Gotion GRID 5015

Liquid Cooling Energy Storage System Ⅲ

System Manual (CE Version)

Using This Manual

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Clarification of Battery Component Terminology

To standardize terminology across Gotion ESS technical documentation, we adhere to the following nomenclature hierarchy for battery components:

Cell -> Module -> Pack -> Rack -> Bank -> Stack/Cluster -> Container

The table below provides detailed definitions for each component level:

Item	Definition
Battery cell	The smallest unit of the battery system. It consists of electrodes, electrolyte, separator, and casing.
Battery module	A module is a group of interconnected cells. These can be in a series and/or parallel configuration to achieve the desired voltage, capacity, or power levels.
Battery pack	A pack may consist of one or several connected modules, along with all the necessary electronic components to manage the cells, such as the battery management unit (BMU) of the battery management system (BMS), detectors, and often thermal management systems. Note: conceptually, the pack-level referred to here is equivalent to the module-level when it comes to UL9540A testing or certifications.
Battery rack	Racks are assemblies that house multiple battery packs. They facilitate integration into larger systems by providing structural support, electrical connections, and protective measures. Note: conceptually, the rack-level referred to here is equivalent to the unit-level for UL9540A testing.
Battery bank	A bank is a physical assembly of one or more battery racks mounted together to fit into the container. For example, in the GRID5015 container, 2 racks, each containing 4 packs are mechanically mounted together on an assembly, herein referred to as a bank.
Battery stack/cluster	These terms are often used interchangeably and refer to groups of racks electrically assembled together to enhance capacity or output according to specific configurations. For example, a GRID5015 container consists of 2 stacks, which provides 2 independent DC outputs.
Container/system	A "container" or "system" typically refers to a large, self-contained unit that houses multiple battery racks. These containers are designed to be modular and scalable, enabling easy integration into larger energy storage setups. Note: conceptually, the container/system-level in this context is equivalent to the installation-level for UL9540A testing.

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Abbreviations

AC	Alternating Current
AWG	American Wire Gauge
BAMU	Battery Array Management Unit (3rd-level BMS)
BCMU	Battery Cluster Management Unit (2nd - level BMS)
BESS	Battery Energy Storage System
BMS	Battery Management System
BMU	Battery Management Unit (1st -level BMS)
CCU	Central Control Unit
DC	Direct Current
DI/DO	Data Input / Data Output
DOD	Depth of Discharge
DN38	Diameter Nominal 38
DEC	Diethyl Carbonate
EMC	Ethyl Methyl Carbonate
End of Life (EoL)	The point where a battery falls below a certain failure threshold.
ESD	Electrostatic Discharge
ESS	Energy Storage System
EMS	Energy Management System
FS%	Full Scale %
ft	Feet in measurement
gpm	Gallons per Minute
GND	Ground (or Grounding)
HMI	Human Machine Interface
HVAC	Heating, Ventilation and Air Conditioning
ICP	Integrated Control Panel
IP Class	Ingress Protection Class, an international standard used to rate the degree of protection or sealing effectiveness in electrical enclosures against intrusion of objects, water, dust or accidental contact.
LEL	Lower Explosive Limit
LFL	Lower Flammability Limit
LFP	Lithium Iron Phosphate

MCB	Miniature Circuit Breaker
O&M	Operation and Maintenance
PCS	Power Conversion System
P-rate (0.5P)	The ratio of the charge/discharge power to the battery energy as measured by the system.
PPE	Personal Protective Equipment
RH (%)	Relative Humidity (%)
SoC	State of Charge
SoH	State of Health
UPS	Uninterruptible Power Supply
DT Terminal	Deutsch Terminal
OT Terminal	Open Terminal

1Safety information

1.1General safety

Before transporting, storing, installing, operating, using, or maintaining the equipment, it is crucial to read and strictly adhere to the instructions in this document, as well as all safety guidelines provided on the equipment itself.

For the purposes of this document, "equipment" encompasses the products, software, components, spare parts, and services related to this guide; "the Company" refers to the equipment's manufacturer, seller, or service provider; "you" refers to the entity handling the equipment in any of the mentioned capacities.

The safety statements—Danger, Warning and Notice—within this document do not encapsulate all necessary safety precautions. You must also observe applicable international, national, or regional standards and industry practices.

The Company disclaims liability for any harm or loss resulting from non-compliance with safety requirements or standards in terms of equipment design, production, and usage. The equipment must operate in environments that fulfill its design specifications. Failure to do so can lead to defects, malfunctions, or damage not covered by warranty.

Furthermore, the Company is not responsible for any property loss, personal injury, or death that may occur. Ensure all activities such as transportation, storage, installation, operation, use, and maintenance comply with relevant laws, regulations, standards, and specifications.

Refrain from reverse engineering, decompiling, disassembling, adapting, embedding, or creating derivative works from the equipment software. Avoid attempting to understand the internal logic, accessing the software's source code, infringing on intellectual property rights, or disclosing any performance test results of the software.

The Company will not be held liable under the following circumstances:

- Damage to the equipment due to force majeure events such as earthquakes, floods, volcanic eruptions, landslides, lightning, fires, wars, conflicts, and severe weather conditions.
- Operation of the equipment beyond the stipulated conditions in this document.
- Installation or usage in environments that do not meet established international, national, or regional standards.
- Damage resulting from storage conditions that do not adhere to those specified in the product documentation.
- Installation or usage by unqualified personnel.
- Damage due to negligence, intentional misconduct, or improper operations by the receiving party or a third party.
- Failure to adhere to operation instructions and safety precautions provided on the product and within this document.
- Unauthorized removal or modification of the product or software code.
- Equipment damage caused by the receiving party or a third-party during transportation.
- Inadequate preparation of materials and tools that comply with local laws, regulations, and related standards.

1.2Personal safety

DANGER

- Always confirm that the power is disconnected before beginning installation. Never install or remove cables while power is on. Making contact between the cable core and any conductor while power is live can lead to electric arcs, sparks, fire, or explosions, potentially causing personal injury.

Figure 1- 1 Cable core

- Non-standard and improper operations on the energized equipment may cause fire, electric shocks, or explosion, resulting in property damage, personal injury, or even death.
- Before operations, remove conductive objects such as watches, bracelets, bangles, rings, and necklaces to prevent electric shocks.
- During operations, employ specialized insulated tools to mitigate the risk of electric shocks or short circuits. Ensure these tools meet the dielectric withstanding voltage requirements set by local laws, regulations, standards, and specifications.

WARNING

During operations, wear appropriate personal protective equipment, including protective clothing, insulated footwear, safety goggles, helmets, and gloves.

General Safety Requirements

- **Handling Protective Devices:** Never disable protective devices. Always heed the warnings and precautionary measures both in this document and on the equipment.
- **Emergency Response:** If there's a risk of personal injury or equipment damage, immediately halt operations, inform your supervisor, and implement appropriate safety measures.
- **Power Safety:** Do not activate the equipment until it has been installed and inspected by professionals.
- **Direct Contact:** Avoid direct contact with power supply equipment, especially with damp objects or conductors. Always measure voltage before touching any conductor surfaces or terminals to prevent electric shock.
- **Operational Safety:** Do not touch equipment during operation as surfaces may be hot, and avoid contact with moving parts like fans to prevent injuries.

Fire Safety Protocol

- In the event of a fire, evacuate the area immediately, activate the fire alarm, or contact emergency services. Under no circumstances should you re-enter the affected area.

Personnel Requirements

- **Qualification and Training:**
  - **Professionals:** Only those familiar with the equipment's principles, trained in operations, and aware of potential hazards are permitted to handle the equipment. These individuals must understand the extent of hazards associated with installation, operation, and maintenance.

- **Trained Personnel:** Must be educated in technology and safety, experienced, conscious of potential operational hazards, and capable of implementing safety measures to minimize risks.

- **Special Tasks**: Personnel performing electrical tasks, working at heights, or operating special equipment must have the appropriate qualifications as required by local regulations.
- **High-Voltage Operations**: Only certified high-voltage electricians may operate medium-voltage equipment.
- **Equipment and Component Handling:**
  - **Installation and Maintenance:** Only qualified professionals or trained personnel should install, operate, and maintain the equipment.
  - **Safety Facility Removal and Inspections:** Only qualified professionals may remove safety devices and perform inspections.
  - **Component Replacement:** Only authorized professionals can replace equipment or components, including software.
  - **Access Restrictions:** Access to the equipment should be limited to personnel directly involved in working on it.

1.3Electrical safety

DANGER

Before connecting to a power source, ensure the equipment is in good condition to avoid risks of electric shock or fire.

Non-standard and improper operations may result in fire or electric shocks.

- Ensure that no foreign objects enter the equipment during operations, as this can lead to equipment damage, reduced load power, power failure, or personal injury.

DANGER

Before connecting to a power source, ensure the equipment is in good condition to avoid risks of electric shock or fire.

Non-standard and improper operations may result in fire or electric shocks.

Ensure that no foreign objects enter the equipment during operations, as this can lead to equipment damage, reduced load power, power failure, or personal injury.

NOTICE

Do not route cables near the air intake or exhaust vents of the equipment.

General Requirements

- **Compliance with Procedures**: Adhere to the specified procedures for installation, operation, and maintenance outlined in this document. Unauthorized modifications, additions, or alterations to the equipment are prohibited.
- **Utility Approval**: Secure approval from relevant national or local electric utility companies before connecting the equipment to the grid.
- **Safety Measures**: Follow all power plant safety regulations, including operation and work ticket

mechanisms.

- **Restricted Access**: Erect temporary fences or warning ropes and display "No Entry" signs around operational areas to restrict access to unauthorized personnel.
- **Power Protocol**: Before handling power cables, ensure all related equipment and switches are turned off.
- **Liquid Detection**: If liquid is present inside the equipment, disconnect the power immediately and refrain from using the equipment.
- **Tool Management**: Verify tools meet operational requirements and log them before use. After operations, collect all tools to prevent them from being left inside the equipment.
- **Cable Precautions**: Prior to power cable installation, confirm cable labels are accurate and terminals are insulated.
- **Installation Accuracy**: Utilize a torque tool with the correct measurement range for tightening screws. Maintain tool alignment and ensure torque error remains within 10% of the specified value.
- **Bolt Management**: After double-checking, mark tightened bolts with blue (by installation personnel) and red (by quality inspection personnel) across the bolt edges.

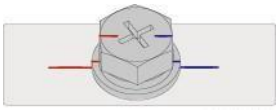


Figure 1- 2 Bolt diagram

- **Protective Measures:** After installation, confirm that all protective cases and insulation tubes are securely in place to prevent electric shocks.
- **Input Management:** Disconnect all inputs before operating the equipment.
- **Maintenance Protocol:** Before servicing downstream electrical or power distribution devices, switch off the power supply equipment's output.
- **Safety Signage:** During maintenance, place "Do not switch on" labels near all related switches or circuit breakers and display warning signs to avoid accidental power connection. Only power on the equipment after completing troubleshooting.
- **Safety Shutdown:** If troubleshooting post-power-off is required, disconnect the power, verify de-energization, install a ground cable, hang warning signs, and set up barriers.
- **Regular Checks:** Periodically inspect equipment connections to ensure all screws are securely tightened.
- **Professional Handling:** Only qualified professionals should replace damaged cables.
- **Label Integrity:** Maintain the integrity of all equipment labels and nameplates. Replace any that are worn out.
- **Cleaning Precautions:** Avoid using solvents like water, alcohol, or oil to clean electrical components.

Grounding

- **Compliance with Standards**: Ensure the grounding impedance complies with local electrical standards.
- **Reliable Grounding**: Maintain a permanent connection to the protective ground. Verify the electrical connection for reliable grounding before operation.
- **Grounding Installation**: Do not operate equipment without a properly installed ground conductor and ensure no damage occurs to the ground conductor.
- **Three-Pin Sockets**: For equipment utilizing a three-pin socket, confirm the ground terminal is

connected to the protective ground point.

- **Touch Current Precautions**: If high touch current is possible, ground the protective ground terminal on the equipment enclosure before connecting to the power supply to prevent electric shock.

Cabling Requirements

- **Safety Compliance:** Select, install, and route cables according to local safety regulations.
- **Cable Handling:** Ensure cables are straight, without coiling or twisting. Avoid joining or welding cables. Use longer cables if necessary.
- **Cable Protection:** Verify all cables are correctly connected, insulated, and meet specifications. Ensure routing slots and holes are free from sharp edges, and use cushion materials where cables pass through to prevent damage.
- **Cable Arrangement:** When routing cables into a container from above, bend them into a U-shape outside before entry. Bundle same-type cables neatly and keep different types at least 30 mm apart. Immediately seal any cable holes with sealing putty when installation is paused.
- **Cable Support:** Secure buried cables with supports and clips, ensuring close ground contact in the backfill area to prevent damage.
- **Environmental Considerations:** Reassess cable suitability if external conditions change, such as layout or ambient temperature, according to standards like IEC-60364-5-52.
- **Thermal Clearance:** Maintain at least 30 mm clearance between cables and heat sources to protect insulation.
- **Cold Weather Handling:** Only install cables above 0°C and store cables at room temperature for 24 hours before laying if they have been in subzero conditions.
- **Handling Care:** Avoid dropping cables from heights as it can damage them and affect their performance

NOTICE

Static electricity from human bodies can damage electrostatic-sensitive components, such as large-scale integrated (LSI) circuits:

- **ESD Precautions:** Always follow ESD (Electrostatic Discharge) protection regulations when handling equipment, boards, or modules with exposed circuit boards, such as application-specific integrated circuits (ASICs). Wear ESD-protective clothing and gloves, or use a well-grounded ESD wrist strap.

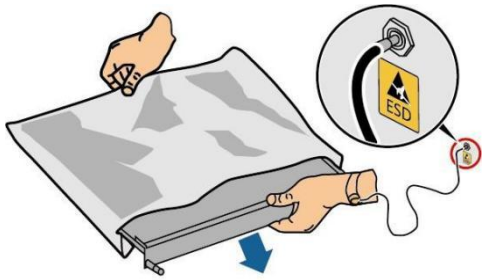


Figure 1- 3 Follow ESD protection regulations

- **Handling Components:** When picking up a board or module, grasp it by the edges without touching any of the components. Avoid direct contact with the components using bare hands.
- **Packaging for Safety:** Always use ESD-safe packaging materials to store or transport boards or modules to prevent static damage.

1.4Mechanical safety

Hoisting Guidelines

- Only trained and qualified personnel should perform hoisting operations.
- Isolate the hoisting area with temporary warning signs or fences.
- Verify that the hoisting foundation can support the load.
- Before hoisting, ensure all tools are securely attached to a fixed object that can bear the load.
- Avoid walking or standing under the crane or hoisted objects during operations.
- Do not drag steel ropes or hoisting tools, and avoid colliding hoisted objects with hard surfaces.
- Maintain a hoisting rope angle of no more than 90 degrees to ensure stability and safety.

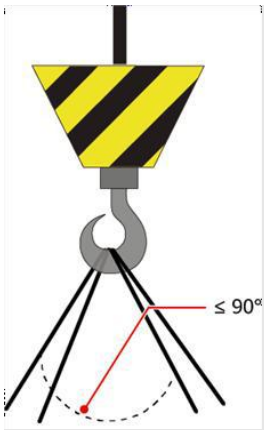


Figure 1- 4 Hoisting angle diagram

Hole Drilling Guidelines

- Secure approval from both the customer and contractor prior to drilling holes.
- Always wear safety goggles and protective gloves while drilling.
- Ensure not to drill into buried pipes or cables to prevent short circuits and other risks.
- Protect equipment from metal shavings during drilling and clean up all shavings afterward.

Working at Heights Safety Guidelines

- Operations conducted 2 meters or higher above the ground must be properly supervised.
- Only trained and qualified individuals are allowed to work at heights.
- Avoid working at heights during hazardous conditions, such as when surfaces are wet. Resume work only after the safety owner and technical personnel have inspected the equipment and confirmed safety.
- Establish restricted zones and place conspicuous signs to prevent access by unauthorized personnel.
- Install guard rails and warning signs around edges and openings to prevent falls.
- Avoid stacking scaffolding, springboards, or other objects on the ground beneath work areas. Ensure no one remains or passes underneath these areas.
- Properly carry operation machines and tools to avoid damage and injuries from falling objects.
- Do not throw objects to or from heights. Use slings, hanging baskets, highline trolleys, or cranes for transporting objects.
- Avoid simultaneous operations on upper and lower layers. If necessary, install protective shelters or take other safety measures. Keep tools and materials from accumulating on upper layers.

- Dismantle scaffolding from the top down and not simulataneously at multiple levels. Ensure stability of the structure during dismantling.
- Personnel must strictly adhere to safety regulations when working at heights. The company disclaims responsibility for accidents resulting from non-compliance.
- Exercise caution at all times when at heights and avoid resting in elevated locations.

Ladder Safety Guidelines

- Use wooden or insulated ladders for live-line work at heights.
- Opt for platform ladders with protective rails. Avoid using single ladders.
- Before using a ladder, ensure it is in good condition and verify its load-bearing capacity. Do not exceed this capacity.
- Position the ladder securely and ensure it is stable before use.

Figure 1- 5 Ensure ladder is held firm

- Maintain stability and keep your center of gravity within the ladder's side rails while climbing. Avoid reaching out too far to the sides.
- If using a step ladder, make sure the pull ropes are firmly secured.

1.5Installation and wiring

1.5.1ESS safety guidelines

Operational Precautions

- **Access Control:** Do not open container doors while the system is operational. In the event of a malfunction, avoid standing within the opening range of the container doors.
- **Emergency Protocol:** Immediately evacuate the area if the fire alarm horn or strobe is activated.

Protective Measures

- **Site Security:** Implement protective and isolation measures around the ESS, such as fences, walls, and safety warning signs, to prevent unauthorized access and mitigate risks of personal injury or property damage.

Installation Requirements

- **Compliance with Standards:** Ensure that ESS installation adheres to local fire separation distances or firewall requirements as per standards like GB 51048-2014 "Design Code for Electrochemical Energy Storage Station" and NFPA 855 "Standard for the Installation of Stationary Energy Storage Systems."

Maintenance and Inspection

- **Regular Fire Safety Checks:** Conduct fire safety inspections of the ESS at least monthly.

- **Power System Inspection:** When inspecting the system with power on, adhere to hazard warning signs and avoid standing at the battery container doors.
- **System Updates and Changes:** After replacing power components or modifying cable connections, manually initiate cable connection detection and topology identification to ensure system integrity.

Documentation and Record Keeping

- **Recording Procedures:** It is advisable to use a camera to document the detailed processes of equipment installation, operation, and maintenance for future reference and compliance verification.

1.5.2Battery safety guidelines

Handling and Connection:

- Avoid connecting the positive and negative poles of a battery directly to prevent short circuits, which can cause leakage, smoke, fire, or explosion. To avoid battery short circuits, only maintain batteries with the system powered off and de-energized.
- Ensure batteries are not exposed to high temperatures or near heat sources like sunlight or heaters, as overheating can also lead to dangerous outcomes.
- Protect batteries from mechanical damage such as vibration, falls, collisions, or punctures to prevent fires or other hazards.
- Never disassemble, alter, or insert foreign objects into batteries, and avoid touching terminals with metal objects to prevent short circuits and leakage.
- Use only the battery model recommended by the manufacturer to avoid risks of fire or explosion.

Installation and Storage:

- Install batteries in dry areas away from potential water sources like air conditioner vents or water pipes.
- Ensure batteries are stored and transported in their original packing, positioned according to the labels to prevent damage, avoid placing them upside down, vertically, on their side, or tilted. Do not stack batteries improperly.
- Before installation and operation, prepare and install firefighting facilities, such as fire sand and CO2 fire extinguishers, in compliance with local regulations.

Maintenance and Emergency Procedures:

- Wear appropriate protective gear and power down equipment immediately in the event of a battery leak or odor; evacuate the area and contact authorities.
- Tighten the screws on copper bars or cables to the specified torque. Regularly check these connections for tightness and inspect for signs of rust, corrosion, or the presence of foreign objects, cleaning as necessary. Loose connections can cause excessive voltage drops and increase the risk of fire under high current conditions.
- Recharge batteries promptly after discharge to prevent damage from overdischarge.

Chemical and Fire Safety:

- In case of a battery fire, be aware that gases produced may irritate eyes, skin, and throat; take protective measures promptly.
- Properly exhaust any flammable gases generated to prevent fire or equipment corrosion.

1.6Operation and maintenance

Liability Disclaimer

The Company will not be liable for damage or other consequences to the batteries under the following conditions:

- **Force Majeure:** Damage due to natural disasters such as earthquakes, floods, volcanic eruptions, or extreme weather conditions.
- **Environmental Non-compliance:** Damage resulting from an operating environment or external power parameters that do not meet the requirements for normal operation, such as inappropriate temperature or unstable power grids.
- **Improper Handling:** Damage from incorrect handling or connection, including falling, leaking, or cracking of batteries.
- **Delayed Power On:** Damage due to not powering on the batteries promptly after installation, leading to overdischarge.
- **Delayed Acceptance:** Damage because batteries were not accepted promptly as scheduled.
- **Unauthorized Changes:** Damage from relocating, reinstalling, or altering usage scenarios without notifying the Company or compliance with its requirements.
- **Additional Load Connections:** Damage from connecting extra loads to the batteries.
- **Storage and Warranty Expiration:** Damage when the storage period exceeds the upper limit or the warranty period has expired; using expired batteries poses safety risks.
- **Incorrect Settings and Mixed Usage:** Damage from setting incorrect operating parameters, using batteries of different types together, or mixing our batteries with those from other vendors or of different capacities.
- **Maintenance Failures:** Damage from improper maintenance, such as frequent overdischarge, expanding load capacity without notice, or long-term lack of full charging.
- **Neglect in Maintenance:** Damage from failing to perform regular maintenance checks on battery terminals or store batteries according to specified requirements.

General Guidance:

- Use only batteries provided by the Company to ensure safety and management accuracy. The Company is not responsible for faults in batteries not supplied by it.

Installation and Maintenance:

- Carefully read and adhere to the battery manufacturer's instructions before installing, operating, or maintaining batteries. Pay special attention to the safety precautions outlined in this document and additional instructions provided by the manufacturer.
- Charge batteries within the specified temperature range. Avoid charging when the ambient temperature is below the allowed range to prevent internal short circuits during low-temperature charging.
- Inspect packaging before unpacking. Do not use batteries if packaging is damaged and report any damage to the carrier and manufacturer immediately.
- Install batteries within 24 hours of unpacking. If installation is delayed, store batteries in their original packaging in a dry, indoor environment free of corrosive gases. Power on the ESS within 24 hours of installation and complete the process from unpacking to system activation within 72 hours. Ensure power-off time during routine maintenance does not exceed 24 hours.

Handling and Storage:

- Do not use batteries that are visibly damaged (e.g., dropped, bumped, bulged, or dented), as such damage could lead to electrolyte leakage or flammable gas release. Contact professional

operations and maintenance personnel immediately for replacement or removal.

- Store damaged batteries away from other devices, flammable materials, and untrained individuals.
- Before handling batteries, ensure there is no irritating or burnt odor present.
- Keep installation tools and metal objects off the batteries during installation.
- Clean up the installation area thoroughly once setup is complete.
- Avoid installing batteries during adverse weather conditions like rain, snow, or fog, as moisture can corrode the battery packs.
- If batteries become wet, do not install them. Instead, move them to a safe location and arrange for their proper disposal.
- Before installing a battery pack, check for any deformation or damage to the enclosure.
- Ensure that the battery terminals are not unexpectedly grounded. If they are, disconnect them from the ground.
- Avoid performing welding or grinding near batteries to prevent fires from sparks or arcs.
- If batteries are not in use for extended periods, store and charge them according to specified requirements.
- Use only devices that comply with local laws and regulations for charging or discharging batteries.
- Disconnect the battery loop during installation and maintenance.
- Monitor stored batteries for any signs of smoke, flame, electrolyte leakage, or excessive heat.
- Handle batteries carefully if they show signs of fault or high surface temperature to avoid burns.
- Never stand on, lean on, or sit atop battery equipment.

Usage Restrictions:

- Do not use batteries in critical backup power scenarios that involve:
  - Life-supporting medical devices
  - Essential control equipment such as trains and elevators, where failure could result in personal injury
  - Key computer systems crucial for social and public functions
  - Proximity to sensitive medical equipment
  - Similar high-risk applications

Safety Compliance:

- Wrap exposed battery terminals with insulation tape during installation and maintenance to protect against short circuits.
- In cases of electrolyte leakage, which can corrode metal parts and damage boards, follow immediate safety protocols: evacuate the area, seek fresh air, rinse affected skin or eyes thoroughly with water, and seek medical attention for any exposure.

Emergency and Leakage Handling:

- **Short Circuit Protection:** During installation and maintenance, ensure all exposed battery terminals are covered with insulation tape to prevent short circuits.
- **Preventing Contamination:** Keep foreign objects, including conductive materials, screws, and liquids, away from batteries to avoid causing short circuits.
- **Leakage Response:** Treat electrolyte leakage seriously as it can corrode metal parts and damage boards. If exposed to electrolyte, execute the following emergency protocol:
  - Inhalation: If you inhale fumes from the electrolyte, leave the contaminated area immediately, seek fresh air, and obtain medical attention without delay.

- Eye Contact: Rinse your eyes with water continuously for at least 15 minutes if electrolyte comes into contact with them. Avoid rubbing your eyes and seek medical attention promptly.
- Skin Contact: If electrolyte contacts your skin, wash the affected area immediately with soap and water and then seek medical attention.
- Ingestion: If electrolyte is ingested, seek immediate medical attention.

Recycling and Disposal:

- **Regulatory Compliance:** Dispose of waste batteries in accordance with local laws and regulations. Never treat batteries as ordinary household waste, as improper disposal can lead to environmental pollution or even explosions.
- **Handling Leaks and Damage:** If a battery is leaking or damaged, immediately contact technical support or a designated battery recycling company for proper disposal.
- **End-of-Life Management:** For batteries that have reached the end of their service life, arrange for disposal through a battery recycling company.
- **Storage Precautions for Disposal:**
  - Avoid exposing waste batteries to high temperatures or direct sunlight.
  - Do not store waste batteries in environments with high humidity or corrosive substances.
  - Faulty Batteries: Do not use damaged or faulty batteries. Contact a battery recycling company to dispose of them promptly to prevent environmental harm.

2Product description

2.1Model description

The product is a 5.015MWh (nominal energy) liquid cooled energy storage system, which consists of main components such as enclosure, batteries, integrated control panel, liquid cooling system, battery management system, and fire protection systems, etc.

Configuration details:

- The system utilizes 314Ah Lithium-ion Phosphate (LiFePO4, or LFP) cells arranged in series to create a 1P104S battery pack.
- Four such battery packs are connected in series to configure a 1P416S battery rack.
- Six battery racks within the cabin are connected in parallel to configure a battery stack.
- Two such battery stacks within the container are also connected in parallel, culminating in a complete 1331.2V/5.015MWh battery energy storage system container.
- The battery system is managed by Level 3 Battery Management System (BMS), providing comprehensive system-level control and management.

Figure 2- 1 Container appearance

The liquid-cooled energy storage system is a crucial platform product, incorporating advanced temperature control technology suitable for large-scale energy storage applications. This system supports factory production, testing, and the overall hoisting and transportation of energy storage containers, meeting a broad range of industrial requirements.

2.2Label description

Table 2-1 Label description

Label	Name	Description
	Electric Shock Warning	High voltage may occur after the device is powered on. Only qualified and trained electrical technicians are allowed to install and operate the device.
	Dangerous Warning	Indicates the device might cause harmful to the personnel. Only qualified and trained electrical technicians are allowed to install and operate the device.
	Explosive Warning	Indicates the device might cause explosion. Only qualified and trained electrical technicians are allowed to install and operate the device.
	Grounding Symbol	Indicates the position for connecting the ground cable.
	ADR transportation warning label – diamond-shape label	Helps other traffic participants identify and keep away from hazardous sources in a timely manner to reduce the risk of accidents.
	Hoisting Mark	Indicates the position for hoisting the battery ESS cabin.
	Water Firefighting Mark	Indicates this is to be connected with fire hose for firefighting.
	Emergency Stop Mark	Indicate the button is only for emergency stop. It is a fail-safe control switch that when de-energized, will stop the operation of the equipment.
	Height label	The equipment is high. You may need tools such as an insulation stool or a step ladder to facilitate operation.
	Height (or mind the step) warning label	Indicates that the container height is greater than 2.6m to alert the personnel during transportation and operation.

2.3Functions and features

2.3.1 Functions

The ESD1331-05P5015 battery container is designed to manage the charging and discharging of DC power, converted by the Power Conversion System (PCS), for applications such as power grid peak shaving and frequency regulation.

Battery Charging: The PCS interfaces with the rack controller, issuing commands to charge the batteries.

Battery Discharging: During times when grid power is insufficient, the system directs the batteries to supply power to the loads via the PCS.

This system is a prefabricated all-in-one Lithium-ion Battery Container System that consolidates a prefabricated modular structure, power supply and distribution, monitoring, fire suppression, and an integrated cabling system into a single unit.

2.3.2 Features

The ESD1331-05P5015 battery container has the following key features:

- **High Energy Density:** This system uses high-energy density battery cells and is a highly integrated system that supports side to side、 back-to-back installation, effectively saving floor space.
- **Standardization:** This system adopts a modular design and is a standard 20 foot container, which is easy to transport, maintain, and install.
- **High Security:** The battery cells have passed many safety tests; the system has multi-level overcurrent protection, there are fuses inside the packs、 high-voltage box、 integrated control panel; the system monitors the battery through Level 3 BMS to achieve early warning and fault diagnosis; the system adopts a three-layer partition design (steel/rock wool/steel), with a 2-hour fire resistance;the system has a three-level fire protection system, including pack-level submerged fire suppression, aerosol fire extinguishing system, water fire protection system.
- **Intelligent Temperature Control Technology:** The system achieves intelligent temperature control through BMS control of air conditioner and liquid cooling unit.

2.4Appearance

The content below shows the appearance of the BESS container from various angles.

