User Manual - V1.0

Outdoor Energy Storage System

GS105-229AS

Zhuhai Virtual Power Plant Technology Co., Ltd.

Catalogue

1. Preface

1.1 Statement

This manual elaborates and explains the installation, use, operation, maintenance, troubleshooting, and technical performance of the energy storage cabinet. Users are advised to read and understand this manual carefully before installation and to keep it properly for future reference.

The company reserves the right to modify the manual and is not obligated to provide separate notice.

1.2 Safety tips

When operating and using the device, it is essential to strictly follow the instructions in the manual and adhere to all safety precautions indicated on the device and in the manual. Additionally, relevant international, national, or regional standards must be observed. Any violations of operational safety requirements or breaches of design, production, and usage safety standards that result in personal injury or damage to the device will not be the responsibility of the company.

1.3 Safety instructions

1.3.1 Warning Label

Warning: Indicates precautions or instructions that may pose a danger to user safety or could cause serious damage if not followed properly.

Warning: Indicates precautions or instructions that may pose a danger to the user's personal safety or could cause significant damage if not handled properly.

⚠ CAUTION

Caution: Indicates precautions or instructions that may pose a danger to the user's personal safety or could cause minor damage if not handled properly.

1.3.2 Safety rules

⚠ DANGER

- The power supply must be disconnected during the installation and replacement of the device, and proper grounding must be ensured to prevent electric shock. Installation and maintenance must be performed by qualified personnel.
- All cables of the device must be securely connected, well insulated, and of appropriate size. Loose, damaged, or undersized cables can cause circuit failures, which may severely damage the device and even lead to personal injury or fire.
- Devices that have been tipped over, even if they appear undamaged, must not be installed directly, as some internal damage may cause system disruption or circuit short circuits. They must be inspected by professional personnel to determine if they are undamaged before deciding whether they can be installed.
- If water ingress or residual water stains are found inside the cabinet during installation, please be sure to notify professional personnel for inspection; otherwise, it may lead to safety accidents.
- Incorrect use and storage of batteries pose risks of explosion and burns; Batteries must not be exposed to high-temperature environments exceeding the temperature conditions specified in this manual for extended periods; otherwise, it may lead to fire.

⚠ WARNING

s that may affect the safety performance of the machine must be eliminated by professional personnel before it can be restarted.

- The product must be installed by the company's professional technical personnel (or authorized professional institutions). Unauthorized installation or modification may lead to safety accidents or equipment damage. The company will not bear any responsibility for losses incurred as a result.

1.3.3 Safety precautions

When operating the energy storage cabinet, strict adherence to safety measures and relevant operating procedures is required; any incorrect operation methods may result in personal injury and damage to the equipment. Before starting operation, ensure that the operator has read this manual to prevent electric shock and burns.

(1) The operators of the battery system must be specially trained and obtain electrical equipment operation certification;

(2) Before connecting the cables, it is necessary to confirm that the cables and labels match the actual installation situation before proceeding with the connection;

(3) The installation site of the device must have safety guardrails set up for protective isolation, and appropriate safety signage should be in place ;

(4) It is prohibited to place flammable materials next to the battery system;

(5) Before performing installation or removal operations on the power lines, it is essential to disconnect the relevant power switches;

(6) Do not open the cabinet door during operation without authorization, as there is a risk of electric shock;

(7) When performing operations, specialized tools must be used, and the tools should be insulated;

(8) It is strictly prohibited to wear watches, bracelets, bangles, rings, and other conductive objects during operation, and to touch the battery system with wet hands;

(9) During maintenance, it is essential to follow operational procedures, such as wearing insulated gloves, insulated shoes, and safety goggles; there must be other supervisory personnel present during work ;

(10) The battery pack maintenance must be performed by professional personnel; it is strictly

prohibited for non-professionals to disassemble it; During use or maintenance operations, it is strictly prohibited to wear down or damage the internal and external connections of the battery pack to avoid danger;

2. System Introduction

2.1 Product Overview

2.1.1 Product Description

The GS105-229AS is an integrated energy storage product for commercial and industrial use, incorporating a battery system, inverter system, BMS/EMS, temperature control, and fire protection system. This product enables the storage and release of electrical energy, primarily applied in user-side commercial and industrial energy storage scenarios.

The system integrates energy storage battery systems, PCS modules, air-cooled heat dissipation systems, and perfluorohexane fire protection systems, providing customers with safe and reliable commercial and industrial energy storage products that can meet the grid application needs such as peak-valley arbitrage and demand management for conventional energy storage systems.

2.1.2 Product Appearance and Dimensions

The appearance of the GS105-229AS unit is shown in Figure 2-1, and the dimensions are provided in Table 2-2 for reference during installation.

Figure 2-1 Unit Appearance

Table 2-1 Appearance Dimensions

Total Height	Total Width	Total Depth
2280mm	1500mm	1200mm

2.2 Technical Parameters

Table 2-2 Main Technical Parameters

Model	**Genius Stack 105-229AS**
AC Side Parameters	
Rated Power	105kW
Output Voltage	400 V / 230V (-20%~15%)
Grid Frequency	50Hz / 60Hz
Power Factor	-1~1
Wiring Method	Three-phase Four-wire + PE
Maximum Output Current	160A
Maximum Output Power	110kW (Long-term)
DC Side Parameters	
Cell Type	LFP 3.2V/280Ah
Rated Capacity	229kWh

Depth of Discharge	≤95% DOD (Recommended)
Rated Voltage	819.2V
Maximum current	170A
Battery Pack Specifications	51.2V/280Ah(1P16S)
Number of Current Groups	16 units
System Parameters	
Operating Temperature	-20 to 55℃ (Derating > 45℃)
Relative Humidity	0 to 95%, no condensation
Altitude	2000m (Derating > 2000m)
Noise	<75dB@1m
Communication Method	LAN，4G，BT，Wifi
Protection Level	IP54
Corrosion Resistance Level	C3, Whole Cabinet Galvanized Steel
Heat Dissipation Method	Air Cooling
Isolation Method	Non-Isolated
Fire Protection Method	Cell-Level Point-to-Point Perfluoroketone Fire Extinguishing + Water Fire Protection (Energy Storage Cabinet)
Third-Party Certification	UN38.3/ROHS/IEC62477/IEC61000/IEC62619/ VDE 2510/EN50549
System Weight	2650kG

2.3 Main Components of the System

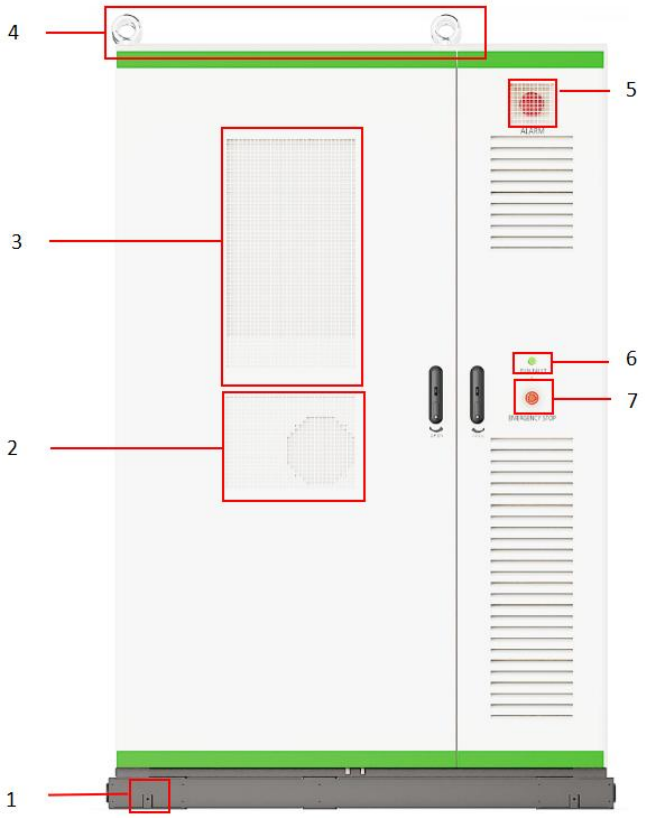


Figure 2-2 Component Introduction (Door Closed)

Table 2-3 Main Component Description (Door Closed)

No.	Module Description	Quantity of Single Cabinet	Instructions
1	Enclosure grounding	4	Energy storage system grounding
2	Air inlet of the heat exchanger	1	Air intake of the air-cooled refrigeration main unit heat exchanger
3	Air outlet of the heat exchanger	1	Air outlet of the air-cooled refrigeration main unit heat exchanger
4	Lifting ring	4	Lifting of the energy storage system (optional accessory)
5	Sound and light alarm	1	Internal anomaly alarm
6	Operation	1	Operating status indication:

	indicator light		● Red light steady on: abnormal state warning ● Green light steady on: normal operating state
7	Emergency stop switch	1	Emergency stop of the energy storage system

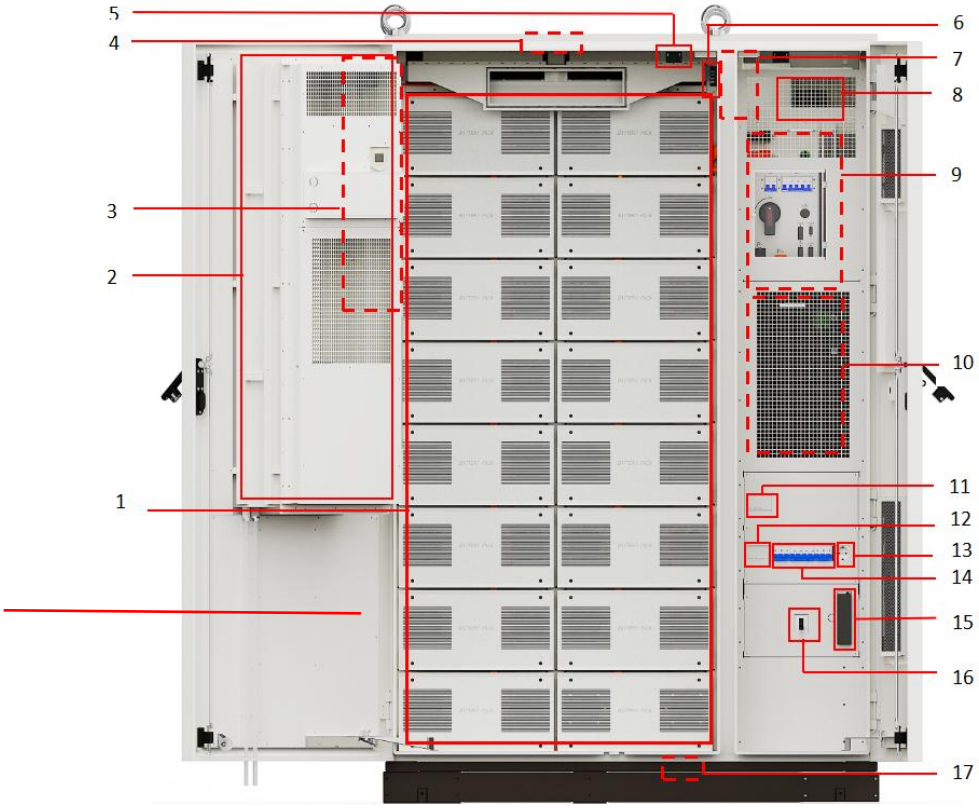


Figure 2-3 Component Introduction (Door Open)

Table 2-4 Main Component Description (Door Open)

No.	Module Description	Quantity of Single Cabinet	Instructions
1	Battery Pack	16	A combination of batteries for storing and outputting electrical energy, including busbars, cooling fans, battery management systems, etc.
2	Air Conditioning Host	1	Air-cooled Cooling/Heating Host
3	Fire Extinguishing Device	1	Pressure-stored perfluorohexane, 5kg extinguishing agent
4	Sprinkler Device	1	Fire Sprinkler
5	Composite Detector	1	Detects multiple combustible gases

6	Door Magnetic Switch	2	Induction Door Switch Status
7	Smoke Exhaust Fan and Explosion Vent	1	Emergency smoke exhaust and explosion relief for internal abnormal conditions
8	Electrical cooling fan	1	Electrical side cooling auxiliary exhaust
9	High Voltage Box	1	Management of the high voltage power circuit in the battery system
10	PCS	1	Energy conversion system
11	Electric meter	1	Power recording
12	Surge Protector	1	Lightning protection device
13	Socket	1	Spare socket
14	AC control switch	1	Main component control switch
15	Switch	1	Network communication
16	AC circuit breaker	1	Overcurrent and overload protection
17	Water immersion sensor	1	Bottom Water Accumulation Sensor

2.4 Working Principle Diagram

2.4.1 System Topology Diagram

The Energy Storage Cabinet BCS is a centralized control system that communicates with the BMU to control the battery side, achieving operational management of the battery system; BCS communicates with the PCS module for energy management, issuing power scheduling to realize functions such as peak shaving and valley filling, and demand management; BCS communicates with fire composite detectors, air conditioners, water immersion sensors, and other dynamic environmental devices to ensure the energy storage system operates safely in a suitable environment; BCS communicates with the ECS to achieve centralized data processing, cloud data transmission, receiving cloud strategies, and executing them. The topology of the energy storage system is shown in Figure 2-4.

