高安全 长循环 高能效

User Manual

Magna-UTL-373

DC liquid-cooled outdoor energy storage cabinet

鹏辉能源

鹏辉专注于锂电池二十余载，通过全球多场景安装实施经验，电芯、PACK、RACK和电池系统以高安全、长循环、高能效的优势赢得客户青睐。

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Introduction

Product Description

DC liquid-cooled outdoor energy storage cabinet (372.7kWh) (Magna-UTL-373) is optimally combined with Battery Manage System (BMS), Thermal Manage, Battery, Power Distribution System and Extinguishing System. It is safe, long life, easy to be extended and highly integrated. And it is single series design, which would lead no capacity lost in parallel. For using on the grid side, Magna-UTL-373 can use for harmonic suppression, reactive compensation, three phases unbalance adjustment. It can also release energy which is stored in valley time, and help to adjust the rush hour power and frequency. Magna-UTL-373 can be in parallel with another(other) Magna-UTL-373 cabinet(s) after fully wired if the energy system capacity is supposed to be extended.

Introductions gave in this user manual are including the functions' characteristics and the use method of Magna-UTL-373. It shows the product installation, parameters setting, field debug, fault diagnosis, General operation and maintaining requirements and cautions. Users must read this manual carefully and fully understand the safety requirements before using the Magna-UTL-373.

Description

- BMS：Battery Management System
- BMU：Battery Management Unit
- QF： Q（Switching device for power circuit），F（Protection device），QF(Circuit Breaker or Disconnector Switch)。
- ESS：Energy Storage System
- BPU: Battery Protection Unit, or High Voltage Box
- PCS：Power Conversion System
- SOC：State Of Charge
- SOH: State Of Health
- PDU：Power Distribution Unit
- TMS：Thermal Management System
- FSS: Fire Suppression System

Warranty declaration

Under normal use, if the product breaks down or is damaged, Great Power will provide warranty service within the warranty period (please refer to the product warranty for details). After the warranty period, a repair fee will be charged.

During the warranty period, the product damage caused by the following circumstances will be charged for maintenance,

- Product damage caused by operating this product but not in line with the requirements of this manual.
- Damage of product caused by external fires, floods or abnormal voltage.
- Damage of product caused by using this product in an abnormal function mode.
- Damage of product caused by using this product in an un-expectation use purpose.
- Second damage caused by force majeure factors(natural disasters, earthquakes, lightning).

The relevant service fee shall be calculated according to the unified standard of the manufacturer. If there is a contract, the contract shall be treated with the principle of priority. For details about the warranty, refer to the Product Warranty Card.

Safety related caution items

Safety declaration

- This section descripts the safety related caution for using this product in a correct way. Before using this product, please read this user manual and fully understand the safety related caution items. It might cause death, heavy hurt or devices damaged, if user(s) is(are) not in line with the requirements in this section.
- DANGER, WARNING and CAUTION in this manual, are not represent all safety related items, it can only be supplementary for all safety related items.
- This product should be used in an environment which is in line with the designed specifications. Otherwise it might be cause break down. It is not in the warranty scope if the abnormal function and components damage is caused by using this product that not in line with the stipulation in this manual.
- Great Power will not bear any legal liability to human safety accident, property loss caused by using product that not in line with the description in this manual and illegal operation.

Definition of safety level

DANGER	Indicates that death or serious bodily injury resulted if not followed.
WARNING	Indicates that death or serious bodily injury may result if not done in accordance with the regulations.
CAUTION	Indicates that minor bodily injury or damage to the equipment may result if not operated in accordance with the regulations.

Safety warning signage

DANGER

When installing, maintaining and servicing liquid-cooled outdoor cabinets, it is important to prevent any accidents or mishandling by uninvolved personnel. Please observe the following:

- Clearly mark switches located at the circuit before and after of the liquid-cooled outdoor cabinet to prevent accidental closing of the switch.

- Establish warning signs or safety strips near the operating area.
- Always remove the key from the cabinet door and keep it in a safe place after maintenance and repair operations.

Escape route requirements

DANGER

- During the entire process of maintenance, servicing and other operations on the liquid-cooled outdoor cabinet, the escape routes must be kept completely clear.
- It is strictly forbidden to pile up debris in the escape routes or to occupy them in any way.

Energy storage battery protection

DANGER

- The voltage between the positive and negative terminals of the energy storage battery pack is very high; if touched accidentally, there is a risk of electric shock or even life.
- Fatal high voltage exists between positive and negative energy storage batteries. When maintaining the equipment, ensure that the connection between the energy storage converter and the energy storage battery is completely disconnected.
- Fatal high voltage exists between the positive and negative side of the energy storage battery. Make sure that the disconnection is not accidentally reconnected by placing a warning sign at the point of disconnection.

Aerial work requirements

DANGER

- Any work shall be performed on field, including but not limited installing, daily maintaining, overhaul and so on, should be fully evaluated the hazards level according to the working location height. And they should be performed by a person who have already get a qualification of aerial work. Supports or platforms, or cranes shall be ready if necessary. And these works must be performed in line with the requirements of local regulations and standards.

Safety Precautions

- The product illustrations in this manual are sometimes shown with the enclosure or safety cover removed in order to show the detailed parts of the product. When using this product, please ensure that the enclosure or safety cover as specified and operate in accordance with the manual.
- The product illustrations in this manual are only examples and may differ slightly from the product you have ordered, please refer to the actual product ordered.

Unpacking and acceptance

WARNING

- Do not install products and product accessories found to be damaged, rusted, or showing signs of use when unpacked!
- If you find water inside the product, missing parts or damaged parts when unpacking, please do not install it!
- Please check the packing list carefully. If you find that the packing list does not match the product name, please do not install it!

CAUTION

- Before opening the box, please check that the outer packaging of the equipment is in good condition and that it is not damaged, wet, damp or deformed.
- Please open the packaging according to the order of the hierarchy, it is strictly forbidden to knock violently!
- When unpacking, please check the surface of the equipment and accessories for damage, rust, bruises, etc.
- After unpacking, please check carefully against the packing list to see if the equipment and accessories are complete in quantity and information.

When storing and transporting

WARNING

- Always use professional lifting equipment and have large or heavy products handled by qualified professionals. Otherwise there is a risk of injury or product damage!
- Before lifting the product vertically, make sure that the front cover, terminal block and other components of the product are securely screwed in place, otherwise there is a risk of injury or damage to the product if the components fall off!
- Do not stand or stay under the product while it is being lifted by lifting equipment.
- When lifting the product with a wire rope, lift it at a steady and even speed, do not subject the product to vibration or shock, do not overturn the product and do not leave the product in a lifted state for a long time, otherwise there is a risk of injury or damage to the product!

CAUTION

- When handling products, always lift gently and keep an eye on objects under your feet to

prevent tripping or falling, otherwise there is a risk of injury or damage to the product!

- When handling products with your bare hands, make sure you hold onto the product casing to avoid dropping the product parts, otherwise there is a risk of injury!
- Store and transport in strict accordance with the storage and transport conditions required by the product, otherwise there is a risk of damage to the product.
- Avoid storage and transport in places subject to water, rain, direct sunlight, strong electric fields, strong magnetic fields, strong vibrations, etc.
- Avoid storing the product for longer than 3 months. If the storage time is too long, please carry out tighter protection and necessary tests.
- Please pack the product strictly before transporting it by vehicle. For long distance transport, closed boxes must be used.
- It is strictly forbidden to transport this product in mixed packages with equipment or objects that may affect or damage this product.

When installing

DANGER

- Only trained professionals with knowledge of electrical equipment may operate. Operation by non-professionals is strictly forbidden!

WARNING

- Be sure to read the product manual and safety precautions carefully before installation!
- Do not install the product in places where strong electric fields or strong electromagnetic waves interfere!
- Make sure that the mechanical strength of the installation position is sufficient to support the weight of the equipment before carrying out installation work, otherwise a mechanical hazard may result.
- Do not wear loose clothing or accessories when carrying out installation work, as this may result in a risk of electric shock!
- Modification of the product is strictly forbidden!
- It is strictly forbidden to unscrew the fixing bolts and red marked bolts of the product parts and components!
- When installing equipment with strong electromagnetic interference, such as transformers, please install shielding protection to avoid false operation of the product!
- Do not allow flammable materials to come into contact with the product or attach flammable materials to the product, as this may cause a fire hazard.
- This product is only permitted to be installed and used outdoors or in a dedicated building (not a public building such as a residence or office).

CAUTION

- When carrying out installation work, please cover the air inlet and outlet of the product with cloth or paper to prevent foreign objects such as metal shavings, oil and water from entering

the product during drilling, which may cause the product to malfunction. After the work is finished, please remove the coverings to avoid blocking the ventilation holes and affecting the heat dissipation, resulting in abnormal heat generation.

When connecting the wires

DANGER

- Installation, wiring, maintenance, inspection or replacement of parts by unprofessional personnel is strictly prohibited!
- Before wiring, disconnect all equipment from the power supply. Please wait at least the time specified on the warning label on the product before wiring etc. Measure the DC voltage of the main circuit to make sure it is under a safe voltage, otherwise there is a risk of electric shock.
- Do not connect the product, remove the cover or touch the circuit board without disconnecting the power supply, otherwise there is a risk of electric shock.
- Make sure that the equipment and product are well grounded, otherwise there is a risk of electric shock.

WARNING

- It is strictly forbidden to connect the input power to the output of the device or product, as this may cause damage to the device or even cause a fire.
- The cables used for wiring must comply with the appropriate wire diameter and shielding requirements, and the shielding layer of shielded cables must be reliably earthed at one end!
- Please tighten the terminal screws according to the tightening torque specified in the manual. Insufficient or excessive tightening torque may lead to overheating and damage to the connection and may cause a fire hazard.
- After wiring, make sure that all cables are wired correctly and that there are no dropped screws, gaskets or exposed cables inside the product, otherwise there may be a risk of electric shock or damage to the product.

CAUTION

- Follow the procedures specified in the electrostatic discharge prevention measures (ESD) and wear an electrostatic hand ring for wiring and other operations to avoid damage to the equipment or the circuitry inside the product.
- When wiring the control circuit, use a double stranded shielded wire and connect the shield to the ground terminal of the product for grounding, otherwise the product may operate abnormally.

At power up

DANGER

- Before powering up, please make sure the product is well installed and firmly wired.

- Please make sure that the power supply meets the requirements of the product before applying electricity to avoid damage to the product or causing a fire!
- It is strictly forbidden to open the door of the product or the protective cover of the product, touch any terminals of the product or dismantle any device or part of the product in the energised state, otherwise there is a risk of electric shock!

- Once the wiring operation and parameter setting is complete, please carry out a test run of the machine to confirm that it can operate safely, as failure to do so may result in injury to personnel or damage to the equipment.
- Before powering up the machine, ensure that the rated voltage of the product corresponds to the mains voltage. If the wrong supply voltage is used, there is a risk of fire.
- Make sure that there are no people around the product or machine before powering it on, as failure to do so may result in injury or death.

Running time

- It is strictly forbidden to run the product by non-professional personnel, otherwise there is a risk of injury or death!
- It is strictly forbidden to touch any terminals of the equipment, disassemble any devices or parts of the equipment and products in the operating state, otherwise there is a risk of electric shock!
- When the product is being tested and operated, the cabinet door must be kept tightly closed, otherwise condensation water will form on the surface of the product, and long-term condensation water may cause rust on the sheet metal;

- Do not touch the appliance casing, fan or resistors etc. to test the temperature, as this may cause burns!
- Avoid dropping other objects or metal objects etc. into the appliance during operation, as this may cause fire or product damage!

When maintaining

- Installation, wiring, maintenance, inspection or replacement of parts by non-professionals is strictly forbidden!
- Do not carry out maintenance on the appliance while it is energised, otherwise there is a risk of electric shock!

- After disconnecting all equipment from the power supply, please wait at least the time specified on the warning label on the product before carrying out maintenance etc.

WARNING

- Please carry out routine and regular inspections and maintenance of equipment and products in accordance with equipment maintenance and servicing requirements and keep maintenance records.

When repairing

DANGER

- Installation, wiring, maintenance, inspection or replacement of parts by non-professionals is strictly forbidden!
- It is strictly forbidden to carry out maintenance of the equipment in an energised state, otherwise there is a risk of electric shock!
- When servicing, always switch off the machine and make sure that the energy storage system has stopped running before performing maintenance or overhaul operations on the equipment.
- After disconnecting all equipment from the power supply, please wait at least the time specified on the warning label on the product before carrying out equipment checks, repairs etc.
- Even if the external circuit is completely disconnected, there is still a high voltage situation between the positive and negative terminals of the energy storage battery pack. Some measurement parameters need to be carried out under charged conditions and the testing process needs to be carried out with special instruments and by specialist personnel.
- Do not modify the internal equipment of the battery system as this may be dangerous.

WARNING

- Please follow the product warranty agreement to report the equipment for repair.
- In the event of a blown fuse, tripped circuit breaker or tripped earth leakage circuit breaker (ELCB), please wait at least the time specified on the warning label on the product before switching on the power or operating the machine, otherwise injury or damage to the equipment may result.
- In the event of equipment failure or damage, it is important that the equipment and products are troubleshot and repaired by professional personnel in accordance with the maintenance instructions and that maintenance records are kept.
- Please follow the product wear parts replacement instructions.
- Do not continue to use an already damaged machine as this may result in injury or greater damage to the product.
- After replacing the equipment, be sure to re-check the equipment wiring and parameter settings.

When scrapped

WARNING

- Please dispose of equipment and products in accordance with the relevant national regulations and standards to avoid property damage or casualties!
- Please dispose of your equipment and products in accordance with industrial waste disposal standards to avoid pollution of the environment.

Safety markings

To ensure safe operation, it is important to observe the safety signs attached to the equipment and not to damage or peel them off.

The safety signs are described as follows:

Safety markings	Description of contents
	With high voltage inside the cabinet, ensure that all power is cut off before maintenance and wait 35 minutes until you are sure that the capacitors and other energy storage devices inside the equipment are free of power before professionals can operate them.
	The temperature here is above the acceptable range for the human body, please do not touch to avoid burns!
	This area is electrically charged, please do not touch to avoid electric shock!

