



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 carefully before installing, maintaining and troubleshooting, especially the warning information in the manual.

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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 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 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 it includes the compressor, condenser coil and the 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 conditioner.
- 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.

1.2 Model Description

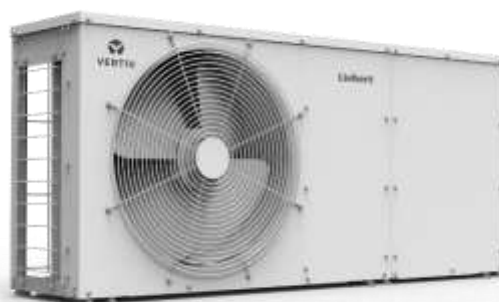
The physical appearance of air conditioner is shown in Figure 1-2.



Indoor unit



Standard condensing unit



Low ambient condensing unit

Figure 1-2 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 1-3.

VRC 2 0 0

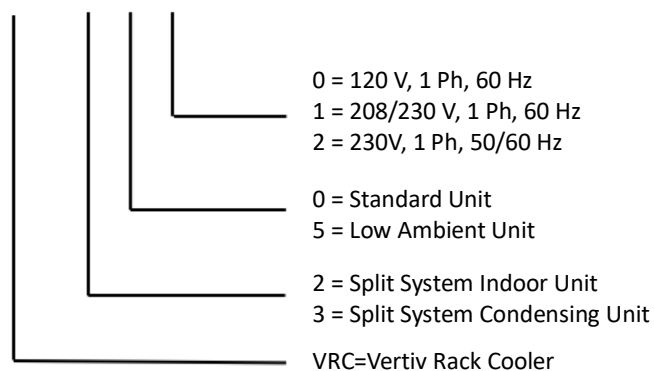


Figure 1-3 Nomenclature

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 which are placed in the Indoor and the Condensing unit as shown below.

1.4.1 Indoor Unit

The components of the indoor unit are depicted in Figure 1-4.

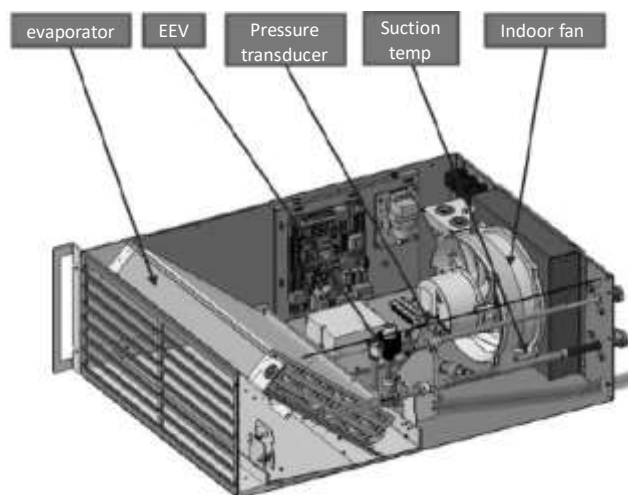


Figure 1-4 Indoor unit

- **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, it is ensured that 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 that 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.



1.4.2 Condensing Unit

The components of the condensing unit are depicted in Figure 1-5 and Figure 1-6.

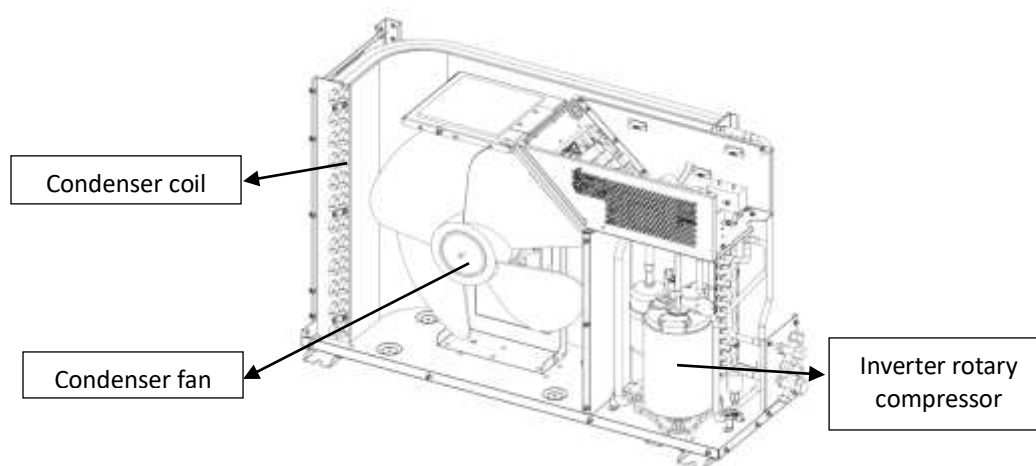


Figure 1-5 Standard condensing unit internal parts

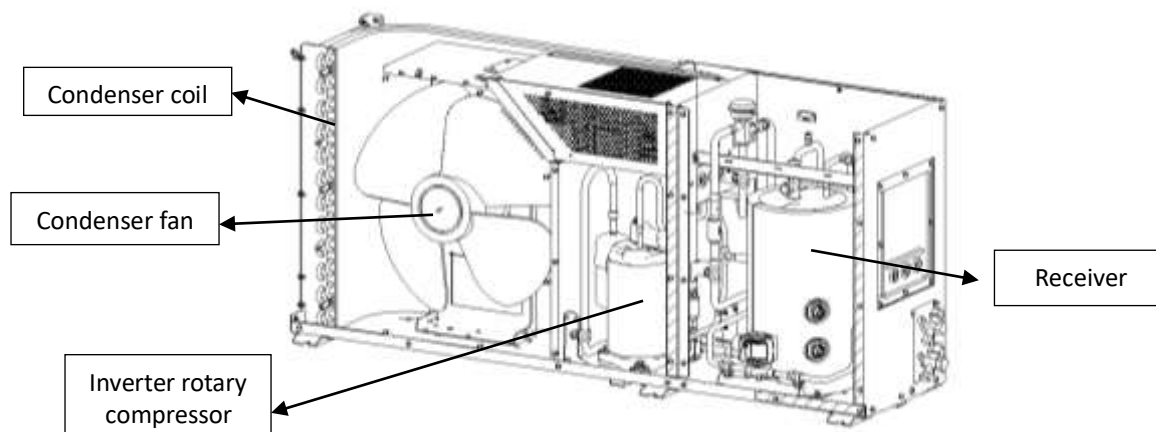


Figure 1-6 Low ambient condensing unit internal parts

- **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 mentioned 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	0.9 - 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)		
Outdoor Temperature range, °C (°F)	/			-15 (5) to 45 (113)			-34 (-29.2) to 45 (113)		

NOTES:

- There are two control methods which are supply air control and return air control. The return air control mode is applied to an open environment, while the supply control mode is applied to a closed rack.
- Supply air temperature set point varies between 12.8 °C (64.4 °F)- 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 (Supply Air Control)	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 (Return Air Control)	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 (Supply Air Control)	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 (Return Air Control)	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 (Supply Air Control)	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 (Return Air Control)	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 (Supply Air Control)	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 (Return Air Control)	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.

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

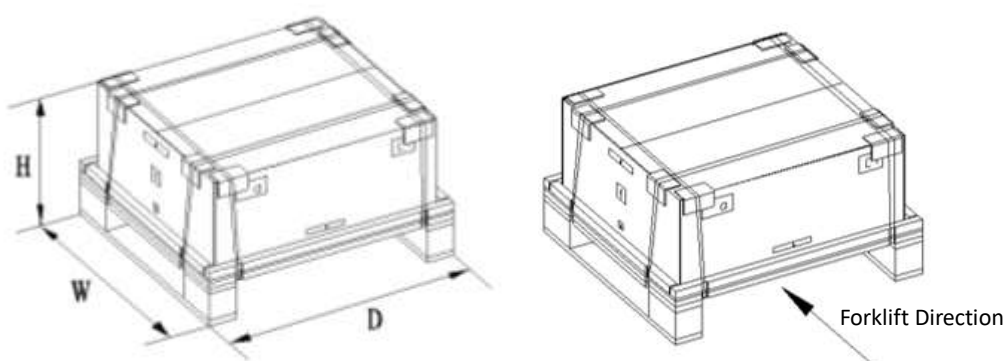


WARNING! The components of the unit are comparatively large and heavy. Therefore, there may be a risk when the containment collapses. The collapse may result in physical injury, fatality and damage to the equipment.



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 units component with the package.


Figure 2-2 Package dimensions – indoor unit

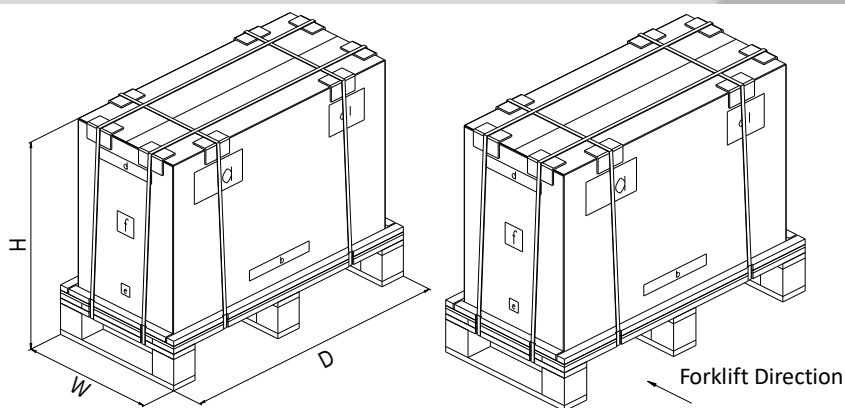


Figure 2-3 Package dimensions – condensing unit

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	Wooden pallet with cardboard box	460	760	830	51
	VRC201		(18.11)	(29.92)	(32.68)	(112)
	VRC202					
	VRC300		750	480	970	70
	VRC301		(29.53)	(18.90)	(38.19)	(154)
	VRC302					
	VRC350		755	480	1350	85
	VRC351		(29.72)	(18.90)	(53.20)	(187)
	VRC352					

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

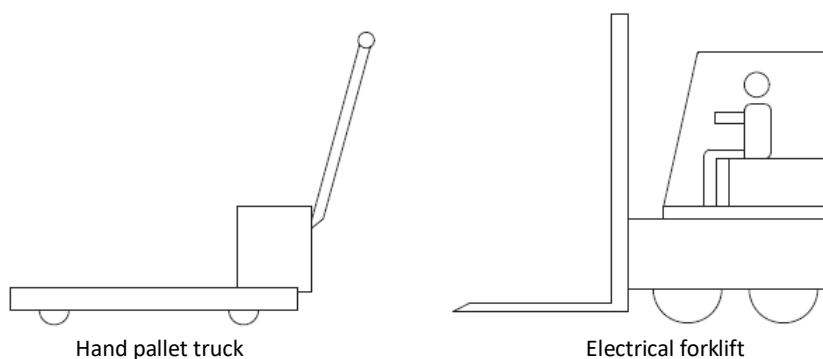


Figure 2-4 A hand pallet truck and an electric forklift

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.

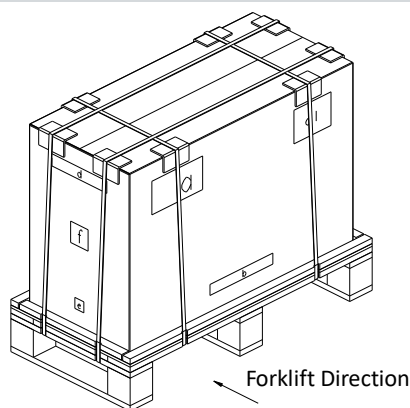


Figure 2-5 Forklift direction

While moving the package, the obliquity must be maintained at an angle of $90^\circ \pm 10^\circ$. Figure 2-6 depicts the $90^\circ \pm 10^\circ$ obliquity is suitable to move the rack to the vicinity of the desired location.

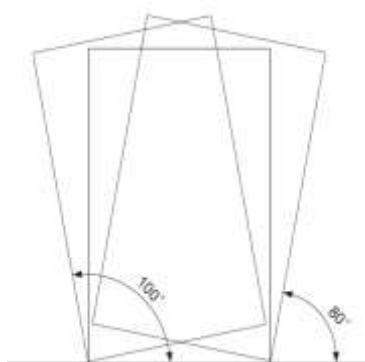


Figure 2-6 Carrying obliquity

NOTES:

- 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.