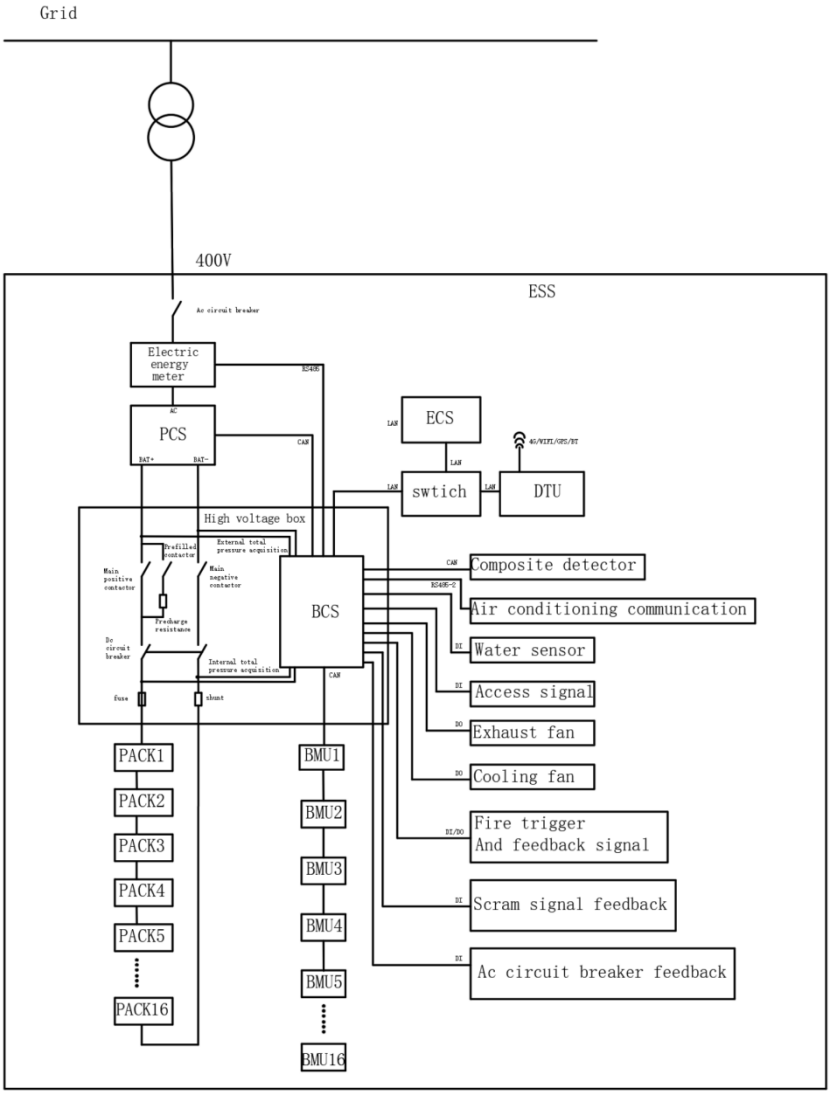


Figure 2-4 Energy Storage System Topology Diagram

3. Component Introduction

3.1 EMS System

The EMS system consists of a three-tier architecture, which includes the ECS Energy Storage Monitoring Manager, BCS Battery Management System Main Control, and BMU Battery Management System. The EMS mainly includes data collection and monitoring, energy management and scheduling, system protection and safe operation, status assessment and fault diagnosis functions. The communication topology diagram is as follows:

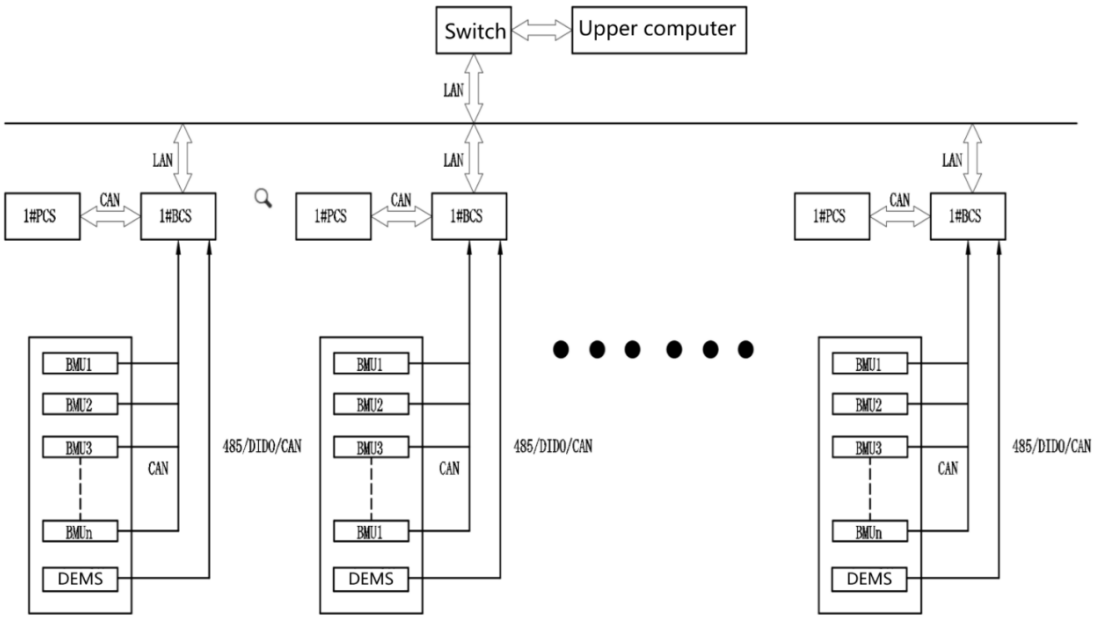


Figure 3-1 Communication System Topology Diagram

3. 2 PCS Inverter

3. 2. 1 Function Introduction

The Energy Storage Inverter PCS (Power Conversion System) is primarily based on power electronics technology, controlling the on-off state through thyristor switching devices to achieve energy conversion and bidirectional flow. During the charging and discharging process, the PCS energy storage inverter also needs to perform precise power control and energy management based on the grid's demand and the state of the energy storage battery to ensure the stable operation and efficient utilization of the energy storage system.

3. 2. 2 PCS Schematic Diagram and Technical Parameters

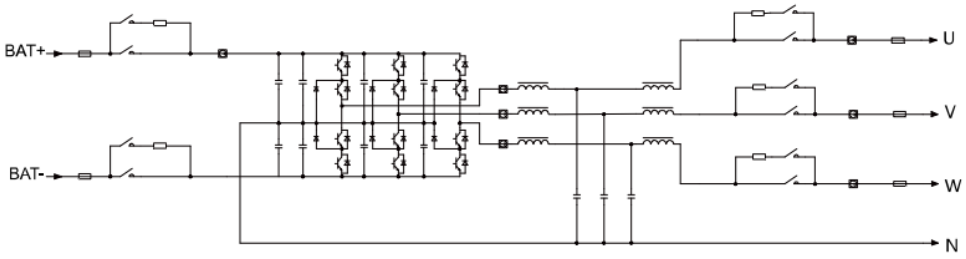


Figure 3-2 PCS Topology Diagram

Table 3-1 PCS Technical Parameters

Item	**Parameter**
Model	EPCS105-AM-F
DC side	
Operating Voltage Range (V)	615~950（3W+PE）/650~950（3W+N+PE）
Full Load Voltage Range (V)	615~950（3W+PE）/680~950（3W+N+PE）
Input Channels	1
Maximum Current (A)	170
AC Side (Grid-connected)	
Rated Voltage (V)	230/400
Voltage Deviation	-15%~+15%
AC Output Type	(3W+PE) Three-phase Three-wire / (3W+N+PE) Three-phase Four-wire
Rated Output Power (kW)	105kW
Maximum Output Power (kW)	115.5
Maximum Current (A)	167
Rated Grid Frequency (Hz)	50/60
Power Factor	0.99
Power Factor Range	1 (Leading) ~ 1 (Lagging)
Current Distortion Rate	<2% (Rated Power)
Overload Capacity	110% Long-term
Maximum Efficiency	98.5%
AC Side (Off-grid)	
Rated Output Voltage	230/400
AC Voltage Harmonics	<3% (Linear Load)

Rated Frequency (Hz)	50/60
Rated Output Power (kW)	105
Maximum Apparent Power (kVA)	115.5
Maximum Output Current (A)	167
General Parameters	
Dimensions (W×D×H, mm)	500×770×270
Altitude (m)	4000m (derating above 2000m)
Operating Temperature	-30℃ to 55℃ (derating above 45℃)
Storage Temperature	-45℃～70℃
Humidity	5%RH~95% RH, no condensation
Cooling Method	Intelligent Forced Air Cooling
Protection Level	IP20
Communication Interface	CAN/RS485
Grid Support	L/HVRT, Active and Reactive Power Control

3. 3 Battery System

This battery system uses 280Ah 3.2V lithium iron phosphate square batteries as cells, forming a 1P8S module with a voltage of 25.6V, composed of positive and negative modules to create a 1P16S dual-fan air-cooled PACK with a voltage of 51.2V. The battery cluster consists of 16 PACKs connected in series, with a voltage of 819.2V and an energy capacity of 229kWh.

Table 3-2 Technical Parameters of the Battery System

No.	Technical Specifications	Parameter
1	Rated Voltage	819.2V
2	Nominal Capacity of the Cell	280Ah
3	Battery Configuration	1P256S

4	Module Dimensions (L*W*H)	1200±2.0 mm *1460±2.0mm *2280.0±2.0mm
5	Weight	2650±50Kg
7	Standard Charge and Discharge Current	≤0.5P
8	Charging Upper Limit Voltage	921.6V
9	Discharging Lower Limit Voltage	716.8V
10	Operating Temperature	Discharge: -20~45℃ Charge: 0℃~45℃
11	Storage Temperature	-20℃ ～ 45℃; ≤1 month 0℃ ～ 35℃; ≤1 year
12	Storage Humidity	< 95%RH (No condensation)

3.4 Fire Protection System

This product adopts a three-level fire protection measure, as follows:

Level 1 active detection, early warning, and suppression: The composite detector can detect multiple parameters such as CO, VOC (flammable gases), smoke, and temperature. When the detected parameters reach the preset threshold, it triggers an alarm, controls the activation of the perfluorohexane fire extinguishing system, and informs the ECS of the fire event. The ECS controls the local sound and light alarm and system energy storage shutdown, simultaneously activating the smoke exhaust fan to reduce smoke, gas concentration, and temperature, thereby suppressing the risk of fire and explosion.

Level 2 passive fire extinguishing: When the cell catches fire and the fire detection tube ruptures, the perfluorohexane extinguishing agent continuously sprays towards the fire point;

Three-level passive water fire protection: When the fire is too large or the battery reignites, the flames will break the temperature-sensitive glass bulb of the sprinkler head inside the battery compartment. The fire hydrant can be opened manually from a distance, and fire-fighting water will be injected into the battery compartment through pre-arranged pipelines, effectively extinguishing the fire.

3.5 Combiner Box (Optional)

The energy storage cabinet supports parallel connection of multiple cabinets and can be used with an optional combiner box. One combiner box can support up to five energy storage cabinets in parallel. The main function of the combiner box is circuit distribution and connection, providing a centralized connection point and overload and short-circuit protection on the main circuit.

Figure 3-3 Combiner Box Outline

Table 3-3 Combiner Box Parameter Description

No.	Technical	Parameter

	Specifications	
1	Rated Voltage (V)	380
2	Output Power (kW)	525
3	Output Current (A)	800
4	Dimensions (W×D×H, mm)	600*1200*2280
5	Weight (kg)	220

4. Storage and Transportation

4.1 Transportation Requirements

⚠ DANGER

Rough handling is prohibited; otherwise, it may cause short circuits, damage (leakage, rupture, etc.), fire, or explosion of the batteries inside the enclosure.

⚠ WARNING

- During handling, the package should be moved in the direction specified in the packaging requirements; inversion, tilting, dropping, mechanical impact, exposure to rain or snow, and immersion in water are prohibited.
- Transportation and storage service providers must possess the qualifications for hazardous materials operations as required by the laws and standards of the location where the business occurs; transportation must use rigid box trucks, and open-top vehicles are strictly prohibited.
- During transportation, choose sea freight or roads in good condition; rail and air transport are not supported. During transportation, minimize bumps and tilting as much as possible.

- Before transportation, compliance and accurate declaration must be conducted. Packaging and labeling must be checked for completeness and integrity, and there should be no unusual odors, leakage, smoke, or fire; otherwise, transportation is prohibited.
- During loading, unloading, and transportation, handle with care. Do not place items on their sides or upside down, implement moisture-proof measures, and ensure that packaging is securely tied to prevent displacement, with hazardous materials labels facing outward.

