



BC197DE

User Manual of Industrial and Commercial Battery Cabinet



Overview

This manual introduces the main characteristics, performance indicators, system principle and outline structure of BC197DE industrial and commercial battery cabinet, as well as installation, use and operation instructions, maintenance management and other contents.

Target Readers

This document is intended for the following engineers:

Sales Engineer

Technical Support Engineer

System Engineer

Hardware Installation Engineer

Commissioning Engineer

Maintenance Engineer

Symbol Stipulations

The following symbols may appear in this document, and their meanings are as follows.

Symbol	Explanation
	Representing the danger with a high-level risk that may cause deaths or severe injuries if not avoided.
	Representing the danger with a medium-level risk that may cause deaths or severe injuries if not avoided.
	Representing the danger with a low-level risk that may cause minor or moderate injury if not avoided.
	Warning for equipment or environmental safety. Failure to avoid this may lead to equipment damage, data loss, equipment performance degradation, or other unpredictable results. "NOTICE" does not involve personal injury.
 Description	Supplementary description of key information in the text. "Description" is not safety warning information and does not involve personal injury, equipment and environmental hazard information.

Revision History

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1 General Safety Precautions

1.1 General Safety

Statement

When installing, operating and maintaining the equipment, please read this manual first, and follow all safety precautions on the label on the equipment and in the manual.

The "Caution", "Warning", and "Danger" signs in this manual do not encompass all safety precautions to be followed but act as a supplement to the safety precautions. Kstar New Energy is not responsible for any breach of general safety operation requirements or equipment design, production and operation safety standards. This equipment should be used in an environment that meets the requirements of design specifications, otherwise, it may cause equipment faults. The resulting abnormal equipment function or component damage, personal safety accidents and property losses are not within the scope of equipment quality assurance.

The equipment shall be installed, operated and maintained in accordance with local laws, regulations and codes. The safety precautions in this manual are intended only as a supplement to local laws, regulations and codes.

In case of any of the following circumstances, Kstar New Energy shall not be liable.

- It is not operated under the service conditions described in this manual.
- The installation and use environment is beyond the provisions of relevant international or national standards.
- Unauthorized disassembly, alteration of the product or modification of the software code.
- Failure to operate according to the operating instructions and safety warnings in the products and documents.
- Equipment damage caused by abnormal natural environment (force majeure, such as earthquake, fire and storm).
- Transportation damage caused by the customer's own transportation.

- Damage caused by storage conditions that do not meet the requirements of product documentation.

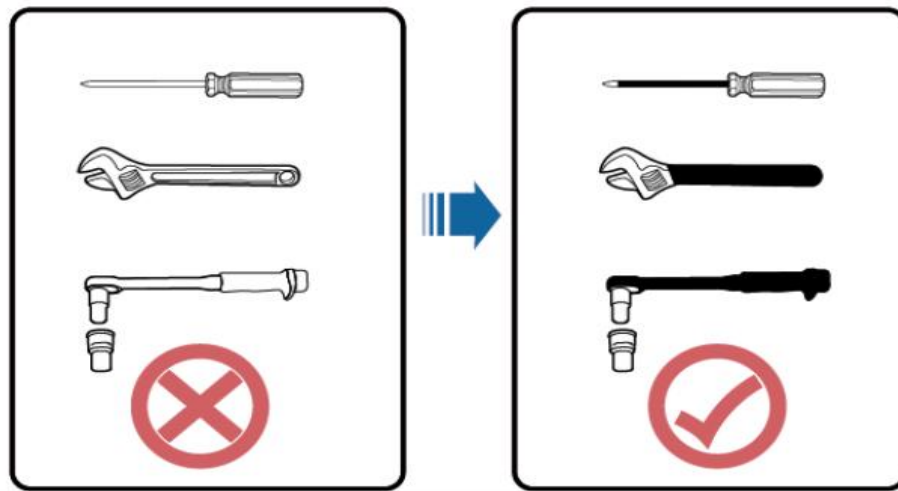
General Requirements

- It is strictly prohibited to install, use and operate outdoor equipment and cables in severe weather such as thunder and lightning, rain, snow and strong wind of Grade VI (including but not limited to handling equipment, operating equipment and cables, plugging and unplugging signal interfaces connected to outdoors, working at heights, outdoor installation, etc.).
- It is strictly prohibited to wear watches, bracelets, bangles, rings, necklaces and other conductive objects during installation, operation and maintenance to avoid electric shock burns.
- Special protective equipment must be used during installation, operation and maintenance, such as wearing insulating gloves, goggles, safety clothing, safety helmets, safety shoes, etc., as shown in the following figure.

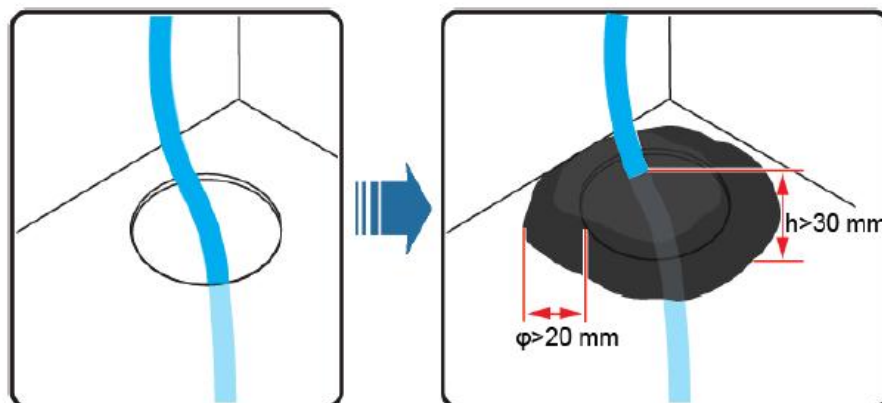


- Installation, operation and maintenance must be carried out according to the steps in this manual.
- Before touching any conductor surface or terminal, the voltage at the contact point shall be measured to confirm that there is no risk of electric shock.
- After the equipment is installed, empty packaging materials such as cartons, foam, plastic and cable ties shall be removed from the equipment area.
- In case of fire, evacuate from the building or equipment area and press the fire alarm bell, or call the fire emergency number. Under no circumstances is it allowed to re-enter the burning building.
- Do not disable the protection device and ignore the warnings, cautions, and preventive measures on the manual and equipment. Danger signs that have become unclear due to long-term use shall be replaced in time.
- Except for the personnel operating the equipment, other personnel are not allowed to approach the equipment.

- The handle of the tool used needs to be insulated for protection, or an insulating tool is required, as shown in the figure below.



- Seal all cabling holes with fireproof mud. Use the cover that comes with the cabinet to block those that are not routed. The correct construction standards for fireproof mud sealing are shown in the figure below.



- It is strictly prohibited to artificially alter, damage or block the marks and nameplates on the equipment.
- When installing the equipment, tighten the screws with a tool.
- Live operation is strictly prohibited during installation.
- Paint scratches occurred during equipment transportation and installation must be repaired in time. It is strictly prohibited to expose the scratched part to the outdoor environment for a long time.
- Before operation, the equipment shall be reliably fixed on the floor or other stable

objects, such as walls or mounting frames.

- It is forbidden to clean the electrical parts inside and outside the cabinet with water.
- Do not change the structure and installation sequence of the equipment without authorization.

Personal Safety

- During equipment operation, if any fault that may cause personal injury or equipment damage is found, the operation should be stopped immediately, the person in charge should be reported, and effective protective measures should be taken.
- To avoid the risk of electric shock, it is forbidden to connect safety extra-low voltage (SELV) circuits to telecommunication network voltage (TNV) circuits.
- Do not power on the equipment before it is installed or confirmed by professionals.

1.2 Personnel Requirements

- The personnel responsible for the installation and maintenance of KSTAR equipment must first receive strict training, understand various safety precautions and master correct operation methods.
- Only qualified professionals or trained personnel are allowed to install, operate and maintain the equipment.
- Only qualified professionals are allowed to dismantle safety facilities and overhaul equipment.
- Personnel who operate the equipment, including operators, trained personnel and professionals, shall have special operation qualifications required by the local country, such as high-voltage operation, working at heights and special equipment operation qualifications.
- Professional: a person who has training or equipment operation experience and is aware of potential sources and magnitudes of hazards during installation, operation and maintenance of the equipment.
- Trained personnel: personnel who have received corresponding technical training and

have the necessary experience, can be aware of the dangers that may be brought to them during an operation, and can take measures to minimize the risks to themselves or other personnel.

- Operators: operators who may come into contact with the equipment, except for trained personnel and professionals.
- Replacement of equipment or components (including software) must be completed by professionals or authorized personnel.

1.3 Electrical Safety

Grounding Requirements

- When installing the equipment to be grounded, the protective grounding wire must be installed first; when dismantling the equipment, the protective grounding wire must be removed finally.
- It is prohibited to damage grounding conductors.
- It is forbidden to operate the equipment without installing a grounding conductor.
- The equipment shall be permanently connected to protective ground. Before operation, inspect the electrical connection of the equipment to make sure that it is reliably grounded.

General Requirements

- Please use special insulating tools for high-voltage operation.

AC and DC Operation Requirements



Never install or remove live power cords. At the moment when the power cord core contacts the conductor, it will generate an arc or electric spark, which may lead to fire or personal injury.

- If the equipment is affixed with a sign of "large leakage current", before connecting the AC input power supply, the protective grounding terminal of the equipment casing must be grounded to prevent the leakage current of the equipment from causing electric shock

to the human body.

- The power switch must be turned off before installing and removing the power cord.
- Ensure that the power cord's label is correct before connecting it.
- If the equipment has multiple inputs, disconnect all inputs and operate the equipment only after it has been completely powered off.
- It is not recommended to configure the air switch with a leakage protection function.
- If the power cord is damaged, it must be replaced by the manufacturer, business agent or specialist to avoid risks.
- Personnel who carry out high-voltage operations and install AC equipment must have qualifications for high-voltage and AC operations.

Wiring Requirements

- The use of cables in high-temperature environments may cause aging and damage to the insulation layer. The distance between cables and heating devices or the periphery of the heat source area shall be at least 30 mm.
- Cables are not allowed to pass through the air inlet and outlet of the equipment.
- The cable shall meet the requirements of VW-1 flame retardant rating.
- Cables of the same type shall be bound together, and cables of different types shall be laid at least 30 mm apart. It is forbidden to twine or cross each other.
- When the temperature is too low, severe impact and vibration may cause brittle cracking of the plastic sheath of the cable. In order to ensure construction safety, the following requirements shall be followed:
 - All cables shall be laid and installed above 0°C and shall be handled with care when handling cables, especially during construction in low-temperature environments.
 - If the storage environment temperature of the cable is below 0°C, the cable must be moved to room temperature and stored for more than 24 hours before laying.
 - Non-standard operations such as pushing the cable directly down from the vehicle are prohibited.
 - The selection, erection and routing of cables must comply with local laws,

regulations and codes.

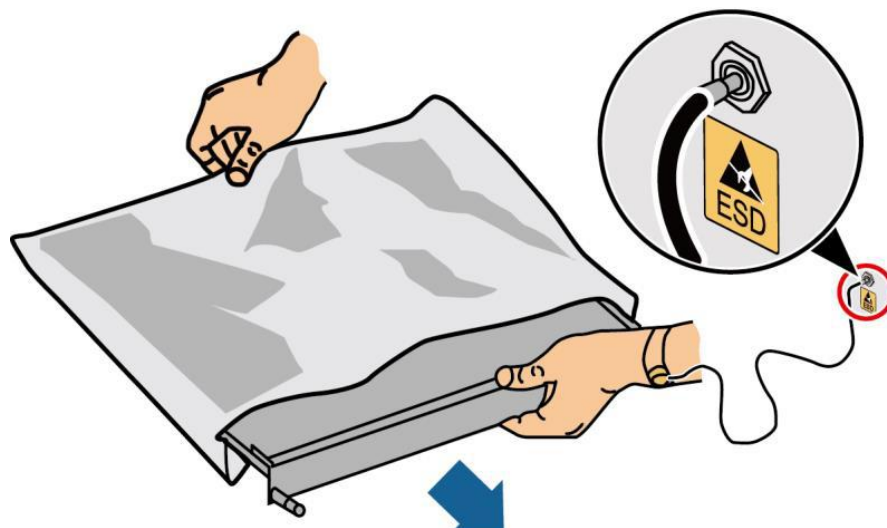
Anti-static Requirements

NOTICE

Static electricity generated by the human body will damage the electrostatic-sensitive components on boards, such as the large-scale integrated circuit (IC), etc.

