HC53 V1

Hydro cooling container & Dry cooling Product Manual

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Contents

Declaration 1
Change Record 3
1 About This Document 4
1.1 Application Scope 4
1.2 Intended Audience 4
1.3 Use of Manual 4
1.4 Symbol Conventions 4
2 Safety Precautions 6
2.1 General Safety Instructions 6
2.2 All Safety Instructions 6
2.3 Electrical Safety 7
2.4 Mechanical Safety 8
2.5 Operation Safety 9
2.6 Others 9
3 Overview 11
3.1 How It Works 11
3.2 Operation Mode 11
4 Composition and Working Principle 14
4.1 System Composition 14
4.2 Specification 14
4.3 Working Principle 16
4.4 Control Mode 18
4.5 Mandatory Component 18
4.6 Ports 18
5 Installation 19
5.1 Installation Precautions 19
5.2 Tools 20
5.3 Transportation and Inspection 21
5.4 Installation Requirements 21
5.5 Container Leveling Before Installation 21
5.6 Container Installation 21
5.7 Hoisting of Container 23
6 Power Distribution 25
6.1 Power Distribution Steps 25
6.2 Connect the Main Power Cable 26
7 High-pressure insulation test 27
7.1 On-site Pressure Test Precautions 27
7.2 Verification Items 28
7.3 Preparation Before Pressurization 29
7.4 Pressurization Steps 30

7.5 Air-Hydraulic Pressurization Steps 31
7.6 Cleaning Procedure 32
7.7 Inspection Before Power On 32
7.8 System Commissioning 32
7.9 System Liquid Filling 34
7.10 Electrical wiring 36
7.11 Power-on and power-off process 36
7.12 Operation instructions of the touch screen 44
7.13 Summary of site installation 50
8 General faults and troubleshooting 52
8.1 Container fault and troubleshooting 52
8.2 General fault and troubleshooting of dry cooler 55
9 Maintenance and maintenance of container 57
9.1 Overview 57
9.2 Preventive maintenance 57
9.3 Regular Container Inspection 58
9.4 Maintenance of dry cooler 62
10 Safety instructions 65
10.1 Maintenance 65
10.2 Operation 65
10.3 Note 65

Declaration

The product installation and use manual (hereinafter referred to as the "Product Manual") is intended solely to provide guidance information to assist you in using the HC53 V1 Hydro cooling container & dry cooling system (hereinafter referred to as "this product"). When installing and using this product for the first time, please carefully read all the attached materials beforehand, particularly the precautions mentioned herein, as they will help you use this product more effectively and safely. Please retain the product manual for future reference.

Ensure that all product components are complete before use. Should any parts be missing, contact CADRO promptly and inspect the product carefully before installation and use.

CADRO does not accept responsibility for any property damage to you or third-party personnel under the following circumstances, and such product damage is not covered by the warranty. If the user requests repair services, paid repair services can be provided following approval by the CADRO service organization.

1) The unit or components of this product that have exceeded the warranty period, or damage resulting from abnormal operations or abnormal natural environments.

2) Incorrect installation, use, or storage of this product, not in accordance with the instructions and requirements outlined in the manual.

3) Operations conducted under working conditions not specified in this manual.

4) Usage in installation and operating environments not specified in related international specifications or local laws, regulations, and industry regulations.

5) Repair or product alterations performed by technical personnel not authorized by CADRO.

6) Usage of the random software provided with the product on other products, or the use of other software, excluding non-random and specialized software, on this product.

7) Other scenarios not requiring liability within the legal scope of the country (region) where the operation is performed.

Notice: Should the user acquire this product through a non-CADRO official sales channel, CADRO cannot assure the complete delivery of the product manual. Training and services pertaining to installation, usage, maintenance, etc., are to be provided by the seller. It is presumed that the user is cognizant of the relevant installation, usage, and maintenance procedures for the product, which also pertains to the content of this statement.

The product manual is not intended to imply that CADRO has made any promises or warranties, whether express or implied, regarding its products and services. This includes, but is not limited to warranties of applicability, safety, and suitability for a specific purpose as recommended in the product manual.

The images, diagrams, charts, and illustrations within the product documentation are intended solely for explanatory purposes and may differ from the actual product. The specifications and configurations of the product are subject to change as needed and may therefore vary from those described in this manual. In the event of any discrepancies, the physical characteristics of the purchased product will take precedence over any inconsistencies in the documentation.

To ensure alignment with evolving product innovations and technological advancements, our products may undergo continuous refinements in both hardware configurations and software functionalities. These updates may incorporate emerging designs, novel materials, and technical improvements driven by various considerations such as performance optimization, environmental adaptability, and feature enhancements.

The product documentation is subject to periodic revisions without prior notification to reflect these developments. Should you encounter any variances between your physical product and its accompanying documentation, or if you require updated specifications or wish to provide feedback, we invite you to connect with our technical support team through our designated service hotline or official online support platform.

Change Record

Version	Change Items	Before Changing	After Changing	Change Time	Changed By
V1.0.2	Initial	/	/	12/25/2024	Liang

CADRO

1 About This Document

This manual mainly introduces the CADRO H53-V1 Hydro cooling container & Dry cooling product in terms of working principle, installation, troubleshooting and maintenance.

1.1 Application Scope

This manual is applicable to the H53-V1 model.

Unless specified otherwise, the version intended for use with the Hydro cooling container and Dry cooling system will be used as an example to briefly introduce the installation and operation of the product.

1.2 Intended Audience

This manual is intended for professional and technical personnel for installation, operation and maintenance. Professional and technical personnel must meet the following requirements:

- Possess certain professional knowledge in electronics, electrical wiring and mechanics,and be familiar with electrical and mechanical schematic diagrams.
- Familiar with the composition and working principles of liquid cooling systems and related products.
- Have received professional training about the installation and commissioning of electrical products.
- Able to respond to dangers or emergencies during installation or commissioning.
- Familiar with the relevant standards and specifications in the country/region where the project is carried out.

1.3 Use of Manual

Please read the manual carefully befor using the product.

Although the content of the manual will be continuously updated and modified, there still may be errors or slight differences from the actual product. In this case, the actual product purchased shall prevail. Users can download or obtain the latest version of the manual through www.CADRO.com or sales channels.

1.4 Symbol Conventions

To ensure the personal and property safety of users while using the product, and to use the product more efficiently and effectively, the manual provides relevant information, which is highlighted with the following symbols.

The symbols that may be found in this document are defined in the following table. Please read carefully to better use this manual.

Danger

A high potential danger .If not avoided, could result in serious accidents, such as personal injury, equipment damage, etc.

Warning

A moderate potential hazard . If not avoided, could result in serious accidents such as equipment damage.

Caution

A potential danger. if not avoided, may result in abnormal operation of the equipment.

2 Safety Precautions

2.1 General Safety Instructions

DISCLAIMER: The equipment company is not responsible for any of the following situations.

Operation beyond the conditions specified in this document.

Usage under installation and operating environments which are not specified in related international specifications.

Failure to follow the operation instructions and safety precautions on the product and in the document.

Damage caused by abnormal natural environments.

2.2 All Safety Instructions

To ensure safety of humans and the equipment, pay attention to the safety symbols on the equipment and all the safety instructions in this document.

The "NOTICE", "CAUTION", "WARNING" and "DANGER" marks in this document do not represent all the safety instructions. They are only supplements to the safety instructions.

1) Local Safety Regulations

When operating the equipment, you must follow the local laws and regulations. The safety instructions in this document are only supplements to the local laws and regulations.

2) Personal Requirements

Only trained and qualified personnel are allowed to install, operate, and maintain CADRO equipment, and they must understand basic safety precautions to avoid hazards.

Only trained and qualified personnel are allowed to install, operate, and maintain CADRO equipment.

Only personnel certified or authorized by equipment provider are allowed to replace or change the equipment or components (including software).

Any fault or error that might cause safety problems must be reported immediately to a supervisor.

3) Grounding Requirements

Equipment to be grounded must meet the following requirements:

When installing the device, always make the ground connection first and disconnect it at the end.

Do not damage the ground conductor.

Do not operate the equipment in the absence of a properly installed ground conductor.

Ensure that the equipment is connected permanently to the protective ground.

4) Personal Safety

Keep irrelevant people away from the equipment. Only operators are allowed to access the equipment.

Before operating a device, wear insulated shoes and insulated gloves, and pay attention to eye protection. Remove conductive objects such as jewelry and watches to avoid electric shocks or burns.

Ensure that tool handles are insulated.

5) Equipment Safety

Put away the keys to the device when installation, operation and maintenance.

Before operations, ensure that the equipment is firmly secured to the floor or other solid objects, such as a wall or an installation rack.

Do not block the ventilation while the device is operating.

Tighten the screws by using a tool after initial installation and subsequent access to the panel.

After the installation, remove packing materials from the equipment area.

2.3 Electrical Safety

1) High Voltage

Danger

The high voltage power supply provides power for the device operation. Direct or indirect contact through damp objects (or conductors) with high voltage and alternating current (AC) mains supply may result in fatal danger.

Non-standard and improper high voltage operations may result in fire and electric shocks. Signal cables must be bound separately from strong electricity cables and high-voltage cables.

2) High Electrical Leakage

Danger

1. Ground the device before powering it on. Otherwise, personal injury or device damage may be caused by high leakage current.

2. If a "high electrical leakage" tag is attached on the equipment, ground the protective ground terminal on the equipment enclosure before connecting the AC power supply; otherwise, electric shock as a result of electricity leakage may occur.

3. Bind the bare parts of power cables with insulation tapes and properly place them.

3) Power Cable

Danger

Do not install or remove a cable with power on. Transient contact between the core of the cable and the conductor will generate electric arcs or sparks, which may cause a fire or hurt human eyes.

Before installing or removing a power cable, turn off the power switch.

Before connecting a power cable, check that the label on the power cable is correct. If the power cable is damaged, it must be replaced by the manufacturer, its service agent or similarly qualified persons in order to avoid a hazard.

The appliance should fit with means for disconnection from the supply mains having a contact separation in all poles that provide full disconnection under overvoltage category III conditions, and these means must be incorporated in the fixed wiring in accordance with the wiring rules.

2.4 Mechanical Safety

1) Drilling Holes

Warning

Do not drill the cabinet at will. Drilling holes without complying with the requirements damages the internal components or pipelines and the cables inside the cabinet. In addition, if the metal shavings caused by drilling enter the cabinet, the pipelines may be blocked, foreign matters may occur, and the printed circuit boards (PCBs) may be short circuited.

2) Sharp Objects

The fins of the heat exchanger of dry cooling system are extremely sharp. Please wear protective gloves when operating close to the fins.

Warning

Before you hold or carry a device, wear protective gloves to avoid getting injured by sharp edges of the device.

3) Fans

When replacing a component, ensure that the component, screws, and tools are placed in a safe location. Otherwise, if any of these items fall into the operating fans, they may cause damage.

When replacing a component near fans, refrain from inserting fingers or boards into the operating fans until they are turned off and have come to a complete stop.

4) Moving Heavy Objects

Warning

1. Wear protective gloves when moving heavy objects to prevent scratches.
2. Be cautious to prevent injury when moving heavy objects.
3. When removing a heavy or unstable component from a cabinet, be aware of unstable or heavy objects on the cabinet.
4. At least two persons are required to move the equipment. When moving the equipment, ensure that it does not tilt at an angle that exceeds 15 degrees from the vertical direction.
5. When moving or lifting the equipment, well protect the equipment to avoid scratches or crashes.
6. When moving the equipment, do not use a part to support the body. Otherwise, the part may be damaged.

2.5 Operation Safety

1) High Temperature and Pressure

Misoperations may cause over high-pressure, which may result in eruption of coolant. Pay attention to high-pressure parts: exhaust valves and drain valves.

2) High-Speed Running

Pay attention to high-speed running part: fan.

2.6 Others

1) Binding Signal Cables

Caution

Signal cables must be bound separately from strong electricity cables and high-voltage cables.

2) Laying Out Power Cables

When the temperature is very low, violent strikes or vibrations may damage the power cable sheathing. To ensure safety, adhere to the following requirements:

Power cables should only be laid or installed when the temperature is above 0°C.

Before laying out power cables that have been stored at temperatures below 0°C, transfer the cables to an environment with the ambient temperature and allow them to acclimate for at least 24 hours.

Handle power cables with care, particularly in cold conditions. Avoid dropping the power cables directly from the vehicle.

3) Storage

Do not store devices near a heat source or in direct sunlight.

Ensure devices are kept away from fire or high-temperature objects, particularly those containing pressurized nitrogen or refrigerant; otherwise, there is a risk of explosion or refrigerant leakage, which may result in personal injury.

4) Recovery and Disposal

The sign indicates that the product cannot be disposed of with other wastes that have a shell in European Union (EU) areas. To prevent possible harm to the environment or human health from uncontrolled waste disposal, recycle it responsibly to promote the sustainable reuse of material resources.

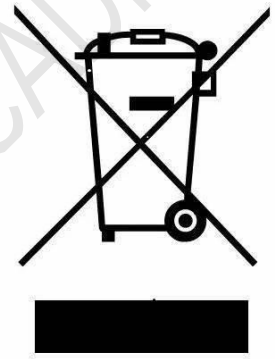


Figure 2-1 Sign

3 Overview

3.1 How It Works

The CADRO Hydro cooling container HC53-V1 is an integrated product that combines a hydro cooling container with a dry cooling system, primarily designed for use in various data centers. It offers effective, predictable, and economical cooling solutions for diverse spaces. The system continuously supplies low-temperature coolant that meets the requirements for container computing server units, ensuring an optimal working environment for computing servers. The coolant used can be either pure water or ethylene glycol antifreeze, depending on the environmental conditions of the project site.

3.2 Operation Mode

The dry cooling system draws air through fans and independently cools the coolant. The coolant then dissipates heat to the air via a heat exchanger. The cooled coolant is subsequently sent to the computing server to absorb the heat generated by the server. The heated coolant then returns to the dry cooling system for further heat dissipation and cooling, maintaining a continuous circulation to ensure the stable operation of the computing server.