4.2 Forklift Operation Requirements

- The forklift used should have sufficient load capacity (at least 5 tons);
- The forklift can be inserted around the enclosure, and the forks of the forklift should be inserted to the full depth of the enclosure. The forklift diagrams are shown in Figures 4-1, 4-2, and 4-3;
- During lifting, lowering, and moving, it is necessary to ensure that the process is slow and smooth.
- During the forklift operation, it is recommended to tie a safety rope around the enclosure connected to the forklift crossbeam;
- It is recommended to prioritize side loading for the energy storage cabinet, as shown in Figure 4-1;

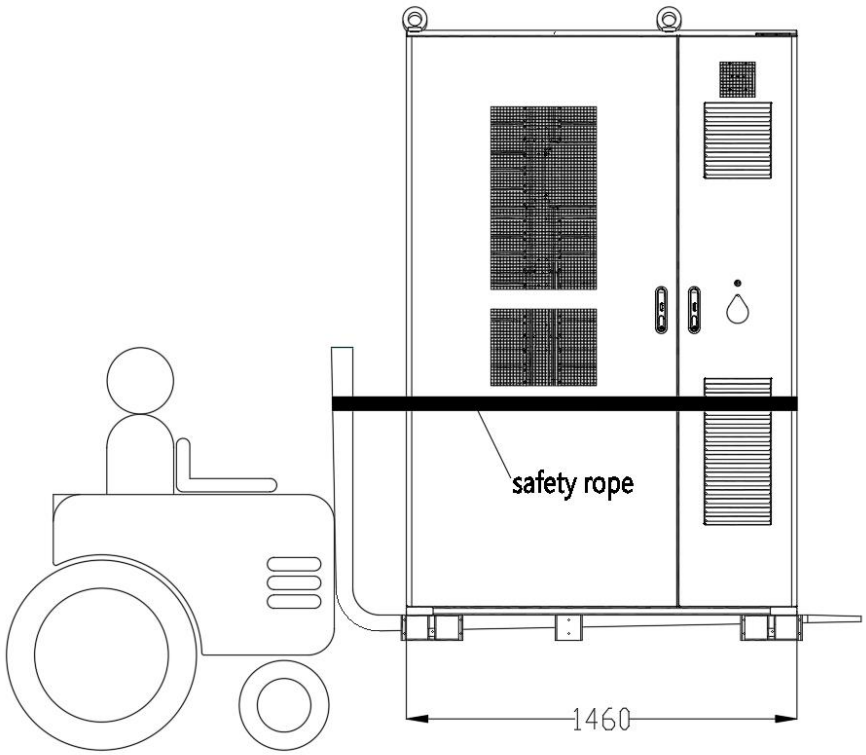


Figure 4-1 Side loading diagram of the energy storage cabinet (can only be inserted from the battery compartment side)

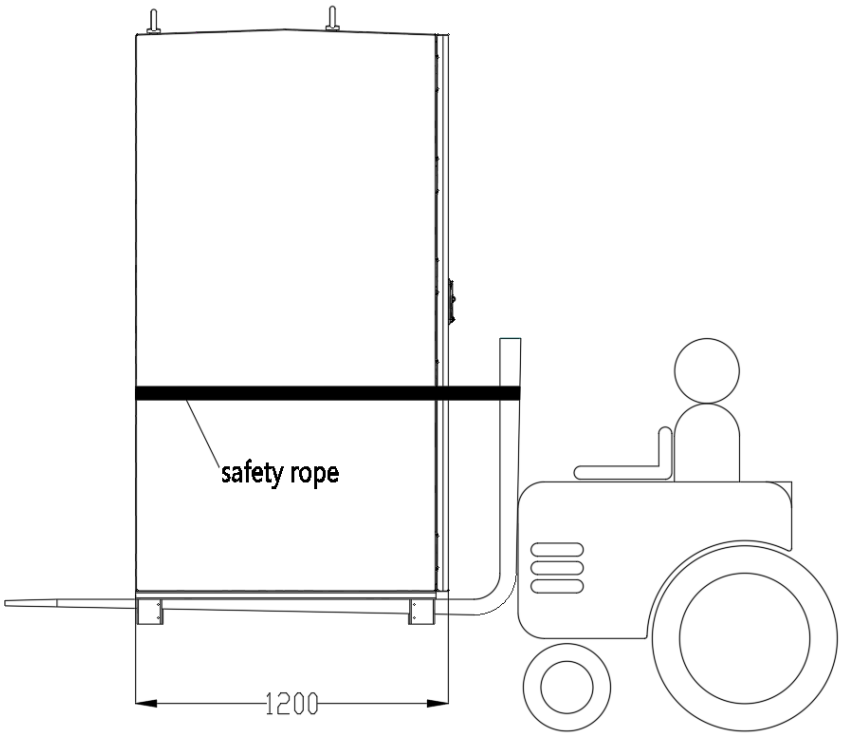


Figure 4-2 Forklift Installation Diagram for the Front/Back of the Energy Storage Cabinet

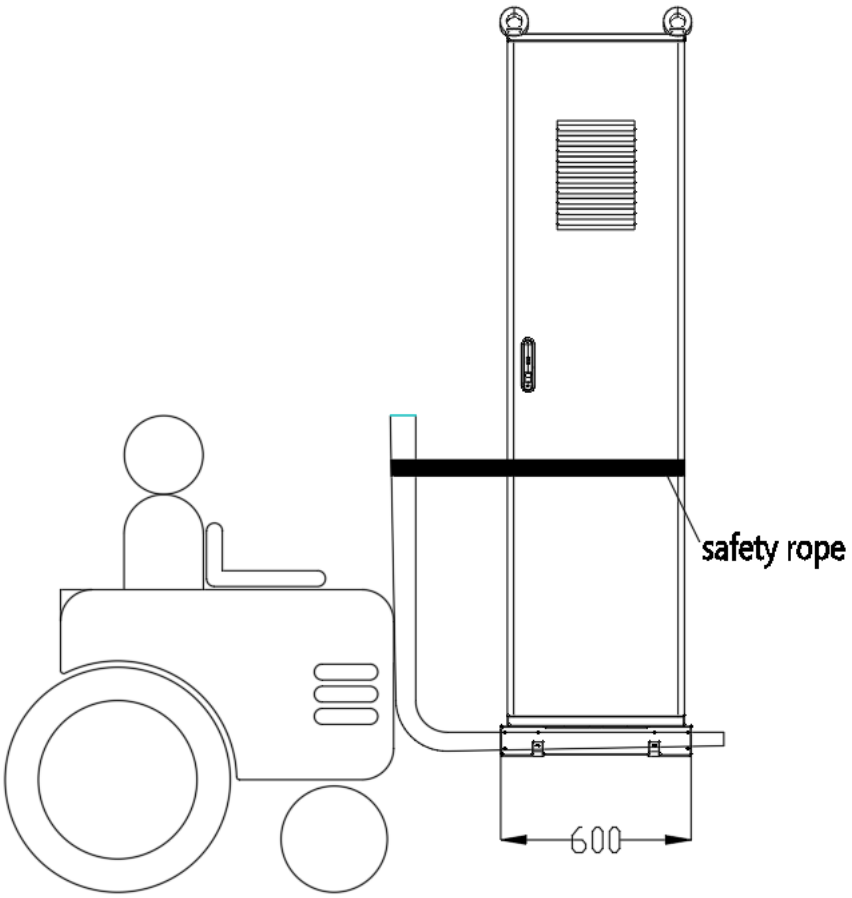


Figure 4-3 Forklift Installation Diagram for the Side of the Combiner Box

4.3 Lifting Operation Requirements (Lifting Ring is Optional)

4.3.1 Preparation Before Lifting

① Crane Preparation:

The total weight of the energy storage cabinet is approximately 2.7 tons. Please select the lifting capacity of the crane based on the total weight of the equipment and site conditions. Recommended capacity: 5 ~ 8 tons.

② Tool Preparation:

Steel wire rope, hooks, M24 lifting rings, hexagon socket wrenches (19mm across flats), etc.

③ Use a hexagon socket wrench to unscrew the 4 plugs at the lifting ring installation position on the top of the energy storage cabinet, as shown in Figure 4-4: the same operation applies to the combiner box;

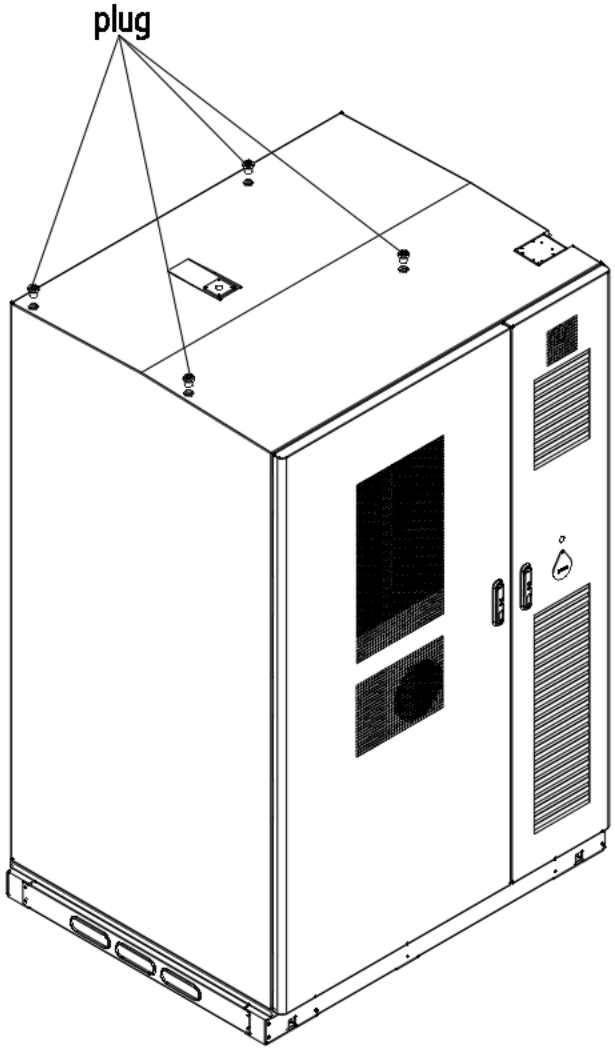


Figure 4-4 Schematic of the Energy Storage Cabinet Plug Removal

④ Screw the M24 lifting ring into the installation position on the top of the energy storage cabinet, ensuring that the lifting ring is fully screwed in and not loose, as shown in Figure 4-5: the same operation applies to the combiner box;

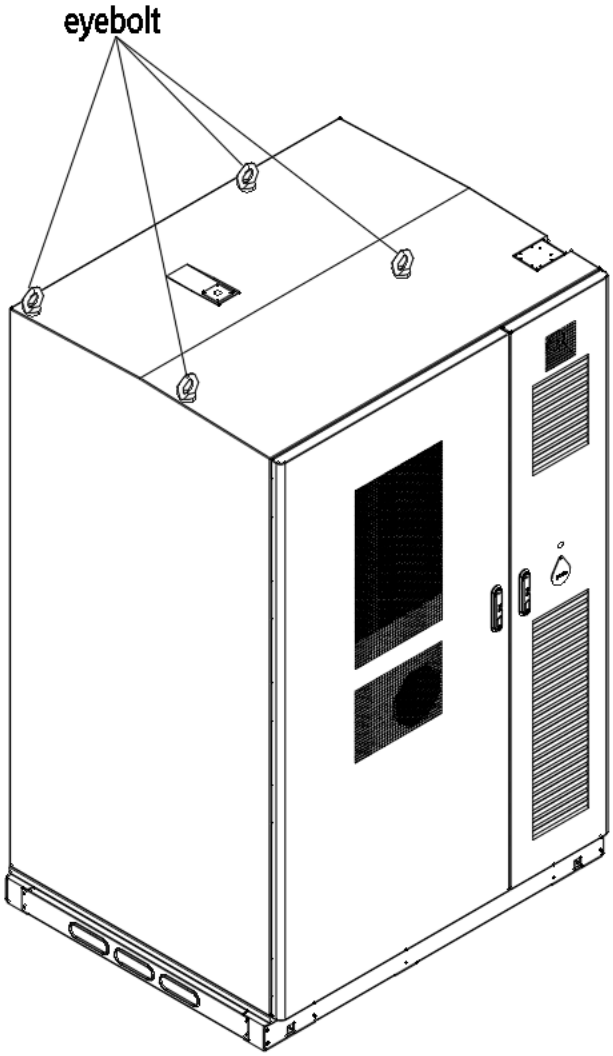


Figure 4-5 Schematic of the Energy Storage Cabinet Lifting Ring Installation

4.3.2 Lifting Process

① The lifting process must strictly follow the lifting diagram, see Figure 4-6 for details;