FIGURE 2-2 is the schematic diagram of the main sections of BESS:

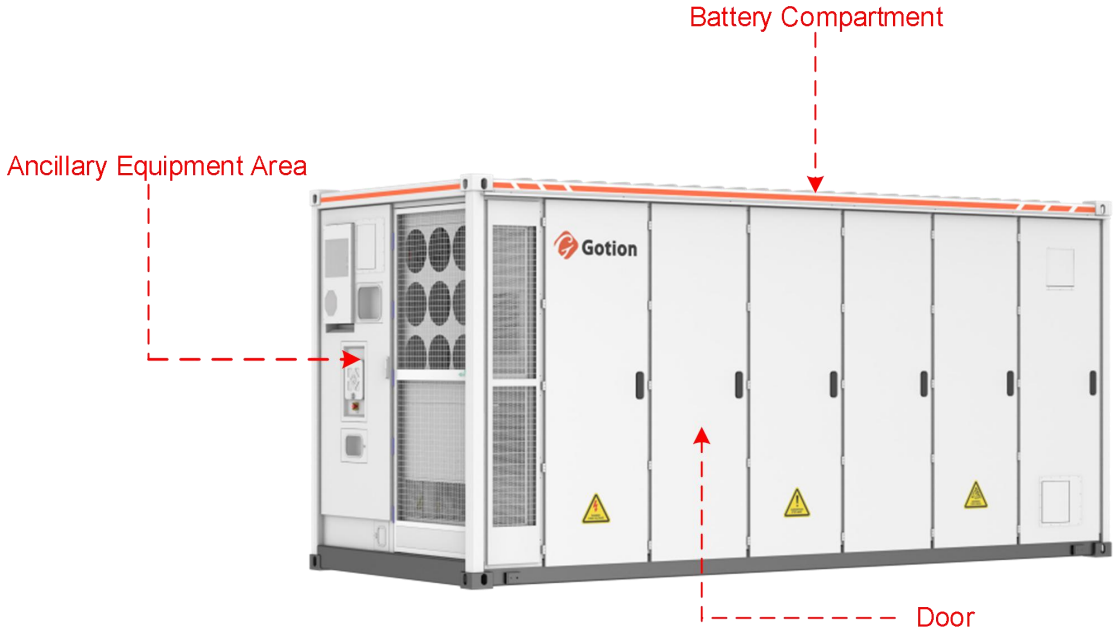


Figure 2-2 Schematic diagram of BESS main sections

FIGURE 2-3 is the front view of the BESS:

Figure 2-3 Front view of the battery container

FIGURE 2-4 is the rear view of the BESS:

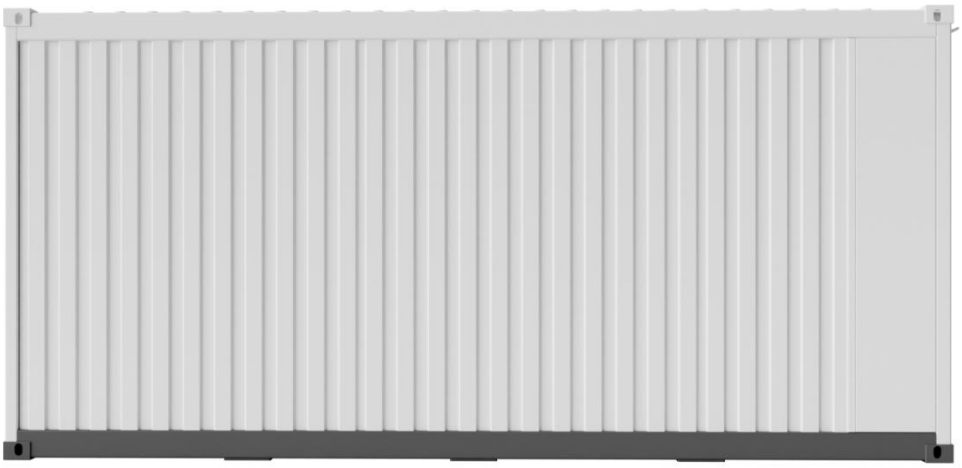


Figure 2-4 Rear view of the battery container

FIGURE 2-5 is the left-side view of the BESS:

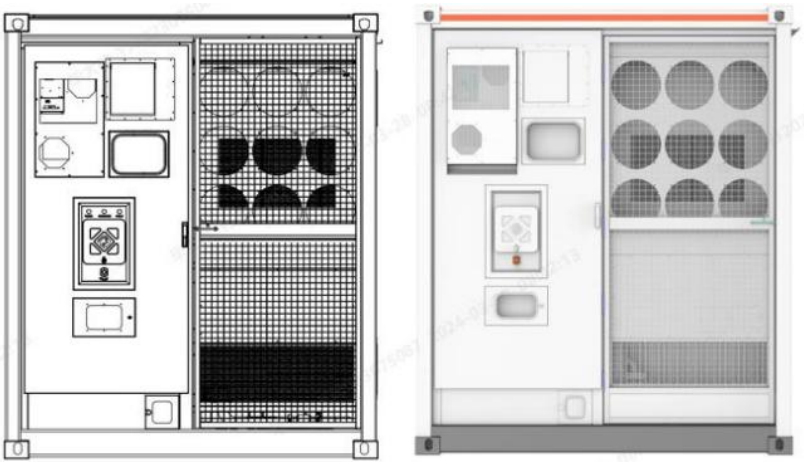


Figure 2-5 Left-side view of the battery container

FIGURE 2-6 is the right-side view of the BESS:

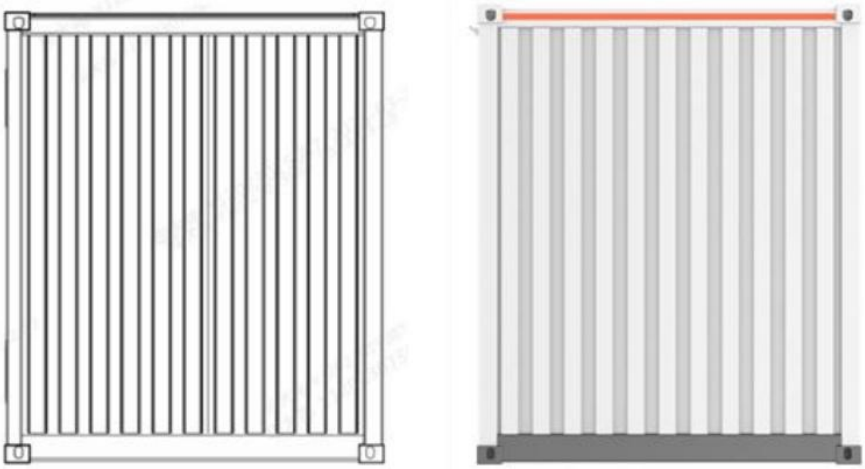


Figure 2-6 Right-side view of the battery container

FIGURE 2-7 is the top view of the BESS:

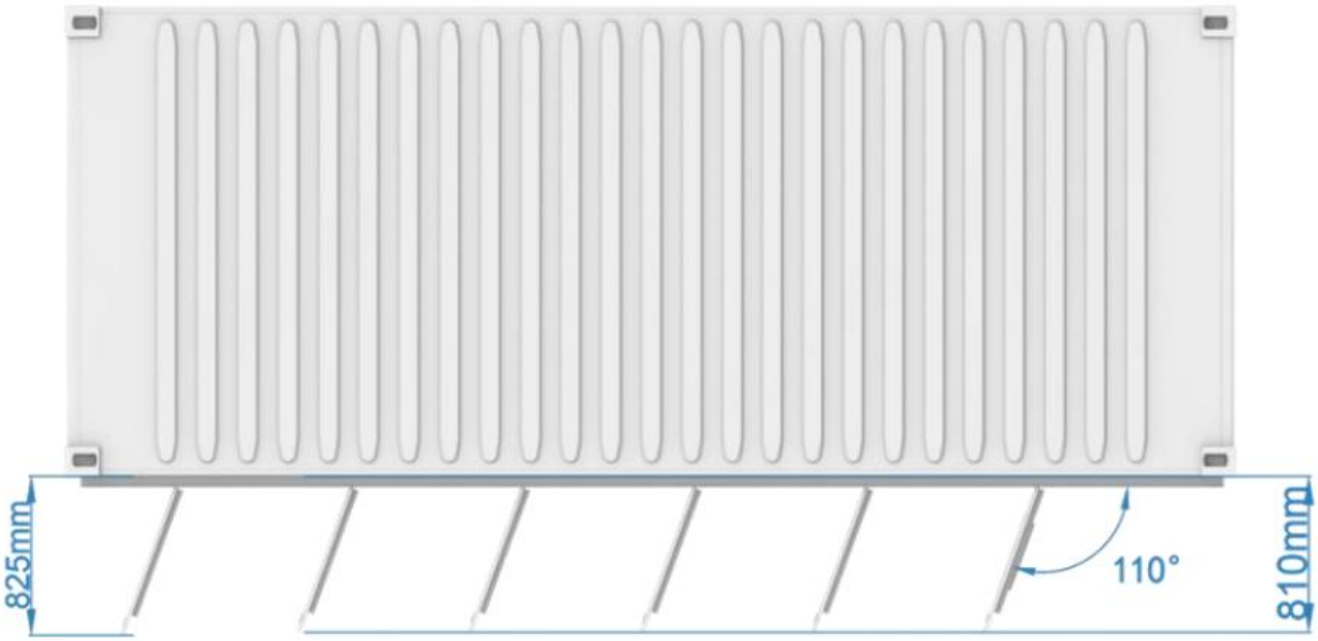


Figure 2- 7 Top view of the battery container

Note:

- ✧ The site foundation should be designed by qualified technical personnel, such as those from a design institute. These professionals may refer to the foundation drawings provided by the company. To obtain these drawings, please contact Gotion.

2.5Internal design of battery system

2.5.1Main components

The Battery ESS comprises the following essential components:

- **Battery container enclosure**
- **Battery packs**
- **Fire protection system:** Including water spray pipeline, smoke detector, temperature detector, Li-ion battery off-gas detector, aerosol fire extinguisher, FSS control panel, and exhaust system, etc.
- **High-voltage boxes**
- **Integrated control panel:** Including UPS, isolation switch, busbar, BAMS, ect.
- **Temperature control system:** Including liquid cooling unit and air conditioner.
- **HMI**

FIGURE 2-8 is the overview of BESS key components.

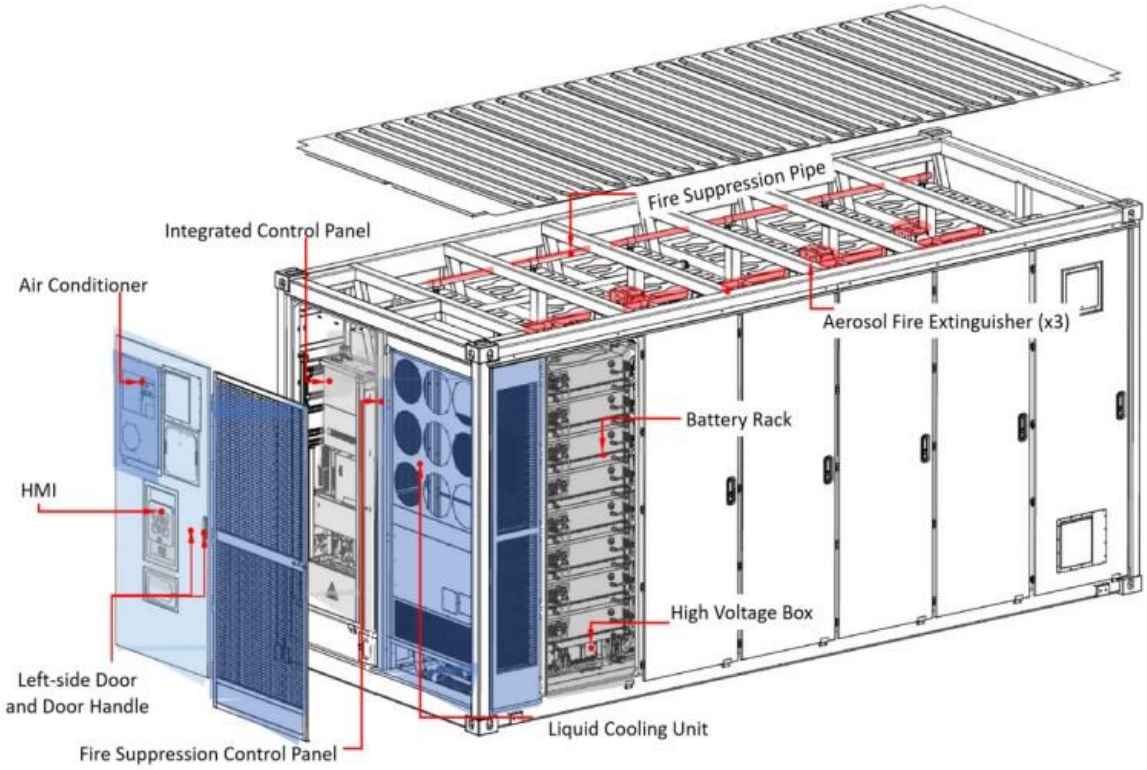


Figure 2-8 BESS key components

2.5.2 Cell

The battery cell employed is a Lithium Iron Phosphate (LiFePO4 or LFP) prismatic cell.

Figure 2- 9 Appearance of the cell

The table below shows the basic technical parameters of battery cell.

Table 2-1 Technical parameters of the cell

No.	Item	Technical Parameters	Remark
1	Model number	IFP72175207-314Ah	
2	Nominal capacity	314Ah	LiFePO4
3	Dimensions (W×D×H)	(174.8±0.5) mm × (71.65±0.5) mm × (207.1±0.5) mm	Contains height of poles
4	DC internal resistance	0.3mΩ＜R＜0.5mΩ	25°C±2°C, 50% SoC@3C(30s)
5	Nominal voltage	3.2V	
6	Nominal energy	1004.8Wh	0.5P,25℃
7	Voltage range	2.5V ~ 3.65V	100% DOD, T＞0°C
8	Weight	5.76±0.3kg	
9	Operating temperature	0°C～55°C	Charging temperature
		-30～60°C	Discharge temperature
10	Storage temperature	-30～60°C	30% ~ 50% SoC
11	Cycle life	≥12000	25±2°C, 0.5P/0.5P 90%DOD, 70%EOL

2.5.3 Battery pack

The battery pack is composed of four 1P26S sub-modules linked in series to create a 1P104S configuration, with a rated specification of 332.8V/314Ah. At the pack level, voltage and temperature data from individual cells are collected and cell balancing is managed by the Level 1 BMS.

Figure 2- 10 Appearance of the pack

The table below shows the technical parameters of Pack.

Table 2-2 Technical parameters of the Pack

No.	Item	Technical Parameters	Remark
1	Model number	EPD332-05P104	
2	Cell capacity	314Ah	
3	Configuration	1P104S	
4	Nominal energy	104.4kWh	0.5P, 100%DOD, 25±2°C
5	Nominal voltage	332.8V	3.2V×104
6	Rated Capacity	314Ah	0.5P, 100%DOD, 25±2°C
7	Recommended operating	291.2V ~ 374.4V	(2.8~3.6V) × 104
8	Charge and discharge rate	≤0.5P	
9	Maximum Charge/Discharge	52.2kW	
10	Operating temperature	0 ~ 55°C	Charging temperature
		-30 ~ 60°C	Discharge temperature
11	Working humidity	5% ~ 95%	
12	Thermal management method	Liquid cooling	
13	Dimensions (W×D×H)	(785±1.5)mm×(2192±1.5)mm×(240±1.5)mm	
14	Weight	680±10kg	
15	Key components	104 cells, 2 Level 1 BMS, and 1 fuse	

2.5.4 Battery bank

Each battery bank[1] is composed of two electrical racks, each containing four battery packs connected in series, and the high-voltage box for each rack is located at the bottom of the mechanical structure as a rack-level control module.

Figure 2- 11 Appearance of battery bank (2 racks)

The table below shows the technical parameters of Rack.

Table 2-3 Technical parameters of Rack

No.	Item	Technical Parameters	Remark
1	Model number	ERD1331-05P418	
2	Cell capacity	314Ah	
3	Rack configuration	1P416S	
4	Nominal energy	418kWh	0.5P, 100%DOD, 25±2°C
5	Nominal voltage	1331.2V	3.2V×416
6	Rated capacity	314Ah	0.5P, 100%DOD, 25±2°C
7	Recommended operating voltage range	1164.8 ~ 1497.6V	(2.8~3.6V) × 416
8	Charge and discharge rate	≤0.5P	100%DOD, 25°C
9	Maximum Charge/Discharge Power	208.9kW	0.5P, 25±2°C
10	Working temperature	0～55°C	Charging temperature
		-30～60°C	Discharge temperature
11	Working environment humidity	5% ~ 95%	
12	Thermal management method	Liquid cooling	

[1] A bank is a collection of battery racks physically mounted together to fit into the container. In the GRID 5015kWh container, 2 racks are mounted together which is called a bank.

2.5.5 Battery container

The standard container configuration comprises 12 racks and 12 high-voltage boxes, though a varying number of rack options can be flexibly selected based on customer requirements for system capacity.

Figure 2- 12 Front view of the battery container(Open door status)

The table below shows the technical parameters of battery container.

Table 2-4 Technial parameters of battery container

No.	Item	Technical Parameters	Remark
1	Product number	ESD1331-05P5015	
2	Product configuration	12P416S (12 racks)	
3	Cell capacity	314Ah	0.5P, 100%DOD, 25±2℃
4	Nominal energy	5.015MWh	0.5P, 100%DOD, 25±2℃
5	Nominal voltage	1331.2Vdc	
6	Recommended operating	1164.8Vdc～1497.6Vdc	(2.8~3.6V) × 416
7	Charge and discharge rate	≤0.5P	
8	Auxiliary power	AC400V, 50Hz, 3P4L	
9	Storage temperature	-30°C～60°C	
10	Working temperature	-30°C～45°C	
11	Working environment humidity	0～95%	
12	Protection level	IP55 (except liquid cooler)	
13	Applied altitude	<2000m	
14	Weight	≈43t	
15	Dimensions (W×D×H)	6058mm×2438mm×2896mm	

2.5.6 High-voltage box

The high-voltage box is a rack-level control unit specifically designed by Gotion for the liquid-cooled energy storage battery system.

The high-voltage box is a high-voltage loop management and protection unit used to connect the battey cluster and intergrated control panel, housing key components such as isolation switch, relay, fuses, Level 2 BMS, and switching power supply. There are 12 high-voltage boxes inside the battery container.

Figure 2- 13 Schematic diagram of high-voltage box location

In the design of the high-voltage box, careful consideration has been given to electrical characteristics, heat dissipation, waterproofing, safety, operability, and maintainability. Its space layout is optimized for a compact structure, flexible configuration, and enhanced safety and reliability.

The high-voltage box integrates a Level 2 BMS and a 24VDC switching power supply internally, and reserves CAN communication interface externally to communicate with the Level 1 BMS and Level 3 BMS, enabing data communication, control, and protection of the battery management system.

The table below shows key technical parameters of the high-voltage box:

Table 2-5 Technial parameters of the high-voltage box

No.	Item	Technical Parameters
1	Appearance	
2	Dimension (W x H x D)	390mm x 614mm x 200mm
3	Weight	27 kg
4	Maximum allowable operating voltage	1500VDC
5	Maximum allowable operating current	250A
6	Working temperature range	- 10 ℃～+ 40 ℃
7	Altitude	≤2000m

8	Communication interface	CAN

Function description:

- Connect the battery cluster and the integrated control panel.
- High-voltage box has functions of battery cluster voltage acquisition, battery cluster current acquisition, battery cluster circuit isolation switch control.
- Summarize the data of the Level 1 BMS (BMU) and achieve data communication with the Level 3 BMS (BAMU).
- Features power, running, and fault indicators for clear product status visualization.
- Equipped with high-voltage quick-connect plug-ins for fast, safe, and reliable connections.
- The internal fuses, isolating switches, and DC contractor have electrical protection functions.

Key components descriptions:

Table 2-6 Key components of the high-voltage box

No.	Component	Descriptions	Qty	Unit
1	Isolating switch	NDG3VH-250, 1500V	1	pc
2	Relay	DC1500V(max)/350A, No Polarity	2	pc
3	Fuse	DC 1500V/315A	2	pc
4	Current detector	Range ± 300A	1	pc
5	Positive pole socket	DC1500V/250A, orange Color	2	pc
6	Negative pole socket	DC1500V/250A, black Color	2	pc
7	Level 2 BMS	Developed by Gotion	1	pc

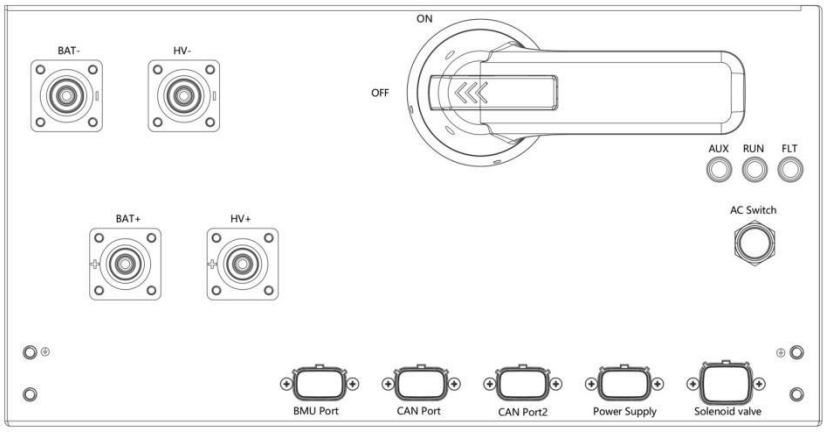


Figure 2- 14 High-voltage box external front panel

The external front panel of the high-voltage box is shown in the figure above, with the main interfaces detailed in the TABLE 2-7 below.

Table 2-7 Port definition of the high-voltage box

No.	Port definition	Function description	Remark
1	BAT+	PACK Positive pole connector	
2	BAT-	PACK Negative pole connector	
3	HV+	External output positive connector	
4	HV-	External output negative connector	
5	AUX	Auxiliary power indicator light	Green light indicates normal power supply.
6	RUN	Running indicator light	Green light indicates that the main output relay in the high-voltage box is closed, the light is off when the relay is off.
7	FLT	Fault indicator light	Red light indicates that the system has fault.
8	Solenoid Valve	Solenoid valve control interface	Connect to the solenoid valve.
9	CAN Port	Cascaded CAN communication interface	CAN bus, hand-in-hand
10	BMU port	BMU (Level 1 BMS) communication interface	
11	Power supply	Power supply for high voltage box	AC220V Input interface
12	⏚	Grounding connection	
13	ON/OFF	Swicth of battery cluser	Controls the opening and closing of battery cluster high-voltage (disconnect switch handle)

2.5.7 Integrated control panel

2.5.7.1About the integrated control panel

The integrated control panel (also called confluence cabinet) is specifically designed for our standard liquid-cooled battery energy storage container. It serves as the intermediary unit connecting the high-voltage box and PCS (Power Conversion System), mainly equipped with functions such as battery cluster convergence, battery stack power main circuit control, short circuit protection, overload protection, emergency stop protection, etc.

The panel includes isolation switches, fuses, Level 3 BMS, and an UPS, etc. The design carefully considers the electrical characteristics, heat dissipation, safety, operability, and maintainability of each component. With a compact structure, flexible configuration, and a well-organized space layout, the Integrated Control Panel offers enhanced safety and reliability.

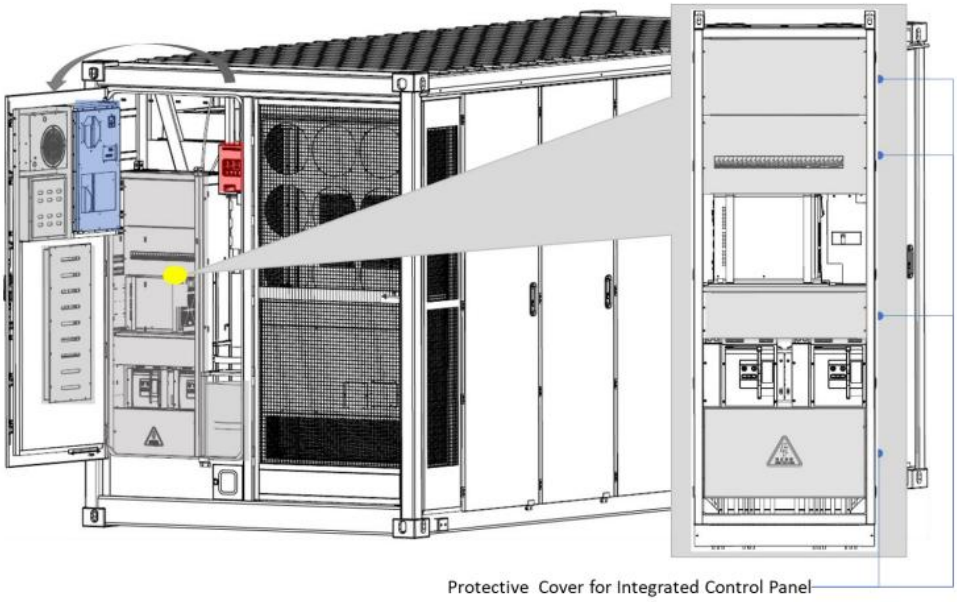


Figure 2- 15 Integrated control panel of the battery container

The Level 3 BMS integrated into the integrated control panel is equipped with CAN, RS-485, and RJ45 ethernet communication interfaces, enabling communication with the Level 2 BMS, PCS, or EMS (Energy Management System). It facilitates data exchange, system control, and protective functions of the energy storage system.

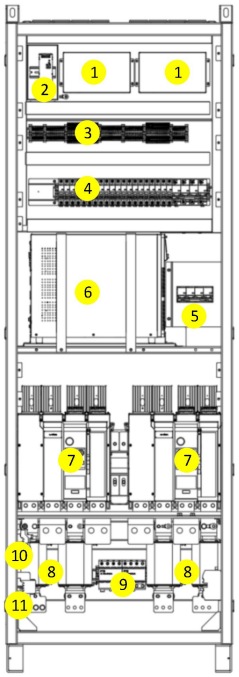
Function description:

- Supports up to 12 battery clusters to converge.
- Supports AC 400V distribution input and AC 400V and AC 230V distribution output.
- Supply DC 24V power supply for the Level 3 BMS.
- Facilitates CAN communication with the Level 2 BMS located within the high-voltage box, enabling effective monitoring and management of battery stack data.
- Supports communication with PCS and dry contact alarm, and supports CAN, RS485, and ethernet communication methods/protocols.
- Supports communication with EMS, and supports CAN, RS485, and modbus TCP communication methods/protocols.
- Supports digital signal input detection for monitoring switch statuses, fire alarms, and other signals.

Key components descriptions:

Table 2-8 Key components of the integrated control panel

No.	Component	Descriptions	Qty	Unit
1	Isolation switch	1500VDC1600A	2	pcs
2	Fuse	1500VDC1800A	4	pcs
3	Level 3 BMS	Developed by Gotion	2	pcs
4	UPS	3KVA / Backup power for 30 minutes	1	pcs
5	Switch power supply	240W (output power)	1	pcs

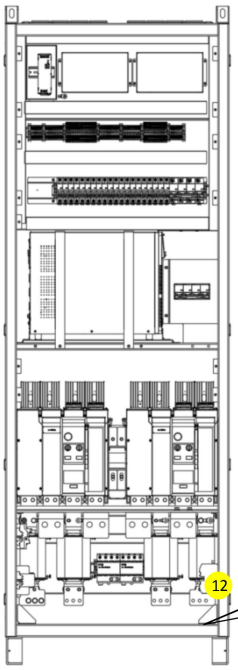


1 - BAMS
2 - Switching power supply
3 - Terminal block
4 - Miniature circuit breaker (MCB)
5 - Circuit breaker
6 - UPS
7 - Isolation switch
8 - Fuse
9 - DC SPD
10 - Photovoltaic fuse
11 - AC SPD

Figure 2-16 Key components of integrated control panel

2.5.7.2 Grounding the integrated control panel cabinet

As shown in the diagram below, the grounding point of the integrated control panel is connected to the cabin housing. This ensures proper grounding of the integrated control panel through the grounding of the cabin housing.



12 - Terminal block
13 - Grounding bar on the panel inner bottom frame

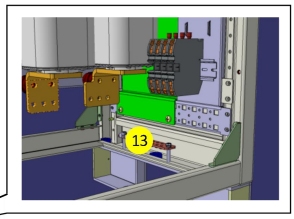


Figure 2-17 Diagram of the integrated control panel's grounding tab

NOTICE

The grounding connection of the busbar control cabinet is pre-connected at the factory. The customer only

needs to verify that the grounding wire is properly connected.

2.5.8 Monitoring system (HMI)

The monitoring system provides real-time operation information for the air conditioning, fire protection, liquid cooling unit, and other equipment through the human-machine interface (HMI). It also fully displays various battery data, including current, temperature, voltage, and more.

The monitoring system is mounted on the left side of the container, as shown in the image below.

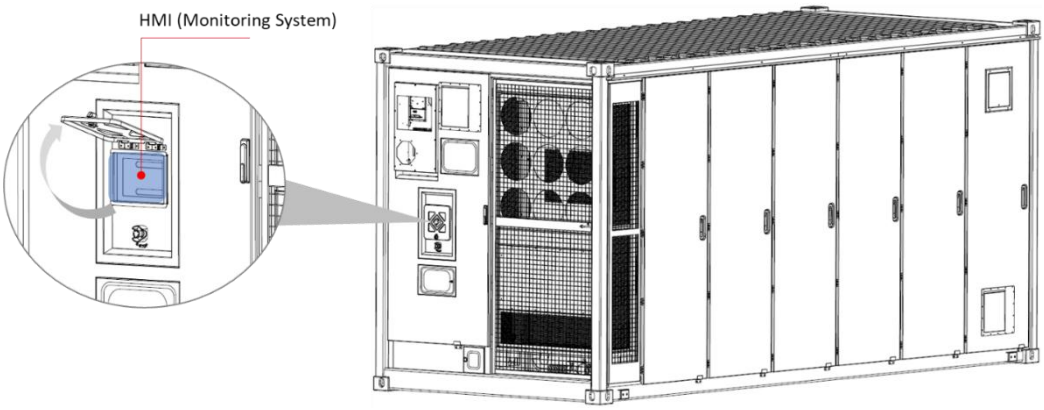
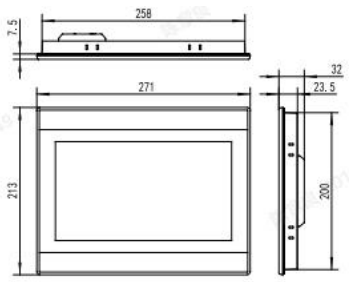


Figure 2-18 Location of the HMI

Apperance of the HMI are provided in the table below.

Table 2-9 Apperance of the HMI

Item	Appearance
Front appearance	
Back appearance	

Installation dimensions (mm)	

Key functions of the monitoring system:

- Monitors battery information within the Battery ESS.
- Tracks the status of liquid cooling units, the fire suppression system, and other external nodes.
- Manages system operation, faults, alarms, and other statuses.
- Monitors the charge and discharge status of the battery.
- Monitors the input and output port statuses of the Level 3 BMS.
- Monitors the communication status of the 1st-level and Level 2 BMS.

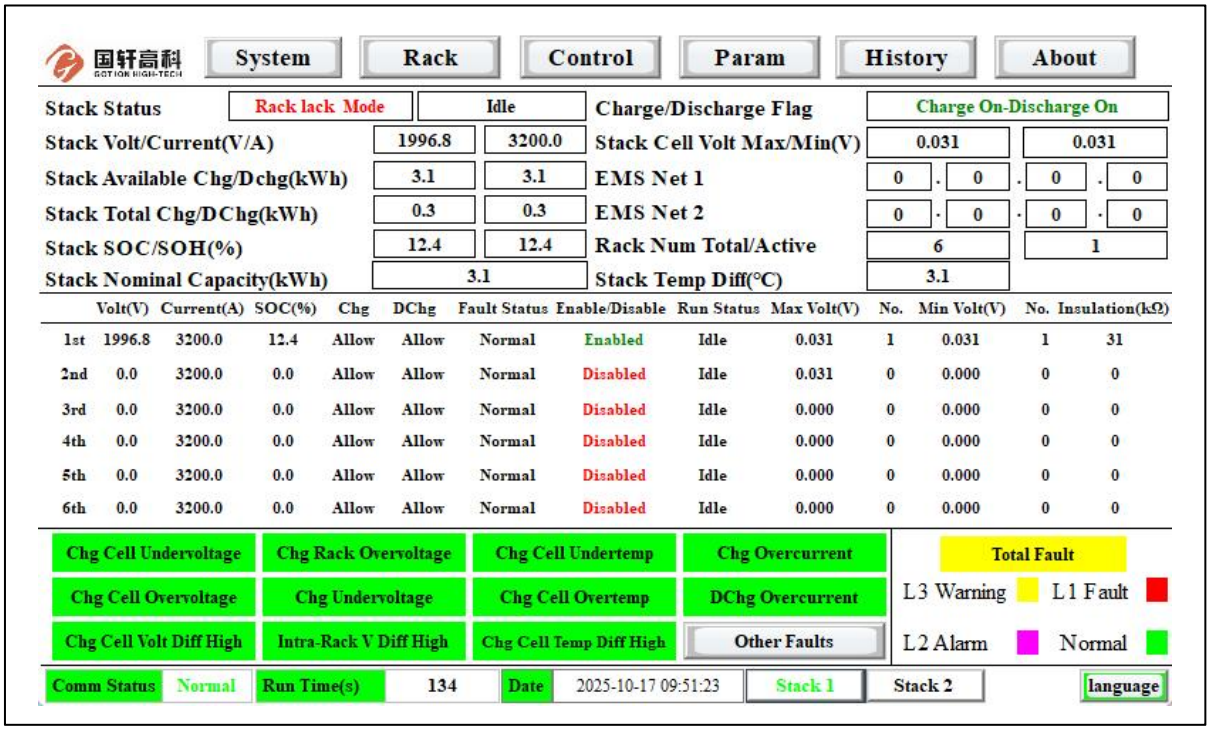


Figure 2-19 HMI software interface （for reference）

2.5.9 BMS

The BMS in the BESS uses a three-level hierarchical architecture to perform the following functions:

- Real-time monitoring of voltage and temperature of battery cells.
- Real-time monitoring of total voltage、current of the battery racks.
- Insulation resistance detection.
- Fault diagnosis, alarm notifications, fault protection.
- Self-testing capabilities.
- Protection against overcharge, overdischarge, and overcurrent in the battery system.
- Anti-backflow control between battery racks.
- SOC and SOH estimation.
- Passive battery balancing.
- Timing synchronization.
- Setting battery operating parameters, alarms, and protection values locally or remotely.
- Event recording, data storage, and display.
- Communication with PCS, EMS, and ancillary equipment.