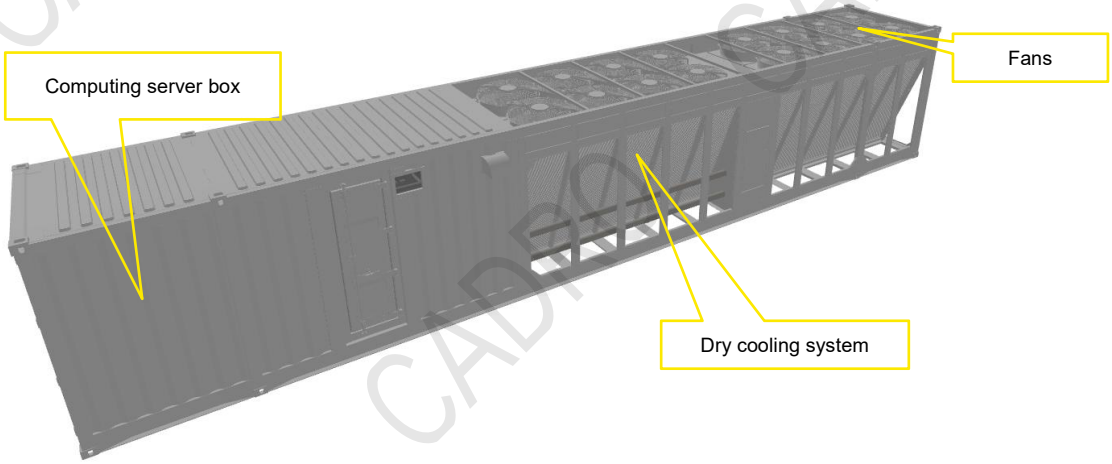


Figure 3-1 CADRO HC53-V1 Hydro cooling container

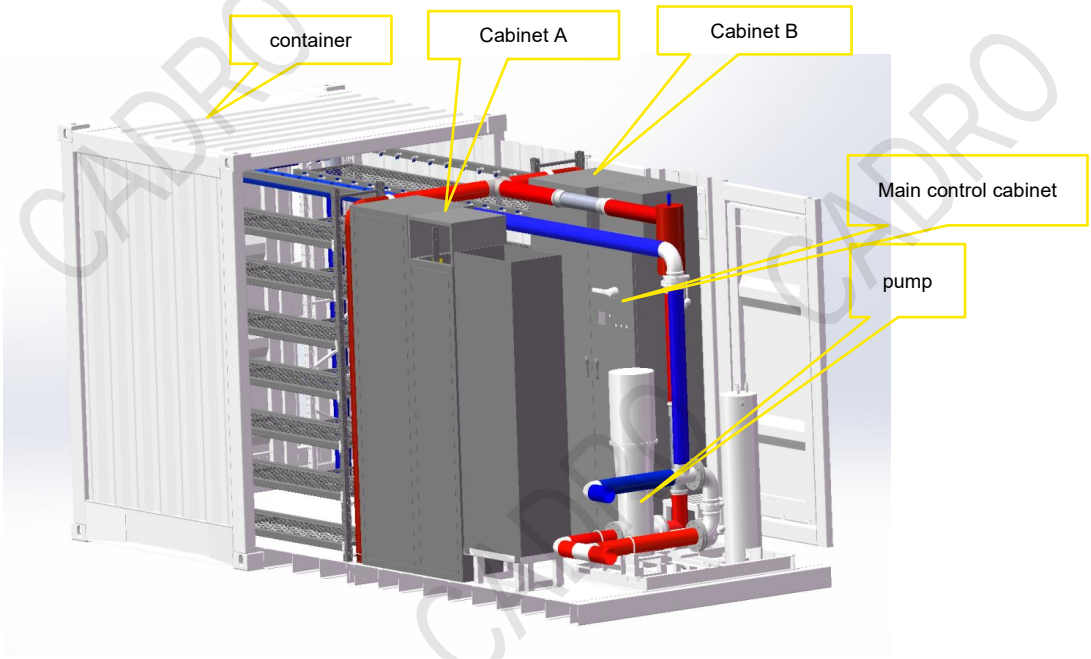


Figure 3-2 CADRO HC53-V1 Hydro cooling container,interior

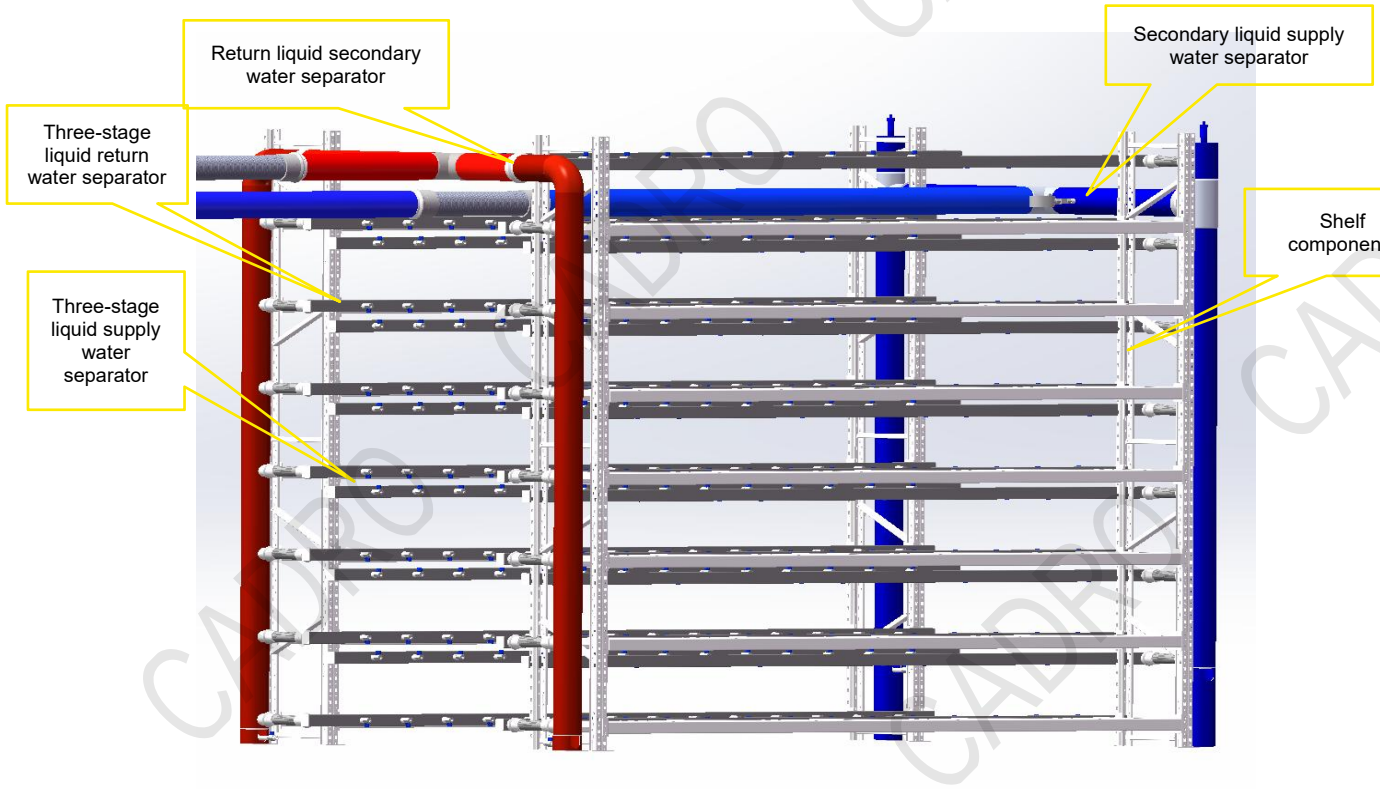


Figure 3-3 Internal view of the water separator assembly

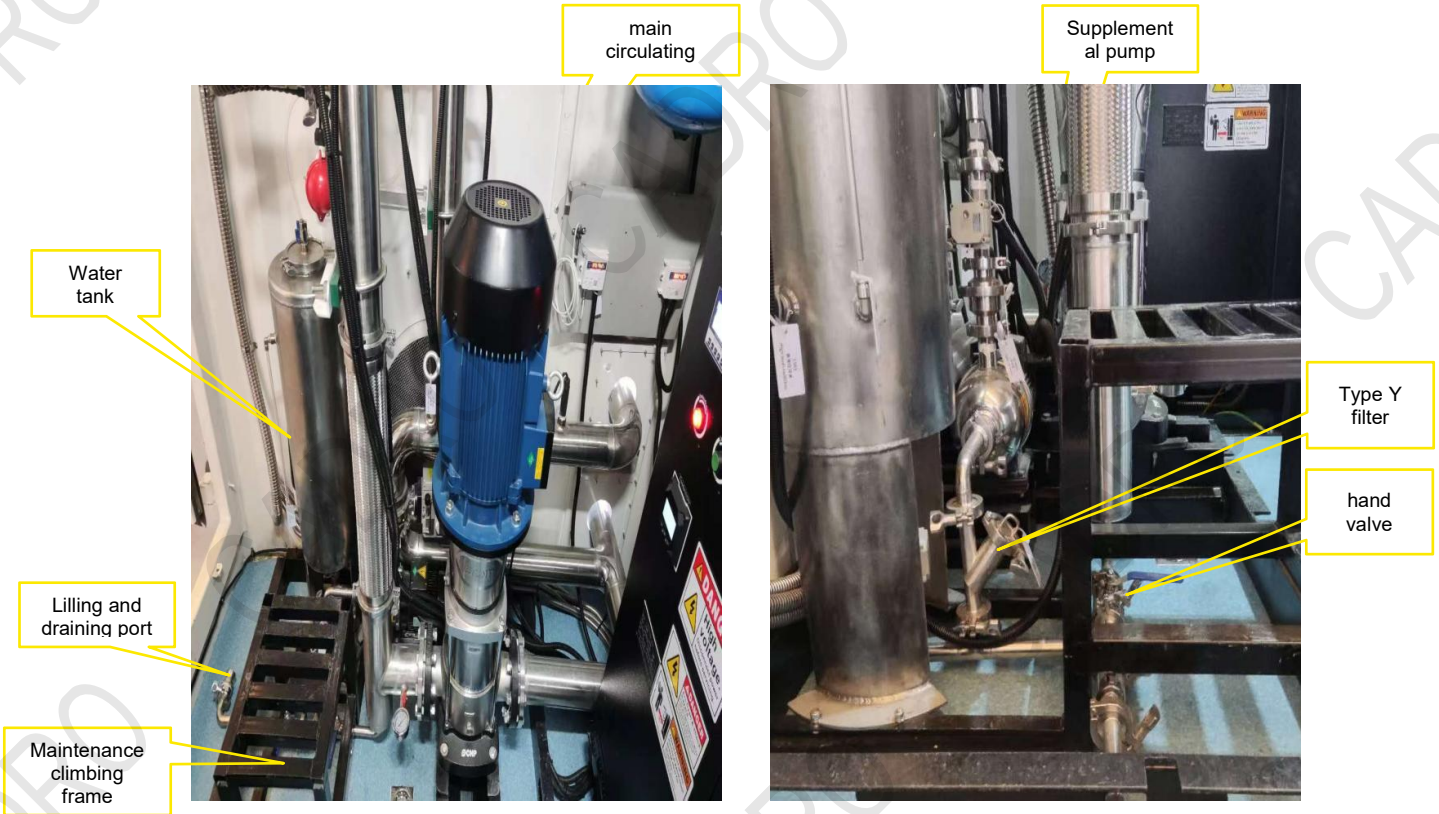


Figure 3-4 Pump station

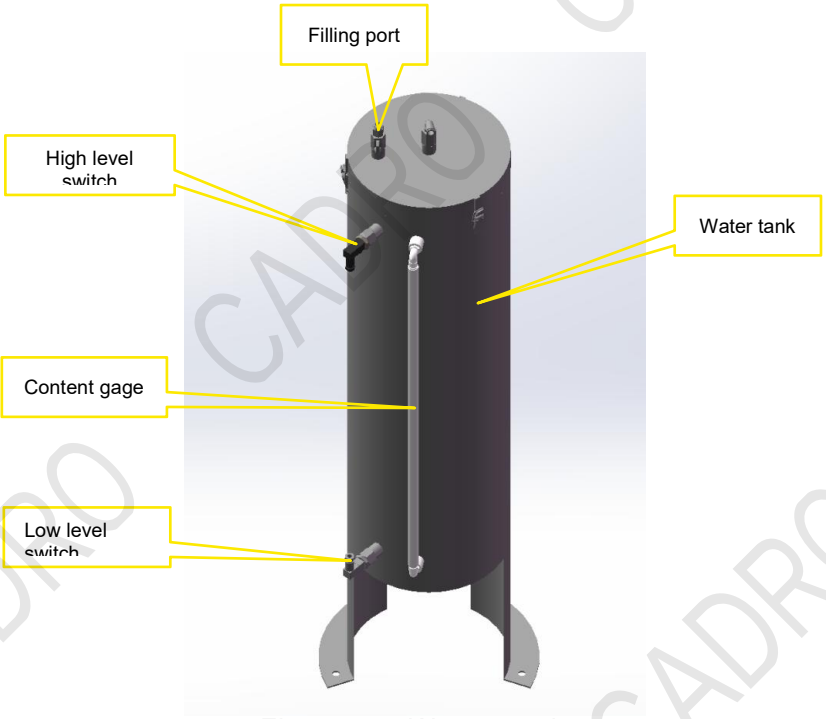


Figure 3-5 Warter tank

4 Composition and Working Principle

4.1 System Composition

The Hydro cooling container HC53-V1 use a 53ft container , make hydro cooling container and dry cooling system together, including an efficient heat exchenger, fans, two cabinets&two electric control boxes, etc.

1) Container

The container is used to install components such as computers, and electric control boxes, efficient heat exchangers, fans, pumps,pipes,etc.It has sufficient strength to ensure the firmness and reliability during transportation, handling, and operation.

2) Efficient Heat Exchanger

The efficient heat exchanger is composed of stainless steel tubes, aluminum fins, water collection pipes, etc. It is a closed circulation system, though which coolant dissipates heat into the air.

3) Fan

The fan mainly provides forced ventilation to the efficient heat exchanger, taking away the heat of the coolant inside the heat exchanger through the rapid air flow, thereby cooling the coolant.

4) Cabinets & Electric Control Box

All the swiths for computers are installed in cabinets.electronic control components of pumps,fans are installed in the main control cabinet and fan control cabinet.

5) Pipeline,vavles, Pressure gauges, flow meters, various sensors.

4.2 Specification

Table 4-1 Specification of 53ft hydro cooling container

Number	Item	Requirement	Remarks
Environment			
1	Working temperature	-35~40℃	Outdoor horizontal mount
	Working temperature	5~40℃	Indoor (control the temperature range by adjusting the fan)
2	Working humidity	10%～90%	
3	Storage temperature	-35~70℃	Clear,dust free
4	Storage humidity	5%～95%	
5	Height	≤2000m	
Container technical indicators			
1	Dimension(mm)	16154×2438×2896	
2	High computing power server capacity	196 sets of S21 Hyd. series and S19 Hyd. Series of high computing power server	
3	Box certification	China Classification Society certification	

4	Security certificate	NFPA 79:2021 UL 508A:2018 R8.21 CSA C22.2 No. 14-18 ANSI/ISO 12100:2012	
5	Service rating (kw)	1047~1050	No dry cooler power consumption
6	Power of dry cooler (kw)	43.2	
7	Input voltage and frequency	400V±5% AC,60Hz/50Hz	
8	hauled weight (T)	19.5	No high computing power server and coolant
9	Operating weight (T)	24	Including high computing power server and coolant
10	Main switch capacity of power distribution cabinet (A)	1200	The container water cooling system contains two power distribution cabinets, each with a 1200A main switch
11	rated current (A)	≤986	Rated current for each power distribution cabinet in the container
12	calibration power (kW)	1047	Dry cooler power consumption is not included
13	maximum power (kW)	1050	Dry cooler power consumption is not included
14	Single-machine position rated current (A)	≤10	The container water cooling system contains two power distribution cabinets, each with a 1200A main switch
15	Internal interface	DN125 (nominal size 139.7-ISO 2852)	
16	Rate of flow (m³/h)	≥85	
Technical index of dry cooler			
1	Type	Dry cooler	
2	Heat-sinking capability (kW)	1000	
3	Water temperature @30℃ ring temperature	35℃±1℃	
4	Box certification	China Classification Society	
5	Security certificate	NFPA 79:2021 UL 508A:2018 R8.21 CSA C22.2 No. 14-18 ANSI/ISO 12100:2012	
6	Service rating (kW)	20~32	
7	Noise @25℃, 15 m	70dBA	

4.3 Working Principle

The circulation pump P01 maintains a constant pressure and flow rate of coolant for the heat exchanger in the dry cooling system, which is ventilated by 16 fans. The coolant releases heat into the air through the heat exchanger. After this heat dissipation, the cooled coolant re-enters the high-performance computing server to remove heat. The high-temperature coolant, now carrying the absorbed heat, returns to the inlet of the circulation pump and is subsequently recirculated to the heat exchanger for further heat dissipation and cooling. This continuous cycle ensures the computing server remains cool and operates stably. shown in Figure 4-1.

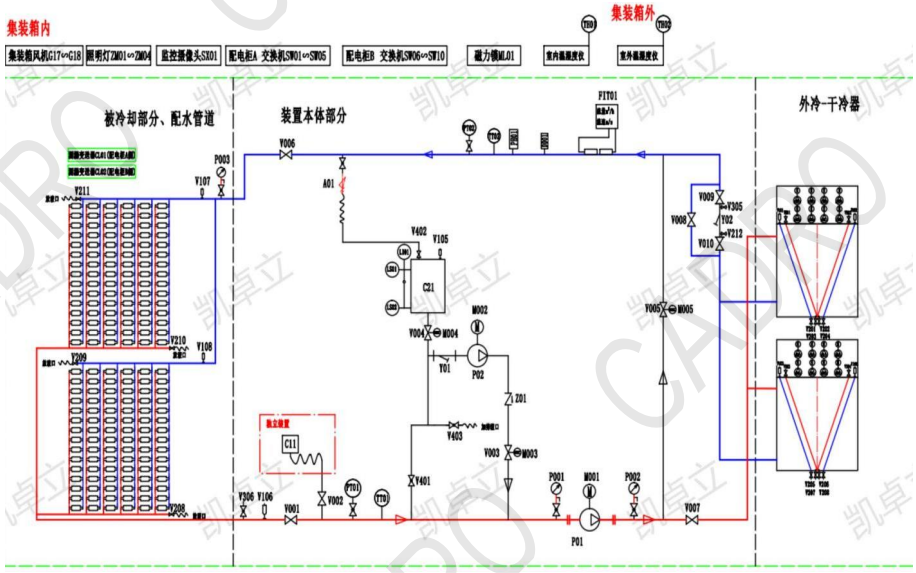


Figure 4-1 Schematic diagram of hydro cooling system

The dry cooling system is equipped with automatic exhaust valves, manual exhaust valves and manual drain valves, and the specific position is shown in Figure 4-2.

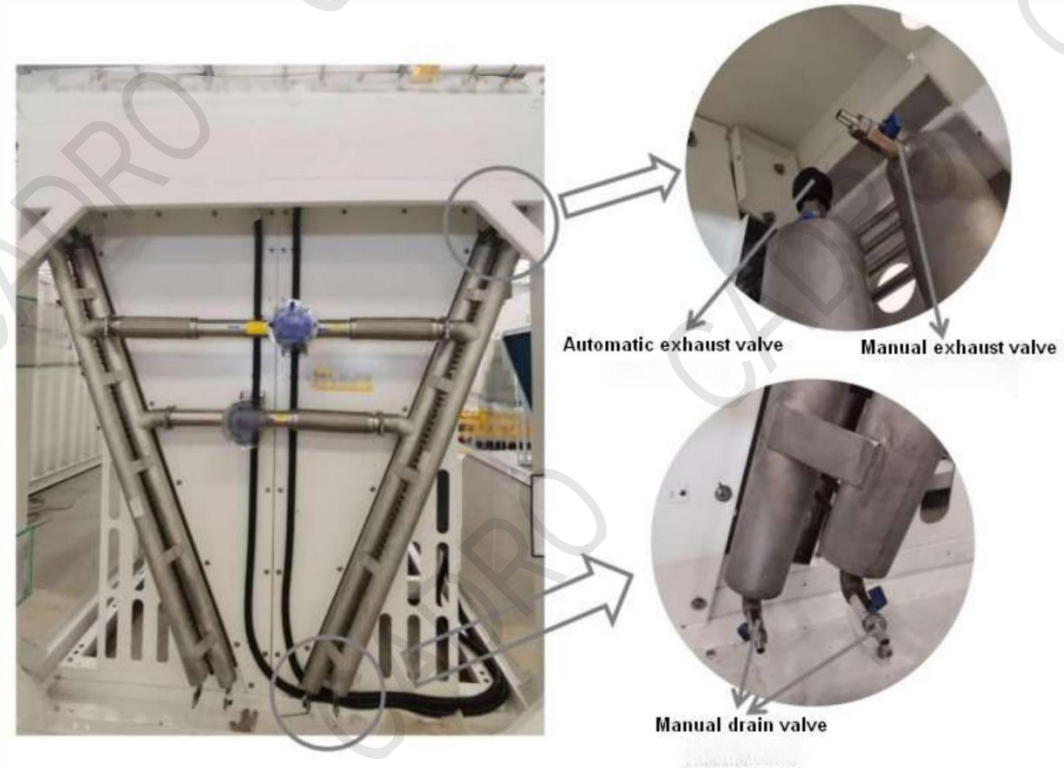


Figure 4-2 Schematic diagram of dry cooling system valve port

The automatic exhaust valves remain open during system operation (closed during pressurization), automatically discharging gas from the pipe to ensure stable operation of the system. The manual exhaust valves are used during the first liquid replenishment of the system to exhaust the gas inside the pipe system. When the system runs stably, that any working fluid flows out of the valves, the manual exhaust valves should be closed at this time. The manual exhaust valves remain closed during normal system operation. The manual drain valves are used when the system needs to be drained, and the scenarios that require drainage mainly include:

1) If the dry cooling system is at a low temperature with an ambient temperature of ≤ 5°C, and the circulating system is not filled with antifreeze and the system is temporarily not running, water in the heat exchanger must be drained by opening the drain valve at the end of the dry cooling system, bottom of the water collection pipes. If necessary, sweep the internal pipes with an air compressor to minimize fluid residue.

Caution

Antifreeze meeting the requirements does not need to be drained.

2) If the container needs to be moved from a high-temperature area to a low-temperature area, to prevent freezing and cracking of the heat exchanger and pipes, the water in the heat exchanger must be drained by opening the drain valve at the end of the dry cooling system, bottom of the water collection pipes. While the system is running, the manual drain valves should be closed.

Working principle diagram is shown in Figure 4-3.

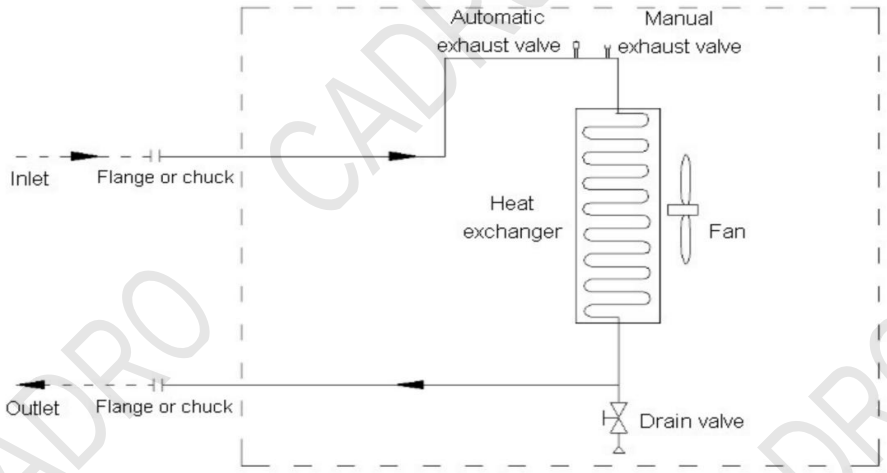


Figure 4-3 Working principle diagram of dry cooling

Caution

1. Open the manual exhaust valve and loosen the nut of the automatic exhaust valve to exhaust the unit before ensuring the heat exchange efficiency.

2. In areas where the ambient temperature may be lower than 0°C, it is necessary to add antifreeze after the unit is pressurized or operated to prevent the heat exchanger from freezing and cracking. For the configuration of antifreeze, please refer to Table 8-1 Comparison table of concentration, freezing point, and boiling point of ethylene glycol coolant.

3. If the antifreeze is not added as required, CADRO will not take responsibilities for equipment pipeline freezing and cracking caused by low ambient temperature.

4. If transporting from a high-temperature area to a low-temperature area, open all drain valves!

4.4 Control Mode

The dry cooling system can be operated in both manual and automatic modes. The two modes can be switched as needed (as mentioned later)，In manual mode, the fan can be started and stopped manually via the touch screen of the container system.In automatic mode,system will automatically control the start and stop of the fan, and automatically adjust the rev of the fan.

4.5 Mandatory Component

1) Fan

Each system is equipped with 16 fans.All fans are controlled by two frequency converters (each for 8 fans) to adjust the rotation rate.The fans have the characteristics of high energy conservation, high efficiency, long service life, low vibration, small noise, and continuous and uninterrupted operation.

2) Exhaust and drainage device

The inlet and outlet water collection pipe of the dry cooling system is equipped with an automatic exhaust valves and manual exhaust ball valves, and the bottom of the inlet and outlet water collection pipe is equipped with a drain ball valve. The specific valve position is shown in Figure 4-4, referred to 4.2.

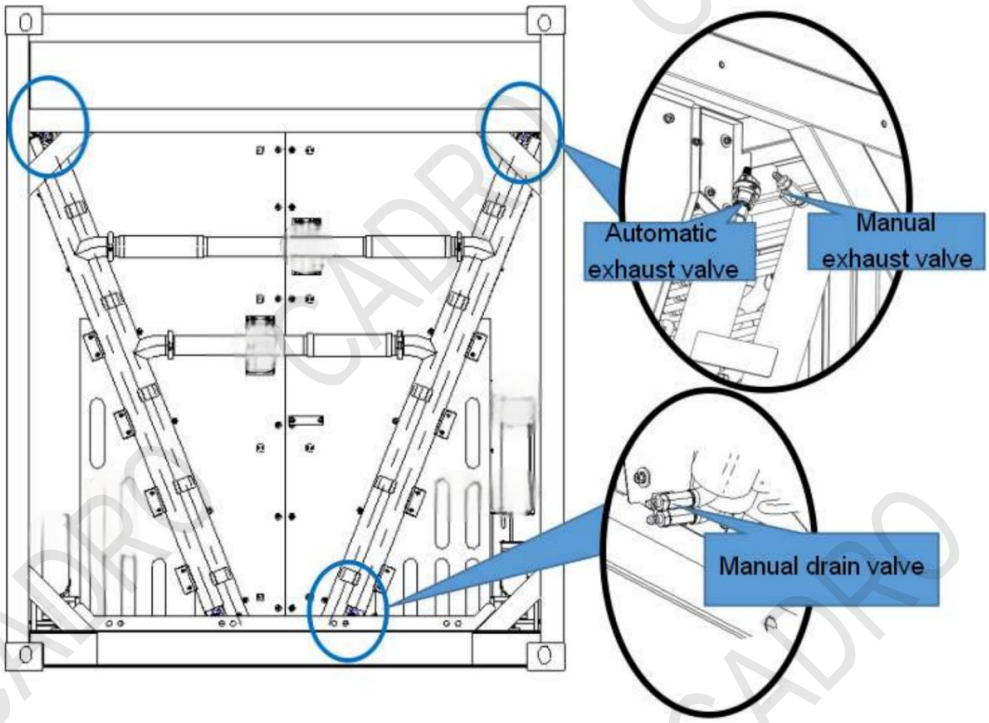


Figure 4-4 Exhaust and drain valves position diagram

4.6 Ports

Table 4-1 Port description

Name	Parameter description
Main pipe specification	DN125 (flange standard: HGT 20592–20635-2009)
Manual exhaust port specification	G1/4
Drain port specification	G1/4

5 Installation

This chapter describes the installation instructions for dry cooling container , including installation tools, transportation and inspection, and installation requirements.