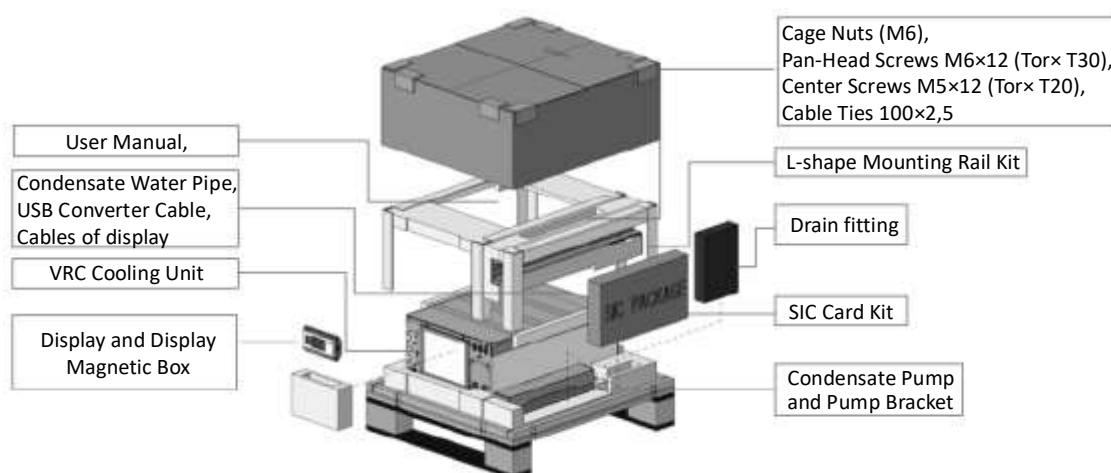


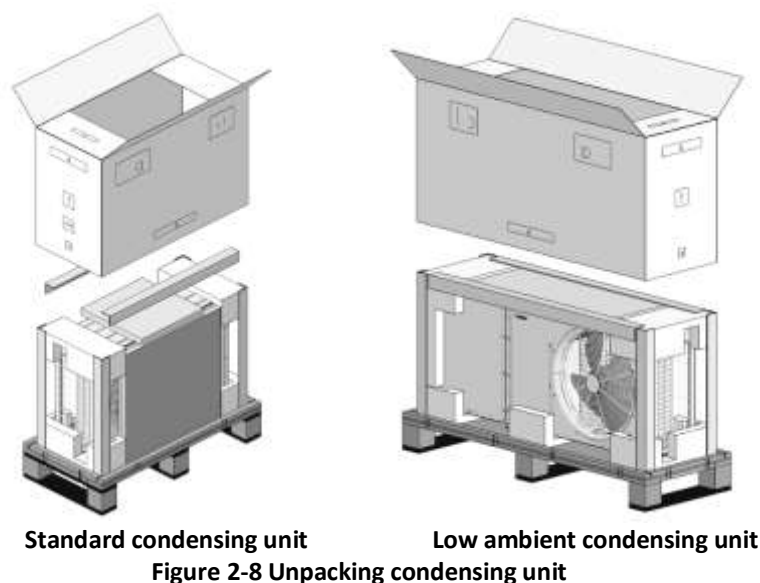
Figure 2-7 Unpacking indoor unit

Table 2-4 VRC2 series accessories

Sr 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.



NOTES:

- **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
2	Front Panel	1	VRC301
3	Screws (M4x10)	10	VRC302

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.

NOTES:

- **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 uncondusive 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]: $-5 \text{ m } (-16.40 \text{ ft.}) \leq \Delta H \leq 15 \text{ m } (49.21 \text{ ft.})$
Ambient temperature	Indoor: $18^{\circ}\text{C} - 40^{\circ}\text{C}$ ($64.4^{\circ}\text{F} - 104^{\circ}\text{F}$) Standard condensing: $-15^{\circ}\text{C} - 45^{\circ}\text{C}$ ($5^{\circ}\text{F} - 113^{\circ}\text{F}$) Low ambient condensing unit: $-34^{\circ}\text{C} - 45^{\circ}\text{C}$ ($-29.2^{\circ}\text{F} - 113^{\circ}\text{F}$)
Ambient humidity	$<90\% \text{ RH } 30^{\circ}\text{C}$ (86°F) (Non-condensing)
Protection level	Condensing unit: IPX4 (IEC 60529)
Altitude	$< 1000 \text{ m } (3280.84 \text{ ft.})$. 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	$< 95\% \text{ RH } 40^{\circ}\text{C}$ (104°F) (Non-condensing)
Ambient temperature	$-40^{\circ}\text{C} - 70^{\circ}\text{C}$ ($-40^{\circ}\text{F} - 158^{\circ}\text{F}$)
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.

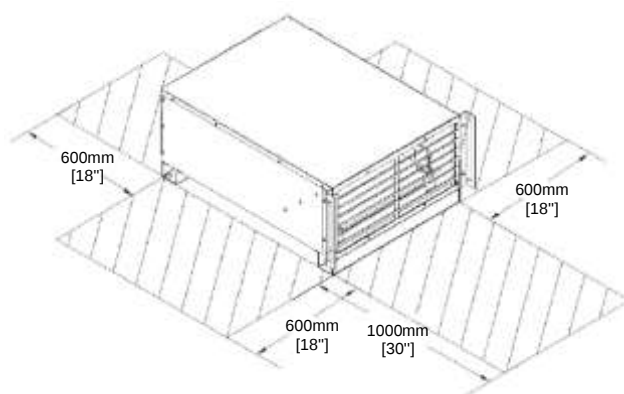


Figure 2-9 The minimum distance for pull-out during maintenance (top view)

2.8.2 Condensing Unit

The required distance for installing condensing unit is shown in the following picture. For standard unit, the recommended distance from the wall should be 200 mm (7.87 in.). For low ambient condensing unit, 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 2-10 and Figure 2-11 to ensure appropriate airflow across the condensing unit.

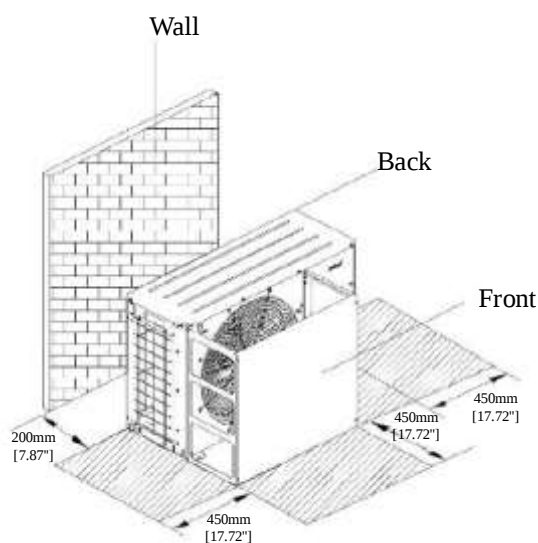


Figure 2-10 Recommended clearance space required for standard condensing unit

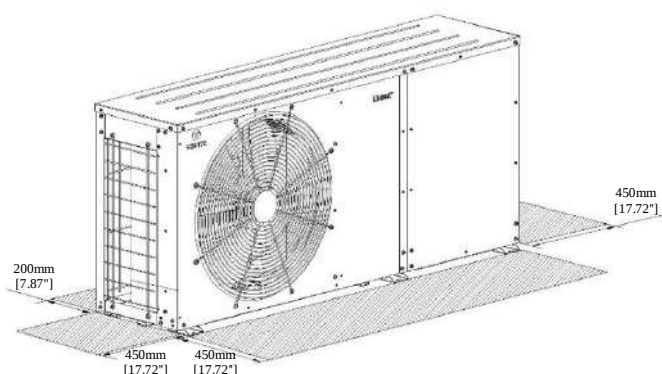


Figure 2-11 Recommended clearance space required for low ambient condensing unit

2.9 Weight Bearing Capacity

The cooling unit will be installed inside the rack due to 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 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 about the same. 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

NOTES:

- 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.
- It needs 2 persons during 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 of both the indoor unit and the condensing unit is depicted in Figure 3-2, Figure 3-3 and Figure 3-4.

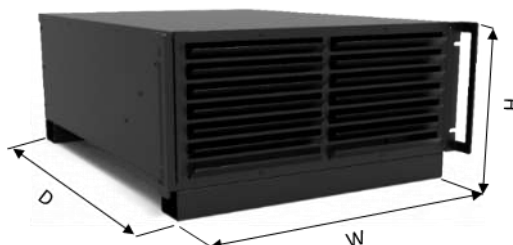


Figure 3-2 Indoor unit

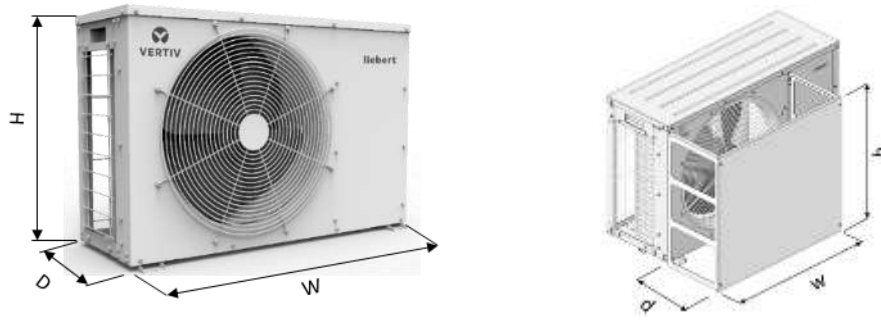


Figure 3-3 Standard condensing unit



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	264	442	602
	VRC201	(10.39)	(17.40)	(23.70)
	VRC202			
Condensing Unit	VRC300	527	786	282
	VRC301	(20.75)	(30.94)	(11.10)
	VRC302			
	VRC350	527	1158	282
	VRC351	(20.75)	(45.60)	(11.10)
	VRC352			

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 The dimension of the air deflector

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

3.3 Installing the Unit

3.3.1 Installing the indoor unit inside the rack

A front view intricate detailed image depicting the dimensions which would help enable to mount the unit inside the rack are shown in Figure 3-5 and Figure 3-6.

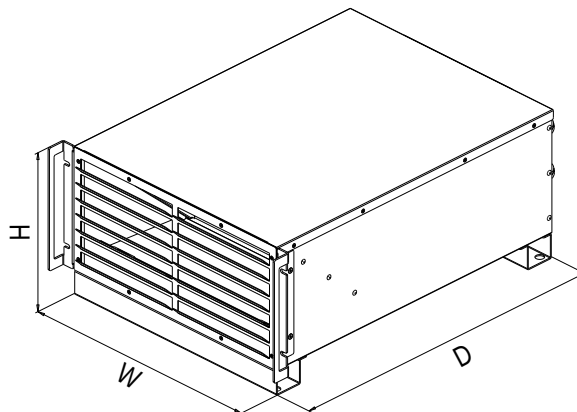


Figure 3-5 Indoor unit dimensions

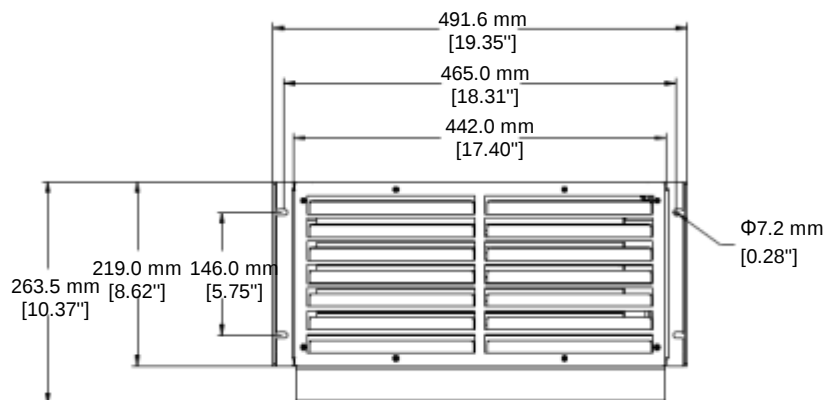


Figure 3-6 The front view of indoor unit

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 are 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.).

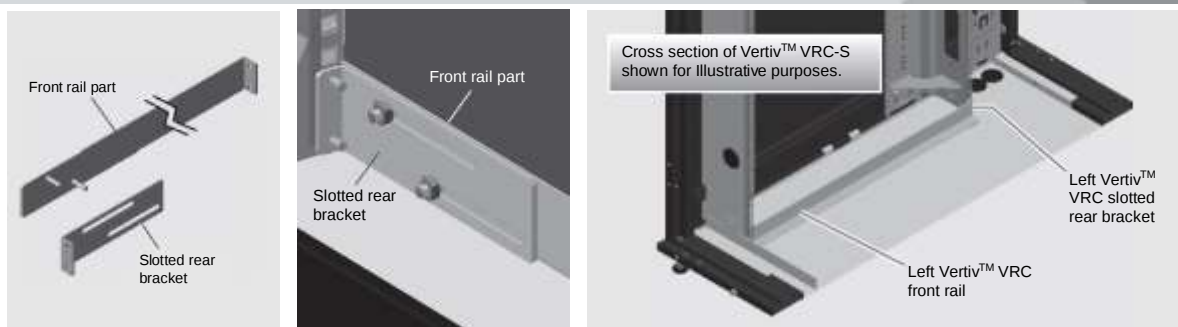


Figure 3-7 L-shape rails installation

2. Inserting the indoor unit into the rack

Insert the indoor unit into the front of the rack until the 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.

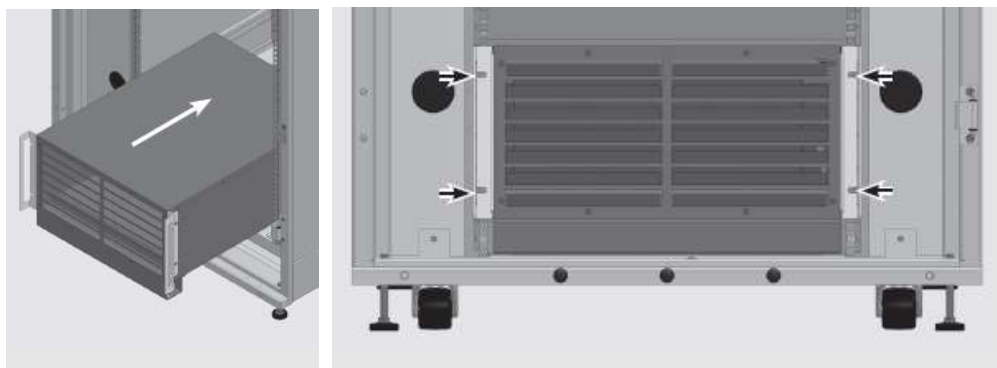


Figure 3-8 Indoor unit installation

NOTES:

- 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.

