DCTANK

AW1

Product Manual

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BITMAIN

Bitmain Technologies Inc.

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Statement

The product installation manual (hereinafter referred to as the product manual) is only intended to guide the user in installing and using the DCTANK AW1 system (hereinafter referred to as the product). When installing and using this product for the first time, please carefully read all attached materials in advance, especially the precautions mentioned herein, which will help you better use the product safely. Please keep the product manual for future reference.

Please check if the product components are complete before using. If there are any missing parts, please contact BITMAIN in time and carefully inspect the product before installation and use.

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2. Incorrect or failure to install, use, and store this product according to the instructions and requirements of the product manual.
3. Operations under working conditions that are not specified in this manual.
4. Usage under installation and operating environments that are not specified in related international specifications, local laws and regulations, or industry regulations.
5. Repair or product changes by technical personnel who are not authorized by BITMAIN.
6. Usage of the software provided with the product on other products, or usage of software not provided with the product / non-specialized software on this product.
7. Other scenarios that do not require liability within the legal scope of the country (region) where the operation is carried out.
8.

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The photos, graphics, charts, and illustrations provided in the product manual are for explanation and illustration only, and may differ from the actual product. The actual specifications and configurations of the product may change as needed, so they may differ from those in the product manual. In this case, the actual product purchased shall prevail.

Due to the continuous product iteration and the application of new designs, materials, and technologies, BITMAIN will make improvements or modifications to the software and hardware described in the product manual and the content of the product manual at any time based on factors including but not limited to product characteristics, product performance, and usage environment, without prior notice. If you find any inconsistencies between the actual product and the product manual during use, or if you wish to obtain the latest information or have any questions or suggestions, please call us or log in to the service website for inquiries.

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Change History

Version	Change Item	Before Change	After Change	Date	Revised by
V1.0.4	Initial release	/	/	July 2025	

Chapter 1 Overview

This manual mainly introduces the working principle, troubleshooting, and maintenance of the DCTANK AW1 system.

1 Scope

This manual applies to the DCTANK AW1 model.

Unless otherwise specified, the air conditioner used in conjunction with the cooling tower is taken as an example to briefly introduce the installation and operation methods of the product.

2 Intended Audience

This manual is applicable to 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 the indirect evaporative cooling (IEC) system 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 located.

3 Use of Manual

Please read the manual carefully before 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. The manual is for reference only. Users can download or obtain the latest version of the manual through www.bitmain.com or sales channels.

4 Symbol Conventions

To ensure the personal and property safety of users when using the product, and to use the product more efficiently and optimally, 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

Indicates a high potential danger that, if not avoided, could result in serious accidents such a spersonal injury,equipment damage,etc.

Warning

Indicates a moderate potential hazard that,if not avoided,could result in serious accidents such as equipment damage.

Caution

Indicates a potential danger that,if not avoided,may result in abnormal operation of the equipment.

Chapter 2 Safety Instructions

1 Safety Precautions

DISCLAIMER: Bitmain does not take responsibility for the following situations:

- **Operation beyond the conditions specified in this document.**
- **Usage under installation and operating environments that 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 All Safety Precautions

To ensure personal and equipment safety, please follow all safety symbols on the equipment and all safety instructions in this manual.

The "CAUTION", "WARNING", and "DANGER" items in this manual do not cover all the safety instructions. They are only supplements to the safety instructions.

1) Local Laws and Regulations

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

2) Personnel Requirements

- **Only trained and qualified personnel are allowed to install, operate, and maintain the equipment, and they must understand all safety precautions and correct operations to avoid hazards.**
- **Only trained and qualified personnel are allowed to install, operate, and maintain the equipment.**
- **Only personnel certified or authorized by Bitmain 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:

- Always make the ground connection first during installation and disconnect it at the end.
- DO NOT damage the ground conductor.
- DO NOT operate the equipment when the ground conductor is not installed.
- Ensure that the equipment is connected permanently to the protective ground.

4) Personal Safety

- This equipment is not accessible to the general public.
- Before operations, insulated shoes and gloves must be worn, and eye protection should be applied. Remove conductive objects such as jewelry and watches to avoid electric shocks or burns.
- Ensure that tools have insulated handles.

5) Equipment Safety

- Put away the keys to the equipment during 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 equipment is operating.
- The screws must be tightened with a tool during panel installation.
- After the installation, remove packing materials from the equipment area.

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 mayresult 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 acable 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 to avoid a hazard.
- The equipment shall be equipped with disconnection mechanisms from the main power supply, providing contact separations at all levels that are capable of disconnecting under Category III overvoltage conditions. These mechanisms must be incorporated into the permanent wiring following the wiring specifications.

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.

2) Sharp Objects

The fins of the heat exchanger 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, place the component, screws, and tools in a safe place. Otherwise, if any of them fall into the operating fans, the fans may be damaged.
- When replacing a component near the fans, do not insert your fingers or boards into the operating fans until the fans are switched off and have stopped running.

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.

5 Operation Safety

1) High-Temperature and High-Pressure

Misoperations may cause over-pressure, which results in the eruption of coolant.

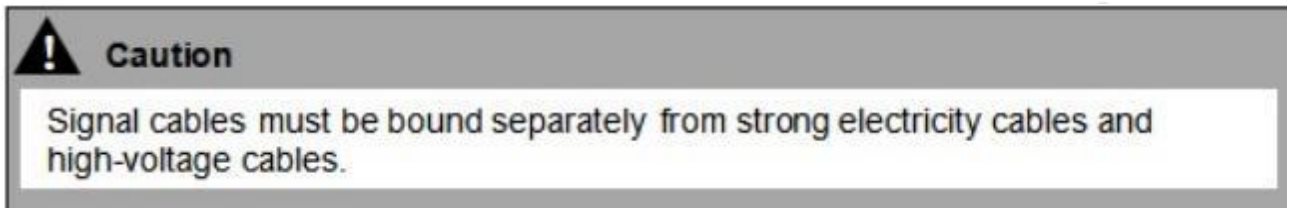
Caution—high-pressure components: compressor, evaporator, and condenser.

2) High-Speed Running

Caution—high-speed running components: fan and pump.

6 Others

1) Signal Cable Binding



2) Power Cable Laying

When the temperature is too low, a violent strike or vibration may damage the power cable sheathing. To ensure safety, comply with the following requirements:

- Power cables can be laid or installed only when the ambient temperature is higher than 0℃.
- Before laying out power cables that have been stored at a temperature lower than 0℃, move the power cables to an environment of the ambient temperature, where they shall be stored for at least 24 hours before further operations.
- Handle the power cables with caution, especially at low temperatures. DO NOT push the power cables down directly from the vehicle.

3) Storage

- The equipment shall not be stored near heat sources or exposed to direct sunlight.
- Keep the equipment away from fire or high-temperature objects, especially when the equipment is injected with pressurized nitrogen or refrigerant; otherwise, explosion or refrigerant leakage may occur, causing personal injury.

4) Recycling

The mark below indicates that the product cannot be disposed of with other wastes that have a shell in European Union (EU) areas. To avoid environmental pollution and harm to human health, wastes must be classified and recycled. This also promotes resource reuse.

Figure 2.1 Mark

Chapter 3 System Composition and Working Principle

1 Overview

The DCTANK AW1 system is designed to continuously supply the internal computing power server heat dissipation units with cold air and power distribution that meet requirements, ensuring a good working environment for the loads.

The DCTANK AW1 system is divided into upper and lower layers. The upper layer is the cooling tower air conditioner, and the lower layer is the server container. During operation, the upper-layer cooling tower A/C continuously supplies the lower-layer server container with cold air that meets requirements.

2 System Composition

Table 3.1 Composition of DCTANK AW1 System

Sub-System	Function	Key Component
Heat exchange system	Transfers heat from the loads to the outdoors.	Heat exchange core, indoor fan, outdoor fan, etc.
Spray system	Sprays water to the heat exchange core to achieve efficient evaporative cooling.	Circulating pump, spray nozzle, drain pan, liquid level sensor, float valve, inlet/outlet electric valve, etc.
DX cooling system	When the outdoor temperature and relative humidity are high, the DX cooling system is activated for additional cooling capacity.	Variable-frequency scroll compressor, heat exchange coil, electronic expansion valve (EEV), indoor fan, outdoor fan, G4 filter, and temperature/pressure/differential pressure sensors, etc.
Electric control box	Controls the operation of cooling tower A/C components; reads, displays, and uploads sensor values.	Circuit breakers, intermediate relay, PLC, switching power supply, HMI, and other accessories.

Sub-System	Function	Key Component
Network and power distribution system	Provides network and power distribution for computing power servers.	Switches, aviation connectors, cables, network switches, and other accessories.
Fire extinguishing system	Provides fire prevention and control for the system.	Fire extinguisher controller, smoke detector, heat detector, HFC-227ea (heptafluoropropane) fire extinguisher, electrical conduits, etc.
Server racks	Secure servers and other node devices; support cable arrangement and air duct management.	Racks, L-shaped guide rails, rack blind plates, PDUs, etc.
Accessories	Supporting spare parts and accessories for the system.	Screws, MCBs, rack blind plates, L-shaped guide rails, standby batteries for the fire extinguishing system, and other accessories.

3 Working Principle

The DCTANK AW1 system employs a highly efficient air-cooling solution. Hot air generated by the servers, under the combined action of circulating fans and server fans, passes through an enclosed return air hot aisle into the heat exchange core, where it exhcanges heat with the cold air entering from the outdoor air intake duct. After heat exchange, the cooled air returns to the lower-layer container to cool down the servers. The heated outdoor air exiting the core is exhausted to the outdoor environment by the outdoor fans at the top of the unit.

As the heat load changes, the control system adjusts the speed of EC fans and manages the start/stop and frequency of the variable-frequency compressor based on cooling demand.

The system incorporates an IEC system, which includes two spray pumps to provide the water power required for cooling in spray mode. A filter is installed in the water pipeline to ensure the circulating water remains free of impurities or other foreign matter that could affect unit operation.

Filters are installed on the air intake side of the heat exchange core to prevent the heat exchange system from being blocked.

The system is equipped with a DX cooling system, containing components such as scroll compressor, evaporator, and condenser. When the outdoor temperature and relative humidity are high, the DX cooling system is activated for additional cooling capacity.

The mechatronics units and sensor signals are integrated into the control system, which can control and monitor the cooling system.

The system appearance and structure are as shown in Figure 3.1, and its working principle is as shown in Figure 3.2.

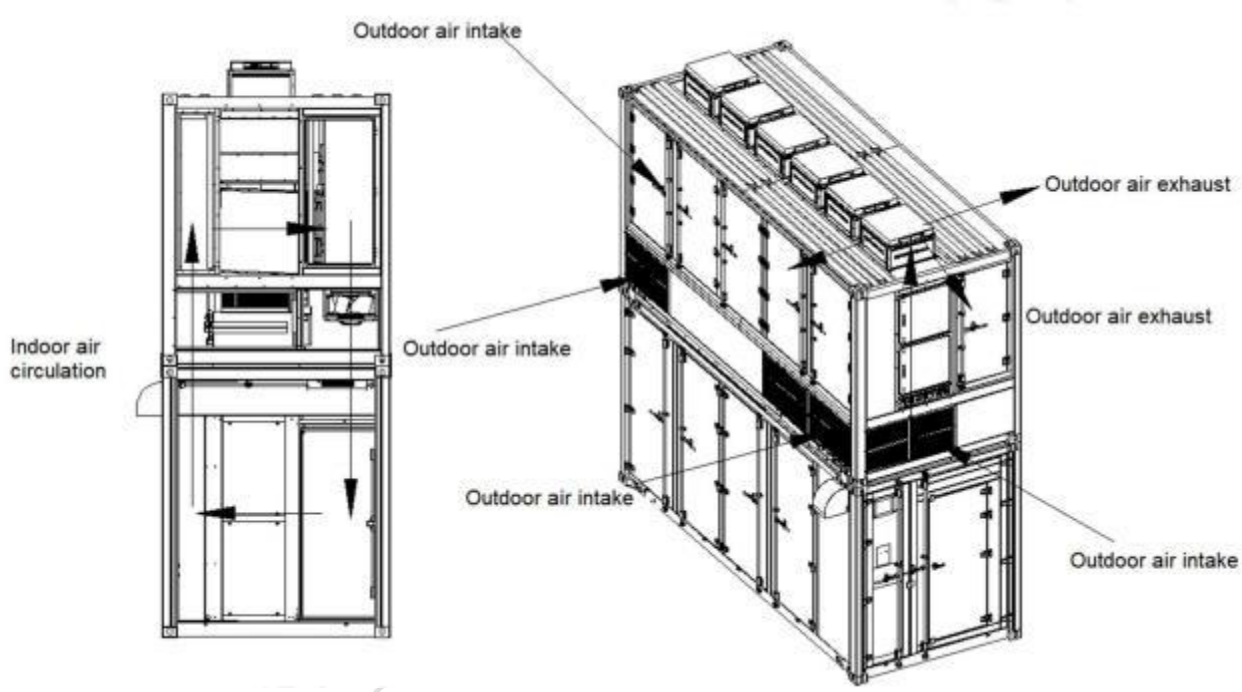


Figure 3.1 System appearance and structure

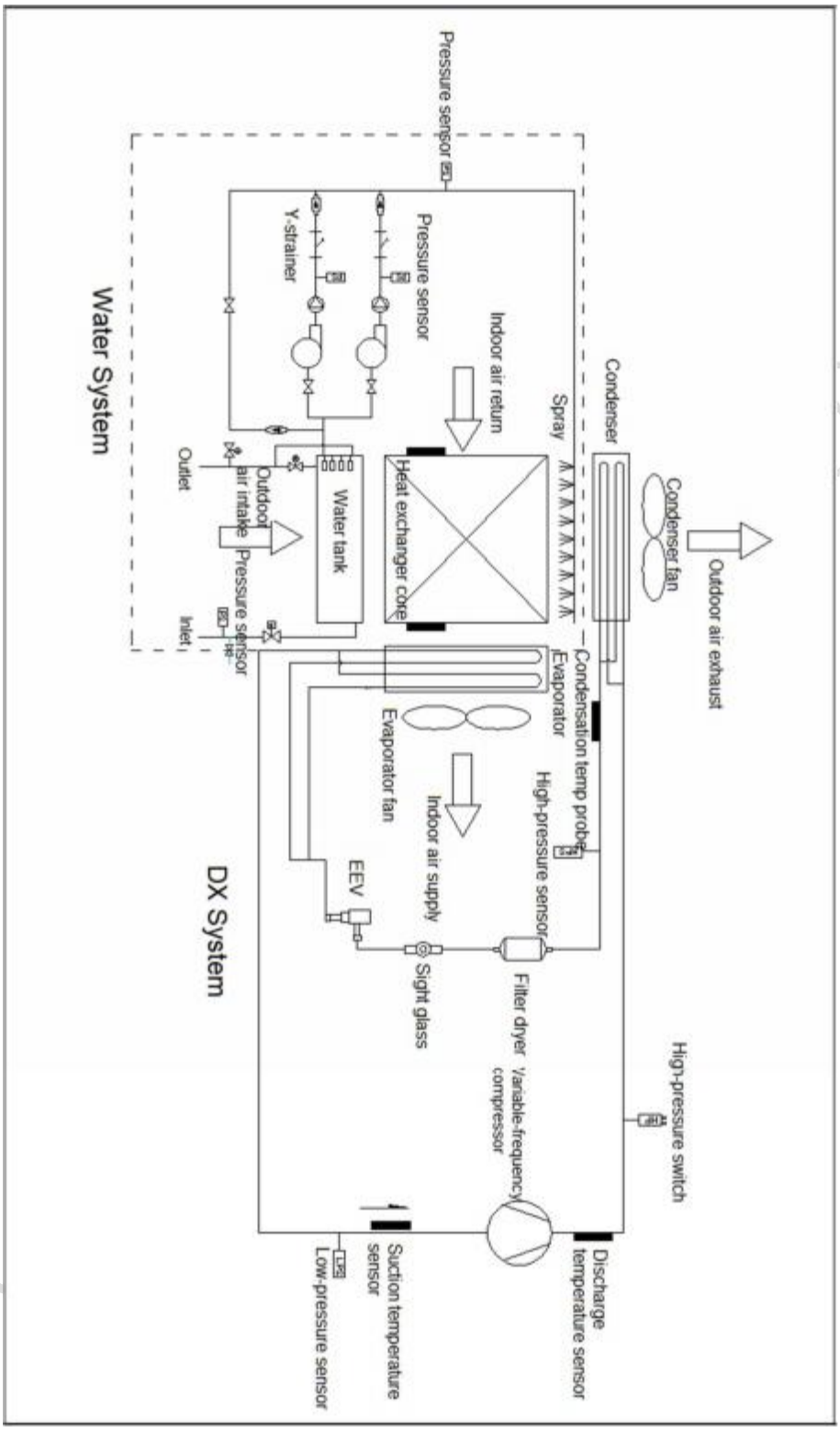


Figure 3.2 System working principle

4 Operating Mode

The cooling tower air conditioning system features free cooling as the primary, and mechanical cooling as the secondary. The cooling system has three operating modes: dry mode, spray mode, and spray + DX cooling mode.

1) Dry Mode

In cold weather, sufficient cooling capacity for the computing power servers can be provided solely by heat exchange between indoor and outdoor air within the heat exchange core. In this scenario, the system operates in dry mode.

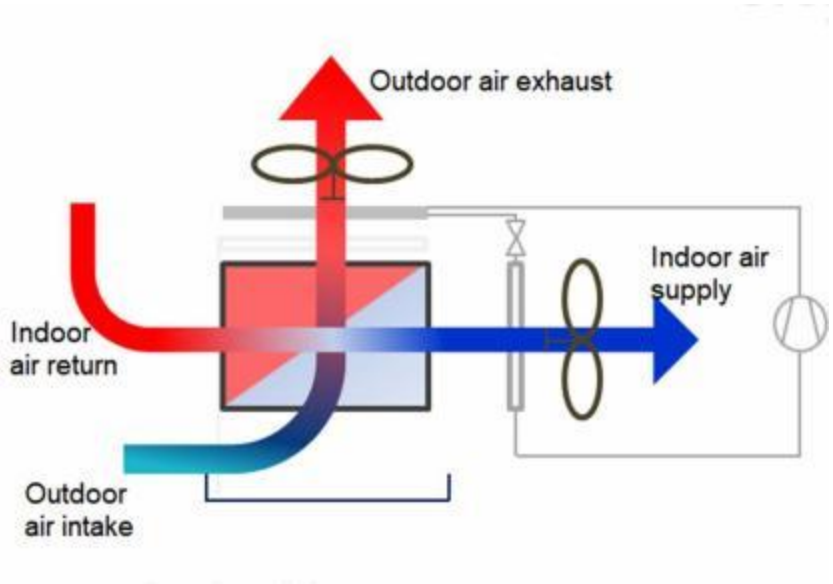


Figure 3.3 Dry mode

2) Spray Mode

In cool weather, when the indoor-outdoor temperature difference is insufficient to provide adequate free cooling capacity, evaporative cooling is adopted. By evaporating water into the air to lower its temperature, the cooling system provides sufficient cooling for the servers. In this scenario, the cooling system operates using evaporative cooling combined with efficient heat exchange, which is called the spray mode.

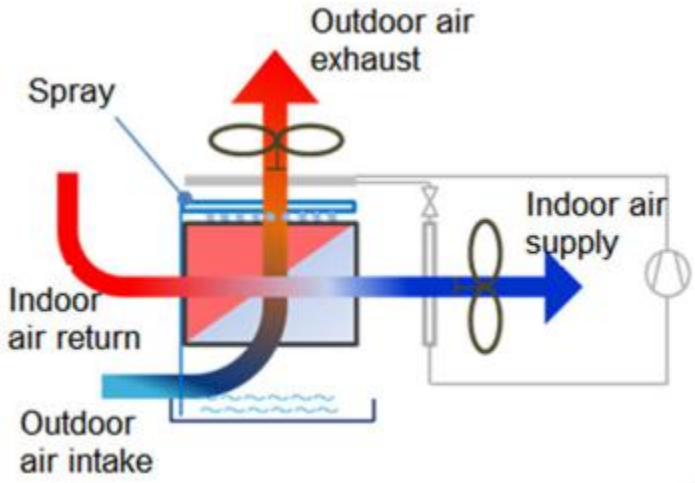


Figure 3.4 Spray mode

3) Spray + DX Cooling Mode

In hot weather, when free cooling cannot meet the cooling demand, the DX cooling system can be activated to supplement the insufficient cooling capacity.