② The lifting must be vertical, and dragging on the ground is not allowed;

③ After lifting the cabinet approximately 300mm off the ground, pause the movement to check the connection of the lifting equipment. Only continue lifting after confirming that the connection is secure;

④During the entire lifting process, it should be carried out slowly, paying attention to the balance of the cabinet, and the speed must not be too fast;

⑤During the entire lifting process, it is strictly prohibited for anyone to stand under the cabinet and crane;

⑥The combiner box is operated in the same manner;

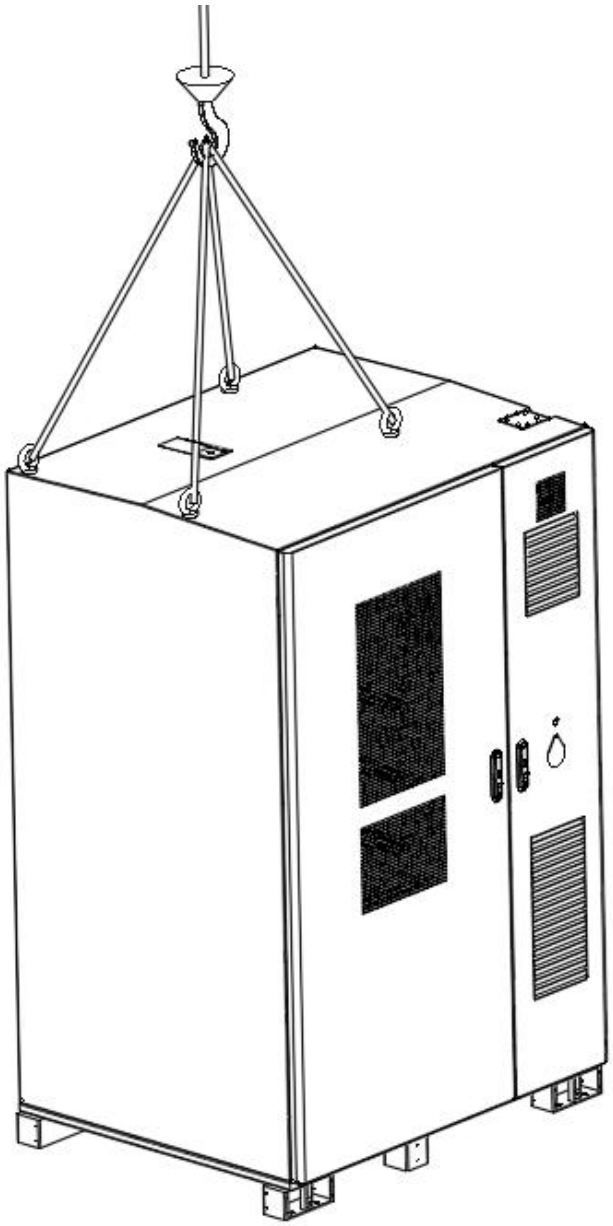


Figure 4-6 Schematic Diagram of Energy Storage Cabinet Lifting

4. 4 Storage Requirements

It is recommended to store the energy storage cabinet indoors, away from direct sunlight or rain, in a dry and well-ventilated area, with a clean surrounding environment, free from significant infrared radiation or other types of radiation, without organic solvents or corrosive gases, and without metallic conductive dust, keeping it away from heat sources and fire sources.

⚠ **CAUTION** toring the energy storage cabinet, it should be placed correctly according to the markings on the packaging box. It is strictly prohibited to place it upside down, on its side, or at an angle.

- The energy storage cabinet must be disconnected from external connections during storage, and the indicator light of the energy storage cabinet should be in the off state.
- Storage environment requirements:

No.	Item	Parameter
1	Average daily storage temperature	≤30°C
2	Permissible storage temperature	Short-term storage temperature range (within 1 month): -20°C ~ 45°C
		Long-term storage temperature: 0°C ~ 35°C
3	Storage Humidity	≤95%, no condensation

5. Device installation and operation

5.1 Precautions before installation

⚠ CAUTION

- To avoid the device tipping over, please secure the box containing the device to the forklift with ropes before moving. Care should be taken when moving the device, as impact or falling may cause damage to the device.
- When removing the outer packaging, please take protective measures for high-altitude operations. Once the device is positioned, carefully remove the packaging to avoid scratching the device. Keep the device stable during the packaging removal process.
- If the installation environment is poor, please take dust and condensation prevention measures after removing the packaging (such as using dust covers, plastic film, or fabric coverings) to avoid condensation or dust corrosion inside the battery.

5.2 Preparation Before Installation

5. 2.1 Installation Environment Requirements

The installation environment for the energy storage system should meet the following requirements:

Project Content	Environmental Requirements
Installation Site Requirements	Outdoor areas with good ventilation and high airflow
	Necessary fireproof, waterproof, and rodent-proof measures
	The surface slope of the cabinet placement area must be ≤1°, with seismic resistance >8
Foundation Requirements	The installation surface must be flat and dry, and standing water is strictly prohibited

	Ensure the ground is level and stable, and can support the weight of the energy storage device
Space Requirements	Sufficient space must be left in front, back, sides, and above the device for ventilation and maintenance
Environmental Temperature	-20 to 45℃
Relative Humidity	≤95%, no condensation
Altitude	≤2000m

5. 2. 2 Installation Site Requirements

The energy storage device must be installed on a concrete or other non-combustible surface. The installation surface must be level, firm, and flat, with sufficient load-bearing capacity, and must not be recessed or tilted.

When constructing the foundation, the issue of cable exit must be considered, and a trench or other exit holes for cables must be reserved. If the device uses a bottom exit for cables, it must exit through the trench. Therefore, the site needs to pre-set the trench. The trench must meet the following requirements: it needs to have necessary waterproof and moisture-proof designs to prevent cable aging and short circuits, which could affect the normal operation of the energy storage device.

Due to the high power of the device, thicker cables are required, and the design of the trench must fully consider the cross-sectional area of the cables.

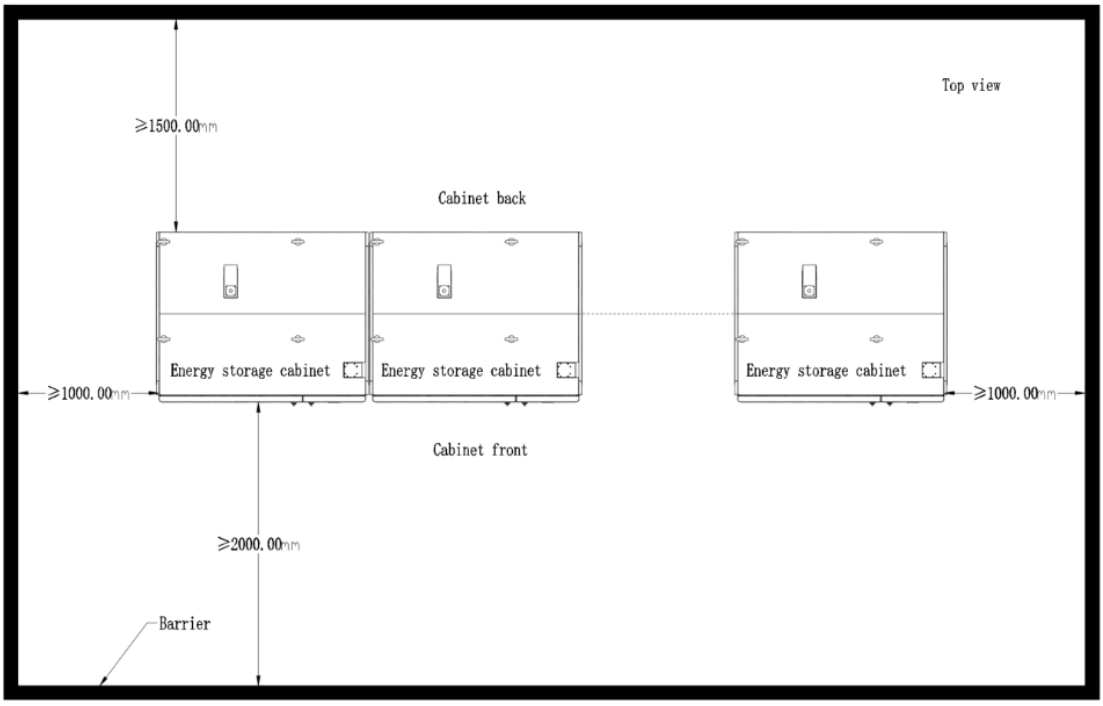
Customers can determine the number of cable brackets according to their needs; the cable brackets must fully consider the weight and dimensions of the device.

When laying cables, communication lines, power lines, and power cables must be laid separately. DC circuits and AC circuits need to be laid separately, with a distance of more than 300mm between different cables.

The surrounding climate of the installation site should be dry, well-ventilated, and away from Class A factories or flammable and explosive areas;

The foundation soil needs to have a certain degree of compaction; it is recommended that the relative density of the installation site soil be >98%. If the soil is loose, appropriate measures must be taken to ensure the stability of the foundation.

The installation site space for the energy storage cabinet is shown in the figure below. The distance from the back of the cabinet to the isolation measures is 1.5 meters, the distance from the front of the cabinet to the isolation measures is 2 meters, and the distance from the sides of the cabinet to the isolation measures is 1 meter. The specific installation distances shall comply with the requirements of local design and installation standards.



5. 2. 3 Device ventilation requirements

The operation of energy storage devices generates a large amount of heat. Excessive device temperature can lead to deterioration of the electrical parameters of the energy storage device and may potentially cause damage to the energy storage device. To ensure proper heat dissipation of the energy storage device, the installation environment must meet the following requirements:

① The device should be installed in a well-ventilated environment.

② The air intake must ensure sufficient fresh air enters.

③ It is recommended that the device's ventilation system be separate from other ventilation systems in the control room.

If the device shows signs of overheating, please check that the ventilation openings are functioning properly.

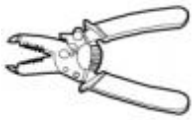
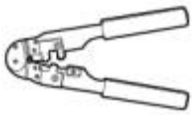
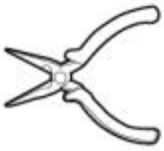
The energy storage battery integrated cabinet adopts a front air intake and rear air exhaust design, with the positions of the air intake and exhaust shown in the diagram below.

5. 2. 4 Installation Tool Instructions

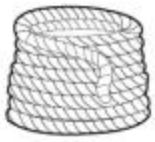
Before installing the device, the following tools need to be prepared:

- The illustrated tools are for reference only; please refer to the actual items.

➢ Due to varying site conditions, this tool list may not fully enumerate all possible tools that may be needed. Installation personnel and users should prepare any

Installation Tools	 Cross Insulated Torque Screwdriver	 Insulated Torque Socket Wrench (with Extension Bar) Socket Specification: 7mm~19mm Socket Depth ≥ 32mm Socket Interface Matches Torque Wrench Torque Range: 1.2N·m~45N·m	 Flat Insulated Torque Screwdriver	 Diagonal Cutting Pliers
	 Wire Stripping Pliers	 Wire Cutting Pliers	 Rubber Hammer	 Utility Knife
	 Crystal Head Crimping Pliers	 Hydraulic Pliers	 Needle Nose Pliers	 Marker Pen

	 Steel Tape Measure	Level	 Multimeter DC Voltage Range ≥1500V	 Impact Drill

			DC	
	 Impact Drill Bit Φ16mm	 Heat Shrink Tubing	 Hot Air Gun	 Cable Tie
	 Insulated Ladder (Height ≥1.7m)	 Lifting Rope Length ≥2110mm×4	 Vacuum Cleaner	 Powered Forklift (Forklift Load Capacity ≥3t, Recommended Fork Length ≥1800mm, Width 230mm~300mm Thickness 25mm~80m)
	 Crane (Lifting Capacity ≥3t; Working Radius ≥2m)	-	-	-

Protecti on Tools	 Insulated gloves	 Protective gloves	 Safety goggles	 Dust mask
	 Insulated shoes	 Reflective vest	 Safety helmet	 Safety harness

Unlisted tools based on the actual situation.