5.1 Installation Precautions

Before accepting HC53 V1 hydro cooling containers, a comprehensive exterior inspection must be conducted, encompassing all six structural surfaces, with particular attention to the upper deck panel integrity. Visible defects identified during unboxing operations require immediate documentation and notification to the carrier. Latent damage discovered post-inspection must be formally reported to the designated logistics provider, accompanied by photographic evidence and timestamped documentation.

For maximum operational efficiency and extended equipment longevity, strict adherence to manufacturer-prescribed installation protocols is mandatory. Prior to deployment execution, it is imperative to:

Conduct a comprehensive assessment of facility compatibility with technical specifications

Verify structural modification requirements for:

Utility conduit routing;

Power distribution infrastructure;

Any deviations from prescribed environmental parameters must be rectified through certified engineering interventions before proceeding with installation;

Install the device according to the design drawing and reserve space for maintenance.

Warning

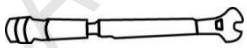
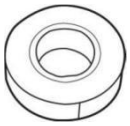
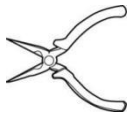
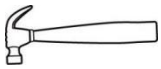
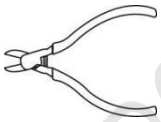
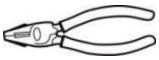
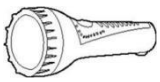
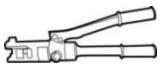
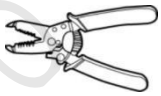
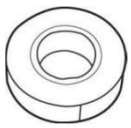
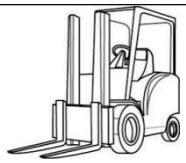
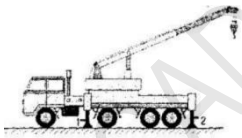
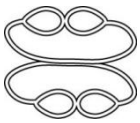
1. During the handling process, the container can only be moved horizontally.Collision and trampling are strictly prohibited. Failure to comply with prescribed operating conditions will render any resultant container damage ineligible for warranty.

2. Equipment should be installed in accordance with the manufacturer's construction specifications.

5.2 Tools

Necessary handling equipments and tools are listed in table 5-1. The onsite technical personnel can add or delete tools based on the site requirements.

Table 5-1 Dry cooling system installation tools

Appearance, Specifications & Name of General Tools			
Adjustable wrench （200 mm × 24 mm）	Philips screwdriver （M4/M6/M8）	Flat-head screwdriver （ M3/M4）	Socket wrench （10#/13#/18# ）
			
Torque wrench (10#/13#/18#)	Insulation tape	Antifreeze gloves	Needle-nose pliers
			
Claw hammer	Diagonal pliers		
			
Combination pliers	Tape measure	Flashlight	Step ladder
			
ESD gloves	Insulated gloves	Power cable crimping tool	Wire strippers
			
Heat gun	Insulation tape	Multimeter	
			
Electric forklift	Crane	Crowbar	Hanging rope
			

Note: The lifting weight of the crane should be ≥ 25 T.

5.3 Transportation and Inspection

Inspect the container's exterior and interior to ensure they are in good condition and free from any collision or scratches. Should there be any damage to the container's interior, reach out to the equipment company.

Upon unpacking, tally the number of container installation accessories against the provided accessories list.

5.4 Installation Requirements

All the internal pipelines and wirelines have been connected,there is no need for additional pipe and wire connection. There should be no obstruction within 2 meters around the container when installing. All components in the system need to be fixed firmly, and the fastening torque of fasteners meets the national standard and transportation requirements, and meets the structural strength requirements of sea transportation, land transportation and air transportation.

All cables meet the current selection and regulatory requirements of the safety regulations in the sales area, and meet the overall environmental requirements of the product. The cables outside the container should be protected by weather-resistant corrugated pipes. The perforations in and out of the container plate are provided with waterproof glen head or corrugated pipe joints. Do not directly thread bare wires through the sheet metal.

5.5 Container Leveling Before Installation

Place the level meter on the ground, perform an accurate calibration before use, and make sure the air bubbles of the level in the middle position. Level out a reference line. Use a ruler to measure the height of the baseline from the top of the cement foundation, then adjust the height to the same size with steel plates or other materials. After the foundation has been adjusted horizontally, hoist the container on the foundation for subsequent installation.

5.6 Container Installation

1) Remove the panels from the outer packaging of the dry cooling system:

The panel of the dry cooling system is divided into top panels and side panels. There is no assembly relationship between the top panels and side panels, so either the top panels or the side panels can be removed first. The process of removing the side panels is shown in Figure 5-1:

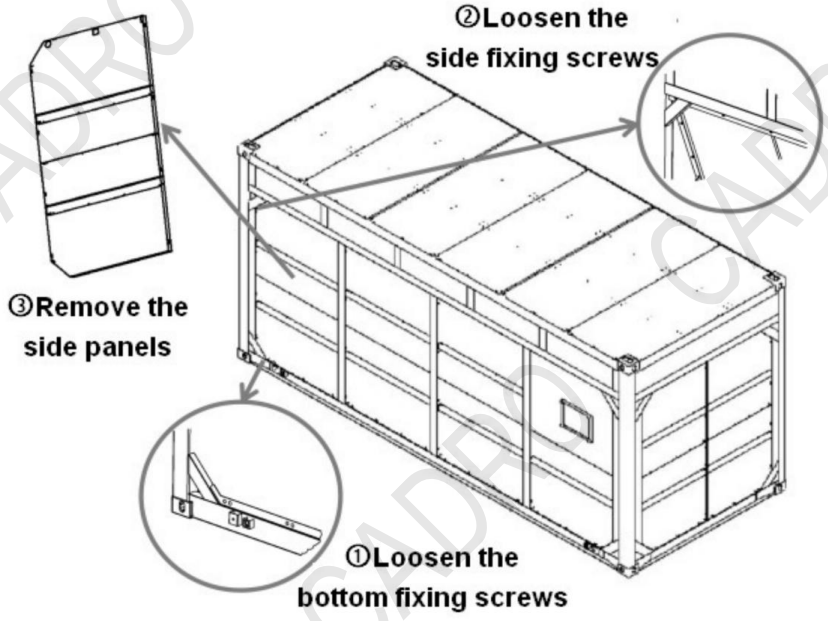


Figure 5-1 Schematic diagram of removing the side panels

Each side panel is independent, with a total of 22 plates, and there is no requirement for removal sequence.

The schematic diagram of the top panels is shown in Figure 5-2.There are a total of 9 top panels,no requirement for removal sequence.

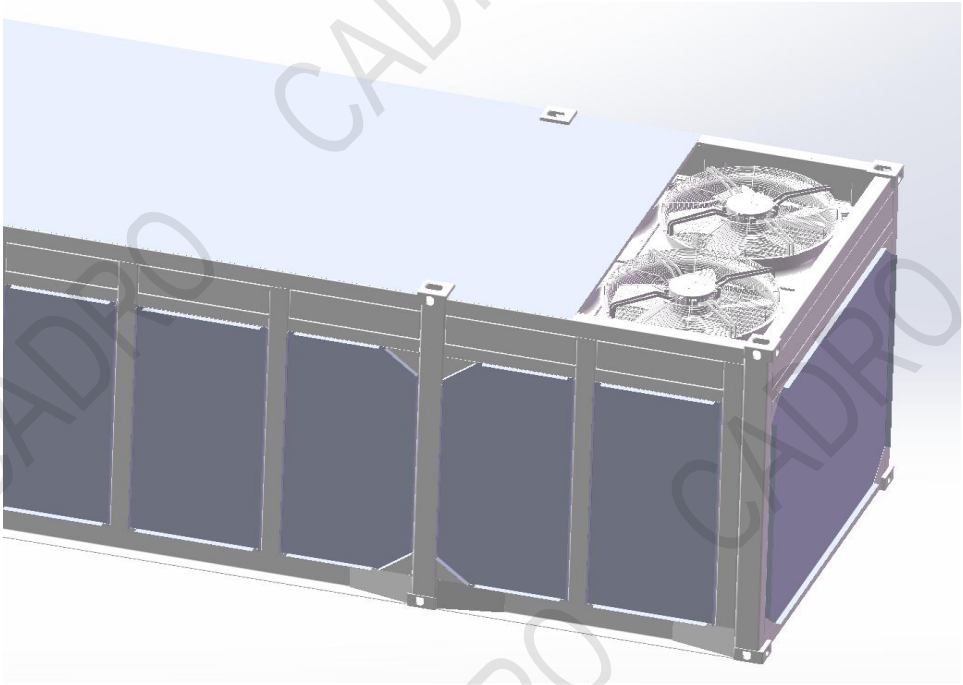


Figure 5-2 Schematic diagram of removing the top panels

Caution

Please remain the panels after dismantling for subsequent transportation.

2) Remove the bottom plate and fasteners for the transportation,remove components of the dry cooling system or water curtain, as shown in Figure 5-3.

3) The position of automatic exhaust valve and drain valves are shown in Figure 5-4.

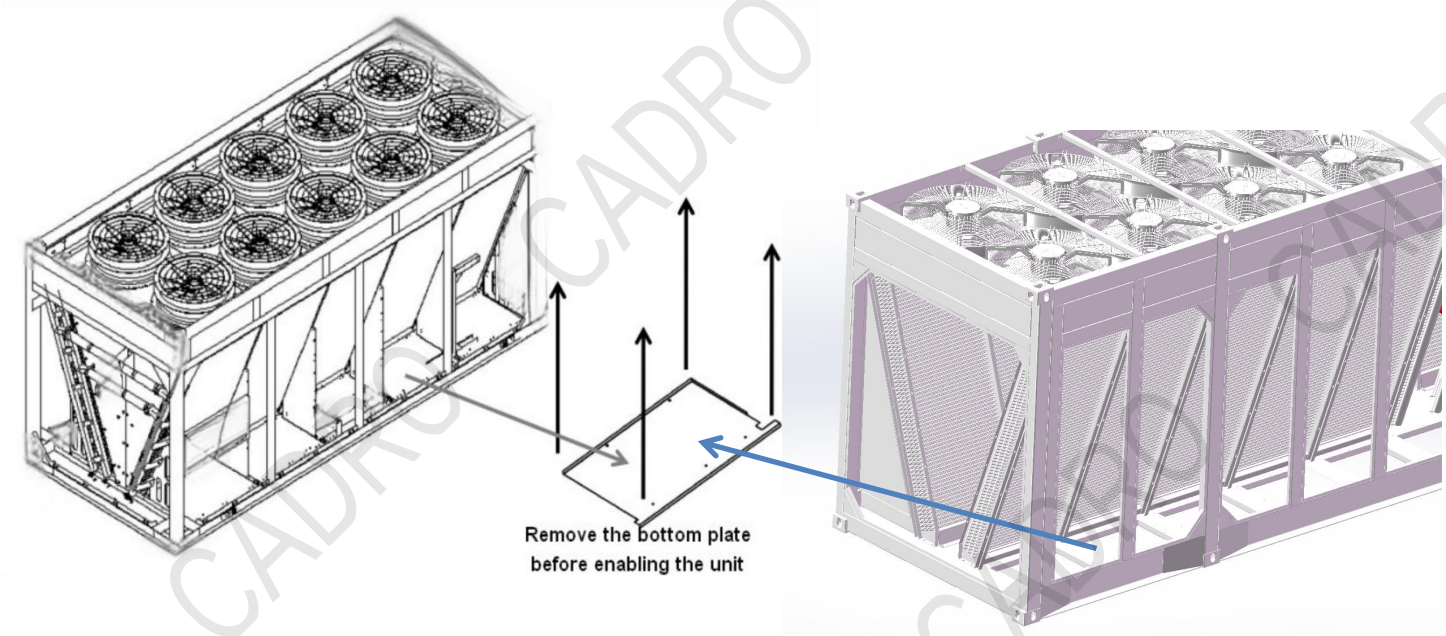


Figure 5-3 Remove bottom plate and fasteners for components of the dry cooling system or water curtain

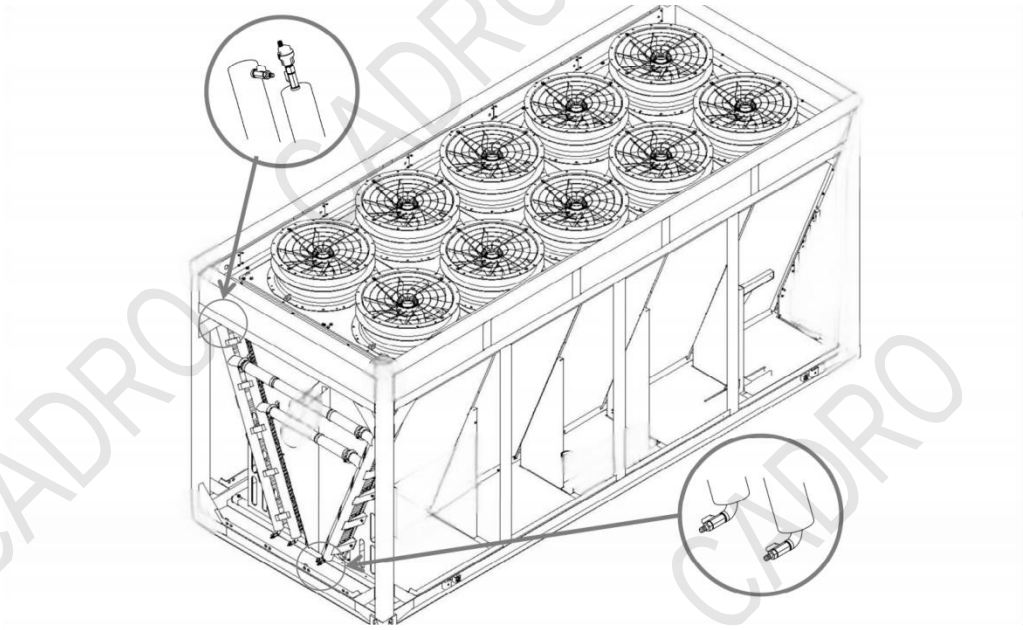


Figure 5-4 Position of automatic exhaust valve and drain valve

5.7 Hoisting of Container

The container should be placed on the ground,which requires a certain strength (withstand a weight of 25 tons, ± 1° horizontality).The steps for fixing the container are as follows:

1) Confirm that the all components installed inside the container are removed to prevent them from falling off during the hoisting process.

2) Thread the sling through the four corner fittings below the unit, as shown in Figure 5-5.

3) Hoist the container horizontally with boom and crane and place it on the cement floor, leaving sufficient space for container installation.

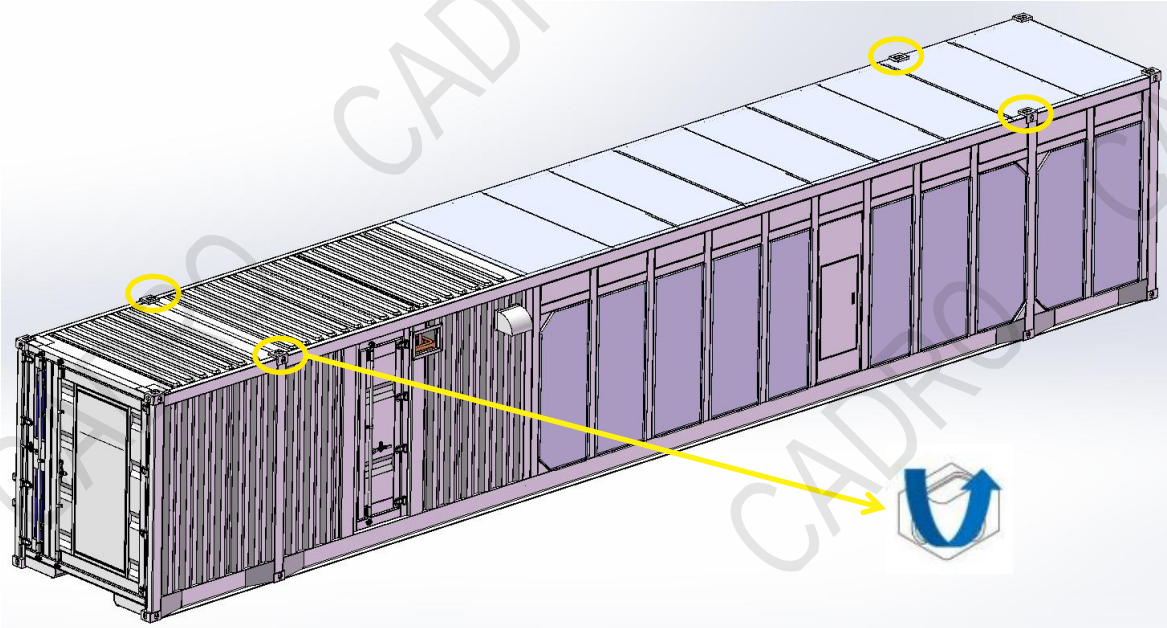


Figure 5-5 Lifting lug diagram

Danger

Only professional personnel can hoist the unit.

Hook on the middle(40ft) four corner fittings during the the hoisting. Do not hang to other positions of the container.

Do not stuff the sling into corner fittings, otherwise the sling will be worn down. Do not lift the container from the bottom.

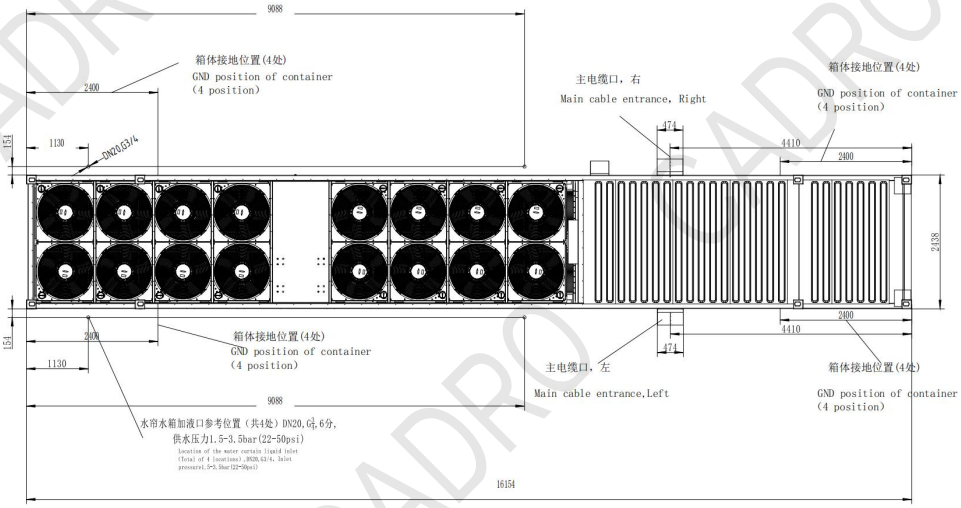
6 Power Distribution

6.1 Power Distribution Steps

Refer to the container use manual for power cable wiring.

1) Connect the cable from the upper two holes on the side of the container. Specific location is shown in Figure 7-1 (Note: Use the rain cover in the accessory for protection). The cable is connected from the top wiring box of the two power distribution cabinets(PDC,similarly hereinafter), extends to the orresponding copper block, and is fixed with screws.

2) There are grounding studs on both sides of the container. Ensure that the shell of the container is reliably grounded. At least two diagonal corners of the container should be reliably grounded. Specific location is shown in Figure 6-1 , 6-2.



53尺集装箱尺寸及主电缆线进线口位置尺寸
The size of the 53-foot container and the position of the main cable entance .

Figure 6-1 The size of 53fts container and the position of the main cable entance

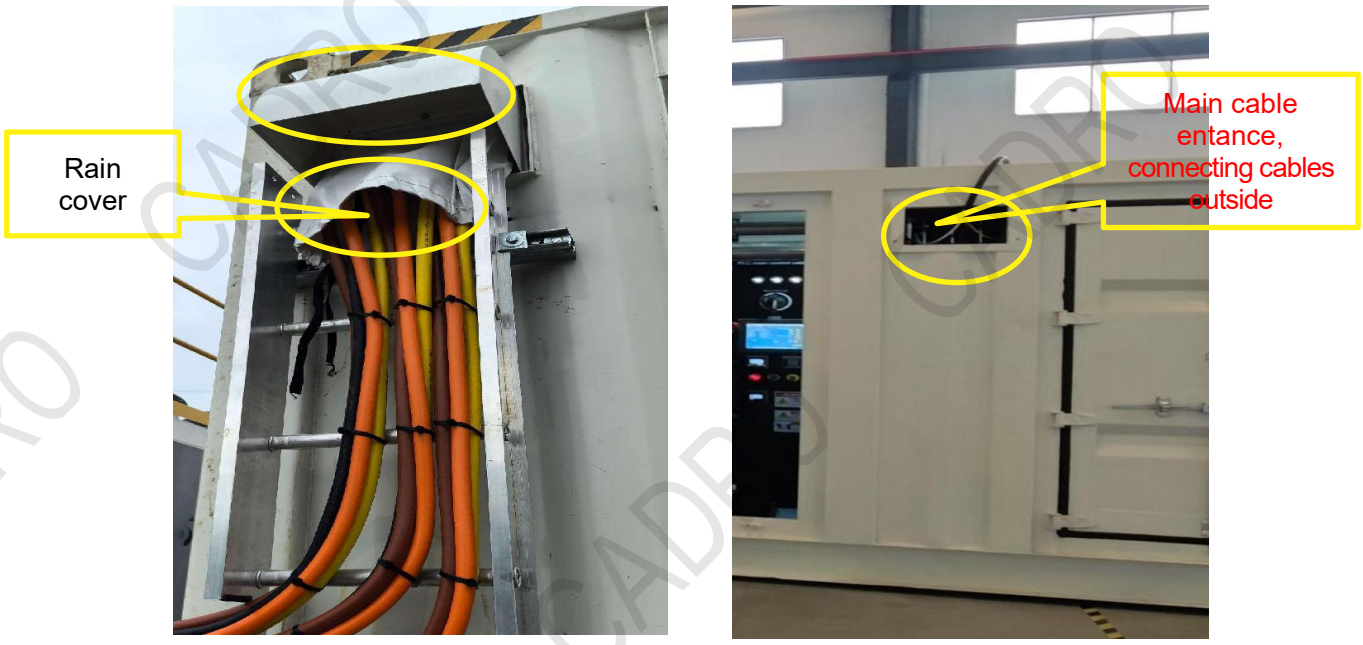


Figure 6-2 Cable entrance holes (under the rain cover)

The phase sequence of the equipment is determined when leaving the factory. When the equipment is transported to the site, it only needs to be adapted to the phase sequence of the on-site substation. The operation is as follows:

1) Connect the three-phase electricity of the substation to the PDC, power on the electric control box, and check whether the power monitor is faulty.

