Containerized Energy Storage System User Manual

BRES-1200-625

Zhuhai OTE Electronic Technology Co.,Ltd.

Version No.: V1.4

Introduction

Dear customer, thank you for buying our BRES series products! We sincerely hope that our products can meet your needs, and sincerely thank you for your comments and suggestions on our products and services. We will continue to improve to better serve our customers.

This manual systematically introduces the main components, appearance and structure, performance indexes and system principles of the BRES series products of prior-control energy storage systems, as well as providing transportation and storage, installation instructions, use and operation instructions and maintenance management.

Please keep this manual in a safe place for future use.

Before use, be sure to read this manual carefully and in detail and use the product after understanding the product precautions in it.

NOTE
◆ When using the product, you must complete the installation of the peripheral cable wires as specified and follow the contents of the manual.
◆ The illustrations in this manual are for illustrative purposes only and may differ from the product you ordered, users should refer to the actual product purchased.
◆ Our company is committed to the continuous improvement of the product, product features will be constantly upgraded, the information provided is subject to change without notice.
◆ The company provides customers with a full range of technical support, if you have questions or suggestions in the use, please contact the company's customer service center in a timely manner.
◆ The contents of the manual are owned by the Company, and the contents may not be publicly reproduced without written authorization by non-internal personnel of the company.

Special Announcement

Personal safety

1. The installation and commissioning of this product can be carried out according to the manual, if necessary, you can contact our technical staff for remote guidance.

2. Before installing and commissioning the product, be sure to read the product manual and safety matters in detail, otherwise it may lead to product failure or jeopardize personal safety.

3. This product cannot be used as a power source for any life support equipment.

4. It is strictly prohibited to put the built-in battery or external battery of this product in fire, in order to avoid explosion and jeopardize personal safety.

Equipment safety

1. If stored or left unused for a long time, the product must be placed in a dry, clean and specified temperature range of the environment.

2. This product should be used in a proper working environment (see the Environmental Requirements section of this product manual for details).

3. It is prohibited to use this product in the following working environments:

   - High temperature, low temperature or humid places beyond the technical specifications of this product.
   - Places with conductive dust, corrosive gases, salt spray or flammable gases.
   - vibration, vulnerable to impact places.
   - Places close to heat sources or strong electromagnetic field interference.

Disclaimer

Our company is not responsible for defects or malfunctions caused by the following reasons:

- Exceeding the scope of use and working environment specified for the product.
- Unauthorized modification or repair, incorrect installation, improper operation.
- Encountering force majeure.
- Other violations of the provisions of this product manual.

Preamble

Overview

This document describes the installation, electrical connection, commissioning and troubleshooting of 10-foot containerized energy storage systems , 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 Reader

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

Symbolic Stipulation

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.

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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 obscure 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 & 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 crossly 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:

① All cables should be laid and installed above 0°C. Handle cables with caution, especially in a low-temperature environment.

② In the case where the cables are stored in an environment with a temperature below 0℃, 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



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

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:

① Ambient temperature: 0°C~40°C, recommended storage temperature: 20°C~30°C.

② Relative humidity: 5%RH~80%RH

③ Dry, ventilated and clean.

④ Avoid contact with corrosive organic solvents, gases and other substances.

⑤ Avoid direct sunlight.

⑥ The distance from heat source should not be less than two meters.

⑦ 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.



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 Installation

- 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.

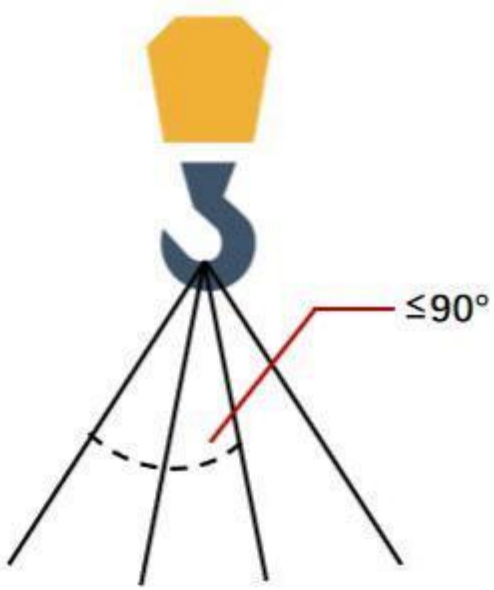
1.6 Mechanical safety

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

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：



Safety in the Use of Ladder

- 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.

① Keep your body balanced and stable.

② 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.

③ 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

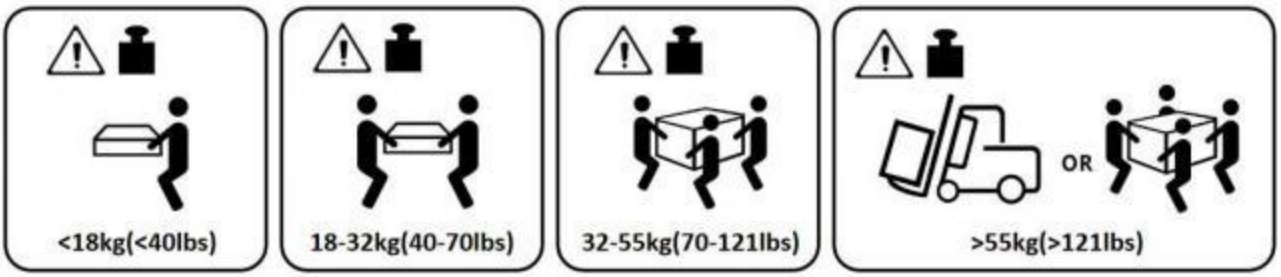
Do not drill holes in the equipment. Drilling may damage the electromagnetic shielding of the equipment, internal components and cables, and metal shavings from drilling can enter the equipment and short-circuit the circuit board.

- 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-720-375（20ft）
- BRES-960-500（20ft）
- BRES-1200-625（20ft）

Other compatible models are not listed.

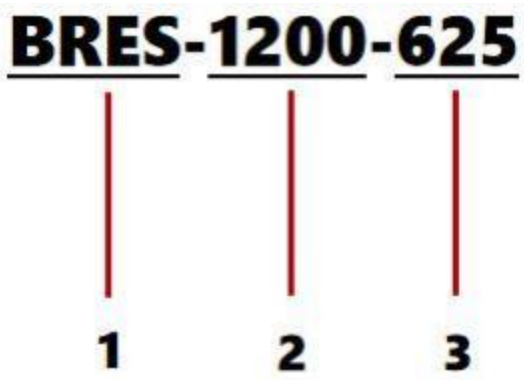


Fig. 2-1 BRES-1200-625 Model Identification

Table 2-1 Model Identification

Marking	Implication	Values
1	Series name	BRES: Containerized Energy Storage System
2	Battery capacity	1200: The nominal battery capacity is 1200 kWh
3	PCS capacity	625: The nominal PCS capacity is 625 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.
	No Open Flames	All open-flame working is prohibited.
	Battery Charging Area	Battery charging area, please pay attention to safety.

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**

1. The system utilizes high-quality lithium iron phosphate (LiFePO4) battery cells that are widely recognized within the industry.
2. Air-conditioned design for long system life and smooth operation.
3. 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.
4. 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.
5. 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**

1. PCS and battery systems are modularized for easy installation, maintenance and expansion.
2. Direct integration of PV and diesel generator inputs facilitates intelligent management and control of multiple energy sources.
3. Integrated equipment that can be fixed or mounted on vehicles, offering convenient mobility.
4. Remote monitoring, device management, remote troubleshooting and data analysis.

- **Cost optimization**

1. 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.
2. Compact size and lightweight design, resulting in reduced land occupancy and installation costs.
3. 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, if not otherwise specified, 20 on the BRES-1200-625 (5 battery clusters) as an example.

20-foot container: According to the size consideration and configuration, it can be applied to BRES-1200-625 (5 groups of battery clusters, fully equipped); BRES-960-500 (4 groups of battery clusters); BRES-720-375 (three groups of battery clusters). (Configurations with less than 3 clusters of batteries would leave too much unused space in the box because of the 20-foot size, so they are not listed downward.)

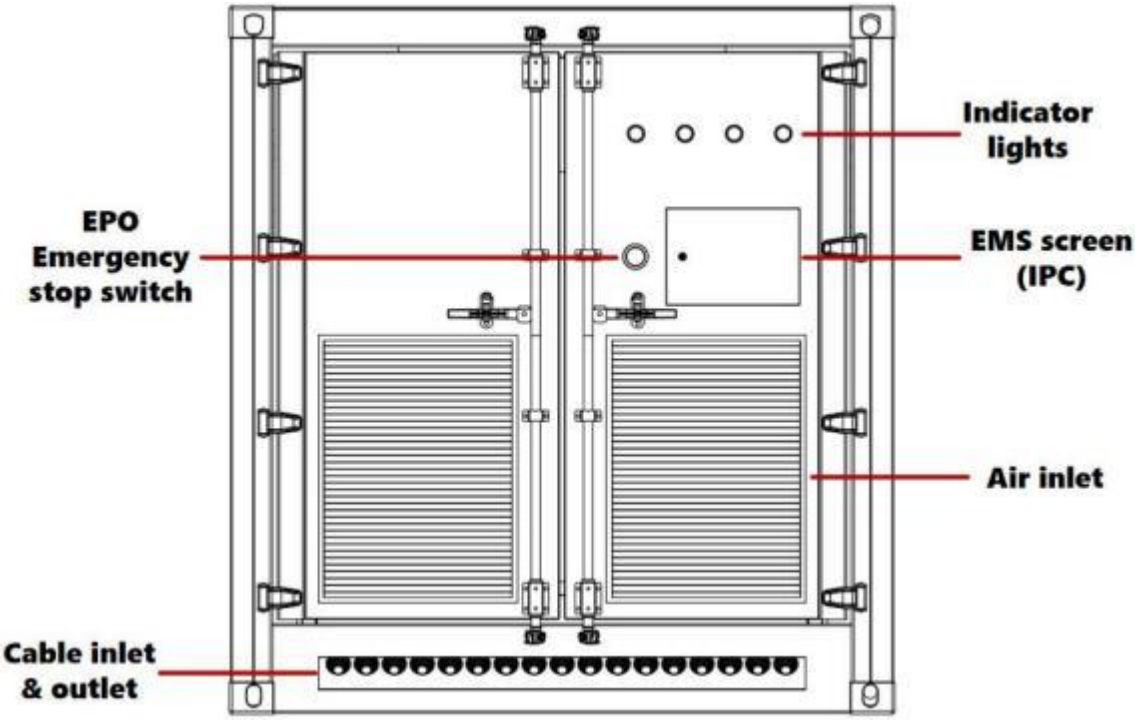
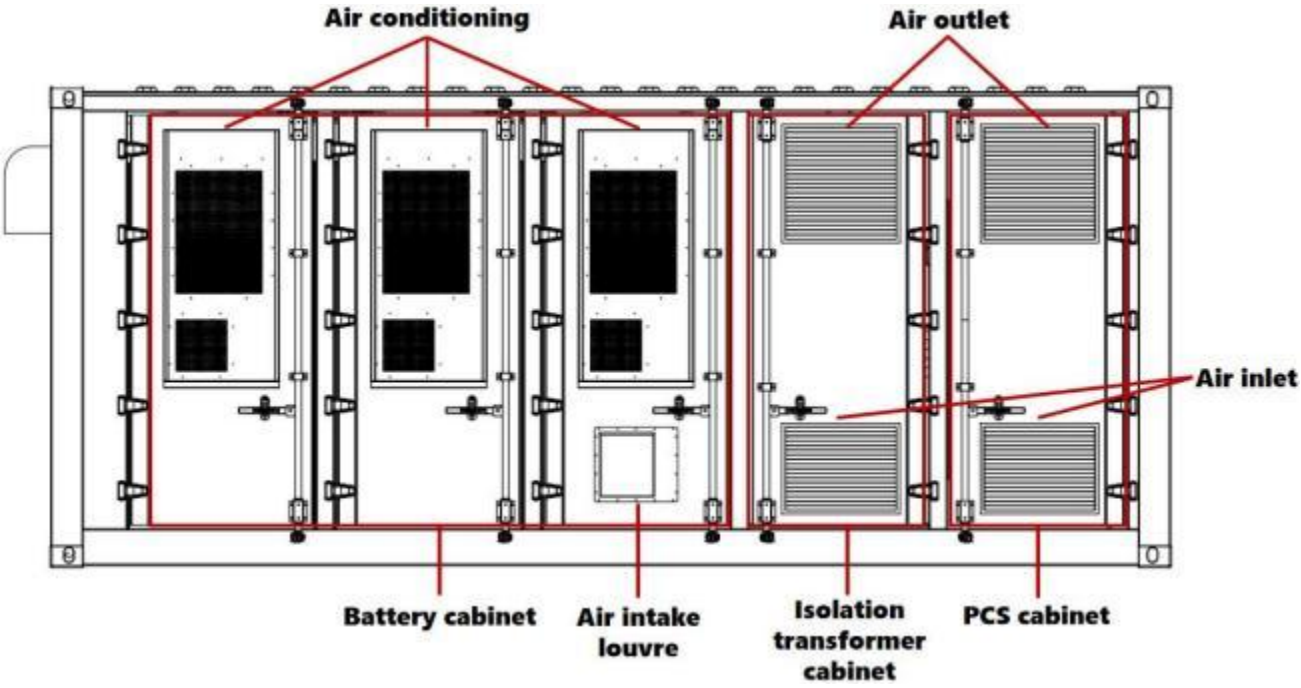