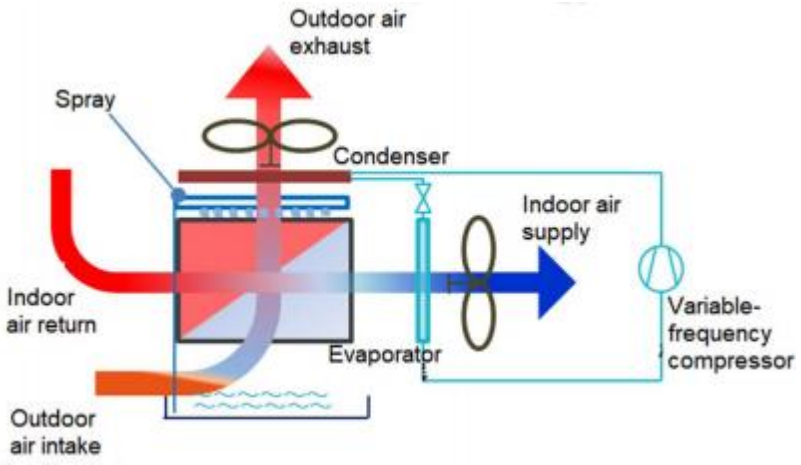


Figure 3.5 Spray + DX cooling mode

5 Control Mode

The cooling tower A/C supports two control modes: Manual and Automatic.

- Manual Mode: Supports manual start/stop operations of system components via the container system's HMI.
- Automatic Mode: The cooling tower A/C automatically adjusts the operating status of all cooling components based on temperature fluctuations within the computing power container. It also switches between different cooling modes based on changes in ambient temperature and server load.

Chapter 4 System Performance Specifications

The AW1 system performance specifications primarily include environmental specifications and cooling system performance specifications. Environmental specifications specify the operating temperature, humidity, altitude, and other environmental requirements for the cooling system. Performance specifications specify cooling system dimensions, weight, noise, and thermal/electric performance during operation.

Table 4.1 AW1 system performance specifications

No.	Name	Parameter	Note
Environmental specifications			
1	Operating temp (℃)	-35 to 40	Outdoor
	Operating temp (℃)	5–35	Indoor
2	Operating humidity (RH)	20%–80%	-
3	Storage temp (℃)	-40 to 70	-
4	Storage humidity (RH)	5%–90%	-
5	IP rating	IPX5	-
6	Altitude (m)	≤ 2000	Derated when the altitude exceeds 2000 m
Server container technical specifications			
1	Outline dimensions (L × W × H) (mm)	6058 × 2438 × 2896	Tolerance complies with classification society requirements
2	Server capacity (U)	376	8 racks with 47 U per rack.
3	Container certificate	Classification society certificate	-
4	Safety certificate	North America, CE	-
5	Operating power (kW)	≤ 100	No-load

No.	Name	Parameter	Note
6	Input voltage & frequency	AC 400 V ± 5%, 50/60 Hz	-
7	Input power quality	THD < 5%	-
8	Shipping weight (T)	4.6	Excluding the computing power servers
10	Distribution cabinet main switch rating (A)	250 × 2	2 × 250 A main switches in the distribution cabinet.
11	Rated current (A)	≤ 405	-
12	Rated power (kW)	120	-
Cooling tower A/C technical specifications			
1	Category	Cooling tower A/C	-
2	Outline dimensions (L × W × H) (mm)	6058 × 2438 × 2896	Tolerance complies with classification society requirements
3	Heat dissipating capacity (kW)	120	-
4	Air supply temp (°C)	25 ± 1	Adjustable
5	Container certificate	Classification society certificate	-
7	Operating power (kW)	≤ 40	-
8	Shipping weight (T)	6.8	-
9	Operating weight (T)	7.8	-
10	Water consumption @ 25°C (m^3/h)	0.2	Under the rated load of 120 kW, when the outdoor ambient temperature is < 16°C, the water consumption is 0 (spray system is OFF).

No.	Name	Parameter	Note
11	External port (container)	External threaded port	• Water tank refill port: R3/4", external thread • Water tank drain port: R1", external thread • Condensate drain port: G1-1/4 ", external threaded union
12	Noise @ 25°C, 15 m	≤ 75 dB(A)	-

Table 4.2 Spray system specifications

Item		Value
Mandatory	Water pressure (MPa)	0.1–0.7
	pH (25°C)	6.5–8.0
	Sulfate ion (mg/L)	< 200
	Acid consumption (pH=4.8)	< 100
	Total hardness (mg/L)	≤ 100
	Total alkalinity (mg/L)	≤ 200
	Chlorine ion (mg/L)	≤ 150
	Conductivity (μs/cm)	≤ 600
Reference	COD (chemical oxygen demand) (mg/L)	≤ 30
	Iron (mg/L)	< 1.0
	Sulfur ion	Not allowed
	Ammonium ion (mg/L)	< 1.0
	Silica (mg/L)	< 50
	Turbidity (NTU)	≤ 5

Chapter 5 System Structure

1 Computing Power Cooling System (External View)

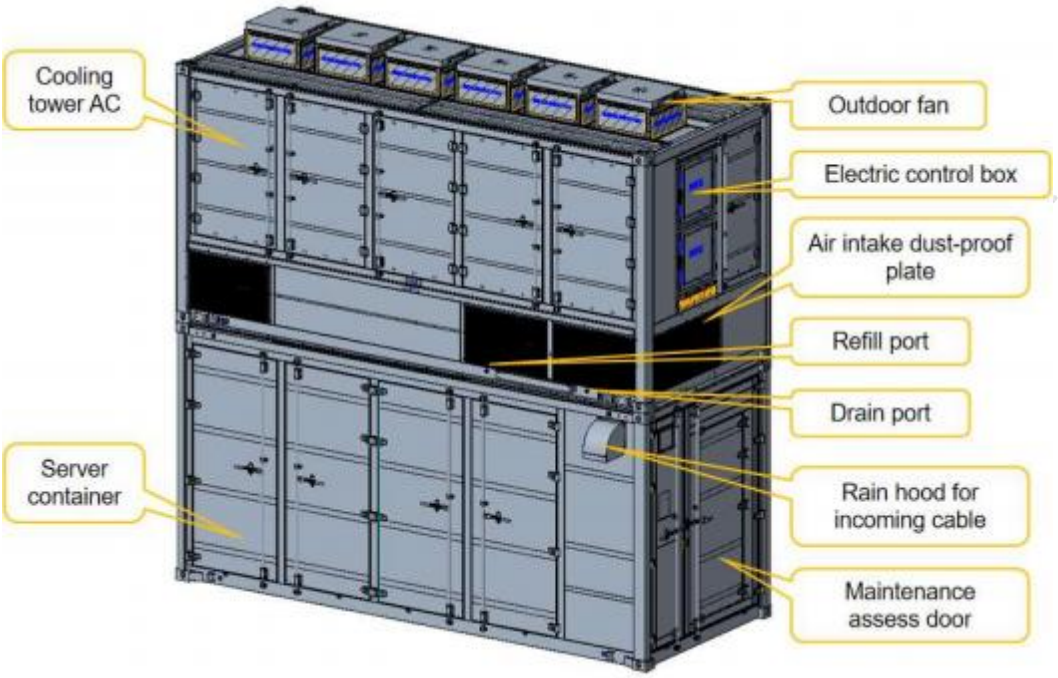


Figure 5.1 External view of computing power cooling system

2 Server Container (Internal View)

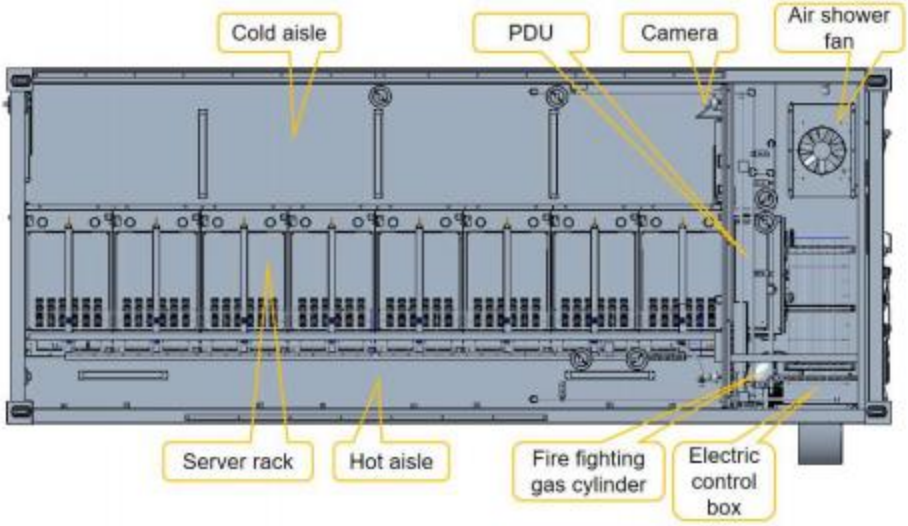


Figure 5.2 Internal view of server container

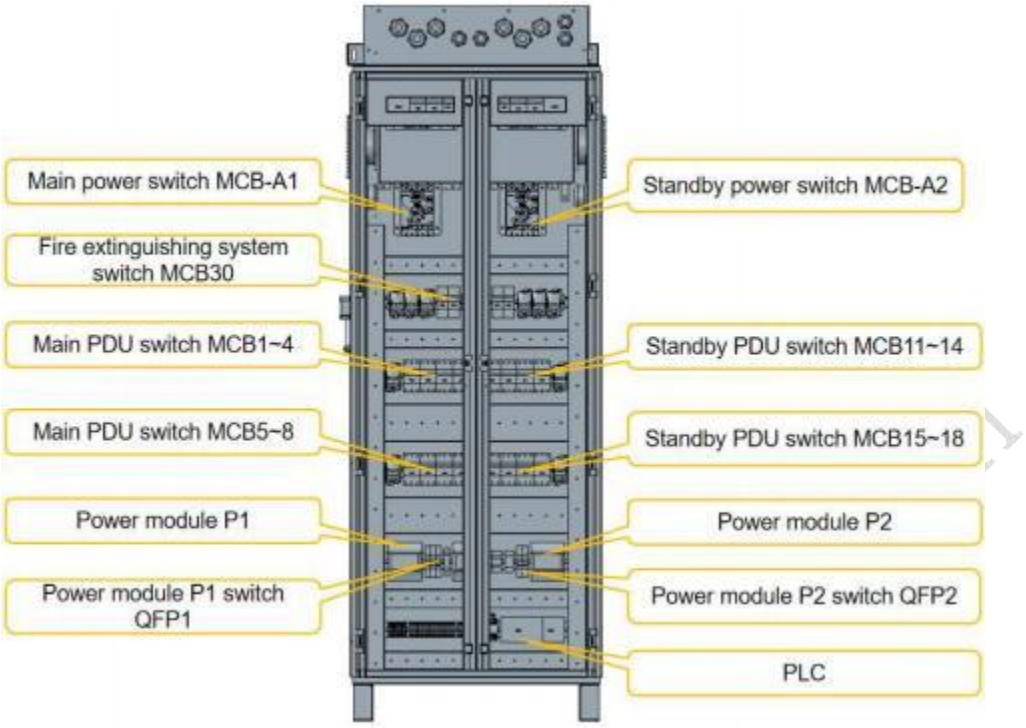


Figure 5.3 Internal view of the distribution cabinet

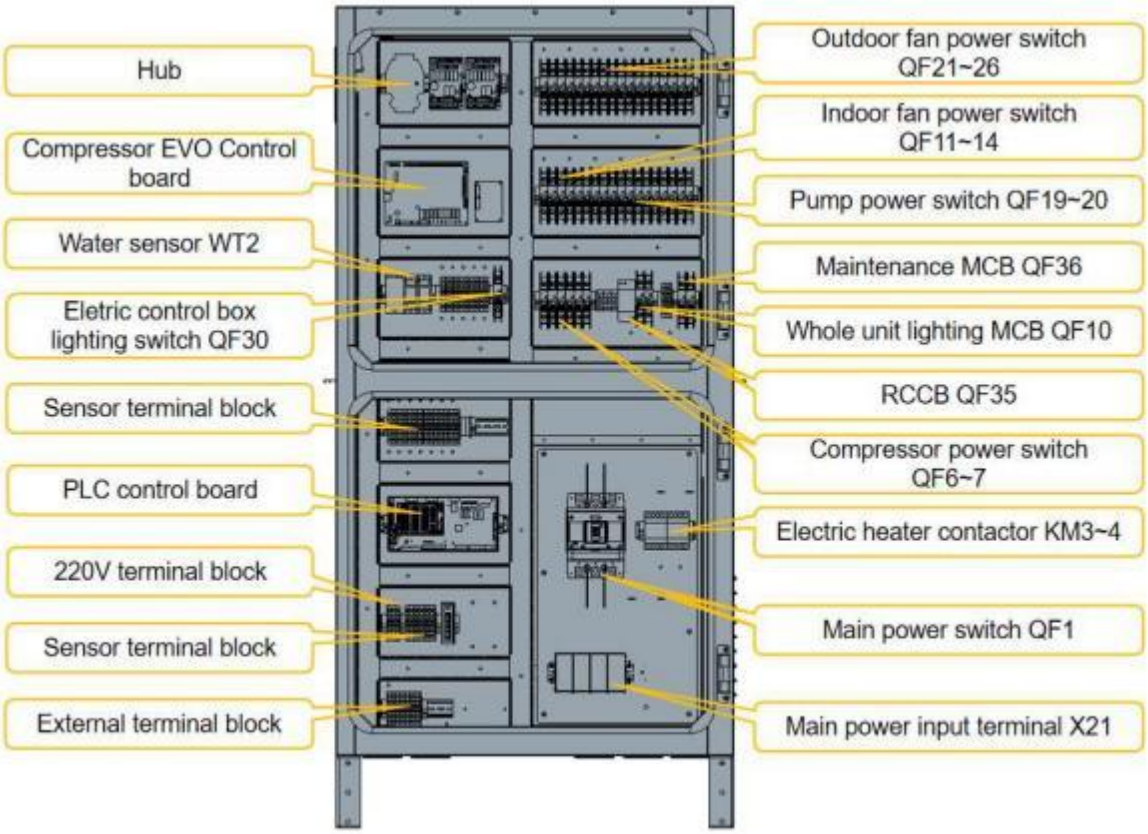


Figure 5.4 Internal view of the cooling tower A/C control cabinet

Chapter 6 Product Installation

1 Leveling Before Server Container Installation

Place the level on the ground and level it properly before us to ensure the bubble is centered. The leveling procedures are as follows:

Step 1 Establish a reference line using the level. Measure the height from this line to the top of the concrete foundation using a ruler.

Step 2 Adjust the height uniformly using a steel plate or others.

After the adjustment, the foundation is leveled. Proceed to hoist the container onto the base for subsequent installation.

The total operating weight of the stacked system exceeds 14 tons. The foundation must adequately support this weight with a safety margin.

2 Server Container Installation

Step 1 Hoisting the server container.

Follow the steps below for server container hoisting:

1. Thread lifting slings through the four corner castings at the top of the container (corner casting locations are as shown in Figure 6.1).

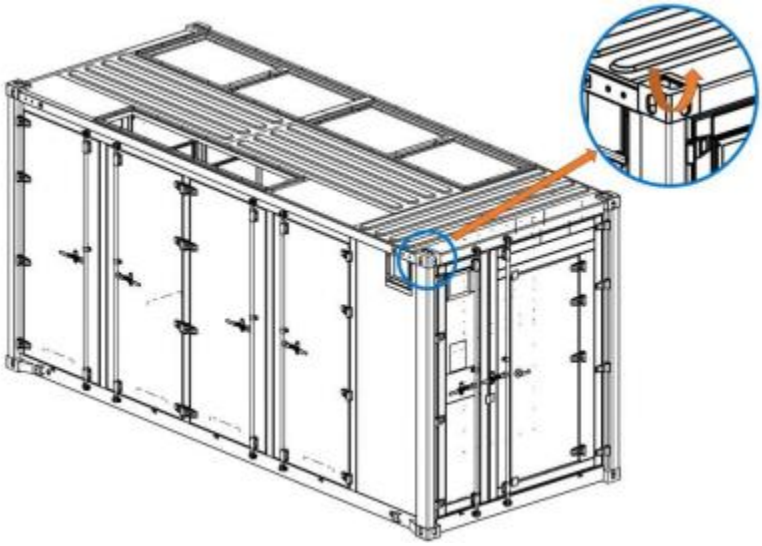


Figure 6.1 Corner casting

2. Use spreader bars and a crane to hoist the unit horizontally and position it on the concrete foundation, leaving sufficient clearance for installation.

Danger

Only professional personnel can hoist the unit.
Hook on the lower four corner fittings during the the hoisting. Do not hang to other positions of the unit.
Do not stuff the sling into corner fittings, otherwise the sling will be worn down.
Do not lift the unit from the bottom.

Step 2 Remove the server container sealing plate.

1. Remove the top sealing plates and the left-side power cable entrance sealing plate from the server container.

   The top sealing plates and the left-side power cable entrance sealing plate (4 in total) are separate, and thus have no requirement for removal order.

   The locations ofthe sealing plates to be removed are shown in Figure 6.2: A, B, C, D (4 in total).

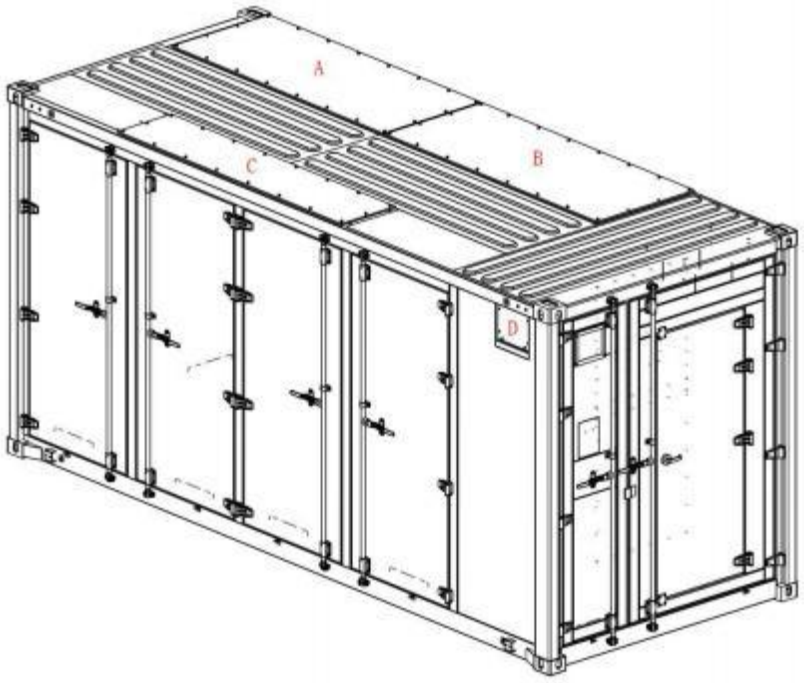


Figure 6.2 Locations of sealing plates to be removed

The unit appearance after sealing plate removal is shown in Figure 6.3.

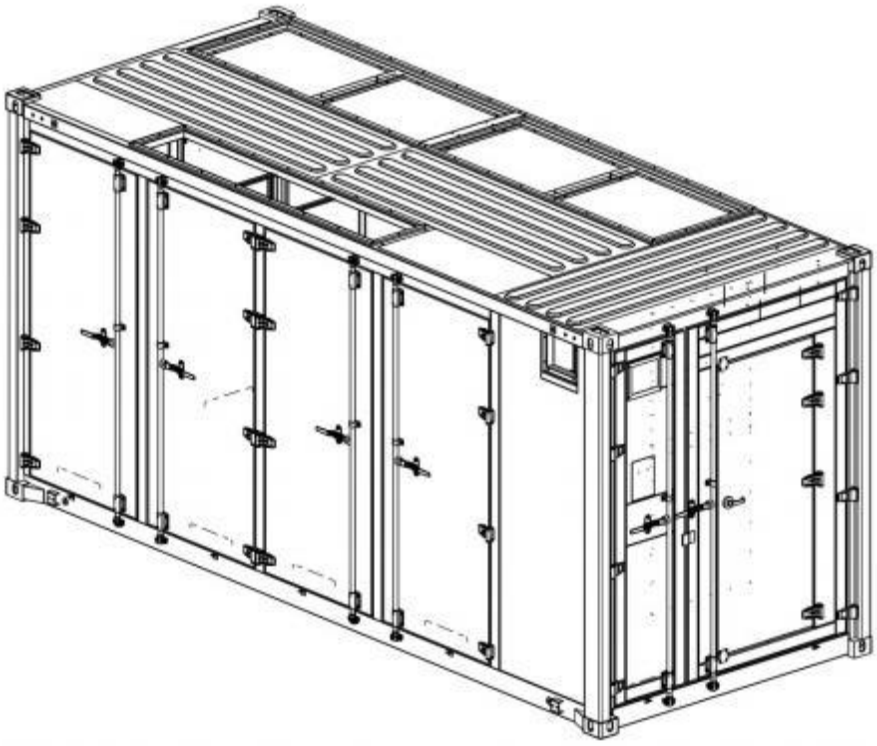


Figure 6.3 Unit appearance after sealing plate removal

Caution

Keep the removed sealing plates for subsequent transportation.