5.3 Installation process

Step 1: After placing the energy storage cabinet in the designated position, secure the cabinet base with M12 bolts, as shown in Figures 5-1 and 5-3 below:

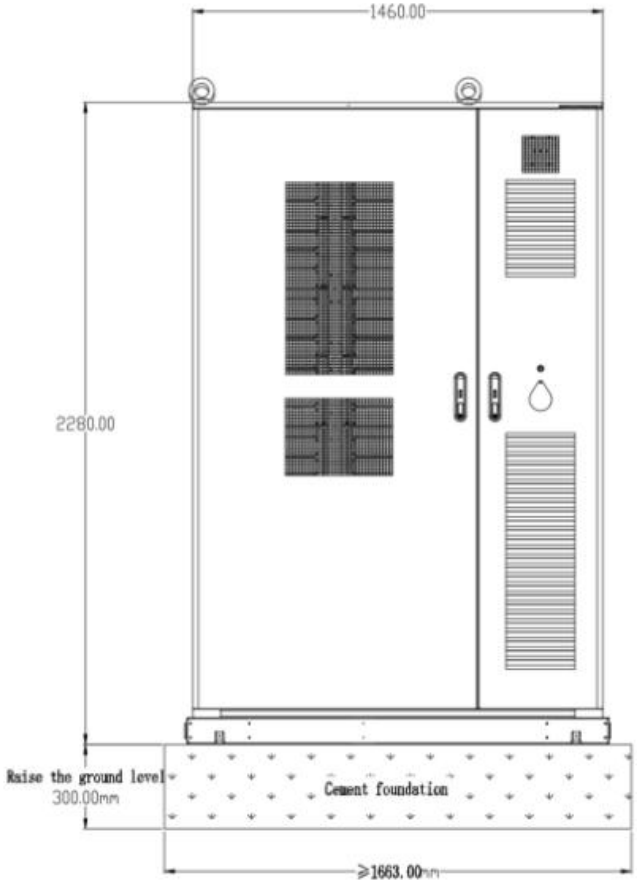


Figure 5-1 Energy storage cabinet fixing diagram

Note: If there is a combiner box, after placing it in the designated position, secure the cabinet base with M12 bolts, as shown in Figures 5-2 and 5-3 below:

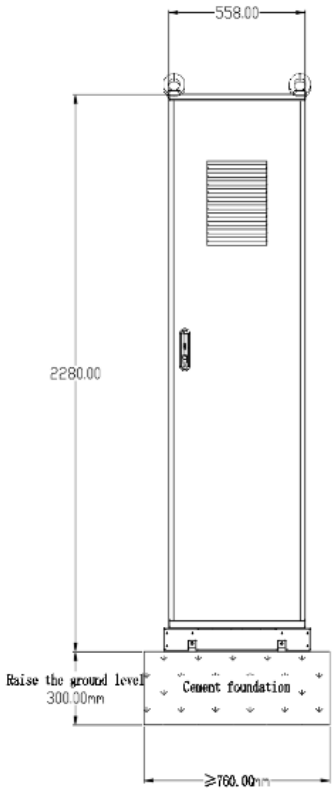


Figure 5-2 Combiner box fixing diagram

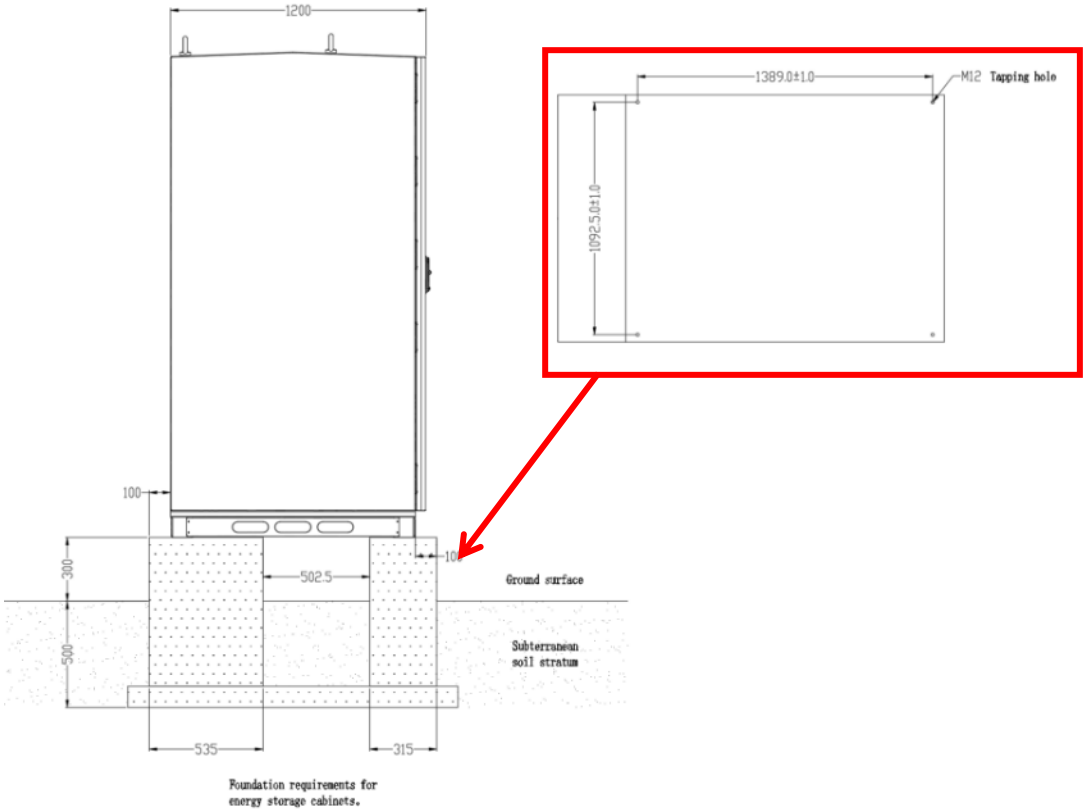


Figure 5-3 Base Fixing Diagram

Step 2: Cabinet Grounding

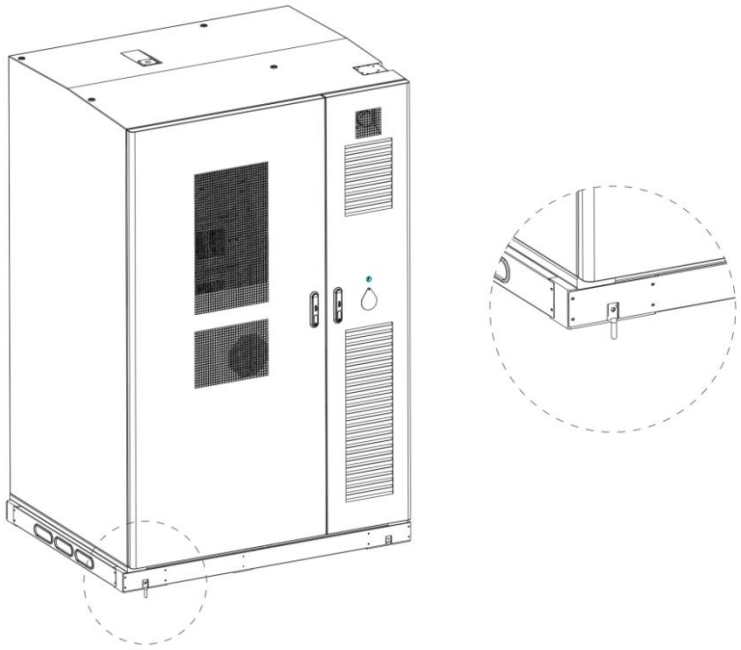


Figure 5-4 Grounding Position as Shown

Note: If the cabinet is already well grounded through the internal grounding busbar, grounding at this location is not necessary.

Step 3: Install end plates around the device base

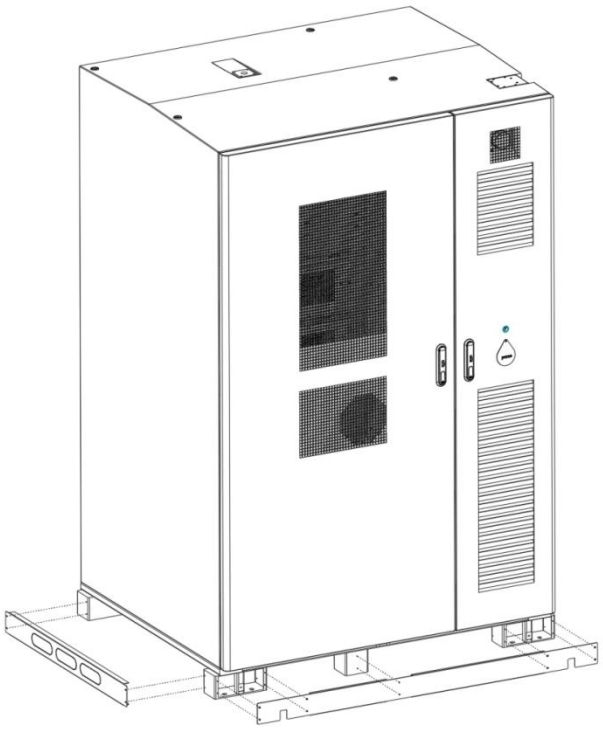


Figure 5-5 End Plate Installation

Note: If multiple cabinets are placed side by side, the end plates between the two cabinets may not be installed.

Step 4: Internal Wiring of the Cabinet

The A/B/C three-phase and N line and PE line are connected as shown in Figure 5-6， The locking torque of each phase sequence is shown in Table 5-1.

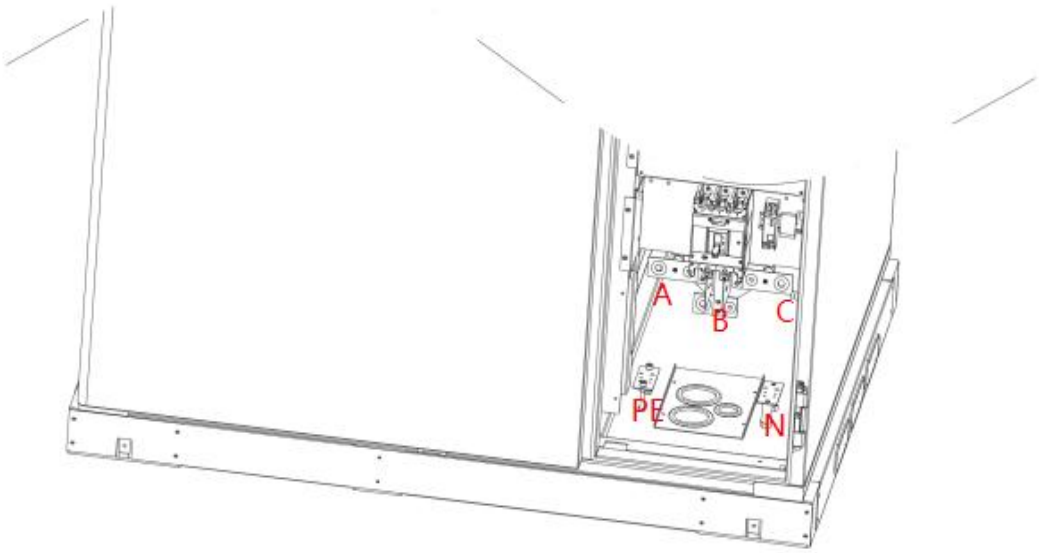


Figure 5-6 Internal Wiring Diagram of the Energy Storage Cabinet

Table 5-1 The requirements for the locking torque of each phase sequence

phase sequence	thread specification	torque requirement（NM）
N	M4	2.5
	M6	5
	M8	15
PE	M4	2.5
	M6	5
	M8	15
A	M10	25
	M14	120

B	M10	25
	M14	120
C	M10	25
	M14	120

Note: If there is a combiner box, the wiring positions are shown in Figure 5-7. The user's grid connection cable should be connected to the busbars A, B, C above the circuit breaker and to N and PE below. The cable from the energy storage cabinet to the combiner box should be connected to the busbars A, B, C, N, and PE below the circuit breaker， The locking torque of each phase sequence is shown in Table 5-2。

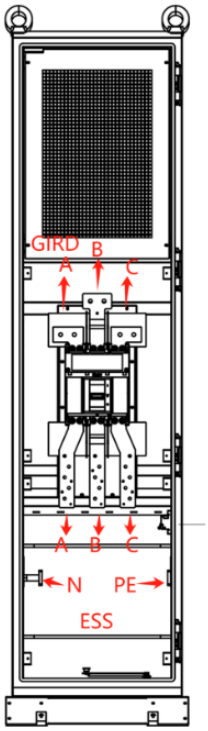


Figure 5-7 Wiring Diagram Inside the Combiner Box

Table 5-2 The requirements for the locking torque of each phase sequence

phase sequence	thread specification	torque requirement（NM）
N	M8	15
	M10	35

PE	M8	15
	M10	35
A	M10	35
	M12	55
	M14	75
B	M10	35
	M12	55
	M14	75
C	M10	35
	M12	55
	M14	75

Note: Select the appropriate distribution cable based on the number of energy storage cabinets on site, refer to the table below for details:

No.	Number of Cabinets in Parallel	Cable Specifications (Copper Cable Recommended)	Remarks
1	1 Main Cabinet	3*70mm²+35mm²（N）+35mm²（PE）	No Combiner Box
2	1 Main Cabinet + 1 Sub-Cabinet	3*150mm²+70mm²（N）+70mm²（PE）	No Combiner Box
3	1 Main Cabinet + 2 Sub-Cabinets	2*（3*120mm²+70mm²（N）+70mm²（PE））	1 Combiner Box
4	1 Main Cabinet + 3 Sub-Cabinets	2*（3*150mm²+70mm²（N）+70mm²（PE）)	1 Combiner Box
5	1 Main Cabinet + 4 Sub-Cabinets	2*（3*185mm²+95mm²（N）+95mm²（PE））	1 Combiner Box
6	1 Main Cabinet + 5 Sub-Cabinets	2*（3*185mm²+95mm²（N）+95mm²（PE））；3*70mm²+35mm²（N）+35mm²（PE）	1 Combiner Box

