User Manual for Containerized Energy Storage System

BRES-1075-500
BRES-860-400
BRES-645-300

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Preamble

Overview

This document describes the installation, electrical connection, commissioning and troubleshooting of 10/20-foot containerized energy storage systems BRES1075-500, BRES860-400, BRES645-300, and energy storage systems with compatible capacities below. Please read this manual carefully for safety information and to familiarize yourself with the functions and features of the energy storage system before installing and using it.

Target Readers

This manual is intended for operators of energy storage power plants and appropriately qualified electrical technicians.

Symbolic Stipulations

The following symbols may appear in this article and what they represent is as follows.

Symbols	Description
	A hazard with a high level of risk that would result in death or serious injury if not avoided
	A hazard with a medium level of risk that, if not avoided, could result in death or serious injury
	A hazard with a low level of risk that, if not avoided, could result in minor or moderate injury
	Used to communicate equipment or environmental safety warning messages. If not avoided, it may result in equipment damage, loss of data, degradation of equipment performance, or other unforeseen results. "Requirement" does not involve personal injuries.
	Additional explanations of key information in the main text. "Instruction" are not safety warnings and do not involve personal, equipment, or environmental damage.

Content

1. Notes

1.1 General Safety

Declaration

Before installing, operating, and maintaining the equipment, read this manual first and follow all safety precautions identified on the equipment and in the manual.

The "NOTICE", "WARNING" and "HAZARD" items in this manual do not represent all safety precautions to be observed, and are only intended as a supplement to all safety precautions. The Company shall not be liable for any breach of the general safety operation requirements or the violation of the safety standards for the design, production and use of equipment.

This equipment should be used in an environment that meets the design specifications, or it may cause equipment malfunction, and the resulting malfunction of the equipment or damage to parts, personal safety accidents, property damage, etc. are not covered by the equipment quality warranty.

Installation, operation, and maintenance of the equipment should comply with local laws, regulations, and norms. The safety precautions in the manual are intended only as a supplement to local laws, regulations and norms.

The Company shall not be liable in any of the following cases.

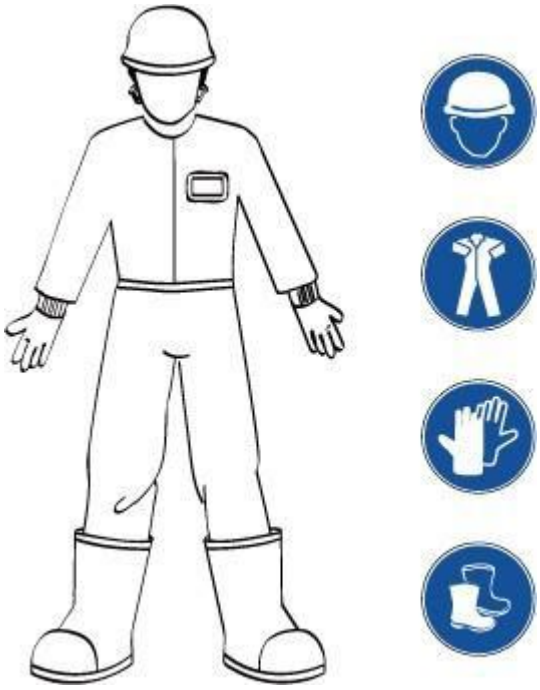
- The equipment does not operate under the operating conditions described in this manual.
- Installation and operating environments go beyond those specified in the relevant international or national standards.
- Unauthorized disassembly, alteration of products or modification of software code.
- Failure to follow the operating instructions and safety warnings in the product and documentation.
- Damage to equipment caused by abnormal natural environment (force majeure, such as earthquakes, fires, and windstorms).
- Shipping damage caused by the customer's failure to follow shipping requirements.
- Damage caused by storage conditions that fall short of the requirements of the product documentation.

General Requirements

- It is strictly prohibited to install, use and operate outdoor equipment and cables in bad

weather such as thunders, rain, snow, or force-6 gale.(including, but not limited to, handling equipment, operating equipment and cables, plugging and unplugging signal interfaces connected to the outdoors, working at heights, outdoor installations, etc.).

- It is strictly prohibited to wear watches, bracelets, bangles, rings, necklaces and other easily conductive objects during installation, operation and maintenance to avoid being burned by electric shock.
- Special protective equipment such as insulated gloves, goggles, safety clothing, safety helmets, and safety shoes.
- Must be used during installation, operation and maintenance.



- Installation, operation and maintenance must be carried out in the order of steps stated in the instructions.
- The voltage at the contact point should be measured before touching any conductor surface or terminal to confirm that there is no risk of electric shock.
- Upon installing the equipment, be sure to remove empty packing materials such as cartons foam, plastic, and cable ties from the equipment area.
- In the event of a fire, evacuate the building or equipment area and ring the fire alarm, or call fire emergency number. Under no circumstances is it permitted to re-enter a burning building.
- Do not deactivate the protective device.
- Do not ignore warnings, cautions and precautions in manuals and on equipment.
- Promptly replace hazard signs that have become unclear due to prolonged use.
- Other personnel than those operate the equipment should not approach the equipment.
- The handles of the tools used need to be insulated, or insulated tools should be used.
- All wiring holes need to be sealed, and fireproof mud should be used to seal the wiring holes that have been passed through.
- It is strictly prohibited to alter, damage or obOur companyre the markings and nameplates

on the equipment.

- When installing the equipment, use a torque wrench with the appropriate measuring range to tighten the screws to the torques specified in the instructions.
- Electrical operations are strictly prohibited during the installation.
- Paint scratches during transportation and installation of equipment must be corrected in a timely manner, and it is strictly prohibited to expose the scratched areas to outdoor environments for an extended period.
- Prior to operation, the equipment should be securely fastened to the floor or another stable object.
- Do not use water to clean electrical parts inside or outside the cabinet.
- Do not alter the structure, installation order, etc. of the equipment without authorization.
- Under no circumstances should fingers, components, screws, tools, or circuit boards come into contact with a running fan before it is powered off and stops running, to prevent injury to hands or damage to the equipment.

Personal safety

- In the course of operating the equipment, if a fault is detected that may potentially cause personal injury or equipment damage, operation should be immediately ceased, reported to the responsible person, and effective protective measures should be implemented.
- Before using any tools, please ensure you are familiar with the correct usage methods to prevent injury to individuals and damage to equipment.
- While the equipment is running, the housing may reach high temperatures, presenting a danger of burns. Do not touch it.
- Do not power on the equipment unless it has been fully installed and verified by a professional.

1.2 Personnel Requirements

- Operators should be fully familiar with the composition, working principle and relevant standards of the country/region for the entire energy storage system where the project is located.
- Those accountable for installing and maintaining our equipment are required to undergo stringent training initially to acquire knowledge of diverse safety considerations and proficiently handle the proper operation methods.
- Only qualified professionals or trained personnel are allowed to install, operate, and maintain the equipment.
- Only qualified professionals are allowed to remove safety facilities and repair equipment.
- Personnel who operate the equipment, including operators, trained personnel, and professionals, should possess the special operational qualifications required by the local country, such as high-voltage operation, working at heights, and special equipment operation certifications.
- Replacement of equipment or components (including software) must be performed by a professional or authorized person.
  - **Professional:** An individual who possesses training or operational experience with the

equipment, and has a clear understanding of the various potential sources of danger and the levels of risk involved in the installation, operation, and maintenance of the equipment.

– **Trained personnel:** These are individuals who have undergone the appropriate technical training and possess the necessary experience. They are aware of the potential dangers that a particular operation may pose to them and can take measures to minimize the risk to themselves and others to the lowest possible extent.

– **Operators:** These are personnel who, apart from trained and professional individuals, may come into contact with the equipment during operation.

1.3 Electrical Safety

Grounding Requirements

- For equipment that requires grounding, protective ground wires must be installed first during installation. Conversely, when removing the equipment, the protective ground wire must be the last to be disconnected.
- The destruction of grounding conductors is strictly forbidden.
- It is prohibited to operate the equipment without a grounding conductor installed.
- The equipment should be permanently connected to the protective earth. Prior to operating the equipment, the electrical connections should be inspected to ensure that the equipment is securely grounded.

General Requirements

It is imperative to verify that the equipment is intact before proceeding with electrical connections, as any damage could potentially lead to electrocution or ignition of a fire.

- All electrical connections must comply with the electrical standards of the country or region where the project is located.
- Obtaining permission from the electrical authority in the respective country or region is mandatory before commencing grid connection.
- User-provided cables should comply with the local laws and regulations.
- When conducting high-voltage operations, it is imperative to use specialized insulated tools.

AC and DC Operating Requirements

It is strictly prohibited to install or remove power cables while they are electrically charged. At the instant when the core of a power cable comes into contact with a conductor, electric arcs or sparks may be generated, potentially leading to fires or personal injury.

- Before installing or removing the power cable, the power switch must be turned off.
- Prior to connecting power cables, it is essential to verify that they are correctly identified before proceeding with the connection.
- If the equipment has multiple input channels, all inputs should be disconnected, and operations on the equipment should only be performed after the equipment has been completely powered off.
- If a component is damaged, it must be replaced by a professional to mitigate potential risks.

Cabling Requirements

- Cables used in high-temperature environments may experience insulation layer aging and damage. The minimum distance between the cable and heating devices or the outer perimeter of heat source areas should be at least 30 mm.
- The inlet and outlet vents of equipment must not have cables passing through them.
- Flame-retardant cables should be selected, and their flame-retardant rating should meet the requirements stipulated by local laws and regulations.
- Similar cables should be bundled together, while different types of cables should be separated by a minimum distance of 30 mm during installation. It is prohibited to intertwine or crosslay cables of different types.
- In energy storage systems, the cables used must be securely connected, have excellent insulation, and be of appropriate specifications.
- At extremely low temperatures, severe impact or vibration can potentially lead to the plastic sheath of cables cracking due to increased fragility. To ensure construction safety, the following requirements should be followed:
  - All cables should be laid and installed above 0°C. Handle cables with caution, especially in a low-temperature environment.
  - In the case where the cables are stored in an environment with a temperature below 0°C, they should be transferred to a room temperature setting for storage lasting more than 24 hours before deployment.
- It is strictly prohibited to perform improper operations such as directly pushing cables off a vehicle.
- The selection, installation, and routing of cables must adhere to local laws, regulations, and standards.

Anti-static Requirements

Requirement

Static electricity generated by the human body can damage static-sensitive components on individual boards, such as Large Scale Integrated circuits (LSI).

- Prior to handling equipment, individual boards or PSUs, it is imperative to wear anti-static gloves.
- When holding circuit boards or PSUs, it is crucial to grip the edge of the board devoid of components and strictly avoid touching the components with your hands.
- The dismantled individual boards or PSUs must be packaged in an anti-static package for storage or transportation.

1.4 Requirements on Storage and Installation Environment

Storage Requirements

- When stacking energy storage systems, the maximum limit should not exceed five stacks.
- The storage and transportation time of the energy storage system shall not exceed 8 months in total. (Time from shipment)
- Requirements on storage environment:

  a. Ambient temperature: 0°C~40°C, recommended storage temperature: 20°C~30°C.

  b. Relative humidity: 5%RH~80%RH

  c. Dry, ventilated and clean.

  d. Avoid contact with corrosive organic solvents, gases and other substances.

  e. Avoid direct sunlight.

  f. The distance from heat source should not be less than two meters.

  g. During the storage of the energy storage system, the main power circuit must be disconnected, and it is recommended to power on the auxiliary supply to maintain the normal operation of the monitoring system.

Instruction

While the system is in storage, it is necessary to furnish appropriate evidence of compliance with storage stipulations, including daily temperature and humidity log data, photographs of the storage environment, inspection reports, etc.

It is generally advised against prolonged battery storage; instead; they should be used promptly. Long-term storage of lithium-ion batteries can result in capacity loss. At recommended storage temperatures, irreversible capacity loss typically ranges from 3% to 10% after 12 months of storage.

Requirements on Installation Environment

- The external environment meets the requirements of GB 51048-2014 Design Code for Battery Energy Storage Station.

- During equipment operation, do not block vents or the cooling system to prevent high temperatures-induced fires.
- The equipment should be installed in an area far away from liquid, and it is not advisable to install it beneath locations where condensation is likely to occur, such as water pipes or exhaust outlets. In addition, the equipment should not be installed beneath positions prone to water leaks, such as air conditioning vents, ventilation openings, or cable outlet windows in machine rooms, to prevent liquids from entering the interior of the equipment, which could result in equipment malfunctions or short circuits.
- If liquid enters the equipment, immediately turn off the power and notify on-site management.
- Do not place the equipment in environments with flammable, explosive gases, or smoke, and refrain from any operations in such environments.
- Avoid installing the energy storage system in areas prone to salt damage, as corrosion and fire may occur. Do not install the energy storage system outdoors in areas prone to salt. Areas prone to salt refer to regions within 2 km of the coastline or areas affected by sea breezes. Areas affected by sea breezes can vary depending on meteorological conditions (e.g., typhoons, seasonal winds) or variations in terrain (including dikes and hills).

Requirements on Elevated Installations

- Any operation performed at a height above two meters from the ground is considered operation at height.
- Operation at height should be halted in the following circumstances, e.g., during rainy days, as well as in the presence of other potentially hazardous circumstances. Once the aforementioned conditions have been cleared, a thorough examination of all operational equipment by the company's Safety Director and pertinent technicians is mandatory; operations at heights can only proceed with their consent and endorsement.
- Operations at heights must comply with requirements of local regulations for operations at heights.
- Prior to engaging in operations at heights, one must successfully complete the required training and acquire the appropriate certification of competence.
- Before commencing operations at heights, thorough inspections of access tools and safety equipment, such as safety helmets, safety harnesses, ladders, scaffolds, and lifting equipment, should be conducted. Any items found to be non-compliant should be promptly rectified or the operations at heights should be rejected.
- Adequate safety precautions must be taken, including wearing safety helmets and safety harnesses, waist ropes, securely fastened to sturdy structural components. Under no circumstances should they be attached to movable, insecure objects or sharp, angular metallic surfaces, as this could lead to hook disengagement and potential falling accidents.
- In areas where operations at heights are taking place, hazardous areas must be identified and marked with conspicuous signage to prevent unauthorized individuals from accessing them.
- Safely transport and maintain control over operating instruments and tools to avoid unintentional drops that could potentially injure others.
- It is strictly prohibited for operators at heights to throw objects from above to the ground, and equally forbidden to toss objects from the ground to heights. Objects should be transported using strong ropes, basket lifts, elevated vehicles or cranes, etc.

- At the edges and openings of high-altitude work areas, guardrails and warning signs should be installed to prevent accidental falls or missteps.
- Underneath high-altitude work areas, the ground must not be used for stacking scaffolds, planks or any other miscellaneous objects. Ground personnel are strictly prohibited from lingering or traversing directly underneath elevated operation area.
- Scaffolding, planks, workbenches, etc. for operation at heights must be appraised in advance for safety checks to ensure that the structure is firm and the scaffolding is not overloaded.
- On-site persons-in-charge and safety officers, upon discovering high-altitude workers not adhering to prescribed procedures, should immediately address the issue and demand corrective action. Failure to do so should result in the suspension of their work.

1.5 Transportation Requirements

It's essential to pass the certification as per UN38.3 (UN38.3: Section 38.3 of the Sixth Revised Edition of the Recommendations on the Transport of Dangerous Goods: Manual of Tests and Criteria) and SN /T 0370.2-2009 Rules for the inspection of packaging for export dangerous goods—— Part 2: Performance test (this product has been certified as a Class 9 hazardous material).

The products can be delivered directly to the site, meeting the transportation requirements for vehicles, ships, and other modes of transport. The transportation pack cases must be sturdy, and its exterior should comply with national standards while bearing labels such as "Handle with Care" and "Moisture Sensitive." Due to the influence of external factors such as temperature, transportation, and storage, the product specifications and parameters shall be based on the date of manufacture.

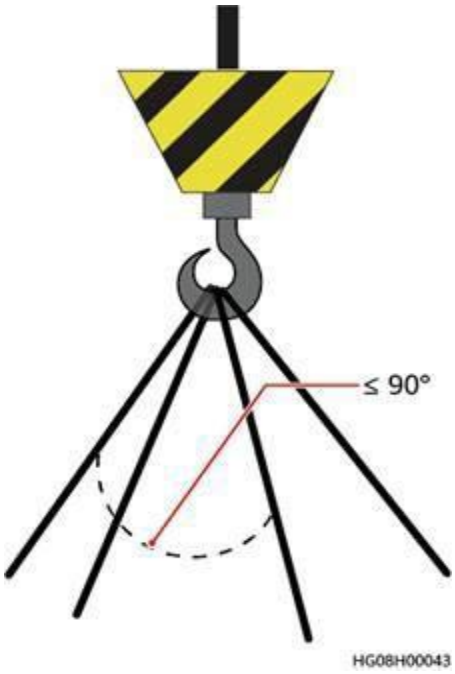
During transportation, the following should be avoided:

- Direct exposure to rain or snow, or immersion in water.
- Drops or mechanical impacts.
- Inversion or tilting.

1.6 Mechanical safety

Lifting safety

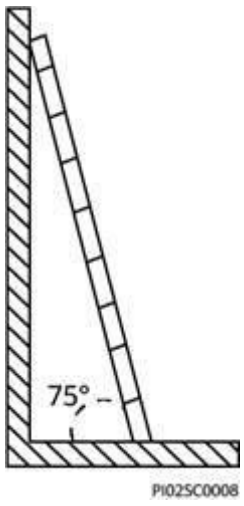
- Under no circumstances should one be allowed to walk beneath the lifting arm or the lifted object during the hoisting of heavy items.
- Individuals performing lifting tasks are required to complete pertinent training and pass the assessment before they can assume their duties.
- Lifting equipment must undergo inspection, and only when all tools are complete can they be used.
- Prior to conducting lifting tasks, make sure that the hoisting tools are firmly attached to a sturdy, weight-bearing fixture or wall.
- While conducting the lifting operation, make sure that the angle between the two ropes remains less than or equal to 90 degrees, as depicted in the diagram below.



- It is prohibited to drag the steel wire ropes or lifting appliance during lifting operations, and to use hard objects for impact.

Safety in the Use of Ladders

- In the event of possible electrical involvement in height-related tasks, either wooden or fiberglass ladders should be used.
- During the operation of a stepladder, the securing rope must be securely attached, and the ladder should be held in place by an assistant at all times.
- Before using a ladder, please ensure that it is in good condition and undamaged, with its weight-bearing capacity meeting the requirements. The use of ladders beyond their capacity limit is strictly prohibited.
- The ladder must be situated on a solid and secure footing. The inclination of the ladder should ideally be 75°, which can be measured using an angle square, as illustrated in the following diagram. In the operation of a ladder, ensure that the broad steps are positioned downwards, or employ safety measures at the bottom of the ladder to avert any slipping accidents.



- To reduce risks and ensure your safety while ascending a ladder, kindly follow the following recommended actions.
  - Keep your body balanced and stable.
  - The highest point where the operator's feet should be placed should not go beyond the fourth rung when counting downwards from the top of the ladder.
  - Ensure that your center of gravity does not deviate from the edge of the ladder frame.

Drilling Safety

The following safety considerations need to be taken into account when drilling in the ground:

Requirement

Do not drill holes in the equipment. Drilling may damage the electromagnetic shielding of the equipment, internal components and cables, and metal shavings from drilling can enter the equipment and short-circuit the circuit board.

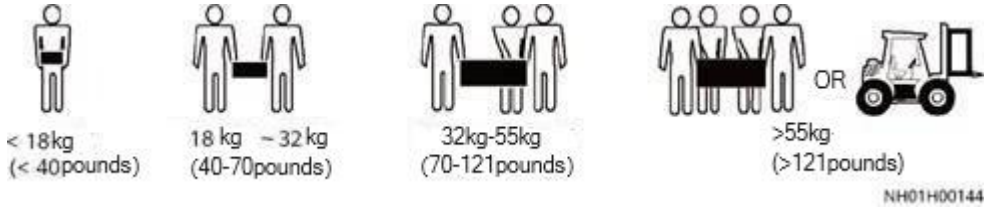
- Customer's consent should be sought before drilling.
- Goggles and protective gloves should be worn during drilling operations.
- The equipment should be shielded during drilling operations to prevent debris from falling into the equipment, and the debris should be promptly removed and cleaned up after drilling.

Safe Handling of Heavy Loads

Hazard

When pulling equipment out of the cabinet, be careful of equipment that may be unstable or heavy when mounted on the cabinet to avoid being crushed or smashed.

- Be prepared to carry heavy loads to avoid being crushed or sprained by them.



- Use protective gloves when handling equipment by hand to avoid injury.
- Avoid scratching the surface of the equipment or damaging parts and cables during handling.
- During forklift operations, it is essential to ensure that the forks are placed in the middle to avoid tipping. Prior to commencing movement, ensure the equipment is firmly tied to the forklift with ropes; a designated individual should oversee the operation while in motion.
- Exercise caution while moving the equipment to prevent any collisions or falls that may result in damage to the equipment.

1.7 Battery Safety

Fundamental Requirement

Before proceeding with battery operations, it is essential to thoroughly read and comprehend the safety precautions for the task, as well as master the correct methods for connecting the batteries.

Do not expose batteries to high-temperature environments or the vicinity of heat-generating devices, such as direct sunlight, open flames, transformers, heaters, or similar equipment. Battery overheating can potentially lead to fire or explosion.

It is strictly prohibited to disassemble, modify, or damage batteries (e.g., by inserting foreign objects, immersing them in water or other liquids), as these actions may lead to battery leakage, overheating, fires, or even explosions.

- In the event of electrolyte spillage, non-professional battery personnel should not approach the battery, and professional battery personnel should also wear safety goggles, rubber gloves, and protective clothing to prevent harm caused by the spilled electrolyte. Once battery leakage occurs, ensure that the skin or eyes do not come into contact with the spilled liquid. In the event that the leaked substance comes into contact with your skin or eyes, immediately rinse thoroughly with clean water and seek medical treatment at a hospital.
- Please use dedicated insulated tools for installation and wiring.
- Batteries should be handled in the desired direction, and inversion and tilting are strictly prohibited.
- The battery circuit shall remain disconnected during installation, maintenance, and other operations.
- Please use the specified type of batteries. Casual use of non-specified type of batteries may cause damage to the batteries.
- Please dispose of used batteries following local laws and regulations. Do not dispose of batteries as household waste. Improper disposal of batteries may lead to environmental pollution.
- The site must be equipped with the required fire-fighting facilities, such as fire sand and fire extinguishers.