Danger

When removing server container sealing plates, wear protective gear to prevent scratches from plates.

2. Install the rain hood.

The rain hood for incoming cables is shipped as an accessory. Take the hood out of the container accessory package and install it at the left-side power cable entrance on the lower-layer container as shown in Figure 6.4 .

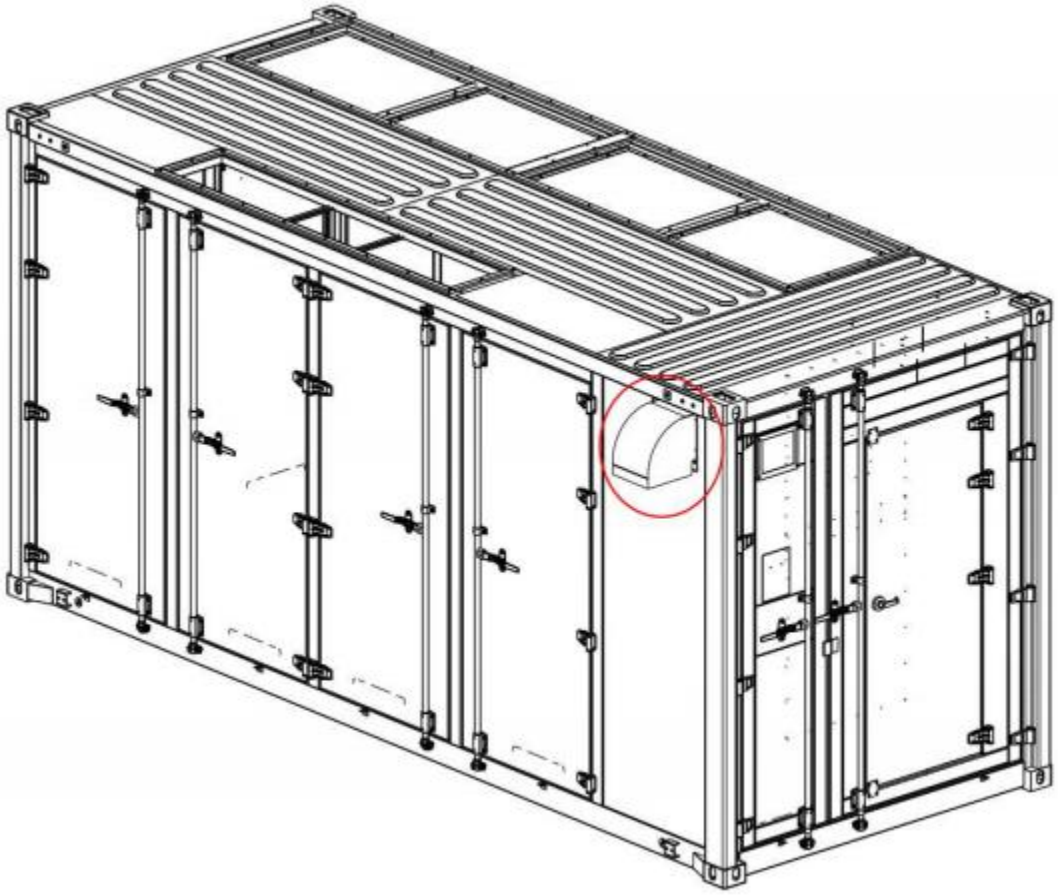


Figure 6.4 Rain hood installation

3 Installation of Server Container and Cooling Tower A/C

Step 1 Remove the transport sealing plates.

A total of 10 sealing plates on the bottom and sides of the cooling tower A/C should be removed before hoisting. The plate locations are as shown in Figure 6.5.

Caution

Keep the removed sealing plates for subsequent transportation.

Danger

When removing server container sealing plates,wear protective gear to prevent scratches from plates.
When removing bottom sealing plates,the containers must be firmly secured to prevent toppling or falling causing operator injury.

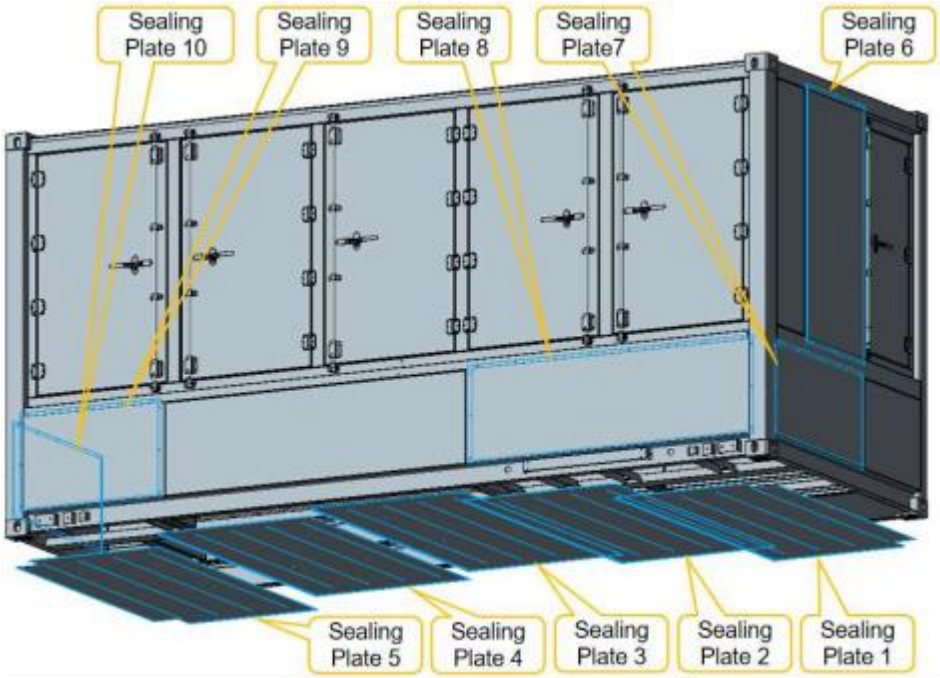


Figure 6.5 Locations ofA/C sealing plates

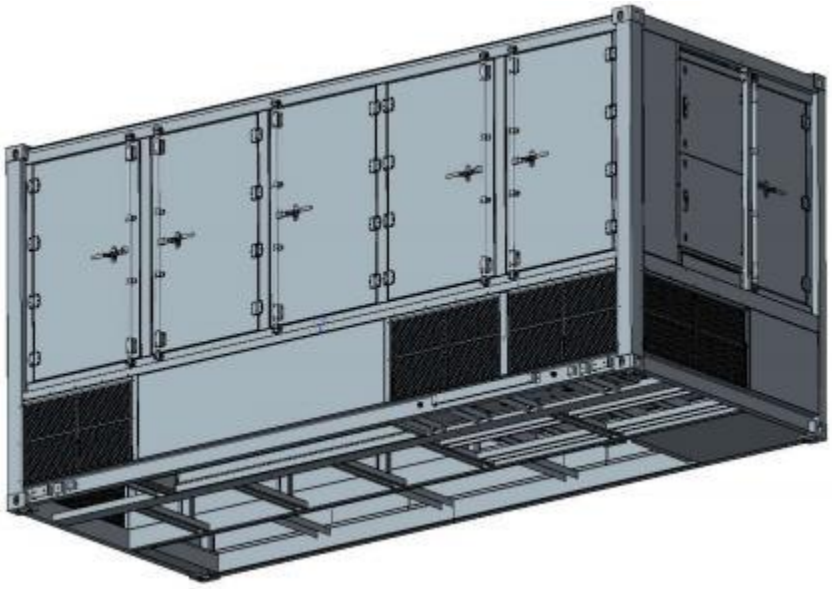


Figure 6.6 Unit appearance after sealing plate removal

Step 2 Hoist the cooling tower A/C onto the server container.

Place the server container on the ground with a certain bearing strength (capable of bearing a weight of 25 tons and a ground level of ± 1°). Insert pins into all four corner castings on the container top. Then, hoist the cooling tower A/C onto the server container. (Hoisting orientation: Cold/hot aisles of the A/C must correspond vertically with the server container's aisle configuration.)

During hoisting, there should be no obstructions at the A/C base or the top of the server container.

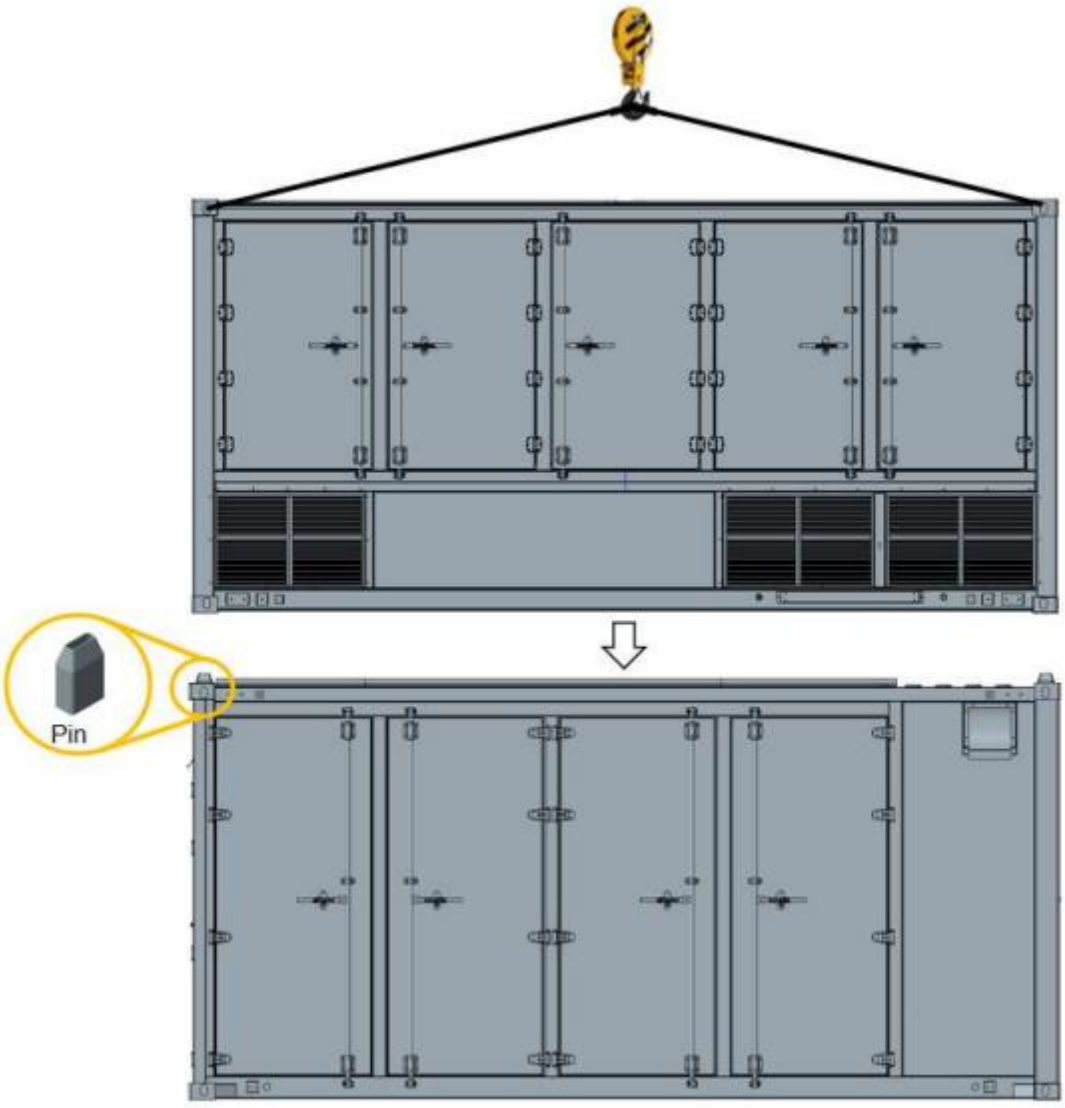


Figure 6.7 A/C-to-container installation

4 Baying Bracket Installation

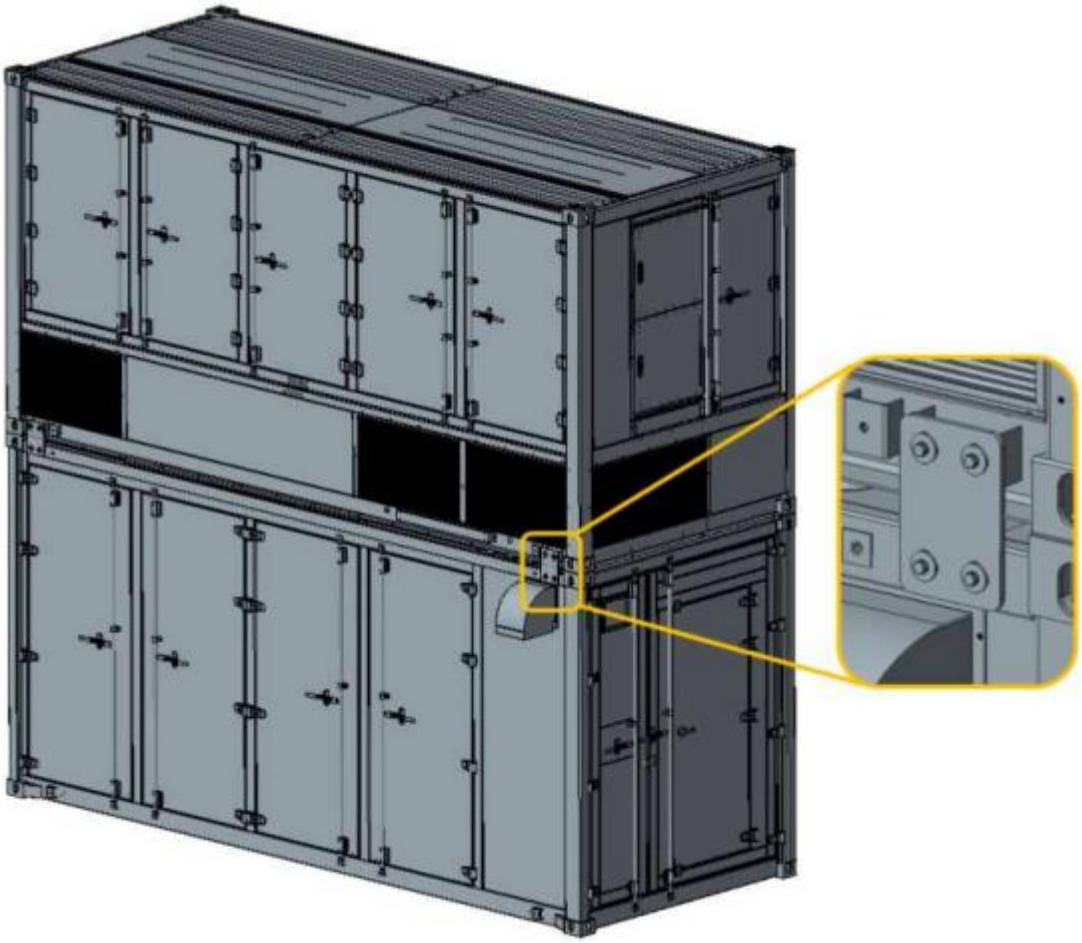


Figure 6.8 Upper-layer A/C installation

The steps for joining the A/C with the server container are as follows:

Step 1 Use provided fasteners (bolts, spring washers, flat washers) to join the upper/lower containers at four corner casting positions per assembly diagram.

Step 2 Seal and secure cold/hot aisle connections respectively.

Step 3 Connect the external water supply and drain pipelines.

5 Outdoor Fan Installation

Step 1 Remove the top sealing plates.

There are a total of 2 sealing plates on the top of the A/C for outdoor fan protection. Remove them before installing the outdoor fans. See Figure 6.9 for details.

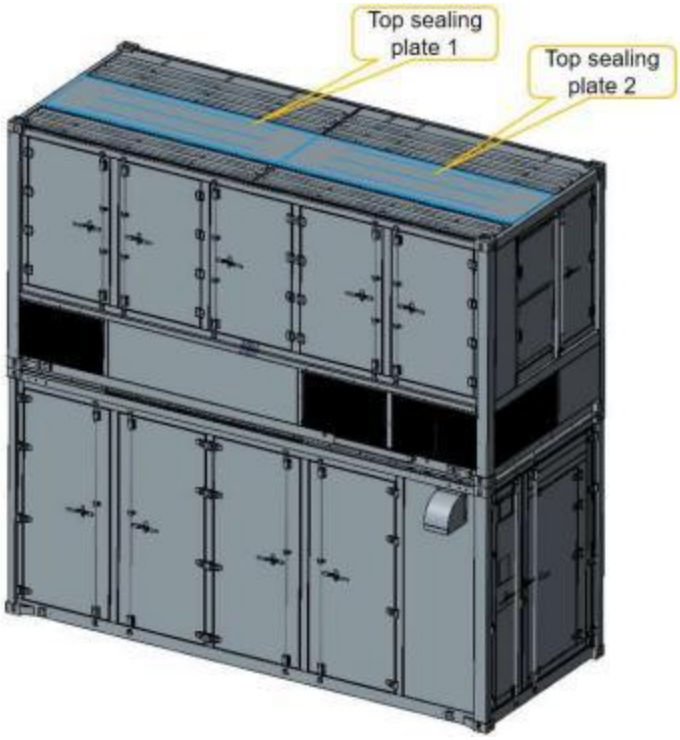


Figure 6.9 Top sealing plates

Step 2 Install the outdoor fan modules on the top of the cooling tower A/C.

After removing the sealing plates, the outdoor fan modules fixed inside can be seen. Remove and install them on top of the cooling tower A/C, as shown in Figure 6.10.

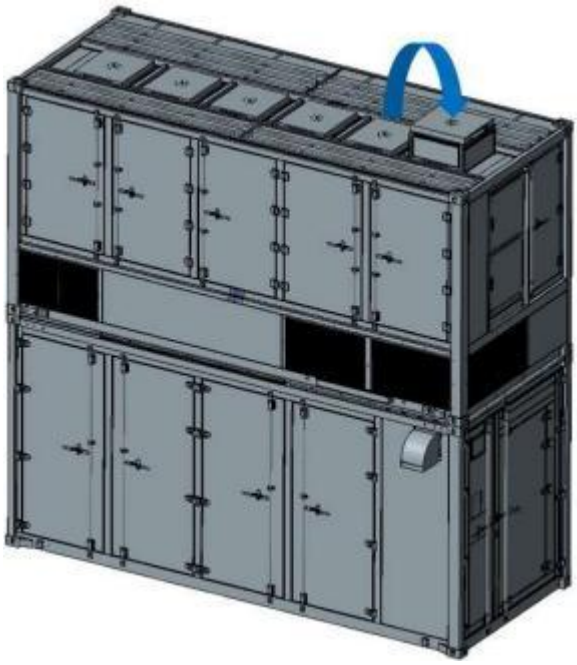


Figure 6.10 Outdoor fan installation

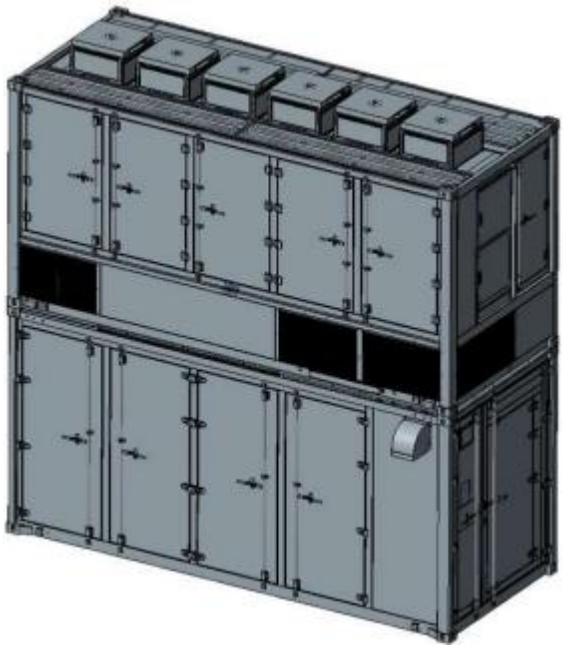


Figure 6.11 Outdoor fan installation completed

6 External Pipe Connection

The spray system requires water meeting specified quality standards. Please connect the water supply/drain pipes according to specifications in Table 4.1 to ensure proper function of the spray system. The connection points are as shown in Figure 6.12.

