Liebert® CRV Row Based Cooling

CRD10 User Manual

Original Instructions

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Suppliers Declaration of Conformity

Unique Identifier: CRD100-0D00A, CRD101-0D00A, CCD100S-00A.

FCC Compliance Statement (for products subject to Part 15)

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

NOTE:

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

Version History

Revision Date	Code	Version Number
16-06-2019	31014025	1.0
29-07-2019	31014025	1.1
30-10-2019	31014025	1.2
16-03-2020	31014025	1.3
25-05-2020	31014025	1.4
05-11-2020	31014025	1.5

IMPORTANT SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS

This manual contains important safety instructions that should be followed during the installation and maintenance of the Liebert CRV. Read this manual thoroughly before attempting to install or operate this unit.

Only qualified personnel should move, install or service this equipment.

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

Any operation that requires opening doors or equipment panels must be carried out only by properly trained and qualified personnel.

To identify the unit model and serial number for assistance or spare parts, locate the identification label on the unit.

A warning label on the front and back panels reminds users that:

- the Liebert® CRV restarts automatically
- the main switch must be opened before opening the internal compartments for any operation.

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 over-pressurization of the refrigeration system. Can cause explosive discharge of high-pressure refrigerant, loss of refrigerant, environmental pollution, equipment damage, injury, or death. This unit contains fluids and gases under high pressure. Use extreme caution when charging the refrigerant system. Do not pressurize the system higher than the design pressure marked on the unit's nameplate.

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. If control voltage is applied, the fan motor can restart without warning after a power failure.

WARNING! Risk of top-heavy unit falling over. Improper handling can cause equipment damage, injury or death. Read all of the following instructions and verify that all lifting and moving equipment is rated for the weight of the unit before attempting to move, lift, remove packaging from or prepare the unit for installation.

WARNING! Risk of unsecured unit rolling off pallet. Can cause equipment damage, injury or death. The unit is on casters. Ensure that the unit/pallet is located on a flat surface before loosening the hardware securing the to its shipping pallet.

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.

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! 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.

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.

CAUTION: Risk of exposure to harmful noise levels. Can cause hearing injury or loss. Depending on the installation and operating conditions, a sound pressure level greater than 70 dB(A) may arise. Take appropriate technical safety measures. Operating personnel must wear appropriate, OSHA-approved PPE and observe all appropriate hearing-protection safety requirements.

CAUTION: Risk of excessive refrigerant line pressure. Can cause tubing and component rupture resulting in equipment damage and personal injury. Do not close off the refrigerant-line isolation valve for repairs unless a pressure-relief valve is field- installed in the line between the isolation valve and the check valve. The pressure-relief valve must be rated 5% to 10% higher than the system-design pressure. An increase in ambient temperature can cause the pressure of the isolated refrigerant to rise and exceed the system-design pressure rating (marked on the unit nameplate).

NOTICE!

Risk of improper power-supply connection. Can cause equipment damage and loss of warranty coverage.

Prior to connecting any equipment to a main or alternate power source (for example: back-up generator systems) for start-up, commissioning, testing, or normal operation, ensure that these sources are correctly adjusted to the nameplate voltage and frequency of all equipment to be connected. In general, power-source voltages should be stabilized and regulated to within ±10% of the load nameplate nominal voltage. Also, ensure that no three-phase sources are single-phased at any time.

NOTICE!

CRD10 unit 96VA transformer default wiring is orange cable (230V to 24V). If the unit rated voltage is 208V, a properly trained and qualified electrician must change the transformer wiring from orange to red cable (208V to 24V). See section 4.3.3 Transformer Connection Cable for details.

NOTICE!

Risk of oil contamination with water. Can cause equipment damage.

Liebert® CRV 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.

NOTICE!

Risk of improper refrigerant charging. Can cause equipment damage.

Refrigerant charge must be weighed into air-cooled compressorized systems before they are started. Starting compressors without proper refrigerant charging can cause the compressors to operate at less than 5°F (–15°C) evaporator temperature and at less than 20 psig (138 kPa). Operation for extended periods at less than 20 psig (138 kPa) can cause premature compressor failure.

NOTICE!

Risk of clogged or leaking drain lines and leaking water-supply lines. Can cause equipment and building damage.

This unit requires a water drain connection. Drain lines must be inspected at start-up and periodically, and maintenance must be performed to ensure that drain water runs freely through the drain system and that lines are clear and free of obstructions and in good condition with no visible sign of damage or leaks. This unit may also require an external water supply to operate.

Improper installation, application and service practices can result in water leakage from the unit. Water leakage can result in catastrophic and expensive building and equipment damage and loss of critical data center equipment.

Do not locate unit directly above any equipment that could sustain water damage.

We recommend installing a monitored fluid-detection system to immediately discover and report coolant-fluid system and condensate drain-line leaks.

NOTICE!

Risk of doorway/hallway interference. Can cause unit and/or structure damage. The unit may be too large to fit through a doorway or hallway while on the skid. Measure the unit and passageway dimensions, and refer to the installation plans prior to moving the unit to verify clearances.

NOTICE!

Risk of damage from forklift. Can cause unit damage. Keep tines of the forklift level and at a height suitable to fit below the skid and/or unit to prevent exterior and/or underside damage.

NOTICE!

Risk of improper storage. Can cause unit damage.

Keep the unit upright, indoors and protected from dampness, freezing temperatures and contact damage.

NOTICE!

Risk of improper maintenance. Can cause equipment damage.

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."

Ignoring safety instructions is dangerous. Soiled parts cause a loss of performance and, for switch or control devices, can lead to the breakdown of the unit performance and operation.

NOTICE!

Risk of release of hazardous substances into the environment. Can cause environmental pollution and violation of environmental regulations.

The Liebert® CRV contains substances and components hazardous for the environment (electronic components, refrigerating gases and oils). At the end of its useful life, the Liebert® CRV must be dismantled by specialized refrigerating technicians. The unit must be delivered to suitable centers specializing in the collection and disposal of equipment containing hazardous substances.

Agency Listed Standard 60-Hz units are UL Certified to the harmonized U.S. and Canadian product safety standard CSA C22.2 No 236/UL 1995 for “Heating and Cooling Equipment” and are marked with the UL logo.

Table of Contents

Chapter 1: Product Overview

The Liebert CRV, CRD10 is the next generation of air conditioner that provide precise environmental control. The Liebert CRV, CRD10 models are the latest in the long chain of modern enterprise-grade products from the Liebert family. Incorporating the high standards associated with the Liebert name, the CRD10 utilizes the latest technology, system components, and streamlined manufacturing process.

1.1 Product Introduction

CRD10 air conditioners are products specifically created and designed for small to medium data centers, computer rooms, equipment room, modularized machine room and similar high heat density systems requiring a high degree of accuracy and precision. It addresses the needs and challenges associated with such applications and setups. It caters to sensitive applications which need a suitable environment for optimal performance. Therefore, care should be taken when testing the product to maintain favorable conditions for mission-critical equipment. Thermal management units must not only keep the room conditions within a specific range but also be able to react quickly to drastic changes in the heat load and prevent wide temperature fluctuations.

CRD10 air-cooled AC unit is packed with features like high reliability, high sensible heat ratio, and large airflow. The Liebert CRD10 is an advanced row-based cooling unit. It provides the 10kW cooling capacity under designed condition. It can adjust the cooling capacity by changing the output of inverter compressor and EC fans, depending on the change in the heat load.

CRD10 air-cooled unit requires a condenser. The condenser is powered and controlled by indoor unit.

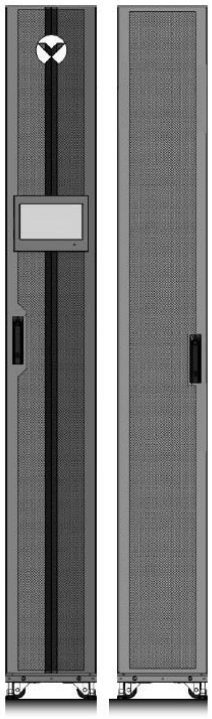
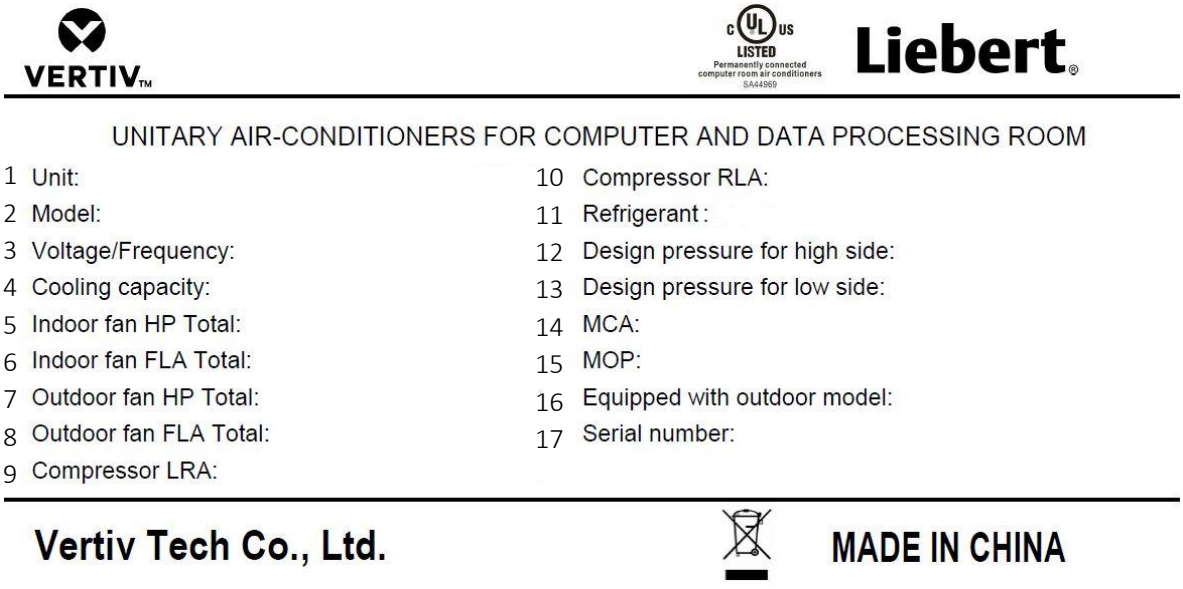


Figure 1-1 Appearance of the Air Conditioner

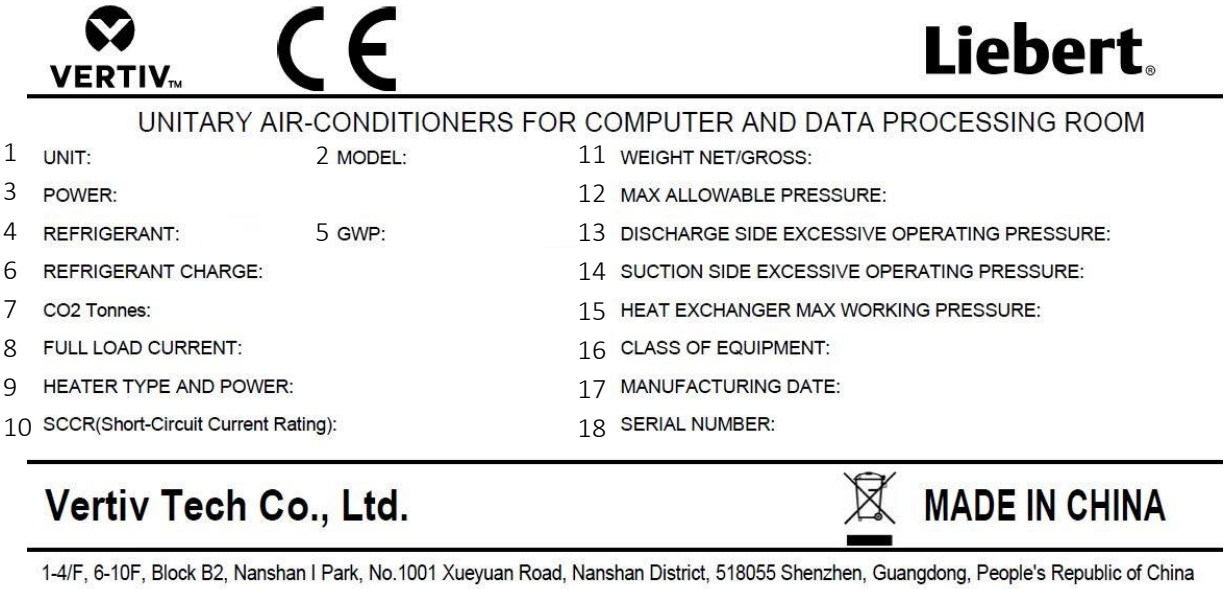
Refer Figure 1-2 for the nameplate description of the CRD10 model:

UL Model:



POS.	DESCRIPTION	POS.	DESCRIPTION
1	Unit defined by 6 digits	10	Rated load current of compressor
2	Model defined by 12 digits	11	Refrigerant Amount Charged on site
3	Supply Power	12	Discharge Side Excessive Operating Pressure
4	Cooling capacity	13	Suction Side Excessive Operating Pressure
5	Indoor fan power in total	14	Minimum Circuit Amps
6	Indoor fan full load current in total	15	Maximum Overcurrent Protection
7	Outdoor fan power in total	16	Equipped with outdoor model
8	Outdoor fan full load current in total	17	Serial Number
9	Locked rotor current of compressor		

CE Model:



POS.	DESCRIPTION	POS.	DESCRIPTION
1	Unit defined by 6 digits	10	Short-circuit current rating
2	Model defined by 12 digits	11	Net weight and Gross weight
3	Supply Power	12	Max Allowable Pressure of the Unit
4	Refrigerant Category	13	Discharge Side Excessive Operating Pressure
5	Global Warming Potential	14	Suction Side Excessive Operating Pressure
6	Refrigerant Amount Charged on site	15	Heat Exchange Max Working Pressure
7	CO_2 Tonnes	16	Class of Equipment
8	Full load Current	17	Manufacturing Date
9	Heater type and power	18	Serial Number

Figure 1-2 Product Nameplate and Model Description

1.2 Product Description

The CRD10 cooling unit is a comprehensive system that includes all the main functions fundamental to precision cooling units such as cooling, dehumidification, reheating(CE certified model only), air filtration, condensation management, temperature control, alarm functions and compatibility with data communications. CRD10 is designed to comply with mission-critical requirements and ensure that servers are maintained at the correct temperature and humidity levels. Figure 1-3 & 1-4 shows the various components and their respective locations.

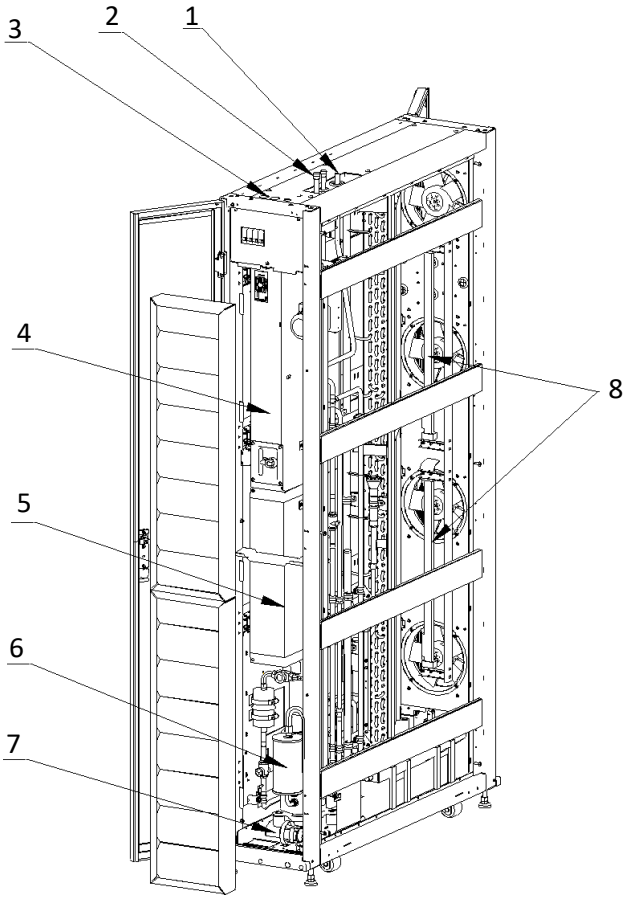


Figure 1-3 Components and their Locations at Rear

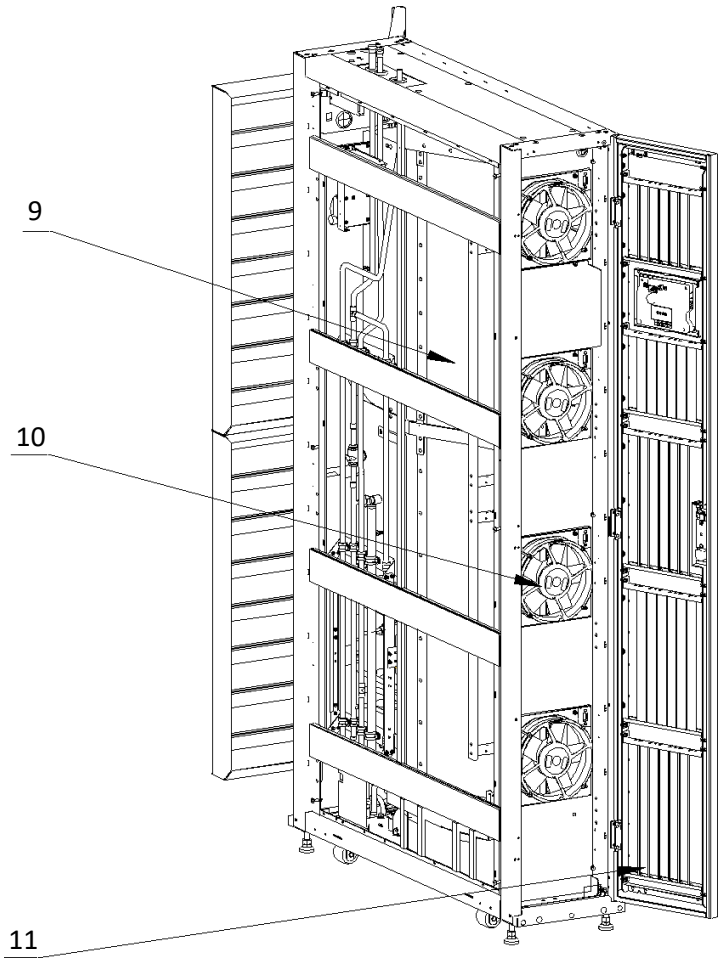


Figure 1-4 Components and their Locations at Front

Item	Description	Item	Description
1	Drainage pipe of pump	7	Condensate pump
2	Supply and Return refrigerant pipe	8	Electric heaters (optional)
3	Top electrical entrance	9	Evaporative Coil
4	Electric box	10	EC plug fans
5	Compressor Driver	11	Baffles
6	Compressor		

Table 1-1 CRD10 Dimensions

Model	Unit Dimensions (W x D x H) mm(inch)	Package Dimensions (W x D x H) mm(inch)	Net weight (kg/lb)	Gross weight (kg/lb)
CRD100-0D00A	300x1132x2000 (11.8x44.6x78.7)	776x1276x2228 (30.6x50.2x87.7)	231/509	313/690
CRD101-0D00A				
CRD102-1D00A				

1.3 Model Nomenclature

The model of the CRD10 air conditioner is fully-defined by 12 digits as shown in Table 1-2, and details of the condenser is given in Table 1-3.

Table 1-2 Model Nomenclature Indoor Unit

Digit	1	2	3	4	5	6	7	8	9	10	11	12
Example	C	R	D	1	0	0	-	0	D	0	0	A

Digit	Variable	Description of Variable
1	CR	Liebert CRV
2		
3	D	D- DX (Air cooled) W- (Water cooled) C- (Chilled water)
4	10	Model Number: 10
5		
6	0,1,2	0- 208/230V/1Ph/60Hz, UL 1- 208/230V/3Ph/60Hz, UL 2- 230V/1Ph/50/60Hz, CE
7	-	Separator
8	0,1	0- Cooling only 1- Reheat only
9	D	D- Dual Power Supply
10	0	0- R410A refrigerant
11	0	Free digit (future)
12	A~Z	Revision

Table 1-3 Model Nomenclature of Condenser Unit

Digit	1	2	3	4	5	6	7	8	9	10	11
Example	C	C	D	1	0	0	S	-	0	0	A

Digit	Variable	Description of Variable
1	CCD	Liebert CRV Condenser
2		
3		
4	10	Model Number: 10
5		
6	0,1	0- 208/230V/1Ph/60Hz, UL 1- 230V/1Ph/50/60Hz, CE
7	S	S- Standard Temp (-15°C to 45°C [5°F to 113°F])
8	-	Separator
9	0	0- R410A refrigerant
10	0	Free digit (future)
11	A~Z	Revision

1.4 Basic Performance Parameters

The basic performance parameters of the Liebert CRD10 are given in Table 1-4.

Table 1-4 Performance Parameters

Certification	UL		CE
Unit	CRD100	CRD101	CRD102
Model	CRD100-0D00A	CRD101-0D00A	CRD102-1D00A
Voltage/Frequency	208/230V 1PH 60Hz	208/230V 3PH 60Hz	230V 1PH 50/60Hz
Cooling Capacity (kW)	10.0	10.0	10.0
Heating Capacity (kW)	-	-	2.0
Power Input(kW)	3.2	3.2	3.2(Without the heater)
Full Load Current (A)	-	-	38 (With the heater) 28 (Without the heater)
MCA (A)	29	21	-
MOP (A)	40	30	-

Test Condition: Return air 29.4°C (85°F), 32% RH & 35°C (95°F) Outdoor temperature.

Note: The allowed thermal load shall not be lower than 20% of nominal air conditioner cooling capacity. Lower thermal load will drive to imprecise temperature and humidity control and frequent compressor(s) switch on/off.

The performance data of CRD100 and CRD101 rated with the AHRI stand 1360 are given in Table 1-5.

Table 1-5 Performance data of AHRI

Model Number	CRD100-0D00A		CRD101-0D00A	
Voltage (Volts/Phase/Hz)	208/1/60	230/1/60	208/3/60	230/3/60
Net Total Cooling Capacity, kW (kBtuh)	10.0(34.1)	9.98(34.0)	10.32(35.2)	10.41(35.5)
Net Sensible Cooling Capacity, kW (kBtuh)	9.92(33.8)	9.96(33.9)	10.08(34.4)	10.12(34.5)
Net Sensible Coefficient of Performance (NSenCOP), kW/kW	3.57	3.62	3.69	3.71
Unit Airflow, ACFM	1960	1961	1897	1898
Unit Airflow, SCFM	1896	1887	1835	1836
Ext. Static Pressure, Pa	0.0		0.0	
Humidification	None		None	
Refrigerant	R-410A		R-410A	
Return Air Conditions 95°F DB, 52°F DP (35°C DB, 11.1°C DP) 32% RH				
Outdoor Ambient Temperature 95°F (35°C)				
Certified in accordance with the AHRI Datacom Cooling Certification Program at AHRI Standard 1360 Standard Rating Conditions. Certified units may be found in the AHRI Directory at www.ahridirectory.org.				

1.5 Sound parameters

The sound parameters of the Liebert CRD10 are given in Table 1-6.

Table 1-6 Sound Parameters

1/3 Octave Band Center Freq [Hz]	Air volume		50 dB	63 dB	80 dB	100 dB	125 dB	160 dB	200 dB	250 dB	315 dB	400 dB	500 dB	630 dB
	m3/h	SCFM												
IDFAN 75%	3250	1913	28.6	25.4	33.8	33.7	32.3	40.2	42.7	46.4	52.9	68.3	67.3	58.0
IDFAN 70%	3000	1766	29.1	24.5	34.7	31.2	30.9	38.2	40.5	45.2	53.6	64.4	58.9	56.2
IDFAN 60%	2500	1471	24.8	26.8	28.9	28.9	30.9	33.9	39.3	45	59.3	59.5	53.2	59.4

1/3 Octave Band Center Freq [Hz]	800 dB	1000 dB	1250 dB	1600 dB	2000 dB	2500 dB	3150 dB	4000 dB	5000 dB	6300 dB	8000 dB	10000 dB	db(A)
IDFAN 75%	63	63.1	67.8	65.7	65.4	66.4	63.7	61.8	59.8	57.4	55.2	49.4	**76.3**
IDFAN 70%	62.1	58.7	64.4	64.4	63.6	64.1	61.5	60.1	57.8	55.2	52.6	47.2	**73.1**
IDFAN 60%	60	59.2	59.7	60.4	59	59.7	57.4	55.4	53.1	50.1	47.1	42.3	**70.1**

Test Conditions:

- Semi-anechoic chamber environmental test.
- The test point is 2m(6.6ft.) away from the unit and 1m(3.3ft.) away from the ground.

1.6 Main Components of Indoor Unit

The following section expounds the list of components used in the CRD10 Precision Air conditioning models.

1.6.1 DC Brushless Compressor

The CRD10 Air conditioning models comprise of a DC Brushless compressor which has a host of promising features as mentioned in the following list:

- Low operational noise
- Rapid Cooling
- Less Vibration

Figure 1-5 DC Brushless Compressor

1.6.2 Fan

The EC Fan used in the CRD10 models are energy-efficient and innovative with integrated electronics and a maintenance-free design.

- Ability to regulate the airflow and reduce the fan input power leading to high energy-efficiency.
- Hot swappable, easy-to-connect facility with minimal wiring resulting in to high performance with a wide range of possible air flow rates. Figure 1-6 shows the EC Fan used in CRD10 model.

Figure 1-6 EC Fan

1.6.3 Evaporator

The sophisticated design of the distributor ensures that the refrigerant is evenly distributed in each loop, thereby improving the effectiveness of the heat exchanger.

- Streamlined heat exchanger design and air distribution for optimum performance.
- Fin-tube heat exchanger for higher efficiency Figure 1-7 shows the image of an evaporator.

Figure 1-7 Evaporator

1.6.4 Electronic Expansion Valve (EEV)

The EEV is designed for modulating control of the refrigerant mass flow with precision. The EEV simultaneously collects temperature and pressure signals regulate the refrigerant flow accurately. The EEV's wide operating envelope also lowers down the condensing pressure, thereby resulting in significant energy savings.

- Designed for modulating control of the refrigerant mass flow with precision
- Ensures effective control on super-heating at the end of the evaporator
- Better low load capacity
- Designed for easy Installation-and-Service. Figure 1-8 shows the image for the EEV used in the CRD10 models.

Figure 1-8 Electronic Expansion Valve

1.6.5 Electric Heater

In the CRD10 models, the PTC (Positive Temperature Coefficient) heater is used on models equipped with reheat, as they have lower running temperatures, thereby ensuring operational safety.

- Less susceptible to overheating and long lasting due to less wear
- Lower Maintenance and smooth operation, Figure 1-9 shows an image of the electric heater.

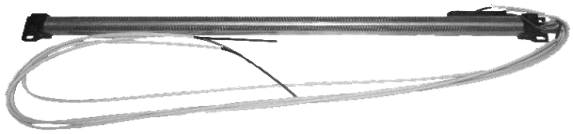


Figure 1-9 PTC Heater

1.6.6 Sight Glass

The sight glass is a utility for observing the refrigerant state; specifically, the moisture content of the system. If the moisture content exceeds the defined standards, the color changes, thereby, indicating irregularity in the moisture content.

1.6.7 Filter Drier

Moisture in the refrigeration lifecycle can adversely affect the operations and service life of a system. In order to rectify that condition, filter driers are used to filter out particles, remove, and hold moisture to prevent it from circulating through the system.

1.6.8 Micro-Controller

The micro-controller used in CRD10 provides a simple operational user-interface and is developed using the latest and highly advanced PID (Proportional–Integral–Derivative) regulation technology.

- Multilevel Password protection
- Self-recovery upon power failure, high-voltage & low-voltage protection & Phase loss protection
- Automatic phase-sequence switching upon the antiphase and rotate speed control of the outdoor fan
- High-end Fault diagnostic system to facilitate easy equipment maintenance Figure 1-10 shows the image of the micro-controller

Figure 1-10 Display Panel of the Controller

1.6.9 Unity Card

The CRD10 unit is equipped with a Unity card. Unity card employs the Modbus Protocol to monitor and manage a wide range of operating parameters, alarms, and notifications from the Micro-controller. The card communicates with Building Management Systems and Network Management Systems via BACnet, Modbus, SNMPv1/v2c/v3, LIFE/Remote Services, and YDN23 protocols.

The Unity card monitors up to 10 Liebert SN modular and integrated sensors. Available sensor types include

temperature, humidity, door closure, contact closure and leak detection. Sensor tab menus permit configuring sensors and putting them in user-configured order for easier checking of high-priority conditions. Sensor data is available via SNMP and the Web user interface.

1.6.10 Remote Temperature Sensor

The Liebert CRD10 models are compatible with multiple temperature sensors based on the requirement. Each unit can be connected with up to maximum 10 temperature sensors.

1.6.11 Condensate pump

The Liebert CRD10 models include a condensate pump which is used for drainage. The performance curve is shown in Figure 1-11.

Note: Maximum recommended vertical rise is 5m(16.4ft.).

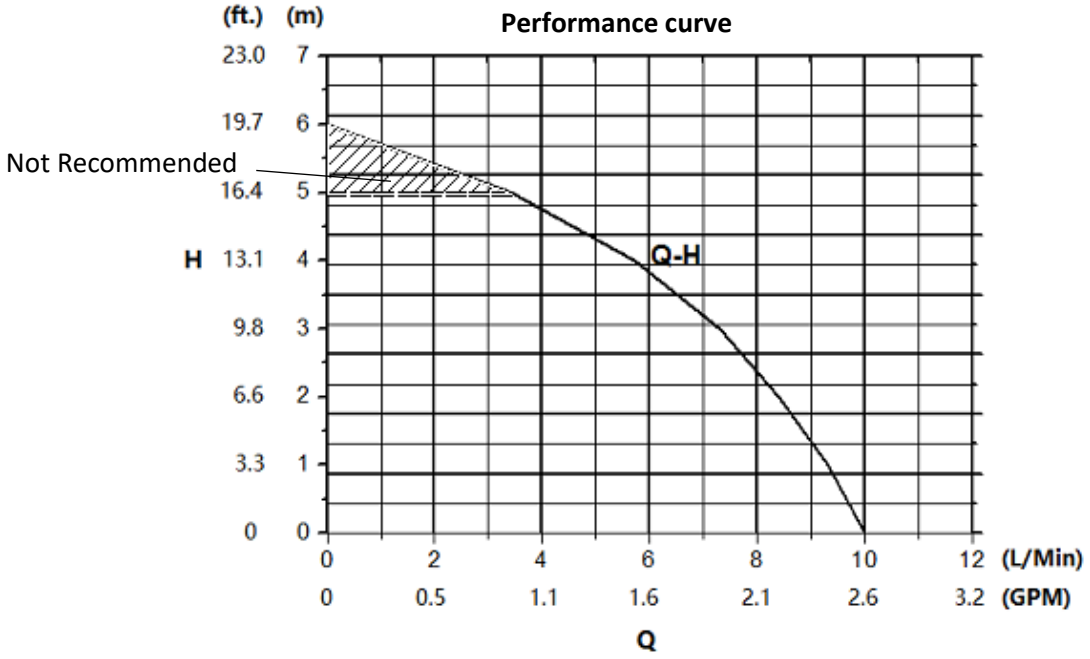


Figure 1-11 Performance curve of condensate pump

1.6.12 Liquid Line Solenoid Kit

The liquid line solenoid kit is a solenoid valve used to prevent refrigerant from condensing into liquid line in condenser and pipe of outdoor when the unit is turned off at the condition of low ambient temperature. Figure 3-1 shows the install location of solenoid valve in the system. Figure 1-12 shows the solenoid valve.

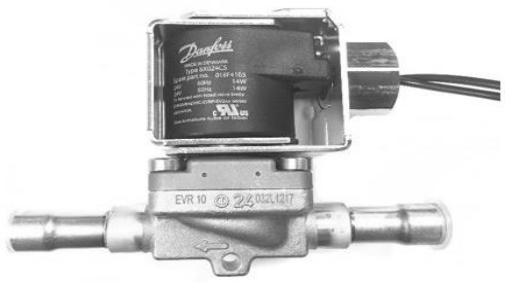


Figure 1-12 Solenoid Valve

1.6.13 Ramp

Ramp is used to easily remove the unit from the pallet, the operation process illustration is shown in Figure 1-13.

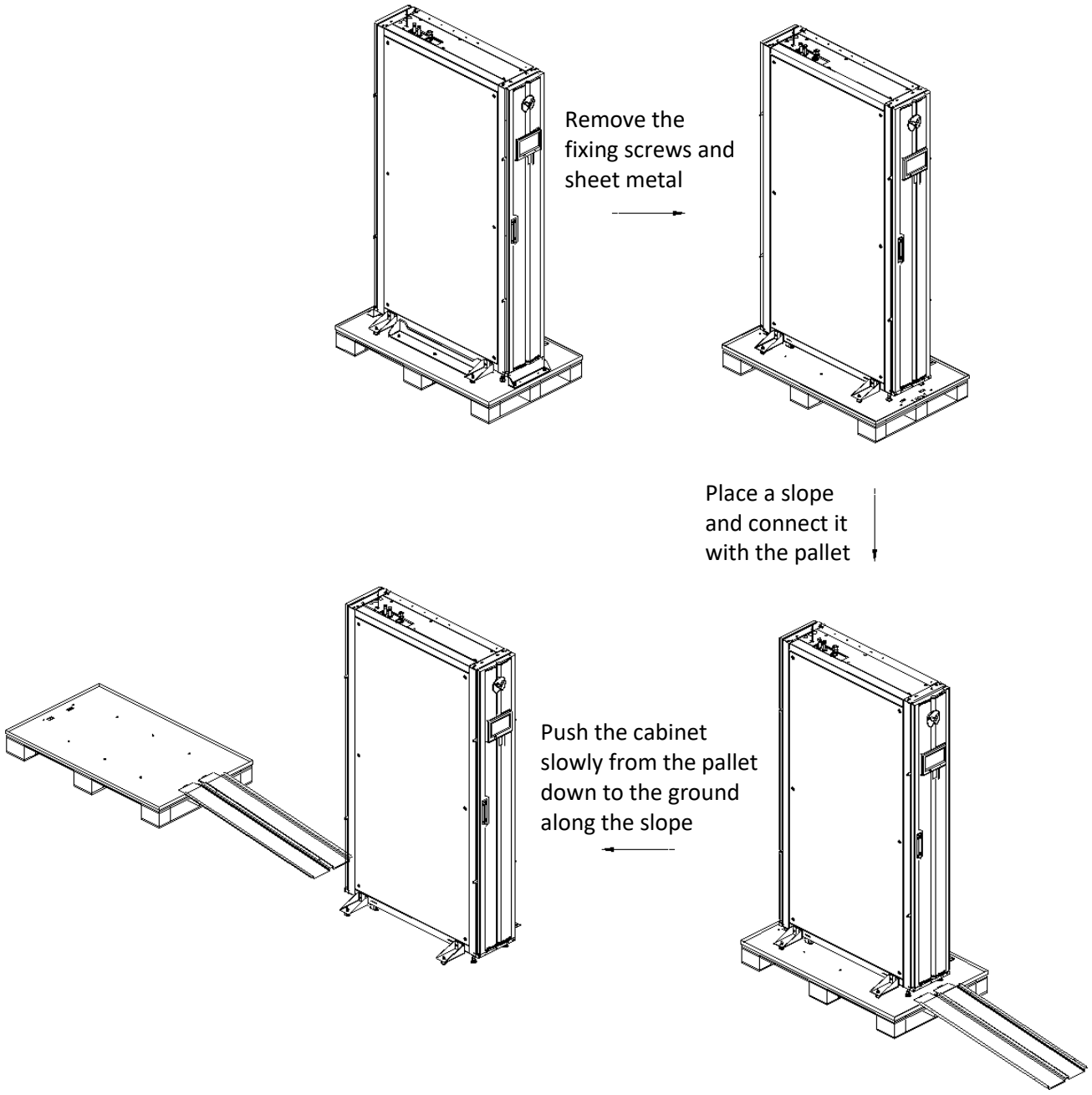


Figure 1-13 Ramp Unloading

1.7 Technical Specification

The detailed technical specifications which include the mechanical and the electrical details are mentioned in Table 1-7.