1 Product information

1.1 Product Principle

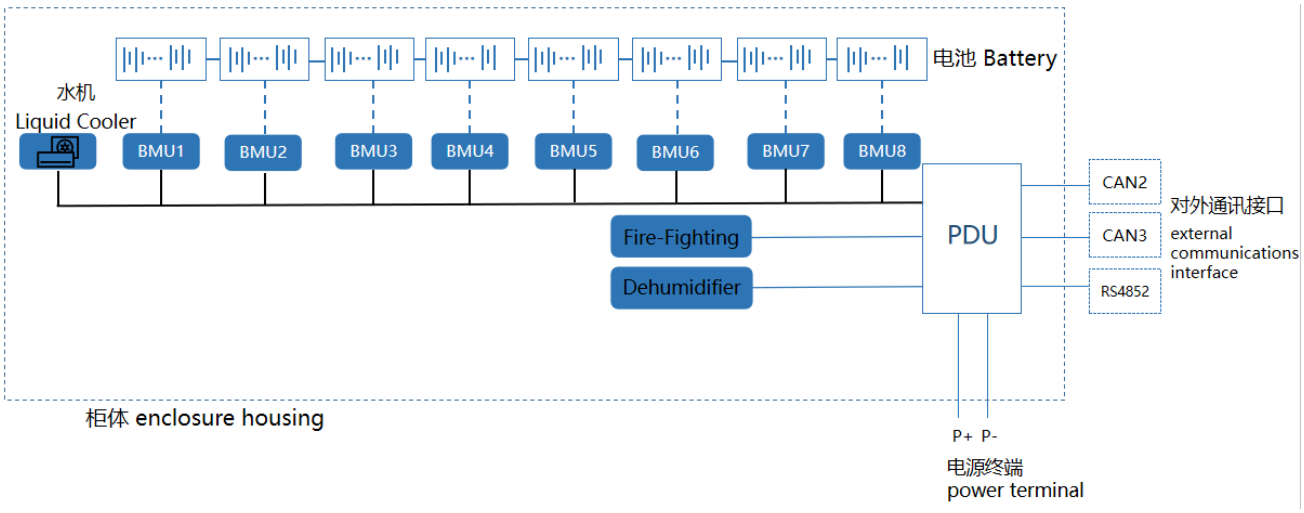

Figure 1-1 Main circuit diagram

1.2 Description of the nameplate

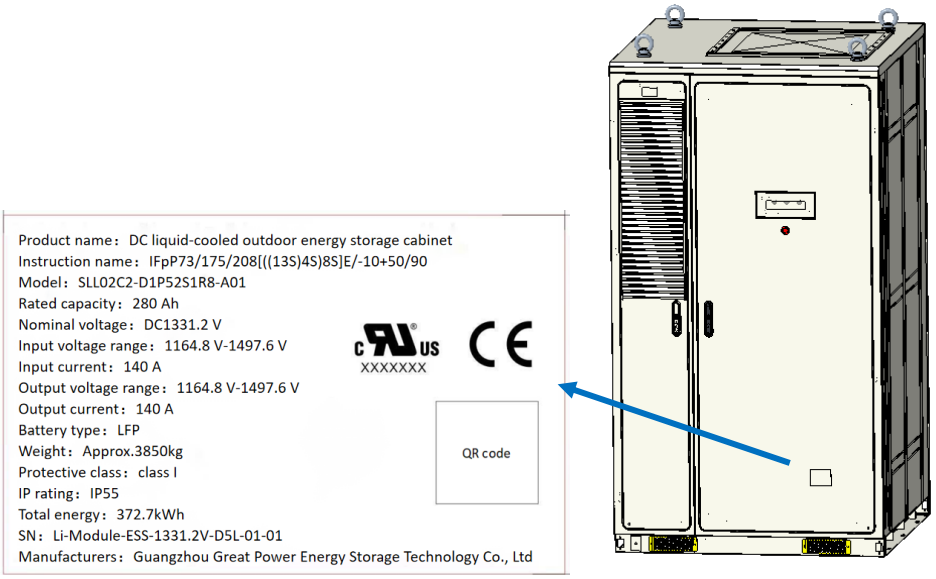

Figure 1-2 Illustration of the nameplate（reference only, see the rating table for detail parameters）

1.3 Product specifications

Table 1-1 Electrical specification parameters

Item	Magna-UTL-47	Magna-UTL-93	Magna-UTL-140	Magna-UTL-186	Magna-UTL-233	Magna-UTL-280	Magna-UTL-326	Magna-UTL-373	Remark
Model number	SLL02C2-D1P52S1R1-A01	SLL02C2-D1P52S1R2-A01	SLL02C2-D1P52S1R3-A01	SLL02C2-D1P52S1R4-A01	SLL02C2-D1P52S1R5-A01	SLL02C2-D1P52S1R6-A01	SLL02C2-D1P52S1R7-A01	SLL02C2-D1P52S1R8-A01	
Series and parallel	1P52S	1P104S	1P156S	1P208S	1P260S	1P312S	1P364S	1P416S	
Cell model	GSP71173204F,3.2V280Ah								
Nominal capacity (Ah)	280								Environmental temperature：25℃±5℃；Charge and discharge rate：0.5C；Depth of discharge ：DOD100%；Voltage Range：2.5V~3.65V/cell
Nominal energy（kWh）	46.59	93.18	139.78	186.37	232.96	279.55	326.14	372.74	
Available Energy (kWh)	45.05	90.11	135.16	180.22	225.27	270.33	315.38	360.44	
Nominal voltage（Vd.c.）	166.4	332.8	499.2	665.6	832.0	998.4	1164.8	1331.2	3.2V/cell

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Work voltage range(V)	145.6 ~ 184.6	291.2 ~ 369.2	436.8 ~ 553.8	582.4 ~ 738.4	728 ~ 923	873.6 ~ 1107.6	1019.2 ~ 1292.2	1164.8 ~ 1476.8	Cell 2.80～3.55
Maximum charge current(A)	173								25±5℃，5min
Maximum discharge current(A)	173								25±5℃，5min
Rated charging current(A)	140								0.5C
Rated discharge current(A)	140								0.5C
Charge discharge rate	≤0.5C								
Environment Temperature	25±5								Guaranteed cycle life conditions

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Power Consumption (W)	≤100W								Without liquid cooling system 110~230Vac AC power supply
Short-circuit current (A)	5950								Duration 13.4ms
Cooling method	Liquid cooling								
Weight (kg)	≈1400	≈1750	≈2100	≈2450	≈2800	≈3150	≈3500	≈3850	Base on actual weight
System efficiency	≥94%								25℃±2℃ DOD 95%
Number of cycles of the cells	≥6000 times								25±2℃ Cycle test at the standard cycle method under 300±20Kgf preload,80%SOH
Communication interface	RS485/CAN								
IP level	IP55								
Noise	≤75dB								

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Cabinet outer dimensions(mm)	D1300*W1300*H2355		Without hoist rings
Altitude (m)	≤2000		2000m~4500m Customizable
Protection	DC input	Disconnect switch+Fuse	
	AC input	Circuit breaker	
	Overvoltage protection	DC Type II/AC OVC III	
	Fire protection systems	Aerosol/perfluorohexanone	
Environmental Requirements	Battery permissible ambient temperature	25±5℃	
	Cabinet ambient temperature	-30~50℃	
	Permissible ambient humidity	20-85%RH	
	Working altitude	≤2000 meters	
	Cooling methods	Intelligent liquid cooling	
Inlet method	Bottom inlet/Top inlet		

Note: This energy storage cabinet is treated as a component and is supposed to be use with PCS(power conversion system). Please make sure the parameters and match other choose devices, when the energy storage cabinet is integrated in a end product use purpose. And make sure the integrated system is in line with local standards and regulations.

1.4 Description of the main components

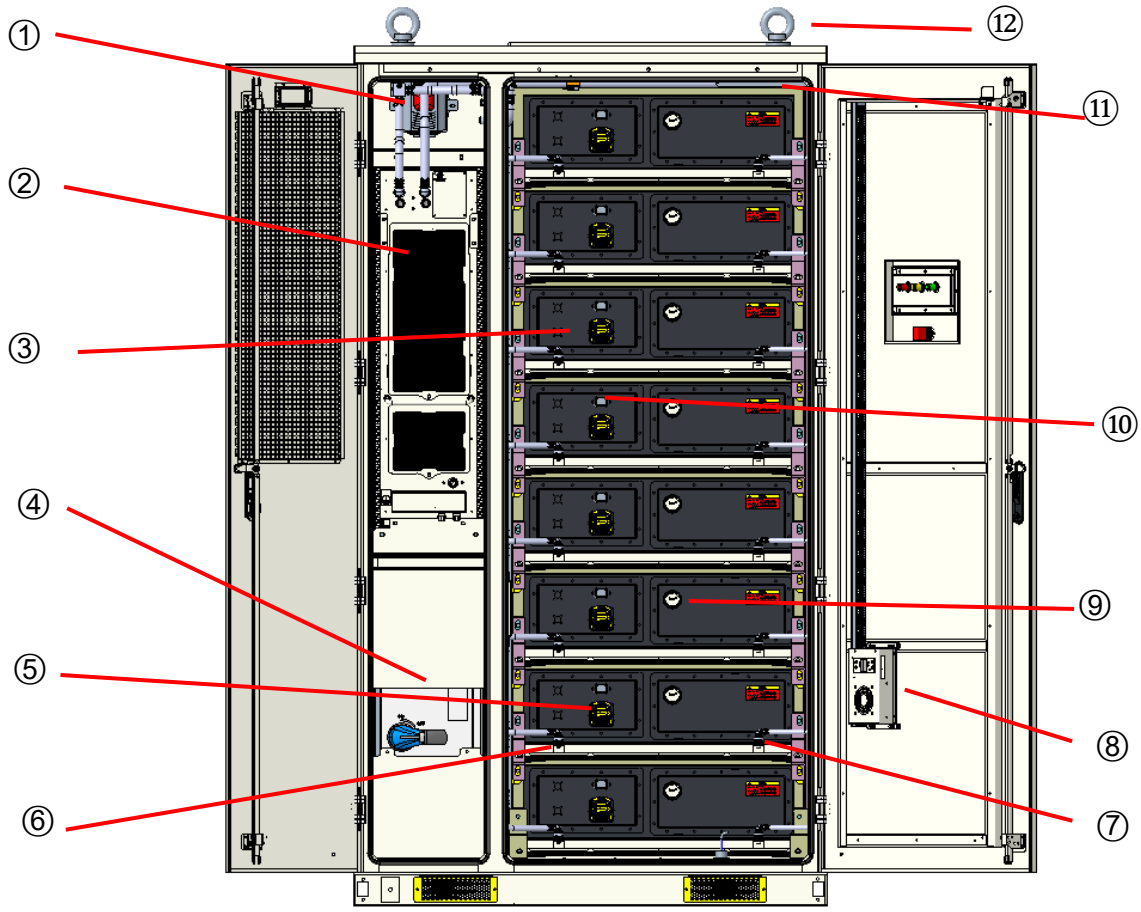


Figure 1-3 Front View

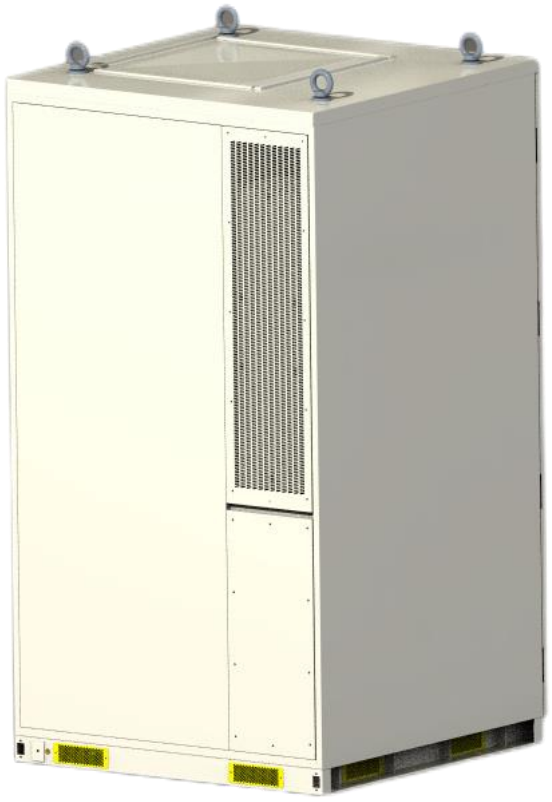


Figure 1-4 Back view

Table 1-2 Description of main parts

No.	Name	Description
①	Audible and visual fire alarms, part of FSS	In the event of a fire hazard at the cabinet terminal, the system automatically activates the fire protection device and sounds an alarm. For details, please refer to "1.4.4 Fire protection system" .
②	TMS, Liquid-cooled units	Using liquid coolant, the battery pack is cooled down. Please refer to "1.4.3 Liquid cooled units" for a detailed description.
③	Energy storage battery packs	1P52S, 166.4V, 46.5kWh, see "1.4.1 Energy storage battery system" for details.
④	BPU, High voltage control box	● is responsible for the management, protection and monitoring of the battery pack. For details, please refer to "1.4.1 Battery Management System". ● It`s responsible for communication with EMS, PCS ● It`s responsible for capturing fire status, water machine status, and executing related curricula.
⑤	MSD	● Manual Switch Device.

No.	Name	Description
⑥	Hot spout	The refrigerant conductor passes through the liquid cooler plate to exchange heat with the battery pack, from where it flows back into the liquid cooler cycle.
⑦	Cold water inlet	The refrigerant conductor flows from the liquid cooler and then enters the liquid cooling plate through the water nozzle to exchange heat with the battery pack.
⑧	Dehumidifier	To maintain the humidity level in the battery compartment.
⑨	Pressure relief valve	This indicator pops forward if an uncontrolled fire in the energy storage pack causes the aerogel inside the pack to be released to extinguish the fire.
⑩	Communication plugs	Used to connect the BMU to the BCMU in the battery pack.
⑪	FSS, Fire fighting gas extinguishers(optional)	In the event of a fire hazard at the cabinet terminal, the system automatically activates the fire protection device.
⑫	Hoist Ears	For lifting and handling.

1.4.1 Energy storage battery packs

The interior of the battery pack contains 52 cells and a BMU (Battery Monitoring Unit). A battery pack contains 24 NTC temperature samples and the battery monitoring unit collects the voltage, current and temperature of the cells inside the box.

Table 1-3 Technical parameters of the battery pack

Item		Specification
Basic parameters	Nominal power	46.59kWh
	Number of cells	52
	Monthly self-discharge of battery cells	≤3.5% 25℃,30%SOC
	Voltage range	145.6V DC~187.2V DC(CELL:2.8V DC~3.6VDC)
	Rated voltage	166.4V DC

Item		Specification
	Rated charge and discharge multiplier	0.5P
	Max. continuous current	173A
	Maximum short-circuit current	9550A（79ms）
	Balanced approach	Passive balance
Working environment	Electrical box operating temperature range	Charging: 0℃ ~ 60℃; Discharging: -20℃ ~ 60℃
	Storage temperature	-20℃~60℃
	Recommended working temperature	25 ± 5℃
General parameters	Control system power supply method	24Vdc
	Size	786mm*1141mm*251.5mm
	Weight	350kg ± 5kg
	Housing material	SPCC iron sheet material
	Cooling methods	Liquid cooling
	Communication methods	CAN