Fig. 2-2 20ft BRES Electrical Cabin exterior schematic



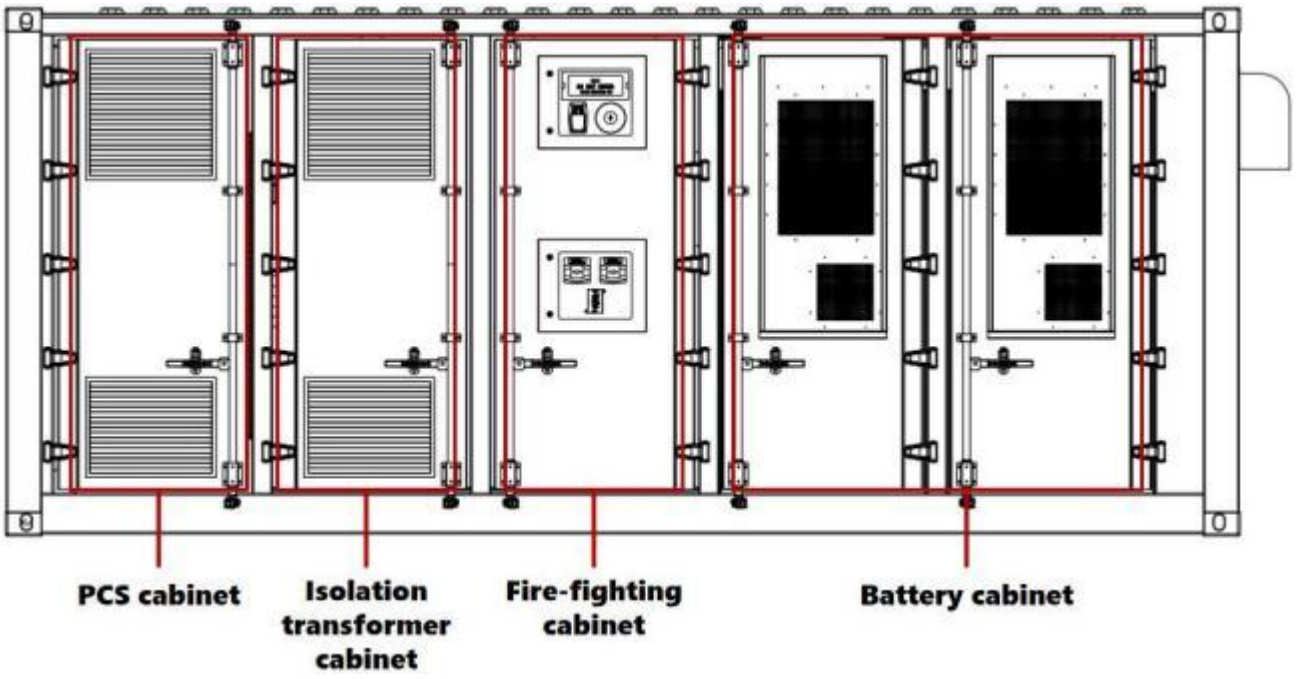


Fig. 2-3 20ft BRES Battery Cabin exterior schematic

2.5 Container System Components

2.5.1 PCS Cabin

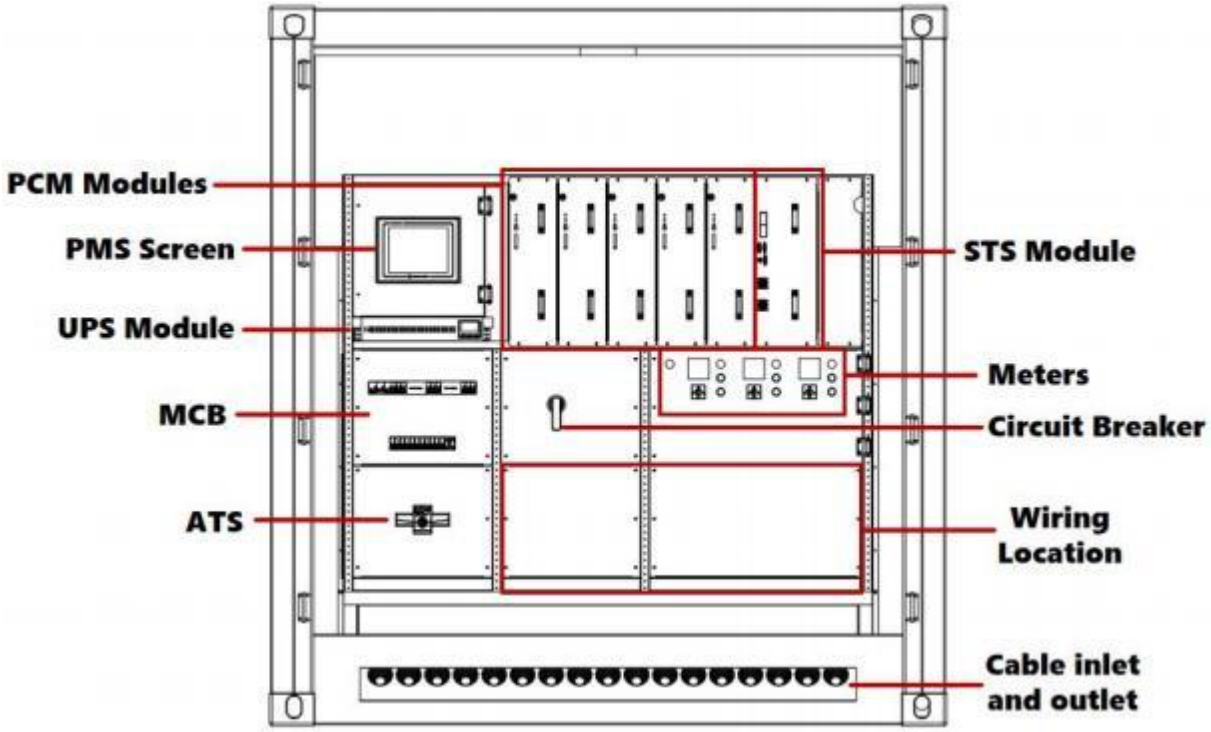


Fig. 2-4 20ft BRES Electrical Cabin interior diagram

Table 2-2 Configuration of Electrical Compartment Parts

No.	Name	Required/Optional	Description
1	PCM module	Required	Bidirectional variable flow module
2	STS module	Optional	If used off-grid (without switching between grid-connected and off-grid), the STS module is not required.
3	PMS Screen	Required	Operation screen
4	Grid circuit breakers	Required	AC input and output
5	UPS module	Required	Power supply to IPC screen
6	MCB	Required	/
7	Meters	Optional	/
8	ATS	Optional	Used when switching between different power supplies