Battery Installation Specification

The following basic precautions should be observed before battery installation to ensure safety:

- Batteries should be installed in a well-ventilated, dry, and cool environment, and kept away from heat sources, flammable materials, moisture, areas with substantial infrared radiation, organic solvents, and corrosive gases. Adequate fire prevention measures should also be implemented in the chosen location.

- Batteries should be placed horizontally and secured firmly.
- During the battery installation, pay careful attention to the positive and negative terminals. It is strictly prohibited to short-circuit the positive and negative terminals of the battery pack, as this can result in a battery short circuit.
- Please conduct regular inspections of the battery terminal screws to ensure they are tightened properly and free from looseness.
- It is strictly prohibited to place installation tools on the battery during battery installation.

Battery Short Circuit Protection

A short-circuited battery produces an instantaneous high current and releases a large amount of energy, which may cause personal injury and property damage.

To avoid short circuit, the battery should not be operated under electricity.

Special Scenarios of lithium-ion battery

Safety precautions for lithium-ion battery operation also include the following points.

Replacing a battery with an incorrect model poses a fire hazard.

- Only batteries of the manufacturer-recommended model should be used for replacement.
- When handling lithium-ion batteries, it is prohibited to invert, tilt, or collide them.
- The lithium-ion battery module shall remain disconnected during installation, maintenance, and other operations.
- When the ambient temperature in the energy storage compartment falls below the lower limit of the operating temperature (charging is prohibited at 0°C), charging should be avoided to prevent the formation of crystallization due to low-temperature charging, which can lead to internal short circuits in the battery.
- Do not exceed the battery temperature range to avoid affecting battery performance and safety.
- It is strictly prohibited to throw lithium-ion battery modules into a fire source.
- Upon completion of maintenance, used lithium-ion battery modules should be returned to the maintenance facility.

1.8 Maintenance and Replacement

High voltage is present during the operation of equipment and may result in electric shock, leading to fatalities, severe personal injuries, or substantial property damage. Therefore, before conducting any maintenance, it is essential to first power down the equipment and strictly adhere to the safety precautions listed in this manual and other relevant documents.

- Please perform maintenance on the equipment only after becoming familiar with and understanding the contents of this manual, and with the appropriate tools and testing equipment available.
- Before commencing any maintenance, ensure that the equipment is powered down first. Then, follow the instructions on the time-delay discharge label and wait for the specified duration to ensure that the equipment has fully discharged.
- During the maintenance, please make every effort to prevent unauthorized or unrelated personnel from entering the maintenance area. It is essential to erect temporary warning signs or barriers to isolate the workspace.
- If the equipment malfunctions, contact your dealer or the manufacturer for assistance in addressing the issue.
- The equipment must not be re-energized until the fault has been thoroughly addressed and resolved. Failing to do so may lead to the expansion of the existing fault or cause damage to the equipment.

2. Product Overview

2.1 Model Description

Product Model

This article deals with the following product models:

- BRES-1075-500
- BRES860-400
- BRES - 645-300

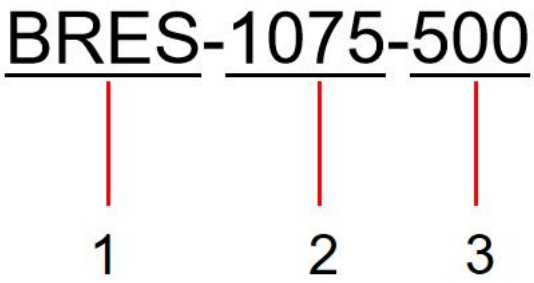


Fig. 2-1 BRES-1075-500 Model Identification

Table 2-1 Model Identification

Marking	Implication	Values
1	Series name	BRES: Containerized Energy Storage System
2	Battery capacity	1075: The nominal battery capacity is 1075 kWh
3	PCS capacity	500: The nominal PCS capacity is 500 KW

2.2 Label instructions

Symbols	Symbol names	Symbol meanings
	Electric shock hazard warning sign	High voltage is present when the equipment is powered up. All operations on the equipment must be carried out by trained and specialized electrical technicians.

	Ground marking	Location of protective ground wire connection

2.3 Functions and features

Product functions

The Containerized Energy Storage System is an intelligent and modular power supply equipment that integrates lithium-ion batteries and a multi-functional bi-directional energy storage converter (MPCS) into a single unit. For different application scenarios, the lithium-ion batteries, bi-directional DC/AC converters, MPPT PV DCDC modules, and other unit modules can be freely combined to achieve a range of functions such as grid-connected power supply, off-grid power supply, uninterrupted grid-connected and off-grid power supply, static reactive power compensation, harmonic suppression, among others. Furthermore, the system can integrate new energy sources, power grid, lithium-ion batteries, and loads, optimizing their configuration and utilization in a scientific manner. This integration provides users with green, environmentally friendly, noise-free electricity services that boast high reliability and safety. Additionally, the system features easy installation, user-friendly operation, and a wide range of potential applications.

Product Features

The energy storage system is a prefabricated, integrated energy storage product that combines a prefabricated modular structural system, power distribution system, monitoring system, environmental control system, fire protection system, and comprehensive wiring into a single unit. It boasts features such as safety, reliability, rapid deployment, low cost, high energy efficiency, and intelligent management.

- **Safe and reliable**

The system utilizes high-quality lithium iron phosphate (LiFePO4) battery cells that are widely recognized within the industry.

Air-conditioned design for long system life and smooth operation.

The system is designed with an IP54 protection rating, ensuring safe and reliable operation in harsh environments. The PCS (Power Conversion System) and battery string design eliminate circulation effects, thereby enhancing the system's reliability and maintainability.

The system incorporates a Battery Management System (BMS) and multi-layer protection settings for both AC (alternating current) and DC (direct current) to ensure safe operation.

The battery cells are separated using heat-insulating and insulating supports, and the module incorporates built-in fire protection mechanisms to guarantee the safety of battery system.

- **Efficient and convenient**

PCS and battery systems are modularized for easy installation, maintenance and expansion.

Direct integration of PV and diesel generator inputs facilitates intelligent management and control of multiple energy sources.

Integrated equipment that can be fixed or mounted on vehicles, offering convenient mobility.

Remote monitoring, device management, remote troubleshooting and data analysis.

- **Cost optimization**

Multi-functional capabilities: Grid-connected and off-grid uninterrupted power supply, dynamic capacity expansion, load shifting for optimized power usage, reactive power compensation, harmonic suppression, improvement of three-phase imbalance, enabling complementary use of multiple energy sources and scientifically configured operations.

Compact size and lightweight design, resulting in reduced land occupancy and installation costs.

Long service life and low failure rate, resulting in reduced operational and maintenance costs.

Maximizing the utilization of green energy, leading to savings on electricity expenses.

2.4 Appearance Description

Instruction

The following illustrations are based on the BRES-1075-500 if not otherwise noted.

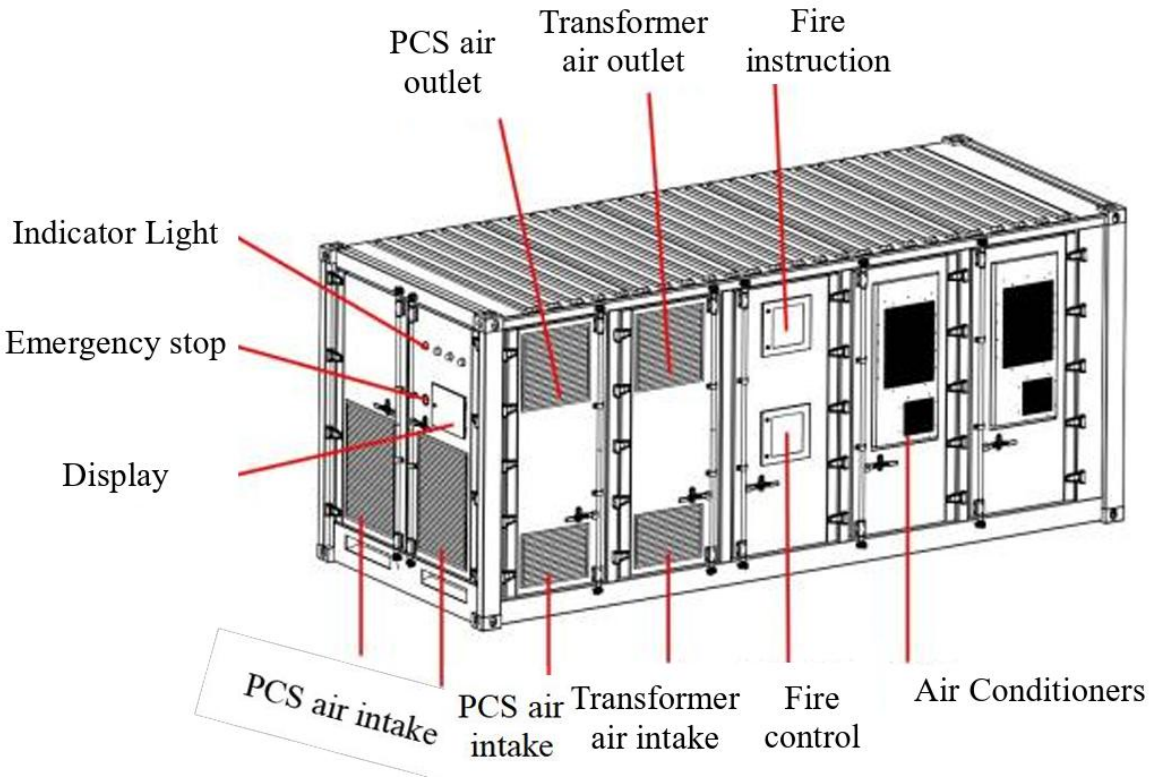

PCS air outlet
Transformer air outlet
Fire instruction
Indicator Light
Emergency stop
Display
PCS air intake
PCS air intake
Transformer air intake
Fire control
Air Conditioners

Fig. 2-4

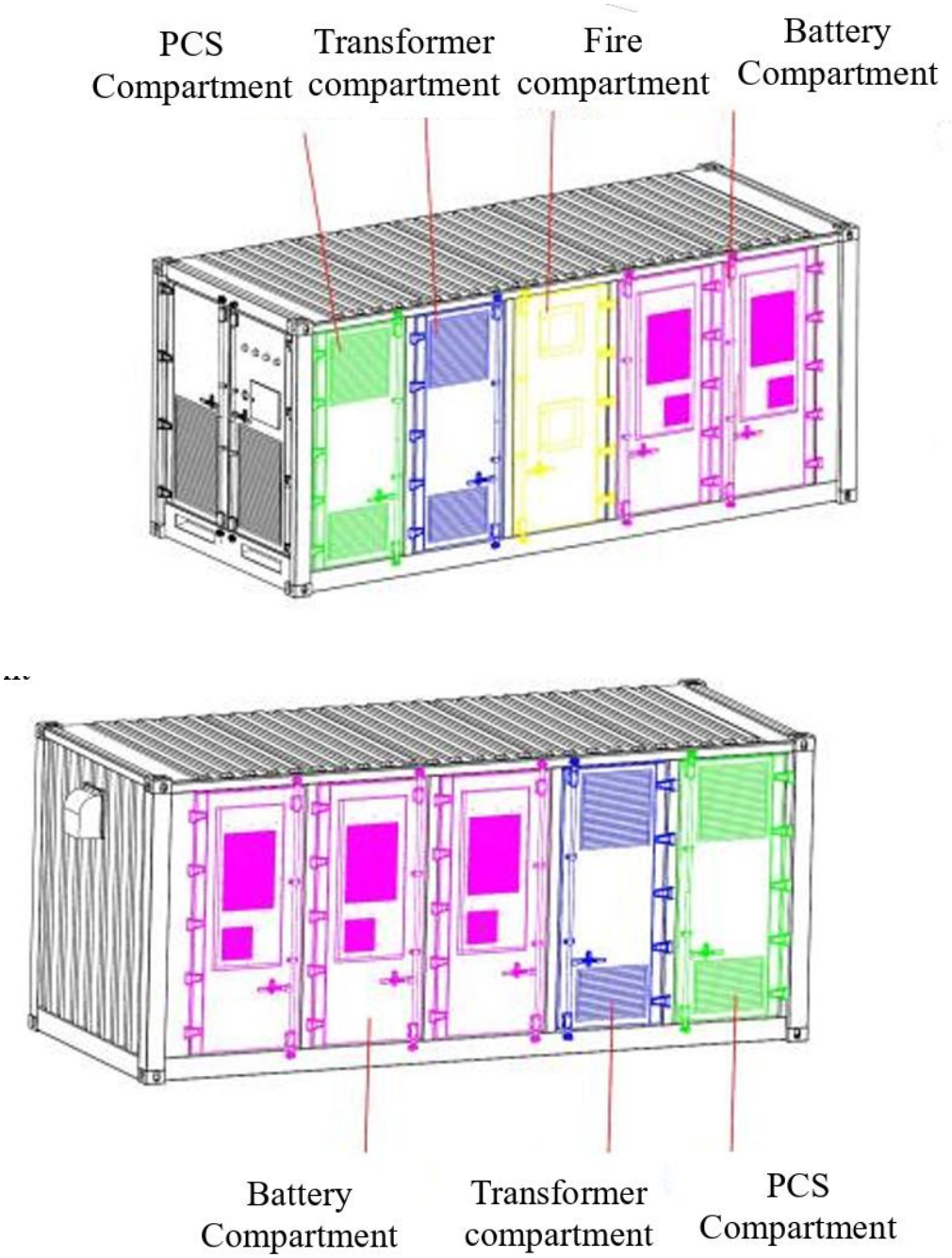

PCS Compartment
Transformer compartment
Fire compartment
Battery Compartment
Battery Compartment
Transformer compartment
PCS Compartment

Fig. 2-5

2.5 Container System Components

2.5.1 Electrical Compartment

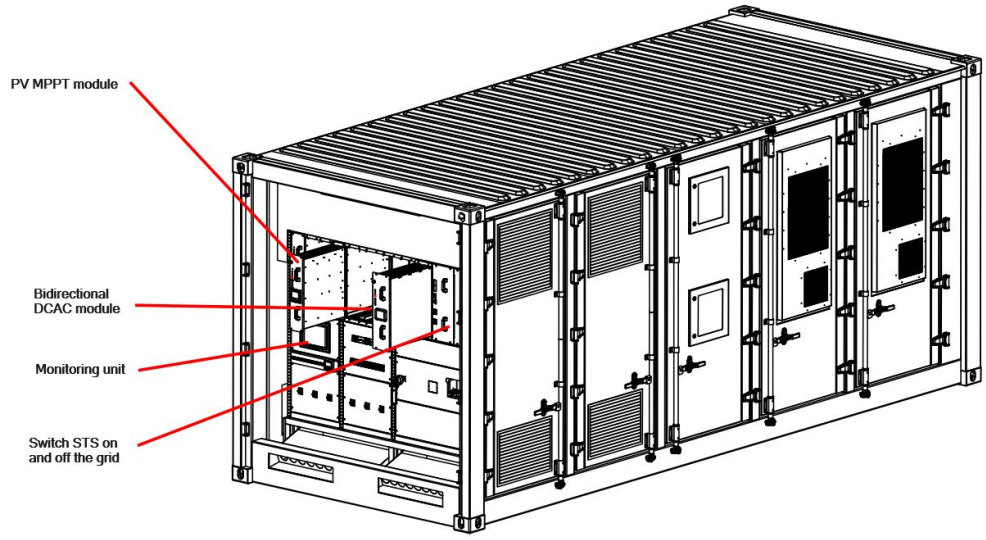


Fig. 2-6 Electrical Compartment Configuration

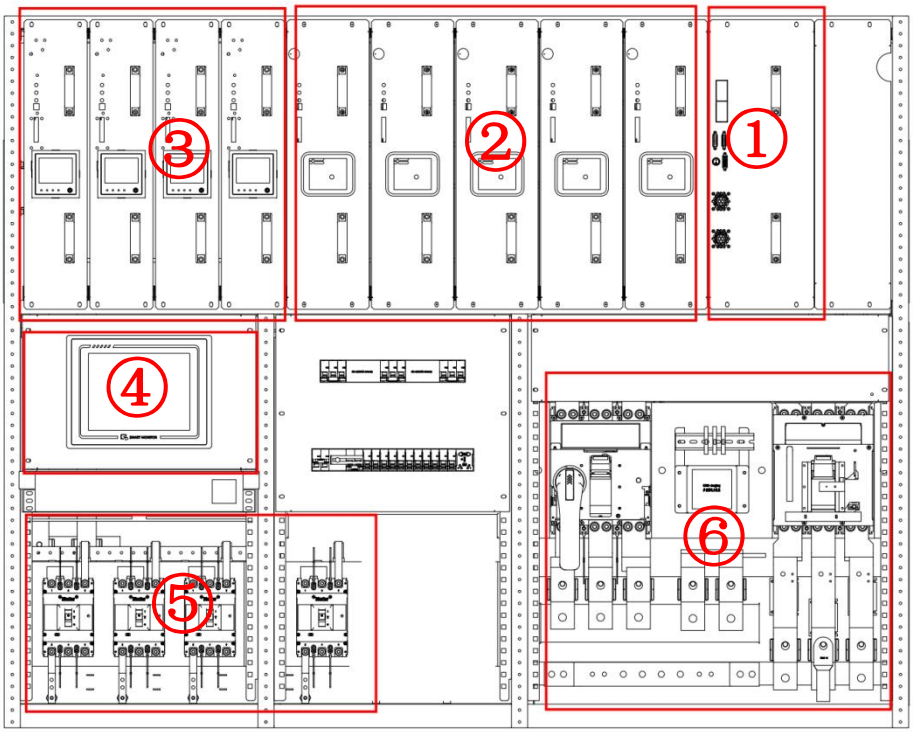


Table 2-2 Configuration of Electrical Compartment Components

No.	Name	Required/ optional	Description
1	STS module	Required	On-off-grid switch
2	PCM module	Required	Bidirectional converter module
3	PDMD module	Optional	PV DC module
4	Monitoring unit	Required	Operating screen
5	PV DC switch	Optional	
6	AC power distribution unit	Required	I/O AC switch

2.5.2 Battery compartment

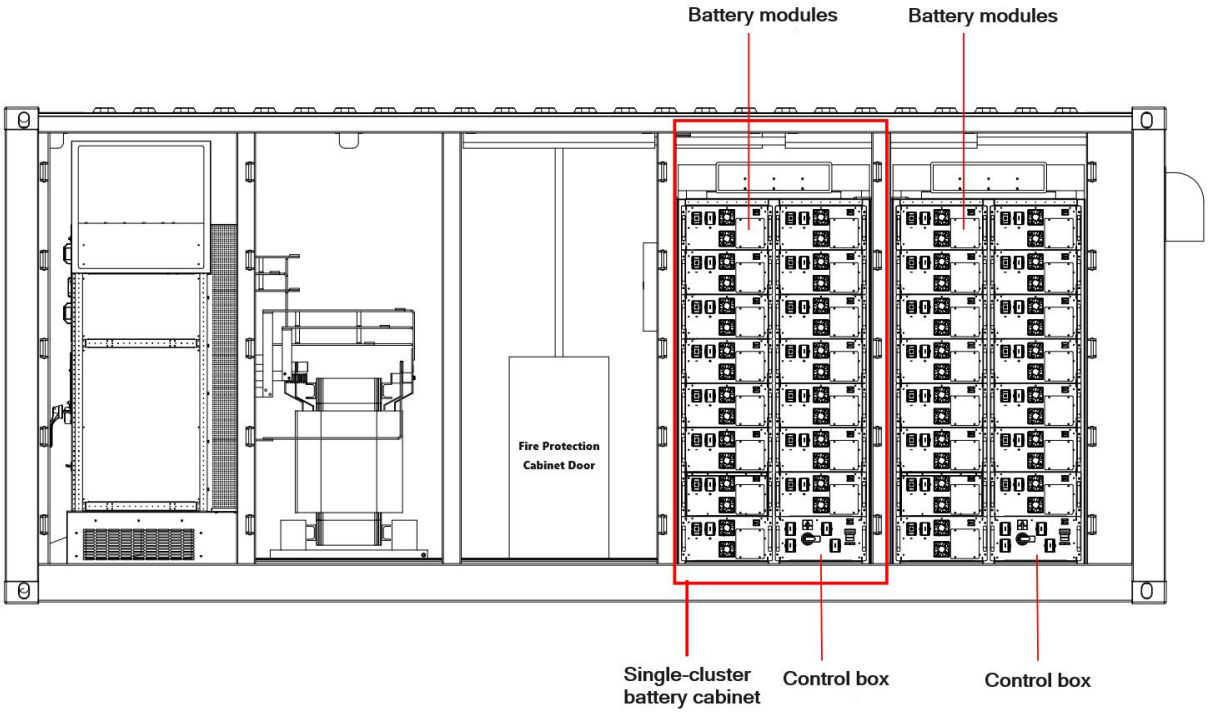


Fig. 2-8-1 External and Internal Configuration of the Battery Compartment

Table 2-3 Battery Compartment Component Configuration

Serial number	Name	Required/optional	Number of single energy storage system configurations	Description
1	Control box	Required	1	Includes BMS and charge/discharge control circuit
2	Battery pack & module	Required	15	Includes batteries, aerosol fire protection, fuse, and BMU