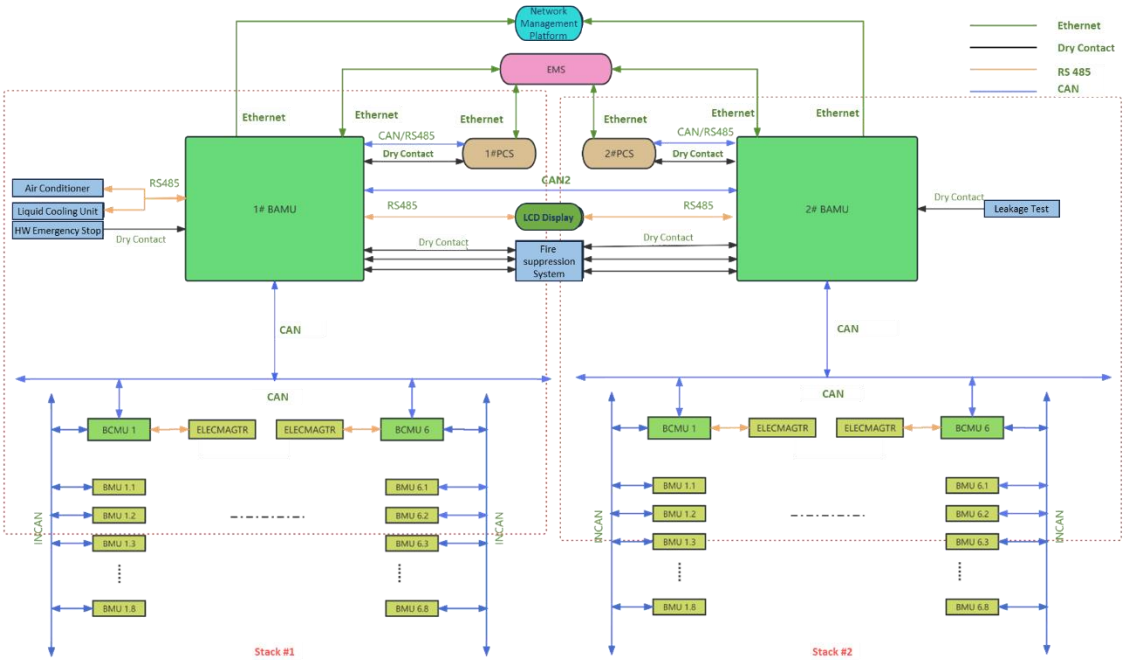


Figure 2- 20 Battery clusters connecting to 2 PCS

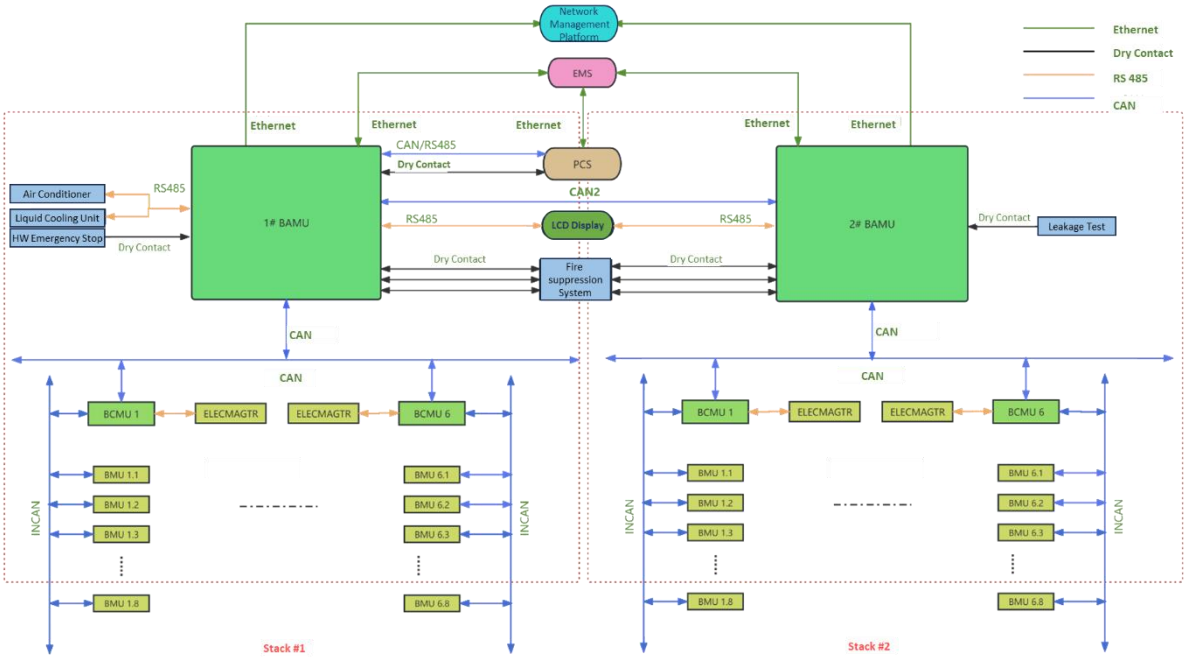


Figure 2- 21 Battery clusters connecting to 1 PCS

2.5.9.1 Level 1 BMS (BMU)

The Level 1 54S BMS, also called Battery Management Unit (BMU), is a slave control unit with an integrated passive balancing function, designed for lithium battery management systems:

- Supports voltage monitoring for 54 individual cells.
- Supports 30 channels of NTC (10K) temperature monitoring.
- Support passive balancing, balancing current ≥ 100mA.
- Transmits the data to the superior main control unit (second-level BMS) in real time through the CAN bus.
- Supports Bootloader upgrades, allowing firmware updates online via CAN.
- Support communication status detection with BCMU and internal daisy chain.
- Support the collection of wire harness (voltage、temperature) disconnection detection function.

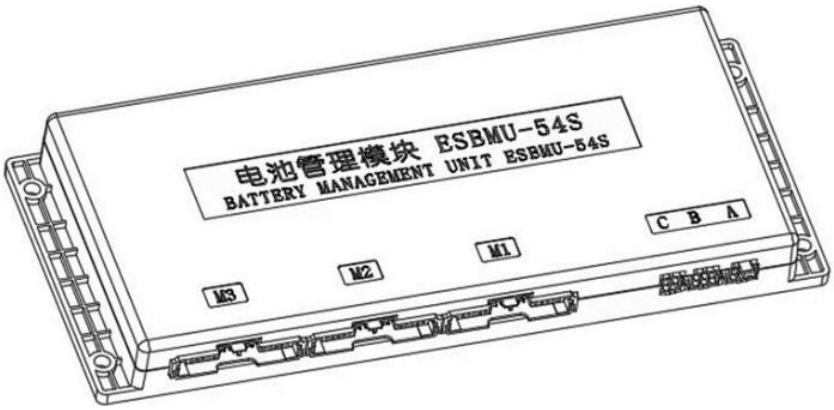


Figure 2- 22 BMU appearance

The BMU has overall dimensions of 260 mm × 110 mm × 23.5 mm and features hardware interfaces including A-port, B-port, C-port, M1 port, M2 port, and M3 port.

The technical specifications of Level 1 BMS are shown in the following table:

Table 2-10 Technical specifications of the Level 1 BMS

No.	Description		Parameter				Remark
			Minimum	Typical	Maximum	Unit	
	Working power supply	Nominal voltage	9	-	32	Vdc	
		Nominal power consumption	-	-	1	W	DI/DO/IO not connected
	Single cell voltage acquisition	Channels	3	-	54		Voltage for battery modules should be above (>) 6V
		Range	1.5	-	4.5	Vdc	
		Accuracy	≤±0.1%FS, voltage≤5mV				
	Temperature acquisition	Channels	-	-	30	Channel	
		Range	-40	-	125	℃	
		Accuracy	-	±1	-	℃	±1℃@-25℃~65℃; ±2℃@-40℃~ -25℃, or 65℃~125℃
	DO	Channels	-	-	1	Channel	
		Output current (A)	-	-	1	A	Peak Current 5A@100ms
	DI	Channels	-	-	1	Channel	
		High level	9	24	32	Vdc	

2.5.9.2Second-level BMS (BCMU)

The Level 2 BMS, known as the Battery Cluster Management Unit (BCMU), operates at the battery Rack level. Its primary responsibilities include:

- Real-time monitoring of the total voltage, current, insulation resistance, and switching status of the battery clusters.
- Receive cell voltage and temperature data uploaded by BMU to complete the estimation of SOC/SOH and other state variables of battery clusters, as well as the judgment of balancing strategies.
- Supporting fault diagnosis of the battery system and enabling safety control functions for protection equipment such as circuit breakers and relays.
- It can also automatically respond according to the established strategy through communication with the upper-layer battery array management system, thus ensuring the safe, stable and reliable operation of the energy storage system.

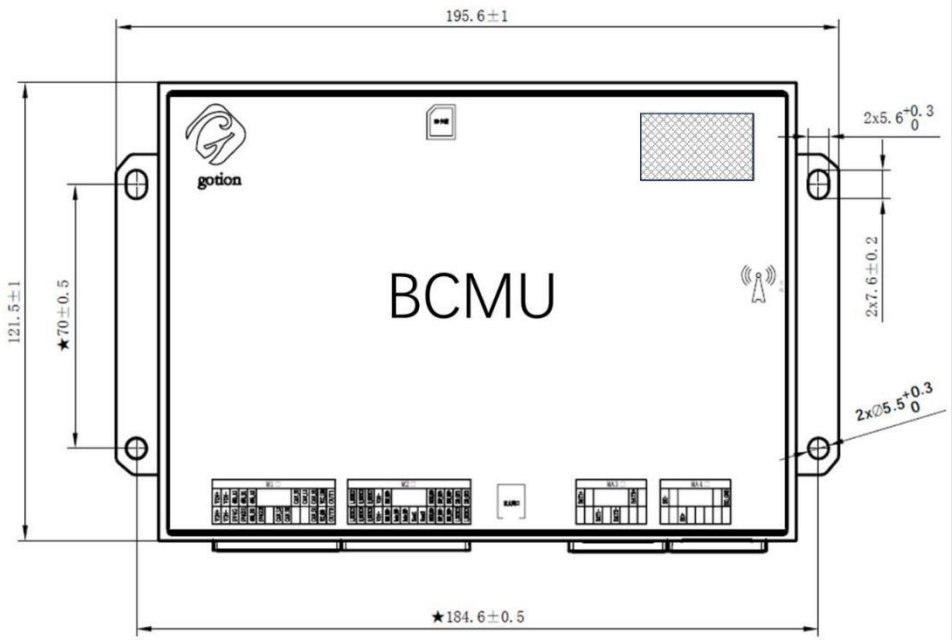


Figure 2-23 BCMU appearance

The technical specifications of Level 2 BMS are shown in the following table:

Table 2-11 Technical specifications of the Level 2 BMS

No.	Item	Specification
1	Dimension	195mm x 120mm x 20.8mm
2	Weight	800g
3	Material	Sheet metal
4	Insulation resistance	> 10MΩ 2500VDC
5	Withstand voltage	3100V AC @ 50Hz
6	Power supply voltage	24V DC
7	Power consumption	< 3W
8	Maximum number of slaves BMS	Max. 24 Slave BMS
9	Communication protocol	2 * non-isolated CAN / 2 * isolated RS485 / 1 * Ethernet
10	Baud rate	250kbps / CAN; 9600Kbps/RS485
11	Total voltage acquisition accuracy (rack level)	≤5mV(<5V), <0.2%(5V-15V)
12	Current acquisition accuracy (rack level)	≤2A (<200A), ≤1% (≥200A)
13	Insulation resistance acquisition accuracy (rack level)	Relative error ≤ 20% when nominal total voltage ≥ 400V; Relative error≤30% when nominal total voltage<400V

14	Operating environment	Ambient temperature: -10°C ~ 55℃; Relative humidity: < 95% (RH, no condensing) ; Ambient magnetic Field: < 400A/m; Corrosive, flammable, and explosive gases are not allowed around

2.5.9.3Third-level BMS (BAMS)

The Level 3 BMS, also known as the Battery Array Management System (BAMS), serves as the control host for the battery management system in energy storage power stations. Its key functions include:

- Communicating with the Level 2 BMS to obtain real-time data from the battery rack, such as voltage, current, temperature, and SOC.
- Monitoring the operation status of air conditioners, fire-fighting equipment, circuit breakers, and other devices through network communication.
- Performing data analysis, alarm processing, parameter setting and adjustments, and time-based data storage.
- Collaborating with the PCS host and EMS to optimize control strategies based on actual power output needs and the SOC of each battery group.
- Automatically adjusting and enabling coordinated control to ensure the safe and stable operation of the power station, while promoting extended battery life.

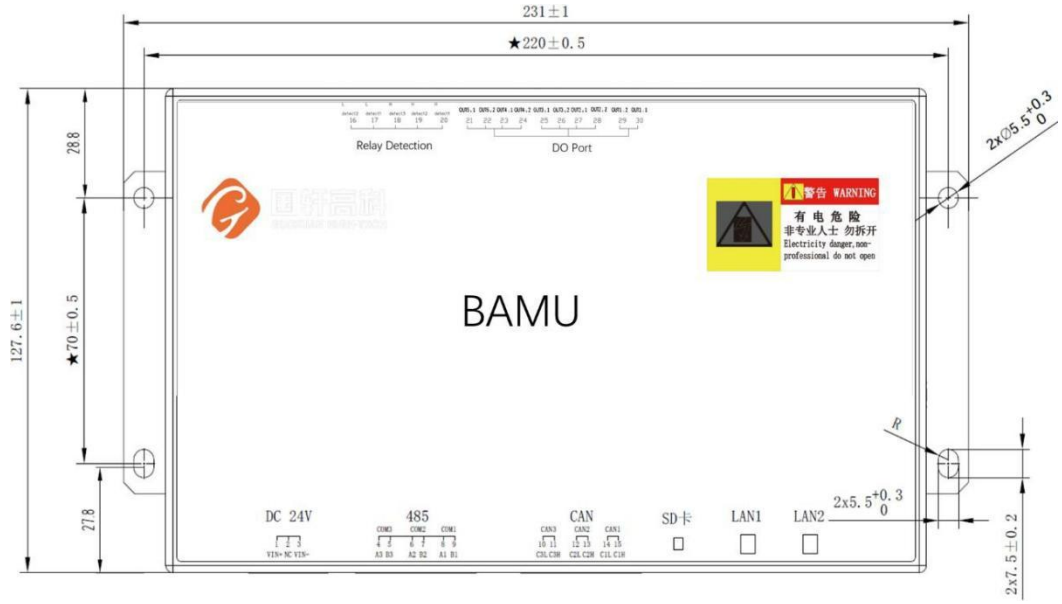


Figure 2- 24 BAMU appearance

The technical specifications of Level 3 BMS are shown in the following table:

Table 2-12 Technical specifications of the Level 3 BMS

No.	Item	Specification
1	Dimension	231mm x 125mm x 20.8mm
2	Weight	1800g
3	Material	Sheet metal

4	Insulation resistance	>10MΩ 1000 VDC
5	Withstand voltage	1800 VAC @ 50Hz
6	Power supply voltage	24 VDC
7	Power consumption	< 5W
8	Communication port	2 * 10/100M LAN(RJ45), 3 * isolated CAN, 3 * isolated RS485
9	Baud rate	9600bps/RS485, 250Kbps/CAN, 100Mbps/LAN
10	Data recording interval time	≤ 60 seconds
11	Event log database	> 5000 events, including exception class, occurrence time,protection action
12	Query method	On site panel query method, remote computer query method
13	Alarm mode	Light alarm, and display alarm prompt
14	Display	10.2” TFT LCD Screen, resolution (1024 x 600)
15	Operating environment	Ambient temperature: -10°C ~ 55℃; Relative humidity: < 95% (RH, no condensing); Ambient magnetic Field: < 400A/m; Corrosive, flammable, and explosive gases are not allowed around

2.5.10 Thermal management system

At the ESS container level, the temperature of the battery container is managed through a combination of air conditioning and a liquid cooling temperature control system.

The liquid cooling system comprises the liquid cooling unit, piping system, and battery pack cooling system to regulate the temperature of the battery packs.

Figure 2-25 Air flow direction of the liquid cooling unit

Figure 2-35 Front and view of the manual automatic transfer switch

2.5.11.7 Temperature and smoke detector

The temperature detector measures and monitors the internal temperature of the battery container.

Figure 2-36 Temperature detector appearance

More parameters of the temperature detector are shown in the table below.

Table 2-19 Technical parameters of the temperature detector

No.	Item	Parameters
1	Type	55000-121
2	Dimension	100mm * 42mm
3	Operating voltage	24 V (9 ~ 33 V DC)
4	Quiescent current	55 μA at 24V
5	Normal alarm current	52 mA at 24V
6	Operating temperature	-20°C ~ +90°C
7	Ambient humidity	0% ~ 95% RH (non-condensing or icing)

The smoke detector monitors the internal smoke concentration of the battery container.

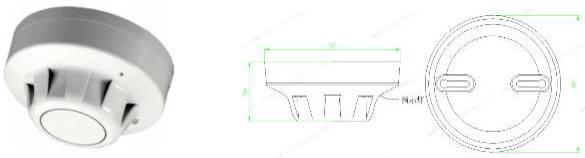


Figure 2-37 Smoke detector appearance

More parameters of the smoke detector are shown in the table below.

Table 2-20 Technical parameters of the smoke detector

No.	Item	Parameter
1	Dimension	100mm * 42mm
2	Operating voltage	24 V (9 ~ 33 V DC)
3	Quiescent current	30 ~ 50μA at 24V
4	Normal alarm current	52 mA at 24V
5	Operating temperature	-20°C ~ +60°C
6	Ambient humidity	0% ~ 95% RH (non-condensing or icing)

The temperature sensor and smoke sensor are integrated with red light-emitting diodes. The working status of the sensors can be determined based on the status of the diodes, as shown in the table below.

Table 2-21 Status of the indicator

Item	Color	Status	Description
Temperature/smoke detector	Red	Steady on	The detector activates into alarm mode.
		Blinking	The detector switches to monitoring mode.

2.5.11.8 Aerosol Fire Extinguishing System

The aerosol fire extinguisher utilizes GreenSol© A1000, based on environmentally friendly SFE powdered aerosol technology, which is listed on the EPA Halon Alternatives SNAP list as powdered aerosol A, designed for total flood fire suppression applications.

The A1000 is designed to extinguish Class A (solid fuel), Class B (liquid and gas fuel), and Class C (electrical) fires in enclosed spaces. It produces large quantities of powdered aerosol, designed to extinguish fires in a 10.0m³ enclosed volume.

The system is compatible with standard detection and control systems and can be installed inside or outside the protected volume.

Figure 2- 38 Appearance of the aerosol fire extinguisher

Table 2-21 Technical parameters of the aerosol fire extinguisher

No.	Item	Parameter
1	Model	A1000

2	Dimensions (W*D*H)	120mm*320mm*120mm
3	Fire extinguishing capacity	10m³ (100g/m³)
4	Start-up mode	Electric start
5	Powdered Aerosol color	White / light grey
6	Discharge time	46 seconds
7	Temperature range	-40℃ ~ 54℃
8	Toxicity	None
9	SFE weight	1000g / 35.27oz
10	SFE specific gravity	1.2 ~ 1.5 g/cm³
11	SFE combustion velocity	1.1 ~ 1.2 mm/sec
12	Total weight	12.5 kg
13	Resistance	0.85 ~ 1.85 Ohm (±0.2)
14	Power supply	1.35A
15	Ignition	Electrical match SPEX (1a – 1w) type
16	Ozone Depletion Potential	None
17	Global Warming Potential	None

Three GreenSol© A1000 Aerosol Fire Extinguishers are mounted on the top roof of the container, as shown in the top view image below.

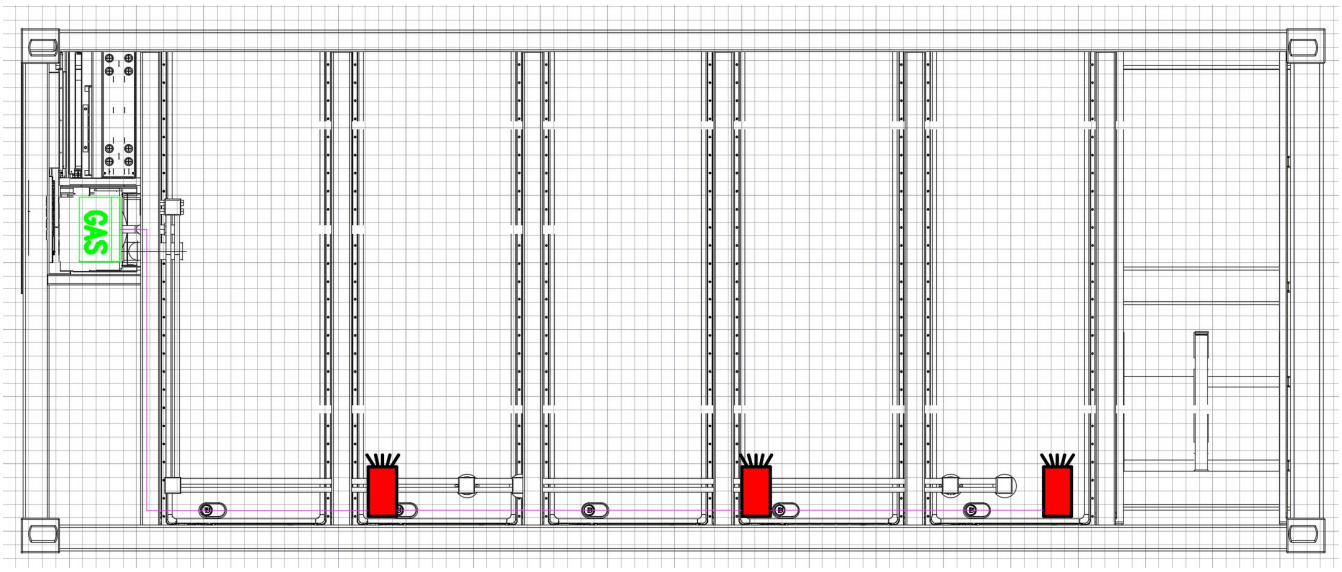


Figure 2-39 Top view of Aerosol fire extinguishers (x3) and fire suppression pipes in the BESS container

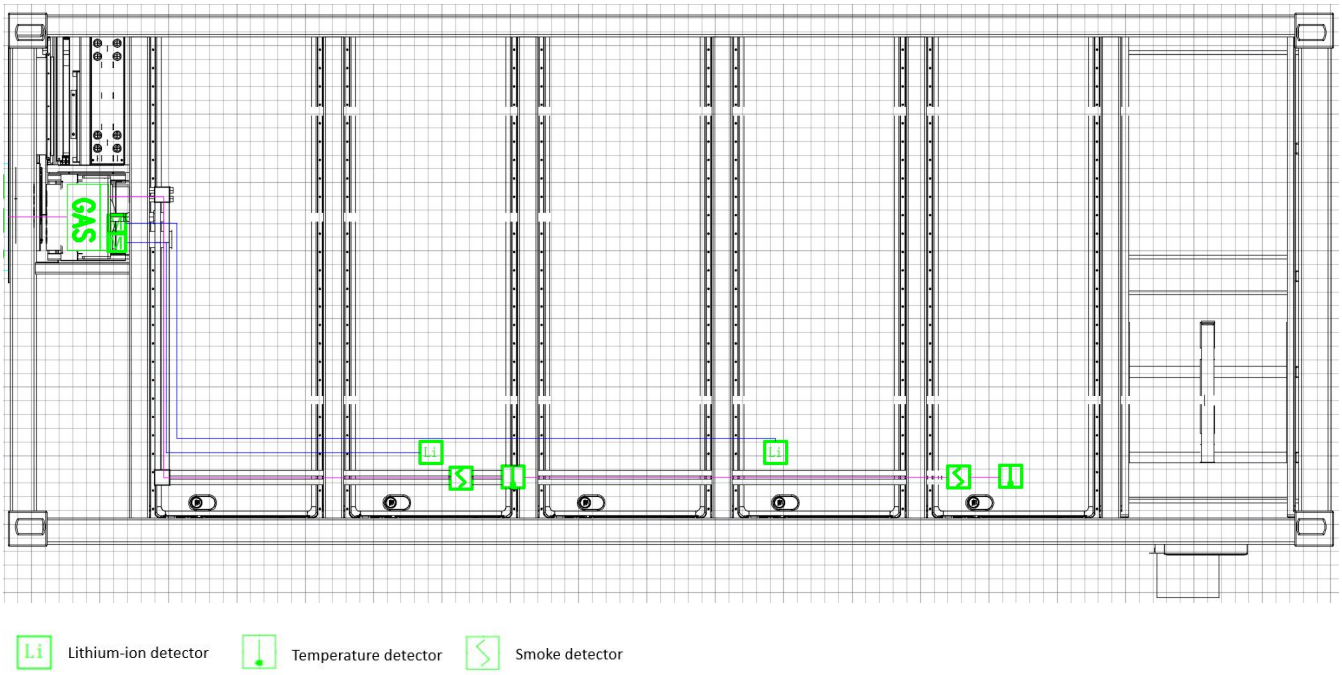


Figure 2-40 Top view of smoke and heat detectors in the BESS container

2.5.11.9 Gas ventilation system

The gas ventilation system consists of an air intake electric louver and an air-exhaust louver with an exhaust fan, all mounted on the wall of the BESS container.

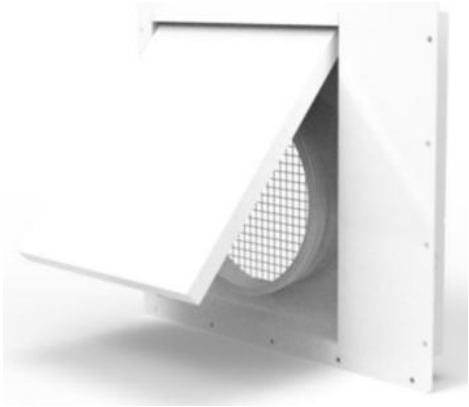


Figure 2-41 Actual picture of air intake device

Figure 2-42 Actual picture of air exhaust device

The technical parameters of the exhaust fan and louver are as follows:

Table 2-22 Technical parameters of the exhaust fan and louver

No.	Parameters	Air-exhaust louver	Air-intake louver
1	Dimension (W*D*H)	350mm*110mm*400mm	350mm*52mm*400mm
2	Rated voltage	230Vac@50Hz	24Vdc
3	Frequency	50Hz	/
4	Rated power	120W	30W
5	Maximum air volume	820 CFM	/
6	Operating temperature	-20℃ ~ 55℃, 85%RH	-20℃ ~ 55℃, 85%RH
7	Storage temperature	-40℃ ~ 65℃, 95%RH	-40℃ ~ 65℃, 95%RH
8	IP rating	IP55	IP55
9	Material	Galvanized Steel	Galvanized Steel
10	Anti-corrosion rating	C4 or C5	C4 or C5
11	Explosion-proof rating	Exd II CT4	Exd II CT4

2.5.11.10 Automatic pressure relief device

The automatic pressure relief device is a key component of the gas fire extinguishing system, typically remaining in a "CLOSED" state.

When the gas fire extinguishing system is activated, excess pressure may build up in the protected area. The automatic pressure relief device will release this overpressure, protecting the area. Once the pressure decreases, the device closes again to maintain the airtightness of the protected area and ensure effective fire extinguishing.

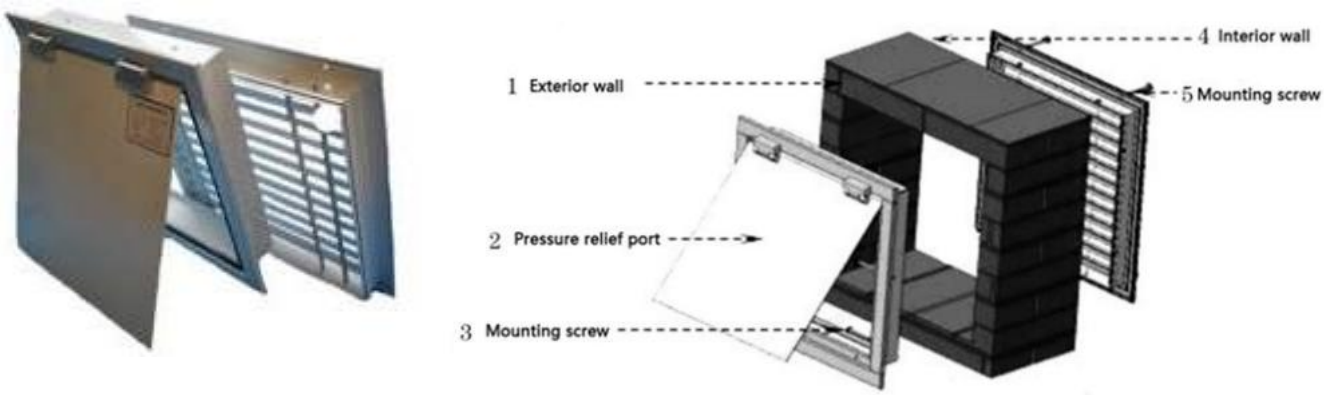


Figure 2- 43 Pressure relief device

The technical parameters of the pressure relief device are as follows:

Table 2-23 Technical parameters of the pressure relief device

No.	Item	Parameters
1	Dimension (W*D*H)	375mm * 80mm* 375 mm
2	Cut-out size (W*H)	300mm*300mm
3	Opening Pressure	1100±50Pa
4	Pressure relief area	0-0.07m^2

2.6Battery ESS working principle

2.6.1Main circuit diagram

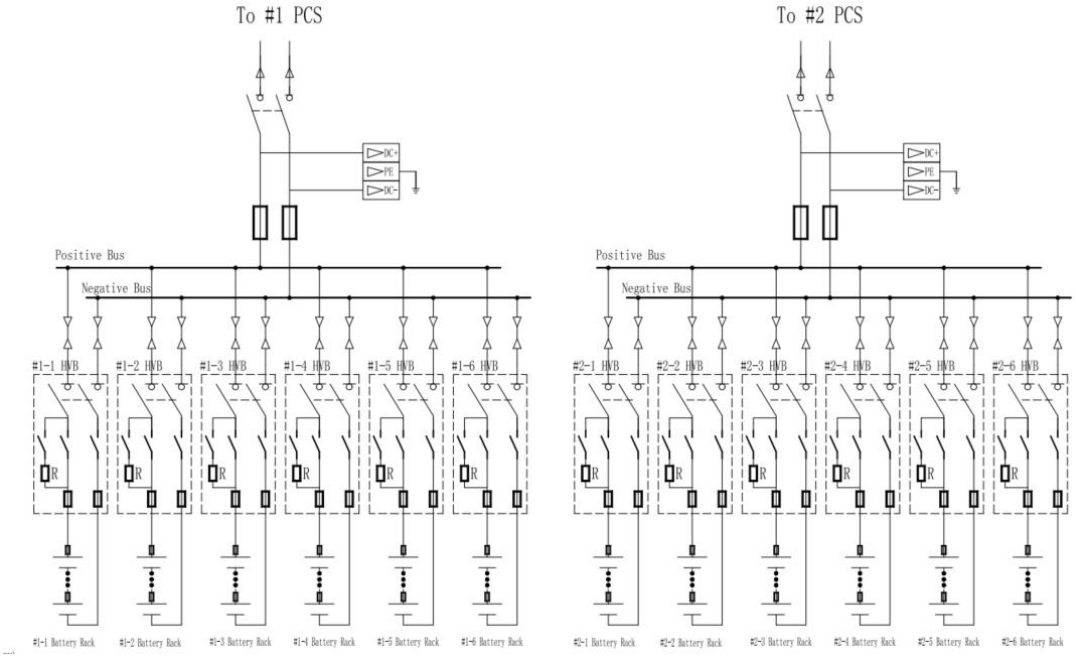


Figure 2- 44 Primary single line diagram with 2 PCS outputs

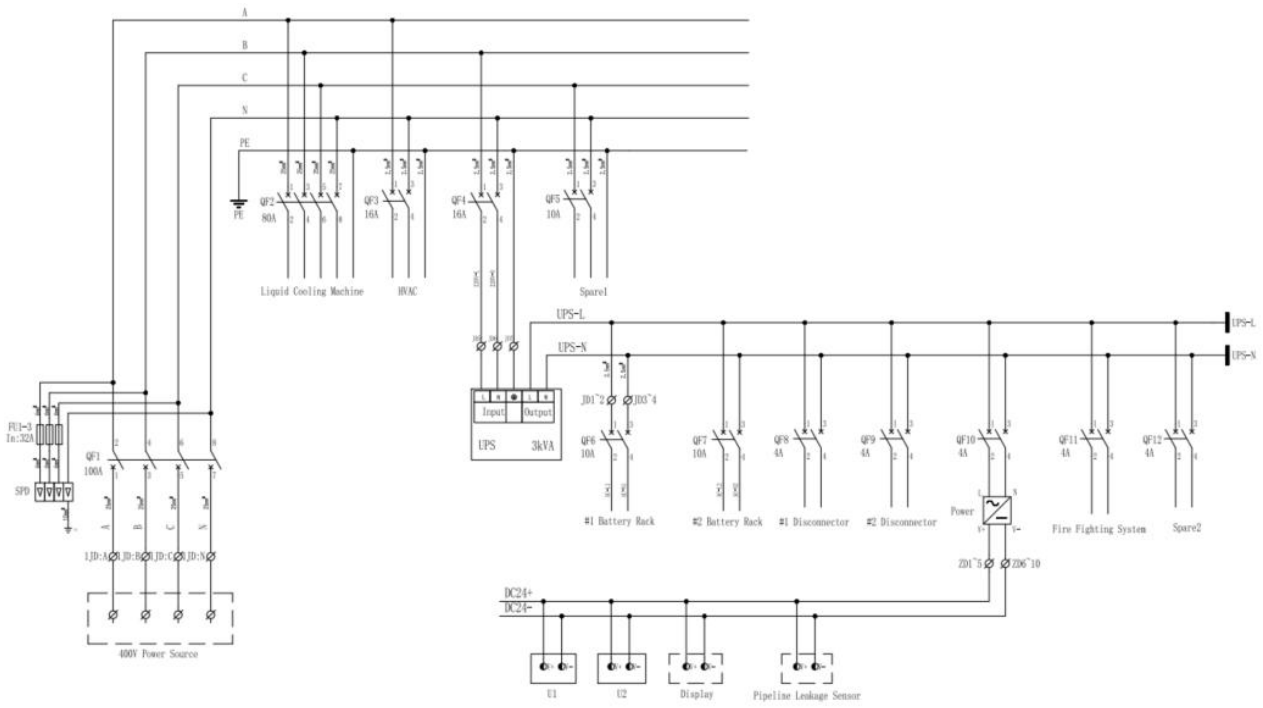


Figure 2- 45 Secondary auxiliary single line diagram

2.6.2 Working modes

The BESS operates in four modes: Charging, Discharging, Idle, and Fault.