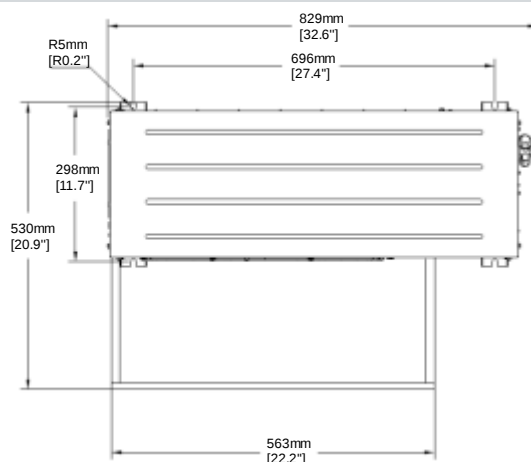


Figure 3-9 Standard condensing unit top view

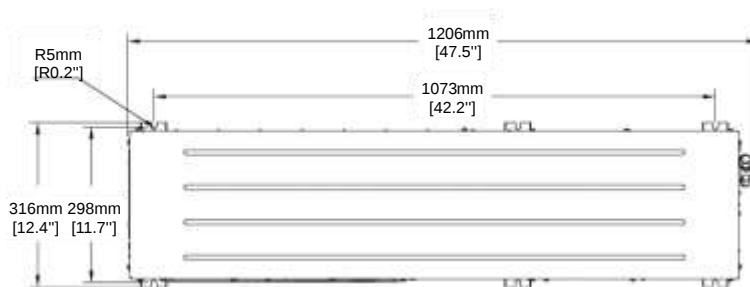


Figure 3-10 Low ambient condensing unit top view

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 the vertical riser and return to the compressor immediately.

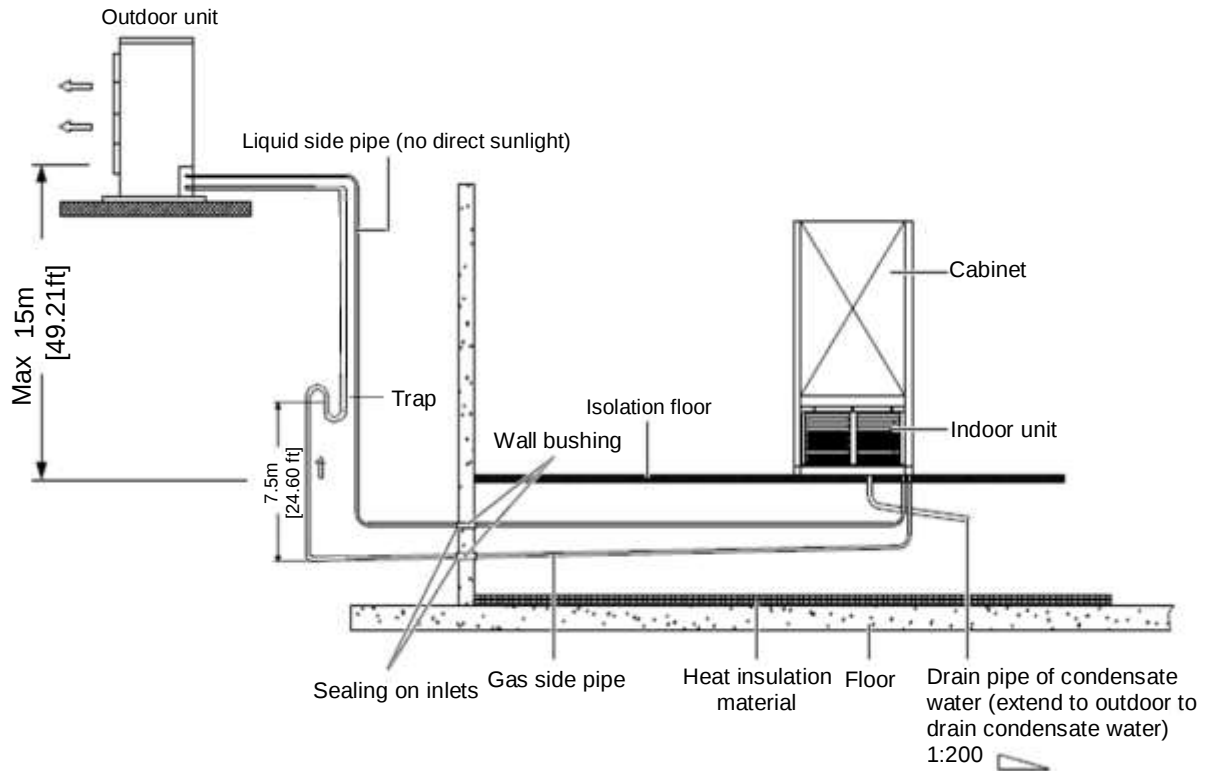


Figure 3-11 The Condensing unit is installed higher than the indoor unit

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

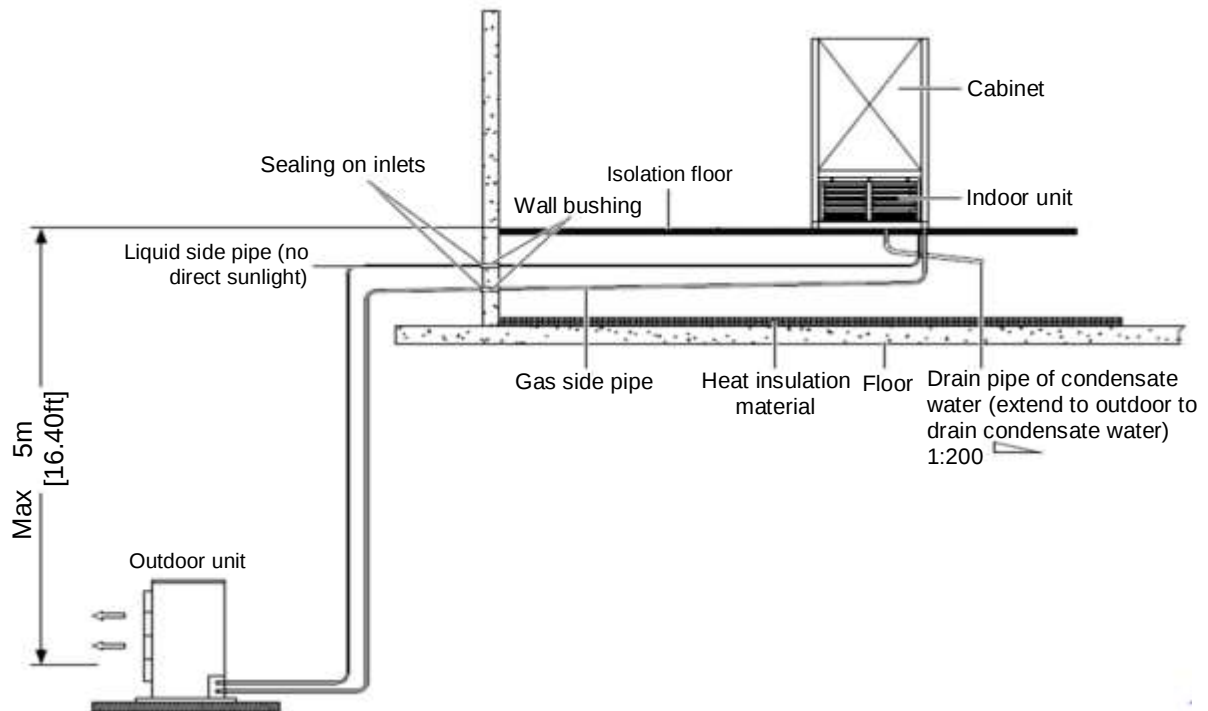


Figure 3-12 The Condensing unit is installed lower than the indoor unit

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. The method to implement placement of the condensing units on top of the other is shown in Figure 3-13.

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

NOTES:

- The condensing unit must be placed appropriately in a safe place for maintenance. It also should not be installed on the bottom floor of the public site. It should not be 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 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 exhaust gas near the condensing unit.
- Preferably, keep above 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 condensing is around 44 kg (97 lbs.); therefore, utmost care must be taken while removing it; any mishandling will result in severe injury and damage to the equipment.

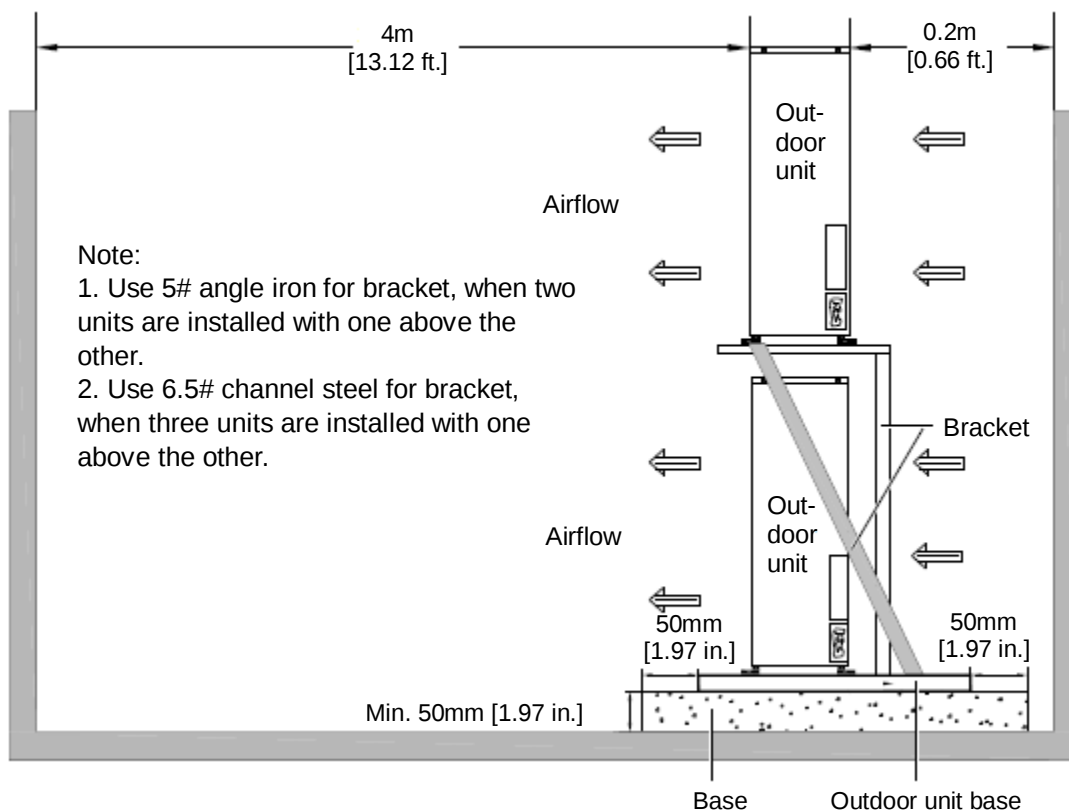


Figure 3-13 Installing multiple condensing units one above the other

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.

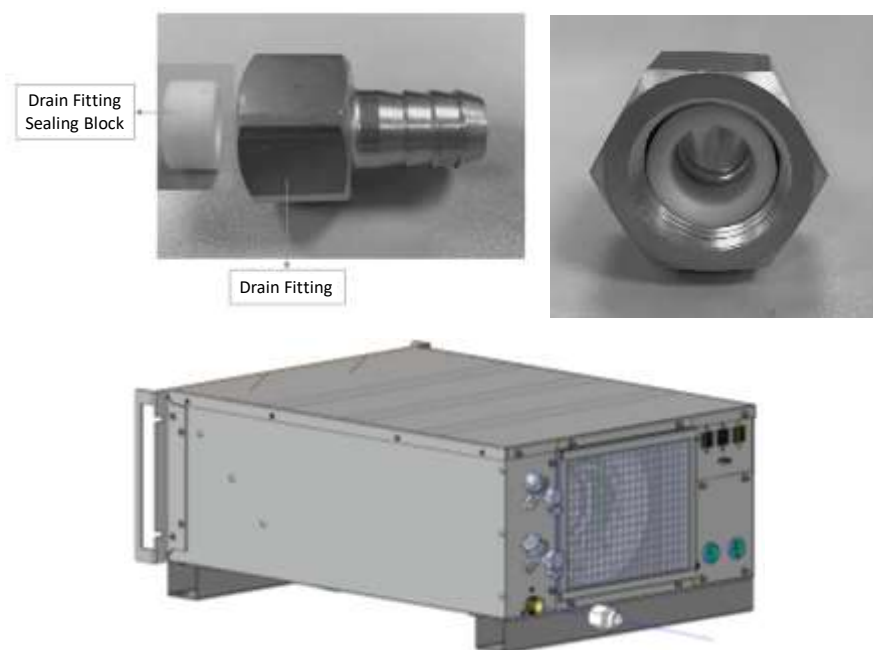


Figure 3-14 Installing the drain fitting

3.3.4 Installing the condensate pump

NOTES:

- 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.

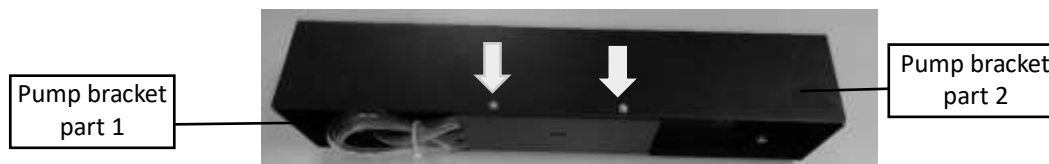


Figure 3-15 Appearance of pump bracket



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.

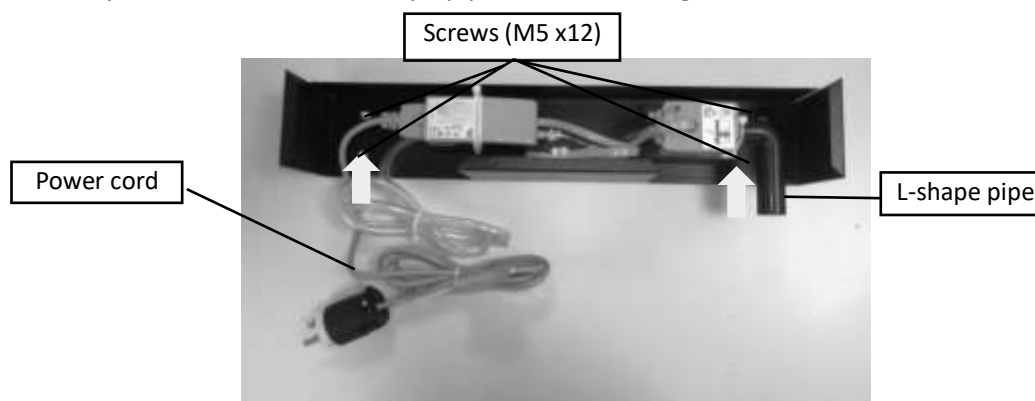


Figure 3-17 Internal structure of water pump bracket

3. Loosen the four screws in Figure 3-17 about 4 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. Fix the pump bracket part 1 with tightening the 4 screws in Figure 3-17.