- Static electricity generated by the human body will damage the electrostatic-sensitive components on boards, such as the large-scale integrated circuit (IC), etc. Before touching the equipment or holding the board or application-specific integrated circuit (ASIC) chip, you must wear anti-static gloves or an anti-static wrist strap, and the other end of the anti-static wrist strap is well grounded.
- Operators must grip the edge of the board that does not contain components. It is important not to touch any components with hands.
- Any removed boards must be packaged using anti-static packaging materials for storage or transport.

Fig. 1-1 Schematic Diagram of Wearing Anti-static Wrist Strap



Zero-to-earth Voltage

- It is recommended that users balance the three-phase load to make the zero-to-earth voltage less than 2V and meet the distribution requirements.

1.4 Requirements for Installation Environment

- Do not block the vent or heat dissipation system when the equipment is running, so as to prevent high-temperature fire.
- The equipment shall be installed in an area away from liquids. It is forbidden to install it under positions prone to condensate water such as water pipes and air outlets, or under positions prone to water leakage such as air conditioning ports, vents and outgoing line windows of machine rooms, so as to prevent liquids from entering the equipment and causing equipment fault or short circuit.
- If any liquid is found to enter the equipment, please turn off the power supply immediately and notify the administrator.
- It is forbidden to place or operate the equipment in an environment with flammable and explosive gases or smoke.
- The equipment shall be installed away from the desert or sandy and dusty environment.

Installation at Heights

- All operations carried out at a height of more than 2 meters above the ground belong to high-altitude operations.
- In case of any of the following circumstances, work at heights shall be stopped: rainwater in steel pipes is not dry, and other situations that may cause danger. When the above situation is over, all kinds of operating equipment must be checked by the company's safety director and relevant technical personnel, and the operation can only be carried out after confirmation and approval.
- When working at height, the requirements of local regulations for work at height must be met.
- They must receive relevant training and obtain relevant certificates before taking up their posts and working at heights.
- Before working at heights, climbing tools and safety appliances shall be carefully checked, such as safety helmets, safety belts, ladders, springboards, scaffolds, lifting equipment, etc. If there is any non-conformance, it shall be improved immediately or the

work at heights shall be rejected. Carry out safety protection, wear safety helmets, safety belts or waist ropes, and tie them to firm and solid structural members. It is strictly prohibited to hang them on movable objects that are not firm or metal with sharp edges and corners, so as to prevent falling accidents caused by hook slippage.

- Dangerous areas shall be divided for the site in which working at height is carried out. Prominent signs shall be provided to prevent irrelevant personnel from entering.
- Carry operating instruments and tools to prevent falling tools from injuring others.
- It is strictly prohibited for operators working at heights to throw objects from high altitude to the ground, and it is strictly prohibited to throw objects from the ground to high altitude. Strong ropes, hanging baskets, overhead vehicles or cranes shall be used to transfer objects.
- Guardrails and signs shall be set up at the mouth and holes of high-altitude operations to prevent slipping and missing steps.
- Scaffolding, springboards and other sundries are strictly prohibited to be piled up on the ground below the aerial work area. Ground personnel are strictly prohibited from staying or passing directly below the aerial work area.
- Scaffolds, springboards and workbenches for working at height must be subject to safety inspection and appraisal in advance to ensure that the structure is firm and the scaffolds are not overloaded.
- If the person in charge of the site and the safety officer find that the construction personnel working at height do not operate according to regulations, they shall immediately report it and ask them to make corrections; otherwise, their operations must be stopped.

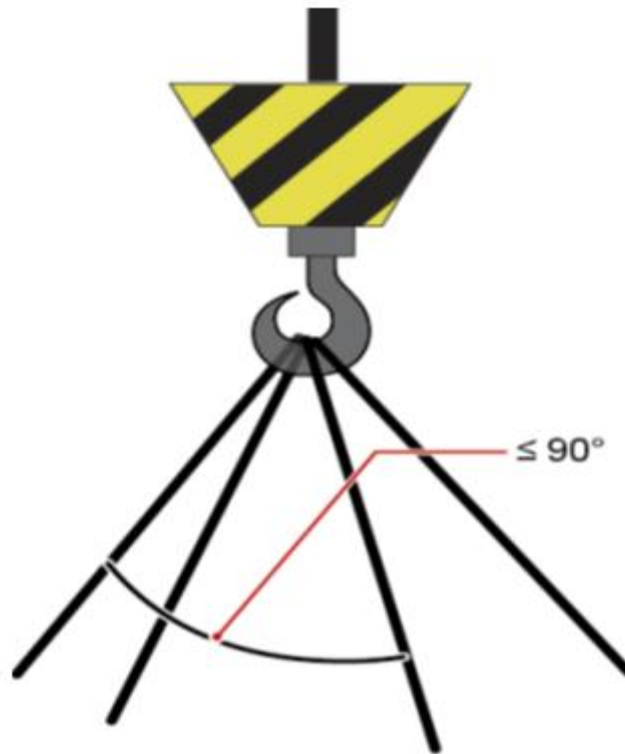
1.5 Mechanical Safety

Hoisting Safety

- When hoisting heavy objects, it is strictly prohibited to walk under the boom and hoisted objects.
- Personnel carrying out hoisting operations shall receive relevant training and can only

take up their posts after passing the examination.

- Hoisting tools shall be inspected and used only when the tools are complete.
- Before hoisting, ensure that the hoisting tool is firmly fixed to a load-bearing fixture or wall.
- During the hoisting process, ensure that the included angle between two cables is not more than 90° , as shown in the following figure.

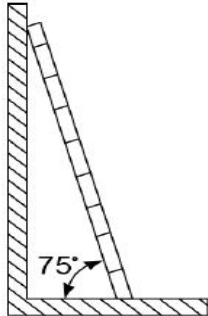


- During hoisting, it is forbidden to drag wire ropes and slings or hit them with hard objects.

Use Safety of Ladders

- When there is a possibility of climbing operations involving electricity, wooden ladders or FRP ladders shall be used.
- The pull rope must be firm when using a herringbone ladder, and the ladder must be held by someone during operation.
- Before using the ladder, please confirm that the ladder is in good condition and the bearing weight of the ladder meets the requirements. It is strictly prohibited to use it while overweight.
- Ladders shall be placed in a stable place. The inclination of the ladder should be 75° ,

which can be measured with an angle square, as shown in the following figure. Ladders shall be used with the wide feet pointing down or protected at the bottom to prevent slipping.



- When climbing the ladder, please pay attention to the following actions to reduce danger and ensure safety.
- Keep your body steady.
- The maximum height of the operator's feet shall not exceed the 4th step from top to bottom of the ladder.
- Ensure that the center of gravity of your body does not deviate from the edge of the ladder.

Drilling Safety

- The following safety precautions need to be considered when drilling holes in walls and ground:

NOTICE

It is strictly prohibited to drill holes in the equipment. Drilling will damage the electromagnetic shielding performance of the equipment, internal devices and cables. The entry of metal chips generated by drilling into the equipment will cause a short circuit of the circuit board.

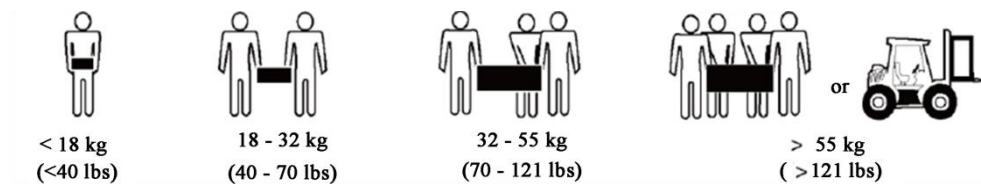
- The tripartite agreement between the Client, Contractor and KSTAR shall be obtained before drilling.
- Goggles and protective gloves should be worn while drilling.
- During drilling, the equipment shall be covered to prevent debris from falling into the equipment. After drilling, the debris shall be cleaned in time.

Safety in Handling Heavy Objects



When pulling the equipment out of the cabinet, be aware of other equipment that may not be securely installed in the cabinet to avoid being crushed or injured.

- When handling heavy objects, make preparations for load bearing to avoid being crushed or sprained by heavy objects.



- Wear protective gloves to avoid injury when handling the equipment by hand.
- When moving or lifting the equipment, hold the handle of the equipment or support the bottom edge of the equipment instead of holding the handle of the installed module in the equipment.
- During equipment handling, avoid scratching the surface of the cabinet or damaging the components and cables of the cabinet.
- When a forklift is used for handling, the fork of the forklift must be in the middle position to prevent overturning. Before moving, please fasten the equipment to the forklift with ropes; during movement, special personnel shall be assigned to take care of it.
- Railway transportation, sea transportation or roads in good condition shall be selected as far as possible to ensure the safety of equipment. Jolting and tilting shall be minimized during transportation.
- The cabinet must be moved carefully to avoid any damage to the equipment caused by impact or dropping.

1.6 Battery Safety

Basic Requirements

Before operating the battery, you must carefully read the safety precautions for operation and master the correct connection method of the battery.

** DANGER**

- Do not expose the battery to a high-temperature environment or around heat-generating equipment, such as sunlight, fire source, transformer and heater. Overheating of the battery may cause an explosion.
 - Do not incinerate the battery; otherwise, it may cause an explosion.
 - It is strictly prohibited to disassemble, refit or damage the battery (such as inserting foreign matters or immersing it in water or other liquids) to avoid battery leakage, overheating, fire or explosion.
-
- Wear goggles, rubber gloves and protective clothing to prevent the hazards caused by electrolyte overflow. If the battery is leaking, do not allow skin or eyes to contact with the leaked liquid. In case of contact with skin or eyes, rinse immediately with clean water and go to the hospital for medical treatment.
 - Please use special insulating tools.
 - When handling the battery, it shall be handled in the direction required by the battery. Inversion and tilting are strictly prohibited.
 - During installation, maintenance, and other operations, the battery circuit shall be kept disconnected.
 - Please use the battery of the specified model. Using batteries of non-specified models at will may cause battery damage.
 - Please dispose of used batteries according to local laws and regulations. Do not dispose of batteries as domestic waste. Improper disposal of batteries may cause them to explode.
 - The site must be equipped with fire-fighting facilities that meet the requirements, such as fire sand and dry powder extinguishers.

NOTICE

In order to ensure the safety of battery use and the accuracy of the battery management function, please use the batteries configured by KSTAR with a PCS host. KSTAR is not responsible for battery-related faults if batteries other than those supplied by KSTAR are used.

Battery Installation Specification

- To ensure safety, the following basic precautions shall be observed before the installation and operation of batteries:
- The battery shall be installed in a ventilated, dry and cool environment, away from heat sources, flammable and damp environments with a large amount of infrared radiation, organic solvents and corrosive gases, etc., and fire prevention measures shall be taken. Batteries shall be placed horizontally and fixed.
- Pay attention to the positive and negative poles during battery installation. It is strictly prohibited to short-circuit the positive and negative poles of the same battery or the same string, otherwise it will cause a short circuit of the battery.
- Please check the battery connection terminal screws regularly to make sure that they are tightened without looseness.
- It is strictly prohibited to place installation tools on the battery during its installation.

Battery Short-circuit Protection



A short circuit of the battery will generate an instantaneous high current and release a large amount of energy, which may cause personal injury and property loss.

In order to avoid short circuit of the battery, online maintenance is not allowed for the battery.

Special Scenarios of Lithium Battery

Please refer to the safety precautions for lead-acid battery operation. In addition, please pay attention to the following matters.



There is a risk of explosion if you replace the battery with an incorrect model.

- Use only the same or similar type of battery recommended by the manufacturer for replacement.
- Do not invert, tilt or bump the lithium battery when handling it.
- During installation, maintenance and other operations, the lithium battery module circuit shall be kept disconnected.
- When the lithium battery temperature is lower than the lower limit of working temperature, charging is prohibited (charging is prohibited at 0°C), so as to avoid the

internal short circuit of the battery caused by crystallization during low-temperature charging.

- Please do not exceed the temperature range, which will affect the performance and safety of the battery.
- Do not put the lithium battery module into a fire source.
- When maintenance is completed, the used lithium battery module shall be returned to the maintenance site.

1.7. Others

Transportation, Storage and Maintenance

- For long-term storage, a charge-discharge cycle shall be carried out every 6 months according to the method specified in the specification.
- When loading and unloading the battery during transportation, please be careful not to drop it, do not place it overturned, and ensure that it is facing upwards.

Warning and Precautions

Please read the specifications and warning signs on the surface of the battery box carefully before using the battery. Improper use of the battery may cause overheating damage to the battery. Kstar New Energy will not assume any responsibility for any accident caused by non-compliance with the specifications. In order to ensure the safe use and disposal of the battery, please read the operating instructions carefully before use.