In Charging mode, the grid or other energy systems charge BESS, charging stops when one of the battery cells reaches the charging cut-off voltage.

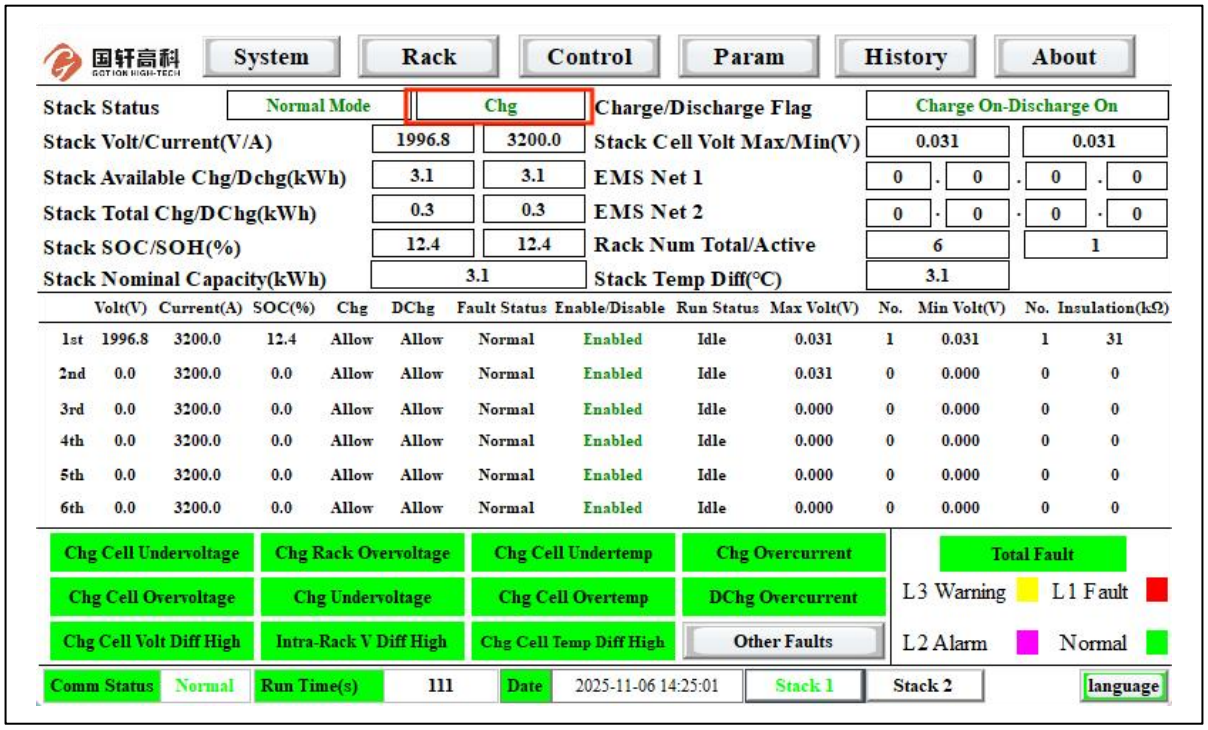


Figure 2-46 Charging mode displayed on HMI

In Discharging mode, the BESS supplies power to the load or transmits power to the grid. When one

of the battery cells reaches to discharge cut-off voltage, the discharge stops.

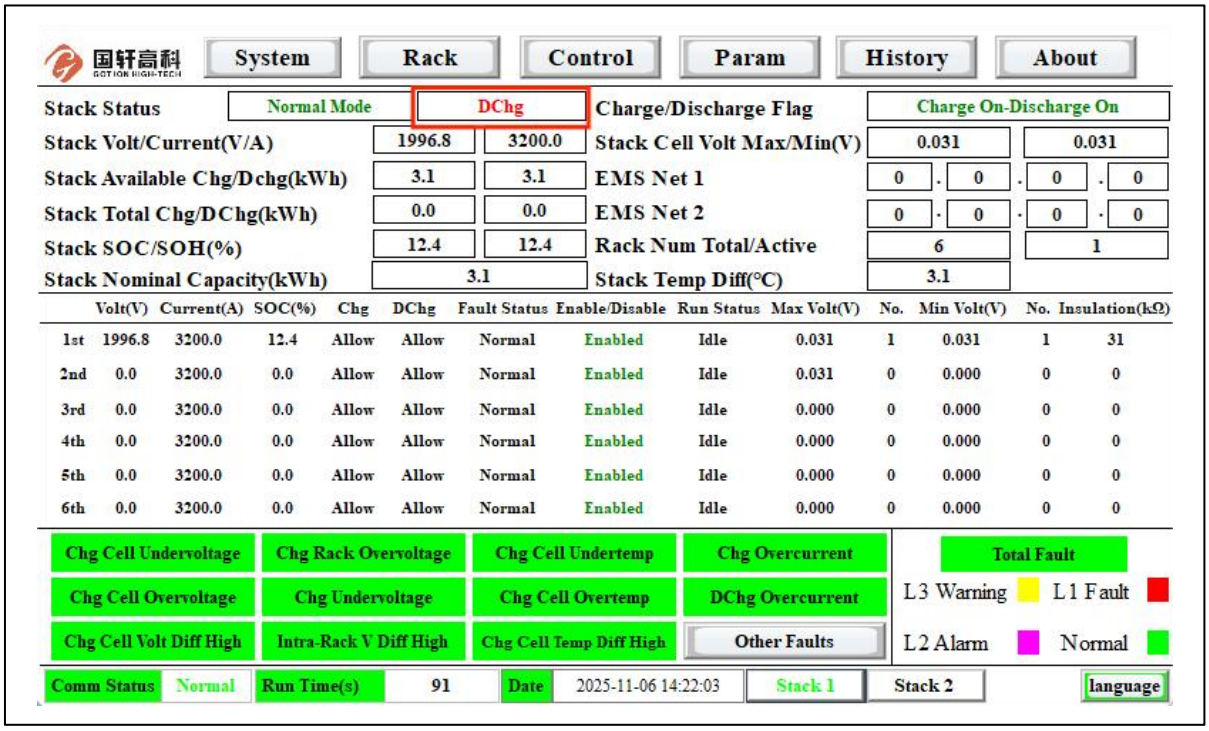


Figure 2-47 Discharging mode displayed on HMI

In Idle mode, the Battery ESS remains inactive.

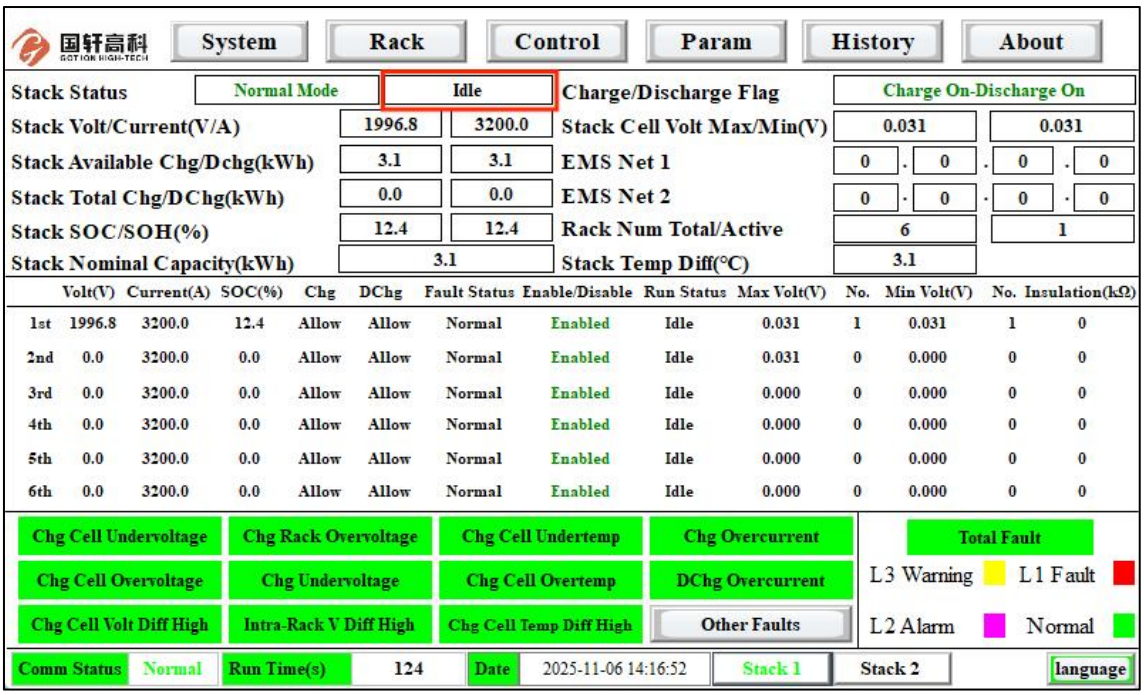


Figure 2-48 Idle mode displayed on HMI

In Fault mode, there is a fault inside the battery conatiner , which can be reviewed on the display screen.

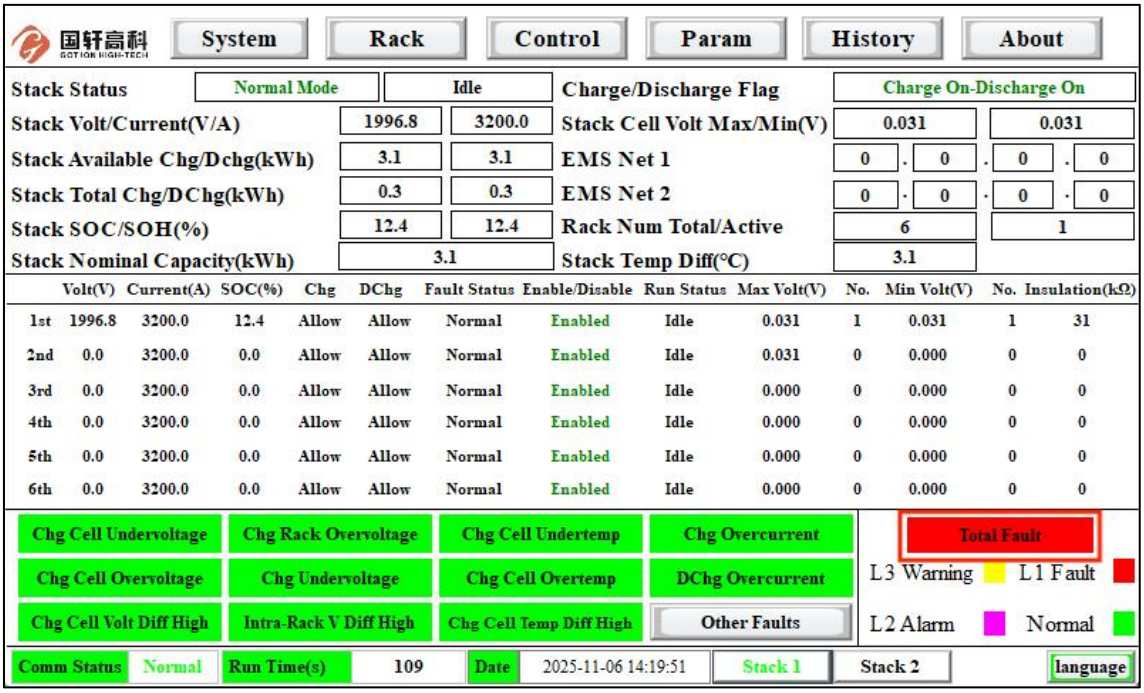


Figure 2-49 Fault mode displayed on HMI

2.7 Typical application scenario

From a system-wide perspective, energy storage applications can be categorized into three scenarios: power generation side energy storage, transmission and distribution side energy storage, and user side energy storage. These scenarios can be further classified into energy-based and power-based demands.

Energy-based demands typically require long discharge times, such as energy time-shifting, with no need for rapid response. In contrast, power-based demands prioritize fast response times, though the discharge duration is generally short, such as in system frequency regulation.

In practical applications, energy storage technologies must be evaluated based on the specific requirements of each scenario to determine the most suitable solution.

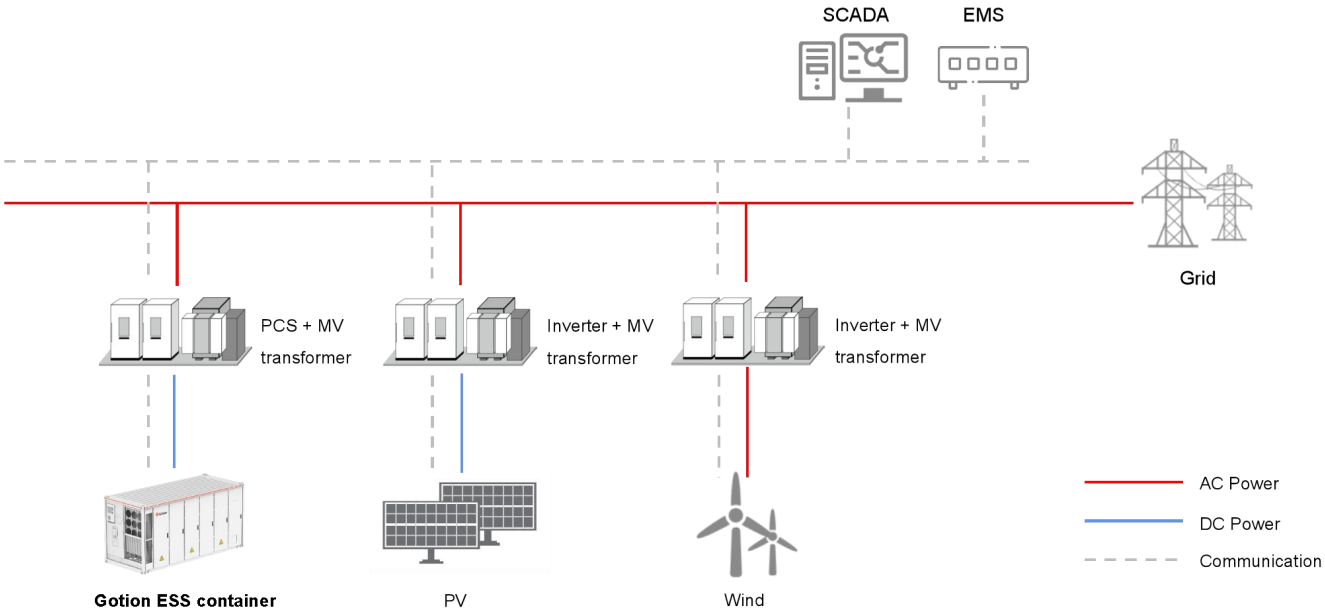


Figure 2- 50 Schematic of energy flow and communication in the system

3Transportation requirement

DANGER

Load or unload batteries with caution. Otherwise, the batteries may be short- circuited or damaged (such as leakage and crack), catch fire, or explode.

WARNING

Do not move a battery by holding its terminals, bolts, or cables. Otherwise, the battery may be damaged.

Keep batteries in the correct direction during transportation. They must not be placed upside down or tilted, and must be protected against falling down, mechanical impact, rains, snows, and falling into water during transportation.

General Requirements for Transporting Batteries:

- **Certifications and Classification:**
  - Batteries have obtained UN38.3 and UN3536 certifications.
- Classified as Class 9 dangerous goods.
- **Transportation Provider:**
  - Must be qualified to transport dangerous goods.
  - Open truck transportation is prohibited.
- **Delivery and Compliance:**
  - Batteries should be delivered directly to the site via road or sea, complying with international dangerous goods transport regulations.
  - Ensure compliance with regulations of departure, route, and destination countries.
- **Transportation Methods:**
  - Prefer sea or road transportation; avoid railway or air transport.
  - Adhere to the International Maritime Dangerous Goods Code (IMDG Code) for maritime transport.
  - Follow the Agreement Concerning the International Carriage of Dangerous Goods by Road (ADR) or JT/T 617 for road transport.
  - Avoid tilting or jolting during transportation.

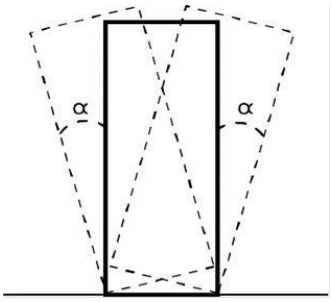


Figure 3- 1 Diagram showing proper angles for safe navigation

- **Pre-Transport Checks:**
  - Inspect battery packages for integrity, odor, leakage, smoke, or signs of burning.
  - Ensure all container doors are locked.
  - Select appropriate cranes or hoisting equipment based on site conditions.
  - Use tools with sufficient load-bearing capacity, arm length, and rotation radius.

- Remove potential obstacles like trees and cables.
- Transport equipment in good weather conditions.
- Set up warning signs or belts to prevent unauthorized entry into the hoist area.
- Secure equipment to the transport vehicle with ropes to prevent excessive tilting.

➢ **Packaging and Handling:**

- Secure the packing case during transport.
- Handle with care during loading and unloading; take moisture-proof measures.
- Vehicles must meet load-bearing capacity requirements.
- Road transport speed limit: 80km/h (50 mph) on flat roads, 60km/h (37 mph) on rough roads, or follow local traffic regulations.

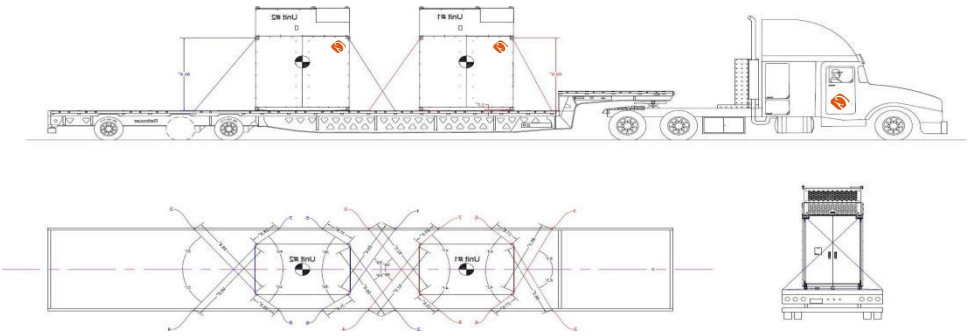


Figure 3- 2 Road transport diagram

➢ **Safety Precautions:**

- Exercise caution to prevent bumps and ensure personal safety.
- Do not mix dangerous goods with food, medicine, animal feed, or their additives.
- Separate dangerous goods from ordinary goods using spacers or maintaining a distance of at least 0.8 meters.

➢ **Faulty Battery Transport:**

- Insulate terminals, pack, and place faulty batteries in an explosion-proof box.
- Record site name, address, time, and fault symptom on the box.
- Avoid transporting faulty batteries near flammable materials, residential areas, or densely populated places.

➢ **Moving Heavy Objects:**

- Plan manpower and work division for equal weight distribution.

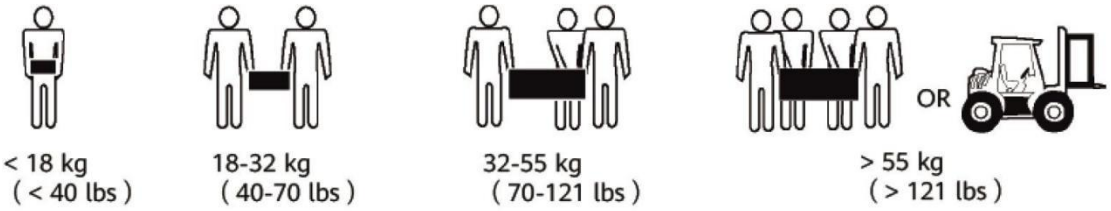


Figure 3- 3 Lifting diagram

- Ensure synchronized lifting and landing with supervision.
- Wear protective gear such as gloves and shoes.
- Use legs to lift objects gently and stably; avoid using your back.
- Hold equipment handles or lower edges; avoid module handles.
- Lift objects to waist height, adjust grip, and lift.
- Move heavy objects stably and slowly to prevent damage.

- Be cautious of workbenches, slopes, stairs, and slippery places.
- Ensure door width allows safe movement through it.
- Move feet to change direction; avoid twisting your waist.
- Secure equipment to forklift trucks and assign personnel for care.
- Prevent collisions or falls during movement.

4 Storage requirement

4.1General requirements

- Proof that the product is stored according to the requirements must be available, such as temperature and humidity log data, storage environment photos, and inspection reports.
- Do not store battery packs for extended periods. Long-term storage of lithium batteries may cause capacity loss. Generally, the irreversible capacity loss is 3% to 5% after the lithium batteries are stored at the recommended storage temperature range for 12 months.
- The storage environment must be clean and dry. The product must be protected against rain and water.
- The air must not contain corrosive or flammable gases.
- Do not tilt the product or place it upside down.
- If equipment except battery packs has been stored for more than two years, it must be checked and tested by professionals before use.

4.2Battery container storage (excluding battery packs)

- Do not unpack the battery container if it will be stored for a long time.
- Do not stack the battery container.
- Ensure that the ground surface is flat (for long-term or temporary storage).
- Close the door of the battery container.
- Storage temperature: -30°C to 60°C (without UPS); relative humidity: 5%–95%.

4.3Battery pack storage and single battery pack charge

4.3.1Material delivery check

WARNING

- Ensure that batteries are stored in a dry, clean, and well-ventilated indoor environment, free from sources of strong infrared or other radiation, organic solvents, corrosive gases, and conductive metal dust. Avoid exposure to direct sunlight, rain, and keep batteries away from heat and ignition sources.
- If a battery is faulty (showing signs of scorch, leakage, bulge, or water intrusion), relocate it to a designated dangerous goods warehouse for separate storage. Ensure the battery is at least 3 meters away from any combustible materials and arrange for its disposal as soon as possible.
- Store batteries correctly according to the markings on the packing case. Avoid placing batteries upside down, laying them on one side, or tilting them. Stack batteries in accordance with the specified stacking requirements on the packing cases.
- Store batteries separately from other devices. Do not stack batteries too high. Ensure the storage site is equipped with qualified firefighting facilities, such as fire sand and fire extinguishers.
- After batteries are powered off, static power consumption and self-discharge loss may occur in internal modules, potentially leading to battery damage due to overdischarge. Avoid storing batteries in a low SoC and charge them in a timely manner. Permanent battery faults caused by delayed charging are not covered by the warranty. Scenarios leading to low SoC storage include but are not limited to:1.Disconnected power or signal cables; 2.Inability to charge batteries due to a system fault after

discharge; 3.Incorrect system configurations preventing battery charging; 4.Long-term mains power failure preventing battery charging.

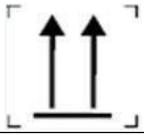
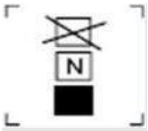
WARNING

Do not move a battery by holding its terminals, bolts, or cables. Otherwise, the battery may bedamaged.

Keep batteries in the correct direction during transportation. They must not be placed upside down or tilted, and must be protected against falling down, mechanical impact, rains, snows, and falling into water during transportation.

4.3.2Packaging label descriptions

Table 4-1 Packaging label descriptions

Label	Description
	This way up: The package shall be vertically oriented during transport and storage.
	Fragile: The package contains fragile objects and shall be handled with care.
	Keep dry: The package shall be kept away from rain.
	Stacking limit by number: The packages shall not be vertically stacked beyond the specified number. The actual label may vary.

4.3.3Battery storage strategy

- Storage environment requirements are as follows:
  - **Ambient temperature:** -30°C to 60°C (Recommended: 0°C to 30°C. Extended storage at temperatures above 40°C may degrade battery performance and shorten service life.)
  - **Relative humidity:** 5%–95% (Recommended: approximately 45%)
  - **Conditions:** Keep in a dry, clean, and well-ventilated area; avoid exposure to corrosive organic solvents, gases, and direct sunlight
  - **Proximity:** Maintain a distance of at least 2 meters from heat sources
- **Disconnection:** Ensure batteries in storage are disconnected from external devices. All indicators on the batteries should be off.
- **Charging Intervals:** For batteries stored in a low SOC, charge within the maximum interval corresponding to the SOC when powered off to avoid overdischarge damage.
- **Qualified Personnel:** Only trained and qualified personnel should charge batteries. Use insulated gloves and dedicated insulated tools.
- **Monitoring:** Observe the batteries during charging and promptly address any issues.

- **Handling Abnormalities:** If a battery bulges or smokes during charging, stop immediately and dispose of the battery properly.

4.3.4 Other precautions

Conditions for Determining Overdue Storage of Battery Packs

- Avoid storing batteries for extended periods.
- If batteries exceed the allowed storage time, report to the responsible person promptly.
- Dispose of any deformed, damaged, or leaking batteries immediately, regardless of storage duration.

Preparing Charging Devices

- Multimeter
- Clamp meter
- Insulated torque socket wrench
- Charger

Inspection Before Charging

- Visual Check: Inspect the battery's appearance before charging. Only charge batteries that are free from defects.
- Qualification Criteria: Ensure the battery has no:
  - Deformation
  - Shell damage
  - Leakage
- Accessory Check: Verify that all accessories are complete based on the packing list provided with the charger.

Full Charge Strategy

- Ambient Temperature: Charge within 15°C to 40°C (Recommended: 25°C ± 2°C).

5Installation

5.1Site requirements

5.1.1Site selection

NOTICE

Refer to the NFPA855, Standard for the Installation of Stationary Energy Storage Systems, and applicable local laws and regulations.

5.1.1.1General requirements

Site Requirements:

- The installation site must be at least 300mm above the highest historical water level of the area and should not be located in low-lying land.
- The distance between the ESS and residential buildings must be at least 12m, and the distance from densely populated buildings (schools, hospitals) must be greater than 30.5m. If these distances cannot be met, fire walls must be installed between the ESS and the buildings.
- The ESS and site must be in environments free from explosion risks.
- The site must have convenient transportation access and reliable fire suppression facilities.

Fire Safety:

- Ensure at least two gas fire extinguishers are near each unit during installation, commissioning, and operation.
- Reserve sockets for the water fire suppression system at the ESS site.
- The site must be spacious enough to accommodate capacity expansion.
- The ESS should be installed more than 30m away from third-party wireless communication facilities.
- Select a dry and well-ventilated location for the site.

Prohibited Site Conditions:

- Avoid areas with strong vibration, loud noises, and strong electromagnetic interference.
- Avoid areas with dust, oil fumes, harmful gases, and corrosive gases.
- Avoid areas with corrosive, flammable, and explosive materials.
- Avoid areas with existing underground facilities.
- Avoid areas with adverse geological conditions such as rubbery soil, soft soil layers, waterlogging, and land subsidence.
- Do not place under reservoirs, water landscapes, or water rooms.

Notes for Waterlogging Areas:

- If prone to waterlogging, install water-blocking and drainage facilities or raise the ground.
- Do not use cable trenches for drainage.
- Implement fire retardant sealing at cable holes.

Seismic and Hazard-Prone Areas:

- Avoid areas prone to earthquakes (seismic fortification intensity > 9), debris flow, landslides, quicksand, karst caves, mining land subsidence, blasting hazards, flood due to dam or levee failure, important water supply sources, historic relics, populated areas, high-rise buildings, and

underground buildings.

- Avoid intersections and busy roads of urban main roads.

Flood and Waterlogging Prevention:

- Large-scale systems (power ≥ 100 MW): Site elevation must be higher than the flood level with a 1% probability or the highest historical waterlogging level.
- Medium- or small-scale systems (power < 100 MW): Site elevation must be higher than the flood level with a 2% probability or the highest historical waterlogging level.
- If elevation requirements cannot be met, change the site location or implement appropriate flood prevention measures.
- For sites prone to wind and waves from rivers, lakes, and seas, consider the wind and wave height with a 2% probability plus an additional 0.5m safety height.
- Build side ditches or drainage ditches to manage catchment water.

Foundation Construction:

- Investigate site conditions (location, environment, climate) in detail before constructing the foundation for the Battery ESS.
- Ensure maintenance access to the battery pack and other equipment by hardening the side road of the container with cement or asphalt.

5.1.1.2Outdoor site requirements

General Requirements for Selecting an Outdoor ESS Site:

- **Vegetation:** Ensure no vegetation, especially flammable plants, within 3m of the ESS to prevent potential fires. Exceptions include single specimens of trees, shrubbery, or cultivated ground cover (such as grass, ivy, succulents) that do not readily transmit fire.
- **Obstacles:** No obstacles should be above the ESS. The ESS must not be installed under structures like parking sheds, and PV modules must not be installed on top of the ESS.
- **Safety Distances:** The distance between the ESS and production buildings must comply with local fire protection regulations:
  - The ESS must be at least 10 ft (3.048 m) away from lot lines, public ways, buildings, combustible materials, hazardous materials, high-piled stock, parking spaces, and other exposure hazards.
  - If either of the following conditions is met, the distance can be reduced to 3 ft (0.914 m):
    - Presence of 1-hour freestanding firewalls extending 5 ft (1.5m) above and beyond the ESS installation boundary.
    - Non-combustible exterior walls with no openings or combustible overhangs, with a 2-hour fire resistance rating as per ASTM E119 or UL 263.
- **Exhaust Device:** The distance between the exhaust device of the ESS and any heating and ventilation vents, air intake vents of air conditioners, windows, doors, unloading platforms, and fire sources of other buildings or facilities must be greater than 15 ft (4.6m).
- **Airflow Considerations:** Ensure the air inlet and outlet of the battery container are correctly oriented and do not affect the heat dissipation of other equipment.

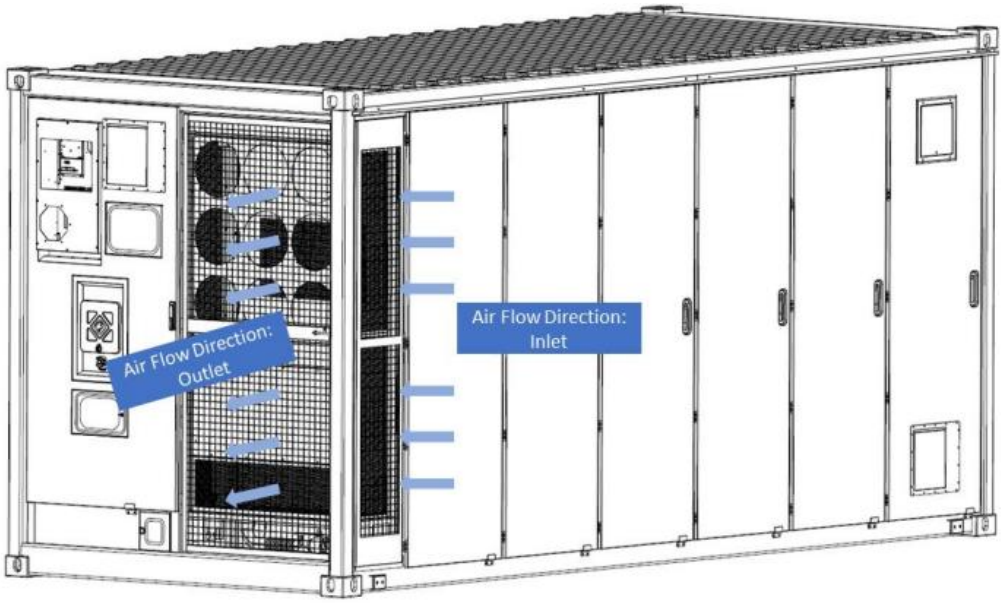


Figure 5- 1 The direction of airflow is indicated by the arrows

Environmental conditions:

- **Corrosion Prevention:** The ESS must not be installed in salt-affected or polluted areas. Suitable environments include:
  - Outdoor locations more than 1.2 mile (2000m) from the coast. Avoid areas 0.3 mile (500m) to 1.2 mile (2000m) from the coast unless confirmed with the vendor or company's engineers. Outdoor deployment is not allowed within 0.3 mile (500m) of the coast; indoor installation as per section 5.1.1.3 is required.
  - Locations more than 1 - 2 mile (1500–3000m) from heavy pollution sources (e.g., smelteries, coal mines, thermal power plants).
  - Locations more than 0.6 - 1.2 mile (1000–2000m) from medium pollution sources (e.g., chemical, rubber, electroplating industries).
  - Locations more than 0.3 - 0.6 mile (500–1000m) from light pollution sources (e.g., packing houses, tanneries, boiler rooms, slaughterhouses, landfill sites, sewage treatment plants).