7. Install pump bracket part 2 to pump bracket part 1 with tightening the 2 screws in Figure 3-19.

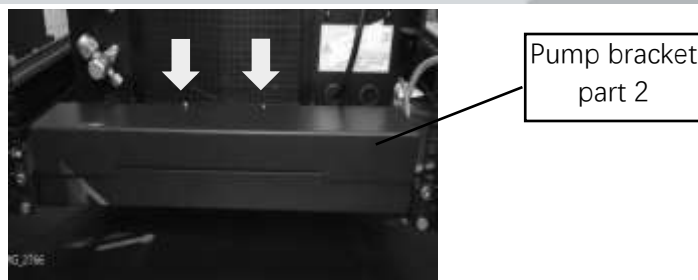


Figure 3-19 Installation of the pump bracket part 2

There are an 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, before connecting the copper pipes, it is needed to install the air deflector first as shown in Figure 3-21.

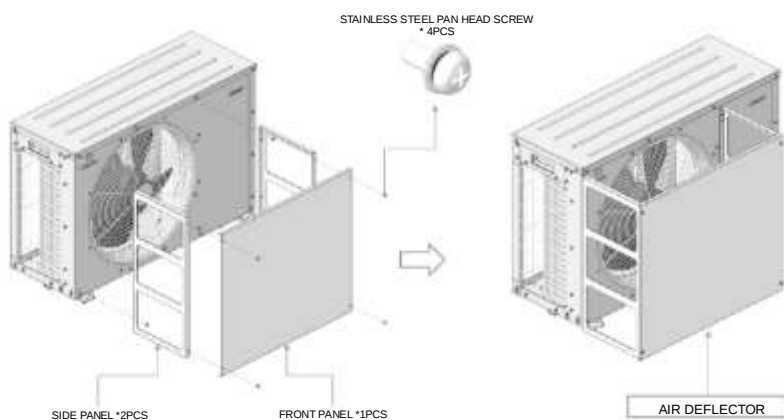


Figure 3-21 Air deflector installation for standard condensing unit

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, in that case, piping joints must be brazed.
- Follow standard industry practices in selection and placement of pipes, system evacuation charging with refrigerant (only when the pipeline is long). The standard refrigerant of the unit is R410A. The charging amount for low ambient condensing unit is 4.0kg (8.82 lbs), while other units is 1.3 kg (2.87 lbs).

- Take the pipeline pressure drop and the oil return to the compressor into consideration to avoid oil leakage and clogging in parts of the system. Utmost care while considering these factors minimizes the noise and vibration significantly.
- If an extended piping kit is required or if the equivalent length exceeds 20 m (65.62 ft.), it's necessary to add a check valve at the liquid pipe outlet of the condensing unit. Also, consult your local Vertiv Sales Office, if the vertical distance between the indoor unit and condensing unit exceeds 15 m (49.21 ft.).

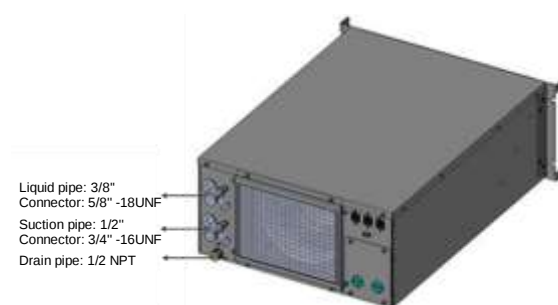


Figure 3-22 Connectors of indoor unit

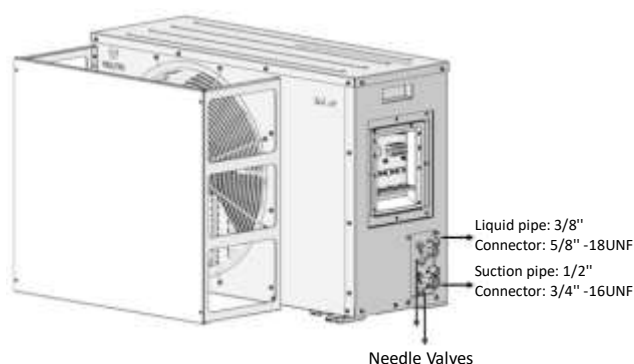


Figure 3-23 Connectors of standard condensing unit

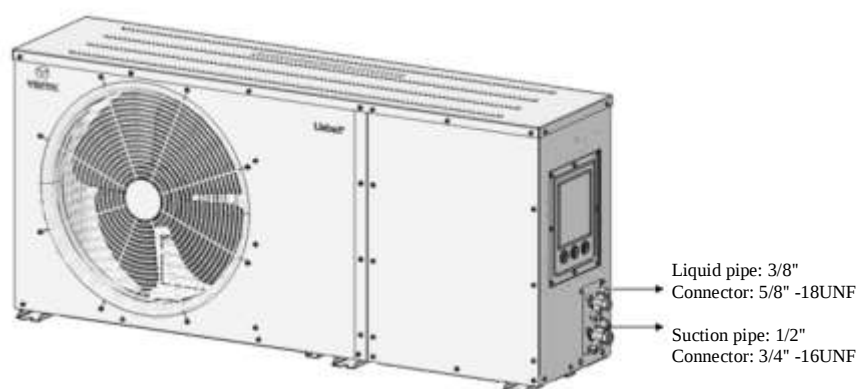


Figure 3-24 Connectors of low ambient condensing unit

- 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.

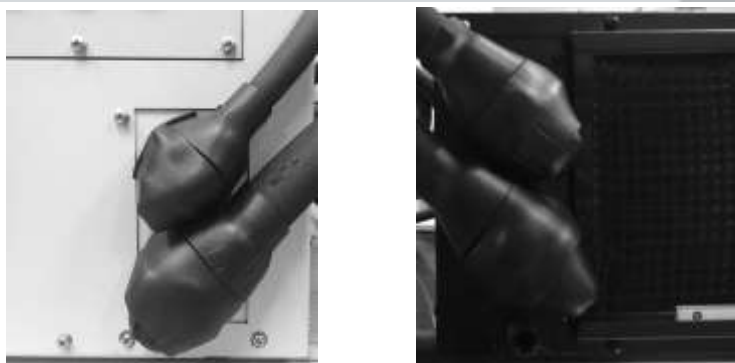


Figure 3-25 Keep copper piping and quick thread connector insulation

Installation Notes of the connector

Both top as well as the bottom piping method 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 depicts how much the coupling has been tightened. The final quarter turn is essential to ensure that the joint doesn't leak.

NOTES:

- **The maximal equivalent length of piping between the indoor unit and condensing unit is 30 m (98.43 ft.).**

The Table 3-6 prescribes 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.

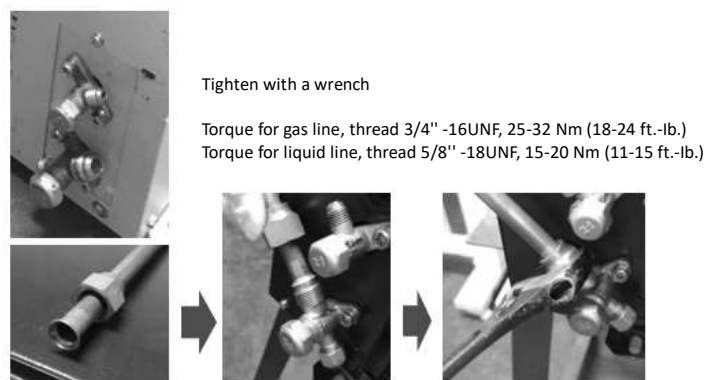


Figure 3-26 Tightening the connectors of the condensing unit

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, leakage testing, dehydration of refrigerant pipes evacuation 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 the vertical riser 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 extended liquid pipe (m. (ft.))

Table 3-8 shows the refrigerant and refrigerant oil amount to be added per meter of the liquid pipe. Total length of the extended liquid pipe (m (.)) = Total length of the liquid pipe (m (ft.)) – 10.0 m (ft. (32.8))

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)

NOTES:

- **Risk of oil contamination with water.** Can cause equipment damage. VRC systems require the use of PVE (FV50S) oil. PVE oil absorbs water at a much faster rate when exposed to air than previously used oils. Because water is the enemy of a reliable refrigeration system, extreme care must be used when opening systems during installation or service. If water 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, it may require an oil change. PVE oils also have a property that makes them act as a solvent in a refrigeration system. Maintaining system cleanliness is extremely important because the oil will tend to bring any foreign matter back to the compressor.
- **Risk of improper refrigerant charging.** Can cause equipment damage. Refrigerant charge must be weighed into air-cooled compressorized systems before they are started.

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. The suction and liquid pipe should be filled with 27 bar nitrogen at the needle valves on suction and liquid pipe connectors for at least 3 hours to check for any leakage in the piping and connections. If there is no leakage observed, vacuum the liquid and suction lines at the needle valves. 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, then the suction and liquid pipe should be filled with 27 bar nitrogen at the needle valves on suction and liquid pipe connectors for at least 3 hours to check for any leakage in the piping and connections. If there is no leakage observed, vacuum the unit at the needle valves. Add refrigerant to air conditioner after evacuation.

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

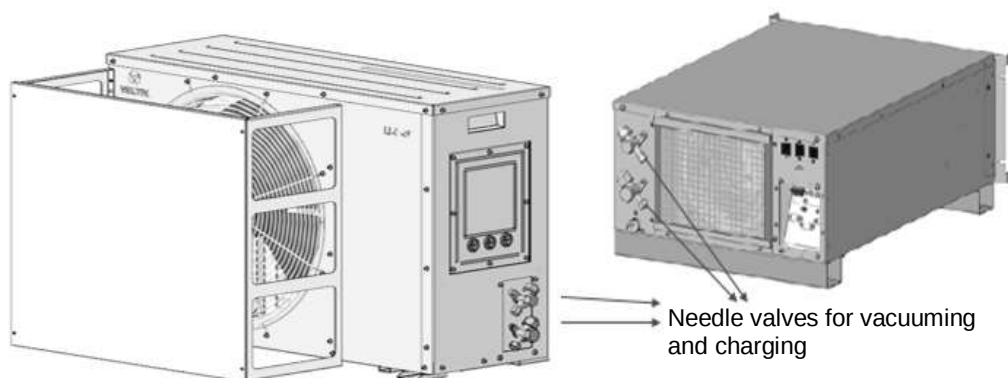


Figure 3-27 Charging the refrigerant gas

For low ambient condensing unit, position of needle valves for vacuuming and charging the refrigerant is shown Figure 3-30. 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. When vacuuming or charging the refrigerant, it should be carried out simultaneously from the three points. Especially when vacuuming, it must be vacuumed at point 3, otherwise the vacuum will fail.

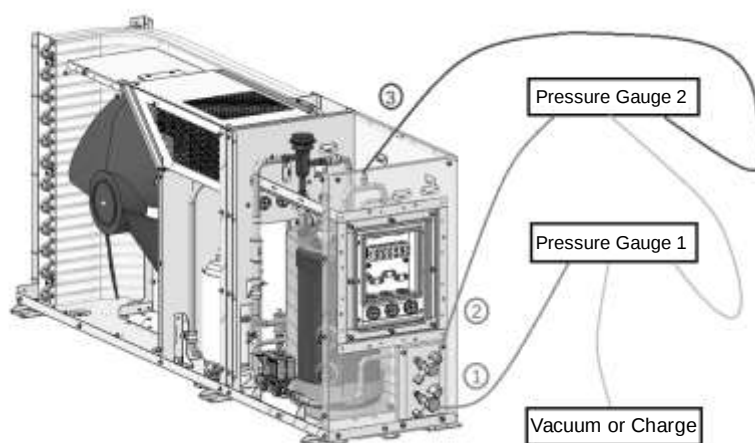


Figure 3-28 Vacuuming and charging for low ambient condensing unit

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 with the all the necessary mechanical connections done, 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	
Ensure all the fittings are connected firmly.	
The placement direction of the indoor unit is correct, pay attention to that the supply air is sent to the cold aisle at the front, 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 so on)	
The condensate pump and pipes are connected properly	
All pipe joints are firmly fixed	
All pipe connectors and fasteners are tightly fastened.	

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

4 Electrical Installation

This chapter describes the electrical installation of unit, including installation noted, 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 done through the cover panel at the back-side of the unit as shown in Figure 4-1.

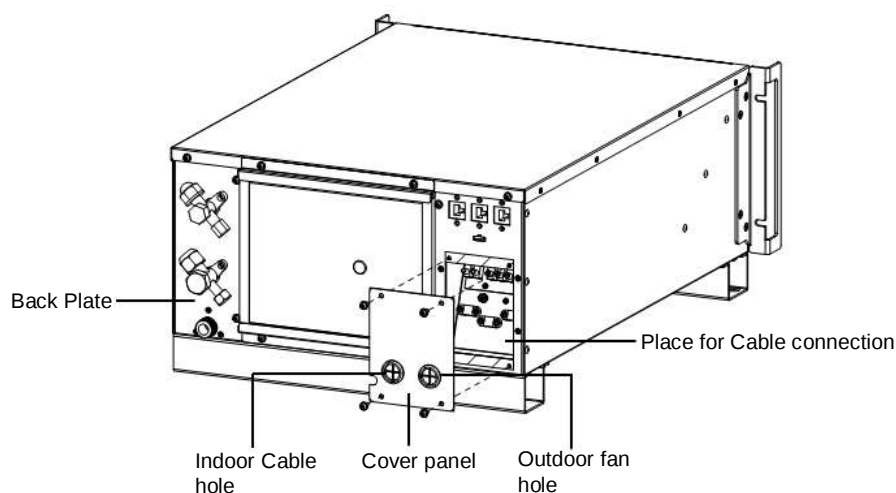


Figure 4-1 Cover panel for cabling connections

The power cables can be selected based on the amperage ratings for each component that is mentioned 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.