2.5.3 Transformer compartment

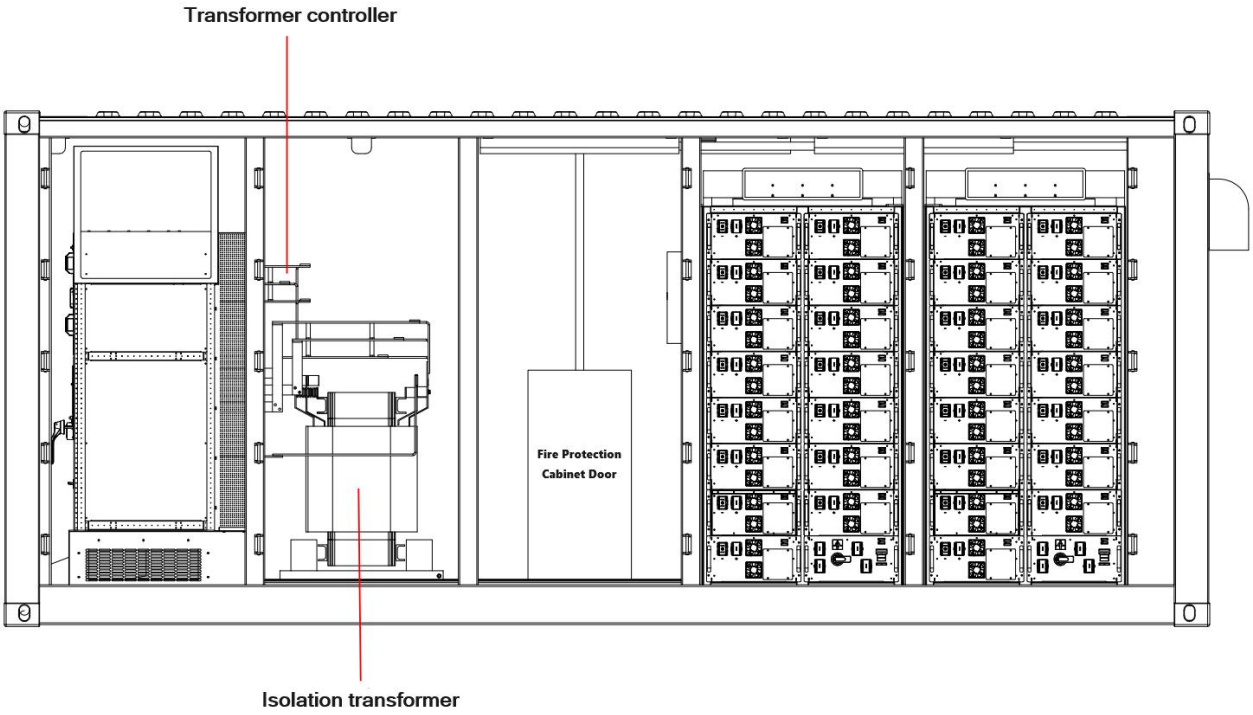


Fig. 2-8-2 External and Internal Configuration of the Transformer Compartment

No.	Name	Required/optional	Number of single energy storage system configurations	Description
1	Isolation transformer	Required	1	
2	Transformer controller	Required	1	Detection of transformer temperature and other information

2.5.4 Fire protection compartment

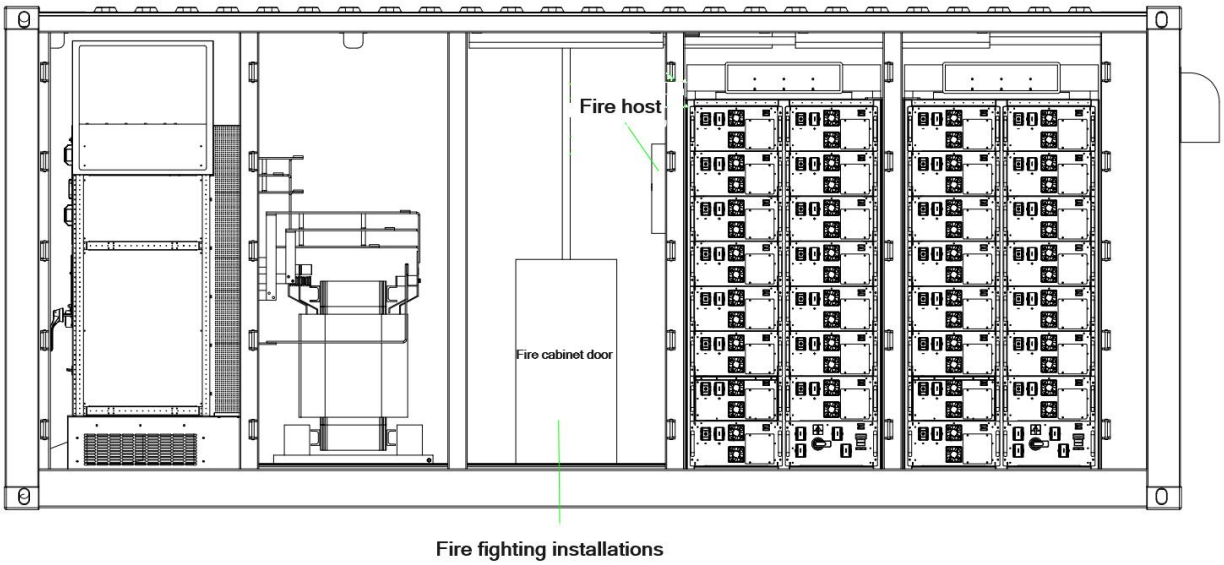


Fig. 2-8-3 External and Internal Configuration of the Fire Protection Compartment

Serial number	Name	Required/optional	Number of single energy storage system configurations	Description
1	Fire extinguisher	Required	1	
2	Fire controller	Required	1	Control based on fire logic

2.6 System and component introduction

2.6.1 System introduction

Table 2-4 Battery Compartment Components Configuration

Parameter table	BRES-1075-500	BRES-645-300	BRES-1075-500
AC parameters (grid-connected)			
Rated output power (kW)	500	300	400
Maximum output power (kW)	550	330	440
Rated grid voltage (V)	3W+N+PE, 380/400V		
Grid voltage range	-15%~+10%		
Rated grid frequency (Hz)	50/60		
Grid frequency range (Hz)	±2		
Output current harmonics	≤3% (rated power)		
DC component	<0.5%In		
Power factor range	-0.9~+0.9		
Overload capacity	105%]: Continuous operation, (105%~120%]: 10 min, 120%): Halt		
AC parameters (off-grid)			
Rated output power (kW)	500	300	400
Maximum output power (kW)	550	330	440
Rated output voltage (V)	3W+N+PE, 380/400V		
Output voltage harmonics	3% (linear full load)		
Rated frequency (Hz)	50/60		
Overload capacity	105%]: Continuous operation, (105%~120%]: 10 min, 120%): Halt		
Battery parameters			
Cell type	Lithium iron phosphate		
Capacity per battery cabinet (kWh)	215.04		
Number of battery cabinets	5	3	4
Capacity of battery	1075.2	645.12	860.16

system (kWh)			
Rated operating duration (h)	2 (other durations can be selected by changing the number of battery modules)		
Battery life	25°C 0.5C/0.5C 100%DOD EOL80% ≥ 6000 cycles		
Efficiency			
Maximum efficiency	93%		
Protection			
AC switch	W/		
PV electrically operated AC switch	W/		
Grid monitoring	W/		
Surge protection	W/		
Basic parameters			
Dimensions (Width * Depth * Height) (mm)	6058*2438*2591	3000*2438*2591	6058*2438*2591
Weight (kg)	16000	10000	13000
Isolation Method	Built-in isolation transformer		
On-off-grid switching device	STS		
Protection Class	Outdoor type IP54		
Working Temperature Range	-20~55°C (>45°C To be derated)		
Relative Humidity (no condensation)	0~95%		
Temperature Control Method	Air Conditioners		
Maximum Working Altitude (m)	4000 (>2000 derating)		
Display	HMI		
Communication Interface	RS485, CAN, LAN		
Communication Protocol	Modbus-RTU, Modbus-TCP, CAN2.0B		

2.6.2 Components

2.6.2.1 Static switch STS

Through the intelligent control of the static switch module, the working mode switching of the PCS system can be implemented. Under normal circumstances, the PCS system is in a grid-connected discharge state, at which time the energy generated by the PCS system is supplied to the load and the grid. If the load

power is greater than the set output power of the PCS system, the exceeding portion of the power will be provided by the grid. When the power grid suddenly drops out, the static switch is disconnected and the PCS system switches to the off-grid mode, while the loads are powered by the PCS system; when the power grid is back to normal, the PCS system switches back to its original working state. When the PCS system is in the grid-connected charging state, where the load is powered by the grid, the PCS system utilizes the excess electrical energy beyond the load to charge the battery. When the power grid suddenly drops out, the static switch is disconnected and the PCS system switches to the off-grid mode, while the loads are powered by the PCS system; when the power grid is back to normal, the PCS system switches back to its original working state.

Fig. 2-9 Static Switch Appearance

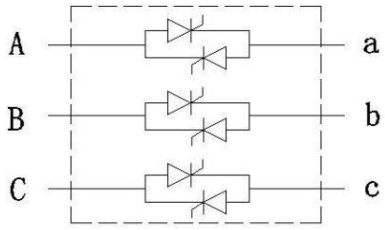


Fig. 2-10 Static Switch Schematic

Table 2-5 Technical Data of Static Switch

Model grade	STSD150	STSD600
Rated power	300KW	600KW
Rated grid voltage	AC 380V/400V	
Input voltage range	-20%~+15%	
Output voltage range	-20%~+15%	
Rated current	454A	909A
Overload capacity	110%	
Rated frequency	50Hz/60Hz	
Frequency Range	±5Hz	
Switching time	≤10ms	
Output line system	3W +PE	

Efficiency	99.50%	
Noise	<75 db	
Installation method	modular rack-mounted	
Communication method	CAN/RS485	
Cooling method	Air-cooled, intelligent fan speed regulation	
Protection Class	IP20	
Size W*D*H (mm)	560*530*177	560*530*352
Weight	30kg	50kg

2.6.2.2 PCS power modules

The PCM series PCS power modules from Sicon facilitate the creation of small to medium-sized energy storage systems through effortless parallel connection of several units. They boast distinctive attributes such as adaptable module placement, user-friendly installation, and convenient maintenance. The modules employ a rack-mounted installation method, featuring compact size, lightweight design, and support for hot-swappable module replacement during operation. They offer a wide DC voltage range and exhibit strong grid adaptability and load adaptability.

Fig. 2-11 Appearance of PCS Power Module

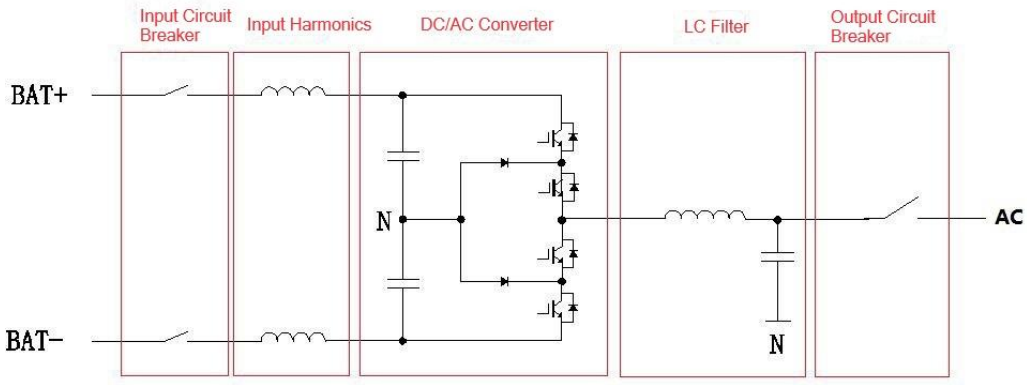


Fig. 2-12 PCS Power Module Schematic

Table 2-6

Model grade		PCM50	PCM100
DC side parameters	Voltage range	DC580V~DC900V (with isolation transformer) DC650V~DC900V (without isolation transformer)	
	Rated power	50KW	100KW
	Maximum current on DC side	85A	170A
AC grid-connected parameters	Output line system	3W / 3W+N	
	Rated power	50KW	100KW
	Rated voltage	AC 380V/400V	
	Rated current	75A	151A
AC grid-connected parameters	Voltage range	-15%~+10%	
	Rated frequency	50Hz/60Hz	
	Frequency Range	±2Hz	
	Power factor	-0.9~+0.9	
	Output harmonics	≤3%	
	Charge/discharge conversion time	<100ms	
AC off-grid parameters	Output line system	3W+N+PE	
	Rated power	50KW	100KW
	Rated voltage	AC 380V/400V	
	Rated frequency	50Hz/60Hz	
	Rated current	75A	151A
	Voltage accuracy	1%	
	Frequency accuracy	±0.2Hz	
	Output voltage harmonics	≤3% linear full load	
	Dynamic response	20ms	
	Unbalanced load capacity	100%	
	Overload capacity	≤ 105%: Long-term operation; (105,110]: Running time ≥10min (110,120]: Running time ≥1min	≤ 105%: Long-term operation; (105,110]: Running time ≥10min > 110%: Halt

Ambient	operating temperature	-20°C~55°C (>45°C derating)	
	Storage temperature	-40°C~70°C (without battery)	
	Relative humidity	0%RH~95%RH, no condensation	
	Operating altitude	@45°C, 2000m; 2000m~4000m derating use	
	Noise	<75 db	
Others	Communication method	CAN/RS485	
	Isolation Method	Non-Isolation Type	
	Protection Class	IP20 (internal "three protections" treatment)	
	Cooling method	Air-cooled, intelligent fan speed regulation	
	Maximum efficiency	98.5%	
	Size W*D*H	560*530*133	560*530*177
	Weight	30kg	50kg

2.6.2.3 PDMD power modules

The function of the PDMD module is to filter and boost the electrical energy emitted by the PV panels for use by bidirectional DC/AC converters or to store energy for lithium-ion batteries. The low voltage end of the DC-DC converter is connected to the PV panel and the high voltage end is connected to the Li-ion battery. The module contains a PV controller, which uses the maximum power point tracking technology to extract the maximum power from the PV array to ensure the maximum utilization of solar energy.

Fig. 2-13 PDMD Module Appearance

Table 2-7 Technical Parameter Diagram of PDMD Power Module

Model grade		**PDMD50**
Electrical	Operating voltage range	DC200V~DC700V

parameters	MPPT voltage range	DC370V~DC700V
	Rated power	50KW
	Maximum current per channel	135A
	Number of MPPTs	1~3
	Voltage regulation accuracy	<1%
	Output ripple	<0.5%
	Overload capacity	105% load, long-term operation
Others	operating temperature	-20°C~55°C (>45°C derating)
	Storage temperature	-40°C~70°C (without battery)
	Relative humidity	0%RH~95%RH, no condensation
	Operating altitude	@45°C, 2000m; 2000m~4000m derating
	Noise	<75 db
	Communication method	CAN/RS485
	Isolation Method	Non-Isolation Type
	Protection Class	IP20
	Cooling method	Air-cooled, intelligent fan speed regulation
	Maximum efficiency	98.2%
	Size W*D*H	560*530*133
	Weight	30kg

2.6.2.4 Lithium-ion Battery Systems

The battery system in the containerized energy storage system belongs to the energy storage part, and it consists of a total of 1~5 independent battery clusters, with each battery room corresponding to 1 battery cluster. Each battery cluster is composed of15 battery modules and 1 high-voltage control box.

The battery module consists of a 3.2V280Ah single lithium iron phosphate cell, which constitutes a battery module. The module has a built-in BMU system, which collects the voltage and temperature of the single cell and manages cell equalization to ensure the normal operation of the whole module safely and efficiently.

Fig. 2-14 Battery Module Appearance

Table 2-8 Technical Data of Battery Module

Parameter table	EP280-1P16S
Capacity	280Ah
Combination approach	1P16S
Rated voltage	51.2V
Energy rating	14.336kWh
Maximum continuous charging current	140A (0.5C)
Maximum continuous discharge current	140A (0.5C)
Voltage range	30~43.8V
Operating ambient temperature	-20°C~60°C
Weight	115kg
Size (W*D*H)	474mm*601mm*230mm
Communication method	CAN
Cooling method	Intelligent air cooling

2.6.2.5 Temperature control system

See air conditioning specifications for detailed parameters

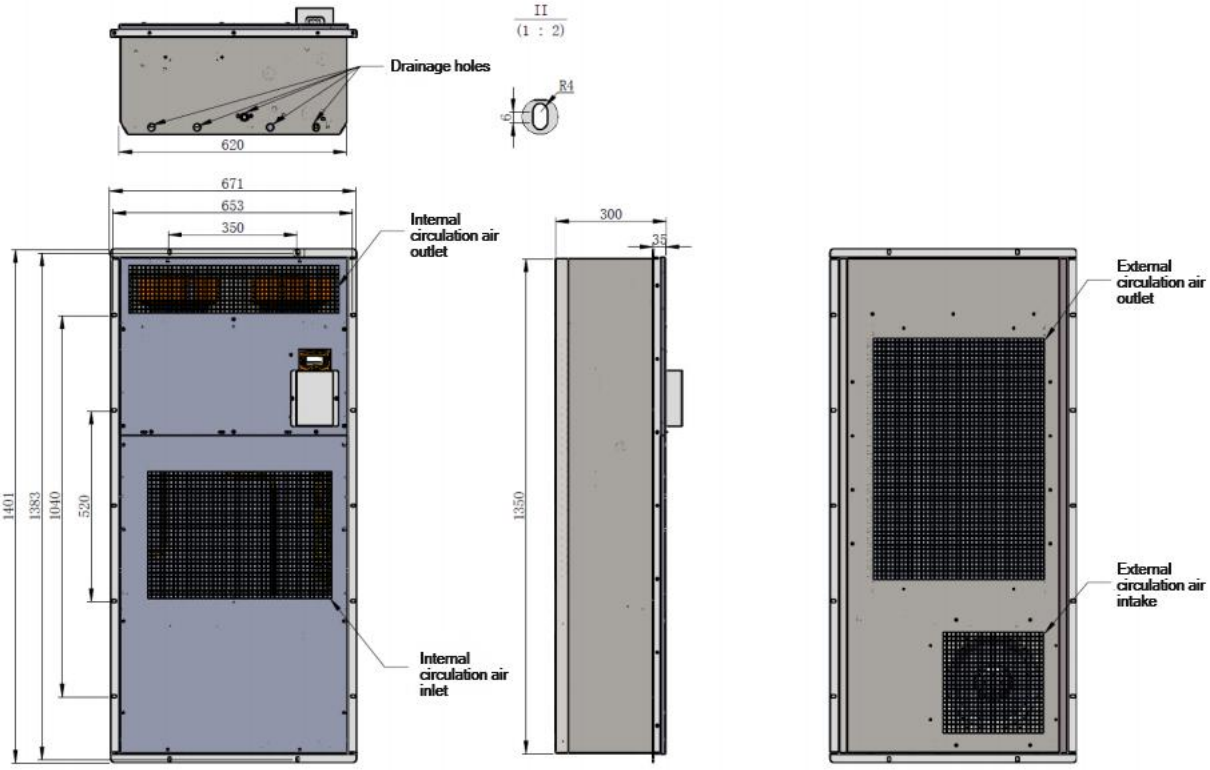


Fig. 2-15 Air Conditioner Appearance

Table 2-9 Technical Data of Air Conditioning

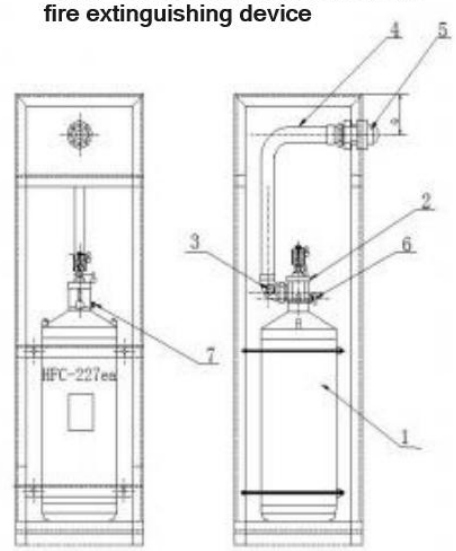
Item	Unit	PRAMS
Operating ambient temperature	℃	-40 to +55
Rated AC input power supply		220±10%VAC~50Hz
Cooling capacity (L35/L35)	W	5000
Rated AC input power (L35/L35)	W	1900
Rated current (L35/L35)	A	8.6
Heating capacity	W	4000
Overall dimensions of cabinet (H*W*D)	mm	1350*620*300

2.6.2.6 Fire protection system

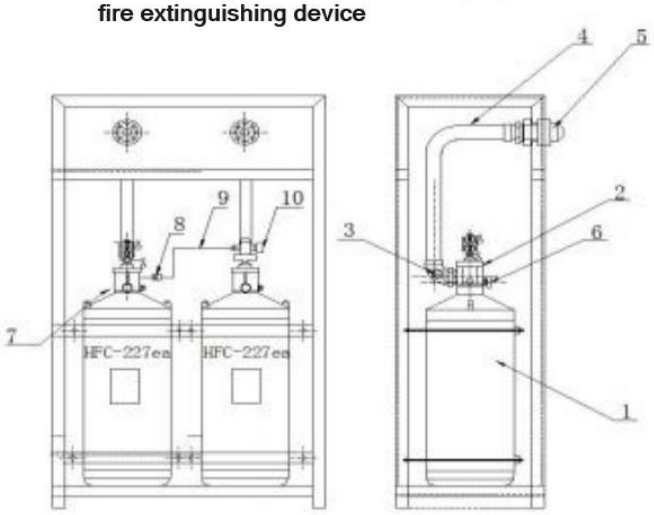
Cabinet type																
No.	Model	Device parameters (height with valve)			Pressure		Material	THE MAXIMUM FILLING DENSITY KG/M3	Drive medium	Safe bleed value	Nozzle		Ejection time	Full submerged extinguishing capacity m^3 (charge density calculated as 1.0)			Aptitude
		DIAMETER (MM)	HEIGHT (MM)	THICKNESS (MM)	Work pressure	Filling pressure					Model	Screw thread		Archives	Switchroom	Machine room	
1	GQQ40/2.5	350	610	6	4.2T	2.5MPa	HP295	≤1.0	Nitrogen	5.9 ± 0.295	QPT40/32	M48*2	≤10s	50	57	65	3C
2	GQQ70/2.5		915	6										89	100	113	
3	GQQ90/2.5		1125	6										114	129	145	
4	GQQ120/2.5		1430	6							QPT50/40	M56*2		150	171	194	
5	GQQ150/2.5	400	1410	7							QPT63/50	M68*2		190	214	243	
6	GQQ180/2.5	400	1660	7										229	258	292	