Table 1-7 Technical Specifications of the Unit

Parameters	Specifications		
Unit	CRD100	CRD101	CRD102
Model	CRD100-0D00A	CRD101-0D00A	CRD102-1D00A
Certification	UL		CE
Cooling Type	Air Cooled		
Cold Source Type	DX		
Refrigerant	R410A		
Compressor Type	Double rotor DC Inverter Compressor		
Flow Control	Electronic Expansion Valve		
Fan Type	EC Fan		
Air Filter	MERV8		G4
Air Discharge Baffles	Standard		
Drain Pump	Standard		
Air Pressure Switch	Standard		
Unity Card	Standard		
Remote Sensors	Standard		
Reheat	No		Standard
Matched with outdoor model	CCD100S-00A		CCD101S-00A

Chapter 2: 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.

NOTICE:

Before installing unit, determine whether any building alterations are required to run piping, wiring and duct work. Follow all unit dimensional drawings and refer to the submittal engineering dimensional drawings of individual units for proper clearances.

The Installation process consists of the following procedures, namely-

- Pre-installation
- Installation Preparation
- Mechanical Installation
- Electrical Installation

2.1 Pre-Installation

CRD10 precision air conditioner is an engineered equipment and requires installation works for which the preliminary preparation is very important. This chapter describes the pre-installation, including how to prepare the installation environment, space and reserve the maintenance space; the air conditioner running and storage environment requirement, and how to unpack and inspect.

NOTE: Please read this chapter carefully before installation.

Pre-installation contains the following 3 sub sections, namely-

- Transportation & Movement
- Unpacking
- Inspection

2.2 Installation Tools

Table 2-1 shows the standard tool sets and utilities used in the installation and maintenance process:

Table 2-1 Standard Tool Sets

Name	Drawing	Name	Drawing
Electric hand drill		Adjustable wrench	
Slotted screwdriver		Cross head screwdriver	
Stepladder		Forklift	
Drill		Wire cutting pliers	
Claw hammer		Diagonal cutting pliers	
Insulating shoes		Antistatic gloves	
Electrician knife		Cable ties	
Insulating tape		Insulating gloves	
Crimping pliers		Heat shrinkable tube	
Insulated torque wrench		Torque screwdriver	
Multimeter		Clip-on ammeter	

The tools mentioned in Table 2-1 are standard and commonplace; however, depending on various factors such as site environment, cables, installation equipment, and on-site electrical connections these tools may vary in a real-time scenario.

- Fasteners

The fasteners are shown in the Figure 2-1.

Floating nut M5 countersunk head screw M6 panel screw M6 panel head screw Cable tie fixture kit

Figure 2-1 Fasteners

The fastener nuts and their usage are shown in Table 2-2.

Table 2-2 Fitting Utilities

Fasteners	Usage
Floating Nut	Used together with the M6 screw, used to install the parts in the cabinet
M5 Countersunk Head Screw	Used to install the cabinet connector
M6 Panel Screw	Used to install the power distribution unit, monitoring system, & User equipment
M6 Pan Head Screw	Used to connect and fix the frame
M6 Flange Nut	Used together with the M6 Pan head screw, used to install the L Fastener
Adhesive Tape	Used to seal the gap between the connected frames
Cable Tie Fixture Kit	Used to fix & bind the cables

2.3 Prerequisite Arrangements

The cables routed from the room to the CRD10 unit and the circuit breakers must be prepared at the customer's site or obtained by the customer; the specifications for the site preparation are given in the Table 2-3.

Table 2-3 Prerequisite Materials Requirements

Parts	Specifications
Input power supply cables	Please refer to FLA (MCA) of the Unit
System Grounding cables	Please prepare the yellow/Green cable
Liquid copper pipes	Please refer to pipe connection of Unit
Gas copper pipes	Please refer to pipe connection of Unit
External drainage pipe	External drainage pipe with screws, please refer to drainage pipe connection.

2.4 Transportation & Movement

WARNING! Risk of top-heavy unit falling over. Improper handling can cause equipment damage, injury or death. Read all of the following instructions and verify that all lifting and moving equipment is rated for the weight of the unit before attempting to move, lift, remove packaging from or prepare the unit for installation.

WARNING! Risk of unsecured unit rolling off pallet. Can cause equipment damage, injury or death. The unit is on casters. Ensure that the unit/pallet is located on a flat surface before loosening the hardware securing the to its shipping pallet.

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.

NOTICE!

Risk of doorway/hallway interference. Can cause unit and/or structure damage. The unit may be too large to fit through a doorway or hallway while on the skid. Measure the unit and passageway dimensions, and refer to the installation plans prior to moving the unit to verify clearances.

NOTICE!

Risk of damage from forklift. Can cause unit damage. Keep tines of the forklift level and at a height suitable to fit below the skid and/or unit to prevent exterior and/or underside damage.

NOTICE!

Risk of improper storage. Can cause unit damage.

Keep the unit upright, indoors and protected from dampness, freezing temperatures and contact damage.

Transportation by rail or by ship are the preferred options for the units. If transport by rail or by ship is unavailable, transport by road is recommended. When selecting road transport, roads without too many bumps are highly recommended.

- Liebert CRD10 unit is heavy, it is recommended to use the mechanical equipment like electrical forklift to move the unit.
- Move the equipment to the location near the installation site.
- If an electric forklift is used, insert the tines of the forklift below the pallet as displayed in Figure 2-2.
- Figure 2-2 shows how the forklift tines are inserted underneath the pallet and shows in the same picture below the illustration to the right that the lines should be aligned with the center of gravity to prevent the

equipment from falling over.

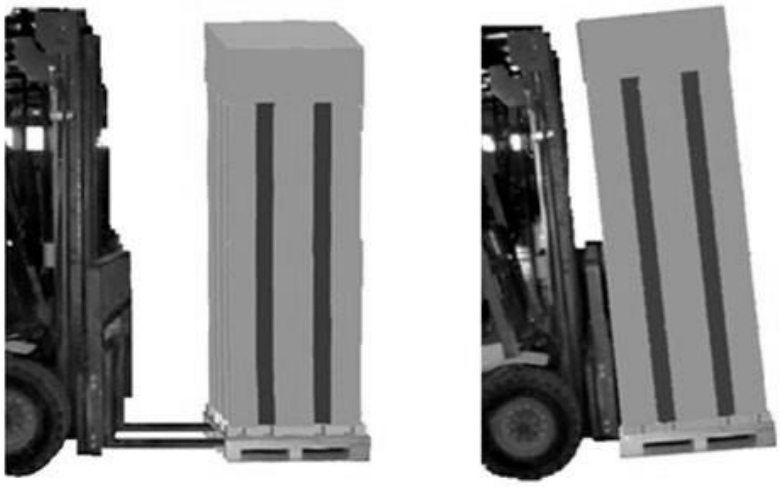


Figure 2-2 Moving the Equipment using a Forklift Truck

While moving the indoor unit, keep the obliquity within the range of 75° to 105°, as shown in Figure 2-3.

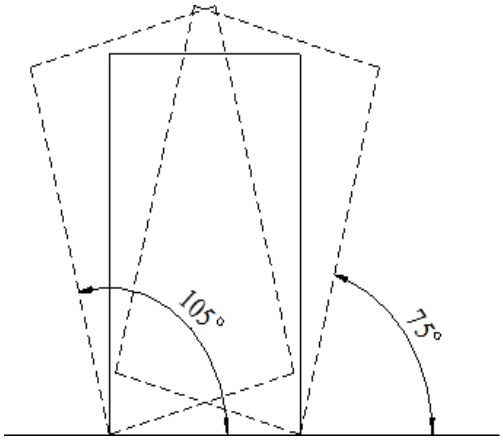


Figure 2-3 Obliquity of the System

2.5 Unpacking

Shift the product to a location closer to the final installation site prior to unpacking the unit. Open all the latches on the shipping crate, then remove top and later wooden panels of shipping crate as depicted in Figure 2-4.

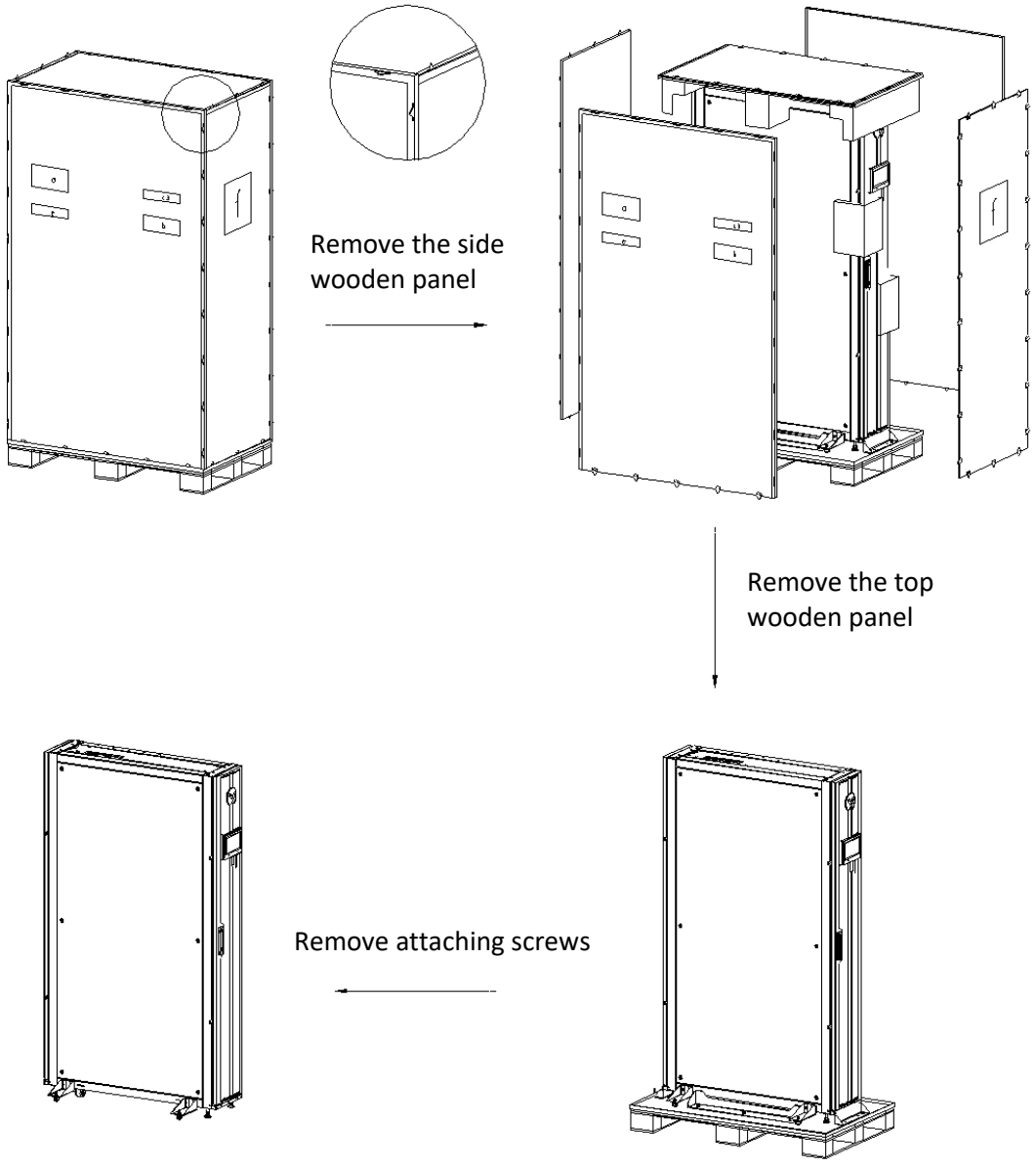


Figure 2-4 Unpacking the Outer Package

Take care of the center of the gravity.

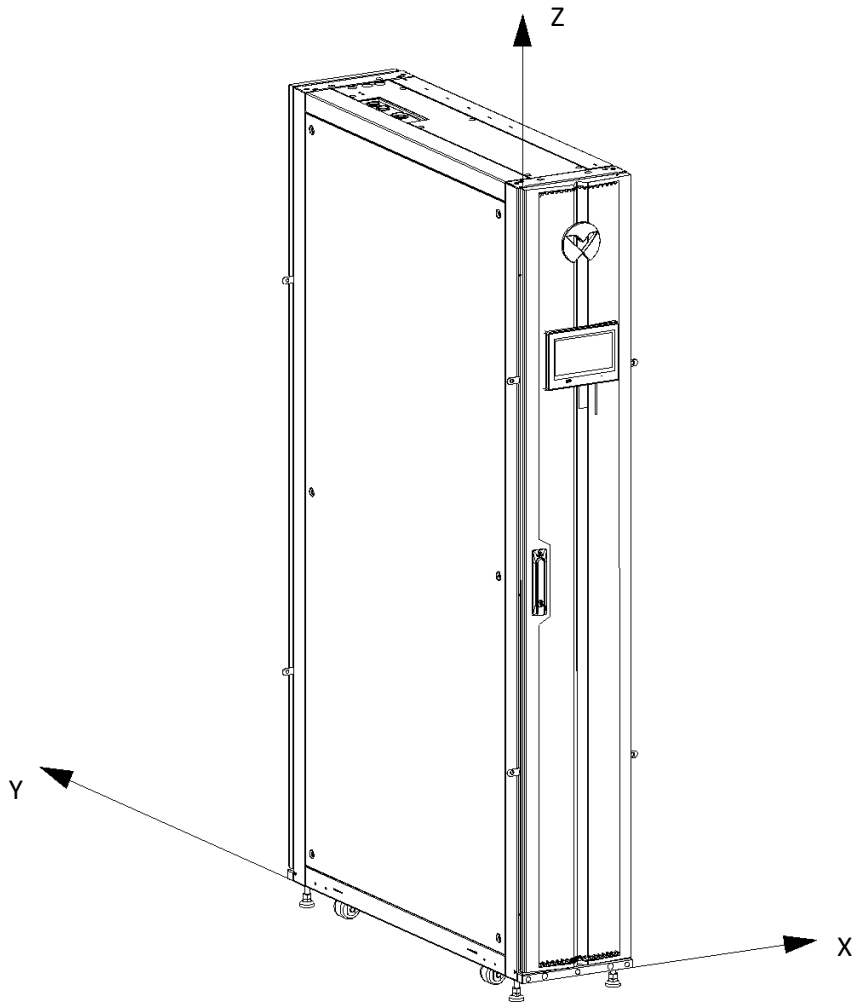


Figure 2-5 Axis of Coordinates

CENTER OF GRAVITY ±10mm (0.4in.)		
X	Y	Z
150mm (5.9in.)	550mm (21.7in.)	970mm (38.2in.)

- Inspection

Moving forward, check the system fittings and its components against the packing list to ensure that everything is in place and the assembly is intact. If any parts or components are missing or damaged, immediately report the issue to the carrier and the local office of Vertiv at the earliest.

2.6 Installation Preparation (Site Preparation)

The CRD10 models of air conditioners are streamlined for maintaining a favorable environment for data centers, computer rooms, and similar systems. Strict adherence to the installation procedures is mandatory to ascertain proper installation of the air conditioner.

2.6.1 Equipment Room Requirement

The equipment room must be prepared to ensure smooth operation and obtain accurate results. The equipment room must meet the standards for appropriate ventilation and heating. The design specifications for the air conditioners must be ideal and should be-in-line with energy-efficient design standards. Following are the requirements for maintaining a favorable room environment prior to installation:

1. The equipment room should be well insulated and have a sealed damp-proof layer.

2. The outdoor air entering in should be kept at a minimum. The outside air will add the loads of heating, cooling, humidifying, and dehumidifying of the system. It is recommended that the inhalation of outside air be kept below 5% of the total indoor airflow.

3. All the doors and windows should be properly sealed to minimize the leakage. The seams should be as narrow as possible.

NOTES:

- **Vertiv recommends defining the site preparation as per the requirements. However, if these requirements are not met, the site must be rectified to meet the specified requirements and conditions.**
- **If the recommended rectifications or modifications are not implemented, then Vertiv does not guarantee the accuracy and precision of the temperature and humidity provided by the Liebert CRD10 models.**
- **An important aspect to be considered is that the indoor unit must not be used for the outdoor environment.**

2.6.2 Installation Space Requirements

The Liebert CRD10 models are advanced precision air cooling units and therefore, air conditioners must be installed, preferably in a row of cabinets with high heat density and in a hot aisle and cold aisle arrangement. Allocate space to make it accessible to qualified service staff for repair, maintenance and service.

A minimum space of 600mm[23.6in.] must be assigned for maintenance at the front of the system and at the rear of the system. The allocated space is to facilitate regular maintenance tasks such as removing filters for cleaning, fans or compressor. Figure 2-6 shows the space allocation for servicing and maintenance.

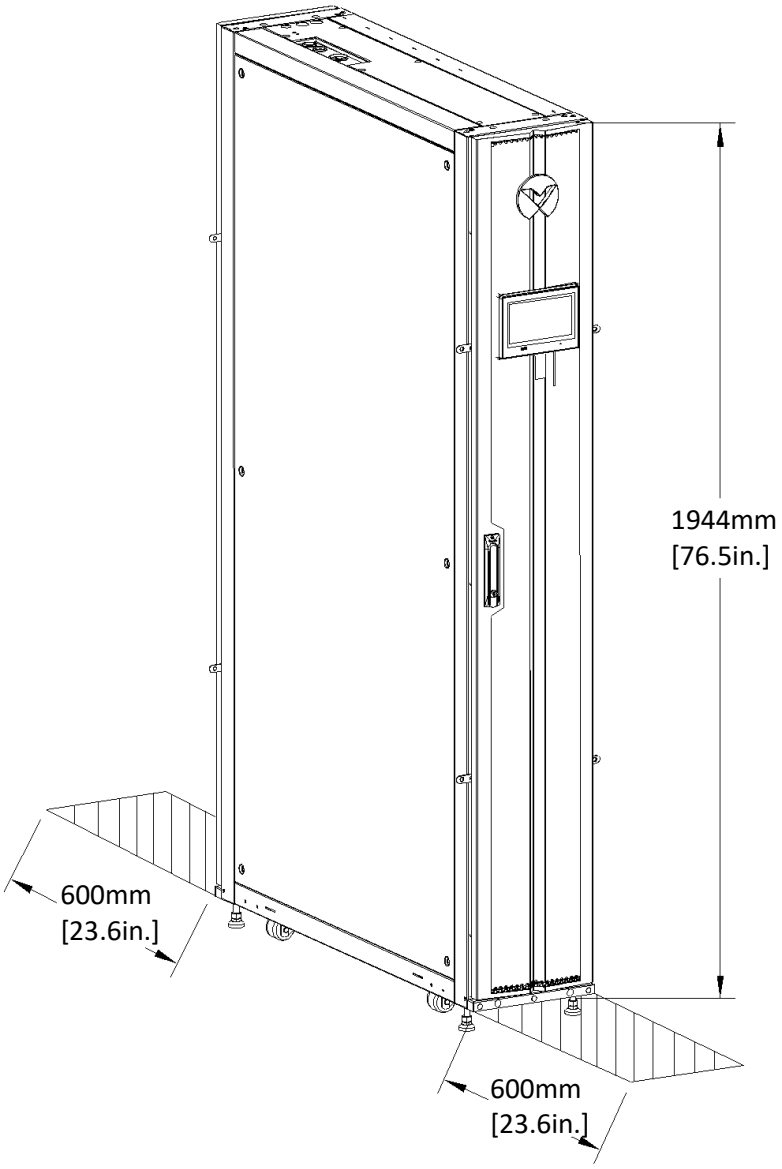


Figure 2-6 CRD10 Maintenance Space

2.7 Operating and Storage Environment Conditions

In this section, take a look at the environmental conditions including the Operating and Storage environment.

2.7.1 Operating Condition

Table 2-4 defines the operating condition parameters including the ambient temperature, protection level, altitude and voltage range.

Table 2-4 Operating Parameters

Item	Requirement		
Ambient temperature	Indoor: Temperature 18°C (64.4F) to 40°C (104F), Relative humidity 17% to 60% Outdoor: Temperature -15°C (5°F) to 45°C (113°F) without Low Ambient Kit Temperature -34°C (-29.2°F) to 45°C (113°F) with Low Ambient Kit		
Protection level	Indoor Unit: IP20, Outdoor Unit: IPX4		
Altitude	< 2000m(6561.6ft.). Above that, please contact Vertiv		
Operation voltage range	CRD100-0D00A	CRD101-0D00A	CRD102-1D00A
	208/230V/1PH/60Hz	208/230V/3PH/60Hz	230V/1PH/50/60Hz

2.7.2 Storage Condition

Table 2-5 defines the Storage condition parameters including the ambient humidity, ambient temperature, and storage time conditions.

Table 2-5 Storage Parameters

Item	Requirement
Storage environment	Indoor, clean (without dust)
Ambient humidity	< 95%RH @ 30°C(86F)
Ambient temperature	-40°C (-40F) to 70°C(158F)
Storage time	Total transportation and storage time should not exceed six months. Otherwise, the performance needs to be re-calibrated

2.8 Weight Bearing Capacity

The CRD10 unit is installed on the floor of the computer room, Therefore, the weight bearing capacity of the floor of the computer room must be taken into consideration.

If the weight bearing capacity cannot be estimated, consult Vertiv or the customer service/support center.

2.9 Refrigerant Charging Requirement

The CRD10 unit has a specifically designed air conditioning system that requires a desired pre-specified quality of refrigerant (R410A) to perform continuously at the most optimum efficiency. For the details on the quantity of refrigerant to be charged inside the system please refer to the installation section.

NOTE: Do not use refrigerant of inferior quality, Vertiv does not assume responsibility for warranty or any consequences resulting from using inferior quality refrigerant.

2.10 Inspection

NOTES:

- **To ensure that everything is in its designated position and that the entire product assembly is intact, check the system fittings and their components against the packing list.**
- **Check that the fittings are complete and the components are intact against the packing list. Please report immediately to the carrier's local offices and Vertiv if any parts are missing or damage is found.**

Chapter 3: Mechanical Installation

To achieve optimum performance and prolong product life, proper installation is important. In this section, the mechanical installation will be discussed in detail to help the personnel with the installation process. Before proceeding with the mechanical installation, the following 3.1 installation notes need to be considered.

3.1 Installation Notes

1. Prior to installation, ensure that the installation preparations have been carefully read and implemented as per the requirement (refer to section 2.6 on 'Installation Preparation' for the details). Check if any modifications are made to the plumbing, wiring, or ventilation facility before mounting the equipment. After considering the installation preparations, proceed to the next step in the installation process and finally set up the system.

2. The CRD10 is designed as a split system. The indoor unit must be installed on the floor of the equipment room or computer room. The outdoor unit must be installed outdoors or on the floor of the other rooms as per the building architecture.

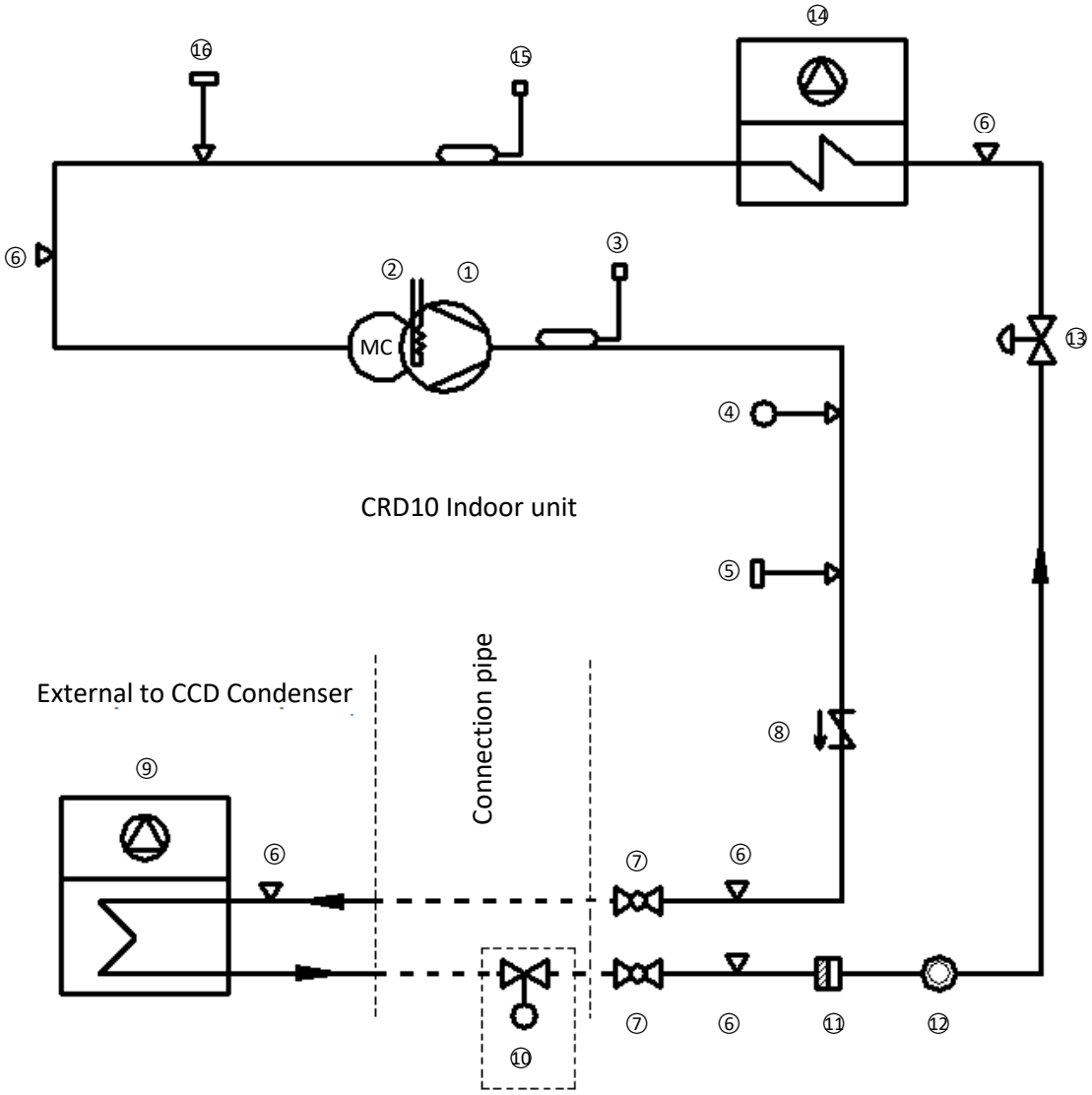
3. Industry-wide standards are followed for the selection, layout, and fixing of pipes.

4. During the design and installation process, various factors such as pressure drop, compressor oil return, noise reduction, and vibration must be considered.

5. When installing the equipment, follow the design drawings strictly. Reserve space as per the maintenance and serviceability instructions in the Chapter 2, section 'Installation Preparation'. The manufacturing engineering dimension drawings must be taken as a reference while installing the equipment.

3.2 System Arrangement during Installation

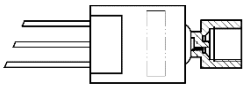
The general arrangement of the CRD10 air cooled AC unit is shown in Figure 3-1, and the Table 3-1 shows the calibration of safety components.



Pos.	Description	Pos.	Description
1	Compressor	9	Air Cooled Condenser
2	Crankcase Heater	10	Solenoid Valve (Connection on site)
3	Discharge Temperature Sensor	11	Filter Drier
4	High Pressure Switch	12	Sight Glass
5	High Pressure Transducer	13	Electronic Expansion Valve
6	Schrader Valve	14	Evaporating Coil
7	Ball Valve	15	Suction Temperature Sensor
8	Check Valve	16	Low Pressure Transducer

Figure 3-1 System Arrangement of the Unit System

Table 3-1 Calibrations of electrical components

Refrigeration Circuit Item No	Component	Setting	Notes	Contact
4	High Pressure Switch	Open 4.1±0.1MPa Close 3.3±0.1MPa		Normally Closed
5	High Pressure Transducer	Range 0-4.5MPa 0.5-4.5VDC		-
16	Low Pressure Transducer	Range 0-1.73MPa 0.5-4.5VDC		-
-	Clogged Filter Different Pressure Switch	Set Point Range 50-400Pa		Normally Closed

3.3 Product Dimensions

The dimensions and weight of the indoor unit are shown in Figure 3-2 and in Table 3-2.

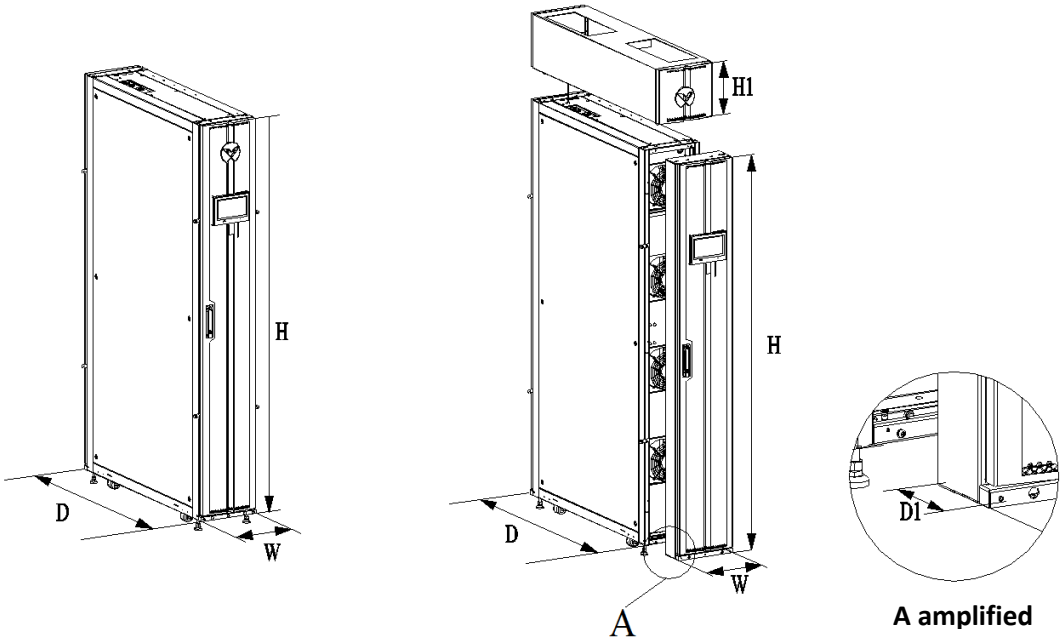


Figure 3-2 Dimensions of the Indoor Unit

Table 3-2 Dimension of the Indoor Unit

Model	H (mm/in.)	H1 (mm/in.)	D (mm/in.)	D1 (mm/in.)	W (mm/in.)	Net weight (kg/lb)	Gross weight (kg/lb)
CRD100-0D00A	2000/78.7	267/10.5	1132/44.6	100/3.9	300/11.8	231/509	313/690
CRD101-0D00A							
CRD102-1D00A							

Note: H1 and D1 dimensions are associated with optional frame extension kits allowing CRD10 to match rack heights or depths.

3.3.1 Base Plate Pipe Outlet Location & Dimensions

The locations of the pipe inlets and outlets on the unit base plate are shown in Figure 3-3 and corresponding dimensions of the base plate pipe outlet are tabulated in Table 3-3.

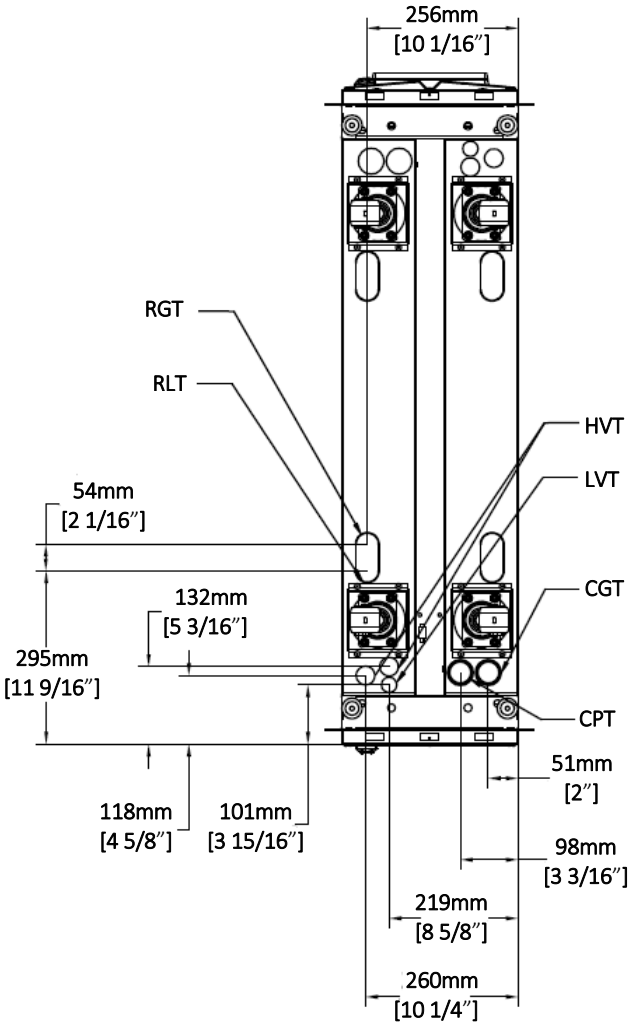


Figure 3-3 Base Plate Location for Pipe Outlets

Table 3-3 Dimensions of Base Plate Pipe Outlet (mm/inch)

UNIT BOTTOM CONNECTIONS		CRD10
RLT	Refrigerant Liquid Line Inlet	1/2" O.D. Copper
RGT	Refrigerant Gas Line Outlet	5/8" O.D. Copper
CPT	Condensate Pump	NPT 1/2"(Rc1/2”) Female copper threaded joint
CGT	Condensate Gravity	NPT 1/2" (Rc1/2”) Female copper threaded joint
HVT	High Voltage Bottom Connection	Combination Knockout
		1-1/8" (29 mm)
LVT	Low Voltage Bottom Connection	Knockout Hole Diameter
		7/8" (22 mm)

NOTE: NPT threaded joint is for UL model, Rc threaded joint is for CE model.