2 Overview

2.1 Product Introduction

The industrial and commercial battery cabinet contains an HV box, battery module, EMS, SBMU, BMU and other modules, which can store and release electric energy according to the requirements of the ESS energy management system. The input and output ports of the industrial and commercial battery cabinet are all HVDC.

- **Battery charging:** The output of the battery cabinet is connected to the energy storage terminals (BAT+, BAT-) of the PCS. Under the control of the PCS, the battery is charged and the energy in PV or mains supply is transferred into the battery.
- **Battery discharge:** When the photovoltaic energy is insufficient to supply power to the load, the system needs to control the battery to supply power to the load and output the stored battery energy to the load through the PCS.

2.1.1 Product Appearance



Front View of Battery Cabinet



Side View of Battery Cabinet

Fig. 2-1 Battery Cabinet

The main battery cabinet has the following functions: managing the battery cluster, communicating with PCS, displaying and saving all system data, EMS management, modifying system parameters, etc. The main battery cabinet has an EMS display on the front door of the cabinet.

2.1.2 Product Structure

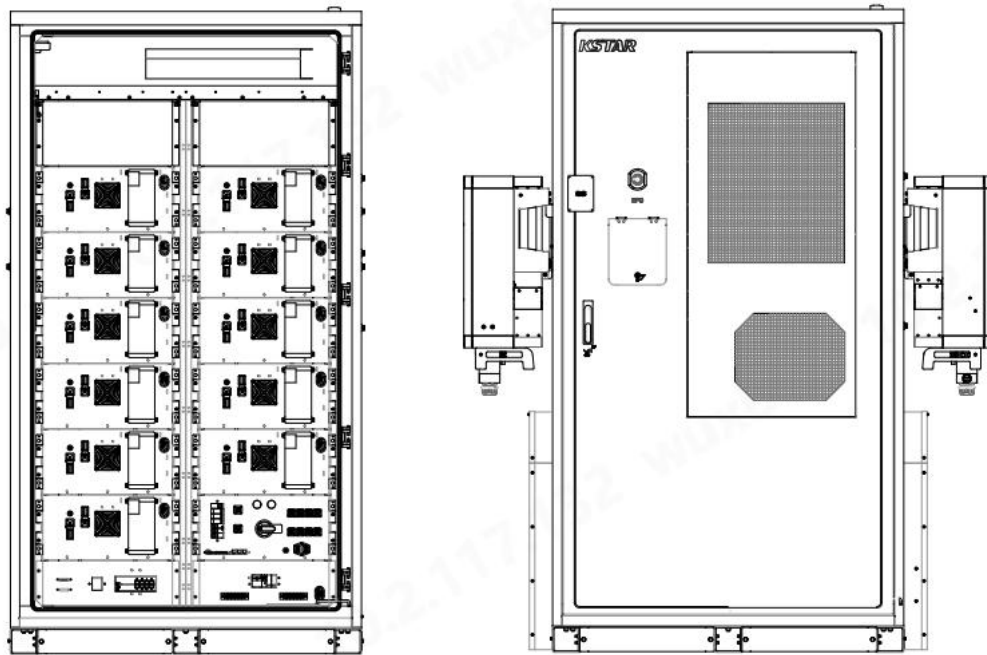


Fig. 2-2 Product Structure

2.1.2.1 HV box

The HV box contains the protection components of the whole system, such as relays, circuit breakers, fuses and DC lightning arresters.

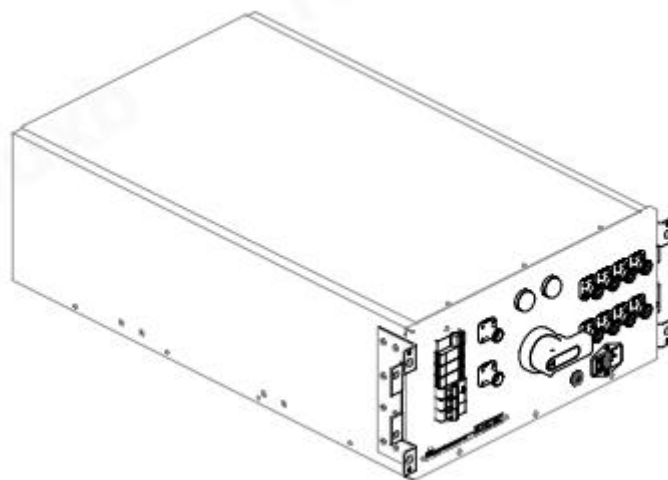


Fig. 2-3 HV Box

Function

The HV box is used to collect information such as total battery voltage, current, temperature and external digital input signals, and cooperate with BMS to implement the system operation strategy. The dimensions of the HV box are as follows:

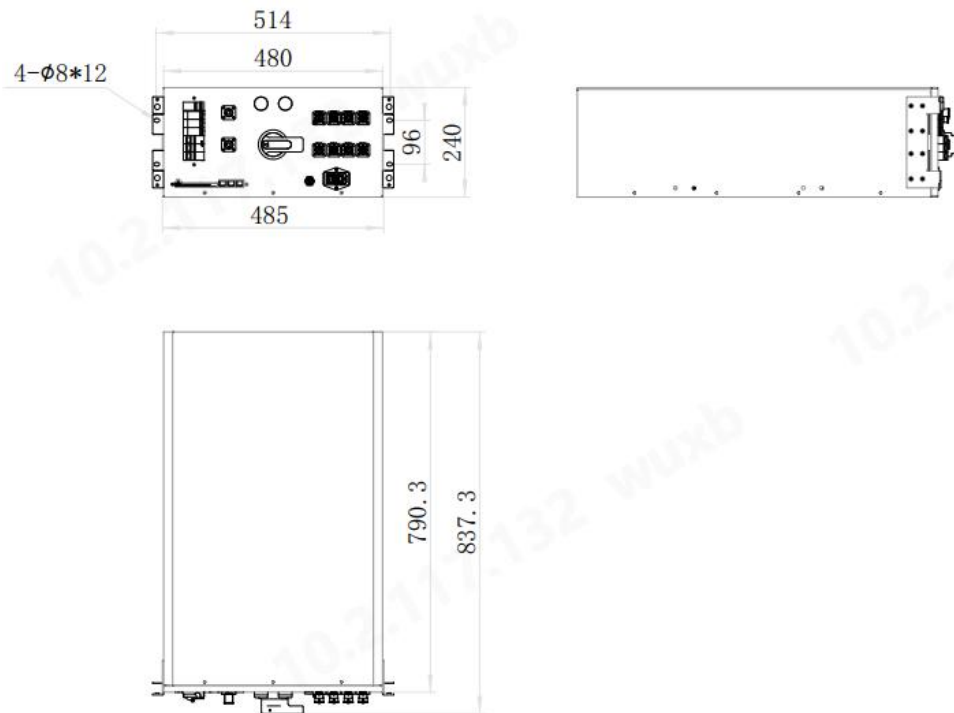


Fig. 2-4 Dimensions of HV Box (mm)

2.1.2.2 Battery module

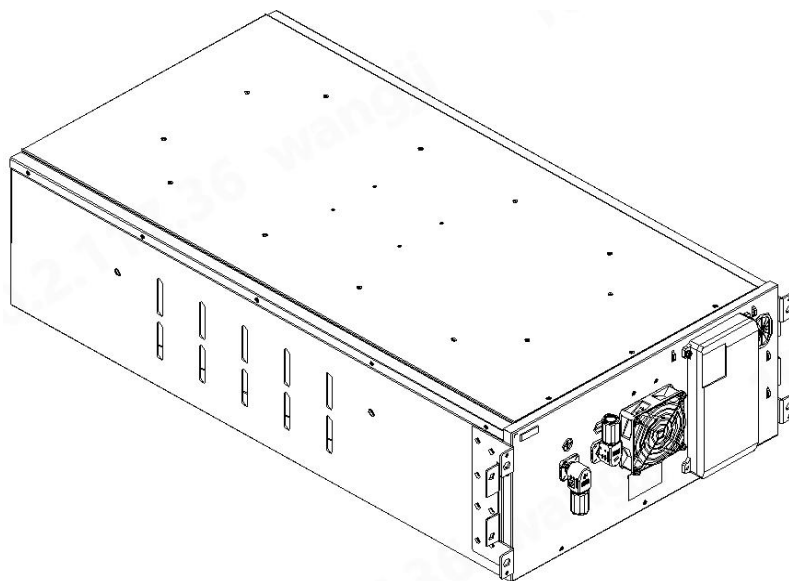


Fig. 2-5 Battery Module

Function

The battery module contains a battery pack composed of cells, which is the power source of the whole system. The BMU configured for the battery module is used to collect information such as the voltage and temperature of lithium batteries and upload the information to the SBMU control unit. The battery module is also equipped with a firefighting unit for automatic fire extinguishing. The dimensions of the battery module are as follows:

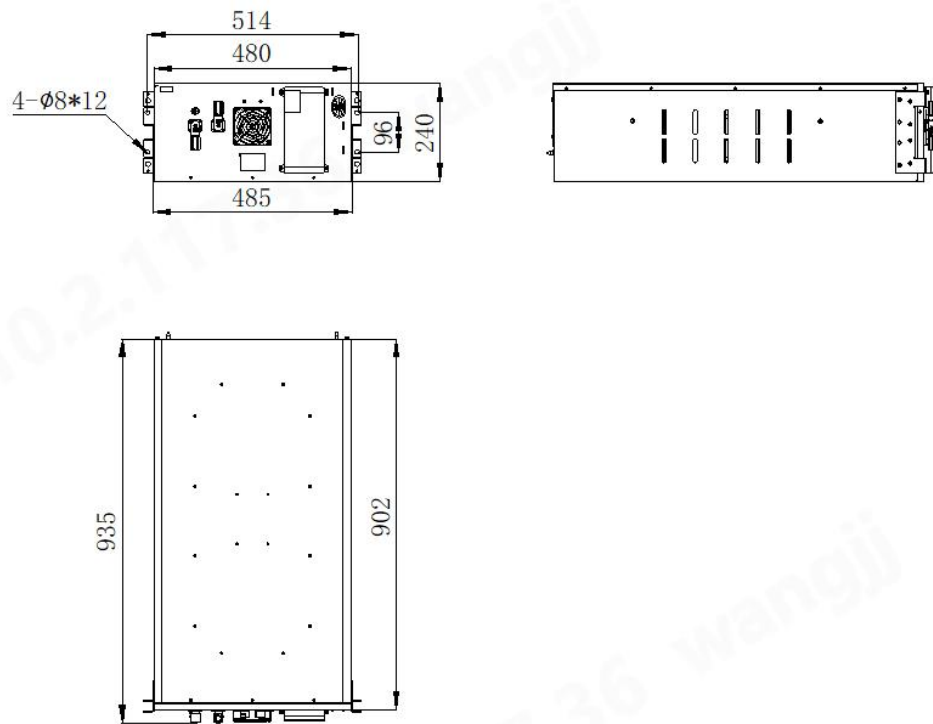
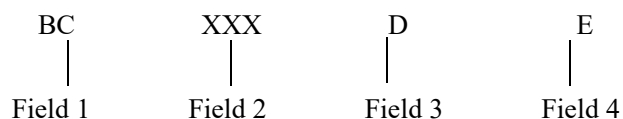


Fig. 2-6 Dimensions of Battery Module (mm)

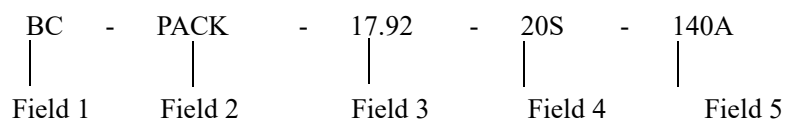
2.1.3 Product Model and Naming Rules

2.1.3.1 Naming rules for battery cabinet models:



Field 1	Field 2	Field 3	Field 4
BC: Battery cabinet Industrial and commercial battery cabinet	Energy 197:197KWH	D: outdoor Vacancy: Indoor	E: With the EMS unit Vacant: without EMS unit

2.1.3.2 Naming rules for battery module models:



Field 1	Field 2	Field 3	Field 4	Field 5
BC: Battery cabinet Industrial and commercial battery cabinet	PACK Battery module	Energy 17.92: 17.92KWH	20S: 20 cells connected in series	140A: maximum current of the cell

2.2 Battery System Parameters

2.2.1 Cell Parameters

S/N	Item	Features
1	Cell type	Square lithium iron phosphate
2	Nominal voltage	3.2V
3	Rated capacity	280AH
4	Rated energy	896WH

5	Maximum continuous charging current	0.5C
6	Recommended charging current	$\leq 0.5C$
7	Maximum continuous discharging current	0.5C
8	Recommended discharging current	$\leq 0.5C$

2.2.2 Battery Module Parameters

S/N	Item	Features
1	Series/parallel connection	20S1P
2	Rated voltage	64V
3	Rated capacity	280AH
4	Rated energy	17.92KWH
5	Rated charging voltage	72V
6	Recommended charging/discharging current	$\leq 140A @ 25\pm 5^{\circ}C$
7	Weight	About 137kg

Charging instructions of battery module:

If the customer needs to charge a separate battery module, it is necessary to set the charger in strict accordance with the above-recommended values of battery module parameters; otherwise, the battery module will be easily damaged.