2.5.2 Battery Cabin

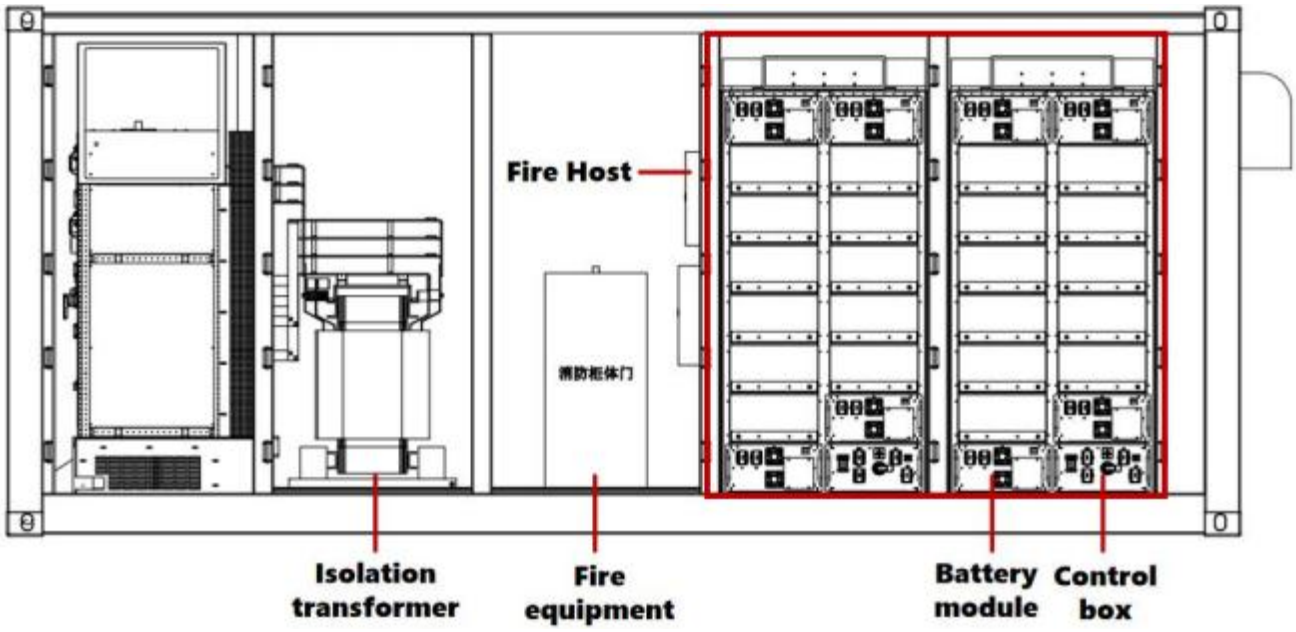


Fig. 2-5 20ft BRES Battery Cabin interior diagram

Table 2-3 Battery Compartment Component Configuration

No.	Name	Required/optional	PCS	Description
1	Control box	Required	1	Includes BMS and charge/discharge control circuit
2	Battery module	Required	15	Includes batteries, aerosol fire protection, fuse, and BMU

2.5.3 Transformer Cabin

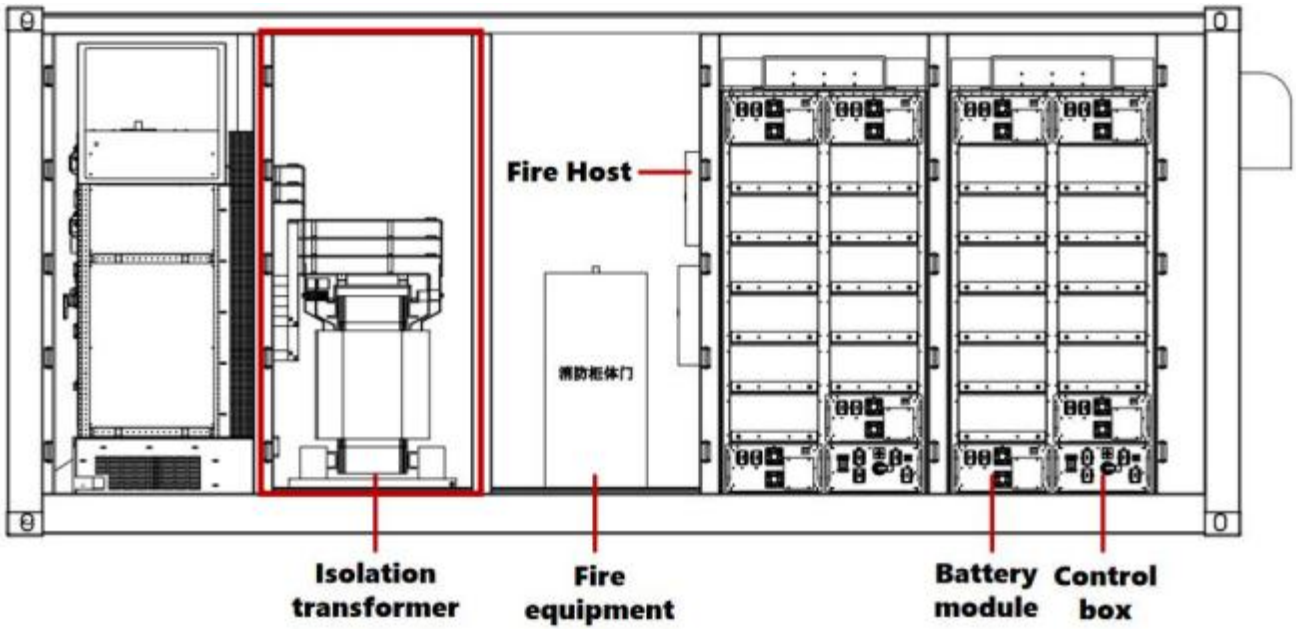


Fig. 2-6 20ft BRES transformer compartment diagram

Table 2-4 Transformer Bin Component Configuration

No.	Name	Required/optional	PCS	Description
1	Isolation transformer	Required	1	/
2	Transformer controller	Required	1	Detection of transformer temperature and other information

2.5.4 Fire Cabin

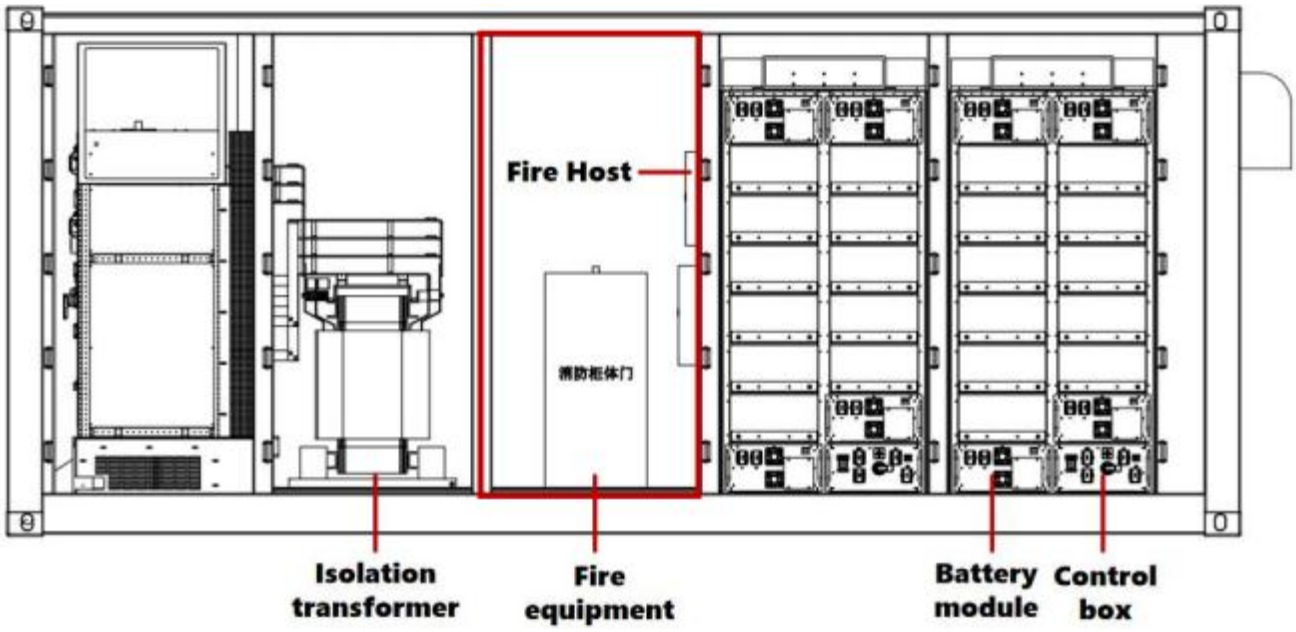


Fig. 2-7 20ft BRES fire compartment schematic

Table 2-5 Configuration of Fire Cabin Component

No.	Name	Required/optional	PCS	Description
1	Fire Equipment	Required	1	/
2	Fire Host	Required	1	Control based on fire logic

2.6 System and component introduction

2.6.1 System introduction

Table 2-6 System parameter table

Parameter table	BRES-720-375	BRES-960-500	BRES-1200-625
AC parameters (grid-connected)			
Rated output power (kW)	375	500	625
Rated grid voltage (V)	3W+N+PE, 380/400		
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		
AC parameters (off-grid)			
Rated output power (kW)	375	500	625
Maximum output power (kW)	393	525	656
Rated output voltage (V)	3W+N+PE, 380/400		
Output voltage harmonics	3% (linear full load)		
Rated frequency (Hz)	50/60		
Overload capacity	<110% : Long-term operation (110, 120) : Running time >10 minutes 120% : Stop running after 1 minute		
Battery parameters			
Cell type	LFP		
Capacity per battery cabinet (kWh)	241		
Number of battery	3	4	5

cabinets			
Capacity of battery system (kWh)	723	964	1205
Rated operating duration (h)	2 (other durations can be selected by changing the number of battery modules)		
Battery life	>6000 cycles（0.5P， 25±2℃@100%DOD@80%SOH）		
Maximum efficiency	93% (0.5P)		
Basic parameters			
Dimensions (W * D * H) (mm)	6058*2438*2591		
Weight (kg)	12000	14000	16000
Isolation Method	Isolation transformer (built-in)		
On-off-grid switching device	Electrical operation		
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	Battery cabin: air-conditioned PCS cabin: air-cooled		
Maximum Working Altitude (m)	≤4000 (>2000 derated)		
Display	HMI		
Communication Interface	RS485、LAN		
Communication Protocol	Modbus-RTU、Modbus-TCP		

2.6.2 Components

1) PCM module

The PCM series PCS power modules from our company 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. 2-8 Appearance of PCS Power Module

Table 2-7 PCM module para table

Module Model	PCM125V	
Battery interface parameters	Voltage range	DC580 V–DC950 V（3W3L）
		DC650 V–DC950 V（3W+N）
	Maximum DC current	230 A
AC grid-ties parameters	Output line	3W+N+PE
	Rated power	125 kW
	Rated voltage	AC 400 V
	Rated current	181 A
	Voltage range	-15%–+10%
	Rated frequency	50 Hz/60 Hz
	Frequency range	±2 Hz
	Output current harmonic	≤3% (rated power)
AC off-grid parameters	Output line	3W+N+PE
	Rated power	125 kW

	Rated voltage	AC 400 V
	Rated frequency	50 Hz/60 Hz
	Rated current	181 A
	Voltage accuracy	1%
	Frequency accuracy	±0.2 Hz
	Output voltage harmonic	3% (linear full load)
	Unbalanced load capacity	100%
	Overload capacity	≤110%: long-time running; (110, 120): running time≥10 min; 120%: 1 min stop running 150%: 10s stop running
Environment	Operating temperature	-20°C–70°C (derating above 50°C)
	Storage temperature	-40°C–70°C (without battery)
	Relative humidity	0% RH–95% RH, non-condensing
	Working altitude	≤4,000 m (derating above 2,000 m)
Communication and management	BMS communication interface	CAN/RS485
	EMS communication interface	Net interface/RS485
	Communication protocol	CAN2.0/ ModBus RTU/ ModBus TCP
Installation method		Cabinet
Isolation mode		Non-isolated type
Degree of protection		IP20 (internal glue filling)
Cooling mode		Air-cooled, with intelligent fan speed control
Peak efficiency		98.5%
Size (W×D×H, mm)		642×540×172
Weight		62 kg
Air-out method		Front-to-back airflow