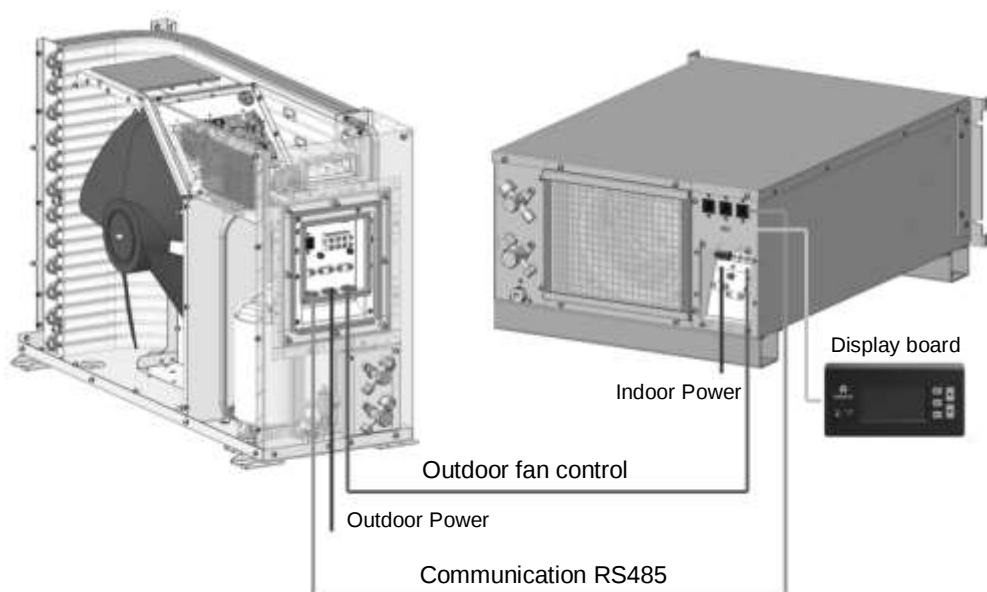


Figure 4-2 Overview of the cabling connections (Standard condensing unit)

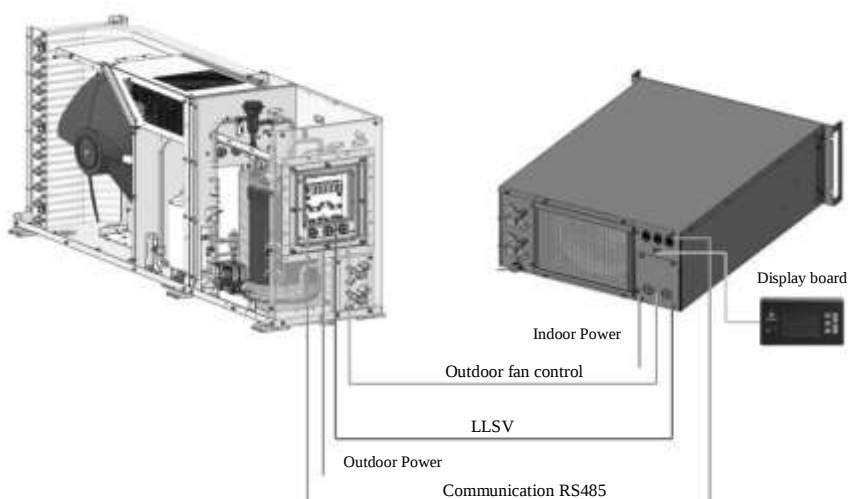


Figure 4-3 Overview of the cabling connections (Low ambient condensing)

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

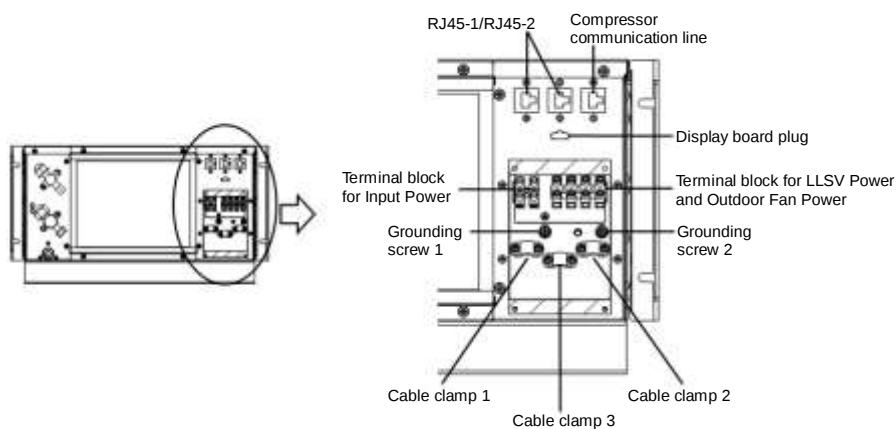


Figure 4-4 Input Cabling connections – Indoor Power terminal

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

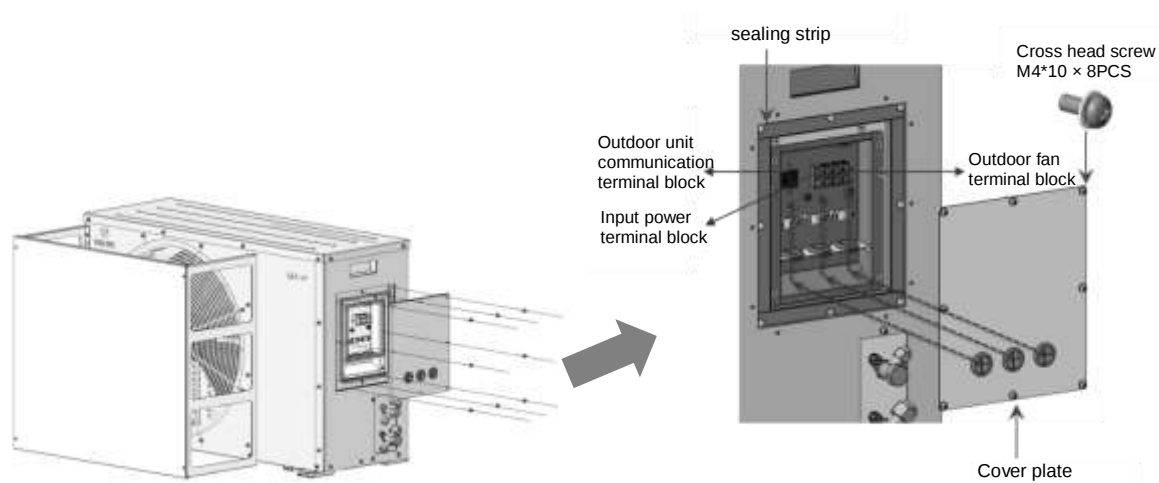


Figure 4-5 Input Cabling connections – Condensing Power terminal

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

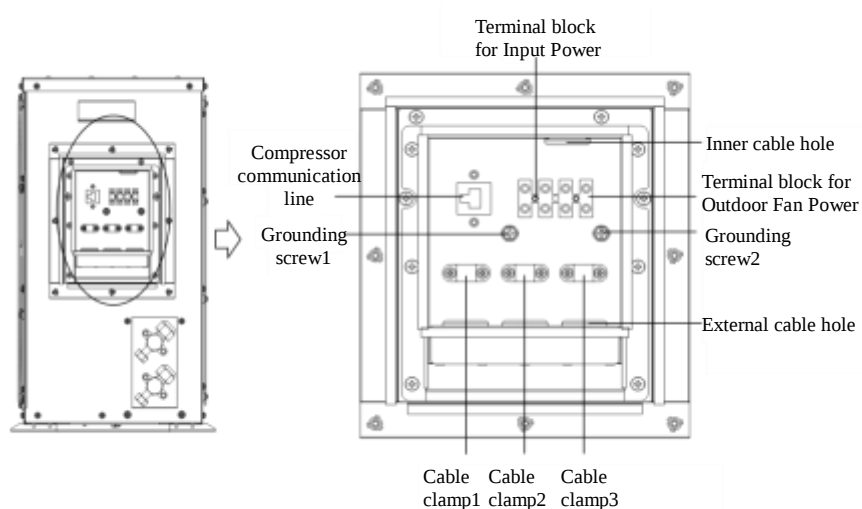


Figure 4-6 Standard condensing unit electric connection illustration

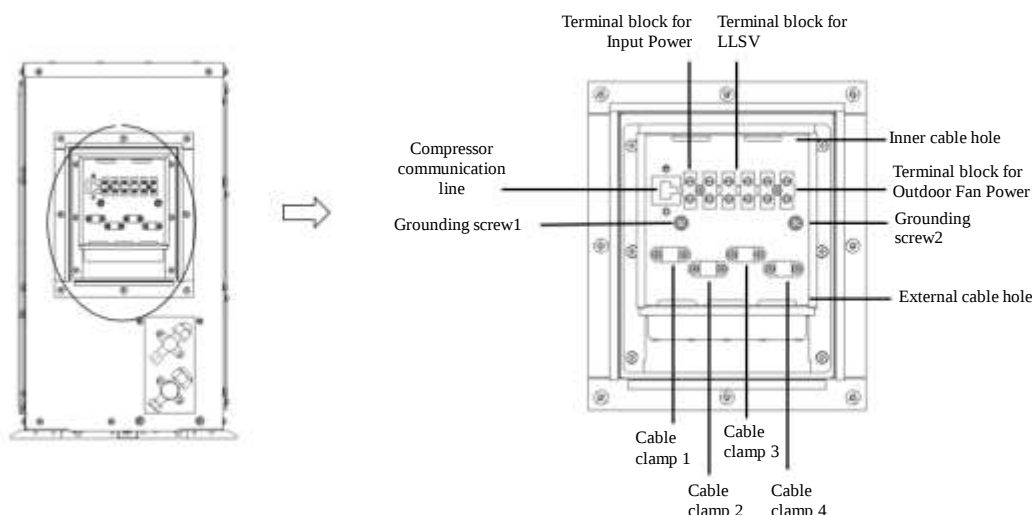


Figure 4-7 Low ambient condensing unit electric connection illustration

4.3 Communication Cable Connecting

4.3.1 Display cable connection

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

4.3.2 Communication connection

The RJ-45 port (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 RS485-1 and RS485-2 ports 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 SIC card monitoring kit. The aforementioned connections are shown in Figure 4-8 and Table 4-2. Please refer to **RDU-SIC G2 Card Field Installation** for details.

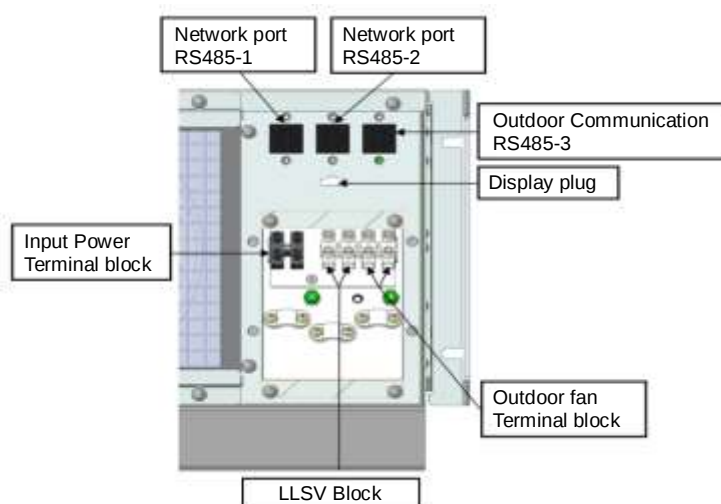


Figure 4-8 Display, power and monitoring cable connections in the indoor unit

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 the electrical installation is completed, it should be confirmed according to Table 4-3 below.

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.

NOTES:

- **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.

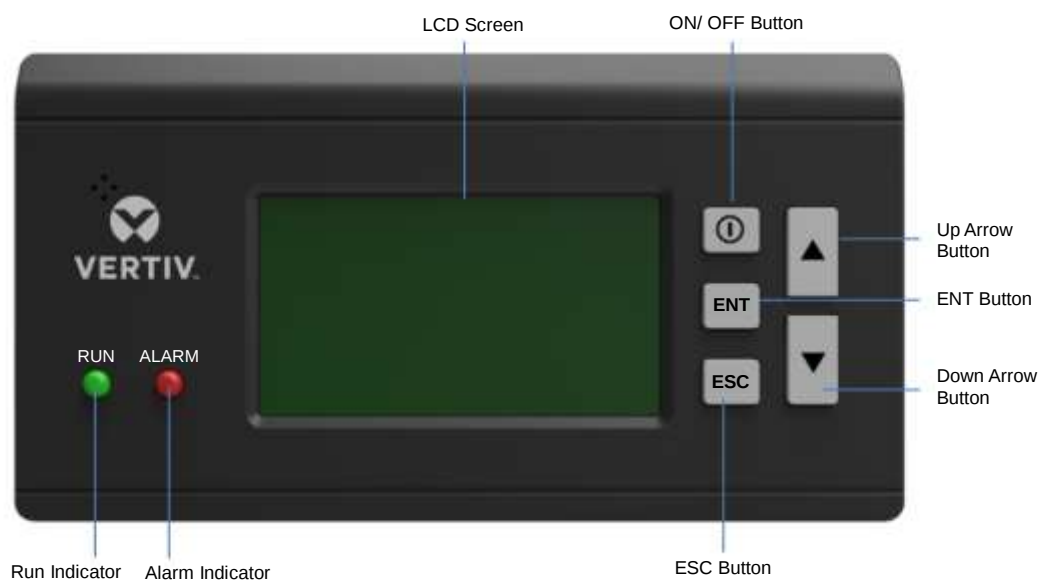


Figure 5-1 Controller Display

5.2 Control Buttons

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

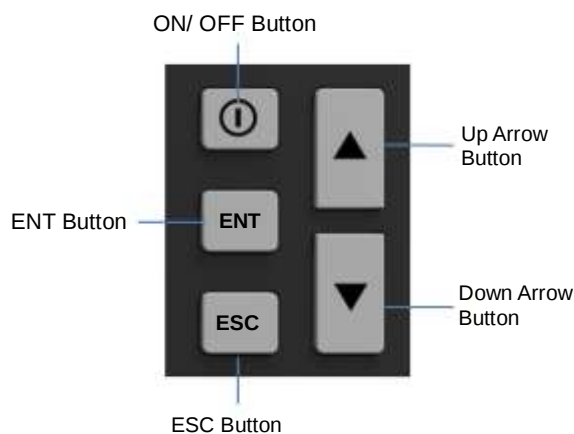


Figure 5-2 Control Buttons

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 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 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.