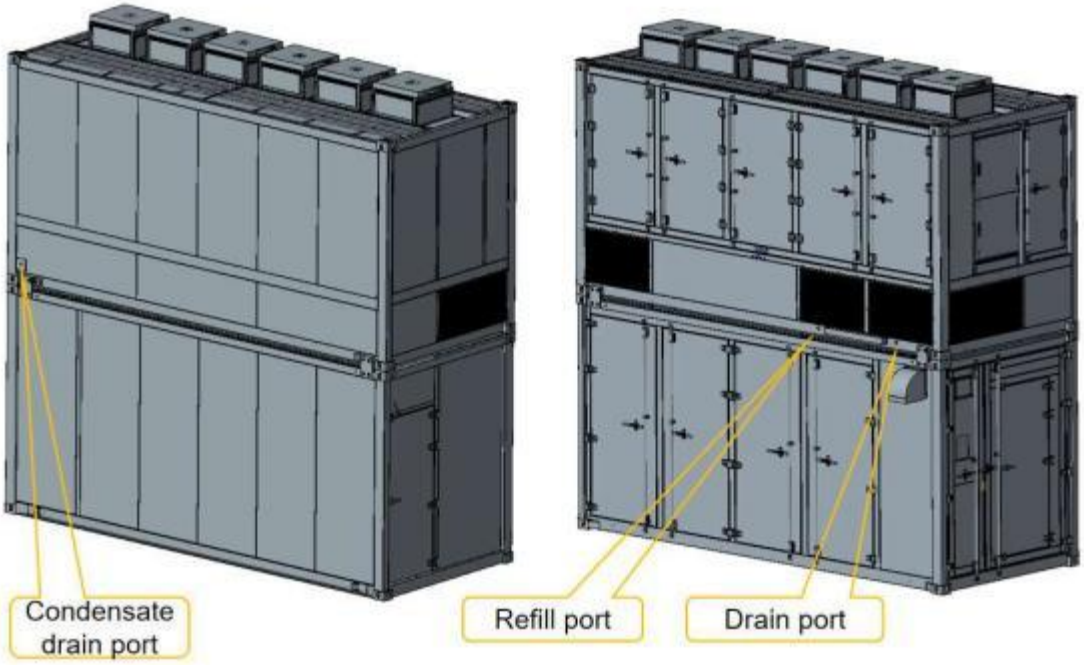


Figure 6.12 External pipe connections

7 Power Distribution

Danger

Power distribution work is hazardous. Operators must be qualified professionals with relevant certifications, comply with local regulations, and follow standard procedures. Unauthorized personnel are prohibited from operating.

1) Steps

The server container contains a distribution cabinet with both main and standby power supply inputs. To ensure safe and stable equipment operation, two 3-phase 5-wire cables with a load of 227.7 kW each should be prepared in advance (reference specifications: 3×350 kcmil + 2×250 kcmil).

Step 1 Ground the container enclosure reliably.

The container has M12 grounding studs on both sides; use them to reliably ground the container enclosure. The container must be reliably grounded at a minimum of two diagonally opposite locations. See Figure 6.13 for the grounding stud locations.

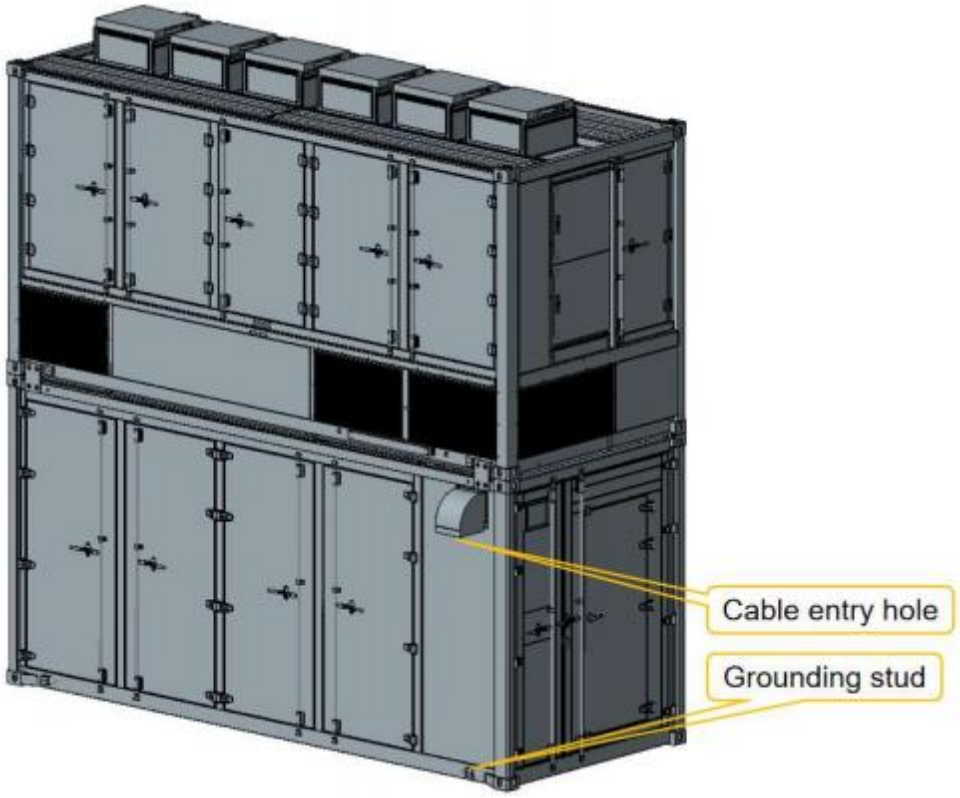


Figure 6.13 Cable entry hole (under the rain hood)

Step 2 Route the cables through the cable entry hole located on the upper-left of the container's front door before cable connection.

See Figure 6.13 for cable entry hole location. (Notice: Use the rain hood in the accessories for protection). The cable is connected from the top junction box of the distribution cabinet and extends to the corresponding copper bus bar, then fixed with screws.

2) Main Power Cable Connection

Connect the L1, L2, L3, N, and PE wires to their corresponding terminals/bus bars. The required screw tightening torque is 12–15 N·m. Ensure correct calibration during tightening. Select the cable model based on the maximum operating current of the unit. OT terminals are used at the container distribution cabinet end. Select appropriate terminals for the site substation end based on actual conditions. For the wiring of the copper bus bar in the junction box at the top of the distribution cabinet, see the figure below:

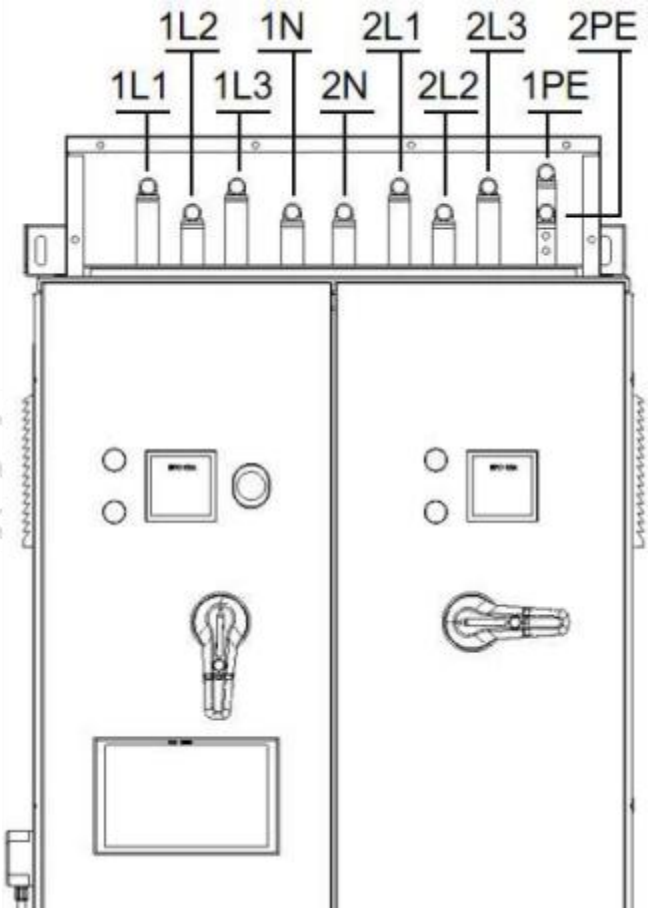


Figure 6.14 Junction box wiring

Danger

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.

3) Upper and Lower-Layer Wiring

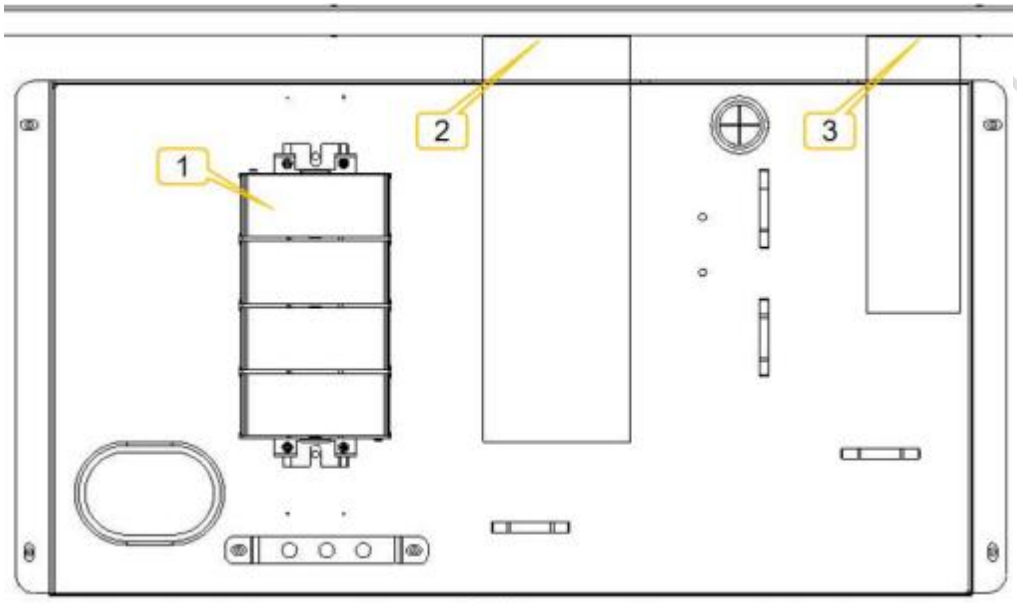


Figure 6.15 Upper and lower-layer connection

1: Upper-layer power terminal block;

2: Upper-layer power cable entry hole;

3: Upper-layer signal cable entry hole;

- The power cables connecting the lower-layer are pre-installed before delivery. Only the connection between the upper-layer power cables and the right side of the terminal block is required, as shown in Figure 6.16.

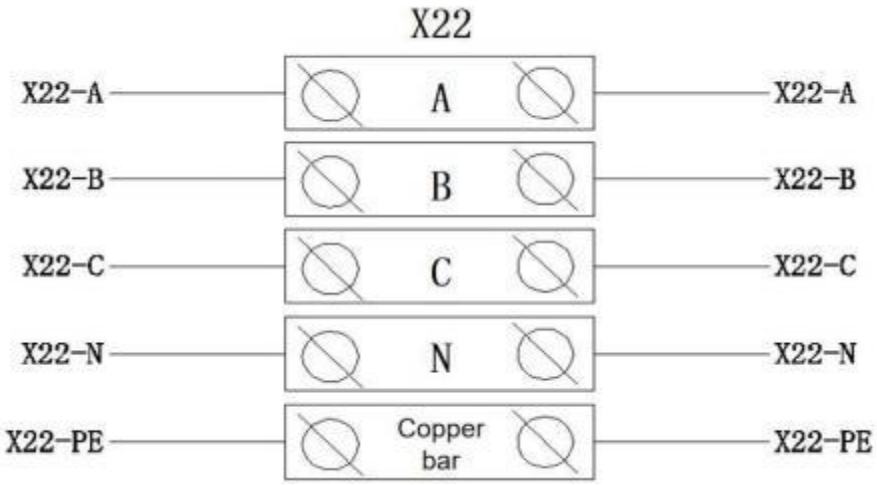


Figure 6.16 Wiring diagram

- Connect the upper and lower layer signal cables using connectors. Simply mate the cables with identical markings on both sides. See Figure 6.17 for the connector schematic diagram.

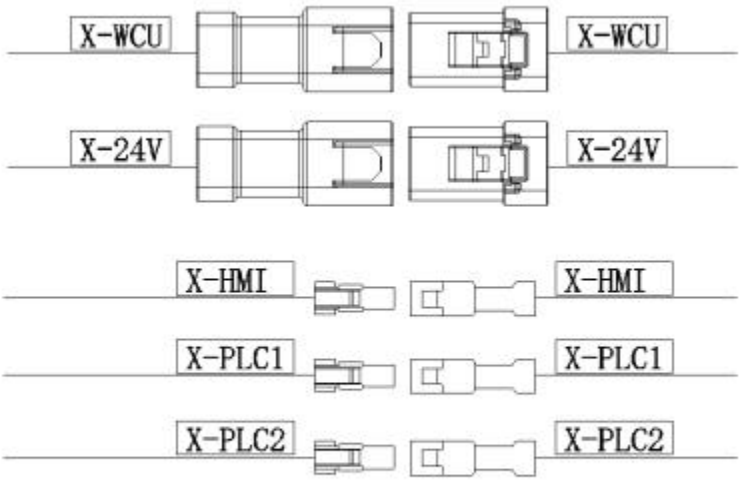


Figure 6.17 Connector mating

- When connecting cables, route them along the cable tie mounts.When routing, the cable needs to be fixed on the cable tie mounts and cannot be hung.

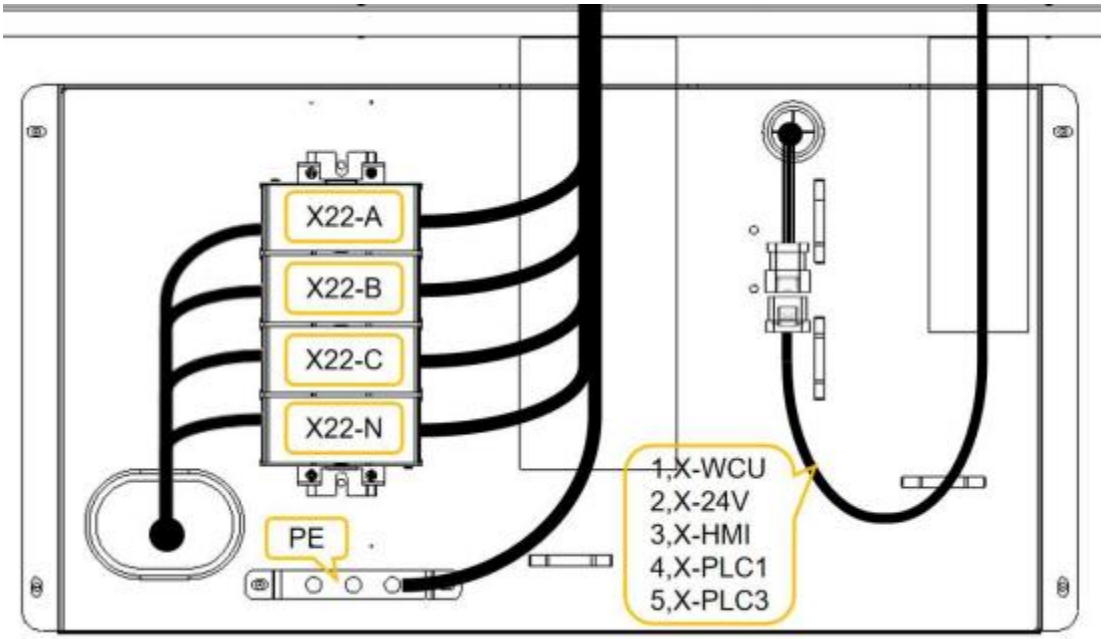


Figure 6.18 Cable routing

Caution

Before initial power-on, check whether the current-carrying screws are loose. If any, tighten them to the specified torque.

4) Post-Installation Verification

After installation, the following items need to be verified. Only after they are all qualified can the unit be powered on.

Table 6.1 Post-installation verification checklist

Item	Description
Container	The container is installed properly, without any tilt. The container is secured to the base rack by using bolts. The foreign matter (e.g., cable ties, stubs) inside the container has been removed.
Fans	No debris inside the fans.
Compressor	The sheet metal fasteners on the compressor have been removed. The bolts on the compressor are tightened.

Item	Description
Filters	The filters are correctly installed according to the air flow direction marked on the frame.
Inlet/outlet pipes	The upper-layer inlet/outlet pipes are securely connected.
Electrical check	Power supply voltage is within the rated voltage range specified on the nameplate. Cables are intact. No open circuits, short circuits, or incorrect connections in the electrical circuits. All cables in the upper and lower layer electric control boxes are connected. Check that the rating of the external main power MCB is correct by referring to the current values. All cables, connectors, and screws are secured with no looseness.

Chapter 7 System Operation and Commissioning

1 Safety Rules

1) Symbol for Hazard Levels

Danger

The " ⚠ " symbol inside the equipment indicates live parts. Do not open the protective panels marked with this symbol while energized.Even when de-energized, non-professionals either cannot open the panels.

2) Usage Precautions

- Spray water should comply with specifications, and there should be no floating objects or particles within the circulating system.
- When the ambient temperature is below 0℃, the water in the collection tank and spray pipeline must be drained to prevent the equipment from freezing.
- The equipment must avoid mid-circuit wiring and parallel connection with other equipment.
- In case ofany abnormalities (e.g., a burnt odor), shut down the equipment and cut offthe power for inspections.
- Emergency stop buttons are located on the distribution cabinet door and container door. In case of an emergency, press the emergency stop button to immediately disconnect the power. After the emergency is cleared, turn the main switches to the OFF position before powering on.
- Switch MCB-A1 can only de-energize side A of the distribution cabinet. Switch MCB-A2 can only de-energize side B of the distribution cabinet. Switch QF1 in the upper-layer control cabinet can only de-energize the main control cabinet of the cooling tower A/C.

  MCB-A1, MCB-A2, and QF1 can only de-energize high-voltage components (servers, fans, pumps, etc.). The low-voltage components (PLC, sensors, lights, etc.) remain energized. In case of special power off needs: For the lower-layer server container section, disconnect MCB-A1 and MCB-A2, then open the distribution cabinet door to disconnect QFP1 and QFP2 inside. For the upper-layer cooling tower A/C section, open the wall-mounted white distribution box and disconnect QF15 and QF16 inside.

Warning

All emergency stop buttons used in this system are of the twist-to-release type. After pressing an emergency stop button and confirming the system operates normal, rotate the button clockwise to release it. Only then can the main switch of the distribution cabinet and the main control cabinet switch be switched on. Note that first turn the switches to the OFF position before switching on.

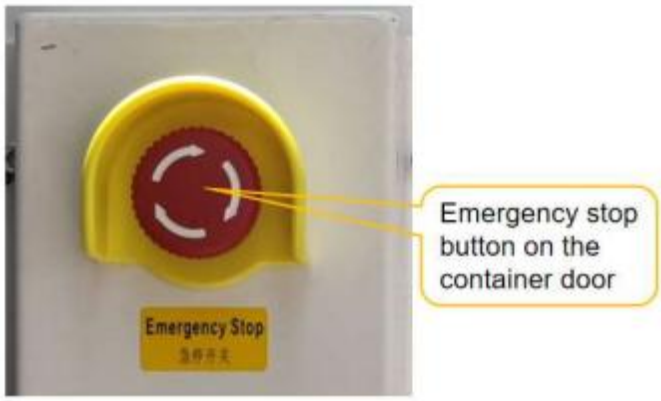


Figure 7.1 (a) Container emergency stop button

Figure 7.2 (b) MCB-A1/A2 locations

Danger

After the main switch of the distribution cabinet is disconnected, the SPD MCB-B1 and MCB-B2, energy meter MCB21 and MCB22, power indicator MCB24 and MCB26, upper terminals of MCB30, QFP1, and QFP2 and ATS inside the wall-mounted electric control box, and upper terminals of QF15 and QF16 are still energized. Non-professionals cannot open the cabinet for operation to prevent electric shock accidents.

To prevent danger, when repairing a single computing server, its power plug must be disconnected from the PDU before the repair. If the whole container needs to be de-energized, the steps are as follows:

(1) Manually turn off the cooling tower A/C.

(2) Disconnect the two main switches in the distribution cabinet.

The main switches in the distribution cabinet should also be disconnected for prolonged power outages. Operators MUST strictly follow the above sequence.