2) Lithium-ion Battery module

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 of 15 battery modules and 1 high-voltage control box.
The battery module consists of a 3.2V314Ah 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. 2-9 Battery Module schematic

Table 2-8

Parameter table	EP314-1P16S
Capacity	314Ah
Combination approach	1P16S
Rated voltage	51.2V
Energy rating	16.0768kWh
Maximum continuous charging current	157A (0.5C)
Maximum continuous discharge current	157A (0.5C)
Voltage range	44.8~56V(Cell:2.8~3.5)
Operating ambient temperature	-20°C~60°C
Weight	117kg
Size (W*D*H)	474mm*763mm*230mm
Communication method	CAN
Cooling method	Intelligent air cooling

3) Temperature control system

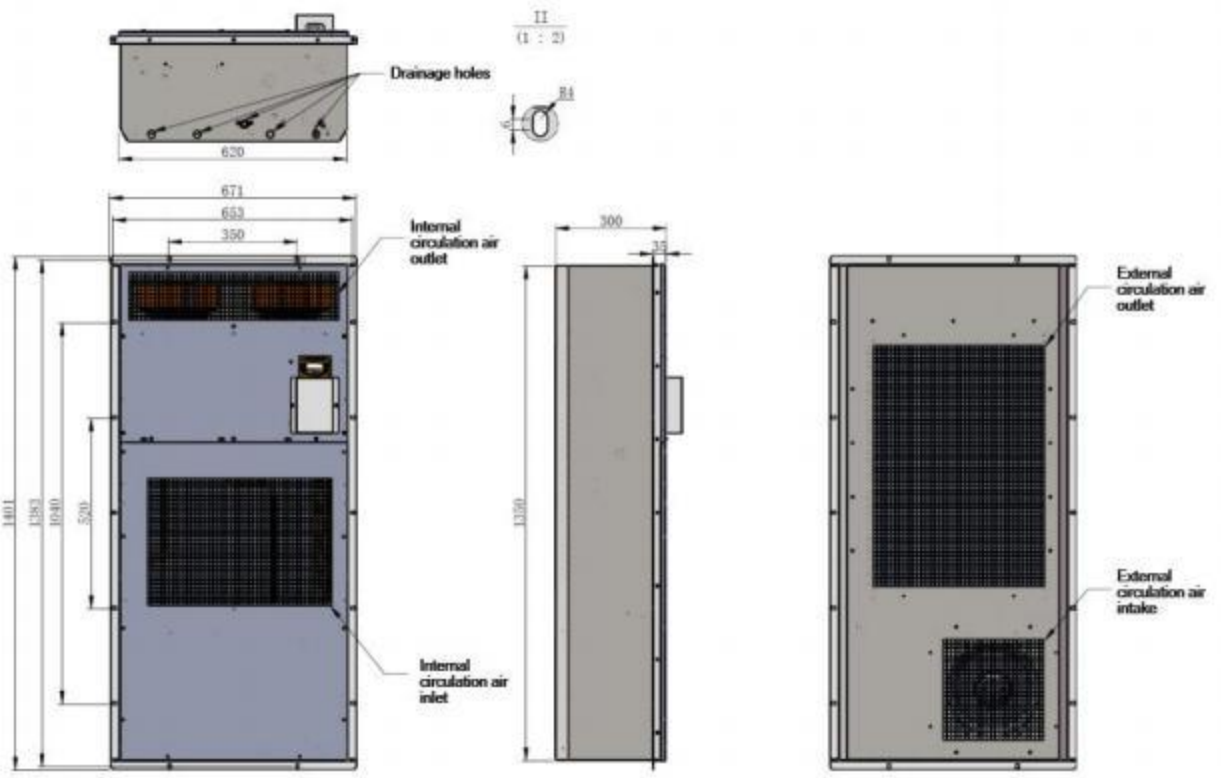
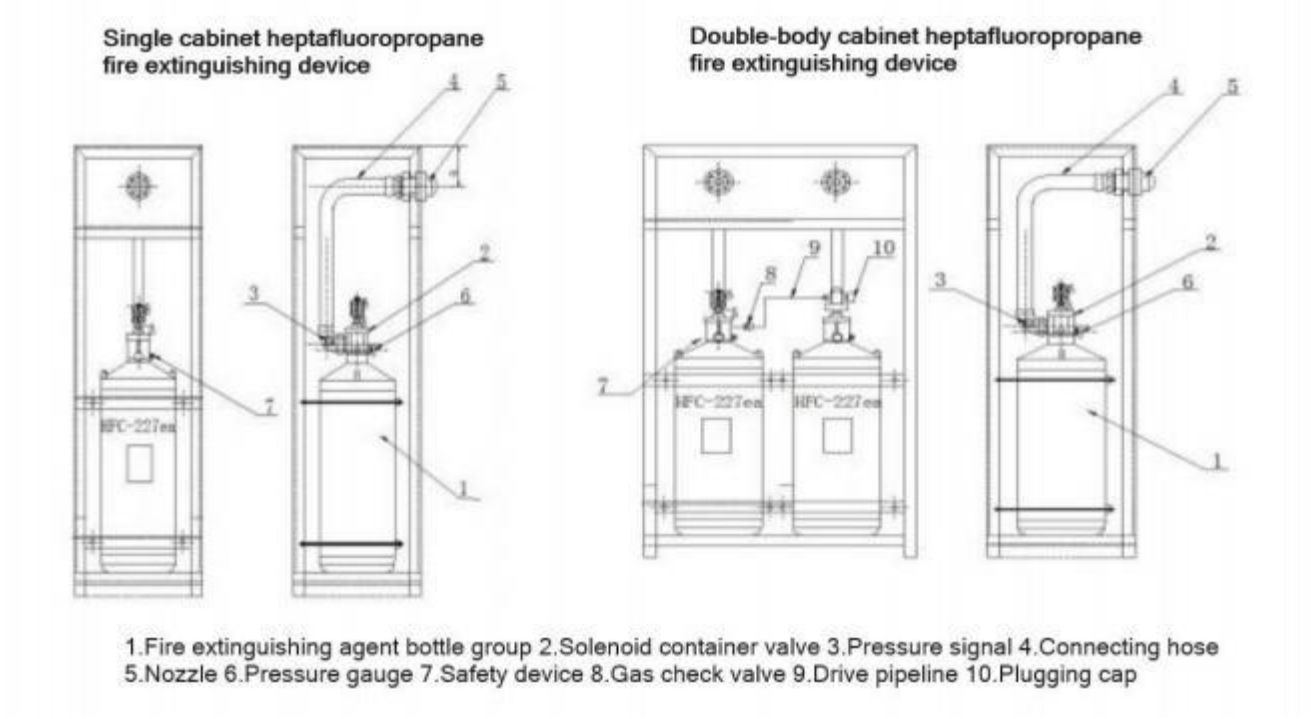


Fig. 2-11 Air Conditioner Appearance

Table 2-7 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

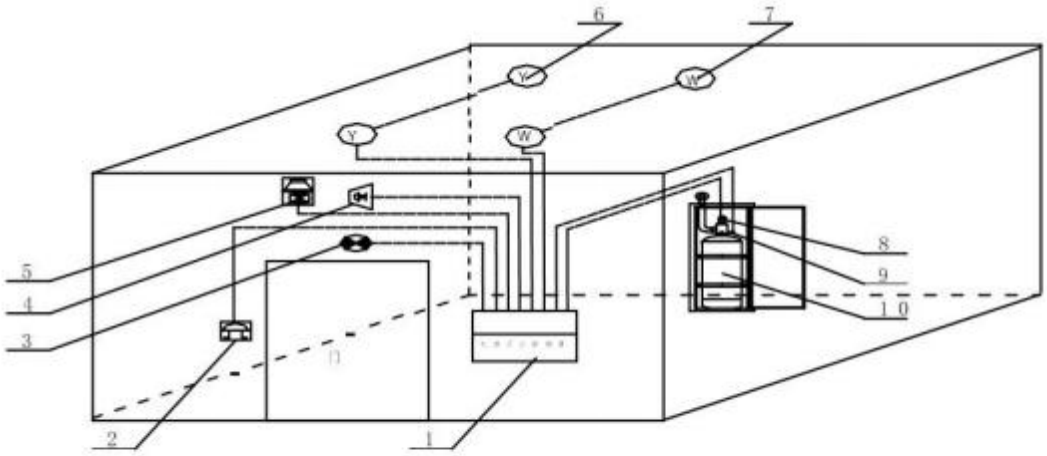
4) Fire protection system



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**

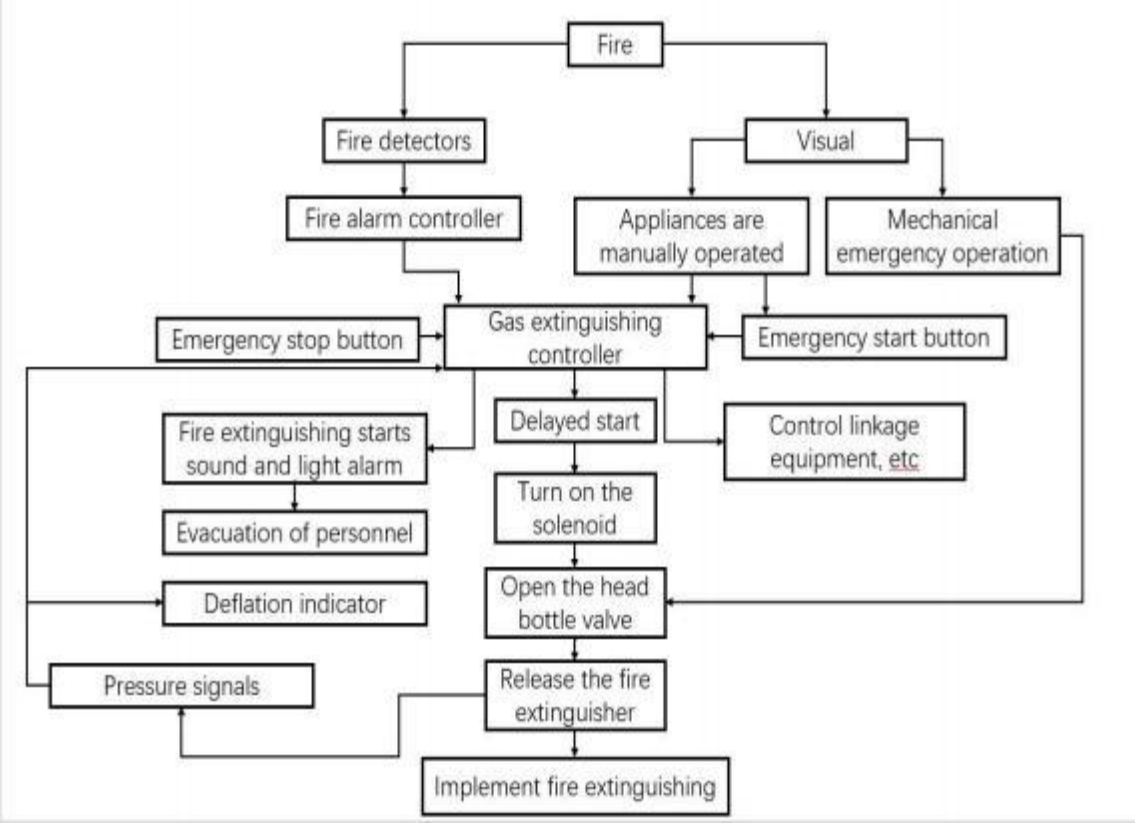
Upon simultaneous fire signals from smoke detectors and heat detectors, the controller initiates audible and visual fire alarms and issues commands to deactivate associated devices, such as fans and fire dampers. The system then autonomously proceeds to issue fire suppression instructions, initiate the 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.



