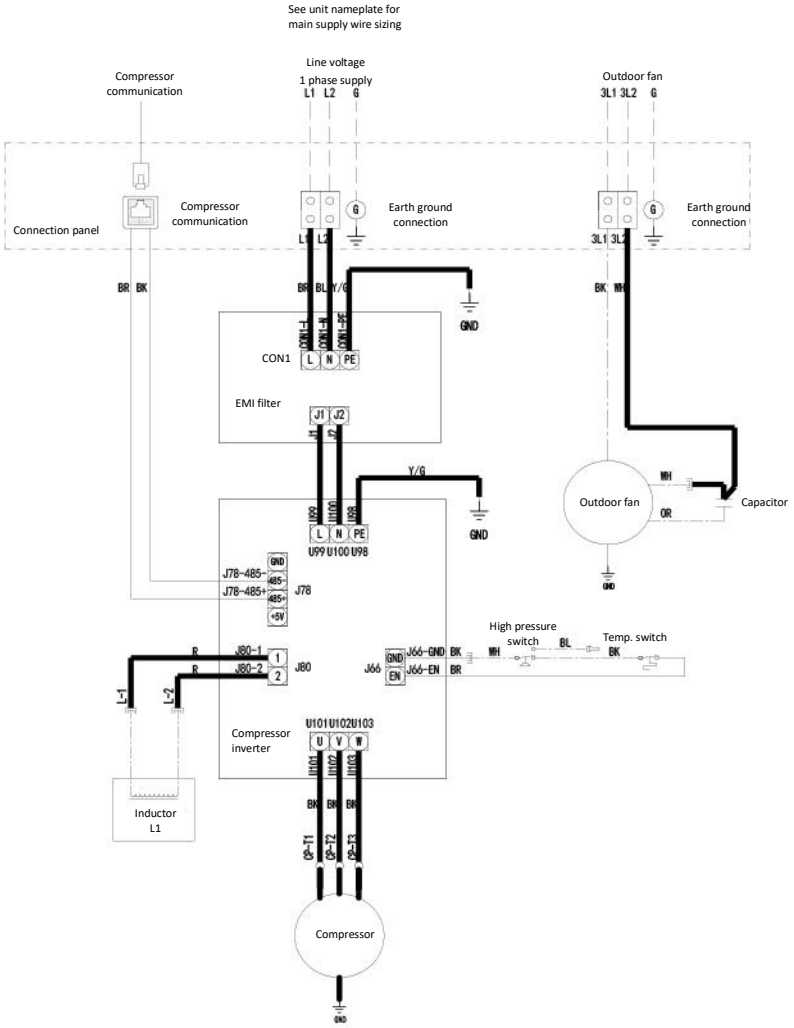
Appendix II: System Diagram (Low Ambient Unit)



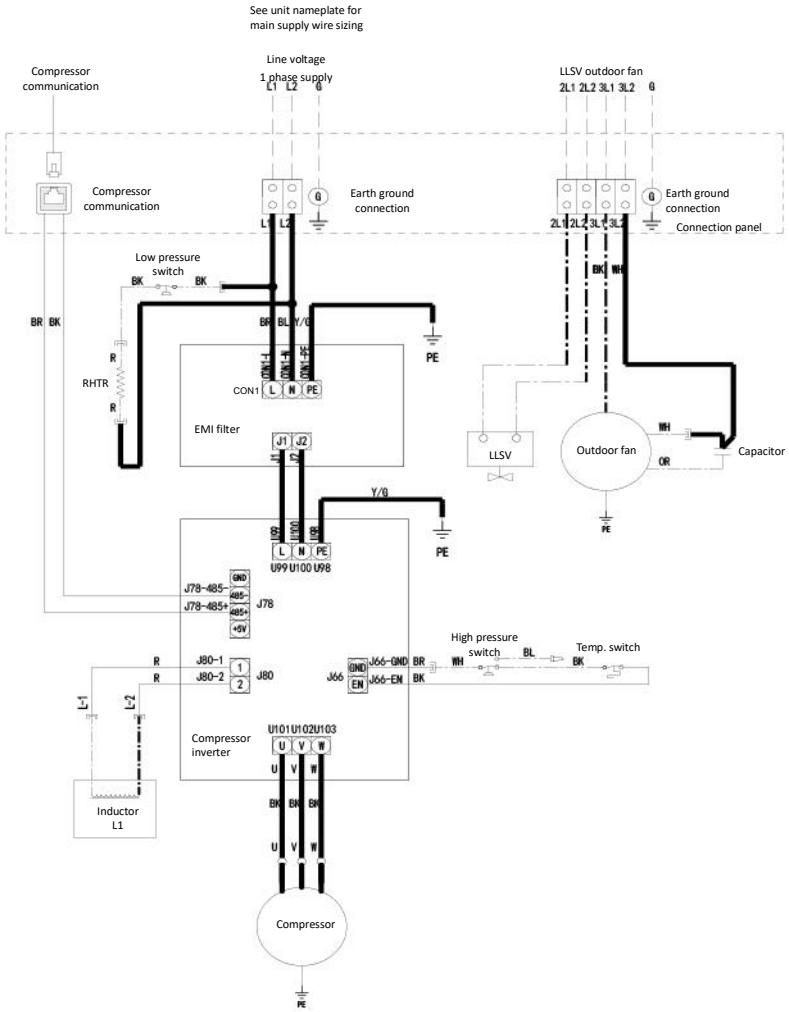
Appendix III: Wiring Diagram (VRC200/VRC201 Unit)



