CoolCenter Immersion Cooling System

User Manual (Original Instructions)

The information contained in this document is subject to change without notice and may not be suitable for all applications. While every precaution has been taken to ensure the accuracy and completeness of this document, Vertiv assumes no responsibility and disclaims all liability for damages result from use of this information or for any errors or omissions.

Vertiv recommends installing a monitored fluid detection system that is wired to activate the automatic closure of field-installed coolant fluid supply and return shut off valves, where applicable, to reduce the amount of coolant fluid leakage and consequential equipment and building damage. Refer to local regulations and building codes relating to the application, installation, and operation of this product. The consulting engineer, installer, and/or end user is responsible for compliance with all applicable laws and regulations relation to the application, installation, and operation of this product.

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Technical Support Site

If you encounter any installation or operational issues with your product, check the pertinent section of this manual to see if the issue can be resolved by following outlined procedures. Access to the unit and technical support on site can be performed only by trained and authorized CE.

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1 Important Safety Instructions

Save These Instructions

This manual contains important instructions that should be followed during operation and maintenance of the Vertiv™ CoolCenter Immersion cooling system (hereinafter referred to as the system or the unit).

WARNING! Risk of improper wiring, piping, moving, lifting, and handling. Can cause serious injury or death. Building and equipment damage may also result. 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 moving. Can cause serious injury or death. Building and equipment damage may also result. Use only lifting equipment that is rated for the unit weight by an OSHA-certified rating organization.

WARNING! Risk of top-heavy unit falling over when improperly lifted or moved. Can cause serious injury or death. Building and equipment damage may also result. 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! This unit is powered by HIGH VOLTAGE. Serious injury or death can occur. All electrical work must only be carried out by a suitably qualified electrician. Installation should include a locally mounted isolator/switch disconnect to enable safe maintenance of the unit (to be supplied by others).

WARNING! Arc flash and electric shock hazard. Can cause serious injury or death. Building and equipment damage may also result. Disconnect all local and remote electric power supplies and wear appropriate, OSHA approved personal protective equipment (PPE) per NFPA 70E before working within the electric control enclosure. Customer must provide earth ground to unit, per NEC, CEC, and local codes, as applicable. Verify with a voltmeter that power is Off. The controller does not isolate power from the unit, even in the “Unit Off” mode. Some internal components still require and receive power even during the "Unit Off” mode of the controller. The factory-supplied, optional disconnect switch is inside the unit. The line side of this switch contains live high voltage. 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. 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. Follow all local codes.

WARNING! Risk of electric shock. Can cause serious injury or death. Building and equipment damage may also result. Open all local and remote electric power supply disconnect switches and verify that power is off with a voltmeter before working within any electric connection enclosures. The 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. Installation, 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 short circuits and electric shock. Can cause serious injury or death. Building and equipment damage can result from cut insulation or damaged wires. Can cause overheated wiring, smoke, fire. Verify that all wiring connections are tight and that all wiring is contained within the junction box prior to closing and securing the cover. Insert CSA-certified or UL-listed bushings into holes and/or knockouts used to route wiring through metal panels to protect the wire insulation from contact with sheet metal edges.

WARNING! Risk of improper wire sizing/rating and loose electrical connections causing overheated wire and electrical connection terminals resulting in smoke or fire. Can cause serious injury or death. Building and equipment damage may also result. 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 passageway interference. Can cause unit and/or structure damage. The unit may be too large to fit through a passageway while on or off 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 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 +/- 5% of the load nameplate nominal voltage. Also, ensure that no three-phase sources are single-phased at any time.

NOTICE

Risk of improper electrical connection of three-phase input power. Can cause backward pump rotation and unit damage. Service technicians should use a gauge set on the system during the initial start up to verify that the three-phase power is connected properly. Three-phase power must be connected to the unit line voltage terminals in the proper sequence so that the pump rotates in the proper direction. Incoming power must be properly phased to prevent pump from running backward. We recommend checking the unit's phasing with proper instrumentation to ensure that the power connections were made correctly.

NOTICE

Installation, service, and maintenance work must be performed only by properly trained and qualified personnel and in accordance with applicable regulations and manufacturers' specifications.

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2 Product Overview

Vertiv™ CoolCenter Immersion cooling system (hereinafter referred to as the system or the unit) is a professional small and medium heat dissipation equipment, suitable for places that are not easily accessible by the general public.

This section describes the model nomenclature, product appearance, and main components of the system.

2.1 Product Description

The unit is designed for high performance servers in data centers. It uses water or other liquid as the heat rejection medium (primary loop) and dielectric coolant as the refrigerant to directly cool the servers (secondary loop).

The unit is known for its low power consumption and high cooling efficiency operations:

Efficient cooling

The servers are immersed into the coolant in the Tank, with higher cooling efficiency compared to conventional air cooled method (i.e. servers are cooled by means of air convection). The system removes hot spots concerns from the server racks. It dissipates the server heat completely into the liquid, to achieve even temperature distribution across the entire server. This meets the typical CPU/GPU cooling demand in big data analysis, cloud computing and AI applications.

Energy saving

The unit is able to remove the intensive server heat with minimum temperature difference to the outdoor ambient. This means that the unit can be coupled directly with heat rejection devices, e.g. dry cooler, cooling tower etc., to improve the annual operation efficiency of the data center, results in better operation costs with lower power consumptions.

2.2 Abbreviations

2U: The unit that indicates the external dimensions of the server. The width of the server is 48.26 cm, and the height of the server is 4.445 x 2 = 8.89 cm

CDU: Cooling Distribution Unit

FKM: Fluororubber

HMI: Human Machine Interface

PC: Polycarbonate

PUE: Power Usage Effectiveness

RCD: Residual Current Device

2.3 Model Nomenclature

Vertiv™ CoolCenter Immersion cooling system has two types: the modular unit and the self-contained unit. The system includes the distribution unit (CDU), the liquid cooling cabinet (Tank), and the self-contained unit (CDU+Tank).

CDU and the self-contained unit are named in 13 digits.

Figure 2.1 Nomenclature of CDU and the self-contained unit

1	2	3	4	5	6	7	8	9	10	11	12	13
I	C	D	1	2	0	N	C	T	2	P	0	0

Digit 1, 2 Product model

IC Immersion Cooling

Digit 3 Product type

D CDU

S Self-contained

Digit 4 to 6 Cooling capacity kW

025 Nominal cooling capacity kW

120 Nominal cooling capacity kW

240 Nominal cooling capacity kW

Digit 7 Power mode

N 380-400V 3N~ 50&60Hz

Digit 8 Distribution unit structure

C Cabinet dispensing unit

A Self-contained unit

Digit 9 Cooling source

T Cooling tower or dry cooler

C Chilled water unit

Digit 10 Coolant pump configuration

2 2N redundancy

Digit 11 Version

A Asia

E EMEA

P China

Digit 12 Order special identifier

0-9 Factory code

Digit 13 Optional parts

0 None

Tank is named in 9 digits.

Figure 2.2 Nomenclature of Tank

1	2	3	4	5	6	7	8	9
I	C	T	4	2	L	0	P	0

Digit 1, 2 Product model

IC	Immersion Cooling

Digit 3 Product type

T	Tank

Digit 4, 5 Tank mode

42	42U
52	52U

Digit 6 Tank pipe connection position

L	Pipe connection at left
R	Pipe connection at right

Digit 7 Optional parts

0	None

Digit 8 Version

A	Asia
E	EMEA
P	China

Digit 9 Order special identifier

0-9	Factory code

2.4 Product Appearance

The modular unit includes CDU and Tank.

Figure 2.3 Appearance of the modular unit (CDU and Tank)

The self-contained unit integrates the CDU and Tank together.

Figure 2.4 Appearance of the self-contained unit

2.5 Main Components

2.5.1 Indoor Main Components

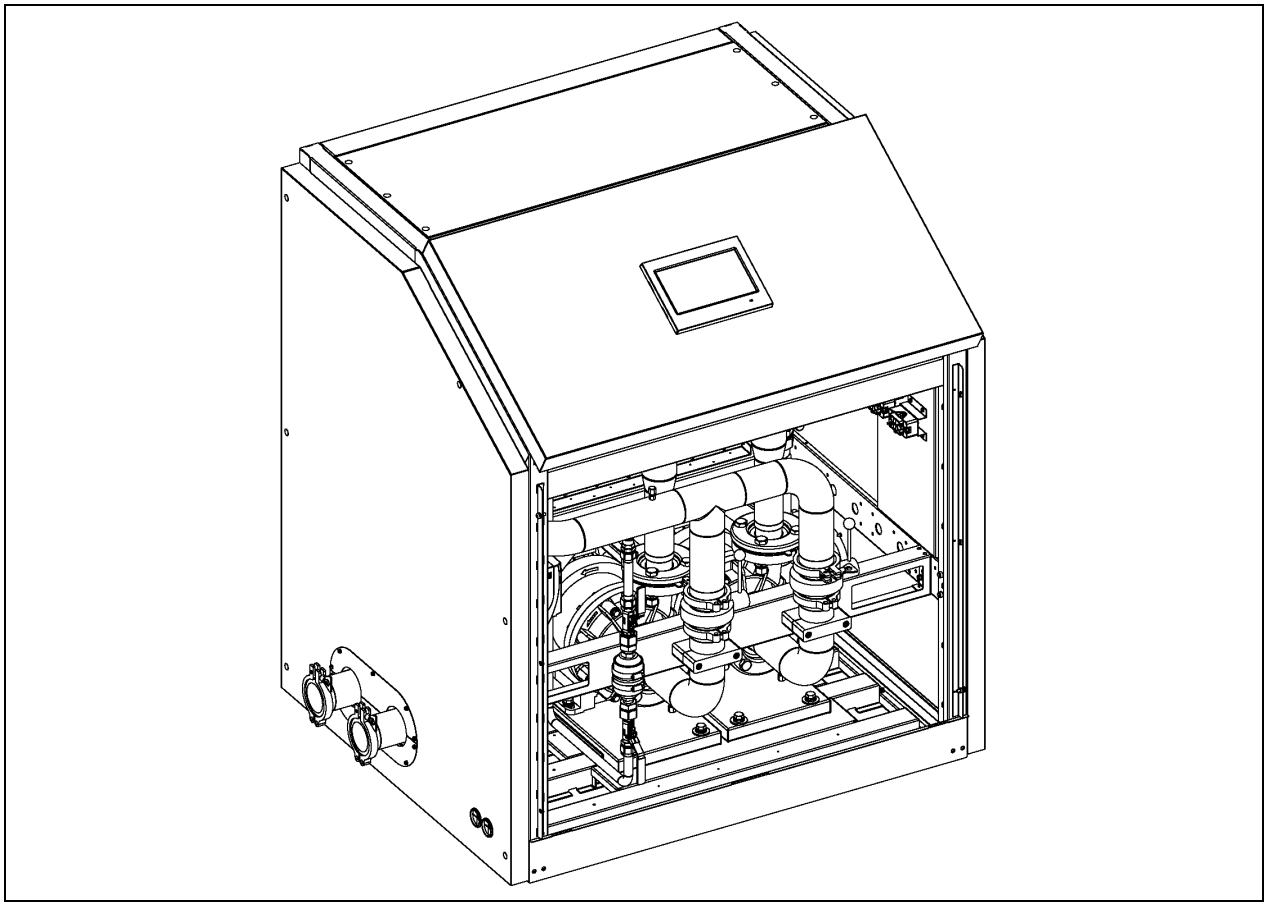
Vertiv™ CoolCenter Immersion cooling system includes CDU, Tank, and the self-contained unit.

The system includes standard components such as pump, plate heat exchanger, water valve, HMI screen, and ambient light, as well as the optional component Unity card.

CDU

- The CDU is equipped with coolant pump, filter, plate heat exchanger, and other components.
- Each CDU supports one, two, three, or four Tanks.
- Built-in circuit breaker to prevent electrical overload.
- Double pumps, 2N redundancy backup, sharing the same heat exchanger.
- Dual power supply, 2N redundancy backup.

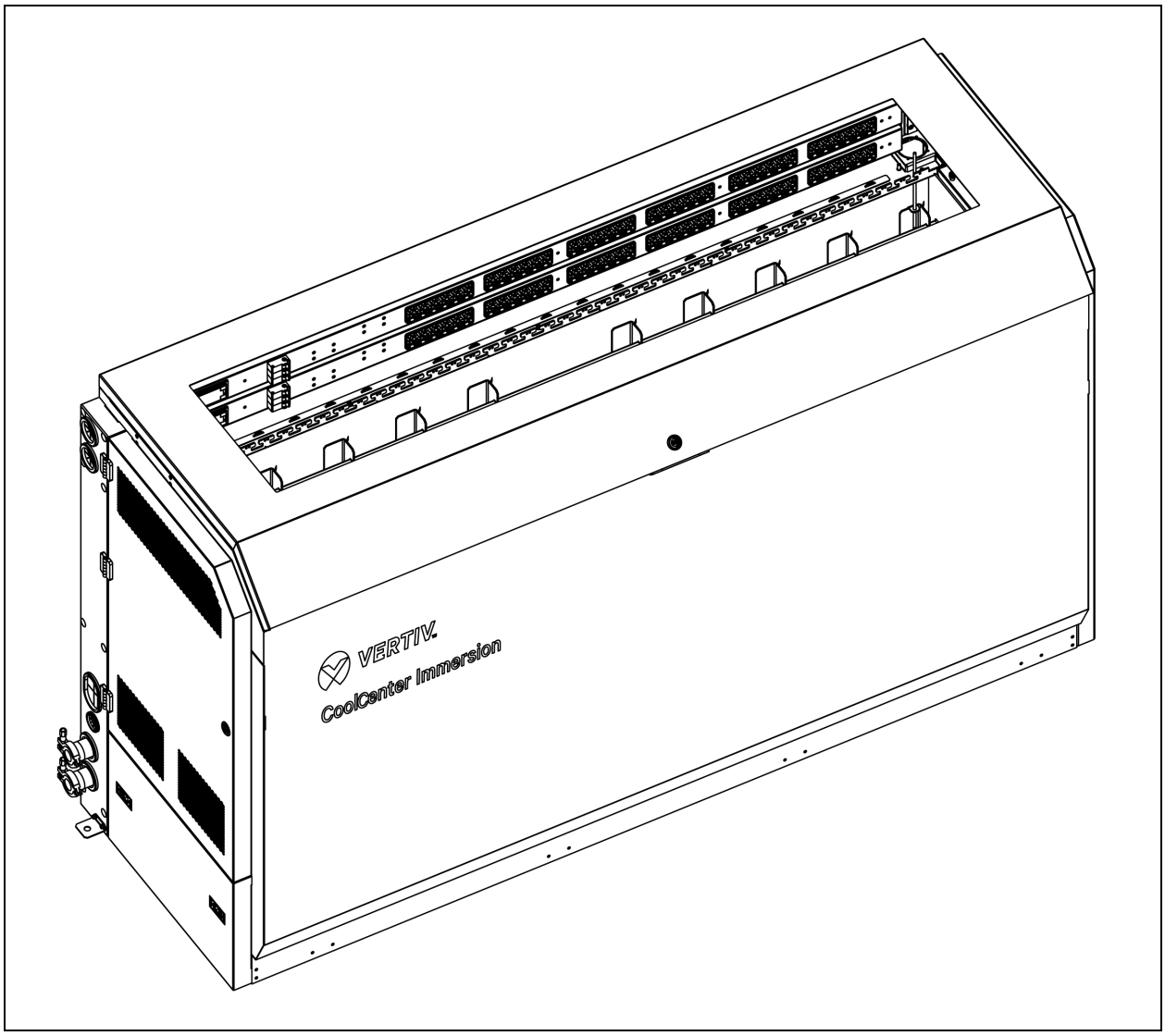
Figure 2.5 Appearance of the CDU



Tank

- Tank is available in two standard sizes: 42U and 52U. The Tank is installed on flat ground.
- It is formed by high quality steel plate whose surface is plated with zinc.
- The end of the top cover is connected with hinges and gas spring, and the top cover can be opened conveniently.
- The transparent window is made of PC and it is easy to observe the inside of the Tank.
- The entire steel structure is coated with electrostatic spraying. The surface has a smooth finish and is anti-corrosive.
- The liquid inlet and outlet pipes are specially designed to ensure that the coolant can be evenly distributed and converged.
- It is equipped with built-in temperature sensor and liquid level sensor to precisely control the temperature of the coolant and monitor the liquid level.

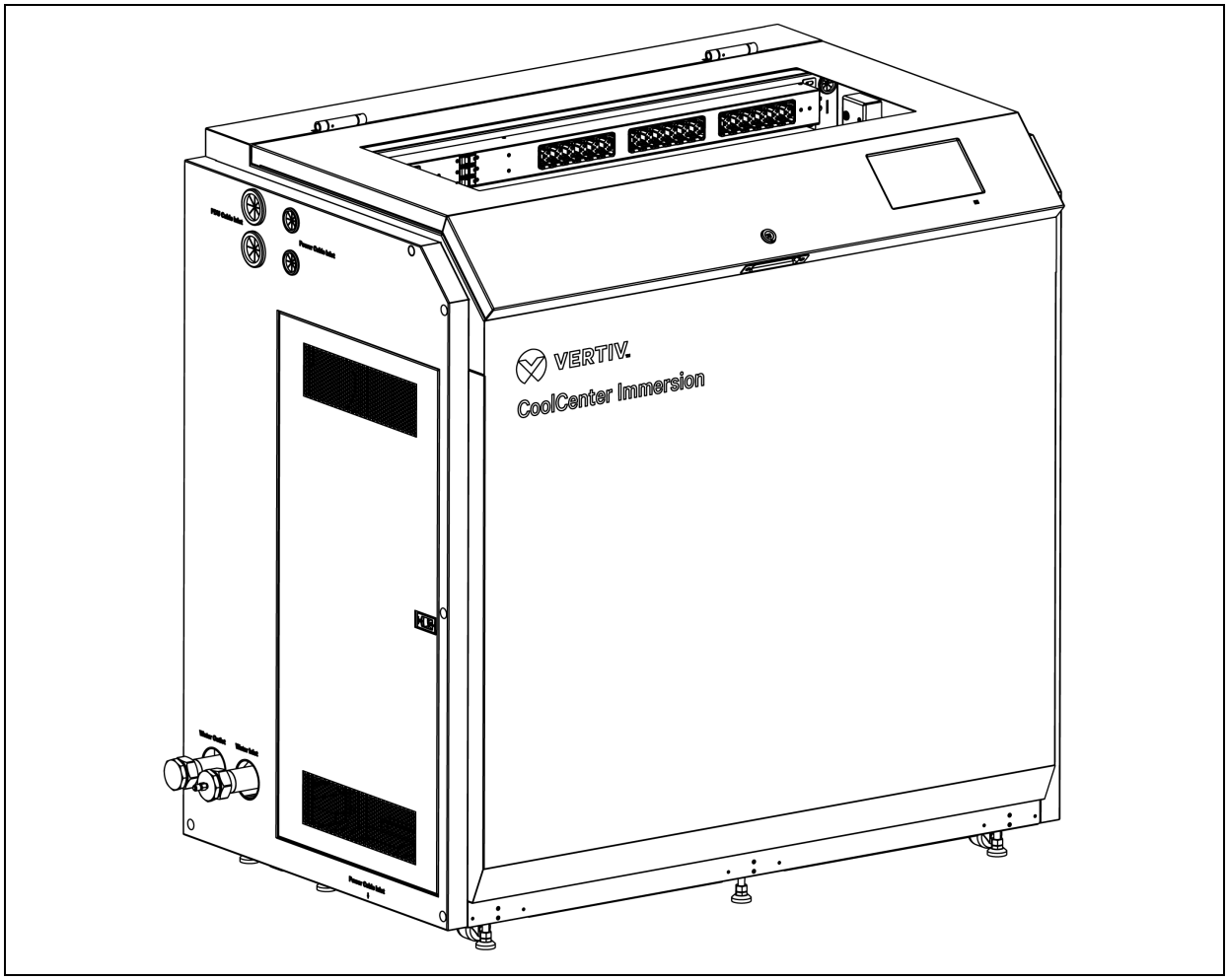
Figure 2.6 Appearance of the Tank



Self-contained unit

- The self-contained unit integrates the CDU and Tank together, and is equipped with coolant pump, filter, plate heat exchanger, and other components.
- Double pumps, dual power supply, 2N redundancy backup.
- Tank size is 24U.
- The unit is formed by high quality steel plate whose surface is plated with zinc. The structure is firm and reliable.
- The end of the top cover is connected with hinges and gas spring, and the top cover can be opened conveniently.
- The transparent window is made of PC and it is easy to observe the inside of the unit.
- The entire steel structure is coated with electrostatic spraying. The surface has a smooth finish and is anti-corrosive.
- The liquid inlet and outlet pipes are specially designed to ensure that the coolant can be evenly distributed and converged.
- It is equipped with built-in temperature sensor and liquid level sensor to precisely control the temperature of the coolant and monitor the liquid level.

Figure 2.7 Appearance of the self-contained unit



Pump

Horizontal variable frequency centrifugal pump is adopted, which has compact structure and high reliability. The rubber material is FKM, which has high resistance to oily liquids.

Plate heat exchanger

The brazed plate heat exchanger is used. The standard material is stainless steel, made of pure copper solder produced in the vacuum brazing furnace. The plate heat exchanger has high heat exchange efficiency, compact structure, small footprint, and light weight.

Water valve

The two-way water valve and the water valve actuator are used to accurately adjust the chilled/cooling water on the primary side.

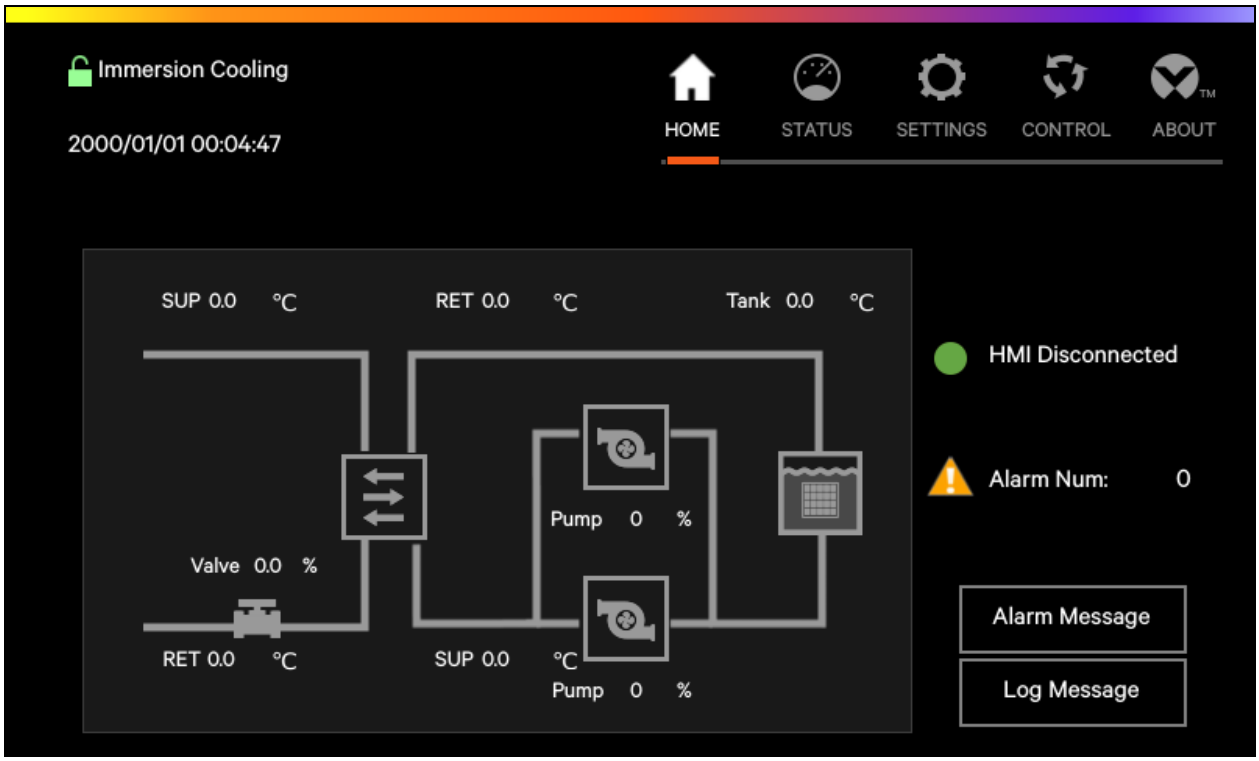
Sensor

- The unit is equipped with 6 NTC temperature sensors. Four are located at the inlet and outlet of the plate heat exchanger to monitor the inlet and outlet temperatures of the coolant and chilled water/cooling water. Two are located in the Tank to monitor the coolant temperature. The accuracy of this NTC temperature sensor is ±0.3°C.
- There is one pressure sensor by default and it is located at the outlet of the pump, to monitor the pressure of the coolant. The operating range of the pressure sensor is 0 to 9 bar, and the accuracy is 2.5%.
- There are two liquid level sensors, located inside the Tank, to monitor the level of the coolant.
- The CDU, Tank and self-contained unit each have a photoelectric sensor to monitor whether the coolant leaks.

HMI display

- The unit is equipped with a 9-inch HMI color touch screen with user friendly interface. The HMI display features power-down self-recovery, high/low voltage protection, and multi-level password protection.
- The unit's running status, parameters, measured temperature and data can be displayed in real time on the screen.
- The operation of main components can be monitored from the control menu.
- The expert-level fault diagnosis system automatically display the active alarms/warnings, which helps the maintenance personnel to troubleshoot/carry out maintenance work.
- The control system can store 500 historical event records.

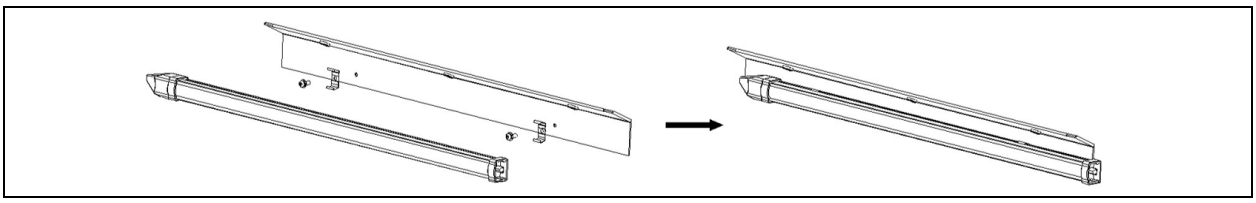
Figure 2.8 HMI display



Ambient light

The ambient light is installed on the interior of the front side of the Tank. The light has three colors. The white light is on when the Tank top cover is open, the blue light is on when the Tank top cover is closed and the system is operating normally, and the red light is on when the Tank top cover is closed and the system fails.

Figure 2.9 Appearance of the ambient light



2.5.2 External Cooling Source Configuration

The unit needs to be coupled with primary cooling system, such as dry cooler, cooling tower, and chiller, in order to reject the server heat out of the data center. The primary cooling design depends on various factors, such as the applications, overall design considerations, and PUE requirements.

Vertiv is able to provide some of the following primary loop solutions. Please feel free to contact your corresponding Vertiv team for more information.

Dry cooler

Dry cooler is composed of the finned tube heat exchanger with fans. There is no water consumption in the working process. Cooling is achieved by the heat exchange between the high-temperature liquid in the pipe and the natural wind outside the pipe.

The dry cooler directly utilizes the natural cold source and is suitable for areas with low outdoor ambient temperature. If the cooler is installed in areas with poor heat dissipation in summer, a water spray cooling system is required to enhance heat transfer.

Cooling tower

In the cooling tower, a small amount of water evaporates to reduce the temperature of the remaining water. It requires low power consumption and is the preferred cooling source for low PUE solutions.

When using a cooling tower, take into consideration of the following points:

- To choose the right model, consider the local climate in summer and reserve an appropriate margin.
- If it needs to be shut down for a long time, drain all the circulating water in the tower and the water in the pipeline.
- To save energy, the cooling tower can be equipped with a corresponding frequency conversion speed regulator.
- The water temperature provided by the cooling tower is related to the air wet bulb temperature, and the tower should be placed in a ventilated place.