3.3.2 Top plate pipe outlet Locations & Dimensions

The locations of the pipe inlets and outlets on the unit top plate are shown in Figure 3-4 and corresponding dimensions of the top plate pipe outlet are tabulated in Table 3-4.

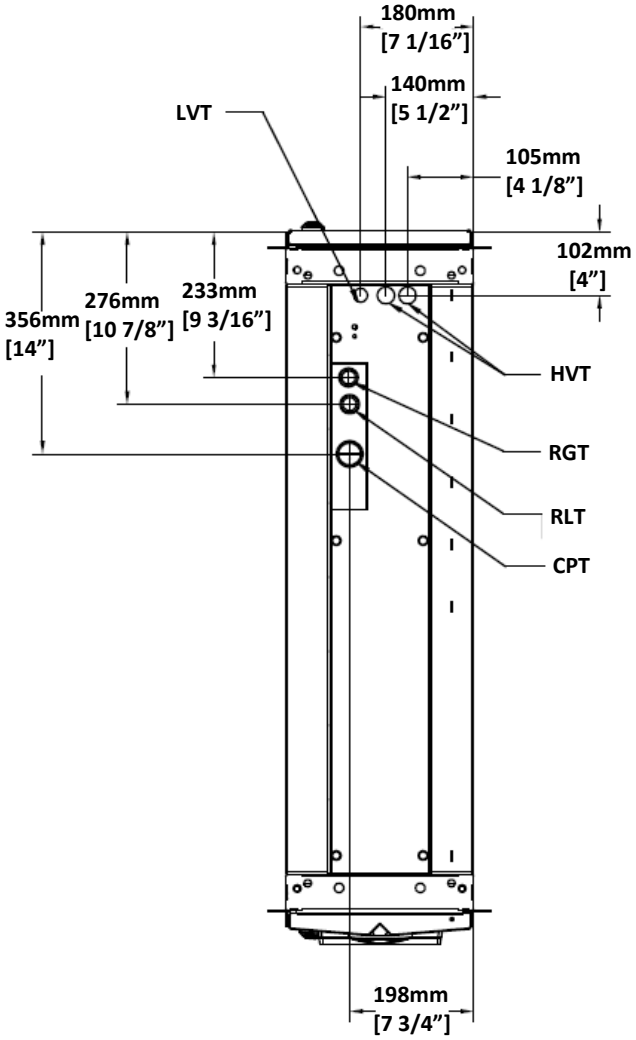


Figure 3-4 Top Plate Locations for Pipe Outlets

Table 3-4 Dimension of Top Plate Pipe Outlet (mm/inch)

UNIT TOP CONNECTIONS		CRD10
RLT	Refrigerant Liquid Line Inlet	1/2" O.D. Copper Sweat
RGT	Refrigerant Gas Line Outlet	5/8" O.D. Copper Sweat
CPT	Condensate Pump	NPT 1/2" (Rc1/2”) Female copper threaded joint
HVT	High Voltage Top Connection	Combination Knockout
		1-1/8" (29 mm)
LVT	Low Voltage Top Connection	Knockout Hole Diameter
		7/8" (22 mm)

NOTE: NPT threaded joint is for UL model, Rc threaded joint is for CE model.

3.3.3 Front Air outlet Locations and Dimensions

The location and dimensions of the air outlet at the front are shown in Figure 3-5.

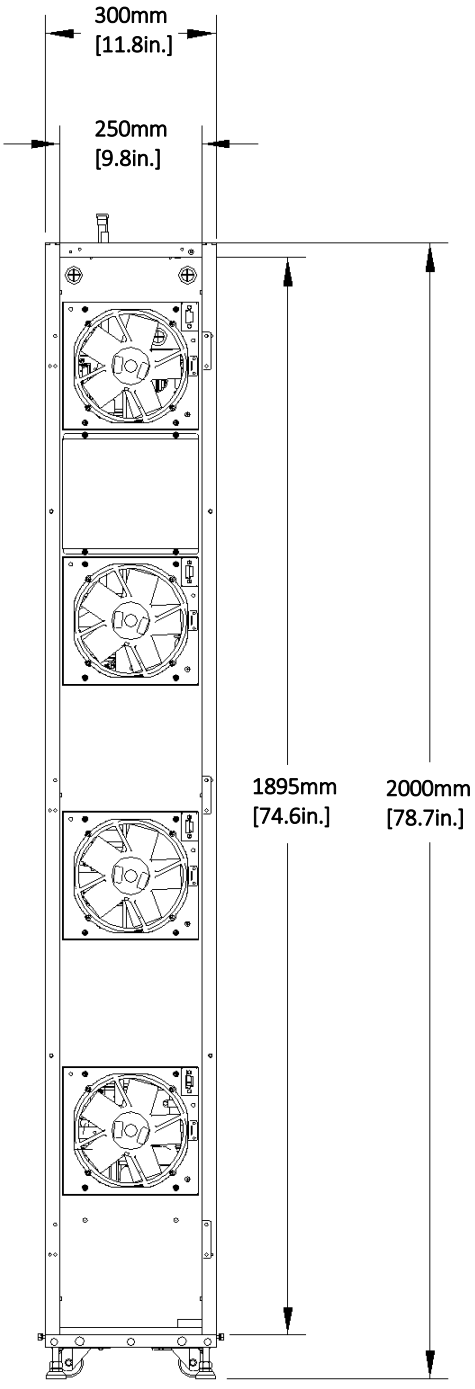


Figure 3-5 Front Air Outlet Locations & Dimensions

3.4 Top frame and front frame

The CRD10 unit can be optionally field configured with a top frame and a front frame. The top frame and front frame are installed as follows.

3.4.1 Top frame installation without front frame

The 267×1132mm (10.5×44.6in.) specification top frame installation does not require the front frame to be installed, and the top frame can be directly installed. The installation method is as follows in figure 3-6.

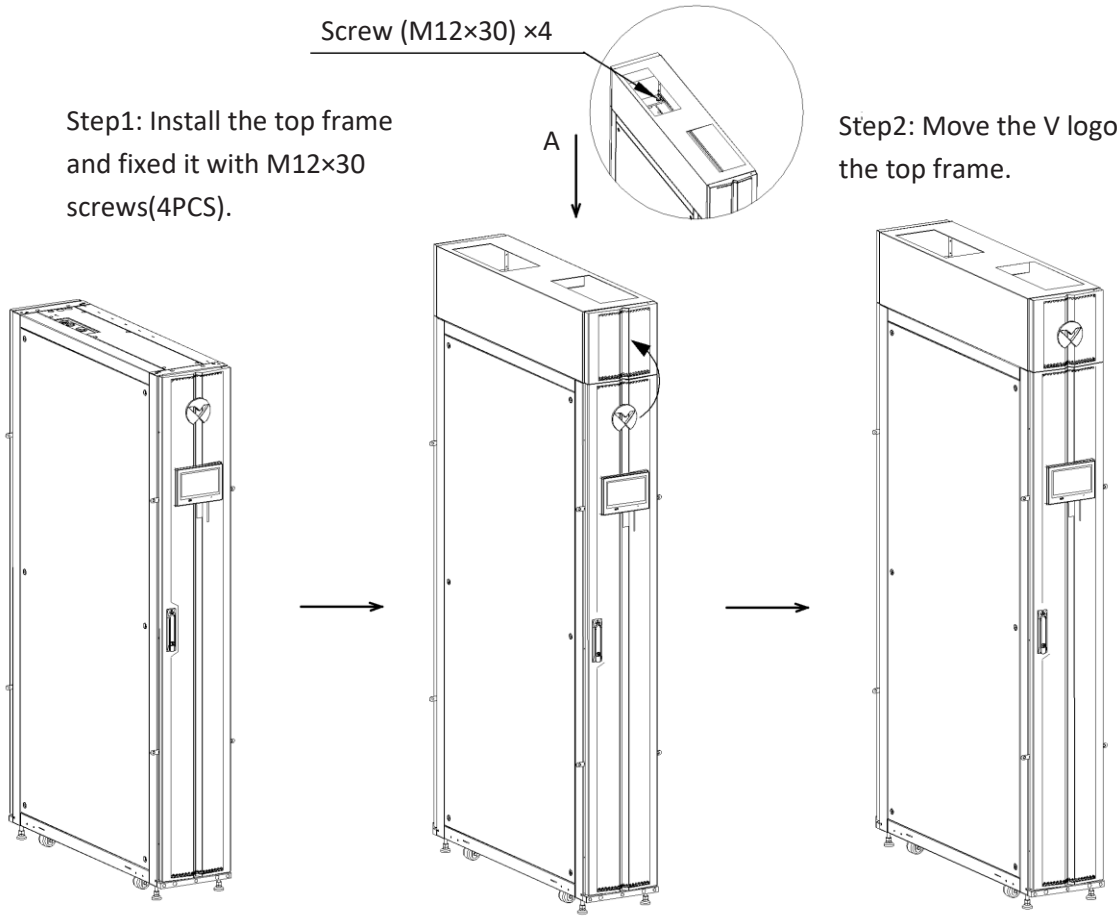


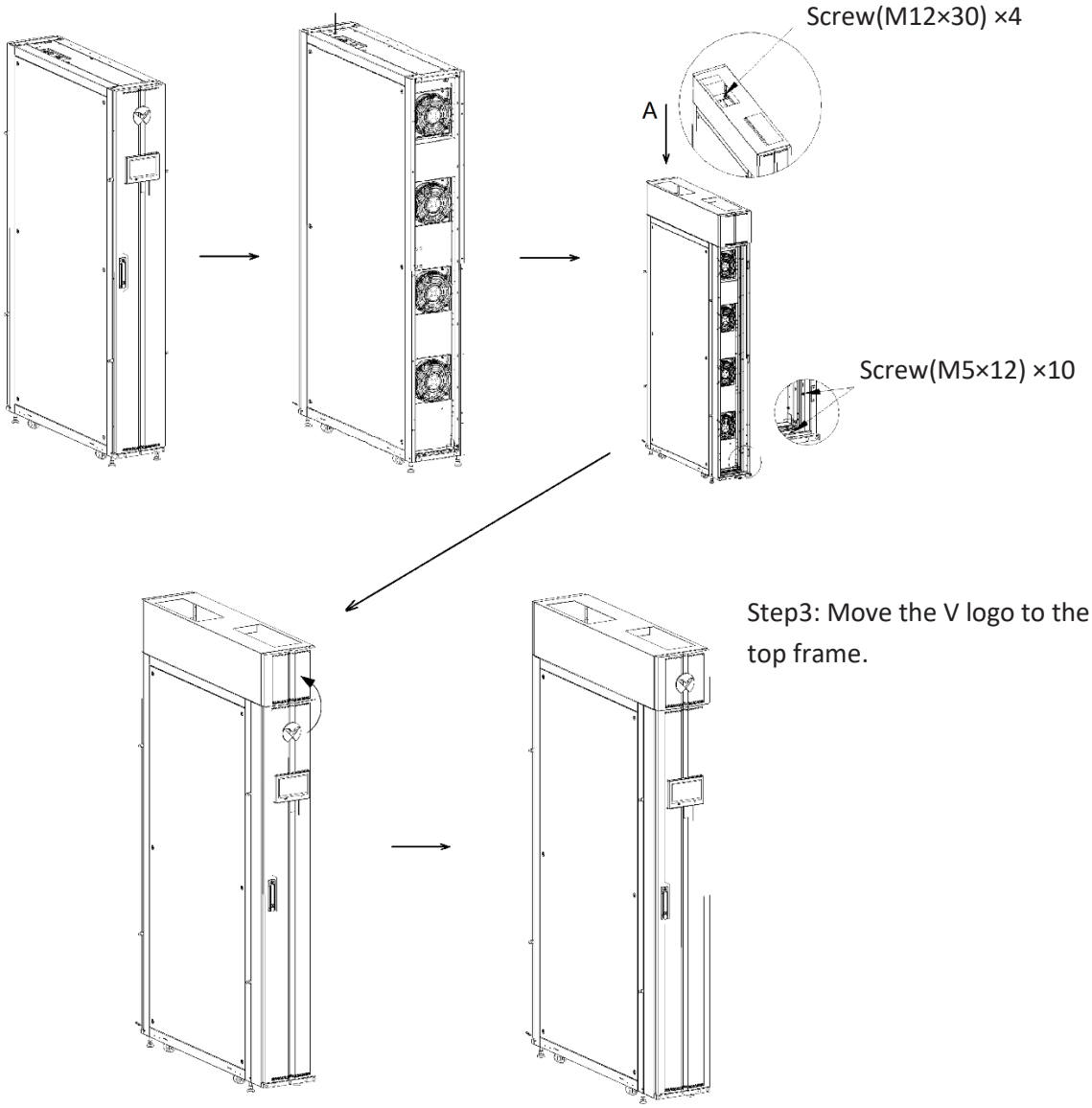
Figure 3-6 Top frame installation without front frame

3.4.2 Top frame installation with front frame

When installing the 267×1232mm (10.5×48.5in.) specification top frame, the front frame needs to be installed at the same time. The installation method is as shown in figure 3-7. The door is linked to the cabinet by hinges, and the display and foot rail is fixed with screws. To remove them, pull out the hinges and loosen the screw.

Step1: Remove front door, display and foot rail from the unit.

Step2: Fix front frame with M5×12 screws(10PCS). And fix the top frame with M12×30(4PCS) as well. Then install back the front door, display and foot rail.



Step3: Move the V logo to the top frame.

Figure 3-7 Top frame installation with front frame

3.5 System Installation Layout

The installation modes of the CRD10 unit are shown in Figure 3-8 and 3-9.

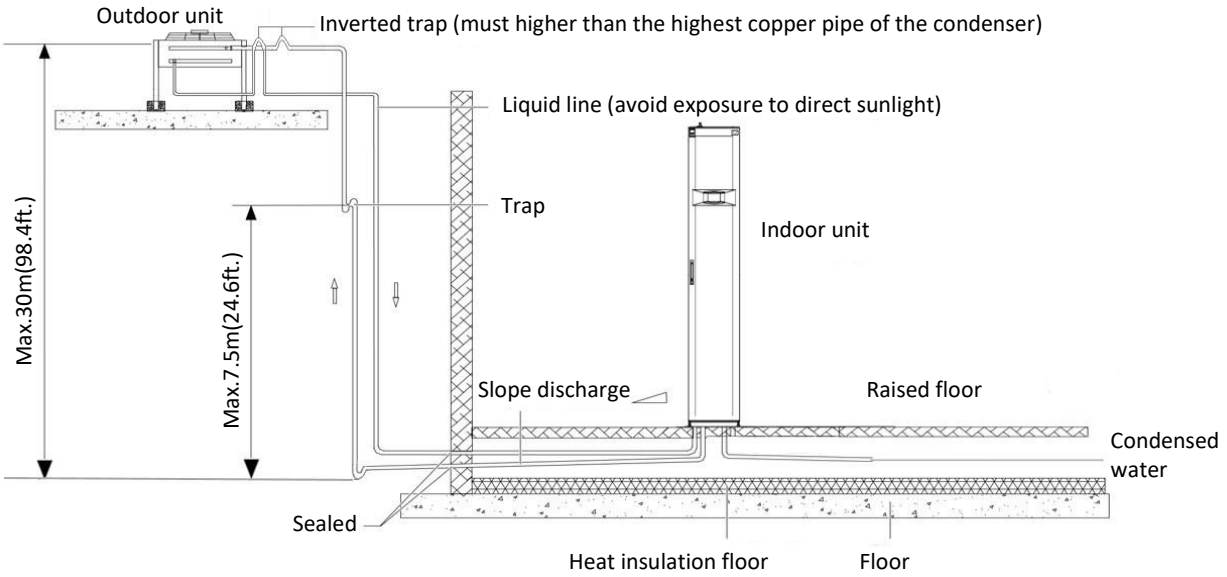


Figure 3-8 Condenser is Placed Higher than the Compressors during Installation

In Figure 3-8, the condenser is installed higher than the compressor. Therefore, an inverted trap is fitted to the discharge line and the liquid line of the condenser. The inverted trap is essential as it helps prevent the liquid refrigerant from flowing back once the condenser stops. The top end of the inverted trap must be installed higher than the ultimate level of the copper pipe of the condenser. Recommended the minimum height difference is 150mm (5.9in.). A trap must be installed every 7.5m(24.6ft.) of the vertical discharge line.

However, if the condenser is installed lower than the compressor, then no modification is required. Figure 3-9 shows the schematic diagram of system installation when the condenser is installed at a lower level than the compressor. If using low ambient kit when mounting condenser below level of the indoor unit, the allowable height refers to Table 3-5.

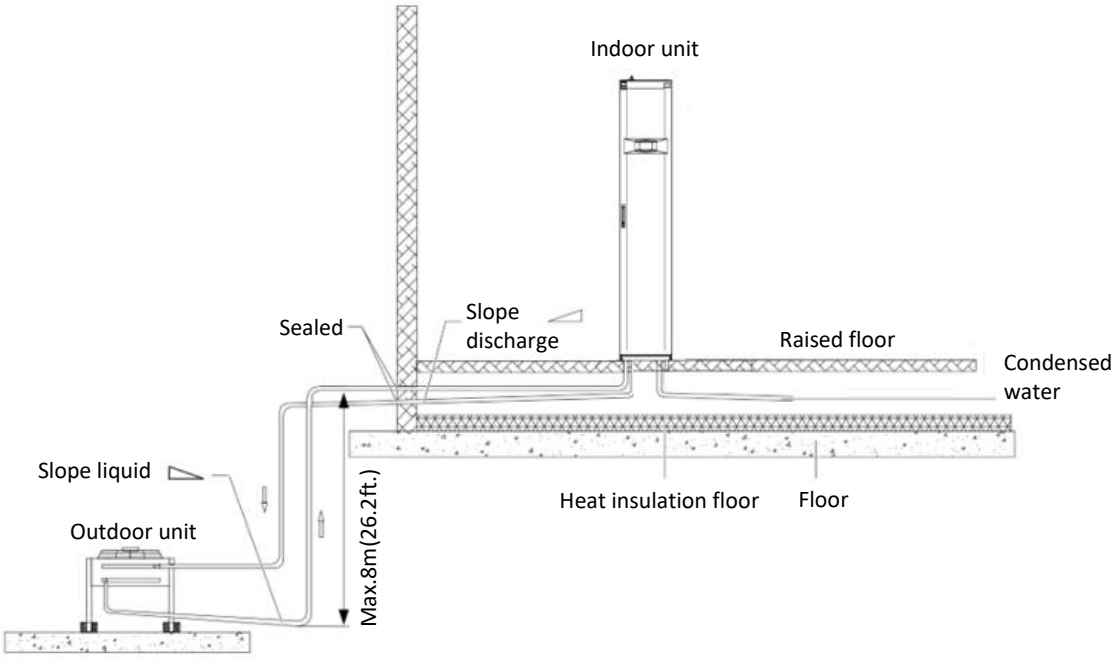


Figure 3-9 The Condenser is Lower than the Compressor during Installation

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

Table 3-5 Vertical Distance between Condenser and Indoor Unit

Positioning of the Outdoor Unit		Height						
Outdoor unit is higher than the Indoor unit		Maximum: +30m (98.4ft.)						
Outdoor unit is lower than the indoor unit		Maximum: -8m (-26.2ft.)						
Outdoor unit with Low Ambient Kit is lower than the indoor unit	Piping Equivalent Length m(ft.)	10(33)	15(49)	30(99)	45(147)	60(197)	75(246)	91(300)
	Max. Height m(ft.)	-5(-16)	-4.7(-15)	-3.7(-12)	-2.8(-9)	-1.9(-6)	-1(-3)	0(0)

3.6 Installation Procedures

The CRD10 models of air conditioners are used between racks and one side of it is adjacent to the server cabinet. The CRD10 models of air conditioners are targeted for small-and-medium data centers, computer rooms, and similar systems.

3.6.1 Leveling the Cabinet

Once all the components of the cabinet have been installed, level the cabinet. The following section is a step-by- step illustration of the process of leveling the cabinet.

1. Place the cabinet at the desired location (preferably an open ground). Use a movable wrench to loosen the fixing nuts on the four foot bolts in a clockwise direction.

2. Rotate the hexagonal bolts at the bottom of the feet in the clockwise or counterclockwise direction until the feet rise or fall to a suitable position. Use a gradient measuring tool to ensure that the cabinet is in a uniform level state. Refer to the Figure 3-10 to understand the process better.

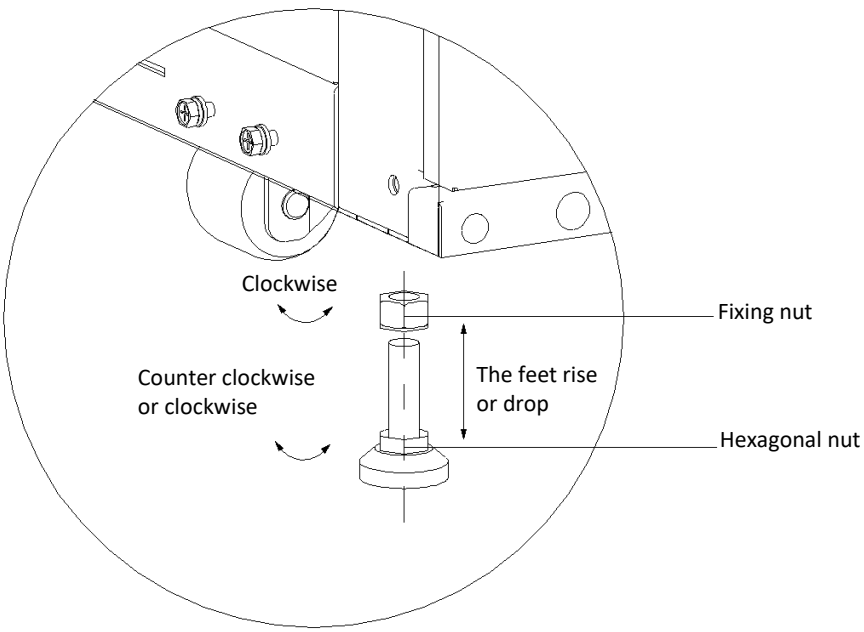


Figure 3-10 Leveling the Cabinet

3. Screw down the fixing nuts on the feet bolts counter-clockwise and the leveling gets completed. If the machine room has a mounting bracket, and its width does not exceed 30mm, remove the feet and fix the cabinet onto the mounting bracket.

3.6.2 Removing the Feet and Fixing the Cabinet

NOTE: Before removing the feet and eventually fixing the cabinet, it is vital that 2 Technicians will be required for this operation to avoid personal injury and cabinet damage.

Follow the instructions to remove the feet and fixing the cabinet;

- Removing the feet: Use a movable wrench to loosen the fixing nuts on the four feet bolts in a clockwise direction. Rotate the hexagon bolts at the bottom of the feet clockwise until the feet drops from the cabinet frames.

- Fixing the cabinet: As shown in Figure 3-11, the cabinet provides two holes (diameter: 13.5 mm) on top, bottom, front and rear respectively.

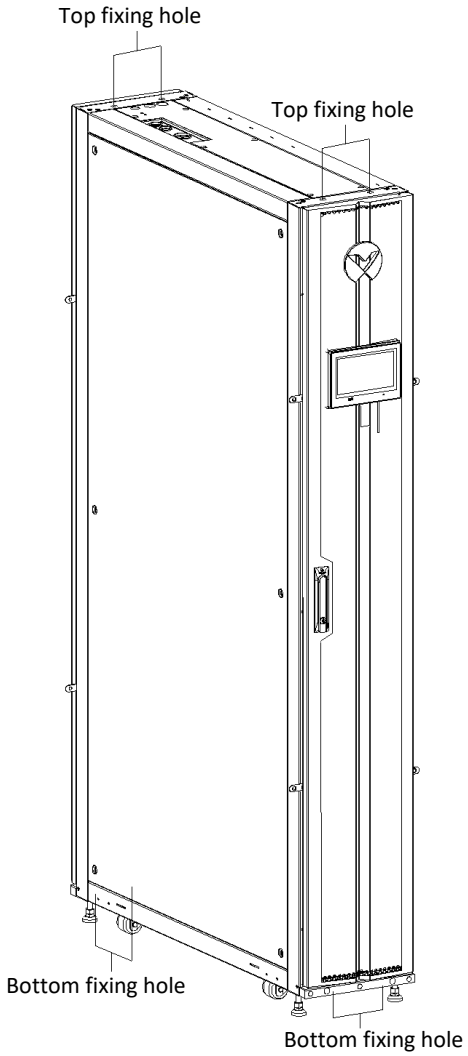


Figure 3-11 Fixing Holes of the Cabinet

Install bolts in the four holes at the bottom to fix the cabinet onto the floor bracket of the equipment room. Install bolts in the four holes at the top to fix the cabinet to connect the cabinet with the top bracket of the machine room.

3.7 Cabinet Connection

The cabinet connectors come along with the accessories. Connect the unit with adjacent cabinets using the cabinet connectors. Refer the following procedures for connecting the cabinet.

NOTE: Before connecting the cabinet, level the cabinet as mentioned in the earlier section (for more details, refer to section 3.6.1 "Leveling the Cabinet").

1. Loosen the fixing screw of the cabinet connector on the frame of the cabinet. Rotate the cabinet connector to 90° horizontally. Use M5 countersunk head screws to fix it on the cabinet frame (side of the door lock)as shown in Figure 3-12.

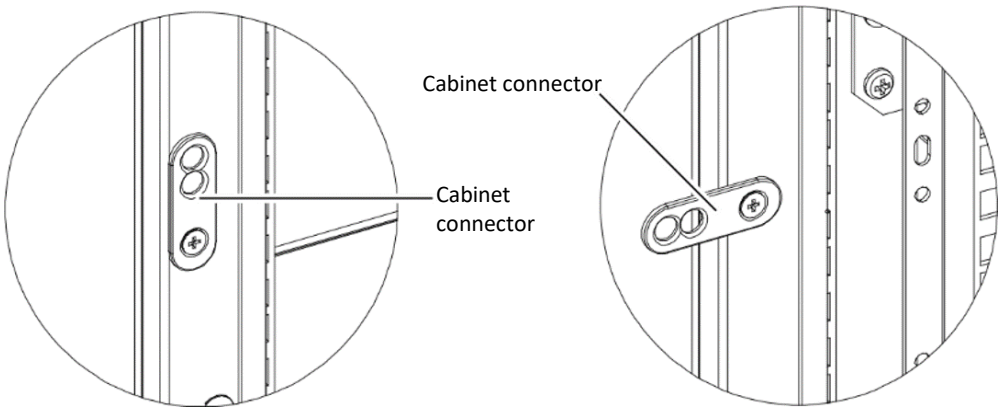


Figure 3-12 Rotating the Cabinet Connector

2. Use the M5 countersunk head screws to fix the cabinet connector (L-shaped) in the installation holes of the cabinet frame (side of the hinge) and rack frame adjacent to the cabinet as shown in Figure 3-13.

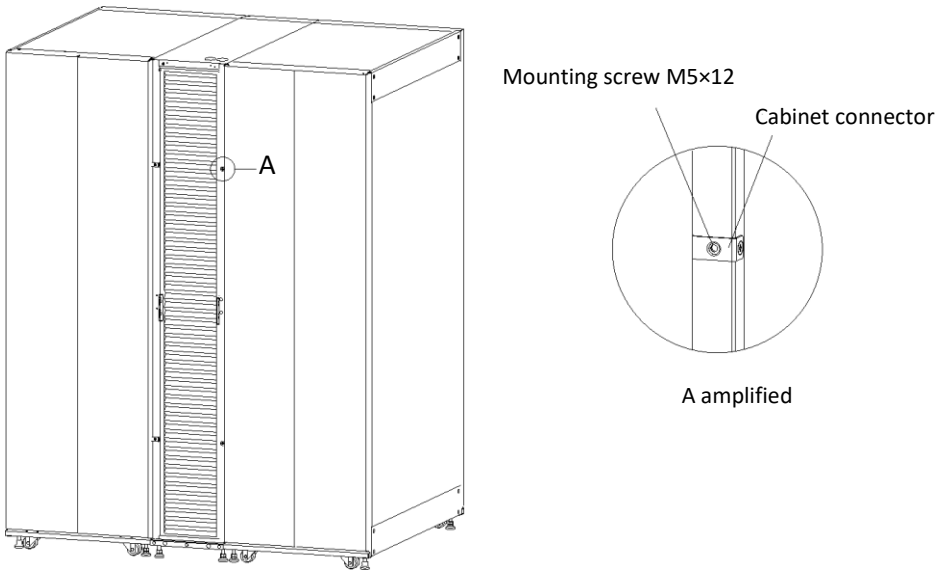


Figure 3-13 Schematic Diagram for Connecting the Cabinet

3. Repeat step 1 and 2 to Install the other 6 cabinet connectors based on the same method.

3.7.1 Piping Connections

WARNING! Risk of over-pressurization of the refrigeration system. Can cause explosive discharge of high-pressure refrigerant, loss of refrigerant, environmental pollution, equipment damage, injury, or death. This unit contains fluids and gases under high pressure. Use extreme caution when charging the refrigerant system. Do not pressurize the system higher than the design pressure marked on the unit's nameplate.

The pipes to be included in the piping process of the AC are listed below:

- Condensed water drainage pipe of the indoor unit
- Connection of the copper pipe (discharge pipe and liquid pipe) between the indoor unit and outdoor unit
- Liquid line solenoid valve kit

NOTES:

- **On-site pipeline connection must be completed by qualified technician.**
- **On-site pipeline connection must comply with local regulations, such as ASHRAE 15, CSA B52 and local construction laws.**
- **Pipeline welding will cause overheating of the pipeline and open flame. If the installation environment does not allow, installation is prohibited. The installation environment must be free of combustible materials to avoid fire.**

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

- **All the joints of the refrigerating pipes must be silver-brazed.**
- **Use a flow of dry nitrogen through the piping during brazing to prevent formation of copper oxide scale inside the piping. When copper is heated in the presence of air, copper oxide forms. PVE oils will dissolve these oxides from inside the copper pipes and deposit them throughout the system, clogging filter driers and affecting other system components.**
- **A pure dry nitrogen flow of 1-3 ft^3/min (0.5-1.5 l/s) inside the pipe during brazing is sufficient to displace the air. Control the flow using a suitable measuring device.**
- **The selection, layout, and fixing of the pipes must conform to the industry standards and norms.**
- **Vacuum pumping and refrigerant charging operations, and procedures must conform to the industry standards.**
- **Pressure drop, compressor oil return, noise return, and vibration must be considered during the designing and installation process.**

3.7.2 Removing Filters

Before the connection of the pipes in the indoor unit, the filters need to be removed:

1. Open the rear door of the cabinet to reveal the 2 filters, namely- the top and bottom filters.
2. Next, proceed to remove the fixing flake of the top filter. Before the fixing flake is removed, the screws of the flake must be loosened. Then, remove the fixing flake, followed by removing the top filter.
3. Repeat step 1-2 to remove the bottom filter. Figure 3-14 shows the fixing flake of the filters.

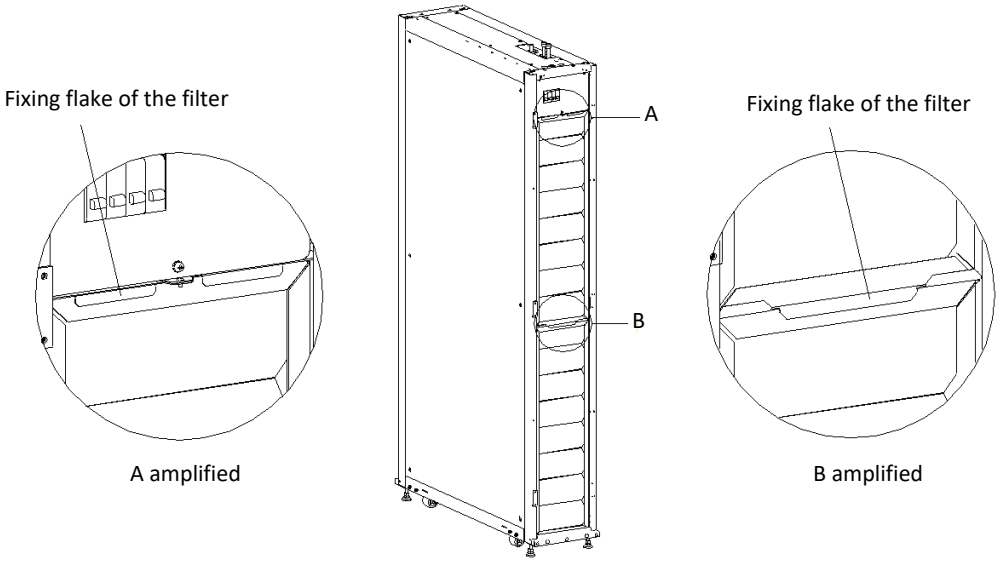


Figure 3-14 Removing the Filters

3.7.3 Connecting the Condensate Drainage Pipe of the Indoor Unit

The condensed water of the evaporator converges to a common water tray further which is drained through the drainage pipe of the drain pump.

1. The unit is configured to adopt the top drain mode by default; therefore, connect the drainage pipe of the pump upwards to the top drainage copper pipe.
2. Fix the drainage pipe to the drainage pipe connector with the hose clamps available in the shipped accessories. The torque of the hose clamp is 15kg·cm (13lb·in.).
3. Connect the drainage pipe to the drainage hole on the top of the cabinet.
4. To drain water from the bottom, direct the rubber drainage hose of gravity through the drainage hole. Or connect the rubber drainage hose in accessory with the outlet of pump, and direct it through the bottom drainage hole. When applying the gravity drainage, also applying pump drainage from bottom is recommended, otherwise, disable the pump function from HMI display.
5. Fix the pipe with the hose clamp to the copper pipe connector. Moving forward, connect it to the outer drainage pipe.