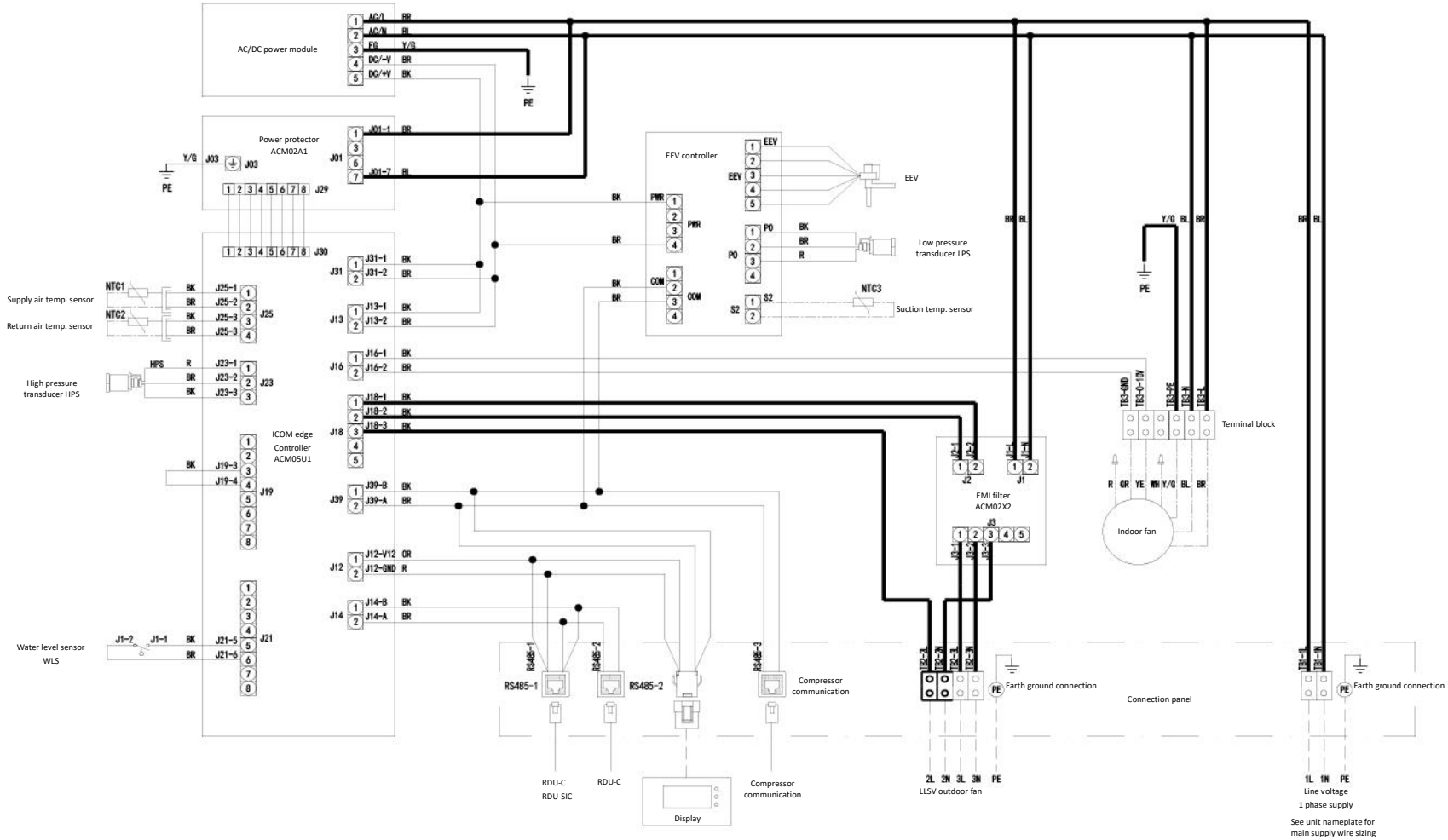
Appendix IV:Wiring Diagram (VRC300/VRC301 Unit)