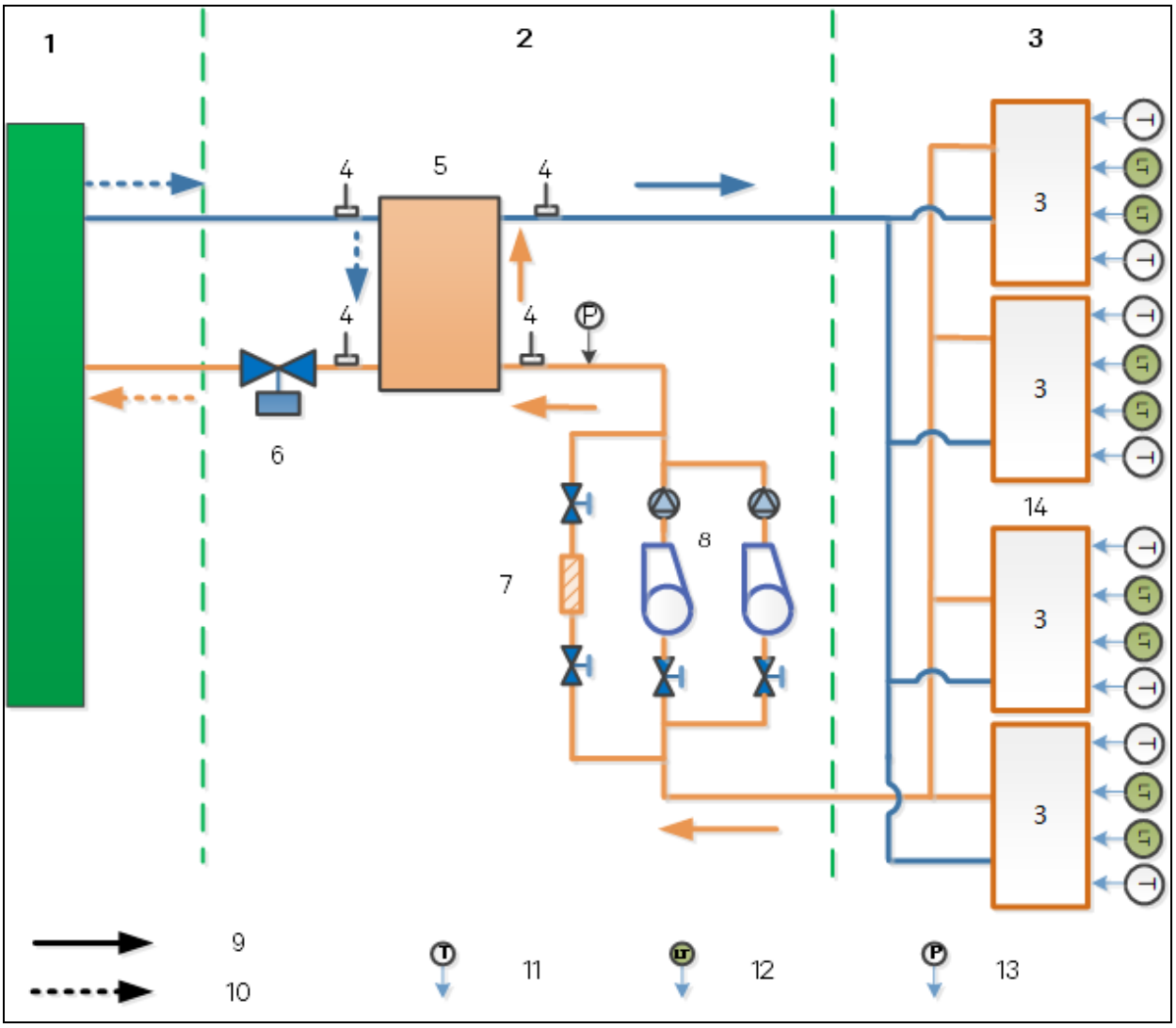
Chilled water unit

Chilled water unit generates chilled water by compression refrigeration. The temperature of chilled water is not limited by the ambient temperature and can be much lower than the ambient temperature. Therefore, the Tank can maintain a low temperature and a single CDU can provide large heat exchange capacity.

2.6 System Introduction

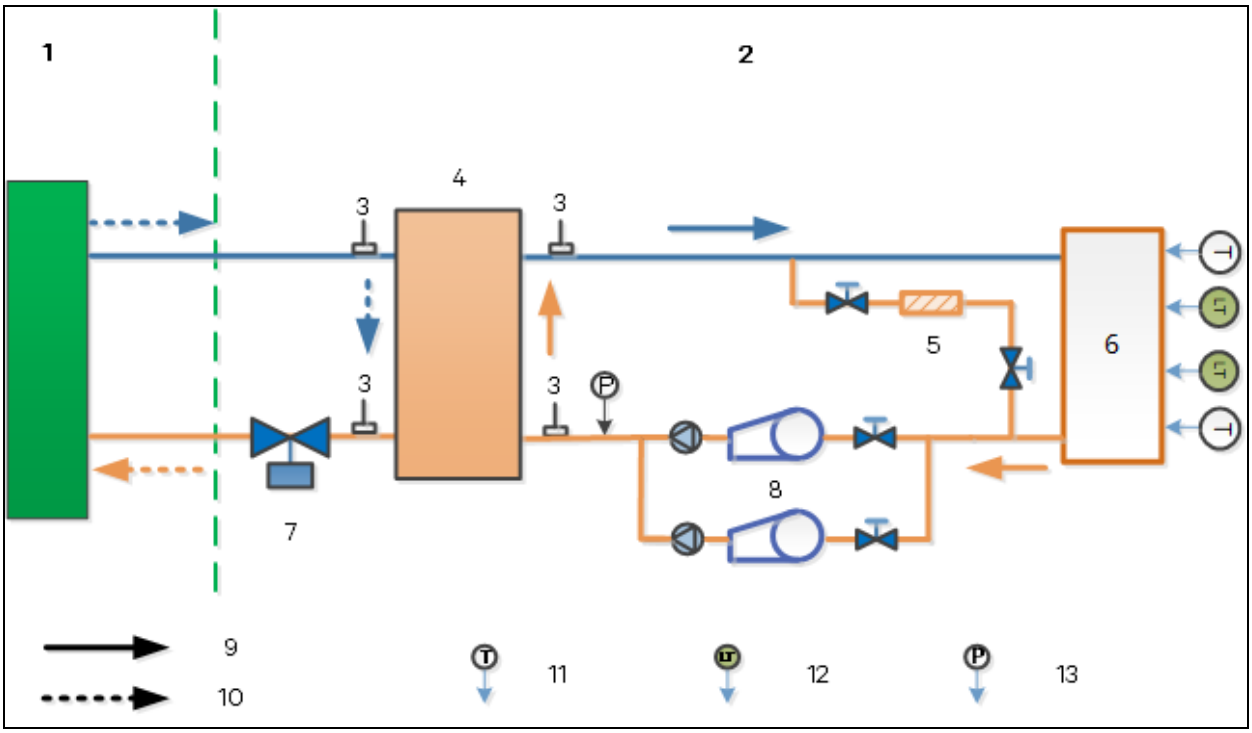
The unit is composed of plate heat exchanger, coolant pump, filter, Tank, and connecting pipes. The primary loop side (water side) of the heat exchanger needs to be connected to an external cooling source to cool the coolant on the secondary side (coolant side).

Figure 2.10 System of the modular unit



Item	Description	Item	Description
1	Chilled water cooling system (dry cooler/cooling tower/chilled water)	8	Pump
2	CDU	9	Coolant loop
3	Tank	10	Chilled/cooled water loop
4	NTC temperature sensor	11	NTC temperature sensor
5	Heat exchanger	12	Liquid level sensor
6	Water valve	13	Pressure sensor
7	Filter	14	Maximum 4 Tanks

Figure 2.11 System of the self-contained unit



Item	Description	Item	Description
1	Chilled water cooling system (dry cooler/cooling tower/chilled water)	8	Pump
2	Self-contained unit	9	Coolant loop
3	NTC temperature sensor	10	Chilled/cooled water loop
4	Heat exchanger	11	NTC temperature sensor
5	Filter	12	Liquid level sensor
6	Tank	13	Pressure sensor
7	Water valve		

2.7 Water Quality Requirements

Conventional chilled water contains sediment, oxygen, microorganisms, chloride ions, calcium/magnesium ions, and other substances, which are prone to scaling or corroding pipelines and heat exchangers. Therefore, water quality treatment must be carried out to ensure that the quality of chilled water meets the requirements for use.

Table 2.1 Quality requirements for circulating chilled water and supplement water

Item	Unit	Water quality requirements	Tendency to fail	
			Scaling	Corrosion
PH (25°C)	-	6.5 - 8.5	Yes	
Electric conductivity (25°C)	mS/cm	<800	Yes	
Chloride ion	mg/L	<200	Yes	
Sulfate ion	mg/L	<200	Yes	
Acid consumption	mg/L	<150		Yes
Full hardness	mg/L	<200		Yes
Calcium hardness	mg/L	<150		Yes
Silicon chloride	mg/L	<50		Yes
Ammonium ion	mg/L	<1	Yes	
Free oxygen	mg/L	<1	Yes	

WARNING!

If the water quality does not meet the requirements, it will affect the performance and service life of the unit, and may cause equipment damage in severe cases.

Vertiv is not responsible for the loss caused by the user's water quality.

Please drain the water of the system if it is not used for a long time.

2.8 Operating Environment Requirements

The operating environment of the unit should meet the following requirements.

Table 2.2 Operating environment requirements

Item	Requirements
Ambient temperature and humidity	Under indoor environment, the dry bulb temperature is 5°C to 40°C, the humidity is 20%RH to 80%RH, and the maximum wet bulb temperature is 24°C
Inlet water	12°C to 35°C
Altitude	Less than 2000 m
Operating voltage range	380 - 400V (+/-15%) 3N~ 50Hz&60Hz
Minimum thermal load	The allowed thermal load must be higher than 30% of the unit nominal cooling capacity

NOTE: Please contact Vertiv when using the system in the following situations: (a) The operating ambient temperature exceeds the range specified in Operating environment requirements above . (b) The voltage exceeds the operating voltage range. (c) Other applications out of scope.

2.9 Storage Environment Requirements

The storage environment of the unit should meet the following requirements.

Table 2.3 Storage and transportation environment requirements

Item	Requirements
General requirement	Indoor, clean (with no dust)
Ambient temperature	-18°C to +50°C
Ambient humidity	Less than 95%RH (30°C)
Ingress Protection Rating or International Protection Rating (IP rating)	IP 20
Storage time	Transportation and storage time should not exceed six months

NOTE: If the system needs to be stored for an extended period, please contact Vertiv.

2.10 Reference Norms

The unit is designed, manufactured and tested according to the following directives and standards:

EU Directives

- Machinery Directive 2006/42/EC
- EMC Directive 2014/30/EU
- RoHS II Directive 2011/65/EU
- RoHS III Directive (EU)/2015/863
- Reach Regulation (EC) No 1907/2006

CE Marking and Conformity Declaration

- The units are marked “CE”.
- Each unit complies with EU directives.

3 Preinstallation Preparation

This section describes the preinstallation preparation for the unit , including unpacking, inspecting, and moving the unit.

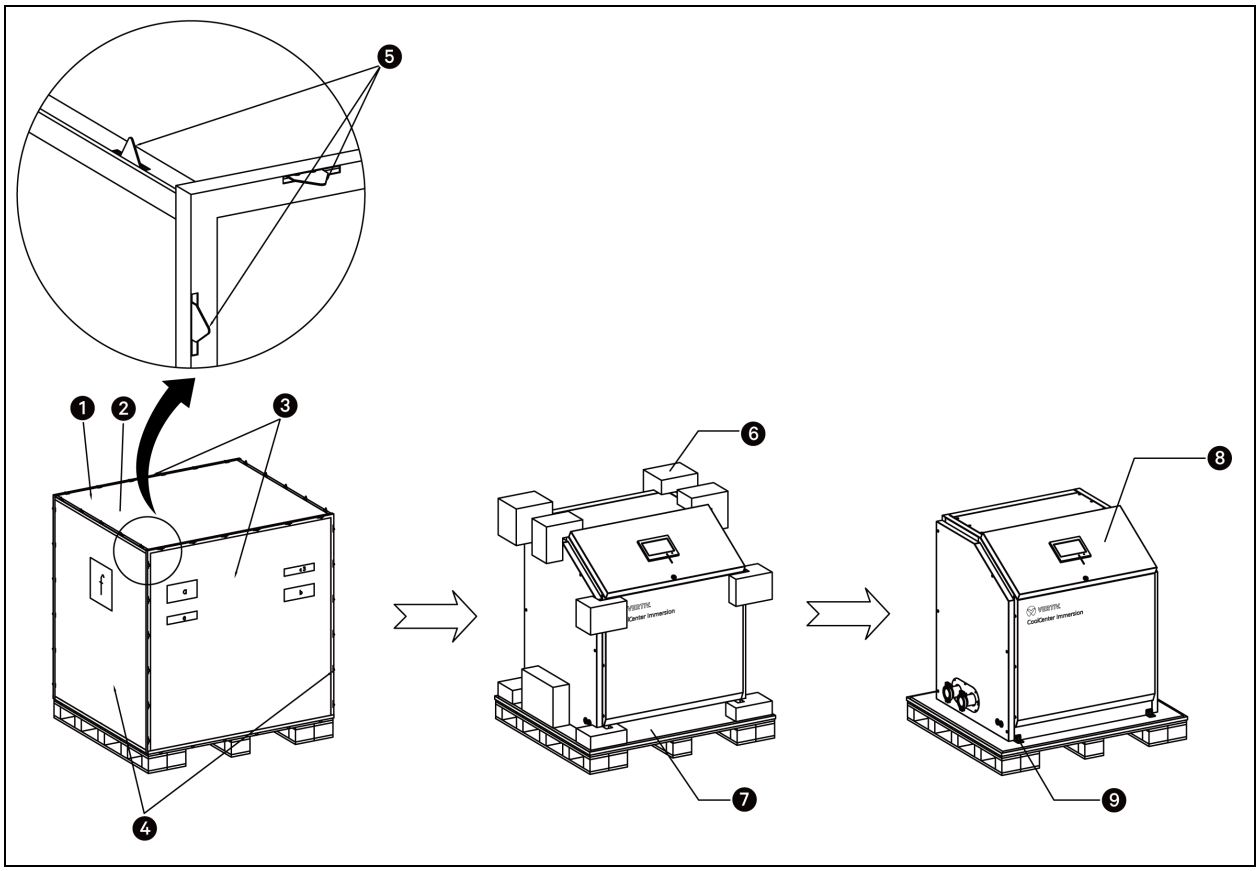
3.1 Unpacking and Inspecting the Unit

After the system arrives at the delivery place stipulated in the contract, the receiver should organize relevant personnel to unpack and inspect. Before unpacking, move the system as close as possible to its installation location.

Unpacking

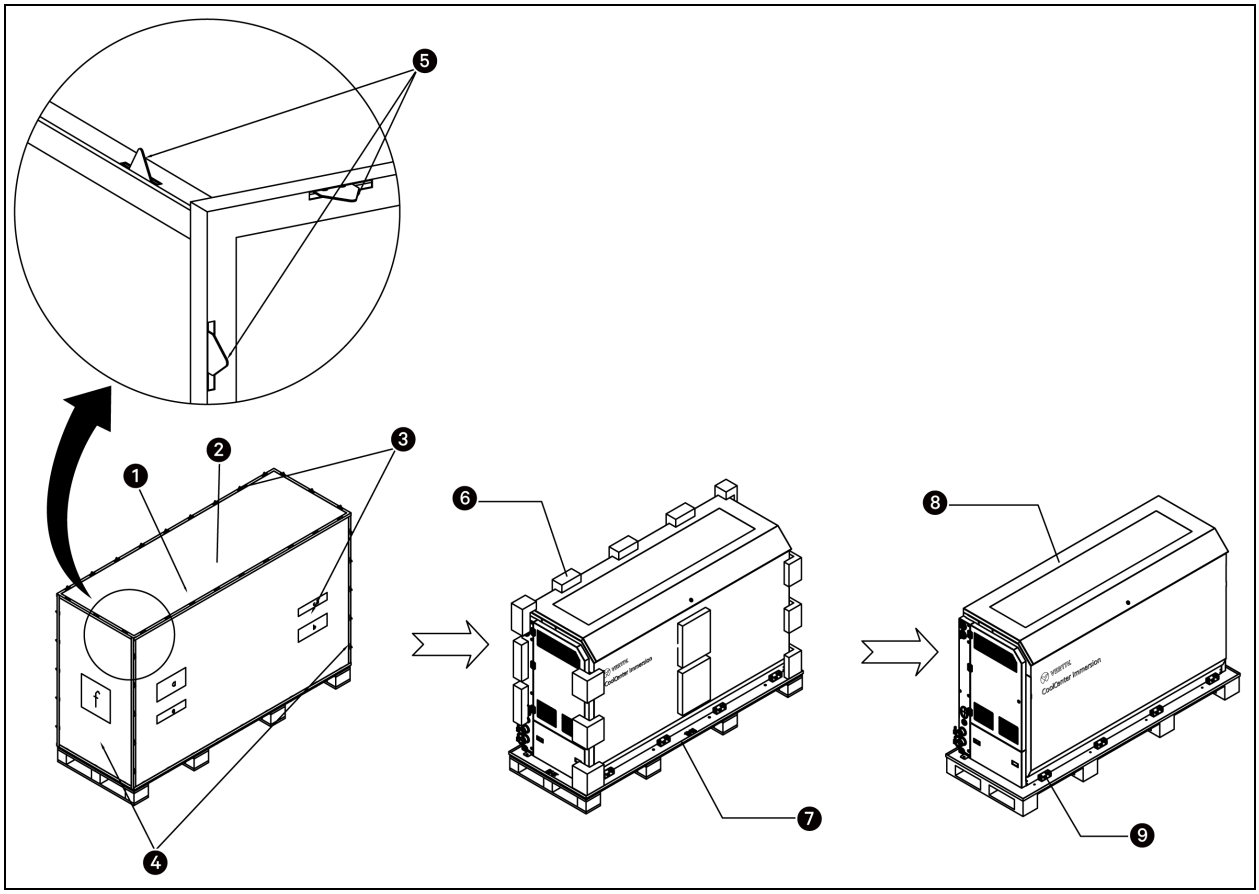
The package is made of wood, and there are two layers of waterproof plastic film on the surface of the unit. When unpacking, first remove the outer wooden package by straightening the metal buckles, removing the front and rear wooden plates, removing the left and right wooden plates, and then removing the top wooden plates. Then remove the plastic film and cushion, and finally remove the fixing bolts and remove the unit from the pallet.

Figure 3.1 Unpacking the CDU



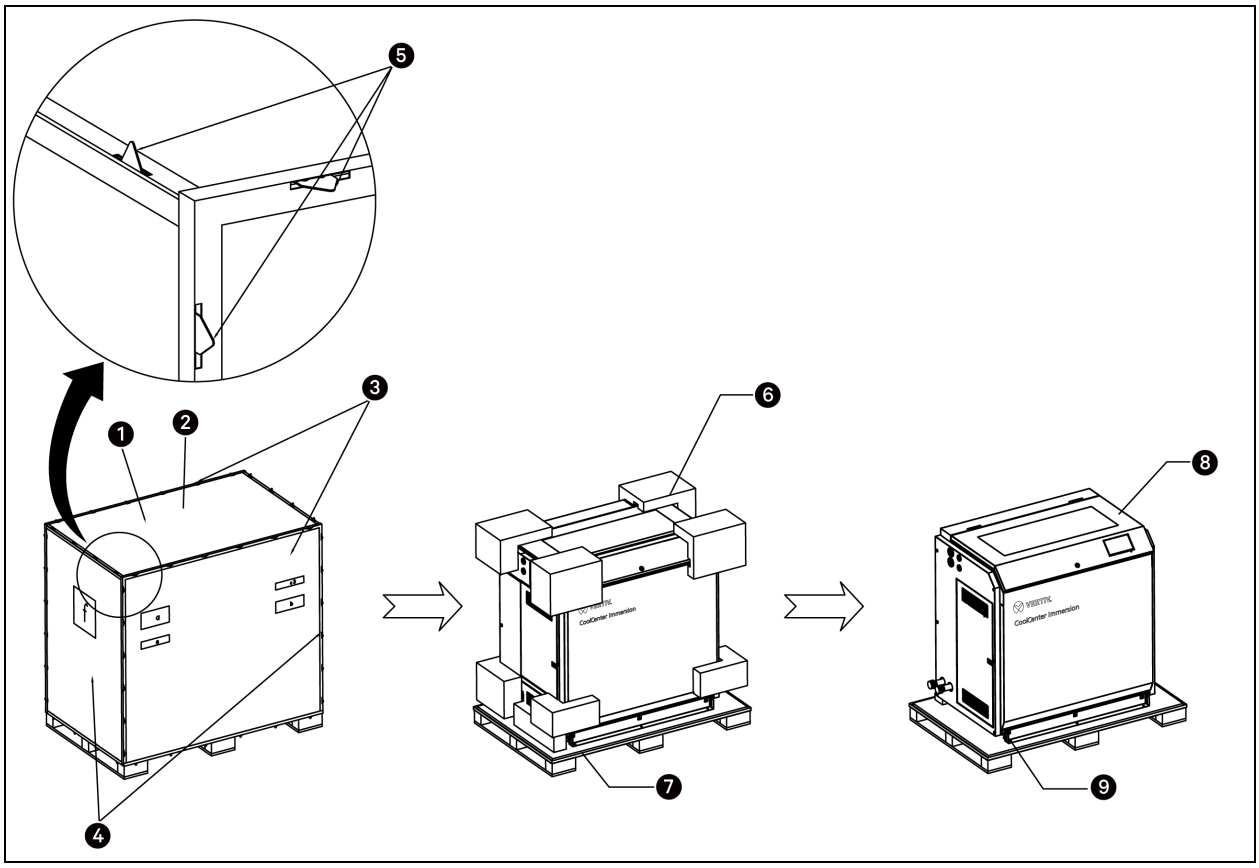
Item	Description	Item	Description
1	Wooden box	2	Top wooden plate
3	Front and rear wooden plates	4	Left and right wooden plates
5	Metal buckle	6	Cushion
7	Pallet	8	CDU
9	Fixing bolt		

Figure 3.2 Unpacking the Tank



Item	Description	Item	Description
1	Wooden box	2	Top wooden plate
3	Front and rear wooden plates	4	Left and right wooden plates
5	Metal buckle	6	Cushion
7	Pallet	8	Tank
9	Fixing bolt		

Figure 3.3 Unpacking the self-contained unit



Item	Description	Item	Description
1	Wooden box	2	Top wooden plate
3	Front and rear wooden plates	4	Left and right wooden plates
5	Metal buckle	6	Cushion
7	Pallet	8	Self-contained unit
9	Fixing bolt		

Hoisting:

The CDU and Tank can be removed from the pallet using hoisting. First, remove the fixing bolt shown in the figure above and install the pin included in the accessories. When hoisting, secure the hook to the pin to lift the unit safely.

Precautions for storage after unpacking:

- Do not store the unit in a location that does not meet the requirements of Storage and transportation environment requirements on page 18 .
- Cover and protect the unit to prevent dust accumulation.
- Keep the items supplied with the unit properly to prevent loss or theft.
- It is recommended to check the unit regularly during storage.

Inspection

Check whether the accessories are complete according to the packing list.

Table 3.1 Modular unit accessories

Item	Size	Quantity
Tank power cable	Length 10 m	1
Tank communication cable	Length 10 m	1
Pin for hoisting	-	4
Key of the top panel	-	1

Check the unit model, specifications, and accessories according to the above documents. Check that the unit is not damaged, the accessories are complete, and there is no leakage.

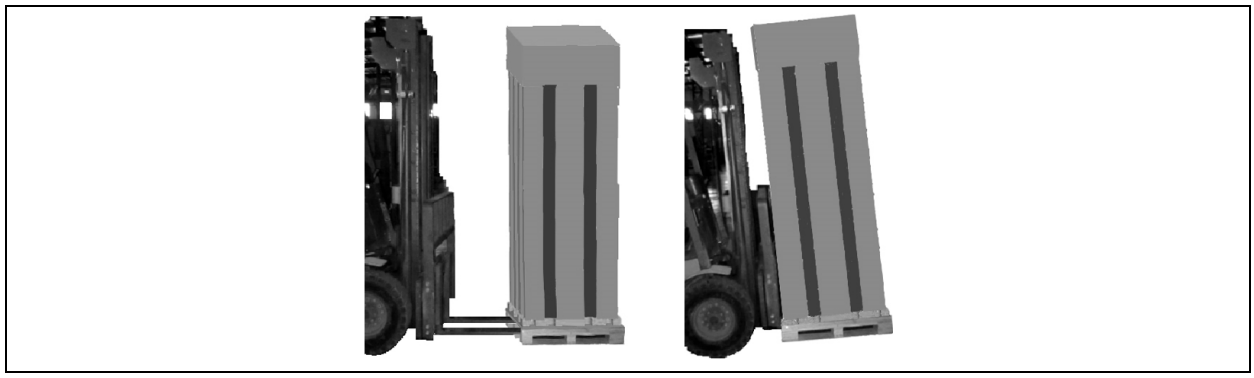
If you find any missing or damaged during the inspection, please report to the carrier immediately. If you find hidden damage, please also report to the carrier or Vertiv local office, and do not accept the damaged unit.

NOTE: After inspecting the unit, take protective measures to avoid damage to the unit.

3.2 Moving the Unit

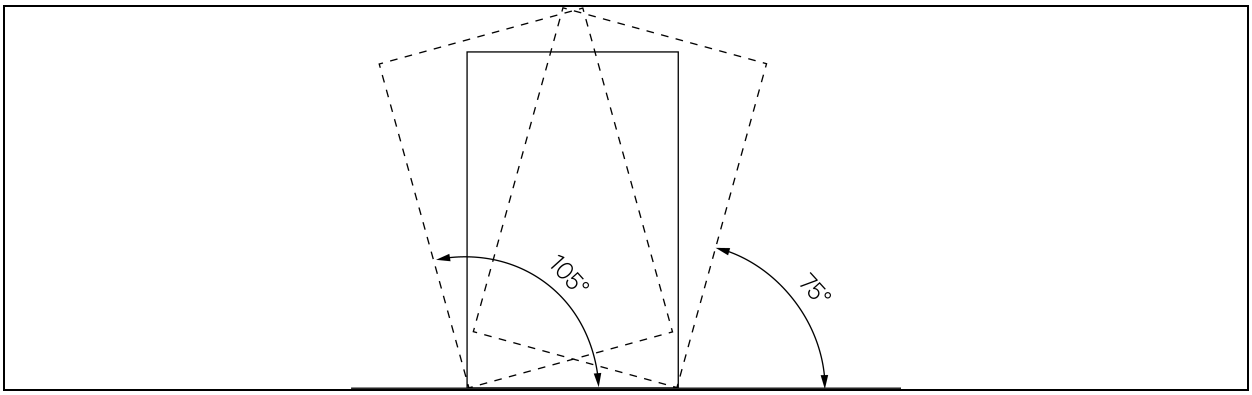
When moving the unit on the flat ground, you can use mechanical tools such as electric forklifts. Move the unit to the place closest to the installation site. Insert the tines under the pallet. Mind the center of gravity of the packaged unit to prevent tipping.

Figure 3.4 Moving the unit



When moving the unit, keep the inclination angle of the unit within the range of 75° to 105°, and do not tilt the unit excessively.

Figure 3.5 Inclination angle



NOTE: Please move the unit carefully to avoid damage to the wooden packaging material and the cooling unit inside.

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4 Mechanical Installation

Proper installation is essential to ensure reliable use of the equipment. This section describes the mechanical installation of the unit, including installation precautions, mechanical parameters, equipment layout, and mechanical installation inspection. Perform the installation by also referring to the current codes of practice for mechanical and electrical installations.

4.1 Installation Requirements

4.1.1 Equipment Room Requirements

Requirements for the equipment room are as follows:

- Reserve a maintenance channel for not less than 1 m between the modular units.
- The load-bearing capacity of the building should meet the requirements listed in Load-bearing Capacity on page 32 . If necessary, the building could be modified to match the pipeline and cable layout.
- The ground must be level. If the Tank or the self-contained unit is placed on an uneven plane, it may cause coolant leakage.
- Consider the needs of pipeline water supply and drainage during the design and construction process.

WARNING!