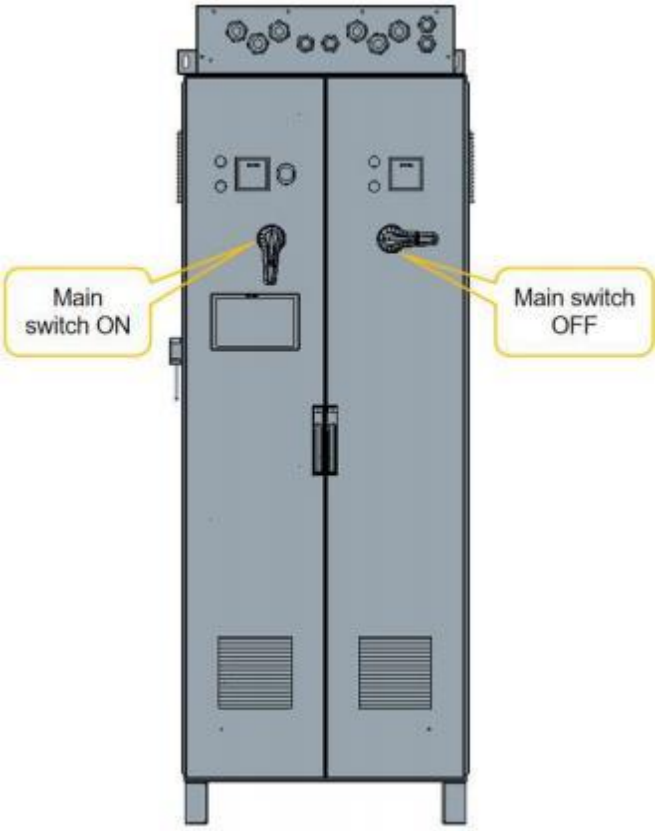


Figure 7.3 Distribution cabinet main switches

Warning

1. Disconnect the main power supply if the equipment remains idle for a long period.
2. Do not open the protective cover on the fan.
3. Do not test fan rotation by touching blades with hands, nor manually rotate fan blades.
4. Do not operate the equipment with wet hands to prevent electric shock accidents.
5. Do not place foreign objects inside the equipment. Keep all ventilation spaces clear.

2 Spray System Refill

The spray liquid is recycled within the cooling tower A/C. The spray water should complies with Table 4.2. First, connect the water supply pipe to the water tank refill port. The system determines whether to open the makeup valve based on the water level. The system automatically closes the makeup valve when the liquid level in the water tank reaches the required height.

Tap the triangle icon on the left of the home screen to enter the refill interface.

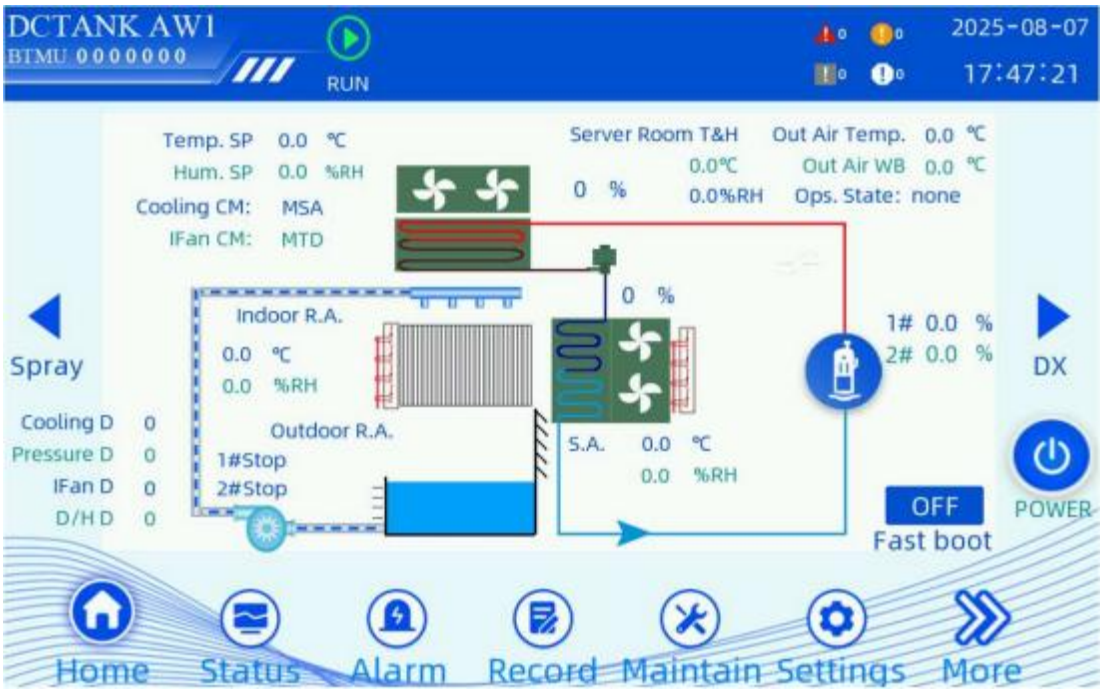


Figure 7.4 Home screen

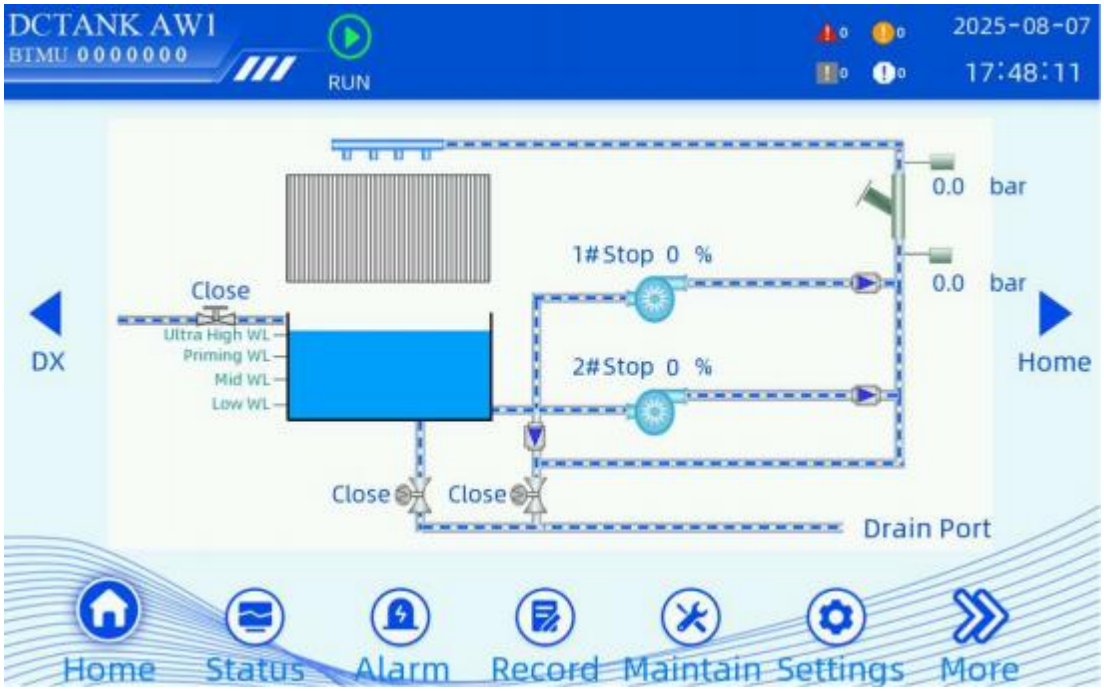


Figure 7.5 Refill system interface

3 System Power-On/Off Procedure

The keys for opening the main control cabinet and distribution cabinet doors are located near the main control cabinet inside the container. During use, the keys should be kept by designated personnel.

The distribution cabinet main switches are as shown in the figure below:

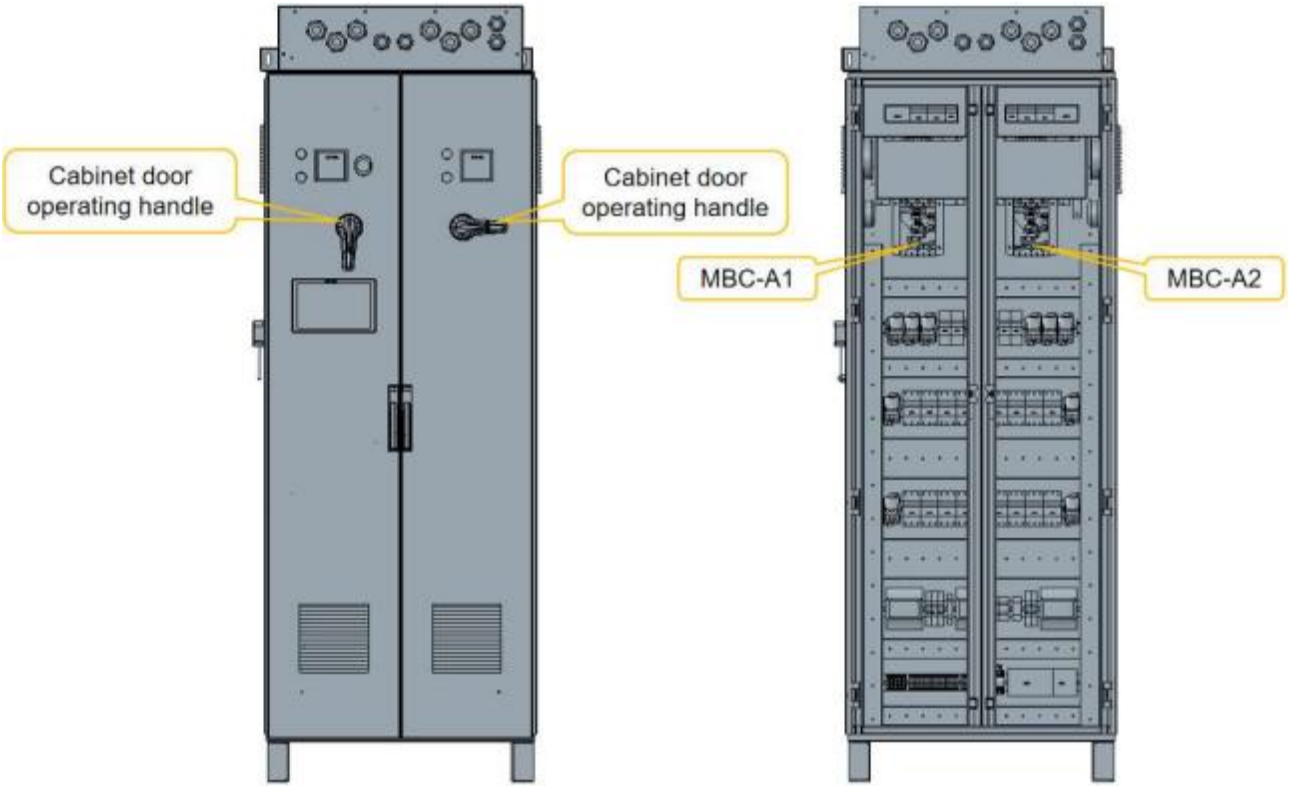


Figure 7.6 Distribution cabinet main switches (internal and external views)

1) Switch Functions

Table 7.1 Switch functions (AW1 system distribution cabinet)

No.	Name	Upstream	Direction	Downstream
1	MCB-A1	Power input 1L1, 1L2, 1L3	→	Main switch MCB-A1
2	MCB-A2	Power input 2L1, 2L2, 2L3	→	Main switch MCB-A2
3	MCB-B1	1L1, 1L2, 1L3	→	SPD 1
4	MCB-B2	2L1, 2L2, 2L3	→	SPD 2
5	MCB30	1L1, 1L3	→	Fire extinguishing system
6	MCB24	1L1, 1L2	→	Main power indicator (white)
7	MCB25	L11, L13	→	Main power ON indicator (green)
8	MCB26	2L1, 2L2	→	Standby power indicator (white)
9	MCB27	L21, L23	→	Standby power ON indicator (green)
10	MCB31	2L1, 2N	→	Standby
11	MCB1-8	XD11–XD14	→	Server main PDU 1–8

No.	Name	Upstream	Direction	Downstream
12	MCB11~18	XD21–XD24	→	Server standby PDU 11–18
13	QFP1	1L1, 1N	→	24 V main power supply switch P1, pin L
14	QFP2	2L1, 2N	→	24 V standby power supply switch P2, pin L
15	QFPZ1	PLC power DP1, pin V+	→	P1_L+
16	QFG01	PLC power DP1, pin V+	→	Dust removal fan G01
17	QFMF	PLC power DP1, pin V+	→	Distribution cabinet cooling fans MF1, MF2
18	QFPZ3	Camera power supply P3, pin V+	→	Smart router, camera power supply

Table 7.2 Switch functions (AW1 system control cabinet)

No.	Name	Front-end	Direction	Back-end
1	QF1	Main power input	→	MCB power input of all fans, compressors, and lights
2	QF6	Main power MCB	→	Compressor 1
3	QF7	Main power MCB	→	Compressor 2
4	QF10	X4-01/04U	→	Air supply/return passage lights
5	QF11	Main power MCB	→	Indoor fan 1
6	QF12	Main power MCB	→	Indoor fan 2
7	QF13	Main power MCB	→	Indoor fan 3
8	QF14	Main power MCB	→	Indoor fan 4
9	QF15	ATS main power	→	Main control PSU
10	QF16	ATS standby power	→	Standby control PSU
11	QF19	Main power MCB	→	Pump 1
12	QF20	Main power MCB	→	Pump 2
13	QF21	Main power MCB	→	Outdoor fan 1
14	QF22	Main power MCB	→	Outdoor fan 2
15	QF23	Main power MCB	→	Outdoor fan 3
16	QF24	Main power MCB	→	Outdoor fan 4
17	QF25	Main power MCB	→	Outdoor fan 5
18	QF26	Main power MCB	→	Outdoor fan 6
19	QF30	Main power MCB	→	Electric control box lighting
20	QF35	Main power MCB	→	Electric heater
21	QF36	Main power MCB	→	Maintenance MCB

2) Precautions for Initial Power-on

Danger

After the system wiring is completed, use a multimeter to measure whether there are short circuits between the phase lines, between phase lines and neutral lines, between phase lines and ground wires, and directly between neutral lines and ground wires of the input distribution cabinets. If the resistance reading is not ∞ Ω, the short circuit shall be troubleshooted before powering on the system. Otherwise, there is a risk of short-circuit explosion, equipment damage, and electric shock hazards.

Danger

Before powering on the equipment, the withstand voltage, insulation resistance, and grounding resistance shall be tested to ensure compliance with specifications. Reference values are as follows:

Withstand voltage test: Use a withstand voltage tester to test the leakage current at the power input terminal of the equipment; apply AC 1500 V between phase lines and between phase lines and ground wires for 30 s. Leakage current shall be < 10 mA.

Insulation resistance test: Use a megohmmeter to measure the insulation resistance between phase lines and between phase lines and ground wires under DC 500V at the power input terminal. Insulation resistance shall be >10 MΩ.

Grounding resistance test: Use a resistance tester to measure the resistance between the internal and external grounding studs. Resistance shall be ≤ 0.1 Ω.

After completing all system wiring, the equipment may only be powered on for commissioning after verifying phase-to-phase and phase-to-ground insulation with a megohmmeter. If any short circuit exists in the above connections, the fault must be identified and resolved before energizing. After energizing the front-end power source (system not powered; distribution cabinet main switches are OFF), measure the front-end voltage to confirm compliance with equipment specifications.

Equipment power specifications: AC 400 V ± 5%, 50/60 Hz.

3) System Power-On Procedure

When front-end power is turned on (the white indicator of the distribution cabinet lights up) and the voltage meets specifications, proceed to power on the system.

1. First, power on the lower-layer distribution cabinet and the wall-mounted distribution box.

   Open the door of the wall-mounted distribution box, and turn on MCBs QF15 and QF16.

   After opening the distribution cabinet door, first turn on MCB-A1 and MCB-A2, and then turn on all switches in the cabinet. See Table 7.1 for the switch functions. Upon powering on, the display on the distribution cabinet door and PLC start operating.

   When the system needs to be powered on, first connect all the MCBs in the cabinet, then close the cabinet door. Turn on MCB-A1 and MCB-A2 using the operating handles to energize the system.

Danger

After the front end of the system is powered on, the SPD MCB-B1 and MCB-B2, energy meter MCB21 and MCB22, upper terminals of MCB30, QFP1, and QFP2 and ATS inside the wall-mounted electric control box, and upper terminals of QF15 and QF16 are energized. Only professionals can open the cabinet panel.

2. Power on the control cabinet

   Open the door of the upper-layer control cabinet. First, turn on QF1, then turn on all the other switches in the cabinet. See

Table 7.2 for the switch functions.

After the main control cabinet is powered on, start the IEC system per the control system operating instructions. Only when the server rack ambient temperature stabilizes near the target temperature can the computing power servers be turned on.

3. Power on the rack servers

After powering on, all PDUs on the rack are energized. Next, start the servers in sequence as required. The system contains 8 server racks with 2 PDUs per rack (a total of 16 PDUs). Turn on L1, L2, and L3 switches on each PDU sequentially. After starting up the PDUs in one rack, wait 10 seconds, then proceed to start the next rack's PDUs. DO NOT start up multiple servers within a short time frame.

Caution

Please refer to Tables 7.1 and 7.2 for the correspondence between components and switches.

4) System Power-Off Procedure

When de-energizing the system, the first step is to de-energize the servers, i.e., turn off the L1, L2, and L3 switches on the PDUs. After the server is powered off, wait 20 seconds, then manually stop the IEC system via the HMI. The rack side ambient temperature may rise slightly without damaging the system. Next, disconnect the main power supply of the main control cabinet and the distribution cabinet. Finally, open the doors of the distribution cabinet and the wall-mounted distribution box on the lower layer to disconnect QFP1, QFP2, QF15, QF16, and then the control power supply. This procedure de-energizes the whole system.

It is the safe power-off procedure. As for critical system failures, press the emergency stop button on the container door. This triggers immediate tripping of the distribution cabinet main switch, followed by 5-second delayed tripping of the main control cabinet main switch. The system is then de-energized completely for professional maintenance.

Danger

After pressing the emergency stop button inside the container, the high-voltage power supply (e.g., servers, fans, pumps) for both upper and lower containers will be disconnected. However, control components such as SPD, energy meter, PLC, and touchscreen will remain powered, as will wall-mounted distribution units. Only professionals can open the access panel for maintenance.

Danger

In emergencies, press the emergency stop button on the front of the distribution cabinet. This button controls the power supply to the respective cabinet. When pressed, the cabinet power will be cut off, but control components such as SPD, energy meter, PLC, and touchscreen will remain powered. Only professionals can open the access panel for operations.

Caution

After pressing the emergency stop button and troubleshooting and before re-powering on, rotate the emergency stop button clockwise to release it. Then, turn the main switch of the distribution cabinet and the main control cabinet switch to the OFF position before re-switching on.

4 HMI Operation

Warning

Do not connect/disconnect the communication cable between the touchscreen and PLC while the power is on. Otherwise, it may damage the communication serial port of the touchscreen or PLC.

Caution

HMI account: "**2**"; Password: "**6656**".

1) Initial Startup

When the system is powered on, the initial startup screen is as shown in Figure 7.7.

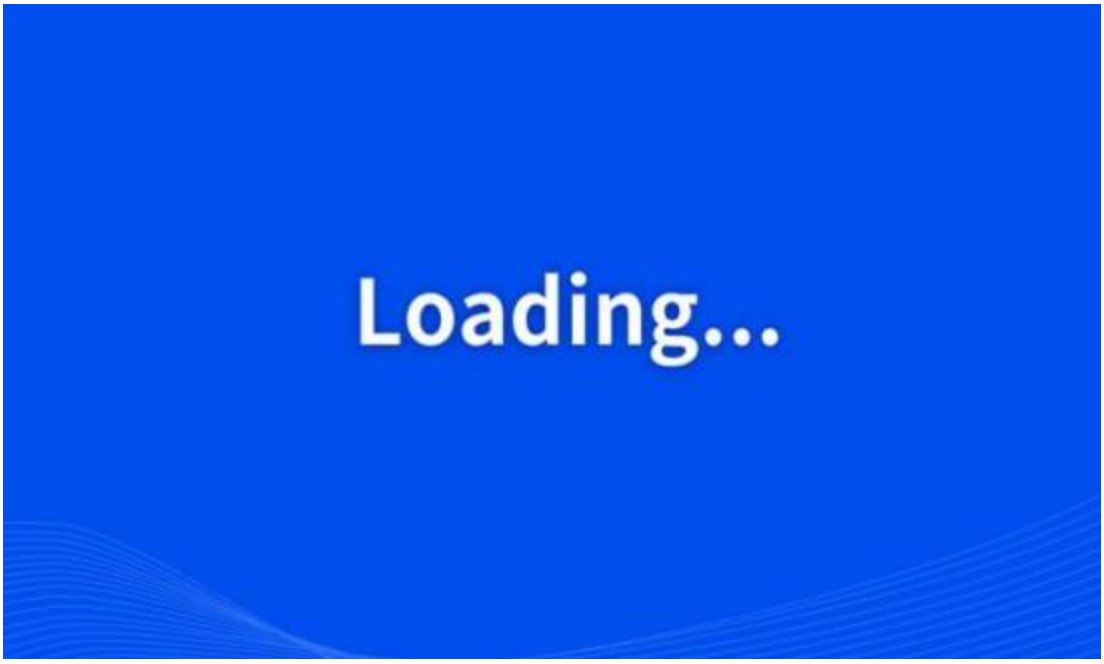


Figure 7.8 Initial startup screen

Press the blue ON/OFF button at the bottom right of the home screen to turn the system on or off.

If the system is powered on again after a power failure, it will automatically restore to the state before the power failure. (For instance, if the system is on before the power failure, it will automatically start up and enter the normal display interface.)