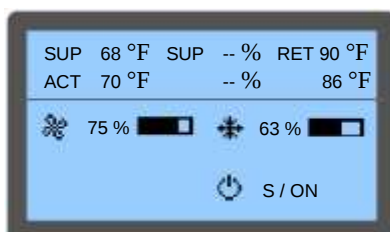


Figure 5-3 Normal Screen

It displays the settings and actual values in the upper half of the display related to the settings and actual supply air temperature in the first column, humidity in the second column and return air temperature in the third column.

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

The icons on the main screen indicate the unit output status, unit property unit operating status. The icons and their definitions are displayed in the Table 5-2.

Table 5-2 Controller display icon details

Icons	Definitions
	Fan rotating speed. Displaying the percentage of actual fan rotating speed
	Compressor capacity. Displaying 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: lock

5.5 Unit Working Icons

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

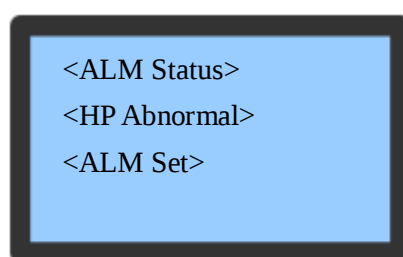
Table 5-3 Description of Icons

Icon	Description
SUP	Supply air temperature setpoint
ACT	Actual air temperature
RET	Specified return temperature
	Cooling, the 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 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. It prompts no alarm or specific alarm information. The specific alarm information includes XX/YY, alarm type alarm generation time, as shown in Figure 5-5. XX indicates the alarm SN YY indicates the total number of reported alarms.

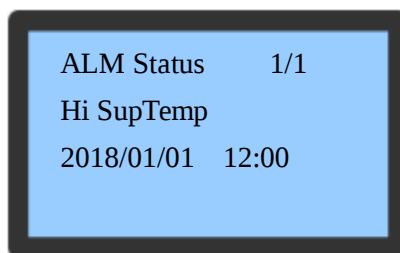


Figure 5-5 Current alarm menu

NOTES:

- 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 Alarm Handle, as shown in Figure 5-6, Figure 5-7 and Figure 5-8. Parameter settings can be saved permanently.

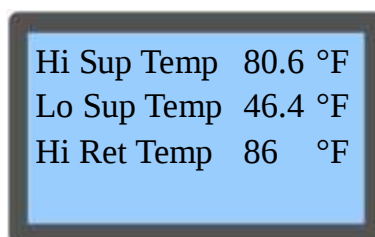


Figure 5-6 Items of the alarm value setup menu

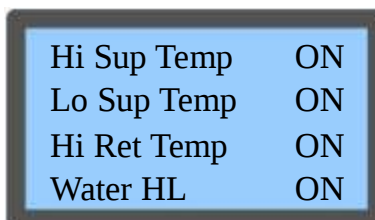


Figure 5-7 Items of the system alarm attribute setup menu

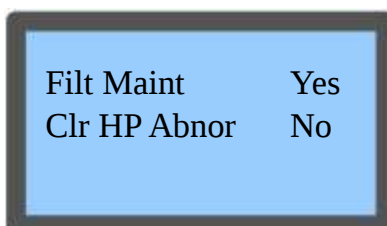


Figure 5-8 Items of alarm handle attribute menu

Temp Set

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

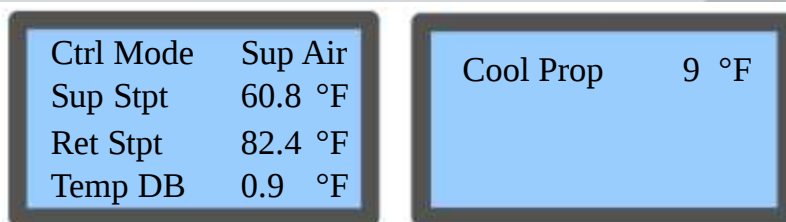


Figure 5-9 Temp & Hum Set menu

NOTES:

- 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.

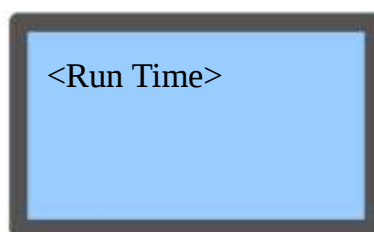


Figure 5-10 System Status

Run Time

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

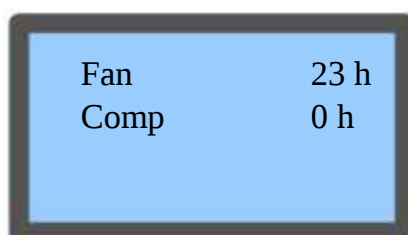


Figure 5-11 Run time menu

Help Menu

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

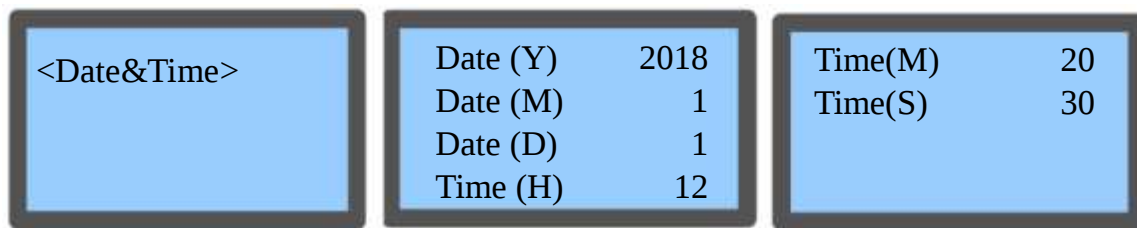


Figure 5-12 Date & Time menu

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 $\pm 10\%$ of the rated voltage and that the power disconnecter 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.

6.2 Start-up Inspection Checklist

Before powering up the unit, ensure the below mechanical and electrical inspections are properly checked as per the Table 6-1 below.

Table 6-1 Start-up inspection checklist

Inspection	Items	Remarks
Mechanical inspection	Check if the indoor unit and condensing unit have been connected as an entire system.	
	Check if all valves in system have been opened fully.	
	Check whether refrigerant and oil were added as instructed.	
	Check if drainage pipe has been connected properly and tightly.	
	Check if there is heat load for AC operating, if not, please increase the heat load by some devices, such as heaters.	
Electrical inspection	Check, measure confirm if the AC mains voltage and frequency are normal verify if the AC mains correction is correct without any short circuit	
	Check if 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, the steps mentioned below should be followed to ensure the normal operation of the unit:

6.3.1 Start up the unit

- Close all the circuit breakers of the unit only after a careful inspection of the entire unit installation is done.
- 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 there are no alarms or warnings displayed.
- Ensure 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 disconnect all circuit breakers.

6.3.2 Check refrigerant charge capacity of low ambient condensing

The low ambient condensing unit has been charged with refrigerant before delivery. Check whether the refrigerant charge capacity is proper after powering on by using the following method.

There are two sight glasses on the receiver, as shown in Figure 1-6. When the high pressure is not lower than 20.3 bar, the liquid level of the refrigerant will reach the higher sight glass. When the ambient temperature is low and the high pressure cannot meet the requirement, the liquid level of the refrigerant will reach the lower sight glass.

6.4 Commissioning Complete Inspection

Check according to Table 6-2 after commissioning.

Table 6-2 Checklist after commissioning

Inspection Items	Inspection Results
Check that all outputs are functional.	
Check that the temperature settings are correct and are controlled within range	
Are there any abnormal alarms or warnings displayed on the controller?	
Make sure 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 cable connection of the fan.



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

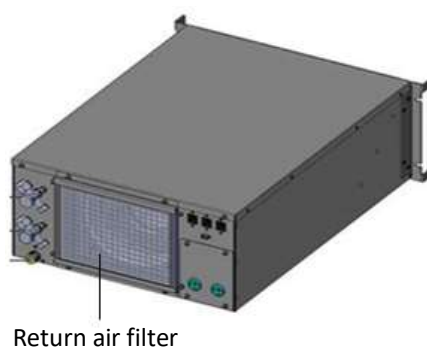


Figure 7-1 Return air filter

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.

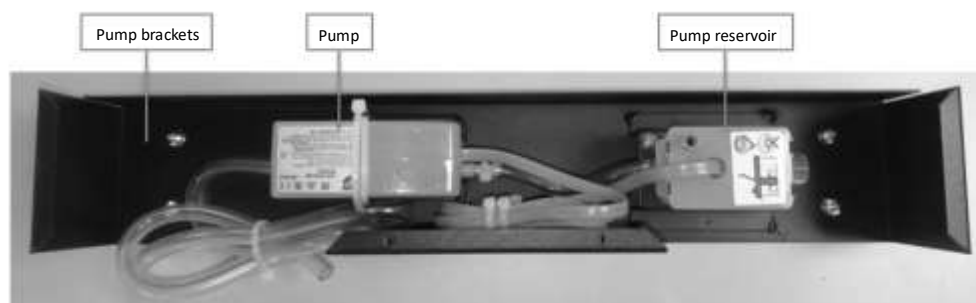


Figure7-2 Condensate pump kit



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 (alkalascency) to clean the dust and debris that inhibits 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. See following for details:

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.

NOTES:

- **Wear long rubber gloves to handle contaminated parts.**
- **The air conditioning system contains refrigerant and release of refrigerant to the atmosphere is harmful due to 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 whether the surface of the control interface board, control board-temperature NTC electronic expansion valve control board shows 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 control interface boards, including the control board, interface board-temperature NTC electronic expansion valve control board.
- Check whether the contact and connection of the fan power cable, signal cable rotating speed feedback signal cable are firmly fixed.

- Check whether the interconnection terminals between the control interface board and the temperature or pressure sensor 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 finding 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 not allowed to 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 leaks 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.

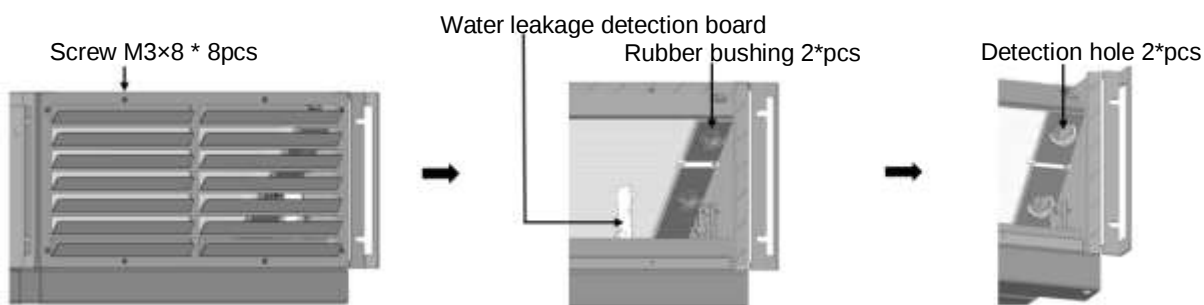


Figure 7-4 The detection holes in VRC202 (front)

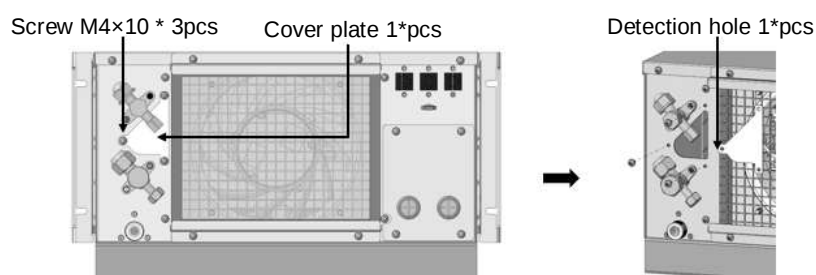


Figure 7-5 The detection holes in VRC202 (rear)

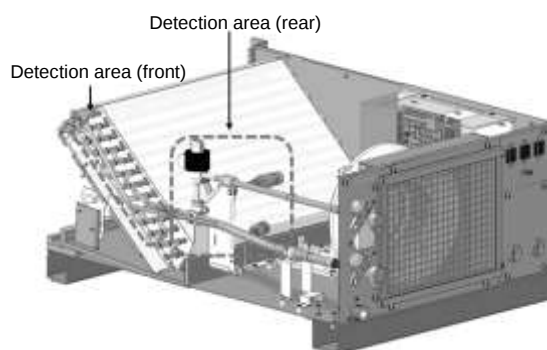


Figure 7-6 The detection area in VRC202 (rear)

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 the Table 7-1 below.