No.	Model	Container valve		Signal feedback	High pressure hose			Driver	Start-up mode	Working environment	Cabinet dimensions (mm)	Wisdom function
		Imported thread	Export thread		Model	Thread	Length					
1	GQQ40/2.5	PZ56	M48*2	QXF0.8/4.2 Nominal pressure : 4.2Mpa Action pressure : 0.8M Contact capacity : 24V 5A Thread : R1 / 2	QRG32/4.2	M48*2	L:700	Driving device : QDQ90N Voltage : DC24 Current : 1.5A Thread : M8 * 1.5	Electric start emergency start	0 ℃ -50℃	500×430×1400	Yes
2	GQQ70/2.5	PZ56	M48*2			M48*2	L:700				500×430×1400	
3	GQQ90/2.5	PZ56	M48*2			M48*2	L:700				500×430×1700	
4	GQQ120/2.5	M56*2	M56*2		QRG40/4.2	M56*2	L:750				600×500×2000	
5	GQQ150/2.5	M80*2	M68*2		QRG50/4.2	M68*2	L:800				600×570×2000	
6	GQQ180/2.5	M80*2	M68*2			M68*2	L:850				700×570×2350	

Single cabinet heptafluoropropane fire extinguishing device



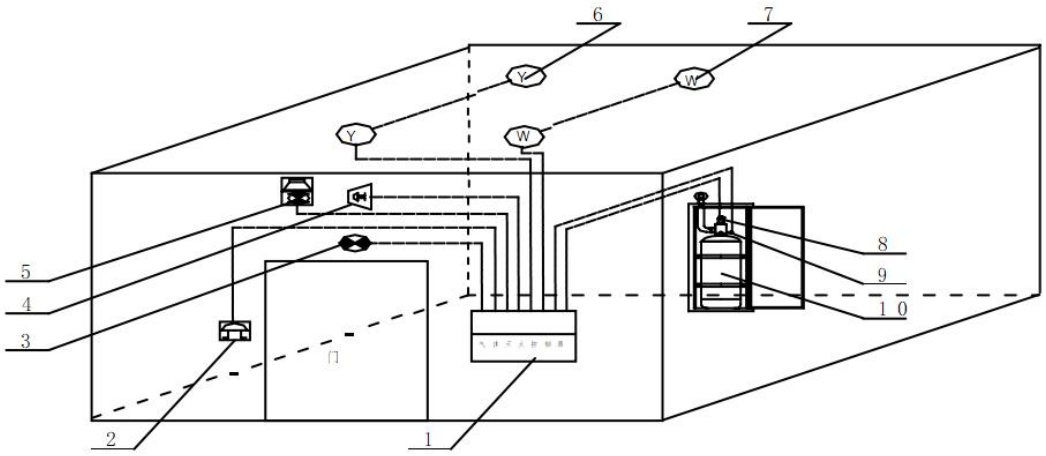
Double-body cabinet heptafluoropropane fire extinguishing device



1.Fire extinguishing agent bottle group 2.Solenoid container valve 3.Pressure signal 4.Connecting hose 5.Nozzle 6.Pressure gauge 7.Safety device 8.Gas check valve 9.Drive pipeline 10.Plugging cap

- **Operating Procedure**

The system is designed with three starting modes: automatic, manual and mechanical emergency operation. The operation control procedure is shown in the figure



1.Gas fire extinguishing controller 2.Manual control box 3.Release indicator light 4.Fire alarm bell 5.Sound and light alarm 6.Smoke detector 7.Temperature detector 8.Solenoid start valve 9.Container valve 10.Heptafluoropropane cylinder

- **Automatic startup**

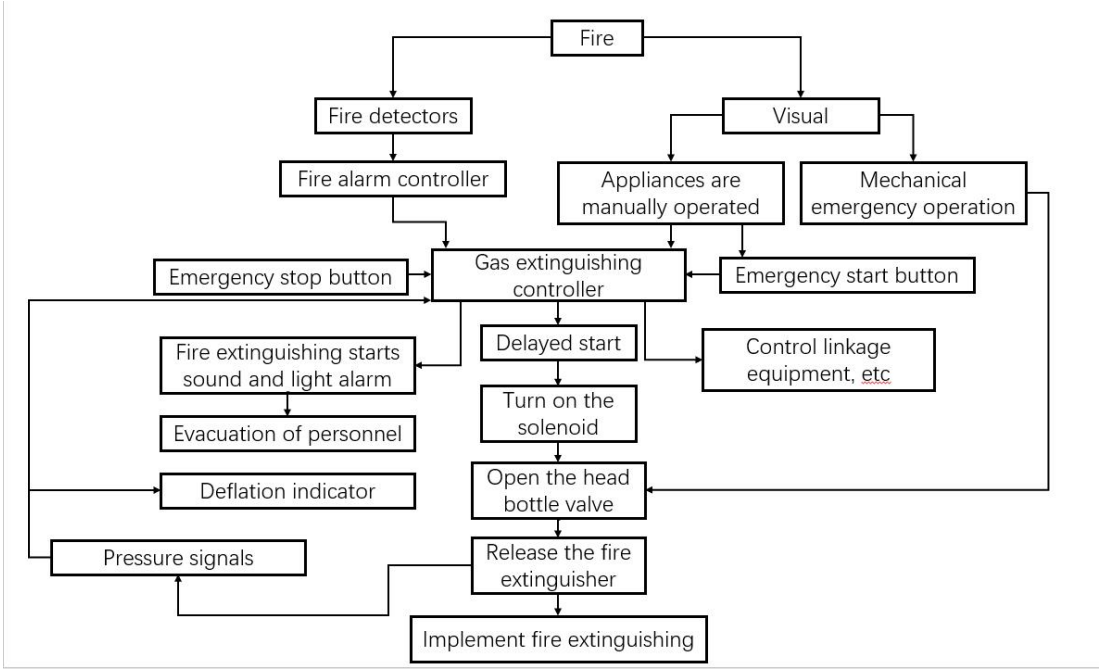
Upon simultaneous fire signals from smoke detectors and heat detectors, the controller initiates audible and visual fire alarms and issues commands to deactivate associated devices, such as fans and fire dampers. The system then autonomously proceeds to issue fire suppression instructions, initiate the fire extinguishing apparatus, and release fire extinguishing agent to extinguish the fire without requiring human intervention or operation.

- **Manual startup**

When the fire detector sends a fire alarm signal, the controller immediately initiates audible and visual fire alert signals but does not activate the fire suppression system. It requires human observation and confirmation of the fire. Upon verifying the occurrence of a fire, pressing the "Emergency Start Button" located outside the protected area or on the controller's operation panel will initiate the fire suppression system, releasing the fire extinguishing agent for fire suppression.

- **Emergency startup**

In the event that both automatic and manual startup fails, and upon personnel's determination that a fire has occurred, they should immediately notify all individuals present to evacuate the site. Only after confirming the evacuation of all personnel from the site should the fire suppression system be manually activated using the mechanical emergency operation provided, releasing the fire extinguishing agent for fire suppression.



2.7 Operating principle

2.7.1 Circuit block diagram

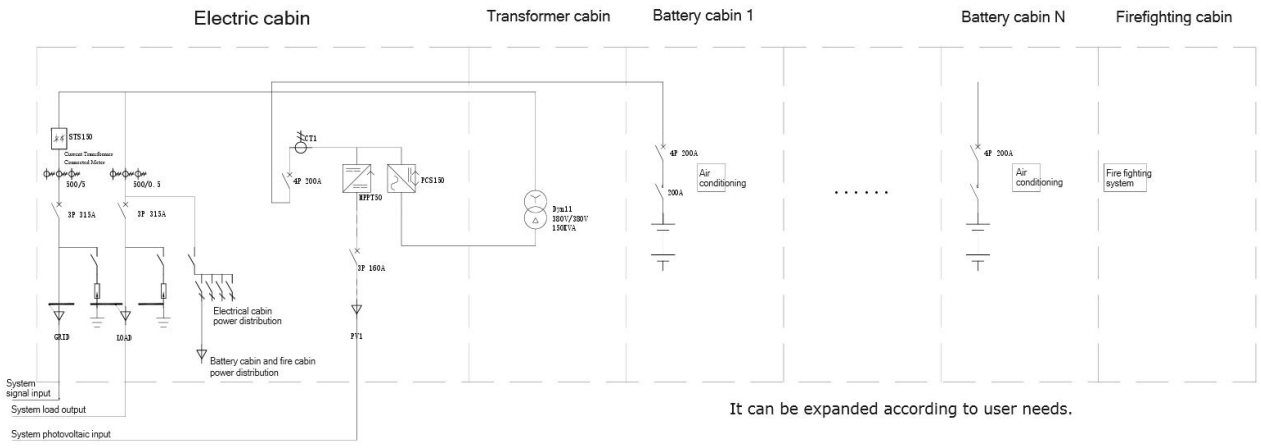


Fig. 2-16. BRES-1075-500 Circuit Block Diagram

2.7.2 Operating mode

The energy storage system operates in three distinct modes: The PCS, the self-generation-and-consumption mode, and the backup power mode.

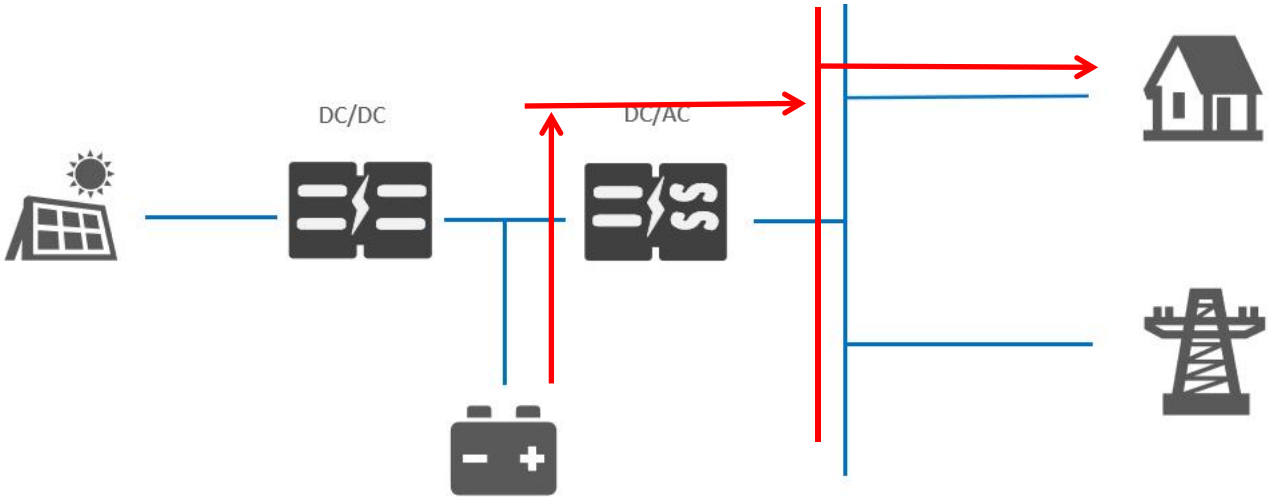
Table 2-10 Operating Mode Description

Operating mode	Description
PCS mode	Normal mode of use.
Self-generation-and-consumption mode	When PV modules are available and effective, they are given priority to supply power to the loads. In cases where the power output from the PV modules is insufficient, the system draws power from the grid or the battery storage to supplement the energy needs.
Backup power mode	Priority is given to ensuring that the battery remains fully charged. Meanwhile, grid power takes precedence in supplying electricity to the loads.

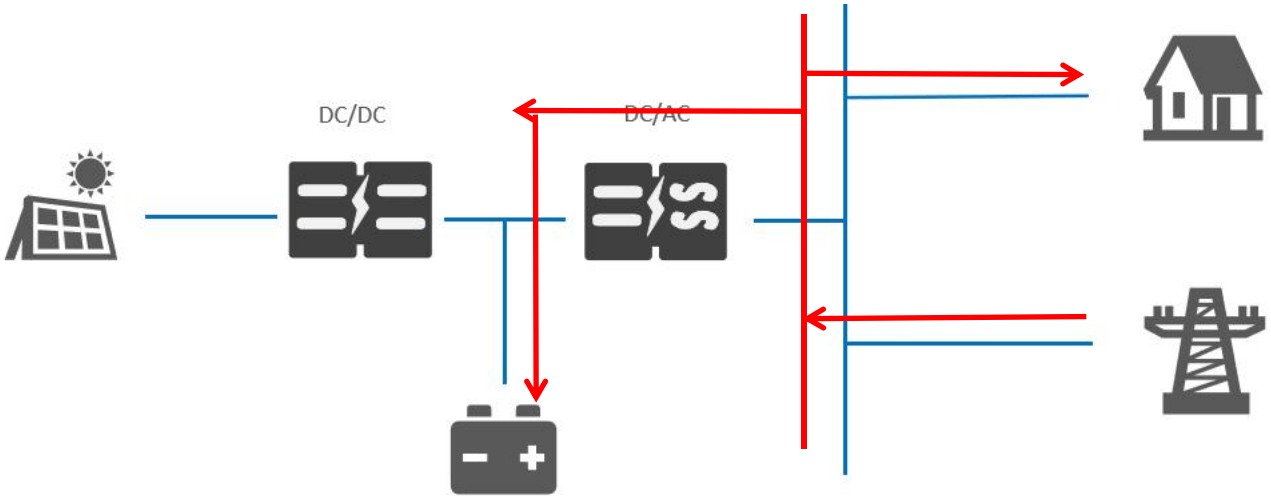
2.8 Typical applications

2.8.1 Peak-load shifting

- Without the presence of PV modules, during peak electricity price periods or peak electricity consumption periods, the system operates in grid-connected discharge mode;

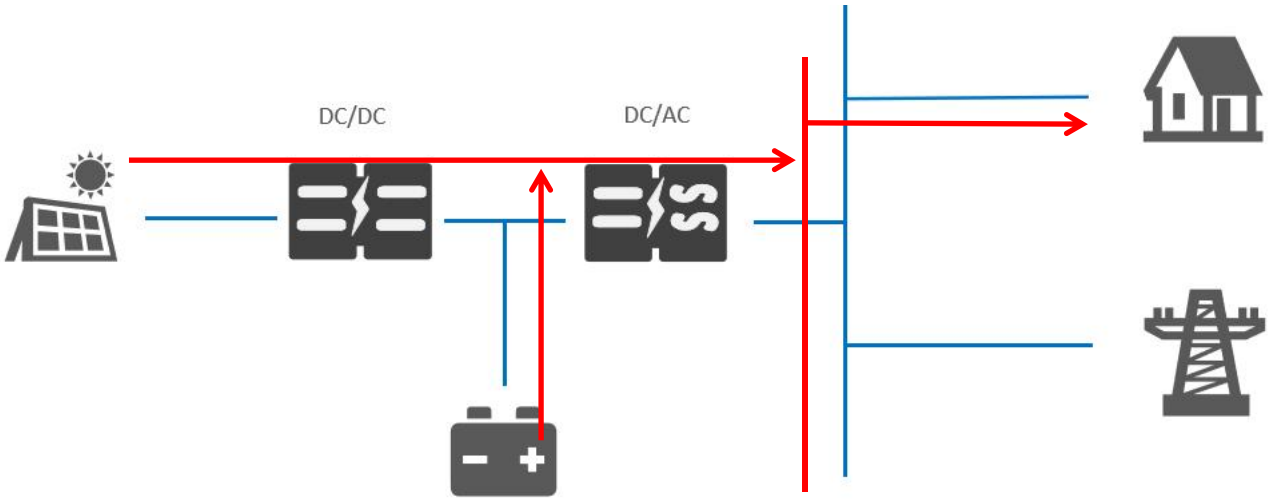


- Without the presence of PV modules, during off-peak electricity price periods or low electricity consumption periods, the system operates in grid-connected charging mode;

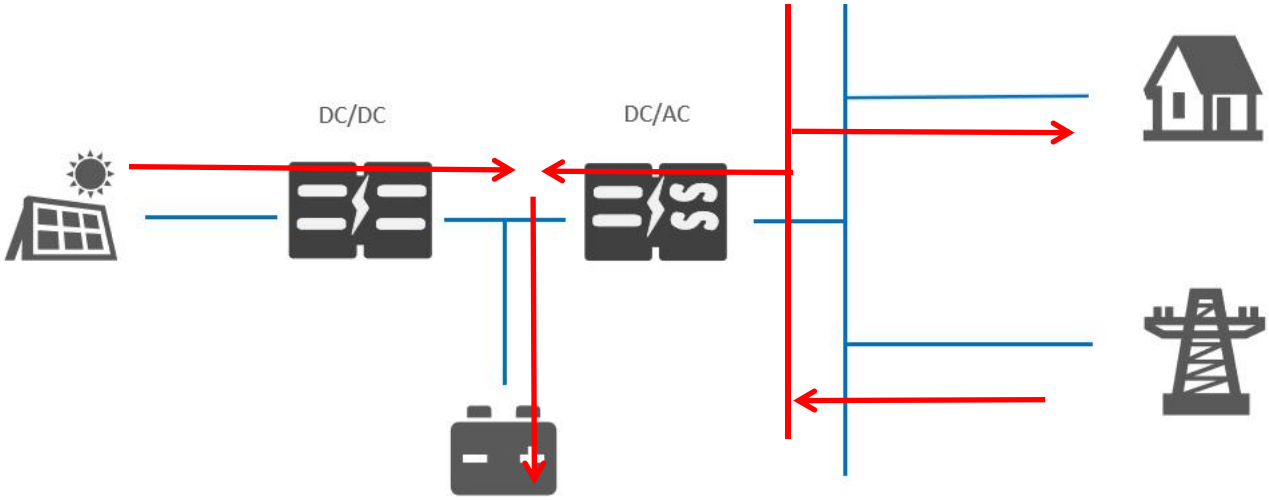


- In the presence of PV modules, the energy storage system operates based on peak and off-peak electricity price schedules or load peak and valley strategies for charging and discharging;

1) With the presence of PV modules, during peak electricity price periods or peak electricity consumption periods, the system operates in grid-connected discharge mode;

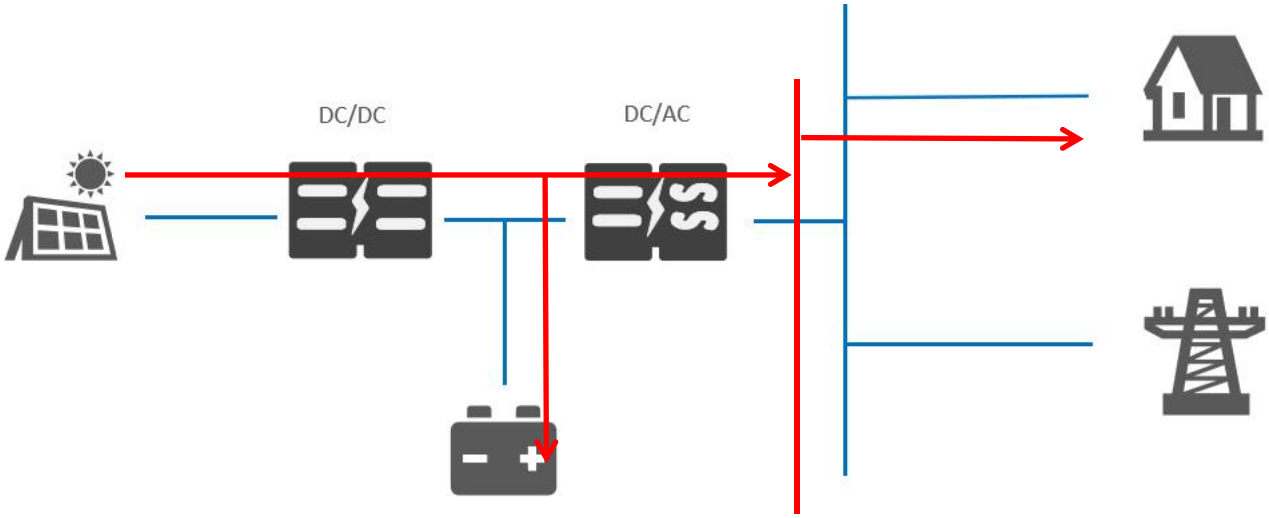


2) With the presence of PV modules, during off-peak electricity price periods or low electricity consumption periods, the system operates in grid-connected charging mode;

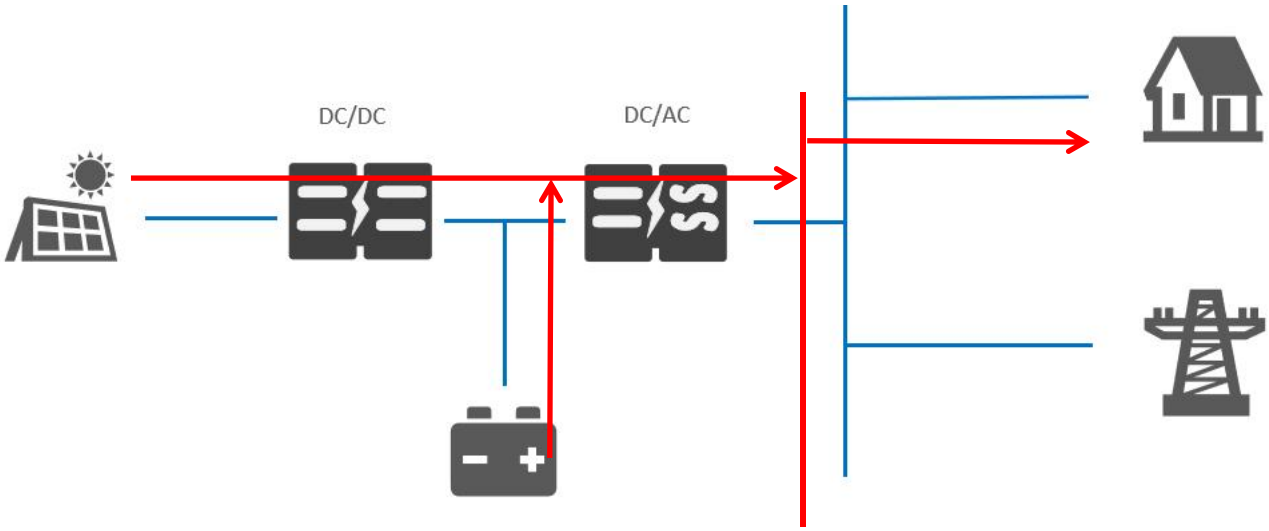


3) In the presence of PV modules, when the system is not operating during peak and off-peak pricing periods or load peak and valley strategies, it operates in the self-generation-and-consumption mode;

① When the power output from PV generation is greater than the load power, the surplus power is used to charge the battery;

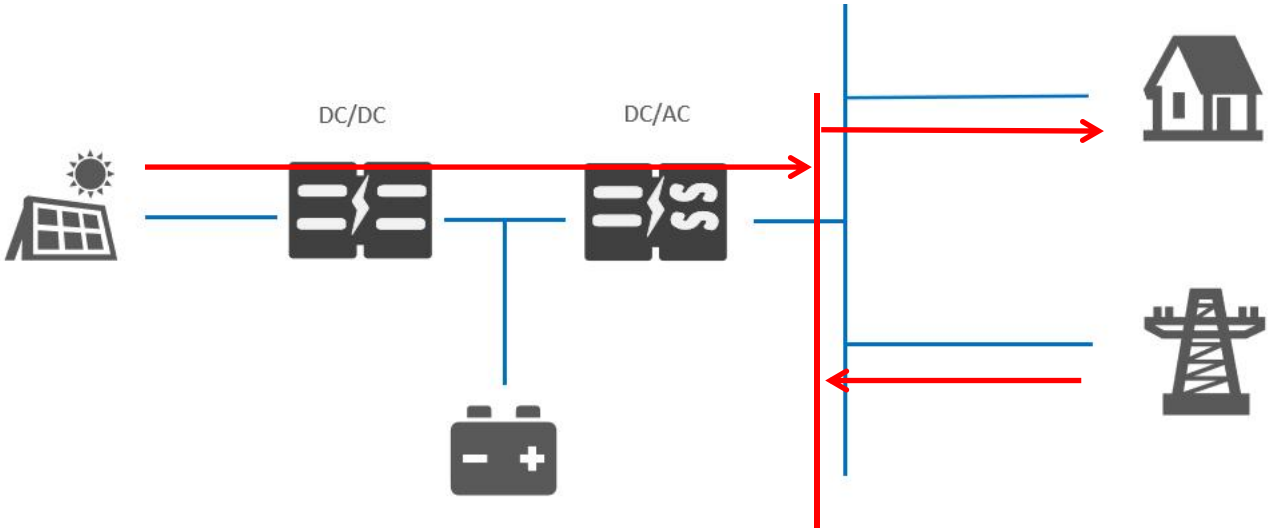


② When the power output from PV generation is less than the load power, the battery and PV system work together to supply the required power.