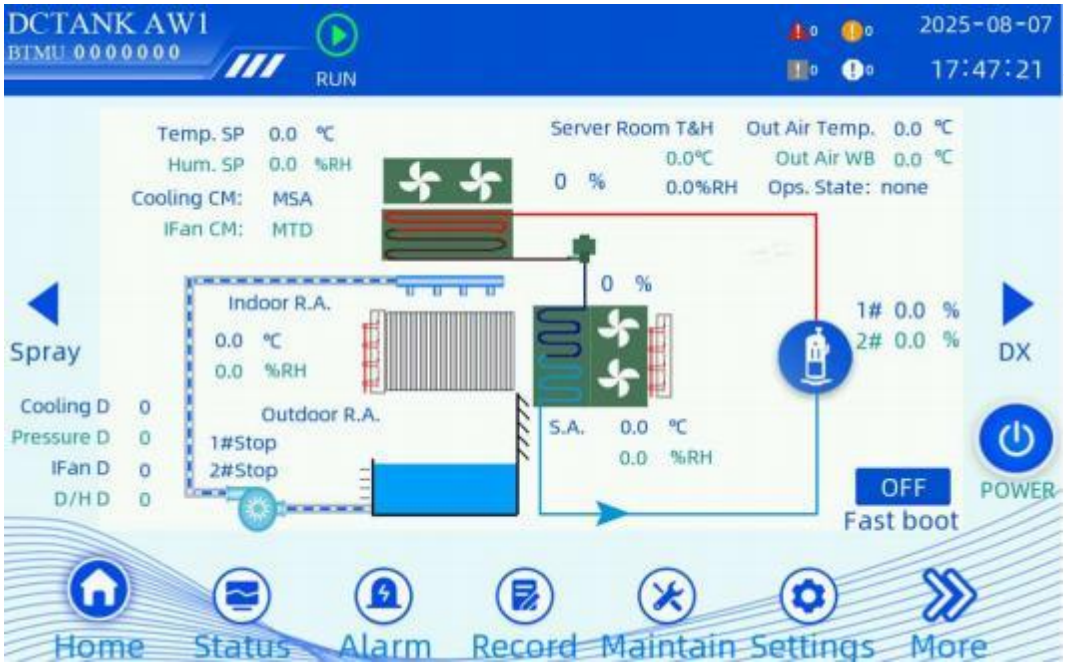


Figure 7.9 Home screen

2) Home Screen

The home screen displays the basic operating status of the unit.

When the A/C is turned on, manual control is used for commissioning, and automatic control is used for system operation.

- Click Status to enter the status interface.
- Click Alarm to enter the fault alarm interface.
- Click Record to enter the data information interface.
- Click Maintain to enter the maintenance settings interface.
- Click Settings to enter the parameter settings interface.
- Click More to enter the other settings interface;

3) Manual Control Interface

When the equipment requires commissioning, enter the maintenance interface and activate Manual mode for respective systems.

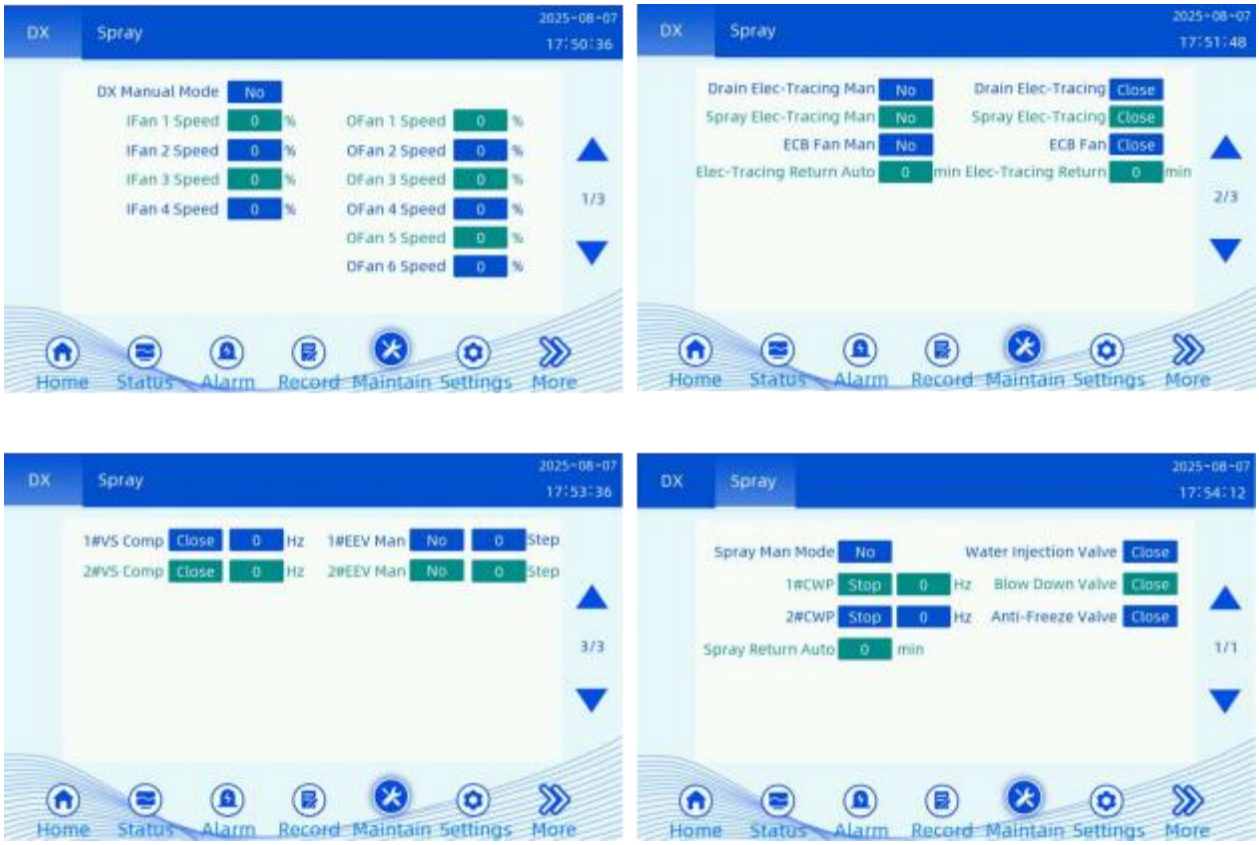


Figure 7.10 Manual control interfaces

Within the DX System page and Spray System page of the maintenance interface, after activating manual mode, the operators can manually configure the indoor/outdoor fan operating parameters, electric heater on/off, as well as the on/off and operating parameters of compressors, EEVs, and circulating pumps.

4) Parameter Settings Interface

In this interface, the following items can be adjusted according to the user's needs: temperature/humidity settings, alarm settings, system configuration, account management, time settings, alarm thresholds for high/low temperature and high/low humidity, etc. The items are as shown in Figure 7.11.

Click Settings on any interface to enter the settings interface. When user permissions are insufficient, the password entry interface will appear. Log in with the user name "2" and the password "6656" to enable parameter configuration.

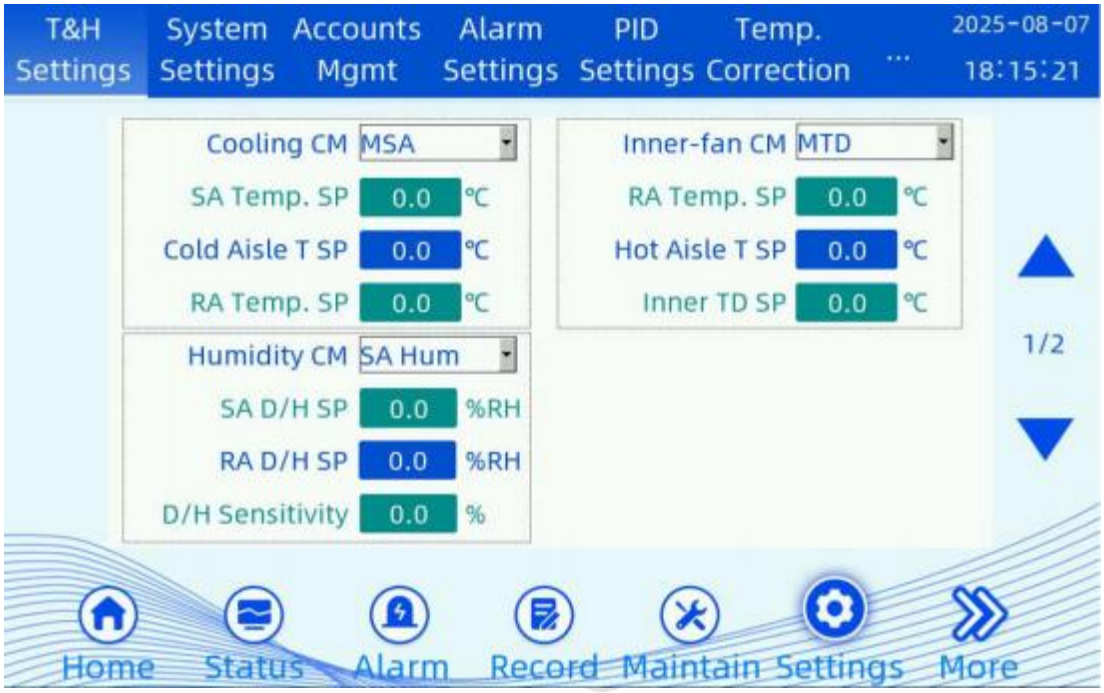


Figure 7.11 Parameter settings interface

After unit startup, the aforementioned parameters are set to initial default values. After the initial startup, verify whether parameter settings are appropriate and reconfigure if necessary. In the parameter settings interface, manual configuration is available for cooling control mode, air supply/return temperature settings, humidity control mode, and air supply/return dehumidification settings.

5) Detailed Parameter Settings Interface

Figure 7.12 Detailed parameter settings interface

Click "..." at the upper right of the parameter settings interface to enter the detailed parameter settings interface. In this page, detailed control parameters for each cooling component can be modified. In the initial startup, the parameters restore to factory settings. Before changing the parameter settings, O&M personnel need to identify the possible problems. The parameters can only be changed when the modification does not affect system operation.

6) Active Alarm Interface

This interface shows active alarms. The alarms are numbered, and the latest alarm is always listed at the top. The time of the alarm is also recorded and displayed. Users can check the number of alarms on this page. The items are as shown in Figure 7.13. Click Alarm on any interface to enter the active alarm interface.

When the system is in operation, if there is any fault, it will be displayed on this interface.

After the fault occurs, the fault form will be displayed in the Active Alarm interface. In this case, first analyze the cause of the fault, then troubleshoot it, and finally click Reset in the right side Option.

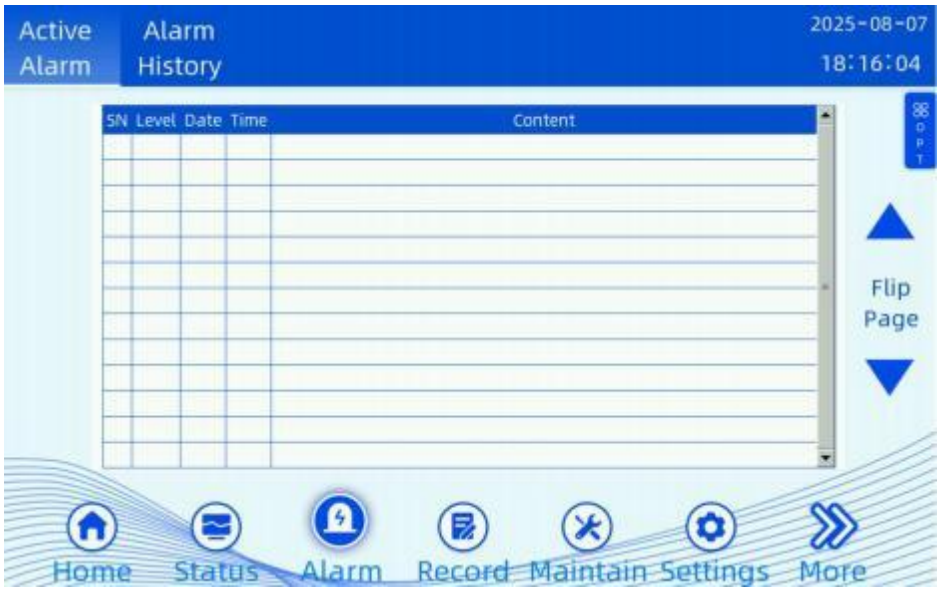


Figure 7.13 Active alarm interface

7) Alarm History Interface

The alarm information in the system will be restored in this interface through the time record, helping users to query the fault time.

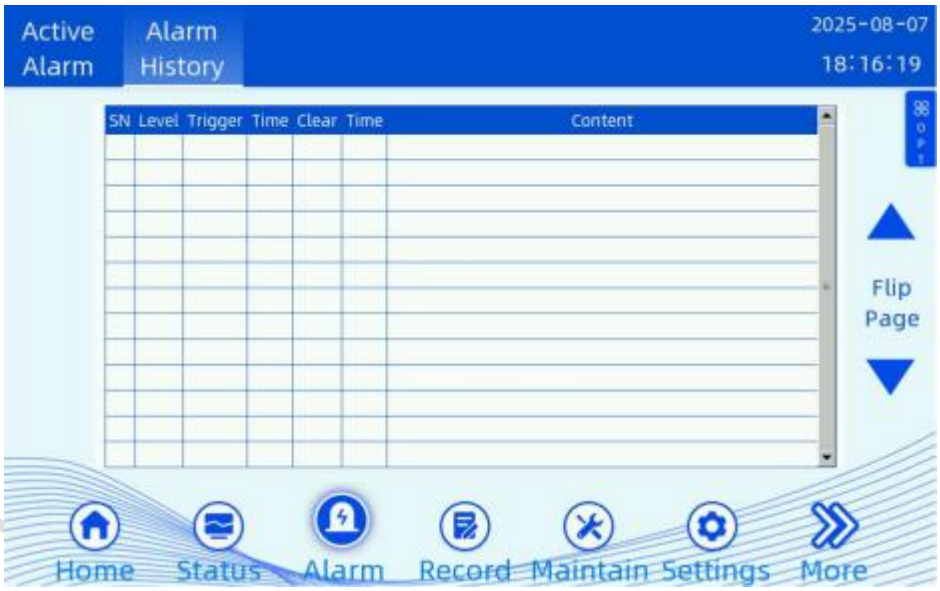


Figure 7.14 Alarm history interface (reference only)

8) Curve Interface

The curves show the values detected by various sensors of the system. The users can zoom in and out for detailed information. The items are as shown in Figure 7.15. In the left-hand setpoint and

actual value columns, operators can select relevant curve parameters to view the comparisons between setpoints and actual operating parameters during runtime.

Click Record on any interface to access the curve interface. Each parameter has a different color.

Figure 7.15 T/H curves

9) Power Status Interface

This interface displays voltage, current, and power consumption measured by the electric meters monitoring the 2 power inputs.

Figure 7.16 Power consumption and power supply parameters

10) Automatic Control Mode

When the cooling tower A/C requires automatic operation, access the Maintain interface to restore all parameters to default values in both DX System and Spray System pages, then click to turn off manual mode. The system will automatically detect current environmental conditions and initiate automatic operation.

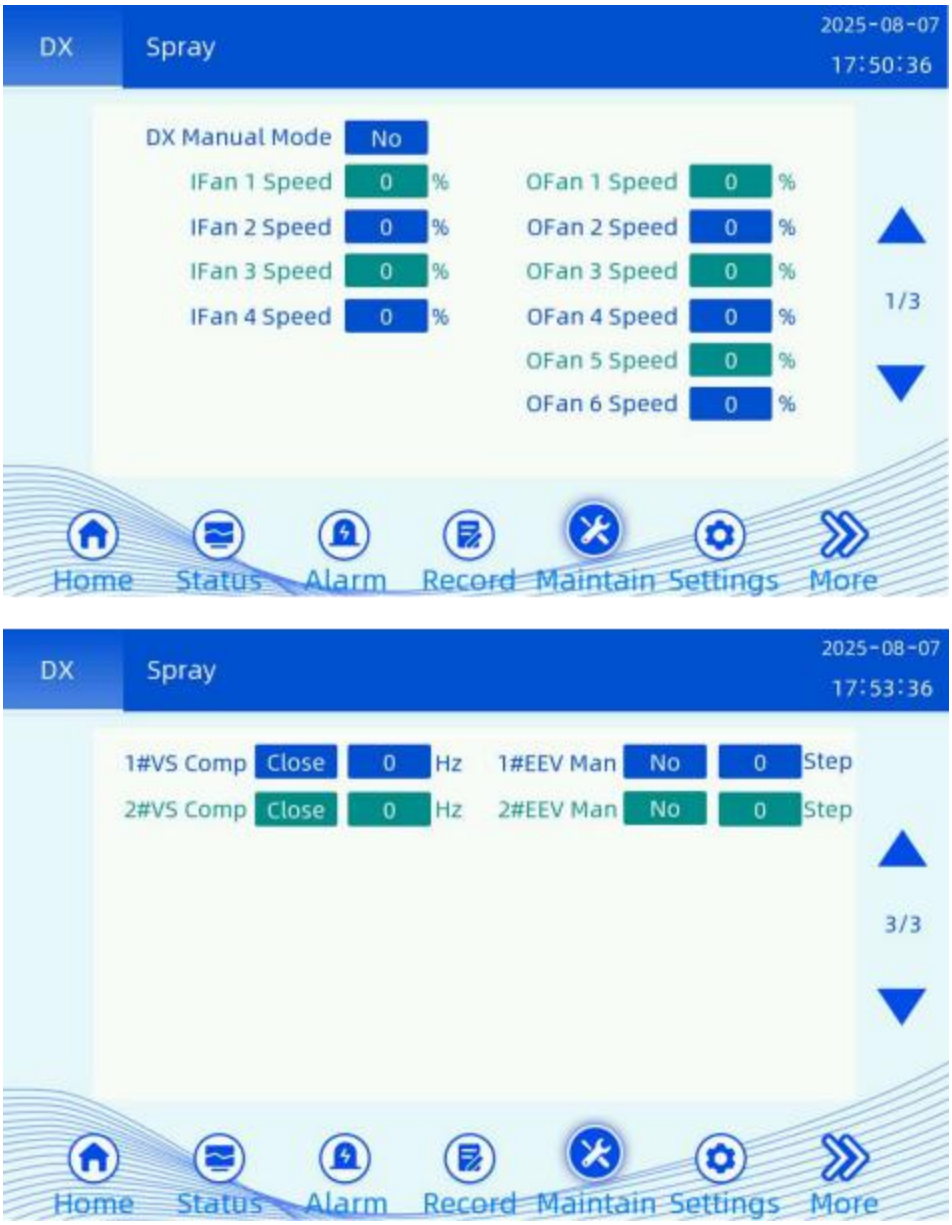


Figure 7.17 Manual-to-auto switch steps

5 Commissioning Preparations

Before the system commissioning, verify that:

- There are no foreign objects inside the air duct.
- The input voltage and frequency of the main power supply are within the nominal range, and the phase sequence is correct.
- There are no missing wires, loose connections, worn wires, or copper exposure of the cables inside the distribution cabinet junction box. And the cable connections are correct. The connection screws of all cables are tightly secured.
- There are no short circuits between various components and phases in the cabinet.
- All switches are in the OFF state.
- All device number tags are pasted correctly.

Power cable connection inspection:

Before wiring, verify that the upper power output switch is disconnected. Before turning on the MCB, use a multimeter to measure L1, L2, and L3 to check if they are disconnected from PE and if these three phases are disconnected from each other. After turning on the MCB, use a multimeter to measure if the voltages between L1, L2, and L3 phases are 400 V ± 5%. Verify the insulation of all wiring terminals. Check for any worn cables or loose screws.

Danger

1. During the operation of the cooling tower, there may be high voltage inside the equipment. All precautions and warnings on the component equipment 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.

1) Commissioning Procedure

Step 1 Disconnect all MCBs except the main power supply MCB. Then, turn on the main power supply MCB to ensure the voltages of the main power supply phases are 400 V ± 5%.

Step 2 Turn on the Indoor fan MCB. The fans start running after the operators click ON on the home screen.

Step 3 Ensure that the Indoor fans rotate clockwise when viewed from above.

Step 4 Measure all the phase currents of the Indoor fans.

Step 5 Turn on the outdoor fan and spray system MCBs.

Step 6 Initiate cooling by setting the temperature value 5℃ below the equipment room temperature, then monitor the pump operating current and the operation of the outdoor fans.

Step 7 Observe whether the water tank begins injection. After injection completes, check pump activation and spray flow rate. If the pump operates loudly with a low flow rate, this indicates reversed pump rotation requiring correction of the power phase sequence.

Caution

Water injection for spraying will only be activated when the ambient temperature exceeds the antifreeze temperature.