For space reasons, more detailed fire instructions can be found in the ***Container Fire Instructions***.

2.6.3 Response Time

The power response time of an energy storage system is a key indicator of its dynamic performance, referring to the time it takes for the system to go from receiving a charge/discharge command to actually outputting the target power.

Scope of application:

Energy storage products: GRES series, BRES series, response time within 600ms.

Precautions:

When the EMS communicates with the energy storage system in the background, the interval time between issuing the target power value should be greater than 600ms.

3.Site Requirement

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

No.	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

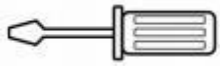
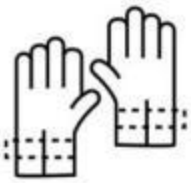
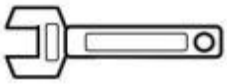
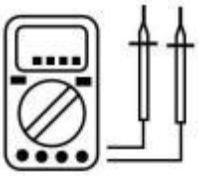
4.1 Preparation for installation

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

- BRES-720-375
- BRES-960-500
- BRES-1200-625

And offline compatible configurations.

Tool Preparation

Phillips screwdriver	One screwdriver	Hexagonal wrench
		
Insulated gloves	**Wrench or socket**	**Multimeter**
		

Requirement

Before installing the container, please check the following:

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

4.2 Installation of energy storage system

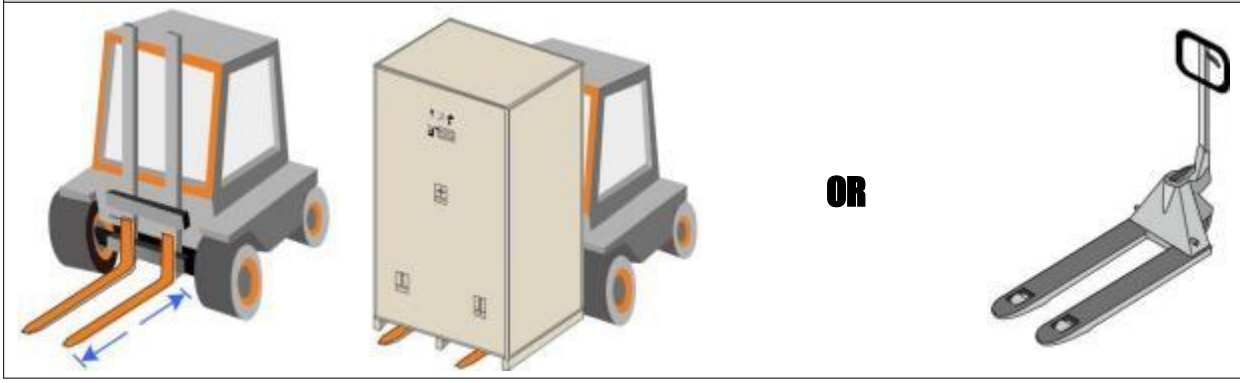
- Check for any external damage, deformation, or other appearance issues.
- Open all containerized energy storage internals and check for any damage or deformation. (If there are abnormalities, contact us immediately.)
- Remove the base support.
- Use a crane to place the cabinet on the base so that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

Note

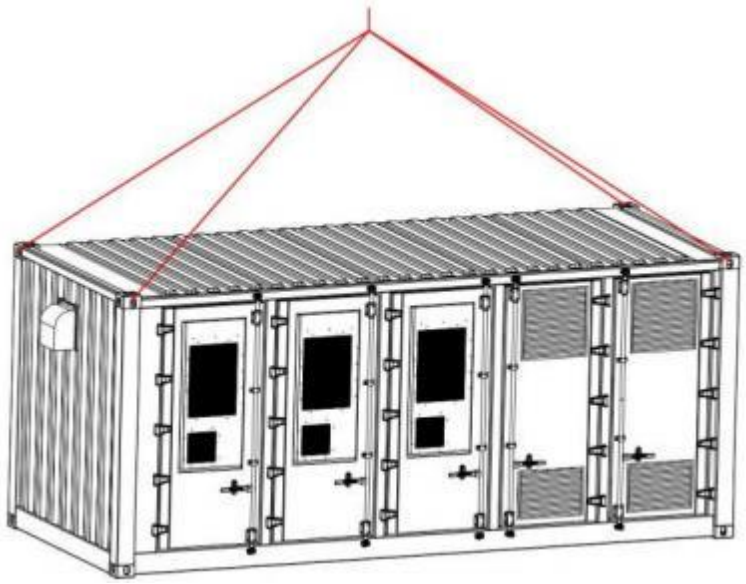
1. When installing the container, consider whether the space around the container meets the space requirements for installing battery modules;
2. Installation location should not be in low-lying areas. The installation horizontal plane should be higher than the historical highest water level in the area 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.

Installation and Transportation

1) For smaller and lighter equipment, forklifts can be used for transportation.

Forklift transportation


2) For equipment that is large and heavy (e.g. products such as containers), lifting is used.

Lifting


Note

1. Due to the significant weight of the battery module, it is advisable to consider fixing the cabinet in place before installing the battery module.

2. 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

1. Install signal cables before installing power cables.

2. 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.

3. 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.

4. 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.

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

	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.	

Note

1. See the diagram below for an explanation of label positions.
2. Refer to the diagram below for the battery module, control box, and fixing hole positions.
3. See the diagram below for signal cable connections in the green sections.
4. Refer to the yellow connection lines in the diagram for power cable installation.

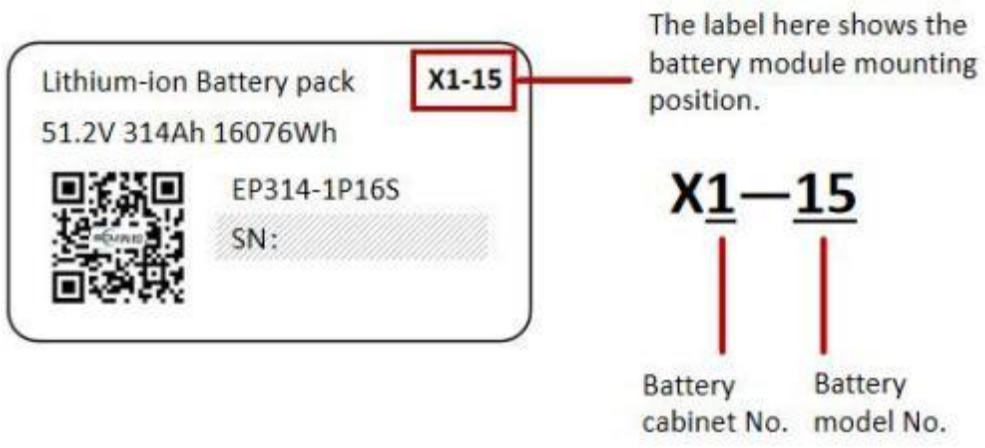


Figure 4-1 Battery module label schematic

Requirement

Regarding the order of battery clusters in containers (only applicable to string connection, the system internal connection defaults to this method):

1. For string type container, the address of each battery cluster is 1 by default, so there is no special requirement for which battery compartment to place.
2. Battery modules in the same cluster are numbered (labelled on the front panel of the battery module) and need to be installed in order (e.g. X1-1 to X1-15, X2-1 to X2-15).