1.4.2 Battery management systems

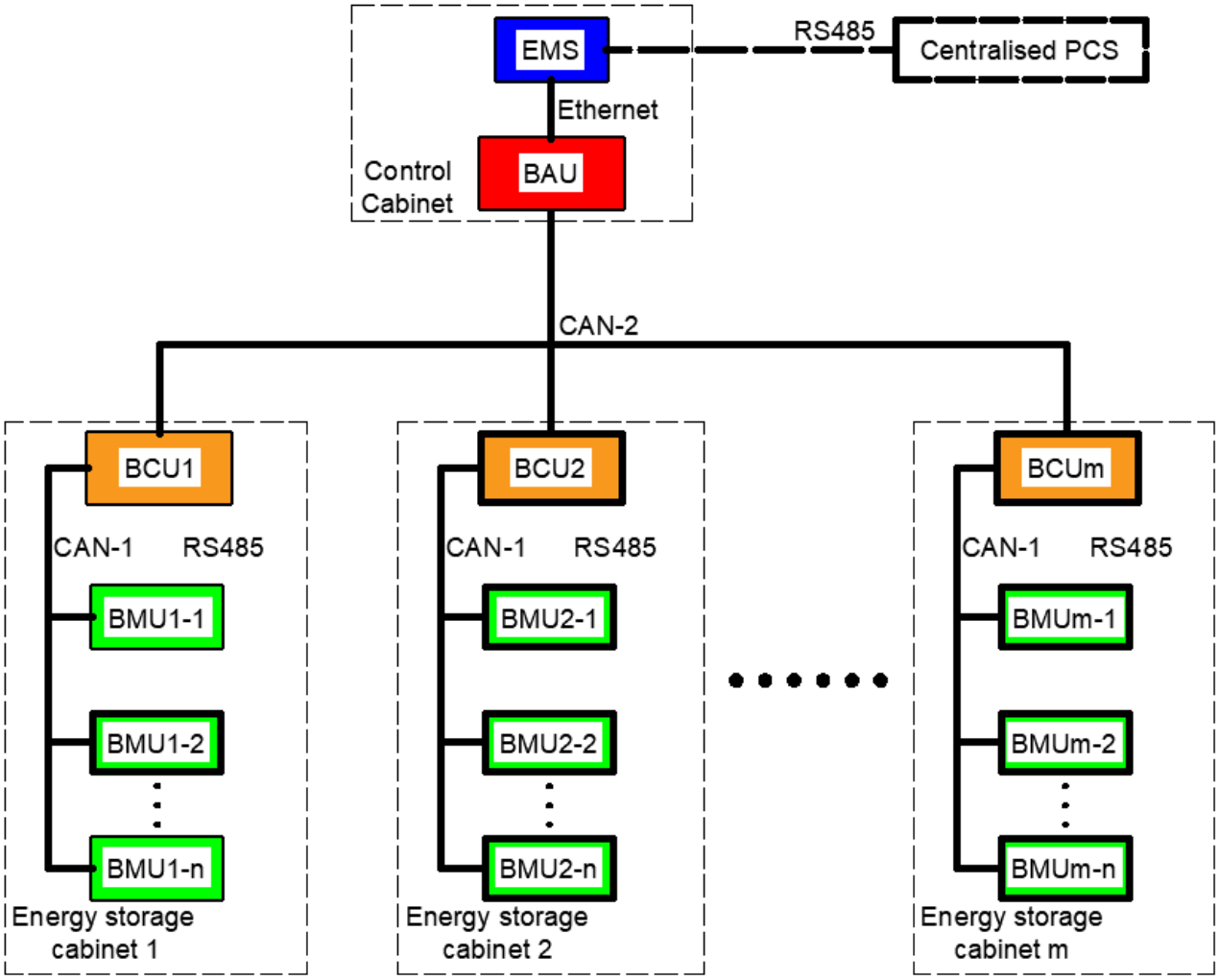


Figure 1-5 Battery management system topology diagram （Centralised PCS）

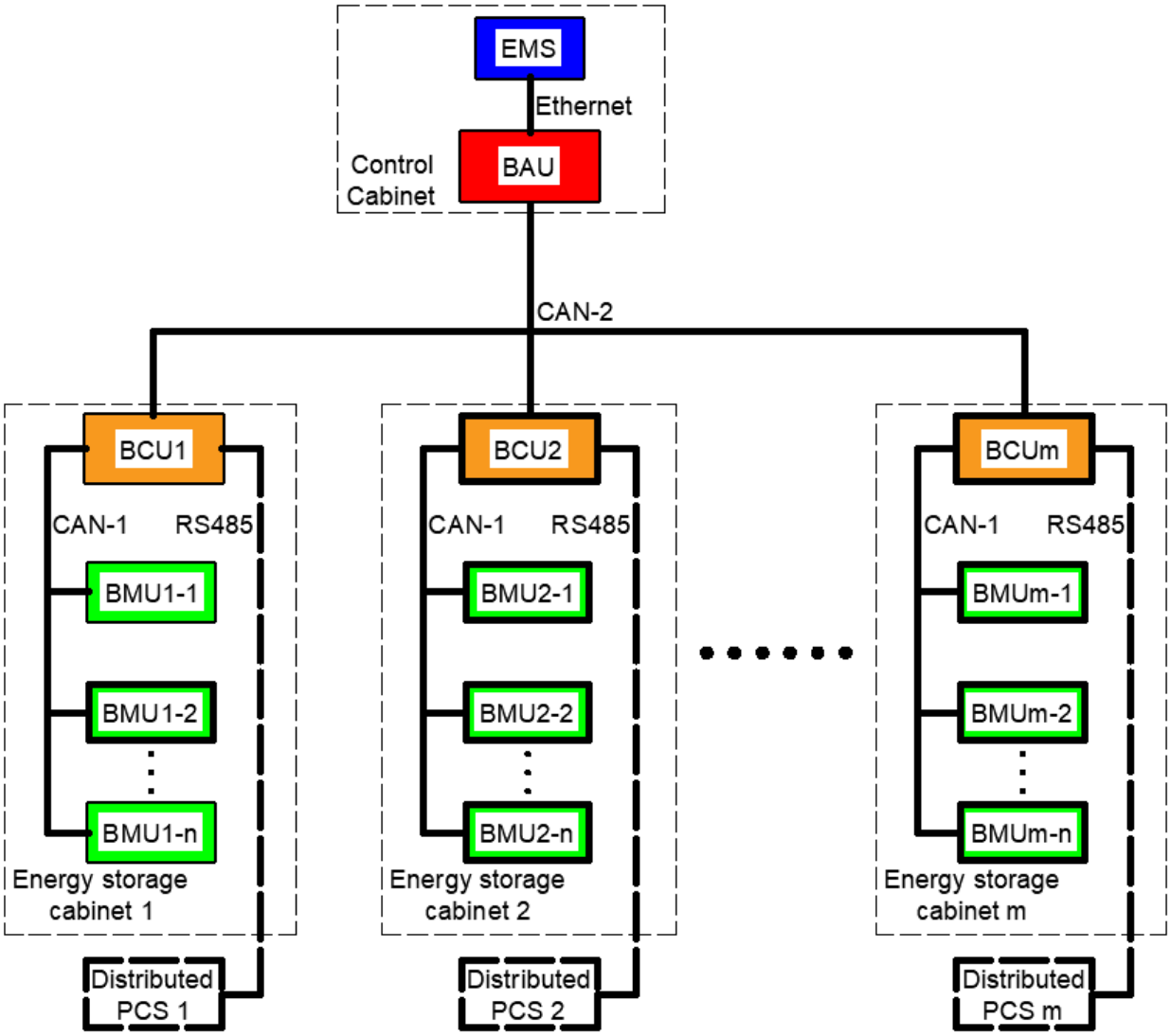


Figure 1-6 Battery management system topology diagram （Distributed PCS）

Table 1-4 Battery management units

No.	Item	Specification
1	Working environment	-40℃-+75℃/5-95%
2	Single-unit voltage sampling accuracy	<±5mV
3	Monoblock voltage collection range	0-5V
4	Total voltage sampling accuracy	<±1% or<±2V
5	Total voltage detection range	100-1500V
6	Current sampling accuracy	<±1% or<±0.5A

No.	Item	Specification
7	Protection class	IP40

1.4.3 TMS-Air to Liquid Chiller

The liquid-cooled unit consists mainly of a compressor, condenser, throttling element, evaporator, water pump, expansion valve, PTC liquid heater and the necessary control components. The liquid-cooled unit is used to regulate the temperature of the battery pack in the energy storage system to ensure that it always works within the right temperature range in order to maintain the best working conditions of the system. With the following functions:

- Precise measurement and monitoring of the coolant temperature.
- Effective heat dissipation when the battery pack temperature is high to prevent thermal runaway accidents.
- Pre-heating when the battery temperature is low, to raise the battery temperature and ensure charging and discharging performance and safety at low temperatures.

The operating principle is shown in the following diagram:

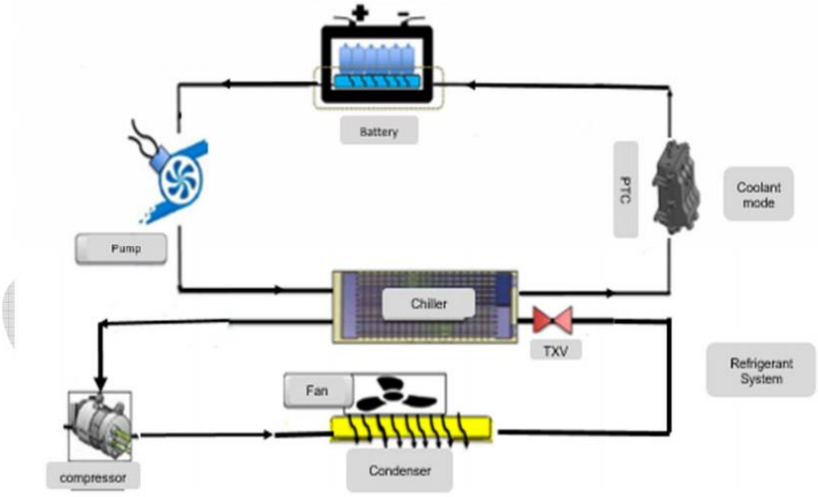


Figure 1-7 Working principle diagram of the chiller

Cooling mode

Both the refrigerant circulation circuit and the coolant circulation circuit are open.

- On the refrigerant side, the compressor compresses the low-temperature, low-voltage gaseous refrigerant into a high-temperature, high-voltage gaseous refrigerant, which enters the condenser. After forced convection cooling by the condensing fan, a phase change occurs and heat is released into a medium temperature, high voltage liquid refrigerant, which enters the throttle valve. In the throttle valve, an equal enthalpy throttling and voltage reduction takes place and the refrigerant becomes a low temperature, low voltage liquid mist refrigerant and enters the evaporator. In the evaporator, the liquid fog refrigerant evaporates and absorbs the heat of the coolant to become a low-

temperature, low-voltage gaseous refrigerant, which then enters the compressor to start the next cycle again.

- On the coolant side, the liquid pump works to make the high temperature coolant in the battery pack cooling plate enter the evaporator to exchange heat with the refrigerant and become low temperature coolant, which flows back into the battery pack cooling plate to cool down the battery pack.

Heating mode

The refrigerant circulation circuit, the compressor and the condensing fan are switched off and the coolant circulation circuit is switched on. On the coolant side, the water pump starts and the heater turns on. The coolant flows through the heater and is heated and then flows back into the battery pack cooling plate to heat and keep the battery pack warm.

Technical specifications

Table 1-6 Table of technical parameters of Chiller

Item	Specification
Power rating	Cooling: ≤4500W,Heating: ≤3500W
Heat production	≥2.5kW
Cooling capacity	≥8kW
Operating ambient temperature	-30℃~+60℃
Coolant type	50% ethylene glycol aqueous solution
Refrigerant type	R134A
High voltage power supplies	220VAC,50Hz/60Hz
Water circulation flow	≥50L/min
Operating environment	Indoor/Outdoor use
Noise level	≤75dB
Grounding resistance	≤0.1Ω
Maximum operating pressure	2bar

1.4.4 Fire Suppression Systems

Fire Suppression System consists of cabinet smoke detector, temperature detector, sound and light alarm, fire extinguishing device, a single outdoor cabinet cabinet sound and light alarm and smoke detector

is connected, when the smoke detector detects the combustible gas or smoke reaches a certain level, the sound and light alarm starts. When the temperature detector detects that the temperature reaches a certain level, the fire fighting system opens the aerosol fire fighting module to spray fire extinguishing agents and start the fire suppression system.

Table 1-7 Fire Suppression System components

No.	Main components
1	Smoke detectors: photoelectric smoke detectors
2	Temperature detectors: fire detection devices that use a network of thermistors to monitor temperature
3	audible and visual alarm
4	300g aerosol fire extinguishing device

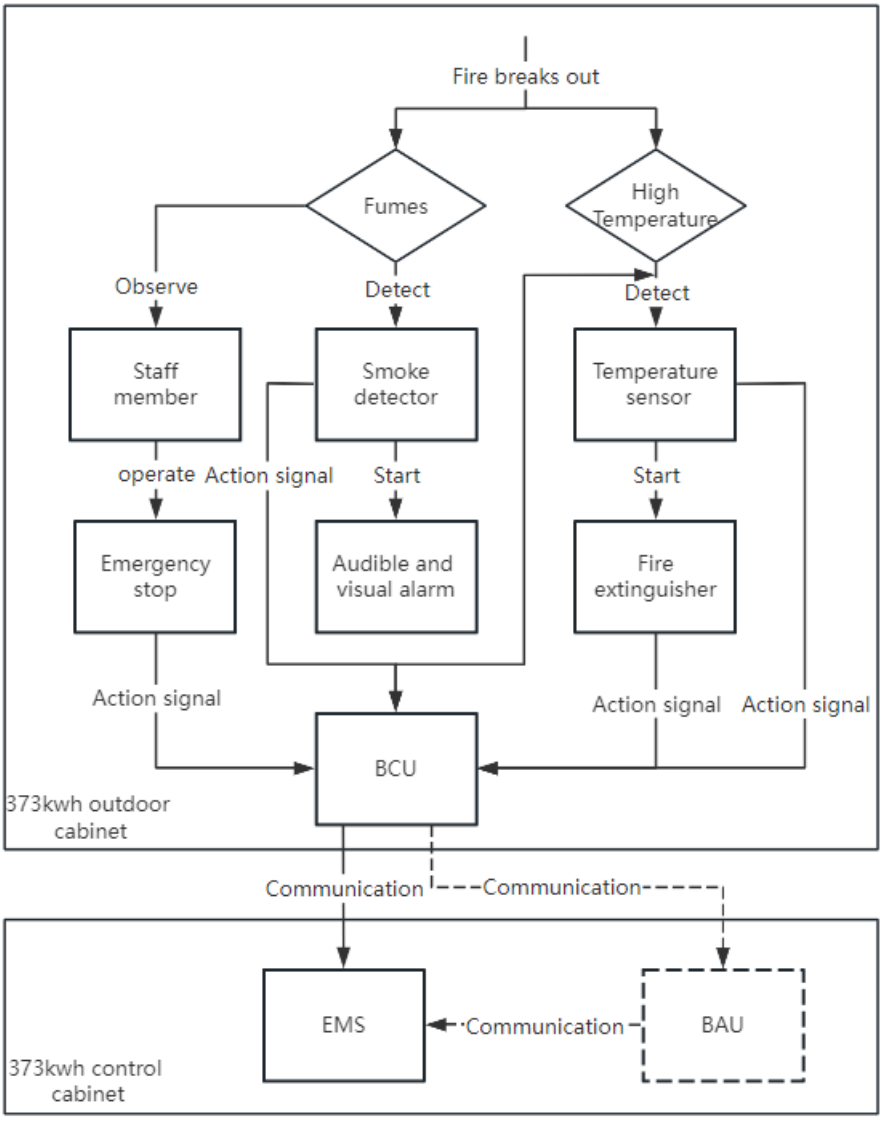
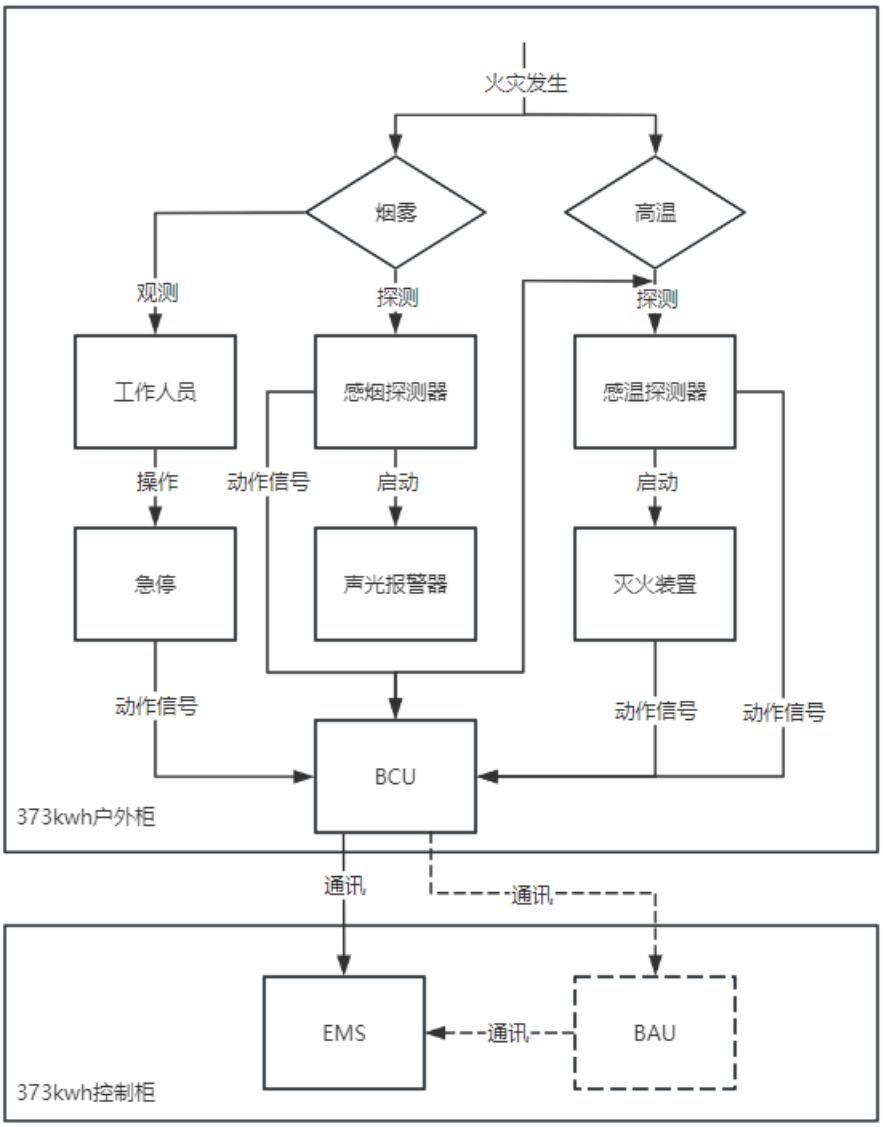


Figure 1-8 FSS Logic Diagram



1.4.5 BPU, High voltage box

High-voltage box is mainly composed of isolation switch, fuse, relay, shunt, pre-charging relay, pre-charging resistance, BMS, miniature circuit breaker, switching power supply, UPS and other devices. High-voltage box has the functions of controlling high-voltage line on and off, voltage and current detection, short-circuit protection, AC power distribution, emergency power supply, communication and control of devices in the cabinet.