5.1.1.3 Indoor building requirements

The fire safety of ESS dedicated-use buildings or structures must comply with local laws and regulations, referencing standards such as NFPA 855. The following requirements must be met:

General Building Requirements:

- **Dedicated-Use Building/Structure:**
  - Must have a 2-hour fire resistance rating for walls and store a maximum of 600 kWh lithium batteries per fire protection unit.
  - Solely for the operation of ESS equipment.
  - Occupants limited to professional personnel for operating, maintaining, servicing, testing, and repairing the ESS and other energy systems.
  - No other occupancy types permitted.
- **Safety Distances:**
  - Must be at least 3 m from lot lines, stored combustible materials, hazardous materials, high-piled stock, electrical infrastructure, public ways, buildings, and parking spaces.
- **Internal Layout:**

- Comply with local fire protection laws and standards, considering safe distances and layout of buildings and materials.

- **Combustible Materials:**
  - Not stored in the ESS building. Must be at least 3 m away from the building.
- **Fire Extinguishers:**
  - Equipped with halogenated agents, FM-200, FK-5-1-12, carbon dioxide, or dry powder. At least two extinguishers per fire protection unit, checked and replaced periodically.
- **Smoke Detectors:**
  - Room-level smoke detectors, at least two of each type, with an enabled automatic fire alarm system.
- **Ventilation Devices:**
  - Independent ventilation devices interacting with the fire alarm system, limiting flammable gas concentration below 25% of the lower flammability limit (LFL). Ventilation rate: ≥ 1 $ft^3/min/ft^2$ (5.1 $L/sec/m^2$).
- **Flammable Gas Detection:**
  - Rooms protected by a continuous gas detection system that activates the mechanical exhaust ventilation system at 25% LFL and remains on until the gas level is below 25% LFL. Minimum 2 hours of standby power.
  - System failure should trigger a trouble signal at the monitoring center.
- **Fire Suppression Facilities:**
  - Equipped with water spray or sprinkler systems, with water supply for over 2 hours at designed flow rate and continuous supply for 12 hours post-fire. Sprinkler design density: 0.3 gpm/ft^2 (12.2 mm/min) over the room area or 2500 ft^2 (230 m^2), whichever is smaller.
- **Pressure Relief:**
  - Equipped with pressure relief explosion-proof devices or equivalent channels. Protective fences or walls must be installed if side pressure relief is used, maintaining at least 3 m distance from the relief wall.
    - Ambient Temperature: Inside the building should be below 55°C during ESS operation.
    - Ceiling Height: At least 4.5 m, with 2 m clearance above the ESS for pressure relief. No flammable materials above the ESS.
- **Maintenance Clearances:**
  - Doors must accommodate forklift installation. The indoor area should meet clearance requirements for ESS maintenance and forklift operations.
- **Exits and Aisles:**
  - Safety exits and aisles as per local building codes, with emergency lighting for all exit doors and aisles, and all exit doors opening toward the exit direction.

Exemption Conditions:

- **Fire Department Approval:**
  - Installation requirements must align with local fire department approvals. Water sprinkler systems, smoke detection, flammable gas detection, and explosion-proof requirements can be exempted if approval is obtained, but mechanical exhaust ventilation, pressure relief clearance, heat dissipation, and maintenance clearances must still be met.
- **Distance-Based Exemptions:**
  - Fire control and suppression systems, size and separation requirements, and water supply can be omitted for ESS buildings located more than 100 ft (30.5 m) from buildings, lot lines, public ways, stored combustible materials, hazardous materials, high-piled stock, and other exposure hazards.

Offshore Indoor Applications:

- **Proximity to Coast:**
  - If within 500 m of the coast, the ESS must be in a dedicated indoor environment with controllable temperature and humidity. Indoor environment must meet C4 or higher levels as specified in ISO 12944/ISO 9223. Site selection requirements for indoor applications must be met.
- **Anti-Salt Fog Measures:**
  - Outdoor air conditioners and ventilation devices must have anti-salt fog measures. Anti-salt fog filters must be installed at air intake and exhaust vents, or anti-salt fog devices used, maintained, and replaced periodically.

5.2Unpacking and acceptance procedures

- Securing and Moving Equipment:
  - Before moving, secure the equipment to a pallet truck or forklift with ropes to prevent it from tipping over. Handle the equipment carefully to avoid any bumps or falls that could cause damage.
- Pre-Unpacking Check:
  - Inspect the packaging to ensure it is intact before unpacking the batteries. Do not use batteries with damaged packaging. If any damage is detected, immediately inform the carrier and the manufacturer.
- Unpacking Process:
  - Once the equipment is in the installation position, unpack it carefully to avoid scratches. Ensure the equipment remains stable during the unpacking process.
  - If the installation environment is not ideal, take precautions against dust and condensation (e.g., using a dust cover, plastic film, or fabric cloth) after unpacking the batteries to prevent potential corrosion.
- Post-Unpacking Inspection:
  - Verify that all deliverables are present and match the packing list.
  - Confirm that the received container matches the ordered model.
  - Inspect the BESS and internal components for any signs of damage.
  - Check that all fastening and removable components are secure. If any components are loose, promptly notify the carrier and manufacturer.

5.3Installation preparations

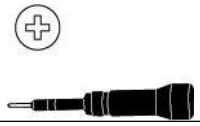
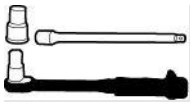
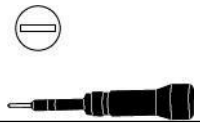
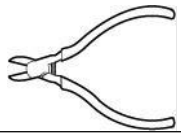
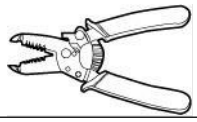
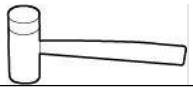
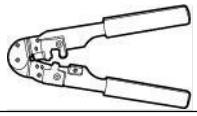
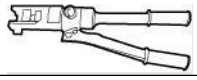
WARNING

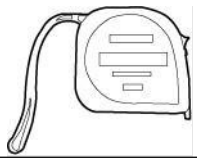
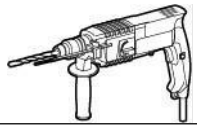
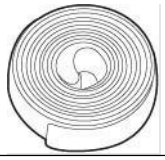
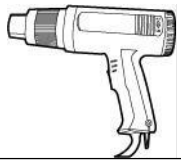
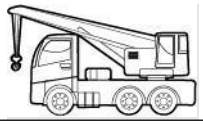
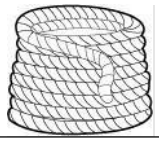
- Ensure the power circuit breaker is turned OFF before beginning battery installation.
- During battery installation, avoid placing tools, metal parts, or other items on the batteries.
- After completing the installation, clean the batteries and the surrounding area to remove any objects.
- When moving batteries, do not remove protective components, such as protective covers or waterproof caps, from the battery terminals.
- Avoid standing or working under the forklift tines.
- Operate the battery pack installation kit only after the forklift has come to a complete stop.

5.3.1Preparing tools

Here are the installation tools you might need:

Table 5-1 Tool description

Tool	Description
	Phillips insulated torque screwdriver
	Insulated torque socket wrench (including an extension bar) • Socket specifications: 7–19 mm • Socket depth ≥ 32 mm • The socket connector matches the torque wrench. • Torque range:1.2–45 N·m
	Flat head insulated torque screwdriver
	Diagonal pliers
	Wire stripper
	Cable cutter
	Rubber mallet
	Utility knife
	RJ45 crimping tool
	Hydraulic pliers
	Multimeter (DC voltage measurement range ≥ 1500 V DC)
	Marker

	Steel measuring tape
	Level
	Vacuum cleaner
	Hammer drill
	Hammer drill bit Φ16 mm
	Heat shrink tubing
	Heat gun
	Cable tie
	Insulated ladder
	Crane
	Lifting rope Rope length ≥ 1845mm x 4
	Electric forklift

	Pallet truck

Note:

- ✧ The tool images are for reference only.
- ✧ The tool tables may not include all the tools needed onsite. Installation personnel and the customer should prepare additional tools based on the specific site requirements.

5.3.2Personal Protective Equipment (PPE)

Here is the PPE you might need:

Table 5-2 Tool description

Insulated gloves	Protective gloves	Goggles	Dust mask
Insulated shoes	Reflective vest	Safety helmet	Safety harness

5.4Installing the ESS

5.4.1Installation environment check

Before starting the installation, carefully verify that all site requirements are met. Installation should only proceed once these conditions are satisfied. The company is not responsible for any issues arising from installations conducted in non-compliant environments.

Note:

- ✧ Establish a safe zone by using red caution belts to clearly define the area.
- ✧ Remove any obstacles within the safe zone.
- ✧ Place construction and warning signs in prominent, visible locations.

5.4.2Determining the installation position of the ESS

Prerequisites:

- ➢ Ensure that all site requirements are fulfilled.
- ➢ Verify and adjust the height of the concrete platforms, making sure the height difference between the upper surfaces of all platforms does not exceed 5mm.

Note:

- ✧ Confirm that the concrete platforms adhere to the necessary specifications.
- ✧ Determine the installation position and orientation of the ESS based on the specific site conditions.

Procedure:

- ➢ Identify the reference points for installing the ESS on the concrete platforms and mark them with a marker.
- ➢ Based on the reference points, use an ink fountain and a long, flexible measuring tape to mark the mounting positions for the four corner fittings of the ESS.

Note:

- ✧ When marking the positions for the corner fittings, ensure that the four lines form a rectangle.

5.4.3Foundation requirements

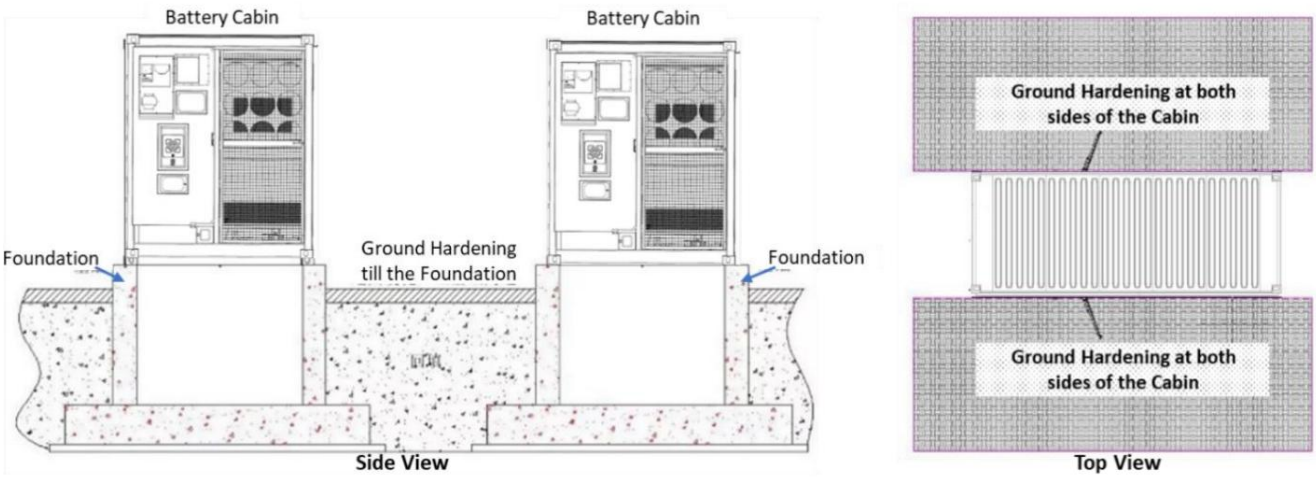


Figure 5- 2 Foundation diagram

Foundation Design Requirements:

- **Installation Surface:** The ESS must be installed on concrete or another non-combustible surface that is horizontal, secure, and flat, with sufficient load-bearing capacity. Subsidence or slopes are not permitted.
- **Load-Bearing Capacity:** The foundation must support the total weight of the equipment. If the foundation's load-bearing capacity does not meet the required standards, a review is necessary.
- **Foundation Preparation:** The bottom of the excavated foundation must be compacted and level.
- **Water Prevention:** After excavation, ensure that water does not enter the foundation. If water does enter, the affected areas must be excavated and refilled.
- **Level Tolerance:** The tolerance between the foundation and the Container's contact surface must be less than or equal to 3 mm.
- **Elevation:** The foundation must be above the highest recorded local water level and at least 300 mm above ground level.
- **Drainage Facilities:** Construct drainage systems according to local geological conditions and municipal requirements to prevent water accumulation at the equipment foundation. The foundation must be capable of handling the maximum historical rainfall. All drained water must be disposed of in compliance with local laws and regulations.
- **Cable Inlets and Trenches:** Reserve trenches or cable inlets for the ESS during foundation construction. Ensure that reserved holes on the foundation and cable inlets at the bottom of the equipment are sealed.
- **Foundation Diagram:** The provided foundation diagram is for reference only and should not be used as the final construction drawing. The design specifications of the ESS foundation must be reviewed and adjusted according to the installation environment, geological characteristics, and seismic requirements of the project site.

5.4.4Hoisting operation

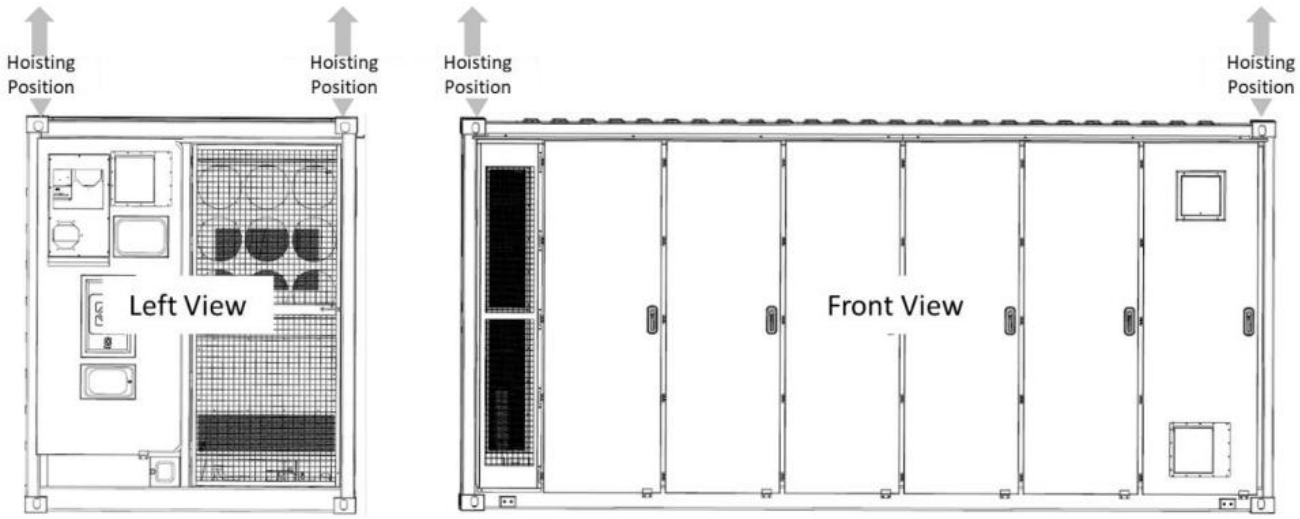


Figure 5- 3 Hoisting diagram (left and front view)

Hoisting Prerequisites:

- **Pre-Installation Inspection:** Before installing the equipment, thoroughly inspect the ESS for any signs of damage, such as holes or cracks, and verify that the equipment model is correct. If any abnormalities are found or the model is incorrect, contact the dealer immediately.
- **Hoisting Equipment Verification:** Ensure that the crane and hoisting ropes meet the required load-bearing specifications. Use steel hoisting ropes as needed, and select an appropriate crane based on the crane company's standards, with onsite assessment by professionals.

- **ESS Preparation:** Confirm that all doors of the ESS are securely closed before hoisting. It is advisable to conduct hoisting operations outdoors during clear, wind-free weather conditions.
- **Handling During Installation:** When installing or removing the hoisting equipment, avoid dragging it on the ESS to prevent scratches.

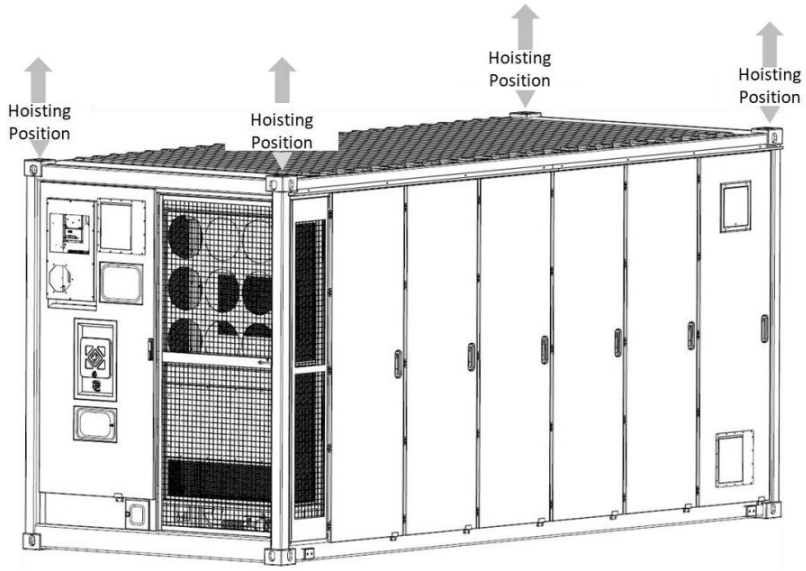


Figure 5- 4 Hoisting diagram (stereo view)

Detailed operation instructions can be found below:

Table 5-3 Detailed operation instructions

Stage	Precautions
Before hoisting	Crane hoisting capacity ≥ 40 t, working radius ≥ 10 m (These are suggested information for reference only). If the onsite environment does not meet the required working conditions, ask a professional to assess the conditions.
	Only trained and qualified personnel are allowed to perform hoisting operations.
	Check that hoisting tools are complete and in good condition.
	Ensure that the hoisting tools are secured to a load-bearing object or wall.
	When the equipment is used outdoors, it is recommended that you hoist the equipment when the weather is good and there is no wind.
	Ensure that the crane and steel ropes meet the requirements before the hoisting.
	All doors of the equipment are closed and locked.
	Ensure that the steel hoisting ropes are securely connected.
During hoisting	Do not allow any unauthorized person to enter the hoisting areas and do not stand under the crane arm.
	Ensure that the crane is properly located and avoid long- distance hoisting.
	Keep the Cabinet stable and horizontal during hoisting, and ensure that the diagonal gradient of the Cabinet is less than or equal to 5 degrees.

	Ensure that the angle between two ropes is less than or equal to 90 degrees.
	Hoist and land the Cabinet slowly to prevent shock to equipment inside it.
	Remove the ropes after ensuring that the Cabinet is placed evenly on the Cabinet base.
	Do not drag steel ropes or hoisting appliances. Do not collide with the equipment.
	Secure the Cabinet you have hoisted before hoisting another Cabinet.
	Do not allow any unauthorized person to enter the hoisting areas and do not stand under the crane arm.
	Secure the Cabinet you have hoisted before hoisting another Cabinet.

5.4.5Forklift operation

Figure 5- 5 Forklift schematic diagram

- **Avoid Moving After Installation:**
  - Do not move the ESS once the battery packs are installed.
- **Forklift Requirements:**
  - Ensure the forklift has a load-bearing capacity of at least 2 tons.
  - It is recommended that the tynes are at least 1.2 meters in length, with a width between 80 mm and 160 mm, and a thickness between 25 mm and 70 mm.
- **Lifting Height Guidelines:**
  - For foundations 0.3 meters or lower, the forklift lifting height should be at least 2 meters.
  - If the foundation is higher than 0.3 meters, the lifting height should be adjusted accordingly.

5.4.6Layout guidance

Note:

✧ The figure below illustrates the minimum clearance requirements for installation and O&M. Additionally, the equipment clearances must comply with the site selection criteria outlined in Section 5.1.1 (Site Selection Requirements).

Layout requirements:

- When protective walls (hollow ventilation) or fences are set up around the battery container, the distance between the heat dissipation surface and the outer wall should not be less than 2m, the distance between the non-heat dissipation surface on the short side and the wall should not be less than 0.5m, the distance between the side with a door on the long side and the outer wall

should not be less than 4m, and the distance between the side without a door on the long side and the outer wall should not be less than 0.5m, as shown in FIGURE 5-6.

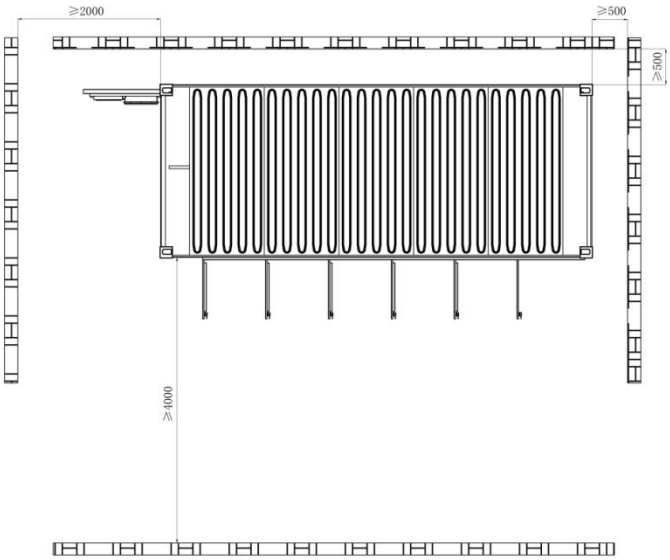


Figure5-6 Schematic diagram of distance requirements between battery container and wall (hollow)

- When a protective wall (solid) is installed around the battery container, the distance between the heat dissipation surface and the outer wall should not be less than 4m, the distance between the non-heat dissipation surface on the short side and the wall should not be less than 0.5m, the distance between the side with a door on the long side and the outer wall should not be less than 4m, and the distance between the side without a door on the long side and the outer wall should not be less than 0.5m, as shown in FIGURE 5-7.

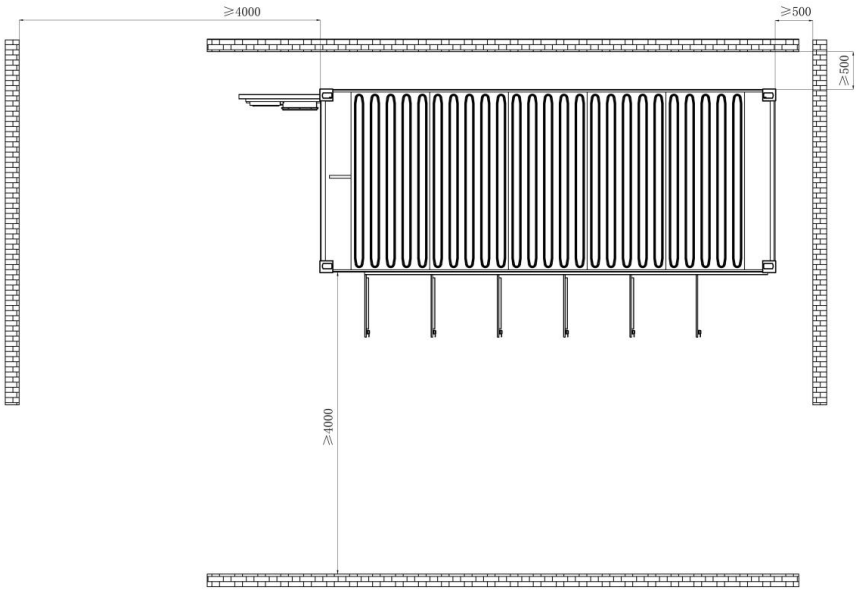


Figure 5-7 Schematic diagram of distance requirements between battery container and wall (solid)

- Distance requirements between battery containers (conventional scheme): The distance between long sides should not be less than 4m, and the distance between short sides should not be less than 4m, as shown in FIGURE 5-8.

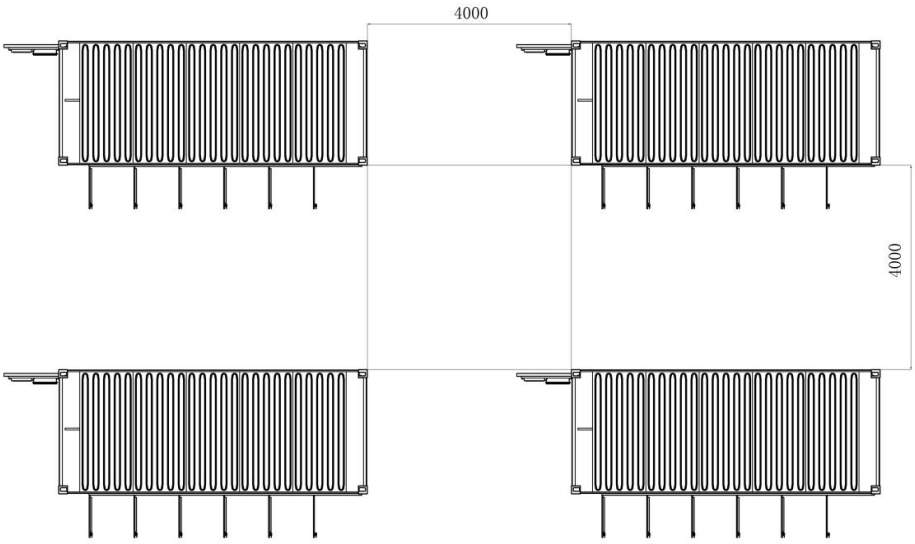


Figure 5-8 Schematic diagram of distance requirements between battery containers (conventional scheme)

- The distance requirements between battery containers (back-to-back plan for A or B containers): the distance between long sides should not be less than 4m, and the distance between short sides (not less than 4m for heat dissipation surfaces and not less than 100mm for non-heat dissipation surfaces), as shown in FIGURE 5-9.

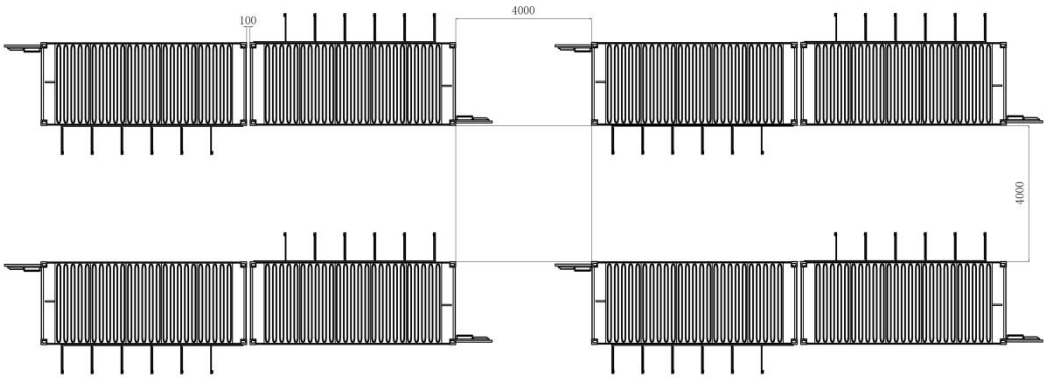


Figure 5-9 Schematic diagram of distance requirements between battery containers (back-to-back plan for A or B container)

- The distance requirements between battery containers (AB container back-to-back plan): the distance between the long sides should not be less than 4m, and the distance between the short sides (the heat dissipation surface should not be less than 4m, and the non-heat dissipation surface should not be less than 100mm), as shown in FIGURE 5-10.

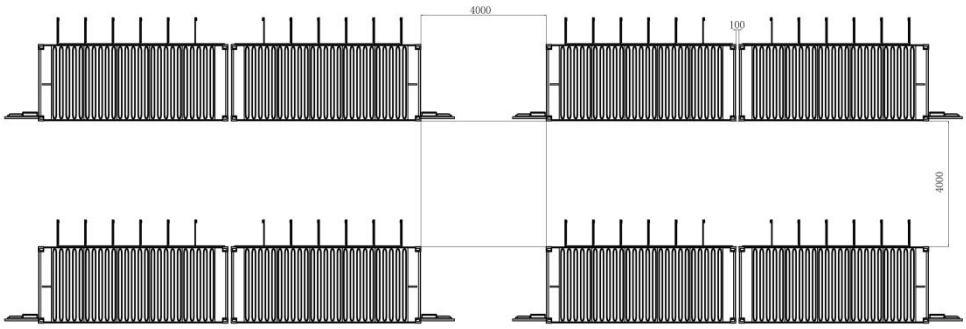


Figure 5-10 Schematic diagram of distance requirements between battery containers (AB container back-to-back plan)

- The distance requirements between battery containers (AB containers side by side, back-to-back plan): the distance between the long sides (not less than 4m on the side with doors and not less

than 100mm on the side without doors), and the distance between the short sides (not less than 4m on the heat dissipation surface and not less than 100mm on the non-heat dissipation surface), as shown in FIGURE 5-11.

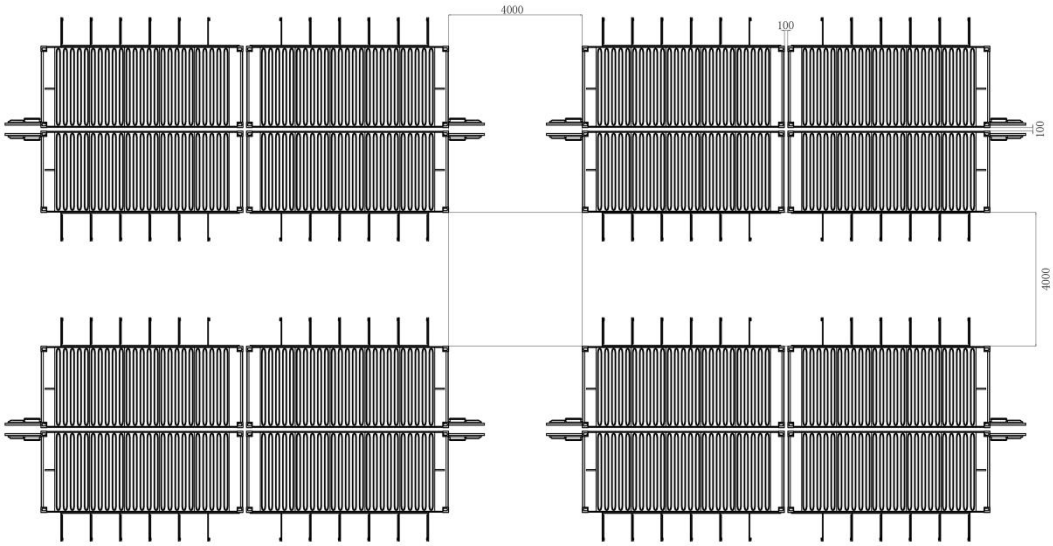


Figure 5-11 Schematic diagram of distance requirements between battery containers (AB container side by side, back-to-back plan)

5.4.7Bottom fixation of the battery container

The bottom of the battery container is secured to the foundation through welding. After the welding is complete, the welded areas are treated with anti-corrosion measures to ensure durability.

The foundation and mounting diagrams below are for your reference.