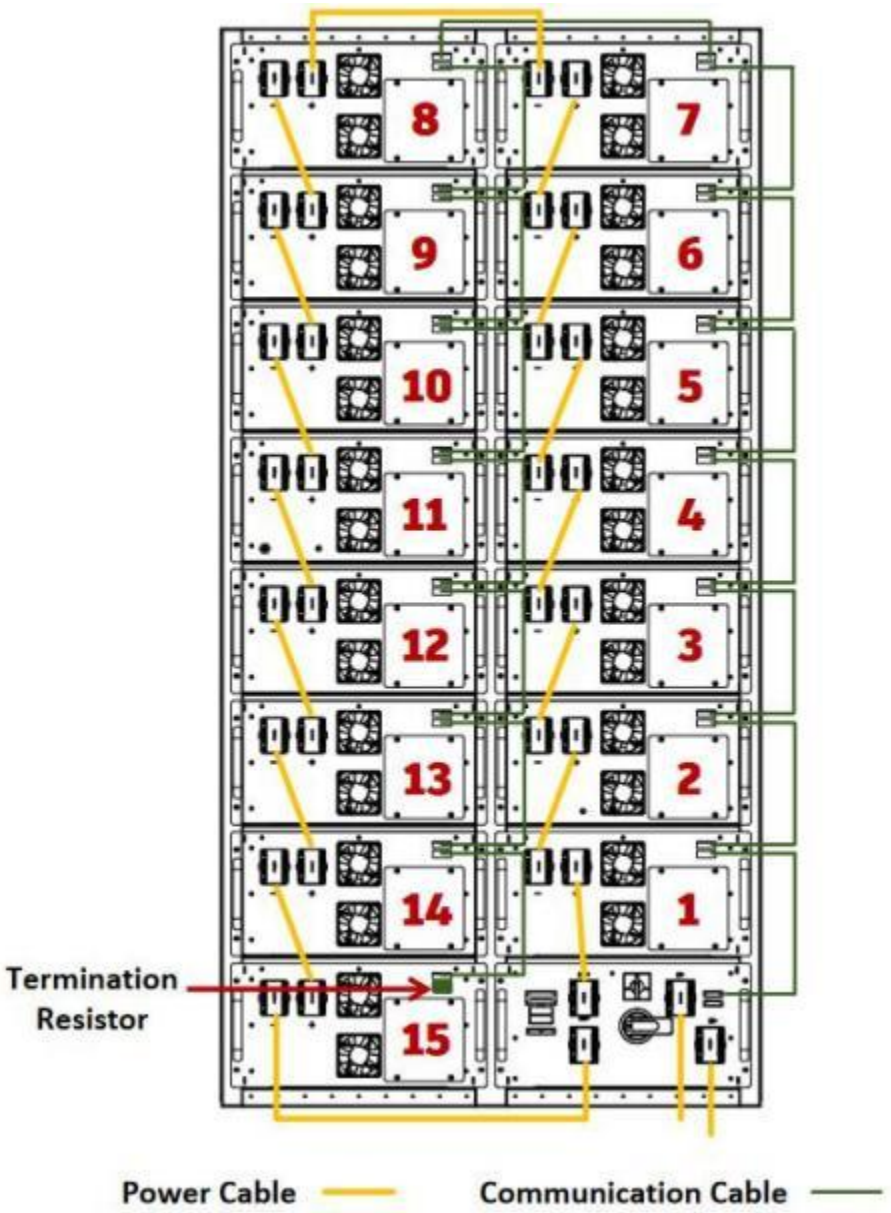


Fig. 4-2 Battery module connection diagram

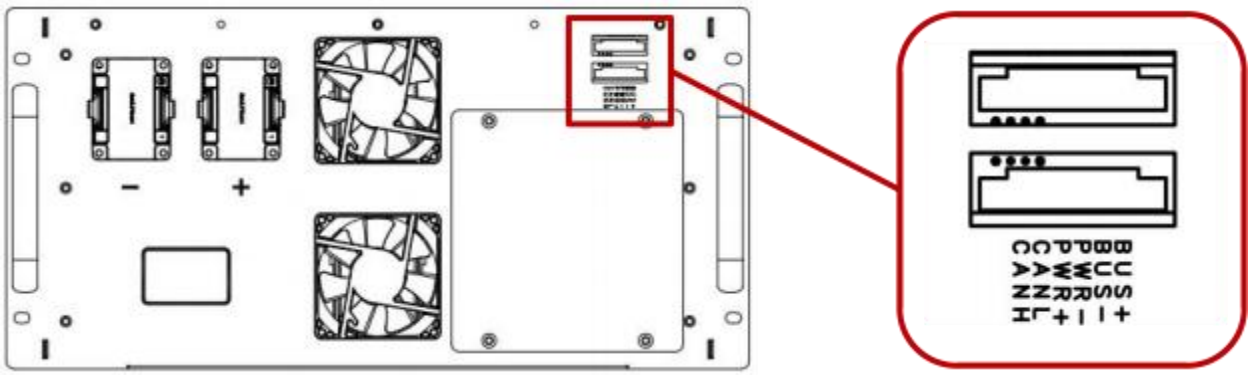


Table 4-2 Meaning table of communication interfaces on the battery module

Marking	Meaning
BUS+、BUS-	Active equalization power supply.
PWR-、PWR+	Battery module power supply communication port with BMU board enabling.
CANL、CANH	CAN communication between BCU and BMU.

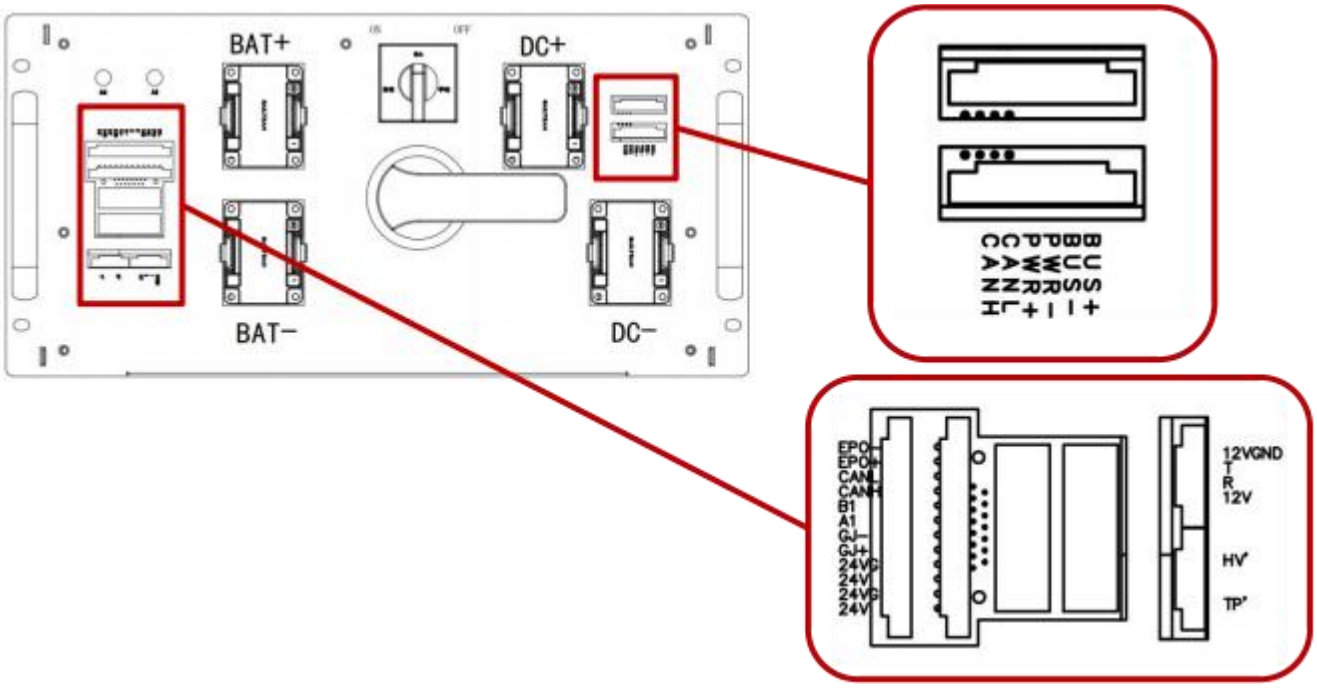


Table 4-3 Meaning of communication interfaces on the control box

Marking	Meaning
Communication interface with battery module	
BUS+、BUS—	Active equalization power supply
PWR—、PWR+	Communication port for battery module power supply, enable with BMU board
CANL、CANH	CAN communication between BCU and BMU
Communication port with electrical section	
EPO+、EPO—	EPO emergency stop signal
CANL、CANH	H and L of CAN communication interface for parallel communication with PCS
B1、A1	A, B of 485 communication interface, used for communication with the upper computer
GJ—、GJ+	Shutdown interface
24VG、24V	On interface
12VGND、12V、T、R	RS232 communication, connecting to the display
HV'、TP'	Alternate power-on interface

Parallel port 1/2	/
Control box indicator light	
RUN	Run indicator (green)
ALM	Alarm indicator (red)



Indications on the control box are used to observe the operation of individual cell clusters and to ensure that no danger occurs when commissioning or other work is carried out!

4.3.2 PCM Module Installation

① Make sure that the PCM readiness switch remains off and the ship button is turned to [OFF] before installation.

② Install the module in position.

③ Secure and check the module.

④ Set the switch on the PCM module to [ON].

⑤ Make sure that the address of the same type of module is not duplicated and that the address bits are differentiated by dialling codes, which are set at the factory.

⑥ After the module is in place, use a Phillips screwdriver to fix the panel.

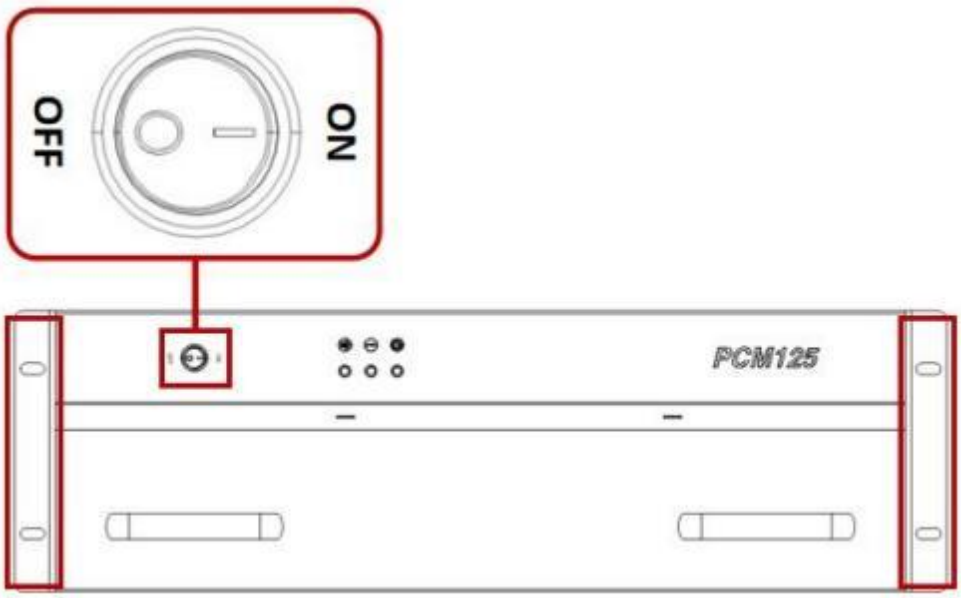


Figure 4-3 Front view of PCM125V module

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.



1. All electrical connections must comply with the electrical connection standards of the country or region where the project is located.
2. Only professional electricians or individuals with professional qualifications are permitted to carry out electrical connections on this product.
3. Follow the wiring instructions strictly according to the equipment's labeling.
4. Follow the silk-screen on the distribution room for wiring, and do not reverse the live and neutral wires.
5. 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!

The recommended cross-sectional areas of the individual cables of the container energy storage system are shown in the table in the appendix:

The diameter of the cable used is related to the distance, the appendix is only the recommended size! When wiring, please check the actual situation in the calculation!

Distance to 50m as a reference, connecting distance more than 50m, please choose a larger diameter cable for connection!

Note: For recommended cable diameters and bolt torque tables, please refer to the appendix.

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.



1. Please strictly follow the wiring instructions indicated inside the equipment.
2. 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

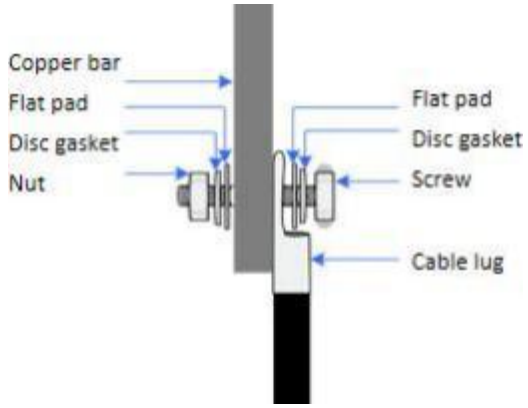
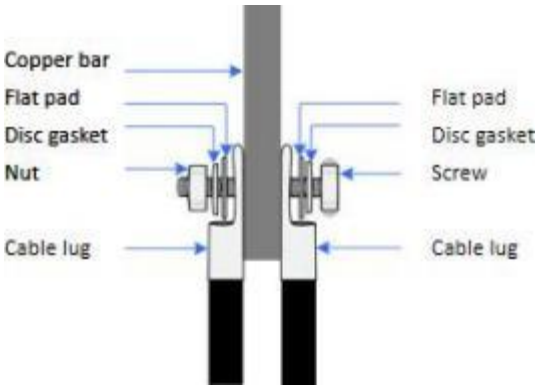
For multi-core cables, it is recommended to add cable protection sleeves at the branching points to prevent outer insulation cracking.