Table 1-8 BPU High voltage box parameters table

Item	parameters
Operating Voltage	Max.1500Vdc
Rated current	150A

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Maximum continuous working current	180A
AC Voltage Range	220~277Vac
AC Current Range	0~26A
Rated voltage of control system	24Vdc
Control system Backup time	2h
Communication Protocol	CAN2.0
Shell material	SPCC
Dimensions	W850(±3)*H760±2)*D278（±3) mm
Weight	≈40kg
Cooling	Natural cooling
Working temperature	25±5℃
Storage temperature	-40℃ ~ 60℃

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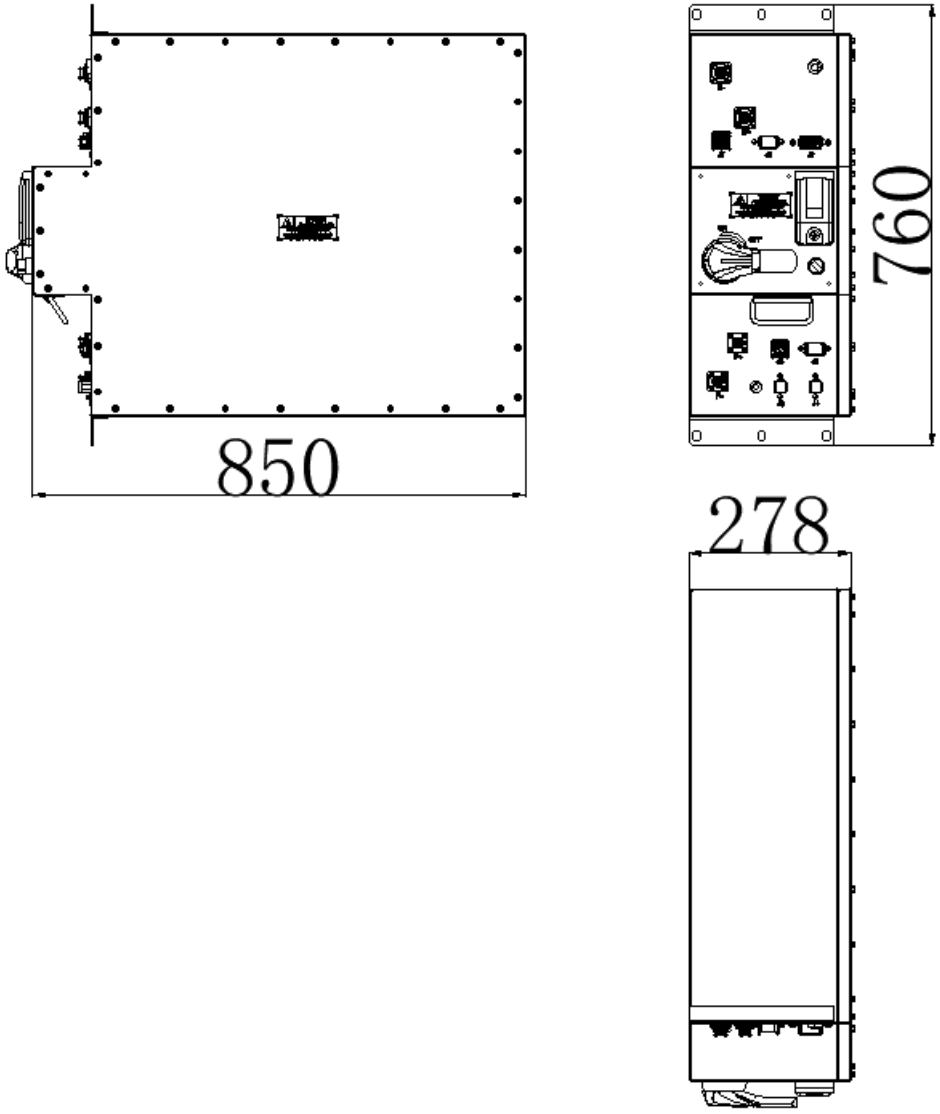
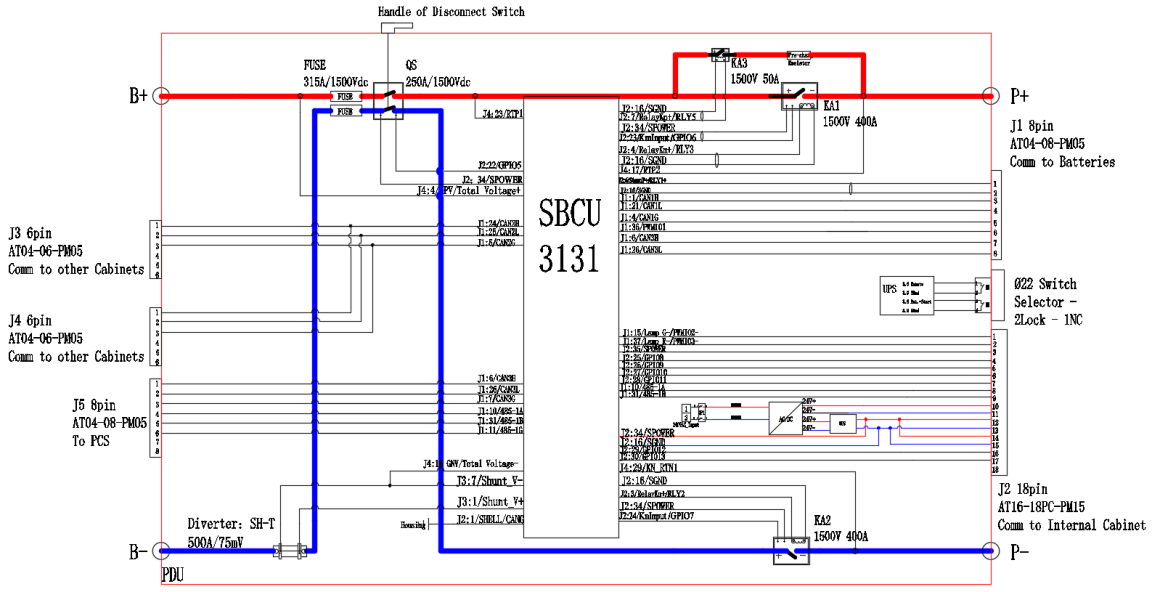
Dimensions	



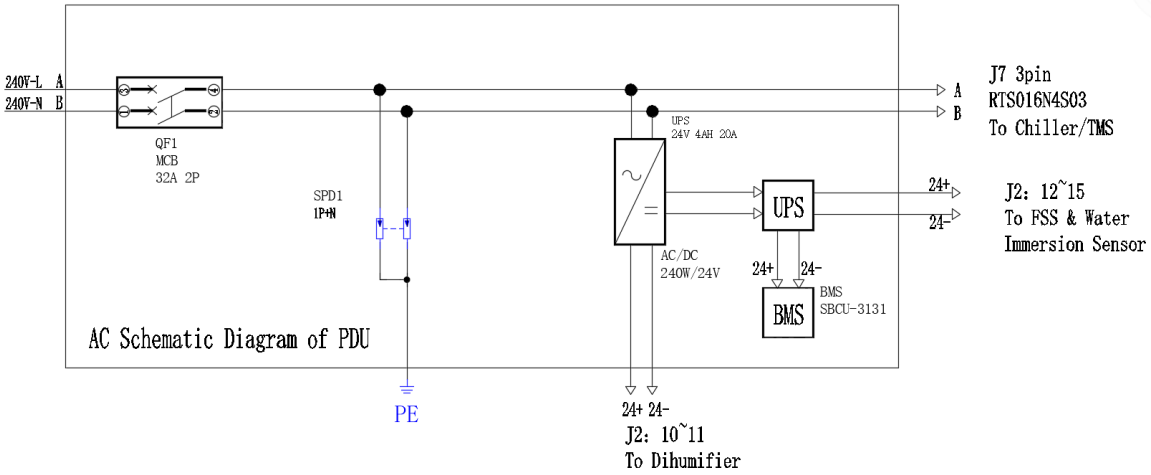


Figure 1-9 Electrical schematic diagram of high voltage box

1.4.6 UPS, Uninterruptible power supply

QUINT4-UPS 24DC 24DC 20 - Uninterruptible power supply

1. Safety notes and warning instructions

Prior to startup, read the installations notes and check the device for damage.

Keep these instructions in a safe place – this packing slip contains important safety notes which must be observed during installation and maintenance of the UPS devices and batteries.

WARNING: Danger to life by electric shock!

– Only skilled persons may install, start up, and operate the device.

– For indoor use only.

– Never carry out work when voltage is present.

– Establish connection correctly and ensure protection against electric shock.

– Cover termination area after installation in order to avoid accidental contact with live parts (e. g., installation in control cabinet).

– This unit receives power from more than one source - disconnect the input power source and the energy storage to de-energize this unit before servicing.

– Keep flames, embers or sparks away from the module.

– When connecting the external batteries, observe the polarity and do not short circuit the pole terminals.

– Provide a switch/circuit breaker close to the device at the DC input, DC output and at the battery terminals, which are labeled as the disconnecting device for these devices.

– Do not disconnect the fuse and / or battery connection under hazardous location conditions.

NOTE

– Observe the national safety and accident prevention regulations.

– Assembly and electrical installation must correspond to the state of the art.

– The uninterruptible power supply is a built-in device. The protection class IP20 of the device is meant to be applied in a clean and dry environment.

– The device must be installed in a control cabinet that can be locked and only opened by specialist staff.

– Observe mechanical and thermal limits.

– Ensure sufficient convection. Housing can become hot. The minimum distance (above/below) is shown in the relevant figure.
– Use a current-limited source (QUINT POWER) or a suitable fuse at the DC input and a battery with a suitable fuse at the UPS battery connection. Mark the fuses as being disconnection devices.
– Ensure that the primary-side wiring and secondary-side wiring are the correct
size and have sufficient fuse protection.
– Use copper cables for operating temperatures of 75 °C (ambient temperature 55 °C) 90 °C (ambient temperature 75 °C).
– You can find the connection parameters, such as the necessary stripping length for the wiring with and without ferrule, in the associated table.
– Protect the device against foreign bodies penetrating it, e.g., paper clips or metal parts.
– To reduce the risk of fire, replace fuses only with those that have the same type and rating. Relevant fuses can be found in the accessories in the ordering data.
– To reduce the risk of fire, connect only to a circuit provided with the following maximum branch circuit overcurrent protection in accordance with the National Electrical Code, ANSI/NFPA 70.
– The uninterruptible power supply is maintenance-free. Repairs may only be carried out by the manufacturer. The warranty no longer applies if the housing is opened.
– The uninterruptible power supply may only be used for its intended use.
– Improper use invalidates the device protection.

2. Certifications

IEC 61010-2-201 / UL 61010-2-201 NOTE:
Use ferrules for flexible cables.
DNV GL NOTE:
Tighten screws on all unused terminals

3. General

The QUINT4-UPS uninterruptible power supply enables continued supply of critical loads in the event of a power supply malfunction. The uninterruptible power supply is equipped with signal contacts for signalling in the standard version. The device versions with additional communication interfaces (USB, PROFINET, EtherNet/IP™, EtherCAT®) enable integration into industrial networks.

Features

– Battery management system (BMS) with IQ technology
– Monitoring via USB, Ethernet interface or signal contact
– Launch of the UPS without mains supply (battery start)
– High-performance output characteristics with SFB Technology
– Robust design in the narrow metal housing

For additional information, please refer to the corresponding documentation of the relevant product at phoenixcontact.net/products.

4. Designation of the elements

1 Connection terminal blocksinput voltage: Input DC +/-
2 Connection terminal blocks output voltage: Output DC +/-
3 Take-up for cable binders

4 Connection terminal block signaling
5 LED bar graph (charging state of the battery)
6 Universal DIN rail adapter (rear of housing)
7 Rotary selector switch for setting the buffer time tmax [min]
8 Service key for battery replacement
9 Connection terminal blocks battery: +/-/signal
10 Communication interface (device underside)
Valid only for the following device versions:
- QUINT4-UPS/24DC/24DC/xx/**USB, .../PN, .../EIP, .../EC**
11 Factory-set programming interface (device underside)
1x 8-pole or 2x 8-pole
12 QR code web link
13 LED status indicators for data traffic
Valid only for the following device versions:
- QUINT4-UPS/24DC/24DC/xx**/PN, .../EIP, .../EC**
14 LED status indicators (device status)

5. Connection and signal terminal blocks

– 24V 20mA: permanent +- output voltage for the signal supply (e.g. potential free contact), reference potential SGnd
– Alarm: potential-free switch contact, max. contact load: 30 V DC / 100 mA
– Battery mode: UPS in battery mode, digital output
– Battery ready: Connected battery ready for operation, digital output
– Remote: battery operation block
– PS Boost: QUINT PS Boost operation, digital input
– Battery start: Start the UPS without network supply (cold restart), digital input
– SGnd (Signal Ground): reference potential signals, not electrically isolated from the DC output voltage

6. Mounting/removel

6.1 Mounting/removing the uninterruptible power supply
The uninterruptible power supply unit can be snapped onto all DIN rails according to EN 60715. It should be mounted horizontally in the normal mounting position.
6.2 Installation height
The uninterruptible power supply can be operated at an installation height of up to 2000 m without any limitations. Different data applies for installation locations above 2000 m due to the differing air pressure and the reduced convection cooling associated with this.
6.3 Fastening connection wiring onto uninterruptible power supply Two images for bundled fixing of the connection wiring are integrated into the left and right housing wall. If required, secure the connection wiring with cable binders (optional PKB 140X3.6 - Order No. 1005460).

Technical data	
Input data	
Nominal input voltage U_N	24 V DC

Input voltage range	18 V DC ... 30 V DC
Current consumption max.	31,2 A
Activation threshold	< 22 V DC
Output data (mains operation)	
Nominal output voltage	24 V DC
Secondary voltage range （U_{OUT}=U_{IN}-0.5V DC）	18 V DC ... 30 V DC
Output current I_N/$I_{Stat\ Boost}$/$I_{Dyn.Boost}$/I_{SFB}	20 A / 25 A / 30 A (5 c) / 120 A (15 MC)
Output data (battery operation)	
Nominal output voltage	24 V DC
Output voltage range （U_{OUT}=U_{BAT}-0.5V DC）	19,2 V DC ... 27,6 V DC
Output current I_N/$I_{Stat\ Boost}$/$I_{Dyn.Boost}$/I_{SFB}	20 A / 25 A / 30 A (5 c) / 120 A (15 ms)
Energy storage	
Nominal voltage	24 V DC
Nominal capacity max. (without additional loader)	100 Ah
Charge characteristic curve	IU_0U
Charging voltage max. (temperature compensated)	32 V DC
Charge current	5 A
Interface	
Without/USB/Ethernet (...PN/...EIP/...EC)	Signal terminal blocks/ MINI-USB Typ B/ RJ45
General data	
Degree of efficiency	98 %
Overvoltage category EN 61010-1	II
Degree of pollution	2
Degree of protection / Protection class	IP20 / III
Ambient temperature (operation)	-25 °C ... 70 °C
Ambient temperature (storage/transport)	-40 °C ... 85 °C
Humidity at 25°C, non-condensing	≤ 95 %
Installation height (> 2000 m, observe derating)	≤ 4000m
Dimensions (W/H/D)	40 x 130 x 125 mm
Weight	0,6 Kg
Distance left, right / top, bottom	0 mm / 50 mm

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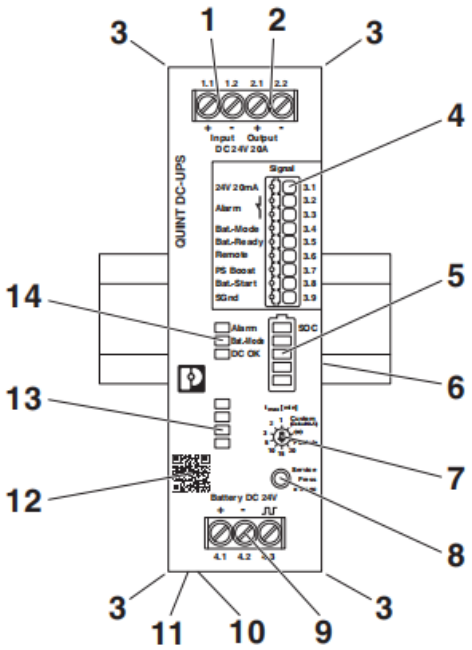