Do not take power from inside the unit during pipeline construction.

Selecting, arranging, and fixing the pipeline in accordance with industry standards.

4.1.2 Maintenance Space Requirements

Table 4.1 Maintenance space requirements

Unit	Position	Minimum maintenance distance	Description
CDU	Front	600 mm	For maintaining pumps, frequency converters, pipes of the unit, etc.
	Rear	600 mm	For maintaining plate exchanger, pipes of the unit, etc.
	Side	600 mm	For connecting the pipes of the primary side
Tank	Front	600 mm	For operating on the servers and maintaining the servers
	Rear	600 mm	For maintaining the unit
	Side (where outlet pipes are located)	600 mm	For connecting the pipes of the unit and connecting power cables
Self-contained unit	Front	600 mm	For operating on the servers and maintaining the servers

Table 4.1 Maintenance space requirements (continued)

Unit	Position	Minimum maintenance distance	Description
	Rear	600 mm	For maintaining the cooling components and the cooling pipes
	Side	600 mm	For connecting the pipes of the primary side and connecting the cables of the switch
Note: The space requirements are for single unit maintenance only. For multiple-unit configuration, please refer to Equipment Layout in next page.			

Figure 4.1 CDU maintenance space (unit: mm)

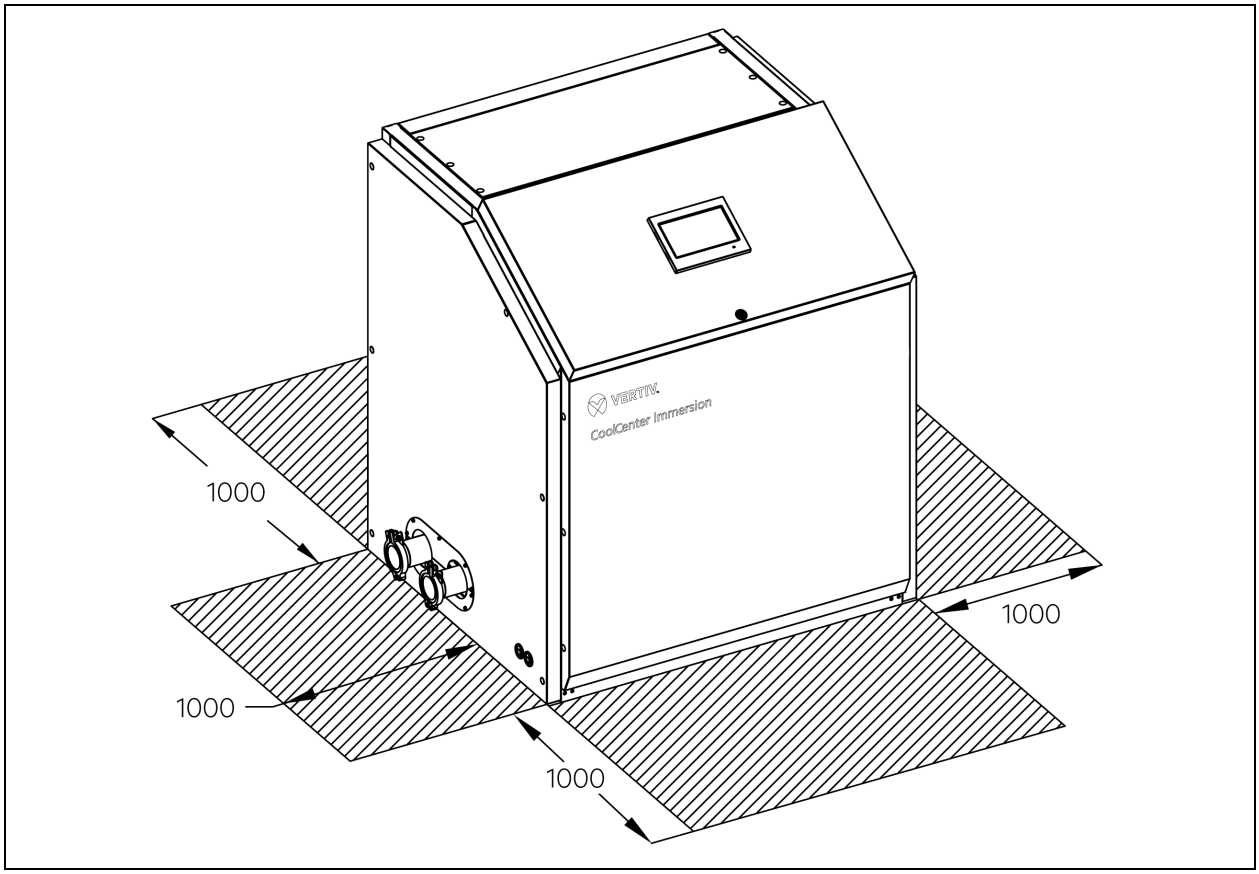


Figure 4.2 Tank maintenance space (unit: mm)

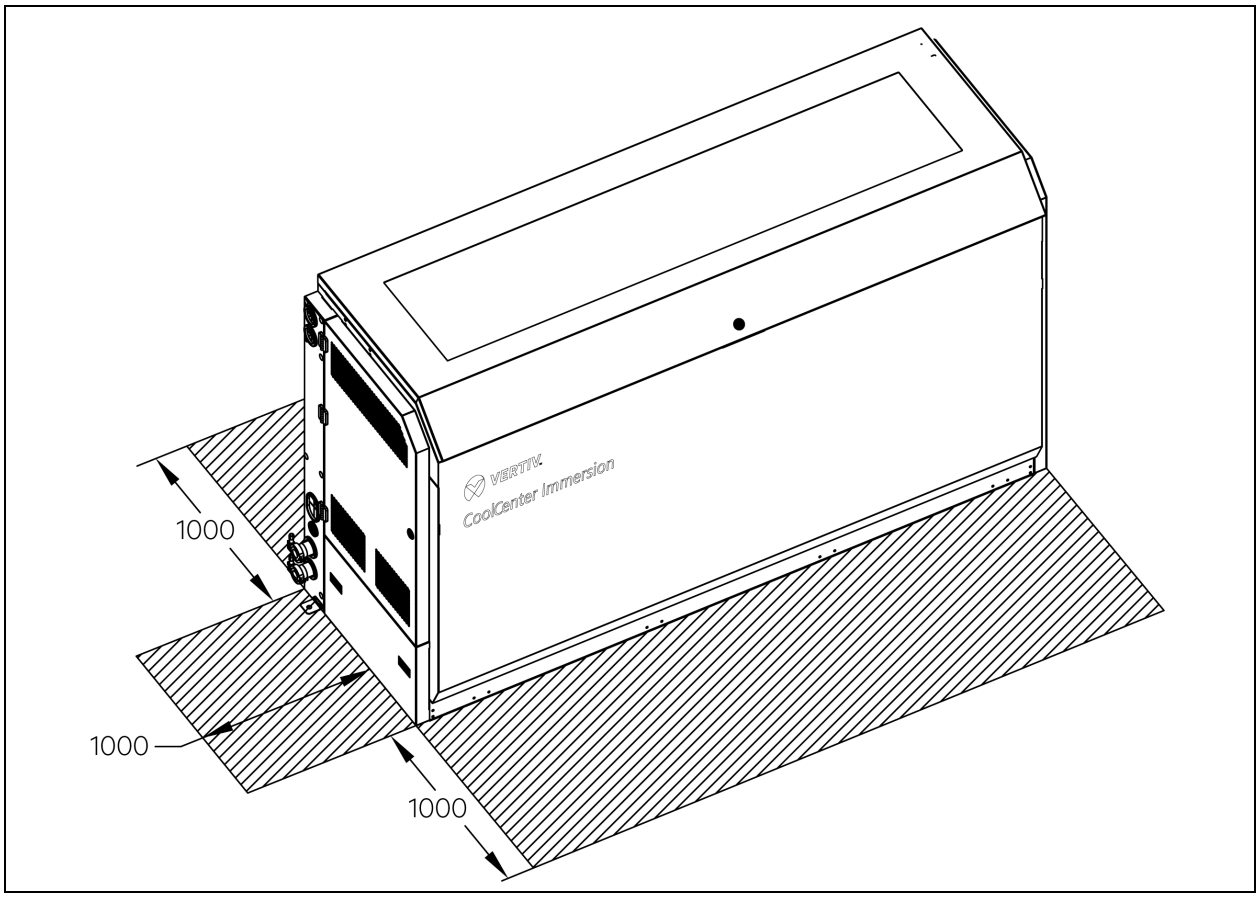
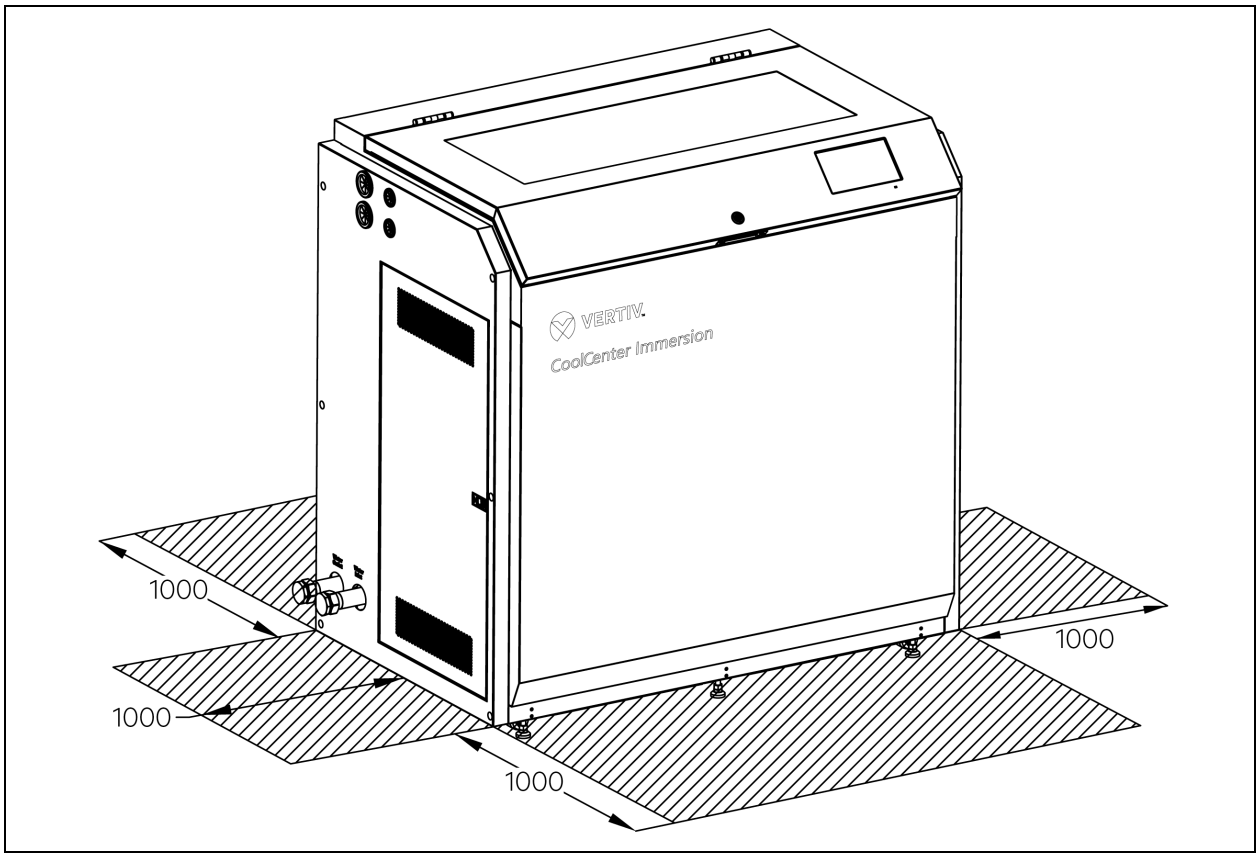


Figure 4.3 Self-contained unit maintenance space (unit: mm)

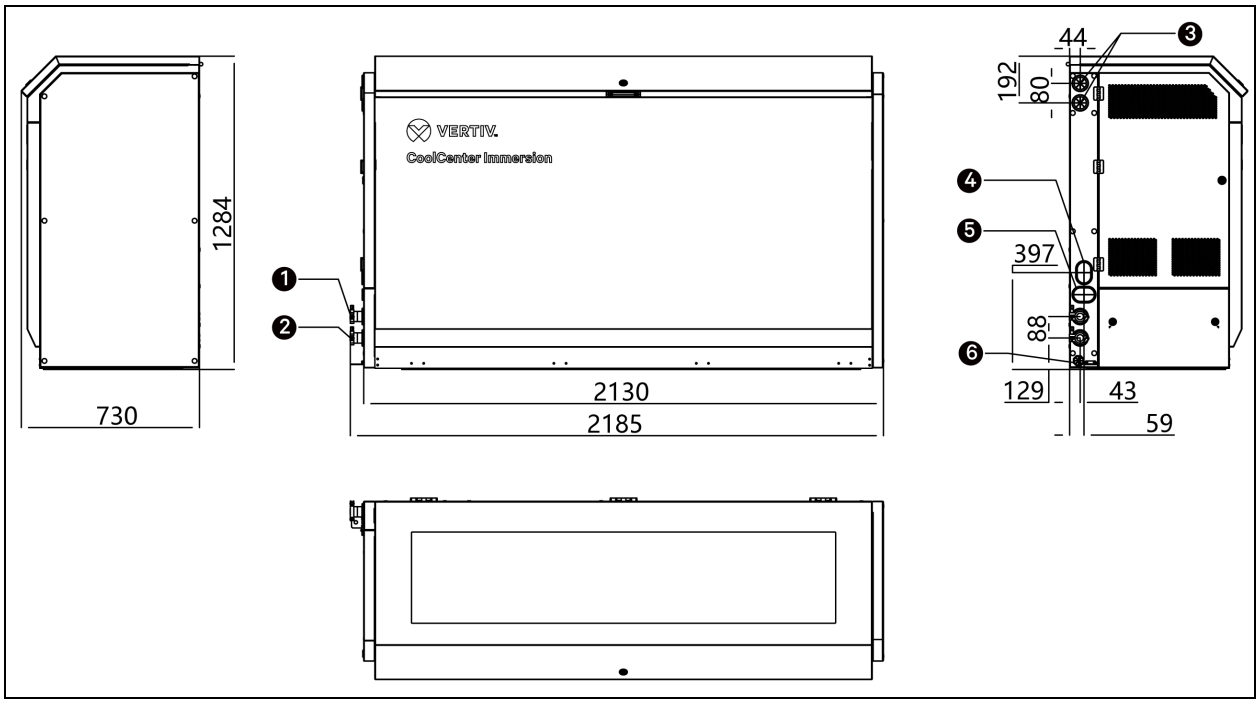


NOTE: If any component in the system fails to work and it needs to be repaired or replaced, please contact Vertiv.

4.1.3 Tank Dimensions

Tank is available in two standard sizes: 42U and 52U. The lengths of their structural parts are different, but the materials and configuration are the same.

Figure 4.4 42U Tank mechanical parameters (unit: mm)

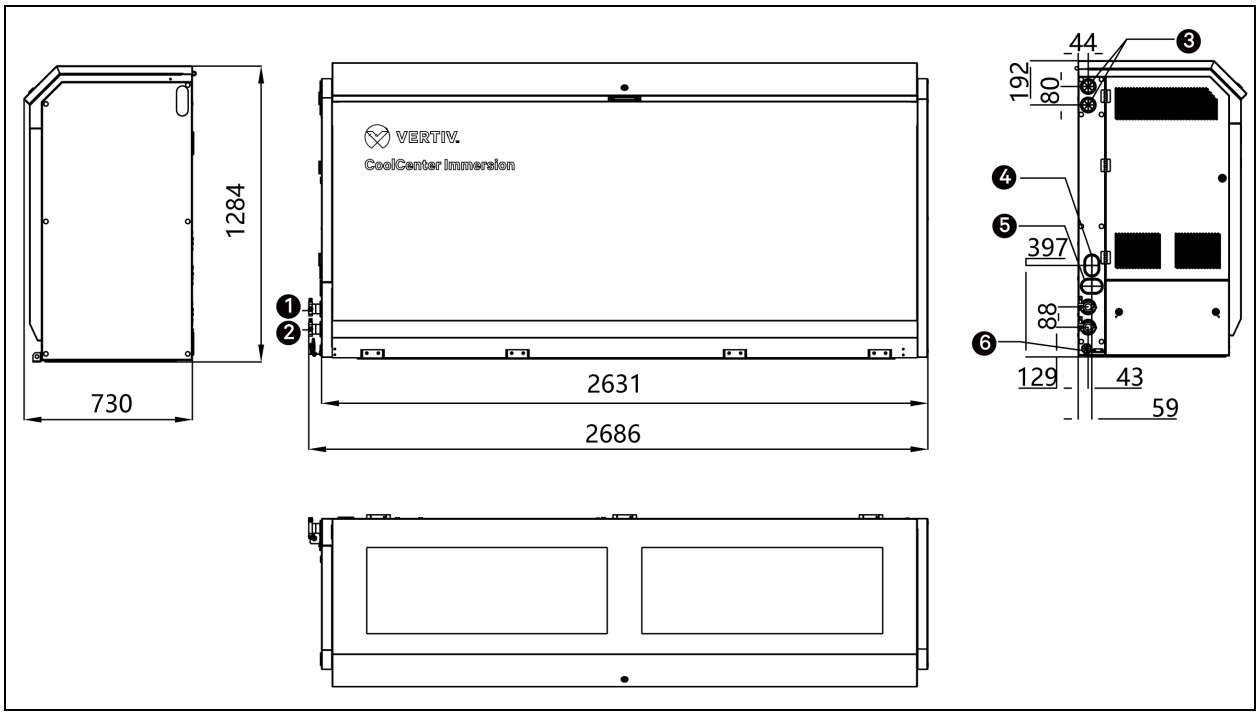


Item	Description	Item	Description
1	Coolant outlet	4	Network cable inlet
2	Coolant inlet	5	Cable Inlet (cable inlet hole for power supply cable and communication cable from CDU to Tank)
3	PDU cable inlet	6	Sensor inlet (photoelectric sensor cable inlet hole)

Table 4.2 42U Tank mechanical parameters

Model	Dimensions (W×D×H) (mm)	Unit Weight (kg)	Shipping Dimensions (W×D×H) (mm)	Shipping Weight (kg)
ICT42L0E0 / ICT42R0E0	2130x730x1284	342	2256x796x1527	451

Figure 4.5 52U Tank mechanical parameters (unit: mm)



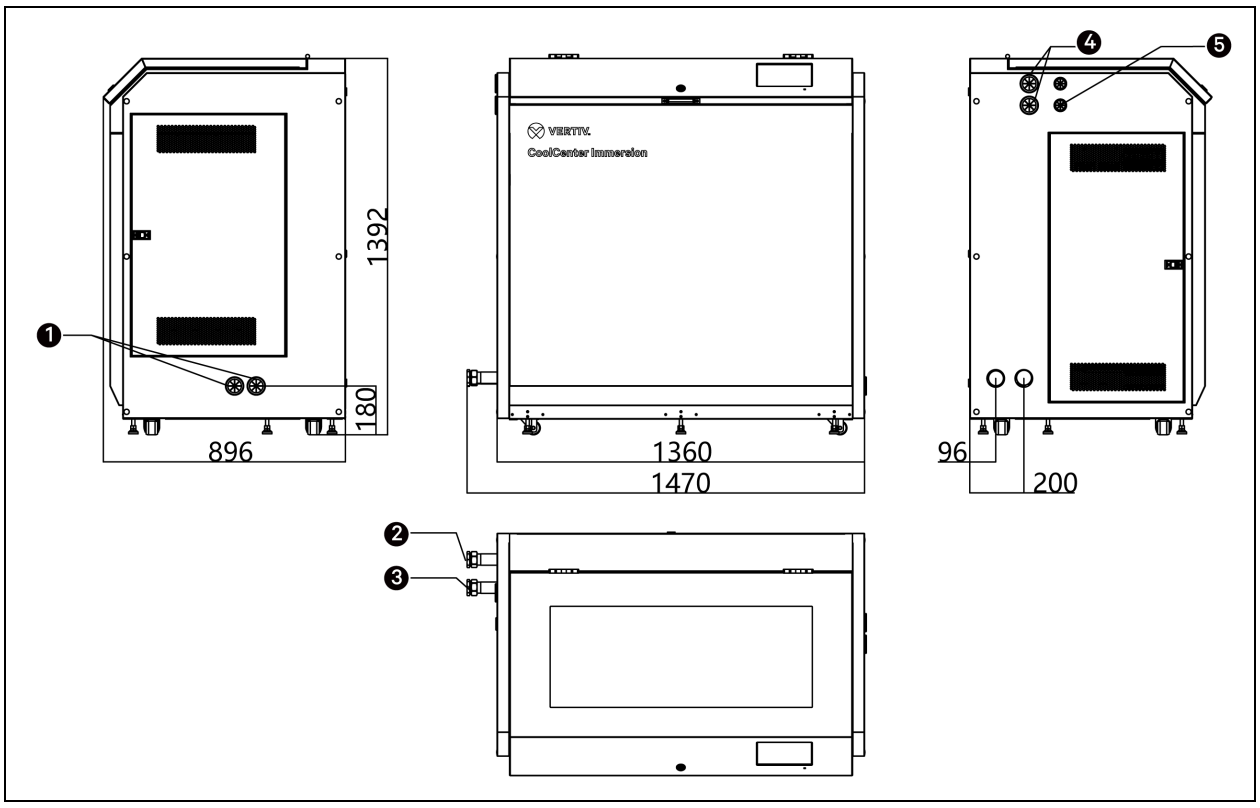
Item	Description	Item	Description
1	Coolant outlet	4	Network cable inlet
2	Coolant inlet	5	Cable Inlet (cable inlet hole for power supply cable and communication cable from CDU to Tank)
3	PDU cable inlet	6	Sensor inlet (photoelectric sensor cable inlet hole)

Table 4.3 52U Tank mechanical parameters

Model	Dimensions (W×D×H) (mm)	Unit Weight (kg)	Shipping Dimensions (W×D×H) (mm)	Shipping Weight (kg)
ICT52L0E0 / ICT52R0E0	2631x730x1284	423	2756x796x1527	558

4.1.4 Self-contained Unit Mechanical Parameters

Figure 4.6 Self-contained unit mechanical parameters (unit: mm)



Item	Description	Item	Description
1	Network cable inlet	4	PDU cable inlet
2	Water outlet	5	Power cable inlet
3	Water inlet		

Table 4.4 Self-contained unit mechanical parameters

Model	Dimensions (W×D×H) (mm)	Unit Weight (kg)	Shipping Dimensions (W×D×H) (mm)	Shipping Weight (kg)
ICS025NAT2E00	1360x896x1392	401	1700x1090x1630	492

4.1.5 Load-bearing Capacity

The system must be installed on a level ground; otherwise there will be a risk of falling. When the ground is a floor, check whether the load-bearing capacity of the floor meets the requirements required by the equipment.

Table 4.5 Load-bearing capacity of CDU and Tank

Item	CDU	42U Tank	52U Tank
Net weight of the unit (kg)	575	342	423
Weight of the unit without load (kg)	631	1102	1315
Weight of the unit with full load (kg)	631	1732	2095
Load-bearing area (m^2)	1.10	1.01	1.25
Load-bearing capacity of the unit without load (kg/m^2)	574	1095	1054
Load-bearing capacity of the unit with full load (kg/m^2)	-	1721	1679
Occupancy area (with a support frame) (m^2)	-	1.55	1.91
Load-bearing capacity of the unit with full load (with a support frame) (kg/m^2)	-	1118	1094

At the base of the self-contained unit, 8 feet are used as support. The maximum load-bearing capacity of a single foot must be considered, as shown in the table below.

Table 4.6 Load-bearing capacity of each foot of the self-contained unit

8 feet	**Location**	**Front left**	**Front middle**	**Front right**
	Load-bearing capacity of one foot without load	2554.3N	282N	2618.9N
	Load-bearing capacity of one foot with full load	3598N	397.2N	3689N
	Location	**Middle left**	-	**Middle right**
	Load-bearing capacity of one foot without load	409.5N		458N
	Load-bearing capacity of one foot with full load	576.8N		645.1N
	Location	**Rear left**	**Rear middle**	**Rear right**
	Load-bearing capacity of one foot without load	793N	666.1N	829.2N
	Load-bearing capacity of one foot with full load	1117N	938.3N	1168N

Taking the foot with the largest load bearing capacity - the front right foot as the reference, the load-bearing requirements of the self-contained unit are shown in the table below.

Table 4.7 Load-bearing capacity of the self-contained unit

Unit	Self-contained unit
Net weight of the unit (kg)	401
Weight of the unit without load (kg)	881
Weight of the unit with full load (kg)	1241
Area of a single foot (m^2)	0.000962

Table 4.7 Load-bearing capacity of the self-contained unit (continued)

Unit	Self-contained unit
Load-bearing capacity of the unit without load (N/m^2)	2722311
Load-bearing capacity of the unit with full load (N/m^2)	3834719
Occupancy area (with a support frame) (m^2)	1.22
Load-bearing capacity of the unit with full load (with a support frame) (kg/m^2)	1021

WARNING!

Weight of the unit without load indicates the weight of the unit plus the weight of the coolant. Weight of the unit with full load indicates the net weight of the unit, the weight of the coolant, and the weight of servers. The weight of the server is considered as 15 kg per U.

You can install a support frame on site to reduce the load-bearing requirements of the floor.

If users need to install base for the unit, please refer to the following figures (bottom view, looking up). The CDU and Tank can be fixed to the base through the screw holes at the four corners of the bottom of the unit. The self-contained unit can be fixed to the base through leveling feet and casters.