7	1 Main Cabinet + 6 Sub-Cabinets	2*（3*185mm²+95mm²（N）+95mm²（PE））；3*150mm²+70mm²（N）+70mm²（PE）	1 Combiner Box
8	1 Main Cabinet + 7 Sub-Cabinets	4*（3*150mm²+70mm²（N）+70mm²（PE）)	2 Combiner Boxes
9	1 Main Cabinet + 8 Sub-Cabinets	2*（3*185mm²+95mm²（N）+95mm²（PE））；2*（3*150mm²+70mm²（N）+70mm²（PE）)	2 Combiner Boxes
10	1 Main Cabinet + 9 Sub-Cabinets	4*（3*185mm²+95mm²（N）+95mm²（PE））	2 Combiner Boxes

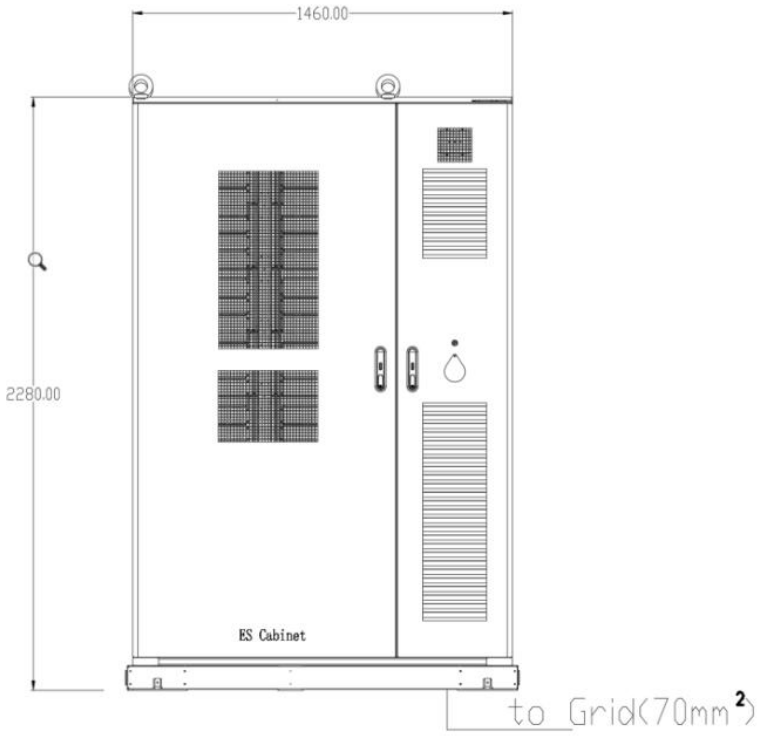


Figure 5-8 Single Energy Storage Cabinet Connection Diagram

Figure 5-9 Connection Diagram for Two Energy Storage Cabinets

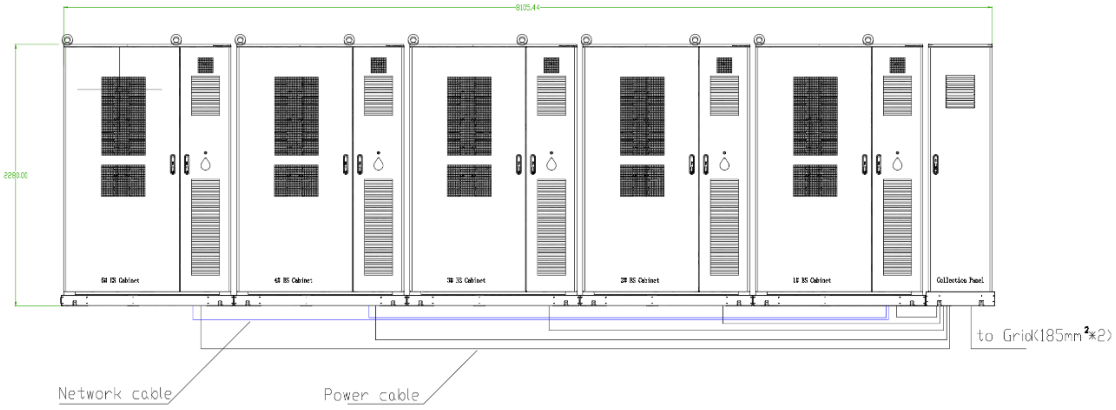


Figure 5-5 Connection Diagram for Multiple Energy Storage Cabinets

⚠ DANGER

- Smoking or using an open flame near the energy storage cabinet is prohibited.
- On-site fire safety equipment must meet requirements, such as fire sand, carbon dioxide extinguishers, and water-based fire-fighting equipment.
- Please use dedicated protective gear and insulated tools to avoid electric shock hazards or short circuit faults.

⚠ CAUTION

- When connecting the energy storage cabinet, ensure that terminal connections are secure and that cables are undamaged.
- The cable colors shown in all electrical connection diagrams in this chapter are for reference only; the selection of cables should comply with local cable standards (yellow-green two-color wire can only be used for protective grounding).

5.4 Trial Operation

5.4.1 Pre-Startup Inspection

No.	Inspection Items	Acceptance Criteria
1	Device Appearance	● The device appearance is intact, with no damage, rust, or paint peeling. If there is paint peeling, please perform touch-up painting. ● The device label is clear and visible; damaged labels should be replaced promptly.
2	Cable Appearance	● The protective layer of the cable is intact with no obvious damage. ● The conduit for the cable is in good condition.
3	Cable Connection	● The cable connection points match the design. ● The terminals are made according to specifications, and the connections are firm and reliable. ● The labels on both ends of each cable are clear and consistent, with the labels facing the same direction.
4	Cable Routing	● The routing meets the principle of separating strong and weak currents. ● Cables are organized and aesthetically pleasing. ● Cable ties are trimmed evenly, with no sharp edges exposed. ● Leave excess at corners as required; do not pull tight. ● Routing is straight and smooth, with no crossing of cables inside the cabinet.

5	Cabinet Door Stopper	No severe deformation affecting the opening and closing of the door; when closing the door, lift the stopper support rod with your foot first, then close the door to prevent deformation of the support rod. 
6	Enclosure grounding	Grounding conductor reliably connected to the cabinet grounding terminal.
7	Cable Entry Hole Sealing	The cable pass-through hole gland lock has been completed.

5.4.3 Power-On Operation Procedure

⚠ DANGER

Please wear insulated gloves and use insulated tools to avoid electric shock hazards or short circuit faults.

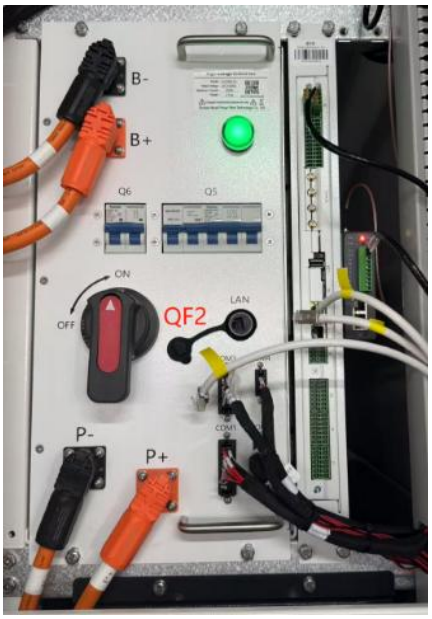
⚠ CAUTION

- During the power-on process, observe simultaneously; if any abnormal phenomena are found, immediately power down the energy storage system, investigate the cause, and only continue powering on after resolving the issue.
- When the circuit breaker trips inside the energy storage system, please first check the corresponding load side to confirm there is no short circuit and no faults before performing the closing operation to avoid exacerbating the fault and increasing safety risks. For example, when a trip occurs, please first measure whether there is a short circuit at the

220V AC output terminal of the high voltage box and whether there are any faults on the corresponding load circuit; confirm there is no short circuit and no faults before closing the circuit.

- When operating the switches on the high voltage box panel, please first remove the end plate of the high voltage box, and reinstall it after completing the power-on operation.
- Before powering on, ensure that the power cables (BAT+, BAT-) from the PACK to the high voltage box are connected.

Operating Steps



Step 1 Before powering on, first use a multimeter in resistance mode (ohm setting) to check whether there is an incorrect short circuit between phases A, B, and C of the QF1 circuit breaker; check whether phases A, B, and C are incorrectly shorted to the ground and neutral wires; verify that the phase sequence of A, B, and C matches the external wiring phase sequence; ensure that the ground and neutral wires are correctly connected.

Step 2 Close the main circuit breaker switch and surge protector switch (if applicable) of the combiner box.

Step 3 Close QF1 AC main circuit breaker and QF2 DC main circuit breaker. The meter connects and the display lights up, and the PCS connection indicator lights up.

Step 4 Close Q1 miniature circuit breaker to supply power to the surge protector.

Step 5 Close Q2 miniature circuit breaker to power the air conditioner, and the display lights up.

Step 6 Close Q3 miniature circuit breaker, the high voltage box indicator lights up, the operation indicator on the cabinet door lights up, the cabinet's LED lighting turns on, and power is supplied to the auxiliary equipment.

Step 7 Close Q4 miniature circuit breaker to supply power to the maintenance socket.

Step 8 Close Q5 Mini circuit breaker, take power from the DC side of the auxiliary equipment.

Step 9 Close Q6 mini circuit breaker, supply power to the DC side of the auxiliary equipment.

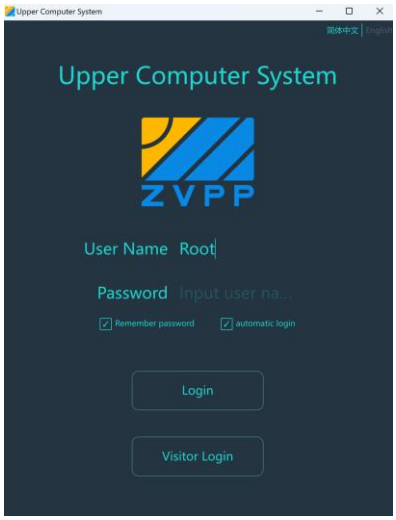
5.4.4 Shutdown Power Off Operation Process

Prerequisites

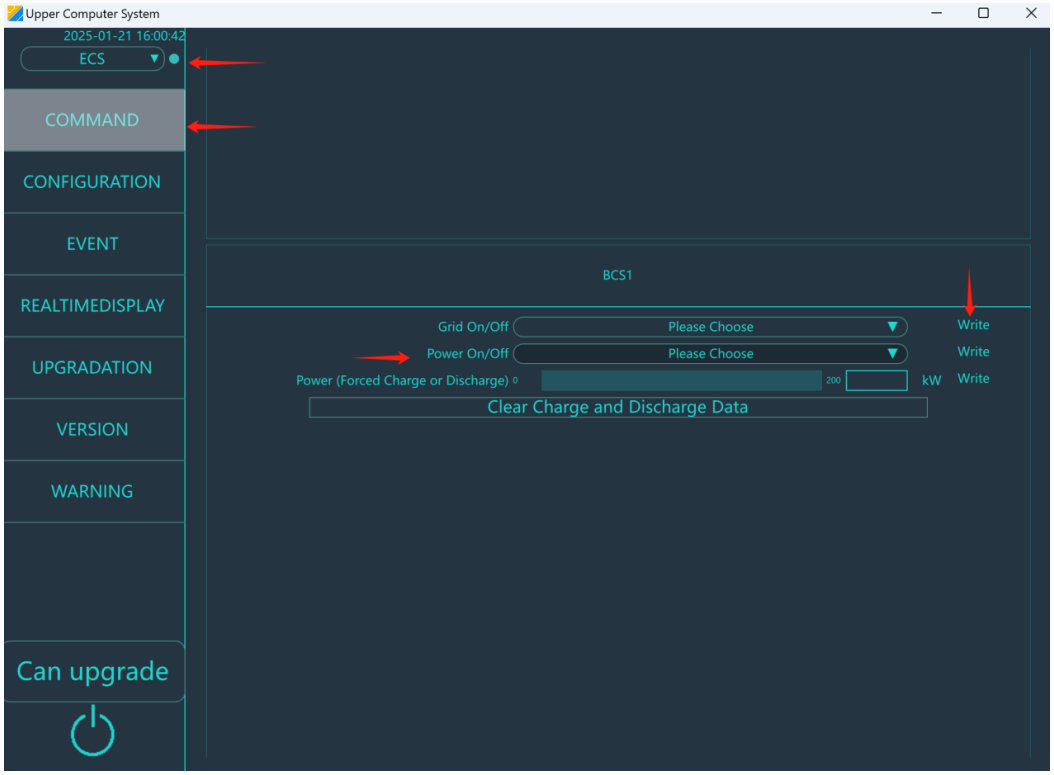
The system's original working state is grid-connected, with the system connected to the grid and operating with power.