2.2.3 Parameters of Battery Cluster

S/N	Item	Features
1	Series/parallel connection	220S1P
2	Rated voltage	704V
3	Rated capacity	280AH
4	Rated energy	197.12KWH

5	Rated charging voltage	792V
6	Maximum charging/discharging current	140A

2.2.4 Parameters of Battery Cabinet

S/N	Item	Features
1	Total energy	197.12KWh
2	Rated voltage	704VDC
3	Recommended depth of discharge	90%
4	Operating voltage range	627VDC–792VDC
5	Number of battery clusters/cabinet	1
6	Maximum charging current	140A (0.5C)
7	Maximum discharging current	140A (0.5C)
8	Monitoring parameters	Battery cluster voltage, current, cell voltage, cell temperature, ambient temperature, etc.
9	Communication mode	CAN/Ethernet
10	Operating temperature range	-30°C - +50°C
11	Storage temperature range	-30°C ~ +60°C (25°C is recommended for long-term storage)
12	Relative humidity	5%~95%, non-condensing
13	Temperature control mode	A/C cooling or heating
14	Net weight	About 2,360 kg
15	Product dimension	W1957mm*D1442mm*H2380mm (including A/C and PCS)
16	Protection rating	IP54
17	Recommended altitude	≤3,000 m
18	AC input port conditional short-circuit current(I _{cc})	6kA
19	External protection device current	32A
20	Maximum short current and duration	3.415KA/0.29ms
21	Noise grade	≤70db

2.2.5 Interface of HV Box

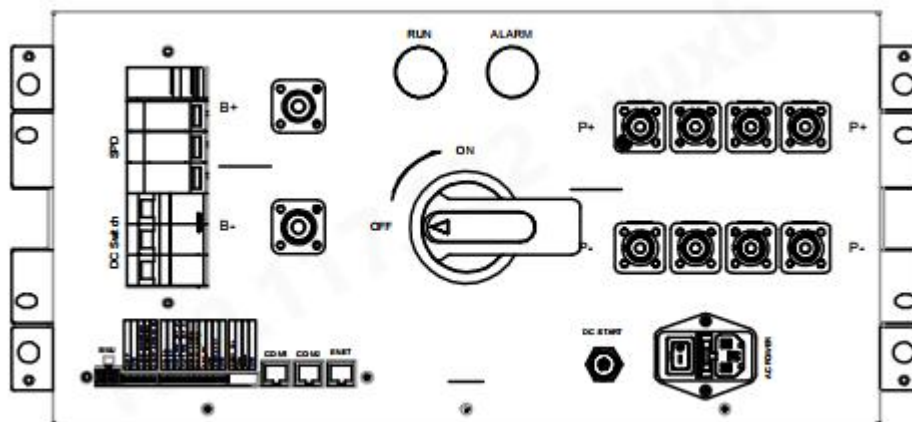


Fig. 2-7 Panel of HV Box

Definition of panel elements:

Port	Port description
P+	DC output anode
P-	DC output cathode
B+	Positive pole of the series-connected battery
B-	Negative pole of the series-connected battery
DC START	DC start button/black start button
AC POWER	230VAC input
RUN	Running indicator
ALARM	Alarm indicator
Circuit breaker handle	DC system switch
DC Switch	DC power switch
SPD	Lightning protection module

Definition of weak current/communication port:

Port	Port description
PCS_CAN/MBMU	CAN interface communication of PCS or MBMU
RLY_FIRE_EXT	Reserved dry contact 1
BMU	Battery module information exchange interface
24VOUT	24V power output interface
RELAY2_RES	Reserved dry contact 2
RS485A/RS485B	A/C communication interface

FIRE_FB+	Fire protection feedback input
SMOKE_FB+	Reserved feedback
DOOR_FB+	Door state detection
IMM+	Immersion test
GND	One GND for each FB+ signal and 24V

RJ45 description

RJ45 port	Port description
COM1	CAN input line of the combined cabinet (the first cabinet is suspended)
COM2	CAN output line of the combined cabinet (the end cabinet is connected to the terminal resistance 120Ω)
ENET	Ethernet, 100M Ethernet, network port

BMU interface

+24V	BMU power supply input
GND	
BMU_CANH	CAN communication
BMU24V_START	BMU 24V enabling
BMU_CODEID_DO	Autoencoding hardware flag bit (output)
BMU_CANL	CAN communication

2.2.6 Front Cabinet Door Panel

Description of cabinet panel

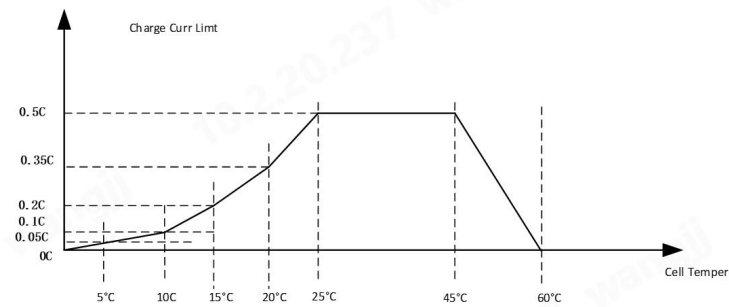


EPO: EPO is an emergency stop button. After it is pressed, the battery cabinet will cut off high voltage and AC power supply, resulting in power failure of the battery cabinet.

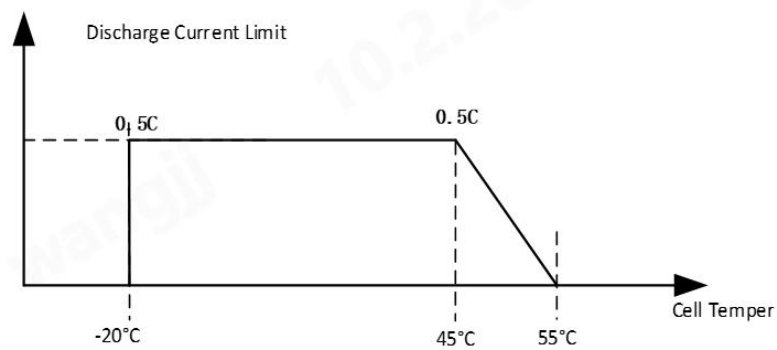
Below the EPO button is EMS, and you can see the screen by opening the protective cover with a key.

2.2.7 Charge and discharge power curve

1 、 Charging power curve: below 45 °C , according to the battery specification charging requirements to develop charging power curve; Charging power above 45 ° C needs derating; When it reaches 60 °C , the charging current is 0. More intuitive, the following charging power diagram.



2、Discharge power curve: -20°C – 45°C discharge current limit 140A; When the discharge current exceeds 45°C , it needs to be derated. When the discharge current reaches 55°C , it is limited to 0. More intuitive, the following discharge curve.



3 Installation

3.1 Site Planning

3.1.1 Dimensions of Battery Cabinet

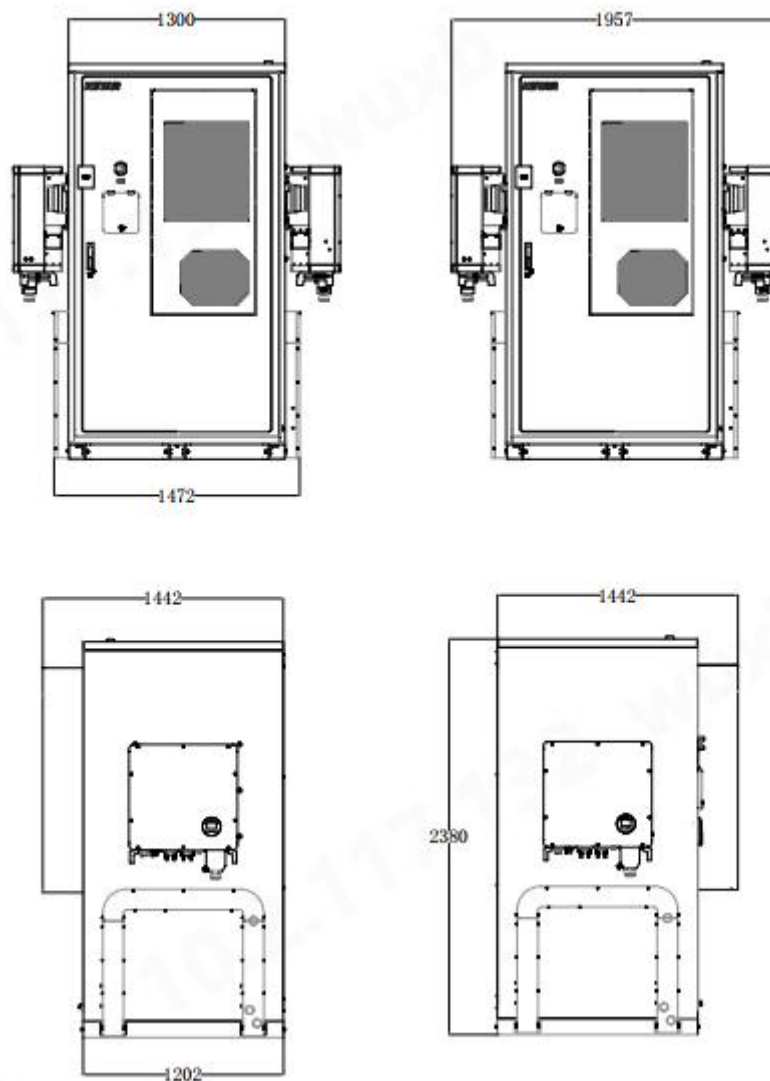


Fig. 3-1 Dimensions of Cabinet (mm)

3.1.2 Precautions for Installation

Please place the battery cabinet on a horizontal ground, and ensure that it is placed stably without shaking or tilting.

The installation of the battery cabinet shall consider the bearing and load capacity of its installation ground and floor slab (according to the requirements of architectural drawings).

Do not cover the ventilation holes with objects, so as not to hinder the heat dissipation of the battery cabinet, cause the internal temperature of the system to rise and affect the use safety and service life of the battery.

Please keep the installation environment of the battery cabinet well ventilated, avoid installing it in places with too high or too low temperature and high humidity, away from water, combustible gas or corrosive agents, and heat sources, avoid direct sunlight, and try to keep the air inlet/outlet free of dust.

Please avoid using it in an environment with dust, volatile gas, corrosive gas or too high salt content. Do not place inflammable and explosive articles around the battery cabinet.

In order to reduce the possibility of fire and reduce the damage caused by it, the walls, ceilings and floors of the room where the battery cabinet is placed shall be made of fireproof materials as far as possible and equipped with portable dry powder fire extinguishers.

Please refer to the relevant applicable safety regulations for installation.

3.1.3 Space Reservation

Reserve a certain operation and ventilation space around the cabinet:

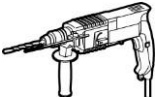
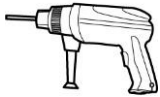
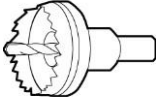
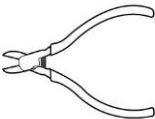
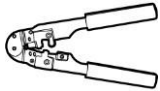
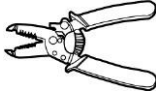
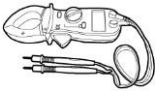
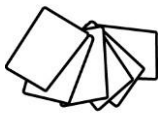
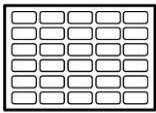
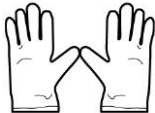
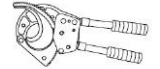
- It is recommended to reserve 1,200 mm of space for ventilation and operation since doors need to be opened and maintained at the front and back.
- It is recommended to reserve 1,000 mm operating space for PCS on the left and right sides.