Figure 4.7 CDU bottom view (looking up) (unit: mm)

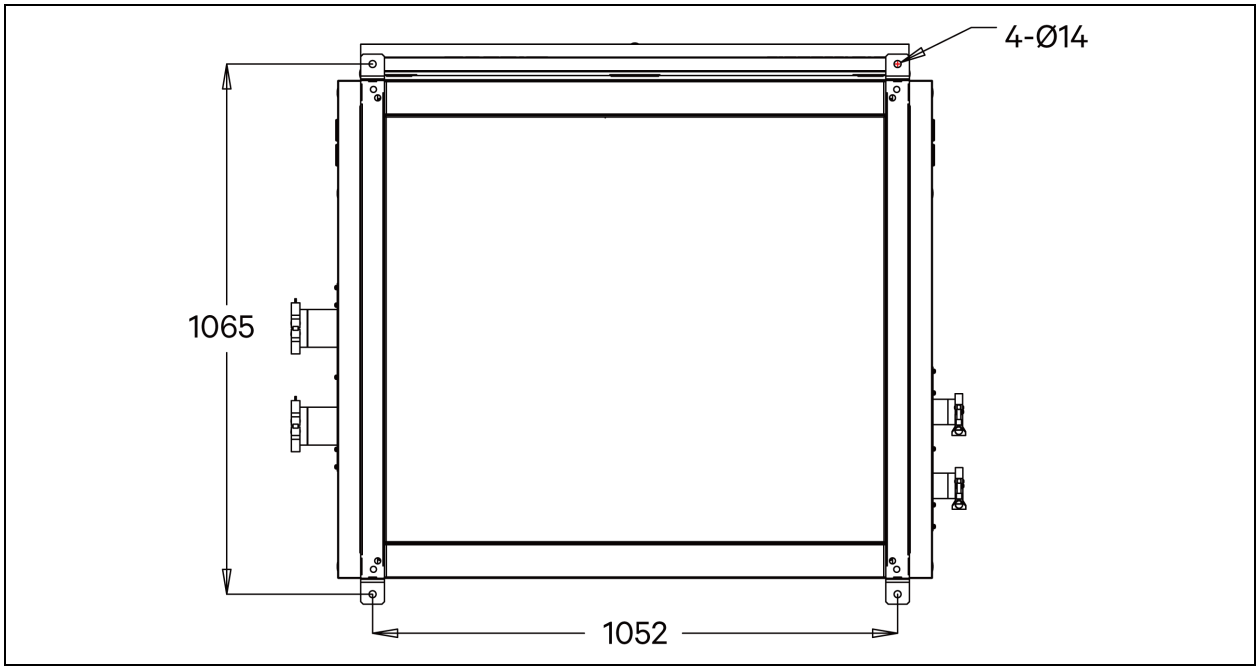


Figure 4.8 42 U Tank bottom view (looking up) (unit: mm)

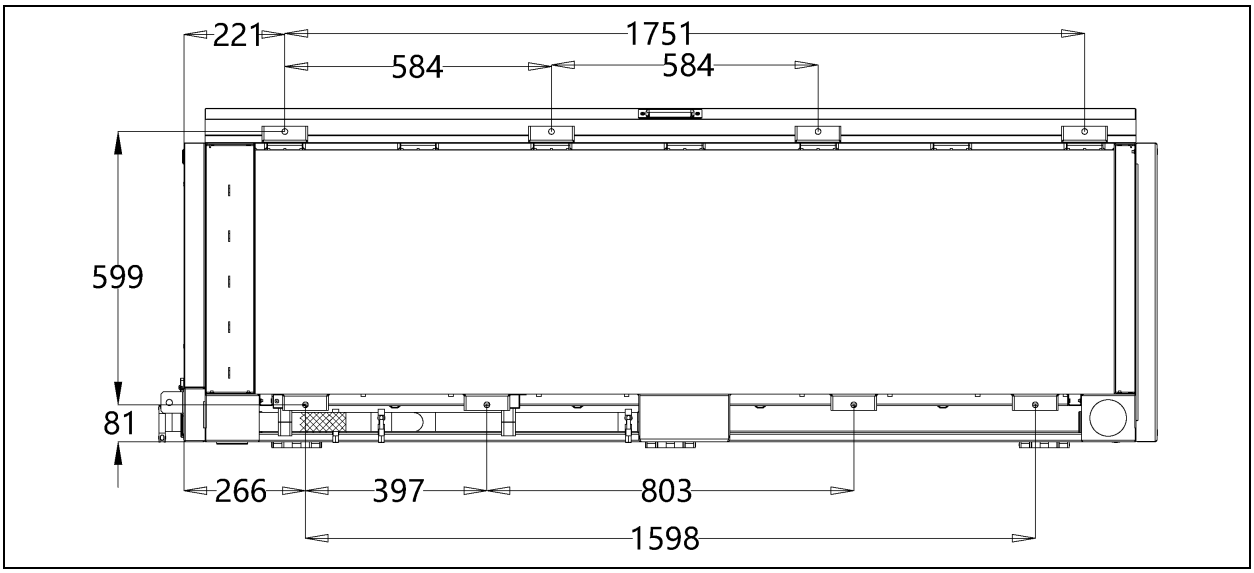


Figure 4.9 52 U Tank bottom view (looking up) (unit: mm)

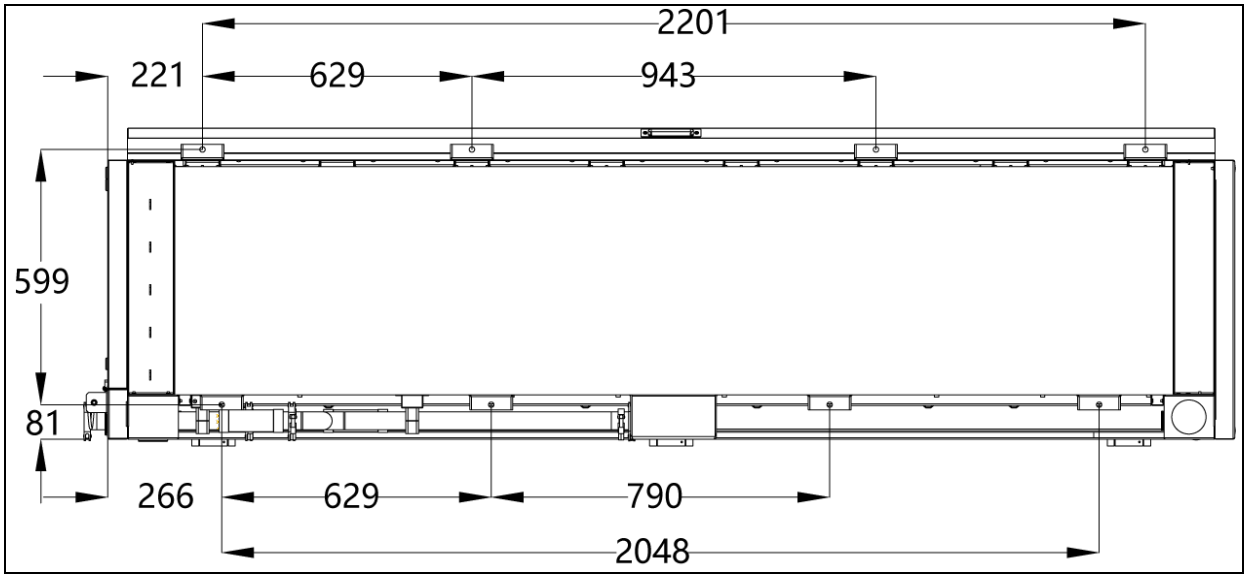
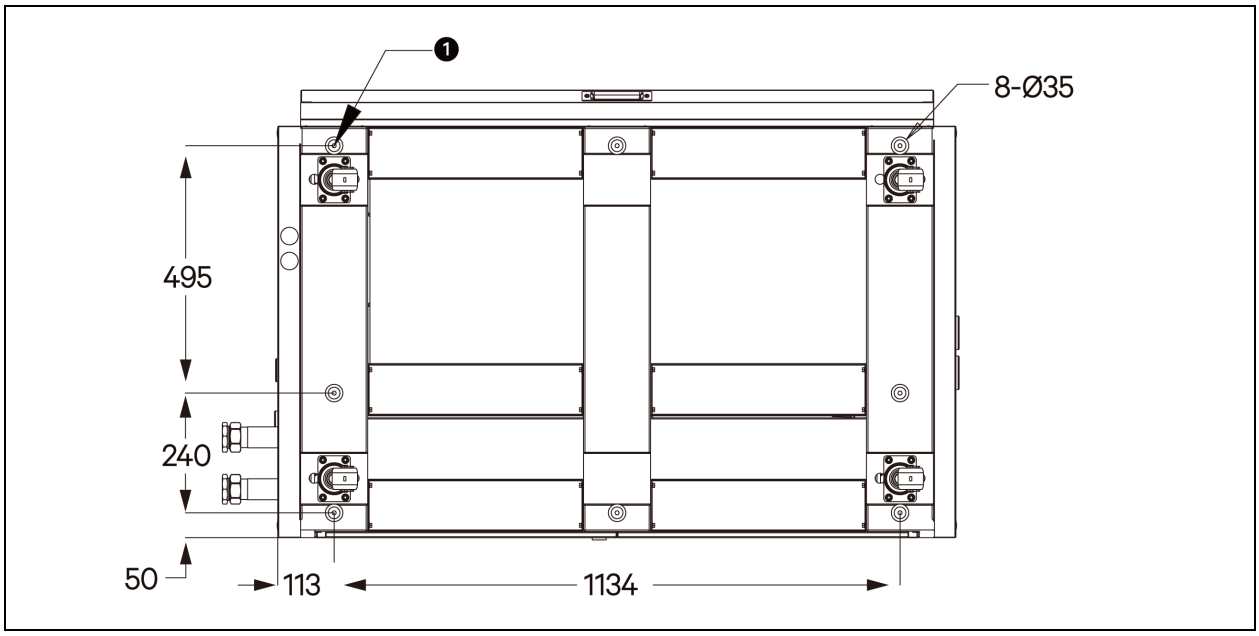


Figure 4.10 Self-contained unit bottom view (looking up) (unit: mm)



Item	Description
1	Leveling foot

NOTE: To install the base, note the following points: (a) Fix the base through the identified installation holes. (b) Place a shock-absorbing rubber pad between the base and the unit. The thickness of the rubber pad is recommended between 10mm and 12mm. (c) Tightly fit the shock-absorbing rubber pad, and reserve installation holes on the pad.

4.2 Equipment Layout

For the modular unit, one CDU can support one to four Tanks.

The top view of the layout of single, double, three, and four Tank systems is shown in the figure below. The space shown in the figure is the minimum maintenance space, and it only supports the raised floor with unit bottom piping. The raised floor is recommended to be 500 mm or above. For above the floor or overhead piping, please consult Vertiv.

Figure 4.11 Installation diagram of one 42U Tank (top view)

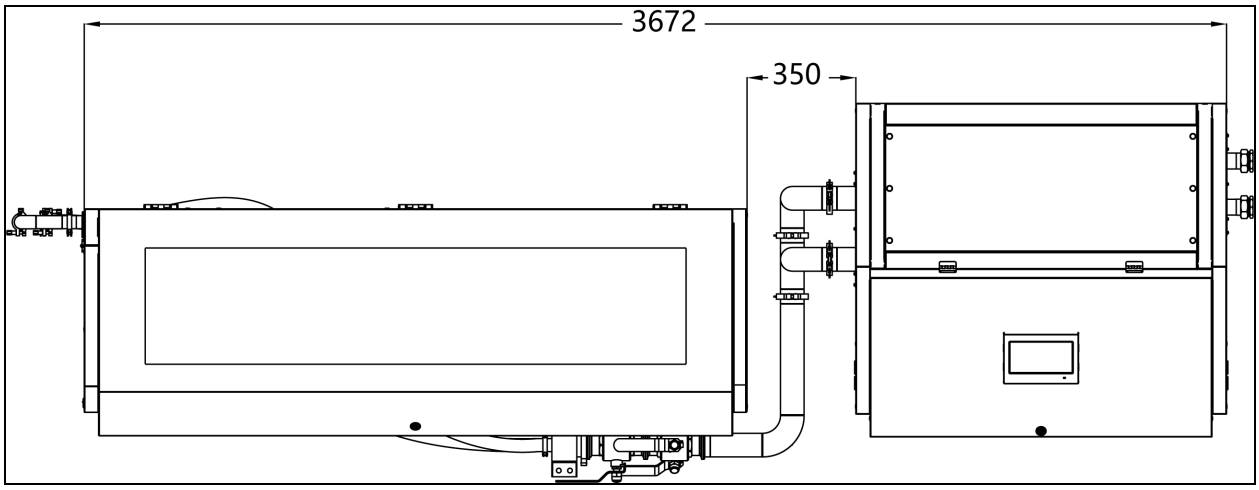


Figure 4.12 Installation diagram of two 42U Tanks (top view)

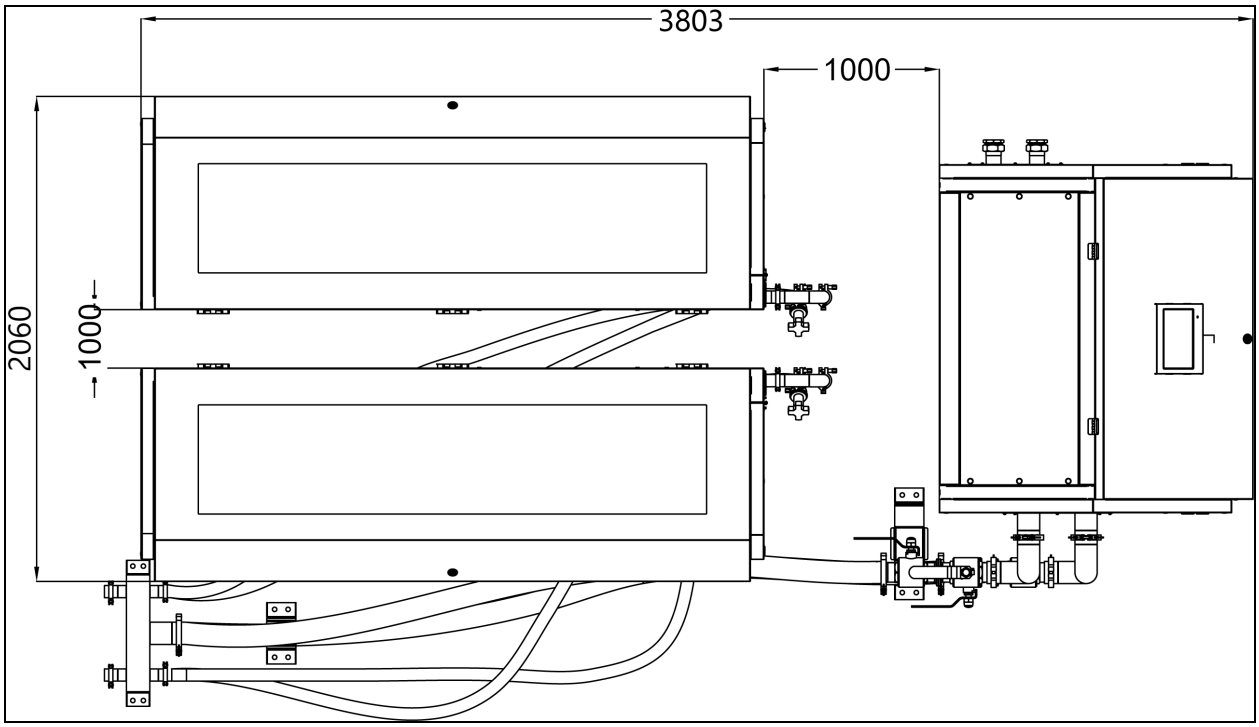


Figure 4.13 Installation diagram of three 42U Tanks (top view)

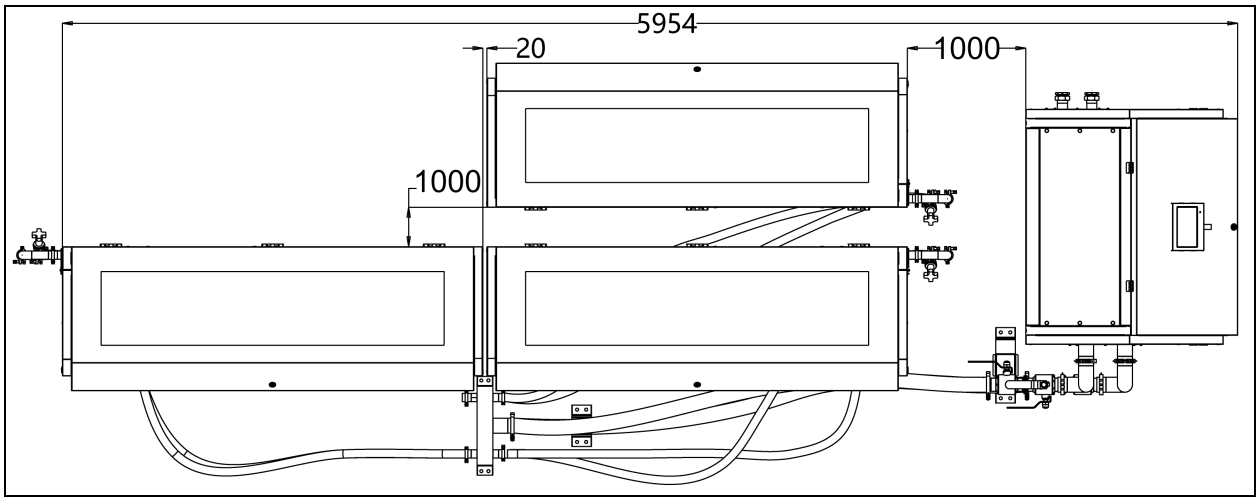
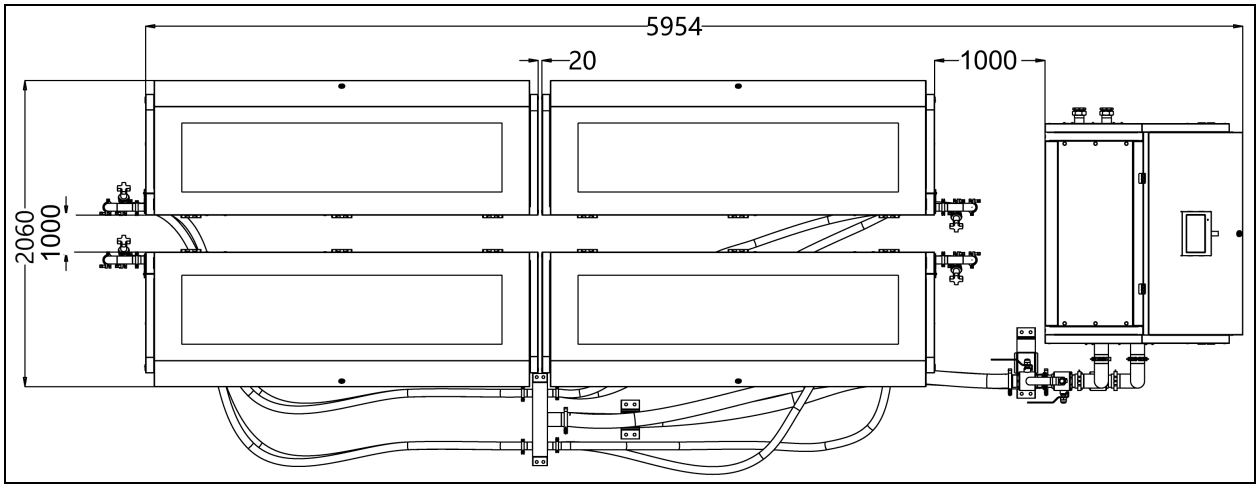


Figure 4.14 Installation diagram of four 42U Tanks (top view)



4.3 Pipe Connection

4.3.1 Pipe Connection for the Unit

Two types of pipes need to be connected to the unit: secondary coolant pipe (between CDU and Tanks) and primary water pipe (between CDU and chilled water system such as chiller/cooling tower/dry cooler). The secondary coolant pipes are supplied with the unit by Vertiv and the pipes are stainless steel hoses. The primary water pipes are provided by others.

Table 4.8 Pipe connection specifications

Model	Connection	Connector	Specifications
Modular unit	Tank coolant inlet	Grooved clamp	DN40
	Tank coolant outlet	Grooved clamp	DN40
	CDU coolant inlet	Grooved clamp	DN65
	CDU coolant outlet	Grooved clamp	DN65
	CDU chilled water inlet	G2" internal thread	DN50
	CDU chilled water outlet	G2" internal thread	DN50
Self-contained unit	Chilled water inlet	G1-1/2" internal thread	DN40
	Chilled water outlet	G1-1/2" internal thread	DN40

All of the stainless steel pipes of the unit are connected through grooved clamps, with sealing rubber rings, clamps, and locking bolts. It is recommended to torque the grooved clamp at 3 N·m.

Figure 4.15 Connecting the Grooved Clamp

Modular unit

After placing and installing the modular unit, you can connect pipes. The modular unit has been connected internally at the factory before delivery. On site, you need to connect the primary water pipes between CDU and chilled water system such as chiller/cooling tower/dry cooler and connect the secondary coolant pipes between CDU and Tank.

- At the Tank inlet pipe, install a static balance valve, a clamp, and a DN40 maintenance valve in sequence.
- At the Tank outlet pipe, install a DN40 maintenance valve, a clamp, and a DN40 maintenance valve in sequence.
- At the CDU inlet pipe port and outlet pipe, install a DN65 maintenance valve, a clamp, and a DN65 maintenance valve in sequence.
- Finally, connect the CDU and the Tank with stainless steel pipes.

Installing several maintenance valves can reduce the loss of coolant in the pipeline during unit maintenance.

CDU and Tank inlet and outlet pipes are labeled. During installation, pay attention that the CDU coolant inlet pipe should be connected to the Tank coolant outlet pipe, and the CDU coolant outlet pipe should be connected to the Tank coolant inlet pipe.

NOTE: When installing the static balance valve, connect it to the pipe through its internal threaded interface, and seal the connection with 5441 thread sealant.

Self-contained unit

The self-contained unit has been connected internally at the factory before delivery. On site, the self-contained unit only needs to be connected to the primary pipework (between the unit and chiller/cooling tower/dry cooler), and the pipework are furnished by others.

4.3.2 Pipe Connection for the Primary Side

The connecting of the primary water pipe is similar to the connecting of the coolant pipe. Note the following points:

- Use filters for water pipes, and it is recommended to use the 40-mesh filter.
- Install a manual maintenance valve on the water supply pipe outside the equipment room to prevent chilled water from entering the room if the water supply pipe bursts.
- Install a pressure differential bypass valve between water inlet and outlet pipes, and configure the valve according to primary system design. Because the water inlet pipe inside the CDU or self-contained unit is equipped with a water flow regulating valve and the valve automatically closes when there is no load, the pressure differential bypass valve can help prevent the water pipe from being over-pressurized and bursting.
- If the system uses chilled water, insulate the water pipes to preserve heat.
- Users need to test the chemical content in the supplied water. After confirming that the water quality meets the requirements listed in Water Quality Requirements on page 16 , the unit can be connected to the primary water side. If the water quality does not meet the requirements, users need to add filters or other devices to improve the water quality.
- After confirming that the water quality meets the requirements, thoroughly clean and flush the water system and remove the residual debris in the water filter.
- After the CDU or the self-contained unit is connected to the primary water pipes, check that there is no leakage on the pipe and inside the heat exchanger. Please be noted that, for the modular unit, check for leakage before connecting the coolant pipe between the Tank and the CDU.

NOTE: It is recommended to arrange a pressure differential bypass valve on the primary water side, which is crucial to the safe operation of the system.

Primary water side design parameters are listed in the table below.

Table 4.9 CDU primary water side parameters

Item	Primary water side maximum pressure drop	Primary water side design bearing pressure	Recommended water supply pressure range
Parameter	80 kPa	2500 kPa	200 to 700 kPa

NOTE: If the chilled water system requires higher operating water pressure due to design reasons, please contact Vertiv in advance.

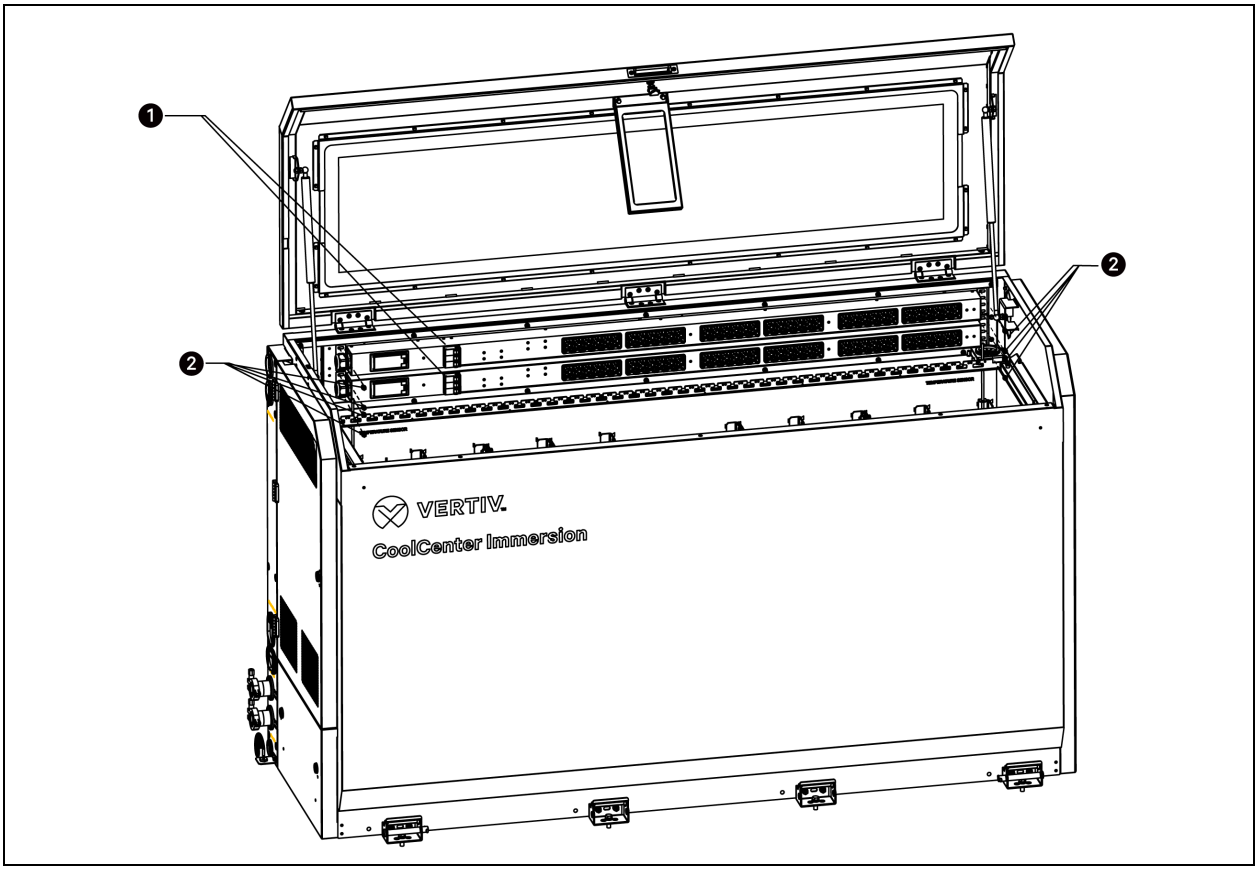
NOTE: Insufficient water flow of the system will affect the cooling capacity of the equipment and even endanger the safe use of the server.

NOTE: For the parallel use of multiple systems on the primary water side, hydraulic balance testing is required during system commissioning to prevent water imbalance in each system.

4.4 Installing PDU

The PDU installation position is shown in the figure below. Each PDU requires four M6x15 screws to fix both ends.

Figure 4.16 PDU installation



Item	Description
1	PDU (2 pieces)
2	M6x15 screw (4 pieces)

4.5 Mechanical Installation Inspection

After the mechanical installation, perform the inspection according to the table below.

Table 4.10 Mechanical installation inspection

Inspection Item	Result
The layout of the CDU and Tank is as required	
A one-meter maintenance channel is reserved between different modular units or between different self-contained units in the equipment room	
The primary chilled water inlet pipe is installed with a differential pressure bypass valve and the valve is properly set up	

Table 4.10 Mechanical installation inspection (continued)

Inspection Item	Result
The primary drainage pipe is connected for the CDU or the self-contained unit	
The water pipe and coolant pipe should be routed downwards, and the data line should be routed upwards	
All fittings are tightened	
Before connecting the unit, the water leakage of the chilled water system is checked and there is no leakage, the pipeline is flushed, and the impurities in the filter are removed	
The sundries (such as transportation materials, structural materials, and tools) in or around the equipment are removed	

After everything is checked and confirmed, proceed to electrical installation.

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5 Electrical Installation

This section describes the electrical installation, including installation precautions, main power wiring, and electrical installation inspection.

5.1 Installation Precautions

- If the power supply cable is damaged, it must be replaced by a professional personnel from Vertiv technical service team.
- The power supply system uses the TN and TT modes and the WYE wiring method. If you need to configure other grid systems, please consult Vertiv.
- All power, control, and ground connections must comply with national and local electrical codes.
- Electrical installation and repair work must be carried out by authorized professional installers.
- Main power requirements: 380 to 400VAC (+/-15%), 50&60Hz±1% (short time fluctuation±2%), 3N~, overvoltage class II.
- The power cable is a 3-phase 5-core wire. The cable should not be lighter than the No. 53 cable of ordinary PVC sheathed cables in GB5023.1 (idt IEC60277), the cable diameter of the modular unit should not be less than 4mm^2, and the cable diameter of the self-contained unit should not be less than 2.5mm^2. The FLA value of the modular unit is 10A, and the FLA value of the self-contained unit is 6A.
- Verify that the specifications on the CDU enclosure match your power supply and applicable safety requirements.
- Before connecting the circuit, measure the input power supply voltage with a voltmeter, and make sure that the upstream power supply is disconnected.
- The upstream power supply of the unit must be equipped with a circuit breaker that is disconnected from all poles of the grid in the fixed wiring according to the wiring rules.
- All circuit breakers on the unit must be set to OFF before installation.
- The system must be grounded with an external ground strap. Failure to provide an adequate ground could cause serious damage to the servers in the Tank.
- For Tank, the protective grounding cable should have with a minimum cross-sectional area of 4 mm^2.
- Residual Current Operated Protector (RCD) should be installed according to the actual installation situation, and the rated RCD value is 10 mA.
- The emergency power off must be installed if the circuit breaker is not installed close to the unit.
- Check that all wiring to the CDU, Tank, and distributor is correctly installed.
- Check that all cable and circuit connectors, screws, and bolts are tightly installed.

WARNING!

When wiring the equipment, the ground wire must be connected first; when removing the power cord, the ground wire must be removed last.