Operating Steps

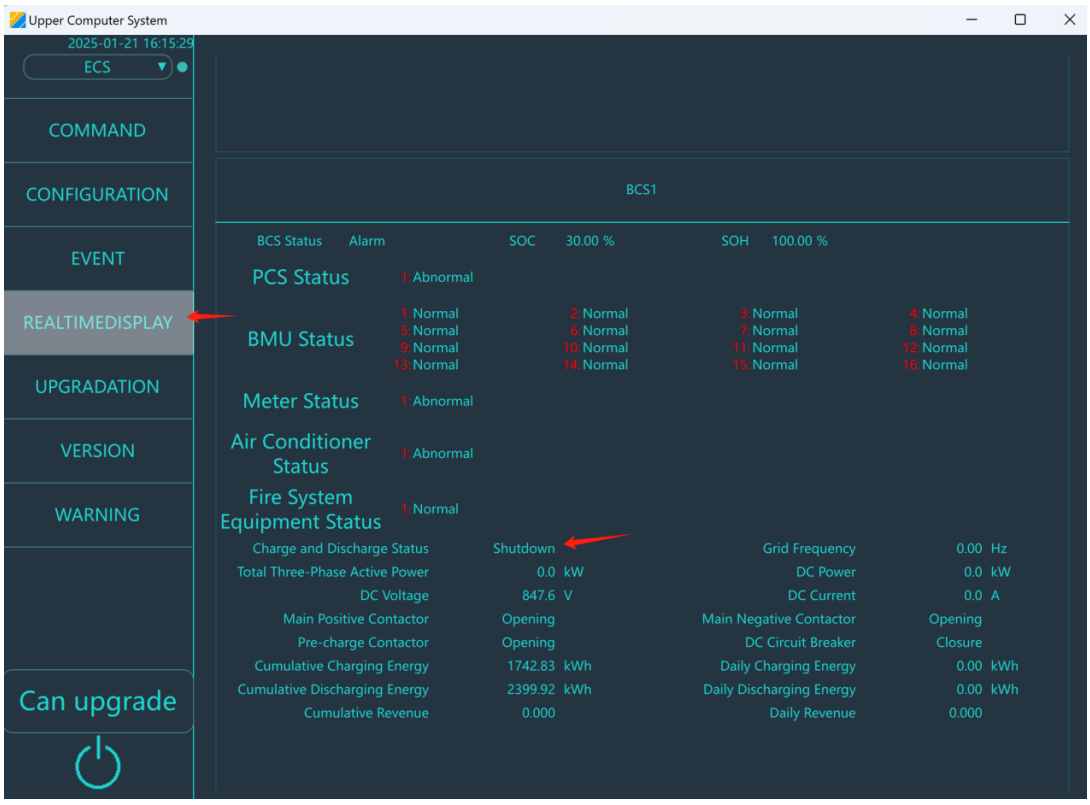
Step 1 Open the upper computer software program, and log in by entering the username and password on the login interface.



Step 2 Click the ▼ in the upper right corner to switch to the ECS command interface, select shutdown from the ▼ options, and click write.



Step 3 In the ECS display interface, check that the charging and discharging status of the corresponding device is stopped, confirming that the shutdown has been successfully executed.



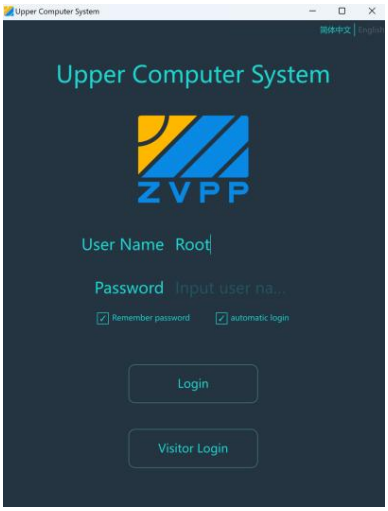
Power down operation

Follow the reverse order of the reference 5.4.3 Power-on operation process, which is to sequentially disconnect Q6~Q1, and then disconnect QF2 and QF1.

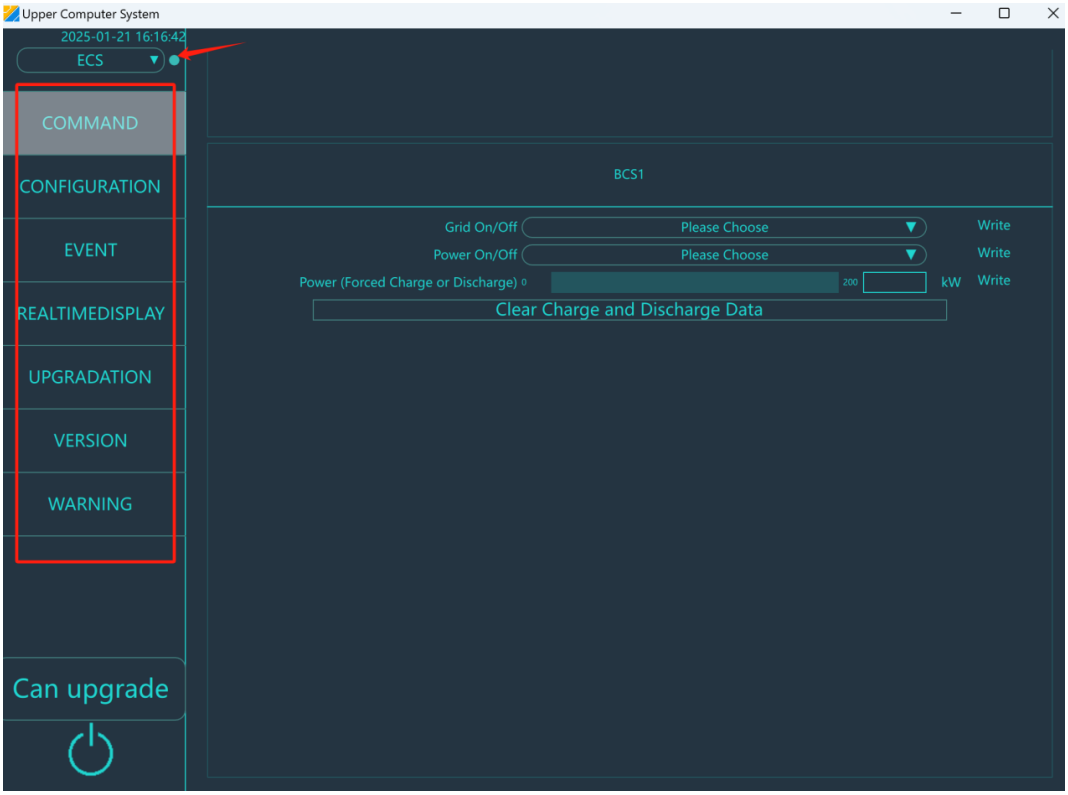
5.5 Upper computer operation instructions

5.5.1 Page introduction

- The upper computer login interface has two login methods: root user login and guest login. Guest login does not require an account password but can only view partial information and status, and cannot send operation commands to the energy storage system. Root user login allows for parameter configuration, sending operation commands, system upgrades, and other operations on the energy storage system.

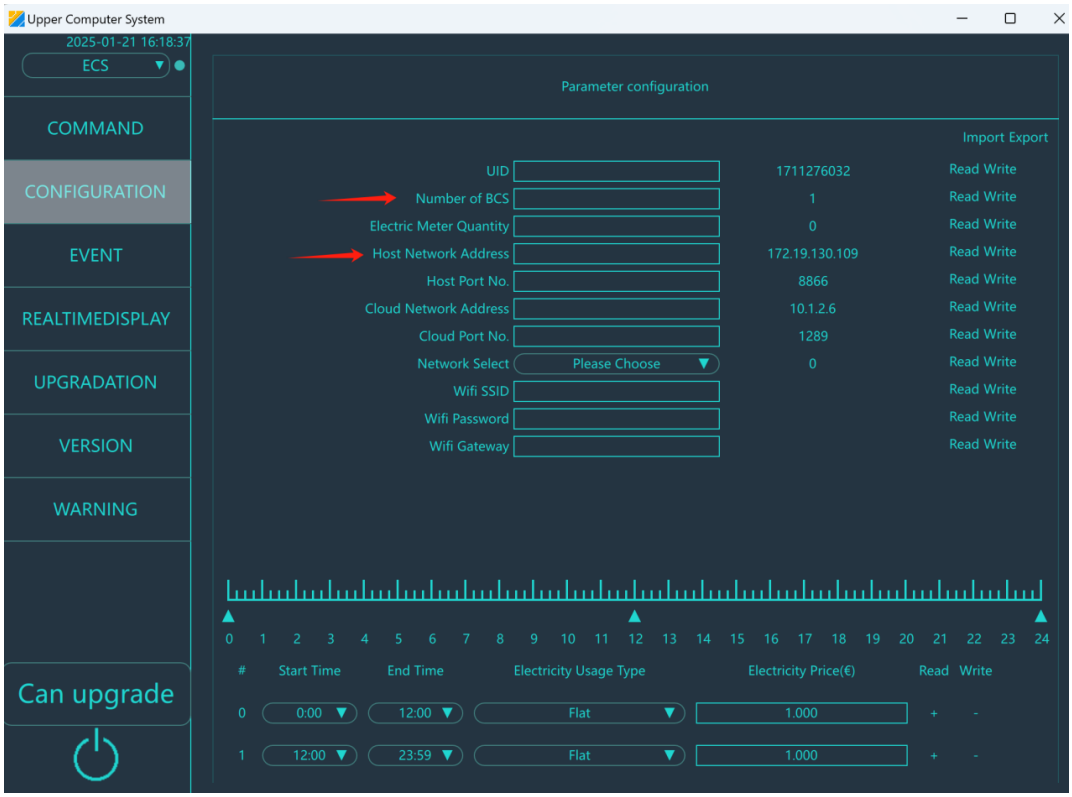


- The upper left corner 'ECS▼' can switch between all energy storage systems in parallel networking. Through the corresponding interface bar on the left side, operations such as sending commands, parameter configuration, event viewing, status display, software upgrades, version checking, and warning viewing can be performed.

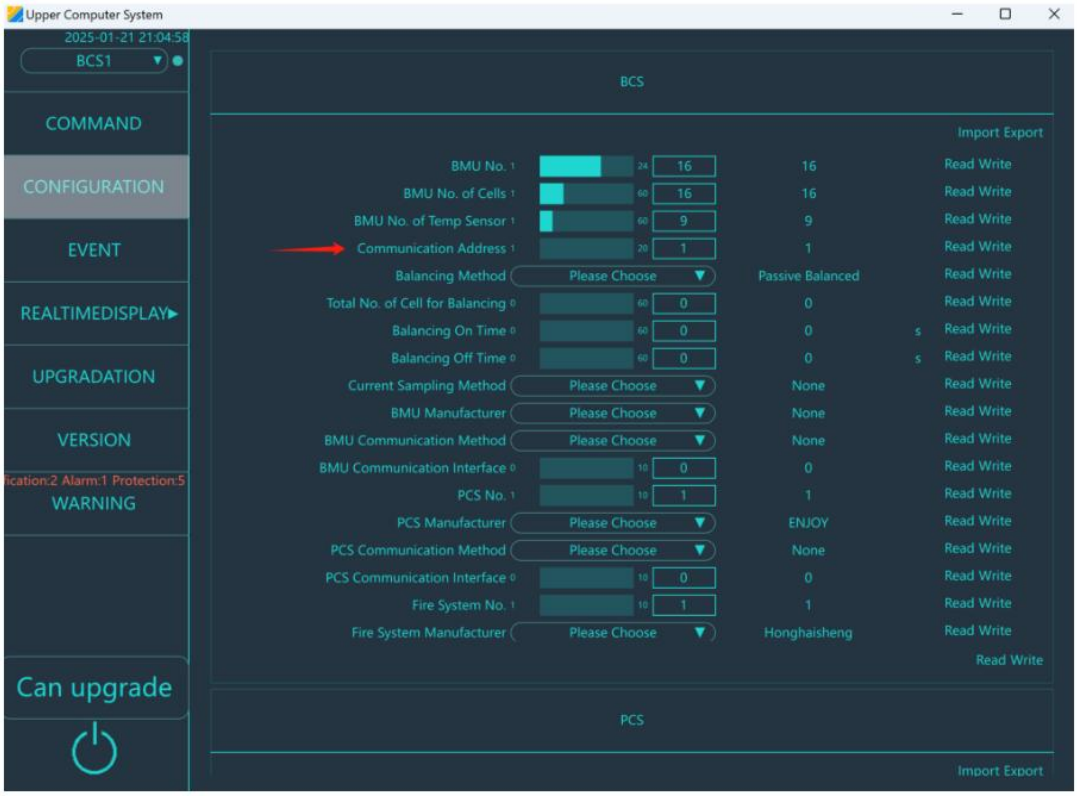


5.5.2 Basic Configuration

- In the ECS configuration interface, set the number of BCS units according to the number of parallel energy storage systems, and input the host network address information to complete the parameter configuration for communication between the upper computer and ECS.