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 whether the fan generates any noise during operation	
		Check whether the fan has stopped rotating.	
		Check and fasten the circuit connector.	
		The fan base should be firm	
	Drainage pump	Check whether filter is clogged or damaged	
		Clean the filter	
		Check whether the pipes are loose.	
		Check whether there are impurities and debris in the water tray.	
		Check the drain pump connection line for clogging.	
		Check whether the cable of the drain pump is loose.	
Semi-annually:	Compressor	Signs of oil leakage	
		Check if there is abnormal vibration and noise of compressor	
	Condenser	Check the fins cleanliness	
	Low ambient kit	Check whether there is leakage	
		Check whether heating belt works normally	
		Check whether pressure switch works normally	
		Check whether the liquid line solenoid valve works normally	
	Cooling system	Suction pressure	
		Discharge pressure	
		Superheat	
		Connection pipe no leakage	
		Charging capacity of refrigerant	
	Electrical control part	Check whether the main circuit breaker and the circuit breaker cable of the power module are tightly connected.	
		Check and fasten the circuit connector.	
		Check whether the cables and meter reading of each sensor are within prescribed range.	
	EEV electric board	Check whether 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 mentioned in the below 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 whether 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 to see 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 sensor is abnormal	Check if the high-pressure sensor 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
Severe condensation or water leakage	The air humidity is too high	Use other dehumidifier to control the air humidity
	EEV adjusts abnormally	Check if the EEV coil or EEV cable is loose

Fault Occurrence	Possible Cause	Check or Remedy
	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 whether the cable from the main control board, fan fault detection board, or power module to the control terminal bar is firmly fixed. Check whether 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 sensor is faulty.	Check whether the sensor cable is firmly fixed. Check whether the sensor cable position on the control board is correct.
	The control board is powered off.	Check whether the output fuse of the transformer has tripped/broken. Check whether 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 whether the valve cable connection on the control board of the electronic expansion valve is faulty. Check whether the communication cable between the electronic expansion valve control board and the main control board is properly connected.

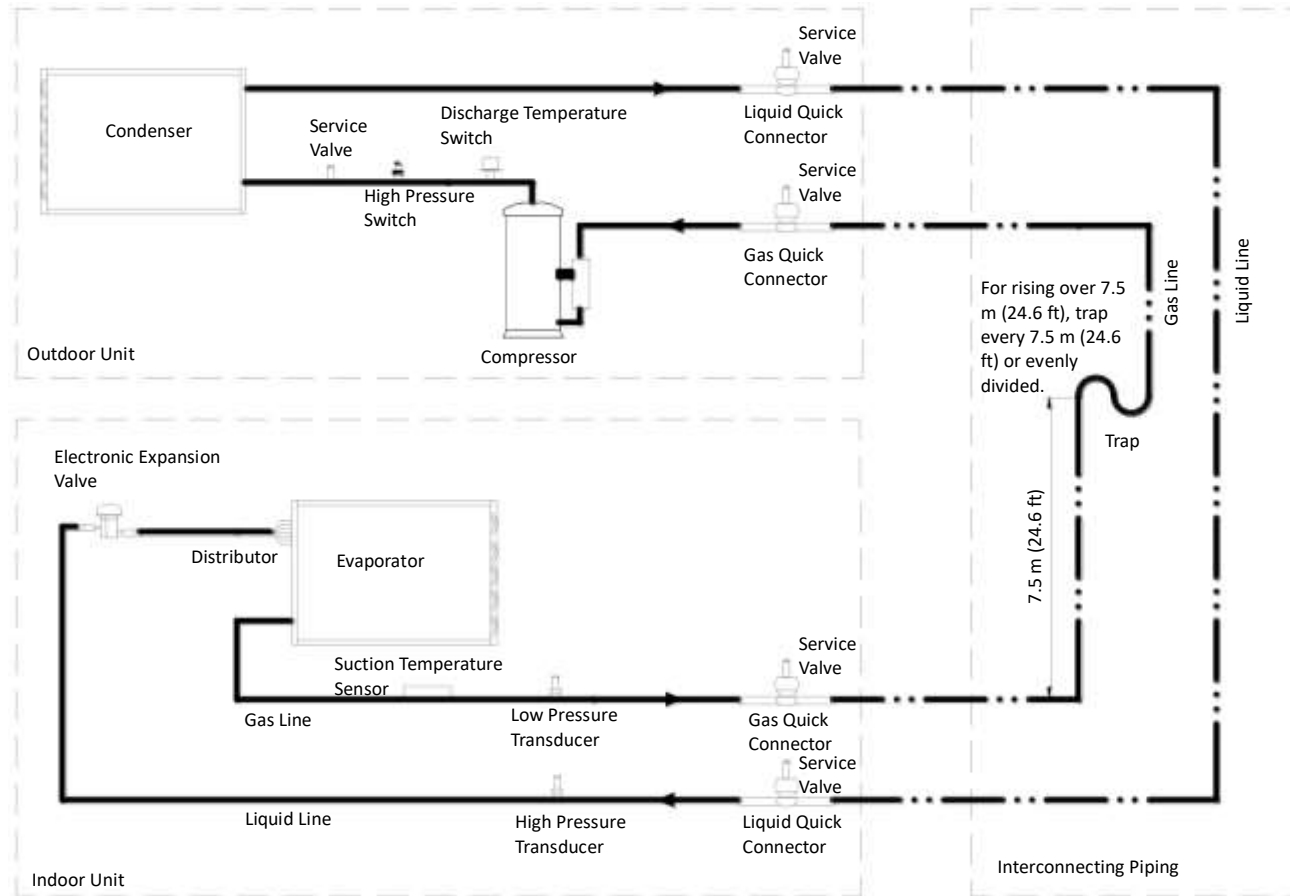
8.4 Fault Diagnosis and Handling of the Air Conditioning System

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.

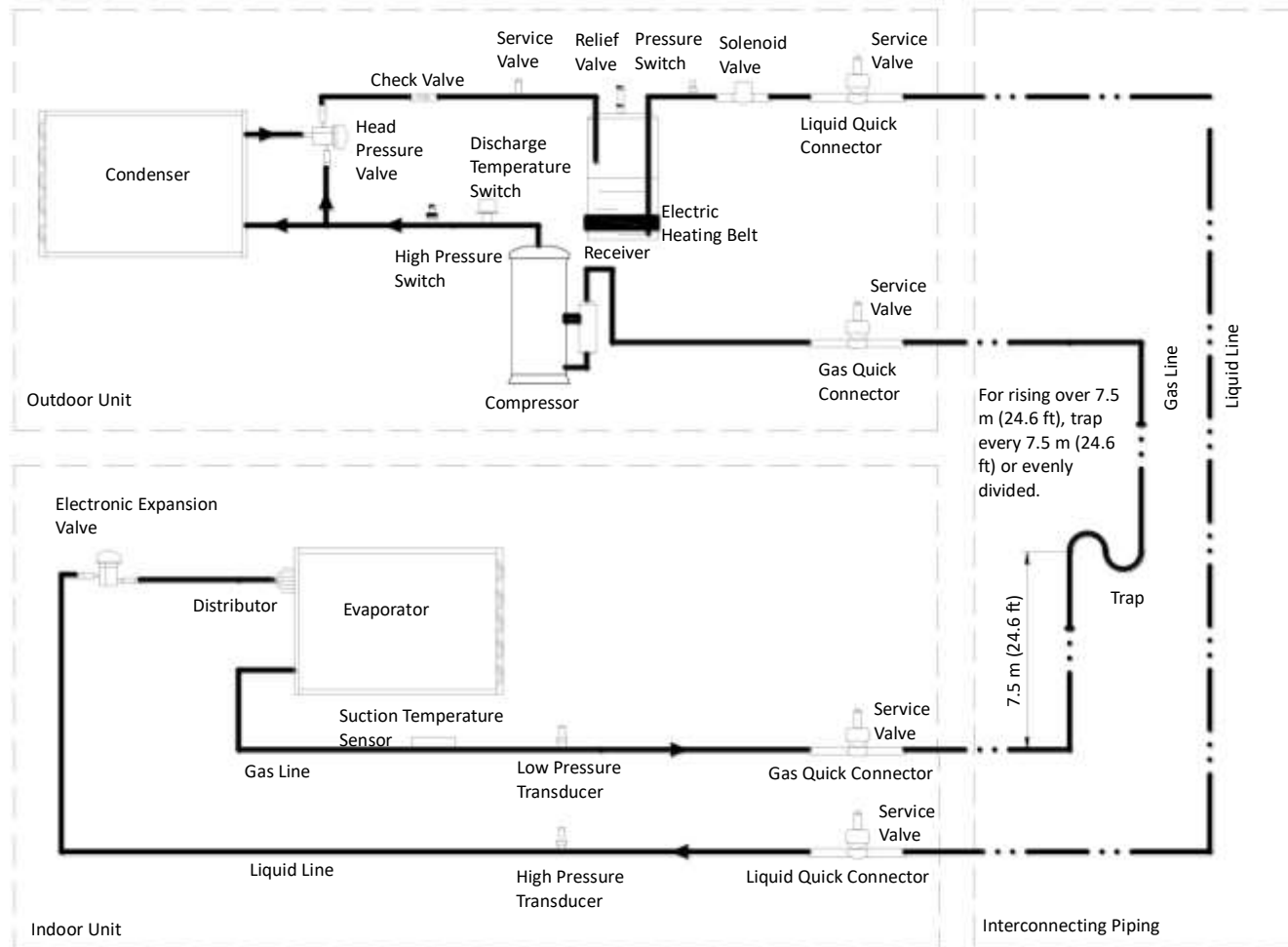
Table 8-4 Refrigeration system faults and troubleshooting methods

Symptom	Probable Causes	Check Items and Handling Methods
The surface of the evaporator has serious condensation.	Check whether 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 whether the fan is faulty. Table 8-1 describes the diagnosis and handling methods.
	Blockage of the evaporator	Check the surface of the micro-channel evaporator and periodically handle the blockage problem.

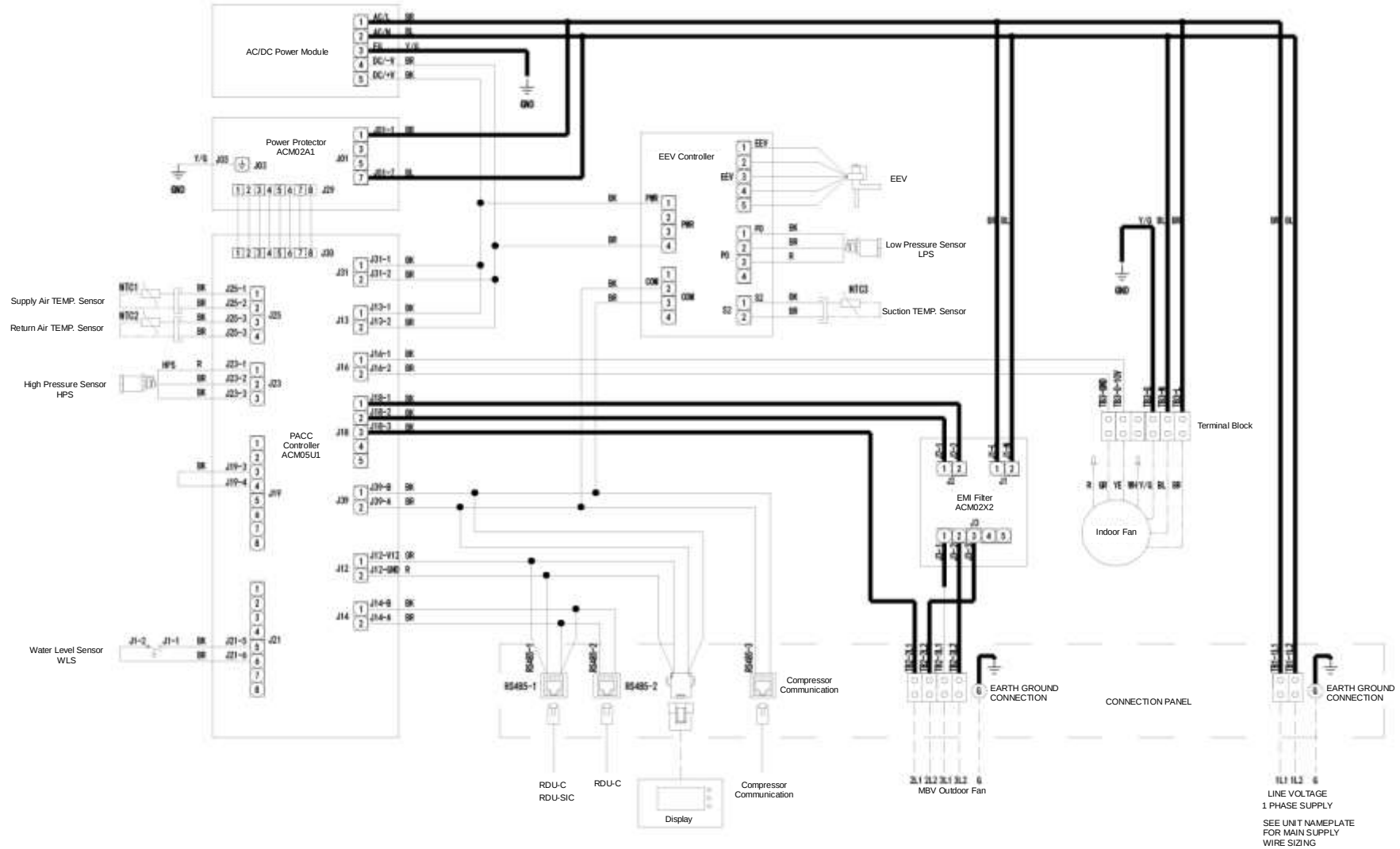
Appendix I: System Diagram (Standard Unit)