2.8.2 Peak power limit

- A limit is set for the grid power value. When the load exceeds the predefined power value, the energy storage system supplements the remaining power;


DC/DC
DC/AC

3. Site requirements

3.1 Site selection requirements

The energy storage system is suitable for general outdoor scenarios. The site selection requirements are as follows:

- There should be convenient transportation conditions and reliable fire protection measures at the station.
- The site should meet the immediate space requirements and provide room for expansion based on the full lifecycle needs.
- The soil is in good condition and the ground is solid. Areas with adverse geological conditions such as rubber soil, soft soil layers, prone to water accumulation, and sinking should be avoided.
- Choose well-ventilated locations.
- Choose a site away from strong vibrations, noise, and electromagnetic field interference.
- Avoid places with existing underground facilities whenever possible.
- The site should be located at a distance from places that generate dust, oil fumes, harmful gases, or locations where corrosive, flammable, or explosive materials are produced or stored.
- The distance from airports, landfill waste disposal sites, river banks, coasts or dams should not be less than 500 m.
- An open location should be chosen to ensure that there are no obstacles within 10 m of the site.
- Keep a distance of at least 50 m from residential areas to avoid noise pollution.
- Installation location should not be in low-lying areas. The installation horizontal plane should be higher than the historical highest water level in the area.

3.2 Foundation requirements

Concrete platforms and trenches should be constructed on the selected ground before installing the equipment. Foundation construction requirements are as follows.

- The foundation dimensions meet the requirements for cabinets installation and bearing capacity.
- The strength of the supporting foundation is more than 100 kg/cm2 on average.
- The level error of the contact surface between foundation and cabinet is less than 5 mm.

The ground grid should be properly installed, and a grounding copper busbar should be reserved at the grounding position of the cabinet. The grounding copper busbar should be made of hot-dip galvanized flat steel with a cross-sectional area of 40 mm × 4 mm. One end of the bar should be connected to the pre-buried ground grid, while the other end should be connected to the grounding point of the container. When the ground grid is pre-embedded, the grounding lug needs to be reserved for sufficient length to ensure that it is connected to the grounding point of cabinet.

- The lap resistance of cabinet grounding is not more than 0.1Ω.

- The energy storage system employs a bottom cable routing design, which requires burying cables underneath the integrated control compartment.
- The inner diameter of the protective pipe used for cable laying should not be less than 1.5 times the outer diameter of the cable (including the protective layer).
- The foundation construction should meet the local historical maximum rainfall drainage requirements. The discharged water should be treated in accordance with local laws and regulations.

Table 3-1 Inspection Items

Serial number	Inspection items	Acceptance inspection criteria
1	Bottom routing space	Where there is no maintenance space at the bottom, it is recommended that the height of the cable routing space beneath the container bottom should not be less than 1.2 m. Where there is a maintenance space at the bottom, it is recommended that the height of the cable routing space beneath the container bottom should not be less than 1.5 m.
2	Cables	The bending radius of low-voltage and medium-voltage cables should not be less than 15 times the cable diameter. The voltage drop of the farthest circuit should not be more than 5%. The sensitivity, voltage level, and thermal stability of the cable should meet local design specifications.

4. Installation of equipment

4.1 Preparation for installation

This article gives the installation instructions for containerized energy storage system, and is suitable for:

- BRES-1075-500
- BRES-860-400
- BRES-645-300

And offline compatible configurations,

Tool Preparation:

- Phillips screwdriver;
- Allen key; (#5)
- Small flat-head screwdriver;
- Insulated gloves;
- Wrench or socket; (#13)
- Multimeter.

Requirement

Before installing the container, please check the following:

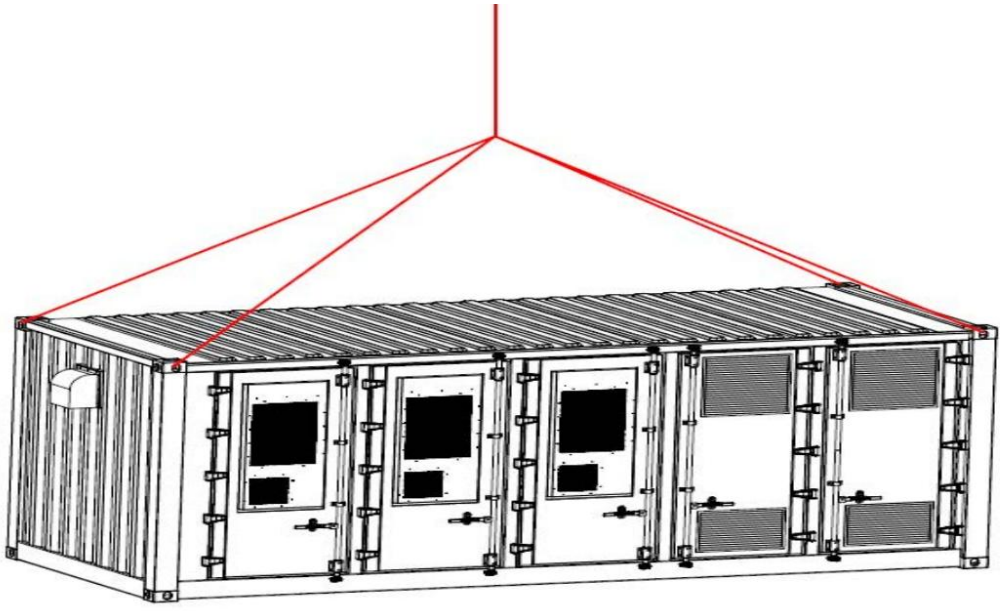
- The base for placing containerized energy storage system or fixing the vehicle is already constructed.
- Cables to be connected to the container have been laid.
- Ensure that the container AC and DC circuit breakers are disconnected.
- Installation tools are ready.

4.2 Installation of energy storage system

- Check for any external damage, deformation, or other appearance issues.
- Open all containerized energy storage internals and check for any damage or deformation. (If there are abnormalities, contact us immediately.)
- Remove the base support.
- Use a crane to place the cabinet on the base so that it corresponds to the fixing holes.
- Install screws.

Note

1. When installing the container, consider whether the space around the container meets the space requirements for installing battery modules;
2. Installation location should not be in low-lying areas. The installation horizontal plane should be higher than the historical highest water level in the area and at least 300mm above the horizontal ground.
3. To prevent wildfires caused by high temperatures in summer, there should be no vegetation or flammable plants within 3m of the installation site of the energy storage system or energy storage power
station.
4. The distance from the top of the energy storage system to combustible materials should be ≥2m.
5. For safety considerations, the distance between the energy storage system and residential buildings should be ≥12m, and the distance from schools, hospitals, and other densely populated buildings should be >30.5m. If the safety distance cannot be met, a fire-resistant wall should be built between the energy storage system and the building.
6. The safety distance between the energy storage system and production buildings should comply with local fire regulations or standards.
7. During equipment operation, do not block vents or the cooling system to prevent overheating.
8. If liquid enters the equipment, immediately turn off the power and notify on-site management.
9. Do not place the equipment in environments with flammable, explosive gases, or smoke, and refrain from any operations in such environments.



Due to the significant weight of the battery module, it is advisable to consider fixing the cabinet in place before installing the battery module.
The dimensions of the system cabinet base are shown in the schematic diagram below (unit: mm).

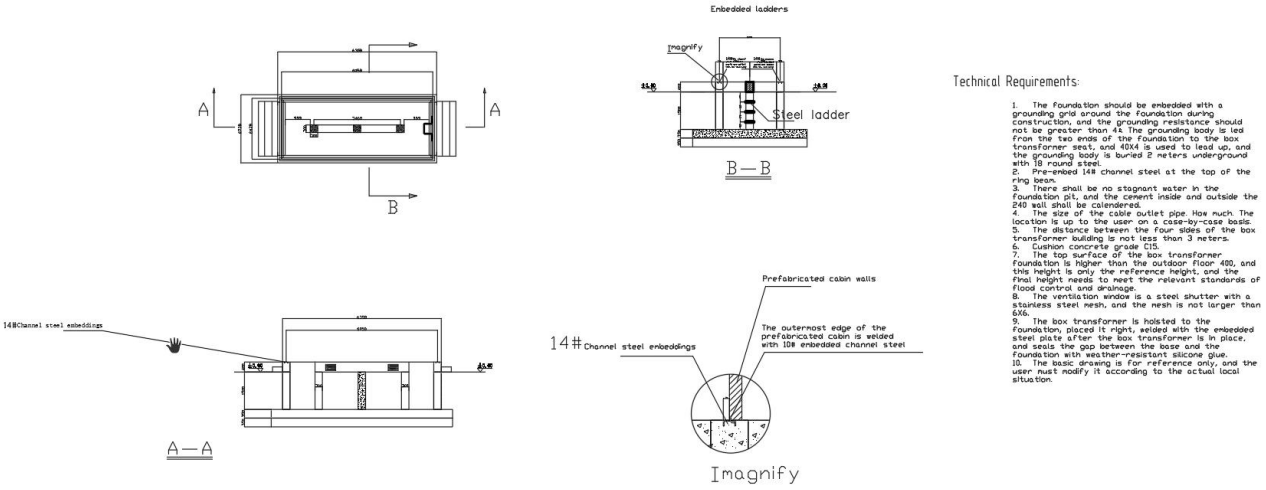


Fig. 4-3 Containerized Energy Storage - 1075-500 Cabinet Base Dimensions Schematic

Note

When installing the cabinet, ensure that the surrounding space meets the requirements for installing the battery module.

4.3 Installation of components

4.3.1 Battery Module Installation

Note

Install signal cables before installing power cables.

After the installation of signal cables is completed, use a small Phillips screwdriver to secure the terminal of the signal cable to prevent it from vibrating and falling off.

Due to the weight of the battery module, it is recommended to use a lifting or forklift to install it to prevent the battery module from falling and causing damage.

The modules of each battery cluster should not be mixed for use.

1.During the installation of power cables, ensure that the cable connection is correct, and there is no short circuit between the positive and negative of the battery module, as follows:
① Select tools with insulated handles as much as possible.
② Avoid simultaneous contact of the body with the cabinet shell and battery terminal, as it may cause numbness.
③ Avoid simultaneous operations by two people to prevent simultaneous contact of cable terminals with the shell, causing a short circuit.
④ For modules that are not installed or already installed, make sure to install the protective cover on the cable terminal to prevent a short circuit.
⑤ The cables between modules should be installed with tightening screws from top to bottom to prevent cable short circuits (clockwise or counterclockwise).
2. After completing cable installation, when installing the PCB board, avoid contact between the power cable terminals and the PCB board to prevent short circuits.

Table 4-1 Battery Module Installation Accessories Table

Name	Model	Units	Quantity
Communication Wiring Harness 1	200mm	PCS	13
Communication Wiring Harness 2	1925mm	PCS	1
Power Wiring Harness 1	110mm	PCS	13
Power Wiring Harness 2	150mm	PCS	1
Power Wiring Harness 3	1780mm	PCS	1
Power Wiring Harness 4	2030mm	PCS	1
Hexagonal Combination Screws	M8*16	PCS	60
Hexagonal Combination Screws	M6*16	PCS	60
Matching Resistor	/	PCS	1

Installation steps:

1. Position the module	① Open the packaging of the battery module. ② Examine the module label and determine the position of the battery module in the cabinet based on its number. ③ Position the battery module.	See the diagram below for an explanation of label positions.
2. Install the module	Each battery module and control box must be secured using 4 internal hex combination screws, model M6*16.	Refer to the diagram below for the battery module, control box, and fixing hole positions.

3. Install the signal cable	① Connect the signal cables between modules according to the diagram. ② The signal cables numbered 7 and 8 in the diagram is fixed in the battery compartment. Only positive and negative connections are needed for others. ③ Install the matching resistor at the communication interface of module 15.	See the diagram below for signal cable connections in the green sections.
4. Install the power cable	① The power cables between modules can be directly connected positive and negative according to the diagram. Both need to be fixed using 2 internal hex screws, model M6*12. ② The power cables numbered 7 and 8 in the diagram is fixed in the battery compartment. Only positive and negative connections are needed. ③ The power cable numbered 15 in the diagram is fixed in the control box of the battery compartment. Only positive and negative connections are needed.	Refer to the yellow connection lines in the diagram for power cable installation.

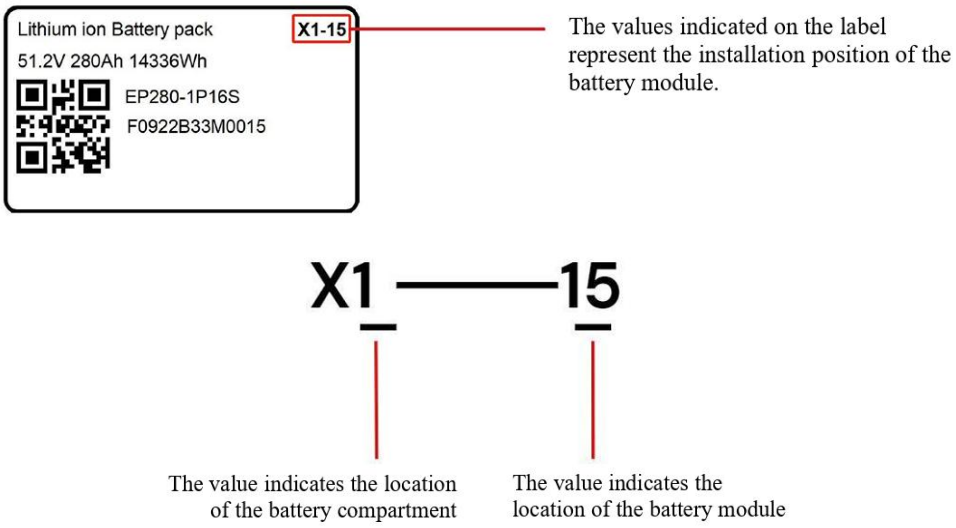
Note

See the diagram below for an explanation of label positions.

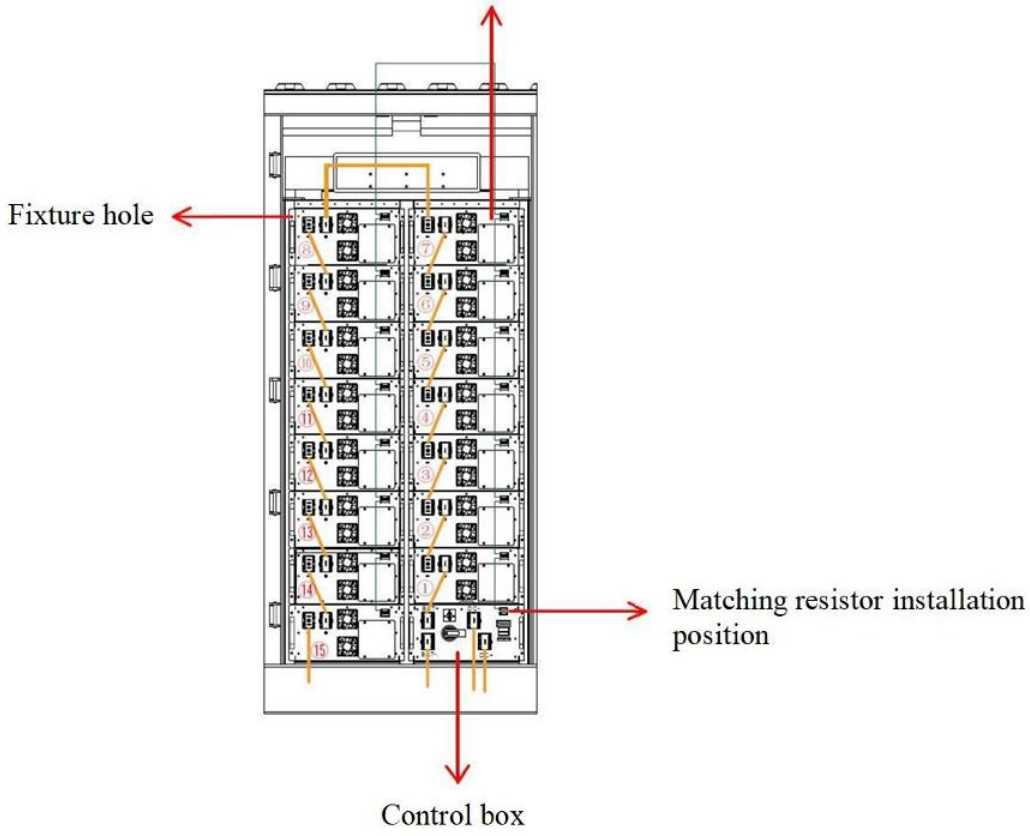
Refer to the diagram below for the battery module, control box, and fixing hole positions.

See the diagram below for signal cable connections in the blue and green sections.

Refer to the yellow connection lines in the diagram for power cable installation.



Arrangement of battery modules inside a single battery compartment



Representation and meaning of signal cable:

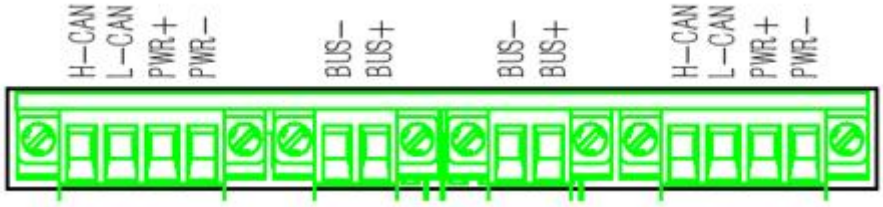


Table 5-3 Meaning of Marking

Marking	Meaning
H-CAN, L-CAN	Battery module CAN communication port
PWR+, PWR-	Battery module power supply
BUS+, BUS-	Active equalizing power supply for battery module

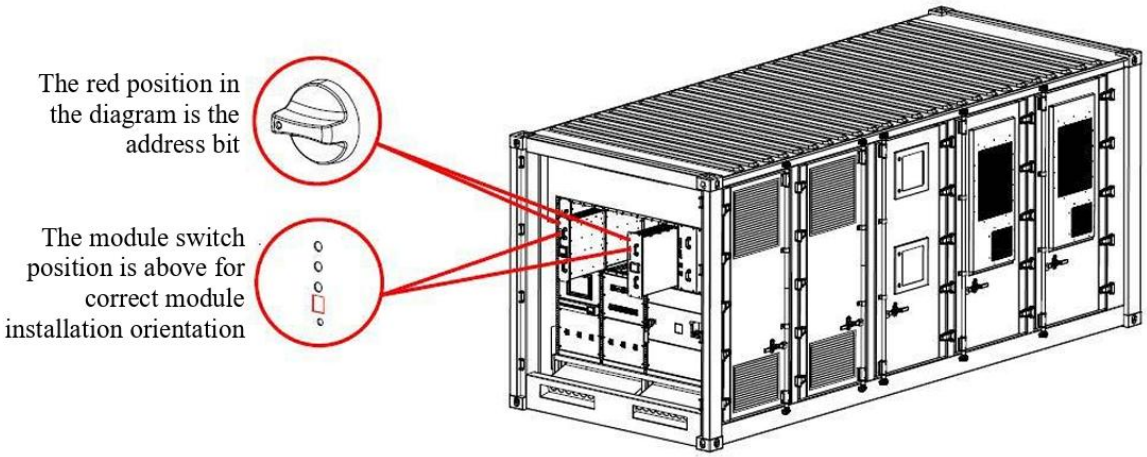
4.3.2 PCM and PDMD Module Installation

- Confirm that the PCM ready switch is in the "unready" state before installation, as shown in the diagram "🔓".
- Install the module in its designated position.
- Secure and inspect the module.