Disconnecting devices such as circuit breakers cannot be connected to the grounding wire.

Without the confirmation of the technical personnel of Vertiv, the user should not install electrical components such as ammeters inside the unit.

5.2 Main Power Wiring

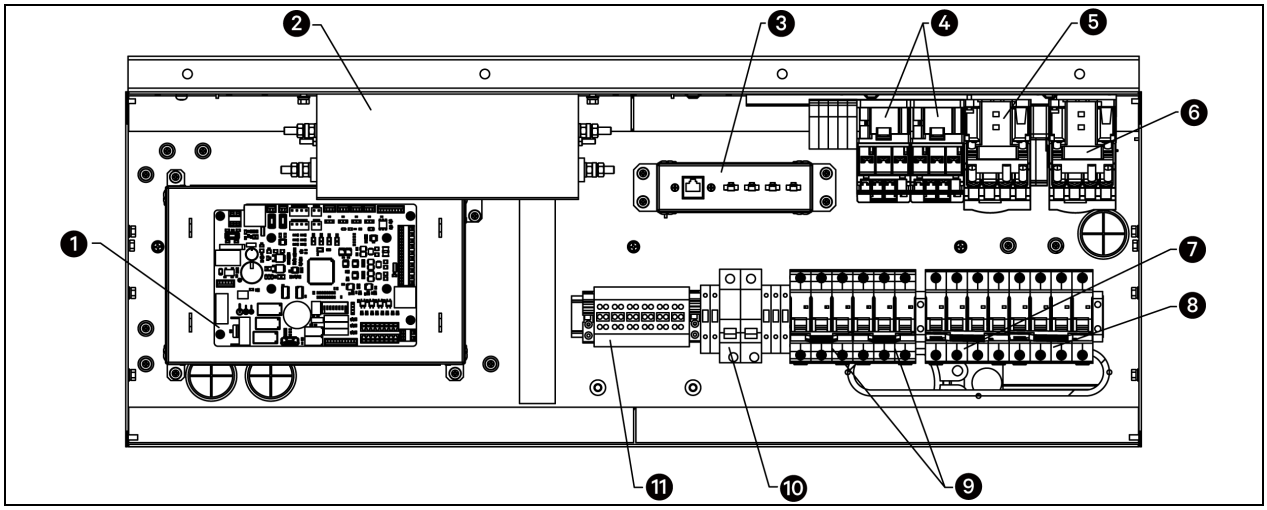
The power input of the CDU and the self-contained unit adopts three-phase 380-400 VAC (+/-15%), which supplies power to the pump 1 driver, pump 2 driver, and power module respectively. Each front end is equipped with a circuit breaker for short-circuit protection and overload protection.

WARNING! All power circuits must be disconnected before connecting the terminals.

5.2.1 CDU Main Power Wiring

Open the top cover of the CDU and you can see the layout of low-voltage components identified by labels. The unit adopts dual power backup. Connect the main power to the lower interface of the main circuit breaker 1, and connect the backup power to the lower interface of the main circuit breaker 2.

Figure 5.1 CDU electrical control box

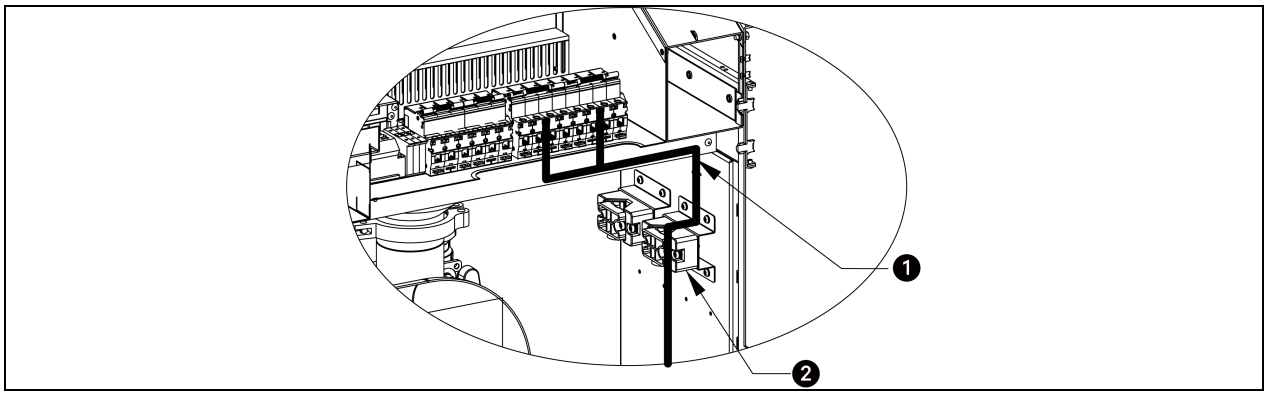


Item	Description	Item	Description
1	Control board	7	Main circuit breaker 1
2	Electric filter	8	Main circuit breaker 2
3	Plug-in terminals	9	Pump circuit breaker
4	Electric relay	10	Power module circuit breaker
5	Contactor 1	11	Terminal block
6	Contactor 2		

Connect the L1, L2, L3, and N terminals of the CDU to the corresponding terminals of the external power supply. The user cable inlet hole is located at the lower part of the right panel of the CDU, and the cable fixing clip is located inside the right panel of the CDU. Prepare longer power cable. After routing the cable through the inlet hole, fix the cable with the fixing clip, and then connect it to the main circuit breaker in the upper electrical control box. As shown in the figure below, fix the cable on the cable mount with binding ties along the route.

NOTE: There are cables holes under the fixing clip of the self-contained unit. If the user power cable is short, the cable can be connected from the bottom of the self-contained unit.

Figure 5.2 CDU main power wiring

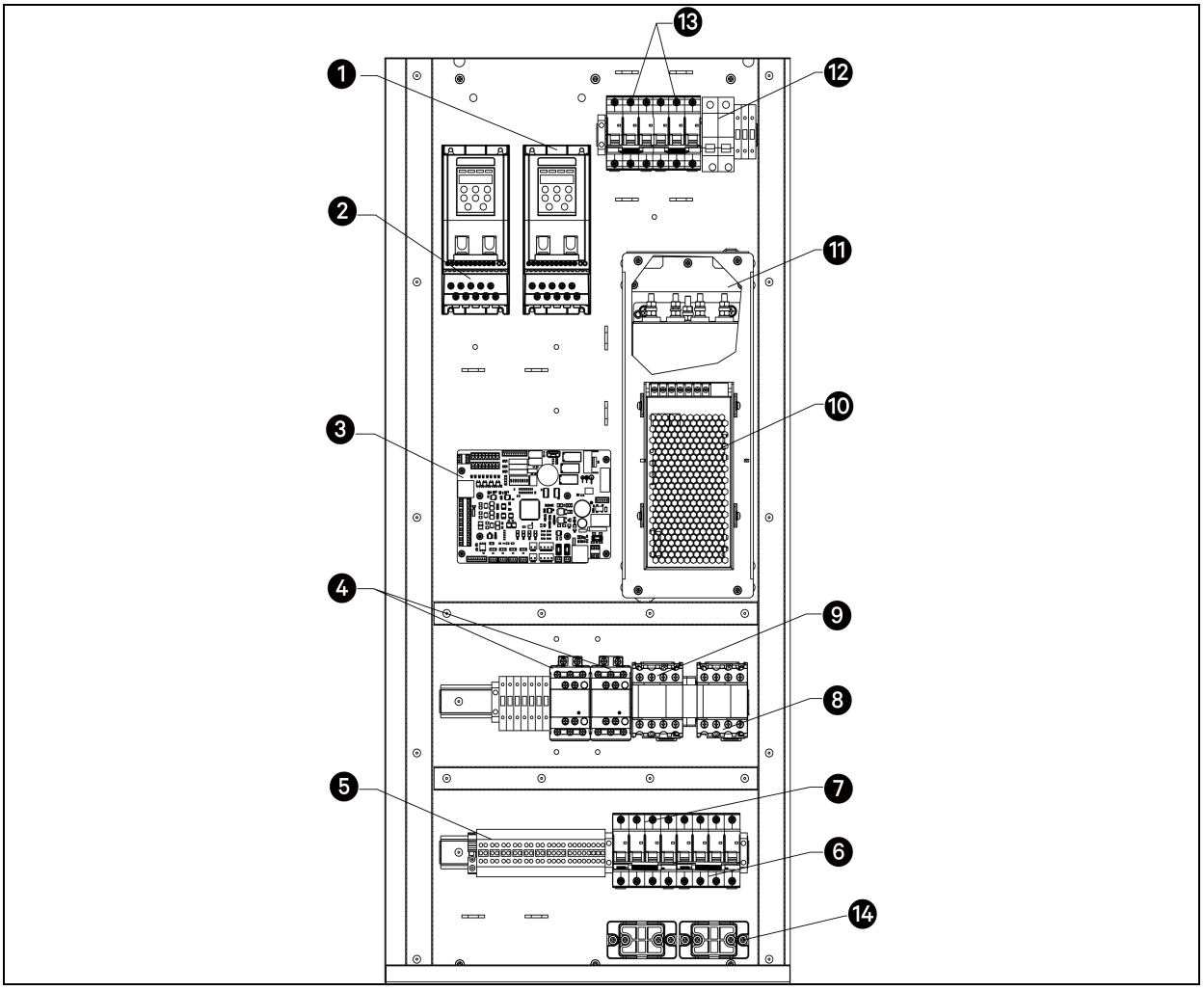


Item	Description
1	Fix the user inlet power cable with binding ties along the route
2	Cable fixing clip

5.2.2 Self-contained Unit Main Power Wiring

Open the left cover of the self-contained unit and you can see the layout of the low-voltage components that are identified by labels. The unit adopts dual power supply. Connect the main power to the lower interface of the main circuit breaker 1, and connect the backup power to the lower interface of the main circuit breaker 2.

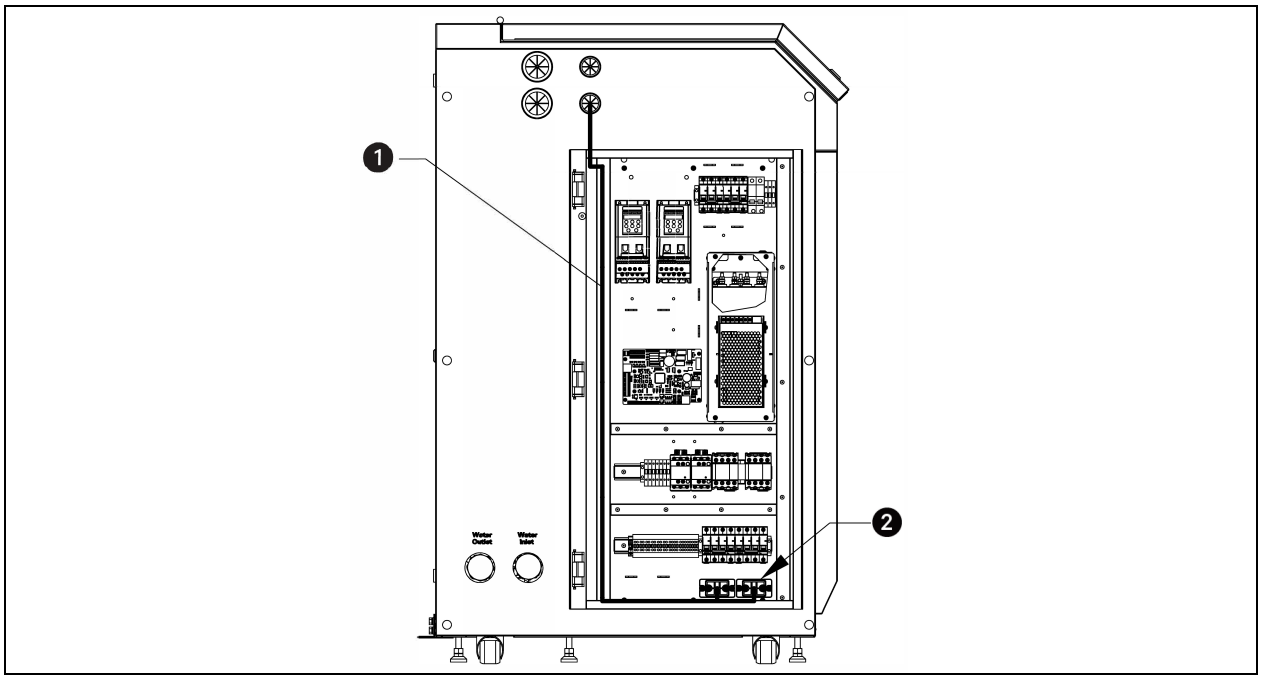
Figure 5.3 Self-contained unit electrical control box



Item	Description	Item	Description
1	Frequency converter 2	8	Contactor 2
2	Frequency converter 1	9	Contactor 1
3	Control board	10	Filter
4	Electric relay	11	Power supply module
5	Terminal block	12	Power supply module circuit breaker
6	Main circuit breaker 2	13	Pump circuit breaker
7	Main circuit breaker 1	14	Cable fixing clip

Connect the L1, L2, L3, and N terminals of the self-contained unit to the corresponding terminals of the external power supply. The cable inlet hole is located at the upper left side of the self-contained unit, and the cable fixing clip is located at the lower left side of the self-contained unit. Prepare a power cable with sufficient length. Route the cable through the inlet hole, fix the cable on the cable tie mount with the tie wrap, and then fix the cable on the fixing clip. Finally connect the cable to the main circuit breaker in the top electrical control box. As shown in the figure below, fix the cable on the cable mount with binding ties along the route.

Figure 5.4 Self-contained unit main power wiring



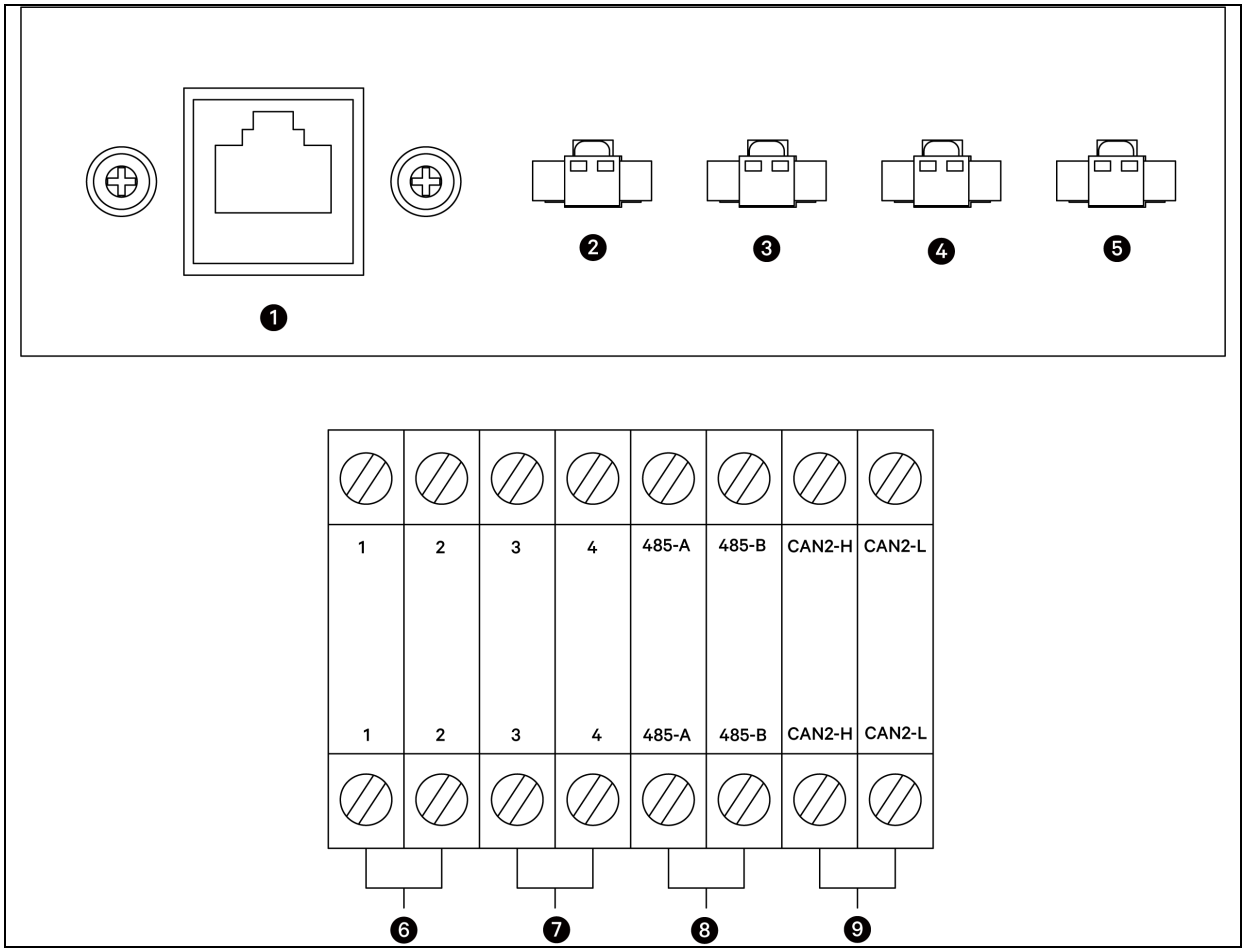
Item	Description
1	Fix the inlet power cable with tie wraps along the route
2	Cable fixing clip

5.3 Control Cable Wiring

5.3.1 CDU Plug-in Terminals and Terminal Block

The figure below shows the CDU plug-in terminals and terminal block for user on-site wiring.

Figure 5.5 CDU plug-in terminals and terminal block



Item	Description	Item	Description
1	Tank communication	6	Remote power on/off switch
2	Tank1 24V	7	Customized alarm
3	Tank2 24V	8	Backend monitor
4	Tank3 24V	9	Teamwork
5	Tank4 24V		

WARNING! Before connecting the control lines, the wiring personnel must take appropriate anti-static measures

5.3.2 Tank Communication Wiring

The power input of the Tank is 24VDC, which takes power directly from the CDU. Connect one end of the power cable to the 24V port on the plug-in terminal of the CDU, and the other end to the 24V port on the Tank terminal block.

Tank and the CDU host uses CAN communication. Tank has two CAN communication ports, one in and one out. Route the signal cable from the CAN communication port on the plug-in terminal of the CDU, and then connect it to the in/out CAN communication ports of the four Tanks in series.

NOTE: It is recommended to use shielded twisted pair cables for communication cables. Cable specification is UL2464 22AWGx2C.

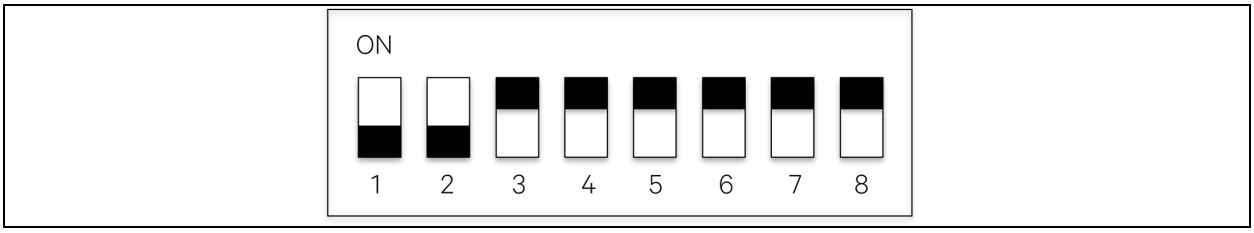
5.3.3 Multi-Tank Communications

In the modular unit, the communication address of the Tank is set on the DIP switch on PACC. Up to four Tanks can communicate with one another. After wiring is completed, set the DIP switch on PACC to set the address. The addresses of four Tanks are shown in the table below. The DIP switch setting for the address 3 (11000000) is shown in the figure below. When the toggle of the DIP switch is moved to ON, it indicates 0; otherwise, it indicates 1. Move the toggles on the DIP switch from left to right.

Table 5.1 Tank DIP switch setting

Unit	ID	DIP switch setting ON-"0" OFF-"1"							
		1	2	3	4	5	6	7	8
Tank 1	1	1	0	0	0	0	0	0	0
Tank 2	2	0	1	0	0	0	0	0	0
Tank 3	3	1	1	0	0	0	0	0	0
Tank 4	4	0	0	1	0	0	0	0	0

Figure 5.6 Tank3 DIP switch setting

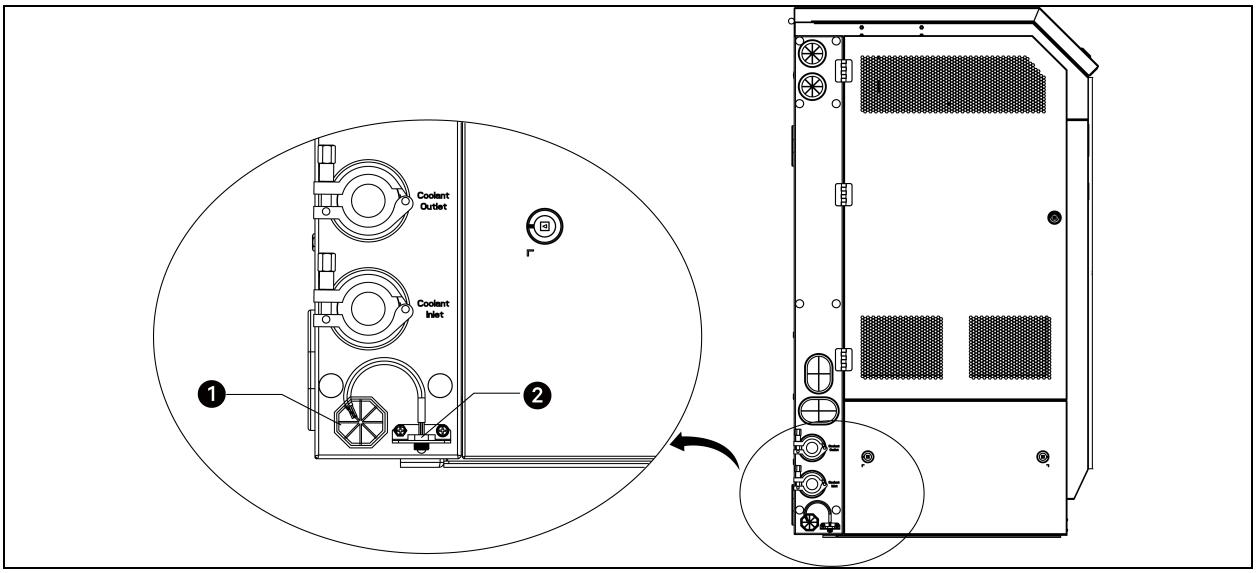


5.3.4 Photoelectric Sensor

Tank and the self-contained unit are equipped with photoelectric sensors to monitor whether or not the unit is leaking oil. The sensor is located at the bottom of the unit.

The photoelectric sensor of the self-contained unit has been installed before leaving the factory. The photoelectric sensor for Tank is strapped onto the side plate of the Tank. During site installation, untie the leak detection sensor cable, run it through the sensor cable hole and connect to J6 port on the control board. The following figure shows the location of the photoelectric sensor of the Tank with pipe connection at left.

Figure 5.7 Tank photoelectric sensor location



Item	Description
1	Cable hole for the photoelectric sensor
2	Photoelectric sensor

5.4 Electrical Installation Inspection

After the electrical installation is completed, perform the inspection according to the table below.

Table 5.2 Electrical installation inspection

Inspection item	Result
The power supply voltage is the same as the rated voltage on the equipment nameplate	
There is no open circuit or short circuit in the electrical circuit of the system	
Main power cable and ground cable have been connected	
The circuit breaker or fuse is correctly rated	
The control cable is connected	
All cables and circuit connectors are tightened, and the fastening screws are not loose	

After the inspection and all items are correct, you can proceed to commissioning. Commissioning is a professional operation. Please contact Vertiv technical engineers or certified and authorized professional technicians to carry out the operation.

WARNING! Users are prohibited from powering on the device before Vertiv technical engineers or certified and authorized professional technicians check and confirm.

6 HMI Display Operation

This section describes the features, appearance, main page, and operation examples of the HMI display.

6.1 Features

The HMI display has the following features:

- Through LED display and menu operation, the HMI display monitors and displays the operating status of the system, and keeps the control environment within the set range.
- Self-recovery after power failure, high and low voltage protection, phase loss protection, and reverse phase protection.
- Through the menu operation, you can accurately see the main parameters and operating status of the system.
- The expert-level fault diagnosis system can automatically display the current fault, which is convenient for maintenance personnel to carry out equipment maintenance.
- Up to 500 historical alarms can be stored.
- CAN interface and CAN communication protocol are adopted.

NOTE: The HMI display is a resistive screen. When you touch the HMI display for related operations, if the HMI display does not respond in time, please tap the HMI display with your fingertips with a little force.

6.2 Appearance

Figure 6.1 HMI display appearance

6.3 Main Page

6.3.1 Startup Page

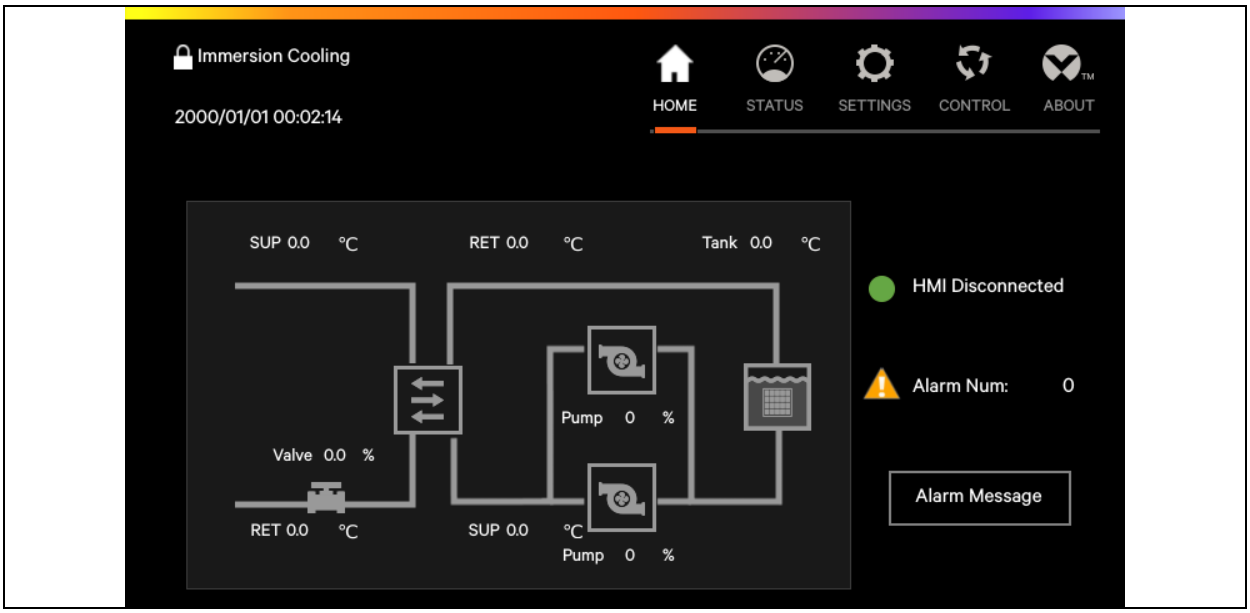
After the unit is powered on, the startup page is displayed.