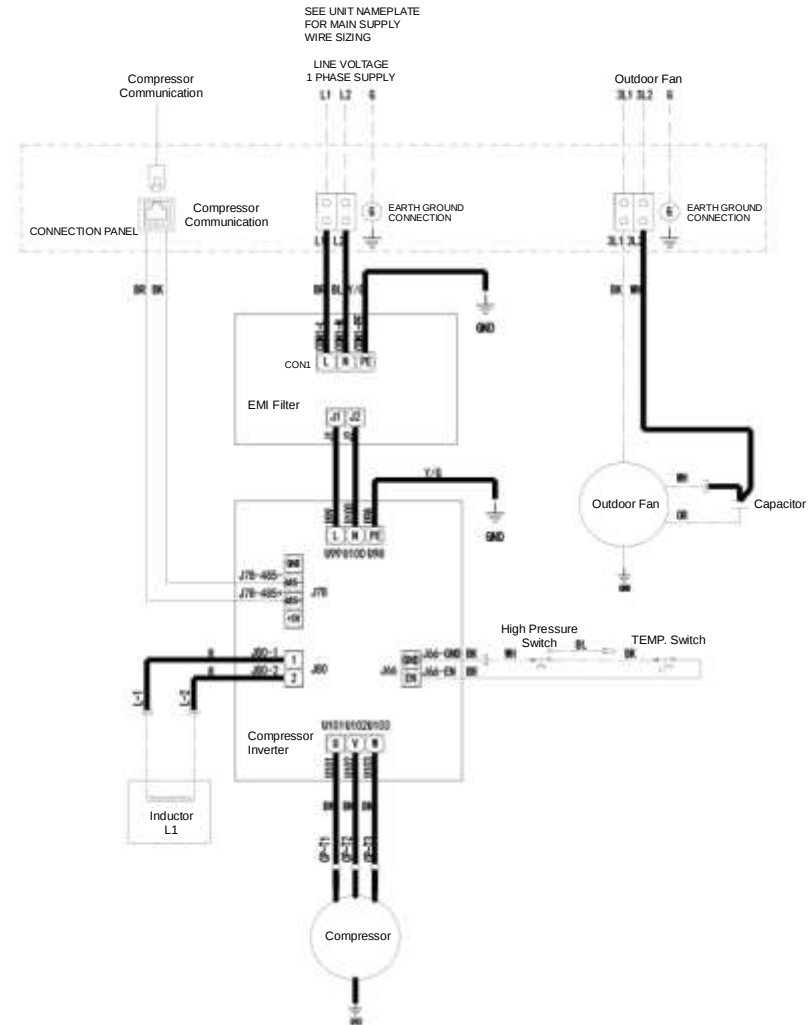
Appendix II: System Diagram (Low Ambient Unit)



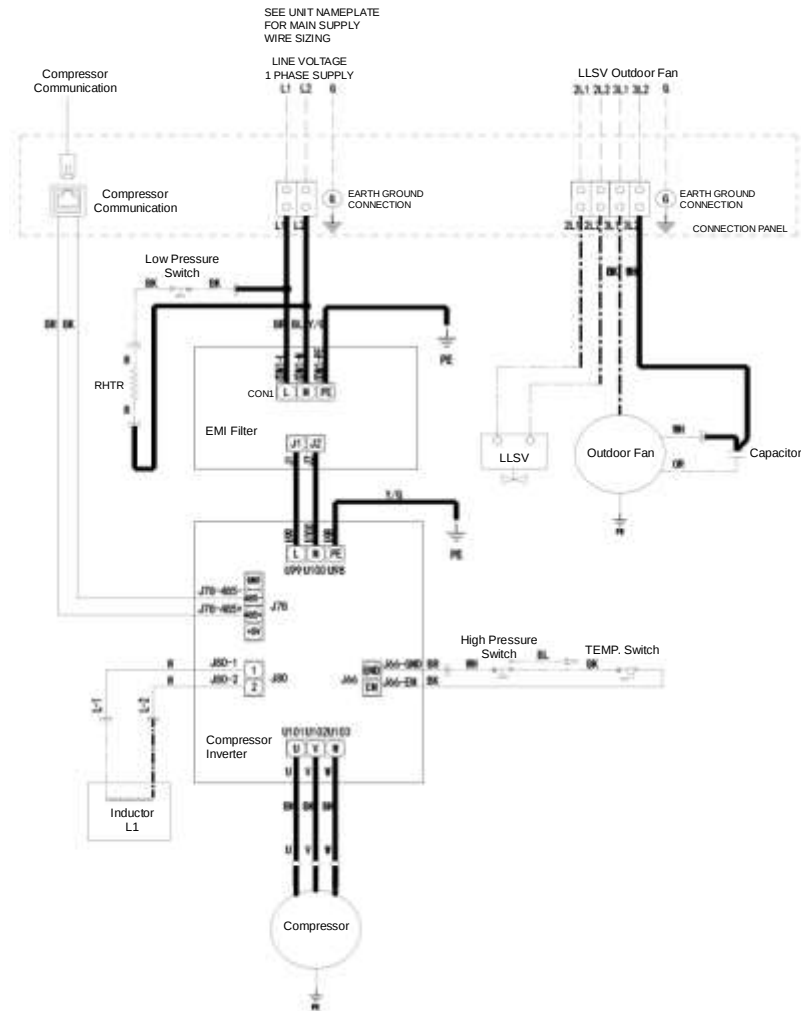
Appendix III: Wiring Diagram (VRC200/VRC201 Unit)



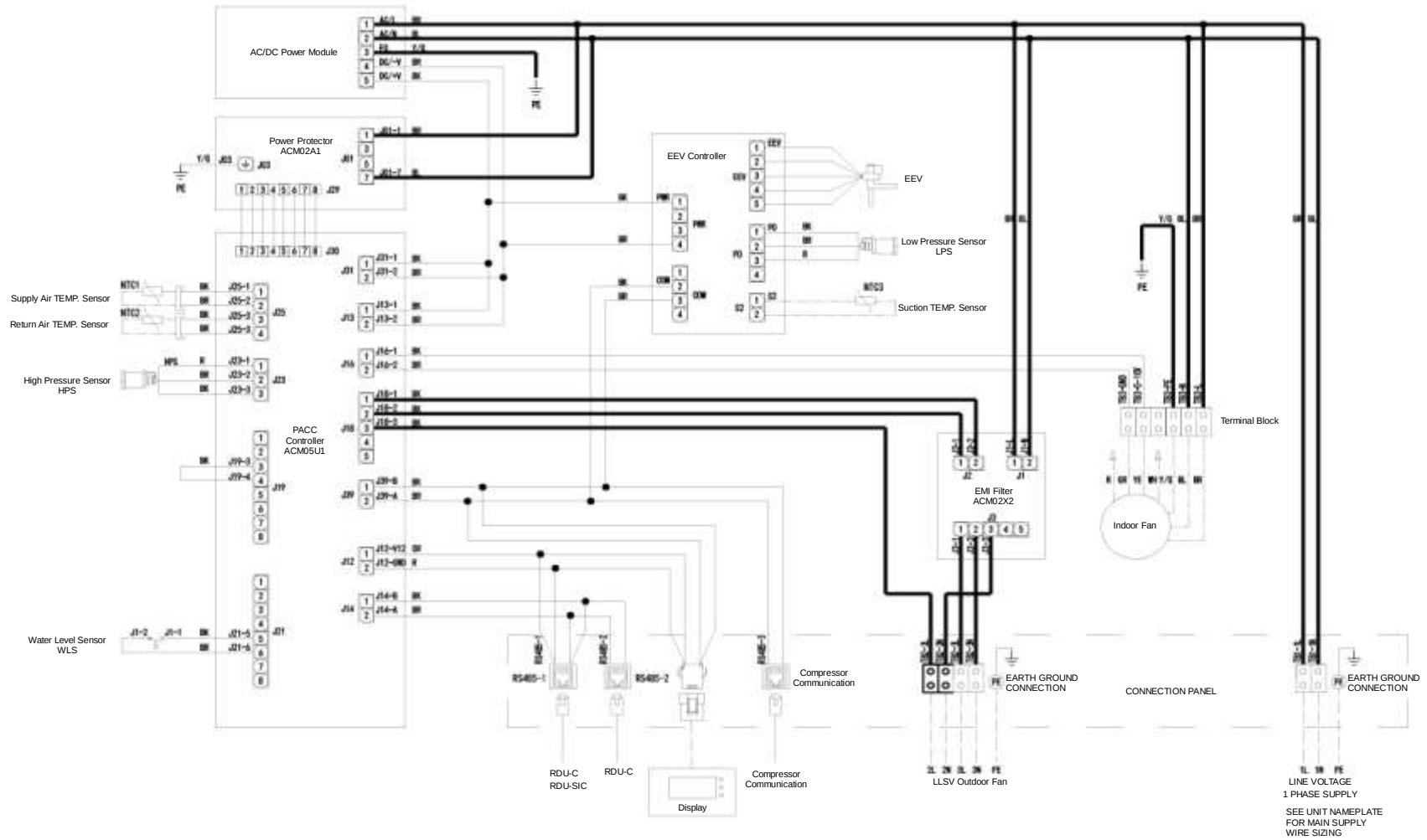
Appendix IV:Wiring Diagram (VRC300/VRC301 Unit)



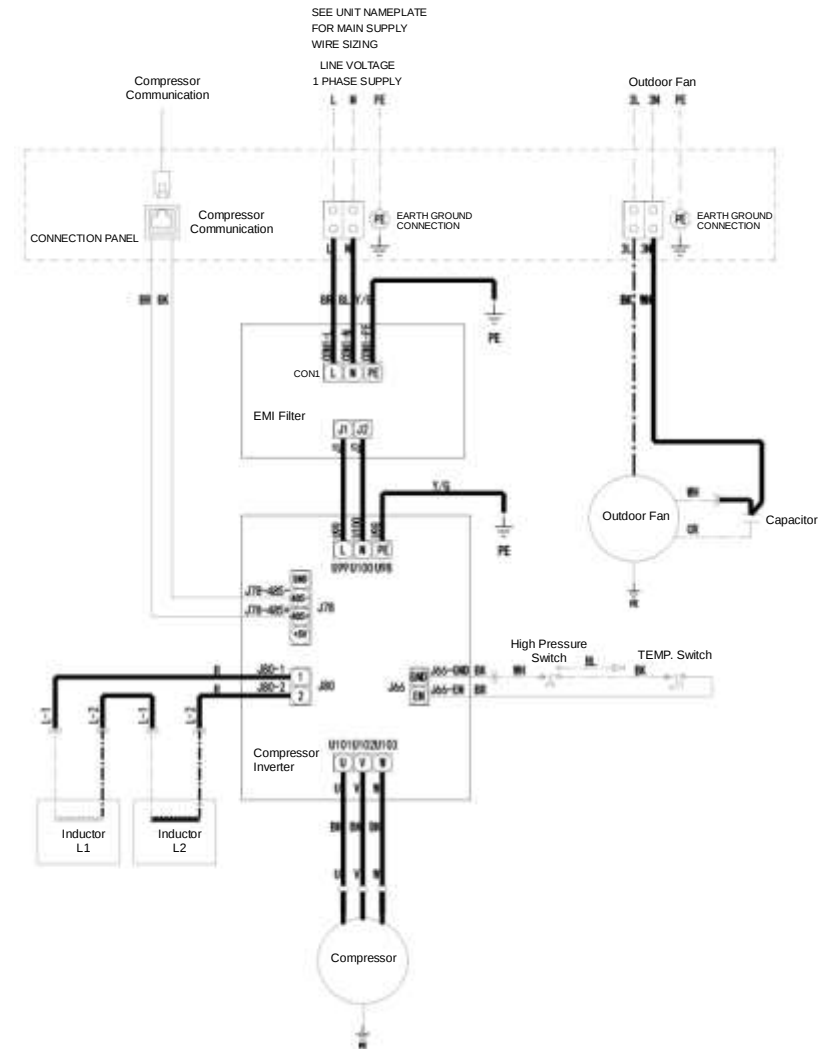
Appendix V:Wiring Diagram (VRC350/VRC351 Unit)



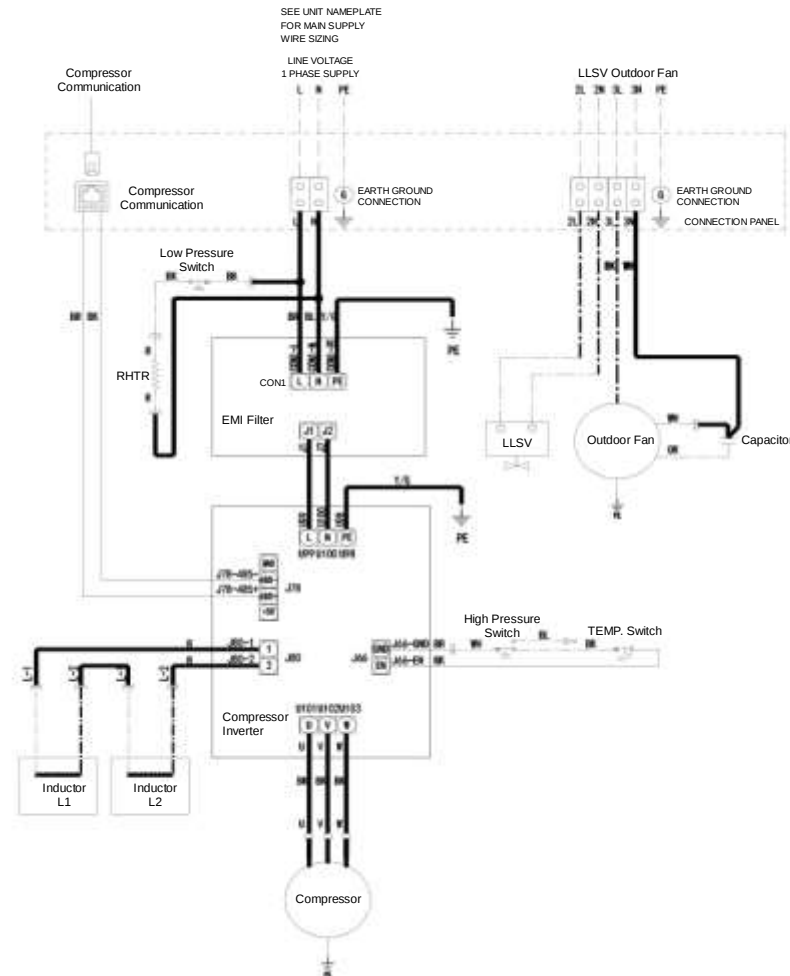
Appendix VI: Wiring Diagram (VRC202 Unit)



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 and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.



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