6. Table 3-6 provides a details of piping connection of water drainage pipe with condensate pump.

Table 3-6 Standards for Water Drainage Pipe and Condensate Pump

Connection	UL Model	CE Model
Water Drainage pipe with Condensate Pump	NPT 1/2 Female	Rc 1/2 Female

The outer diameter of the copper pipe is 12.7mm/0.5”, the internal diameter of the rubber drain hose of condensate gravity and pump are 16mm/0.6”and 9mm/0.35” respectively. However, the rubber hose is equipped with threaded joint which has the same interface diameter 12.7mm/0.5”. If using condensate gravity rather than pump, the rubber drain hose of the water tray should pass through the drainage hole of the tray and connect to the outer drainage pipe. The ‘Trap’ is essential to drain the condensate water.

NOTES: The following points are to be taken into consideration about the trap:

- **Adopt a galvanized steel, PVC, or polyethylene pipe with a fair amount of flexibility.**
- **Allow a tilt of 2° towards the direction of the drainage flow.**

The trap is mandatory and should be located 300mm (11.8”) below the water tray. The trap must be kept under the raised floor as shown in Figure 3-15.

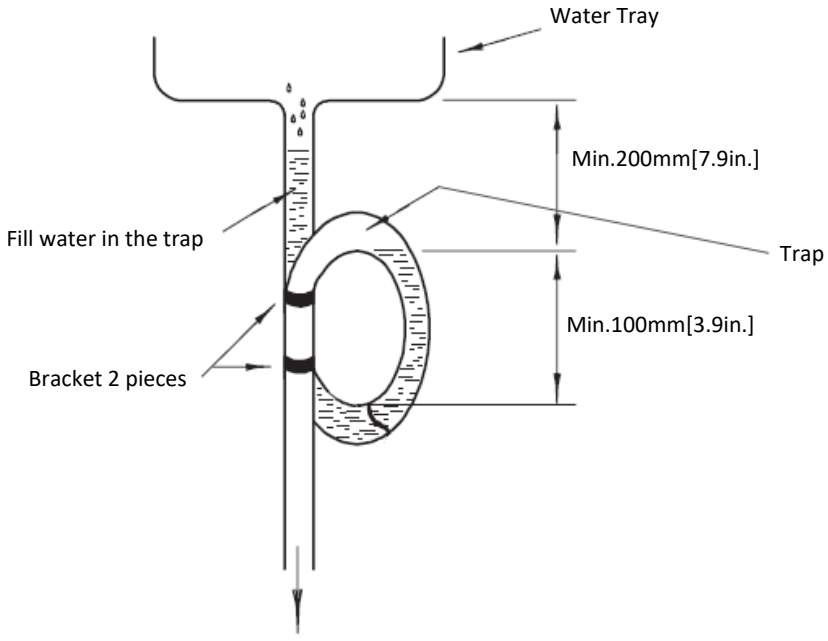


Figure 3-15 Process of Draining the Condensate Water

NOTES:

- **Don’t cut off the brackets of the trap lest affecting the drainage.**
- **Filling the trap with water to avoid blowing water before the unit is powered on.**
- **Use a Teflon tape between the flexible pipes and connector to avoid water leakage.**

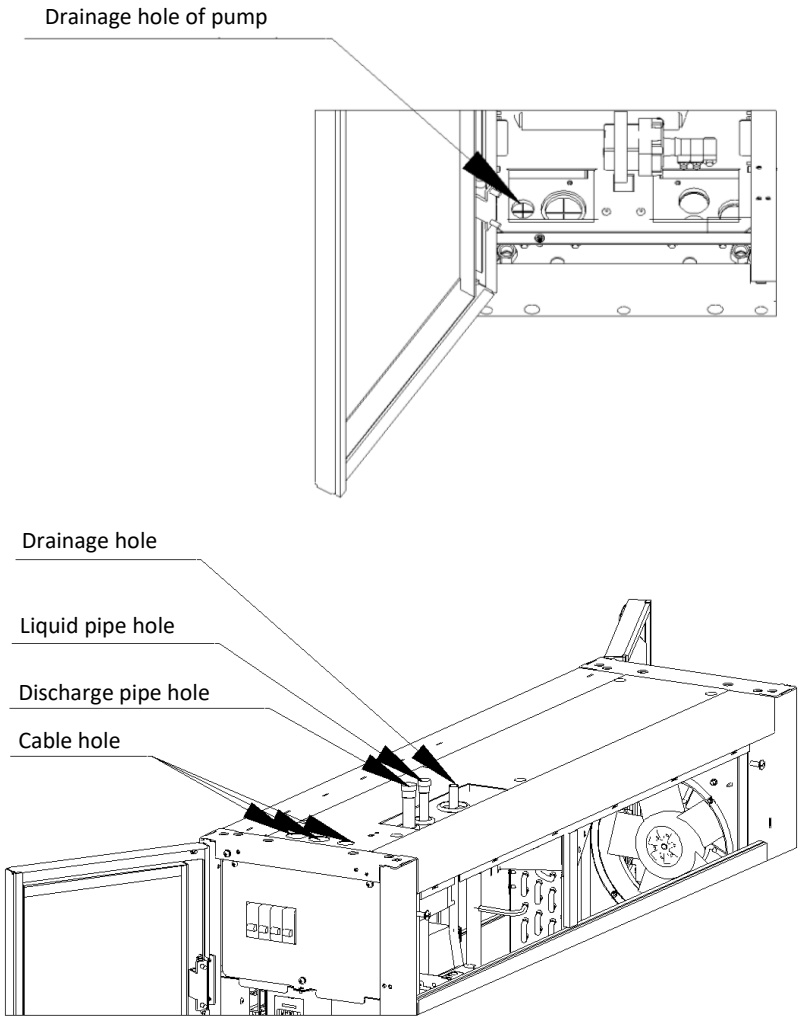


Figure 3-16 Connection of Drainage Pipes

3.7.4 Connecting the Copper Pipes between the Indoor and Outdoor Unit

The indoor and outdoor units are connected through the silver-brazed copper pipes. Piping must be type ACR copper tubing, Table 3-7 shows the standard pipe diameters for connection between the indoor unit and the remote condenser. The pipe diameter of the indoor unit and outdoor unit should be determined by the specifications mentioned in Table 3-7, taking into account the effect of the pipe diameter on the system pressure drop. Alternatively, consult Vertiv technician for details.

Table 3-7 Recommended Refrigerant Line Sizes

Model	CRD10	
Pipe length L (m(ft.))	External Diameter x Pipe Thickness mm(in.)	
	Discharge pipe	Liquid pipe
0 < L≤40(131.2)	16(5/8) x 1(0.04)	12.7(1/2) x 1(0.04)
40(131.2) < L≤91(300.0)	18(3/4) x 1(0.04)	16(5/8) x 1(0.04)

NOTE: Pipe length = Actual length + Equivalent Length of Partial Components

Recommended equivalent length of the partial components for the different pipe diameters which also include resistance loss from the elbow joints are listed in Table 3-8. Before installation, make a choice

according to site condition.

Table 3-8 Equivalent Length of Partial Components

Liquid pipe, External Diameter x Pipe Thickness mm(in.)	Equivalent length (m(ft.))		
	90° bend	45° bend	T Type 3-way
12.7 (1/2) x 1(0.04)	0.5 (1.64)	0.25(0.82)	0.76 (2.49)
16 (5/8) x 1(0.04)	0.55 (1.8)	0.27 (0.88)	0.76 (2.49)
18 (3/4) x 1(0.04)	0.6 (1.96)	0.3 (0.98)	0.76 (2.49)
22.2 (7/8) x 1.2(0.05)	0.7 (2.29)	0.35 (1.14)	1.1 (3.6)

As shown in Figure 3-17 and 3-18, the unit has refrigerated pipe connectors and labels on top and bottom. Don't burn the labels during brazing. These labels assist and point out the connections to the discharge pipe and liquid pipe of the indoor unit. The horizontal sections of the discharge pipes must be tilted downwards from the compressor with a slope of at least 1:200 (5mm down for every 1m run). The discharge pipes must be insulated from heat at the location where they are routed in the conditioned space (including the raised floor).

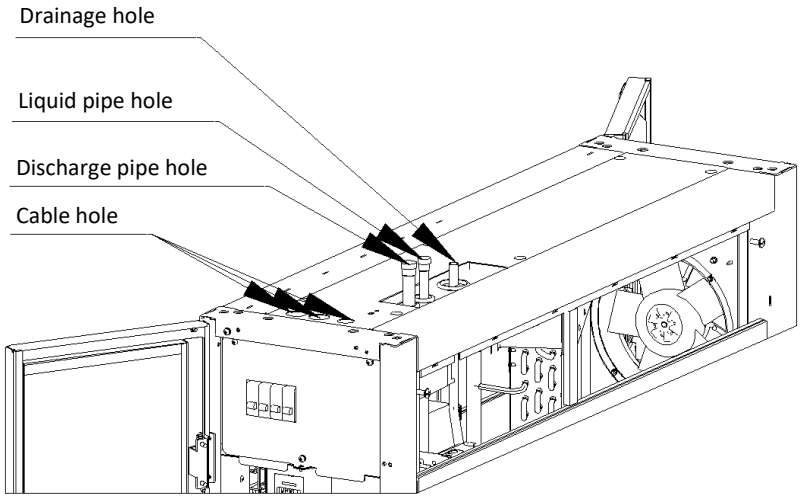


Figure 3-17 Top Pipe Connectors

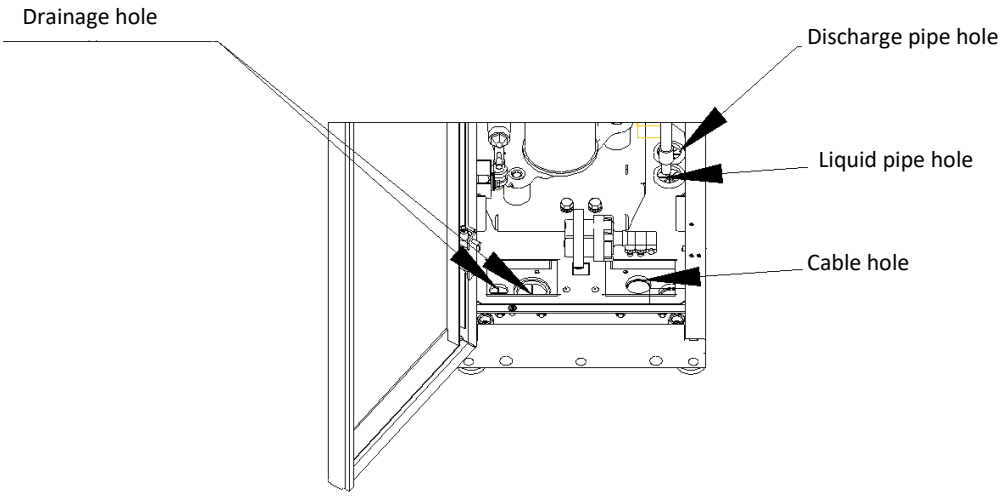


Figure 3-18 Bottom Pipe Connectors

NOTES:

- **For bottom piping, before brazing the compressor discharge pipe and liquid pipe, follow the requirement labeled on the copper pipe; cut the copper pipe using a cutter (a little bit of the compressor lubricating oil may leak); however, do not braze-weld the copper cap on the seal directly as it may result in heating of the oil following that may catch fire.**
- **The exposure time of the system pipes should not exceed 15 minutes. If exposed for too long, it will lead to the PVE refrigeration oil absorbing moisture from the air and contaminating the refrigerant system. It may result in an adverse effect on the life of the key components and the stability of the system operation.**

3.8 Installing Liquid Line Solenoid Valve Kit and Low Ambient Kit

3.8.1 Installing Solenoid valve Kit (for site installation)

In order to prevent the opening of the pipe, it is recommended that the solenoid valve be installed outside the ball valve of the liquid pipe. After the entire system is installed, open the ball valve to keep the pressure and carry out the vacuum operation, thereby avoiding the moisture absorption of the compressor refrigeration oil. Thus, it accounts for operational safety and also extends the service life of the compressor (for electrical connections related to the solenoid kit, refer to Chapter 4- 'Electrical Installation').

NOTE: The solenoid valve is a standard accessory and it needs to be installed for all installations. The solenoid valve is recommended to be installed horizontally, and the valve body must be upward.

Following is the procedure for installing the solenoid valve in the liquid pipe:

1. The solenoid valve needs to be installed to the liquid pipe. The solenoid valve must be as close to the indoor unit as possible, and the distance from the solenoid valve to the indoor unit pipe does not exceed 2m(6.6ft.), as shown in Figure 3-19. The valve body and coil of the solenoid valve are separated when the valve is shipped out.

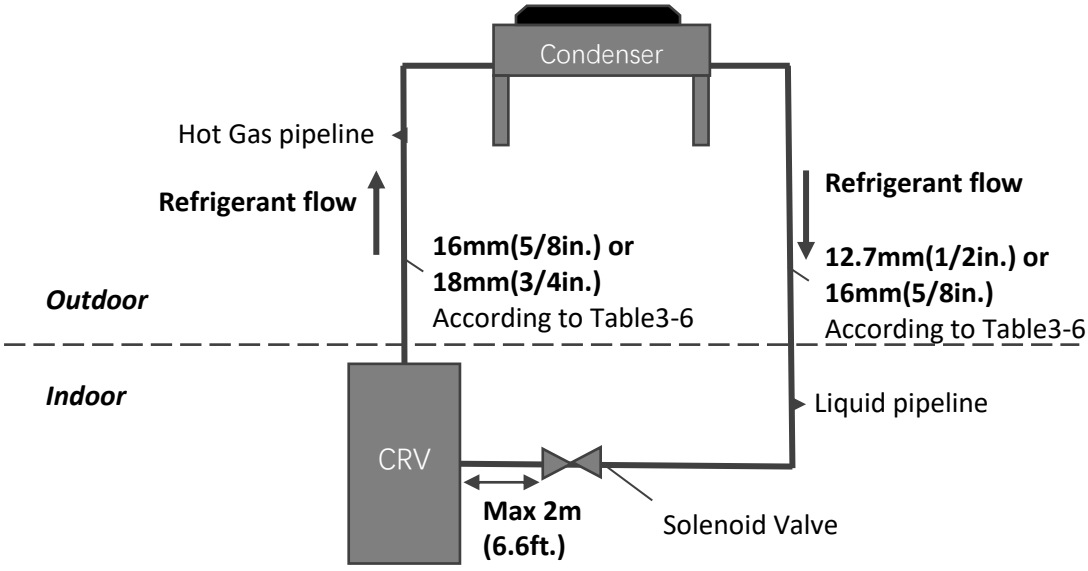


Figure 3-19 Installation position of Solenoid valve and pipe dimensions

2. Mount the valve body horizontally in the refrigerant pipe as shown in Figure 3-20. Pay attention to the arrow on the valve body as the arrow indicates the flow direction of the refrigerant in the valve. Ensure that the arrow points towards the indoor unit. The connection pipe diameter of the valve body is 12mm(1/2inch).

Figure 3-20 Installing the Solenoid Valve Horizontally

3. After brazing, install the coil and the wiring terminals. Figure 3-21 shows the process of connecting the cables and coil of the solenoid valve.

Figure 3-21 Install the coil of the Solenoid Valve

4. Finally, as shown in Figure 3-22, clip the valve body coil, press the coil tightly to ensure full contact between the coil and valve body.

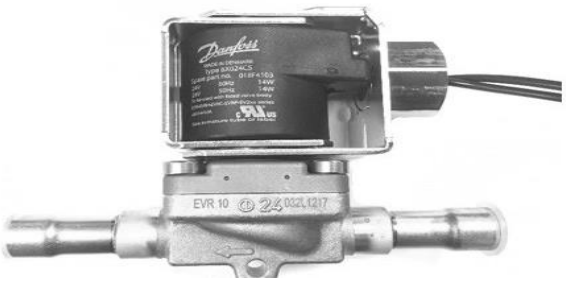


Figure 3-22 Fixing the Coil

3.8.2 Installing Low Ambient Kit(for site installation)

The Low Ambient Kit consists of liquid receiver (with electric heater for outdoor installations), check valve, head pressure valve to bypass the condenser. When Low Ambient Kit is a part of the system, figure 3-23 shows the installation position. The Low Ambient Kit is installed with the condenser, for the detailed installing instruction, please refer to the CCD10 condenser user manual.

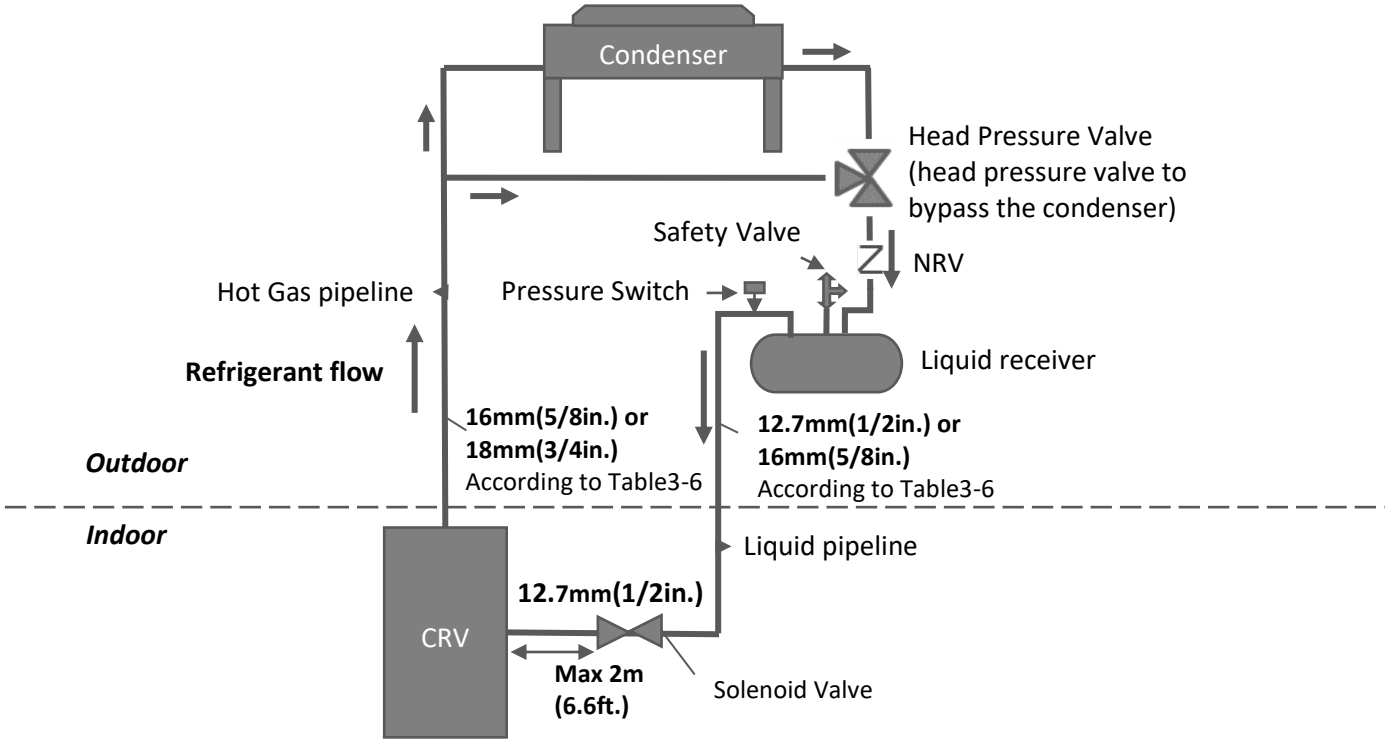


Figure 3-23 Installation position of Low Ambient Kit and pipe dimensions

3.9 Recommended Refrigerant and Oil Charging Amount of the System

WARNING! Risk of over-pressurization of the refrigeration system. Can cause explosive discharge of high-pressure refrigerant, loss of refrigerant, environmental pollution, equipment damage, injury, or death. This unit contains fluids and gases under high pressure. Use extreme caution when charging the refrigerant system. Do not pressurize the system higher than the design pressure marked on the unit's nameplate.

NOTICE!

Risk of oil contamination with water. Can cause equipment damage.

Liebert® CRV 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.

NOTICE!

Risk of improper refrigerant charging. Can cause equipment damage.

Refrigerant charge must be weighed into air-cooled compressorized systems before they are started. Starting compressors without proper refrigerant charging can cause the compressors to operate at less than 5°F (–15°C) evaporator temperature and at less than 20 psig (138 kPa). Operation for extended periods at less than 20 psig (138 kPa) can cause premature compressor failure.

The Liebert CRD10 comes with pre-charged 2 bar of Nitrogen in the factory. Discharge the nitrogen before plugs unsoldering. The users can determine the charging amount of the refrigerant according to the system configuration and the length of the connection pipes between the indoor and outdoor unit. Table 3-9 represents the recommended refrigerant and oil charging amount of the CRD10 unit.

Table 3-9 Refrigerant and Oil Charging Amount

Model	Base refrigerant charging without Low Ambient Kit (kg/lb)	Base refrigerant charging with Low Ambient Kit (kg/lb)	Base refrigerant oil charging with Low Ambient Kit Fluid ounces (ml/oz)	Additional Refrigerant oil charging (ml/oz)	Total refrigerant charging (kg/lb)
CRD10+CCD100S/CCD101S	4.1/9.0	9.0/19.8	1000/33.8	b	c

The refrigeration oil used in the CRD10 air conditioner is PVE (FV50S). The refilled refrigerant dilutes the PVE oil in the system and plays a major role in the lubrication and cooling effect of the PVE oil. Therefore, the refrigerant oil must be extra added for this reason.

when the liquid pipe length of the connection between the indoor unit and the outdoor unit is shorter than 30m(98.4ft.), and the system is not equipped with Low Ambient Kit, then the additional refrigerant oil charging is not needed, alternatively, the base refrigerant oil charging is 1000ml(33.8oz). when the liquid pipe length of the connection between the indoor unit and the outdoor unit is longer than 30m(98.4ft.), the extra additional refrigerant oil charging is b ml/oz. The filling amount of the extra additional refrigerant oil(b) is calculated using the following formula:

*Value **b** (ml) = Refrigerant filling amount of per meter liquid pipe (kg/m) × [Total length of liquid pipe (m)-30m] ×1000 ×25%*

*Value **b** (oz) = Refrigerant filling amount of per meter liquid pipe (lb/ft) × [Total length of liquid pipe (ft)-98.4ft] ×3.84*

The filling amount of the refrigerant is calculated using the following formula:

*Refrigerant filling amount **c** (kg) = Base Refrigerant Charge(kg) + Refrigerant filling amount of per meter liquid pipe (kg/m) × [Total length of liquid pipe (m)-10(m)]*

*Refrigerant filling amount **c** (lb) = Base Refrigerant Charge(lb) + Refrigerant filling amount of per meter liquid pipe (lb/ft) × [Total length of liquid pipe (ft)-32.8(ft)]*

Table 3-10 Refrigerant charge required per meter (foot) of liquid pipe

Liquid Pipe Diameter ×Thickness (mm(in.))	Unit length refrigerant addition amount (kg/m(lb/ft))
12.7(1/2)×1(0.04)	0.107/0.0719
16(5/8)×1(0.04)	0.145/0.0974

If the liquid pipe length of the connection between the indoor unit and the outdoor unit is shorter than 10m(32.8ft.), the refrigerant is charged according to the base refrigerant charge. Table 3-11 is the quick check list of refrigerant and oil filling amount.

NOTES:

- **The unit has been added 1270ml of basic refrigerant oil in factory. So the installation site only needs to charge with an additional mount of refrigerant oil b ml(oz) when without Low Ambient Kit, if equipped with Low Ambient Kit, the oil charging amount is 1000ml(33.8oz) + b ml(oz).**
- **The unit did not charge with refrigerant in the factory, and the total amount of refrigerant c kg(lb) needs to be charged on site installation.**
- **Refill the oil from the schrader valve of the liquid pipe ball valve.**
- **Select the right make and type of refrigeration oil depending on the model. Do not use poor quality refrigeration oil as it can damage the system.**
- **If any error or damage occurs due to usage of the incorrect make and type of oil, the warranty will be void.**

Table 3-11 Quick check list of refrigerant and oil filling amount

Liquid Pipe Length (m)	Total Refrigerant filling amount		Additional Oil filling amount		Liquid Pipe Length (ft)	Total Refrigerant filling amount		Additional Oil filling amount	
	without Low Ambient Kit (kg)	With Low Ambient Kit (kg)	Without Low Ambient Kit (ml)	With Low Ambient Kit (ml)		without Low Ambient Kit (lb)	with Low Ambient Kit (lb)	without Low Ambient Kit (oz)	with Low Ambient Kit (oz)
≤10	4.1	9.0	-	1000	≤32.8	9.0	19.8	-	33.8
15	4.6	9.5	-	1000	45	9.9	20.7	-	33.8
20	5.2	10.1	-	1000	60	11.0	21.8	-	33.8
25	5.7	10.6	-	1000	75	12.0	22.8	-	33.8
30	6.2	11.1	-	1000	98.4	13.7	24.5	-	33.8
35	6.8	11.7	134	1134	120	15.3	26.1	6.0	39.8
40	7.3	12.2	268	1268	131.2	16.1	26.9	9.1	42.9
45	9.2	14.1	544	1544	150	20.4	31.2	19.3	53.1
50	9.9	14.8	725	1725	165	21.9	32.7	24.9	58.7
55	10.6	15.5	906	1906	180	23.3	34.1	30.5	64.3
60	11.4	16.3	1088	2088	195	24.8	35.6	36.1	69.9
65	12.1	17.0	1269	2269	210	26.3	37.1	41.7	75.5
70	12.8	17.7	1450	2450	225	27.7	38.5	47.4	81.2
75	13.5	18.4	1631	2631	240	29.2	40.0	53.0	86.8
80	14.3	19.2	1813	2813	255	30.6	41.4	58.6	92.4
85	15.0	19.9	1994	2994	270	32.1	42.9	64.2	98.0
91	15.8	20.7	2211	3211	285	33.6	44.4	69.8	103.6
\	\	\	\	\	300	35.0	45.8	75.4	109.2

NOTE: "-" represents no need to fill oil.

3.10 Adjusting the Supply Air Baffle and Sealing the Holes

3.10.1 Adjusting the supply air baffle

Adjust the installation direction of the supply air baffle to lead wind to the left or right depending on the installation location of the Liebert CRD10 models air conditioners. The supply air baffle is composed of several pieces. Remove the screws on both sides of the single piece of the supply air baffle, rotate it by 180°. Install it back to change the wind direction. Figure 3-24 shows the mounting screws of a single piece of the supply air baffle.

Figure 3-24 Fixed Mode of the Supply Air Baffle

3.10.2 Sealing the Holes of the Top Plate of the Cabinet

Holes are reserved at the top of the cabinet to facilitate smooth on-site installation as well as the connection of the rack on the top of the machine room. Use rubber plugs and bolts to seal the remaining holes after the cabinet is installed on the site. Use M13.5 rubber plugs to seal four holes at the top of the cabinet and M12x30 bolts to seal 8 holes at the top plate of the cabinet. This prevents water from entering the cabinet. Figure 3-25 depicts the schematic diagram of sealing the holes on the top plate of the cabinet. Use the provided four M13.5 rubber plugs to seal the holes. Use the provided eight M12x30 bolts to seal the holes.

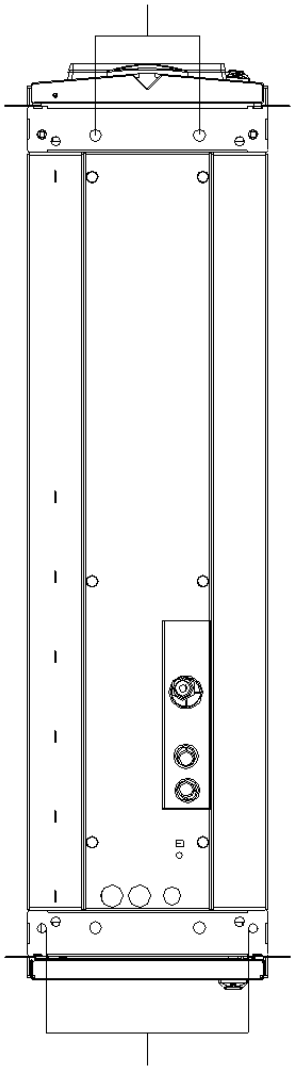


Figure 3-25 Sealing the Top Holes of the Cabinet

3.11 Checklist for Completed Mechanical Installation

Following are the points in the checklist (refer Table 3-12) that need to be verified and confirmed to ensure mechanical installation was implemented successfully.

Table 3-12 Mechanical Installation Checklist

Item	Result
Sufficient space is kept for maintenance, according to the user manual	
The equipment is placed vertically and mounting fasteners are fastened	
The pipes between the indoor unit and outdoor unit are completed. The ball valves of the indoor unit and outdoor unit are fully opened	
The wind direction of the wind-leading grill has been adjusted (if required)	
Drainage pipe is connected	
All pipe connectors are tight	
The fasteners used for transportation have been removed	
After installation, foreign materials in and around the equipment are removed (such as shipping materials, construction materials, tools, and so on)	

Chapter 4: Electrical Installation

In this chapter, the electrical installation of the CRD10 air cooled units is explained in-depth to help users with the various tasks that include the cable connections of the indoor unit apart from the checklist. The air conditioners of the Liebert CRD10 models are the professional devices used in industrial, commercial, or other professional occasions. It is not tailored for the general public. A port of greater than a 350 short-circuit-ratio is required between the user power and the grid. Permission is required from the power supply department to ensure that the air conditioner is connected to a power greater than 350 short-circuit-ratio.

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 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.

NOTICE!

Risk of improper power-supply connection. Can cause equipment damage and loss of warranty coverage.

Prior to connecting any equipment to a main or alternate power source (for example: back-up generator systems) for start-up, commissioning, testing, or normal operation, ensure that these sources are correctly adjusted to the nameplate voltage and frequency of all equipment to be connected. In general, power-source voltages should be stabilized and regulated to within ±10% of the load nameplate nominal voltage. Also, ensure that no three-phase sources are single-phased at any time.

4.1 Installation Notes

1. The connections of all power cables, control cables, and ground cables should be in compliance with the local and national electrical regulations.

2. Observe the unit nameplate for the full load current. The cables sizes must meet the conditions as specified in the local wiring protocols and rules.

3. The power supply of the unit must be consistent with the power supply specifications of the nameplate, otherwise the unit will be damaged. Mains supply requirement:

Model	CRD100-0D00A	CRD101-0D00A	CRD102-1D00A
Power Supply	208/230V/1PH/60Hz	208/230V/3PH/60Hz	230V/1PH/50/60Hz

4. If the power cable is damaged, it must be replaced immediately to eliminate the dangers. The replacement procedure must be carried out by an authorized professional or experienced service personnel.

5. The electrical installation and maintenance must be carried out by some authorized personnel or a trained engineer well-versed with the inner workings of the electrical connection.

6. Prior to the wiring, a voltmeter must be used to measure the power supply voltage and ensure that the power supply is switched off.

7. Use screws, guide rails, or other modes to fix the device firmly during the installation process to avoid the movement or shaking during the start-up or operation mode.

8. For the air conditioner configured with EC fans, the unit power grid adheres to the TN or TT star connection power distribution system. However, contact Vertiv if there is a need to configure another type of power grid.

9. A rated circuit breaker shall be provided to be disconnected from power supply.

10. SCCR (Short-Circuit Current Rating) of the CRD10 air cooled unit - 6kA (CE Model), or 10kA (UL Model).

4.2 CRD10 Wiring Connections

Followings are the intricate cable connections to all the critical components inside the CRD10 unit:

1. Power cable and control cabinet of the indoor unit
2. Solenoid valve cable of the liquid line solenoid valve kit
3. Low Ambient Kit power cable from indoor to outdoor (if configured)
4. Input and output control cable of the unit

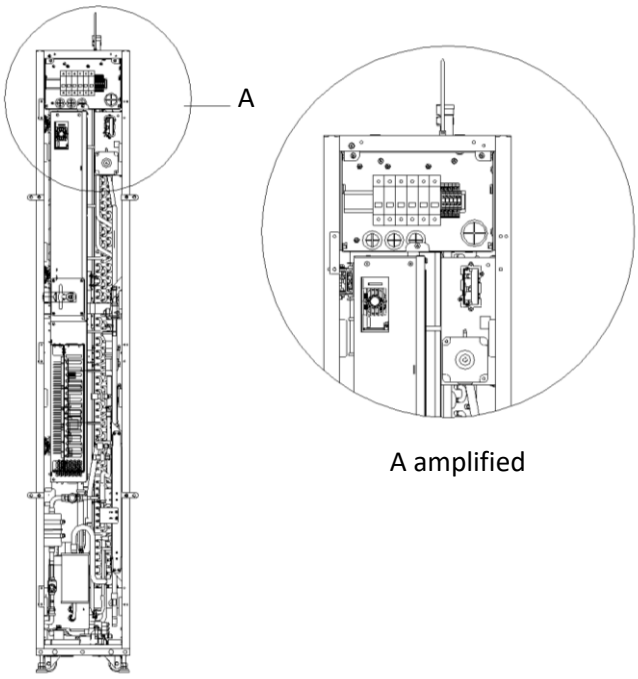
4.2.1 Power Cable and Control Cabinet of the Indoor unit

This section deals with the different types of connections related to the indoor unit, namely–

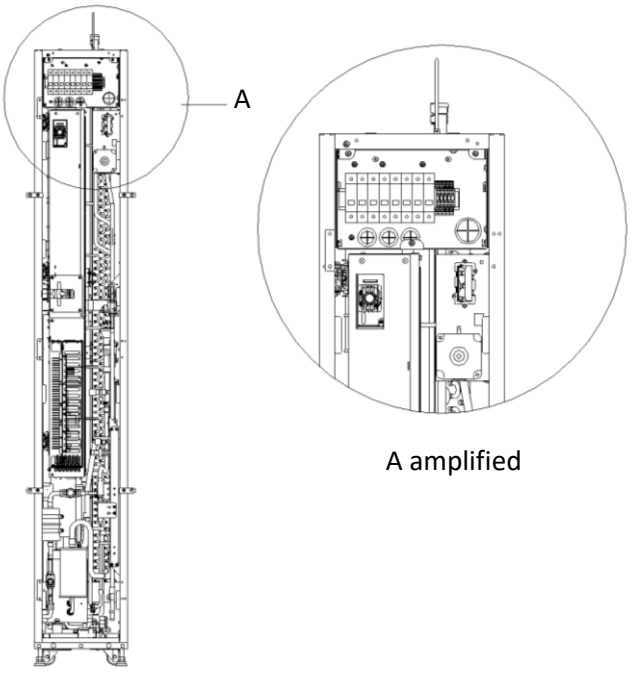
1. Electrical port location of the indoor unit
2. Connecting the Power cables of the indoor unit
3. Connecting the Control cables
4. Connecting the Solenoid valve of the liquid line solenoid valve kit
5. Confirm the transformer connection cable according to voltage of power supply
6. Connecting the outdoor unit and the indoor unit
7. Teamwork Control

4.2.2 Electrical Port location of the indoor unit

For any model of the CRD 10kW, open the rear door of the indoor unit following which the specific layout and locations of the low voltage components can be viewed as shown in Figure 4-1, such as the dual power supply input breaker, outdoor breaker and terminal blocks. For detailed layout information on low voltage components, refer to the labels on the cabinets and units.