2) If there is a fault, adjust the phase sequence of the accessed electric control box.

3) If there is no fault, the equipment can run normally.

6.2 Connect the Main Power Cable

A(L1), B(L2), C(L3), N, G are connected to the corresponding terminals.You can connect the main cable outside the container.Pay attention to calibrate the torque. For the selection of wiring model, please refer to the maximum running current of the unit. The PDC end of the container adopts OT terminal. Select appropriate terminal at the on-site substation end according to the actual conditions. Schematic diagram of copper-row wiring in the wiring box on the top of the PDC is shown as below:

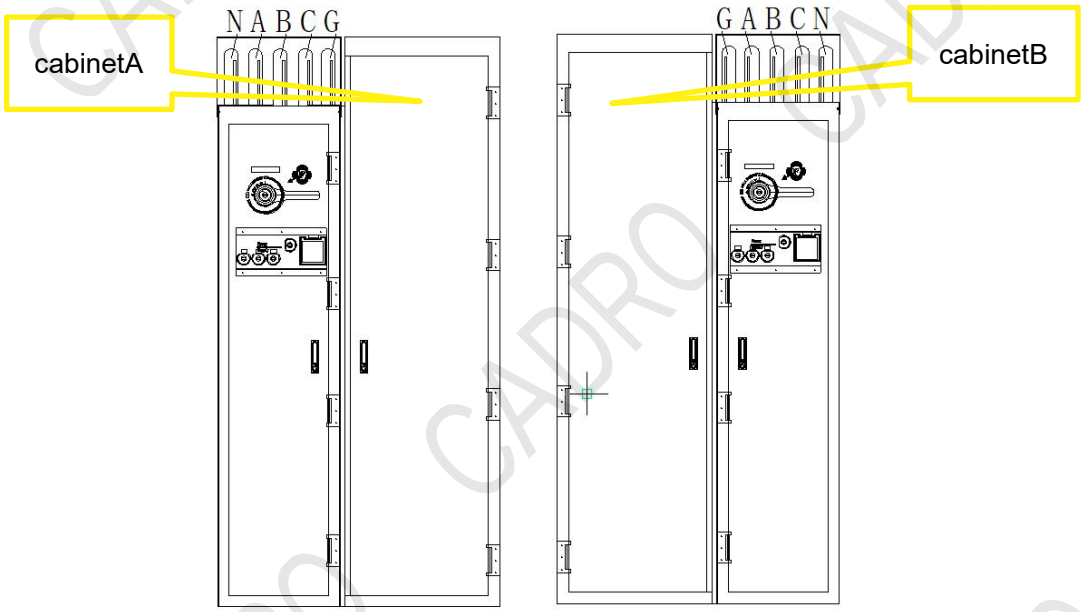


Figure 6-3 Wring diagram for wiring box

Caution

Before connecting cables, take effective ESD protection measures.
The schematic diagram of the control port of the indoor unit is for reference only. The installation should be subject to the special wiring diagram pasted on the unit.

Caution

Check whether the current-carrying screws are loose before the first power-on. If they are loose, please tighten them according to the specified torque.

7 High-pressure insulation test

7.1 On-site Pressure Test Precautions

1) The product underwent rigorous leak testing at the manufacturing plant; however, we suggest conducting an air pressure test at 7 bar. Maintain the pressure for at least 3 hours. If there is no leakage and the pressure reading decreases by less than 5%, it indicates that the on-site air leakage inspection is qualified.

Notice: The decrease of ambient temperature will lead to the decrease of pressure.

2) we also suggest an air-hydraulic pressure test should be conducted .Hold the pressure at 7 bar for at least 30 minutes to check whether there is leakage in each pipeline and joint. If there is no leakage, it indicates the onsite air-hydraulic leakage inspection is qualified.

3)All The pipeline are cleaned in the manufacturing plant. however ,the pipelines chould be cleaned again after all tests are completed.

4)To prevent the heat exchanger or pipeline from freezing and cracking, the water left in the pipeline systemlit should be discharged, when the equipment is not running.

5)When the ambient temperature is lower than 0°C during the storage period. The dry cooling system is installed in an area where the ambient temperature may be lower than 0°C, and the equipment needs to be added with an appropriate concentration of antifreeze to prevent the heat exchanger or pipeline from freezing and cracking. If the main component of the antifreeze used in the project site is ethylene glycol solution, it is necessary to consult the local meteorological data before preparing the ethylene glycol solution, and choose the freezing point of the ethylene glycol solution according to the local minimum temperature over the years, which is reduced by 2°C. Use a freezing point meter to detect the freezing point of the prepared solution. If you need technical support, you can consult the equipment manufacturer in advance.

The following is the comparison table of concentration, freezing point, and boiling point of ethylene glycol coolant, which is for reference only.

Table 7-1 Comparison table of concentration, freezing point, and boiling point of ethylene glycol coolant

Concentration		Freezing Point °C	Boling point °C
Mass Conc %	Volume Conc%		
0.0	0.0	0.0	100
5.0	4.4	-1.4	100.6
10	8.9	-3.2	101.1
15	13.6	-5.4	102.2
20	18.1	-7.8	102.2
25	22.9	-10.7	103.3

Concentration		Freezing Point °C	Boling point °C
Mass Conc %	Volume Conc%		
30	27.7	-14.1	104.4
35	32.6	-17.9	105
40	37.5	-22.3	105.6
45	42.5	-27.5	106.7
50	47.6	-33.8	107.2
55	52.7	-41.1	108.3
60	57.8	-48.3	110.0

Danger

The antifreeze must be prepared in strict accordance with the lowest possible ambient temperature. If the antifreeze is not prepared according to the instructions, CADRO will not bear any responsibility for the feezing and cracking of the heat exchanger due to that the ambient temperature is lower than the

7.2 Verification Items

When the installation of the container is completed, the following items need to be verified again. Only after they are fully qualified can the container be powered on and turned on.

1. The equipment is placed horizontally.
2. All pipe joints have been tightened and sealed well.
3. The pipeline has been connected and the gas pressure test has been performed to confirm that there are no leaks in the pipeline.
4. The power supply voltage is the same as the rated voltage on the equipment nameplate.
5. All cables and circuit connectors have been tightened.
6. After the installation of the equipment is completed, debris inside or around the equipment has been removed (such as transportation materials, tools, etc.).
7. The circuit breaker in the electric control box is disconnected.

7.3 Preparation Before Pressurization

1) Prepare hose and air pump (recommended brand: OUTSTANDING; model 2200 W-40 L; selection basis: the internal volume of the system is about 1.5 m3/h. Select the air pump corresponding to the exhaust volume according to the time requirements. The maximum output pressure is required to be more than 8 bar, and 10 bar is the optimal).

2) Connect the external pipeline according to chapter 6.

3) Close the expansion tank and pipeline connection ball valve, and close the

pipeline safety valve. Close all exhaust nuts above the exhaust valves on the

pipeline. The position of the exhaust valves are shown in Figure 4-4 and Figure 7-1.

4) Check whether the safety valve ball valve and expansion tank ball valve are closed, and check whether each filling and discharging valves are closed.

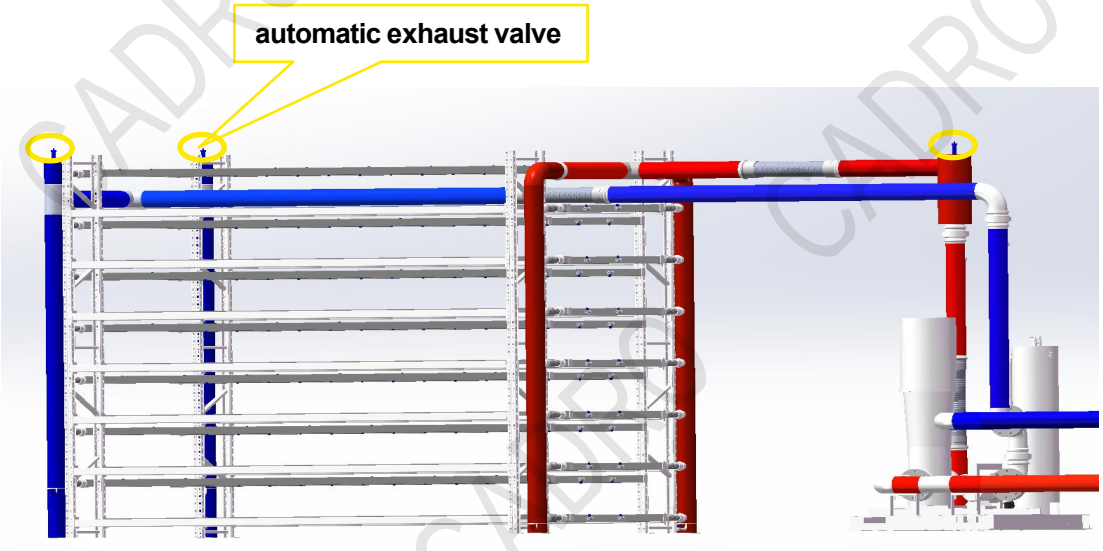


Figure 7-1 Container-automatic exhaust valve

7.4 Pressurization Steps

Step 1 Recheck whether the exhaust valves and the ball valves are closed.

Step 2 Close the ball valves at the top of the dry cooling system and the drain valves at the bottom of the dry cooling system.

Step 3 Open all mini ball valves on the water distributor.

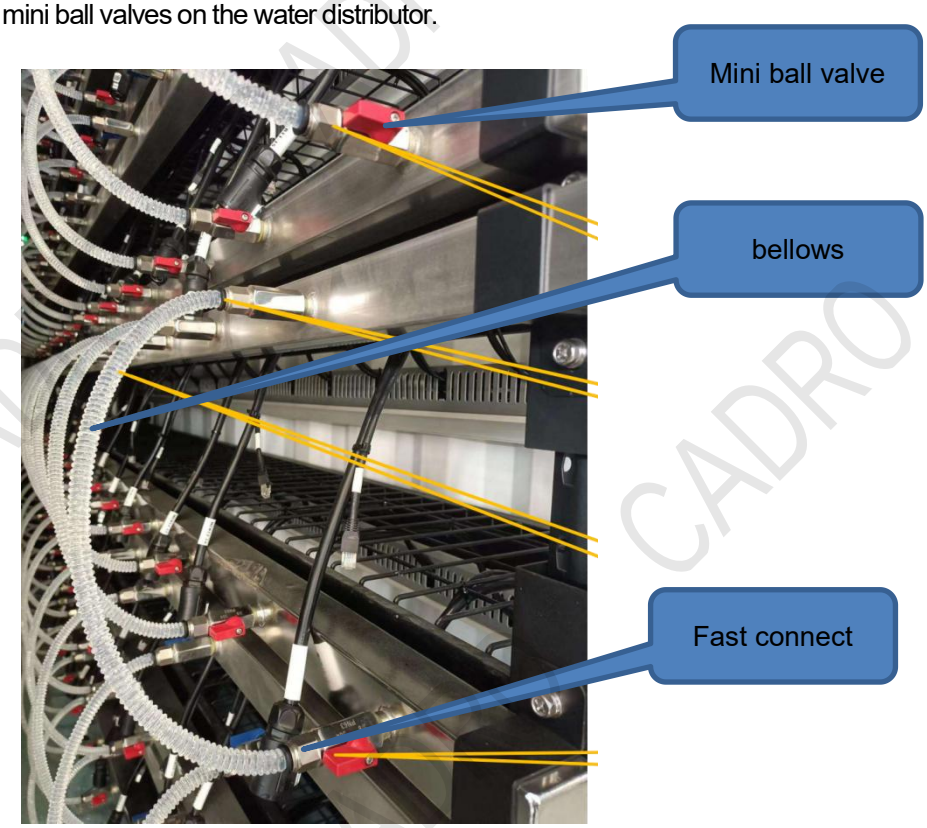


Figure 7-2 System-pipeline connection ball valve

Step 4 Connect the air pipe to any quick connector and close the corresponding ball valve.

Step 5 Press to 7 bar with the air compressor and stabilize for over 12 h. Check whether there is a leakage point.

Step 6 The key inspection parts are as follows:

a) The joint between the quick-plug connector and the mini ball valve.

b) The joint between the quick-plug ball valve and the bellow.

c) The joint between the mini ball valve and the water distributor.

d) The joint between the quick-plug connector and the computing device.

e) Each flange/chuck/thread/welding joint.



Figure 7-3 Chuck joint & mini ball valve

Step 7 The inspection method is as follows:

a) Leak detection by seeing, hearing and touching.

b) Choose a detergent, which is added with water to make soap solution and apply to the suspected leakage point, especially at the joint. The part with bubbles bulging is the leakage point.

Step 8 After the air test is completed, it is necessary to replenish the liquid, then check the system for any leakage, and promptly handle it if existed. The pressure is required to maintain at 7 bar for 30 minutes.

7.5 Air-Hydraulic Pressurization Steps

Step 1 Check the drain valve at the bottom of the container to ensure it is closed.

Step 2 Check the automatic exhaust valve at the top of the container to ensure that it is open.

Step 3 Check the drain valve at the bottom of the dry cooling system to ensure it is closed.

Step 4 Check the manual exhaust valve at the top of the dry cooling system to ensure it is closed.

Step 5 Check the automatic exhaust valve at the top of the dry cooling system to ensure it is open.

Step 6 Open all ball valves on the water distributor and all butterfly valves on the main pipeline to ensure that the entire pipeline system is connected.

Step 7 Open the corresponding replenishment valve at the bottom of the pump station, use an external water pump to inject water into the entire pipeline system,and check if there are any small leakage points in the pipeline system. The pressure is required to maintain at 7 bar for 30 minutes.

Step 8 The key inspection parts are as follows:

a) The joint between the quick-connection rod and the mini ball valve.

b) The joint between the quick-plug ball valve and the bellow.

c) The joint between the mini ball valve and the water distributor.

d) The joint between the quick-plug connector and the computing device.

e) Each flange/chuck/thread/welding joint.

Step 9 The inspection method is as follows:

Leak detection by seeing, hearing, and touching.

7.6 Cleaning Procedure

1) Check the drain valve at the bottom of the container to ensure it is closed.

2) Check the automatic exhaust valve at the top of the container to ensure that it is open.

3) Check the drain valve at the bottom of the dry cooling system to ensure it is closed.

4) Check the manual exhaust valve at the top of the dry cooling system to ensure it is closed.

5) Check the automatic exhaust valve at the top of the dry cooling system to ensure it is open.

6) Open all ball valves on the water distributor and all butterfly valves on the main pipeline to ensure that the entire pipeline system is connected.

7) Link the replenishment pipe and open the corresponding replenishment valve at the bottom of the pump station.

8) Open the main control screen and click on the "Add Water Pump" button on the touch screen (manual) interface to start filling liquid.

9) When adding liquid to the system,and the static pressure reaches above 0.3 bar, click on the "Add Water Pump" button on the touch screen (manual) interface to stop the replenishment pump.

10) Click "Main Circulation Pump" on the touch screen (manual) interface to turn on the main circulation pump for 5 minutes. Click "Main Circulation Pump" on the touch screen (manual) interface to turn off for 3 minutes, and repeat it for 3 times

11) Discharge the dirty water after cleaning.

7.7 Inspection Before Power On

Inspection before power on:

1. Check if there are any missing wires, virtual wires, worn wires, and copper leakage of the cables inside the electric control box of the dry cooling system and verify the accuracy of the cables. In addition, it is necessary to check the connection screws of all cables to ensure they are in a tight state;

2. Check whether there is a short circuit between various components and phases in the cabinet;

3. Check that all switches must be in the off state;

4. Check if all device tag numbers have been pasted and if there are any errors.

5. Power wiring inspection:

Before wiring, please check that the upper power output switch is in a disconnected state. Before turning on the circuit breaker, use a multimeter to measure L1, L2, L3 and verify that whether they are disconnected from PE and whether the three phases are disconnected. After turning on the circuit breaker, use a multimeter to measure L1, L2, and L3 phases as 400V±10%. Check whether the insulation at all wiring terminals is good, whether the cables have been worn, and whether the fastening screws are loose.

7.8 System Commissioning

The procedure is as follows:

1. Turn on the main power circuit breaker, and disconnect the other circuit breakers. Confirm that the voltage of each phase of the main power supply is 400V±10% through the power monitor.

2. Activate the motor protector for the circulation pump (located in the main control box) or for one of the fans (ocatedin the fan control box), operate the touchscreen panel, and brief initiate the pump or fan. The pump or fan will begin to run, indicating that the unit is in operation. Inspect the operating status and rotation direction of the pump (indicated by an arrow) or fan (the air should be moving upward).

Warning

Make sure that pumps and all fans rotate correctly.

3. Except the pumps,commissioning for 30 minutes and check if the equipment is operating normally.

4. After the commissioning is completed, reset the settings changed due to the adjustment of the dry cooling system. And make sure that all system alarms are handled correctly.

Warning

1. During the operation of the dry cooling system, there may be high voltage inside the equipment. All precautions and warnings on the component and in this manual must be followed, otherwise it may result in personal injury or death.
2. Only qualified repair and maintenance personnel can operate and handle the equipment.
3. Be sure to cut off the power supply before maintaining or repairing the equipment.

7.9 System Liquid Filling

During the installation , it is necessary to check whether the filter in the external pipeline is intact.

It is recommended to choose appropriate antifreeze or deionized water according to the local climate conditions as the circulating media inside the container. Firstly, add liquid to the system with a replenishment pump (P02). When the return pressure reaches the required value, stop adding liquid to the system. Switch the pipeline switch, add liquid to the water tank. When the liquid level in the water tank reaches the required height, switch the pipeline switch, and the system can be in automatic operation.

The specific liquid filling procedure is as follows:

1. Preparation: prepare materials and tools, and open all exhaust valves of the

system (open the manual exhaust valve of the system and the manual exhaust valve on the dry cooling system for the first liquid filling).

2. System liquid replenishment: Replenish the system with liquid filling pump.

3. Water tank replenishment: Replenish the water tank with liquid filling pump.

4. Regular replenishment of water tank: Replenish the water tank through the manual filling port on the top or bottom of the water tank.

7.9.1Preparation

1) Prepare the coolant.

2) Connect the external filling port,which under the water tank .

3) Check if all the plugs on the automatic exhaust valves on the internal and external connecting pipelines of the container are open.

4) Open the manual filling valve (V401,403)，close the manual drain valve.

5) Open the exhaust ball valve on the top of the water tank(V105) to ensure that the water tank is connected to atmospheric pressure.

6) Open the manual exhaust valve(V402) of the system and connect the PU pipe to the quick connector on the water tank (to accelerate the first liquid filling).

7.9.2System and Water Tank Replenishment

1) Replenish the system and water tank with the replenishment pump.

2) Find an external water source (with a certain pressure), and connect the hose to liquid filling/drain port on the container. Fill the connecting pipeline with liquid for the first liquid filling (until water flows out). Find the liquid filling port outside the container and plug in the hose (at the side door of the container). Then, connect the external water tank to the replenishment pump.

3) Open the exhaust valve of the replenishment pump (Allen wrench), switch to manual mode on the touch screen, and open the solenoid valve . After water is discharged, close the manual exhaust valve of the replenishment pump.

4) Open the solenoid valve V004, switch to manual mode on the touch screen, and open the "Manual Liquid Replenishment" mode "External → System" of the liquid filling system, which means adding liquid to the system. Open "External → C21", which means adding liquid to the water tank C21 externally.

5) When adding liquid to the system, pay attention to whether there is water flowing out of the exhaust valve of the cooling system and the manual exhaust valve of the system. When there is water flowing out, it indicates that the system has been fully filled. Then, open the automatic exhaust valve, and close the manual exhaust valve of the system.