Figure 6.2 Start-up page

6.3.2 Main Page

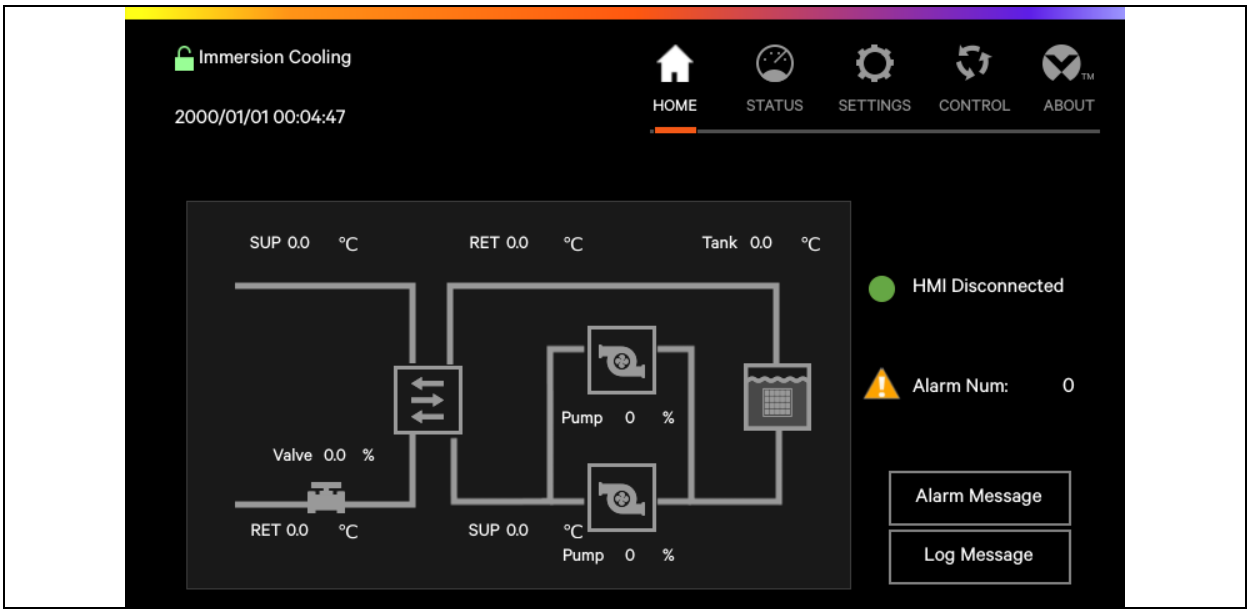
On the main page, tap the unlock button in the upper left corner, enter the user password to unlock, and then you can browse the menu page and set parameters.

Figure 6.3 Main page (locked)



After the HMI display is unlocked, the uppermost part of the page shows the menu, containing the sound icon, homepage icon, status icon, settings icon, control icon, and the about icon; the middle part displays the main components and main operating status of the unit; the far right part displays the alarm information of the unit.

Figure 6.4 Main page (unlocked)



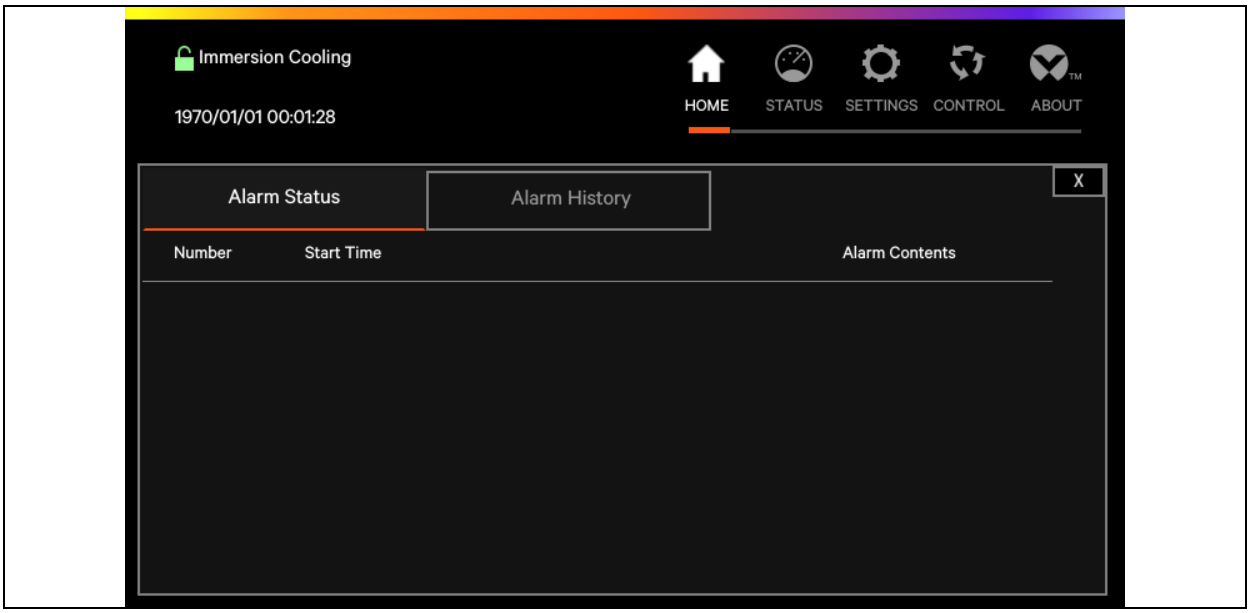
When browsing the menu, tap the corresponding menu button to view the relevant parameters.

Table 6.1 Touch button function description

Touch Button	Functional Description
Sound	Tap this button to mute the alarm sound
Home	Tap this button to access the main page to view the main operating data of the system and alarm information
Status	Tap this button to access the status page to view the system running status and operation information
Settings	Tap this button to access the settings page to set the temperature and alarm value
Control	Tap this button to access the control page to control the unit on and off or to manually adjust the unit
About	Tap this button to view the controller software model and version, monitor software model and version

Tap the alarm information button in the lower right corner of the main page to enter the alarm information page. This page shows current alarms and history alarms.

Figure 6.5 Alarm information



Current alarm

The current alarm page is used to monitor the current alarm status record of the system, including the alarm occurrence time and alarm content.

History alarm

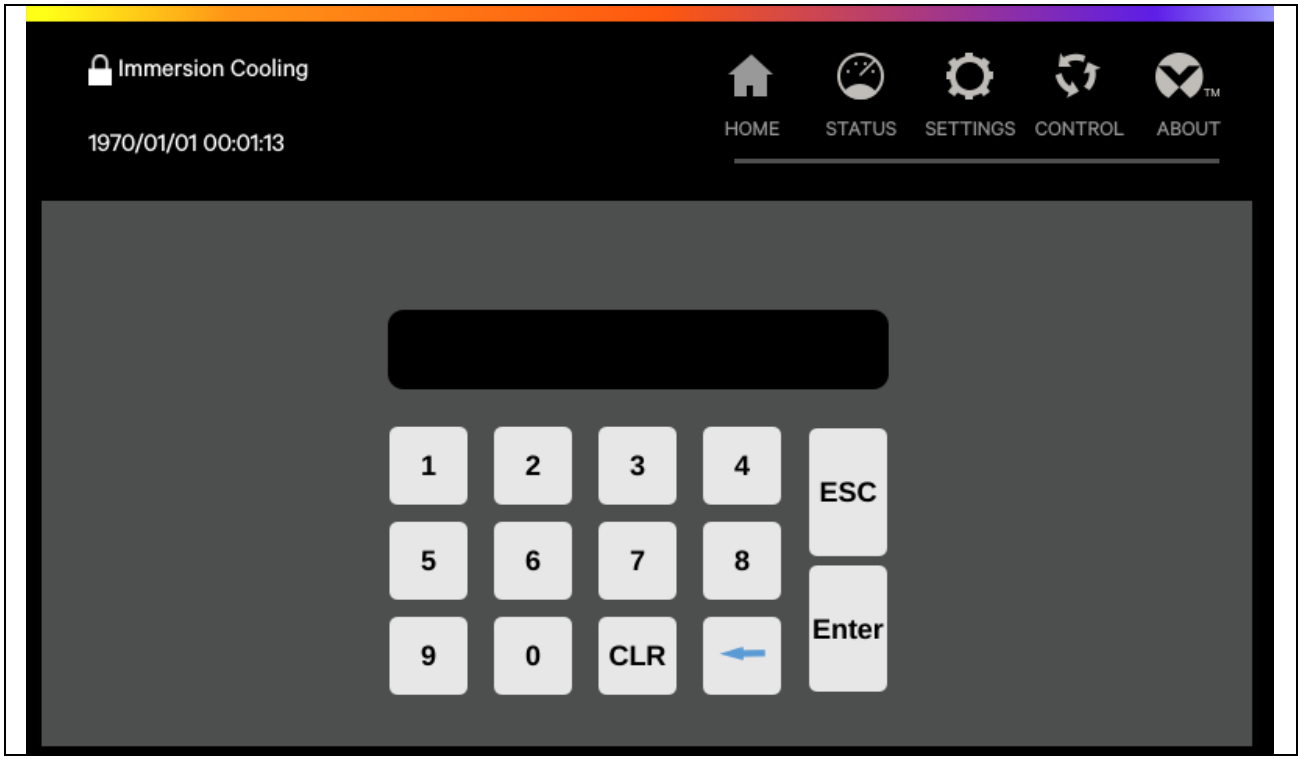
The history alarm page is used to query the history alarm information of the system, including the alarm occurrence time, alarm content, and alarm clearance time.

6.4 Other Pages

6.4.1 Password

Tap the unlock icon in the upper left corner to display the password page.

Figure 6.6 Password page



To enter the menu, use the level-one or level-two password.

Table 6.2 Password level

Password level	User	Initial password	Note
Level one	User	1490	Change communication settings and time settings
Level two	General operating personnel	-	Change Tank quantity, pump temperature settings, water valve temperature settings, Tank high and low temperature alarm value, water inlet high and low temperature alarm value, etc.
Level 3	Vertiv technical engineer	-	-

For details on password, see 6.5 on page 61. If you enter a wrong password, you can tap CLR (the clear button) to modify it.

6.4.2 Status Page

Tap the status icon to view the running status of the unit, including running information, run hour, on/off record, power information, etc.

Figure 6.7 Running information - 1

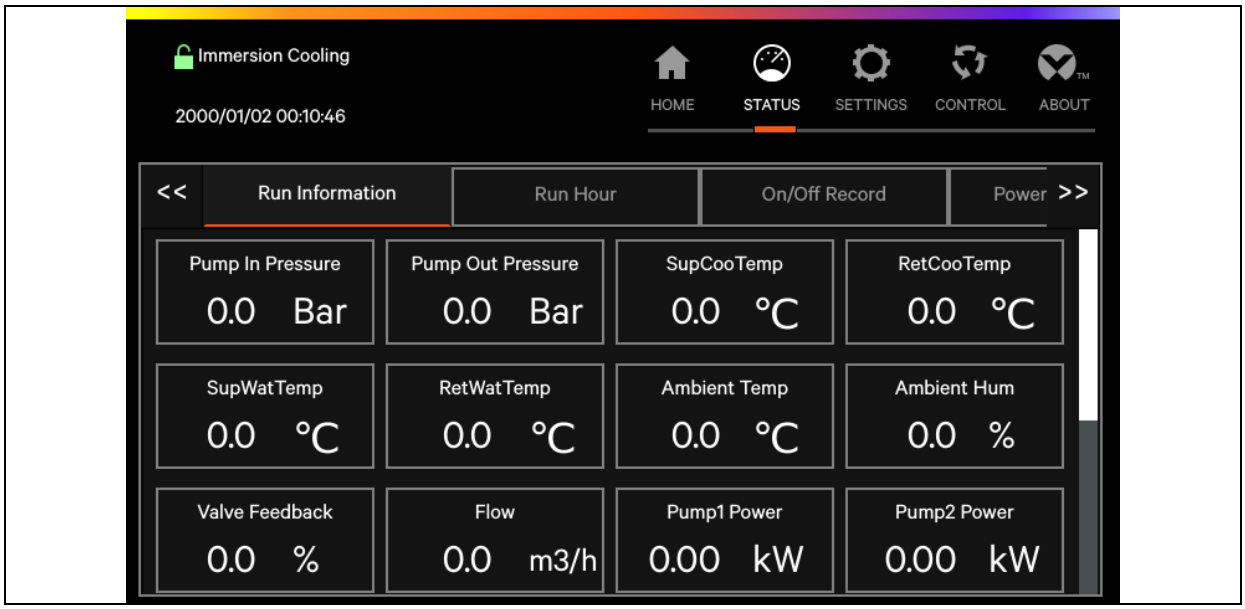


Figure 6.8 Running information - 2

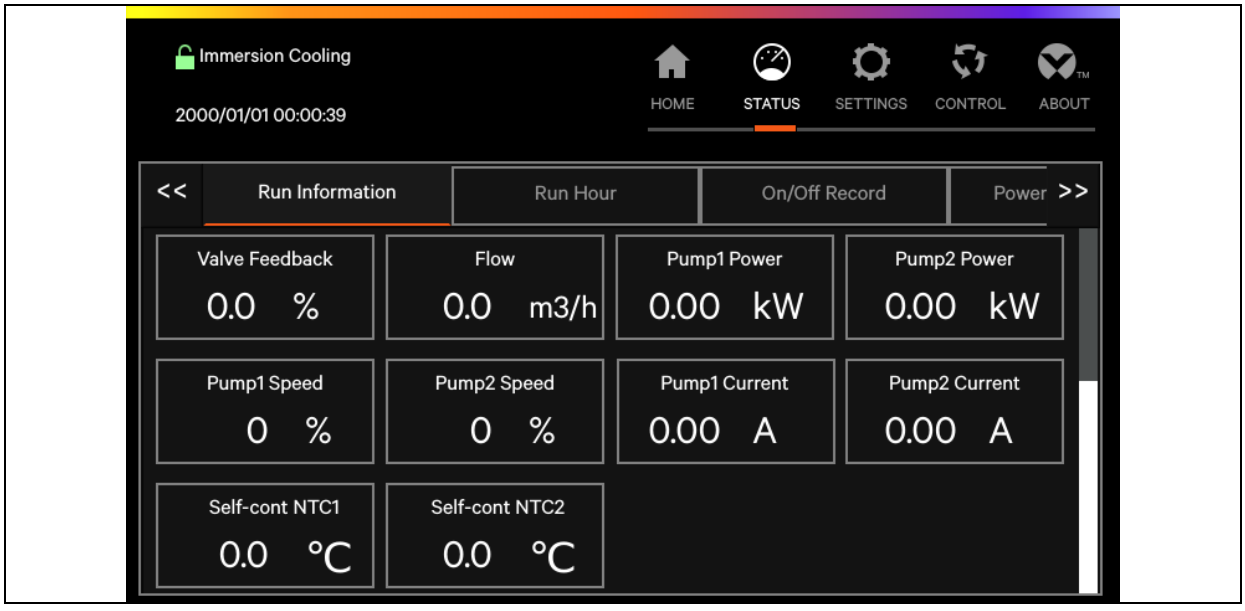


Figure 6.9 Running information - 3

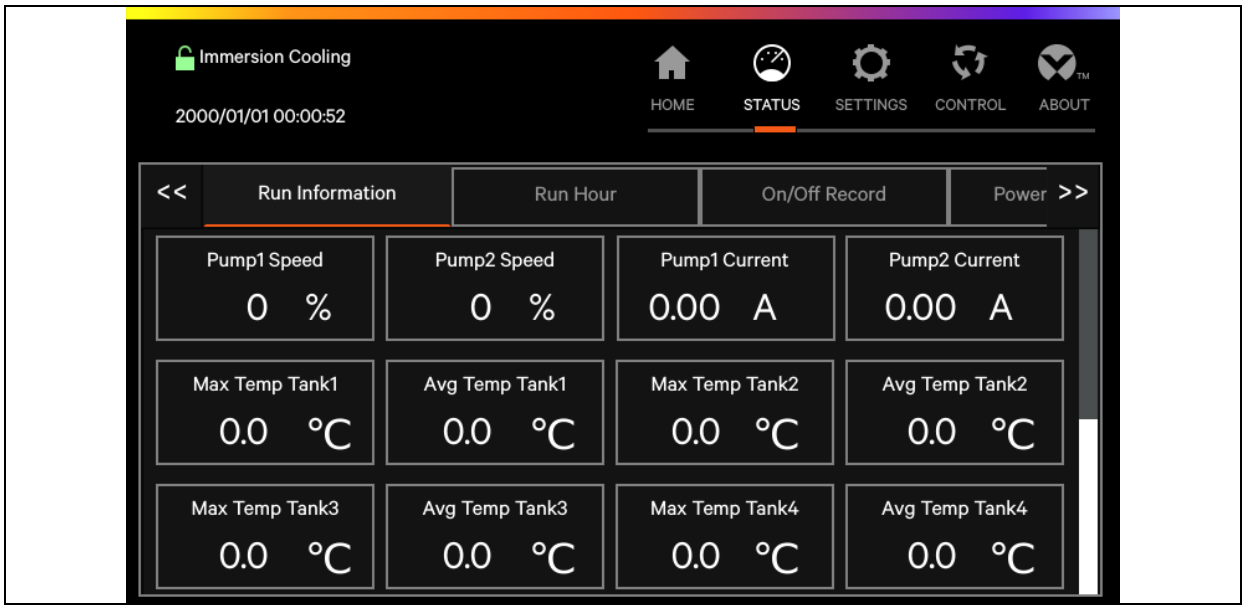


Figure 6.10 Run hour

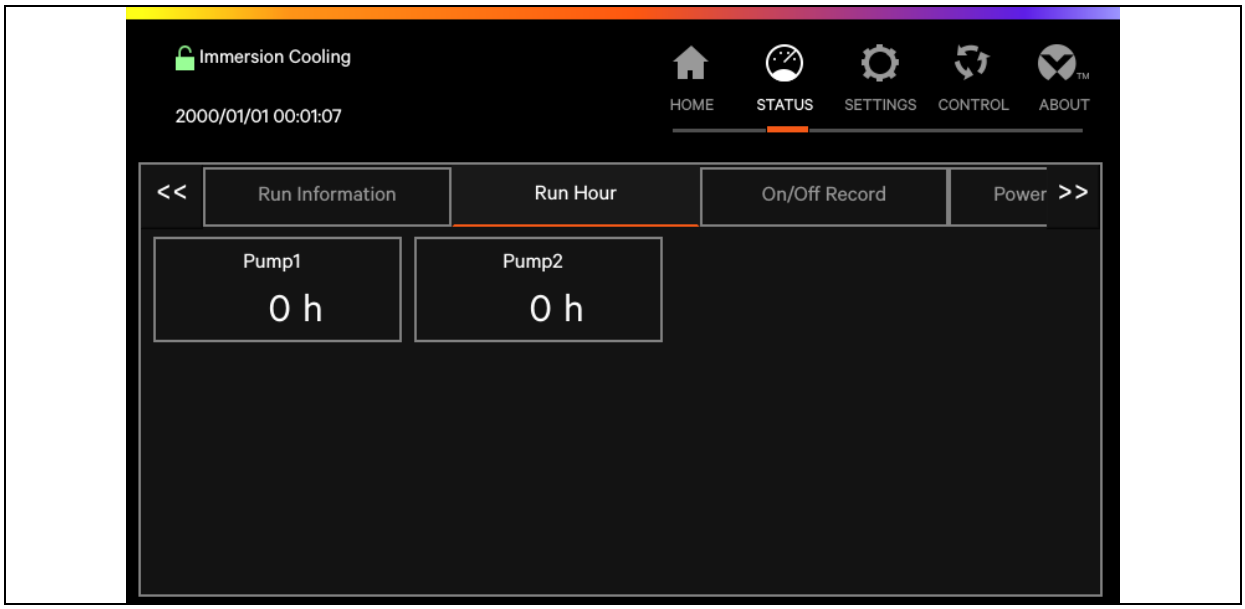


Figure 6.11 On/Off record

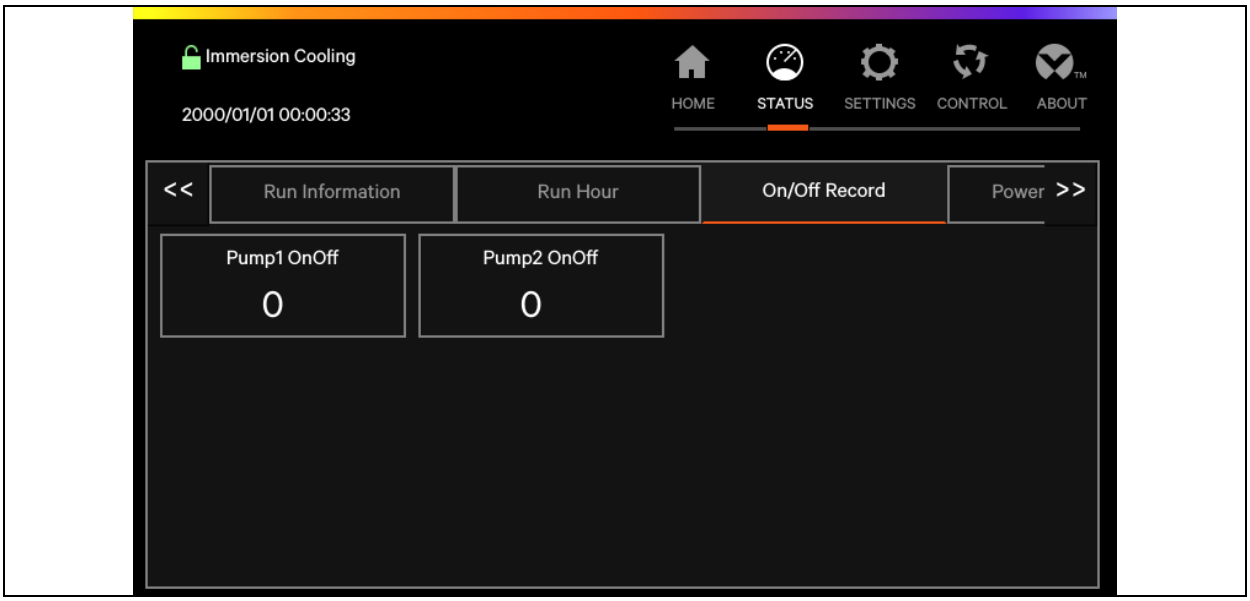


Figure 6.12 Power information

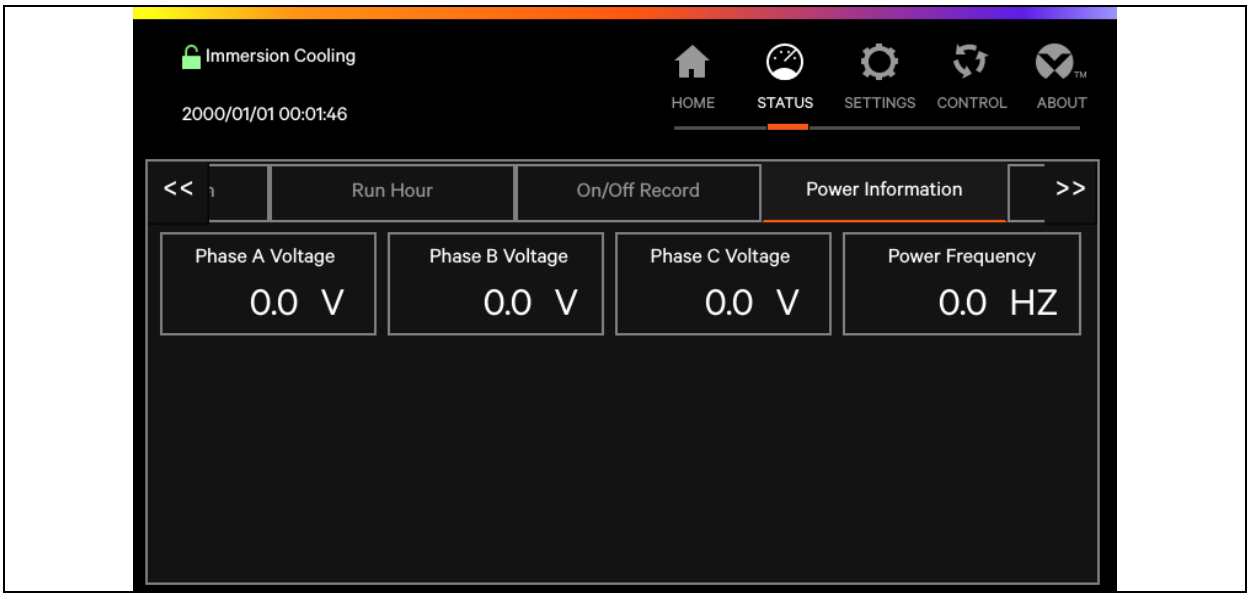
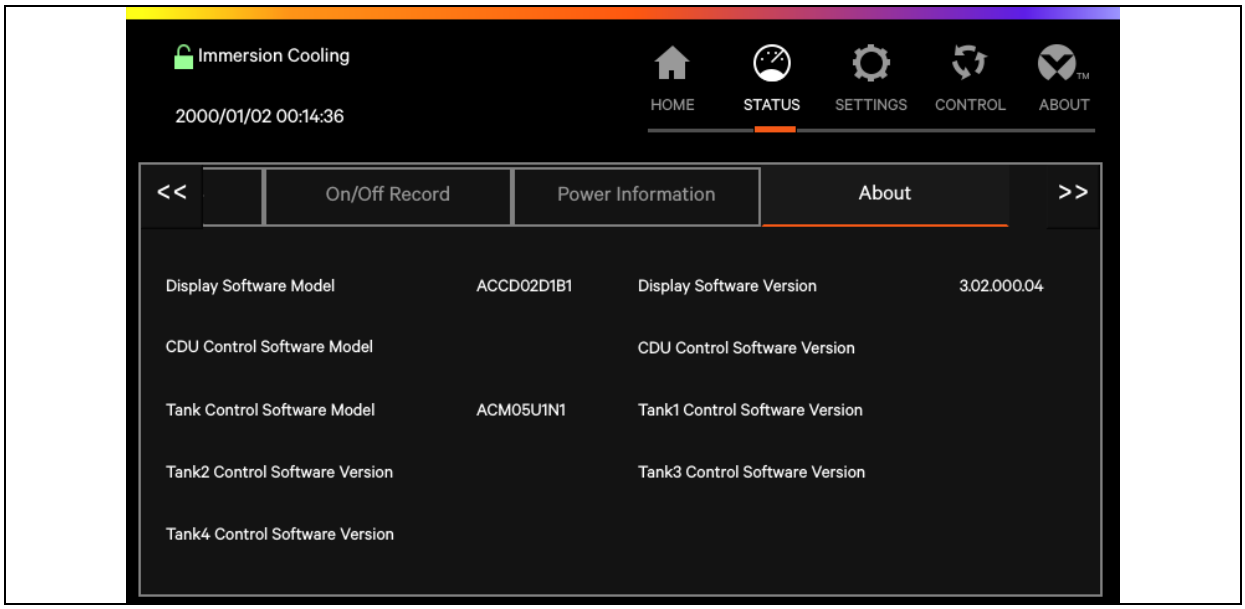


Figure 6.13 About



6.4.3 Settings Page

Tap the settings icon to view parameters of the unit, including basic setting, pump setting, valve setting, Tank setting, etc. You can view information such as alarm properties and alarm processing, and switch the display language in the Display Setting page.