Single-phase unit



Three-phase unit

Figure 4-1 Unit Electrical Control Box and Cable Connection (open the back door 120°)

Table 4-1 MCB Current Rating

Model	MCB	Current (A)
CRD100-0D00A	NDB2-63C40/2	40
CRD101-0D00A	NDB2-63C25/3	25
CRD102-1D00A	NDM1-63C50/2	50

4.2.3 Connecting the Power Cable of the Indoor unit

The specific location of the power port of the indoor unit is shown in Figure 4-1. Connect the supply terminals L, N (or L1, L2 or L1, L2, L3) and PE (or G) supply terminal to their respective counterparts of the external power supply respectively. Fix the input cables to the cable clamp, located on the inner side panel of the unit. The top cable entry hole and bottom cable entry hole are shown in Figure 4-2. For the cable specifications, refer to the Full-Load Current (FLA), MCA, MOP described in the Table 4-2.

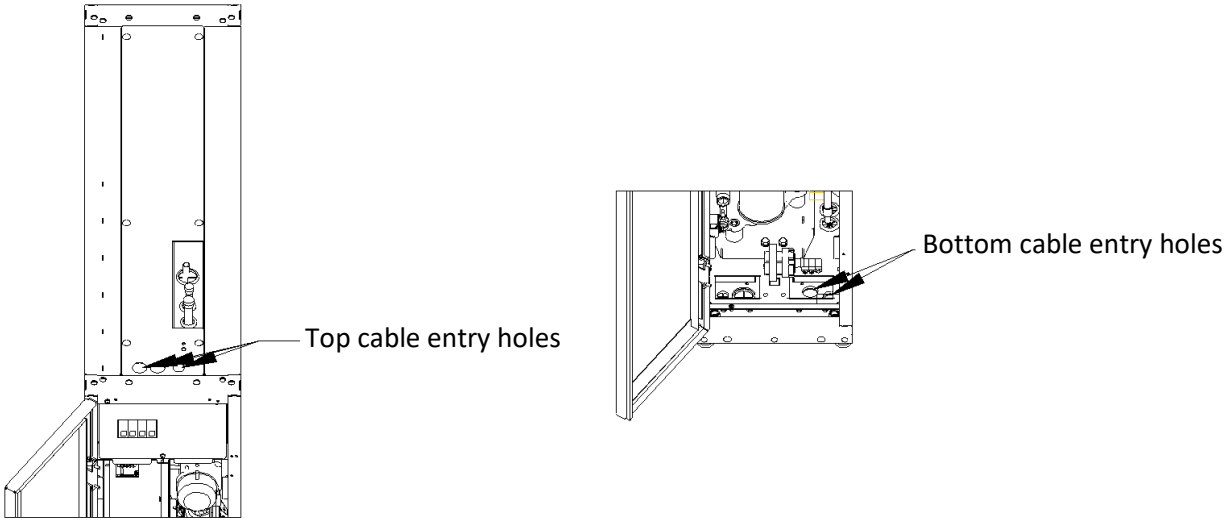


Figure 4-2 Top and Bottom Cable Entry Holes

The cable sizes must strictly meet and adhere to the local wiring regulations and protocols as it supersedes every type of connection.

Table 4-2 Full Load Current (Unit A)

Region	UL		CE
Model	CRD100-0D00A	CRD101-0D00A	CRD102-1D00A
Full load Current (A)	-	-	38 (With the heater) 28 (Without the heater)
MCA (A)	29	21	-
MOP (A)	40	30	-

4.2.4 Connecting the Power Cable of the outdoor unit

The outdoor unit (CCD10) is controlled by indoor unit, the specific location of the power port of the outdoor unit is also shown in Figure 4-1. Connect the outdoor breaker terminals L, N (or L1, L2) and PE (or G) to their respective counterparts of the outdoor respectively. The detailed specification of cable, please refer to CCD10 user manual.

4.3 Connection of the Control Cables

The location of the terminal block for cable connections in the site is shown in Figure 4-1. The amplified view of the terminals is shown in Figure 4-3.

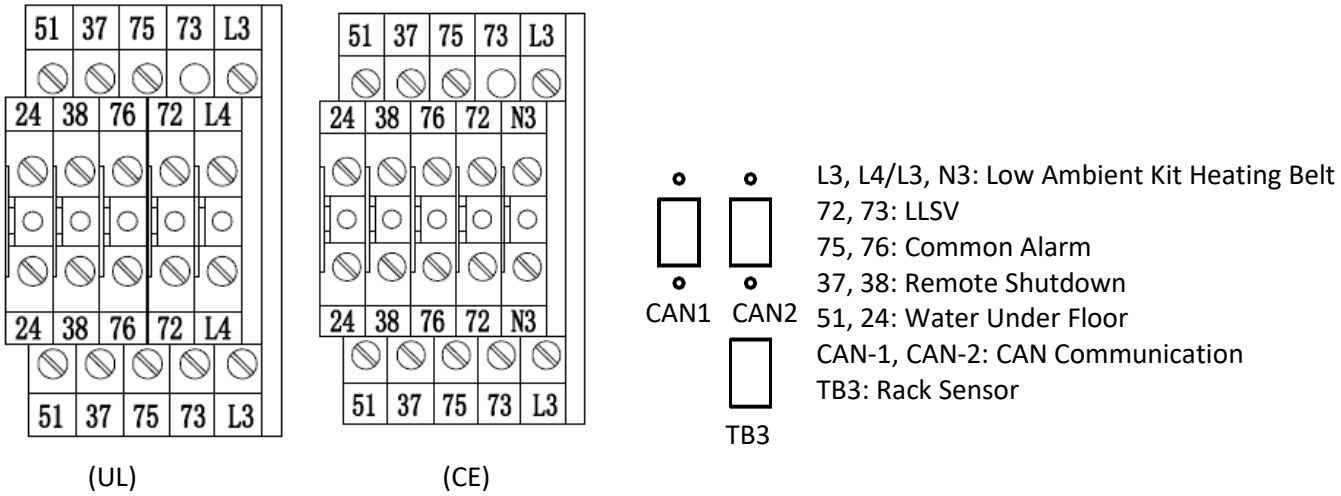


Figure 4-3 Amplified View of Terminal

NOTE: The connection personnel must take anti-static measures before connecting the control cables.

4.3.1 Water-Under-Floor Sensor

NOTICE!

Risk of clogged or leaking drain lines and leaking water-supply lines. Can cause equipment and building damage.

This unit requires a water drain connection. Drain lines must be inspected at start-up and periodically, and maintenance must be performed to ensure that drain water runs freely through the drain system and that lines are clear and free of obstructions and in good condition with no visible sign of damage or leaks. This unit may also require an external water supply to operate.

Improper installation, application and service practices can result in water leakage from the unit. Water leakage can result in catastrophic and expensive building and equipment damage and loss of critical data center equipment.

Do not locate unit directly above any equipment that could sustain water damage.

We recommend installing a monitored fluid-detection system to immediately discover and report coolant-fluid system and condensate drain-line leaks.

The unit accessories are equipped with a water-under-floor sensor, connect one end of the sensor to

terminal 51# and the other end to common terminal 24#. Each unit can be connected with multiple sensors in parallel, but there would be only one water-underfloor alarm.

4.3.2 Solenoid Valve Kit

When installing the solenoid valve kit (LLSV), connect one end of the solenoid valve coil cable to terminal 72# and the other end to terminal 73#. Figure 4-4 shows the liquid line solenoid valve connection with the respective terminals.

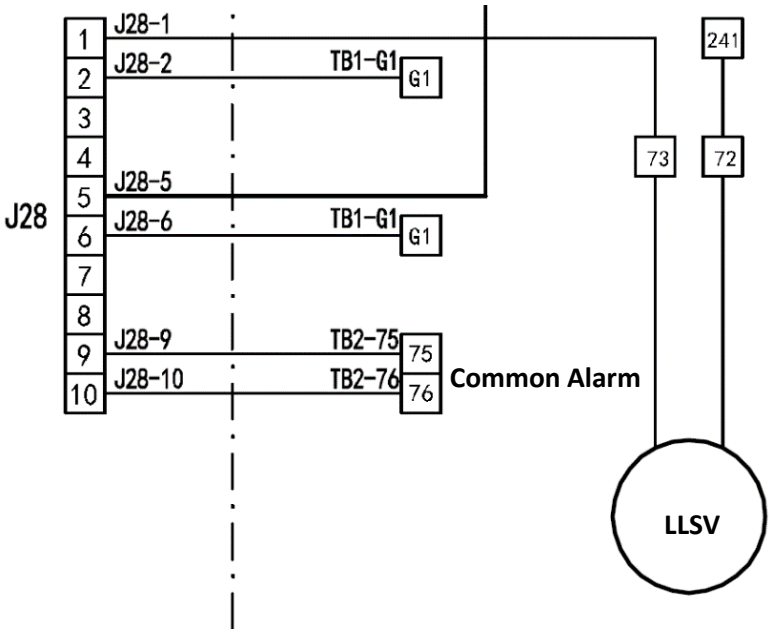


Figure 4-4 Freon Solenoid Connection with Terminal

4.3.3 Transformer connection cable

NOTICE!

CRD10 unit 96VA transformer default wiring is orange cable (230V to 24V). If the unit rated voltage is 208V, a properly trained and qualified electrician must change the transformer wiring from orange to red cable (208V to 24V).

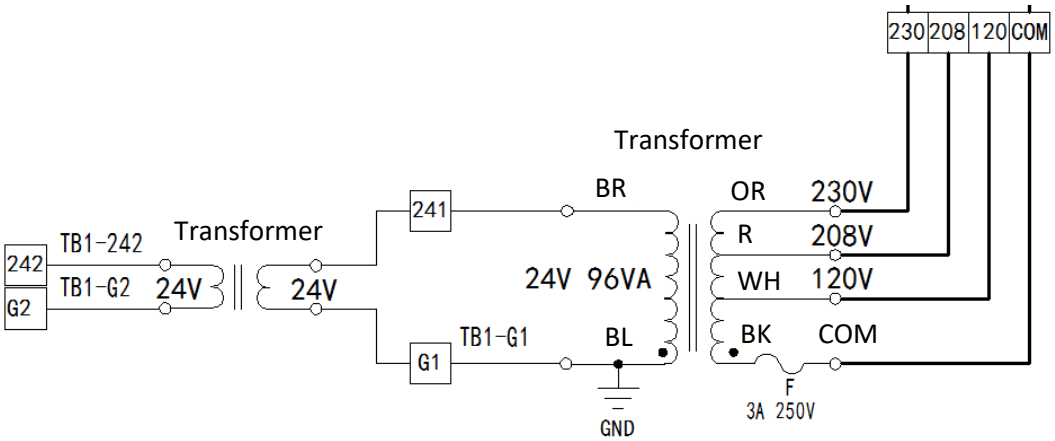


Figure 4-5 Transformer wiring diagram

4.3.4 Low Ambient Kit

If the unit is configured with Low Ambient Kit, which power supply is from indoor unit. Connect the cable of Low Ambient Kit to terminal L3, L4 (or L3, N3).

4.3.5 Rack Sensor

Each unit comes standard with a remote temperature sensor, and it can be connected with a maximum of 10 temperature sensors. It is recommended that the sensors be located in front of the heat loads to achieve the most precise temperature. If the sensors are connected in series (refer Figure 4-6), each temperature sensor monitors the temperature of air entering each rack, and the read temperature value is used to control unit operation. The standard location of the sensor is 1.5m(4.9ft.) height from the end of the unit base. Therefore, the sensors should be placed in positions as shown in Figure 4-6, or the devices cannot operate appropriately.

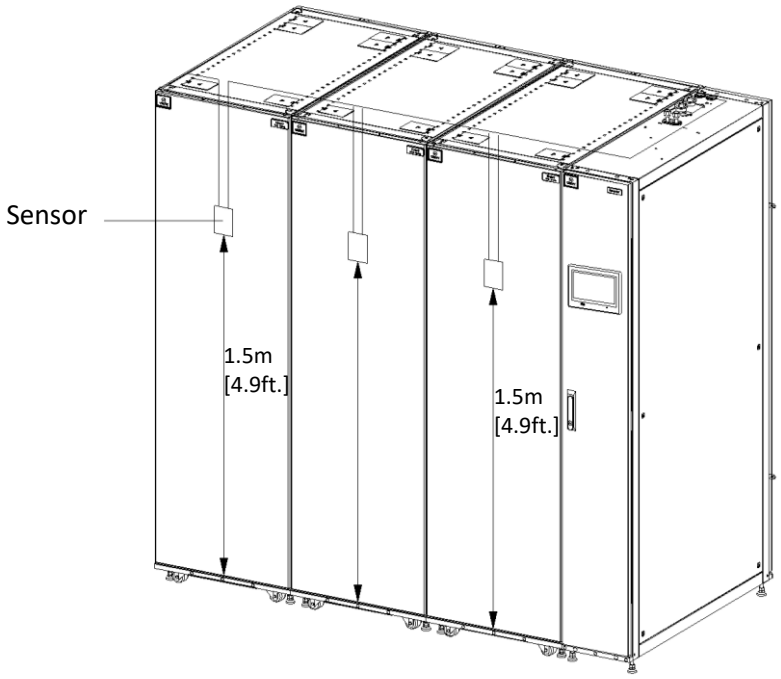


Figure 4-6 Layout of Rack Sensors

Following is the procedure to connect sensors for Liebert CRD 10kW model:

1. Insert the connector of the rack temperature sensor into the TB3 point. On connecting the cable, route the cable through the top or bottom of the unit after which it should be connected to the first sensor. Connect the first sensor to the second sensor. Thus, the sensors are connected in a series.

2. Fix the temperature in-front of the hottest source inside the rack. Do not fix it in-front of the empty sub-rack. Affix the sensor on the rack surface using the magnets provided in the kit. The sensor must be fixed in a position that is mostly short of cool air. Rack temperature sensor IRM-S01 address settings are tabulated in the Table 4-3.

Table 4-3 Rack Temperature Sensor Address

Sensor	1	2	3	4	5	6	ID	Notations
Rack temperature 1	0	0	0	1	0	0	10	ON — “1”; OFF — “0”
Rack temperature 2	0	0	0	1	0	1	11	
Rack temperature 3	0	0	0	1	1	0	12	
Rack temperature 4	0	0	0	1	1	1	13	
Rack temperature 5	0	0	1	0	0	0	20	
Rack temperature 6	0	0	1	0	0	1	21	
Rack temperature 7	0	0	1	0	1	0	22	
Rack temperature 8	0	0	1	0	1	1	23	
Rack temperature 9	0	0	1	1	0	0	30	
Rack temperature 10	0	0	1	1	0	1	31	

4.3.6 Remote Shutdown

As shown in Figure 4-4, terminals 37# and 38# can be connected to the remote shutdown switch. The terminals must be shorted before delivery. If a remote shutdown signal is to be connected, remove the short-connect cable.

NOTE: Opening the terminals 37# and 38# will shut down the unit.

4.3.7 External Common Alarm

Terminals 75# and 76# can be connected to the external common alarms. They provide signals to external alarm devices such as an alarm indicator. When the critical alarm occurs, the contact will be closed to trigger remote alarms, send signals to the building management system, or automatically dial the paging system. Users have to obtain the power supply of external common alarm system. For an in-depth definition of the other terminals, refer to the circuit schematic.

4.3.8 Teamwork Control

- **Teamwork function**

Teamwork control has 4 functions, Standby function, Rotation function, Avoid fighting function and Cascade function.

1. Standby function

   One or several units can be defined as standby unit. The standby units’ fan run at a default speed of 20%. If a running unit generates an alarm that cannot operate normally, a standby unit will start to run. The “critical fault alarms” will cause the unit to go into standby. The “secondary fault alarms” unit will not standby but continue running.

Following is the list of Critical and Secondary fault alarms:

1) Critical fault alarms: High pressure lock, Low pressure lock, High discharge temperature lock, Low discharge superheat lock, Low pressure sensor fail lock, Compressor drive fail lock, Fan fail alarm (Alarm process setting is shut down), Water underfloor alarm (Alarm process setting is shut down), Power fail alarm (Alarm process setting is shut down).

2) Secondary fault alarms: High discharge temperature alarm, Air flow temperature sensor failure, Air flow loss alarm, Discharge temperature sensor failure, Suction temperature sensor failure, Low pressure sensor failure, EEV drive communication failure, Compressor drive communication failure, Compressor temperature control sensors failure, Fan temperature control sensors failure, Power fail alarm (Alarm process setting is fan only), High supply temperature alarm, High return temperature alarm.

2. Rotation function

   Rotation function is utilized to ensure that all the units have an equal run-time.

3. Avoid fighting function

   Avoid units performing conflicting operations. For example: (a) units are not allowed to heat if other units are cooling and vice versa, and (b) units are not allowed to humidify if other units are dehumidifying and vice versa, so the master will calculate the number of cooling run unit and heat run unit, if the cooling run unit number is bigger than heat run unit, so in the team group, it keep all the cooling unit run, and stop all the heat unit. It is the same with humidify/dehumidify run unit.

4. Cascade function

   If the run unit occur “High Temperature alarm”, then auto start a standby unit

- **Teamwork connection and setting**

To use the teamwork control function, connect the communication cable to terminals CAN1 & CAN2 port on the unit. The connection diagram as shown in Figure 4-7:

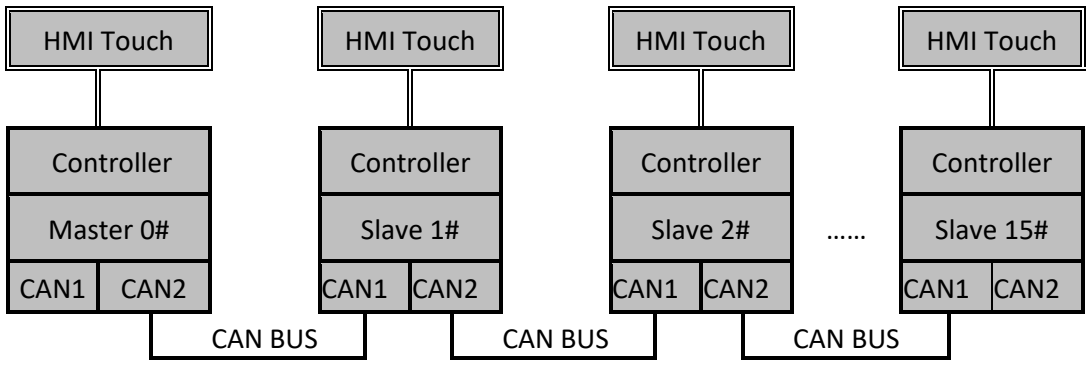


Figure 4-7 The connection diagram of the Teamwork Control

Master unit will share teamwork parameters, temperature and humidity set point, proportional band, dead band, fan control mode, compressor control mode to the slave unit. Slave unit upload run status, alarm signs to the master unit.

Unit with address 0 is defined as the master unit. Units with the non-zero address are defined as the slave units. Teamwork parameters only can be set in master unit and share to the slave units. Slave units can only set their own unit address. After the teamwork connection is completed, set the unit CAN ID through the DIP SW3 of the PACC board. The address setting method is shown in the Figure 4-8 and Table 4-4.

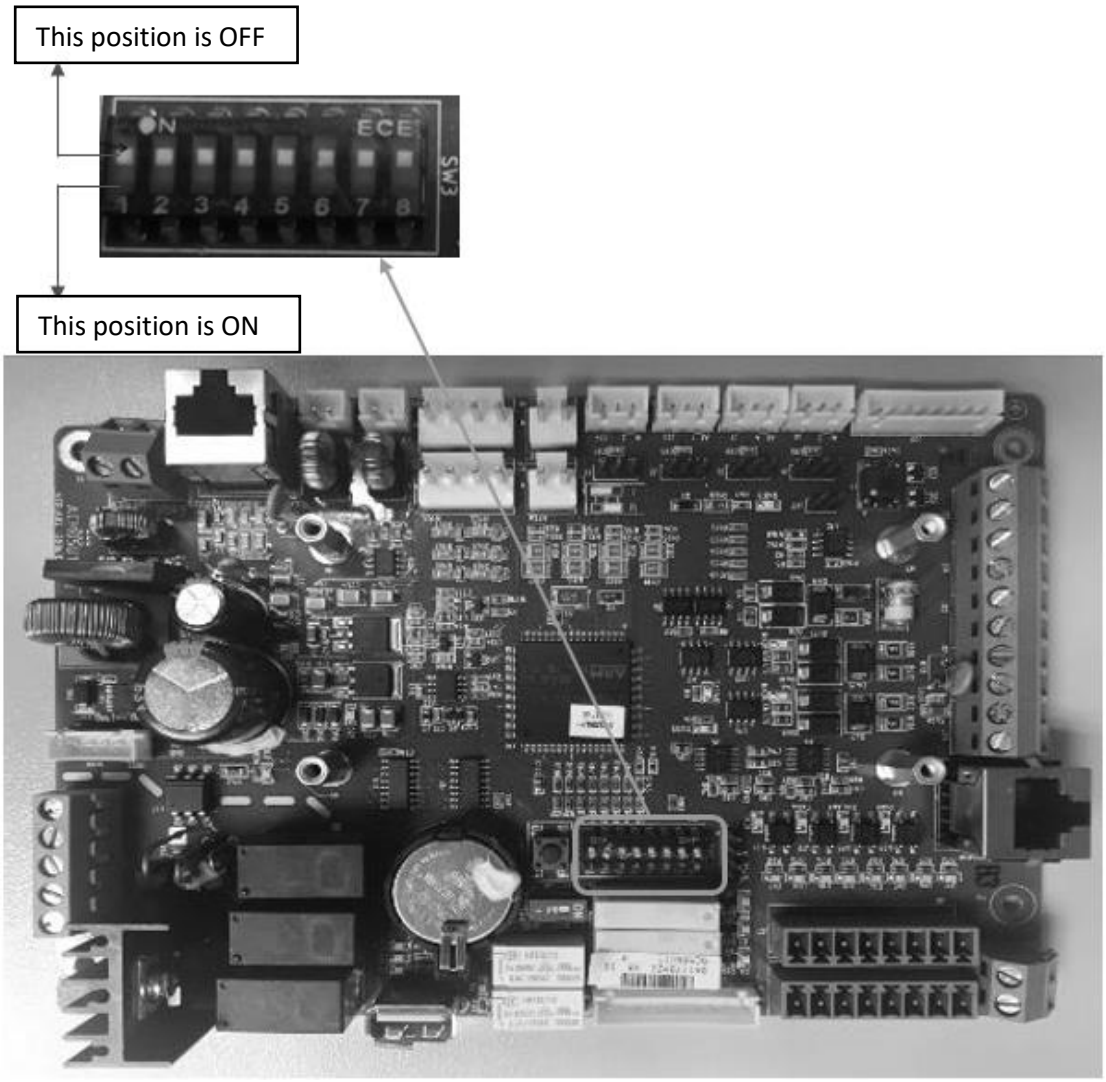


Figure 4-8 Significance of the DIP SW3 position

Table 4-4 Correspondence between unit CAN ID and DIP SW3 address

CAN ID	SW3-1	SW3-2	SW3-3	SW3-4	SW3-5	SW3-6	SW3-7	SW3-8	Comment
0	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	Master Unit
1	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	Slave Unit #1
2	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	Slave Unit #2
3	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	Slave Unit #3
4	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF	Slave Unit #4
5	ON	OFF	ON	OFF	OFF	OFF	OFF	OFF	Slave Unit #5
6	OFF	ON	ON	OFF	OFF	OFF	OFF	OFF	Slave Unit #6
7	ON	ON	ON	OFF	OFF	OFF	OFF	OFF	Slave Unit #7
8	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	Slave Unit #8
9	ON	OFF	OFF	ON	OFF	OFF	OFF	OFF	Slave Unit #9
10	OFF	ON	OFF	ON	OFF	OFF	OFF	OFF	Slave Unit #10
11	ON	ON	OFF	ON	OFF	OFF	OFF	OFF	Slave Unit #11
12	OFF	OFF	ON	ON	OFF	OFF	OFF	OFF	Slave Unit #12
13	ON	OFF	ON	ON	OFF	OFF	OFF	OFF	Slave Unit #13
14	OFF	ON	ON	ON	OFF	OFF	OFF	OFF	Slave Unit #14
15	ON	ON	ON	ON	OFF	OFF	OFF	OFF	Slave Unit #15

NOTE: The PACC can connect up to 16 units, and the unit CAN ID address must be set in sequence from 0 to 15.

4.4 Checklist for the Completed Electrical Installation

Confirm the items listed in Table 4-5 on completion of the electrical installation.

Table 4-5 Electrical Installation Checklist

Items to be Inspected	Results
The power voltage is same as that of rated voltage on the unit nameplate.	
No open-circuit or short-circuit exists in the electrical connection.	
Confirm, if the power cables and earth cables connected to the disconnect switch, indoor unit, and outdoor unit are correct as per the norms.	
The circuit breakers or fuses have correct ratings for the installed equipment.	
The control connections are configured and subsequently, fixed properly.	
All the wiring and connector connections, including the fixing blocks, are fixed firmly and appropriately.	

NOTE: Do not power on or operate the installed unit as Vertiv's authorized professional technicians have to perform a check and confirm whether it is good to go. Starting up and Operating the unit should only commence if the commissioning process is successful, following which Vertiv’s engineers give the go-ahead.

Chapter 5: Commissioning Overview

There are four different sections in commissioning starting with Self-Check, Preparation, Inspection of Auxiliary Parts and Cables, Start-Up Inspection, Operating instructions, and Refrigerant oil re-filling & Troubleshooting.

NOTE: Remember that only the authorized staff and engineers of Vertiv can carry out the commissioning process. This section is for information purpose only.

5.1 Self Check

In self check, verify whether the construction and installation meet the standard requirements to ensure normal operation and enhanced service life of the unit. Vertiv engineers and personnel need to perform the check-up as per the Table 5-1.

Table 5-1 Start-up Inspection Checklist

Items	Inspection contents	Results
Room environment	Thermal isolation, moisture proof and sealing performances of protective structure.	
Mounting base	Whether the fixing is reliable and whether the vibration absorbing material between the base and the unit is well installed.	
Display panel	Check for any sign of damage, check whether it has good insulation and clean surface.	
Compressor	The fixing metal plate at the bottom has been removed and the compressor has been fixed as well.	
Filter net	All the filter nets have been installed in the right positions; not damaged and clean surface.	
Outdoor unit	The outdoor unit has been installed in the right position; pipes are properly supported with suitable inclination; the oil trap has been installed in the right position.	
Fan	The air inlet and outlet areas are not blocked; the blades must not be stuck or have abnormal noises when rotating the blades.	
Heater (if installed)	The heating component has been firmly fixed and the heating cables are reliably connected.	
Power supply	Check whether the voltage, phase rotation and frequencies of the front-end power sup- plies for the indoor and outdoor units are normal. Check whether the power supply cables are well connected. Check whether each functional circuit breaker and contactor are reliably connected.	
SPD (if installed)	The SPD module should not be loosened, and the alarm terminals should be correctly connected.	
Controller	All the control wirings are reliable.	
Pipes	The pipes are connected and supported reliably. The solenoid valve kit is installed in the right positions and directions. There are no exposed copper pipes, and thermal insulation cotton is well attached.	

5.2 Preparations for Start-up

This section explains in brief the basics of the commissioning process to help users understand checks before start-up.

5.2.1 Inspection of Pipes

- Installing the connection pipes

1. Check if the equivalent length of the single-way pipe of the air cooled unit exceeds 30m(98.4ft.).
2. Check whether the solenoid valve kit and oil trap are installed.
3. Confirm if the corresponding refrigerant oil needs to be re-filled.
4. Check if the rated voltage of the solenoid valve on the liquid pipe meets the requirements.
5. Check the relative positions between the indoor and the outdoor unit. If the condenser is higher than the indoor unit, the liquid pipe should be at a greater height than the “U” bend of the condenser coil.

- Vacuuming

1. Open all the ball valves, electronic expansion valve (EEV) and solenoid valve of the system (Enter vacuum mode).
2. Connect the compound pressure gauge to the corresponding high and low pressure schrader valves. Vacuum from both the high and low pressure locations (shown in Figure 5-1) as indicated by the labels.

   Requirements:

   > Pull an initial deep vacuum of 500 microns on the system with a suitable pump.

   > After 4 hours, check the pressure readings and, if they have not changed, break vacuum with dry nitrogen. Pull a second and third vacuum to 500 microns or less. Re-check the pressure after 2 hours.

   > When the 3 checks are complete, proceed to charging.

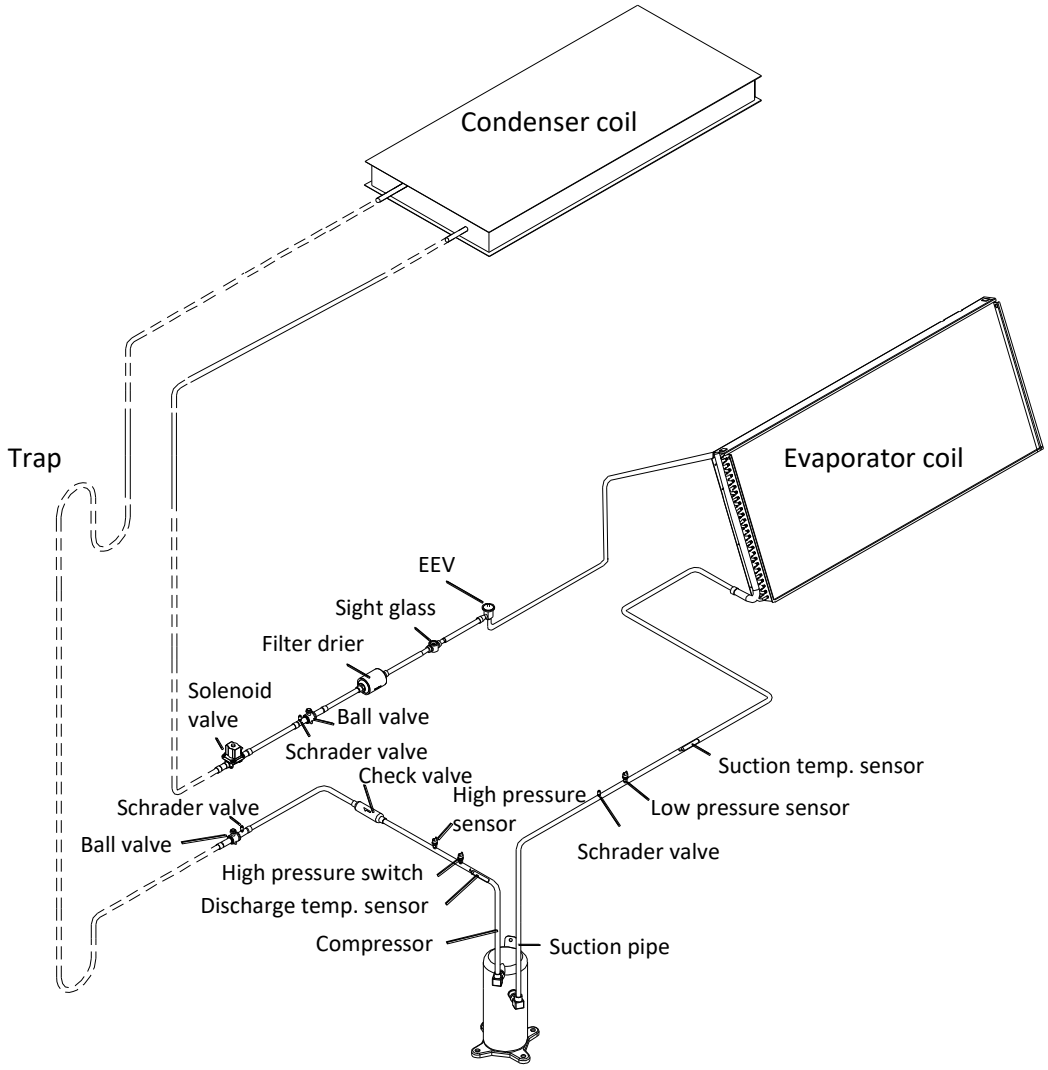


Figure 5-1 Connection Point of Compound Pressure Gauge on the System

3. Now the machine is ready for completing the charge and the start-up.

NOTES:

- **If the unit can be switched on, you can select "Vacuum model" by micro controller, this model will open the Electronic Expansion Valve and Solenoid Valve automatically; if not, the Electronic Expansion Valve and Solenoid Valve will need to be opened manually.**
- **Never use the compressor to create a vacuum (this invalidates its guarantee).**

- Inspection of auxiliary parts and cables

1. Check if the drainage is normal.

2. Check the electric circuits: Fasten all the electrical connections, and ensure that there is no short circuit & open circuit and the insulation is good.

3. Check the main power supply voltage of the unit.

5.2.2 Start-up Inspection

1. Open the corresponding circuit breaker of each component of the unit, close the general circuit breaker and the transformer circuit breaker, and check the control voltage.

2. Check the indoor fan: Close the fan circuit breaker; manually set output value to 75% to check the fan running current.

3. Check the Electric Heating kit: Close the Electric Heating circuit breaker, start the Electric Heating device manually, check the Electric Heating running current, and close the Electric Heating device after completion of the operation.

4. Check the air cooled condenser: Check if the condenser is installed correctly, including whether the wiring is correct, whether the fan is reliably fixed, and whether the fan blades is in contact with the fan frame, and whether the obstacles near the condenser have been cleared away.

5. Run the fan to check if the fan rotates normally and check the input voltage.

6. Charge refrigerant and start-up.

5.3 Refrigerant Charge

The air-cooled unit must be charged on - site with refrigerant, charge the suitable quantity of liquid refrigerants as indicated on the label. Following are the procedure of charging refrigerant: Depending on the different connecting conditions, there is a standard charge amount for the air-cooled unit, so be sure to refer to the calculated charge amount to avoid overcharge.

1. Charging refrigerant statically: The refrigerant system should be charged quickly with a suitable amount of liquid refrigerant after vacuuming the system (usually the system pressure can be charged equal to the tank pressure). Connect the high-low pressure compound pressure gauge to the refrigerant cylinder, air in the hoses connect to the gauge should be drained-out. Connect the high-low pressure compound pressure gauge to the schrader valve behind electronic expansion valve and ball valve of the liquid tube, keep the cylinder handstand at the process of charging statically. Stop charging when the charge amount is more than the calculated value.