- Turn the PCM ready knob to the ready state, as shown in the diagram "🔒".
- Confirm that modules of the same type have unique addresses, using the DIP switch for address differentiation (see the diagram).
- After the module is in place, use a crosshead screwdriver to secure the panel.

- PCM ready switch; turn to 🔒 for module ready state, or to 🔓 for module not ready state.

- PDMD ready switch; turn to 🔒 for module ready state, or to 🔓 for module not ready state.



Module Installation Schematic

5. Installation of main power cable

5.1 Preparing Cables

5.1.1 Safety Instructions

The energy storage system is suitable for general outdoor scenarios. The site selection requirements are as follows:

Throughout the entire process of electrical connection to the battery cabinet and system cabinet, as well as any other operations performed on the system cabinet, adhere to the following safety rules:

- Disconnect all external connections to the battery cabinet and connections to the internal power supply.
- Ensure that the battery cabinet will not be accidentally re-energized.
- Use a multimeter to ensure that the interior of the battery cabinet is completely de-energized.
- Implement necessary grounding and short-circuit connections.
- Use insulating materials to cover adjacent parts that may be live during operations.

- All electrical connections must comply with the electrical connection standards of the country or region where the project is located.
- Only professional electricians or individuals with professional qualifications are permitted to carry out electrical connections on this product.
- Follow the wiring instructions strictly according to the equipment's labeling.
- Follow the silk-screen on the distribution room for wiring, and do not reverse the live and neutral wires.
- For multi-core cables, it is recommended to add cable protection sleeves at the branching points to prevent outer insulation cracking.

5.1.2 Cable Requirements

The cable selection requirements are as follows:

- The selected cables must have sufficient current-carrying capacity. The current-carrying capacity of the conductors should be at least related to environmental conditions, conductor insulation
- material type, laying method, conductor material, and cross-sectional area.
- The diameter of all cables must be selected according to the maximum current during charge and discharge of the system cabinet, with an additional margin.
- Cables on the same side should be of the same specification and type.
- Use flame-retardant cables.

- Overloading of cables is strictly prohibited!
- Refer to the table below for the recommended cross-sectional area of containerized energy storage system single-machine cables.

Recommended cross-sectional area of single-machine cable (unit: mm^2, ambient temperature: 25°C)

Power	System DC side		System and grid	System and load	N-line	Ground wire
	Module connected to the battery separately	Module connected to the battery in parallel				
200KW	2*50	120	120	120	120	75
300KW	3*50	2*95	2*95	2*95	2*95	95
400KW	4*50	2*95	2*95	2*95	2*95	95
500KW	5*50	2*120	2*120	2*120	2*120	120

5.1.3 Pre-Wiring Inspection

Before connecting power cables, perform the following checks:

- Measure the open-circuit voltage of all terminal connections to ensure that the open-circuit voltage does not exceed the human body's tolerance limit.
- Confirm the positive and negative poles of the battery cables and the phase sequence of the AC cables and label them accordingly.

Please strictly follow the wiring instructions indicated inside the equipment.
Power cable connection can only commence after all checks and measurements are completed and meet the requirements.

5.2 Power Cable Connection Steps

a.Ensure that the circuit breakers and the circuit breakers of the connected equipment are in the off state.

b.Strip the insulation from the end of the cable; the length of insulation stripped should be the depth of the copper nose hole plus an additional 5mm.

c.Crimp the wire onto the copper nose.

- Place the stripped wire core into the crimping hole of the copper nose.
- Use a terminal crimping machine to crimp the copper nose tightly, with at least two crimps.

d.Install heat shrink tubing.

- Choose heat shrink tubing that fits the cable size; the length should exceed the crimping hole of the copper nose by about 2cm.

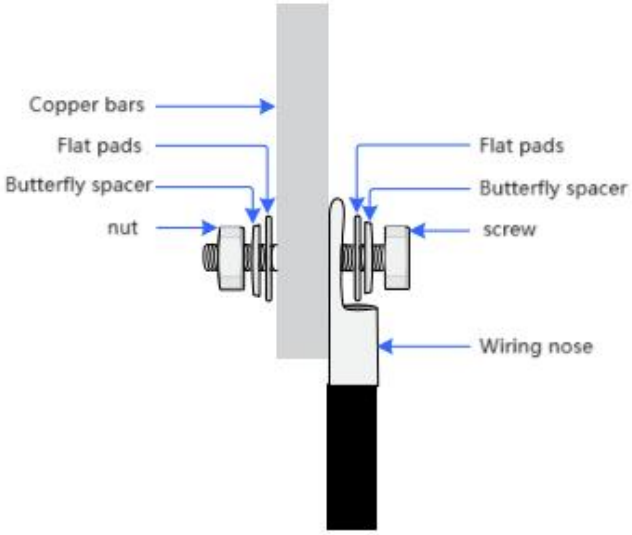
- Place the heat shrink tubing over the copper nose to completely cover the crimping hole.
- Use a heat gun to shrink the heat shrink tubing.

Note

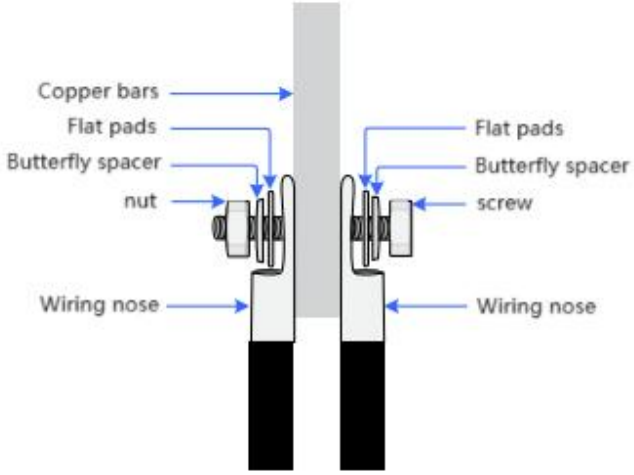
For multi-core cables, it is recommended to add cable protection sleeves at the branching points to prevent outer insulation cracking.

e. Wiring.

- Use screws that match the copper nose for connection.
- Press the copper nose onto the DC busbar in accordance with the connection sequence shown in the diagram below.
- Tighten the screws with a screwdriver or wrench. The tightening torque for copper cable is 60 N·m.



The size and number of cables should be reasonably selected based on the on-site conditions. Up to 4 cables can be connected. If the number of cables is more than 2, connect the cables in the sequence shown in the diagram below.



- Adhere to all safety regulations listed by the relevant equipment manufacturers on-site. Incorrect wiring order may cause fire. Pay attention to the connection sequence of wiring components.
- During connection, ensure the fastening of the connectors. Insufficient connection or oxidation of the contact surface may cause excessive heat, leading to fire.

If using aluminum cables, use copper-aluminum transition pieces or copper-aluminum transition wire noses.

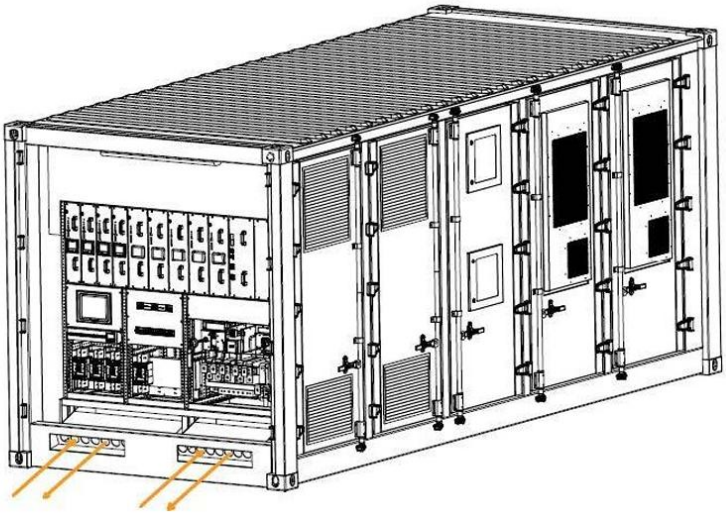
- The length of the connecting screws should be appropriate, slightly exposing the installation holes of the copper bars. Excessive length may affect insulation performance or even cause a short circuit.
- Check whether the connection point between the wiring copper nose and the copper bar has any heat-shrink tubing being clamped. If clamped, remove it immediately, as it may cause poor contact or even heat damage.

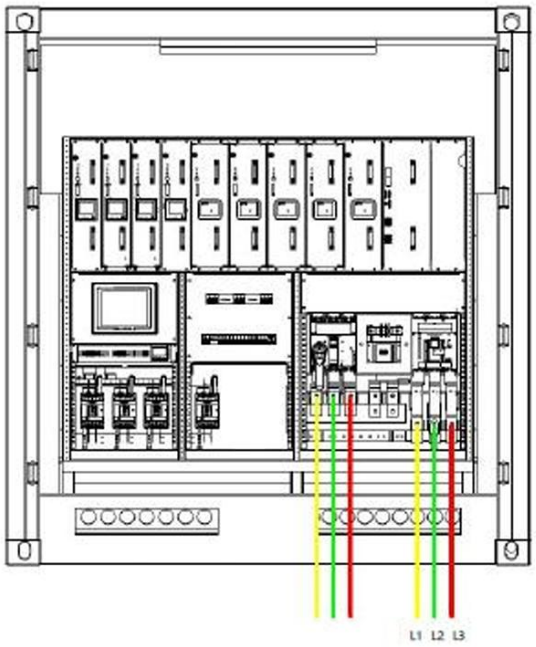
- Confirm that the connection is secure.
- To ensure safety, all battery cabinets need to be grounded through conductors.

5.2.1 Installation of AC Input and Output Cables

- Open the front door of container and remove the front cover of the distribution room at the bottom.
- Connect the AC input cables to the corresponding circuit breakers in the distribution room according to phase sequence.
- Arrange the cables.
- Put back the front cover of the distribution room.

Cables enter at the marked positions in the diagram





AC Output AC Input

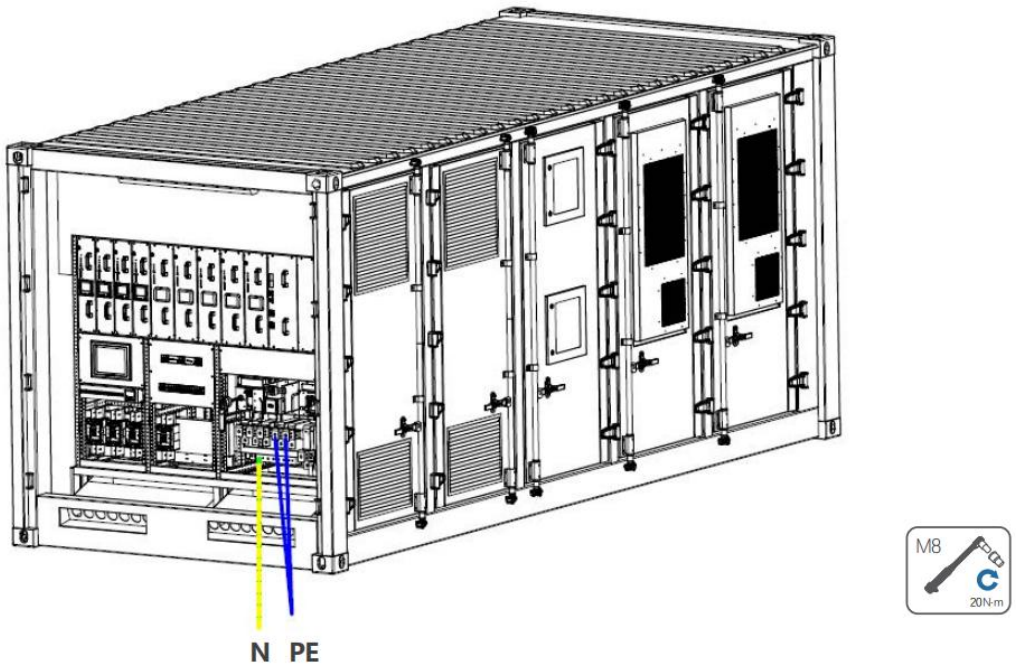
Warning

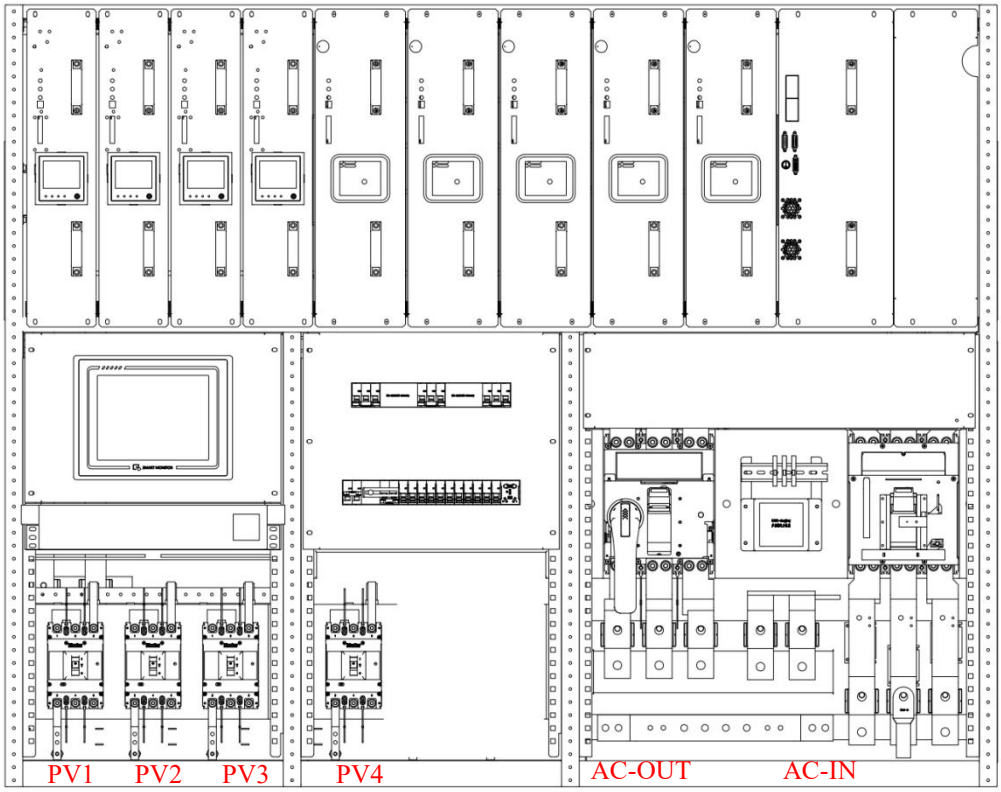
Before connecting AC input lines, ensure that the AC/DC circuit breaker is in the open state and a prominent sign indicating "No Operation" is placed.

The position of the system power cable terminal is shown in the figure below. When connecting, remove the cover plates of the upper (or lower) incoming holes according to the required incoming method, and determine the number of cover plates to be removed based on the number and size of the cables.

Table 5-4

Marking	Meaning
AC-OUT	Load wiring ports (L1, L2, L3)
AC-IN	AC input wiring ports (L1, L2, L3)
PV1, PV2	PV input port (positive and negative)
N	AC input and output N-bar
PE	Grounding position





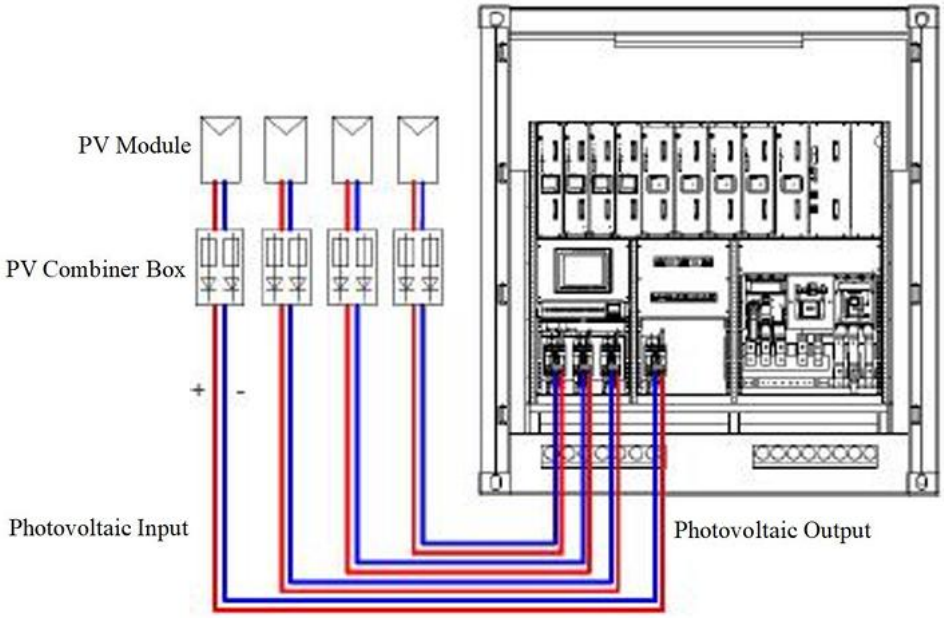
Warning

- The ground cable must be well grounded! Otherwise:
- In the event of failure, it may cause a fatal electric shock hazard to the operator!
- This may cause equipment damage in the event of a lightning strike!
- This may cause the equipment to not function properly!
- The following points should be noted for grounding:
- The grounding connection must comply with the grounding standards and specifications of the country in which the project is located.
- The connection between the grounding connection and the equipment and the grounding electrode must be securely fastened.
- The grounding resistance must be measured upon completion of grounding. The resistance shall not be greater than 4Ω
- Please strictly follow the wiring instructions indicated inside the equipment.

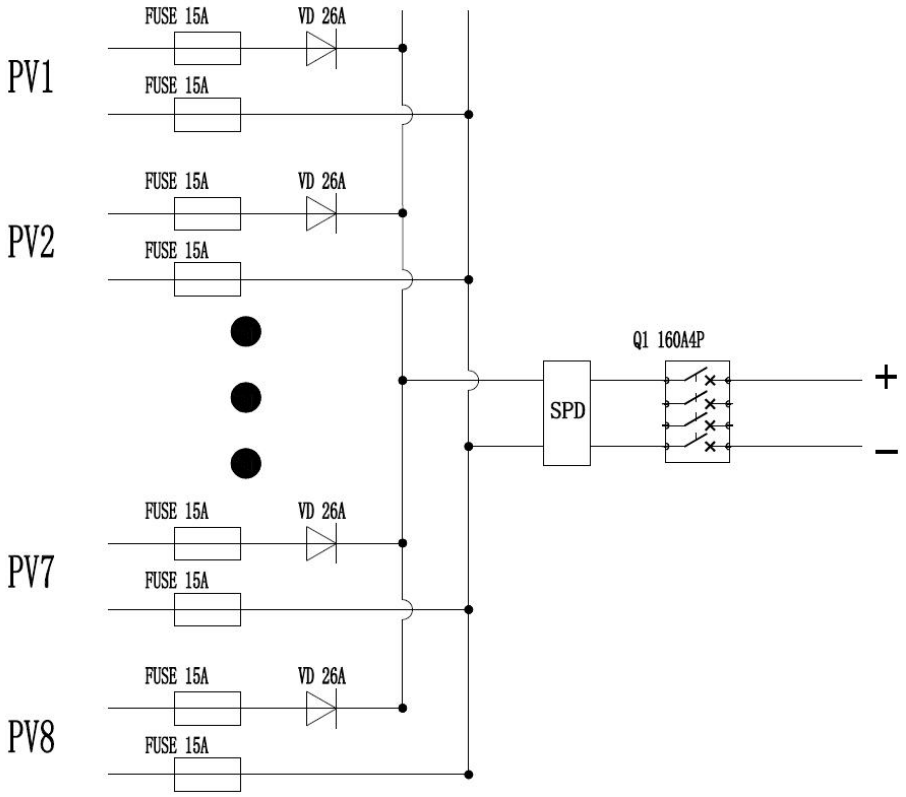
5.2.2 PV Input Installation Instructions

- Open the front door of container and remove the front cover of the distribution room at the bottom.
- Connect the photovoltaic DC cables to the photovoltaic circuit breaker in the distribution room.
- Arrange the cables.
- Put back the front cover of the distribution room.

(AC/DC cables and photovoltaic cables can be connected simultaneously)



The PV system should be designed to address the voltage range and current range of the PV DC module (e.g., 550W PV module: Voltage 50V, current 13A; if configured as a single module with a capacity of 50KW, the maximum configuration would be 14S8P)



Electrical Drawing of PV Combiner Box

6. Process of powering on and off the equipment

6.1 Precautions

At any time, the DC input and AC grid output terminals of the containerized energy storage system carry dangerous voltage.
Before starting the system:

- Ensure that the system input switch at the site is in the off state.
- Ensure all power connections are correct.
- Check that the communication cable is connected correctly.

All control operation keys and LCD displays of the system monitoring unit involved in the operating steps are detailed in the following Control Display Panel introduction.
During operation, a buzzer alarm may occur at any time. Press the LCD key on the system monitoring unit to eliminate the sound alarm.

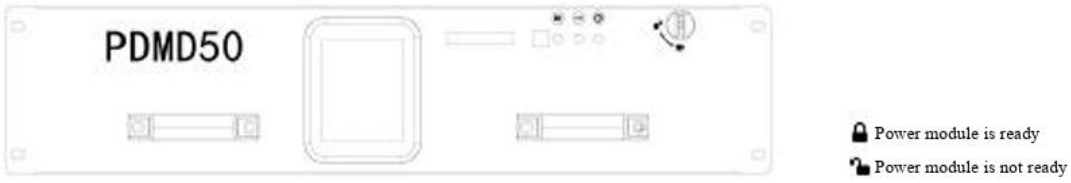
6.2 System Startup Operation

The start-up operation of the container system is differentiated by the presence or absence of PV.