Figure 6.14 Settings page

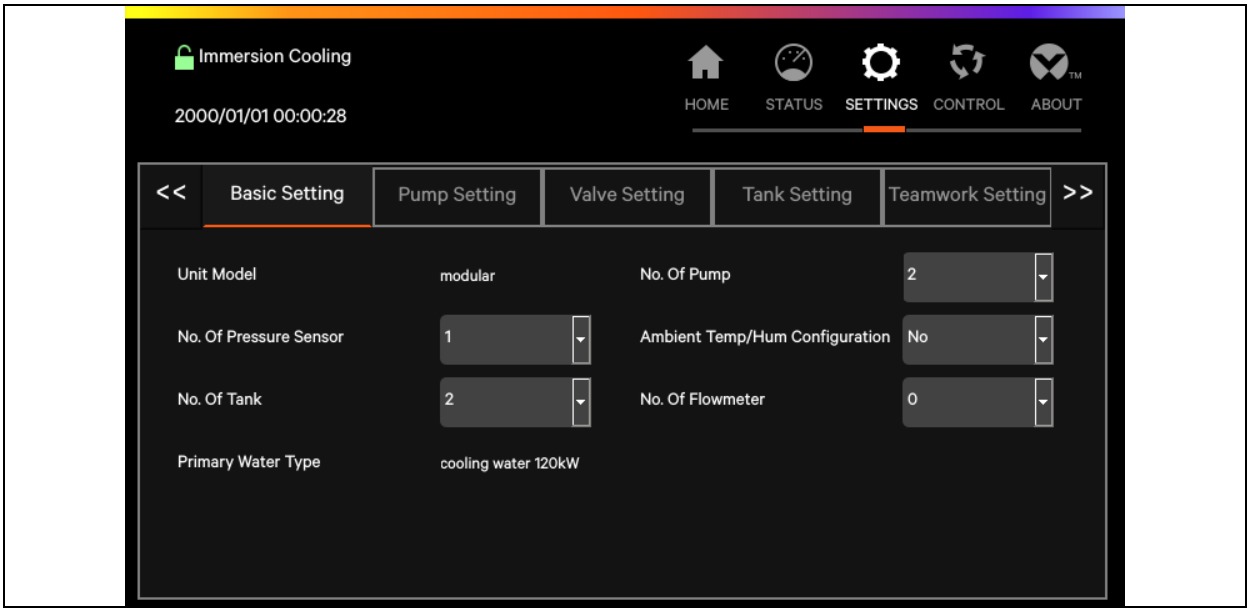
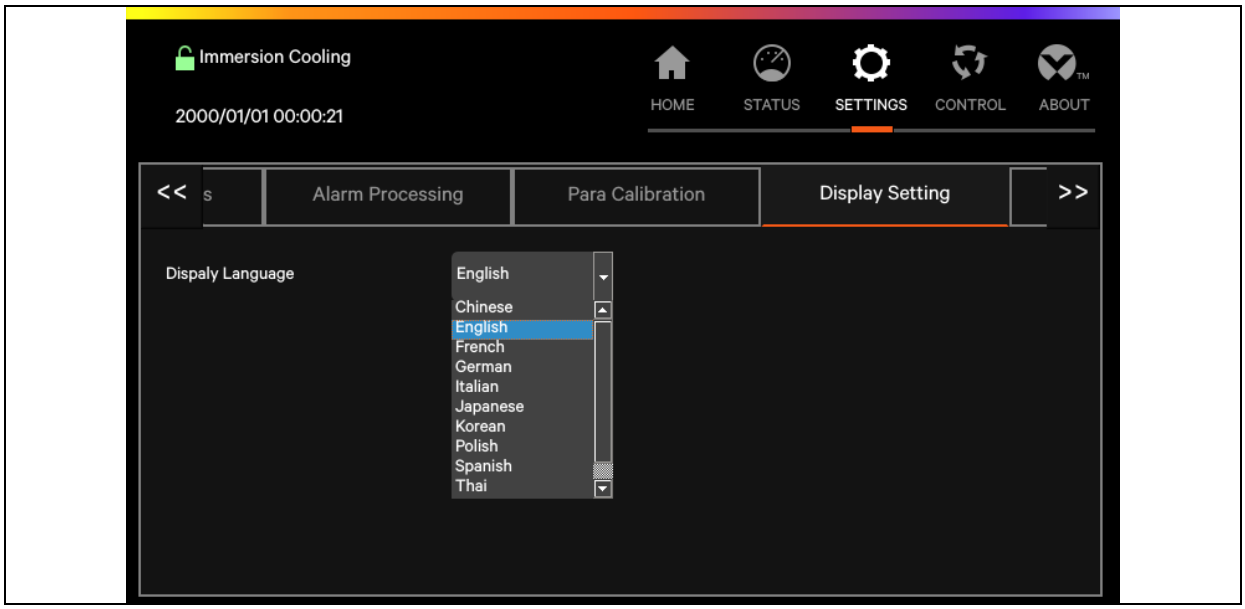


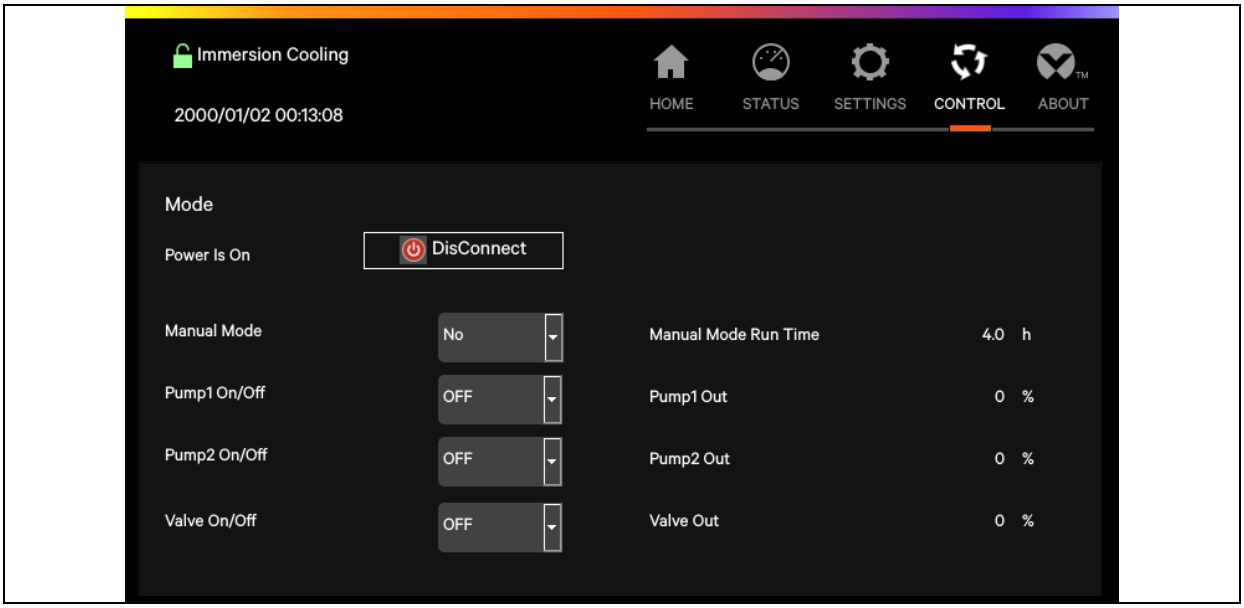
Figure 6.15 Display setting



6.4.4 Control Page

You can turn the device on or off by long-pressing. Additionally, you can control the pump and water valve, toggle them on and off, and switch to manual mode.

Figure 6.16 Control page



6.5 Operation Examples

Example 1: Input the password to enter the main menu.

After starting up, you can enter the main menu through the following operations in the normal interface.

1. Tap the unlock button to enter the password page.
2. Input the user login password in the password page.
3. If the input is correct, enter the main interface to modify the corresponding parameters of the unit.

Example 2: Modify parameters.

Take the high temperature alarm value setting in the alarm settings menu as an example:

1. Tap the settings button on the main page.
2. Enter the settings menu page, and then enter the alarm settings page.
3. Set the value according to the corresponding alarm value.
4. Tap enter to confirm, and the parameters will take effect.
5. Tap the exit button to return to the previous menu page.

NOTE: After changing the parameter, if you do not tap enter to confirm, the high temperature alarm value will remain its original value.

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7 Commissioning and Maintenance

This section describes the coolant application, charging the coolant, commissioning the unit, maintaining the server, and maintaining the filter. All the commissioning and maintenance tasks that are explained in this manual must be carried out only by authorized and trained technicians. We recommend Vertiv™ Customer Service.

7.1 Coolant Application

7.1.1 Coolant Performance

The coolant used in the unit is non-toxic. Using or working around the coolant will not cause health hazards. However, please note the information listed in the following figure.

Table 7.1 Coolant typical physical characteristics

Properties			Method	
Color (Saybolt)			ASTM D156	>+30
Density	@15°C	kg/m^3	ASTM D4052	808
Flash Point		°C	ASTM D92	198
Pour Point		°C	ASTM D97	-42
Kinematic Viscosity	@40°C	mm^2/s	ASTM D445	9.9
Kinematic Viscosity	@0°C	mm^2/s	ASTM D7042	52.3
Neutralisation Value		mg KOH/g	IEC 62021-1	<0.01

7.1.2 Coolant Hazard Information

There is no health hazard from using or working with the coolant. But please note:

- Coolant may stain shoes or clothes if not properly washed/cleaned.
- Do not smoke, eat, or drink near the unit filled with coolant.
- If the coolant contaminates the ground and is not cleaned, it will reduce the friction of the ground and cause the risk of slipping.

7.1.3 Coolant Contact

The coolant is non-toxic and can be kept harmless as long as the following points are observed:

- Do not ingest: Coolant may cause diarrhea and may irritate the digestive tract and cause lung damage.
- Eye contact: It is estimated to be non-irritating to the eye. Rinse with plenty of water (contact lens users may need to remove and wash glasses, or replace contact lenses).
- Skin contact: Wash the exposed area with soap and water. Wear impervious gloves when in contact with the coolant, and take off the gloves after the operation to reduce the coolant from dripping on the ground. After the coolant is absorbed by the skin, it will not have obvious adverse effects on health, but long-term contact with the skin and improper cleaning may block the pores of the skin, leading to oily acne, folliculitis and other diseases.
- Skin irritation: It is estimated to be non-irritating.

7.2 Charging the Coolant

The tools for charging the coolant is provided by user. The tools include pumps and hoses.

The site for charging the coolant is shown in Charging the coolant below . Refer to the following suggestions for operation:

- Wear impervious gloves and protective clothing.
- Use floor anti-slip mats and oil-absorbing mats.
- Engage a trained personnel to fix the hoses that need to put into the Tank, to prevent the hose from slipping and the coolant from splashing out.
- When charging the coolant to the unit, you need to consider both the Tank pipeline and the unit pipeline.
- After releasing air out of the unit, charge the coolant to the recommended level marked on the unit.
- Before charging the coolant, if there is a lot of remaining space in the Tank, it is recommended to use the placeholder module that is officially recommended by Vertiv.

NOTE: If the coolant is not charged to the recommended level, part of the unit will run at high temperature, which may damage the performance of the server.

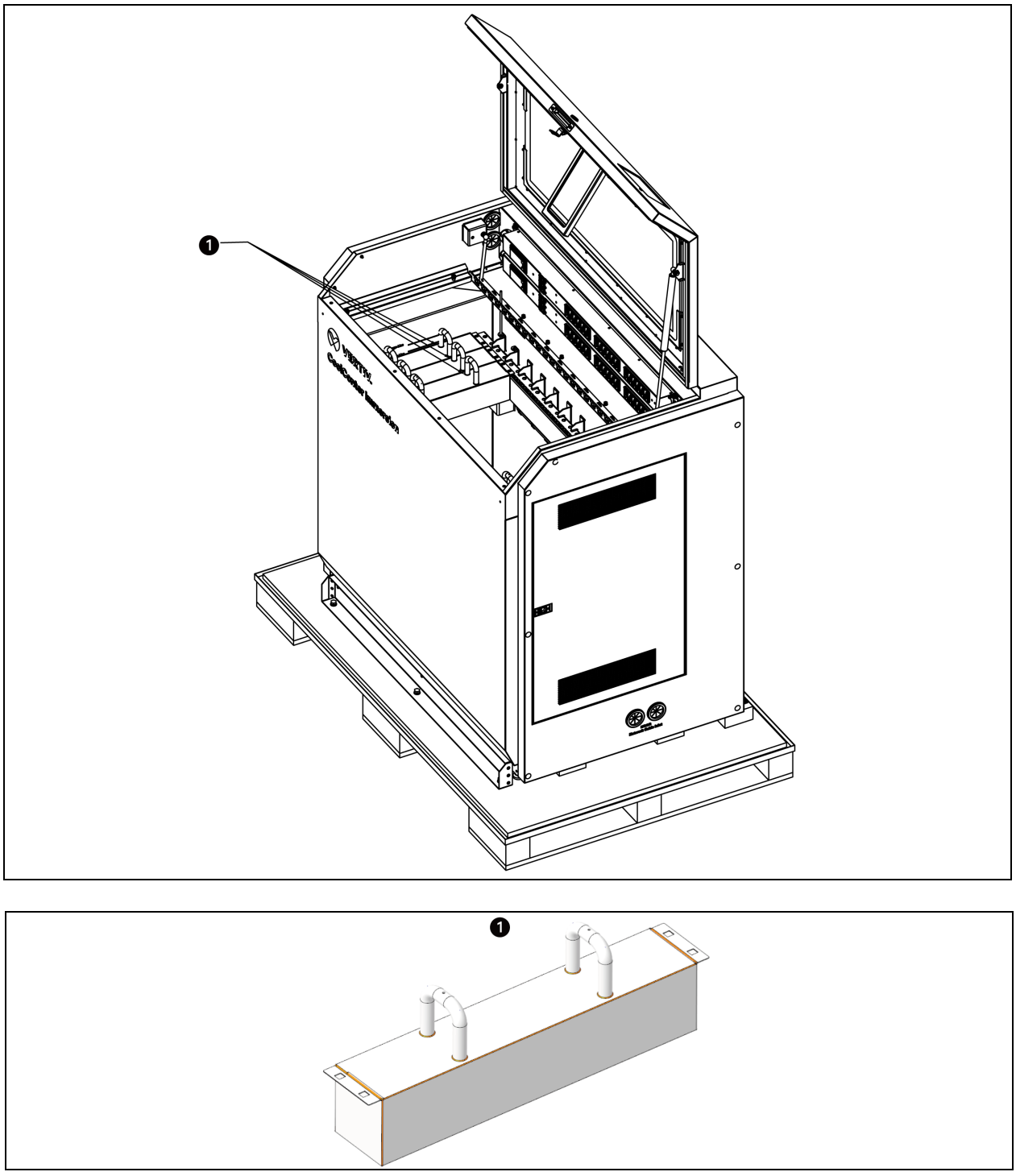
NOTE: When the coolant is charged to the recommended level, during normal operation of the unit, the coolant will be significantly higher than the recommended level. This is caused by thermal expansion and contraction of the coolant, which is a normal phenomenon.

NOTE: If not all the servers required for this stage are arranged before the coolant is charged, placeholder modules must be used. Inserting servers after the coolant is charged will cause the liquid level to rise and trigger the high liquid level alarm.

- After filling the coolant, if the coolant splashes out onto the clothes or ground, clean it immediately. Do not smoke, eat, or drink near the unit filled with coolant.

Figure 7.1 Charging the coolant

Figure 7.2 Placeholder module



Item	Description
1	Placeholder module. Total size: 0.0392m³ Height x width x depth: 100 mm x 443 mm x 88.4 mm

The volume of coolant occupied by a placeholder module is equivalent to the volume of coolant occupied by an 2U server. The self-contained unit can be equipped with 12 placeholder modules, the 42U Tank can be equipped with 21 modules, and the 52U Tank can be equipped with 26 modules.

7.3 Startup and Commissioning

7.3.1 Checking System Operation

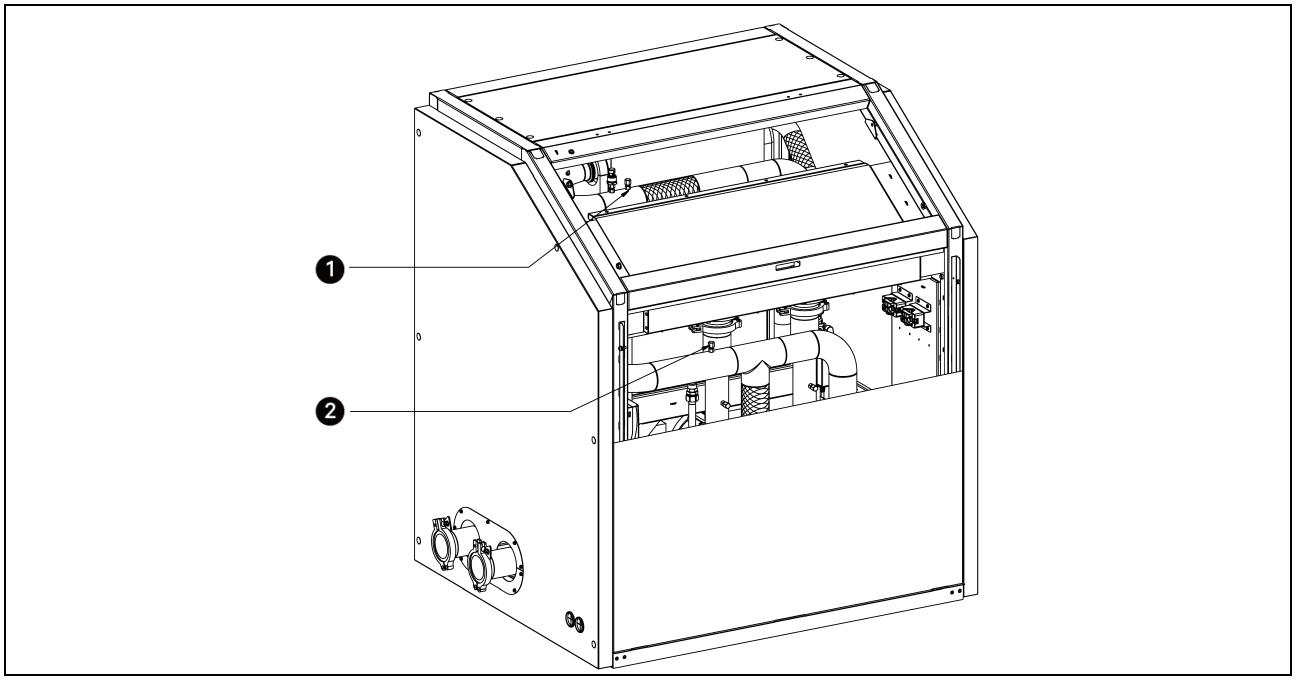
After powering on the system and charging the coolant, check the operation of each contactor, protection switch, and sensor to ensure that each device can operate normally and is in the initial state.

7.3.2 Evacuating the System

Vertiv™ CoolCenter Immersion cooling system is an open system and needs to be evacuated before the system is put into operation.

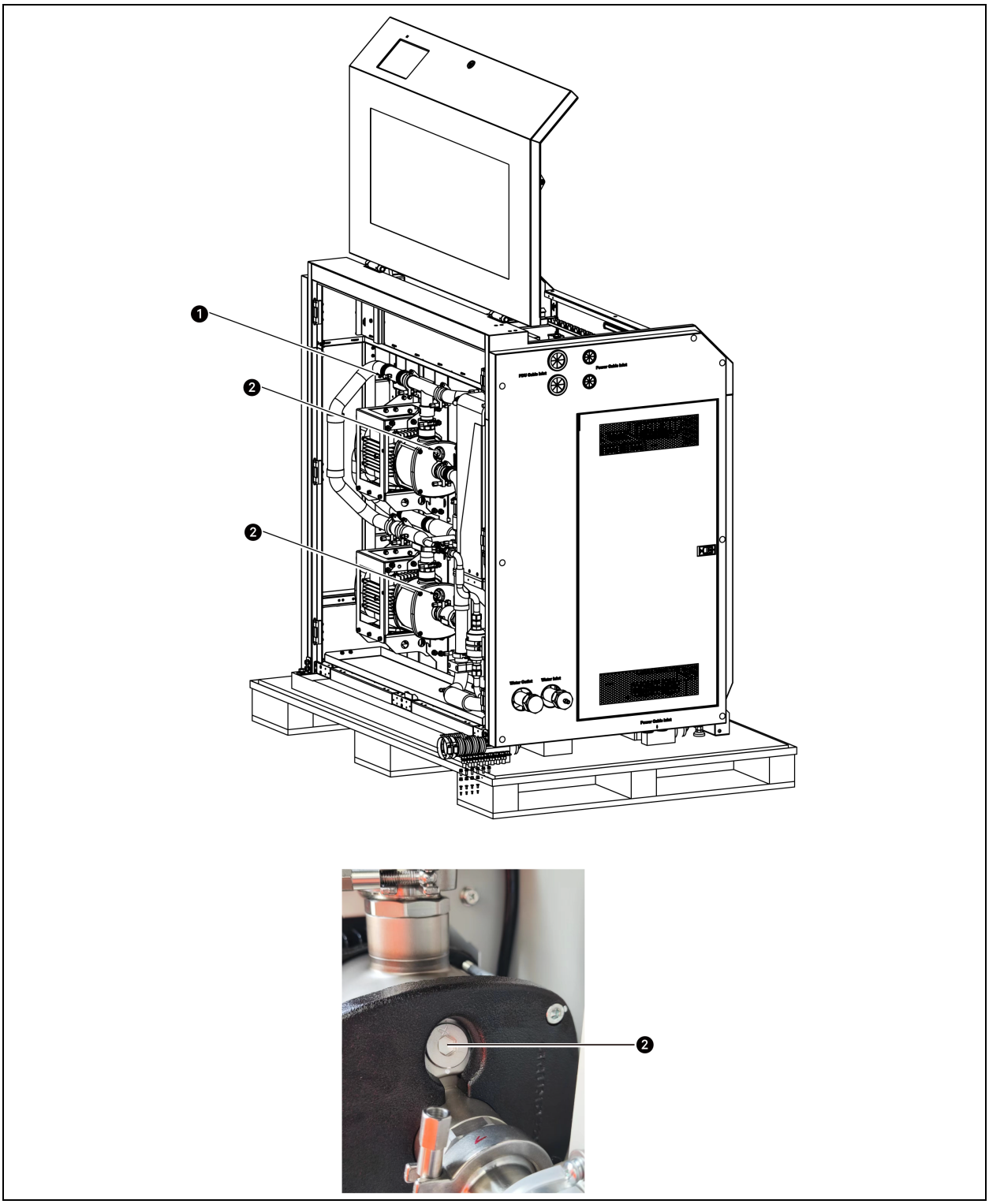
The air is evacuated through the air vent Schrader valve, the pump air vent hole, and Tank liquid inlet hole. The modular unit is equipped with the air vent Schrader valve on the pump inlet pipe (in the middle of the CDU) and the pump outlet pipe (on the top of the CDU). The self-contained unit is equipped with the air vent Schrader valve on the pump outlet pipe. In addition, the pump of the self-contained unit has its own air vent hole.

Figure 7.3 Location of air vent Schrader valve in CDU



Item	Description
1	Air vent Schrader valve on pump outlet pipe
2	Air vent Schrader valve on pump inlet pipe

Figure 7.4 Location of the air vent Schrader valve and pump air vent hole in the self-contained unit



Item	Description
1	Air vent Schrader valve
2	Pump air vent hole

Follow the steps below for evacuating the system:

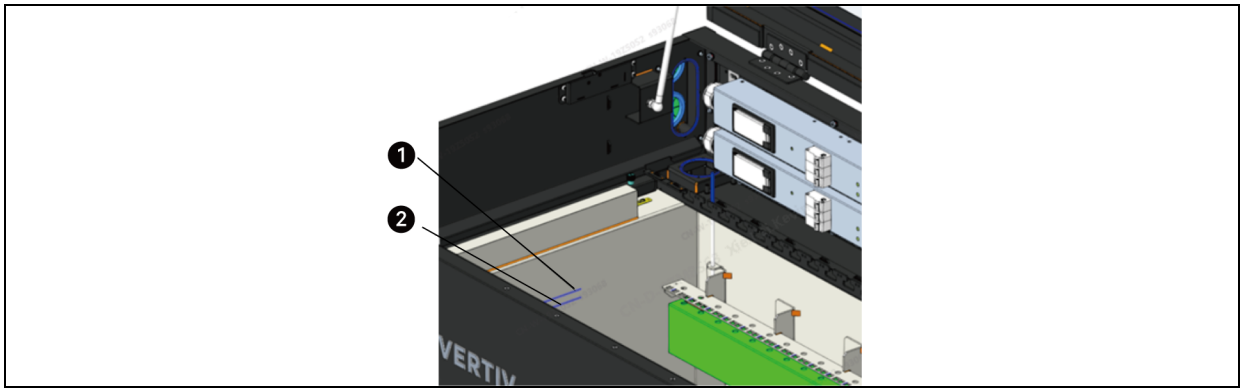
1. After charging the coolant to the recommended level, power on the system, and switch the operation mode to manual mode through the HMI display.
2. Unscrew the bolt of the air vent Schrader valve to release air. After about five minutes, if there is a few liquid coming out of the Schrader valve and there is no obvious air sound, tighten the bolt.
3. Evacuate the air from the self-contained unit through the pump air vent hole. Unscrew the threaded valve counterclockwise until liquid slightly flows out of the air vent hole or there is no obvious air sound, and then screw on the threaded valve.

NOTE: When evacuating the unit through the air vent Schrader valve and the pump air vent hole, evacuate from the unit bottom to the top.

NOTE: The top air vent Schrader valve is located at the top of the pipeline. Before the unit is running, the air cannot be completely evacuated. Evacuate the unit until there is no obvious air sound.

4. In manual mode, set the speed of the dual pumps to 35Hz. The residual air in the coolant pipeline and heat exchanger will be released from the liquid inlet of the Tank, and air bubbles will appear in the Tank.
5. Keep the double pumps running and manually press the air vent Schrader valve on the top to release air. After about 30 seconds, the Schrader valve will slightly release liquid.
6. When there is no air bubbles in the Tank for a period of time and the top air vent Schrader valve releases liquid when the valve is pressed, it indicates that the air in the coolant circuit has been removed.
7. Continue to pay attention to the coolant level in the Tank. If the coolant level is lower than the recommended level, the coolant is insufficient and you need to continue to charge the coolant to reach the recommended level.

Figure 7.5 Coolant recommended charge line



Item	Description
1	Coolant charge line
2	Low level alarm line

NOTE: Before the construction of the equipment room is completed, use a dust cover to cover the cabinet.

NOTE: When evacuating the unit, try to release the air as much as possible. Too much air in the pipeline will cause cavitation in the pump and affect the performance of the pump.

7.4 Server Maintenance

7.4.1 Procedure

When the server needs to be maintained or upgraded, follow the steps below:

1. Open the Tank cover, which is supported by the pneumatic struts on both sides.
2. Power off the server. If allowed, unplug the server's data and power cables; otherwise, see step 5.

NOTE: The customer is in charge of the server maintenance.

3. Place two server guide rails along the width direction of the Tank. The distance between the two guide rails is 450 mm or seven to eight server cable lugs. For the convenience of use, the two guide rails should be on the same side of the server.

Figure 7.6 Placing the guide rail

4. Hang the unplugged server data cables and power cables firmly on the wire-passing lugs inside the Tank. Adjust the cable hanging length, and the coolant flows back into the Tank, to prevent the coolant from dripping on to the rear of the Tank and causing damage.

Figure 7.7 Fixing the server power and data cables

5. Server terminals are located on the top or bottom of the server. If allowed, unplug the data cable and power cable in step 2; otherwise, wait until the server is completely extracted from the coolant before unplugging.
6. Hold the handle of the server and lift the server slowly.

Figure 7.8 Lifting up the server

7. After the server is lifted, make sure that it is not hooked to cables or does not contact other servers.
8. If the server is heavy, prepare a lifting device.
9. If the cable is hooked when the server is lifted, put the server back slowly, and repeat the above steps after loosening the cable.
10. If the server is fully lifted above the liquid return pipe, slowly place the server horizontally on the first guide rail, and then on the second guide rail.

Figure 7.9 Placing the server on guide rail

11. After the server is placed, the coolant will flow away quickly. You can perform the maintenance immediately without waiting for a fixed time.
12. When maintaining or upgrading the sever, please follow the additional requirements of the server manufacturer.
13. After the maintenance of the server is completed, put the server back to the Tank slowly, and avoid obstructing the data line and power line during the process. The server handle is stuck on the manifold.

NOTE: Before the power cables are inserted back into the server, the cables must be fixed behind the branch pipe to prevent the cables from being tangled after the server sinks.

14. Reset and plug the data cable and power cable back into the server.
15. Power on the server. Ensure that the data center control room has confirmed that the server is back online.
16. Dry the guide rail with oil-absorbing paper. Put the used towels in plastic bags and place the bags in the trash. Follow company policy or local requirements for disposal.

Figure 7.10 Wiping the guide rail

17. Remove the service rail and put it in a place for storage.
18. Close the Tank lid.

19. If the clothes come into contact with coolant, pre-treat them with a degreasing detergent, and then wash them normally. If there is any splashed coolant on the ground and work area, clean it with disposable towels or grease solvents.

7.4.2 Hanger for Maintaining Servers

After the system is put into use, the server will be immersed in the coolant in the Tank. When the server needs to be maintained, the server needs to be extracted from the Tank. If the server is light (such as a 1U server), the server can be lifted out by hand; if the server is heavy, a server lifting tool is required. The lifting equipment for the server shall be prepared by user.

Users can also choose the following lifting tool, such as a movable miniature gantry crane. The crane is suitable for the cooling system which has a large number of devices and occupies a large area. A single-arm crane can also be used for picking up, placing, or transferring a small number of servers.

Figure 7.11 Movable miniature gantry crane

Figure 7.12 Single-arm crane

NOTE: The device for lifting the server shall be provided by user.