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.

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

Case 1	Case 2
	

Warning

1. 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.
2. During connection, ensure the fastening of the connectors. Insufficient connection or oxidation of the contact surface may cause excessive heat, leading to fire.



1. 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.
2. 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.
3. Confirm that the connection is secure.

Note: 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.



Before connecting the AC input line, make sure that the AC and DC circuit breakers are disconnected and that the 'No Operation' sign is prominently displayed.

Note: Due to the high degree of customisation of the container, the wiring is not shown here. The wiring locations have corresponding labels, please pay attention to the installation, flexible response.

Table 5-1

Marking	Meaning
GRID	AC input wiring ports (L1, L2, L3)
N	AC input and output N-bar
PE	Grounding position



1. 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!

2. 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!

6.Equipment Power Up & Down

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:

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

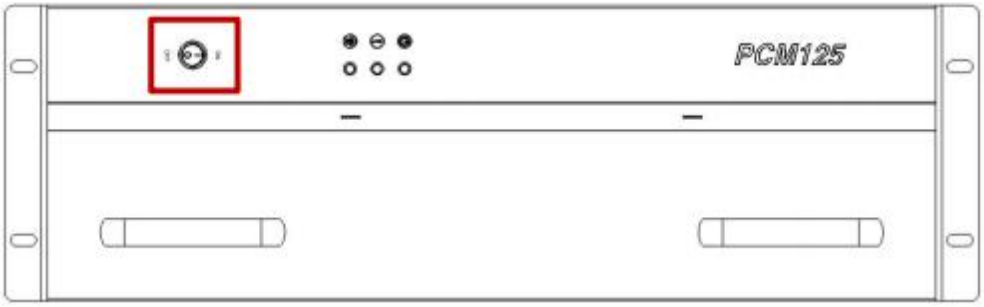
6.2 System ON & OFF Operation

Container system power-up operation is based on whether or not manual operation is distinguished.

The default screen operation is the EMS (IPC) screen operation, the container internal screen (PCS screen) is the engineer screen, used to set up, maintenance equipment. The remote mode has been turned on before shipment, **so there is no need for the customer to set up the operation.**

6.2.1 Manual power up & down operation

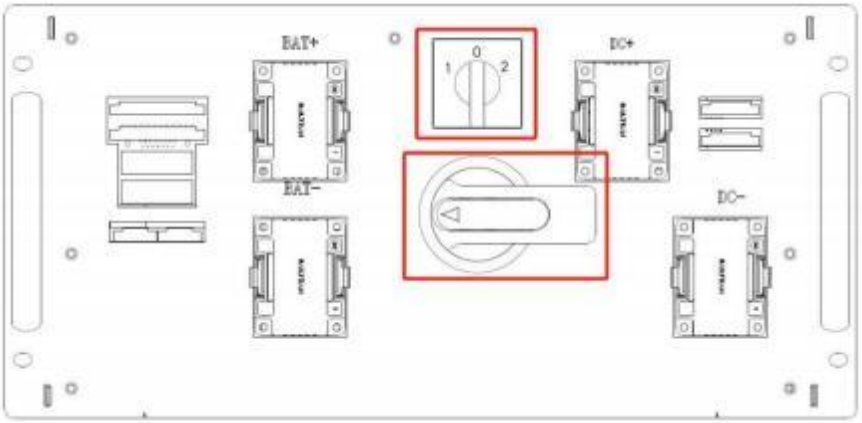
1) 1. Press the PCM button to the on state, as shown in the figure [ON].



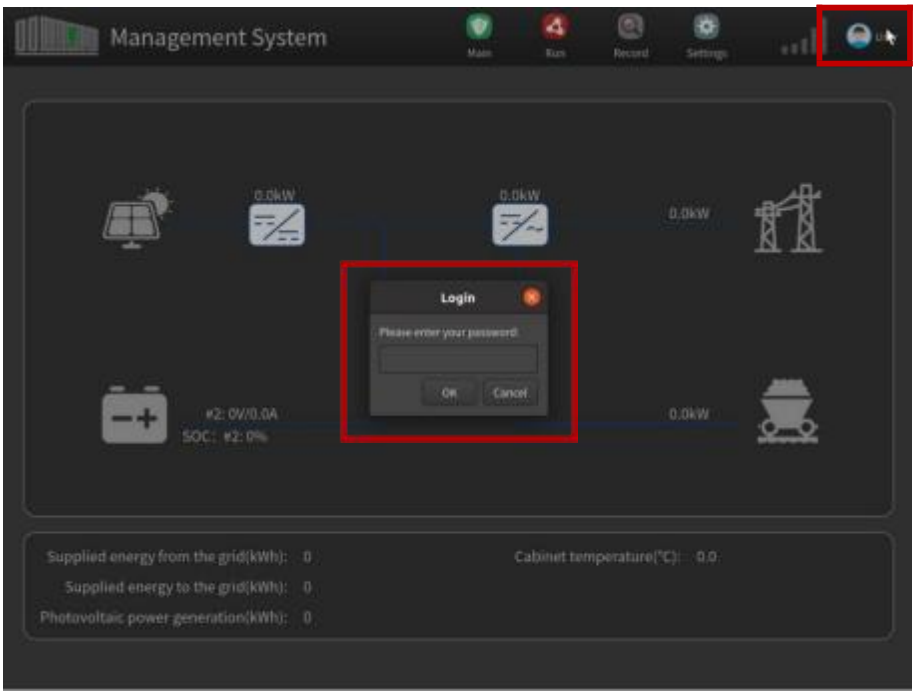
2) Press and hold "ON/MUTE" on the PCS compartment screen for 5s to turn on the UPS, and the screen of IPC will light up.



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)

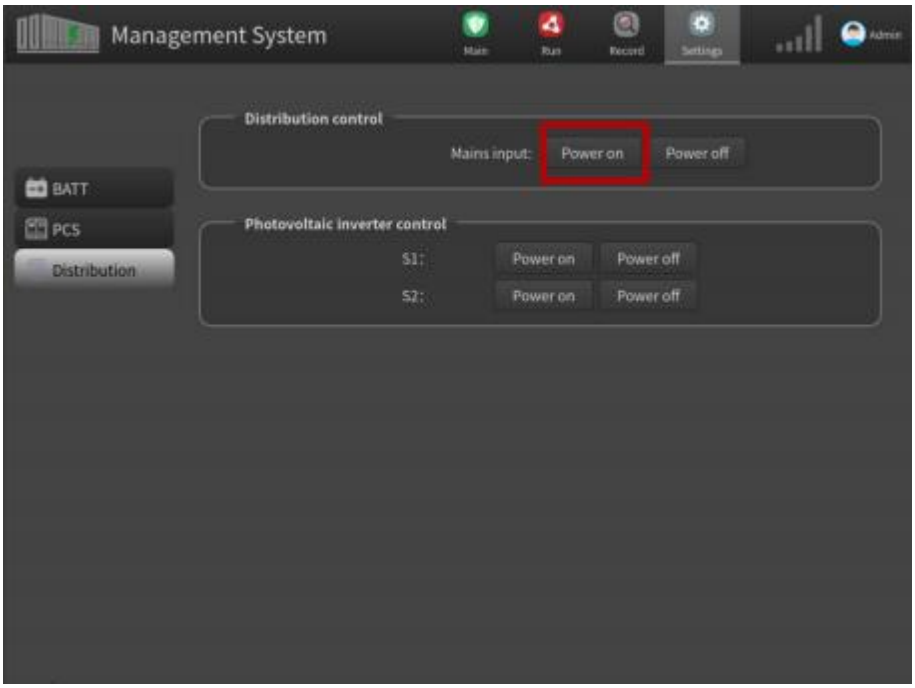


5) Click 【Run】 → 【Battery System】 → 【Battery Cluster No.】 at the top of the IPC screen (different battery compartments can be selected to view the data information) to check whether there is any data information (you can check the switching status (power on, etc.) as well as the system status (quiescent, 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.