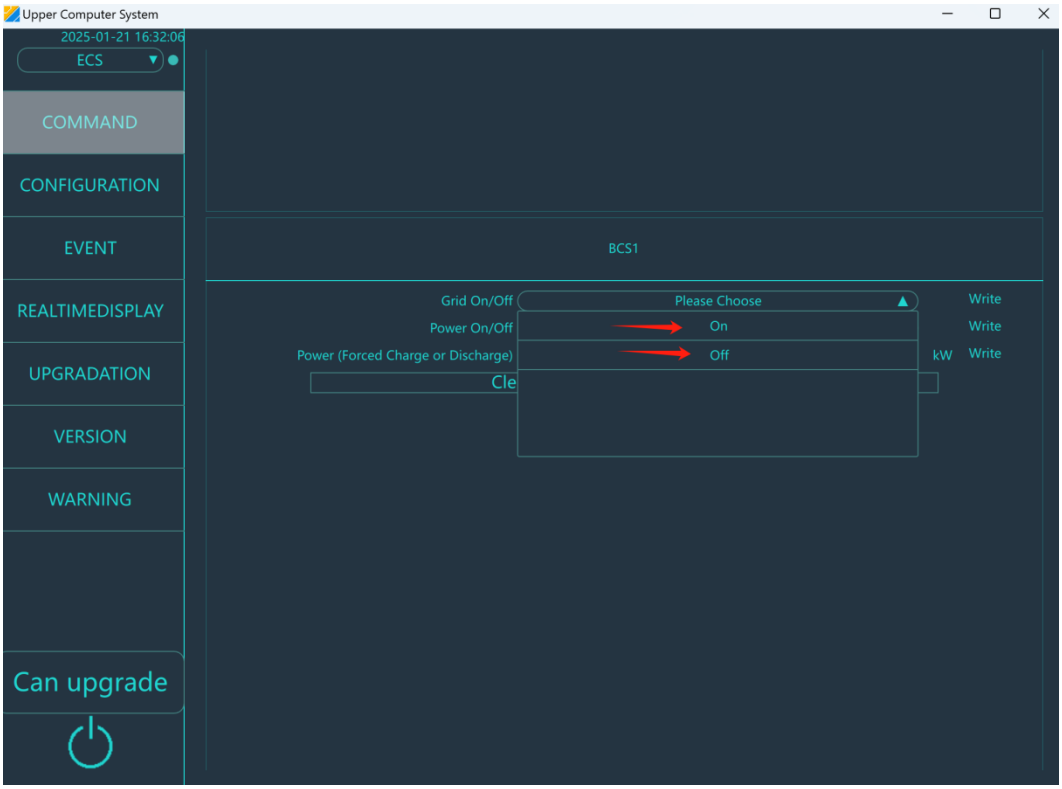


- In the BCS configuration interface, input the communication address of the BCS to complete the parameter configuration for communication between the upper computer and BCS.



5.5.3 Charge and Discharge and Strategy Configuration

- In the ECS command interface, click 'Grid Connection/Disconnection ▼' to select one of two modes: ON or OFF. Set the corresponding operating mode, click write, and the energy storage system will enter grid-connected or off-grid status (this setting is only required during the first power-up).



6. Operation and Maintenance Instructions

6.1 Operational Safety

When the energy storage device is operating normally, undergoing regular maintenance, or experiencing an unexpected failure, the operation and maintenance personnel should carry out their work while adhering to safety regulations. Operational personnel should be familiar with the emergency handling procedures for faults, proficient in the operational steps and methods. In the event of a fault, immediate repair efforts must be organized. If a fault cannot be handled independently, please contact the manufacturer promptly.

6.2 Safety inspection management

Inspections are divided into annual, quarterly, and monthly checks, which require patrols and inspections of the functional areas within the energy storage cabinet. Relevant personnel should possess the ability to assess the type, level, and severity of faults, and report and address any anomalies according to the relevant procedures outlined in the inspection management regulations.

6.3 Battery system usage requirements

The SOC range for storing energy batteries: 20%~50%. Avoid long-term storage of cells below 15% SOC. If the battery is not used for an extended period, disconnect any power-consuming devices in a timely manner.

(1) Conduct a routine inspection of the energy storage system every 3 months and maintain inspection records;

(2) For systems that have been idle (not started for more than 3 months), before the first use, at least one full charge is required to activate the battery system and restore the battery's performance to optimal condition.

6. 4 Maintenance Items

Before maintenance and repair work on the system, relevant personnel must first disconnect all switches within the system. Specific operations can be found in section 5.4.4 Shutdown and Power Off Procedure. Only after ensuring that all switches are in the OFF position and the system is powered off can internal inspections and maintenance of the energy storage cabinet be performed. Check the following items, and if any do not meet the requirements, please correct them immediately:

Maintenance cycle	Maintenance type	Inspection items	Testing methods
Monthly inspection	Energy storage	System status	(1) Energy storage cabinet Check for entry of insects, mice, and other debris ;

	cabinet enclosure		(2) Cooling fan of the energy storage cabinet operates normally, with no unusual noise; (3) Indicator light operates normally; (4) Check for any unusual odors or condensation inside the cabinet.
	Battery System	System status	(1) No abnormal smoke, vibration, or noise; (2) Battery pack appearance is intact with no damage, swelling, or deformation; (3) Cooling fan operates normally, with no unusual noise.
	PCS	System status	(1) No abnormal sounds or alarms; (2) Appearance is intact without damage, swelling, or deformation.
	High Voltage Box	System status	(1) No abnormal sounds or alarms; (2) Appearance is intact without damage, swelling, or deformation; (3) Indicator light is functioning normally.
	Alarm Records	System Alarms and Fault Troubleshooting	View system alarm information and troubleshoot corresponding faults through the upper computer software; refer to section 6.5 for fault handling.
Seasonal Inspection	Fire Protection System	Composite Detector	(1) Check for cleanliness and ensure it is not covered by dust, paint, or other debris; (2) Ensure that installation and wiring are secure.
		Sound and light alarm	(1) Check for dust accumulation and clean it in a timely manner;

			(2) Ensure that installation and wiring are secure.
		Fire Extinguishing Device	(1) Check the pressure gauge value and ensure that the pressure is within the working range (i.e., the pointer is in the green area). If there are any abnormalities, please contact the manufacturer for handling; (2) Ensure that the device's appearance is intact, with no damage, swelling, or deformation; (3) Ensure that the installation and wiring are secure without any looseness.
		Fire detection tube	(1) Check each connector to ensure there is no looseness; (2) Ensure that the device's appearance is intact, with no damage, swelling, or deformation.
	Electric meter	Electrical and fixed connections	(1) Ensure that the device's appearance is intact, with no damage, swelling, or deformation, and that the displayed data is normal; (2) Ensure that installation and wiring are secure.
	PCS	Electrical and fixed connections	(1) The device appearance is intact, with no damage, swelling, or deformation ; (2) Ensure that the installation and wiring are secure, with no rust, dust accumulation, or condensation at the connection points; (3) The grounding point of the enclosure has good contact and is secure: (4) Check if the heat dissipation filter is clogged with dust, which may affect heat dissipation; clean the filter in a timely manner; (5) The cooling fan operates normally, with no unusual

			noises during operation.
	Air Conditioner	Electrical and fixed connections	(1) The device appearance is intact, with no damage, swelling, or deformation ; (2) Ensure that the installation and wiring are secure; (3) Operation is free of unusual noises or vibrations, and the indoor temperature is within the set range; (4) The internal and external filters of the air conditioner should be clean and intact, with no foreign objects blocking the air outlets. If severe dust accumulation is found at the external air inlets and outlets, dusting is required, and cleaning should be done by directly rinsing with clean water from the outside.
	Battery System	Electrical and fixed connections	(1) The main circuit and secondary circuit connections of the battery system should be secure, with no looseness, rust, dust, or condensation present. (2) Ensure that the installation and wiring of the water immersion detector in the battery compartment are secure.
	High Voltage Box	Electrical and fixed connections	(1) The main circuit and secondary circuit connections of the high voltage box should be reliable, with no rust, dust, or condensation present. (2) Ensure that the installation is secure. (3) The grounding point of the enclosure is in good contact and is not loose.
	Combiner Box	System status and electrical connections	(1) Ensure that the connections of the main circuit and secondary circuit are tight, with no rust, dust accumulation, condensation, or other phenomena;

			(2) Check whether there are any insects, mice, or other debris inside; (3) Check for any unusual odors or condensation and water accumulation inside the cabinet.
Annual inspection	Enclosure and structural components	Energy storage cabinet section	(1) Inspect the air filter at the inlet and outlet of the cabinet door. If it is found to be dirty or blocked, please clean the filter in a timely manner (unscrew the metal cover of the filter, remove the filter, wash it with clean water, and reinstall it once it is dry and free of obvious water stains); (2) Check whether there is any paint peeling on the enclosure. If so, please touch up promptly to prevent rust ; (3) Check inside for any fallen screws and promptly remove foreign objects; (4) The grounding point of the enclosure is in good contact and is not loose.
		Combiner Box Section	(1) Inspect the air filter at the inlet and outlet of the cabinet door. If it is found to be dirty or blocked, please clean the filter in a timely manner (unscrew the metal cover of the filter, remove the filter, wash it with clean water, and reinstall it once it is dry and free of obvious water stains); (2) Check whether there is any paint peeling on the enclosure. If so, please touch up promptly to prevent rust ; (3) Check inside for any fallen screws and promptly remove foreign objects;

			(4) The grounding point of the enclosure is in good contact and is not loose.
	Firefighting Device	Pressure Check	(1) The firefighting device needs to undergo a pressure check annually. The normal shipping pressure is 2.5MPa. If the pressure drops below 1.8MPa, contact the supplier for replacement.  (2) To avoid micro-leakage of the perfluorohexane medium through the pressure gauge, the pressure gauge is normally not connected to the air tank. Each time the pressure is checked, use a wrench to turn the nut behind the pressure gauge counterclockwise by 90 degrees. After checking the pressure, use the wrench to turn the nut clockwise by 90 degrees to lock it.

			
	Electrical components	Component maintenance	1. Switch-type components: (1) Check for dust accumulation on the contacts; if present, clean it promptly. (2) Check for oxidation or rust on the contacts; if present, replace them promptly. (3) Check if the mechanical operation is good; operate the switch 3 times to ensure normal action. 2. Surge protector circuit (the specific inspection time should depend on the actual environment; if the installation site is in a high lightning area, it is recommended to change the inspection cycle to once every six months): (1) Check for dust accumulation on the contacts; if present, clean it promptly. (2) Check for oxidation or rust on the contacts; if present, replace them promptly. (3) Check if the grounding wire is secure; (4) Check for cracks, deformation, or other physical

			damage; if any are found, please replace promptly.

The table only provides recommended routine maintenance cycles for the products. The actual maintenance cycle should be reasonably determined based on the specific installation environment of the product. Factors such as location and site environment can affect the maintenance cycle of the product. If the operating environment has significant wind and sand or is heavily dusty, it is essential to shorten the maintenance cycle and increase the maintenance frequency.

6. 5 Troubleshooting

Simple faults of the energy storage system and their handling methods are shown in the table below. For other faults that cannot be determined or handled on-site, please promptly contact the manufacturer's after-sales personnel.

No.	Faulty device	Fault condition	Handling method
1	Water immersion sensor	Feedback contact alarmed without reason	1） Check if the power supply line is normal, and measure if the voltage at the power supply port meets the device's operational requirements 2） Check if the feedback signal line is normal
2	Surge Protector	Feedback contact alarmed without reason	1） Check if the feedback signal line is normal 2） Check if there are any burn or scorch marks on the surface of the surge protector
3	Fire detector	Communication loss	1） Check if the power supply line is normal, and measure if the voltage at the power supply port meets the device's operational requirements 2） Check if the communication line is normal
4	Electric meter	Communication loss	1） Check if the power supply line is normal, and measure if the voltage at the power supply port meets the device's operational requirements

			2） Check if the communication line is normal
5	PCS (Energy Storage Inverter)	Communication loss	Check if the communication line is normal
6	Cooling fan at the back of the cabinet	Sudden stop or not rotating	1） Check if the power supply line is normal, and measure if the voltage at the power supply port meets the device's operational requirements 2）Check if the fan blades are jammed by foreign objects and unable to rotate
7	Cabinet door indicator light	Suddenly goes out or does not light up	Check if the power supply line is normal and measure whether the voltage at the power supply port meets the device's operational requirements