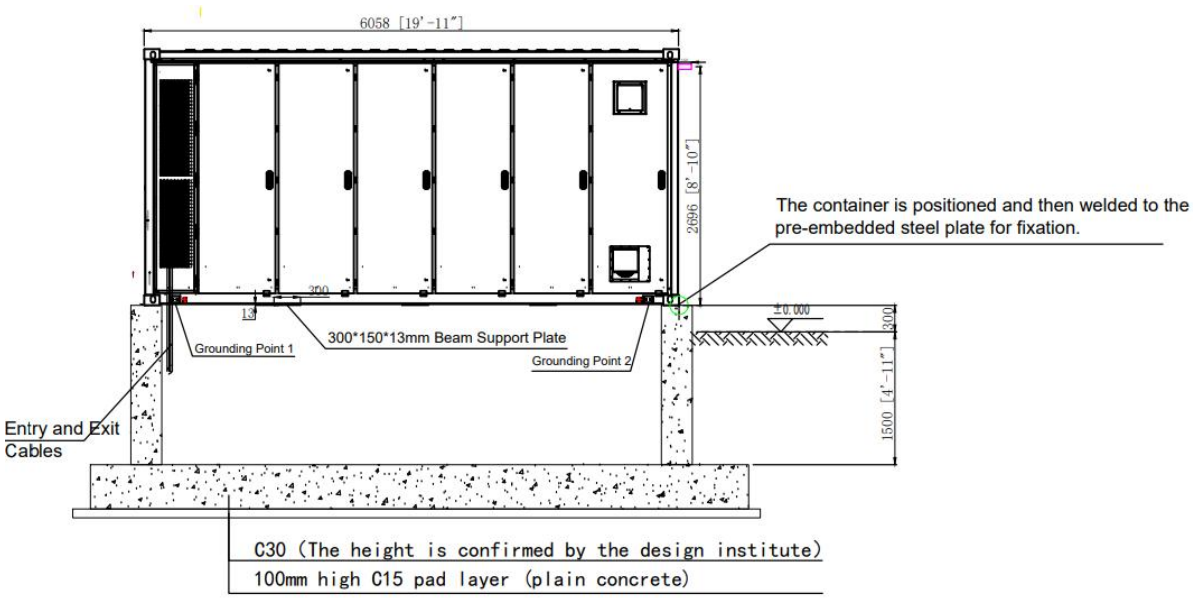


Figure 5-12 Foundation&mounting front view

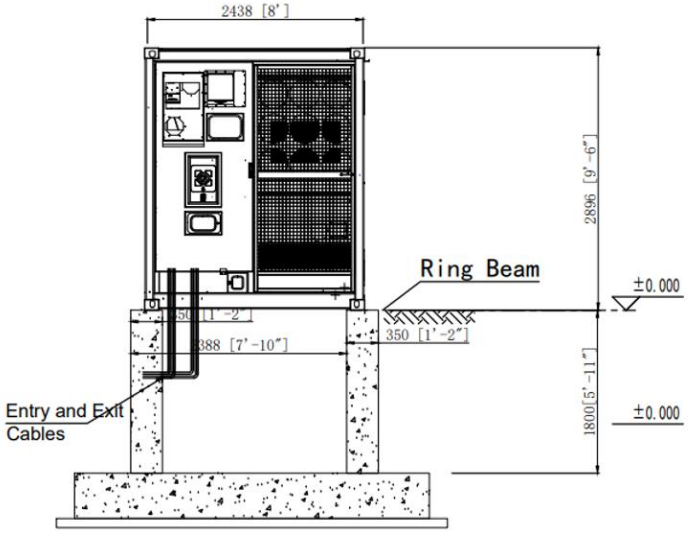


Figure 5-13 Foundation&mounting left view

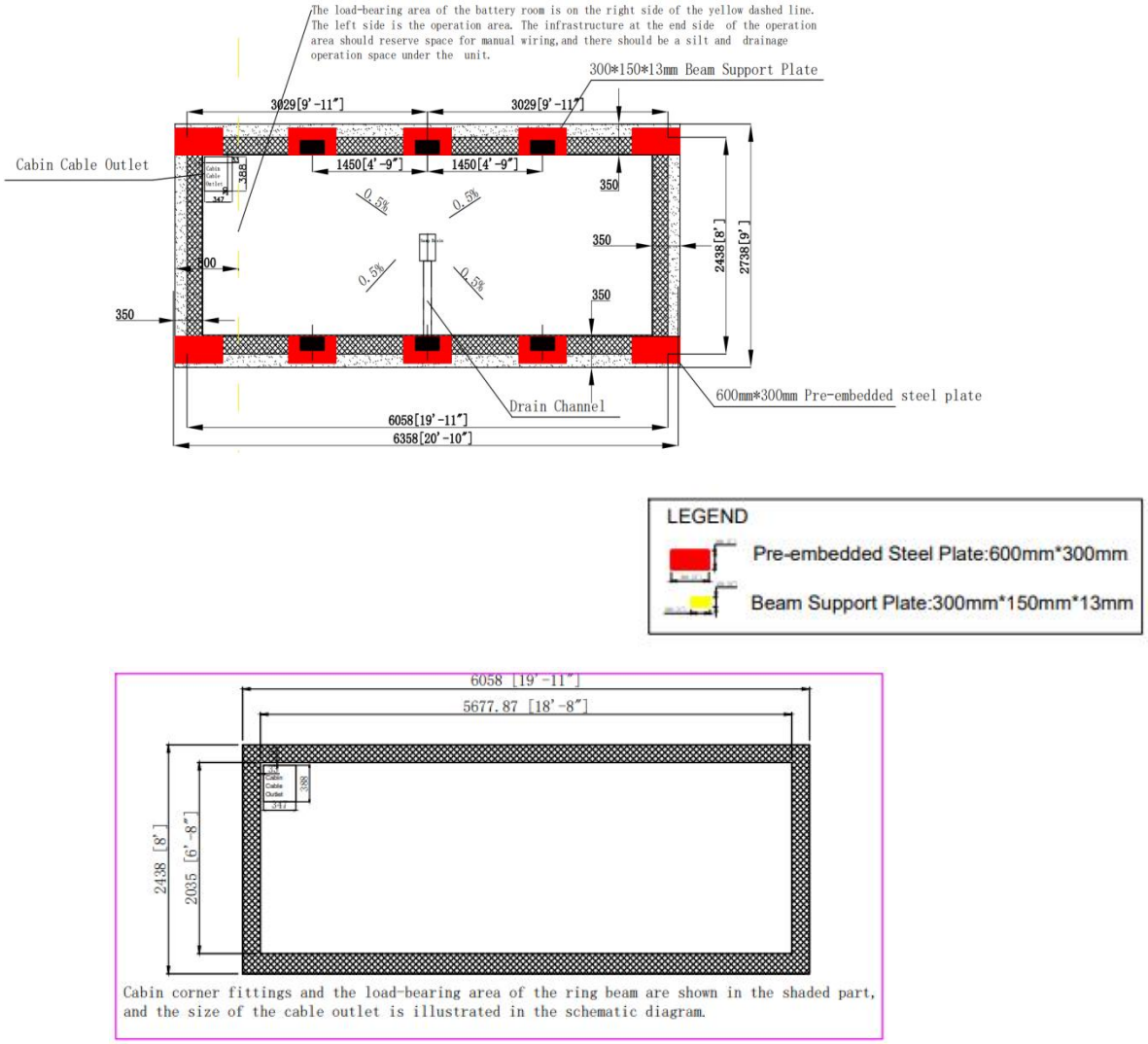


Figure 5-14 Foundation&mounting bottom view

NOTICE

- The megawatt-level BESS container is installed on a concrete foundation.
- The foundation is elevated approximately 300mm above the ground, with its thickness determined by the civil engineer.
- The upper surface of the container foundation must be level, with a height deviation of no more than 5mm.
- Steel plates are pre-embedded at the four corners of the concrete foundation, ensuring they are secure and reliable.
- After positioning the container on the foundation piers, the container base is welded to the embedded steel plates and treated with anti-rust protection.
- The middle section of the container should be supported by steel plates, with at least three support points evenly distributed on each side to prevent deformation from localized sinking.
- Grounding flat steel should be reserved in the foundation, and the container's grounding system must be securely installed with at least two connection points.
- Both ends of all embedded pipes should be temporarily sealed to prevent debris from entering and to facilitate later cable installation.
- The foundation diagram provided is a proposed design; the final design should be confirmed by a professional design institute.
- The total weight of the battery system container is approximately 43 tons.

5.4.8Grounding of the battery container

Grounding Instructions:

- The battery container is equipped with four reserved grounding copper bars, which are connected to the grounding points welded onto the channel beam (or U-bar) of the container using M10 bolts.
- The customer is required to connect at least two grounding points. It is recommended to use hand arc welding if feasible.
- The schematic diagram below shows the on-site grounding of the battery container:

Figure 5-15 On-site grounding of the battery container

5.4.9Installation of the rain eaves

The rain eaves are shipped together with the container.

Step 1:

Unpack the package and remove the rain eaves. Each system cabin comes with 2 sets of rain eaves, and each set consists of symmetrical parts.

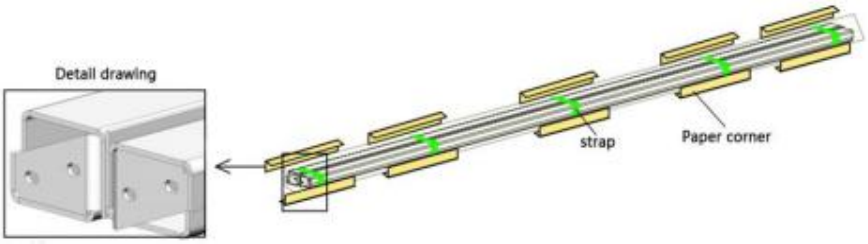


Figure 5-16 Rain eave parts

Step 2:

Connect the left and right symmetrical parts to form a complete eave using M5×16 combination bolts and M5 nuts.

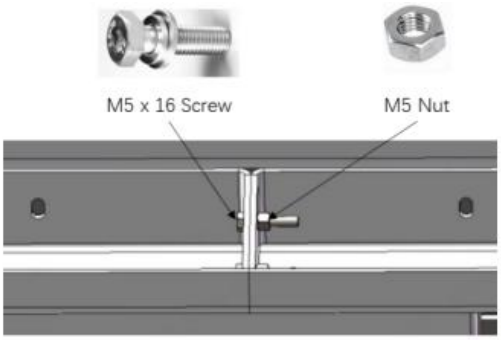


Figure 5-17 Assembly of M5 x 16 screw and M5 nut for fastening

Step 3:

Align the holes on the rain eaves with the corresponding holes on the container and secure them using M6×16 combination bolts.

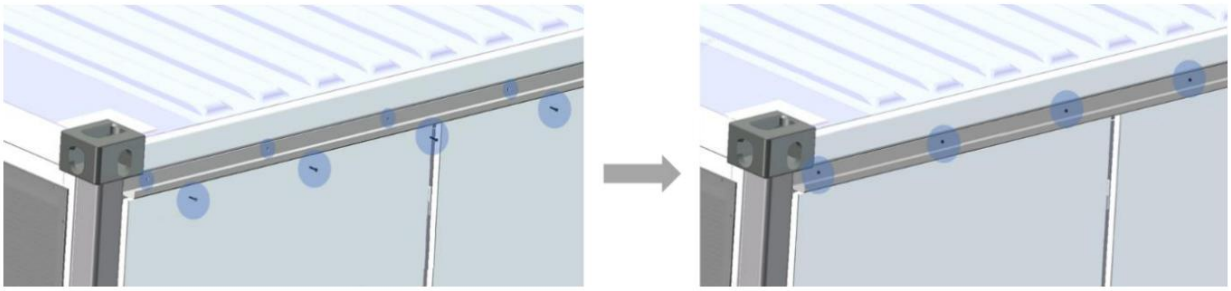


Figure 5-18 Aligning the rain eaves with the container holes

Step 4:

Once installation is complete, seal the joints evenly to prevent rainwater from seeping through the gaps. Repeat the process on the other side of the container to install the second set of rain eaves.

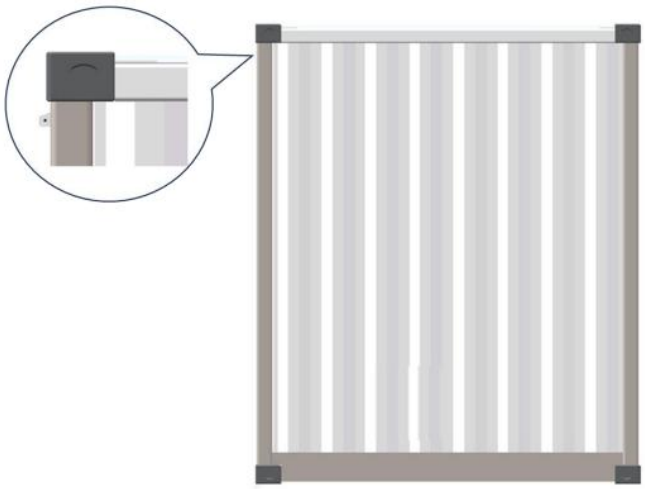


Figure 5-19 Sealing the joints evenly

6Battery connection

6.1Precautions

The safety instructions in this manual must be strictly adhered to at all times.

To prevent potential injuries, property damage, and to maximize the product's lifespan, it is crucial to carefully read and follow the safety instructions.

Improper use or operation may pose risks including:

- Threatening the life and safety of the operator or others.
- Damaging the battery energy storage system or other property belonging to the operator or third parties.

Note:

- The safety precautions in this manual do not cover all necessary specifications, and all procedures should be adapted to the actual on-site conditions.
- Gotion will not be responsible for any losses incurred due to non-compliance with the safety precautions outlined in this manual.

WARNING

- When installing equipment with hazardous voltages, be sure to follow the relevant codes and local installation safety guidelines.
- Please follow the rules regarding the proper use of tools and personal protective equipment.
- All connections must be made under clear guidance, and any form of speculation and fuzzy attempts is strictly prohibited.
- Use tools equipped with an insulating protective layer.
- The connecting cable shall meet the requirements of voltage and current.
- Each connected connector must be safe and reliable to ensure that there will be no loose or false contact problems. The joints or connectors must be corrosion-resistant, wear-resistant, and shock-resistant.
- All kinds of connections must meet the requirements of relevant national standards, and all forms of arc discharge must be strictly complied with and followed.
- The connection between the internal batteries must have an anti-vibration pad and anti-loosening device, and the connection of temperature, voltage and current detectors must also be safe and reliable to prevent loosening, aging and extrusion.
- It is strictly forbidden to expose any metal to any induction line.
- Any form of short circuit during connection is strictly prohibited.
- It is strictly forbidden for operators to operate without wearing protective devices.
- Connect key points: Make sure the connection is correct, reliable (not loose), in good contact, and free of short circuits.
- Once the connection is complete, it must be measured and confirmed point by point.
- All connection points must be made in such a way that they do not come into contact with the outer box or other components, or short circuit.
- If there is any other uncertain point, it should be confirmed by consulting Gotion technical personnel before implementation.

6.2Connecting the cable

6.2.1Tools preparation

Here are the tools you might need:

Table 6-1 Tool description

Safety helmet	Insulation gloves	Insulation shoes
Reflective vest	Insulated safety tools	High-voltage cables
Communication cables	Goggles	Protective gloves

6.2.2Connection steps

Step 1: Checking the DC Circuit Breaker and Switch Status

Before connecting the cables, put on insulated clothing. Then follow these steps:

- Have a professional open the door of the integrated control panel.
- Verify that the following switches and circuit breakers are set to the "OFF" position (locations are indicated in FIGURE 6-1):
  - QS1, isolation switch
  - QF1, miniature circuit breaker (MCB) for main power
  - QF2 to QF13
- Check if the isolation switch of the high voltage box is disconnected. If not, turn it off before proceeding. Ensure all switches are in the "OFF" position before wiring. Disconnect the relay inside the high voltage box.

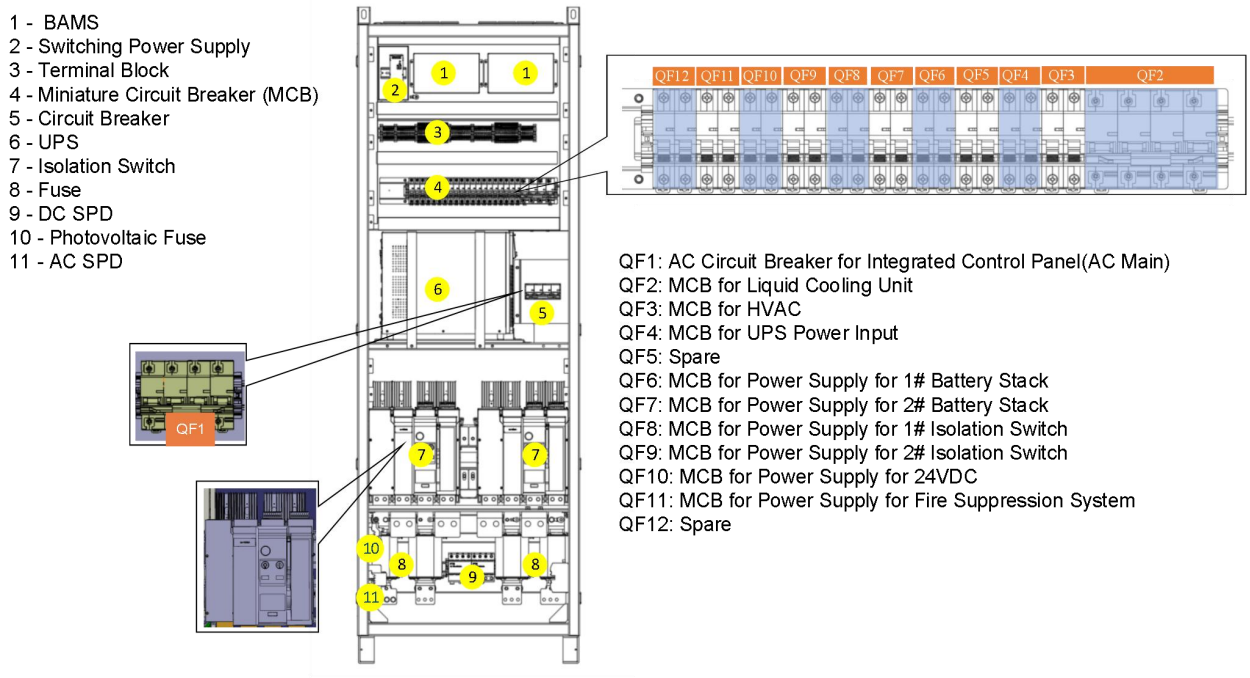


Figure 6- 1 Location of the DC circuit breaker and AC circuit breakers

Step 2: Connecting the High-Voltage cable

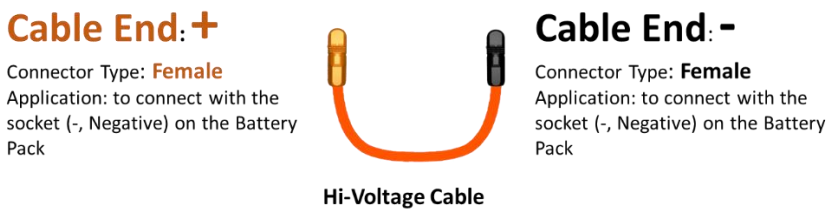


Figure 6- 2 High-voltage cable diagram

- Inspect the cable to ensure it is in good condition and the label is intact.
- If the cable and label are satisfactory, proceed with connecting the power sockets of adjacent battery packs:
  - Align the orange end of the cable with the orange socket of an adjacent battery pack and insert it to the lock position until a "click" sound is heard.
  - Similarly, align the black end of the cable with the black socket of another adjacent battery pack and insert it to the lock position until a "click" sound is heard.
- Repeat steps to connect the high voltage side of the battery rack.

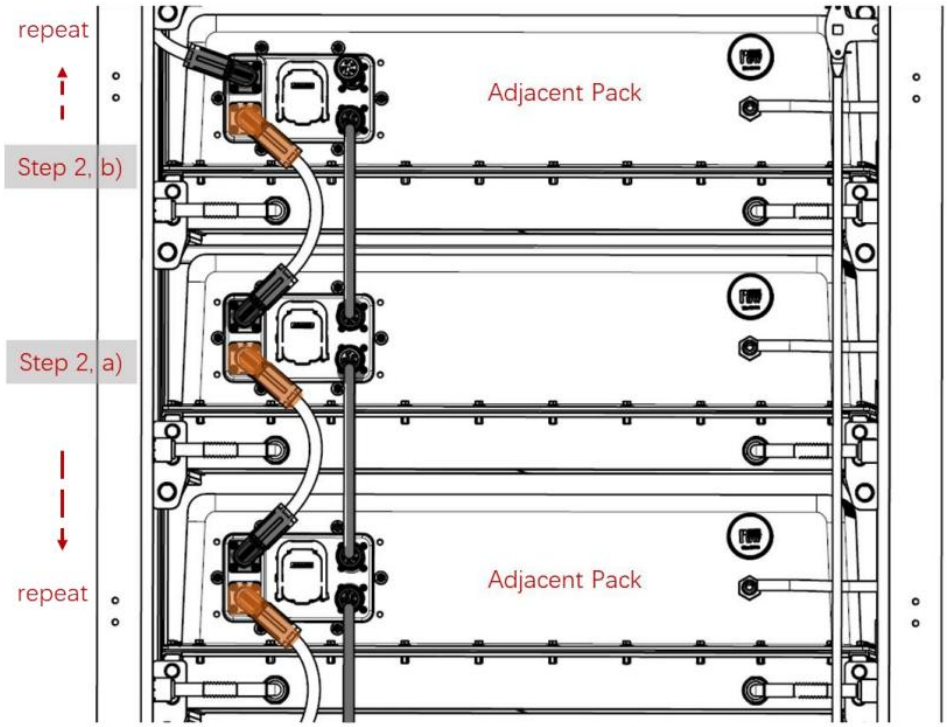


Figure 6- 3 Battery packs diagram for Step 2

Step 3: Connecting the battery communication cable

Before connecting the communication cable:

- Check whether the cable is in good condition and whether the label is complete.

Figure 6- 4 Communication cable diagram

- Use the communication series cable to manually connect the battery packs within the rack in series.
  - Connect one end of the communication cable to communication port 2 of an adjacent battery pack and insert it to the lock position; you will hear a "click" sound, then turn the connector clockwise until it stops.
  - Connect the other end to the communication 1 socket of another adjacent battery pack, following the same procedure as in step a.
- Repeat steps a and b to ensure all communication terminals of the battery rack are connected.

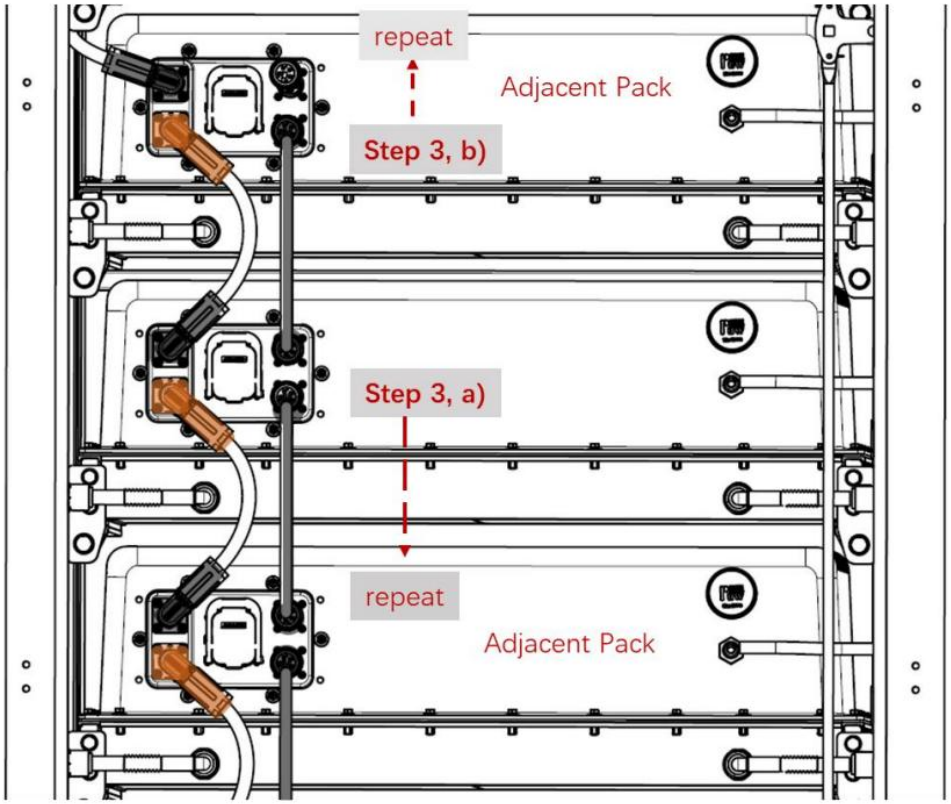


Figure 6- 5 Battery packs diagram for Step 3

Figure 6- 6 Adjacent battery packs after connecting the high-voltage cables and communication cables

7Electrical cable connection

The battery container features a foolproof design. The cables included with the product are labeled with text indicating the function of each port, and the interfaces of electrical components are clearly marked.

7.1ESS container electrical wiring overview

The schematic diagram of the energy storage battery container wiring is illustrated in the figure below:

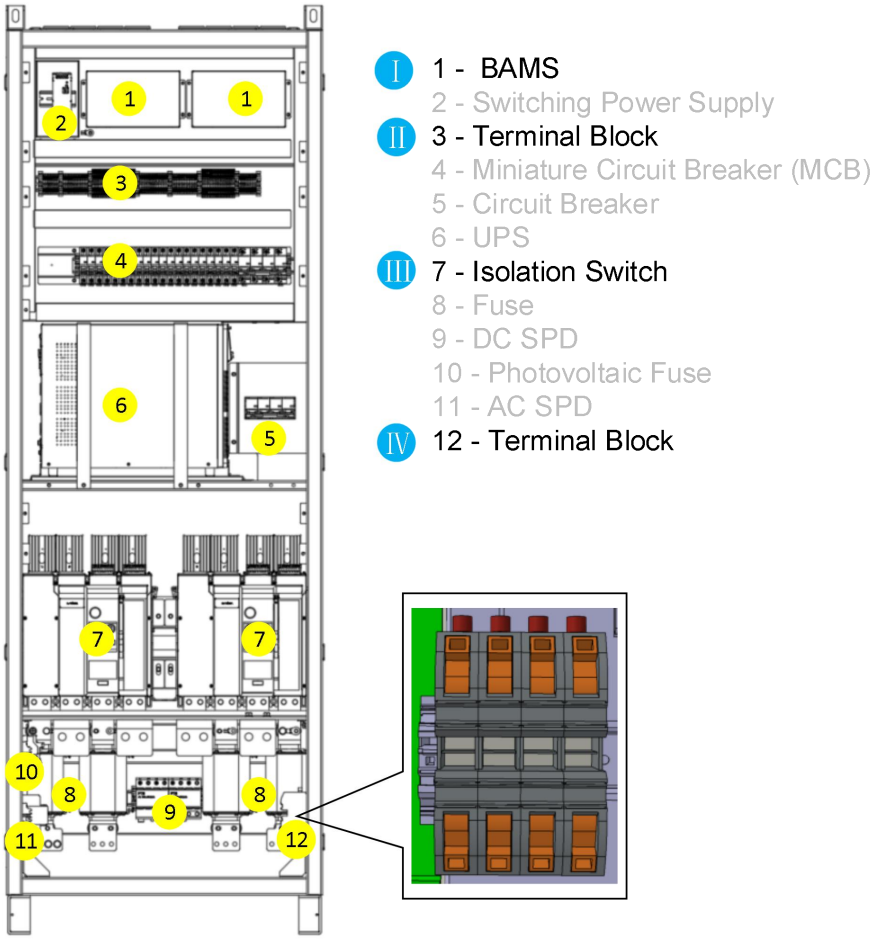


Figure 7- 1 Wiring schematic diagram of the battery container

Descriptions of the ports are provided in the table below.

Table 7-1 Descriptions of the ports

Item	Description	Recommended model
I	Network port	CAT5e shielded network cable
II	Communication port	Shielded twisted pair 2×1.0mm²
III	DC output	Port ZR-YJY23-DC1500V-1×185 mm
IV	External auxiliary power input port	ZR-RVV-4×25 mm²

7.2Preparation before electrical cable connection

7.2.1Tools preparation

Here are the tools you might need:

Table 7-2 Tool description

Safety helmet	Insulation gloves	Insulation shoes
Reflective vest	Insulated safety tools	Multimeter

7.2.2Open the container door and panel door

Step 1: Open the door of the battery container

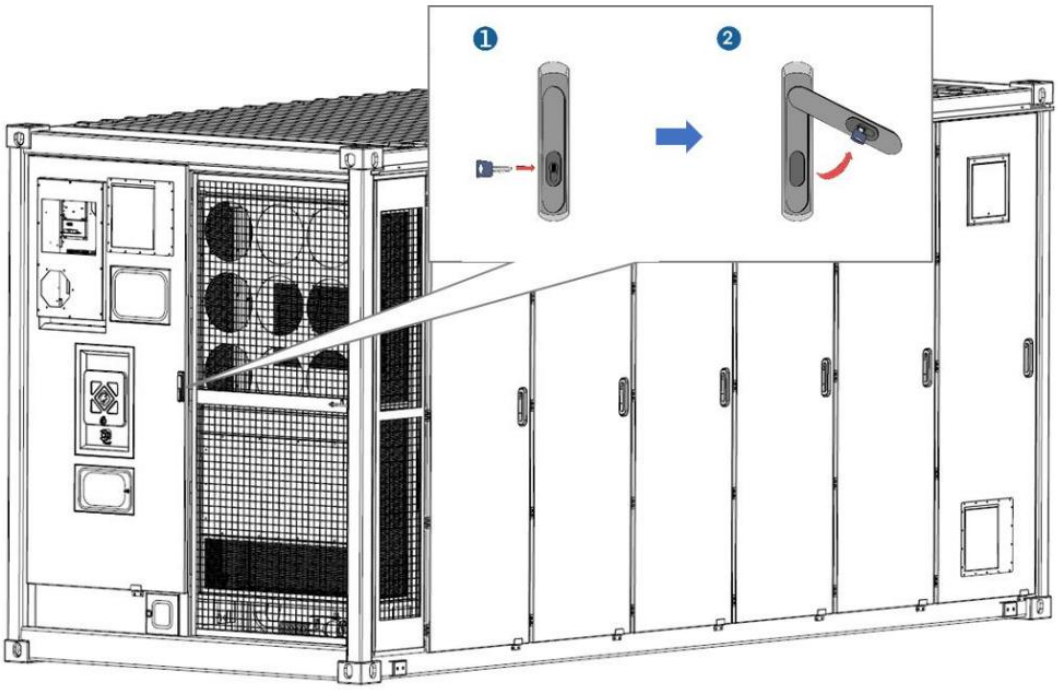


Figure 7-2 Schematic diagram of opening the battery container door

Step 2: Remove the protective covers on the integrated control panel.

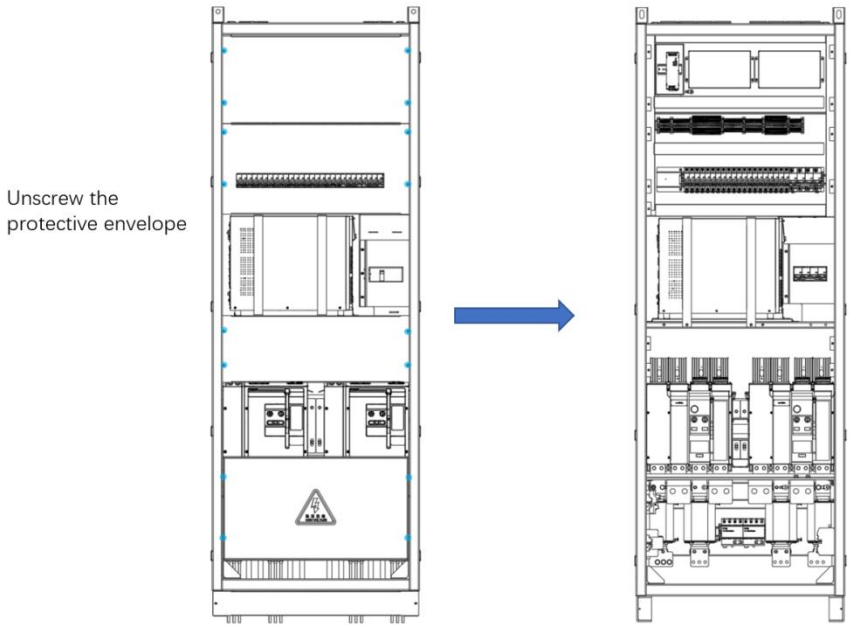


Figure 7- 3 Protective cover on the integrated control panel

Note:

✧ The images above are for reference only, please refer to the actual product for accuracy.

7.2.3Cable requirements

The cable selection requirements are as follows:

- The selected cables must have sufficient current-carrying capacity. The current-carrying capacity of the conductor depends on various factors, such as environmental conditions, type of conductor insulation material, laying method, conductor material, and cross-sectional area.
- Select cable diameter based on maximum current carrying capacity and optimize cable length.
- All DC input cables must be of uniform size and material.
- Ensure consistency in specifications and materials of three-phase AC output cables.
- Choose flame-retardant cables to enhance safety.

Note:

✧ The cables used must comply with local laws and regulations. The cable colors shown in the illustrations of this manual are for reference only; please select cables according to local standards.

7.3DC cable wiring

The internal wiring of the battery container is pre-installed in the factory. Users only need to connect the external wiring.