6) Start the replenishment pump to replenish liquid from outside the system. After the replenishment pump stops, start the circulating water pump ,running for 10 seconds, then close the circulating water pump.

7) Continue to add liquid after there is no obvious gas from the exhaust valve and repeat for twice to ensure that 1.3 –1.5 tons of coolant are added.

8) When the static pressure reaches the default value, stop adding liquid.

9) Restart the circulation pump to circulate the coolant in the system, ensuring that all automatic exhaust valves are in an open state.

10) Due to the first liquid filling and the presence of gas in the system, the discharge of gas during the water pump circulation will cause a decrease in pressure in the system. At this time, the liquid filling function is turned on, and the water tank replenishes the system to ensure that the return pressure is between 1.0 bar and 1.5 bar.

11) After the above operation is completed, the system back pressure will be stabilized at 1–1.5 bar for normal operation. Automatic mode can be turned on and the computing power server can be turned on for operation.

7.9.3Regular Replenishment of Water Tank

When water tank C21 needs to be replenished with a small amount of coolant, the following methods can be referred to:

Method 1: Same as the first liquid filling, connect to an external water source (with a certain pressure; fill the connecting pipeline), turn on the solenoid valve V004 , externally add liquid to the water tank.

Method 2: Open the installation chuck of the exhaust valve on the top of the water tank, and manually add liquid from the top manual filling port to the inside of the water tank.

7.10 Electrical wiring

The equipment's electrical system is a TN-S three-phase five-wire system. Given that there are two PDCs (A/B cabinets) within the equipment, to ensure its safe and stable operation, two three-phase five-wire cables, each rated for 500kW (with the main switch having a rated current of 1200A), should be prepped beforehand.



Figure 7-4 Cable connection diagram

The cables are connected from the upper two holes on the left and right sides of the container. For the specific locations, refer to Figure 7-4 (Note: the rain cover in the accessories should be used for protection). The cable is connected from the top junction box of the two PDCs and extends to the corresponding copper row, and is installed and fixed with screws (M12 or 1/2 inch, which have been installed in the copper row hole).

Grounding studs are present on both sides of the container, and the PDC should also be reliably grounded. Consequently, both the container shell and the PDC shell are reliably grounded. When leaving the factory, the phase sequence of the equipment has been established. Upon arrival at the site, the equipment only needs to match the phase sequence of the site substation.

The operation is as follows: connect L1, L2, L3, N, PE - the three-phase five lines of the substation - to the PDC, power the main switch of the main control cabinet, and observe whether the LCD screen displays a power fault alarm. If there is a power fault alarm, please adjust the phase sequence of the main control cabinet L1, L2, L3. If the LCD screen does not display any fault alarm, it can operate normally.

7.11 Power-on and power-off process

1) Note for first power-on

Once the entire system is connected, the equipment can be powered up for debugging. Prior to energization, it is essential to use a multimeter to check for short circuits between phases, between phases, between neutral and ground of the two power sources. If no short circuits are detected, it indicates that the system can be powered on normally. Should any of the aforementioned short circuits be present, the fault must be identified and resolved before powering on. After the front end of the system is energized (with the main control cabinet switch still open), the voltage at the front end should be verified to ensure it meets the equipment's power supply requirements.

The equipment's power supply requirements are: 400V ± 5%, 50/60Hz.

2) Sequence of power-on

When the system's front end is energized and the voltage meets the equipment's requirements, the system can then be charged. The steps are as follows:

Step 1: Open the door of the PLC main control cabinet, start by turning on QF 1, and then proceed to successively turn on all the switches in the main control cabinet. QF 2 through QF 11 are the 240 Vac power switches located within the PLC main control cabinet.

QF 10 and KM6 are the front-end protection switches that control the PLC system. Press the start button on the door panel to close the KM6 contactor, then sequentially open QF 12 to QF 20, and the touch screen and PLC will begin to operate.

When the main control cabinet door is closed and the system requires power, open all the micro circuit breakers and the two plastic shell circuit breakers inside the cabinet. Then, close the cabinet door, open QF 1 using the operating handle on the cabinet door, and observe the closing indication on the door panel (the red light), as illustrated in Figure 7-5.

An experienced electrician can operate the system via the touchscreen, set parameters, adjust thresholds, switch between operation modes (automatic or manual), and start or stop motors individually or automatically. Initially, the water cooling system can be activated to maintain the liquid supply temperature within the required range, subsequently fulfilling the criteria for powering up the mining machine server.

3) Power-on of the PDC

Once the main control cabinet is powered on, the liquid supply temperature is regulated to remain close to the target temperature, as per the control system's operational procedure. At this juncture, the switches in PDC A and B can be activated to commence powering the mining machine server.

Initially, switch on the main breakers of cabinets A and B, followed by the remaining switches. Subsequently, initiate the server startup in an orderly fashion, beginning with row A, then proceeding to the next row at 20-second intervals, and continuing in this manner..

4) Sequence of power-off

When the system requires a power-off for any reason, the first step is to disconnect the server power. This ensures that the water temperature remains consistent before and after the server is powered off, thereby protecting the server. During the server's power-off state, the water cooling system is halted via the touch screen. Consequently, the water temperature may slightly increase, yet this has no adverse effect on the system. Lastly, the total power supply to the main control cabinet and distribution cabinet is disconnected, ensuring the entire system is completely powered off.

In the event of a safe power outage, should a serious fault occur within the system, you can immediately press the emergency stop button located on the inner door of the container. This action will cause the main switch of the PDC and the main switch of the main control cabinet to trip instantly, placing the system in a complete power-off state, facilitating maintenance by professionals.

Only professional personnel should perform operations.

After resolving the issue,the emergency stop switch must be rotated clockwise, and the main switch of the distribution cabinet must be moved to the OFF position before being switched ON again.

5) Division of personnel authority

Responsibilities of general operation and maintenance personnel include: performing general power operations (turning off or combining switches), managing system startups and shutdowns (via touchscreen button operations), and conducting network cable detection and exchanges.

Professional electrician duties include general maintenance tasks such as disconnecting or merging switches, system startup and shutdown via touchscreen button operations, and network cable detection and replacement. In cases where equipment experiences a short circuit, phase loss, reverse phase, sensor malfunctions, or when switches do not respond and motors operate abnormally, professional electricians are required to perform these operations.



Figure 7-16 External drawing of the PLC control cabinet

6) Description of the switch function in the system

Table 7-2 Description of the switch function in the main control cabinet of the container water cooling

number	Symbol	origin	terminal point
1	QF1	L1,L2,L3	1L1,1L2,1L3 Line row
2	QF2	1L1,N	1L-1,NV1 Switching Mode Power Supply
3	QF3	1L2,N	L14.N14 Emergency power lamp
4	QF4	1L1,1L2,1L3	R,S,T frequency transformer
5	QF5	1L1,1L2,1L3	1L1-1,1L2-1,1L3-1 Heater power supply
6	QF6	1L1,N	X1,2 socket power
7	QF7	1L2,N	L11,N11 back up power
8	QF8	1L3,N	L12,N12 Replacement of the power supply 1 is reserved
9	QF9	1L1,N	L13,N13 Switch power supply 2 is reserved
10	QF10	1L3,N	1L10,N1 KM6
11	QF11	1L1,N	1L12,N2-1 Master control module NanoPi-R4S
12	QF12	DC+,DC-	DC24V-1,DC0V-1 Set the lighting
13	QF14	DC24,DC0V	DC24-3,DC0V-3 The DC power supply is 24V + PLC
14	QF15	DC24,DC0V	DC24-4,DC0V-4 Temperature and humidity instrument power supply
15	QF16	DC24,DC0V	DC24V-5,DC0V-5 Power supply of the electrical conductivity meter
16	QF17	DC24,DC0V	DC24V-6,DC0V-6 Valve valve power supply
17	QF18	DC24,DC0V	DC24V-7,DC0V-7 Flow meter power supply
18	QF19	DC24,DC0V	DC24V-8,DC0V-8 Bypass control valve power supply
19	QF20	DC24,DC0V	DC24-9,DC0V-9 PH instrument power supply
20	FU01~FU03	L1,L2,L3,N	HW1~3 Three-phase power supply instructions
21	FU04	1L1,N	HR1 Switch instructions
22	FU05	1L1,1L2,1L3,N	Ex9U9UE2E 20/M 4P Lightning protection device
23	VDF	R,S,T	U,V,W circulating pump

24	SQ1	KM1	U2,V2,W2 Supplemental pump
25	SQ2	KM2	U3,V3,W4 Container heat fan G4
26	SQ3	KM3	U4,V4,W4 Container-dispersing heat fan G5
27	SQ4	KM4	U5,V5,W5 Water curtain pump
28	KM5	1L1-1,1L2-1,1L3-1	U6,V6,W6 Heater power supply
29	KM6	1L11,N1-1	T1 filter
30	V1-3	T1	DC24V,DC0V direct-current main
31	K1~K6	PLC	KA1~KA20 auxiliary relay
32	CT1~3	1L1,1L2,1L3	PMM1 Multi-function instrument

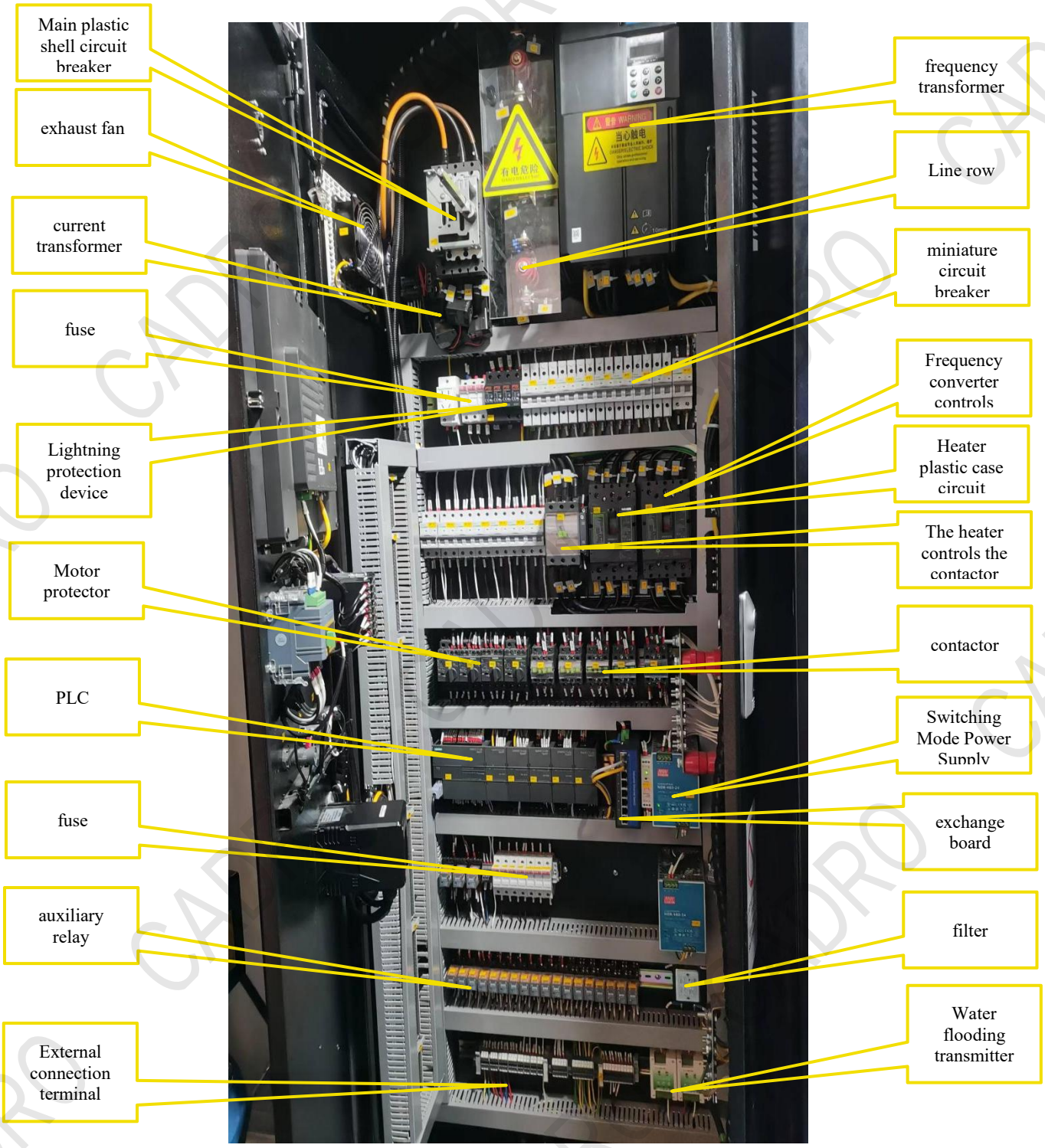


Figure 7-17 View of the components in the PLC cabinet

Table 7-3 Description of switch in frequency conversion fan cabinet

Number	Symbol	Origin	Terminal point
1	QF1	L1,L2,L3	L1,L2,L3 VDF frequency transformer
2	VDF1	L1,L2,L3	1U,1V,1W Branch terminal
3	VDF2	L1,L2,L3	2U,2V,2W Branch terminal
4	1U,1V,1W	Divided line terminal 1 to 3	SQ1~8 Motor protector
5	2U,2V,2W	Divided line terminal 4 to 6	SQ9~16 Motor protector
6	SQ1~8	1U,1V,1W	1-1~8U,1-1～8V,1-1～8W 1-1~1-8 fan
7	SQ9~16	2U,2V,2W	2-1~8U,2-1～8V,2-1～8W 2-1~2-8 fan
8	FU01~03	1L1,1L2,1L3	Ua,Ub,Uc Multi-function meter voltage input
9	FU04~06	L1,L2,L3	Ex9U9UE2E 20/M 4P Lightning protection device
10	CT1~3	L1,L2,L3	PMM2 Multi-function instrument

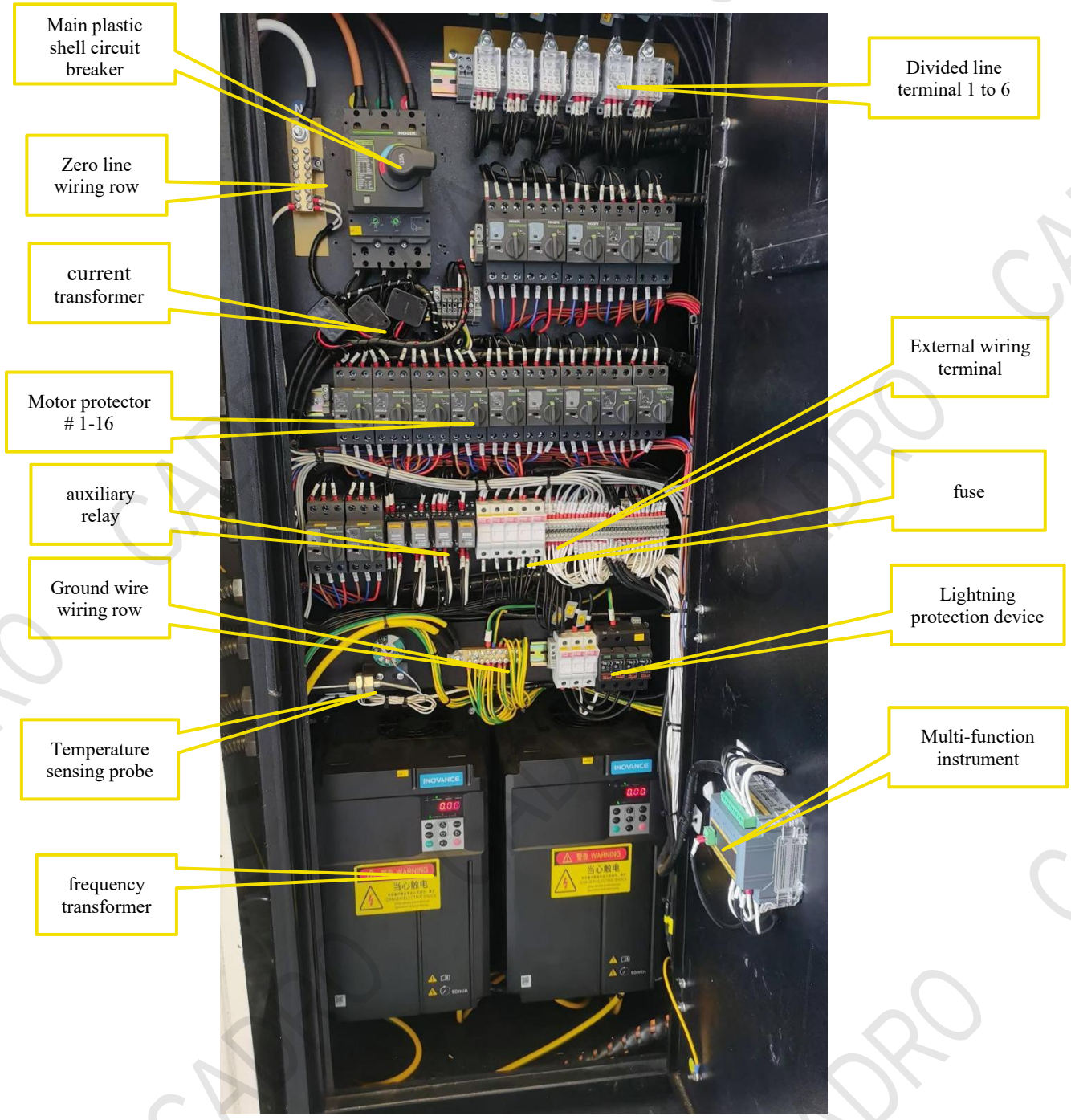


Figure 7-18 View of the components in the frequency conversion fan cabinet

7.12 Operation instructions of the touch screen

1) Switching between Chinese and English

After the system, the screen is shown in Figure 7-20, Main interface,Chinese ; Figure 7-21, Main picture,English .

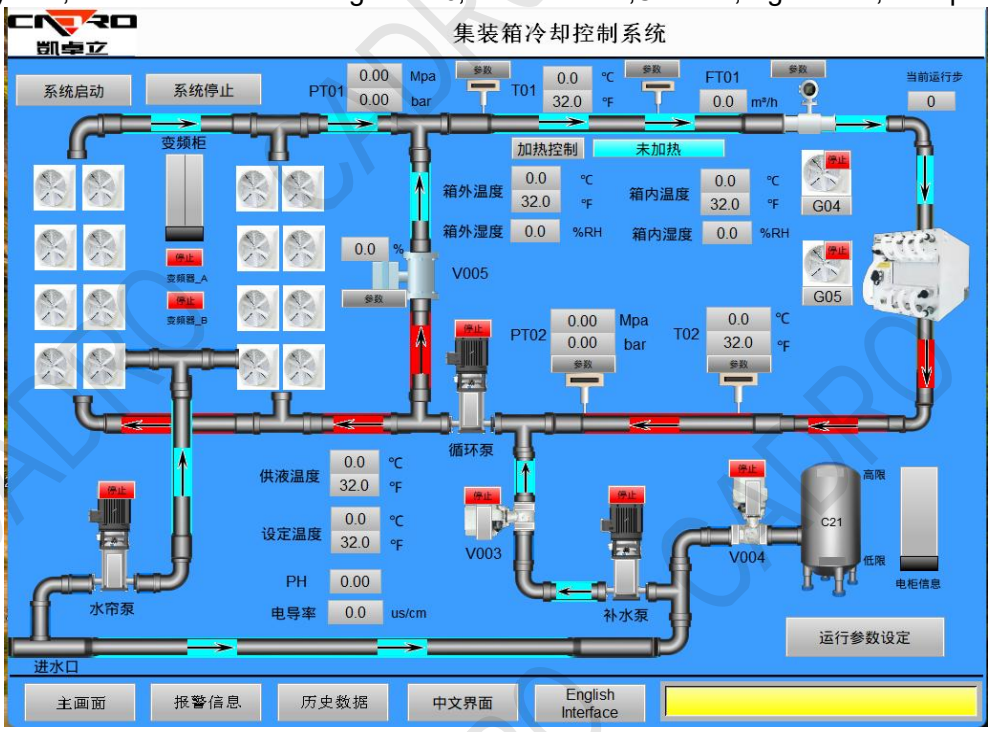


Figure 7-19 Main interface in Chinese

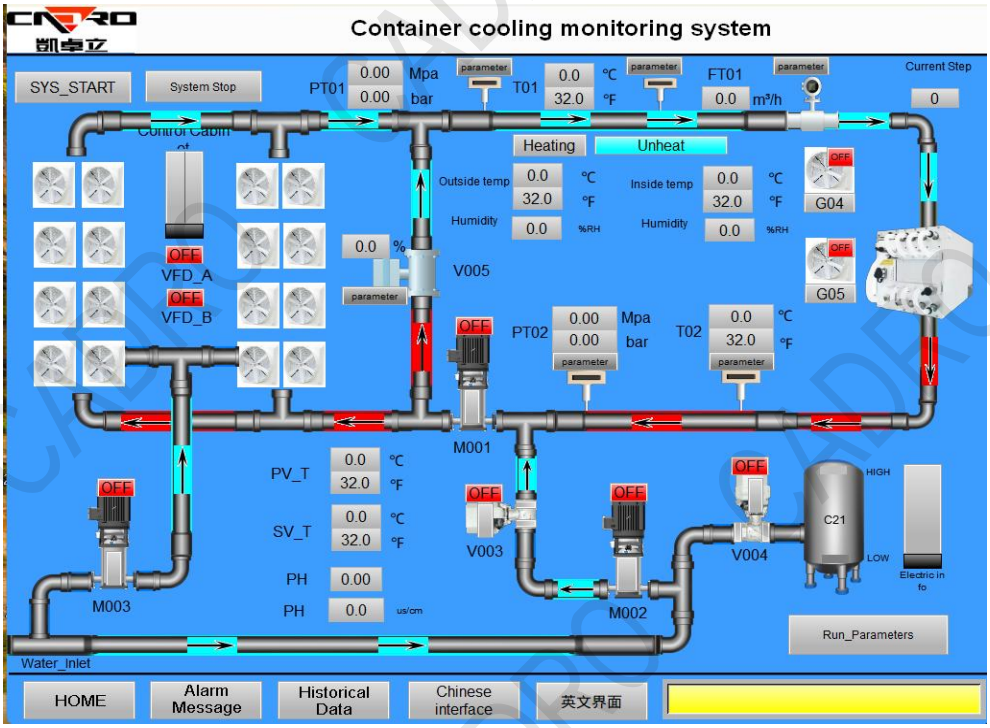


Figure 7-20, Main interface in English

2) Password input



Figure 7-21 Password input

Upon system startup, a password is required to operate the touch screen.(This password is owned by the operator, technician or manager, the original password: 666666).