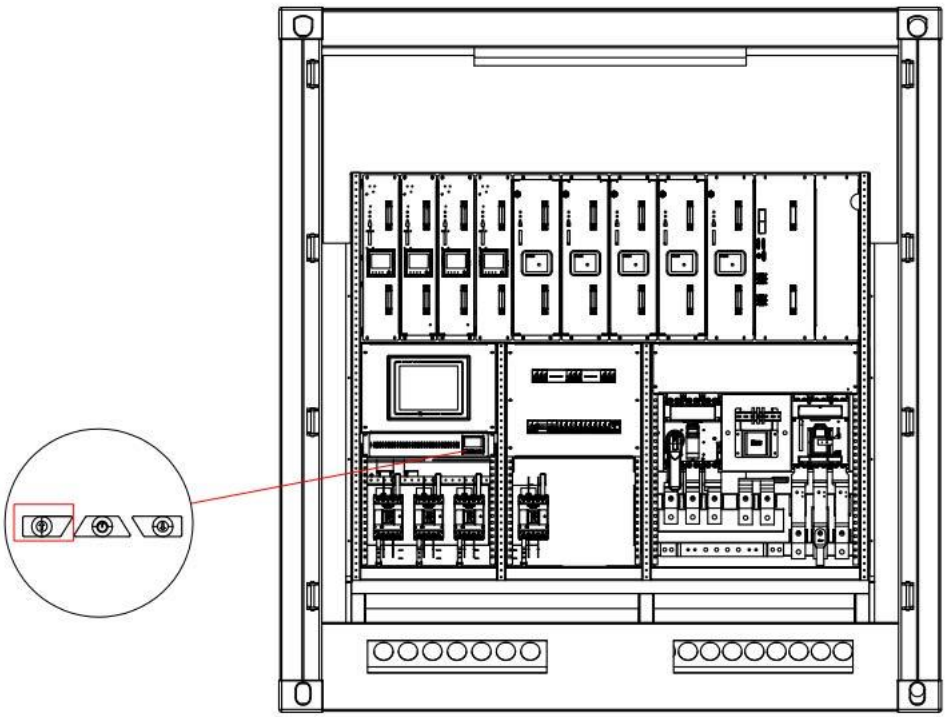
6.2.1 Power-on Operation with PV Configuration

Open all compartment doors, and check & ensure that the connected cables are reliably connected to the terminal blocks.

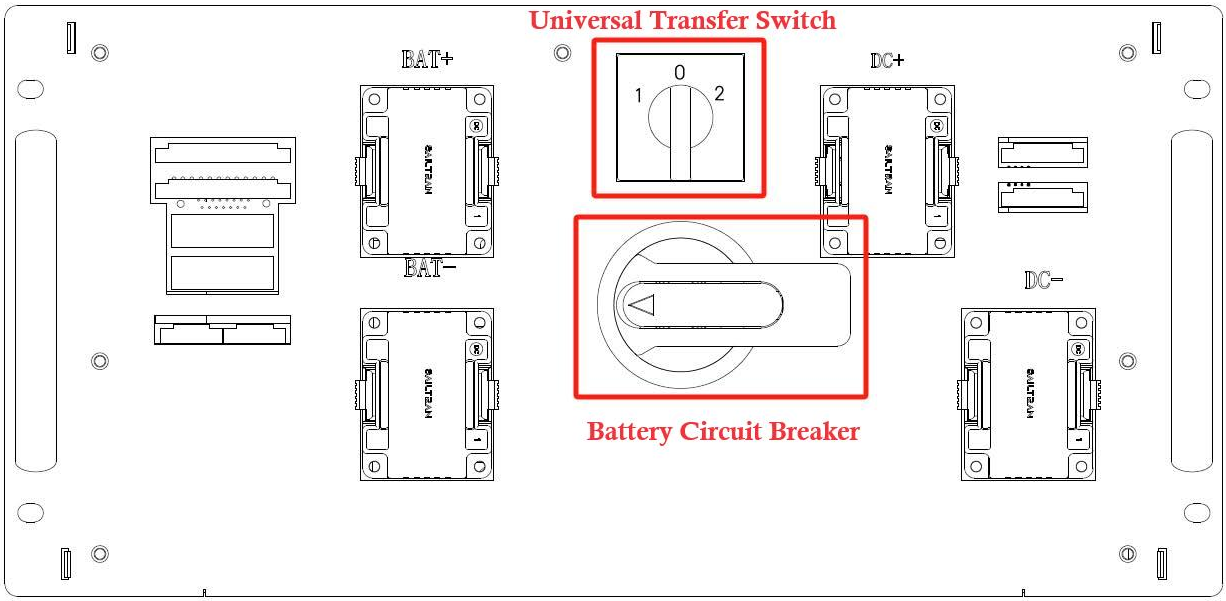
1）Keep the PDMD module ready switch in the unready position, as shown in the diagram " ".



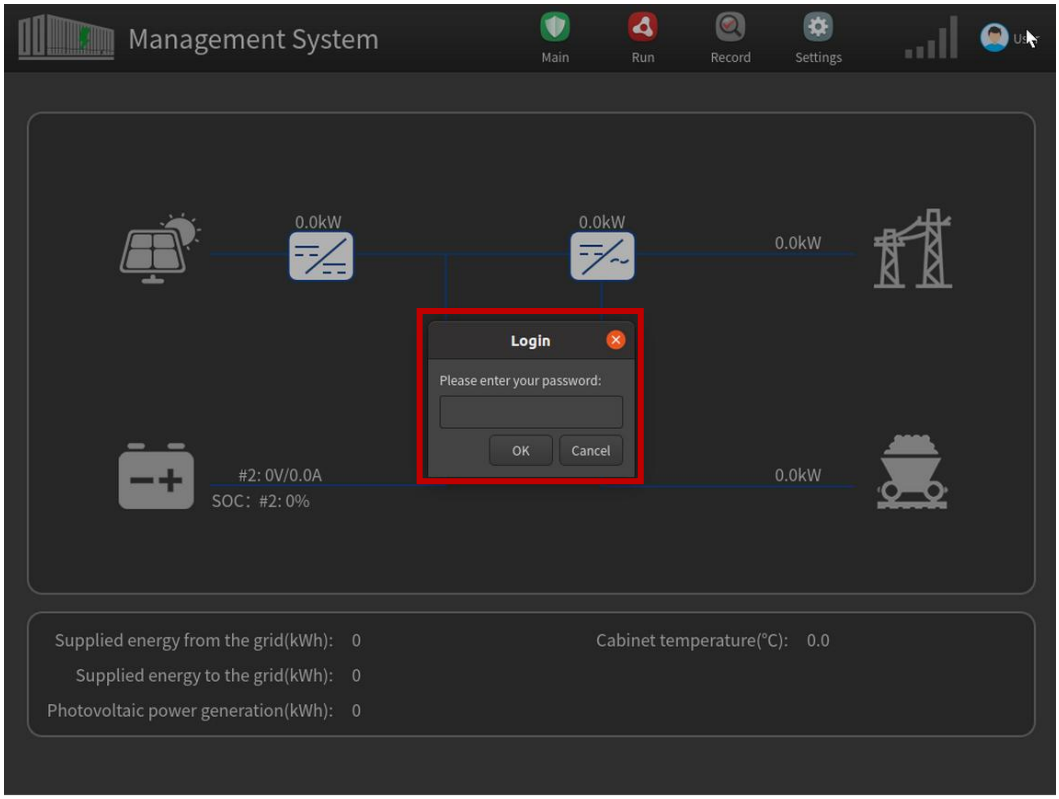
2）Press and hold "ON/MUTE" on the PCS compartment screen for 5s to turn on the UPS, and the screen of IPC will light up.



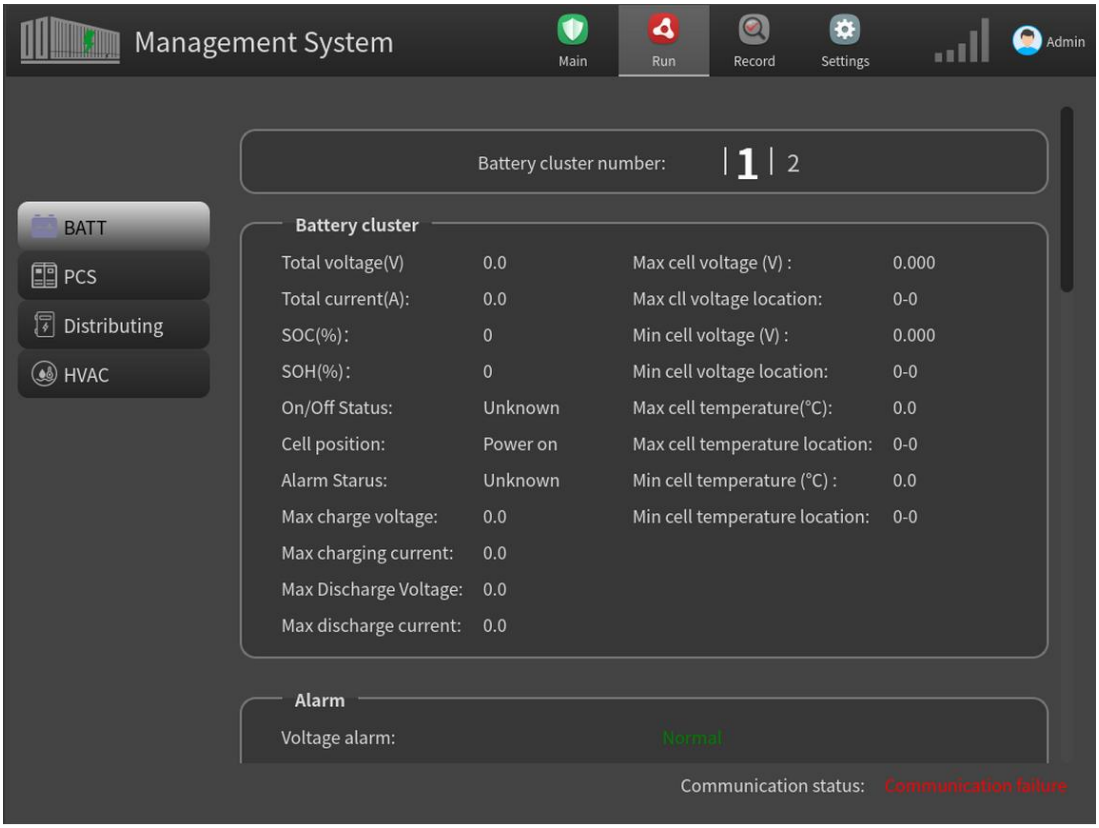
3）Close the circuit breaker of each battery compartment and wait for 5s while the universal switch is turned to "1".



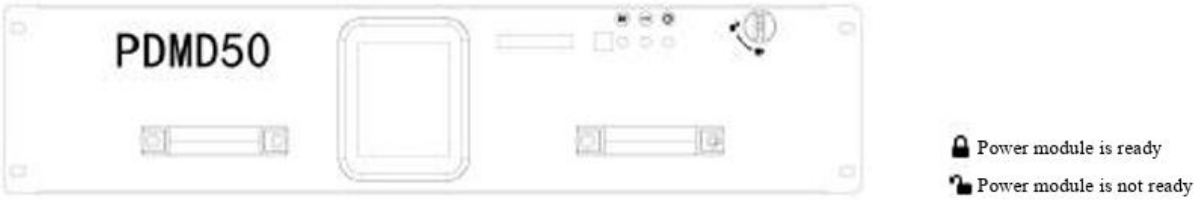
4）Click in the upper right corner of the IPC screen to log in to the administrator mode with password 123. (Swipe up from the bottom of the screen to reveal the on-screen keyboard)



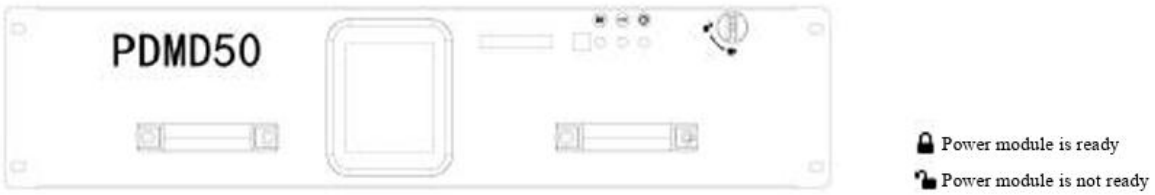
5）Click Run - Battery System - Battery Cluster No. at the top of the IPC screen (different battery compartments can be selected to view the data information) to check whether there is any data information (you can check the switching status (power on, etc.) as well as the system status (quiescent, etc.), and at the same time, determine whether the BMS communication is functioning correctly. If all readings are 0, there is a BMS communication abnormality. If it is functioning normally, the battery startup will be deemed successful.



6）Turn the PDMD ready switch to the ready state, as shown in the diagram " ", and the photovoltaic module will automatically power on. A steady green light on the PDMD indicates a successful startup. If the small PV screen displays output voltage and current values, and after the PV module panel indicator light is steady on, the startup can be considered successful.

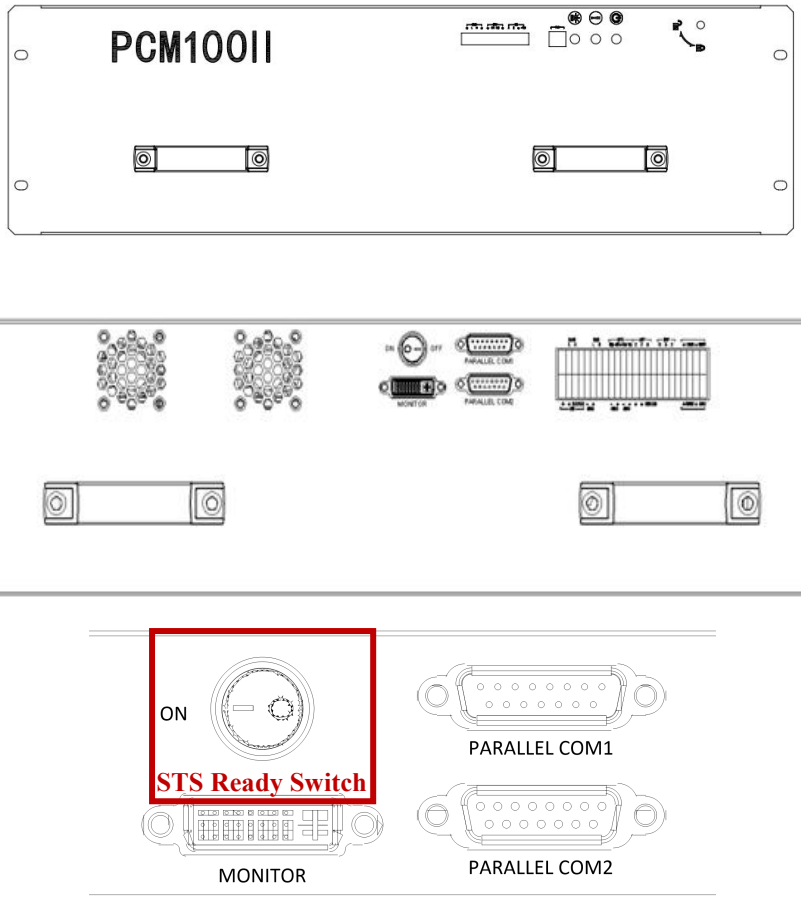


7）Module shutdown: Turn the PDMD module ready switch to the unready state.

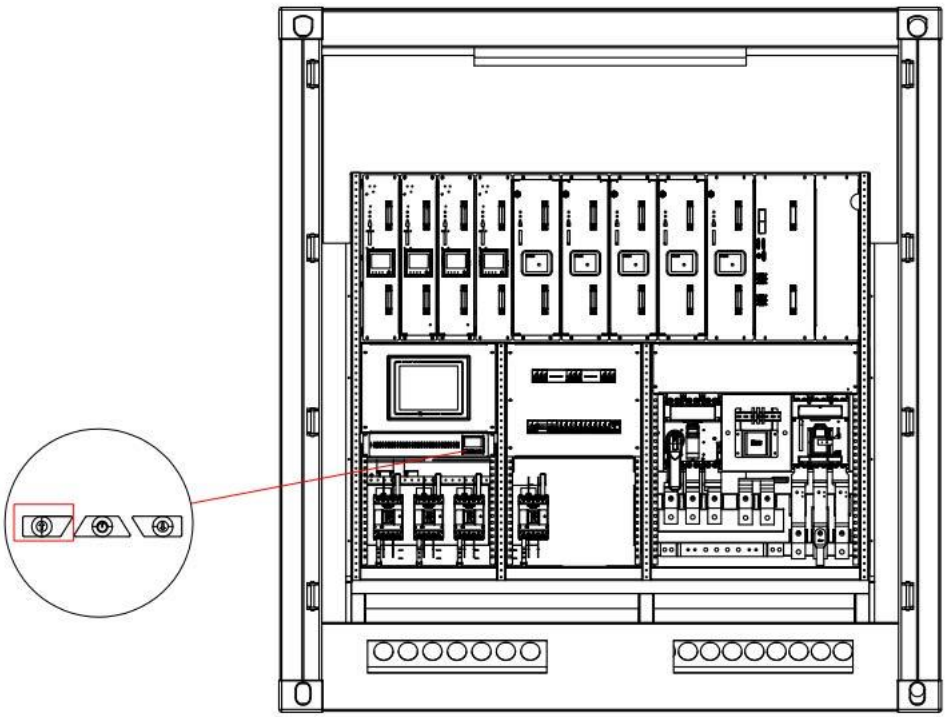


6.2.2 Power-on Operation of PCM Module without PV Configuration

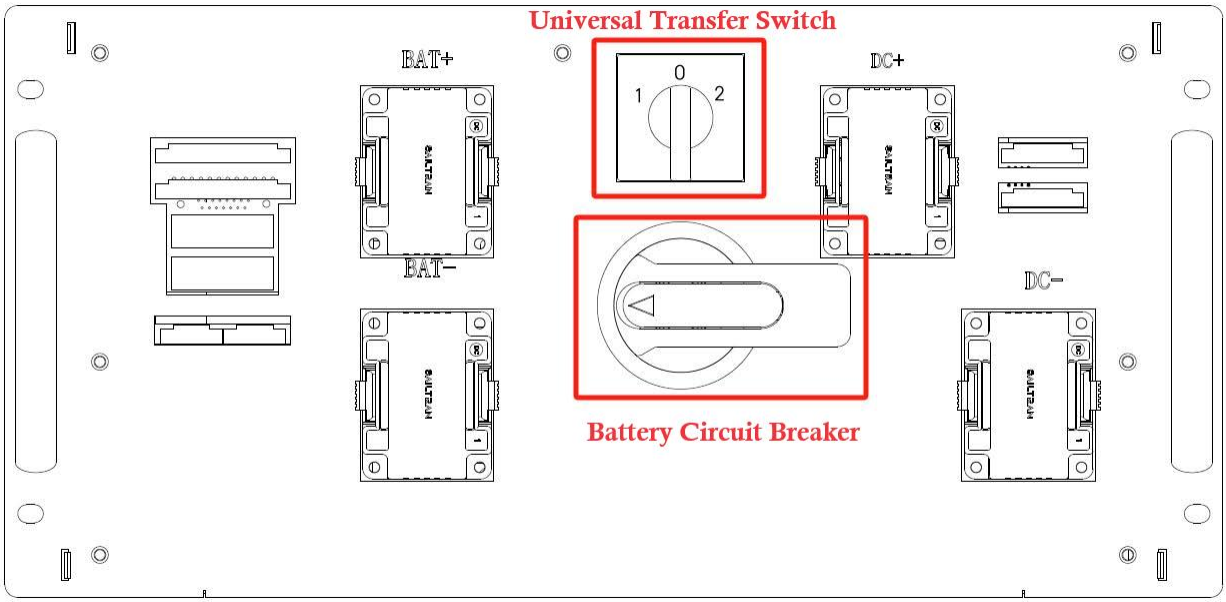
1）Turn the PCM ready knob to the ready position, as shown in the diagram "". Press the STS red button to the "ON" position.



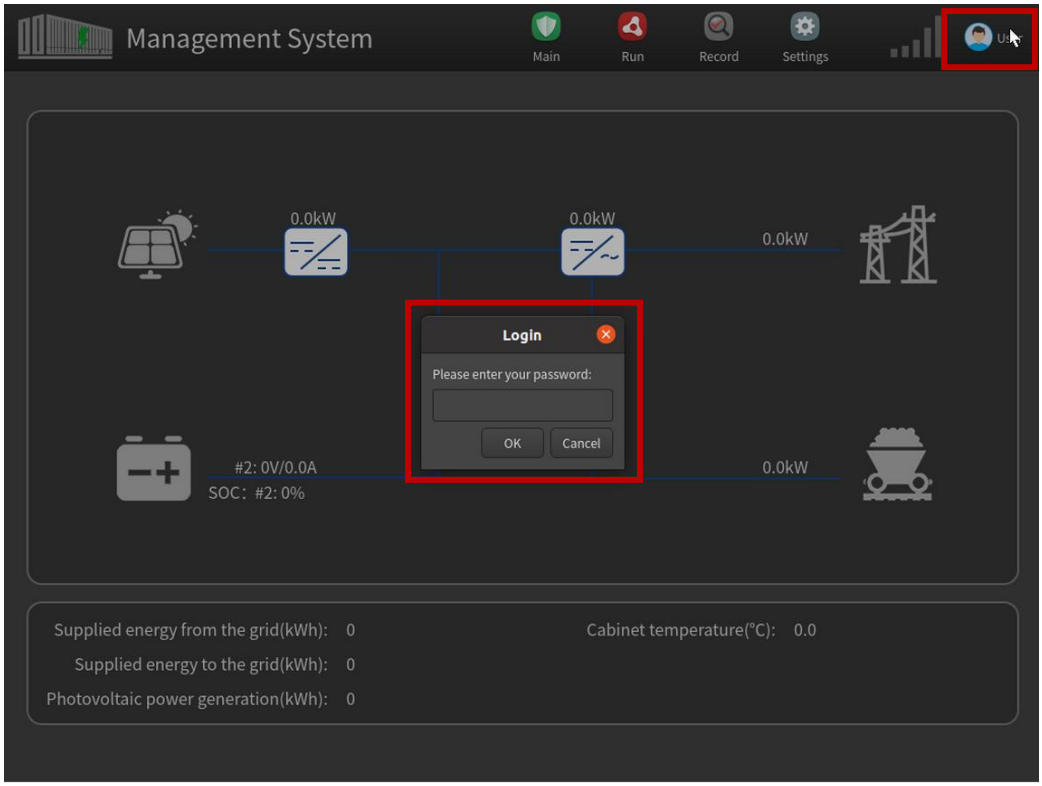
2）Press and hold "ON/MUTE" on the PCS compartment screen for 5s to turn on the UPS, and the screen of IPC will light up.