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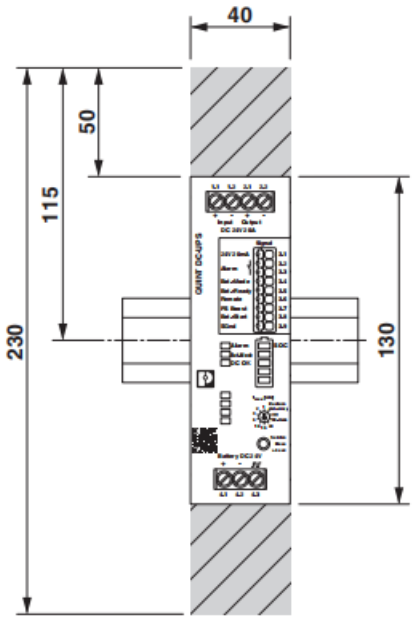

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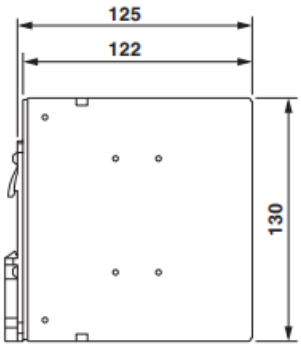
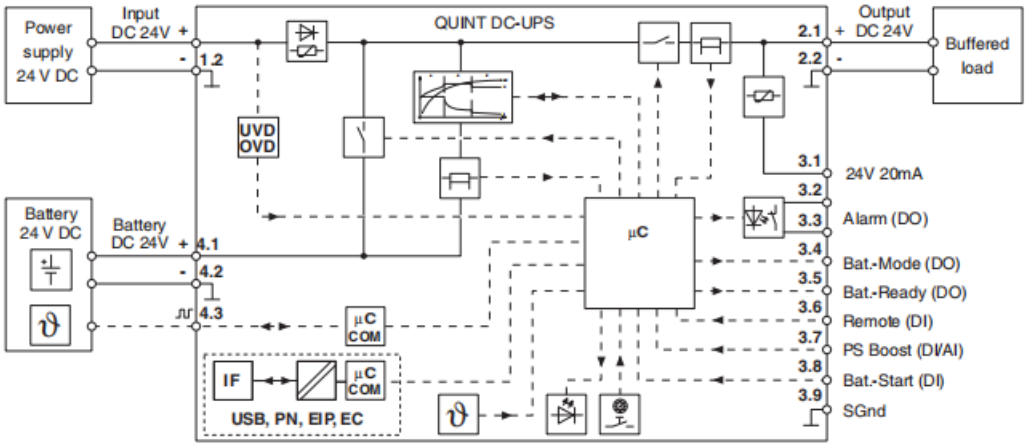


4

		[mm²]	[mm²]	AWG	L [mm]	[Nm]	[lb in]
Input DC 1.1, 1.2	Screw	0.2-6	0.2-4	30-10	8	0.5-0.6	5-7
Output DC 2.1, 2.2		0.2-6	0.2-4	30-10	8	0.5-0.6	5-7
Battery 4.1 ... 4.3		0.2-6	0.2-4	30-10	8	0.5-0.6	5-7
Signal 3.1 ... 3.9	Push-in	0.2-1.5	0.2-1.5	24-16	8	—	—

5



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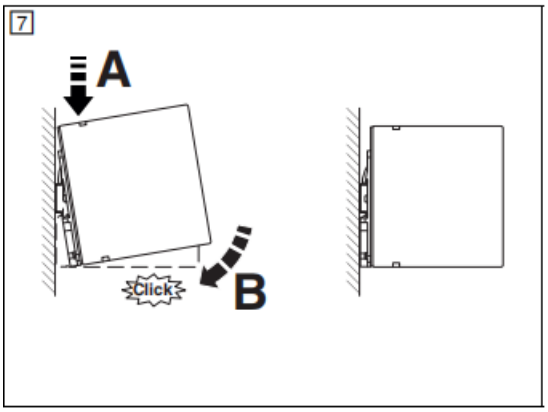
6

	Element	Nature	Mains operation: Fully charged, No alarm	Mains operation: Charging, No alarm	Battery operation: Battery good	Battery operation: Battery almost discharged	Maintenance required: Alarm (Replace battery)	Maintenance required: Alarm (other)
LED	Alarm	red	☐	☐	☐	■	■	■
LED	Bat.-Mode	yellow	☐	☐	■	■	☐	☐
LED	DC OK	green	■	■	■	■	■	■
Signal	Alarm	active low	high	high	high	low	low	low
Signal	Bat.-Mode	active high	low	low	high	high	low	low
Signal	Ready	active high	high	low	low	low	both possible	
LED bar graph (SOC)	100-81%	green	■	depends on SOC status*	depends on SOC status*	depends on SOC status*		
LED bar graph (SOC)	80-61%	green	■					
LED bar graph (SOC)	60-41%	green	■					
LED bar graph (SOC)	40-21%	green	■					
LED bar graph (SOC)	20-0%	green / red	■	■ flashing**		■ 20-11% ■ 10-0%	■ flashing	☐

* SOC status available - with Phoenix Contact battery modules only

** Third-party batteries

7



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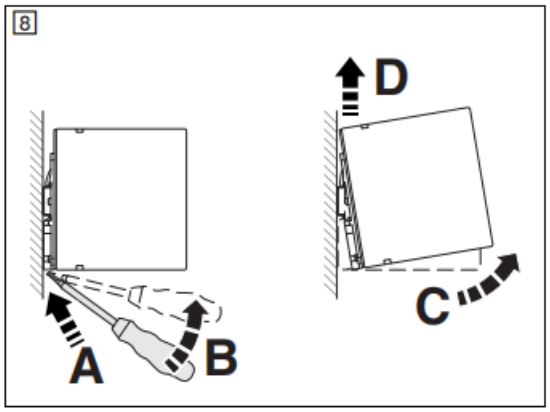

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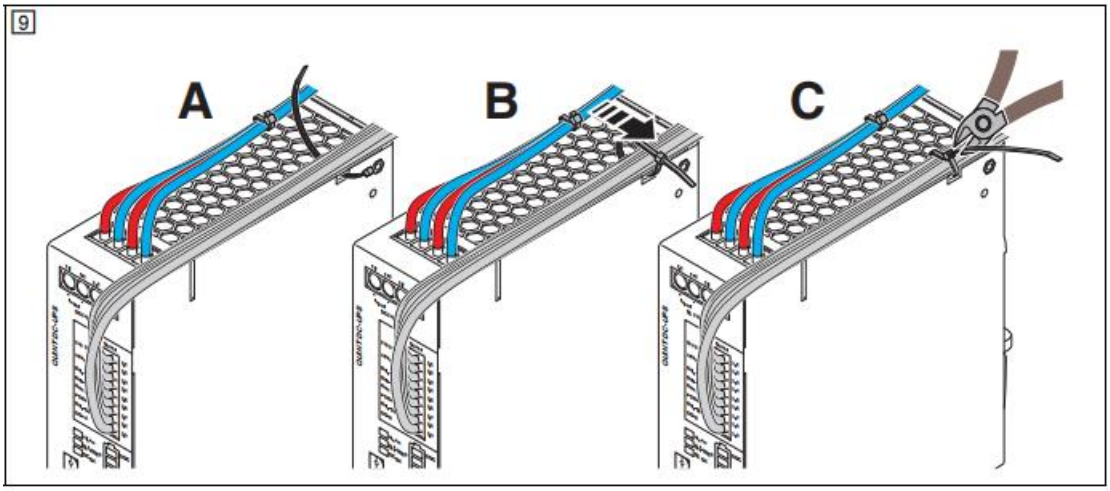

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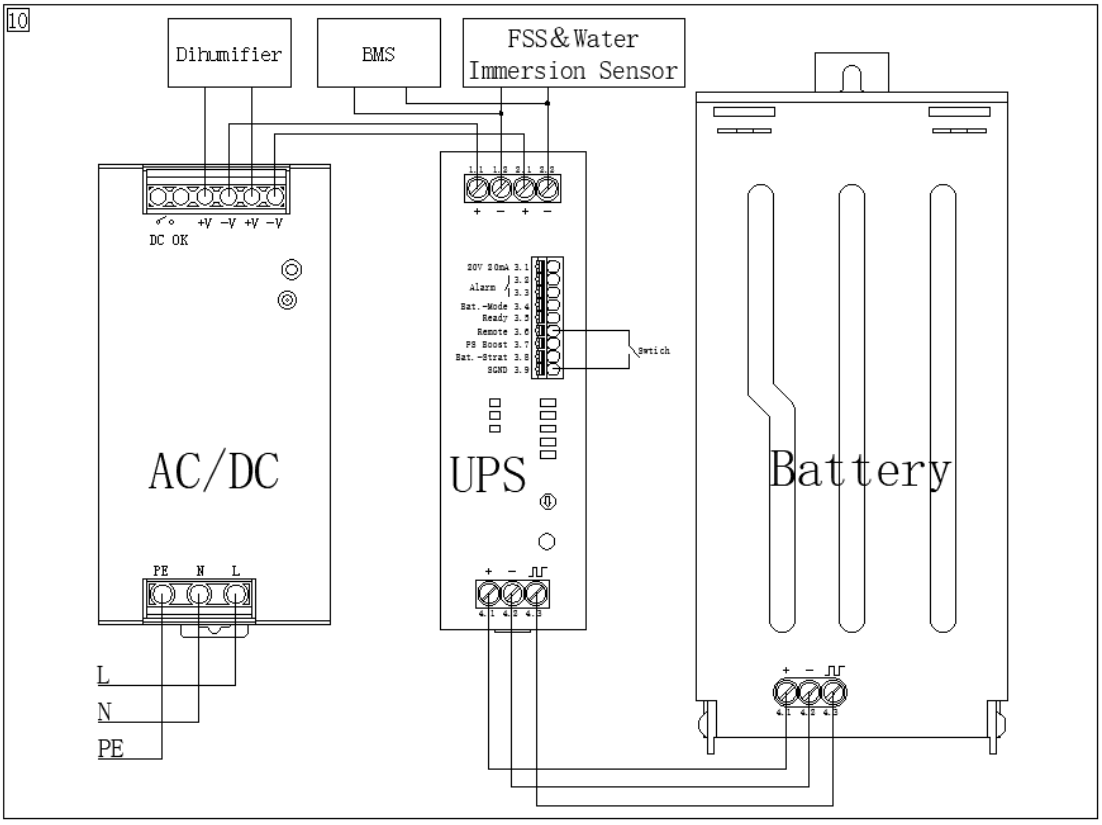


1.6 Product size

Product weight:approx. 3850kg

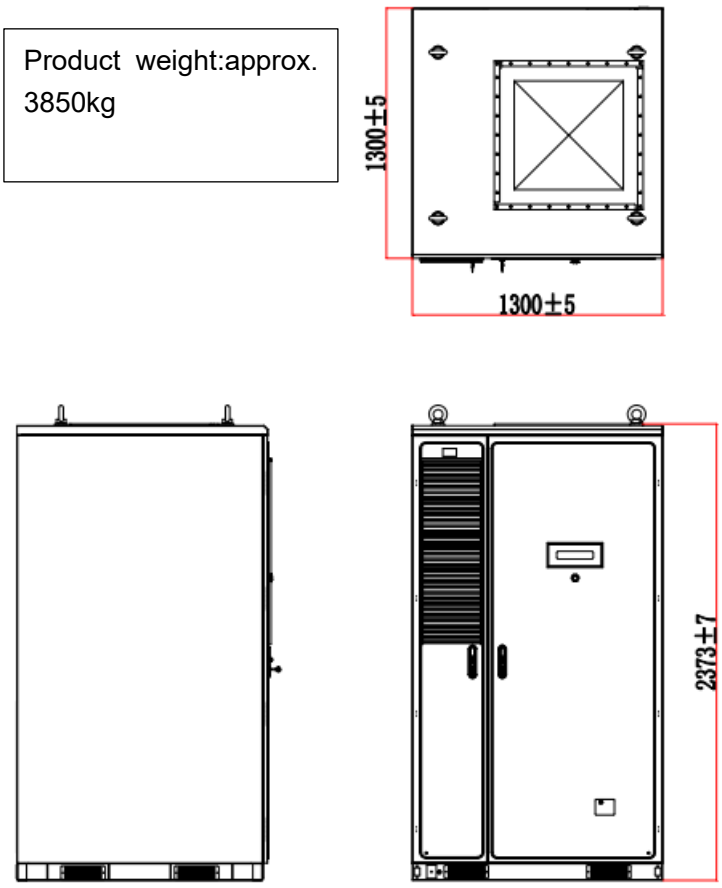


Figure 1-10 Product dimensional drawing (unit: mm)

2 Unpacking and handling

2.1 Unpacking

2.1.1 Checking after opening the box

The following items must be checked after opening the box:

Table 2-1 Checking after opening the box

No.	Inspection items	Confirmation
1	The exterior is free from damage, scratches, dents, etc.	
2	The product is ordered with a full range of options.	
3	The nameplate information corresponds to the model number of the product ordered.	
4	Warning labels are free from damage, scratches, blurring, etc.	

2.1.2 Notes on opening the box

- Liquid-cooled outdoor cabinets are not allowed to be unpacked when stored, but removed when installed.
- When receiving goods from the transport company, it is important to check the product carefully and meticulously and to check each piece received against the delivery note. If the goods are missing or damaged, notify the shipping company as soon as you find them.
- Please check that the outer packaging is intact and free from damage, moisture, dampness and deformation before opening the box.
- Please open the packaging in a hierarchical order, violent knocking is strictly prohibited!
- Please check the surface of the product and product accessories for damage, rust, bruises, etc. when unpacking.

2.2 Storage

- When storing, try to pack in our boxes as per the original packaging.
- The temperature should be kept between -20℃ and +60℃.
- The equipment must be stored in a clean and dry space, avoiding splashing water and rain, humidity, high temperature or outdoor exposure.
- The storage space must be free from harmful gases, flammable and explosive

products and corrosive chemicals.

- When storing for a long period of time, the module must be covered or measures must be taken to ensure that it is protected from contamination and environmental influences.
- Avoid mechanical shocks, heavy pressure, strong electric fields and strong magnetic fields.
- Avoid direct sunlight, distance from heat sources should be ⩾ 2m, and the box should be padded to a height of ⩾ 20cm from the ground and ⩾ 50cm from walls, windows or air inlets.

CAUTION

- Products stored for more than 3 months under the conditions specified above are subject to a supplementary charge.
- Products stored for more than 6 months under the above specified conditions must be subjected to a capacity checkability test.
- Products stored for more than 1 year under the above specified conditions must be re-inspected and passed before use.

2.3 Handling

CAUTION

- Please pack the product strictly before transporting it by vehicle, and closed boxes must be used for long distance transport.
- It is strictly forbidden to transport this product in mixed packages with equipment or objects that may affect or damage this product.

2.4 Forklift handling

CAUTION

Perform a fork test, if not suitable adjust the fork lift truck foot position. After the test fork is suitable, fork up the liquid-cooled outdoor cabinet and carry it to the right position.

- During the handling process, the tilting angle of the liquid-cooled outdoor cabinet should be less than 10° and the heaving height should be as low as possible.
- It is forbidden to carry the hydraulic truck for long distances or on sloping roads, otherwise the truck may be damaged.
- Lifting and lowering needs to be done gently to avoid shocks or vibrations. When lowering the forklift truck, care needs to be taken not to crush the feet.

- When moving, someone needs to support you on the left and right and take care that the ground is level.
- Considering that the equipment is high and may block the driver's view, it is recommended to arrange someone to guide the driver as appropriate.

2.5 Crane handling

CAUTION

Conduct a test lift to confirm that the straps can support the weight of the liquid-cooled outdoor cabinet and that there is no tilt in the lift.

- The hook must be positioned at the centre of gravity.
- After lifting, the swaying angle must be less than 10°.
- Make sure the front door of the cabinet is locked before lifting so that it does not open suddenly and cause injury during lifting.
- Lift and lower the cabinet gently to avoid shocks and vibrations.

2.5.1 Handling before the Unpacking

Handling methods

Unpacked handling is divided into two types of handling: forklift handling and crane handling.

Forklift handling steps

Packaged liquid-cooled outdoor cabinets are handled by forklift trucks on pallets underneath the packaging and the operators must be trained.

Adjust the forklift truck foot width dimension so that the centre of gravity falls in the middle of the forklift truck foot. Insert the position shown in the picture below.