3) Touch-screen password modification

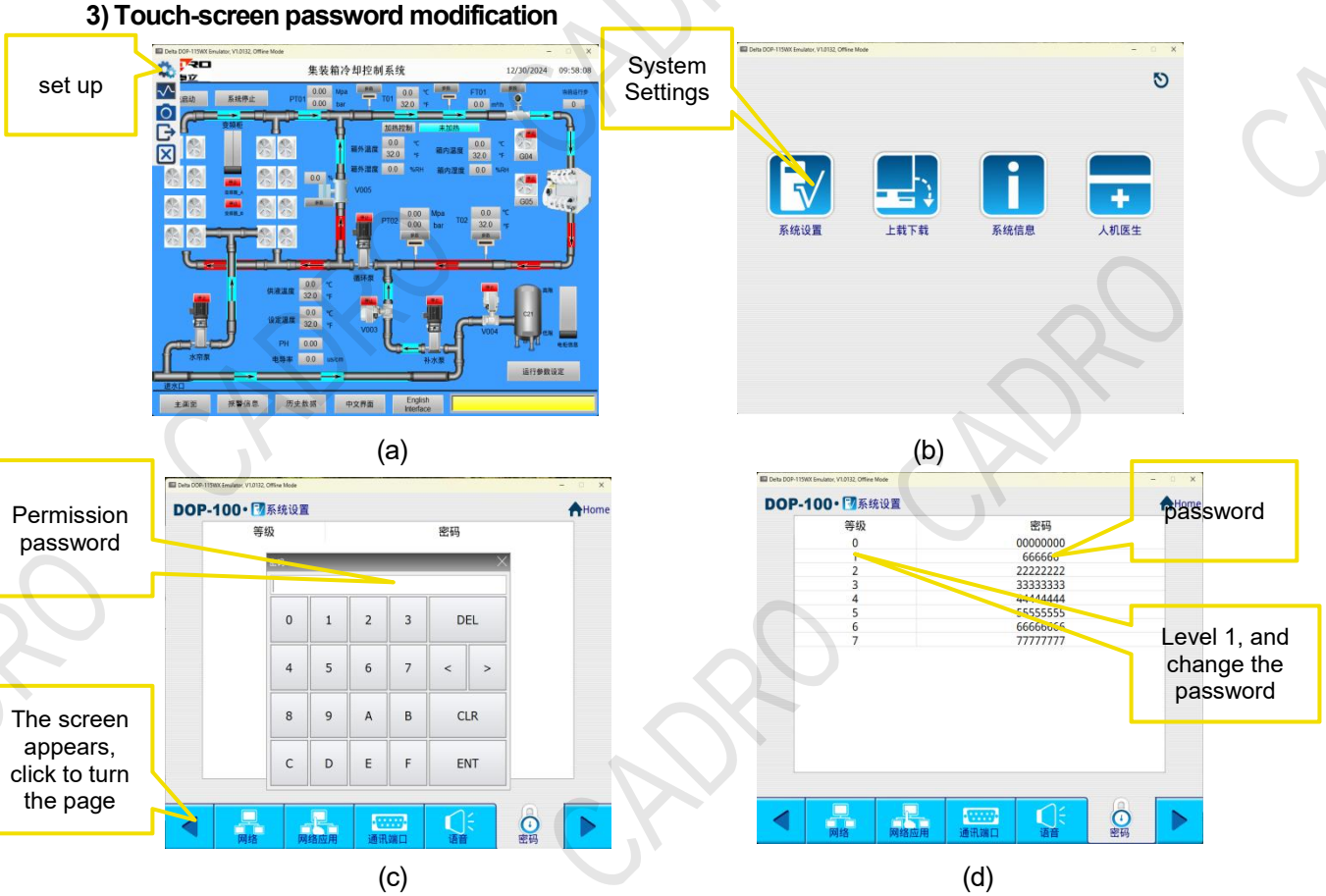


Figure 7-22 Password modification

There are several steps to modify the password for the touchscreen operation :

Step 1, enter the touch screen operation password, long press the screen to appear in Figure A, and click the first "Settings" in the upper left corner.

Step 2,Click "Settings" to appear in Figure b, and click System Settings.

Step 3,Enter the system Settings page, click right turn the page, find the password, click to modify permission password, enter the permission password (original permission password: 12345679).

Step 4,Enter the "change password" page, level 1 (touch screen operation page password), input the new password.

4) Main picture

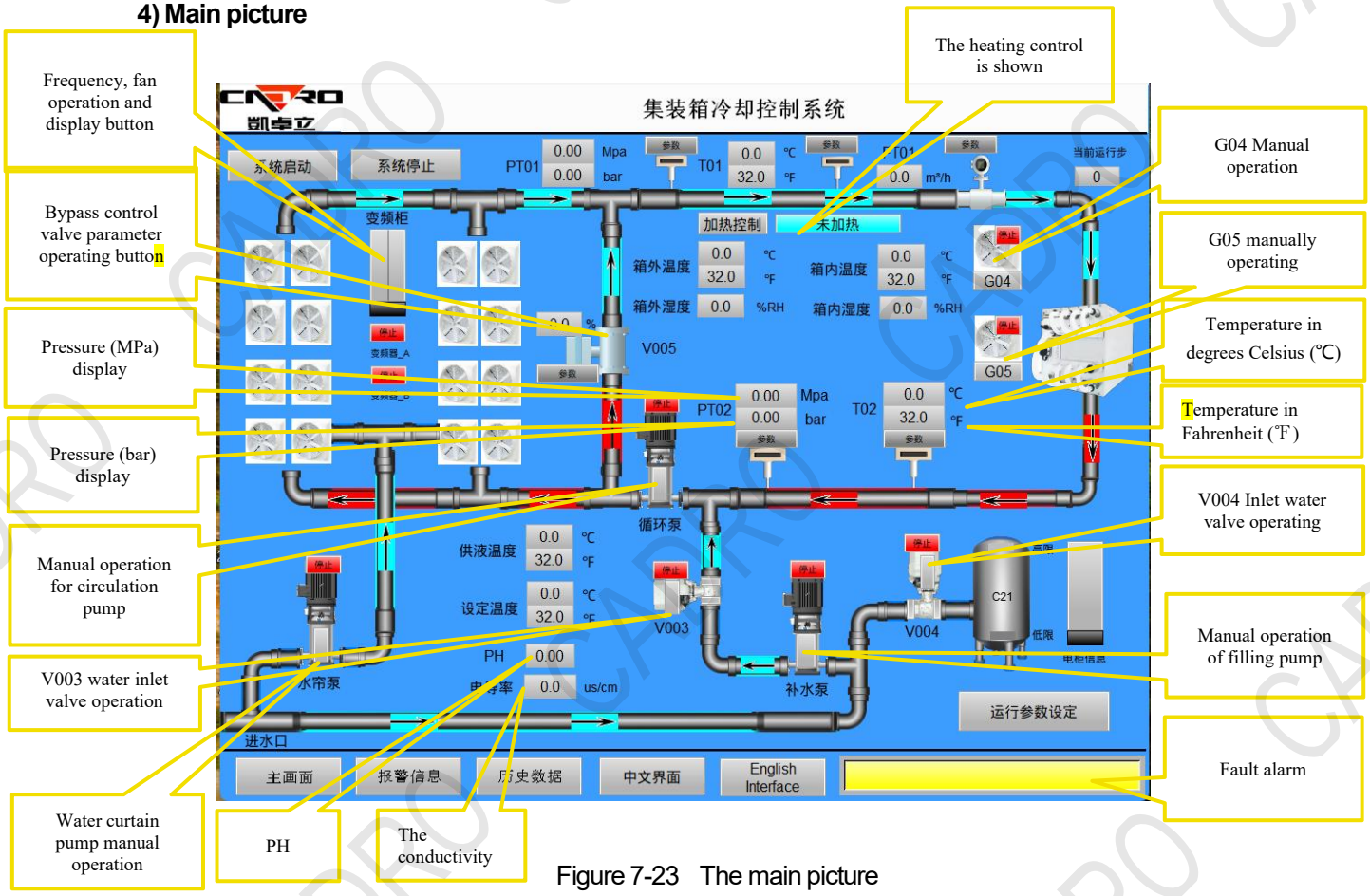


Figure 7-23 The main picture

In dry cooler mode, manual control is used for debugging, while automatic control is utilized for system operation.

Click the "English Interface" to enter the English display screen;

Click the "Operation Parameter Setting" to enter the operating parameter setting screen;

Click the "Instrument parameter" to enter the instrument parameter setting screen;

Click the "Alarm Information" to enter the fault alarm screen;

Click the "Historical Data" to enter the data information screen;

Click the "Frequency conversion Cabinet" to enter the manual operation screen of the fan frequency conversion cabinet;

Click the "Power Cabinet Information" to enter the power and parameter communication information screen.

The system includes pH monitoring and conductivity value monitoring, displaying the pH value of the current coolant (with the optimal pH range being 7.8-8.7) and the conductivity value, with data displayed consistently with the instrument's display.

When the system needs to run automatically, ensure that the internal pressure (PT 01 / PT 02) is higher than (0.08MPa,adjustable), and then set all parameters in the parameter setting screen. Then click "System Start" in the

home page, and the motor in the system will follow the automatic control logic sequence. When you need to close, click the “System Stop ”in the home page.

Before running the system, you need to set the operating parameters, mode selection, and then click the “system start”.(Parameter set reference in Figure 7-24,7-25,7-26.)

5) Operating parameter setting interface

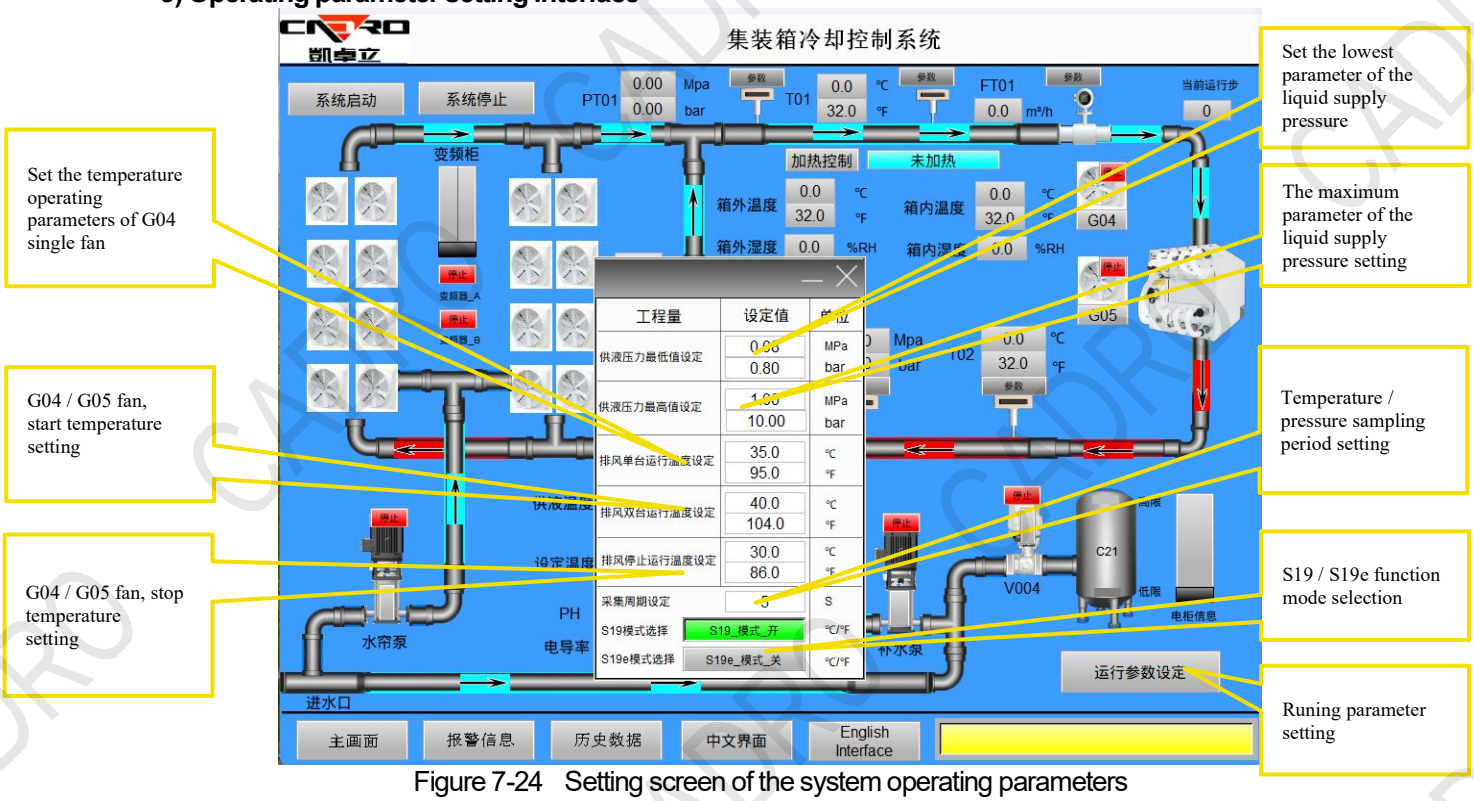


Figure 7-24 Setting screen of the system operating parameters

A. Click the "Run Parameter Setting" button to enter the running parameter setting page

Upon pressing the "system start" button, if the liquid supply pressure (PT 02) falls below the minimum threshold, the system will automatically open the "V004 water tank inlet valve and V003 water tank filling valve" to initiate the water filling process. Conversely, when the liquid supply pressure (PT 02) is not less than the minimum threshold, the filling pump will cease operation, and simultaneously, the V004 water tank inlet valve and the filling valve will close..

When the supply pressure exceeds the highest parameter, the system will trigger a fault alarm, necessitating manual intervention to unload pressure and protect the normal operation of the equipment.

The temperature and pressure sampling cycle parameters are set to be adjustable. The unit (S) can be set according to the user's needs. If the temperature and pressure need to be collected once every minute, the user can set the input (30S) system to perform a cycle of 30 seconds on and 30 seconds off, thereby reciprocating to collect temperature and pressure".

B. S 19 / S19e function mode selection

T1: minimum operating temperature of mining machine (℃/℉)

T2: the maximum operating temperature of the mining machine is (℃/℉)

S19_ Mode, 20-40 (℃ / ℉) (T1-T2)

S19e_ Mode(Include S21series) 20-50 (℃ / ℉) (T1-T2)

C. Air single / double operating temperature setting (adjustable)

The temperature in the container is set to 35℃ / 95 ℉ (adjustable). Once it rises to this temperature, the G04 exhaust fan begins operation. If the G04 starts running, the temperature must not drop below or rise above (40℃ / 104 ℉ adjustable). In this case, both G04 and G05 fans will operate simultaneously.

Based on the temperature change in the container, the system automatically starts or stops one or two fans, or alarms the high temperature .

6) Information interface of the frequency converter cabinet

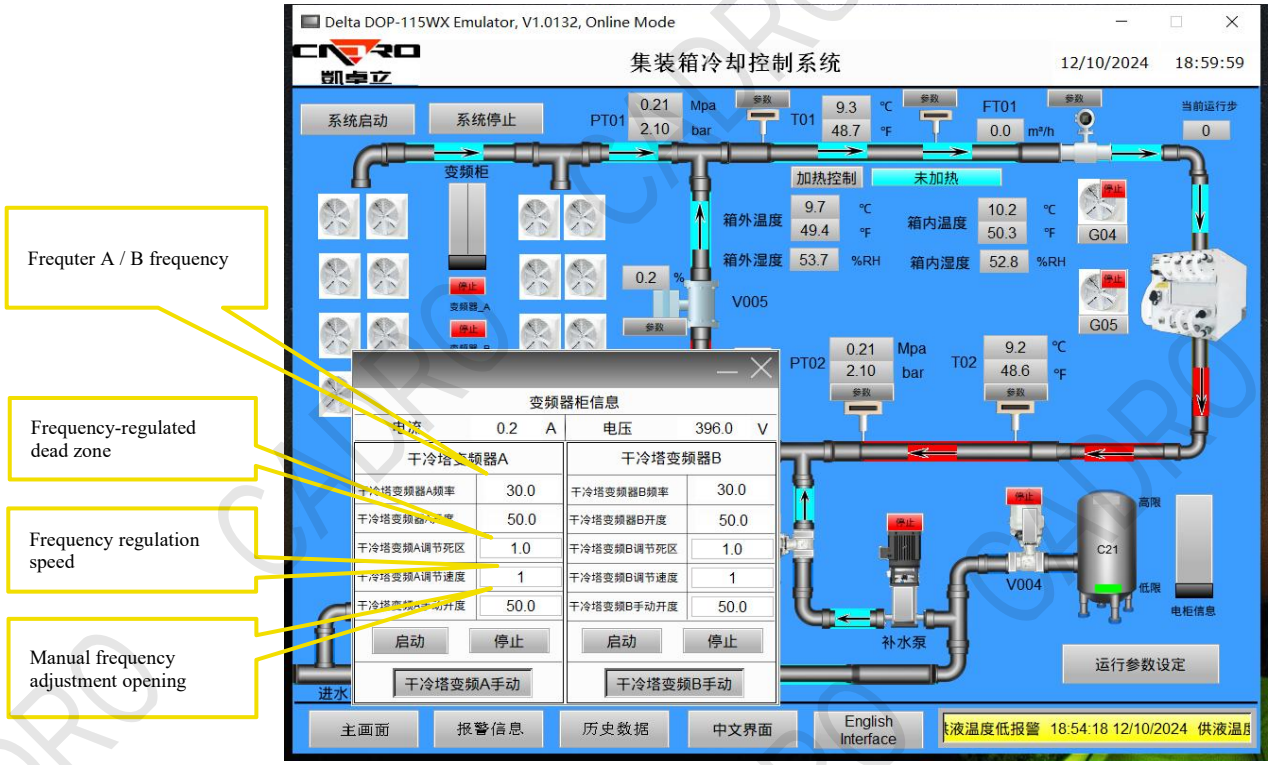


Figure 7-25 Parameter parameters of frequency conversion cabinet

Click the frequency conversion cabinet to enter the inverter A / B information page;

Set dead zone (default setting 1), frequency adjustment speed (default setting 1).

Manual frequency adjustment open input conversion to frequency: 60Hz*%= variable frequency

7) Instrument setting parameter page

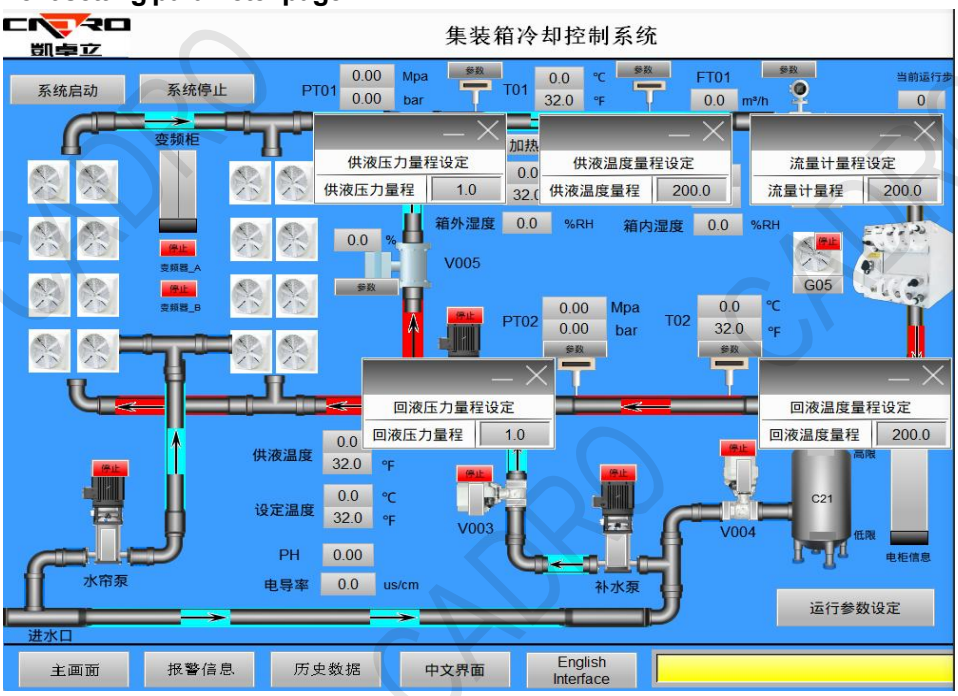


Figure 7-26 Instrument setting parameter page

Details of the instrument range parameter setting: refer to the transmitter range setting.