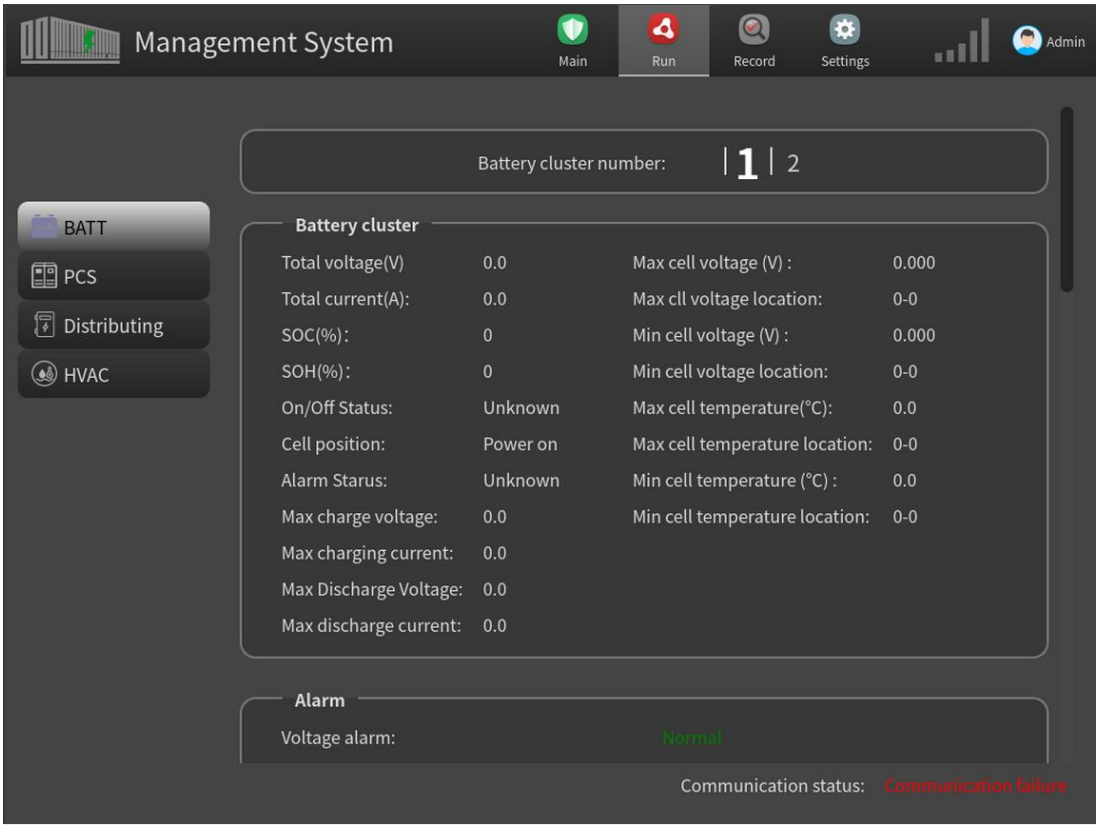
3）Close the circuit breaker of each battery compartment and wait for 5s while the universal switch is turned to "1";



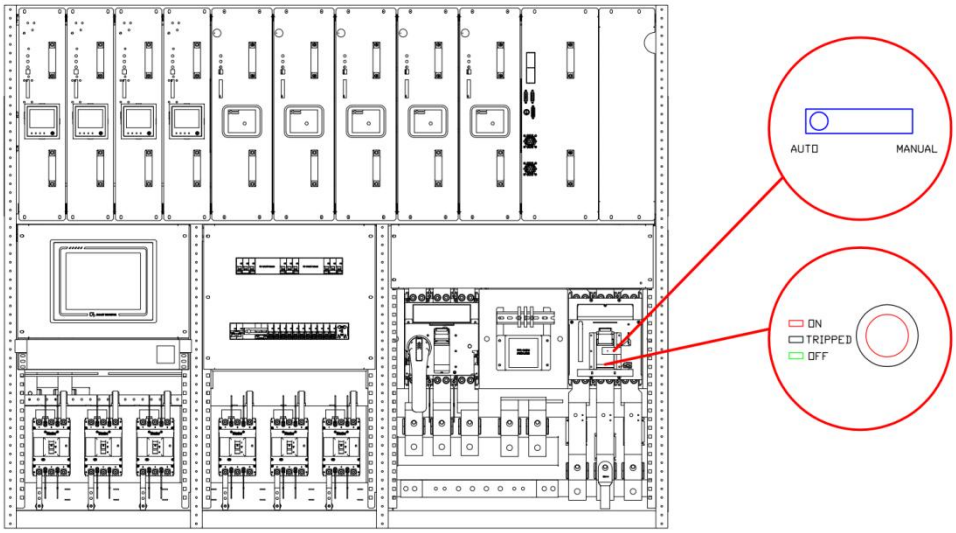
4）Click in the upper right corner of the IPC screen to log in to the administrator mode with password 123. (Swipe up from the bottom of the screen to reveal the on-screen keyboard)



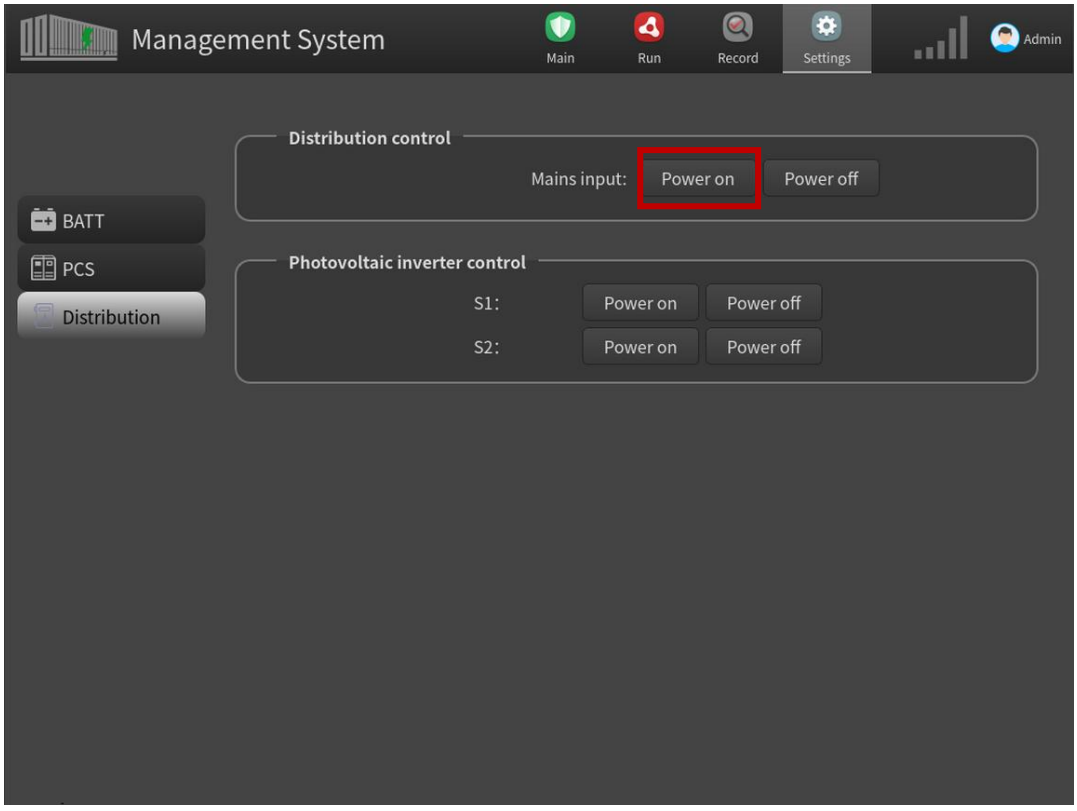
5）Click Run - Battery System - Battery Cluster No. at the top of the IPC screen (different battery compartments can be selected to view the data information) to check whether there is any data information (you can check the switching status (power on, etc.) as well as the system status (quiescent, etc.), and at the same time, determine whether the BMS communication is functioning correctly. If all readings are 0, there is a BMS communication abnormality. If it is functioning normally, the battery startup will be deemed successful.



6）Move the blue switch for lateral movement of the circuit breaker motorized operating mechanism to AUTO.

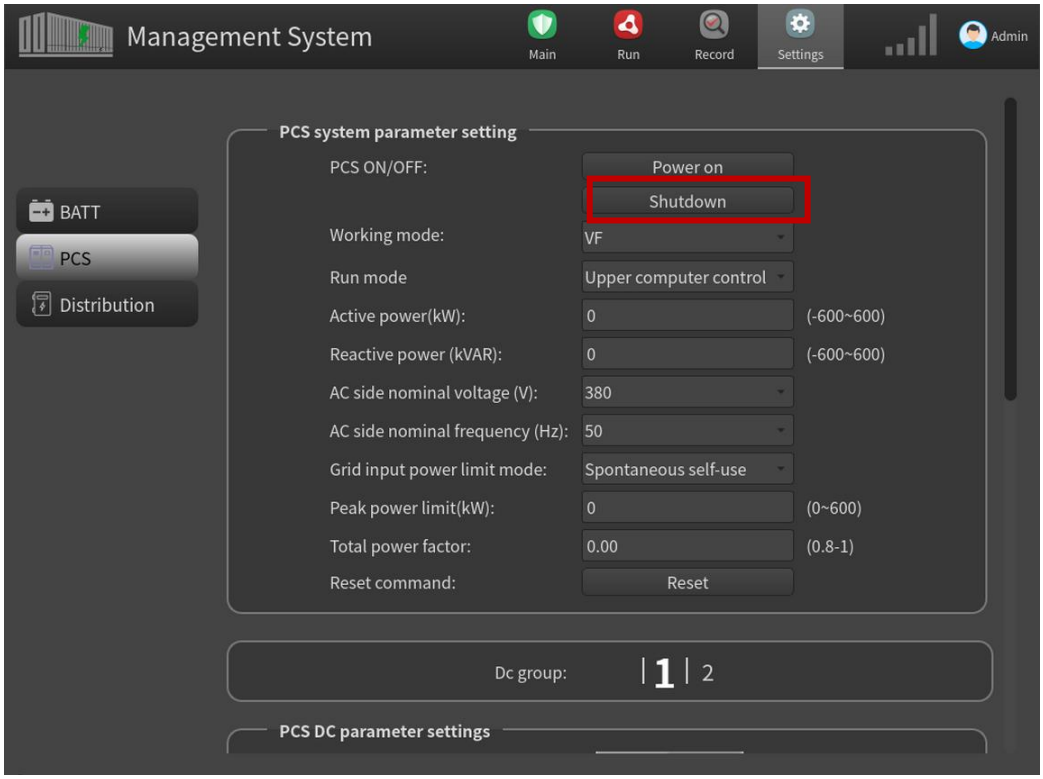


7）Click Configuration - Power Distribution - Power Distribution Control - Utility Input - Power Up. Observe the color inside the left hole; red indicates "ON", at which point the AC input circuit breaker will close. (Same with power-off)

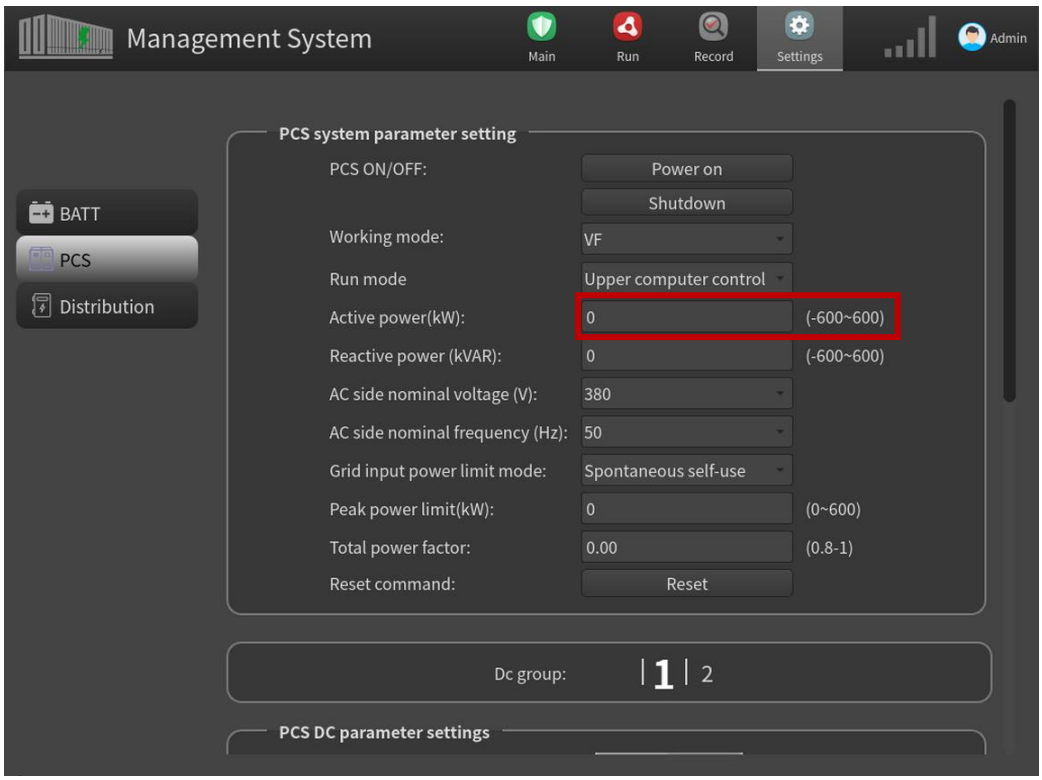


8）Click Configuration - Energy Storage Converter - PCS Parameter Setting (select the setting parameters based on the operational requirements, and/or contact the engineer for verification) - PCM On/Off - Power On, and the module will be powered on. PCM green light flashes while

opening, after the green light is steady on, the PCM is powered on successfully. Click the alarm menu. If there are no other alarms besides "Load Breaker 0 Open", then it is considered normal.



9）Click Manual Control Parameter -Active Power to set the grid-connected power at "Active Power"; the default is 0; the setting range: -N~N (N represents the system-configured PCS power). Set a value <0 for charging and ≥0 for discharging.



Note: As shown in the figure, you can choose different operation modes of PCS depending on the actual operational requirements - manual control/automatic control/remote manual/remote automatic/upper computer control. Proceed with turning on the machine after setting up the desired mode. Otherwise, the parameters cannot be adjusted after the power is turned on, and you need to turn it off and restart it for modification.

7. Routine Maintenance and Faults List

During the long-term operation of the containerized energy storage system (including the battery), regular maintenance and care are required. This chapter mainly explains the service life characteristics of key components of the containerized energy storage system, recommended regular inspections, maintenance and replacement, as well as maintenance and care of the containerized energy storage system and options. Effective maintenance and care of the containerized energy storage system can reduce the risk of system failures and provide a longer working life for the containerized energy storage.

7.1 Safety Instructions

- Daily inspection of the containerized energy storage system can be performed by personnel who have received relevant training. Inspection and replacement
- of components should be carried out by authorized professionals.
- Components behind protective covers that require tools to open are non-user-operable components. Only qualified maintenance personnel are
- allowed to open such protective covers.
- When maintaining the containerized energy storage, be aware that the N line is live.

7.2 Main Power Module and Static Switch Module Maintenance Steps

7.2.1 Precautions

- Only maintenance engineers or personnel under the guidance of an engineer should perform maintenance on the main power modules and static switch modules;
- The principle of disassembling the main power module is to disassemble from top to bottom to prevent the cabinet from tipping over due to a high center of gravity.

7.2.2 Main Power Module Maintenance Steps

- Turn the ready switch on the front panel of the main power module to the not ready state. At this time, the module status indicator light turns off, and the red light is on.
- Confirm that the red light on the front panel of the main power module is always on. Remove the two fixed screws on both sides of the front panel and pull the module out of the cabinet.
- After completing the module maintenance, confirm that the ready switch is in the not ready

state.

- Push the module into the cabinet (allowing at least 15s between each module), and tighten the screws on both sides.
- Turn the ready switch of the module to the ready state to make the module ready, and the module will automatically join the system operation.

7.2.3 Static Switch Module Maintenance Steps

- Press the EPO switch to disconnect the DC output switch, module output switch, grid switch, and load switch.
- Turn the ready switch on the front panel of the static switch module to the not ready state.
- Remove the two fixed screws on both sides of the front panel of the static switch module, as well as the screws connecting it to the system. Pull out and maintain the module.
- After completing the module maintenance, insert the module back into place, and reconfirm the fixed screws with a tool. Tighten the screws.
- Turn the ready switch of the electronic module to the ready state, close all switches disconnected in the first step, and read the power status information on the LCD main interface of the system monitoring unit. The static switch module operates normally, supplying power to the load through the static switch module from the grid.

7.2.4 Battery System Maintenance Procedures

- If a fault or issue is detected in the battery system, it is essential to promptly contact our engineers;
- Follow the battery maintenance manual for operation and maintenance;

7.3 Key Components of the Containerized Energy Storage System and Their Lifespan

During the use of the containerized energy storage system, some components have a shorter lifespan than the containerized energy storage system itself due to wear and tear during operation. For the safety of the containerized energy storage system's power supply, these components need to be regularly inspected and replaced. This section introduces the key components of the containerized energy storage system and the reference lifespan of their operation. For systems under different usage conditions (environment, load rate, etc.), professional assessment is recommended based on the information in this section, along with suggestions on whether the components need replacement.

7.3.1 Lifespan and Recommended Replacement Time of Key Components

When using key components in the containerized energy storage system, regular inspection is recommended within the expected lifespan to prevent wear and tear failures that could lead to

system malfunctions.

Lifespan and Recommended Replacement Time of Key Components

Key components	Life expectancy	Recommended replacement period	Recommended inspection interval
Fan	≥ 7 years	5~6 years	1 year
Bus capacitor	≥ 7 years	5~6 years	/
Dust screen	1~3 years	1~2 years	2 months
Energy storage battery (10 years life)	10 years	6~8 years	6 months

7.3.2 Replacement of Dust Screens

Dust screens must be regularly inspected and replaced, and the interval for inspection and replacement depends on the environmental conditions in which the containerized energy storage system is located. Under normal environmental conditions, dust screens should be cleaned or replaced every two months. In environments with more dust or other harsh conditions, more frequent cleaning and replacement of dust screens are needed. In newly constructed buildings, they should also be frequently inspected or replaced.

The dust screen of the module cabinet is located on the inside of the front door and can be replaced while the machine is running.

For the module cabinet dust screen, fix one fixing strip in the middle of the upper, lower, left, and right sides of the dust screen. Steps of replacing the dustproof net are as follows:

- Open the front door of the containerized energy storage system, and you can see the dust screen on the inside of the front door;
- Remove all fixing strips.
- Remove the dust screen to be replaced.
- Place a clean dust screen.
- Reinstall the fixing strips removed in step 2 to their original positions and tighten the fixing screws.

7.4 Maintenance of the Containerized Energy Storage System and Options

The containerized energy storage system and its options require common sense maintenance work:

- Keep good historical records. Good historical records facilitate troubleshooting.
- Keep it clean to protect the containerized energy storage system from dust and humidity;
- Check connections. Check the tightness of all connecting screws at least once a year.
- Regularly check the upper or lower switches of the containerized energy storage system for abnormal conditions to ensure that the input or output can be cut off when the current is too high;
- Regularly clean ventilation openings, terminals, and mesh to ensure free airflow inside the chassis. It is recommended to clean at least twice a year.

Maintenance personnel should be familiar with the typical environmental conditions under which the

containerized energy storage system operates so that they can quickly locate which environment conditions are exceptional; they should also be familiar with the settings of the containerized energy storage system's operational control display panel.

7.5 Troubleshooting of Containerized Energy Storage System

When the containerized energy storage system experiences abnormalities or faults, please first check and troubleshoot according to the following table. If the problem cannot be solved, please contact Sicon for technical support.

System faults and solutions

Chinese	Recommended solution
AC side abnormal shutdown	Check whether the DC side switch is closed; Check whether the AC side switch is closed; Check whether the DC side voltage is normal; Check whether the AC side voltage is normal; Check whether the static switch is working normally.
DC side abnormal shutdown	
Grid phase sequence inverted	Check whether the grid side three-phase sequence is correct;
Output voltage abnormal	Check whether the output air switch is at closed state; 2. Check whether the upper three-phase voltage of the output circuit breaker is normal; 3. Check whether the upper three-phase voltage of the output terminal is normal; 4. Check whether the lower three-phase voltage of the output terminal is normal.
Inverter fan abnormal	Check whether the corresponding module fan is plugged or damaged;
Output overload	Check if the system load is within the specified range;
Output overload overtime	
Power module is not ready	1. Check if the power module is properly plugged in; 2. Check if the power module's ready switch is in the "  " position;
Bypass auxiliary power supply failure	Check if the grid-side power supply is normal.
Bypass control box is not ready	The ready switch of the static switch is not pulled out;
Bypass SCR fan is abnormal	Check if the fan of the static switch is blocked or damaged.
Bypass overtemperature	Remove dust from the static switch module of the system;
Bypass takeover	Prompt alarm; no fault handling is required;
Inverter is out of synchronous	Please directly contact your supplier;
Inverter fault	
Inverter over-temperature	
Bus abnormal shutdown	
DC bus overvoltage	
Inverter relay failure	