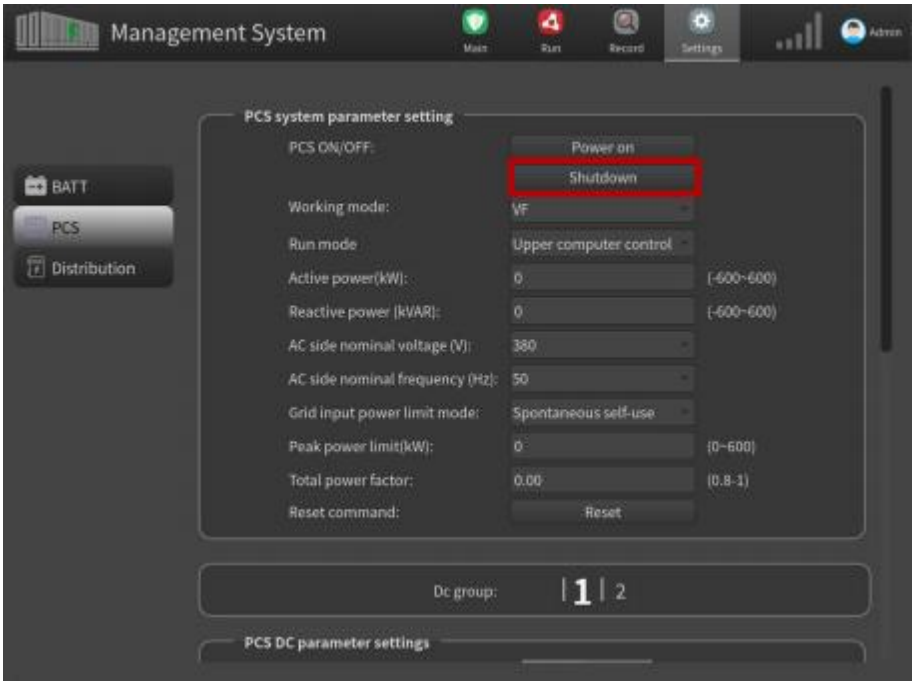




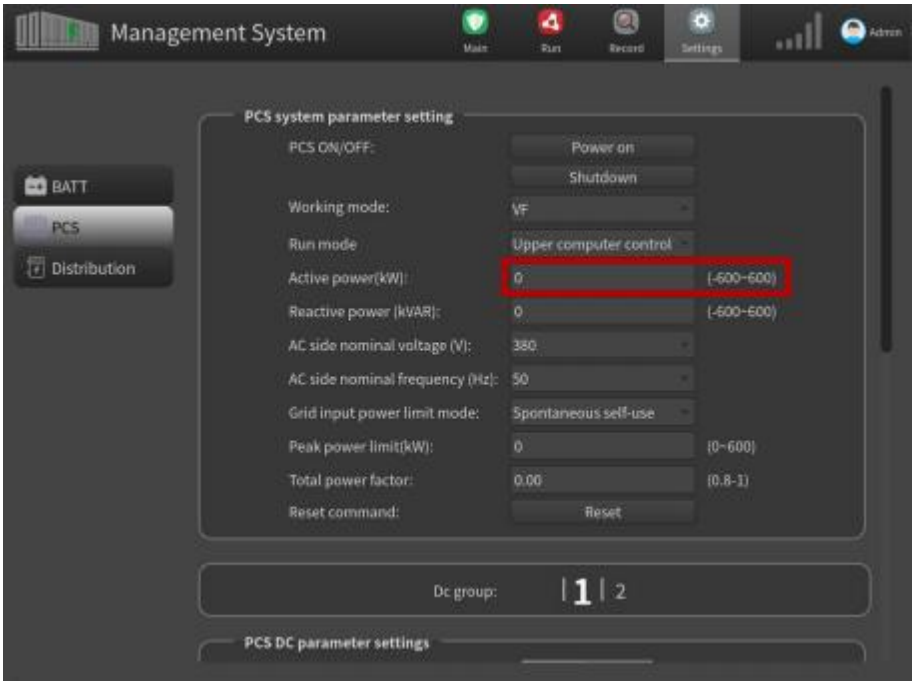
6) Click 【Configuration】 → 【Power Distribution】 → 【Power Distribution Control】 → 【Grid Input】 → 【Power Up】. Observe the color inside the left hole; red indicates "ON", at which point the AC input circuit breaker will close. (Same with power-off)



7) 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.



8) 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.

Note: Depending on the configuration of different needs, the operation interface may change accordingly, please adjust flexibly according to the actual situation.
Specific instructions are detailed in the *<EMS Screen Manual>*.

7.Routine Maintenance & Faults List

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 Modules 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 PCM 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 STS 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 Steps

- 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 & 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 & 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.

Table 7-1 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	8~10 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 dust proof 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 Orient Power for technical support.

Table 7-2 System faults and solutions

ITME	Recommended solution
AC side abnormal shutdown	Check whether the DC side switch is closed; Check whether the AC side switch is closed;
DC side abnormal shutdown	Check whether the DC side voltage is normal; Check whether the AC side voltage is normal; Check whether the static switch is working normally.
Grid phase sequence inverted	Check whether the grid side three-phase sequence is correct.
Output voltage abnormal	1. 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 "OFF" 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 over-temperature	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	

Version Update

Version	Update	Content
V1.2	2024.12.24	1. Module: PCM100IIHC 2. Cell: 280Ah
V1.3	2025.04.22	1. Split the 10-foot and 20-foot container description. 2. Module: PCM100IIHC→PCM125V 3. Cell: 280Ah→314Ah 4. Refine the description of the recommended cable table and move it to an appendix
V1.4	2025.05.29	Added instructions about system response time.

Appendix

Appendix 1: Recommended Wire Diameter

Standard:N cable cross-sectional area = L cable cross-sectional area (to avoid neutral line overload, GB/T 16895.3-2017); PE cable: still according to ≥ 50% of the L cable cross-sectional area (TN-S system)

(Prerequisites: 380/220V standard voltage; copper-core cable; divided into overhead and trench/buried alignment; <50m calculated according to 2.5A current, >50m calculated according to 2A current; consider safety margin and derating.)

Table 1 ≤50m (short distance) Wire diameter recommendation table

Data Calculation		Overhead cable (derated 1.0, 2.5A/mm²) ≤ 50m (mm²)				Trench cable routing (derated 0.8, 2.0A/mm²) ≤ 50m (mm²)			
Power（KW）	Current（A）	Theoretical Cut-off Area	L	N	PE	Theoretical Cut-off Area	L	N	PE
125	189.39	75.76	95*1	95*1	50*1	118.42	70*2	70*2	70*1
250	378.79	151.52	95*2	95*2	95*1	236.84	120*2	120*2	95*1
375	568.18	227.27	95*3	95*3	95*1	355.26	120*3	120*3	120*1
500	757.58	303.03	185*2	185*2	150*1	473.68	240*2	240*2	120*1
625	946.97	378.79	240*2	240*2	185*1	592.11	240*3	240*3	150*2
750	1136.36	454.55	185*3	185*3	120*2	710.53	240*3	240*3	185*2
875	1325.76	530.30	240*3	240*3	300*1	828.95	300*3	300*3	150*3
1000	1515.15	606.06	240*3	240*3	300*1	947.37	240*4	240*4	240*2
1125	1704.55	681.82	240*3	240*3	240*2	1065.79	300*4	300*4	300*2
1250	1893.94	757.58	400*2	400*2	400*1	1184.21	400*3	400*3	300*2

The cables follow the standards:

① *GB/T 3956-2008 Cable Conductor Standard*

② *GB 50217-2018 Power Engineering Cable Design Specification*

③ *IEC 60364-5-52 Electrical Installation Standard*

Table 2 >50m (long distance) Wire diameter recommendation table

Data Calculation		Overhead cable (derated 1.0, 2.0A/mm²) ≤ 50m (mm²)				Trench cable routing (derated 0.8, 1.6A/mm²) ≤ 50m (mm²)			
Power（KW）	Current（A）	Theoretical Cut-off Area	L	N	PE	Theoretical Cut-off Area	L	N	PE
125	189.39	94.70	120*1	120*1	70*1	148.04	95*2	95*2	95*1
250	378.79	189.39	95*2	95*2	95*1	296.09	150*2	150*2	120*1
375	568.18	284.09	150*2	150*2	150*1	444.13	150*3	150*3	120*2
500	757.58	378.79	240*2	240*2	240*1	592.17	300*2	300*2	300*1
625	946.97	473.48	185*3	185*3	240*1	740.21	300*3	300*3	185*2
750	1136.36	568.18	240*3	240*3	150*2	888.26	240*4	240*4	240*2
875	1325.76	662.88	240*3	240*3	185*2	1036.30	300*4	300*4	300*2
1000	1515.15	757.58	300*3	300*3	240*2	1184.34	400*3	400*3	300*2
1125	1704.55	852.27	240*4	240*4	240*2	1332.38	300*4	300*4	300*2
1250	1893.94	946.97	240*4	240*4	240*2	1480.43	400*4	400*4	400*2

Notes:

For 1125KW and above power, it is recommended to use closed busbar solution. Specific construction methods need to be consulted and based on professional design and construction team design!

Appendix 2: Recommended Bolt Torque Table

The two tables are for reference only, please ask the operator to be flexible according to the situation.

Bolt Strength Grade	Yield strength（N/mm²）	Nominal bolt diameter（ mm）							
		6	8	10	12	14	16	18	20
		Tightening torque（N • m）							
4.6	240	4-5	10-12	36-45	55-70	90-110	90-110	120-150	170-210
5.6	300	5-7	12-15	70-90	70-90	110-140	110-140	150-190	210-270
6.8	480	7-9	17-23	93-124	93-124	145-193	145-193	199-264	282-376
8.8	640	9-12	22-30	124-165	124-165	193-257	193-257	264-354	376-502
10.9	900	13-16	30-36	180-201	180-201	280-330	280-330	380-450	540-650
12.9	1080	16-21	38-51	209-278	209-278	326-434	326-434	448-597	635-847

Bolt Strength Grade	Yield strength（N/mm²）	Nominal bolt diameter（ mm）						
		22	24	27	30	33	36	39
		Tightening torque（N • m）						
4.6	240	230-290	300-377	450-530	540-680	670-880	900-1100	928-1237
5.6	300	290-350	370-450	550-700	680-850	825-110	1120-1400	1160-1546
6.8	480	384-512	488-650	714-952	969-1293	1319-1759	1694-2259	1559-2079
8.8	640	512-683	651-868	952-1269	1293-1723	1759-2345	2259-3012	2923-3898
10.9	900	740-880	940-1120	1400-1650	1700-2000	2473-3298	2800-3350	4111-5481
12.9	1080	864-1152	1098-1464	1606-2142	2181-2908	2968-3958	3812-5082	4933-6577

Appendix 3： Chinese and American wire gauge wire diameter comparison table.

The actual wire diameter will have deviation, please calculate according to the actual needs before choosing the appropriate cable.

CWG	Diameter mm	—	—	9.00	8.00	7.10	6.30	5.60	5.00	4.50	4.00
AWG	Number	4/0*	3/0*	2/0*	1/0*	1	2	3	4	5	6
	Diameter mm	11.684	10.404	9.266	8.252	7.348	6.543	5.827	5.189	4.620	4.115
	Diameter inch	0.4600	0.4096	0.3648	0.3245	0.2893	0.2576	0.2294	0.2043	0.1819	0.1620
Cross-sectional area	mm^2	107.2200	85.0100	67.4300	53.4900	42.4100	33.6200	26.6700	21.1500	16.7700	13.3000

CWG	Diameter mm	3.55	3.15	2.80	2.50	2.24	2.00	1.80	1.60	1.40	1.25
AWG	Number	7	8	9	10	11	12	13	14	15	16
	Diameter mm	3.665	3.264	2.906	2.588	2.304	2.052	1.829	1.628	1.450	1.290
	Diameter inch	0.1443	0.1285	0.1144	0.1019	0.0907	0.0808	0.0720	0.0641	0.0571	0.0508
Cross-sectional area	mm^2	10.5500	8.3700	6.6300	5.2600	4.1700	3.3320	2.6270	2.0750	1.6460	1.3180

CWG	Diameter mm	1.12	1.00	0.90	0.80	0.71	0.63	0.56	0.50	0.45	0.40
AWG	Number	17	18	19	20	21	22	23	24	25	26
	Diameter mm	1.151	1.024	0.912	0.813	0.724	0.643	0.574	0.511	0.455	0.404
	Diameter inch	0.0453	0.0403	0.0359	0.0320	0.0285	0.0253	0.0226	0.0201	0.0179	0.0159
Cross-sectional area	mm^2	1.0260	0.8107	0.5667	0.5189	0.4116	0.3247	0.2588	0.2047	0.1624	0.1281

CWG	Diameter mm	0.355	0.315	0.28	0.25	0.244	0.20	0.18	0.16	0.14	0.125
AWG	Number	27	28	29	30	31	32	33	34	35	36
	Diameter mm	0.361	0.320	0.287	0.254	0.226	0.203	0.180	0.160	0.142	0.127
	Diameter inch	0.0142	0.0126	0.0113	0.0100	0.0089	0.0080	0.0071	0.0063	0.0056	0.0050
Cross-sectional area	mm^2	0.1021	0.0804	0.0647	0.0507	0.0401	0.0316	0.0255	0.0201	0.0169	0.0127