Step 8 Keep the system running for at least 30 min and check if it works properly.

Step 9 Restore to the preset temperature after the test operation.

2) Check After Commissioning

The commissioning check items are listed in

Table 7.3.

Table 7.3 Commissioning checklist

No.	Item
1	All alarms are correctly set.
2	The temperature, humidity, and control accuracies are properly set.
3	All MCBs are ON.

6 On-Site Installation Summary

1) On-Site Installation Summary

After the equipment is transported to the site, it needs to be installed in the order shown in

Table 7.4. After installation is completed, the control mode can be changed to Automatic. Click Auto ON and the system will start automatic operation.

Table 7.4 On-site installation summary

No.	Item	Description
1	Server container positioning and hoisting	Hoist the container onto the installation platform, remove the sealing plates, and install the rain hood.
2	Cooling tower A/C positioning and hoisting	After removing the transport sealing plates, hoist the cooling tower A/C onto the server container.
3	Fans installation on top of the A/C	Install the fans securely with no obstructions.
4	Ventilation duct connection	The upper and lower layer ducts are tightly connected with no leakage.
5	Container power distribution	After reasonable and standardized cabling, check the quality with calibration torque and power-on test.
6	Spray water supply	Connect to the water supply and fill the water tank.

Chapter 8 Common Faults and Troubleshooting

1 Power Supply

Table 8.1 Power supply alarms and troubleshooting

Alarm	Possible cause	Reference solution	Note
Abnormal power supply	Phase loss	Check the main power supply for phase loss.	-
	Overvoltage	Check the main power supply for overvoltage.	The voltage of the on-site power supply does not match the rated voltage of the equipment.
	Undervoltage	Check the main power supply for undervoltage.	
	Incorrect phase	Adjust the phase sequence of the power cables connected from the distribution cabinet to the main control cabinet.	-

2 Cooling Tower A/C

1) Cooling Tower A/C Alarms and Troubleshooting

The common faults, analysis, and troubleshooting of the product are shown in o 8.2.

Table 8.2 Cooling tower A/C alarms and troubleshooting

Alarm	Severity	Possible cause	Reference solution
Return air temperature sensor failure	Critical	The T/H sensor fails to communicate with the main control board.	Check the communication cables to the T/H sensor.
		Dirt or water exists around the sensor, which leads to a detection fault.	Clean the T/H sensor.
		The T/H sensor is faulty.	Repair or replace the T/H sensor.

Alarm	Severity	Possible cause	Reference solution
Return air high temperature alarm	Critical	The return air high temperature alarm threshold is inappropriate for the working conditions.	Adjust the return air high temperature alarm threshold.
		The temperature displayed on the screen is different from the actual temperature.	Replace the T/H sensor.
		The cooling capacity is insufficient, or the load is too high.	Add more air conditioning units.
		The ambient temperature is too high.	Check the ambient temperature.
Return air low temperature alarm	Warning	The return air low temperature alarm threshold is inappropriate for the working conditions.	Adjust the return air low temperature alarm threshold.
		The temperature displayed on the screen is different from the actual temperature.	Replace the T/H sensor.
		The ambient temperature is too low.	Check the ambient temperature.
Return air humidity sensor failure	Major	The T/H sensor fails to communicate with the main control board.	Check the communication cables to the T/H sensor.
		Dirt or water exists around the sensor, which leads to a detection fault.	Clean the T/H sensor.
		The T/H sensor is faulty.	Repair or replace the T/H sensor.
Return air high humidity alarm	Warning	The return air high humidity alarm threshold is inappropriate for the working conditions.	Adjust the return air high humidity alarm threshold.
		The humidity displayed on the screen is different from the actual humidity.	Replace the T/H sensor.
Return air low humidity alarm	Warning	The return air low humidity alarm threshold is inappropriate for the working conditions.	Adjust the return air low humidity alarm threshold.

Alarm	Severity	Possible cause	Reference solution
		The humidity displayed on the screen is different from the actual humidity.	Replace the T/H sensor.
Compressor high pressure alarm	Major	Cables to the high pressure switch are loose or damaged.	Check cables to the high pressure switch.
		The high pressure switch is faulty.	Repair or replace the high pressure switch.
		Outdoor fans do not run properly. (The outdoor fan on/off signal cable is disconnected, the input power supply has a phase loss, or the fans are damaged.)	Repair or replace the outdoor fans. (Verify correct connection of the outdoor fan on/off signal cable, ensure the input power supply has no phase loss, or replace the fans.)
		The condenser is blocked.	Clean the condenser.
		Refrigerant is overfilled.	Decrease a certain amount of refrigerant.
Compressor high pressure lock alarm	Critical	Cables to the high pressure switch are loose or damaged.	Check cables to the high pressure switch.
		The high pressure switch is faulty.	Repair or replace the high pressure switch.
		Outdoor fans do not run properly. (The outdoor fan on/off signal cable is disconnected, the input power supply has a phase loss, or the fans are damaged.)	Repair or replace the outdoor fans. (Verify correct connection of the outdoor fan on/off signal cable, ensure the input power supply has no phase loss, or replace the fans.)
		The condenser is blocked.	Clean the condenser.
		Refrigerant is overfilled.	Decrease a certain amount of refrigerant.
Compressor low pressure alarm	Major	The filter dryer is blocked.	Repair or replace the filter dryer.
		The expansion valve is blocked.	Repair or replace the expansion valve.
		Refrigerant is leaking.	Check for any leakages. Fill refrigerant after repair.
Compressor low pressure	Critical	The filter dryer is blocked.	Repair or replace the filter dryer.

Alarm	Severity	Possible cause	Reference solution
lock alarm		The expansion valve is blocked.	Repair or replace the expansion valve.
		Refrigerant is leaking.	Check for any leakages. Fill refrigerant after repair.
Compressor discharge high temperature alarm	Major	The discharge temperature probe is faulty.	Replace the discharge temperature probe.
		Outdoor fans are faulty.	Repair or replace the outdoor fans.
		The condenser is blocked.	Clean the condenser.
		Refrigerant is leaking.	Check for any leakages. Fill refrigerant after repair.
Compressor high temperature lock alarm	Critical	The discharge temperature probe is faulty.	Replace the discharge temperature probe.
		Outdoor fans are faulty.	Repair or replace the outdoor fans.
		The condenser is blocked.	Clean the condenser.
		Refrigerant is leaking.	Check for any leakages. Fill refrigerant after repair.
Filter block alarm	Warning	An inappropriate threshold is set for the filter differential pressure switch.	Adjust the differential pressure threshold.
		The differential pressure tube is blocked, or it is secured in an inappropriate position.	Adjust or replace the differential pressure tube.
		Differential pressure sensor wiring is faulty.	Check the wiring of the differential pressure sensor.
		Filter is blocked.	Repair or replace the filter.
Power supply overvoltage alarm	Major	The power grid is unstable.	Check the power grid.
Power supply undervoltage alarm	Major	The power grid is unstable.	Check the power grid.
Power supply phase loss alarm	Critical	The power grid is unstable.	Check the power grid.
		Loose power cables.	Check the power cable connections.

Alarm	Severity	Possible cause	Reference solution
Power supply phase reverse alarm	Critical	The power grid is unstable.	Check the power grid.
Floor water overflow alarm	Critical	Water exists on the floor.	Check and clear the water.
		The overflow detection board is faulty.	Repair or replace the overflow detection board.

Caution

1. Since some circuits of the IEC cooling system have lethal high voltage, only professional technicians are allowed to carry out maintenance. Exercise caution during live-line troubleshooting.
2. When using jumpers for troubleshooting, always remember to remove the jumpers after the repair work is completed. Legacy connected jumpers may affect control functions and cause equipment damage.

2) Cooling Tower A/C Fault and Troubleshooting

The common product faults, analysis, and troubleshooting methods are as shown in Table 8.3.

Table 8.3 Fault and troubleshooting

Symptom	Possible cause	Reference solution
The unit generates abnormal noise.	The compressors, fans, or pipelines are loose.	Check the fixtures and ensure that all components are securely installed.
The compressor does not work.	The high pressure switch reacts.	Check the high pressure switch status.
	Circuit breakers, fuses, or cables are disconnected.	Check the main MCB, compressor MCB, fuses, and cables.
	The compressor is damaged.	Replace the compressor.
	No startup demand for the compressor.	Check for startup demands on the display.

Symptom	Possible cause	Reference solution
	Discharge pressure is too high.	Check whether the discharge pressure is too high. If so, discharge the air by recharging the refrigerant.
	Heat dissipation is poor because of blockages in the condenser.	Clean the condenser fins.
	Refrigerant is overfilled, insufficient, or leaking (low suction pressure).	Adjust the refrigerant charging amount.
The compressor discharge pressure is too low.	Refrigerant is leaking.	Check the pipeline for any leakages.
The compressor suction pressure is too low, or liquid returns.	The refrigerant charging amount is insufficient.	Increase refrigerant charging amount.
	The indoor temperature setpoint is too low.	Modify the temperature setpoint.
	Filter is blocked.	Replace the filter.
	The external excess pressure is too high, and the air flow rate decreases.	Check if the air duct is blocked.
	Check if the discharge pressure is too low.	Check if the outdoor fans are running properly.
The compressor generates excessive noise.	Liquid returns in the compressor.	Check whether the oil temperature and discharge temperature are within the normal range.
	The lubricant is insufficient.	Add more lubricant.
	The transport sheet metal fasteners are not removed from the compressor.	Remove the sheet metal fasteners.

Symptom	Possible cause	Reference solution
The compressor suction temperature is too high.	The measured compressor suction temperature is higher than 25℃.	Adjust the EEV or add refrigerant.
An indoor /outdoor fan fails to start.	Either the main MCB or the Indoor/Outdoor fan MCB is not turned on.	Check the MCBs.
	The indoor/outdoor fan activated high temperature protection.	Check the high temperature protection switch status.
	The fan is damaged.	Measure the output voltage of the fan contactor (main power input voltage ±10%). If the voltage is normal, then the fan is damaged. Replace the faulty fan.

Warning

The equipment has high voltage, so cut off the power supply before conducting internal maintenance. When the unit circuit breaker is turned off, the external power cable may be live.

Chapter 9 Cooling Tower A/C Maintenance

1 Overview

Preventive maintenance refers to maintenance performed at predetermined intervals or according to prescribed standards to reduce the probability of product failure and prevent functional degradation. It primarily includes adjustments, regular inspections, and necessary repairs. It familiarizes equipment maintenance and operating personnel with the product's performance, structural principles, operating methods, and precautions, enabling the equipment to function as intended.

Effective maintenance can ensure the equipment remains in a good working condition.

2 Preventive Maintenance

1. Operator Monitoring

- During normal equipment operation, operators monitor its status to identify potential faults.
- Operators shall promptly perform fault confirmation, inspection, and cause identification upon detecting any system fault alarms.

2. Operational Inspection

During normal equipment operation, operators conduct planned regular inspections to verify that the product is functioning well.

- Inspect the connections of cold/hot aisles, power cables, etc. to ensure they are intact.

  Description: Verify the integrity of all aisle connections and power circuits.

  Method: Visual inspection.
- Check the outdoor ambient temperature and humidity, and the data should be recorded every half day.

  Description: Record the outdoor environment data, and verify consistency with system operational logic.

  Method: Visual inspection, data comparison.
- Check the supply/return air temperature and humidity, and the data should be recorded every half day.

Description: Record the data of supply/return air temperature, supply/return air humidity, and fan speed to confirm operational stability over extended periods.

Method: Visual inspection, data comparison.

- Check the alarm status for temperature, humidity, fans, etc. (the aforementioned fault states are displayed in the Active Alarm interface), and the data should be recorded every half day.

  Description: Check the alarm items and perform troubleshooting per the manual.

  Method: Visual inspection; troubleshooting on demand.

- After verifying normal operation of the container, inspect the cable connections within the distribution cabinet and the cooling tower A/C junction box. This inspection is required during initial operation, the first operation after relocation, and subsequently every six months during normal operation.

  Description: Check if cable connection points are secure and if there is any abnormal temperature rise.

  Method: Visual inspection; use a hand-held infrared detector to check if connection point temperatures are abnormal. When the displayed temperature exceeds 70℃ or is 30℃ higher than the ambient temperature, inspect and re-tighten the connection points.

Danger

If abnormal temperature rise or other abnormalities are detected in the equipment, the unit shall be shut down immediately for troubleshooting to prevent component overheating that could lead to equipment burn-out or fire accidents. Do not start the unit until the issue is identified and resolved.

3 Recommended Maintenance Frequency for the A/C

To ensure long-term normal system operation, perform routine maintenance inspections according to the recommended frequency:

No.	Frequency	Item
1	Monthly	Indoor filter
2		Outdoor filter
3		Water tank filter
4		Y-strainer
5		Indoor/Outdoor fan
6		Spray system
7		Heat exchange core
8		Compressor
9	Quarterly	Spray nozzle
11	Semi-Annually	Condenser filter
12		Water storage tank
14		Electric control system
15	Annually	Other cooling systems
17		Evaporator and condensate gutter
18		Condenser

4 Indoor Filter

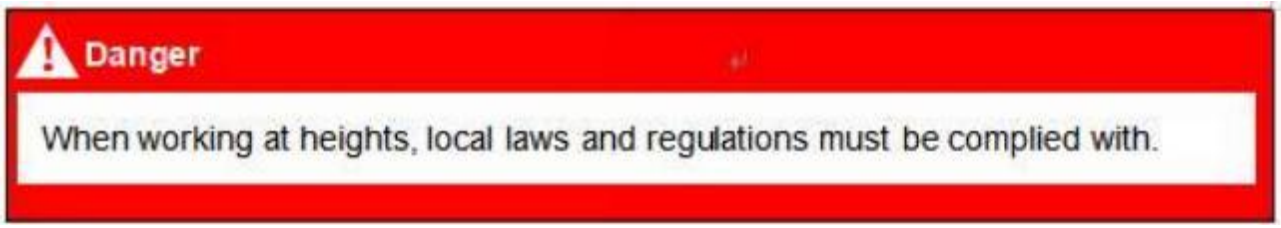


Table 9.1 Maintenance items

No.	Item	Operations	Troubleshooting	Note
1	Check if the filter is blocked.	Check the surfaces of the filter.	Clean or replace the filter (by using a vacuum cleaner or beating the dust out).	Perform the operations with the power on.
2	Check if the filter is damaged or deformed.	Check the surfaces of the filter.	Replace the filter.	Perform the operations with the power on.
3	Check if the differential pressure sensor of the filter works properly.	Block 100% of the air return vent with plastic foam or baffles. If a filter block alarm is triggered, the differential pressure sensor is working properly. If the filter block alarm is not triggered, check if the differential pressure tube is correctly connected.	Check if the pressure tube of the sensor is fixed properly. (The pressure tube is fixed on the sheet metal part at the top of the filter back.) If the problem is not resolved, contact technical support to replace the sensor.	Perform the operations with the power on.

5 Outdoor Filter

Table 9.2 Maintenance items

No.	Item	Operations	Troubleshooting	Note
1	Check if the filter is blocked.	Check the surfaces of the filter.	Clean or replace the filter (by using a vacuum cleaner or beating the dust out).	Perform the operations with the power on.
2	Check if the filter is damaged or deformed.	Check the surfaces of the filter.	Replace the filter.	Perform the operations with the power on.

6 Y-Strainer

Table 9.3 Maintenance items

No.	Operations	Troubleshooting	Note
1	Check if the Y-strainer is blocked.	Clean or replace the strainer.	Perform the operations with the pumps stopped.
2	Check if the Y-strainer is damaged or deformed.	Replace the strainer.	Perform the operations with the pumps stopped.

7 Fan

Table 9.4 Maintenance items

No.	Operations	Troubleshooting	Note
1	Check if there are foreign matters in the fan.	Clean the foreign matter.	Perform the operations with the power off.
2	Check if the blades are intact.	Repair the blades. If they cannot be repaired, replace the fan.	Perform the operations with the power off.
3	Check if there is any abnormal noise (e.g., metal friction sound, harsh noise, etc.) during fan operation.	Clean the foreign matter and verify that the fan fixing bolts are tightened.	Perform the operations with the power on.
4	Check if the fixing screws are tightly secured with no deformation.	Tighten the screws or replace the screws.	Perform the operations with the power off.
5	Check if the wiring terminals have no looseness	Reconnect the cables.	Perform the operations with the power off.

8 Spray System

Table 9.5 Maintenance items

No.	Operations	Troubleshooting	Note
1	Check if there is any foreign matter in the spray pipe.	Clean the foreign matter.	Perform the operations with the pumps stopped.
2	Check if the pipelines are intact	Replace the damaged pipes.	Perform the operations with the pumps stopped.

9 Heat Exchange Core

Table 9.6 Maintenance items

No.	Operations	Troubleshooting	Note
1	Confirm that there is no air/water leakage inside or outside the core.	Contact technical support.	Perform the operations with the power off.

10 Compressor

Table 9.7 Maintenance item

No.	Operations	Troubleshooting	Note
1	Check if the four fixing screws on the compressor are firm.	Tighten the loose screws.	Perform the operations with the power off.
2	Check if the solder joints on the compressors have any leakages or oil stains.	Clean the oil stains and verify that there is no leakage in the solder joints.	Perform the operations with the power off.

11 Evaporator and Condensate Gutter

Table 9.8 Maintenance items

No.	Operations	Troubleshooting	Note
1	Check if there is water blowing in the evaporator.	Clean the evaporator (5% sodium carbonate solution is recommended).	Perform the operations with the power off.
2	Check if the evaporator surface is clean.		
3	Check if the condensate gutter is blocked.	Clean the condensate gutter.	

12 Condenser

Table 9.9 Maintenance items

No.	Operations	Troubleshooting	Note
1	Check if the condenser is blocked.	Clean the condenser.	Perform the operations with the power off.

13 Condenser Filter

Table 9.10 Maintenance items

No.	Operations	Troubleshooting	Note
1	Check if the condenser filter is blocked.	Clean the condenser filter.	Perform the operations with the power off.

Caution

During condenser cleaning, avoid water splashing onto the internal walls of the unit.

14 Water Storage Tank

Table 9.11 Maintenance items

No.	Operations	Troubleshooting	Note
1	Check if there is any debris or sediment in the tank.	Turn off the water pump and manually drain the tank. Then, use cleaning tools to remove any foreign matter.	Perform the operation with the water cut off.
2	Check if the tank coating shows any peeling.	Contact a technical engineer for coating repair.	Perform the operations with the power off.

Caution

Do not flush large amounts of sediment directly into the pump's water inlet or drain port during water tank maintenance.

15 Electric Control System

Semiannual maintenance items for the electric control system are shown in Table 9.12.

Table 9.12 Maintenance items

No.	Operations	Troubleshooting	Note
1	Check and secure all circuit cables, and ensure that all wiring terminals are securely tightened.	Secure the terminals.	Perform the operations with the power off.
2	Check if each plug has proper contact.	Reconnect the plug. If the problem is not resolved, replace the terminals.	Perform the operations with the power off.
3	Check if the main control board is well connected to the display panel and T/H sensor.	Reconnect the cables.	Perform the operations with the power off.
4	Check if the main control board is well connected to all contactors, differential pressure sensors, and other inputs.	Reconnect the cables.	Perform the operations with the power off.
5	Use a brush or compressed dry air to clean various electrical components, control components, the main control board, SPD, and the voltage detection board.	-	Perform the operations with the power off.
6	Check if the main control board, display panel, T/H sensor, SPD, voltage detection board, and power cables are free from aging on the surface.	Replace the components or cables.	Perform the operations with the power off.

No.	Operations	Troubleshooting	Note
7	Check if the transformer is intact and the main control board output voltage is within the normal range (12 V DC).	Check if the power input cable is properly connected. If not, reconnect it. If yes, replace the transformer.	Perform the operations with the power on.
8	Check if all MCBs are working properly.	Replace the MCBs.	Perform the operations with the power on.
9	Check if the water sensor (optional) is securely installed.	Secure the water sensor.	Perform the operations with the power off.

16 Pipeline Antifreeze

Table 9.13 Maintenance items

No.	Operations	Troubleshooting	Note
1	During winter power-off, the water in the pipeline should be drained completely to prevent the spray system pipeline from freeze damage.	After the unit is de-energized, open all manual ball valves, blowdown valves, anti-freezing drain valves, injection 2-way valves, and pump drain ports.	Perform the operations with the power off during winter.
2	Verify complete drainage of water from pumps after the water is cut off for winter.	Regular inspection of drainage, and ensure all the valves on the pipelines are opened.	Perform the operations with the water cut off during winter.

Danger

Drain all water from pipelines according to freeze-prevention requirements when ambient temperatures fall below 0°C to prevent damage to the spray system.