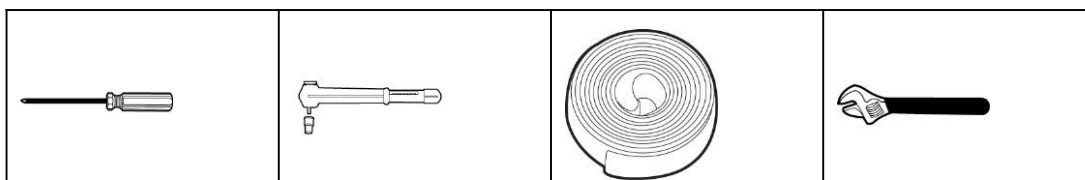
3.2 Preparation of Tools and Instruments



Use insulated tools to avoid electric shock.

Table 3-1 Preparation of Tools and Instruments

Tools and Instruments			
Electric forklift	Manual forklift	Ladder	Rubber hammer
			
Impact swivel	Manual impact	Alloy hole saw	Heat gun
			
Diagonal cutting plier	Crimping tool	Wire stripping plier	Electro-hydraulic
			
Clip-style ammeter	Multimeter	Cable ties	Measuring level
			
Insulating tape	Cotton cloth	Label	Electrician's knife
			
Anti-static gloves	Lead rubber gloves	Heat-resistant gloves	Insulated protective shoes
			
Torque screwdriver	Cable cutter	Brush	Flathead screwdriver
			
Phillips screwdriver (M3 / M4 / M5 / M6 / M8)	Insulated torque wrench (M6/M8/M12/M16)	Heat shrinkable tube	Insulated adjustable wrench



3.3 Unpacking

Operation Steps

Step 1 Use a forklift to transport the battery cabinet to the designated place.

Step 2 Remove the outer packaging of the battery cabinet.

Step 3 After confirming that the equipment is in good condition, remove the bolts securing the battery cabinet and pallet and remove the battery cabinet from the pallet.

3.4 Installation of Single Cabinet

3.4.1 Installation Environment

- Do not install the battery cabinet in high-temperature, low-temperature or humid places beyond the technical specifications.
- The battery cabinet shall be kept away from water sources, heat sources and inflammable and explosive articles.
- Avoid installing the battery cabinet in the desert and its surrounding environment;
- Avoid installing the battery cabinet in an environment with direct sunlight, dust, volatile gases, corrosive substances and excessive salt content.
- Avoid installing the battery cabinet on an unstable or easily vibrated foundation.
- Do not install the battery cabinet in the working environment with metal conductive dust.
- The optimal working temperature of the cells in the battery cabinet is 20°C ~ 30°C. Considering the refrigerating capacity of the air conditioner and the optimal working temperature of the cells, it is recommended that the optimal ambient temperature of the battery cabinet should not exceed 45°C; if it exceeds 45°C, it is recommended to derate for use by 10% for every 1°C increase to maintain the optimal working temperature of

the cells in the cabinet. It is recommended that the maximum ambient temperature should not exceed 50°C. Exceeding 50°C for a long time may accelerate the aging of the battery.

3.4.2 Installation of Cabinet

3.4.2.1 Selection of Installation Site

When choosing an installation site, please consider at least the following principles:

- The climatic environment and geological conditions (such as stress wave emission, groundwater level)

and other characteristics of the place where the integrated ESS is installed should be fully considered.

- The surrounding environment is dry and well ventilated, away from flammable and explosive areas.

- The soil at the installation site needs to have a certain degree of compactness. It is recommended that

the relative compactness of the soil at the installation site be $\geq 98\%$. If the soil is loose, be sure to take

steps to secure the foundation.

3.4.2.2 Foundation Requirements

WARNING

The integrated PCS is relatively heavy as a whole. Before building the foundation, the conditions of the installation site (mainly referring to geological conditions and environmental climate conditions, etc.) should be inspected in detail. Only on this basis can the design and construction of the foundation be started.

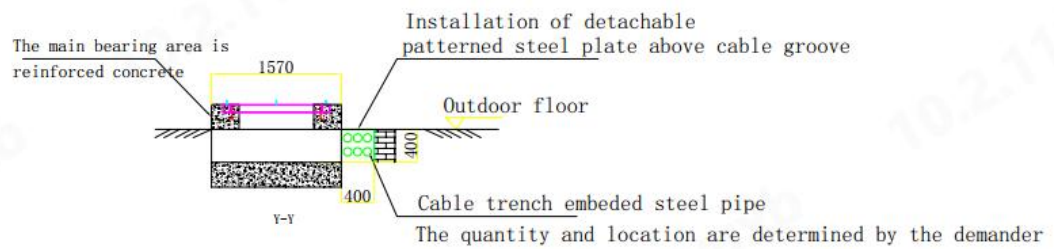


Fig. 3-1 Reference Front View of Battery Cabinet Installation Foundation

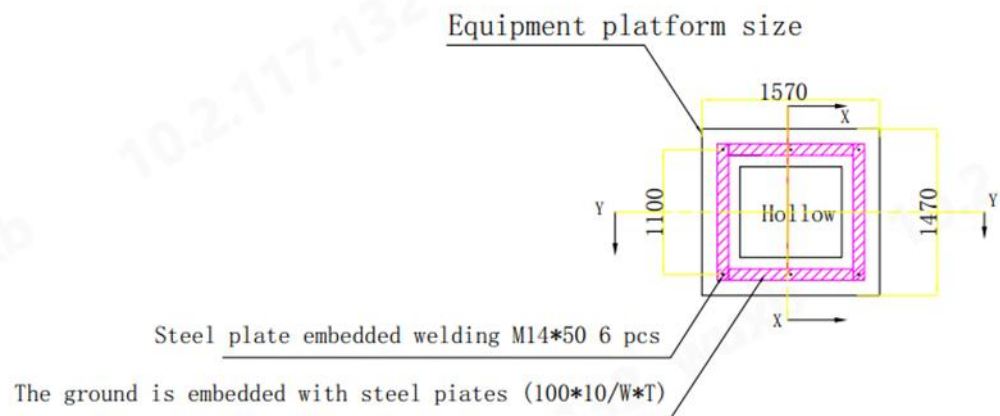


Fig. 3-2 Reference Top View of Battery Cabinet Installation Foundation

An unreasonable foundation construction plan will bring great difficulties or troubles to the placement of the integrated PCS, opening and closing doors, and later operation. Therefore, the installation foundation of the integrated PCS must be designed and constructed in advance according to certain standards to meet the requirements for mechanical support, cable routing, post-maintenance and overhaul, etc.

At least the following requirements should be met when constructing the foundation:

- The bottom of the foundation pit for building the foundation must be compacted and filled.
- The foundation should be sufficient to provide effective load-bearing support for the integrated PCS.
- Elevate the integrated PCS to prevent rainwater from eroding the base and interior. It is suggested that the foundation should be about 300mm higher than the horizontal ground of the installation site.
- It is necessary to construct corresponding drainage measures in combination with local geological conditions.
- Construct concrete foundations of sufficient cross-sectional area and height. The foundation height shall be determined by the construction party according to the site geology.
- Cable routing should be considered when constructing the foundation.
- The maintenance platform should be built around the foundation to provide convenience for later maintenance.
- According to the position and size of the cable inlet and outlet on the outdoor battery cabinet, reserve enough space for the AC/DC side cable trough and pre-embed the cable guide in the foundation construction.
- Determine the specifications and quantity of perforating tubes according to the cable model and the number of incoming and outgoing lines.
- Both ends of all pre-buried pipes are temporarily sealed to prevent impurities from entering; otherwise, it will be inconvenient to route later.
- After all cables are connected, cable entries and exits and joints should be sealed with refractory mortar or other suitable material to prevent the entry of rodents.



Pre-embed the grounding unit according to the relevant standards of the country/region where the project is located.

3.4.2.3 Fixed Installation

After confirming that the foundation construction meets the requirements and is sufficiently dry, firm and flat, hoist the outdoor battery cabinet and PCS to the predetermined position.

Fix the outdoor battery cabinet to the foundation with fastening bolts. After fixing, the U-shaped angle

steel should be treated for anti-rust, such as spraying anti-rust paint, etc. place a fire extinguisher next to battery

Cabinet.

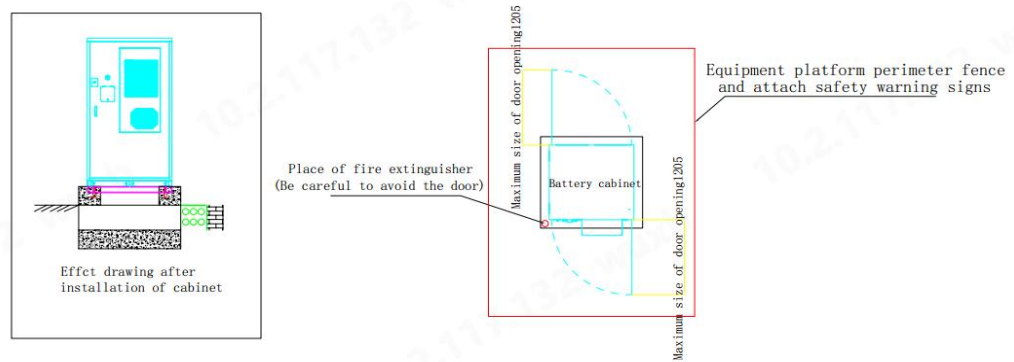


Fig. 3-3

3.4.3 Installation Instructions for Cables between Battery Modules

3.4.3.1 Battery module

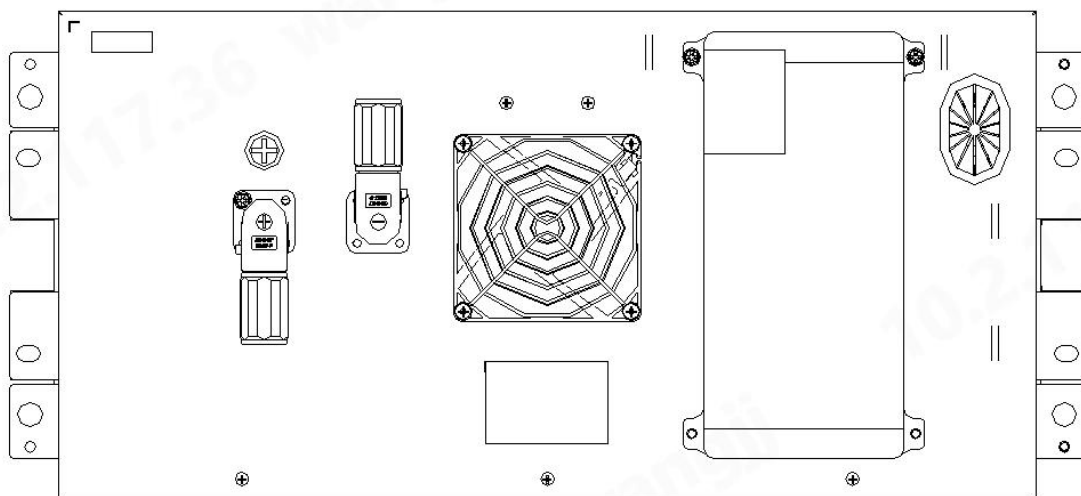


Fig. 3-4 Battery Module

Description:

: the negative pole of the battery module;



: the positive pole of the battery module;

3.4.3.2 Description of power connection of battery module (checking line marks)

The connection between battery modules has been completed when the battery cabinet is shipped. If the customer still needs to maintain the connection between battery modules, please refer to the following:

Component specification:

Name	Description
Series quick-plug power cable	The quick-plug power cable between battery modules, black and red are matched with each other for fool-proofing
"B-" power cable	Connecting cable between module 01 "B-" and PDU "B-"
BMU acquisition cable	Acquisition of cell and temperature
BMU cascade communication cable	BMU cascades CAN bus communication cable and power supply, coding address cable, etc.
BMU fan drive cable	BMU fan drive cable

Cable connection between battery modules:

Wear insulating gloves, and install the quick-plug power cable upward from the battery module in the lower left corner in turn. HV box B- is connected to the cathode of the first PACK in the lower left corner, and the anode of the first PACK in the lower left corner is connected to the cathode of the second PACK in the lower left corner; By analogy, the 6th anode on the left is connected to the cathode of the highest PACK on the right, and the anode of the highest PACK on the right is connected to the second cathode downward from the right. The rest can be done in the same manner until the anode of the fifth PACK counted downward from the right is connected to

the HV box B+. The wiring of the power circuit is completed. Except that there are two black and two red quick plugs at both ends of the quick-plug power cable connected to the HV box, all others are equipped with one black and one red plug.

The sequence of the communication cascade cable is consistent with that of the PACK power cable. A terminal resistor shall be connected to the floating end of the 11th BMU communication socket.