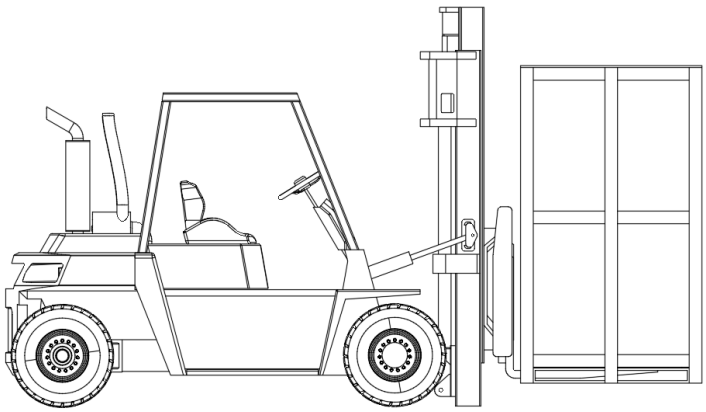


Figure 2-1 Schematic diagram of forklift handling

Crane handling steps

Choose a flexible sling or strap. A single strap needs to be able to withstand a weight of not less than 4t.

Tie the cabinet down with the straps, following the diagram below.

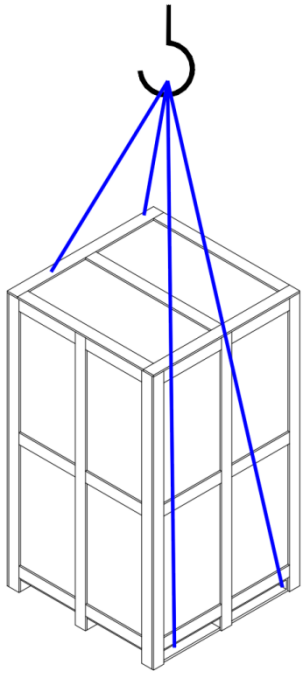


Fig. 2-2 Diagram of lifting and handling with packaging

CAUTION

- The hooks should be at least 1m from the top of the cabinet.
- Cabinet tilt should be less than 10°.

2.3. Handling after unpacking

CAUTION

- When using equipment handling, wooden pallets must be brought and the modules are only allowed to be handled in a flat manner, not upside down or sideways.
- When lifting by crane, the slings must not touch the modules.

Forklift handling

Adjust the forklift foot width dimensions so that the centre of gravity falls in the middle of the forklift foot.

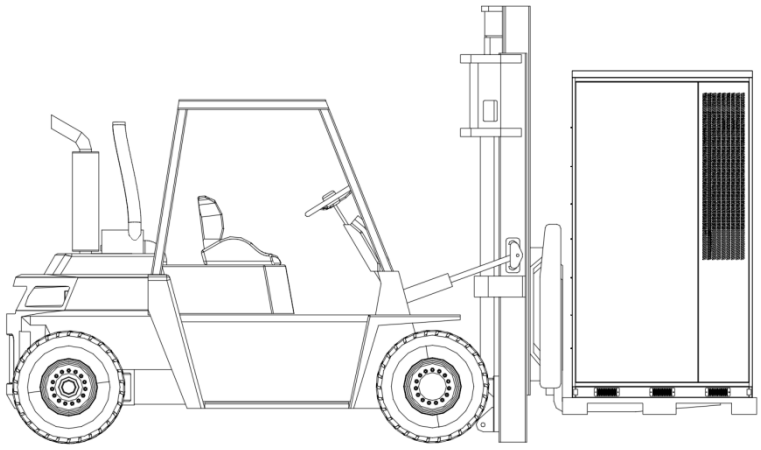


Figure 2-3 Diagram of forklift handling without packaging

Crane handling

For unpackaged transport, use flexible slings or straps. A single strap needs to be able to withstand a weight of not less than 4t.
Tie the cabinet down with the straps, following the diagram below.

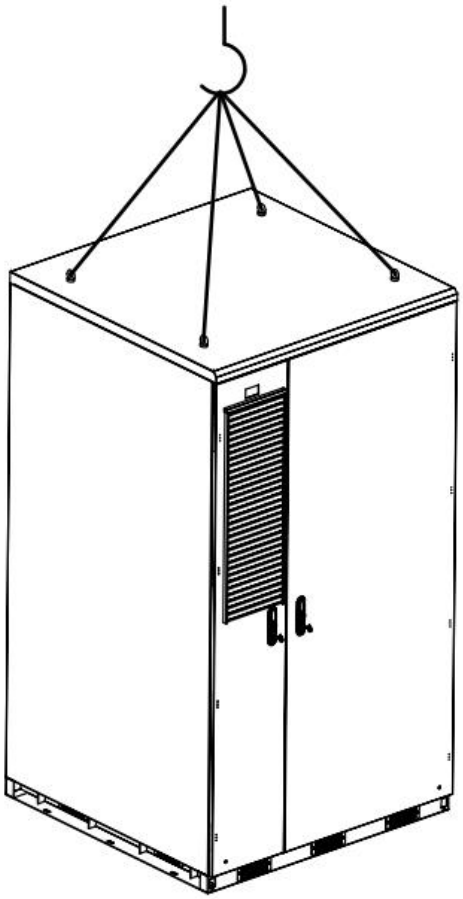


Figure 2-4 Diagram of lifting and handling without packaging

CAUTION

- The hooks should be at least 1m from the top of the cabinet.
- Cabinet tilt should be less than 10°.

3 Mechanical installation

3.1 Safety tips

Disregarding the following safety instructions during installation work may result in equipment damage, personal injury or serious injury or death, please strictly
Observe the following safety instructions.

DANGER

- The installation must be carried out correctly by qualified personnel, following all warning instructions.
- Before carrying out installation work, make sure that the mechanical strength of the installation location is sufficient to support the weight of the appliance, otherwise a mechanical hazard may result.
- Do not wear loose clothing or accessories when carrying out installation work, as this may result in a risk of electric shock!

CAUTION

- For ease of installation and maintenance, it is recommended that sufficient space is allowed around the unit: sufficient cooling airflow, necessary clearance, space required for cables and cable support structures.
- Please ensure that any spanning elements or racks with components installed are properly earthed and that the connection surfaces are unpainted.
- Nickel-plated copper is recommended, but aluminium can also be used.
- Before connecting aluminium busbars, remove the oxide layer and apply a suitable antioxidant caulking mix.

3.2 Pre-installation preparation

3.2.1 Installation environment requirements

Table 3-1 Installation environment requirements

Item	Environmental requirements
Installation site requirements	● A well ventilated environment must be maintained. ● The air inlet and outlet must be professionally treated against

Item	Environmental requirements
	rain, sand and dust. ● Ensure that there are no trees around the installation location to prevent high winds from knocking down branches or scraping off leaves to block the product doors or air inlets. ● Have the necessary fire, water and rodent resistant treatment. ● It should be kept away from areas where toxic and hazardous gases are concentrated. ● Keep away from flammable, explosive and corrosive substances.
Foundation requirements	● The installation surface must be flat and dry, with no standing water on the ground. ● Ensure that the ground is level without swaying and can carry the weight of the liquid-cooled outdoor cabinet.
Space requirements	● Adequate space must be left for cooling, maintenance and escape from the liquid-cooled outdoor cabinet at the front, rear and above.
Elevation	≤ 2000m (non-standard treatment for high altitude models)
Temperature	0℃~60℃
Relative humidity	0%~85%RH。

CAUTION

Moisture intrusion can easily lead to damage to energy storage terminals! To safeguard the normal use of the energy storage terminals:

- Do not open the cabinet door when the air humidity is greater than 85%.
- Avoid opening the cabinet door, carrying out maintenance or servicing operations, etc. in rainy or humid weather conditions.

3.2.2 Installation site requirements

Foundation requirements

Liquid-cooled outdoor cabinets must be installed on concrete or other non-combustible surfaces. The installation plane must be level, solid and flat, with sufficient bearing capacity, no dents or inclinations are allowed.

When constructing the foundation, the liquid-cooled outdoor cabinet needs to be considered for the outlet line and trench or inlet holes are reserved, please refer to the

diagram below for the installation holes.

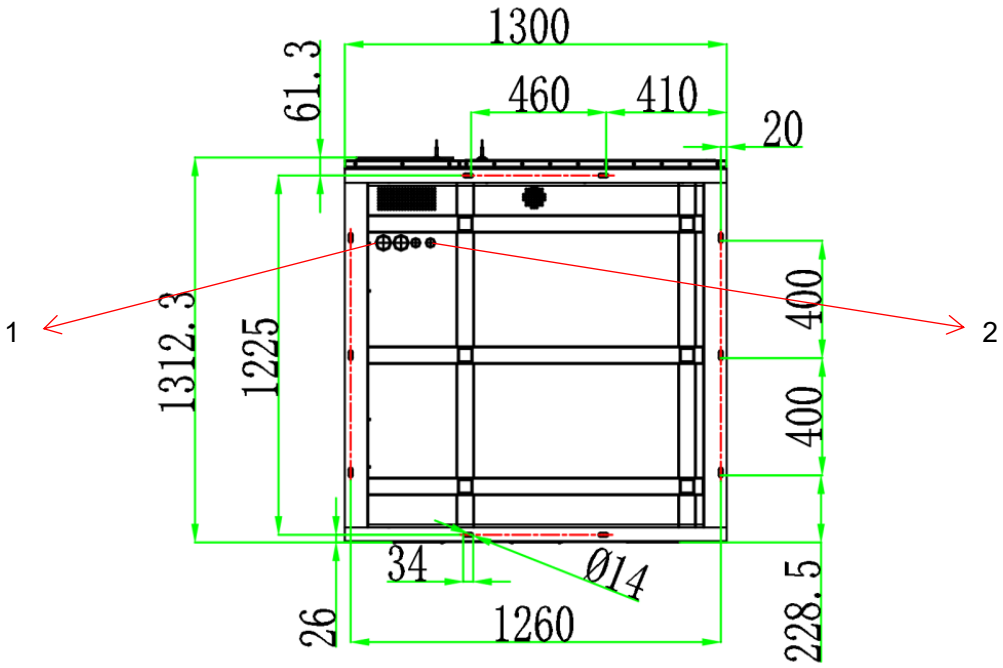


Figure 3-1 Mounting location diagram (in mm)

Where: No.1 power line inlet and outlet, 50 mm diameter; No.2 communication line inlet and outlet, 30 mm diameter.

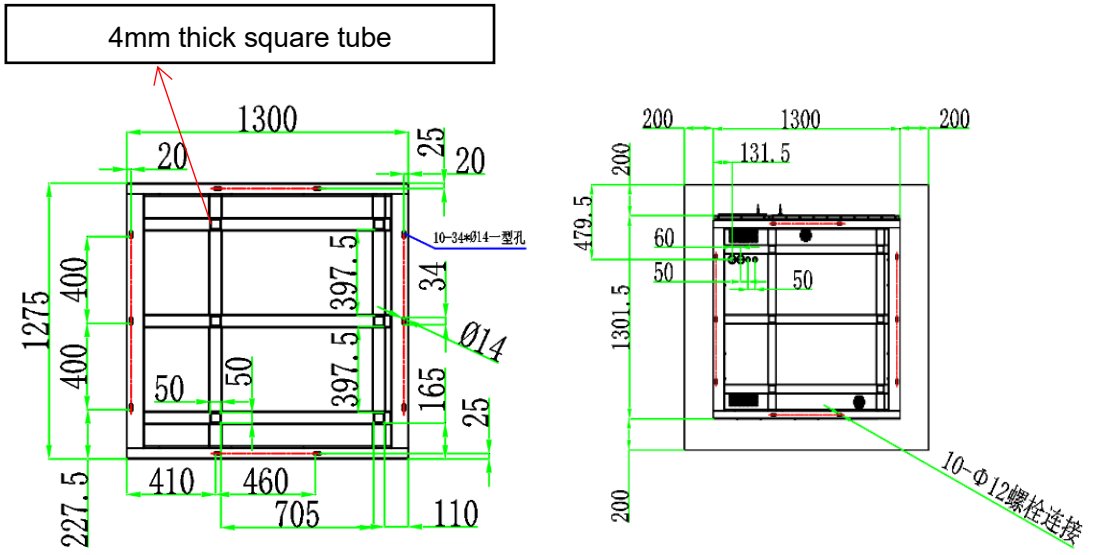


Figure 3-2 Schematic diagram of the structure and foundation width requirements for the bottom bracket of the cabinet (unit: mm)

If the installation is carried out on hard ground, it is recommended to use the bolt connection method. According to the schematic diagram of the bottom bracket structure of the cabinet in Figure 3-2, the corresponding base can be made and the connection points can be adjusted according to the actual situation on site. The specific effect is shown in Figure 3-3:

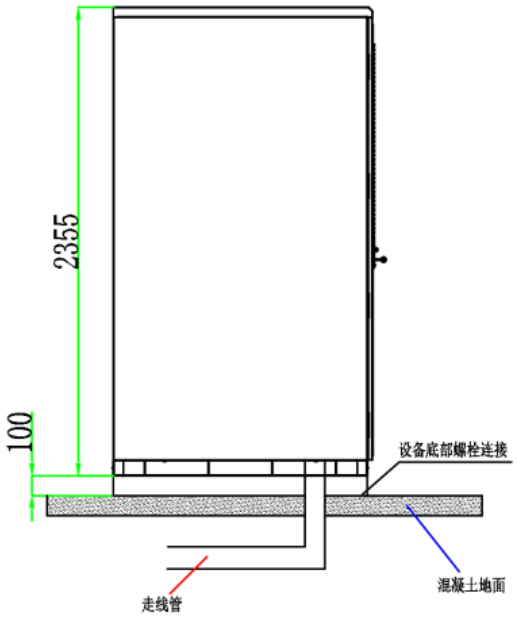


Figure 3-3 Diagram of the cabinet after installation (unit: mm)

地基示意图

Description

- The construction should ensure that the bottom of the equipment is above the highest historical local water level.
- The equipment (including height, pre-buried parts, threading pipes, etc.) is adjusted in conjunction with the process and the site.

- The height of the top mark of the equipment foundation can be adjusted according to the equipment and the actual needs of the site.
- The equipment foundations are configured according to the total weight of the equipment not greater than 4t, which needs to be reviewed when the weight of the equipment exceeds the design.

Description

- The pre-buried detail is the upper equipment bolted to the pre-buried part.
- The threading pipes can be replaced with 2 x Ø125 and 2 x Ø50 PVC pipes depending on the site.

If the installation is on a lawn or other place without hard ground, foundation construction is required first. The connection points are adjusted according to the actual situation on site.

Guttering requirements

The liquid-cooled outdoor cabinets are wired underneath. In order to prevent the entry of foreign objects, the side of the liquid-cooled outdoor cabinets do not have a hole for wiring, so they need to be wired through a trench. Therefore, the site needs to be pre-designed with a trench. The requirements for the trench are as follows:

- As the liquid-cooled outdoor cabinet is wired from the bottom, the trench must have the necessary dust and rodent-proof design to prevent foreign objects from entering.
- The trench must be waterproof and moisture-proof to prevent the cables from aging and short-circuiting, which could affect the normal operation of the liquid-cooled outdoor cabinet.
- The trench must be designed with the necessary waterproof and moisture-proof design to prevent the cables from ageing and short-circuiting, which could affect the normal operation of the liquid-cooled outdoor cabinet.