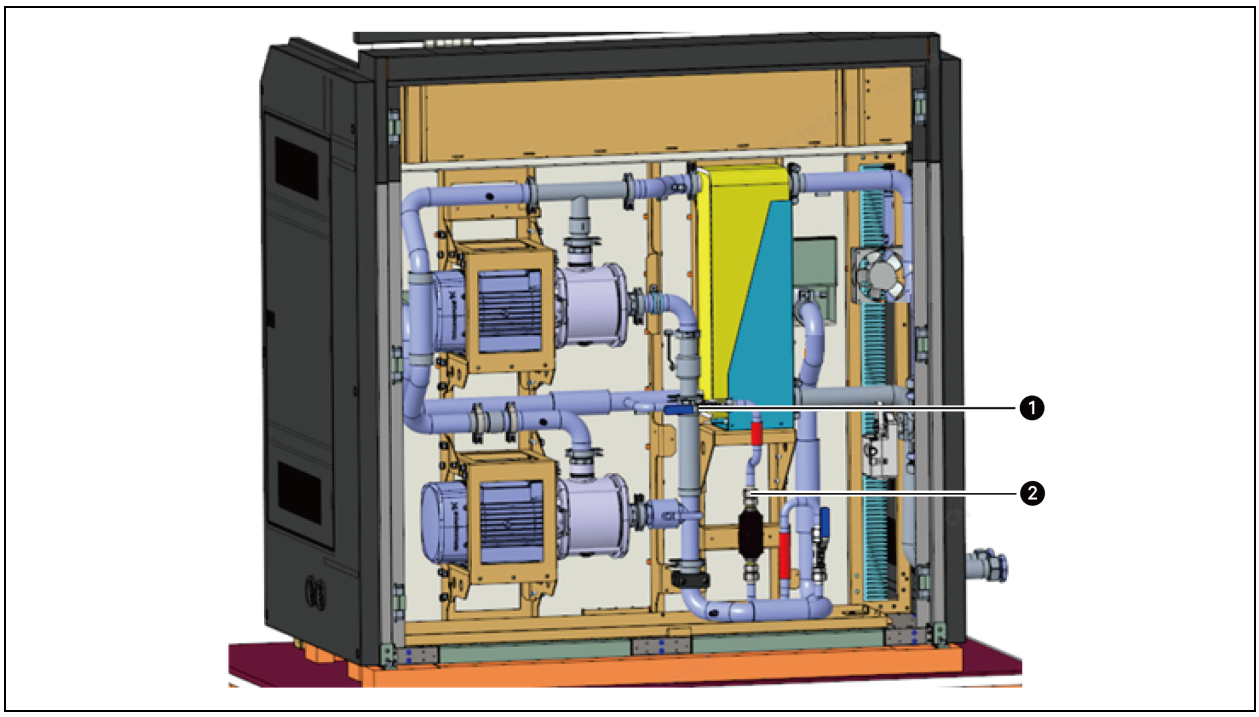
NOTE: After the server is lifted out of the Tank, the server should be carried by a special transfer tool to prevent the coolant from dripping to the ground.

7.5 Filter Maintenance

When the filter needs to be maintained and replaced, first turn off the valves on both sides of the filter branch, and then remove the threaded joints at both ends of the filter in turn to remove the filter.

Under normal circumstances, it is recommended that the filter be maintained and replaced every six months.

Figure 7.13 Filter maintenance



Item	Description
1	DN15 ball valve
2	Threaded joint connecting the filter and pipe

7.6 Leak Maintenance

If the coolant leaks, the photoelectric sensor will trigger an alarm. After solving the leakage problem on site, wipe off the coolant on the surface of the photoelectric sensor and put the photoelectric sensor back to the original place to eliminate the unit alarm reminder.

NOTE: If the leakage cannot be solved, please contact Vertiv technical engineers or certified and authorized professional technicians in time.

7.7 Maintenance Frequency for Each Component

Perform the periodic checks and maintenance operations as specified in the following table.

Table 7.2 Maintenance frequency for each component

Component	Operation	Frequency (months)		
		3	6	12
Coolant	Conduct a test every six months to visually observe whether the color changes. Refer to IEC 60247 to test whether the dielectric constant is less than 1.92 at 90°C		Yes	
Pump	Check every three months to see if the pump operating current exceeds the limit. For the modular unit, the current of the pump should not exceed 8A. For the self-contained unit, the current of the pump should not exceed 6A	Yes		
Plate heat exchanger	Check every three months to see if there are any leaks at the inlet and outlet and whether the pressure alarm is triggered	Yes		
Filter	Replace the filter every six months and reset the filter maintenance reminder alarm		Yes	

8 Fault Diagnosis and Handling

This section describes fault diagnosis and handling.

WARNING! Certain circuits have lethally high voltages and only professional technicians are allowed to operate the unit. Special care must be taken when troubleshooting while powered on.

CAUTION: When troubleshooting with jumpers, always remember to remove the jumpers after the repair work is completed. The remaining connected jumpers may override control functions and cause equipment damage.

Table 8.1 Fault diagnosis and handling

Issue	Possible causes	Items to check and handling measurements
Pump cannot start	Pump circuit breaker not turned on	Check pump circuit breaker
	Loose circuit connections	Turn off the power, tighten the circuit connector, and then power on again
	The unit is in manual mode, but the pump speed is not set	When the unit is in manual mode, manually set the pump speed
Pump stops running	Pump low current alarm	Measure the electrical current of the running pump, and compare this value with the "alarm value + return difference"
	The frequency converter is faulty	Check whether the voltage is within the normal range and clean up debris near the frequency converter
	The communication of the frequency converter fails	Check the circuit of the frequency converter and power it on again to reset
Pump low pressure alarm	The valve is closed or the pipe is clogged	Check whether all the valves are opened and whether the pipes and pump are clogged
Liquid leak alarm	The coolant leaks	Find the leakage point of the unit and contact the local service engineer to deal with it
	The photoelectric sensor has come into contact with foreign liquid	Wipe the liquid on the surface of the photoelectric sensor and put the photoelectric sensor back to its original place
Temperature sensor faulty	The temperature sensor is faulty	Replace the return air temperature and humidity sensor
Pressure sensor faulty	The pressure sensor is faulty	Check whether the pressure sensor wiring is loose and contact the local service engineer to handle it
Low level alarm	Too little coolant in the Tank	Check the fluid level and fill the coolant to the recommended filling line
High level alarm	Too much coolant in the tank	Check the fluid level and drain some of the coolant so that the fluid level is at the recommended filling line
CDU chilled/cooled water inlet high temperature alarm	Chilled/cooled water high temperature alarm value is not reasonably set	Reset the chilled/cooled water high temperature alarm value
	Chilled/cooled water temperature exceeds unit design capacity	Reduce chilled/cooled water inlet temperature

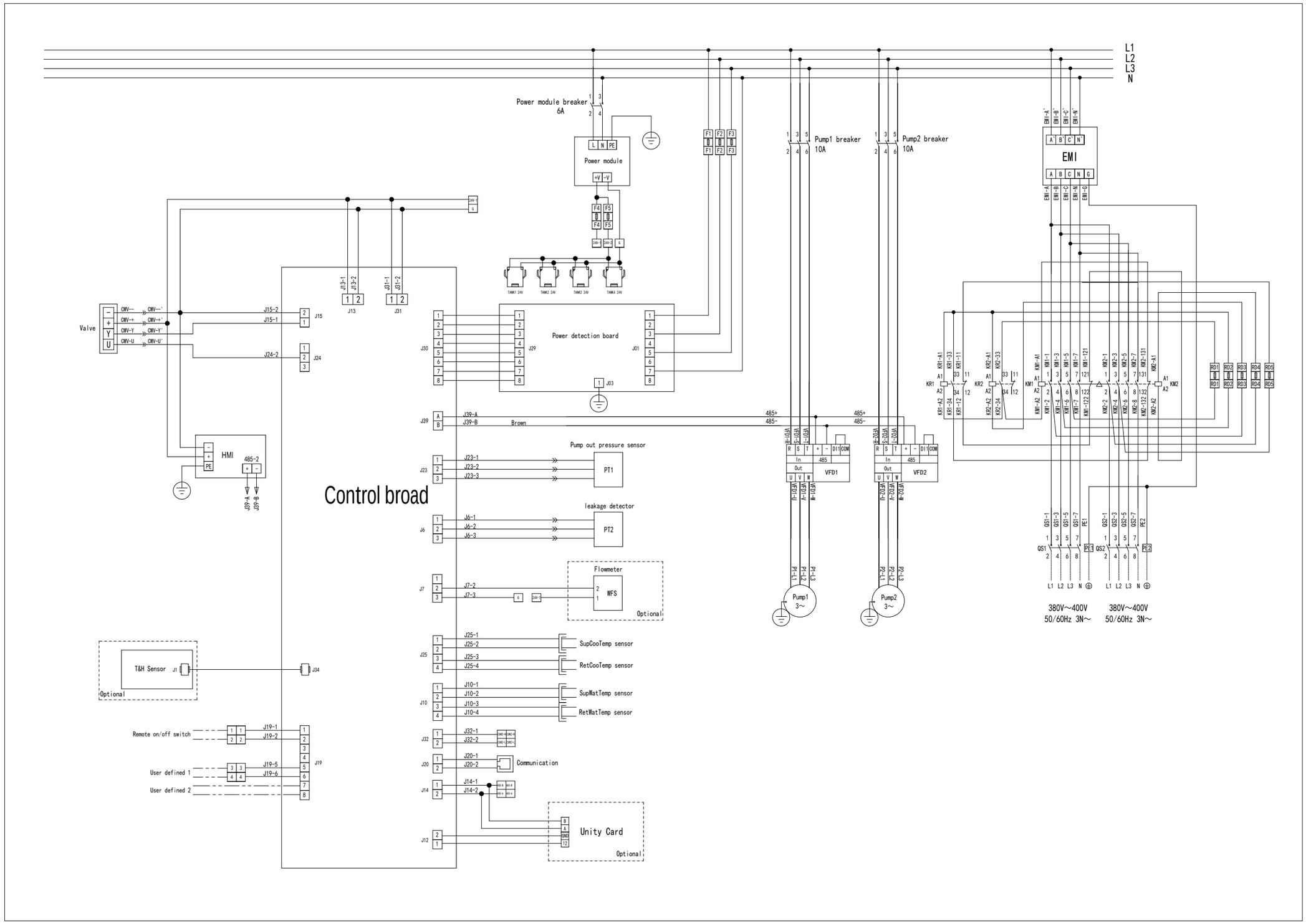
Table 8.1 Fault diagnosis and handling (continued)

Issue	Possible causes	Items to check and handling measurements
CDU chilled/cooled water inlet low temperature alarm	Chilled/cooled water low temperature alarm value is not reasonably set	Reset chilled/cooled water low temperature alarm value
	Chilled/cooled water temperature exceeds unit design capacity	Increase chilled/cooled water inlet temperature
Power loss alarm	Power is lost and then restored while the unit is running	Check the power supply condition of the power input cable
Overvoltage alarm	Power input voltage deviates from the set value	Check the power input voltage
Undervoltage alarm	Power input voltage deviates from the set value	Check the power input voltage
Power frequency offset alarm	Power input frequency deviates from the set value	Check the power input frequency
Power phase loss alarm	Power input phase is lost	Check the wiring condition of the power input cable
Power phase reverse alarm	Power input is inverted	Check the wiring condition of the power input cable
Remote off	The unit is shut down remotely	Adjust the remote control parameters
Filter maintenance alarm	The filter operating time reaches the filter maintenance cycle	Contact local service engineer to handle it

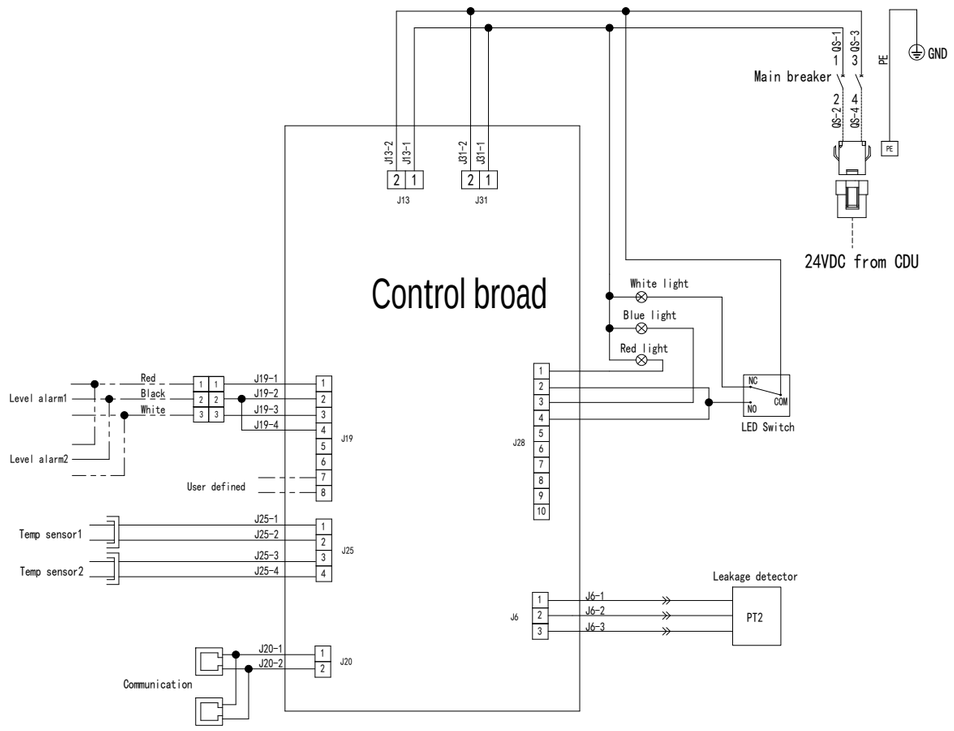
Appendix A: Circuit Diagram

- CDU Circuit Diagram
- Tank Circuit Diagram
- Self-contained Unit Circuit Diagram

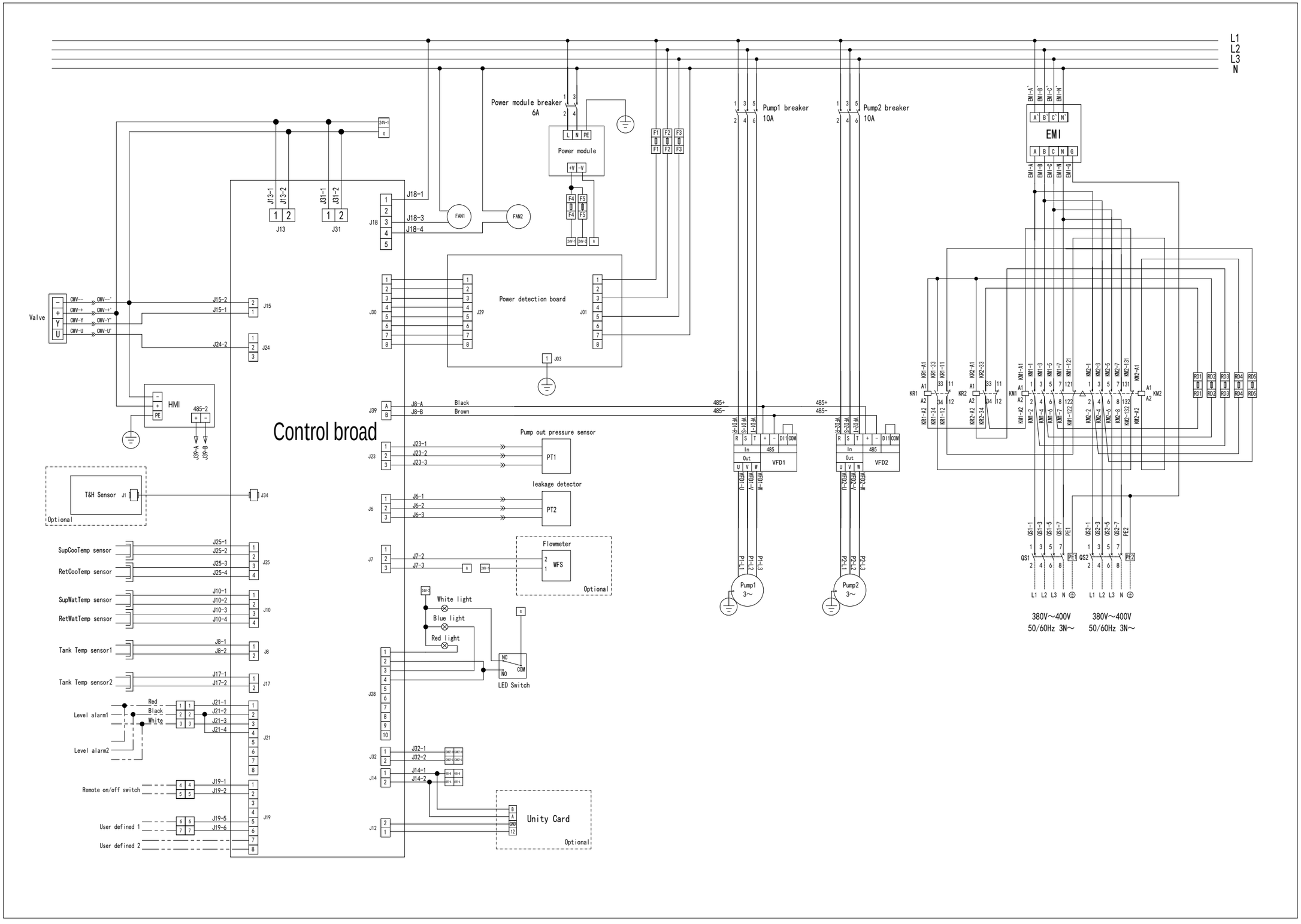
CDU Circuit Diagram



Tank Circuit Diagram



Self-contained Unit Circuit Diagram



Appendix B: Torque for Unit Components

CDU				
Component	Thread type	Specification	Torque	
			N·m	kgf·cm
Clamp	Clamp thread	Outer diameter 91	3	30
Pump	Pump base bolt	M12	10	100
	Pump flange bolt	M16/5/8"	10	100
	Electrical terminal	M5	2.5	25
	Terminal box ground wire	M4	1.5	15
	Fixing screw for terminal box cover	M4	1.5	15
Check valve	Chuck check valve rivet nut	M5	7	70
Filter branch	Welding nut on DN15 main pipe and its matching slipknot	R 1/2"	55	550
	Slipknot nut for both ends of the DN15 ball valve	R 1/2"	55	550
	Slipknot nut for both ends of the filter	3/4"	60	600

Self-contained unit				
Component	Thread type	Specification	Torque	
			N·m	kgf·cm
Clamp	Clamp thread	Outer diameter 50.5	3	30
Pump	Pump base bolt	M10	24	240
	Pump inlet and outlet threads	R 1-1/2"	55	550
	Electrical terminal	M5	2.5	25
	Terminal box ground wire	M4	1.5	15
	Fixing screw for terminal box cover	M4	1.5	15
Three-way ball valve	Outlet thread	R 2"	70	700
Filter branch	Welding nut on DN15 main pipe and its matching slipknot	R 1/2"	55	550
	Slipknot nut for both ends of the DN15 ball valve	R 1/2"	55	550
	Slipknot nut for both ends of the filter	3/4"	60	600

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Appendix C: Operating Menu

Level 1 menu	Level 2 menu
Status	Run Information
	Run Hour
	On/Off Record
	Power Information
	About
Alarm	Alarm Status
	Alarm History
Settings	Basic Setting
	Pump Setting
	Valve Setting
	Tank Setting
	Teamwork Setting
	Alarm Setting
	Alarm Properties
	Alarm Processing
	Para Calibration
	Communication Setting
	Password Setting
	Time Setting
	Reset Parameter
	Data Record
Control	Power Is On
	Manual Mode
	Pump1 On/Off
	Pump2 On/Off
	Value On/Off
	Manual Mode Run Time
	Pump1 Out
	Pump2 Out
	Value Out
About	
Home	

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Appendix D: Alarm Output Menu

Alarm output				
Pump 1/2 high current alarm	Pump 1/2 drive communication failure lock alarm	Pump 1/2 parameter reading and writing abnormality	Water valve sensor failure	Pump low pressure abnormality
Pump 1/2 high current lockout alarm	Pump 1/2 drive module overheat alarm	Pump 1/2 short circuit to ground	Teamwork primary unit lost	Tank1-n temperature sensor 1-6 fault alarm (according to NTC configuration quantity)
Pump 1/2 low current alarm	Pump 1/2 drive acceleration overcurrent alarm	Pump 1/2 drive common fault lock alarm	Teamwork secondary unit lost	Tank1-n high liquid level alarm
Pump 1/2 low current lockout alarm	Pump 1/2 drive deceleration overcurrent alarm	Pump 1/2 drive severe failure alarm	Ambient temperature sensor failure	Tank1-n low liquid level alarm
CDU chilled/cooling water inlet high temperature alarm	Pump 1/2 drive constant speed overcurrent alarm	Power loss alarm	Ambient humidity sensor failure	Tank1-n high temperature alarm
CDU chilled/cooling water inlet low temperature alarm	Pump 1/2 drive acceleration overvoltage alarm	Power overvoltage alarm	Flow meter sensor failure	Tank1-n low temperature alarm
CDU inlet temperature sensor failure	Pump 1/2 drive deceleration overvoltage alarm	Power undervoltage alarm	Self-contained unit temperature 1 sensor failure	Duplicate Tank address
CDU outlet temperature sensor failure	Pump 1/2 drive constant speed overvoltage alarm	Power supply frequency deviation alarm	Self-contained unit temperature 2 sensor failure	Tank micro switch
CDU chilled/cooling water inlet temperature sensor failure	Pump 1/2 under-pressure alarm	Power phase loss alarm	Smoke alarm	
CDU chilled/cooling water outlet temperature sensor failure	Pump 1/2 drive frequency converter overload alarm	Power reverse alarm	Fire alarm	
Liquid leak alarm	Pump 1/2 drive motor overload alarm	Environmental high humidity alarm	Surge protector failure	
Remote shutdown alarm	Pump 1/2 drive input phase loss alarm	Tank1-n loss fault alarm	Floor overflow	
Filter maintenance reminder	Pump 1/2 drive output phase loss alarm	Duplicate CDU address	Custom 1 alarm	
Water valve failure alarm	Pump 1/2 drive communication fault alarm read from the frequency converter	Pump outlet pressure sensor failure alarm	Custom 2 alarm	
Pump 1/2 drive communication failure alarm	Pump 1/2 current detection failure	Pump inlet pressure sensor failure alarm	Pump high pressure abnormality	

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Appendix E: HMI Name Explanation

Name	Explanation
Temp(°C)	"Temp" is a noun, meaning temperature
Hum(%)	"Hum" is a noun, meaning humidity
Avg Temp	"Avg" means average
Min Temp	"Min" means minimum
SupCooTemp	"SupCooTemp" means the temperature of the supplied coolant (the coolant that is supplied from the CDU to the Tank)
RetCooTemp	"RetCooTemp" means the temperature of the returned coolant (the coolant that is returned from the Tank to the CDU)
SupWatTemp	"SupWatTemp" means the temperature of the supplied water
RetWatTemp	"RetWatTemp" means the temperature of the returned water
Log	"Log" is a noun, meaning the records of alarms
Single	"Single" means there is only one unit
Run Standby Delay	"Run Standby Delay" means the delay of the switch from the active unit to the standby unit
Frist Run	"First Run" means the unit that can function normally and can be the first one to start up among other air conditioners
First Run Password	"First Run Password" means the password that is required to start the unit for the first time
Para Calibration	"Para Calibration" means parameter calibration
Manual Mode Run Time	"Manual Mode Run Time“ means for how long the unit has been running in the manual mode
Pump In Pressure	"Pump In Pressure" means the pressure at the inlet of the pump
Pump Out Pressure	"Pump Out Pressure" means the pressure at the outlet of the pump
PID	"PID" means the proportional–integral–derivative controller (PID) controller mechanism
Prop Band	"Prop Band" is proportional band. This is from the proportional–integral–derivative controller (PID) controller mechanism
Dead Band	"Dead Band" (also known as a dead zone or a neutral zone) is a band of input values in the domain of a transfer function in a control system or signal processing system where the output is zero (the output is 'dead' - no action occurs)
Rotation Hold Time	"Rotation Hold Time". For example, if the rotation hold time is 5 minutes, then it will take 5 minutes for the 1st pump to completely switch to the 2nd pump
Rotation Period	"Rotation Period". For example, if the rotation period is 5 days, then the rotation will happen every 5 days
Temp SP	“Temp” is a noun, meaning temperature. "SP" means set point, that is, the target value of a variable
Valve Adjust Step	"Adjust" means adjustment (because of limited characters, it is written as adjust. It can be considered as a noun here). “Step" means at what extent or range something is changed at each time
Initial OD	"OD" means opening degree
Valve Opening Change Delay	"Valve Opening Change Delay" means the delay from "the time A" when the valve actuator sends a command to the valve to "the time B" when the valve actually acts according to the command. "opening change" means the change in the valve's opening degree

Name	Explanation
WUF	"WUF" means water under floor, which means that the water is leaking from the unit and the water runs onto the floor of the equipment room
SPD	"SPD" means Surge protection device
NC	"NC" means normally closed
NO	"NO" means normally open
Custom Polarity	"Custom" means customized. "Polarity" means that the variable has only two values: 0 or 1 (OFF or ON)
Rotation Period	"Rotation Period". For example, if the rotation period is 5 days, then the rotation will happen every 5 days
Leak Sensor	"Leak Sensor" means the sensor that detects the coolant leakage
Power Freq Offset	"Freq" means frequency
Exit High Temp Delay	"Exit High Temp" means the unit stops the high temperature adjustment. "Delay" means the delay from "the time when the condition to stop the function is met" to "the time when the unit actually stops the function"
Pump Driver Comm Lock	"Pump Driver Comm Lock" means that the communication of pump's driver is locked
Pump Driver Comm Fail	"Pump Driver Comm Fail" means that the communication of pump's driver is faulty
TM Primary Unit Loss	"TM Primary Unit Loss" means that the primary unit in teamwork mode is lost
TM Secondary Unit Loss	"TM Secondary Unit Loss" means that the secondary unit in teamwork mode is lost
Pump High Pressure Alarm	Refers to the outlet pressure of the pump
Pump Low Pressure Alarm	Refers to the outlet pressure of the pump

Appendix F: List of Accessories

CDU

Name	Quantity
User manual	1 PCS
Plastic bag	1 PCS

Tank

Name	Quantity
User manual	1 PCS
Plastic bag	1 PCS
Cables connecting CDU to Tank	1 PCS
Photoelectric sensor	1 PCS
Support panel for server	2 PCS

Self-contained unit

Name	Quantity
User manual	1 PCS
Plastic bag	1 PCS
Support panel for server	2 PCS

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Appendix G: Hazardous Substances

Parts	Harmful substance					
	Lead or Plumbum (Pb)	Mercury or Hydrargum (Hg)	Cadmium (Cd)	Hexavalent chromium [Cr(VI)]	Polybromi- nated biphe- nyls (PBB)	Polybromi- nated diphe- nyl ethers (PBDE)
Cabinet	o	o	o	o	o	o
Electrical control unit	x	o	o	o	o	o
HMI display	x	o	o	o	o	o
Heat exchanger	o	o	o	o	o	o
Copper pipe	o	o	o	o	o	o
Cable	o	o	o	o	o	o

o indicates that the content of the hazardous substances in all the average quality materials of the part is within the limits specified in SJ/T-11363 - 2006

x indicates the content of the hazardous substances in at least one of the average quality materials of the part exceeds the limits specified in SJ/T-11363 - 2006

Vertiv™ is committed to the design and manufacture of environment-friendly products. It will reduce and eventually eliminate toxic and hazardous substances in the products through unremitting efforts in research. However, limited by the current technical level, the following parts still contain hazardous substance due to the lack of reliable substitute or mature solution.

The reason that some of the above parts contain Lead or Plumbum (Pb) is as follows: diode medium and high temperature solders contain lead; resistor glass uranium contains lead (exemption); electronic ceramics contain lead (exemption)

About Environmental Protection Use Period: The Environmental Protection Use Period of the product is marked on the product. Under normal working conditions and normal use of products observing relevant safety precautions, the hazardous substances in the product (except battery) will not seriously affect the environment, personnel safety or property in the Environmental Protection Use Period starting from the manufacturing date

Applicable product: Vertiv™ CoolCenter Immersion cooling system

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