NOTES:

- **After charging the refrigerants statically, do not turn on the compressor and charge the refrigerant dynamically until the crank case heating device has been pre-heated for longer than 12 hours.**
- **For dynamic filling of the refrigerants, the charging speed should not be higher in order to avoid the com- pressor damage.**

2. Charging refrigerant dynamically: Keep the refrigerant cylinder handstand, manually start the unit to charge refrigerant dynamically (manually set the output value to 75% for the fan, start the compressor after 5min -> adjust the compressor output to 72%). After compressor operation, refrigerant will be suctioned to the system until there are no bubble in the sight glass and condensation supercooling is more than 3 K, the superheat is more than 7 K. Observe the suction pipe of the compressor, ensure that there are no frosted phenomenon on the surface of pipe and compressor. Ensure that there are 25-40K discharge superheat.

Record the running parameters of the cooling system according to the requirements of CRD10 Air-cooled AC Startup and Commissioning Report.

Record the parameters operating instructions

1. Start the manual mode: Start-up from the panel – Enter level 2 password – Set the system – Manual Mode – Manual Mode Enabled – Set to “Y”

2. Start vacuum mode: Enable Manual Mode - Vacuum mode- Set to “Y”

- Close the transformer circuit breaker
- Ignore the “Fan/Power Failure” alarm after startup
- If the vacuuming starts before the vacuuming mode is started, “low pressure sensor fault” alarm will occur after startup, and then ignore this alarm

3. Manually start/stop each component

Enable Manual Mode- Start/Stop the output of corresponding component. The output percentage value of the compressor and fan can be adjusted after they are started up

- Output percentage value of the compressor cannot be adjusted until the compressor has started up for about 5min (i.e., the soft start is over)
- After the compressor is off (including manual turn-off and unit shutdown), the compressor will be in soft shutdown status (in manual mode - the soft shutdown status is displayed as “Y”), but the derated speed output will still remain. After the soft shutdown phase is ended (about 5-10min), the compressor is off. In order to ensure the reliability of the compressor, avoid directly turning off the circuit breaker of the compressor.

NOTES:

- **Refer Section 3.9 for the calculations of the refrigerant refill and charging**

- **Once the commissioning is completed, Vertiv representative will confirm the unit is charged and operating correctly before the unit is put into operation.**

Table 5-2 Commissioning Confirmation Checklist

Check item	Result
Check and confirm that all the output functions are automatic	
Check that the Temperature & Humidity settings as well as the control precisions are configured correctly	
Ensure that all the other functions are configured and set correctly	

5.4 Start-up Procedure

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.

5.4.1 First Start-up (or after long standstill)

To prevent compressor damage, the crankcase must be preheated for at least 12 hours before conditioner start- up. Start the air conditioner as follows:

1. Open all valves in the refrigerant circuit according to the instruction label attached to the valve.
2. Ensure that refrigerant charge is correct.
3. Using a leak detector, verify that there are no refrigerant leakages.
4. At least 12 hours before start-up, the main switch should be closed.
5. Verify the operation of the crankcase heater.
6. Check that there are no water leakages.
7. Ensure that the indoor temperature is higher than 18°C (64.4°F) and there are thermal load exists. If this situation doesn't exist, preheat the indoor by using other heating device or heater of the unit manually.
8. Close all MCB's on the electrical panel.
9. Check the supply voltage on all phases.
10. Ensure that the compressor has been preheated for at least 12 hours before starting the unit.
11. Start the unit by press the ON/OFF button on the Micro-Control for 3s.
12. Press the Enter button again to highlight the input data field in the Password screen, set the target value of temperature and humidity.

13. Ensure that all control system settings are correct and that there are no alarms.

14. Once the system is operating under load, carry out the following checks:

- Verify that the fans are operating properly.
- Ensure that the temperature and relative humidity are being reached, and the heating steps operate when required.

5.4.2 Automatic Restart

If requested, the unit will automatically restart on the return of power after a power supply interruption. If the power interruption is expected to last several hours, to avoid an automatic cold restart of the compressor stop the unit before the interruption and on the return of power, allow the compressor to preheat before restarting the unit.

Chapter 6: Micro-Controller

This section introduces content related to the controller, basic system maintenance, and routine troubleshooting which enables the customer to understand the functioning of the equipment. It helps customers gain insight into the inner workings of the product comprising the information such as System setup, Alarm menus, and Basic operations of the controller interface.

6.1 Features

Following are the features of the micro-controller:

1. The micro-controller is used for monitoring and displaying the operation status of the CRD10 unit to keep the environment within a setting range.
2. The Liebert CRD10 air conditioning configuration 7-inch HMI color screen, which makes user interface operation simple.
3. It provides a three-level password protection to effectively prevent unauthorized operation.
4. User can accurately understand the main parameters and operating status of the system through menu operation.
5. Real time display of measured Temp & Hum curves.
6. It accurately displays the running time of critical components through menu operation.
7. The expert-level fault diagnosis system can automatically display the current fault information to facilitate maintenance personnel in effective servicing and repair of the unit.
8. It can store up to 500 historical alarm records.

6.2 Appearance

Appearance of 7- inch HMI display color screen is shown in Figure 6-1.

Figure 6-1 Color Screen

The display indicator lamp has 4 colors. The corresponding color and function are described in the Table 6-1.

Table 6-1 Function Description

Indicator Color	Description
Blue	Starting display
Yellow	Display system shutdown or failure in the control panel communications.
Green	System operating normally
Red	Alarm in system and buzzer

6.3 Control Screen

6.3.1 Main Screen

After the startup is completed, enter the main interface. The top part of the color screen displays the menu button, first page button, time and date and unlock button. You cannot enter the option menu as the menu button is not unlocked. Click the unlock button and enter correct password, the top part of the screen will display temperature/humidity setting button, curve button and on/off button as shown in Figure 6-2. You can switch the on/off functions by pressing the on/off button for at least 3s.

As shown in the left half part of the Figure 6-2, the text on the left of the control mode displays the humidity control mode (air supply humidity control), the text on the right displays the temperature control mode (default air supply control mode, and is consistent with the compressor control mode), and the temperature value in the circle shows the actually measured temperature / humidity values (default is air supply temperature) in current mode, and the humidity value means the air supply humidity. For the two triangles on the edge of perimeter, the left one means the air supply humidity setpoint and the right one means the temperature setpoint in current mode. Clicking toggle button 1 can switch the display between the graphic display and table display. Click the setting button can enter the temperature / humidity setting interface to set the temperature / humidity.

As shown in the right half of Figure 6-2, the sensor data or alarm data is displayed. Click the toggle button 2 to switch between the sensor data and the alarm data.

Figure 6-2 Color display screen - Unlock

Table 6-2 provides the list of menu keys and its functional description:

Table 6-2 Functional Description

Touch keys	Functional Description
Home button	Press this button to enter the main page to see the systems primary data readings.
Menu button	Press this button to display the main menu page by page and enter the various sub-menus
Setting button	Press this button to enter the temperature and humidity settings page, t which can set the system temperature and humidity and the control mode.
Graph button	Click this button to enter the curve interface, you can view the average return air temperature, the remote average temperature, the average air supply temperature, and the average air supply humidity of 0~48Hour.
Time display	Displays the current time
Unit address	Displays the unit address
Display address	Displays the display address
ON/OFF button	Unit is turned off, press the button at least 2s, the unit will boot; the unit is running, Press on the button at least 2s, the unit will shut down;
Unlock button	Press the unlock button, enter the correct user login password to log in; the menu icon appears after logon to set parameters; Click the unlock button to enter the unlocked interface.
Operating status	Display the current operating status of the unit (shutdown, operation, standby, lock, communication interruption).
Toggle button 1	Press the toggle button to switch between the graphical display mode and the list display mode
Toggle button 2	Press this button to switch between the current sensor readings and alarm pages
Control mode	Display the current setting value of the unit and the environmental conditions of the equipment, as described in the following main interface control mode
Status display	Displays the current state of the unit
Sensor reading list	Displays the current operating status of each sensor and its respective components
Alarm list	Displays all the current alarms and its occurrence time

6.3.2 Main Interface Control Mode

The main interface is divided into temperature control mode, humidity control mode, temperature value in current control mode, theoretical supply air humidity value, three read-only status of temperature / humidity setting value.

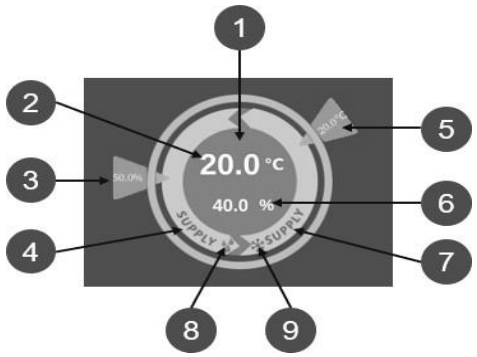


Figure 6-3 Control Mode Diagram

Table 6-3 Description of control mode diagram

No.	Description
1	The colors in the circle are green, gray, and red. For details, see Table 6-4.
2	The measured supply air temperature value changes with the change of the compressor's current control mode.
3	The humidity setting value changes and rotates clockwise between 30-150 polar coordinate angles according to the range of humidity setting value. When the humidity setting is the minimum value, the value is 30 degrees in the polar coordinate, when the humidity setting value is the maximum value, and the humidity setting value is 150 degrees in the polar coordinate.
4	Humidity control is the air supply humidity control by default, showing "supply"
5	The temperature setting value changes and rotates clockwise between 30-150 polar coordinate angles according to the range of temperature setting value. When the temperature setting is the minimum value, the value is 30 degrees in the polar coordinate, when the temperature setting value is the maximum value, and the temperature setting value is 150 degrees in the polar coordinate.
6	Theoretical air supply humidity value
7	The current control mode of compressor is air supply humidity control by default, showing "supply"
8	means humidity
9	means temperature

There are three types of main interface unit status colors, as shown in Figure 6-4.

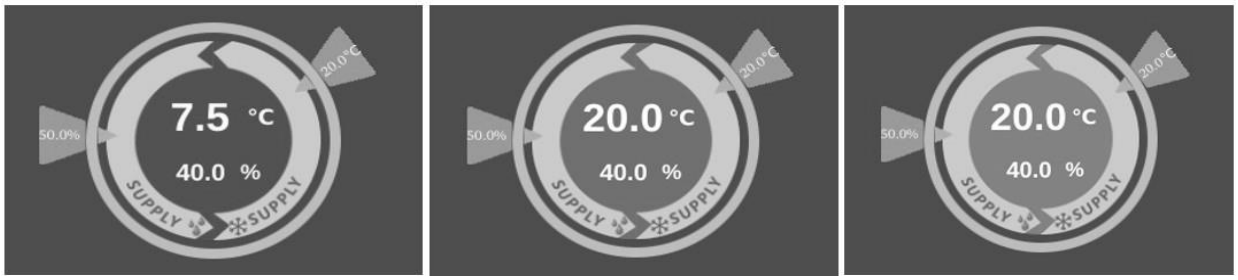


Figure 6-4 Unit Status Color

Table 6-4 Unit Status Color Description

Status	System Status Description
Red	Power-on sensor data is not in the normal range or is invalid
Gray	Off state
Green	Power on status is within the normal range

6.3.3 Password Interface

Press the unlock icon in the upper right corner of the display, the password interface is displayed, as shown in Figure 6-5.

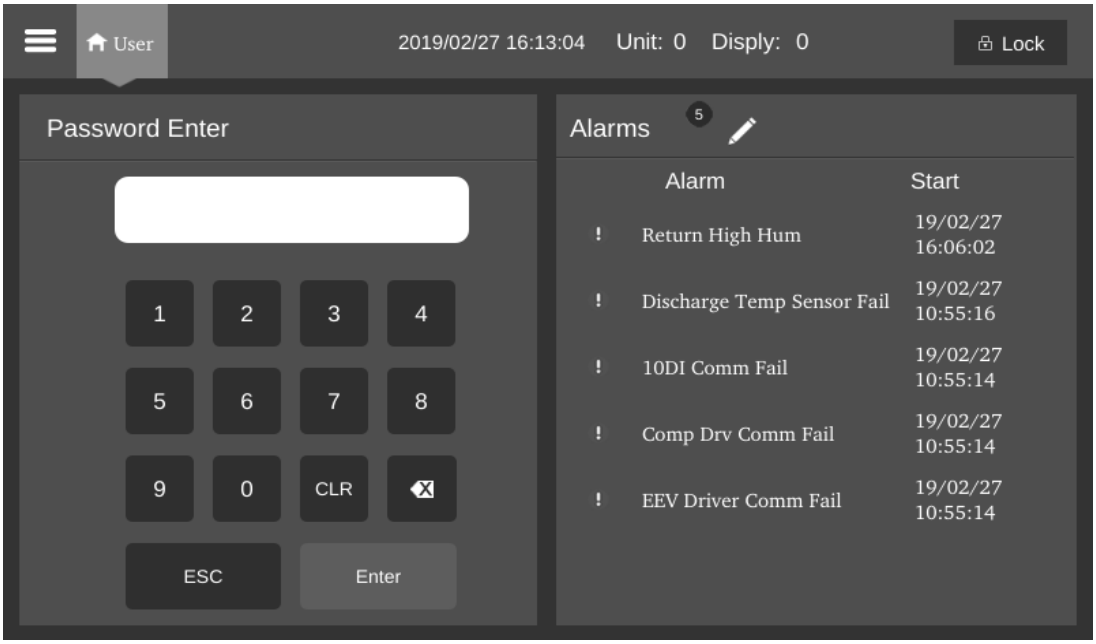


Figure 6-5 Password interface

The Table 6-5 reflects the 2 levels of passwords for accessing the menu.

Table 6-5 Password Level

Password level	User	Initial password	Remark
Level 1	General operator	1490	Browse all menu information. Set all parameters except running and maintenance menu.
Level 2	Maintenance personnel	-	Browse all menu information. Set some running and maintenance menu parameters.

Users can't change the settings when entering an incorrect password; however, they can view the menu. To go back to the Main screen, press the Esc button and then click on the Enter button to get access to the Password interface again.

NOTE: If the users do not enter a password and press the Enter button, the users can view the menu settings but can't change any parameters, similar to the incorrect password example.

6.4 Menu Structure

The Main Menu screen will be accessible by entering and confirming the correct password credentials, as shown in Figure 6-6. For more information, refer to the Appendix II Display Menu Structure Diagram.

Figure 6-6 Main Menu

The menu structure is described in Table 6-6.

Table 6-6 Main Menu Description

Menu item		Descriptions
Menu	Run Information	View temperature/humidity information, switch status, power information, Teamwork information
	Alarm Information	View system active alarms and history alarms
	Temp & Hum setting	Set the temperature/humidity value
	Param Setting	Set teamwork control settings, some alarm setpoint settings, some alarm attribute settings, communication settings, time settings, display settings and password settings
	Graph	View return air temperature curve, return air humidity curve, supply air temperature curve, and remote temperature curve
	About	View the controller software and hardware version number, and the software and hardware version number of the display
Homepage		Display operating status, operating data, alarm data, sensor data
Setting		Temperature/humidity setting under the same menu
Curve		Temperature/humidity curve under the same menu

6.5 Run Information

In the main menu, select Run Information to enter the interface as shown in Figure 6-7, including temperature humidity information, switch status, power information, and teamwork information.

- Temperature Humidity

The Tem/Hum information displays the temperature/humidity parameters of the device in real time, including return air temperature/humidity, supply air temperature, remote temperature and other information, as shown in Figure 6-7 of temperature/humidity information. To scroll up or down the query, press the scroll bar at the far right.

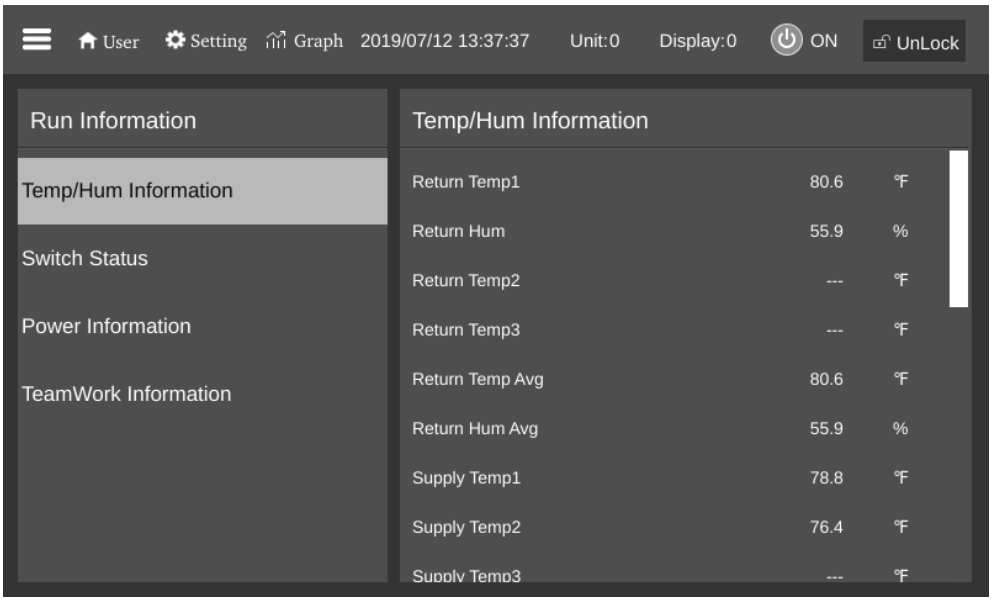


Figure 6-7 Temperature Humidity Information

- Switch Information

From the menu, the current input and output states of the devices can be viewed using the switch status utility. Figure 6-8 shows the screen for the digital signal function.

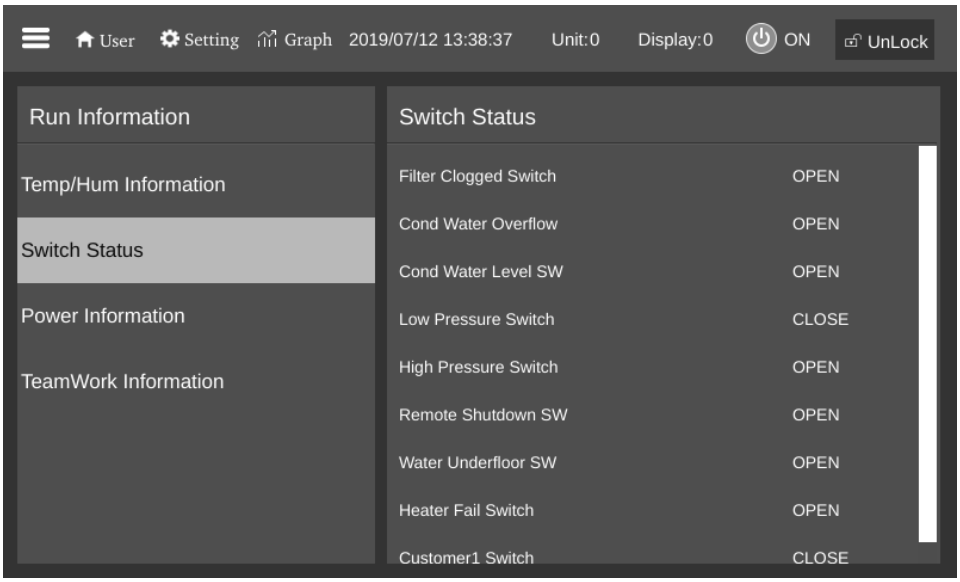


Figure 6-8 Switch Status Information

- Power Information

The Power Information menu displays the voltage and frequency, as shown in Figure 6-9.

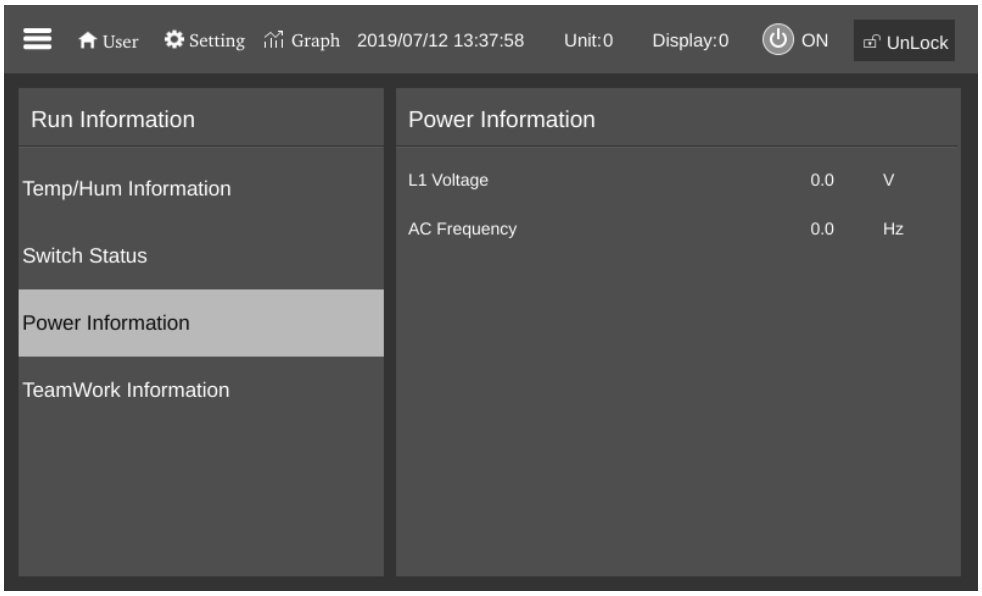


Figure 6-9 Power Information

- Teamwork Information

The Teamwork Information menu displays the status of the group information, as shown in Figure 6-10.

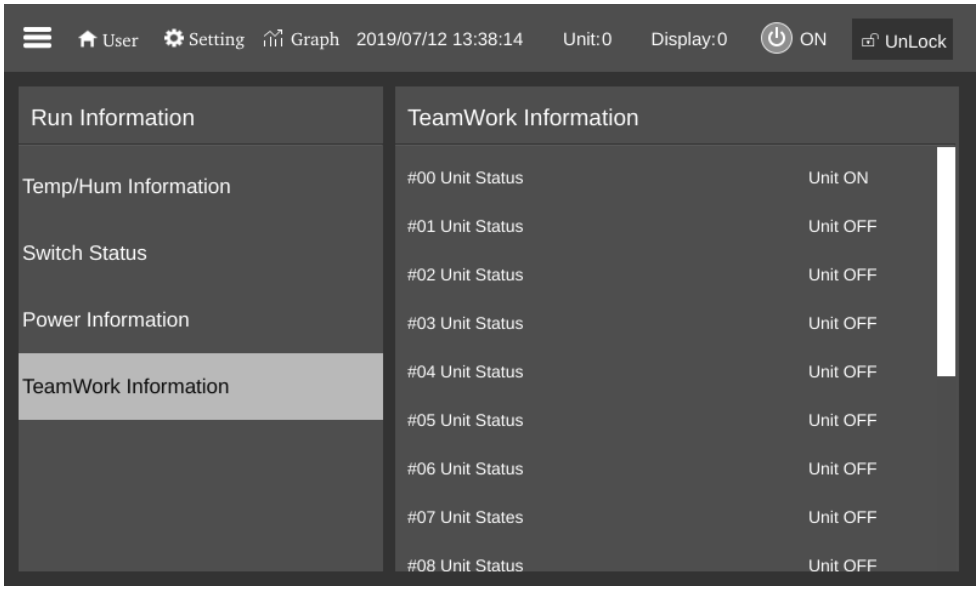


Figure 6-10 Teamwork Information

6.6 Alarm Information

Press the Alarm Information icon in the main menu to enter the page as shown in Figure 6-11. It contains two pages: alarm status and alarm history.

- Alarm Status

The Alarm Status page is used to monitor the current alarm status record of the AC unit, indicating no alarm or specific alarm status information. Specific alarm status information includes serial number, alarm content, alarm time, as shown in Figure 6-11.

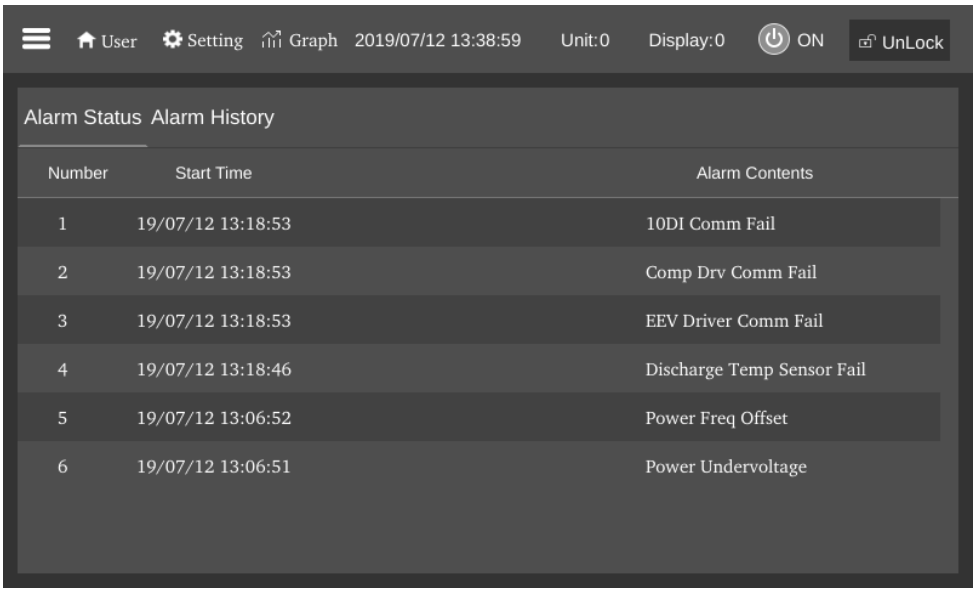


Figure 6-11 Alarm Status

NOTES:

- **The latest Alarm SN is the least number. Press the Up or Down button to scroll through the status records if more than one alarm is activated.**
- **They will be cleared upon system Power-Off.**

- Alarm History

The Alarm History is used to view the historical alarm records, including the Alarm Status Number (quantifiable number of history alarms), Alarm Serial Number and Alarm Type., Alarm Time (Start and End Time) as shown in Figure 6-12.

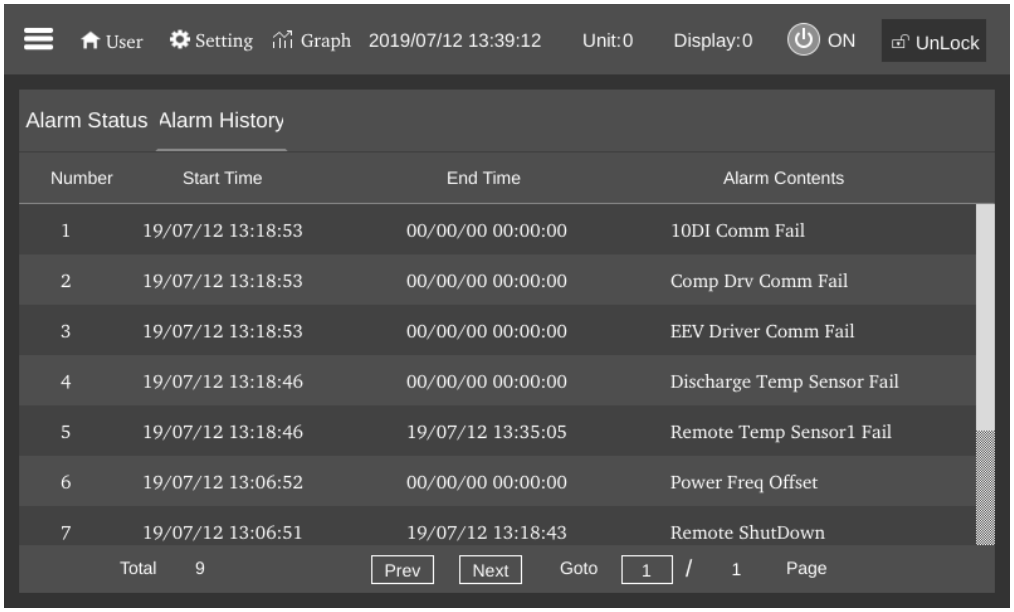


Figure 6-12 Alarm History

NOTES:

- **Press the Up or Down button to scroll through the status records if more than one alarm is activated.**
- **Up to 500 historical alarm records can be stored. They will not be cleared upon system Power-Off.**

6.7 Temp/Hum Setting

Select the Temperature Humidity setting in the main menu to enter the interface as shown in Figure 6-13, including temperature settings and humidity settings.

- Temp Setting

The Temp Setting menu interface is shown in Figure 6-13. The user can set the return air temperature, remote temperature, supply air temperature and temperature difference under this menu.

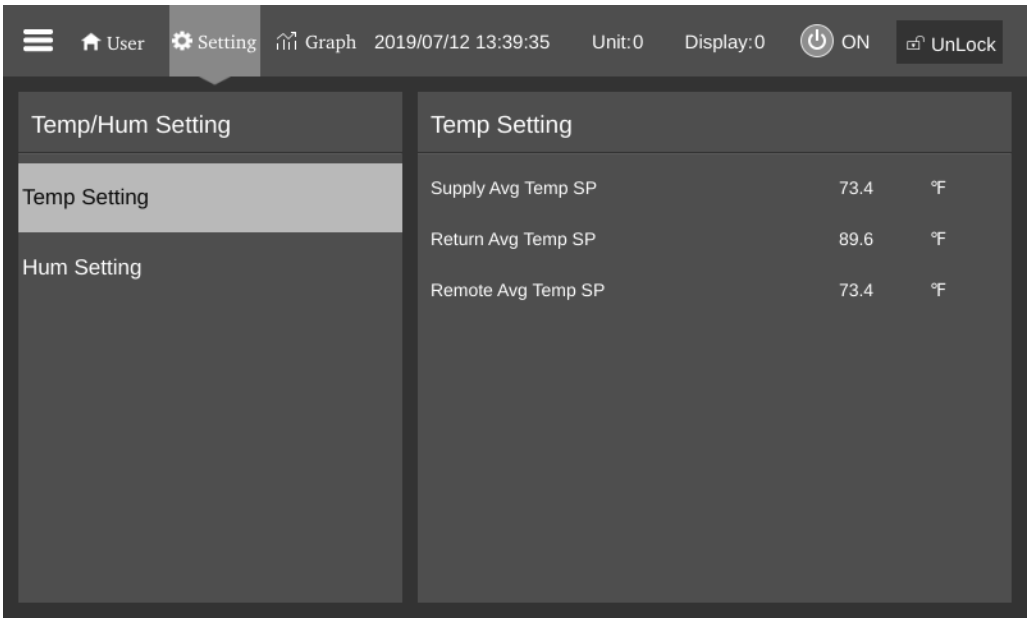


Figure 6-13 Temp Setting

- Hum Setting

The Hum Setting menu interface is shown in Figure 6-14. The user can set the humidity setting value under this menu.

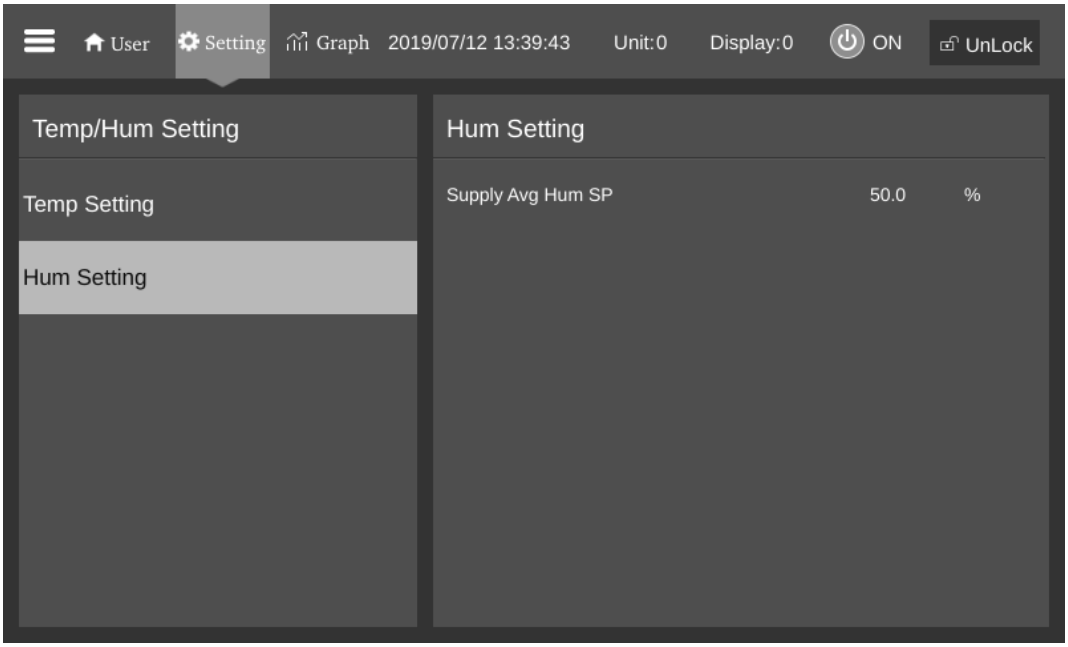


Figure 6-14 Hum Setting

6.8 Parameter Setting

Select Parameter Setting from the main menu to enter the interface as shown in Figure 6-15, including teamwork setting, alarm setting, alarm attribute, communication setting, time setting, display setting, password setting.

- Teamwork Setting

The teamwork Setting menu interface is shown in Figure 6-15. System setting screen, the system parameters can be set to monitoring protocol, baud rate monitoring address, date and time, the display monitor address.

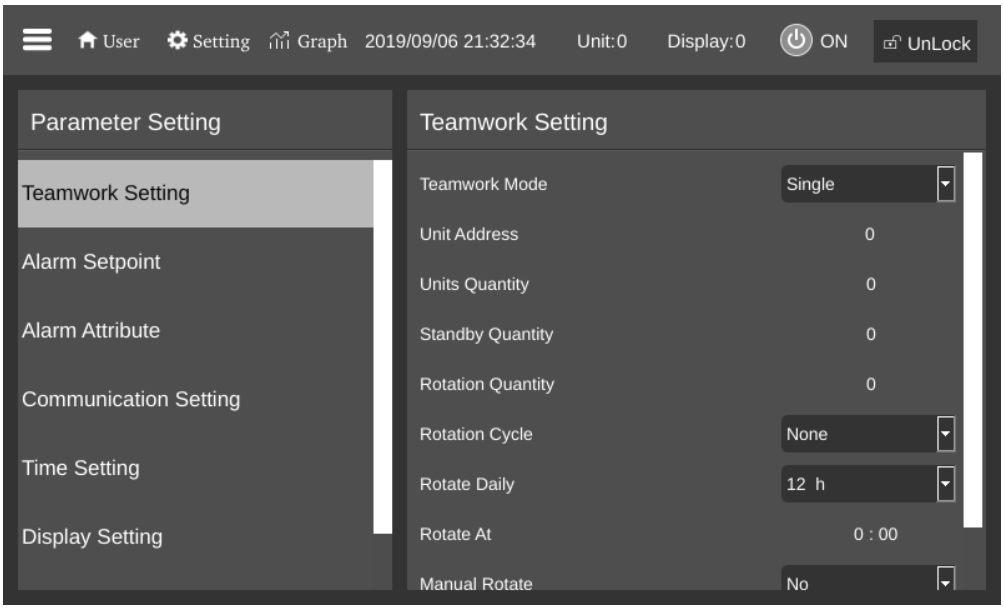


Figure 6-15 Teamwork Setting

- Alarm Setpoint

The Alarm Setpoint menu interface is shown in Figure 6-16.