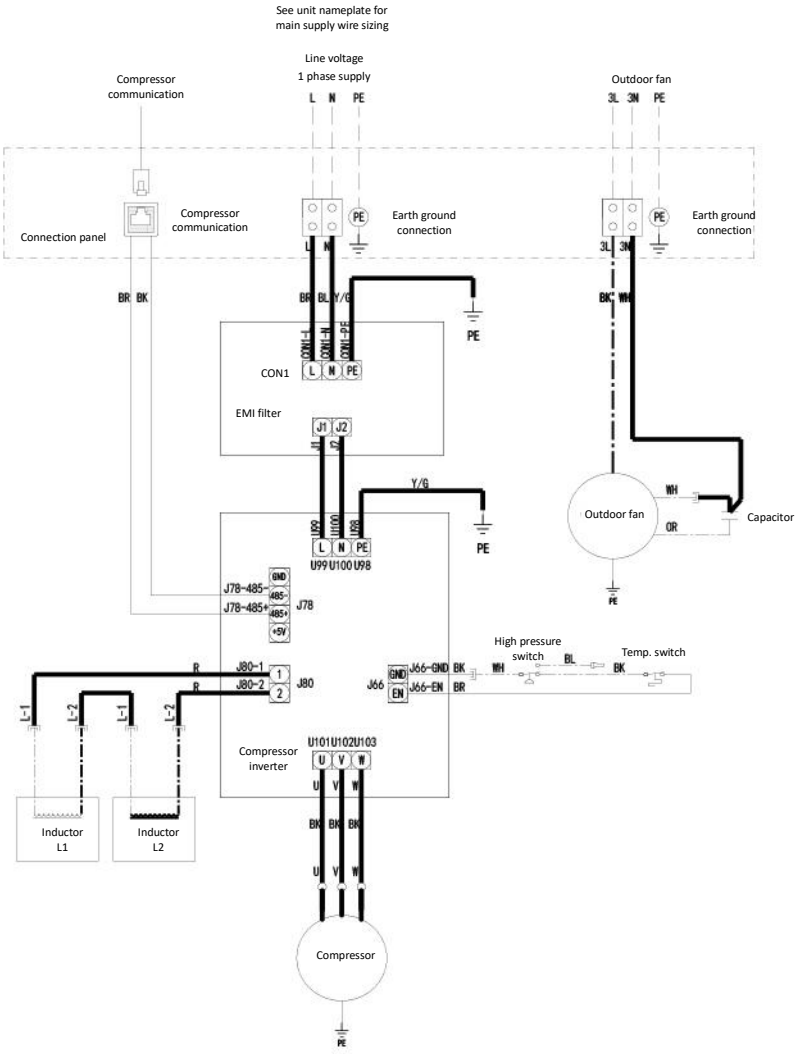
Appendix V:Wiring Diagram (VRC350/VRC351 Unit)



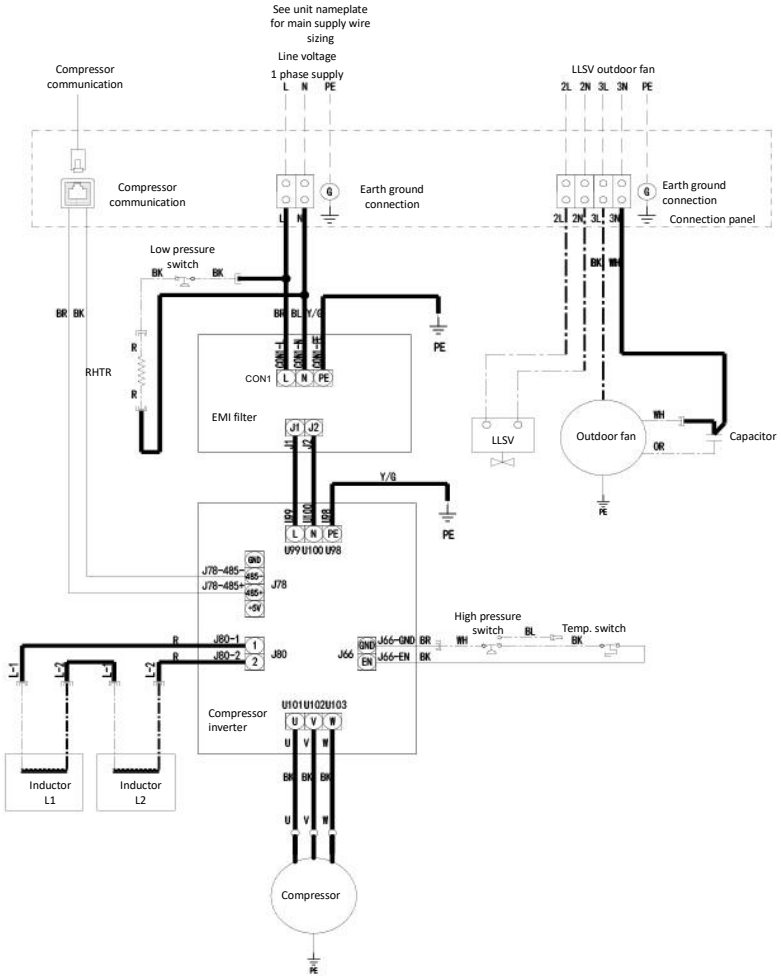
Appendix VI:Wiring Diagram (VRC202 Unit)



Appendix VII:Wiring Diagram (VRC302 Unit)



Appendix VIII:Wiring Diagram (VRC352 Unit)



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:

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.

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