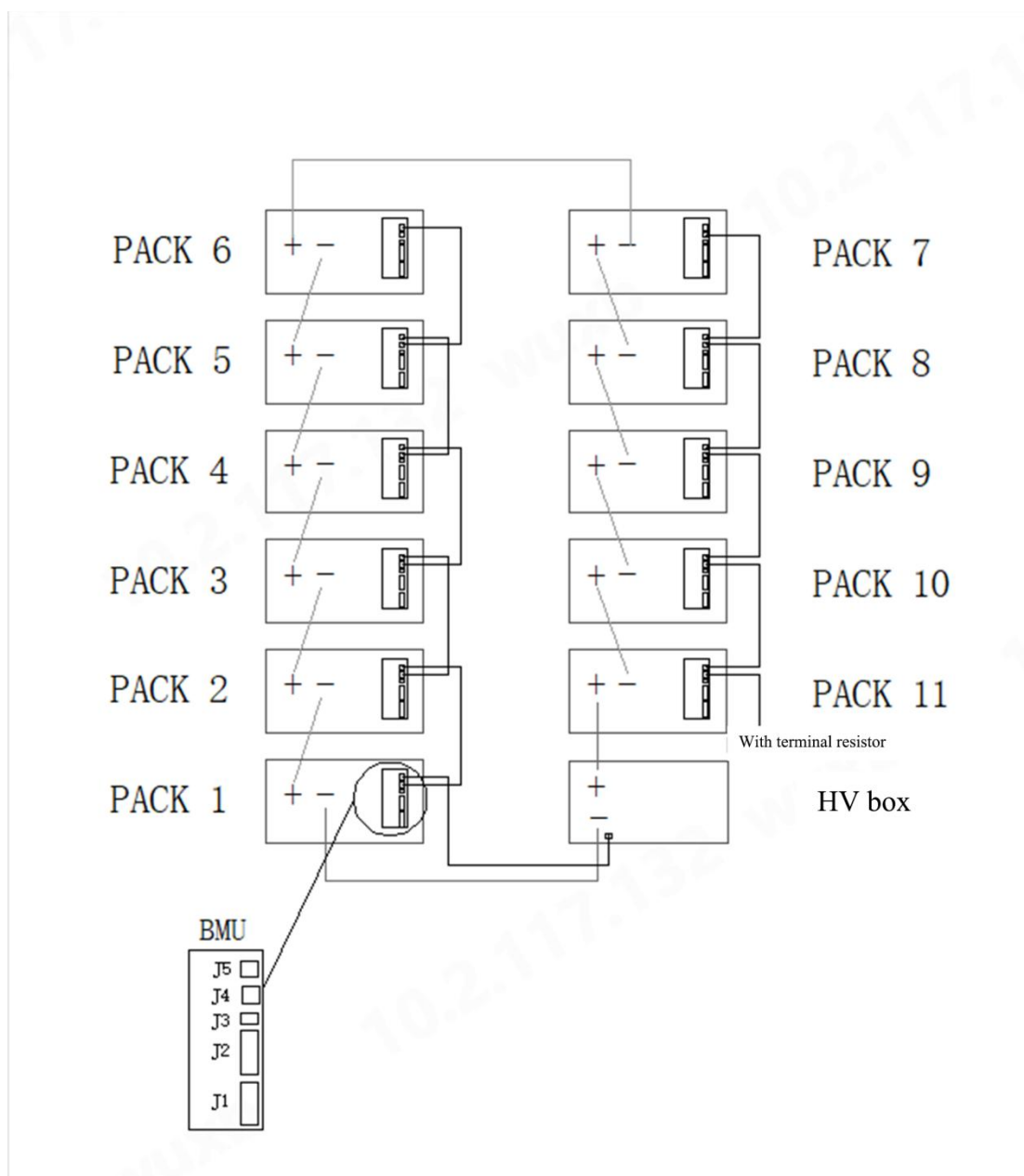


Fig. 3-5 Schematic Diagram of Single Cabinet Communication Cable

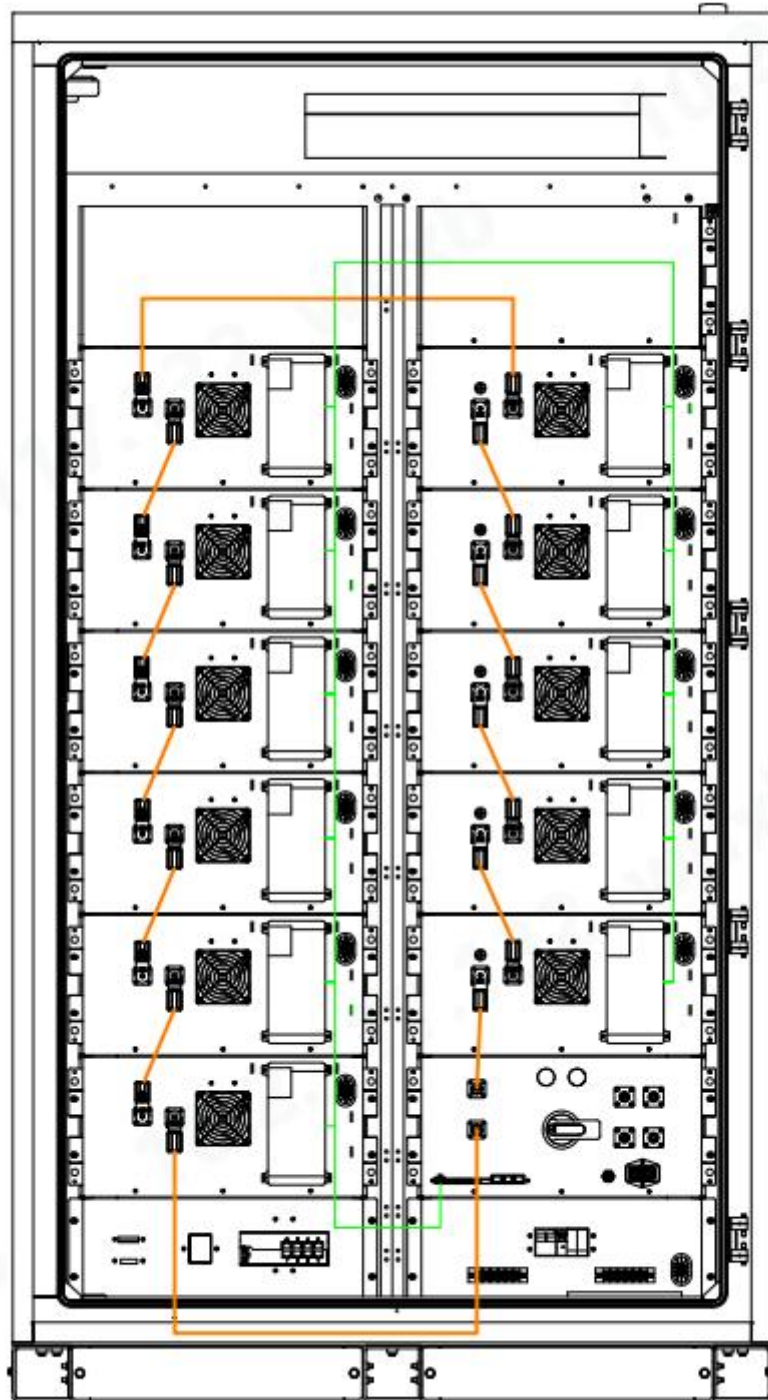


Fig. 3-6 Schematic Diagram of Single Cabinet Power Cable



Fig. 3-7 Power Wiring Diagram

3.5 Electrical Connection



Before installation, make sure that the circuit breaker switch on the HV box is off

3.5.1 AC Input Connection

Step 1 Confirm that the AC Switch is in an "OFF" state.

Note: The AC input is 230VAC single-phase alternating current, and it is necessary to confirm that it is non-live operation before wiring.

The overvoltage level of AC input is AC OVC II.

The AC input provides a 230VAC power supply for the AC/DC power modules of the air conditioner and high-voltage box.

Step 2 Connect the L/N/PE wires of the single-phase 230VAC mains power cable to the corresponding terminals according to the identification in the following figure, and tighten them with bolts (torque ≤ 2 N.M).

Note: The 3 terminals on the right side of "INPUT" are reserved AC input wiring terminals, which can be used for switching of AC power supply. The 2 groups of terminals at the "OUTPUT" end are respectively used for internal wiring such as the HV box and AC power supply of the air conditioner.

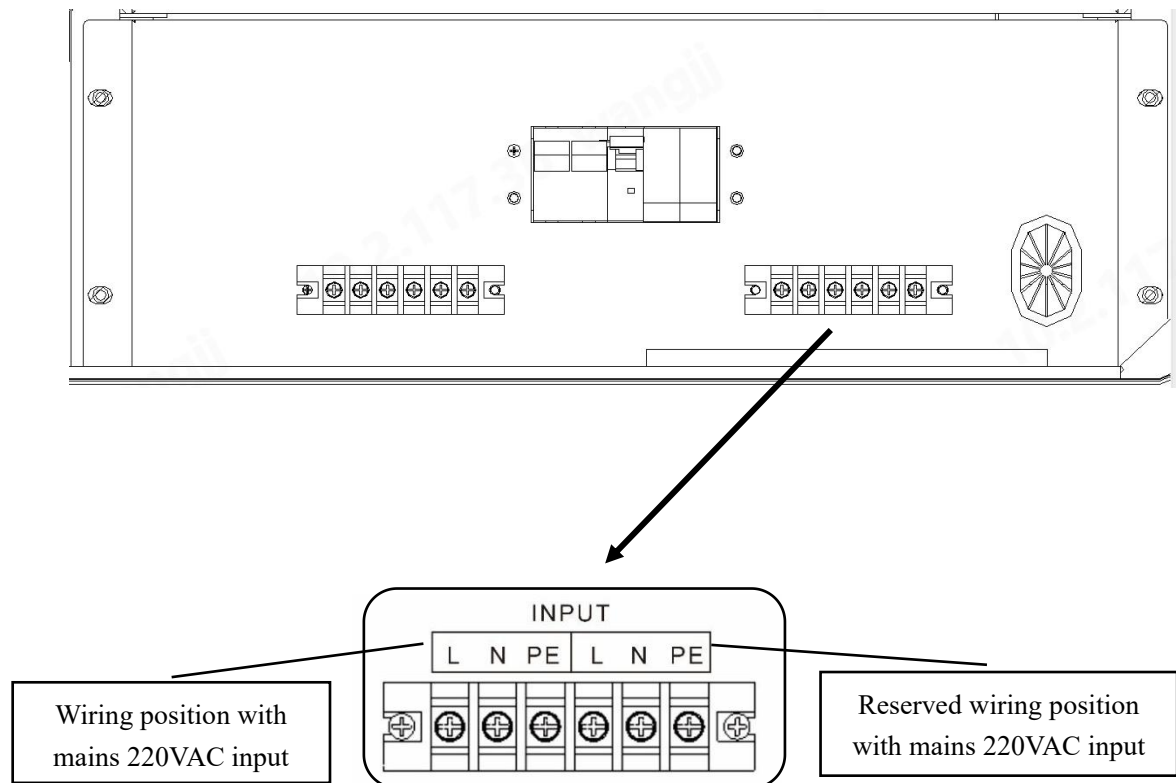


Fig. 3-8 Connection of Mains AC Input

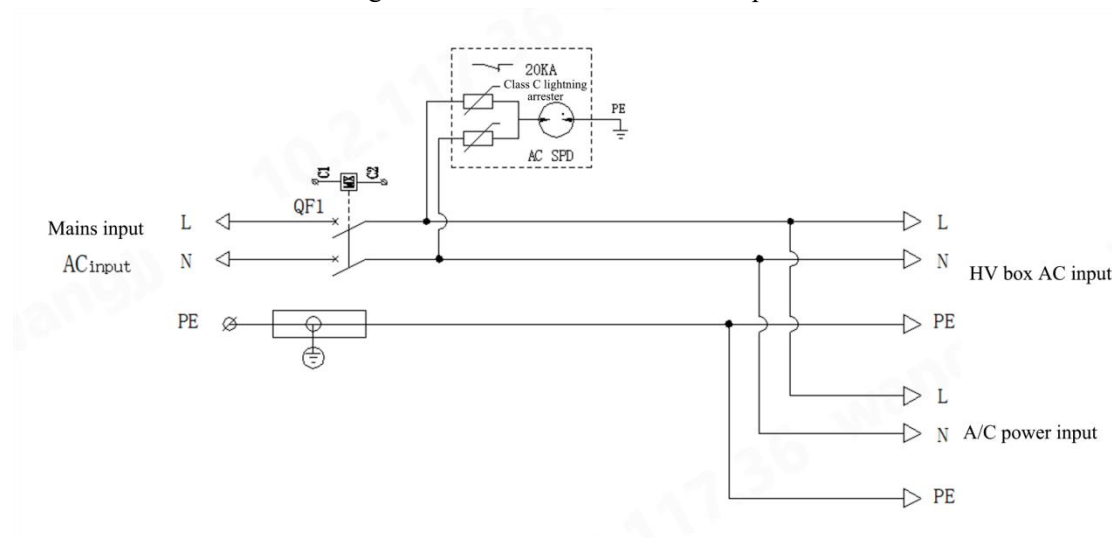


Fig. 3-9 Schematic Diagram of AC Power Distribution

The specifications of air conditioners are as follows:

Item	Specification
Power supply	230VAC 50HZ
Refrigerating capacity	5000W
Heating capacity	3700W
Installation method	Door mounted, integrated with the cabinet
Scope of operating environment	-40°C ~+55°C

3.6 Description of Communication Wiring

1) Network communication interface wiring

The battery cabinet is equipped with a built-in switch, which has been connected to the network port of the EMS controller. Users need to connect to the cloud platform or upper monitoring system and directly connect to the switch through standard network cables;

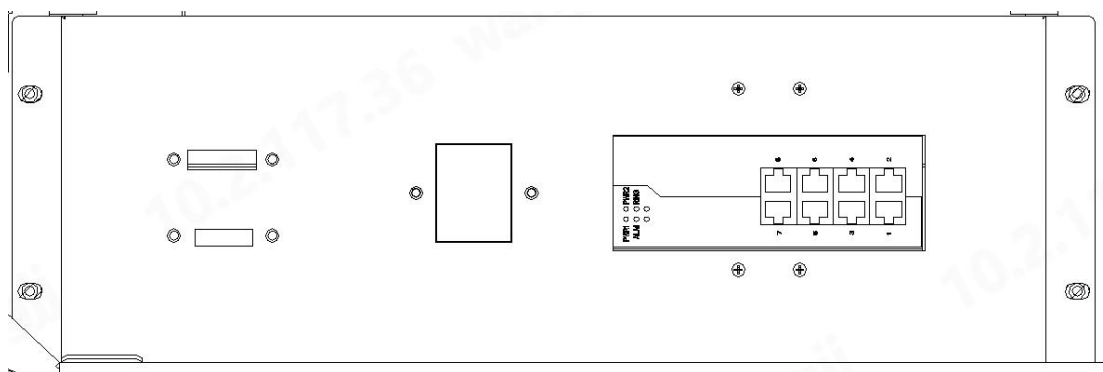


Fig. 3-10 Interface Diagram of Switch

2) PCS (KAC) communication wiring

The four-core signal cable is connected at the position shown in the following figure, and the other end is connected to the PCS communication interface

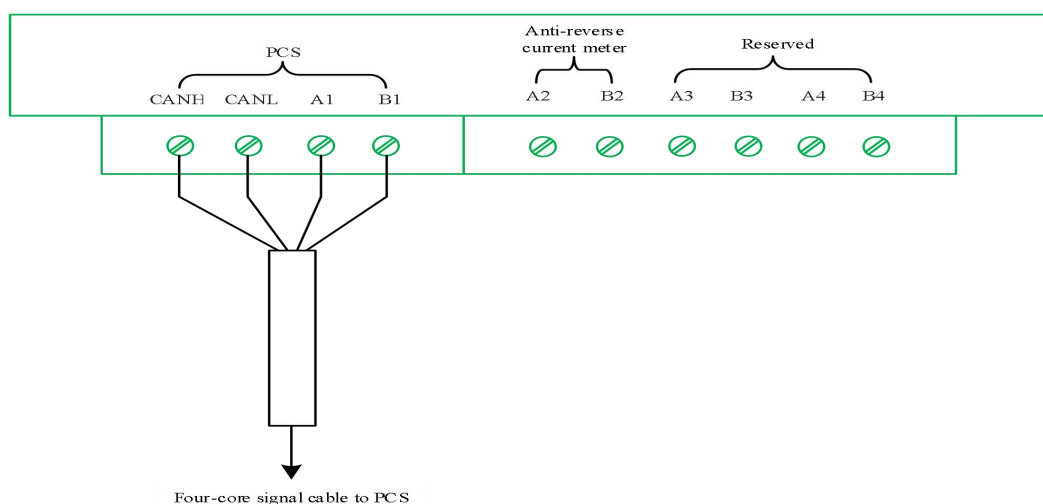


Fig. 3-11 Schematic Diagram of PCS Communication Cable Connection

3.7 Schematic Diagram of EMS Wiring

As an energy management system, EMS not only controls the working mode of the system but also undertakes the function of human-machine interaction. It is convenient for users to view system information. In addition to some system communication interfaces, EMS also controls the tripping, EPO and smoke detection of the AC main circuit of the battery cabinet. If the customer wants to connect to the network cable to visit the cloud platform, insert the J7 network port. Meanwhile, explain that if a third-party EMS is connected, insert a J8 network port and use modbus tcp protocol or IEC-104 protocol.

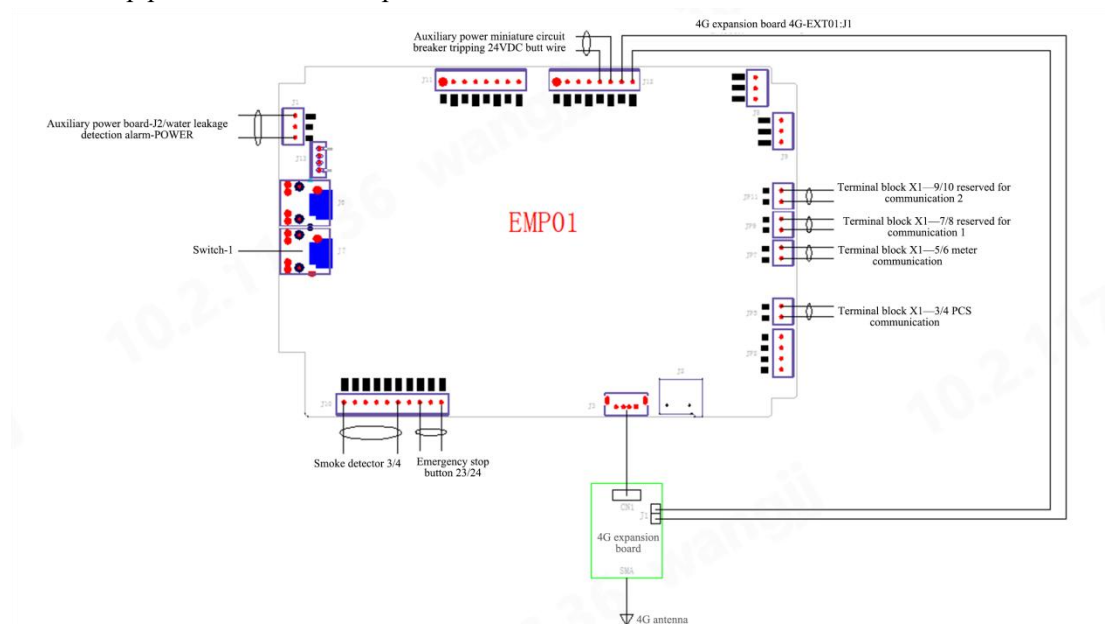


Fig. 3-12 Schematic Diagram of EMS Wiring

3.8 Schematic Diagram of Single Pack

J1 and J2 are mainly acquisition harnesses, including cell voltage acquisition and temperature acquisition. J5 is connected to the previous communication cascade cable, and J4 is connected to the next communication cascade cable. J3 is the fan interface.

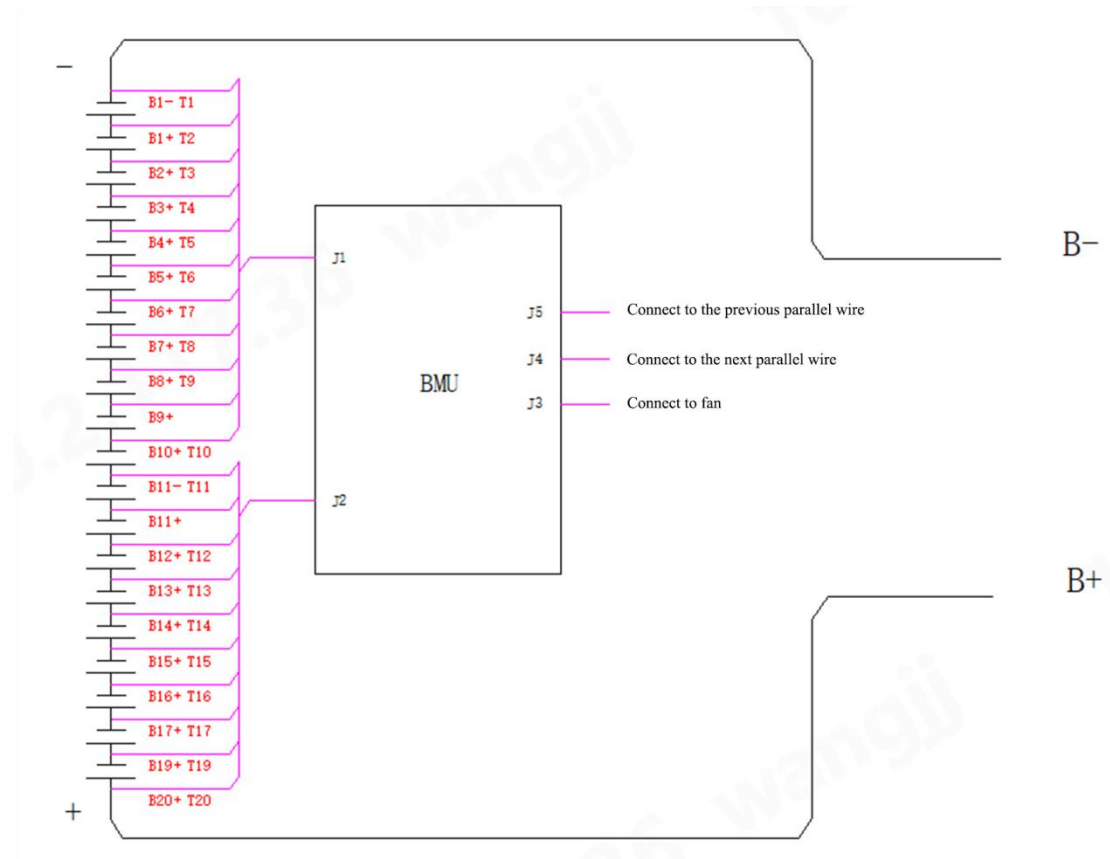


Fig. 3-13 Matters Related to PACK Wiring

4 Operation Guideline

4.1 Inspection after Installation



- The personnel responsible for equipment installation and maintenance must first receive strict training, understand various safety precautions and master the correct operation methods.
 - Only qualified professionals or trained personnel are allowed to install, operate and maintain the equipment.
-

Inspection Steps:

Step 1 Check the fixation of the module box

- Check whether the battery module, HV box and battery cabinet are fixed properly:

Step 2 Check the power harness

- Check whether the power cables between the battery modules and between the battery module and HV box are firmly inserted and clamped;
- Check whether the quick-plug power cable of P+/P- is connected reversely and whether the plug and socket are completely clamped;
- Check whether the 230VAC input cable of the mains supply is reversely connected and whether the fastening bolts are omitted, loose or not torqued;

Step 3 Check the communication harness

- Check whether the communication power supply harnesses between battery modules, between the battery module and the HV box, between HV boxes, between the HV box and the MBMU, and with the EMS unit are loose or missing;
- Check whether the power supply communication harness between the PCS CAN communication harness and the MBMU module is loose or missing;
- Check whether the CAN communication harness of the HV box outside the cabinet is correctly connected with the interface of the HV box inside the

cabinet and whether there is any looseness or missing;

Step 4 Check the power supply, drive and communication harness of the fire starter box

- Check the power supply of the fire starter box. At this time, the power indicator of the fire starter box should be always on or flashing. If the power indicator fails to light up, please contact Kstar New Energy.
- Check whether the harnesses for the fire starter, power supply and feedback are loose or missing;

If any abnormality is found and cannot be recovered, please contact the Customer Service Center of Kstar New Energy.