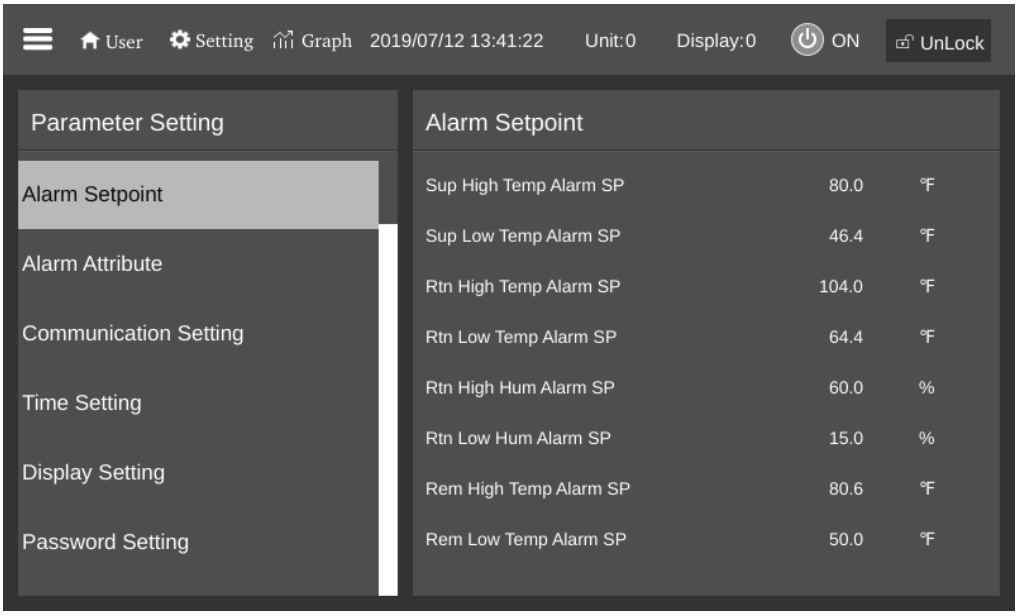


Figure 6-16 Alarms Setpoint

NOTE: Do not change the default values of the initial settings. It is recommended to change the settings only under the guidance of qualified service professional.

- Alarm Attribute

The Alarm attribute menu interface is shown in Figure 6-17.

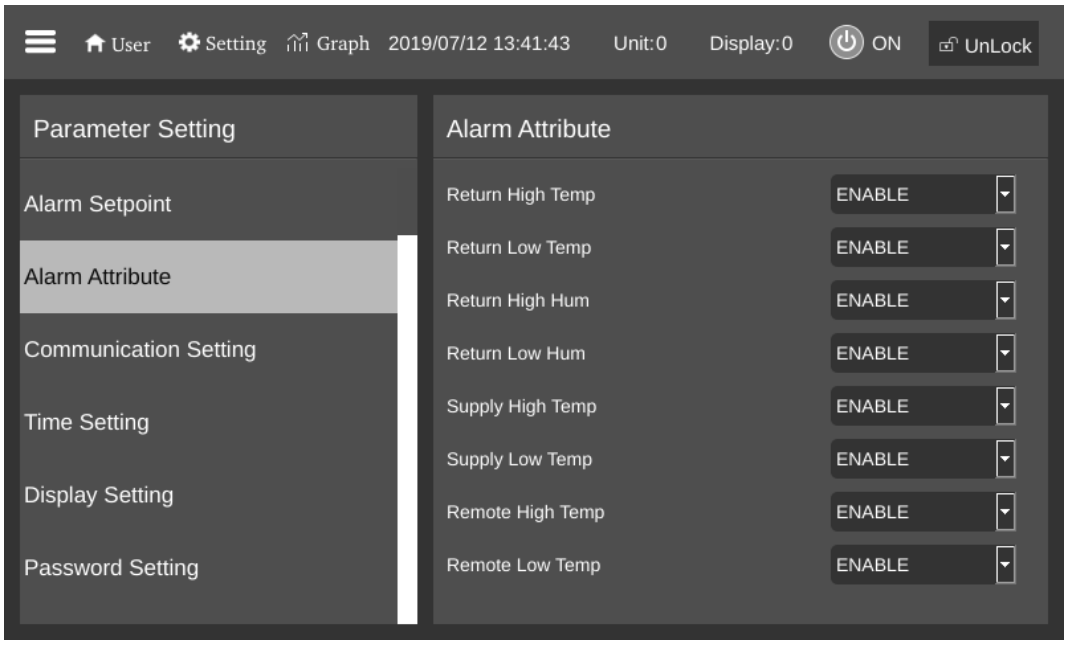


Figure 6-17 Alarm Attribute

- Communication Setting

The Communication Setting menu interface is shown in Figure 6-18.

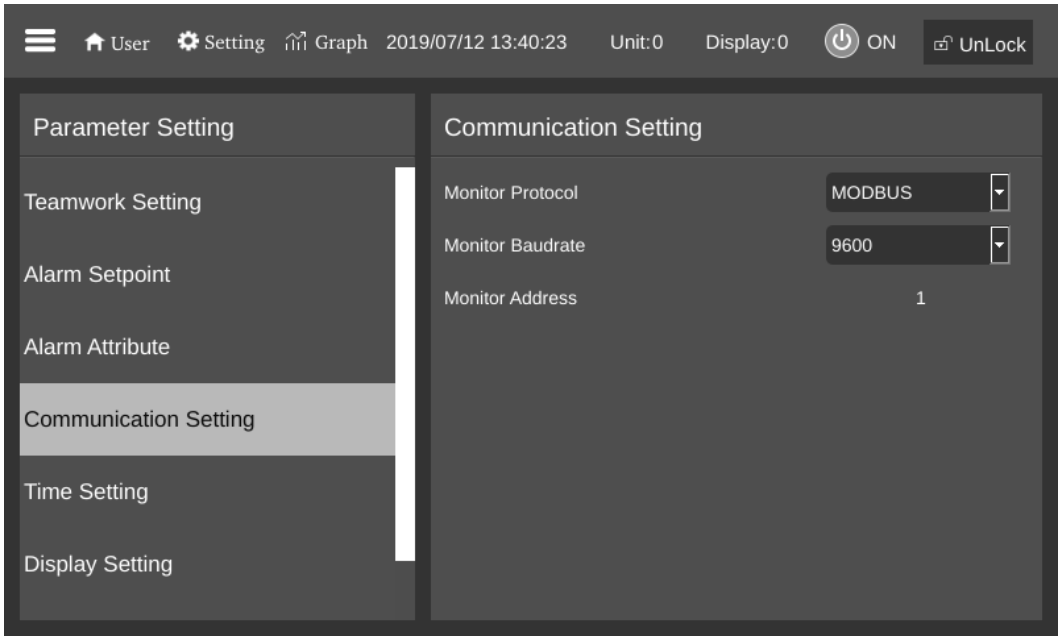


Figure 6-18 Communication Setting

- Time Setting

The Time Setting menu interface is shown in Figure 6-19.

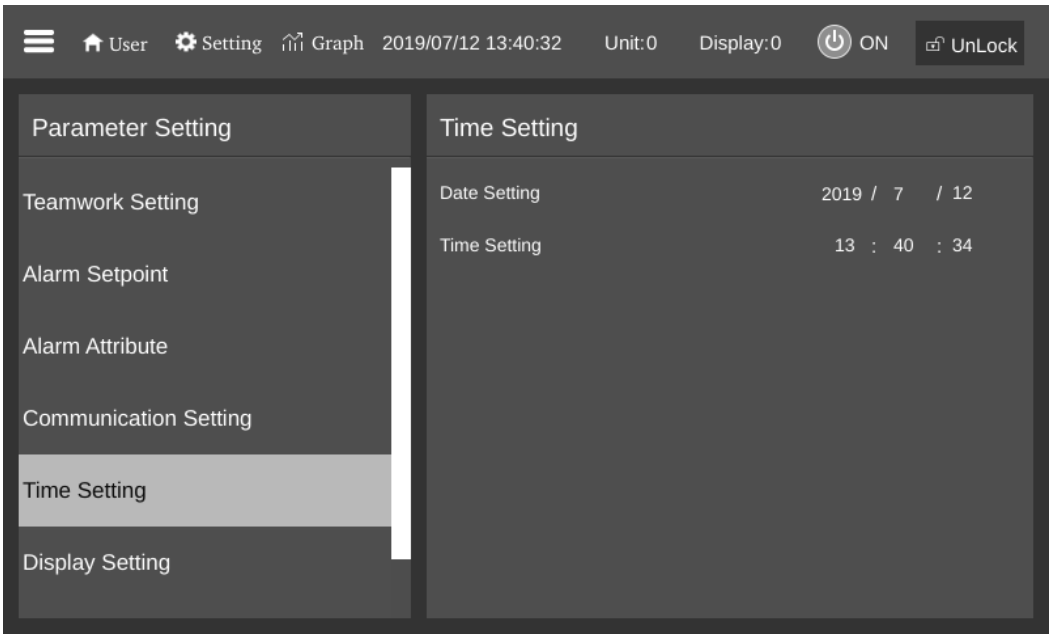


Figure 6-19 Time Setting

- Display Setting

The Display Setting menu interface is shown in Figure 6-20.

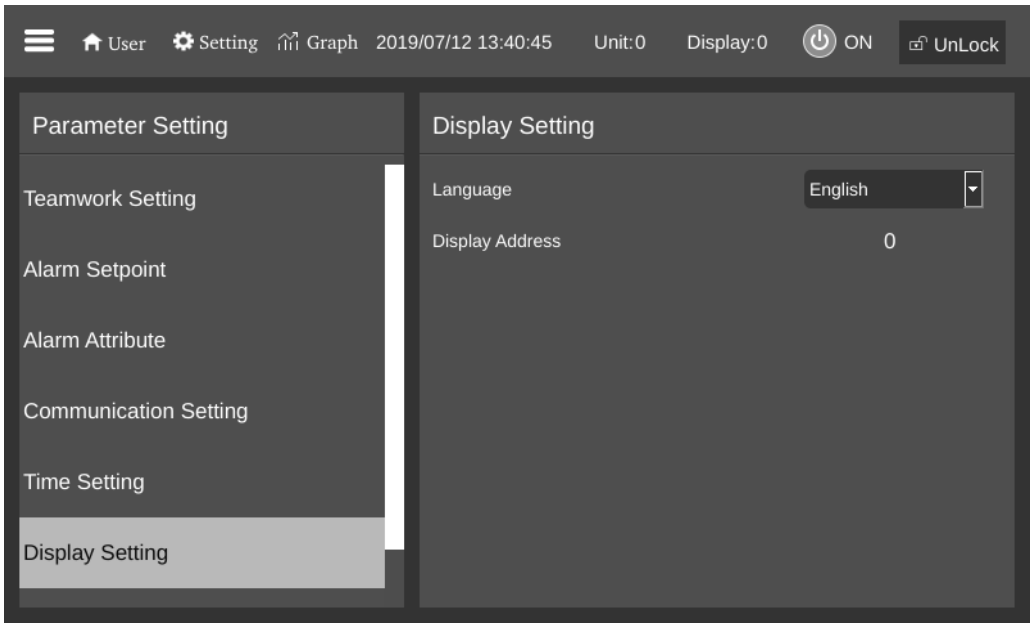


Figure 6-20 Display Setting

- Password Setting

The Password Setting menu interface is shown in Figure 6-21.

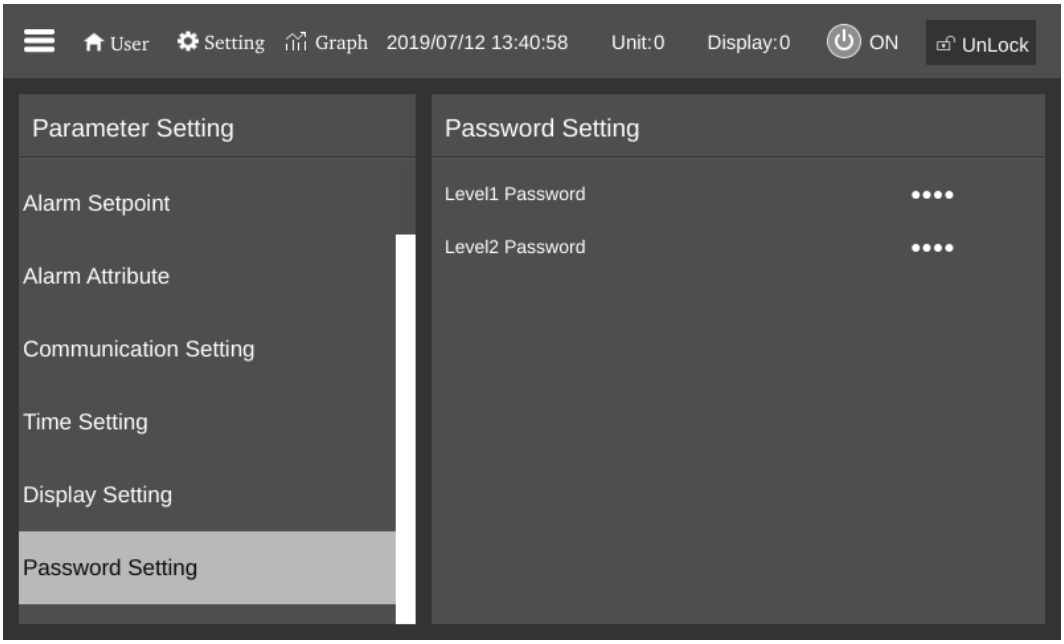


Figure 6-21 Password Setting

6.9 Graph

Select Graph in the main menu to enter the interface as shown in Figure 6-22. Under this menu, the user can query the curve of return temperature, return humidity, supply temperature, and remote temperature of 0 to 48 Hours.

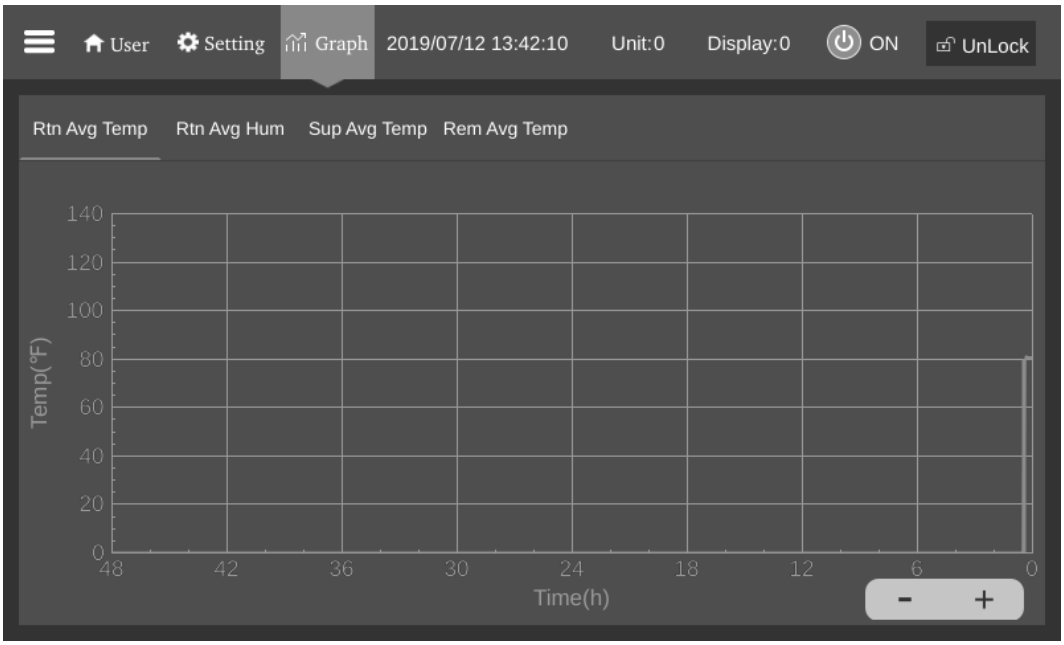


Figure 6-22 Graph

6.10 About

The About menu is used to query the software information and service information, as shown in Figure 6-23 and Figure 6-24.

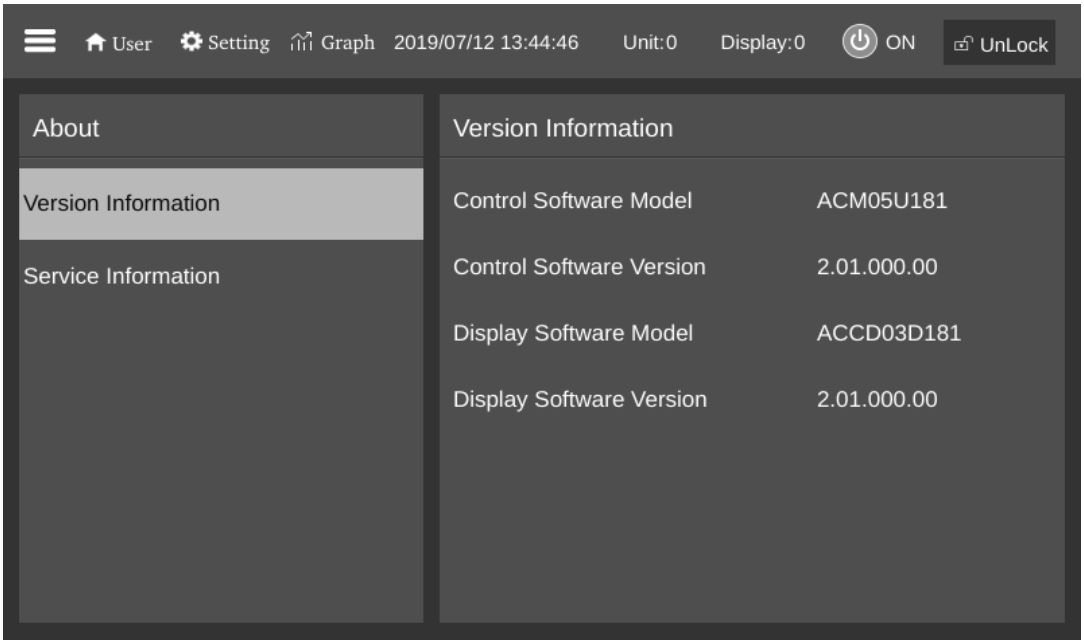


Figure 6-23 Version Information

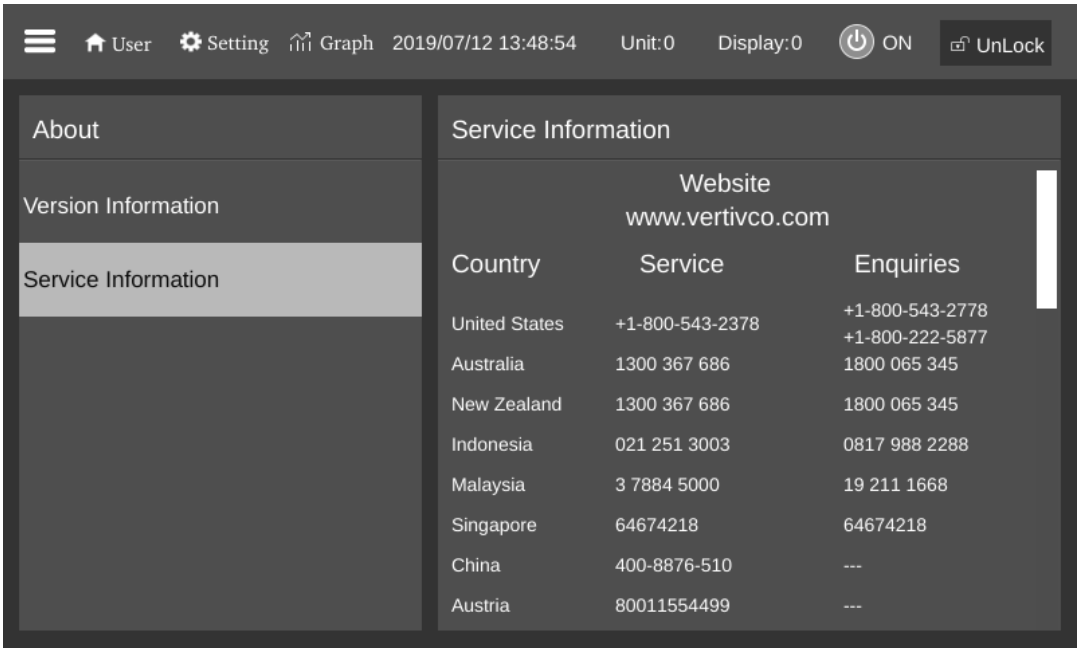


Figure 6-24 Service Information

Chapter 7: Maintenance & Troubleshooting

This chapter deals with the system operation and maintenance of the Liebert CRD10 range of air conditioners. In this chapter, the following points or items will be discussed to help users get to grips with the routine inspections and checks from a end-user-perspective. It includes the maintenance of electrical parts and connections, refrigerant system maintenance guidelines, routine monthly and semi-annual checklists, and drainage system maintenance among others. It also discusses the basic troubleshooting which can be understood from a user perspective.

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 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. If control voltage is applied, the fan motor can restart without warning after a power failure.

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 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.

CAUTION: Risk of excessive refrigerant line pressure. Can cause tubing and component rupture resulting in equipment damage and personal injury. Do not close off the refrigerant-line isolation valve for repairs unless a pressure-relief valve is field- installed in the line between the isolation valve and the check valve. The pressure-relief valve must be rated 5% to 10% higher than the system-design pressure. An increase in ambient temperature can cause the pressure of the isolated refrigerant to rise and exceed the system-design pressure rating (marked on the unit nameplate).

NOTICE!

Risk of improper maintenance. Can cause equipment damage.

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."

Ignoring safety instructions is dangerous. Soiled parts cause a loss of performance and, for switch or control devices, can lead to the breakdown of the unit performance and operation.

NOTICE!

Risk of release of hazardous substances into the environment. Can cause environmental pollution and violation of environmental regulations.

The Liebert® CRV contains substances and components hazardous for the environment (electronic components, refrigerating gases and oils). At the end of its useful life, the Liebert® CRV must be dismantled by specialized refrigerating technicians. The unit must be delivered to suitable centers specializing in the collection and disposal of equipment containing hazardous substances.

7.1 Routine Maintenance & Inspection (Monthly)

Following is the checklist which contains parts and components that are to be checked to ensure proper and accurate functionality. In addition to that, there may be wear and tear of the equipment. Therefore, it is essential that all the checks are performed to ensure a smooth flow in operations. Table 7-1 tabulates the inspection tasks and actions to be implemented and carried out every month during maintenance of the various components in the CRD series of air conditioners.

Table 7-1 Routine Maintenance & Inspection (Monthly)

Components	Item	Remark
Air Filter	Check for clogging or damage	
	Check the filter clogging switch	
	Clean the filter	
Fan	The fan blades are not distorted	
	The bearings are not worn out	
Compressor	Check for leakage	
	Listen to the operation sound, observe the operation vibration	
Air cooled condenser	Make sure that the condenser coil is clear from dirt and debris. Clean if required.	
	The fan base should be firm	
	The fan vibration absorber is not deteriorated or damaged	
	The refrigerant pipes are properly supported	
Refrigeration system	Check the suction pressure	
	Check the discharge pressure	
	Check the refrigerant pipes for signs of leaks	
	Check the moisture condition in the system through the sight glass	
	Check the electronic expansion valve	
Heating system	Check the re-heater operation	
	Check the erosion on the components	

7.2 Routine Maintenance and Inspection (Semi- annually)

Following is the checklist (refer Table 7-2) of the items and functions that need to be checked semi-annually to ensure a smooth operational flow and check the functionality as well as the wear-and-tear of the components in the Liebert CRD 10kW range of air conditioners.

Table 7-2 Routine Maintenance & Inspection (Semi-annually)

Components	Item	Remark
Air Filter	Check for clogging or damage	
	Check the filter clogging switch	
	Clean the filter	
Fan	The fan blades are not distorted	
	The bearings are not worn out	
	Check and fasten the circuit connections	
Compressor	Check for leakage	
	Listen to the operation sound, observe the operation vibration	
	Check and fasten the circuit connections	
Air-cooled condenser	Check the fins cleanness	
	The fan base should be firm	
	The fan vibration absorber is not deteriorated or damaged	
	Check the voltage regulating function of the rotation speed controller	
	The temperature switch is set at the required position	
	The refrigerant pipes are properly supported	
	Check and fasten the circuit connections	
	Check the suction pressure	

Components	Item	Remark
Refrigeration system	Check the discharge pressure	
	Check the refrigerant pipes	
	Check the moisture condition in the system through the sight glass	
Heating system	Check the re-heater operation	
	Check the erosion situation of the components	
	Check and fasten the circuit connection	
Electric control part	Check the fuse and the MCB	
	Check and fasten the circuit connections	
	Check the control program	
	Check the contactor action	
Pump filter	Check if there is any foreign matter in the water tray	
	Check pump filter	

7.3 Self-Diagnosing Functions

The micro-controller has a built-in diagnostic function that helps to turn on/off the components and check their functionality.

7.4 Maintenance of Electrical Control Utilities

In this section, the following processes will be discussed in brief, namely-

1. Maintenance of Electric Parts
2. Maintenance of Control System
3. Water-Leak-Detector

7.4.1 Maintenance of Electric Parts

Visual checks and handling needs to be carried out to check the correctness of electrical connections for the following items:

1. Conduct the electrical insulation test on the system to find out bad electrical connections and contacts. Disconnect all the fuses and MCBs of the control part during the test as high voltage from the insulation test

could damage the components.

2. Check the contactors prior to powering on the unit to ensure that the contactors can hold and un-hold freely.
3. Clean the electrical and control components off dust with brush or dry compressed air.
4. Check the closing of contactors for arcs or signs of burning. Replace the contactors, if required.
5. Fasten all the electrical connection terminals.
6. Check that the sockets and plugs are in good condition. Replace the contactors, if required.
7. If the power cables are damaged, get them replaced by a qualified/certified electrician.

7.4.2 Maintenance of Control System

Appearance checks and simple, functional tests, coupled with handling of control parts needs to be carried out on the following items:

1. Carry out visual checks on the power transformers and isolation transformers for any burn marks followed by testing the output voltage (of the indoor unit and outdoor condensers).
2. Check for signs of ageing on the control interface board, control board, temperature and humidity sensor boards, and fuse boards.
3. Clean the electrical control components and control board to remove dust. Debris, dust, and dirt must be removed, preferably by a dust removing agent.
4. Check and fasten the Input/ Output ports on the control interface board. It should also include the connections between the control board and control interface boards as well as between the Temperature/Humidity sensor boards and the control interface board.
5. Check the connection between the user terminals (24#, 51#, 37#, 38#, 72#, 73#, 75# and 76#) and the control interface board.
6. Check the output connections between the control interface board and various components including contactors and solenoid valves for liquid pipes. Inspect the input connection between the control interface board and various components, including high pressure switches, heating overtemperature protection switches, discharging temperature and high pressure sensors. Specifically, check the inserting terminals such as high pressure switches and heating over temperature switch followed by replacing the component if it is loosened or in poor condition.
7. Replace the faulty electric components such as faulty control fuses (or MCB’s) and control boards.
8. Check the trunking or insulation condition of the control and power cable connected to the condenser from the indoor unit. Replace the cable, if required.
9. Use a temperature/humidity measuring meter with high precision to calibrate Temperature/Humidity sensor.

10. Regulate the setting point. Meanwhile, check the action of the various function components according to the control logic

11. Simulate and inspect the operation-and-working states of protecting units such as High/Low pressure alarm, High/Low Temperature alarm, High Water Level alarm, and over-temperature alarm and over-temperature protection.

12. Check the sensors.

7.4.3 Water-Leak-Detector

When the unit is installed on the raised floor, the water leak detector is arranged on the ground under the floor; when the unit is installed on the floor, the leakage water detector are arrange on the floor. Confirm the alarm information through the controller. The detector should be located away from any water pool or drainage discharge on the floor, 2 to 2.5 meters away from the unit. Do not place it directly under the machine. Figure 7-1 shows the recommended location for the water-leak-detector:

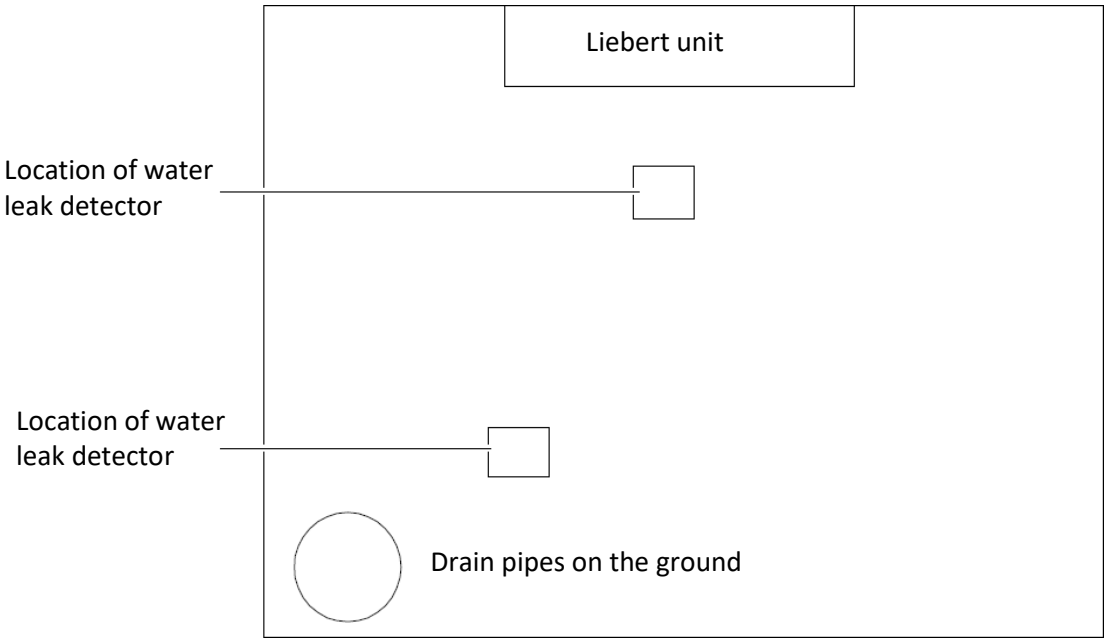


Figure 7-1 Recommended Location for the Water-Leak-Detector

NOTE: Do not use the water-leak-detector in the vicinity of flammable liquids; do not use it to detect any flammable liquids.

7.5 Air Filter Maintenance

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. If control voltage is applied, the fan motor can restart without warning after a power failure.

Air filter filtration class is America MERV8/Europe G4 standard.

1. Set the filter maintenance and alarm logic to ensure efficient operation. The fan operating time is 90 days by default (though the time is set and customized based on the local operating environment); the filter maintenance alarm is triggered based on the configuration and settable operation time.

2. Check and replace the filter according to its dust and clogging condition. During normal operations, the filter needs to be checked once a month and replaced as per the requirement.

NOTE: Cut off the power before replacing the filter. Clear the fan operating time after replacing the filter.

7.6 Fan Kit Maintenance

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 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. If control voltage is applied, the fan motor can restart without warning after a power failure.

Regular checking of the EC fans includes inspection of the motor operating status, fan impeller state, and the co- operative clearance between the fan and wind-leading ring.

Check whether the fan or the wind-leading ring has been installed properly and firmly. Ensure that the fan blades do not hit the adjacent metal plates under any circumstances. Clear the clogging element of the air duct to avoid damage to the refrigerating system and other system kit due to reduced air volume.

In addition, the fan fault alarm of the control board and alarm point of the EC Fan is connected in series. If

the rotating speed is abnormal, the unit will ideally generate an EC fan fault alarm.

If one of fans break down, you can repair or replace it by taking it off from the unit. Because all fans of the unit are equipped independently. Following are the procedures to replace the fan:

1. Shut off all power to the unit by closing the main disconnect switch on the electrical panel.
2. Open the front door of the unit.
3. Unscrew the fan, take it out from fixed frame.

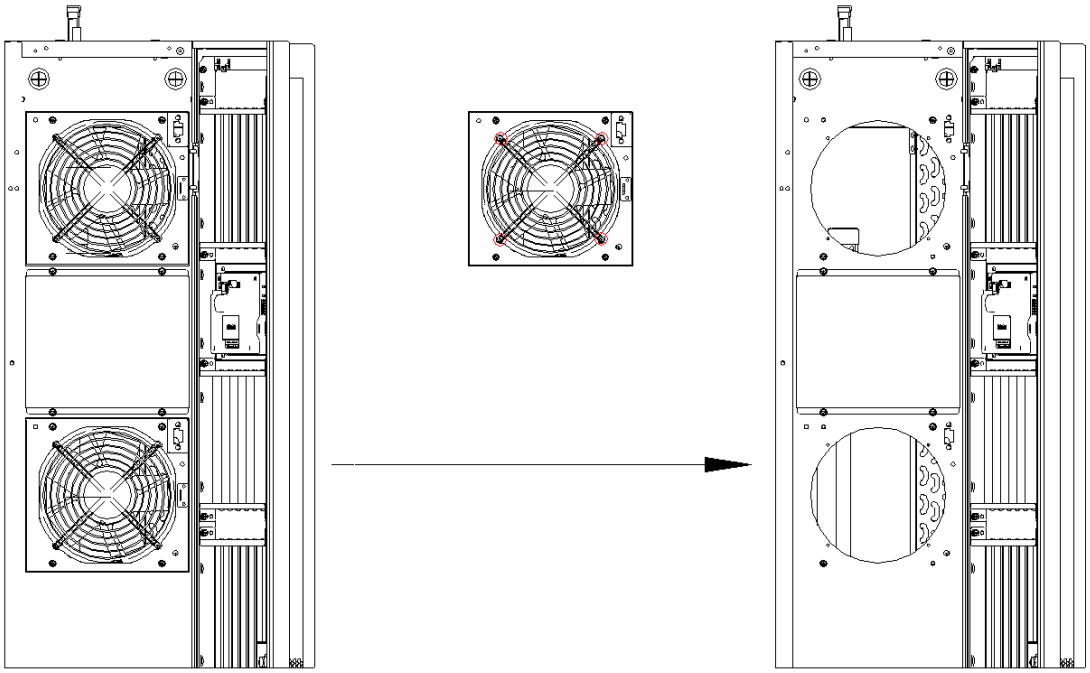


Figure 7-2 Removal the Fan

4. Remove other fans using the same way.

7.7 Electrical Heater Maintenance (Only CE Model)

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.