3.2.3 Outdoor cabinet installation in different scenarios

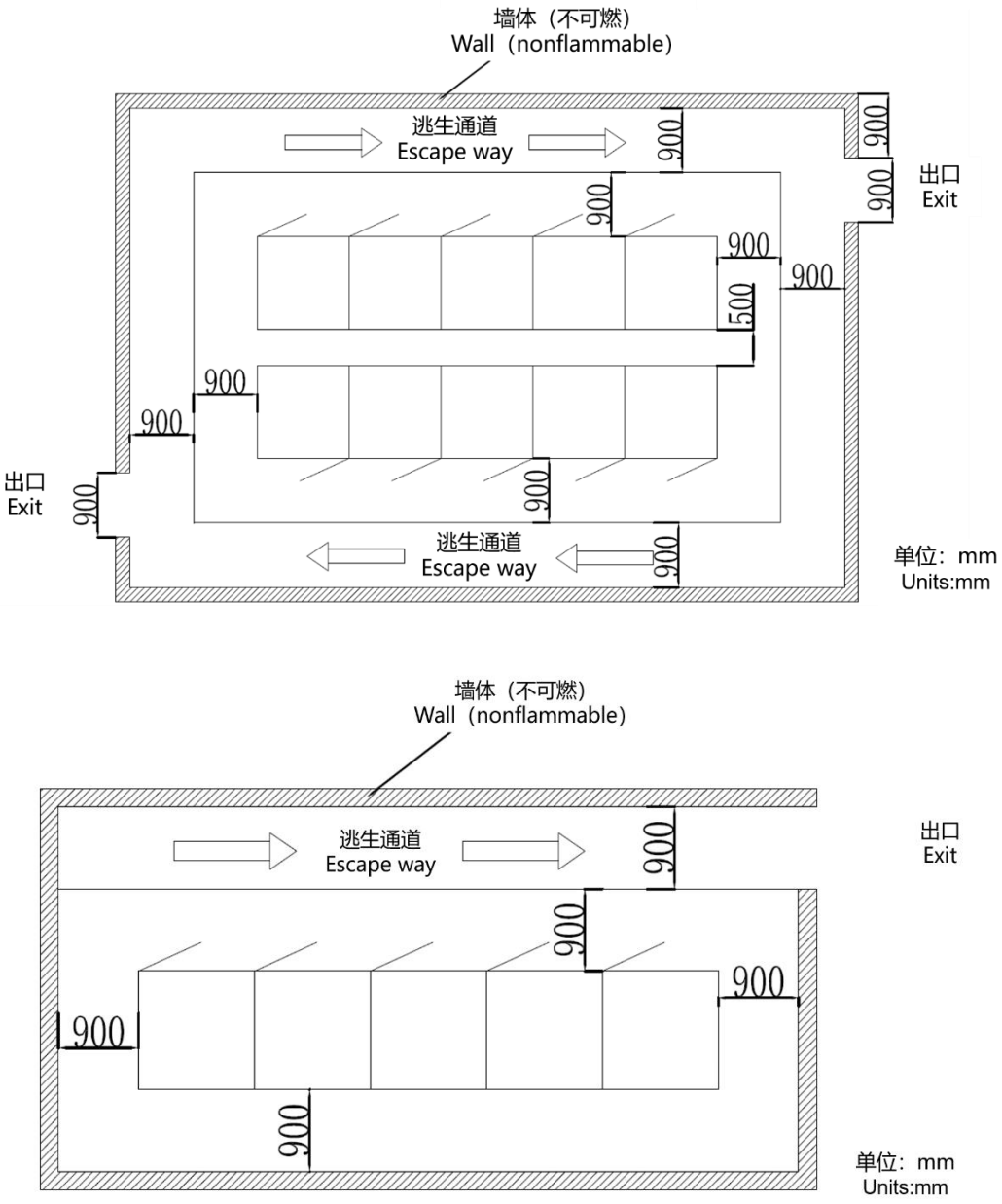


Figure 3-6 Usage Scenario 1: In-building Installation

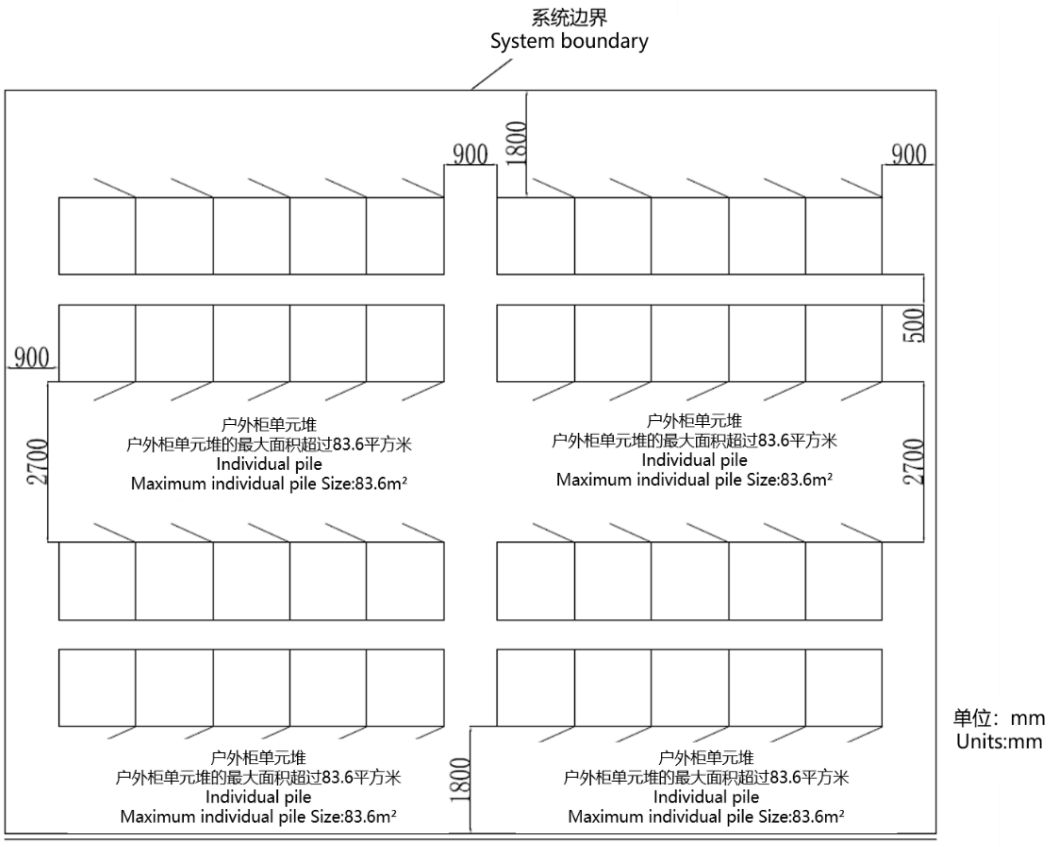


Figure 3-7 Use Scenario 2: In outdoor open areas, maintain a distance of at least 1800mm in the length direction of the installation direction and at least 900mm in the width direction from other units unrelated to the power grid facilities.

3.2.4 Preparation of installation tools

Table 3-2 List of mechanical installation tools

Tools	Quantity	Instructions for use
Forklift / crane	1 vehicle	For indoor and outdoor handling

3.3 Installation of liquid-cooled outdoor cabinets

1. Make sure that the fixing holes on the mounting plane are the same as the bottom mounting holes of the cabinet, please refer to "Figure 3-1" for the location of the fixing holes.
2. Move the liquid-cooled outdoor cabinet to the mounting position. 3.
3. Align the screw holes and fix the unit to the channel or foundation with 10 M12 bolts, torque 27 N-m. The cabinet can also be welded to the metal floor of the channel or prefabricated bin, taking care to avoid welding and to prevent rusting.

CAUTION

- During the handling of the liquid-cooled outdoor cabinets, they should be handled gently.
- When placing the cabinet, make sure that there are no dents in the installation plane and that it is not unable to bear the weight of the liquid-cooled outdoor cabinet.

3.4 Post-installation inspection

Once the installation is complete, please check each item in the table below and tick the ones that match.

No.	Confirmation of projects	Handling measures	Confirmation
1	Liquid-cooled outdoor cabinets are installed at pre-designed fixing points as specified and are not loosened.	If it is loose, tighten the screws again.	
2	The installation space conforms to the space dimensions recommended in "3.2.3 Installation space requirements" .	If there is insufficient space, it is recommended that the outer cabinet be redesigned before installation.	
3	Whether the cooling circuit is circulating properly.	If this is not normal, please adjust the position of the water pipe.	

4 Electrical installation

4.1 Terminal description

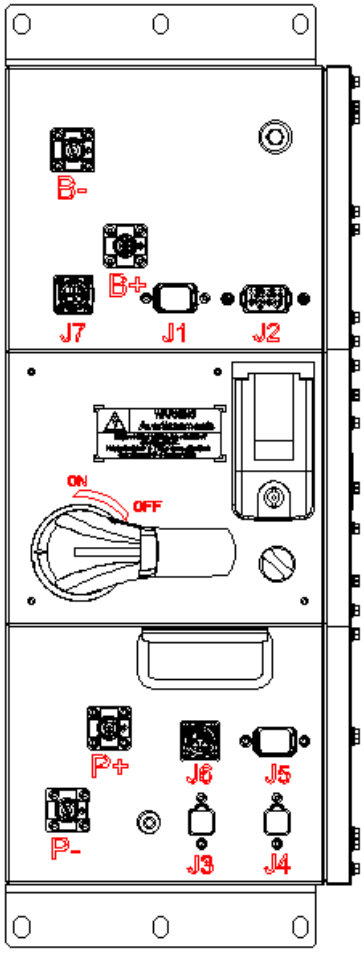
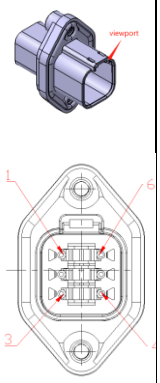
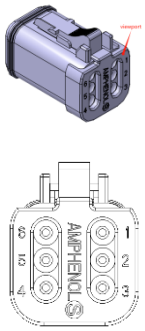
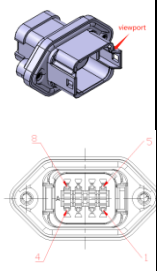
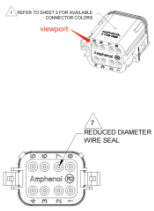
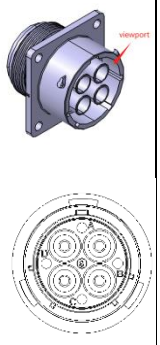
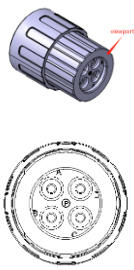


Figure 4-1 Diagram of the distribution of wiring terminals

Table 4-1 Connector Definition Table

Define	Use	BPU,High voltage box		Mating Wiring Cables		PIN Define	Recommended line
		model	View	Mating	View		

		number		Plug			
J3/J4	Control cabinet communication	Amphenol AT04-08PC-PM05GEC		Amphenol AT06-08SA-RD01		1:CAN-2H	AWG20
						2:CAN-2L	AWG20
						3:CAN-2G	AWG20
J5	PCS communications	Amphenol AT04-6P-PM05GRN		Amphenol AT06-6S-EC01 GRN		1:CAN-3H	AWG20
						2:CAN-3L	AWG20
						3:CAN-3G	AWG20
						4:RS485-2A	AWG20
						5:RS485-2B	AWG20
						6:RS485-2G	AWG20
J6	AC Input	Amphenol RTS016N4S03		Amphenol C-RTS016X4S_REV		A:AC L	AWG10
						B:AC N	AWG10

4.2 Safety tips

In order to ensure the safety of the installer's life, the necessary safety precautions must be in place when electrically installing this product. When carrying out the electrical

installation, the following protocols must be followed:

DANGER

- The installation of liquid-cooled outdoor cabinets must be carried out by qualified personnel and in strict accordance with the instructions in the user manual.
- The installer must comply with the relevant electrical operating regulations of the country or region in which they are located.
- Installation in an electrically charged state is not permitted, otherwise there is a risk of electric shock.
- Before installation, all switches on the liquid-cooled outdoor cabinet and the external front must be disconnected and wait 15 minutes to confirm that all cables and the interior of the liquid-cooled outdoor cabinet are free of electricity.
- A warning sign must be left in the disconnected position to prevent reapplication of power during installation.
- The necessary earth and short circuit connections need to be made.
- The live parts need to be treated as necessary and isolated with insulating material to avoid injury to personnel.

4.3 Preparation before wiring

4.3.1 Preparation of installation tools

Table 4-2 List of electrical installation tools

Tools	Quantity	Instructions for use
Live-port torque spanners	1PCS	Fastening nuts
Sockets and spanners	1PCS	Maximum torque must be more than 45N ·m
Phillips screwdriver	2PCS	Screws for M6 and M4
Automatic outer sheath strippers	1PCS	Stripping the outer sheath of the cable
Steel Plate Ruler	1PCS	Measuring the length of the wire
Automatic crimping machines	1PCS	Crimping of cores, sealing plugs and tab jacks
Heat shrink tubing	1PCS	Insulate exposed parts of terminals

4.3.2 Cable preparation

Wire terminal cable production recommendations

Connector	Maximum voltage	Maximum current	Terminal type	Cable recommendation
Grounding wire	/	/	TLK25-8	#3AWG Cable
Control cabinet communication	24V	50mA	E0512	J3/J4 Customised wires
AC Input	277V	26A	E6012	J6 Customised wires
Power cable	1500VDC	173A	TLK50-8	P+/P- Customised wires

Description

- The communication cables are thin and need to be protected from being torn by force.
- The cable must meet the voltage insulation level and must be protected from scratches and damage to the cable insulation.

Main circuit cable preparation

DC Power cable connection

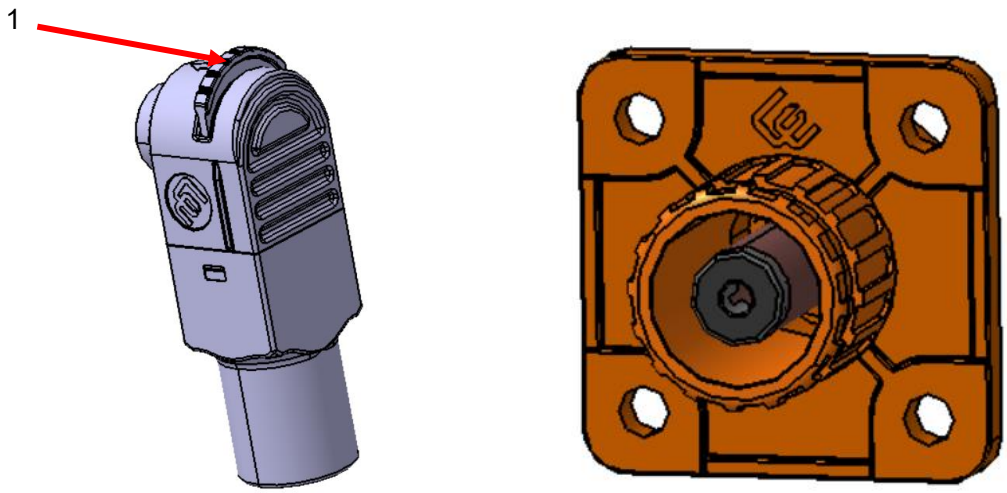


Figure 4-2 Schematic diagram of DC power harness connections

When connecting, the positive power harness plug corresponds to the positive connector, and the negative power harness plug corresponds to the negative connector, insert the plug into the socket, and when you hear the snap sound, it means that the tightening effect has been achieved, and if you don't hear the snap sound, you can pull the

plug outward to check whether it is connected securely.

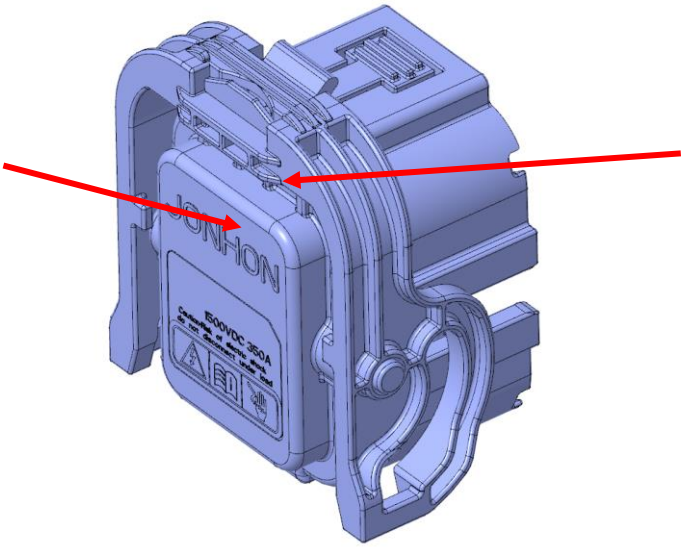
To disconnect, press and hold the button at 1 and pull out the plug backwards.

CAUTION

- When unplugging, do not pull out forcibly to avoid damage to the wire harness and plug.
- It is necessary to distinguish correctly between positive and negative plugs and it is recommended that one person operates and one person monitors the working mode.

- Diagram of how to operate MSD (manual maintenance switch)

1. Pull this pin back and out.



2.Wrench the handle clockwise along the ground until it is horizontal and pull the plug backwards.