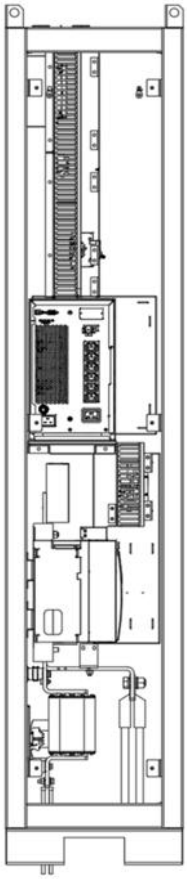


Figure 7- 4 Copper cable terminals

Wiring descriptions are as follows:

Table 7-3 Wiring description

No.	Description	Qty	Recommended model
1	DC+ DC wiring	8	1×185mm² copper conductor power cables
2	DC- DC wiring	8	1×185mm² copper conductor power cables
3	Connector	/	DT185

DC cable wiring steps:

Step 1:

Ensure the output switches of both the parent and subordinate circuits in the integrated control panel are in the OFF position.

Step 2:

Strip the insulation layer from the cable end. The stripped length should be approximately 0.2in/5mm longer than the depth of the crimping hole in the copper lug, as shown in the figure below.

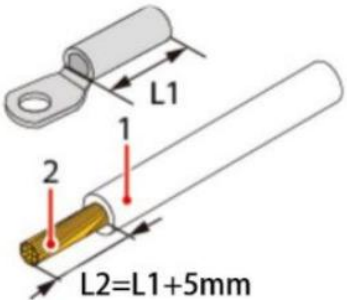


Figure 7- 5 Stripped insulation layer length diagram

Step 3:

Crimp the copper lug:

1. Choose the appropriate copper lug based on the cable size.
2. Insert the exposed copper core into the crimping hole of the copper lug.
3. Use a crimping tool to securely crimp the copper lug. Perform at least two crimpings for a secure connection.

Step 4:

Install the heat shrink tubing:

1. Select a heat shrink sleeve that closely matches the cable size, ensuring it extends about 2cm beyond the copper lug.
2. Place the heat shrink sleeve over the copper lug, completely covering the crimping hole.
3. Use a heat gun to shrink the sleeve for a tight fit.

Step 5:

Wiring:

1. Use an M16 bolt that matches the copper lug size.
2. Secure the copper lug onto the DC busbar, following the sequence shown in FIGURE 7- 5.

7.4External power supply and communication interface

The integrated control panel includes communication ports and external auxiliary power supply ports. The locations of these ports are illustrated in the figure below. During installation, ensure wiring is done according to the terminal labels.

Descriptions of the wiring are provided in the table below, refer to the position in FIGURE 7-4.

Table 7-4 Description of the wiring

Item	Location	Description	Qty	Recommended model
I	BMS	External network port	1	CAT5e shielded network cable
II	Terminal block	External communication line (Backbone Node, RS485, CAN)	2	Shielded twisted pair 2×1.0mm²
III	Terminal block (mounted on lower right panel wall)	External power supply (3-phase 4-lines, 400VAC/50Hz)	4	4×25mm²

7.5Operation after electrical cable connection

After all electrical connections have been completed, the wiring should be thoroughly and carefully inspected.

At the same time, the following procedure shall be carried out:

- Check that all the air inlets and outlets are free of foreign objects or blockages.
- The outlet holes and the surrounding gaps of the battery container are tightly sealed and plugged with fireproof and waterproof materials.
- Close the cabinet door, lock it, pull out the key, and keep it safe.

WARNING

- Failure to seal properly can lead to moisture ingress.
- Failure to seal properly can lead to rodent entry.

NOTICE

Make sure the sealing strip around the door does not curl when the door is closed.

8Power-on and power-off procedure

8.1Power-on

WARNING

The battery container may only be operated after approval by a qualified professional and authorization from the local power authority.

WARNING

If the battery container has been inactive for an extended period, a thorough and detailed inspection must be conducted prior to powering on, ensuring that all parameters meet the necessary requirements.

8.1.1Inspection before power-on

Before powering on, carefully verify the following items to ensure everything is correct:

- Inspect the battery container for foreign objects (e.g., small animals, tools).
- Ensure all switches and circuit breakers in the integrated control panel are set to OFF.
- Confirm that the isolation switch on the high-voltage box front panel is in the OFF position.
- Verify that the air conditioning system is properly connected and its switch is OFF.
- Check that the positive and negative terminals of the DC power cable in the integrated control panel are connected correctly.
- Inspect the connecting cables within the battery container for any signs of damage or insulation deterioration.
- Ensure that the communication and power supply cable terminals inside the battery container are secure and not loose.
- Check for any unusual or irritating odors inside the battery container.
- Confirm that both the PCS AC and DC side switches are in the OFF position.
- Clean the installation area, ensuring it is free of debris, flammable, or explosive materials.

8.1.2Overview of power-on procedures

The reference table below provides a summary of the power-on procedures.

Table 8-1 Summary of the power-on procedures

Step	Item		Serial number	Remarks
1	Power-on the AC auxiliary power	Turn on the 380V AC power supply.	1	in FIGURE 8-1
2		Turn on the power supply of the liquid cooling unit.	2	in FIGURE 8-1
3		Turn on the power supply of the HVAC.	3	in FIGURE 8-1
4		Turn on the power supply	4	in FIGURE 8-1

		of the UPS.		
5		Turn on the UPS.	5	in FIGURE 8-1
6		Turn on the power supply of the 1# battery stack.	6	in FIGURE 8-1
7		Turn on the power supply of the 2# battery stack.	7	in FIGURE 8-1
8		Turn on the power supply of the 1# isolation switch inside the integrated control panel.	8	in FIGURE 8-1
9		Turn on the power supply of the 2# isolation switch inside the integrated control panel.	9	in FIGURE 8-1
10		Turn on the power supply of the 24VDC.	10	in FIGURE 8-1
11		Turn on the power supply of fire suppression system.	11	in FIGURE 8-1
12		Check that each module works properly.	12	in FIGURE 8-1
13	Power-on the DC power	Close the isolation switch of the high voltage box , as shown in FIGURE 8-2.	13	in FIGURE 8-1
14		Use the BMS to close the relay of the high voltage box relay, as shown in FIGURE 8-3.	14	in FIGURE 8-1 and FIGURE 8-3
15		Use the BMS to close the isolation switch inside the integrated control panel by clicking the “M Iso Switch-Close” button on the LCD Display, as shown in FIGURE 8-3.	15	in FIGURE 8-1 and FIGURE 8-3

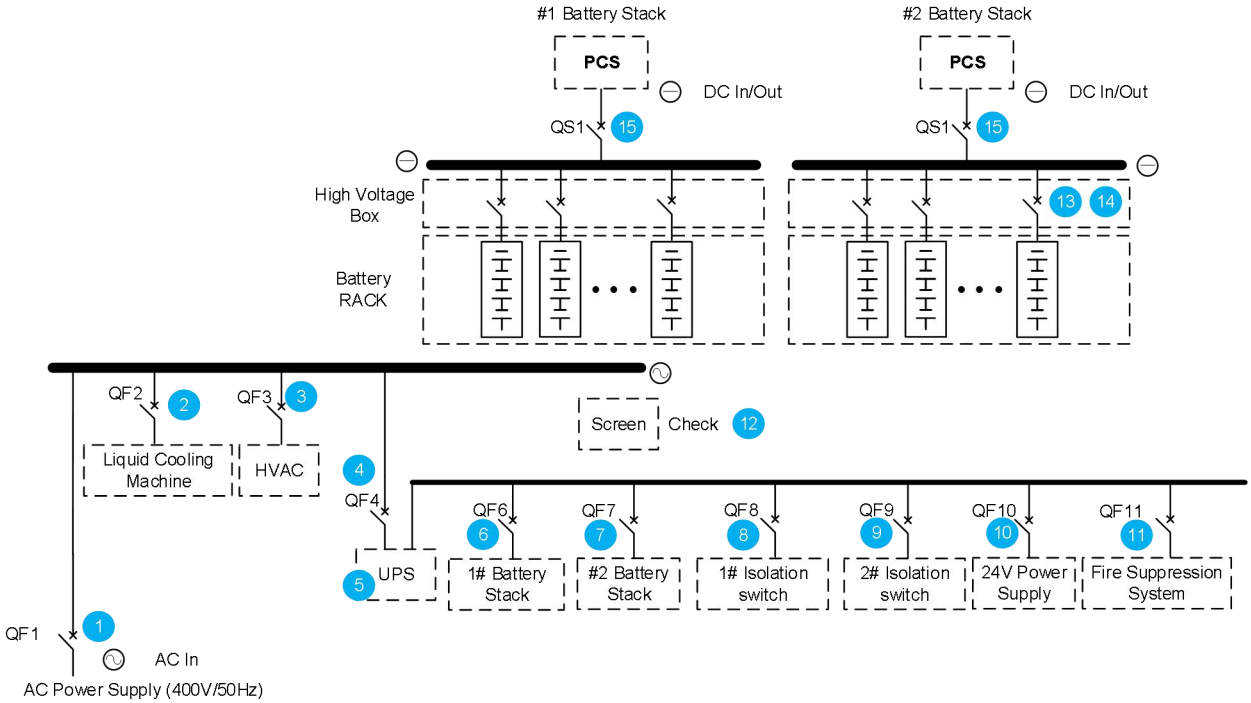


Figure 8- 1 Circuit diagram of power-on procedure

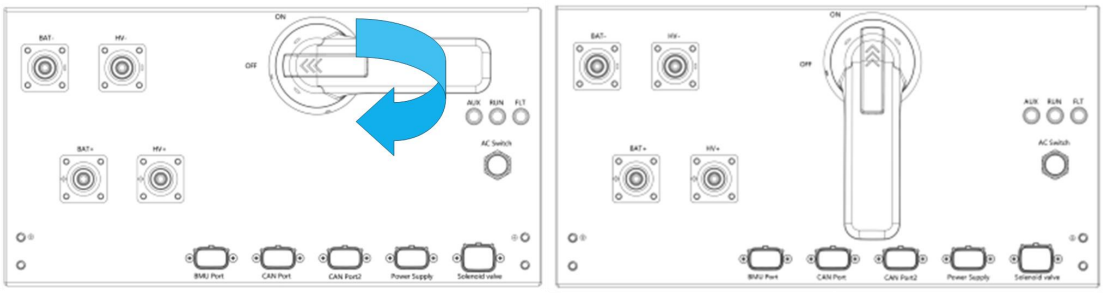


Figure 8- 2 Manually switch on high-voltage box

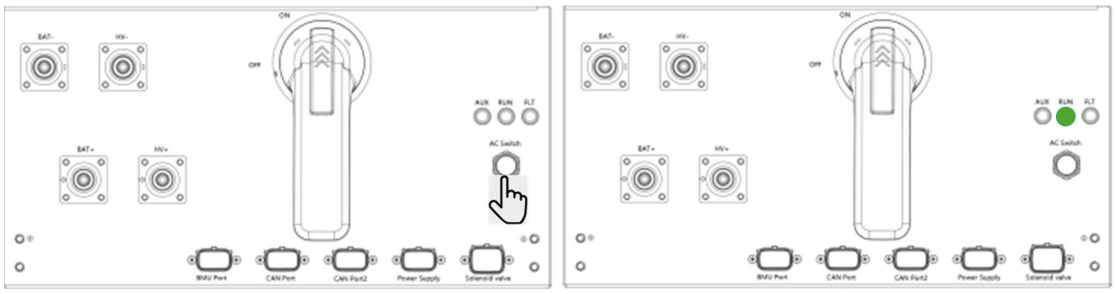


Figure 8- 3 Turn on AC switch on high-voltage box

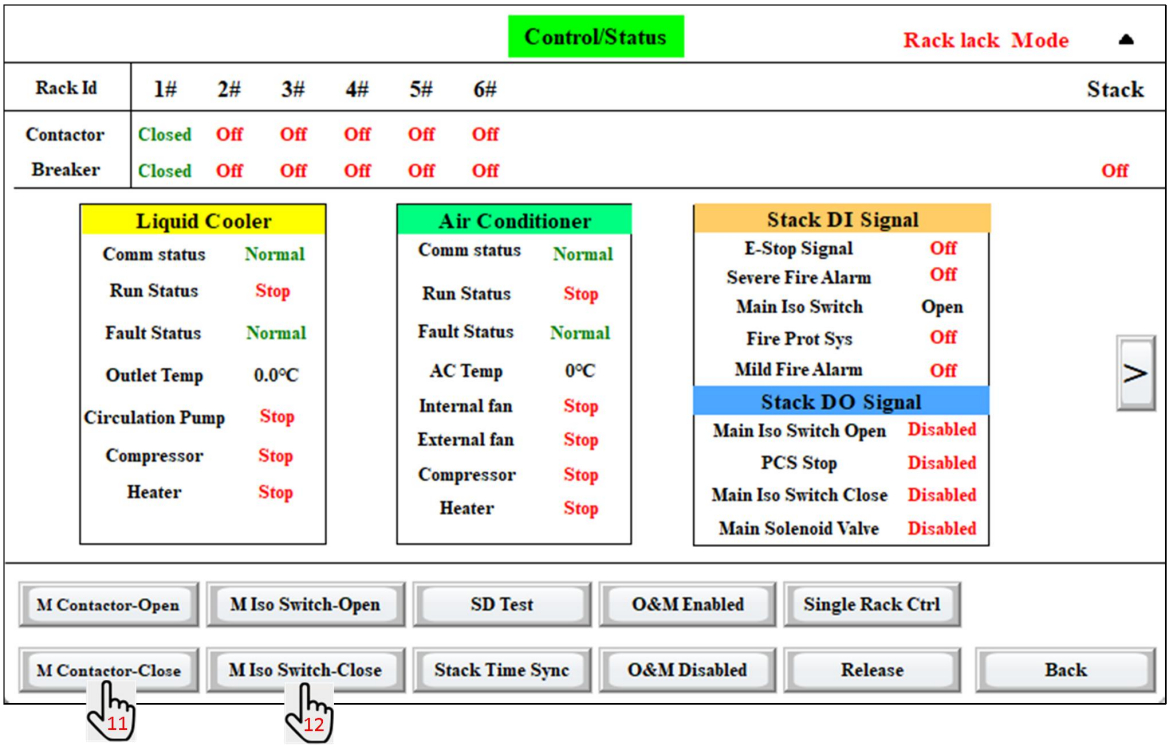


Figure 8- 4 Use the BMS to turn on the high-voltage box

8.1.3Detailed power-on steps

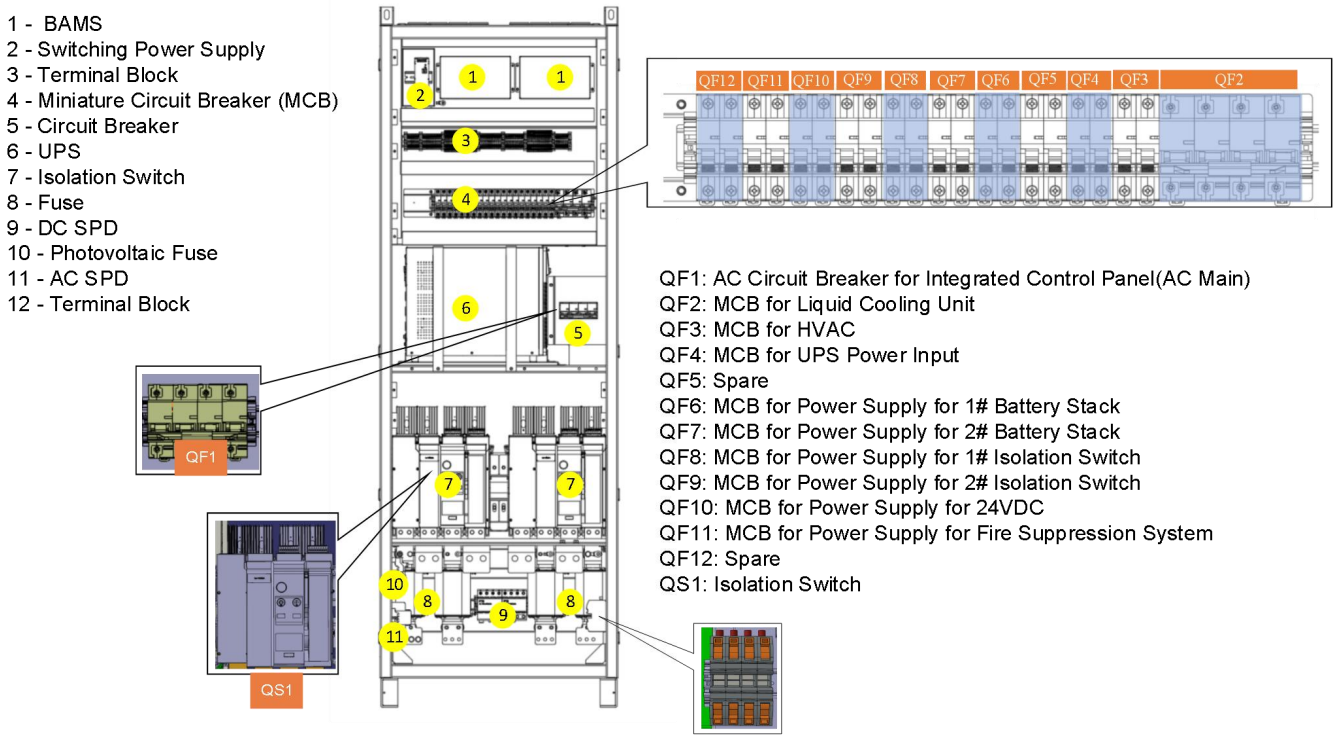


Figure 8- 5 Location of the DC circuit breaker and AC circuit breakers from

Step 1:

Turn on the external auxiliary power supply switch (QF1), followed by turning ON the miniature circuit breakers (MCBs) for the liquid cooling unit, air conditioning system, and UPS power:

- Turn on the power supply switch (QF2) for the liquid cooling unit.
- Turn on the power supply switch (QF3) for the air conditioner.
- Turn on the power supply switch (QF4) for the UPS.
- Turn on the UPS power.
- Turn on power supply switch (QF6) for battery stack #1.
- Turn on power supply switch (QF7) for battery stack #2.
- Turn on power supply switch (QF8) for 1# isolation switch.
- Turn on power supply switch (QF9) for 2# isolation switch.
- Turn on power supply switch (QF10) for the 24VDC .
- Turn on power supply switch (QF11) for the fire suppression system.

Step 2:

Once Step 1 is complete, turn on the display screen on the integrated control panel. Check the LCD display to confirm that the liquid cooling unit, air conditioner, fire suppression system, and other modules are operating normally.

Step 3:

- Ensure all modules are functioning correctly.
- Manually close the isolation switch for each high-voltage box cluster (hold the handle of the high-voltage box, rotate it 90 degrees clockwise from OFF to ON, as shown in FIGURE 8-2).
- Turn ON the 220VAC power supply switch for each high-voltage box cluster (locate the AC switch button on the high-voltage box and press it, as shown in FIGURE 8-3).
- Return to the display panel and press the main relay closure button on the screen to complete the relay closure for each high-voltage box cluster.
- Observe the indicator lights on the high-voltage box:
  - **AUX:** Power indicator (green light indicates normal power supply).
  - **RUN:** Running indicator (green light indicates the total output relay in the high-voltage box is ON; light is OFF when the box is disconnected).
  - **FLT:** Fault indicator (red light indicates system faults, such as hardware failures, internal communication issues, or battery failures).

Step 4:

Close the isolation switch (QS1) inside the integrated control panel by pressing the button on the display screen.

Step 5:

- After the battery rack is powered on, manually issue relay closure commands to the Level 2 BMS through HMI or remotely issue relay closure commands through EMS, engaging the second-level BMS and activating the main positive and negative relays, successfully powering on the DC bus of the 6-rack battery system.
- The Level 3 BMS monitoring display will turn GREEN (as shown in FIGURE 8-6 Level 3 BMS monitoring display below), indicating "Normal" status, completing the power-on process and allowing the system to enter charging and discharging mode.

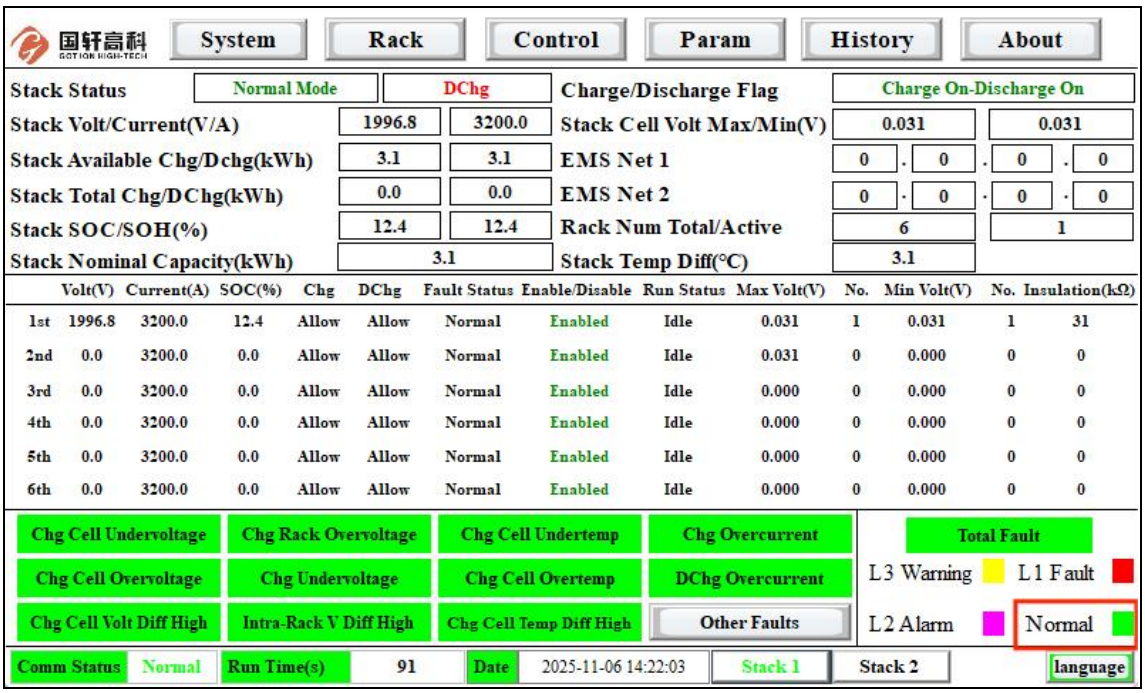


Figure 8- 6 Level 3 BMS monitoring display

WARNING

If a circuit breaker trips during the power-on process, stop closing other circuit breakers and immediately check for a short circuit in the load of the affected circuit.

8.2 Planned power-off

WARNING

Ensure that the DC main connection to the BESS on the PCS side is disconnected.

8.2.1Overview of power-off procedures

The reference table below provides a summary of the Power-Off procedures.

Table 8-2 Summary of the Power-Off procedures

Step	Item		Serial number	Remarks
1	Power-off the DC power	Disconnect the isolation switch inside the integrated control panel(via BAMS), by clicking the “M Iso Switch-Open” button on the LCD display, as shown in FIGURE 8-8.	1	in FIGURE 8-7
2		Disconnect the relay inside the high voltage box (via BAMS), by clicking the “M Contactor-Open” button on the LCD display, as shown in FIGURE 8-8	2	in FIGURE 8-7
3		Disconnect the isolation switch inside	3	in FIGURE 8-7

		the high voltage box, as shown in FIGURE 8-9 and FIGURE 8-10.		
4	Power-off the AC auxiliary power	Disconnect the the the power supply of fire suppression system.	4	in FIGURE 8-7
5		Disconnect the the the power supply of 24VDC.	5	in FIGURE 8-7
6		Disconnect the power supply of the 2# isolation switch inside the integrated control panel.	6	in FIGURE 8-7
7		Disconnect the power supply of the 1# isolation switch inside the integrated control panel.	7	in FIGURE 8-7
8		Disconnect the power supply of the 2 # battery stack.	8	in FIGURE 8-7
9		Disconnect the power supply of the 1# battery stack.	9	in FIGURE 8-7
10		Turn off the UPS.	10	in FIGURE 8-7
11		Disconnect the power supply of UPS.	11	in FIGURE 8-7
12		Disconnect the power supply of air conditioner.	12	in FIGURE 8-7
13		Disconnect the power supply of liquid cooling unit.	13	in FIGURE 8-7
14		Switch off the 380VAC power supply.	14	in FIGURE 8-7

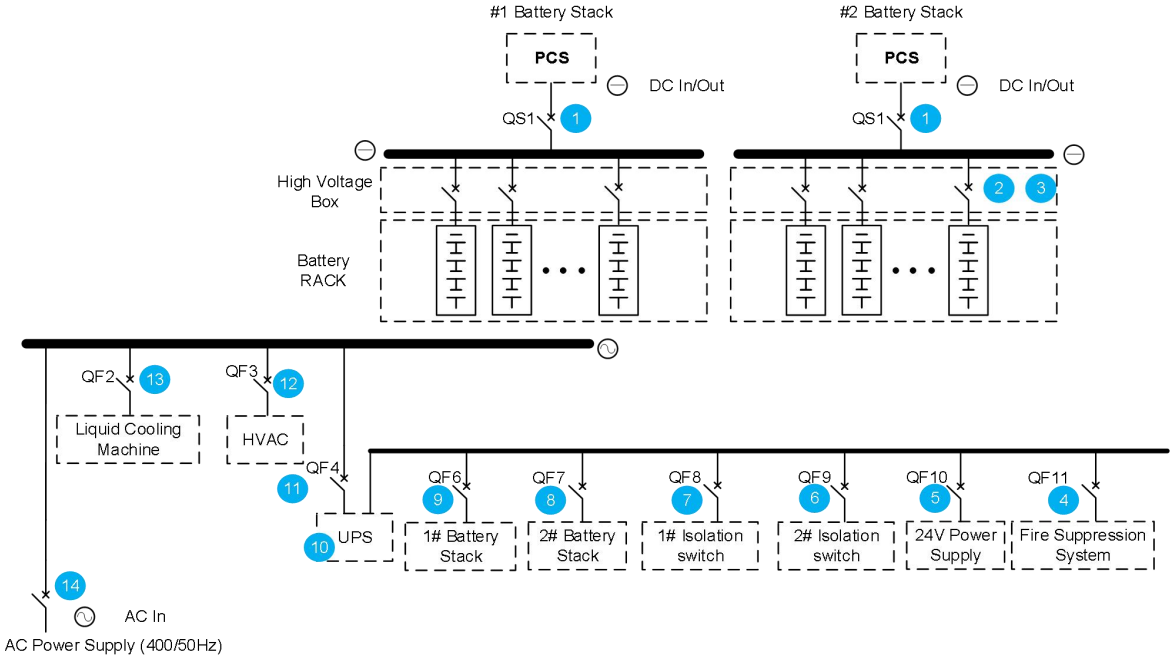


Figure 8-7 Circuit diagram of power-off procedure

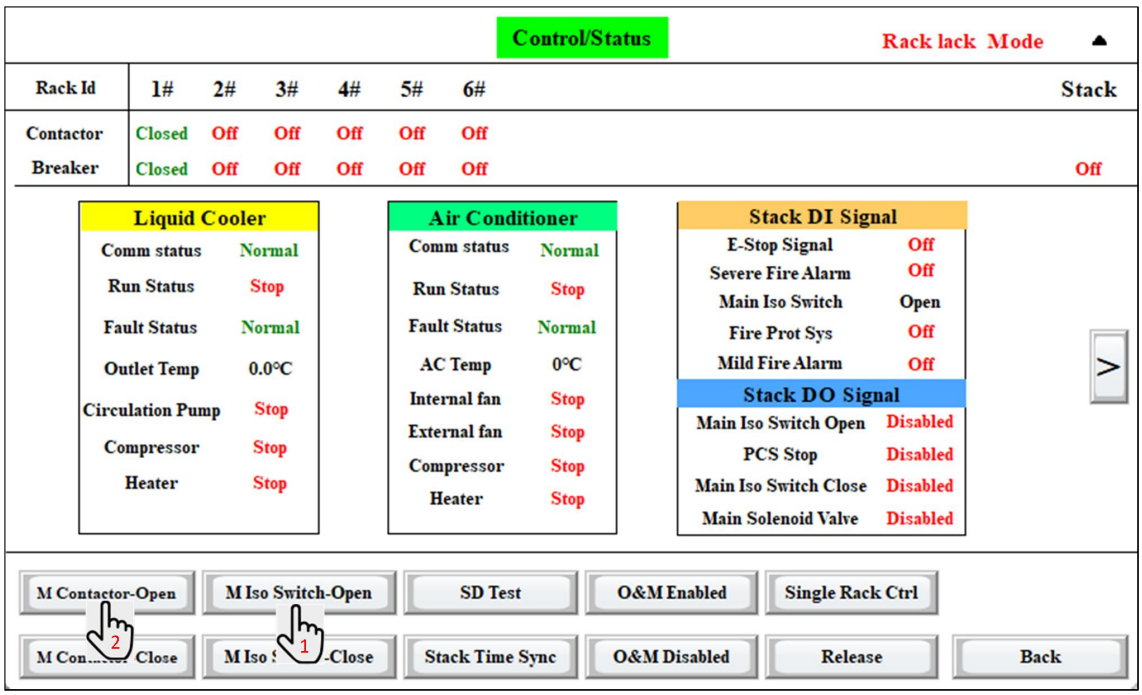


Figure 8-8 Use BMS powering off high-voltage box

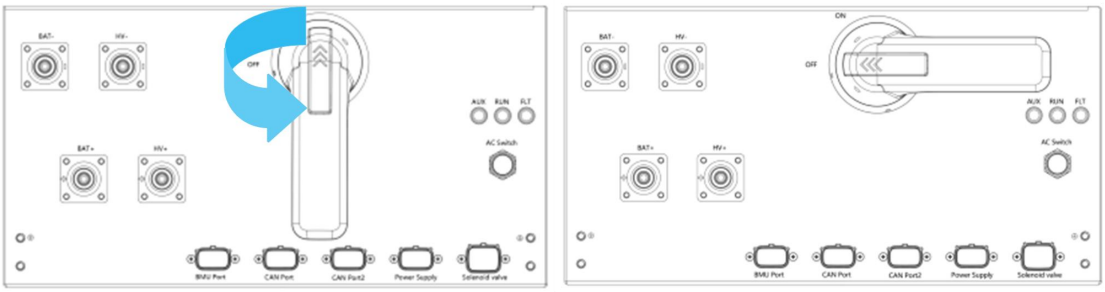


Figure 8-9 Manually switch off high-voltage box

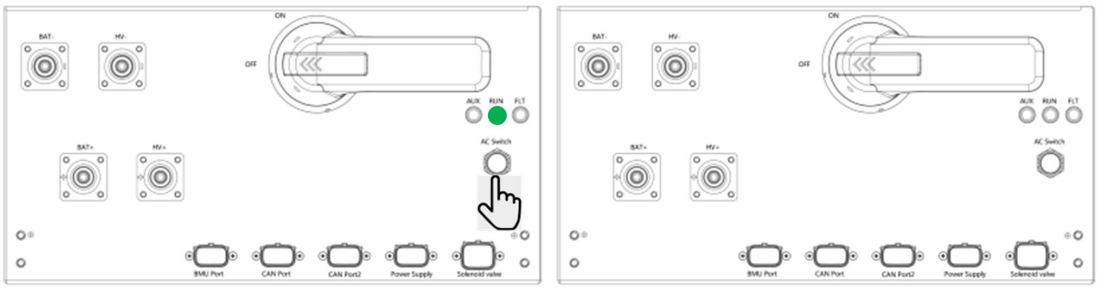


Figure 8- 10 Disconnect 220VAC power supply switch

8.2.2Detailed power-off steps

Refer to FIGURE 8-7 for the following steps.

Step 1:

Use EMS or PCS control system to shut down and disconnect the circuit breaker on the DC side of PCS.

Step 2:

Disconnect the isolation switch (QS1) inside the integrated control panel

Step 3:

- On the integrated control panel screen (as shown in FIGURE 8- 7 Use BMS powering off high-voltage box), issue the battery cluster relay disconnection command to the Level 3 BMS, so that each cluster of high-voltage boxes is disconnected (via the relays in the high-voltage box).
- Manually disconnect the isolation switch for each high-voltage box cluster by holding the handle, rotating it 90 degrees counterclockwise from ON to OFF, as shown in FIGURE 8- 8 Manually switch off high-voltage box.
- Disconnect the 220VAC power supply switch for each high-voltage box cluster (locate the AC switch button on the high-voltage box and press it, as shown in FIGURE 8- 9).

Step 4:

Switch off the air conditioning system, fire protection system, UPS, and other components:

- Turn off the power supply switch (QF11) for the fire suppression system.
- Turn off the power supply switch (QF10) for 24VDC.
- Turn off the power supply switch (QF9) for 2# isolation switch.
- Turn off the power supply switch (QF8) for 1# isolation switch.
- Turn off the power supply switch (QF7) for battery stack #2.
- Turn off the power supply switch (QF6) for battery stack #1.
- Turn off the UPS.
- Turn off the the power supply switch UPS (QF4).
- Turn off the power supply switch (QF3) for the air conditioner.
- Turn off the power supply switch (QF2) for the liquid cooling unit.