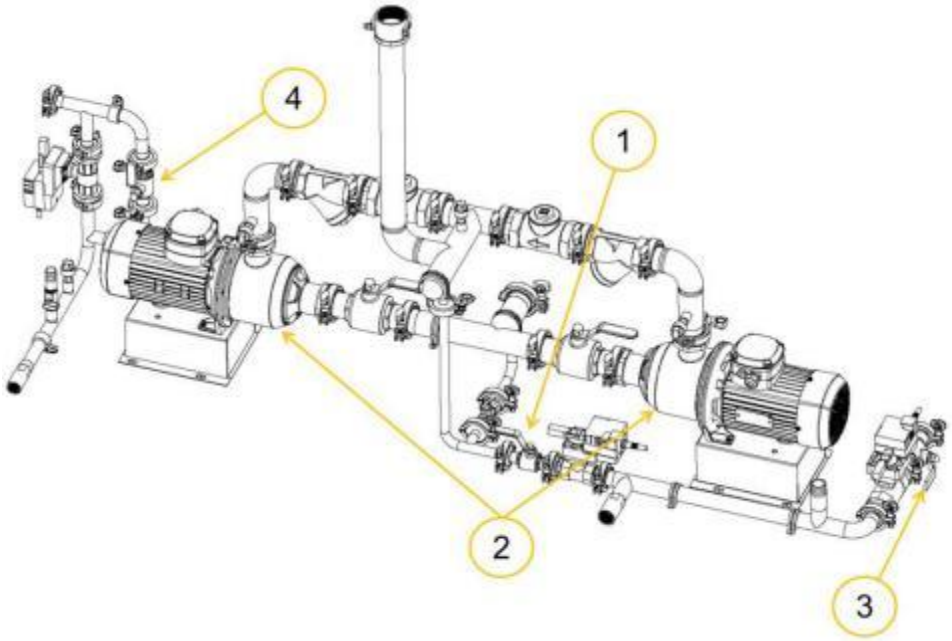


Figure 9.1 Pipeline antifreeze diagram

Winter antifreeze procedures are as follows:

Step 1 Verify manual valve □ on the antifreeze pipeline is open to prevent pipe freezing/cracking.

Step 2 Open the pump drain port □ to completely drain water from the pump.

Step 3 Keep bypass manual valve □ on the water supply pipe open to drain water from the valve.

Step 4 Open manual valve □ on the blowdown pipe to completely drain water from the drain pan.

Chapter 10 Component Replacement

1 Filter Replacement

Context

The indoor filter locations are as shown in Figure 10.1.

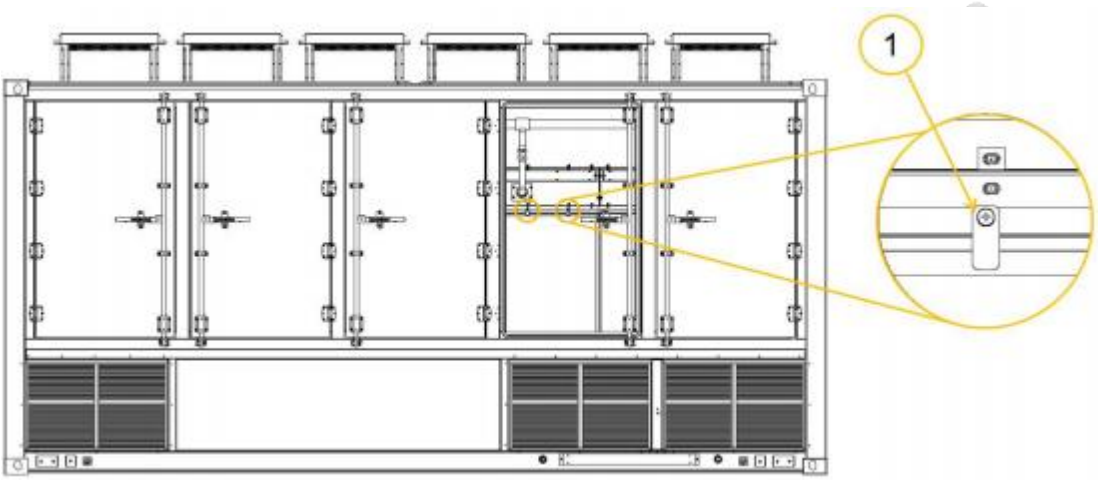


Figure 10.1 Filter removal

Procedure

Step 1 Open the second-layer maintenance access door of the unit to enter the return air passage.

Step 2 Remove the filter mechanical part ㄱ in the direction as shown in the figure, then take out the filter.

Step 3 Install a new filter in the inverse order.

Caution

Ensure correct installation sequence of filters.

2 Indoor Fan Replacement

Context

Indoor fan replacement is as shown in Figure 10.1.

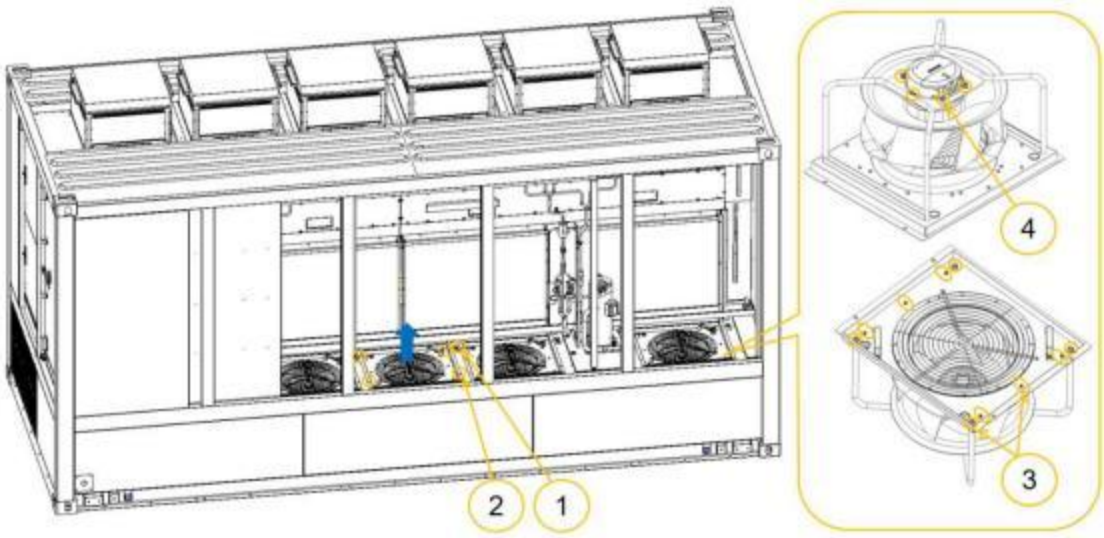


Figure 10.2 Indoor fan removal

Caution

Exercise caution throughout the process due to the heavy weight of evaporator fans to avoid personal injury.

Procedure

Step 1 In the cold aisle, disconnect the Indoor fan power supply □ and remove the fan connection cables.

Step 2 Remove screws □□ securing the Indoor fan module to the frame, then pull the fan out of the frame.

Step 3 Remove screws and nuts □ to separate the fan mounting plate from the installation bracket. Replace with a functional fan.

Step 4 Install a new Indoor fan in the inverse order.

Step 5 Energize the unit and check if the fan rotates normally.

3 Outdoor Fan Replacement

Context

Outdoor fan removal and replacement are as shown in Figure 10.3.

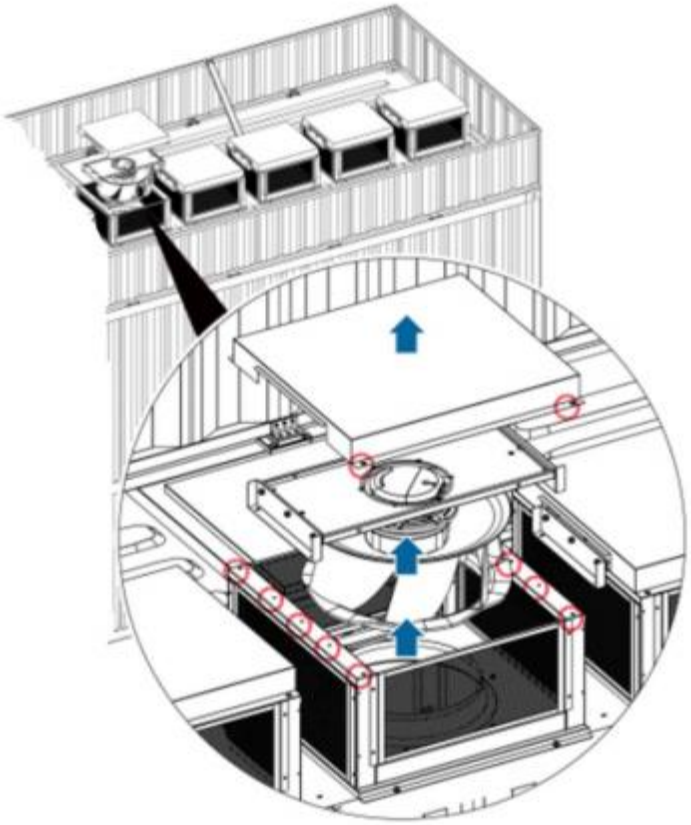


Figure 10.3 Outdoor fan removal

Caution

Maintain condenser fans individually. Close top maintenance doors carefully to prevent collisions.

Maintainers must take protective measures and possess valid qualifications when working at heights.

Procedure

Step 1 Cut off the power supply.

Step 2 Remove the rain hood and the fan cover, then disconnect the fan cables.

Step 3 Remove screws around the fan base and remove the fan as shown in Figure 10.3.

Step 4 Detach safety guards from all four sides, then remove the fan's mechanical parts.

Step 5 Withdraw the fan along the maintenance passage for replacement.

Step 6 Install a new outdoor fan in the inverse order.

Step 7 Energize the unit and check if the fan rotates normally.

4 Pump Replacement

Context

Pump replacement is as shown in Figure 10.4.

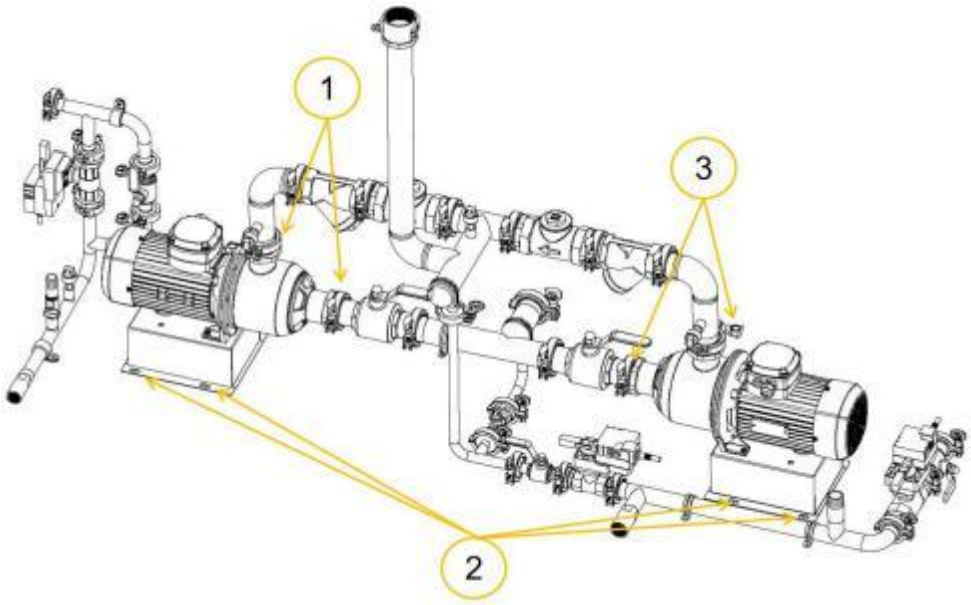


Figure 10.4 Pump removal

Caution

When a pump remains idle for a long period during winter, it is recommended to open the drain port to empty the water in it.

Procedure

Step 1 Disconnect the pump power supply. Then, remove the fixing screws at the upper-left corner of the low-voltage control box and close the manual ball valve at the pump inlet.

Step 2 As shown in Figure 10.4, remove the chucks at the pump inlet/outlet ports, then remove the fixing bolts from the pump base.

Step 3 Remove the pump and replace it.

Step 4 After maintenance, install a new pump in the inverse order.

Step 5 Power on the unit and check if the pump operates normally.

5 Spray Nozzle Replacement

Context

The spray pipeline location is as shown in Figure 10..

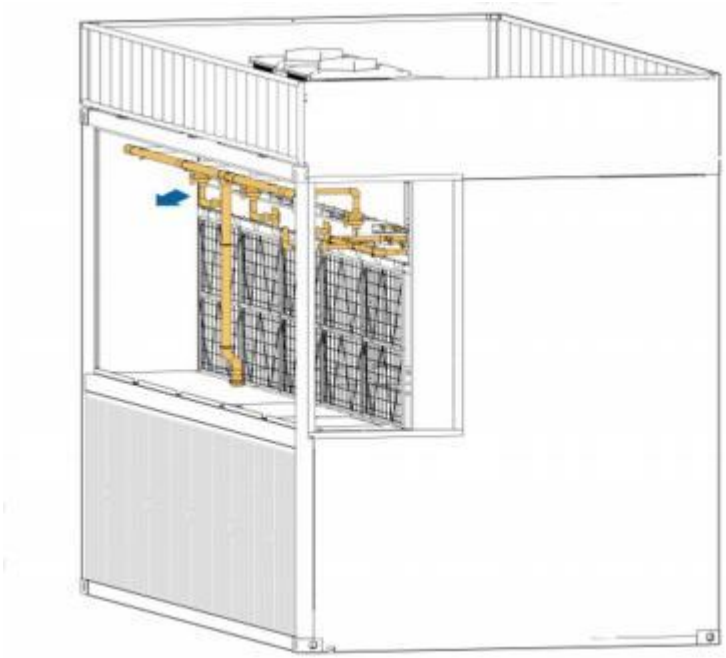


Figure 10.5 Spray pipeline removal

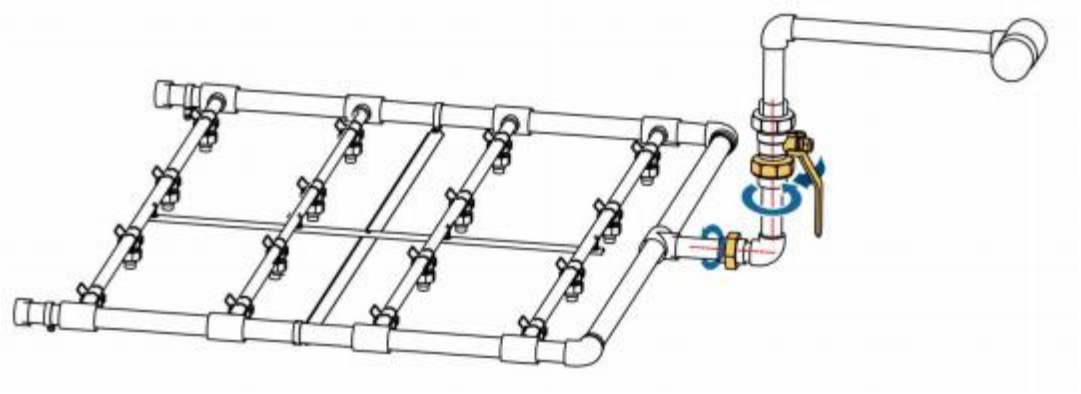


Figure 10.6 Spray system (zoom in)

Caution

Do not step on the unit's drain pan when replacing spray nozzles.

Danger

When working at heights, relevant local regulations shall be followed. And operators must possess relevant qualifications and take necessary protective measures.

Procedure

Step 1 Cut off the power supply.

Step 2 Use a ladder to reach the nozzle.

Step 3 Unscrew the nozzle tip retaining clip and replace a new nozzle.

Step 4 Energize the unit and check if the spray system operates normally.

6 Compressor Replacement

Context

Compressor replacement is as shown in Figure 10..

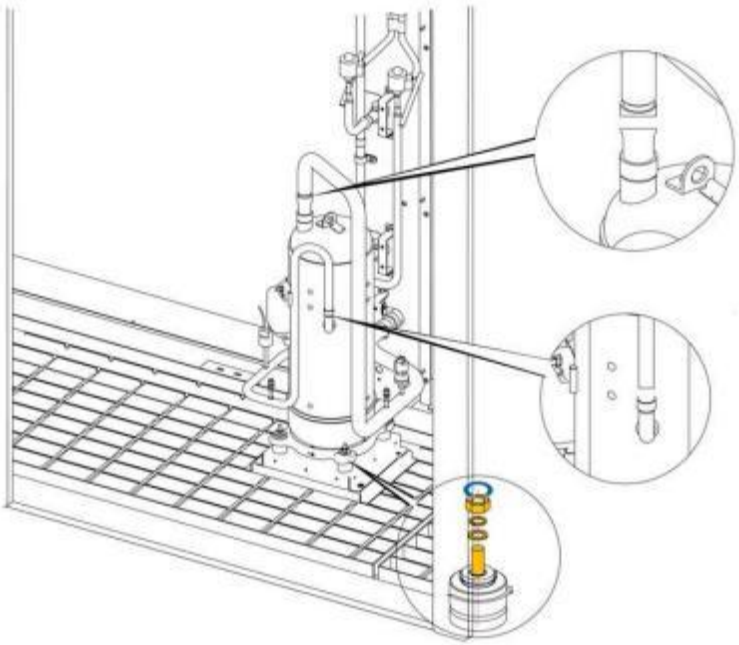


Figure 10.7 Compressor removal

Danger

When replacing a compressor, avoid skin contact with the refrigerant or lubricant to prevent frostbite or burns.

Caution

Do not tilt the compressor during replacement to prevent lubricant leakage.

Recover or dispose of refrigerant according to local regulations. Do not discharge it directly into the atmosphere.

Install a new compressor immediately after you remove the rubber plugs of suction inlet and exhaust outlet to prevent the moisture intake.

Warning

Refrigerant discharge must comply with local environmental requirements.

Procedure

Step 1 Cut off the power supply.

Step 2 Reclaim the refrigerant.

Step 3 Disconnect the cables from the compressor.

Step 4 Remove the suction and discharge pipes and seal the suction and discharge ports to ensure that the system is clean and does not draw in moisture.

Step 5 Loosen the tightening bolts to take out the compressor as shown in Figure 10..

Step 6 Blow away dirt with nitrogen, check the filter dryer, and replace it if necessary. Meanwhile, protect pipelines from foreign matter.

Step 7 Install a new compressor, perform evacuation and precharge refrigerant to the system.

Step 8 Connect cables to the new compressor, start it, and continue to charge the refrigerant based on the system parameters to the optimal level.

Chapter 11 Safety Precautions

Danger

When the system remains inactive for a long period, disconnect the main power supply.After extended power outages,follow the standard startup procedure.

1 Maintenance

Only qualified and authorized personnel can perform maintenance or other operations on the electrical systems.

2 Operations

The server container is equipped with a fire extinguishing system (stored on the left side of the distribution cabinets with clear labeling). Fire extinguishing agent: HFC-227ea, compliant with local fire regulations.

The equipment must have ≥ 2 reliable grounding points. Verify protective grounding continuity (resistance < 0.1 Ω); failure may cause fatal accidents.

DO NOT clean the equipment with power ON—risk of electric shock or other injuries. DO NOT clean the equipment with water—risk of electric shock.

Confirm all valves are open before startup (where applicable).

Distribution cabinet & main control cabinet safety protocols:

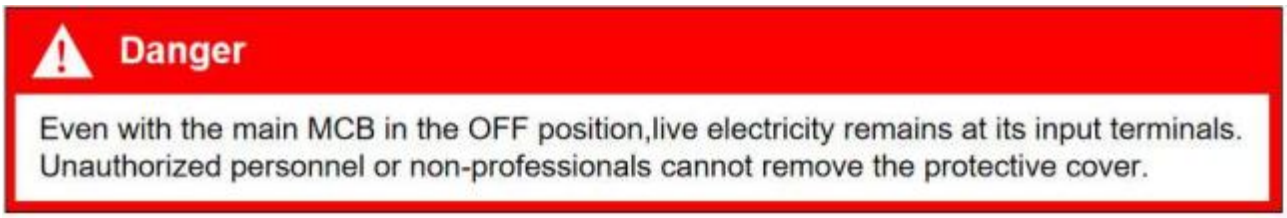
Before operations on the distribution cabinet or main control cabinet, ensure that the cabinet doors are locked to prevent electric shock. This also prevents salt spray, moisture, dust in the air, or other conductive contaminants from entering the cabinets.

When powering on, DO NOT touch the internal boards, cables, terminals, modules, or sensors—risk of severe injury.

In case of malfunctions, abnormal odors, or unusual noises, immediately shut off the main switches of all three cabinets or press the emergency stop button on the container door. Failure may cause electric shock or fire.

3 Notice

- Unauthorized/unqualified personnel must NOT open the doors of the distribution cabinets.
- Distribution cabinet doors may only be opened when the main switches are in the OFF position.



Before using this equipment, please read this manual carefully. Should you have any difficulties or problems, please consult authorized personnel from the factory for assistance.