4.2 Operating Environment Inspection

Operating temperature inspection Operating temperature of battery cabinet: -30°C~50°C

Operating humidity inspection Operating humidity of the battery cabinet: 5%~95%, without condensation

4.3 Power-on Operation

4.3.1 Preconditions

- Before power-on, please confirm that all post-installation check items have been checked.
- Before power-on, measure that the input voltage of the battery cabinet is normal (between 627~792VDC).
- Before power-on, make sure that all switches are off.

4.3.2 Operation Steps

- **If there is 230VAC AC mains input**

Step 1 Supply power to the 230VAC AC port of the battery cabinet;

Step 2 Close the AC air switch in the cabinet: close the rocker switch on the side of the

three-hole plug of the HV box;

Step 3 Turn the switch handle of the HV box in the battery cabinet to the "ON" position, and confirm whether the green light of the indicator is normally on;

Step 4 Confirm whether the air conditioner is running;

Step 5 Check the EMS display screen at the front door of the battery cabinet to see whether the parameters on the EMS display screen are normal and whether there is any fault;

----End

● **If there is no 230VAC AC mains input**

Step 1 Turn the switch handle of the HV box in the battery cabinet to the "ON" position;

Step 2 Press the "DC START" button on the HV box in the battery cabinet, and the indicator light is always on after startup. Long press the "DC START" button for 3-6s until a crisp closing sound of the HV contactor in the HV box is heard, and then release the button to realize DC black start;

Step 3 Confirm whether the green light of the indicator is normally on;

Step 4: Close the "AC POWER" rocker switch of the HV box; power supply switching can be realized when there is mains supply;

Step 5 Check the EMS display screen at the front door of the battery cabinet to see whether the parameters on the EMS display screen are normal and whether there is any fault;

Step 6 Close the "AC Switch" air switch in the cabinet;

Step 7 Repeat steps 1~4 to open another cluster of batteries in the battery cabinet;

----End

After all clusters in the energy storage battery cabinet pass the self-inspection, the DC contactor of the cluster in the system is closed through the touch screen or other system control tools of the system. After the DC contactor closing operation is completed, it is necessary to confirm whether there is a system fault. After all battery clusters in the system are online, the high-voltage power-on operation of the system is completed.

4.4 Power-off Operation

4.4.1 Power-off Steps

Step 1 Confirm whether the charging/discharging power of PCS is zero through EMS of the system, or set the operating power of PCS to zero;

Step 2 Turn the switch handle on the HV box in the battery cabinet to the "OFF" position;

Step 3 Disconnect the "AC POWER" rocker switch on the HV box;

Step 4 Repeat steps 2~3 to disconnect the HV box battery and mains input of another cluster in the cabinet;

Step 5 Disconnect the "AC Switch" in the cabinet;

----End

4.4.2 Emergency Power-off



Fig. 4-1 Emergency Stop Switch Button

Press the emergency stop switch. The trip unit of the HV box will be disconnected, the AC air switch will be tripped, and the battery system will be powered off.

4.5 Trial Operation of Battery Cabinet

The battery cabinet carries out energy interaction with the outside through the PCS. Precautions for trial operation are as follows:

Capacity calibration: ensure that the battery can undergo a complete normal charge-discharge cycle. If the rated capacity needs to be corrected, deep charging/discharging can be carried out during trial operation and joint commissioning. It is recommended to carry

out a capacity calibration during the trial operation, with charging/discharging depth DOD=100%. The test shall be carried out according to the rated power of the product. The default process is "emptying + standing (2h) + full charging", which is described as follows:

- Emptying: The battery cluster is discharged to SOC=0% during the emptying test.
- Standing: Stand for more than 2h (for SOC correction). When standing, there shall be no charging/discharging current, and there is no requirement for an auxiliary power supply in the HV box.
- Full charging: After the standing time is up, carry out a full charge test, i.e. charging to SOC=100%.
- If it is not used for a long time (6 months), the energy storage battery shall be recharged in time to > 50% SOC. Considering that SOC may have accumulated errors caused by long-term shallow charging/discharging, it is recommended to shut down after full charging.

Operation stability: The power circuit, communication, acquisition and other components should operate at rated power when conditions are met during commissioning. It is used to determine whether there is any abnormality in each link of system installation, especially under abnormal conditions such as overtemperature, overcurrent, overvoltage and overdischarge, which should be handled in time to avoid potential safety hazards.

5 Routine Maintenance

NOTICE

- Insulating tools shall be used for all maintenance and service work inside the battery cabinet, which shall be performed by trained personnel. Devices behind the protective cover plate that can only be opened with tools are unmaintainable devices for users. If maintenance is required, please consult Kstar New Energy for details.

- The battery cabinet shall be maintained regularly according to the following requirements; otherwise, it will affect its normal operation and reduce its normal service life.

5.1 Maintenance

The battery system needs to be inspected regularly every month to observe whether there are abnormal alarms and the current electric cabinet status during this period.

- In the EMS interface, check whether there is current BMS alarm information. If an alarm exists, review all recent operations to determine whether it is reasonable.

- Check the historical data during this period to see if there is any serious fault. It is mainly to observe the battery history information of the whole cluster on the EMS interface and whether there are false alarms or non-erasable alarms. See Table 5-1 for specific alarm types.

- Regular patrol inspection shall be carried out to check the fire power indicator. When the power supply battery of the fire extinguisher is insufficient, it shall be replaced in time. to avoid affecting the spray of fire extinguishers.

- Dirty and blocked A/C condenser is the main cause of reduced refrigerating capacity. For better operation of A/C, it is recommended to clean the condenser once every 6 months.

Table 5-1 Fault Alarm Query

Fault content	Description	Refer to handling methods for common abnormalities (non-exhaustive)
Access control alarm	For battery cabinet door status detection, an alarm will be given if the door is opened for more	1. Check whether the mechanical travel switch of access control

	than 2 minutes. If the alarm still sounds when the door is closed, further troubleshooting is required	is loose or abnormal. 2. Check whether the NO/NC wiring is correct 3. Check whether the voltage of the interface on the panel seat of the HV box is triggered by mistake.
Immersion alarm	Check for false alarms and check whether the cabinet is immersed in water	1. If immersed in water, drain first. This alarm is cleared when water evaporates to the water level. 2. If a false alarm is given, check the harness. 3. Measure the interface voltage of the HV box panel for further judgment.
Fire alarm	Check whether there is a false alarm; detect whether the fire extinguisher sprays	1. If the fire extinguisher sprays, first observe the situation in the cabinet to see if there is any trace of fire. In case of a fire, the cabinet will be basically scrapped. If there is no fire or smoke, first check the

		integrity of the cabinet. If it is intact, the aerosol in the cabinet needs to be cleaned first. The fire extinguisher after spraying out needs to be replaced. 2. If it is a false alarm, check whether the harness is abnormal. After disconnecting the external harness, measure whether the interface voltage of the HV box panel is normal.
Contactor fault or adhesion	Adhesion or failure to close	Use the upper computer to observe whether the drive and feedback of the contactor are consistent. If not, the contactor is faulty. That is, the auxiliary contact opens when there is a drive and closes when there is no drive.
Cell overvoltage level 4	Cell voltage up to 3.8V, SOC100%	The upper computer is required to contact the locking state, properly adjust the cell overvoltage

		parameter value and carry out forced discharge. After recovery, restore the cell overvoltage parameter value, and find out the cause of overvoltage level 4.
Cell overvoltage levels 1, 2 and 3	Cell voltage between 3.6-3.8V, SOC100%	It can be restored by the forced discharge function of the system
Cell undervoltage level 4	The maximum cell voltage is lower than 2.5V	If the voltage of a cell is lower than 2.0V, it shall be scrapped. For level 4 undervoltage higher than 2.0V, the locking state must be unlocked by the upper computer and the parameter values must be modified. It can be restored through forced charging of the system. After the alarm is cleared, restore the parameter values, and investigate the cause of undervoltage.
Cell undervoltage levels 1, 2 and 3	Cell 2.5-3.0V	It can be recovered through the forced charging function of the system
Cell voltage difference alarm in the cluster	The voltage difference is greater than 500mV	1. When operating close to full load, it is easy to

		occur after crossing the platform voltage, which is a normal phenomenon. 2. With the use and gradual aging of the electric cabinet, the internal resistance of the cell increases, it is more likely to occur under high current charging and discharging. It is a normal phenomenon. As long as the cell voltage, temperature and current are within the normal range, the system operates normally.
The cell voltage of the battery system fluctuates greatly during standing	The voltage fluctuation is greater than 10mV during standing	1. Check whether the wiring is loose 2. Replace the corresponding BMU
Cell over-temperature alarm	Cell temperature $\geq 45^{\circ}\text{C}$	1. Whether the A/C can refrigerate normally 2. Whether the ambient temperature is too high 3. Whether the BMU

		temperature sampling is faulty or not 4. NTC fault or not
Charging temperature too low	Cell temperature $\leq 0^{\circ}\text{C}$	1. Check whether the A/C works normally 2. Whether the ambient temperature is too low 3. Whether NTC acquisition is normal 4. Whether BMU acquisition is normal 5. Whether the wiring is loose
Discharging temperature too low	Cell temperature $\leq -25^{\circ}\text{C}$	1. Check whether the A/C works normally 2. Whether the ambient temperature is too low 3. Whether NTC acquisition is normal 4. Whether BMU acquisition is normal 5. Whether the wiring is loose
PCS-BMS communication fault	Abnormal CAN communication	1. CAN of PCS or BMS works abnormally; PCS is not started, etc. 2. Check whether the harness is in poor contact, wrongly

		connected or not connected
Parallel communication fault	SBMU-MBMU communication CAN	1. Lack of or excessive terminal resistors 2. Check the harness for poor contact or abnormalities 3. The board works abnormally, etc.
A/C communication fault	485 communication	1. Check the harness 2. The A/C is not turned on 3. The board works abnormally 4. A/C fault, etc.
BMS communication fault	BMS-EMS communication Ethernet	1. Reconnecting due to communication interruption 2. Poor contact 3. PHY chip fault, etc.
Insulation fault	Insulation resistance $<1K\Omega/V$	1. There is electric leakage, and the sampling wire or HV side harness directly or indirectly contacts the housing 2. The board works abnormally.
Pre-charging fault	Pre-charging failed for three times	1. The load capacitance is

	in total	too large 2. Short circuit of load 3. The power device of the precharging circuit is damaged, etc. 4. The board works abnormally
SPD lightning protection fault	Lightning arrester trigger alarm	1. The NO/NC contacts of lightning arrester are connected reversely 2. Lightning arrester is damaged 3. The board works abnormally
Positive and negative pole temperature fault	Pole temperature	1. Poor pole contact 2. Check whether the board is working properly 3. Poor contact of harness, etc.
Excessively large cell temperature difference	Temperature difference between cells $\geq 10^{\circ}\text{C}$	1. Check whether the A/C works normally, and refrigerates, heats and supplies air normally under corresponding conditions. 2. Check whether the board sampling is abnormal

6 List of Accessories

A single battery cabinet contains the following accessories (placed in the accessory box):

S/N	Description	Quantity	Purpose
Accessory 1	Parallel communication cable	(Optional)	Main battery cabinet-CAN communication harness of slave battery cabinet
Accessory 2	Fireproof mud	Reserved	Fill the threading holes for the input and output of the battery cabinet.
Accessory 3	Base baffle	(Reserved)	Base baffle of the battery cabinet
Accessory 4	PCS power and communication cables	Reserved	Connect the power and communication cables between the PCS and the battery cabinet
Accessory 5	Parallel operation power cable	(Optional)	Cluster parallel power cable
Accessory 6	Desiccant	1 bag	Damp-proofing

7 Terms

1 Cell

Single cell.

2 Battery Module

A combination of multiple cells connected in series, parallel or series-parallel mode, with only a pair of positive and negative output terminals, and used as a power supply.

3 Battery Cluster

Multiple battery packs, an HV box and connecting cables form a complete battery cluster, which has the functions of independent external energy interaction and self-protection.

4 Battery Array

Multiple battery clusters form a battery array, and the following cluster energy interaction is managed in a unified manner through a three-level architecture control mode.

5 Battery Management System

Electronic device that controls or manages the electrical or thermal performance of a battery system.

Battery Management Unit

Slave Battery Management Unit (SBMU)

Master Battery Management Unit (MBMU)

Energy Management System (EMS)

6 Battery System

Energy storage device, including the integration of battery module or battery pack, battery management system, and HV and LV circuits.

7 Battery Capacity

Size of battery storage capacity.

8 State of Charge (SOC)

The percentage of the capacity that can be released by the cell, module, battery pack or system according to the conditions specified by the manufacturer in the actual capacity, also called residual capacity.

9 State of Health (SOH)

The deviation ratio between the actual performance of the battery and the normal design index.