8) Alarm information page



Figure 7-27 Alarm display screen

Upon the occurrence of a fault, the yellow alarm bar illuminates and initiates a rolling prompt. The fault table subsequently appears on the alarm display screen. At this juncture, the cause of the fault is analyzed, after which the fault is cleared. The alarm information page then indicates the function recovery time, and ultimately, the system is restarted.

9) Historical data logs page

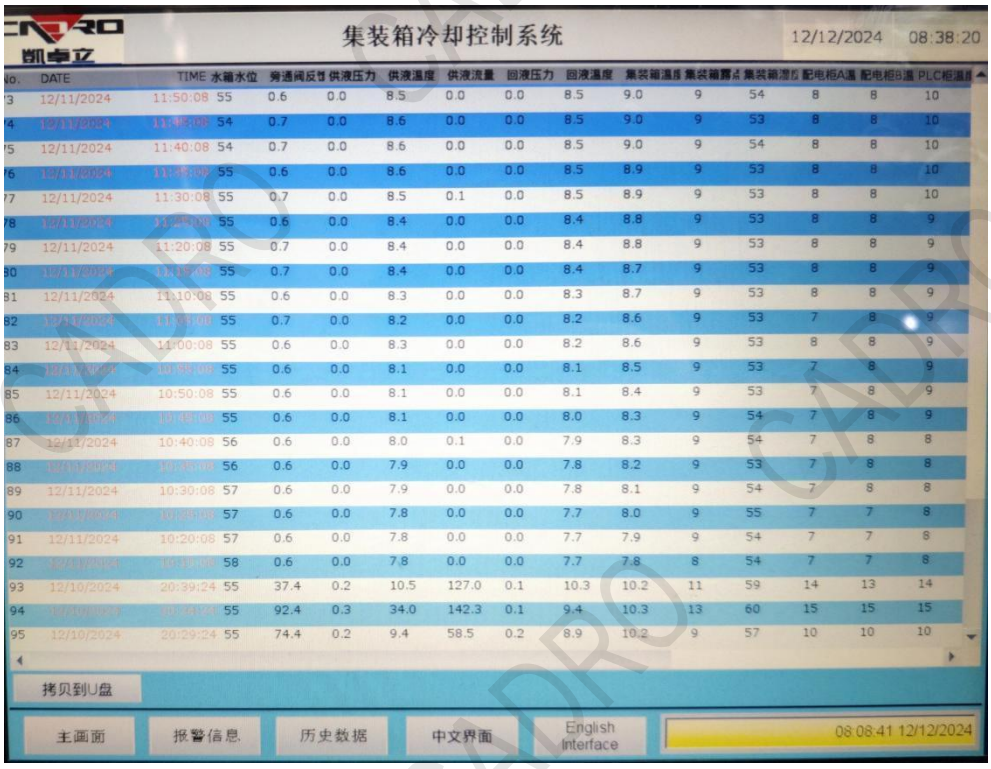


Figure 7-28 Table diagram of equipment history data logs

The page displays information including supply temperature, return temperature, supply pressure, return pressure, and supply flow. The data in the table can be downloaded and copied using a USB flash drive with a capacity of up to 32GB.

10) Page of the electric cabinet information

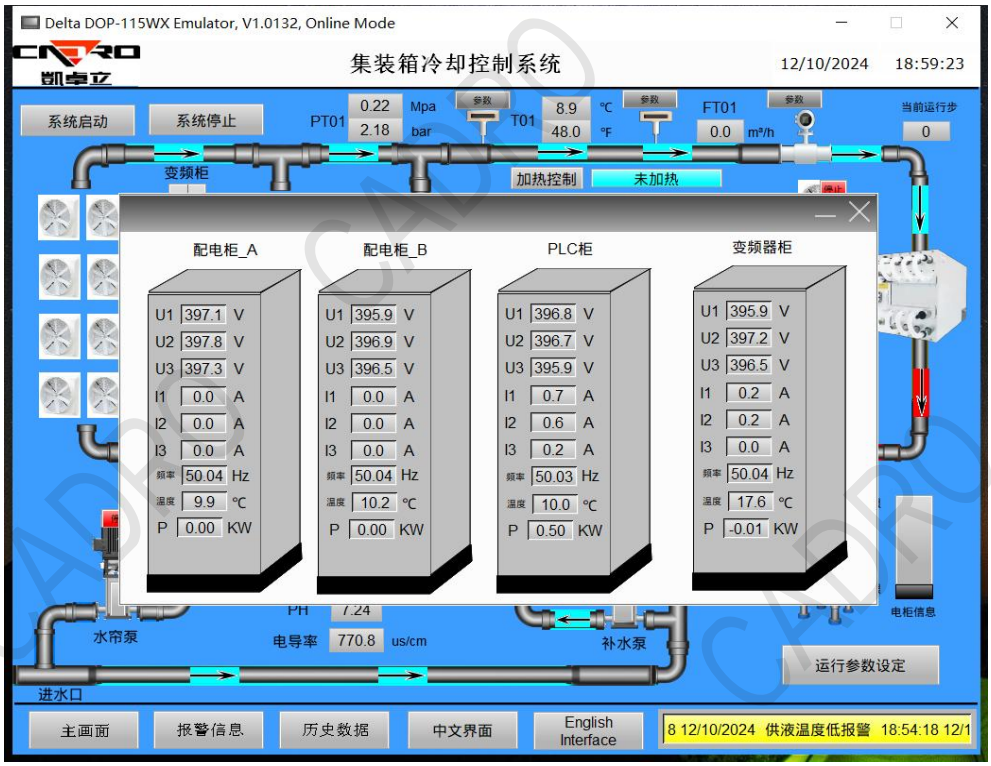


Figure 7-29 Information interface of the electric cabinet

The page displays the ambient temperature, power, three-phase voltage values, and frequency in the PDCs A and B, the PLC cabinet, and the frequency converter cabinet. The data is presented in floating-point format.

11) Use of the heater

The system has a special heater loop involved in the control, with a total power of 25kW and 5 heaters of 5kW with rated power. The heater is used as follows:

Initially, the heater is integrated into the system's automatic heating loop, enabling it to partake in the system's temperature regulation. When the system operates in automatic mode, it continuously monitors the liquid supply temperature, ensuring it reaches the preset value for normal operation. A sensor is tasked with real-time monitoring of the supply temperature within the pipeline and relays this data to the control system. The temperature controller governs the heater, which ceases operation once the supply temperature hits the predetermined upper limit, thus preventing overheating. Concurrently, the system maintains ongoing temperature surveillance. Should the supply temperature dip below the minimum set threshold, the heater reactivates to sustain the stability of the coolant temperature within the pipeline.

Secondly, the system's automatic heating loop is not connected to the heater. When the liquid supply temperature exceeds the minimum set temperature, the system functions in automatic mode. Should the supply temperature drop below the minimum set temperature, the system is designed to automatically activate the heater for warming purposes. However, due to the disconnection of the heater, no actual heating occurs, potentially preventing the supply temperature from reaching the minimum set temperature. Consequently, the touchscreen will continuously indicate heating, and the automatic process will remain stagnant. If the supply temperature stays below the minimum set temperature, the system will prompt an alert to install the heater promptly, without affecting the operational server. In the absence of any interruptions, the system allows for manual operation by clicking on the circulation pump and frequency converter cabinet, enabling the switch from automatic to manual mode. This permits manual adjustment of the operating frequency, ensuring the system's normal cyclical operation. Once the temperature stabilizes, the system can revert to automatic mode.

Thirdly, the mining machine accesses the heater through the power supply port.

This is a temporary measure; the heater does not participate in automatic control. It must be manually turned on or off, with reference to the second case above, manual adjustment is required. The system operates in either manual or automatic mode.

7.13 Summary of site installation

1) Summary of on-site installation

Upon arrival at the site, the sequential installation work as detailed in Table 7-1 . Afterward, the control mode can be switched to "automatic," and upon clicking "System Start," the system will begin to run automatically.

Table 7-4 Summary of the field installation steps

	Step content	remarks
1	Positioning and hoisting	The whole container is smoothly lifted and positioned on the basis. Remove all sealing plates, install the external temperature and humidity sensor of the box, and install the water cover and the cable inlet
2	Container power distribution work	Reasonable wiring, standard wiring, torque calibration, power-on inspection
3	Container suppression operation	air 7bar / 3h, air+hydro at 7bar / 30min ,no leakage
4	Container liquid operation	Preparation-system replenishment-water tank replenishment-regular replenishment

2) On-site installation and inspection

After installation, the project should be inspected in accordance with Table 7-1. Ensure that it is fully qualified.

Table 7-5 Installation Completion Checklist

Inspection item	Scope of examination	Confirm options
container	Container installation meets the installation requirements without inclination. The container is placed on horizontal hard ground with room for installation and maintenance. The sundries inside the container (such as tie strap and thread head) have been cleared.	□ has been confirmed
fans	The fan is installed correctly according to the component function.	□ has been confirmed
Closure parts	The internal and external blocking structural parts and fixed parts of the container have been removed, and there is no debris inside.	□ has been confirmed
rain cover	The rain cover is installed right above the inlet port.	□ has been confirmed
Internal pipeline connection	The filling orifice clamp and pipe clamp are fixed reliably. No loose fixed connection of circulation system line. The pipeline pressure drop meets the requirements.	□ has been confirmed
Circuit connection	The dry cooler fan wiring casing is intact and not loose. The incoming line of the whole machine is connected to the PDC through the lower inlet port of the rain hood.	□ has been confirmed
Electrical inspection	The power supply voltage is within the rated voltage range on the equipment nameplate. No damage to the cable. There is no open circuit, short circuit and wrong connection of the system. Make sure that all the cables of the upper and lower electric control boxes are connected. Check whether the rating value of the external main power supply switch is correct according to the current value. All cables and circuit joints have been fastened, and the fastening screws are not loose.	□ has been confirmed

8 General faults and Troubleshooting

8.1 Container fault and troubleshooting

Refer to Table 8-1 for common equipment faults and their troubleshooting methods..

Table 8-1 List of common equipment faults and troubleshooting methods

Type	Cause	Solution	Remarks
The power supply indicates the failure	1. The three-phase power indicator light is not on or one of them is not on.	1. Close the upper plastic case switch (in the cabinet A and B), and then close the main plastic shell switch (QF 1) (in the main control cabinet), to ensure that the main control cabinet is not charged, check (FU 01 ~ 03 fuse), whether the line joint is loose, check whether the molten core is intact.	Warning: Be sure to close the plastic case switch (in the cabinet A and B) before operating.
Low level alarm	The water tank level of the container is low	Fill the water tank in the container.	
Cycle pump failure	Water pump idling, under pressure (low return pressure) lead to the circulation pump overcurrent	1: Close the air in the main control cabinet on (QF 1) first. 2. First, close the plastic case switch (QF 4) in the main control cabinet, and reset the frequency converter (corresponding number VDF) in the main control cabinet. 3. Check whether the operating parameters of the system are normal (the pressure and flow will be reported first), and check the problem according to the alarm. 4. After troubleshooting, the fault scroll bar in the main interface (lower right corner) disappears automatically. 5. Turn on the circulation pump after a 2-3min interval.	Warning: The circulating pump is prohibited when the system is powered up and there is no liquid in the pipeline.
G4 / G5 exhaust fan fault	If the current of the exhaust fan is too large, the strip may be sandwiched in the fan blade to hinder the operation of the fan	1. Check whether there is debris in the fan blade and remove the debris first; if there is no debris and no fan fault, contact the manufacturer. 2. Then reset the motor protector in the main control cabinet (SQ 2 for G4 row fan; SQ 3 for G5 row fan) (manually rotate the knob of the motor protector to the vertical position, that is, close). 4. After troubleshooting, the fault scroll bar displayed in the reference interface (lower right corner) will automatically disappear. 5. Turn on the exhaust fan after a 2-3min interval.	
1-1 / 1-8,2-1 / 2-8 fan fault	If the fan current is too large, the fan blade may contain the strip and hinder the operation of the fan	1. Close the plastic case switch (QF 1) in the control cabinet of the variable frequency fan first. 2. Check whether there is debris in the fan blade and clear up the debris first; if there is no debris and no fan fault, contact the manufacturer. 3. Then the motor protector (corresponding to SQ 1-SQ 16) in the frequency conversion fan control cabinet is reset operation (manually rotate the knob of the motor protector to the vertical position, that is, close). 4. After troubleshooting, the fault scroll bar displayed in the reference interface (lower right corner) will automatically disappear. 5. Turn on the exhaust fan after a 2-3min interval.	
filling pump fault	1. Overload caused by dirty plugging of	1. Wash the Y-type or replace the filter screen. 2. Reset the motor protector (corresponding	After the system is powered on, the

	Y-fill filter	number SQ 1) in the main control cabinet (manually turn the knob of the motor protector to the vertical position, that is, close it). 4. After troubleshooting, the fault scroll bar displayed in the reference interface (lower right corner) will automatically disappear. 5. Turn on the rehydration pump after a 2-3min interval.	liquid filling pump can not be idle when there is no liquid in the system
	2. The low position of the suction port of the filling pump leads to overload	1. Turn off the air switch (QF 1) in the main control cabinet first. 2. Reset the motor protector (corresponding number SQ 1) in the main control cabinet (manually turn the knob of the motor protector to the vertical position, that is, close it). 3. Make the external water suction port lower than the coolant bucket. 4. After troubleshooting, the fault scroll bar displayed in the reference interface (lower right corner) will automatically disappear. 5. Turn on the rehydration pump after a 2-3min interval.	After the system is powered on, the fluid replenishment pump cannot be idle if there is no liquid in the system
Fluid leakage alarm	The inlet and outlet port of the high computing server leaks liquid into the floor, soaking the leakage sensor	1. Find the liquid parts of the floor. 2. Above this part, carefully look for whether there is an outlet of the high computing server. 3. After finding the leakage part, take the treatment by changing the quick insertion and bellows, and then clean up the leakage site, and dry the leakage monitoring belt.	
High temperature alarm	1. The cooling fans is not operating	Check whether the fan is running normally, and check whether the power supply circuit of the fan is normal	
	2. Temperature sensor damage	Replace the temperature sensor; the high supply temperature alarm value can be set in the screen as required.	
High temperature report	After the alarm of high supply temperature, the operation and maintenance personnel did not handle it in time, resulting in the continuous increase of the supply temperature	1. Before investigating the cause, consider reducing the load by turning down some high-computing power servers, and then identify the reason for the high supply temperature alarm. 2. The alarm threshold for the high liquid supply temperature can be adjusted on the screen as needed.	
High pressure of liquid supply alarm	1. Filter is blocked	Clean the filter element	
	2. The supply and return fluid valve is faulty or not fully opened	Open the supply and return fluid valve	
	3. Pressure sensor fault	Replace the pressure sensor	
Return hydraulic too low	1. Lack of liquid in water tank	Fill the tank with liquid	
	2. Refill pump failure	Check the cause of the rehydration pump failure	

	3. Pressure sensor fault	Replace the pressure sensor	
	4. Fluid leakage	Check the system leakage point	
Supply liquid flow rate too samall	1. The supply and return fluid valve is faulty or not fully opened	Open the supply and return fluid valve	
	2. Filter is dirty and blocked	Clean the filter element	
	3. Flow sensor fault	Replace the flow rate sensor	
	4. Fluid leakage	Check the system leakage point	
Pressure fluctuations	1. There is an air present in the system	Please let the on-site operation and maintenance personnel open the exhaust valve for exhaust gas	
	2. Lack of liquid in the system	If the return fluid pressure is lower than the set value, the rehydration pump will automatically replenish the system	
	3. The sensor is damaged	Replace the sensor	
No pressure show	1. The sensor is damaged	Replace the sensor	
	2. The cable is loose	Check and tighten the wiring loop of the pressure sensor in place	
	3. The PLC acquisition channel damage	Replace the module of the PLC corresponding sensor	
Pumpwith insufficient flow rate	1. The water pump suction port has air	Open the exhaust port above the suction port of the pump with a wrench, wait until the uniform liquid flows out, repeat 2-3 times (refer to the operation and maintenance manual for specific operation)	
	2. Filter is blocked	Clean the filter element	
	3. System fluid deficiency (low return fluid pressure)	System rehydration	

8.2 General fault and troubleshooting of dry cooler

1) Failure analysis and handling

Common fault phenomena and analysis and treatment methods of products are shown in Table 8-2.

Table 8-2 Failure analysis and handling of dry cooler

Fault phenomenon	Probable cause	Check or repair
The fan cannot start	The device is not powered on	Check the power supply
	The switch for controlling the power supply is already open	Find the short circuit and reset the open circuit switch
	Fan overload	Check the system and the wiring
	The fan itself is damaged	Replace the fan
No cooling or poor cooling effect	Heat exchanger fin is dirty and blocked	Clean the heat exchanger.
	System traffic is insufficient	Clean the filter.

2) Anti-freezing maintenance in winter

Dry cooler needs to pay attention to special maintenance at low temperature in winter.

A) At an ambient temperature of 5℃, if the circulation system lacks antifreeze and is not operating, the drainage valve at the bottom of the collecting pipe at the end of the dry cooler must be manually opened to drain the water from the heat exchanger. This action is necessary to prevent freezing and cracking of the heat exchanger and pipeline. Additionally, the cooling system must be treated with antifreeze to ensure the cooling medium does not freeze.

B) If it is necessary to move the entire machine from a high-temperature area to a low-temperature one, the drain valve at the bottom of the collecting pipe at the end of the dry cooler must be manually opened to drain the liquid from the unit. Otherwise, the heat exchanger and pipeline risk freezing and cracking damage.

3) Replace the fans

The replacement of fans must be performed by qualified professional and technical personnel. The operation steps are as follows:

A) Turn off the main power supply.

B) Open the junction box at the top of the fan and remove the power input line.

C) Remove the fastening bolts on the fan mounting plate.

D) Maintain or replace the fan and mounting plate.

E) After the maintenance is completed, reinstall the fan. The tightening torque should be 13N · m.

F) Connect the power input line of the original fan to the junction box at the top of the new fan. The tightening torque for the junction box is 2.6N · m, and for the wave pipe, it is 4N · m.

G) Power on again and check if the fan rotation is normal.

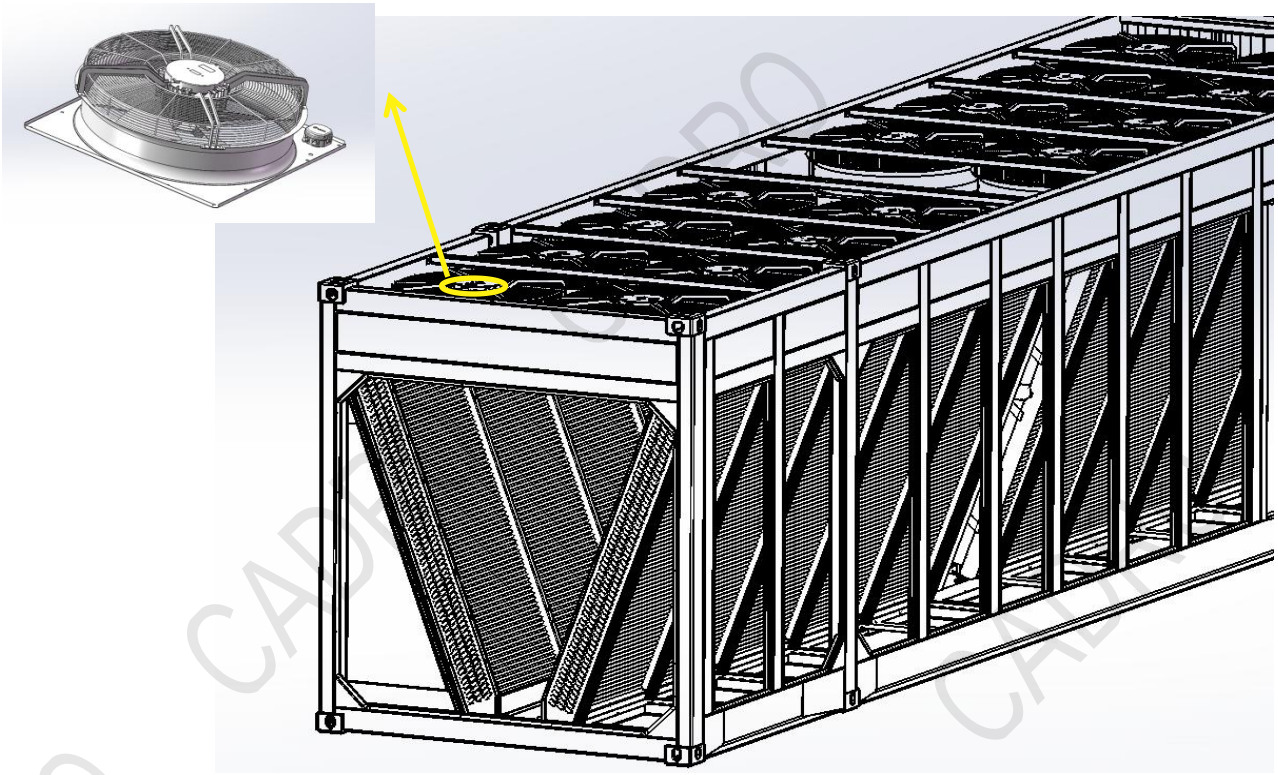


Figure 8-1 Replacement diagram of dry cooler fan

4) Replace the automatic exhaust valve

The steps for replacing the automatic exhaust valve are as follows:

A) Close the repair ball valve located at the front end of the automatic exhaust valve.