Following are the basic instructions relevant to the maintenance of the Electrical Heater from the user perspective:

1. If an optional electrical heater is used, then it should be monitored periodically.

2. Ensure that there is no dust, debris, or foreign matter on the surface. The heater elements will heat continuously in the normal state.

3. Inspect the heater every six months for its functionality.

If the heating is not effective, the electric heater needs to be replaced. Following are the procedures of replacing electrical heater:

1. Shut off power to the unit by closing the main switch.

2. Open the front door and remove the fan assemblies. If replacing the electrical heater above, remove the upper two fan assemblies, if replacing the electrical heater below, remove the two fan assemblies below.

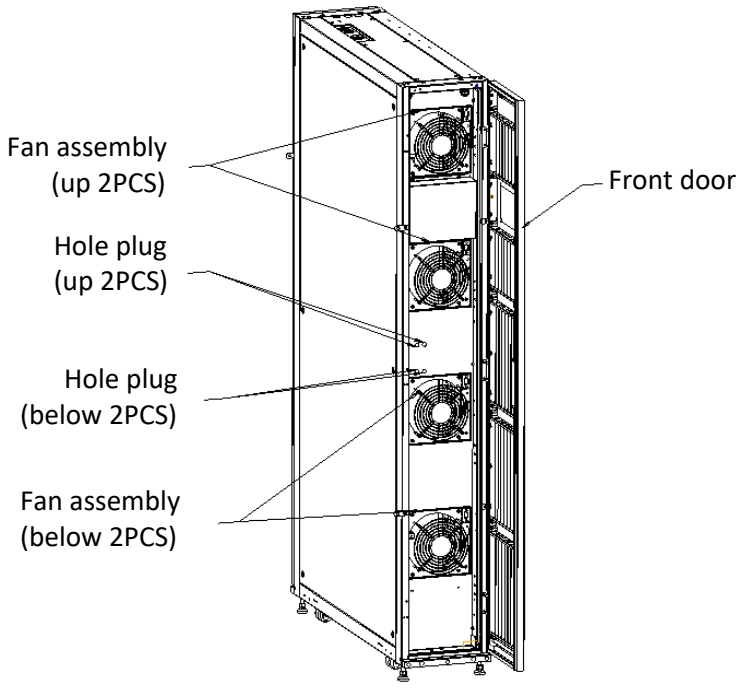


Figure 7-3 Removal the Fixed Plate

3. Remove the electric heater by unscrewing the fixed screws. Figure 7-4 shows the location of the electric heater screws.

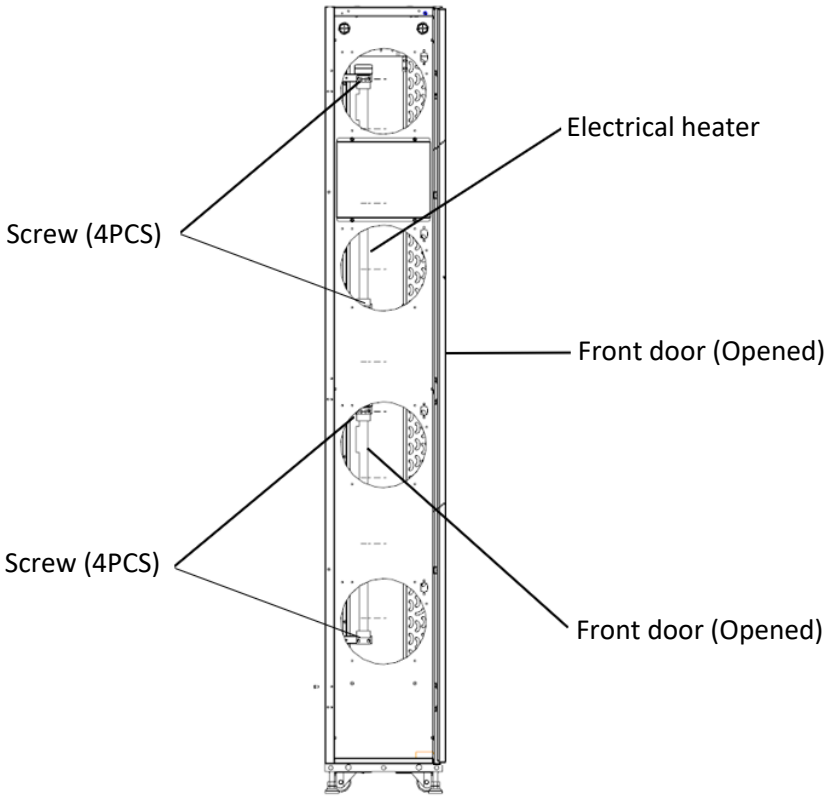


Figure 7-4 Removal the Electric Heater

For replacement, contact the maintenance personnel and support team of Vertiv.

7.8 Condensate pump maintenance

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.

7.8.1 Pump Replacement:

1. Disconnect the power to unit using disconnect switch.
2. Open the rear door.

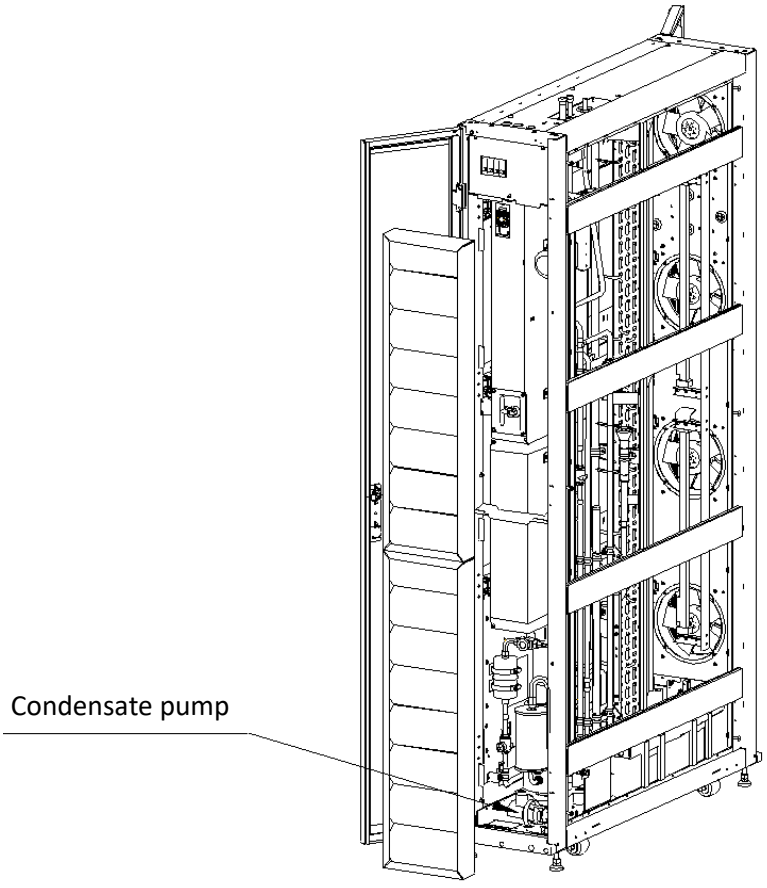


Figure 7-5 The Location of Condensate Pump

3. Pull out pipe of the pump by unscrewing the hose clamp.
4. Unscrew the hose clamp that was used to fix the pump.

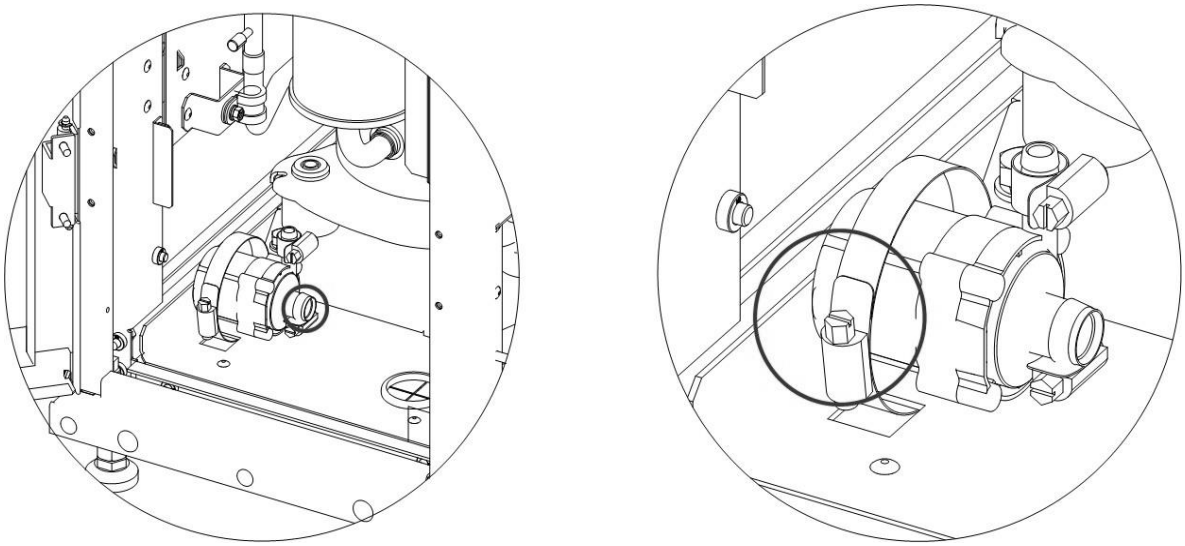


Figure 7-6 Removal the Condensate Pump

7.8.2 Pump Maintenance

1. Disconnect power to unit using disconnect power switch.
2. Open the rear door.
3. Check and clear any obstructions in the main line of the condensate pump.
4. Remove the pump and clean it with a mild cleaning solution.
5. Check that the float mechanism is clean and free of foreign matter.
6. Re-install the pump and check the operation.

7.9 Refrigerating System Maintenance

Following are the basic instructions relevant to the maintenance of the Refrigerating system:

1. Check the refrigerating system once a month to ensure the system functionality.
2. Perform a visual check for detecting signs of wear and tear.
3. Regular inspection is a good practice to ensure long service life of the refrigerating system
4. Check the refrigerant pipes once every 6 months to ensure that there is no wear and tear.

7.10 Drainage System Maintenance

NOTES:

- **Inspect the water tray periodically to ensure normal operation of the drainage pipe.**
- **Ensure no sediments, debris, foreign matter, or leakage occurs in the water tray.**

7.11 Dismantling the Unit

The machine has been designed and built to ensure continuous operation. The working life of the main components, such as the fan and the compressor, depends on the operation and maintenance that they receive. The unit contains environmentally hazardous substances and components (electronic components, refrigerating gases and oils). At the end of the useful life, when the unit is dismantled, the operation must be carried out by specialized refrigerating technicians. The unit must be delivered to appropriate centers specialized in the collection and disposal of equipment containing hazardous substances. The refrigerating fluid and the lubricating oil inside the circuit must be recovered according to the laws in force in the relevant country. To recover the gas use all the connections described in the user manual.

7.12 Troubleshooting

Troubleshooting is to be performed by the trained and qualified service personnel. However, the checklists have been provided for reference purpose only.

NOTE: If jumpers are used for troubleshooting, remember to remove the jumpers after the troubleshooting, failing which the connected jumpers may bypass certain control functions and increase the risk to the equipment.

Table 7-3 Troubleshooting the Fan

Symptom	Possible Causes	Items to be Checked
EC fan can't be started	Power Supply Disconnected	Check whether the fan MCB is closed; If the MCB is closed, check if the power voltage of each phase is normal
	Control board faulty	Check J16 on the micro-processing control board, to ascertain whether the control board is faulty or functions correctly
	Fan power module faulty	Check the alarm lamp on the fan power module to ascertain whether it is faulty or functions correctly
	EC fan faulty	Check power cable of the fan against power failure, phase loss, and low voltage
		Check whether the analog output is within the specific range of 0to10Vdc as per the requirement
		Check whether the motor is clogged (due to large current)
		Check whether the motor is too hot

NOTES:

- **If the previous three problems (i.e. Motor Clogging, Hot Motor, or Hall failure) occurs, the motor can restore normal operation after the faults are cleared.**

- **If the motor is too hot, cut off the fan power; after the motor cools down, power on it again for recovery.**
- **In the event of a hall failure, factory service is required to fix the issue.**

7.12.1 Troubleshooting of the Heating System

Table 7-4 Troubleshooting the Heating System

Symptom	Possible Causes	Items to be Checked or Handling Method
Heating system does not start, the contactor does not close	No heating demand	Check the state of the micro-processing controller, and confirm if there is a requirement for the heating command
	Safety device of the heating system is open	Use a multi-meter to measure the resistance on both ends of the temperature controller; if the resistance is very large, it indicates that the safety device may be open. Next, check whether the fuse is open and the temperature controller is damaged. Measure the resistance of the heater with an ohmmeter to judge if the heater is damaged
The Contactor closes, but heating is ineffective	Heater main power is off	Check if the heater's MCB is turned ON; Check whether the voltages are normal when the contactor is energized
	Electric heater burned	Turn off the power; then physically check the condition of the heater

7.12.2 Troubleshooting of Compressor and Cooling System

Table 7-5 Troubleshooting the Cooling System

Symptom	Possible Causes	Items to be Checked or Handling Method
Compressor can't be started	Does not power-on (shutdown)	Check the main power against under-voltage, over-voltage, and phase loss
	MCB and contactor faulty	Check the compressor MCB, contactor, and connecting cables
	Alarm lock	View the unit alarm records, replace the damaged component and power it on again
	Compressor coils shorted and burnt	Check the motor and replace it in case of any defects or malfunction
The Contactor does not get closed, and the compressor does not start	Low discharging overheat degree alarm	Check the state of the micro-processing controller
	High pressure MCB action	Check if there is an HP alarm.
	Discharging temperature alarm	Check whether a discharging low/high temperature alarm exists
	Low pressure alarm	View if a low-pressure alarm exists in the history alarm
	Contactor faulty	Check if the contactor is able to energize.
	Compressor driver faulty	Check the compressor driver
The Compressor stops after running for 3 minutes. Contactor open	Refrigerant leaked, the low-pressure check is too low or abnormal	Check the suction pressure
		Check the circuit of the low-pressure sensor
		Calibrate accordingly so that the low-pressure sensor reader is within ±0.3 bar range of the actual pressure
High pressure protection	Condenser clogged	Clean the condenser
	Condenser system does not start	Check the condenser fan for the air-cooled system
	Too much refrigerant has been charged	Check whether the sub-cooling degree is too high
Low discharge pressure	Refrigerant leaked	Locate the leakage point, repair it and add the refrigerant
	The Fan speed controller of the outdoor unit is faulty, while the output voltage remains 100%, irrespective of the change in the condensing pressure	If the fan speed controller is found faulty, then it has to be replaced

Symptom	Possible Causes	Items to be Checked or Handling Method
The suction and discharge pressures do not change after startup	Either the Compressor is reversed or the internal air tightness of the compressor has failed	If the compressor is reversed, exchange any two L lines of the compressor. If the internal air tightness of the compressor has failed and cannot be restored, replace the compressor
Low suction pressure or liquid returned	Insufficient refrigerant in the system	Check for leaks. Seal the leaking point and add the refrigerant
	Air filter too dirty	Replace the air filter
	Filter drier clogged	Replace the filter drier
	Improper superheating degree	Check the control board of the Electronic Expansion Valve (EEV)
	Sensing element of the electronic expansion valve faulty	Replace the sensing element
	Improper air flow distribution	Check the air supply and return system
	Low condensing pressure	Check whether the condenser is faulty
Compressor too noisy	Liquid returned	Refer to the handling methods of “Low suction pressure or liquid returned”
	Bearing worn out due to lubricant loss	Add lubricant
Compressor over temperature	Too high compression ratio	Check the settings of the HP value and LP value, and inspect if the condenser is clogged.
		Check that the fans of the evaporator and condenser are normal
	Too high suction overheat degree	Add proper amount of refrigerant

Chapter 8: Regulation (EU) no. 517/2014 (F-gas)

8.1 Introduction

Stationary air conditioners placed into the European Community market and operating with fluorinated greenhouse gases (F-gas, such as R407C, R134a, R410A), have to comply with the F-gas Regulation (EU) No. 517/2014.

This Regulation is in force since Jan 1, 2015 an it replaces the Re. (EU) no. 342/2006.

This document summarizes the obligations for the operators that are responsible for the equipment during all its operative life until its disposal.

8.2 Normative References

F-gas	517/2014	Regulation (EU) No 517/2014 of the European Parliament and of the Council of 16 April 2014 on fluorinated greenhouse gases and repealing Regulation (EC) No 842/2006.
Certified personnel and Companies	2015/2067	Commission Implementing Regulation (EU) 2015/2067 of 17 November 2015 establishing, pursuant to Regulation (EU) No 517/2014 of the European Parliament and of the Council, minimum requirements and the conditions for mutual recognition for the certification of natural persons as regards stationary refrigeration, air conditioning and heat pump equipment, and refrigeration units of refrigerated trucks and trailers, containing fluorinated greenhouse gases and for the certification of companies as regards stationary refrigeration, air conditioning and heat pump equipment, containing fluorinated greenhouse gases.
Leak check air conditioning	1516/2007	Commission Regulation No 1516/2007 of 19 December 2007 establishing, pursuant to Regulation (EC) No 842/2006 of the European Parliament and of the Council, standard leakage checking requirements for stationary refrigeration, air conditioning and heat pump equipment containing certain fluorinated greenhouse gases.
Leak check fire protection systems	1497/2007	Commission Regulation No 1497/2007 of 18 December 2007 establishing, pursuant to Regulation (EC) No 842/2006 of the European Parliament and of the Council, standard leakage checking requirements for stationary fire protection systems containing certain fluorinated greenhouse gases. From 01/01/2017 to be replaced by: Commission Implementing Regulation (EU) 2015/2068 of 17 November 2015 establishing, pursuant to Regulation (EU) No 517/2014 of the European Parliament and of the Council, the format of labels for products and equipment containing fluorinated greenhouse gases.

8.3 Fluorinated Greenhouse Gases

Following notes have to be considered when operating with the above mentioned equipments:

- Fluorinated greenhouse gases are covered by the Kyoto Protocol.
- The fluorinated greenhouse gases in this equipment should not be vented to the atmosphere.
- Referring to the value noted in Annex I and Annex IV of Regulation (EU) No 517/2014 here below the global warming potential (GWP) of some major F-gases or mixtures:

-- R-134a GWP 1430

-- R-407C GWP 1774

-- R-410A GWP 2088

NOTE: The refrigerants as R22 are not F-gas and their relevant regulation is Reg. (EU) no. 1005/2009.

8.4 Operators

8.4.1 Definitions

• Operator, according to Regulation 517/2014 Article 2, point 8, means the natural or legal person exercising actual power over the technical functioning of products and equipment covered by this Regulation.

• The State may, in defined, specific situations, designate the owner as being responsible for the operator's obligations.

• Where large installations are involved, service companies are contracted to carry out maintenance or servicing. In these cases the determination of the operator depends on the contractual and practical arrangements between the parties.

8.4.2 Obligations

Operators of stationary air conditioners, which contain fluorinated greenhouse gases, shall, using all measures which are technically feasible and do not entail disproportionate cost:

a Prevent leakage of these gases and as soon as possible repair any detected leakage.

b Ensure that they are checked for leakage by certified personnel.

c Ensure for putting in place arrangements for the proper recovery by certified personnel.

d According to Regulation 517/2014 the operators shall ensure that the equipment is checked for leaks as following:

Case 1 - Non-sealed equipment contains less than 5 tonnes of CO 2 equivalent of fluorinated greenhouse gases.

►►**Leakage test not required**

Case 2 - Hermetically sealed equipment contains less than 10 tonnes of CO 2 equivalent of fluorinated greenhouse gases.

►►**Leakage test not required**

Case 3

►►**Leakage test required:**

check the equipment for leaks with the minimum frequency given in the following table:

X = Tonnes of CO2 Equivalent	Y = equivalent amount of refrigerant [kg]			Minimum frequency for leak check	
	R134a	R410A	R407C	with leakage detection	without leakage detection
5 ≤ X < 50	3,5 ≤ Y < 35	2,4 ≤ Y < 24	2,8 ≤ Y < 28	12 Months	24 Months
50 ≤ X < 500	35 ≤ Y < 350	24 ≤ Y < 240	28 ≤ Y < 282	6 Months	12 Months
X ≥ 500	Y ≥ 350	Y ≥ 240	Y ≥ 282	3 Months	12 Months

e Recovery for the purpose of recycling, reclamation or destruction of the fluorinated greenhouse gases, pursuant to Art. 8 of the Regulation 517/2014 shall take place before the final disposal of that equipment and, when appropriate, during its servicing and maintenance.

8.5 Leakage Detection

The manufacturer approves the following leakage check methods according to Reg. 1516/2007 and Reg. 1497/2007:

Method	Specifications
a Check of circuits and components representing a risk of leakage with gas detection devices adapted to the refrigerant in the system	Gas detection devices shall be checked every 12 months to ensure their proper functioning. The sensitivity of portable gas detection devices shall be at least five grams per year.
b Application of ultraviolet (UV) detection fluid or suitable dye in the circuit	The method shall only be undertaken by personnel certified to undertake activities which entail breaking into the refrigeration circuit containing fluorinated greenhouse gases.
c Proprietary bubble solutions/soapsuds	---

8.6 Labelling

The label applied on the unit (see Onboard Label) is designed to fill-in the relevant amounts of refrigerant according to Regulation 1494/2007 (2015/2068):

a Where fluorinated greenhouse gas is foreseen to be added to the equipment outside of the manufacturing site at the point of installation, a dedicated label accommodates notation of both the quantity (kg) pre-charged in the manufacturing plant and of the quantity charged at the installation site as well as the resulting total quantity of F-gas as a combination of the above mentioned quantities, in a manner which conforms to the legibility and indelibility.

Our split units are usually not pre-charged on factory, in this case the total quantity of refrigerant charged in the unit has to be written in the relevant label, during the commissioning operation at the installation site.

All of the quantities of must be given both as mass of refrigerant [kg] and as Tonnes of CO2 Equivalent. Use the following rule for computation:

$$\text{Tonnes of CO2} = \frac{\text{kg of refrigerant x GWP of refrigerant}}{1000}$$

where:

Refrigerant	GWP
R-134a	1430
R-407C	1774
R-410A	2088

b Our packaged units (not split) operating with F-gas are usually full charged on factory and the total amount of refrigerant charge is already reported on the label. In this case, the label has no need of further written information.

c In general, the above mentioned information has been located in the main nameplate of relevant unit.

d For equipment with double refrigeration circuits, in regards to differentiates requirements on the basis of the quantity of F-gas contained, the required information about refrigerant charge quantities has to be listed separately for each individual circuit

e For equipment with separate indoor and outdoor sections connected by refrigerant piping, the label information will be on that part of the equipment which is initially charged with the refrigerant. In case of a split system (separate indoor and outdoor sections) without a factory pre-charge of refrigerant, the mandatory label information will be on that part of the product or equipment which contains the most suitable service points for charging or recovering the fluorinated greenhouse gas(es).

NOTE: Safety data sheets of F-gases used in the products are available on demand.

8.7 Record Keeping

Operators of equipment which is required to be checked for leaks (see 8.5 Leakage Detection), shall establish and maintain records for each piece of such equipment specifying the following information:

a The quantity and type of fluorinated greenhouse gases installed.

b The quantities of fluorinated greenhouse gases added during installation, maintenance or servicing or due to leakage.

c Whether the quantities of installed fluorinated greenhouse gases have been recycled or reclaimed, including the name and address of the recycling or reclamation facility and, where applicable, the certificate number.

d The quantity of fluorinated greenhouse gases recovered.

e The identity of the undertaking which installed, serviced, maintained and where applicable repaired or decommissioned the equipment, including, where applicable, the number of its certificate.

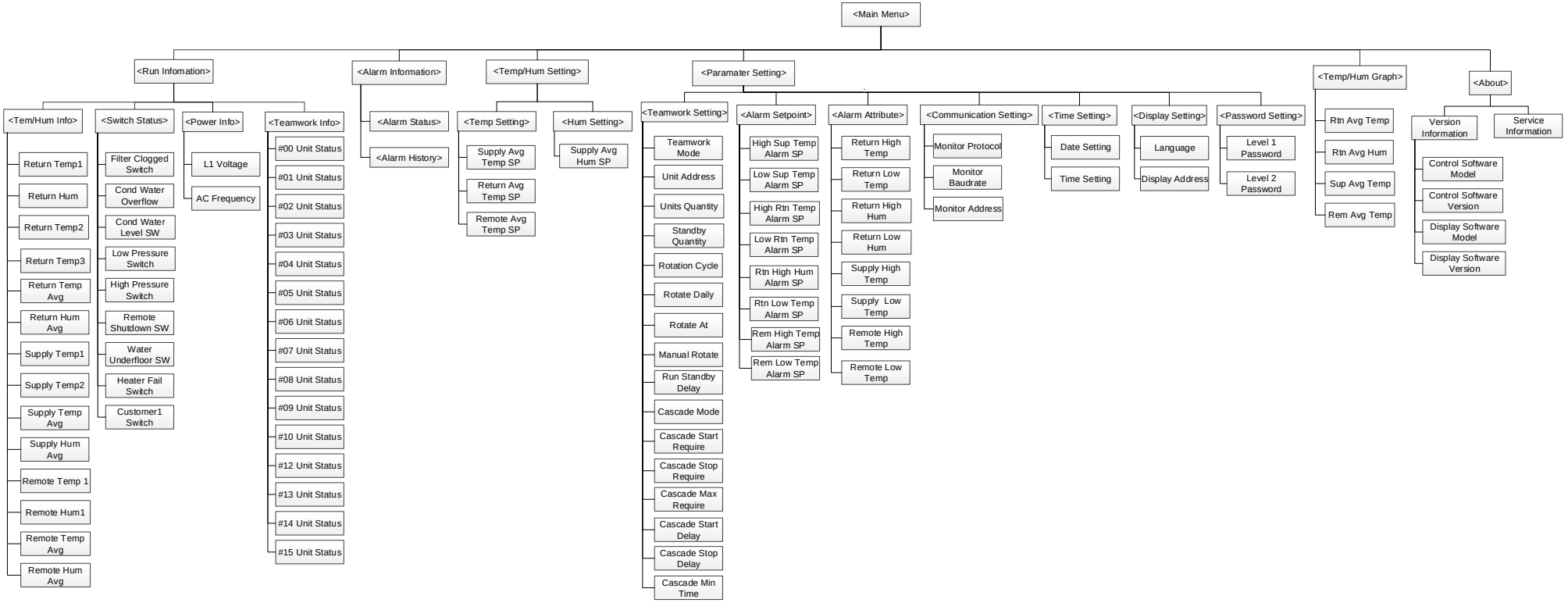
f The dates and results of the leak checks carried out (see 8.5 Leakage Detection).

g If the equipment was decommissioned, the measures taken to recover and dispose of the fluorinated greenhouse gases Unless the records are stored in a database set up by the competent authorities of the Member States the following rules apply:

a The operators shall keep the records for at least five years.

b Undertakings carrying out activities for operators shall keep copies of the records for at least five years.

Appendix I: Display menu structure



Appendix II: Display parameter list

Lv.1 Menu	Lv.2 Menu	Parameter
Run Information	Temp/Hum Information	Return Temp1
		Return Hum
		Return Temp2
		Return Temp3
		Return Temp Avg
		Return Hum Avg
		Supply Temp1
		Supply Temp2
		Supply Temp3
		Supply Temp Avg
		Supply Hum Avg
		Remote Temp1
		Remote Temp2
		Remote Temp3
		Remote Temp4
		Remote Temp5
		Remote Temp6
		Remote Temp7
		Remote Temp8
		Remote Temp9
		Remote Temp10
		Remote Hum1
		Remote Temp Avg
		Remote Hum Avg
	Switch Status	Filter Clogged Switch
		Cond Water Overflow
		Cond Water Level SW
		Low Pressure Switch
		High Pressure Switch
		Remote Shutdown SW
		Water Underfloor SW
		Heater Fail Switch
		Customer1 Switch
	Power Information	L1 Voltage
		AC Frequency

Lv.1 Menu	Lv.2 Menu	Parameter
Run Information	Teamwork Information	#00 Unit Status
		#01 Unit Status
		#02 Unit Status
		#03 Unit Status
		#04 Unit Status
		#05 Unit Status
		#06 Unit Status
		#07 Unit Status
		#08 Unit Status
		#09 Unit Status
		#10 Unit Status
		#11 Unit Status
		#12 Unit Status
		#13 Unit Status
		#14 Unit Status
		#15 Unit Status
Alarm Information	Alarm Status	--
	Alarm History	--
Temp/Hum Setting	Temp Setting	Supply Avg Temp SP, Default 23C (73.4F), Range 15 to 32C (59 to 89.6F)
		Return Avg Temp SP, Default 32C (89.6F), Range 18 to 40C (64.4 to 104F)
		Remote Avg Temp SP, Default 23C (73.4F), Range 15 to 32C (59 to 89.6F)
	Hum Setting	Supply Avg Hum SP, Default 50%, Range 20% to 60%
Parameter Setting	Teamwork Setting	Teamwork Mode
		Unit Address
		Units Quantity
		Standby Quantity
		Rotation Quantity
		Rotation Cycle
		Rotate Daily
		Rotate At
		Manual Rotate
		Run Standby Delay
		Cascade Mode
		Cascade Start Require
		Cascade Stop Require
		Cascade Max Require
		Cascade Start Delay
		Cascade Stop Delay
		Cascade Min Time
	Alarm Setpoint	Sup High Temp Alarm SP, Default 27C (80.6F), Range 20 to 35C (68 to 95F)
		Sup Low Temp Alarm SP, Default 8C (46.4F), Range 5 to 20C (41 to 68F)
		Rtn High Temp Alarm SP, Default 40C (104F), Range 30 to 45C (86 to 113F)
		Rtn Low Temp Alarm SP, Default 18C (64.4F), Range 5 to 25C (41 to 77F)
		Rtn High Hum Alarm SP, Default 60%, Range 50% to 99%

		Rtn Low Hum Alarm SP, Default 15%, Range 1% to 50%
		Rem High Temp Alarm SP, Default 27C (80.6F), Range 20 to 45C (68 to 113F)
		Rem Low Temp Alarm SP, Default 10C (50F), Range 5 to 20C (41 to 68F)
Parameter Setting	Alarm Attribute	Return High Temp
		Return Low Temp
		Return High Hum
		Return Low Hum
		Supply High Temp
		Supply Low Temp
		Remote High Temp
		Remote Low Temp
	Communication Setting	Monitor Protocol
		Monitor Baudrate
		Monitor Address
	Time Setting	Date Setting
		Time Setting
	Display Setting	Language
		Display Address
	Password Setting	Level 1 Password
		Level 2 Password
Temp/Hum Graph	Rtn Avg Temp	--
	Rtn Avg Hum	--
	Sup Avg Temp	--
	Rem Avg Temp	--
About	Version Information	Control Software Model
		Control Software Version
		Display Software Model
		Display Software Version
	Service Information	--

Appendix III: Alarms Table

Alarm Table			
High Pressure Alarm	Low Pressure Alarm	Discharge High Temp	Discharge Low SH
Dsch High Temp Lock	High Pressure Lock	Low Pressure Lock	Dsch Low SH Lock
Return High Hum	Return Low Hum	Return High Temp	Return Low Temp
Supply High Temp	Supply Low Temp	Remote High Temp	Remote Low Temp
Loss Of Power	Power Overvoltage	Power Undervoltage	Power Freq Offset
Filter Clogged Alarm	Clogged Maintenance	Water Underfloor	Cond WOF
Loss Of Airflow	Loss Of Master Unit	Loss Of Slave Unit	Remote Shutdown
Return Temp Sensor1 Fail	Return Hum Sensor1 Fail	Supply Temp Sensor1 Fail	Supply Temp Sensor2 Fail
High Pressure sensor Fail	Low Pressure sensor Fail	Discharge Temp Sensor Fail	Suction Temp Sensor Fail
Remote Temp Sensor1 Fail	Remote Temp Sensor2 Fail	Remote Temp Sensor3 Fail	Remote Temp Sensor4 Fail
Remote Temp Sensor5 Fail	Remote Temp Sensor6 Fail	Remote Temp Sensor7 Fail	Remote Temp Sensor8 Fail
Remote Temp Sensor9 Fail	Remote Temp Sensor10 Fail	Heater Fail	10DI Comm Fail
EEV Driver Comm Fail	Comp Drv Comm Fail	Unit Addr Repeat	Comp Drv Protect00
Comp Drv Protect01	Comp Drv Protect02	Comp Drv Protect03	Comp Drv Protect04
Comp Drv Protect05	Comp Drv Protect06	Comp Drv Protect07	Comp Drv Protect08
Comp Drv Protect09	Comp Drv Protect10	Comp Drv Protect11	Comp Drv Protect12
Comp Drv Protect13	Comp Drv Protect14	Comp Drv Protect15	Fan1 Fail
Fan2 Fail	Fan3 Fail	Fan4 Fail	Customer1 Alarm
Smoke Sensor Fail	Fire Sensor Fail		

Fabbricante-Manufacturer-Hersteller-Fabricant-Fabricante

Fabricante- Tillverkare – Fabrikant – Valmistaja – Produsent

Fabrikant – Κατασκεναστηξ – Producent

Il Fabbricante dichiara che questo prodotto è conforme alle direttive Europea:

The Manufacturer here by declares that this product conforms to the European Union directives:

Der Hersteller erklärt hiermit, dass dieses Produkt den Anforderungen der europäischen Richtlinien gerecht wird:

Le Fabrican déclare que ce produit est conforme aux directives Européennes:

El Fabricante declara que este producto es conforme a las directivas Europeas:

O Fabricante declara que este produto está em conformidade com as directivas Europeias:

Tillverkare försäkrar härmed att denna produkt överensstämmer med Europeiska Uniones direktiv:

De Fabrikant verklaart dat dit product conform de Europese richtlijnen is:

Vaimistaja vakuuttaa täten, että tämä tuote täyättää seuraavien EU-direktiivien vaatimukset:

Produsent erklærer herved at dette produktet er i samsvar med EU-direktiver:

Fabrikant erklærer herved, at dette product opfylder kravene i EU direktiverne:

κατασÀευαστρj δηλνξι ϋτι το παÃϋν πÃοϊϋν εβναι ÀατασÀευαmϒνο αϋm ωνα με τιj οδηγβεj τηj E.E.:

2006/42/EC; 2014/30/EU; 2011/65/EU with its amendment (EU) 2015/863

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