Step 5:

Switch off the AC auxiliary power supply (QF1) in the integrated control panel.

8.3Unplanned power-off (outage)

1. **Fire Accidents:**

Immediately contact your local fire department for professional assistance.

2. **Unplanned Outages (caused by failures):**

Promptly contact Gotion for support.

9Fire extinguishing system

WARNING

- Please adhere to the fire laws and regulations of the country or region where the project is located. Regularly inspect and maintain fire safety equipment to ensure all functions operate correctly.
- The battery container features an automatic fire extinguishing system. The fire extinguishing switch should not be activated unless there is an emergency.
- All fire-related components in the BESS products sold by GOTION in the IEC area, including combustible gas detectors, smoke detectors, heat detectors, input and output modules, and aerosols (if applicable), comply with IEC standards. For additional certifications or to meet other fire safety requirements specific to the project location, please contact Gotion.

9.1System description

The Battery ESS Container is equipped with a water-based firefighting system, Aerosol fire extinguishing system, an automatic fire alarm and control system, a combustible gas detection and alarm system, and a ventilation system.

This integrated fire extinguishing system efficiently detects fires using devices such as gas detectors, smoke detectors, and heat detectors.

When an abnormality is detected, a signal is sent to the station-level alarm system (Battery ESS Site Station Level) to trigger the fire alarm and control battery system operations through corresponding logic controls.

9.2Fire suppression control logic design description

Design principle

- When any detector is triggered:
  - Alarm bell activates;
  - Output the first level fire alarm signal.
- When any two types of detectors are triggered at the same time:
  - Sound and light alarm activates;
  - Output the second level fire alarm signal; turn off the air conditioning and ventilation, and cut off the power of the equipment;
  - The gas fire extinguishing controller begins to enter the 30-second delay stage;
  - After the delay, aerosol is sprayed;
  - Release feedback signal to the gas fire extinguishing controller;
  - Fire extinguishing is completed.
- When the Li-ion battery off-gas detector reaches the set alarm state:
  - Turn on the ventilation system for ventilation, the exhaust fan starts to operate, and the louve automatically open;
  - Alarm bell activates;
  - Output the first level fire alarm signal.
- When the flammable gas alarm concentration is lower than the set alarm state:
  - The exhaust fan stops operating and the louver automatically close;
  - The air inlet device louver automatically close.

- When the automatic fire extinguishing controller is in manual mode, and any detector is triggered, the alarm controller only sends out an alarm signal:
  - The alarm bell activates;
  - Outputs a first-level fire alarm signal;
  - Duty personnel confirm whether a fire has occurred;
  - Upon confirmation of a fire, press the emergency start button on the alarm control panel or the emergency start button at the entrance of the protected area;
  - The automatic fire extinguishing controller begins a 30-second delay phase;
  - After the delay, aerosol is sprayed;
  - The aerosol release signal is fed back to the gas fire extinguishing controller;
  - The extinguishing is completed.
- When the automatic fire extinguishing controller enters 30 seconds delay and personnel are not evacuated in time:
  - Press and hold the emergency stop button at the entrance of the protected area;
  - Stop the countdown when the delay countdown reaches 10 seconds, and continue the delay countdown after releasing the emergency stop button;
  - If the delay countdown is less than 10s, release the emergency stop button and the delay countdown will start counting down from 10s.

The fire protection system has two operating modes: automatic control mode and manual control mode.The aerosol fire suppression system can be controlled by automatic mode and manual mode.

Below is the fire suppression system flow chart. Adjustments can be made according to the requirements of customer.

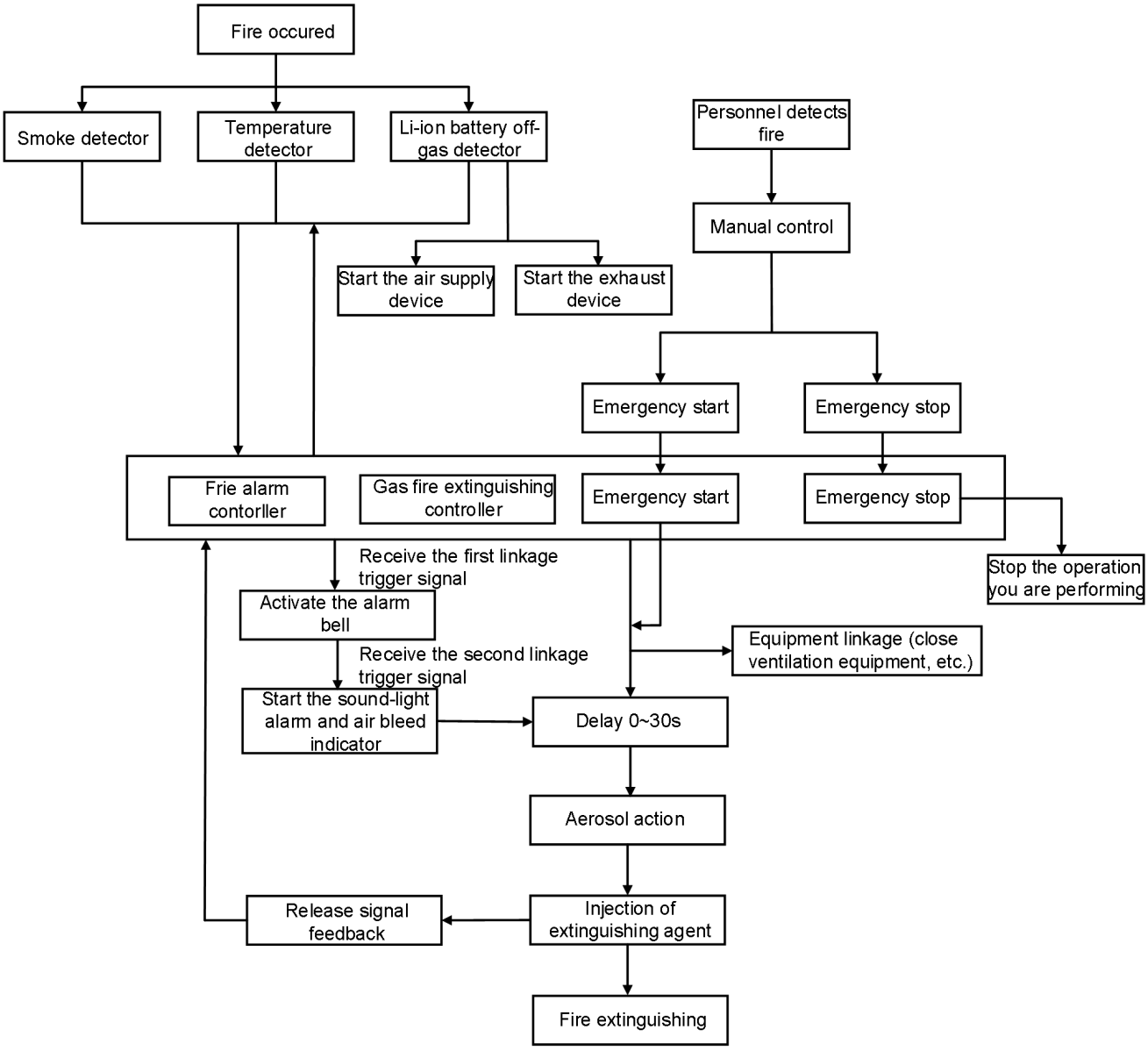


Figure 9- 1 Fire suppression system flow chart

9.3Exhaust system

Combustible gas detection equipment is installed in the battery cabinet. When the detected gas reaches 10% Lower Explosive Limit (LEL), the system sends a signal to the station-level alarm host via the fire control panel, triggering a fire warning and activating the exhaust system.

The battery container is equipped with an air intake electric louver (referred to as "inlet" in the diagram below) and an electric louver with an exhaust fan (also called the ventilation louver, referred to as "outlet" below). The container fire protection adopts the structural design of front air intake and left air outlet. The air enters from the front of the container and is sent out from the left of the container.

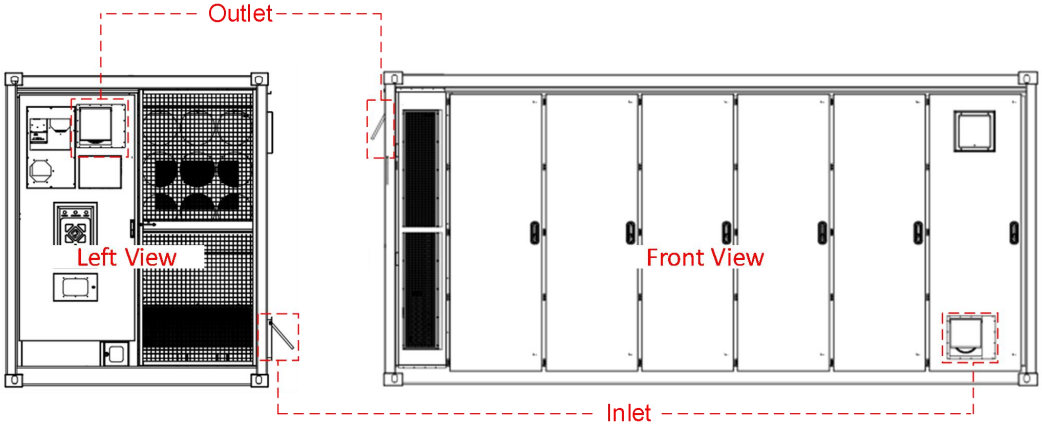


Figure 9- 2 Inlet and outlet position

Under normal conditions, the electric louvers remain closed. When the system's controller receives an alarm signal from the gas detector, it activates the ventilation and exhaust system. If the concentration of combustible gas exceeds 10% LEL, the air intake louver opens to allow fresh air in, while the ventilation louver opens and the exhaust fan engages to expel the gas from the energy storage container. Once the process is complete, the main controller automatically shuts down the exhaust system.

9.4Aerosol fire extinguishing system

The Aerosol Fire Extinguisher utilizes the GreenSol©A1000, an eco-friendly extinguisher based on SFE Powdered Aerosol technology, which is listed as Powdered Aerosol A on the USEPA Halon Alternatives SNAP list.

The A1000 is designed to combat Class A (solid fuel), Class B (liquid and gas fuel), and Class C (electrical) fires within enclosed areas. The extinguishing agent is a powdered aerosol, generated in-situ by a chemical reaction within a non-pressurized container. This reaction produces fine dry powder particles (1-5 microns) suspended in inert gases.

SFE (Powdered Aerosol A) extinguishes fires through multiple mechanisms. It combines the heat absorption properties of traditional dry powder agents with the chemical disruption abilities of Halon agents. The SFE aerosol produces active species—solid particles—that interfere with the fire by heterogeneous reactions on the particle surfaces or homogeneous reactions in the gas phase. These reactions disrupt the fire chain precursors (OH, H), preventing recombination and halting the combustion process.

Paired with the control panel, the Aerosol extinguishing system detects and extinguishes fires in their early stages.

For detailed FSS design, you can contact Gotion for more details.

9.5Water-based fire extinguishing system

The BESS is equipped with a water-based fire suppression system designed for effective fire extinguishing. This system features prefabricated sprinkler pipes and nozzles, which can be activated either automatically or manually. If an automatic sprinkler system is required, additional construction is necessary to connect external water supply pipes and equipment to the BESS sprinkler connections, based on the specific project requirements. The system uses upright nozzles to ensure full water coverage in all areas of the container.

The fire sprinkler system consists of the main pipe (DN65), the branch pipe (DN40), the water sprinkler heads, and DN65 water interface. The designed water flow rate is 5.6L/min for a single nozzle, 12 in total, and the water flow rate for the entire container is 67.2L/min.

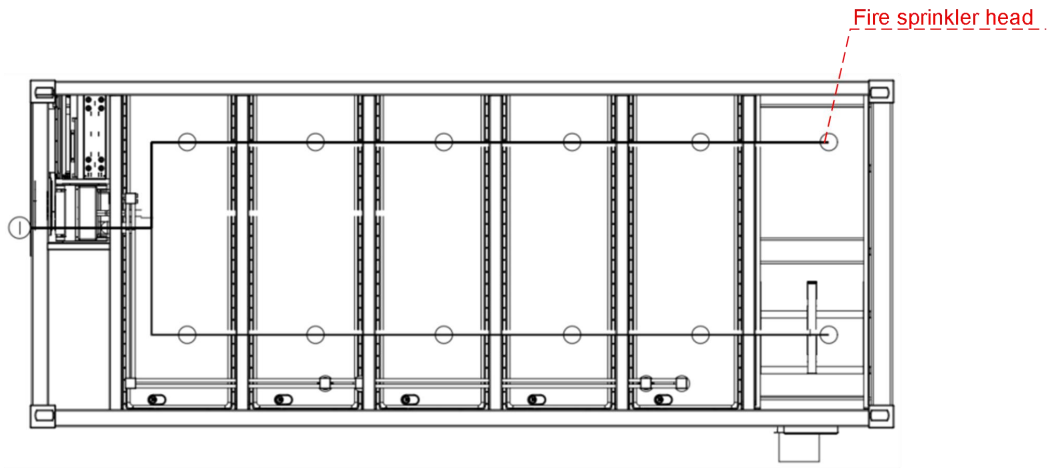


Figure 9-3 Fire water pipe layout

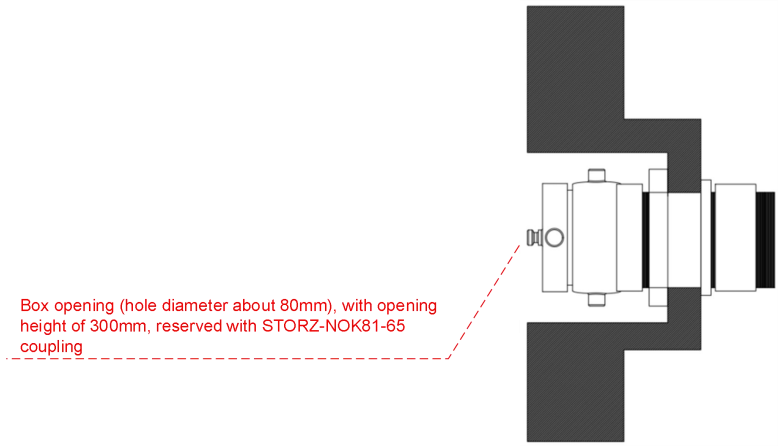


Figure 9-4 Schematic diagram of fire water coupling

10Routine maintenance

The following recommended maintenance cycle should be adjusted based on the specific installation environment of the product. Factors such as the size of the power plant, installation location, and site environment will influence the maintenance cycle. For example, if the operating environment is windy and sandy, leading to significant dust accumulation, the maintenance interval should be shortened, and the frequency of maintenance increased.

NOTICE

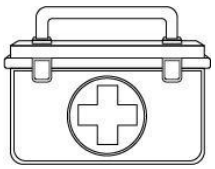
Safety requirements for maintenance and repair:

- Before connecting or disconnecting cables, turn off the protection switch for the corresponding circuit.
- Place a warning sign indicating that the switch must not be turned on at the switch location.
- Verify the appropriate voltage level by checking for any live equipment and ensure the equipment is fully powered off.
- If live parts are found nearby, block or cover them with insulating plates or insulating tape.
- Before starting maintenance or repairs, securely connect the circuit to be serviced to the main ground loop using a grounding cable.

After completing maintenance or repairs, remove the grounding cable between the serviced circuit and the main ground loop.

10.1Pre-maintenance preparation

Table 10-1 Tool description

Insulated gloves	Protective gloves	Goggles	Dust mask
Insulated shoes	Reflective vest	Safety helmet	Safety harness
 Medical kit	-	-	-

Note:

✧ This section lists only PPE. For detailed information on the tools required for replacement, refer to the specific parts replacement section.

10.2Maintenance precautions

To safely and effectively maintain the system, maintenance personnel must carefully read and adhere to the following safety guidelines:

- Must possess a valid electrician certificate and have completed professional training.
- Follow all relevant safety precautions, use appropriate tools, and wear personal protective equipment.
- Wearing metal accessories such as jewelry or watches is strictly prohibited.
- Under no circumstances should both hands touch the high-voltage positive and negative terminals of the energy storage system simultaneously.
- Disconnect all high-voltage and low-voltage switches before performing any maintenance on the battery energy storage system.
- Avoid cleaning with water, if necessary, use a vacuum cleaner for cleaning.
- When plugging or unplugging cables, follow proper procedures—do not use excessive force or perform violent operations.
- After maintenance, ensure all tools and materials are cleaned up and check for any metal objects left inside or on top of the equipment.
- If you have any questions regarding operation or maintenance, contact Gotion's customer service center. Unauthorized operation is strictly prohibited.

10.3Equipment maintenance guidelines

To ensure the safe and efficient operation of the battery energy storage system, the following comprehensive maintenance guidelines outline key procedures for regular inspection, cleaning, and system calibration.

- Regular Dust Removal: Clean the system regularly, paying special attention to the fan's air inlet and outlet. Use a vacuum cleaner if necessary to ensure proper air circulation in the container. Before dust removal, cut off the power supply, and never use water for cleaning.
- Cable Inspection: Regularly check the cable connection terminals for looseness, rust, or oxidation, ensuring good contact.
- Cable Condition: Regularly inspect cables for signs of aging, damage, or poor insulation.
- Indicator Lights: Regularly check if the indicator lights are functioning correctly and whether all system functions are normal.
- System Charging: Charge the system every 3 months to maintain a SOC of at least 30%.
- SOC Calibration: The BMS estimates SOC based on parameters like current and time, which can result in cumulative errors due to factors such as charge/discharge rates, temperature, and self-discharge. To correct these errors, the BMS supports full charge (100%) and full discharge (0%) calibration functions.
- System Inspection (Every 2 Years): Conduct a comprehensive on-site inspection of the battery system every two years to ensure normal system function and battery status.
- System Upgrade: If you notice a significant reduction in battery power supply time or frequent system failures, contact Gotion for professional diagnosis and maintenance.
- System Status and Alarm Check: Regularly check the status of the battery energy storage system

and alarm indicators to ensure proper functionality.

- Emergency Stop Button: Regularly verify the effectiveness of the battery energy storage system's emergency stop button to ensure quick system shutdown in emergencies.
- Fire Protection System: Regularly inspect the fire protection system to ensure it is in good condition and within its validity period.
- Battery Modules: Do not use different types of battery modules in series or parallel.

10.4Routine system maintenance operations

10.4.1Alarm check

Review the Event History to check for any major or minor alarms.

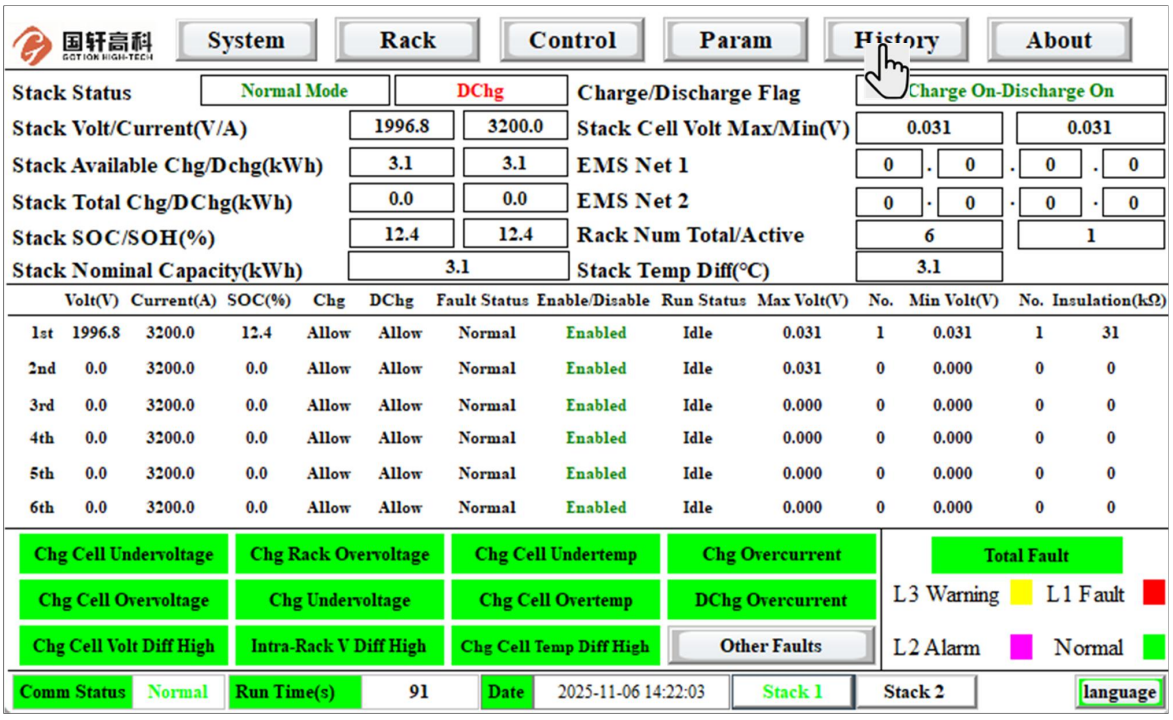
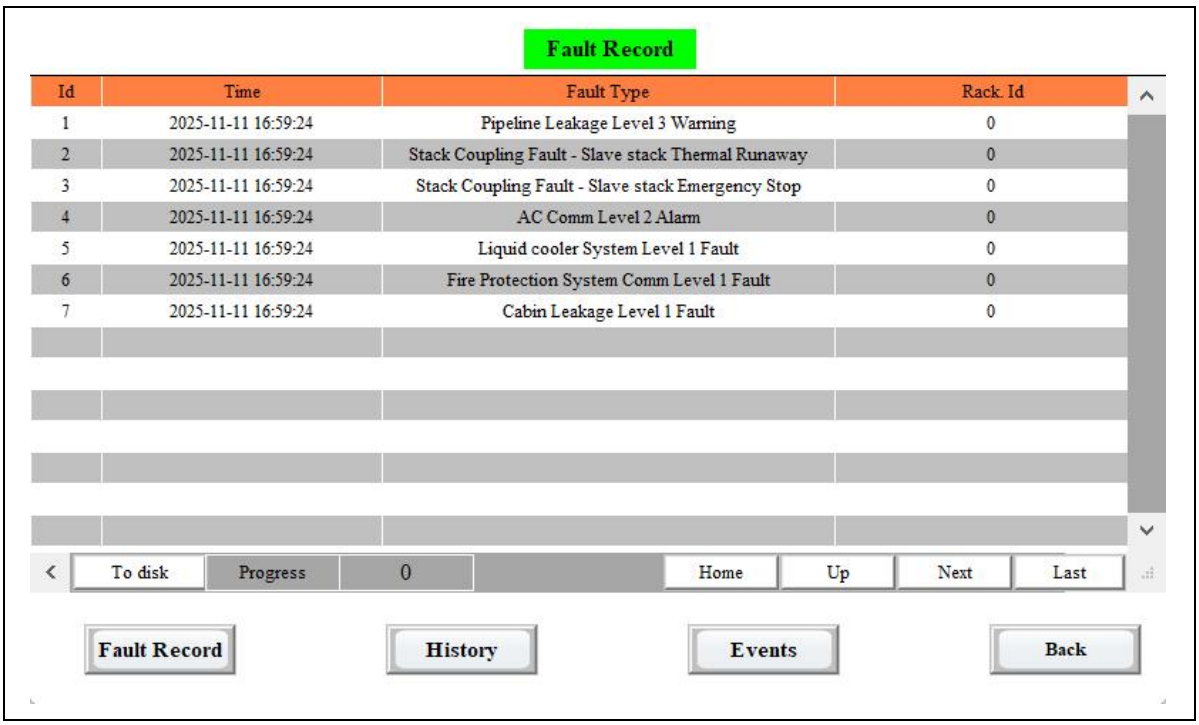


Figure 10- 1 Screenshot example of checking event history -1



Fault Record

Id	Time	Fault Type	Rack. Id
1	2025-11-11 16:59:24	Pipeline Leakage Level 3 Warning	0
2	2025-11-11 16:59:24	Stack Coupling Fault - Slave stack Thermal Runaway	0
3	2025-11-11 16:59:24	Stack Coupling Fault - Slave stack Emergency Stop	0
4	2025-11-11 16:59:24	AC Comm Level 2 Alarm	0
5	2025-11-11 16:59:24	Liquid cooler System Level 1 Fault	0
6	2025-11-11 16:59:24	Fire Protection System Comm Level 1 Fault	0
7	2025-11-11 16:59:24	Cabin Leakage Level 1 Fault	0

To disk | Progress | 0 | Home | Up | Next | Last

Fault Record | History | Events | Back

Figure 10- 2 Screenshot example of checking event history

Note:

✧ You can refer to the GRID5015 O&M Manual for more details.

10.4.2Quarterly maintenance

The table below outlines the quarterly maintenance checklist.

Table 10-2 Quarterly maintenance checklist

Maintenance category	Maintenance action	Expected result	System power off or not
Container	Conduct a visual inspection: • Appearance • Rust condition • Door locks • Vents • Temperature • Noise	• No peeling or scratched coating. • No noticeable paint peeling or rust. • Door locks are intact and undamaged. • Vents are free from dust. • No presence of insects, rodents, snakes, or other animals. • No damaged or deformed equipment inside the container. • No abnormal noise during equipment operation. • No areas of excessive temperature within the battery racks. • No oxidation or rust inside the battery racks.	No
Air conditioner[1]	• Check the appearance • Clean the filter[2]	• No obvious damage to the appearance. • No obvious paint peeling or rust. • The screws are secured. • The fans rotate properly without abnormal sound. • The filter is clean and free from blockage.	No
Integrated control panel	Check the UPS battery	The UPS battery status is normal (100% SOC)	No
Power distribution area	Check whether there are foreign objects in the power distribution area.	The area is clean and free from foreign objects.	No
Pressure relief window[3]	Conduct a visual inspection: • Appearance • Rust condition • Foreign objects, ice or snow	• No obvious paint peeling or rust. • Pressure relief windows are not damaged. • No foreign object, ice, or snow on the top.	No

Warning signs	Conduct a visual inspection: • Appearance	• No obvious paint peeling, rust, or defacement (otherwise, change if necessary).	No
Note: 1. Monthly maintenance is recommended in high-temperature environments (≥ 35°C) or low-temperature environments (≤ 0°C). 2. In sandstorm-prone areas, it is recommended to clean the filter after each sandstorm and before summer. In other areas, clean the filter as needed, ensuring the filter or condenser is not blocked. A high-pressure water gun is the suggested cleaning tool. 3. In regions with severe sandstorms or heavy ice/snow, perform maintenance as needed. Ensure there are no foreign objects, ice, or snow on the pressure relief windows. Clean these areas to prevent damage to the pressure relief devices caused by improper operation.			

10.4.3Semi-annual maintenance

The table below outlines the semi-annual maintenance checklist.

Table 10-3 Semi-annual maintenance checklis

Maintenance category	Maintenance action	Expected result	System power off or not
Air conditioner	Conduct a visual inspection: • Appearance • Rust condition • Screws • Fans • Filter	• No obvious damage to the appearance. • No obvious paint peeling or rust. • The screws are secured. • The fans rotate properly without abnormal sound. • The filter is clean and free from blockage.	No
Air conditioner external fan	Clean the air filter of the external fan[1]	The filter is clean and free from blockage.	No
Ambient temperature and humidity check	Conduct a visual inspection on records	The ambient temperature and humidity records are within the operating range.	No
Smoke detector and Temperature and temperature detector	Spot check the smoke detector and temperature detector with smoke or heat generated by using dedicated devices[2].	The smoke and temperature detectors are solid red, and the sound and light alarm is triggered.	Yes
Fire suppression module	Conduct a visual inspection and do the cleaning in necessary.	• Cables are not damaged, loose, or disconnected. • The module is clean and free from dust. • Cables are intact and securely connected.	Yes

Function check	Conduct a visual inspection on event records, and do measurement using multimeter.	• Verify the operational status of the total positive and total negative relays in the high-voltage box by sending open/close commands and confirming normal operation. • Measure the 24V output voltage to ensure it falls within the specified range. • Review the operation records of the battery racks to confirm that current, voltage, and temperature are within acceptable limits. • Ensure the UPS status on the Integrated Control Panel is functioning normally.[3]	Yes
Note: 1. In areas prone to sandstorms, it is recommended to clean the filter after each sandstorm and before the summer season. In other regions, clean the filter as needed, ensuring the filter or condenser is not obstructed. A high-pressure water gun is the suggested cleaning tool. 2. Disconnect the cables from the solenoid valve before testing to avoid releasing the extinguishing agent. 3. If the UPS is not used for an extended period, charge it at least every 6 months. The battery's state of charge (SOC) will reach 90% within 3 hours. After long-term storage, it is recommended to charge the UPS for 48 hours.			

10.4.4Annual maintenance

The table below outlines the annual maintenance checklist.

Table 10-4 Annual maintenance checklist

Maintenance category	Maintenance action	Expected result	System power off or not
Battery pack and high-voltage box	Conduct a visual inspection: • Appearance • Rust condition • Screws • Fans • Front panel vent	• No obvious damage to the appearance. • No noticeable paint peeling or rust. • The screws are secured. • The fans rotate properly without abnormal sound. • The front panel vent is clean and free from blockage. • No flammable object on top of the battery racks. • The mounting points between the battery rack and the foundation steel plate in the container are secure, with no signs of corrosion. • No coolant leakage.	Yes

Cabling and wiring connections	Conduct a visual inspection.	• Ensure the cable layout and wiring are correct, with no damaged cables, proper connector placement, and no overlap or short circuits. Any abnormalities should be corrected immediately. • Verify that all inlet and outlet openings on the battery racks are properly sealed. • Inspect the battery racks for any signs of water seepage. • Check if the DC cable and copper bar connections are loose. • Inspect the power and communication cables for any damage, paying particular attention to areas where the cable insulation may be in contact with metal surfaces for signs of cuts or wear.	Yes
Grounding	Conduct a visual inspection and take measurements using a multimeter.	Check whether the grounding connection is correct, and the grounding resistance value should not be greater than 4Ω.	Yes

11 Emergency handling

If an accident occurs onsite (including but not limited to the scenarios below), prioritize the safety of onsite personnel and contact service engineers from GOTION.

Battery falling or strong impact:

- If the battery shows obvious damage, or if there is an abnormal odor, smoke, or fire, evacuate personnel immediately, call emergency services, and contact professionals. Professionals should use fire extinguishing facilities with safety protection to extinguish the fire.
- If there is no deformation or visible damage, and no abnormal odor, smoke, or fire, ensure safety and proceed as follows:
  - Warehouse: Evacuate personnel, have professionals using mechanical tools transfer the battery to a safe, open area, and contact the Company's service engineers. Leave the battery for an hour and ensure its temperature is within the room temperature range (±10°C) before handling.
  - ESS Onsite: Evacuate personnel, close the ESS doors, have professionals using mechanical tools transfer the battery to a safe, open area, and contact the Company's service engineers. Leave the battery for an hour before handling.

Flood:

- Power off the system if safe.
- Avoid touching any submerged batteries to prevent electric shock.
- Do not use water-soaked batteries. Contact a battery recycling company for disposal.

Fire:

- If a fire occurs, power off the system if safe.
- Use carbon dioxide, FM-200, or ABC dry powder fire extinguishers to extinguish the fire.
- Advise firefighters to avoid contact with high-voltage components to prevent electric shock.
- Overheating can lead to battery deformation, malfunctions, and the release of corrosive electrolytes or toxic gases. To avoid skin irritation and chemical burns, use respiratory protective equipment and maintain a safe distance from the batteries.

Fire alarm horn/strobe:

- When the alarm indicator blinks or buzzes, do not approach, open doors, or stay nearby.
- Cut off the power supply remotely only when your safety is ensured.

Gas exhaust:

- Onsite personal protection: Avoid direct exposure to exhaust vents.
- Post-disaster product maintenance: Contact the Company's service engineers for evaluation.

Extinguishant release or fire:

- Onsite O&M personnel suggestions:
  - In the event of a fire, evacuate the building or equipment area, activate the fire alarm, and call the fire emergency service. Provide professional firefighters with relevant product information.
  - Do not enter the affected area under any circumstances or open the ESS doors. Isolate and monitor the site and keep unauthorized personnel away.
  - After alerting the fire service, remotely power off the system while ensuring your own safety.
  - Provide professional firefighters with all relevant product information upon their arrival.
  - After the fire is extinguished, have professionals manage the site according to local laws. Do not open ESS doors without permission.
  - Post-disaster product maintenance: Contact the Company's service engineers for evaluation.
- Professional firefighters suggestions:
  - Refer to product information provided by O&M personnel.
  - Do not open ESS doors until it is deemed safe by professionals.

- Adhere to local firefighting regulations.