B) Using the appropriate maintenance or replacement tool, unscrew the automatic exhaust valve. Ensure that the valve is threaded and sealed properly.

C) After maintenance, reinstall the automatic exhaust valve by reversing the previous steps. The required torque for the exhaust valve is 4N · m.

D) Restart the equipment and verify that the exhaust valve operates normally. If leakage occurs, reinstall the valve until it is completely sealed.

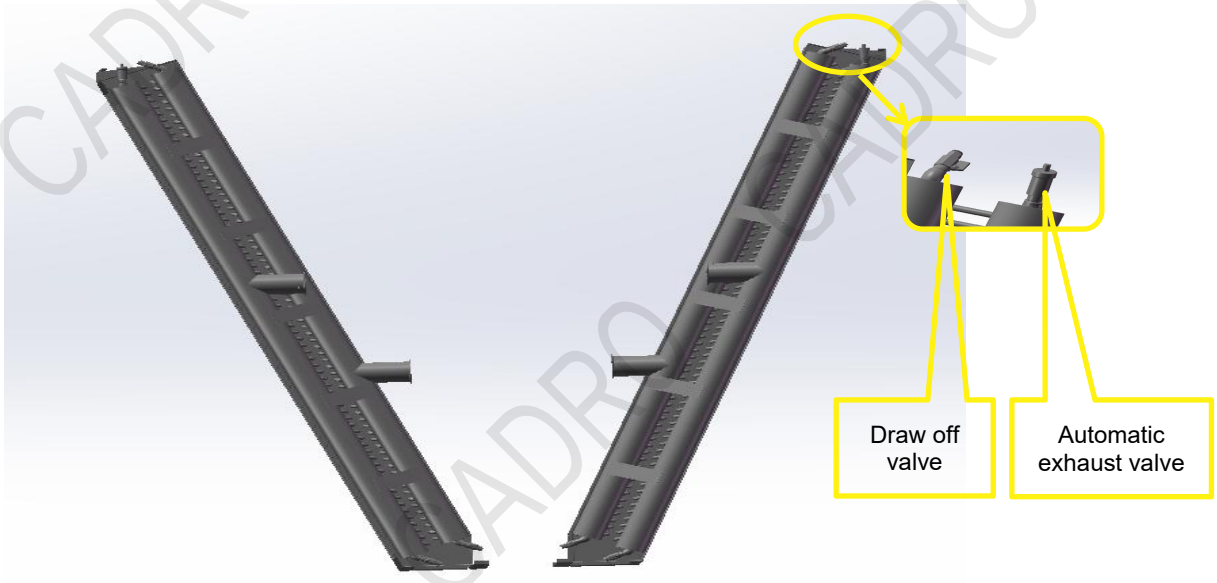


Figure 8-4 Schematic diagram of automatic exhaust valve replacement

9 Maintenance and maintenance of container

9.1 Overview

Preventive maintenance is carried out at predetermined intervals or in accordance with established guidelines to minimize the likelihood of product failure or to prevent functional degradation. It primarily involves adjustments, regular inspections, and necessary repairs. By ensuring that equipment is well-maintained and operators are familiar with the product's performance, structural principles, usage methods, and attentions, the equipment can fulfill its intended function.

Proper maintenance is essential to ensure that equipment remains in optimal working condition.

9.2 Preventive maintenance

1) Operators' monitoring

The operators shall monitor the status of the equipment in order to detect potential faults.

Once the operator found the system fault alarm, should quickly confirm, check, find the cause of the fault.

2) Use inspection

During normal operation, the operator should perform regular inspections as scheduled to ensure the equipment functions as specified.

A) Verify that the supply and return fluid lines, as well as the power lines, are in good condition.

Inspection requirements: Ensure there is no leakage in the pipeline or connections, and that cables are undamaged;

Inspection method: Visual inspections.

B) Verify if the supply pressure is low and ensure the fluid is replenished promptly.

Inspection requirements: The return fluid pressure should exceed 1 bar (as indicated on the main interface of the touchscreen or the pressure gauge). If the pressure falls below this threshold, fluid replenishment is necessary;

Inspection method: Visual inspections and data comparison.

C) Inspect the liquid supply system and document the temperature, pressure, and other relevant data every twelve hours.

Inspection requirements: Record the supply and return temperatures, supply and return pressures, and supply flow data. Observe the stability of these data during prolonged operation;

Inspection method: Visual inspections and data comparison.

D) Check the fault alarm situation of the system, such as: temperature, pressure, flow, etc. (the above fault status is displayed in the "fault alarm screen" in the touch screen), and record it once a day.

Inspection requirements: check the alarm points of the system, and refer to the instructions for troubleshooting;

Inspection method: visual, as required.

E) Upon verifying the normal operation of the container, the reliability of the cable connections in the distribution cabinet A&B , PDU,main control cabinet, fan control cabinet and fan junction box must be inspected following the initial operation or migration. Subsequently, these connections should be tested semi-annually during normal operation.

Inspection requirements: Ensure that the cable lap points are securely fastened and that there is no abnormal temperature rise;

Inspection method: Visual inspection , use a hand-held infrared thermometer to check for abnormal junction temperatures. If the displayed temperature exceeds 70℃ or is 30℃ higher than the ambient temperature, it is necessary to inspect and re-tighten the connection point.

9.3 Regular Container Inspection

1) Maintenance of the filter

The system has set two filters for internal circulation. These filters should be cleaned or replaced after the system has been running for a certain period. The corresponding cleaning or replacement intervals are as follows:

The main filter ,which in the circulation pipeline, should be cleaned or replaced once a month, or as required;

The filling filter ,which in the pump filling system, should be cleaned or replaced once every six months, or as required.

Cleaning method : after washing with clean water, allow it to dry.

The main filter's clean or replacement steps are as follows:

A) Open the manual valve V008 and close the manual valve V009, V010. Allow the coolant to flow through the bypass;

B) After finding the filter, open the manual exhaust valve and the drain valve, remove the clamp connection, and take out the pipe filter element from the handle;

C) Remove the filter inside , clean or replace;

D) Reinstall the cleaned filter, tighten the clamp with the wrench and close the manual exhaust valve and the drain valve; open V009 and V010 , close V008,allow coolant to pass through the main filter.



Main filter

2) Maintenance of the pipeline

The pipe network should be inspected for leaks every six months to prevent leakage. If any serious leaks are discovered, immediate action must be taken to halt them and proceed with maintenance. Maintenance should

begin by shutting down the user-end load devices, followed by stopping the equipment for repair. Concurrently, monitor the system after leak detection.

3) Maintenance of electrical components

Inspect and maintain the wiring terminals and securing screws on the electrical components within the main control cabinet of the fan cabinet every six months to prevent their loosening. This ensures proper contact and avoids damage to the components, maintaining the normal operation of the equipment and, consequently, the entire container water cooling system.

4) Systematic sewage discharge

After the operation of the system for 6~12 months, there may be some sundries in the system pipeline, so the coolant of the system should be discharged and replaced in time.

A)Locate the drain ball valve location (see Figure 9-1);

B) Connect the drain hose to the drain ball valve, tighten the throat band; direct the hose to the equipment and open the V403 valve (Figure 9-1) to drain the coolant.

Open other drain valves located in dry cooling and circulation pipes to speed up drainage.

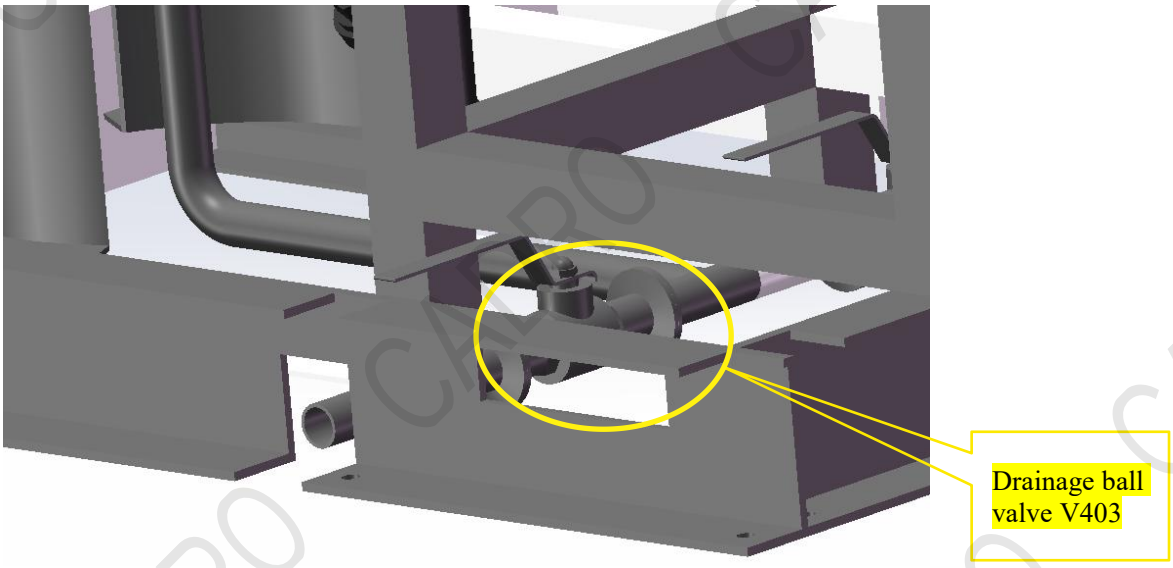


Figure 9-1 Location of liquid drain ball valve in pump station

5) Water tank liquid level check

The system monitors the water tank's liquid level within the container (refer to Figure 5-5). When the water tank's liquid level falls below the required threshold, the touchscreen alerts with an alarm to indicate the low level and initiates the process of replenishing the water tank's liquid level. Nonetheless, the tank should be inspected regularly once a week, except during winter when the dry-cooling mode is utilized; in such cases, the internal water of the dry cooler must be drained.

6) Maintenance of the coolant

A) Keeping the coolant in good condition is very important for the proper operation of the water cooling system, and it is recommended to follow up and record it regularly. In addition to online monitoring, sampling monitoring should be carried out at least once every 3 months;

B) During coolant procurement, relevant parameters in Table 9-1, and fluid rehydration and replacement shall be considered as appropriate;

C) Attention should be paid to the pH value of the coolant; it is not recommended when the pH value is lower than 7. The detection methods are shown in Table 9-1.

D) Regularly check the coolant for its freezing point, ethylene glycol ratio, total hardness, and so forth; in the later stages, monitor for increases in the content of elements such as Al, Fe, Cu, indicating potential contact corrosion; the detection methods are shown in Table 9-1;

E) It is recommended to add corrosion inhibitor to maintain antifreeze according to the requirements of the supplier.

Table 9-1

Items	Metric		Method
Color	specified color		visualization
Character	No peculiar smell, no precipitation, no suspended matter		visualization
Freezing point	<Local minimum freezing point temperature		
Boiling point	108℃ (low-temperature type)		
PH	7.8-8.7		
Reserve alkalinity	4ml (organic formula) 9ml (including inorganic formula)		
Total hardness	<120 mg/l		
Main element content	B	<20mg/kg	
	Si	<20mg/kg	
	P	<20mg/kg	
	Mo	<20mg/kg	
	Ca	<20mg/kg	
	Al3+	<50mg/L	
	Fe2+	<50mg/L	
	Cu2+	<50mg/L	

Table 9-2 Control table of ethylene glycol freezing concentration and freezing point

Glycol concentration		Freezing point ℃
Mass concentration %	Volume concentration %	
0	0.0	0.0
5	4.4	-1.4
10	8.9	-3.2
15	13.6	-5.4
20	18.1	-7.8
25	22.9	-10.7
30	27.7	-14.1
35	32.6	-17.9

40	37.5	-22.3
45	42.5	-27.5
50	47.6	-33.8
55	52.7	-41.1
60	57.8	-48.3

Table 9-3 Recommended criteria for deionized water

Metric	Deionized water	Reference standard	Explain
PH price	8.5-9.5	Intel 632983	
sulfide	<1 ppm	TC9.9/Intel 632983	
sulfate	<10 ppm	TC9.9/Intel 632983	
chlorid	<5 ppm	TC9.9/Intel 632983	
Bacterial groups	<100 CFUs/ml	TC9.9/Intel 632983	
Total Hardness (as CaCO3)	<20 ppm	TC9.9/Intel 632983	
conductivity	<20 us/cm (Reference value, not mandatory)	TC9.9	High conductivity is not necessarily unacceptable, such as 1000us / cm, because both corrosion inhibitors and fungicides can lead to water conductivity increases, and it is necessary to understand the reasons behind the sharp increase in conductivity trends during loop operation.
Residues after evaporation	50 ppm	TC9.9/Intel 632983	
turbidity	<20 NTU	TC9.9/Intel 632983	
iron content	0.1 ppm	occupation standard	
Copper content	10 ppm	occupation standard	
Carbon steel corrosion rate	3mpy(0.075mm/a)	GB/T 50050-2017	
Copper or stainless steel corrosion rate	0.2mpy (0.005mm/a)	GB/T 50050-2017	

7) Pump maintenance

Instructions for maintaining pump motor bearings: To preserve the original performance of the rolling bearings, it is essential to inspect and maintain the bearings at the specified intervals to prevent malfunctions, ensure

reliable operation, and enhance efficiency. For the three-phase asynchronous motors used in water-cooled container product pumps, the motor bearings can be maintained following these instructions.

The bearing models of the circulating pump products supporting motors in the current system are shown in table 9-5:

Table 9-5 Bearing model number

Model	Bearing	Quantity	Validation of refueling cycle		Oil model
			Polar logarithm 2P	Polar logarithm 4P	
CDMF85-2-2FSLSC	DE:7309B NDE:6309	12	10800h	10800h	The # 2 lithium-based lubricating grease

The Southern pump industry CDMF vertical multi-stage centrifugal pump detailed disassembly and assembly can be referenced through the following video link:

Website: https://www.ixigua.com/7020670825342698024

9.4 Maintenance of dry cooler

1) Routine maintenance overview

Routine maintenance is a form of preventive maintenance that involves maintenance personnel performing operations periodically while the equipment is in normal operation.

This includes checking and maintaining the equipment, as well as finding and eliminating any alarms and potential issues promptly.

The purpose of routine maintenance is to ensure the equipment operates stably over an extended period.

Through routine maintenance, key faults can be identified promptly, preventing further deterioration and ensuring the equipment's stable operation.

It also enables the timely detection of hidden issues, allowing for the elimination of faults in their early stages and avoiding economic losses due to equipment failure.

Additionally, routine maintenance can identify the operational trends of the equipment, allowing for targeted optimization and an improvement in operational efficiency.

Routine maintenance precautions are mainly as follows:

Before commencing operations, please read the safety precautions and product information thoroughly. Comply with local safety norms and laws and regulations to prevent accidents. The "attention, warning, danger" sections in each manual do not encompass all safety considerations but are intended as a supplement to the safety precautions for various operations. Consequently, personnel who responsible for installation ,maintenance and other oparations must possess basic knowledge of safe operation, have mastered the correct operation methods following rigorous training, and hold the appropriate operation qualifications.

When carrying out all operations of the product, the relevant precautions and special safety instructions provided by the manufacturer must be strictly observed. The safety warnings listed in the manual represent only those that are known to the manufacturer, and the manufacturer shall not be liable for any violation of general safe operating requirements or violations of safety standards for the design, production and use of equipment.

Most of the maintenance must be performed after the equipment is power off and do not power on during maintenance. For some maintenance work (such as measuring current, pressure, temperature, etc.), the equipment must be fully connected, and the power supply should be cut off immediately upon completion of maintenance.

Protective measures shall be taken for electrical maintenance, including but not limited to wearing insulating gloves and insulating shoes, and complying with local regulations.

Please be careful for professional maintenance. Please consult the customer service center for details.

Danger

Comply with local prevention and protection requirements of working at heights.

2) Maintenance of dry cooler and heat exchanger fins

Table 9-6 Monthly maintenance items of fins of heat exchanger

Scope of examination	concrete operations	exception handling
The heat exchanger fin is whether or not dirty	Check of fin surface (monthly inspection is recommended)	If the dust is not severe, use an air gun for cleaning; if the dirt is serious, use a pressure washer to spray water.

Cleaning method of heat exchanger fin:

Turn off the power supply of the dry cooler;

Before cleaning the heat exchanger fins, calibrate the professional cleaning machine to ensure normal cleaning operations;

Switch the water gun to a water column setting and rinse the heat exchanger fins gradually from the outside of the dry cooler, starting from the top and moving down, until the dust and dirt on the fins are completely washed away.



Figure 9-7 Schematic diagram of cleaning heat exchanger fins

Danger

The water used for high-pressure water gun rinsing must be clean water or clean water added with professional air conditioner cleaning additives, sewage or other corrosive liquids are prohibited.

Table 9-8 Quarterly maintenance items for top drainage of dry cooler

concrete operations	exception handling
Confirm that the top drain ports is not blocked	Clean up the leaves and other debris accumulated on the top of the dry cooler.

Danger

Comply with local prevention and protection requirements of working at heights.

Table 9-9 Monthly maintenance items of electronic control box

number	concrete operations	exception handling
1	Check whether there is any water in the electric control box	Check the drain holes for blockage

5) Fan maintenance

Danger

Before maintenance of the fan, the main power supply must be disconnected!
Comply with local prevention and protection requirements of working at heights.

Table 9-10 Monthly maintenance items of fans

number	concrete operations	exception handling
1	Ensure that there is no foreign matter in the fan	Clean up the foreign body.
2	Verify that the fan blade is not damaged	Repair the blades. If they cannot be repaired, please replace the fan
3	Confirm that the fan running sound is not abnormal, abnormal sound such as metal friction sound, harsh noise, etc	Clean up the foreign objects and confirm that the fan fixing bolts have been fastened
4	Verify that the fan installation fixing screw is not loose or deformed	Re-tighten or replace the screws
5	Ensure that the wiring terminals are not loose	Repress the torque tightening

6) Other system maintenance

To ensure the normal operation and service life of the system, it shall be checked at least once a year.

Caution

It is recommended that you inspect the cooling system at shorter intervals in adverse working environments.

10 Safety instructions

Danger

If the container liquid cooling system is not used for a long time, the total power supply shall be turned off. After a long power outage, it should be treated as normal Power up the process operation.

10.1 Maintenance

Only qualified and authorized personnel are allowed to perform maintenance and other operations on the electrical system.

10.2 Operation

Fire extinguishers shall be provided before starting the inner container cooling system.

The equipment must have reliable grounding at more than two points, and the protective grounding resistance must be verified to ensure continuity, which should be less than 0.3 Ω. Failure to do so may result in personal injury or casualties;

Clean the equipment only after it has been powered off and shut down. Operating the equipment while it is on may lead to electric shock or injury. Do not use water for cleaning, as this could also cause electric shock;

Always check that the valve (in the case of a valve) is open before starting up;

Operation safety clauses for the PDC and main control cabinet:

Before operating PDC A and B, the main control cabinet and the fan control cabinet, ensure that the cabinet door is in a locked state to prevent personal injury such as electric shock, and to avoid salt spray, moisture, dust, or other conductive substances from entering the PDC and main control cabinet;

When powered on, it is forbidden to contact the single board, cables, terminals, modules, sensors and other equipment inside the cabinet to avoid causing safety accidents;

In the event of a fault, unusual odor, or abnormal sound, please turn off the main switch of the four cabinets or press the emergency stop button on the container door and the two cabinets to prevent the risk of electric shock or fire;

When the container has the risk of rapid freezing in the abnormal use environment, the cooling water in the system must be excluded by the air pump as soon as possible. .

10.3 Note

1. Non-professional authorized personnel are prohibited to open the PDC door;
2. Open the distribution cabinet door only when the main switch is in the OFF position

Danger

Even though the main circuit breaker is in the OFF position, the front end remains energized. Unauthorized and unqualified personnel must not attempt to remove the protective plate.

Please read this manual carefully before using this equipment. If you have any difficulties or problems, please ask the factory authorized personnel for help.