Figure 4-3 MSD operation diagram

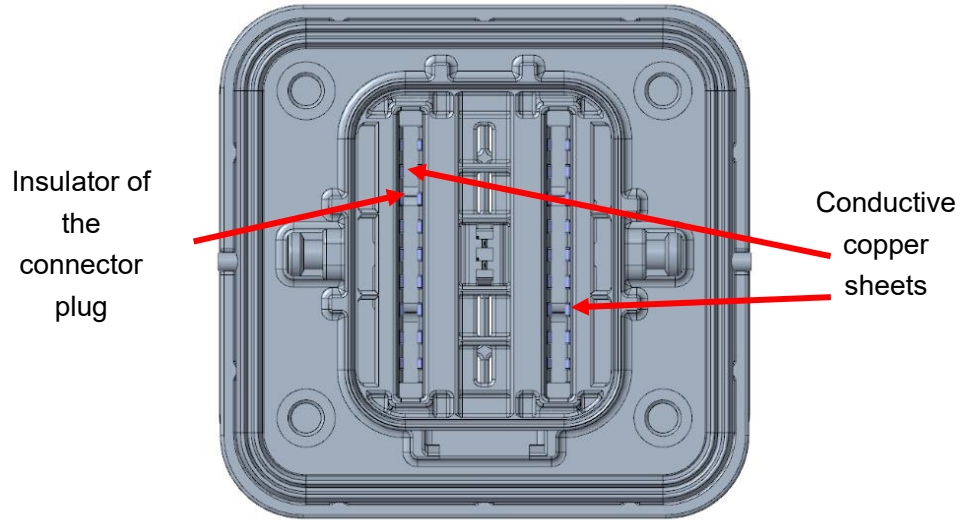


Figure 4-4 MSD socket

4.4 Pre-wiring checks

Please ensure that the following checks are completed before wiring.

Table 4-3 Pre-wiring checklist

No.	Check items	Confirmation
1	The cables used for the wiring have been adapted to the appropriate gauge and shielding requirements.	
2	Good grounding of equipment and products has been ensured.	
3	Observe the steps specified in the electrostatic preventive measures (ESD) and have worn an electrostatic hand ring.	
4	The relevant options for the wiring are ready to use.	

4.5 Wiring of the DC/AC side terminals

DANGER

- The battery voltage must not be greater than the maximum permitted DC voltage of the converter, otherwise damage to the converter may occur.
- If there is an earth fault, the fault must be removed before wiring.
- Incorrect wiring sequence may cause a fire.
- The cable must be tightened, otherwise it may cause a fire.

- Incorrect wiring can cause the converter to not work properly and may burn out the unit.
- Outputs should be fully evaluated that it is connected to an OVC II circuit, otherwise it might require external voltage isolation.

4.6 Check after wiring

After the wiring has been completed, the following items must be checked and measured again to avoid damage to equipment and damage to property:

Table 4-4 Post-installation checklist

No.	Check items	Confirmation
1	Before the measurement, disconnect the battery side and grid side switches to ensure that the DC and AC sides of the converter are uncharged.	
2	The positive and negative connections between the battery and the PCS.	
3	The external control cable, earth wire and communication cable have been tightened.	
4	Earth wire resistance less than 0.12Ω, cable intact, no damage or cracks.	
5	Clean up the installation area, no tools or foreign objects left in the installation area.	

5 Test & Run

5.1 Pre-operation checks

Before running, the following items need to be checked:

No.	Contents	Confirmation
1	Check the liquid-cooled outdoor cabinets and devices for condensation (water film or water droplet production on the surface). If so, the cabinet must be opened for ventilation until the phenomenon disappears. Check the piping connections to ensure that there are no liquid leaks.	
2	Measure whether the voltage on the incoming side of the liquid-cooled outdoor cabinet is within the specified range and confirm that no faults such as phase loss or short circuit exist.	
3	The power input must be properly connected and secure.	
4	The liquid-cooled outdoor cabinet must be reliably earthed.	
5	Each control signal cable is wired correctly.	
6	The wiring terminals are intact, undamaged and insulated.	
7	Liquid-cooled outdoor cabinets are free of foreign objects at the internal and external cables.	
8	The cooling circuit is working properly.	

5.2 Turn on steps

After checking before switching on, the storage liquid-cooled outdoor cabinet can be switched on.

Close all circuit breakers in turn.

1. Turn the emergency stop knob clockwise to normally open;
2. Turn the handle clockwise to on;
3. Close the AC circuit breaker;
4. The run indicator light is on;
5. Malfunction indicator light is not on；

Start-up is complete.

CAUTION

DC liquid-cooled outdoor energy storage cabinet need to be switched on in strict accordance with the above steps, otherwise there is a risk of damaging the system equipment or causing the system equipment to work abnormally.

5.3 Stopping steps

5.3.1 Normal shutdown

Confirm that the PCS is in shutdown, disconnect the handle on the high voltage box clockwise, and turn the switch on the high voltage box counterclockwise to disconnect the circuit breaker on the high voltage box.

CAUTION

A warning sign is required at the disconnect switch to prevent others from being accidentally powered up.

5.3.2 Emergency shutdown

In the event of an emergency, press the emergency stop button on the energy storage cabinet and control cabinet to disconnect the energy storage cabinet.

CAUTION

- After disconnecting all input power to the liquid-cooled outdoor cabinet, wait 35 minutes before opening the door to inspect the liquid-cooled outdoor cabinet.
- Before opening the door, make sure that the interior of the liquid-cooled outdoor cabinet is free of power.
- Under normal circumstances, use the normal shutdown procedure for liquid-cooled outdoor cabinets. An emergency shutdown must be used in case of emergency to ensure a quick response and to protect life, the liquid-cooled outdoor cabinet and peripheral equipment.

5.4 System commissioning

During commissioning, the energy storage system interacts with external energy via a DC converter or energy storage converter. The following points should be noted during commissioning:

Capacity calibration: ensures that the battery is ready for a full normal charge/discharge cycle. By default, the rated capacity is corrected for the first ten initial runs, so deep charging and discharging should be carried out during commissioning and interconnection. It is recommended to do a capacity calibration during commissioning, with a depth of charge/discharge of DOD = 100%, according to the rated power of the product, with the default process of "empty + rest (30min) + full", as described below:

- Empty: RACK performs the emptying test, i.e. discharges to SOC=0%.
- Resting: resting for more than 30min (resting is used for SOC correction), when resting, no charging and discharging current is required and no auxiliary power supply to the switch box is required.
- Full: After the resting time has been reached, a full test is carried out, i.e. charging to SOC=100%.

The capacity calibration process can be adjusted to "full + resting (30min) + empty" according to the site conditions.

Operational stability: busbar, communication, collection and other components are suitable for rated power operation during commissioning, provided conditions are available. Used to determine whether there are abnormalities in the various parts of the system installation, especially in the event of over-temperature, over-current, over-voltage, over-discharge and other abnormalities, should be dealt with in a timely manner to avoid safety hazards.

6 Troubleshooting

DC liquid-cooled outdoor energy storage cabinet has comprehensive protection functions and warning messages, which can be read via EMS in the event of a fault. The relevant fault information can be read through EMS.

Before seeking service, users can follow the tips in the table below to perform a self-test, analyse the cause of the fault and find a solution, if you cannot solve the problem, please contact your agent or contact Great Power Energy directly.

Do not disassemble the machine components during the self-test.

Fault level

- Fault: indicates that the Great Power liquid-cooled cabinet, power grid, battery and other external conditions are abnormal, automatic shutdown, requiring personnel to troubleshoot abnormalities in a timely manner.
- Warning: Indicates that the Great Power liquid-cooled cabinet, power grid, battery and other external conditions are abnormal, no shutdown, personnel are required to troubleshoot the abnormality in time.

Fault reset

Overvoltage, overcurrent or overtemperature occurrence on single or multiple battery cell(s) during battery system operating would lead a protecting action. This action can't be reset before connecting manufacturer and confirming the battery status by manufacture.

Beside situations mentioned above, The fault reset methods are divided into automatic reset and manual reset.

- Automatic fault reset: After a fault has occurred, the system will clear the fault itself at certain intervals.
  - If the fault condition is removed, the system exits the fault state;
  - If the fault condition still exists, the fault is re-announced.
- Manual reset of the fault: After the cause of the fault has been eliminated, a click on reset is required before the liquid-cooled cabinet can resume work.

6.1 List of faults

Failure level:
Level I: Alarm, no human handling required.
Level 2: Alarm, no human handling required.
Level 3: Alarm, of safety hazard, some of the faults are recoverable and others not, maintenance needs to be organized as soon as possible.

No.	Fault name	Possible causes	Troubleshooting
1	BMS_Single cell overvoltage Class I	1. BMS failure; 2. Voltage collection point failure;	1. Replacement of the BMU; 2. Check the voltage collection points;
2	BMS_Single cell overvoltage Class II		
3	BMS_Single cell overvoltage Class III		

No.	Fault name	Possible causes	Troubleshooting
4	BMS_Single cell undervoltage class I	1. BMS failure; 2. Voltage collection point failure;	1. Replacement of the BMU; 2. Check the voltage collection points;
5	BMS_Single cell undervoltage class II		
6	BMS_Single cell undervoltage class III		
7	BMS_Single cell overtemperature class I	1.Chiller wiring abnormality; 2. Chiller failure.	1. Check whether the wiring harness connection is normal; 2. Try to restart the Chiller；
8	BMS_Single cell overtemperature class II		
9	BMS_Single cell overtemperature class III		
10	BMS_Single cell Cryogenic Class I	1. Chiller wiring abnormality; 2. Chiller failure.	1. Check whether the wiring harness connection is normal; 2. Replace the Chiller;
11	BMS_Single cell Cryogenic Class II		
12	BMS_Single cell Cryogenic Class III		
13	BMS_Charging overcurrent alarm	1. Charging current exceeds the maximum system current ；	1、Reduce power；
14	BMS_Discharging overcurrent alarm	1. The discharge current exceeds the maximum system current ；	1. Reduce power；
15	BMS_ Excessive Single cell temperature difference Class I	1. Chiller wiring abnormality; 2. Chiller failure.	1. Check whether the wiring harness connection is normal; 2. Try to restart the Chiller；
16	BMS_ Excessive Single cell temperature difference Class II		
17	BMS_ Excessive Single cell temperature difference Class III		
18	BMS_SOC too low Class I	1. Low SOC； 2. BMS does not activate protection；	1.Carry out charging； 2.Check if BMS is malfunctioning；
19	BMS_SOC too low Class II		
20	BMS_SOC too low Class III		
21	BMS_ Excessive Single cell voltage difference Class I	1. BMS failure; 2. Voltage collection point failure； 3. Abnormal cell consistency；	1、Replacement of the BMU; 2. Check the voltage collection points; 3. Carry out balancing；
22	BMS_ Excessive Single cell voltage difference		

No.	Fault name	Possible causes	Troubleshooting
	Class II		
23	BMS_ Excessive Single cell voltage difference Class III		
24	BMS_Equalisation Class I failure	1. BMU balancing module failure；	1. Replace the BMU；
25	BMS_Equalisation Class II failure		
26	BMS_Equalisation Class III failure		
27	BMS_Overload cut relay alarm	1.The power exceeds the maximum battery power；	1. Power down and restart；
28	BMS_Pre-charge relay closure fault	1. Relay failure； 2.Relay wiring harness loose; 3. Relay wiring harness short circuit;	1. Replace the relay； 2. Check relay harness connector; 3. Check relay harness
29	BMS_Main positive relay closure fault		
30	BMS_Main negative relay closure fault		
31	BMS_Main positive relay sticking fault		
32	BMS_Main negative relay sticking fault		
33	BMS_Single cell voltage measurement faults	1. BMU failure； 2. Voltage collection point failure； 3. BMU connector is loose;	1. Replacement of the BMU； 2. Check the voltage collection point; 3. Check the BMU connector
34	BMS_Single cell temperature measurement faults	1. BMU failure； 2. Temperature acquisition point failure; 3. Temperature acquisition harness disconnection;	1. Replacement of the BMU； 2. Check the temperature acquisition point failure; 3. Check the temperature acquisition wiring harness
35	BMS_Pack current measurement fault	1. Current transformer failure；	1. Replacement of the current transformer；

No.	Fault name	Possible causes	Troubleshooting
		2. The current collection harness is disconnected;	2. Check the current collection harness;
36	BMS_Multiple upper high voltage failure alarms	1. Pre-charge resistance damage; 2. Relay damage; 3. BMS fault alarm; 4.Wiring harness broken.	1. Check the precharge resistance; 2. Check the relay; 3.Clear the BMS alarm; 4.Check the wiring harness;
37	BMS_CS24V power supply failure	1.No 24V DC power output; 2. The power supply harness is disconnected;	1.Check the AC/DC power supply; 2. Check the power supply harness;
38	High Voltage Lock function of the BMS Abnormal Voltage of battery.	1.The MSD is not plugged in; 2.MSD is damaged;	1. Reconnect the MSD; 2. Examine the MSD;
39	Abnormal energy storage battery voltage	1.Battery voltage too high or too low at power-on ;	1.Check if the battery voltage;
40	DC side switch failure	1.Switch contact is burnt. 2.Switch feedback signal line disconnected; 3.Switch control signal line disconnected;	1.Test the switch contacts for adhesion; 2.Check if the switch control signal is normal; 3.Check if the feedback signal connection is normal ;

7 General care and maintenance

Due to the temperature, humidity, dust and vibration of the environment, the internal components of liquid-cooled outdoor cabinets can deteriorate, potentially causing This can lead to potential failures or reduce the service life of the cabinet. Therefore, it is necessary to carry out routine and regular maintenance work on liquid-cooled outdoor cabinets.

CAUTION

- Only professionally qualified personnel are required to carry out maintenance on liquid-cooled outdoor cabinets.
- The cabinet contains strong electricity and the necessary safety precautions must be taken before starting maintenance.
- Before maintenance, ensure that all power sources are disconnected.
- During maintenance, the correct operating procedures must be strictly followed.
- After disconnection of the power supply, warning signs must be hung at the disconnection point to prevent people from being powered up during the maintenance process.
- To avoid accidental danger, maintenance personnel should wear insulated protective equipment during the maintenance process.

7.1 General Inspection Program

The General inspection program is carried out according to the following points:

Table 7-1 List of General inspection items

No.	General Inspection Program	Confirmation
1	The input and output voltages and currents as well as the operating status of the liquid-cooled outdoor cabinets need to be monitored in real time and observed at regular intervals, so that abnormal work or abnormal voltages and currents can be maintained in time.	
2	Listen to the inside of the liquid-cooled outdoor cabinet for any unusual noises.	
3	Smell the inside of liquid-cooled outdoor cabinets for odours.	
4	Read the internal temperature of the system and observe that the temperature is within the normal range.	

5	Check that the surface of the chassis is free from damage, clean up any dirty areas with water or alcohol and refinish any damaged paint. For detailed procedures, please refer to "7.3 Painting instructions".	
6	The deflagration value is installed on the top of the Cabinet, so it's needed to clean the snow on the top when it's over 20cm in thickness, to make sure the deflagration valve is functioning.	

7.2 Regular check-up items

Periodic inspections focus on routine checks and areas that are difficult to inspect during General operation:

Table 7-2 List of periodic inspection items

No.	Regular check-up items	Confirmation
1	Check the appearance of the equipment for damage and rust.	
2	No abnormalities in the internal temperature of the unit using a temperature measuring instrument.	
3	Check that the environment around the equipment, such as ventilation, ambient temperature, humidity and dust, meets the requirements.	
4	Check that the cable is free from ageing or damage to the edge layer. If this occurs, add appropriate insulation or replace the cable.	
5	Check that there are no signs of ageing or burning at the terminal bolts and shake them by hand to make sure they are in a tightened position.	

7.3 Instruction for refinishing operations

- When only the outer surface is dirty

  Use a rag with water or 97% alcohol to clean.
- If the finish is damaged
  1. Smooth the surface of the damaged area with sandpaper.
  2. Clean the surface with 97% alcohol.
  3. Wait for the surface to dry and then refinish the damaged area as evenly and beautifully as possible.
- If the paint is broken and leaks out of the substrate
  1. Use sandpaper to smooth the surface of the damaged area.
  2. Clean the surface with 97% alcohol.
  3. After the surface has dried, spray the damaged area with a zinc-rich primer.
  4. After the primer has dried, apply the top coat as evenly and beautifully as possible.

鹏辉能源
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